BMX-III
Broadcast Console

BMX-18 Mainframe: PR&E # 99-260-3CU
BMX-22 Mainframe: PR&E # 99-260-4CU
BMX-26 Mainframe: PR&E # 99-260-5CU
BMX-30 Mainframe: PR&E # 99-260-610U
BMX-34 Mainframe: PR&E # 99-260-7CU

Operations
&
Technical
Manual

***PR&E Document* #75-10**

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This listing provides a reference of current pages of this document, and their revision numbers (i.e., A.1, A.2, etc.). When a revision to this document is received from PR&E, simply replace the old pages with the new ones, discard the old pages, and post the new status page in the front of this manual (**NOTE**: It may be desirable to retain replaced status pages in order to have a record of document changes). If deemed necessary by PR&E's Engineering Department, comment information relating to any change may also be included on this page.

Page No.	Revision	Comments
ALL	B	Corporate Name Change
4,5,78,89 90,100,101	C	Standard output level is now +4 dBu instead of +8 dBu. References in text updated.
ALL	C	Files changed to PC format. Text & graphics updated.

TABLE OF CONTENTS

BMX SERIES III BROADCAST CONSOLE TECHNICAL MANUAL

1.0 GENERAL INFORMATION

This chapter contains an introduction to the BMX Series III Broadcast Console Technical Manual, an overview of the BMX III's features, its specifications and warranty information.

1.1 INTRODUCTION

Congratulations on your decision to join the growing ranks of Pacific Research & Engineering Corporation (PR&E) broadcasters. PR&E is in the business of supplying the finest audio systems to the world's leading broadcast facilities. Your decision to go with PR&E means that you expect more than simple working hardware. Please be assured that it is our strong desire to provide each of our customers with the kind of products, systems, documentation and support that we would specify if we were in your position.

We invite your comments and suggestions for improvement of this document, and of all our services. By constant attention to our customer's needs, we will continue to earn our reputation for excellence, and to refine our understanding of the requirements of the marketplace.

This manual is designed to provide the information required to understand, install, operate and maintain the BMX III Broadcast Console. It is assumed that the reader has a working knowledge of audio control consoles, systems and installation practices. The BMX III is a very sophisticated device with an extensive range of features and capabilities. To obtain the maximum benefit of the console's capabilities, it is strongly recommended that the Installation, Operation, and Equipment Description chapters of this manual be read thoroughly prior to installing the console.

Each BMX III is specifically configured to the customer's requirements, thoroughly tested, and "burned-in" prior to packing for shipment. Should you encounter any difficulty during installation or initial operation, we recommend that you contact PR&E for assistance.

1.2 DESCRIPTION

The BMX III is designed with the capacity to accomplish almost any type of stereo on-air audio control task in a radio broadcast facility. In addition, patch points are supplied for all the input and the line output amplifiers for the insertion of processing equipment. This gives the BMX III the capability for creative production as well as on-air applications.

The BMX III was developed in parallel with our AMX Broadcast Operations Console, and many of the function modules were derived from the AMX concepts. For example, the BMX III Microphone and

Stereo Line Input Modules are almost identical to the AMX modules, with the exception of the two Send circuits, while the Control Room Monitor, Two-Studio Monitor, Stereo Line Output, and Slate/ Talkback/Test Oscillator Modules are identical. The BMX III will also accommodate the AMX input modules with Sends, along with the optional Send And Return Module. The Monaural Output, Telco Mix and Send And Return Modules for the AMX have been combined into a single module for the BMX III, but all are still available as individual modules, depending upon customer requirements.

NOTE: The BMX III was not derived from the BMX Series II, but was designed to be part of the ABX and AMX family of broadcast consoles. Therefore, the BMX Series II and Series III consoles do not share any common modules or subassemblies.

The BMX III is currently being produced in seven mainframe sizes which will accommodate 10, 14, 18, 22, 26, 30 and 34 input modules. The term "input modules" refers to microphone and line input modules. The seven mainframes are virtually identical with the only difference being the available space for the meter panel.

In order to realize the full potential of the BMX III, it is important that the user become fully acquainted with the extensive audio and logic control functions available. The console and module block diagrams, located in Chapter 7 of this document, show the audio signal flow and the extensive logic control inputs and outputs which are available to the user. These block diagrams present a concise picture of the modules' operating functions and features as well as the overall console system, and can be very useful in determining how to best utilize your BMX III.

The BMX III has been designed functionally, mechanically and electronically to provide the maximum value in performance and features of any currently available broadcast console. Highest quality components and circuit designs are used throughout the console. The gain structure of the console has been designed so that normal operation is easily achieved without danger of internal clipping (when operating the amplifiers at optimum signal to noise conditions).

The input modules accommodate the range of input levels normally found in broadcast operations without the use of external pads or amplifiers. A patch point is provided for each input position after the input amplifier and before the fader. This is the optimum point at which to insert external processing devices such as limiters and equalizers. Patch points are also provided in each main output channel (after the mixing amplifier and before the line output amplifiers).

All console inputs and program outputs are balanced, for best noise rejection and simplified system grounding. When properly installed using the information in this manual, the BMX III console is free of internal pops, clicks, and radio-frequency interference (RFI).

The separately packaged power supply is fully regulated, and is protected with magnetic circuit breakers, as well as electronic safeguards against excessive current and line voltage fluctuations. The power supply provides four separate voltage outputs. Two of these outputs (± 22 volts) are used to power the audio circuitry. The third output (+12 volts) is used to power the logic control circuitry, lamps and relays. The fourth output (+ 48 volts) is for the phantom powering of condenser microphones connected to the Microphone Input Modules.

1.3 SPECIFICATIONS

Following is a list of specifications for the BMX III Broadcast Operations Console:

MICROPHONE INPUTS

Source Impedance	150 ohms.
Input Impedance	1000 ohms minimum, balanced.
Input Level Range	Adjustable from -60 dBu to -35 dBu.
Input Headroom	Greater than 30 dB above nominal input.

HIGH LEVEL INPUTS

Source Impedance	600 ohms.
Input Impedance	Greater than 40K ohms, balanced.
Input Level Range:	
Line Input Module	Adjustable from -12 dBu to +4 dBu.
Return Module	Adjustable from -15 dBu to +4 dBu.
Monitor Module Inputs	Nominal +4 dBu/+4 dBu.
Input Headroom	Greater than 30 dB above nominal input.

MAIN OUTPUTS

Load Impedance	600 ohms and greater.
Source Impedance	30 ohms, balanced.
Output Level Range	Adjustable from +4 dBu to +4 dBu.
Maximum Output Levels:	
Line Output Amplifiers	+28 dBm, 600 ohm load.
Send Module	+26 dBm, 600 ohm load.

MONITOR OUTPUTS

Main Outputs:	
Load Impedance	600 ohms or greater.
Source Impedance	30 ohms, unbalanced.
Output Level	0 dBu nominal, +20 dBu maximum.
Headphone Outputs:	
Load Impedance	45 ohms or greater.
Source Impedance	Less than 4 ohms.
Output Level	0 dBu nominal, +20 dBu maximum.

PATCH SENDS AND RETURNS

Patch Send Outputs	Nominal -10 dBu; unbalanced.
Patch Return Inputs	Nominal -10 dBu; 40k ohm balanced and bridging.

FREQUENCY RESPONSE

Microphone Input to Program Output	+0 dB, -0.9 dB, 20 Hz to 20 kHz.
Line Input to Program Output	+0 dB, -0.8 dB, 20 Hz to 20 kHz.

NOISE

Microphone Input Amplifier	-127 dBu equivalent input noise, 150 ohm source, 20 kHz bandwidth.
Line Input Amplifier	-88 dBu equivalent input noise, 600 ohm source, 20 kHz bandwidth.
Output Noise with one microphone channel ON, fader at -15 dB, Input sensitivity at -50 dBu	76 dB below output, reference +4 dBu, 150 ohm source, 20 kHz bandwidth.
Output Noise with one line channel ON, fader at -15 dB, Input sensitivity at +4 dBu	80 dB below output, reference +4 dBu, 600 ohm source, 20 kHz bandwidth.
Output Noise with no input channels ON	82 dB below output, reference +4 dBu, 20 kHz bandwidth.

DISTORTION, T.H.D.

Mic Input to Program Output	Less than 0.02%, 20 Hz to 20 kHz, -50 dBu input, +4 dBu output into 600 ohm load, 80 kHz meter bandwidth; less than 0.01 at 1 kHz, +28 dBu output.
Line Input to Program Output	Less than 0.008%, 20 Hz to 20 kHz, +4 dBu input, +4 dBu output into 600 ohm load, 80 kHz meter bandwidth; less than 0.01 at 1 kHz, +28 dBu output.

DISTORTION, I.M.D.

Mic Input to Program Output	Less than 0.008 %, -50 dBu input, +4 dBu output into 600 ohm load; less than 0.01% at +28 dBu output.
Line Input to Program Output	Less than 0.005 %, +4 dBu input, +4 dBu output into 600 ohm load; less than 0.01% at +28 dBu output.

CROSSTALK

Interchannel Crosstalk	Less than -85 dB at 1 kHz; less than -75 dB at 20 kHz.

POWER REQUIREMENTS

120 VAC, ±8%, 50/60 Hz

BMX III-10, fully configured	360 watts.
BMX III-14, fully configured	390 watts.
BMX III-18, fully configured	420 watts.
BMX III-22, fully configured	450 watts.
BMX III-26, fully configured	480 watts.
BMX III-30, fully configured	500 watts.
BMX III-34, fully configured	520 watts.

NOTES:

A) These specifications are for the basic signal paths, per channel, with either or both channels of a stereo pair operating, and with 600 ohm loads connected to the program outputs.

B) 0 dBu corresponds to an amplitude of 0.775 volts RMS regardless of the impedance of the circuit. It is the same voltage value as 0 dBm measured in a 600 ohm circuit. This enables convenient level measurement with meters calibrated for 600 ohm circuits.

C) Noise specifications are for a 14-input console; larger consoles will have slightly reduced signal to noise ratios due to increased summing amplifier gain. Noise specifications are based upon a 20 kHz measurement bandwidth; the use of a meters with 30 kHz bandwidth will result in a noise measurement increase of approximately 1.7 dB.

1.4 WARRANTY INFORMATION

This product carries a manufacturer's warranty which is subject to the following guidelines and limitations:

A) Except as expressly excluded hereinafter, Pacific Research & Engineering Corporation ("Seller") warrants equipment of its own manufacture against faulty workmanship or the use of defective materials for a period of one (1) year from date of shipment to Buyer. The liability of the Seller under this Warranty is limited to replacing, repairing or issuing credit (at the Seller's discretion) for any equipment, provided that Seller is promptly notified in writing within five (5) days upon discovery of such defects by Buyer, and Seller's examination of such equipment shall disclose to its satisfaction that such defects existed at the time shipment was originally made by seller, and Buyer returns the defective equipment to Seller's place of business in Carlsbad, California, packaging and transportage prepaid, with return packaging and transportage guaranteed.

B) Equipment furnished by Seller but manufactured by another shall be warranted only to the extent provided by the other manufacturer.

C) Thermal filament devices such as lamps and fuses are expressly excluded from this warranty.

D) The warranty period on equipment or parts repaired or replaced under warranty shall expire upon the expiration date of the original warranty.

E) This Warranty is void for equipment which has been subject to abuse, improper installation, improper operation, improper or omitted maintenance, alteration, accident, negligence (in use, storage, transportation or handling), operation not in accordance with Seller's operation and service instructions, or operation outside of the environmental conditions specified by Seller.

F) This Warranty is the only warranty made by Seller, and is in lieu of all other warranties, including merchantability and fitness for a particular purpose, whether expressed or implied, except as to title and to the expressed specifications contained in this manual. Seller's sole liability for any equipment failure or any breach of this Warranty is as set forth in subparagraph A) above; and Seller shall not be liable or responsible for any business loss or interruption, or other consequential damages of any nature whatsoever, resulting from any equipment failure or breach of this warranty.

2.0 INSTALLATION

This chapter provides instruction in the proper installation of the BMX III Broadcast Operations Console. Included are sections describing general installation guidelines, cable preparation, mainframe configuration, grounding and shielding, power connection, patch point connection, audio and logic connection, remote control connection, and module internal option switches.

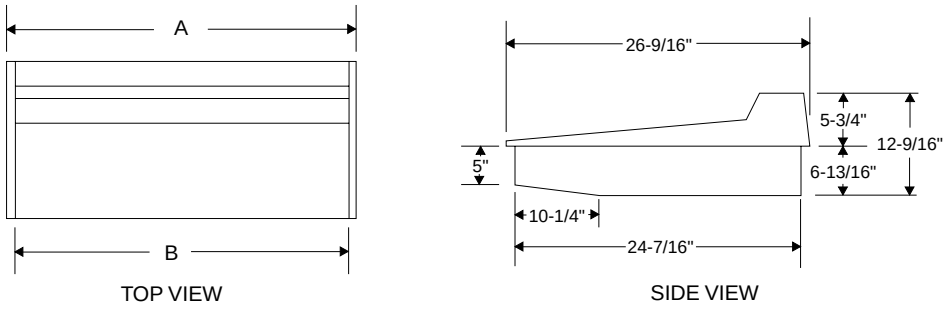
2.1 GENERAL GUIDELINES

The BMX III should be carefully unpacked and inspected for any shipping damage. If the inspection reveals any damage, immediately file a claim with the delivering carrier. The packing material should be kept as evidence of mishandling, as well as to allow return of the equipment to the factory, if necessary.

Included with the console are the tool and spare parts kits (as described in Chapter 6), and the appropriate connector kit, which contains all of the Molex connector housings and pins necessary to prepare the audio input/output and logic cables (as described in Section 2.2).

The console is physically installed by setting it into a cutout in the work surface of the studio cabinetry (console and cutout dimensions are provided in Figure 2.1). Prior to installing the mainframe, a final check should be made to confirm that the cutout dimensions are correct. Also, be sure that the cabinetry is in its proper position and leveled, as it is unlikely that the cabinetry can be moved, squared or leveled once the weight of the BMX III has been added.

NOTE: The cabinetry in which the BMX III is to be mounted must be of sufficiently sturdy construction to support the console.



DIMENSION TABLE			
CONSOLE	A	B	C
BMX III-10	32"	30-1/2"	30-3/4"
BMX III-14	38"	36-1/2"	36-3/4"
BMX III-18	44"	42-1/2"	42-3/4"
BMX III-22	50"	48-1/2"	48-3/4"
BMX III-26	56"	54-1/2"	54-3/4"
BMX III-30	62	60-1/2"	60-3/4"
BMX III-34	68	66-1/2"	66-3/4"

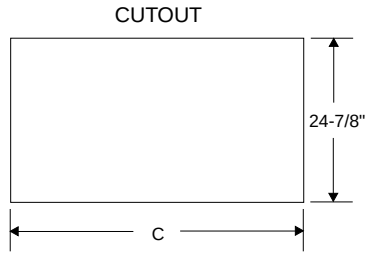


FIGURE 2.1 CONSOLE DIMENSIONS

The console mainframe is supported by the hardwood oak end panels, and is actually suspended between the two end panels, with the front oak piece serving only as trim molding.

NOTE: Care should be taken to avoid locating the console within six feet of any intense electromagnetic hum fields such as are produced by large power transformers and motors. Likewise, cables to and from the console should be routed to achieve maximum practical distance from AC mains power wiring. Particular attention should be paid to some of the low-cost, supposedly "professional", power amplifiers which have appeared in the marketplace. In many cases the low cost has been partially achieved through the use of small core power transformers operating on the edge of saturation. While these units may operate to their own specifications, the electromagnetic fields they radiate may impair the performance of the console, neighboring turntables, tape recorders and cartridge machines.

Signal, logic and power connections are made to the connector panel located at the rear of the console. This panel is recessed to provide the installer flexibility of wire routing in console installation.

The power supply is usually installed in the console support cabinetry using EIA standard rack rails. Adequate ventilation must be provided for the proper dissipation of heat. The power supply is designed for convection cooling by the two massive rectifier/regulator heat sinks located on opposite sides of the chassis. Large heat sinks were chosen over the use of fans to eliminate the problems of dust circulation, noise, and potential mechanical failure associated with fan cooling.

Install legend strips by sliding them into the tops of the legend panels. Monitor legend strips are 0.6 inch wide by 5.15 inches high (15 mm by 131 mm); Remote Line Selector legend strips are 0.6 inch wide by 5.7 inches high (15 mm by 145 mm); Meter Switcher legend strips are 0.6 inch wide by 2.8 inches high (15 mm by 71 mm). Vertical switch spacing is 0.6 inch (15 mm).

2.2 CABLE PREPARATION

Before beginning the installation, a plan should be drawn up showing how the system will be interconnected (use the module pin-out information contained in Section 2.7 as a guide). All cables and connectors should be tagged with numbers and/or legends, and logged.

Only unspliced (preferably new) cables should be used in connecting the mainframe. Audio connections should be made with 2-conductor stranded insulated foil shielded cable with drain wire. The cable used should be equivalent to Belden types 8451, 9451, or 8761.

Strip the cable insulation jacket and foil shield back about 1-1/2 inches, and sleeve the shield drain wire with heat-shrink tubing, leaving about 3/16 inch of the wire exposed. Then, strip the insulation of each signal wire back about 3/16 inch, and sleeve the shield (at cable ends) with heat-shrink tubing.

NOTE: It is very important to sleeve the shield drain wire and the shield (at cable ends) with heat-shrink tubing. This is the only means of assuring an installation according to recommended grounding procedures.

The Molex pins are designed so that the short tab “ears” are crimped onto the stripped wire to make the electrical connection, while the long “ears” are crimped over the insulated section of the wire to help support the connection.

In order to crimp, insert the short ears of the Molex crimp pin into notch “B” of the crimping tool (PR&E #70-3), with the ears pointing toward the letter “B”. Insert the wire into the terminal so that the stripped portion is between the short crimp ears, and the insulation is between the long crimp ears. Crimp the short ears.

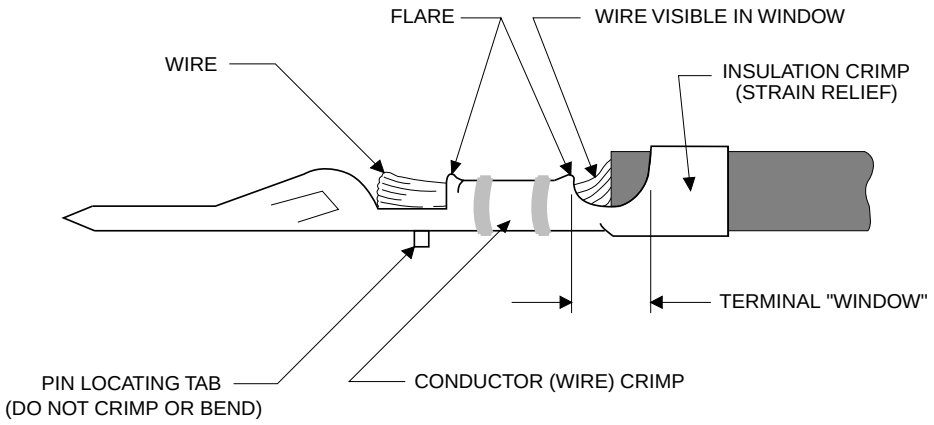


FIGURE 2.2 MOLEX CRIMP PIN

Now place the long ears of the pin into tool notch “A”, with the ears pointing toward the letter “A”. Crimp the long ears over the insulated section of wire. See Figure 2.2 for an example of a properly crimped Molex pin.

NOTE: When using the ratchet type Molex Crimping Tool #HTR-1719-C (PR&E #70-5), place a pin into slot “B” with the long ears on the “B” of the tool and pointing toward the letter “B”. Place the wire into the tool from the “B”, and then crimp the pin.

Logic control cables should be fabricated in a similar manner using 22 gauge multiple conductor, non-shielded, jacketed cable. The number of conductors required will be determined by application.

Once the pins are crimped, they may be inserted and locked into the nylon connector housing in accordance with the pin-out diagrams contained in Section 2.7. A click can be felt indicating that the locking ears on the pin have set. If a pin is inserted in the wrong connector position, or it is desired to make a circuit change, use the connector pin extractor tool (PR&E #70-4) to release the pin and press it out of the connector housing.

2.3 MAINFRAME CONFIGURATION

Each BMX III mainframe is factory configured to the customer's order by the installation of microphone input, line input and other modules in their specified and/or dedicated locations. This section contains descriptions of the BMX III mainframe's control panel, meter panel and connector panel.

2.3.1 Control Panel

Figure 2.3 illustrates the control panel layout of an BMX III-14 console. The positions identified by module names are dedicated to those modules only, and will not accept any other type of plug-in module.

The positions indicated by shading are "optional", and blank panels will be installed in these positions when no modules are present. Any unused "optional" module positions may be used for the installation of customer designed special purpose panels. OPTION cutouts have been provided in the Molex connector panel for the routing of wiring from these positions to the rear of the console (reference Figure 2.5).

NOTE: The "optional" module positions labeled A through E are pre-wired with 24-pin logic cables. These cables are routed to corresponding rear panel OPTION cutouts, as defined in Figure 2.5.

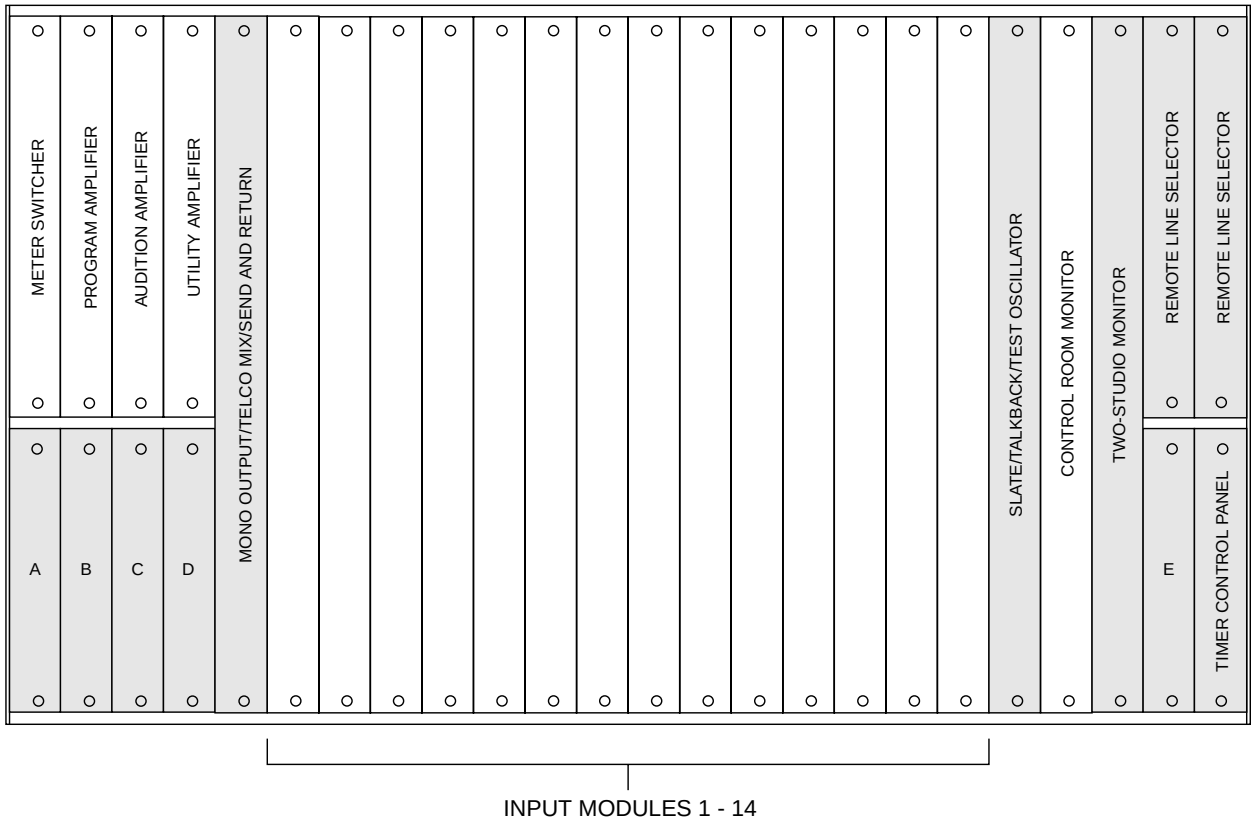


FIGURE 2.3 CONTROL PANEL LAYOUT

2.3.2 Meter Panel

Figure 2.4 illustrates the layout of the meter panels for the entire range of BMX III consoles. The AUXILIARY meters are utilized for metering the AUDITION and UTILITY outputs of the BMX III-10 and BMX III-14 mainframe sizes, and for metering the UTILITY output of the BMX III-18 and BMX III-22 mainframe sizes. This is accomplished by means of the Meter Switcher Module, which can also be used to display the Monaural, Send-1, Send-2 or other desired source levels. The AUXILIARY meters are also used to meter CUE and SOLO signals.

The built-in electret condenser microphone is used as the Control Room source for Slate and Talkback operations.

NOTE: Blank filler panels are supplied for any unused clock or timer position.

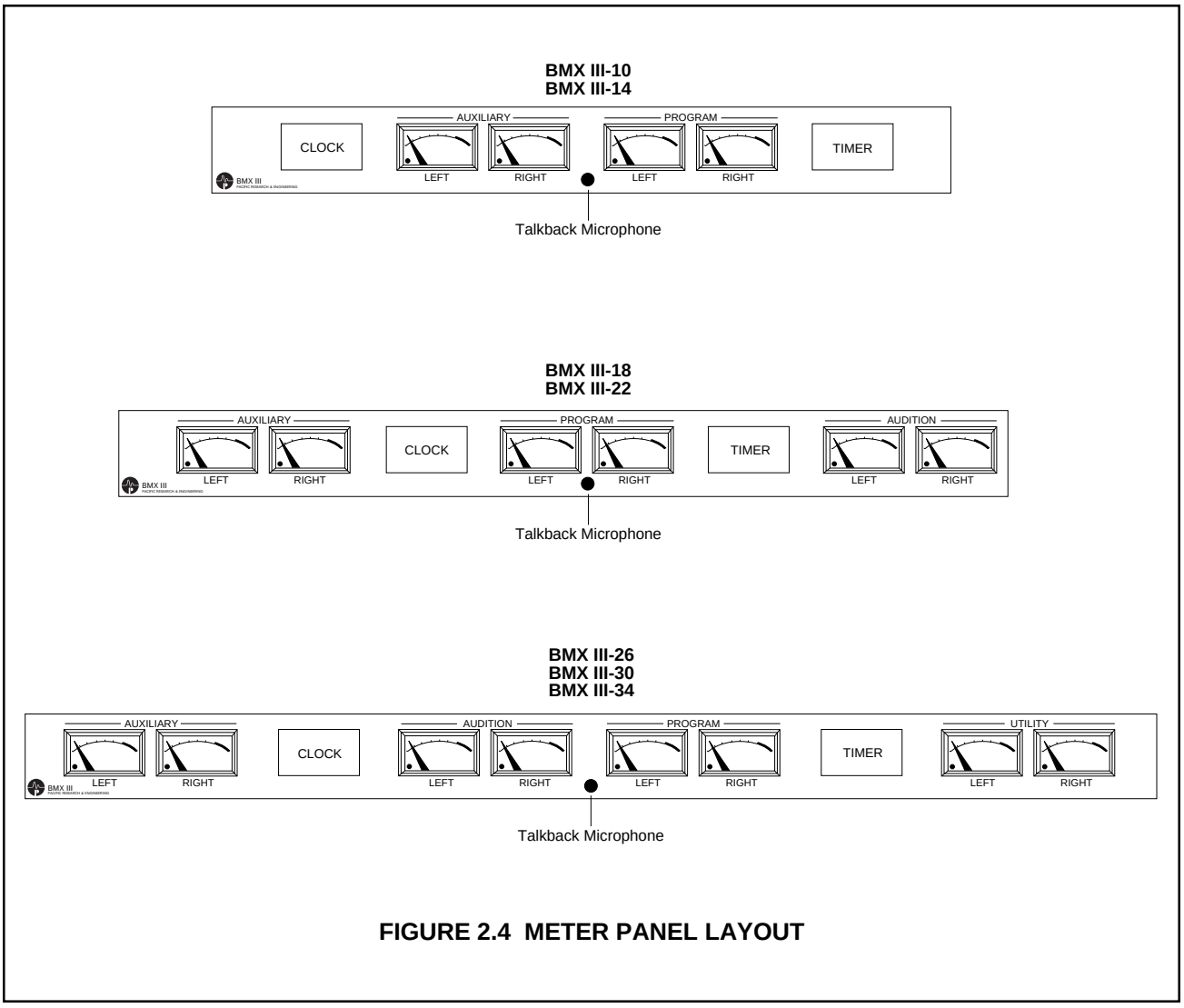


FIGURE 2.4 METER PANEL LAYOUT

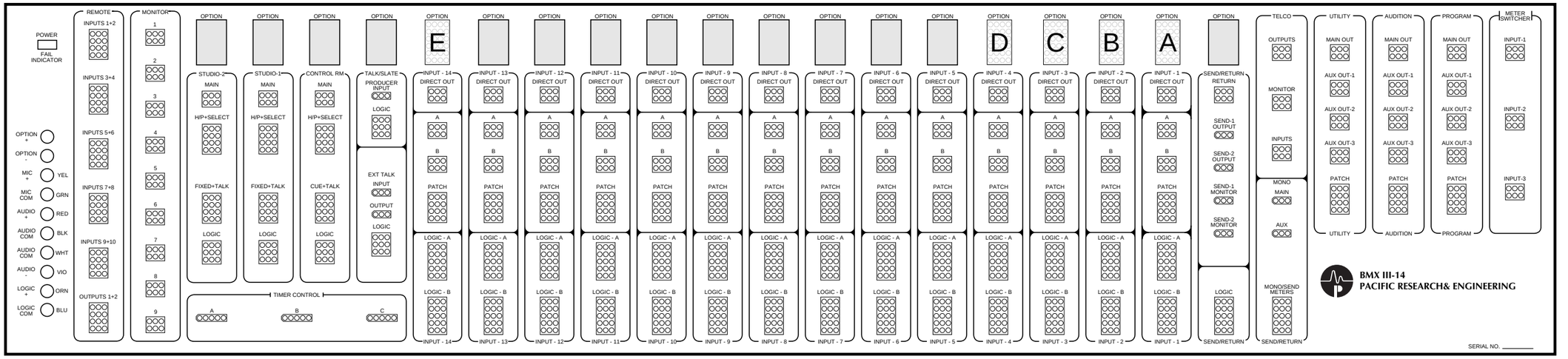
2.3.3 Connector Panel

Figure 2.5 (on the following page) illustrates the Molex connector panel for an BMX III-14 console, and is intended to provide the installer with a map to the location of the various groups of connectors on the panel. As a general rule, the connectors for any given module are located on the panel behind that module's position in the mainframe.

Cutouts are provided for a 24-pin Molex connector for each input position in the mainframe. These are labeled "OPTION" and are available for the installation of remote control connectors, special purpose panels, etc. The OPTION connectors labeled A through E on Figure 2.5 are pre-wired with 24-pin logic cables, which are routed to corresponding positions in the mainframe, as defined in Figure 2.3.

Nylon tie anchors are provided along the length of the Molex connector panel for tying down patch cables between the various module positions and the meter and monitor connectors. Factory configured consoles will have the appropriate patch wiring in place.

NOTE: Audio and logic pin assignment information is provided in Figure 2.6 as a quick reference only. It is highly recommended that the complete information contained in Section 2.7 be used when connecting the console.



REMOTE LINE SELECTOR AUDIO PIN ASSIGNMENT

		Pin Number		
Signal	**Connector**	**Shield**	**Low**	**High**
Input 1/Left	INPUTS 1+2	1	2	3
Input 1/Right	"	4	5	6
Input 2/Left	"	7	8	9
Input 2/Right	"	10	11	12
Input 3/Left	INPUTS 3+4	1	2	3
Input 3/Right	"	4	5	6
Input 4/Left	"	7	8	9
Input 4/Right	"	10	11	12
Input 5/Left	INPUTS 5+6	1	2	3
Input 5/Right	"	4	5	6
Input 6/Left	"	7	8	9
Input 6/Right	"	10	11	12
Input 7/Left	INPUTS 7+8	1	2	3
Input 7/Right	"	4	5	6
Input 8/Left	"	7	8	9
Input 8/Right	"	10	11	12
Input 9/Left	INPUTS 9+10	1	2	3
Input 9/Right	"	4	5	6
Input 10/Left	"	7	8	9
Input 10/Right	"	10	11	12
Output 1/Left	OUTPUTS 1+2	1	2	3
Output 1/Right	"	4	5	6
Output 2/Left	"	7	8	9
Output 2/Right	"	10	11	12

MONITOR INPUT AUDIO PIN ASSIGNMENT

		Pin Number		
Signal	**Connector**	**Shield**	**Low**	**High**
Input 1/Left	INPUT 1	1	2	3
Input 1/Right	"	4	5	6
Input 2/Left	INPUT 2	1	2	3
Input 2/Right	"	4	5	6
Input 3/Left	INPUT 3	1	2	3
Input 3/Right	"	4	5	6
Input 4/Left	INPUT 4	1	2	3
Input 4/Right	"	4	5	6
Input 5/Left	INPUT 5	1	2	3
Input 5/Right	"	4	5	6
Input 6/Left	INPUT 6	1	2	3
Input 6/Right	"	4	5	6
Input 7/Left	INPUT 7	1	2	3
Input 7/Right	"	4	5	6
Input 8/Left	INPUT 8	1	2	3
Input 8/Right	"	4	5	6
Input 9/Left	INPUT 9	1	2	3
Input 9/Right	"	4	5	6

TWO-STUDIO MONITOR AUDIO PIN ASSIGNMENT

		Pin Number		
Signal	**Connector**	**Shield**	**Low**	**High**
Monitor Output/Left	MAIN	1	2	3
Monitor Output/Right	"	4	5	6
H/P Output/Left	H/P+SELECT	1	2	3
H/P Output/Right	"	4	5	6
Selector Output/Left	"	7	8	9
Selector Output/Right	"	10	11	12
Fixed Level Output/Left	FIXED+TALK	1	2	3
Fixed Level Output/Right	"	4	5	6
-No Connection-	"	7	8	9
Talkback Output, Direct	"	10	11	12

TWO-STUDIO MONITOR LOGIC PIN ASSIGNMENT

Function	Pin Number
Logic Common	1
Logic +12 VDC	2
TALKBACK	3
MUTE	4
DIM	5
WARNING TALLY	6
Logic Common	7
DIM Studio Monitors	8
MUTE Studio Monitors	9

CONTROL ROOM MONITOR AUDIO PIN ASSIGNMENT

		Pin Number		
Signal	**Connector**	**Shield**	**Low**	**High**
Monitor Output/Left	MAIN	1	2	3
Monitor Output/Right	"	4	5	6
Headphone Output/Left	H/P+SELECT	1	2	3
Headphone Output/Right	"	4	5	6
Selector Output/Left	"	7	8	9
Selector Output/Right	"	10	11	12
Cue Output/Left	CUE+TALK	1	2	3
Cue Output/Right	"	4	5	6
Talkback Output, Var. w/mute	"	7	8	9
Talkback Output, Direct	"	10	11	12

CONTROL ROOM MONITOR LOGIC PIN ASSIGNMENT

Function	Pin Number
Logic Common	1
Logic +12 VDC	2
TALKBACK	3
MUTE	4
DIM	5
WARNING TALLY	6
Logic Common	7
DIM Control Room Monitors	8
MUTE Control Room Monitors	9

TALK/SLATE AUDIO PIN ASSIGNMENT

		Pin Number		
Signal	**Connector**	**Shield**	**Low**	**High**
Producer's Mic Input	PRODUCER INPUT	1	2	3
External Mic/Line Input	EXTERNAL INPUT	1	2	3
Talk to External Output	EXTERNAL OUTPUT	1	2	3

PRODUCER TALKBACK LOGIC PIN ASSIGNMENT

Function	Pin Number
Logic Common	1
Logic +12 VDC	2
TALK to Studio-1	3
TALK to Studio-2	4
TALK to External	5
-No Connection-	6
-No Connection-	7
SLATE	8
-No Connection-	9

EXTERNAL TALKBACK LOGIC PIN ASSIGNMENT

Function	Pin Number
Logic Common	1
Logic +12 VDC	2
TALK to Studio-1	3
TALK to Studio-2	4
TALK to Control Room	5
-No Connection-	6
-No Connection-	7
TALK	8
-No Connection-	9

TIMER CONTROL LOGIC PIN ASSIGNMENT

Function	Pin Number
HOLD	1
Logic Common	2
RESET	3
START	4
STOP	5

MIC INPUT MODULE AUDIO PIN ASSIGNMENT

		Pin Number		
Signal	**Connector**	**Shield**	**Low**	**High**
Direct Output/Left	DIRECT OUT	1	2	3
Direct Output/Right	"	4	5	6
Microphone A	A	1	2	3
-No Connection-	"	4	5	6
Microphone B	B	1	2	3
-No Connection-	"	4	5	6
Patch Send	PATCH	1	2	3
-No Connection-	"	4	5	6
Patch Return	"	7	8	9
-No Connection-	"	10	11	12

MIC INPUT MODULE LOGIC PIN ASSIGNMENT

Function	Pin Number
Logic Common	1
Logic +12 VDC	2
ON	3
OFF	4
ON TALLY	5
OFF TALLY	6
COUGH	7
TALK to Control Room	8
TALK to Studio-1	9
TALK to Studio-2	10
TALK to External	11
-No Connection-	12
INHIBIT Cue & Solo (Privacy Mode)	13
-No Connection-	14
-No Connection-	15

LINE INPUT MODULE AUDIO PIN ASSIGNMENT

		Pin Number		
Signal	**Connector**	**Shield**	**Low**	**High**
Direct Output/Left	DIRECT OUT	1	2	3
Direct Output/Right	"	4	5	6
Input A/Left	A	1	2	3
Input A/Right	"	4	5	6
Input B/Left	B	1	2	3
Input B/Right	"	4	5	6
Patch Send/Left	PATCH	1	2	3
Patch Send/Right	"	4	5	6
Patch Return/Left	"	7	8	9
Patch Return/Right	"	10	11	12

LINE INPUT MODULE LOGIC PIN ASSIGNMENT

Function	Pin Number
Logic Common	1
Logic +12 VDC	2
ON	3
OFF	4
ON TALLY	5
OFF TALLY	6
READY	7
AUDIO RESET TO OFF	8
CUE	9
START PULSE	10
STOP PULSE	11
CUE TALLY	12
SOLO	13
SOLO TALLY	14
-No Connection-	15

SEND & RETURN AUDIO PIN ASSIGNMENT

		Pin Number		
Signal	**Connector**	**Shield**	**Low**	**High**
Return/Left	RETURN	1	2	3
Return/Right	"	4	5	6
Send-1 Output	SEND-1 OUTPUT	1	2	3
Send-2 Output	SEND-2 OUTPUT	1	2	3
Send-1 Monitor Output	SEND-1 MONITOR	1	2	3
Send-2 Monitor Output	SEND-2 MONITOR	1	2	3

SEND & RETURN LOGIC PIN ASSIGNMENT

Function	Pin Number
Logic Common	1
Logic +12 VDC	2
Send-1 ON/OFF	3
Send-2 ON/OFF	4
Send-1 ON TALLY	5
Send-2 ON TALLY	6
Return ON	7
Return OFF	8
Return ON TALLY	9
Return OFF TALLY	10
-No Connection-	11
-No Connection-	12
-No Connection-	13
-No Connection-	14
-No Connection-	15

TELCO MIX AUDIO PIN ASSIGNMENT

		Pin Number		
Signal	**Connector**	**Shield**	**Low**	**High**
Output 1	OUTPUTS	1	2	3
Output 2	"	4	5	6
Monitor Output, Variable	MONITOR	1	2	3
Monitor Output, Fixed	"	4	5	6
Input 1	INPUTS	1	2	3
Input 2	"	4	5	6

MONO OUTPUT AMPLIFIER AUDIO PIN ASSIGNMENT

		Pin Number		
Signal	**Connector**	**Shield**	**Low**	**High**
Main Output	MAIN OUT	1	2	3
Auxiliary Output	AUX OUT	1	2	3
Monaural Meter Source	MONO/SEND METERS	1	2	3
-No Connection-	"	4	5	6
Send-1 Meter Source	"	7	8	9
Send-2 Meter Source	"	10	11	12

STEREO OUTPUT AMPLIFIER AUDIO PIN ASSIGNMENT

		Pin Number		
Signal	**Connector**	**Shield**	**Low**	**High**
Main Output/Left	MAIN OUT	1	2	3
Main Output/Right	"	4	5	6
Auxiliary Output-1/Left	AUX OUT-1	1	2	3
Auxiliary Output-1/Right	"	4	5	6
Auxiliary Output-2/Left	AUX OUT-2	1	2	3
Auxiliary Output-2/Right	"	4	5	6
Auxiliary Output-3/Left	AUX OUT-3	1	2	3
Auxiliary Output-3/Right	"	4	5	6
Patch Send/Left	PATCH	1	2	3
Patch Send/Right	"	4	5	6
Patch Return/Left	"	7	8	9
Patch Return/Right	"	10	11	12

METER SWITCHER AUDIO PIN ASSIGNMENT

		Pin Number		
Signal	**Connector**	**Shield**	**Low**	**High**
Input 1/Left	INPUT-1	1	2	3
Input 1/Right	"	4	5	6
Input 2/Left	INPUT-2	1	2	3
Input 2/Right	"	4	5	6
Input 3/Left	INPUT-3	1	2	3
Input 3/Right	"	4	5	6
Input 4/Left	INPUT-4	1	2	3
Input 4/Right	"	4	5	6
Input 5/Left	INPUT-5	1	2	3
Input 5/Right	"	4	5	6

NOTE: The audio and logic pin assignment information provided here is for quick reference only. Refer to Section 2.7 Audio & Logic Connection (pages 16-30) while connecting the console.

FIGURE 2.4 CONNECTOR PANEL LAYOUT

2.4 GROUNDING AND SHIELDING

Grounding in modern broadcast consoles is more critical than with older devices of more limited band-pass capabilities. Achieving low system ground impedance with a small piece of equipment is relatively easy. However, the problem becomes progressively more difficult as the system becomes larger. In designing the BMX III, much thought was given to system grounding requirements and the elimination of DC path ground loops.

The shield pins on each console connector are connected directly to the console mainframe ground, and the only location where the console mainframe ground meets the console's "audio common" point is the power terminal strip on the console mainframe. Therefore, the station's "technical ground" should be connected to either of the two screw terminals labeled "AUDIO COMMON" on the **console** power terminal strip.

NOTE: Do **not** connect the station's "technical ground" to any terminals on the power supply terminal strip.

A preferred method of connecting the line shields in a system is to connect **both** ends of every shield to **all** affiliated equipment. However, this method is only satisfactory if every component shares a common earth ground. This can be accomplished using isolated ground receptacles tied to the station's "technical ground".

If isolated ground receptacles are not available when grounding the BMX III, observe the following guidelines:

A) Shields of cables connecting the console to auxiliary equipment should be connected at the console end only, and should not be terminated to the ground of the auxiliary equipment.

B) Ensure that the auxiliary equipment is connected to a "clean" ground by its power cord assembly, or by the addition of a separate ground wire connected between the chassis of the auxiliary equipment and the station's "technical ground".

NOTE: Buzz pickup is generally electrostatic, due to capacitive pickup between an audio line and a power line. When shielded lines are used this should be no problem, unless the audio lines are run in the same wireways or area as a power line. Radio-frequency interference can also manifest itself as a buzz in the program audio. RFI is minimized by the extensive RF bypassing and ground-plane techniques used in the BMX III, and the shielded lines external to the unit.

2.5 POWER CONNECTION

A separate power outlet should be assigned exclusively to the BMX III power supply. Confirm that the outlet supplies 120 VAC, ± 8%, 50/60 Hz, and that the voltage does not sag under a load of up to 5 amperes. The third pin "U-ground" on the power connector must be left intact and connected to a properly installed three way AC outlet. For safety, the "U-ground" wire is connected to the chassis of the power supply and the cores of the power transformers.

WARNING: Do not defeat the safety ground in any way. To do so may provide a potentially dangerous condition to the operator.

NOTE: The DC outputs of the power supply are not referenced to the power supply chassis and, therefore, are completely floating from the AC safety ground.

The AC mains cord should be kept away from low level audio wiring to avoid the possibility of inducing hum into that wiring. Also, even though the power transformers were designed for very low radiated magnetic fields, the power supply should not be placed unnecessarily close to tape playback units or other sensitive equipment.

Console connection to the power supply is made with the supplied six foot multiconductor cable. This cable carries only regulated DC power, and will not radiate hum into adjacent audio wiring. The cable is color-coded, and the corresponding color names are printed adjacent to the terminals on the console and the power supply.

Should it be necessary to install the power supply at a distance further than permitted by the supplied cable, it is recommended that a new cable be made rather than splicing a longer length to the existing cable. Cable lengths up to twenty feet may be fabricated using 14 gauge wire. Cables longer than 20 feet are not recommended.

It is very important to check and double-check the power supply connections prior to turn-on. An error in wiring could result in damage to the power supply and/or console circuitry. Once the power supply is turned on, the meter lamps will illuminate. Use an accurate DC volt meter to verify the operating voltages at the test terminals on the front panel of the power supply.

NOTE: For information on the Redundant Power Supply Coupler Unit (PR&E #99-76), see Chapter 8.

2.6 PATCH POINT CONNECTION

Each BMX III input and output module features an audio PATCH connector. These connectors provide the ideal point to connect external processing equipment such as equalizers, limiters, filters, etc. A patch bay system may also be connected to provide a very flexible processing/patching facility.

The output at each patch point is unbalanced, and designed to operate into low-impedance (600 ohm or higher) loads. The patch return is balanced, 40k ohm impedance.

The level at all patch points is -10 dBu nominal. This level was determined to provide optimum headroom within the console as well as a good compatibility match with currently available processing equipment. See Section 2.7 for PATCH connector pin assignment.

2.7 AUDIO AND LOGIC CONNECTION

Good wiring practice calls for care in making each connection and in neatness of cable layout. Complete information relative to console input, output and logic terminations is contained in the connection reference drawings included in this section.

A standard connection theme is used throughout all PR&E consoles and mixers - the use of 3, 6 and 12 pin Molex connectors for audio wiring. The standard pin-out sequence is as follows:

Pin #1	Shield of monaural or left channel signal pair.
Pin #2	Low of monaural or left channel signal pair.
Pin #3	High of monaural or left channel signal pair.
Pin #4	Shield of right channel signal pair.
Pin #5	Low of right channel signal pair.
Pin #6	High of right channel signal pair.
Pin #7	Shield of left channel signal pair.
Pin #8	Low of left channel signal pair.
Pin #9	High of left channel signal pair.
Pin #10	Shield of right channel signal pair.
Pin #11	Low of right channel signal pair.
Pin #12	High of right channel signal pair.

This system of pin assignments takes advantage of the three pin per row design of the Molex connectors. As viewed from the rear of the console, the shields are always connected to the left pins, the low wires (black) to the center pins and the high wires (red) to the right pins. While this inspection will not indicate if a connector is in the correct position, it will verify proper shield and polarity connection.

Each BMX III input module offers a comprehensive set of logic functions, as outlined in Section 2.8. These functions are brought out from each input module position to a pair of 15-pin Molex connectors labeled LOGIC-A and LOGIC-B, and are designed to drive interface relays and/or opto-isolators to control auxiliary equipment.

Fabrication of interface systems is straightforward. However, should the installer prefer to use prefabricated units, interface devices and cable assemblies are available from PR&E to control most professional grade tape decks, cartridge machines and turntables. Information on these interfaces is provided in Chapter 8.

NOTE: The control commands and functions are referenced to the console logic power supply and, as such, should never be directly connected to auxiliary equipment control logic supplies and/or grounds.

The BMX III uses “common” or “ground” switching for all of its control inputs, thus preventing the possibility of defective remote controls shorting out the logic power supply.

Connection to the control circuitry requires an understanding of the logic nomenclature and symbols. These are outlined below.

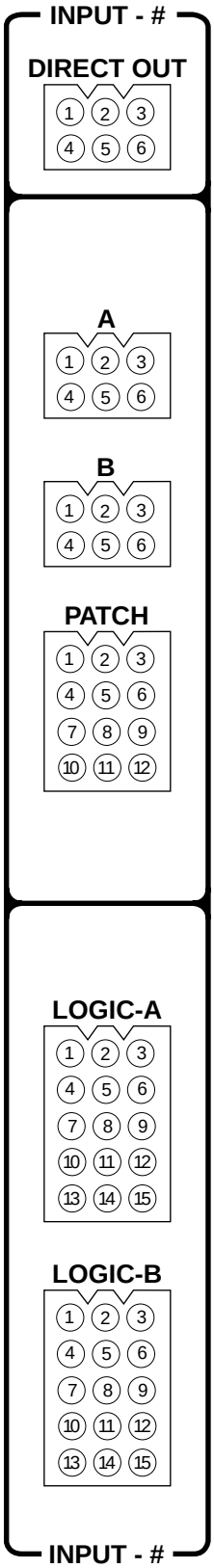
Control Outputs:

Tally (light)		Provides a +12 VDC continuous source when activated.
Pulse		Provides a +12 VDC pulse source when activated.
Sink		An open collector that provides a connection to Logic Common when activated.

Control Inputs:

Control	$\overline{\text{ON}}$	A line above the word indicates that the function is activated when a connection to Logic Common is made.

2.7.1 Microphone Input Module Connection



AUDIO PIN ASSIGNMENT				
		Pin Number		
Signal	Connector	Shield	Low	High
Direct Output/Left	DIRECT OUT	1	2	3
Direct Output/Right	"	4	5	6
Microphone A	A	1	2	3
-No Connection-	"	4	5	6
Microphone B	B	1	2	3
-No Connection-	"	4	5	6
Patch Send	PATCH	1	2	3
-No Connection-	"	4	5	6
Patch Return	"	7	8	9
-No Connection-	"	10	11	12

NOTES:

A) The Patch Send is unbalanced; the Patch Return is balanced.

B) The PATCH connector must be wired so that the Patch Send is connected through to the Patch Return. If no external processing or patch bay equipment is connected, a mating connector with jumpers from pins #2 to #8 and #3 to #9 must be installed.

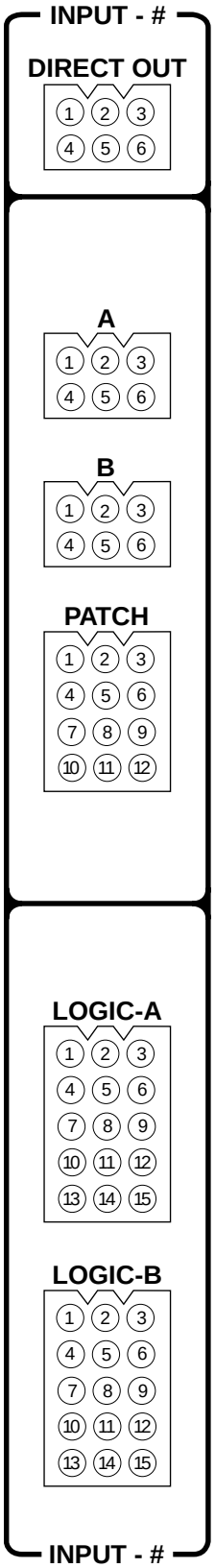
LOGIC PIN ASSIGNMENT	
Function	Pin Number
Logic Common	1
Logic +12 VDC	2
$\overline{\text{ON}}$	3
$\overline{\text{OFF}}$	4
ON TALLY ⎍	5
OFF TALLY ⎍	6
$\overline{\text{COUGH}}$	7
$\overline{\text{TALK}}$ to Control Room	8
$\overline{\text{TALK}}$ to Studio-1	9
$\overline{\text{TALK}}$ to Studio-2	10
$\overline{\text{TALK}}$ to External	11
-No Connection-	12
$\overline{\text{INHIBIT}}$ Cue & Solo (Privacy Mode)	13
-No Connection-	14
-No Connection-	15

NOTES:

A) A input logic is connected to LOGIC-A; B input logic is connected to LOGIC-B.

B) Consult Section 2.8.1 when connecting Microphone Input Module remote controls.

2.7.2 Stereo Line Input Module Connection



AUDIO PIN ASSIGNMENT				
		Pin Number		
Signal	Connector	Shield	Low	High
Direct Output/Left	DIRECT OUT	1	2	3
Direct Output/Right	"	4	5	6
Input A/Left	A	1	2	3
Input A/Right	"	4	5	6
Input B/Left	B	1	2	3
Input B/Right	"	4	5	6
Patch Send/Left	PATCH	1	2	3
Patch Send/Right	"	4	5	6
Patch Return/Left	"	7	8	9
Patch Return/Right	"	10	11	12

NOTES:

A) When connecting a monaural line level source (such as a Telco hybrid) to a Stereo Line Input Module, connect the signal to the left input channel, and insert jumpers between pins #1 and #4, #2 and #5, and #3 and #6.

B) The Patch Sends are unbalanced; the Patch Returns are balanced.

C) The PATCH connector must be wired so that the Patch Sends are connected through to the Patch Returns. If no external processing or patch bay equipment is connected, a mating connector with jumpers from pins #2 to #8, #3 to #9, #5 to #11 and #6 to #12 must be installed.

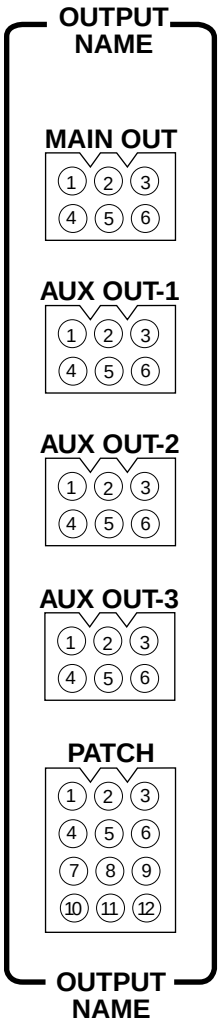
LOGIC PIN ASSIGNMENT	
Function	Pin Number
Logic Common	1
Logic +12 VDC	2
$\overline{\text{ON}}$	3
$\overline{\text{OFF}}$	4
ON TALLY ⌐	5
OFF TALLY ⌐	6
$\overline{\text{READY}}$	7
$\overline{\text{AUDIO RESET TO OFF}}$	8
$\overline{\text{CUE}}$	9
START PULSE ⌐⌐	10
STOP PULSE ⌐⌐	11
CUE TALLY ⌐	12
$\overline{\text{SOLO}}$	13
SOLO TALLY ⌐	14
-No Connection-	15

NOTES:

A) A input logic is connected to LOGIC-A; B input logic is connected to LOGIC-B.

B) Consult Section 2.8.2 when connecting Stereo Line Input Module remote controls.

2.7.3 Stereo Line Output Amplifier Connection



AUDIO PIN ASSIGNMENT				
		Pin Number		
Signal	**Connector**	**Shield**	**Low**	**High**
Main Output/Left	MAIN OUT	1	2	3
Main Output/Right	"	4	5	6
Auxiliary Output-1/Left	AUX OUT-1	1	2	3
Auxiliary Output-1/Right	"	4	5	6
Auxiliary Output-2/Left	AUX OUT-2	1	2	3
Auxiliary Output-2/Right	"	4	5	6
Auxiliary Output-3/Left	AUX OUT-3	1	2	3
Auxiliary Output-3/Right	"	4	5	6
Patch Send/Left	PATCH	1	2	3
Patch Send/Right	"	4	5	6
Patch Return/Left	"	7	8	9
Patch Return/Right	"	10	11	12

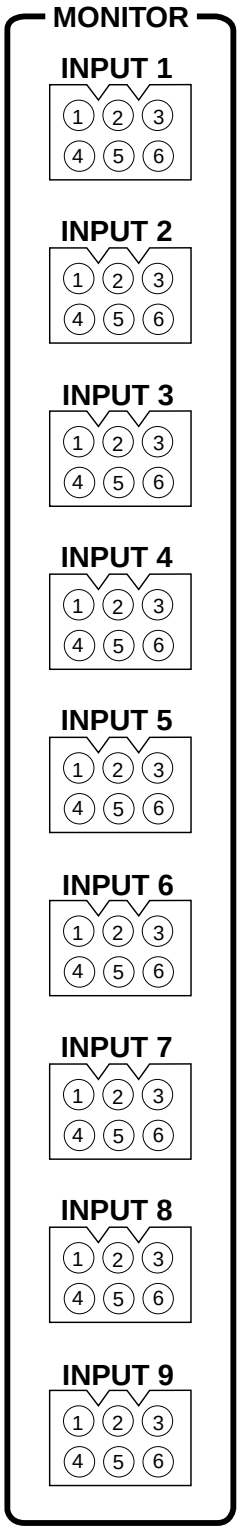
NOTES:

A) The Main and Auxiliary Outputs are balanced.

B) The Patch Sends are unbalanced; the Patch Returns are balanced.

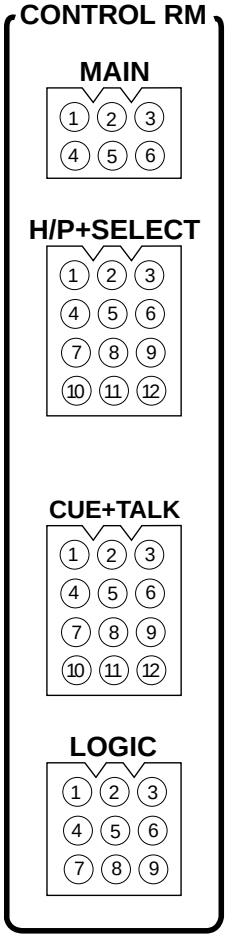
C) The PATCH connector must be wired so that the Patch Sends are connected through to the Patch Returns. If no external processing or patch bay equipment is connected, a mating connector with jumpers from pins #2 to #8, #3 to #9, #5 to #11 and #6 to #12 must be installed.

2.7.4 Monitor Module Input Connection



AUDIO PIN ASSIGNMENT				
		Pin Number		
Signal	Connector	Shield	Low	High
Input 1/Left	INPUT 1	1	2	3
Input 1/Right	"	4	5	6
Input 2/Left	INPUT 2	1	2	3
Input 2/Right	"	4	5	6
Input 3/Left	INPUT 3	1	2	3
Input 3/Right	"	4	5	6
Input 4/Left	INPUT 4	1	2	3
Input 4/Right	"	4	5	6
Input 5/Left	INPUT 5	1	2	3
Input 5/Right	"	4	5	6
Input 6/Left	INPUT 6	1	2	3
Input 6/Right	"	4	5	6
Input 7/Left	INPUT 7	1	2	3
Input 7/Right	"	4	5	6
Input 8/Left	INPUT 8	1	2	3
Input 8/Right	"	4	5	6
Input 9/Left	INPUT 9	1	2	3
Input 9/Right	"	4	5	6

2.7.5 Control Room Monitor Module Connection



AUDIO PIN ASSIGNMENT				
		Pin Number		
Signal	Connector	Shield	Low	High
Monitor Output/Left	MAIN	1	2	3
Monitor Output/Right	"	4	5	6
Headphone Output/Left	H/P+SELECT	1	2	3
Headphone Output/Right	"	4	5	6
Selector Output/Left	"	7	8	9
Selector Output/Right	"	10	11	12
Cue Output/Left	CUE+TALK	1	2	3
Cue Output/Right	"	4	5	6
Talkback Output, Var. w/mute	"	7	8	9
Talkback Output, Direct	"	10	11	12

NOTES:

A) The Selector Output is the direct output of the Control Room Monitor Module, and consists only of the source selected on the 12-station Monitor Input switch. However, Talkback signals may be assigned to this output (reference Section 2.9.3).

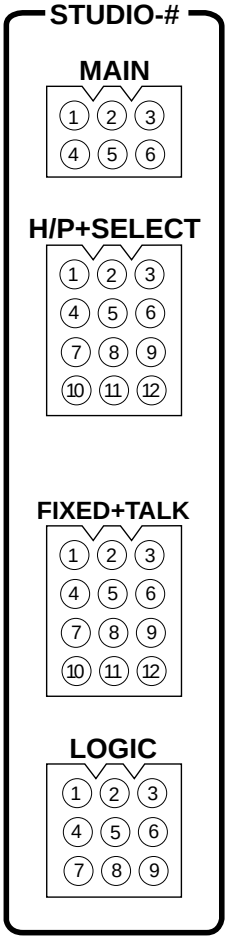
B) The Talkback outputs consist of any Talk To Control Room signals, and are provided for connection to self-contained headphone and/or monitor systems, if desired.

C) The Variable Talkback Output is only active when the Control Room is muted.

LOGIC PIN ASSIGNMENT	
Function	Pin Number
Logic Common	1
Logic +12 VDC	2
TALKBACK ⌐└	3
MUTE ⌐└	4
DIM ⌐└	5
WARNING TALLY └⌐	6
Logic Common	7
$\overline{\text{DIM}}$ Control Room Monitors	8
$\overline{\text{MUTE}}$ Control Room Monitors	9

NOTE: Consult Section 2.8.3 when connecting Control Room Monitor Module remote controls.

2.7.6 Two-Studio Monitor Module Connection



AUDIO PIN ASSIGNMENT				
		Pin Number		
Signal	Connector	Shield	Low	High
Monitor Output/Left	MAIN	1	2	3
Monitor Output/Right	"	4	5	6
H/P Output/Left	H/P+SELECT	1	2	3
H/P Output/Right	"	4	5	6
Selector Output/Left	"	7	8	9
Selector Output/Right	"	10	11	12
Fixed Level Output/Left	FIXED+TALK	1	2	3
Fixed Level Output/Right	"	4	5	6
-No Connection-	"	7	8	9
Talkback Output, Direct	"	10	11	12

NOTES:

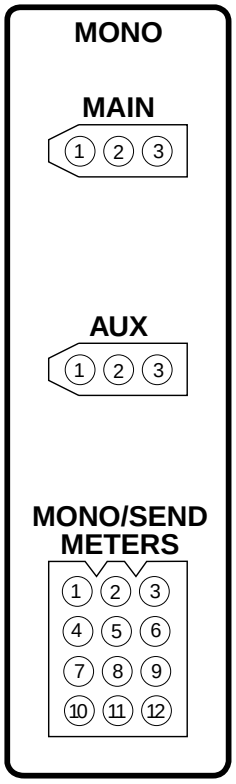
A) The Selector Output is the direct output of the Two-Studio Monitor Module, and consists only of the source selected on the 12-station Monitor Input switch.

B) The Talkback Output consists of the respective Talk To Studio signals, and is provided for connection to self-contained headphone and/or monitor systems, if desired.

LOGIC PIN ASSIGNMENT	
Function	Pin Number
Logic Common	1
Logic +12 VDC	2
TALKBACK ⌐_	3
MUTE ⌐_	4
DIM ⌐_	5
WARNING TALLY _⌐	6
Logic Common	7
$\overline{\text{DIM}}$ Studio Monitors	8
$\overline{\text{MUTE}}$ Studio Monitors	9

NOTE: Consult Section 2.8.4 when connecting Two-Studio Monitor Module remote controls.

2.7.7 Monaural Line Output Amplifier Connection



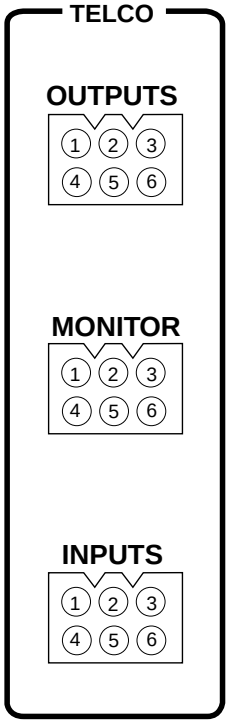
AUDIO PIN ASSIGNMENT				
		Pin Number		
Signal	**Connector**	**Shield**	**Low**	**High**
Main Output	MAIN OUT	1	2	3
Auxiliary Output	AUX OUT	1	2	3
Monaural Meter Source	MONO/SEND METERS	1	2	3
-No Connection-	"	4	5	6
Send-1 Meter Source	"	7	8	9
Send-2 Meter Source	"	10	11	12

NOTES:

A) The Main and Auxiliary Outputs are balanced.

B) Monaural and Send Meter Source signals are provided for connection to a Meter Switcher Module input, if desired.

2.7.8 Telco Mix Module Connection



AUDIO PIN ASSIGNMENT				
		Pin Number		
Signal	Connector	Shield	Low	High
Output 1	OUTPUTS	1	2	3
Output 2	"	4	5	6
Monitor Output, Variable	MONITOR	1	2	3
Monitor Output, Fixed	"	4	5	6
Input 1	INPUTS	1	2	3
Input 2	"	4	5	6

NOTES:

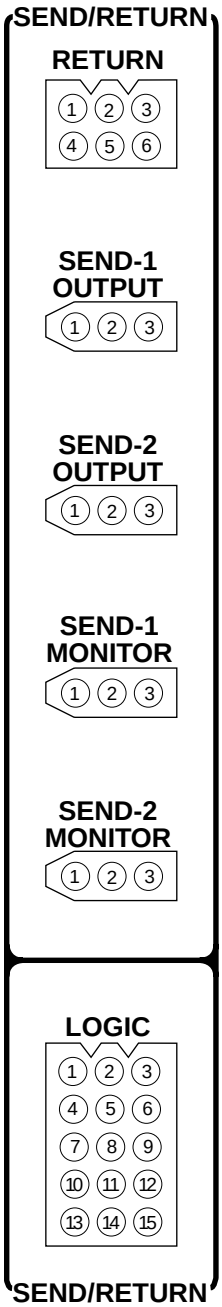
A) Telco Outputs are routed to the telephone hybrid(s).

B) The Fixed and Variable Monitor Outputs consist of only those callers assigned to the Telco Mix System.

C) The Telco Mix Module receives its inputs from the Direct Output/Left signals of those Stereo Line Input Modules designated as Telco inputs.

NOTE: When "off-air" Telco monitoring facilities are desired, these Direct Outputs should be continuous (reference Section 2.9.2). This allows the Telco system to be fed caller audio regardless of the ON/OFF status of the caller's Stereo Line Input Module.

2.7.9 Send And Return Module Connection



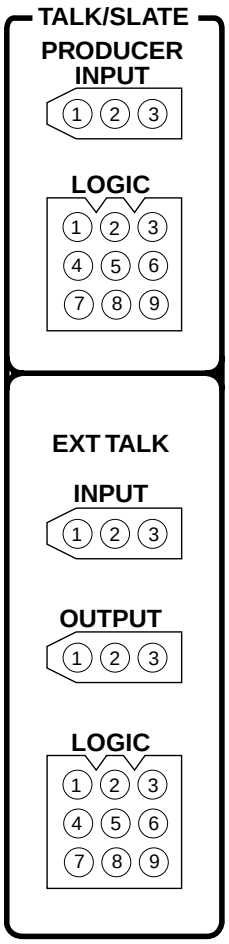
AUDIO PIN ASSIGNMENT				
		Pin Number		
Signal	Connector	Shield	Low	High
Return/Left	RETURN	1	2	3
Return/Right	"	4	5	6
Send-1 Output	SEND-1 OUTPUT	1	2	3
Send-2 Output	SEND-2 OUTPUT	1	2	3
Send-1 Monitor Output	SEND-1 MONITOR	1	2	3
Send-2 Monitor Output	SEND-2 MONITOR	1	2	3

NOTES:
A) The Sends and the Return are balanced.
B) The Send Monitor Outputs are provided for connection to monitor module inputs, if desired.

LOGIC PIN ASSIGNMENT	
Function	Pin Number
Logic Common	1
Logic +12 VDC	2
Send-1 $\overline{\text{ON}}$/$\overline{\text{OFF}}$	3
Send-2 $\overline{\text{ON}}$/$\overline{\text{OFF}}$	4
Send-1 ON TALLY ⌐¬	5
Send-2 ON TALLY ⌐¬	6
Return $\overline{\text{ON}}$	7
Return $\overline{\text{OFF}}$	8
Return ON TALLY ⌐¬	9
Return OFF TALLY ⌐¬	10
-No Connection-	11
-No Connection-	12
-No Connection-	13
-No Connection-	14
-No Connection-	15

NOTE: Consult Section 2.8.5 when connecting Send And Return Module remote controls.

2.7.10 Slate/Talkback/Test Oscillator Module Connection



AUDIO PIN ASSIGNMENT				
		Pin Number		
Signal	Connector	Shield	Low	High
Producer's Mic Input	PRODUCER INPUT	1	2	3
External Mic/Line Input	EXTERNAL INPUT	1	2	3
Talk to External Output	EXTERNAL OUTPUT	1	2	3

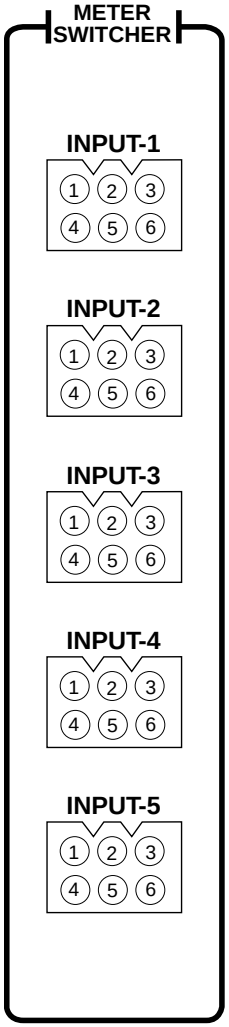
NOTE: The External Input is switchable between microphone and line input levels (reference Section 2.9.7).

PRODUCER LOGIC PIN ASSIGNMENT	
Function	Pin Number
Logic Common	1
Logic +12 VDC	2
$\overline{\text{TALK}}$ to Studio-1	3
$\overline{\text{TALK}}$ to Studio-2	4
$\overline{\text{TALK}}$ to External	5
-No Connection-	6
-No Connection-	7
$\overline{\text{SLATE}}$	8
-No Connection-	9

EXTERNAL LOGIC PIN ASSIGNMENT	
Function	Pin Number
Logic Common	1
Logic +12 VDC	2
$\overline{\text{TALK}}$ to Studio-1	3
$\overline{\text{TALK}}$ to Studio-2	4
$\overline{\text{TALK}}$ to Control Room	5
-No Connection-	6
-No Connection-	7
TALK ⌐└	8
-No Connection-	9

NOTE: Consult Section 2.8.6 when connecting Slate/Talkback/Test Oscillator Module remote controls.

2.7.11 Meter Switcher Module Connection



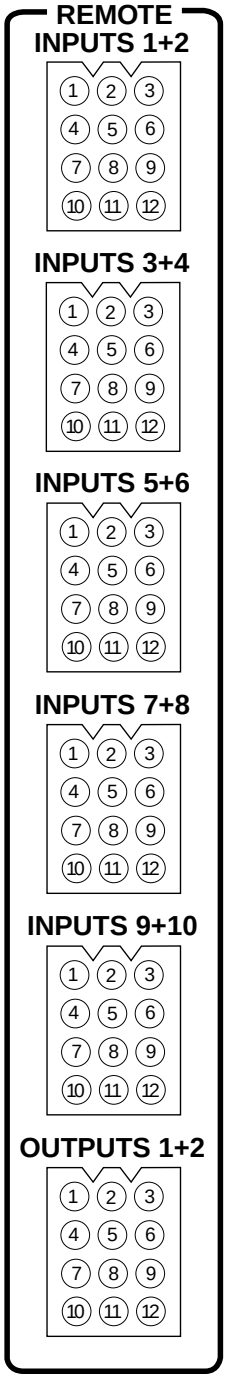
AUDIO PIN ASSIGNMENT				
		Pin Number		
Signal	Connector	Shield	Low	High
Input 1/Left	INPUT-1	1	2	3
Input 1/Right	"	4	5	6
Input 2/Left	INPUT-2	1	2	3
Input 2/Right	"	4	5	6
Input 3/Left	INPUT-3	1	2	3
Input 3/Right	"	4	5	6
Input 4/Left	INPUT-4	1	2	3
Input 4/Right	"	4	5	6
Input 5/Left	INPUT-5	1	2	3
Input 5/Right	"	4	5	6

NOTES:

A) On BMX III-18 and 22 mainframes, Input 5 will be pre-wired for UTILITY metering, and the INPUT-5 connector will not be present.

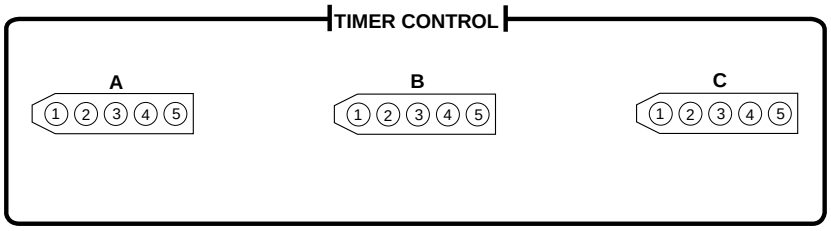
B) On BMX III-10 and 14 mainframes, Input 4 will be pre-wired for AUDITION metering and Input 5 will be pre-wired for UTILITY metering. The INPUT-4 and INPUT-5 connectors will not be present.

2.7.12 Remote Line Selector Module Connection



AUDIO PIN ASSIGNMENT				
		Pin Number		
Signal	Connector	Shield	Low	High
Input 1/Left	INPUTS 1+2	1	2	3
Input 1/Right	"	4	5	6
Input 2/Left	"	7	8	9
Input 2/Right	"	10	11	12
Input 3/Left	INPUTS 3+4	1	2	3
Input 3/Right	"	4	5	6
Input 4/Left	"	7	8	9
Input 4/Right	"	10	11	12
Input 5/Left	INPUTS 5+6	1	2	3
Input 5/Right	"	4	5	6
Input 6/Left	"	7	8	9
Input 6/Right	"	10	11	12
Input 7/Left	INPUTS 7+8	1	2	3
Input 7/Right	"	4	5	6
Input 8/Left	"	7	8	9
Input 8/Right	"	10	11	12
Input 9/Left	INPUTS 9+10	1	2	3
Input 9/Right	"	4	5	6
Input 10/Left	"	7	8	9
Input 10/Right	"	10	11	12
Output 1/Left	OUTPUTS 1+2	1	2	3
Output 1/Right	"	4	5	6
Output 2/Left	"	7	8	9
Output 2/Right	"	10	11	12

2.7.13 Timer Control Connection



LOGIC PIN ASSIGNMENT	
Function	**Pin Number**
HOLD ⌐└	1
Logic Common	2
RESET ⌐└	3
START ⌐└	4
STOP ⌐└	5

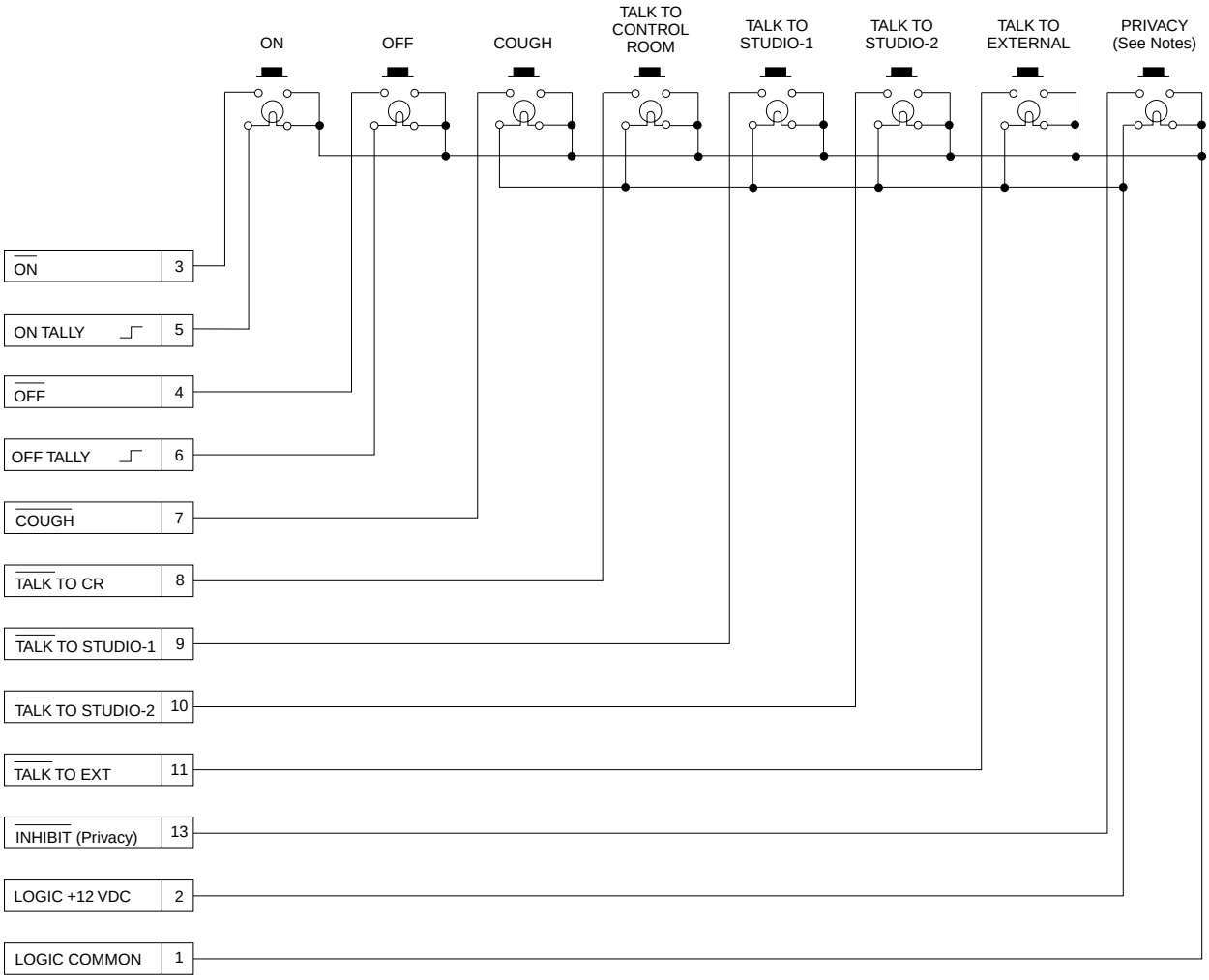
NOTE: These output commands are provided for the control of external "slave" timers.

2.8 MODULE REMOTE CONTROL CAPABILITIES

This section outlines BMX III module remote control capabilities. Included are descriptions of Microphone Input, Stereo Line Input, Control Room Monitor, Two-Studio Monitor, Send And Return, and Slate/Talkback/Test Oscillator Module remote control capabilities.

2.8.1 Microphone Input Module Remote Control

The schematic below illustrates the full remote control capability of the Microphone Input Module's A and B inputs. Since it is not desirable for a microphone to “talk” to its own location, or to locations which may not exist in a particular installation, delete any inappropriate talk buttons. The INHIBIT command disables module CUE and SOLO functions for as long as the PRIVACY button is engaged. This facility ensures at private "off-mic" conversations cannot be overheard in the Control Room.

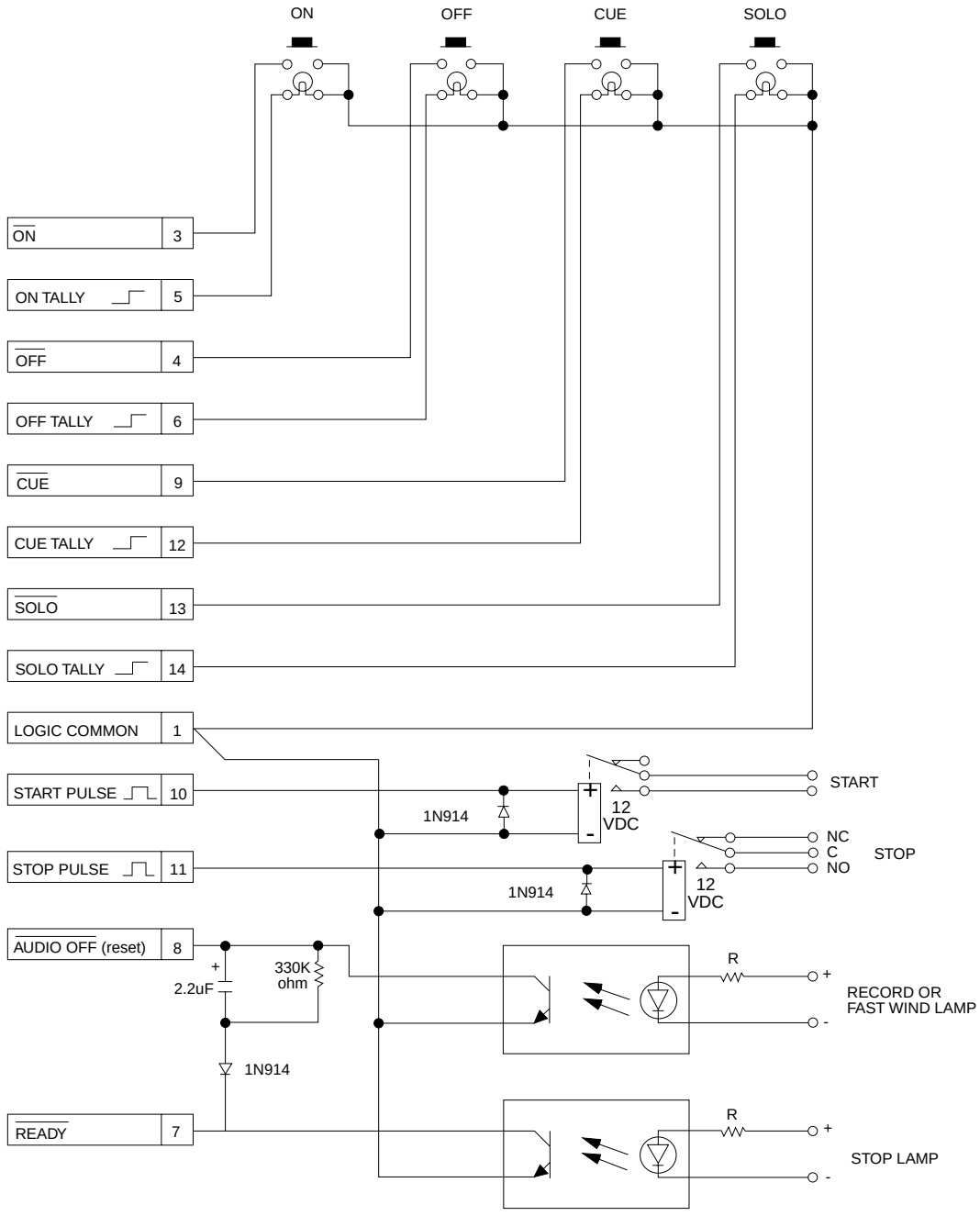


NOTES:

A) All button switches except PRIVACY are momentary-action (the PRIVACY button switch is maintained-action.
B) Lamps are 12-14 volt, 80 mA.
C) When COUGH, TALK TO and PRIVACY tallies are connected as shown above, switch lamps will be illuminated at all times.

2.8.2 Stereo Line Input Module Remote Control

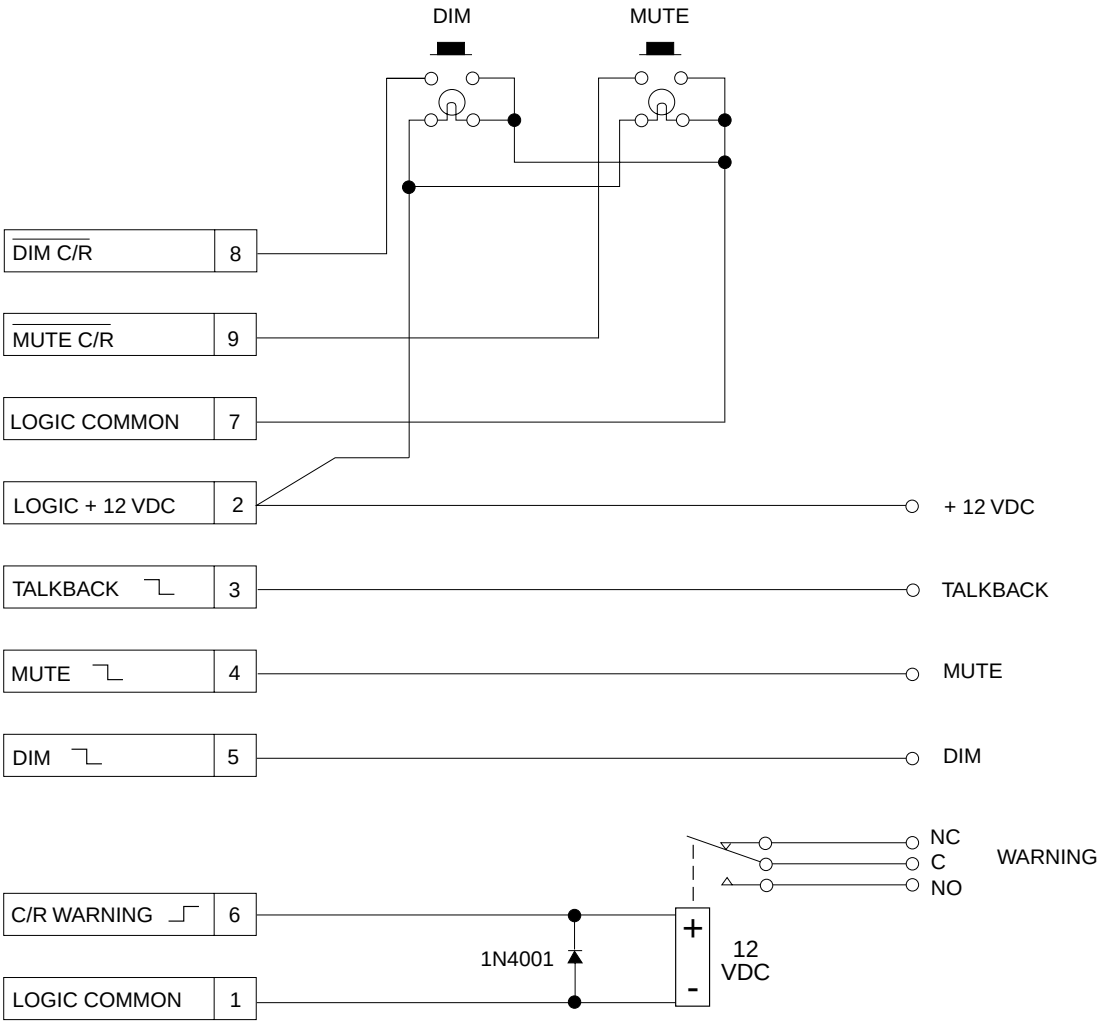
The schematic below illustrates the full remote control and machine interface capability of the Stereo Line Input Module's A and B inputs. Typical applications include providing cartridge input ON and OFF buttons at co-host or news turret positions, and ON, OFF, CUE and SOLO buttons adjacent to turntables and tape recorders.



NOTES:
A) Button switches are momentary-action.
B) Lamps are 12-14 volt, 80 mA.
C) Relays are 12 volt DC, 100 mA maximum.
D) Opto-isolators are Motorola MCT-2 or equivalent.

2.8.3 Control Room Monitor Module Remote Control

The schematic below illustrates the full remote control capability of the Control Room Monitor Module.



NOTES:
A) Button switches are momentary-action.
B) Lamps are 12-14 volt, 80 mA.
C) Relay is 12 volt DC, 100 mA maximum.
D) When DIM and MUTE tallies are connected as shown above, switch lamps will be illuminated at all times.

While it is unlikely that a "typical" installation will utilize all of these facilities, it is important to understand what is available, along with the potential applications.

The DIM control input may be used to remote control the dim function of the Control Room Monitor Module. Typical applications include equipping the Control Room door with a "door open" switch, or a telephone set with an "off-hook" switch to automatically dim the Control Room speakers whenever the door opens or the telephone is picked up.

The MUTE control input may be used to remote control the mute function of the Control Room Monitor Module. Typical applications include operations where two on-air consoles are used in the same room, such as a second console for news and sports programming.

The TALKBACK control output is a current-sinking open collector, which is active (low) whenever the Control Room is receiving Talkback from another location. This command is intended for connection to active, self-contained, headphone and monitor systems, and is used to switch the Talk To Control Room signals into the headphone and monitor circuits. Such headphone and/or monitor systems are usually provided to co-host and news positions in a Control Room.

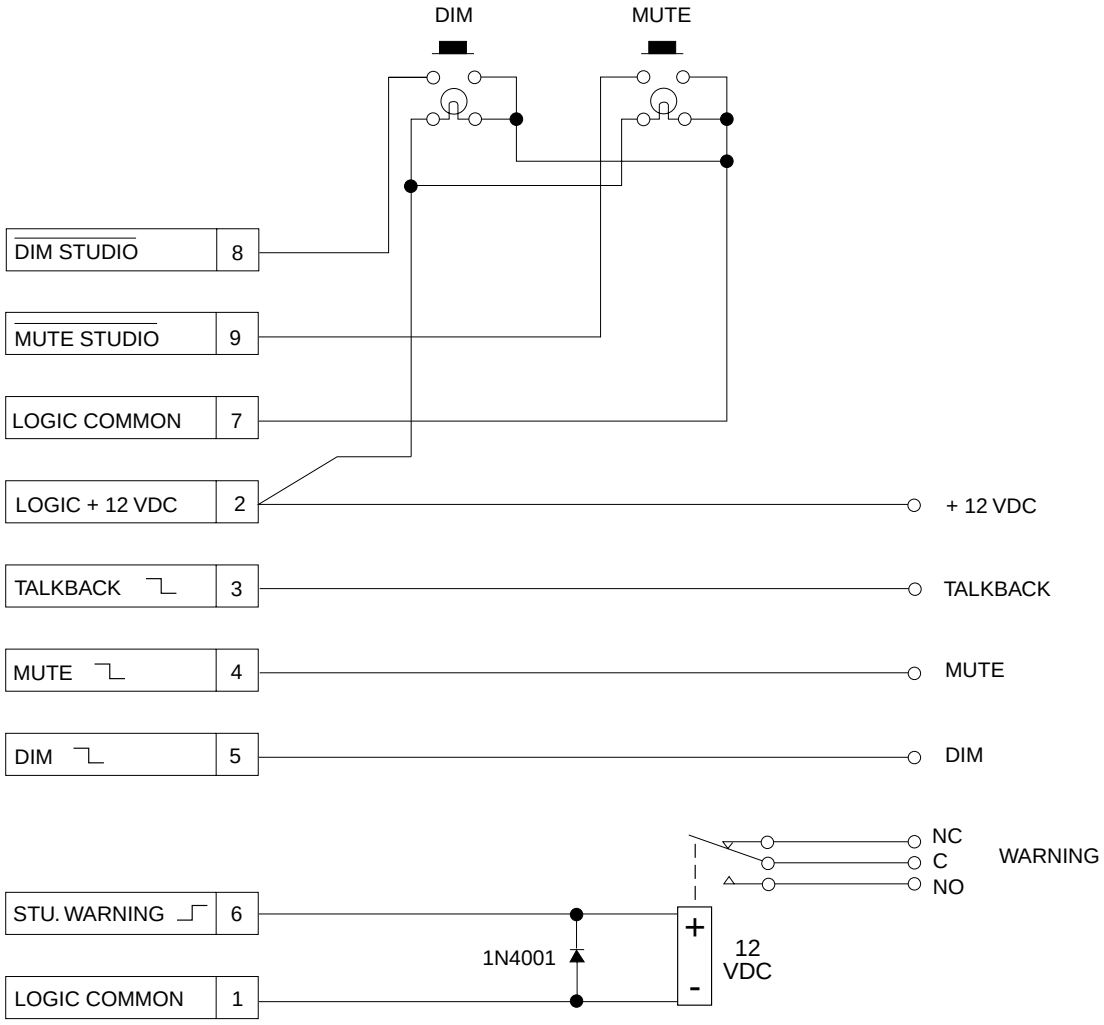
The MUTE control output is a current-sinking open collector, which is active (low) whenever a Control Room microphone is ON. This command is provided for interface to intercoms, telephones and/or other external equipment which may need to be muted whenever a Control Room microphone is “live”.

The DIM control output is a current-sinking open collector, which is active (low) whenever Talkback is occurring from the Control Room to another location. This command is provided for similar applications as the MUTE command.

The C/R WARNING tally is a 12 volt DC, 150 mA maximum, source output for connection to a magnetic or solid-state relay unit for driving the Control Room entry warning light(s).

2.8.4 Two-Studio Monitor Module Remote Control

The Two-Studio Monitor Module is equipped with many of the same audio and logic features provided in the Control Room Monitor Module. The schematic below illustrates the full remote control capability of each of the two Studio logic connectors.



NOTES:
A) Button switches are momentary-action.
B) Lamps are 12-14 volt, 80 mA.
C) Relay is 12 volt DC, 100 mA maximum.
D) When DIM and MUTE tallies are connected as shown above, switch lamps will be illuminated at all times.

While it is unlikely that a "typical" studio installation will use all of these features, it is important to understand what is available, along with the potential applications.

The DIM control input may be used to remotely control the dim function of the Studio Monitor Module. Typical applications include equipping the Studio door with a "door open" switch, or a telephone set with an "off-hook" switch to automatically dim the Studio speakers whenever the door opens or the telephone is picked up.

The MUTE control input may be used to remotely control the mute function of the Studio Monitor Module. A typical application would be to provide a host with a Monitor Mute button in those installations where a monitor volume control is not provided in the Studio itself.

The TALKBACK control output is a current-sinking open collector, which is active (low) whenever the Studio is receiving Talkback from another location. This command is intended for connection to active, self-contained, headphone and monitor systems, and is used to switch the Talkback signal into the headphone and monitor circuits. Such headphone and/or monitor systems are usually provided to the host and co-host positions.

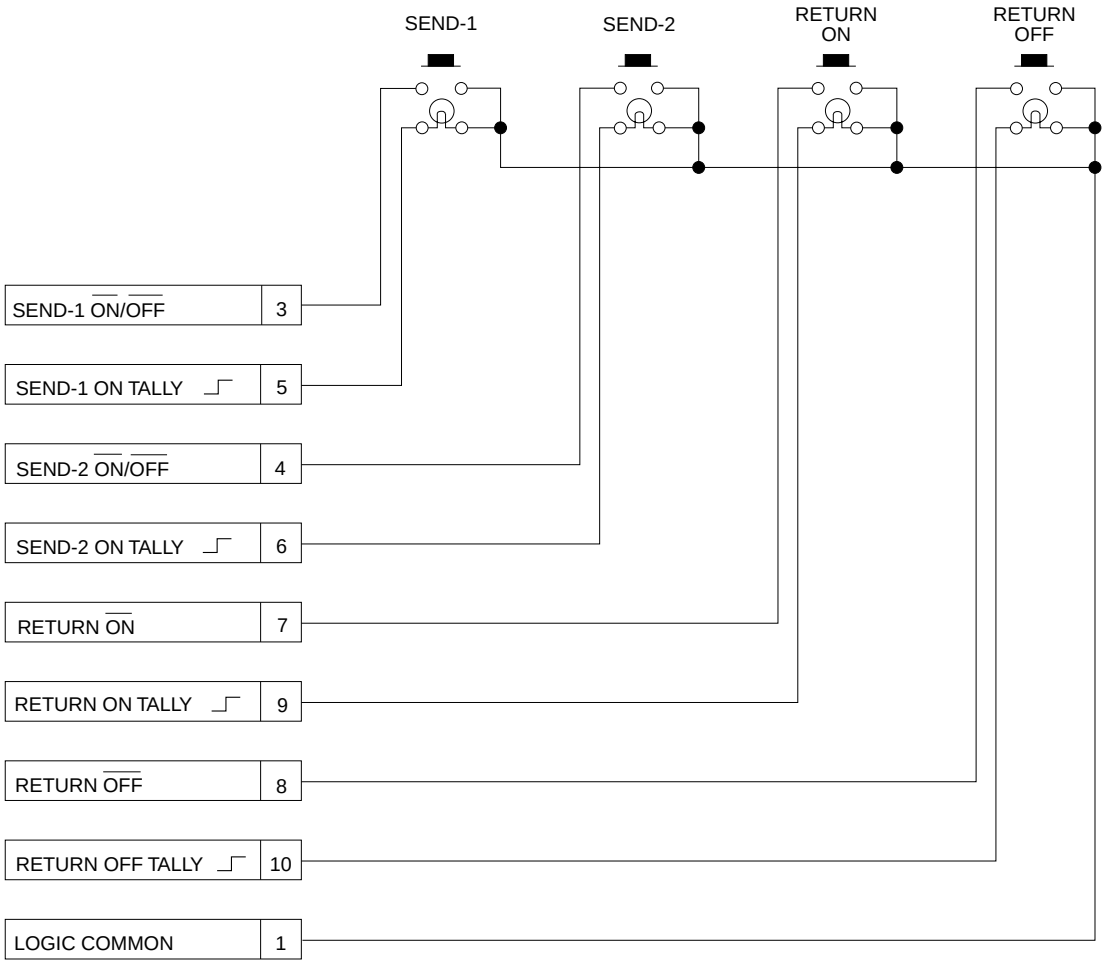
The MUTE control output is a current-sinking open collector, which is active (low) whenever a Studio microphone is ON. This command is provided for interface to intercoms, telephones and/or other external equipment which may need to be muted whenever a Studio microphone is “live”.

The DIM control output is a current-sinking open collector, which is active (low) whenever Talkback is occurring from the Studio to another location. This command is provided for similar applications as the MUTE Command.

The STUDIO WARNING tally is a 12 volt DC, 150 mA maximum, source output for connection to a magnetic or solid-state relay unit for driving the Studio entry warning light(s).

2.8.5 Send And Return Module Remote Control

The Send And Return Module contains three independent sets of circuitry: two Send circuits and one stereo Return input channel. The schematic below illustrates the full remote control capability of this module, which consists of controlling and tallying the ON/OFF status of both Send circuits and the Return circuitry.



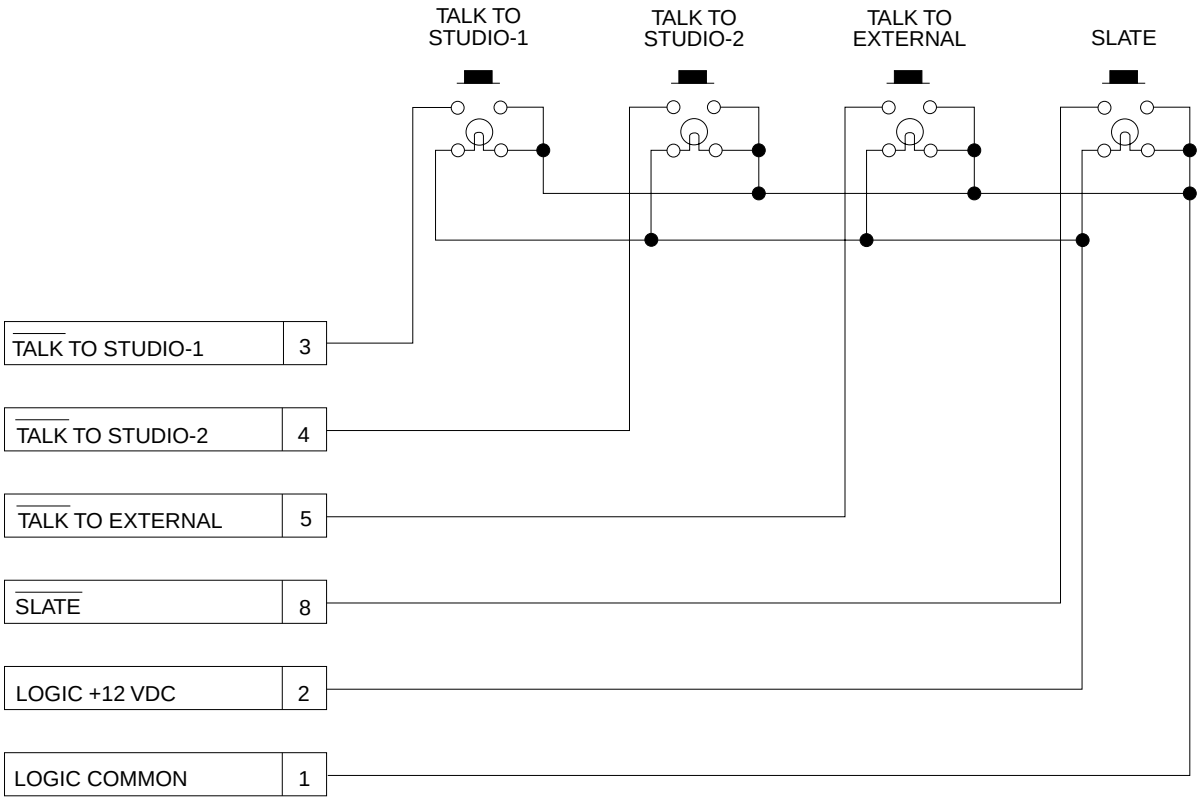
NOTES:
A) Button switches are momentary-action.
B) Lamps are 12-14 volt, 80 mA.
C) SEND-1 and SEND-2 remote ON/OFF control inputs can be momentary- or maintained-action, as determined by module internal option switches (reference Section 2.9.5).

2.8.6 Slate/Talkback/Test Oscillator Remote Control

The Slate/Talkback/Test Oscillator module has remote control circuitry available for both “Producer” and “External” locations.

PRODUCER INPUT

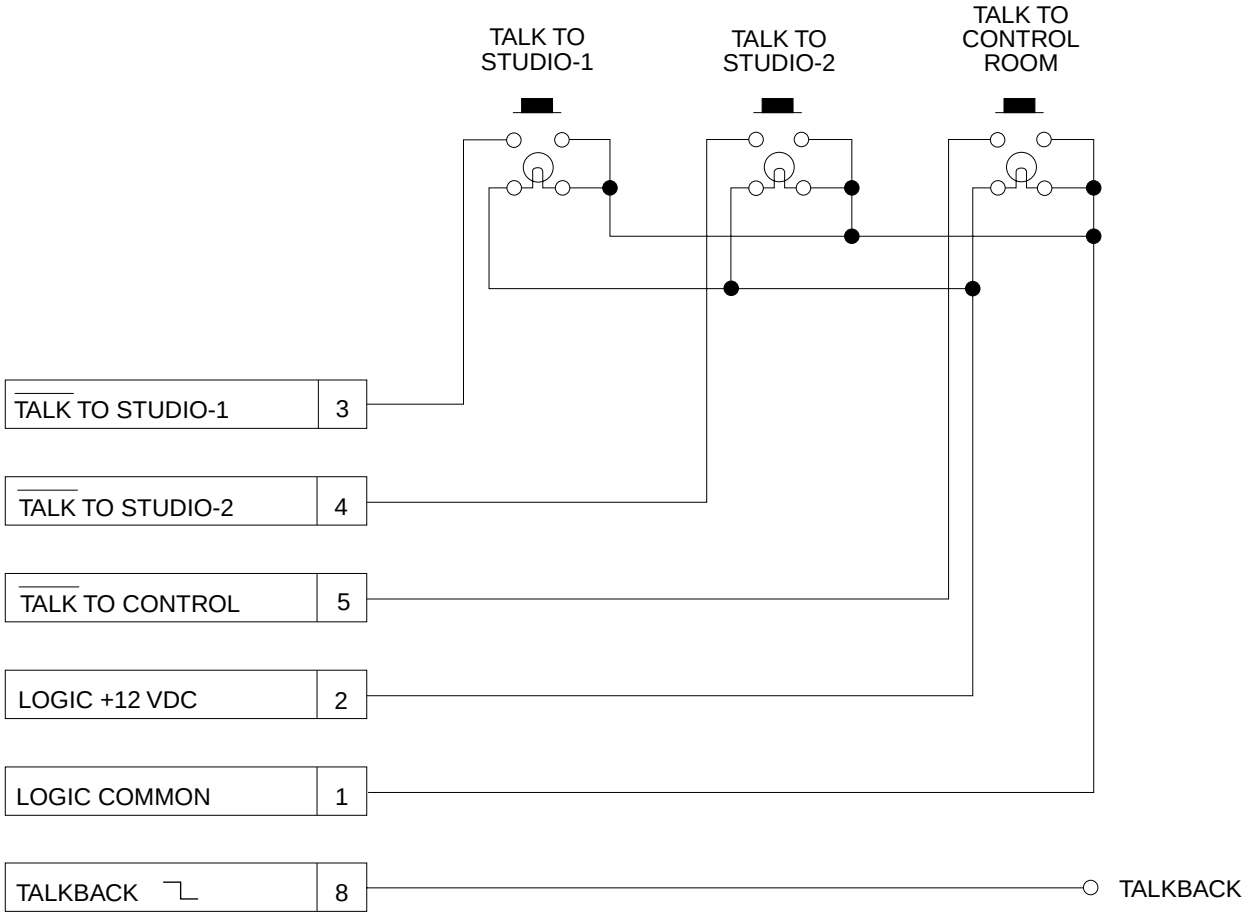
The “Producer” is usually located somewhere in the Control Room. TALK control inputs route the Producer’s Microphone Input signal to the selected location. The schematic below illustrates the full remote control capability of this input.



NOTES:
A) Button switches are momentary-action.
B) Lamps are 12-14 volt, 80 mA.
C) When tallies are connected as shown above, switch lamps will be illuminated at all times.

EXTERNAL INPUT

The “External” circuitry is intended for a variety of possible applications, including a telephone call screener booth, announce booth, newsroom, or even connection to a two-way transmitter/receiver for communicating with the rush-hour traffic reporter. The schematic below illustrates the full remote control capability of this input.



NOTES:
A) Button switches are momentary-action.
B) Lamps are 12-14 volt, 80 mA.
C) When tallies are connected as shown above, switch lamps will be illuminated at all times.

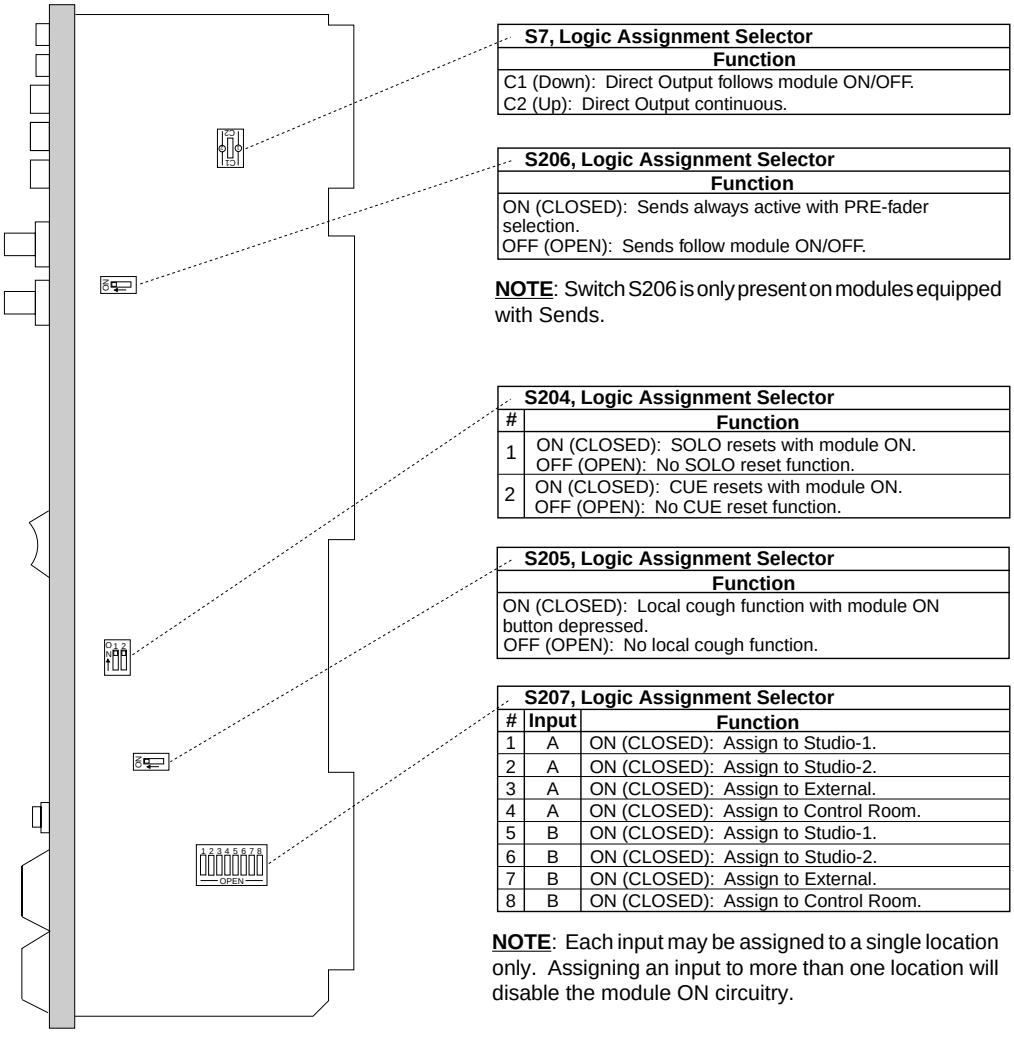
The TALKBACK control output is a current-sinking open collector, which is active (low) whenever the external location is receiving Talkback from another location. Typical applications include keying a two–way transmitter or dimming an external monitor.

2.9 MODULE INTERNAL OPTION SWITCHES

Some BMX III console modules are equipped with PCA-mounted option switches to enable or disable selected module functions. This section shows the locations of these switches on each PCA as well as their functions. Included are descriptions of the Microphone Input, Stereo Line Input, Control Room Monitor, Two-Studio Monitor, Send And Return, Telco Mix, Slate/Talkback/Test Oscillator, Meter Switcher, and Monaural and Stereo Equalizer Module option switches.

2.9.1 Microphone Input Module Option Switches

The illustration below shows the locations of the Microphone Input Module internal option switches, and defines their functions.



S7, Logic Assignment Selector
Function
C1 (Down): Direct Output follows module ON/OFF. C2 (Up): Direct Output continuous.

S206, Logic Assignment Selector
Function
ON (CLOSED): Sends always active with PRE-fader selection. OFF (OPEN): Sends follow module ON/OFF.

NOTE: Switch S206 is only present on modules equipped with Sends.

S204, Logic Assignment Selector	
#	**Function**
1	ON (CLOSED): SOLO resets with module ON. OFF (OPEN): No SOLO reset function.
2	ON (CLOSED): CUE resets with module ON. OFF (OPEN): No CUE reset function.

S205, Logic Assignment Selector
Function
ON (CLOSED): Local cough function with module ON button depressed. OFF (OPEN): No local cough function.

S207, Logic Assignment Selector		
#	**Input**	**Function**
1	A	ON (CLOSED): Assign to Studio-1.
2	A	ON (CLOSED): Assign to Studio-2.
3	A	ON (CLOSED): Assign to External.
4	A	ON (CLOSED): Assign to Control Room.
5	B	ON (CLOSED): Assign to Studio-1.
6	B	ON (CLOSED): Assign to Studio-2.
7	B	ON (CLOSED): Assign to External.
8	B	ON (CLOSED): Assign to Control Room.

NOTE: Each input may be assigned to a single location only. Assigning an input to more than one location will disable the module ON circuitry.

Switch S7 sets whether the module's Direct Output follows the ON/OFF status of the module or has continuous audio output.

Switch S204 sets the Cue and Solo reset functions. S204-1 determines if SOLO resets when the module is turned ON. S204-2 determines if CUE resets when the module is turned ON.

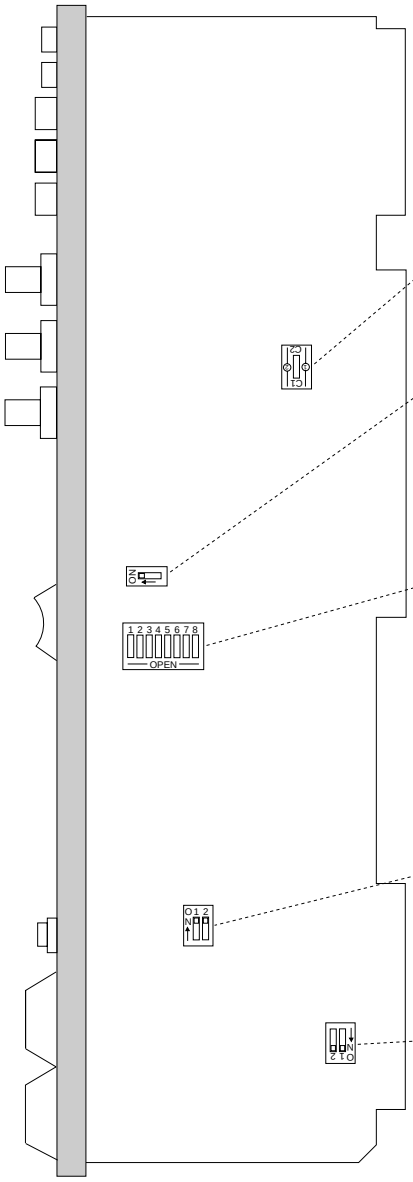
Switch S205 enables the local cough function, allowing the module ON button to function as a cough button. The cough function mutes the module audio from all buses for as long as the module ON button is pressed.

Switch S206 is only found on modules with the Sends option. The Sends normally follow the ON/OFF status of the module. For applications that require continuous Sends, such as on or off-air telephone contest recording, the PRE-fader Send audio can to be set “on” and available at all times by closing S206. This setting engages the Send relay whenever the PRE button is engaged, regardless of the ON/OFF status of the module.

Switch 207 is an eight-station switch that assigns the microphone to its own location (Control Room, Studio-1, Studio-2, External) to enable the correct monitor mute function for that location. This also enables Talkback from that location to all other locations.

2.9.2 Stereo Line Input Module Option Switches

The illustration below provides the locations of the Stereo Line Input Module internal option switches, and defines their functions.



S7, Logic Assignment Selector
Function
C1 (Down): Direct Output follows module ON/OFF. C2 (Up): Direct Output continuous.

S206, Logic Assignment Selector
Function
ON (CLOSED): Sends always active with PRE-fader selection. OFF (OPEN): Sends follow ON/OFF.

NOTE: Switch S206 is only present on modules equipped with Sends.

S200, Logic Assignment Selector		
#	**Input**	**Function**
1	A	ON (CLOSED): Control Room mute enable.
2	A	ON (CLOSED): Studio-1 mute enable.
3	A	ON (CLOSED): Studio-2 mute enable.
4	A	ON (CLOSED): Timer reset enable.
5	B	ON (CLOSED): Control Room mute enable.
6	B	ON (CLOSED): Studio-1 mute enable.
7	B	ON (CLOSED): Studio-2 mute enable.
8	B	ON (CLOSED): Timer reset enable.

S205, Logic Assignment Selector	
#	**Function**
1	ON (CLOSED): CUE resets with module ON. OFF (OPEN): No CUE reset function.
2	ON (CLOSED): SOLO resets with module ON. OFF (OPEN): No SOLO reset function.

S207, Logic Assignment Selector		
#	**Input**	**Function**
1	A	ON (CLOSED): No Ready lamp function. OFF (OPEN): Ready lamp function enabled.
2	B	ON (CLOSED): No Ready lamp function. OFF (OPEN): Ready lamp function enabled.

Switch S7 sets whether the module's Direct Output follows the ON/OFF status of the module or has continuous audio output.

Switch S200 is an eight-station switch that can enable muting of the Control Room, Studio-1 and Studio-2 on the A and/or B inputs (typically only used when a preamplified microphone is connected to the module). S200-4 and S200-8 separately enable the timer reset function for each input. When closed the console timer resets at module ON.

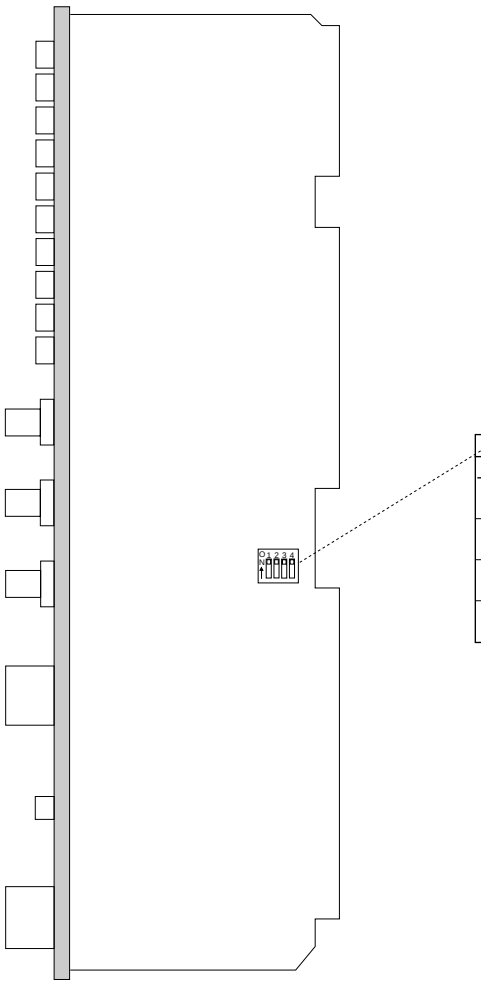
Switch S205 sets the Cue and Solo reset functions. S205-1 determines if CUE resets when the module is turned ON. S204-2 determines if SOLO resets when the module is turned ON.

Switch S206 is only found on modules with the Sends option. The Sends normally follow the ON/OFF status of the module. For applications that require continuous Sends, such as on or off-air telephone contest recording, the PRE-fader Send audio can to be set “on” and available at all times by closing S206. This setting engages the Send relay whenever the PRE button is engaged, regardless of the ON/OFF status of the module.

Switch S207 is a two-station switch that enables the ready lamp function for each input. When set closed, the OFF lamp follows the module’s ON/OFF status. When set open, the OFF lamp is controlled by the Ready Logic coming from a peripheral device. This allows the OFF lamp to function as a “ready indicator,” to easily alert the operator to the status of the cart machine, tape player, etc. connected to the module.

2.9.3 Control Room Monitor Module Option Switches

The Control Room Monitor Module has a four-station internal option switch and an Auto-Cue option. The illustration below provides the location of this switch, and defines its functions. See the following page for a description of the Auto-Cue option.



S200, Logic Assignment Selector	
#	Function
1	ON (CLOSED): Talkback assigned to CUE. OFF (OPEN): No Talkback to CUE assignment.
2	ON (CLOSED): Receiving Talkback dims C/R. OFF (OPEN): No dim function.
3	ON (CLOSED): Talkback assigned to Selector Output. OFF (OPEN): Talkback not assigned to Selector Output.
4	ON (CLOSED): C/R dim disables receiving Talkback. OFF (OPEN): C/R dim does not disable receiving Talkback.

Switch S200-1 allows Talkback to be assigned to the console CUE system. The CUE output is dimmed by 10 dB while Talkback is inserted at unity level.

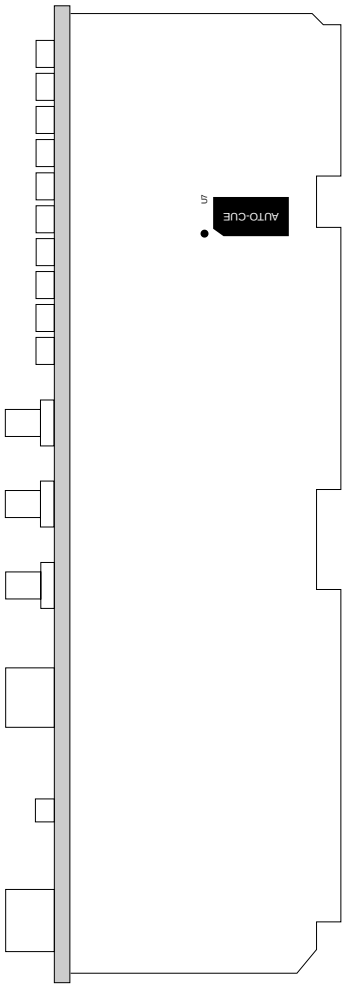
Switch S200-2 allows the Control Room speakers to be dimmed while the Control Room is receiving incoming Talkback communication. Note that the Control Room speakers already dim when the Control Room is talking to another location.

Switch S200-3 allows the Talkback circuitry to be assigned to the Selector Output. The monitor feed to this direct output will be dimmed by 10 dB while Talkback is inserted at unity level.

Switch S200-4 can be set to block incoming Talkback to the Control Room whenever the Control Room is talking to another location. This option prevents other locations from talking to the Control Room while it is talking, and is desirable where the console operator and/or producer want the absolute priority of communication.

AUTO-CUE

The Auto-Cue headphone monitoring system is activated while the Control Room Module AUTO button is engaged. While Auto-Cue is active, putting any module into CUE switches the console operator's headphones from the normal stereo source monitor selection to one of two user-assigned Auto-Cue modes—Mode 1: stereo Cue audio is fed to both headphone channels, or Mode 2: the source monitor audio is summed into the left headphone and the stereo Cue audio is summed into the right headphone. The Auto-Cue Mode is selected by the orientation of header/jumper U7 in its 16-pin socket as shown below. Note that this socket is located below the Monitor Source Selector PCA.

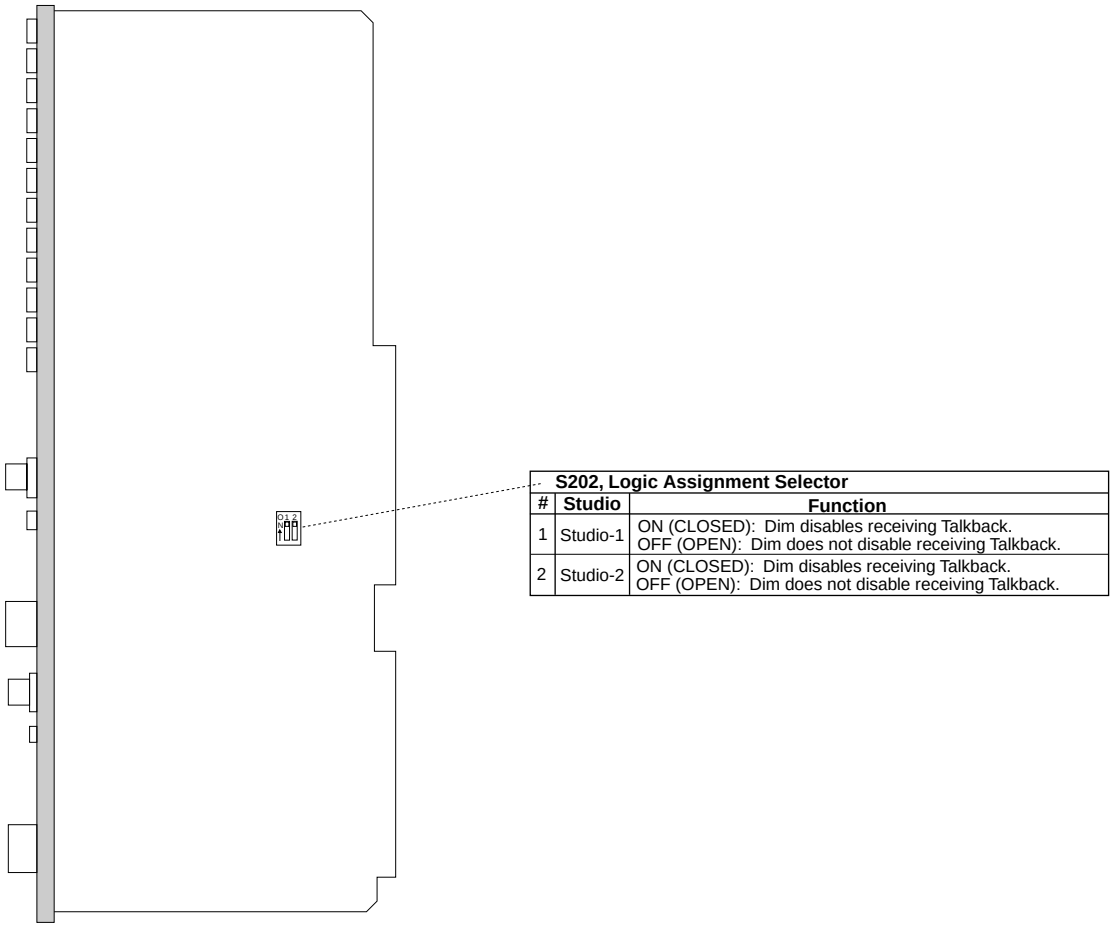


MODE 1: Stereo Cue is fed to left and right headphones, while source monitor is cut off.

MODE 2: Cue is summed to the right headphone, source monitor is summed to left headphone.

2.9.4 Two-Studio Monitor Module Option Switch

The illustration shows the location of the Two-Studio Monitor Module internal option switch and outlines its functions.



S202, Logic Assignment Selector

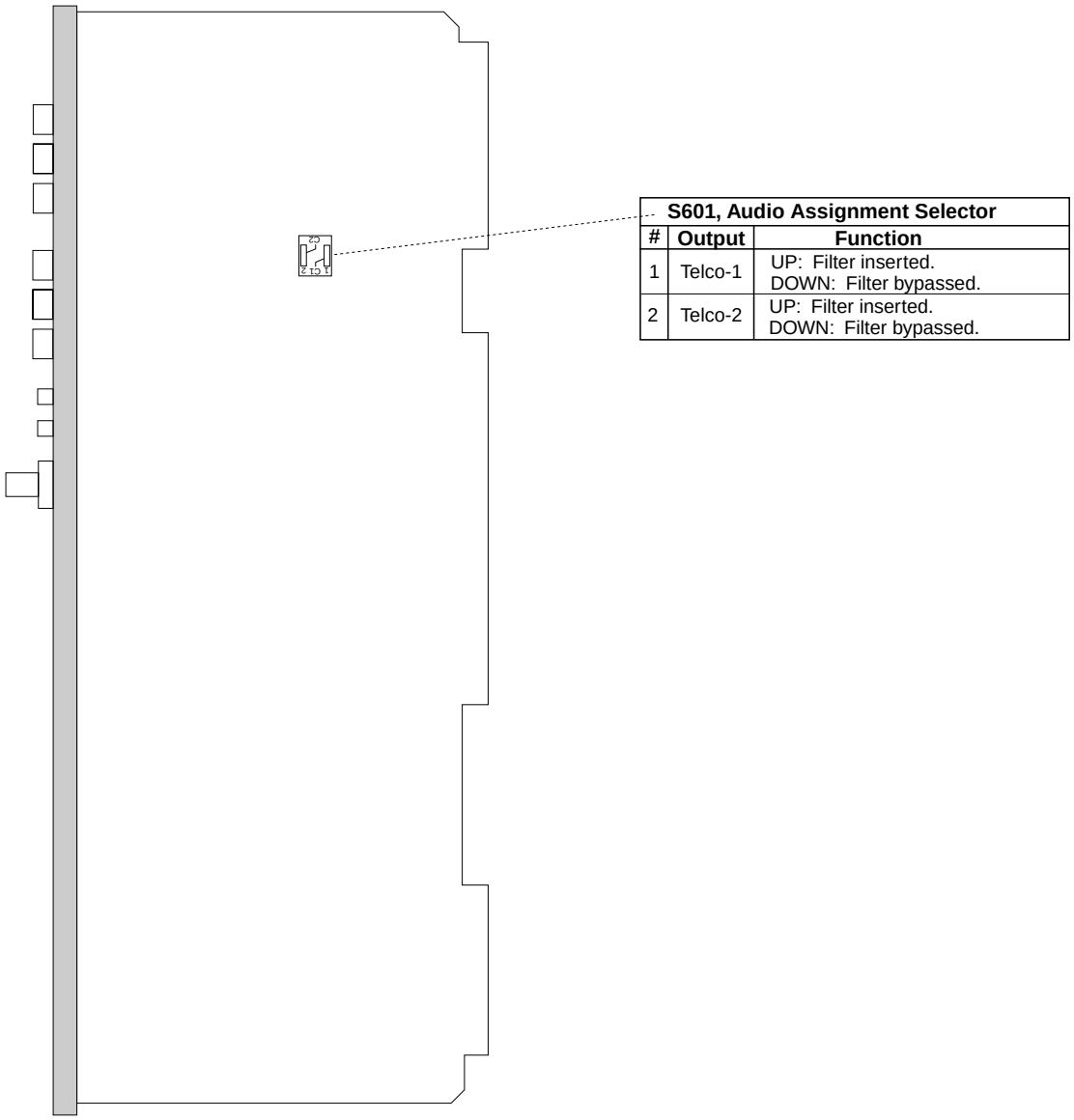
#	Studio	Function
1	Studio-1	ON (CLOSED): Dim disables receiving Talkback. OFF (OPEN): Dim does not disable receiving Talkback.
2	Studio-2	ON (CLOSED): Dim disables receiving Talkback. OFF (OPEN): Dim does not disable receiving Talkback.

Two-station switch S202 determines how the Studio-1 and Studio-2 dim functions affect Talkback communication. Closing S202-1 causes the Studio-1 dim function to block incoming Talkback signals to Studio-1. Closing S202-2 causes the Studio-2 dim function to block incoming Talkback signals to Studio-2. Since the dim function is the result of the studio talking to another location, this function prevents other locations from talking to the studio while it is talking.

2.9.5 Telco Mix Option Switch

The Monaural Output/Telco Mix Module is equipped with two bandpass filters for the Telco-1 and Telco-2 outputs used with telephone hybrids. The filters are three-pole, 18 dB/octave designs with a bandpass of 300 Hz to 3 kHz. The filters limit the frequency response to the range typically within the null capabilities of professional-grade hybrid systems. The filters may not be required, nor desirable, for non-hybrid mix-minus applications, thus each filter is equipped with its own bypass switch.

NOTE: This option switch is also present on the Monaural Output/Telco Mix/Send And Return Module (PR&E #99-266).

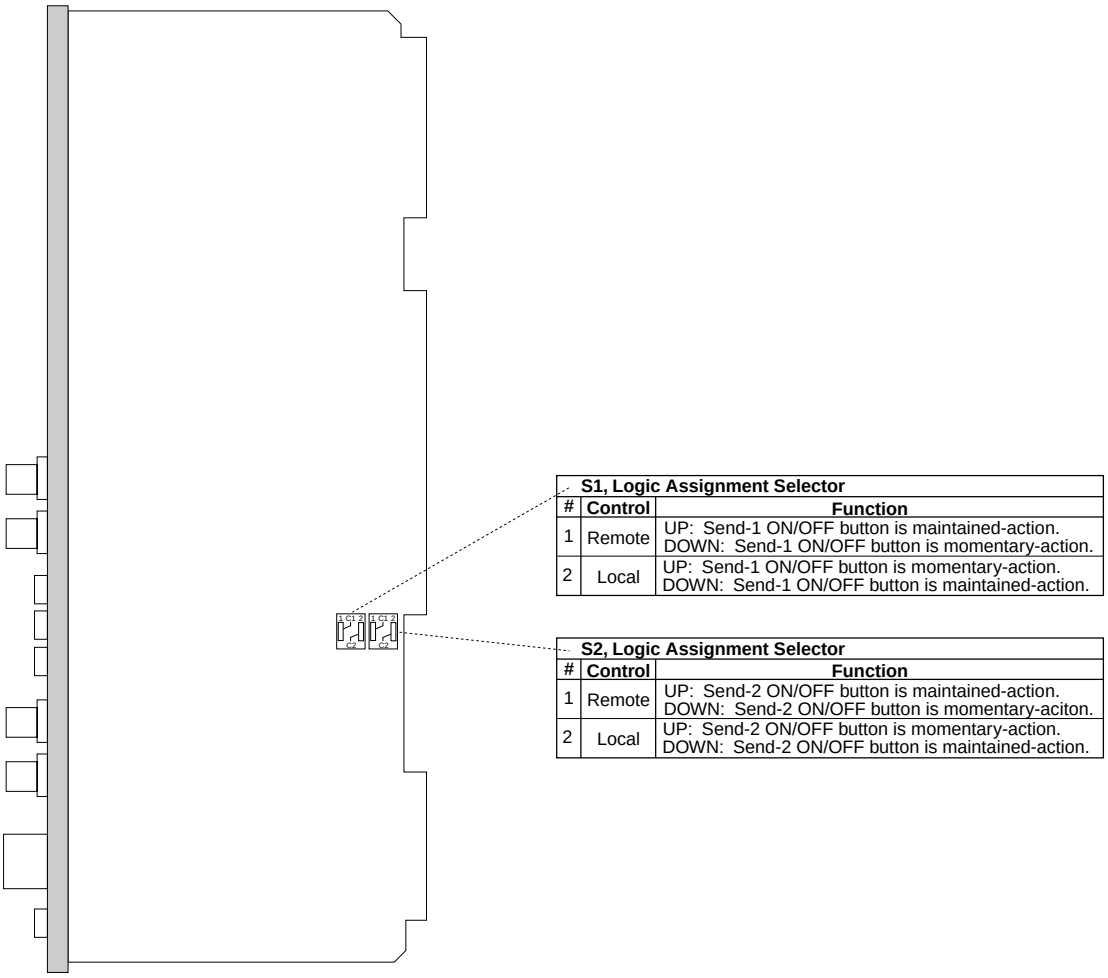


S601, Audio Assignment Selector		
#	Output	Function
1	Telco-1	UP: Filter inserted. DOWN: Filter bypassed.
2	Telco-2	UP: Filter inserted. DOWN: Filter bypassed.

2.9.6 Send And Return Module Option Switches

The illustration shows the location of the Send And Return Module internal option switches and defines their functions.

NOTE: These option switches are also present on the Monaural Output/Telco Mix/Send And Return Module (PR&E #99-266).



S1, Logic Assignment Selector		
#	Control	Function
1	Remote	UP: Send-1 ON/OFF button is maintained-action. DOWN: Send-1 ON/OFF button is momentary-action.
2	Local	UP: Send-1 ON/OFF button is momentary-action. DOWN: Send-1 ON/OFF button is maintained-action.

S2, Logic Assignment Selector		
#	Control	Function
1	Remote	UP: Send-2 ON/OFF button is maintained-action. DOWN: Send-2 ON/OFF button is momentary-aciton.
2	Local	UP: Send-2 ON/OFF button is momentary-action. DOWN: Send-2 ON/OFF button is maintained-action.

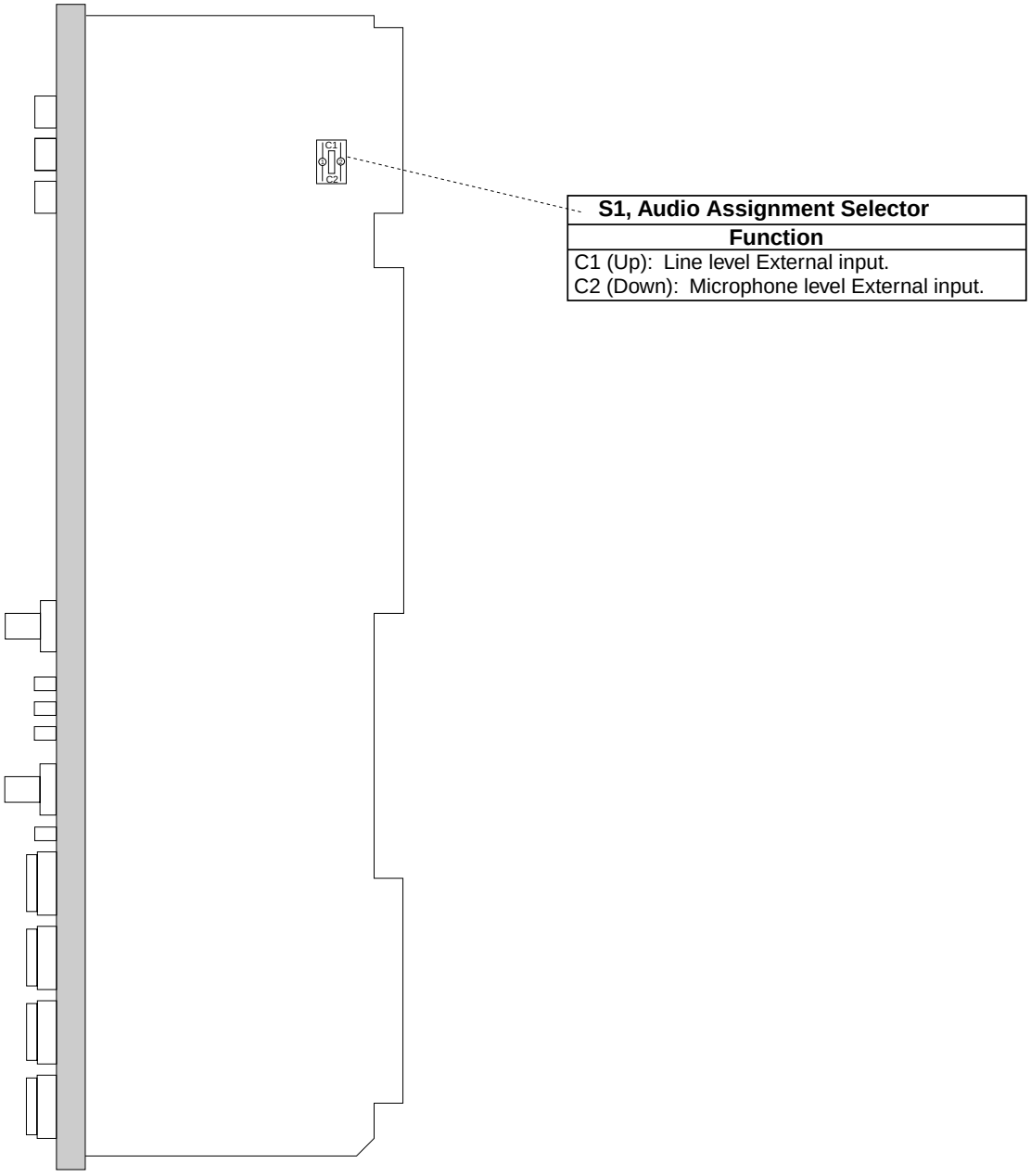
Two-station switch S1 sets whether the Send-1 local and/or remote ON/OFF buttons are momentary or maintained-action. When momentary-action is selected for the local and/or remote ON/OFF buttons, Send-1 is active only as long as the button is held depressed.

Two-station switch S2 sets whether the Send-2 local and/or remote ON/OFF buttons are momentary or maintained-action. When momentary-action is selected for the local and/or remote ON/OFF buttons, Send-1 is active only as long as the button is held depressed.

The momentary-action function may be desired when using Sends for special effects applications.

2.9.7 Slate/Talkback/Test Oscillator Module Option Switch

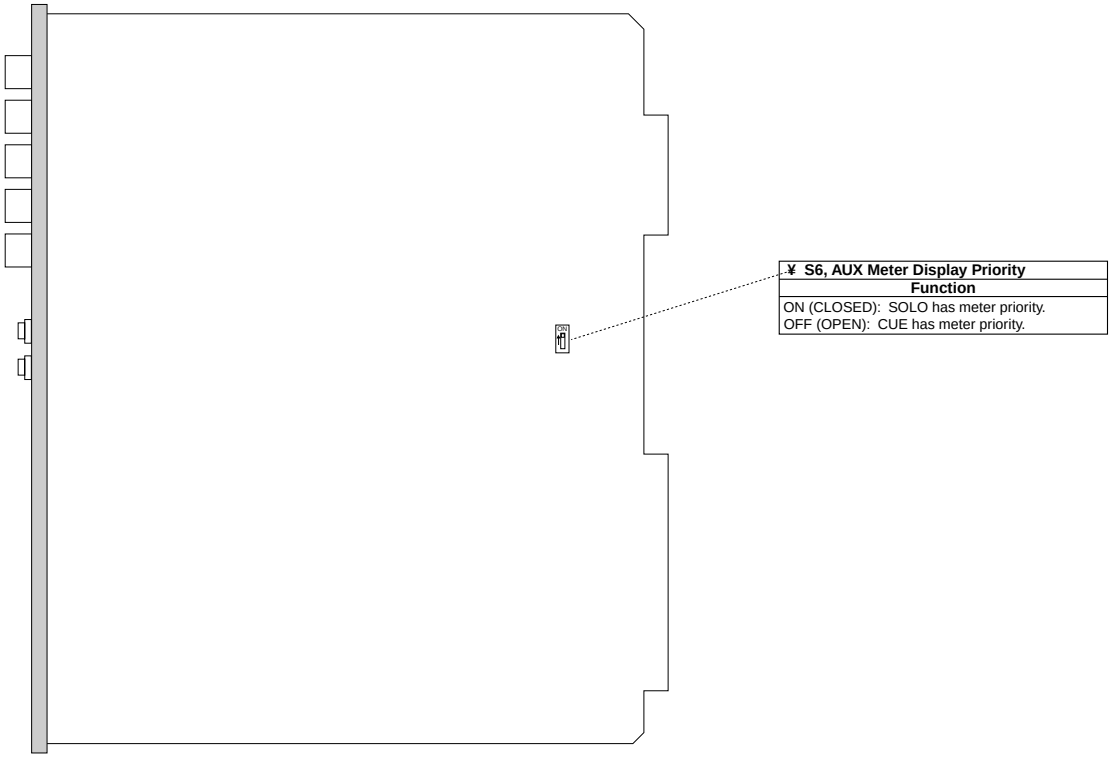
The Slate/Talkback/Test Oscillator Module has one internal option switch, which sets the External Talk audio input to be either microphone or line level. The illustration below provides the location of this switch, and defines its function.



S1, Audio Assignment Selector
Function
C1 (Up): Line level External input. C2 (Down): Microphone level External input.

2.9.8 Meter Switcher Module Option Switch

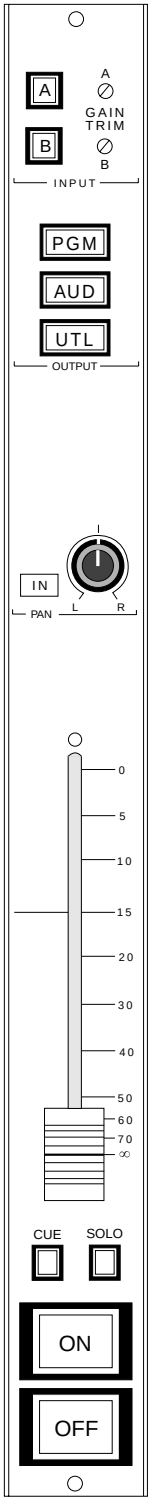
The Meter Switcher Module has one internal option switch, which sets the priority of the AUXILIARY meter display between CUE and SOLO. The illustration provides the location of this switch, and defines its function.



3.0 OPERATION

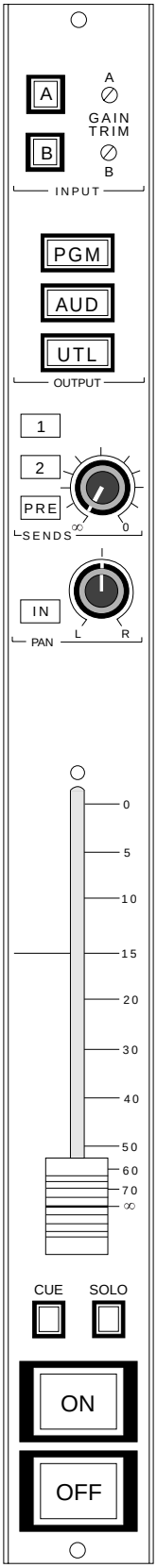
This chapter describes the function for each control on the BMX III modules.

3.1 MICROPHONE INPUT MODULE



- The INPUT buttons select the Input source, typically microphones, connected to the A and B inputs of the module.
- The recessed GAIN TRIM controls set the microphone preamplifier gain for the microphones connected to the two inputs.
- The OUTPUT buttons assign the module's audio to any combination of the PROGRAM, AUDITION and UTILITY output buses.
- The PAN control, with INsert switch, allows positioning of the microphone signal within the stereo sound field.
- The mixing fader is a stepless, infinite resolution control with a reference line at the -15 dB point. The reference is the nominal position for a properly adjusted input level to achieve "0" VU on the console output meters.
- The electronic alternate-action CUE button routes the pre-fader audio to the console Cue monitoring and metering systems. The CUE button lamp flashes to indicate its ON status. A steady lamp indication is available with the installation of an optional jumper wire in the lamp driver logic (reference Section 5.4).
- The electronic alternate-action SOLO button routes the input signal (after the fader and pan controls) to the console SOLO monitoring and metering systems. The SOLO button lights to indicate its ON status.
- The ON button turns the module on and initiates the appropriate muting commands, as set during installation. In addition, the ON button may be optionally set to provide a momentary cough function while held depressed (reference Section 2.9.1).
- The OFF button turns the module off and cancels the muting commands.

3.2 MICROPHONE INPUT MODULE WITH SENDS



- The INPUT buttons select the Input source, typically microphones, connected to the A and B inputs of the module.

- The recessed GAIN TRIM controls set the microphone preamplifier gain for the microphones connected to the two inputs.

- The OUTPUT buttons assign the module's audio to any combination of the PROGRAM, AUDITION and UTILITY output buses.

- The SEND-1, SEND-2 and PRE-fader buttons assign the pre- or post-fader microphone audio to the console's Send & Return module. The rotary control adjusts the Send level for both Send outputs.

- The PAN control, with INsert switch, allows positioning of the microphone signal within the stereo sound field.

- The mixing fader is a stepless, infinite resolution control with a reference line at the -15 dB point. The reference is the nominal position for a properly adjusted input level to achieve "0" VU on the console output meters.

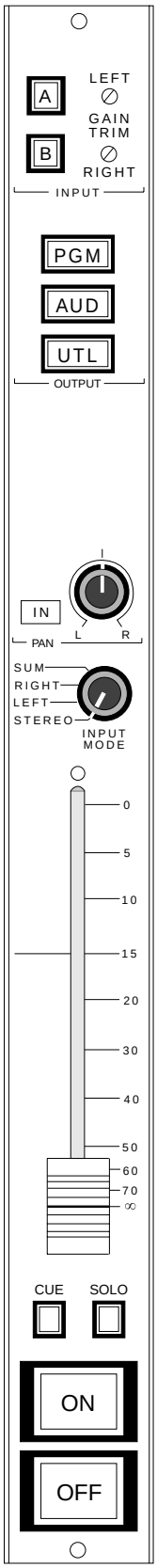
- The electronic alternate-action CUE button routes the pre-fader audio to the console Cue monitoring and metering systems. The CUE button lamp flashes to indicate its ON status. A steady lamp indication is available with the installation of an optional jumper wire in the lamp driver logic (reference Section 5.4).

- The electronic alternate-action SOLO button routes the input signal (after the fader and pan controls) to the console SOLO monitoring and metering systems. The SOLO button lights to indicate its ON status.

- The ON button turns the module on and initiates the appropriate muting commands, as set during installation. In addition, the ON button may be optionally set to provide a momentary cough function while held depressed (reference Section 2.9.1).

- The OFF button turns the module off and cancels the muting commands.

3.3 STEREO LINE INPUT MODULE



- The INPUT buttons select between stereo sources connected to the A and B inputs of the module.

- The recessed GAIN TRIM controls adjust the gain of the LEFT and RIGHT input buffers. These affect both inputs equally.

- The OUTPUT buttons assign the module to any combination of the PROGRAM, AUDITION and UTILITY output buses.

- The PAN control with INsert button may be used to adjust the left-right balance of a stereo signal, or to position a monaural or sum mode signal within the stereo sound field.

- The INPUT MODE selector determines the module mode as follows:

STEREO	Discrete stereo channels.
LEFT	Left input is routed to both output channels.
RIGHT	Right input is routed to both output channels.
SUM	Left and right inputs are summed to both output channels.

- The mixing fader is a stepless, infinite resolution control with a reference line at the -15 dB point. The reference is the nominal position for a properly adjusted input level to achieve “0” VU on the console output meters.

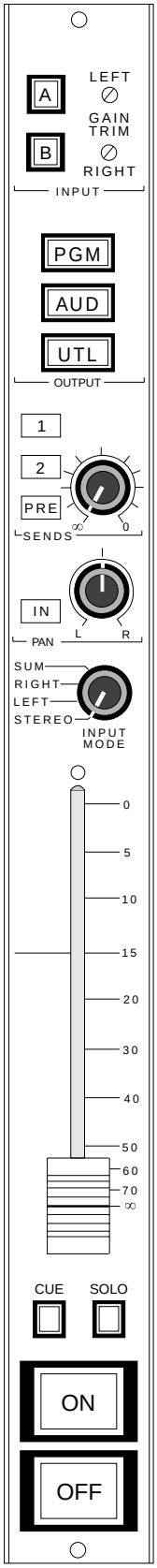
- The alternate-action CUE button routes pre-fader audio to the console Cue monitoring and metering systems. The button lamp flashes to indicate its ON status. For a steady lamp indication, available with the installation of an optional jumper wire, see Section 5.4.

- The alternate-action SOLO button routes the input signal (after the fader and pan controls) to the console SOLO monitoring and metering systems. The SOLO button lights to indicate its ON status.

- The ON button turns the module on and initiates machine start control, timer reset or muting commands, as set during installation.

- The OFF button turns the module off and initiates machine stop control commands as set during installation. The OFF lamp may be set to act as a machine ready status indicator, see Section 2.9.2.

3.4 STEREO LINE INPUT MODULE WITH SENDS



- The INPUT buttons select between stereo sources connected to the A and B inputs of the module.

- The recessed GAIN TRIM controls adjust the gain of the LEFT and RIGHT input buffers. These affect both inputs equally.

- The OUTPUT buttons assign the module to any combination of the PROGRAM, AUDITION and UTILITY output buses.

- The SEND-1, SEND-2 and PRE-fader buttons assign the pre- or post-fader audio to the console's Send & Return module. The rotary control adjusts the Send level for both Send outputs. Optional stereo Send functions and operation are available, see Section 5.3.

- The PAN control with INsert button may be used to adjust the left-right balance of a stereo signal, or to position a monaural or sum mode signal within the stereo sound field.

- The INPUT MODE selector determines the module mode as follows:

STEREO	Discrete stereo channels.
LEFT	Left input is routed to both output channels.
RIGHT	Right input is routed to both output channels.
SUM	Left and right inputs are summed to both output channels.

- The mixing fader is a stepless, infinite resolution control with a reference line at the -15 dB point. The reference is the nominal position for a properly adjusted input level to achieve "0" VU on the console output meters.

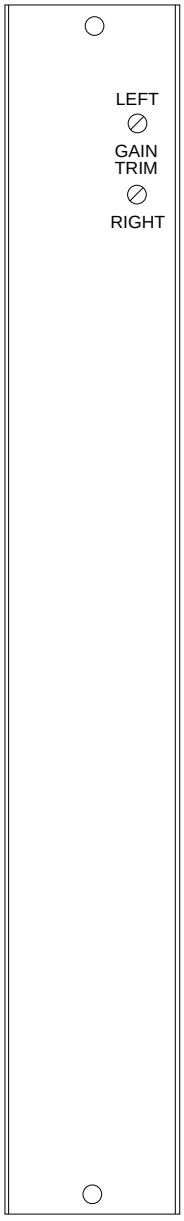
- The alternate-action CUE button routes pre-fader audio to the console Cue monitoring and metering systems. The button lamp flashes to indicate its ON status. For a steady lamp indication, available with the installation of an optional jumper wire, see Section 5.4.

- The alternate-action SOLO button routes the input signal (after the fader and pan controls) to the console SOLO monitoring and metering systems. The SOLO button lights to indicate its ON status.

- The ON button turns the module on and initiates machine start control, timer reset or muting commands, as set during installation.

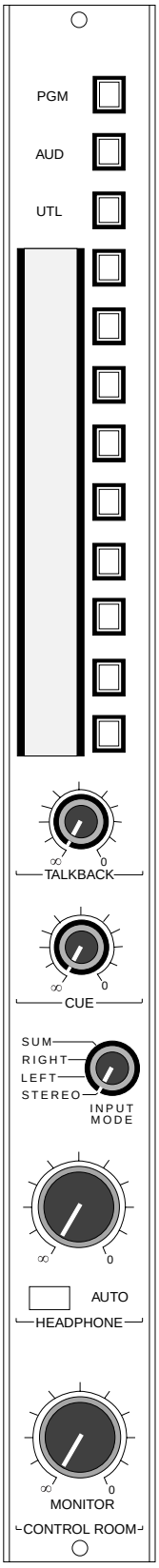
- The OFF button turns the module off and initiates machine stop control commands as set during installation. The OFF lamp may be set to act as a machine ready status indicator, see Section 2.9.2.

3.5 STEREO LINE OUTPUT AMPLIFIER



- The recessed LEFT and RIGHT GAIN TRIM controls set the gain of the line output distribution amplifiers. These controls are for engineering personnel only.

3.6 CONTROL ROOM MONITOR MODULE



- The 12-station Monitor Input switch selects the monitor source from the PROGRAM, AUDITION or UTILITY buses, or any one of nine external sources.

  NOTE: Legend strip dimensions are provided in Section 2.1.

- TALKBACK controls the level of Talkback communication received in the Control Room via the adjustable Talkback output or the Cue output (when Talkback is assigned to Cue per Section 2.9.3).

  NOTE: The TALKBACK control functions only when the Control Room is muted.

- CUE controls the level of the Control Room Cue output.

- INPUT MODE sets the module's monitor and headphone outputs as follows:

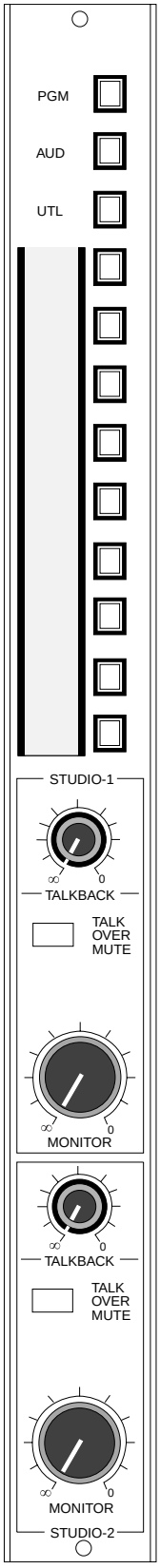
STEREO	Discrete stereo is output.
LEFT	The Left input is routed to both output channels.
RIGHT	The Right input is routed to both output channels.
SUM	Left and Right inputs are summed to both output channels.

- HEADPHONE controls the output level for the console operator's headphone system.

- When the AUTO button is up, Cue is not routed to the operator's headphones. With the AUTO button down, and Cue active on any module, the operator's headphones automatically switch to Cue using the selected Auto-Cue Mode. Refer to Section 2.9.3 for information on the two Auto-Cue Modes.

- MONITOR controls the volume of the Control Room monitors.

3.7 TWO-STUDIO MONITOR MODULE



This optional module includes the monitoring and talkback controls for two separate rooms, refered to as Studio-1 and Studio-2.

- The 12-station Monitor Input switch selects the monitor source, for both Studio-1 and Studio-2, from the Program (PGM), Audition (AUD) or Utility (UTL) buses, or from one of the nine external Monitor Inputs.

NOTE: Legend strip dimensions are provided in Section 2.1.

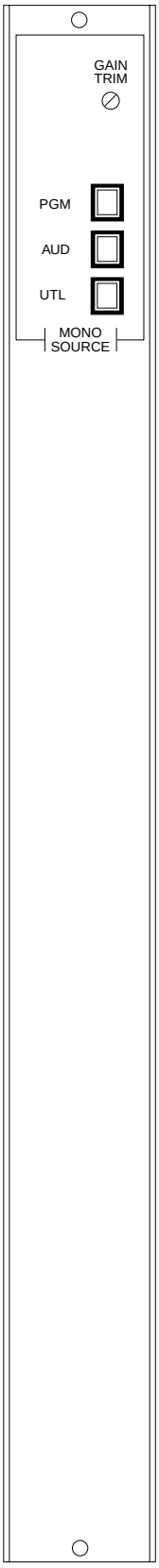
STUDIO-1 CONTROLS

- TALKBACK controls the level of Talkback communications received in Studio-1.
- TALK OVER MUTE is an alternate-action switch which, when engaged (down), allows communication to Studio-1 even when there is a live microphone in the studio and the studio speakers are muted. This function is usually limited to off-air recording and production, although some "personality" formats do allow the console operator to talk to the hosts on-air.
- MONITOR controls the volume of the Studio-1 monitors.

STUDIO-2 CONTROLS

- TALKBACK controls the level of Talkback communications received in Studio-2.
- TALK OVER MUTE is an alternate-action switch which, when engaged (down), allows communication to Studio-2 even when there is a live microphone in the studio and the studio speakers are muted.
- MONITOR controls the volume of the Studio-2 monitors.

3.8 MONAURAL LINE OUTPUT AMPLIFIER



This optional module includes the Source Selection for the Mono Main and Aux Outputs and the gain trim for these outputs.

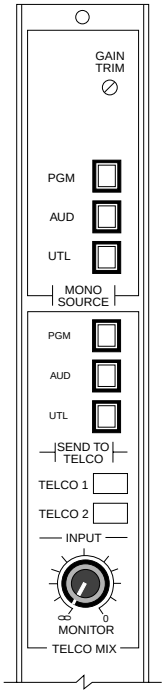
- The recessed GAIN TRIM control sets the gain of the monaural line output distribution amplifier. This control is for engineering personnel only.

- The MONO SOURCE buttons select the monaural output source. Any combination of the summed PROGRAM, AUDITION and UTILITY output buses can be selected.

3.9 MONAURAL OUTPUT/TELCO MIX MODULE

This optional module includes the independent functions for the Mono Main and Aux Outputs and the Telco Inputs, Outputs and Monitor. The Telco Mix half of the module produces the two outputs fed back to the callers. Each of the caller Feeds is a mix-minus output consisting of the selected SEND TO TELCO bus (normally the UTL bus, as described below) plus any selected callers minus the caller himself. This mix-minus matrix is best illustrated through the module's block diagram in Section 7.1.7.

NOTE: To assign a caller to an output bus (such as the PGM bus for "on-air" Telco operations), select the desired bus on the caller's Input module and turn the module ON. Do not assign the caller's Input module to the SEND TO TELCO bus (normally UTL), as the callers are added to the base mix-minus using the TELCO INPUT assignment buttons, as described below.



NOTE: The Monaural Output and Telco Mix sections of this module function independently. The Monaural Output operations are covered in Section 3.8.

- The three SEND TO TELCO assignment switches selects the console buses that are fed to all telephone callers (normally the Utility bus, as described below).
- The TELCO-1 and TELCO-2 INPUT buttons select the input feeds from the Input Modules assigned as telephone hybrid inputs and assign them to the mix matrix, where the two Telco outputs and the monitor mix are created.
- MONITOR controls the level of the variable Telco Monitor Output.

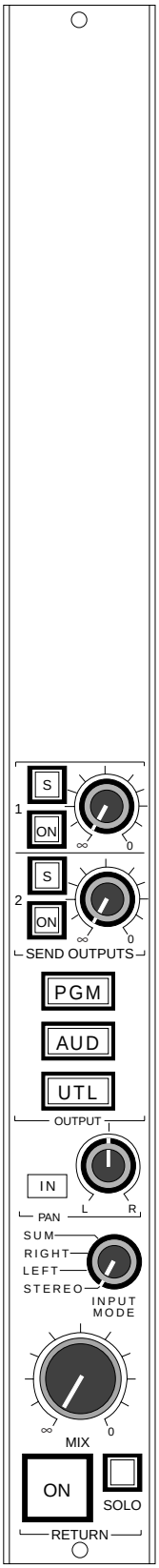
  NOTE: Both Telco Monitor Outputs (fixed and variable) are non-muted caller-only outputs.

UTILITY BASE MIX

The Utility (UTL) bus is normally assigned as the base mix bus for Telco operations by configuring the console as follows:

1. Assign all Input modules to be included in the base mix to the UTL bus. Do Not assign any Input Module with the Telco input to the UTL bus.
2. Select only UTL on the SEND TO TELCO switches.
3. Select which callers to add to the base mix using the TELCO-1 and TELCO-2 INPUT assignment buttons.

3.10 SEND AND RETURN MODULE



This optional module includes the independent functions for the two Send Outputs and Monitors and the stereo Return Input.

- ON controls the individual Send outputs. These buttons may be maintained- or momentary-action, as set by the setting of internal option switches (see Section 2.9.5).

- S (SOLO) routes the individual pre-fader Send mix bus audio to the SOLO monitoring and metering systems. The two rotary controls independently adjust the two Send levels.

- The OUTPUT buttons assign the stereo Return audio to any combination of the PROGRAM, AUDITION and UTILITY output buses.

- PAN controls, when the INsert switch is down, the left-right balance of a stereo Return signal, or the position of a monaural or sum mode signal within the stereo sound field.

- The INPUT MODE switch routes the Return audio as follows:

STEREO	Discrete stereo channel throughput.
LEFT	Left input is routed to both outputs.
RIGHT	Right input is routed to both outputs.
SUM	Left and right inputs are summed to both outputs.

- MIX is a stepless, infinite resolution control for the Return audio.

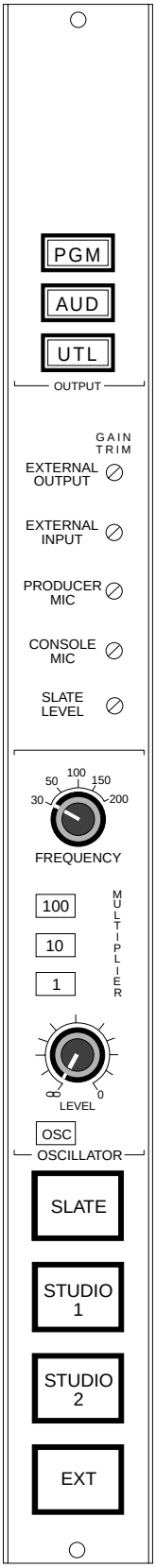
- The alternate-action SOLO button routes the stereo Return audio to the console SOLO monitoring and metering systems. The SOLO button illuminates to tally its ON status.

- The alternate-action ON button turns the Return audio ON and OFF.

3.11 MONAURAL OUTPUT/TELCO MIX/SEND AND RETURN MODULE

This optional multi-function module combines the independent functions of several modules previously covered in this chapter. The Monaural Output (MONO SOURCE) functions are listed in Section 3.8. The TELCO MIX functions are listed in Section 3.9. The SEND OUTPUTS and RETURN functions are listed in Section 3.10.

3.12 SLATE/TALKBACK/TEST OSCILLATOR MODULE



This optional module includes the independent functions for Control Room Talkback to several locations, the Producer and External Talk interfacing, a 30 Hz slate tone generator and a test tone oscillator.

- The OUTPUT buttons assign the test tone and the slate tone generators to any combination of the Program (PGM), Audition (AUD) and Utility (UTL) output buses.

- The recessed GAIN TRIM controls independetly set these levels:

  EXTERNAL OUTPUT sets the level of the External Talkback Output.
  EXTERNAL INPUT sets the level of the External Talkback Input.
  PRODUCER MIC sets the gain of the Producer Input preamplifier.
  CONSOLE MIC sets the gain of the meter panel electret microphone.
  SLATE LEVEL sets the output level of the slate tone. This control is factory-set for a -6 VU meter reading.

- The FREQUENCY selector and MULTIPLIER buttons set the output frequency of the built-in test tone oscillator.

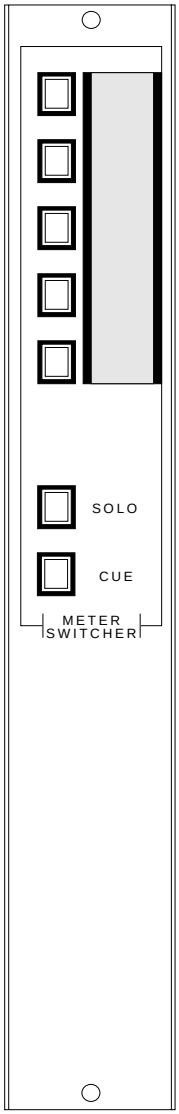
- LEVEL adjusts the output level of the test tone oscillator.

- OSC, when engaged (down), switches the test tone oscillator output to the buses selected by the OUTPUT assignment buttons. OSC, when not engaged (up) switches the Slate tone output to the buses adn turns off the tone oscillator.

- Pressing SLATE sends a mix of the 30 Hz Slate tone and the console Talkback microphone to the buses selected by the OUTPUT assignment buttons.

- The three Talkback buttons (STUDIO 1, STUDIO 2, EXT) provide communications to two Studios and an External location. Multiple buttons can be pressed for simultaneous communications.

3.13 METER SWITCHER MODULE



- The five-station Meter Source switch selects the Auxiliary meter source. On 26, 30 and 34 input mainframes, all five sources come from the Meter Switcher Inputs. This allows metering of the monaural and Send buses, remote modulation readouts, etc. On the smaller mainframes, one or two of the Meter inputs are used to meter the Utility (UTL) and Audition (AUD) buses. On the 18 and 22 input mainframes, Input 5 (the bottom input) selects UTL metering. On the smaller 10 and 14 input mainframes, the two bottom inputs (Input 4 and 5) are used to meter AUD (Input 4) and UTL (Input 5).

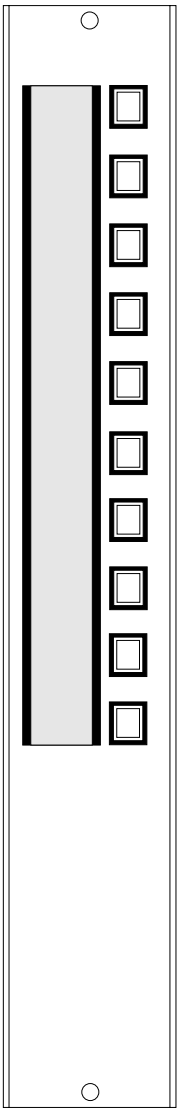
  NOTE: Legend strip dimensions are provided in Section 2.1.

- The SOLO and CUE tallies indicate when either function is engaged somewhere in the console. While the SOLO or CUE tallies are lit, the Solo or Cue level is displayed on the Auxiliary meters.

  NOTE: SOLO or CUE metering priority is set by an internal option switch (see Section 2.9.8).

3.14 REMOTE LINE SELECTOR MODULE

Up to two optional Remote Line Selectors may be installed in the BMX III mainframe. The ten Remote Inputs are common between the two RLS modules.

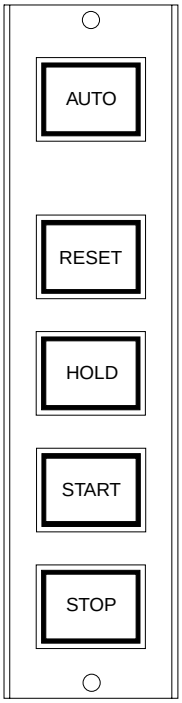


- A ten-station switchbank selects one input source from among the ten Remote Inputs. The stereo output from each RLS module is then routed to an Input module, tape recorder, station playback system, etc.

  NOTE: Legend strip dimensions are provided in Section 2.1.

3.15 TIMER CONTROL PANEL

The optional Production Timer is controlled by this optional panel.



- AUTO, when engaged (latched down), allows those Stereo Line Input modules with their timer reset function enabled, to reset and restart the timer at every module ON (refer to Section 2.9.2 on selecting this function). The AUTO button illuminates to tally its ON status. When AUTO is disengaged (button up, tally off) the Timer is manually controlled through the panel buttons.

- RESET resets the timer to zero (00:00.0). If the timer is already running, it continues to run from 00:00.0.

- HOLD is a momentary function. Pressing HOLD holds the timer display at the present time count while the running time count continues internally. Releasing HOLD jumps the display to the running time count.

- START starts the timer from the displayed stop time.

- STOP stops the timer displaying the final running time count.

NOTE: The Timer Control Panel schematic is located in Section 8.6.6.

4.0 EQUIPMENT DESCRIPTION

This chapter describes the functions and circuitry of the various components incorporated in the BMX III console and its associated modules. Included are sections describing the mainframe, Microphone Input Module, Stereo Line Input Module, Stereo Line Output Amplifier, Control Room Monitor Module, Two-Studio Monitor Module, Monaural Line Output Amplifier, Monaural Output/Telco Mix Module, Send and Return Module, Monaural Output/Telco Mix/Send And Return Module, Slate/ Talkback/Test Oscillator Module, Meter Switcher Module, Remote Line Selector Module, VU Meter Power Regulator, VU Meter Buffer Amplifier, and Power Supply Assembly.

Corresponding diagrams and schematics are located in Chapter 7.

4.1 MAINFRAME

4.1.1 Function

The console mainframe contains all the interconnection wiring required to accommodate a full complement of modules. Each input position is wired in a universal fashion and, therefore, will accept either a Microphone Input or Stereo Line Input Module.

NOTE: Section 7.27 has the complete mainframe wiring diagrams.

4.1.2 Circuitry

The only active electronic components in the mainframe are the VU meter power regulator assembly and the meter buffer amplifiers. These are described in detail in Sections 4.14 and 4.15, respectively. The meter buffer amplifiers are mounted on their respective meters, and the power regulator assembly is mounted on the bottom of the console mainframe, beneath the Remote Line Selectors. The VU meter distribution board is mounted inside the mainframe, immediately below the meters.

NOTE: The BMX III power supply assembly provides ±22 volt DC power to the console mainframe. This is regulated to ±16 volts DC by the VU meter regulator assembly and by regulator assemblies on all BMX III modules except output amplifiers, which regulate the ±22 volt DC power to ±18 volts DC (reference the module schematics located in Chapter 7).

The meter panel assemblies on the BMX III-10 and BMX III-14 are equipped with two sets of stereo VU meters (PROGRAM and AUXILIARY). The Audition and Utility buses are metered on the Auxiliary meters, as selected by the Meter Switcher module.

The BMX III-18 and BMX III-22 are equipped with three sets of stereo meters (PROGRAM, AUDITION and AUXILIARY). The Utility bus is metered on the Auxiliary meters, as selected by the Meter Switcher module.

The BMX III-26, BMX III-30 and BMX III-34 are equipped with four sets of stereo meters (PROGRAM, AUDITION, UTILITY and AUXILIARY).

4.2 MICROPHONE INPUT MODULES

This section describes the function and circuitry of the Microphone Input Module (PR&E #99-262) and the Microphone Input Module With Sends (PR&E #99-252). See Chapter 7 for the module schematics.

4.2.1 Function

Both versions of the Microphone Input Module accommodate a wide range of input levels, permitting the use of all contemporary microphones. Phantom powering for condenser microphones on both A and B inputs is built into each Mic module (see Section 5.1 for details). Individual A and B input preamp gain trimpots allow the module to handle nominal input levels from -60 dBu to -35 dBu.

The A/B input selector provides two microphone inputs per module, each with programmable monitor mute selection for Control Room, Studio-1 or Studio-2. The mute circuitry incorporates an automatic 40 millisecond delay before the microphone is turned on, permitting “room reverb” to decay off-mic.

The PAN control allows for positioning of the microphone signal within the stereo sound field, and the alternate action PGM, AUD and UTL buttons allow the module to be assigned to any or all of the console stereo output buses.

4.2.2 Circuitry

NOTE: Except for the presence or absence of the Send circuitry, the two Microphone Input Modules function identically. The additional Send circuitry is described at the end of the audio and logic circuit descriptions.

AUDIO

Transformer-coupled microphone input preamplifier U1 utilizes variable feedback control to provide an overall voltage gain range of 24 dB to 50 dB. Gain trim controls R9 and R10 adjust the preamplifier gain for the A and B inputs respectively. The gain is adjusted to provide a nominal -10 dBu level to the Patch Output. The Patch Input is buffered by balanced differential amplifier U2 operating at unity gain. This amplifier provides input common mode noise isolation and signal drive to the mix fader, Cue relay K3, and Talkback relays K4 and K5.

The mix fader “in-hand” attenuation is 15 dB, which is recovered by fader buffer amplifier U3 to the –10 dBu internal system level. The output of U3 is routed to the pan pot and the pan INsert switch. The left and right outputs of the pan circuit are buffered and amplified 3 dB by dual amplifier U4, and routed to channel on/off relay K1, and Solo relay K6. The channel on/off relay routes the signal to the output bus assignment button switches.

With Sends

PRE/post fader Send switch S5 gets its pre-fader input from balanced differential amplifier U2, and its post-fader input from dual amplifier U4. The outputs of the Send PRE/post switch are controlled by dual

channel Send potentiometers R43 and R44, and routed through Send relay K2 to the two Send circuit ON/off switches. This module may be modified for post-pan stereo Send operation by following the procedure outlined in Section 5.3.

LOGIC

The selection of the A or B input to the module results in the selection of the corresponding control logic. One contact on input selector switch S2 is connected to pin 9 of U200, U201, U202 and U212. The set of logic controls for input A are chosen when this line is low and the logic controls for input B are chosen when this line is high. U200 and U201 select the A and B remote control inputs, U202 selects the status of A and B programming switch S207, and U212 selects A and B tally output drivers.

Pressing the module's ON button, or the On button on a remote control panel, causes the output of U207A to go high and toggle flip-flop circuit U208 to the "on" state. The low output from pin 4 of the flip-flop is connected to U206 pin 9, and U211 pins 12 and 8. If the logic programming switch has been set for a microphone located in the Control Room, the output of U206 will turn on transistor Q200 to pull down the Control Room mute bus. In the same manner U211D/Q201 and U211C/Q202 provide Studio-1 and Studio-2 monitor muting for inputs set to those locations.

The high output from pin 3 of the flip-flop is connected to the inputs of U215B and U211B. The other inputs of U215B are normally high; therefore, the high provided by the flip-flop will give a high output to the tally lamp and audio relay drive circuits U213A/Q229 and U216B/Q228. The input to U216B is delayed with a 40 millisecond network consisting of R273 and C237. Circuit U211B, used as an inverter, along with U213B and Q230, removes the tally voltage from the OFF light. The outputs of U213A and U213B also connect to U212, for routing to the appropriate remote tally lamp driver. Each of the four tally outputs has its own lamp driver, shown schematically as Lamp Driver B, and each of the two 12 volt output sources has its own driver, shown schematically as Lamp Driver A.

The lamp is driven by a low applied to R280, which pulls down the base of Q211 via conducting FET Q210. Q210 normally operates at zero bias.

NOTE: If a short should occur in the load, Q210 will be pinched off to remove the base current from Q211. This protection circuit is reset by switching off the drive and removing the short.

Pressing the OFF button on the module, or on the selected input's remote control panel, will cause the output of U214 to go high and toggle flip-flop circuit U208 to the "off" state. Time delay network R273, C237, R274 is bypassed by CR209 to eliminate any delay in turning the audio relay off.

Operation of either the A or B input selector button places a momentary low pulse into the input of U214, which will key the channel logic to the "off" state to prevent any input switching transient from being routed into the console mix buses.

The CONSOLE COUGH ENABLE switch is intended for use with a microphone located at the console. This switch connects the ON button directly to U215B to provide momentary channel muting whenever the ON button is held depressed.

The remote control cough muting function is achieved by pulling low the appropriate A or B cough line, which is selected by U201, and routed through U215B to U215A. Whenever any of the inputs to U215A are low, the "on" tally lights are extinguished and the channel outputs are muted. When the cough line is released, the outputs are unmuted and the "on" lamps illuminated.

Pressing the CUE button gives a high output from U207B to CUE bistable U210A. When the CUE function is engaged, U210A output pin 1 goes high to turn on CUE relay K3, and pull the CUE command bus low via Q203. Output pin 2 goes low and is routed to Control Room monitor mute selector U206B. A Control Room microphone selection causes a high at the output of U206, saturating Q200, and pulling down the Control Room mute bus to prevent feedback. This change of state is also routed to network C222 and R223, through U209A, to reset SOLO bistable U210B if this function was engaged. The CUE bistable output is also coupled to a lamp flashing circuit for the CUE lamp. The lamp flashing circuit may be defeated by strapping together points E200 and E201 on the printed circuit board. The module will be taken out of the CUE mode when the channel ON button is pressed, if CUE RESET ENABLE switch S204B pins 2 and 3 are closed.

Pressing the SOLO button gives a high output from U207C to SOLO bistable U210B. When the SOLO function is engaged, U210B output pin 13 goes high to turn on SOLO relay K6, and pull the SOLO command bus low via Q204. Output pin 12 goes low and is routed to Control Room monitor mute selector U206B. A Control Room microphone selection will causes a high at the output of U206B, saturating Q200, and pulling down the Control Room mute bus to prevent feedback. The change of state is also routed to network C219 and R220, through U209B, to reset CUE bistable U210A, if the CUE function was engaged. The low at pin 12 also drives Q206 to turn on the lamp in the SOLO button. The module will be taken out of the SOLO mode when the channel ON button is pressed, if SOLO RESET ENABLE switch S204A pins 1 and 4 are closed.

A remote control "privacy" mode is available which prevents the module from being able to enter the CUE or SOLO functions. This INHIBIT function is routed from logic input selector U201 through U208 to both U209A and U209B. The inhibit function puts a high into the reset inputs of both the CUE and SOLO bistables to lock them in the "off" mode.

Circuit U200 selects the input A and B Talkback selection functions. Pin 14 is low for Talkback to the Control Room, pin 4 for Studio-1, pin 5 for Studio-2, and pin 13 for the External location. Circuit U202 is used as the input microphone location status selector, as determined by module programming switch S207. Pin 13 will be low for a Control Room microphone, pin 14 for Studio-1, pin 4 for Studio-2, and pin 5 for the External location. The outputs of U200 and U202 are routed to gates U203, U204, U205, and U206B. These gates provide the logic controls for a location to Talk to any other location, dim the monitor levels at the originating location, and command the Talkback function at the destination location.

For an input module to Talk to the Control Room, one of the Talk to Control Room lines is pulled low by a "Talk to Control Room" push-button switch. This will cause a low at U200 pin 14, which is routed to U203 pin 1, which will generate a low output at U203 pin 7. The low at U203 pin 7 is routed to U215A pin 3, giving a low at the output of U215A, which is routed to U215B. The "on" tally circuit will be de-energized. The low at U203 pin 7, via inverter U213F, saturates Q221, pulling down the Talk to

Control Room bus, and also drives U216C via time delay network R253, R254, C229 and CR203. The output of inverter U216C drives Talkback relay K5 at pin 6.

The other Talkback functions operate in a similar fashion. One of the input control lines is pulled low by a push-button switch, the appropriate output from A/B selector U200 will then be low, and the logic in U203, U204, U205 and U206 will pull down the appropriate control bus, dim the monitor, engage the Talk circuit, and mute the signal from being on program lines at the same time. This logic design also prevents a microphone from Talking to its own location.

With Sends

Send relay K2 is energized through Q228. When internal option switch S206 is ON, Sends are always active with PRE-fader selection, regardless of the ON/OFF status of the module.

4.3 STEREO LINE INPUT MODULES

This section describes the function and circuitry of both the Stereo Line Input Module (PR&E #99-263) and the Stereo Line Input Module With Sends (PR&E #99-253). Schematics for both modules are located in Chapter 7.

4.3.1 Function

Both Stereo Line Input Modules will accommodate nominal input levels from -12 dBu to +8 dBu. The A/B input selector allows for the selection of either of two stereo inputs. Separate logic controls are available for each input for the remote control of tape machines and/or other sources, and the INPUT MODE switch allows for the selection of a STEREO, MONO, LEFT or RIGHT source to be sent to the output assignment switches.

4.3.2 Circuitry

NOTE: Except for the presence or absence of the Send circuitry, the two Stereo Line Input Modules function identically. The additional Send circuitry is described at the end of the audio and logic circuit descriptions.

AUDIO

NOTE: The stereo audio path consists of two identical sets of circuitry. For clarity and simplicity, only the left channel is described below.

The input to the module is a balanced, symmetrical input, instrumentation amplifier. This amplifier is configured with three operational amplifiers, contained on plug-in function amplifier A1, operating with a cross-coupled input stage feedback gain trim control. The voltage gain range from module input to the output of the amplifier is -18 dB to +2 dB. The gain trim control is adjusted to provide a level of -10 dB to the Patch Output line.

The Patch Input signal is buffered by balanced differential amplifier U1A operating at unity gain, and then routed to the INPUT MODE switch. The output of the mode switch is connected to the mix fader, and CUE bus relay K2.

The mix fader "in-hand" attenuation of 15 dB is recovered by fader buffer amplifier U2A to the -10 dBu internal system level, and routed to the PAN pot and the pan insert switch. The pan switch selects between the attenuated output of the fader buffer and the output of the pan pot, and then routes the signal to amplifier U3A, which operates at a gain of 3 dB. The output of U3A is connected to channel on/off relay K3 and SOLO relay K4. The channel on/off relay then routes the signal to the output bus assignment switches and the direct output lines.

With Sends

PRE/post fader Send switch S3 gets its PRE-fader input from INPUT MODE switch, and its post-fader input from amplifiers U3A and U3B. The outputs of the two-section Send fader are routed through Send relay K1 to the two Send ON/off switches. The two Send signals are a monaural mix of the left and right channels. However, this module may be modified for stereo Send operation by following the procedure outlined in Section 5.3.

LOGIC

The module is provided with two sets of control logic, one for each of the A and B inputs. This logic includes the capacity to provide independent machine and remote controls for the ON, OFF, CUE, and SOLO functions for each input. A contact on the A/B input selector switch is routed to integrated circuit switches U206, U200, U212 and U201. U206 selects the A/B logic status of the module, as determined by programming switches S200, U200 (the A and B remote control input lines), and U212, U201 (the A and B output tally lamp and control pulse lines).

When the module or the selected input's remote control ON button is pressed, the output of U202A will go high. This output is routed to channel on/off flip-flop U209, and CUE and SOLO reset enable switches S205-1 and S205-2, respectively. The low "on" output from U209 pin 3 is routed to the monitor mute gates in U207, to delay circuit R239, C213, R240 and U208D, to channel ON/OFF relay drive transistor Q204, and also to ON relay K3. This low is also connected to output switch U212, and to "on" lamp drive transistor Q205. The high "on" output from U209 pin 11 is routed to "off" lamp gate U205A, through "start" pulse generator circuit U211A to output switch U212, and through timer "reset" pulse generator U211B to transistor Q207.

When the module or the selected input's remote control OFF button is pressed, the output of U203 will go high. This output is connected to channel on/off flip-flop U209, and resets it to the "off" state. The output of U209 pin 3 goes high, and bypasses the turn-on delay network via diode CR202 to turn off the channel relays. The channel audio is also switched off when either the A or B input selector switch is operated by generating a short pulse into "off" gate U203 pins 11 and 12, respectively.

Output driver short-circuit protection is provided to prevent damage caused by shorts in the output lines. As an example of this protection, consider the case when the A INPUT ON TALLY lamp is powered;

a short circuit will drop the gate of Q208 to ground, which turns the FET off and removes the drive current from the base of output transistor Q209.

The module's OFF lamp may be remotely controlled by applying a low to the selected remote READY input. This is routed through U200 pin 4 to U205A pin 2, which will result in a low output at pin 9, keying "on" OFF lamp driver Q206. This provides the facility of using the module's OFF lamp to tally the ready state of remote controlled equipment.

Pressing the module or the selected input's remote control CUE button causes a high to appear at the output of U202B, which is connected to U210A. Circuit U210A is connected in a bistable configuration, with each positive-going transition causing the output of U210 to change state. The output of this CUE bistable is routed to CUE relay K2, CUE logic bus drive transistor Q224, SOLO reset circuit U205C, and to the CUE lamp flasher circuit of U202 and U208. The circuitry around U202 and U208 is a free-running multivibrator. The lamp flasher may be defeated by installing a jumper between E212 and E213 on the printed circuit board. The output of the lamp flasher circuit is connected to CUE lamp drive transistor Q225, and to remote CUE tally output switch U201.

Pressing the module or the selected input's remote control SOLO button causes a high to appear at the output of U202C, which is connected to U210B. Circuit U210B is connected in a bistable configuration, with each positive-going transition causing the output of U210 to change state. The output of this SOLO bistable is routed to SOLO relay K4, SOLO logic bus drive transistor Q226, CUE reset circuit U205B, and SOLO lamp drive transistors Q227 and Q228. The low output from transistor Q227 is also routed to remote SOLO tally output switch U201.

With Sends

Send relay K1 is energized by channel ON/OFF relay drive transistor Q204. When internal option switch S206 is ON, Send-1 and Send-2 are always active with PRE-fader selection, regardless of the ON/OFF status of the module.

4.4 STEREO LINE OUTPUT AMPLIFIER

4.4.1 Function

The Stereo Line Output Amplifier contains the mixing and distribution amplifiers for a console line output. The console mainframe is supplied with three of these modules; one each for the PROGRAM, AUDITION and UTILITY buses. Each module supplies four distribution outputs, with each output capable of supplying up to +28 dBm. The main output is an active balanced design. Patch send and return points are available for the connection of external processing equipment and/or a patch field.

4.4.2 Circuitry

NOTE: The stereo audio path consists of two identical sets of circuitry. For clarity and simplicity, only the left channel is described below.

Bus summing amplifier A3 is a discrete JE-990 type operational amplifier constructed on a plug-in module. The output of the summer is connected to inverting amplifier U1 to provide an inphase output to the bus patch point. Both of these amplifiers operate at unity gain and, therefore, provide a nominal level of -10 dBu to the Bus Patch Output.

The Patch Return input signal is buffered by balanced differential amplifier U4 operating at unity gain. The output of U4 is routed to variable gain amplifier U5, and also to monaural mixing amplifier U6. Voltage gain amplifier U5 is adjusted by front panel Gain Trim control R26, and has sufficient range to adjust the output level from +4 dBu to +8 dBu. The output of U5 is connected to line output amplifiers A1 and A2 operating as a push-pull pair to provide balanced drive to the console distribution output lines.

NOTE: The early version of the Stereo Line Output Amplifier was designed to accommodate the optional installation of a Jensen type JE-123A transformer in the main output, meter and monitor lines. This option was discontinued in 1986 due to lack of interest.

4.5 CONTROL ROOM MONITOR MODULE

4.5.1 Function

The Control Room Monitor Module allows for the monitoring of PROGRAM, AUDITION, UTILITY, or any of nine stereo line inputs by means of an interlocking monitor selector. The module consists of five sections: monitor, SOLO, CUE, Talkback and headphone. Each section has a relationship with the others that can be best appreciated by reviewing the module block diagram located in Chapter 7.

4.5.2 Circuitry

AUDIO

NOTE: The stereo audio paths for the monitor, solo, cue and headphone sections consist of two identical sets of circuitry. For clarity and simplicity, only the left channel of each section is described below.

The input to the monitor is selected by the front panel 12-station push button switch assembly. The input to the module is a balanced, symmetrical input, instrumentation amplifier. This amplifier is configured with three operational amplifiers, contained on the plug-in function amplifier A1, operating with cross-coupled input stage feedback. The voltage gain from module input to the output of the instrumentation amplifier is -8 dB for consoles operating at a +8 dBm reference level, and -4 dB for consoles operating at a +4 dBm reference level. The output of this stage is routed through the SOLO relay, INPUT MODE switch, dim relay, MONITOR level control, mute relay, and output buffer amplifier U4A. This buffer operates at unity gain, as supplied by the factory. The gain of this stage may be increased to 6 dB with the installation of R28 and C19 as shown in the schematic in Chapter 7 of this document.

The output of the monitor input stage is also routed through Talk to selector output relay K1 to select buffer amplifier U1A. The 6 dB loss of the Talk to direct relay circuit is made up by the 6 dB gain of

amplifier U1A. The output of the INPUT MODE switch is also routed to the AUTO-CUE FUNCTION header, and relays K5 and K6.

The SOLO bus input is summed by amplifier U2A and inverted by U3A. The output is connected to the SOLO METER output terminal, and to SOLO relay K2 in the monitor section.

The CUE bus input is summed by amplifier U5A and inverted by U6A. The output is connected to the CUE METER output terminal and AUTO-CUE FUNCTION header U7. The output of U6A is also routed through the front panel CUE level control, mute relay K9, and output buffer amplifier U10A. The 6 dB loss of the Talkback insert circuit is made up by the 6 dB gain of the buffer amplifier.

The headphone signal from AUTO-CUE relays K5 and K6 is routed through Talkback insert relay K7 and the HEADPHONE level control, to plug-in amplifier assembly A2. The line amplifier operates at a fixed gain of 12 dB.

The Talkback to Control Room bus signal is summed by U8A and inverted by U8B. The output of U8B is connected to the TALKBACK OUTPUT terminal, to Talkback insert relays K1 and K7, and to the TALKBACK level control. The output of the TALKBACK control is routed to Talk to CUE relay K8A, Talkback mute relay K8B, and output buffer amplifier U9. This buffer operates at unity gain, as supplied by the factory. The gain of this stage may be increased to 6 dB with the installation of R61 and C44 as shown in the schematic.

LOGIC

The Control Room monitor system may be muted by a low applied to the MUTE CR logic bus or by a low applied to the REMOTE MUTE CR input line. In either case, the low command causes a high output on gate U200A. This high signal is routed to monitor mute relay K4, MUTE OUTPUT transistor Q200, and through inverter U201F to warning lamp driver circuit Q201 and Q202.

The Control Room monitor system may be dimmed by a low applied to the DIM CR logic bus or by a low applied to the REMOTE DIM CR input line. In either case, the low command causes a high output on gate U200D. This high is routed through gate U202D to dim relay K3, and to DIM OUTPUT transistor Q203.

The TALK CR bus is driven low whenever a Microphone Input Module, or the External input to the Slate/Talkback/Test Oscillator Module, initiates communication to the Control Room. This low is routed through gate U202B and inverter U201B to Talk to headphone relay K7. This low may also be applied to Talk to CUE relay K8A by closing internal option switch S200-1, and to Talk to direct relay K1 by closing switch S200-3.

The Talk to Control Room command may also be set to dim the Control Room monitor system by closing switch S200-2, which directs the high output of U201B to monitor dim relay K3.

The Control Room monitors are automatically dimmed whenever the console initiates Talkback to another location. This low dim command comes into the monitor module on the DIM CR bus. This

low command may be routed by option switch S200-4 through inverter U201E and gate U202B to hold the input of U201B high. This high locks out the Talk to Control Room logic, and establishes a priority of communication in the Control Room's favor.

The CUE system is activated whenever a low is applied to the CUE logic bus. This results in a high output from inverter U201D, which is routed to auto-CUE relays K5 and K6 and the CUE TO METER SW output.

The SOLO system is activated whenever a low is applied to the SOLO logic bus. This results in a high output from inverter U201C, which is routed to SOLO relay K2 and the SOLO TO METER SW output.

4.6 TWO-STUDIO MONITOR MODULE

4.6.1 Function

The Two-Studio Monitor Module is expressly designed for applications where separate voice/announce booths or conference Studios are required. This module provides the monitor, headphone and Talkback facilities for up to two Studios. Monitoring of PROGRAM, AUDITION, UTILITY, or any of nine external sources is provided by means of an interlocking monitor selector.

The module consists of a common monitor source selector and two identical sets of "guest" and "talent" headphone outputs, fixed and variable level monitor outputs, and Talkback to Studio circuits. Each section of each Studio's monitor circuitry has a relationship with the others which can best be appreciated by reviewing the module block diagram located in Chapter 7 of this document.

4.6.2 Circuitry

AUDIO

NOTE: The stereo audio paths for the monitor and headphone sections consist of two identical sets of circuitry. For clarity and simplicity, only the left channel of the Studio-1 section is described below.

The input to the Studio monitors is selected by the front panel 12-station push button switch assembly, and routed to the balanced, symmetrical input, instrumentation amplifier. This amplifier is configured with three operational amplifiers contained on plug-in function amplifier A1, operating with cross-coupled input stage feedback. The voltage gain from module input to the output of the instrumentation amplifier is -8 dB. The output of this stage is connected to the module MONITOR SELECT OUT terminals, to Talk to talent headphone relay K3, and to the input of mute Studio relay K1.

The output of Talk to talent headphone relay K3 is buffered by amplifier U3A, which operates with 6 dB of gain to recover the 6 dB loss of the Talkback insert circuit. The output of U3A is connected to the module TALENT HEADPHONE OUT terminal.

The output of the mute Studio relay is routed through dim relay K2 and feeds both the fixed and variable level monitor circuits. The "fixed level" signal is routed through Talk to Studio relay K4 and buffer

amplifier U4A. Dim relay K2, when energized, inserts a fixed 12 dB attenuator into the signal path. The gain of U4A is 6 dB to recover the 6 dB loss of the Talkback insert circuitry. The output of U4A is connected to the module FIXED OUTPUT LEFT terminal.

The "variable level" signal path includes the front panel MONITOR level control, Talk to Studio relay K5, and buffer amplifier U5A. The gain of U5A is also 6 dB to recover the loss of the Talkback insert circuitry. The output of U5A is connected to the module VARIABLE OUTPUT LEFT terminal.

The TALK TO STUDIO BUS-1 signal is summed and inverted by dual amplifier U1, and routed to Talk to talent relay K3 and Talk to Studio relays K4 and K5. An additional output from U1 is connected to the TALK TO STUDIO-1 OUT terminal. The resistor network around each of the Talkback relays causes the monitor signal to be dimmed by 10 dB whenever the relay is energized to insert the Talkback signal, and allows the Talkback signal to be inserted at unity gain over the attenuated monitor signal.

LOGIC

The Studio-1 monitor system may be muted by a low applied to the MUTE STUDIO-1 logic bus, or by a low applied to the REMOTE MUTE input line. In either case, a low input will cause a high output from gate U200D. This high is routed through Q201 to monitor mute relay K1, REMOTE MUTE COMMAND transistor Q200, through inverter U203E to warning lamp driver circuit Q202 and Q203, and to front panel TALK OVER MUTE switch S200.

The Studio-1 monitor system may be dimmed by a low applied to the DIM STUDIO-1 logic bus, or by a low applied to the REMOTE DIM input line. In either case, a low input will cause a high output from gate U200A. This high is routed through Q205 to drive dim relay K2, and to REMOTE DIM DRIVE COMMAND transistor Q204. The logic bus dim command is also connected to internal option switch S202 ("dim disables Talk"). This switch provides the ability to establish a one-way priority of communication from the Studio by switching the DIM STUDIO command to inhibit the receipt of TALK TO STUDIO commands. This is accomplished by closing switch S202, which then routes the dim command through inverter U202C to Talk to Studio gate U201.

The TALK STUDIO-1 bus is driven low whenever a Microphone Input Module assigned to Studio-1 initiates communication to another location. This low is routed to Talk to Studio gate U201, and to inverter U203D. Gate U201B provides the control logic for the TALK OVER MUTE feature. The output of U201B is routed through inverter U202E to Talk to Studio relays K4 and K5. The output of inverter U203D drives Talk to talent headphone relay K3 and REMOTE TALK COMMAND transistor Q206.

4.7 MONAURAL LINE OUTPUT AMPLIFIER

4.7.1 Function

The Monaural Line Output Amplifier may select or mix any combination of the PROGRAM, AUDITION and UTILITY stereo signals to produce balanced MAIN and AUXILIARY monaural outputs.

4.7.2 Circuitry

The input signals are supplied by the three Stereo Line Output Amplifiers, and are selected by the front panel MONO SOURCE switch and connected to variable gain amplifier U1. The voltage gain of U1 is adjusted by the front panel GAIN TRIM control, and has sufficient range to adjust the output level from +4 dBu to +8 dBu. The output of U1 is connected to line output plug-in amplifiers A1 and A2, operating as a push-pull pair to provide balanced drive to the output lines.

4.8 MONAURAL OUTPUT/TELCO MIX MODULE

The Monaural Output and Telco Mix sections of this module function independently. The Monaural Output section is described in Section 4.7.

4.8.1 Function

The Telco Mix section produces up to three unique output mixes from the two telephone caller inputs and a selection of the PROGRAM, AUDITION or UTILITY bus. The module receives its inputs from those Stereo Line Input Modules designated as Telco inputs, and creates a unique output for each caller which includes the selected bus plus any other caller except the caller's own voice (i.e., "mix-minus"). Each mix-minus output may be bandpass limited with internally switchable filters for improved hybrid operation (reference Section 2.9.5).

NOTE: In order to assign a caller to the PROGRAM, AUDITION and/or UTILITY output buses (such as the PROGRAM bus for "on-air" Telco operations), the desired bus must be selected on the Stereo Line Input Module being used as the caller's Telco input.

The Telco Mix Module also creates a "monitor mix", which is the summed inputs of all callers. This mix may also be used for applications where it is desired to create one or more custom mix-minus foldback mixes or CUE feeds.

4.8.2 Circuitry

The inputs for the two telephone input module signals are routed to the front panel TELCO 1 and TELCO 2 INPUT selectors. A monaural mix of each of the three main console outputs is connected to the SEND TO TELCO switch. The output of this selector is buffered by input amplifier U601B operating at unity gain to provide a level of -10 dBu to the mix-minus matrix.

The Telco monitor mix matrix consists of resistors R603 and R703 and mixing amplifier U601A. Amplifier U601A operates with a voltage gain of 10 dB resulting in a nominal output level of 0 dBu, which is connected to the front panel MONITOR control and the MONITOR OUTPUT terminals.

NOTE: The two Telco mix-minus circuits are identical, thus only the Telco 1 path is described.

The Telco 1 mix matrix consists of resistors R614 and R615 and summing amplifier U602B operating at unity gain.

The -10 dBu output of U602B is routed to the bandpass filter circuit and to filter in/out switch S601A. The highpass filter is a three-pole, 18 dB/octave design, using U603B and its related components. The output of the highpass filter is applied to a lowpass filter, also a three-pole design, using U603A and associated parts. The 3 dB points of the resulting bandpass filter are slightly below 300 Hz and slightly above 3400 Hz. The output of the filter is connected to filter in/out switch S601A.

The signal, as chosen by the filter in/out switch, is connected to output amplifiers U604A and U604B. The first stage operates at a gain of 4 dB and the second, inverting stage, at unity. The input to output gain of the push-pull pair is 10 dB, resulting in an output level of 0 dBu.

4.9 SEND AND RETURN MODULE

4.9.1 Function

The Send and Return Module contains both the two Send amplifiers and the stereo Return circuits. The Send portion of the module contains the mixing and output amplifiers for the effects/foldback channels. The Return signal may be assigned to the PROGRAM, AUDITION or UTILITY output buses.

4.9.2 Circuitry

SEND AUDIO

NOTE: The two Send output circuits are identical, thus only Send-1 is described.

The Send-1 bus signal is summed and inverted by amplifiers U101A and U101B, which are operating at unity gain. The output of U101B is routed through Send on/off relay K100 and the front panel SEND–1 master fader to balanced line output amplifiers U102A and U102B. Amplifier U102A operates with a gain of 22 dB while inverting amplifier U102B operates at unity. Therefore, the total voltage gain from input to balanced output of the line amplifiers is 28 dB. This gain provides a master fader "in-hand" attenuation of 10 dB for an output level of +4 dBu.

The output of U101B is also connected to solo relay K1A. When energized, this relay routes the pre-fader signal to both of the stereo SOLO buses via resistors R321 and R421.

SEND LOGIC

NOTE: The logic circuitry for the two Send circuits are essentially identical. For clarity and simplicity, only the circuitry for Send-1 is described below.

Pressing the Send ON button will pull down the input to inverter U3B, which will deliver a high output to S1A and the input of U8C. If S1A is as shown, pin 2 closed to pin 4, the high output from U3B will be applied to the input of U6D. Each time the ON button is pressed, bistable U5A will be toggled by the positive-going signal applied to its input, and its output will change state. The output of bistable U5A is connected to one input of gate U4A. A high at any input to this device will cause a high at its output. This high is applied through inverter U7B to ON lamp drive transistor Q3, and to transistor Q2

to drive Send on/off relay K100. The output of U4A also drives inverter U7C, which activates Send-1 ON Tally transistors Q4 and Q5.

Note that the circuit, as described, is an alternate-action system in which the Send is switched on when the ON button is pressed, and is switched off when the ON button is pressed again. If switch S1A is set to connect pin 2 to pin 3, the bistable is removed from the circuit. Under this condition the Send will be switched on only while the ON button is held down. The remote ON function operates in a similar manner, using U3D as an input buffer and S1B to determine the choice between alternate action and momentary control.

The SOLO function operates in a similar manner except that the switching is always alternate-action. The input buffering is done by U3F and the toggling by U9A. The output of U9A at pin 2 is applied to SOLO lamp driver Q1. The output of U9A pin 1 operates SOLO relay K1. The output of U9A pin 1 also drives OR gate U4C. Any logic high at the input to this gate results in a high output, which pulls down the SOLO BUS via transistor Q6. Operating the SOLO button again will toggle bistable U9A to turn off the SOLO mode. If a local or remote Send ON button is pressed, a high will be delivered to one of the inputs of U8C. Either of these highs will cause a high on the output of U8C, which will reset the SOLO bistable to the "off" condition.

RETURN AUDIO

NOTE: The stereo return circuits consist of two identical sets of circuitry. For clarity and simplicity, only the left channel is described below.

The input signal is buffered by balanced differential amplifier U300B, operating with a gain of -8 dB. The output of U300B is routed through the front panel INPUT MODE switch, MIX level control, and buffer to the PAN control and pan insert switch. The output of the pan circuitry is buffered by U302B, and then connected to channel on/off relay K300 and SOLO relay K301. The output of channel relay K300 is connected to the stereo mix bus assignment buttons, while the output of SOLO relay K301 is routed through resistor R320 to the SOLO LEFT BUS terminal.

RETURN LOGIC

Pressing the local RETURN ON button causes the output of U10F to go high. This high is connected through gate U6A to the input of bistable U12A, which causes the bistable to toggle. The output of U12A pin 1 will go high. This high is inverted by U7F to operate the remote "on" lamp via Q14 and Q15, inverted by U10E to energize ON relay K300 and the ON tally via Q13, and routed through gate U11B to turn off remote "off" tally drive circuit Q16 and Q17. Pressing the ON button again toggles U12A, causing pin 1 to go low and drive remote "off" lamp drive circuit U11B, Q16 and Q17. The additional circuitry around remote tally drive circuits is for short-circuit protection on the external lines.

Unlike the module's controls, the remote controls are not alternate action, but are independent "on" and "off" controls. Pressing a remote ON button causes a high output from U10B, which is routed to U11C. If U12A is in the off state (pin 2 high), then U11C will deliver a high at its output. This will toggle U12A via U6A. Pressing the remote ON button again causes no further action because U11C pin 10

will then be low. Pressing a remote OFF button causes a high output from U10D, which is routed to U6B, causing a high output. This high is routed to U12A to reset the bistable to the off state. Further operation of the remote OFF button has no effect.

Pressing the SOLO button causes a high output at U7A, which toggles SOLO bistable U12B with output pin 13 high and pin 12 low. The high output from U12B pin 13 is routed through U4C to SOLO bus drive transistor Q6. The high output of U12B also energizes SOLO relay K301. The low output from U12B pin 12 saturates transistor Q12 to drive the SOLO button lamp. Pressing the SOLO button again toggles U12B, de-energizing the SOLO relay and extinguishing the SOLO button lamp. Pressing either the local or remote ON buttons will produce a high output from U8B, which will reset solo bistable U12B.

4.10 MONAURAL OUTPUT/TELCO MIX/SEND AND RETURN MODULE

The Monaural Output, Telco Mix, and Send And Return sections of this module function independently. The Monaural Output section is described in Section 4.7; the Telco Mix section is described in Section 4.8; and the Send And Return section is described in Section 4.9.

4.11 SLATE/TALKBACK/TEST OSCILLATOR MODULE

4.11.1 Function

The Slate/Talkback/Test Oscillator Module provides a slate tone oscillator, Talkback facilities, and a test oscillator for the BMX III console.

Slate commentary may be added to a tape recording via the console-mounted electret microphone and/or from a Producer's microphone. A low-distortion spotter tone (nominal 30 Hz, adjustable), with carefully controlled envelope rise and fall times, may be recorded with the commentary for ease of fast-wind identification of the cuts on a track.

The console and Producer microphones can Talk to any two Studios plus a remote or External location. The External location can also Talk back to the Studios, as well as to the Control Room.

The test oscillator generates low-distortion, stable amplitude tones to allow system test and lineup with any 15 frequencies. The tones may be assigned to any combination of the PROGRAM, AUDITION and UTILITY mix buses.

4.11.2 Circuitry

The Slate/Talkback/Test Oscillator module contains these five major circuit sections:

- Slate Tone Oscillator
- Console Talkback Microphone/Amplifier
- Producer Microphone Input
- Test Oscillator
- Talkback

The interrelationship of these five sections is best understood by referring to the module block diagram located in Section 7.1.9 of this manual.

SLATE TONE OSCILLATOR

Pressing the SLATE button causes a high output from U15A, which is connected to one input of U20A. When a Producer's remote SLATE button is pressed, the output of U15B, which is connected to the other input of U20A, goes high. Either input will cause a high output from U20A to the base of Q1, which drives opto-isolator U12, and applies +15 volts to the slate oscillator supply line. The output of U20A is also connected to the base of Q2, which pulls the Control Room monitor mute bus low.

The low frequency slate tone is produced by function generator U13, which generates a 30 Hz signal whenever the supply line is energized. The frequency of the signal is determined by timing capacitor C78 and resistor network R115, R117 and R116 (the frequency trimmer). The output of U13 is taken from pin 2 (the distortion at this point is about 2% and there is a modest keying transient). This signal is applied to bandpass filter U14B to eliminate the keying transient and reduce the harmonic distortion. This filtering also shapes the envelope rise and fall time. The frequency of this filter is determined by C82, C83, R122, R120 and R121, the tuning control. Additional filtering is provided by R118, C81 and R119. The output of the filter is routed to the front panel SLATE TONE level control, and then to slate relay K7.

As soon as the slate oscillator supply line is keyed on, a positive voltage is applied to comparator U14A via diode CR11. The output of the comparator switches slate relay K7 on. Therefore, when the slate tone is requested, K7 immediately switches on and 200 milliseconds later the output of the bandpass filter builds up and provides tone into the slate relay. The output of the relay is routed to the out position of the front panel OSC button switch via R123. When the OSC switch is in the out position, the slate tone is connected to buffer amplifier U11, whose output may be routed to Program, Audition, and Utility.

When the slate oscillator supply line is keyed off, function generator U13 immediately stops oscillating, and the ringing output of the bandpass filter decays over a 200 millisecond interval. Shortly thereafter the C76 discharges through R109, and the comparator output goes negative to de-energize slate relay K7. The overall sequence is: whenever the slate tone is keyed on, relay K7 is immediately energized and the slate tone builds up in amplitude; when the slate tone is keyed off, the tone is allowed to decay and then relay K7 is switched off.

Pressing the console SLATE button also keys on the console's electret microphone. While the button is pressed, U15A presents a high to the time-delay network using R143 and C106. The network output is applied to U18A about 40 milliseconds after the SLATE button is pressed. The output of U18A goes high, energizing relay K1A, and routing console microphone to the "out" position of the OSC switch.

When the Producer's SLATE button is pressed, the slate tone and the Producer microphone are keyed on. Pressing the button causes a high output from U15B, which is routed through delay network R145 and C107 to U18B. As with the console slate system, about 40 milliseconds after the Producer's SLATE button is pressed, the output of U18B goes high. This operates the Producer microphone, keying relay K1B, and the signal is routed to the "out" position of the OSC switch.

CONSOLE MICROPHONE/AMPLIFIER

The console microphone is an electret type, and is powered by a filtered +11 volt DC supply derived by CR1, R1, R2 and C1. The signal from the microphone is connected to preamplifier U1A, which operates with a midband voltage gain of 40 dB. The output of the preamplifier is routed through front panel CONSOLE MIC level control R148, and then to amplifier U1B, which operates with 31 dB of midband gain. The reactive components around the microphone preamplifier stages have been chosen for a response characteristic favoring speech frequencies.

PRODUCER MICROPHONE INPUT

The Producer microphone input is a conventional design intended to be driven by a 150 ohm microphone, which is coupled to the preamplifier using input transformer T1. The first stage of the amplifier uses U2A operating with a midband gain of 32 dB. The output of this stage is routed through the front panel PRODUCER MIC level control to amplifier U2B, which operates with 21 dB of midband gain. As with the console microphone preamplifier, the reactive components around these circuits have been chosen to favor speech frequencies. The output of U2B is connected to Producer mic relay K1B.

TEST OSCILLATOR

The built-in multifrequency test oscillator is of the Wein-bridge configuration, with an AGC loop to keep the operating level precisely defined. U10 and the associated circuitry form the basic oscillator. Positive feedback around this amplifier is via the frequency-determining network. The output of U10 is applied to the top end of the network, and the midpoint of the network is fed back to the non-inverting input of U10. The resistor/capacitor network has maximum transmission and minimum phase shift at only one frequency, which is the frequency of oscillation.

The frequency-determining network uses a pair of fixed value capacitors and a set of 5 pairs of resistors, which are selected by the front panel FREQUENCY switch assembly. Additional pairs of fixed value capacitors are switched into the network to provide three ranges of frequencies.

Negative feedback for U10 is provided with R86 in parallel with opto-coupler U9, R85, R84, and feedback adjustment control R83. The oscillator's AGC circuit operates by adjusting the amount of negative feedback around the circuit. The output of U10 is connected to full-wave, absolute value, rectifier system U7A and U7B. The output signal of U7B is a precise full wave rectified version of the oscillator output signal. It is connected to the non-inverting input of comparator U8A, and the reference voltage connected to the inverting input. The reference voltage is +5.9 volts, as set by voltage divider R79 and R81.

Should the oscillator output peak amplitude rise above +5.9 volts, the comparator will deliver a more positive output. This is applied to the input of voltage-to-current converter U8B, to drive the LED in opto-coupler U9 harder. This lowers the resistance of the output side of the coupler to increase the negative feedback around U10, and thus reduces the output amplitude of the oscillator to its design value.

If the oscillator output amplitude should drop, the output from comparator U8A will be less, which causes the opto-coupler LED to be driven less. This reduces the negative feedback around the oscillator, and the amplitude of the oscillation will be increased to its design value.

Comparator U8A continuously delivers a DC control signal, which may be measured at the AGC test point. It is set to a nominal value of +6 volts by adjusting oscillator feedback control R83. This voltage should remain within the limits of +5.5 to +6.5 volts.

The wide-band distortion of the oscillator is quite low. However, distortion in the low frequency region is trimmed by DIST ADJ control R78. This is not a "nulling" type of control; it provides a trade-off between distortion and AGC-loop dynamics. It is normally set for an oscillator total harmonic distortion figure of 0.1% at 20 Hz. It is characteristic of the circuit that the distortion will roll off at 6 dB per octave above 30 Hz, until it falls to the midband value of about 0.015%. The distortion at 30 Hz may be lowered to about 0.05%, however, amplitude transients during frequency changing (pressing various frequency selecting buttons) will be more noticeable. Changing the setting of R78 will not significantly affect the distortion of frequencies above 200 Hz. It is normal for the oscillator distortion to rise slightly at frequencies above 5 kHz, until it reaches a value of about 0.05% at 20 kHz.

When the test oscillator is not selected, it is muted by injecting a voltage into the AGC loop at R71 to cancel oscillation.

The output of the oscillator is connected through the front panel OSCILLATOR LEVEL control to the "in" position of the front panel OSC button switch.

TALKBACK

Intercommunication facilities are contained in this module to allow various locations in the broadcast operation to Talk to each other. Rather than use separate speaker/microphone assemblies, use is made of the existing broadcast microphones, input modules, associated preamplifiers, and existing monitors.

A built-in electret microphone is located in the center of the meter panel. A Producer may also be located in the Control Room; however, the Producer's position is usually far enough from the console that it would be difficult to operate the console Talkback facilities directly. Therefore, remote controls have been provided for that position, along with an input for the Producer's microphone.

When a person with a broadcast microphone wants to Talk to a particular location, use is made of that microphone and the preamplifier in its input module.

The EXTERNAL location is usually a telephone-call screening booth, announce booth, or even a two-way link to a traffic reporter. Circuitry is provided for microphone or line level input along with balanced line level output, for use with the EXTERNAL location facility. Remote control is provided for Talking to the console and the two Studios.

When the console operator presses the Talk to STUDIO-1 button, the output of U15C goes high, which is routed through U21A which then goes high, driving Q3 to pull down the Talk to STUDIO-1 logic

control bus. The high output of U15C is also routed through delay circuit R125, C100 and U19A to Talk to Studio-1 relay K2A, which routes the Talkback signal to the TALK TO STUDIO-1 audio bus. The high output of U15C is also routed through U22A to U20B, and causes a high to appear at the output of U20B. This saturates Q7, pulling down the DIM C/R BUS.

Operating the console STUDIO-2 button causes a chain of events schematically similar to operating the STUDIO-1 button. When the STUDIO-2 button is pressed the output of U15D goes high, which is routed to U21B which then goes high, driving Q4 to pull down the Talk to Studio-2 control bus. The high output of U15D is also routed through delay circuit R127, C101 and U19B, to Talk to Studio relay K2B, which connects the audio signal to the TALK TO STUDIO-2 mix bus. The high output of U15D is also routed to U22A, U20B to DIM C/R BUS transistor Q7.

Pressing the EXT Talkback button on the console causes a high output from U15E, which is routed through delay circuit R129, C102 and U19C, to Talk to External relay K3A. The high output from U15E is also routed through U22A and U20B to DIM C/R BUS drive transistor Q7, and through U21C to TALK TO EXT CMD transistor Q6.

The Producer's Talkback functions are a duplicate of the console's facilities, so that the Producer may also Talk to the same locations.

Pressing the Producer's STUDIO-1 button causes a high output from U15F, which is routed through U21A which then goes high, driving Q3 to pull down the Talk to STUDIO-1 logic control bus. The high output of U15F is also routed through delay circuit R131, C103 and U19D, to Talk to Studio-1 relay K3B, which routes the Talkback signal to the TALK TO STUDIO-1 audio bus. The high output of U15F is also routed through U22B to U20B, which saturates Q7, pulling down the DIM C/R BUS.

Operating the Producer's STUDIO-2 button causes a chain of events schematically similar to operating the STUDIO-1 button. When the STUDIO-2 button is pressed, the output of U16A goes high, and is routed to U21B which then goes high, driving Q4 to pull down the Talk to Studio-2 control bus. The high output of U16A is routed through delay circuit R133, C104 and U19E, to Talk to Studio relay K6A which connects the audio signal to the TALK TO STUDIO-2 mix bus. The high output of U16A is also routed to U22B, U20B and Q7 to the DIM C/R BUS.

Operating the Producer's EXT Talkback button causes a high output from U16B, which is routed through delay circuit R135, C105 and U19F, to Talk to External relay K6B. The high output from U16B is also routed through U22B and U20B to the DIM C/R BUS drive transistor Q7. The high output of U16B is also routed to gate U21C to drive TALK EXT CMD logic bus transistor Q6.

The microphone preamplifier for the External location is very similar to that for the Producer's microphone. It makes use of both halves of dual amplifier U3, with the front panel EXTERNAL INPUT adjusting the level. The External preamplifier has a switchable pad, located before the input transformer in order that line-level input signals can be accommodated. The EXTERNAL remote controls operate similarly to the Producer controls, with the addition of the ability to Talk to the Control Room.

Pressing the External STUDIO-1 button will cause a high output from U16C to U21A, which will drive transistor Q3 to pull down the Talk to Studio-1 control bus. The high output of U16C is also routed to relay K4A, which connects the External audio signal to the TALK TO STUDIO-1 mix bus.

Pressing the External STUDIO-2 button will cause a high output from U16D to U21B, which will drive transistor Q4 to pull down the Talk to Studio-2 control bus. The high output of U16D is also routed to relay K4B, which connects the External audio signal to the TALK TO STUDIO-2 mix bus.

Pressing the External CONTROL ROOM button will cause a high output from U16E to relay K5, which will route the External audio signal to the TALK TO CONTROL ROOM mix bus. The high output of U16E also is connected to transistor Q5, which pulls the TALK C/R BUS low.

Any of the Microphone Input Modules can Talk to the External location. This is accomplished by that module pulling down the TALK EXT CONTROL BUS, causing the output of U16F, which is routed to U21C, to go high. The high output of U21C drives transistor Q6, which pulls down the remote TALK EXT CMD line. The Microphone Input Module which pulled down the Talk to External control bus also applies audio to the Talk to External audio bus. Any signals on that bus are summed and inverted by amplifiers U6B and U6A. These amplifiers provide a balanced push-pull output to the TALK TO EXTERNAL terminals. The gain of this output stage is set by the front panel EXTERNAL OUTPUT gain trim control.

4.12 METER SWITCHER MODULE

4.12.1 Function

The Meter Switcher Module drives the AUXILIARY meters in the BMX III meter panel. This module also provides switchable metering facilities for the AUDITION and UTILITY outputs in the smaller mainframe sizes. The unassigned inputs may be used to meter user determined external sources.

The module automatically defaults from the selected status whenever a CUE or SOLO button is engaged on any module. The AUXILIARY meters will then display the nominal operating level at the CUE or SOLO point selected. This enables quick input level check when displaying CUE, and very convenient level lineup when displaying SOLO. The SOLO metering function eliminates the need to use one of the main output buses for preview and level setting.

NOTE: SOLO or CUE metering priority may be set by means of an internal option switch (reference Section 2.9.8).

4.12.2 Circuitry

The signal path for the manual selector to the AUXILIARY meters is through the normally closed contacts of meter relay K1.

When a console module is placed in the CUE or SOLO mode, the Control Room Monitor Module routes the appropriate CUE or SOLO stereo signal and logic command to the Meter Switcher Module. The

CUE command is connected to U5A and the SOLO command to U5C. A meter display priority is required, since it is possible for the Meter Switcher to receive CUE and SOLO commands simultaneously from different console modules. This priority is selected by internal option switch S6. CUE will have priority when this switch is open, and SOLO will have priority when it is closed.

The output of CUE logic circuit U5A is routed to CUE tally drive transistor Q1, CUE select relay K3 drive transistor Q2, and through diode CR3 to the base of meter relay drive transistor Q3. The output of SOLO logic circuit U5B is routed through U5D to SOLO tally drive transistor Q4, and through diode CR2 to the base of meter relay drive transistor Q3.

Whenever the CUE or SOLO function is engaged, transistor Q3 will drive meter relay K1 to select the output of amplifiers U1 and U2. These amplifiers are required to bring the -10 dBu nominal level of the stereo CUE or SOLO signal up to either the +4 dBu or +8 dBu level required by the AUXILIARY meters. The gain of left channel amplifier U1A is adjusted by trim potentiometer R5, and the gain of right channel amplifier U2A is adjusted by R19. These amplifiers, along with their unity gain inverters, U1B and U2B, provide balanced outputs through the meter relay to the AUXILIARY meters.

4.13 REMOTE LINE SELECTOR

4.13.1 Function

The Remote Line Selector provides a selection of ten stereo input signals switched to one output. Up to two parallel-input selector modules may be installed in the BMX III. The inputs and outputs for the modules are all brought out to the connector panel for ease of assignment. Typical applications include use as a line pre-selector ahead of input modules and tape recorders.

4.13.2 Circuitry

This module consists of one ten-station stereo selector switch fed from ten common remote inputs. The switch used is equipped with a mechanical lockout mechanism to prevent actuation of two or more buttons simultaneously.

4.14 VU METER POWER REGULATOR

4.14.1 Function

The VU meter power regulator assembly is mounted on the bottom of the console mainframe below the Remote Line Selector positions. This location was selected to allow for ease of maintenance. It provides regulated ±16 volt DC power to the VU meter buffer amplifiers via the distribution board, which is mounted inside the mainframe immediately below the meters.

4.14.2 Circuitry

The +22 volt console power is regulated down to +16 volts by series regulator U1. The -22 volt console power is regulated down to -16 volts by series regulator U2. The various small components around the

regulators are used to set the output voltage and improve the noise and transient response of the regulators.

4.15 VU METER BUFFER AMPLIFIER

4.15.1 Function

The console VU meters are driven by balanced isolation buffer amplifiers, which are mounted on their respective meters. The assemblies fully conform to American National Standard C16.5-1954.

4.15.2 Circuitry

The VU meter buffer amplifier consists of dual integrated circuit amplifier U1 configured for a balanced symmetrical input, and operating with cross-connected feedback. The gain of the amplifiers is adjusted by trim potentiometer R8. The output of the two amplifiers is coupled to the VU meter through the recommended source resistance of 3600 ohms. Light emitting diodes DS1 and DS2 provide overdrive protection to the meter movement.

4.16 POWER SUPPLY ASSEMBLY

4.16.1 Function

The fully regulated power supply provides four separate voltage outputs, and is protected with magnetic circuit breakers, as well as electronic safeguards against excessive current.

4.16.2 Circuitry

The power supply has three discrete power modules: a bipolar 22 volt audio supply, a 12 volt logic supply and a 48 volt “phantom” supply. Each module has its own magnetic circuit breaker, power transformer and regulator circuitry. Color-coded voltage test points are located on the front panel for ease of routine measurement.

The bipolar 22 volt, 5 amp, audio supply is configured by two identical +22 volt monopolar supplies which are powered from two separate secondary windings of power transformer T1. The first secondary of T1, terminals 6 and 7, is rectified by diode bridge CR1, filtered by capacitor C1, and regulated by series regulator U1. The various small components around the regulator are used to set the output voltage and improve the noise and transient response of the regulator. When the supply is initially turned ON, Q2 is turned ON by Q1 to provide start-up current through R7. After a short time, Q1 and Q2 turn OFF, leaving regulator U1 to provide all of the console current.

The second secondary of T1, terminals 8 and 9, is rectified by diode bridge CR2, filtered by capacitor C2, and regulated by series regulator U2. The high current, low noise regulators are a plug-in integrated circuit design and are mounted on the large heat sink located on the right side of the power supply (as viewed from the front). The outputs of these two supplies are coupled in series for the required bipolar

configuration with the common point referred to as “Audio Common”. Inside the console mainframe this coupling only occurs at the two power terminals labeled “Audio Common”.

The monopolar 12 volt, 10 amp, logic supply uses the same type of high voltage integrated circuit regulator as used in the audio supply. The secondary of T2, terminals 6 and 7, is rectified by diode bridge CR3, filtered by capacitor C3, and regulated by series regulator U3. The various small components around the regulator are used to set the output voltage and improve the noise and transient response of the regulator. This regulator is mounted on the large heat sink located on the left side of the power supply (as viewed from the front).

NOTE: The regulator/heat sink assemblies used for the audio and logic supplies are each capable of delivering up to 10 amps of current to the BMX III console. This capacity requires proper thermal installation of the regulators on the heat sinks to provide efficient heat dissipation. Even though the regulators are of a plug-in design, replacement of any of the power regulators should be performed by personnel experienced in working with high power devices.

The 48 volt supply consists of printed circuit assembly #90-148, and is powered by transformer T1, rectified by diodes CR1 and CR2, and filtered by capacitor C1. The regulator is a discrete design, using a highly filtered zener diode reference and a series-pass Darlington transistor. The output noise is extremely low, in keeping with the requirements for the phantom powering of microphones.

5.0 OPTIONS AND MODIFICATIONS

This chapter describes available BMX III options and modifications. Included are sections describing phantom microphone powering, +4 dBu to +8 dBu conversion, stereo Sends, input module steady CUE indication, using Send circuits for Telco operations, and the Talkback/Intercom Module.

5.1 PHANTOM MICROPHONE POWERING

The BMX III is equipped with a +48 volt "phantom" power supply for the powering of condenser microphones connected to the Microphone Input Modules. This "phantom" power is available whenever the MICROPHONE toggle switch on the BMX III power supply is placed in the ON position. All necessary modifications to the Microphone Input Modules have been accomplished at the factory (see note below), so condenser microphones may be connected just like any other microphone.

NOTE: To power microphones connected to the A input, jumper wires have been installed between points E1 and E3 on the Microphone Input Module PC assembly. To power microphones connected to the B input, jumper wires have been installed between points E2 and E4 (reference the schematic located in Chapter 7 for more information).

5.2 OUTPUT LEVEL CONVERSION (+4 dBu to +8 dBu)

All consoles are set for a +4 dBu output level at the time of factory test, unless a +8 dBu level is specified at the time of order. In order to convert a +4 dBu console operating level to +8 dBu, it will first be necessary to change resistors on the Control Room Monitor Module and Telco Mix Module PC assemblies as follows:

1. Change 4.32K ohm, 1% resistors R5 and R105 on the Control Room Monitor Module PC assembly to 10K ohm, 1% (PR&E #1-1002). This change provides a gain match between the Monitor Selector and the SOLO bus levels.

2. Change 5.1K ohm, 5% resistor R51 on the Telco Mix Module PC assembly to 3.0K ohm, 5% (PR&E #2-302). This change rectifies the Telco Meter Output for +8 dBu operation.

Once these resistors have been changed, align the console to the +8 dBu operating level in accordance with the following procedures:

STEREO LINE INPUT MODULES

Apply a 1 kHz test signal at +8 dBu (600 ohm source) to both the left and right module inputs. Adjust the module GAIN TRIM controls for a -10 dBu output at the module Patch Sends.

STEREO LINE OUTPUT AMPLIFIER

Apply a 1 kHz test signal at -10 dBu (600 ohm source) to both the left and right Patch Returns. Adjust the module GAIN TRIM controls for a +8 dBu output into a balanced bridging load.

MONAURAL LINE OUTPUT AMPLIFIER

Apply a 1 kHz test signal at -10 dBu (600 ohm source) to the module Patch Return. Adjust the module GAIN TRIM control for a +8 dBu output into a balanced bridging load.

VU METER BUFFER AMPLIFIER CALIBRATION

The gain trim control for each VU meter buffer amplifier is located on the buffer amplifier PC assembly.

PROGRAM, AUDITION and UTILITY meters: Apply a 1 kHz test signal at -10 dBu (600 ohm source) to both the left and right Patch Returns of the appropriate Stereo Line Output Amplifier. Adjust both meter gain trim controls for 0 VU.

AUXILIARY meters: Apply a 1 kHz test signal at +8 dBu to Meter Switcher Module external INPUT 1. Adjust both meter gain trim controls for 0 VU.

METER SWITCHER MODULE

NOTE: The Meter Switcher Module amplifiers should be adjusted after the VU meter amplifiers have been calibrated.

The Meter Switcher Module has a pair of amplifiers which boost the level of the CUE and SOLO VU meter signals from -10 dBu to +4 dBu. The gain trim controls for these amplifiers are located on the module PC assembly (R5 and R19) and are accessible by removing the adjacent modules, or by using an extender board.

Apply a 1 kHz test signal at -10 dBu to the left and right Patch Returns of a Stereo Line Input Module. Place the module in CUE and adjust the Meter Switcher Module gain trim controls for a 0 VU level on the AUXILIARY meters.

5.3 STEREO SEND OPERATION

Normally, the input module Send 1 and Send 2 signals are a monaural sum of the left and right input signals. However, the Stereo Line Input Modules may be modified for stereo Send operation by cutting the two jumpers between points E1 and E2 and points E3 and E4 on the module PC assembly. Removing both of these jumpers provides a monaural mix to either Send-1 or Send-2. However, when both Send assignment buttons are depressed the left module channel is routed to Send-1 and the right to Send-2.

Microphone Input Modules may also be modified in this manner by cutting the jumpers between points E5 and E6 and points E7 and E8 on the module PC assembly. This modification allows the post-fader microphone signal to be manipulated in the stereo image by means of the module PAN control.

NOTE: PRE-fader Microphone Input Module operation will be the same as before this modification.

5.4 INPUT MODULE STEADY CUE INDICATION

Under normal circumstances, the Microphone and Stereo Line Input Module CUE button lamp flashes to tally its ON status. This function can be modified to provide a steady indication on both local and remote CUE tallies by adding a jumper wire between two "E" points on the module PC assemblies. On Microphone Input Modules, insert the jumper wire between points E200 and E201. On Stereo Line Input Modules, insert the jumper wire between points E212 and E213.

5.5 USING SEND CIRCUITS FOR TELCO OPERATIONS

The BMX III Telco Mix-Minus System provides the console operator with the ability to communicate with up to two individual callers at one time (as described in Section 3.8). However, in some cases, it may be desirable to have the additional capability to take calls both "on-air" and "off-air" without changing the configuration of this system.

This can be accomplished by utilizing the two console Send outputs as a second, "off-air", mix-minus system. Once configured per the instructions contained in this section, these Send outputs are routed, in addition to the Telco Mix-Minus System outputs, to the telephone hybrid, and connected via a relay. This relay is energized by the ON tally of the Stereo Line Input Module being used as a Telco input. When the input module is turned ON, the caller is placed "on-air", and is fed the Telco output. When the module is turned OFF, the caller is "off-air", and is fed the Send output (reference Figure 5.1).

In order to configure the Send outputs as mix-minus outputs, console input module internal option switches must be set as follows:

1. On Stereo Line Input Modules assigned as Telco inputs, set internal option switch S7 to enable the module Direct Output to be continuous. This will cause the audio signal to be sent to the Telco Mix Module regardless of the ON/OFF status of the input module, thereby allowing the connection of the intercom speaker via the caller-only Telco Mix Module Monitor Output, as shown in Figure 5.3.

2. On all Microphone and Stereo Line Input Modules, set internal option switch S206 so that the Sends are always active with PRE-fader selection.

Once these internal option switches have been set, the steps for connecting the Telco and Send outputs to the telephone hybrid(s), and for assigning signal sources to the Send outputs, vary, depending on whether one or two Send outputs are being used. Both procedures are provided below.

NOTE: Each telephone hybrid requires an individual Send output.

SINGLE SEND OPERATION (Using One Hybrid)

In systems where a single Send output is being used, connect Telco Output 1 and the Send-1 Output to the telephone hybrid as shown in Figure 5.1 (on the following page).

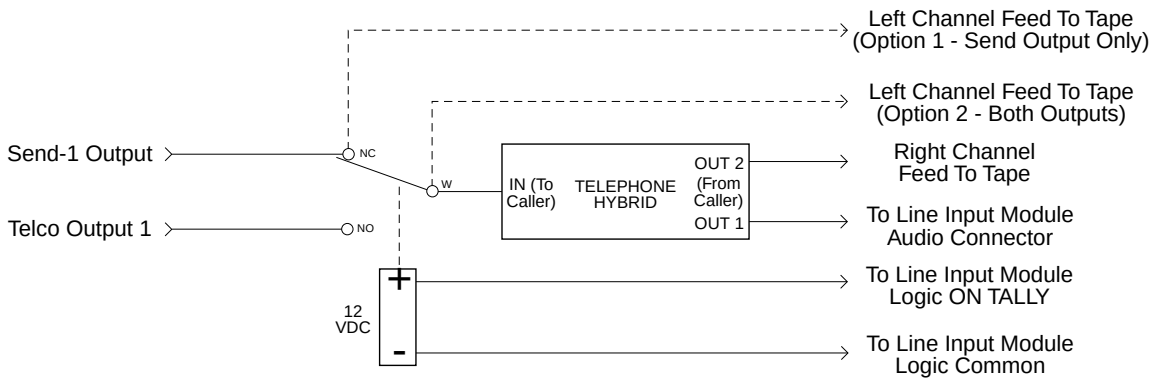


FIGURE 5.1 SEND MIX-MINUS CONNECTION USING A SINGLE TELEPHONE HYBRID

Once this has been accomplished, assign signal sources to the Send-1 output as follows:

1. Depress the PRE-fader and SEND-1 buttons on all input modules to be added to the Send–1 output, including the console operator's Microphone Input Module.

   NOTE: When assigning input signals to the Send-1 bus, do not assign Caller-1 audio to the Send-1 bus, since it is undesirable for the caller to hear his/her own voice.

2. Turn Send-1 ON via the Send And Return Module.

3. Adjust input and Send And Return Module rotary faders as required.

   NOTE: The Send-1 output can be metered on the AUXILIARY meters by selecting Send 1+2 on the Meter Switcher module. Send-1 is on the left meter, Send-2 on the right meter.

DUAL SEND OPERATION (Using Two Hybrids)

In systems where both Send outputs are being used, connect Telco Outputs 1 and 2 and the Send-1 and Send-2 outputs to the two telephone hybrids as shown in Figure 5.2 (on the following page).

Once this has been accomplished, assign signal sources to the Send-1 and Send-2 outputs as follows:

1. Depress the PRE-fader and SEND-1 buttons on all input modules to be added to the Send–1 output. This includes Caller-1 audio, since Send-1 will be fed to Caller-2 and Send-2 will be fed to Caller-1, as shown in Figure 5.2.

2. Depress the PRE-fader and SEND-2 buttons on all input modules to be added to the Send–2 output, including Caller-2 audio.

3. Turn Send-1 and Send-2 ON via the Send And Return Module.

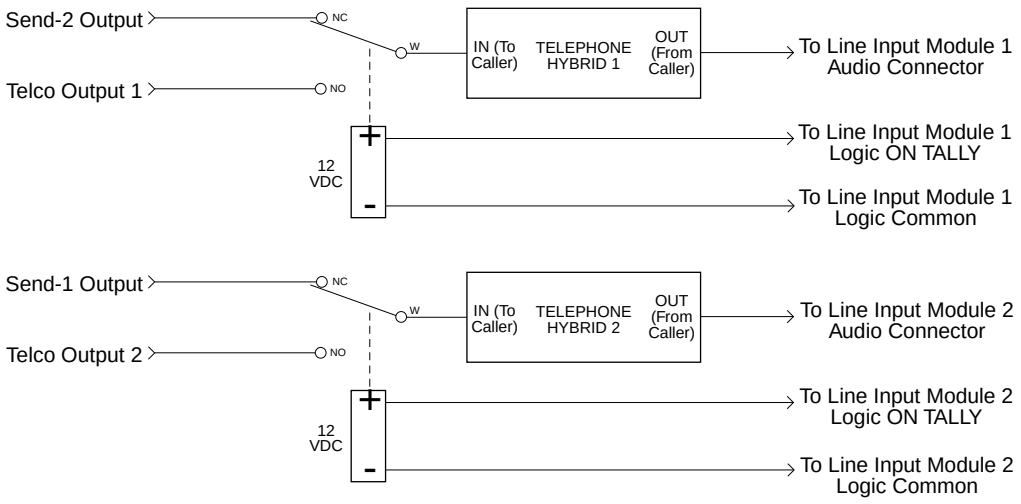


FIGURE 5.2 SEND MIX-MINUS CONNECTION USING TWO TELEPHONE HYBRIDS

4. Adjust input and Send And Return Module rotary faders as required.

   NOTE: Both Send outputs can be metered on the AUXILIARY meters by selecting Send 1+2 on the Meter Switcher Module. Send-1 will be on the left meter and Send-2 on the right.

Connect tape equipment to the hybrid and console outputs as shown in Figure 5.1.

"OFF-AIR" TELCO MONITORING

Callers can be monitored during "off-air" Telco operations by means of the console CUE system, or an external speaker connected to the Telco Mix Module's variable Telco Monitor Output. When using the console CUE system, depress the CUE button(s) on the module(s) being used as the Telco input(s) to route caller audio to the console operator's headphones (the CUE buttons will reset when the module is turned ON). When connecting an external speaker, use a relay driven by the Control Room Warning Tally, so that the speaker will mute whenever the Control Room is muted, as shown in Figure 5.3.

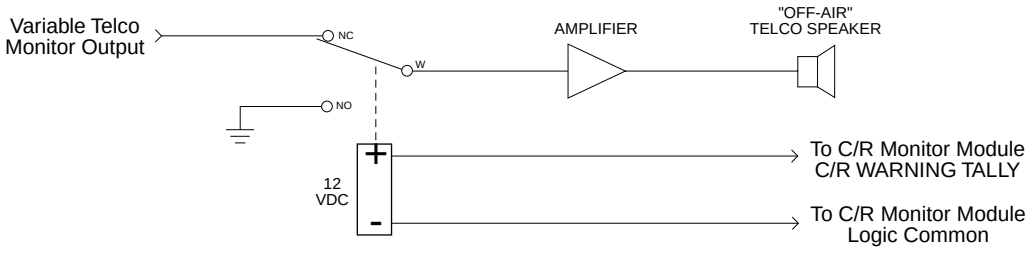


FIGURE 5.3 "OFF-AIR" TELCO SPEAKER CONNECTION

5.6 TALKBACK/INTERCOM MODULE

The optional Talkback/Intercom module (PR&E #99-371, #99-371-1 with TALK OVER MUTE) enables Talkback communication between the Control Room and up to two external locations without a Two-Studio Monitor module. This module, while lacking the full monitor control facilities of the Two-Studio Monitor module, provides two-way Talkback audio and logic functions.

Section 7.15 has the Talkback/Intercom module schematic. Installation, audio connection, remote control connection, internal options and its circuitry are described below.

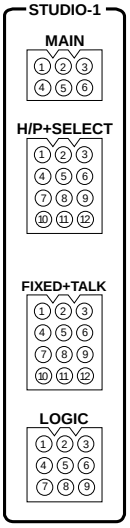
INSTALLATION

The Talkback/Intercom module is installed in the mainframe position reserved for the Two-Studio Monitor module (see Figure 2.3, page 10) and uses the STUDIO-1 and STUDIO-2 rear panel Molex connectors for audio and logic connection.

AUDIO CONNECTION

When a Slate/Talkback/Test Oscillator module is installed in the console mainframe, the console electret microphone will be the Talk To Studio Output source. When there is no Slate/Talkback/Test Oscillator module present, a Microphone Input module assigned to the Control Room (see Section 2.9.1) is the Talk To Studio Output source. A customer-supplied remote control panel must be installed to control the microphone Talkback logic (refer to Section 2.8.1, page 31).

A Studio-assigned microphone connected to a Microphone Input module (Section 2.9.1, page 40) will be the Studio Talkback source. In the event that there is no Studio-assigned Microphone Input module, a Talk From Studio Input is provided at the Studio connector for the connection of a high level microphone source. However, when this input is used, the signal is assigned to the Control Room bus only, and no Talkback communication between the two Studios is possible. Pin assignment for each Studio is identical. Audio pin assignment for the STUDIO-1 connector is defined below.



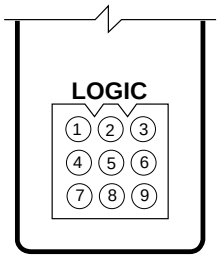
AUDIO PIN ASSIGNMENT				
		Pin Number		
Signal	Connector	Shield	Low	High
- No Connection -	MAIN	1	2	3
- No Connection -	"	4	5	6
- No Connection -	H/P+SELECT	1	2	3
- No Connection -	"	4	5	6
- No Connection -	"	7	8	9
- No Connection -	"	10	11	12
Talk From Studio-1 Input	FIXED+TALK	1	2	3
- No Connection -	"	4	5	6
- No Connection -	"	7	8	9
Talk From Studio-1 Output	"	10	11	12

NOTE: The Talk From Studio Input and Talk To Studio Output are calibrated for a 0 dBu operating level.

REMOTE CONTROL CONNECTION

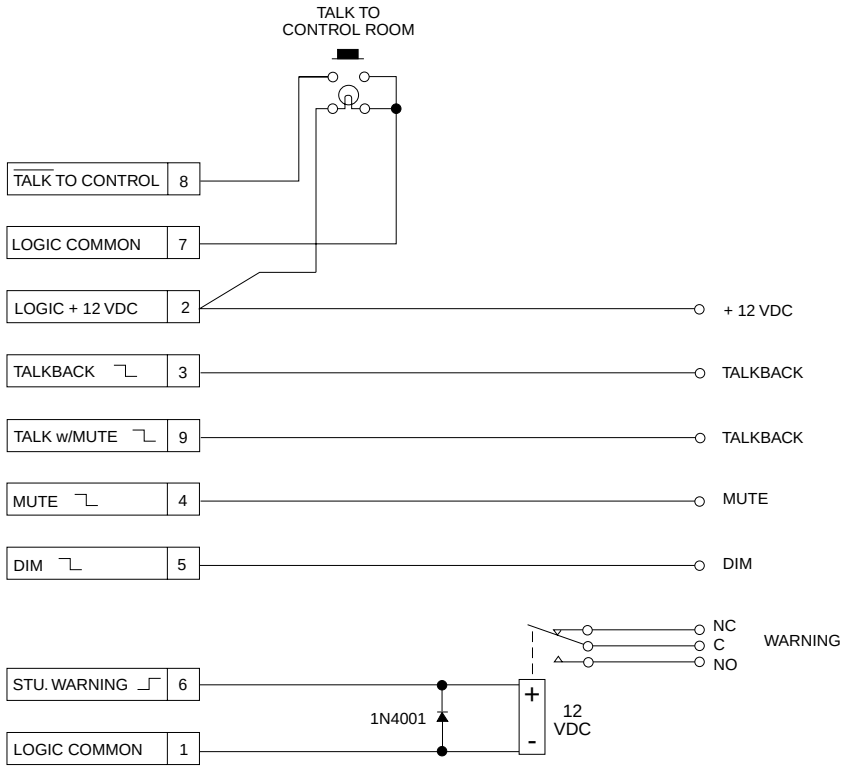
When using a microphone connected to a console Microphone Input Module as the Studio Talkback source, connect microphone logic as defined in Section 2.8.1.

The Talkback/Intercom Module is equipped with many of the same logic features as the Two-Studio Monitor Module. Logic pin assignment for each Studio is identical, and is defined below.



LOGIC PIN ASSIGNMENT	
Function	**Pin Number**
Logic Common	1
Logic +12 VDC	2
TALKBACK ⌐	3
MUTE ⌐	4
DIM ⌐	5
WARNING TALLY ⌐	6
Logic Common	7
$\overline{\text{TALK}}$ to Control Room	8
TALKBACK w/Mute ⌐	9

The schematic below illustrates the full remote control capability of each Studio.



NOTES:

A) Button switch is momentary-action.
B) Lamp is 12-14 volt, 80 mA.
C) Relay is 12 volt DC, 100 mA maximum.
D) When the TALK TO CONTROL ROOM tally is connected as shown above, the switch lamp will be illuminated at all times.
E) The MUTE and DIM outputs are only active when Talkback is taking place via a console Microphone Input Module.

While it is unlikely that a "typical" installation will utilize all of the Talkback/Intercom module logic facilities, it is important to understand what is available, along with the potential applications.

The TALK TO CONTROL ROOM control input dims the Control Room monitors and enables Talkback from the Studio to the Control Room when using a line level source connected to the Talk From Studio Input as the Studio Talkback source. This input will not be used when Talkback is taking place via a console Microphone Input module, as each microphone input has its own Talkback control inputs (reference Section 2.8.1).

The TALKBACK control output is a current-sinking open collector, which is active (low) whenever the Studio is receiving Talkback from the Control Room. This command is intended for connection to active, self-contained, headphone and monitor systems, and is used to switch the Talkback signal into the headphone and monitor circuits. Such headphone and/or monitor systems are usually provided to the host and co-host positions.

The TALKBACK WITH MUTE control output is a current-sinking open collector, which is active (low) whenever the Studio is receiving Talkback from the Control Room. This output differs from the TALKBACK output (pin 3) in that it is disabled whenever the Studio is muted.

NOTE: The TALKBACK WITH MUTE output will function identically to the TALKBACK output by cutting the jumpers between points E1 and E2 (for Studio-1) and E3 and E4 (for Studio-2) on the Talkback/Intercom Module PC assembly. Also, PR&E #99-371-1 is equipped with a front panel TALK OVER MUTE button which, when depressed, performs the same function.

The MUTE control output is a current-sinking open collector, which is active (low) whenever a Microphone Input Module assigned to the Studio is turned ON. This command is provided for interface to intercoms, telephones and/or other external equipment which may need to be muted whenever a Studio microphone is "live".

The DIM control output is a current-sinking open collector, which is active (low) whenever Talkback is occurring from the Studio to another location via a console Microphone Input Module. This command is provided for similar applications as the MUTE Command.

The STUDIO WARNING tally is a 12 volt DC, 150 mA maximum, source output for connection to a magnetic or solid-state relay unit for driving the Studio entry warning light(s).

INTERNAL OPTIONS

The Talkback/Intercom module is equipped with a two-station internal option DIP switch (S3) which determines how the Studio-1 and Studio-2 dim functions affect Talkback communication.

NOTE: Since the Studio only dims when Talkback is occurring via a console Microphone Input module, this switch will have no effect when the Talk From Studio Input is being used.

Closing S3-1 causes the Studio-1 dim function to block incoming Talkback signals to Studio-1. Closing

S3-2 causes the Studio-2 dim function to block incoming Talkback signals to Studio-2. This switch is identical to the Two-Studio Monitor Module option switch (see Section 2.9.4, page 46 for switch location).

CIRCUITRY

NOTE: The Studio-1 and Studio-2 audio and logic paths consist of identical sets of circuitry. For clarity and simplicity, only the Studio-1 audio and logic paths are described below.

Audio

The TALK TO STUDIO-1 bus signal is summed by U2A, amplified by U2B, and routed to the TALK STUDIO-1 output terminal.

The TALK FROM STUDIO-1 signal is fed to balanced differential input amplifier U1A. This signal feeds Talk to Control Room relay K1. When closed, Talkback audio is directed to summing resistor R11, and to the TALK TO CONTROL ROOM audio bus.

Logic

The TALK TO CONTROL ROOM input command forces the output of gate U10D high. Transistor Q13 conducts, causing Studio-1 Talk relay K1 to close. The output of U10D also feeds the input of gate U10B. The output of this NOR gate is inverted to drive TALK TO CONTROL ROOM bus switch Q14. These logic functions allow received Studio-1 Talk to connect to the console TALK TO CONTROL ROOM bus.

The five external commands are activated by three internal control buses. The MUTE STUDIO 1 bus is inverted by gates U6F. This gate output drives MUTE OUTPUT switch Q1 and the WARNING COMMAND driver, consisting of inverter U7E, Q2 and Q3. The MUTE STUDIO 1 command connects to gate U8B through the E1 to E2 jumper or the TALK OVER MUTE switch (when it is in the disengaged position). The output of U8B is inverted by U9E to turn on TALKBACK WITH MUTE switch Q5. Note that OR gate U8B is used as an inverted NAND gate.

The DIM STUDIO 1 bus command connects to gate U6A, is inverted, and drives DIM OUTPUT switch Q4. This bus signal also feeds DIM DISABLES TALK switch S3, which disables gates U8C and U8B from operating Talkback output switches Q5 and Q6.

The TALK STUDIO 1 bus will force gate U8C low if switch S3-1 is open. This gate output will be inverted by U7D to drive TALKBACK OUTPUT switch Q6 low. The output of U8C connects to U8B, which will allow the TALKBACK WITH MUTE switch to go low if the E1 to E2 is installed or the TALK OVER MUTE switch is disengaged.

6.0 MAINTENANCE AND ALIGNMENT

This chapter contains sections describing routine maintenance, troubleshooting, the installation and servicing tool kit, the spare parts kit, and replacement parts for the BMX III console.

6.1 ROUTINE MAINTENANCE

Routine maintenance is usually limited to checking button switches for proper operation and keeping panel surfaces clean. The panel surfaces are finished with a baked polyurethane paint and may be cleaned with a weak solution of dishwashing detergent. The procedures for checking power supply voltages, lamp replacement, button replacement, and collet knob removal are described below.

NOTE: The Penny & Giles faders used in BMX III input modules (PR&E #24-115 for Stereo Line Input Modules and PR&E #24-116 for Microphone Input Modules) are not field serviceable.

6.1.1 Checking Power Supply Voltages

The BMX III power supply is designed to provide very low noise power to the console. Banana jacks are provided on the front panel of the power supply for checking power supply voltages. Each output should be within 0.5 volts of its specified DC voltage. The outputs should also be checked periodically for ripple and noise using a sensitive AC voltmeter. The reading should be less than 350 microvolts RMS.

6.1.2 Lamp Replacement

NOTE: When replacing a lamp, replace it with an identical type. Do not substitute lamps of different voltage or current ratings.

Meter lamp replacement is accomplished by squeezing the mounting ears on the lamp socket to remove the socket from the rear of the lamp bracket assembly. Replace the wedge based lamp with PR&E #12–22, and reinstall the socket into the lamp bracket assembly.

Module ON and OFF lenses are removed by hand by lifting them straight up out of the switch housing, and are unique in that they unseat and withdraw the lamp with them. Install the wedge based replacement lamp (PR&E #12-20) into the socket in the switch housing, and reinstall the lens.

Talkback, Return ON, and timer and machine remote control panel switches are EAO series 31, and the procedure for lamp replacement is as follows:

1. Remove the lens by using the tong-shaped EAO Lens Removal Tool (PR&E #70-40) to grasp the top and bottom of the lens and pull it straight out of the button housing.

   NOTE: Failure to use this tool will probably result in damage to the lens' molded retaining notches.

2. Remove the defective lamp using the rubber EAO Lamp Removal Tool (PR&E #70-41).

3. Install the replacement 14 volt, .08 amp lamp (PR&E #12-51) into the switch, and carefully snap the lens back into the body of the switch.

The CUE, SOLO and Send ON buttons are EAO series 19, and may be relamped by removing the button cap by hand and using the rubber EAO Lamp Removal Tool (PR&E #70-23) to extract the miniature bi-pin lamp. Note the orientation of the square cap's tangs as it is removed. The cap must be reinstalled in the same orientation. Install the replacement 12 volt, .07 watt lamp (PR&E #12-46) into the switch, and gently reinstall the button cap.

6.1.3 Button Replacement

The square and rectangular "winkeye" button caps can be removed by applying even pressure to the back of the cap to dislodge it from the switch shaft. This can be accomplished using a two-prong device, such as a needlenose pliers. It may take considerable force to remove the button, so exercise caution. Carefully snap the replacement button onto the switch shaft.

6.1.4 Collet Knob Removal

The knobs used for the console's rotary controls are attached to the pot and switch shafts with collets instead of set screws. The machined brass collets provide the advantages of true alignment and concentricity with the axis of rotation, no set screws to score the shaft , the ability to clutch slip when excessive force is applied, and no holes in the side of the knob for the set screws. To remove a collet knob, carefully pry off the top cap of the knob using a thin blade or similar tool, then use the appropriate end of PR&E tool #70-44 to loosen the nut on the collet (as shown in Figure 6.1).

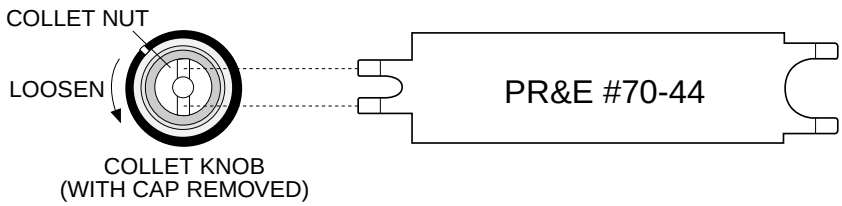


FIGURE 6.1 COLLET KNOB REMOVAL

Once the nut is loosened, the collet should release from the shaft. This nut should not need to be removed unless the collet refuses to release.

6.2 TROUBLESHOOTING (MODULE REMOVAL)

The modular construction of the console greatly enhances troubleshooting, since module substitution will usually isolate any problem.

NOTE: An important feature when troubleshooting the BMX III is that modules may be removed or inserted with power supplied to the console.

To remove a module from the mainframe, remove the black button head retaining screws from the top and bottom of the module, and the silver button head screws from the module face. Screw the Module Pull/Extractor Tools (PR&E #70-43) into the holes vacated by the silver button head screws, and then use both hands to extract the module from the mainframe.

Once the module at fault has been identified, it is recommended that the Equipment Description section for the module in question be read thoroughly prior to troubleshooting that module. Use the appropriate module extender board (PR&E #99-272 for input, Slate/Talkback/Test Oscillator and Send And Return Modules; PR&E #99-274 for Control room and Studio Monitor Modules; PR&E #99-231 for Monaural Output, Telco Mix and Meter Switcher Modules; PR&E #99-230 for Processing Modules; and PR&E #99-273 for Stereo Line Output Amplifiers) or standard bench service techniques to isolate the problem.

NOTE: Most of the analog and logic components are socketed for ease of replacement.

WARNING: The CMOS logic devices are susceptible to destruction from static discharge while being handled. It is recommended that considerable caution be exercised when working with these parts.

6.3 LEVEL ALIGNMENT

All consoles are set for a +4 dBu output level unless +8 dBu is specifically requested at the time of order. It is very important that the test levels are maintained exactly as specified to avoid a buildup of tolerance errors. The GAIN TRIM controls on the output amplifiers should not require trimming unless components which affect amplifier gain have been replaced.

Input module GAIN TRIM controls should always be adjusted so that the input accommodates the signal level of the source equipment.

BMX III modules were aligned at the time of factory test in accordance with the following procedures (**NOTE**: Instructions for aligning the console for an output level of +8 dBu are contained in Section 5.2):

MICROPHONE INPUT MODULES

Apply a 1 kHz test signal at -50 dBu (150 ohm source) to the module input. Adjust the module GAIN TRIM controls for a -10 dBu output at the module Patch Send.

STEREO LINE INPUT MODULES

Apply a 1 kHz test signal at +4 dBu (600 ohm source) to both the left and right module inputs. Adjust the module GAIN TRIM controls for a -10 dBu output at the module Patch Sends.

STEREO LINE OUTPUT AMPLIFIERS

Apply a 1 kHz test signal at -10 dBu (600 ohm source) to both the left and right Patch Returns. Adjust the module GAIN TRIM controls for a +4 dBu output into a balanced bridging load.

MONAURAL LINE OUTPUT AMPLIFIER

Apply a 1 kHz test signal at -10 dBu (600 ohm source) to the module Patch Return. Adjust the module GAIN TRIM control for a +4 dBu output into a balanced bridging load.

SLATE/TALKBACK/TEST OSCILLATOR MODULE

The slate tone level control is set for -6 VU.

The CONSOLE MIC GAIN TRIM control is set for a meter reading of 0 VU using a voice speaking at a "normal" level. This level is important since it sets the microphone level for the Talkback communication functions. It should be readjusted as required upon completion of installation.

The EXTERNAL OUTPUT, EXTERNAL INPUT and PRODUCER MIC GAIN TRIM controls are set for a 0 dBu output level with a -50 dBu, 150 ohm input.

VU METER BUFFER AMPLIFIER CALIBRATION

The gain trim control for each VU meter buffer amplifier is located on the buffer amplifier PC assembly.

PROGRAM, AUDITION and UTILITY meters: Apply a 1 kHz test signal at -10 dBu (600 ohm source) to both the left and right Patch Returns of the appropriate calibrated Stereo Line Output Amplifier. Adjust both meter gain trim controls for a 0 VU meter reading.

AUXILIARY meters: Apply a 1 kHz test signal at +4 dBu to Meter Switcher Module external INPUT 1. Adjust both meter gain trim controls for a 0 VU meter reading.

METER SWITCHER MODULE

NOTE: The Meter Switcher Module amplifiers should be adjusted after the VU meter amplifiers have been calibrated.

The Meter Switcher Module has a pair of amplifiers which boost the level of the CUE and SOLO meter signals from -10 dBu to +4 dBu. The gain trim controls for these amplifiers are located on the module PC assembly (R5 and R19) and are accessible by removing the adjacent modules, or by using an extender board.

Apply a 1 kHz test signal at -10 dBu to the left and right Patch Returns of a Stereo Line Input Module. Place the module in CUE and adjust the Meter Switcher Module gain trim controls for a 0 VU level on the AUXILIARY meters.

6.4 TOOL KIT

The following installation and servicing Tool Kit (PR&E #76-22) is provided with each console:

DESCRIPTION	PR&E#
MOLEX Connector Pin Crimp Tool	70-3
MOLEX Connector Pin Insertion Tool	70-8
MOLEX Connector Pin Extractor Tool	70-4
EAO Lens Removal Tool (series 31 button switch)	70-40
EAO Lamp Removal Tool (series 19 button switch)	70-23
EAO Lamp Removal Tool (series 31 button switch)	70-41
EAO Nut Wrench (series 19 button switch)	70-38
EAO Nut Wrench (series 31 button switch)	70-39
PR&E Module Pull/Extractor Tools (2)	70-43
SIFAM Double-Ended Spanner Wrench (for collet knobs)	70-44

6.5 SPARE PARTS KIT

The following Spare Parts Kit (PR&E #76-21) is supplied with each console. This kit is excluded from the limited warranty, and is provided to support initial installation only.

DESCRIPTION	QTY	PR&E#
Diodes		
1N4001	2	11-7
1N4004	1	11-17
1N914B	2	11-13
Integrated Circuits		
Dual D flip-flop, 4013	2	21-43
Dual Monostable, 4538	2	21-76
Dual Voltage Comparator, LM393	1	20-60
Dual 5-input Majority Gate, 4530	2	21-89
Dual 4-input AND, 4082	2	21-91
Dual 4-input NAND, 4012	2	21-70
Dual 4-input OR, 4072	2	21-92
Dual SPDT Analog Switch, HI-307	2	21-93
Hex, Schmidt Inverter, 4584	2	21-46
Op Amp, DIP, 5534	2	20-28
Op Amp, Dual, LF353N	2	20-32
Op Amp, Dual, 8-Pin, DIP, 5532	2	20-53
Quad 2-input AND, 4081	2	21-68
Quad 2-input NAND, 4093	2	21-4
Quad 2-input OR, 4071	2	21-57
Quad 2-input NOR, 4001	2	21-61
Quad 2-input Multiplexer, 4551	2	21-90
Triple 3-input OR	2	21-67

DESCRIPTION	QTY	PR&E#
Triple 2-input Analog Switch, 4053	2	21-71
8-input NAND, 4068	2	21-56
8-input NOR, 4078	2	21-77
Lamps		
12V, 0.7W Bi-Pin, 1099BPE	2	12-46
14V, .08A, 658	4	12-20
14V, .08A, 73	4	12-22
14V, .08A, 386	2	12-51
Operational Amplifier, NE5534	2	20-28
Relay, DPDT, 12 volt, Polarized, Gold Contact	2	28-5
Transistors		
FET, PN4303	2	9-1
FET, 2N5638	2	9-2
NPN, MJE181	2	7-1
NPN, MPSA13	1	7-4
NPN, MPS6560	2	7-11
NPN, 100V, 2A, TIP112	1	7-23
NPN, 80V, 0.5A, MPSA06	1	7-24
PNP, MJE171	2	8-1
PNP, MPSA63	2	8-4
PNP, MPSU95	2	8-6
PNP, 2N3638A	2	8-8
PNP, MPS2907	2	8-16
Voltage Regulators		
Variable, 1.5A, Pos., LM317T	1	20-49
Variable, 1.5A, Neg., LM337T	1	20-59
Variable, 5A, LM338K	1	20-57
Variable, 10A, LM396	1	20-58

This kit should provide sufficient support spares for the initial operating period; however, it is recommended that this kit be replenished and kept on hand for service use.

In applications where any system “downtime” is unacceptable, it is recommended that the following modules be kept on hand as spares:

DESCRIPTION	PR&E#
Power Supply Assembly	99-238A
Microphone Input Module	99-252
Stereo Line Input Module	99-253
Stereo Line Output Amplifier	99-258-1
Control Room Monitor Module	99-257

6.6 REPLACEMENT PARTS

The components used are, wherever possible, standard items of general availability. However, should difficulty be encountered locating any of the items, PR&E maintains a stock of replacement parts.

The power supply transformers and circuit breakers, Penny & Giles faders, potentiometers, VU meters, "winkeye" button switches, and all engraved button caps are manufactured to custom design specifications and are, therefore, available only from PR&E.

Following is a partial list of parts and assemblies used in the BMX III console, and the PR&E part number for easy reference:

DESCRIPTION	**PR&E#**
Blank Panels	
6-inch	99-209
10-inch	99-271
16-inch	99-259
Buttons	
Rectangular, White	25-771
Rectangular, White, "PRE"	25-771-1
Rectangular, White, "OSC"	25-771-5
Rectangular, White, "100"	25-771-6
Rectangular, White, "10"	25-771-7
Rectangular, White, "1"	25-771-8
Rectangular, Gray	25-772
Rectangular, Gray, "IN"	25-772-3
Rectangular, Gray, "1"	25-772-4
Rectangular, Gray, "2"	25-772-5
Buttons, Illuminating	
Red, "ON" (Input Module)	25-2-1
Yellow, "OFF" (Input Module)	25-5-1
Rectangular, Orange, "SLATE"	25-121-1
Rectangular, White, "STUDIO 1"	25-125-1
Rectangular, White, "STUDIO 2"	25-125-2
Rectangular, White, "EXT"	25-125-5
Square, Red, "ON" (Return)	25-127-1
Square, Red, "ON" (Sends)	25-115-1
Square, White (Solo)	25-118
Square, White, "S"	25-118-1
Square, Yellow (Cue)	25-116
Buttons, Self-Indicating ("Winkeye")	
Rectangular, Blk/Org, "PGM"	25-768-1
Rectangular, Blk/Org, "AUD"	25-768-2
Rectangular, Blk/Org, "UTL"	25-768-3
Square, Blk/Org	25-769

DESCRIPTION	PR&E#
Square, Blk/Org, “A”	25-769-1
Square, Blk/Org, “B”	25-769-2
Capacitors	
Electrolytic, 1µF, 50V, Low Leakage	60-45
Electrolytic, 2.2µF, 50V, Low Leakage	60-50
Electrolytic, 4.7µF, 40V, Axial	60-21
Electrolytic, 10µF, 25V, Low Leakage	60-67
Electrolytic, 10µF, 25V, NP	60-84
Electrolytic, 10µF, 100V	60-41
Electrolytic, 22µF, 16V	60-55
Electrolytic, 22µF, 16V, Low Leakage	60-47
Electrolytic, 22µF, 25V	60-76
Electrolytic, 22µF, 25V, Axial	60-11
Electrolytic, 22µF, 25V, NP	60-85
Electrolytic, 47µF, 16V, NP	60-81
Electrolytic, 100µF, 16V, NP	60-82
Electrolytic, 100µF, 25V, NP	60-87
Electrolytic, 100µF, 63V	60-53
Electrolytic, 220µF, 16V	60-44
Electrolytic, 220µF, 16V, NP	60-83
Electrolytic, 220µF, 25V	60-78
Electrolytic, 470µF, 80V	60-40
Electrolytic, 16,000µF at 50WVDC	60-93
Electrolytic, 51,000µF at 40WVDC	60-92
Metalized Polyester, .01µF, 400V	63-4
Metalized Polyester, .015µF, 100V	63-1
Metalized Polyester, .022µF, 250V	63-9
Metalized Polyester, .047µF, 250V	63-6
Metalized Polyester, .1µF, 100V	63-7
Metalized Polyester, .22µF, 100V	63-8
Metalized Polyester, .47µF, 100V	63-10
Monolythic, .1 µF, 50V	62-5
Monolythic, 1µF, 50V	62-6
Polypropylene, 4700pF, 160V, Axial	64-23
Tantalum, 2.2µF, 35V	65-14
Tantalum, 10µF, 20V	65-6
Tantalum, 10µF, 35V	65-5
Tantalum, 10µF, 50V	65-8
Circuit Breakers	
For Audio Power Supply	30-32
For Logic Power Supply	30-28
For Phantom Power Supply	30-9
Cue Header Assembly	90-326

DESCRIPTION	PR&E#
Diodes	
1N4001	11-7
1N4004	11-17
1N914B	11-13
MBR 350, 50V, 3A	11-39
Zener, 51V, 1N4757A	11-21
DIP Switches	
1 DPDT	26-11
1 SPST	26-7
2 SPDT	26-12
2 SPST	26-10
4 SPST	26-13
8 SPST	26-8
Dual Capacitor Shield (for .25 diameter radial capacitors)	80-525
Fader Assemblies	
Monaural	90-348-2
Rotary, 5K	24-113
Stereo	90-348-1
Function Modules	
Instrumentation Input	95-123
Output Amplifier	95-119
990	95-120
Heatsinks	
For TO-220, PC Mount	31-6
+12V, Power Supply	80-508
With Two Mating Positions	80-202-3
Heatsink Assemblies	
Dual Regulator, Power Supply	90-338
Single Regulator, Power Supply	90-339
Insulator for TO-220AB, Silpad	31-3
Integrated Circuits	
Dual D flip-flop, 4013	21-43
Dual Monostable, 4538	21-76
Dual 5-input Majority Gate, 4530	21-89
Dual 4-input AND, 4082	21-91
Dual 4-input OR, 4072	21-92
Dual SPDT CMOS Analog Switch	21-93
Function Generator, 2206	20-38
Hex Inverter, 4584	21-46
Hex Buffer, Non-Inverting, 4050	21-47
Op Amp, DIP, NE5534N	20-28
Op Amp, Dual, LF353N	20-32
Op Amp, Dual, 8-pin DIP, NE5532N	20-53
Op Amp, Dual, 8-pin DIP, NE5532, Ceramic	20-61

DESCRIPTION	PR&E#
Opto-Isolator	29-4
Quad 2-input NAND, 4093	21-4
Quad 2-input OR, 4071	21-57
Quad 2-input NOR, 4001	21-61
Quad 2-input AND, 4081	21-68
Quad 2-input Analog Multiplexer, 4551	21-90
Triple 2-input Analog Switch, 4053	21-71
Triple 3-input OR, 4075	21-67
8-input NAND, 4068	21-56
IC Sockets	
6-pin	16-107
8-pin	16-108
14-pin	16-114
16-pin	16-116
Knobs	
21 mm, Grey	32-138
11 mm, Grey, With Black Base Indicator	90-327-1
Knob Caps	
Black (for 11 mm knob)	32-121
Blue (for 11 mm knob)	32-123
Gray (for 11 mm knob)	32-124
Green (for 11 mm knob)	32-122
Orange (for 11 mm knob)	32-127
Orange (for 21 mm knob)	32-140
Red (for 21 mm knob)	32-139
Lamps	
12V, 0.7W, bi-pin, 1099BPE (for CUE and SOLO)	12-46
14V, .08A, 658 (for module ON/OFF)	12-20
14V, .08A, 73 (for VU meters)	12-22
14V, .08A, 386 (for Talkback and remote controls)	12-51
Microphone Power Supply PCA, 120 VAC	90-148-1
Modules	
Control Room Monitor	99-257
Switching Board	95-146
Meter Switcher	99-268
Microphone Input With Sends	99-252
Output Assignment Switcher Assembly	95-143-1
Microphone Input Without Sends	99-262
Monaural Output Amplifier	99-264
Monaural Output/Telco Mix	99-265
Remote Line Selector	99-267
Send and Return	99-255
Output Assignment Switcher Assembly	95-143-2
Send and Return/Mono Output/Telco Mix	99-266

DESCRIPTION	PR&E#
Slate/Talkback/Test Oscillator	99-254
Output Assignment Switcher Assembly	95-143-3
Stereo Line Input With Sends	99-253
Output Assignment Switcher Assembly	95-143-1
Stereo Line Input Without Sends	99-263
Stereo Line Output Amplifier	99-258-1
Two-Studio Monitor	99-256
Switching Board	95-146
Module Extender Boards	
Control Room and Studio Monitor	99-274
Input, Slate/Talkback/Test Osc., Send and Return	99-272
Stereo Line Output Amplifiers	99-273
Potentiometers	
Dual, 10K, CW Log	24-100
Dual, 10K, CW Log (2-Studio)	24-101
Dual, 25K, Linear	24-99
Single, 10K, 1/2W, CCW, Audio Taper	24-20
Single, 10K, 1/2W, CW, Audio Taper	24-108
Single, 10K, CW Log	24-98
Power Supply Assembly, 120 Volts	99-238A
PPM Meter, 3.5", with Buffer Amplifier	99-224-1
Regulator Board PCAs	
+12V Power Supply	95-89
+/-22V Power Supply	95-91
Relays	
DPDT, 12 volt, Polarized, Gold Contact	28-5
Opto-Isolator, 40mA, 1.65-2.0V	28-602
Resistor/Inductor Assembly, 40µH	90-91
Spare Parts Kit	76-21
Switches	
SPDT, Momentary, Rectangular (Slate/Talkback)	25-119
SPDT, Momentary, Square	25-126
SPST, Momentary, Pushbutton Input Module ON/OFF)	25-102
SPST, Momentary, Square	25-114
Toggle, DPST, 15A, 125V	26-100
1-Station, 2PDT, Push-Push	25-757
1-Station, 4PDT, Push-Push	25-775
2-Station, 6PDT, Interlock/Lockout	25-755
3-Station, 2PDT, Push-Push	25-764
3-Station, 2PDT, Interlock (Telco Mix, Mono Output)	25-765
3-Station, 2PDT, Interlock/Lockout (Slate/Talkback/Test)	25-774
5-Station, 4PDT, Interlock/Lockout	25-763
10-Station, 4PDT, Interlock	25-793
12-Station, 4PDT, Interlock/Lockout	25-761

DESCRIPTION	PR&E#
Transformers	
Audio, Input (Slate/Talkback/Test)	49-9
Audio, Mic Input	49-5
Power for Phantom Supply	48-7
Power for Audio Supply	48-12
Power for Logic Supply	48-13
Transistors	
FET, PN4303	9-1
FET, 2N5638	9-2
NPN, MPSA13	7-4
NPN, MPS6560	7-11
NPN, PN2484	7-21
NPN, 80V, 0.5A, MPSA06	7-24
NPN, 100V, 2A, TIP112	7-23
NPN, LM394H	10-2
PNP, MPSA63	8-4
PNP, MPSU95	8-6
PNP, PN3638A	8-8
PNP, PN4250A	8-12
PNP, MPS-2907	8-16
Transistor/Diode Assemblies	
MJE171/1N914B	90-119-1
MJE181/1N914B	90-119-2
Trim-pots	
Single-Turn, 72PR1K	24-51
Single-Turn, 72PR10K	24-54
Single-Turn, 100K	24-58
Voltage Regulators	
Variable, 1.5A, Pos., LM317T	20-49
Variable, 1.5A, Neg., LM337T	20-59
Variable, 5A, LM338K	20-57
Variable, 10A, LM396	20-58
VU Meters	
3.5"	46-12
3.5", with Buffer Amplifier	99-222-1
VU Meter Buffer Amplifier	95-72

7.0 DRAWINGS AND SCHEMATICS

This chapter is made up of the following drawings and schematics:

7.27 Console Wiring (Edge Connector Layout)
- 7.27.1 Microphone Input Module Audio
- 7.27.2 Stereo Line Input Module Audio
- 7.27.3 Input Module Logic
- 7.27.4 Program Amplifier Output
- 7.27.5 Audition Amplifier Output
- 7.27.6 Utility Amplifier Output
- 7.27.7 Monitor Module Input
- 7.27.8 Control Room Monitor Module
- 7.27.9 Two-Studio Monitor Module
- 7.27.10 Monaural Amplifier Output
- 7.27.11 Telco Mix
- 7.27.12 Send And Return
- 7.27.13 Slate/Talkback/Test Oscillator Audio
- 7.27.14 Slate/Talkback/Test Oscillator Logic
- 7.27.15 Meter Switcher Module
- 7.27.16 Remote Line Selector Inputs
- 7.27.17 Remote Line Selector Outputs
- 7.27.18 Meter Power
- 7.27.19 Timer Control
- 7.27.20 Remote Control Panel Cable Assembly

NOTE: On PR&E schematics, capacitor values are in microfarads (µF), unless otherwise specified, and resistors are 1/4 watt, 5%, unless otherwise specified.

8.0 ACCESSORIES

This chapter contains descriptions of the various BMX III console accessories. Included are sections describing tape machine remote control panels, clocks and timers, the PPM Meter, the Redundant Power Supply Coupler Unit, and logic interfaces. Section 8.6 contains schematics for the accessories described in this chapter. Contact PR&E for further details and price information.

8.1 TAPE MACHINE REMOTE CONTROL PANELS

There are two tape machine remote control panels available for use in the BMX III mainframe—one for cart recorders (PR&E #99-240) and one for cassette and reel-to-reel tape recorders (PR&E #99-221). Both consist of five momentary-action switches, and both are mounted in the lower module area of the mainframe in the positions labeled A through E, as shown in Figure 2.3. These positions are pre-wired with 24-pin logic cables, which are routed to OPTION A - E positions on the rear of the mainframe, as shown in Figure 2.5.

Tape machine remote control panels operate in conjunction with input module remote controls, and connection to cart and tape recorders is accomplished by means of a "Y" cable located at the recorder, as shown in Figure 8.5. Prefabricated remote control "Y" cables for most commercial cart and tape machines are available from PR&E.

8.1.1 Cart Recorder Remote Control Panel

The cart recorder remote control panel (PR&E #99-240) can control the record, tertiary cue tone, secondary cue tone, play and stop functions of a connected cart recorder. For a schematic showing rear panel Molex connector pin assignment, and an illustration of the panel controls, see Section 8.6.

Presently, there are four different versions of this panel available from PR&E: #99-240-0, for use with cart machines with no lamp tallies; #99-240-1, for use with cart machines with 5 volt lamp tallies; #99-240-2, for use with cart machines with 14 volt lamp tallies; and #99-240-3 for use with cart machines with 28 volt lamp tallies.

8.1.2 Cassette And Tape Recorder Remote Control Panel

The cassette and reel-to-reel tape recorder remote control panel (PR&E #99-221) can control the record, forward, rewind, play and stop functions of a connected cassette or tape recorder. For a schematic showing rear panel Molex connector pin assignment, and an illustration of panel controls, see Section 8.6.

Presently, there are five different versions of this panel available from PR&E: #99-221-0, for use with tape machines with no lamp tallies; #99-221-1, for use with tape machines with 5 volt lamp tallies; #99-221-2, for use with tape machines with 14 volt lamp tallies; #99-221-3, for use with tape machines with 28 volt lamp tallies; and 99-221-4, for use with tape machines with a 5 volt record tally only.

8.2 CLOCKS AND TIMERS

BMX III meter panel clock and timer positions are defined in Figure 2.4 (Section 2.3.2). These positions accommodate the TD-2 Digital Clock (PR&E #99-179-1) or the TD-171 Digital Slave Clock (PR&E #99-312-1), and the DT-4 Digital Timer (PR&E #99-180-1).

8.2.1 TD-2 Digital Clock

The TD-2 is a six-digit (hours, minutes, seconds) general purpose digital clock. The only connection required at the rear of the clock is the external power source (PR&E #50-17, supplied with the clock).

Setting the clock requires the use of the supplied magnet tool (PR&E #90-151) to operate the Hall-effect switches located immediately behind the front panel lens. These switches are centered beneath the three pairs of digits about 1/4 inch above the bottom of the bezel, as shown in Figure 8.1.

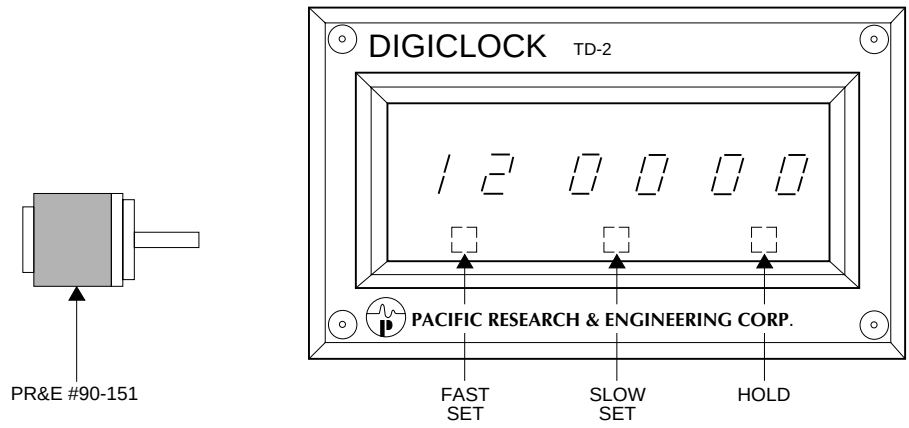


FIGURE 8.1 TD-2 DIGITAL CLOCK

To adjust the clock, place the end of the adjusting magnet against the panel in the appropriate area. Use the FAST SET switch to advance the hours, and the SLOW SET switch to advance the minutes. The HOLD switch will cause the hours, minutes and seconds to stop and hold at their current setting.

CIRCUITRY

The TD-2 is designed around MM5314 digital clock integrated circuit U3. The time base is supplied by crystal oscillator/divider circuit Y1 and U1. The voltage doubler circuit of Q1, Q2, C4, CR1, CR2, and C5 provides the high positive voltage required to pin 15 of U3. The display multiplex frequency is determined by C3 and R2.

The segments of displays DS1 through DS6 are driven by transistors Q4 through Q10, and the digits are selected by inverters Q11 through Q16 and drivers Q17 through Q22. Hall-effect switches U4 through U6 are magnetically activated to set the clock's FAST, SLOW and HOLD functions.

8.2.2 TD-171 Digital Slave Clock

The TD-171 Digital Slave Clock is a six-digit (hours, minutes, seconds) digital display specifically designed to operate with an ESE or compatible master clock time code generator. It is constructed in an aluminum case for shielding, uses an external power supply (PR&E #50-17, supplied with the clock), and is designed specifically for use in PR&E consoles. Power and master clock connection are made to the rear of the unit.

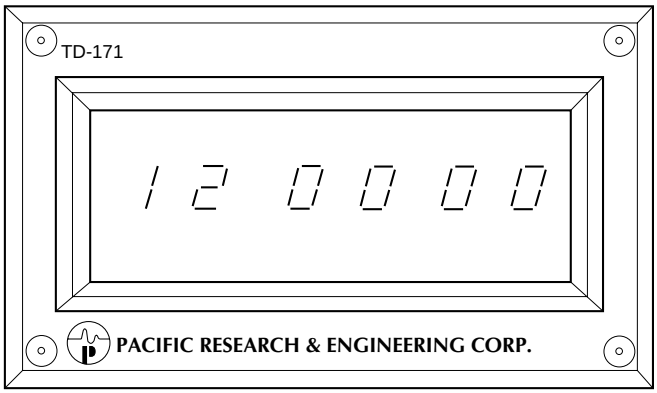


FIGURE 8.2 TD-171 DIGITAL SLAVE CLOCK

CIRCUITRY

The TD-171 circuit is virtually the same as the ESE model ES-171 unit (the TD-171 is manufactured with the express consent of ESE). The time code consists of 24 bits of pulse width modulated data. A wide pulse (260 microseconds) represents a binary one (1), and a narrow pulse (65 microseconds) represents a binary zero. The data rate is 60 Hz.

Demodulation is accomplished using shift registers U3, U4 and U5. The incoming data is buffered by transistor Q2 and gate U1 before it is fed to shift register U3. One of the one-shots of dual monostable U2 is used to clock the shift registers. The pulse width of this one-shot is set to be 2.5 times the pulse width of the narrow data pulse. As a result a “one” or “zero” will be clocked into U3 depending on the width of the data pulse.

The second one-shot of U2 is retriggered by each data pulse until the completion of all 24 bits of data. U2 then times out and triggers another one-shot, formed by two gates of U1. This transfers the data from the shift register outputs to the latches contained in decoder/drivers U6 through U11, prior to the next transmission of data. This completes the serial-to-parallel conversion. The decoder/drivers and displays then translate the parallel BCD information into the visual time display.

8.2.3 DT-4 Digital Timer

The DT-4 is a five-digit (minutes, seconds, tenths-of-a-second) digital timer which is controlled by either the Timer Control Panel (PR&E #99-220) or the console timer reset bus. The Timer Control Panel is located in the lower far right console position. See Section 3.15 for instruction in operating the timer.

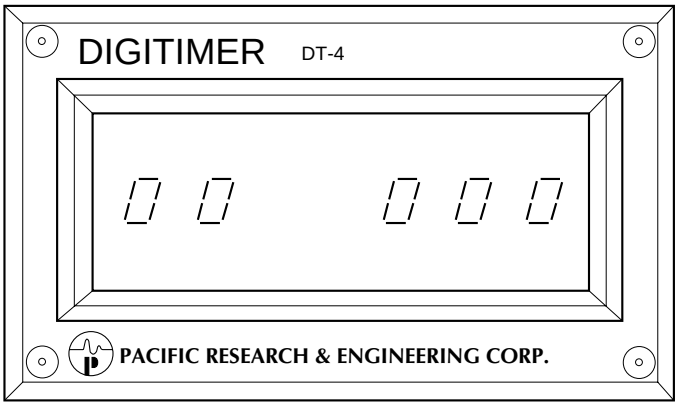


FIGURE 8.3 DT-4 DIGITAL TIMER

NOTE: Three five-pin timer reset Molex connectors are provided at the rear of the mainframe for connection to external timers, if desired.

CIRCUITRY

The DT-4 is designed around MK50397 timer integrated circuit U4. The time base and display multiplex frequency is provided by crystal oscillator/divider circuit Y1 and U1. The segments of displays DS1 through DS5 are driven by transistors Q1 through Q7, while the digits are selected by transistors Q8 through Q12.

Power-up circuit R13, CR1 and C9 resets U4 to zero, and sets start/stop flip-flop U2A and U2C so that the NOT RUN line is high. An external START command causes the flip-flop to change state to the RUN condition. An external STOP command via U2C will set the flip-flop back to the STOP condition. An external RESET command via U2B will reset U4 to zero. An external HOLD command via U3D will momentarily hold the display at the present time count, while the real time count continues internally.

A READ or RUN command is routed via U3C, U3B and U3A to enable the tenth of second display, and, via Q13, to turn on the decimal point. Strapping J1 pin E to J1 pin F continuously enables both the tenth of second display and decimal point. A BLANK command to U4 allows the entire display to be blanked.

NOTE: In some cases it may be desirable to disable the tenth of second and decimal point indicators. This can be accomplished by cutting the strap between pins E and F (.1 SEC LOCK) on the timer connector.

8.3 PPM METER

The optional Peak Program Meter is a peak level indicating meter which can be supplied to replace or augment the standard VU meters. The PPM fully conforms to British Standard 4297:1968, which specifies the characteristics for the meter movement and the overall performance when connected to the required drive circuitry.

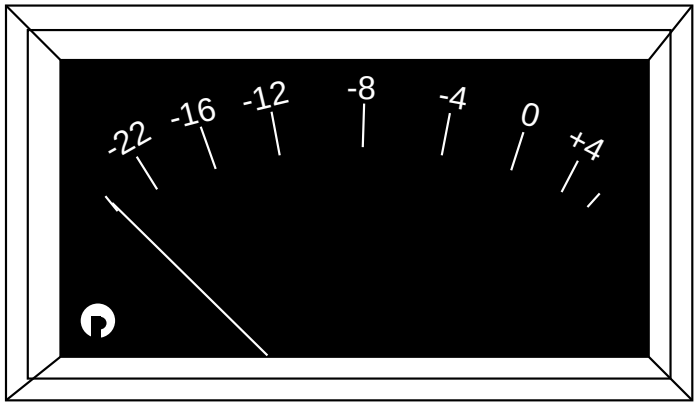


FIGURE 8.4 PEAK PROGRAM METER

The PPM has a faster rise than standard VU meters, and its dynamic characteristics are radically different. The rise time is measured with isolated variable length tone bursts of 5 kHz sinusoidal voltage, whose steady-state value will result in a "0" reference reading. The burst times and scale indications are as follows: 100 ms = 0 dB, 10 ms = -2.5 dB, 5 ms = -4 dB, and 1.5 ms = -9 dB. The fall-back time is defined as between 2.5 and 3.2 seconds for the pointer to fall from +4 to -20 after the removal of a steady-state 1 kHz sinusoidal voltage.

8.4 REDUNDANT POWER SUPPLY COUPLER UNIT

The Redundant Power Supply Coupler Unit (PR&E #99-76) is used whenever redundant power is desired. When two power supplies are connected to the unit, the power supply voltages are diode-coupled, with the highest of the two voltages being supplied to the console. If there is a voltage failure, redundant power is instantaneously supplied to the console, and the Remote Power Fail Indicator on the coupler unit is illuminated.

The unit should be installed adjacent to the two console power supplies, and connected with the two prefabricated cables supplied. The connections to the supplies and to the console are made to the heavy–duty barrier strips on the rear of the coupler. The cables are color-coded, and the corresponding color names are printed adjacent to the terminal strips.

NOTE: The high-current diodes used in the coupler have very low forward voltage drop and, therefore, do not add significantly to the heat dissipation of the power supply system. However, the second power supply in a redundant system does add approximately 50 watts of heat, due to the excitation current consumed by the power transformers.

8.5 LOGIC INTERFACES

PR&E recommends the use of logic interface electronics between the console and any piece of auxiliary equipment to protect the console from hazardous voltages, and to prevent ground loops, such as those which occur when control circuitry is referenced to a different ground or power supply.

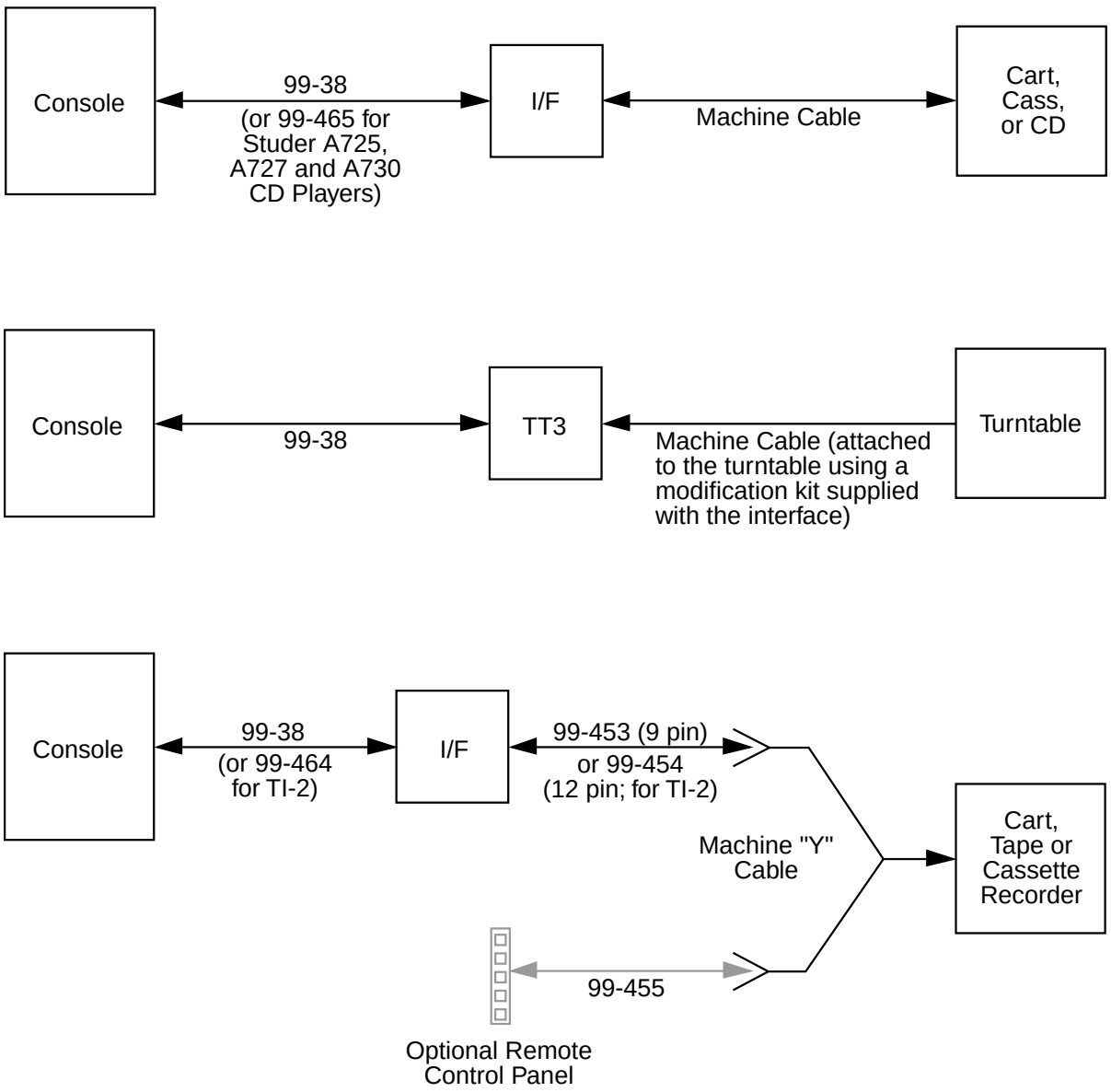
A variety of different interfaces is manufactured by PR&E to accommodate most types of cart, tape and cassette machines, turntables, and compact disc players. Cable assemblies connecting the console to the interface, and the interface to the auxiliary equipment are also produced by PR&E. For complete interface information, including all standard machine cable assemblies and machine “Y” cables, contact PR&E.

The table below provides a listing of the various interfaces described in this section, as well as their part numbers and a general description of their use.

Interface	PR&E P/N	For Use With
TCI-2A	99-165	PR&E TOMCAT, Micromax cart machines
CI-2	99-125-0	Cart machines, CD players and cassette machines w/12-28 V lamp tallies
CI-2 (5V)	99-125-1	Cart machines, CD players and cassette machines w/5 V lamp tallies
TI-2	99-111	Reel to reel tape machines w/12-28 V lamp tallies
TT-3	99-110	Turntables
WL-2	99-143	Studio and Control Room warning lights
Dual Relay	99-419	General purpose switching, mute contacts
Cassette Skimmer	99-410	Cassette recorders

Section 8.6 contains schematics of these interfaces, and diagrams of the three console to interface cables: PR&E #99-464 (for use with the TI-2 Tape Interface); PR&E #99-465 (for use with the CI-2 Cart Interface when interfacing Studer A725, A727 and A730 compact disc players); and PR&E #99-38 (for use with all other interfaces). It also contains diagrams of the 9-, 12- and 24-pin control cables (PR&E #99-453, #99-454 and #99-455, respectively), which are used when connecting to a cart, tape or cassette recorder "Y" cable.

While there are three console to interface cables, there is a variety of interface to machine cables, each with a configuration dependent upon the individual machine being connected. When a machine "Y" cable is used in an installation, only the "Y" cable (not the control cables) is machine dependent. Figure 8.5 (on the following page) provides an overview of the logic interface and cable system.



NOTES:

A) The addition of the optional cart or tape recorder remote control panel is made possible by the installation of the machine "Y" cable.

B) Pin assignment for the PR&E #99-38, #99-464 and #99-465 console to interface cables, and the #99-453, #99-454 and #99-455 control cables, is defined in Section 8.6.

FIGURE 8.5
LOGIC INTERFACE AND CABLE SYSTEM OVERVIEW

8.5.1 TCI-2A Cartridge Interface

The TCI-2A Cartridge Interface (PR&E #99-165) was specifically designed for use with PR&E TOMCAT and Micromax cart machines. Each TCI-2A can accommodate up to three reproducers or recorder/reproducers. For a schematic of this interface, as well as a diagram of the console to interface cable (PR&E #99-38), see Section 8.6.

NOTE: If you already have TCI-2 interfaces for TOMCAT, they may be modified slightly to work with both TOMCAT and Micromax cart machines, as follows:

1. Replace resistors R1, R3, R5, R7 and R9 with 750 ohm, 1/2 watt resistors (PR&E #3-751).

2. On the component side of the PC board, cut the trace going to J4 pin 4.

3. Add an insulated jumper wire between J4 pin 1 and the trace that previously went to J4 pin 4 (which was cut in step 2).

4. Verify that resistor R14 is a 10M ohm, 1/4 watt resistor (PR&E #2-106).

CIRCUITRY

The TCI-2A uses opto-isolators to eliminate potential audio/logic ground loops. The LED inputs of opto-isolators U1 thru U5 are connected to the cart machine tally outputs through current limiting resistors R1, R3, R5, R7 and R9. The collector of opto-isolator U1 is connected to the AUDIO RESET line on console connector J1. When the FWD LIGHT tally is present at cart connector J4, current flows through U1's LED, turning on its output transistor, and pulling the AUDIO RESET line to console LOGIC COMMON. When the STOP LIGHT tally is present at cart connector J4, U2 will operate in the same manner, pulling the READY line to console LOGIC COMMON. Capacitor C2 will pulse the AUDIO RESET line low at the "rising edge" of the STOP LIGHT tally, thus providing a console AUDIO RESET when the cart machine stops.

Opto-isolators U3, U4 and U5 provide open collector outputs referenced to an isolated COMMON on connector J3. These opto-isolators function in the manner described above, in conjunction with the remaining cart tallies: PLAY LIGHT, SEC LIGHT and TER LIGHT.

NOTE: These outputs can be used to provide automatic "cart sequencing" by connecting the appropriate cart cue line on connector J3 to the console ON input on J2 of the "next" cart machine interface. The isolated COM on connector J3 needs to connect to LOGIC COMMON as well. If needed, a switch can be installed in series with the connection to disable the cart sequence. The J3 outputs from several cart machines may also be paralleled together to form an "end of message" warning bus. This bus can then be buffered, as needed, to drive external warning lights. Contact PR&E for more information.

Opto-isolators U6 and U7 are connected through current limiting resistors R11 and R13 to the console START and STOP pulses on J1, respectively. The open collector outputs of U6 and U7 are connected to

the cart START and STOP inputs of connector J4, respectively. The resistor and capacitor on each opto-isolator (i.e., C1/R2 on U1, etc.) slows down the switching time on the opto-isolator's output transistor.

8.5.2 CI-2 Cartridge Interface (+12 to +28 Volt Logic)

The CI-2 Cartridge Interface (PR&E #99-125-0) was designed for use with those commercial cart machines which use +12 to +28 volt logic. The CI-2 uses dry relay contacts for start and stop functions, and also serves as a capable logic interface for CD players and cassette machines. The CI-2 also routes machine status indicator feedback to the console module "OFF" lamp, mimicking machine READY, PAUSE or STOP indicators.

Each CI-2 can accommodate up to three machines. For a schematic of this interface, as well as a diagram of the console to interface cable (PR&E #99-38), see Section 8.6.

CIRCUITRY

When a cartridge is inserted, current is fed to isolator circuit CR9-12, R2, R4, C2 and U2, forcing the NOT READY line low and momentarily pulsing NOT AUDIO reset low (ensuring module turnoff). A START pulse input via CR1 will turn on relay K1, starting the cartridge machine. Current fed to isolator circuit CR5-8, R1, R3, C1 and U1 will force the NOT AUDIO RESET line low. A STOP pulse input via CR2 will turn on relay K2, stopping the cartridge machine.

8.5.3 CI-2 Cartridge Interface (+5 Volt Logic)

The CI-2 Cartridge Interface (PR&E #99-125-1) was designed for use with those commercial cart machines which use +5 volt logic feedback. Its function is identical to the CI-2 Interface for +12 to +28 volt logic. For a schematic of this interface, as well as a diagram of the console to interface cable (PR&E #99-38), see Section 8.6.

CIRCUITRY

The circuitry for the +5 volt version of the CI-2 Cartridge Interface functions identically to that of the +12 to +28 volt version (reference Section 8.4.2), except that resistors R3 and R4 are 100 ohm, 1/4 watt, instead of 1K ohm, 1/2 watt.

8.5.4 TI-2 Tape Interface

The TI-2 Tape Interface (PR&E #99-111) was designed for use with those commercial reel to reel tape machines which use +12 to +28 volt logic. Each TI-2 accommodates one machine. For a schematic of this interface, as well as a diagram of the console to TI-2 interface cable (PR&E #99-464), see Section 8.6.

NOTE: This interface may also be used with cartridge machines. In this event, use console to interface cable #99-38 if the replay lockout function is desired.

CIRCUITRY

When the tape machine is stopped, current is fed to STOP LAMP isolator circuit R1, R2, R3, CR1, C1 and U1, forcing the NOT STOP LAMP line low, which, via U4C and pulse driver circuit R4, R20, CR8, C10 and Q1, momentarily holds the NOT AUDIO RESET low (ensuring module turnoff).

When the tape machine is in the record mode, current is fed to RECORD LAMP isolator circuit R9, R10, C3, CR3 and U3, holding the NOT AUDIO RESET low.

The NOT REPLAY line, strapped low by jumpering pins 14, 15 or J1 (i.e., reel to reel mode) via R11, R12, C4, U5B and U5C, holds resistor U6B such that the START ENABLE line is always high. When the STOP LAMP and START ENABLE lines are both high, via U5D, R14 and Q2, the NOT READY output will go low. With the NOT START ENABLE line low, a START pulse input via R16, R17, C6, U4E and U4D will trigger monostable circuit R18, C7, CR4 and U6A, which momentarily turns on driver circuit R19 and Q3 and TAPE START relay K1 (starting the tape machine). A STOP pulse input via CR6 turns on TAPE STOP relay K2 (stopping the tape machine).

Either the NOT STOP LAMP line's low state or current fed to PLAY LAMP isolator circuit R6, R7, R8, CR2, C2 and U2 forces the NOT RUN line low, which, via U5A and U4A, asserts the CART line high (i.e., there is a cartridge in place).

When used for cartridge machine operation, the NOT REPLAY line is left unstrapped to the high state. Without a cartridge loaded, the CART line is low, which, via U5B and U5C, presets U6B such that the NOT START ENABLE line is low. After insertion of a cartridge (CART line is high), a start pulse input will, as in reel to reel operation, start the cartridge machine. The NOT RUN line will then go low, which, via U4B, will clock the low state on the data input of register U6B, asserting the NOT START ENABLE line high. When the cartridge machine recues and stops, the RUN line will go low and the NOT START ENABLE line remains high, which inhibits further start pulses from triggering monostable U6A, and prevents restarting the cartridge machine. Either the CART line going low (by removing the cartridge) via U5B, or a STOP pulse input, via R13, C5 and U4F via U5C, will again preset register U6B, asserting the NOT START ENABLE line low.

8.5.5 TT-3 Turntable Interface

The TT-3 Turntable Interface (PR&E #99-110) was designed for use with most commercial turntables. Each TT-3 can accommodate up to two turntables. For a schematic of this interface, as well as a diagram of the console to interface cable (PR&E #99-38), see Section 8.6.

CIRCUITRY

When the turntable is stopped, no current will be fed to isolator circuit R1, R2, C1, C2 and U1, allowing the NOT RUN line to go high, which, via driver R3, R12, and Q1, holds the NOT READY output low (i.e., turntable is ready) and momentarily pulses, via C8, the NOT AUDIO RESET line low (ensuring module turnoff). With the NOT RUN line's high state fed to U2D, a START pulse, via R4, R5, C3, U2D and U2B, will cause a CONTROL pulse output via isolator circuit R8, R9, Q2, U3, R10, R11 and C5,

starting the turntable. With the RUN line's high state fed to U2C (i.e., the turntable is running), a STOP pulse, via R6, R7, C4 U2C and U2B will similarly cause a CONTROL pulse output, stopping the turntable.

8.5.6 WL-2 Warning Light Interface

The WL-2 Warning Light Interface (PR&E #99-143) is an opto-isolated switched AC relay designed to illuminate external studio and/or control room warning lights. This interface has two inputs (STUDIO and CONTROL ROOM), which are activated by 12 volt DC commands. Each input has a corresponding AC output. For a schematic of this interface, see Section 8.6.

NOTE: The WL-2 inputs are polarity sensitive, and will not work unless connected correctly.

CIRCUITRY

NOTE: The WL-2 contains two independent relays. For clarity and simplicity, only relay K1 is described below.

A voltage between 3 VDC and 32 VDC applied to input connector J1 energizes solid state relay K1. Relay K1 then switches the "hot" lead (black) of the 115 VAC input to output connector J2. Switching transitions occur during the zero crossing point of the AC source to minimize noise transients.

8.5.7 Dual Relay Interface

The Dual Relay Interface (PR&E #99-419) consists of two separately controlled relays, which can be used for audio or control circuitry. For a schematic of this interface, see Section 8.6.

CIRCUITRY

NOTE: The Dual Relay Interface contains two independent 4PDT relays. For clarity and simplicity, only relay A is described below.

With no control voltage applied, relay A will have continuity between each WIPER terminal and its respective N.C. terminal. With 12 VDC applied to terminals COM and +12 V, each WIPER will have continuity to its respective N.O. terminal.

NOTE: Relays A and B each draw .036 amps when energized with contacts rated at 2 amps at 30 VDC.

8.5.8 Cassette Skimmer Interface

The Cassette Skimmer Interface (PR&E #99-410) is used to create cassette recordings of selected console microphone inputs. One to four Microphone Input Modules may be connected to the skimmer, which will toggle up to two cassette tape machines from the pause mode into the record mode the instant a connected mic module is turned ON. When the mic module is turned OFF, the cassette tape machines toggle from the record mode into the pause mode. In this way, a recording of a personality or personalities may be created for later review.

NOTE: When the mic module is turned OFF, there is a one-second delay in the cassette machine toggling from the record mode to the pause mode. This allows for the recording of the voice-to-music transition.

Another method of connecting the cassette skimmer is to connect it to the Control Room Monitor Module. When this is accomplished, the tape machine will be placed in record whenever the Control Room speakers mute.

For a schematic of this interface, see Section 8.6.

CIRCUITRY

Power is applied to the interface through input connectors J1 through J4 and diodes CR2, CR4, CR6 and CR8. This arrangement allows any or all of the four inputs to be used. The ON TALLY voltage is routed through diodes CR1, CR3, CR5 and CR7 to the "fast attack/slow release" circuit comprised of R1, R2, CR9, R3 and C5.

When ON TALLY voltage is applied, C5 is charged quickly through CR9 and R3. When ON TALLY voltage is removed, C5 is discharged slowly through R2 and R1. Schmidt inverter squares up and inverts this signal and sends it to monostables that generate the PLAY and PAUSE pulses for each cassette recorder. U2 generates pulses for Cassette 1 and U5 generates pulses for Cassette 2.

U2A and U5A are configured to trigger on the "falling edge" of the inverted ON TALLY voltage, which indicates the beginning of cassette skimming and cassette RECORD. U2B and U5B are configured to trigger on the "rising edge" of the inverted ON TALLY voltage, which causes the cassette to PAUSE.

Grounding the SKIM DISABLE input on J5 disables the PLAY and PAUSE pulses for Cassette 1, and grounding the SKIM DISABLE input on J7 disables these pulses for Cassette 2.

Each of the four monostables generates a 0.1 second pulse governed by the time constant of C7/R6, C8/R9, C10/R14 and C11/R17. Each monostable is connected to an opto-isolator to eliminate any audio or logic ground loops. Opto-isolators U3, U4, U6 and U7 are driven by transistors Q1, Q2, Q3 and Q4.

8.6 ACCESSORY SCHEMATICS

This section contains schematics for the various accessories described in this chapter, as follows:

NOTE: On PR&E schematics, capacitor values are in microfarads (µF), unless otherwise specified, and resistors are 1/4 watt, 5%, unless otherwise specified.