



DIGITAL HYBRID III

*Installation and
Operations Manual*

Digital Hybrid III Installation and Operations Manual

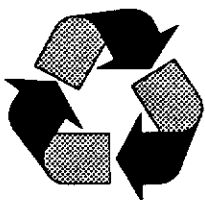
Copyright© 1993 by Gentner Communications Corporation. All rights reserved. No part of this manual may be reproduced in any form or by any means without permission from Gentner Communications Corporation.

Printed in the United States of America. Gentner Communications Corporation reserves specification privileges.

Information in this manual is subject to change without notice.

This manual was written and designed by Renee Gibson.

*Gentner Part No. 800-009-312
November 1993 (Rev. A1)*



Gentner Communications Corporation is committed to protecting the environment and preserving our natural resources.

This manual has been printed entirely on recycled paper.

TABLE OF CONTENTS

INTRODUCTION	1
About this Manual	1
FEATURES	2
BENEFITS	3
APPLICATIONS	4
Typical Broadcast Applications	4
Conferencing Multiple DH III Units	5
DETAILED PRODUCT DESCRIPTION	6
Front Panel Controls	7
Back Panel Connectors	10
Block Diagram	13
INSTALLATION	14
Instructions for your Application and Phone System	14
Check your Shipment	14
Tools Required	15
Environmental Requirements	15
Check Operating Voltage	15
Mounting	16
Making Connections	16
CONNECTING DIRECTLY TO A SINGLE CENTRAL OFFICE TELEPHONE LINE	17
CONNECTING TO AN EXISTING MULTI-LINE TELEPHONE SET	18
USING A GENTNER TELEMIX 2000 SYSTEM AS A CALL DIRECTOR	20
CONNECTING TO AN ELECTRONIC KEY SERVICE TELEPHONE SET	22
Compatibility with Electronic KSU Telephone Sets	22
Connections With DC Current Flow	22
Connections Without DC Current Flow	24

CONNECTING TO AUDIO EQUIPMENT 26

Introduction 26
 Creation of a Separate Mix Channel 27
 Internal Mix-Minus Bus 27
 Make Your Own Mix-Minus 27
 Discrete Microphone Mixer 27
 One Channel Send 27

FUNCTIONS OF THE REMOTE CONTROL 28

Pin 1 Remote On / Pin 5 Switch Common 29
 Pin 2 Remote Off / Pin 5 Switch Common 29
 Pin 3 Remote Record / Pin 5 Switch Common 29
 Pin 4 Remote CUE / Pin 5 Switch Common 29
 Pin 5 Switch Common 30
 Pin 6 Send Mute (Privacy Switch) / Pin 5 Switch Common 30
 Pin 7 Receive Mute / Pin 5 Switch Common 31
 Pin 8 Remote Cue (Console) / Pin 5 Switch Common 31
 Pin 9 Auxiliary Send + / Pin 22 Auxiliary Send Ground 31
 Pin 10 Unbalanced Caller + / Pin 23 Unbalanced Caller Ground 31
 Pin 11 Unbalanced Record/Mix Audio Output + /
 Pin 24 Record/Mix Ground 31
 Pin 12 Aux Relay N.O. / Pin 13 Aux Relay N.C. /
 Pin 25 Aux Relay Common 32
 Pin 14 Remote On Indicator / Pin 15 Remote Off Indicator
 Pin 16 Remote Record Indicator / Pin 17 Remote Cue Indicator 32
 Pin 18 Indicator Common 33
 Pin 19 Send Presence Remote Indicator / Pin 20 Caller
 Presence Remote Indicator 33
 Pin 21 Indicator Common 33
 Remote Indicators 33
 Adding External Relays 34

FUNCTIONS OF THE TAPE CONNECTOR 35

Pin 1 N.O. Tape Start Relay Contact /
 Pin 2 N.C. Tape Start Relay Contact /
 Pin 6 Common (Wiper) Tape Start Relay Contact 35
 Pin 3 N.O. Tape Stop Relay Contact /
 Pin 4 N.C. Tape Stop Relay Contact /
 Pin 8 Common (Wiper) Tape Stop Relay Contact 36
 Pin 5 N.O. Record Enable / Pin 9 Record Enable Common 36

SETUP AND CALIBRATION	37
Analog (Coarse) Null	37
Digital (Fine) Nulling	38
Adjust Main Send Levels	38
Adjusting Cue Send Level	39
Adjust Caller Level and Caller Control	39
DIP Switch Settings	41
#1—Auto-Answer	41
#2—Auto-Disconnect	42
#3—Auto-Renull	42
#4—On/Off Latching	42
#5—Tape Start Latching	43
#6—Tape Stop Latching	43
#7—625 Hz Test Tone	44
#8—Digital Nulling	44
#9—Cue	44
#10—Enhanced Null	44
OPERATION	46
Answering a Call	46
Disconnecting a Call	46
Cue	46
Recording Calls	47
Renulling the Line	47
Remote Controls	47
SPECIFICATIONS	48
Physical Specifications	48
Electrical Specifications	48
Telephone Specifications	48
Telephone Transmit	48
Telephone Receive	49
Audio Interface	49
Back Panel Connectors	49
MAINTENANCE	50
TROUBLESHOOTING	51
Questions and Answers	51
TECHNICAL INFORMATION	55
Brief Technical Description	55
Theory of Operation	56
Send Audio Circuit Description	57
Caller Audio Circuit Description	58
Telephone Interface Circuit Description	59

FIRMWARE LICENSE	61
WARRANTY	62
PRODUCT LINE UPDATES	63
SCHEMATICS	64

TABLE OF FIGURES

Figure 1	Typical Broadcast Application	4
Figure 2	Front Panel Controls	7
Figure 3	Back Panel Connections	10
Figure 4	XLR Connectors	11
Figure 5	Line and Set Connectors	12
Figure 6	Setting Operating Voltage	15
Figure 7	Connecting to a Single Central Office Line	17
Figure 8	Connecting to a Multi-Line Telephone Set	18
Figure 9	DH III to Telemix 2000 Interconnection Cable	20
Figure 10	Connecting to Digital Telephones	23
Figure 11	Installation in a Digital Telephone System with DC on the Audio Pair	24
Figure 12	Locate the Jumper on the PC Board	25
Figure 13	Function of a Telephone Hybrid	26
Figure 14	Making Audio Connections	26
Figure 15	Remote Connector Audio Pin Outs	28
Figure 16	Remote ON/OFF Control	29
Figure 17	Remote CUE Controls	30
Figure 18	Remote RECORD Controls	30
Figure 19	Remote Send/Receive Muting	31
Figure 20	Auxiliary Relay Pin Out	32
Figure 21	Remote ON, OFF, RECORD, and CUE Indicators	32
Figure 22	Remote SEND and CALLER Presence Indicators	33
Figure 23	Adding External Relays	34
Figure 24	Back Panel TAPE Connector	35
Figure 25	Remote Tape Start / Stop / Record Control	36
Figure 26	Front Panel Controls	37
Figure 27	Remote ON/OFF Controls	42
Figure 28	Front Panel Functions	55
Figure 29	Back Panel Summary	56
Figure 30	Functional Block Diagram	57

INTRODUCTION

Thank you for purchasing Gentner's Digital Hybrid III. When installed properly, according to the instructions contained in this manual, the Digital Hybrid III will provide the highest audio quality available.

The Digital Hybrid III has been developed to meet the needs of the broadcast industry, whose discriminating listeners demand the highest quality telephone audio available. Since the telephone has become such an important part of a broadcaster's format, providing clear, clean telephone audio is a must. Gentner has long been an industry leader providing high quality, dependable digital hybrids.

The Digital Hybrid III is DSP based and connects directly to the telephone line. It separates the send audio from the receive audio for a wide variety of applications. Its four front panel On, Off, Cue and Record functions control the hybrid's functions.

About this Manual

This manual is designed to walk you through simple installation, setup and operation of your Digital Hybrid III for broadcast users. Installation details are provided for connecting your hybrid to most current telephone systems. Gentner publishes a detailed primer on standard telephone systems titled "Telephone Basics". If your application requires more information about phones, phone systems and non-standard installations not contained in this manual, contact Gentner at the numbers listed below and ask for a copy.

To receive the full benefit of the Gentner Digital Hybrid III, we recommend that you take a few minutes to review the "Applications" and "Installation" sections of this manual before proceeding. You may discover other applications for your new hybrid that will continue to enhance the operation of your telephone interface equipment. We are confident you will be very pleased with the ease of use, its quick installation, versatility, and of course, high quality.

Please refer to this manual first if you have any questions or problems regarding the use of the Digital Hybrid III. If you cannot find an answer in the manual, please contact:

Gentner Communications Corporation
Technical Support
1825 Research Way
Salt Lake City, Utah 84119
Telephone: (801) 975-7200
Facsimile: (801) 977-0087

FEATURES

- **100% digital signal processing**
- **16 bit processing with 2 times over sampling**
- **20 kHz sampling rate**
- **Automatic and continuous nulling to the telephone line**
- **Quiet line switching**
- **Automatic recording**
- **Automatic cueing between mix-minus on console and mic preamp**
- **Automatic answer/disconnect**
- **Adjustable caller control**
- **Fully remote capable**
- **Internal test tone generator**
- **Built-in power supply**
- **Meets international power requirements**
- **Sturdy rack mount design**

BENEFITS

The Gentner Digital Hybrid III provides these benefits:

- Complete talent control over the conversation
- Excellent hybrid performance. Prevents feedback and discoloration of Send audio, and maximizes isolation between the Send and Caller sides of telephone conversations.
- The Digital Hybrid III adapts automatically and continuously to telephone line conditions and programming content.
- Carefully designed bandpass filters on both the Send and Caller circuits minimize hum, central office switching noise, and telephone multiplex distortion.
- Caller Control circuitry permits dimming (reducing) Caller audio by a variable amount when Send audio is present. This allows for a smooth interchange while maintaining adjustable announcer dominance.
- All functions, features and controls are contained in an EPROM (Erasable Programmable Read Only memory) chip, permitting simple future updates of the Digital Hybrid III.
- Two-times over sampling and 16 bit resolution combine the excellent audio quality of an analog hybrid with the null performance offered only by a digital device.
- Auto-answer, auto-disconnect, and automatic muting of Caller audio are standard features.

APPLICATIONS

The Digital Hybrid III offers full duplex audio transmission. This means that both sides of the conversation may be heard continually, without gating or switching or ducking—even when both sides are speaking simultaneously. This permits conversation to occur in a normal manner without the irritating restrictions imposed by speakerphones.

The Digital Hybrid III's ease of use and capabilities make it ideally suited for the following applications:

Typical Broadcast Applications

The broadcasters value the features of the Digital Hybrid III because of its superior phone line quality and ease of use. The selected phone line is routed to the Digital Hybrid III. When the talent is ready to put the call on the air, the ON button is pressed. The line is immediately terminated (connected), and a 300 millisecond burst of white noise is sent down the line, then the hybrid automatically nulls to the noise burst. The output audio is unmuted and the Caller audio is routed to the input of the console. Figure 1 shows a typical broadcast installation.

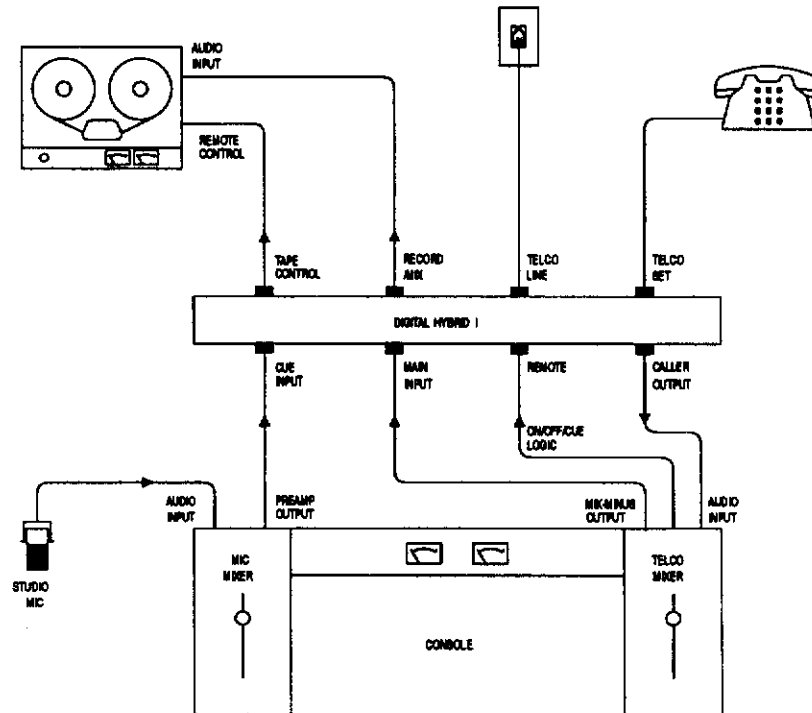


Figure 1

Typical Broadcast Installation

The muting function is useful in broadcast applications because it masks the termination pops and clicks, making the telephone connection clean and clear.

Adjustable "Caller-Control" dims (reduces) received (caller) audio to permit the desired degree of announcer dominance.

**Conferencing
Multiple Digital
Hybrid III
Units**

Multiple Digital Hybrid III's can be conferenced for the airing of multiple callers or for use as a teleconference bridge. A VIP setup is used when a two channel console is available. Callers can be mixed or separated according to your requirements, depending on your setup configuration.

DETAILED PRODUCT DESCRIPTION

The Digital Hybrid III utilizes highly sophisticated digital circuitry and digital signal processing techniques to optimize the isolation between the Send and Receive sides of a telephone conversation.

The performance improvements provided by the Digital Hybrid III help reduce feedback over the hybrid, even when you have an open microphone in the same room with a loudspeaker.

The Digital Hybrid III provides a Caller Control circuit, that permits Caller audio to be dimmed (reduced) by an adjustable amount when Send audio is present.

The Digital Hybrid III offers a user-selectable Null Enhancement mode.

The hybrid connects directly to the telephone line and provides auto-answer/auto disconnect capability.

Remote control functions of the unit can be accessed via a single back panel REMOTE connector.

A removable metal panel on the front of the unit allows access to controls for MAIN SEND level, CUE SEND level, CALLER level, and CALLER CONTROL. Coarse (analog) null adjustments are available, as well as a series of DIP switches for programming other functions and features of the Digital Hybrid III.

The unit has two LED indicators on the front panel. The SEND and CALLER LED's flash green to indicate the presence of respective audio, and flash red to indicate a level of 6 dB before clipping. This helps you prevent distortion due to excessive audio levels.

The Digital Hybrid III incorporates a RECORD function that allows you to record telephone conversations with a push of a single button. In the RECORD mode, the selected SEND input audio is mixed with Caller audio and feeds both balanced and unbalanced RECORD/MIX audio outputs which can be used to feed both sides of the telephone conversation to a tape recorder.

Remote connections are provided to automatically start, enable record, and stop the tape recorder.

The CUE button selects either of two separate Send audio input sources. It toggles between MAIN SEND, (normal console mix-minus send), and CUE SEND, (usually the announcer's microphone preamplifier output). The selected source is routed to the caller and the RECORD/MIX output. MAIN SEND and CUE SEND inputs have individual level controls.

The use of console logic permits automatic switching between MAIN SEND and CUE SEND audio sources for on-the-air or off-the-air recording.

Front Panel Controls

Easy to access and read front panel controls and LED indicators make operation of the Digital Hybrid III simple to control and adjust. The front panel drawing below shows each front panel trim pot, DIP switch and button. The descriptions below the drawings are referenced to the numbers on the Front Panel Controls drawing in Figure 2.

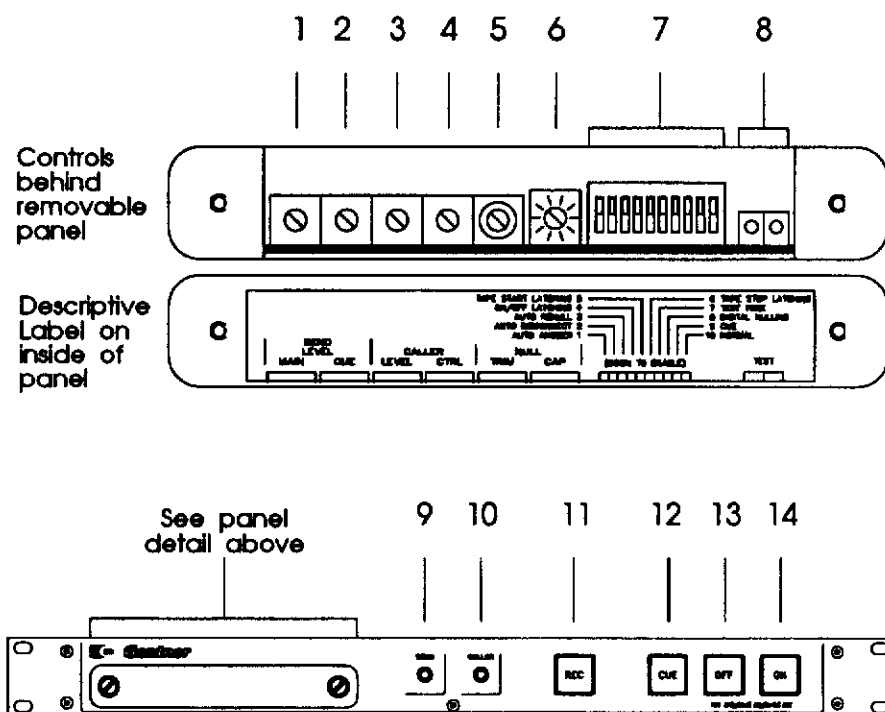


Figure 2

Front Panel Controls

1. **MAIN SEND LEVEL.** Use to adjust Main Send audio level into the hybrid. Monitor the send level with the SEND LED (9).
2. **CUE SEND LEVEL.** Use to adjust the Cue Send audio level into the hybrid while in Cue mode. Monitor the send level with the SEND LED (9).
3. **CALLER LEVEL.** Use to adjust the Caller audio level into the hybrid.
4. **CALLER CONTROL.** Use to adjust the talent's level of audio dominance over Caller audio. (Typically set in full counter-clockwise position.)

5. **NULL TRIM.** This Null trim pot is used to provide a coarse analog null. This is a one-time procedure during installation that will minimize voltage across the test jacks and allow maximum separation of the send and caller audio.
6. **NULL CAP.** Used during the analog Null procedure, the Null Capacitance adjustment is used to minimize the voltage across the test jacks.
7. **DIP SWITCHES.** Ten DIP switches are provided to program your system to operate in the mode(s) required for your application.

DIP SWITCH FUNCTIONS			
SWITCH NO.	DEFAULT POSITION	DEFAULT DESCRIPTION	ALTERNATE
1	UP	Auto-Answer disabled.	Switch to DOWN to automatically answer phone after one ring.
2	UP	Auto-Disconnect disabled.	Switch to DOWN to disconnect call on sensing loop drop.
3	UP	Auto Renuil disabled.	DOWN enables auto mute on disconnect and unmuting and auto-renulling on reconnection.
4	UP	Front panel or remote On/Off momentary control.	On/Off controlled by single remote latching control in DOWN position.
5	UP	Tape Start momentary relay through Remote connector.	Tape start latching relay through Remote connector in DOWN position.
6	UP	Tape Stop momentary relay through Remote connector.	Tape stop latching relay through Remote connector in DOWN position.
7	DOWN	625 Hz Test Tone enabled for setup.	Switch to UP for normal operation.
8	DOWN	Digital Nulling enabled.	UP disables digital nulling during setup.
9	DOWN	Cue.	UP (for Audio Conferencing applications).

Table 1

8. **TEST.** These test points will be used during setup procedure for Analog Null.
9. **SEND LED.** This red/green LED flashes green to indicate the presence of Send audio, and flashes red to indicate a level of 6 dB before clipping. When the LED flashes red, the MAIN SEND level trim pot (1) should be adjusted to reduce distortion due to excessive audio levels.
10. **CALLER LED.** This red/green LED flashes green to indicate the presence of caller audio, and flashes red to indicate a level of 6 dB of caller audio before clipping. When the LED flashes red, the CALLER LEVEL trim pot (3) should be adjusted to reduce distortion due to excessive audio levels.

11. **RECORD** button (with indicator light). The RECORD button activates the start tape mode to record calls.
12. **CUE** button (with indicator light). The CUE (HOLD) button toggles the cue function on/off. When lit, the caller audio will not be heard.
13. **OFF** button (with indicator light). Pressing the OFF button mutes the caller audio and disconnects the call. When not on an active call the OFF indicator light will remain on steady.
14. **ON** button (with indicator light). Press the ON button to connect the Digital Hybrid III to the telephone line. An automatic null process is performed that causes the call to be muted for less than a second while the line is nulled, then unmuted. Pressing the ON button again during a telephone call repeats the null and muting process, if necessary. While on an active call, the indicator light will remain on steady.

Back Panel Connectors

Back panel connections are shown in Figure 3 below and identified by number in the descriptions.

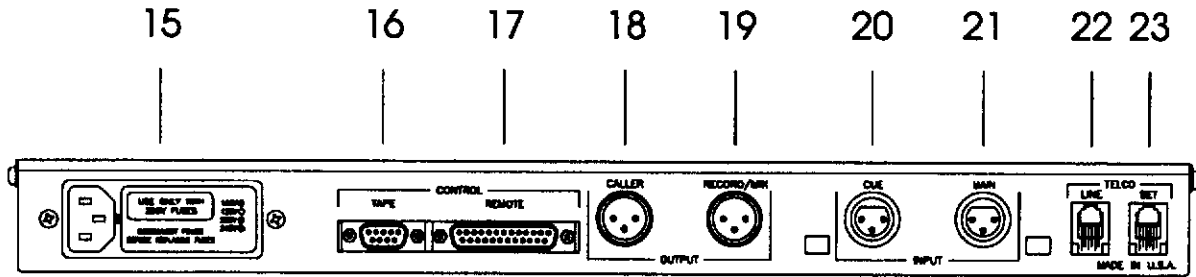


Figure 3

Back Panel Connections

- 15. **POWER MODULE.** (Multiple voltage selections). Select correct voltage between 100, 120, 220 and 240 volts, 50/60 Hz, 15 watts.
- 16. **TAPE.** The DB-9 TAPE connector controls tape recording functions remotely. Pin outs are shown in Table 2.

DB-9 TAPE CONNECTOR PIN OUTS			
PIN NO.	DESCRIPTION	PIN NO.	DESCRIPTION
1	N.O. Tape Start	6	Tape Start Common
2	N.C. Tape Start	7	Not Used
3	N.O. Tape Stop	8	Tape Stop Common
4	N.C. Tape Stop	9	Record Enable Common
5	Record Enable N.O.		

Table 2

DB-25 REMOTE CONNECTOR PIN OUTS			
PIN NO.	DESCRIPTION	PIN NO.	DESCRIPTION
1	Remote ON	14	ON Indicator ^(a)
2	Remote Off	15	OFF Indicator ^(a)
3	Remote Record	16	RECORD Indicator ^(a)
4	Remote Cue (Hold)	17	CUE Indicator ^(a)
5	Switch Common ^(b)	18	Indicator (Common) ^(b)
6	Send Mute (Privacy)	19	Send Presence Indicator ^(a)
7	Caller (Receive) Mute	20	Caller Presence Indicator ^(a)
8	Remote Cue (Console)	21	Indicator Common ^(b)
9	Unbalanced AUX Send	22	AUX Send Audio Common ^(c)
10	Unbalanced Caller	23	Caller Audio Common ^(c)
11	Unbalanced REC/MIX	24	REC/MIX Audio Common ^(c)
12	AUX Relay N.O.	25	AUX Relay Common
13	AUX Relay N.C.	NOTES: (a) Open Collector Ground (b) Digital Ground (c) Analog Ground	

Table 3

17. **REMOTE.** The DB-25 connector remotely controls functions and audio connections. Refer to Table 3 for pin out information.
18. **CALLER Output.** 3-pin male XLR connector. Caller Output connects to your console. This 600 ohm active balanced output is adjustable via the front panel CALLER LEVEL trim pot. Nominal output level is +4 dBm, with a clipping threshold of 20 dBm. Audio at this connector contains CALLER (receive) audio only.
19. **RECORD/MIX Output.** 3-pin male XLR connector. Contains a mix of Caller Output and Send Input for recording both sides of the telephone conversation. This is a 600 ohm active balanced output. Audio available at this connector is the sum of the selected audio input (MAIN or CUE) and the CALLER audio (unity gain). This output does not contain AUXILIARY SEND audio (unbalanced input on the REMOTE connector).

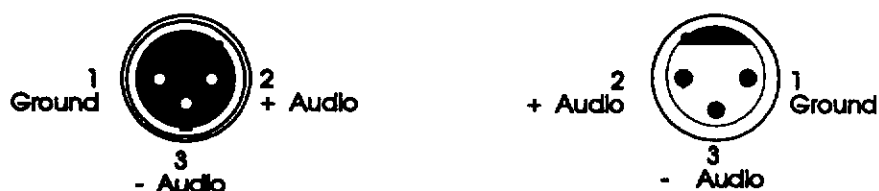


Figure 4

**XLR Connectors,
as viewed from the back panel**

20. **CUE Input.** 3-pin female XLR cue audio input. This is a +4 dBm, balanced, bridging, CUE send input to the Digital Hybrid III. Input level is adjustable via the second trim pot from the left, inside the front access panel. When the CUE feature is enabled, audio fed to this input will be sent to the caller, and summed with the CALLER at the RECORD/MIX output.
21. **MAIN Input.** 3-pin female XLR connection. Contains Main Audio Input from your console. This is a +4 dBm, balanced, bridging, MAIN send input to the Digital Hybrid III Input level is adjustable via the first trim pot on the left, inside the front access panel. When the CUE feature is not enabled, audio fed to this input will be sent to the caller and summed with the caller at RECORD/MIX output.

22. **LINE.** A modular RJ-11C jack connects your telephone line to the hybrid.
23. **SET.** A modular RJ-11C jack connects your telephone set to the hybrid. The set is used during hybrid setup and may also be used to make or receive callsoff air.

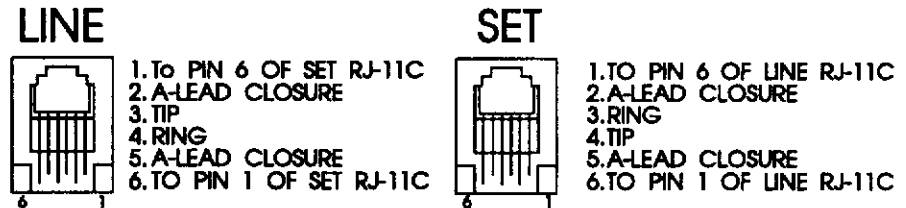
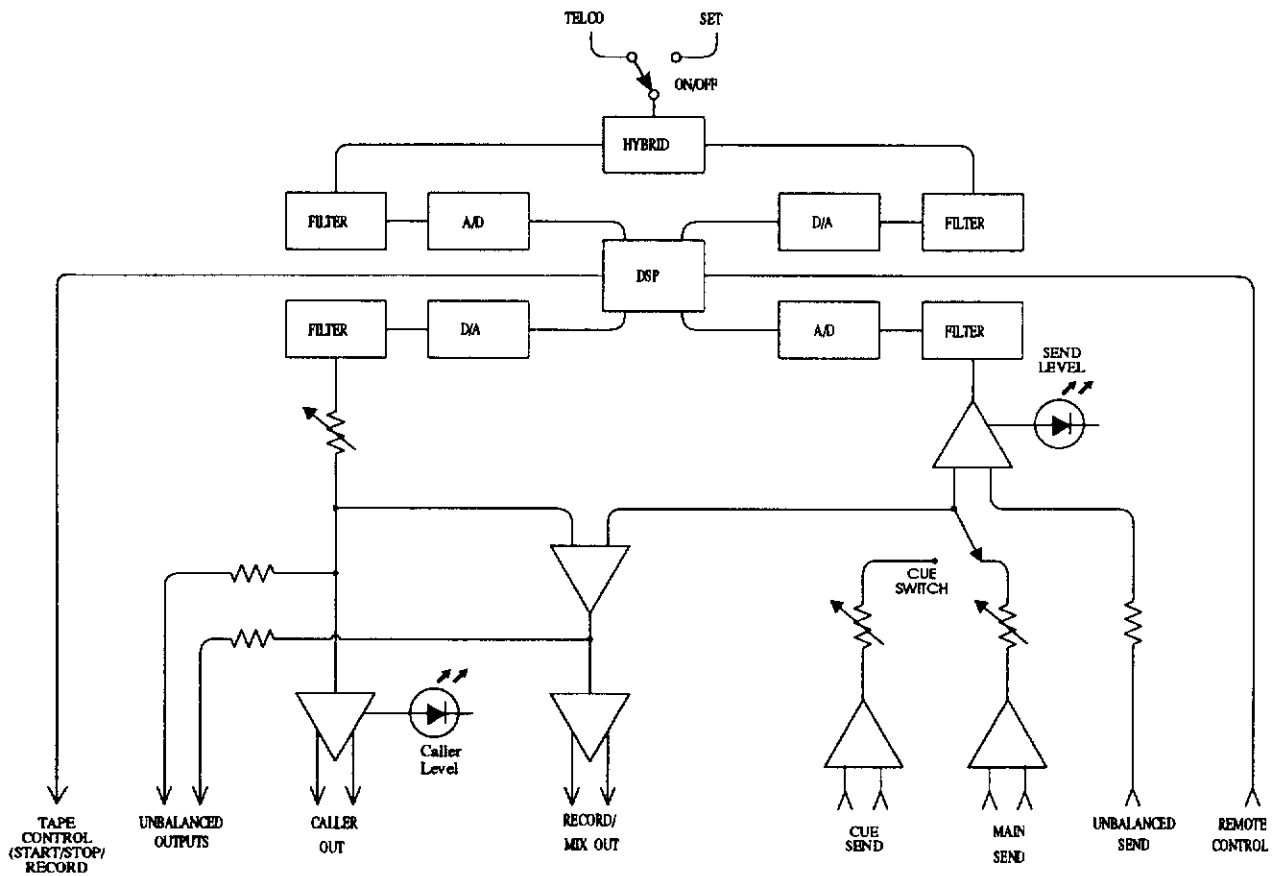


Figure 5

Line and Set Connectors

Block Diagram A functional block diagram of the Digital Hybrid III is shown below for reference.



INSTALLATION

This section details the installation procedures for your new Digital Hybrid III. General information is included to help you understand each procedure, where required.

Instructions for your Application and Phone System

This section is sub-divided to detail installation for various broadcast applications and shows detailed drawings for connecting your hybrid to the most common telephone systems in the various configurations. You are encouraged to locate the drawings for your specific application by reviewing this section *before proceeding*, to become familiar with the procedure prior to installation. This will prove beneficial and will save time during installation.

If this manual does not address information on your phone type, or more information is required about the telephone and its operation, contact Gentner's Sales or Technical Support group at (801) 975-7200 and request Gentner's "Telephone Basics", and "Interfacing to Electronic Telephone Systems" White Paper. These primers should answer your questions.

Check your Shipment

Gentner is not responsible for product damage incurred during shipment. You must make claims directly with the carrier. Inspect your shipment carefully for obvious signs of damage. If the shipment appears damaged, retain the original boxes and packing material for inspection by the carrier. Contact your carrier immediately.

Please check your Digital Hybrid III shipment to be certain that each item listed below is included. If any item is missing, notify Gentner immediately.

Digital Hybrid III Unit Assembly Installation and Operations Manual Warranty Registration Card

- 4 Rack Screws**
- 6 Rack Cups**
- 1 Modular Telephone Cord**
- 1 DB-25 Connector**
- 1 Hood for DB-25 Connector**
- 1 DB-9 Connector**
- 1 Hood for DB-9 Connector**
- 1 Molded Power Cord**
- 1 Gentner Screwdriver**

Tools Required

- Phillips screwdriver for mounting into an equipment rack
- Long nosed pliers when a power voltage change is necessary

Environmental Requirements

The Digital Hybrid III can be safely operated in a room with varying temperatures between 32° and 122° Fahrenheit (0° to 50° Centigrade) and between 0% and 80% relative humidity.

Check Operating Voltage

The back panel contains the connectors you will use to install your system. The left-most connector is your power module. You will notice it contains four voltage selections: 100, 120, 220, 240 (50/60 Hz, 15 Watts maximum). Refer to Figure 6.

1. Before proceeding, make certain **power is disconnected** from the hybrid. Unplug the power cable from the rear panel, if necessary.

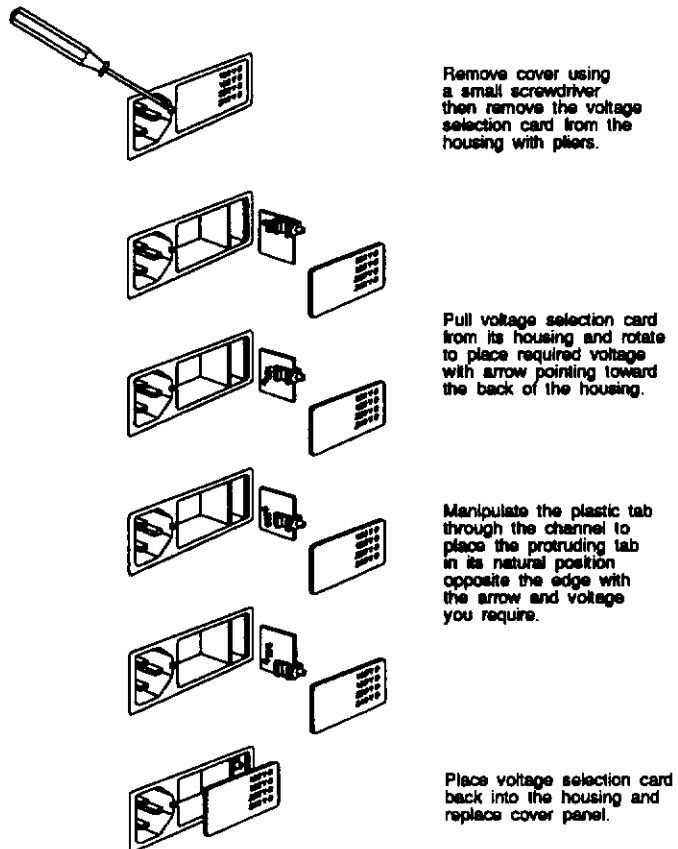
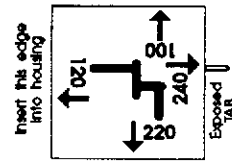


Figure 6

Setting Operating Voltage

2. Use a small screwdriver to remove the black access cover from the power module.

3. Using long nosed pliers, pull the voltage selection card containing the nylon tab from its housing (located near the right side of the assembly).
4. Each edge of the small card contains *one voltage selection and a directional arrow*. Locate your required voltage and rotate the card so that the arrow points toward the back of the housing from where the board came.
5. Before re-inserting the card, manipulate the plastic tab through the cut-out channel until it reaches its natural position *opposite* the edge with the arrow and voltage you require. The diagram to the right is set for 120 volts.
6. With the arrow pointing toward the back of the housing, place the card back into the housing.
7. Replace the black cover and make sure that the white dot (from the plastic tab) is visible next to the voltage rate you require.
8. Do not apply power to your system yet.



Mounting

Your Digital Hybrid III is designed for mounting in a standard 19" equipment rack. Rack ears are mounted at the factory, and screws and rack cups are provided.

Do not block any ventilation holes.

The Digital Hybrid III can be mounted in a road case for easy transport and to protect it from the elements and other environmental hazards. If you do mount it into a case, make sure that the equipment receives adequate ventilation during operation.

Making Connections

The Digital Hybrid III is a very versatile product that can be used in many applications. Connections vary depending on its use and according to the type of equipment you may be using; including types of telephone systems. The following pages describe various installation techniques specifically tailored to the most common usages. Locate the method applicable to your application then proceed with the installation.

Many different operating modes can be selected by using DIP switch changes to customize your operation of the Digital Hybrid III. Refer to DIP Switch Selections starting on page 41 to select the modes best suited to your operation.

NOTE: It is not possible to specify wire colors or terminal numbers for 1A2 telephone equipment in this manual due to the wide variety of telephone instruments and manufacturers of 1A2 equipment. Additional help may be obtained by contacting your telephone interconnect company or Gentner Technical Support.

CONNECTING DIRECTLY TO A SINGLE CENTRAL OFFICE TELEPHONE LINE

Connect the incoming telephone line to the Digital Hybrid III's RJ-11C LINE jack with the modular connector. In this application, the Digital Hybrid III takes control of the call on connection without use of a telephone set.

A telephone set can be connected to the RJ-11C SET jack. (A telephone set is not required for normal use.) The telephone set can be used privately when the hybrid is in the OFF mode.

The drawing in Figure 7 below shows a typical installation.

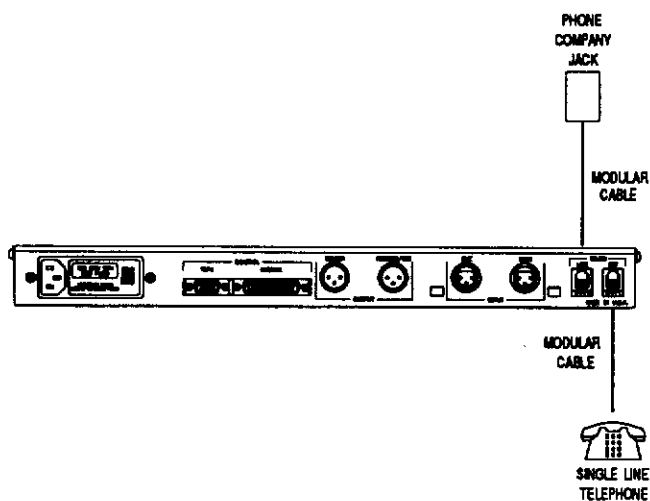


Figure 7

Connecting to a Single Central Office Line

CONNECTING TO AN EXISTING MULTI-LINE 1A2 TELEPHONE SET

When using an existing multi-line telephone set, the buttons on the set can provide the necessary line selection function for the Digital Hybrid III.

1. Remove the telephone's cover and locate the common Tip and Ring connections that go from the line selector button array to the telephone electronics network.
2. Sever this connection as shown in Figure 8.
3. Connect the Tip and Ring wires coming from the line selector button array to the red and green conductors of a modular cable. The yellow and black conductors provide the A-lead closure and should be connected to the common A-lead that is normally found at the telephone hook switch.

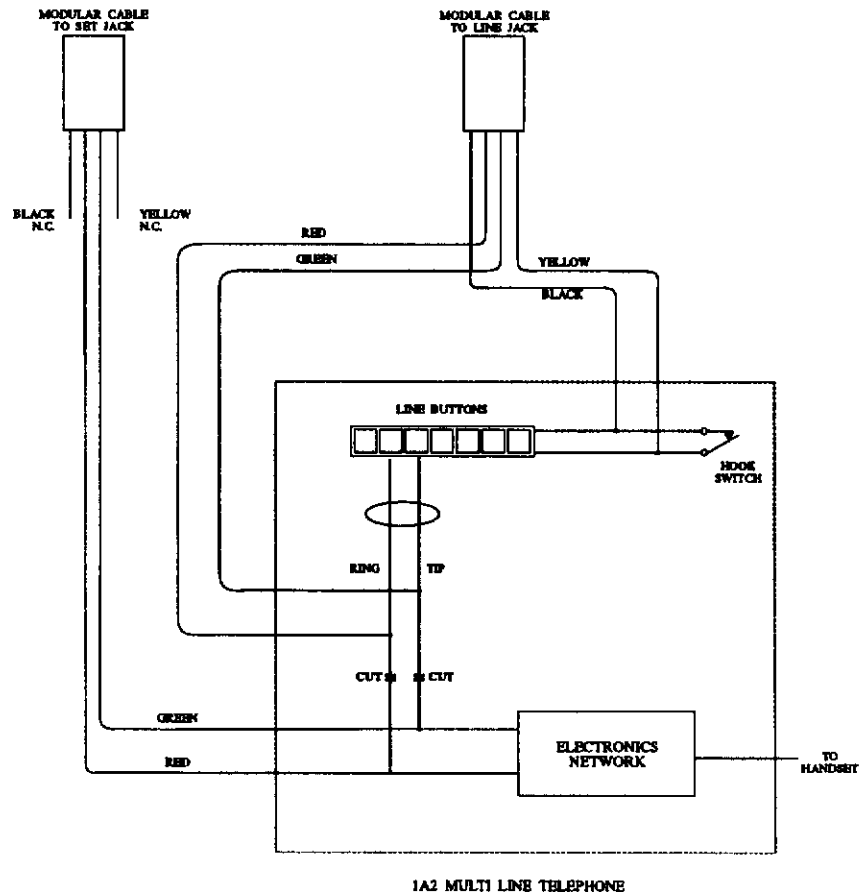


Figure 8

Connecting to a Multi-Line Telephone Set

4. This modular cable can now be connected to the LINE jack on the Digital Hybrid III.
5. The red and green conductors of a second modular cable should be connected to the severed Tip and Ring of the telephone electronics network as indicated in Figure 8. The yellow and black conductors of this cable should be left unconnected.
6. This second cable should be connected to the SET jack on the Digital Hybrid III.

This installation technique will allow the multi-line instrument to operate normally when the Digital Hybrid III is off-line.

When the Digital Hybrid III is placed on-line, it will provide the necessary A-lead closure to light the selected line and it will automatically disconnect the telephone instrument's electronics network.

USING A GENTNER TELEMIX 2000 SYSTEM AS A CALL DIRECTOR

Your Telemix 2000 System should include the proper cable (Gentner Part No. 830-004-903) to connect the Digital Hybrid III to your Telemix 2000. Refer to Figure 9 below.

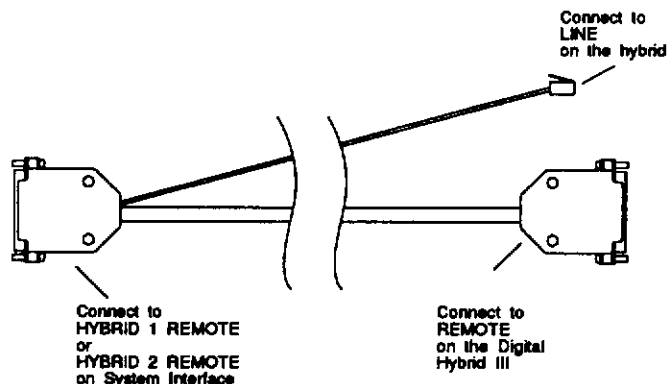


Figure 9

Digital Hybrid III to Telemix 2000 Interconnection Cable (Gentner Part No. 830-004-903)

NOTE: There are three types of hybrid cables. Make sure you have been sent the proper cable for your system.

DB-25 to DB-25 Connector Pin Outs	
DB-25 REMOTE Connector for Telemix 2000	DB-25 LINE Connector for Digital Hybrid III
1	1
2	2
3	3
4	4
5	5
6	6
7	7
8	8
9	9
10	10
16	16
17	17
18	18
21	21
22	22
23	23
24	Tip (RJ-11C)
25	Ring (RJ-11C)

The following steps will enable you to make the proper connections:

1. Connect the DB-25 connector (the end with the RJ-11C phone connector coming from it) to the HYBRID 1 REMOTE connector on the back panel of the Telemix System Interface.
2. Connect the modular phone cable (RJ-11C) to the LINE connector on the back panel of the Digital Hybrid III.
3. Connect the other end of the cable (DB-25 connector) to the REMOTE connector on the back panel of the Digital Hybrid III.
4. Audio connections will be made by following the information beginning on page 26, "Connecting To Audio Equipment".

NOTE: *Multiple line conferencing and control will work with the Telemix 2000. More information on operating in this mode, and how to make connections, is available in the Telemix 2000 manual.*

CONNECTING TO AN ELECTRONIC KEY SERVICE TELEPHONE SET

Compatibility with Electronic KSU Telephone Sets

Many broadcast facilities and offices employ telephone equipment that uses microprocessor controlled key service units. Even though these systems are referred to as digital, the actual audio to the multi-line telephone instrument is often carried on an analog balanced pair.

Such systems can usually be satisfactorily interfaced to the Digital Hybrid III. It is recommended that you contact your interconnect company and inquire if they offer units (often called "jack sets" or "modem interface units" or "Tip and Ring equivalent jacks") that bring out the necessary connections for interface to the Digital Hybrid III.

Your interconnect company may also be able to tell you if the audio is digital or analog and if there is DC on the audio pair. This information will be needed to accomplish the procedure described in the installation steps below. Ask for: (1) a line that a facsimile machine can be connected to; or, (2) a line that a telephone answering machine can be connected to. A 100% digital system will require an analog adapter or single line extension.

Because of the large number of manufacturers and wide variety of equipment available, the information below can only give a general overview of how to interface the Digital Hybrid III to electronic key service systems.

Connections With DC Current Flow

The installation steps below allows the digital telephone set to be used normally when the Digital Hybrid III is off-line.

When the Digital Hybrid III is on-line, the analog path to the telephone electronics is automatically disconnected and the hook switch connection is closed. This allows line selection to be made on the telephone without having to lift the handset.

1. Most digital telephones connect to the KSU with either a four or six wire modular connection cable. Unplug this cable from the telephone and carefully remove the set's cover.
2. Locate the wires coming from the KSU connector. Two of these wires will be the analog pair. In most digital telephones, this analog pair is found to be the red and green wires. (The remaining wires are used for telephone power, intercom and microprocessor communications.)

9. Connect the red and green wires of the second modular cable to the analog pair going to the electronics of the telephone set. The yellow and black wires of this cable are left unconnected.
10. Connect this cable to the SET jack of the Digital Hybrid III.
11. The telephone set can now be reassembled and reconnected to the KSU by plugging its cable back in.

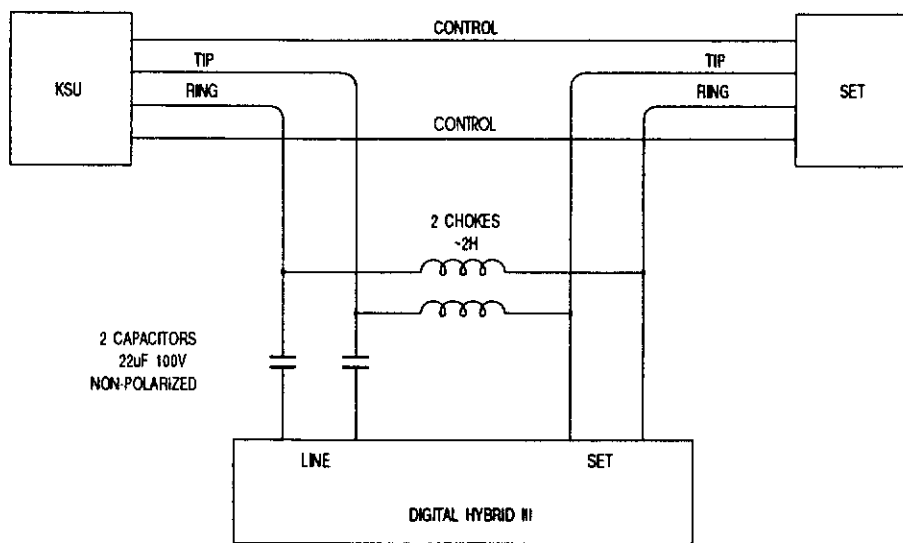


Figure 11

**Installation in a Digital Telephone System
with DC on the Audio Pair**

**Connections Without
DC current flow**

When installing the Digital Hybrid III on digital telephones that do not provide "battery" (DC current flow), it will be necessary to change a jumper inside the Digital Hybrid III.

This jumper by-passes the line sensing circuitry of the Digital Hybrid III and allows non-DC biased audio to flow. Without the jumper in place, the rectifiers would attenuate the pure AC audio signal.

If it is necessary to change the jumper, refer to the Board drawing in Figure 12 to locate the jumper, then follow the instructions below. (This jumper is also shown on Sheet 1 of 10 of the Schematic Drawings found in the Schematics section of this manual.)

WARNING! To avoid accidental electrical shock, disconnect the Digital Hybrid III from AC power before proceeding.

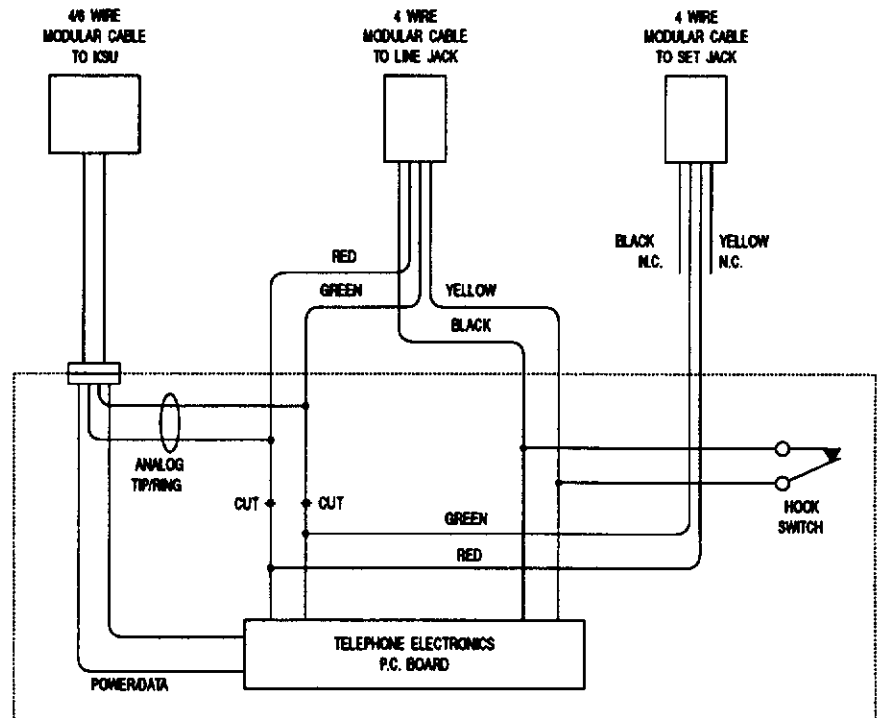


Figure 10

Connecting to Digital Telephones

3. The analog pair can be verified by connecting a pair of high impedance headphones through $10\ \mu\text{F}$ capacitors across the suspected analog pair. With the headphones connected as described, plug in the cable and select a line. If dial tone is heard in the headphones, the analog pair has been located.
4. Sever this pair between the jack and the electronics of the telephone as indicated in Figure 10. Frequently DC is found on the audio pair which is used to power the telephone set. This can be verified if the set goes dead when this pair is severed. (If DC is present on the audio pair, it can be isolated using the hookup shown in Figure 8.) For more detailed information, refer to Gentner's publication "Interfacing to Electronic Telephone Systems". For a copy, contact Gentner at (801) 975-7200.
5. Prepare two telephone cables with modular connectors on one end of each cable. Make sure the cables have sufficient length to reach from the normal location of the telephone to the location of the Digital Hybrid III.
6. Connect the red and green wires of one of these cables to the analog pair coming from the KSU jack of the telephone set.
7. Connect the yellow and black wires of this cable in parallel with the hook switch contacts of the digital telephone.
8. Connect this cable to the LINE jack on the Digital Hybrid III.

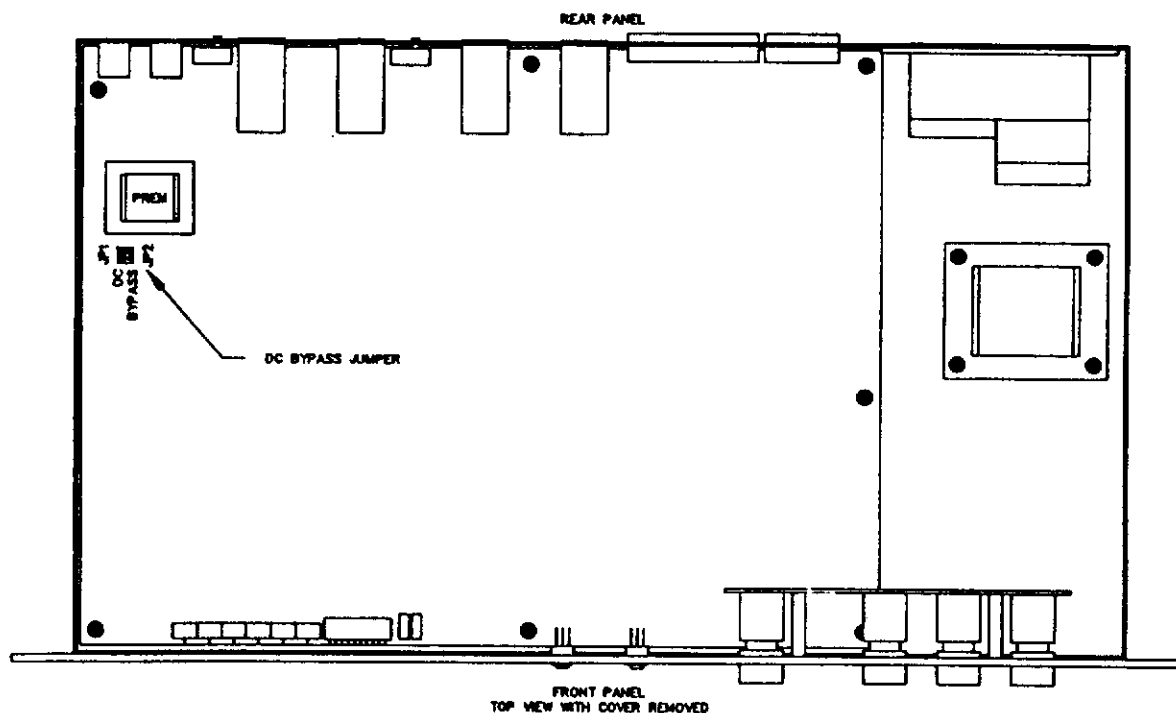


Figure 12

Locate the Jumper on the PC Board

1. Remove the top cover of the Digital Hybrid III by loosening the four retaining screws and lifting the cover straight up.
2. Locate the PREM transformer near the modular telephone jacks on the back panel of the Digital Hybrid III. See Figure 12.
3. Locate the jumper posts labeled BYPASS DC on the circuit board near the PREM transformer.
4. For digital telephone lines with only audio (no DC bias), the jumper must be placed in the JP2 (bypass) position.

NOTE: If the jumper is used in the JP2 (bypass) position, front panel DIP Switches 1, 2 and 3 will be inoperative.

CONNECTING TO AUDIO EQUIPMENT

Introduction The basic function of the Digital Hybrid III is to separate audio being sent to the caller (SEND audio) from audio being received from the caller (CALLER audio). Refer to Figure 13.

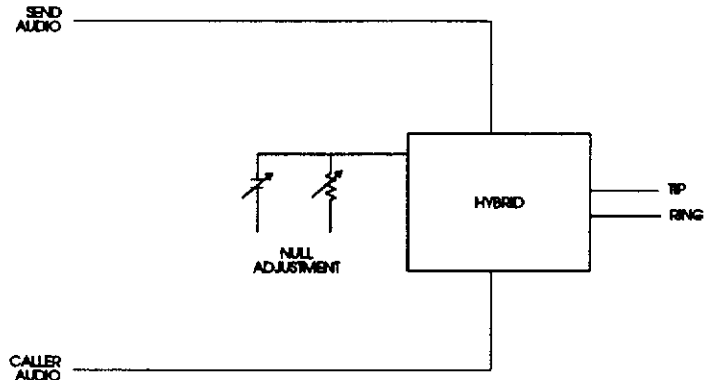


Figure 13

Function of a Telephone Hybrid

The primary audio connections for the Digital Hybrid III are made via XLR connectors and include MAIN SEND input, CUE SEND input, CALLER audio output and RECORD/MIX audio output. Refer to Figure 14.

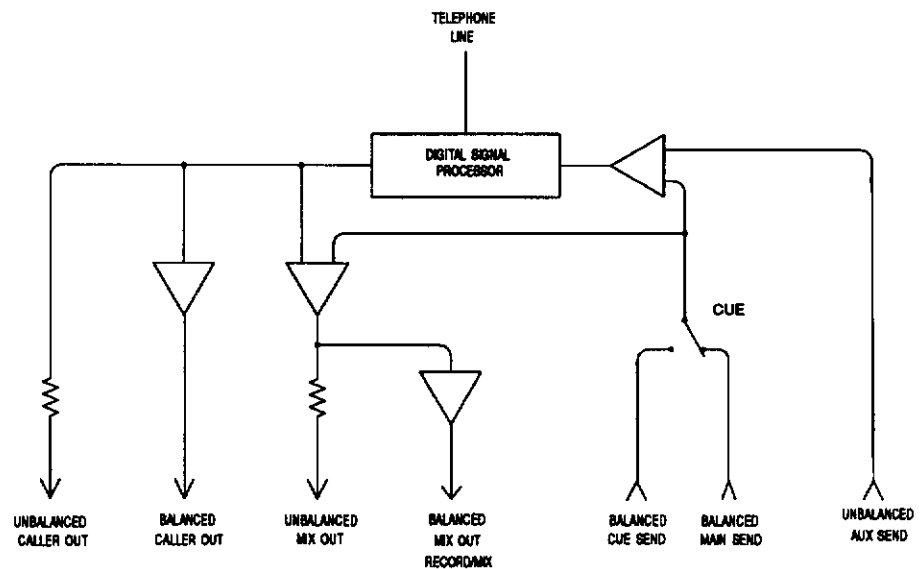


Figure 14

Making Audio Connections

The MAIN SEND and the CUE SEND inputs are balanced, bridging line level inputs. Only one of these inputs is selected for use at a time. This selection is dependent on the status of the CUE function.

The RECORD/MIX audio output provides a balanced line level sum of the selected audio (MAIN or CUE), and CALLER audio.

The CALLER out is caller audio only. It is a balanced line level output.

Additional unbalanced audio inputs and outputs are found on the DB-25 REMOTE connector.

If a mixing console will be used to feed the MAIN or CUE inputs of the Digital Hybrid III, the audio going down the line must not contain any CALLER audio. There are several ways to accomplish this:

Creation of a Separate Mix Channel

If the console has an extra mixing output channel, use this channel to mix all audio you want to send to the Digital Hybrid III, *except* the channel that will be connected to Caller audio.

Internal Mix-Minus Bus

Mix-minus refers to a sum of all the audio sources in the console *minus* the Caller audio. Many console manufacturers provide this feature.

Make Your Own Mix-Minus

You can make your own mix-minus by summing all audio sources to be sent to the caller.

Discrete Microphone Mixer

If only microphone audio will be sent down the line, a separate microphone mixer may be utilized. This audio can then be sent to either input of the Digital Hybrid III as well as the input of the console.

One Channel Send

If a single source of audio will be sent to the caller (such as a microphone), simply use the line level output of the microphone preamplifier.

The CALLER output XLR must be connected to a separate channel of an audio console or the input of an audio amplifier. This will allow monitoring of Caller audio.

The RECORD/MIX output XLR contains a sum of both Send and Caller audio. This audio combination is useful for recording both sides of telephone conversations.

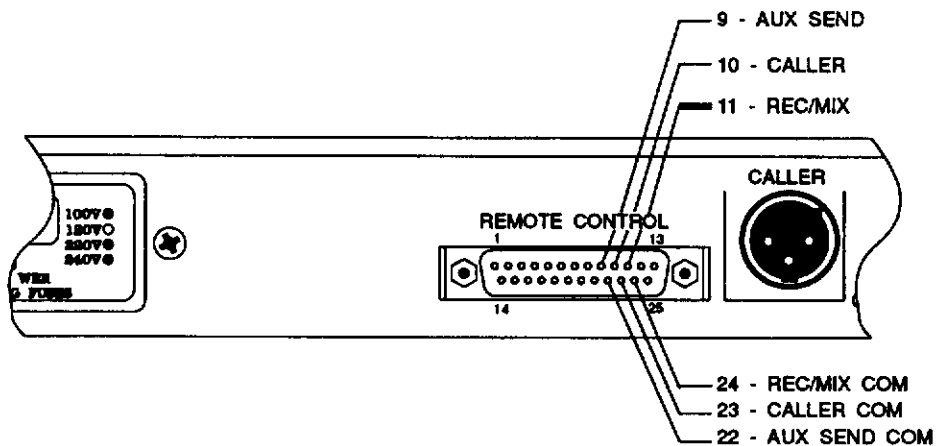
FUNCTIONS OF THE REMOTE CONTROL

The REMOTE connector is a 25-pin D-type connector located on the rear panel of the Digital Hybrid III. Table 4 is a pin out of remote control functions and audio connections that appear on this connector:

DB-25 REMOTE CONNECTOR PIN OUTS			
PIN NO.	DESCRIPTION	PIN NO.	DESCRIPTION
1	Remote ON	14	ON Indicator ^(a)
2	Remote Off	15	OFF Indicator ^(a)
3	Remote Record	16	RECORD Indicator ^(a)
4	Remote Cue (Hold)	17	CUE Indicator ^(a)
5	Switch Common ^(b)	18	Indicator (Common) ^(b)
6	Send Mute (Privacy)	19	Send Presence Indicator ^(a)
7	Caller (Receive) Mute	20	Caller Presence Indicator ^(a)
8	Remote Cue (Console)	21	Indicator Common ^(b)
9	Unbalanced AUX Send	22	AUX Send Audio Common ^(c)
10	Unbalanced Caller	23	Caller Audio Common ^(c)
11	Unbalanced REC/MIX	24	REC/MIX Audio Common ^(c)
12	AUX Relay N.O.	25	AUX Relay Common
13	AUX Relay N.C.	NOTES: (a) Open Collector Ground (b) Digital Ground (c) Analog Ground	

Table 4

Refer to Figure 15 for orientation of the REMOTE connector.



NOTE: AUDIO CONNECTIONS ON REMOTE CONNECTOR ARE UNBALANCED.

Figure 15

Remote Connector Audio Pin Outs

The functions of the DB-25 pins are as follows:

Pin 1 Remote On / Pin 5 Switch Common

These connections are used to remotely turn the Digital Hybrid III on. The switching action can be either momentary or latching, as selected by front panel DIP Switch 4. The Digital Hybrid III is shipped with DIP Switch 4 in the UP position. In this position, a momentary closure between REMOTE connector pins 1 and 5 will turn on the Digital Hybrid III.

NOTE: If you choose to use the remote ON/OFF switching in the latching mode, the Digital Hybrid III front panel ON/OFF switches are disabled.

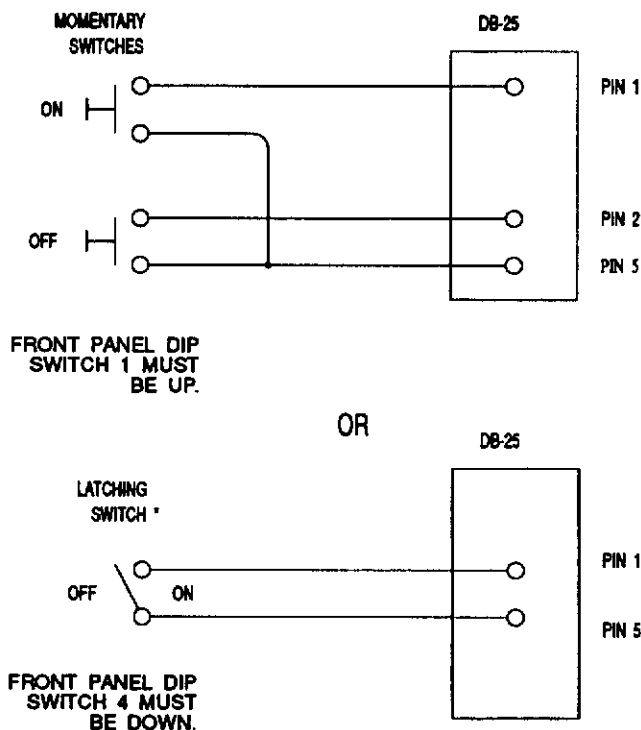


Figure 16

Remote ON/OFF Control

Pin 2 Remote Off / Pin 5 Switch Common

A momentary closure between these pins turn the Digital Hybrid III off. This function is pre-empted if DIP Switch 4 is in the down position, causing the ON/OFF switching to be via latching closure of pins 1 and 5.

Pin 3 Remote Record / Pin 5 Switch Common

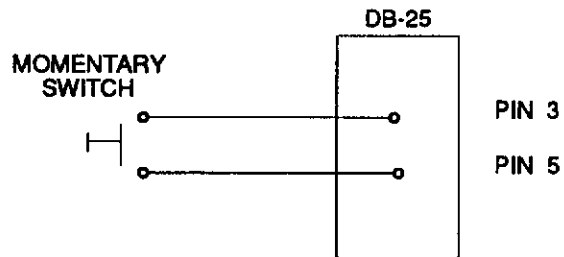


Figure 17

Remote CUE Controls

A momentary closure between these pins toggles alternately between the Normal and Record modes.

Pin 4 Remote CUE / Pin 5 Switch Common

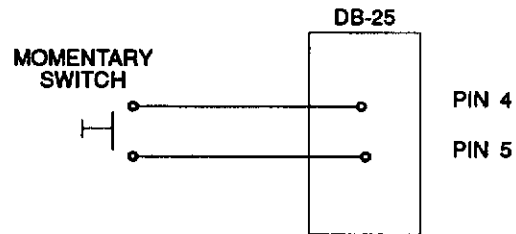


Figure 18

Remote RECORD Controls

A momentary closure between these pins toggles alternately between CUE (indicator illuminated) and normal operation.

NOTE: The Remote CUE connection functions exactly like the front panel CUE switch, whereas the remote CUE (console) connection provided at pin 8 functions differently, requiring latching closure to enable the CUE function.

Pin 5 Switch Common

This is the common ground return for all remote switching functions. It is suggested that this return be the only ground reference used for this purpose.

Pin 6 Send Mute (Privacy Switch) / Pin 5 Switch Common

A closure between these pins will cause the Digital Hybrid III's Send audio to be muted. This must be a latching closure. This mute can be used as a privacy switch because the caller will not be able to hear anything when this function is active. Refer to Figure 19.

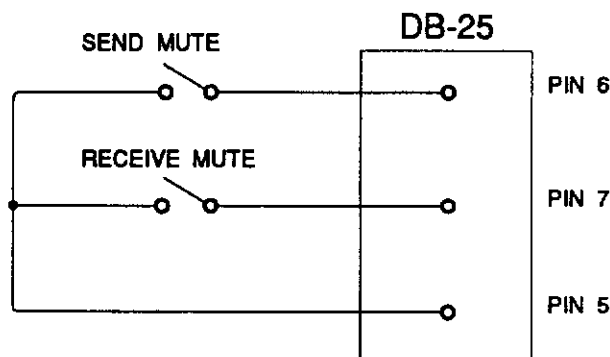


Figure 19

Remote Send/Receive Muting

Pin 7 Receive Mute / Pin 5 Switch Common

A latching closure between these pins will cause the Digital Hybrid III Receive audio to be muted.

Pin 8 Remote Cue (Console) / Pin 5 Switch Common

This remote cue connection is intended to be interfaced with latching console logic closures. The CUE feature is enabled continually as long as the closure between these pins is provided, unless over-ridden by action of the front panel CUE switch or Pin 4.

Pin 9 Auxiliary Send + / Pin 22 Auxiliary Send Ground

This is an unbalanced Auxiliary Send audio input. These connections will be used when conferencing multiple Digital Hybrid IIIs.

NOTE: Do not connect the minus (-) audio signal from actively balanced source to Pin 22, as this would place a direct short circuit across the minus half of the source. Connection to the plus (+) audio signal is all that is necessary. A single ground-return path is suggested.

Pin 10 Unbalanced Caller + / Pin 23 Unbalanced Caller Ground

This is an unbalanced Caller audio output. It can be used for applications requiring an additional unbalanced Caller output.

Pin 11 Unbalanced Record/Mix Audio Output + / Pin 24 Record/Mix Ground

This provides an unbalanced Record/Mix audio output which may be used for a wide range of applications. For example, this output may be used to feed a tape recorder for recording telephone conversations.

**Pin 12 Aux Relay N.O. / Pin 13 Aux Relay N.C. /
Pin 25 Aux Relay Common**

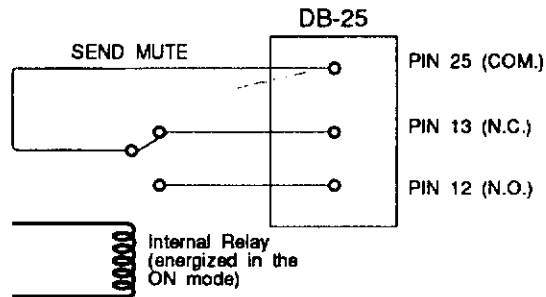


Figure 20

Auxiliary Relay Pin Out

These pins provide access to the Auxiliary Relay contacts that follow the action of the ON/OFF switching functions. Pin 12 is normally open when the Digital Hybrid III is in the OFF mode, and closes to Common when the hybrid is switched ON.

**Pin 14 Remote On Indicator / Pin 15 Remote Off Indicator
Pin 16 Remote Record Indicator / Pin 17 Remote Cue Indicator**

These pins are used to remote the ON, OFF, RECORD and CUE indicators. Pins 14, 15, 16, and 17 provide open collector outputs capable of sinking 100 mA at 40 VDC. An external voltage supply must be used to power the remote indicators. This supply must be referenced to Pin 12 and must not exceed 40 VDC. Also, the total current into each of these pins must not exceed 100 mA.

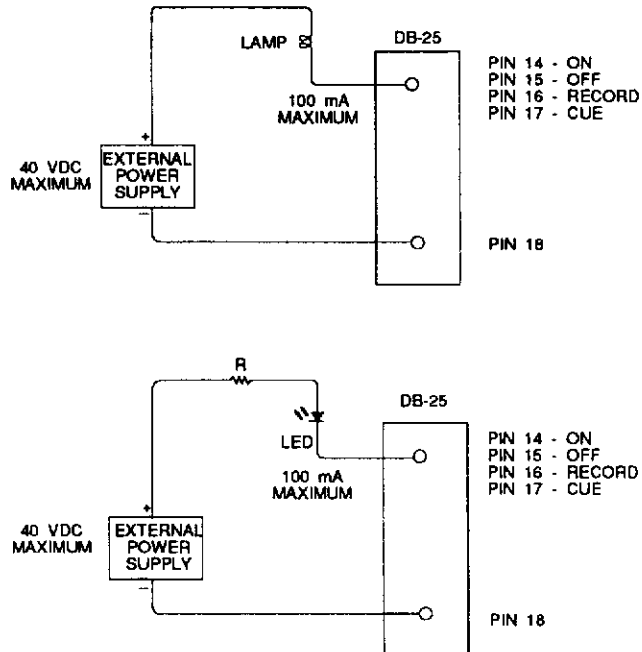


Figure 21

Remote ON, OFF, RECORD, and CUE Indicators

Pin 18 Indicator Common

Use this pin as the negative reference for the external power supply used to drive remote indicator lamps or LEDs. See Pins 14, 15, 16 and 17, above.

Pin 19 Send Presence Remote Indicator / Pin 20 Caller Presence Remote Indicator

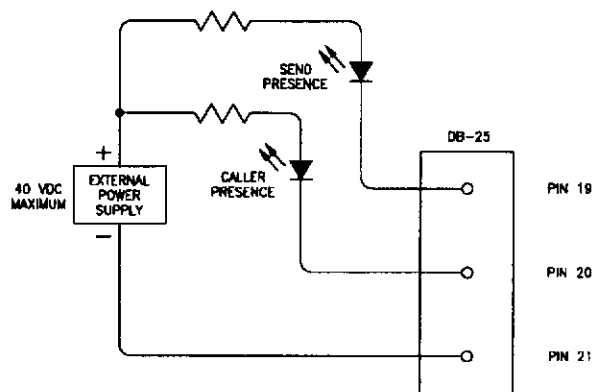


Figure 22

Remote SEND and CALLER Presence Indicators

These pins are used to provide remote indication of the front panel Send Presence and Caller Presence LEDs. They provide open collector outputs capable of sinking 100 mA at 40 VDC. An external voltage supply must be used to power the remote indicators. This supply can be referenced to Pin 21 and must exceed 40 VDC. Also, the total current into each of these pins must not exceed 100 mA.

These outputs will be active whenever the front panel indicators are illuminated with green. These outputs are inactive when the front panel indicators are extinguished or illuminated red.

Pin 21 Indicator Common

Use this pin as the negative reference for the external power supply used to drive remote indicator lamps or LEDs. See Pins 19 and 20 above.

Remote Indicators

LED's or incandescent lamps may be used for remote monitoring of the Digital Hybrid III's status indications.

Figure 21 shows how lamps may be used as remote ON, OFF, RECORD and CUE status indicators by connecting them respectively to pins 14, 15, 16 and 17.

An external DC power supply to provide lamp voltage is required on the remote device.

CAUTION! Care must be taken to reference the external power supply to the ground provided at Pin 18 of the Digital Hybrid III REMOTE connector. Total current into each of Pins 14, 15, 16 and 17 must not exceed 100 mA, and the power supply voltage must not exceed 40 VDC.

Figure 22 shows how remote indicators may be used to monitor the SEND presence and CALLER presence status.

These may be remoted by connecting to Pin 19 for SEND presence and Pin 20 for CALLER presence.

These outputs are open collectors and will be active whenever the corresponding front panel LEDs are illuminated green. These outputs will be inactive when the corresponding front panel LEDs are extinguished or illuminated red.

An external DC power supply to provide lamp voltage is required.

CAUTION! Care must be taken to reference the external power supply to the ground provided at Pin 21 of the Digital Hybrid III REMOTE connector. Total current into each of Pins 9 and 20 must not exceed 100 mA, and the power supply voltage must not exceed 40 VDC.

Adding External Relays

An external relay can be driven from any one of the following REMOTE indicator outputs: ON, OFF, RECORD or CUE.

An illustration of a relay connection is shown in Figure 23.

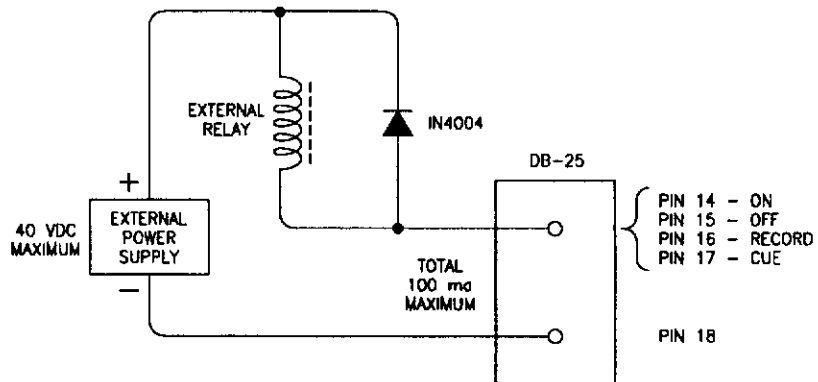


Figure 23

Adding External Relays

An external power supply capable of providing the relay's coil voltage is required.

CAUTION! Care must be taken to reference the external power supply to ground at Pin 18 of the Digital Hybrid III's REMOTE connector. Total current into any one pin must not exceed 100 mA, and the power supply voltage must never exceed 40 VDC.

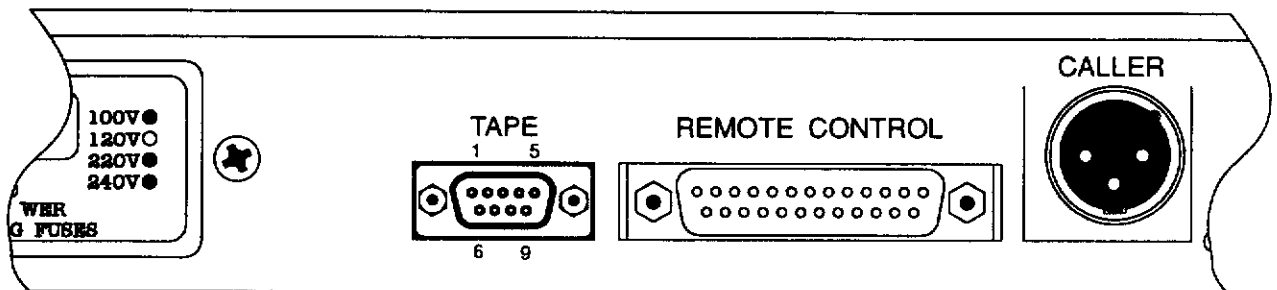
FUNCTIONS OF THE TAPE CONNECTOR

The TAPE connector is a 9-pin D-type connector located on the rear panel of the Digital Hybrid III. The TAPE connector allows you to remotely control a tape recorder with the Digital Hybrid III. Refer to Table 5.

DB-9 TAPE CONNECTOR PIN OUTS			
PIN NO.	DESCRIPTION	PIN NO.	DESCRIPTION
1	N.O. Tape Start	6	Tape Start Common
2	N.C. Tape Start	7	Not Used
3	N.O. Tape Stop	8	Tape Stop Common
4	N.C. Tape Stop	9	Record Enable Common
5	Record Enable N.O.		

Table 5

When viewing the TAPE connector on the rear panel of the Digital Hybrid III, Pins 1 through 5 appear left to right on the top row of pins. Pin 6 through 9 appear left to right on the bottom row of pins.



VIEW OF BACK PANEL

Figure 24

Back Panel TAPE Connector

A brief description of each pin on this connector is as follows:

- Pin 1 N.O. Tape Start Relay Contact /**
- Pin 2 N.C. Tape Start Relay Contact /**
- Pin 6 Common (Wiper) Tape Start Relay Contact**

These connections provide dry contact closures for the tape start relay. Action of the relay is momentary when front panel DIP Switch 5 is in

the UP position, and latching with this DIP switch in the DOWN position.

**Pin 3 N.O. Tape Stop Relay Contact /
Pin 4 N.C. Tape Stop Relay Contact /
Pin 8 Common (Wiper Tape Stop Relay Contact**

These connections provide dry contact closures for the tape stop relay. Action of the relay is momentary when front panel DIP Switch 6 is in the UP position, and latching when this DIP switch is in the DOWN position.

Pin 5 N.O. Record Enable / Pin 9 Record Enable Common

These connections provide dry contact closures for the record enable function of the tape recorder. Action of the relay is momentary with DIP Switch 5 in the UP position and latching when this DIP switch is in the DOWN position.

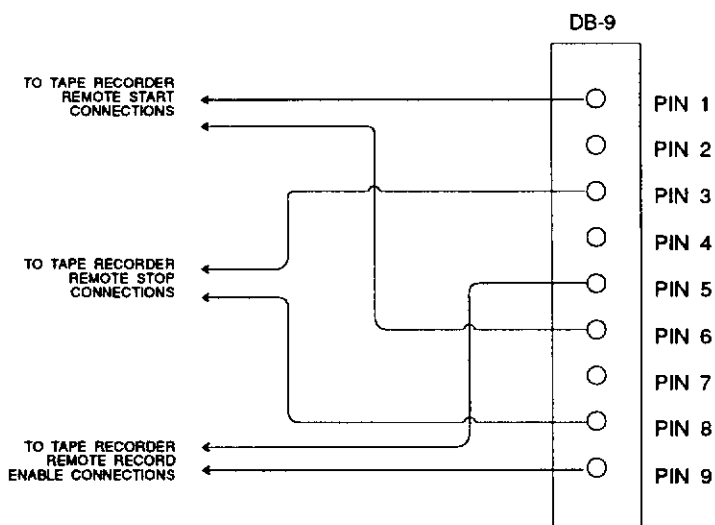


Figure 25

Remote Tape Start / Stop / Record Control

SETUP AND CALIBRATION

When all system connections have been completed for your application, a setup routine will be initiated to optimize the performance of your hybrid. These routines include analog and digital nulling, audio control settings, and setting the DIP switches for your operating preferences.

All of these controls are located behind the removable front panel. Each control is named and labeled on the inside of the removable panel.

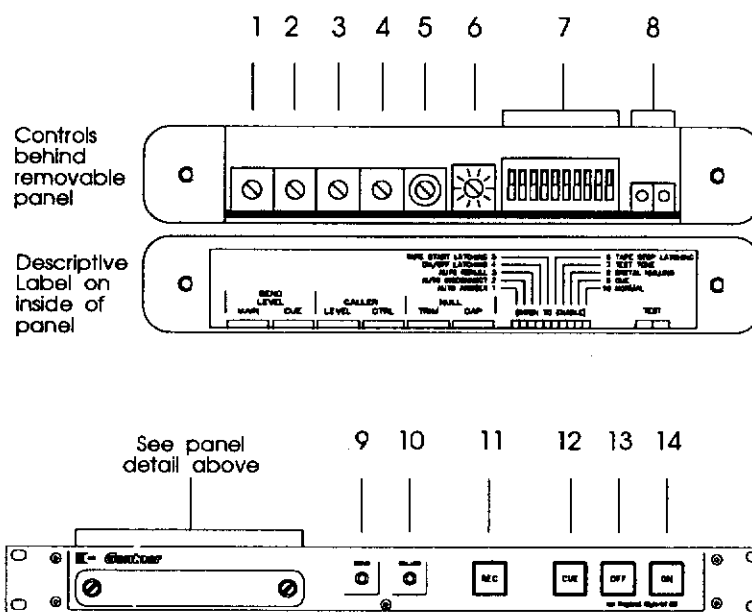


Figure 26

Front Panel Controls

Analog (Coarse) Null

This is performed only once, when the system is first installed.

1. Press the front panel OFF (13) button. Its indicator light will glow.
2. Using the telephone connected to the hybrid (23), dial an outside telephone number. (This provides connection through the phone company's Central Office.)
3. Ask your party to either disconnect the cord from their telephone handset or cover the mouthpiece of their telephone handset to create a "quiet line".
4. Connect an AC voltmeter to the test jacks (8), located on the right end of the open front panel.

5. Press the hybrid's front panel ON button (14). Its indicator light will glow, and the OFF light will extinguish.

NOTE: *If a monitor speaker is being used, the volume level on the monitor must be turned down now.*

6. Locate DIP Switch 7 and place in the DOWN position. This enables a 625 Hz null test tone.
7. Place DIP Switch 8 in the UP position. This disables the digital nulling.
8. Adjust the Null Trim Pot (4) for minimum voltage across the test jacks (8).
9. Adjust the Null Capacitor Switch (5) for minimum voltage across the test jacks (8).
10. Repeat steps 8 and 9 above to obtain the minimum possible voltage across the test jacks.

Digital (fine) Nulling

1. Place DIP Switch 8 in the DOWN position.
2. Place DIP Switch 7 in the UP position to disable the 625 Hz test tone.
3. Disconnect the voltmeter connection from the test points (8).
4. Press the OFF button (13) to disconnect the call you made. The OFF indicator light will glow.

Adjust Main Send Levels

1. Press the front panel OFF (13) button. Its indicator light will glow.
2. Using the telephone connected to the hybrid (23), dial an outside telephone number. (This provides connection through the phone company's Central Office.)
3. Ask your party to either disconnect the cord from their telephone handset or cover the mouthpiece of their telephone handset to create a "quiet line".
4. Press the hybrid's front panel ON button (14). Its indicator light will glow, and the OFF button (13) light will extinguish.
6. The CUE button (12) on the front panel must be off (indicator light will be off). Press this toggle button again, if necessary to turn off.
7. Apply program audio at a normal operating level to the MAIN INPUT XLR connector (21) on the back panel of the hybrid.
8. Locate the MAIN SEND LEVEL trim pot (1) on the front panel and adjust the trim pot. The SEND LED (9) should glow green most

of the time and occasionally flash red on peaks. (Red indicates a level of 6 dB before input clipping.)

9. Press the front panel OFF button (13). Its light will glow.

This completes the MAIN SEND level adjust. Proceed to CUE SEND level next.

Adjusting Cue Send Level

1. Press the front panel OFF (13) button. Its indicator light will glow.
2. Using the telephone connected to the hybrid (23), dial an outside telephone number. (This provides connection through the phone company's Central Office.)
3. Ask your party to either disconnect the cord from their telephone handset or cover the mouthpiece of their telephone handset to create a "quiet line".
4. Press the hybrid's front panel ON button (14). Its indicator light will glow, and the OFF button's light (13) will extinguish.
5. Press the CUE button (12). Its indicator light will glow.
6. Apply program audio at a normal operating level to the CUE INPUT XLR (20) connector on the rear panel.
7. Locate the CUE SEND level trim pot (4) and adjust until the front panel SEND LED (9) glows green most of the time and flashes red occasionally on peaks. (Red indicates a level of 6 dB before input clipping.)
8. Press the front panel OFF button (13). Its indicator light will glow, and the ON button's indicator light (14) will extinguish.

This complete the initial CUE SEND setup. The MAIN SEND and CUE SEND adjustments may be readjusted at your discretion, depending on your evaluation.

You will want to avoid sending too much audio level down the telephone line. By sending a minimum audio level, the hybrid leakage into the Caller (receive) output is reduced, improving the effective performance of the hybrid. Additionally, sending a minimum audio level has a positive side-effect by causing the caller to speak louder, thereby improving the signal-to-noise ratio on the telephone line.

Adjust Caller Level and Caller Control

1. Locate the CALLER LEVEL trim pot (3) on the front panel.
2. Press the front panel OFF button (13). Its indicator light will glow.

3. Using the telephone connected to the hybrid (23), dial an outside telephone number. (This provides connection through the phone company's Central Office.)
4. Press the ON button (14). Its indicator light will glow and the OFF indicator light will extinguish.
5. With your called party speaking normally, adjust the CALLER LEVEL trim pot (5) to provide the proper output level for your audio equipment.
6. Locate the CALLER CONTROL trim pot (4).

The Caller Control automatically reduces (dims) the level of the Caller audio when Send audio is present (when the talent is talking). The purpose of this control is to allow the talent to dominate the conversation while speaking normally. The amount of this Caller level reduction (dimming) is determined by the Caller Control trim pot (4).

When the CALLER CONTROL trim pot is fully counter-clockwise, there is no Caller Control action. This is equal to 0 dB of Caller level reduction or dimming.

With the CALLER CONTROL trim pot fully clockwise, approximately 40 dB of Caller level reduction (dimming) will occur whenever the talent is speaking (Send audio is present). This much Caller Control causes the unit to act much like a speaker phone and is not recommended for most applications.

The CALLER CONTROL trim pot may be set for any amount of caller level reduction (dimming) desired within the 0 dB to 40 dB range.

For broadcast applications, 8 dB of caller level reduction allows the talent to always be on top of a telephone conversation. The 8 dB setting allows the caller to still be heard clearly in a two-way conversation.

2. Place DIP Switch 7 in the UP position to disable the 625 Hz test tone.
3. Disconnect the voltmeter connection from the test points (8).
4. Press the OFF button (13) to disconnect the call you made. The OFF indicator light will glow.

Adjust Main Send Levels

DIP SWITCH FUNCTIONS			
SWITCH NO.	DEFAULT POSITION	DEFAULT DESCRIPTION	ALTERNATE
1	UP	Auto-Answer disabled.	Switch to DOWN to automatically answer phone after one ring.
2	UP	Auto-Disconnect disabled.	Switch to DOWN to disconnect call on sensing loop drop.
3	UP	Auto Renuil disabled.	DOWN enables auto mute on disconnect and unmuting and auto-renulling on reconnection.
4	UP	Front panel or remote On/Off momentary control.	On/Off controlled by single remote latching control in DOWN position.
5	UP	Tape Start momentary relay through Remote connector.	Tape start latching relay through Remote connector in DOWN position.
6	UP	Tape Stop momentary relay through Remote connector.	Tape stop latching relay through Remote connector in DOWN position.
7	DOWN	625 Hz Test Tone enabled for setup.	Switch to UP for normal operation.
8	DOWN	Digital Nulling enabled.	UP disables digital nulling during setup.
9	DOWN	Cue.	UP (for Audio Conferencing applications).
10	DOWN	Normal operating mode.	UP selects null-enhancement mode.

Table 6

1. Press the front panel OFF (13) button. Its indicator light will glow.
2. Using the telephone connected to the hybrid (23), dial an outside telephone number. (This provides connection through the phone company's Central Office.)
3. Ask your party to either disconnect the cord from their telephone handset or cover the mouthpiece of their telephone handset to create a "quiet line".
4. Press the hybrid's front panel ON button (14). Its indicator light will glow, and the OFF button (13) light will extinguish.

#2—Auto-Disconnect

With switch #2 in the ON (down) position, the Digital Hybrid III will automatically disconnect the active call upon sensing loop drop. The hybrid immediately mutes caller audio to prevent the “pop” of the loop current interruption from reaching the audio equipment.

To disable the Auto-Disconnect feature at any time, move switch #2 to OFF (up).

Switch #2 is ignored if switch #3 (Auto Renuil) is in the ON (down) position. See the explanation of switch #3 below.

#3—Auto-Renuil

With switch #3 in the ON (down) position, the hybrid will automatically go through the nulling and muting process when telephone loop current is dropped and then renull and unmute the line when a new call is answered.

When the Auto-Renuil feature is on, the Auto-Disconnect feature (Switch #2) is disabled.

To disable the Auto-Renuil feature at any time, move switch #3 to OFF (up).

#4—On/Off Latching

Normal operating position for this switch is in the OFF (up) position to allow operator control of ON and OFF buttons from either the front panel or remotely via the DB-25 REMOTE connector on the back panel.

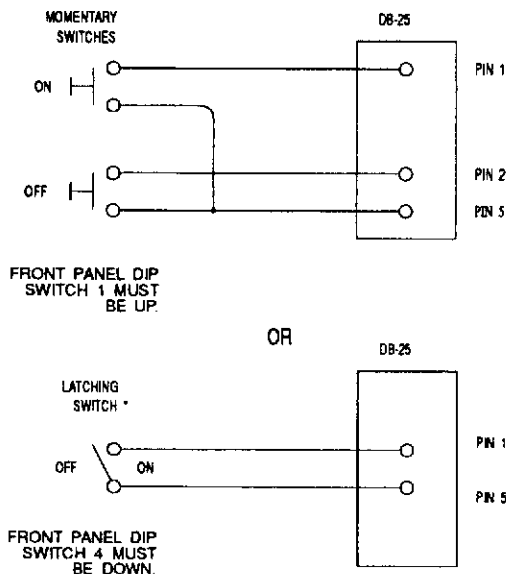


Figure 27

Remote ON/OFF Control

With switch #4 in the ON (down) position, the hybrid's on/off functions can only be controlled by a single remote latching on/off switch from the user's equipment.

A latching closure across the REMOTE connector's ON pins (#1 and #5) will cause the hybrid to perform normal nulling and then unmuting of the caller audio output. When the closure is reopened, the hybrid will mute and return to the off-line state. (No remote OFF switch is used.) In this configuration, the front panel ON and OFF buttons will not function.

See REMOTE connector pin out chart on page 28 for more pin out information.

#5—Tape Start Latching

Normal operating position for this switch is in the OFF (up) position, since the majority of tape recorders used in professional applications require a momentary remote start dry contact closure.

With switch #5 in the OFF (up) position, the hybrid's Tape Start relay uses momentary action.

When this switch is in the ON (down) position, the Tape Start relay operates as a latching relay. This may be useful for cassette decks with a remote pause function. A cassette deck could be utilized as a skimmer in this way.

Refer to the pin out chart for the TAPE connector on page 35. The Tape Start relay contacts appear at pins #1, #2 and #6.

***NOTE:** When using latching TAPE START switching, no remote TAPE STOP switch is necessary. However, normally open and normally closed TAPE STOP contacts are provided for any auxiliary functions you may wish to add.*

#6—Tape Stop Latching

Switch #6 determines the action of the Tape Stop relay which has contacts appearing at pins #3, #4, and #8 of the TAPE remote control connector on the back panel of the Digital Hybrid III.

When switch #6 is in the OFF (up) position, the Tape Stop relay provides momentary action. The normal position of this switch is off (up).

When the switch is in the ON (down) position, the Tape Stop relay operates as a latching relay. Although a latching Tape Stop is normally not needed, both N.O. and N.C contacts are available for use.

#7—625 Hz Test Tone

The normal operating mode for switch #7 is in the OFF (up) position to disable the test tone.

The Test Tone is enabled when checking audio and in setting up the Analog Null. (See page 37 for the procedure in setting up the Analog Null.)

#8—Digital Nulling

The normal operating mode for switch #8 is in the ON (down) position.

The Digital Hybrid III uses analog nulling techniques to achieve a coarse null and digital nulling techniques to fine tune the null. Placing the switch in the OFF (up) position disables the digital nulling portion of the hybrid to allow the coarse null setup procedure to be accomplished. (See Analog [Coarse] Null procedure on page 37.)

#9—Cue

This switch is normally in the ON (down) position.

NOTE: *If the position of DIP Switch #9 is changed, the Digital Hybrid III must be powered down and then powered back up before the new operating mode (position) is recognized.*

When the hybrid is powered up with switch #9 in the ON (down) position, the following operating sequences will occur:

1. When the front panel CUE button is activated (lamp lights), the CUE INPUT is selected as the send audio source for routing to the caller. The CUE INPUT might be connected to the output of the console microphone preamplifier to allow the talent the ability to speak with a guest "off air".
2. If the Digital Hybrid III is in the OFF (up) mode and the front panel RECORD button is activated (lamp is on steadily), the send audio source is automatically switched to the CUE INPUT and the CUE function is activated (Cue lamp lights). If the unit is then switched to the ON mode, the Digital Hybrid III will issue a Tape Start command via the Tape Start relay, the front panel RECORD lamp will begin to flash, and the Send Audio source (audio sent to the caller) will be the CUE INPUT.

#10—Enhanced Null

For normal operation switch #10 should be in the ON (down) position when the Digital Hybrid III is powered up.

NOTE: *If the position of DIP Switch #10 is changed, the Digital Hybrid III must be powered down, then powered back up before the new position is recognized.*

The OFF (up) position selects the Null Enhancement mode. When the Digital Hybrid III is powered up with switch #10 in the OFF position, enhanced nulling is enabled. This provides an additional increase in the separation of Send and Caller audio that may be useful in certain circumstances.

The Null Enhancement mode may be desirable if you are using a PBX or encounter any situation where the quality of the null is compromised due to external circumstances.

Due to the wide variation of results brought about by different audio material, evaluation under "real world" conditions that pertain to your specific applications is highly recommended.

OPERATION

Answering a Call *Auto-Answer mode off.* Press the ON button. The ON indicator will glow, indicating a connected call. The same muting and adaptation routine described above is completed automatically.

Auto-Answer mode on. The Digital Hybrid III will automatically answer the incoming call after one complete ring. The ON button indicator will glow, to indicate a connected call.

(As the line is connected, the hybrid mutes the caller audio, waits for the telephone loop current to become stable, then applies a 300 millisecond burst of white noise to the telephone line. This noise is used by the DSP to adjust its filter coefficients to maximize the hybrid null. One-hundred milliseconds later, the hybrid removes the mute from the caller amplifier, allowing telephone line audio to appear at the appropriate output connections on the rear panel.)

Record enabled. If RECORD mode was enabled prior to pressing the ON button, the tape recorder will start automatically via the Tape Start relay.

Disconnecting a Call *Auto-Disconnect mode off.* Press the OFF button to disconnect a call. The call will be muted to prevent line noise, beeps and clicks from being broadcast. The OFF indicator light will glow.

Auto-Disconnect mode on. When the caller hangs up, the hybrid senses loop drop and disconnects the line. (The line is first muted to prevent line noise, beeps and clicks from being broadcast. The ON indicator light will glow, indicating an active call.)

Record enabled. When the OFF button is pressed, the Tape Stop relay is triggered, stopping the recording.

Cue (DIP switch 9 should be in DOWN position.) When the CUE button is pressed, its indicator light glow steadily. The Digital Hybrid III will toggle between the MAIN SEND and CUE SEND audio inputs. This enables you to make recordings off air for playback at a later time.

During live broadcasts, the CUE should not be active (lamp will be off).

Console module switching logic can be used to control this function; however, the operator can override the selection. The console module logic will always update the hybrid Send source status insuring that the proper audio will always be sent to the Caller.

Recording Calls

Before taking a call. Press the RECORD button to place the hybrid in record mode. When the call is answered (during either auto-answer mode or by pressing the ON button) the record function is activated, simultaneously starting the tape recorder via the Tape Start relay and enabling the tape recorder's "record" function via the Record Enable relay. When the call is disconnected, the record function stops.

While on an active call. Pressing the RECORD button starts the recorder and enables the record function.

Renulling the Line

While you are on an active call, the line can be renulled by pressing the ON button again without disconnecting the line. This reinitializes the filter coefficients and the nulling and muting process repeats itself automatically.

Remote Controls

Several functions of the Digital Hybrid III can be controlled and monitored remotely via the back panel REMOTE and TAPE connectors. These must be set up properly to comply with your usage. Complete function and pin out information of the Remote connector begins on page 28. Complete function and pin out of the Tape connector begins on page 35. When set up properly, each of the functions below can be remotely controlled:

- ON/OFF Switching
- Record
- Cue
- Send Mute
- Caller (Receive) Mute
- Auxiliary Relay Contacts
- Tape Start Relay
- Tape Stop

SPECIFICATIONS

Physical Specifications

The Digital Hybrid III is enclosed in a rugged metal case, which may be mounted in a standard 19" equipment rack with the provided rack ears (1 rack unit high). The actual physical dimensions of the unit are:

Dimensions	19" W x 1.75" H x 12" D 48.3 cm W x 4.45 cm H x 30.5 cm D
Weight (dry)	10 lbs. (4.53 kg)
Shipping Weight:	13 lbs. (5.9 kg)

Electrical Specifications

Power Requirements	100-120/220-240 VAC 50/60 Hz; 5 watts maximum
Temperature Range	32 to 122 degrees Fahrenheit 0 to +50 degrees Centigrade
Humidity Range	0% to 80%

Telephone Specifications

Line Connection	Modular RJ-11C
External Set	Modular RJ-11C (LINE connected to SET when the unit is off)
Common Mode Protection	Intentional path to ground at 230 volt on tip or ring
Automatic Answer	Answers after one complete ring when enabled
Automatic Disconnect	Disconnects on loop drop or loop reversal when Automatic Disconnect is enabled
Hybrid	Standard Hybrid transformer coupled with Digital Signal Processor (DSP) leakage suppression
Key Service Compatibility	Any key system providing true tip and ring compatibility to telephone instruments
Tip/Ring Switching	Two Omron magnetically latching, DPDT relays

Telephone Transmit

All measurements are referenced to a +4 dBm input and a -15 dBm level put on the telephone line

Send Distortion	0.3% THD, 270 to 2800 Hz
Send SNR	60 dB

Send Filter	-1 dB points: 270 and 2800 Hz -30 dB points: 100 Hz and 6300 Hz
-------------	--

Telephone Receive

All measurements are referenced to a -15 dBm telephone input and a +4 dBm output level.

Receive distortion:	0.15% THD, 270 to 3300 Hz
Receive SNR:	60 dB
Receive Filter:	-1 dB points: 270 and 3300 Hz -30 dB points: 100 Hz and 6300 Hz

Audio Interface

MAIN SEND Input	600 ohm active balanced, XLR bridging input, +4 dBm nominal with clipping threshold of 20 dBm. Level is adjustable via front access panel trim-pot
CUE SEND Input	Active balanced, XLR bridging input, +4 dBm nominal. Level is adjustable via front access panel trim-pot
AUXILIARY SEND Input	Unbalanced line level. Fixed unity gain; XLR. Active balanced, XLR bridging input, +4 dBm nominal. Level is adjustable via front access panel trim-pot Pin 9 of Remote Connector. This AUXILIARY SEND audio does NOT appear at the RECORD/MIX output.
CALLER Output	Active balanced, 600 ohm nominal output impedance. Nominal output level +4 dBm, clip level +20 dBm. Also 600 ohm unbalanced CALLER output at Remote Connector. Level is adjustable via front access panel trim-pot.
RECORD/MIX Output	600 ohm active balanced output impedance; XLR 0 dBm nominal fixed output level. Also 600 ohm unbalanced RECORD/MIX output at Remote Connector.

Back Panel Connectors

REMOTE	25-pin D-type
TAPE	9-pin D-type
XLR	3-pin audio connectors
LINE	RJ-11C modular (USOC)
SET	RJ-11C modular (USOC)

Specifications are subject to change without notice.

MAINTENANCE

Your Digital Hybrid III is a highly reliable device. It was thoroughly tested at the factory before being shipped to you. To protect your Digital Hybrid III from damage, do not operate it in an excessively hot or cold environment and avoid subjecting the unit to physical shock.

If you leave your Digital Hybrid III permanently connected to a telephone line, it is strongly recommended that you provide external surge protection for the telephone line and the AC power input. Gentner can provide highly reliable surge protection devices for both the telephone lines and the AC power input. Call the Gentner sales office for more information at (801) 975-7200.

The Digital Hybrid III does not contain any user serviceable parts. Should your unit not operate satisfactorily, please call Gentner Communications Corporation and ask for Technical Support.

WARNING: THE DIGITAL HYBRID III CONTAINS CMOS INTEGRATED CIRCUITS. ALL SERVICE TO THE UNIT MUST BE PERFORMED IN A STATIC FREE ENVIRONMENT.

TROUBLESHOOTING

Questions and Answers

This section is intended to answer the most common questions about installation and operation of the Digital Hybrid III. If you need further assistance, call Gentner Technical Support at (801) 975-7200.

- 1. I am replacing my Digital Hybrid ANA with a Digital Hybrid III. I cannot get it to work right. What should I check first?***

Please check the DIP switch settings. The Digital Hybrid III uses a "DOWN TO ENABLE" plan that is sometimes the reverse of the DIP switch settings you used with the Digital Hybrid ANA. See the DIP Switch chart on page 41.

- 2. I can change the DIP switch settings on DIP switches 9 and 10 but nothing happens. Are they malfunctioning?***

Each time you wish to change DIP switches 9 or 10 you will have to disconnect the AC electrical power to the Digital Hybrid III and power up with the DIP switches in the desired position in order for the Digital Hybrid III to recognize the new selection. See the DIP Switch chart on page 41.

- 3. I can't get the Auto Answer, the Auto Disconnect, or the Auto Re-null to work right. What could cause this?***

These symptoms indicate the internal DC Bypass Jumper is in the JP2 position. Refer to pages 24 and 25 for information about this jumper.

- 4. The Caller level coming into my console is too low (or too high) and I have to run the pot unusually high (or low). Do I need additional amplification (or attenuation)?***

Perhaps, but first try adjusting the CALLER LEVEL trim pot located behind the removable front access panel. See page 39, "Adjust Caller Level and Caller Control".

- 5. My Digital Hybrid III gates the Caller audio like a speakerphone. Should it do this?***

When the CALLER CONTROL trim pot located inside the front access panel is in the full clockwise position, the effect can be like that of a speakerphone. Typically the CALLER CONTROL trim pot is set at the full counter-clockwise position. See page 39, "Adjust Caller Level and Caller Control".

- 6. *I can't get the Digital Hybrid III to auto-answer. What can I check?***

To enable to Auto-Answer feature, DIP Switch 1 inside the front access panel must be in the DOWN position. In this setting, the Digital Hybrid III should answer after one complete ring.

- 7. *I am using the Auto-Renull feature, but now the Auto Disconnect does not work. Is this a malfunction?***

When the Auto-Renull feature is enabled, the Auto-Disconnect feature is disabled. There often is misunderstanding of the Auto-Renull function. This feature is only necessary if the Digital Hybrid III is left in the ON mode to permit taking calls with a multi-line telephone set or a Telemix 2000 Call Director. See page 37, "Auto-Renull" and page 44, "Enhanced Null" for more information.

- 8. *I have installed remote toggle switches to control the ON and OFF functions of the Digital Hybrid III, but now I can't turn off the unit after it is turned on. Also, the front panel OFF button doesn't work.***

Check the setting of DIP Switch 4 located behind the front access panel. With any latching ON/OFF switching configuration, DIP Switch 4 should be placed in the DOWN position. When using the latching ON/OFF switching, no remote OFF button is used, and the front panel ON/OFF Buttons on the Digital Hybrid III will be inoperative. See the DIP Switch chart on page 41.

- 9. *I have hooked up a cassette deck to use as a "skimmer" to record all telephone calls. I connected the remote TAPE START contacts of the Digital Hybrid III to the remote Pause connections on the cassette deck. I can't get the tape to roll. Is an interface necessary?***

Probably not. Since your application requires a latching remote start closure, place front panel DIP Switch 5 in the DOWN position. These are dry relay contact closures fully compatible with your cassette deck.

- 10. *All I get out of the Digital Hybrid III is a loud tone. Is there something wrong with the unit?***

Check the setting of front panel DIP Switch 7. This should be in the UP position except when adjusting the analog null as described in "Analog (Coarse) Null" on page 37 of this manual. See also the DIP Switch chart on page 41.

- 11. When I try to use the Digital Hybrid III, there is a lot of howling and feedback. It sounds like it is not nulling very well. What is wrong?**

Check to make sure that front panel DIP Switch 8 is in the DOWN position. With DIP Switch 8 in the UP position, the digital nulling of the hybrid is defeated. The only time DIP Switch 8 is placed in the UP position is for setting the analog null as described in the DIP Switch chart on page 41, or for diagnostic tests as recommended by Gentner Technical Support.

- 12. I want to hook up the remote CUE function of the Digital Hybrid III, but I can't get it to operate properly. What should I do?**

If console logic is to select the CUE function, Pins #8 and #5 are used. This type of interface requires latching closure to enable the CUE function. The remote CUE connection at Pin #4 is for momentary remote operation identical to the front-panel CUE Button on the Digital Hybrid III. Refer to "Functions of the Remote Control" starting on page 28.

- 13. I'm using the Digital Hybrid III on my PBX. The signal-to-noise ratio (SNR) and hybrid performance is poor. Why?**

The Digital Hybrid III reduces line noise by using a bandpass filter to limit extraneous low and high frequencies coming in on the telephone line. Therefore, noise which falls within the passband will not be filtered out. One such source on digital telephone systems is the CPU noise induced into adjacent audio wires in a cable. Hybrid performance can be severely degraded when something other than the telephone Central Office hybrid is seen by the Digital Hybrid III. When other inductive or capacitive components such as switches, relays, chokes, or transformers are added to the circuit, it becomes much more difficult for the hybrid to match the line characteristics.

Wide variance between optimum SEND and CALLER (receive) levels can also degrade hybrid performance. For some applications, using an outside telephone line which bypasses the PBX is the only way to achieve satisfactory performance.

- 14. My Digital Hybrid III needs to put louder Send audio on the telephone line. What can I do?**

Try adjusting the MAIN SEND and/or CUE SEND input level trim pots as needed. Please note that a level of -9 dBm sent down the telephone line is the maximum permitted by the FCC. Level settings are described under "Adjust Main Send Levels" starting on page 38.

15. Callers report there is quite a difference in SEND level when the Caller is placed on-the-air. I have tracked it down to a change of level that occurs whenever the CUE function is activated or deactivated. What can I do to fix this?

Try adjusting the CUE SEND level to match that of the MAIN SEND. See page 39.

16. Is it OK to do a "button-mash" conference; that is, direct more than one telephone line to the Digital Hybrid III at a time?

"Button-mash" conferences can be done, but much better results can be achieved by using multiple hybrids.

TECHNICAL INFORMATION

Brief Technical Description

The Digital Hybrid III is based on Digital Signal Processing (DSP) technology, which maximizes the separation between the Send and Caller sides of a telephone conversation.

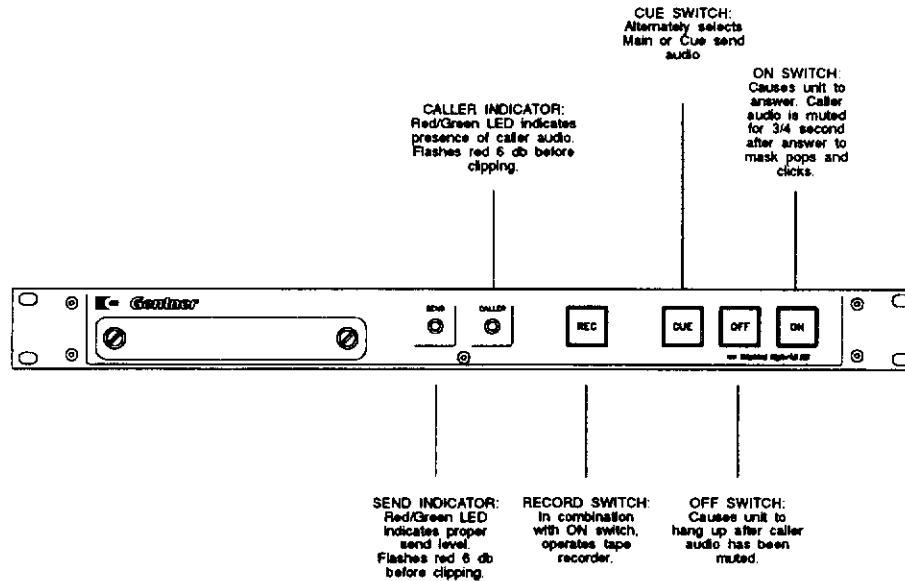


Figure 28

Front Panel Functions

When the ON Button is pressed, the Digital Hybrid III activates a relay that connects the hybrid circuitry to the telephone line.

The internal microprocessor mutes Caller Audio, waits for the telephone loop current to become stable and then applies a 300 millisecond burst of which noise to the telephone line.

The microprocessor analyzes the noise and adapts the digital filter coefficients to maximize the hybrid null.

After the white noise burst is completed, the microprocessor removes the mute from the Caller audio amplifier, allowing Caller audio to appear at the Caller XLR connector on the rear panel of the unit.

While the Digital Hybrid III is on line, the null is constantly optimized to adjust for changing telephone line and program audio conditions.

If the ON button is pressed during the course of a telephone call, the nulling and muting process repeats itself without disconnecting the telephone line.

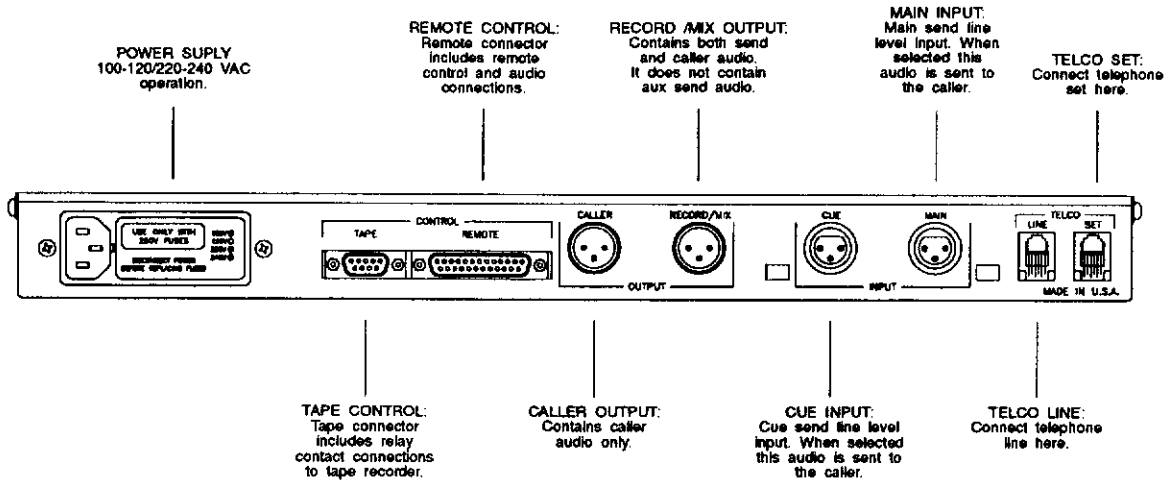


Figure 29

Back Panel Summary

When the OFF button is pressed, the Digital Hybrid III disconnects the telephone line and illuminates the OFF button indicator.

In Broadcasting applications, the CUE Button selects either MAIN SEND, (normal console mix-minus send), or CUE SEND, usually the announcer's microphone preamplifier output).

Theory of Operation

The basic theory of operation for the Digital Hybrid III presented in this section is divided into three general areas based on signal flow:

- a. Send Audio Circuitry
- b. Caller (Receive) audio Circuitry
- c. Telephone Interface Circuitry

Figure 30 of this section shows a functional block diagram of the Digital Hybrid III.

Schematic Diagrams of the Digital Hybrid III are found in the Schematics section, starting on page 64 of this manual.

Connections that transfer from one sheet of the schematics to another are conveniently labeled with numbered "Tags" which help to track signal flow through the schematics.

Examine the functional block diagram of Figure 30 and refer to the schematics beginning on page 65 while reading about the circuit operation provided in this section.

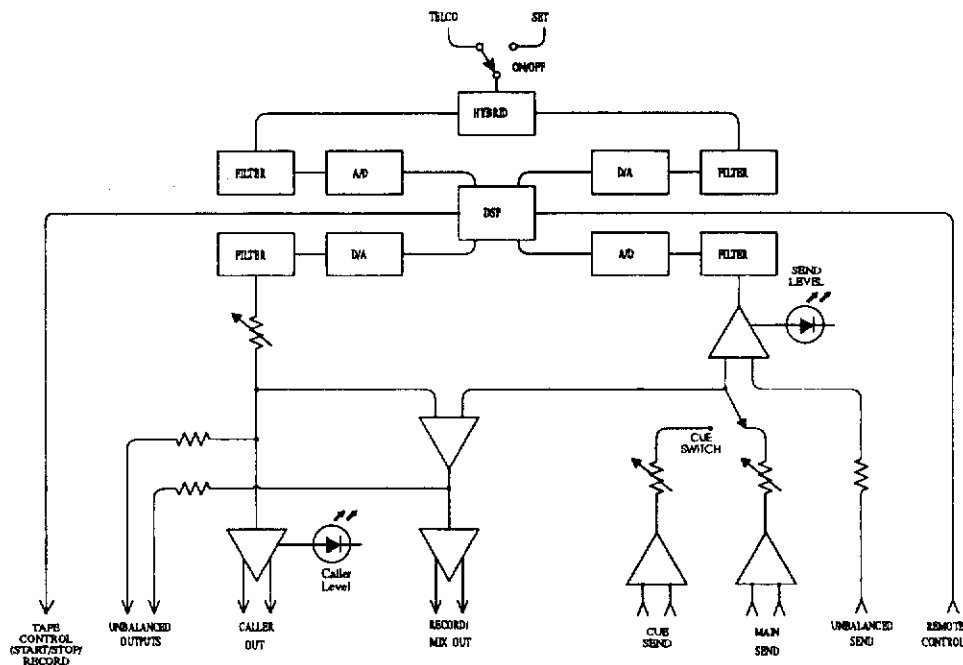


Figure 30

Functional Block Diagram

Send Audio Circuit Description

The MAIN SEND input (J3) and the CUE SEND input (J4) are found on the upper left-hand corner of sheet 6 of 10 of the schematic diagrams.

All audio connections on the Digital Hybrid III are provided with RFI suppression, an example of which may be seen between the MAIN SEND and CUE SEND jacks and the buffer amplifiers, U2 and U3.

The MAIN SEND input passes through U2, is buffered, and converted to unbalanced audio. JP4 selects the adjustable front-panel MAIN SEND trim pot (R168). JP3 selects a fixed gain structure to be used in future applications.

The CUE Send input passes through U3, is buffered, and converted to unbalanced audio. JP6 selects the adjustable front-panel CUE SEND trim pot (R169), while JP5 selects a fixed gain structure to be used in future applications.

The unbalanced AUXILIARY SEND input on the remote connector J7 is found on the upper right-hand corner of sheet 6 of 10 of the schematic diagrams.

After RFI suppression, the AUXILIARY SEND is forwarded on to sheet 7 of 10 via Tag 39, the MAIN SEND goes to sheet 7 via Tag 35, and the CUE SEND arrives at sheet 7 via Tag 36.

On the upper left-hand side of sheet 7 of 10, the MAIN SEND and the CUE SEND audio enter U22, a PMISW06 Analog switch.

Audio that is to be sent to the Caller is selected from either the MAIN SEND input or the CUE SEND input. The selection is determined by the DSP (Digital Signal Processor) and relayed to U22 via Tag 17 from sheet 3 of 10.

U16 provides further attenuation of selected SEND audio. At this point, SEND audio is picked off which is destined to be summed with Caller audio and appear at the RECORD/MIX outputs. This portion of the SEND audio exits via Tag 37 and continues on to the lower right-hand side of sheet 6 of 10.

This "Mix" SEND audio is summed with Caller audio at U5 which feeds the unbalanced RECORD/MIX Output, and also feeds U4, which provides the balanced RECORD/MIX Output.

Please return now to sheet 7 of 10 to continue the discussion of SEND audio. The selected SEND audio is summed with the unbalanced AUXILIARY SEND audio at U10. U10 also serves as an elliptical low-pass filter which provides anti-aliasing filtering before audio proceeds to the DSP section.

In the DSP section, the audio is digitized and processed to separate the CALLER audio from the SEND audio.

After processing in the digital domain, a conversion is made back to analog audio. The analog SEND output comes out of the DSP section, found on Sheet 4 of 10, and is fed to an offset null amplifier (U13) to remove any DC offset coming out of the D/A Converter.

U12 is an elliptical low-pass filter designed to eliminate any aliasing resulting from the sampling process. Some gain is realized at this stage to compensate for attenuation prior to A/D conversion.

The SEND audio comes out of U12 at pin 8 and transfers to sheet 1 of 10 via Tag 4.

On the lower right-hand corner of sheet 1 of 10, the SEND audio passes through RFI filtering and is fed to the PREM. transformer and on to the telephone line.

Caller Audio Circuit Description

The CALLER audio takes a similar, but opposite path as compared with the SEND audio.

Please refer to schematic sheet 1 of 10 in the Schematics section, beginning on page 64.

CALLER audio passes from the telephone line through K1, then through the PREM transformer, and some RFI filtering, and then exits sheet 1 of 10 and continues to the top of sheet 2 of 1, via Tag 3.

U11 is a bandpass filter comprised of a 4-pole high-pass and a 4-pole low-pass filter. The high-pass filtering gets rid of any 60-120 Hz hum and low-frequency noise components present on the telephone lines. The low-pass filter provides anti-aliasing filtering for the A/D conversion to follow and reduces high-frequency telephone multiplexing or switching noise.

Filtered CALLER audio proceeds to the DSP section. Next, the CALLER audio is processed together with the selected SEND audio.

The digitized caller audio is sent to the DSP (U32) via Tag 10 on sheet 3 of 10. The digitized audio is processed and sent to U20 on sheet 4 of 10 via Tag 14. At U20 the digitized audio is converted back to analog audio and routed through the offset null amplifier, U13. CALLER audio then continues to sheet 5 of 10 via Tag 33.

Beginning on the upper left-hand side of sheet 5 of 10, U20 and U23 form an elliptical low-pass filter. Audio then passes through a buffer amplifier, U16. The Null Test Points are located here. JP10 selects the adjustable front-panel CALLER level trim pot, R170. JP9 selects a fixed gain structure to be used in future applications.

U5 provides about 13 dB of gain at the output of pin 14. A sample is taken off at this point (Tag 34 to sheet 6 of 10) that will be mixed with the MAIN SEND, or CUE SEND audio at the RECORD/MIX outputs.

From U5, pin 14, CALLER audio also goes to the unbalanced 600 ohm output, pin 10 of the REMOTE connector, and to U6, to provide balanced XLR output (J6).

Telephone Interface Circuit Description

Please refer to Sheet 10 of 10 of the schematic diagrams found in Section beginning on page 65 of this manual while reading the following.

The TIP and RING conductors of the telephone line are applied to J1. This is an RJ-11C connector on the rear panel of the Digital Hybrid III.

TIP and RING are then routed through fusing resistors to line relay K1.

When K1 is not energized, the telephone line TIP and RING are routed directly to the Set Jack, J2. When K1 is energized, Tip and Ring are routed past TZ1 and TZ2 which provide surge protection in conjunction with R1, R2, and R3. This protects the hybrid from surges on the telephone line such as those caused by lightning.

When K1 is not energized, ring voltage appears across the PREM transformer. If the jumper JP1 is selected (in the DC Position), the voltage is passed on to bridge rectifier DB1 where it is rectified, limited and squared at U9 before proceeding to the DSP on page 3 of 10 via Tag 2.

U9 performs two functions:

- a. Ring voltage detection: The ring signal is output as a square wave recognized by the DSP.
- b. Loop or "battery" current detection: When loop current is present, the output of U9 will remain active.

The DSP has buffered logic outputs that either set or reset relays K1 and K2 to connect or disconnect the telephone line.

The coarse (analog) null circuitry is connected to the center tap of the PREM coil secondary. SW1 selects progressively increasing combination of C165, C166, C167 and C168. R172 is the front-panel null trim pot.

FIRMWARE LICENSE

The Digital Hybrid III is a microprocessor based system. All firmware for the unit was developed by Gentner Communications Corporation.

By purchasing the Digital Hybrid III, you accept the terms of the Gentner Firmware License Agreement stated below. This License Agreement becomes effective as of the date of purchase of the Digital Hybrid III.

GENTNER FIRMWARE LICENSE AGREEMENT

Gentner Communications Corporation, (hereinafter referred to as Gentner), is sole owner of the Digital Hybrid III firmware. The Digital Hybrid III firmware is defined as all software stored in the memory device supplied with this license. Gentner grants to the purchaser and/or the end-user of the Gentner Digital Hybrid III unit a non-exclusive license to use the firmware under the following terms and conditions.

This firmware is:

- a. For use only on the Digital Hybrid III which has been purchased and properly registered by serial number with Gentner.
- b. Not to be copied or duplicated in any way, and not to be transferred or delivered to any other person or entity without the written consent of Gentner.
- c. Protected by all applicable copyright and patent laws. Any copyrights and patents assigned to Gentner for the Digital Hybrid III remain the sole property of Gentner.

This license does not assign or transfer ownership of the firmware. Included in this license is all information contained in the instruction manuals, schematic diagrams, and related materials. This license shall remain in effect for the life of your Digital Hybrid III. You may terminate the license by returning the Digital Hybrid III to Gentner in its original container. This license is automatically terminated if you violate any of the terms and conditions of this license. Upon such termination, the Digital Hybrid III must be returned to Gentner.

This license agreement is granted solely to the original purchaser of the Digital Hybrid III. If the Digital Hybrid III, and thus the firmware and this license, is to be passed to another person or entity in any way, the original purchaser must advise Gentner in writing of this transfer. The new holder of the Digital Hybrid III must acknowledge in writing acceptance of the terms and conditions of this license. The license be deemed terminated if such written acceptance is not presented to Gentner.

WARRANTY

GENTNER COMMUNICATIONS CORPORATION (Manufacturer) warrants that this product is free of defects in both materials and workmanship. Should any part of this equipment be defective, Manufacturer agrees, at its option, to:

- A. Repair or replace any defective part free of charge (except transportation charges) for a period of one year from the date of the original purchase, provided the owner returns the equipment to the Manufacturer at the address set forth below. No charge will be made for parts or labor during this period;
- B. Furnish replacement for any defective parts in the equipment for a period of one year from the date of original purchase. Replacement parts shall be furnished without charge, except labor and transportation.

This Warranty excludes assembled products not manufactured by Manufacturer whether or not they are incorporated in a Manufacturer product or sold under a Manufacturer part or model number.

THIS WARRANTY IS VOID IF:

- A. The equipment has been damaged by negligence, accident, act-of-God or mishandling, or has not been operated in accordance with the procedures described in the operating and technical instructions; or,
- B. The equipment has been altered or repaired by other than Manufacturer or an authorized service representative of Manufacturer; or,
- C. Adaptations or accessories other than those manufactured or provided by Manufacturer have been made or attached to the equipment which, in the determination of Manufacturer, shall have affected the performance, safety or reliability of the equipment; or,
- D. The equipment's original serial number has been modified or removed.

NO OTHER WARRANTY, EXPRESS OR IMPLIED, INCLUDING WARRANTY OF MERCHANTABILITY OR FITNESS FOR ANY PARTICULAR USE, APPLIES TO THE EQUIPMENT, nor is any person or company authorized to assume any warranty for Manufacturer or any other liability in connection with the sale of Manufacturer's products.

Manufacturer does not assume any responsibility for consequential damages, expenses or loss of revenue or property, inconvenience or interruption in operation experienced by the customer due to a malfunction in the purchased equipment. No warranty service performed on any product shall extend the applicable warranty period.

In case of unsatisfactory operation, the purchaser shall promptly notify Manufacturer at the address set forth below in writing, giving full particulars as to the defects or unsatisfactory operation. Upon receipt of such notice, Manufacturer will give instructions respecting the shipment of the equipment, or such other matters as it elects to honor this warranty as above provided. This warranty does not cover damage to the equipment during shipping and Manufacturer assumes no responsibility for such damage. All shipping costs shall be paid by customer.

This warranty extends only to the original purchaser and is not assignable or transferable.

Gentner Communications Corporation • 1825 Research Way • Salt Lake City, Utah 84119

PRODUCT LINE UPDATES

Gentner Communications Corporation will offer, from time to time, new products, options, and firmware updates for its product line. As a registered owner of a Gentner product, you will automatically be notified of updates when they become available.

You must complete and return the Warranty Card included in your shipment in order to be notified of updates to the product line.

If the card is lost, you may notify us by letter. Your letter must include the following information:

- The Digital Hybrid III Serial Number.
- Your Name.
- The name of your organization.
- Your address.
- Date of purchase.
- The name of the company from whom you purchased your Digital Hybrid III.

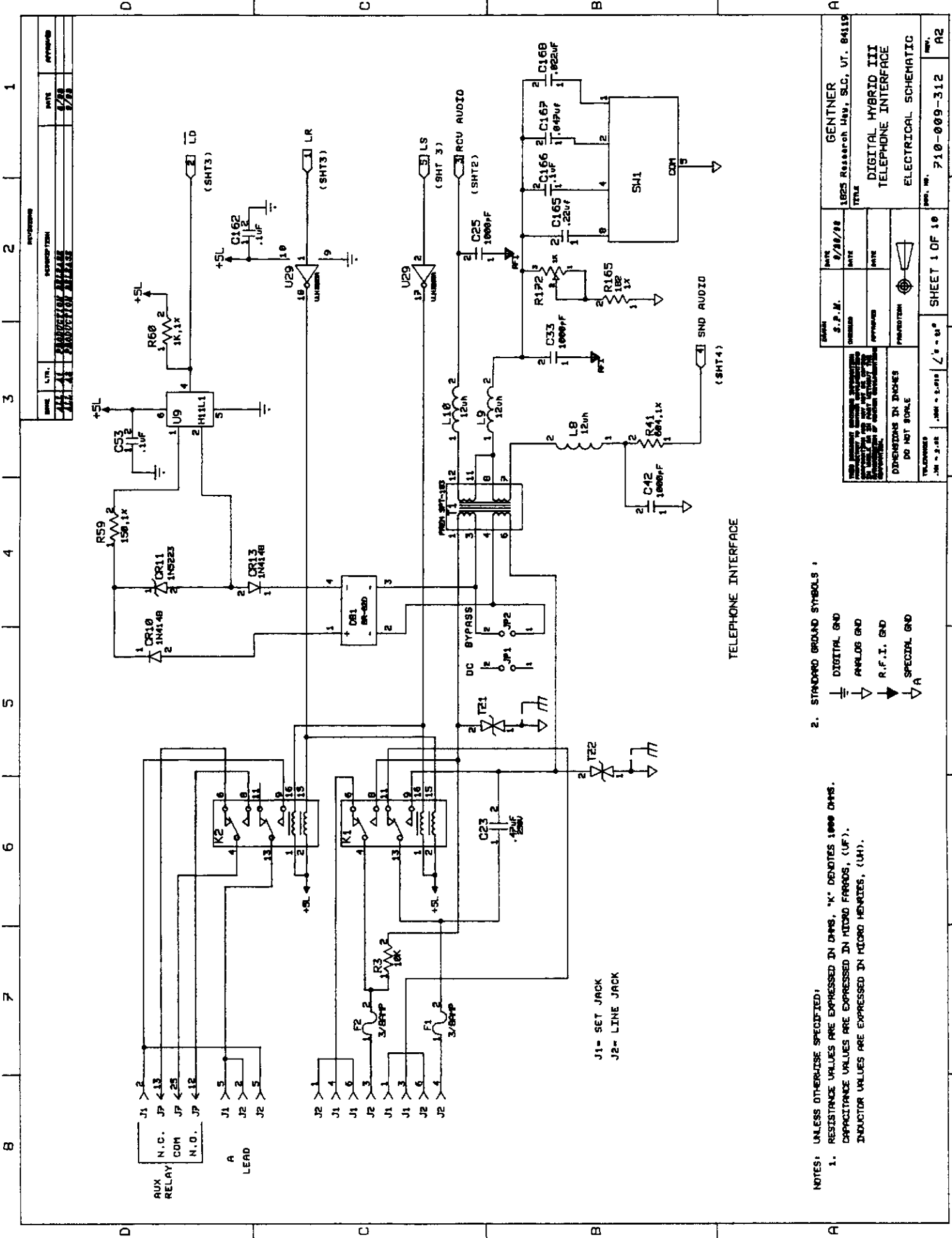
Mail your Warranty Registration Card to:

Gentner Communications Corporation
Professional Audio Products Division
1825 Research Way
Salt Lake City, Utah 84119

SCHEMATICS

The schematics found on the following pages will assist during trouble shooting.

Gentner encourages all operators of the Digital Hybrid III to contact Gentner Technical Support at (801) 975-7200 before any repair is attempted. Your warranty will be void if this equipment is altered or repaired by other than the manufacturer or the manufacturer's authorized representative.



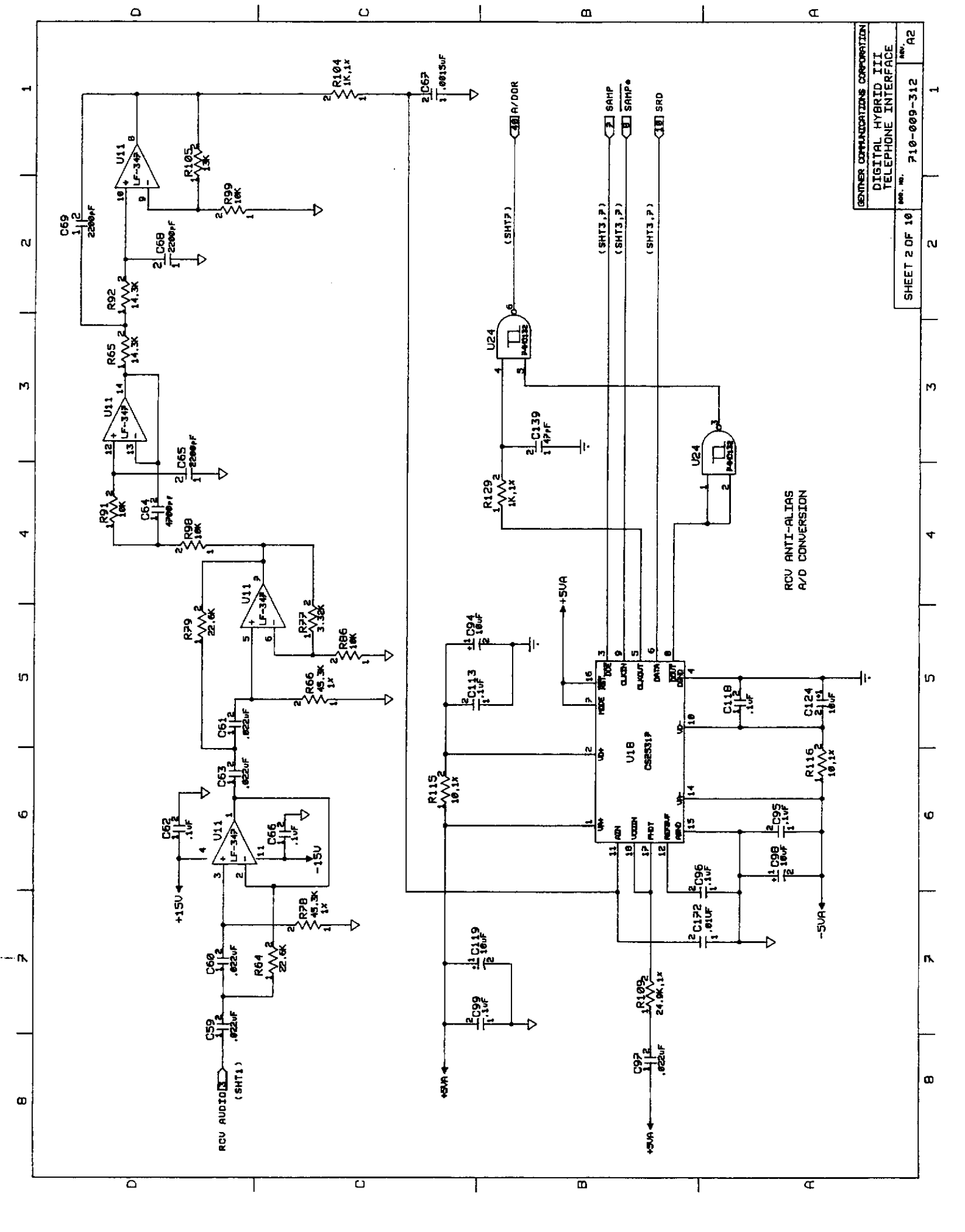
NOTES: UNLESS OTHERWISE SPECIFIED:

- RESISTANCE VALUES ARE EXPRESSED IN OHMS, "K" DENOTES 1000 OHMS. CAPACITANCE VALUES ARE EXPRESSED IN MICRO FARADS, (UF). INDUCTOR VALUES ARE EXPRESSED IN MICRO HENRIES, (UH).

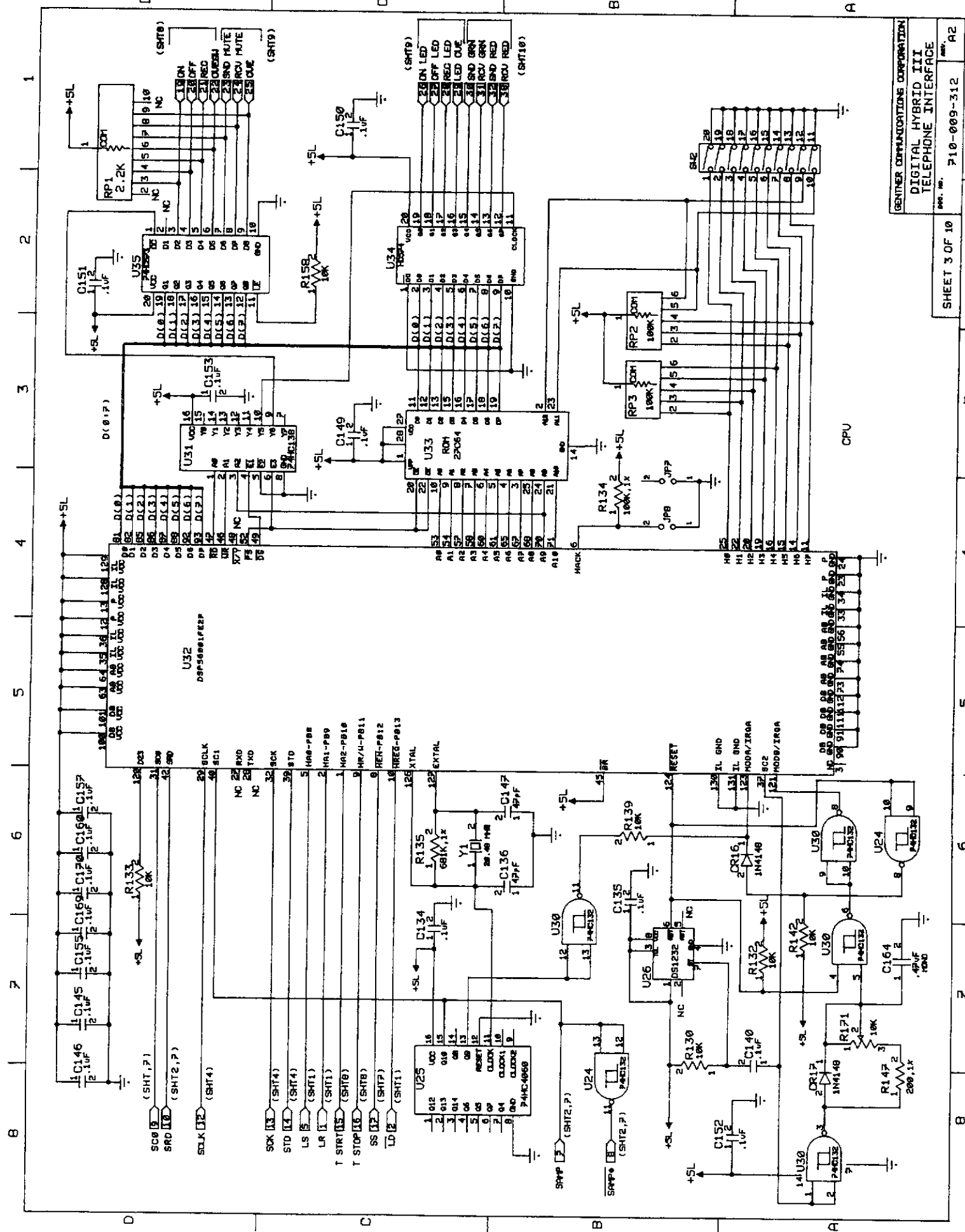
2. STANDARD GROUND SYMBOLS:

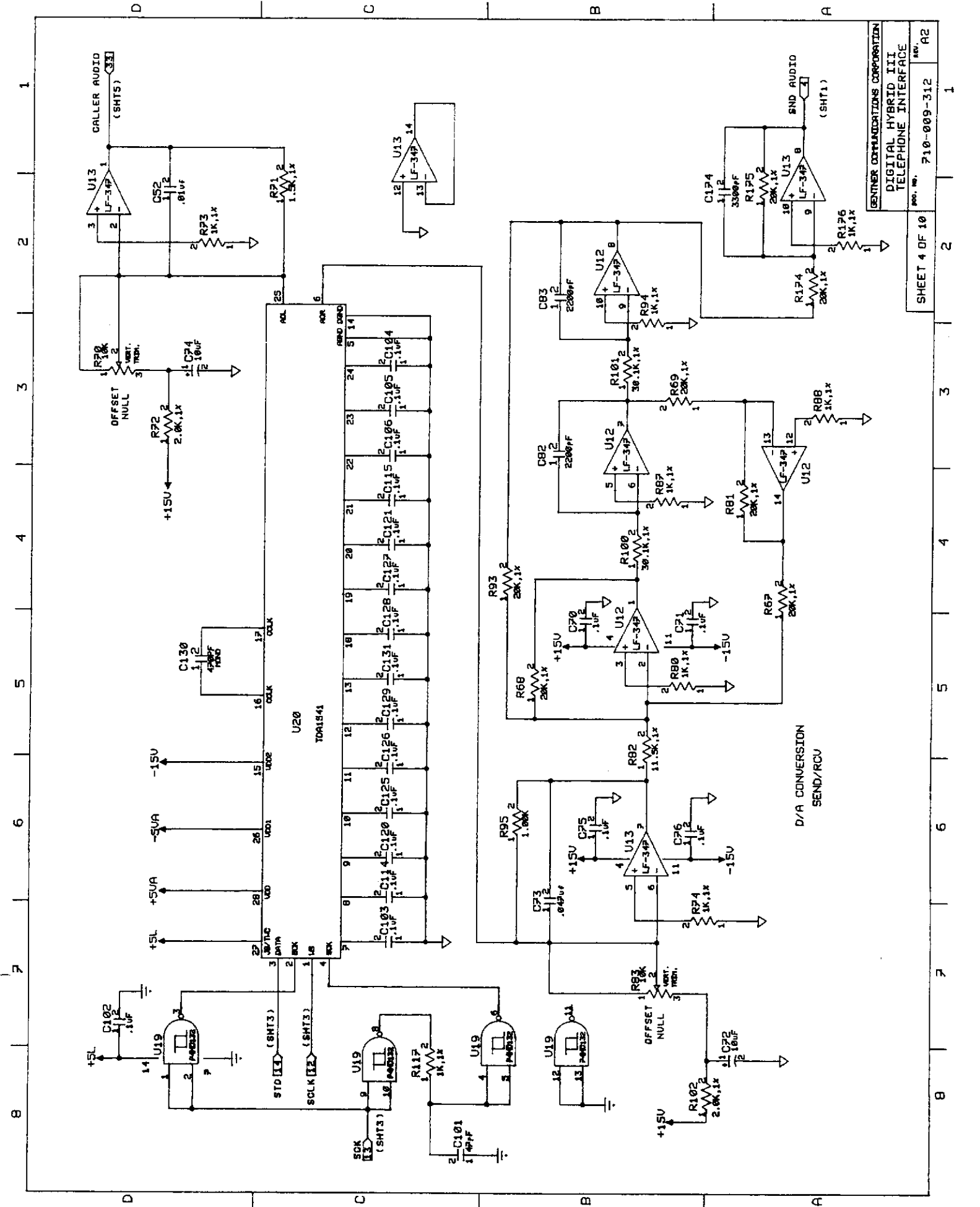
- DIGITAL GND
- ANALOG GND
- R.F.I. GND
- SPECIAL GND

DATE	REV.	BY	CHKD.	APP'D.
8/18/68				
GENTNER				
1825 Research Hwy, SLC, UT. 84119				
TITLE				
DIGITAL HYBRID III				
TELEPHONE INTERFACE				
ELECTRICAL SCHEMATIC				
SHEET 1 OF 10				
DRAWING NO. 710-009-312				
REV.				
A2				

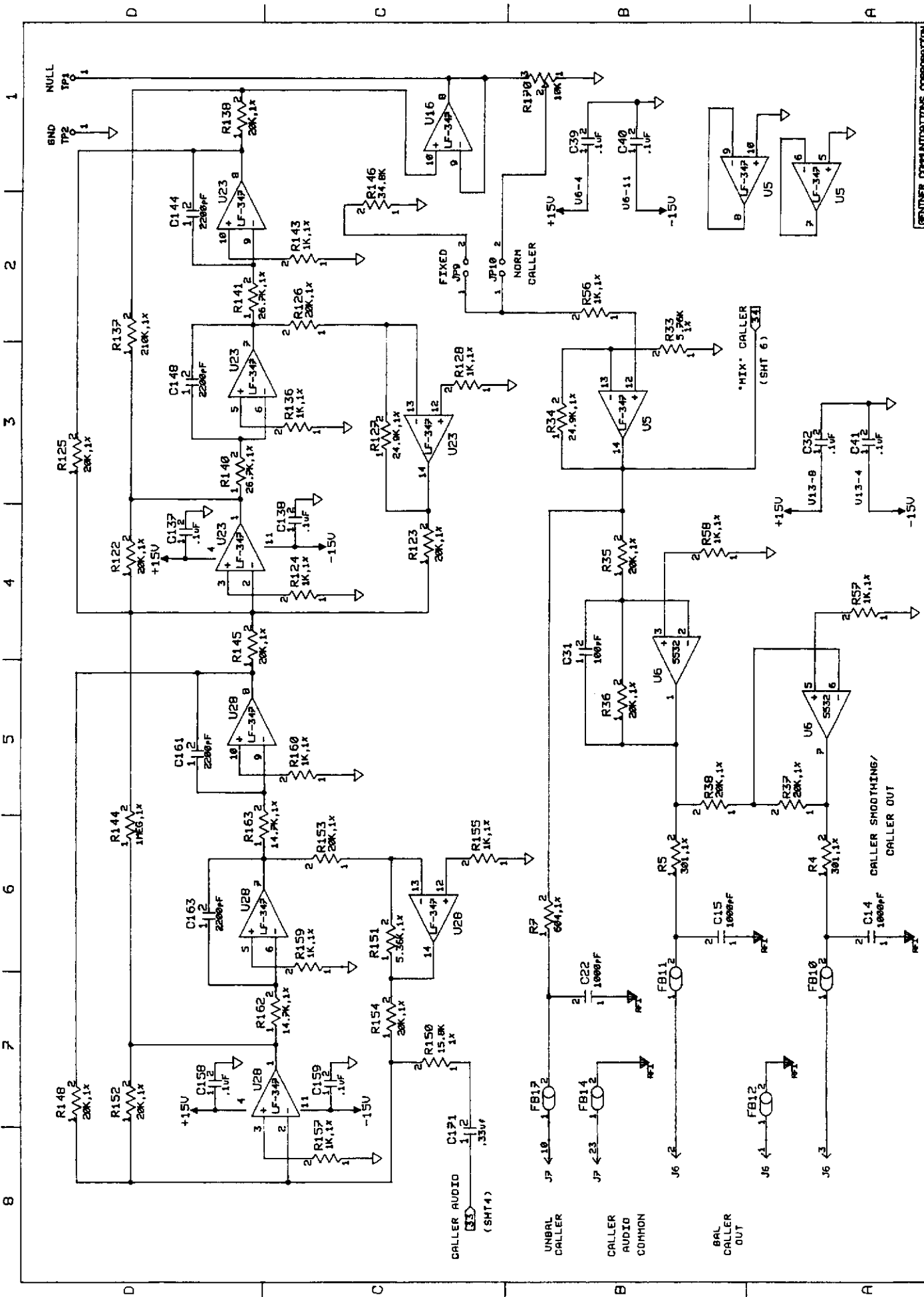


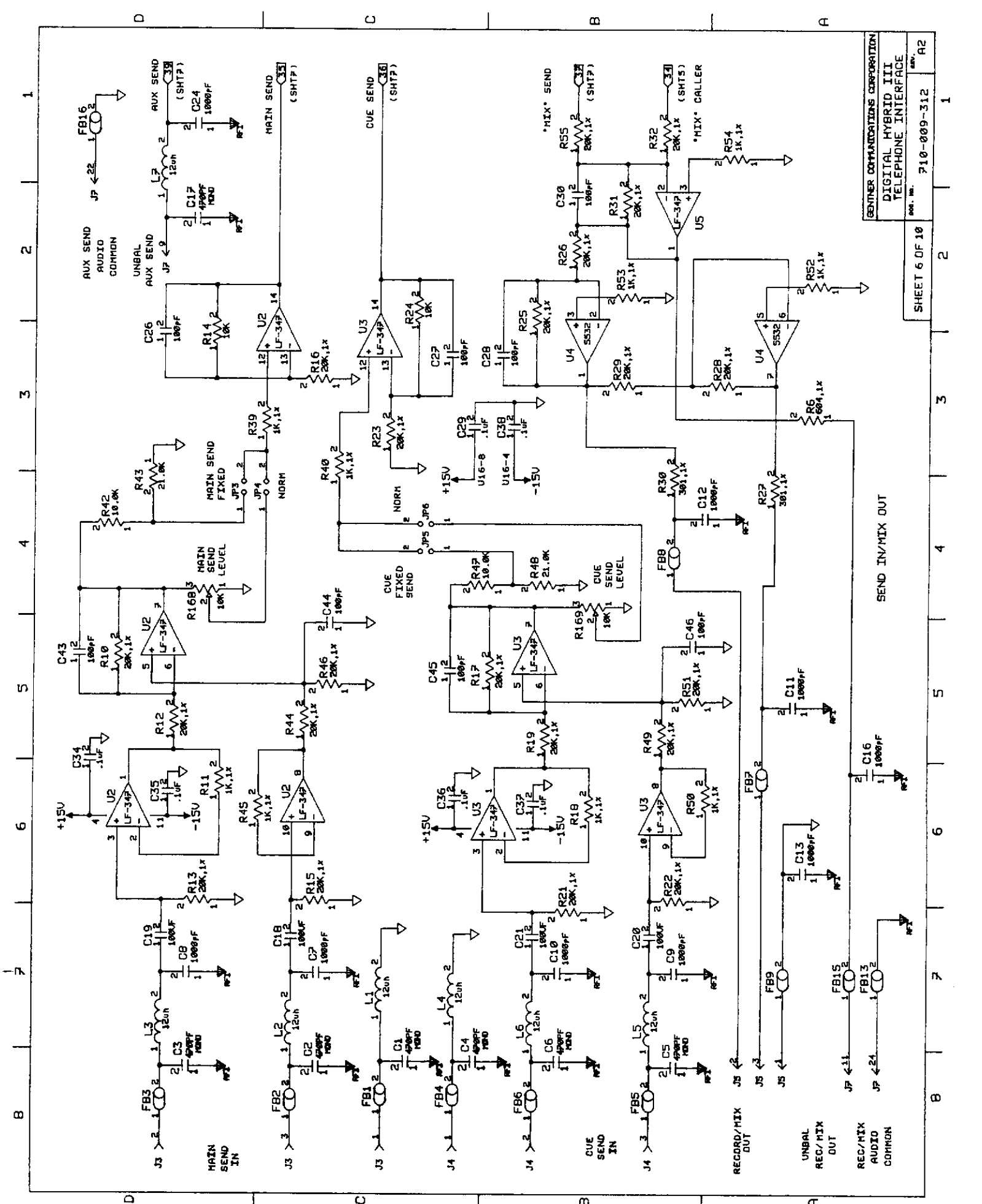
RCV ANTI-ALIAS
A/D CONVERSION





GENINER COMMUNICATIONS CORPORATION
 DIGITAL HYBRID III
 TELEPHONE INTERFACE
 REV. NO. 710-009-312





GENIER COMMUNICATIONS CORPORATION
 DIGITAL HYBRID III
 TELEPHONE INTERFACE
 600.000 710-009-312
 REV. 1

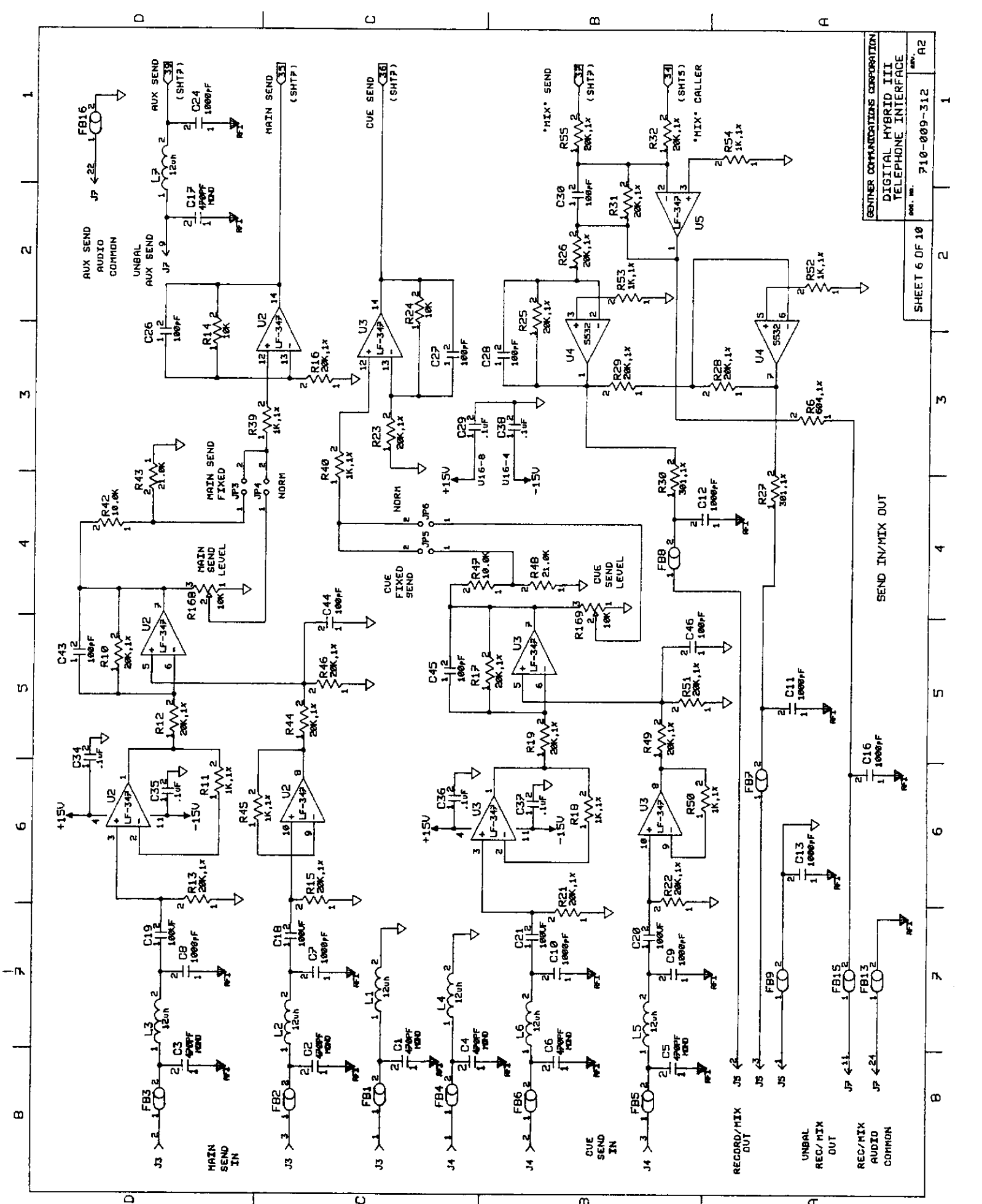
SHEET 6 OF 10

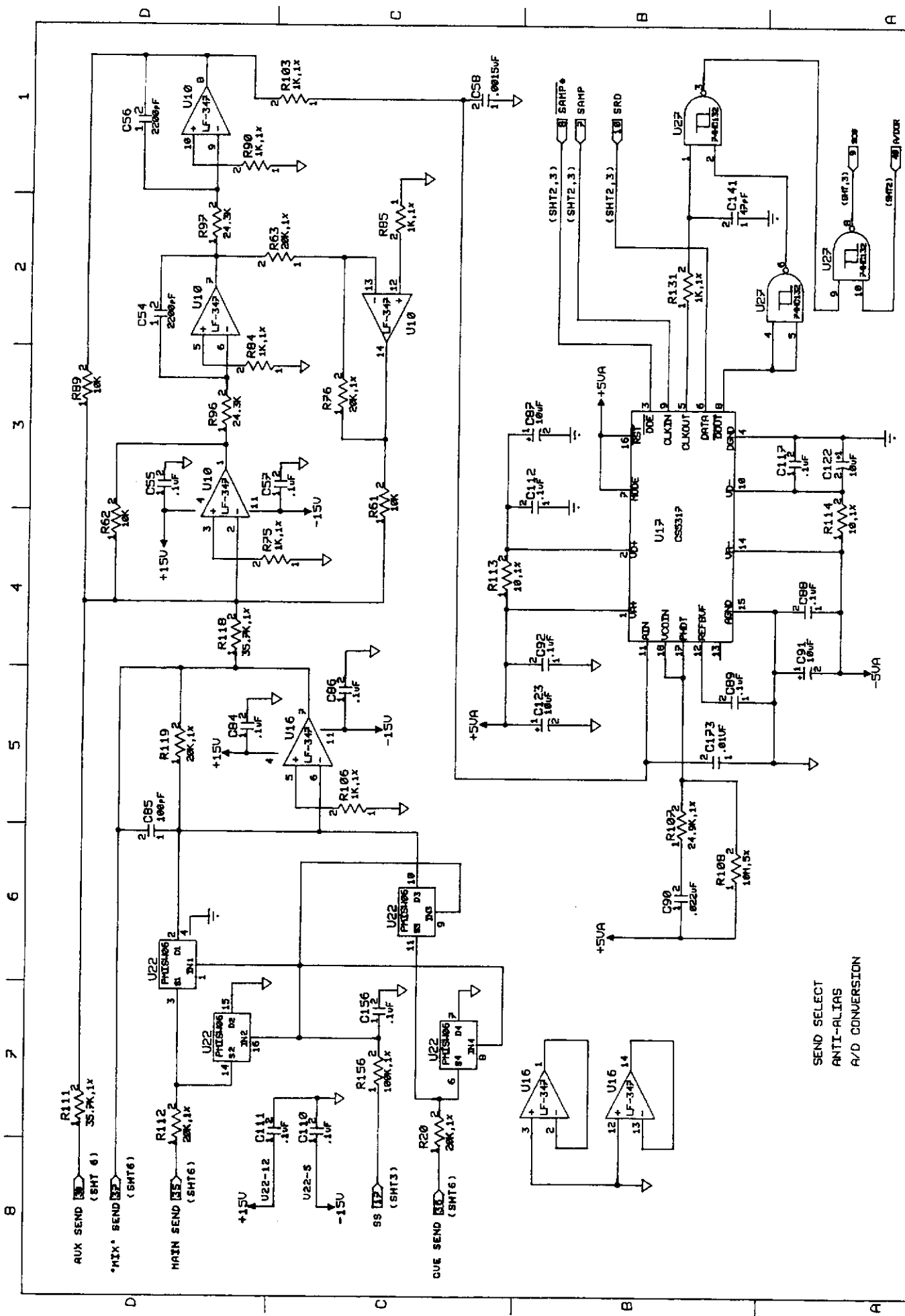
SEND IN/MIX OUT

RECORD/MIX OUT

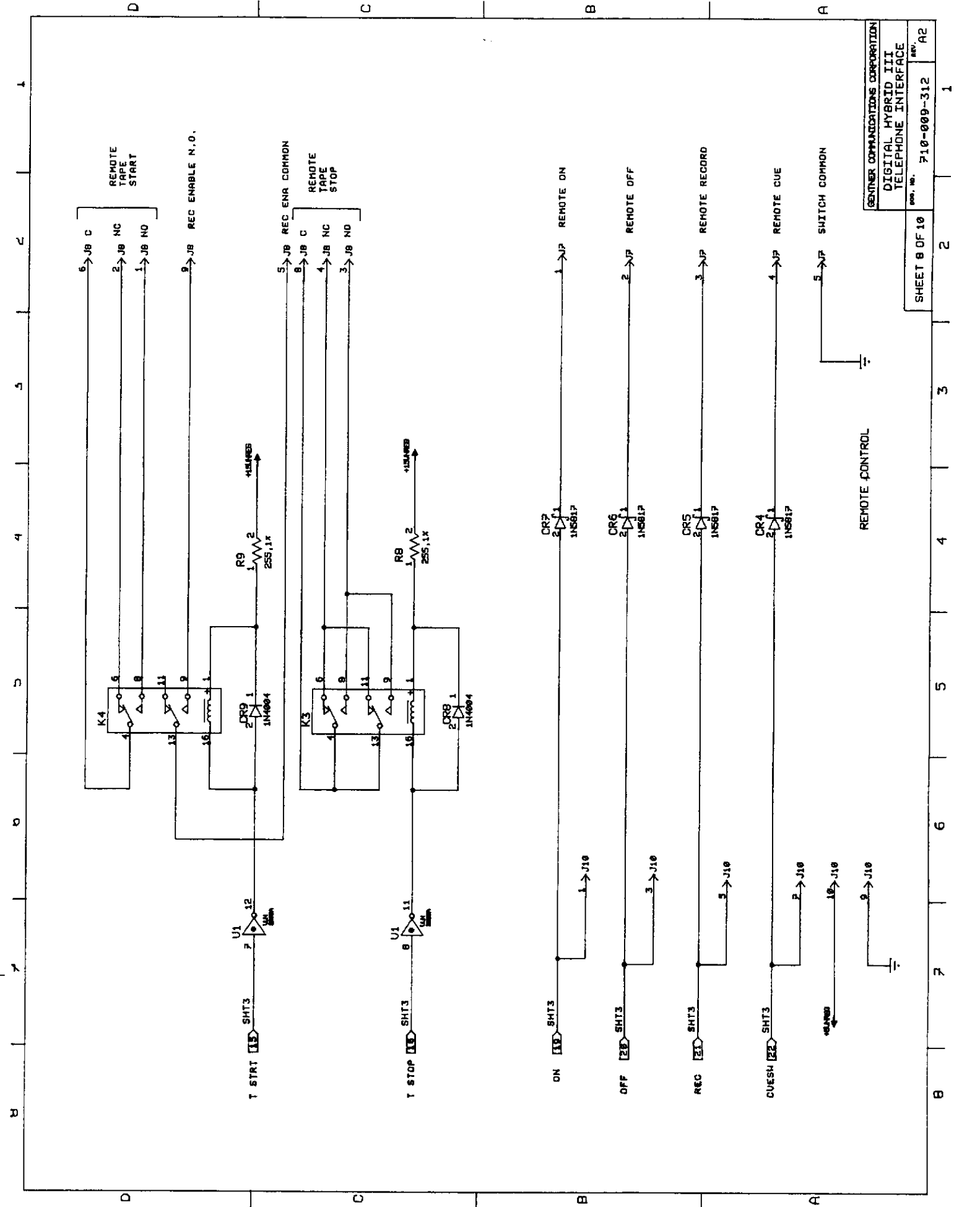
UNBAL REC/MIX OUT

REC/MIX AUDIO COMMON





SEND SELECT
ANTI-ALIAS
A/D CONVERSION

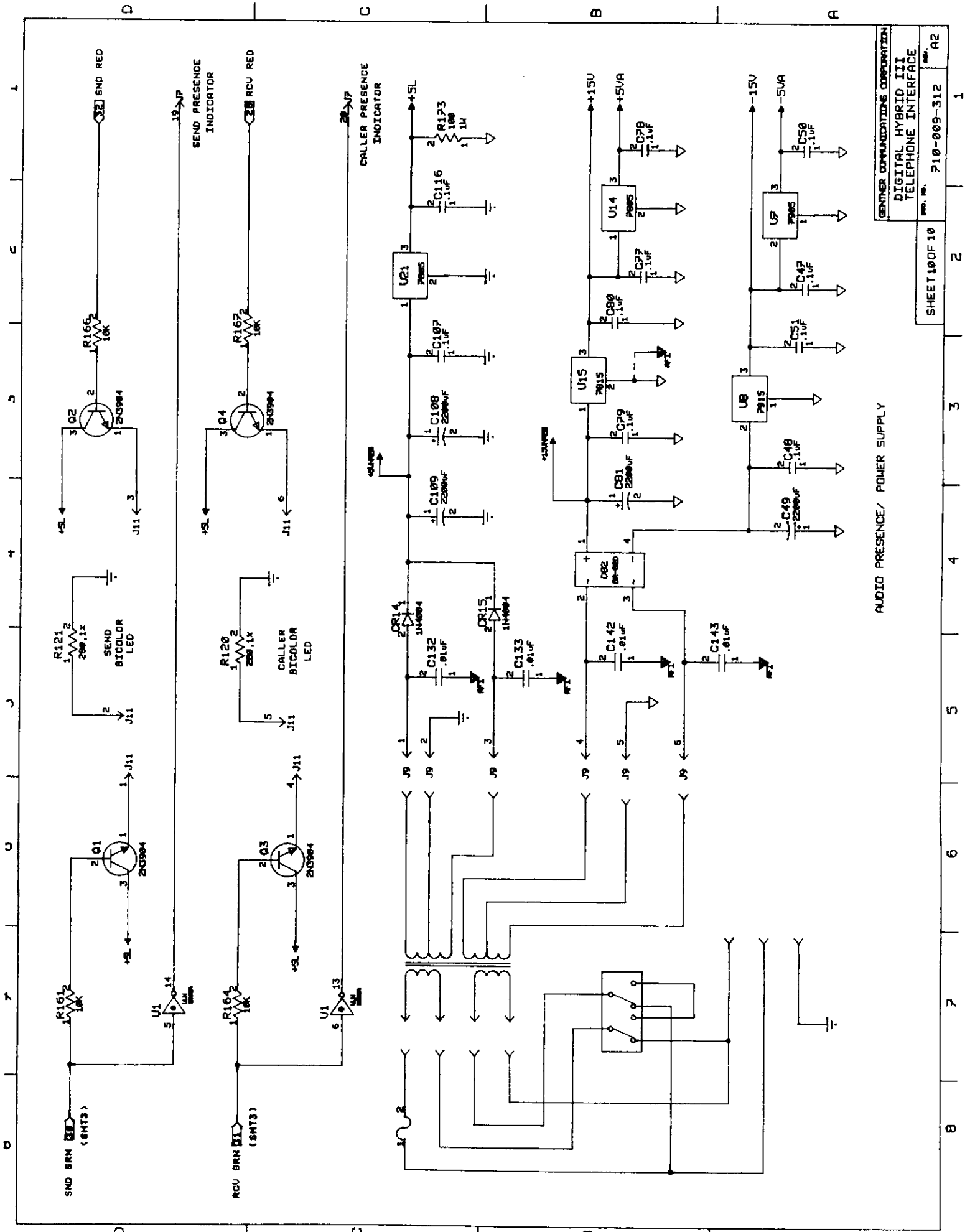


GENETEC COMMUNICATIONS CORPORATION
 DIGITAL HYBRID III
 TELEPHONE INTERFACE
 REV. NO. 710-009-312

SHEET 8 OF 10

REV. A2

1 2 3 4 5 6 7 8



AUDIO PRESENCE/ POWER SUPPLY

GENEX COMMUNICATIONS CORPORATION
 DIGITAL HYBRID III
 TELEPHONE INTERFACE

SHEET 10 OF 10

REV. NO. 710-009-312

REV. A2

1
2
3
4
5
6
7
8