AUDIO BROADCAST RECEIVER

Operator Guide

ComStream
A Spar Company

10180 Barnes Canyon Road • San Diego, CA 92121 • (619)458-1800

CPN 01-0483-401
Rev. A 03/95

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ABR700

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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 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 ABR700 Audio Broadcast Receiver Equipment!
Service Only By ComStream!

The ABR700 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.

Table of Contents

Chapter 3: Full Installation and Startup (continued)

Chapter 4: Functional Description

Chapter 5: Front Panel Operation

Chapter 6: ABR700 Command Descriptions

Chapter 7: Maintenance and Troubleshooting

Chapter 8: Technical Specifications

Appendix A: Interface Pinouts

List of Figures

List of Tables

Introduction

Using this Guide

Welcome to the ComStream world of satellite-based communication systems and networks. This guide is your sourcebook for using ComStream's ABR700 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 ABR700. 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.

The glossary and index are located at the end of this guide. The glossary contains technical terms and system commands for easy reference. The Index can be used to help you quickly locate information.

Special Paragraphs

Throughout this guide you will find two special 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.

Organization

This guide groups information and procedures together by the types of activities and tasks you will perform when working with ABR700 Audio Broadcast Receiver. This guide contains seven chapters and five appendices.

Getting Started

If you are new to satellite communications or are unfamiliar with either ComStream products or the ABR700, you should read the following chapters before unpacking or installing this product:

- Chapters 1 and 4 for an overview of the ABR700
- Chapter 3 for a full set of ABR700 installation procedures

If you are an experienced user familiar with the ABR700 and ComStream products, you may wish to begin with:

- Chapter 1 for an overview of the ABR700
- Chapter 2 for the quick installation procedure
- Other chapters as needed

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 ABR700 Audio Broadcast Receiver is warranted against any above-mentioned defects that appear within two years from the date 20 days after the shipping date.

Should it be necessary to make a claim against this warranty, the buyer shall first notify the NPR Satellite Maintenance and Repair Depot to define the nature of the problem. When returning products, please be aware of the following:

1. Products returned to the Depot, whether for upgrade, warranted or out-of-warranty repair work, or maintenance, must comply with the Depot procedures.
2. Products shall be forwarded to the Depot, transportation prepaid.
3. Products returned to the Depot freight collect or without a return material authorization (RMA) number will NOT be accepted.
4. The Depot shall not accept any responsibility for returned products that are improperly packaged and/or damaged in shipment. If possible, please use original shipping and packing 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
NPR Satellite Maintenance and Repair Depot at
202-414-2650.

Return Procedure

Before using this return procedure, determine whether your satellite network or service provider has a maintenance, repair, or replacement program.

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 that 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 packing (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, power cords, 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.

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

Table 1. Revision History

Revision	Date	Pages
Rev. A	03/95	Initial release

Customer Support

We hope this guide provides all of the information and instructions you need to operate the ABR700 Audio Broadcast Receiver.

However, in the event that you need further assistance, or if problems are encountered, please feel free to contact the NPR Satellite Maintenance and Repair Depot, located in the United States, by phone at the following number:

- 202-414-2650

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Chapter 1: Overview

Overview

This chapter describes a typical satellite digital audio distribution network and provides an overview of the ABR700 audio broadcast receiver within such a network.

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 ABR700 is a key component, sets a new worldwide standard for digital audio distribution.

Satellite Broadcast Network Summary

As Figure 1-1 illustrates, a satellite broadcast network consists of three major subsystems:

- Satellite transmission uplink site
- Satellite link
- Satellite transmission downlink site

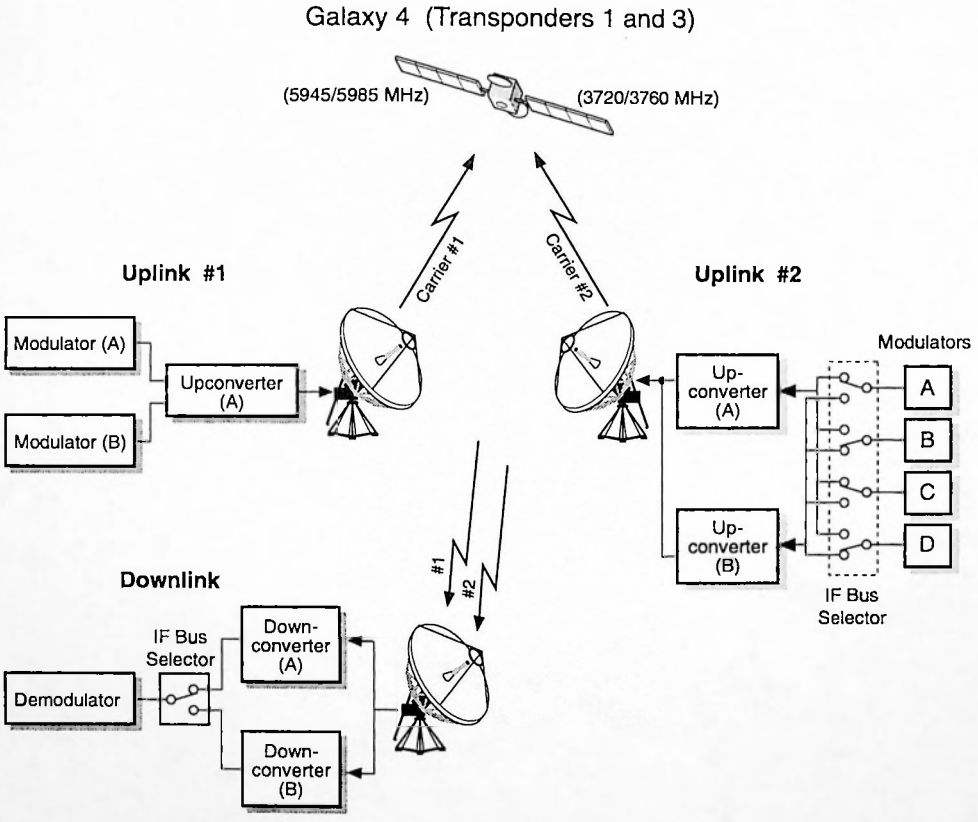

Figure 1-1. Satellite Digital Audio Distribution Network

The satellite transmission uplink site is the facility at which the audio to be transmitted is uplinked to the satellite. The modulators within an uplink are units such as a CM701 with a DAC700. The satellite link consists of a commercial telecommunications satellite in geosynchronous orbit above the earth. The downlink site is the remote satellite receiver, which consists of three major components:

- Satellite antenna subsystem
- Downconverters and IF bus selector switches
- Satellite audio receiver such as the ABR700

In Figure 1-1, the demodulator within the downlink would be a unit such as the ABR700.

ABR700 Features

The ABR700 is a multiple data rate digital audio receiver. Figure 1-2 details the position of this receiver within the Public Radio Satellite System (PRSS) application (for instance, a radio station environment).

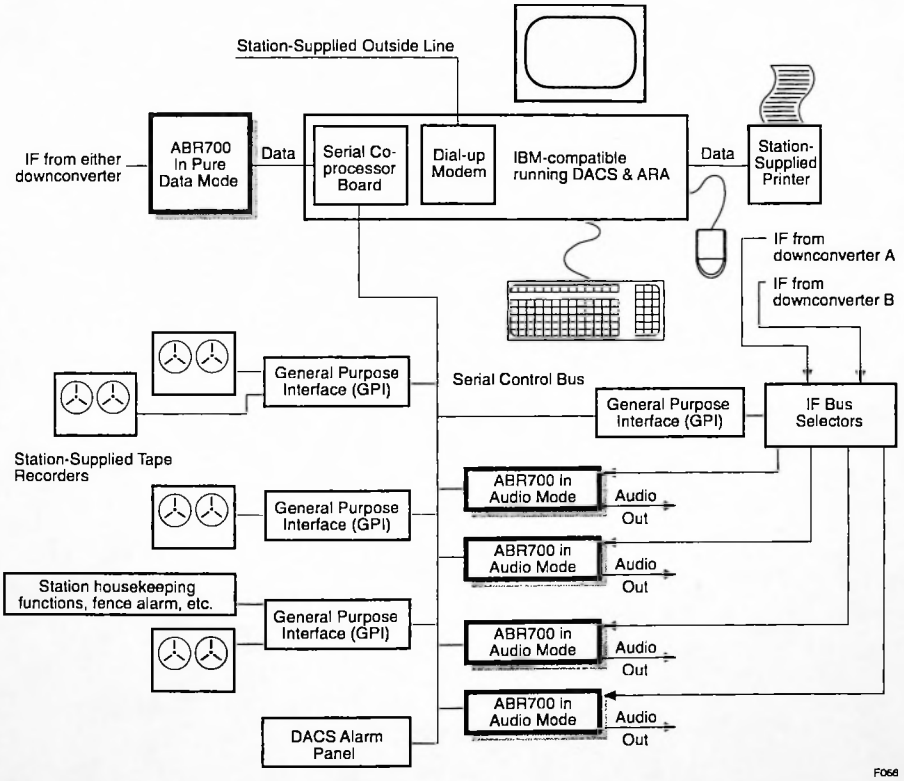

Figure 1-2. Typical ABR700 Installation

The analog output audio from the ABR700 may feed both the on-air studio console and the recording equipment.

The ABR700:

- Provides quality audio at 64, 128, 192, and 256 kbps
- Provides a standalone audio broadcast receiver capable of receiving a Quadrature Phase Shift Keying (QPSK) modulated input signal within an input frequency of 52 to 88 MHz

- Utilizes front panel or remote control operation to configure the unit and move the user through a sequence of menus and various operational conditions
- Mutes audio when a noncompliant data stream is received
- Uses ISO/MPEG Layer II (Musicam) bit rate coding algorithm to produce monaural or stereo high-quality audio
- Uses Quick Channel Access, which promotes rapid switching among multiple audio reception channels of different bit rates
- Can be associated with a station and network for subscription purpose
- Is addressable to provide complete program access control
- Allows audio channel changes either locally or from an external terminal or computer
- Is equipped with a pure data mode function operating at 64 kbps for the Downlink Services Channel (DSC). When in this mode, 64 kbps data appears at the auxiliary connector
- Provides remote control capability from the Satellite Operating Support System (SOSS)
- Provides built-in audio and data port diagnostics
- Has a built-in performance monitoring capability that displays the highest and lowest received Energy per Bit to Noise Power Density Ratio (E_b/N_0) and counts RF and audio sync losses
- Tunes to the last channel on power-up

The remaining portion of this guide describes, in detail, the steps necessary to install, configure, and operate the ABR700 digital audio receiver within a network environment.

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Chapter 2: Quick Installation

Overview

This chapter provides quick installation and startup instructions for experienced users familiar with satellite communications equipment. It assumes the ABR700 is configured correctly for your network.

Quick Installation Procedure

Since the ABR700 is a plug-and-play component when it is correctly configured for a network, system startup is straightforward. If the receiver is not correctly configured or you experience problems following the Quick Installation procedure, refer to *Chapter 3: Full Installation and Startup*.

To perform quick installation:

1. Make sure the ABR700 is properly installed in an equipment rack and connected (via the rear panel) with:
   - AC power cord
   - Monitor and Control (M&C), Audio, and Auxiliary port cables
   - IF input cable

   Since the unit has no on/off power switch, you turn it on by plugging in the AC power cable.

NOTE: Ensure that adequate airflow is available around the equipment rack.

NOTE: The ABR700 is capable of full configuration and operation from the front panel without requiring that a computer or computer terminal be connected.

2. Observe the following about the front panel indicators:
   - When the unit is powered on, the front panel light emitting diodes (LEDs) flash briefly. (The ABR700 has no on/off power switch and no separate power indicator on the front panel.) Power is indicated by the presence of the liquid crystal display (LCD).
   - When signal acquisition is complete (allow four minutes), the RF Sync and Audio Sync indicators are illuminated if any authorized audio channel of the correct format is received.

3. Verify that audio is available at the audio output port. If the receiver configuration is correct and the receiver has permission from the uplink, audio will be heard.

You have now installed the ABR700 satellite audio receiver system. To verify proper operation of the ABR700 or to resolve any problem experienced during quick installation, consult *Chapter 3: Full Installation and Startup*.

Chapter 3: Full Installation and Startup

Overview

This chapter describes the steps necessary to install and start up an ABR700. These steps include:

- Planning the site
- Installing, connecting, and starting up the unit
- Validating or verifying the installation

This chapter also describes solutions to common startup problems.

Planning the Site

Planning the site before installing the ABR700 receiver allows you to identify any special installation or operational requirements. Spending time in planning:

- Prevents unnecessary complications during installation
- Allows potential problems to be resolved before work begins

When planning the receiver installation site, you should consider:

- Where to locate and how to mount the antenna assembly with which the ABR700 is to interface
- How to route the cables interconnecting the ABR700 with other components of the system
- Where to locate the ABR700

Installing the ABR700

The ABR700 should be located close to the equipment it serves.

The ABR700 functions over a wide range of power and environmental conditions. An autoranging power supply allows the receiver to use the most common utility power feeds. For maximum availability and reliability, connect the receiver to an Uninterruptible 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 8: Technical Specifications*.

NOTE: ComStream strongly recommends that you use surge suppression on the AC input to any rack containing an ABR700. Many surge suppression vendors can recommend and supply products to meet your voltage and power requirements.

The physical location of the ABR700 is flexible and depends largely on the location of the audio processing equipment rack. Mount the ABR700 unit in a standard 19 inch equipment rack, occupying one rack unit of height (1.75 inches). Ensure that placement within the rack allows for easy access to its rear panel.

NOTE: The maximum ambient temperature specification for the ABR700 is 50°C. This temperature is measured one inch from either side of the receiver within the rack enclosure. To maintain the product's warranty, ambient temperature must not exceed 50 °C. To ensure that the internal ambient temperature within the rack does not exceed this specification, use proper rack ventilation and forced airflow techniques.

External Connections

This section describes the physical and electrical connections to the ABR700 receiver.

All external connections to the ABR700 are made through the rear panel connectors. The ABR700 has three possible connections on the rear panel, as shown in Figure 3-1. Each connector is different, either in size or type, from the other, thereby minimizing errors when making the connections. The three ports are M&C, Audio Out, and Auxiliary. The rear panel also contains a jack for RF In and a power connector.

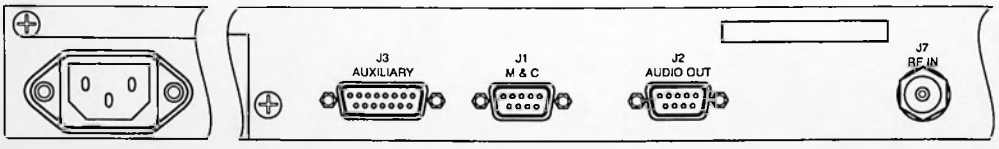

Figure 3-1. ABR700 Rear Panel Connectors

Table 3-1 summarizes connector-type characteristics for each of these connectors and details the pinouts for these interfaces.

Table 3-1. Connector Types

Port/Connector	Type
M&C	DB-9, Female (RS-232, RS-485)
Audio Out	DB-9, Male (Analog Audio)
Auxiliary (Data)	DB-15, Female (Various Signals)
RF In	BNC, 75 ohm, Female (RF)
Power	IEC 320, Male (Socket)

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.

Monitor and Control

Through the M&C port, the ABR700 is connected to either an SOSS computer (for normal system operation) or a debug terminal. The SOSS interface is achieved by connecting the M&C port with an RS-485 cable to the serial control bus that is connected to the SOSS computer. During normal system operation, commands are received from the SOSS computer via the serial control bus. You can also issue control and diagnostic commands to the receiver through the RS-232 port. That interface is achieved by connecting the M&C port with an RS-232 cable to the debug terminal. When used for diagnostic purposes, the port provides details about the ABR700's status.

The M&C port is configurable via front panel configuration commands, as described in *Chapter 5: Front Panel Operation,* or the M&C port configuration (P2) command, described in *Chapter 6: ABR700 Command Descriptions*.

NOTE: The ABR700 is capable of full configuration and operation from the front panel without requiring that a computer or computer terminal be connected.

Audio Out

The Audio Out port provides the analog audio output for Left and Right (LR) audio channels. Outputs are directly coupled, actively balanced, and capable of driving 600 ohm impedance. A current-limiting resistor (30 ohm) resides in series between the op-amp output and the connector. This resistor prevents damage resulting from short circuits and provides a characteristic output impedance of about 60 ohm.

When the ABR700 is operating in monaural, identical audio appears at both Left and Right outputs unless the user selects otherwise.

The mating female DB-9 connector on the rear panel connects the ABR700's audio to appropriate studio equipment. This connector has a metal shell cover. The cable that connects these two pieces of equipment is a customer-provided cable. That cable should be a shielded, twisted-pair audio cable.

Auxiliary

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

- Status Relay (SR) contacts
- Digital (AES/EBU) audio output
- AGC monitor voltage
- Composite ISO/MPEG (Musicam) synchronous RS-422 receive clock/data output

RF In

The RF In port is the primary input to the receiver. The RF signal is brought into the receiver through this connector.

The power of the input carrier should be in the range of -80 dBm to -20 dBm with the RF frequency in the range of 52 MHz to 88 MHz. The input impedance is 75 ohm, and it has a return loss of greater than 15 dB.

Power Connector

The ABR700 power supply autoranges from 90 to 264 VAC and from 47 to 63 Hz. The typical power consumption for the ABR700 is less than 40 watts.

The ABR700 has no on/off power switch. You turn on the unit by plugging in the AC power cable, and you turn it off by removing the power cable from the unit.

NOTE: Always power down the ABR700 before connecting or disconnecting signal cables to it.

If an unterminated power cord is supplied with the unit, the appropriate certified termination plug must be installed. (Table 3-2 lists the required certifying agencies for certain countries.) The power cord wires are color-coded as follows:

- Green and yellow: earth/ground
- Blue: neutral
- Brown: line (hot)

Table 3-2. Certifying Agencies by Country

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

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

1. Connect the green and yellow wire to the terminal in the plug that is marked by the letter E or by the earth symbol or colored green and yellow.
2. Connect the blue wire to the terminal that is marked by the letter N or colored black.
3. Connect the brown wire to the terminal that is marked by the letter P or colored red.

Starting Up the System

This section describes the activities necessary to bring an assembled ABR700 system online. The following steps assume that the antenna, interconnection cable, and ABR700 have been properly installed and connected. Do not proceed until this setup is complete.

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

To start up the ABR700:

1. Make sure the ABR700 is properly installed in the equipment rack with the interconnection cable and the audio/data cables connected.
2. Turn on the unit by connecting the AC power cable to the unit.
3. Tune to a known audio channel of the proper format. Allow at least 60 seconds for acquisition.
4. Observe the front panel LEDs.

   In pure data mode, when acquisition is complete, only the RF Sync LED is illuminated; in other modes, both the RF Sync and Audio Sync LEDs are illuminated.
5. 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 ABR700 is ready for verifying proper equipment setup and operation.

Validating Installation

View the Demod E_b/N_0 at the front panel Monitor menu. In a properly designed and installed downlink, receiving from a properly operating uplink, the E_b/N_0 should be between 8 and 22. The E_b/N_0 should never fall below 5.

Startup Problems

Except for changing channels, the ABR700 has been designed for unattended operation and should evidence few problems. The most common problems encountered during startup—and steps to solve them—appear below.

The receiver will not lock onto the satellite signal

The most common cause of a receiver not locking onto the desired satellite signal is a lack of signal at the IF input. This lack of signal usually stems from either the interconnection cable or improper pointing of the antenna. To determine whether the signal is present, examine the AGC value via the front panel Monitor Menu. If the AGC value equals 255, no signal is present.

To troubleshoot this problem:

1. Check the connectors on the interconnection cables and the downconverters and signal splitters for proper installation. With each cable disconnected, verify that each passes a continuity and no-short test.
2. Verify that the antenna is properly aligned and pointed at the correct satellite. If it is not, refer to the antenna manufacturer's documentation. The AGC output signal (0 to 10 V) may be used during antenna alignment. It is available at J3, pin 5.

Another cause of nonacquisition is that the received channel is more than 50 kHz off frequency. The major cause of an off-frequency channel is usually an off-frequency downconverter. Contact the NPR Satellite Maintenance and Repair Depot for help.

No audio is received from the Audio Out port

The most common cause of a front panel Audio Sync LED being on (indicating that the signal is locked) yet no audio being available is that either the receiver is not authorized to receive audio or the audio output port cabling is incorrectly installed.

To troubleshoot this problem:

1. Double-check the pinouts on the cable and check to see if audio is available at the audio out port.
2. Look at the default front panel display. If the default display is not showing, press the front panel Esc(ape) button four times. The lower right quadrant of the display should read *Authorized* or *Not Authorized*. If neither of those terms appears, the demodulator is probably in pure data mode.

   To switch back to audio mode, select the following options from the Main Menu in this order:

   a. Config

   b. Ports

   c. Data

   d. Pure Data Mode

   e. Off

   Press Enter.
3. Check the front panel Faults, Current menu, which indicates if the audio output is muted and why.
4. Check with NPR Satellite Operations to ensure audio is available on the receiver you are checking.

NOTE: For information on front panel menu options, see *Chapter 5: Front Panel Operation*. For information on antenna peaking, see *Appendix B: Antenna Peaking*. For other problems or ideas, refer to *Chapter 7: Maintenance and Troubleshooting*.

Chapter 4: Functional Description

Overview

The ABR700 is a multiple transmission rate digital audio receiver. The unit receives audio, data, and control commands, which it may feed to an on-air studio console and to recording equipment for off-hours distribution of programmed material.

This chapter describes the ABR700's functionality, details its theory of operation, and defines the three types of carrier signal acquisition (power-up, channel change, and fade) that it performs.

Functionality

The ABR700 is a state-of-the-art, standalone satellite receiver. It is capable of receiving a compressed, modulated bit stream within the 70 MHz IF band, decoding and producing ISO/MPEG (Musicam)-compliant stereo/monaural audio. The bit stream it receives is a QPSK-modulated input signal within an input frequency of 52 to 88 MHz. The unit filters, demodulates, sequentially decodes, and decompresses (using ISO/MPEG (Musicam) Layer II) the received signal into stereo or monaural high quality audio. A front panel view of the ABR700 chassis is shown in Figure 4-1.

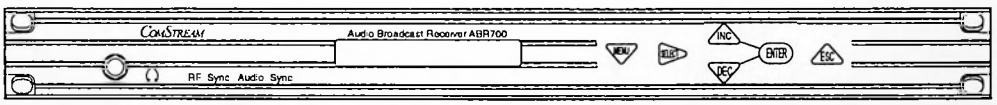

Figure 4-1. ABR700 Receiver Chassis

Contained in a rack-mounted, one-unit 19 inch chassis, the ABR700 has front panel controls and rear panel input/output connectors. The front panel also provides a quarter-inch stereo headphone jack. Users can program the ABR700 either from the front panel or via the remote connector located at the rear of the chassis.

The ABR700 chassis is designed to meet worldwide emissions, safety, and power requirements. Its two-piece construction is optimized so every joint in the box overlaps, meeting Federal Communications Commission requirements for emission control. The receiver contains an autosensing power supply that allows the unit to accommodate virtually any AC power source.

The ABR700 rear panel, illustrated in Figure 4-2, contains ports for data output (auxiliary), remote control (M&C), and audio out (audio) connectors. It also contains connectors for RF In and power. For pinouts, see *Appendix A: Interface Pinouts*

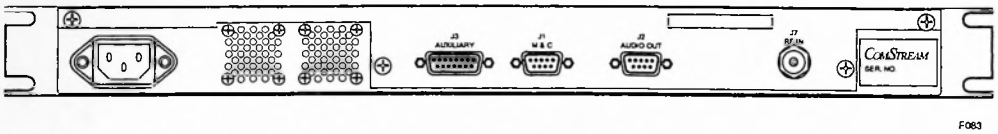

Figure 4-2. ABR700 Rear Panel

Theory of Operation

The ABR700 is a multiple rate, Quadrature Phase Shift Keying (QPSK) digital audio receiver. The rack-mounted receiver requires only one rack unit (1.75 inches) of vertical space. With the exception of the headphone jack (which connects to the front panel), all input and output connections are made on the rear panel. Since each connector is unique in size or gender, no interconnection mistakes can be made during installation.

As shown in Figure 4-3, this compact, fully integrated digital receiver contains the following major functional blocks:

- 70 MHz IF section
- Baseband demodulator
- Single DSP-based audio decoder (MPEG decoder) providing two audio outputs (analog and Audio Engineering Society/European Broadcast Union [AES/EBU])
- Front panel with easy-to-use controls
- Single microprocessor controller providing overall receiver control and configuration

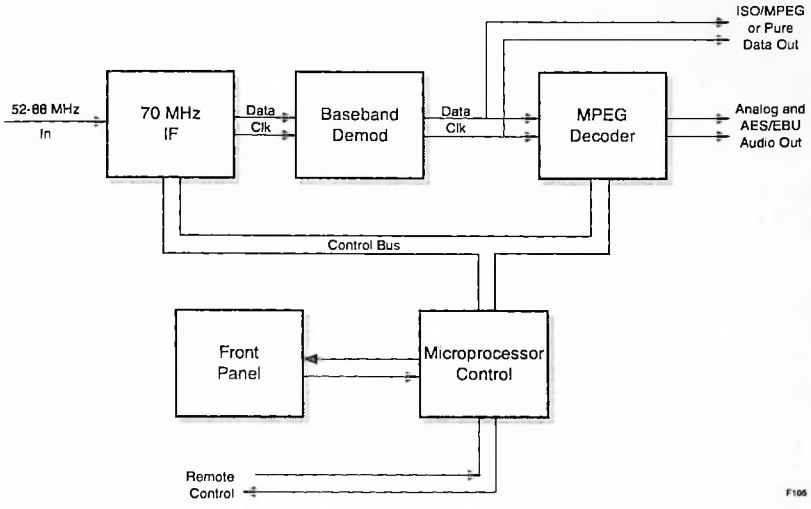

Figure 4-3. ABR700 Functional Block Diagram

The ABR700 receives the input IF signal as a quadrature phase (QPSK) modulated signal within an IF frequency of 52 to 88 MHz. This narrow band, single carrier per channel (SCPC) signal typically has a bandwidth of less than 500 kHz. The demodulator is commanded to a specific frequency where it begins an acquisition process that results in carrier lock, bit timing lock, and acquisition of the baud rate.

The ABR700 then passes the demodulated bit stream and a bit clock to the sequential decoder (rate ½), where the stream is sequentially decoded (error correction bits are removed) and the resulting compressed ISO/MPEG (Musicam) audio bit stream is output to the audio ISO/MPEG (Musicam) decoder. The ISO/MPEG (Musicam) audio decoder determines the type of encoding process used (discrete stereo, monaural, joint stereo) and produces stereo/monaural audio output with a bandwidth of up to 20 kHz. Stereo programs only require a single channel and a single demodulator.

The ABR700 uses the microprocessor bus to control all demodulation and decoding processes (including acquisition) and to monitor the front panel for button activity. In addition, while the front panel display is being updated for commands entered via the button area, the microprocessor bus receives and processes commands over the M&C interface.

Signal Acquisition

Acquisition is the process a receiver uses to adjust its frequency, phase, gain, and synchronization to match the incoming carrier signal. For the ABR700, this process is quite sophisticated. Frequency errors arising from temperature changes in the outdoor environment and the aging of components can make signal acquisition difficult. The ABR700 has been designed to overcome these errors by the use of internal synthesizers that correct for nearly all sources of frequency error and require no operator intervention.

The automatic acquisition feature of the ABR700 operates in three distinct modes:

- Power up mode acquisition is performed when the system is powering up and locking onto a new carrier.
- Channel change mode acquisition is performed when the frequency changes because the demodulator is switched to a new channel.
- Fade acquisition is performed when the receiver loses the carrier to which it was previously locked, although the receiver's channel has not been changed.

During signal acquisition, the receiver monitors three tracking loops—frequency/carrier channel, Automatic Gain Control (AGC), and bit timing—plus sequential decoding. The ABR700's demodulator monitors the tracking loops until they fall within a satisfactory range and a *loop locked* or *function acquired* condition is established. The sequential decoder cannot begin its acquisition until this condition exists.

The ABR700 monitors the output of the sequential decoder because a false locking condition may be entered if only the tracking loops are monitored. The demodulator's acquisition time is a function of three metrics:

- Carrier
- Bit
- Decoder lock

Under most circumstances, carrier and bit timing are simultaneously acquired. Then the bit stream is presented to the decoder and lock occurs after approximately 10^4 bits. Empirical data suggests that the receiver requires from 10^4 to 10^6 symbols to determine that lock is not taking place and that it must select a new frequency offset.

When the frequency offset of an input signal is greater than the pull-in range of the carrier loop, the receiver searches frequency bins, beginning with those centered around the nominal carrier frequency. The pull-in range (slightly larger than the width of each bin) varies with the symbol rate and is generally less than the total frequency error (offset) expected in the system. After tuning to a given frequency, the receiver waits for the circuitry to acquire within a given number of symbols before moving to a new bin. Table 4-1 lists the bin times. This process continues until the total range of expected offsets has been covered or acquisition has occurred, at which time the receiver notes the difference (local offset) between the tuned and actual frequencies.

Table 4-1. Binning Parameters

Bit Rate (kbps)	Symbol Rate (ksps)	Bin Size (kHz)	Bin Time (Sec)	Number of Bins	Pull Range (kHz)
64	64	12	2	9	±16
128	128	24	2	5	±32
192	192	36	2	3	±48
256	256	48	2	3	±64

Once the receiver achieves RF carrier acquisition, the RF sync indicator illuminates. If the ISO/MPEG (Musicam) audio decoder can properly decode the incoming data stream, the audio sync indicator illuminates. At this point the unit compares the incoming network identifiers against the configuration within the receiver. If the unit is not authorized to receive this channel, the unit maintains RF sync and audio sync, but all audio outputs are muted.

Power-Up Acquisition

Figure 4-4 illustrates the process for both the power-up and channel change acquisition modes. During power-up, the receiver attempts to acquire the carrier by searching a range of frequencies, called a frequency bin, centered around the nominal carrier center frequency. By selecting Config, Demod, Rec Freq from the front panel, the user sets the nominal carrier center frequency; the size of a frequency bin (B1) is determined by the data rate. If the receiver is unable to find the carrier within the specified range, it moves to the next contiguous bin below the center carrier frequency and repeats the process. If the carrier is not found, the receiver moves to the next contiguous frequency bin above the center carrier frequency and continues the search.

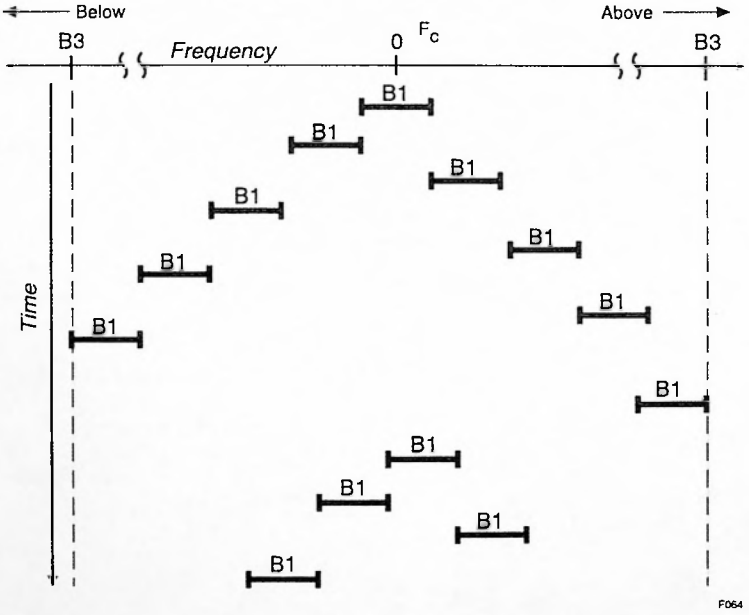

Figure 4-4. Power-Up and Channel Change Acquisition Modes

The receiver continues this process, each time searching the next outside frequency bin (on either side of the starting point) until either the carrier is found or the defined acquisition range limit (B3) is reached. As the lower portion of Figure 4-4 illustrates, if the receiver reaches this limit without finding the carrier, it begins the process at the next data rate. Data rates are searched in the order 256, 128, 64, 192 kbps. If the receiver checks all data rates and still does not find the carrier signal, it repeats the entire process, starting again at the center carrier frequency.

NOTE: The maximum offset search variable (B3) shown in Figure 4-4 is set to ± 50 kHz.

After it achieves RF carrier and audio synchronization, the ABR700 unmutes its audio outputs. If the receiver does not receive appropriate authorization after 100 seconds, the ABR700 mutes its audio output.

Channel Change Acquisition

Figure 4-4 illustrates the process for both power-up and channel change acquisition modes. In power-up acquisition, the search pattern from bin to bin varies depending on the type of acquisition the receiver requires. The unit starts with the center bin (defined at the tuned frequency) and implements a search pattern based on an ever-widening pattern of bins. During channel change acquisition, however, searching begins at the last known offset frequency, and the power on search range (B3) is replaced with the channel change search range (B4). B4 defaults to ±25 kHz.

Fade Acquisition

The search pattern for fade acquisition appears in Figure 4-5. As with other acquisition approaches, fade acquisition covers the entire search range (B3); however, it uses a search pattern that concentrates the search in a narrower frequency range centered on the point at which the carrier was last seen (F_c). That is, 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 (F_c). The size of this range (B1) is defined by the data rate being searched. If no carrier is found, the search proceeds in the frequencies above and below simultaneously.

As Figure 4-5 illustrates, the fade acquisition algorithm searches one bin to the left of F_c, then back to F_c, and then one bin to the right of F_c. In this manner, the system expands the search until it finds the carrier or it reaches the user-defined acquisition range limit (B3). If the range limit is reached without finding the carrier, the receiver declares an acquisition range fault (FL 9) and a power-up acquisition is implemented.

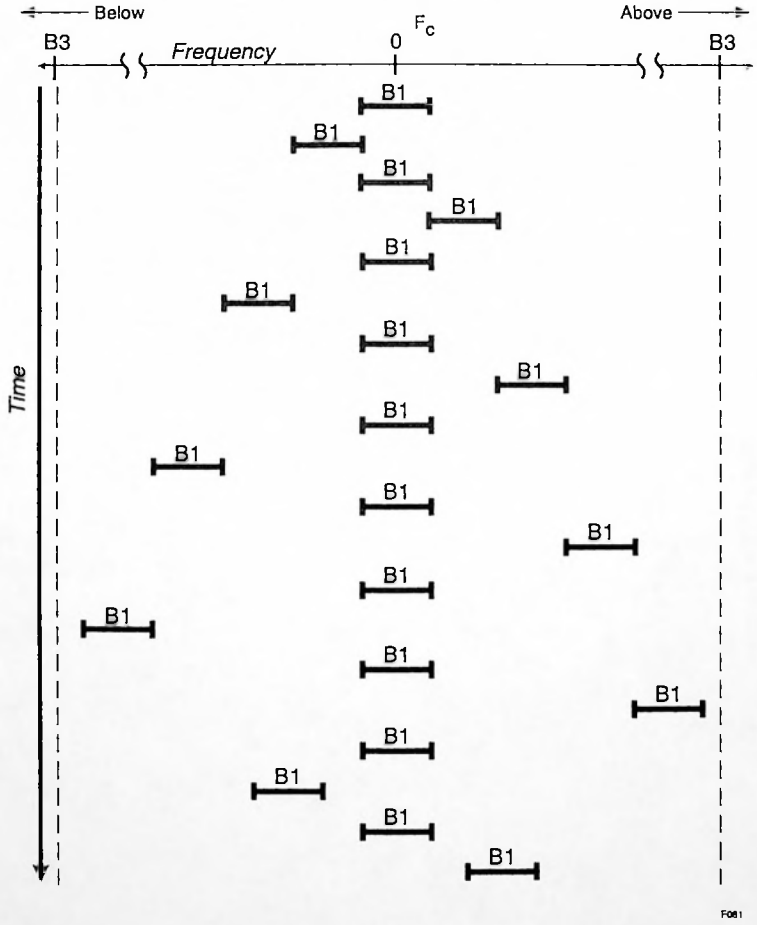

Figure 4-5. Fade Acquisition Mode

Chapter 5: Front Panel Operation

Overview

The ABR700 front panel provides the user with command, control, and monitoring capabilities. The design supports simple, user-friendly operation.

This chapter describes the front panel features and user interface.

ABR700 Front Panel

The ABR700 front panel, shown in Figure 5-1, contains an LCD for displaying commands and six buttons for operator entry of commands.

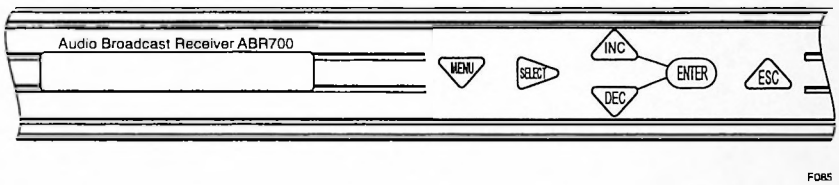

Figure 5-1. Front Panel Display/Button Area

The command entry buttons include:

- Menu
- Select
- Inc(rement)
- Dec(rement)
- Enter
- Esc(ape)

The LCD window is two lines by 24 characters and displays commands and information. The following information is shown by the default display:

- Operational status (authorized/not authorized or data mode)
- Bit rate
- Frequency
- Signal level (the factory default thresholds that appear in Table 5-1)

Table 5-1. Signal Level Defaults

Signal Level (E_b/N_0)	Description
>7.0 dB	Nominal
>4.0 dB, <7.0 dB	Marginal
<4.0 dB	Unusable

The front panel also has a stereo headphone jack, for operator monitoring of audio output, and two LED indicators, which are visible only when illuminated. Figure 5-2 is an illustration of the front panel with the headphone jack and the LED indicators as they appear when illuminated.

The indicators provide the following information:

- RF Sync illuminates green to indicate that acquisition of the incoming RF signal is complete.
- Audio Sync illuminates green to indicate the digital audio decoder has synchronized to the uplink audio encoder. If the unit is properly authorized for audio reception, near CD quality audio is then available for output from the receiver.

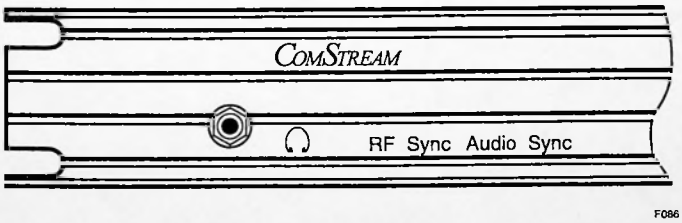

Figure 5-2. Front Panel Indicator Area

Front Panel Operation

The front panel commands are organized in a menu-driven tree structure. Figure 5-3 is a diagram showing the major branches of the tree structure and the order of commands within each branch.

Command Tree

The command tree starts at the default screen, shown as the uppermost screen in Figure 5-3. This is the first screen the LCD displays when the ABR700 is powered up. The default screen contains the following four commands:

- Receiver frequency
- Receiver data rate
- Incoming signal strength
- Authorization mode

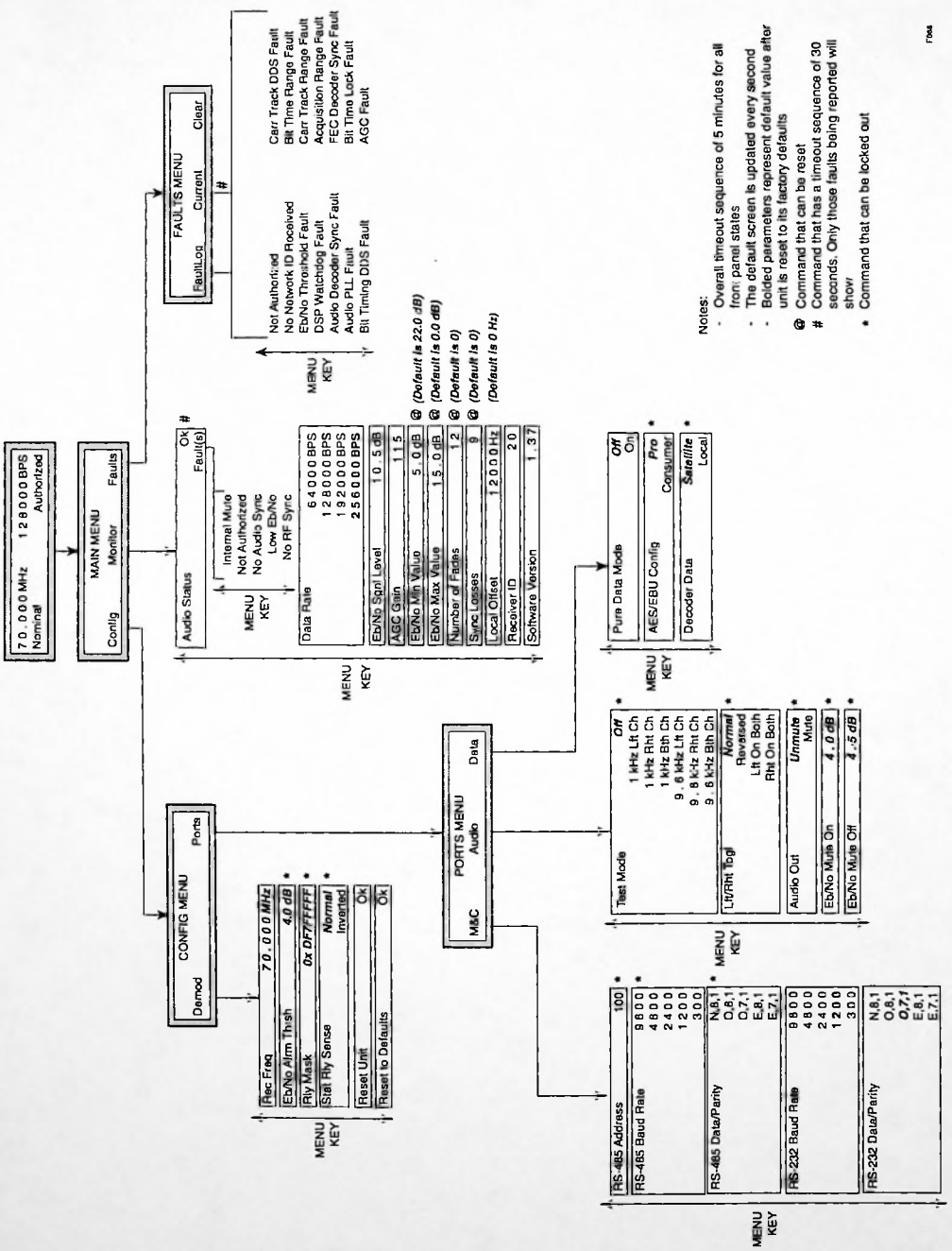

Figure 5-3. Front Panel Commands

When you press the Menu button, the screen in the display area changes from the default screen to the Main Menu. The Main Menu displays the three main category of commands.

- Configure Commands (shown as *Config* on the display)
- Monitor Commands (shown as *Monitor* on the display)
- Faults (shown as *Faults* on the display)

Configuration has the following functional groups:

- Demod
- Ports, which further branches into:
  - M&C
  - Audio
  - Data

Monitor displays the following:

- Audio status
- Audio-related faults

Faults contains the following:

- Log of all faults since the fault log register was last cleared
- Current faults
- Means to clear the fault log

Moving Through the Tree

Figure 5-4 defines the elements that appear on the screen as you move through the menus. To move down through the tree from one menu to another, as well as through the individual commands at the menu nodes, press the Menu button. Each time you press the Menu button, you move down one level in the tree.

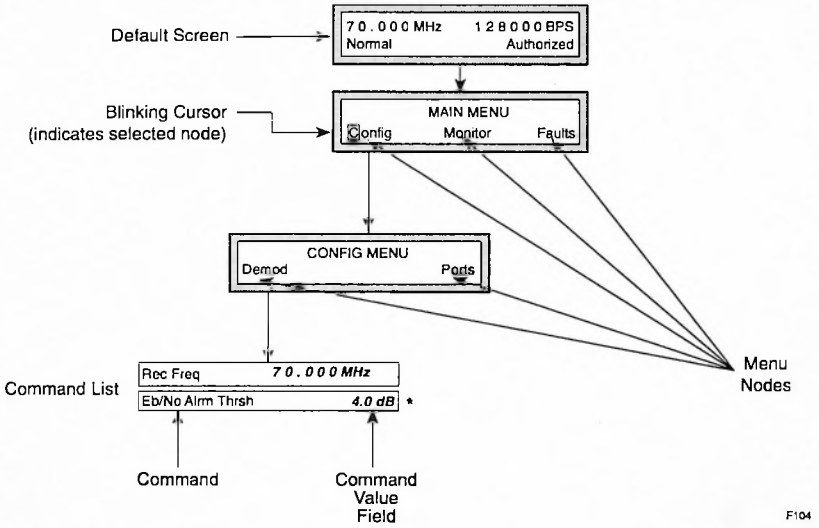

Figure 5-4. Screen Elements

To move from left to right to highlight a menu node or command value, press the Select button while the node or value you wish to select is visible in the display area. Pressing the Select button causes the highlighted area to blink. For example, the first letter of the word *Config* in Figure 5-4 is surrounded by a box, denoting the blinking cursor's location. Pressing Select again causes the first letter of the word *Monitor* to blink. You may scroll through the different menu nodes by pressing the Select button.

Modifying a Command

To modify a command, use the following general procedure:

1. Move through the tree until the command you wish to modify appears in the display area.
2. Press Select one or more times until the command value you wish to change is highlighted.

   Some commands have only one value that can be changed, so you would only press Select once. Other commands have a series of digits or characters that can be changed. In these cases, you need to press Select until the specific digit you wish to change is highlighted.
3. Press the Inc(rement) or Dec(rement) button, as appropriate, until you reach the desired value.

   Only when the blinking cursor is positioned over a command value may the Inc and Dec buttons be used.
4. Accept the changed command value by pressing the Enter button.

   At this point, the cursor stops blinking, indicating that the new command value has been accepted.

   If Enter is not pressed, the value remains unchanged.
5. Exit the procedure by pressing the Esc(ape) button until the default screen appears.

   If you press Esc without pressing Enter first, the value is not changed.

   The ABR700 reverts to displaying the default screen if no button is pressed for five minutes.

Example 1: Modifying the Rec Freq Command

In the following example, the user has decided to change the receive frequency from its default setting of 70.000 MHz to 75.000 MHz. The steps to make this change are as follows:

1. From the Default screen, access the Main Menu by pressing the Menu button.
2. Press the Menu button until Rec Freq appears in the display area.
3. Move to the first digit in the current receive frequency by pressing the Select button. The first digit (7) in the current receive frequency value begins to blink.
4. Press the Select button again. The second digit (0) in the current receive value begins to blink.
5. Press the Inc button until a 5 appears as the second digit. The Rec Freq now reads 75.000.
6. Press the Enter button to accept the new receive frequency.
7. Press the Esc button until the default screen appears in the display area.

   If you do not press the Esc button and no other buttons are pressed, the default screen reappears after a five-minute timeout.

Example 2: Modifying the RS-485 Baud Rate

In this example, the user has decided to change the RS-485 baud rate from its default setting of 9600 to 1200. The steps to accomplish this change are as follows:

1. Press the Menu button until the Ports Menu appears on the right side of the display area.
2. Select it by pressing the Select button. This action causes the cursor to blink on the *P* of the Ports Menu Node.
3. Press the Menu button, and the M&C Submenu appears in the display area. The cursor blinks on the *M* of the M&C Submenu Node.
4. Press the Menu button to go into the M&C command list.
5. Press the Menu button again, and *RS-485 Baud Rate* appears in the display area.
6. Select it by pressing the Select button. This action causes the current baud rate value to blink.
7. Press the Dec button until *1200* appears in the display area.
8. Press the Enter button to accept 1200 as the new RS-485 baud rate. The *1200* stops blinking.

9. Press the Esc button until the default screen appears in the display area.

   If you do not press the Esc button at this time and no other buttons are pressed, the default screen reappears after a five-minute timeout.

Configuration Commands

Configuration commands are those commands that can be modified to change operating characteristics or perform real-time functions.

Table 5-2 summarizes the ABR700 configuration commands in the order in which they appear in the command tree. For detailed descriptions of these commands, see *Chapter 6: ABR700 Command Descriptions.*

Table 5-2. Configuration Commands

Command Type	LCD Display	Description	Command Parameters	Default
Demod	Rec Frequency	Set Receive Frequency Input	Valid values range from 52.000 to 88.000 in 25 kHz increments	70.000 MHz
	E_b/N_0 Alrm Thrsh	E_b/N_0 Alarm Threshold	Refer to *Chapter 6: ABR700 Command Descriptions.*	4.0 dB
	Rly Mask	Relay Mask	Refer to *Chapter 6: ABR700 Command Descriptions.*	OxDF7FFFFF
	Stat Rly Sense	Status Relay Sense	Normal, Inverted	Normal
	Reset Unit	System Reset	OK	—
	Reset to Defaults	Master Reset	OK	—
M&C Port	RS-485 Address	RS-485 (SOSS) Port Configuration	1 to 255	100*
	RS-485 Baud Rate	RS-485 (SOSS) Port Configuration - Baud Rate	9600, 4800, 2400, 1200, 300	9600
	RS-485 Data/Parity	RS-485 (SOSS) Port Configuration - Parity, Data Bits, Stop Bits	N,8,1; O,8,1; O,7,1; E,8,1; E,7,1	N,8,1

*Does not change current value upon master reset.

Table 5-2. Configuration Commands (continued)

Command Type	LCD Display	Description	Command Parameters	Default
M&C Port	RS-232 Baud Rate	RS-232 Port Configuration - Baud Rate	9600, 4800, 2400, 1200, 300	1200
	RS-232 Data/Parity	RS-232 Port Configuration - Parity, Data Bits, Stop Bits	N,8,1; O,8,1; O,7,1; E,8,1; E,7,1	O,7,1
Audio Port	Test Mode	Audio Test	Off 1 kHz left channel 1 kHz right channel 1 kHz both channels 9.6 kHz left channel 9.6 khz right channel 9.6 kHz both channels	Off
	Lft/Rht Toggle	Left/Right Channel Toggle	Normal, Reversed, Lft on Both, Rht on Both	Normal
	Audio Out	Audio Mute	Unmute, mute	Unmute
	E_b/N_0 Mute On	E_b/N_0 Mute On	0.1 dB to E_b/N_0 Mute Off value	4.0 dB
	E_b/N_0 Mute Off	E_b/N_0 Mute Off	> E_b/N_0 Mute On value to 20.0 dB	4.5 dB
Data Port	Pure Data Mode		On, Off	Off
	AES/EBU Config	AES/EBU Control	Pro, Consumer	Pro
	Decoder Data	Decoder Data Source Select	Satellite, Local	Satellite

Monitor Commands

The ABR700 has several monitoring mechanisms that are constantly measuring the receiver operating environment. The monitor commands report the results of these measurements.

On the ABR700, the first command under Monitor is the Audio Status command. When the user views the Audio Status command, the right side of the display indicates any faults.

- If no faults exist, the right side of the LCD contains the word *Ok*. Pressing the Menu button displays the next Monitor command.
- If faults do exist, the word *Fault(s)* appears on the right side of the display. Using the Menu button, the user can scroll through these faults. If the Menu button is pressed after the last fault, the LCD displays the next Monitor command.

The monitor commands for the ABR700 are summarized in Table 5-3. For a detailed description of these commands, see *Chapter 6: ABR700 Command Descriptions.*

Table 5-3. Monitor Audio Status Command Summary

LCD Display	Description	Default	Reset at Front Panel
Data Rate	Audio data rate	256000	No
E_b/N_0 Sgnl Level	E_b/N_0 signal quality	—	No
AGC Gain	Demod IC AGC value (255=low signal)	—	No
E_b/N_0 Min Value	E_b/N_0 minimum value since reset	22.0 dB	Yes
E_b/N_0 Max Value	E_b/N_0 maximum value since reset	0.0 dB	Yes
Number of Fades	Number of fades since reset	0	Yes
Sync Losses	Sync loss count since reset	0	Yes
Local Offset	Local oscillator offset for most recently locked channel	0 Hz	No
Receiver ID	Display identification PROM (equipment ID)	—	No
Software Version			No

Resetting a Command

Some monitor commands can be reset to their defaults. To reset a command:

1. Move through the menu to the command you wish to reset.
2. Press the Select button. The current command value changes to the word *Reset*, which blinks.
3. Press the Enter button. The command resets to its default value.

The commands that can be reset are indicated in Figure 5-3 by the @ symbol.

Fault Commands

The fault commands provide information about fault-related conditions.

The FaultLog and Current commands are query only. The faults reported by either command are shown in Figure 5-3.

- FaultLog reports all faults reported since the last time a Clear command was issued.
- Current reports only real-time faults.

The Clear command clears the accounts of the faultlog and current fault list.

Lockout Feature

The front panel lockout mode can be set so that certain command values cannot be changed; they can only be viewed. Essentially, lockout mode turns such commands into query (read-only) commands. Figure 5-3 indicates those commands that can be locked out using this keying sequence with asterisks.

Using the Lockout Feature

To lockout front panel commands, simultaneously press the Menu, Select, and Esc buttons. The LCD then displays the default screen, and the front panel enters lockout mode.

To exit lockout mode, simultaneously press the Inc, Dec, and Enter buttons. The LCD reverts to the default screen, and front panel commands return to normal operation.

LCD Display Update

For configuration and monitor commands, the front panel display is updated every second to show the current command value for the item being viewed. If the user is in the FaultLog Menu, the Current Faults Menu, or the Audio Status Faults Menu, the display is not updated. Additionally, the Current Faults and Audio Status Faults Menus have 30-second timeout sequences that revert to the Faults Menu or the Main Menu, respectively.

Timeout

If the user leaves the unit in a screen other than the default, the display times out and reverts to the default screen in five minutes if no buttons are pressed.

COMSTREAM
A Spar Company

Chapter 6: ABR700 Command Descriptions

Overview

Commands are used to set or display ABR700 parameters. This chapter provides an alphabetical listing of all ABR700 front panel commands and a detailed description of each.

Command Descriptions

Table 6-1 lists the commands in alphabetical order by the way they appear on the front panel (LCD Display) and describes each command in detail.

Table 6-1. Command Listing Descriptions

LCD Display	Command	Syntax/Description	Default
AES/EBU Config	AES/EBU Consumer/ Pro Select	This command controls the selection of the Consumer/Pro option on the AES/EBU digital interface. Channel status bits are used for different purposes for Consumer and Pro. Parameters are: Consumer Pro	Pro
AGC Gain	AGC Register	This command reads the contents of the AGC register in the Demod IC. This register controls the analog front end gain. The value returned is an indication of the signal strength. A value of 0 corresponds to an over-saturated, strong signal, whereas a value of 255 corresponds to no signal being present.	—
Audio Out	Audio Mute	This command allows the user to activate the audio mute function. Parameters are: Unmute Mute	Unmute
Clear	Clear Fault Register	Clears FaultLog. All faults are shown on power-up; therefore, they must be cleared by the user before fault alarm messages will be sent.	—
Current	Status Register	This command causes the receiver to display the current content of the status register. The FaultLog gives the faults that have occurred since the last time the fault register was cleared. The Current command gives the current condition of those fault monitors.	—

Table 6-1. Command Listing Descriptions (continued)

LCD Display	Command	Syntax/Description	Default
Decoder Data	Decoder Data Source Select	This command selects the input source for the audio decoder on the ABR700. When set to Local, the Musicam decoder in the ABR700 may be used to decode an external data source. Parameters are: Satellite Local	Satellite
E_b/N_0 Alrm Thrsh	E_b/N_0 Alarm Threshold	This command configures the receiver for a minimum E_b/N_0 threshold. An E_b/N_0 threshold error is generated whenever the value of E_b/N_0 is strictly less than the threshold value. The format for the threshold value is x.y or x in the range $0 < x \leq 22.0$, $0 \leq y \leq 9$.	4.0 dB
E_b/N_0 Max Value	E_b/N_0 Maximum	This command queries the receiver for the maximum E_b/N_0 value recorded since the last time this command was cleared. Resetting the command returns the maximum E_b/N_0 value to 0.	0.0 dB
E_b/N_0 Min Value	E_b/N_0 Minimum	This command queries the receiver for the minimum E_b/N_0 value that was measured since the last time the minimum value was reset. Reset sets the minimum value of E_b/N_0 to the highest possible E_b/N_0 value. The minimum value is not affected if the receiver loses lock.	22.0 dB
E_b/N_0 Mute Off	E_b/N_0 Mute Off	This command allows for unmuting the output audio based on the received signal quality (E_b/N_0). The audio mute is unmuted when the E_b/N_0 value rises to or above the specified E_b/N_0 value. It is used in conjunction with the E_b/N_0 Mute On command, which mutes the output audio. The valid range is > the E_b/N_0 Mute On value to 20.0 dB.	4.5
E_b/N_0 Mute On	E_b/N_0 Mute On	This command allows for muting the output audio based on the received signal strength (E_b/N_0). The audio is muted when the E_b/N_0 value falls to or below the specified E_b/N_0 value. It is used in conjunction with the E_b/N_0 Mute Off command, which enables the output audio. The valid range is 0.1 dB to < the E_b/N_0 Mute Off value.	4.0
E_b/N_0 Signal Level	Display E_b/N_0	This command reads the current value of E_b/N_0 as calculated from the interval processing. An estimate of the E_b/N_0 is returned in the range of 3 dB to 20 dB for rate 1/2 coding. The E_b/N_0 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 ABR700 acquisition and is updated every five seconds. The E_b/N_0 value can be used to initiate several receiver functions, such as muting audio (E_b/N_0 Mute On and E_b/N_0 Mute Off commands), activating the E_b/N_0 threshold alarm, and setting the condition of the front panel signal indicator. N/A indicates the E_b/N_0 is temporarily not available.	—
FaultLog	Accumulated Fault Mappings	This command queries the receiver for the accumulated fault history of the receiver. Fault codes and response values are retained in a fault register until the faults are cleared using the Clear command.	—
Lft/Rht Togl	Left/Right Channel Toggle	This command instructs the receiver to reverse the LR audio channels. Parameters are: Normal — Left input goes out on left channel, Right input goes out on right channel Reversed — Left input goes out on right channel, Right input goes out on left channel Lft on Both — Left input goes out on both channels Rht on Both — Right input goes out on both channels	Normal

Table 6-1. Command Listing Descriptions (continued)

LCD Display	Command	Syntax/Description	Default
Local Offset	Local Oscillator Offset	This command queries the receiver for the value of the effective offset between the input RF frequency and the demodulator IF frequency in kilohertz. These offsets include the offset present in the LO of the downconverter and the LO of the receiver, as well as those of the uplink and satellite. With a knowledge of the actual offsets present at the receive site, the ABR700 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.	0 Hz
Number of Fades	Number of Fades	This command queries the receiver for the number of fade acquisitions the receiver has performed since the last time the NF value was reset. Power-on and channel change acquisitions are not included in the NF value. A fade is the same as a carrier outage.	0
Pure Data Mode	Decoder Data Source Select	This command enables the pure data mode. In pure data mode, the receiver is limited to the 64,000 bps data rate. Received data is delivered through the Musicam output pins on the Auxiliary port. Parameters are: Off On	Off
Rec Freq	Receiver Synthesizer Frequency Input	This command reads or sets the RS frequency input into the receiver that is to be downconverted to baseband data. The query returns a value that is in units of megahertz. Valid values range from 52.000 to 88.000.	70.000 MHz
Receiver ID	Display Identification PROM	This command displays the ABR700 ID PROM value (equipment ID). The ID number should be identical to the unit serial number displayed on the label on the rear panel.	—
Relay Mask	Status Relay Mask	This command sets or reads the status relay mask. The parameter is a decimal number that represents the bit map of the faults to be monitored by the status relay. The mappings are shown in Table 6-2. For example, to set faults 6, 7, and 8, you would input 0x100 (0x20+0x40+0x80) as the value of the parameters.	0xDF7FFFFF
Reset to Defaults	Master Reset	This command allows the user to reinitialize the receiver's nonvolatile parameters to the factory default settings.	—
RS-232 Baud Rate and RS-232 Data/Parity	RS-232 Monitor and Control Port Configuration	This command configures the diagnostic port for the specified operating parameters. Valid values for these parameters are shown below. **Parameter** **Valid Values** Baud 300,1200,2400,4800,9600 Parity O (odd), N (none), or E (even) Data bits 7 or 8 Stop bits 1 or 2	1200,O,7,1

Table 6-1. Command Listing Descriptions (continued)

<table>
<tr><th>LCD Display</th><th>Command</th><th>Syntax/Description</th><th>Default</th></tr>
<tr><td>RS-485 Address</td><td>Packet Address</td><td>This command allows the user to set the packet address of the receiver. The packet address is the external device address that the receiver responds to when attached to an RS-485 multidrop bus. Using a terminal program that supports the NPR/IBM Serial Control Bus packet protocol, all devices on this bus can be communicated with either individually or as a group. The receiver responds only to those commands that are addressed to it specifically or that are addressed to all devices on the bus. The valid values are 1 to 255.</td><td>100</td></tr>
<tr><td>RS-485 Baud Rate
and
RS-485 Data/Parity</td><td>RS-485 Satellite Operating Support System Port Configuration</td><td>These commands configure the SOSS Monitor and Control port for the specified operating parameters. The parameters are shown below.
Parameter Valid Values
Baud 300,1200,2400,4800,9600
Parity O (odd), N (none), or E (even)
Data bits 7 or 8
Stop bits 1 or 2</td><td>9600,N,8,1</td></tr>
<tr><td>Stat Rly Sense</td><td>Status Relay Sense</td><td>This command configures the remote status relay sense.
Parameters are:
Normal - status relay is normally open
Inverted - status relay is normally closed</td><td>Normal</td></tr>
<tr><td>Sync Losses</td><td>Sync Loss Count</td><td>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. Reset returns sync loss count to 0.</td><td>0</td></tr>
<tr><td>Test Mode</td><td>Audio Test</td><td>The audio test command selects the available audio test that the audio Digital Signal Processor (DSP) can perform.
Parameters are:
Off
1 kHz Lft Ch
1 kHz Rht Ch
1 kHz Bth Ch
9.6 kHz Lft Ch
9.6 kHz Rht Ch
9.6 kHz Bth Ch
The chart below provides detailed performance specifications for the audio tests.
Test Frequency Output Level THD Termination
Lft Ch 1.00 kHz +4.00 dBm 0.01% 100 K ohm
Rht Ch 1.00 kHz +3.25 dBm 0.01% 600 ohm
Bth 1.00 kHz +1.11 dBm 0.01% 150 ohm
Lft 9.60 kHz +4.00 dBm 0.01% 100 K ohm
Rht 9.60 kHz +3.25 dBm 0.01% 600 ohm
Bth 9.60 kHz +1.11 dBm 0.01% 150 ohm</td><td>Off</td></tr>
</table>

The mappings for the bit map of faults to be monitored by the status relay mask are shown in Table 6-2.

If a fault's decimal or hex weight is included in the mask, then that fault is monitored for status relay activation. If a fault's decimal or hex weight is not included in the mask, then an occurrence of that fault will not activate the status relay.

Table 6-2. Fault List 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 Fault	0x00000010	16
6	Bit Time Lock Fault	0x00000020	32
7	Carrier Lock Fault	0x00000040	64
8	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 Timeout Fault	0x00008000	32768
17	Audio Phase Lock Loop Fault	0x00010000	65536
18	Audio Sync Fault	0x00020000	131072
19	DSP Watchdog Fault	0x00040000	262144
20	DSP Bit Failure	0x00080000	524288
21	Auxiliary Input 1 Status	0x00100000	1048576
22	Auxiliary Input 2 Status	0x00200000	2097152
23	Auxiliary Input 3 Status	0x00400000	4194304
24	Not Used	0x00800000	8388608
25	E_b/N_0 Threshold Fault	0x01000000	16777216
26	Not Used	0x02000000	33554432
27	EPROM Checksum Fault	0x04000000	67108864
28	Download Fault	0x08000000	134217728
29	Channel Change Fault	0x10000000	268435456
30	No Network Identification Received Fault	0x20000000	536870912
31	Network Identification Timeout Fault	0x40000000	1073741824
32	Not Authorized	0x80000000	2147483648

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Chapter 7: Maintenance and Troubleshooting

Overview

This chapter describes how to maintain the ABR700. It lists key performance monitoring commands and possible fault conditions. It also details steps for troubleshooting problems and summarizes test point information.

Maintenance

The ABR700 does not require periodic or preventive maintenance. In addition, an inline fuse—located within the power supply inside the receiver—protects the power input. This fuse is designed to protect the unit from internal damage in the event of a severe power line condition or internal failure. It is not user-serviceable. A lithium battery is used to power the nonvolatile memory while power is off. This battery's average lifetime is 10 years.

Performance Monitoring

The ABR700 is designed to monitor the performance of its own key system parameters. The commands listed in Table 7-1 are especially useful for helping you determine your system's overall performance.

These commands are available from the Front Panel. Select the Monitor at the Main Menu. Press the Menu button to go to Audio Status, and then keep pressing the Menu button until the specific command appears in the display area. For more information on using the front panel commands, see *Chapter 5: Front Panel Operations.*

Use these commands periodically for each of your receivers and, if improvement of system performance proves necessary, make the adjustments described in the table.

Table 7-1. Key Performance Monitoring Commands

LCD Display	Command	Description
E_b/N_0 Min Value	Minimum E_b/N_0 Value	This command measures and records the minimum receive signal value E_b/N_0. The parameter indicates how weak the receive signal has become, owing to impacts such as local weather conditions, fades, uplink stations operating at different powers, coverage differences among satellite transponders, or antenna misalignment since the last time the parameter was reset. It is possible to determine actual system availability based on measured fades. If actual numbers differ from the desired availability, corrective action can be taken. The receive antenna can be realigned or up-sized.
Number of Fades	Number of Fades	This command records the number of RF signal fades or outages that have occurred since the last time the counter was reset. While the Minimum E_b/N_0 Value command records the lowest signal level, the Number of Fades command records the number of signal fade events. A fade event occurs when the receiver loses RF signal lock for any reason other than receive channel changes. A fade causes a disruption in audio and data. Typically, weather conditions, A/B switching, or switches from one uplink to another on the same channel could be the cause. Antenna obstruction by a large truck or interconnection cable damage could also cause intermittent connections. Receiver sites that record unusual fade events should be investigated to determine the cause so that uninterrupted service can be provided.
Sync Losses	Sync Loss Count	This command records the number of audio decoder sync losses since it was last reset. An audio sync loss normally occurs when a fade condition exists; however, in some instances the decoder may lose synchronization with the uplink audio encoder. Very low signal levels (between 3.0 and 3.5 dB E_b/N_0) may cause sufficiently high bit error rates, which, in turn, might cause the decoder to lose sync (but not cause an RF sync loss.) Additionally, if the uplink encoder began to operate marginally, all receive sites will record decoder sync loss events, though they may not all record the same number of events. The monitoring of audio sync losses eases system-wide and/or individual receive site troubleshooting.

Fault Conditions

The ABR700 identifies certain fault conditions for you. Table 7-2 lists the cause for each fault condition and, where appropriate, indicates when a persistent fault condition means the unit requires servicing.

You can view the faults from the front panel. From the Main menu, select Faults. From the Faults menu, select FaultLog to view accumulated faults and Current to view current faults. For more information on using the front panel to view faults, see *Chapter 5: Front Panel Operation.*

Table 7-2. Fault Conditions and Their Causes

Fault Condition	Cause
AGC Range Fault	This fault condition exists when the input signal to the demodulator for the currently received channel is less than -80 dBm or greater than -20 dBm (approximately).
Bit Time Lock Fault	This fault condition exists when the demodulator bit time loop has lost lock. The receiver output data is disabled when this fault occurs.
Carrier Tracking Lock Fault	This fault condition exists when the demodulator carrier frequency tracking loop has lost lock. The receiver output data is disabled when this fault occurs.
Forward Error Correction Decoder Sync Fault	This fault condition exists when the FEC decoder output bit error rate is greater than 10^{-2} (approximately).
Acquisition Range Fault	This fault condition exists when the demodulator has completed a search of all frequencies out to the limits defined by the B3 parameter (for a power-up acquisition) or B4 parameter (for a fade acquisition) and it has been unable to acquire a carrier (at any data rate).
Carrier Tracking Range Fault	This fault condition exists when the demodulator carrier tracking register has reached its maximum (or minimum) setting.
Bit Time Range Fault	This fault condition exists when the demodulator bit time accumulator has reached its maximum (or minimum) setting.
Nonvolatile Memory Fault	This fault condition exists when one of the parameters in the demodulator nonvolatile memory may have become corrupted. If this indication occurs repeatedly, the nonvolatile memory is defective.
Carrier Tracking DDS Fault	This fault condition exists when any errors are detected in the carrier tracking Digital Data System during power-up initialization. The fault indicates a hardware failure with the carrier tracking Application Specific Integrated Circuit (ASIC).
Bit Time DDS Fault	This fault condition exists when any errors are detected in the bit time DDS during power-up initialization. The fault indicates a hardware failure with the bit time ASIC.

Table 7-2. Fault Conditions and Their Causes (continued)

Fault Condition	Cause
Watchdog Timer Fault	This fault condition exists when the demodulator microprocessor fault timer has failed to reset. A Watchdog Timer fault normally indicates a memory fault, which means the unit may be operating in an unintended manner. When this fault occurs, the receiver automatically resets. If this fault occurs repeatedly, contact the NPR Satellite Maintenance and Repair Depot.
Phase Lock Loop Lock Fault	This fault condition exists 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 does not clear when you cycle the power off and on, return the receiver to the NPR Satellite Maintenance and Repair Depot for servicing.
Audio Decoder Sync Fault	This fault condition exists when the receiver audio decoder is not in synchronization with the audio encoder at the uplink. This condition normally occurs if RF sync is not achieved.
Digital Signal Processor (DSP) Watchdog Fault	This fault condition exists when the DSP audio decoder is not functioning normally. If this fault persists, return the unit to the NPR Satellite Maintenance and Repair Depot for servicing.
DSP Built-in Test Failure	This fault condition exists when the DSP audio decoder built-in tests do not successfully pass during startup. If this fault persists, return the unit to the NPR Satellite Maintenance and Repair Depot for servicing.
E_b/N_0 Threshold Fault	This fault condition exists when the measured RF signal level (E_b/N_0) has dropped below the level set by the E_b/N_0 Alarm Thrsh menu item.
EPROM Checksum Fault	This condition exists when the main control processor memory has been corrupted and is not functioning normally. If this fault persists, the unit should be returned for servicing.
Software Download Failure	This fault condition exists when software download has been unsuccessful. The control processor operates from the EPROM firmware while this fault is active. When the download succeeds, this fault automatically clears.
Network ID Timeout Fault	This fault condition exists when the network ID information is not received over the ancillary channel every 100 seconds. Typically, it indicates that a problem exists at the uplink or that you are tuned to a network to which your station does not subscribe; however, if other receivers in the correct network are not showing this alarm condition, the unit may need servicing.
Site ID Not Authorized Fault	This fault condition exists when the receiver has RF sync, but the receiver's ID is not authorized to receive the programming.

Troubleshooting

When problems arise that do not pertain to the aforementioned fault conditions, you should review this section as an aid to isolating equipment problems and performing appropriate actions to solve them. If you cannot solve a particular problem, contact your ComStream distributor or uplink provider. If you purchased this equipment directly from ComStream, contact the NPR Satellite Maintenance and Repair Depot 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 rack in which the ABR700 is mounted located in a closet? If so, is there sufficient air circulation in the closet? Is the ABR700 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?
- Has anyone recently worked on the equipment or been near the satellite dish? If so, visually inspect the equipment to ensure that:
  - Power has not been turned off
  - No cables are loose
  - No connectors are damaged
- Are other downlinks experiencing any problems?

Troubleshooting Process

Tables 7-3 and 7-4 have been developed to help diagnose and correct minor problems in the unlikely event difficulties occur with your ABR700. A quick reference troubleshooting flowchart is also provided in *Appendix D: Troubleshooting Flowchart*. If you decide to use the flowchart and find that you need additional information, refer back to this section.

Table 7-3. Troubleshooting Symptoms and Actions

Symptom	Action
Unable to communicate with the receiver through the RS-232 ASCII Monitor and Control port	The RS-232 port is not necessary. Configuration and normal operation can be performed from the front panel. 1. Ensure the correct terminal, cable, and configuration are 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 **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, is an active input (high) of the M&C port. d. Check that the terminal is configured properly: full-duplex ASCII communications at 1200 baud, 7 data bits, odd parity, and 1 stop bit (default). 2. Once the terminal has been connected and configured, press Enter to see if the login message displays. If the login message: a. Does not display, contact the NPR Satellite Maintenance and Repair Depot. b. 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 NPR Satellite Maintenance and Repair Depot for technical support.
RF sync light is not illuminated	1. If the audio sync LED is illuminated, the unit requires servicing. 2. If it is not, ensure the configuration parameters are correct for the installed application. Contact the NPR Satellite Maintenance and Repair Depot. 3. If the configuration parameters have been confirmed: a. Ensure proper signal is present. b. If required, repeak the antenna.

Table 7-3. Troubleshooting Symptoms and Actions (continued)

Symptom	Action
Audio sync light is not illuminated	If the RF sync LED is not illuminated, check with the network provider 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.
No audio output, but RF and audio sync lights are illuminated	1. Check default screen of front panel for authorization. 2. Check the audio status to ensure audio operation is permitted. If it is not, check with the network provider 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 (the Test Mode front panel menu item) 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 the NPR Satellite Maintenance and Repair Depot for technical support.
Audio is highly distorted or garbled	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, a wiring problem to the external equipment exists; you should therefore operate the external equipment via a distribution amplifier.
Audio has unusually high background noise	When operating in joint stereo mode, a high background (common mode) noise indicates a phase reversal exists at the encoder's audio inputs. 1. Have the uplink 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 (for example, + only), the output level is down 6 dB when compared to balanced operation.
No data, but RF and audio sync lights are illuminated	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-through). Auxiliary port pinouts are described in *Appendix A: Interface Pinouts.*
Unable to communicate with the receiver through the RS-485 SOSS Monitor and Control port	1. Check the serial control bus wiring between the SOSS computer and this receiver to ensure that it is intact and contains no reversals of the wire conductors. 2. Check the serial port number on the breakout box of the SOSS computer being used to communicate with this receiver. Ensure that it matches the port number for this receiver shown on the setup screen. 3. Check to ensure that the receiver RS-485 address matches the one shown on the setup screen of the SOSS computer.

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Chapter 8: Technical Specifications

Overview

This chapter details performance, mechanical, and environmental specifications for the ABR700. It also specifies information regarding the ABR700's three rear panel ports.

The ABR700 shall meet the performance requirements presented in this chapter. Additional performance requirements include:

- Data mode – The receiver shall have a data mode operating at 64 kbps. When the receiver is in this mode, 64 kbps data shall appear at the auxiliary connector.
- Auto baud – The receiver shall acquire the proper data rate in less than 10 seconds for 128 and 256 kbps, and less than 30 seconds for 64 and less than 50 seconds for 192 kbps, assuming a channel of usable E_b/N_0 and frequency.
- MPEG mute – When a noncompliant data stream is received, the audio outputs will be muted.
- Can be associated with a station and network for subscription purposes.
- Power-up – The receiver shall power up tuned to last frequency received.

The ABR700's front panel contains:

- Six buttons
- 2-by-24 line display area
- RF Sync LED
- Audio Sync LED
- ¼ inch stereo headphone jack

The buttons allow the user to move through a sequence of menus. (*Chapter 5: Front Panel Operation* describes button functioning, and *Chapter 6: ABR700 Command Descriptions* summarizes the commands.) The display area shows button entries and pertinent operating parameters such as bit rate, frequency, and operational status. The headphone jack allows the user to monitor audio output.

The ABR700's rear panel contains ports for remote control (M&C), audio out (audio), and data output (AUX) connectors. Details on these rear panel ports appear in the final section of this chapter.

Performance

IF

Input frequency	52 to 88 MHz
Input signal level	-20 to -80 dBm per channel (75 ohm)
Terrestrial interface rejection	TI at -20 dBm ±2 MHz from carrier at -55 dBm
Frequency synthesis	10 Hz
Acquisition range	0 to ±100 kHz, initially set for ±50 kHz tracking ±25 kHz
Demodulation type	QPSK
FEC decoding	Rate 1/2 sequential
BER performance	128 kbps (QPSK) 2.5 x 10^{-2} at 4.0 dB E_b/N_0 within 1 dB theoretical; 128 kbps (QPSK) 2 x 10^{-2} at 4.5 dB E_b/N_0
Audio threshold	4.0 E_b/N_0 (QPSK)
Symbol rates	64, 128, 192, 256 kbps (QPSK)
AGC monitor	0 to 10 VDC
Channel selectivity	Channel may be spaced 1.4 x encoded symbol rate with no degradation; adjacent channel at same level and symbol rate

Audio

Frequency response	15 Hz to 20.0 kHz ±0.5 dB for MPEG rate >64 kbps; 20 Hz to 8.25 kHz ±0.5 dB for MPEG rate ≤64 kbps
Audio output levels	Average Program Level (APL) = 4 dBu; Peak Program Level (PPL) = 18 dBu
Audio output channels	1 or 2
Operating modes	Mono, discrete stereo, joint stereo
Compression	ISO/MPEG (Musicam) Layer II/IIa
ISO/MPEG rates	64, 128, 192, 256 kbps
Channel change time	<450 msec, excluding acquisition time
Total harmonic distortion	<0.2% at 1 kHz
End-to-end dynamic range	>82 dB (1 kHz tone at 100 Hz bandwidth)
Signal-to-noise	>82 dB (1 kHz tone at 18 dBu, measured 10 Hz to 22 kHz)

Idle channel noise	Better than -64 dBu unweighted, 600 ohms termination
Channel mute	< -100 dB (unweighted) relative to +18 dBu
Crosstalk (2 channel)	Better than -80 dB_r referenced to +18 dBu
Digital sampling rate	48 kHz
Stereo phase deviation	<3.0° for 10 Hz to 20 kHz
Output level	Max +18 dBm into 600 ohms
End-to-end gain	±0.25 dB
Output impedance	60 ohms (short-circuit protected)

SOSS Interface Capabilities

Electrical interface	RS-485 multidrop
Software network control	IBM SOSS serial control protocol
Addressing	By unit; address can be set at front panel
Receiver control	Receive frequency, status, selection
Operating speed	300, 1200, 2400, 4800, 9600
Data and Parity	N,8,1; O,8,1; O,7,1; E,8,1; E,7,1

Monitor and Control Capabilities

Monitor	Receive signal level (E_b/N_0) based on channel error rate, AGC level, bit error rate, equipment alarms and faults, performance monitoring
Control	Receive channel configuration, alarm reporting, and so on
Remote control interface	300, 1200, 2400, 4800, 9600 baud
Status (Front Panel)	Power, RF Sync, Audio Sync

Auxiliary

AES/EBU	RS-422 at 3.072 Mbps
MPEG/pure data	RS-422 at encoded rate or 64 kbps if pure data

Mechanical

Size	1.75" H x 16.75" W x 15" D (19" rack-mount)
Weight	<13 lbs
Shipping weight	24 lbs

Environmental

Power	
Operating range	90 to 264 VAC
Operating frequency	47 to 63 Hz
Power consumption	<40 watts typical
Temperature	
Operating	0 to 50°C
Nonoperating	-20 to 70°C
Humidity	
Operating	0 to 95% noncondensing
Nonoperating	0% to 100% noncondensing
Altitude	
Operating	10,000 ft
Nonoperating	50,000 ft
Safety/Emissions	UL 1950 Listed CSA 950 Certified Meets FCC Part 15B, Class A

Rear Panel Ports

Monitor and Control Port

Interface type

Asynchronous RS-232 and addressable RS-485 multidrop using

Connector

DB-9, female

Transmit data + (RS-485)	1
Signal ground	5
Transmit data - (RS-485)	7
Receive data + (RS-485)	8
Receive data - (RS-485)	9
Receive data (RS-232)	2
Transmit data (RS-232)	3
Not used	4
Not used	6

Default parameters

RS-232: 1200, odd parity, 7 data bits, odd parity, 1 stop bit,
RS-485: 9600,N,8,1

Functions

Performs unit configuration, diagnostics, and status
RS-232 connects to ASCII terminal or telco modem
RS-485 connects to NPR/IBM Satellite Operating Support System

Audio Out Port

Connector

DB-9, male

Left audio -	1
Left audio +	2
Right audio -	4
Right audio +	5
Audio ground	6
Audio ground	9

Function

Left and right channel analog audio output

Auxiliary Port

Connector

DB-15, female

Signal ground	1
DSC/MPEG data (RS-422) - [A]	3
DSC/MPEG clock (RS-422) - [A]	4
AGC output	5
AES/EBU out – [A]	8
DSC/MPEG data (RS-422) + [B]	10
DSC/MPEG clock (RS-422) + [B]	11
AES/EBU out + [B]	15
External receive data (RS-422) + [B]	14
External receive data (RS-422) - [A]	7
External receive clock (RS-422) + [B]	13
External receive clock (RS-422) - [A]	6
Status relay NO	2
Status relay com	9

Functions

AES/EBU digital output (48 kHz sampling rate);
AGC monitor voltage (1 pin);
Receiver fault alarm relay, normally open;
Synchronous composite data stream input/output with clock, RS-449 levels

Appendix A: Interface Pinouts

Monitor and Control Port

Table A-1 details the interface pinouts for the M&C port.

Table A-1. DB-9 Female, RS-232/RS-485 Connector

Pin #	I/O	Name	Description
1	I	TD+	Transmit Data, RS-485 (+) [B]
2	O	RD	Receive Data, RS-232
3	I	TD	Transmit Data, RS-232
4	—	—	Not Used
5	O	SG	Signal Ground
6	—	—	Not Used
7	I	TD-	Transmit Data, RS-485 (-) [A]
8	O	RD+	Receive Data, RS-485 (+) [B]
9	O	RD-	Receive Data, RS-485 (-) [A]

Audio Output Port

Table A-2 details the interface pinouts for the audio output port.

Table A-2. 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-3 details the interface pinouts for the data (AUX) port.

Table A-3. 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 (-) [A]
4	O	RT-	Receive Timing RS-422 (-) [A]
5	O	AGC	AGC Output Voltage 0-10 VDC
6	I	BBRT-	External Receive Timing RS-422 (-) [A]
7	I	BBRD-	External Receive 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 (+) [B]
11	O	RT+	Receive Timing RS-422 (+) [B]
12	—	—	Not Used
13	I	BBRT+	External Receive Timing RS-422 (+) [B]
14	I	BBRD+	External Receive Data RS-422 (+) [B]
15	O	DIGOUT+	AES/EBU Digital Audio Out (+)

[A] Denotes primary signal for differential input/output
[B] Denotes return signal

Appendix B: Antenna Peaking

Overview

This appendix describes the activities necessary to perform antenna AGC adjustments, which is one of the steps involved in aligning the antenna with which the ABR700 will operate.

NOTE: To ensure overall system performance, it is imperative to verify antenna alignment by peaking the antenna.

For the ABR700 to operate successfully within the system, the antenna with which it operates must be properly aligned. The antenna alignment process includes 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). If no carriers are received after coarse alignment, move azimuth or elevation in small increments, and give the ABR700 one minute to acquire at each new position.
4. Peak the antenna by maximizing the receive signal.
5. Record final antenna-aiming values.

Step 4, peak the antenna by maximizing the receive signal, is the sole subject of this appendix. For information regarding the other steps to align the system's antenna, refer to the applicable documentation supplied by the antenna manufacturer or maintenance depot.

Tool/Equipment Requirements

To properly align the antenna, you need the following tools and test equipment:

- Adjustable, open-end wrenches for all pointing and polarization hardware on your antenna
- Permanent ink (felt-tip) marking pen

In addition, to perform initial coarse pointing, you will find the following tools helpful:

- Inclinometer
- Magnetic compass
- Calculator (for computing azimuth, elevation, and polarization)

Antenna Peaking

The time and effort needed to perform the steps outlined here are well worth potential gains in system performance.

Elevation Peaking

To achieve the optimum elevation peak:

1. Connect a pair of wires from the ABR700 AGC output (J3, Pin 5) and ground (J3, Pin 1) signals to a voltmeter.
2. Observe the AGC voltage on the voltmeter. Make one clockwise turn of the elevation adjustment bolt.
3. Check the AGC voltage. Lower voltage indicates increased signal strength.
   - If the voltage remains the same or decreases, continue to increase the elevation angle one turn at a time with voltage measurements between each adjustment until the voltage increases.

     Once the voltage increases, stop and proceed to decrease the elevation angle (counter-clockwise turns) until the voltage increases again. Keep track of how many turns are made. Divide the number of turns by two and increase the elevation by that many turns. The measured voltage should be at its lowest value.
   - If the voltage increases after the first increase in the elevation angle, decrease the elevation angle (counter-clockwise turns) and note the peaking voltage until it dips then increases again.

     Keep track of how many turns are made. Divide the number of turns by two and increase the elevation by that many turns. The measured voltage should be at its lowest value, and the E_b/N_0 should be at its highest value.
4. Tighten the locking mechanism on the elevation adjustment bolt. To ensure that tightening this mechanism does not cause a drop in the E_b/N_0, observe the AGC voltage or monitor the E_b/N_0 measurements while locking.

Azimuth Peaking

The procedure for achieving the optimum azimuth peak is similar to that for achieving the optimum elevation peak:

1. Change the azimuth in one direction very slightly and perform E_b/N_0 or AGC voltage measurements after each change until:
   a. E_b/N_0 decreases
      or
   b. AGC voltage increases
2. Repeat this process in the other direction until:
   a. Maximum E_b/N_0 measurement is obtained
      or
   b. Minimum AGC voltage is obtained
3. Tighten the locking mechanism. To ensure that tightening this mechanism does not cause a drop in the E_b/N_0, observe the AGC voltage or monitor the E_b/N_0 measurements while locking.

Polarization Peaking

To achieve the optimum polarization peak:

1. Ask the Public Radio Satellite System Technical Center or NPR Satellite Maintenance and Repair Depot for advice on how to test for best polarization.
2. Tighten the polarity locking mechanism.

Final Steps

To complete the antenna-peaking procedure:

1. Verify that all locking mechanisms and bolts on the antenna are securely tightened.
2. Using the marking pen, mark the azimuth, elevation, and polarization settings.
3. Remeasure the azimuth, elevation, and polarization, and then record these values for future reference.

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Appendix C: Software Revision History

Audio Broadcast Receiver Control Software

Version 2.00, Release Date: 03/95

This release is the initial version of the ABR700 control software.

Audio Decoder Software

The revision number of the decoder software can be displayed from the front panel.

This release is the initial version of the audio decoder software issued for use with the ABR700:

Version 1.16, Release Date: 01/93

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Appendix D: 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 ABR700.

The first two pages of the flowchart list the primary symptoms you may experience. Whenever you experience any difficulties with the ABR700, 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, start at the beginning of the flowchart and work through each symptom again.

If you need additional information while working through the flowchart, refer to *Chapter 6: Maintenance and Troubleshooting*.

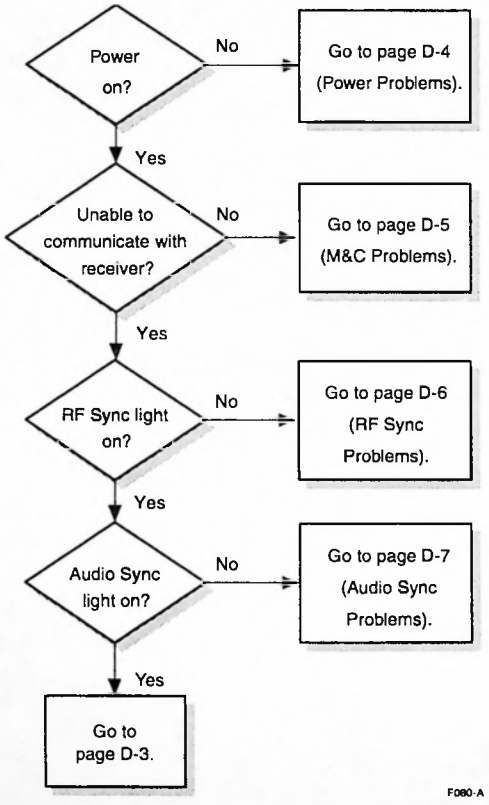


Figure D-1. Troubleshooting Flowchart (Page 1 of 10)

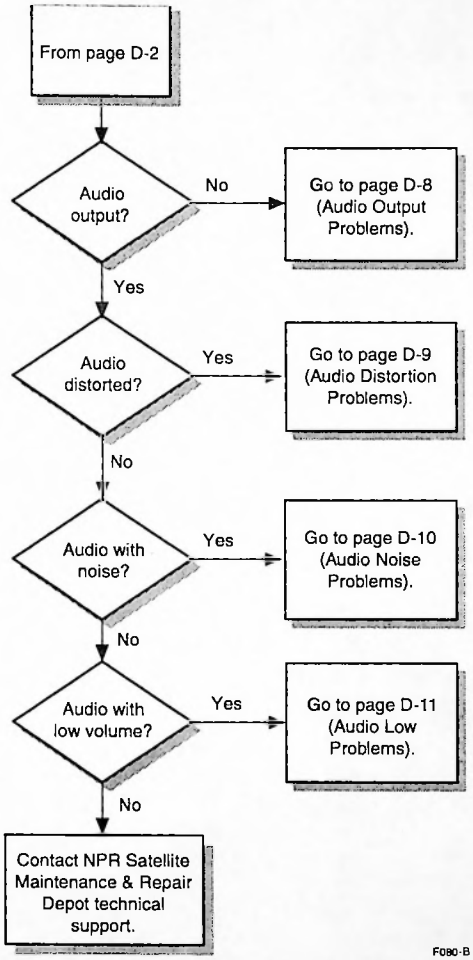


Figure D-1. Troubleshooting Flowchart (Page 2 of 10)

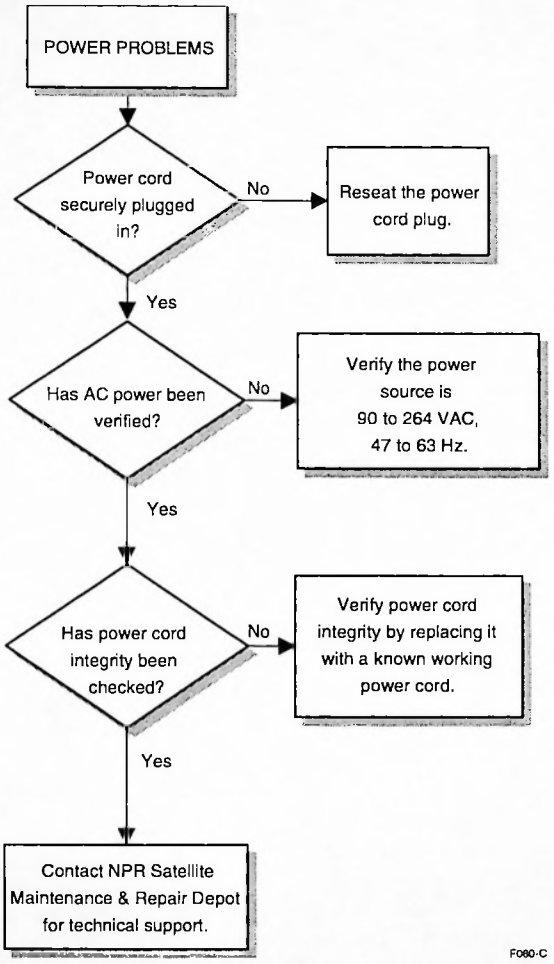


Figure D-1. Troubleshooting Flowchart (Page 3 of 10)

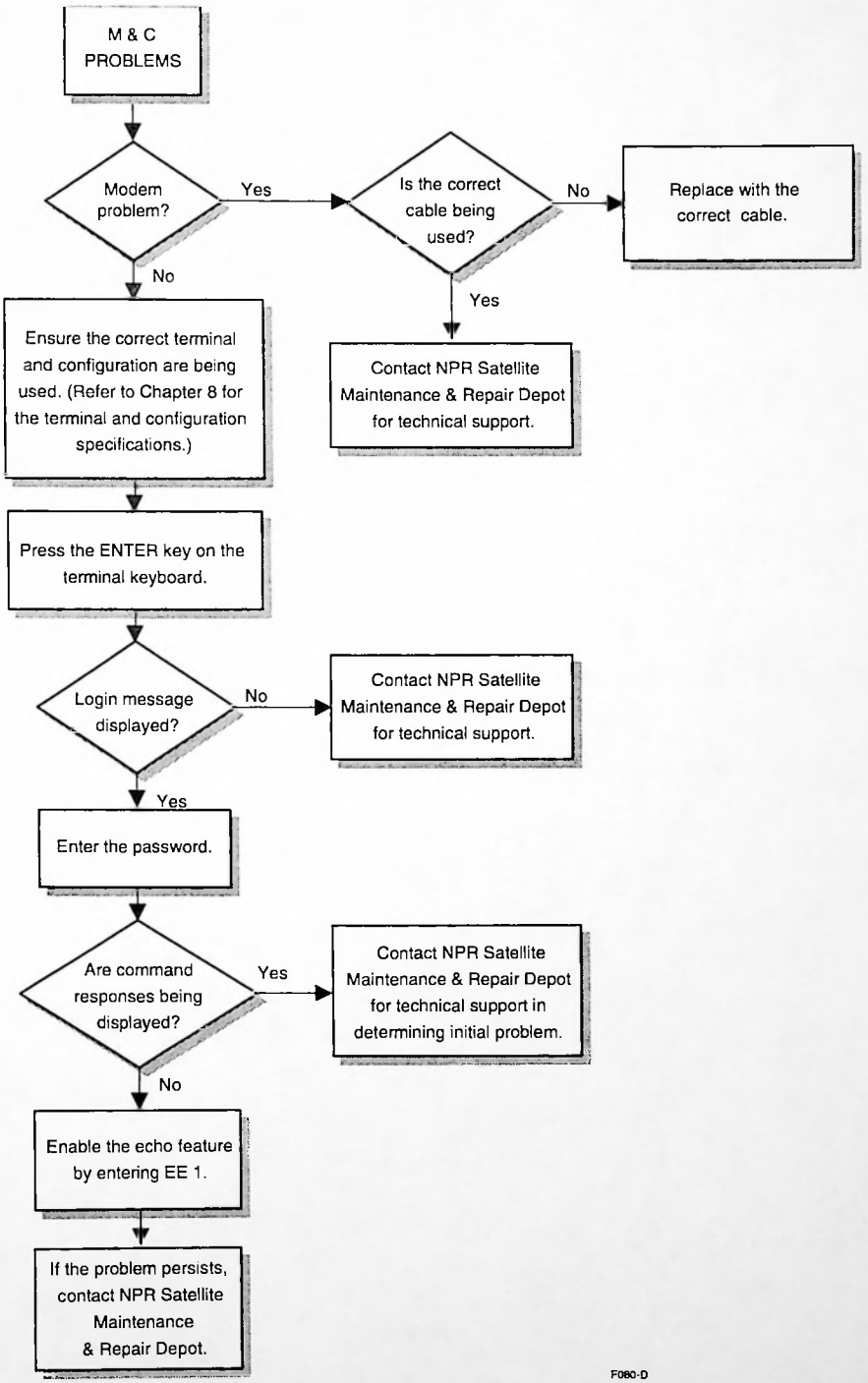


Figure D-1. Troubleshooting Flowchart (Page 4 of 10)

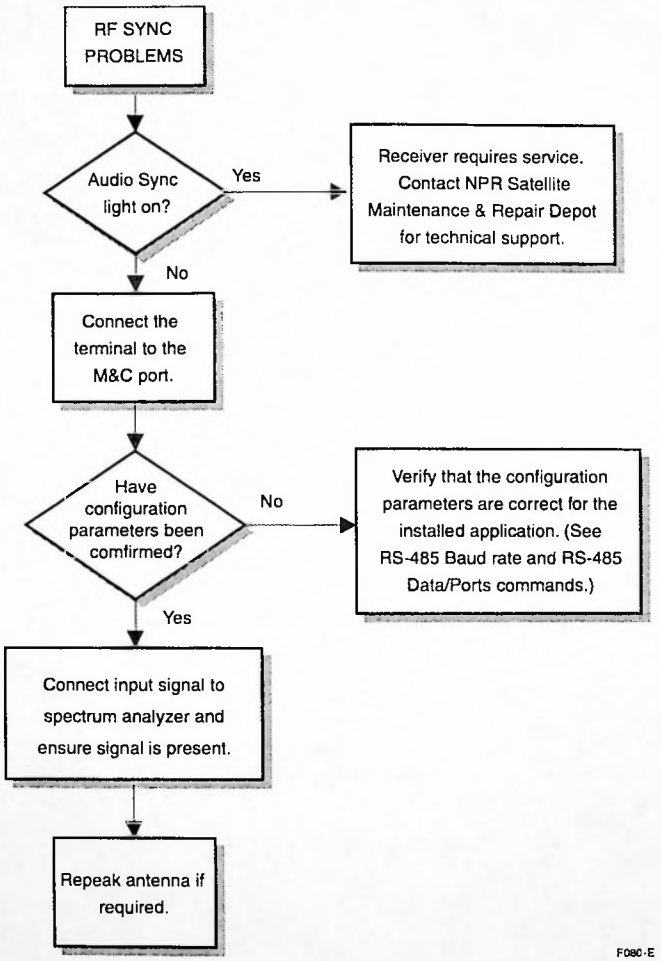


Figure D-1. Troubleshooting Flowchart (Page 5 of 10)

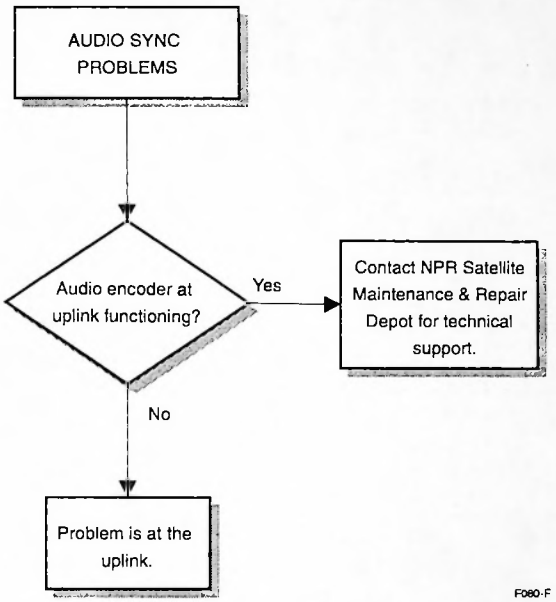


Figure D-1. Troubleshooting Flowchart (Page 6 of 10)

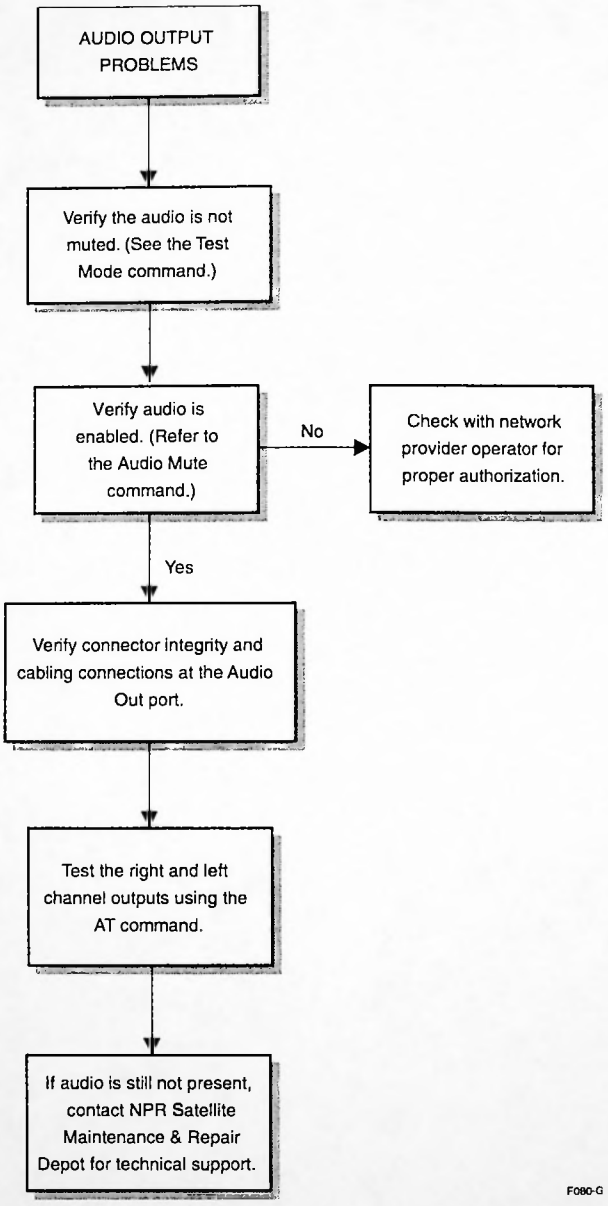
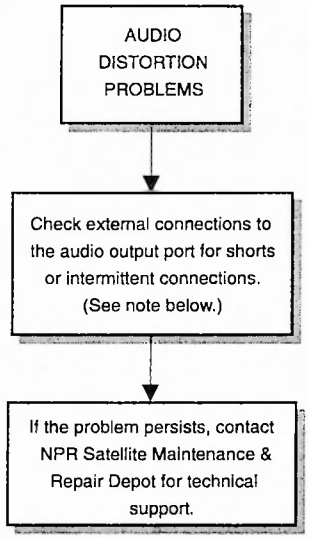


Figure D-1. Troubleshooting Flowchart (Page 7 of 10)



NOTE:
If audio output feeds several pieces of equipment, disconnect the equipment and monitor the audio at the connector. If the problem disappears, a wiring problem to the external equipment exists or operate the equipment via a distribution amplifier.

F080-H

Figure D-1. Troubleshooting Flowchart (Page 8 of 10)

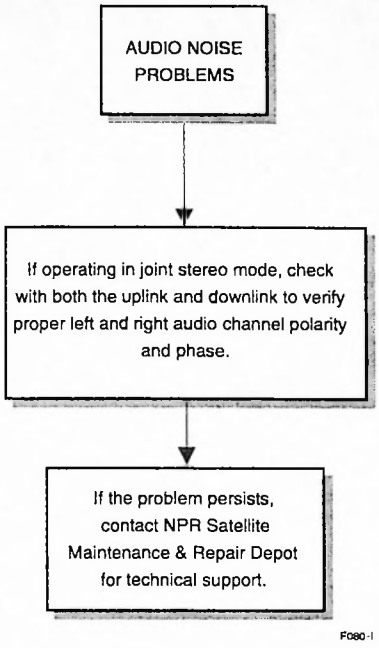


Figure D-1. Troubleshooting Flowchart (Page 9 of 10)

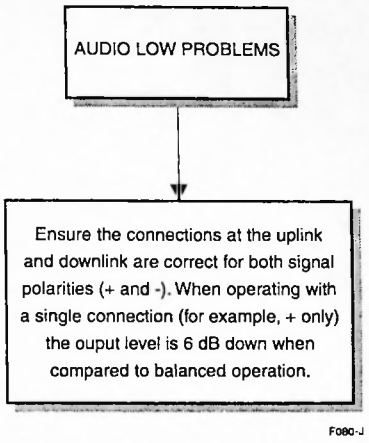


Figure D-1. Troubleshooting Flowchart (Page 10 of 10)

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Appendix E: List of Acronyms

ABR	Audio Broadcast Receiver
AES/EBU	Audio Engineering Society/European Broadcast Union
AGC	Automatic Gain Control
AO	Acquisition Offset
APL	Average Program Level
ARA	Audio Recording Automation
AS	Audio Status
ASIC	Application Specific Integrated Circuit
AT	Advanced Technology
BPSK	Bi-Phase Shift Keying
CC	Channel Configuration
DACS	Digital Access and Cross-Connect System
dB	Decibel
dBm	Decibels referenced to 1 mW
dB_r	Decibels above reference
dBu	Decibels below 1 uW
DDS	Digital Data System
DSC	Downlink Services Channel
DTR	Data Terminal Ready
DRO	Dielectric Resonance Oscillator
DSP	Digital Signal Processor
DTE	Data Terminal Equipment
E_b/N_0	Energy Per Bit to Noise Power Density Ratio
EPROM	Erasable Programmable Read Only Memory
ERP	Effective Radiated Power

FCC	Federal Communications Commission
FD	Format Definition
FEC	Forward Error Correction
FS	Format Select
Hz	Hertz
ID	Identification
IF	Intermediate Frequency
ISO	International Organization for Standardization
kbps	kilobits per second
kHz	Kilohertz
LCD	Liquid Crystal Display
LED	Light Emitting Diode
LNA	Low Noise Amplifier
LNB	Low Noise Block
LR	Left and Right
M&C	Monitor and Control
MHz	Megahertz
MPEG	Motion Picture Experts Group
MR	Master Reset
mW	Milliwatt
PC	Personal Computer
PCM	Pulse Coded Modulation
PPL	Peak Program Level
PROM	Programmable Read Only Memory
QPSK	Quadrature Phase Shift Keying
RAM	Random Access Memory
RMA	Return Material Authorization
RF	Radio Frequency
RS	Receive Synthesizer

SCPC	Single Carrier Per Channel
SOSS	Satellite Operating Support System
SR	Status Relay
TB	Terrestrial Backlink
TI	Terrestrial Interferer
TTL	Transistor-Transistor Logic
UPS	Uninterruptible Power Supply
V	Volt
W	Watt

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