MODEL DCR-974 *DIGICEIVER* ®

Description
Installation
Operation
Maintenance

International Communications Products, Inc.

Model DCR-974 *DigiCeiver*®

Description, Installation, Operation and Maintenance

International Communications Products, Inc.
242 Riverwalk Drive
Melbourne Beach, Florida 32951, USA

DCR-974 *DigiCeiver*® Installation, Operation, and Maintenance Manual
Preliminary Version: November 2000
First Revision: May, 2002
Second Revision: Mar, 2008

Notice

International Communications Products, Inc. (ICP) has developed this equipment to meet the requirements of its customers. The equipment is designed to be safe when installed and used with normal care. Users should carefully follow the instructions in this manual. All cautions and warnings must be observed to avoid possible damage to equipment and dangerous electrical shock. ICP is specifically not liable for damage or injury if workers do not follow instructions given in this manual or other related publications, or are careless in performing installation, operation, checkout, or service operations on the equipment and/or other products herein described.

International Communications Products, Inc., does not assume any liability arising out of the application or use of any products, circuits, or software described herein or in other publications. ICP, Inc., reserves the right to make changes, without notice, in the products described in this manual, or in the contents of this manual.

****

NOTE: The Model DCR-974 Receiver described herein complies with Part 15 of FCC Rules. Operation of the receiver is subject to the following two conditions:

1. The device may not cause harmful interference, and
2. The device must accept any interference received, including interference that may cause undesired operation.

****

WARNING

This manual contains special warnings that indicate possible dangers to personnel installing and/or using this equipment or product. To avoid human injury, and/or possible damage to equipment, *carefully follow all instructions and warnings contained herein*. Exercise care in handling and servicing the equipment or product. When power is on, substantial currents or voltages may be present, either through design or short circuit, which can produce shock hazards. Use care when lifting or hoisting equipment, especially heavy structures. Specifically, you should:

- Read all safety and operating instructions *before* using the product(s).
- Retain this manual for future reference, together with all other related safety, installation, maintenance, and operation information.
- Heed all warnings contained in this manual, in related documents, and/or affixed to the product(s).
- Follow all instructions relating to the installation, operation, and maintenance of the product(s).
- Ground (earth) the product(s), in accordance with accepted practices, for continued protection against the risk of electric shock, fire, and equipment damage. Use three-wire grounded electrical outlets, or otherwise ground to a secure, proven ground connection. Do not remove the grounding pin from the product cord.
- Ground outdoor antenna systems and cables to provide protection against voltage surges and built-up static charges. See Article 810 of the National Electrical Code, ANSI/NFPA 70, together with instructions from the manufacturer(s). These documents provide essential information regarding proper grounding of the antenna and its supporting structure, grounding the lead-in wire to the antenna discharge unit, connections to grounding electrodes, and the requirements for grounding electrodes.
- DO NOT locate outdoor antenna systems and components in the vicinity of overhead power lines or other light or power circuits, or where the antenna system might fall into such power lines or circuits. During installation and maintenance, exercise extreme care to avoid touching power lines and circuits with the body, tools, ladders, or cranes. ***Contact with power lines and circuits can be fatal.***
- There are no user serviceable parts inside the chassis. The user must not remove the cover from the unit. Installation of optional components, as described elsewhere in this manual, must be performed only by qualified service personnel.

Contents

(Continued)

Appendixes

Tables

Tables (Continued)

Illustrations

1 Description

1.1 About this Manual

This manual provides information to install and operate the Model DCR-974 *DigiCeiver*® Digital Satellite Receiver designed and manufactured by International Communications Products, Inc. A brief description of the unit, specifications, and basic principles of operation, are included for general reference. These sections are followed with complete instructions for installing, operating, and maintaining the unit. Guidelines for field-level troubleshooting are also given, but users are cautioned against attempting internal repairs without first consulting the system administrator or ICP, as appropriate.

1.2 Unit Description

The Model DCR-974 is an all-digital receiver designed for use in satellite-based broadcast systems. Newly available technology is utilized to permit deployed systems to be upgraded without making internal modifications. All operating parameters are programmable via the front-panel operator interface, the receiver remote control port, or the satellite network control (NCS) channel. Future upgrades may be readily accomplished by downloading new operating software via the satellite link.

A central feature of the DCR-974 is its optional ability to store data in an internal mass storage device. Textual information, such as web pages, audio files, etc., may be stored for access at any desired time. The unit may be equipped with one or two storage devices to meet customer requirements, but it may be used without the storage feature, if appropriate. Two types of storage devices are available: an IDE hard drive, and an IDE flash drive. These components may be installed in any needed combination. A typical configuration could include either one IDE hard disc drive of (typically) 2 Gigabytes, or one IDE Flash drive of (typically) 64 Megabytes or greater.

The DCR-974 operates at digital symbol rates from 64 ksps (kilosymbols per second) to 4096 ksps. This permits data rates ranging from 64 kbps (kilobits per second) to 2048 kbps in the BPSK mode, or from 64 kbps to 4096 kbps in the QPSK mode, in increments of 64 kbps.

The DCR-974 can be supplied to be fully compatible with existing BPSK and QPSK, 1/2-rate coded digital signals currently transmitted by many service providers.

Users are offered a factory option choice of high performance forward error correction (FEC) devices:

- Rate 1/2 sequential decoder, with two bits soft decisions, implemented in a custom ASIC.
- Rate 1/2, 3/4, or 7/8, K=7, 3-bit soft decision Viterbi encoder.
- Concatenated Reed-Solomon/Viterbi FEC decoder compatible with DVB standard. This option provides essentially error-free operation at any E_b/N_o above threshold.

1.3 Options

Several options are available to extend the operating capabilities of the DCR-974:

- **Model SAP-104 Expansion Card.** The SAP-104 card supports the simultaneous decoding of four MPEG audio streams or (in the dual mono mode) up to eight audio channels. In addition, the SAP-

104 permits the playback of real-time audio, or of audio files previously downloaded from the network head end and stored on the receiver storage device. Audio files are transported by the file transfer channel over the satellite link and stored in the storage device(s) in the main receiver. The Model SAP-104 also supports up to 16 switch-closure inputs to trigger pre-selected events. In addition, up to 16-switch-closure outputs may be controlled from the network head end to trigger events in the affiliate station.

- **Model SAP-102 Expansion Card**. The SAP-102 card is similar to the SAP-104 expansion card except that two MPEG decoders support the simultaneous decoding of two MPEG audio streams instead of four. Sensing of eight input closures is also provided along with eight output closures.

- **Remote Switch Closure Module** (P/N 100368). The Remote Switch Closure Module provides an interface for the switch closure input/output capability of the receiver. It is not necessary to access the interior of the receiver to install this module; convenient connectors permit it to be attached to a receiver rear panel. Configuration is via DIP switches on the closure module.

- **Model DDP-104 Four-channel Demultiplexer Expansion Card**. The DDP-104 card provides four additional data output channels and can demultiplex either TDM or packet-multiplexed channels. Each output channel of the DDP-104 Card may be operated either in a TDM (transparent) mode or in an HDLC (packet multiplexed) mode, compatible with the ICP Model AD3311 Data Broadcast Multiplexer. The output electrical interface is selectable: RS-232 or RS-422. Two Model DDP-104 Cards can be installed in a chassis, providing up to eight additional data output ports. Thus, 10 data output ports, (in addition to the Ethernet port) are available when two DDP-104 Cards are used.

- **Model DAP-102 Digital Audio Expansion Card.** The DAP-102 card enables the receiver to decode a single MPEG audio stream and provide two high quality audio channels utilizing ISO/MPEG Layer II encoding. Both analog audio outputs and AES/EBU digital outputs are available. Ancillary data streams may also be provided from the MPEG decoders. Each DAP-102 card can produce up to eight remote contact closures. Two DAP-102 cards may be installed to provide 8 audio outputs and 16 contact closures.

- **Model DAP-104 Digital Audio Expansion Card.** The Model DAP-104 card has the same functionality as the DAP-102 card, but has the ability to decode two MPEG audio streams to provide four audio channels

Note: Some versions of the DCR-974 receiver may not contain all of the components described in this manual. For example: certain versions may not contain a hard drive. In this event the operation of the receiver will be as described, except for the functions provided by those components.

1.4 Packaging and Power

The Model DCR-974 Receiver is packaged in a low profile, three-inch high (7.7-cm) chassis, designed for use on a tabletop or similar surface. An optional 2U (3½ inch) high adapter is available for installations requiring rack mounting. An internal, universal-input, switching power supply permits the receiver to be operated from AC power anywhere in the world.

1.5 Circuit Overview

Figure 1-1 is a block diagram of the DCR-974 showing the main circuit elements in the receiver. The Demodulator Card and the Controller Card are separate cards located in the lower part of the chassis. The controller can accept up to two DAP or DDP cards or one SAP

card; one SAP card is the normal configuration. The SAP-104 card is an expansion card which plugs into the controller card. The data storage devices, either flash drive(s) or hard drive(s), mount to the top of the chassis along with the power supply.

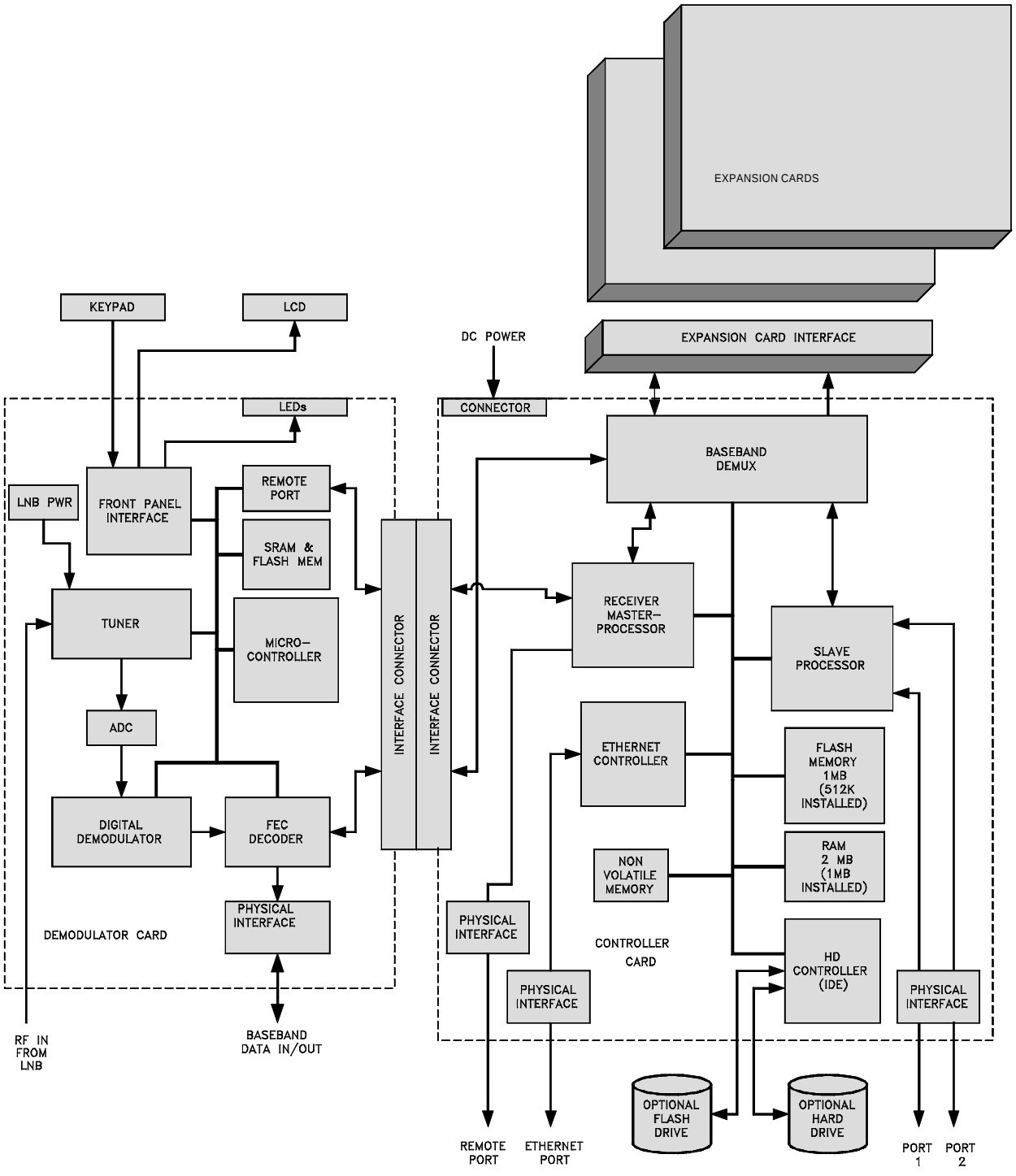


Figure 1-1. Receiver Block Diagram

The demodulator card receives and demodulates the satellite signal, and supplies the recovered baseband signal to the controller card. The controller card demultiplexes the baseband signal and routes the recovered user data to all the appropriate parts of the receiver. The Master Processor, located on the Controller Card, controls all functions of the receiver. It communicates with the Demodulator Card (and expansion cards, if installed) through a field-programmable gate array. File storage devices (flash or hard disc drives) interface to the master processor. The SAP-104 expansion card includes four independent MPEG audio decoders which provide processing of both real-time audio feeds and the play of stored audio files.

Main and accessory cards are described in more detail in sections that follow.

1.5.1 Demodulator Card

The demodulator card provides tuning downconversion, A/D conversion, demodulation and forward error correction. L-Band signals from the LNB are applied to the tuner input. To power the LNB, a bias circuit supplies voltage to the input connector (positive on center conductor). This circuit also senses the current drawn by the LNB, and uses this current sensing to drive a comparator. If the current draw drops significantly below nominal (approximately 45 ma.), the comparator circuit generates a fault signal on the front-panel LED indicator marked LNB. A regulator controls LNB voltage to a nominal 19.5 volts. LNB power may be enabled or disabled from the front panel.

In the tuner, an input tracking filter selects signals from the desired satellite transponder. This filter attenuates frequencies that might cause image responses or other problems. The filter output is amplified and used to drive a mixer. The local oscillator for this mixer is a synthesizer that is phase-referenced to the internal 10 MHz crystal reference oscillator. Synthesizer frequency is controlled by programming from the on-board microcontroller, which in turn is controlled from the front panel or via the NCS. The synthesizer also provides the tuning voltage for the tracking filter.

The difference frequency between the desired signal and the local oscillator signal is amplified and selected by bandpass filters to form the first IF. This signal drives a second mixer for downconversion to a second IF centered near 44 MHz. The local oscillator for the second down-conversion is also phase-locked to the 10 MHz reference.

The tuner second IF output is digitized by an A/D converter, prior to being routed to the demodulator circuits. Subsequent processing is entirely digital.

The digital demodulator circuits recover the carrier and clock, filter the carrier to match the spectrum of the desired signal, and recover the transmitted digital data stream.

The recovered data and clock signals are input into a forward error correction decoder circuit that corrects errors due to noise and also provides descrambling and ambiguity resolution. The result is a digital baseband signal identical to the baseband signal which was input to the modulator at the headend.

The recovered clock and data signals are passed to the controller board for demultiplexing and further processing. A baseband data interface is also provided to the rear panel to permit backhauling of the aggregate data stream. This data port may be used in installations where the network signal is received at one location (such as the transmitter site), but must be used at another location (e.g. the studio). In this instance twisted pair cable or a fractional T1 or ISDN service may be used to transport the signal.

The demodulator controller is a one-chip microcomputer with flash memory and SRAM. This unit serves as the controller for the receiver, tunes the RF section synthesizers, and functions as the front panel interface controller. The microcontroller also communicates with the controller board to receive control and configuration information, as well as providing the controller board access to the front panel keyboard and LCD display. Associated components include the 2 line by 20 character LCD display, the front-panel control keys, and LED indicators.

1.5.2 Controller card

In the controller card, the baseband clock and data signals from the demodulator card are applied to the FPGA. The FPGA (Field Programmable Gate Array) is used to implement the demultiplexing circuitry which reconstructs the original data channels from the TDM multiplexed aggregate signal. These channels may be used to carry data, of several different types, or they may carry MPEG digital audio streams. From the FPGA the audio streams may be sent directly to the audio decoders on the SAP-104 board or they may be sent to on board storage devices, via the master communication controller. The stored audio streams may later be forwarded to the decoders from storage.

The master and slave communication controllers provide for routing all user data streams between the incoming baseband data, the user data ports, the MPEG audio decoders and the on-board storage devices (flash or hard drive storage). The master controller recovers the NCS (Network Control System) control stream from the incoming signal and configures the various functions of the receiver accordingly. NCS also provides the ability to download software upgrades to the all processors in the receiver. The controller also recovers a real-time control channel from the incoming signal to issue commands used to record and play audio files, operate closures, control the faders, etc.

Peripherals of the communication controllers include SRAM and flash memory as well as high speed non-volatile memory. An optional Ethernet interface is provided to allow transfer of audio and data files from the receiver to a local network or computer.

The optional on-board storage capability is provided by installing either a "flash" drive, for all solid state storage, or a standard hard drive for storing large amounts of data.

1.6 Specifications

Specifications for the Model DCR-974 are given in Table 1-1. Refer to the appropriate manuals for specifications regarding optional cards.

Table 1-1

Parameter	Specification
Input Characteristics:	
Input Frequency Range	950-1450 MHz Compatible with Data Grade C-Band or Ku-Band low-noise block downconverters (LNBs).
Input Impedance	75 ohms
Input Connector	Type F, Female
Noise Figure	15 dB maximum.
Maximum Input Power	-30 dBm (per transponder). -20 dBm (950 MHz to 1450 MHz).
Minimum Signal Level	-85 dBm @ 64 kbps -70 dBm @2048 kbps -67 dBm @ 4096 kbps
Carrier Frequency Tuning	Synthesized in 0.010 MHz steps from 950 MHz to 1450 MHz.
Demodulator Characteristics	
Symbol Rate	64 ksps to 4096 ksps, depending on data rate, FEC encoding rate, and modulation mode.
PSK Mode	BPSK or QPSK, programmable.
Data Rate	BPSK Mode: 64 kbps up to 2048 kbps, in 64 kbps increments. QPSK Mode: 64 kbps up to 4096 kbps, in 64 kbps increments; also 1544 kbps.
Matched Filtering	40% rolloff square root Nyquist.
Demodulator Architecture	Costas Loop, with digitally implemented carrier and clock recovery phase-locked loops.
Ambiguity Resolution	Differential Encoding.
Descrambling	V.35 (IESS 308).

Parameter	Specification
Forward Error Correction	Factory Selectable: Rate ½ sequential decoder, with 2 bit soft decisions, or Rate 1/2, 3/4, or 7/8, K=7, 3-bit soft decision Viterbi decoder. Option for concatenated Reed-Solomon/Viterbi FEC decoder compatible with DVB Standard.
Data Format	Compatible with existing BPSK and QPSK rate ½ coded signals transmitted by many service providers.
Performance Characteristics	
Frequency Uncertainty Sweep	Programmable up to ±2 MHz.
Bit Error Rate Performance	Typically within 0.4 db of PSK theory in BPSK mode, and within 0.6 db of theory in QPSK mode.
Receive clock frequency uncertainty range.	Greater than 10^{-4}.
Demultiplexer Characteristics	
Aggregate Rate	64 kbps up to 4096 kbps, in 64 kbps increments, compatible with clear channel fractional T1/E1 services. The aggregate may be composed of a combination of TDM and HDLC (packet multiplexed) channels.
Channel Rates	Increments of 64 kbps up to 2.048 Mbps in the TDM mode. Standard synchronous and asynchronous rates from 300 baud up to 115,200 baud in the ICP packet multiplexed mode.
TDM Channels (optional)	In the TDM mode, provides channels which are synchronous with the clock provided by the multiplexer on the transmit end, and by the demultiplexer on the receive end. The TDM channels are transparent, or independent, of protocol. The TDM channels may be provided in increments of 64 kbps up to 2.048 Mbps.
Packet Multiplexed Channels (optional)	Packet multiplexed synchronous or asynchronous channels may be provided by the receiver. The packet-multiplexed channels are transmitted within the TDM channels, which are allocated to packet data within the aggregate stream. Standard baud rates are supported. The receiver supports the ICP packet multiplex protocol, which is compatible with other ICP packet multiplexing products.
File Transfer Channel	A file transfer channel may be included in the aggregate data stream to transport packets from the head end to the receiver. This channel may be used to transport a high-speed channel capable of transporting many types of data, such as text, audio or video files, etc.
Audio Channels	TDM channels may be allocated to provide capacity for real-time MPEG Layer II audio outputs of up to 20 kHz in bandwidth. Audio decoding is provided via the DAP-102, DAP-104, SAP-102 and SAP-104 plug-in expansion cards. The SAP-104 Audio Store and Forward expansion card provides for the decoding of up to 4 MPEG audio streams and storage/playback of real-time streaming audio and audio files.
Number of Output Data Channels	One or two data channels from the multiplexed aggregate. A 10/100Bast-T Ethernet interface is also available. Model DDP-104 expansion cards may be installed to provide additional output data channels.
Electrical Interface	Data output levels are EIA RS-232 or RS-422 electrical interface, selectable via plug-in interface ICs.
Demultiplexer Configuration	Controlled at the receive site via the network control channel, which is multiplexed into the aggregate data stream.
Configuration Storage	All configuration of the receiver and demultiplexer is retained in non-volatile memory.
Storage Characteristics	
Storage Media	Optional 2.5" laptop IDE hard drive. Optional solid-state IDE flash drive. Up to two storage drives may be installed
Audio Sources for Storage	File transfer stream or up to two simultaneous real-time TDM audio streams.
Types of Data that can be Stored	MPEG2 layer 2 audio files and data files.
Synchronization & Control Characteristics	
Channel Structure	Synchronization and control consumes a total of 8 kbps; 4 kbps to transmit the synchronization pattern required to recover frame timing in the demultiplexer, and 4 kpbs for control of the receiver. This remote control channel is an internal interface to the receiver and is not available externally.

Parameter	Specification
Carrier Identification	The 4kbps-synchronization channel also contains information that allows the receiver to identify the proper carrier in a multi-carrier system. Up to 254 carriers may be provided with unique identifiers. The proper identifier is user-selectable via the receiver front panel or the NCS.
Network Control Characteristics	
Addressability for receiver configuration	Each site is individually addressable. Addresses may be global or individual.
Receiver Address	Each receiver contains a permanent, unique serial number that is assigned at the time of manufacture. The number may be read at the remote site via the panel display or the remote NCS port. This is serial number is also printed on the bottom of the unit.
NCS Commands	NCS commands control all the configuration parameters of the unit. .See the ICP Network Control System Protocol Specification.
Network Control Interface	Commands may be generated at the head end NCS computer or accepted from local external sources.
Audio Control Language (ACL)	ACL is a real-time, interpreted, scripting language used to control the store and forward capabilities of the receiver. ACL provides full control over these real-time functions as well as providing a powerful group addressing capability. For more information see the ICP ACL specification.
Panel Controls and Indicators	
Keypad Controls	LNB Band, Carrier Frequency Selection, BPSK/QPSK Mode, Data (Symbol) Rate, Sweep Width, Local/Remote Control, Signal Strength (E_b/N_o) Display, Error Rate Display, and other parameters, depending on receiver configuration.
Indicators	Front panel LEDs indicate: Power, Summary Fault, LNB Fault, Demodulator Sync, Carrier ID Recognition, Local Mode, and Download Status. LCD alphanumeric display indicates: LNB Band, Carrier Frequency, Signal Quality (BER), Carrier Frequency Sweep, Mode (BPSK/QPSK), Signal Strength (E_b/N_o), Software Version, Serial Number, and other messages. Rear panel LEDs indicate: Data port activity, Ethernet port activity, Drive activity, Record/Play activity and Fault.
Connectors & Fuses	
Input (LNB)	Type "F" female.
Data Output	Type "D" 9-pin female.
Remote/Diagnostic	Type "D" 9-pin male.
Ethernet Port	RJ-45.
Baseband Port	RJ-45.
AC Power	IEC 320 Connector
Fuses	AC Input and LNB Current
Remote/Diagnostic Port	
Function	Remote control of receiver configuration and monitoring of receiver operating parameters. All front panel functions may be accessed through this port. This port also provides local access for providing commands, in the ACL language, to receiver. Connector pin assignments are compatible with a standard 9-pin RS-232 serial port (DTE).
Data & Message Protocol	Serial data communications. See NCS Protocol Specifications for protocol and message definition. For real-time control functions see the ICP ACL specification.
Baud Rate	Standard baud rates up to 38400 bps.
Power	
LNB Power	+19.5 V nominal, at up to 0.5 A, separately fused and surge-protected, supplied on the center conductor of the LNB cable. LNB power is controlled from front panel. An LNB fault is indicated in the LNB current falls below approximately 45 ma.
AC Operating Power	Universal input, 90 VAC to 260 VAC, 47 Hz to 63 Hz, less than 75 W.
Package	
Type	Tabletop or similar surface, with option for rack mounting.
Size	3" high, 12" wide, 12" deep metal chassis, with molded plastic front panel. (Approx. 7.7 cm x 30.5 cm x 30.5 cm.) The rack mount adapter provides a standard 2U (3-1/2 inch) high rack mountable package.
Weight (mass)	Less than 7.5 lbs. (3 kg)
Environmental (Operating)	

Parameter	Specification
Temperature	0° C to 50° C operating temperature.
Humidity	0 to 100%, non-condensing.
Cooling	Convection cooled
Shock and Vibration	Unaffected by normal commercial shipping, handling, and maintenance.

2 Installation

2.1 Antenna and LNB Requirements

The size and type of antenna to be used with the DCR-974 Receiver may vary with satellite and network requirements. For a typical network operating at C-band, antennas of nine to ten feet in diameter (2.7 to 3 meters) are used. Ku-band systems may use antennas as small as one meter or less. Consult your network administrator for specific recommendations.

Low Noise Block Downconverters (LNBs) used with the DCR-974 must convert the received satellite band down to the 950-1450 MHz range. Not all LNBs, however, are suitable for use with the DCR-974. In addition to having the proper input and output frequency bands, LNBs must meet the following criteria:

- Provide accuracy in converting frequencies. The receiver will compensate for a frequency drift in the LNB of up to 2 MHz. ICP recommends that you select an LNB unit having initial accuracy within 500 kHz (or better) to ensure that drift will remain within the receiver's correction range over a long period.

- Be free of microphonics, frequency jumps, "phase hits" or other short-term disturbances. These problems cannot be corrected by the receiver.

ICP recommends that either selected data grade LNBs, or phase-locked LNBs, be used in the system. This is especially true at lower data rates or when using QPSK modulation.

The maximum recommended noise temperature of the LNB can also depend on satellite and equipment requirements. LNB performance requirements depend upon many factors, so it is impossible to recommend a specific unit that will provide acceptable performance in every instance. ICP has consulted with program and service providers to determine LNB units requirements for their systems. Contact your program or service provider for information on LNBs suitable for your installation.

Some antenna manufacturers, as part of the antenna package, supply a weather shield for the LNB. If a weather shield is supplied, ICP recommends that it be used. The shield will extend the life of the LNB and provide some isolation from potential problems due to rapid changes in environmental conditions.

Figure 2-1 shows a typical installation.

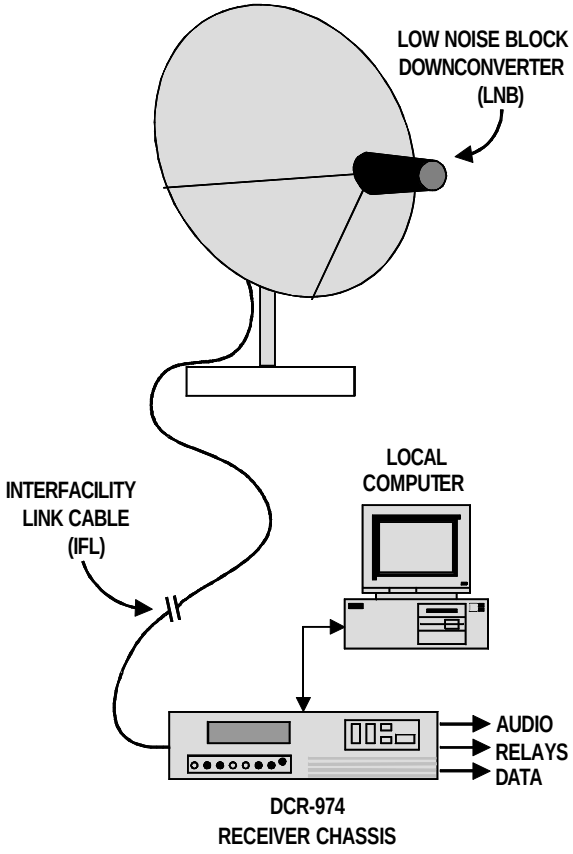


Figure 2-1. Typical Installation

2.2 Interfacility Link

The cable connecting the LNB to the receiver is called the Interfacility Link (IFL). The IFL must have the following characteristics:

- 75 Ohms impedance.
- Total signal loss between the LNB and the receiver less than 20 db at the highest frequency used (generally 1450 MHz).
- Low DC resistance. (Voltage drop between receiver and LNB less than 4.5 volts.)

These requirements naturally limit the length of cable that may be used to connect the LNB with the receiver. For long runs, one or more line amplifiers and/or supplemental power supplies may be needed.

To minimize DC voltage drop in the cable, use only cables with solid copper center conductors. Cables made with copper-clad steel center conductors have much greater resistance and should *not* be used. ICP also recommends cables with a high percentage of shield coverage. This will minimize the possibility of interference due to signal leakage through the shield and also reduce DC resistance

The maximum allowable DC resistance depends on the current drain of the LNB and on the maximum input voltage required by the LNB. The DCR-974 supplies approximately 19.5 volts, measured at the receiver, on the center conductor of the IFL cable. To calculate the maximum allowable cable resistance, you must know both the minimum allowable supply voltage for the LNB (typically 15 volts) and the maximum current drain (typically 150 mA for a non-phase-locked unit; 400 mA for a phase-locked unit). Under these conditions, the allowable voltage drop for most LNBs will be 4.5 volts. This implies a maximum cable loop resistance of 11.25 ohms for a phase-locked LNB or 30 Ohms for a non-phase-locked unit. *Make certain that you include both the center conductor resistance and the shield resistance in calculating drop. The combination is termed "loop resistance."*

Table 2-1 shows typical cables and their characteristics.

Table 2-1. IFL Cables and Characteristics.

Type	Manufacturer & Part No.	Center Conductor Resistance (Ohms /1000 ft.)	Shield Resistance (Ohms/1000 ft.)	Loop Resistance (Ohms /1000 ft.)	Loss at 1450 MHz (db/100 ft.)
RG-59	Belden 9659	15.0	2.6	17.6	13.2
RG-6	Belden 9258	7.5	5.0	12.5	8.7
RG-11	Belden 9292	2.6	3.0	5.6	5.6
RG-8	Belden 9913	0.9	1.8	2.7	4.5

For a non-phase-locked LNB, the RF loss is the usual limiting factor for cable length. In this case, the maximum recommended IFL cable lengths are as follows:

- Belden 9659: 150 feet
- Belden 9258: 230 feet
- Belden 9292: 350 feet
- Belden 9913: 450 feet

2.3 Line Amplifier

If the IFL run is long enough to cause the RF loss to exceed 20 db, a line amplifier must be used. The installation must meet the following criteria:

- The DC current required by the line amplifier (if provided by the DCR-974)

must be added to the current required by the LNB. Use the total current to calculate the maximum loop resistance allowable in the cable.

- If the additional current required by the line amplifier causes excessive voltage drop, power the amplifier with a separate power supply. The power supply must be located as near the amplifier as possible.

The combination of cable loss and amplifier gain must be between 0 db and 20 db. Too much amplifier gain will overload the receiver and degrade performance. To avoid overloading the line amplifier, install it at a point in the line where the RF loss from the LNB to the amplifier is approximately equal to the amplifier gain. To avoid additional noise, however, the loss between the LNB and the line amplifier must not be greater than 25 db. Assuming an amplifier gain of 18 db, the amplifier should be inserted within the range of distances from the LNB shown in Table 2-2.

Table 2-2. Cable Length Between LNB and Line Amplifier.

Cable Type	Minimum Distance	Maximum Distance
Belden 9659	135 feet	185 feet
Belden 9258	205 feet	285 feet
Belden 9292	320 feet	445 feet
Belden 9913	400 feet	555 feet

***NOTE**: If multiple line amplifiers are used, the RF loss in the IFL between line amplifiers must be approximately equal to the gain of the preceding line amplifier.*

Typical line amplifiers are powered by DC voltage on the center conductor of the IFL cable. The amplifiers also apply the DC voltage through to the next section of IFL to power the LNB (and, if necessary, additional line amplifiers). If a separate power supply is used for line amplifiers and/or the LNB, make certain that receiver LNB power is disabled via the front-panel controls. This will eliminate having a false LNB fault indication displayed on the front panel.

When possible, locate line amplifiers so that they are shielded from the weather. If this is not possible, weather-seal connections with a tight wrapping of plastic electrical tape or use some other approved sealing method. If tape is used, install a plastic tie-wrap over the tape end to keep it in place.

2.4 Mounting

The DCR-974 is designed for use on a desk, table, or shelf. Rubber feet are provided to prevent sliding on or marring the surface. Choose a location that will allow access to the rear panel connectors without the danger of cables being accidentally moved or dislodged. The unit is cooled by convection so select a location that will provide adequate ventilation. Avoid making installations in extremely hot, cold, humid, or dusty locations.

An optional front-panel adapter is available for use where rack mounting is required. The rack-mount adapter allows mounting the unit in a standard 3-1/2 inch (2 U) panel height.

To install the adapter, first remove the two large screws located near the front panel on each side of the receiver. Then insert the receiver through the *rear* of the adapter panel opening and reinstall the two large screws on each side. Do not tighten excessively. The assembled unit may then be installed in a rack in the conventional manner. If more than two units are stacked together, it is recommended that either additional space be allowed between units or that forced air cooling be provided.

Contact your service provider for information on obtaining the rack mount adapter.

2.5 Rear Panel Connections

Figure 2-2 shows the rear panel of the Model DCR-974. Make connections as described in the following text.

1. **IFL Connection:** The IFL cable must be terminated with a standard Type F male connector. Connect the cable to the connector marked RF INPUT.

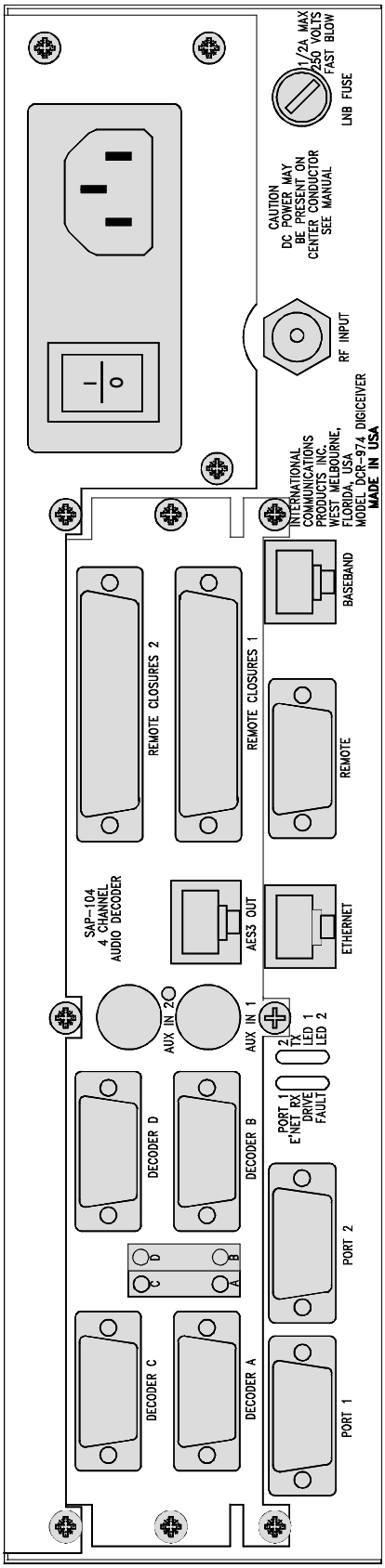


Figure 2-2. Rear Panel.

2. **Output Connections:** Data connections to associated equipment are via 9-pin D female connectors marked Port 1 and Port 2. An RJ-45 jack is provided to connect to a local network or affiliate computer. The REMOTE port connector is a 9-pin D male.

NOTE: *All data cables must be shielded and have metal housings. This is necessary to eliminate the possibility of unwanted RF interference from the unit,*

Tables 2-3 through 2-7 show pin assignments for all connectors on the DCR-974. Refer to Appendix A for pin assignments on the expansion boards. *(Note that Tables 2-4 and 2-5 show RS-232 and RS-422 functions, respectively, for the data output ports. See Section 2.6 for instructions regarding selection of the output interface.)*

Table 2-3. Pin Assignments, Remote Control Port, DB-9, Male (DTE).

Pin No.	Signal Name	Signal Direction
1	DCD	Input
2	RXD	Input
3	TXD	Output
4	DTR	Output
5	Signal Ground	
6	DSR	Input
7	RTS	Output
8	CTS	Input
9	RI	Input
Shell	Chassis Ground	

(NOTE: Using this pin assignment requires the use of a null modem cable to connect to a computer serial port. To connect to an external modem, use a standard straight modem cable.)

Table 2-4. Pin Assignments, Data Output Port 1 and Port 2, DB-9, Female (DCE), RS-232 Function.

Pin No.	Signal Name	Signal Direction
1	DCD	Output
2	RXD	Output
3	TXD	Input
4	N/C	
5	Signal Ground	
6	DSR	Output
7	RTS	Input
8	N/C	
9	RXC	Output
Shell	Chassis Ground	

Table 2-5. Pin Assignments, Data Output Port 1 and Port 2, DB-9, Female (DCE), RS-422 Function.

Pin No.	Signal Name	Signal Direction
1	TT-A	Input
2	TT-B	Input
3	DCD-A	Output
4	DCD-B	Output
5	Signal Ground	
6	RXD-A	Output
7	RXD-B	Output
8	RXC-B	Output
9	RXC-A	Output
Shell	Chassis Ground	

*(**NOTE REGARDING DATA OUTPUT**: In the RS-422 configuration, pin assignments for data output shown in Tables 2-5 and 2-6 maintain pin compatibility with ICP Model DTR-961 TDM ports. In the RS-232 configuration, pin assignments are compatible with the 9-pin "IBM Serial Port Standard " [DCE]. This allows direct connection to a PC serial port using a standard modem cable. The pin assignments in the RS-232 mode are **NOT** compatible with the output data ports on the Model AD-4112.*

*Some PC "com" ports may not be compatible with the clock signal on pin 9 of the data output ports. It is recommended that pin 9 **not** be connected when a PC is used as an RS-232 data terminal.*

The electrical configuration of the ports is determined by plug-in modules, which may be changed in the field. Refer to Section 2.6 of this manual.

Table 2-6. Pin Assignments, 10/100Base-T Ethernet Port, RJ-45 Jack, Shielded (DTE).

Pin No.	Signal Function	Signal Direction
1	TD+	Output
2	TD-	Output
3	RD+	Input
4	N/C	
5	N/C	
6	RD-	Input
7	N/C	
8	N/C	
Shield	Chassis Ground	

The Ethernet Port is used in conjunction with an optional external application enabling the receiver to forward downloaded files to an external server. Connection to the user's network or external computer is made with standard RJ-45 connector and cable. Additional information concerning configuration for this feature will be supplied by the network provider.

Table 2-7. Pin Assignments, Baseband Interface Port, Type RJ-45 Jack, Shielded.

Pin No.	Signal Function	Signal Direction
1	Data In B	Input
2	Data In A	Input
3	Data Out B	Output
4	Clock Out A	Output
5	Clock Out B	Output
6	Data Out A	Output
7	Clock In B	Input
8	Clock In A	Input
Shield	Chassis Ground	

***(NOTE:** The above signals are RS-422 levels [differential]).*

The BASEBAND port permits demultiplexing the signal at a location remote from the satellite antenna. Two identical receiver units must be used for this mode of operation. One receiver unit, located at the receive site, operates in the RF mode and provides the demodulator function. A second receiver, located at the point of use, operates in the BASEBAND mode and provides the demultiplexing function. The aggregate clock and data signals (Clock Out, A and B; Data Out, A and B) are obtained from the baseband interface port RJ-45 connector of the demodulating receiver. These signals are then fed via a twisted pair cable to the baseband interface port of the demultiplexing receiver. Refer to the signal directions given in Table 2-8 when making connections. Clock and data signals *output* from the demodulating receiver must be fed to corresponding *inputs* of the demultiplexing receiver (*i.e.* Data Out B to Data In B, *etc*.). Note that these differential signals must be carried on a good quality twisted-pair, such as Category 5 LAN cable. Use shielded cables with metal housings to eliminate the possibility of unwanted interference from the unit.

Operation of the baseband port: In the RF mode the received aggregate clock and data are output from the corresponding pins of the baseband connector. In the BASEBAND mode the aggregate signal is input to the clock and data pins. This baseband signal is also buffered and sent out on the baseband output clock and data pins. This feature is designed to allow "daisy chaining" of several receivers in the baseband mode.

2.6 Selection of Output Interface

Selection of the output electrical interface for the RS-232 mode or the RS-422 mode is accomplished by installing the appropriate interface circuit. The functions and locations of these ICs are marked on the circuit board.

Caution! You can install either an RS-232 IC or an RS-422 IC on a port, as needed. Only one type of interface IC may be installed on a port at any given time. If you change from RS-232 to RS-422, or vice versa, you must remove the existing interface IC.

Interface circuits may be installed in the field. Figure 2-3 shows the location of the drivers. The DCR-974 circuit board is also marked to show the location of the drivers.

If an RS-232 interface is required, the 24-pin IC must be installed. Acceptable part numbers for this IC are given in Table 2-8.

Table 2-8. IC Part Numbers, RS-232 Output Interface.

Manufacturer	Part Number
Analog Devices	ADM206AN*
Maxim	MAX206ECNG
*(*NOTE: Not ESD-Protected.)*	

If an RS-422 interface is required, the 16-pin IC must be installed. Acceptable part numbers for this IC are given in Table 2-9.

Table 2-9. Part Numbers, RS-422 Output Interface.

Manufacturer	Part Number
Linear Technology	LTC486CN
Motorola	MC75172BP
Sipex	SP486CS
Texas Instruments	SN75172N

To accept an external clock (Terminal Timing), when an RS-422 interface is used, an RS-422 receiver IC (Table 2-10) must be used in addition to that shown in Table 2-9.

Table 2-10. Part Numbers, IC for External Clocking With RS-422 Interface.

Manufacturer	Part Number
Maxim	MAX490ECPA
Sipex	SP490ECS

The clock signal may be terminated if required. If you wish to terminate the clock input signal with an on-board 100 Ohm resistor, add a shunt jumper to the appropriate two pin jumper marked "EXT CLK".

2.6.1 Installing an Output Interface

⚠ ***Caution! Use care and follow accepted procedures in handling circuit boards and components to prevent electrostatic damage. ICP recommends using protective equipment.***

⚠ ***Warning! This unit should be opened by qualified personnel only. Switch the unit* OFF *and remove the power cord from the unit before removing the cover. The unit must be fully assembled before connecting the power cord.***

If electrostatic protection equipment is *not* available, proceed as follows:

1. Turn off power at the rear panel and disconnect the power cord.

2. Remove the cover of the unit (see below).

3. Touch a finger to the metal chassis of the unit. If possible, maintain finger contact during the installation process. If this is not practicable, always touch the metal chassis before handling parts to be installed or removed.

4. Avoid touching components on the chassis or the parts to be installed or removed.

5. After the screws have been removed, carefully slide the cover toward the rear of the receiver about an inch (approximately 2.5 cm.), then lift it from the chassis. Place the cover aside, out of the way. It should not be necessary to remove connectors. If, however, adequate working space is not available, the connectors may be temporarily removed. Note connector markings to assure proper reinstallation.

6. Find the proper location by referring to Figure 2-3 and to the circuit board itself. *Make certain that you orient the IC correctly before you attempt to insert the pins into the socket.* The notch on the IC must align with the mark on the circuit board. Make certain that the pins are straight. Use a pin-straightener if necessary.

7. Carefully insert the pins into the socket, making certain that all pins enter the socket correctly and without bending. Gently push down on the IC to seat it firmly.

8. Reassemble the unit and apply power.

2.7 LNB Fuse

The LNB fuse is a fast-blow, 0.5 A maximum, 5 x 20mm, sized to protect the receiver from damage caused by LNB failure or a transient. To help detect any possible LNB failure that would cause loss of signal (but not damage the receiver), a smaller-value fuse may be installed. If no line amplifiers are used (and a non-stabilized LNB is installed), you may optionally replace the original fuse with one rated at 0.25 A. See Figure 2-2 for location of the LNB fuse.

2.8 Input Power

DC operating power for the receiver is provided by a universal-input switching power supply designed to accommodate AC input voltages ranging from 90 Volts through 260 Volts, 47 Hz through 63 Hz. This allows the receiver to be operated from standard AC power virtually anywhere in the world.

Note that the AC power switch is located on the rear-panel power-entry module. *This switch should be in the* OFF *position before attaching the power cord.*

The AC power connector on the receiver is a standard IEC 320 receptacle. After all other connectors have been attached, connect the power cord to the power entry module on the rear panel and then to an AC source. (It may be necessary to obtain an appropriate cordset to fit the local power outlet.) Make certain that the power cord connection provides for a secure ground (earth) connection.

Double-check all connections before powering up the unit.

2.8.1 AC Fuse Replacement

To replace the fuse:

1. Turn off power at the rear panel and disconnect the power cord from the power entry module.

2. Remove the plastic fuse retainer from the power entry module. To do this, use a small screwdriver (or similar tool) and gently pry the retainer loose. Remove the blown fuse and replace it with one of the same type and rating. The proper fuse is 5 X 20 millimeter, slow blow, rated at 1 ampere and 250 volts.

3. Reapply power.

2.9 Installing Expansion Cards

Warning! This unit should be opened by qualified personnel only. Switch the unit* OFF *and remove the power cord from the unit before removing the cover. The unit must be fully assembled before connecting the power cord. Caution! Observe electrostatic precautions!

Optional expansion cards are usually installed at the factory or the network depot. Cards may be installed in the field when necessary.

The DCR-974 can accommodate various expansion cards. For more information, refer to the installation manual for the expansion card, which is to be installed. The following procedure is typical for most cards:

Refer to Figure 2-3. To install a circuit card, remove the receiver cover as previously described, then proceed as follows:

1. After the cover is removed, locate and remove the two screws near the ends of the expansion card connector (the 50-pin socket shown on the controller card in the figure).

2. Remove the blank panel that covers the expansion card slot on the rear of the chassis. Save all hardware for use in reassembling the unit with the new card(s).

3. Locate the two male/female standoff spacers, which are provided with the expansion card. Carefully thread these spacers into the holes where the two screws adjacent to the expansion card connector were removed. The spacers should be tightened moderately so that the printed circuit card will be held firmly in place on the chassis. ***Do not overtorque the standoffs.***

4. Inspect the pins on the bottom of the expansion board to assure that none are bent. *These are long pins and must be straight.* Working carefully, install the expansion card in the DCR-974 unit by lowering the board onto the receiver so that the pins of the 50-pin connector mate properly. As an aid in aligning the card correctly, look down through the two mounting holes to make sure they line up with the mounting holes in the standoffs. When you are *certain* that all 50 pins are aligned, push the expansion board down firmly so that it rests against the standoff spacers installed previously.

5. Reinstall the two screws previously removed from receiver to secure the expansion board to the standoffs. (Continued)

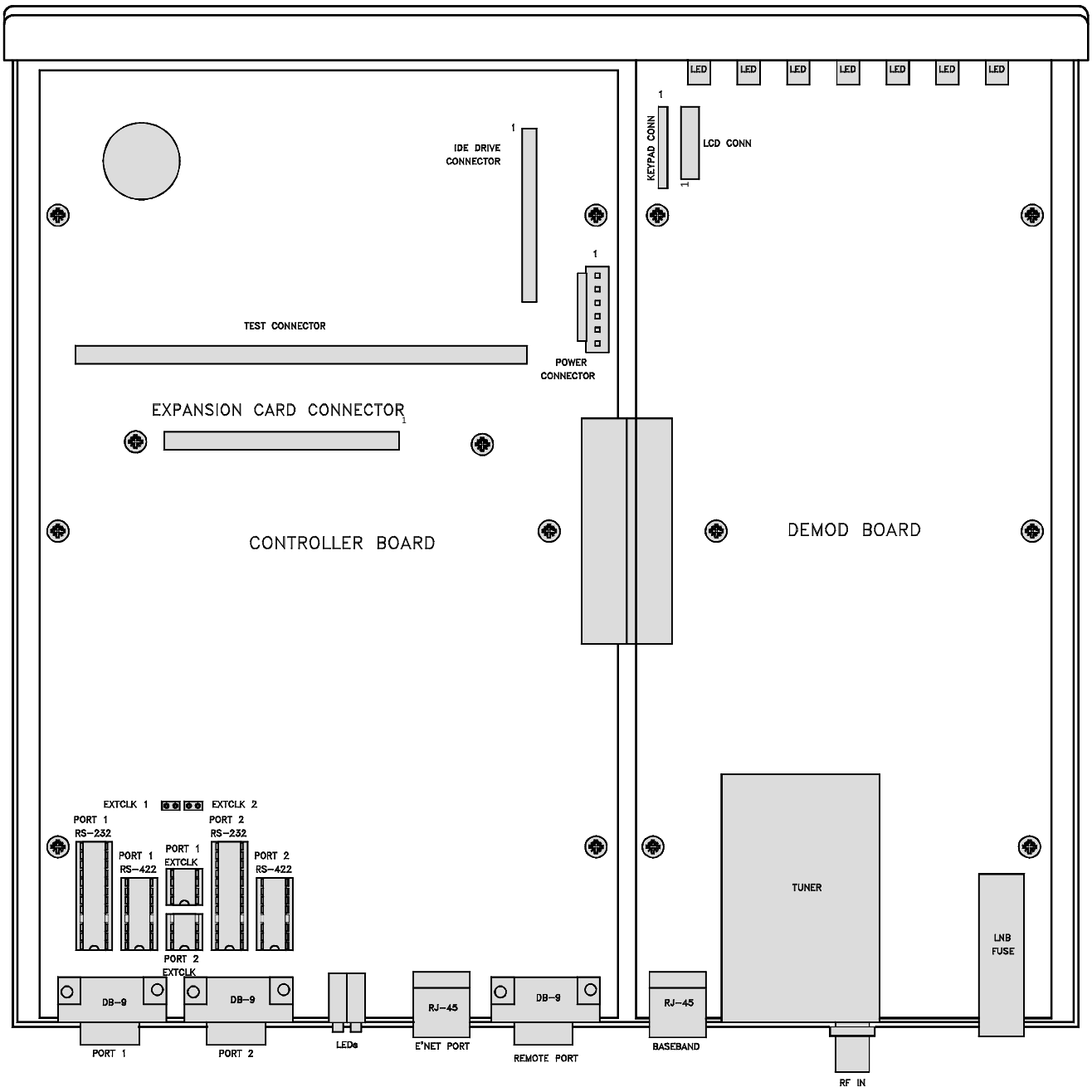


Figure 2-3. Simplified Drawing of Circuit Boards, Showing Location of Components

6. Install screws (previously removed from the blank panel) to attach the rear panel of the expansion card to the receiver. If there is to be only one short expansion card installed, the top expansion slot must be covered with the blank panel previously removed.

7. Replace the top cover using the original screws.

8. Reconnect all cables and power up the receiver.

Typically, the new expansion card(s) will be configured by the network provider via the satellite NCS channel.

2.10 Antenna Alignment

If the receiver is being installed at a site with an existing antenna that was previously aligned to the proper satellite, only minor peaking adjustments may be required. If, however, the antenna is *not* accurately pointed toward the satellite, a complete antenna alignment procedure will be required. Figure 2-4 provides a graph that may be used to determine the proper azimuth and elevation angles for initial antenna pointing. Follow the procedures given with the graph to determine the azimuth and elevation angles.

2.10.1 Alignment Procedure

1. Use a compass to set the antenna at the approximate azimuth angle as calculated from the graph or as supplied by your network. Make certain that you correct for magnetic deviation at your location.

2. Hold an inclinometer on the edge of the antenna (or other location specified by the antenna manufacturer) to measure and set the elevation angle. To aid in acquiring the signal, set this angle as accurately as possible.

3. Temporarily locate the DCR-974 receiver near the antenna. Connect the receiver to the LNB using a short jumper of RG59 cable with Type F connectors.

4. Run an extension cord to supply temporary AC power near the antenna. This will be used to power the receiver during antenna peaking.

5. Power up the receiver. Tune the unit and set it up to receive its normal signal. Refer to the operating instructions in Section 3 of this manual and to tuning instructions supplied by your network.

6. Make sure the LNB power is enabled.

7. Select the signal strength page of the front-panel LCD display. This is calibrated in E_b/N_o. A bar graph is also provided.

8. When the unit receives a signal, it usually requires only a few seconds to acquire signal lock. Signal strength will not be indicated properly until the demod is locked. Because of this delay, you must move the antenna *very slowly* or in small increments. Give the unit time to respond. Pause several seconds between movements while searching for the signal. Move antenna in azimuth first, around the expected look angle. If the signal is not located, change elevation in 0.5-degree increments and repeat the azimuth movement.

9. If repeated searching does not locate the satellite, you may need to rotate the LNB 90^o on its axis to change the polarization.

10. When the signal has been located, carefully adjust the antenna in azimuth and elevation to peak the signal.

11. To adjust polarization, first peak the signal strength reading, then rotate the LNB *very* slowly in one direction until the signal strength (E_b/N_o) decreases noticeably. Mark this point, and note the reading. Rotate the LNB back past peak, then continue rotating slowly until you read the same reduced reading previously noted. Mark this point. Set the LNB halfway between the two marks (where signal is strongest). *This procedure is important to minimize interference from cross-polarized satellite signals.*

12. Note the maximum reading of signal strength (E_b/N_o) display. The proper value will vary depending on frequency, location, antenna size, and satellite parameters. Generally, a minimum reading of 6 to 7 db will be required to provide reliable operation at C-band frequencies. Ku-band systems will typically provide higher values. Contact your service provider for E_b/N_o values you should expect in your application.

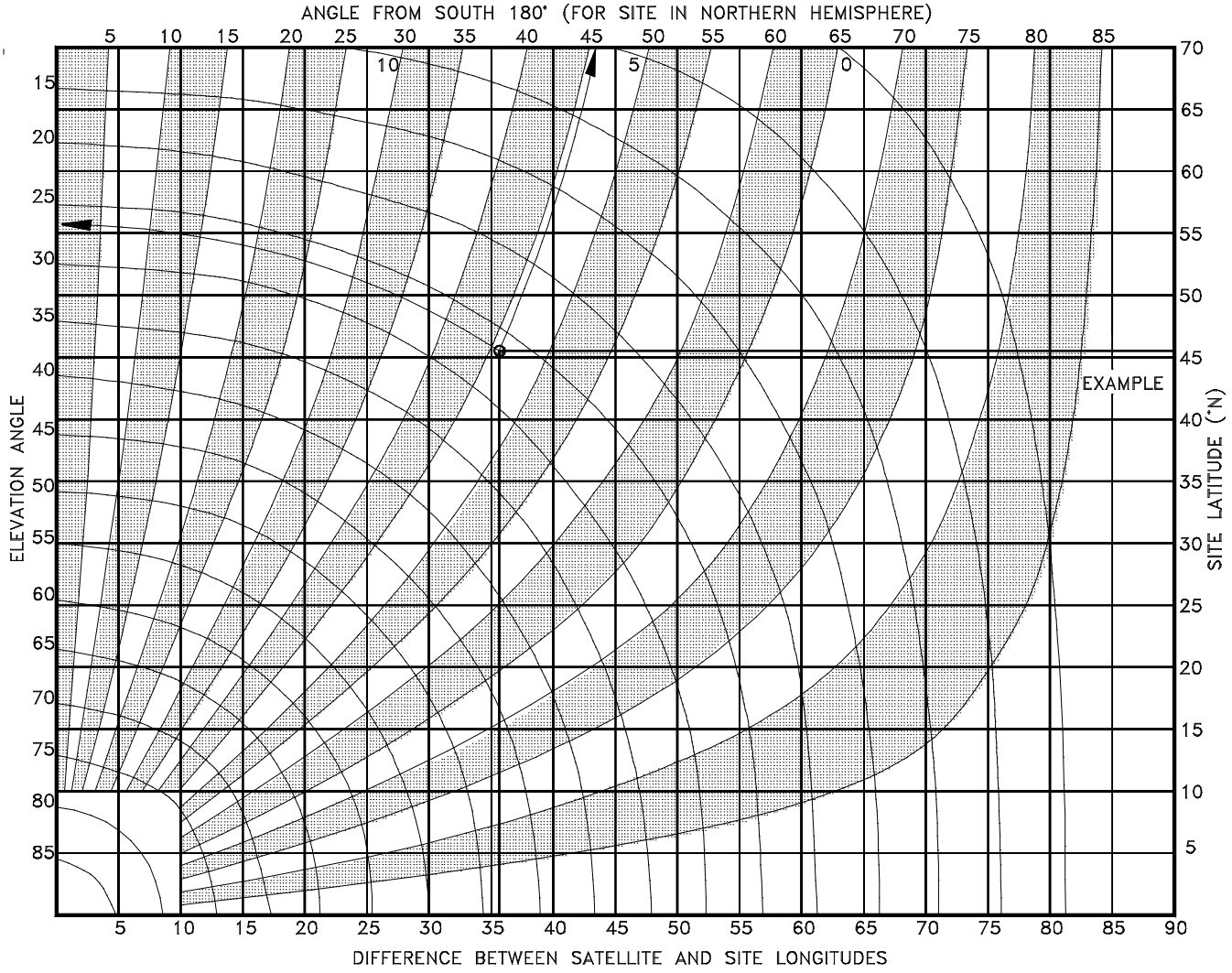


Figure 2-4. Antenna Alignment Graph.

To use the graph:

1. From a reliable map, find the longitude and latitude of your site. (Example: Portland, Oregon is at 45.5° N, 122.7° W).

2. Find the difference, in degrees, between the longitude of your site and the longitude of the satellite. (Example: Spacenet 3 is at 87° W, so 122.7° – 87° = 35.7°)

3. On the lower scale, locate the point corresponding to the longitude difference. On the right side, locate the point corresponding to the site latitude.

4. Project these points to where they intersect, as shown.

5. Follow the azimuth and elevation curves around from the intersection point to determine the antenna pointing angles. (Example: For Portland, the elevation is about 27°, and the azimuth about 46° from south. Since the satellite is east of the site, the azimuth angle is also eastward, at a heading of 180° −46°, or 134°.)

3 Operation

3.1 Controls and Indicators

Tables 3-1, 3-2, and 3-3 describe the functions of each control and indicator. The front panel of the *DigiCeiver*® is shown in Figure 3-1.

Table 3-1. Front-Panel Indicators

Indicator	Function
POWER (green)	If lighted, unit is ON.
LNB (yellow)	If lighted, LNB may be defective or not connected properly, or LNB power may be on but not in use. LNB fuse may be blown or missing. If a separate LNB power supply is being used, disable LNB power using front-panel controls.
FAULT (red)	If lighted, a hardware fault has been detected in the receiver. (This LED also normally lights during the boot-up cycle of the receiver.)
DEMOD (green)	If lighted steadily, the receiver's demodulator is locked on the received signal.
CXR ID (green)	If lighted, the receiver is locked *and* has detected the proper carrier identification signal from the NCS data stream (if a value other than 00 has been selected).
DN LOAD (yellow)	If on solid (or nearly so), new software is being received. If flashing, the receiver has received a configuration command. Press the cancel key to clear this indication.
LOCAL (yellow)	If flashing, the receiver is set for LOCAL control. After a few minutes, the receiver will automatically revert to remote control and the LED will stop flashing. NOTE: network NCS control is NOT disabled in the LOCAL mode.
LCD Display	Alphanumeric display. Two lines, 20 characters.

If the DN LOAD LED shows a download in progress, it is recommended that the keypad not be accessed, in order to avoid any re-configuration which could interrupt the download.

Table 3-2. Rear-Panel Indicators.

Indicator	Function
Left Group:	
PORT 1 (green)	Indicates activity (data transitions) on data port 1.
E'NET RX (green)	Indicates a packet was received on the Ethernet 10/100 Base T port.
DRIVE (yellow)	Lights to indicate activity of the on-board hard drive or flash drive
FAULT (red)	When lighted, indicates that a fault has been detected by the main processor. Also lights during boot-up.
Right Group:	
2 (green)	Indicates activity (data transitions) on data port 2
TX (green)	Indicates a packet was transmitted on the Ethernet port.
LED 1 (yellow)	If on or flashing, indicates that an audio file is being **played** from the internal hard drive. The flash duration and rate are dependant on the data rate of the file and whether one or two files are being played.
LED 2 (red)	If on or flashing, indicates that an audio file is being **recorded** to the internal hard drive. The flash duration and rate are dependant on the data rate of the MPEG stream and whether one or two files are being recorded.

Expansion cards may also have rear-panel indicators. Operating information for expansion cards is in appendixes to this manual.

Table 3-3. Controls.

Control	Function
CURSOR (left/right arrows)	Dual keys used to move among menus in the display. Also, on some pages, used to select the digit of a numeric entry to be modified.
PAGE (up/down arrows)	Dual keys used to select or review pages within a menu.[1]
VALUE (up/down arrows)	Dual keys used to select changes within a page to configure features of the receiver. Press and hold to scroll through selections.
ENTER	Single key used to access a menu and also enter (activate) a configuration change.
CANCEL	Single key used to abort a proposed change or to leave a page without pressing ENTER. Also used to return the display to the next higher level. Also used to clear the DN LOAD indicator after configuration commands have been received.
Power Switch (rear panel)	ON/OFF rocker switch to control AC power to unit.
[1]NOTE: The PAGE keys may also be used to move from menu to menu, if desired.	

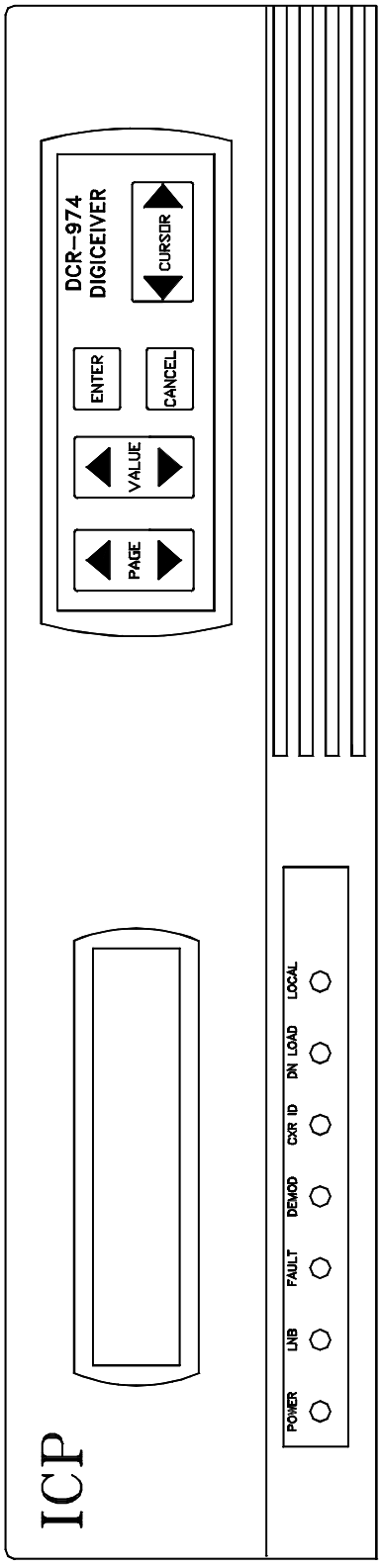


Figure 3-1. DigiCeiver® Front Panel.

3.2 *DigiCeiver®* Operator Control

By default, the receiver operates in the remote mode, under NCS control from the network headend. You can read the current configuration by accessing the pertinent menus and pages.

To make parameter changes by using the front-panel control keys, you must first enable LOCAL control. The LOCAL LED will flash to show that the unit is in the local mode, as described in Section 3.3. Note that NCS control is *not* disabled when the unit is placed in the local control mode; it will always accept NCS commands. If changes are not being made, the unit will automatically revert to remote control in a few minutes. This prevents inadvertent changes being made via the front panel and eliminates the need to manually return the unit to NCS control.

Normally, the satellite service provider will advise users of all the receive parameters that must be entered via the front-panel controls. Alternatively, the service provider will remotely control your unit after initial setup.

Power up the unit by operating the power switch on the rear panel. Observe the front panel. The POWER indicator will light and the display will show that booting is in process. During the boot process the FAULT indicator will be on. After initialization, which takes only a few moments, the FAULT indicator should go out. The unit is now ready for use. If problems are encountered, check all connections. If necessary, contact your service provider.

3.3 Menus and Pages

Figure 3-2 shows the organization of display menus and pages. The top line shows the several menus available. Pages within each menu are listed below.

The first menu shows the model number and the software version. To access other menus, use the CURSOR arrow keys.

To enter a menu, press the ENTER key. Then press either the up or down PAGE keys to reach the required page. From any page, press CANCEL to return to the next higher level menu. If desired, you may then use the CURSOR keys to select another menu.

Within most pages, selections may be made to configure the various features of the receiver. Remember that the receiver must be placed in the LOCAL control mode before it will accept configuration changes from the front panel. To do this, access the DEMOD page, press ENTER, use the PAGE keys to display LOCAL CONTROL, then press ENTER. The LOCAL indicator will flash to show that the unit will accept local commands. Then select the required page within the DEMOD menu by pressing the PAGE keys, or return to the "top level" menu by pressing CANCEL. You can then use the CURSOR keys to select a different menu, if needed.

On some pages (such as FREQUENCY MHz), you can use the CURSOR keys to select the digit of a numeric entry which is to be modified. Use the VALUE keys to increment or decrement the required value and then press ENTER to activate the new configuration.

In some pages, there are only two selections available (such as LNB POWER, ON/OFF). To toggle between these selections, use the VALUE keys, then press ENTER.

Use caution in making entries. *The software will reject out-of-range values, but in-range values will be accepted, even if incorrect. Make certain that all entries and selections are correct before pressing ENTER.*

– CURSOR + **(Continued >)**

DCR974 VERSION 2.20	**ADDRESS**	**IP**	**DEMOD**	**TIME SLOTS**
DSP VERSION 0.05	NCS ADDRESS 12000	IP ADDRESS **192.168.0.1**	LOCAL CONTROL **PRESS ENTER**	TOTAL TIME SLOTS 5
FPGA VERSION 0.26	DATA ADDRESS 0	IP SUBNET MASK **255.255.255.000**	CARRIER ID **BB**	RECORD CH 1 **02-00-04-31**
SAP-104 VERSION 0.09		IP GATEWAY **255.255.255.000**	LNB FREQUENCY BAND **3700-4200 MHz**	RECORD CH 2 **02-00-04-31**
DEMOD VERSION 1.0 SERIAL 12000		SERVER ADDRESS **255.255.255.255**	FREQUENCY MHz **1145.20**	FILE TRANSFER **01-00-01-31**
		ETHERNET ADDRESS 00:04:2F:00:2E:E0	RECEIVER MODE **QPSK**	REAL-TIME CONTROL **00-00-00-31**
		DEBUG UDP PORT **65535**	DATA RATE kbps **320**	DATA **31-00-00-31***
		CONSOLE UDP PORT **65535**	SWEEP LIMIT khz **500**	AUDIO DECODER A **02-00-04-31**
		NCS UDP PORT **65535**	ERROR TEST LENGTH **1E5**	AUDIO DECODER **02-00-04-31**
			SYMBOL ERROR RATE 3.5E-2	AUDIO DECODER C **02-00-04-31**
			SIGNAL STRENGTH 5.6	AUDIO DECODER D **02-00-04-31**
		PAGE	LNB POWER **OFF**	
			DEMUX INPUT **RF**	
			SCPC MODE **OFF**	

* Denotes disabled service.

The menus and pages displayed by the DCR-974 are shown above and on the opposite page. The top row lists the menus provided by the display. Below each menu are listed the pages within the menu. In the pages shown above the values in **bold** are selectable by the user. Other values are "display only".

Menus are accessed by pressing the CURSOR arrow keys. When the desired menu is displayed, press ENTER to open the menu. Use the PAGE arrow keys to move up or down through the pages available within a menu. At any point in a page, you can press CANCEL to return to the menu.

Figure 3-2. Organization of Display Menus and Pages (Sheet 1)

(< Continued) **– CURSOR +**

DATA PORTS	REMOTE PORT	DOWNLOAD COUNT DCR974:0	DATE AND TIME 2002/3/22 17:29:34	ENTER TO RUN SCRIPT 0
PORT 1 MODE **ASYNC**	REMOTE PORT BAUD **38400**			
PORT 1 RATE **38400**				
PORT 1 FLOW CNTRL **HARDWARE**				
PORT 1 PROTOCOL **8N1**				
PORT 1 SOURCE PORT **1**				
PORT I CHAR SET **0**				
PORT 2 MODE **ASYNC**				
PORT 2 RATE **38400**				
PORT 2 FLOW CNTRL **HARDWARE**				
PORT 2 PROTOCOL **8N1**				
PORT 2 SOURCE PORT **1**		PAGE		
PORT 2 CHAR SET **0**				

Within most pages, selections may be made to configure the various features of the receiver. Available choices may be viewed by pressing the VALUE arrows, up or down, until the needed value is displayed. In some parameters (such as frequency), select the digit you want to modify by using the CURSOR arrow, then use the VALUE keys to change the numeral to the needed value. When the correct value is displayed, press ENTER. A message will appear briefly to show that the unit is configuring.

To abort a proposed configuration change, press CANCEL, or simply leave the page without pressing ENTER. See text for additional information.

When presented, the display for any page will show the current configuration. Before *any* configuration changes can be made, the receiver must be placed in the LOCAL control mode. To do this, access the DEMOD menu, press ENTER, select LOCAL CONTROL, and press ENTER. (NOTE: The unit will continue to accept NCS commands when in the LOCAL mode.)

Figure 3-2. Organization of Display Menus and Pages (Sheet 2)

The various menus and pages are shown and explained in the remainder of this section. Remember that if expansion boards are installed in the receiver, a menu for each board will also be available. Information concerning these menus is given in the manuals supplied with the boards.

3.3.1 DCR-974 Menu

The first menu shows the receiver model number and the installed software version number for the main processor. The version number will always reflect the version of the last software downloaded.

DCR974 VERSION X.X

Entering this menu will allow access to the pages listed below. Press ENTER, then PAGE up or down to reach the desired page. The pages listed below display the version of all software modules installed in the receiver. The version pages are display only.

- DSP VERSION – This is the version of the DSP code used by the MPEG audio decoders. If code this module needs updating the network provider will download it at a convenient time.
- FPGA VERSION – This is the version of the programmable logic device within the receiver which performs many of the internal logic functions. If this code module needs updating the network provider will download it at a convenient time.
- SAP-104 VERSION – This is the version of the software which operates the microcontroller on the SAP-104 (audio board). This microcontroller manages the operation of the audio decoders as well as the closure inputs and outputs and the fader/mixer. If code in this module needs updating the network provider will download it at a convenient time.
- DEMOD VERSION – This is the version of operating software for the microcontroller which manages the operation of the demodulator board. If code this module needs updating the network provider will download it at a convenient time.
- DEMOD SERIAL NUMBER – This line shows the serial number of the demodulator card. Normally it will be the same as the unit serial number. See NCS address below.

3.3.2 Address Menu

The address menu displays several electronic addresses that may be resident in the receiver. These include NCS ADDRESS and DATA ADDRESS. These addresses are loaded at the time of manufacture and are not field-changeable. To view the addresses, press ENTER and then use the PAGE keys.

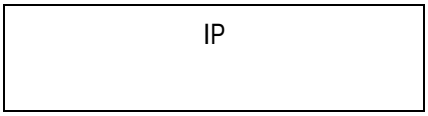
ADDRESS

- NCS ADDRESS -- Used by the satellite NCS control system to identify a particular receiver for routing configuration commands. This number is also the receiver serial number. It will be found printed on the underside of the unit.
- DATA ADDRESS -- This is the address of an optional data broadcast service that can be provided by the receiver. The address will be entered by the factory if needed. The service provider will supply additional information on the setup and use of this service.

3.3.3 IP Menu

The IP menu allows the setup of the 10/100base-T Ethernet port on the rear of the receiver. This port will normally be used in conjunction with an external computer running an optional custom application. The custom ap-

plication provides a web-based interface for the control and management of audio files downloaded to the receiver from the network headend.



In most instances the network provider will provide full details on the setup of the remote application. This section of the manual provides basic guidance in the configuration of the receiver's networking interface.

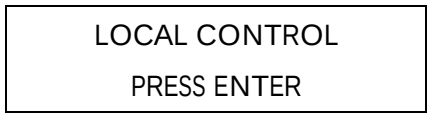
Note that certain of these items should be configured even if this port is not being used. These items are marked with an asterisk (*).

- IP ADDRESS – This is the IP address assigned to the receiver. The address to use will be provided by the network provider or be assigned by the local network administrator.
- IP SUBNET MASK -- This is the subnet mask for the local network on which the receiver resides. If a gateway is used, the subnet mask should be assigned by the service provider or local network administrator. Otherwise, the subnet mask should be set to all zeros.
- IP GATEWAY -- This is the IP address of the local network gateway router. If access to the server is through a router (not recommended), this address should be assigned by the service provider or local network administrator. If a gateway is not used it should be set to all zeros.
- SERVER ADDRESS – This is the IP address of the networked server which is the destination for files pushed by the receiver. The server IP address should be assigned by the network service provider or local network administrator
- ETHERNET ADDRESS – This is the Ethernet (or MAC) address of the receiver Ethernet port. The Ethernet address is assigned at manufacture and is not changeable in the field.
- * DEBUG UDP PORT – The debug port provides access to internal functions of the receiver. This is not normally a user function. If the external server is used this should be set to 09742. If no external server is used it should be set to 65535.
- * CONSOLE UDP PORT -- ACL (store and forward) commands may be sent to the receiver from a proprietary application running on the networked server. It is not used unless so directed by the network. If the external server is used this should be set to 09741. If no external server is used it should be set to 65535.
- * NCS UDP PORT – ICP NCS functions may be performed from a proprietary application running on the networked server. If the external server is used this should be set to 09740. If no external server is used it should be set to 65535.

3.3.4 Demod Menu

The demod menu provides most of the pages used to configure the unit for initial reception. Press ENTER, then use the PAGE keys to access the needed pages.

- LOCAL CONTROL -- This page permits enabling local control so that commands may be entered using the front-panel keys.



See Section 3.2. The receiver is normally operated unattended in the REMOTE mode. When the LOCAL CONTROL page is displayed, the local control mode may be selected by pressing ENTER. When LOCAL mode is selected, the LOCAL indicator on the front panel will flash. The unit will, however, continue to accept commands via the NCS channel or the remote port. After a few minutes, the unit

will return to the remote control mode if the control keys are not being used.

- CARRIER ID -- This page provides the carrier identifier value, as two hexadecimal digits, that the demultiplexer will recognize.

CARRIER ID
AA

The CARRIER ID allows the receiver to identify the desired carrier in a multi-carrier environment. The service provider will supply the proper carrier identifier value to enter into the unit. Use the VALUE keys to change the ID, then press ENTER. Moving to another page will cancel any displayed selection if ENTER has not been pressed.

00 -- When set to 00, the receiver ignores any carrier ID signals and can lock to any signal within the sweep range.

FF -- When set to FF, the receiver will respond only to a carrier ID embedded in the packet multiplex channel.

With any other setting, the receiver will respond to the carrier ID signal located in the NCS stream. The NCS carrier ID must match the value entered in the carrier identifier page for the receiver to stop its sweep.

- LNB FREQUENCY Band -- This page displays the frequency range selected. The receiver always tunes the 950 MHz to 1450 MHz range, but will display L-Band, C-Band, or any of three different Ku-Band frequency plans.

LNB FREQUENCY BAND
nnnnn - nnnnn MHz

To change the frequency range, press the VALUE keys to select the required range, then press ENTER. The five possible ranges are:

950 to 1,450 MHz -- The L-band frequency output range from the LNB that is input to the *DigiCeiver*®, *NOT* the frequency over the satellite link.

3,700 to 4,200 MHz -- The standard C-band satellite receive frequency range.

11,200 to 11,700 MHz -- The standard European Ku-band satellite frequency range, also used by some other Ku-band satellites. This selection should be used for LNBs with an LO frequency of 10.25 GHz.

11,700 to 12,200 MHz -- The standard U.S. Ku-band satellite frequency range, also used by some other Ku-band satellites. This selection should be used for LNBs with an LO frequency of 10.75 GHz.

12,250 - 12,750 MHz -- An alternate frequency range used by some Ku-band satellites, especially in Europe. This selection should be used for LNBs with an LO frequency of 10.30 GHz.

- FREQUENCY MHz -- This page displays the carrier center frequency in MHz. Tuning steps of 0.01 MHz are provided.

FREQUENCY-MHz
nnnnn.nn

The frequency, nnnnn.nn, will be in the range previously selected on the LNB FREQUENCY BAND page. To change the frequency up or down, position the cursor with the CURSOR keys, then use the VALUE keys to set each digit.

To retune the *DigiCeiver*® to a selected and displayed new frequency, press ENTER. Moving to another page will cancel any displayed selection if ENTER has not been pressed.

- RECEIVE MODE -- This page displays the current receive mode and provides mode options.

RECEIVE MODE
BPSK

Mode options are BPSK, BPSK ALT (Scientific Atlanta compatible), QPSK, and QPSK INV (inverted spectrum). The BPSK ALT mode will also allow acquisition in the BPSK mode to provide compatibility with some manufacturer's BPSK modulators. To change the mode, use the VALUE keys. When the desired mode is displayed, press ENTER to reconfigure the *DigiCeiver®*. Moving to another page will cancel any displayed selection if ENTER has not been pressed.

Note: C-Band LNBs invert the frequency spectrum, Ku band LNBs do not. Spectrum inversion will change the QPSK phase rotation. Normal and inverted QPSK receive modes are provided to allow acquisition of a QPSK carrier with any LNB. If you cannot acquire a QPSK signal with normal QPSK setting, try QPSK INV.

The mode **must** be set to match the characteristics of the transmitted satellite signal, and the characteristics of your LNB, as specified by your service provider. Note that forward error correction decoding is active in all modes.

- DATA RATE-kbps -- This page displays the current data rate and provides access to bit rate options. Data rate selection is provided in 64 kbps increments, from 64 kbps to 4096 kbps. In the QPSK mode, 1544 kbps is also available.

DATA RATE kbps
nnnn

The bit rate ***must*** match the received signal or the *DigiCeiver®* will not operate. The data rate range and step size available depends on the mode selected, as follows:

BPSK -- 64 kbps to 2048 kbps

QPSK --64 kbps to 4096 kbps (1544 kbps also available).

To change the rate, use the VALUE keys. To reconfigure the receiver to a selected and displayed bit rate, press ENTER. Moving to another page will cancel any displayed selection if ENTER has not been pressed.

- SWEEP LIMIT-kHz -- This page displays current sweep limit and allows selection of carrier sweep limits *above and below* the nominal carrier frequency.

SWEEP LIMIT kHz
nnnn

The sweep limits are 10 kHz to 2000 kHz, selectable in increments of 10 kHz. Use the sweep limit that has been calculated for your satellite signal and LNB type, as specified by your satellite service provider.

CAUTION. *Using a sweep width that is too wide may cause the receiver to lock on the wrong signal or to take excessive time locking up, particularly at low data rates. Using a sweep width that is too narrow may prevent locking on the received signal. Generally, a sweep limit of 50 - 100 kHz is recommended when the receiver is used with a phase-locked LNB. Limits of 250 - 500 kHz are appropriate for most types of non-phase-locked, "data grade" LNBs with frequency accuracy of better than 250 – 500 kHz.*

To change the limit, use the VALUE keys. When the desired sweep limit value is displayed, press ENTER. Moving to another page will cancel any displayed selection if ENTER has not been pressed.

- ERROR TEST LENGTH -- This page shows the current error test length of the built-in symbol error rate test and permits changing the test length.

ERROR TEST LENGTH
1En

The number of symbols tested ranges from 1E5 to 1E8. The error test length is the number of bits used for the error rate measurement, and may be changed by the user over the range 10E5 (10^5) to 10E8 (10^8). Larger samples provide more accuracy but require more time for updates. In general, use the smallest length that gives a meaningful result.

Use the VALUE keys to make a selection, then press ENTER. Moving to another page will cancel any displayed selection if ENTER has not been pressed.

- SYMBOL ERROR RATE -- This page provides the result of the built-in error rate test.

SYMBOL ERROR RATE

The display shows the error rate of the satellite channel ***before*** *error correction*. For example, if the display shows 1.0 E-5, then the *DigiCeiver*® is detecting one error in every 100,000 received bits (1.0×10^{-5}). The result is a very accurate estimate of the link error rate, which is the best measure of link performance and margin. This is NOT the error rate the user will experience. The FEC decoder reduces this error rate by many orders of magnitude.

- SIGNAL STRENGTH -- This page provides a signal strength display featuring a number and a bar graph.

SIGNAL STRENGTH
nn.n **OOOOOO**

Signal strength is displayed as estimated E_b/N_o. The estimate is digitally derived from the demodulator chip and is a valuable aid to antenna peaking and signal level monitoring. The figure is quite accurate at normal values of E_b/N_o, but will be somewhat less accurate at higher values (above 15 to 20 dB). The bar graph provides an easy-to-read relative indicator. The number of sectors showing in the graph gives a quick visual indication of the signal-to-noise ratio for the received signal.

ICP recommends that the normal signal strength (E_b/N_o), once known, be recorded for future reference. See also Section 4.3.

- LNB POWER -- This page permits enabling or disabling LNB power. The current setting will be displayed when the page is accessed.

LNB POWER
ON/OFF

If the LNB and/or line amplifiers are being powered from a separate source (*i.e.* not by the receiver itself), LNB power from the receiver must be disabled. When the LNB POWER page is displayed, the second line will show either ON *or* OFF, in accordance with the selection previously commanded. Press a VALUE key to toggle to the alternate choice (*i.e.* ON to OFF, or OFF to ON). When the desired selection is displayed, press ENTER. When LNB power is commanded OFF, the LNB fault indicator on the front panel will be disabled.

- DEMUX INPUT -- This page allows the receiver to be configured to accept a baseband input signal from a remotely-located receiver.

DEMUX INPUT
RF/BASEBAND

When the page is displayed, the current input selection will be shown. In the RF mode, the receiver will operate normally, with the demux section being fed from the demodulator (RF) section of the unit. In the BASEBAND mode, the unit will accept its input signal from a

remotely located receiver via the rear-panel BASEBAND port.

To change the current selection, toggle to the alternate selection with one of the VALUE keys, then press ENTER. Moving to another page will cancel any selection if ENTER has not been pressed.

- SCPC MODE -- This page permits commanding the SCPC mode ON or OFF. The current mode is shown when the page appears. To change, toggle to the alternate mode with the VALUE keys, then press ENTER. Moving to another page will cancel any selection if ENTER has not been pressed. The Carrier ID must be set to 00 when in this SCPC mode.

SCPC MODE
ON/OFF

The SCPC mode is used when it is necessary to receive a signal which is not multiplexed and does not contain an NCS channel. In the SCPC mode, the received signal is routed to PORT 1 (and to the audio ports, if DAP-102, DAP-104 or SAP-104 MPEG Audio Decoder Expansion Boards are installed).

Note that SCPC mode is an option that is not available in all versions of the receiver. Be sure that your version of the receiver supports SCPC before trying to use it.

3.3.5 TIME SLOTS Menu

Usually all the parameters in this menu will be set remotely by the service provider. The information provided below is for reference or in case the service provider should request that you manually enter certain parameters. ***Incorrect setup of these parameters may result in the loss of service.***

TIME SLOTS

The description below refers to the slots and rows of the system multiplex format. These terms come from the graphical representation of this format. The aggregate data stream is divided into time slots which each provide 64 kbps of data capacity. The "slots" are further divided into "rows". Each row contributes 2 kbps of capacity. A full slot, therefore, consists of 32 rows, numbered 0 through 32. Most menu pages which set the data capacity of various channels will require a starting slot and row and an ending slot and row. The value for these settings will be provided by your service provider. It is important that all these values to be set properly in order to receive all authorized services.

Within each page which selects slots and rows for a channel there are four entries to be made. The format of each channel definition is as follows:

Starting Slot	Starting Row	Ending Slot	Ending Row

The range of the row values is always 0-31. If a full slot is being used the starting row is 0 and the ending row is 31. The range of the slots value is 0 up to potentially 63. The maximum slot value is dependent on the aggregate data rate in use. For the example of a 1536 kbps aggregate signal the maximum slot value is 23 (for a total of 24 slots).

- TOTAL TIME SLOTS – This is the total number of 64 kbps time slots that make up the aggregate carrier data rate. For example: a 1536 kbps carrier would contain 24 time slots.
- RECORD CH1– This is a TDM channel which will be used to retrieve real-time audio from the aggregate carrier and record it to the internal storage drive. This channel will normally be a full time slot, or multiple time slots. In this case the starting row will always be 0 and the ending row will always be 31.

- RECORD CH 2 – This is a second TDM channel which will be used to retrieve real-time audio from the aggregate carrier and record it to the internal storage drive. This channel will normally be a full time slot, or multiple time slots. In this case the starting row will always be 0 and the ending row will always be 31.
- FILE TRANSFER – This is the TDM channel within the aggregate which is used to carry downloaded files. This data may either be files which are processed and them stored on the local storage drive or it may be data which will be passed on via the Ethernet port.
- REAL-TIME CONTROL – This is the real-time control channel which is used to control the real-time actions of the receiver. This includes recording and playing audio flies as well as operating the external relay closures. This channel will typically require less than a full time slot and will require valid entries for both rows and slots.
- DATA – This page selects the time slots and rows to provide an optional asynchronous user data channel.
- AUDIO DECODER A – Selects the slots and rows which will supply real-time MPEG data to audio decoder A on the SAP-104 card.
- AUDIO DECODER B – Selects the slots and rows which will supply real-time MPEG data to audio decoder B on the SAP-104 card.
- AUDIO DECODER C – Selects the slots and rows which will supply real-time MPEG data to audio decoder C on the SAP-104 card.
- AUDIO DECODER D – Selects the slots and rows which will supply real-time MPEG data to audio decoder D on the SAP-104 card.

DISABLING SERVICES – Any of these services can be disabled by setting the starting slot higher than the ending slot. ICP advises using the values of 31 00 00 31 to turn off a service.

If the system provider is not transmitting a particular channel, it is recommended that the service be turned off by selecting the starting slot higher than the ending slot as described above. However, users should not turn off any services unless advised to by the service provider.

3.3.6 DATA PORTS Menu

The packet multiplexed operation described below refers to systems that use the AD3311 (or equivalent) ICP packet multiplexer. This multiplexer can provide up to 64 ports of packet multiplexed data. Your service provider will inform you if this multiplexer is in use and if you must setup the parameters described below. If it is in use the service provider will normally configure your receiver for proper operation. The information provided below is for reference only unless your service provider requests you to enter any of these parameters.

- PORT 1 MODE – If this setting is TDM, and the unit is equipped with the optional TDM data feature, the other port 1 settings in this menu are ignored and data is retrieved directly from the aggregate carrier in the time slots defined in “SLOTS” menu. It is then passed directly out of port 1 with no further processing. Uses for this mode include high-speed synchronous data transmission such as picture transmission.

  If other than the TDM mode is selected, the port operates in the packet multiplexed mode and the other port 1 settings in this menu must also be set. In asynchronous mode, these data ports may be used for an optional asynchronous data service or for

printing logs or text from the receiver's hard drive.

- PORT 1 RATE – In the packet multiplex mode this selects the output baud rate of the port.
- PORT 1 FLOW CONTROL – In the packet multiplex mode this parameter selects the flow control utilized for the port.
- PORT 1 PROTOCOL – In the packet multiplex mode this parameter selects the protocol implemented on the port.
- PORT 1 SOURCE PORT – In the packet multiplex mode this parameter selects the headend multiplexer input port from which data will be recovered.
- PORT 1 CHAR SET – In the packet multiplex mode several character sets may be downloaded from the headend multiplexer. This parameter selects the character set in use for the port.
- PORT 2 MODE (Etc.) – All the above pages are duplicated for user port 2.

3.3.7 Remote Port Menu

The remote port menu permits selecting the baud rate of the rear-panel remote control port.

REMOTE PORT

Standard baud rates are supported: 1,200; 2,400; 4,800; 9,600; 19,200 and 38,400. The current rate will be displayed when the menu is entered.

To change the rate, use the VALUE keys. When the desired rate is displayed, press ENTER. Moving to another page will cancel any selection if ENTER has not been pressed.

3.3.8 Download count

This screen displays the number of NCS (configuration) commands received since the receiver was rebooted or the counter was last cleared. It may be used in certain network trouble shooting applications. The count will increment each time a command is received to change some configuration parameter within the receiver (data rate, frequency, slot settings, etc.). The counter will reset upon power up or reset. It may be cleared by pressing the CANCEL key while in this menu.

DOWNLOAD COUNT
DCR974:0

When an NCS command is received, the DN LOAD LED will also flash until reset by the CANCEL key. This feature is useful to provide an indication that the service provider has made a configuration change to the receiver.

3.3.9 Date and Time

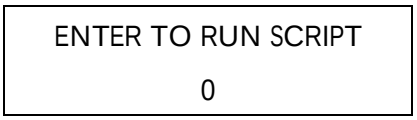
This screen displays the date and time set in the non-volatile clock module within the receiver. The date and time will be periodically updated by the network provider and will be valid only if your network uses this function. It is not settable from the front panel.

DATE AND TIME
2002/3/22 17:29:34

3.3.10 User scripts

This menu allows a local user to execute a script loaded on the receiver. A script is a predefined set of instructions which may be stored on the hard drive by the service provider. The script might allow the printing of a logfile, playing a particular spot, etc. The network service provider will provide instructions for the use of this feature in your network.

To run a script first enter the local mode and return to the ENTER TO RUN SCRIPT menu. Use the VALUE keys to select the proper script (0 to 99) and press ENTER.



3.3.11 Other Menus and Pages

Other menus and pages may be added from time to time as additional features are developed for the DCR-974. These features will be added to the receiver via software download from the headend. Typically these features will be configured and enabled from the headend by the service provider. The service provider will notify you if any action is required on your part to properly configure the receiver for operation with the added features.

4 Maintenance

4.1 Overview

The ICP Model DCR-974 *DigiCeiver*® is conservatively designed and will provide high reliability in normal use.

Troubleshooting and repair procedures in this section will allow a technician to localize a problem to either the *DigiCeiver*® itself, or to external equipment such as the LNB or the IFL cable. Because the receiver is a self-contained unit, recommended corrective action in the event of failure is replacement with a spare. Aside from fuse replacement, repairs cannot be made in the field. Return failed equipment to the factory or a depot for repair. See Section 5.2.

4.2 Spares

Recommended spares are:

- Model DCR-974 *DigiCeiver*® unit.
- Expansion board(s), if used.
- LNB unit.
- LNB fuse: 0.5 Amp, 5 x 20 mm fast-blow.
- AC Fuse: 1.0 Amp, 250 Volt, slow-blow, 5 x 20 mm.

Spare LNBs and receivers should be available rapidly by contacting the help desk of your satellite service provider. Several fuses should always be kept on hand for immediate use.

4.3 Routine Maintenance

The *DigiCeiver*® is designed to operate with little or no routine maintenance, other than following the steps suggested below.

- ICP recommends that the signal strength display page (E_b/N_o) be checked regularly and compared to the value previously recorded. Monitoring this display on a routine, periodic basis will assure that an adequate margin is available for reliable operation. Any evidence of signal degradation should be investigated at once.
- Once a month, check the chassis and cable connections, as follows:

✓ Check for dust buildup around vent openings. Remove dust with a soft brush. Do not open unit for internal cleaning. Minor dust that builds up on internal components will not interfere with their operation.

✓ Check wires, cables, and connectors at rear of cabinet for damage, pinching or chafing. Make certain that all connectors are secure.

✓ Clean the cabinet and front panel with a soft cloth *lightly* moistened with mild detergent solution (such as a glass cleaner). *Do not spray directly on the cabinet.* Carefully remove smudges and dirt. Keep moisture away from interior components.

4.4 Troubleshooting

If you are having problems with the operation of your satellite receive system, use Table 4-1 to identify the symptom, then refer to the appropriate section for recommended procedures. Also refer to the appropriate manual(s) if expansion boards are installed in the receiver chassis.

Table 4-1. Problem Symptoms.

Symptom	Refer To
POWER Indicator off	A
LNB Indicator on	B
FAULT Indicator on	C
DEMOD Indicator off	D
CARRIER ID Indicator off	E
DN LOAD Indicator on or flashing	F
Excessive errors or noise	G
Other problems	H

A. POWER Indicator Off

✓ Check AC outlet to make certain that unit is connected to live (energized) circuit.

✓ Check chassis fuse. If blown, replace with correct fuse. If fuse blows again, replace unit.

✓ In rare instances, the POWER indicator circuit may be faulty but the receiver will operate normally. In this case, continue to use the receiver, but arrange for a replacement.

B. LNB Indicator On

✓ If the LNB is NOT powered by the receiver, make certain that LNB power is disabled via the front-panel control. The LNB indicator will light if the power output from the receiver is not disabled when a separate LNB power supply is installed. (See Section 2.3.)

✓ Check the LNB fuse. If the fuse is blown, the IFL or the LNB may be shorted. Replace fuse with a 5 x 20 mm fast-blow, 0.5 Amp maximum spare. If the replacement blows, disconnect the LNB and check the IFL cable for a short circuit. *(Note: If a line amplifier is installed, it must also be checked for a short. If multiple amplifiers are used, each one must be checked until the short is located. Replace shorted unit.)*

✓ If the IFL is *not* shorted (and line amplifiers, if installed, are not shorted), replace the LNB.

✓ If the LNB fuse is normal, check to make certain the LNB is securely connected to the IFL cable. A disconnected unit will cause the LNB indicator to light.

✓ Disconnect the IFL cable at the LNB. ***Be careful not to short center conductor to shield or ground.*** Measure the voltage available at the end of the cable. The voltage should measure about 19.5 VDC. If not, check for broken or disconnected IFL cable.

✓ Check IFL-to-LNB connector for corrosion, moisture or damage. Clean or replace, as necessary.

✓ If connector and voltage are normal, replace LNB unit and recheck.

C. FAULT Indicator On

✓ Turn off AC power at the rear panel. Wait a few moments, then reapply power to re-boot control circuits.

✓ If problem cannot be otherwise corrected, replace receiver with a spare.

D. DEMOD Indicator Off

This symptom is caused by either loss of demodulator lock on a received signal, or by the input signal not being present.

✓ If LNB indicator is also lighted, perform checks specified in B.

✓ If FAULT indicator is also lighted, perform checks specified in C.

✓ Check to make certain the receiver is set to the proper mode, bit rate, frequency, sweep width, and carrier ID. Refer to information provided by your satellite service supplier. Make certain that the

LOCAL LED is illuminated when manually configuring the unit via the front-panel controls.

✓ If the LNB is intended to be powered by the receiver, make certain that the unit is configured to supply LNB power.

✓ If no other fault indicators are lighted, check to make certain that the antenna is properly pointed toward satellite. If the input signal is not present, the DEMOD indicator will turn off.

✓ If the receiver is used for Ku-band operation, loss of signal may be caused by rain in the signal path (rain-fade). (In rare instances, extremely heavy rainfall may also cause fade in C-band signals.)

✓ Make certain that the sweep width is set wide enough for the LNB or down-converter being used.

✓ Rarely, this problem may be due to an uplink station fault or the uplink signal not being transmitted.

✓ Remove the F connector from the RF INPUT jack on the rear panel. Check for +19.5 VDC. If this voltage is not present, the LNB will not operate and the LNB indicator will NOT light.

✓ If no other problems are detected, replace the receiver and recheck.

✓ Some LNB or line amplifier failures may not be detected by the LNB fault circuits. If the problem continues, replace the LNB and/or the line amplifier and recheck.

✓ During each spring and autumn, for a few minutes on consecutive days, the sun's path across the sky will place it in line with the satellite, as viewed from your site. The radio noise from the sun will override the satellite signal. Normally, your service provider will give you a schedule for sun outages at your site. There is nothing that can be done to avoid this problem, but knowing that it will occur at specified times can eliminate having to check for other possible causes.

E. CARRIER ID Indicator Off

If the carrier ID value is set incorrectly, the receiver will lock only momentarily (the DEMOD indicator will flash on), and then continue to sweep. Recheck the carrier ID setting. (NOTE: The CARRIER ID indicator will not operate when the receiver is in the SCPC mode.)

F. DN LOAD Indicator On or Flashing

If the DN LOAD indicator is on solid (it may blink off momentarily), the receiver is being downloaded with new operating software. At the completion of the download the receiver will re-boot running the new software. Wait a few minutes for normal operation to resume. If the DN LOAD indicator goes out and the receiver does not re-boot, the download was either received in error or the download was not intended for your unit.

If a download is being received, refrain from using the keypad until the download is complete and the unit has re-booted. This will avoid accidentally interrupting the download process.

If the DN LOAD indicator is blinking regularly on and off, the receiver has received a valid re-configuration command since it was last reset. This feature is helpful in notifying the user that the network provider has re-configured the receiver. If this was expected it is confirmation that the change was made. To clear the DN LOAD LED indicator press the CANCEL key from any menu.

The DOWNLOAD COUNT menu, on the front panel LCD display, will also display the number of commands received since the unit was last reset. To reset the DOWNLOAD COUNT press

CANCEL from the DOWNLOAD COUNT menu. (Remember to enter the "local mode" first.)

G. Excessive Errors or Noise

✓ Make certain that the receiver is not tuned to an improper frequency.

✓ Make certain that the selected sweep width matches the characteristics of the LNB being used. Try the next wider sweep width.

✓ Check the signal strength (E_b/N_o) display. If the reading is low, the problem is likely to be with the IFL cable, LNB, or antenna pointing. A satellite problem or an unusual weather condition could also cause a low E_b/N_o reading. If the E_b/N_o reading is normal, the LNB may be defective.

✓ Repeak the antenna on satellite in azimuth, elevation, and polarization as specified in Section 2 of this manual.

✓ Interference (from either terrestrial or satellite sources) can cause errors and dropouts. Terrestrial interference can come from microwave links and nearby RADARS. Bandpass filters ahead of the LNB can often resolve these problems, especially in C-band systems. Satellite interference will usually come from defective, mis-pointed or mis-polarized antennas in both C-band and Ku-band systems.

✓ If the problem continues, check for moisture or corrosion in IFL connectors, especially in outdoor connections.

✓ If line amplifiers are used, recalculate signal losses and gains to make certain that the receiver is not being overloaded by excessive signal strength.

✓ Line amplifiers may fail and generate excessive noise. Replace and recheck.

✓ If antenna pointing and IFL connectors are correct and normal, the LNB may be excessively noisy. Replace the LNB and recheck.

✓ For a few minutes on consecutive days in the spring and autumn, interference from the sun, when it is in line with the satellite, can cause noise and data errors, including total override of the satellite signal. Normally, your service provider will give you a schedule for sun outages for your site. This schedule should be available at the operating location.

✓ If no other problem can be found, replace the receiver and recheck.

H. Other Problems

Assuming all indications are normal:

✓ If panel display is blank or garbled, turn off AC power at the rear panel. Wait a few moments, then reapply power. If the problem continues, replace the receiver.

✓ Contact the help desk of your satellite service provider for assistance with any problem you cannot identify or correct.

✓ Occasionally, problems occur with the satellite uplink earth station or with the satellite itself. If no faults can be found, and if all receiving equipment is known to be functional, check with another user of the same service to verify that the service is functional. Alternatively, check with your service provider.

5 Warranty and Repair Return

5.1 Warranty Statement

International Communications Products, Inc. (ICP) warrants the DCR-974 *DigiCeiver*® to be, at the time of shipment, free of defects in material and workmanship. The warranty will remain in effect for one (1) year from the date the unit is shipped from the factory. ICP will promptly repair or replace (at its option) equipment with any such manufacturing defects during the warranty period.

ICP's liability under the warranty extends only to the repair or replacement of defective equipment. ICP, Inc. does not accept liability for special or consequential damages.

This warranty does not cover damage due to:

- Abuse,
- Shipping and handling,
- Conditions or equipment external to the receiver,
- The failure of installers, operators, and/or other users to follow the instructions contained in this manual, and with the product, relative to safety, installation, operation, and maintenance of the unit.

This warranty is in lieu of any other warranty, expressed, implied, or statutory.

A complete statement of warranty is included in ICP's "Standard Terms and Conditions of Sale."

5.2 Repair Return

Contact the help desk of your satellite service supplier for shipping and handling instructions related to the return of failed or damaged equipment. This procedure applies both during and after the warranty period.

Do not return equipment to International Communications Products, Inc., without a specific return authorization from the company.

Appendix A SAP-102/SAP-104 Expansion Boards

A.1 Overview

The SAP-102/SAP-104 are optional expansion boards for the DCR-974. They provide high quality MPEG Layer 2 audio decoders, along with their required support circuitry. High level electronically balanced analog outputs are provided. Internal mixer/fader circuits provide the capability of mixing off-air audio, stored audio and locally sourced audio to allow complete formats to be produced directly from the receiver. Interfaces are provided to an ICP relay closure module, to allow the receiver to trigger local events or to sense local event triggers.

The SAP-102 includes two MPEG decoders and one mixer/fader, as well as the ability to interface with one closure module providing 8 closure inputs and 8 outputs.

The SAP-104 includes four MPEG decoders and two mixer/fader which allow supporting two radio formats with a single receiver. Up to 16 closure inputs and 16 closure outputs may also be supported.

The following description applies to both the SAP-102 and SAP-104 units

A.2 Circuit Description

Refer to the block diagram, Figure A-1. The digital audio decoders receive digital audio streams, in the form of clock and data, from the controller card of the DCR-974 receiver. These streams may be either real-time audio received off-air or stored streams from the DCR-974 storage device (hard drive or flash drive). The decoders decompress the MPEG streams and provide linear PCM data to the DACs (digital to analog converters) and to the optional AES/EBU (AES3) drivers. The DAC outputs are filtered and boosted in level prior to being fed to the mixer/fader circuitry and then the balanced electronic analog drivers. The MPEG decoders also recover the ancillary data channel from the digital streams and feed this information to the on-board microprocessor for further processing.

The Mixer/faders are configured as stereo three-into-one mixers with the capability of fading each input independently. Each fader receives the output of two decoders as well as a local auxiliary analog input. This allows the output of the fader (output B or output D) to potentially mix a real-time (off-air) signal with a previously recorded signal (a commercial spot for example) and/or a local audio source to produce a ready to air output. Note that the AES3 digital outputs from each decoder are not mixed but are the direct output of each decoder.

An on-board microprocessor controls the operation of the SAP-102/SAP-104. This processor provides control and configuration of the MPEG decoders as well as receiving status and ancillary data from them. The processor also provides an interface to the ICP remote closure modules. These modules each provide eight opto-isolated MOSFET outputs which are equivalent to a relay closure. Each module also can sense eight local switch closures via opto-isolators. The closure module also includes an eight-position DIP-switch which allows the card to provide a 5 Volt bias to allow sensing dry closures. One module may be installed on the SAP-102 and up to two closure modules may be installed on the SAP-104.

Rear panel LEDs assigned to each MPEG decoder are also controlled by the processor to indicate the presence of a valid MPEG stream at the input to the decoder.

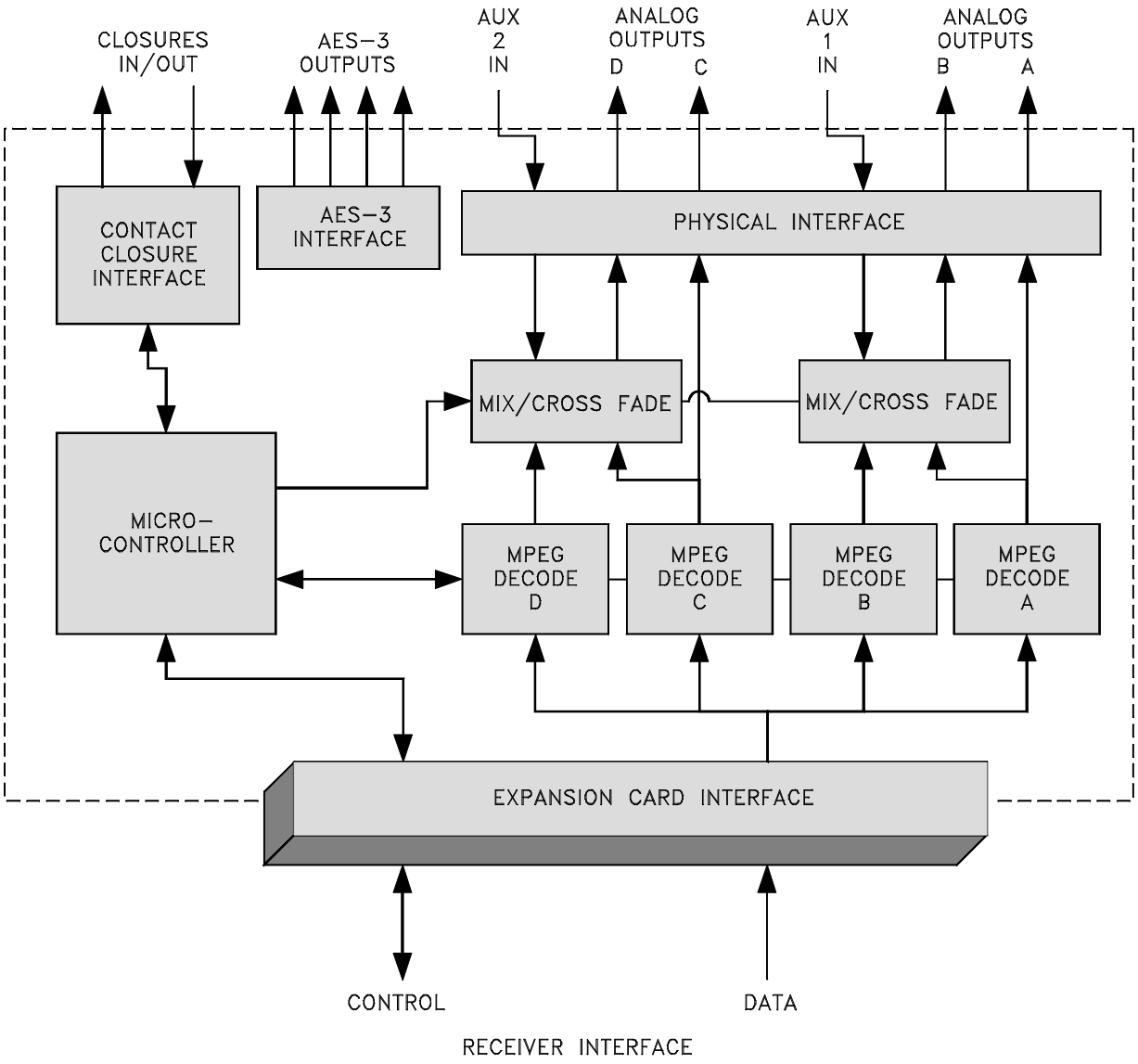


Figure A-1. Block Diagram of SAP-102/SAP-104 Card

A.3 Installation

The SAP-102/SAP-104 are optional expansion boards for the DCR-974 DigiCeiver. The board will normally be installed at the factory and should be ready for use when received. If for some reason it is necessary to install an SAP-102/SAP-104 card in the field please refer to Section 2.10 of this manual for instructions and cautionary information. Figure A-2 shows positions of connectors and mounting screws.

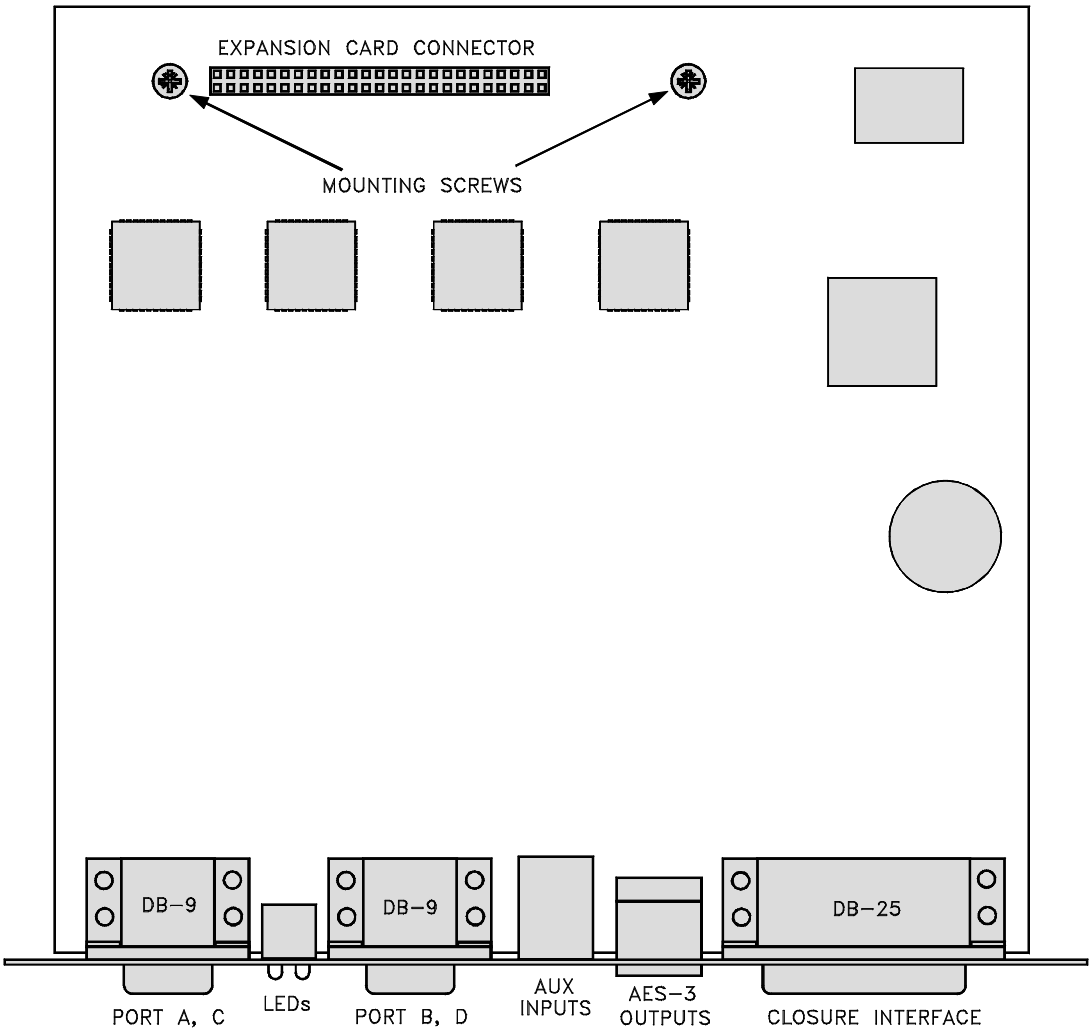


Figure A-2. Simplified Top View of SAP-102/SAP-104 Card

Connection to the rear panel connectors will be required as a part of installation of the SAP-102/SAP-104.

The pin assignments for the rear panel connectors are shown in tables that follow. Please note that each cable should be shielded to prevent interference to the audio produced by the receiver or the introduction of RF interference into the receiver circuitry. All signals into and out of the receiver are provided with internal RF filtering but special care should be used to reduce the risk of interference in sites where the receiver is co-located with the transmitter.

A.4 SAP-102/SAP-104 Connector Pin Assignments

Table A-1. Pin Assignments, Audio Output Decoder A, B, C, D; DB-9 Male.

Pin No.	Signal name
1	Chassis Ground
2	Right analog output (+)
3	Chassis ground
4	Left analog output (+)
5	Reserved
6	Chassis ground
7	Right analog (–)
8	Chassis ground
9	Left analog (–)

These outputs are electronically balanced. We recommend that each analog signal pair be individually shielded to prevent crosstalk between channels. Shielding will also reduce the likelihood of RF interference into the audio outputs if the equipment is located at the transmitter site.

Table A-2. Pin Assignments, AES-3 Outputs.

Pin No.	Signal name
1	Decoder C AES output (–)
2	Decoder C AES output (+)
3	Decoder B AES output (–)
4	Decoder A AES output (+)
5	Decoder A AES output (–)
6	Decoder B AES output (+)
7	Decoder D AES output (–)
8	Decoder D AES output (+)
Metal housing	Chassis ground (shield)

The AES-3 outputs are provided in an RJ-45 connector. This is the same connector used for most Ethernet LAN connections. A short cut to providing a mating cable for this connector is to utilize a standard CAT-5 LAN jumper cable (TIA/EIA-568A or B). The pairing of digital signals on the SAP-104 is consistent with the pairing of these cables. One end of the jumper cable may be cut off and re-terminated into the desired connector. Figure A-3 shows a drawing of the AES-3 connector to help in identifying the signal pin numbers.

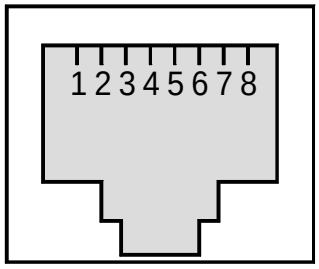


Figure A-3. RJ-45 Connector Pinout (Looking Into Rear Panel)

Table A-3. Pin Assignments, Auxiliary Audio Input 1.

Pin No.	Signal name
1	Chassis ground (shield)
2	Chassis ground (shield)
3	Input 1 right (+)
5	Input 1 right (–)
6	Input 1 left (+)
8	Input 1 left (–)
Metal housing	Chassis ground (shield)

These auxiliary audio inputs are provided to allow local insertion, via the built-in mixer/fader circuitry, of local analog audio feeds. The connector is a standard 6 pin mini-DIN connector. The gain of the path from the auxiliary input to the audio output is unity. Make sure you match the auxiliary input level to the desired output level. As with all the audio signals, use care to shield each pair individually. Connect the shield to the receiver chassis to reduce the possibility of RF interference to the receiver circuitry. Figure A-4 shows a drawing of the mini-DIN connector to help in identifying the signal pin numbers.

Table A-4. Pin assignments, Auxiliary Audio Input 2.

Pin No.	Signal name
1	Chassis ground (shield)
2	Chassis ground (shield)
3	Input 2 right (+)
5	Input 2 right (–)
6	Input 2 left (+)
8	Input 2 left (–)
Metal housing	Chassis ground (shield)

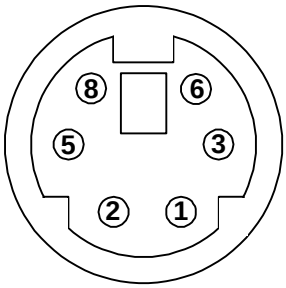


Figure A-4. Auxiliary Audio Input Connector Pinout (Looking Into Rear Panel)

A.4.1 Remote Closure Connector

The remote closure connector is not intended to be a user interface. It is intended to interface only to the ICP 100368 Remote closure module. The pinout for this connector is given in Appendix B.

A.5 Operation

The SAP-102/SAP-104 operates as a part of the DCR-974 receiver. As such its operation will normally be controlled by the network headend. There are no user adjustments for audio levels.

A.5.1 SAP-102/SAP-104 Rear Panel Indicators

A green LED indicator is associated with each MPEG decoder output. When Illuminated this LED indicates that the decoder is receiving a valid MPEG data stream even if the channel is quiet. The LED will be off if the decoder is not receiving MPEG data. This may occur if a decoder is not assigned to an MPEG stream or if the decoder is assigned to spot play but a spot is not playing at the time.

Appendix B Remote Switch Closure Module

B.1 Purpose and Description

The ICP Remote Switch Closure Module (Part No. 100368) provides a switch-closure interface capability for the Model DCR-974 Receiver. In many radio stations, switch closures outputs from the receiver are used to trigger local events in the station. Similarly, switch closure inputs to the receiver may be used to cause it to perform some predetermined action. The Module provides a convenient means of obtaining such inputs and outputs without having to set DIP switches or jumpers within the receiver cabinet. Each module provides eight optically-isolated inputs and outputs. Two modules may be installed to provide a total of 16 inputs and outputs.

The module size is approximately 1/2" x 2-3/4"x 3-1/2", (14 mm x 70 mm x 90 mm). A 25-pin Type "D" connector mates with the rear-panel REMOTE CLOSURE port on the receiver where it is held in place with slide latches. The user interface is a 37-pin female Type "D" connector provided with 4-40 jack screw receptacles. DIP switches on the top surface of the module are set as appropriate for the installation prior to powering up the receiver.

Internally, inputs are provided by eight opto-isolators and outputs by eight opto-isolated MOSFETs. Figure B-2 is a schematic drawing showing internal and external circuits.

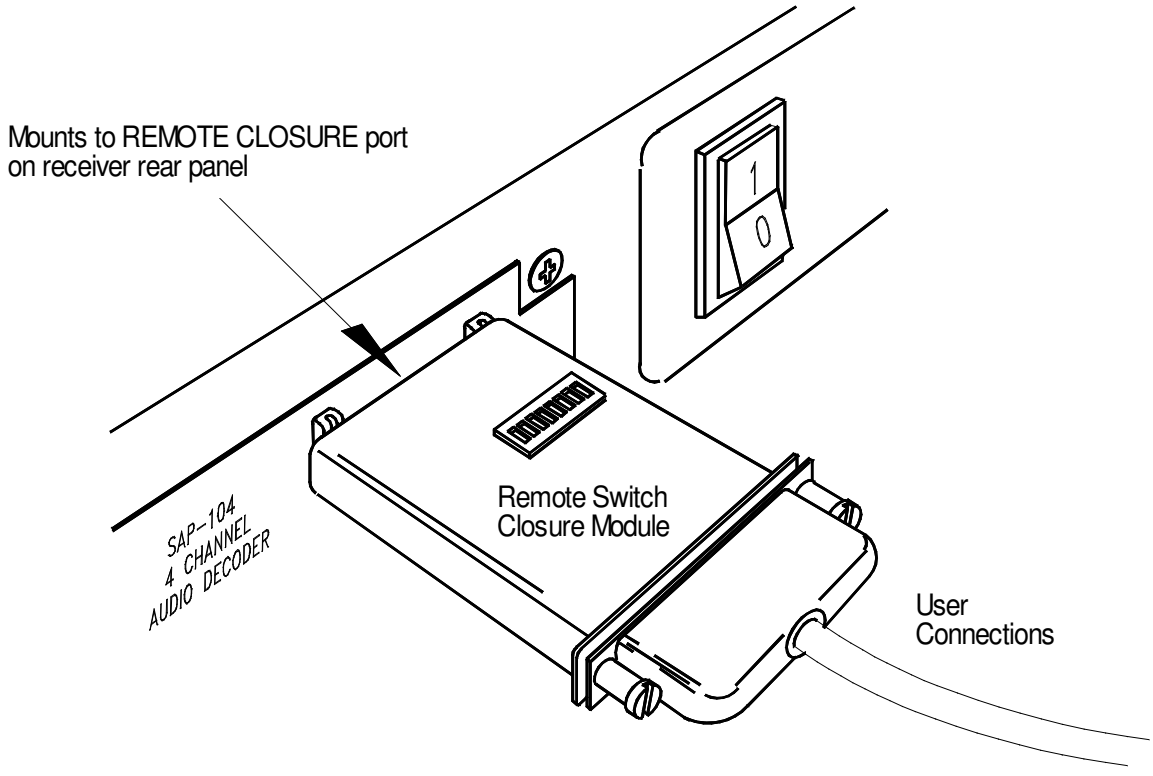


Figure B-1. Remote Closure Module

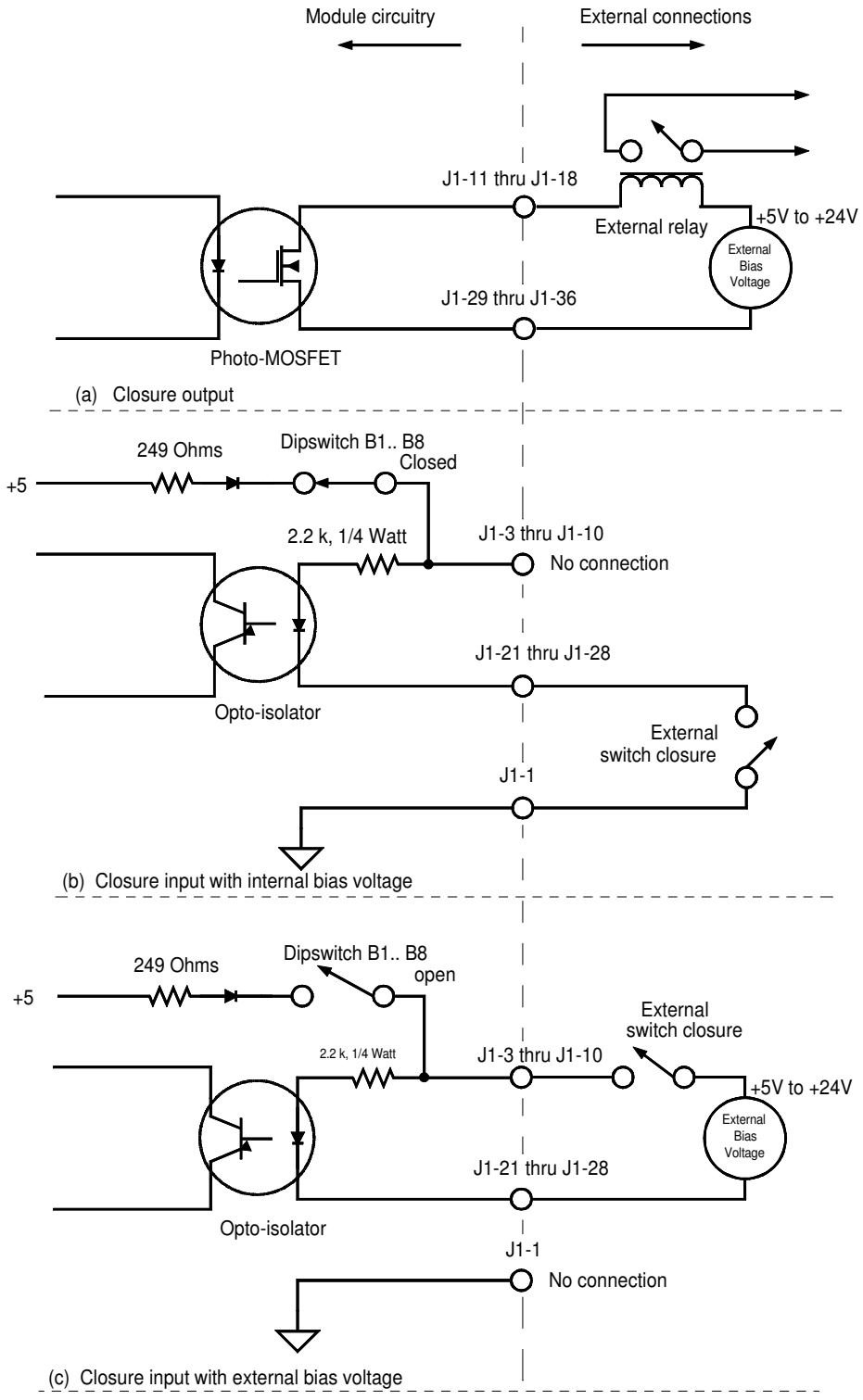


Figure B-2. Simplified Schematic, Internal and External Connections

Figure B-2 shows the typical input and output circuits of the module. Each module provides eight opto-isolated inputs and eight opto-isolated outputs. Connections are shown for typical configurations. In each case the ICP closure internal circuitry is shown on the left and the user connections are shown on the right.

The closure outputs are provided by optically isolated MOSFETs. These devices provide interface ratings similar to standard reed relays but have the advantage of being solid state devices. Each MOSFET switch output is fully isolated from the receiver power supply and chassis. The output may be used in the same way that a set of normally open relay contacts would be used. A typical connection is shown in the lower part of Figure B-2a.

The closure input sensing is via an opto-isolated transistor. When current is applied to the LED, the transistor is turned on and the receiver senses the external closure. The closure may be configured in different ways depending on the source of the bias voltage for the LED. If the bias is supplied externally, installation consists of just applying the signal to the opto-isolator LED. This configuration is shown in Figure B-2c. With this type connection the closure input is fully isolated from the receiver power supply and chassis. The voltage applied to the closure input may range from 5 volts to 24 volts DC.

If the module must sense a dry closure (where no voltage is provided) then the module may be configured as shown in Fig B-2b. Here a dipswitch, on the closure module, enables a +5 Volts bias from the receiver. This allows a simple external switch closure to be used. Note that in this configuration the input is no longer fully isolated. Make sure that the external switch is isolated from any ground or power source which is not at the same potential as the receiver chassis. ICP recommends that the external switch be isolated from any other ground or power supply.

Other configurations are possible as long as the ratings of the input and output devices are observed. See Table B-1 for a list of these ratings.

B.2 User Connections and DIP Switch Settings

Input and output ratings are shown in Table B-1. User connections are made to the 37-pin connector on the module, as shown in Table B-2, using a standard male 37-pin D connector. Make user connections and set DIP switches before installing the module on the receiver.

Table B-1. Input and Output Ratings

Input Parameter	**Specification**
Type	Opto-isolator
Input voltage range	5 to 24 VDC
Input isolation voltage	1500 V. Note: Inputs are isolated only if the internal bias voltage is NOT used.
Output Parameter	**Specification**
Type	Opto-isolated MOSFET
Maximum current	0.5 Amps DC
Maximum voltage	100 VDC
Output isolation voltage	1500 V.

Outputs provide a remote-commanded MOSFET switch between the (+) and (−) output pins. Make sure proper polarity is observed on all connections.

Eight DIP switches are visible on the top surface of the Closure Module, identified at B1-B8. These switches may be positioned as needed to provide a 5-Volt bias. Note that the switch positions apply to *inputs* only. Also, note that the switches must be set to the ON position to provide the positive bias on the associated connector pin. Using this bias allows an external contact closure to trigger events without the use of an external power supply.

To use the internal 5V bias for an input circuit, set the corresponding DIP switch to ON. Connect one of the two leads from the set of external contacts to ground (pin 1), the other

lead to the selected negative (–) input of the module

Table B-2. DIP Switch Settings and User Pinout.

Bias Switch	Function	Pins	
	INPUT	(+)	(–)
B1	1	3	21
B2	2	4	22
B3	3	5	23
B4	4	6	24
B5	5	7	25
B6	6	8	26
B7	7	9	27
B8	8	10	28
N/A	OUTPUT	(+)	(–)
	1	11	29
	2	12	30
	3	13	31
	4	14	32
	5	15	33
	6	16	34
	7	17	35
	8	18	36

B.3 Installation

The module is ready to install as it comes from the package. Check to make certain that the slide latches are OPEN (see marking on unit). . Note that the two latches move in opposite directions, one up, the other down. Orient the 25-pin Type "D" connector to match the REMOTE CLOSURE port on the receiver and carefully press the connector into position. When the connector is fully seated, engage the slide latches.

The module may be located remotely from the chassis if desired. To do this use a 25 pin "D" jumper cable. The cable should be wired 1:1 with a male connector on one end and a female connector on the other. This cable should be no longer than 8 feet.

A flat ribbon cable is a convenient option. If a shielded cable is used, the shield should be tied to pin 13.

B.4 Reference Information

Table B-3 shows complete pinout for the user port. Note that this duplicates information in Table B-2, but also shows additional pin assignments.

Table B-3. User Interface Pin Assignments (Female 37-Pin D).

Pin No.	Function	Signal Direction
1	Chassis ground, shell	N/A
2	No connection	N/A
3	Input 1 +	To receiver
4	Input 2+	To receiver
5	Input 3+	To receiver
6	Input 4+	To receiver
7	Input 5 +	To receiver
8	Input 6 +	To receiver
9	Input 7 +	To receiver
10	Input 8 +	To receiver
11	Output 1 +	From receiver
12	Output 2 +	From receiver
13	Output 3 +	From receiver
14	Output 4 +	From receiver
15	Output 4 +	From receiver
16	Output 6 +	From receiver
17	Output 7 +	From receiver
18	Output 8 +	From receiver
19	No connection	N/A
20	No connection	N/A
21	Input 1–	To receiver
22	Input 2–	To receiver
23	Input 3–	To receiver
24	Input 4–	To receiver
25	Input 5–	To receiver
26	Input 6–	To receiver
27	Input 7–	To receiver
28	Input 8–	To receiver
29	Output 1–	From receiver
30	Output 2–	From receiver
31	Output 3–	From receiver
32	Output 4–	From receiver
33	Output 5–	From receiver
34	Output 6–	From receiver
35	Output 7–	From receiver
36	Output 8–	From receiver
37	No connection	N/A