DOLBY® SPECTRAL RECORDING SYSTEM

Technical Manual

PACIFIC RECORDERS & ENGINEERING CORPORATION
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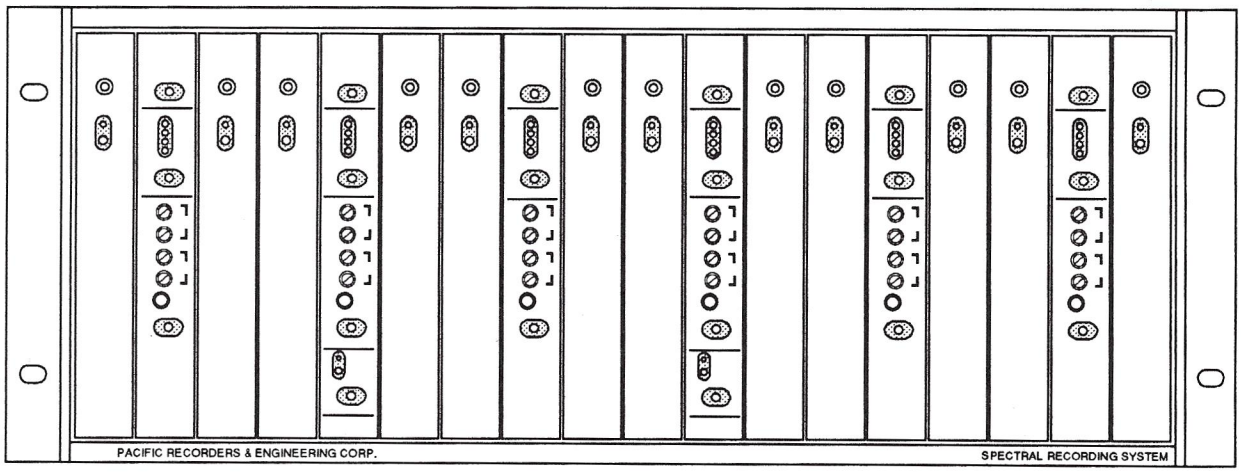

PR&E DOCUMENT #75-23

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PR&E DOCUMENT #75-23
STATUS PAGE
(Revision A - July 1989)

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ALL	A	New Release.

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1.0 GENERAL INFORMATION

This chapter contains an introduction to the Dolby Spectral Recording System Technical Manual, an overview of the system's features, its specifications and warranty information.

1.1 INTRODUCTION

Congratulations on your decision to join the growing ranks of Pacific Recorders & 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 Dolby Spectral Recording System (SR System). It is assumed that the reader has a working knowledge of audio devices, systems, and installation practices. To obtain the maximum benefit of the SR System's capabilities, it is strongly recommended that the Installation, Setup and Operation, and Equipment Description chapters of this manual be read thoroughly prior to installing the unit.

Each SR System is 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 OVERVIEW

The SR System is a new professional mastering system yielding analog recordings with an unprecedented purity of sound. By mutual agreement with Dolby Laboratories, PR&E has developed the SR System especially for broadcast cartridge and reel-to-reel tape machines, and designed it to be controlled remotely at the tape source, making it completely transparent to the operator. The results are analog recording with a substantial extension of available headroom and dynamic range and the practical elimination of the influence of noise and non-linearity on the reproduced sound.

Each SR System consists of a mainframe and the appropriate number of Interface and SR Processing Modules. The six mainframe positions are universal, and will accommodate any one of the three

available Interface Modules, each accompanied by two SR Processing Modules (one left and one right) for stereo processing. There are three different Interface Modules designed for use in the SR System: the Cartridge Reproducer Interface Module, the Cartridge Recorder/Reproducer Interface Module, and the Tape Recorder/Reproducer Interface Module.

The SR Processing Modules are manufactured by Dolby Laboratories especially for use in this system. These modules encode the analog signal prior to recording, and decode it upon playback, thereby optimizing the modulation capabilities of the magnetic tape. Encoding maximizes the spectral loading of the magnetic media, while applying signal characteristics designed to eliminate or greatly minimize saturation at the extreme ends of the audio spectrum. Subsequent decoding provides an analog reproduction with performance equal to or better than 16-bit linear PCM digital audio recording. In keeping with the Dolby SR philosophy of "least treatment" (i.e., "the best treatment of the signal is the least treatment"), high level signals remain virtually unprocessed during encoding and decoding.

NOTE: For a more detailed description of the SR process, see the the insert located in the front pocket of this manual, "Dolby Spectral Recording; What It Is and What It Does", which is published by, and provided here with the consent of, Dolby Laboratories.

The SR System's power supply assembly uses a toroidal transformer equipped with an electrostatic shield, to prevent coupling of common-mode line noise and RFI. The input, output and logic connectors are the same Molex series used in PR&E's audio consoles.

1.3 SPECIFICATIONS

Following is a list of specifications for the SR System:

INPUTS

From Console:

Source Impedance	600 ohms or less.
Input Impedance	40K ohms, balanced.
Input Level Range	0 dBu to +8 dBu.

From Tape Deck:

Source Impedance	600 ohms or less.
Input Impedance	40K ohms, balanced.
Input Level Range	0 dBu to +8 dBu.

OUTPUTS

To Tape Deck:

Source Impedance	80 ohms, differential.
Load Impedance	600 ohms or greater, balanced.
Output Level Range	0 dBu to +8 dBu.

To Console:

Source Impedance	80 ohms, differential.
Load Impedance	600 ohms or greater, balanced.
Output Level Range	0 dBu to +8 dBu.

LOGIC

Cartridge Deck Interface:	
Record Sense	+5 to +24 VDC.
Play Sense	+5 to +24 VDC.
LED Current Source	+12 VDC with 560 ohm series resistor (approximately 20 mA).
Photo Sensor Input	CMOS Input, 10K ohm pull-up to +15 VDC.
Tape Recorder Interface:	
Record Sense	Requires sustained contact closures or ground referenced open collectors.
SR Engage/Bypass	Momentary contact closure, 1.5 mA.
SR Tally Drive	+12 VDC, current limited at 100 mA.
CT (Check Tape)	Momentary contact closure, 1.5 mA.
CT Tally Drive	+12 VDC, current limited at 100 mA.
DIMENSIONS	7 inches high, 15-3/4 inches deep (not including mating connectors).
POWER REQUIREMENTS	117 VAC, 60 Hz, 60 Watts (fully configured).

NOTE: 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.

Pacific Recorders & Engineering Corporation reserves the right to change specifications without notice or obligation.

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 Recorders & 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 SR System, which consists of a mainframe and the appropriate number of Interface and SR Processing Modules. Included are sections outlining general installation guidelines, cable preparation, rear panel configuration, audio input connection, audio output connection, logic connection, grounding and shielding, power connection, interface module internal option switches, and SR sense modification.

2.1 GENERAL GUIDELINES

The SR System 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.

The packed items should include the SR System itself, the power cord, and a connector kit (PR&E #76–612). This connector kit is used to prepare the audio and logic cables (as described in Section 2.2), and contains the following:

DESCRIPTION	QTY	PR&E#
Connector Housing, 9 Pin, Male	6	15-604
Connector Housing, 6 Pin, Male	24	15-603
Molex Crimp Pins, Male	220	15-3

When installing the SR System, signal, logic and AC power connections are made via the connectors located on the rear of the unit (reference Section 2.4).

The SR System requires four rack units of height (7 inches) in a standard rack width of 19 inches. The depth of the SR System from the rack rails is 15.75 inches; however, it is recommended that the installation allow an additional two inches to accommodate rear panel connections and cable bends. While the SR System was designed to convect most of its heat through its front panel, it is recommended that the installation provide one open rack space above and below the SR System to provide additional ventilation.

The SR System is aligned at the factory to the prescribed "System Operating Level" (levels of 0 dBu to +8 dBu can be accommodated). Should any further system alignment be required, it should be accomplished per the procedure outlined in Section 5.3 of this document.

The power transformer used in the SR System is a toroidal type, which exhibits a low radiated hum field. This allows the system to be installed near sensitive magnetic tape machines without adversely affecting their performance.

NOTE: Care should be taken to avoid locating the SR System within six feet of any intense electromagnetic hum fields, such as those produced by large power transformers and motors. Likewise, cables to and from the unit 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 at or 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 SR System or neighboring equipment, such as tape recorders or magnetic phonograph cartridges.

2.2 CABLE PREPARATION

Before beginning the installation, a plan should be drawn up showing how the system will be interconnected. 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 SR System. Audio input and output, and logic 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 cable drain wire and the shield (at cable ends) with heat-shrink tubing. This is the only means of assuring an installation in accordance with 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. See Figure 2.1 for an example of a properly crimped Molex pin.

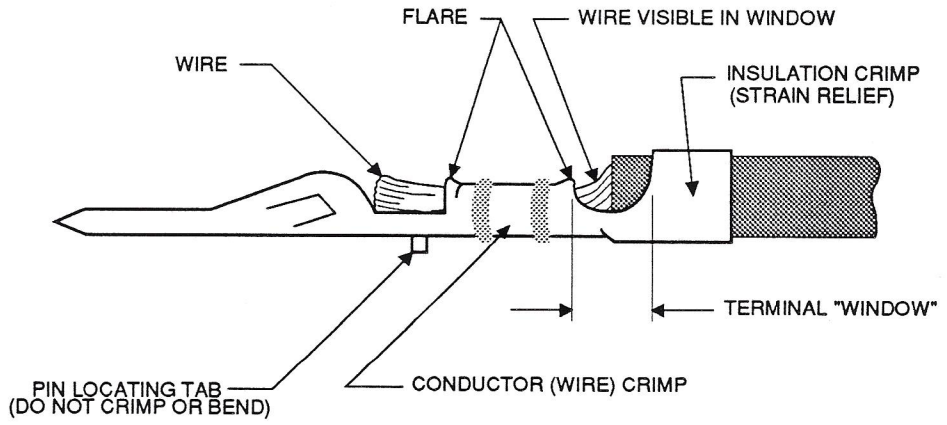


FIGURE 2.1 MOLEX CRIMP PIN

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.

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 the wire.

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

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 Sections 2.5, 2.6 and 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 GROUNDING AND SHIELDING

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

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".

SR System shield pins are tied together and connected to a grounding point on the mainframe chassis. The power cord assembly then provides the SR System to ground connection.

If isolated ground receptacles are not available when grounding the SR System, 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 the 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 wire-way or areas as a power line. Radio-frequency interference can also manifest itself as a buzz in the program audio. RF interference is minimized by the extensive RF bypassing and ground-plane techniques used in the SR System, and the shielded lines external to the unit.

2.4 REAR PANEL CONFIGURATION

The rear panel of the SR System is configured to allow for ease of power, audio input, audio output, and logic connection. See Figure 2.2 for an example of the SR System's rear panel configuration.

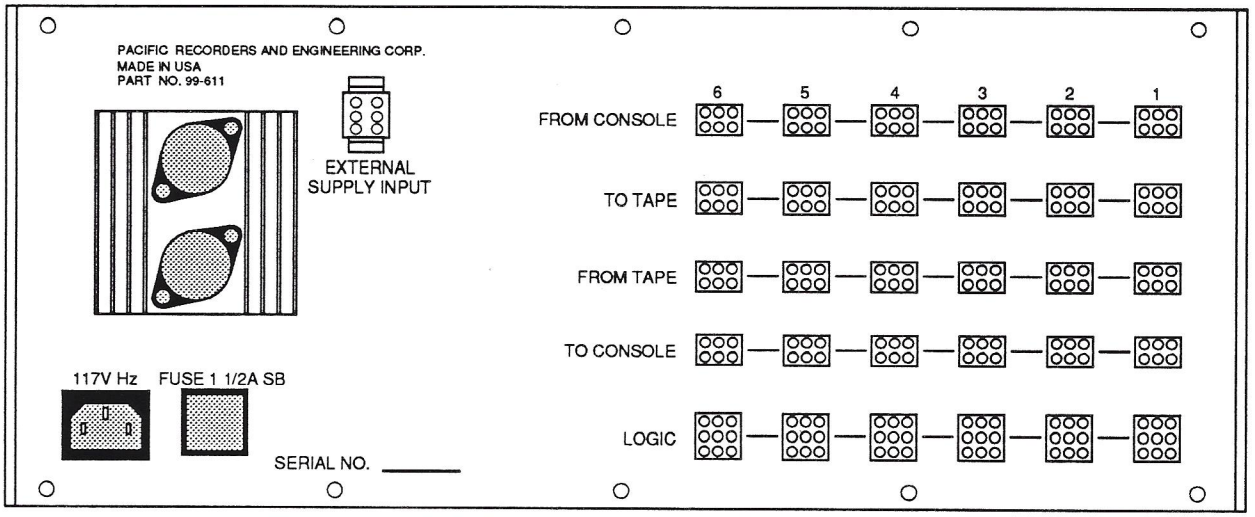
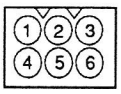


FIGURE 2.2
SR MAINFRAME REAR PANEL CONFIGURATION

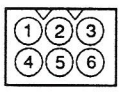
2.5 AUDIO INPUT CONNECTION

SR interface audio input connection is accomplished by means of two 6-pin Molex connectors (one "From Console" and one "From Tape") for each of the six mainframe positions. Pin assignment for both connectors is identical, and is defined in Figure 2.3.

NOTE: The "From Console" input is not used for Cart Reproducer Interfaces.



FROM CONSOLE



FROM TAPE

DOLBY SR AUDIO INPUT				
		Pin Number		
Signal	Connector	Shield	Low	High
Stereo Input/Left	Input	1	2	3
Stereo Input/Right	Input	4	5	6

FIGURE 2.3
AUDIO INPUT CONNECTORS

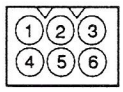
NOTE: A standard connection theme is used throughout most PR&E equipment designs - the use of 3,

6 and 12 pin Molex connectors for audio wiring. This system of pin assignments takes advantage of the three pin per row design of the Molex connectors and, therefore, makes visual inspection of the finished wiring easier. As viewed from the rear of the mainframe, the shields (if connected) 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.

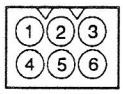
2.6 AUDIO OUTPUT CONNECTION

SR interface audio output connection is accomplished by means of two 6-pin Molex connectors (one "To Tape" and one "To Console") for each of the six mainframe positions. Pin assignment for both connectors is identical, and is defined in Figure 2.4.

NOTE: The "To Tape" output is not used for Cart Reproducer Interfaces.



TO TAPE



TO CONSOLE

DOLBY SR AUDIO OUTPUT				
		Pin Number		
Signal	Connector	Shield	Low	High
Stereo Output/Left	Output	1	2	3
Stereo Output/Right	Output	4	5	6

FIGURE 2.4
AUDIO OUTPUT CONNECTORS

2.7 LOGIC CONNECTION

SR System logic input/output connection is accomplished by means of a single 9-pin Molex connector for each of the six mainframe positions. Pin assignment is unique for each of the three interface modules, and is defined in the following sections.

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

Control Outputs (Commands):

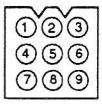
Tally (light) — Provides a 12 VDC continuous source when activated.

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 Cart Reproducer Interface Logic Connection

The Cart Reproducer Interface Module was designed for use with professional cartridge reproducers. Logic pin assignment for this interface is defined in Figure 2.5.



LOGIC PIN ASSIGNMENT	
Function	**Pin Number**
Logic Common	1
Logic +12 VDC	2
Not Used	3
Not Used	4
Not Used	5
Not Used	6
Current Source (Approx. 20mA)	7
Remote SR Sense	8
Not Used	9

FIGURE 2.5 CART REPRODUCER INTERFACE LOGIC CONNECTOR

The 20 mA Current Source (pin 7) and the Remote SR Sense input (pin 8) are provided for the connection of the remote SR sense function, as described below.

REMOTE SR SENSE CONNECTION

The Remote SR Sense function was designed to provide the ability to play a mixture of both SR encoded and non-SR encoded carts, while still allowing the SR System to be transparent to the operator. This function requires that a reflective switch be installed in the cart machine's right-hand cart guide, and connected to the cart interface module logic connector as shown in Figure 2.6.

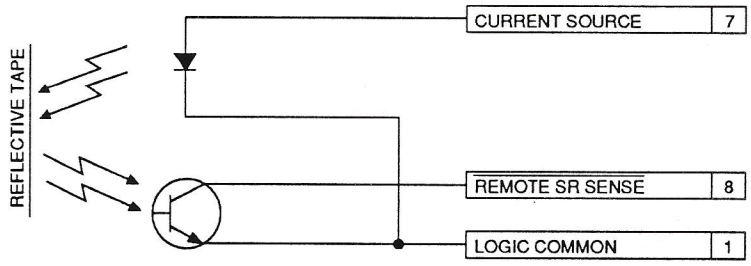


FIGURE 2.6 CART INTERFACE REMOTE SR SENSE CONNECTION

In order to enable the Remote SR Sense function, place the cart interface module's front panel SR MODE switch into the SENSE position. Then, when a cart with a reflective scan tape is installed in the cart machine, the reflective switch will send a signal to the interface module turning SR processing on or off, as determined by the interface module internal option switch described in Section 2.9.

NOTE: SR Sense Modification Kits are available from PR&E for Tomcat and Micromax Recorders and Reproducers. Contact PR&E's Customer Service Department for details.

In configurations not using the Remote SR Sense function, the REMOTE SR SENSE input can be used as an SR on/off remote control by placing a maintained action switch into the loop between this input and Logic Common, as shown in Figure 2.7.

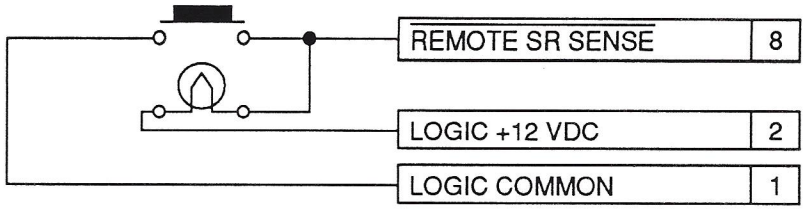
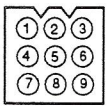


FIGURE 2.7 CART INTERFACE REMOTE SR ON/OFF SWITCH CONNECTION

This allows the SR processing function to be controlled remotely by the operator whenever the cart interface module front panel SR MODE switch is in the SENSE position. When using this method of remote control, it it will be necessary to set the internal option switch on the interface module to the "SENSE = ON" position (reference Section 2.9), so that when the switch is engaged SR processing is also engaged.

2.7.2 Cart Recorder/Reproducer Interface Logic Connection

The Cart Recorder/Reproducer Interface Module was designed for use with professional cartridge recorder/reproducers. Logic pin assignment for this interface is defined in Figure 2.8.



LOGIC

LOGIC PIN ASSIGNMENT	
Function	**Pin Number**
Logic Common	1
Logic +12 VDC	2
Record Tally Input (+)	3
Record Tally Input (-)	4
Play Tally Input (+)	5
Play Tally Input (-)	6
Current Source (Approx. 20mA)	7
Remote SR Sense	8
Not Used	9

FIGURE 2.8 CART RECORDER/REPRODUCER INTERFACE LOGIC CONNECTOR

The 20 mA Current Source (pin 7) and the Remote SR Sense input (pin 8) are provided for the connection of the remote SR sense function, as described in Section 2.7.1. The Record and Play Tally Inputs (pins 3 through 6) are provided for connection to the cart recorder/reproducer's record and play tally outputs. These opto-isolated inputs control the encode/decode status of the SR Processing Modules, and may be connected to machines which utilize voltage source tallies, such as PR&E's Tomcat or Micromax models, or machines which utilize relay contacts.

NOTE: The Cart Recorder/Reproducer Interface Module defaults to the encode mode, so that when the cart machine is in "stop" or "record ready" the user can preview the encoded signal. Therefore, the Record and Play Tally Inputs must be connected in order for the interface module to switch to the decode mode when a "play only" condition exists. Connect these inputs as shown in Figure 2.9.

NOTE: The Record and Play Tally Inputs will accommodate machine tally output voltages in the range of +5 VDC to +24 VDC.

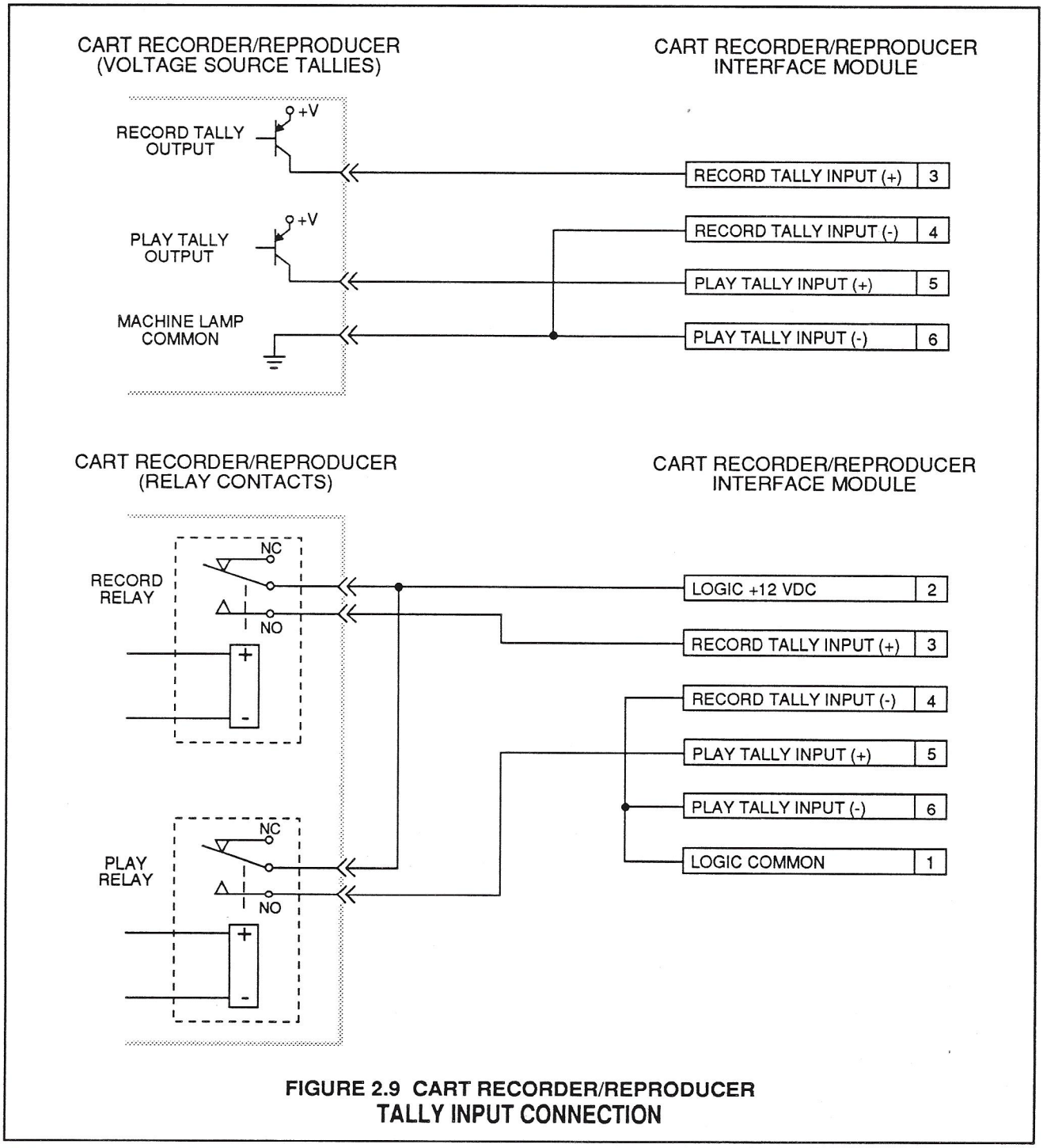


FIGURE 2.9 CART RECORDER/REPRODUCER TALLY INPUT CONNECTION

The Cart Recorder/Reproducer Interface module may also be used exclusively as a "playback" interface, per the following description.

"PLAYBACK" ONLY OPERATION

When using the Cart Recorder/Reproducer Interface Module with a cart reproducer as a "playback" interface, place the front panel RECORD MODE switch into the AUTO position, and connect the Play Tally Inputs on the module logic connector as shown in Figure 2.10. This will place the SR Processing Modules in the decode mode, overriding their default (encode) setting.

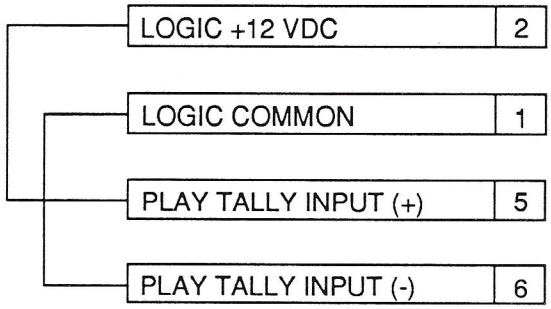
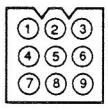


FIGURE 2.10 CART RECORDER/REPRODUCER INTERFACE "PLAYBACK" TALLY INPUT CONNECTION

2.7.3 Tape Recorder/Reproducer Interface Logic Connection

The Tape Recorder/Reproducer Interface Module was designed for use with professional reel-to-reel tape recorder/reproducers which have Noise Reduction (NR) control connectors. Logic pin assignment for this interface is defined in Figure 2.11.



LOGIC

LOGIC PIN ASSIGNMENT	
Function	**Pin Number**
Logic Common	1
Logic +12 VDC	2
Left Record Sense	3
Right Record Sense	4
SR On/Off	5
SR Tally ⌐	6
Check Tape On/Off	7
Check Tape Tally ⌐	8
+ Opto Voltage	9

FIGURE 2.11 TAPE RECORDER/REPRODUCER INTERFACE LOGIC CONNECTOR

The Left and Right Record Sense inputs (pins 3 and 4) are provided for connection to tape recorder/

reproducer left and right noise reduction connections. These opto-isolated inputs control the encode/ decode status of the left and right SR Processing Modules, respectively, and may be connected to machines which utilize relay contact or open collector transistor noise reduction connections, as shown in Figure 2.12.

NOTE: When utilizing the Left and Right Record Sense inputs, the + Opto Voltage input must be tied to a positive reference voltage (+5 VDC to +28 VDC).

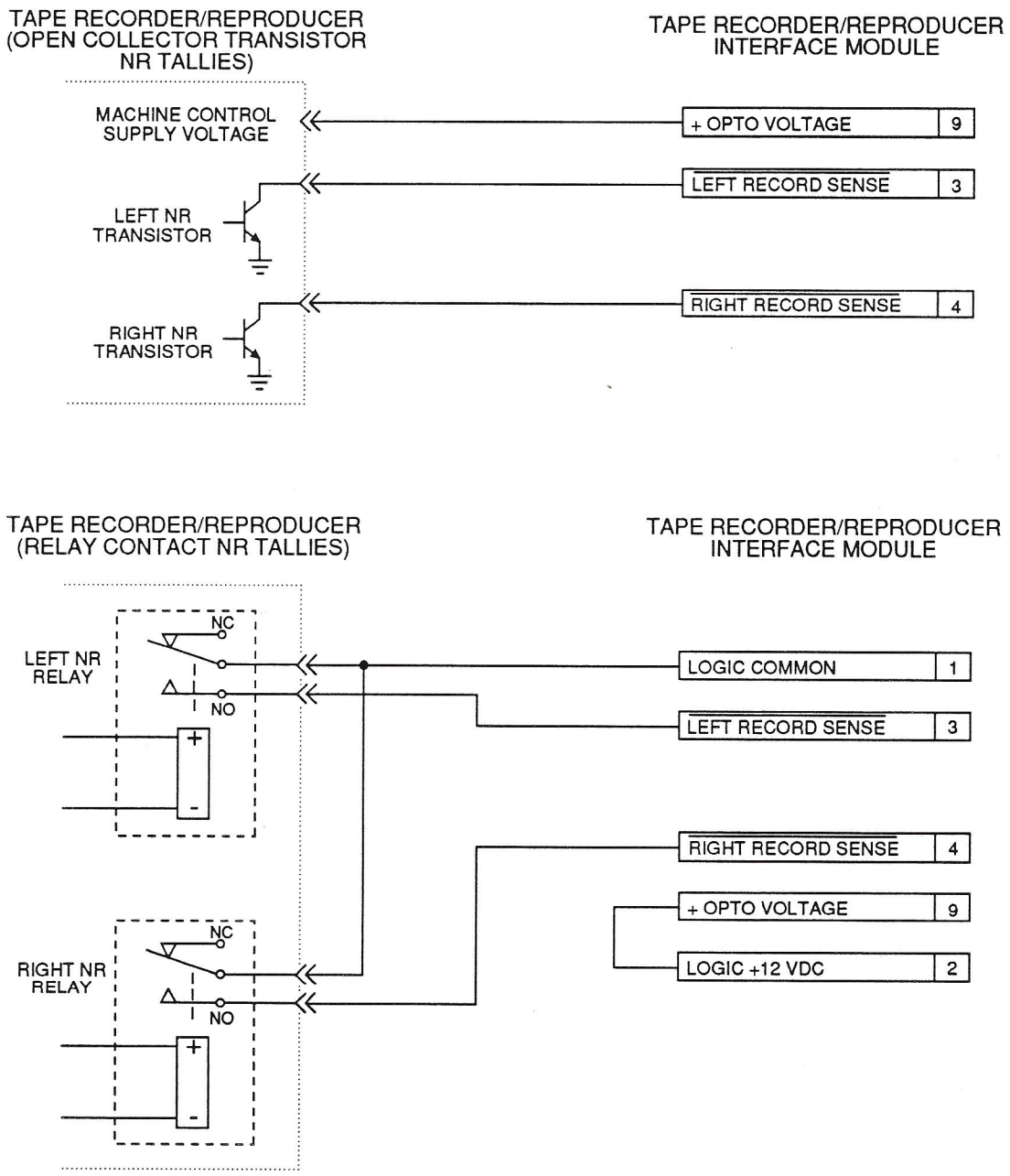


FIGURE 2.12 TAPE RECORDER/REPRODUCER SR SENSE INPUT CONNECTION

The SR On/Off and Check Tape On/Off inputs (pins 5 and 7), and their accompanying tallies (pins 6 and 8), are provided for the connection of an interface remote control panel, as shown in Figure 2.13.

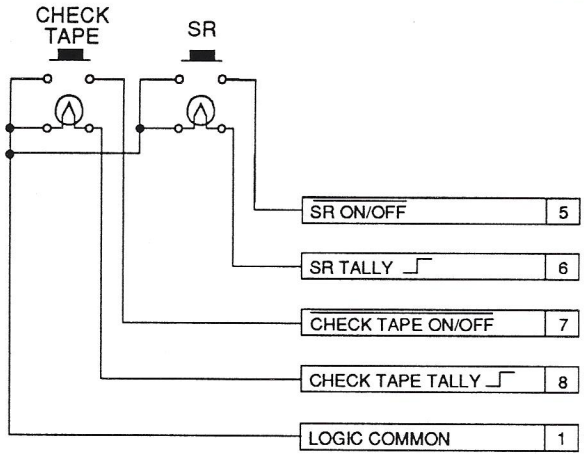


FIGURE 2.13 TAPE INTERFACE REMOTE CONTROL PANEL CONNECTION

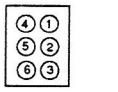
2.8 POWER CONNECTION

The SR System is designed to operate at 117 VAC, 60 Hz, and requires a 1.5A slo-blo line fuse. Should the fuse ever need to be replaced, replace with the proper type only. The appropriate 3-wire power cord (supplied with the equipment) should be installed between the SR System and the AC mains.

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

EXTERNAL POWER SUPPLY INPUT CONNECTION

An EXTERNAL SUPPLY INPUT connector is provided on the SR System mainframe's rear panel to allow for the connection of a redundant DC power supply, if desired. While connection of an external power supply is not necessary, one is available from PR&E. Contact PR&E's Customer Service Department for details. Connector pin assignment is defined in Figure 2.14.



EXTERNAL SUPPLY INPUT

EXTERNAL SUPPLY INPUT PIN ASSIGNMENT	
Signal	**Pin Number**
External +22 VDC Supply	1
+22 VDC Supply Sense	2
Common	3
Common	4
-22 VDC Supply Sense	5
External -22 VDC Supply	6

FIGURE 2.14 EXTERNAL POWER SUPPLY INPUT CONNECTOR

NOTE: The +22 VDC Supply Sense and -22 VDC Supply Sense outputs are used to feed a tally system to alert the operator in the event of an internal power supply failure.

2.9 INTERFACE MODULE INTERNAL OPTION SWITCHES

This section describes the Cart Reproducer and Cart Recorder/Reproducer Interface Module internal option switches, and their function.

2.9.1 Cart Reproducer Interface Internal Option Switch

The Cart Reproducer Interface Module is equipped with an internal option switch (S4) which allows for the selection of the sense input mode. When the interface module front panel SR MODE switch is in the SENSE position, the REMOTE SR SENSE input from a cart reproducer (reference Section 2.7.1) will remotely turn SR processing ON or OFF, as defined in Figure 2.15.

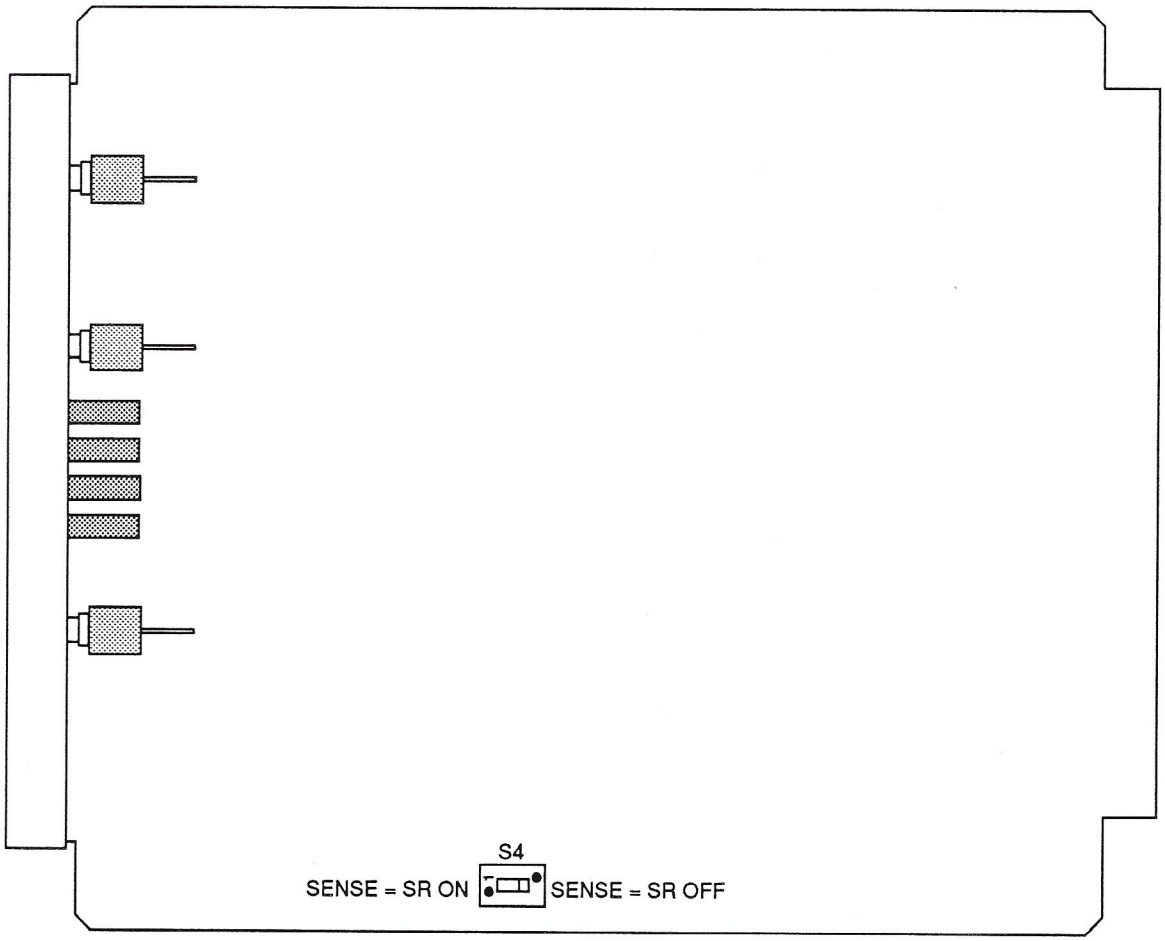


FIGURE 2.15
CART REPRODUCER INTERFACE
INTERNAL OPTION SWITCH

2.9.2 Cart Recorder/Reproducer Interface Internal Option Switch

The Cart Recorder/Reproducer Interface Module, like the Cart Reproducer Interface Module, is equipped with an internal option switch (S5) which allows for the selection of the sense input mode. When the interface module front panel SR MODE switch is in the SENSE position, the REMOTE SR SENSE input from a cart recorder/reproducer (reference Section 2.7.1) will remotely turn SR processing ON or OFF, as defined in Figure 2.16.

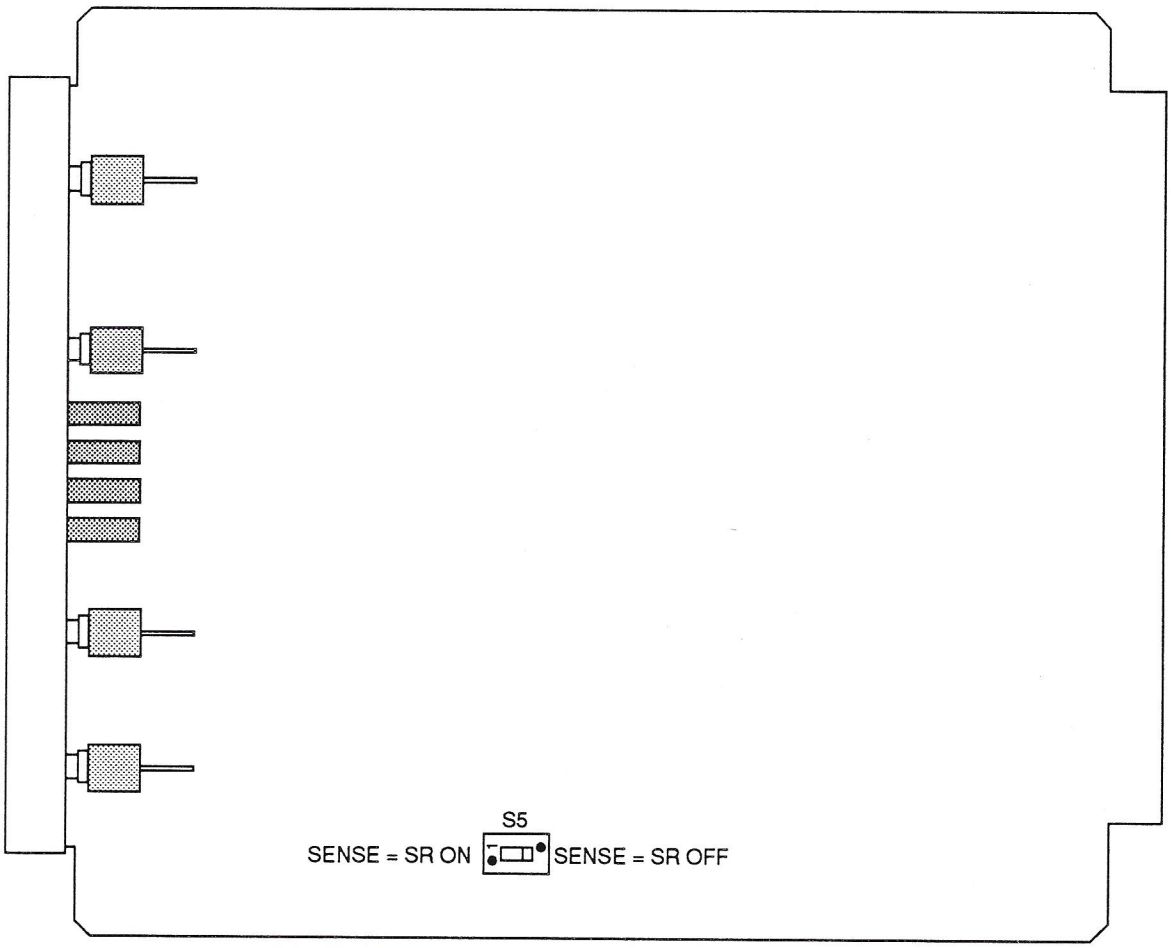


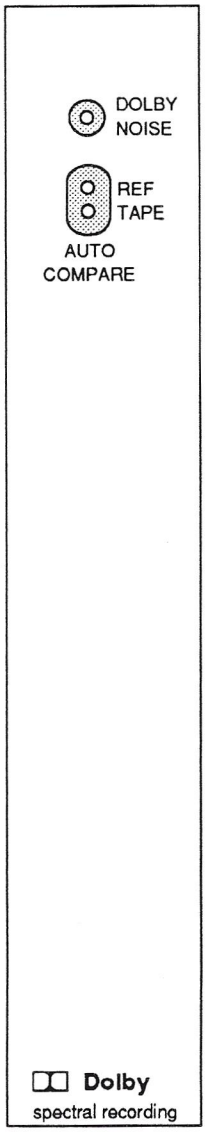
FIGURE 2.16
CART RECORDER/REPRODUCER INTERFACE
INTERNAL OPTION SWITCH

3.0 SETUP AND OPERATION

This chapter provides instruction in the proper setup and operation of the SR System. Included are descriptions of the SR Processing, Cart Reproducer Interface, Cart Recorder/Reproducer Interface, and Tape Recorder/Reproducer Interface Module front panel controls and indicators, as well as functional block diagrams illustrating the main operating modes of each. Also included is a section describing SR System operation. For a description of the SET UP modes, and their use in verifying cart/tape machine alignment, see Section 5.4. For a detailed description of the module components, and their function, see Chapter 4 of this document.

3.1 SR PROCESSING MODULE

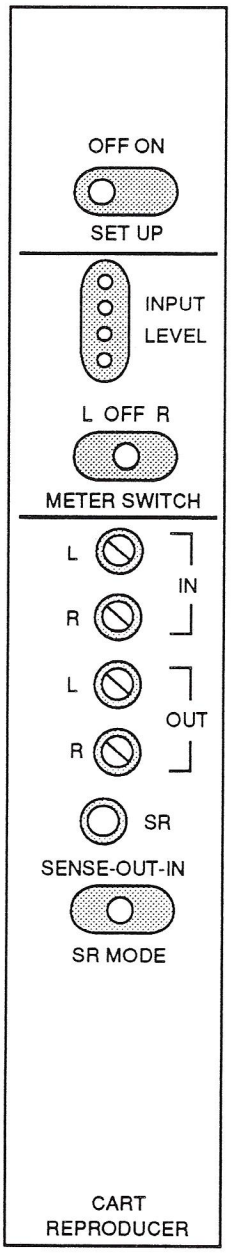
This section contains a figure illustrating the SR System Processing Module's front panel indicators, along with descriptions of the function of each.



- The DOLBY NOISE LED illuminates whenever the interface SET UP control is placed in the ON position, and indicates that Dolby Noise is being produced by the processing module.
- The REF and TAPE LEDs indicate which mode the processing module is in during alignment verification, as outlined in Section 5.4.

3.2 CART REPRODUCER INTERFACE MODULE

This section contains a figure illustrating the Cart Reproducer Interface Module's front panel controls and indicators, along with descriptions of the function of each. For a functional block diagram illustrating the module's main operating modes, see Figure 3.1 on the following page.



- The SET UP control engages and disengages the Dolby Noise calibration mode of the SR Processing Modules. This switch will be placed to the ON position when playing back Dolby Noise for the purpose of alignment verification, as described in Section 5.4.

  NOTE: The SET UP mode can only be engaged when SR processing is engaged.

- The INPUT LEVEL meter consists of four LEDs: two red (top and bottom) and two green.

- The METER SWITCH selects the left or right SR Processing Module as the meter source.

- The IN and OUT stereo level controls align the SR System to the console and tape machine, as described in Section 5.3.

- The SR LED illuminates whenever the SR processing circuitry is engaged.

- The SR MODE switch selects the operating mode of the associated SR Processing Modules. The IN and OUT positions manually engage and disengage the SR circuitry. The SENSE position enables the Remote SR Sense function, allowing SR engagement to be controlled remotely (reference Section 2.7.1).

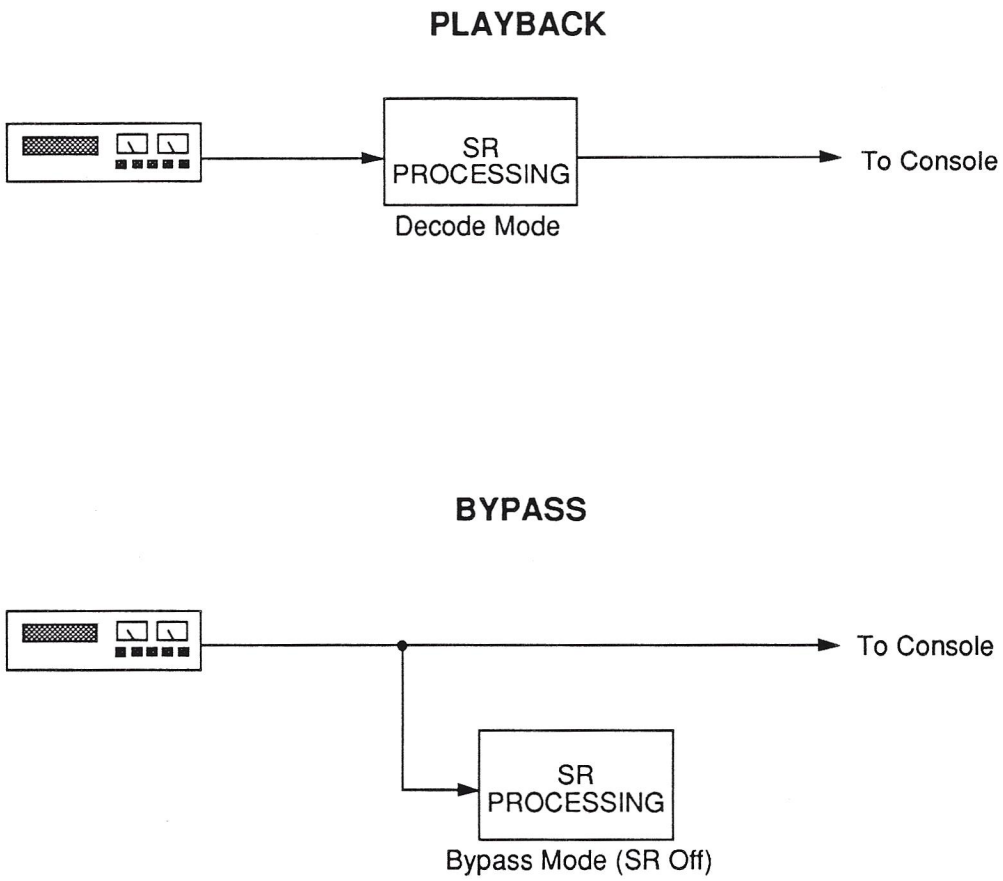
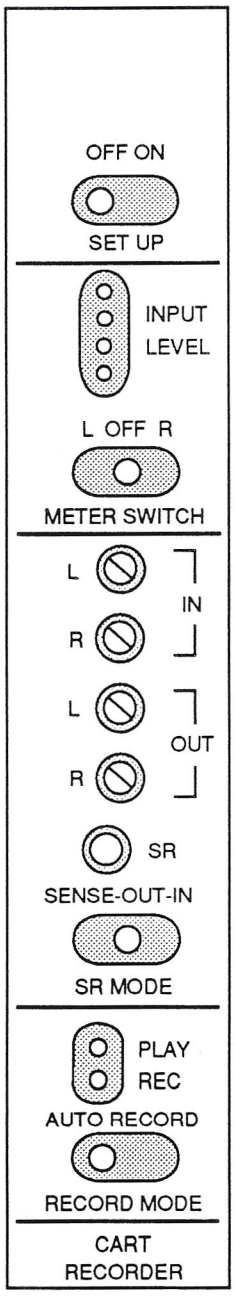


FIGURE 3.1
CART REPRODUCER INTERFACE MAIN OPERATING MODES

3.3 CART RECORDER/REPRODUCER INTERFACE MODULE

This section contains a figure illustrating the Cart Recorder/Reproducer Interface Module's front panel controls and indicators, along with descriptions of the function of each. For a functional block diagram illustrating the module's main operating modes, see Figure 3.2 on the following page.



- The SET UP control engages and disengages the Dolby Noise calibration mode of the SR Processing Modules. This switch will be placed in the ON position when playing back Dolby Noise for the purpose of alignment verification, as described in Section 5.4.

  NOTE: The SET UP mode can only be engaged when SR processing is engaged.

- The INPUT LEVEL meter consists of four LEDs: two red (top and bottom) and two green.

- The METER SWITCH selects the left or right SR Processing Module as the meter source.

- The IN and OUT stereo level controls align the system to the console and tape machine, as described in Section 5.3.

- The SR LED illuminates whenever the SR processing circuitry is engaged.

- The SR MODE switch selects the operating mode of the associated SR Processing Modules. The IN and OUT positions manually engage and disengage the SR circuitry. The SENSE position enables the Remote SR Sense function, allowing SR engagement to be controlled remotely (reference Section 2.7.1).

- The PLAY/REC LEDs (play = green, record = red) indicate the signal routing status and processing mode of the associated SR modules.

- The RECORD MODE switch sets the operating mode of the interface and its associated SR modules. The AUTO position automatically switches the SR system between the record/encode and playback/decode operating modes. The automatic switching is controlled remotely by the cartridge recorder. The RECORD position is selected when separate sets of SR systems are used to provide simultaneous record encoding and playback decoding. See Section 3.5.2 for details.

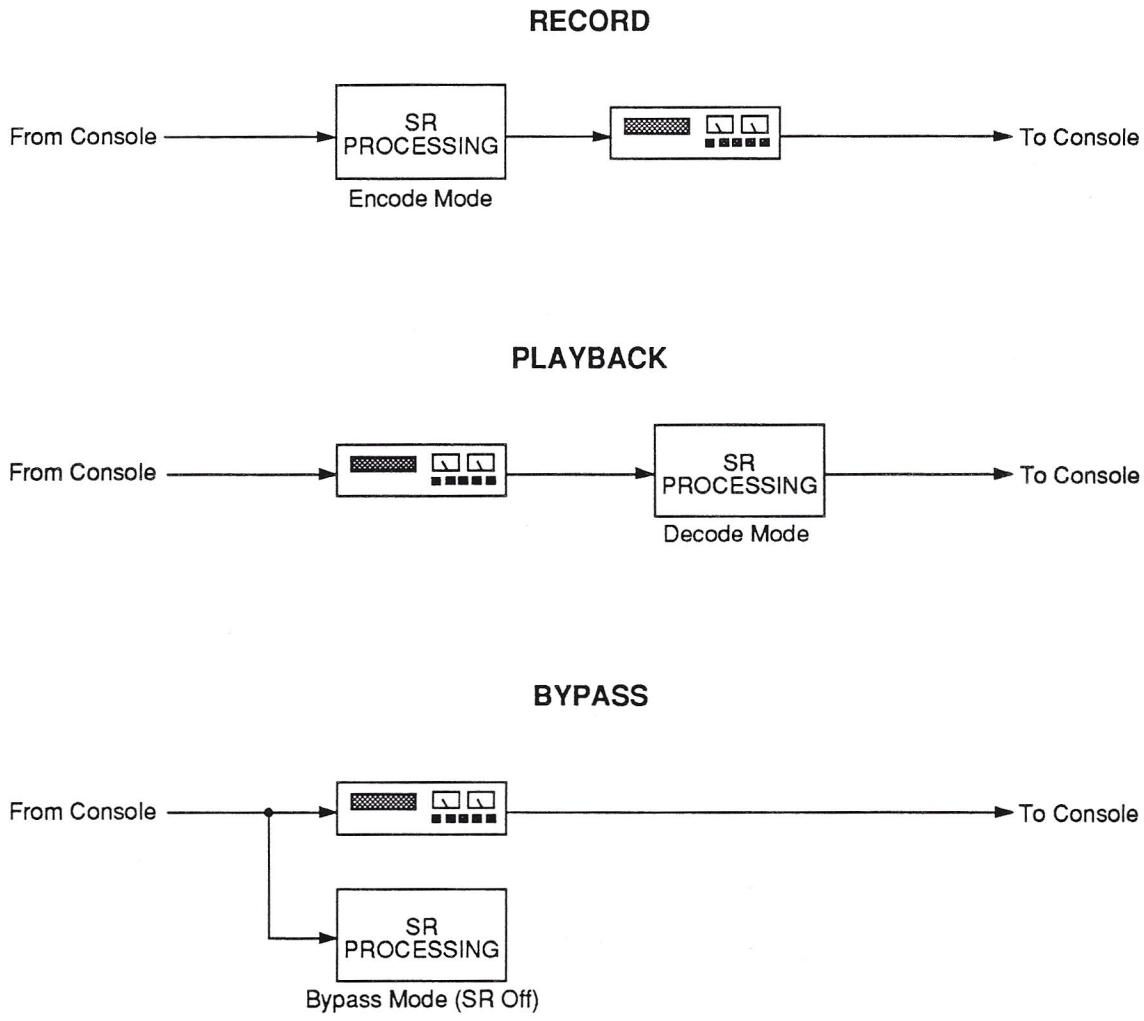
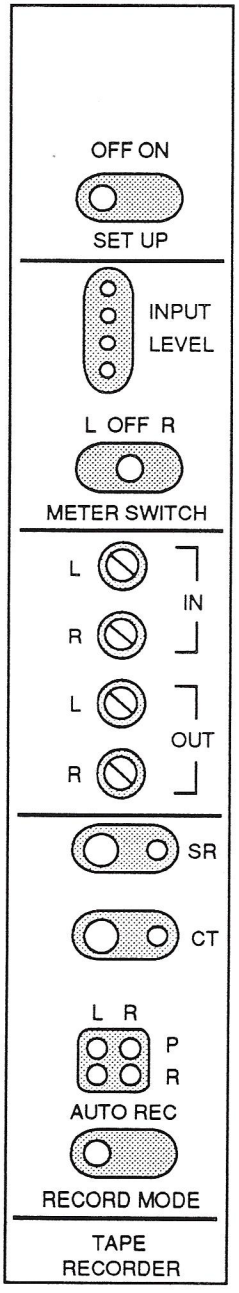


FIGURE 3.2
CART RECORDER/REPRODUCER INTERFACE MAIN OPERATING MODES

3.4 TAPE RECORDER/REPRODUCER INTERFACE MODULE

This section contains a figure illustrating the Tape Recorder/Reproducer Interface Module's front panel controls and indicators, along with descriptions of the function of each. For a functional block diagram illustrating the module's main operating modes, see Figure 3.3 on the following page.



- The SET UP control engages and disengages the Dolby Noise calibration logic of the SR Processing Modules. This switch will be placed to the ON position when playing back Dolby Noise for the purpose of alignment verification, as described in Section 5.4.

  NOTE: The SET UP mode can only be engaged when SR processing is engaged.

- The INPUT LEVEL meter consists of four LEDs: two red (top and bottom) and two green.

- The METER SWITCH selects the left or right SR Processing Module as the meter source.

- The IN and OUT stereo level controls align the system to the console and tape machine, as described in Section 5.3.

- The SR button switch (an electronic alternate action switch with LED indicator) is used to engage or bypass the SR circuitry. The SR function may also be controlled remotely.

- The CT (Check Tape) button switch sends the tape machine output signal directly to the console (reference Figure 3.3), so that the operator may verify tape machine operation. This function may also be controlled remotely.

- The four PLAY/REC LEDs (play = green, record = red) indicate the signal routing status of the left and right SR Processing Modules.

- The RECORD MODE switch sets the operating mode of the interface and its associated SR modules. The AUTO position automatically switches the SR system between the record/encode and playback/decode operating mode for each of the tape recorder's stereo channels. The automatic switching is controlled remotely by the tape recorder through the tape machine's NR (noise reduction) commands. The RECORD position is selected when separate sets of SR systems are used to provide simultaneous record encoding and playback decoding. See Section 3.5.2 for details.

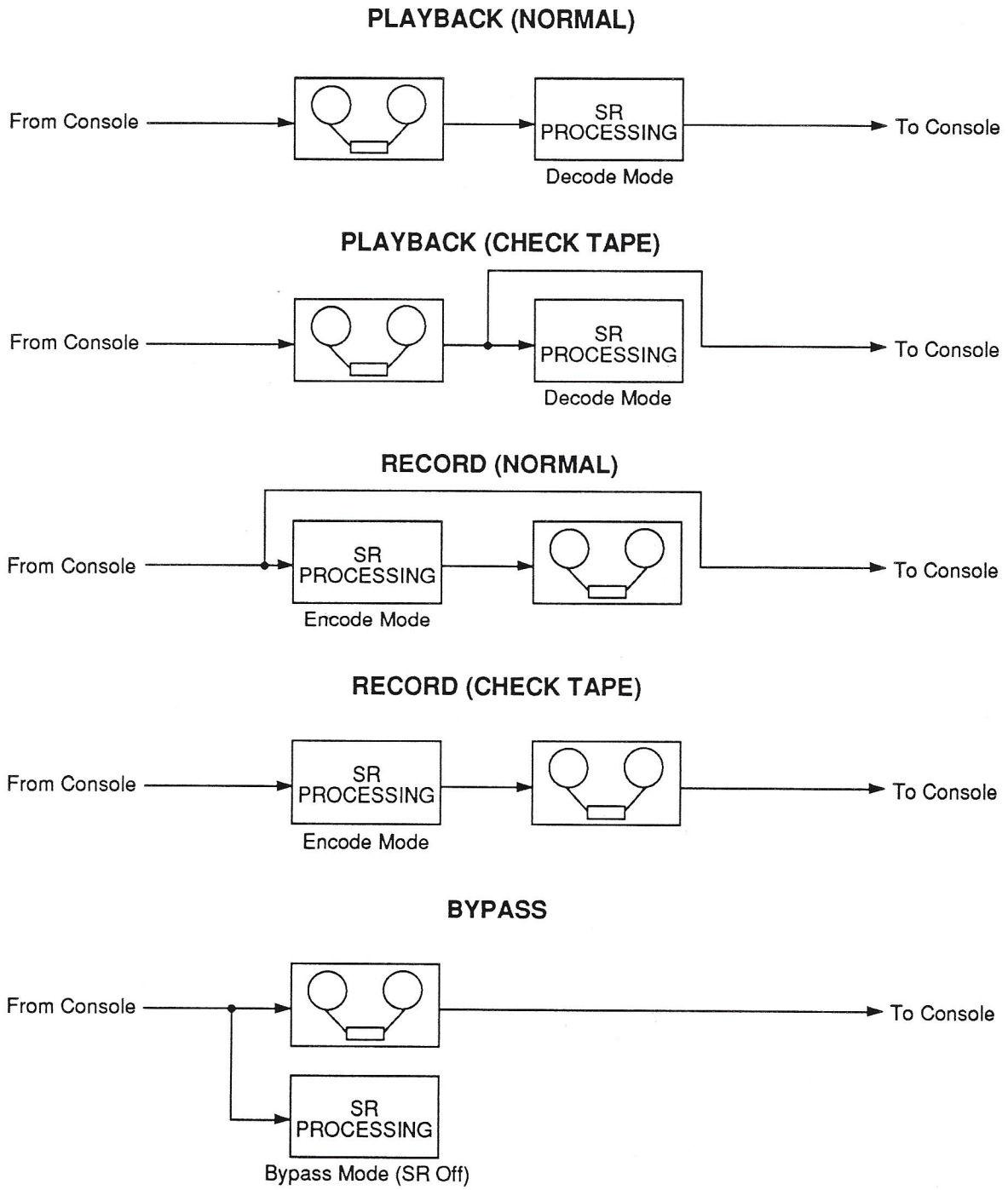


FIGURE 3.3
TAPE RECORDER/REPRODUCER INTERFACE MAIN OPERATING MODES

3.5 SR SYSTEM OPERATION

The SR System was designed to be "transparent" to the operator, so play and record operations utilizing the SR System will be exactly the same as play and record operations prior to SR System installation. However, there are some differences which need to be noted, and these are described in the following sections.

3.5.1 Playing A Dolby SR Cart/Tape

Playing a cartridge or tape that was recorded using the SR System requires only that SR processing be engaged on the cart/tape machine's interface module. At stations where all carts or tapes are recorded using the SR System, SR processing will probably always be engaged. However, in some cases SR System recordings may be mixed with normal recordings (such as when a station is transferring its library to SR System recordings). If this is the case, it will be necessary to verify that SR processing is engaged.

Once SR processing is engaged, play the cartridge or tape in accordance with the machine's normal operating instructions.

3.5.2 Recording A Dolby SR Cart/Tape

Recording a cartridge or tape using the SR System requires only that SR processing be engaged on the cart/tape recorder's interface module. At stations where all carts or tapes are recorded using the SR System, SR processing will probably always be engaged. However, in some cases SR System recordings may be mixed with normal recordings (such as when a station is transferring its library to SR System recordings). If this is the case, it will be necessary to verify that SR processing is engaged.

Once SR processing is engaged, record the cartridge or tape in accordance with the recorder's normal operating instructions.

NOTE: During normal recording operations, the user is monitoring either the encoded signal (when recording carts) or the source signal (when recording tapes). In order to monitor the decoded playback of a cart or tape while recording, it will be necessary to use two interface modules for simultaneous encoding and decoding, as described below.

SIMULTANEOUS ENCODE/DECODE OPERATION

Simultaneous encode/decode operation allows the user to monitor the decoded playback of the cart or tape while recording, rather than having to play it back once recording is completed. This operation requires the use of two interfaces and their accompanying sets of processing modules. One interface is used for the encoding and one for the decoding functions, connected as shown in Figure 3.4.

Place the RECORD MODE switch of the cart/tape interface being used for encoding in the RECORD position. Either a Cart Reproducer or Cart Recorder/Reproducer Interface Module (configured as a "playback" interface per Figure 2.10) may be used for decoding.

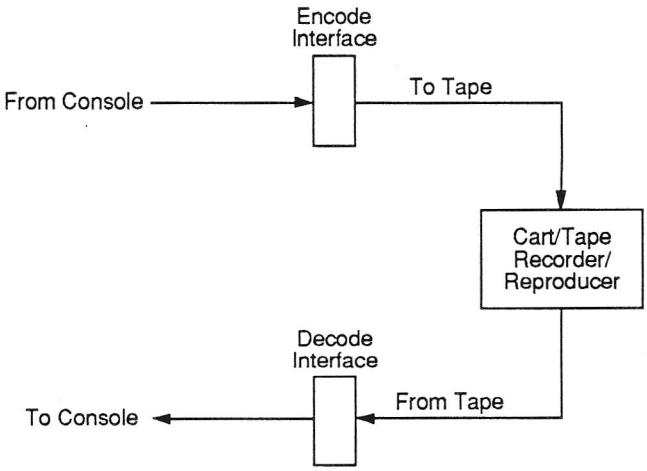


FIGURE 3.4 SIMULTANEOUS ENCODE/DECODE CONNECTION

Another method of performing a simultaneous encode/decode operation is to use a single encode interface feeding multiple recorder/reproducers, such as in a dubbing environment. This can be accomplished by feeding the encoded signal to a distribution amplifier, which, in turn, feeds multiple machines. The outputs of these machines will then each feed a dedicated decoding interface, as shown in Figure 3.5. The advantage of this method is that it requires a single encode interface.

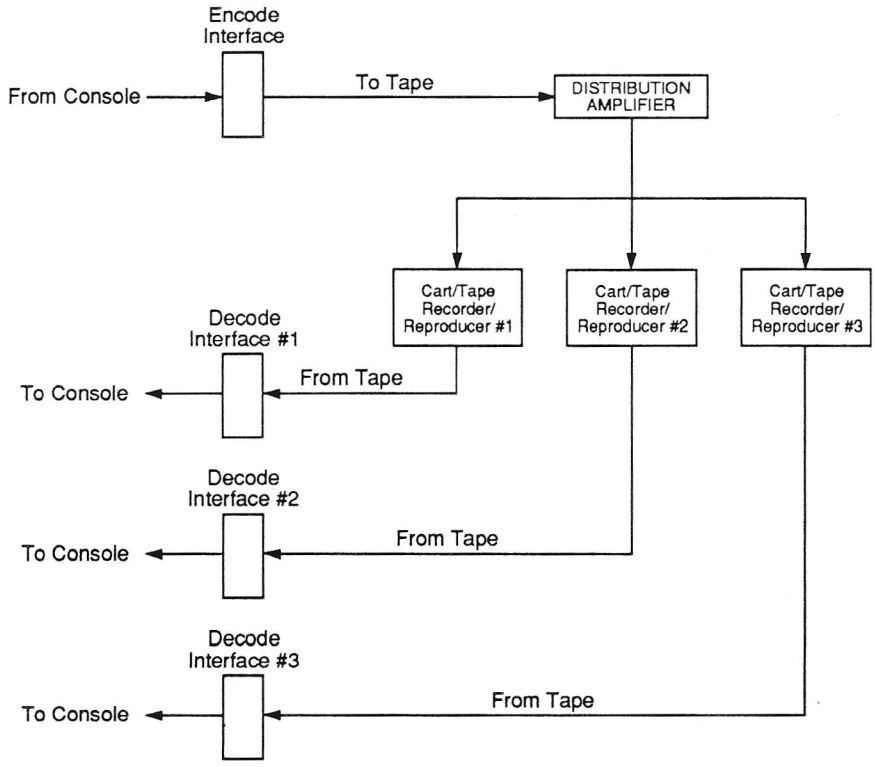


FIGURE 3.5 SINGLE INTERFACE ENCODE, MULTIPLE INTERFACE DECODE CONNECTION

4.0 EQUIPMENT DESCRIPTION

This chapter describes the various equipment and features incorporated into the SR System. Included are sections describing the mainframe, power supply assembly, and Cart Reproducer Interface, Cart Recorder/Reproducer Interface, Tape Recorder/Reproducer Interface and SR Processing Modules. Corresponding schematics are located in Chapter 6 of this document.

4.1 MAINFRAME

The SR System mainframe assembly will accommodate up to six interface modules with accompanying pairs of SR Processing Modules. Interconnection is accomplished by means of a mother board, which is connected to the rear panel assembly by ribbon cables. All of the active components are contained in the removable modules and the removable rear panel assembly.

Each of the six plug-in positions is wired universally, and will accept any of the three interface modules. All module and mainframe power is supplied by the power supply assembly, which is mounted on the inside of the rear panel assembly.

4.2 POWER SUPPLY ASSEMBLY

4.2.1 Function

The regulated power supply is installed on the inside of the rear panel assembly, and provides power for all of the SR System's audio and logic circuitry. The design employs a single toroidal power transformer equipped with an electrostatic shield to prevent coupling of common-mode line noise and RFI. The AC mains supply is protected against faults by a 1-1/2 amp "slo-blo" fuse, located on the rear panel assembly, and by power and current limiting internal to the regulators.

4.2.2 Circuitry

NOTE: The power supply assembly schematic is included as part of the mainframe schematic (Section 6.1).

The bipolar 22 volt power supply (+22 VDC at 2.8A, -22 VDC at 1.0A) is powered from two separate windings of power transformer T1, wired in a simulated center-tap configuration. The secondaries are rectified by diode bridge BR1, and filtered by capacitors C5 and C6 on the positive supply, and C7 on the negative supply. U1 is a 3 amp positive series regulator, and U2 is a 1.5 amp negative series regulator. Both of these low-noise regulators are of a plug-in integrated circuit design, and both are mounted on the heat sink located on the outside of the power supply bracket. The various small components around the regulators are used to set the output voltage and improve the noise and transient response of the regulators.

The regulated DC voltages are fed to the mother board via connector P13, and through coupling diodes CR1 and CR4. These diodes provide the necessary blocking action for connecting a redundant power supply to the SR System through External Supply Input Connector P15. In the event of an on board power

supply failure, the coupling diodes would prevent the failed power supply from affecting the redundant supply, and the corresponding Supply Sense signal on P15 would drop, providing the ability to alert the operator of a power supply failure.

4.3 CART REPRODUCER INTERFACE MODULE

4.3.1 Function

The Cart Reproducer Interface Module is designed for use with a professional cartridge reproducer, and accommodates the playback of carts recorded using SR processing. It is equipped with balanced stereo inputs (to receive the outputs of the cartridge machine), stereo input and output level calibration controls, remote SR sense logic, an input level LED meter with meter switch, and a SET UP switch. For a description of these front panel controls and indicators, and their functions, see Section 3.2 of this document. Each interface module controls its set of two SR Processing Modules as a stereo pair.

4.3.2 Circuitry

The following paragraphs discuss the Cart Reproducer Interface Module's audio, logic, meter and power circuitry. Also included at the end of this section is a logic truth table (Figure 4.1).

AUDIO

NOTE: Since the left and right audio channels of this interface perform identically, only the left channel will be discussed below.

The FROM TAPE input to the interface is fed to active differential amplifier U1A, operating with 6 dB of attenuation. The output of U1A drives LEFT INPUT GAIN control R8, whose wiper feeds the input of the SR Processing Module (TO SR LEFT). R8 has enough range to adjust a FROM TAPE input level of from 0 dBu to +8 dBu to the appropriate TO SR level of -8.24 dBu.

The output of the SR Processing Module (FROM SR LEFT) has a nominal signal level of -3.8 dBu, and drives LEFT OUTPUT GAIN control R13, which subsequently feeds the output amplifier through selection FET Q2. R13 has enough range to drive the TO CONSOLE output level from 0 dBu to +8 dBu. The TO CONSOLE output amplifier consists of inverting amplifiers U2A and U2B operating in a push-pull configuration, providing a balanced output signal at System Operating Level. The output amplifier derives its source from selection FETs Q1 and Q2.

NOTE: The level of the TO CONSOLE output amplifier needs to be adjusted to the same level as the FROM TAPE signal. This level is considered the "System Operating Level", and all components in the system should be calibrated to this level. The SR System can accommodate System Operating Levels in the range of 0 dBu to +8 dBu.

LOGIC

The SR Processing Modules are engaged whenever they are plugged into the SR System mainframe, but

the audio signal may bypass the processing modules via the electronic switching on the interface. This switching is controlled by the SR MODE selector on the interface front panel, which allows the audio signal to be routed around the processing modules (OUT), or through the processing modules (IN). This switching can also be remotely controlled if the SR MODE selector is in the SENSE mode.

SR Off Logic

When the SR MODE selector is in the OUT position (middle), R51 pulls the SR enable line low, causing Q5 to turn off, and extinguishing the SR LED. The low SR enable line also disables the SET UP mode via nand gate U5A, and turns audio selection FETs Q1 and Q3 on by pulling their gates low through R53. Audio selection FETs Q2 and Q4 are turned off by a high at the output of inverter U4C, which is fed to their gates through R52.

SR On (Play Mode) Logic

When the SR MODE selector is placed in the IN position, Q5 and the SR LED are turned on, the SET UP mode is enabled, Q1 and Q3 are turned off, and Q2 and Q4 are turned on.

When the SR MODE selector is in the SENSE position, the engagement and disengagement of the processing modules is controlled via the REMOTE SR SENSE input. This input is an active low level input intended to be driven by the collector of a phototransistor or a switch, as described in Section 2.10. The internal DIP switch (described in Section 2.9) controls whether a low at the interface module's REMOTE SR SENSE input will engage or disengage the processing modules. In the "Sense=SR On" position, a low at the REMOTE SR SENSE input will engage the processing modules by providing a high to the SR enable line via inverter U4A. In the "Sense=SR Off" position, a low at the REMOTE SR SENSE input will disengage the processing modules by providing a low to the SR enable line via inverters U4A and U4B.

SET UP On Logic

NOTE: The SET UP mode can only be engaged when the SR processing is engaged.

When SR processing is engaged, sliding the SET UP switch to the ON position will cause the processing modules' internal Dolby Noise circuits to be engaged by pulling down the L & R DOLBY NOISE LOGIC connections via Q6. As soon as a tape is played containing a recording of Dolby Noise, the processing modules' AUTO COMPARE mode will be in effect. The processing modules will then alternate every four seconds between the internal Dolby Noise source and the tape, allowing the operator to make an auditory comparison of the tape machine's reproduce characteristics and the original source (reference Section 5.4).

METER

An LED level indication meter is provided on the interface for convenience in level alignment (per the procedure in Section 5.3). When the METER SWITCH selector is placed in either the LEFT or RIGHT positions, the meter signal from the corresponding processing module is fed to the precision rectifying

circuitry of U6A and U6B. The AC is rectified, filtered, and amplified to a DC level appropriate to drive the comparator circuitry of U7 and U8.

When the processing module's input level is correct (i.e., TO SR is -8.24 dBu, +/- .5 dB), then both green LEDs will be lit at the same intensity. Only one green LED will be illuminated if the signal is from .5 dB to 1.5 dB away from the correct Dolby level (the upper LED if the signal is high, and the lower LED if the signal is low). The lower red LED will illuminate if the signal is 1.5 dB to 10 dB lower than the correct Dolby level (**NOTE**: If the lower LED does not illuminate, verify that the Interface Module input signal is in the range of 0 dBu to +8 dBu). The upper red LED will illuminate if the signal is more than 1.5 dB higher than the correct Dolby level.

NOTE: METER ADJust trim-pot R72 is factory calibrated to cause the LED meter circuitry to respond correctly to the appropriate meter signal voltages. This trim-pot should not be adjusted by the user.

POWER

The positive and negative 22 volt power supply voltages are regulated down to positive and negative 15 VDC and positive 12 VDC voltages by U9, U10 and U11. The +12 VDC voltage drives both the external LOGIC +12 VDC connection and the CURRENT SOURCE connection through R86, providing approximately 20 mA DC for use by an external photodiode. The +12 VDC is regulated once again by shunt regulator CR3 down to +6 VDC, for use by the meter comparator circuitry.

The +15 VDC regulator supplies all CMOS integrated circuits, and the analog circuits are supplied by both the positive and the negative 15 VDC regulators.

CART REPRODUCER INTERFACE MODULE LOGIC TRUTH TABLE

SR MODE	SET UP	SR MODULE	AUDIO OUTPUT SOURCES	
			TO SR SIGNAL	TO CONSOLE SIGNAL
OUT	X	DECODE	FROM TAPE	FROM TAPE
IN	OUT	DECODE	FROM TAPE	FROM SR
IN	IN	DECODE	FROM TAPE	FROM SR

X = DON'T CARE

FIGURE 4.1 CART REPRODUCER INTERFACE LOGIC TRUTH TABLE

4.4 CART RECORDER/REPRODUCER INTERFACE MODULE

4.4.1 Function

The Cart Recorder/Reproducer Interface Module is designed for use with a professional cartridge recorder/reproducer. The module is equipped with balanced stereo inputs, to receive the outputs of the mixing console and tape machine, and balanced stereo outputs, to feed the inputs of the tape machine and console. It is also equipped with stereo input and output level calibration controls, remote SR sense logic, an input level LED meter with meter switch, a SET UP switch, and a RECORD MODE selector switch. For a description of these front panel controls and indicators, and their functions, see Section 3.3 of this document. Each interface module controls its set of two SR Processing Modules as a stereo pair.

4.4.2 Circuitry

The following paragraphs discuss the Cart Recorder/Reproducer Interface Module's audio, logic, meter and power circuitry. Also included at the end of this section is a logic truth table (Figure 4.2).

AUDIO

NOTE: Since the left and right audio channels of this interface perform identically, only the left channel will be discussed below.

The FROM TAPE and the FROM CONSOLE inputs to the interface are fed to active differential amplifiers U1A and U1B, both operating with 6 dB of attenuation. The input of the SR Processing Module derives its source from either the FROM TAPE or the FROM CONSOLE input through selection FETs Q1 and Q2, which are followed by FET buffer U2A, configured as a unity gain inverting amplifier. The output of U2A drives LEFT INPUT GAIN control R23, whose wiper feeds the input of the SR Processing Module (TO SR LEFT). R23 has enough range to adjust input levels from 0 dBu to +8 dBu to the appropriate TO SR level of -8.24 dBu.

The output of the SR Processing Module (FROM SR LEFT) has a nominal signal level of -3.8 dBu, and drives LEFT OUTPUT GAIN control R25, which has enough range to drive the interface output levels from 0 dBu to +8 dBu. The wiper of R25 feeds selection FET Q4 through unity gain inverting amplifier U2B, which serves to provide the proper signal polarity to the output circuitry.

The TO CONSOLE output amplifier derives its source by selection FETs Q3 and Q4 from the FROM TAPE input or the SR Processing Module. The TO TAPE output amplifier derives its source by selection FETs Q5 and Q6 from the FROM CONSOLE input or the SR Processing Module. The TO CONSOLE output amplifier consists of inverting amplifiers U3A and U3B operating in a push-pull configuration, providing a balanced output signal at System Operating Level. The TO TAPE output amplifier is configured identically to the TO CONSOLE output amplifier utilizing inverting amplifiers U4A and U4B.

NOTE: It is extremely important that all levels to and from tape machines and consoles be identical. The INPUT GAIN and the OUTPUT GAIN controls only affect the levels going into and out of the SR

Processing Module and are intended to allow the SR system to accommodate a range of System Operating Levels from 0 dBu to +8 dBu.

LOGIC

The SR Processing Modules are engaged whenever they are plugged into the SR System mainframe, but the audio signal may bypass the processing modules via the electronic switching on the interface. This switching is controlled by the SR MODE selector on the interface front panel, which allows the audio signal to be routed around the processing modules (OUT), or through the processing modules (IN). This switching can also be remotely controlled if the SR MODE selector is in the SENSE mode.

SR Off Logic

When the SR MODE selector is in the OUT position (middle), R165 pulls the SR enable line low, causing Q16 to turn off, and extinguishing the SR LED. The low SR enable line also disables the SET UP mode via nand gate U19A, and forces the output of U18B high and the output of U18C low. This turns audio selection FETs Q5 and Q11 on by pulling their gates low through R151. Audio selection FETs Q6 and Q12 are turned off by a high at the output of inverter U17C, which is fed to their gates through R150. The low SR enable line also forces the output of U18D high, which turns off audio selection FETs Q2, Q3, Q8, and Q9 via resistor R153. Audio selection FETs Q1, Q4, Q7, and Q10 are turned on by a low at the output of inverter U17B, which is fed to their gates through R152.

SR On (Record Mode) Logic

When the SR MODE selector is placed in the IN position, Q16 and the SR LED are turned on, the SET UP mode is enabled and the status of the audio selection FETs will be controlled by the status of the RECORD MODE switch.

When the SR MODE selector is in the SENSE position, the engagement and disengagement of the processing modules is controlled via the REMOTE SR SENSE input. This input is an active low level input intended to be driven by the collector of a phototransistor or a switch, as described in Section 2.10. The internal DIP switch (described in Section 2.9) controls whether a low at the interface module's REMOTE SR SENSE connection will engage or disengage the processing modules. In the "Sense=SR On" position, a low at the REMOTE SR SENSE input will engage the processing modules by providing a high to the SR enable line via inverter U17F. In the "Sense=SR Off" position, a low at the REMOTE SR SENSE input will disengage the processing modules by providing a low to the SR enable line via inverters U17F and U17D.

When SR processing is engaged, the status of the audio selection FETs is determined by the logic level appearing at RECORD MODE switch S4. When S4 is in the RECord position, the high record enable line forces the output of U18B low and the output of U18C high, which turns off audio selection FETs Q5 and Q11 by forcing their gates high through R151. Audio selection FETs Q6 and Q12 are turned on by a low at the output of inverter U17C, which is fed to their gates through R150. The high record enable line also causes the output of inverter U17A to go low, which drives the output of U18A high, forcing the output of U18D low and turning on audio selection FETs Q2, Q3, Q8, and Q9, via resistor R153.

Audio selection FETs Q1, Q4, Q7, and Q10 are turned off by a high at the output of inverter U17B, which is fed to their gates through R152.

The low appearing at the output of U17A turns off Q17, which extinguishes the PLAY LED and turns on Q18 and the RECORD LED. When Q18 is on, Q19 is also on, which puts the SR Processing Modules in the RECORD mode.

AUTO On Logic

With SR processing still engaged, and the RECORD MODE switch in the AUTO position, the logic inputs from the cart recorder will determine the mode of the interface module. If the machine is stopped, in "record ready" mode, or recording, the module will be in RECORD mode, operating exactly the same as if the RECORD MODE switch were in the RECORD position. When the machine is playing (not recording), both inputs of U19C will be high, which will cause its output to be low.

The low at the output of U19C is fed through the RECORD MODE switch, driving the record enable line low and forcing the output of U18B high and the output of U18C low, which turns on audio selection FETs Q5 and Q11 by forcing their gates low through R151. Audio selection FETs Q6 and Q12 are turned off by a high at the output of inverter U17C, which is fed to their gates through R150. The low record enable line also causes the output of inverter U17A to go high, which drives the output of U18A low, forcing the output of U18D high and turning off audio selection FETs Q2, Q3, Q8, and Q9 via resistor R153. Audio selection FETs Q1, Q4, Q7, and Q10 are turned on by a low at the output of inverter U17-B, which is fed to their gates through R152.

The high appearing at the output of U17A turns on Q17, which illuminates the PLAY LED and turns off Q18 and the RECORD LED. When Q18 is off, Q19 is also off, which puts the Dolby Processing Modules in the PLAY mode.

The PLAY TALLY and RECORD TALLY inputs are intended to be driven from the cart recorder's play and record logic tallies. These logic inputs are configured to accommodate a wide range of input voltages (from 5 VDC to 24 VDC) by regulating the current in the photo-diode of an opto-isolator. The collectors of the opto-isolator's transistors drive the logic inputs of U19C to determine the interface module's status.

SET UP On Logic

NOTE: The SET UP mode can only be engaged when SR processing is engaged.

When SR processing is engaged, sliding the SET UP switch to the ON position will cause the processing modules' internal Dolby Noise circuits to be engaged by pulling down the L & R DOLBY NOISE LOGIC connections via Q20. As soon as a tape is played containing a recording of Dolby Noise, the processing modules' AUTO COMPARE mode will be in effect. The processing modules will then alternate every four seconds between the internal Dolby Noise source and the tape, allowing the operator to make an auditory comparison of the tape machine's reproduce characteristics and the original source (reference Section 5.4).

METER

An LED level indication meter is provided on the interface for convenience in level alignment (per the procedure in Section 5.3). When the METER SWITCH selector is placed in either the LEFT or RIGHT positions, the meter signal from the corresponding processing module is fed to the precision rectifying circuitry of U9A and U9B. The AC is rectified, filtered, and amplified to a DC level appropriate to drive the comparator circuitry of U10 and U11.

When the processing module's input level is correct (i.e., TO SR is -8.24 dBu, +/- .5 dB), then both green LEDs will be lit at the same intensity. Only one green LED will be illuminated if the signal is from .5 dB to 1.5 dB away from the correct Dolby level (the upper LED if the signal is high, and the lower LED if the signal is low). The lower red LED will illuminate if the signal is 1.5 dB to 10 dB lower than the correct Dolby level (**NOTE**: If the lower LED does not illuminate, verify that the Interface Module input signal is in the range of 0 dBu to +8 dBu). The upper red LED will illuminate if the signal is more than 1.5 dB higher than the correct Dolby level.

NOTE: METER ADJust trim-pot R72 is factory calibrated to cause the LED meter circuitry to respond correctly to the appropriate meter signal voltages. This trim-pot should not be adjusted by the user.

POWER

The positive and negative 22 volt power supply voltages are regulated down to positive and negative 15 VDC and positive 12 VDC voltages by U13, U12, and U14. The +12 VDC voltage drives both the external LOGIC +12 VDC connection and the CURRENT SOURCE connection through R138, providing approximately 20 mADC for use by an external photodiode. The +12 VDC is regulated once again by shunt regulator CR3 down to +6 VDC, for use by the meter comparator circuitry.

The +15 VDC regulator supplies all CMOS integrated circuits, and the analog circuits are supplied by both the positive and the negative 15 VDC regulators.

CART RECORDER/REPRODUCER INTERFACE MODULE LOGIC TRUTH TABLE

MACHINE	SR MODE	SET UP	RECORD MODE	SR MODULE	AUDIO OUTPUT SOURCES		
					TO TAPE SIGNAL	TO SR SIGNAL	TO CONSOLE SIGNAL
X	OUT	X	X	X	FROM CONSOLE	FROM CONSOLE	FROM TAPE
STOP	IN	OUT	AUTO	ENCODE	FROM SR	FROM CONSOLE	FROM TAPE
PLAY	IN	OUT	AUTO	DECODE	FROM CONSOLE	FROM TAPE	FROM SR
REC • PLAY	IN	OUT	AUTO	ENCODE	FROM SR	FROM CONSOLE	FROM TAPE
X	IN	OUT	RECORD	ENCODE	FROM SR	FROM CONSOLE	FROM TAPE
X	IN	IN	RECORD	ENCODE	FROM SR	FROM TAPE	FROM SR
STOP	IN	IN	AUTO	ENC/S.U.	FROM SR	FROM TAPE	FROM SR
PLAY	IN	IN	AUTO	DEC/S.U.	FROM CONSOLE	FROM TAPE	FROM SR
REC • PLAY	IN	IN	AUTO	ENC/S.U.	FROM SR	FROM TAPE	FROM SR

X = DON'T CARE

FIGURE 4.2 CART RECORDER/REPRODUCER INTERFACE LOGIC TRUTH TABLE

4.5 TAPE RECORDER/REPRODUCER INTERFACE MODULE

4.5.1 Function

The Tape Recorder/Reproducer Interface Module is designed for use with professional reel-to-reel tape machines which are equipped with NR (noise reduction) control connectors. The module is equipped with balanced stereo inputs, to receive the outputs of the mixing console and tape machine, and balanced stereo outputs, to feed the inputs of the tape machine and console. It is also equipped with stereo input and output level calibration controls, an input level LED meter with meter switch, a record mode selector switch, and SR engage/bypass and Check Tape functions. The SR engage/bypass and Check Tape functions are remote controllable, with the interface module providing current limited +12 VDC tally voltages to indicate each function. For a description of these front panel controls and indicators, and their functions, see Section 3.4 of this document. Each interface module controls its set of two SR Processing Modules as a stereo pair (only one SR Processing Module is required for monaural applications).

4.5.2 Circuitry

The following paragraphs discuss the Tape Recorder/Reproducer Interface Module's audio, logic, meter and power circuitry. Also included at the end of this section is a logic truth table (Figure 4.3).

AUDIO

NOTE: Since the left and right channels of this interface perform identically, only the left channel will be discussed below.

The FROM TAPE and the FROM CONSOLE inputs to the interface are fed to active differential amplifiers U1A and U1B, both operating with 6 dB of attenuation. The input of the SR Processing Module derives its source from either the FROM TAPE or the FROM CONSOLE input through selection FETs Q1 and Q2, which are followed by FET buffer U2A, configured as a unity gain inverting amplifier. The output of U2A drives LEFT INPUT GAIN control R23, whose wiper feeds the input of the SR Processing Module (TO SR LEFT). R23 has enough range to adjust input levels from 0 dBu to +8 dBu to the appropriate TO SR level of -8.24 dBu.

The output of the SR Processing Module (FROM SR LEFT) has a nominal signal level of -3.8 dBu, and drives LEFT OUTPUT GAIN control R25 which has enough range to drive the interface output levels from 0 dBu to +8 dBu. The wiper of R25 feeds selection FET Q4 through unity gain inverting amplifier U2B, which serves to provide the proper signal polarity to the output circuitry.

The TO CONSOLE output amplifier derives its source by selection FETs Q3 and Q4 from the FROM TAPE input or the SR Processing Module. The TO TAPE output amplifier derives its source by selection FETs Q5 and Q6 from the FROM CONSOLE input or the SR Processing Module. The TO CONSOLE output amplifier consists of inverting amplifiers U3A and U3B operating in a push-pull configuration, providing a balanced output signal at System Operating Level. The TO TAPE output amplifier is configured identically to the TO CONSOLE output amplifier utilizing inverting amplifiers U4A and U4B.

NOTE: It is extremely important that all levels to and from tape machines and consoles be identical. The INPUT GAIN and the OUTPUT GAIN controls only affect the levels going into and out of the SR Processing Module and are intended to allow the SR system to accommodate a range of System Operating Levels from 0 dBu to +8 dBu.

LOGIC

The SR Processing Modules are engaged whenever they are plugged into the SR System mainframe, but the audio signal may bypass the processing modules via the electronic switching on the interface. This switching is controlled by the SR MODE button switch located on the interface front panel, which allows the audio signal to be routed around the processing modules (OFF), or through the processing modules (ON). This switching can also be remotely controlled by an external momentary switch.

Power Up Logic

When power is first applied to the module, capacitor C99 is discharged, which sets SR latch U18B and resets CHECK TAPE latch U18A. The low at pin 2 of U18B turns on transistor Q16, driving regulator U15, which is configured as a current regulator for short circuit protection. The output of U15 drives the REMote SR TALLY high, and also the local SR LED through R147. Depression of a local or remote SR switch forces a high to appear at the output of U17D, which toggles U18B pin 2 high, turning off transistor Q17 and the SR tally and LED.

SR Off Logic

When SR processing is off, the low at U18B pin 1 forces the outputs of nand gates U20B, U20A, U24A, U24B, U24C, and U24D all high. The high at U20B pin 3 drives the output of inverter U17B low, forcing the output of nand gate U19A high, locking the CHECK TAPE latch off by driving its reset input, pin 10, high. The high at U24A pin 3 drives the output of U23A low, which turns on audio selection FET Q5 through R173. The low at U23A pin 11 forces the output of inverter U22C high and turns off audio selection FET Q6, turning on transistor Q18, which illuminates Left Play LED DS5A. The low at U23A pin 11 turns off transistors Q23 and Q21. When Q21 is off, the Left REC/PLAY LOGIC line is low, which tells the left processing module to decode (this is the SR Processing Module's default mode, even when no audio processing is taking place). The high at U24B pin 4 drives the output of U23B low, which turns on audio selection FET Q11 through R168. The low at U23B pin 10 forces the output of inverter U22D high and turns off audio selection FET Q12, turning on transistor Q19 which illuminates the Right Play LED DS5B. The low at U23B pin 10 turns off transistors Q24 and Q22. When Q22 is off, the Right REC/PLAY LOGIC line is low, which tells the right processing module to decode.

The high at the output of U24C is inverted by nand gate U23C, whose low output turns on audio selection FET Q2 through R174, forcing the output of inverter U22E high, which turns off FET Q1. The low at U23 pin 3 also forces the output of U20C high, which turns off audio selection FET Q4 through R169 and causes the output of U21A to go low, turning off FET Q3 through R170. The low at U21 pin 11 also forces the output of U21B high, which turns off audio FET Q14. The high at the output of U24D is inverted by nand gate U23D, whose low output turns on audio selection FET Q8 through R176 and forces

the output of inverter U22F high, turning off FET Q7. The low at U23 pin 4 also forces the output of U20D high, which turns off audio selection FET Q10 through R164 and causes the output of U21C to go low, turning off FET Q9 through R165. The low at U21 pin 4 also forces the output of U21D high, which turns off audio FET Q15.

SR On (Record Mode) Logic

Depression of a local or remote SR switch forces a high to appear at the output of U17D, which toggles U18B pin 2 low, turning on transistor Q16 and the SR tally and LED.

NOTE: The following description applies when SR is on, CHECK TAPE and SET UP are both off, and the RECORD MODE switch is in the REC position.

The high at U18B pin 1 causes the output of U20A to go low, driving the outputs of U21C and U21A high. The high at U21 pin 4 turns of audio selection FET Q9 through R165, and the high at U21 pin 11 turns off FET Q3 through R170.

With S5 in the RECord position, R189 pulls pins 13 and 8 of U19 low. This causes the outputs of U19B and U19C to go high. The high at U19 pin 11 forces the output of U24A low, which is inverted by U23A, whose high output turns off audio selection FET Q5 through R173. The high at U23 pin 11 also turns on transistor Q23, turning on Q21, which illuminates the Left RECord LED and tells the left processing module to encode. The high at U23 pin 11 also drives the output of inverter U22C low, turning off transistor Q18 and the Left PLAY LED, and also turning on audio selection FET Q6. The high at U19 pin 11 also drives the output of inverter U22A low, forcing the output of U24C high. This, in turn, causes the output of U23C to go low, which turns on audio selection FET Q2 through R174 and forces the output of inverter U22E high, which turns off FET Q1 through R175. The low at U23 pin 3 also drives the output of U20C high, turning off audio FET Q4 through R169 and forcing the output of U21B low, which turns on FET Q14.

The high at U19 pin 10 forces the output of U24B low, which is inverted by U23B, whose high output turns off audio selection FET Q11 through R168. The high at U23 pin 10 also turns on transistor Q24, turning on Q22, which illuminates the Right RECord LED and tells the right processing module to encode. The high at U23 pin 10 also drives the output of inverter U22D low, turning off transistor Q19 and the Right PLAY LED, and also turning on audio selection FET Q12. The high at U19 pin 10 also drives the output of inverter U22B low, forcing the output of U24D high. This, in turn, causes the output of U23D to go low, which turns on audio selection FET Q8 through R176 and forces the output of inverter U22F high, which turns off FET Q7 through R177. The low at U23 pin 4 also drives the output of U20D high, turning off audio FET Q10 through R164 and forcing the output of U21D low, which turns on FET Q15.

AUTO On Logic

NOTE: The following description applies when SR is engaged, CHECK TAPE is off, and the RECORD MODE switch is in the AUTO position.

When neither the LEFT nor the RIGHT RECORD SENSE logic inputs are pulled low, the module will default to "play" or "decode" mode, as follows. R161 and R162 pull up the inputs of U19B and U19C and drive their outputs low. The low at U19 pin 11 forces the output of U24A high, which is inverted by U23A, whose low output turns on audio selection FET Q5 through R173. The low at U23 pin 11 also turns off transistor Q23, turning off Q21, which extinguishes the Left RECord LED and tells the left processing module to decode. The low at U23 pin 11 also drives the output of inverter U22C high, turning on transistor Q18 and the Left PLAY LED, and also turning off audio selection FET Q6. The low at U19 pin 11 also drives the output of inverter U22A high, forcing the output of U24C low. This, in turn, causes the output of U23C to go high, which turns off audio selection FET Q2 through R174 and forces the output of inverter U22E low, which turns on FET Q1 through R175. The high at U23 pin 3 also drives the output of U20C low, turning on audio FET Q4 through R169 and forcing the output of U21B high, which turns off FET Q14.

The low at U19 pin 10 forces the output of U24B high, which is inverted by U23B, whose low output turns on audio selection FET Q11 through R168. The low at U23 pin 10 also turns off transistor Q24, turning off Q22, which extinguishes the Right RECord LED and tells the right processing module to decode. The low at U23 pin 10 also drives the output of inverter U22D high, turning on transistor Q19 and the Right PLAY LED, and also turning off audio selection FET Q12. The low at U19 pin 10 also drives the output of inverter U22B high, forcing the output of U24D low. This, in turn, causes the output of U23D to go high, which turns off audio selection FET Q8 through R176 and forces the output of inverter U22F low, which turns on FET Q7 through R177. The high at U23 pin 4 also drives the output of U20D low, turning on audio FET Q10 through R164 and forcing the output of U21D high, which turns off FET Q15.

When the LEFT RECORD SENSE logic input is pulled low (and the + OPTO SUPPLY input is high), current flows through the left LED of opto coupler U25. This causes the photo-transistor to saturate and pull pin 8 low, forcing the output of U19B high. The high at U19 pin 11 forces the output of U24A low, which is inverted by U23A, whose high output turns off audio selection FET Q5 through R173. The high at U23 pin 11 also turns on transistor Q23, turning on Q21, which illuminates the Left RECord LED and tells the left processing module to encode. The high at U23 pin 11 also drives the output of inverter U22C low, turning off transistor Q18 and the Left PLAY LED, and also turning on audio selection FET Q6. The high at U19 pin 11 also drives the output of inverter U22A low, forcing the output of U24C high. This, in turn, causes the output of U23C to go low, which turns on audio selection FET Q2 through R174 and forces the output of inverter U22E high, which turns off FET Q1 through R175. The low at U23 pin 3 also drives the output of U20C high, turning off audio FET Q4 through R169 and forcing the output of U21B low, which turns on FET Q14.

When the RIGHT RECORD SENSE logic input is pulled low (and the + OPTO SUPPLY input is high), current flows through the Right LED of opto coupler U25. This causes the photo-transistor to saturate and pull pin 6 low, forcing the output of U19C high. The high at U19 pin 10 forces the output of U24B low, which is inverted by U23B, whose high output turns off audio selection FET Q11 through R168. The high at U23 pin 10 also turns on transistor Q24, turning on Q22, which illuminates the Right RECord LED and tells the right processing module to encode. The high at U23 pin 10 also drives the output of inverter U22D low, turning off transistor Q19 and the Right PLAY LED, and also turning on audio selection FET Q12. The high at U19 pin 10 also drives the output of inverter U22B low, forcing the output

of U24D high. This, in turn, causes the output of U23D to go low, which turns on audio selection FET Q8 through R176 and forces the output of inverter U22F high which turns off FET Q7 through R177. The low at U23 pin 4 also drives the output of U20D high, turning off audio FET Q10 through R164 and forcing the output of U21D low, which turns on FET Q15.

CHECK TAPE On Logic

The CHECK TAPE mode affects the audio being sent to the console by allowing the TO CONSOLE audio to monitor the FROM TAPE audio, without decoding. If this function is engaged while recording, the TO CONSOLE signal will monitor the encoded audio going to the tape machine. If the function is engaged during playback, the TO CONSOLE audio will monitor the non-decoded tape machine playback signal. The CHECK TAPE function is disabled when SR is off or when SET UP is engaged.

NOTE: The following description applies only when SR is on and SET UP is disengaged.

Depression of a local or remote CHECK TAPE switch forces a low to appear at the output of U17A, which toggles U18A pin 12 low, turning on transistor Q17 and the CHECK TAPE tally and LED. The low at U18 pin 12 also drives the output of U20A high, which enables U21 pins 6 and 12. The low at U18 pin 12 also drives the output of U20C high, turning off audio selection FET Q4 through R169 and causing the output of U21A to go low, which turns on FET Q3. The low at U21 pin 11 drives the output of U21B low, which turns on audio FET Q14. The low at U18 pin 12 also drives the output of U20D high, turning off audio selection FET Q10 through R164 and causing the output of U21C to go low, which turns on FET Q9. The low at U21 pin 4 drives the output of U21D low, which turns on audio FET Q15.

SET UP On Logic

NOTE: The SET UP mode can only be engaged when the SR processing is engaged.

When SR processing is engaged, sliding the SET UP switch to the ON position will cause the processing modules' internal Dolby Noise circuits to be engaged by pulling down the L & R DOLBY NOISE LOGIC connections via Q20. As soon as a tape is played containing a recording of Dolby Noise, the processing modules' AUTO COMPARE mode will be in effect. The processing modules will then alternate every four seconds between the internal Dolby Noise source and the tape, allowing the operator to make an auditory comparison of the tape machine's reproduce characteristics and the original source (reference Section 5.4).

When the SET UP switch is engaged, the low at U18 pin 2 is fed to inverter U17E, whose high output turns on transistor Q20, which engages the Dolby Noise logic in the left and right processing modules. The low at the switch also causes the output of U20B to go high, which is inverted by U17B, whose low output forces the output of U19A high and locks CHECK TAPE latch U18A in the off mode. The low at the switch also turns on meter gain FET Q13, which serves to boost the gain of the meter circuitry to compensate for the difference between Dolby Noise and tones.

If the RECORD MODE switch is in the AUTO position and neither the LEFT or RIGHT RECORD SENSE logic inputs are pulled low, the module will default to the "play" or "decode" mode, as follows.

R161 and R162 pull up the inputs of U19B and U19C and drive their outputs low. The low at U19 pin 11 forces the output of U24A high, which is inverted by U23A, whose low output turns on audio selection FET Q5 through R173. The low at U23 pin 11 also turns off transistor Q23, turning off Q21, which extinguishes the Left RECord LED and tells the left processing module to decode. The low at U23 pin 11 also drives the output of inverter U22C high, turning on transistor Q18 and the Left PLAY LED, and also turning off audio selection FET Q6. The low at U19 pin 11 also drives the output of inverter U22A high, forcing the output of U24C low. This, in turn, causes the output of U23C to go high, which turns off audio selection FET Q2 through R174 and forces the output of inverter U22E low, which turns on FET Q1 through R175. The high at U23 pin 3 also drives the output of U20C low, turning on audio FET Q4 through R169 and forcing the output of U21B high, which turns off FET Q14.

The low at U19 pin 10 forces the output of U24B high, which is inverted by U23B, whose low output turns on audio selection FET Q11 through R168. The low at U23 pin 10 also turns off transistor Q24, turning off Q22, which extinguishes the Right RECord LED and tells the right processing module to decode. The low at U23 pin 10 also drives the output of inverter U22D high, turning on transistor Q19 and the Right PLAY LED, and also turning off audio selection FET Q12. The low at U19 pin 10 also drives the output of inverter U22B high, forcing the output of U24D low. This, in turn, causes the output of U23D to go high, which turns off audio selection FET Q8 through R176 and forces the output of inverter U22F low, which turns on FET Q7 through R177. The high at U23 pin 4 also drives the output of U20D low, turning on audio FET Q10 through R164 and forcing the output of U21D high, which turns off FET Q15.

When RECORD MODE switch is in the RECord position, or the LEFT RECORD SENSE logic input is pulled low, current flows through the left LED of opto coupler U1. This causes the photo-transistor to saturate and pull pin 8 low, forcing the output of U19B high. The high at U19 pin 11 forces the output of U24A low, which is inverted by U23A, whose high output turns off audio selection FET Q5 through R173. The high at U23 pin 11 also turns on transistor Q23, turning on Q21, which illuminates the Left RECord LED and tells the left processing module to encode. The high at U23 pin 11 also drives the output of inverter U22C low, turning off transistor Q18 and the Left PLAY LED, and also turning on audio selection FET Q6. The low SET UP enable line forces the output of U23C high, which turns off audio selection FET Q2 through R174 and forces the output of inverter U22E low, which turns on FET Q1 through R175. The high at U23 pin 3 also drives the output of U20C low, turning on audio FET Q4 through R169 and forcing the output of U21B high, which turns off FET Q14.

When the RECORD MODE switch is in the RECord position, or the RIGHT RECORD SENSE logic input is pulled low, current flows through the Right LED of opto coupler U1. This causes the photo-transistor to saturate and pull pin 6 low, forcing the output of U19C high. The high at U19 pin 10 forces the output of U24B low, which is inverted by U23B, whose high output turns off audio selection FET Q11 through R168. The high at U23 pin 10 also turns on transistor Q24, turning on Q22, which illuminates the Right RECord LED and tells the right processing module to encode. The high at U23 pin 10 also drives the output of inverter U22D low, turning off transistor Q19 and the Right PLAY LED, and also turning on audio selection FET Q12. The low SET UP enable line forces the output of U23D high, which turns off audio selection FET Q8 through R176 and forces the output of inverter U22F low, which turns on FET Q7 through R177. The high at U23 pin 4 also drives the output of U20D low, turning on audio FET Q10 through R164 and forcing the output of U21D high, which turns off FET Q15.

METER

An LED level indication meter is provided on the interface for convenience in level alignment (per the procedure in Section 5.3). When the METER SWITCH selector is placed in either the LEFT or RIGHT positions, the meter signal from the corresponding processing module is fed to the precision rectifying circuitry of U9A and U9B. The AC is rectified, filtered, and amplified to a DC level appropriate to drive the comparator circuitry of U10 and U11.

When the processing module's input level is correct (i.e., TO SR is -8.24 dBu, +/- .5 dB), then both green LEDs will be lit at the same intensity. Only one green LED will be illuminated if the signal is from .5 dB to 1.5 dB away from the correct Dolby level (the upper LED if the signal is high, and the lower LED if the signal is low). The lower red LED will illuminate if the signal is 1.5 dB to 10 dB lower than the correct Dolby level (**NOTE**: If the lower LED does not illuminate, verify that the Interface Module input signal is in the range of 0 dBu to +8 dBu). The upper red LED will illuminate if the signal is more than 1.5 dB higher than the correct Dolby level.

NOTE: METER ADJust trim-pot R72 is factory calibrated to cause the LED meter circuitry to respond correctly to the appropriate meter signal voltages. This trim-pot should not be adjusted by the user.

POWER

The positive and negative 22 volt power supply voltages are regulated down to positive and negative 15 VDC and positive 12 VDC voltages by U13, U12, and U14. The +12 VDC voltage drives the external LOGIC +12 VDC connection. The +12 VDC is regulated once again by shunt regulator CR3 down to +6 VDC, for use by the meter comparator circuitry.

The +15 VDC regulator supplies all CMOS integrated circuits, and the analog circuits are supplied by both the positive and the negative 15 VDC regulators.

TAPE RECORDER/REPRODUCER INTERFACE MODULE LOGIC TRUTH TABLE

MACHINE	SR MODE	SET UP	CHECK TAPE	RECORD MODE	SR MODULE	AUDIO OUTPUT SOURCES: TO TAPE SIGNAL	TO SR SIGNAL	TO CONSOLE SIGNAL
X	OFF	DISABLED	DISABLED	X	DECODE	FROM CONSOLE	FROM CONSOLE	FROM TAPE
X	ON	OFF	OFF	RECORD	ENCODE	FROM SR	FROM CONSOLE	FROM CONSOLE
X	ON	OFF	ON	RECORD	ENCODE	FROM SR	FROM CONSOLE	FROM TAPE
RECORD	ON	OFF	OFF	AUTO	ENCODE	FROM SR	FROM CONSOLE	FROM CONSOLE
RECORD	ON	OFF	ON	AUTO	ENCODE	FROM SR	FROM CONSOLE	FROM TAPE
NOT RECORD	ON	OFF	OFF	AUTO	DECODE	FROM CONSOLE	FROM TAPE	FROM SR
NOT RECORD	ON	OFF	ON	AUTO	DECODE	FROM CONSOLE	FROM TAPE	FROM TAPE
X	ON	ON	DISABLED	RECORD	ENC/S.U.	FROM SR	FROM TAPE	FROM SR
RECORD	ON	ON	DISABLED	AUTO	ENC/S.U.	FROM SR	FROM TAPE	FROM SR
NOT RECORD	ON	ON	DISABLED	AUTO	ENC/S.U.	FROM CONSOLE	FROM TAPE	FROM SR

X = DON'T CARE

FIGURE 4.3 TAPE RECORDER/REPRODUCER INTERFACE LOGIC TRUTH TABLE

4.6 SR PROCESSING MODULE

The SR Processing Module, manufactured by Dolby Laboratories, is a specialized version of the Cat. 280 module. The Cat. 280, a retrofit for the Cat. 22 Type-A noise reduction module, is equipped with a programming switch and circuitry to accommodate a variety of existing Dolby Chassis frames. The SR System processing module, however, does not need the programming switch, and uses the input and output amplifier circuitry contained on the interface module to which it is connected.

5.0 MAINTENANCE AND ALIGNMENT

This chapter contains sections describing routine maintenance, installation and servicing tools, SR System alignment, cart/tape machine alignment verification using Dolby Noise, and replacement parts.

5.1 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.

5.2 TOOLS

The following tools may be desired for installing and servicing the SR System. If you already have a PR&E console, you probably own these tools. If not, they can be purchased for a nominal charge.

DESCRIPTION	PR&E#
MOLEX Connector Pin Crimp Tool	70-3
MOLEX Connector Pin Extractor Tool	70-4
MOLEX Connector Pin Crimp Tool (#HTR-1719-C)	70-5

5.3 SR SYSTEM ALIGNMENT

The SR System is factory aligned at the time of shipment to the prescribed "Standard Operating Level" (the level at which all tape machines and consoles are aligned throughout a system). The SR System will accommodate Standard Operating Levels in the range of 0 dBu to +8 dBu. If it should become necessary to adjust the SR System's alignment, do so per the procedures contained in this section.

NOTE: For simplicity's sake, the alignment procedures contained in this section describe a system with a +8 dBu operating level.

5.3.1 Cart Reproducer Interface

This paragraph describes the steps to be followed when aligning an SR System Cart Reproducer Interface Module, as follows:

NOTE: Prior to beginning this procedure, verify that the console inputs, outputs, and meters have all been properly aligned to the System Operating Level.

1. Switch the SR MODE selector to the OUT position.

2. Using a reference standard alignment cartridge, completely align the cart machine to +8 dBu, in accordance with the machine's normal alignment procedure (reproduce level, equalization, etc.).

3. Switch the SR MODE selector to the IN position, and the METER SWITCH to the Left position.

4. Using the same reference standard alignment cart used in the cart machine alignment (step 2), play back the 1 kHz portion and adjust the Left INput level control on the front of the interface module until the two green LEDs on the INPUT LEVEL meter are illuminated at equal intensities.

5. Switch the METER SWITCH to the Right position, and repeat step 4, adjusting the Right INput level control until both green LEDs are illuminated at equal intensities.

6. Return the METER SWITCH to the OFF position.

7. Continue to play the 1 kHz portion of the alignment cart, and adjust the Left OUTput level control of the interface module until the TO CONSOLE output is +8 dBu (0 VU on the console meters).

8. Repeat step 7 adjusting the Right OUTput level control.

9. While playing the 1 kHz portion of the alignment cart, watch the output level of the SR System on the console VU meters and toggle the SR MODE selector between IN and OUT, verifying that levels match.

5.3.2 Cart Recorder/Reproducer Interface

This paragraph describes the steps to be followed when aligning an SR System Cart Recorder/ Reproducer Interface Module, as follows:

NOTE: Prior to beginning this procedure, verify that the console inputs, outputs, and meters have all been properly aligned to the System Operating Level.

1. Switch the SR MODE selector to the OUT position.

2. Using a reference standard alignment cartridge, completely align the cart machine to +8 dBu, in accordance with the machine's normal alignment procedure (reproduce level, equalization, etc.).

3. Switch the SR MODE selector to the IN position, and the METER SWITCH to the Left position.

4. Using the same reference standard alignment cart used in the cart machine alignment (step 2), play back the 1 kHz portion and adjust the Left INput level control on the front of the interface module until the two green LEDs on the INPUT LEVEL meter are illuminated at equal intensities.

5. Switch the METER SWITCH to the Right position, and repeat step 4, adjusting the Right INput level control until both green LEDs are illuminated at equal intensities.

6. Return the METER SWITCH to the OFF position.

7. Continue to play the 1 kHz portion of the alignment cart, and adjust the Left OUTput level control of the interface module until the TO CONSOLE output is +8 dBu (0 VU on the console meters).

8. Repeat step 7 adjusting the Right OUTput level control.

9. Next, send a +8 dBu 1 kHz signal from a console test oscillator to the FROM CONSOLE input of the interface module. Then, set the meter mode of the cart recorder to meter its input signal and verify that the input signal is +8 dBu (0 VU on the cart recorder's meters). If not, repeat steps 4 through 8.

10. While still sending the +8 dBu signal to the FROM CONSOLE input, toggle the SR MODE selector between IN and OUT and verify that the interface LED levels match.

11. Finally, play the 1 kHz portion of the alignment cart, and watch the output level of the SR System on the console VU meters. Toggle the SR MODE selector between IN and OUT, verifying that the levels match.

5.3.3 Tape Recorder/Reproducer Interface

This paragraph describes the steps to be followed when aligning an SR System Tape Recorder/ Reproducer Interface Module, as follows:

NOTE: Prior to beginning this procedure, verify that the console inputs, outputs, and meters have all been properly aligned to the System Operating Level.

1. Switch the SR MODE selector to the OUT position.

2. Switch the tape machine's left and right monitor selectors to the "repro" position, so that the playback audio is monitored.

3. Using a reference standard alignment tape, completely align the tape machine to +8 dBu, in accordance with the machine's normal alignment procedure (reproduce level, equalization, etc.).

4. Switch the SR MODE selector to the IN position, and the METER SWITCH to the Left position.

5. Using the same reference standard alignment tape used in the tape machine alignment (step 3), play back the 1 kHz portion and adjust the Left INput level control on the front of the

interface module until the two green LEDs on the INPUT LEVEL meter are illuminated at equal intensities.

5. Switch the METER SWITCH to the Right position, and repeat step 4, adjusting the Right INput level control until both green LEDs are illuminated at equal intensities.

6. Return the METER SWITCH to the OFF position.

7. Continue to play the 1 kHz portion of the alignment tape, and adjust the Left OUTput level control of the interface module until the TO CONSOLE output is +8 dBu (0 VU on the console meters).

8. Repeat step 7 adjusting the Right OUTput level control.

9. Next, send a +8 dBu 1 kHz signal from a console test oscillator to the FROM CONSOLE input of the interface module. Then, set the meter mode of the tape recorder to meter its input signal and verify that the input signal is +8 dBu (0 VU on the cart recorder's meters). If not, repeat steps 4 through 8.

10. While still sending the +8 dBu signal to the FROM CONSOLE input, toggle the SR MODE selector between IN and OUT and verify that the interface LED levels match.

11. Finally, play the 1 kHz portion of the alignment tape, and watch the output level of the SR System on the console VU meters. Toggle the SR MODE selector between IN and OUT, verifying that the levels match.

5.4 CART/TAPE MACHINE ALIGNMENT VERIFICATION

Each processing module is equipped with a unique setup signal, called Dolby Noise, along with an automatic comparison system for frequency response and level confirmation of the tape equipment. Dolby Noise is pink noise. Engaging the SET UP switch on the recorder interface module (with SR processing engaged) will cause Dolby Noise to be fed to the recorder at 15 dB below the standard reference level. This signal is interrupted with identifying 20 millisecond nicks every two seconds (distinguishing the recorded signal from the internal reference signal).

Upon playback of the signal while in the SET UP mode, the recorded Dolby Noise is automatically alternated with the internal reference pink noise every four seconds, and fed to the system output for monitoring. The two signals may be recognized by the presence or absence of nicks, or by observing the REF and TAPE indicators on the individual SR Processing Modules. Any significant frequency response error in recorded pink noise can be easily heard, and a decision made about whether adjustments in the cart/tape equipment are necessary.

The gain of the LED level meter on the interface module is also decreased slightly in the SET UP mode, to facilitate observing the Dolby Noise reference level.

The procedures contained in this section describe recording a Dolby Noise reference tape, and then playing it back to verify the proper level and frequency response alignment of the cart/tape equipment.

5.4.1 Recording Dolby Noise

The procedure for making a Dolby Noise reference recording differs for cart and tape machines. Both procedures are outlined below. For a functional block diagram illustrating the recording of a Dolby Noise cart/tape while in the SET UP mode, see Figure 5.1.

NOTE: Prior to recording Dolby Noise, verify that the cart or tape recorder being used is properly aligned according to its own alignment procedure.

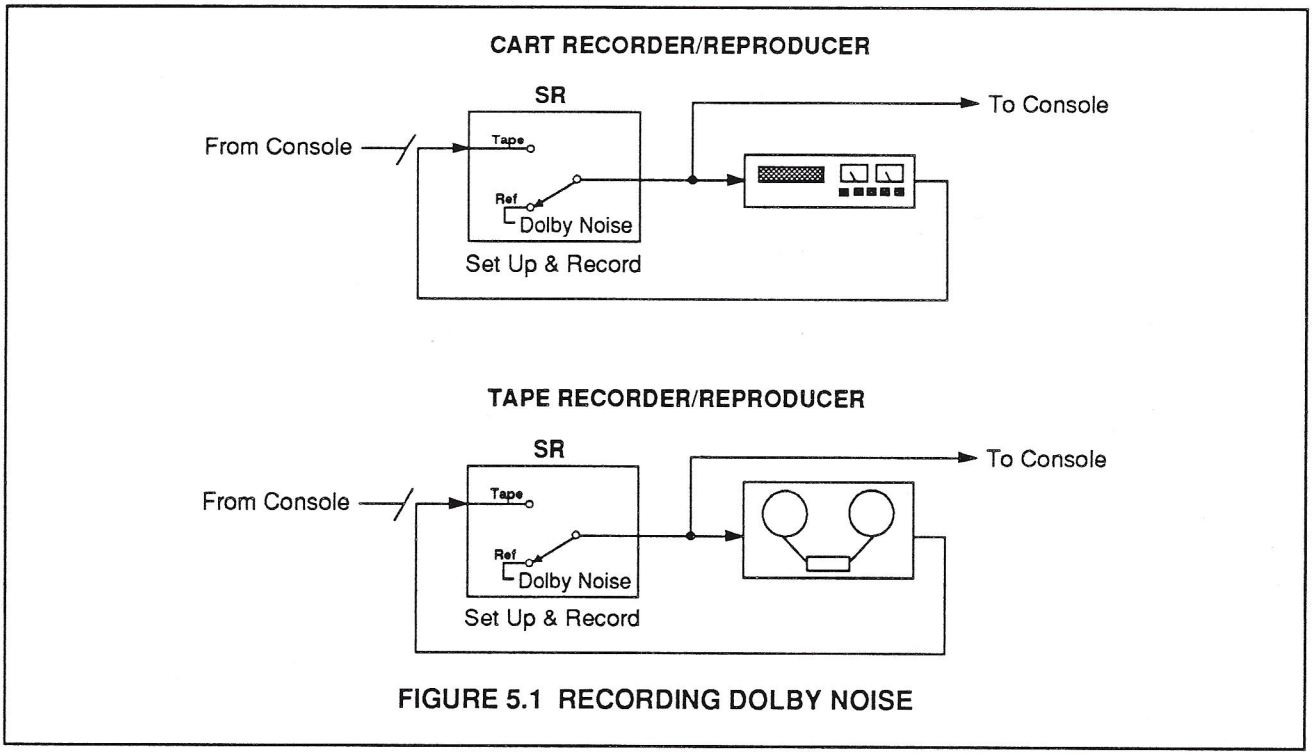


FIGURE 5.1 RECORDING DOLBY NOISE

RECORDING DOLBY NOISE TO CART

1. Place a clean (erased) cartridge of the desired length into the cart recorder.

2. Verify that SR processing is engaged.

3. Place the SET UP switch on the Cart Recorder Interface Module into the ON position.

4. Place the cart recorder into the record mode, allowing it to re-cue once the recording is completed.

5. With the SET UP switch still in the ON position, play back the cart and verify that the system switches between cart and internal Dolby Noise every four seconds. This can be confirmed

by watching the LEDs on the front of the SR Processing Modules.

6. Once the cart is recorded and verified, place the SET UP switch on the interface module into the OFF position.

RECORDING DOLBY NOISE TO TAPE

1. Thread a clean (erased) tape of the desired length onto the tape recorder.

2. Verify that SR processing is engaged.

3. Place the SET UP switch on the Tape Recorder Interface Module into the ON position.

4. Place the tape recorder into the record mode for the desired length of the recording.

5. With the SET UP switch still in the ON position, play back the tape and verify that the system switches between tape and internal Dolby Noise every four seconds. This can be confirmed by watching the LEDs on the front of the SR Processing Modules.

6. Once the tape is recorded and verified, place the SET UP switch on the interface module into the OFF position.

5.4.2 Playing Back Dolby Noise

The procedure for playing back a pre-recorded Dolby Noise reference tape to verify proper level and frequency response alignment is identical for Cart Reproducer, Cart Recorder/Reproducer, and Tape Recorder/Reproducer Interface Modules, and is as follows:

1. Verify that SR processing is engaged.

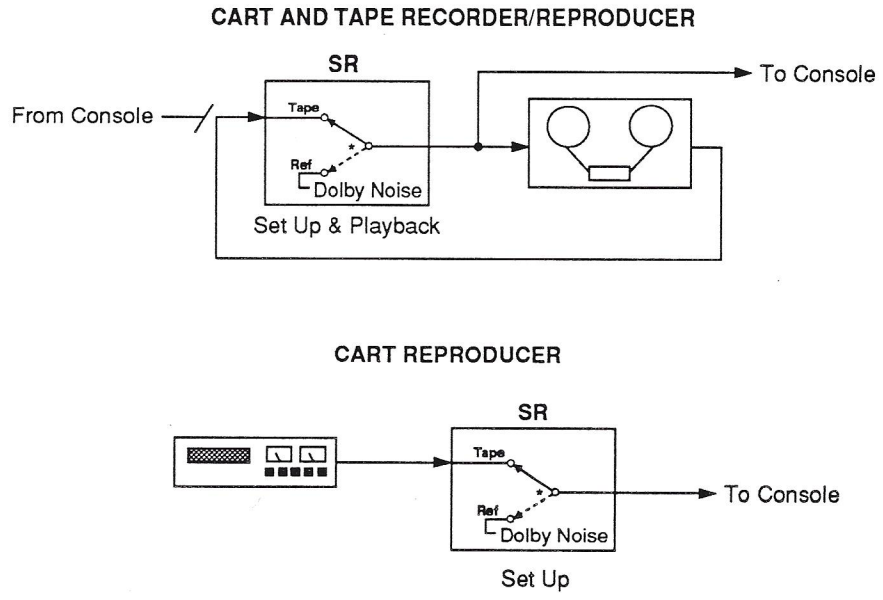
2. Place the SET UP switch on the interface module into the ON position.

3. Play back the previously recorded Dolby Noise reference cart or tape. The output of the system will automatically switch between the tape and the internal Dolby Noise source every four seconds. This can be confirmed by watching the LEDs on the front of the SR Processing Modules.

4. Listen to the output of the system. There should be little or no difference between the tape and the internal Dolby Noise sources.

5. If there is any significant difference in the level or frequency response of the tape noise, an alignment of the cart/tape machine is necessary. Accomplish this per the cart/tape machine's own alignment procedure.

For a functional block diagram illustrating the playing back of a Dolby Noise tape while in the SET UP mode, see Figure 5.2.



* In Playback mode, the SR output automatically switches between Dolby Noise (REF) and the tape/cart machine output every four seconds.

FIGURE 5.2 PLAYING BACK DOLBY NOISE

NOTE: When playing back a Dolby Noise reference tape, its output level can be confirmed by using the interface module's INPUT LEVEL LEDs, and placing the METER SWITCH to the desired position (L or R).

5.5 METER CALIBRATION

This section describes the procedure for calibrating interface module front meter panel LEDs. The procedure is identical for all three interface modules, and is as follows:

NOTE: These meters are calibrated at the factory, and should never require field calibration. When accomplishing this procedure, it is recommended that you contact PR&E Customer Service for assistance.

1. Use the Interface Module Extender Board (PR&E #99-616) to access the interface module's PC assembly.

2. Switch the front panel METER SWITCH to the OFF position.

3. Attach the output of a 1 kHz sine wave signal generator to the center terminal of the METER SWITCH, and attach the signal generator ground to a convenient audio ground point on the interface module PC assembly.

4. Attach a digital voltmeter to the signal generator output, and adjust the generator output for a voltage of 1.85 volts RMS.

5. Adjust trim-pot R72 (on the Cart Reproducer Interface) or R124 (on the Cart and Tape Recorder/Reproducer Interfaces) until the two green LEDs on the module front panel are illuminated at equal intensities.

5.6 REPLACEMENT PARTS

Most of the components used are 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 transformer is manufactured to custom design specifications and is, therefore, available only from PR&E.

NOTE: The SR Processing Module is manufactured by Dolby Laboratories, and is not field serviceable. If trouble should arise with this module, return it to PR&E for servicing.

The following is a partial list of parts and assemblies used in the SDA-8A, and PR&E part numbers for easy reference:

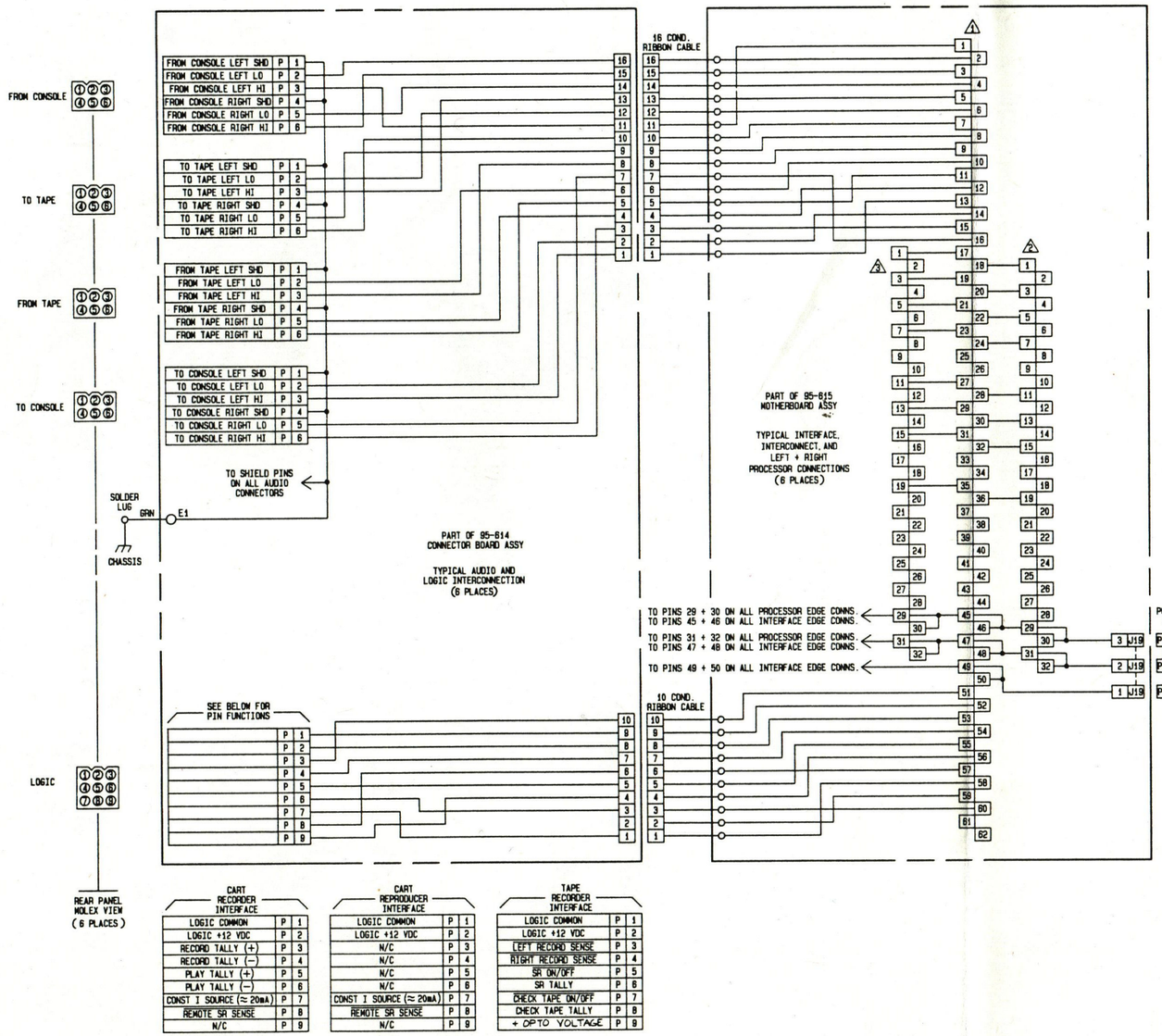
DESCRIPTION	PR&E#
Capacitors	
Electrolytic, 2.2µF, 50V, Radial	60-50
Electrolytic, 10µF, 25V, Radial	60-67
Electrolytic, 10µF, 25V, Radial, NP	60-84
Electrolytic, 4700µF, 50V, Radial	60-94
Tantalum, 4.7µF, 35V	65-11
Connector Kit	76-612
Diodes	
1N4001	11-7
1N914B	11-13
Bridge, 25A, 100V	11-15
MR750, 50V, 6A	11-19
Zener, 6.0V, IN5233	11-35
DIP Switch, 1 SPDT	26-14
Fuse, Slo-Blo, 3AG, 1-1/2A, 250V	30-40
Fuse Holder (for 3AG)	30-711
Integrated Circuits	
Dual D Flip-Flop, 4013	21-43
Hex, 4584	21-46
Op Amp, Dual, LF353N	20-32
Op Amp, Dual, 5532	20-53
Opto-Isolator, MCT2-DIP	29-4
Opto-Isolator, PS2501-2	29-8
Quad, 2 Input Nand, 4093	21-4

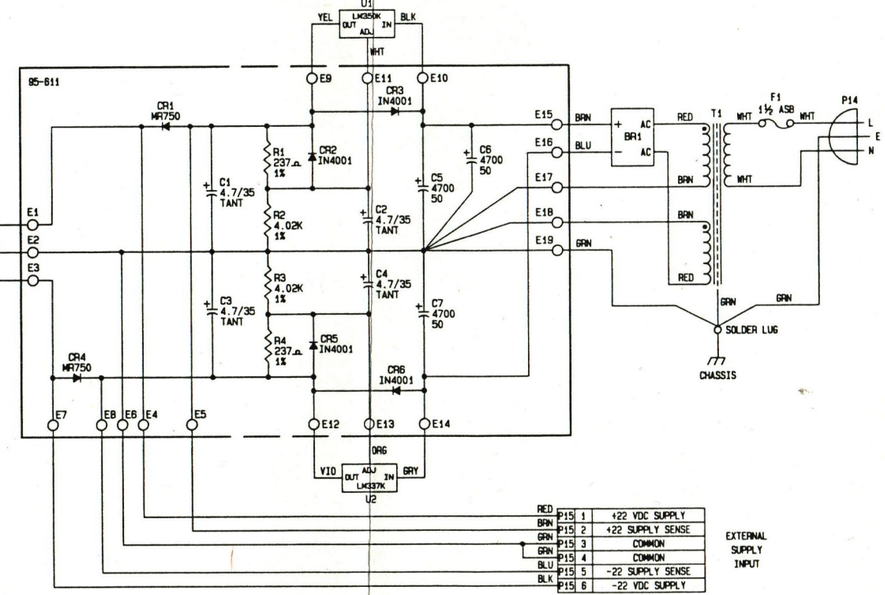
DESCRIPTION	PR&E#
Interface Module Extender Board	99-616
LEDs	
Dual T-1, Red/Red	12-74
Dual T-1, Green/Green	12-75
Green, Black Case	12-72
Red, Black Case	12-71
Red, Diffused	12-7
Yellow, Black Case	12-73
Modules	
Cart Recorder/Reproducer Module	99-613
Cart Reproducer Module	99-612
Tape Recorder/Reproducer Module	99-617
Blank Filler Panel	80-1069
Regulators	
-15V, 1.5A, TO-220 UA7915CKC, LM320T-15	20-19
+12V, 1A, TO-220 UA7812CKC, LM34OT-12	20-18
+15V, 1.5A, TO-220 UA7815CKC, LM340T-15	20-21
Variable, LM350K Steel	20-30
Variable, 1.5A, Neg., SG337K	20-50
Variable, 100mA, POS TL317C	20-71
Switches	
Right Angle PC, SPDT, MOM w/LED Indicator	25-804
Toggle, 2-position	26-104
Toggle, 3-position	26-105
Transformer, Toroidal	48-114
Transistors	
FET, J-174	9-5
NPN, PN2222 or 2N2222	7-25
PNP, MPSA63	8-5
Trim-pots	
Multi-turn Cermet, 5K	24-85
Multi-turn Cermet, 10K	24-96

6.0 SCHEMATICS AND DRAWINGS

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

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



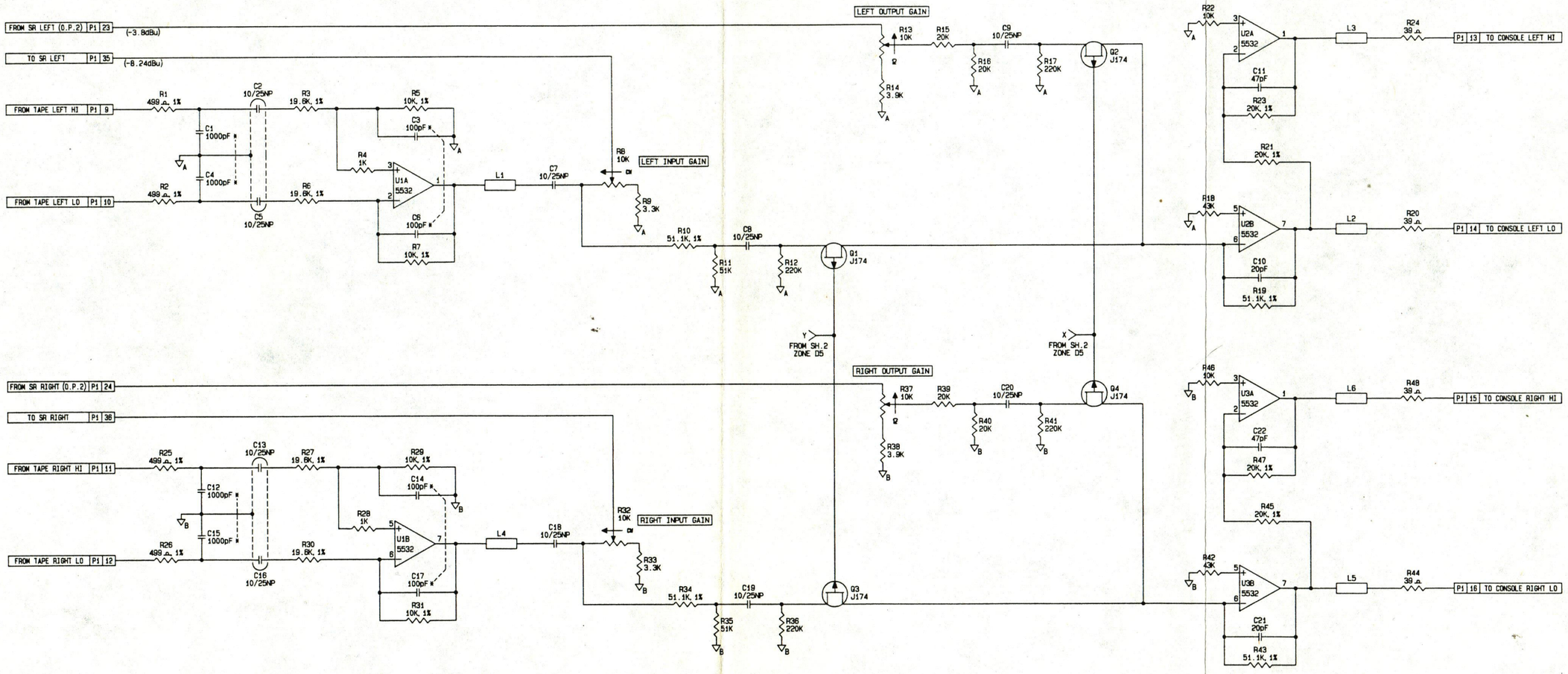


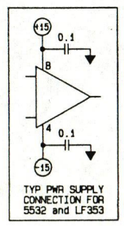
⚠1 LEFT PROCESSOR EDGE CONNECTOR. (6 PLACES)
⚠2 RIGHT PROCESSOR EDGE CONNECTOR. (6 PLACES)
⚠ INTERFACE EDGE CONNECTOR. (6 PLACES)
NOTES: UNLESS OTHERWISE SPECIFIED.

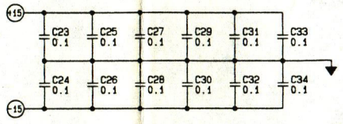
PACIFIC RECORDERS & ENGINEERING CORPORATION

6.1 DOLBY SR SYSTEM MAINFRAME SCHEMATIC

92-612C







GROUND LEGEND	
▽	AUDIO COMMON
▼	GROUND PLANE
⏚	LOGIC COMMON
⏚	CHASSIS GND

--- INDICATES MATCHED PAIRS.

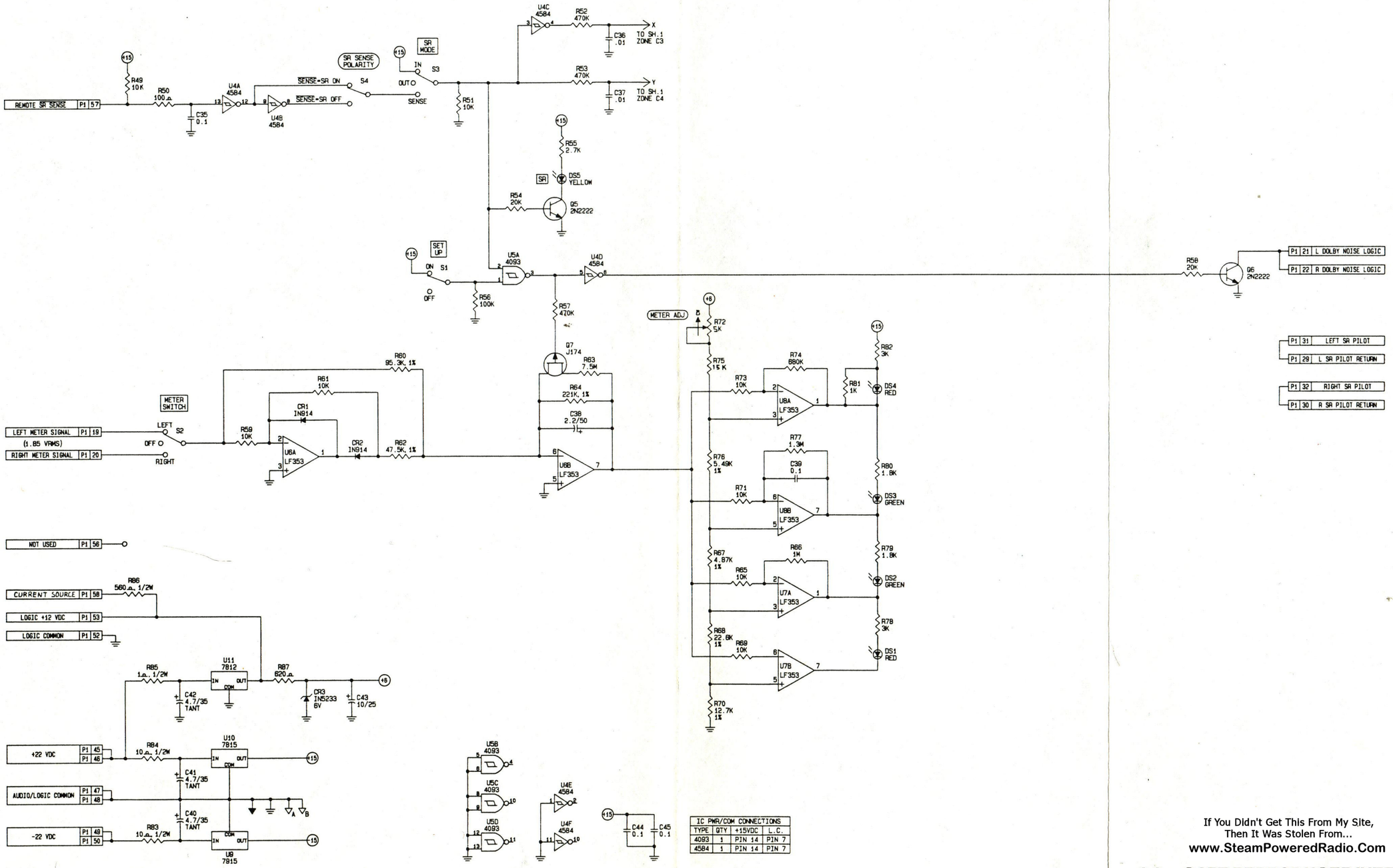
NOTES: UNLESS OTHERWISE SPECIFIED.

PACIFIC RECORDERS & ENGINEERING CORPORATION

6.2 CART REPRODUCER INTERFACE MODULE SCHEMATIC

SHEET 1 OF 2

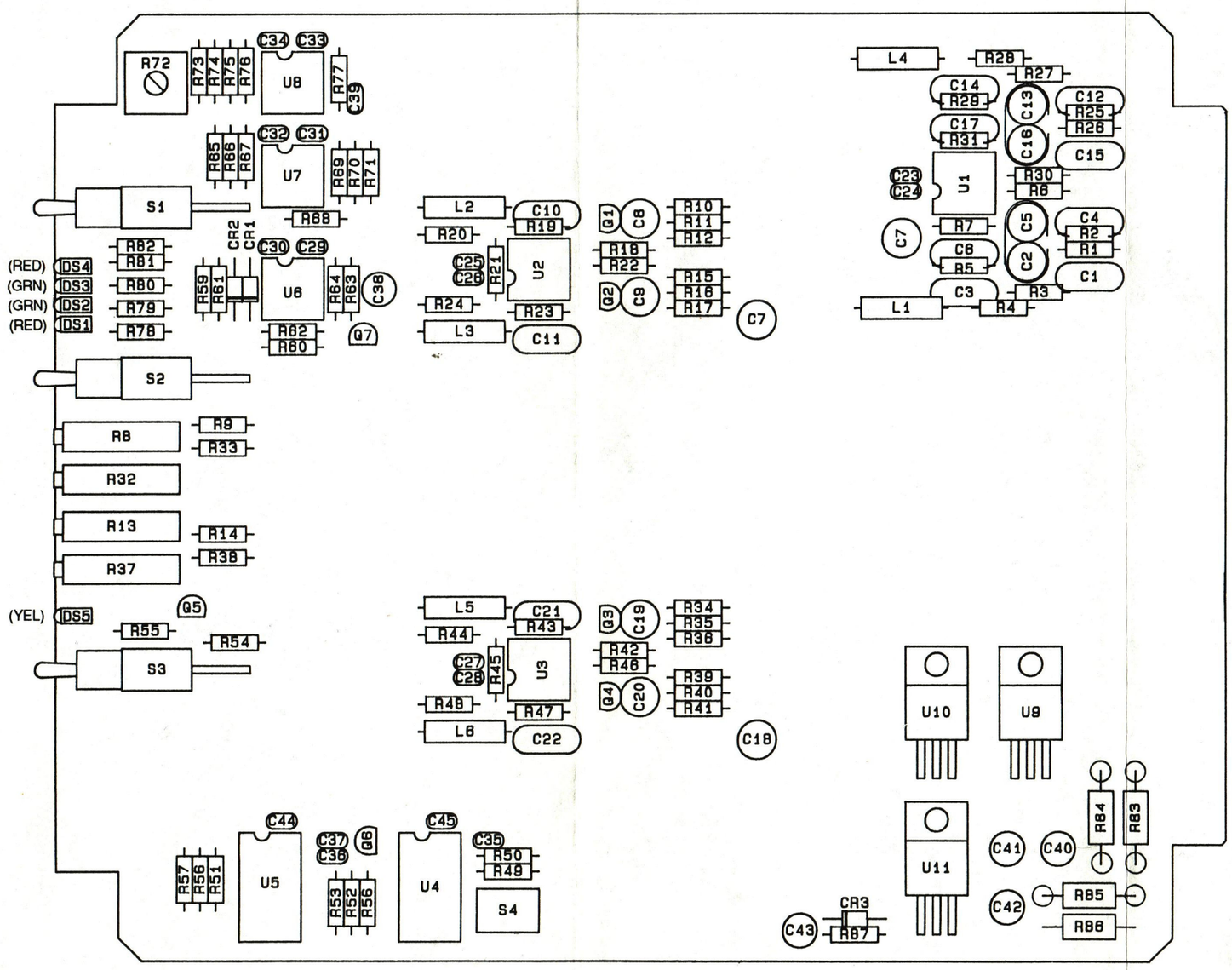
92-612C



PACIFIC RECORDERS & ENGINEERING CORPORATION

6.2 CART REPRODUCER INTERFACE MODULE SCHEMATIC

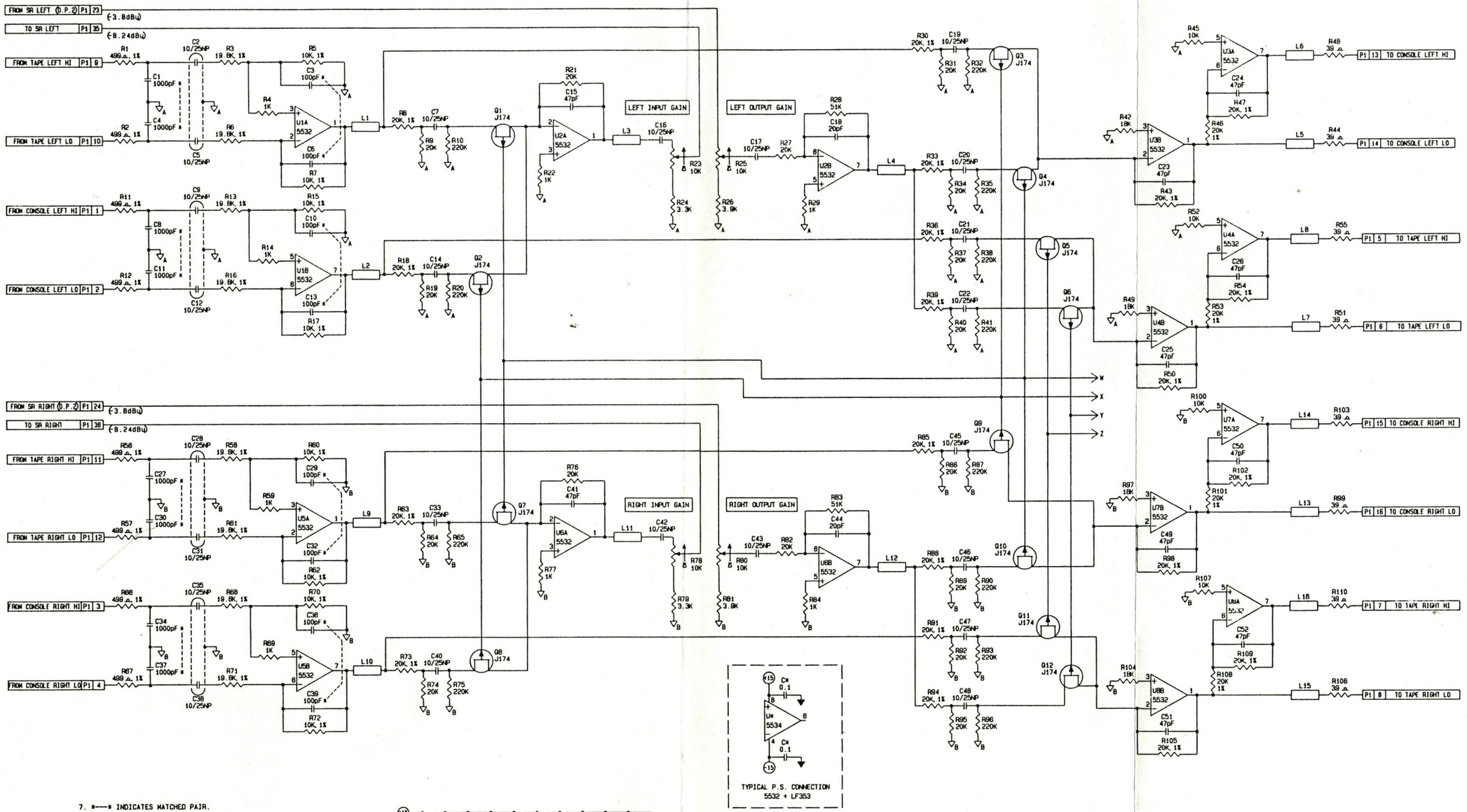
SHEET 2 OF 2



PACIFIC RECORDERS
& ENGINEERING CORPORATION

6.3 CART REPRODUCER INTERFACE MODULE PC ASSEMBLY

92-613D



7. ⊏—⊐ INDICATES MATCHED PAIR.
6. ⬭ INDICATES PCB MOUNTED COMPONENT, NOT ACCESSIBLE FROM FRONT PANEL.
5. ▭ INDICATES FRONT PANEL COMPONENT.
4. FOR PCA SEE DRAWING 85-813 LATEST REV.
3. NP=NONPOLARIZED.
2. ALL CAPACITORS ARE MEASURED IN MICROFARADS.
1. ALL RESISTORS ARE 1/4W, 5%.

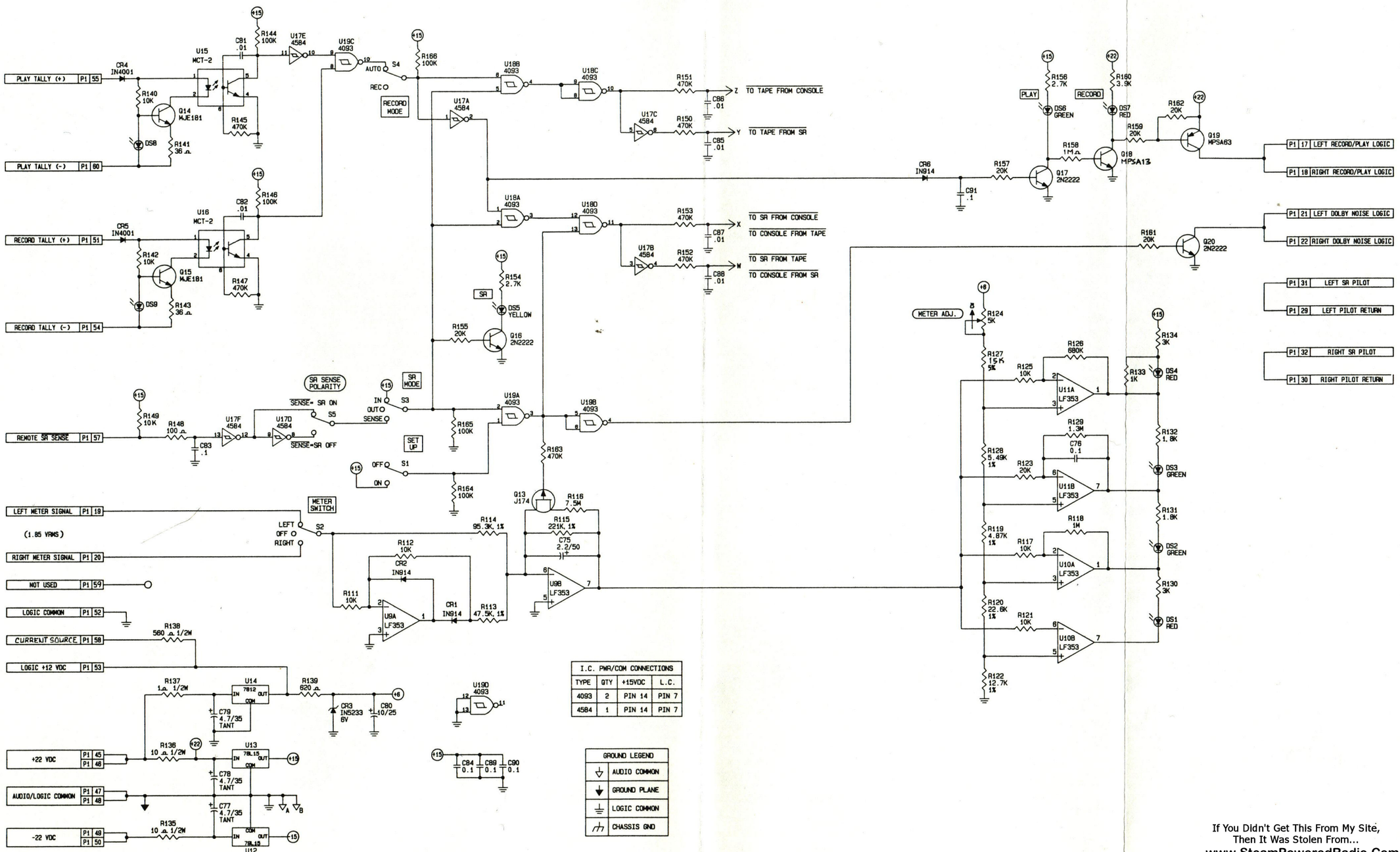
NOTES: UNLESS OTHERWISE SPECIFIED.

PACIFIC RECORDERS & ENGINEERING CORPORATION

6.4 CART RECORDER/REPRODUCER INTERFACE MODULE SCHEMATIC

SHEET 1 OF 2

92-613D



I.C. PWR/COM CONNECTIONS			
TYPE	QTY	+15VDC	L.C.
4093	2	PIN 14	PIN 7
4584	1	PIN 14	PIN 7

GROUND LEGEND	
	AUDIO COMMON
	GROUND PLANE
	LOGIC COMMON
	CHASSIS GND

PACIFIC RECORDERS
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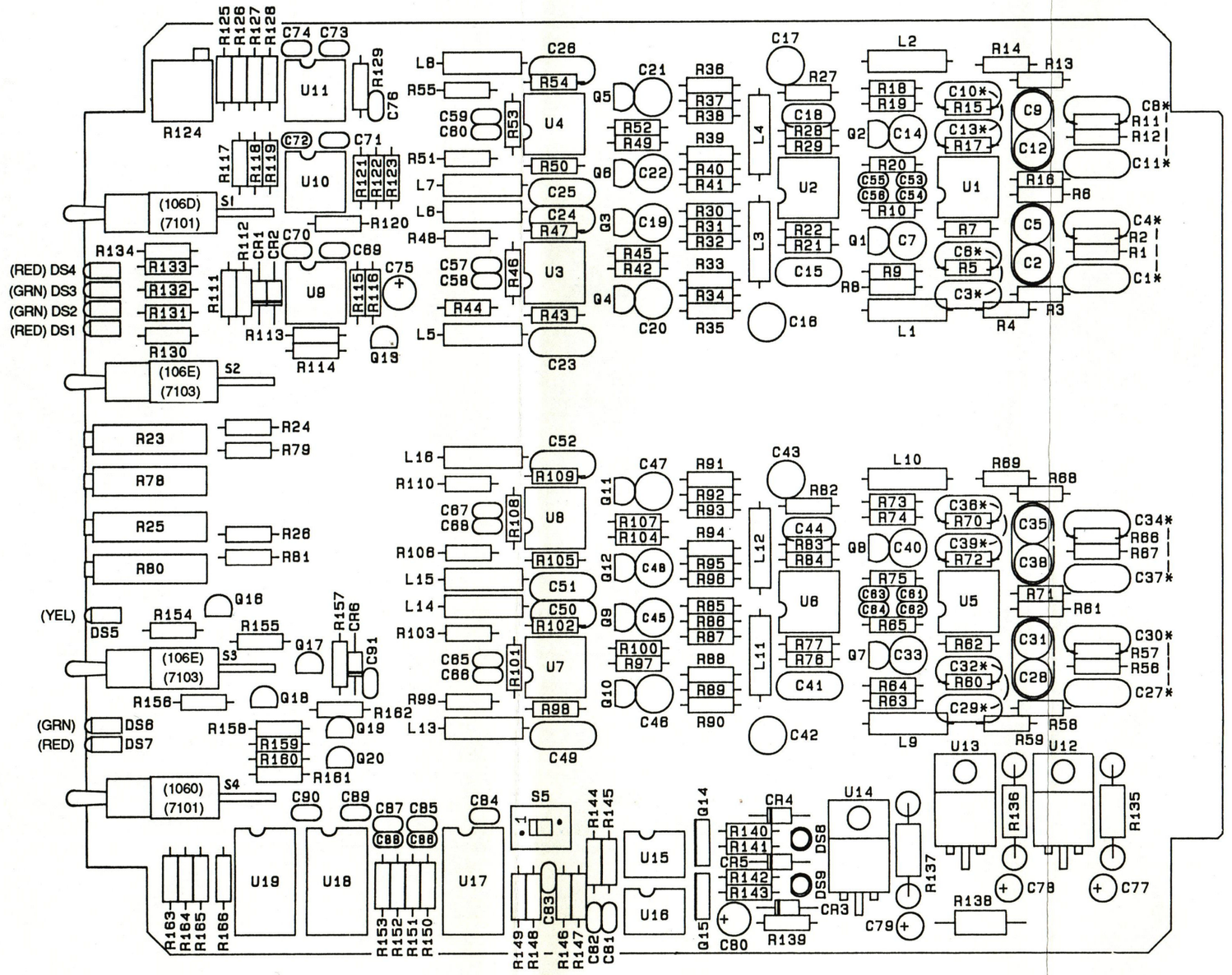
6.4 CART RECORDER/REPRODUCER INTERFACE MODULE SCHEMATIC

SHEET 2 OF 2

95-613 C



--- INDICATES MATCHED PAIRS.

NOTES: UNLESS OTHERWISE SPECIFIED.

PACIFIC RECORDERS
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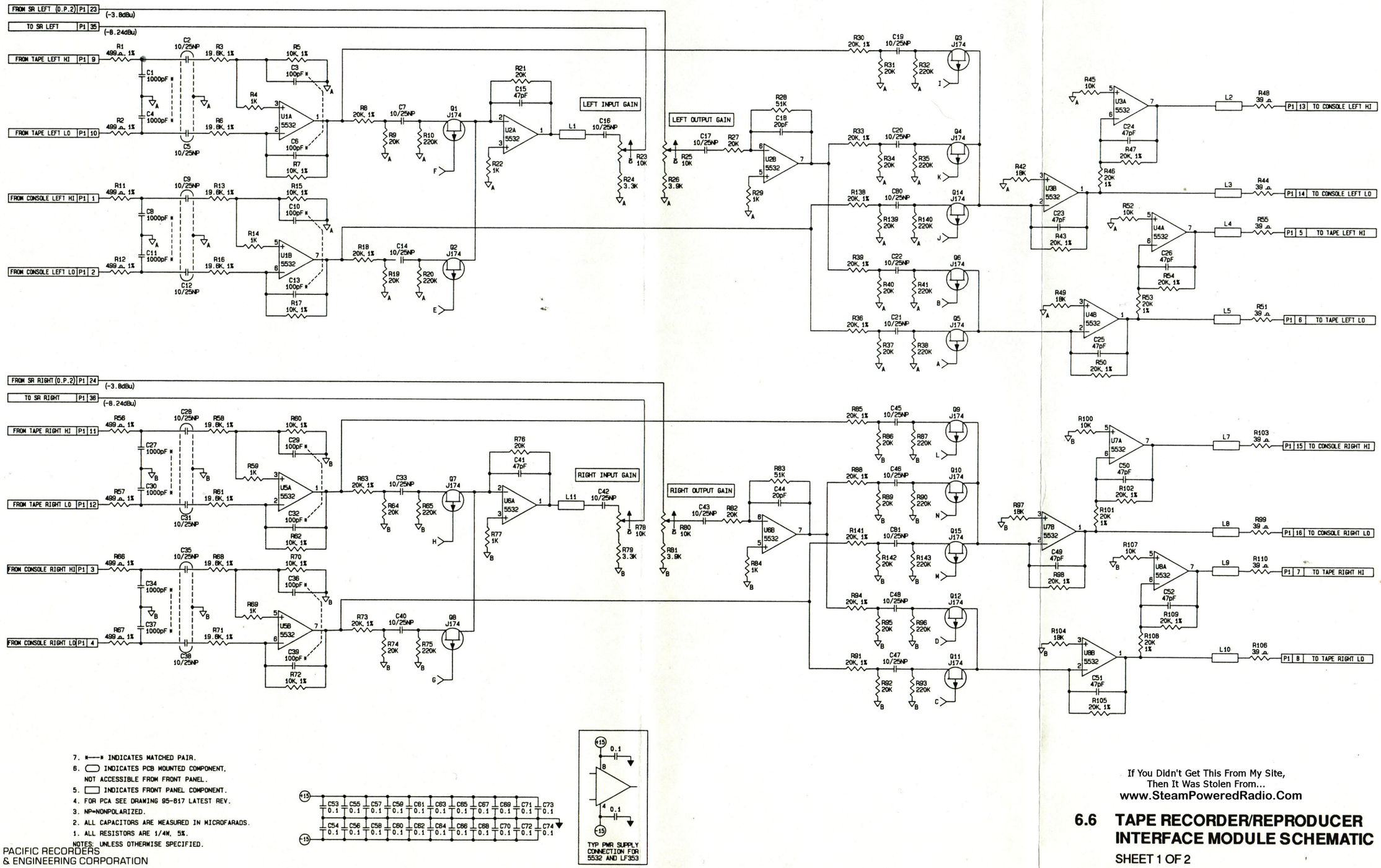
6.5 CART RECORDER/REPRODUCER INTERFACE MODULE PC ASSEMBLY

92-617A



7. ⊢—⊣ INDICATES MATCHED PAIR.
6. ⬭ INDICATES PCB MOUNTED COMPONENT, NOT ACCESSIBLE FROM FRONT PANEL.
5. ▭ INDICATES FRONT PANEL COMPONENT.
4. FOR PCA SEE DRAWING 95-817 LATEST REV.
3. NP=NONPOLARIZED.
2. ALL CAPACITORS ARE MEASURED IN MICROFARADS.
1. ALL RESISTORS ARE 1/4W, 5%.

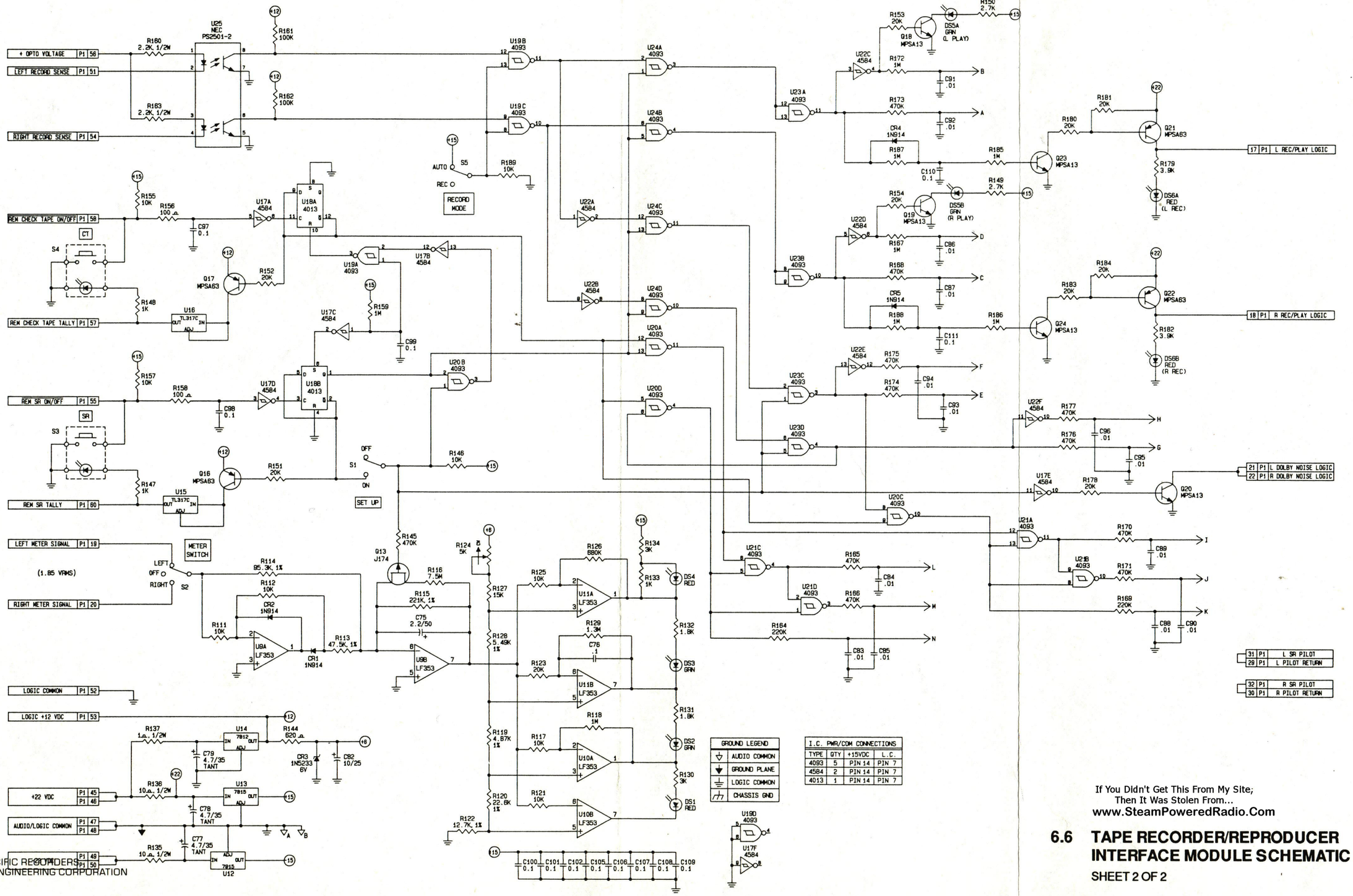
NOTES: UNLESS OTHERWISE SPECIFIED.

PACIFIC RECORDERS & ENGINEERING CORPORATION

6.6 TAPE RECORDER/REPRODUCER INTERFACE MODULE SCHEMATIC

SHEET 1 OF 2

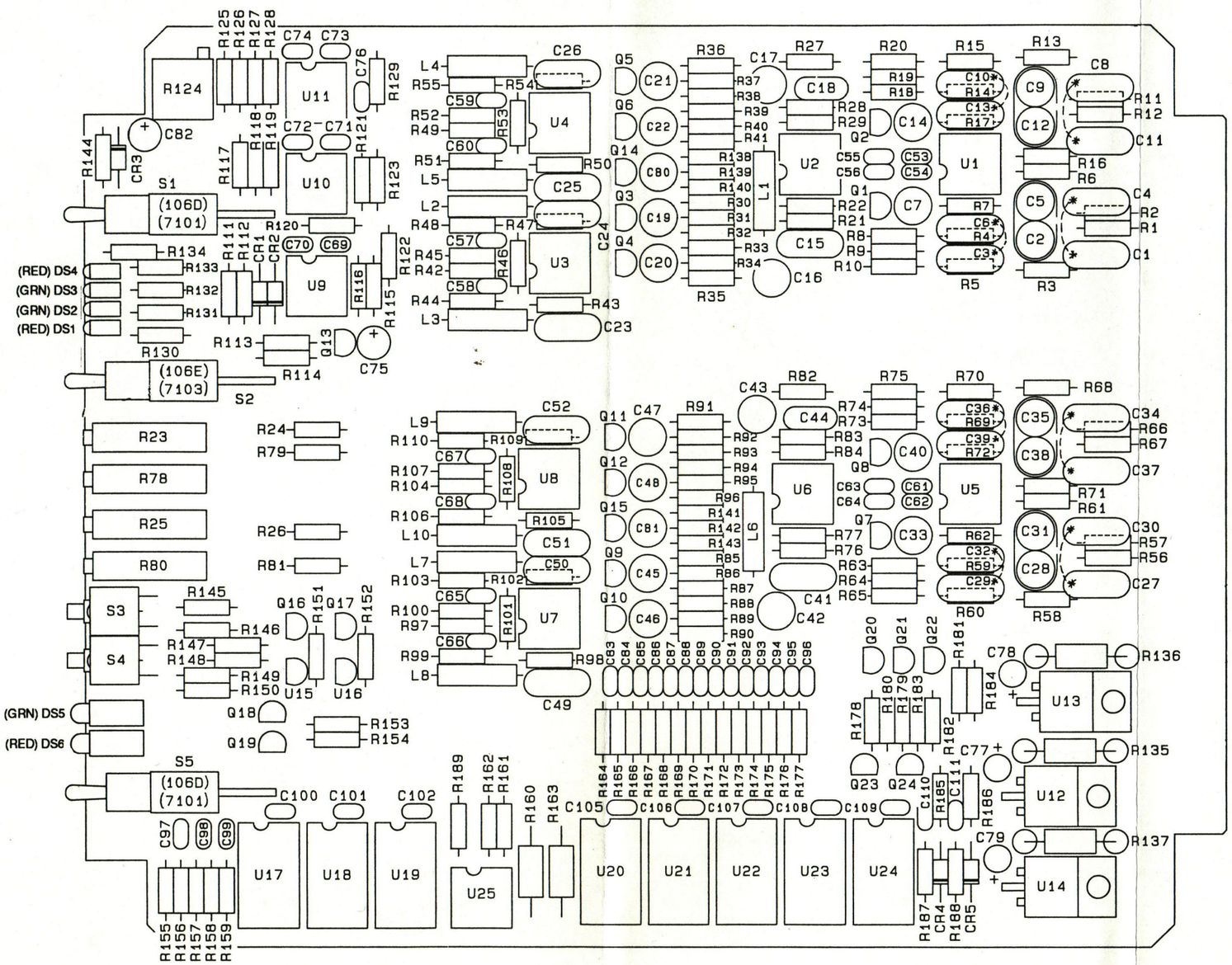
92-617A



6.6 TAPE RECORDER/REPRODUCER INTERFACE MODULE SCHEMATIC

SHEET 2 OF 2

95-617A



--- INDICATES MATCHED PAIRS.
NOTES: UNLESS OTHERWISE SPECIFIED.

PACIFIC RECORDERS
& ENGINEERING CORPORATION

6.7 TAPE RECORDER/REPRODUCER INTERFACE MODULE PC ASSEMBLY