

108

BROADCAST TELEPHONE SYSTEM

Installation and Operation Manual
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Foreword

The 108 Multi-Line Telephone Interface is easy to set-up and easy to use. Its proprietary embedded software allows sophisticated signal routing functions to be carried out with simple switches.

The system leaves the factory ready to install. Only minor fine-tuning will be necessary to match the 108's hybrids to the telephone lines in your area.

This manual is divided into nine sections. Before attempting to install or operate the 108, please take a few minutes to read this manual.

Section 1, Introduction

Gives a brief introduction to the 108, to this manual, and defines some of the specialized terms used.

Section 2, Installation

Discusses AC power, tools and supplies necessary for installation, F.C.C regulations, and desk console connections, provides a block diagram, includes connection of audio and telephone lines, adjustment of audio levels and hybrid networks, connection of the utility relays and opto-isolators, and acoustical problems that must be considered for proper operation of the 108.

Section 3, Options DIP Switch Programming

Gives switch settings for pre-setting certain control functions.

Section 4, Main Controller Unit Programming

The mode switch functions, and their effect on the 108's operation, are discussed. The six modes, and their use for different kinds of programming, are illustrated.

Section 5, Operation

Discusses system operation, including the use of all controls and switches, single and dual console operation.

Section 6, Typical Applications

Illustrates how the 108 works for one-person and two-person operations, contests, talk shows, listener polls, and off-air conference calls.

Section 7, Troubleshooting Guide

A quick listing of common malfunctions and their solutions, basic fault diagnosis procedures, and system block diagram.

Section 8, Specifications

Lists the 108 specifications.

Section 9, Warranty and Service

States the Symetrix limited warranty and gives instructions on how to obtain warranty and non-warranty service from Symetrix.

Appendix A how to derive a "mix-minus" signal.

Appendix B using electronically balanced inputs and outputs.

Appendix C sources for desk console cable and connectors.

Appendix D pin-out drawings for the 108's rear panel connectors.

Appendix E sources for microphone splitters.

Appendix F installing the 108RB accessory controller

Appendix G hybrid and phone line allocation

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1. Introduction

1.1 108 Description

The Symetrix model 108 Multi-line Telephone Interface is an electronic telephone system for broadcasting, teleconferencing, and audio production. The 108 has specialized switching systems that interface as many as eight standard dial-up telephone lines to an audio mixing console or tape recorder.

The 108 has three telephone hybrids, which electronically subtract studio generated audio from the bi-directional audio on the telephone line. The resulting signal is primarily the caller. Once separated by the hybrid, the caller signal may be routed through its own level control, re-combined (external to the 108) with the studio generated audio, and routed to either air or tape.

This separation of signals maintains the quality of the host's audio, and also maintains the obvious difference between the studio originated signals and telephone signals. Complex switching is made simple by the 108 - its operation is easily learned by non-technical personnel in a matter of minutes.

Installation of the system is straight-forward, but should not be undertaken before reading this manual. All telephone and audio in/out connections are made to the rack mountable controller unit, but all the controller's switching and signal routing functions are directed from a small, attractive desk console which is usually operated by the host.

Like all Symetrix products, the 108 Multi-line Telephone Interface is designed for years of trouble-free service. Rugged steel chassis enclosures are used for their superior interference protection and excellent mechanical integrity. All circuit boards are glass/epoxy, with 2-ounce copper traces. For serviceability, all semiconductors are socketed, except where contra-indicated by design or performance considerations.

1.2 About this Manual

This manual is organized into nine sections. A general description of each Section can be found in the Foreword.

1.2.1 Notation Conventions

Within this manual several different notation conventions are used:

- "CAPS" (in quotes) indicate a marked feature on the 108, like the "RELEASE" key or the "CALLER OVERRIDE" control.
- CAPS (no quotes) are used to identify signal paths, like AIR or CUE.
- Boldface type** is used for emphasis.

1.2.2 Notes, Cautions, Warnings

Some of the text in this manual is set apart by one of the headings Note, Caution, or Warning. These terms are used to designate varying degrees of awareness required of the user during installation or operation of the 108.

A Note conveys information that is included to make certain functions more obvious, and to supply extra information about process, techniques, connectors, etc. An example of a NOTE may be found in Section 4.1.

A Caution indicates a potential danger to the 108. An example of a CAUTION may be found in Section 2.1.

A Warning indicates a potential hazard to the operator. An example of a WARNING can be found in Section 2.2.3.

1.2.3 Definition of Terms Used in this Manual

| | |
|-----------------|--|
| 25-pair cable | The large, grey jacketed cable used to connect the controller unit to the desk console. As supplied, the cable is with the fitted with 50-pin D connectors. |
| Central office | The telephone company facility where the phone lines for each exchange are terminated. The central office (C.O.) for any line, in any exchange, is indicated by the three digit prefix of the phone number (all lines of the same prefix are terminated at the same C.O.). |
| Controller Unit | One of the two types of chassis components that comprise the 108 system. The controller unit requires AC power, and may be placed on any flat surface, or mounted in a 19" rack. It may be identified by the several holes in its flat front panel, and by the eight modular telephone connectors (Telco 1-8) on the back panel. |
| Desk console | The other chassis component of the 108 that may be identified by the switches and knobs mounted on a sloped front panel. The desk console is designed to be placed on a table top. It gets its power via the 25-pair cable from the controller unit. Two desk consoles may be used with the 108 system. |
| Hybrid | An electronic device used to separate studio generated transmit audio (the host), from audio received via the telephone lines (the caller). There are three hybrids in the 108, each capable of handling two telephone lines simultaneously. |
| Mix-minus | <p>The audio signal from the studio that's fed to the caller via the 108's transmit audio inputs.</p> <p>The mix-minus signal must contain only studio generated (host) audio. The caller signal from the telephone line must not appear in the mix-minus signal. The mix-minus signal must be generated outside the 108 (see Section 2.3.1 and Appendix A).</p> |

Options OFF switch The 4-position switch visible through the small square hole in the front panel of the controller unit. This switch pre-sets certain general operating conditions (see Section 3).

Receive audio The audio signal received via one (or more) of the eight telephone lines. Receive audio is the caller's signal.

Tip and ring The two legs (hi or +, and low or -) of the balanced telephone line from the telephone company central office (C.O.).

Transmit audio The studio generated audio signal from the host's microphone. Transmit audio is also referred to as the mix-minus signal.

2. Installation

Use the following as an installation checklist.

- ___ Read this manual, gather the necessary tools and supplies.
- ___ Physically install the 108 controller and the desk console(s) in their intended operating locations.
- ___ Connect telephone lines to the controller unit. (Section 2.2.5)
- ___ Run and connect the 25-pair interconnecting cable(s) from the 108 controller to the desk console(s). (Section 2.2.6)
- ___ Connect the transmit audio signal to the audio I/O module transmit audio input. If the transmit audio signal is microphone level, remove the top cover of the 108 controller and re-set the MIC/LINE switch on the audio I/O module PCB. (Section 2.4.2)
- ___ Connect the air-monitor (or board output) signal to the audio-on-hold input. (Section 2.3)
- ___ If you use an external hybrid network, connect it to the hybrid module. (Section 2.5)
- ___ Hook-up the controller unit's utility connections as required. (Section 2.B.3)
- ___ Make the various audio module level adjustments. (Section 2.4)
- ___ Make the various hybrid level and balance adjustments. (Section 2.6)
- ___ Set the Option DIP switches on the controller unit as required. A good starting point is all switches in the DOWN position. (Section 3)
- ___ Select an operating mode appropriate to your application. (Section 4)

2.1 Power Requirements

The 108 is comprised of two major components: the desk console and the controller unit. The controller unit is a standard EIA 19" rack mount package. AC power is applied to the controller unit only. The desk console receives its power through the interconnecting cable. The factory prewired nominal operating voltage is marked on the rear panel of the 108 controller unit. Maximum power consumption is 20 watts. The power cord uses a standard IEC connector, which provides chassis ground to the AC mains line.

=====
CAUTION

Do not attempt to operate the 108 if the factory prewired nominal operating voltage is different from the nominal operating voltage in your locale.
=====

2.1.1 Voltage Changeover

If the factory specified nominal operating voltage is different from the voltage in your locale do not attempt to operate the 108. Contact the Symetrix Customer Service Department directly for instructions regarding voltage changeover. See CAUTION above - operating the 108 with improper voltage may result in severe damage.

2.1.2 Rear Panel AC Mains Fuse

The following table indicates the proper AC mains fuse rating for the AC voltage in your locale.

Table 2.1 - AC Mains Fuse Requirements

| Nominal Voltage (AC) | Fuse |
|----------------------|----------------------|
| 100 | 3AG 1 amp slow blow |
| 120 | 3AG 1 amp slow blow |
| 220 | 3AG .5 amp slow blow |
| 240 | 3AG .5 amp slow blow |

Verify mains fuse rating before operating the 108.

2.1.3 Mounting

The 108's controller unit can be mounted in a standard 19" relay rack, or it can rest on any flat surface. It is 5.25" (3 rack spaces) high, and 11" deep.

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CAUTION

Do not mount the 108 controller unit in an unventilated rack. Do not obstruct air-flow around the 108. The controller unit's maximum ambient operating temperature is 38° C (100° F).

=====

If the 108 is to be transported while rack mounted, protect the controller unit from excessive mechanical stress by supporting the back of the chassis in an appropriate manner.

2.2 Controller Unit Connections

2.2.1 Supplies Required for Connection

The following supplies are required to connect the 108 to your system:

- * shielded cable Two wire, twisted pair shielded cable for all audio connections. Belden 8761, 8451 or equivalent.
- * terminal lugs Crimp or solder type lugs suitable for #6 screw terminal. AMP #52929, spring spade, 22-16 awg., #6 stud or equivalent.

- * telephone extension with RJ-11 modular connectors Four wire modular connectors. Prewired telephone extension cords may also be used. Radio Shack part numbers are:
 - 279-374 12' extension with two RJ-11
 - 279-366 35' extension with two RJ-11
 - 279-364 25' extension, RJ-11 to space lugs

- * 25-pair cable 50-conductor paired cable terminated with male and female micro Blue Ribbon connectors. These cables are commonly used for interconnecting key telephone systems. (A suitable cable is supplied with the 108.) DO NOT SUBSTITUTE CABLE TYPES - SEE CABLE SPEC. IN APPENDIX C.

2.2.2 Tools and Test Equipment Required

You will need the following tools and test equipment to perform the various adjustments necessary to complete the installation of the 108:

- * screwdriver A small (1/8") flat blade screwdriver

- * AC voltmeter An AC voltmeter capable of measuring -40dBm, with a high impedance input (1Meg ohm).

2.2.3 Federal Communications Commission (FCC) Regulations

To comply with FCC regulations, the following conditions MUST be met:

1. The FCC registration number of this device (EYDSQ3-15392-0T-T) and Ringer Equivalence Number (0.5B) must be reported to the telephone company. This information can be found on the label attached to the side panel of this device.

2. The Symetrix model 108 complies with the requirements in Part 15 of FCC Rules for a "Class A" computing device. Because of the high speed micro-processor contained in the 108, operation of the 108 in a residential area may cause unacceptable interference to radio and TV reception, requiring the operator to take whatever steps are necessary to correct the interference, at his own expense.

3. The 108 must not be used with coin-operated or multi-party lines.

4. If the 108 malfunctions, the telephone company may temporarily disconnect service. If disconnection is necessary, the telephone company must attempt to notify the user in advance, if possible. If not, they must notify the user as soon as possible.

5. Repair work on the model 108 must be done by Symetrix, Inc. The 108 has been approved by the Federal Communications Commission (F.C.C.) under Part 68 of their regulations for direct connection to telephone lines in the USA.

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WARNING

FEDERAL COMMUNICATIONS COMMISSION REGULATIONS PROHIBIT
SERVICING OF THE 108 BY ANYONE OTHER THAN SYMETRIX
PERSONNEL. REPAIR OR ADJUSTMENT OF THE 108 OUTSIDE THE
SYMETRIX FACTORY IS A VIOLATION OF FEDERAL LAW.

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2.2.4 108 Block diagram

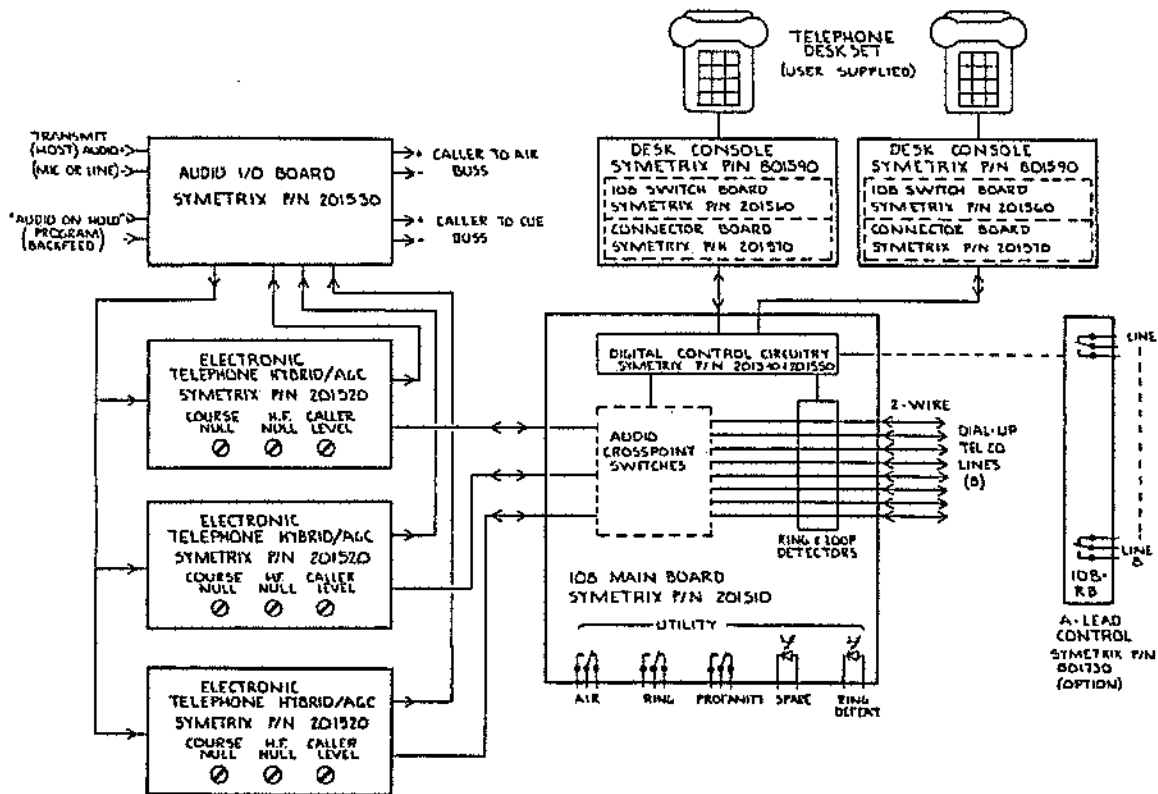


Figure 2.1 - 108 system basic block diagram (some functional blocks have been omitted for clarity).

2.2.5 Connecting Telephone Lines

The 108 accepts up to eight incoming telephone lines. The eight lines may be connected to the 108's controller unit via rear panel mounted modular connectors. On the rear panel you will see these connectors labeled "TELCO LINE 1," "TELCO LINE 2," ... "TELCO LINE 8." Have your local telephone company terminate incoming lines with one of the following connectors:

USOC-RJ11W USOC-RJ11C

With these connectors in place, the 108 may be connected by running a standard telephone extension cable between the incoming telephone company termination connector and the appropriate connector on the back of the 108. If you have fewer than eight incoming telephone lines, connect the available lines in sequence beginning with the input marked "TELCO LINE 1"

The 108 has been approved by the Federal Communications Commission (FCC) under Part 68 of their regulations for direct connection to telephone lines in the US.

2.2.6 Connecting the Desk Consoles

The 108 system supports a maximum of two desk consoles. They are identified as "Console A" and "Console B".

The desk consoles are connected to the controller unit with a 25-pair cable, terminated in 50-pin "D" connectors. The 108 desk consoles are supplied with 25 feet of cable, but up to 300 feet of cable may be used between the desk console and the controller unit. To add additional cable, see Appendix C for the cable specification.

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=====
                        CAUTION
Before connecting a desk console to the 108
controller unit, make sure the AC power switch on the
back of the 108 controller unit is in the "OFF"
position.
=====
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To connect the desk console(s):

- * Connect the female end of the cable to the desk console. Secure the connector with the retaining clip.
- * Connect the male end of the cable to the connector marked "CONSOLE A" on the back of the controller unit. Secure it with the retaining clip.
- * If the second console is to be used, connect the male end of the second console's cable to the connector on the back of the controller unit marked "CONSOLE B".

2.2.7 Connecting the 108RB Accessory Controller

The Symetrix 108RB is an accessory device that provides relay switching for additional functions external to the 108, such as key system A-lead control or telephone line transfer. Installation instructions for the 108RB are given in Appendix F.

2.3 Connecting Audio Module Inputs and Outputs

Before making any audio connections to the 108 make sure the "POWER" switch on the back of the 108 controller unit is in the "OFF" position. The 108 audio module connections are made to barrier strips on the controller unit's rear panel.

The audio modules are labelled "AUDIO I/O", "HYBRID", "HYBRID" and "HYBRID". Before making any connections to the 108 audio modules, be sure you have on hand:

- * sufficient shielded wire to connect the 108 to and from your mixing console, and
- * a quantity of #6 crimp-on terminal lugs. (See Appendix A for a terminal lug specification)

Extra inputs and outputs are included on the 108 to provide extra versatility for special circumstances. In most installations the extra connections will not be used. However, every installation requires a minimum of two audio connections:

- * transmit (host) audio
- * receive audio

=====

CAUTION

The 108's electronically balanced outputs emulate floating (transformer coupled) type outputs. The unused leg must be grounded. Because current flows in this ground connection, it is important that the unused output be grounded to the 108's circuit ground terminal to prevent ground loops. (See Table 2.2)

=====

Table 2.2 - Audio Module Connections

| Pin Number | Description | Source Impedance | Load Impedance | Level (dBu) |
|------------|-------------------------------|------------------|----------------|-------------|
| 1 | Audio-on-hold input low (-) | n/a | 20k | -10 to +4 |
| 2 | Audio-on-hold input hi (+) | n/a | 20k | -10 to +4 |
| 3 | Circuit ground | | | |
| 4 | *Transmit audio input low (-) | n/a | line: 50k | -10 to +4 |
| 5 | *Transmit audio input hi (+) | n/a | mic: 100 | -50 to -30 |
| 6 | Circuit ground | | | |
| 7 | Receive audio output hi (+) | 100 | >600 | 0 to +4 |
| 8 | Receive audio output low (-) | 100 | >600 | 0 to +4 |
| 9 | Cue audio output hi (+) | 100 | >600 | 0 to +4 |
| 10 | Cue audio output low (-) | 100 | >600 | 0 to +4 |

*see Appendix A for information on transmit audio and mix-minus signals

2.3.1 Transmit (host) audio (mix-minus)

Transmit (host) audio is the studio originated signal (the host) that is fed to the caller. This signal is also called "mix-minus," because it is the normal "air" mix, minus the caller signal.

The mix-minus signal must be derived external to the 108. See Appendix A for specifics.

Connect the transmit (host) audio signal to terminals 4 and 5 on the audio module connector strip. See Appendix B for information on balanced or unbalanced operation of electronically balanced inputs and outputs.

In situations where it is not possible to derive a mix-minus signal from your console, or where no mixing console is being used, the 108 has provisions for

accepting a microphone input level. There is a circuit board mounted within the Audio I/O module that selects either microphone input level or line input level; see section 2.4.1.

2.3.2 Receive Audio

Receive audio is the signal received from the telephone line (the caller). This signal enters the 108 through the modular phone jacks on the rear panel, and exits through the "RECEIVE AUDIO OUTPUT" (terminals 7 and 8 on the audio module, and the "CALLER AUDIO OUTPUT" (terminals 5 and 6 on the hybrid modules).

2.3.3 Audio-on-Hold

In addition to transmit and receive audio you may wish to provide audio-on-hold. The 108's audio-on-hold input allows studio generated audio to be sent to the caller whenever he is placed on HOLD. Any audio source may be used (even background music), but for talk shows the caller usually gets the "air" signal so he can listen to the show while he's on HOLD.

All the 108's inputs and outputs are electronically balanced. Refer to Appendix D for audio connection documentation, and to Appendix B for information on balanced vs. unbalanced operation of electronically balanced inputs and outputs.

2.4 Audio Module Level Adjustments

The 108 has four modules. There are three hybrids (that separate studio audio from caller audio), and one audio I/O module (to provide signal interface with the mixing console, tape machine, etc.). There are test points and trim pots on the modules to adjust:

- * The 108's audio input/output levels to match your audio mixing console
and
- * The 108's electronic hybrids to match your local telephone line's impedance.

Several adjustments **must** be made before attempting to use the 108. As you face the front panel of the 108 controller unit the modules are (from left to right): Audio I/O, Hybrid, Hybrid and Hybrid.

2.4.1 Adjusting Audio I/O Level

Transmit (host) audio level adjustments are made on the Audio I/O module. The adjustments on this module are:

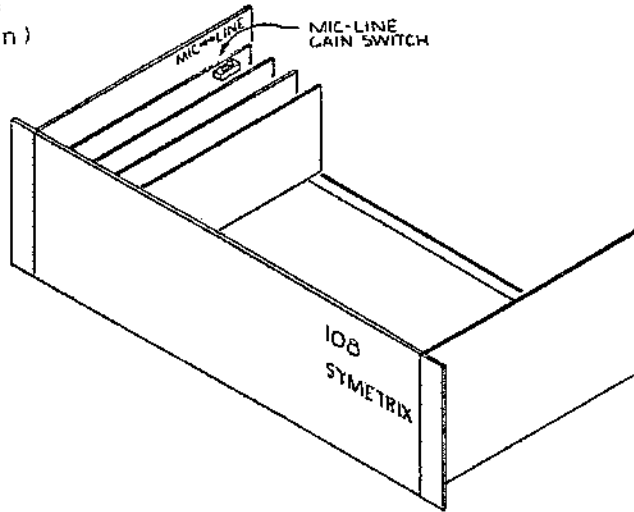
- * mic/line select switch
- * transmit (host) audio level
- * audio-on-hold level

The mic/line select switch is located internally on the Audio I/O module printed circuit board. The top of the 108 must be removed to access this switch.

The "TRANSMIT (HOST) LEVEL", and "AUDIO ON HOLD LEVEL" controls, are located on the front panel. To adjust these controls you will need a small (1/8") flat-blade screwdriver. Also located on the front panel, just below the "TRANSMIT (HOST) LEVEL", is the transmit level test point. You will need an AC voltmeter to monitor the level at this point while adjusting the "TRANSMIT (HOST) LEVEL" control (see procedure below).

2.4.2 Setting Transmit (Host) Audio Source Level

The 108 will accept incoming audio signals at either microphone level (nominal -50dBm) or line level (nominal -10dBm to +4dBm). The 108 is shipped from the factory with the mic/line select switch in the line (low gain) position (slide switch toward the rear of the 108 chassis).



Transmit (host) audio from a mixing console requires no change.

To feed transmit (host) audio to the 108 directly from a microphone, remove the top cover and slide the switch forward (toward the 108 front panel), to the high gain position.

The top cover is secured by a total of 18 fasteners - 4-Allen head screws at the front, 3-Phillips head on each side panel, and 8-Phillips head on the rear panel.

The Allen head screws require a 5/64" hex driver. The Phillips head screws require a #1 Phillips driver.

=====
WARNING
DISCONNECT THE POWER CABLE FROM THE REAR PANEL AC CONNECTOR BEFORE REMOVING THE TOP COVER. CHANGE ONLY THE MIC/LINE SWITCH. DO NOT ATTEMPT TO MAKE ADJUSTMENTS TO ANY OTHER COMPONENTS. ADJUSTING OR TAMPERING WITH THIS DEVICE IS A VIOLATION OF FCC REGULATIONS, AND MAY VOID THE WARRANTY.
=====

2.4.3 Adjusting Transmit (host) Audio Level

To adjust the "TRANSMIT (HOST) LEVEL" control insert one of the probe leads from an AC voltmeter into the test point, located just below the "TRANSMIT (HOST) LEVEL" control. Connect the other lead to the 108 circuit or chassis ground. Have someone speak into the host microphone in a normal speaking voice. Adjust the "TRANSMIT (HOST) LEVEL" control (a multi-turn potentiometer) until a level of -10dBm is displayed on the voltmeter.

2.4.4 Adjusting Audio-on-Hold Level

To adjust the "AUDIO ON HOLD LEVEL" control, use the device to call in on one of the other lines.

Listen on the deskset receiver. Adjust the "AUDIO ON HOLD LEVEL" control (a multi-turn potentiometer) until the program level on the phone is the same as a normal phone call. Higher than normal phone call levels may cause distortion, and may also violate F.C.C. rules regarding allowable levels on phone lines.

2.5 Hybrid Module Connections (External)

Each of the three hybrid modules has seven connections. In most situations these connections are not used. They are provided to increase versatility for unusual situations that require:

- * External hybrid(s)
- * Access to individual caller audio (in AIR mode)

Table 2.3 - Hybrid Module Connections

| Pin Number | Description | Source Impedance | Load Impedance | Level (dBU) |
|------------|---|------------------|----------------|-------------|
| 1 | Connect to external hybrid's 2-wire Telco input | | | |
| 2 | Connect to external hybrid's transmit input | | | |
| 3 | Connect to external hybrid's caller output | | | |
| 4 | Circuit ground | | | |
| 5 | Caller audio output hi (+) | 100 | >600 | +4 |
| 6 | Caller audio output low (-) | 100 | >600 | +4 |
| 7 | Circuit ground | | | |

2.5.1. Using an External Hybrid

Use the hook-up information in Table 2.3 above. Connect the external hybrid to pins 1, 2, and 3. External hybrids that require direct connection to the telephone company's C.O. tip and ring cannot be used with the 108.

2.5.2 Access to Caller Audio

For situations that require different levels, or perhaps different EQ for individual phone lines (such as when two guests or guest hosts are brought in via phone lines) caller audio is available on pins 5 and 6 of the hybrids. The caller audio outputs are active ONLY when the line is on the air. At all other times the caller audio outputs are muted.

2.6 Hybrid Module Adjustments

For proper performance of the 108, the hybrids must be matched to the local telephone line's.

2.6.1 Caller Level Adjustment

Each hybrid module contains a screwdriver adjustable "CALLER LEVEL" adjustment. This control adjusts the caller return level from each of the 108's telephone hybrid circuits.

=====
CAUTION

The "CALLER LEVEL" controls have been carefully adjusted at the Symetrix factory. Do not adjust these controls. Consult Symetrix if the caller level seems too low.
=====

If the "CALLER LEVEL" is increased beyond the factory preset level, oscillation, or "singing," will occur when two or more calls are conferenced on AIR or CUE.

These controls need only be adjusted when the 108 is used outside the U.S., where telephone line operating levels are lower than the standard U.S. operating level. Contact Symetrix if the caller level seems too low.

2.6.2 Balancing the Hybrids

Each hybrid module contains screwdriver adjustable "COARSE NULL" and "HIGH FREQUENCY NULL" adjustments.

These adjustments minimize the amount of transmit (host) audio in the receive (caller) signal, maximizing telephone audio quality and reducing the possibility of acoustic feedback. These controls must be properly adjusted for optimum performance of the 108.

For this adjustment procedure it's most helpful to have two persons present - one to speak into the announce mic, and another to monitor levels and make adjustments. Three simultaneous outside telephone line connections are required for this procedure. Proceed as follows:

1. Dial three outside telephone numbers and ask the parties to set the receivers down, or not to speak for a while. (If the lines used for this procedure are in the studio or control room, be sure the monitor speaker is turned off. Sound from the monitor speaker will return to the system through the off-hook telephone, making it impossible to null the hybrid.)
2. Move the slide switches on the back of two of the hybrid modules to the down "EXT" (external) position. This will momentarily prevent the three calls from "conferencing," which makes hybrid network adjustments nearly impossible because of the interaction between the two telephone lines.

3. Place all three lines in AIR.
4. Monitor the caller output with stereo headphones plugged into the desk console. Unfortunately, you may monitor the caller return level with your hi-voltsmeter connected to the hybrid null test point.
5. Have someone speak into the announce mic. Adjust the "COURSE HYBRID NULL" control on the hybrid whose switch is in the up "INT" (internal) position for MINIMUM return of the announce mic signal as heard through the headphones that are plugged into the 108 desk console. Adjust the "HIGH FREQUENCY NULL" control to further minimize the return signal.
6. Switch the hybrid module that's now adjusted to the "EXT" (or down) position, and switch another hybrid module to the "INT" (or up) position. Adjust this module as outlined above.
7. After all three hybrid modules have been adjusted be sure the rear panel INTERNAL/EXTERNAL switches are in the up (internal) position. This completes hybrid null adjustment.

2.6.3 Utility Connections

The 108 provides three output relays and two input opto-isolators to send and receive information to and from the outside world. Connections to these relays and opto-isolators are made on a thirteen pin horizontally mounted terminal strip on the back of the controller unit. The connections are numbered from 1 - 13 (right to left).

Ring relay - When an incoming telephone rings this relay will close and open in time with the ring pulses. To make a visual ring indicator, connect this relay to an external high current relay to turn a lamp on and off. The ring relay contacts are rated at 24 volts DC, 1 amp resistive load, or .5 amp inductive load.

Air relay - This relay closes when one or more callers are on the air.

Profanity relay - This relay closes for one second every time the "PROFANITY" key on the host's console is pressed. The relay stays closed as long as the "PROFANITY" key remains pressed.

Ring defeat opto-isolator - When a voltage (5 - 12 volts DC) is applied to the ring defeat opto-isolator, the desk console(s) internal ringer is turned off.

Spare opto-isolator - This opto-isolator has no function as of this writing.

Table 2.4 - Utility Relay and Opto-isolator Connections

| Pin Number | Description |
|------------|--|
| 1 | Desk console ring defeat, opto anode (-) |
| 2 | Desk console ring defeat, opto cathode (+) |
| 3 | Spare (-) |
| 4 | Spare (+) |
| 5 | Ring relay - normally closed connection |
| 6 | Ring relay - common |
| 7 | Ring relay - normally open connection |
| 8 | Profanity relay - normally closed connection |
| 9 | Profanity relay - common connection |
| 10 | Profanity relay - normally open connection |
| 11 | Air relay - Normally closed connection |
| 12 | Air relay - common connection |
| 13 | Air relay - normally open connection |

2.7 Acoustical Considerations

Whenever a loudspeaker of any type is used to monitor caller audio, host audio or both, care must be taken to prevent feedback. Feedback occurs when:

- * the input source (microphone or telephone) is physically too close to the output source (speaker or headphones), and/or
- * the speaker or headphones are turned up too loud.

Naturally, any combination of too close and too loud will aggravate the situation. Feedback is insidious - it often goes unnoticed. Even the slightest feedback will cause serious problems when telephone hybrids are in use, because the hybrids are intended to separate the telephone line audio from the studio generated audio. Feedback re-combines the signals acoustically, thereby defeating the operation of the hybrids.

Take these precautions to help prevent feedback:

1. Use headphones or earpieces whenever possible. Keep the volume as low as possible at all times.
2. Use directional microphones whenever possible (most lavaliers are NOT directional).
3. If there is no alternative and a loudspeaker must be used for monitoring:
 - * keep the volume as low as possible at all times
 - * experiment with speaker placement - DO NOT point the speaker toward the microphones.
 - * use a graphic or parametric equalizer to remove feedback frequencies from the loudspeaker signal.
4. If the studio has hard "live" surface treatment (tile, brick, glass, painted sheetrock, etc.), treat reflective surfaces near the speaker and/or microphones with acoustically absorbent materials.

3. Options DIP Switch Programming

3.1 Switch Settings

Located on the front panel of the controller unit is a four-position DIP switch. Certain parameters of system operation (affecting both desk consoles and all telephone lines) are pre-set by these switch settings.

Explanations of how the various options are used may be found in Sections 3.1.1 through 3.1.4 directly following the table below.

Table 3.1 - Options DIP Switch Settings

| Switch | Position | Functions |
|----------|----------|---|
| 1 | UP | Incoming calls may NOT be answered directly to air. |
| | DOWN | Incoming calls may be answered directly to air without having to be received on either the LINE or CUE areas. |
| 2 | UP | 50 millisecond abandon hold time (see paragraph below) |
| | DOWN | 450 millisecond abandon hold time. In the majority of domestic locales the DOWN (factory pre-set) position is the proper choice. |
| 3 | UP | Denies release from hold. The operator must first return a line from hold to AIR, CUE, or LINE before release is allowed. |
| | DOWN | Allows the operator to release a caller from hold. |

3.2 DIP Switch Operating Considerations

3.2.1 Switch 1

Set this switch in the UP position for situations where calls must not be answered directly to AIR. Use this option when on-air lines are shared with the business office to prevent the possibility of business calls or pranksters from inadvertently being put on the air.

Set this switch in the DOWN position for situations where the air personality must put calls on the air without pre-screening. Use this option for phone contests, and request shows.

3.2.2 Switch 2

Proper setting of this switch will prevent "dial tone on the air syndrome." Don't change the setting of Switch 2 from the factory pre-set position unless the 108 will not release a line that's been hung up by the caller.

When a caller who is on HOLD abandons the line, the telephone company central office interrupts the tip and ring current. The length of this interrupt varies in different locales.

Switch 2 matches the 108's internal timing to the length of the interrupt. The DOWN position of the switch matches a 450 millisecond abandon interrupt. The UP position of the switch matches a 50 millisecond abandon interrupt.

In the majority of domestic locales the DOWN (factory pre-set) position is the proper choice. Some newer solid state C.O.'s do not release an abandon interrupt. In these locales, lines must be released manually with the 108's "RELEASE" key.

3.2.3 Switch 3

In the UP position, callers cannot be released from HOLD. For fast-paced operations in which the 108 is in Mode One or Mode Four, this switch should be set UP. This will prevent the inadvertent disconnection of callers by a "slip of the finger," which can happen when the air personality has to do everything.

3.2.4 Switch 4

Switch 4 is spare. It is not used as of this writing.

4. Main Controller Unit Programming Mode Select Switch

The 108 has 6 basic operating modes that are set by the "MODE SELECT SWITCH". Operating mode selection changes the relationship between the two desk consoles, allowing the 108 system to be configured for different operating situations.

The "MODE SELECT" switch is a momentary-contact switch located on the front of the controller module. To the right of the "MODE SELECT" switch are six LED's that indicate which operating mode has been selected.

When power is first applied to the 108, the system automatically comes up in Mode 1. Each time the "MODE SELECT" switch is pushed, the system steps to the next operating mode. If the switch is pushed six times, the 108 will step through all six modes, then back to Mode 1. Once changed, the new mode setting is effective immediately.

For security, the switch is recessed. A pen, pencil, screwdriver, (or some other small cylindrical object) must be inserted through the front panel to actuate the switch.

NOTE

If power to the 108 is interrupted the system resets to Mode 1.

The "MODE SELECT" switch will not operate whenever a desk console is in use. If a line has been seized, the operation of the "MODE SELECT" switch is defeated until it is released.

Each mode changes the operation of certain switches on the two consoles, allowing the 108 to be used in a variety of different situations. The modes can be thought of in pairs. There are three different modes, each having a complementary mode in which the functions of the two consoles are reversed.

Table 4.1 summarizes the operation of the "MODE SWITCH" and its affect on the function of the two consoles. The asterisks indicate which keys are active on the individual consoles, in each of the six modes.

Note that Modes 1 and 4, 2 and 3, 5 and 6 are complementary.

Table 4.1 - Mode Switch Summary

| Mode | 1 | 2 | 3 | 4 | 5 | 6 |
|-------------|---|---|---|---|---|---|
| Console | A | B | A | B | A | B |
| LINE | * | | * | * | | * |
| CUE/HOLD | * | * | * | * | * | * |
| AIR | * | * | | * | * | * |
| RELEASE | * | * | * | * | * | * |
| AIR TO CUE | * | * | | * | * | |
| AIR TO HOLD | * | * | | * | * | * |
| PROFANITY | * | * | | * | * | * |

4.1 Mode 1 (combo one-man show)

Mode 1 is used whenever Console B is not used, or must be rendered inoperative.

| Console A (Host) | | Console B (not used) |
|------------------------|--|----------------------|
| LINE keys active | | LINE keys dead |
| CUE/HOLD keys active | | CUE/HOLD keys dead |
| AIR keys active | | AIR keys dead |
| RELEASE key active | | RELEASE key dead |
| AIR TO CUE key active | | AIR TO CUE key dead |
| AIR TO HOLD key active | | AIR TO HOLD key dead |
| PROFANITY key active | | PROFANITY key dead |

4.2 Mode 2 (two man show)

Mode 2 is used whenever a Call Director is on Console B. The CUE function of Console B's "CUE/HOLD" keys is defeated, so only the Host can put a call on CUE.

The Call Director uses the HOLD ON CUE as a holding area to tell the Host which calls have been screened, and are ready to be put on-the-air. (See Section 5, Operating the 108.)

| Console A (Host) | | Console B (Call Director) |
|------------------------|--|-------------------------------------|
| LINE keys dead | | LINE keys active |
| CUE/HOLD keys active | | CUE/HOLD keys active (to HOLD only) |
| AIR keys active | | AIR keys dead |
| RELEASE key active | | RELEASE key dead |
| AIR TO CUE key active | | AIR TO CUE key dead |
| AIR TO HOLD key active | | AIR TO HOLD key dead |
| PROFANITY key active | | PROFANITY key dead |

4.3 Mode 3 (same as Mode 2, with the consoles reversed)

As the inverse of Mode 2, this mode is used whenever a Call Director is using Console A. The CUE function of the "CUE/HOLD" key on Console A is defeated.

| Console A (Call Director) | | Console B (Host) |
|-------------------------------------|--|------------------------|
| LINE keys active | | LINE keys dead |
| CUE/HOLD keys active (to HOLD only) | | CUE/HOLD keys active |
| AIR keys dead | | AIR keys active |
| RELEASE key active | | RELEASE key active |
| AIR TO CUE key dead | | AIR TO CUE key active |
| AIR TO HOLD key dead | | AIR TO HOLD key active |
| PROFANITY key dead | | PROFANITY key active |

4.4 Mode 4 (same as Mode 1 with the consoles reversed)

Mode 4 is used when a Host is not needed, or must be rendered inoperative.

| Console A (not used) | Console B (Host) |
|----------------------|------------------------|
| LINE keys dead | LINE keys active |
| CUE/HOLD keys dead | CUE/HOLD keys active |
| AIR keys dead | AIR keys active |
| RELEASE key dead | RELEASE key active |
| AIR TO CUE key dead | AIR TO CUE key active |
| AIR TO HOLD key dead | AIR TO HOLD key active |
| PROFANITY key dead | PROFANITY key active |

4.5 Mode 5 (two-man show)

Unlike Mode 2, Mode 5 allows the Host to use the deskset telephone by making the "LINE" keys active. In addition, this mode does not allow the Call Director (Console B) to release calls.

| Console A (Host) | Console B (Call Director) |
|------------------------|-------------------------------------|
| LINE keys active | LINE keys active |
| CUE/HOLD keys active | CUE/HOLD keys active (to HOLD only) |
| AIR keys active | AIR keys dead |
| RELEASE key active | RELEASE key active |
| AIR TO CUE key active | AIR TO CUE key dead |
| AIR TO HOLD key active | AIR TO HOLD key dead |
| PROFANITY key active | PROFANITY key dead |

4.6 Mode 6 (same as Mode 5, with the console functions reversed)

Mode 6 provides the same functions as Mode 5, but the consoles are reversed.

| Console A (Call Director) | Console B (Host) |
|-------------------------------------|------------------------|
| LINE keys active | LINE keys active |
| CUE/HOLD keys active (to HOLD only) | CUE/HOLD keys active |
| AIR keys dead | AIR keys active |
| RELEASE key active | RELEASE key active |
| AIR TO CUE key dead | AIR TO CUE key active |
| AIR TO HOLD key dead | AIR TO HOLD key active |
| PROFANITY key dead | PROFANITY key active |

5. Operating the 108

The desk console controls all normal operations of the 108. Its twenty-eight momentary contact keys, with associated LED indicators, control the switching of the 108 system. In addition to the momentary contact keys, each console has two rotary knobs for the functions "CALLER OVERRIDE" and "MONITOR GAIN," and a side-panel mounted slide switch to defeat the ringer.

5.1 Desk Console Connectors

There are three connectors on the rear panel of the desk console.

5.1.1 The "DESKSET" Desk Console Modular Phone Jack

A standard telephone deskset should be plugged into the RJ-11 modular jack located on the back of the desk console.

```
=====
                        NOTE
Phones used with the 108 desk console must be of the touch-tone
(DTMF) variety. Rotary (pulse) phones will not function
properly.
=====
```

5.1.2 The "STEREO PHONES" Jack

On the back of the desk console is a 1/4" stereo jack labelled "STEREO PHONES." The caller signal from the AIR or CUE buss appears at this jack. The signal at this point is floating (transformer isolated from system signals and from ground). Identical signals appear on both the left and right headphones.

5.1.3 The Controller Unit/Desk Console Interface Connector

The 25-pin D connector is used with the 25' multi-conductor cable that connects the desk console(s) to the controller unit. See Section 2.2.6 for detailed information.

5.2 Desk Console Controls

There are two rotary controls located at the upper right corner of the desk console's control panel.

5.2.1 "CALLER MONITOR GAIN"

This control sets the level of the signal appearing at the "STEREO PHONES" jack on the back of the desk console. The signal at this jack is the same as the AIR or CUE signal in the 108. It is transformer isolated from the system. The host signal does not appear at this jack (assuming the hybrids are properly nulled).

5.2.2 "CALLER OVERRIDE"

The caller override function reduces the loudness of the caller signal whenever the host speaks. Full counterclockwise rotation disables the caller override function. In this state the host and caller communicate in full-duplex.

With the "TALKER OVERRIDE" control in its full clockwise rotation the talker audio is greatly attenuated relative to the host speaker. Four to twenty degrees and less than rotation provide varying amounts of blending. Moderate amounts of talker override can greatly improve the effective performance of the hybrids, and also allow the host to easily dominate the conversation.

5.3 Using the "LINE" Keys

The top row of eight keys are the "LINE" keys. Each key corresponds to one of the eight telephone lines. The "LINE" keys are active only when a telephone deskset is plugged into the modular jack on the back of the 108 desk console. When the deskset receiver is on-hook, the "LINE" keys are active. When the receiver is off-hook, they are inactive. Each line key, has an associated LED indicator.

With the "LINE" keys, the deskset may be used to answer incoming calls off-air, and to originate calls off-air. The deskset cannot be used on-the-air. Calls originated in the studio that are to go on-the-air must be dialed from the deskset, then moved to AIR, CUE, or HOLD ON CUE. The appropriate "line" key must be pressed to dial out. Incoming calls may be seized directly to AIR, CUE, or HOLD ON CUE, with the appropriate keys.

5.3.1 Ringing lines flash the LED's on both the "LINE" and "CUE/HOLD" keys. Calls are answered with the deskset using the "LINE" keys. The "LINE" LED stays lighted (flashing or continuously) as long as the line remains seized.

- * To answer a call and speak to the caller, lift the deskset receiver then press the "LINE" key. The LED will be lighted continuously.
- * To put a call on HOLD, press the "LINE" key again. The LED will flash, and audio-on-hold backfeed will go to the caller.
- * To speak to the caller again, lift the deskset receiver and press the "LINE" key. The LED will be lighted continuously.

5.3.2 If more than one call is put on HOLD, the LED associated with the oldest call on HOLD will flash faster than the others.

5.3.3 To release a line, press the "RELEASE" key and the "LINE" key in sequence.

- * Normally lines may not be released unless they have been previously answered or seized. The LED will go out when the call has been released.
- * To release a line before it has been seized press the "LINE" key twice with the deskset receiver on-hook.

5.3.4 Up to eight lines may be "conferenced" off-air.

- * Lift the deskset receiver and press the "LINE" keys for the appropriate lines.
- * The LINE LED for each line assigned to the conference will be lighted continuously.

5.4 Using the "CUE/HOLD" Keys

The second row of eight keys are the "CUE/HOLD" keys. These keys are active any time a line is ringing, or has been seized. The 108's CUE output is usually connected to the broadcast consoles' cue (off-air) buss. Use of the CUE output is optional. If your console does not have a cue buss, you may use the cue function for something else, or leave it unconnected.

5.4.1 The "CUE/HOLD" keys serve different functions for the call director and the host:

- * The call director uses the "CUE/HOLD" keys to pass screened calls to the host. For the call director the "CUE/HOLD" keys become a "holding area" for those calls that are ready to be put on-the-air.

The appearance of LED's flashing at the hold-rate in the "CUE/HOLD" row signals the host that calls are ready. The first call to be put on-the-air is the oldest call on HOLD ON CUE, and is indicated by its faster flash rate.

- * The host uses the "CUE/HOLD" keys to put callers on either HOLD ON CUE, or on CUE. He uses CUE when he wants to continue a conversation, or when he wants to make comments to a guest and caller(s), off-air during a break.

5.4.2 The difference between CUE and HOLD ON CUE is:

- * Callers on HOLD hear the audio-on-hold backfeed, and cannot communicate with each other. The "CUE/HOLD" LED flashes.
- * Callers on CUE hear the transmit audio backfeed, and can communicate with each other, and with the host. The "CUE/HOLD" LED is lighted continuously.

5.4.3 Ringing lines flash the LED's on both the "LINE" and "CUE/HOLD" keys. Calls not answered with the deskset may be seized directly to CUE (host console only), or to HOLD ON CUE (either console).

- * To seize a line directly to CUE, press the "CUE/HOLD" key. The "CUE/HOLD" LED is lighted continuously.
- * To put the call on HOLD ON CUE, press the "CUE/HOLD" key again. The LED flashes and the caller hears the audio-on-hold backfeed.
- * To put the line back on CUE, press the "CUE/HOLD" key again. The LED will light continuously, and the caller hears the transmit (host) audio backfeed instead of the audio-on-hold backfeed.

- * Lines may be switched directly to HOLD ON CUE by pressing the "CUE/HOLD" key, only if at least one line is already on-the-air.

5.4.4 To communicate with the caller on the telephone deskset after the line has been on either HOLD ON CUE, CUE, or AIR, the transfer must go through CUE/HOLD.

- * To get the caller back to the LINE area, press the "LINE" key. The line goes to HOLD unless the deskset is off-hook.
- * The "CUE/HOLD" key LED goes out when the line is transferred to the LINE area.

5.4.5 To release a caller from HOLD ON CUE or CUE, press the "RELEASE" key followed by the "CUE/HOLD" key.

5.5 Placing Multiple Calls on "CUE/HOLD"

5.5.1 You may assign up to eight callers to HOLD ON CUE simultaneously.

- * Seven LED's will flash at the same rate. The first call put on HOLD ON CUE (the oldest) will flash faster. All callers on HOLD hear the audio-on-hold backfeed, but cannot communicate with each other, or the host.
- * You may place up to six callers on CUE simultaneously (there are three hybrids, two lines each). In this case all callers can hear the host and each other (all six callers and the host may converse).

5.5.2 To release more than one caller from "CUE" at a time, press "RELEASE", then the "CUE/HOLD" keys sequentially.

- * The release function remains activated for two seconds once the "RELEASE" key has been pressed. After two seconds, the sequence must be re-initiated.

5.6 Using the "AIR" Keys

Directly below the "HOLD/CUE" keys are the eight, red "AIR" keys. Do not press an "AIR" key unless you intend to place the call on-the-air.

5.6.1 To put a call on-the-air, press the "AIR" key once.

- * When a call is on AIR, the "AIR" key LED lights continuously.
- * When an "AIR" key is pressed, the system feeds a one second "beep" tone to the caller, to tell them they are on-the-air.

5.6.2 Calls that have been on-the-air may be moved to CUE, HOLD ON CUE, HOLD, or assigned to the deskset via the LINE area.

- * The "AIR" key LED flashes to remind the host which callers have already been on-the-air.
- * To put a call on CUE, press the "HOLD/CUE" key once.
- * To put a call on HOLD ON CUE, press the "HOLD/CUE" key twice.
- * To put a call on HOLD, press the "HOLD" key and the "LINE" key in sequence, or press the "LINE" key with the deskset on-hook.
- * To talk to the caller on the deskset, press the "LINE" key with the deskset off-hook.

5.6.3 Up to six callers may be placed on AIR at one time (two per hybrid). The callers can converse with each other, and the host.

5.7 Special Function Keys

The bottom row of four keys activate special functions.

5.7.1 The "PROFANITY" Key

The "PROFANITY" key mutes the 108's outputs, and closes the profanity relay.

- * All outputs are muted for at least one second each time the "PROFANITY" key is pressed, and all outputs remain muted as long as the "PROFANITY" key remains pressed.
- * The utility relay labeled "PROFANITY" is closed for one second each time the "PROFANITY" key is pressed. This relay connection may be connected to a user provided external broadcast digital delay to initiate that unit's "dump."
- * When the "PROFANITY" key is released, the profanity relay opens, and the audio outputs are un-muted after 1 second.

5.7.2 The "AIR GROUP TO CUE" key places all callers (but only those callers) who are currently on AIR on CUE.

- * The entire group will transfer to CUE and the AIR LED's will flash to indicate which callers have been on AIR.
- * To put the group back on-the-air, press the "AIR GROUP TO CUE" key again.

5.7.3 The "AIR SETUP TO HOLD" key puts all callers (but not those callers who are currently on AIR or HOLD).

- * The group will go to HOLD and the AIR LED's will flash to indicate which callers have been on AIR.
- * To put the group back on-the-air press the "AIR SETUP TO HOLD" key again.

5.7.4 The "RELEASE" key releases a call from the AIR, CUE, HOLD ON CUE or LINE areas.

- * To initiate a release, press the "RELEASE" key followed by the desired "LINE," "HOLD/CUE," or "AIR" key.
- * The release function remains active for two seconds after pressing the "RELEASE" key. Up to eight lines may be released during this time. However if the operation is not completed in two seconds the release function "times out," and the release sequence must be re-initiated.
- * Calls may be released from LINE, CUE, or HOLD ON CUE areas anytime. However, calls may be released from AIR only if they are actually on-the-air.
- * Sequentially pressing the "RELEASE" key and an "AIR" key releases a caller directly from AIR.

5.8 Ringer ON/OFF Switch

A slide switch located on the right side of the desk console allows the console's internal ringer to be switched on or off. When the switch is in the ON position the ringer is heard whenever one or more of the incoming lines is ringing.

6. Typical Applications

6.1 One Person Shows

6.1.1 Call-In Contest

Here's a hypothetical situation in which the 108 is being used by a disc jockey, working combo:

It's Arbitron time again, and the PD has cooked up the contest to end all contests. At 8:45 am the morning man asks the "Question of the Morning" and the phone lines all lit up. To win, some lucky listener has to call in with both the answer to the question, and that day's Secret Word (which is announced only at 6:30 am and 3:30 pm).

The morning man looks at the Symetrix 108 and see's LED's flashing on all eight lines. He picks up the receiver from the deskset and presses "LINE" key #1. Now the LED for Line #1 is lighted continuously. He greets the caller and gives her the standard reminder, "Pay attention now, there'll be a BEEP in your phone just before we go on the air."

To put Line #1 on HOLD, he presses the "CUE/HOLD" key. The LED for Line #1 starts to flash, and the caller hears the show through the audio on hold backfeed.

Then, just to hedge his bets (sometimes these contest callers get nervous and hang up before he can get them on), the jock presses "LINE" key #2 and gets another caller ready.

To put Line #2 on HOLD, he presses "LINE" key #2 again, and the LED on Line #2 flashes at the HOLD rate (slightly faster than the RING rate). The LED on Line #1 flashes faster to remind the jock which call went on HOLD first.

The morning man runs the contest jingle. Then, to put the first caller on the air, he presses the "AIR" key for Line #1. The caller hears a one-second BEEP tone, and they're off and running. This must be the caller's luck day! Not only was she awake enough at 6:30 in the morning to remember the Secret Word, but she actually knew the answer to the question (some arcane bit of music trivia).

The morning man quietly tells her that she just won. After a full second of shocked silence, she lets out a shriek, followed by a statement of disbelief peppered with an unusual assortment of four letter words. Hearing the inappropriate language, the jock immediately presses the PROFANITY button, and the station's broadcast delay unit earns its keep for the day. The jock tells our lucky lady to stay on the line, then presses the "CUE/HOLD" key for Line #1.

He plays the contest closing jingle, then picks up the deskset again to speak to the winner off the air. To talk to her he presses the "LINE" key #1. After getting her particulars, the jock bids his winner farewell, presses "RELEASE" and "LINE" key #1 in sequence. (Of course, if he hadn't been so excited, he could have simply hung up the deskset to release the caller.)

6.2 Two Person Shows

6.2.1 Talk Show with Producer, or Call Director

Here we have the hypothetical late night talk show, where the air personality is assisted by a call director (CD). This particular show uses a variety of production techniques, including the following:

1. The host talks with the callers.
2. The host has a guest in the studio, and they both talk with the callers.
3. The host has a guest on the phone, and they both talk with the callers.

6.2.2 Regular Talk Show Format - No Guest

The host gets the show under way, and the phones start to ring. In the other room the call director lifts the deskset receiver, then presses "LINE 1" to interview the caller. If the caller sounds even reasonably rational, the CD says, "You'll be on the air in a few minutes. You will hear a one-second BEEP in your telephone just before you go on the air."

The call director hits the "LINE 1" key to put the caller on HOLD. Then he presses the "LINE 2" key and screens the next caller. He repeats the process until he finally finds a "live one" on Line 7. This call he moves to the HOLD ON CUE area to signal the host that there's a good call waiting. To move the call, the CD presses the "CUE/HOLD" key for Line 7. The "CUE/HOLD" key for Line 7 flashes at the hold rate.

As soon as he's ready to talk to a caller, the host presses the "AIR" key for Line 7. After they talk and it's time for a break, the host can get rid of the caller by pressing the "RELEASE" key and the "AIR" key in sequence.

If the host wishes to continue the conversation with the caller, he can either put him on HOLD by pressing the "AIR GROUP TO HOLD" key, or he can move the caller to CUE by pressing the "AIR GROUP TO CUE" key. (If he wants to talk to the caller during the break, he uses CUE instead of HOLD.) In either case, the AIR LED flashes to indicate that the line has been on-the-air.

To put the caller back on AIR after the break, the host presses the "AIR" key again. To put another caller on-the-air at the same time, the host presses another "LINE" key. To put both callers on HOLD, the host presses "AIR GROUP TO HOLD." To move both callers to CUE, the host would press "AIR GROUP TO CUE."

To get rid of both callers the host presses "RELEASE" and the two "LINE" keys in sequence.

6.2.3 Talk Show with Guest in the Studio

The production technique for talk shows with a guest in the studio is the same as described above. As long as the studio guest has a microphone that's being fed through the same mixing console as the host's mic, he or she will be heard by the callers on HOLD, CUE, HOLD ON CUE and AIR.

6.2.4 Talk Show with Guest on the Phone

The call director places the call to the guest who will be interviewed by the host and also talk to the callers. He marks that line with a grease pencil (there's a white space on the desk console front panel just for markings of this type).

The CD gets the guest on Line 8. The host puts the guest on the air by pressing the "AIR" key for Line 8. To get a caller on the air along with the guest, the host simply presses the "AIR" key for the line he wants to put on. Now there are two lines on-the-air at once (one the guest, the other a caller).

When he wants to put them both on HOLD for a commercial, he just hits the "AIR GROUP TO HOLD" key. If it were news time and he wanted to continue the conversation off-the-air, he could press the "AIR GROUP TO CUE" key. On CUE, the host and all callers can talk together.

When he wants the group back on-the-air, he hits the "AIR GROUP TO HOLD" or the "AIR GROUP TO CUE" key again.

6.3 Taking Telephone Polls

Telephone polls seem to get more popular every day. The 108 makes polling easy. And, the polling process won't disrupt normal business if the telephone lines used with the 108 are different from the station's business office lines.

When the poll question is announced and the calls start coming in, just pick up the deskset receiver and press the "LINE" key. When the caller gives his answer, press "RELEASE" and the "LINE" key in sequence. Then press the "LINE" key for the next line to be answered. Repeat the operations until the poll is completed.

6.4 Conference Calls Off the Air

The 108 software permits conference calling with the deskset. Calls to be conferenced may be originated or received. However, when the calls are originated they must be put on HOLD before being conferenced so the deskset may be used to dial more calls.

After the calls are established and on HOLD, lift the deskset receiver and press the "LINE" key for each line that is to be included in the conference.

Individual lines may be released or put back on HOLD during the conference by pressing the appropriate key.

7. Troubleshooting Guide

| Problem | What to check for - what to do |
|--|---|
| 1. Hybrid won't null. | <p>1. Is transmit level too high (over -10dBm)? Check level at "TRANSMIT (HOST) LEVEL" test point.</p> <p>Do you have tip & ring directly from Telco central office? (Is the line you're using coming from a PBX?)</p> <p>Has the caller level been tampered with?</p> <p>Do you have mix-minus? (See Section 2.3.1 and/or Appendix A.)</p> <p>Is there acoustic feedback to the phone you're using? If the phone being used for the nulling process is in the control room or studio, be sure the control room and studio monitor speakers are turned down. Even the slightest acoustic coupling between the caller audio and the host audio makes it virtually impossible to null the system.</p> |
| 2. Low caller level. | <p>2. Bad connection or inferior equipment on caller end.</p> <p>Check incoming level at Pin 1 of the appropriate hybrid. With the "INT/EXT" switch down you should measure approximately -10dBm. (See caller level calibration method in #3 below.)</p> |
| 3. Distortion from phone lines. | <p>3. Has the caller level been tampered with?</p> <p>Check caller level calibration as follows:</p> <ol style="list-style-type: none">1. Put "INT/EXT" switch down (EXT).2. Apply -10dBm, 2kHz sine wave to hybrid Pin 3.3. Measure level at "CALLER LEVEL" test point on front panel.4. Adjust "CALLER LEVEL" control for -9dBm at test point. |
| 4. "Click" on air when another incoming call is answered on the deskset. | <p>4. Inferior quality deskset. Remove and replace.</p> |

(more)

5. Dial tone on air.
Unit will not drop line.

5. Are the phone lines on the inside of a PBX? If so the abandon interrupt may not get through from the Central Office.

Check with Telco central office for interrupt timing.

Change 10s interrupt timing with DIP Switch #2 if necessary. (See Section 3, Options DIP Switch Programming.)

6. Erratic switching.
or
Audio on hold heard
on air.
or
Line appears to ring,
but there's no caller.

6. Ground the controller unit carefully.

High RFI locations may cause switching anomalies - ground the unit carefully.

Static electricity discharges may cause switching anomalies - ground the unit carefully, get a static discharge mat.

7. "Singing" or
oscillation on phone
lines.

7. Balance the hybrids (See Section 2.6.2)

8. Specifications

| | |
|-----------------------------|---|
| Telephone Line Connections | standard loop start, Bell-type telephone lines |
| Transmit (host) Audio Input | electronically balanced differential input switchable between mic level (nominal -50dBm) and line level (nominal -10dBm to +4dBm). line input impedance: 100 ohms mic input impedance: 600 ohms |
| Audio on Hold Input | electronically balanced differential input accepts nominal input levels from 10dBm to +6dBm. input impedance: 46.3 Ω ohms |
| Receive (caller) Outputs | electronically balanced differential output impedance: <100 ohms nominal output level: +4dBm |
| System Frequency Response | 300Hz to 3kHz, nominal |
| Telephone Connectors | RJ-11 (modular) |
| Audio I/O Connectors | #6 barrier terminals |
| Dimensions, Controller | 19" x 5.25" x 10.75" |
| Dimensions, Desk Console | 8" x 10" x 3.5" |
| Shipping Weight | 36 lbs. |
| Power Requirements | Factory pre-wired for nominal 120VAC/60Hz 220VAC/60Hz, or 100VAC/60Hz available on request. |
| User Adjustable Controls | transmit level, audio on hold level, caller return level, course hybrid null, HF hybrid null, caller override level, caller monitor gain. |
| Console to Controller Cable | 25 feet, 25 pair, pre-wired with connectors. |

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In the interest of continuing product improvement, specifications are subject to
change without prior notice.

9. Warranty and Repair Service

Symetrix, Inc. warrants the Model 100 to be free of defects in materials and workmanship for a period of 100 days from the date of shipment. For warranty repairs, ship goods freight prepaid to:

Symetrix, Inc.
1211 24th Avenue West
Seattle, WA 98199

(206) 282-2555
Telex 703282 SYMETRIX UD

All items returned must have a Return Authorization (R/A) number. Please call Symetrix at the above phone number to receive an R/A number before returning any item. Items returned to the factory should be returned in the original shipping carton. If original shipping materials are not used the customer will be charged for repackaging for the return shipment. Items under warranty will be returned "NO CHARGE" provided the item(s) have not been improperly installed, damaged or altered.

Symetrix, Inc. maintains a complete repair and test facility to insure proper operation of your equipment. Equipment no longer in warranty may be repaired on a time and material basis, or for a fixed charge. Consult the factory for current charges and service rates.

APPENDIX A - Deriving a Mix-Minus Signal

Mix-minus is the term used to describe a signal that does not include receive audio (the caller). There are many ways to derive a mix-minus signal, but the technique most appropriate for your situation depends on the configuration of the mixing console or sound system that will be used with the 108. The following examples provide interfacing methods for a variety of system configurations.

1. Using the 108's microphone level input

When there is no way to derive a mix-minus signal from the mixing console, the 108's audio module may be switched to accept a mic level (-50dBm) input. To use the system in this manner, the announce mic output is split into two separate lines, then run to both the 108 and to the console. With this method only one studio mic can be used. It therefore is not usable when in-studio guests require the use of more than one mic.

TYPICAL EXAMPLE OF A MIC-SPLITTING BOX

The models 66J0036A,B (two splits), 66J0040A,B (three splits), and 66J0092A,B (four splits) are specially designed audio transformers used for splitting microphones in remote recording studios, churches and TV production. These transformers have separate isolated electro-static shields to prevent common ground-loop problems. They are enclosed in double shielded nested cans for hum protection. They can also be rotated in their mounting for minimum hum.

The Mic-Splitting transformers are designed to be used in a bridging mode to maximize transfer of power without loss of signal or derating performance.

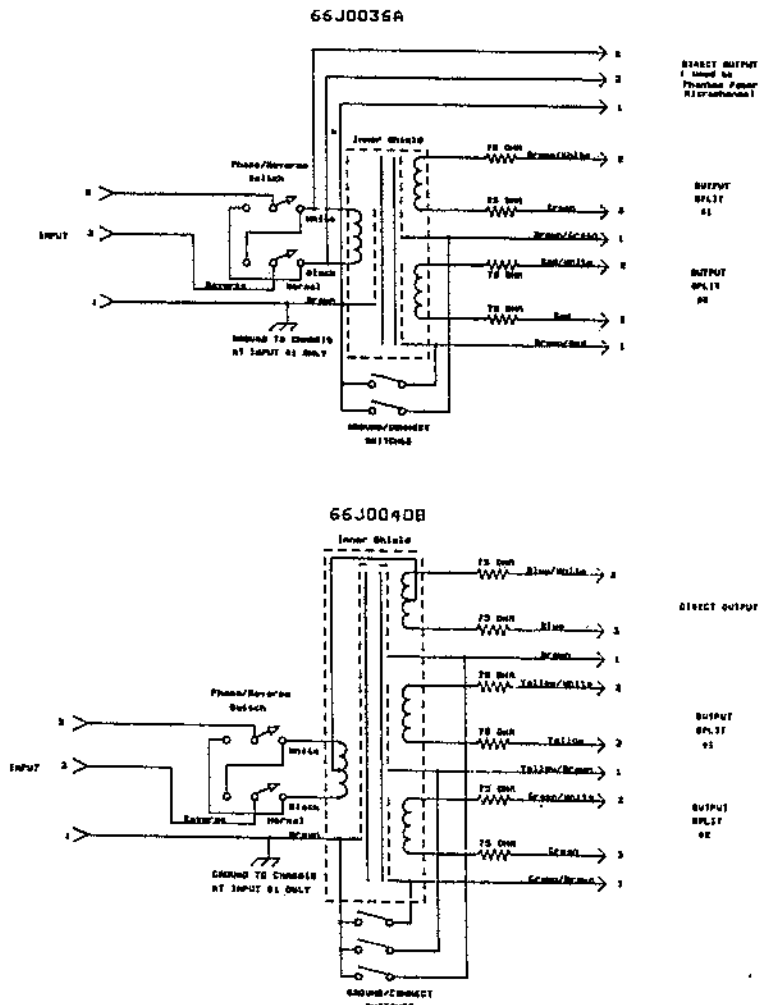


Figure 1 - Wiring diagram of transformer type splitter (Model numbers are Sescocom part numbers.)

Transformer coupled and/or active electronic splitters provide 2 (or more) outputs for every input, and are readily available from several sources (see Appendix E for manufacturer information and part numbers). Transformer coupled splitters provide the best possible isolation from ground loop and RFI problems.

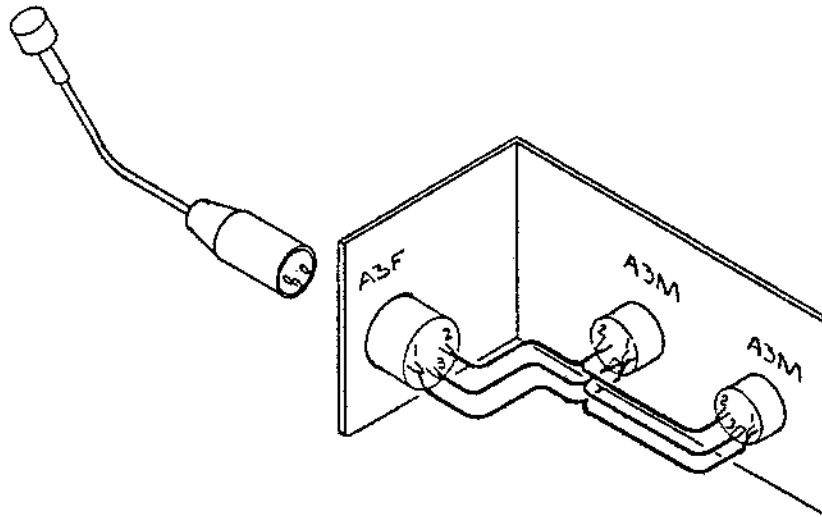


Figure 2 - Pictorial wiring diagram of "Y" type microphone splitter

A "Y" connection will suffice in situations that are reasonably "clean," electrically. This type of connection is simple and inexpensive, and all parts are readily available. If this type of microphone split causes hum, or audible interference from stray RF, use a transformer splitter for more isolation.

2. Using dual microphones

A variation of the technique above is the dual mic method. The second mic needn't be of the finest quality, since its only purpose is to feed host audio to the caller via the telephone line. Like the splitter method above, this technique also precludes the use of multiple mics for in-studio guests.

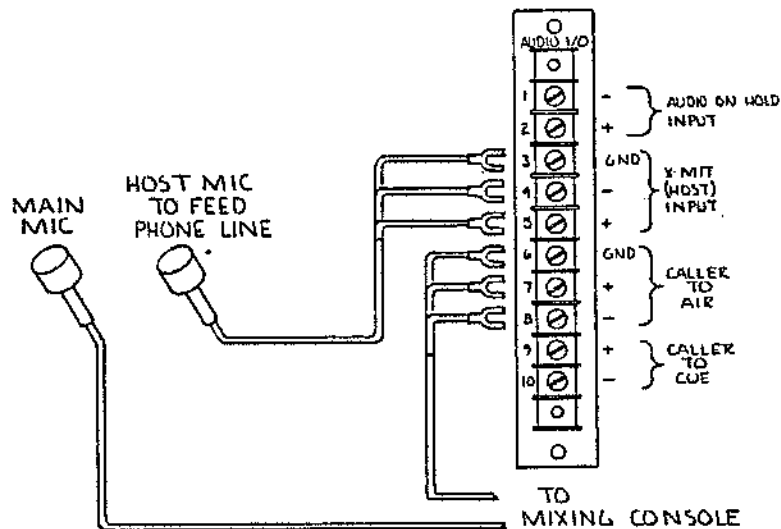


Figure 3 - Pictorial wiring diagram of a dual mic setup

3. Using a small add-on mixer

Any small mixer with mic inputs can be used to derive a mix-minus signal. The outboard mixer can be used as a sub-mixer for all the mics in the booth. If the mixing console used with the 108 doesn't have multiple buss capability, this technique must be used if programming is to include guests (and therefore the need for more than one studio mic).

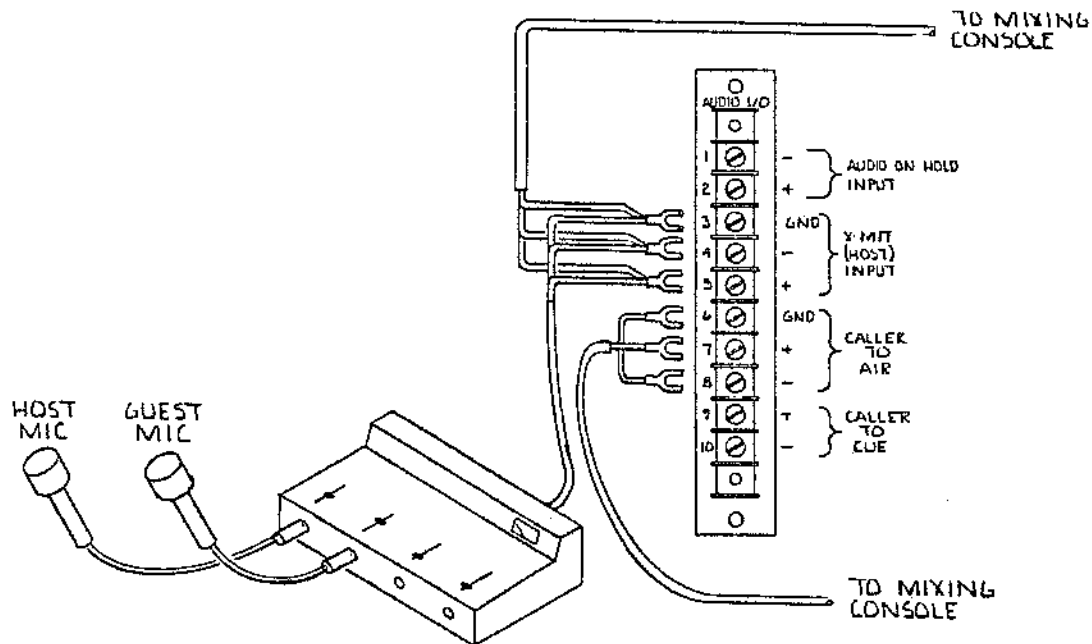


Figure 4 - Pictorial block diagram of mix-minus derived with a sub-mixer

All microphones used during a phone show are routed through the small mixer. Since the output from this mixer contains only signals from the studio mics and no caller audio, it is by definition a mix-minus signal. This output is fed to both the 108 TRANSMIT AUDIO INPUTS (see Section 2.3) and to a line input of the air console. The 108's RECEIVE AUDIO OUTPUT is run to another line input of the air console, so the studio level and the caller level can be controlled separately.

4. Using the cue buss of an existing mixing console

Where there are enough extra line inputs available on the existing air console, use the following technique.

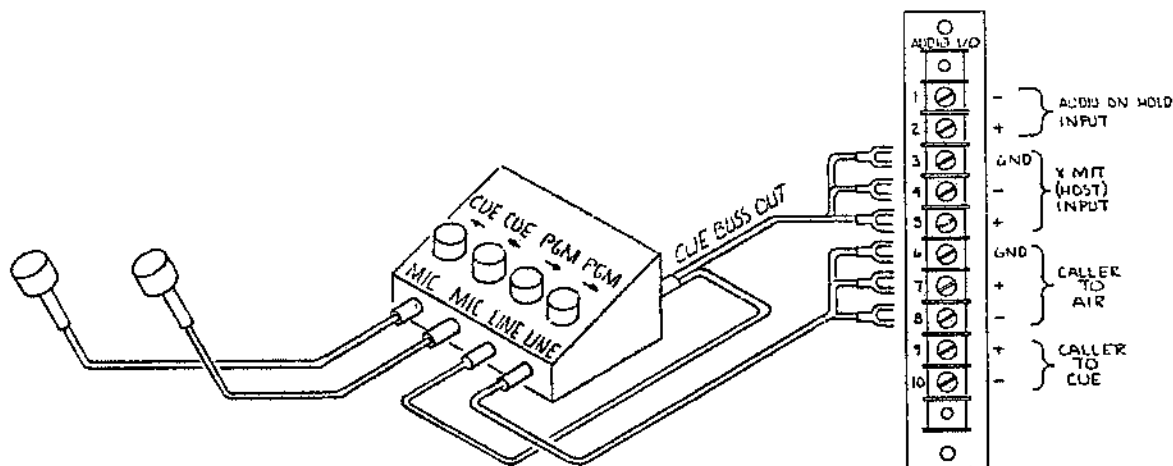


Figure 5 - Pictorial block diagram of mix-minus derived using existing console's cue buss.

The input used for the studio mic is switched to the cue (or audition) buss. Assuming nothing else is put on cue, the cue buss output will be a mix-minus signal because it contains only the signals from the studio microphones. It can therefore be used to feed the "TRANSMIT AUDIO INPUT" on the 108.

In addition, the cue buss output is routed to the air buss through a separate line input on the air console, so the studio mic can be heard on the air. To complete this technique, the 108's "RECEIVE AUDIO OUTPUT" is returned to the console through yet another line input direct to the air buss, providing separate level controls for both the studio host and the caller.

APPENDIX B - Using Electronically Balanced Inputs and Outputs

Electrically balanced inputs and outputs must sometimes be treated differently from transformer coupled inputs and outputs.

With balanced equipment.

When the 108 is used with equipment also equipped with balanced inputs and outputs (of any type):

- * Be sure polarities are matched (if desired), then connect:
 - hi (+) to hi (+)
 - low (-) to low(-)
 - ground to ground

The polarity may be changed by reversing the (+) and (-) connections.

With unbalanced equipment:

When the 108 is used with equipment having unbalanced inputs and/or outputs:

- * To use the 108's INPUTS with unbalanced outputs, connect:
 - tip to hi (+)
 - ring to ground
 - ground the low (-) input

The polarity may be changed by reversing the (+) and (-) connections.

- * To use the 108's OUTPUTS with unbalanced inputs, connect:
 - hi (+) to tip
 - low (-) to ground
 - ground to ring

The polarity may be changed by reversing the (+) and (-) connections.

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CAUTION

The 108's electronically balanced output emulates a floating (transformer coupled) type output. The unused leg must be grounded. Because current flows in this ground connection, it is important that the unused output be grounded to the 108's circuit ground to prevent ground loops. (See Table 2.2, in Section 2.3.)
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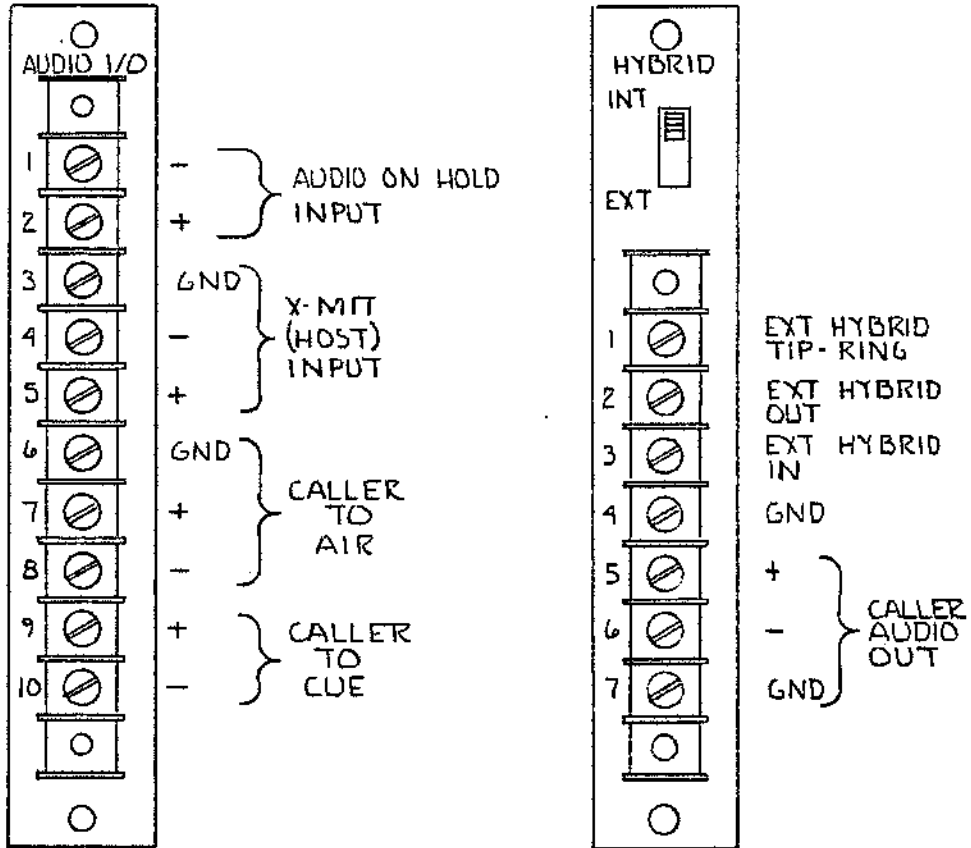
APPENDIX C - Desk Console Cable Specifications and Suppliers

The cable connecting the IOB control module and desk console is a 25-pair cable of the type commonly used to interconnect business telephone systems. The IOB is supplied with a twenty five foot cable with connectors prewired. The cable is held in place with 'U' shaped retaining clips at each end. If additional cabling is desired for your particular installation you may order additional 25 foot lengths of cable directly from Symetrix or contact your local cable supplier for longer lengths.

To order from Symetrix contact the Symetrix factory directly at the address and telephone on the first page of this manual. Order Symetrix part number Q37050 and describe it as a "CABLE ASSEMBLY, 50 LINE, 25 FOOT". The cost is \$50.00 plus freight for this part. If you wish to have a longer length of cable assembled locally you will need to give your local supplier the following specification:

| | |
|---|---|
| Connector manufacturer: | AMP, Inc. Harrisburg, PA 17105 USA (717) 564-0100 |
| Male Connector: | AMP part number 552318-1 |
| Female Connector: | AMP part number 552390-1 |
| Connector Cover (two needed per cable): | AMP part number 551008-1 |
| Retaining Clips (two needed per cable): | AMP part number 552723-1 |
| Cable type: | vinyl jacketed unshielded 25-pair diameter .430 to .490. |
| Rear Panel Barrier Terminal Spade Lug Specification: | #6 spade lug AMP Part Number: 52929 Description: "spring spade insulated." |

APPENDIX D - I/O and Hybrid Module Connector Drawings



APPENDIX E - Microphone Splitters

Mid splitters provide two (or more) outputs from one input. This is accomplished with either a directly connected "Y," or an audio transformer with one primary, and two secondaries. Transformer type splitters are available from:

Sescom
1111 Las Vegas Blvd. North
Las Vegas, NV 89101-1197
U.S.A.

(702)364-0993 TWX (510)397-6996

Order Sescom product MS-11

Whirlwind
P.O. Box 1075
Rochester, N.Y. 14603
(716)663-8820
Telex 646644

Order Whirlwind product IMP Splitter

APPENDIX F - Installing the 108RB Accessory Controller

The Symetrix 108RB provides additional relay controlled switching capabilities external to the 108 Broadcast Telephone System. The 108RB contains eight relays, each corresponding to one of the eight telephone lines used with the 108 Broadcast Telephone System. It is intended to provide remote control for a key system A-lead, telephone line transfer, or other user-defined functions.

Any time a line is seized with one of the 108 desk console "LINE" keys, the corresponding relay in the 108RB is energized. The relay remains energized as long as the line remains seized.

All necessary connections between the 108RB and the 108 controller unit are made with the 16 conductor ribbon cable that is supplied with the RB. Connections between the RB's relay terminals and other equipment are made to the barrier strip terminals on the RB's circuit board.

Installation

To install the ribbon cable between the 108RB and the 108 controller unit, remove the top cover from the controller unit. The cover is secured by a total of 18 fasteners: 4-Allen head screws at the front, 3-Phillips head on each side panel, and 8-Phillips head on the rear panel.

The Allen head screws require a 5/64" hex driver. The Phillips head screws require a #1 Phillips driver.

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NOTE

To insure proper installation, two pins have been removed from the 16-pin headers on both the 108 controller unit circuit board and the 108RB circuit board. The corresponding holes in the female connectors on the ribbon cable have been plugged.

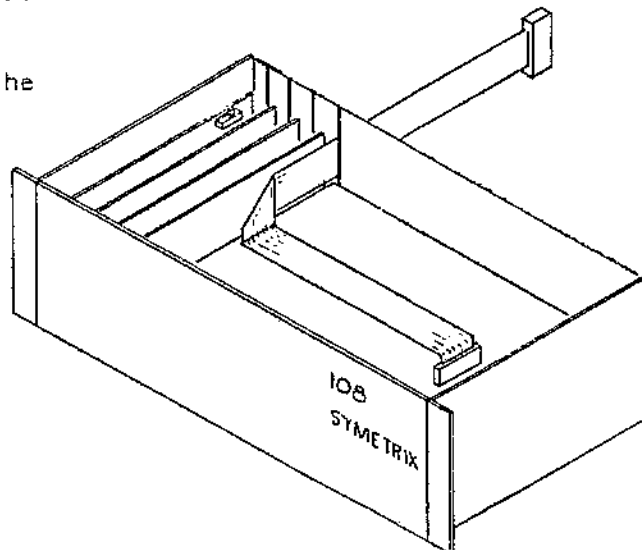
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The female 16-pin connector on the ribbon cable is mated to the 16 pin header on the controller unit circuit board as illustrated below. Do not force the connector. When installed properly, the connectors mate easily.

1. Route the ribbon cable across the 108 controller unit circuit board.

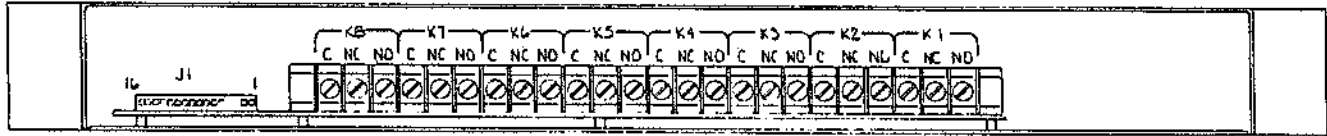
2. Gently twist the cable 90° clockwise, then feed it out the controller unit's back panel through the slot between the last hybrid and the adjoining sheet metal.

3. Connect the other end of the ribbon cable to the header on the back panel of the 108RB.



Relay Connections

The 108RB relay contacts are brought out on the barrier strip terminals on the RB's circuit board. Each of the eight relay provides one normally open (N.O.), and one normally closed (N.C.) set of contacts, as well as a common connection.



108-RB
REAR VIEW

CAUTION

Consult your telephone company or telephone system supplier before connecting the 108RB relay contacts to any telephone lines or auxiliary telephone equipment.

Extending the Ribbon Cable

The ribbon cable may be extended if the 108RB must be placed more than four feet from the 108 controller unit. Use only the cable and connector specified, or their equivalents.

Connector manufacturer:

Panduit Corp.
Electrical Group
17301 Ridgeland Avenue
Tinley Park, IL 60477-0981
(312)532-1800 Telex 25-4560

Connector part number:

CE100F26-16-T

Cable manufacturer:

Molex, Inc.
2222 Wellington Court
Lisle, IL 60532
(312)969-4550

Cable type:

Jet-flecs 16-conductor
flat ribbon cable
Cable series no.: 8996-16

Special Lengths Available

Any length of the completed cable assembly may be ordered from Symetrix. There will be a minimum charge, and prevailing wire and connector costs will be used to compute the total charges. Call Symetrix Service Department weekdays, at (206)282-2555, 8:30am - 4:00pm Pacific time.

Line/Hybrid Assignment

The system software assigns telephone lines to the hybrids in the order in which the lines are put on AIR or on CUE. If line 3 is put on-the-air first, it goes to Hybrid 1. If another line is added to AIR, it goes to hybrid 2, the next line added goes to Hybrid 3, the next to Hybrid 1, and so on. Each hybrid can handle two telephone lines, allowing a maximum of six lines to be put on AIR or CUE simultaneously.

When individual lines are put on-the-air, then released and replaced with another, the new line will always be assigned to Hybrid 1. However, the hybrid assignment shifts when the "AIR GROUP TO CUE" or the "AIR GROUP TO HOLD" function is used to transfer more than one line simultaneously.

Table G.1 - Hybrid Allocation

| Phone line | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
|-----------------------------------|---|---|---|---|---|---|---|---|
| Hybrid (initial assignment) | 1 | 2 | 3 | 1 | 2 | 3 | | |
| Hybrid (after "AIR GROUP TO ...") | 3 | 1 | 2 | 3 | 1 | 2 | | |

Manual Hybrid Assignment

When individual hybrid outputs are run directly to the mixing console it is often necessary to manually assign a phone line to a particular hybrid. For example, when a guest interview is brought in via phone line, that line must be put on-the-air first to be sure it will be assigned to Hybrid 1.

Remember, whichever line is put on-the-air first will be assigned to Hybrid 1, etc. To be sure a guest interview always appears on the same hybrid, manually assign the line used for the guest by pressing the appropriate "AIR" key before putting any other lines on-the-air. Doing so will assure that the guest will always appear on Hybrid 1.

All lines on AIR may be moved to HOLD or CUE simultaneously with one of the "AIR GROUP" keys, but they must be returned to AIR individually.

Symetrix Limited Warranty

Telephone Systems

A. Warranty Registration must be completed and mailed to Symetrix Inc. (Symetrix) within 30 days of the date of purchase.

B. Symetrix warrants the materials, workmanship and proper operation of this Symetrix product for a period of 90 days from the original date of purchase. If any defects are found in the materials or workmanship, or if the product fails to function properly within the specified warranty period, Symetrix will repair or replace the product, at its option.

C. To obtain factory service:

1. Call Symetrix for a Return Authorization Number. R/A numbers are necessary for proper tracking of your product. Call (206)282-2555 or Telex 703282 SYMETRIX UD 8am to 4pm weekdays (Pacific time).

2. The product must be returned in its original shipping carton, freight prepaid to:

Symetrix, Inc.
4211 24th Avenue West
Seattle, WA 98199 USA

D. Symetrix reserves the right to inspect any products which may be the subject of any warranty claim before repair or replacement is carried out. Symetrix may, at its option, require proof of the original date of purchase (dated copy of original retail dealer's invoice). Final determination of warranty coverage lies solely with Symetrix, Inc. Any Symetrix product deemed eligible for repair or replacement under the terms of this warranty will be repaired or replaced within 30 days of receipt of the product at Symetrix' factory. Products which do not meet the terms of this warranty will be repaired and returned C.O.D. with billing for labor, materials, return freight and insurance. Products repaired under warranty will be returned freight prepaid by Symetrix, to any location within the boundaries of the USA. Outside the USA, products will be returned freight collect.

E. This warranty is extended to the original purchaser, and to anyone who may subsequently purchase this product within the specified warranty period.

F. Symetrix does not authorize any third party, including any dealer or sales representative to assume any liability on behalf of Symetrix, or to make any warranty for Symetrix.

G. The above warranty is the only warranty given by Symetrix, Incorporated and is in lieu of all other warranties. All implied warranties, including warranties of merchantability or fitness for any particular purpose shall be strictly limited in duration to 90 days from the date of original purchase. Upon the expiration of the warranty period (90 days), Symetrix shall have no further warranty obligation of any kind, expressed or implied. Symetrix shall in no event be obligated for any incidental or consequential damages that may result from any defect, or warranty claim of any kind, expressed or implied. Some states do not allow exclusion or limitation of incidental or consequential damages or limitation on how long implied warranties last, so some of the above limitations and exclusions may not apply to you. This warranty provides specific legal rights. The purchaser has implied warranty rights, and may also have other rights which vary from state to state.

