Gentner

GENTNER BROADCAST SYSTEMS

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Digital
Hybrid II

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1.1 Introduction

This manual will provide all the information you need
to properly use and maintain the Digital Hybrid II.
Read this manual thoroughly before attempting to use
your Digital Hybrid II.

This manual includes information pertaining to both
Broadcast and **Audio Conferencing** users.

Appendix A of this manual, "Telephone Basics", is a
valuable primer on standard telephone systems and
provides a good review for those persons already
familiar with telephone interfacing requirements.

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

<div align="center">

Gentner Electronics Corporation
Customer Support
1825 Research Way
Salt Lake City, Utah   84119
Tel: (801) 975-7200
FAX: (801) 977-0087

</div>

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

	ITEM	GENTNER PART NUMBER
a)	[1] Digital Hybrid II Unit Assembly	850-009-301
b)	[1] Operations Manual	800-009-301
c)	[4] Rack Screws	681-400-001
d)	[6] Rack Cups	684-400-001
e)	[1] Warranty Registration Card	432-600-000
f)	[1] Modular Telephone Cord	830-000-012
g)	[1] DB-25 Connector	671-020-025
h)	[1] Hood for DB-25 Connector	671-000-025
i)	[1] DB-9 Connector	671-020-009
j)	[1] Hood for DB-9 Connector	671-000-009
k)	[1] Molded Power Cord	699-150-006
l)	[1] HOLD Switch Legend	622-003-004

1.2 Overview

The Digital Hybrid II 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 unit works well in both **Broadcast** and **Audio Conferencing** applications.

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

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

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

The Digital Hybrid II 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 rear 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 II.

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 II incorporates a RECORD function which 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.

For Broadcast applications, the CUE Switch 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 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.

For Audio Conferencing applications, the CUE Switch cap is replaced with a cap engraved "HOLD". Pressing the HOLD Switch will mute the Caller audio and select SEND audio from the CUE SEND input. If a music-on-hold or other feed is desirable when the caller is on HOLD, it can be fed to the CUE input on the rear panel of the Digital Hybrid II. Action of the HOLD Switch is alternate. Press it once and the HOLD Switch indicator comes on, indicating the call has been placed on HOLD. Pressing the HOLD Switch a second time removes the call from hold to resume the conversation.

The Gentner Digital Hybrid II provides these benefits:

a) Excellent hybrid performance. Prevents feedback and discoloration of Send audio, and maximizes isolation between the Send and Caller sides of telephone conversations.

b) The Digital Hybrid II adapts automatically and continuously to telephone line conditions and programming content.

c) Carefully designed bandpass filters on both the Send and Caller circuits minimize hum, central office switching noise, and telephone multiplex distortion.

d) 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.

e) All functions, features and controls are contained in an EPROM (Erasable Programmable Read Only Memory) chip, allowing for future updates of the Digital Hybrid II.

f) Two-times oversampling and 16 bit resolution
    combine the excellent audio quality of an
    analog hybrid with the null performance
    offered only by a digital device.

g) Auto-answer, auto-disconnect, and automatic
    muting of Caller audio are standard features.

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

Radio and Television Talk Shows:

The Digital Hybrid II provides the best possible
sound for all types of telephone call-in shows.
It can be used on-air and off-air with equal ease.

The unit's fast response to variable telephone
line conditions and program audio content make it
the ideal choice where clean, consistent audio
quality is required.

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

Audio Conferencing:

The Digital Hybrid II can be used in any Audio or
Video Conferencing installation to provide high
quality audio.

"Cutoffs" and "Gating" are eliminated with the
Gentner Digital Hybrid II. Full-duplex operation
means simultaneous Send and Receive capabilities.

The unit provides maximum intelligibility and
audio quality.

Use it for return audio in Video Conferences, or
for any high quality Audio Conference.

The excellent performance characteristics of the
Digital Hybrid II help eliminate feedback in
conferencing rooms.

1.3 Brief Technical Description

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

Refer to **Figure 1, Figure 2,** and **Figure 3** while reading
the following brief overview of the Digital Hybrid II.

When the ON Switch is pressed, the Digital Hybrid II
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 white 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 II is on line, the null is
constantly optimized to adjust for changing telephone
line and program audio conditions.

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

When the OFF switch is pressed, the Digital Hybrid II
disconnects the telephone line and illuminates the OFF
switch indicator.

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

For Audio Conferencing applications, the CUE Switch cap
should be replaced with a cap engraved "HOLD".

Digital Hybrid II *TELEPHONE SYSTEM*

GENTNER

CALLER INDICATOR:
Red/green LED indicates presence of caller audio. Flashes red 6db before clipping.

SEND INDICATOR:
Red/green LED indicates proper send level. Flashes red 6db before clipping.

ON SWITCH:
Causes unit to answer. Caller audio is muted for 3/4 second after answer to mask pops and clicks.

CUE (HOLD) SWITCH:
Alternately selects main or cue send audio.

OFF SWITCH:
Causes unit to hang-up after caller audio has been muted.

RECORD SWITCH:
In combination with ON switch, operates tape recorder.

SEND   CALLER

REC   CUE   OFF   ON

DIGITAL HYBRID II 'FRONT PANEL FUNCTIONS'

Figure 1

POWER SUPPLY:
100-120/220-240 VAC
operation.

REMOTE CONTROL:
Remote connector includes
remote control and audio
connections.

RECORD/MIX OUTPUT:
Contains both send and
caller audio.
It does not contain
aux send audio.

MAIN INPUT:
Main send line
level input.
When selected, this
audio is sent to
the caller.

TELCO SET:
Connect telephone
set here.

TAPE CONTROL:
Tape connector includes
relay contact connections
to tape recorder.

CALLER OUTPUT:
Contains caller
audio only.

CUE INPUT:
Cue send line level input.
When selected, this audio
is sent to the caller.

TELCO LINE:
Connect telephone
line here.

USE ONLY WITH
250V FUSES

DISCONNECT PANEL
BEFORE REPLACING FUSES

TAPE — CONTROL — REMOTE

CALLER   RECORD/MIX
— OUTPUT —

CUE   MAIN
— INPUT —

LINE — TELCO — SET

MADE IN U.S.A.

DIGITAL HYBRID II 'REAR PANEL SUMMARY'

Figure 2

DIGITAL HYBRID II FUNCTIONAL BLOCK DIAGRAM

Figure 3

1.4 Physical Specifications

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

    Height: 1.75"/4.45 cm
     Width: 19.0"/48.26 cm
     Depth: 12.0"/30.48 cm

    Weight (dry):   10 lbs/4.53 kg
    Shipping weight: 13 lbs/5.9 kg

1.5 Electrical Specifications

     a)   Power Requirements: 100-120/220-240 VAC;
                               50/60 Hz; 15 watts maximum.

     b)   Temperature Range: 0 to +50 degrees
                             Centigrade.

1.6   Telephone Specifications

a)   Line Connection: Modular RJ-11C

b)   External Set: Modular RJ-11C (LINE connected
     to SET when unit is off)

c)   Common Mode Protection: Intentional path to
     ground at >230 volts on tip or
     ring.

d)   Automatic Answer: Answers after one complete
     ring when enabled.

e)   Automatic Disconnect: Disconnects on loop drop
     or loop reversal when enabled.

f)   Hybrid: Standard hybrid transformer coupled
     with Digital Signal Processor (DSP)
     leakage suppression.

g)   Key Service Compatibility: Any key system
     providing true tip and ring
     compatibility to telephone
     instruments.

h)   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.

a)   Send Distortion: < 0.3%   THD, 270 to 2800 Hz

b)   Send SNR: > 60 db

c)   Send Filter: -1 dB points: 270 and 2800 Hz
     -30 dB point: 6300 Hz

Telephone Receive

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

a)   Receive Distortion: < 0.15% THD, 270 to 3300 Hz

b)   Receive SNR: > 60 dB

c)   Receive Filter: -1 dB points: 270 and 3300 Hz
     -30 dB points: 100 Hz and 6300 Hz

1.7 Audio Interface

a) MAIN SEND Input: Active balanced, XLR bridging input, +4 dBm nominal. Level is adjustable via front access panel trim-pot.

b) CUE SEND Input: Active balanced, XLR bridging input, +4 dBm nominal. Level is adjustable via front access panel trim-pot.

c) AUXILIARY SEND Input: Unbalanced line level. Fixed unity gain. Pin 9 of Remote Connector. This AUXILIARY SEND audio does NOT appear at the RECORD/MIX output.

d) 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.

e) RECORD/MIX Output: Active balanced, 600 ohm nominal output impedance; 0 dBm nominal fixed output level. Also 600 ohm unbalanced RECORD/MIX output at Remote Connector.

1.8 Digital Hybrid II Rear Panel Connectors

The REMOTE connector is a 25-pin D-type connector located on the rear panel of the Digital Hybrid II. See Section 3.12 for more detailed 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.		

[a] Open Collector Output
[b] Digital Ground
[c] Analog Ground

The TAPE connector is a 9-pin D-type connector located on the rear panel of the Digital Hybrid II.

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.		

Format for the XLR Audio Connectors:

Pin 1	GROUND
Pin 2	Audio –
Pin 3	Audio +

Pin-out of LINE and SET Telephone Connectors:

LINE RJ-11C	SET RJ-11C
1 – To pin 6 of SET	1 – To pin 6 of LINE
2 – A-Lead Closure	2 – A-Lead Closure
3 – Tip	3 – Ring
4 – Ring	4 – Tip
5 – A-Lead Closure	5 – A-Lead Closure
6 – To pin 1 of SET	6 – To pin 1 of LINE

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SECTION TWO -- WARRANTY AND FIRMWARE LICENSE

2.1 Digital Hybrid II Firmware License

The Digital Hybrid II is a microprocessor-based system.
All firmware for the unit was developed by Gentner
Electronics Corporation.

By purchasing the Digital Hybrid II, 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 II.

GENTNER FIRMWARE LICENSE AGREEMENT

Gentner Electronics Corporation, (hereinafter referred
to as Gentner), is the sole owner of the Digital Hybrid
II firmware. The Digital Hybrid II 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 II
unit a non-exclusive license to use the firmware under
the following terms and conditions.

This firmware is:

    a)   For use on only the Digital Hybrid II 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 II
        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 II. You may terminate the license
by returning the Digital Hybrid II 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 II must be returned to Gentner.

This license agreement is granted solely to the original purchaser of the Digital Hybrid II. If the Digital Hybrid II, 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 II must acknowledge in writing acceptance of the terms and conditions of this license. The license shall be deemed terminated if such written acceptance is not presented to Gentner.

2.2 Warranty Agreement

The Gentner Warranty Agreement on the following page is effective as of the date of receipt by the purchaser of the Digital Hybrid II. This warranty shall not be effective unless Gentner is notified in writing by the purchaser of the receipt of the unit and the unit's serial number.

You have been supplied with a Gentner Warranty Registration Card. Use this card to notify Gentner of your purchase of the Digital Hybrid II and the serial number of your unit.

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

GENTNER COMMUNICATIONS CORPORATION
1825 West Research Way
Salt Lake City, Utah 84119
Telephone: (801) 975-7200
Facsimile: (801) 977-0087

2.3 Special Notices

The information contained in this manual is subject to change without notice. Gentner Electronics Corporation makes no warranty of any kind with regard to this material including, but not limited to, the implied warranties of merchantability and fitness for a particular purpose. Gentner Electronics Corporation shall not be liable for errors contained herein or for incidental or consequential damages in connection with the furnishing, performance, or use of this material.

The copyright on this manual is held solely by Gentner Electronics Corporation.

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2.4 Product Line Updates

Gentner Electronics 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 return a completed Warranty Card in order to
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:

       a) The Digital Hybrid II serial number

       b) Your name

       c) The name of your organization

       d) Your address

       e) Date of purchase

       f) The name of the company from whom you
           purchased your Digital Hybrid II.

Mail your Warranty Registration Card to:

<div align="center">

Gentner Electronics Corporation
P.O. Box 27647
Salt Lake City, Utah   84127-0647

</div>

SECTION THREE -- INSTALLATION

3.1 Unpacking Your Digital Hybrid II

Carefully unpack your shipment and check for any
damage. Be sure that all the parts listed in Section
1.1 of this manual are included in your package.

If you notice any damage to the unit, notify your
shipping carrier immediately. Be sure to retain the
original boxes and packing material for inspection by
the carrier. Gentner is not responsible for shipping
damage. You must make damage claims directly with the
carrier.

3.2 Mounting Your Digital Hybrid II

If desired, you can mount the Digital Hybrid II into a standard 19" equipment rack.

The Digital Hybrid II does not require an internal cooling fan. As long as the unit receives adequate ventilation, it will operate normally.

Gentner recommends an operating environment between 0 and +50 degrees Centigrade.

Be careful not to block any of the ventilation holes in the unit's chassis. Always be sure that a free flow of air gets to the unit while it is operating.

You can also mount the Digital Hybrid II into a road case, making it easy to transport and protect from the elements and other environmental hazards.

If you install your Digital Hybrid II into a road case, you should ensure that your Digital Hybrid II receives adequate ventilation.

3.3 Setting Up the AC Power Input

CAUTION: Always be sure that the Digital Hybrid II is configured for the correct power source prior to operation.

Your Digital Hybrid II was shipped to you ready to use with a 100-120 VAC 50/60 Hz power source (unless otherwise marked.) You can easily alter the AC power input to accept 220-240 VAC power input.

To change the operating voltage for the Digital Hybrid II, please refer to **Figure 4** while reading the instructions below:

a) DISCONNECT THE UNIT FROM AC POWER. Unplug the electrical power cable from the rear panel.

b) Use a small screwdriver to remove the black access cover from the rear-panel fuse/power assembly.

c) Use long-nosed pliers to pull on the nylon tab located near the right side of the assembly and remove the small square jumper board.

d) Reposition the jumper board so the imprinted voltage designation faces away from the nylon tab.

e) Re-insert the jumper board oriented so that the desired voltage imprint is away from you and the nylon tab is toward you.

f) Replace the fuse with the proper value as indicated below:

For 100-120 VAC, the fuse should be 1/4 amp Slo-Blo. For 220-240 VAC, the fuse should be 1/8 amp Slo-Blo.

g) Replace the black access cover.

h) The tip of the nylon tab should indicate the selected voltage as inscribed on the black access cover.

j) Replace the power cable and proceed with installation.
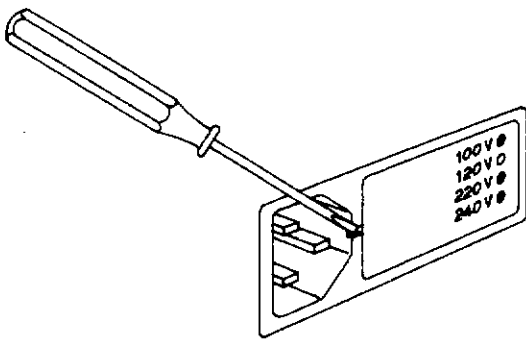
REMOVE COVER PANEL USING SMALL SCREW DRIVER OR SIMILAR TOOL.
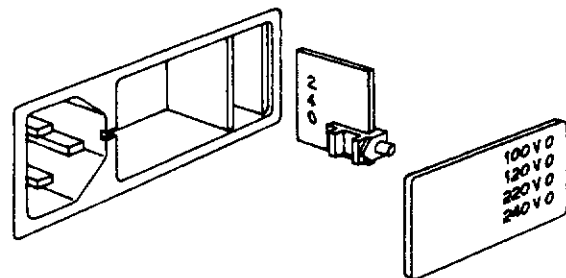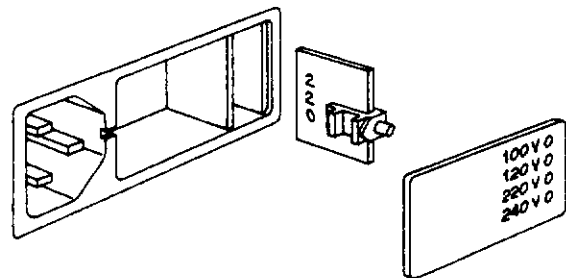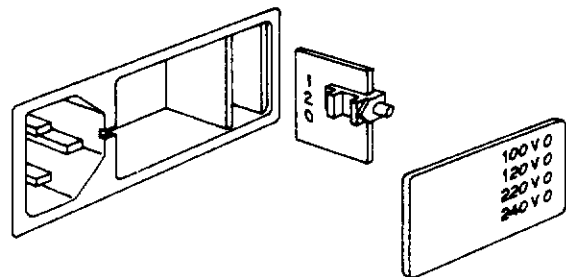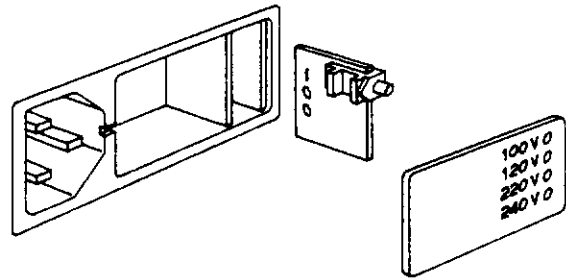
PULL VOLTAGE SELECTION CARD FROM ITS HOUSING AND ROTATE AS SHOWN TO PLACE PLASTIC INDICATOR TAB IN THE REQUIRED POSITION FOR THE DESIRED VOLTAGE.
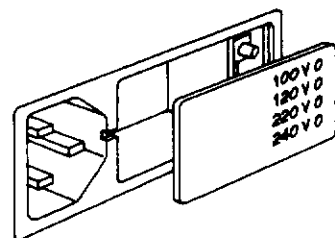
PUSH VOLTAGE SELECTION CARD BACK INTO ITS HOUSING AND REPLACE COVER PANEL.

SETTING UP THE AC POWER INPUT

Figure 4

3.4 Connecting the Digital Hybrid II Directly to a Single Central Office Telephone Line

Connect the incoming telephone line to the Digital Hybrid II's LINE jack with the appropriate modular telephone cable. Refer to **Figure 5** for details.

An optional telephone instrument can be connected to the SET jack. Telephone calls can be placed and received normally with the telephone instrument when the Digital Hybrid II is in the OFF condition.

PHONE
COMPANY
JACK

MODULAR
CABLE

MODULAR
CABLE

SINGLE LINE
TELEPHONE

SET JACK

LINE JACK
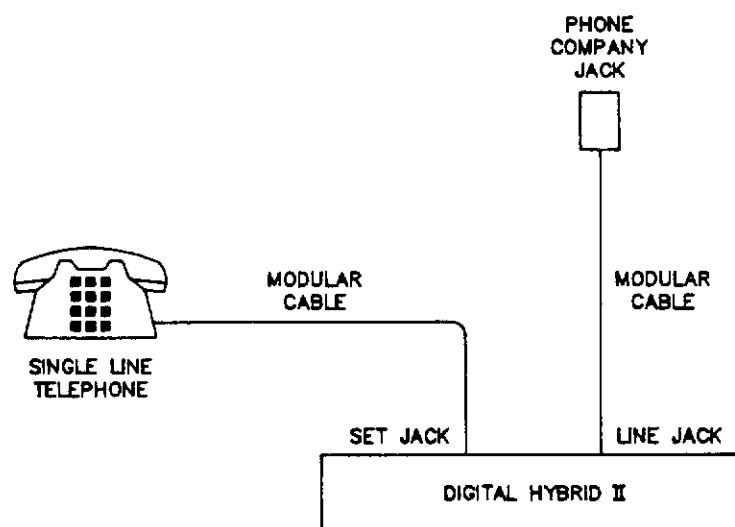
DIGITAL HYBRID II

CONNECTION TO A SINGLE CENTRAL OFFICE TELEPHONE LINE

Figure 5

3.5 Connecting the Digital Hybrid II to a 1A2 Key
Service Unit

The Digital Hybrid II may be used in conjunction with
an existing 1A2 key service unit in one of three ways:

a) Using an existing multi-line telephone set as
a call director. See Section 3.6 for a
detailed discussion.

b) Using an existing Gentner Telemix IX as a call
director. See Section 3.7 for detailed
information.

c) Using a Gentner Telemix X as a call director.
See Section 3.8 for detailed information.

Detailed instructions for using the Digital Hybrid II
in each of these ways are given in the sections
indicated. Please take the time to carefully study
them.

3.6 Using the Digital Hybrid II with an Existing Multi-Line Telephone Set

Refer to **Figure 6** while reading the following information.

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

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.

Sever this connection, as shown in **Figure 6**.

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.

This modular cable can now be connected to the LINE jack on the Digital Hybrid II.

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 6**.

The yellow and black conductors of this cable should be left unconnected.

This second cable should be connected to the SET jack on the Digital Hybrid II.

This installation will allow the multi-line instrument to operate normally when the Digital Hybrid II is OFF line.

When the Digital Hybrid II 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.

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.

MODULAR CABLE
TO SET JACK

MODULAR CABLE
TO LINE JACK

BLACK
N.C.

YELLOW
N.C.

RED

GREEN

YELLOW

BLACK

LINE BUTTONS

HOOK
SWITCH

RING

TIP

GREEN

RED

CUT

CUT

ELECTRONICS
NETWORK

TO
HANDSET

1A2 MULTI-LINE TELEPHONE
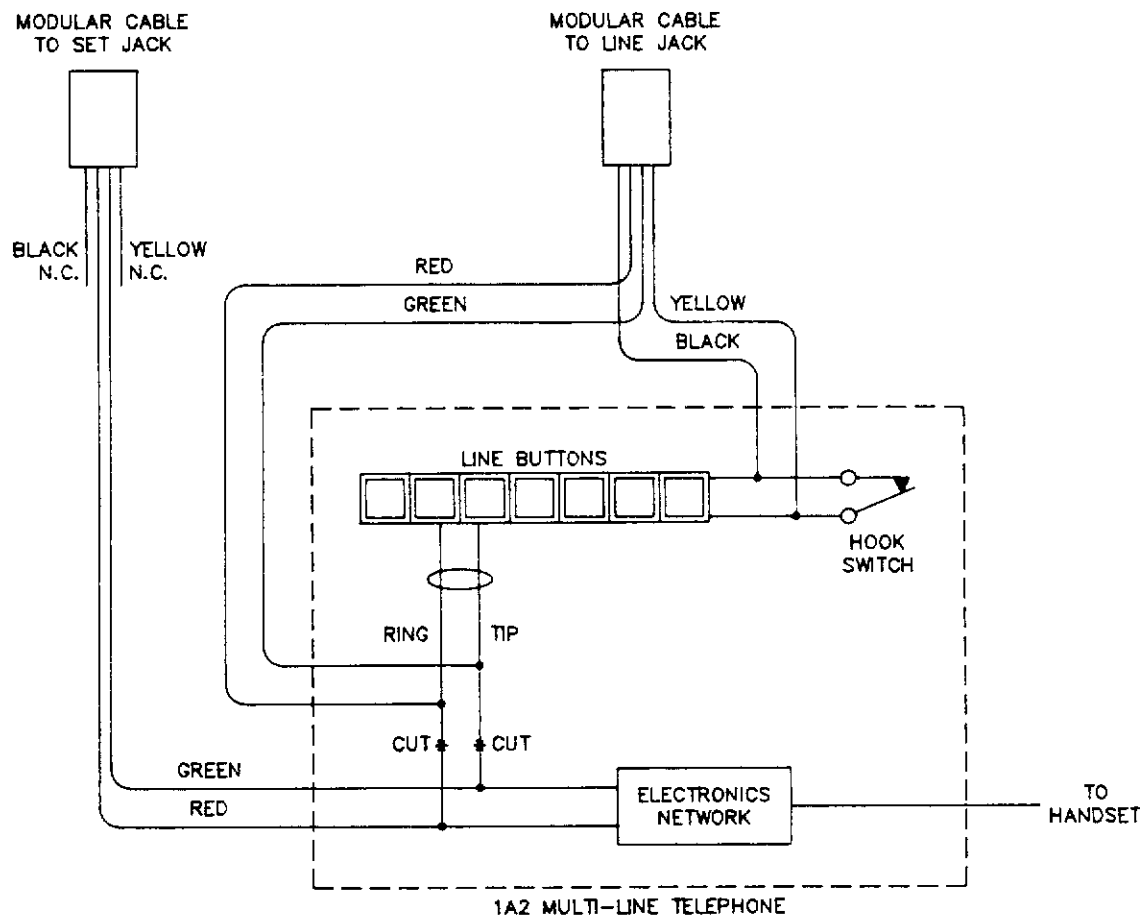
CONNECTION TO A MULTI-LINE TELEPHONE SET

Figure 6

Additional help may be obtained by contacting your
telephone interconnect company or Gentner Customer
Support.

3.7   Using a Gentner Telemix IX as a Call Director

A simple method of connecting a Digital Hybrid II to a Telemix IX uses one modular telephone cable.

Strip one end of the cable and connect spade lugs to the red and green wires. Attach these wires to the Telemix IX rear barrier strip as follows:

a)   To use the Digital Hybrid II on the upper bus (lines 1 through 9), connect to barrier strip pins 1 and 2. Or, to replace the lower bus hybrid with the Digital Hybrid II, connect to barrier strip pins 3 and 4.

b)   Plug the other end of the modular cable into the Digital Hybrid II's LINE jack.

> NOTE: Two external hybrids are required to replace the hybrids in the Telemix IX system. Any combination of hybrids may be used. The best audio quality will be achieved through the use of two Digital Hybrid II's.

Open the Telemix IX and locate the Mascon connector on the audio board that routes to the rear panel barrier strip.

Four jumpers are located on the audio board near this connector. These jumpers route Tip and Ring to the internal hybrids. Removal of the plug-in jumpers will disconnect the internal hybrids and allow external control via Digital Hybrid II's.

In the Telemix IX system, conferencing of upper and lower bus callers is accomplished on the audio board. When the internal hybrids are defeated, the system will no longer provide bus conferencing.

This must be done by cross-connecting the external hybrids. Refer to Section 6.2 for instructions on conferencing multiple Digital Hybrid II's.

The next step is setting the DIP switches on the Digital Hybrid II located behind the front access panel.

Set the Digital Hybrid II's front panel Switch 3 (Auto Re-null) to the DOWN position. This setting will cause the Digital Hybrid II to mute and re-null every time a new line is selected.

NOTE: Selection of Auto Re-null (DIP Switch 3) is
not compatible with the Auto Disconnect feature
(DIP Switch 2). Either option may be selected,
but not simultaneously.

Place DIP Switch 4 (ON/OFF Latching) to the DOWN
position. (This makes ON a latching function on the
Digital Hybrid II.)

Solder a jumper between pins #1 and #5 on the 25-pin
female connector supplied with the Digital Hybrid II.

Plug the 25-pin female connector into the Digital
Hybrid II's REMOTE connector. The combination of this
jumper connector and the front panel Switch 4 setting
will force the Digital Hybrid II to be on line at all
times. However, when the Telemix IX switches a
telephone line to the hybrid, the unit will
automatically null and unmute in the normal fashion.

When this configuration is used, a slight 'pop' will be
heard in the audio when a line is placed on hold or
disconnected.

3.7 Using a Gentner Telemix IX as a Call Director

A simple method of connecting a Digital Hybrid II to a Telemix IX uses one modular telephone cable.

Strip one end of the cable and connect spade lugs to the red and green wires. Attach these wires to the Telemix IX rear barrier strip as follows:

a)   To use the Digital Hybrid II on the upper bus (lines 1 through 9), connect to barrier strip pins 1 and 2. Or, to replace the lower bus hybrid with the Digital Hybrid II, connect to barrier strip pins 3 and 4.

b)   Plug the other end of the modular cable into the Digital Hybrid II's LINE jack.

> NOTE: Two external hybrids are required to replace the hybrids in the Telemix IX system. Any combination of hybrids may be used. The best audio quality will be achieved through the use of two Digital Hybrid II's.

Open the Telemix IX and locate the Mascon connector on the audio board that routes to the rear panel barrier strip.

Four jumpers are located on the audio board near this connector. These jumpers route Tip and Ring to the internal hybrids. Removal of the plug-in jumpers will disconnect the internal hybrids and allow external control via Digital Hybrid II's.

In the Telemix IX system, conferencing of upper and lower bus callers is accomplished on the audio board. When the internal hybrids are defeated, the system will no longer provide bus conferencing.

This must be done by cross-connecting the external hybrids. Refer to Section 6.2 for instructions on conferencing multiple Digital Hybrid II's.

The next step is setting the DIP switches on the Digital Hybrid II located behind the front access panel.

Set the Digital Hybrid II's front panel Switch 3 (Auto Re-null) to the DOWN position. This setting will cause the Digital Hybrid II to mute and re-null every time a new line is selected.

3.8 Using a Gentner Telemix X as a Call Director

Connection of the Digital Hybrid II to a Gentner
Telemix X is very easy.

If the Digital Hybrid II's were ordered in conjunction
with Telemix X, all necessary interconnect cables are
provided with the system:

  a) The Universal Call Director cable. Gentner
      Part Number 830-004-001.

  b) The Digital Hybrid II interface cable, Gentner
      Part Number 830-004-008. (One required for
      each Digital Hybrid II to be utilized).

Simply connect the 25-pin connector on the Universal
Call Director cable to its mating connector marked
HYBRID on the rear panel of the Telemix X Call
Director.

Connect the small Molex connector marked HYBRID 1 on
the Universal Call Director cable to the Molex
connector on one end of a Digital Hybrid II Interface
cable.

Plug the 25-pin connector on the opposite end of the
interface cable onto the REMOTE connector of the
Digital Hybrid II.

Connect the second hybrid in the same manner, using the
small Molex connector marked HYBRID 2.

  NOTE: If only one Digital Hybrid II is to be used
  with the Telemix X system, the second Molex
  connector on the Universal Interface Cable is
  simply left unconnected, and Dip switch 1 on the
  Telemix X is placed in the DOWN position (One
  Hybrid Enable).

Figure 7 shows the Universal cable assembly interfacing
two Digital Hybrid II's with the single Gentner Telemix
X Call Director system.

In dual Call Director systems, a few more connections
are required to setup the system. **Figure 8** shows the
dual Call Director system using four Digital Hybrid
II's.

The six-pin Molex connectors on the Interface Cable
provide remote control logic connections, and supply
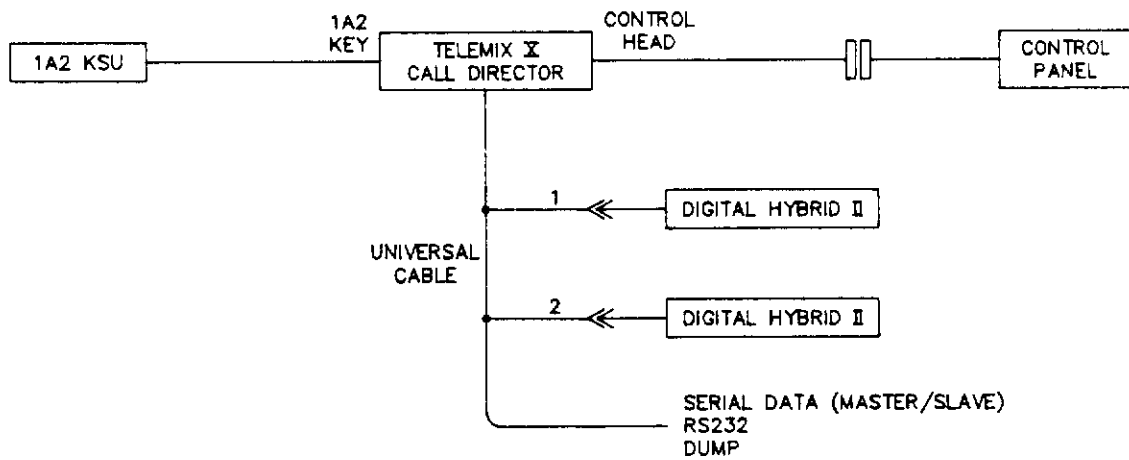
CONNECTION TO A SINGLE TELEMIX $\mathbb{X}$ CALL DIRECTOR

Figure 7
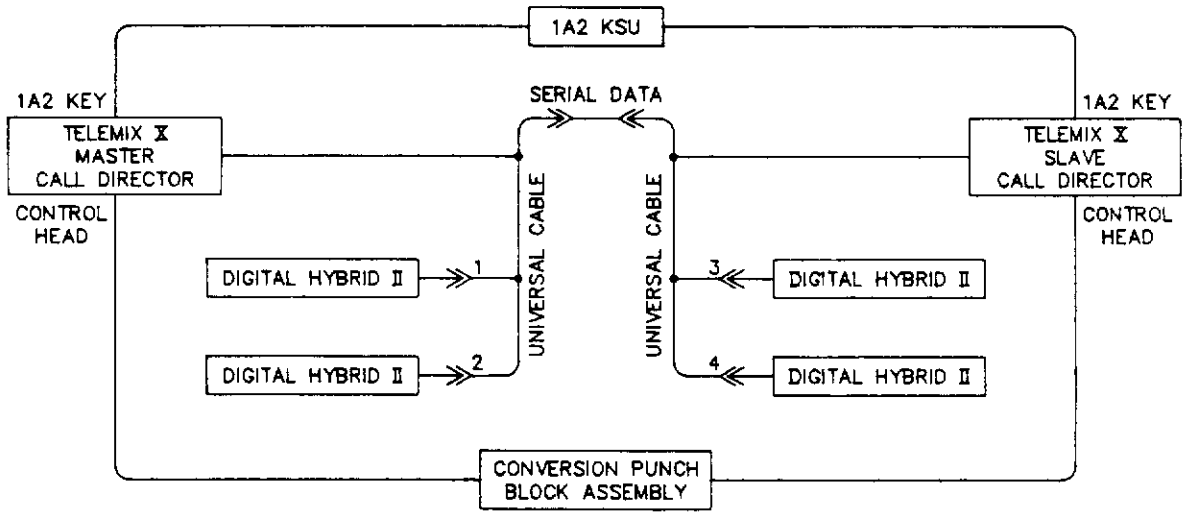
CONNECTION TO A DUAL TELEMIX X CALL DIRECTOR

Figure 8

telephone Tip and Ring to the RJ-11C LINE connector on the rear panel of the Digital Hybrid II.

The Call Director must be able to control the ON, OFF and MUTE functions of the Digital Hybrid II. The following table describes the interconnections between the Telemix X and two Digital Hybrid II's, as provided by the Universal Interface Cable and the Digital Hybrid II interface cable(s):

TELEMIX X (DB-25)	FUNCTION	FIRST DIGITAL HYBRID II INTERFACE CABLE (Molex)	(DB-25)
8	First Digital Hybrid II ON	1	1
9	First Digital Hybrid II OFF	2	2
19	Ground	3	5
10	First Digital Hybrid II MUTE	4	7
22	Tip Bus A	5	(To LINE RJ-11C-3)
23	Ring Bus A	6	(To LINE RJ-11C-4)

TELEMIX X (DB-25)	FUNCTION	SECOND DIGITAL HYBRID II INTERFACE CABLE (Molex)	(DB-25)
7	Second Digital Hybrid II ON	1	1
12	Second Digital Hybrid II OFF	2	2
19	Ground	3	5
11	Second Digital Hybrid II MUTE	4	7
24	Tip Bus B	5	(To LINE RJ-11C-3)
25	Ring Bus B	6	(To LINE RJ-11C-4)

For additional installation information, please refer to the Gentner Telemix X User's Manual.

3.9 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 II. 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 II.

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 needed to
accomplish the procedure described in Section 3.10.

Asking for a "line that a FAX machine can be connected
to" or "a line that a telephone answering machine can
be connected to" will usually solve any problems in
getting the right connections for a Digital Hybrid II
from an electronic key service system.

3.10 Connecting the Digital Hybrid II to an Electronic Key Service Telephone Set

Refer to **Figure 9** while reading the next few paragraphs.

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

Most digital telephones connect to the key service unit with either a four or six wire modular connection cable.

Unplug this cable from the telephone and carefully remove the set's cover.

Locate the wires coming from the KSU connector. Two of these wires will be the analog pair mentioned in Section 3.9.

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.)

The analog pair can be verified by connecting a pair of high impedance headphones through 10 uF capacitors across the suspected analog pair. With the headphones connected as just described, the telephone instrument can then be connected to the KSU (plug in the cable) and a line selected. If dial tone is heard in the headphones, the analog pair has been located.

Sever this pair between the jack and the electronics of the telephone as indicated in **Figure 9**. 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 10**. For a more detailed discussion, please see Appendix A of this manual.

Please refer again to **Figure 9**. 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 II.

Connect the red and green wires of one of these cables to the analog pair coming from the KSU jack of the telephone set. Connect the yellow and black wires of
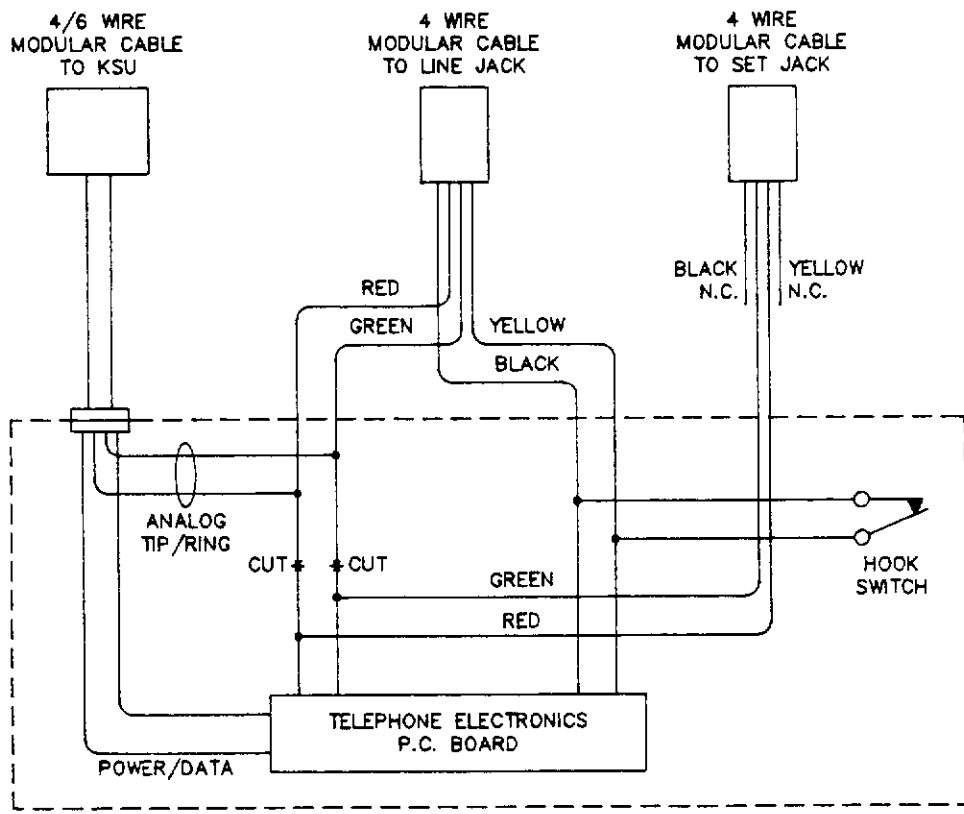
CONNECTION TO DIGITAL TELEPHONES

Figure 9
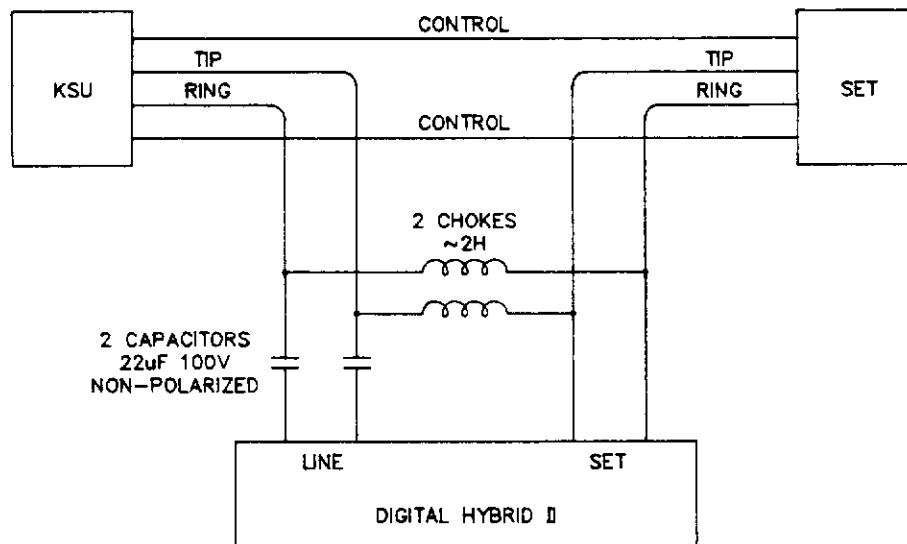
INSTALLATION IN A DIGITAL TELEPHONE SYSTEM
WITH DC ON THE AUDIO PAIR

Figure 10

this cable in parallel with the hook switch contacts of the digital telephone.

This cable connects to the LINE jack on the Digital Hybrid II.

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.) This cable connects to the SET jack of the Digital Hybrid II.

The telephone instrument can now be re-assembled and reconnected to the KSU by plugging its cable back in.

The configuration just described allows the digital telephone set to be used normally when the Digital Hybrid II is OFF line.

When the Digital Hybrid II 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.

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

This jumper bypasses the line sensing circuitry of the Digital Hybrid II 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, follow the instructions below. Refer to **Figure 11** for physical location of the jumper. This jumper is shown on Sheet 1 of 10 of the Schematic Drawings found in Section 9.3 of this manual.

    a)   DISCONNECT THE DIGITAL HYBRID II FROM AC POWER.

    b)   Remove the top cover of the Digital Hybrid II by loosening the four retaining screws and lifting the cover straight up.

    c)   Locate the PREM transformer near the modular telephone jacks on the rear panel of the Digital Hybrid II. See **Figure 11**.

REAR PANEL

PREM

JP1

DC
BYPASS

JP2

DC BYPASS JUMPER

FRONT PANEL
TOP VIEW WITH COVER REMOVED
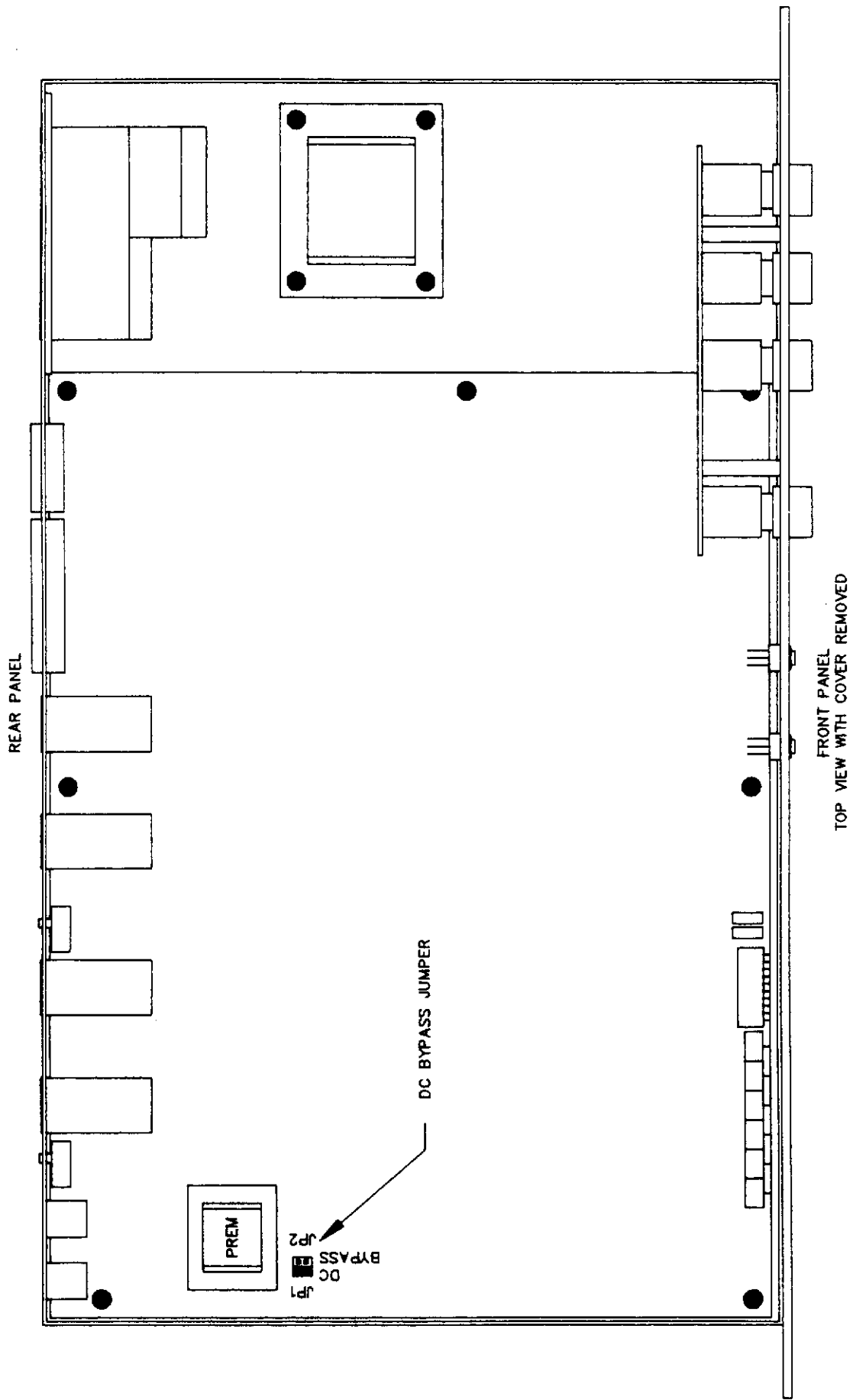
DC BYPASS JUMPER LOCATION

Figure 11

d) Locate the jumper posts labeled BYPASS DC on the circuit board near the PREM transformer.

e) For normal telephone lines that have DC bias, the jumper must be in the JP1 position (DC). The Digital Hybrid II is shipped from the factory with the jumper in the JP1 position.

f) 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.

Other methods of interfacing to multi-line telephones are available. Gentner Electronics Corporation continues to gain experience in interfacing our line of telephone products to an ever-expanding list of digital telephone systems. Contact your telephone system manufacturer or Gentner Customer Support if you need further assistance.

3.11 Connecting the Digital Hybrid II to Audio Equipment

The basic function of the Digital Hybrid II is to separate audio being sent to the caller (SEND audio) from audio being received from the caller (CALLER audio). Please refer to **Figure 12**.

The primary audio connections for the Digital Hybrid II are made via XLR connectors and include MAIN SEND input, CUE SEND input, CALLER audio output and RECORD/MIX audio output. Please refer to **Figure 13**.

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 (HOLD) 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 II, the audio going down the line must not contain any CALLER audio. There are several ways to accomplish this:

a) 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 II, EXCEPT the channel that will be connected to Caller audio.

b) 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.

c) "Build Your Own" mix-minus by summing all audio sources to be sent to the caller.

```
                          TELEPHONE
                            LINE
                              |
                              |
                    ┌─────────────────────┐
                    │        HYBRID        │
                    └─────────────────────┘

         ↓                                        ⋁

      CALLER                                    SEND
      AUDIO                                    AUDIO
```
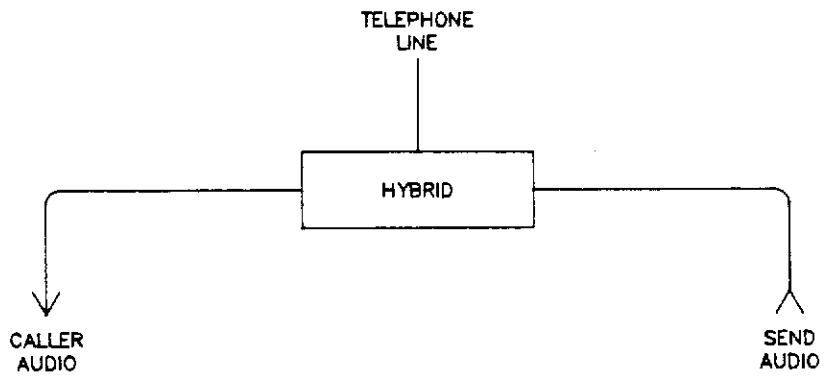
FUNCTION OF A TELEPHONE HYBRID

Figure 12

TELEPHONE
LINE

DIGITAL SIGNAL
PROCESSOR

CUE
(HOLD)

UNBALANCED
CALLER OUT

BALANCED
CALLER OUT

UNBALANCED
MIX OUT

BALANCED
MIX OUT

BALANCED
CUE SEND

BALANCED
MAIN SEND

UNBALANCED
AUX SEND
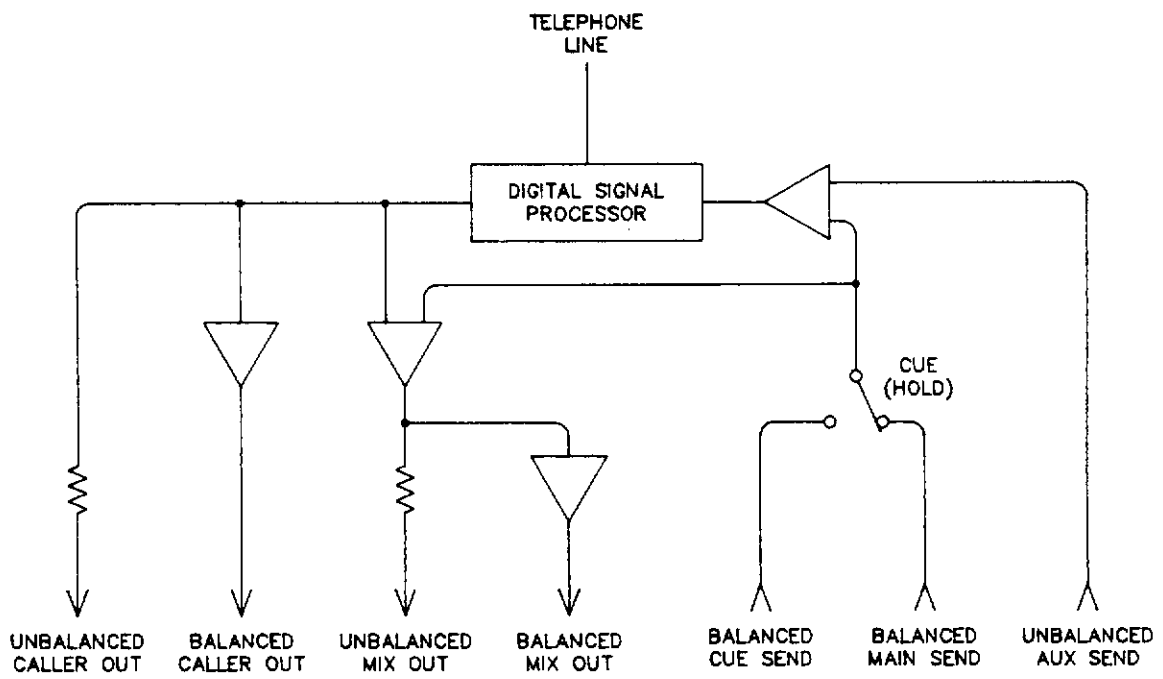
DIGITAL HYBRID II AUDIO CONNECTIONS

Figure 13

d) 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 II as well as the input of the console.

e) 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.

3.12   The REMOTE Connector

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

1	-	Remote On
2	-	Remote Off
3	-	Remote Record
4	-	Remote Cue (Hold)
5	-	Switch Common [b]
6	-	Send Mute (Privacy)
7	-	Caller (Receive) Mute
8	-	Remote Cue (Console)
9	-	Unbalanced AUX Send
10	-	Unbalanced Caller
11	-	Unbalanced REC/MIX
12	-	Aux Relay N.O.
13	-	Aux Relay N.C.

14	-	ON Indicator [a]
15	-	OFF Indicator [a]
16	-	RECORD Indicator [a]
17	-	CUE Indicator [a]
18	-	Indicator Common [b]
19	-	Send Presence Indicator [a]
20	-	Caller Presence Indicator [a]
21	-	Indicator Common [b]
22	-	AUX Send Audio Common [c]
23	-	Caller Audio Common [c]
24	-	REC/MIX Audio Common [c]
25	-	Aux Relay Common

[a] Open Collector Output
[b] Digital Ground
[c] Analog Ground

When looking at the REMOTE connector on the rear panel of the Digital Hybrid II, Pins #1 through #13 appear left to right on the top row of pins. Pins #14 through #25 appear left to right on the bottom row of pins. See **Figure 14**.

A brief discussion of the functions of the pins on the 25-DB REMOTE connector follows:

> Pin #1   Remote On
> Pin #5   Switch Common

> These connections are used to remotely turn the Digital Hybrid II on. The switching action can be either momentary or latching, as selected by front panel DIP Switch 4. The Digital Hybrid II 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 II.

>> NOTE: If you choose to use the remote ON/OFF switching in the latching mode, the Digital Hybrid II front panel ON/OFF switches will not function normally.
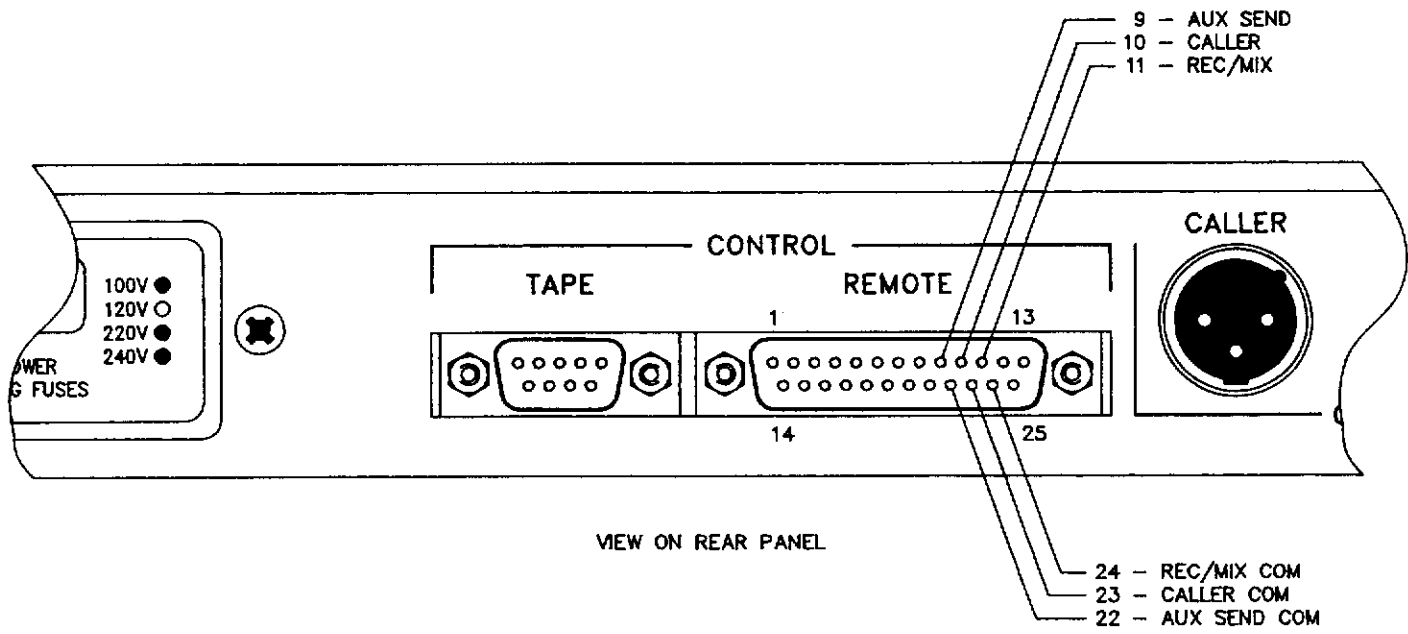
9 — AUX SEND
10 — CALLER
11 — REC/MIX

CONTROL

TAPE   REMOTE

1   13

14   25

CALLER

VIEW ON REAR PANEL

24 — REC/MIX COM
23 — CALLER COM
22 — AUX SEND COM

100V ●
120V ○
220V ●
240V ●

)WER
G FUSES

NOTE; AUDIO CONNECTIONS ON REMOTE
CONNECTOR ARE UNBALANCED.

REMOTE CONNECTOR AUDIO PIN OUTS

Figure 14

<u>Pin #2   Remote Off</u>
<u>Pin #5   Switch Common</u>

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

<u>Pin #3   Remote Record</u>
<u>Pin #5   Switch Common</u>

A momentary closure between these pins toggles
alternately between the Normal and Record modes of
operation. See Section 4.6 of this manual for a
discussion of the Record function.

<u>Pin #4   Remote CUE   (Remote HOLD)</u>
<u>Pin #5   Switch Common</u>

A momentary closure between these pins toggles
alternately between CUE (Indicator illuminated)
and normal operation. For **Audio Conferencing**
applications, placing DIP Switch 8 in the DOWN
position causes this closure to alternately select
HOLD or normal. See Section 4.6 for detailed
discussion of the CUE and HOLD features.

> NOTE: This remote CUE connection functions
> exactly like the front-panel CUE (HOLD)
> switch, whereas the remote CUE (Console)
> connection provided at Pin #8 functions
> differently, requiring latching closure to
> enable the CUE function. See Section 4.6 for
> detailed explanation of the CUE (HOLD)
> function.

<u>Pin #5   Switch Common</u>

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 II'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.

Pin #7   Receive Mute
Pin #5   Switch Common

A latching closure between these pins will cause
the Digital Hybrid II's 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
overridden by action of the front-panel CUE switch
or Pin #4.   See Sections 4.6 and 4.7 for more
information.

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 II's.

> NOTE: Do not connect the minus (-) audio
> signal from an actively balanced source to
> Pin #22, as this would place a direct short
> circuit across the minus half of the source
> amplifier.   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 use 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

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 II 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 #18 and must not
exceed 40 VDC. Also, the total current into each
of these pins must not exceed 100 milliamps.

Pin #18   Indicator Common

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

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

These pins are used to provide remote indication
of the front panel Send Presence and Caller
Presence LED's. 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 not exceed 40 VDC. Also, the

total current into each of these pins must not
exceed 100 milliamps.

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 LED's. See comments for Pins
#19 and #20 above.

Additional information on remote control functions is
given in Section 4.7 of this manual.

3.13   The TAPE Connector

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

The following is a pin-out of remote control functions that appear on the TAPE connector:

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.

When looking at the TAPE control connector on the rear panel of the Digital Hybrid II, Pins #1 through #5 appear left to right on the top row of pins. Pins #6 through #9 appear left to right on the bottom row of pins. See **Figure 15**.

A brief discussion of each pin on this connector 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. See Section 4.6 for a functional description of the RECORD feature.

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 with this DIP switch is in the DOWN position. See Section 4.6 for a functional description of the RECORD feature.
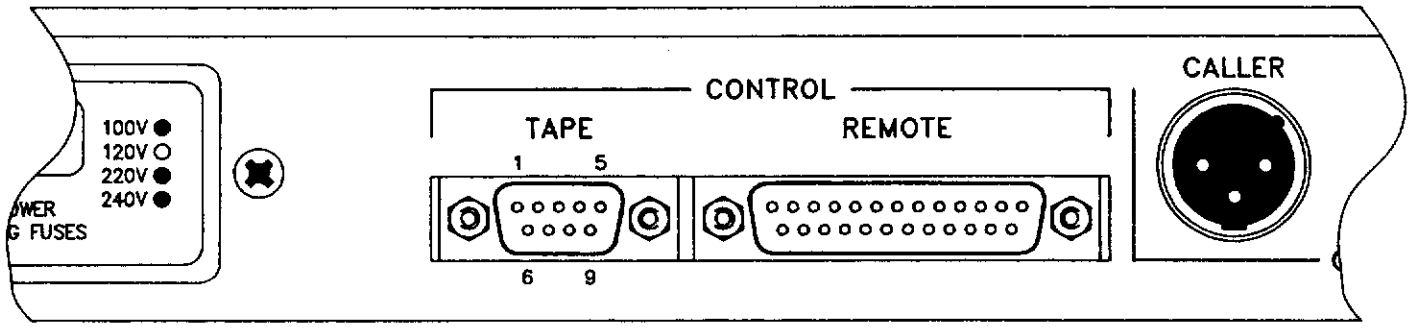
VIEW ON REAR PANEL

DB-9 TAPE CONTROL CONNECTOR PIN LOCATIONS

Figure 15

<u>Pin #5 N.O. Record Enable</u>
<u>Pin #9 Record Enable Common</u>

These connections provide dry contact closure 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 in the DOWN position. See Section 4.6 for
a functional description of the RECORD feature.

3.14 The XLR Audio Connectors

All of the XLR Audio Connectors used on the Digital
Hybrid II follow this pin-out arrangement:

         Pin 1   =   GROUND
         Pin 2   =   Audio -
         Pin 3   =   Audio +

CALLER: This is a 600 ohm active balanced output
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.

RECORD/MIX: 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).

CUE INPUT: This is a +4 dBm, balanced, bridging, CUE
send input to the Digital Hybrid II. 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 caller at the RECORD/MIX
output. See Section 4.6 for a description of the CUE
feature.

MAIN INPUT: This is a +4 dBm, balanced, bridging, MAIN
send input to the Digital Hybrid II. 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 caller at RECORD/MIX output.
See Section 4.6 for a description of the CUE feature.

3.15   The LINE and SET Telephone Connectors

LINE Connector: This modular RJ-11C connector allows direct connection to the telephone line or an associated call director.

Pin designations are, right to left (as viewed from the rear of the Digital Hybrid II):

            1 - To pin 6 of SET RJ-11C
            2 - A-Lead Closure
            3 - Tip
            4 - Ring
            5 - A-Lead Closure
            6 - To pin 1 of SET RJ-11C

SET Connector: This modular RJ-11C connector provides connection for a single line telephone instrument.

When the Digital Hybrid II is in the OFF mode, the telephone line (connected to the LINE RJ-11C connector) is routed to this jack. When the hybrid is in the ON mode, this jack is disabled.

Pin designations are, right to left (as viewed from the rear of the Digital Hybrid II):

            1 - To pin 6 of LINE RJ-11C
            2 - A-Lead Closure
            3 - Ring
            4 - Tip
            5 - A-Lead Closure
            6 - To pin 1 of LINE RJ-11C

4.1 Overview

After the Digital Hybrid II has been installed, the controls behind the removable front panel must be adjusted.

These controls consist of:

    a)   Four audio control trim-pots
    b)   Two coarse (Analog) null adjustments
    c)   Ten option switches

These controls are illustrated in **Figure 16**.

The functions of these controls are conveniently summarized by the reference label attached to the reverse side of the removable front panel.

DIP SWITCH FUNCTIONS ARE
ENABLED IN THE DOWN POSITION

TAPE START LATCHING 5
ON/OFF LATCHING 4
AUTO RENULL 3
AUTO DISCONNECT 2
AUTO ANSWER 1

6 TAPE STOP LATCHING
7 TEST TONE
8 DIGITAL NULLING
9 CUE
10 NORMAL

SEND
LEVEL

MAIN   CUE

CALLER
LEVEL   CTRL

NULL
TRIM   CAP

TEST
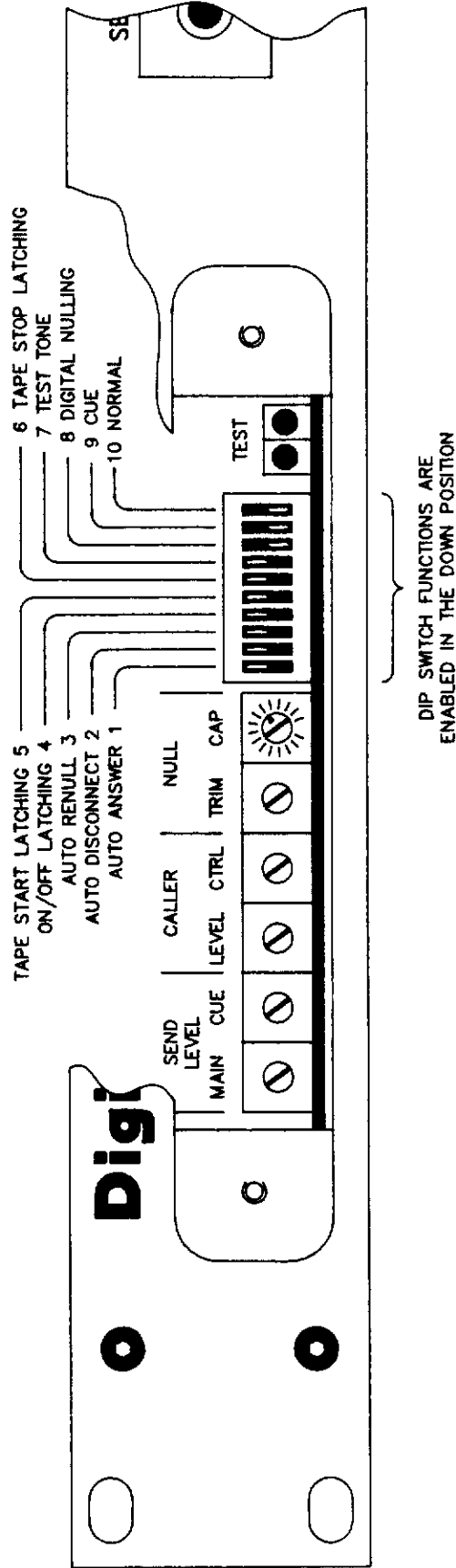
DIGITAL HYBRID II FRONT ACCESS PANEL DETAILS

Figure 16

4.2 Analog Null Setup Procedure

The exceptional performance of the Digital Hybrid II begins with analog hybrid separation of Send and Caller (receive) audio.

The Digital Hybrid II relies on a standard analog hybrid to provide a coarse null. It then uses digital signal processing to fine tune the null.

Therefore it is important to optimize the coarse analog null to enable the digital processing to maximize the fine nulling.

Adjustment of the analog null is a one-time setup operation.

Refer to **Figure 16** for assistance in locating the null adjustment trim pot, the null cap select switch, and the null test points.

To setup the coarse null for this unit, please follow these steps:

a)   Press the front panel OFF Switch.

b)   Use a telephone instrument connected to the SET jack of the Digital Hybrid II to dial an outside telephone line. This will provide a connection through the telephone company's central office.

   The line must be a quiet line to successfully complete this coarse null procedure. This quiet line can be obtained by simply asking the party you have called to cover the mouthpiece of their telephone.

c)   Connect an AC Voltmeter to the test jacks that are located toward the right inside the front panel access door.

d)   Press the Digital Hybrid II's ON Switch.

   NOTE: If a monitor speaker is being used, turn down the level before proceeding.

e)   Place DIP Switch 7 in the DOWN position. This enables a 625 Hz null test tone.

f)   Place DIP Switch 8 in the UP position. This disables the digital nulling.

g)   Adjust Null Trim Pot for minimum voltage
      across the test jacks.

h)   Adjust the Null Capacitor Switch for minimum
      voltage across the test jacks.

i)   Repeat steps g) and h) to obtain the minimum
      possible voltage across the test jacks.

j)   Place DIP Switch 8 in the DOWN position.
      This will re-enable the digital nulling.

k)   Place DIP Switch 7 in the UP position.
      This will disable the 625 Hz test tone.

l)   Press the Digital Hybrid II's OFF Switch.

This completes the procedure for adjusting the coarse
null of the Digital Hybrid II. This procedure is only
required on initial installation.

4.3 Adjusting the MAIN SEND and CUE SEND Input Levels

To adjust the **MAIN SEND** level, follow the procedure outlined below:

a) Press the front panel OFF Switch.

b) Use a telephone instrument connected to the SET jack of the Digital Hybrid II to dial an outside telephone line. The line must be a quiet line. This quiet line can be obtained by simply asking the party you have called to cover the mouthpiece of their telephone.

c) Press the ON Switch of the Digital Hybrid II.

d) Make certain that the CUE (HOLD) Switch on the front panel is inactive (lamp is off). Press the CUE (HOLD) Switch if necessary.

e) Apply audio program material at a normal operating level to the MAIN INPUT XLR connector on the rear panel of the Digital Hybrid II.

f) Locate the MAIN SEND trimmer potentiometer. It is the left-most trim-pot seen when looking at the front panel. See **Figure 16**.

g) Adjust the MAIN SEND LEVEL trim-pot so that the front panel SEND LED glows green most of the time and flashes red occasionally on peaks. Red indicates a level of 6 dB before input clipping.

h) Press the front panel OFF control.

i) This completes adjustment of the MAIN SEND level.

To adjust the **CUE SEND** level, follow the procedure outlined below:

a) Press the front panel OFF Switch.

b) Use a telephone instrument connected to the SET jack of the Digital Hybrid II to dial an outside telephone line. The line must be a quiet line. This quiet line can be obtained by simply asking the party you have called to cover the mouthpiece of their telephone.

c)   Press the ON Switch of the Digital Hybrid II.

d)   Press the CUE (HOLD) Switch on the Digital
     Hybrid II. Make certain that the CUE (HOLD)
     feature is enabled (front panel CUE (HOLD)
     lamp is on).

e)   Apply audio program material at a normal
     operating level to the CUE INPUT XLR
     connector on the rear panel of the Digital
     Hybrid II.

f)   Locate the CUE SEND trimmer potentiometer.
     It is the second trim-pot from the left as
     viewed from the front panel. See **Figure 16**.

g)   Adjust the CUE SEND level trim-pot so that
     the front panel SEND LED glows green most of
     the time and flashes red occasionally on
     peaks. Red indicates a level of 6 dB before
     input clipping.

h)   Press the front panel OFF control.

i)   This completes the CUE SEND level setup.

Following the procedures just described will allow you
to quickly set up the Digital Hybrid II's MAIN SEND and
CUE SEND audio levels. It may be desirable to vary the
settings from this point, depending on your own
evaluation.

Generally speaking, 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.

Also, sending a minimum audio level has a beneficial
side-effect by causing the caller to speak louder,
thereby improving the signal to noise ratio on the
telephone line.

4.4 Adjusting the CALLER LEVEL and CALLER CONTROL Trimmers

Locate the CALLER LEVEL trimmer potentiometer. It is the third trim-pot from the left as viewed from the front of the Digital Hybrid II.

Make certain that the Digital Hybrid II is OFF, then initiate a telephone call using a telephone connected to the SET jack on the Digital Hybrid II.

Press the Digital Hybrid II's ON Switch.

While the party on the other end of the call is speaking, adjust the CALLER LEVEL trim-pot to provide the proper output level for your audio equipment.

Locate the CALLER CONTROL trimmer potentiometer. It is the fourth trim-pot from the left, as viewed from the front of the Digital Hybrid II.

The CALLER CONTROL feature of the Digital Hybrid II 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.

When the CALLER CONTROL trim-pot is fully counterclockwise, 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 speakerphone and is not recommended for most applications.

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

For most **broadcast applications**, we have found that 8 dB of Caller level reduction (dimming) 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 double-talk situation.

For most **audio conferencing applications**, we have found that 0 dB of Caller reduction provides the most natural interaction between conferencing parties, because this allows full-duplex operation. (Speakerphones can only provide half-duplex operation.) 0 dB of Caller reduction is achieved by turning the CALLER CONTROL fully counterclockwise.

4.5 Setting the DIP Switches

There are ten switches contained in a single DIP
package located behind the removeable front panel of
the Digital Hybrid II. These switches are numbered 1
.through 10, left to right, as viewed from the front of
the unit. Refer to **Figure 16**.

A summary of the functions of the DIP switches is given
in the following table:

SWITCH	FUNCTION
1	Auto Answer
2	Auto Disconnect
3	Auto Re-null
4	ON/OFF Latching
5	Tape Start Latching
6	Tape Stop Latching
7	625 Hz Test Tone
8	Digital Nulling
9	Cue
10	Normal

In all cases, if the DIP switch is in the DOWN
position, the function is enabled.

A summary of the DIP switch functions is also
illustrated on the label attached to the back of the
removeable front panel cover of the Digital Hybrid II.

A discussion of the function of each switch is given
below:

Switch 1: Auto-Answer

With this switch in the DOWN position, the Digital
Hybrid II will automatically answer a telephone after
one complete ring.

After the unit answers, it automatically goes through
the same nulling procedure as if the front panel ON
Switch had been pressed.

To disable the Auto-Answer feature, move this switch to
the UP position.

Switch 2: Auto-Disconnect

If this switch is in the DOWN position, the unit will
automatically disconnect from the telephone line when

telephone line loop current is either removed or
reversed.

To disable this function, move the switch to the UP
position.

Most central offices provide a loop drop or loop
reversal as an indication that the calling party has
hung up. When loop current is dropped, the Digital
Hybrid II immediately mutes Caller audio to prevent the
"pop" of the loop current interruption from reaching
the audio equipment.

Switch 2 (Auto Disconnect) is ignored if Switch 3 (Auto
Re-null) is in the DOWN position. See the explanation
of Switch 3 operation.

Switch 3: Auto Re-null

When this switch is in the DOWN position, the Digital
Hybrid II will automatically go through the nulling and
muting process when telephone loop current is dropped
and then re-established.

When the line is dropped (loop current goes away), the
Digital Hybrid II will mute the Caller (receive) audio.

When the line returns (loop current returns), the unit
will re-null and unmute the Caller audio.

This allows the unit to be used with very simple call
directors such as a multi-line 1A2 telephone
instrument.

The Digital Hybrid II will automatically provide the
muting function necessary for a smooth, pop-free
transition from line to line.

When Switch 3 is in the DOWN position, the operation of
Switch 2 (Auto Disconnect) is disabled.

To disable the Auto Re-null feature, move the switch to
the UP position. This will allow the Auto-disconnect
function of Switch 2 to be enabled.

Switch 4: ON/OFF Latching

When this DIP switch is in the UP position, the Digital
Hybrid II's On/Off functions can be controlled by the
two momentary front panel ON and OFF Switches, or two
remote momentary switches connected to the DB-25 REMOTE
connector on the rear panel of the unit. UP is the

normal position for this DIP switch since it enables
the front panel ON and OFF Switches.

If this switch is in the DOWN position, On/Off
switching can only be controlled by a single remote
latching On/Off Switch. The front panel ON and OFF
Switches do not function normally when this DIP switch
is DOWN.

Refer to Section 3.12 for the REMOTE connector pin-out
information regarding the remote ON and OFF control
functions.

If the user's equipment provides a latching closure
output which will be used to control the Digital Hybrid
II, front panel Switch 4 should be placed in the DOWN
position.

With Switch 4 in the down position, a latching closure
across the REMOTE connector's ON pins (#1 and #5) will
cause the Digital Hybrid II to go through its normal
routine of nulling and then unmuting the Caller audio
output. When the closure is re-opened, the hybrid will
mute and return to the off-line state.

> NOTE: When using the latching ON/OFF switching,
> no remote OFF Switch is to be used. Also, the
> front-panel ON and OFF Switches of the Digital
> Hybrid II will not function normally.

Figure 17 shows two examples of connection for remote
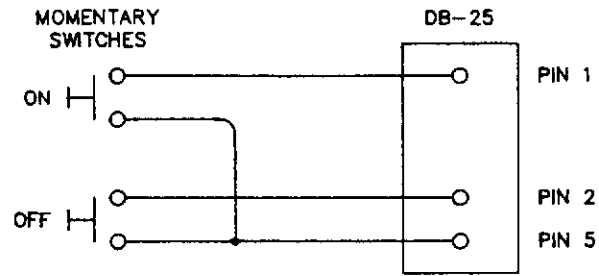ON/OFF control.

Switch 5:   Tape Start Latching

This DIP switch determines the action of the Tape Start
relay which has contacts appearing at Pins #1, #2, and
#6 of the TAPE remote control connector on the rear of
the Digital Hybrid II.

When this DIP switch is in the UP position, the Tape
Start relay uses momentary action. When this switch is
in the DOWN position, the Tape Start relay operates as
a latching relay.

This switch is normally used in the UP position, since
the majority of tape recorders used in professional
applications require a momentary remote start dry
contact closure.

If your application requires a latching remote start
closure, place DIP Switch 5 in the DOWN position.

MOMENTARY
SWITCHES   DB—25

ON   PIN 1

OFF   PIN 2
                                            PIN 5

OR

LATCHING   DB—25
SWITCH *

OFF   ON   PIN 1

                                            PIN 5
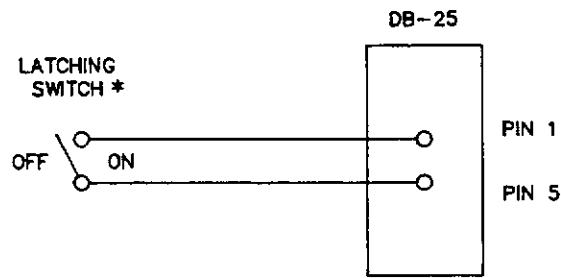
* FRONT PANEL DIP SWITCH
  NO. 4 MUST BE DOWN.

REMOTE ON/OFF CONTROL

Figure 17

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 Section 3.13 for more information on the Tape
Start relay.

> 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.

Switch 6: Tape Stop Latching

This DIP switch 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 rear of
the Digital Hybrid II.

When this DIP switch is in the UP position, the Tape
Stop relay uses momentary action. When this switch is
in the DOWN position, the Tape Start 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. The
normal position of this DIP switch is UP.

Switch 7: 625 Hz Test Tone

With this switch in the DOWN position, the test tone
generator is enabled.

This provides you with a signal source for use in
checking audio and in setting up the Analog Null. (See
Section 4.2.) This DIP switch is normally in the UP
position so that the test tone is disabled.

Switch 8: Digital Nulling

The Digital Hybrid II uses analog nulling techniques to
achieve a coarse null and digital nulling techniques to
fine tune the null.

Placing Switch 8 in the UP position disables the
digital nulling portion of the hybrid to allow the
coarse null setup procedure outlined in Section 4.2 of
this manual to be accomplished. The normal operating
position of this DIP switch is the DOWN position.

Switch 9:   CUE

For **Broadcast applications**, this switch is normally
used in the DOWN position.

For **Audio Conferencing applications**, this switch is
normally used in the UP position.

When the Digital Hybrid II is powered up with DIP
Switch 9 in the DOWN position (**Broadcast Application**),
the following applies:

a)   When the front panel CUE Switch is activated
      (lamp is on), the CUE INPUT is selected as
      the Send audio source for routing to the
      Caller.

      In a broadcast situation, 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".

b)   If the Digital Hybrid II is in the OFF mode,
      and the front panel RECORD Switch 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 on).

      If the unit is then switched to the ON mode,
      the Digital Hybrid II 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.

When the Digital Hybrid II is powered up with DIP
Switch 9 in the UP position (**Audio Conferencing
application**), the following applies:

a)   The front panel CUE/HOLD Switch should have
      the switch cap labeled "HOLD" installed.

b)   When the HOLD Switch is active (lamp is on),
      received Caller audio output is muted and the
      CUE INPUT is selected as the source for the
      Send audio going to the caller.

      If the main audio source is not connected to
      the CUE INPUT, using the HOLD Switch provides
      a convenient way to momentarily discuss
      something privately during an audio

conference without disconnecting the
telephone line.

A discussion of the CUE (HOLD) function is found in
Section 4.6 of this manual.

> NOTE: If the position of DIP Switch 9 is changed,
> the Digital Hybrid II must be powered down, and
> then powered back up before the new position is
> recognized.

<u>Switch 10:   Normal</u>

For Normal operation, the Digital Hybrid II should be
powered up with DIP Switch 10 in the DOWN position.

The UP position selects the Null-Enhancement mode.
When the Digital Hybrid II is powered up with DIP
Switch 10 in the UP position, this enhanced nulling is
enabled. This provides an additional increase in the
separation of Send and Caller audio that may be useful
in certain circumstances.

This 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.

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

4.6 Front Panel Controls and Indicators

In addition to the trim-pots and DIP switches behind
the removable front access panel, the front panel of
the Digital Hybrid II contains the following controls
and indicators from right to left:

        ON Switch, with ON INDICATOR

        OFF Switch, with OFF INDICATOR

        CUE (HOLD) Switch, with CUE (HOLD) INDICATOR

        RECORD Switch, with RECORD INDICATOR

        CALLER LED

        SEND LED

ON Switch: When the ON Switch is pressed, the Digital
        Hybrid II closes its telephone line relay,
        connecting the hybrid circuitry to the telephone
        line. At this time, the ON Switch Indicator will
        glow indicating an on-line status.

        The hybrid mutes Caller audio, waits for the
        telephone loop current to become stable, and then
        applies a 300 millisecond burst of white noise to
        the telephone line. This noise is used by the
        Digital Signal Processor (DSP) to adjust its
        filter coefficients to maximize the hybrid null.

        100 milliseconds after the white noise has been
        removed, the hybrid removes the mute from the
        Caller amplifier, allowing telephone line audio to
        appear at the appropriate output connections on
        the rear panel.

        If the ON Switch is pressed again during the
        course of a call, the filter coefficients are re-
        initialized and the nulling and muting process
        repeats itself without disconnecting the telephone
        line.

        If the RECORD mode was selected prior to
        activating the ON Switch, pressing the ON Switch
        will simultaneously start the tape recorder via
        the Tape Start relay and enable the tape
        recorder's record function via the Record Enable
        relay.

OFF Switch: When the OFF Switch is pressed, the
     Digital Hybrid II disconnects from the telephone
     line and illuminates the OFF Switch Indicator. If
     the RECORD function was enabled, the tape recorder
     will be stopped via the Tape Stop relay.

CUE (HOLD) Switch: For **Broadcast applications** this
     switch is labeled CUE, and front panel DIP Switch
     #9 is in the DOWN position. For **Audio
     Conferencing applications** this switch is labeled
     HOLD, and front panel DIP Switch #9 is in the UP
     position. The discussion here describes operation
     common to both applications. The differences in
     operation are described in Section 4.5 under the
     discussion for DIP Switch #9.

     Pressing the CUE (HOLD) Switch causes the Digital
     Hybrid II to toggle between the MAIN SEND and CUE
     SEND audio inputs.

     When the CUE (HOLD) Switch is active (lamp is on),
     the CUE SEND input is selected as the source for
     Send audio. For **Broadcast applications**, this mode
     allows you to easily make off-the-air recordings
     for playback at a later time. For **Audio
     Conferencing applications**, this mode allows you to
     hold private conversation while the other party is
     listening to music-on-hold.

     When the CUE (HOLD) Switch is not active (lamp is
     off), the SEND audio will be routed from the MAIN
     SEND line level input to the Caller. In **Broadcast
     applications**, this mode would be selected for on-
     the-air live broadcast of telephone conversations.
     In **Audio Conferencing applications**, this is the
     normal conferencing mode.

     When using the Digital Hybrid II in **Broadcast
     applications**, 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 Digital Hybrid
     II Send source status insuring that the proper
     audio will always be sent to the Caller.

RECORD Switch: In **Broadcast applications**, if the
     Digital Hybrid II is OFF and the RECORD Switch is
     pressed, the Digital Hybrid II will automatically
     activate the CUE mode. This function would
     commonly be used for recording conversations for
     playback at a later time.

In **Audio Conferencing applications**, if the Digital Hybrid II is OFF and the RECORD Switch is pressed, the Digital Hybrid II will not alter the state of the HOLD mode.

Please see the discussion of the CUE (HOLD) Switch in this Section.

If the Digital Hybrid II is in the OFF mode, and the RECORD mode is activated (lamp is on), indicating ready to record, pressing the ON Switch will: .

a)   Null the Hybrid.

b)   Connect the Caller to the selected SEND audio source.

c)   Start the tape recorder via the Tape Start relay.

d)   Enable the Record function on the tape recorder via the Record Enable relay.

When the RECORD and ON functions are simultaneously enabled, the RECORD light flashes to indicate that recording is taking place.

With the Digital Hybrid II in the RECORD mode, pressing the ON Switch will start the tape recorder and enable the record function.

If the Digital Hybrid II is already in the ON mode, pressing the RECORD Switch will start the tape recorder and enable the record function.

While operating the Digital Hybrid II in the RECORD mode, pressing either the OFF Switch or the RECORD Switch will stop the tape recorder via the Tape Stop relay

SEND LED: When the Digital Hybrid II is on-line, the SEND LED will glow green when it senses that Send audio is present. The SEND LED will flash red to indicate that the Send level is 6 dB before clipping.

CALLER LED: This LED will glow green when the Digital Hybrid II senses Caller (receive) audio from the telephone line. The CALLER LED will flash red to indicate a level of 6 dB before clipping.

4.7 Remote Control of Digital Hybrid II Functions

Many functions of the Digital Hybrid II can be
controlled and monitored remotely via the rear panel
DB-25 and DB-9 connectors as indicated below:

REMOTE FUNCTIONS

Remote On
Remote Off
Remote Record
Remote Cue (Hold)
Remote Cue (Console)
Send Mute (Privacy Switch)
Caller (Receive) Mute
Aux Relay Dry Contacts
Remote Tape Recorder Start
Remote Tape Recorder Stop
Record Enable

REMOTE INDICATORS

ON Indicator
OFF Indicator
RECORD Indicator
CUE (HOLD) Indicator
Send Presence Indicator (Green)
Caller Presence Indicator (Green)

Sections 3.12 and 3.13 of this manual also contain
installation information regarding remote control
functions.

ON/OFF Switching

The ON and OFF functions of the Digital Hybrid II may
be remoted using separate momentary ON and OFF Switches
or by a single toggle switch.

If momentary switches are used, front panel DIP Switch
4 must be in the UP position; if a toggle switch is
used, front panel DIP Switch 4 must be DOWN.

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

A momentary closure between Pins #1 and #5 on the 25-pin REMOTE connector will turn ON the Digital Hybrid II (if DIP Switch 4 is in the UP position). Section 4.5 of this manual discusses DIP switch settings.

A momentary closure between Pins #2 and #5 on the 25-pin REMOTE connector will turn OFF the Digital Hybrid II (if DIP Switch 4 is in the UP position). Section 4.5 discusses DIP switch settings and **Figure 17** illustrates momentary and latching methods of remote ON/OFF control.

RECORD

The Remote RECORD function is accessed via Pins #3 and #5 on the 25-pin REMOTE connector. A momentary closure between these pins toggles between the Normal and Record modes of operation. Refer to **Figure 18** for an illustration of using this function.

CUE (HOLD)

Connections to remotely control the CUE (HOLD) feature are found on Pins #4 and #5 of the REMOTE connector. A momentary closure between these pins toggles between CUE (HOLD) active and inactive states.

The remote CUE (HOLD) connections (Pins #4 and #5) are for momentary operation identical to the front-panel CUE (HOLD) Switch of the Digital Hybrid II. See **Figure 19** for an application example.
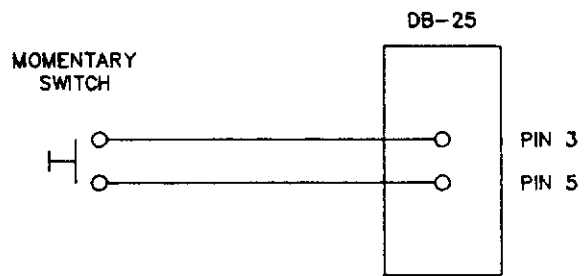

> NOTE: If console logic is to be used to remotely control the CUE feature in **Broadcast applications**, Pins #8 and #5 should be used to control the CUE function because they are setup to accept a latching closure from console logic.

Both types of CUE (HOLD) control may be used simultaneously.

SEND Mute (Privacy Switch)

The Digital Hybrid II's SEND audio (audio going to the Caller) may be remotely muted by providing a closure between Pins #5 and #6 on the REMOTE connector. The muting action is latching, i.e. as long as a closure exists between Pins #5 and #6, SEND audio will be muted. This function does not appear on the front

panel and is valuable for use as a privacy switch when used in **Audio Conferencing applications**. **Figure 20** shows how this function can be remote controlled.
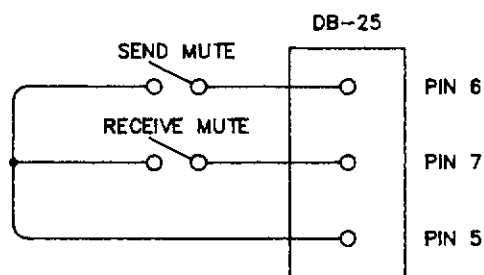
MOMENTARY
SWITCH

DB−25

PIN 3

PIN 5

REMOTE RECORD CONTROL

Figure 18

DB-25

MOMENTARY
SWITCH

PIN 4

PIN 5
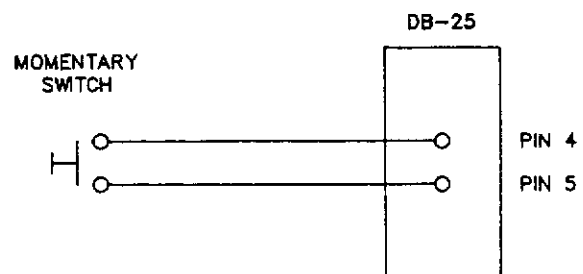
REMOTE CUE (HOLD) CONTROL

Figure 19

DB-25

SEND MUTE

PIN 6

RECEIVE MUTE

PIN 7

PIN 5

REMOTE SEND AND RECEIVE MUTING

Figure 20

CALLER (Receive) Mute

A continuous closure between Pins #5 and #7 on the
REMOTE connector will cause the Digital Hybrid II's
Caller (Receive) audio to be muted. **Figure 20**
indicates how this may be accomplished.

AUXILIARY RELAY CONTACTS

The Digital Hybrid II provides Auxiliary dry relay
contacts that follow the action of the ON/OFF Switching
functions.

The pin-out on the 25-pin REMOTE connector for this
relay is as follows:

            12   Aux Relay N.O.
            13   Aux Relay N.C.
            25   Aux Relay Common

Pin #12 is normally open when the Digital Hybrid II is
in the OFF mode. Refer to **Figure 21**.

TAPE START RELAY

The Digital Hybrid II's unique remote Tape Start
capability of the RECORD feature may be accessed via
connections made to the 9-pin TAPE connector on the
rear panel.

These connections provide dry contact closures for the
Tape Start relay. Action of the relay is momentary
when DIP Switch 5 is in the UP position, and latching
when this DIP switch in the DOWN position. Section 4.5
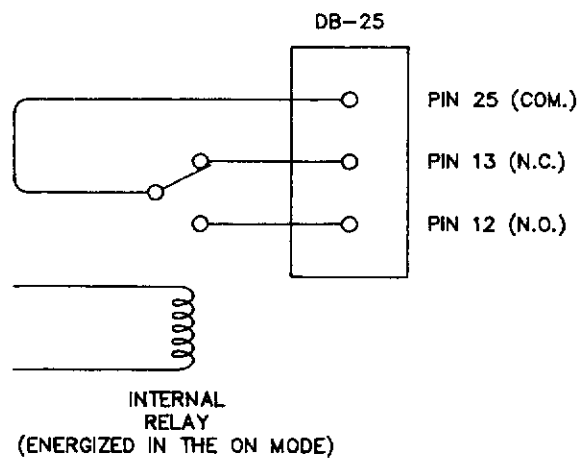discusses DIP switch settings.

The pin-out for the TAPE connector is as follows:

            #1   N.O. Tape Start Relay Contact
            #2   N.C. Tape Start Relay Contact
            #6   Tape Start Common

            #5   N.O. Record Enable (To tape recorder)
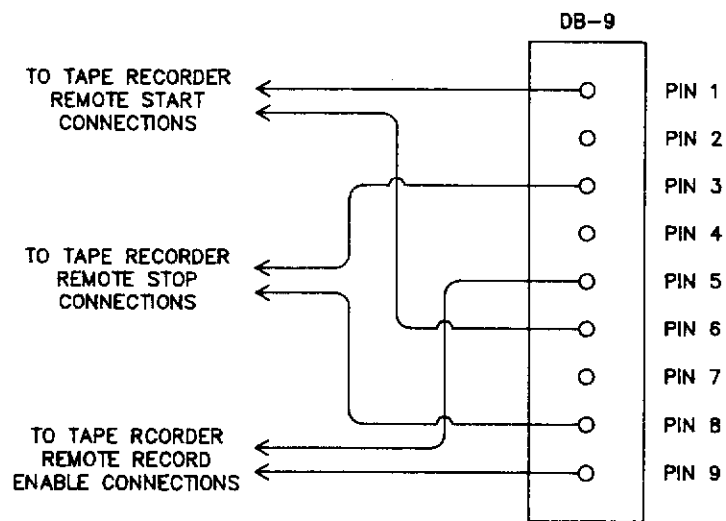   #9   Record Enable Common (To tape recorder)

See Section 4.6 for a description of the RECORD
feature.

Figure 22 illustrates use of these connections.

DB-25

PIN 25 (COM.)

PIN 13 (N.C.)

PIN 12 (N.O.)

INTERNAL
RELAY
(ENERGIZED IN THE ON MODE)

AUXILIARY RELAY PIN-OUT

Figure 21

TO TAPE RECORDER
REMOTE START
CONNECTIONS

TO TAPE RECORDER
REMOTE STOP
CONNECTIONS

TO TAPE RCORDER
REMOTE RECORD
ENABLE CONNECTIONS

DB-9

PIN 1
PIN 2
PIN 3
PIN 4
PIN 5
PIN 6
PIN 7
PIN 8
PIN 9

REMOTE TAPE START/STOP/RECORD CONTROL

Figure 22

TAPE STOP

Connections are provided on the TAPE connector to
access the Tape Stop relay.

The pin-out for the Tape Stop relay is given below:

        #3 N.O. Tape Stop Relay Contact
        #4 N.C. Tape Stop Relay Contact
        #8 Tape Stop Common

Action of this relay is momentary when DIP Switch 6 is
in the UP position, and latching when this DIP switch
is in the DOWN position. Section 4.5 discusses DIP
switch settings.

Please refer to **Figure 22** for an example of using this
relay.

4.8   Remote Indicators

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

Figure 23 shows how incandescent lamps may be used as remote ON, OFF, RECORD, and CUE (HOLD) status indicators by connecting them respectively to Pins #14, #15, #16, and #17.

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 #18 of the Digital Hybrid II 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 24 shows how remote indicators may be used to monitor the Send Presence and Caller Presence status.
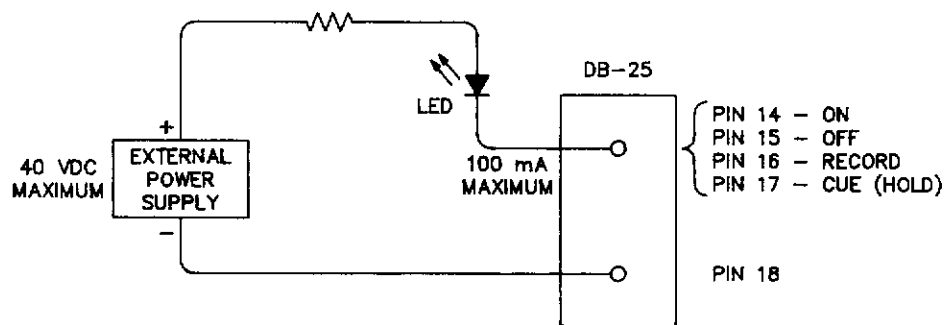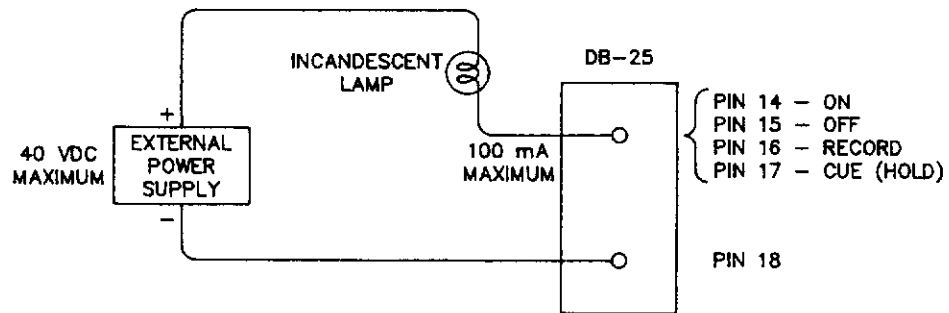
These may be remoted by connecting to Pin #19 for Send Presence and Pin #20 for Caller Presence.

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

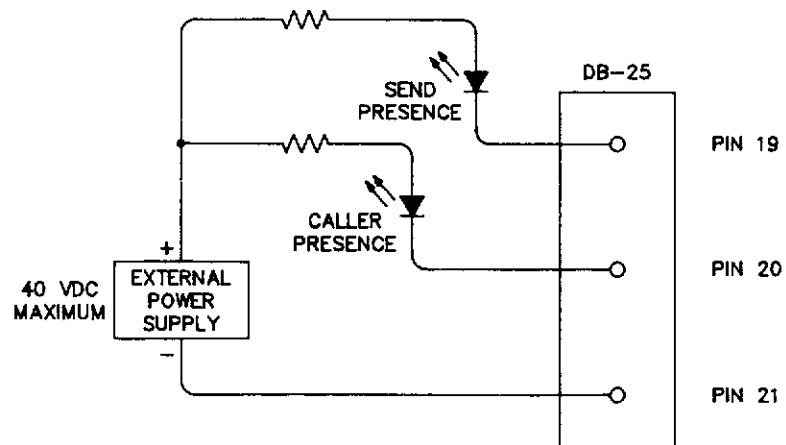An external DC power supply to provide lamp voltage is required.

> CAUTION: Care must be taken to reference the external power supply to the ground provided at Pin #21 of the Digital Hybrid II REMOTE connector.

> Total current into each of Pins #19 and #20 must not exceed 100 mA, and the power supply voltage must not exceed 40 VDC.

Top circuit labels:
- INCANDESCENT LAMP
- DB-25
- 40 VDC MAXIMUM
- EXTERNAL POWER SUPPLY
- 100 mA MAXIMUM
- PIN 14 — ON
- PIN 15 — OFF
- PIN 16 — RECORD
- PIN 17 — CUE (HOLD)
- PIN 18

Bottom circuit labels:
- LED
- DB-25
- 40 VDC MAXIMUM
- EXTERNAL POWER SUPPLY
- 100 mA MAXIMUM
- PIN 14 — ON
- PIN 15 — OFF
- PIN 16 — RECORD
- PIN 17 — CUE (HOLD)
- PIN 18

REMOTE ON/OFF/RECORD/CUE(HOLD) INDICATORS

Figure 23

REMOTE SEND AND CALLER PRESENCE INDICATORS

Figure 24

4.9   Adding External Relays

An external relay can be driven from any one of the
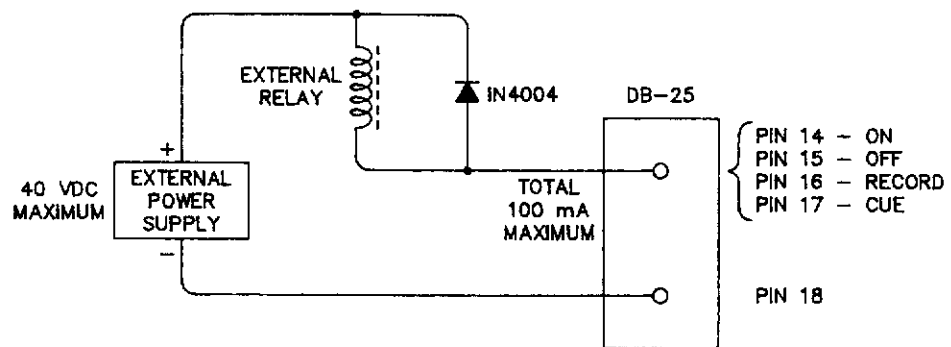following remote indicator outputs:

ON, OFF, RECORD, or CUE (HOLD)

An illustration of relay connection is shown in **Figure
25.**

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 II's REMOTE connector. Total
> current into any one pin must not exceed 100 mA,
> and the power supply voltage must never exceed
> 40 VDC.

More information regarding the 25-pin REMOTE connector
and the 9-pin TAPE connector is contained in Sections
3.12 and 3.13 of this manual.

EXTERNAL
RELAY   ▲ 1N4004   DB-25

                                        ⌠ PIN 14 — ON
                                        ⎪ PIN 15 — OFF
40 VDC   EXTERNAL   TOTAL   ⎨ PIN 16 — RECORD
MAXIMUM   POWER   100 mA   ⎩ PIN 17 — CUE
           SUPPLY   MAXIMUM

                                          PIN 18

ADDING EXTERNAL RELAYS

Figure 25

(This page is intentionally blank.)

5.1 Overview

The Gentner Digital Hybrid II 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.

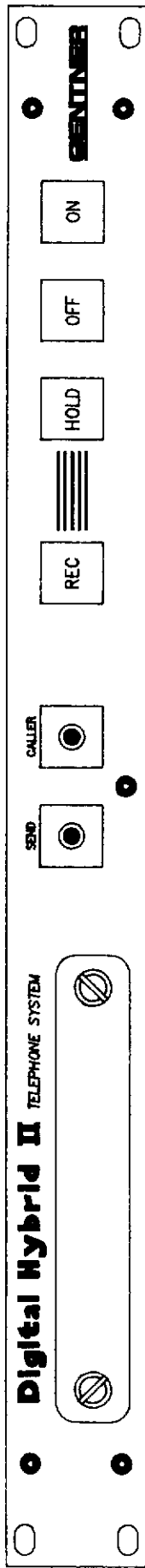Please refer to **Figure 26** to locate the switches mentioned below.

The Digital Hybrid II's HOLD Switch allows you to mute the incoming Caller's audio and either mute or switch Send audio (audio going to the Caller) to another source while you conduct a private conversation.

With the Digital Hybrid II, you can record both sides of a telephone conference simply by pressing the RECORD Switch. A tape recorder is automatically started by the Digital Hybrid II. Pressing the RECORD Switch again, or the OFF Switch on the Digital Hybrid II, stops the recorder.

The Digital Hybrid II can be used with a wide variety of microphone mixers and sound systems. If you have any questions about interfacing the Digital Hybrid II with your sound system, contact:

Gentner Customer Support

(801) 975-7200

DIGITAL HYBRID II 'FRONT PANEL FUNCTIONS'

Figure 26

5.2 Audio Conferencing Installation

Audio Conferencing users will have a slightly different setup of the Digital Hybrid II than **Broadcast** users.

See **Figure 27** for an illustration of a basic Audio Conferencing setup.

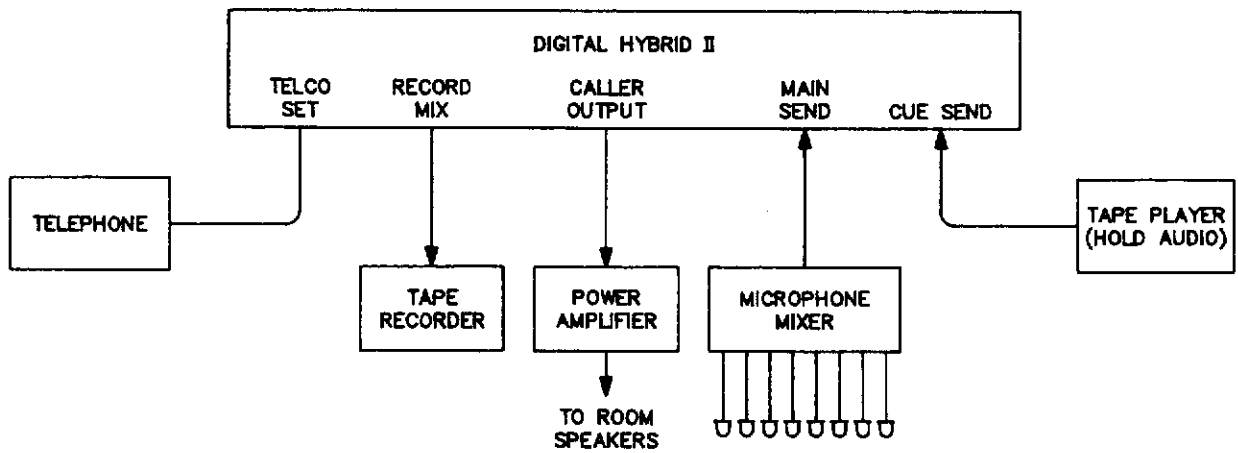To install the unit in a conference room, do the following:

a) Make sure the Digital Hybrid II is configured for the proper AC power input. See **Figure 28**. Section 3.3 of this manual contains additional information.

b) Remove the CUE Switch cap by grasping it with your fingers and pulling it straight out. Remove the clear plastic cover from the cap and replace the CUE legend with the HOLD legend supplied. Replace the clear plastic cover and re-install the switch cap.

c) Mount the unit in a standard 19" equipment rack or in a rack cabinet adjacent to the room's microphone mixer and amplifier system. Be sure the unit receives adequate ventilation.

d) Connect audio equipment to the Digital Hybrid II as indicated:

FROM	TO
Microphone mixer output	MAIN SEND input
"Hold" audio source	CUE SEND input
CALLER output	P.A. input
RECORD/MIX output	Tape recorder

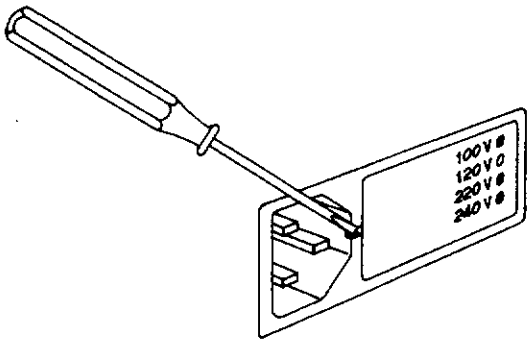**Figure 27** shows a good overview of a complete system.

All audio connections to the Digital Hybrid II should be balanced, 600 ohm, +4 dBm nominal as shown in **Figure 29**.

Additional unbalanced audio connections are found on the Remote connector as indicated in **Figure 30**.

DIGITAL HYBRID II

TELCO SET   RECORD MIX   CALLER OUTPUT   MAIN SEND   CUE SEND

TELEPHONE

TAPE RECORDER
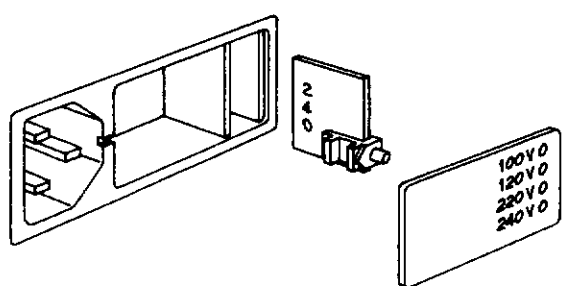
POWER AMPLIFIER

MICROPHONE MIXER

TAPE PLAYER (HOLD AUDIO)
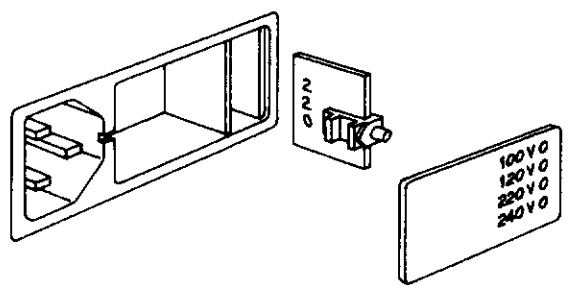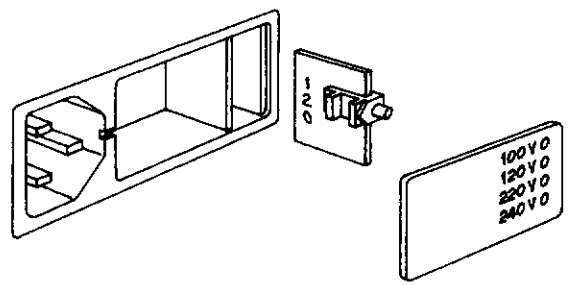
TO ROOM SPEAKERS

BASIC AUDIO CONFERENCING SETUP

Figure 27

REMOVE COVER PANEL USING
SMALL SCREW DRIVER OR
SIMILAR TOOL.
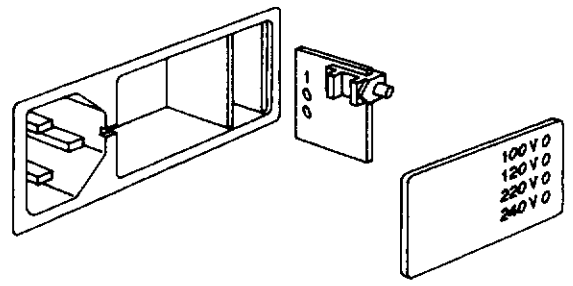
PULL VOLTAGE SELECTION CARD
FROM ITS HOUSING AND ROTATE
AS SHOWN TO PLACE PLASTIC
INDICATOR TAB IN THE REQUIRED
POSITION FOR THE DESIRED
VOLTAGE.

PUSH VOLTAGE SELECTION CARD
BACK INTO ITS HOUSING AND
REPLACE COVER PANEL.

SETTING UP THE AC POWER INPUT

Figure 28

TELEPHONE
LINE

DIGITAL SIGNAL
PROCESSOR

CUE
(HOLD)

UNBALANCED
CALLER OUT
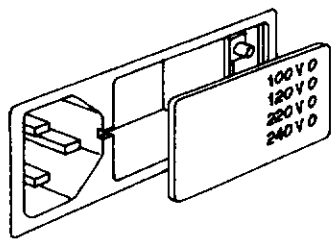
BALANCED
CALLER OUT

UNBALANCED
MIX OUT

BALANCED
MIX OUT

BALANCED
CUE SEND

BALANCED
MAIN SEND

UNBALANCED
AUX SEND
(REMOTE
CONNECTOR)
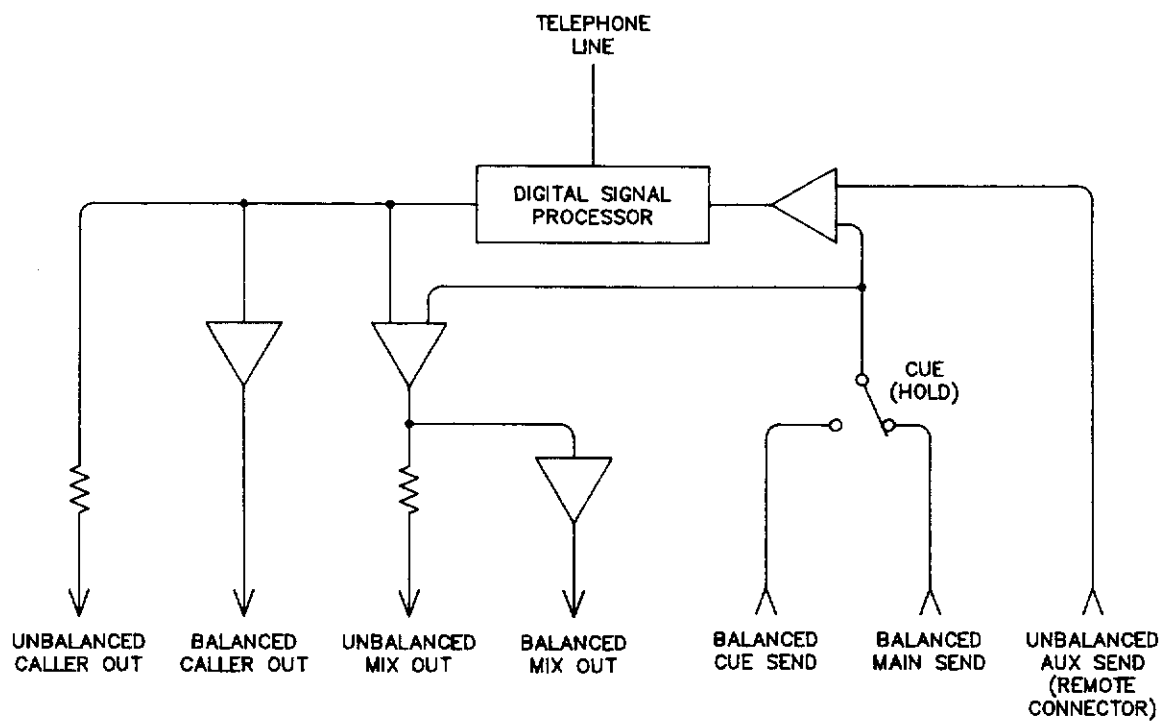
DIGITAL HYBRID II AUDIO CONNECTIONS

Figure 29

VIEW ON REAR PANEL

NOTE; AUDIO CONNECTIONS ON REMOTE
CONNECTOR ARE UNBALANCED.

REMOTE CONNECTOR AUDIO PIN OUTS

Figure 30

e)   Refer to **Figure 31** and connect a telephone
     line cord to the modular RJ-11C connector
     marked "LINE" on the rear of the Digital
     Hybrid II.

f)   Refer to **Figure 31** and connect a telephone set
     to the modular RJ-11C connector marked "SET"
     on the rear of the Digital Hybrid II. This
     set will be used to establish conference
     calls, and to access the telephone line when
     the conference system is not in use.

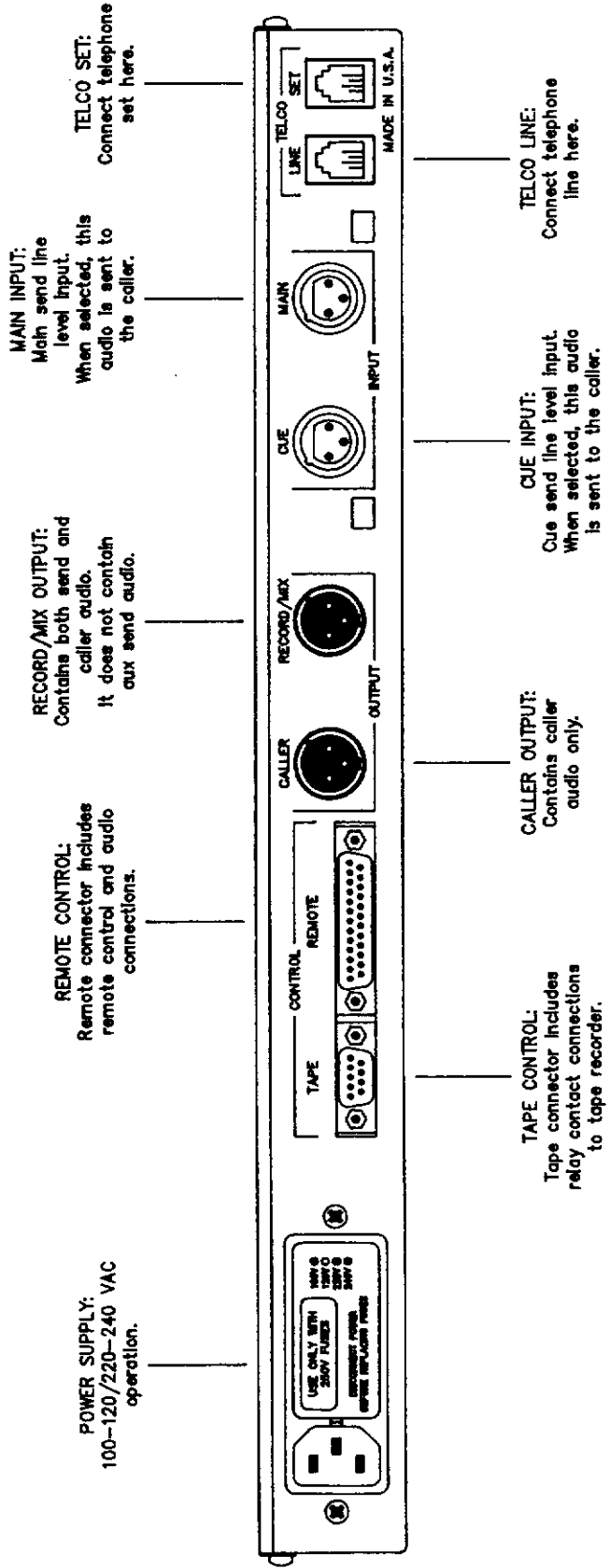g)   Connect the unit to power.

h)   Setup the analog null and audio levels
     following the procedures outlined in Sections
     4.2 and 4.3 of this manual.

i)   If you are planning to operate the Digital
     Hybrid II from an outboard control panel, all
     controls of the unit can be accessed via the
     REMOTE connector on the rear panel. See
     Figure 32. This connector includes contacts
     for installing a "privacy switch". Refer to
     Section 3.12 for more information regarding
     remote connections.

NOTE: When installing the Digital Hybrid II on digital
telephone systems that do not provide "battery" (DC
current flow), it will be necessary to change a jumper
inside the Digital Hybrid II. See Section 3.10 and
Figure 11 for information.

TELCO SET:
Connect telephone
set here.

TELCO LINE:
Connect telephone
line here.

MAIN INPUT:
Main send line
level input.
When selected, this
audio is sent to
the caller.

CUE INPUT:
Cue send line level input.
When selected, this audio
is sent to the caller.

RECORD/MIX OUTPUT:
Contains both send and
caller audio.
It does not contain
aux send audio.

CALLER OUTPUT:
Contains caller
audio only.

REMOTE CONTROL:
Remote connector includes
remote control and audio
connections.

TAPE CONTROL:
Tape connector includes
relay contact connections
to tape recorder.

POWER SUPPLY:
100-120/220-240 VAC
operation.

DIGITAL HYBRID II 'REAR PANEL SUMMARY'

Figure 31

VIEW ON REAR PANEL

THE REMOTE CONNECTOR IS A 25-PIN D-TYPE CONNECTOR LOCATED ON THE REAR PANEL OF THE DIGITAL HYBRID II. SEE SECTION 3.12 FOR MORE SPECIFIC DETAILS.

1 – REMOTE ON
2 – REMOTE OFF
3 – REMOTE RECORD
4 – REMOTE CUE (HOLD)
5 – SWITCH COMMON
6 – SEND MUTE (PRIVACY SWITCH)
7 – CALLER MUTE
8 – REMOTE CUE (CONSOLE)
9 – UNBALANCED AUX SEND
10 – UNBALANCED CALLER
11 – UNBALANCED REC/MIX
12 – AUX RELAY N.O.
13 – AUX RELAY N.C.

14 – ON INDICATOR
15 – OFF INDICATOR
16 – RECORD INDICATOR
17 – CUE INDICATOR
18 – INDICATOR COMMON
19 – SEND PRESENCE INDICATOR
20 – CALLER PRESENCE INDICATOR
21 – INDICATOR COMMON
22 – AUX SEND AUDIO COMMON
23 – CALLER AUDIO COMMON
24 – REC/MIX AUDIO COMMON
25 – AUX RELAY COMMON

THE TAPE CONNECTOR IS A 9-PIN D-TYPE CONNECTOR LOCATED ON THE REAR PANEL OF THE DIGITAL HYBRID II.

1 – N.O. TAPE START
2 – N.C. TAPE START
3 – N.O. TAPE STOP
4 – N.C. TAPE STOP
5 – N.O. RECORD ENABLE

6 – TAPE START COMMON
7 – NOT USED
8 – TAPE STOP COMMON
9 – RECORD ENABLE COMMON

REMOTE AND TAPE CONNECTOR PIN OUTS

Figure 32

5.3   Setting the DIP Switches for Audio Conferencing

There are ten switches contained in a single DIP package located behind the removable front panel of the Digital Hybrid II.

These switches are numbered 1 through 10, left to right, as viewed from the front of the unit.

> NOTE: In all cases, if the DIP switch is in the DOWN position, the function is enabled.

Refer to **Figure 33**, remove the front access panel, and configure the DIP switches as follows:

> Switch #1   Auto Answer - place in the DOWN position if you want the Digital Hybrid II to automatically answer the line after one complete ring.

> Switch #2   Auto Disconnect - place in the DOWN position if you want the Digital Hybrid II to automatically disconnect when the Caller hangs up.

> Switch #3   Auto Re-null - place in the UP position for use in most audio conferencing situations. This switch is used in the DOWN position only if you are installing the Digital Hybrid II for use with a multi-line telephone set. This type of installation is not typically used in audio conferencing situations.

> Switch #4   On/Off Latching - this DIP switch is normally used in the UP position. It should be placed in the DOWN position only if you are wiring a latching remote On/Off switch to the Digital Hybrid II.

> NOTE: If you choose to use the remote On/Off switching in the latching mode, the Digital Hybrid II front panel ON/OFF Switches are disabled, and no remote Off switch need be used.
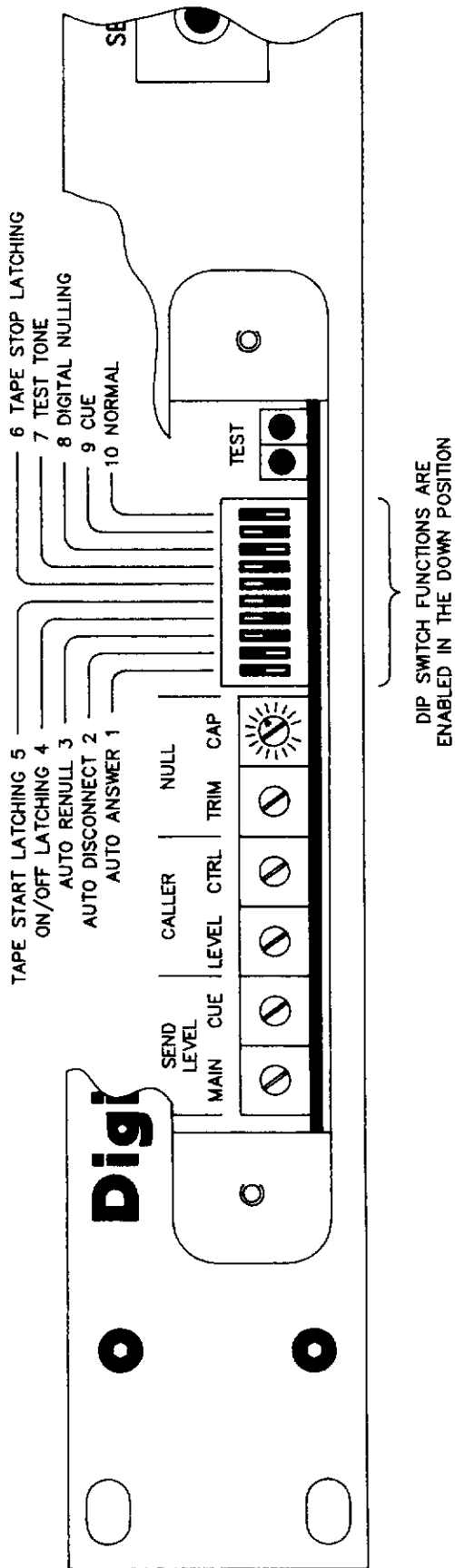
DIGITAL HYBRID II FRONT ACCESS PANEL DETAILS

Figure 33

Switch #5 Tape Start Latching - this switch
        determines whether the Tape Start relay
        action to your tape recorder will be
        momentary or latching, and is typically used
        in the UP (momentary) position. Place this
        switch in the DOWN position for latching
        contact action of the Tape Start relay.

            NOTE: When using the Latching Tape
            Start switching, no remote Tape Stop
            switch needs to be used.

Switch #6 Tape Stop Latching - this is normally
        used in the UP position.   This switch
        determines whether the action of the Tape
        Stop relay shall be momentary or latching.
        The UP position causes momentary action and
        the DOWN position causes latching action.

Switch #7 Test Tone - this switch is normally in
        the UP position. When this switch is DOWN, a
        test tone is generated for use in setting up
        the Digital Hybrid II. Refer to Section 4.2
        of this manual for the setup procedure which
        uses this switch.

Switch #8 Digital Nulling - This switch is
        normally in the DOWN position. It is used in
        the UP position only when performing the
        setup procedure of Section 4.2 of this
        manual.

Switch #9 Cue - this dip switch should be placed
        in the UP position to convert the CUE
        function to HOLD. Otherwise, activating the
        HOLD function will not mute Caller audio.

Switch #10 Normal - for Normal operation, the
        Digital Hybrid II should be powered up with
        Dip Switch 10 in the DOWN position. When the
        unit is powered up with DIP Switch 10 in the
        UP position, the Null Enhancement mode is
        enabled.

For other information on the functions of the DIP
switches, refer to Section 4.5 of this manual.

5.4 Conference Room Setup

Figure 34 illustrates a typical conference room setup.

The major advantage of the setup shown in **Figure 34** is that the participants can listen while talking; the speaker is not turned off as it would be on a speakerphone.

This permits a more natural, two-way flow of conversation between conference rooms, without annoying cut-offs.

In this setup, four directional microphones are mixed together.

The output of the mixer is routed to the SEND input of the Digital Hybrid II.

The CALLER output of the Digital Hybrid II is sent to the input of a power amplifier.

The power amp drives a loudspeaker.

Care must be taken to ensure that speaker placement does not result in acoustic pick-up by microphones.

Time spent considering the choice of microphones, their placement, and pickup patterns is well spent.

Relative position of the microphones to the loudspeakers must be carefully considered to minimize the possibility of feedback.

If room resonance is a problem, corrective equalization of the P.A. system may be necessary. Your sound contractor will be able to assist you if equalization is needed.

SPEAKER

MICROPHONES

CONFERENCE
TABLE

1

3

2

4

TELEPHONE
LINE

TAPE

RECORD/MIX
OUT

DIGITAL HYBRID II

CALLER
OUT

CUE
SEND

OPTIONAL
MUSIC
ON HOLD

MAIN
SEND

MIXER

POWER AMP.
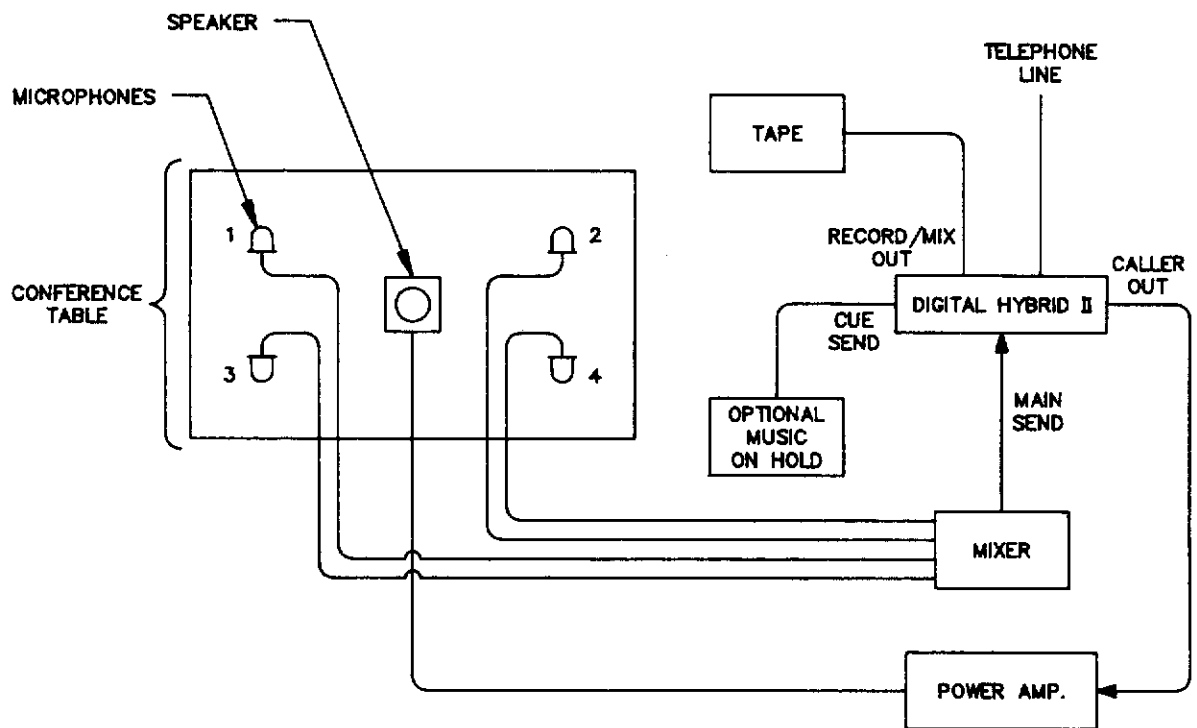
CONFERENCE ROOM SET-UP

Figure 34

5.5 Auditoriums or Large Meeting Rooms

The Digital Hybrid II can be used to provide audio conferencing in an auditorium, church, arena or other large areas.

Using the configuration shown in **Figure 35**, the Caller is heard through loudspeakers while anyone speaking on a microphone is heard by the Caller.

This permits guests to speak at large meetings without requiring them to be on location.

> NOTE: Proper acoustic treatment and careful placement of speakers with regard to microphone pickup patterns are essential. Careful planning initially will save considerable time and expense when compared to the "fix-it-later" approach.

The Digital Hybrid II is adaptable to many different applications. If you need further assistance contact Gentner Customer Support.

MICROPHONES

MIXER

CUE
SEND
MAIN
SEND

STAGE
SPEAKERS
AMPLIFIER
CALLER
OUT
DIGITAL HYBRID II
TELEPHONE LINE

MIX
OUT

AUDITORIUM
SPEAKERS
P.A. SYSTEM
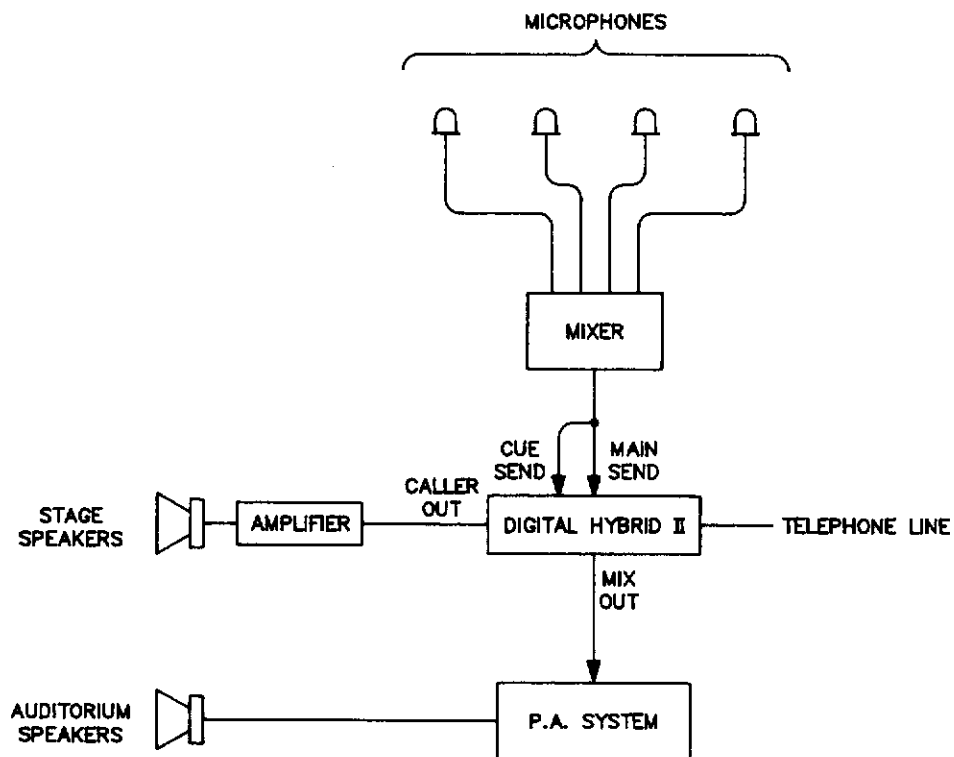
AUDITORIUM SETUP

Figure 35

5.6 Video Conferencing or Business Television Use

When using the Digital Hybrid II for return audio in video conferencing, setup is similar to a broadcast application.

Many audio mixing consoles contain a mix-minus output for feeding telephone callers. This output should be applied to the Main Send XLR of the Digital Hybrid II.

If your console does not contain a mix-minus output, you can use the output of the microphone mixer or the moderator's microphone preamplifier. Other audio sources are acceptable as long as they do not contain any of the Caller's own audio.

The Caller output of the Digital Hybrid II is connected to a separate input of the mixing console. The audio is then mixed with the main program feed and sent to the entire audience.

> NOTE: Callers should be cautioned to turn down their television sets and listen to the program on the telephone line to avoid confusion from delayed transmissions and to avoid creating feedback from speakers.

The CUE SEND Input is not typically used in video conferencing applications.

If the conference involves a feed to an auditorium, with a guest panel or moderator on a stage, the Digital Hybrid II's RECORD/MIX Output can be used to feed a separate power amplifier for sound reinforcement in the auditorium. The RECORD/MIX Output contains both sides of a telephone conversation. Caution must be taken to ensure that the people on stage do not receive a feed containing their own audio, or feedback will occur.

> NOTE: Placing the Digital Hybrid II in the HOLD mode switches from the MAIN SEND input to the CUE SEND input. If you feed the microphone mixer into the MAIN SEND input only, placing the Digital Hybrid II in the HOLD mode will interrupt the audio feed from the microphone mixer to the P.A. amplifier.

If the audio feed from the microphone mixer is also sent to the CUE SEND input, this interruption of P.A. audio will not occur. **Figure 36** illustrates a simple method to parallel both MAIN and CUE SEND inputs.

FEMALE XLR
FROM
SEND SOURCE

1

2

3

MALE XLR
TO MAIN SEND
INPUT

1

2

3

MALE XLR
TO CUE SEND
INPUT

1

2

3
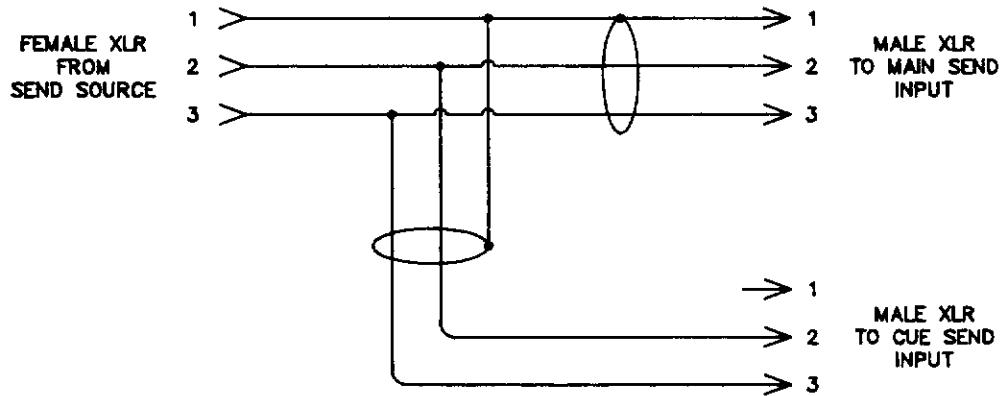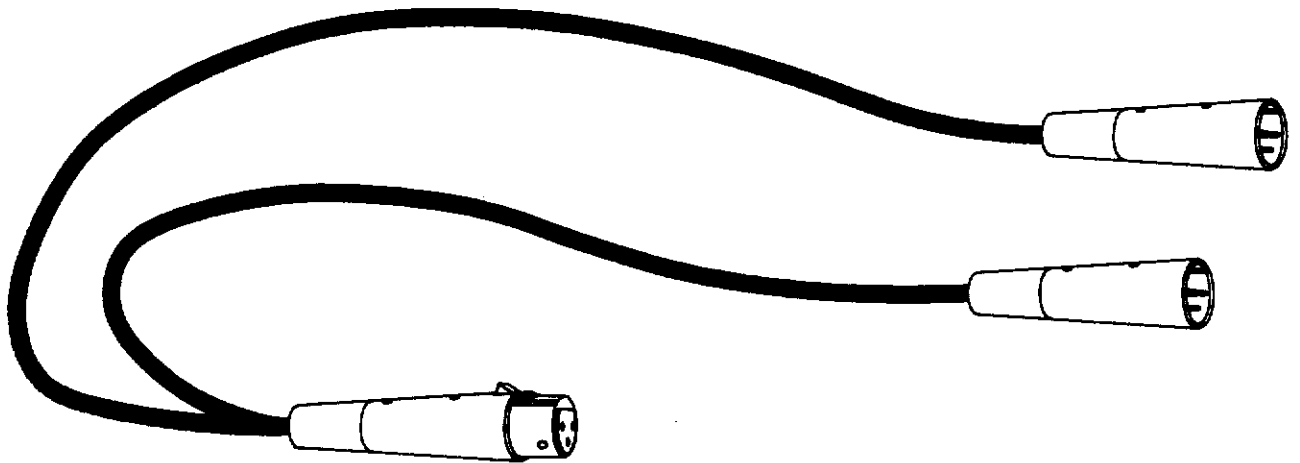
PARALLEL FEED TO MAIN SEND AND CUE SEND INPUTS

Figure 36

A "Y" (parallel) feed to both the MAIN SEND and CUE
SEND inputs will allow the Caller to hear the Send feed
and cues while the HOLD function is enabled.

The Digital Hybrid II can be installed for use with a
multi-line telephone set. In this case, a multiple
line telephone set is used to select one Caller at a
time to send to the Digital Hybrid II.

The Digital Hybrid II is able to mute audio and
automatically re-null whenever a new line is selected.
For more information on multi-line installations, refer
to Section 3.6 of this manual.

If your application requires combining multiple Digital
Hybrid II's for multi-line use, refer to Section 6.2 of
this manual for instructions and illustrations.

Contact Gentner Customer Support if you need assistance
with your video conferencing applications.

6.1 Typical Broadcast Applications

Figure 37 shows how a typical broadcast station would use the Digital Hybrid II.

A multi-line telephone is used to select a telephone line to be routed to the Digital Hybrid II. When the talent is ready to put the call on the air, the ON Switch is pressed. The following then occurs:

a)   The selected phone line is terminated.

b)   A 300 millisecond burst of white noise is sent down the phone line.

c)   The hybrid automatically nulls to the noise burst.

d)   The output audio is unmuted and the Caller audio is routed to the input of the console.
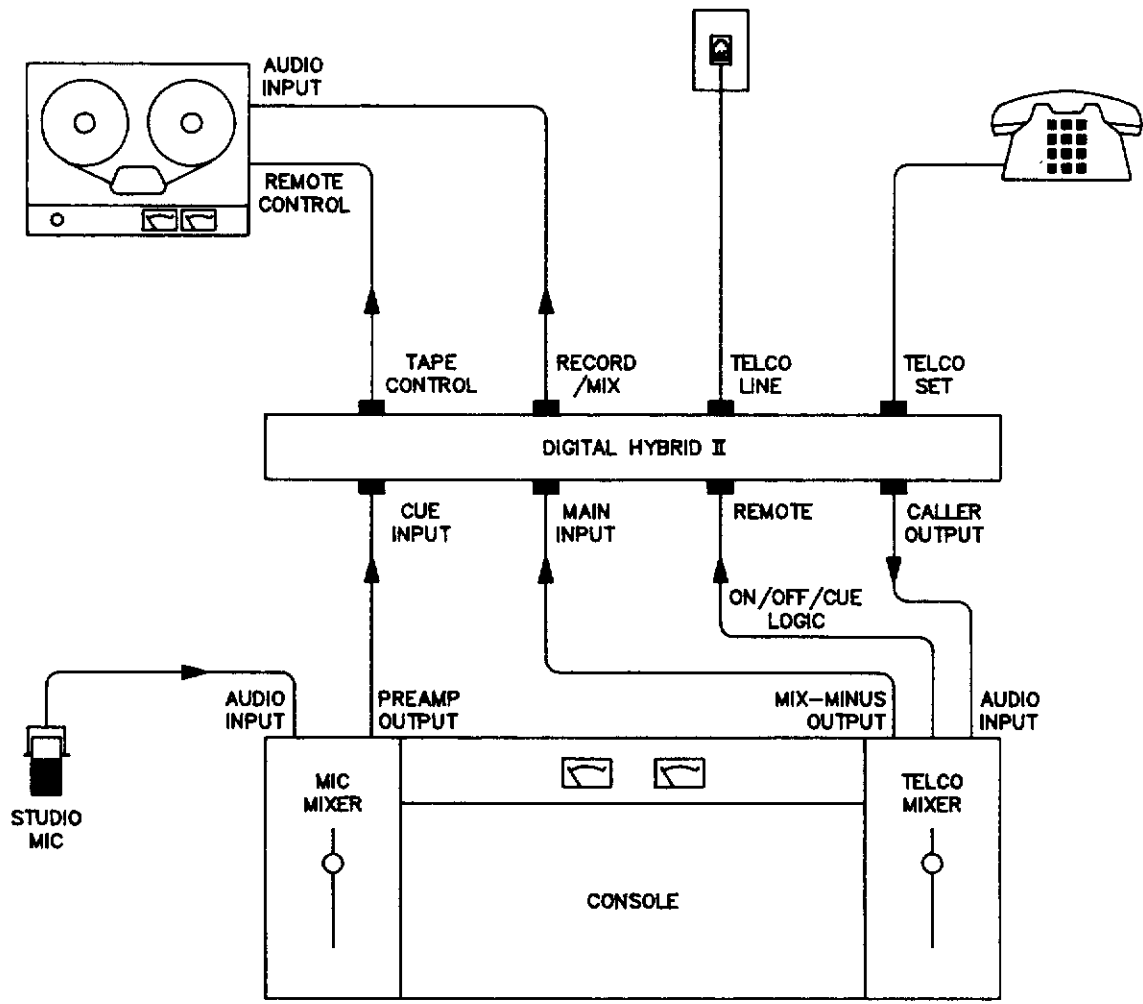
The muting function is useful in broadcast applications because it masks the termination pops and clicks, making telephone connection clean and clear.

When the CUE function is inactive, audio from the mix-minus output of the console is routed to the MAIN SEND audio input of the Digital Hybrid II, and to the CALLER.

If the CUE function is active (CUE lamp is on), audio from the CUE SEND audio input (usually the announcer's microphone preamplifier output) is routed to the CALLER.

The unit continues to automatically null whenever there is Send audio present but stops nulling when Caller (receive) audio is present.

In applications where calls are selected and answered via a multi-line telephone set or Call Director, the Auto-Renull feature should be enabled by placing front-panel DIP Switch 3 in the DOWN position. The Digital Hybrid II ON/OFF control should be left in the ON mode continuously in this application.

AUDIO
INPUT

REMOTE
CONTROL

TAPE
CONTROL

RECORD
/MIX

TELCO
LINE

TELCO
SET

DIGITAL HYBRID II

CUE
INPUT

MAIN
INPUT

REMOTE

CALLER
OUTPUT

ON/OFF/CUE
LOGIC

AUDIO
INPUT

PREAMP
OUTPUT

MIX—MINUS
OUTPUT

AUDIO
INPUT

STUDIO
MIC

MIC
MIXER

TELCO
MIXER

CONSOLE

TYPICAL BROADCAST INSTALLATION

Figure 37

This will allow the talent to select another line on the multi-line telephone without pressing any switches on the Digital Hybrid II. In this mode of operation, the following occurs whenever a new line is selected:

a) The Digital Hybrid II senses loop drop.

b) The Caller output audio to the console is muted.

c) The Digital Hybrid II senses selection of the next line.

d) The nulling and unmuting process is repeated.

This mode of operation provides clean connection (no "pops" or "clicks" on the air) to each selected telephone line, with maximum hybrid performance ensured.

> NOTE: If front-panel DIP Switch 3 is left in the UP position while used in this application, the Digital Hybrid II will not re-null automatically with each telephone call. See Section 4.5 for information on setting the DIP switches.

6.2 Conferencing Multiple Digital Hybrid II Units

Multiple Digital Hybrid II units can be conferenced for
the airing of multiple Callers or for use as a
telephone conference bridge.

Figures 38, 39, and 40 show three methods of
conferencing Digital Hybrid II's for different
applications.

Figure 38 shows a talk show application where an out-
of-studio guest is to participate via a dedicated
telephone line through a hybrid. A second hybrid,
connected to a multi-line telephone, is conferenced to
the guest hybrid.

In this configuration, both Callers can hear the studio
announcer and each other in a fully amplified
conference.

Separate Caller and guest Caller audio signals are
available for application to two console channels.
With the use of the CUE function of the guest Digital
Hybrid II, off-air conversation can be held with the
guest during breaks such as commercials, national news,
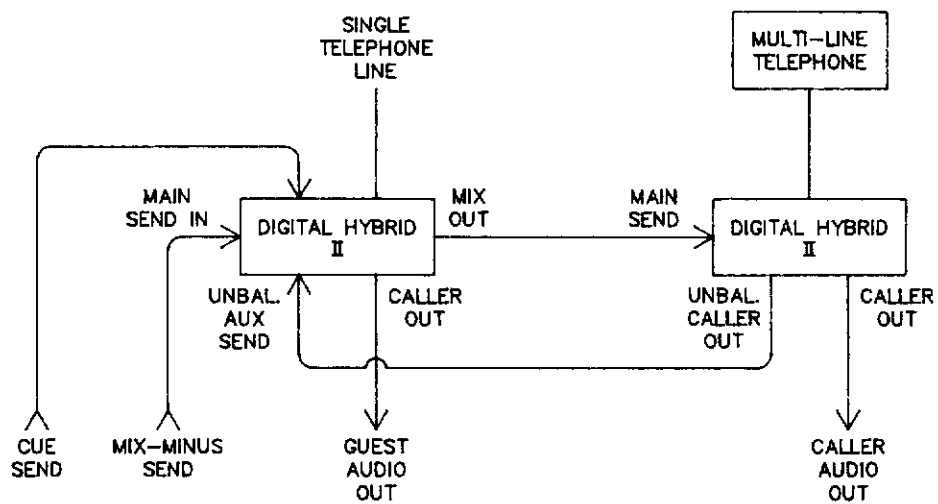or music.

Figure 39 shows two Digital Hybrid II's that could be
connected to either a dedicated telephone line or to
multi-line call directors.

When connected to multi-line call directors, maximum
flexibility in placing two Callers in a fully amplified
conference is achieved.

In this configuration, both Callers would hear the
studio announcer and each other. Separate Caller audio
outputs are available for application to the mixing
console.

Figure 40 shows two Digital Hybrid II's in a conference
setting where both Caller outputs are mixed together
for application to one console input.

Additional units could be stacked, in a similar manner
to those shown in **Figure** 40, depending on individual
applications. If a particularly large architecture or
unique application is desired, please contact Gentner
Customer Support for assistance.

SINGLE
TELEPHONE
LINE

MULTI-LINE
TELEPHONE

MAIN
SEND IN

MIX
OUT

MAIN
SEND

DIGITAL HYBRID
II

DIGITAL HYBRID
II

UNBAL.
AUX
SEND

CALLER
OUT

UNBAL.
CALLER
OUT

CALLER
OUT

CUE
SEND

MIX-MINUS
SEND

GUEST
AUDIO
OUT

CALLER
AUDIO
OUT

DUAL HYBRID SINGLE AND MULTI-LINE CONFERENCE

Figure 38

MULTI—LINE TELEPHONE
OR
SINGLE TELEPHONE LINE

MULTI—LINE TELEPHONE
OR
SINGLE TELEPHONE LINE

UNBAL.
CALLER
OUT

UNBAL.
AUX
SEND

MAIN
SEND

DIGITAL HYBRID II

MAIN SEND

DIGITAL HYBRID II

AUX
SEND

CALLER
OUT

CUE
SEND

CUE
SEND

UNBAL.
CALLER
OUT

CALLER
OUT

MIX—MINUS
AUDIO

CALLER
#1

CUE
AUDIO
SEND

CALLER
#2
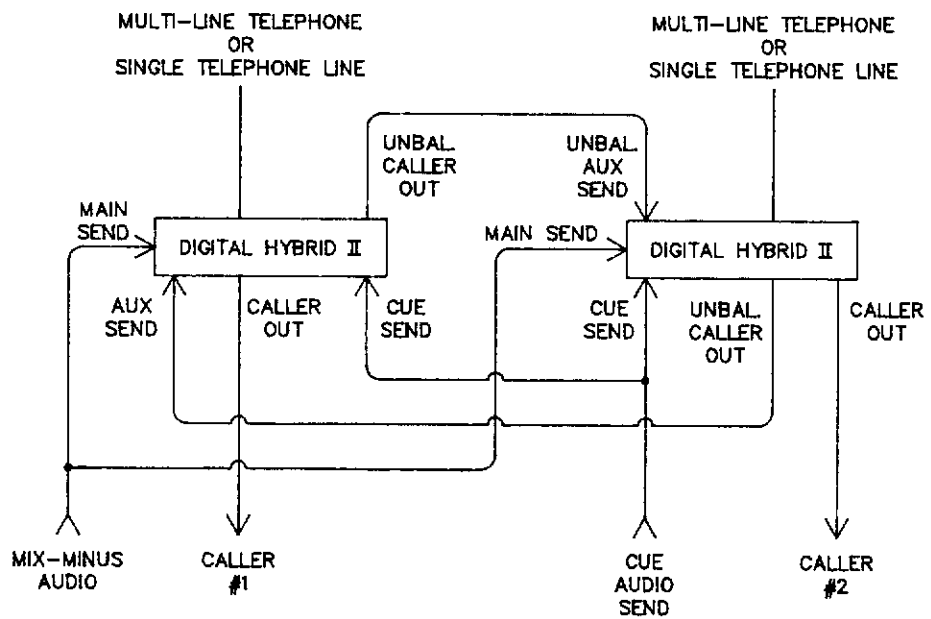
DUAL HYBRIDS WITH SEPARATE AUDIO OUTPUTS

Figure 39

MULTI–LINE TELEPHONE
OR
SINGLE TELEPHONE LINE

MULTI–LINE TELEPHONE
OR
SINGLE TELEPHONE LINE

MAIN
SEND

CALLER

RECORD/MIX
OUT

DIGITAL HYBRID II

DIGITAL HYBRID II

CALLER
OUT

MAIN
SEND

CUE
SEND

AUX
SEND

AUX
SEND

CUE
SEND

CUE
AUDIO
SEND

UNBALANCED
MIX–MINUS

CALLER #1
+
CALLER #2
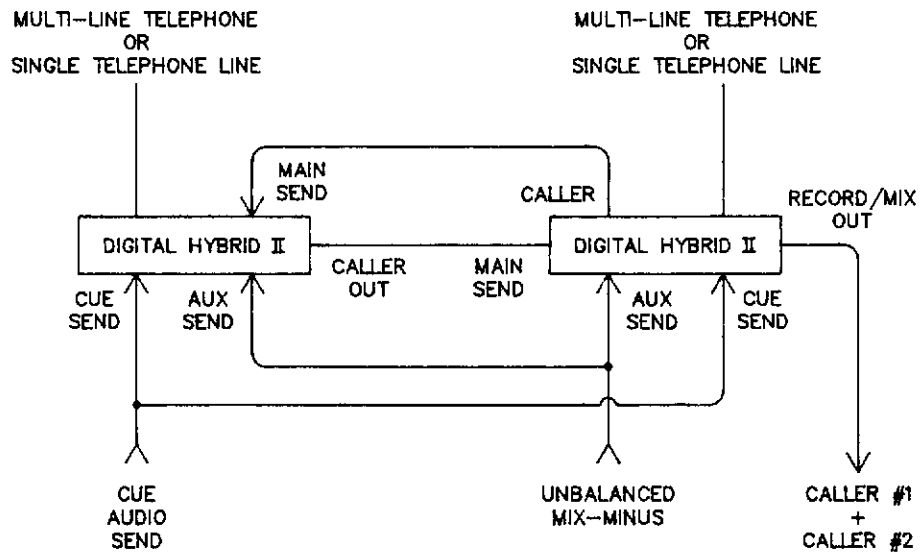
DUAL HYBRIDS WITH MIXED AUDIO OUTPUT

Figure 40

(This page is intentionally blank.)

7.1 Overview

The basic theory of operation for the Digital Hybrid II
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 41 of this section shows a functional block
diagram of the Digital Hybrid II.

Schematic diagrams of the Digital Hybrid II are found
in Section 9.3 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 41** and
refer to the schematics located in Section 9.3 while
reading the discussion of circuit operation provided in
this section.
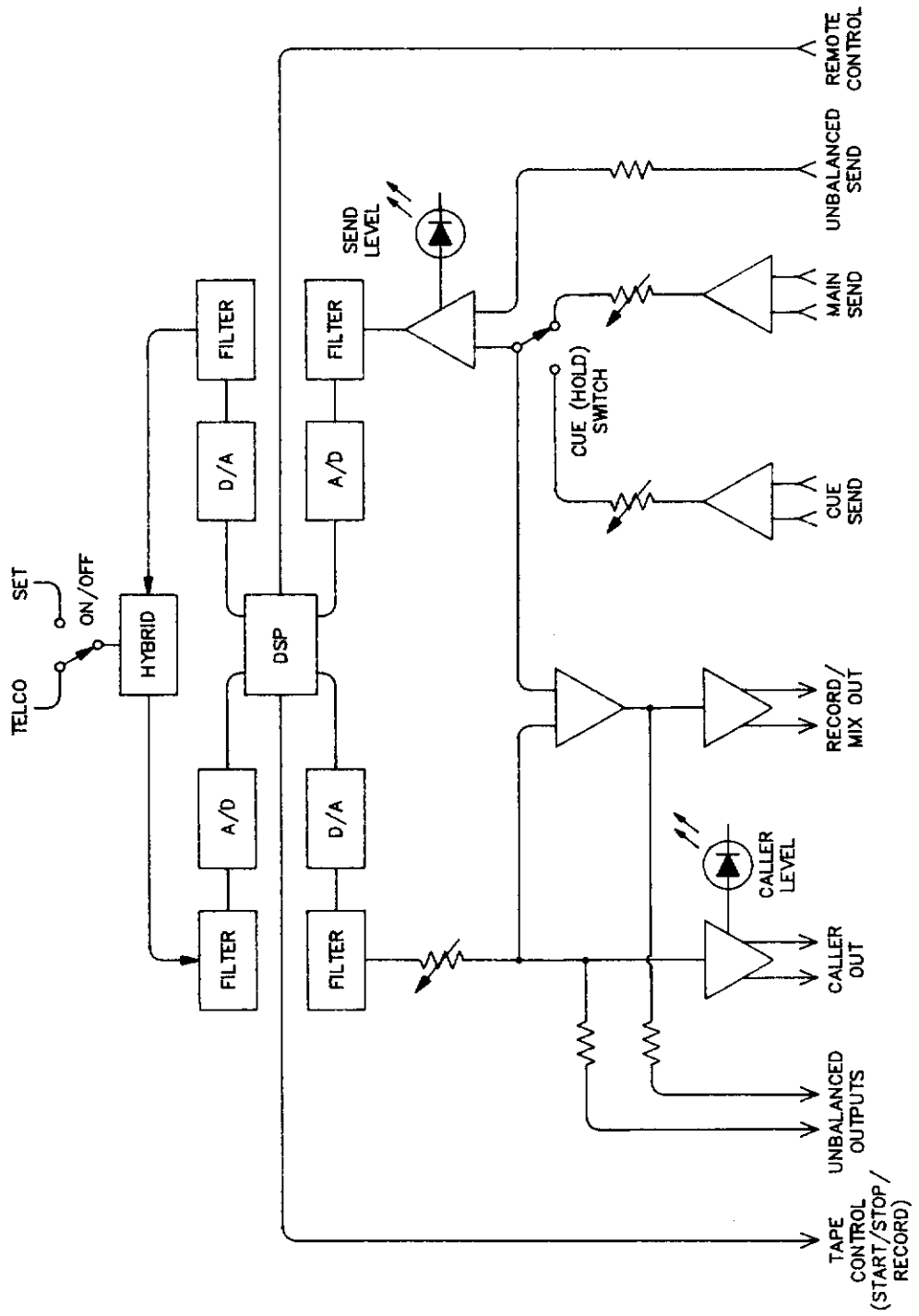
DIGITAL HYBRID II FUNCTIONAL BLOCK DIAGRAM

Figure 41

7.2 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 II 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 the 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.

7.3 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 Section 9.3.

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 10 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, U28 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 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).

7.4 Telephone Interface Circuit Description

Please refer to sheet 1 of 10 of the schematic diagrams found in Section 9.3 of this manual while reading the following.

The TIP and RING conductors of the telephone line are applied to J1. This is an RJ11C connector on the rear panel of the Digital Hybrid II.

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 combinations of C165, C166, C167, and C168. R172 is the front-panel null trim pot.

This concludes the basic theory of operation for the Digital Hybrid II.

8.1 Product Line Updates

Gentner Electronics 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 as they become available.

You must return a completed Warranty Card in order to be notified of updates to the product line. See Section Two of this manual for more information regarding the Warranty.

All control functions of the Digital Hybrid II are contained in an EPROM (Erasable Programmable Read Only Memory) chip. This means that by simply changing the firmware EPROM, future updates of the Digital Hybrid II can be implemented.

The replacement of one EPROM, designated U33, will be all that is required for the majority of future upgrades.

For upgrades involving a firmware EPROM change, field installation is possible.

If you prefer to send the unit to the factory, Gentner Customer Support will be able to install future upgrades into your Digital Hybrid II.

Procedures for performing future upgrades will be sent with upgrade kits. However, since the majority of upgrades are anticipated to only require firmware changes, Section 8.2 of this manual contains a procedure to guide you when a firmware upgrade is made.

8.2 Firmware Upgrade Procedure

Today's integrated circuits often require special handling precautions to avoid inadvertent damage due to static electricity discharge.

General precautions to observe when handling the firmware EPROM include the following:

a) Avoid handling the I.C. by the leads.

b) Keep the I.C. in the anti-static container used for shipping until called for in the installation procedure.

c) All packaging material used for shipping must be conductive to keep the leads of the device shorted to prevent build-up of a static charge.

d) The work surface, all handling equipment and containers that will come in contact with the device must be conductive. The work area may be sprayed with a static-control agent if desired.

e) All soldering irons, tools, metal parts, trays, and work surfaces must be grounded to a common point.

f) Individuals working with these devices should wear conductive wrist straps connected through a 470 kilo-ohm resistor to the common point mentioned above.

g) CMOS devices must not be removed or installed when the Digital Hybrid II is connected to any power source.

If you have any questions or need further assistance, please contact:

<div align="center">

Gentner Customer Support
1825 Research Way
Salt Lake City, Utah 84119

Telephone: (801) 975-7200
FAX: (801) 977-0087

</div>

Please follow the procedure outlined below to install a new firmware EPROM into the Digital Hybrid II.

STEP 1

Remove all connections from the Digital Hybrid II, and remove the unit from service.

CAUTION: DISCONNECT THE DIGITAL HYBRID II FROM A.C. POWER BEFORE CONTINUING WITH THIS PROCEDURE

Remove the cover from the Digital Hybrid II by loosening the four cover screws. (Note that the screws need only be loosened, not removed.)

STEP 2

Place the Digital Hybrid II in front of you, top side up, with the front panel of the unit facing you. The removable front panel should now be on the left-hand side, and the OFF and ON switches should be on the right-hand side of the unit.

U33 will be found near the front panel, on the right-hand side of the circuit board near the large white integrated circuit.

Do not remove U33 during this step - just locate it using **Figure 42** as a reference.

Notice that the notch on U33 faces away from you. It is essential that the new upgrade version of U33 is installed with the notch oriented the same way.

STEP 3

Carefully remove the old U33 from its socket on the circuit board and set it aside.

>   NOTE: A small screwdriver can be helpful to remove the I.C. from its socket. Slip the screwdriver blade carefully under the I.C. and lift up on the I.C. while gently rocking the screwdriver back and forth to loosen the I.C.

Locate the new U33 provided with the Upgrade Kit and remove it from its shipping container.

Orient the new U33 so that the notch on the top faces the rear of the unit (away from you).

REAR PANEL

LOCATION AND
ORIENTATION
OF U33

U32

FRONT PANEL
TOP VIEW WITH COVER REMOVED
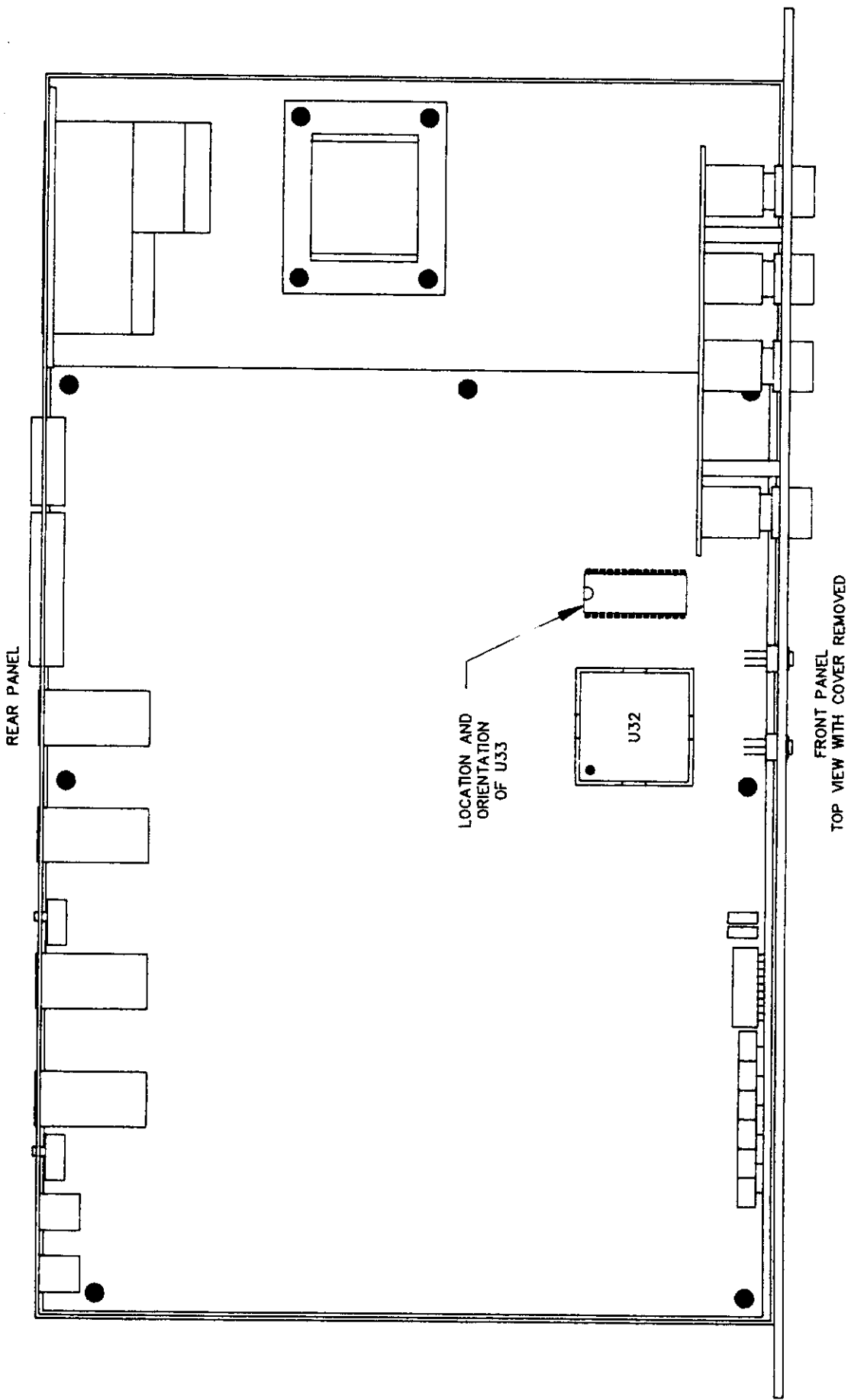
LOCATION DIAGRAM FOR U33

Figure 42

Carefully insert the new U33 into its socket on the circuit board. Be extremely careful not to bend any of the pins on U33 during insertion.

Make certain that U33 is firmly seated in its socket.

STEP 4

Place the old U33 into the shipping container that previously held the new EPROM. Discard or store the old U33 according to your preference.

STEP 5

Replace the top cover of the Digital Hybrid II and secure the cover to the Digital Hybrid II using the four cover screws previously loosened in Step 1.

Re-connect all inputs and outputs for the Digital Hybrid II.

Restore the unit to service.

The upgrade procedure is now completed.

> NOTE: It is possible that an upgrade of firmware will change the front-panel DIP switch functions, and perhaps modify the action of other switches as well. The instructions supplied with future upgrade kits will describe in detail any such changes in operation.

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9.1 Digital Hybrid II Maintenance

Your Digital Hybrid II is a highly reliable device. It
was thoroughly tested at the factory before being
shipped to you.

To protect your Digital Hybrid II 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 II 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.

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

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

9.2 Questions and Answers

This section is intended to answer the most common questions about installation and operation of the Digital Hybrid II.

If you need further assistance, call Gentner Customer Support.

Question: I am replacing my Digital Hybrid ANA with a Digital Hybrid II. I can't get it to work right. What should I check first?

Answer: Please check the DIP switch settings. The Digital Hybrid II uses a "DOWN TO ENABLE" plan that is sometimes the reverse of the DIP switch settings you used with the Digital Hybrid ANA. See Section 4.5 of this manual.

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

Answer: Each time you wish to change DIP switches 9 or 10 you will have to disconnect the AC electrical power to the Digital Hybrid II and power up with the DIP switches in the desired position in order for the Digital Hybrid II to recognize the new selection. See Section 4.5.

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

Answer: These symptoms indicate the internal DC Bypass jumper is in the JP2 position. Refer to Section 3.10 for a discussion of this jumper.

Question: 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)?

Answer: Perhaps, but first try adjusting the CALLER LEVEL trim pot located behind the removeable front access panel. See Section 4.4 of this manual.

Question: My Digital Hybrid II gates the Caller audio like a speakerphone. Should it do this?

Answer: 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 Section 4.4 for details.

Question: I can't get the Digital Hybrid II to auto answer. What can I check?

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

Question: I am using the Auto Re-null feature, but now the Auto Disconnect does not work. Is this a malfunction?

Answer: When the Auto Re-null feature is enabled, the Auto-Disconnect feature is disabled.

There often is misunderstanding of the Auto Re-null function. This feature is only necessary if the Digital Hybrid II is left in the ON mode to permit taking calls with a multi-line telephone set or a Telemix X Call Director. See Section 4.5 of this manual.

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

Answer: 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 Switch is used, and the front-panel ON/OFF Switches on the Digital Hybrid II will be inoperative. Refer to Section 4.5 for more information.

Question: 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 II to the remote Pause connections on the cassette deck. I can't get the tape to roll. Is an interface necessary?

Answer: 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.

Question: All I get out of the Digital Hybrid II is a loud tone. Is there something wrong with the unit?

Answer: 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 Section 4.2 of this manual.

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

Answer: 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 Section 4.2 of the manual, or for diagnostic tests as recommended by Gentner Customer Support.

Question: I am using the Digital Hybrid II in an Audio Conferencing application. When I press the HOLD button, the Caller is not muted. What am I doing wrong?

Answer: For the HOLD function to become electronically enabled two actions must be taken:

a)   Front panel DIP Switch 9 should be placed in the UP position.

b)   The Digital Hybrid II must be completely powered down and powered back up in order to read in the new selection.

The instructions for the DSP that control this function are read out of ROM only during power-up and are not accessed again.

Question: I want to hook up the remote CUE function of the Digital Hybrid II, but I can't get it to operate properly. What should I do?

Answer: 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 Switch on the Digital Hybrid II. Please refer to Section 3.12 of this manual.

Question: I get feedback during audio conferences when I try to turn up the Caller's level. What should I try?

Answer: Try re-locating the microphones and/or speakers, if possible. Careful placement of speakers with regard to the microphones' pickup patterns is essential. Some additional acoustic treatment may be helpful.

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

Answer: The Digital Hybrid II 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 II. 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.

Question: My Digital Hybrid II needs to put louder Send audio on the telephone line. What can I do?

Answer: 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. See Section 4.3 of this manual for instructions for adjusting these trim pots.

Question: 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?

Answer: Try adjusting the CUE SEND level to match that of the MAIN SEND. See Section 4.3 of this manual for instructions for adjusting these trim pots.

Question: Is it OK to do a "button-mash" conference, that is, direct more than one telephone line to the Digital Hybrid II at a time?

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

9.3 Schematics

A set of schematic diagrams for the Digital Hybrid II
unit is presented on the following pages.

TELEPHONE INTERFACE

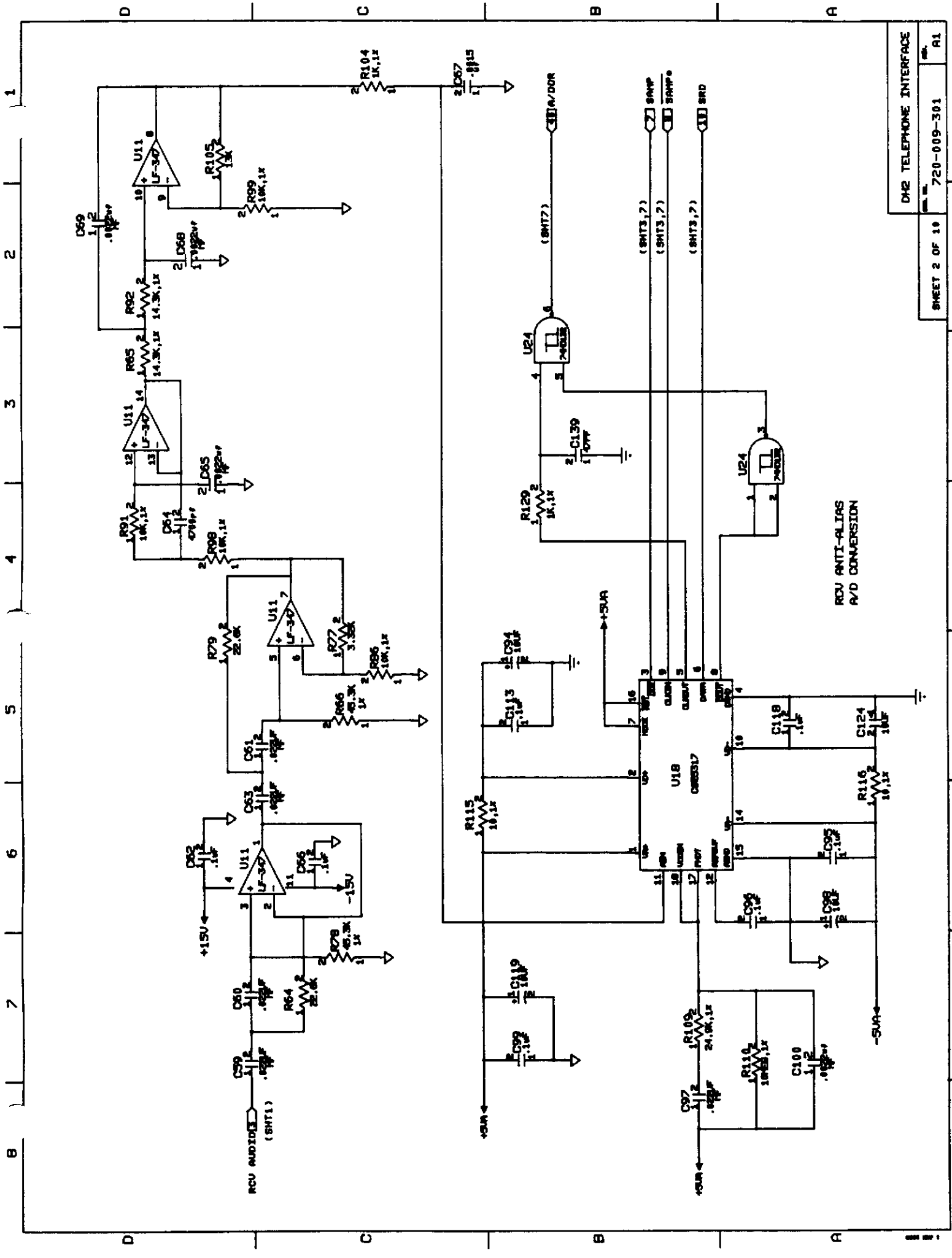J1= LINE JACK

J2= SET JACK
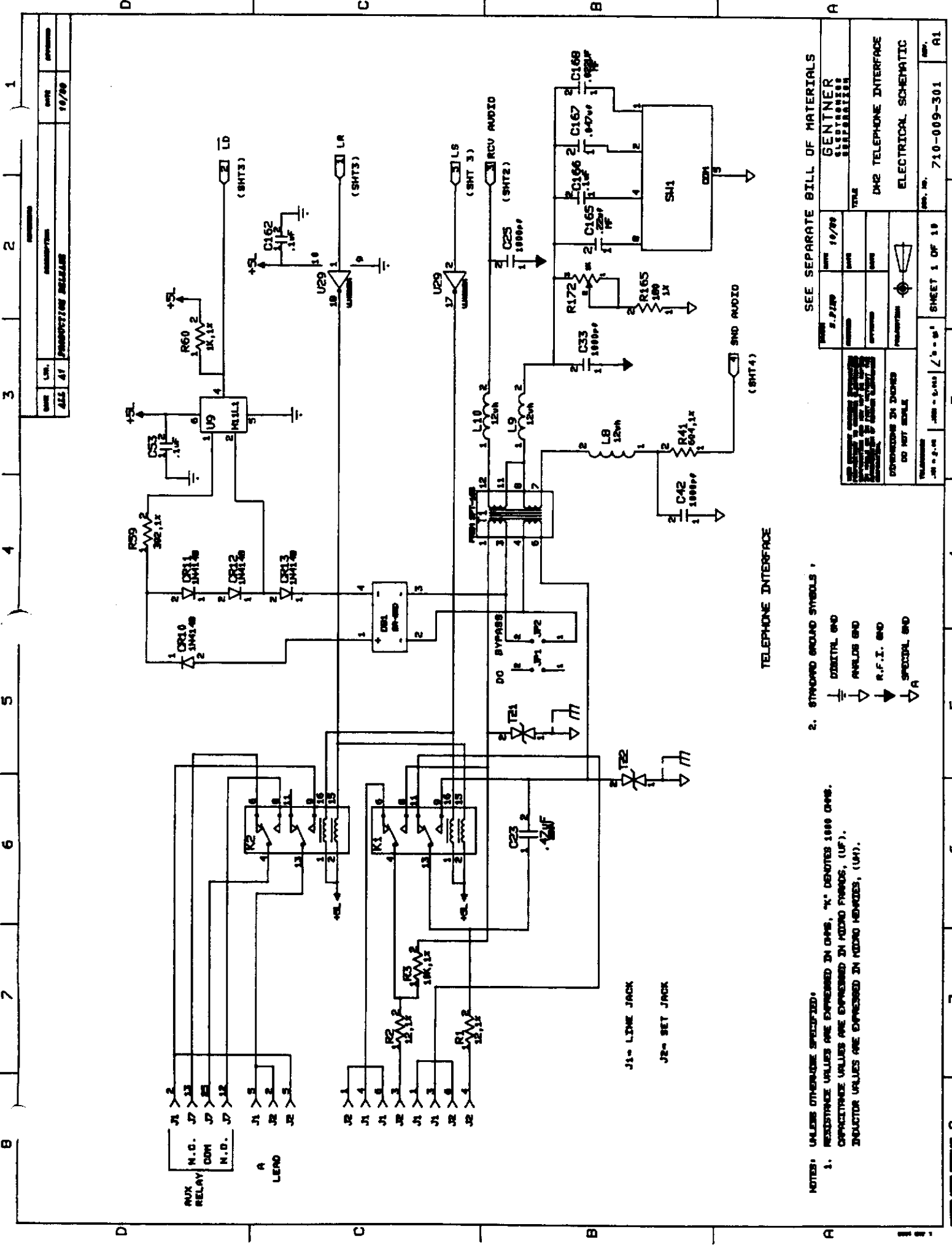
NOTES: UNLESS OTHERWISE SPECIFIED:
1. RESISTANCE VALUES ARE EXPRESSED IN OHMS, "K" DENOTES 1000 OHMS.
   CAPACITANCE VALUES ARE EXPRESSED IN MICRO FARADS, (UF).
   INDUCTOR VALUES ARE EXPRESSED IN MICRO HENRIES, (UH).

2. STANDARD GROUND SYMBOLS:
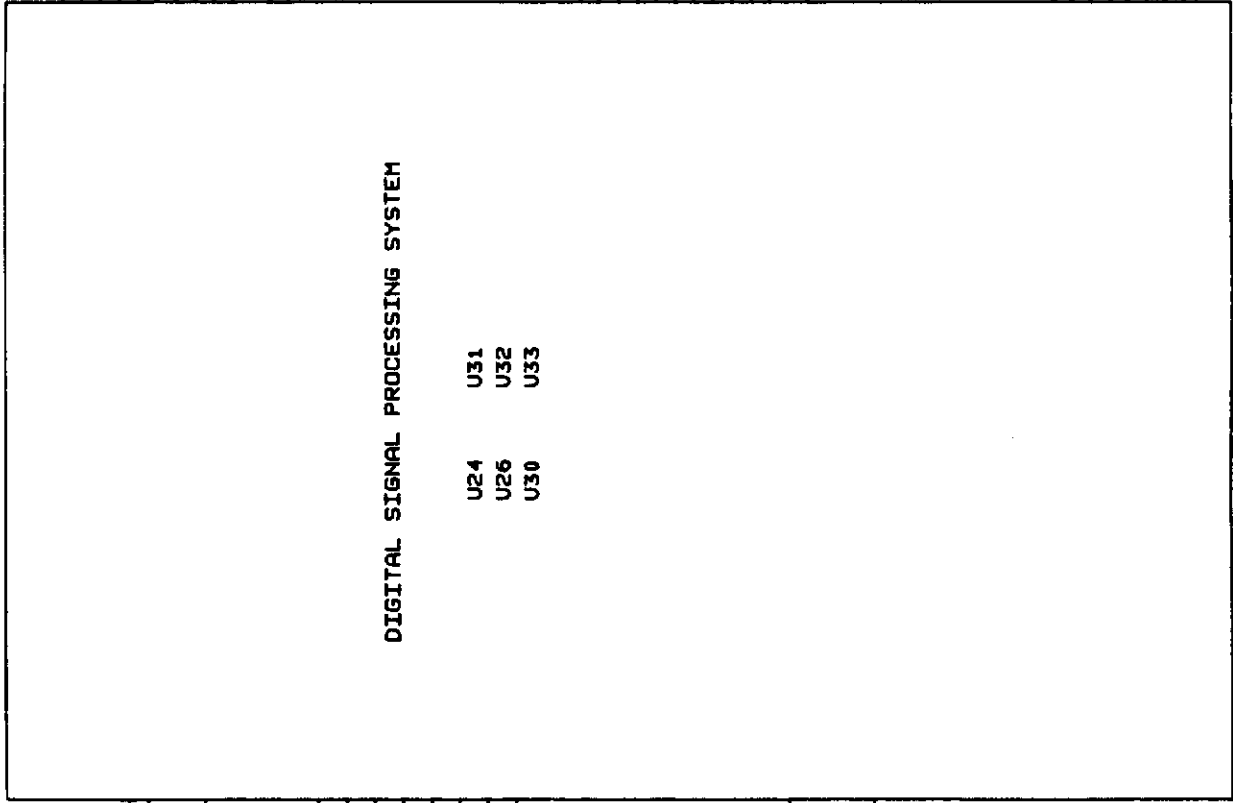   DIGITAL GND
   ANALOG GND
   R.F.I. GND
   SPECIAL GND

SEE SEPARATE BILL OF MATERIALS

GENTNER
ELECTRONICS
CORPORATION

TITLE
DH2 TELEPHONE INTERFACE
ELECTRICAL SCHEMATIC

DWG. NO.
710-009-301

REV.
A1

SHEET 1 OF 10

RCV ANTI-ALIAS
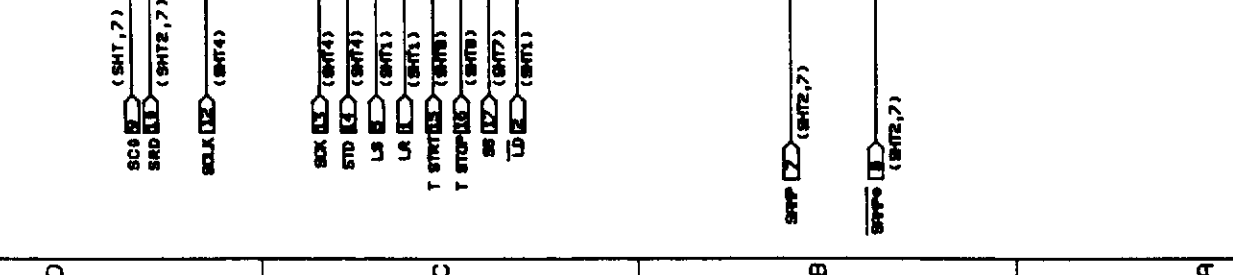A/D CONVERSION

DH2 TELEPHONE INTERFACE

720-009-301

SHEET 2 OF 10

DIGITAL SIGNAL PROCESSING SYSTEM

U24   U31
U26   U32
U30   U33

DM2 TELEPHONE INTERFACE

720-009-301   A1

SHEET 3 OF 10
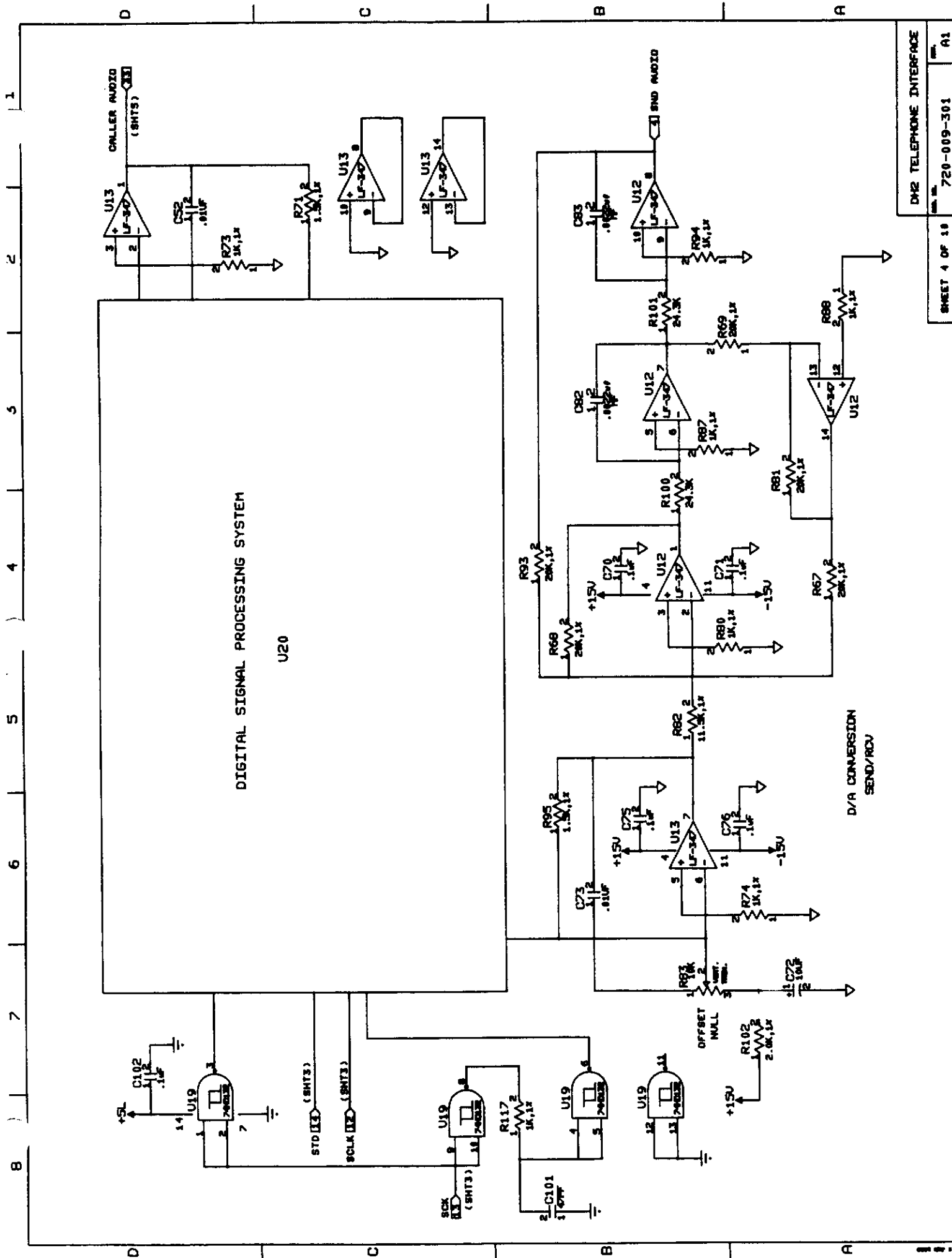
DIGITAL SIGNAL PROCESSING SYSTEM

U20

D/A CONVERSION
SEND/RCV

DM2 TELEPHONE INTERFACE

720-009-301   A1

SHEET 4 OF 10

DM2 TELEPHONE INTERFACE

720-009-301

SHEET 6 OF 18

DIGITAL SIGNAL PROCESSING SYSTEM

U17
U27
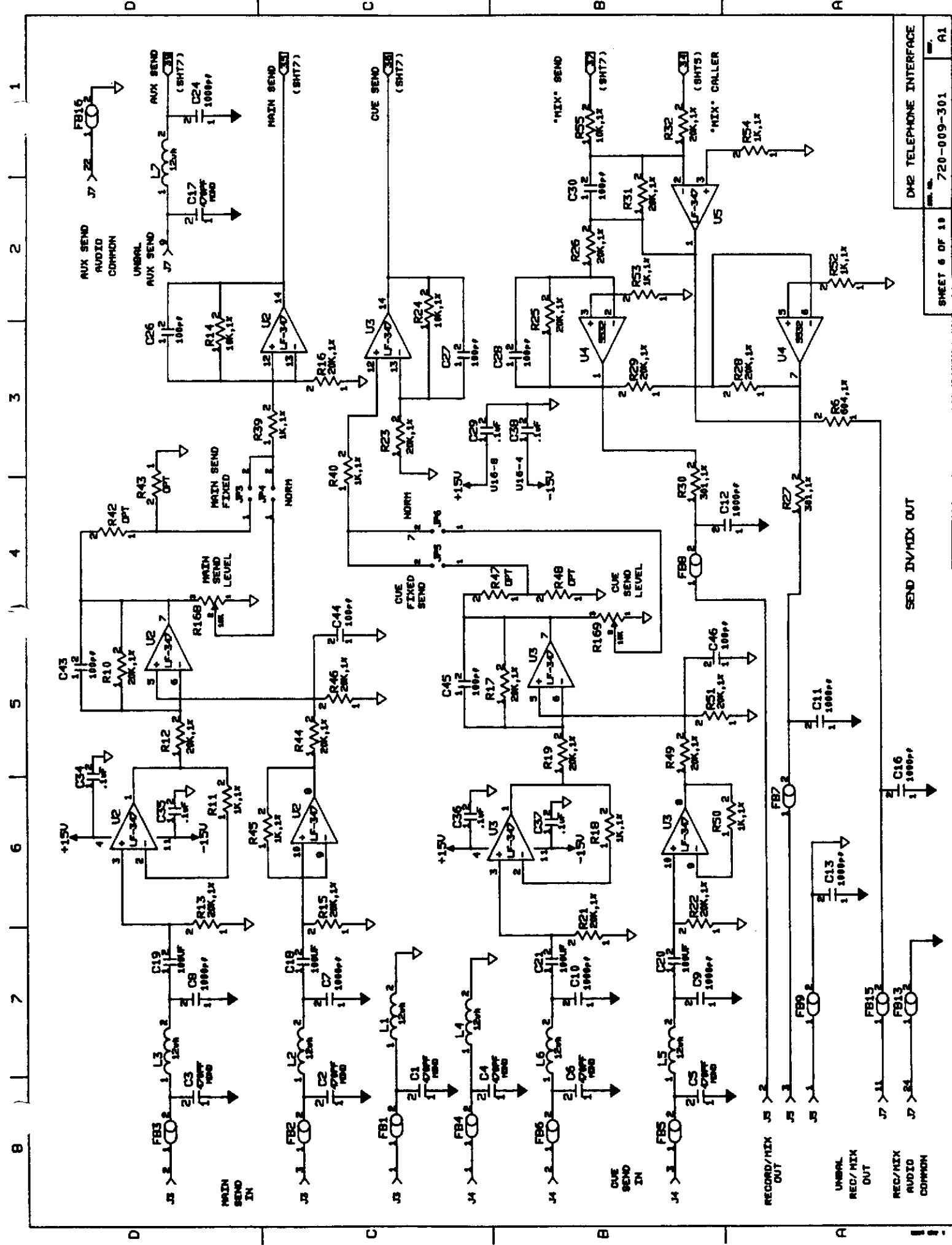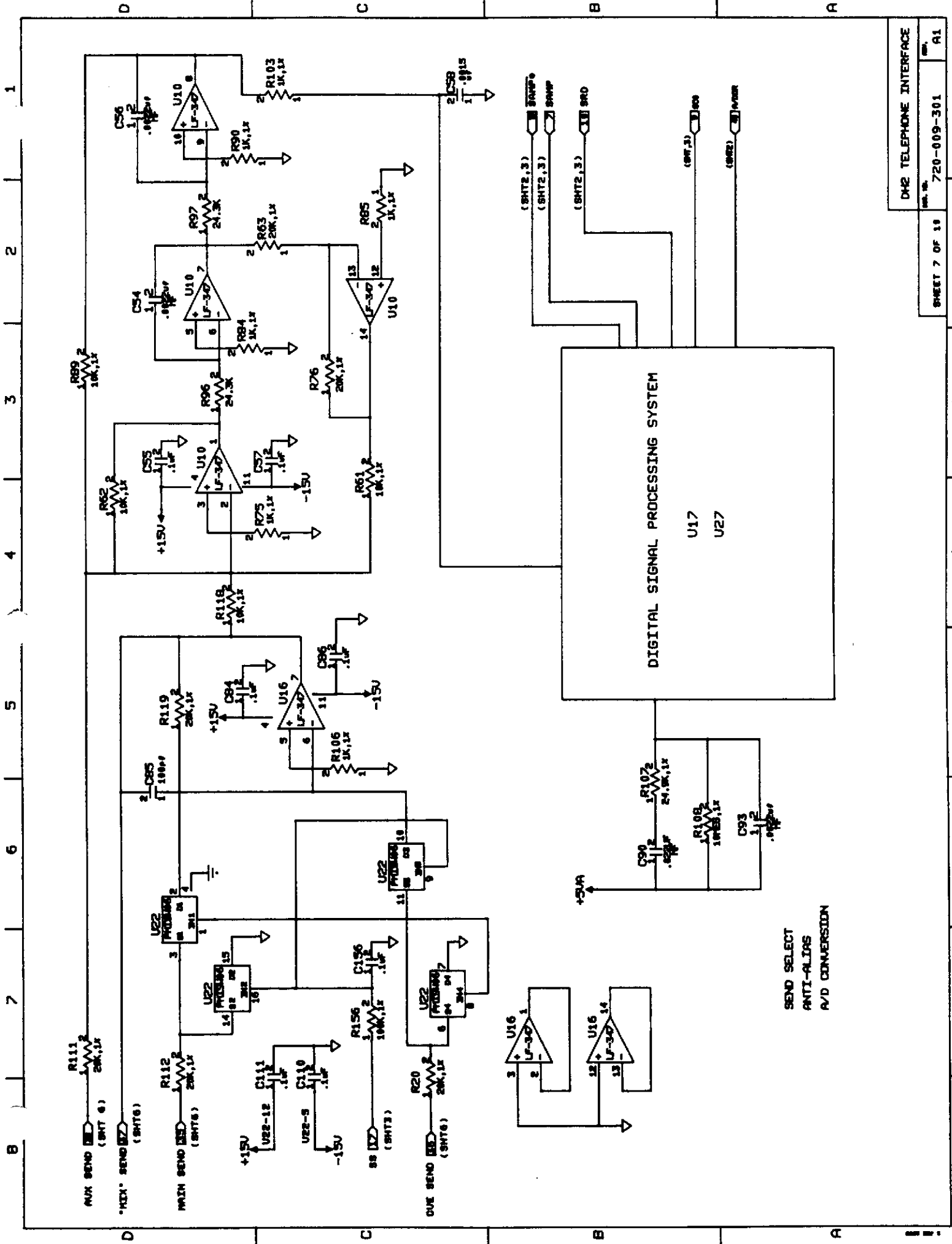
SEND SELECT
ANTI-ALIAS
A/D CONVERSION

DH2 TELEPHONE INTERFACE

720-009-301   A1

SHEET 7 OF 10

REMOTE
TAPE
START

REC ENABLE N.O.

REC ENA COMMON

REMOTE
TAPE
STOP

6 J8 C
2 J8 NC
1 J8 NO
9 J9

5 J8
8 J8 C
4 J8 NC
3 J8 NO

1 J7 REMOTE ON
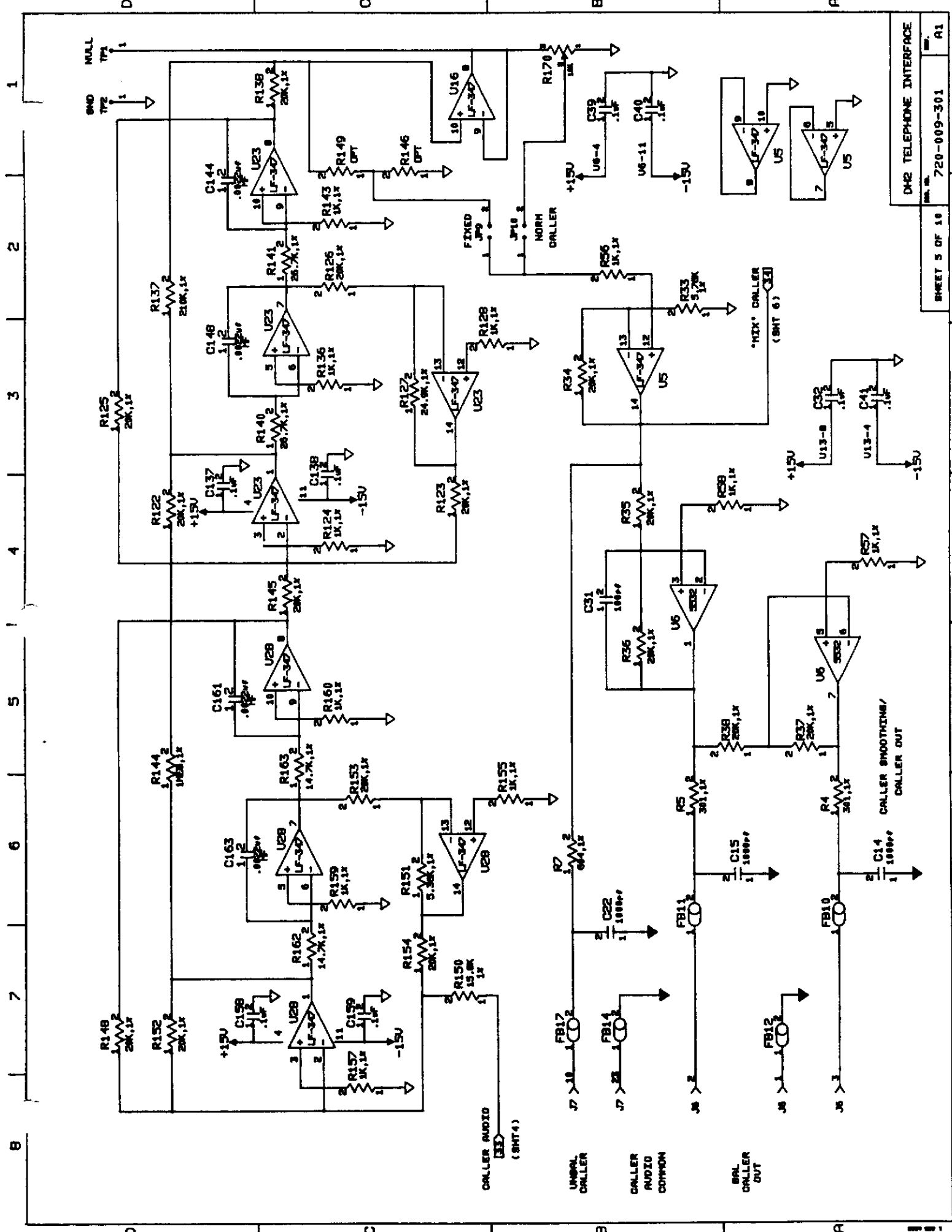2 J7 REMOTE OFF
3 J7 REMOTE RECORD
4 J7 REMOTE CUE
5 J7 SWITCH COMMON

R9
255,1%

R8
255,1%

K4
K3

CR8 1N4004
CR9 1N4004

CR7 1N5817
CR6 1N5817
CR5 1N5817
CR4 1N5817

U1 12 7
U1 11 8

REMOTE CONTROL

T STRT SHT3
T STOP SHT3
ON SHT3
OFF SHT3
REC SHT3
CUE SHT3

1 J10
3 J10
5 J10
7 J10
11 J10
9 J10

DH2 TELEPHONE INTERFACE
720-009-301 A1
SHEET 8 OF 10

DM2 TELEPHONE INTERFACE

720-009-301   A1

SEND MUTE

CALLER MUTE

CONSOLE CUE
REMOTE CUE
(CONSOLE)

ON INDICATOR

OFF INDICATOR

INDICATOR COMMON

RECORD INDICATOR

CUE INDICATOR

LAMP COMMON

CR3   1N5817

CR2   1N5817

CR1   1N5817

U29

U1

ULN2803

SEND MUTE   SHT3

RCU MUTE   SHT3

CUE   SHT3

ON LED   SHT3

OFF LED   SHT3

REC LED   SHT3

LED CUE   SHT3

REMOTE CONTROL

SEND RED

SEND PRESENCE
INDICATOR

RCV RED

CALLER PRESENCE
INDICATOR

R165
10K,1%
Q2
2N3904
J11

R167
10K,1%
Q4
2N3904
J11

R121
200,1%
SEND
BICOLOR
LED
J11

R120
200,1%
CALLER
BICOLOR
LED
J11

Q1
2N3904
J11

Q3
2N3904
J11

R161
10K,1%
U1
R164
10K,1%
U1

SND BRN
(SHT3)

RCV BRN
(SHT3)

C116
.1uF
U21
7805
C107
.1uF
C108
2200uF
C109
2200uF

DR14
1N4004
C132
.01uF
DR15
1N4004
C133
.01uF

C78
.1uF
U14
7805
C77
.1uF
C80
.1uF
U15
7915
C79
.1uF
C81
2200uF
DB2
BR-BD
C142
.01uF
C143
.01uF

+15V
+5VA

C50
.1uF
U7
7805
C47
.1uF
C51
.1uF
U8
7915
C49
.1uF
C49
2200uF

-15V
-5VA

A.8 Installing Telephone Hybrids

A telephone hybrid converts the balanced two-wire medium into a four-wire circuit. This basic function is required in many applications to separate audio being sent to the caller from audio being received from the caller.

When installing a telephone hybrid, a raw Central Office telephone loop (single line) typically provides the best performance and easiest set-up (you simply plug the line into the hybrid). However, since most facilities use multiple line telephones, you'll probably need to access the telephone line from inside a telephone set to install the hybrid.

Analog and Digital Key Service Units (see Section A-5.) typically route a Tip and Ring pair to each telephone. This pair is what you need to connect to the hybrid. Finding the Tip and Ring pair can be tricky at times and a little research and testing is required.

A quick way to find the Tip and Ring pair is to probe inside the telephone set with a pair of high impedance headphones, isolated by 10uF capacitors. Look for a set of red and green wires that enter the phone from the Key Service Unit; these are usually, but not always, the Tip and Ring pair. Connect the headphones across these wires and select a line. You'll hear dial tone on each line selected if you have found the correct terminals.

Another common problem in hybrid installation is the desire to route the output of an audio console to the input of the hybrid for feeding audio to the caller. Although simply sending the main audio output of a console to the caller may seem like a good idea, it electronically sends the caller's audio back to himself, thus creating a feedback loop.

Most hybrid installation instructions call for sending Mix-Minus audio down the phone line. Mix-Minus audio is simply a mixture of the audio sources on the console, MINUS the caller's audio. If Mix-Minus is not available, a good alternative is to use audio from the microphone pre-amp for the send feed. Keep in mind this idea: "Send the caller anything EXCEPT his own audio."
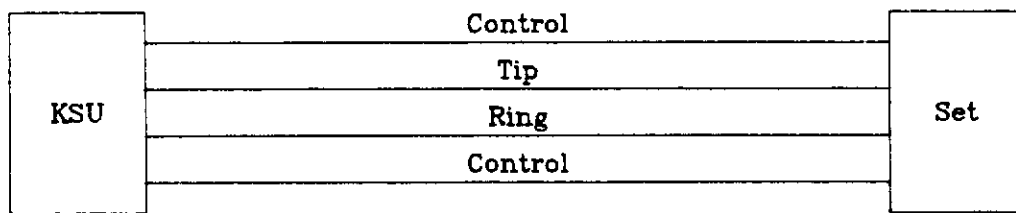
A.9 Installing Telephone Hybrids in Digital
Telephone Systems

So-called digital telephone systems provide a great
variety of features including speed dialing, call
forwarding, and so on. However, these same systems
that make business calls so easy tend to make the
engineer's life a little more complicated when adapting
them for use with telephone hybrids.

In most cases, a telephone hybrid can be installed into
a digital telephone system with good results. Hybrids
require a Tip and Ring pair, which is usually supplied
to extension phones from the EKSU when a line is
selected.

> NOTE: Some digital telephone systems actually
> digitize the audio signals being fed to the
> telephone sets. In such cases, it may be very
> difficult or impossible to make a hybrid work from
> an EKSU extension. Some manufacturers of such
> all-digital telephone systems can supply an
> adaptor which will allow you to easily connect a
> telephone hybrid to the system. Contact your
> telephone system's manufacturer for more
> information.

Installation of telephone hybrids in digital telephone
systems is more complicated than with standard, non-
digital systems. Digital telephone systems can use as
little as four or as many as eight wires to connect the
EKSU to each telephone set. A typical four wire system
is shown in Figure A-11.

```
          ┌──────┐         Control         ┌──────┐
          │      ├───────────────────────┤      │
          │      ├──────────Tip───────────┤      │
          │ KSU  │                         │ Set  │
          │      ├─────────Ring────────────┤      │
          │      ├────────Control──────────┤      │
          └──────┘                         └──────┘
```
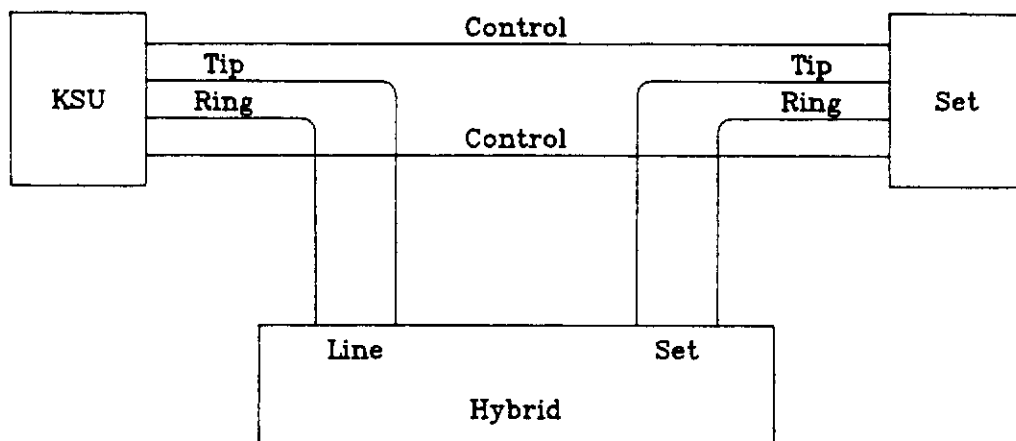
Typical Digital Telephone System

Figure A-11

The Tip and Ring wires, usually the middle pair, carry
the audio while the outer wires carry control
information. A system with six or eight wires uses the
additional wires for intercom or power. When
interfacing a telephone hybrid to this type of system,
the goal is to separate the audio pair from the rest of
the lines.

Basic installation in a four-wire system is shown in
Figure A-12. Note that the control lines remain
untouched. If your system uses six or eight wires, you
will also interface to just the audio pair.

This typical set-up permits the telephone to operate
normally when the hybrid is off. When the hybrid is
turned on, the Tip and Ring are routed to the hybrid
but the control functions are still active at the
telephone. This allows line selection commands to be
sent to the EKSU.

Basic Installation of Telephone Hybrid
in Digital Telephone System

Figure A-12

Some digital phone systems also use the Tip and Ring
pair to provide DC power to the telephone set, or they
might use a differential voltage between the audio and
control lines to carry the DC power. This sort of
phone system is easy to spot after you try the
interface shown in Figure A-12. If your system has DC
on the audio path, the telephone set will function
normally when the hybrid is off, but will go dead about
three seconds after the hybrid is turned on. In this
case, you need a DC path around the hybrid that does
not allow the hybrid to load down the DC. This is
accomplished with the addition of four components as
shown in Figure A-13.

When operating your hybrid with a digital phone, bear
in mind that the telephone set will have to be off hook
to send line selection commands to the KSU. If you
prefer to leave the handset on hook, you can try
selecting the hands free mode on the telephone set (in
many cases, this will route audio to the hybrid); you
could optionally interface to the hook switch wiring
inside the telephone.
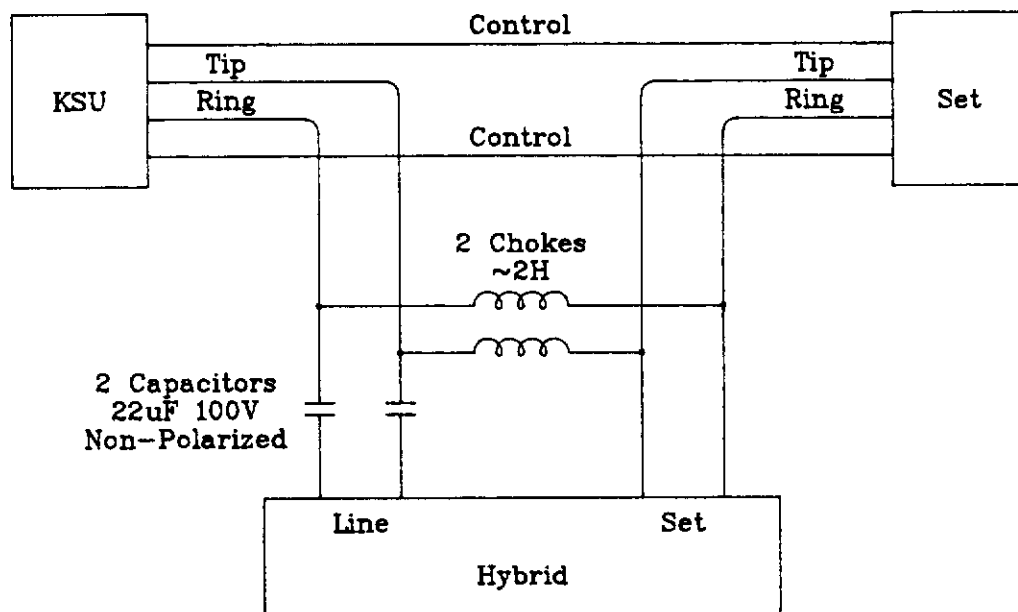
Installation of a Telephone Hybrid in a Digital Telephone System
with DC Voltage on the Audio Pair

Figure A-13

A.10 Frequency Extension

A major problem with standard, untreated telephone
lines is that their frequency response extends from 300
to 3300 Hz. Almost all male voices have significant
vocal energy below 300 Hz, which is lost on the
untreated telephone line.

Frequency Extenders help resolve this problem by
extending the frequency response of the telephone line.
A single line Frequency Extender (in the Encode mode)
shifts the Transmit audio of all frequencies up 250 Hz.
Thus, 50 Hz becomes 300 Hz and 3000 Hz becomes 3250 Hz,
placing the low frequencies within the bandwidth of the
telephone line. At the Receive side of the telephone
line, another Frequency Extender (in the Decode mode)
downshifts the audio, returning the 300 Hz to its
original 50 Hz position. This process preserves two
and a half octaves of critical low frequencies while
sacrificing only one seventh of an octave at the high
end.

All of Gentner's single line Extended Frequency
Transceiver (EFT) units employ patented circuitry for
generating additional new high frequency components
from the remote audio, thus giving the line an apparent
increase in high frequency response. This produces a
more natural sound from the telephone-transmitted
audio.

Frequency Extenders that provide greater audio
bandwidth are also available. Dual line Frequency
Extenders deliver a frequency response of 50 Hz to 5
kHz, using two telephone lines, by upshifting low
frequencies and downshifting higher frequencies so that
they will be passed by the telephone lines.

For those who require maximum performance, Gentner's
three-line EFT-3000 uses three standard telephone lines
to deliver audio with a frequency response of 50 Hz to
7.5 kHz.

Frequency Extenders are very useful in remote broadcast
applications, or for any application where full
fidelity audio transmissions are desirable.