

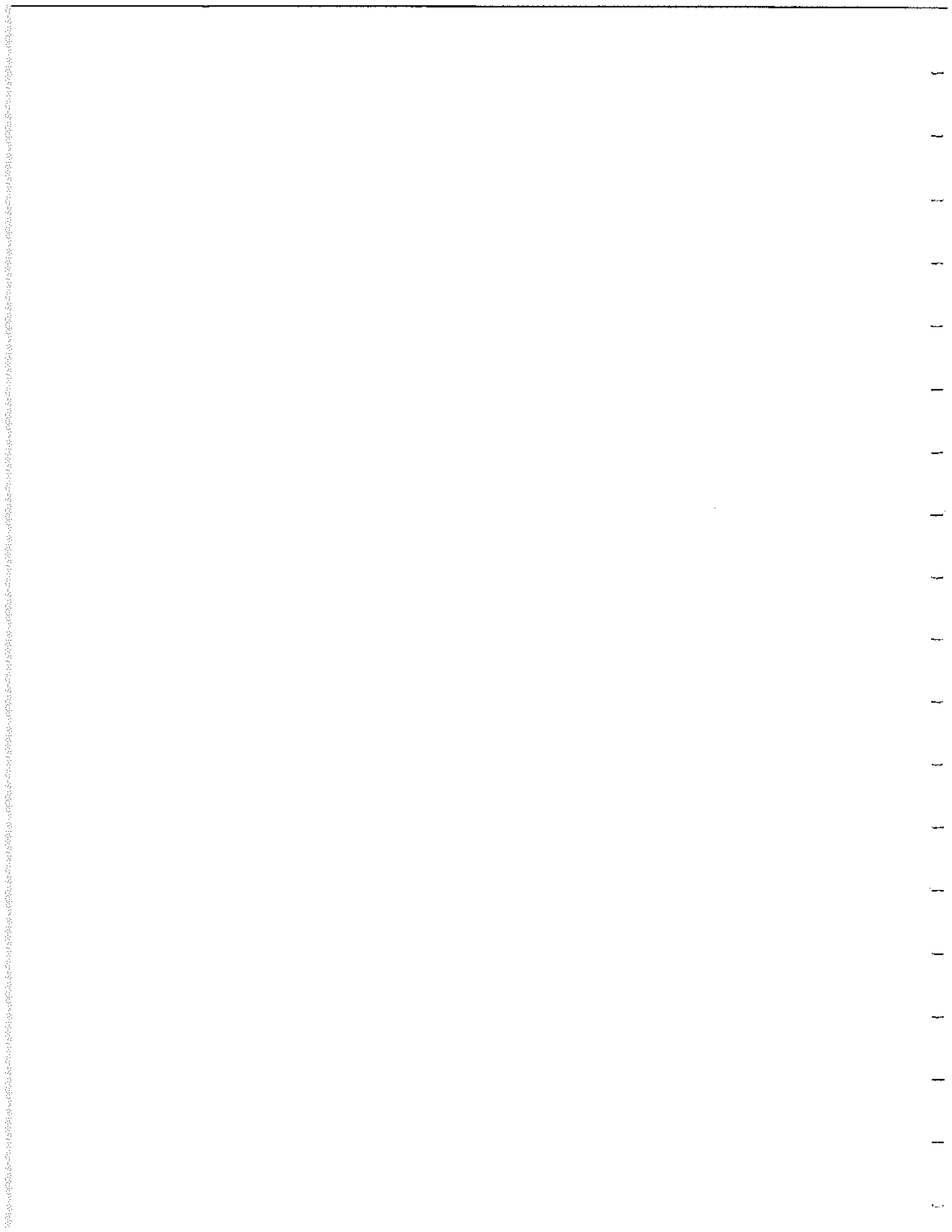
Symetrix



**108A Broadcast
Telephone System**
Installation and Operating Manual

Revision 2.0

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Foreword

The 108A Broadcast Telephone System is easy to set-up and easy to use. Its microprocessor command system allows highly sophisticated signal routing functions to be carried out with simple switches, while Symetrix' proprietary embedded software provides smooth, trouble-free management of up to eight telephone lines.

The 108A leaves the factory ready to install. Only fine tuning of the hybrids is necessary to optimize the 108A's performance with the telephone lines in your area.

To familiarize yourself with the 108A, please take a few minutes to read through this manual. It is divided into nine sections:

Section 1, Introduction

Presents a brief introduction to the 108A, and to this manual.

Section 2, Installation

Discusses AC power, tools and supplies necessary for installation, connection of audio and telephone lines, adjustment of audio levels and hybrid networks, and desk console connections. An installer's checklist is provided.

Section 3, Options DIP Switch Programming

Gives switch settings for pre-setting certain control functions.

Section 4, Main Controller Unit Programming

Describes the operating modes, and their effect on the 108A. The key functions in the various modes are presented in table format.

Section 5, Operating the 108A

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

Section 6, Typical Applications

Provides brief scenarios to illustrate the 108A's operations.

Section 7, Troubleshooting Guide

A quick listing of common malfunctions and their solutions.

Section 8, Specifications

Lists the 108A specifications.

Section 9, Warranty and Non-Warranty Service

Gives instructions on how to obtain warranty and non-warranty service from Symetrix.

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Appendix B Using electronically balanced inputs and outputs.

Appendix C Cable and Spade Lug Specifications and Suppliers.

Appendix D I/O and Hybrid Module Connector Drawings.

Appendix E Microphone Splitters/Combiners.

Appendix F Half-Duplex Cards

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1. Introduction

1.1 108A Description

The Symetrix model 108A Broadcast Telephone System is an electronic telephone system specially designed for use in broadcasting, business teleconferencing, and educational television. Specialized audio interface circuitry and telephone line switching systems are brought together by the 108A to allow up to eight standard dial-up telephone lines to be used with a mixing console or other audio device.

The 108A contains three telephone hybrids to electronically subtract studio generated audio from the bi-directional audio on the telephone line. The resulting output signal is primarily the caller. The hybrids convert the telephone system's two-wire signal path to the four-wire signal path (with separate transmit and receive pairs) used by normal audio equipment.

Complex switching is made simple by the 108A - its operation is easily learned by non-technical personnel in a matter of minutes. Telephone and audio connections are made to the rack mountable controller unit, but all the controller's functions are directed from small, attractive desk consoles.

For unusual or difficult installations, we are always glad to provide extra assistance. If you need help, call Symetrix and ask for "telephone products installation help." But *please*, do not call for help before reading the manual.

1.2 About this Manual

This manual is organized into nine sections. A general description of each section can be found in the Foreword. Installation of the 108A is straight-forward, but should not be attempted before reading this manual.

1.2.1 Notation Conventions

Within this manual several different notation conventions are used to indicate various facets of the 108A's features:

"CAPS IN QUOTES" indicate a marked feature on the 108A, like the "CUE" key or the "CALLER OVERRIDE" control.

UPPER CASE BOLDFACE is used to indicate an internal feature of the 108A, such as the HOLD function, or the AIR buss.

Italics, boldface, and UPPER CASE BOLDFACE are 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 denote varying degrees of awareness required of the user during installation, operation, or maintenance of the 108A.

A **Note**: conveys information that's included to make certain functions more obvious, and to supply extra information about processes, techniques, connectors. An example of a **Note**: may be found in 3.2.4.

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

A **WARNING**: indicates a potential hazard to the operator. An example of a **WARNING**: can be found on the next page, in Section 2.2.3.

1.2.3 Definition of Terms used in this Manual

25-pair cable	The large, grey jacketed cable supplied with the 108A system. It is used to connect the controller unit to the desk console. The cable is 25 feet long, and is fitted with one male and one female 50-pin D connector.
Controller Unit	The main electronics package part of the 108A, that may be identified by the several holes in its front panel. The controller unit requires AC power, and can be placed on any flat surface, or mounted in a 19" rack.
Desk console	The part of the 108A that may be identified by the switches and knobs mounted on a sloped front panel. The desk console gets its power via the 25-pair cable from the controller unit, and is made to be placed on a desk top.
Hybrid	The internal electronic device used to separate transmit audio (the host) from receive audio (the caller). There are three hybrids in the 108A.
Mix-minus	<p>The audio signal from the studio that's fed to the caller.</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 created outside the 108A (see Section 2.3.1 and Appendix A).</p>
Options DIP switch	The 4-position switch visible through the front panel of the controller unit. This switch pre-sets certain operational functions (see Section 3).
Receive audio	The audio signal that originates on one or more of the incoming telephone lines.
Host audio	The audio signal, or mix of signals, that includes the studio host's mic (mix-minus).

WARNING: Federal Communications Commission regulations prohibit servicing of the 108A by anyone other than Symetrix personnel. Repair or adjustment of the 108A outside the Symetrix factory is a violation of Federal law.

2. Installation

Use the following as an installation checklist.

- Read this manual, gather the necessary tools and supplies.
- Physically install the 108A 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 108A 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 108A 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 2.6.3)
- 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 108A is comprised of two major components: the desk console(s) and the controller unit. The controller unit is a standard EIA 19" rack mount package. AC power is applied to the controller unit only, as the desk console receives its power through the interconnecting cable. The factory prewired nominal operating voltage is marked on the rear panel of the 108A controller. 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 108A 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 prewired nominal operating voltage is different from the voltage in your locale contact the Symetrix Customer Service Department directly for instructions regarding voltage changeover. See CAUTION above - operating the 108A with improper voltage may result in severe damage.

2.1.2 Rear Panel AC Mains Fuse

Verify the mains fuse rating before operating the 108A. The following table indicates the proper AC mains fuse rating for the nominal voltage in your locale.

TABLE 1 - AC MAINS FUSE REQUIREMENTS

Nominal Voltage (AC)	Fuse
120	3AG 1 amp slow blow
220	3AG ½ amp slow blow
240	3AG ½ amp slow blow

2.1.3 Mounting

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

If the 108A 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 108A to your system:

- **Shielded cable** Two wire, twisted pair shielded cable (with drain) for all audio connections. Belden 8761, 8451 or equivalent
- **Terminal lugs** Crimp or solder type lugs suitable for #6 screw terminal. AMP #52929, springspade, 22-16 awg., #6 stud or equivalent.
- **Telephone extension wires with RJ-11 modular connectors** Four wire modular connectors. Prewired telephone extension cords may be used. Radio Shack part numbers are:
 - 279-374 12' extension with two RJ-11
 - 279-356 25' extension with two RJ-11
 - 279-364 12' extension, RJ-11 to spade lugs

2.2.2 Tools and Test Equipment Required for Connection

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

- **Screwdriver** A small (1/8") flat blade screwdriver
- **AC voltmeter** A high impedance input (1Meg ohm) AC voltmeter, capable of measuring levels of -10dBm. Use the 108A front panel output meter to set host level, and the voltmeter for checking levels from the phone line, etc.

2.2.3 108A Block diagram

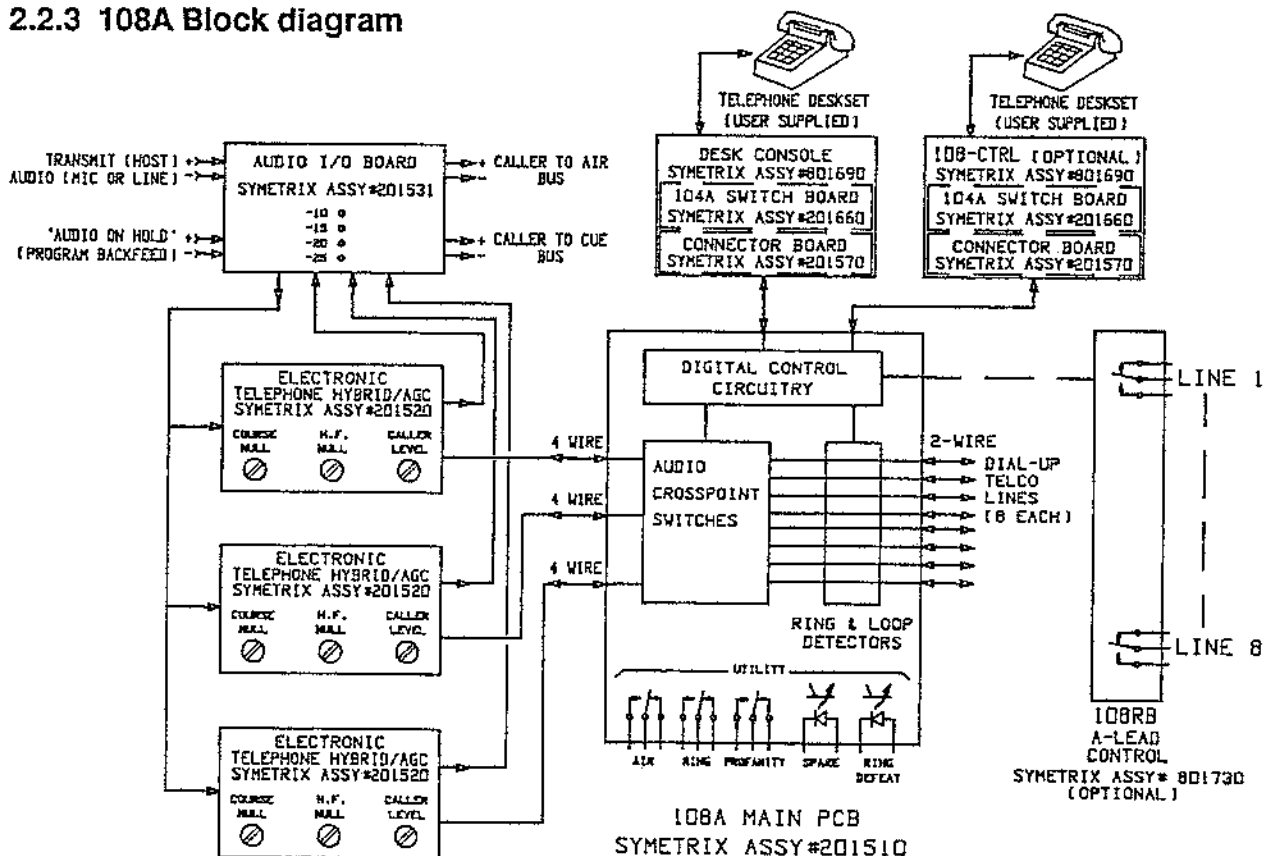


Figure 2.1 - 108A system basic block diagram (some functional blocks have been omitted for clarity).

2.2.4 Federal Communications Commission (FCC) Regulations

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

1. The FCC registration number of this device (EYD5Q3-71186-of-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 rear panel of this device.
2. The Symetrix model 108A complies with the requirements in Part 15 of FCC Rules for a Class A computing device. Because of the high-speed microprocessor contained in the 108A, operation of the 108A 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 108A must not be used with coin-operated or multi-party lines.
4. If the 108A 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 108A must be done by Symetrix, Inc. The 108A 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.

2.2.5 Connecting Telephone Lines

The 108A accepts up to eight telephone lines. These four lines may be connected to the 108A's controller unit via rear panel mounted modular connectors. On the rear panel you will see these connectors labeled as "TELCO LINE 1," "TELCO LINE 2," "TELCO LINE 3," and so on up to "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 108A 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 108A. If you have fewer than eight incoming telephone lines connect the available lines in sequence, beginning with the input marked "TELCO LINE 1".

2.2.6 Connecting the Desk Console

The desk console is connected to the controller unit with a 25-pair cable, terminated in 50-pin "D" connectors. The 108A desk console is 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 of this manual for the cable specification.

CAUTION: Before connecting the desk console to the 108A controller unit, make sure the AC power switch on the back of the 108A controller is "OFF".

To connect the desk console:

- Connect the female end of the cable to the desk console. Secure the connection with the retaining clip.
- Connect the male end of the cable to the connector marked "25 PAIR CABLE TO CONTROLLER" on the back of the controller unit. Secure the retaining clip.

2.2.7 Connecting the I08RB Accessory Controller

The Symetrix I08RB is an accessory device that provides relay switching for the additional functions external to the 108A, such as key system A-lead control or telephone line transfer. Installation instructions for the I08RB are given in Appendix F.

2.3 Connecting Audio Module Inputs and Outputs

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

CAUTION: The 108A's outputs are electronically balanced, transformerless. When driving an unbalanced input, the unused output leg must not be grounded. The output line drivers may be damaged if operated into ground (a "short circuit").

TABLE 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	*Host audio input low (-)	n/a	line: 50k	-10 to +4
5	*Host audio input hi (+)	n/a	mic: 10k	-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

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

The audio modules are labelled "AUDIO I/O," "HYBRID 1," "HYBRID 2," and "HYBRID 3." Before making any connections to the 108A, be sure you have on hand:

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

Extra inputs and outputs are provided on the 108A to provide versatility for special circumstances. In most installations the extra connections will not be needed. Every installation, however, requires a minimum of two audio connections:

- host audio
- receive audio

2.3.1 Transmit Audio (mix-minus)

Transmit audio is the studio originated signal (the host) to be 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 108A. See Appendix A for specifics.

Connect the transmit audio (mix-minus) 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 used, the 108A has provisions for accepting input signals at microphone level. A switch mounted on the Audio I/O circuit board module selects microphone input level, or line input level (see section 2.4.1).

2.3.2 Receive Audio

Receive audio is the signal from the telephone line (the caller). This signal enters the 108A through the modular phone jacks on the rear panel.

2.3.3 Audio on Hold

In addition to transmit and receive audio you may wish to provide audio on hold. The 108A'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 (i.e. background music), but for shows in which the caller participates (like radio talk shows), he usually gets the air signal so he can listen to the show while he's on hold waiting to go on the air.

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

2.4 Audio Module Level Adjustments

The 108A has four modules. There are three hybrids or half-duplex cards, and one audio I/O module to provide signal interface with the mixing console, tape machine, etc. The trim pots on the modules adjust:

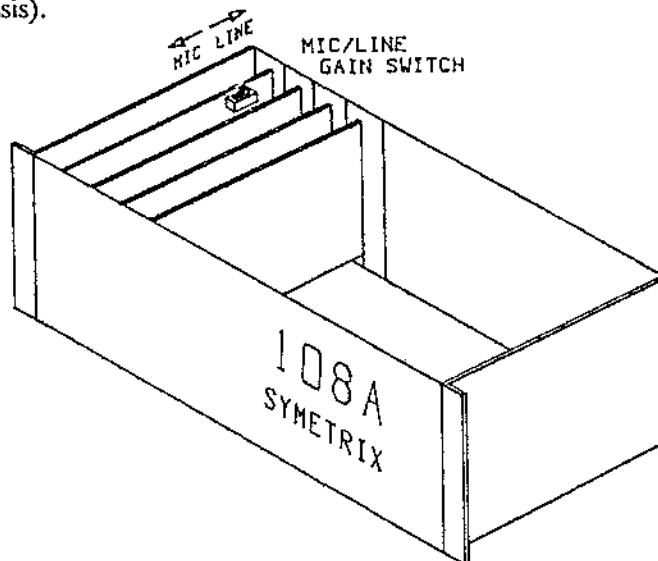
- the audio input/output levels to match your system.
- the electronic hybrids to match your local telephone line impedance.

These adjustments **MUST** be made before the 108A is placed in service. Facing the front panel of the 108A controller unit the modules, from left to right are: Audio I/O, Hybrid 1, Hybrid 2, and Hybrid 3.

2.4.1 Setting Host Audio Source Level

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

If your host audio comes from a mixing console at line level you do not need to remove the top cover of the 108A controller unit to change the setting of this switch. If you wish to feed host audio to the 108A directly from a microphone, you must remove the top cover and slide the switch forward (toward the 108A front panel) to the high gain position.



The top cover is secured by a total of 18 fasteners - four Allen head screws at the front, 3 Phillips head on each side panel, and 7 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 power cable from 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. Misadjustment or tampering is a violation of FCC regulations, and may void the warranty.

2.4.2 Adjusting Host Audio Level

With the host speaking in a normal voice, adjust the "HOST LEVEL" control (a multi-turn potentiometer) until a level of -10dBm is displayed on the associated LED meter.

2.4.3 Adjusting Audio I/O Level

Host audio level adjustments are made on the Audio I/O module. The controls on this module are:

- mic/line level select switch (internal, see Section 2.4.1)
- host audio level
- audio on hold level

The "HOST LEVEL," control with its associated level meter, and the "AUDIO ON HOLD LEVEL" control, are located in the "AUDIO I/O" section of the front panel. A small (1/8") flat-blade screwdriver is needed to adjust these controls.

2.4.4 Adjusting Audio on Hold Level

To adjust the "AUDIO ON HOLD LEVEL" control, call one of the lines to the 108A from another phone. Listening on the phone from which you placed the call to the 108A, adjust the "AUDIO ON HOLD LEVEL" control (a multi-turn potentiometer) until the program level on the phone is the same volume as a normal phone call.

2.5 Hybrid Module Connections (External)

Each of the two 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), or access to individual caller audio (in AIR mode)

TABLE 3 - HYBRID MODULE CONNECTIONS

Pin Number	Description	Source Impedance	Load Impedance	Level (dBu)
1	Connect to external hybrid's 2-wire Telco input			
2				
3				
4	Circuit ground			
5	Caller audio output hi (+)	200	>600	+4
6	Caller audio output low (-)	200	>600	+4
7	Circuit ground			

2.5.1. Using an External Hybrid

To use an external hybrid with the 108A, follow the conventions in the table above. Use pins 1, 2, and 3. External hybrids that require direct connection to the telephone company's central office tip and ring cannot be used with the 108A. (The 108A's ring and loop detectors will not function properly unless the phone lines go directly to the 108A's rear panel modular jacks.)

2.5.2 Access to Caller Audio

For situations that require different levels and/or EQ for different phone lines, such as when two guests or guest hosts are brought in on 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 108A, the hybrids *must* be matched to local telephone line impedance.

2.6.1 Caller Level Adjustment

Each hybrid module contains a screwdriver adjustable "CALLER LEVEL" adjustment. These controls adjust the caller return level from each of the 108A'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 point oscillation or "singing" will occur when two or more calls are conferenced on AIR or CUE.

These controls need only be adjusted in areas 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 Full-Duplex Hybrids

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

These adjustments minimize the amount of host audio in the receive (caller) signal, thereby maximizing audio quality and minimizing the possibility of acoustic feedback. *These controls must be properly adjusted for normal operation of the 108A.*

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. Two 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. (If the lines used are in the studio or control room, be sure monitor speakers are turned off. (Sound from the monitor speaker may 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") position. This will temporarily prevent the two calls from conferencing, which makes proper adjustment of the hybrids nearly impossible because of the interaction between the two telephone lines.
3. Place all three lines on AIR.
4. Monitor the caller output with stereo headphones plugged into the desk console. (Alternately, you may monitor the caller return level with your AC voltmeter connected to the hybrid null test point.)
5. Have someone speak into the announce mic. Adjust the "COARSE HYBRID NULL" control on the appropriate hybrid (the one still set to INTERNAL) for minimum return of the announce mic signal. Adjust the "HIGH FREQUENCY NULL" control to further minimize the return signal.
6. Switch the hybrid module that's now adjusted to the down or EXTERNAL position, and switch the other hybrid module to the up position. Adjust this module as in steps 4 and 5 above.

7. After all three hybrid modules have been adjusted be sure the rear panel **INT**ernal/**EXT**ernal switches are in the up (**INT**ernal) position. This completes hybrid null adjustment.

2.6.3 Utility Connections

The 108A 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 positive DC voltage (5 to 12 volts) 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 3 - 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
10	Profanity relay - normally open connection
11	Air relay - normally closed connection
12	Air relay - common
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 - in the beginning 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 reduce 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 the microphones with acoustically absorbent materials such as Sonex or Acoustifoam.

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 the desk console and all telephone lines) are pre-set by these switch settings.

For explanations of the various options, see Sections 3.1.1 through 3.1.4 directly following the table below.

TABLE 4 - OPTIONS DIP SWITCH SETTINGS

Switch	Position	Functions
1	UP	Incoming calls may not be answered directly to air without first being received on either the LINE or CUE areas.
	DOWN	Incoming calls may be answered directly to AIR.
2	UP	50 millisecond abandon pulse time (see paragraph below)
	DOWN	450 millisecond abandon pulse 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 release from HOLD
4	UP	Not Used
	DOWN	Not Used

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 be able to 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." Do not change the setting of Switch 2 unless the 108A will not release a line after it has been hung up by the caller.

When a caller is on HOLD and abandons the line, the telephone company central office transmits an interrupt pulse. The length of this pulse varies in different locales.

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

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

3.2.3 Switch 3

In the UP position, callers cannot be released from HOLD. For fast-paced operations 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.

With an experienced operator (or producer) handling the phones, placing Switch 3 in the DOWN position lets you get rid of unusable calls with two keystrokes instead of three.

3.2.4 Switch 4

This switch is not used as of this writing.

4. Main Controller Unit Programming (Mode Select Switch)

The 108A standard software provides six modes. Each mode enables and disables certain of the desk console functions, allowing the unit to be configured for various types of programming.

The "MODE SELECT" switch steps the unit through the six modes sequentially. The current mode is indicated by the corresponding LED.

Note: The 108A always powers up in Mode 1 - any power interruption resets the system to Mode 1.

TABLE 4.1 - MODE SWITCH SUMMARY

Mode	1		2		3		4		5		6	
Console	A	B	A	B	A	B	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 when Console B is not needed, or must be made inoperable.

Console A (Host)		Console B (Not Used)	
LINE	active	LINE	dead
CUE/HOLD	active	CUE/HOLD	dead
AIR	active	AIR	dead
RELEASE	active	RELEASE	dead
AIR TO CUE	active	AIR TO CUE	dead
AIR TO HOLD	active	AIR TO HOLD	dead
PROFANITY	active	PROFANITY	dead

4.2 Mode 2 (two-man show)

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

Console A (Host)		Console B (Call Director)	
LINE	dead	LINE	active
CUE/HOLD	active	CUE/HOLD	active
AIR	active	AIR	dead
RELEASE	active	RELEASE	active
AIR TO CUE	active	AIR TO CUE	dead
AIR TO HOLD	active	AIR TO HOLD	dead
PROFANITY	active	PROFANITY	dead

4.3 Mode 3 (same as Mode 2, with console functions reversed)

Use Mode 3 whenever a Call Director uses Console A. The CUE function of Console A's "CUE/HOLD" keys is defeated - only the host can put a call on CUE.

Console A (Call Director)		Console B (Host)	
LINE	active	LINE	dead
CUE/HOLD	active	CUE/HOLD	active
AIR	dead	AIR	active
RELEASE	active	RELEASE	active
AIR TO CUE	dead	AIR TO CUE	active
AIR TO HOLD	dead	AIR TO HOLD	active
PROFANITY	dead	PROFANITY	active

4.4 Mode 4 (same as Mode 1 with console functions reversed)

Use Mode 4 whenever Console A is not needed, or must be made inoperable.

Console A (Not Used)		Console B (Host)	
LINE	dead	LINE	active
CUE/HOLD	dead	CUE/HOLD	active
AIR	dead	AIR	active
RELEASE	dead	RELEASE	active
AIR TO CUE	dead	AIR TO	active
AIR TO HOLD	dead	AIR TO HOLD	active
PROFANITY	dead	PROFANITY	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, Mode 5 does not allow Console B to release calls.

Console A (Host)		Console B (Call Director)	
LINE	active	LINE	active
CUE/HOLD	active	CUE/HOLD	active
AIR	active	AIR	dead
RELEASE	active	RELEASE	active
AIR TO CUE	active	AIR TO	dead
AIR TO HOLD	active	AIR TO HOLD	dead
PROFANITY	active	PROFANITY	dead

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

Console A (Call Director)		Console B (Host)	
LINE	active	LINE	active
CUE/HOLD	active	CUE/HOLD	active
AIR	dead	AIR	active
RELEASE	active	RELEASE	active
AIR TO CUE	dead	AIR TO	active
AIR TO HOLD	dead	AIR TO HOLD	active
PROFANITY	dead	PROFANITY	active

4.7 SPEC 1 Software

Please see Appendix I for a description of the optional SPEC 1 software.

5. Operating the 108A

The 108A desk console controls all normal operations of the 108A. Its eight momentary contact keys control all switching functions of the 108A system. In addition to the momentary action keys, the console has two rotary knobs for the functions "CALLER OVERRIDE" and "MONITOR GAIN".

5.1 Desk Console Connectors

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

5.1.1 Deskset Modular Jack

To use a standard telephone set in conjunction with the 108A system it must be plugged into the RJ-11 modular jack located on the back of the desk console.

<p>Note: Phones used with the 108A desk console must be of the touch-tone (DTMF) variety. Rotary (pulse) phones will not function properly.</p>

5.1.2 The Stereo Headphones Jack

Located 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 ground). Tip and ring are tied together, so identical signals will 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 supplied with the 108A. 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.

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 derived from the AIR or CUE signal in the 108A. It is transformer isolated from the system. The host signal *does not* appear at this jack.

5.2.2 Caller Override

"CALLER OVERRIDE" is used to reduce the loudness of the caller 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 "CALLER OVERRIDE" in its full clockwise rotation the caller audio is greatly attenuated whenever the host speaks. Points between minimum and maximum rotation provide varying amounts of override. Moderate amounts of caller override can greatly improve the effective performance of the hybrids, and 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 108A desk console. When the deskset receiver is on-hook, the "LINE" keys are active. When the receiver is off-hook, they re 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

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.

5.4 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 108A'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 "CUE/HOLD" Key Functions

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

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

- 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 seized 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 Communicating with Callers

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 Release from HOLD and CUE

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 1.5 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, green "AIR" keys. Do not press an "AIR" key unless you intend to place the call on-the-air.

5.6.1 To put a caller 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 call(s) has 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 mutes the 108A'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 AIR outputs are unmuted after 1 (one) 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 GROUP TO HOLD" key puts all callers (but only those callers) who are currently on AIR onto CUE/HOLD.

- The group will go to CUE/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 GROUP TO HOLD" key again.

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

- To indicate a release, press the "RELEASE" key followed by the desired "LINE," "HOLD/CUE," or "AIR" key.
- The release function remains active for 1.5 seconds after pressing the "RELEASE" key. Up to eight lines may be released during this time. However, if the operation is not completed in 1.5 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 re 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 108A 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." Of course, the phone lines are 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 108A 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 lucky 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 darned excited, he could have simply hung up the deskset to release the caller.)

6.2 Two Person Shows

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:

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

6.2.1 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" key 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.

After the usual opening preliminaries, 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 as well 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."

6.2.2 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.

6.2.3 Talk Show with Guest on the Phone

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

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 Talking Telephone Polls

Telephone polls seem to get more popular every day. The 108A makes polling easy. And, the polling process won't disrupt normal business if the telephone lines used with the 108A 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 these steps until the poll is completed.

7. 108A Troubleshooting Guide

Please use the troubleshooting guide below before calling Symetrix.

Problem	What to check for - what to do
1. Hybrid won't null.	<p>1A. Is transmit level too high (above -10dBm)? Check level on host level meter.</p> <p>1B. Do you have tip & ring <i>directly</i> from Telco central office? (Is the line you're using coming from a PBX?)</p> <p>1C. Has the caller level been tampered with? Do you have mix-minus? (See Section 2.6.2 and Appendix A.)</p> <p>1D. Is there acoustic feedback to the phone set 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.	2. Bad connection, or inferior equipment on caller end. Check incoming level at Pin 1 of the appropriate hybrid. With the "INT/EXT" switch down (external) you should measure approximately -10dBm. (See caller level calibration method in #3 below.)
3. Distortion from phone lines.	3. Has the caller level been tampered with? Check caller level calibration as follows: A. Put "INT/EXT" switch down (external). B. Apply -10dBm, 2kHz sine wave to hybrid Pin 3. C. Measure level at "RECEIVE (CALLER) LEVEL" test point. D. Adjust "CALLER LEVEL" control for -9dBm at test point.
4. "Click" on air when another incoming call is answered on the deskset.	4. Inferior quality deskset. Remove and replace.
5. Dial tone on air - unit will not drop line.	<p>5A. Are the phone lines on the inside of a PBX? If so the abandon pulse may not get through from the Central Office. Check with Telco central office for pulse.</p> <p>5B. Change 108A's pulse timing with DIP Switch #2 if necessary. (See Section 3, Options DIP Switch Programming.)</p>
6. Erratic switching. Audio on hold heard on air. Line rings, but there's no caller.	<p>6A. Ground the controller unit carefully. High RFI locations may cause switching anomalies. Ground the unit carefully.</p> <p>6B. Static electricity discharges may cause switching anomalies - ground the unit carefully and get a static discharge mat.</p>
7. "Singing" or oscillation on phone lines.	7. Balance the hybrids (See Section 2.6.2)
8. With <u>Half-Duplex Cards</u> installed, the caller breaks up, or "chatters," when music is played from the host end.	8. This is a normal condition that results from the continuous nature of the music signal over riding the caller.

8. 108A Specifications

Telephone Line Terminations	standard loop start, dial-up telephone lines
Host Audio Input	RFI protected electronically balanced differential input switchable between mic level (nominal -50dBm) and line level (nominal -10dBm to +4dBm) line input impedance: >10k ohms mic input impedance: >600 ohms
Audio on Hold Input	RFI protected electronically balanced differential input accepts nominal input levels from 10dBm to +8dBm. input impedance: 46.3k ohms
Receive (Caller) Output	RFI protected electronically balanced differential output impedance: <100 ohms nominal output level: +4dBm
System Frequency Response	300Hz to 3kHz (phone line limits)
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 wired for 120VAC/60Hz 220VAC/60Hz, or 100VAC/60Hz available on request.
User Adjustable Controls (full duplex)	host level, audio on hold level, receive level, course hybrid null, HF hybrid null, caller override level, caller monitor gain.
Console to Controller Cable	25 feet, 25 pair. Wired with "D" connectors.
Half-Duplex Card	
Caller Threshold	-55dBm
Transition Characteristic	Soft-knee
Transition Time	15mS
Hysteresis	6dB
LED Meter	Host (send) Level -25, -20, -15, -10

Specifications subject to change without notice.

9. Warranty and Non-Warranty Service

Symetrix Limited Warranty covers the Model 108A for a period of 90 days *from the date of shipment*. Please read the warranty statement on Page 41 carefully. For warranty repairs, ship goods freight prepaid to:

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

(206) 282-2555
Telex 703282 SYMETRIX UD
FAX (206) 283-5504

All items returned must first be issued 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 there will be a charge for re-packaging for the return shipment.** Items under warranty will be returned "NO COST" 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. Please consult the factory for current service rates.

APPENDIX A - Deriving a Mix-Minus Signal

"Mix-minus" refers to one of two almost identical bus mixes. The first bus mix, which can be thought of as the main mix, contains all line inputs at its summed output. If a second bus mix contains all but one of the main mix inputs, and is identical to it in every other respect, it is known as a mix-minus.

In broadcasting situations, the mix-minus signal usually contains all but the receive audio (the caller). This might consist of a host and a guest along with a tapedeck or two in a studio, and a guest calling in on the phone. In the studio they are both hearing a full audio mix, but the caller who is also on the air is hearing a mix which contains all but his own voice.

More complex arrangements of 108A's can be found when more than a single mix-minus is required. For a phone interview with a guest in a distant studio, a similar mix-minus backfeed is provided for each location. Simply put, each source is sent a "guest only mix" from the other. Of course a full mix of studio mic with the phone line audio as well is delivered to the headphones and control monitors of each studio location, and is typically broadcast from one end. see [fig.a]

The use of the 108A is also rapidly growing in teleconferencing within business and education fields. Here a group, or several groups in different locations communicate with a single location. (ex. two university cable education programs having a open question period with a professor in a remote location.)

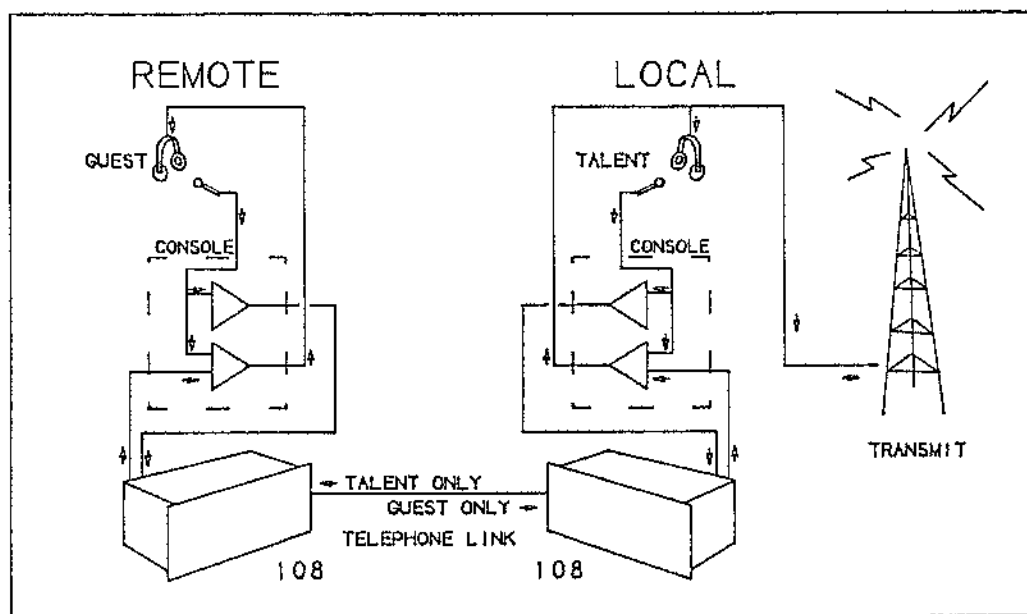


Figure a. An example of a multi mix-minus situation in two locations.

Why Have a Mix-Minus Signal?

Utilizing a mix-minus as a monitoring send for the remote location allows the remote source to hear all aspects of the mix without sending the sources' output back down the line to itself. By doing this, two problems of considerable importance can easily be avoided. The first is feedback. This situation is very much like speaking into a microphone directly in front of the monitoring speaker. Without using a mix-minus approach, the caller source signal would almost inevitably form a regenerative audio loop resulting in a "howl." The second problem is echo, in the circumstance that the call is satellite delivered. This is due to a delay which is inherent to the use of a satellite link in communications. Without a mix-minus, the caller will hear a slap back repeat of his/her own voice.

The following examples provide some of the interfacing methods for a variety of system configurations to derive and apply a mix-minus signal.

1. Using the 108A's microphone level input

When there is no way to derive a mix-minus signal from the mixing console, the 108A's audio module may be switched to accept a mic level (-50dBm) input. To use the system in this manner, the announce mic signal is split into two separate outputs, then run to both the 108A and to the console. Since the 108A has only one input, this technique is not usable when more than one mic is required.

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.

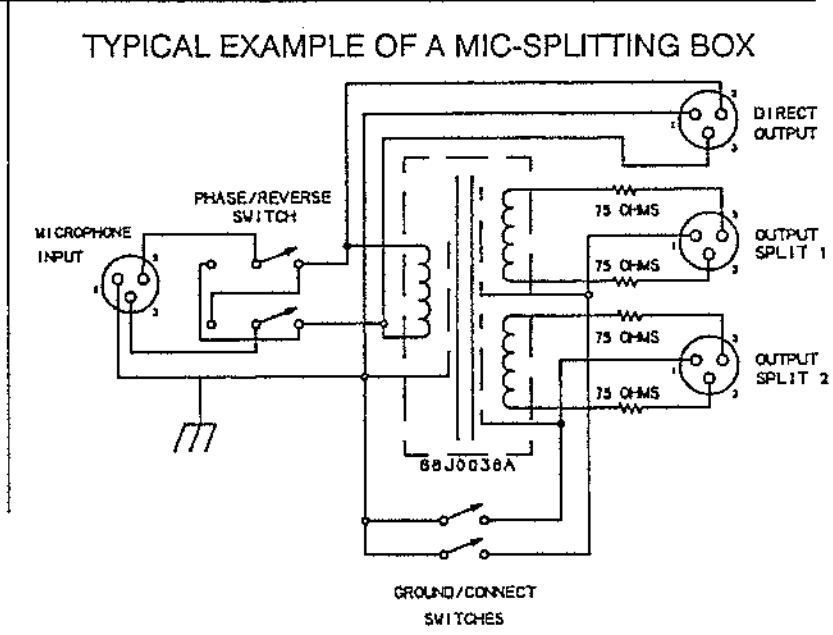


Figure 1 - Wiring diagram of transformer type splitter (Model numbers are Sescom part numbers.)

Transformer coupled and active splitter/combiners 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.

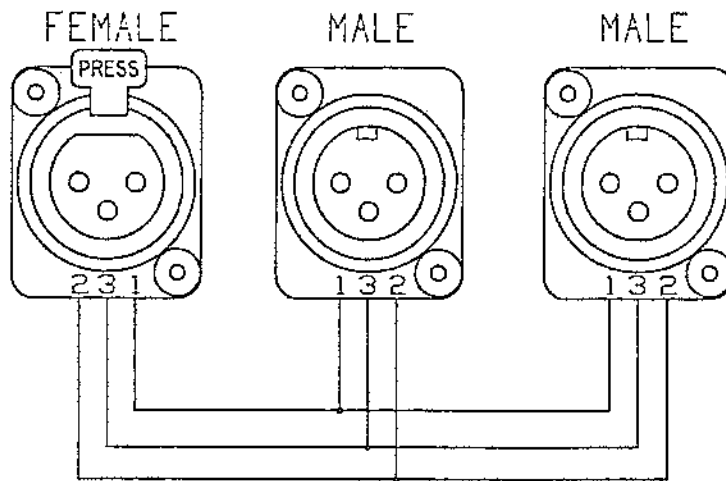


Figure 2 - Pictorial wiring diagram of "Y" type microphone splitter

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 the Y-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.

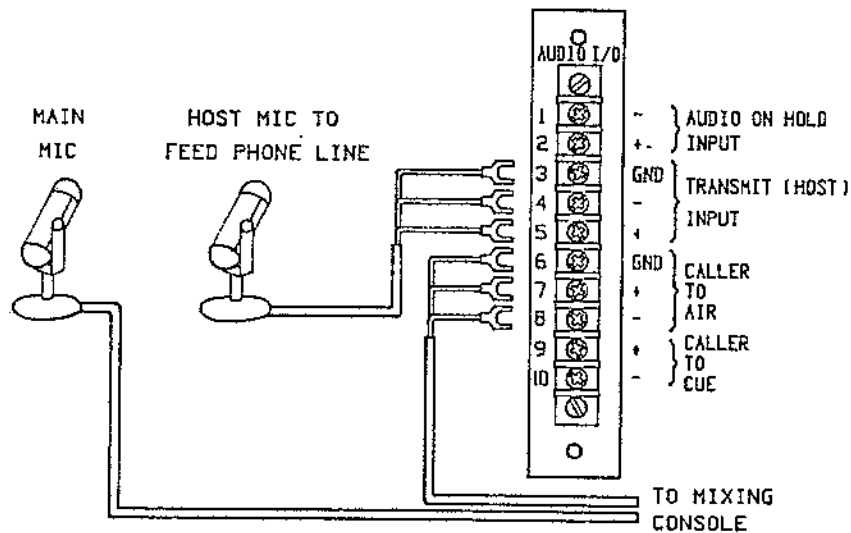


Figure 3 - Pictorial wiring diagram of a dual mic setup

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 108A 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).

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 108A host audio inputs (see Section 2.3) and to a line input of the air console. The 108A'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.

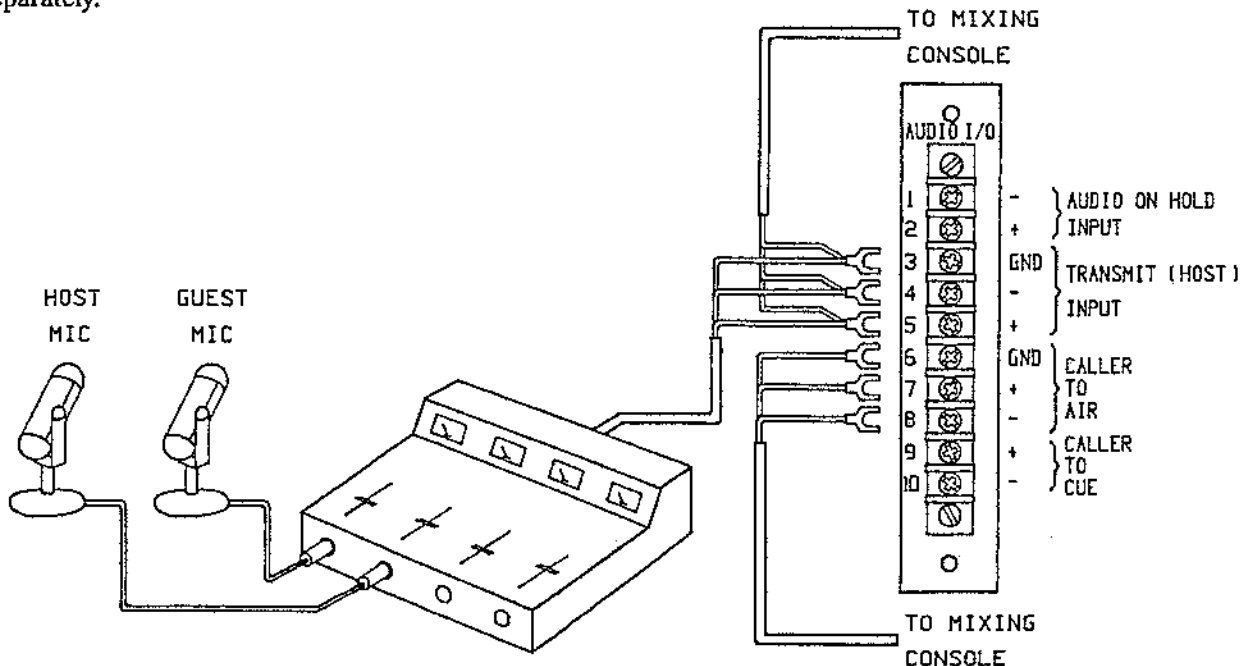


Figure 4 - Pictorial diagram of mix-minus derived with a sub-mixer

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.

The input used for the studio mic is switched to the cue (or audition) buss. Assuming the caller is not 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 "host audio input" on the 108A.

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

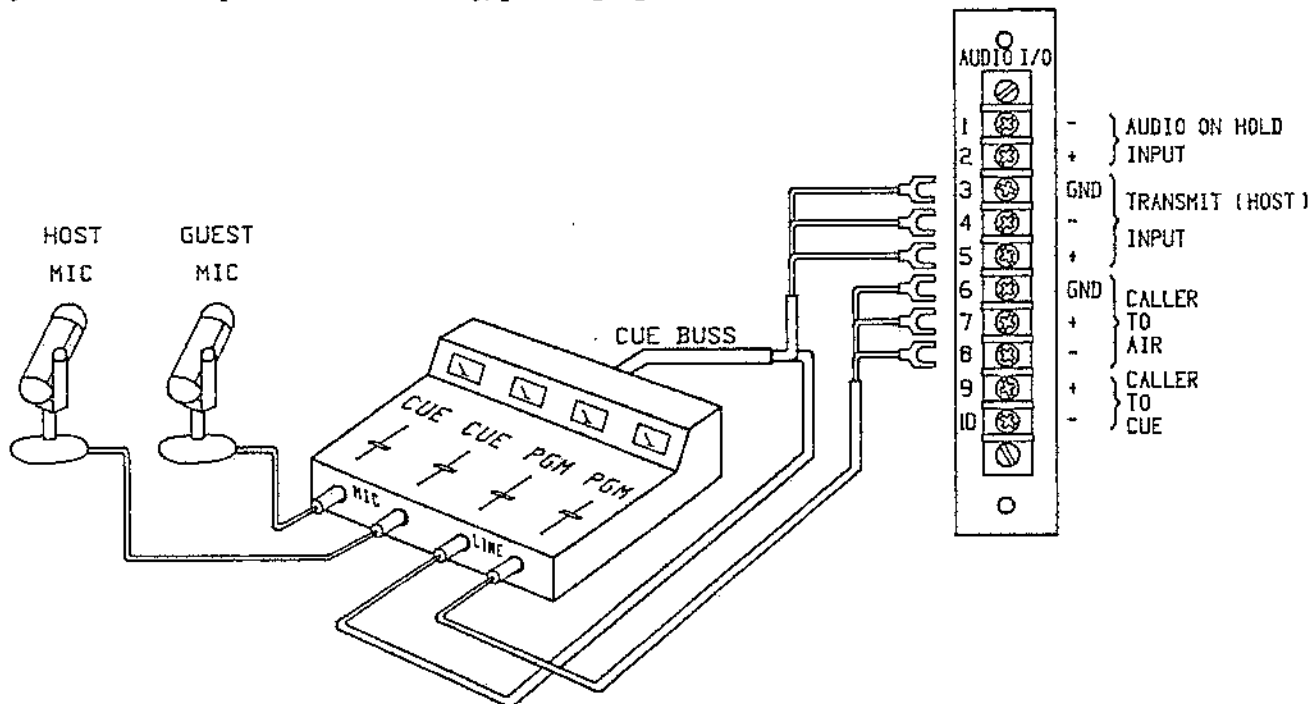


Figure 5 - Pictorial block diagram of mix-minus derived using existing console's cue buss.

APPENDIX B - Using Electronically Balanced Inputs and Outputs

Electronically balanced inputs and outputs must sometimes be treated differently from transformer coupled inputs and outputs. The polarity may be changed by reversing the (+) and (-) connections.

With balanced equipment:

When the 108A 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

With unbalanced equipment:

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

To use the 108A's inputs with unbalanced outputs, connect:

tip to hi (+)
ring to ground
ground the low (-) input

To use the 108A's outputs with unbalanced inputs, connect:

hi (+) to tip
low (-) do not connect
ground to ring

CAUTION: The 108A's outputs are electronically balanced, transformerless. When driving an unbalanced input, the unused output leg **must not be grounded**. The output line drivers may be damaged if operated into ground (a "short circuit").

APPENDIX C - Cable and Spade Lug Specifications and Suppliers

Desk Console Cable

The cable connecting the 108A desk console to the rack mounted controller unit is the "standard" 25-pair type commonly used to interconnect business telephone systems (sometimes called fat cable). The 108A is supplied with a 25' cable, with connectors. The cable's connectors are locked to their chassis mounted mates with "U" shaped retaining clips.

If additional cabling is required, order Model 25/25, 25-pair, 25 foot cable assembly. Contact your local cable supplier for other lengths. The following components are required:

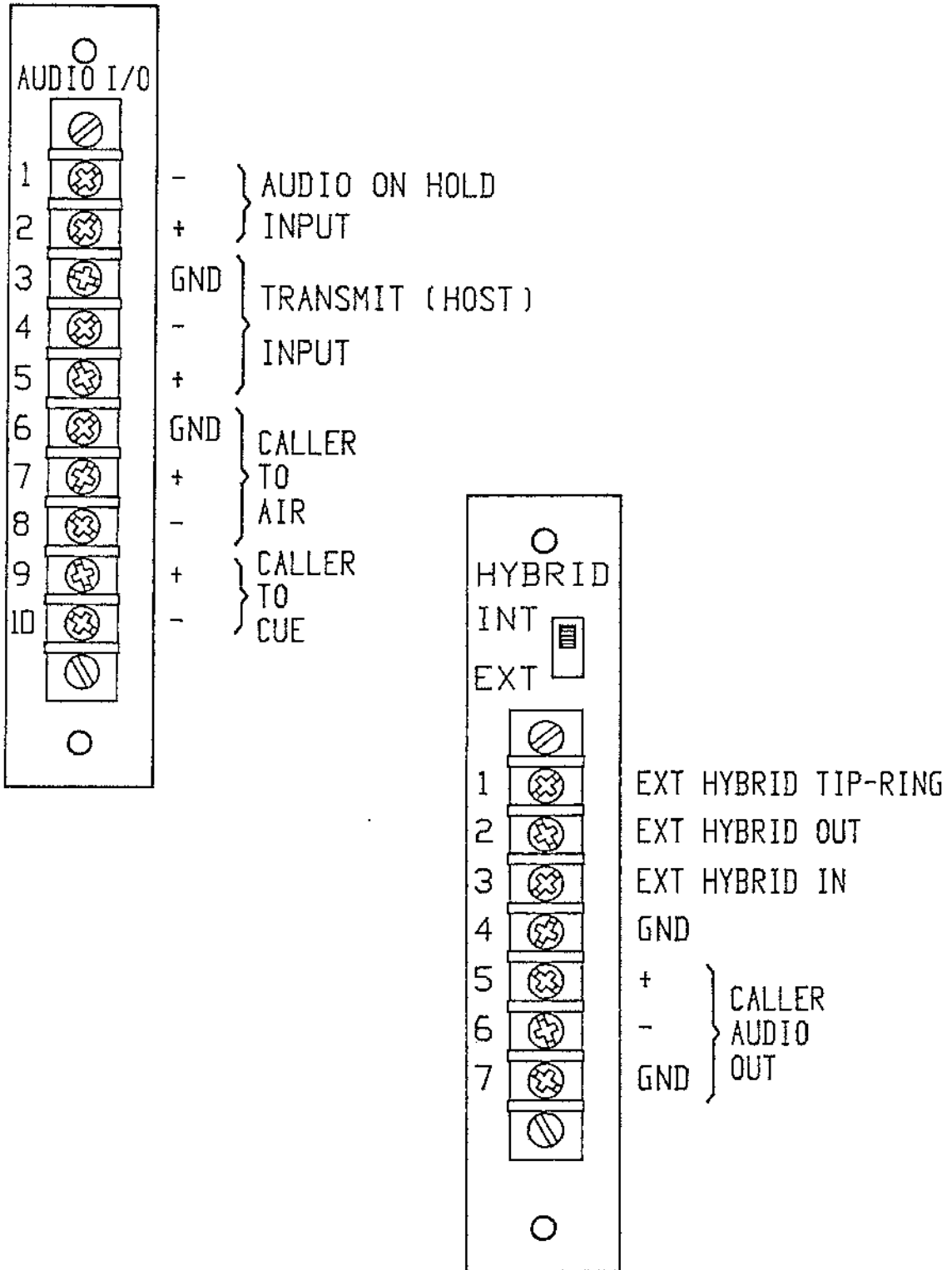
Connector manufacturer:	AMP, Inc. Harrisburg, PA 17105 USA (717) 564-0100
Male Connector:	AMP part number 552319-1
Female Connector:	AMP part number 552390-1
Connector Cover:	AMP part number 552008-1 (two per cable)
Retaining Clips	AMP part number 552723-1 (two per cable):
Cable type:	vinyl jacketed unshielded 25-pair diameter .430 to .490.

Barrier Strip Terminations

The rear panel barrier strip terminals provide all other connections to and from equipment used with the 108A.

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/Combiners

Mic splitters provide two (or more) outputs from one input, and are often used in reverse for two inputs to one output. This combining function can be accomplished with either a directly connected "Y," or the aforementioned audio transformer with one primary and two secondaries.

The only commercially available "Y" adapters are made by Switchcraft, with XLR connectors on both ends. The 108A input is on a barrier strip. A drawing of an easily built "Y" combiner is shown in Figure 2, Appendix A.

"Y" Adapters:

Switchcraft
555 North Elston Avenue
Chicago, IL 60630
(312) 792-2700

TWX 910 221-5199
FAX (312)792-2129
Easylink 62711770

Switchcraft 391Q Audio "Y" Adapter, with XLR connectors:

<u>Connectors</u>	<u>Part No.</u>
1 male to 2 female	391Q43
1 female to 2 female	391Q33
1 female to 2 male	391Q13

Transformer type splitters/combiners:

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

(702) 384-0993 TWX (910)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 - Half-Duplex Hybrids

Full-Duplex Hybrids

The Symetrix 108A contains two full-duplex telephone hybrids. These circuits convert the two-wire telephone audio to four-wire. On a two-wire system the audio signals from both parties are carried over a single pair of twisted wires. Two-wire circuits are bi-directional. In a four-wire system the signal flow is unidirectional. That is to say, each party transmits from an "output" and receives to an "input". When connected to a telephone line, it is the job of the hybrid to interface the two-wire telephone line audio to a four wire device with inputs and outputs such as a mixing console.

The 108A's hybrids use electronic differential amplifier technology to subtract the host voice from the two-wire (both parties) signal. These hybrids (as explained in Section 2) must be adjusted to your phone lines to provide maximum rejection of the host voice. This procedure need only be done during initial setup. No re-adjustment is necessary *unless* the impedance of the phone line(s) changes.

Half-Duplex Hybrids

There are some situations where this may well be a problem. Consider, for example, a 108A installation with three local exchange telephone lines and a fourth "800" number line. In virtually all cases the nominal impedance of the three local lines will be within several dB of each other. It is a safe bet that the impedance of the "800" line will be considerably different from the local lines. The 108A hybrids must be set-up for *either* the "800" line or the local lines. If the hybrids are adjusted to the local lines, for example, the host rejection on the "800" line can be quite poor. Conferencing between local and "800" lines will yield less than satisfactory results.

For those installations which present telephone lines of diverse impedances, Symetrix has developed a half-duplex hybrid to solve the problem. These half-duplex boards (listed on our price list as Half-Duplex Card) may be retrofitted to any 108 or 108A system.

The half-duplex boards require no balancing adjustments, and will work over a wide range of telephone line impedances while automatically providing maximum host rejection from the caller return signal. With the half-duplex units installed, conference audio is superb and the loudspeaker to microphone feedback path is eliminated in those installations where caller monitoring is done on loudspeakers rather than headphones.

The half-duplex hybrid accomplishes its' magic by use of techniques analogous to "speakerphone" operation. Host audio is given priority in all cases. That is to say that when the host speaks, the telephone line audio level is automatically reduced, momentarily removing both the host and the caller from the caller output. Due to the "switching" of the half-duplex circuit, the conversation is no longer simultaneously bi-directional. However, the switch is very fast and in most cases the tradeoff of simultaneous bi-directionality for improved audio quality is more than justifiable.

Half-Duplex Card Installation

1. Remove the top cover. It is secured by a total of 18 fasteners - four Allen head screws at the front, 3 Phillips head on each side panel, and 7 Phillips head on the rear panel.
2. The Allen head screws require a 5/64" hex driver. The Phillips head screws require a #1 Phillips driver.
3. Remove the two screws that secure the hybrid card to the front panel, and the single screw on the back (where the rear panel of the hybrid card meets the bottom of the chassis).
4. The circuit board sits in an edge card connector. Carefully lift the card up, and out of the chassis enclosure.
5. To install the Half-Duplex card, reverse the above steps.

APPENDIX G - Installing the 108RB Accessory Controller

The optional 108RB provides additional relay controlled switching capabilities external to the 108A. The 108RB contains eight relays, each corresponding to one of the eight telephone lines. 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 on the 108A, 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 108A 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 108A controller unit, remove the top cover of the controller unit. The cover is secured by a total of 18 fasteners: 4-Allen head screws at the front, 3-Phillips heads screws on each side panel, and 8-Phillips head screws on the rear panel.

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

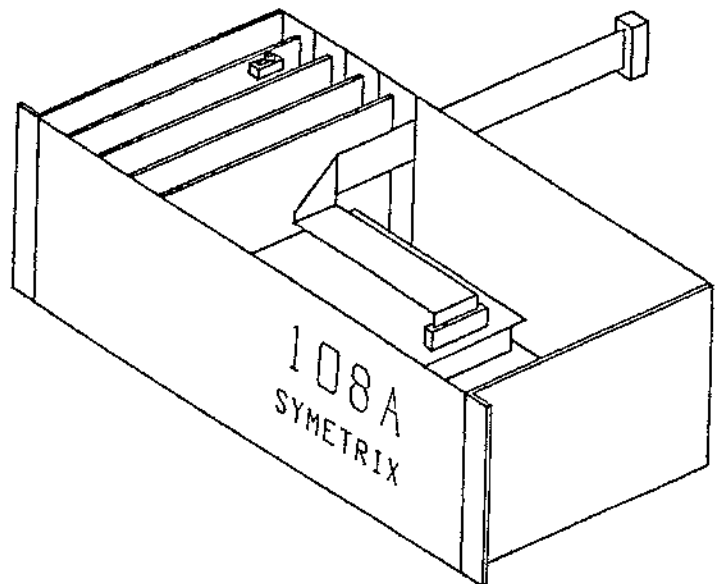
Note: To insure proper installation of the ribbon cable, two pins have been removed from the 16-pin male headers on both the 108A controller unit and the 108RB. The corresponding holes in the female connectors on the ribbon cable have been plugged.

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

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

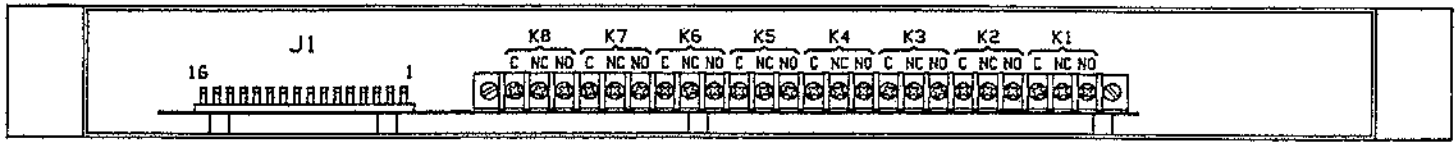
2. Gently twist the cable 90° clockwise, then feed it out the controller unit's back panel through the slot between the last hybrid and the adjoining sheet metal.

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 relays provides one normally open and one normally closed set of contacts, as well as one common terminal.



108-RB
REAR VIEW

CAUTION: Consult your telephone company or system supplier before connecting the 108RB 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 108A 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

APPENDIX H - Phone Line to Hybrid Allocation

Line/Hybrid Assignment

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

When *individual* lines are put on **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 H.1 - HYBRID ALLOCATION

LINE	1	2	3	4	5	6
HYBRID	1	2	3	1	2	3
AIR GROUP...	3	1	2	3	1	2

Hybrid allocation "shifts right" after use of on of the **AIR GROUP** keys.

Manual Hybrid Assignment

When it is necessary to be sure a particular hybrid is used with a selected line, that line can be manually assigned to a hybrid. For example, when a guest interview is brought in via telephone line, that line must be put on **AIR** *first* to be sure it will be assigned to Hybrid 1. Use this technique when slot 1 is occupied by a full-duplex hybrid for guests, and slots 2 and 3 are occupied by Half-Duplex Cards for callers.

Remember, whichever line is put on the air first will be assigned to Hybrid 1. To be sure a guest interview always appears on Hybrid 1, press the appropriate "**AIR**" key before putting any other lines on the air.

APPENDIX I - SPEC 1 Software

The SPEC 1 software revision changes the console status in operating modes 5 and 6, as described on page 21 of the 108 Installation and Operation Manual. With this software installed, the unit comes up in Mode 6, not Mode 1. If another operating mode is desired it must be selected with the MODE SELECT switch, as described on page 19.

SPEC 1 software makes all keys on both consoles active in Modes 5 and 6. In addition, when the unit is operated in Mode 5 or Mode 6, two outgoing calls may be initiated simultaneously (one each from the desksets associated with both consoles).

Mode 5

Console A (Host)		Console B (Call Director)	
LINE	active	LINE	active
CUE/HOLD	active	CUE/HOLD	active
AIR	active	AIR	active
RELEASE	active	RELEASE	active
AIR TO CUE	active	AIR TO CUE	active
AIR TO HOLD	active	AIR TO HOLD	active
PROFANITY	active	PROFANITY	active

Mode 6

Console A (Call Director)		Console B (Host)	
LINE	active	LINE	active
CUE/HOLD	active	CUE/HOLD	active
AIR	active	AIR	active
RELEASE	active	RELEASE	active
AIR TO CUE	active	AIR TO CUE	active
AIR TO HOLD	active	AIR TO HOLD	active
PROFANITY	active	PROFANITY	active

Installation

The SPEC 1 software resides on a 24-pin memory chip, which replaces the existing software in the 108. To install SPEC 1:

WARNING! DISCONNECT THE POWER CABLE FROM THE REAR PANEL AC CONNECTOR BEFORE REMOVING THE TOP COVER.

1. Remove the top cover of the 108. It is secured by a total of 18 fasteners: 4-Allen head screws across the front, 3-Phillips head on each side panel, and 8-Phillips head screws across the back. The Allen head screws require a 5/64" hex driver. The Phillips head screws require a #1 Phillips screwdriver.
2. Observe its orientation, then remove the existing software memory chip. It can be identified by the Symetrix Copyright notice label and Rev. number affixed to the top.
3. Carefully insert the SPEC 1 software memory chip into the socket, following the orientation as observed.
4. Put the "old" memory chip into the protective container had been occupied by the SPEC 1 chip. Store the container in a safe place for possible re-installation.
5. Replace the top cover before reconnecting the AC cable or testing the unit.

LIMITED WARRANTY

The Symetrix 108A is designed and manufactured for use in professional and studio audio systems. Symetrix, Inc., warrants that the 108A manufactured by Symetrix, when properly installed, used and maintained in accordance with instructions contained in the manufacturer's operator's manual, will perform according to the specifications set forth in the operator's manual.

Symetrix expressly warrants that 108A will be free from defects in material and workmanship for one (1) year. Symetrix' obligations under this warranty will be limited to repairing and replacing, at Symetrix' option, the part or parts of the 108A which prove defective in material or workmanship within one (1) year from the date of purchase, provided that the Buyer gives Symetrix prompt notice of any defect or failure and satisfactory proof thereof. Products may be returned by Buyer only after a Return Authorization number (RA) has been obtained from Symetrix and Buyer will prepay all freight charges to return any products to the Symetrix factory. 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. Products repaired under warranty will be returned freight prepaid via United Parcel Service by Symetrix, to any location within the Continental United States. Outside the Continental United States, products will be returned freight collect.

THE FOREGOING WARRANTIES ARE IN LIEU OF ALL OTHER WARRANTIES, WHETHER ORAL, WRITTEN, EXPRESS, IMPLIED OR STATUTORY. SYMETRIX, INC. EXPRESSLY DISCLAIMS ANY IMPLIED WARRANTIES, INCLUDING FITNESS FOR A PARTICULAR PURPOSE OR MERCHANTABILITY. SYMETRIX, INC.'S WARRANTY OBLIGATION AND BUYER'S REMEDIES HEREUNDER ARE SOLELY AND EXCLUSIVELY AS STATED HEREIN.

The Symetrix 108A is designed and manufactured for use in professional sound systems and is not intended for other usage. With respect to products purchased by consumers for personal, family or household use, Symetrix **EXPRESSLY DISCLAIMS ALL IMPLIED WARRANTIES, INCLUDING BUT NOT LIMITED TO WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE.**

This limited warranty, with all terms, conditions, limitations and disclaimers set forth herein, shall extend to the original purchaser and anyone who purchases the product within the specified warranty period.

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

Symetrix does not authorize any third party, including any dealer or sales representative, to assume any liability or make any additional warranties or representation regarding this product performance on behalf of Symetrix.

This limited warranty gives the buyer certain rights. You may have additional rights provided by applicable law.

LIMITATION OF LIABILITY

The total liability of Symetrix, Inc. on any claim, whether in contract, tort (including negligence) or otherwise arising out of, connected with, or resulting from the manufacture, sale delivery, resale, repair, replacement or use of any product will not exceed the price allocable to the product or part thereof which gives rise to the claim. In no event will Symetrix, Inc. be liable for any incidental or consequential damages including but not limited to damage for loss of revenue, cost of capital, claims of customers for service interruptions or failure to supply, and costs and expenses incurred in connection with labor, overhead, transportation, installation or removal of products or substitute facilities or supply sources.

