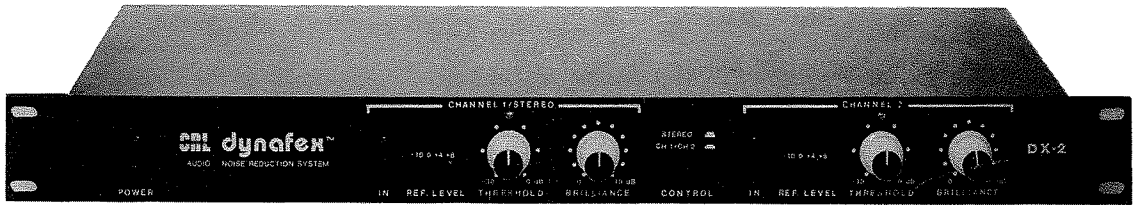
DYNAFEX DX-2
NOISE REDUCTION SYSTEM

INSTALLATION AND OPERATION MANUAL



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DX-2

DYNAFEX™

STEREO NOISE REDUCTION SYSTEM

INSTALLATION AND OPERATION MANUAL

PATENT PENDING

CIRCUIT
RESEARCH
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SECTION 1 - GENERAL

1.1 SAFETY INFORMATION

1.1.1 Definitions of Safety Symbols used on Equipment or in Manual.

This symbol used on the equipment is intended to alert the user to the presence of important operating and maintenance (servicing) instructions in the manual accompanying this audio product.

****
WARNING
****

The WARNING sign denotes a hazard. It calls attention to a procedure, practice, condition, or the like, which, if not correctly performed or adhered to, could result in damage to the unit.

CAUTION

The CAUTION sign denotes a precaution. It calls attention to an operating procedure, practice, condition or the like, which, if not correctly performed or adhered to, could result in the unit not performing properly.

NOTE

The NOTE sign denotes important information. It calls attention to procedure, practice, condition, or the like which is necessary to highlight.

1.1.2 IMPORTANT SAFEGUARDS

The following general safety precautions must be observed during all phases of operation, service, and repair of this equipment. Failure to comply with these precautions or with specific warnings in this manual violates safety standards of design, manufacture, and intended use of this equipment. Circuit Research Labs Inc. assumes no liability for the customer's failure to comply with these requirements.

READ ALL INSTRUCTIONS. All safety and operating instructions should be read before the equipment is operated.

GROUND AND POWER CONNECTIONS. To minimize shock hazard, this equipment must be connected to an electrical ground. Grounding is accomplished by proper use of the three-conductor AC power cable supplied with the equipment. The power cable must either be plugged into an approved three-contact electrical outlet or used with a three-contact to two-contact adapter with the grounding wire (green) firmly connected to an electrical ground at the power outlet. This equipment must only be operated from the type of AC line power source specified. See Section 2.2 for Power Line AC Voltage Selection.

TRANSIENT VOLTAGE PROTECTION. In areas where power fluctuations and voltage spikes are present on the AC power line additional protection may be necessary.

DO NOT OPERATE IN A EXPLOSIVE ATMOSPHERE. Do not operate this equipment in the presence of flammable gases or fumes. Operation of any electrical instrument in such an environment constitutes a definite safety hazard.

WATER AND MOISTURE. Do not operate this equipment near water or in areas with wet floors. Do not operate this equipment in high humidity atmosphere where condensation forms on the equipment.

ATTACHMENTS. Do not use attachments not recommended by the manufacturer.

VENTILATION. This equipment should never be placed near or over a heat register or other source of heated air. This equipment should not be placed in a built-in installation or rack unless proper ventilation is provided.

PARTS REPLACEMENT AND/OR MODIFICATION. The maintenance instructions in this manual are for use by qualified personnel only. To avoid electric shock do not perform any servicing other than that contained in this manual. Do not replace components with the power cable connected. Because of the danger of introducing additional hazards, to not install substitute parts or perform any unauthorized modification to this equipment.

1.2 INTRODUCTION

Circuit Research Labs. Inc. has developed the Dynafex (TM) noise reduction system to provide up to 30 dB of noise reduction. This single ended noise reduction system was developed to overcome the limitations of the traditional encode/decode process used in most systems. The Dynafex circuitry provides a much wider range of applications than most other systems. The DX-2 provides two channels of noise reduction, while allowing the user several control parameters to fine-tune the device to individual requirements.

The Dynafex circuitry uses a Circuit Research Labs. Inc. proprietary noise reduction integrated circuit to eliminate noise from most audio signals. The circuit incorporates dynamically variable bandwidth limiting and a unique type of downward expansion. Two types of noise reduction are provided simultaneously to obtain a greater amount of noise reduction than can be realized in other systems.

The psychoacoustic loss of high frequency content is the greatest shortcoming of systems using dynamic filtering. This is overcome by the addition of a downward expansion circuit. Side effects such as pumping and breathing that are

commonly found in gating or expander type systems are not evident in this system because dynamic filtering occurs prior to downward expansion.

DYNAMIC FILTER CIRCUITRY. This circuit analyzes the input signal and controls the bandwidth. Noise outside this bandwidth is simultaneously removed. Restriction of the signal bandwidth to that required by the input signal and its harmonics greatly reduces the perceived noise. Noise outside the selected bandpass is removed while noise within the band is masked by the signal present.

DOWNWARD EXPANSION CIRCUITRY. This circuit analyzes and responds to signal amplitude. The point at which downward expansion starts is selected by the user adjustable threshold level. As the input signal decreases below the threshold level, gain reduction occurs at an increasing rate. This technique greatly reduces audible noise in quiet musical passages and fade-outs where noise becomes more predominant by always keeping the noise floor below the program material.

USER FLEXIBILITY. Maximum user flexibility is provided by allowing the user to set-up the system to individual requirements. Two switches are provided to set up a reference level for each channel. Two threshold controls are provided to independently adjust the system to operate from the reference level to 30 dB below the reference level. Two brilliance controls are provided to allow the user to add up to 10 dB of high frequency information back into the audio signal path for each channel. This circuitry amplifies the usable portion of the upper frequency segment of the input signal before noise reduction occurs. For maximum flexibility, these three functions are controlled independently when the unit is in the CH1/CH2 mode or ganged when the unit is in the stereo mode.

The DX-2 provides the user with a dramatic improvement in the signal to noise ratio of most audio signals. This system may be utilized in many different applications, including live recording, broadcast production, disc mastering, tape duplication, public address sound systems, satellite communications, plus many more. The unique combination of circuitry found in the DX-2 makes this system ideal for your program processing.

1.3 WARRANTY

PRODUCT WARRANTY

Circuit Research Labs, Incorporated warrants its products to be free of defects in materials and/or workmanship. This warranty shall extend for a period of (1) year from the date the product was originally shipped to the user.

Circuit Research Labs' warranty does not apply to products that have been damaged due to and/or subjected to improper handling by shipping companies, negligence, accidents, improper use, or alterations not authorized by Circuit Research Labs, Incorporated.

THIS WARRANTY IS IN LIEU OF AND EXCLUDES ALL OTHER WARRANTIES, EXPRESSED OR IMPLIED. CIRCUIT RESEARCH LABS, INCORPORATED WILL NOT BE LIABLE FOR ANY INCIDENTAL OR CONSEQUENTIAL LOSS OR DAMAGE WHATSOEVER, WHETHER BASED UPON ALLEGATIONS OF NEGLIGENCE, BREACH OF WARRANTY, OR OTHERWISE. THIS DISCLAIMER OF INCIDENTAL OR CONSEQUENTIAL DAMAGES INCLUDES, BUT IS NOT LIMITED TO, PROPERTY DAMAGES, LOSS OF PROFITS, LOSS OF TIME OR OTHER LOSSES OR INCONVENIENCE RESULTING FROM ANY DEFECT IN THE MATERIAL OR WORKMANSHIP OF THIS PRODUCT OR ANY OTHER CONNECTION WITH THE PURCHASE, OPERATION OR USE OF THIS PRODUCT. (SOME STATES DO NOT ALLOW THE EXCLUSION OR LIMITATION OF INCIDENTAL OR CONSEQUENTIAL DAMAGES, SO THE ABOVE LIMITATION OR EXCLUSION MAY NOT APPLY TO YOU).

PRODUCT CHANGES

Circuit Research Labs Inc. reserves the right to change the published specifications of equipment at any time, and to furnish merchandise in accordance with current specifications. While many previously sold products are later upgraded by field bulletins, Circuit Research Labs Inc. reserves the right to do so without incurring any liability or obligations to modify or update any equipment previously sold.

1.4 DX-2 SPECIFICATIONS

INPUT	
(Ref. 0 dBm=0.775 VRMS)	
Type:	Active Balanced (Differential) (Transformers Optional)
Impedance:	>20K ohms balanced bridging >10K ohms Unbalanced
Termination:	Selectable 600 ohms
Level (nominal):	-10, 0, +4, +8 dBm
Level (maximum):	+20 dBm
OUTPUT	
Type:	Active Balanced (Transformers Optional)
Impedance:	<100 ohms Balanced <50 ohms Unbalanced
Level (Maximum):	+20 dBm
FREQUENCY RESPONSE:	20 Hz to 20 Khz; +/- 0.5 dB (0 dB Ref. at 400 Hz)
DISTORTION:	<0.1 % THD Typical(20 kHz BW)
S+N/N:	>90 dB (20 kHz bandwidth unweighted)
DYNAMIC RANGE:	>110 dB
PROCESSING TYPE:	Downward expansion and Bandwidth limiting
SEPARATION:	>65 dB; 20 Hz-20 kHz
NOISE REDUCTION:	Up to 30 dB
OPERATING TEMP RANGE:	32 to 122 degrees F 0 to 50 degrees C
POWER REQUIREMENTS:	100-130 or 200-250 VAC 50/60 Hz 5 VA
SHIPPING WEIGHT:	7 lbs
DIMENSIONS:	1.75 H x 19 W x 7 D (inches)

Product specifications are subject to changes without notice because of technology updates and product improvements.

SECTION 2 - INSTALLATION

2.1 GENERAL

The front panel of the DX-2 is pictured in Figure 2.1. The back panel is pictured in Figure 2.2.

****
WARNING
****

DO NOT PLUG IN THE DX-2 NOISE REDUCTION SYSTEM UNTIL THE POWER LINE SWITCH HAS BEEN CHECKED AND/OR SET FOR THE CORRECT AC POWER LINE VOLTAGE AS PER SECTION 2.2. IT IS IMPORTANT TO CAREFULLY FOLLOW THE PROCEDURES LISTED BELOW TO PROPERLY PREPARE THE DX-2 FOR OPERATION.

1. Set the power line switch as per Section 2.2

2. Set the front panel controls to the initial settings listed in Section 2.3.

3. Set the internal configuration as required for your system as per Section 2.4.

4. Connect the unit as per Section 2.5.

5. Verify operation of the DX-2 with normal program material, prior to putting the system into service.

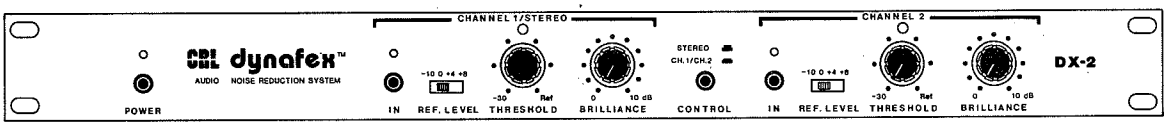


FIGURE 2-1 DX-2 FRONT PANEL

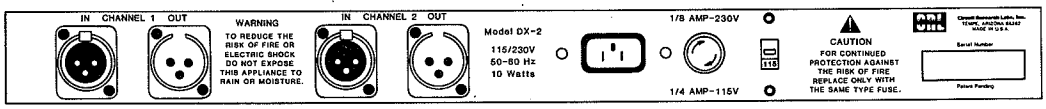
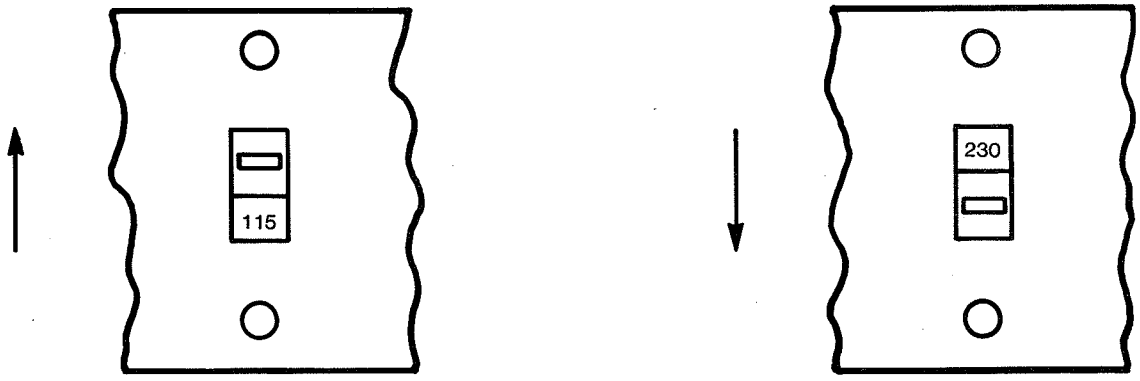


FIGURE 2-2 DX-2 BACK PANEL

2.2 POWER LINE AC VOLTAGE SELECTION

The DX-2 is equipped with a power line switch so that the unit can be operated in areas having various line voltage availabilities. The unit is shipped to USA destinations set-up for a line voltage of 100-130 VAC, using a 1/4 amp. fuse. To set-up the unit for 200-250 VAC line voltage see Figure 2.3 and follow the procedure below.

1. Disconnect the power cord.



100 to 130 VAC operation

200 to 250 VAC operation

FIGURE 2-3 LINE VOLTAGE SELECTION

2. Remove the fuse.

3. Move the switch to the correct position using a small screwdriver.

4. Select a fuse as listed below and insert the fuse in the fuse holder.
   100 to 130 VAC operation 1/4 amp., 250V rating
   200 to 250 VAC operation 1/8 amp., 250V rating
   (SEE CAUTION 2-1 FOR 200-250 VAC OPERATION)

5. Insert the line cord into the line cord receptacle.

CAUTION 2-1 Operation of the unit on 200-250 VAC will require replacement of the plug that is used to connect the unit to the AC line to conform to local codes.

2.3 INITIAL SET-UP

2.3.1 Initial Control Positions

Set the front panel controls as follows:

Power	Out (OFF)
In (Ch. 1)	Out (System Bypassed)
Ref. Level (Ch. 1)	0
Threshold (Ch. 1)	-30
Brilliance (Ch. 1)	0
Control	Out (Stereo)
IN (Ch. 2)	Out (System Bypassed)
Ref. Level (Ch. 2)	0
Threshold (Ch. 2)	-30
Brilliance (Ch. 2)	0

2.3.2 Quick Set-up

The following procedure is given to aid you in setting up the unit for general program requirments. It is recommended that you read the entire manual to become familiar with all of the capabilities of this system.

1. Verify that the unit is set for the correct AC line voltage. (See Section 2.2)

2. Connect two inputs and two outputs as per section 2.5.

3. Feed a line level program signal to both inputs on the unit. Monitor both outputs on the unit.

4. Set each "Threshold" control so that each green expansion LED only illuminates when the program material level is low enough so the noise level is audible. (For example, during fades and pauses in program material.)

5. Switch each channel in and out while comparing the sound. Adjust the "Brilliance" control as necessary for optimum high frequency content of the program material. Return the switches to the "IN" positions for normal operation.

NOTE: See SECTION 3.2 for a functional description of all controls on the DX-2.

2.4 INTERNAL JUMPERS

The DX-2 is equipped with internal jumpers to configure the unit to individual customer requirements. See Figure 2.4 for the location of these jumpers. (DO NOT adjust the controls R2 and R3 on the PCB at this time. See Section 5.2 for making this adjustment.) Set the jumpers as required for your individual system requirements.

JUMPER	FACTORY SET POSITION	FUNCTION OF JUMPER
J4	BAL	Output Mode (Channel 1) BAL Balanced Operation UNBAL Unbalanced Operation
J5	BAL	Output Mode (Channel 2) BAL Balanced Operation UNBAL Unbalanced Operation
J6	600	Input Impedance (Channel 1) 600 600 Ohms (Terminated) HI-Z High Impedance (Bridging)
J7	600	Input Impedance (Channel 2) 600 600 Ohms (Terminated) HI-Z High Impedance (Bridging)

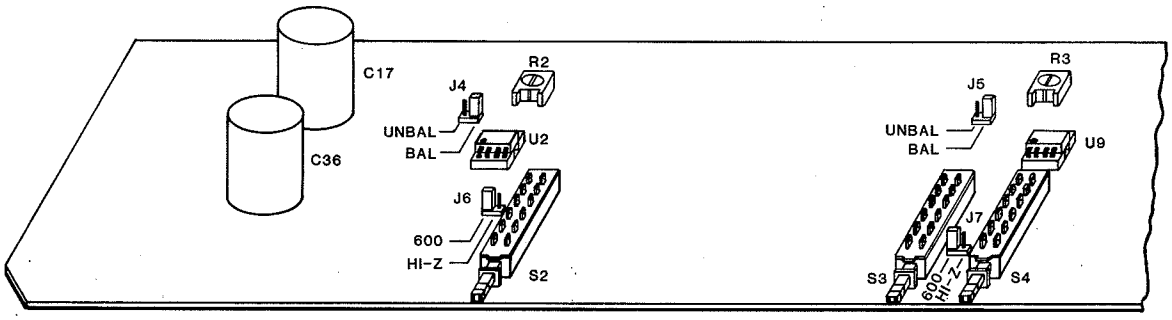


FIGURE 2-4 INTERNAL JUMPER AND CONTROL LOCATIONS

2.5 INTERCONNECTIONS

The DX-2 is designed to interface with many types of professional audio and broadcast systems. See Figure 2.5 for some typical applications of this unit within your overall system. This unit may be wired for either balanced or unbalanced operation. The input and output of the DX-2 is normally configured for transformerless operation. Input and output transformers are available as an option.

2.5.1 BALANCED LINE CONNECTIONS

Most broadcast equipment is designed for balanced line operation. Connect as per FIGURE 2.6. A two conductor shielded cable is used (Belden #8451 or equivalent) with a red and black twisted pair inside a shielded covering. Connect the red lead (+) to pin 2, the black lead (-) to pin 3, and the shield (Gnd.) to pin 1. THE CABLE SHIELD SHOULD BE CONNECTED TO GROUND AT THE SOURCE END ONLY TO PREVENT GROUND LOOPS.

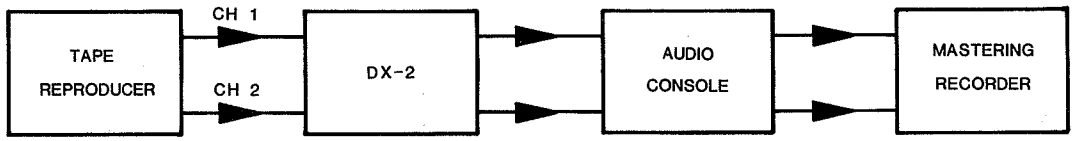
2.5.2 UNBALANCED LINE CONNECTIONS

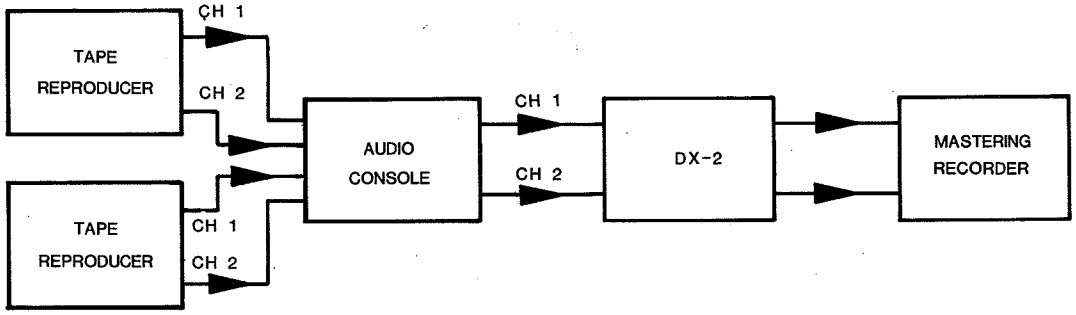
Connect the equipment EXACTLY as shown in FIGURE 2.7 for operation with unbalanced line equipment. Jumpers J4, and J5 should be placed in the "UNBAL" position as per Section 2.4

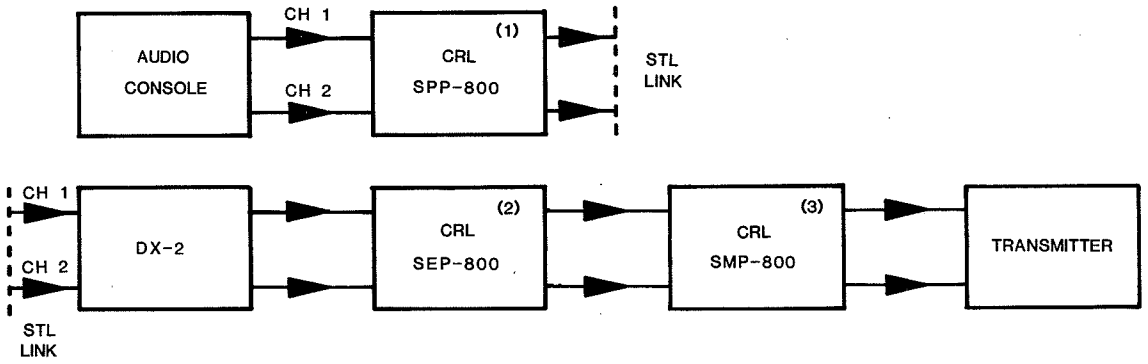
NOTE: When using the unbalanced INPUT connection ONLY, the shield is connected to the ground terminal and the minus (-) terminal is connected to the ground by a jumper wire as shown.

CAUTION: WHEN USING AN UNBALANCED OUTPUT THE SHIELDS MUST BE CONNECTED TO THE GROUND TERMINALS. THE MINUS (-) OUTPUT TERMINAL MUST BE LEFT UNCONNECTED.

This equipment does not use transformers in the standard configuration and accidental grounding of the minus (-) OUTPUT terminal will short half of the output circuit.







NOTES

(1) or equivalent audio preparation processor (AGC)

(2) or equivalent multi-band compressor

(3) or equivalent peak modulation controller or limiter

FIGURE 2-5 TYPICAL SYSTEM CONFIGURATIONS

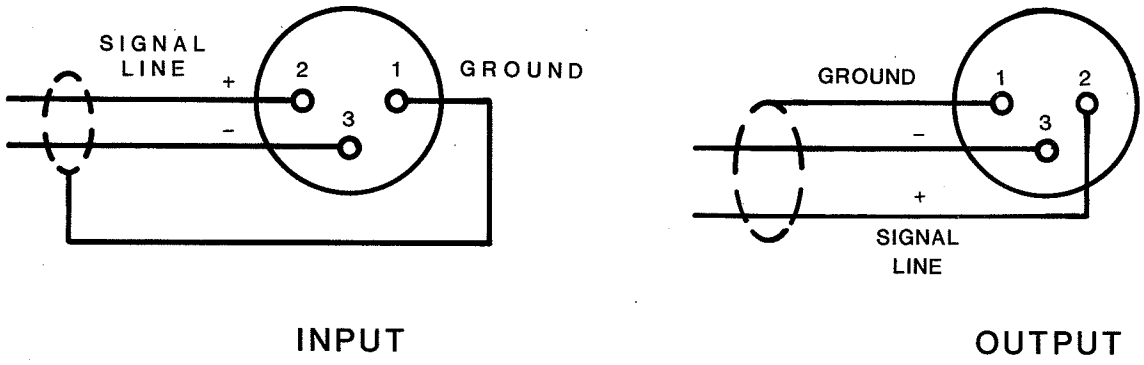


FIGURE 2-6 BALANCED LINE CONNECTIONS

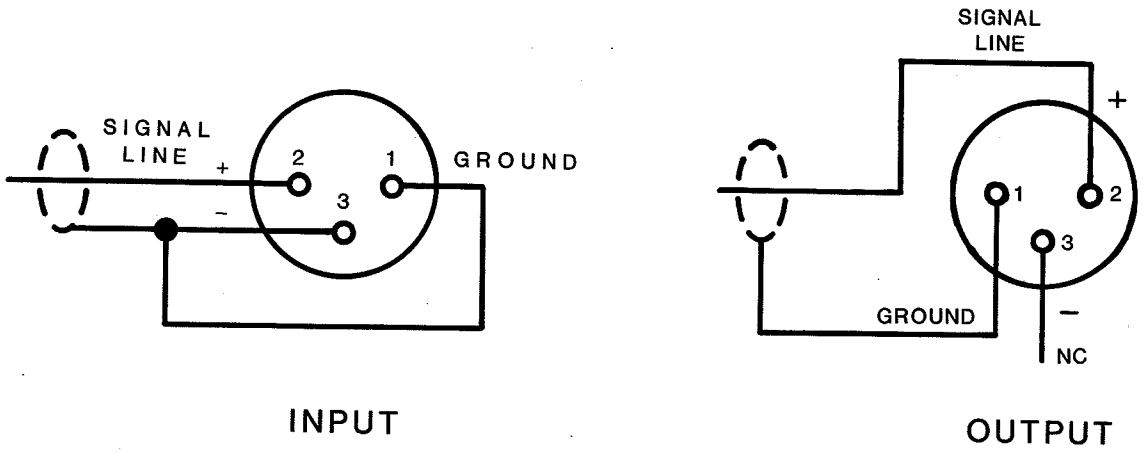


FIGURE 2-7 UNBALANCED LINE CONNECTIONS

2.6 FINAL ADJUSTMENTS

In order to adjust this processor for optimum performance you must be thoroughly familiar with the operation of each control function. See SECTION 3.2 for a description of each control function. After completing the adjustment procedures, special attention should be given to achieving the final desired sound. Since the DX-2 is used in a signal path with other equipment, consideration must be given to all the settings in the audio path in the complete system.

When the sound doesn`t seem quite right coming out of the unit it may be because the input signal is distorted. Many hours of adjusting audio processing equipment have been spent trying to adjust "out" a signal fault which was coming into the processor unit.

Under normal operating conditions, the DX-2 will not cause any audible audio distortions such as THD, IM, etc. If these sounds are perceived, it will usually be caused by miss-alignment of other processing devices in the system, an over driven amplifier, or impedance matching problems between equipment.

SECTION 3 - OPERATING INSTRUCTIONS

3.1 GENERAL

This purpose of this section is to describe the operation of the controls and indicators on the DX-2. A thorough understanding of this section will enable the user to get the most from this system. Each control and indicator will be described as to its operation and purpose.

3.2 FRONT PANEL CONTROLS AND INDICATORS

POWER. This switch turns the AC power to the system "on" or "off." The switch action is: push in for "on," push again for "off" (out position). A red LED, located above the switch, is used as a power on indicator.

IN. A switch is provided for each channel. These switches connect the unit "in" or "out" of the overall system. In the "IN" position the noise reduction circuitry of the DYNFEX is operational. In the "OUT" position all electronic circuitry is bypassed. The switch action is: push in for "in", push again for "out". A red LED, located above the switch is used to indicate when the unit is "IN."

REFERENCE LEVEL. A switch is provided for each channel. These switches are provided to set up the reference level. Proper reference level selection is necessary to achieve maximum noise reduction without undesirable side effects. Lower settings of this switch will increase the bandwidth of the output signal. If the level of the input signal is unknown, set the unit as follows:

-10	Consumer Equipment, typically unbalanced line (Hi-Fi equipment, etc.)
0	Professional Equipment, balanced or unbalanced line (See manual pertaining to equipment used)
+4	Professional Equipment, typically balanced line (See manual pertaining to equipment used)
+8	Broadcast Equipment, balanced line (Radio/TV Stations and Production Houses)

Some applications may require operating the DX-2 with the reference level switch at a level below your actual reference level but never above. If the input signal level is 0 dBm, the switch should be in the "0" position for maximum noise reduction. Selecting the -10 position will cause the circuit's level detectors to think the input signal is 10 dB higher. This delays the onset of expansion, and results in an output signal with a wider bandwidth. If you operate the Dynafex with the switch at a higher level than your reference level, the detectors sense a lower input level resulting in premature expansion and reduced bandwidth.

THRESHOLD. A control is provided for each channel. The threshold controls determine the level at which the dynamic expansion circuitry operates. The control is continuously variable from the setting of the reference level switch (Fully CW) to 30 dB below this setting (Fully CCW). Significant expansion does not occur until the input signal level is approximately 10 dB or more below the threshold. For input signal levels slightly below the threshold the actual expansion ratio is very small. As the signal decreases substantially below the threshold (approaching its noise floor), the expansion ratio increases rapidly to prevent audible noise from appearing in the output, as shown in Figure 3-1. A green LED is mounted above each threshold control. They illuminate when expansion is occuring. When the LED is off the input signal is above the threshold level and no expansion is occuring. This LED is not a peak level indicator. In normal operation the LED will be on only intermittently during pauses, low signal levels, or between recorded tracks. The following is a recommended list of initial settings:

RANGE BELOW REF. LEVEL	TYPE OF PROGRAM MATERIAL
0 to -15	Highly compressed program material with minimum dynamic range.
-15 to -20	General program material
-20 to -30	Wide dynamic range program material (music)

BRILLIANCE. This control is continuously variable and determines the amount of high frequency information that is added to the original signal. The control action starts at 3 kHz with a small signal gain and continues to 20 kHz with a maximum of 10 dB signal gain at 20 kHz. See Figure 3-2 for typical curves. The brilliance control is used to compensate for the psychoacoustic effect of bandwidth limiting. The removal of the upper bandwidth to reduce noise may seem to result in a slight loss of high frequency information, even though no loss occurs. This control compensates for this effect by adding high frequency information to enhance the high frequency response of the program material. The control may be set to any desired position, however higher than necessary settings may result in a slight increase in audible noise on poor quality source material.

CONTROL. This control selects "STEREO" or "CH 1/CH 2" operation. In the "STEREO" position the reference level switch, threshold control and brilliance control located to the left of the CONTROL switch, control both channels simultaneously. In the "CH 1/CH 2" position all controls operate independently.

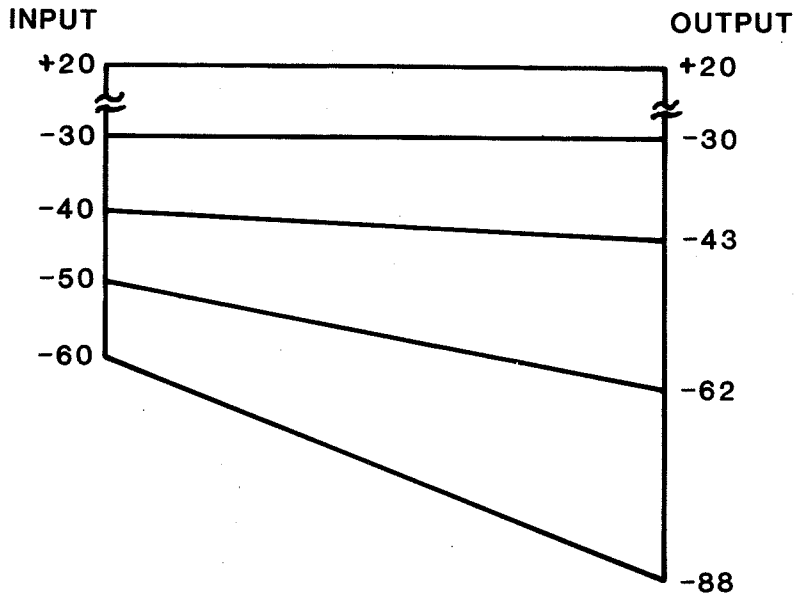


FIGURE 3-1 DYNAFEX EXPANDER CHARACTERISTICS
(At -30 dB Threshold Level)

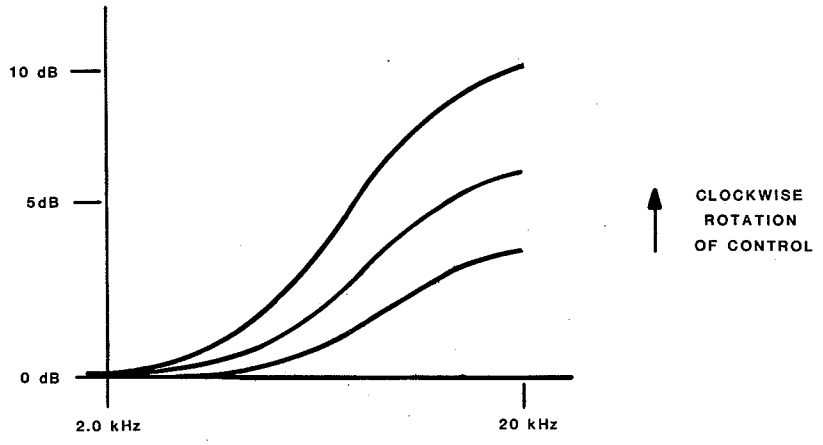


FIGURE 3-2 BRILLIANCE CONTROL TYPICAL OPERATING CURVES

3.3 CONTROL INTERACTION. The Reference Level switch and Threshold control settings interact with each other. To understand how they interact, see the list below which shows the Threshold control range for different reference level switch settings.

REF. LEVEL SWITCH SETTING	THRESHOLD CONTROL RANGE
-10	-10 to -40 dB
0	0 to -30 dB
+4	+4 to -26 dB
+8	+8 to -22 dB

3.4 REAR PANEL CONTROLS. The only control on the rear panel is the line voltage selection switch. See Section 2.2 for a complete description on its use.

SECTION 4 - THEORY OF OPERATION

4.1 GENERAL

This section contains theory of operation for the DX-2. A detailed block diagram of the Noise Reduction System is found in the Appendix. A schematic drawing and PCB parts placement drawing are also found in the Appendix.

4.2 POWER SUPPLY

AC power is supplied to the unit via a standard 3 conductor power cable which plugs into a connector on the back panel of the unit. AC power is applied to power transformer T1 through fuse, F1, and power switch, S1. The power transformer has dual windings to permit powering from either 100 to 130 VAC or 200 to 250 VAC. Switch S7 selects the transformer winding combination required for each input voltage.

******* See Section 2.2 for instructions on selecting the AC
WARNING input voltage. Operation on 200-250 VAC will also
******* require replacement of the AC plug and fuse.

Power transformer T1 provides the operating voltages for the full wave bridge rectifier consisting of CR3, CR4, CR7, and CR8. The pulsating DC voltage is filtered by C17 and C36. The DC voltage from the rectifier is fed to voltage regulators U1 and U14 which develop the two regulated outputs of +15 VDC and -15 VDC. CR1, CR2, CR5, & CR6 are employed as protection diodes. The circuitry is well bypassed on each supply line through the use of several decoupling capacitor sets.

4.3 SIGNAL CIRCUITRY

The DX-2 accepts either balanced or unbalanced audio inputs. See Section 2.5 for interconnection information. The signal is traced through the unit using Channel 1 with the control switch set to the "CH 1/CH 2" position. The same theory of operation applies to channel 2. The parts for channel 2 are referenced in (). Functions common to both channels are explained separately. The signals requiring noise reduction are applied to the input connectors and then fed to the I/O (Input-Output) PCBs. The signals pass through an RFI (Radio Frequency Interference) filter network on the respective PCB.

The signals are then coupled to the main PCB via connector J2 (J3). They are routed through S2 (S4) which either sends the signals directly to the output connector or to the audio input and termination jumper circuitry when the switch is in the "IN" position. When S2 (S4) are in the "IN" position an LED status indicator above the respective switch on the front panel is illuminated. Each signal travels through its

respective input attenuator network consisting of R60 to R63 (R-70 to R73). The signal exits U8a (U13a) and is split into a control signal and an audio signal. The control signal is fed to the control reference amplifier U5a (U4a & U11a). The audio signal is fed to the brilliance amplifier U7/U8b (U12/U13b).

U5a (U4a & U11a) and its associated circuitry establishes a reference level. The reference level is determined by a feedback resistor selected by the "Ref. Level" switch, S6 (S5). The reference level signal is fed to the VCF Reference high pass filter, U5b (U11b), and the VCA control input (pin 14) on the noise reduction chip. U5b (U11b) act as a high pass reference filter for the VCF control input on the noise reduction chip. Figure 4-1 shows the operating range of the VCF circuit.

The audio signal is fed to the brilliance amplifier U7/U8b (U12/U13b). A front panel brilliance control R98(R100) is provided for each channel. This control determines the amount of high frequency information added to the original signal in U7(U12). The output signal is applied to pin 6 of the noise reduction chip, U7(U12). The VCF output of each noise reduction chip appears at pin 5. An external 4.7K risistor on each chip connects the VCF output to the VCA input, pin 10. This resistor makes the maximum VCF output voltage swing compatible with the VCA input level.

The VCA audio output signal emerges from U3 (U10), pin 11. The signal is amplified by U2a (U9a). A PCB mounted trimmer, R2 (R3), in the feedback path of U2a (U9a) sets the system for unity gain. U2b (U9b) acts as an inverter/buffer. The output of U2b (U9b) is used for unbalanced operation or the second half of the balanced line output. The gain of U2b (U9b) is selected via a PCB jumper for balanced or unbalanced operation. The audio output signal is fed to the output switch via S2c,d (S4c,d).

The operation of the noise reduction chip, U3 (U10), is controlled externally by several circuits which operate independently from the input signal. The operation of these circuits is described below.

THRESHOLD CIRCUITRY OPERATION. The voltage necessary for operation of the front panel threshold control is developed across a 5.1 volt zener diode, Z1. The output voltage of this control is fed to buffer amplifier, U6a (U4b) through threshold control R97(R99). The output of the buffer amplifier is then fed to the threshold detector input (pin 12) on the noise reduction chip, U3 (U10). This circuitry develops a control voltage which operates the detector threshold in the noise reduction chip.

RELEASE CIRCUITRY OPERATION. The release time constant is determined by C19 (C21). The capacitor is connected to U3 (U10), pin 13.

The threshold circuit determines the start of the expansion cycle. The release circuitry determines the end of the expansion cycle. Transistor Q1 (Q2), connected to U3 (U10), turns on a front panel LED indicator for the respective channel during the time expansion is occurring.

VCF CUTOFF FREQUENCY CIRCUITRY OPERATION. A capacitor from pin 7 of U3 (U10) to ground determines the VCF cutoff frequency. The frequency is fixed at a value chosen for optimum noise reduction.

VCF ATTACK AND DECAY TIME CONSTANT CIRCUITRY OPERATION. An RC network from U3 (U10) pin 3 to ground determines the expander attack and decay time.

STEREO OPERATION. Stereo operation is selected using the "Control" switch, S3. In the stereo position the reference level switch S6, the brilliance control R96, and the threshold control R97, (located to the left of the "Control" switch), control both channels simultaneously. When in stereo operation, both "IN" switches operate independently. The stereo mode is intended for operation with stereo programming when the left and right channels are correlated.

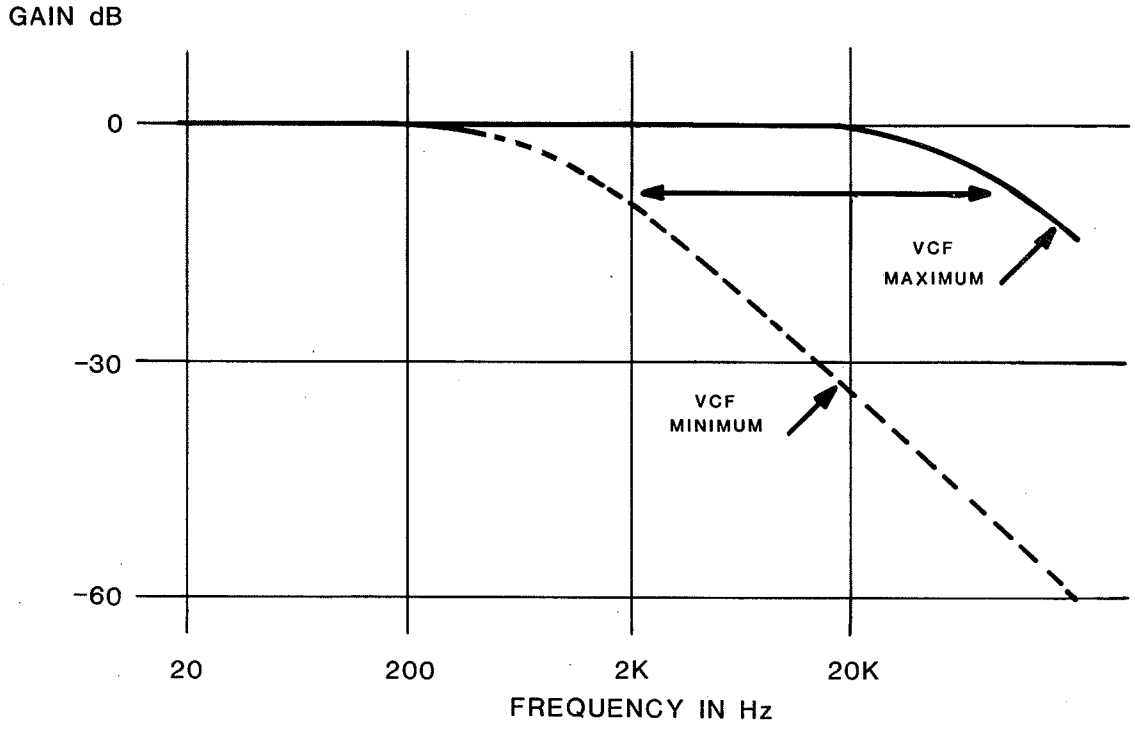


Figure 4-1 VCF CIRCUIT TYPICAL OPERATING RANGE

SECTION 5 - MAINTENANCE

5.1 PREVENTIVE MAINTENANCE

A minimum amount of preventive maintenance is required to insure optimum performance of this unit. If you do not have a regular preventive maintenance schedule in existence, Circuit Research Labs suggests the following check list be performed on a periodic basis.

1. Check to insure that the input and output cables are properly plugged-in to their receptacles. Inspect the cables to make sure they are in good physical condition. (FRAYED WIRES CAN SHORT OUT, CAUSING INTERMITTENT FAILURES).

2. Check to insure that all knobs, switches, and indicators are secure and in good working condition. If they become physically loose, tighten them to prevent intermittent operating results.

3. Remove any dirt or dust around the unit. This may not immediately affect the unit, but long term exposure will.

4. Keep all liquids away from the unit. Accidental spillage can result in serious damage to the unit and will void the warranty.

5.2 ALIGNMENT

The DX-2 is designed so that a minimum amount of alignment is necessary. One PCB mounted alignment control is used for each channel. These controls are aligned at the factory for unity gain. No normal or routine re-alignment is required. Each control is used to adjust the output level of the respective channel so that it equals the input level for that channel. When any of the integrated circuits are changed the unit should be checked for unity gain and re-aligned as required. See Figure 5-1 for the equpment set-up for this alignment.

DX-2 CONTROL SETTINGS FOR ALIGNMENT

CONTROL	SETTING
Power	ON
In (Ch. 1/Stereo)	IN
Ref. Level (Ch. 1)	-10
Threshold (Ch. 1)	-30
Brilliance (Ch. 1)	0
Control (Ch. 1)	OUT (Stereo)
IN (Ch. 2)	IN
Ref. Level (Ch. 2)	-10
Threshold (Ch. 2)	-30
Brilliance (Ch. 2)	0

DX-2 PCB JUMPER POSITIONS FOR ALIGNMENT

See Section 2.4 for factory set positions and Figure 2-4 for jumper locations

JUMPER	DESIGNATOR	POSITION
Input Termination (Ch. 1)	J6	600
Input Termination (Ch. 2)	J7	600
Output Mode (Ch. 1)	J4	Bal
Output Mode (Ch. 2)	J5	Bal

TEST EQUIPMENT REQUIRED (or Equivalent)*

MODEL	MFG.	NOTES
AG-51	Potomac	Audio Generator (Set the output switch to L+R)
IX-51	Potomac	Input transformer (Set to the 600 Ohm position)
AA-51	Potomac	Audio Analyzer (Set the input switch to R or L as required)

*All test equipment must be properly calibrated.

ALIGNMENT PROCEDURE

1. Set-up the equipment as shown in Figure 5-1. Channel 1 and Channel 2 are tested separately.

2. Feed a 1.0 kHz signal at 0 dBm to channel 1's input.

3. Verify that the output level of channel 1 is 0 dBm with the "IN" switch in the "OUT" position.

4. Move the "IN" switch to the "IN" position. Set Unity Gain PCB trimmer (R2) so that the output level is 0 dBm.

5. Repeat the above procedure for channel 2 using the channel 2 inputs and outputs. Adjust R3 for channel 2.

6. This concludes the DX-2 alignment.

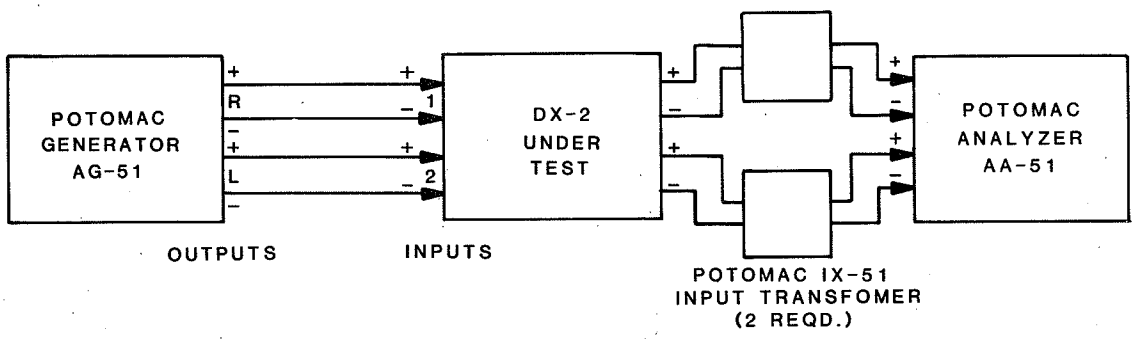


FIGURE 5-1 EQUIPMENT SET-UP FOR ALIGNMENT AND TROUBLESHOOTING

5.3 TROUBLESHOOTING

5.3.1 GENERAL

When trouble is reported with this equipment never assume that the DX-2 is at fault. In many cases the trouble is with other equipment used in combination with the DX-2. It is recommended that you write down the control settings you normally use with this equipment. Before troubleshooting the equipment you should verify that the DX-2 is properly set-up.

The items listed below should be checked before troubleshooting the DX-2.

1. Check for input and output levels causing overloads to the equipment under test or the equipment following it. Make certain any additional equipment which may be connected to the unit is not being over-driven.

2. Check for failures in monitoring or other test equipment if measurements are erratic. Strong RF fields can make some test equipment give strange results. Poor equipment grounds and incorrect grounding of balanced line interconnects will cause problems that are not faults within the DX-2. It is a good idea to use an oscilloscope to verify your testing.

3. Since this is audio equipment, don't be afraid to use your ears. LISTEN to each unit of the equipment while they are inactual operation. A pair of good quality, 600 ohm or higher headphones can be used to "bridge" across the inputs and outputs. Listening can quickly locate a bad unit or clear a suspected unit.

5.3.2 Suggested Component Checks

This section lists typical failure conditions followed by suggested components that could cause that failure mode.

	SYMPTOM	PROBABLE CAUSE
1.	Power Indicator not illuminated	Check AC power to unit Fuse, F1 Switches, S1, S7 Transformer, T1 Power indicator LED, LS1
2.	Fuse repeatedly blows:	Rect. Diodes, CR3, CR4, CR7, CR8 Protection Diodes, CR1, CR2, CR5, CR6 Filter Capacitors, C17, C36 Regulator IC's, U1, U14 Signal IC's, U3, U10, U2, U9, U8, U13

CAUTION Verify that the power supply output voltages are correct. They should be +15 VDC (TP8) and -15 VDC (TP14), +/- 0.6 VDC.

3.	Audio output missing or low:	Verify input audio signal is present and at correct level for both channels Verify audio output present with "IN" switch in the "OUT" position - check both channels Perform alignment procedure in Section 5.2 Check TP8 for +15 VDC and TP14 for -15 VDC
	(Channel 1 only)	IC's, U2, U3, U7, U8
	(Channel 2 only)	IC's, U9, U10, U12, U13
4.	Threshold control circuitry inoperative or erratic	IC's, U4, U6 Zener Diode, Z1 Potentiometers, R97, R99
5.	Frequency response rolloff and/or reduced bandwidth	IC's, U3, U4, U5, U10, U11
6.	Brilliance control circuitry inoperative or erratic	IC's, U7, U12, U13 Potentiometers, R98, R100
7.	Channel 2 controls inoperative	Check "Control" switch See Section 4

8.	Output inbalance	Jumpers, J4, J5 IC's, U2, U9
9.	Expansion indicators don't light	IC's, U3, U10 Transistors, Q1, Q2 LED indicators defective LS3, LS5

5.4 FACTORY SERVICE

In the event this unit must be returned to the factory for repair, IN or OUT of warranty, Circuit Research Labs requires that a RETURN AUTHORIZATION (RA) NUMBER be obtained from the CUSTOMER SERVICE department. Call CRL prior to shipment at 602-438-0888 for this number or the equipment will be returned to you without being serviced. In order to insure prompt service, the following information must also be included with the returned unit:

1. The return authorization number CLEARLY MARKED ON THE OUTSIDE of the shipping container. (See example below)

2. Description of trouble which includes:
   A. The symptom description
   B. The unit control settings when the trouble was detected
   C. A short description of the facility in which the unit is used, for example: Radio station (AM or FM), recording studio, etc.

3. Approximate date of purchase and the serial number of the unit - This will aid in the determination of billing for warranty or out of warranty repairs.

   All repairs must be shipped PRE-PAID via United Parcel Service when shipped in the USA to:

   Circuit Research Labs, Inc.
   2522 W. Geneva Drive
   Tempe, Arizona 85282 USA
   Att: CUSTOMER SERVICE
   RA #_____

6.1 DX-2 PARTS LIST

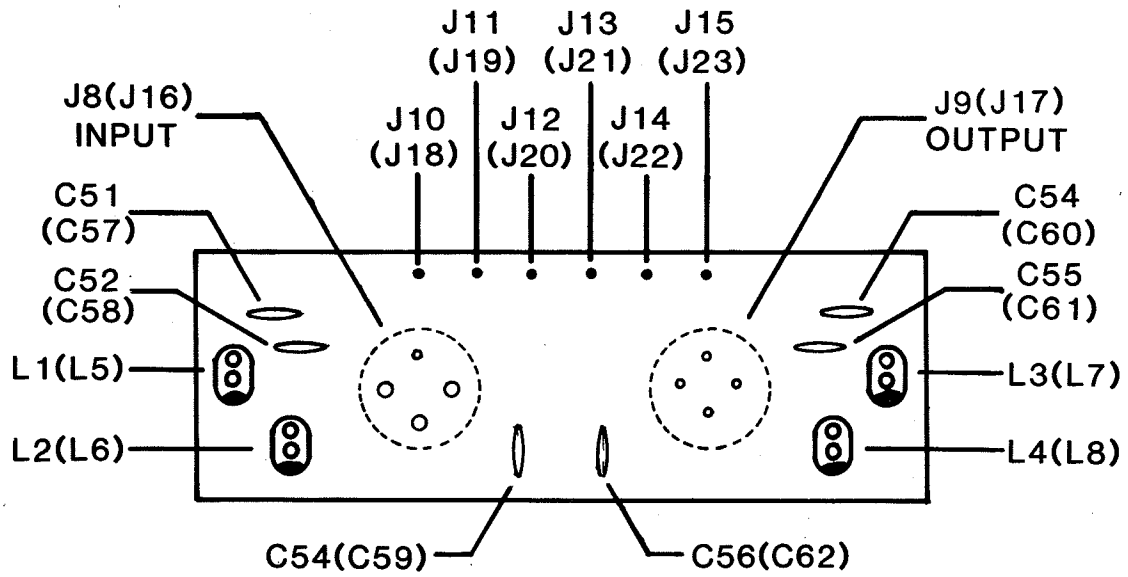
DESIG.	DESCRIPTION	CRL P/N
	PC BOARD A5500	13977
C-1	CAP,FXD,CER MONO .1UF	11945
C-2	CAP,FXD,ALUM,10UF,20%,25V	11970
C-3	CAP,FXD,ALUM,NON POL,100UF,20%,25	11985
C-4	CAP,FXD,CER,MONO,.1UF	11945
C-5	CAP,FXD,ALUM,10UF,20%,25V	11970
C-6	CAP,FXD,CER,MONO .1UF	11945
C-7	CAP,FXD,ALUM,10UF,20%,25V	11970
C-8	CAP,FXD,ALUM,NON POL,100UF,20%,25V	11985
C-9	CAP,FXD,CER,MONO,.1UF	11945
C-10	CAP,FXD,ALUM,10UF,20%25V	11970
C-11	CAP,FXD,TANT22UF,20%,25V	12300
C-12	CAP,FXD,STK FILM,.0047UF,5%,400V	12235
C-13	CAP,FXD,STK FILM,.0047UF,5%,400V	12235
C-14	CAP,FXD,STK FILM,.0047UF,5%,400V	12235
C-15	CAP,FXD,STK FILM.22UF,5%,63V	12260
C-16	CAP,FXD,STK FILM.22UF,5%,63V	12260
C-17	CAP,FXD,ALUM,1000UF,50V	11995
C-18	CAP,FXD,CER,47PF,10%,1KV	11955
C-19	CAP,FXD,TANT,10UF,20%,25V	12295
C-20	CAP,FXD,CER,47PF,10%,1KV	11955
C-21	CAP,FXD,TANT,10UF,20%,25V	12295
C-22	CAP,FXD,POLYPROP,680PF,2.5%,160V	12165
C-23	CAP,FXD,STK FILM,.0047UF,5%,400V	12235
C-24	CAP,FXD,STK FILM,.22UF,5%,63V	12260
C-25	CAP,FXD.STK FILM,.01UF,5%,250V	12225
C-26	CAP,FXD,STK FILM,.01UF,50%,250V	12225
C-27	CAP,FXD,TANT,22UF,20%,25V	12300
C-28	CAP,FXD,CER,47PF,10%,1KV	11955
C-29	CAP,FXD,CER,47PF,10%,1KV	11955
C-30	CAP,FXD,CER,47PF,10%,1KV	11955
C-31	CAP,FXD,STK FILM,.47UF,5%,63V	12285
C-32	CAP,FXD,STK FILM,.22UF,5%,63V	12260
C-33	CAP,FXD,STK FILM,.47UF,5%,63V	12285
C-34	CAP,FXD,ALUM,NONPOL,100UF,20%,25V	11985
C-35	CAP,FXD,POLYPROP,680PF,2.5%,16V	12165
C-36	CAP,FXD,ALUM,1000UF,20%,50V	11995
C-37	CAP,FXD,CER,MONO,.1UF	11945
C-38	CAP,FXD,ALUM,10UF,20%,25V	11970
C-39	CAP,FXD,CER,MONO,.1UF	11945
C-40	CAP,FXD,ALUM,10UF,20%,25V	11970
C-41	CAP,FXD,CER,MONO,.1UF	11945
C-42	CAP,FXD,ALUM,10UF,20%,25V	11970
C-43	CAP,FXD,CER,MONO,.1UF	11945
C-44	CAP,FXD,ALUM,10UF,20%,25V	11970
C-45	CAP,FXD,NONPOL,100UF,20%,25V	11985
C-46	CAP,FXD,TANT,2.2UF,20%,25V	12290
C-47	CAP,FXD,ALUM,NONPOL,10UF,50V	11976
C-48	CAP,FXD,ALUM,NONPOL,10UF,50V	11976
C-49	CAP,FXD,ALUM,NONPOL,10UF,50V	11976
C-50	CAP,FXD,ALUM,NONPOL,10UF,50V	11976

DESIG.	DESCRIPTION	CRL P/N
CR-1	DIO,SILI,1A,50V,1N4001	12800
CR-2	DIO,SILI,1A,50V,1N4001	12800
CR-3	DIO,SILI,1A,50V,1N4001	12800
CR-4	DIO,SILI,1A,50V,1N4001	12800
CR-5	DIO,SILI,1A,50V,1N4001	12800
CR-6	DIO,SILI,1A,50V,1N4001	12800
CR-7	DIO,SILI,1A,50V,1N4001	12800
CR-8	DIO,SILI,1A,50V,1N4001	12800
J-1	CONN,MALE .1564 PIN	12705
J-2	CONN,MALE .156, 6 PIN	12707
J-3	CONN,MALE .156, 6 PIN	12707
P-4	CONN,FEM,MINI-JUMPER	12660
J-4	CONN,MALE,MINI, 4 PIN	12710
P-5	CONN,FEM,MINI-JUMPER	12660
J-5	CONN,MALE,MINI, 4 PIN	12710
P-6	CONN,FEM,MINI-JUMPER	12660
J-6	CONN,MALE,MINI, 4 PIN	12710
P-7	CONN,FEM,MINI-JUMPER	12660
J-7	CONN,MALE,MINI, 4 PIN	12710
	CONN,FEM,MINI, 4 PIN	12645
	CONN,FEM,MINI, 6 PIN	12647
Q-1	TRANSISTOR,SILI,SIGNL,PNP,2N4125	15980
Q-2	TRANSISTOR,SILI,SIGNL,PNP,2N4125	15980
	RESISTORS IN OHMS, FIXED METAL FILM	
R-1	3.32K,1/4W,1%	14650
R-4	22.1,1/4W,1%	14510
R-5	36.5K,1/4W,1%	14740
R-6	47.5K,1/4W,1%	14850
R-7	7.5K,1/4W,1%	14990
R-8	1MEG,1/4W1%	14485
R-9	100K,1/4W,1%	14180
R-10	7.5K 1/4W 1%	14990
R-11	10K 1/4W 1%	14150
R-12	10K 1/4W 1%	14150
R-13	10K 1/4W 1%	14150
R-14	4.02K 1/4W 1%	17290
R-15	2K 1/4W 1%	17270
R-16	36.5K 1/4W 1%	14740
R-17	7.5K 1/4W 1%	14990
R-18	1.5MEG,1/4W 1%	14072
R-19	100K 1/4W 1%	14180
R-20	27.4K 1/4W 1%	14600
R-21	100K 1/4W 1%	14180
R-22	7.5K 1/4W 1%	14990
R-23	10K 1/4W 1%	14150
R-24	10K 1/4W 1%	14150
R-25	10K 1/4W 1%	14150
R-26	4.02K 1/4W 1%	17290
R-27	2K 1/4W 1%	17270
R-28	4.02K 1/4.1%	17290
R-29	2.0K 1/4W 1%	17270
R-30	604 1/4W 1%	14910
R-31	150K 1/4W 1%	14310

DESIG.	DESCRIPTIONN	CRL P/N
R-32	1.5MEG 1/4W 1%	14072
R-33	100K 1/4W 1%	14180
R-34	27.4K 1/4W 1%	14600
R-35	10K 1/4W 1%	14150
R-36	10K 1/4W 1%	14150
R-37	22.1 1/4W 1%	14510
R-38	4.02K 1/4W 1%	17290
R-39	4.02K 1/4W 1%	17290
R-40	2K 1/4 1%	17270
R-41	22.1 1/4W 1%	14510
R-42	604 1/4W 1%	14910
R-43	47.5K 1/4W 1%	14850
R-44	150K 1/4W 1%	14310
R-45	4.75K 1/4W 1%	14810
R-46	47.5K 1/4W 1%	14850
R-47	10K 1/4W 1%	14150
R-48	10K 1/4W 1%	14150
R-49	22.1 1/4W 1%	14510
R-50	4.02K 1/4W 1%	17290
R-51	100K 1/4W 1%	14180
R-52	15K 1/4W 1%	14290
R-53	1.5MEG 1/4W 1%	14072
R-54	4.75K 1/4W 1%	14810
R-55	47.5K 1/4W 1%	14850
R-56	10K 1/4W 1%	14150
R-57	1MEG 1/4W 1%	14070
R-58	1MEG 1/4W 1%	14070
R-59	10K 1/4W 1%	14150
R-60	10K 1/4W 1%	14150
R-61	10K 1/4W 1%	14150
R-62	10K 1/4W 1%	14150
R-63	10K 1/4W 1%	14150
R-64	604 1/4W 1%	14910
R-65	100K 1/4W 1%	14180
R-66	1.5MEG 1/4W 1%	14072
R-67	15K 1/4W 1%	14290
R-68	1MEG 1/4W 1%	14070
R-69	10K 1/4W 1%	14150
R-70	10K 1/4W 1%	14150
R-71	10K 1/4W 1%	14150
R-72	10K 1/4W 1%	14150
R-73	10K 1/4W 1%	14150
R-74	1.5K 1/4W 1%	14110
R-75	604 1/4W 1%	14910
R-76	1.5K 1/4W 1%	14110
R-77	402 1/4W 1%	14790
R-78	31.6K 1/4W 1%	14680
R-79	10K 1/4W 1%	14150
R-80	31.6K 1/4W 1%	14680
R-81	10K 1/4W 1%	14150
R-82	6.19K 1/4W 1%	14880
R-83	3.92K 1/4W 1%	14665
R-84	6.19K 1/4W 1%	14880
R-85	3.92K 1/4W 1%	14665

DESIC.	DESCRIPTION	CRL P/N
R-86	604 1/4W 1%	14910
R-87	1.5K 1/4W 1%	14110
R-88	10K 1/4W 1%	14150
R-89	402 1/4W 1%	14790
R-90	402 1/4W 1%	14790
R-91	31.6K 1/4W 1%	14680
R-92	10K 1/4W 1%	14150
R-93	6.19K 1/4W 1%	14880
R-94	3.92K 1/4W 1%	14665
R-95	10K 1/4W 1%	14150
R-96	604 1/4W 1%	14910
R-97	POTENTIOMETER,10K	15225
R-98	POTENTIOMETER,DUAL,10K	15227
R-99	POTENTIOMETER,10K	15225
R-2	POTENTIOMETER,20K	15185
R-3	POTENTIOMETER,20K	15185
R100	POTENTIOMETER,10K	15225
SW-1	SWITCH,2PDT,PUSH	15600
SW-2	SWITCH,4PDT,PUSH	15610
SW-3	SWITCH,4PDT,PUSH	15610
SW-4	SWITCH,4PDT,PUSH	15610
SW-5	SWITCH,2P4T,SLIDE	15630
SW-6	SWITCH,4P4T,SLIDE	15620
TP-xx	CONNNECTOR (QUAN. 16)	12740
U-1	REGULATOR POS. VA7815C	14030
	HEATSINK,6073B	13155
	HARDWARE,NUT,4.40X1/4 NUT HEX	13190
	HARDWARE,INSUL SIL PAD	13240
	HARDWARE,INSUL COLLOR	13245
	HARDWARE,SCREW,4.40X3/8 SLOT	13300
U-2	IC,LIN,DUAL OP AMP,NE5532N	13610
U-3	IC,NOISE RED,DYNAFEX,CRL-2200	13666
U-4	IC,LIN,DUAL OP AMP,TL072CP	13590
U-5	IC,LIN,DUAL OP AMP,TL072CP	13590
U-6	IC,LIN,DUAL OP AMP,TL072CP	13590
U-7	IC,LIN,DUAL OP AMP,TL072CP	13590
U-8	IC,LIN,DUAL OP AMP,TL072CP	13590
U-9	IC,LIN,DUAL OP AMP,NE5532N	13610
U-10	IC,NOISE RED,DYNAFEX,CRL-2200	13666
U-11	IC,LIN DUAL OP AMP,TL072CP	13590
U-12	IC,LIN DUAL OP AMP,TL072CP	13590
U-13	IC,LIN DUAL OP AMP,TL072CP	13590
U-14	REGULATOR,NEG.,UA7915C	14035
	HEATSINK	13155
	HARDWARE,4.40X1/4"NUT HEX	13190
	HARDWARE,INSUL SIL PAD	13240
	HARDWARE,INSUL COLLOR	13245
	HARDWARE,SCREW,4.40X3/8" SLOT	13300
	HARDWARE,STANDOFF (Quan. 5)	13205
	HARDWARE,NYLON,SWITCH CAP (Quan. 4)	13395
	SOCKET,DIP,16 PIN (Quan. 2)	15350
	SOCKET,DIP,8 PIN (Quan. 10)	15380
Z-1	REG,ZENER 5.1V,5%,1N751A	14005

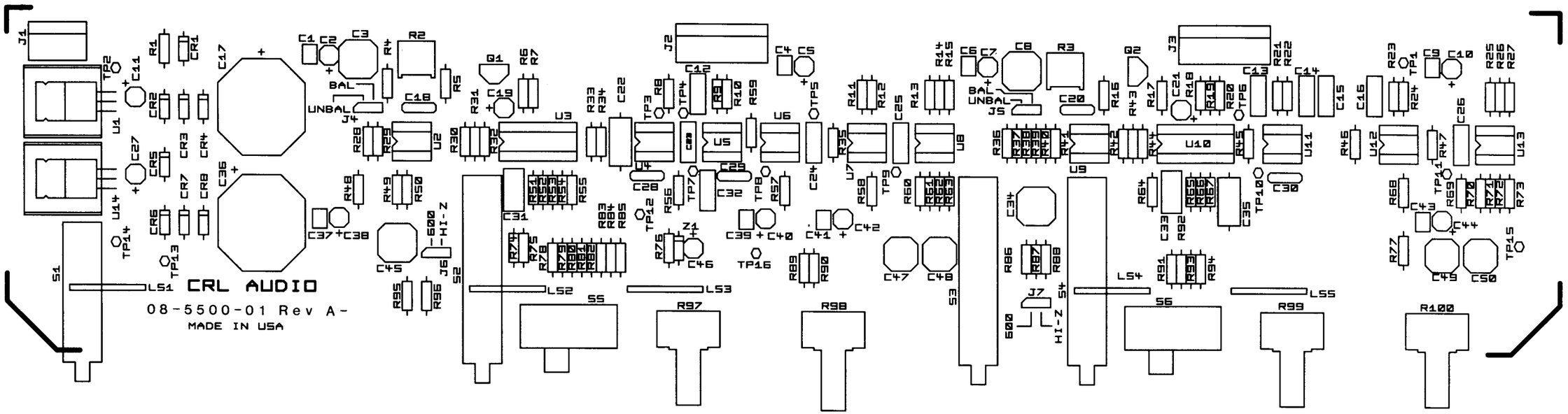
DESIG.	DESCRIPTION	CRL P/N
LS-X	PC BOARD A5001 (Quan. 3)	13972
	LED,RED,T-1, MV5074C	13685
	"F" POST (Quan. 3)	12715
LS-X	PC BOARD A5001 (Quan. 2)	13972
	LED,GREEN,T-1 3/4,MV5453	13672
	"F" POST (Quan. 3)	12715
	CHASSIS DX-2	12335
	XLR,MALE,CONN (Quan. 2)	12709
	XLR,FEMALE,CONN (Quan. 2)	12649
	HARDWARE,SCREW,4.40X3/8 (Quan. 10)	13305
	HARDWARE,SCREW,6.32X1/4 (Quan. 8)	13325
	HARDWARE,SCREW,4.40X1/4 Quan. 3)	13307
	.187,BLACK,HOLE PLUG (Quan 4)	13230
	6MM,PUSH ON KNOB,GRAY (Quan. 4)	13262
	PUSH ON KNOB,CAP,BLACK (Quan. 4)	13265
	HARDWARE,NUT,6.32X1/4 (Quan. 4)	13200
	HDWR,LCKWASH,INT,TOOTH #6, (Quan. 3)	13270
	LID,DX-1,DX-2	13745
	FRONT PANEL DX-2	12825
	SOCKET,AC INPUT	16640
	SOCKET,FUSE PANEL	16630
	FUSE,1/8 AMP SLO BLO	13042
	SWITCH,POWER SELECT	15590
	ASSY,14586,XFMR	80890-WO
	ASSY,PC BOARD,A5010 (Quan. 2)	80880-WO
	ASSY,HARNESS,DYNAFEX (Quan. 2)	80900-WO
	ASSY,PC BOARD,A5500	80840-WO
	A.C.LINE CORD	16435
	STANDOFF,NYLON,1.125 X 0.25	13225
	INSULATOR,NOMEX 2.3 X 3.5	13247
	INSULATOR,NOMEX,4.625 X 3.275	13248
	BOX,SHIPPING	15230
	BOX,INSERT (Quan. 2)	15250
	BOX,INSERT	15275
	MANUAL	10145
	PC BOARD A5010 (Quan. 2)	13975
Jxx	CONN,MINI TUB,.062X.328IN (Quan. 6)	12740
C51(C57)	CAP,FXD,CER,47PF,1KV,DISC	11955
C52(C58)	CAP,FXD,CER,47PF,1KV,DISC	11955
C54(C60)	CAP,FXD,CER,47PF,1KV,DISC	11955
C55(C61)	CAP,FXD,CER,47PF,1KV,DISC	11955
C53(C59)	CAP,FXD,CER,.01UF,DISC	11965
C56(C62)	CAP,FXD,CER,.01UF,DISC	11965
L1(L5)	COIL,FXD,68.0UH,10%	12565
L2(L6)	COIL,FXD,68.0UH,10%	12565
L3(L7)	COIL,FXD,68.0UH,10%	12565
L4(L8)	COIL,FXD,68.0UH,10%	12565



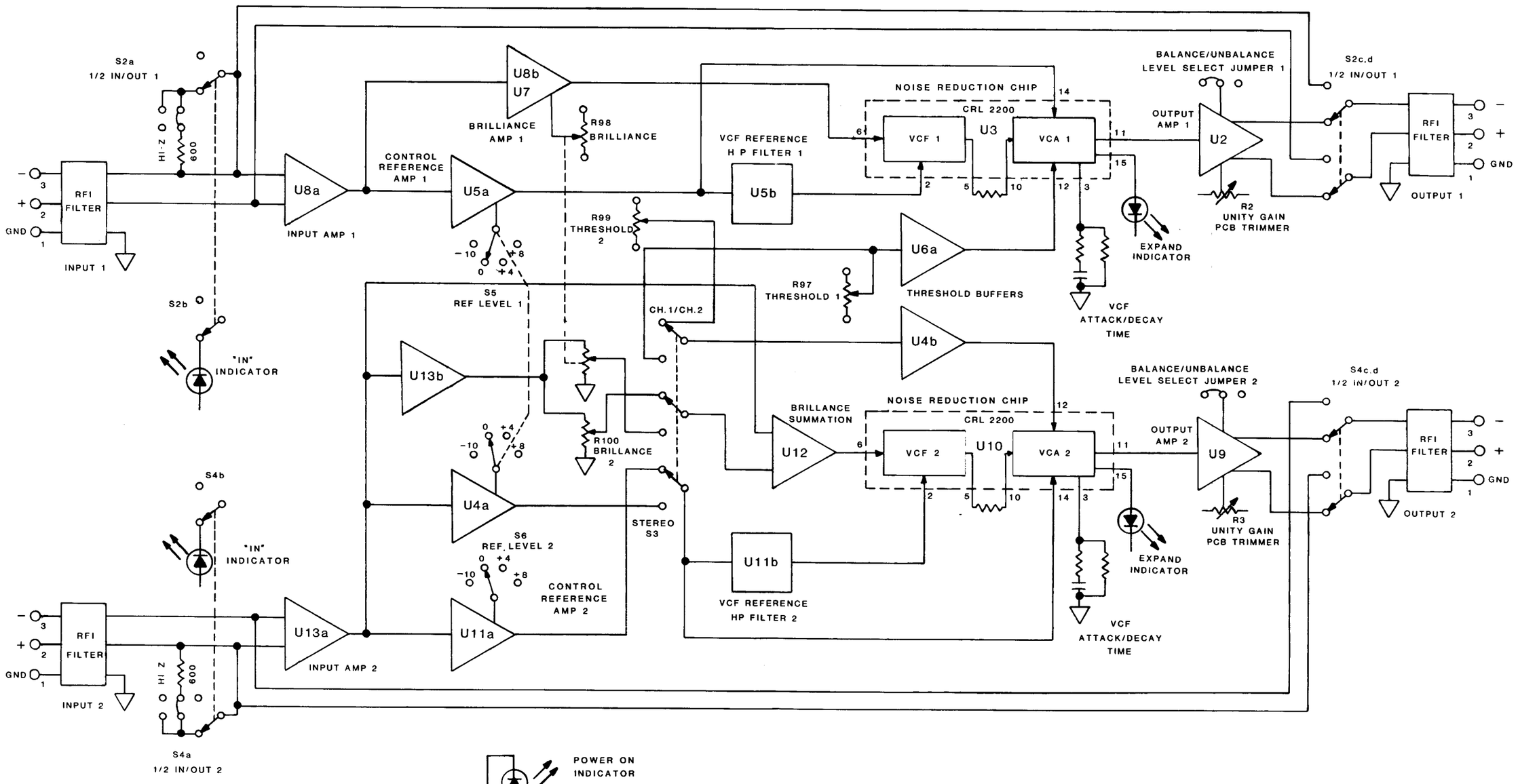
COMPONENT SIDE

(CHANNEL 2 COMPONENTS SHOWN IN PARENTHESIS)

CRL Circuit Research Labs, Inc.		
TITLE	DX-2 INPUT/OUTPUT PCB	
DWG.NO.	08-5500-02	REV A-1
MODEL TYPE	DX-2	SHEET 1 OF 1



Circuit Research Labs, Inc.		
TITLE	DX-2 PCB	
DWG.NO.	08-5500-01	REV A-1
MODEL TYPE	DX-2	SHEET 1 OF 1



Circuit Research Labs, Inc.	
TITLE: DX-2 BLOCK DIAGRAM	
DWG NO: 21-5500-01	REV A-1
MODEL TYPE: DX-2	SHEET 1 OF 1

COMPONENT DESIGNATOR		
FIRST	LAST	DELETED
C1	C56	
CR1	CR8	
F1	F1	
U1	U23	
L1	L8	
LS1	LS3	
P1	P3	
Q1	Q2	
R1	R100	
S1	S6	
T1	T1	
TP1	TP12	
Z1	Z1	

REVISIONS					
REV	DATE	DESCRIPTION	DFTSMN	ENGR	ECN
A-1	5-15-86	Released for Production P. Beam		PB	

CH 1

INPUT

OUTPUT

DWG NO. 02-5010-01 CRL P/N 13975

J6 INPUT TERMINATION SELECT CH 1

"IN" INDICATOR CH 1

S2 "IN" SWITCH CH 1

CH 1 UNITY GAIN TRIMMER

S5 REF LEVEL CH 1

U4 BALANCE / UNBALANCE LEVEL SELECT CH 1.

AC INPUT RECEPTACLE

POWER ON INDICATOR

230 LINE VOLTAGE SELECT S7

TAB IS INTERNALLY CONECTED TO PIN NO. 2.

U1, U14 PINOUT

BRILLIANCE CH 1

THRESHOLD CH. 1

U6 NOT USED

EXPAND INDICATOR

NOTES: UNLESS OTHERWISE SPECIFIED.

1. RESISTORS ARE 1% 1/4W METAL FILM, VALUES ARE IN OHMS.
2. CAPACITOR VALUES ARE IN µF.
3. S1 S2 S3 AND S4 SHOWN IN DEPRESSED POSITION.
4. ALL FRONT PANEL CONTROL AND INDICATOR CALLOUTS ARE UNDERLINED.

PROPRIETARY RIGHTS: THIS DRAWING IS CONFIDENTIAL AND PROPRIETARY. DISCLOSURE TO UNAUTHORIZED PERSONS IS FORBIDDEN.	USED ON: DX-2	DWN BY: Lynn Rugh 4-8-86	MATERIAL: —	Circuit Research Labs, Inc.
TOLERANCE (DECIMAL) U.O.B. .X ± .030 .XXX ± .005 .XX ± .016 ANGLES ± 1°		CHKD: Paul Stanley 5-15-86	FINISH: —	TITLE: DYNAFEX DX-2 SCHEMATIC
		PROJ ENGR: Paul Stanley 5-16-86		TYPE: — SIZE: D DWG. NO. 02-5500-01 REV
		MECH: —	NEXT ASSY: —	MODEL TYPE: DX-2 SCALE: — SHEET 1 OF 2
		P. Beam 5-15-86		

COMPONENT DESIGNATOR		
FIRST	LAST	DELETED

REVISIONS				
REV	DATE	DESCRIPTION	DFTSMN	ENGR	ECN

CH 2

J16 INPUT
L5 68 µH
L6 68 µH
C59 .01
C58 47PF
C57 47PF

J17 OUTPUT
L7 68 µH
L8 68 µH
C62 .01
C61 47PF
C60 47PF

J18 J19 J20 J23 J22 J21
P2 J2

DWG NO. 02-5010-01 CRL P/N 13975

C49 10NP
C50 10NP
R71 10.0 K
R72 10.0 K
U13A TL072
R70 10.0 K
TP11
R87 1.50 K
-15V
LS4 (RED)
"IN" INDICATOR CH2
R86 604
S4 "IN" SWITCH CH2
600
HI-Z
NC

J7
INPUT TERMINATION SELECT CH 2

A B C D E F

CH1 CH2 STEREO
S3 "CONTROL" SWITCH
NC NC NC

R99 10K CW THRESHOLD CH2

CH2 UNITY GAIN TRIMMER
R3 20K CW
R16 36.5K
R40 2000
C20 47PF
U9 B NE5532
R41 22.1
C34 100 NP
R88 10.0 K

R38 4.02 K
R39 4.02 K
+15V
C6 .1
U9 A NE5532
R37 22.1
C8 100 NP
R36 10.0 K
C41 .1
-15V
UNBAL
BAL
J5
BALANCE / UNBALANCE LEVEL SELECT CH 2

TP10
REFERANCE LEVEL CH 2
R94 3.92 K
R93 6.19 K
+8
+4
R92 10.0 K
R91 31.6 K
-10
C30 47 PF

R21 100K
+15V
TP6
R22 7.50 K
U11 B TL072
-15V
C14 .0047
C15 .22
R17 7.50 K
R69 10.0 K
U11 A TL072

+15V
R44 150 K
U10
C33 .47
R64 604
R65 100 K
C35 680 PF
R67 15.0 K
C32 .1
R66 1.50 M
R18 1.50 M
R19 100K
R20 27.4 K
CRL 2200
-15 V

TP1
R24 10.0 K
R23 10.0 K
R46 47.5K
R45 4.75K
C16 .22
U12 A TL072
R47 10.0 K
U12 B TL072
+15V
-15V
TP3

C9 .1
C26 .01
U13 B TL072
C43 .1
R27 2000
R26 4.02 K
R25 10.0 K
BRILLIANCE CH2
R100 10K CW
R77 402
R68 1.00M
R8 1.00 M

U4 B TL072
+15 V
R43 47.5 K
Q2 2N4125
R42 604
NC
LS5 (GRN)
EXPAND INDICATOR

PROPRIETARY RIGHTS THIS DRAWING IS CONFIDENTIAL AND PROPRIETARY. DISCLOSURE TO UNAUTHORIZED PERSONS IS FORBIDDEN.	USED ON DX-2	DWN. BY 5-14-86	MATERIAL —	Circuit Research Labs, Inc.
TOLERANCE (DECIMAL) U.O.S. X ± .030 XXX ± .005 XX ± .015 ANGLES ± 1°		CHKD 5-15-86 PROJ. ENGR. 5-16-86 MECH. — 5-15-86	FINISH —	TITLE DYNAFEX DX-2 SCHEMATIC TYPE D SIZE D DWG. NO. 02-5500-01 REV MODEL TYPE SCALE — SHEET 2 OF 2
			NEXT ASSY.	