bdi Broadcast Devices, Inc.

The *RIGHTRACK*®
Audio Phase Corrector APC-200

TECHNICAL REFERENCE MANUAL

Broadcast Devices, Inc.
Audio Phase Corrector - APC-200
The RIGHTRACK

TECHNICAL REFERENCE MANUAL

Table of Contents

I. Introduction

A. Unpacking and Inspection

Open all cartons upon receipt and inspect for damage caused in shipment. If damage is noted contact shipper as soon as possible. Verify that the contents of each carton match the quantity and description contained in the packing slip.

Inspect the unit to make sure all mechanical and electrical parts are tight and secure before applying power.

B. Improving Audio Quality with Phase Correction

Stereo phase errors can drastically affect your mono sound, or the sum between the left and right channels. The smallest phase error can degrade high frequency performance. Larger phase errors are audible in stereo and can affect your stereo image as well. The RIGHTRACK is a device that can correct phase error and monitor the quality of the audio signal.

In more technical terms, we can take the example of two sine waves which are in phase with each other. Both may have amplitudes of zero dBM. A combination of these two waveforms would result in a signal of +6 dBM, or exactly twice their individual amplitudes. If the phase angle between the two were as much as 90 degrees, the resulting combined output would then be six dB lower than the ideal in-phase case of +6 dBM. Any signals which are out of phase with each other thus result in a lower amplitude at the mono output of the device.

The consequences of an out-of-phase condition may be demonstrated in the case of a typical stereo tape recorder. In order to have the flattest frequency response at the high frequency end of the audio spectrum, the record and playback head azimuths must be precisely adjusted. Because of head or guide wear, tape players commonly have playback azimuths that are as much as 90 degrees different at 10Khz from the machine that the recording was made on. If the playback azimuth is radically off, that recording's mono playback will be six dB down from the zero reference at 10Khz and above, while the low frequency portion of the recording will appear to be normal. Phase errors in tape recorders typically get worse with an increase in frequency. The resulting recording sounds dull and muddy when monitored in mono.

In the past, the only way to correct these phase errors was to adjust the head azimuth of the playback machine to compensate for the phase error. This was of course a tedious task which would soon wear out the alignment screws of your machine. The RIGHTRACK Audio Phase Corrector from Broadcast Devices is an inexpensive, easy-to-use device that can correct for azimuth errors from one tape machine to another regardless of tape format. Connected to your tape player, the RIGHTRACK can monitor the condition of the recording and correct for the phase error with the turn of just one control. This allows you to control the amount of phase correction needed to make your recording sound bright and clean in mono as well as in stereo. The RIGHTRACK is able to give you as much as plus or minus 170 degrees of phase correction at 12.5Khz.

The RIGHTRACK can also be used to correct phase errors which occur within tape record/playback systems such as those that use the broadcast cartridge format. Broadcast tape cartridges are like fingerprints in that each one has its own phase characteristic. Even though all of the players in a system are aligned to the same standard, cartridge-to-cartridge phase differences do occur. The RIGHTRACK can be

connected to your cartridge recorder to monitor and correct the phase error introduced by individual cartridges. The RIGHTRACK also has a three frequency reference oscillator that allows you to record low, mid and high frequency tones on a cartridge to verify its suitability for use. By monitoring the L+R and L-R meters, you can dial in the amount of phase correction necessary to align this cartridge to your system standard.

C. Specifications

Phase Corrector

Input Impedance:	Balanced Bridging 220K ohm
Input Sensitivity:	+24dbm Max.
Gain:	Unity (as factory adjusted)
Frequency Response:	+/- 1db from 20Hz to 20Khz.
Total Harmonic Distortion:	Better than .1% at +24dbm output.
Intermodulation Distortion:	Better than .05% at +24dbm (SMPTE 4:1)
Noise:	Better than 70db below nominal output.
Phase Correction:	+/- 170 degrees at 12.5Khz

Oscillator

Frequency Selection:	150Hz, 1500Hz, 12.5Khz
Total Harmonic Distortion:	0.1% or better

Metering

Input Impedance:	Balanced Bridging/10K ohm
Meter Type:	Volume Unit/Percent
Input Sensitivity:	User Selectable, 0, +4, or +8Dbm

II. Operations Guide

A. Using the RIGHTRACK with Broadcast Cartridge Recorders

With your cartridge recorder connected as described in Section III. A, follow the steps below:

1. Insert a cleanly erased cartridge into the machine and push the RECORD SET button.

2. Put all three front panel switches of the RIGHTRACK in the CALIBRATE, or up position. Adjust the input levels of the recorder, as monitored on its VU meters, for a zero VU indication.

3. Start the recorder and observe the L+R and L-R meters on the RIGHTRACK. There should be a near zero VU indication on the L+R meter and no indication on the L-R meter. If not, adjust the phase control of the RIGHTRACK until the maximum L+R, minimum L-R indication is observed. Put the OSC (oscillator) switch in the 1500Hz and 150Hz positions and verify that the meter indications stay about the same.

NOTE: If an oscilloscope is connected to the RIGHTRACK's X and Y scope outputs, adjust the phase control for an in-phase pattern on the scope. See Figure 1 for the correct scope patterns. If the proper adjustment cannot be made, the cartridge may either be defective or it may be necessary to check the alignment of your recorder.

4. After the proper amount of phase correction has been made in the previous step, erase the cartridge. Find the splice and re-insert it in the machine. Put the RIGHTRACK MODE switch to OPERATE, taking care not to change the phase control. Press the RECORD SET button and make your phase-corrected recording.

B. Using the RIGHTRACK for Playback Azimuth Correction

With your tape recorder connected as described in Section III. B, follow the steps below:

1. Make sure that both channels of the playback electronics of your machine are adjusted for equal output. This will make the phase adjustment more accurate.

2. Place the meter switch in the CALIBRATE, or middle switch up position. This allows you to monitor the L+R and L-R output of the recorder on the left and right meters.

3. Start the machine and observe the meters. The L+R meter should peak near zero VU and the L-R meter should indicate much lower levels, depending on the width of the stereo image. If you notice that the L-R meter reads consistently higher than the L+R meter, adjust the phase control to minimize the L-R reading and maximize the L+R reading. It is a good practice to verify your adjustment by monitoring the mono sum (L+R) for best audible high frequency response.

NOTE: If an oscilloscope is connected to the rear X and Y scope outputs, adjust the phase control for an in-phase pattern on the scope. See Figure 1 for correct scope patterns.

C. Using the RIGHTRACK as a Piece of Studio Test Equipment

The RIGHTRACK can be used as an in-the-rack piece of test equipment to monitor the record and playback alignment of your tape recording system. Playback frequency response can be monitored by observing the left and right VU meters with the meter switch in the OPERATE, or middle switch down position. For a stereo recorder, phase alignment can be checked with the phase control in the zero degrees position and the meter switch in the CALIBRATE position. Use a manufacturer recommended playback azimuth alignment tape to check the phase adjustment of the playback head. If the head azimuth is correct the L+R meter will read zero VU and there will be little or no L-R meter indication.

If you are using the X and Y scope output jacks to drive an oscilloscope, you must make sure that the in-phase head adjustment coincides with a peak level indication as observed on the L+R meter. It is possible to have an in-phase scope pattern and be on the wrong peak. This will result in an actual phase error of 360 degrees or greater. Once the phase is properly adjusted, continue with the manufacturer's recommended playback alignment procedure using the RIGHTRACK to monitor the tape recorder output level.

For broadcast tape cartridge systems, the RIGHTRACK can be used to check and adjust record and playback alignment without any additional test gear other than the optional

use of an oscilloscope as described above. Follow the above procedure to check and align the playback portion of the machine. Once the playback has been carefully aligned and checked, you can use the RIGHTRACK's internal three step oscillator to adjust the recorder's performance. First use the oscillator in the 12.5Khz position to adjust the record bias of the machine. Follow the cartridge machine manufacturer's recommended procedure for this adjustment. After the bias has been adjusted, check the phase of the record head by monitoring the L+R and L-R meters or by using an oscilloscope connected to the RIGHTRACK's rear X and Y scope output jacks. If the record head azimuth is correct, the L+R meter should read zero VU and the L-R meter should have little or no indication. When performing this adjustment make sure that the zero phase indication observed on the oscilloscope coincides with a peak indication on the L+R meter. It is possible to have a correct phase pattern on the scope and be on the wrong phase peak.

NOTE: When an adjustment is performed, there will be a slight delay in the indication as you are monitoring the playback head.

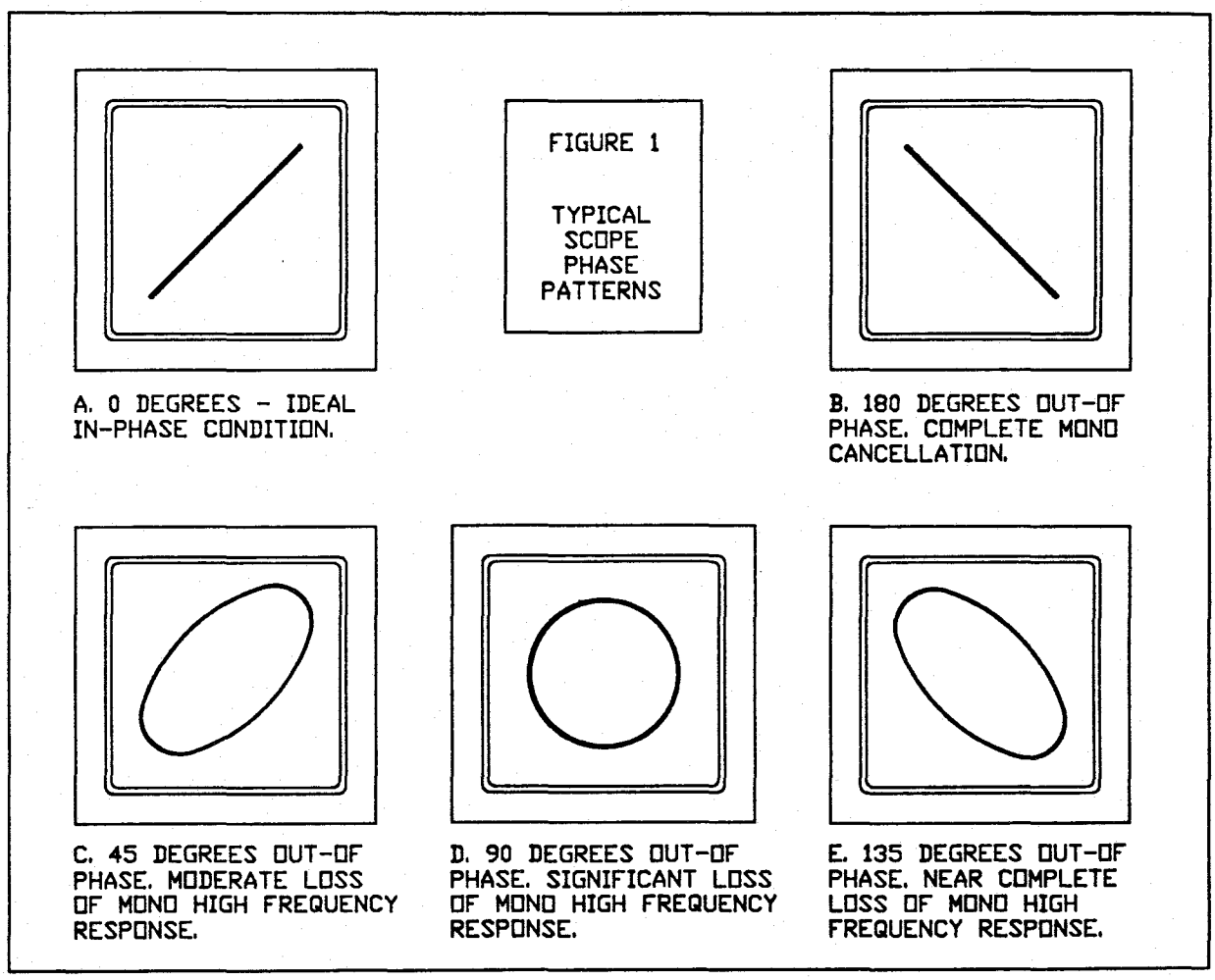
Once the record bias and phase have been adjusted, monitor and adjust the record frequency response if necessary. Use the two other oscillator frequencies, 150Hz and 1500Hz to check the response. This procedure is a good way to diagnose any problems that may occur in frequency response and phase alignment.

D. Using an Oscilloscope with the RIGHTRACK

The left and right signals that are monitored by the RIGHTRACK from the tape machine are available at the rear of the unit on BNC jacks marked X and Y. Connect the X output to the vertical input of an oscilloscope and the Y output to the horizontal input. With a left and right signal feeding the RIGHTRACK, adjust the scope gains for an an on-screen

readable trace. You may use DC or AC coupling since the RIGHTRACK's X and Y outputs are capacitively coupled.

It is now possible to monitor the phase condition of the source by oscilloscope as well as by the RIGHTRACK's internal meters. See Figure 1 for the correct scope pattern as well as the various out-of-phase patterns that you may encounter.



III. Technical Manual

A. Setting up the RIGHTRACK for Broadcast Cartridge Recorders

(Refer to Figure 2)

The RIGHTRACK is a high impedance active balanced input device. This is true for both the phase corrector input and the metering input. The RIGHTRACK can be easily interfaced without loading down existing equipment. A terminating resistor can be installed externally if necessary. The RIGHTRACK output that feeds the cart machine input is an active balanced 600 ohm termination. Before connecting your cart machine, make sure it will not present a ground to either the plus or minus outputs of the RIGHTRACK. NEVER directly ground either of these outputs or connect them together, as serious internal damage may occur. If your machine is unbalanced, connect the hot lead to the plus output and the shield to the ground connection of the RIGHTRACK. Leave the minus output floating. Another method for unbalancing the RIGHTRACK is to use a suitable output transformer. A high quality output transformer is available directly from Broadcast Devices.

To set up the RIGHTRACK for a broadcast cartridge recorder, connect the left and right outputs from the console or signal source to the phase corrector's left and right inputs. Make sure to follow the phasing nomenclature on the RIGHTRACK's input terminals. Connect the RIGHTRACK phase corrector's left and right outputs to the cart machine's left and right inputs. With the phase control at zero, place a 400Hz tone through the console at zero VU as read on the console meters. Put a cart in the machine and depress the record button, adjusting the left and right input levels on the machine for a zero VU indication.

NOTE: As adjusted at the factory, the RIGHTRACK is a unity gain device that will accept nominal inputs of up to +8Dbm.

Connect the cart machine's playback left and right outputs to the metering left and right inputs of the RIGHTRACK. You may use a suitable terminating resistor if desired. Verify the nominal level of your machine with a calibrated level tape and AC voltmeter. The machine's outputs should be the same. If not, adjust the output levels of the machine. Make sure the input sensitivity jumpers on the RIGHTRACK's metering card are correct for your machine's output. As shipped from the factory, these jumpers are placed in the zero position. +4 and +8 positions are also available.

The metering card as well as all other adjustments are available by removing the four front panel screws. To change the metering input sensitivity jumpers, pull the first card on the left (the MTR-200 card) and move the two jumpers (one for each channel) to the setting desired and re-insert the card. Before putting the cover back on, place a calibrated tone tape in your machine and push the start button. Verify that the VU meters are both reading zero with the metering switch in the OPERATE position. If not, adjust the left and right trimmer controls on the metering card to produce a zero VU indication on both meters. See Figure 4 or the card/adjustment location diagram affixed to the inside of the front panel for locating these trimmers.

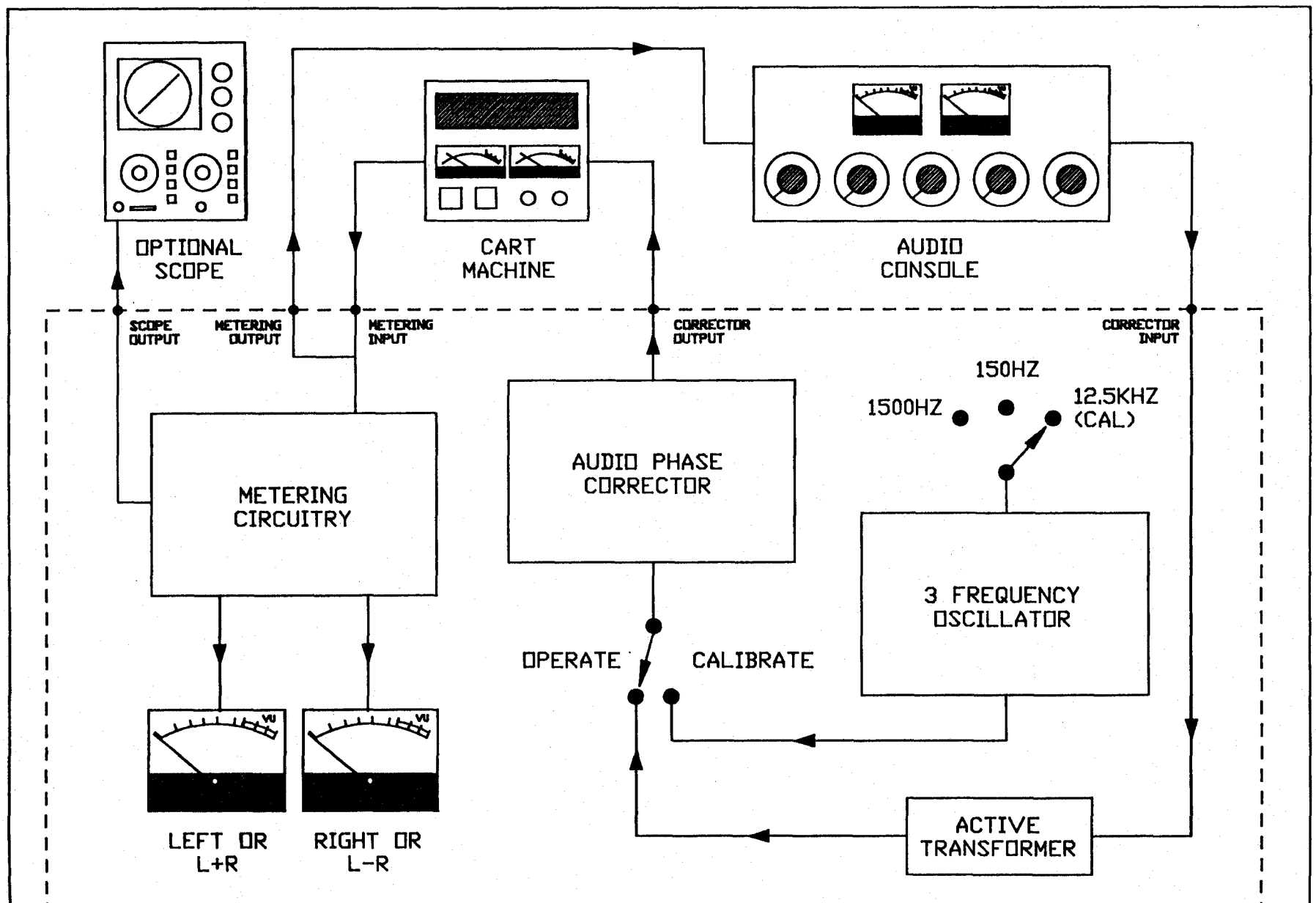


FIGURE 2 - TYPICAL HOOKUP OF THE RIGHTRACK FOR BROADCAST CARTRIDGE RECORDERS.

B. Setting up the RIGHTRACK for Playback Azimuth Correction

(Refer to Figure 3)

The RIGHTRACK may be used to correct the phase error in pre-recorded material using virtually any stereo tape playback system. Such systems include reel-to-reel players, audio cassette systems, and the audio sections of video tape systems.

First, connect the left and right balanced outputs of your tape machine to the phase corrector's left and right inputs. Be careful to follow the phasing nomenclature on the input label. Next, connect a set of jumpers between the phase corrector's left and right outputs to the metering left and right inputs. Be careful to follow the proper wire phasing. Connect the metering left and right outputs to the console input which is normally occupied by the tape player's outputs.

Determine the nominal output of your tape machine and place the jumpers on the metering card in the corresponding level position. To access the metering card, remove the four front panel screws and pull the first card on the left. With the front panel still removed, place a reproduce level tape on the machine and adjust the output levels for a zero VU indication as monitored on the tape machine's VU meters. With the metering switched in the OPERATE position, verify that the levels on the RIGHTRACK's VU meters are also at zero VU. If not, adjust the left and right trimmers on the metering card for a zero VU indication on both meters. See Figure 4 or the card/adjustment location diagram affixed to the inside of the front panel for locating these trimmers.

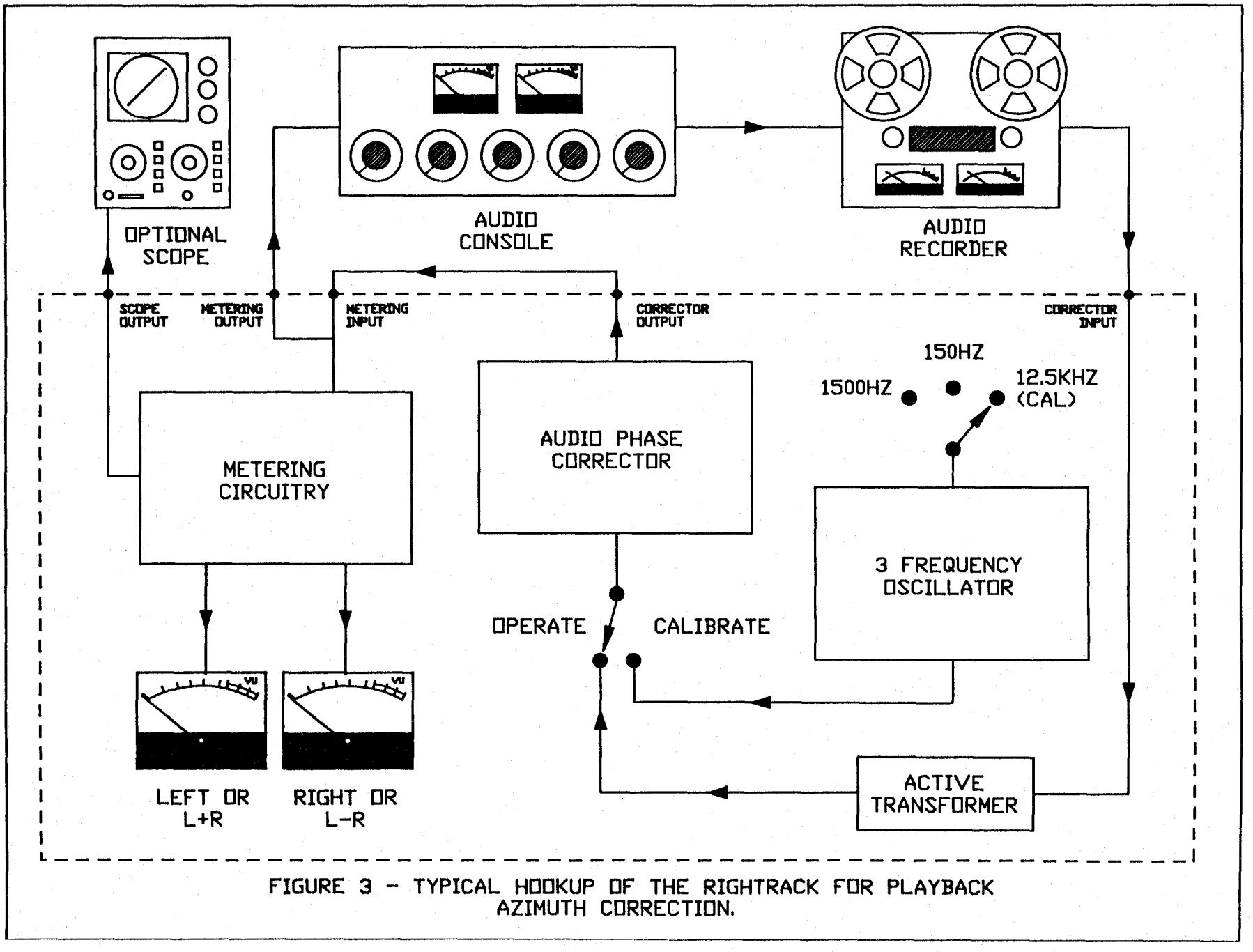


FIGURE 3 - TYPICAL HOOKUP OF THE RIGHTRACK FOR PLAYBACK AZIMUTH CORRECTION.

C. Technical Description

The RIGHTRACK has three sections: the phase corrector, metering amplifiers, and the oscillator. The signals fed into the UBC-200 phase corrector inputs pass through FB1 and FB2, which act as a high impedance to RF signals. C9 and C10 act as a low impedance to RF signals shunting them around the input to ground. C1 and C2 act as a DC block; these capacitors may be bypassed if DC coupling is desired. The signal is then divided by resistor networks R1, R3, R2 and R4. These networks prevent the input signal from overloading U1, the input IC. IC's U1 and U2 compose a high quality differential amp with low noise and distortion. VR1 sets the gain of the differential stage and is preset at the factory. U3 is set at unity gain and is unity gain compensated by C3. VR3 is the common mode null adjustment for U2 and is factory adjusted. This type of circuit exhibits excellent common mode rejection properties. It is only U2 which introduces common mode error. Thus, there is no cascading of common mode error, which is typical of other designs. VR2 is an offset adjustment pot which is factory adjusted. U2, a 5534AN, has excellent offset drift properties in itself; however, it may be desirable to eliminate coupling capacitor C4. If this capacitor is removed, any small DC offset will be amplified by the succeeding stages, which will shift the audio baseline and result in reduced headroom capabilities.

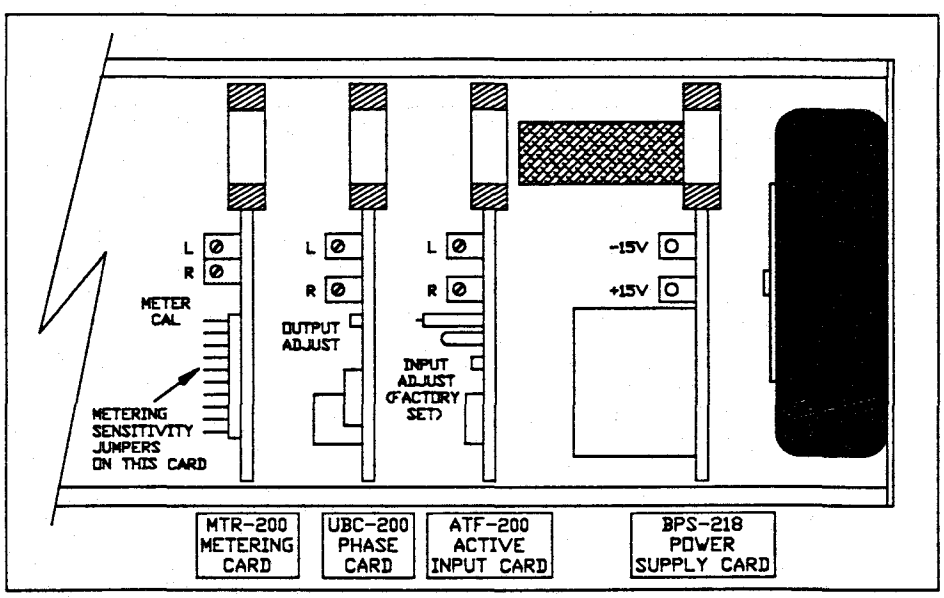


FIGURE 4 - RIGHTRACK CARD LAYOUT/ADJUSTMENT DIAGRAM

The signal is routed from the output pin of the ATF-200 active transformer card to the mode switch located on the front panel. In the OPERATE position of the switch, the signal is routed to the UBC-200 phase shift output board. U1 and U2 of the UBC-200 board are a set of variable allpass filters. By adjusting the front panel phase control, the differential phase of the left and right channels can be varied from +170 to -170 degrees as measured at 12.5Khz. The phase shift of these networks varies proportionally to frequency, electronically reversing the effects of a misaligned tape head. The outputs of these allpass filters are fed to differential drivers U3 and U4. There the phase adjusted signal is amplified and balanced to drive a 600 ohm load.

The MTR-200 metering amplifier card is made up of a set of differential input stages: an L+R and L-R section, and a pair of meter drivers. The signal from the tape machine is fed to one half of U1 and U2, which act as the differential input amplifiers. The signals can be attenuated by placing the input sensitivity jumpers where desired for a particular input level. VR1 and VR2 are the meter trim pots, and are adjusted to produce equal level indications on the meters when the front panel metering switch is in the OPERATE position. The wipers of VR1 and VR2 are connected to mode switch S1 and to a sum and difference matrix which is the other half of U1 and U2. When the metering switch is placed in the operate mode, the left and right signals are routed to the metering amplifiers U3, producing left and right indications on M1 and M2 respectively. In the CALIBRATE position of S1, the signals from the output of the sum and difference matrix are fed to the meter driver amplifiers, thus producing L+R and L-R indications on M1 and M2 respectively. The gain of the difference half of the matrix (L-R) is 13dB greater than the sum (L+R) half providing for a more accurate L-R null. This L-R signal is also high pass filtered through the series RC combination labeled as R30. This filter eliminates the low frequency components which are not necessary for phase correction adjustments.

The PCO-200 oscillator section is composed of a FET stabilized Wien Bridge configuration. Half of U1 on the PCO-200 oscillator card is the Wien Bridge oscillator. You may select frequency by switching different resistor values into the Wien Bridge consisting of C1, C2, and R1-6. A portion of the output of the Wien Bridge oscillator is rectified by D3 and compared to a DC reference at the inverting input pin 6 of the other half of U1. This amplifier is an integrator/filter that biases the gate of Q1. C9 is the integrating capacitor, while C8 and R3 form a damping network to stabilize the integrator function. The values of these components are chosen to produce the best compromise between oscillator settling time and distortion for the three different frequencies. D2 acts as a positive DC clamp to prevent positive voltage from being applied to Q1 which would destroy it. Q1 acts as a variable resistor to keep oscillator output constant. This technique produces a low distortion, stable sine wave output. The output of the oscillator is fed to the MODE switch which applies the oscillator signals to the UBC-200 input card when it is placed in the CALIBRATE position.

The BPS-218 power supply regulator card provides a bipolar 15 volt supply to the system. This card is capable of providing 45 watts of power and has been purposely overrated to provide a long and trouble-free life.

IV. Warranty

Broadcast Devices, Inc. products are warrantied against failure due to faulty materials or workmanship for a period of one year from the date of shipment to the ultimate user. The warranty covers repair or replacement of defective parts at the factory, provided the unit has been returned by the user, via prepaid motor freight under a Return Authorization Number formally obtained from the factory.

The above warranty is void if the unit has been modified by the customer outside of recommendations from the factory, or if it has been abused or operated outside of its electrical or environmental specifications.

If customer conducted field tests suggest that the unit may be faulty whether in or out of the warranty period, a full report of the difficulty should be sent to the Broadcast Devices, Inc. factory at Peekskill, NY. The office may then suggest further helpful field tests, or authorize return for evaluation at the factory.

Units for factory inspection should be shipped via prepaid motor freight direct to the Broadcast Devices, Inc. factory at 5 Crestview Avenue, Peekskill, NY 10566. The Return Authorization Number must appear on the outside of the shipping container, otherwise the unit will not be accepted. NOTE: Freight collect shipments will be refused. When the unit has been received, inspected and tested, you will receive a report on the findings along with a quotation on any recommended repairs falling outside our standard warranty.

Units returned for in-warranty repairs which are found to be not defective will be subject to an inspection and handling charge of $25.00 plus transportation charges.

In-warranty units, found to be the responsibility of Broadcast Devices, Inc. will be repaired and returned via prepaid motor freight. Also at that time, credit will be issued for incoming motor freight charges.

Out-of-warranty units needing repair require a purchase order and will be invoiced for parts, labor and transportation charges. Components used in all Broadcast Devices, Inc. products are the highest commercial grade available. Each one is given a rigid acceptance test upon receipt. Nevertheless, as with all components, there is a certain small percentage of failure. Broadcast Devices, Inc.'s warranty includes free replacement at the factory of any component which fails within one year of the date of shipment.

When ordering replacement parts, always specify the part number, part description, quantity needed, the date the unit was purchased and any special shipping instructions.

Parts orders and all correspondence concerning repairs and performance under the warranty should be addressed to:

Broadcast Devices, Inc.
5 Crestview Avenue
Peekskill, NY10566

V. Parts list and Schemeatics

UBC-200 Phase Corrector/Balanced Output Board
Parts List

BDI P/N	CKT DESIGNATION	VALUE/DESCRIPTION
Resistors:		
RM252002-2	R 1,11	20K, 1/4W, 2%
RM251003-2	R 2,12	100K, 1/4W, 2%
RM251002-2	R 3,13	10K, 1/4W, 2%
RM253302-2	R 4,14	33K, 1/4W, 2%
RM252002-2	R 6,16	20K, 1/4W, 2%
RM50100A-5	R 7,8,17,18	10, 1/2W, 5%
RM251002-2	R 9,10,19,20	10K, 1/4W, 2%
RM251001-2	R 21,22	1K, 1/4W, 2%
Capacitors:		
CEU10A-50	C 1,11	1uf, 50V, EL
CCMP200	C 2,12	20pf, MICA
CMP620	C 3,13	62pf, MICA
CMP101	C 4,14	100pf, MICA
CEU151-35	C 5,6,15,16	150uf, 35V, EL
CFP472-MP	C 7,17 *	4700pf, MYLAR
CCU10C-50	C 8,9,18,19	.1uf, 50V, CERAMIC
CCU10C-50	C 10,20,21,22	.1uf, 50V, CERAMIC
Semiconductors:		
UL85006	U 1,3	NE5534AN OP-AMP
UL85007	U 2,4	NE5532N OP-AMP
Controls:		
VRP103	VR 1,2	10K, MULTITURN TYPE P
VRW203	VR 3,4	20K, MULTITURN TYPE W
Other:		
FB8002	FB 1-4	FERRITE BEADS

* ON SOME BOARDS C7 AND C17 MAY NOT BE MARKED. C7 IS LOCATED BETWEEN C1 AND R1. C17 IS LOCATED BETWEEN C11 AND R11. C7 AND C17 MUST BE A MATCHED PAIR.

ATF-200 Active Transformer Board
Parts List

BDI P/N	CKT DESIGNATION	VALUE/DESCRIPTION
Resistors:		
RM251003-2	R 1,2,21,22	100K, 1/4W, 2%
RM251002-2	R 3,4,23,24	10K, 1/4W, 2%
RM251002-2	R 5,6,25,26	10K, 1/4W, 2%
RM251002-2	R 7,8,27,28	10K, 1/4W, 2%
RM251002-2	R 9,10,29,30	10K, 1/4W, 2%
RM254701-2	R 11,31	4.7K, 1/4W, 2%
RF503000-5	R 12,32	300, 1/2W, 5%
Capacitors:		
CEU10A-50	C 1,2,11,12	1uf, 50V, EL
CMP201	C 3,13	200pf, MICA
CEU470-50	C 4,14	47uf, 50V, EL
CCU10C-50	C 5,6,15,16	.1uf, 50V, CERAMIC
CCU10C-50	C 7,8,17,18	.1uf, 50V, CERAMIC
CCP101	C 9,10,19,20	100pf, CERAMIC
CEU151-35	C 21,22	150uf, 35V, EL
Semiconductors:		
UL85008	U 1,3	TLO72CP OP-AMP
UL85006	U 2,4	NE5534AN OP-AMP
Controls:		
VRP103	VR 1,4	10K, MULTITURN TYPE P
VRW203	VR 2,3,5,6	20K, MULTITURN TYPE W
Other:		
FB8002	FB 1,2,3,4,5,6	FERRITE BEADS

MTR-200 Metering/Interconnect Board
Parts List

BDI P/N	CKT DESIGNATION	VALUE/DESCRIPTION
Resistors:		
RM254701-2	R 1,2,3,4	4.7K, 1/4W, 2%
RM254701-2	R 8,9,10,11	4.7K, 1/4W, 2%
RM254701-2	R 5,12	4.7K, 1/4W, 2%
RM252201-2	R 6,13	2.2K, 1/4W, 2%
RM251301-2	R 7,14	1.3K, 1/4W, 2%
RM251002-2	R 17,18,19,20	10K, 1/4W, 2%
RM251001-2	R 21,22	1K, 1/4W, 2%
RM251002-2	R 29,31,32,35,37	10K, 1/4W, 2%
RM254702-2	R 15,16,28	33K, 1/4W, 2%
RM251002-2A	R 30 *	10K, 1/4W, 2%
RM251003-2	R 33,34	100K, 1/4W, 2%
RM252702-2	R 36,38	27K, 1/4W, 2%
Capacitors:		
CMP62	C 1,2,6	62pf, MICA
CCU10C-50	C 3,4,7,8	.1uf, 50V, CERAMIC
CCU10C-50	C 13,14,17,18	.1uf, 50V, CERAMIC
CMP201	C 5,15,16	200pf, MICA
CMP200	C 9,10	20pf, MICA
CEU47A-50	C 11,12,19,20	4.7uf, 50v, EL NP
Semiconductors:		
UL85008	U 1,2,3,4	TLO72CP OP-AMP
DS914	D 1,2,3,4,5,6,7,8	1N914 DIODE
Controls:		
VRP103	VR 1,2	10K, MULTITURN TYPE P
VRW503	VR 3,4 **	50K, MULTITURN TYPE W
VRW203	VR 5	20K, MULTITURN TYPE W
Other:		
FB8002	FB 1,2,3,4	FERRITE BEADS
XHDM10	P 1	DUAL 10 PIN HEADER
XHDM06	SENS	DUAL 6 PIN HEADER
XHDJ01		HEADER JUMPER
BCA20-01		RIBBON CABLE ASSY

* R30 IS A SERIES RC PAIR. RESISTOR IS 10K OHMS. CAPACITOR IS 1500pf MYLAR. THIS PAIR PROVIDES PREEMPHASIS FOR THE L-R METERING CIRCUIT.
** ON SOME UNITS COMMON MODE CONTROLS VR3 AND VR4 ARE REPLACED WITH 33K OHM 1/4W 2% RESISTORS. BDI P/N RM253302-2.

PCO-200 Oscilator/Switch Board
Parts List

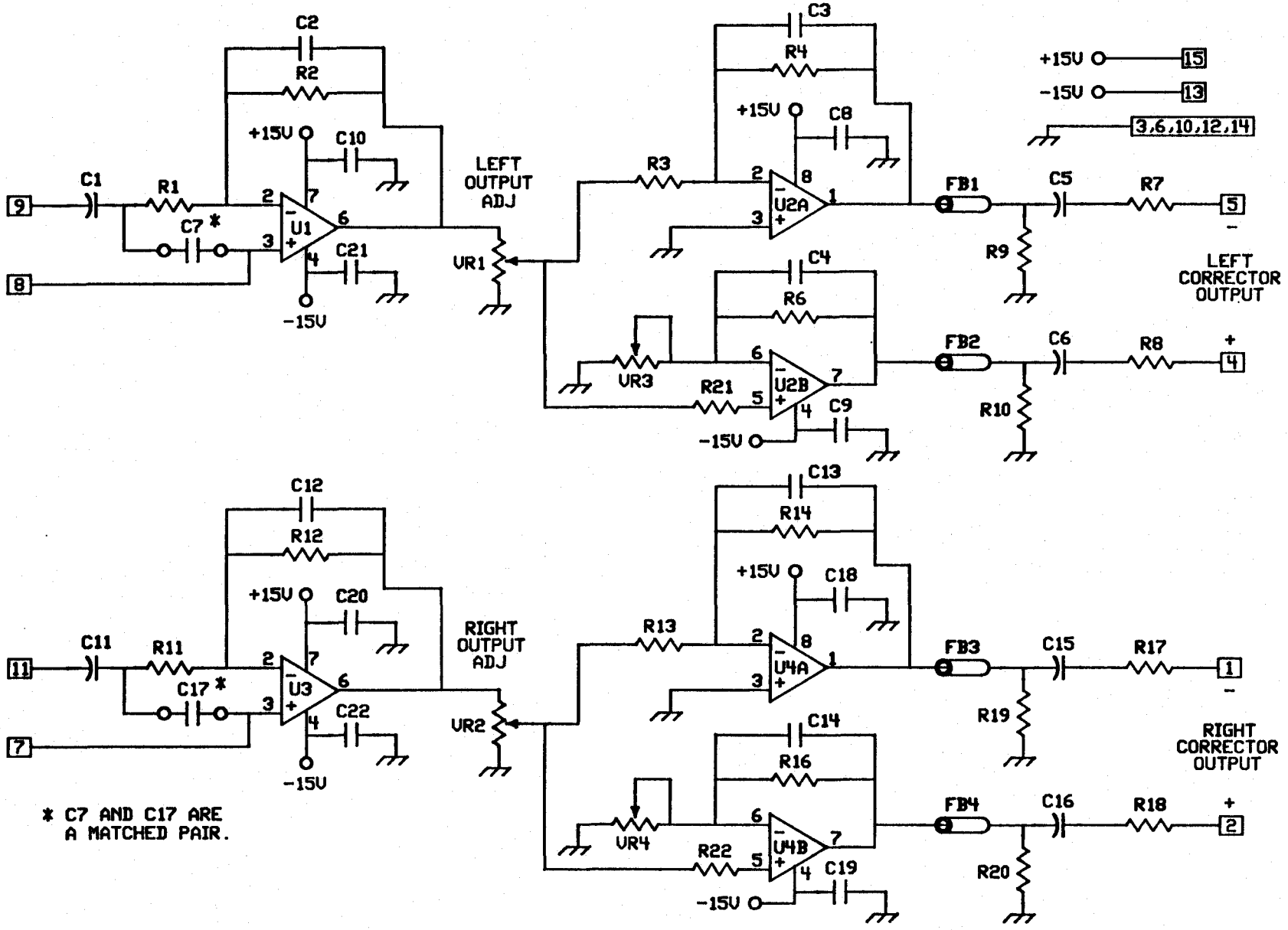
BDI P/N	CKT DESIGNATION	VALUE/DESCRIPTION
Resistors:		
RM251301-2	R 1,4	1.3K, 1/4W, 2%
RM251002-2	R 2,5	10K, 1/4W, 2%
RM251003-2	R 3,6,10,11	100K, 1/4W, 2%
RM253302-2	R 7,14	33K, 1/4W, 2%
RM251000-2	R 8	100, 1/4W, 2%
RM254701-2	R 9	4.7K, 1/4W, 2%
RF501001-2	R 12	1K, 1/4W, 2%
RM251004-2	R 13	1M, 1/4W, 2%
RF502002-2	R 15	20K, 1/4W, 2%
Capacitors:		
CFU10D	C 1,2,9	.01uf, MYLAR
CCU10C-50	C 3,6	.1uf, 50V, CERAMIC
CEU471-25	C 4,5	470uf, 25V, EL
CEU470-50NP	C 7	47uf, 50V, EL NP
CEU220-35	C 8	22uf, 35V, EL
Semiconductors:		
UL85007	U 1	NE5532N OP-AMP
FP5639	Q 1	2N5639 FET
DS914	D 1,2,3	1N914 DIODE
Controls:		
VRW103	VR 1	10K, MULTITURN TYPE W
VRW501	VR 2	500, MULTITURN TYPE W
VRW501	VR 3	10K, LINEAR A-B TYPE W
Other:		
XHDM10	P 1	DUAL 10 PIN HEADER
SPA206N	S 1,2	DPDT SWITCH
SPA206P	S 3	DPDT SWITCH (CTR OFF)
MV3	M 1,2	VU METER
KA1		KNOB (PHASE CONTROL)

BPS-218 Power Supply
Parts List

BDI P/N	CKT DESIGNATION	VALUE/DESCRIPTION
Resistors:		
RM251801-2	R 1,2	1.8K, 1/4W, 2%
Capacitors:		
CEU222-50	C 1,2	2200uf, 50V, EL SNAP MT
CEU151-35	C 3,4	150uf, 35V, EL
Semiconductors:		
Q7815-220	Q 1	7815 REGULATOR
Q7915-220	Q 2	7915 REGULATOR
DS914	D 1,2,3,4,5,6,9,10	1N4007 DIODE
DL4004	D 7,8	LED
Other:		
PEF1		POWER ENTRY MODULE
TT3401	T 1	TOROIDIAL POWER XFMR
PC1608		POWER CORD
ZAGX1	F1	FUSE - AGX 1A
ZAGC5A	F2	FUSE - 3AG .5A

PMB-200 Motherboard/Chassis
Parts List

BDI P/N	CKT DESIGNATION	VALUE/DESCRIPTION
XEC15D	EC 1,2,3,4	EDGE CONN 15 PIN DUAL .156 SPACING - PC MOUNT
XPC12	RP 1,2	REAR PANEL 12 POS CONN
XBNC59	SCOPE X,Y	REAR PANEL BNC CONN
M200		SERIES 200 CARD FRAME (Less front and rear panel)
MR-200		RACK MOUNT ADAPTER SET (Blk - 2RU/3.5in)
H200-A		FRONT/REAR PANEL SCREWS (8-32 x 3/8 Phil Hd)
H200-B		COVER SCREWS (6-32 x 3/8 Blk Phil Hd)
H200-C		REAR PANEL/PMB SCREWS (4-40 X 1/4 Phil Hd)
H200-D		5/8 IN. HEX STANDOFF (4-40 Threads)



APC-200 AUDIO PHASE CORRECTOR UBC-200 PHASE CORRECTOR/OUTPUT BOARD	DWG NO	REV	APPROVALS		DATE
	BDI-2105S	D	Drawn	FPB	9/10/87
			Checked	RCT	11/13/87

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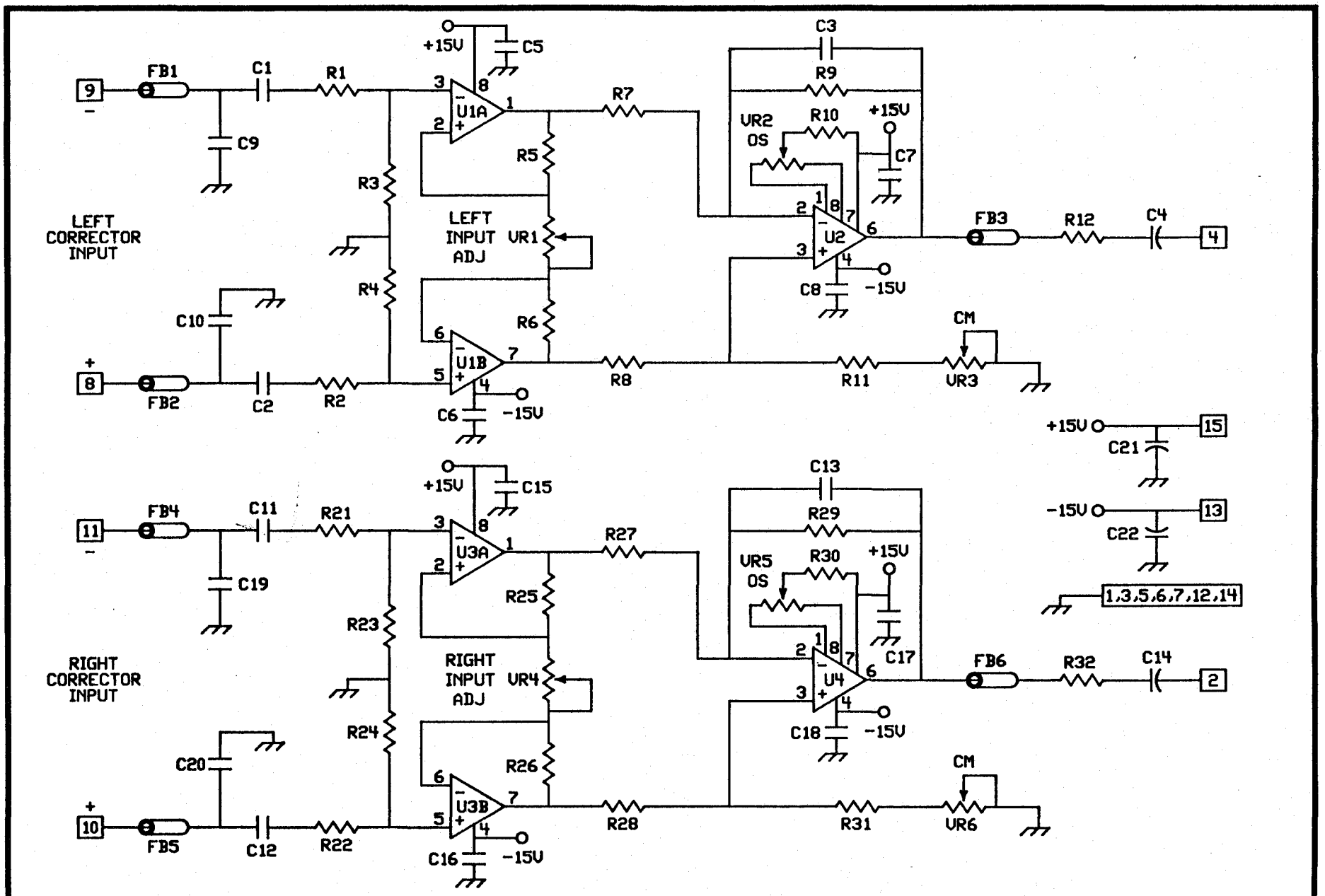

APC-200 AUDIO PHASE CORRECTOR ATF-200 ACTIVE TRANSFORMER BALANCED INPUT BOARD	DWG NO	REV	APPROVALS		DATE
	BDI-2106S	D	Drawn	FPB	9/25/87
			Checked	RCT	10/9/87

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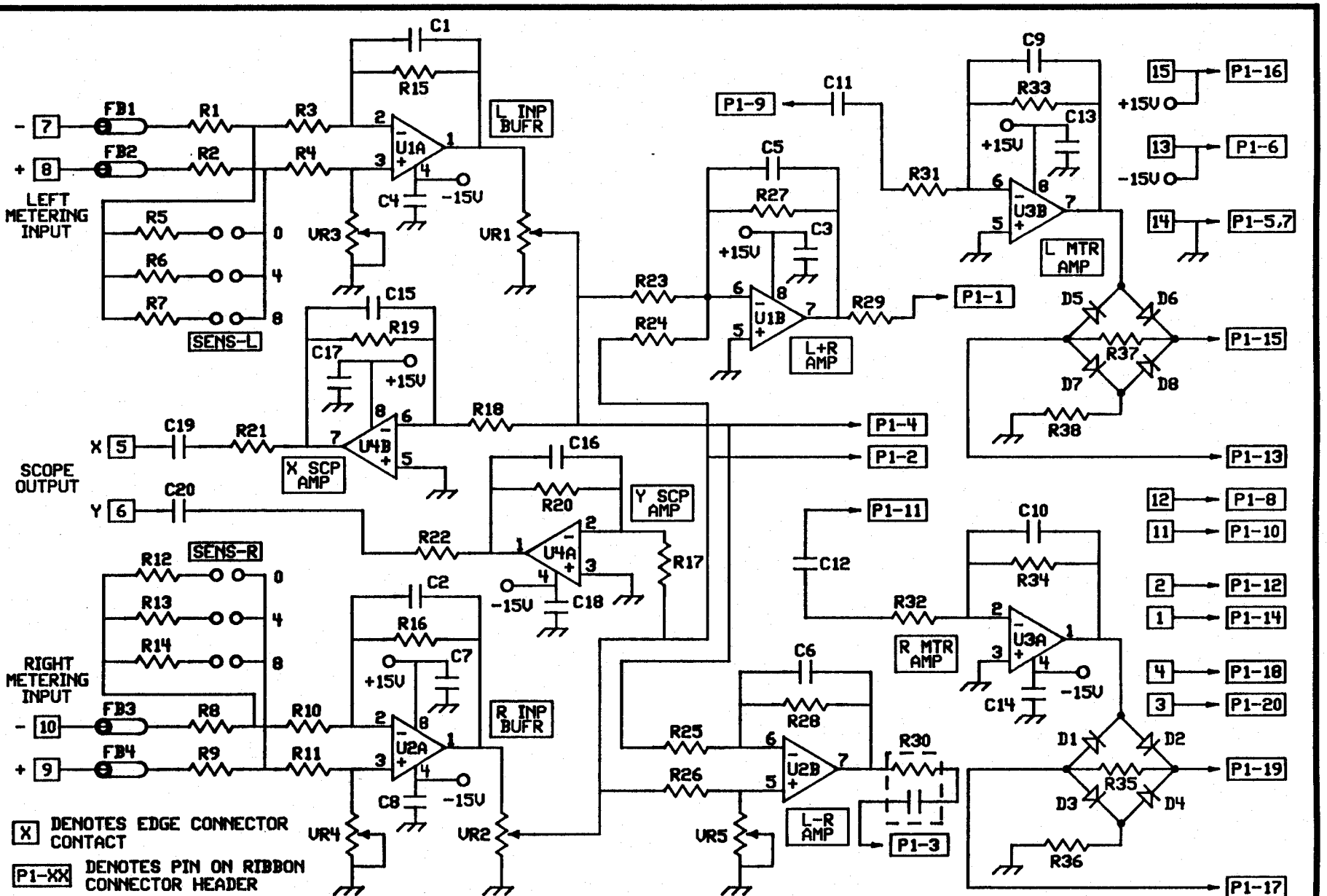

APC-200 AUDIO PHASE CORRECTOR MTR-200 METERING/INTERCONNECT BOARD	DWG NO	REV	APPROVALS		DATE
	BDI-2114S	B	Drawn	FPB	11/14/87
			Checked	RCT	11/15/87

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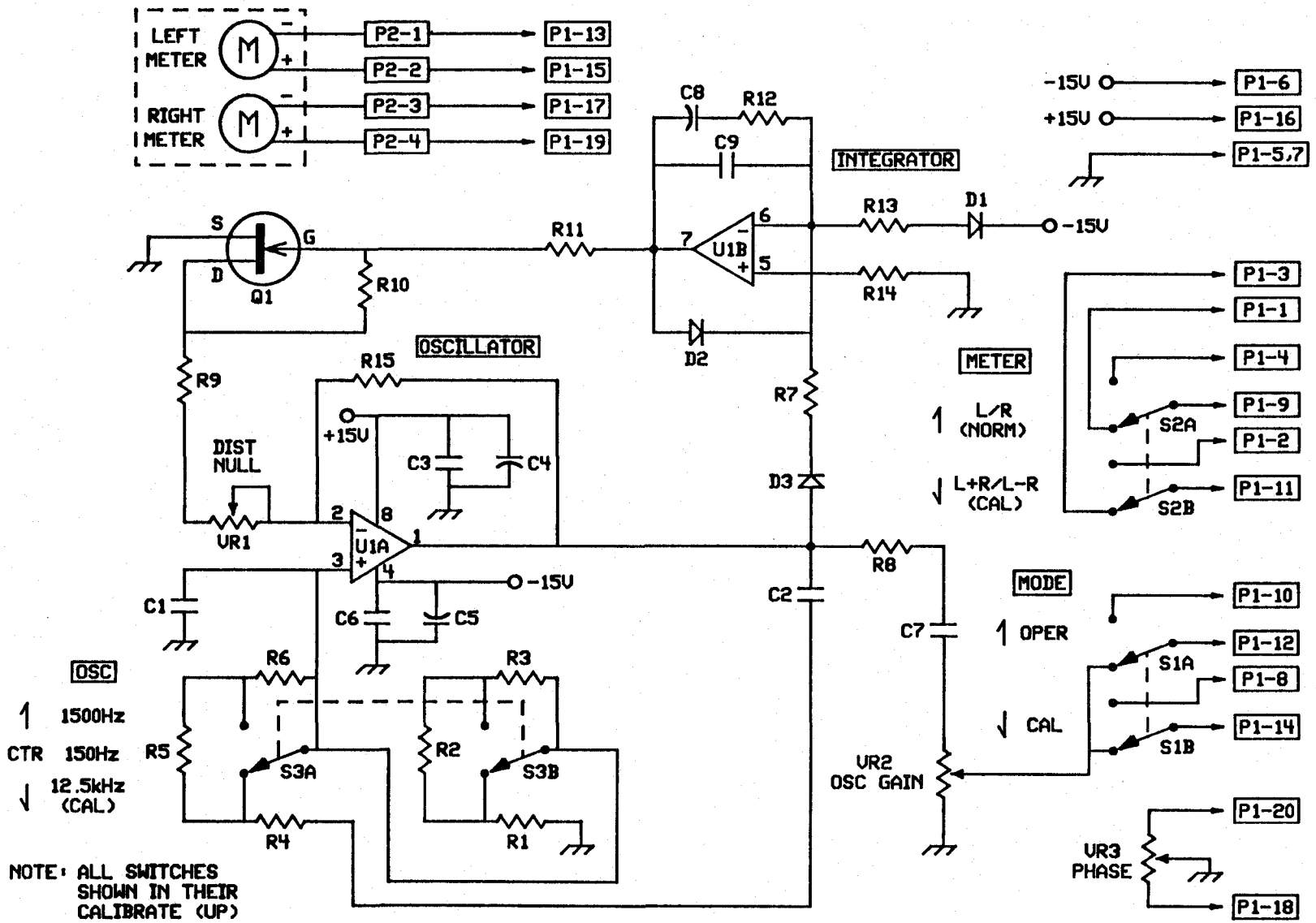

APC-200 AUDIO PHASE CORRECTOR PCO-200 OSCILLATOR/SWITCH BOARD	DWG NO	REV	APPROVALS		DATE
	BDI-2115S	C	Drawn	FPB	11/13/87
			Checked	RCT	11/14/87

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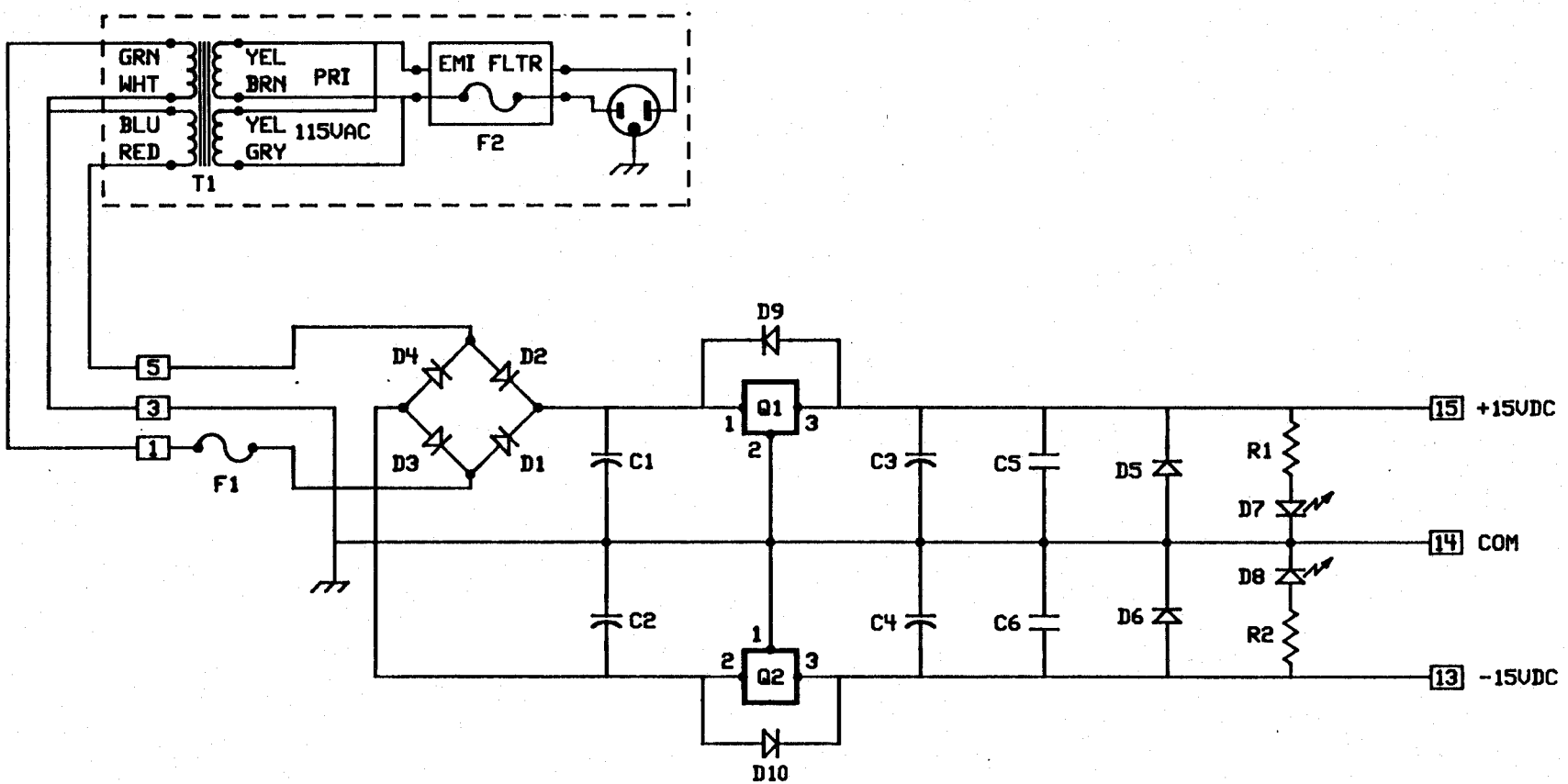

APC-200 AUDIO PHASE CORRECTOR BPS-215 POWER SUPPLY BOARD	DWG NO	REV	APPROVALS		DATE
	BDI-2109S	C	Drawn	FPB	8/12/87
			Checked	RCT	9/22/87

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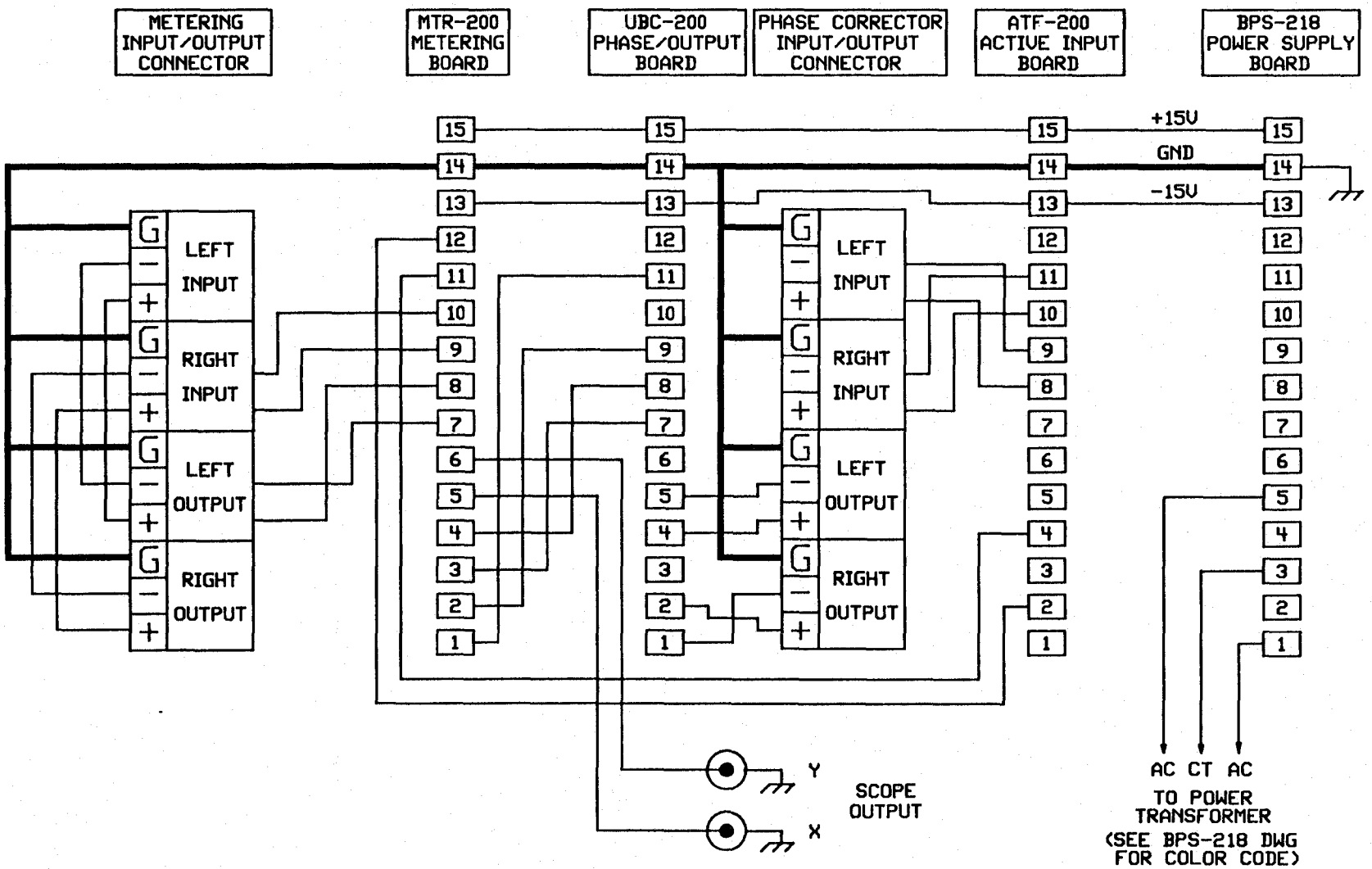

APC-200 AUDIO PHASE CORRECTOR PMB-200 MOTHERBOARD INTERCONNECTIONS	DWG NO	REV	APPROVALS		DATE
	BDI-2116S	B	Drawn	FPB	11/20/87
			Checked	RCT	11/23/87

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