ACCURATE
SOUND
CORPORATION

AS 200-A
HIGH SPEED TAPE DUPLICATING SYSTEM

INSTRUCTION MANUAL

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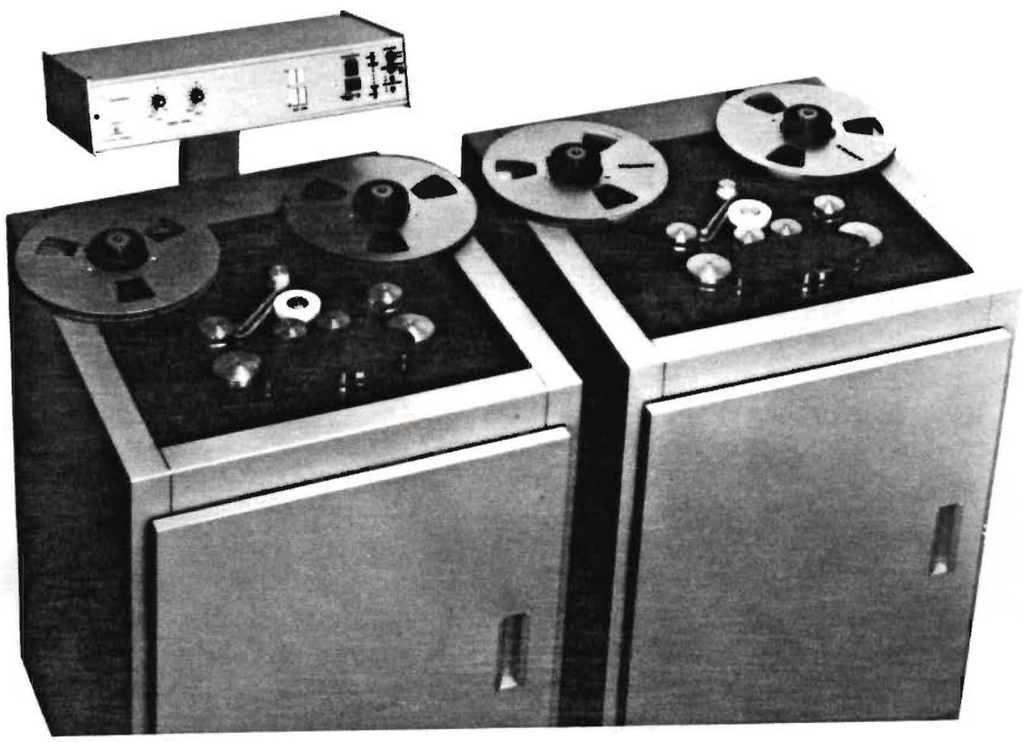
The information contained in this manual is believed to be accurate at the time of printing, however, Accurate Sound Corporation assumes no liability for errors or omissions. In addition, because of Accurate Sound's policy of continual product improvement, we reserve the right to make changes at any time without notice.

October, 1985

Part No. AS200-A-001



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1. INTRODUCTION

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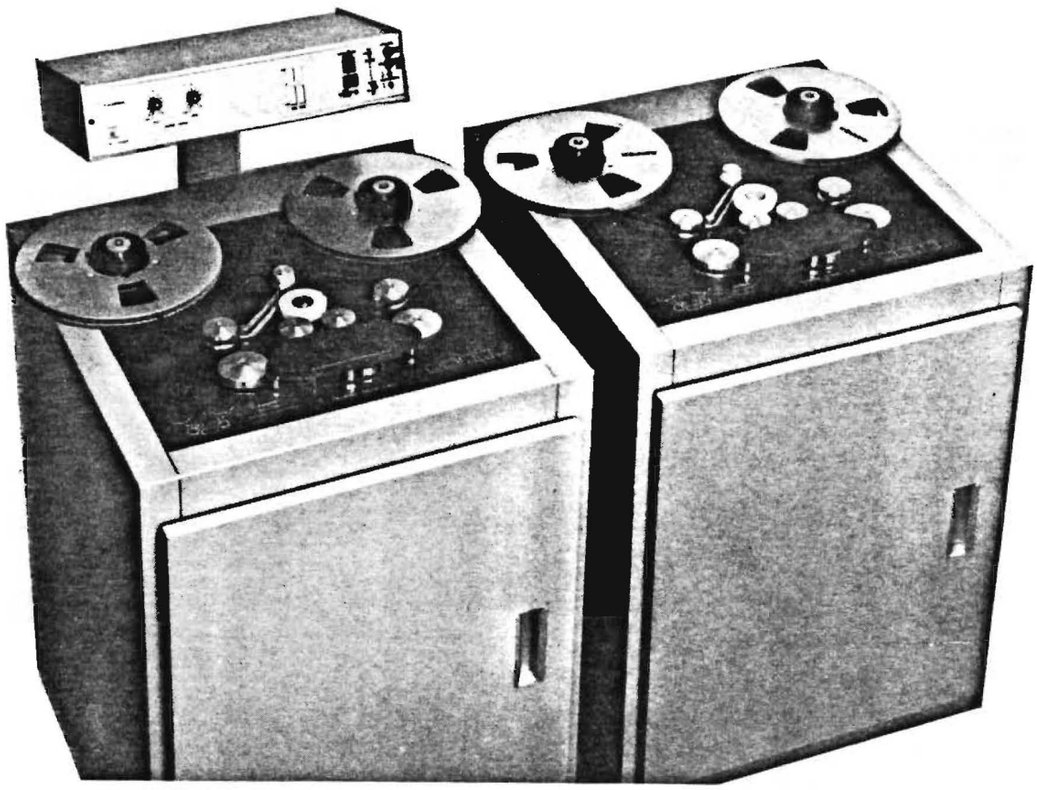


1.1 General

The Accurate Sound model AS200-A high speed duplicator offers state-of-the-art performance and reliability in a production-oriented duplicator system. Offering the highest performance-to-cost ratio in the industry, the AS200-A provides a duplication quality so transparent that even at its highest speed, it will equal or exceed the quality of any conventional duplication performed 1:1.

The AS200-A is ideally suited to a broad range of professional duplication applications including, broadcast, advertising, government, commercial music production, and recording studio duplication.

Designed from the ground-up specifically for high speed duplication, the AS200-A establishes new standards in performance, reliability, ease of use, and flexibility. Employing a totally DC servo controlled transport, the AS200-A overcomes tape handling problems inherent in other systems. This advanced design eliminates the tape degradation and wear problems associated with conventional pinch-roller transport systems.

Other key features of the AS200-A include:

- **Low phase error** (less than 45° total channel-to-channel) through precision transport control and pinch roller-less design. This eliminates tape skew problems inherent in pinch roller systems.

- **Precision speed accuracy.** A crystal-referenced master clock precisely interlocks master and slave capstan servos, eliminating time-base errors.

- **Exceptional signal-to-noise ratio** (duplicates are within 2 dB of Master). High speed duplication effectively eliminates hum. At a 16:1 ratio, 60 and 120 Hz hum noise falls well outside of the normal program spectrum. Ultra-low noise military-grade preamplifiers are used in the reproduce circuit.

- **Ultra-wide frequency response** provides extended high-frequency signal performance. At 64:1, a 20 kHz master top end translates to 1.28 MHz. All AS200-A audio amplifiers are flat to 1.5 MHz.

- **Extremely gentle tape handling.** Exclusive DC servo based transport and advanced tape guidance system mimumizes tape stresses. Master edge wear and HF mechanical erasure is dramatically lower than with capstan pinch-roller transports.

- **Ease of operation.** The AS200-A features a simple tape threading path, easy to understand and use controls and indicators, and an auto-cue/rewind option for greater operator productivity.

- **Solid relibility.** The AS200-A's simplicity of design through modular subsystems, single cable (fiber-optic) slave control, high MTBF and low MTTR design engineering ensure minimum down-time.

- **Easy installation.** AS200-A systems are shipped pre-assembled from the factory for minimized installation time.

1.2 Options and Accessories

The AS200-A System is designed to enable straightforward field change of Master tape formats. 1, 2, or 4 channel playback and record configurations are readily performed through the addition or replacement of modular electronics and head assemblies.

Automatic system operation is also possible through the addition of the Auto-Cue/Rewind option.

A list of available options and accessories is provided in Table 1-1.

Table 1-1, AS200-A Options and Accessories

Option	Function
- Packer Arm	Packs tape on hub when reels are not used.
- Auto Cue Logic	Enables automatic (loop bin-like) system operation.
- Analog VU Meter(s)	Replaces standard LED linear VU meters.
- Spare Parts Kits	Contains recommended spare parts for minimum down-time. Four types available. Consult factory for specific system type.

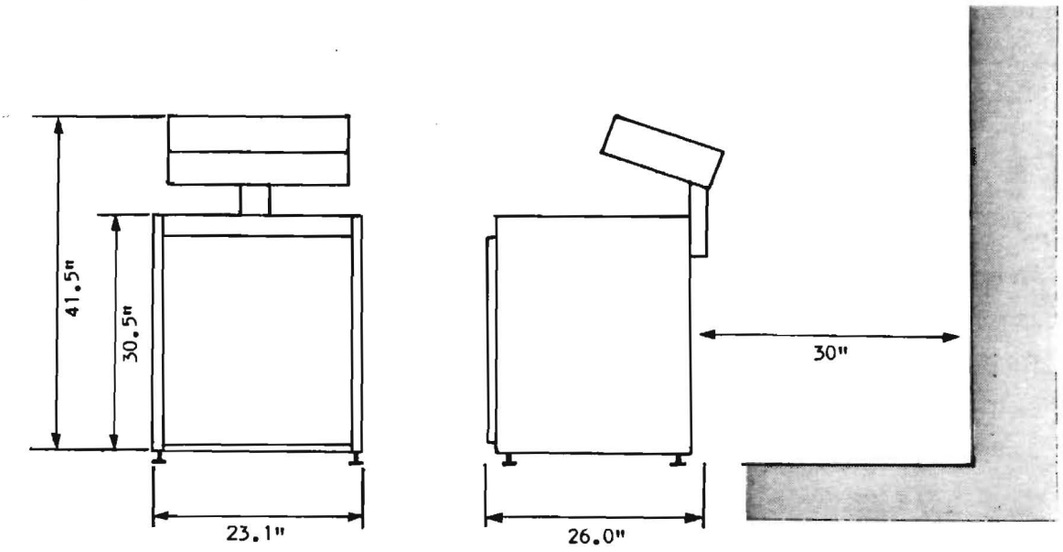
Accessory	Function
- Tentelometer* Tension Gauge	Provides precision measurement of supply and takeup tape tension.
- Extender Board Set	Permits convenient access to circuit boards during power-on operation for service.
- Test Head	Portable playback-only head and wide-band pre-amp used for tape bias and gain adjustment.
- Test Cables	Matched custom test cables for convenience in servicing.
- Alignment Tape	(Format Specific). Used for system Quality Assurance, head and electronics alignment, and troubleshooting.
- Tool Kit	Contains all tools required for AS200-A corrective maintenance and format conversions.
- Test Equipment Package	Contains all required and suggested test equip-ment required for both preventive and correct-ive maintenance of the AS200-A system. Two types (minimum and recommended) are offered.

* Trademark or Tentel Corporation, Cupertino, CA.

1.3 Specifications

Tape Speed:	Master - 60, 120, 240 IPS (1.5, 3, 6.1 m/s) Slave - 60, 120, 240 IPS (1.5, 3, 6.1 m/s)
Start Time:	1980 mS + or - 40 mS @ 240 IPS.
Tape Format:	Master - As required, 1/4 inch, 2-track/4-track is standard. Slave - 1/4 inch Mono, 2 track, and 4 track standard.
Frequency Response:	40 Hz to 18 KHz, + or - 2 dB.
Signal-to-Noise:	Biased tape noise on copies does not exceed tape noise by more than 2 dB (Note 1).
Program-to-Program cross-talk:	75 dB or better (Note 2).
Bias Frequency:	3.5 MHz (Note 3).
Distortion:	Less than 0.2% THD referred to 200 nWb/m (electronics only).
Overload margin:	Greater than 25 dB (Note 4).
Master EQ:	Adjustable to NAB or CCIR at either 3.75, 7.5, or 15 IPS Master recording speed.
Wow and Flutter:	Less than 0.08% RMS.
Speed Accuracy:	Within + or - 0.05% of nominal speed.
Supply Requirements:	90 to 270 VAC at 45 to 65 Hz, single phase.
Power Consumption:	Master - 400 VA Slave - 400 VA
Reel Sizes:	Master - 7.5, 10.5 and 14.0 inches diameter. Slave - 7.5, 10.5 and 14.0 inches diameter.
Environmental:	Operating Temperature - 60° F to 80°F Relative Humidity - 55%, + or - 5%.
Shipping Weight:	Master - 170 lbs. Slave - 150 lbs.

Dimensions:



(Operation of the System outside of these Specifications shall void warranty).

Notes:

1. Measured using a standard A-weighting filter in tape replay signal path, placed between the output of tape reproducing equipment and level measuring meter.

   A) Tape reproducing equipment shall have been adjusted in conformance with the relevant standard alignment tape. In addition, the reproducing machine shall have a noise figure (with tape stopped) at least 10 dB better than that of the tape used in this test.

   B) Slave recorder shall have been adjusted in accordance with this manual and raw tape used shall be of a quality equal to or better than that specified by Accurate Sound Corp.

2. Measured at 1 KHz and tested using a method that ignores any crosstalk present in master recording.

3. Frequency specified is frequency presented to the recording head to effect the function of linearising the tapes' input/output curve.

4. Overload margin is defined as that increase in level which may occur at 1 KHz which just begins to cause an abrust rise in odd harmonic content of a signal applied to the master preamplifier input. This specification is a statement of headroom of the signal electronics within this duplicator. It does not reflect the overload characteristics of either the master tape or the duplicate tape.

2. INSTALLATION

2. INSTALLATION

2.1 General

The high speed duplicating system environment should be as dust-free as possible. Be sure the floor or surface on which the system is placed is stable and not subject to excessive vibration. Also insure that the floor will support the combined weight of all the units. It should be capable of supporting at least 75 psi at the four feet positions of each unit.

Arranging the installation such that all slave transports are to the LEFT of the master will simplify the alignment of the system.

The system should be supplied with an AC power source that is stable and not shared with other equipment. Each unit requires a maximum of 400 VA peak.

The installation procedure requires two persons capable of lifting at least 75 pounds.

2.2 Unpacking and Inspection

Check the shipping containers for visable damage. If significant damage has occurred to the box, notify the carrier and Accurate Sound Corporation.

Should a unit ever have to be returned to the factory, it should be packed in the original crate to provide the same protection as when originally shipped. The container should be plainly marked, "Fragile, Handle with Care".

Unpack the master unit and all slaves:

A. Remove the straps around the shipping container and lift the top cover off.

B. Remove the styrofoam shock absorber from the top.

C. Lift the unit out of the bottom styrofoam shock absorber.

The Master electronics console is shipped protected with bubble wrap and located in the lower portion of the Master unit. A small bag of hardware is also included.

The system interconnecting cables are packed in a box located inside of one of the slave units. This box also contains the screw-in leveling feet for all units.

2.3 Physical

Position the units in their approximate final locations and install the leveling feet by tilting the unit as required. Once all units have the feet installed, adjust the final positions. Use a bubble level on the units to adjust the feet.

2.3.1 Master

Locate the Master electronics console and its mounting hardware. Mount the unit to the pedestal on the top of the Master unit using the mounting hardware provided (see Figure 2-1).

Route the three cable harnesses from the console to the respective connectors on the optical transceiver assembly, and the head assembly.

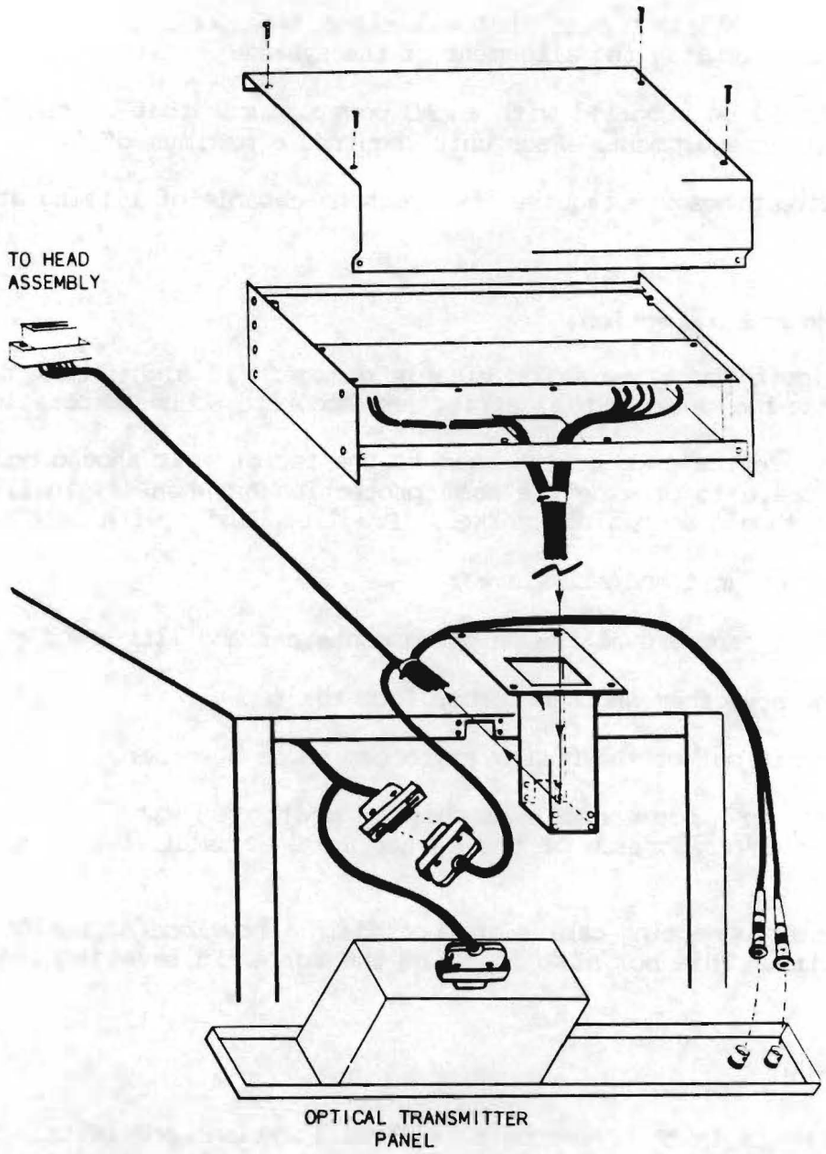


Figure 2-1, Master Unit Console Mounting and Installation

2.4 Electrical

The AS200-A system is designed to operate from a supply source ranging from 100 to 270 VAC. Although the power supply is normally factory configured appropriately for the customers source voltage, it's a good idea to double-check the line voltage switch (located on the side of the power supply).

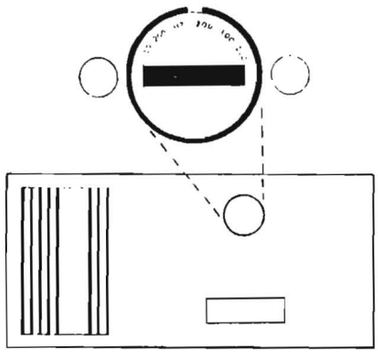


Figure 2-2, Primary Power Voltage Selector Switch Location

Also note that the main power switch is located on the power supply.

2.4.1 Master

Connect the cables from the electronics console to the various connectors as illustrated in Figure 2-1. It is generally easest to remove the optical

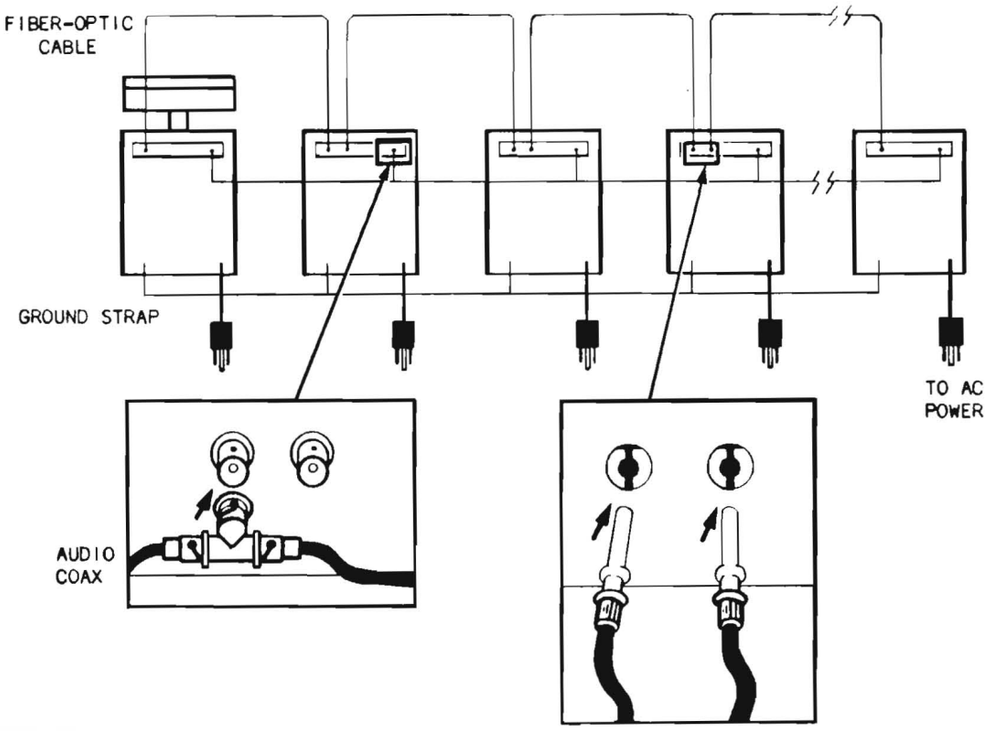


Figure 2-3, System Interconnection

transceiver panel to connect the cables. Re-install it after completing the connections.

The card-edge type connector mates with the tape head assembly. Route the head cable so that is does not interfere with any moving parts under the transport.

2.4.2 Slaves

Connect the RG-58 coaxial audio cables from the Master unit AUDIO OUTPUT to the Slave AUDIO INPUTs. Use a BNC "T" connector at each slave, except for the last unit (see Figure 2-3).

Connect the fiber-optic Slave Control cable from the Master FIBER OPTIC TX socket to the slave FIBER OPTIC RX socket. "Daisy-chain" the slaves as illustrated in Figure 2-3.

Install the ground straps between all system transports. Connection of each end is made near the cleaner tape drive motor near the center (underside) of the deck.

2.5 Options and Accessories

Options are normally factory installed. Any accessories ordered will be packed separately.

2.6 Acceptance

Once installed, the AS200-A system is normally aligned by a factory representative. The equipment should meet the performance specifications detailed in Section 1.3. Refer to Section 4, ALIGNMENT AND ADJUSTMENT for detailed procedures.

3. OPERATION

3. OPERATION

3.1 General

Techniques

There are two ways to make duplicates: running the master tape "head-first", or "tail-first". The operator must determine the best method to suit the specific requirements. A number of advantages are offered by the tail-first duplicating method. If a master tape has been wound to run backwards and placed on the supply reel of the master transport, the duplicates do not have to be rewound, and can be lifted from the slaves ready for use. Obviously, time is saved in packaging. Removal of finished copies from slaves can be done while the master is rewinding. Tail-first duplication also improves transient response and reduces the distortion created by steep wave-fronts of some programs.

Because there are no erase heads in the system, and since residual signal may exist on new tape, it is important to bulk erase all tape before recording.

Other important considerations include cleanliness in the operating environment, and the need for particular attention to slave biasing as dictated by tape type. NOTE: The AS200-A system is shipped from the factory biased for the specific tape type specified at the time of ordering. Refer to Section 4, Adjustments and Alignment, should tape type be changed.

Life of Master Tapes

With an AUTO-CUE system, through repeated cycling, the master tape may be subjected to a great deal of wear. To minimize this wear, several precautions are recommended:

1. Clean the master and slave deck guides and heads frequently.

2. Use the sturdiest tape available. Accurate Sound recommends a back-coated tape for use on the master transport. At 120 or 240 ips, any tape without back coating causes a static build-up on the tape. This generates severe clicks and pops in the system which can appear in the duplicated tape.

3. In formatting the master tape, one should NOT insert splices near the beginning or end of the program material. The beginning of the tape receives additional stress due to repeated high speed start up always at approximately the same location. Should the tape break close to the beginning of the program, a splice may be made, but it is suggested that it be made closer to the program material to provide stronger tape in the area of start-up stress. Two thousand passes of a master tape is about the maximum that can be expected before degradation of audio quality is objectionable.

Relative humidity in the operating environment also affects tape life. Operating in an enviroment having an RH in excess of 60% will cause dramatically accelerated wear of both the head and tape.

3.2 Operating the AS-200A System

3.2.1 General

The AS200-A system provides full control of all system units in high speed duplicating in either a manual, operator controlled mode, or in a fully automatic operating mode for unattended operation (with the Auto-Cue option installed).

In its normal operation, the master unit and slaves operate together as a system controlled by the master. A single fiber-optic control line links the master with up to 10 slaves. All start/stop control, equalization, stereo/-mono mode switching, and transport motor control timing is carried on this control line.

Local control of individual transports is provided by a control switch group on each transport. Operating these switches overrides the system master Start/Stop control.

3.2.2 Controls and Indicators

3.2.2.1 AC Power

AC power to the units is typically switched from a master power switch feeding all units. Each unit has its own power switch located on the front of the power supply, which is mounted on the shelf behind the front door (see Figure 3-1). If the system is controlled by a master AC power switch (customer furnished), all unit power switches must be left ON.

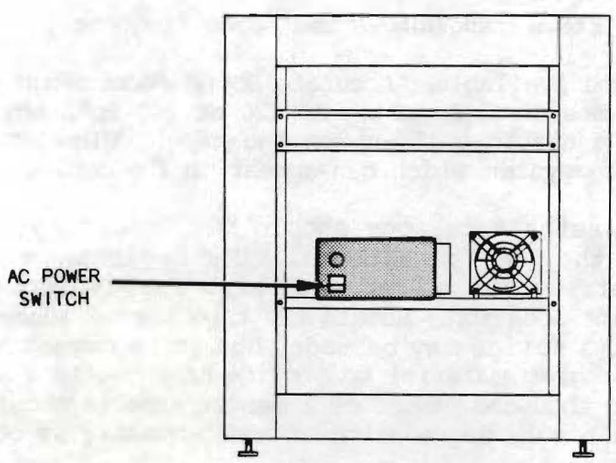


Figure 3-1, AC Power Switch Location

3.2.2.2 Master Console Switches

The Master unit contains all system start/stop, head format, speed, and equalization controls for the entire system (the only controls on the slave units are for local transport control). All slave units are affected identically by these controls (for example, if the SLAVE SPEED is set to 240 IPS on the master console, all system slaves are set to 240 IPS).

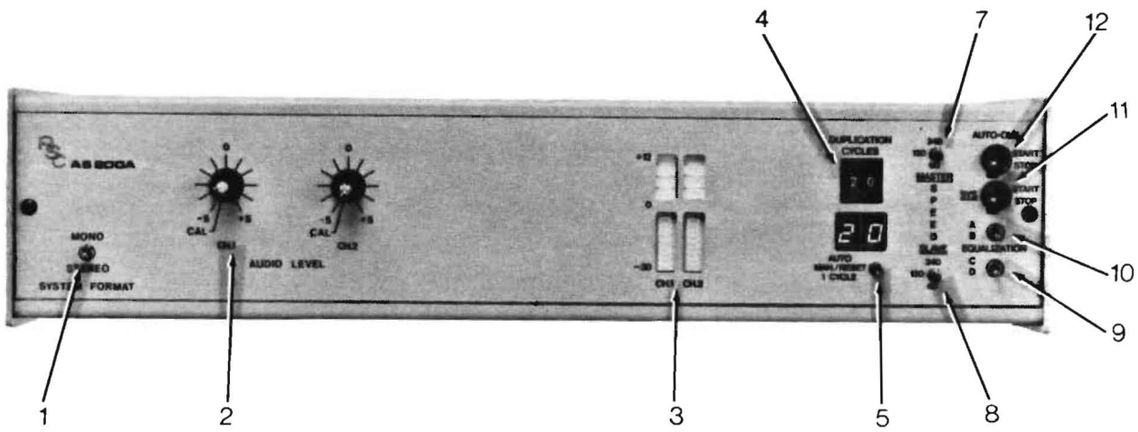


Figure 3-2, Master Front Panel

Reference	Name	Function
1	SYSTEM FORMAT	Selects Slave head format, mono or stereo. DC power is removed from the unselected head electronics.
2	AUDIO LEVEL	Controls audio output level to slaves. Normally in the CAL position. Out of CAL position, it provides up to -5 dB attenuation, and up to +5 dB of gain to compensate for variations in master tape levels.
3	CH1/CH2	LED-type VU meter. Provides a relative indication of master audio output level. Each channel consists of two vertical sections. The lower section contains 10 yellow bars, with the top bar corresponding to a zero reference level. The top section contains 4 red LED bars. Each bar is equal to approximately 3 dB.

Refer-ence	Name	Function
4	DUPLICATION CYCLES	Two-digit thumbwheel-type switch used to enter the number of master tape repeat cycles in the Automatic mode.
5	(LED DISPLAY)	The two-digit LED display below the thumbwheel switch displays the number of cycles yet to be completed in the Auto mode.
6	AUTO MAN/RESET 1 CYCLE	3-position switch. In the AUTO position, the transport is in the Automatic mode, repeating the number of cycles entered via the thumbwheel switch. The MAN/RESET position permits reloading of a new auto-repeat number via the thumbwheel switch. The 1 CYCLE position causes the system to stop after 1 cycle. The master then rewinds to the cue window in the tape (overshooting the window slightly), then advances back to the window, and stops waiting for a manual command from the operator.
7	MASTER SPEED	Selects 240, 120 or 60 IPS master tape speed.
8	SLAVE SPEED	Selects 240, 120 or 60 IPS slave tape speed. NOTE: The system is equalized for 2 of the 3 speeds (specified at ordering)
9	EQUALIZATION C/D	Selects the equalization for the slave (C = Hi, D = Low).
10	EQUALIZATION A/B	Selects the equalization for the master (A = Hi, B = Low).
11	SYS START STOP	Used for manual operation. Pressing once starts the system (LED on), pressing again stops system (LED off).
12	AUTO-CUE START STOP	In the Auto-Cue mode, pressing once starts the master running (LED on). When the cue window passes the sensor, the slaves are started. Pressing again stops the system (LED off). NOTE: Be sure the cue window is on the supply reel side of the sensor before pressing the switch.

3.2.2.3 Transport Controls (All Units)

Both master and slave units are provided with the local transport controls shown in Figure 3-3.

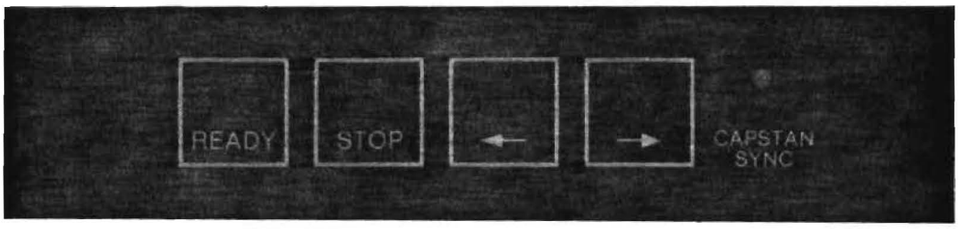


Figure 3-3, Transport Controls (Master and Slaves)

Label	Function
READY	Activates the transport servos and "tensions" the system. NOTE: Manually take up any slack in the tape before pressing READY. Failure to do so may cause the tape to snap or stretch when tensioned.
STOP	Stops tape motion (in both directions). When pressed with the READY push-button, causes the servo system to deactivate tensioning. **CAUTION:** Do not simultaneously press STOP and READY while tape is in motion. Doing so deactivates tension servos and could result in tape spillage.
⟶	Selects the foward direction of tape motion.
⟵	Rewinds the tape.
CAPSTAN SYNC ○	(Green LED) When lit, indicates the capstan is locked at the selected speed (normally lights after about 2 seconds).

3.2.3 Tape Threading

Before tape can be mounted on any system transport, it is first necessary that the reel hold-down knobs be in place and secure. Figure 3-4 illustrates the installation of the reel hold-down knobs. Be sure the knob is positioned to lock into the 7.5" reel index pin in order to lay flush on the spindle

table. Once into place, hold the outside of the knob while tightening the inner metal knob.

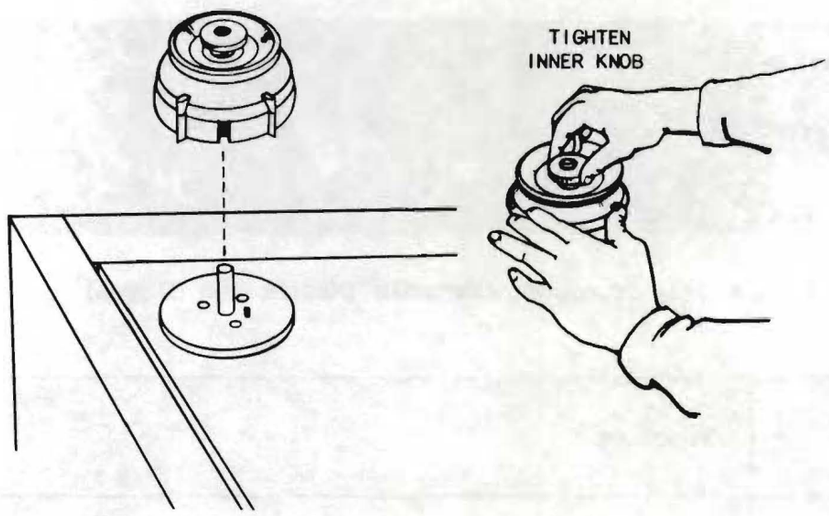


Figure 3-4, Reel Hold-Down Installation

Use of Reels

At high speeds the concentricity or degree of circular uniformity of the tape reels becomes very important. When using the AUTO-CUE system, it is suggested that a small center reel not be used. For all applications, the best result is obtained by using 10 1/2" or 14" aluminum reels.

If the reel being used is not seated securely on the shaft of the supply motor, the reel may oscillate on the shaft, causing disturbances in the tape as it feeds into the head assembly. At slow speed this condition is effectively "filtered" by the reel servos, but at high speeds, decentering of the reels will cause significant flutter.

Mount the tape and thread according to the illustration in Figure 3-5. Be sure the tape passes through the center of the Auto-Cue/End-of-tape sensor on the left side of the transport.

Tensioning The System

Once the tape is threaded, remove any slack by manually advancing the takeup reel. With power applied to the transport, press the transport READY pushbutton to activate the tension servo system thus "tensioning" the transport.

> **CAUTION** -- An attempt to remove the tape from from a "tensioned" transport may result in injury to the operator or damage to the tape. Deactive reel servos by depressing both the READY and STOP pushbuttons simultaneously.

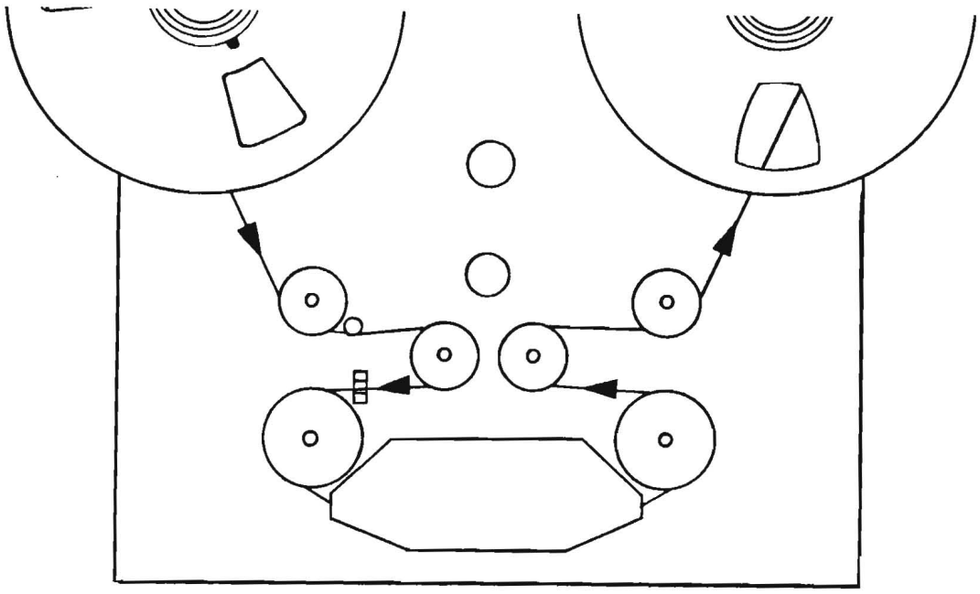


Figure 3-5, Tape Threading Path

Threading the Tape Cleaning Fabric

The use of tape cleaning fabric is highly recommended, as it removes loose oxide from the tape that would otherwise normally accumulate on the head. This effectively maintains a more constant level of performance by preventing oxide buildup on the head that could cause reduced head-to-tape contact. Head life is also extended.

Tape cleaning fabric is available from Accurate Sound (Scotch part number 610-1/2-60-1" CORE).

Install the cleaning fabric as illustrated in Figure 3-6.

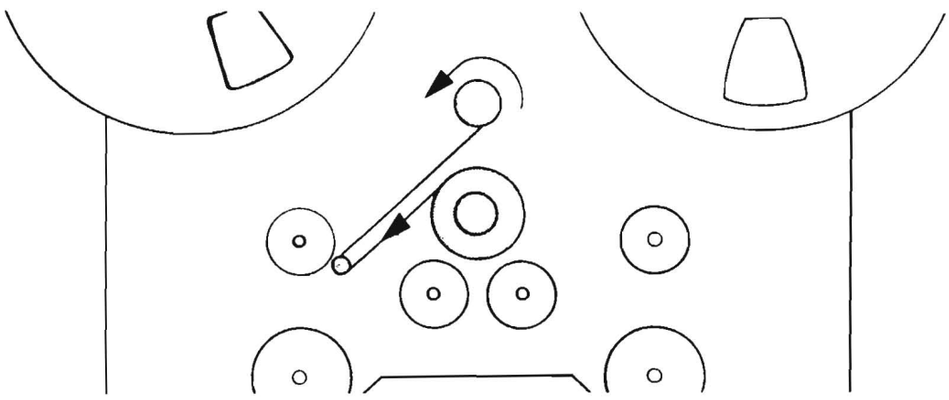


Figure 3-6, Cleaning Tape Threading

3.2.4 Pre-Operational Setup

Before running any duplicates, the following steps are recommended to insure the best possible quality of duplicated material.

A). De-magnetize the master unit head and tape guides.

B). Thorougly clean all transport heads, tape guides and rollers in the tape path.

C). Apply power to the system and mount tape on the transports.

D). "Tension" all transports by removing any slack from the tape, then pressing READY (each unit).

E). If the Auto-Cue facility is to be used, be sure the first window on the master tape is positioned on the supply sided of the window sensor.

F). Place the AUDIO LEVEL control(s) on the master console to the CAL position for standard master levels.

NOTE: If the level of the master is well above or below the LED meter zero reference level, it may be necessary to adjust the AUDIO LEVEL control compensate as needed in order to obtain a zero reference level.

3.2.5 Manual Operation

Manual system operation is normally used only when the Auto-Cue option is not installed, or when an operator desires to manually control the system operation when transparent "windows" are not present in the master tape.

Manual operation is enabled by placing the AUTO MAN/RESET 1 CYCLE switch in the MAN/RESET position.

Allow at least 60 feet of leader before the program material on the master tape to allow the capstan to lock (CAPSTAN SYNC light on).

Procedure

A. Perform the Pre-Operational steps detailed in Section 3.2.4.

B. Place the AUTO MAN/RESET 1 CYCLE switch in the MAN/RESET position.

C. To initiate copying, press the SYSTEM START/STOP button.

D. Should it be necessary to stop a specific slave during this process, press the STOP button on the slave transport. Pressing the SYSTEM START/STOP button again stops the entire system.

3.2.6 Auto-Cue Operation (Requires AUTO-CUE Option)

The Auto-Cue function enables the system to operate unattended in an automatic mode, performing an operator specified number of duplication cycles.

The Auto-Cue function is based on transparent "windows" in the tape used to control the master transport, which in turn, controls the slaves. A window is placed near the beginning of the program material, and near the end. When the tape is started on the master and the window passes the sensor, the slave units are simultaneously started. Slave recording continues until the second window near the end of the tape is sensed at the master. All system transports are then stopped. The master then automatically rewinds and stops upon sensing the first window (overshooting it slightly due to reel inertia). The master then enters the forward mode, advancing to the first window. As the window passes the sensor again, the slaves are started and recording begins again. This cycle is repeated until:

(A), the desired number of cycles have completed (Continuous mode), or
(B), a single cycle has finished (Single Cycle Mode).

The window is normally made in the tape by removing the oxide from the tape using an industrial solvent such as MEK (methyl-ethyl keytone) or Acetone. The window should be at least 1.5 to 2 inches in length.

Allow at least 50 feet of blank tape from the beginning to the first window in order to allow the master capstan to come up to operating speed. From the window to the start of the program material, allow 60' @ 240 IPS, 30' @ 120 IPS, or 15' @ 60 IPS. At the end of the program material, allow at least 50 feet from the second window to the end of the tape.

Be sure the windows are clean and free of smudges or residual oxides for positive action.

IMPORTANT: The Auto-Cue circuit operates by pulses from the sensor photocell located to the left of the supply tension sensor arm on the master transport. Pressing the local STOP button on the master transport stops only the master transport. It does not reset the Auto-Cue logic, or stop the slaves if they are running. Stopping the master transport in this manner, and then removing the tape from the playback head assembly generates a sensor pulse that will sequence the Auto-Cue logic as though a window has passed. When stopping the system for any reason during an Auto-Cue cycle, use the SYSTEM STOP button on the master console.

Single Cycle Mode

In the Single Cycle mode, the first window initiates a FORWARD command at all slaves. The second window stops all slaves and places the master deck in rewind. Upon reaching the window at the beginning of the tape, the master transport stops and awaits another start command from the operator.

This mode is selected by placing the AUTO MAN/RESET 1 CYCLE switch on the master console into the 1 Cycle position.

Continuous Mode

In the Continuous mode, the procedure is the same as above, except that the desired number of cycles are automatically performed until the Cycles Counter Display reaches 00.

This mode is selected by placing the AUTO MAN/RESET 1 CYCLE switch on the master console into the AUTO position.

Auto-Cue operation is totally disabled by placing the AUTO MAN/RESET 1 CYCLE switch in the MAN/RESET position.

Procedure

A. Perform the Pre-Operational steps detailed in Section 3.2.4.

B. Enter the desired number of cycles in the thumbwheel switch. Move the AUTO-CUE switch to the MANUAL/RESET position to load the value into the LED Cycle Counter Display, then place the switch in the AUTO position.

C. Press the AUTO-CUE START/STOP button once to initiate the sequence. The LED below the button lights to indicate the sequence has started.

D. Should it be necessary to stop a specific slave during this process, press the STOP button on the slave transport. Pressing the AUTO-CUE START/STOP button again stops the entire system.

NOTE: In the event a master tape breaks during an Auto-Cue cycle, observe the following procedure:

1. Press the SYSTEM STOP button on the master console.

2. Reset the thumbwheel switches to the same value as the LED counter displays is currently reading.

3. Replace the tape (discard the partial copy).

4. Switch into the MANUAL/SET (OFF) mode.

5. Return to the mode of operation that was active when the tape broke (either SINGLE CYCLE or AUTOMATIC).

6. Press the master transport Forward (⟶) button.

3.3 Operator Maintenance

3.3.1 General

Due to high speed operation and the tendency of oxide shedding, frequent and thorough cleaning of the heads and guides is the primary operator maintenance activity. It is advisable to clean the heads between each loading of the tape on the slave decks. A fragment of oxide lodged on the record head might not be visually detected until many bad duplicates have been run.

Another common problem is loose oxide packing in the edges of the tape guides. This build-up may also scrape oxide from the outside edge of the running tape. These problems can be prevented by close inspection of the guide surfaces, and removal of any deposits. If excessive shedding is noticed (evidenced by the precence of tape particles in and around the head assembly), perform a thorough cleaning and inspection before resuming operation.

Bearings are sealed and do not require routine lubrication.

Be sure to use caution when using any tools near tape path that could cause scratches, etc.

All plastic on the transports is safe for methyol, ethylene, isoprophyl and Acetone.

Table 3-1 lists recommended routine operator maintenance items.

3.3.2 Cleaning Procedures

Use cotton swabs for cleaning heads, tape guides, and rollers in the tape path. Be sure the area is adequately ventalated when using solvents.

3.4 Quality Assurance

3.4.1 General

Generally, most duplicating houses monitor the quality of duplications by pulling random samples for evaluation on a calibrated playback machine. How frequently this is done is largely customer dependent (typically daily, depending on workload).

A more sophisticated procedure involves the method as described above, but duplicating a test tape. A properly aligned AS200-A system will provide duplicates having a frequency response within 3 dB of the master, and a signal-to-noise ratio within 2 dB.

Level variations outside of these limits requires the attention of qualified service personnel.

Table 3-1, AS200-A Routine Maintenace

Activity	Recommended Frequency
Tape Guide Cleaning	At every tape loading (Slaves)
Head Cleaning	At every tape loading (Master and Slaves)
Head de-magnetization	(Master) At least once per shift, or as required.
Capstan Rollers	(All transports) At least once per shift, or as required. Use isoprophyl alcohol.
Tape Lifters (Master only)	Same as Head Cleaning.
End-of-Tape sensors	Same as Head Cleaning.
Visual check for nicks, loose hardware, etc.	At every tape loading.

It's also a good idea to routinely listen for any unusual audible sounds that may signal possible trouble, such as a bearing going bad.

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4. ADJUSTMENT AND ALIGNMENT

4.1 General

The AS200-A system has been conscientiously engineered for long-term stability and reliability. Both mechanical and electrical adjustments have been factory aligned and adjusted for optimum performance and tape handling. The procedures described in this section should, therefore, be necessary only when component replacement occurs as a result of normal system wear due to useage.

When adjustment and alignment becomes necessary, the following equipment is recommended:

- Tentelometer and/or spring type tension gauge (0 - 12 ounces)
- Calibration tapes appropriate to system head format, speed and EQ
- Dual-channel oscilloscope with a bandwidth of DC to at least 25 MHz
- AC Voltmeter (HP 400 F or equivalent)
- Audio Oscillator (HP 204D or equivalent): mimimum, sweep generator; recommended
- Test Cables (2 each)
- Head de-gausser

Expendable materials you will need include:

- Cotton head cleaning swabs
- Head and tape guide cleaning solvent

As a general rule, the gain, frequency response, and head condition should be checked every 100 to 150 hours of operation, depending on useage.

4.2 Transport Setup and Adjustment

4.2.1 General

Precise control of the tape tension over the heads is maintained by the supply and takeup reel servo systems. Freedom of movement of mechanical guides, arms and rollers is essential to proper operation of the servo system. Regular cleaning and inspection of these components for mechanical freedom should therefore, be considered as part of a routine maintenance procedure. Should a problem with tape handling occur, perform these inspections first.

Generally, tape tension is an accurate indicator of the relative condition of the transport tape handling system. During normal operation, tape tension should be in the range of 4 to 6 ounces. Refer to Figure 4-3A for specific tension measurement points.

4.2.2 Tension Sensor Alignment

The following steps are performed with the power removed from the slave or master machine on which the adjustment is performed. Offered as a recommended procedure, these steps may be tailored to your specific practices.

1. Using a tape "noose" on the supply tension sensor arm, measure the force necessary to maintain the sensor arm at its center position. Approximately 6 to 6.5 ounces yields a 4 ounce running tension measured at the head (see Figure 4-2), and a 5 ounce packing tension at the takeup reel.

2. If adjustment is required, unplug the head connector on the record bay (below the transport—slaves only). The transport must then be tilted out of the cabinet as illustrated in figure 4-1. Use a wooden or metal rod about 12 to 14 inches in length to prop the deck open.

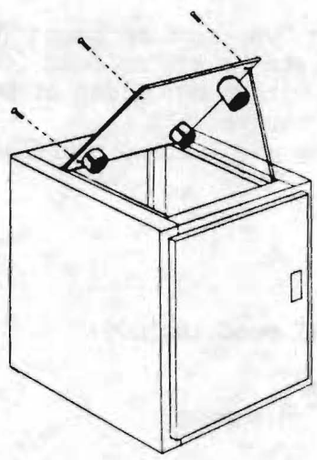


Figure 4-1, Transport Position for Tension Adjustment

3. Disable dashpot by unscrewing the valve screw out (counterclockwise) about 1 and 1/4 turns.

4. Locate the knurled tension spring adjustment knob under the supply sensor arm (Figure 4-3). Determine the direction of the required adjustment: clockwise = less; counterclockwise = more. Loosen the setscrew and move the knob slightly in the required direction. Tighten the setscrew and remeasure tension per step 1.

Repeat this procedure as necessary to obtain the desired tension.

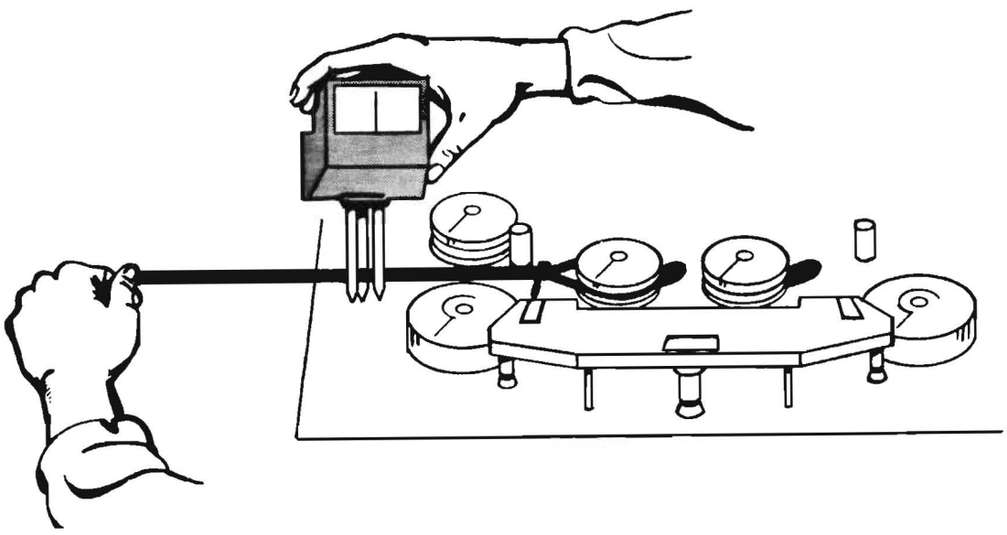


Figure 4-2, Supply and Takeup Tension Measurement

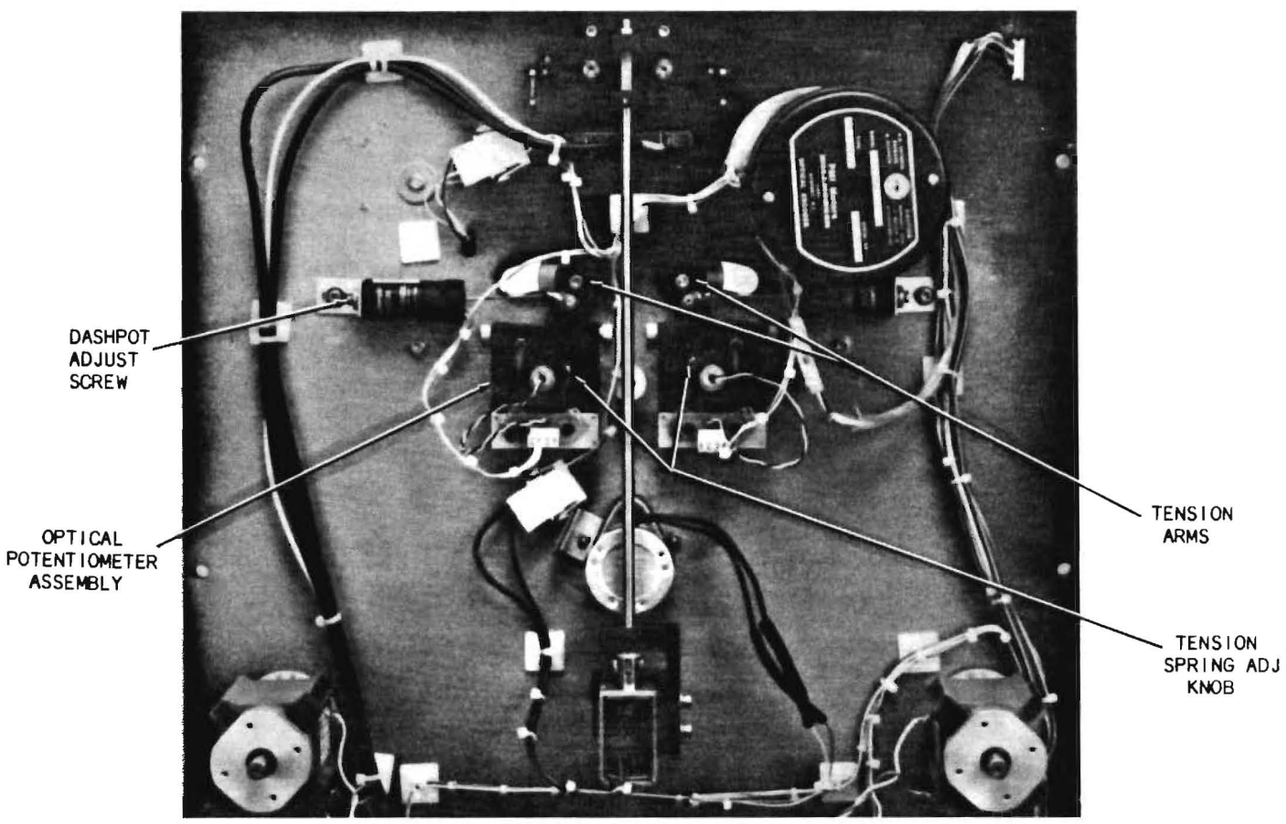


Figure 4-3, Tension Arm Spring and Dashpot Adjustment

5. Adjust the dashpot for proper dampening. Using the tape noose, slowly pull the sensor arm from its inner position toward the outer position while observing the force required to move it from the resting position. Adjust the dashpot valve for approximately 8 to 9 ounces of force.

6. Repeat steps 1 - 3 for the takeup tension arm, except that the desired tension force should be 7 to 7.5 ounces in order to maintain a 5 ounce tension on the takeup reel (see Figure 4-3A).

7. Remove the prop, re-install the head connector, lower the transport into its normal position, and install the four securing screws (Figure 4-1).

4.2.3 Reel Motor Direction Rotation

Insure that the direction of motor rotation and tension arm control operation is correct before proceeding with the tension adjustments.

4.2.3.1 Supply Motor

When the supply tension arm is in the rest position, the motor should be driven clockwise. Moving the arm to the opposite extreme should reverse motor direction. Perform this test by blocking the EOT sensor with an opaque material, pressing READY and observing the direction of supply motor rotation.

4.2.3.2 Takeup Motor

When the take-up tension arm is in the rest position, the motor should be driven counter-clockwise. When the arm is moved outward to the other extreme, the motor should stop. Perform this test by blocking the EOT sensor with an opaque material, pressing READY and observing the supply motor operation.

4.2.4 Tension Arm Range Centering

The tension arm range centering adjustment must be performed with tape threaded on the deck, AC power applied, and the deck "tensioned" (in the ready state).

1. Open the rear door to expose the Servo board. Use a small flat-blade screwdriver to make any adjustments.

2. For Takeup tension arm centering, adjust potentiometer VR3 so that the takeup sensor arm rests in the center of its travel range (see Figure 4-4).

3. For Supply tension arm centering adjust potentiometer VR4 so that the supply sensor arm rests in the center of its travel range (see Figure 4-4).

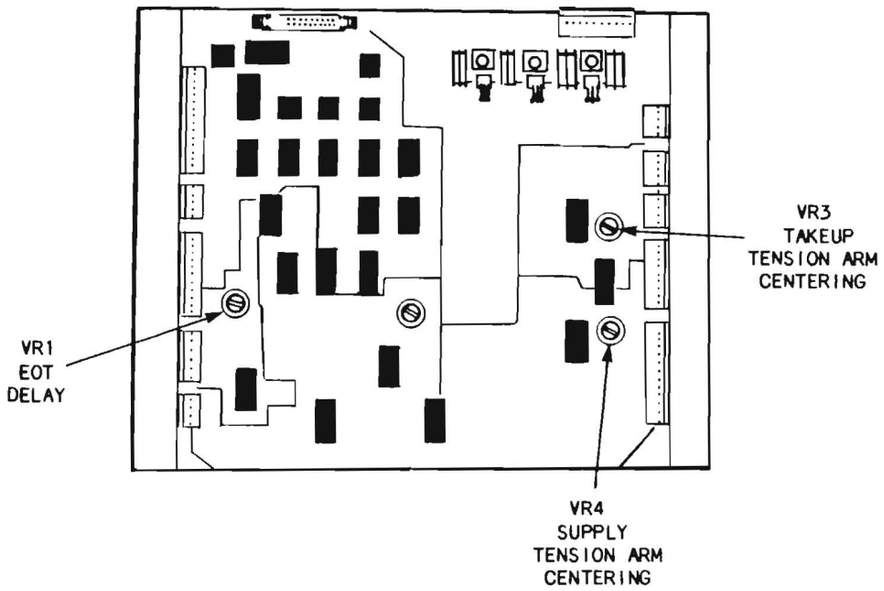


Figure 4-4, Servo Board Adjustments

4.2.5 End-of-tape (EOT) Sensor Adjustment

The AS200 transports are equipped with a no-tape sense circuit that shuts off all servo systems if tape is either not threaded properly, or runs out during normal operation. The EOT sense circuit consists of a optoelectrical sensor on the top plate through which the tape passes.

The EOT adjustment (VR1 on the Servo board) establishes the voltage threshold at which all servos are shut off. VR1 also adjusts the time-delay after which a no-tape condition is sensed and the servos are shut off. The delay can vary from zero (servos cannot be activated by READY) to infinite (servos continue running when a no-tape condition is sensed). The optimum setting is made so that when READY is pressed (without tape threaded), reel servos are turned on for approximately one-half second, then turn off. When adjusted in this manner and tape is threaded, the reel motors are driven for a sufficient time period to "tension-up" the tape and maintain the servo-ready condition. Zero time delay (READY does not activate the servos) is set by adjusting VR1 fully clockwise. Infinite time delay (a no-tape condition does not shut off the servos) is set by adjusting VR1 fully counter-clockwise.

VR1 setting is typically between 9-11 o'clock (1/3 to 1/2 of the resistance) for correct operation.

On the master, end-of-tape sense is normally delayed about 2 seconds to permit the use of transparent windows in the tape (used for the Auto-Cue function).

4.3 Master Electronics (Playback) Alignment

4.3.1 General

This alignment involves checking/setting the reproduce head azimuth, and adjusting the reproduce level, equaliazation and VU meter sensistivity. Before beginning, preform the following preliminary steps:

A). Thoroughly clean the head, tape guides, and all rollers in the tape path using xylene or isoprophyl alcohol.

B). Demagnetize the head and tape guides.

C). Examine all components in the tape path for nicks, scratches, excessive looseness and any indications of abnormal condition.

D). Remove the console front panel.

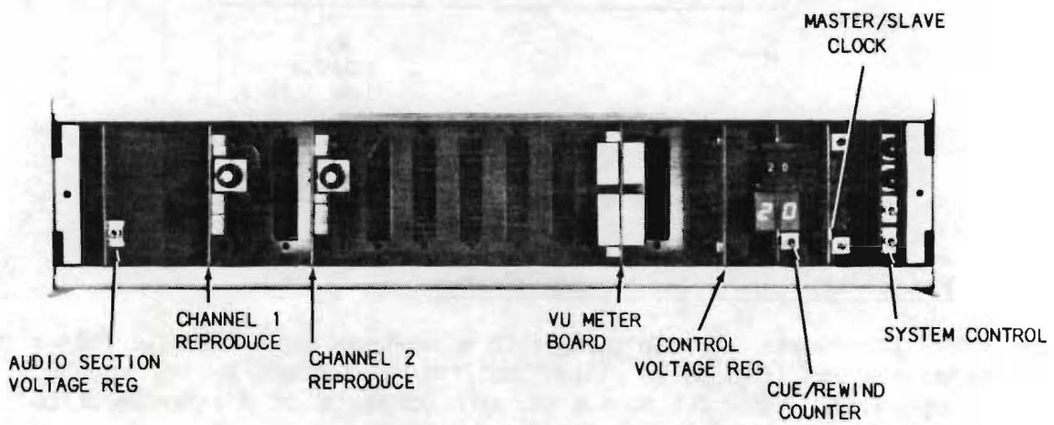


Figure 4-5, Master Electronics Chassis (Console) Board Locations

4.3.2 Head Alignment

This alignment consists of setting the head to tape wrap angle and aligning the head azimuth for proper alignment and minimum phase error (stereo format). To perform these adjustments, you will need an alignment tape and a level reference tape for the appropriate head format and duplicating speed ratio, and a dual-channel oscilloscope.

Generally, excessive stereo phase error and low level high-end (dull) are indications of azimith misalignment.

4.3.2.1 Tape Wrap Adjustment

A). Locate the Reproduce amplifier in the console chassis and adjust the level control to its halfway position.

B). Mount an alignment tape recorded with a reference level tone on the master transport. Using a dual channel scope (Stereo head format), observe the output signal on both channels. Loosen the head mounting assembly securing screw and rotate the Tape Wrap Angle Adjust cam for maximum gain reading on the scope or VTVM (see Figure 4-6A). Re-secure the head mounting screw.

For mono head formats, adjust for maximum gain reading on the scope or VTVM.

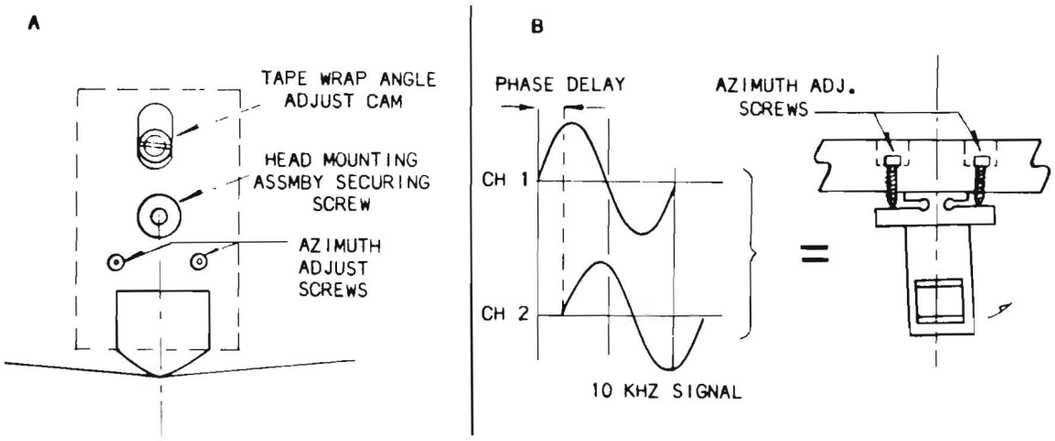


Figure 4-6, Tape Wrap Angle (A) and Azimuth Ajustment (B)

4.3.2.2 Head Azimuth Alignment

A). Connect a dual trace scope to the Audio Output of the master unit. Trigger the scope from the channel 1 output.

B). Thread the appropriate alignment tape on the transport and place the sytem in the FORWARD mode. Play back the full sequence of test tones and observe that no phase reversal occurs. Should phase error exist, adjust the head azimuth adjusting screw to obtain minimum phase error.

Should one channel lag the other, determine which azimuth adjustment requires adjustment (see Figure 4-6). Generally, if channel 2 lags channel 1, the head is tilted too far counterclockwise. Adjust the appropriate azimuth screws as required.

For full track mono, adjust the azimuth for maximum output during playback of the highest tone.

4.3.3 Level Adjustment

This adjustment is based on individual customer preferences. The output level is normally set while reproducing a standard alignment tape of known short circuit fluxivity and adjusting the system reproduce gain appropriately. Alignment tapes typically range from 185 nWb/m @ 700 Hz to 320 nWb/m @ 1000 Hz.

Note that if a full width alignment tape is used to set reproduce gain on a 2 channel system, the fringing effect will produce errors in absolute reproduce senitivity to recorded fluxivity. This error becomes more pronounced at higher tape speeds.

NOTE: Final adjustment of the reproduce equalizers for optimum frequency response is detailed later in this section.

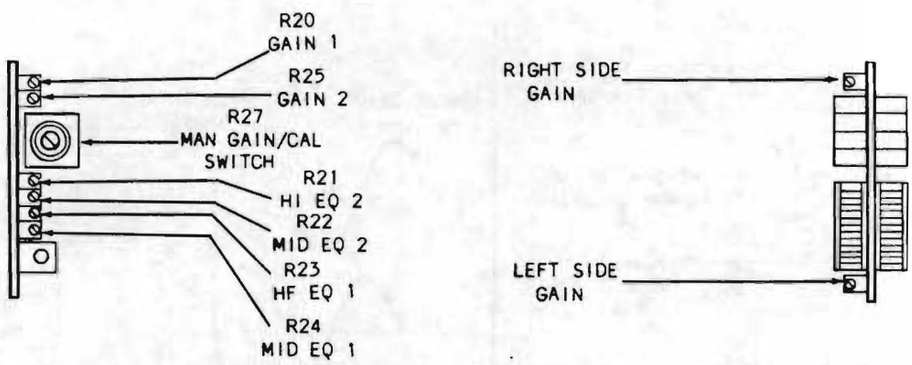


Figure 4-7, Reproduce Amplifier and VU Meter Board Adjustments

4.3.4 Equalization Adjustment

Using a test tape recorded with 1 KHz and 10 KHz tones, adjust the Hi/Mid, Low and Gain controls for flatest response.

4.3.5 VU Meter Sensitivity Adjustment

The VU meters are used as relative indicators of the program output level to the slaves. Although factory set, this level is usually set according to customer preference.

Each segment of the VU meter corresponds to about 3 dB (not linear). Gain is normally adjusted such that all lower (yellow) segments are lit to provide a 0 reference level at the desired output level.

A). Adjust the gain for the desired channel to minimum (full CCW).

B). Using the reference level applied to the desired channel, advance the gain until the uppermost yellow LED just lights (see Figure 4-7).

C). Repeat steps A and B for the remaining channels.

4.4 Slave Electronics (Record) Adjustment

4.4.1 General

This alignment involves checking/setting the record head azimuth, adjusting the bias trap and level, and adjusting the record level and equaliazation. Before beginning, perform the following preliminary steps:

A). Thoroughly clean the head, tape guides, and all rollers in the tape path using xylene or isoprophyl alcohol.

B). Demagnetize the head and tape guides.

C). Examine all components in the tape path for nicks, scratches, excessive looseness and any indications of abnormal condition.

D). Open front door on the transport.

In general, record bias should be adjusted for the particular type of tape to be used. Parameters differ from one tape to another, e.g. magnetic properties of the oxide, the manner of milling, processing of the binders and coating, and tolerances imposed for the specifications. Recognizing these variables, one should adjust the system according to the specific recommendations of the manufacturer.

Optimum bias level is determined by three main criteria (as viewed on a spectrum analyser):

1. Maxmimum output level
2. Sensivity at 10 kHz
3. Third-order harmonic distortion.

Figure 4-8 illustrates the relationship of these criteria.

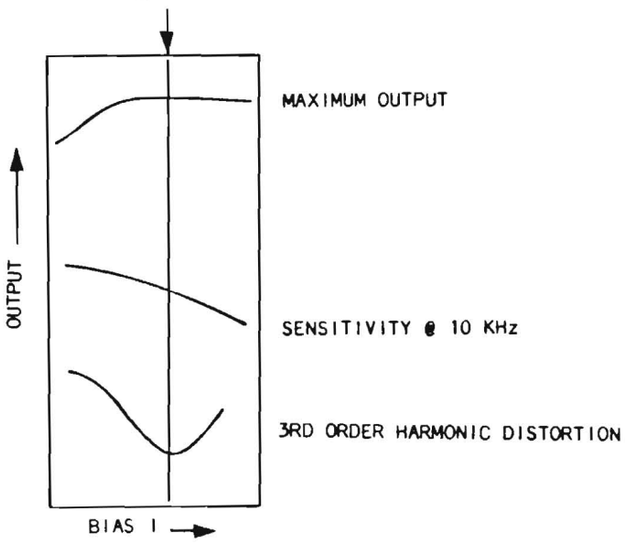


Figure 4-8, Tape Performance Versus Biasing Curve

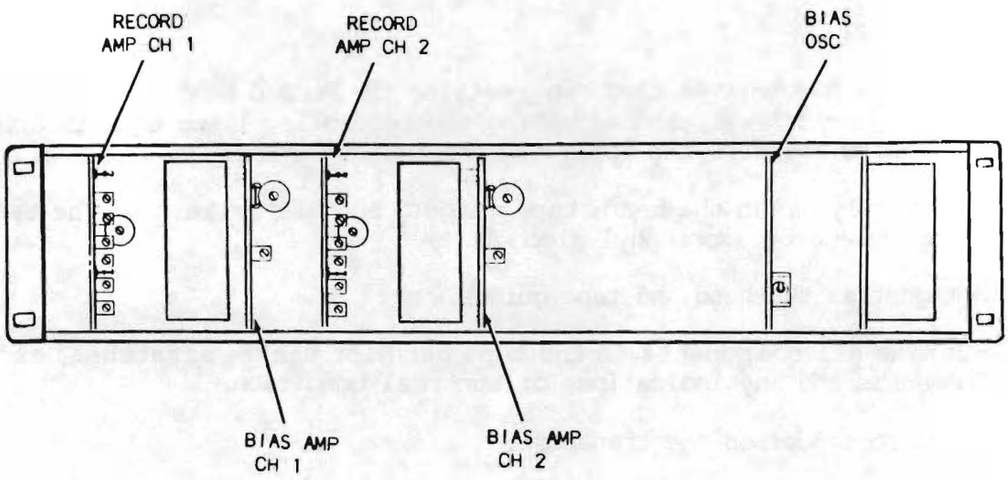


Figure 4-9, Slave Electronics Chassis Board Location

4.4.2 Head Alignment

This alignment consists of setting the head to tape wrap angle and aligning the head azimuth for proper alignment and minimum phase error (stereo format). To perform these adjustments, you will need a calibrated playback machine with a known accurately aligned playback head, a portable playback test head, a signal generator, and a dual channel oscilloscope.

Generally, excessive stereo phase error and low level high-end (dull) are indications of azimith misalignment.

4.4.2.1 Tape Wrap Adjustment

A). Connect the outputs of the portable test head to a dual-channel oscilloscope and position the test head near the takeup reel such that it contacts the tape as illustrated in Figure 4-10A. Connect the signal generator to the input of the desired channel. Adjust the frequency to 10 kHz and set the output level to the normal reference level.

B). Mount a fresh roll of de-magnetized tape on the transport and record the 10 kHz test tone. Observe the test head output signal on the scope. Loosen the head mounting assembly securing screw and rotate the Tape Wrap Angle Adjust cam for maximum gain reading on the scope or VTVM (see Figure 4-10A). Re-secure the head mounting screw.

For mono head formats, adjust for maximum gain reading on the scope.

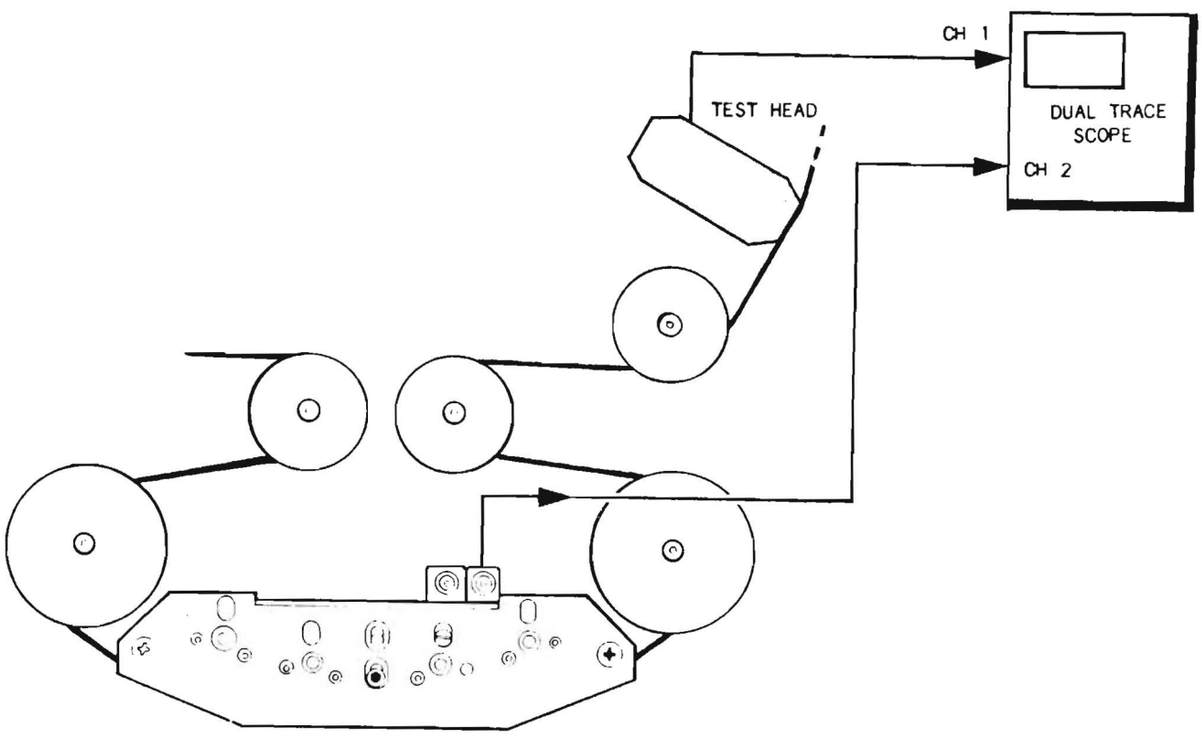


Figure 4-10, Slave (Record) Head Alignment Test Hookup

4.4.2.2 Head Azimuth Alignment

A). Connect the signal generator to the input of the desired channel(s). Set the output level to the normal reference level. Record a sequence of test tones on the slave.

B). Transfer the tape made on the slave being aligned to the calibrated playback machine. Connect a dual trace scope to the outputs of the playback machine. Trigger the scope from the channel 1 output.

C). Play back the full sequence of test tones and observe the scope patterns. Should phase error exist, note the phase relationship and determine the

appropriate azimuth adjustment required. Should one channel lag the other, determine which azimuth adjustment requires adjustment (see Figure 4-6). Generally, if channel 2 lags channel 1, the head is tilted too far counterclockwise. Adjust the appropriate azimuth screws as required.

For full track mono, adjust the azimuth for maximum output during playback of the highest tone.

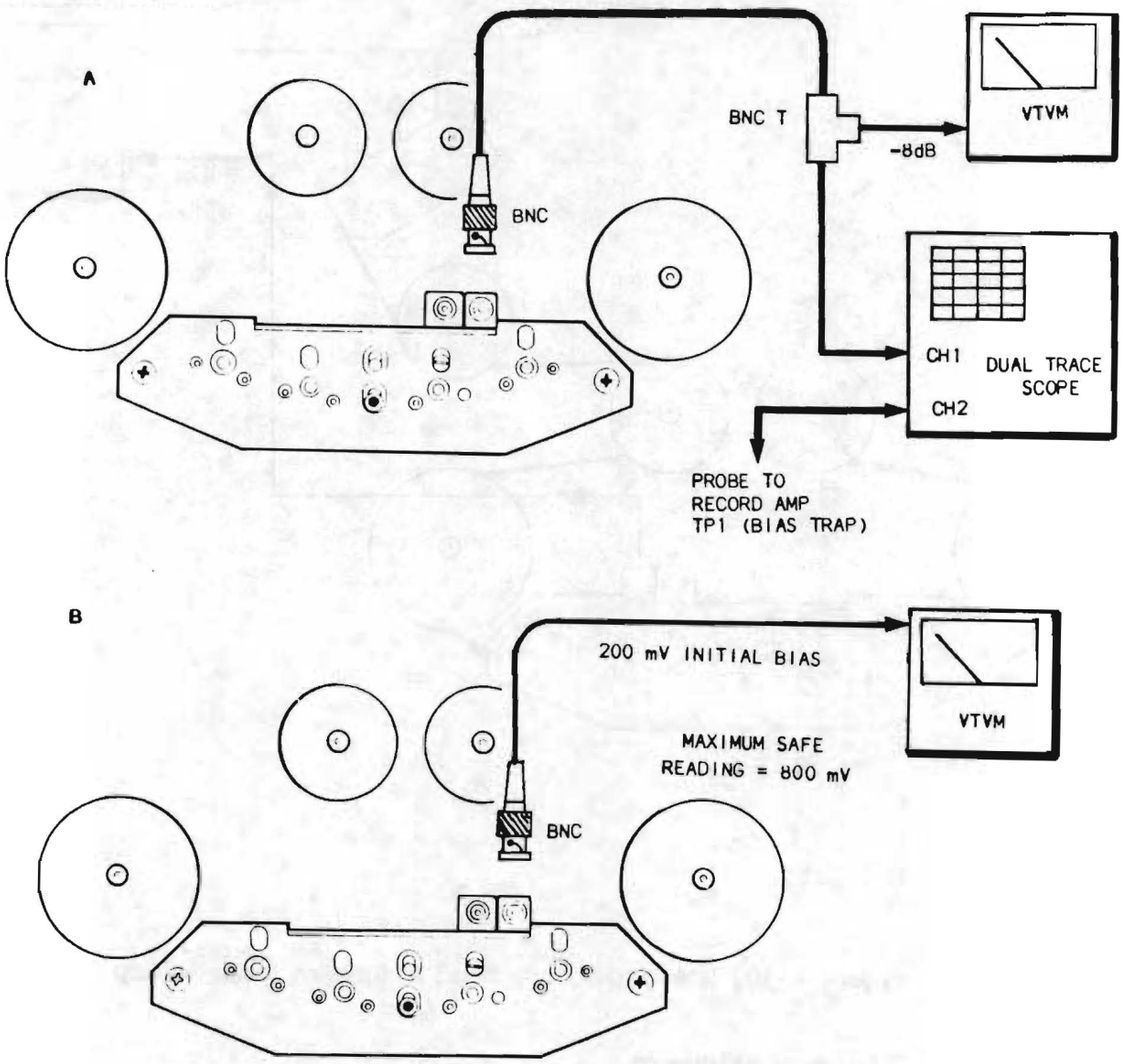


Figure 4-11, Bias Trap Tuning (A), and Level Set (B)

4.4.3 Bias Adjustment

Bias adjustment consists of adjusting the Bias Trap and setting the bias level. It is necessary to know the biasing characteristics of the specific type of tape being used, since this determines the bias level for optimum performance.

To perform bias setup, you will need an AC VTVM and a dual channel oscilloscope. Use a non-metalic screwdriver to perform the following adjustments.

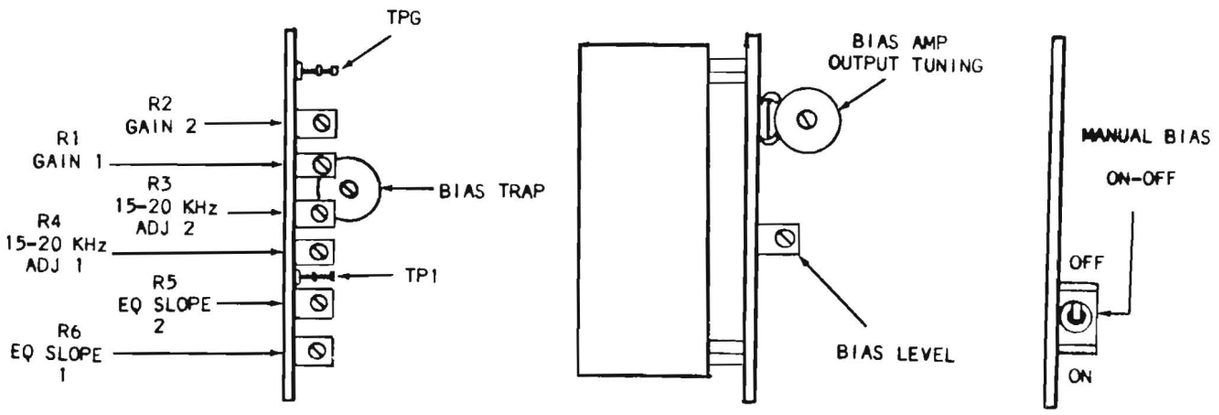


Figure 4-12, Record Amplifier, Bias Oscillator and Bias Amplifier Adjustments

4.4.3.1 Bias Trap Adjustment and Bias Amplifier Tuning

Configure the test equipment as illustrated in Figure 4-11A.

a. Turn the bias oscillator on (MANUAL BIAS switch down).

b. Set the level to -8 dB (300 mv) on the VTVM.

c. Adjust the Bias Amp OUTPUT TUNING capacitor for maximum gain and minimum distortion (a pure sine wave) reading on the scope, channel 1. Reduce the level control as required to maintain a level within 2 dB.

d. Adjust the BIAS TRAP for minimum peak-to-peak level on the scope, channel 2. This typically should be less than 2 V P-P as seen on TP1.

4.4.3.2 Bias Level Adjustment

Before beginning, it is necessary to know the biasing characteristics of the tape being used. Consult tape manufacturers recommendations.

a. Preset gain control (R1 or R2) to maximum, or full CW and set the Bias Level to 200 mV head bias current (Figure 4-11B)

b. Mount and thread a blank tape on the slave. Connect the signal generator to the Audio Input. Adjust the signal generator frequency to the desired bias test frequency (10 KHz X duplication ratio is suggested). Set the level 20 dB below reference operating level (-30 dBm).

c. Place the slave into the READY mode and start the transport in the FORWARD condition. With the portable test head in place, adjust the appropriate bias level control to locate the bias peak. Continue turning the control clockwise until the overbias point recommended by the tape manufacturer is reached (see Figure 4-13).

d. Repeat the procedure on all channels.

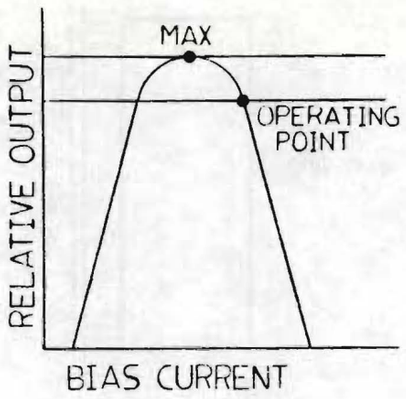


Figure 4-13, Overbias Point

4.4.4 Record Equalization

The Record Equalization controls are located on the Record Amplifier board (you will need an extender board to access some of these controls). The function and adjustment range of each control is illustrated in Figure 4-14, B through E. The objective of the following procedure is to produce the standard NAB equalization curve shown in Figure 4-14A. All gains are reference to the 1 KHz level.

NOTE: The Record Equalization Ajustment procedure should be performed only when changing tape types or replacing a record amplifier board. Routine equalization checks should be made by first recording a test run, then evaluating the results in order to identify specific ajustment requirements.

Connect a signal generator to the desired slave input, or to all slaves via the record bus. The use of a frequency counter on the generator output is also recommended.

a). Set the signal generator output amplitude to about 20 dB below the reference level.

b). Preset all controls on the record amp boards as follows:

Gain (R1 or R2) maximum (full CW),
R3 or R4 mimimum
R5 or R6 50%

c). Connect a VTVM to the appropriate head assembly BNC connector. Adjust the signal generator for a frequency equivalent of 1 KHz, depending on the duplicating ratio to be adjusted. For example, 1 KHz @ 32:1 = 32 KHz. Note the level reading. Set the signal generator to a frequency equivalent of 10 KHz and ajust R5 (or R6) for a 2 dB increase over the 1 KHz level.

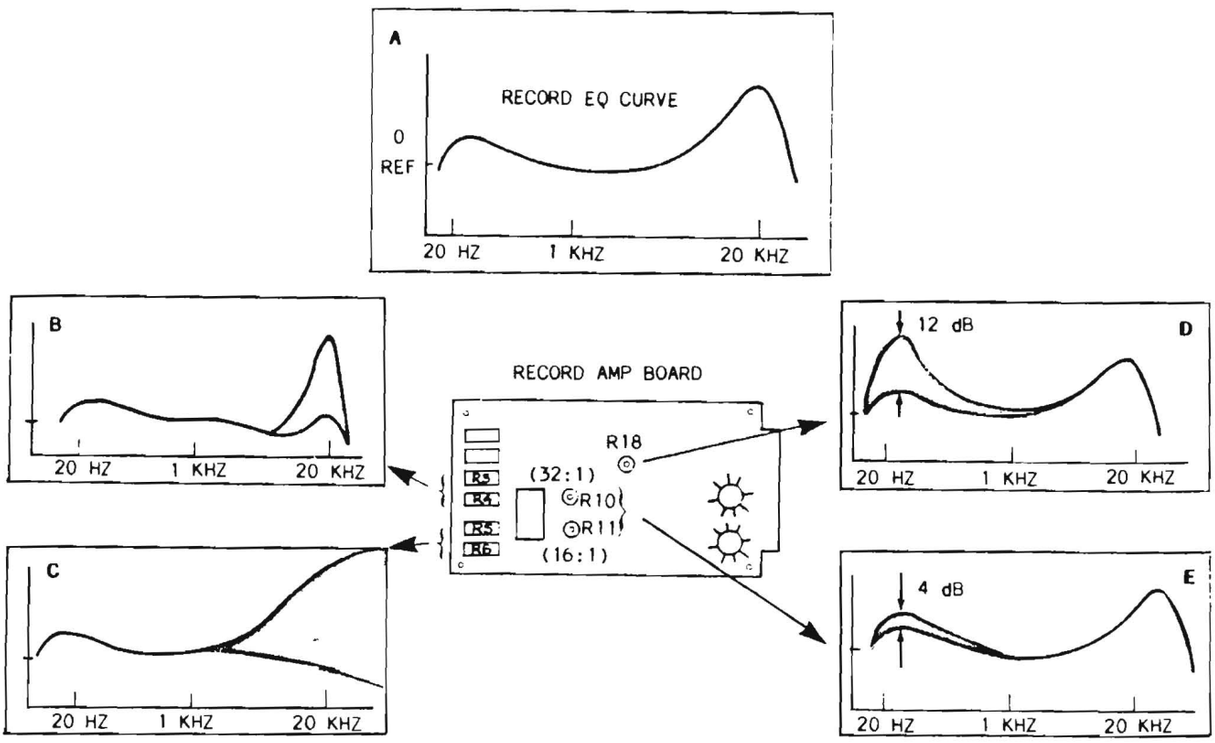


Figure 4-14, Record Equalization Adjustment Curves

d). Mount tape on the slave and begin recording.

e). Sweep the signal generator frequency from the 1 KHz equivalent to the 20 KHz equivalent for the desired ratio.

f). Using a calibrated playback machine, play back the recorded tape and note the required adjustment.

g). After the evaluation of step (f), adjust the 15-20 KHz control as required, compensating for the highest frequency of interest.

h). Check the low end (against the 1 KHz reference point) and compensate R10 (or R11) as needed. If necessary, set R18 (Low-end Boost) first for the main EQ speed, then fine-tune R10 (or R11 for the second EQ speed) to create a flat frequency response. Repeat steps (e) and (f) as required to obtain the desired results.

i). Adjust R1 or R2 for the desired recording level (typically 200 nWb/m).

Table 4-1 is provided as a quick reference in indentifying typical problems affecting normal performance.

Table 4-1, AS200 Symptom/Probable Cause Chart

Symptom	Probable Cause	Action
Lack of HF response	1. Heads dirty.	Clean heads.
A) Requires excessive gain adjust.	2. Heads out of alignment.	Perform azimuth ajust.
	3. Using wrong tape type.	Check tape characteristics for machine setup.
B) Not enough range available on gain	4. Head gap errosion.	Polish head.
	5. Improper biasing.	Recheck/set bias levels.
Low Level	1. Dirty heads.	Clean heads
	2. Improper bias.	Recheck/set bias levels.
Poor S/N ratio	1. 60/120 Hz hum present.	Check power supply ripple
	2. Preamp/repro amp component defective.	Perform board swap and recheck.
	3. Tape not properly erased.	Bulk erase tape.
	4. RF interference or ground loop problem.	Check grounding straps.
	5. Poor master tape.	Check master on reference deck.
Excessive Flutter (irregularities in HF)	1. Bad tape guide or bearing.	Check guides and bearings for audible or visable irregularities.
	2. Tension arm or dashpot improperly adjusted.	Recheck tension and tension arm dampening. Adjust as required.

5. THEORY OF OPERATION

5.1 General

The AS200A system is implemented using modular, building block construction for simplicity, economy, and ease of maintenance. Common mechanical contruction is used for both master and slave units, differing basically in the specific board configurations of the electronics chassis. A common power supply is also used to furnish unregulated power to both audio and transport subsystems.

The AS200-A system can be divided into three major functional areas: Audio, Transport, and Control. The Audio and Control functions share a common electronics chassis in both the master and slave units.

5.1.1 Audio Subsystem

The Audio function includes the master reproduce head and electronics, and the slave record electronics and head.

Audio is recovered from the master tape at a speed corresponding to the duplication ratio (typically a multiple of 16, 32 or 64 times the speed the master was originally recorded at). After passing from the master reproduce head through a wideband preamplifier, the signal is equalized and amplified to line level by the Reproduce Amplifier. The audio is then fed to all system slave record bays via a 50 ohm coaxial cable.

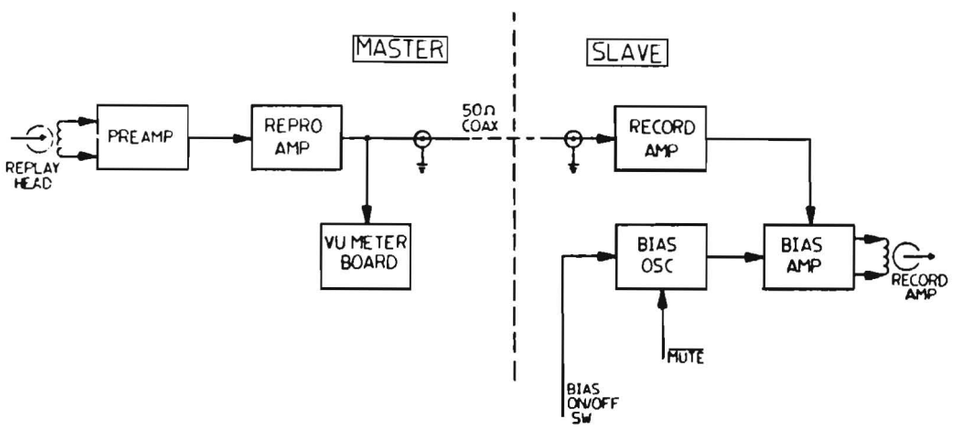


Figure 5-1, AS200-A Audio System Functional Block Diagram

At each slave, the line audio enters the Record Amplifier where it is equalized for the duplication speed before being fed to the Bias Amplifier, where it is mixed with the 3.5 MHz Bias Oscillator output. The combined signal is then filtered and applied to the recording head.

Because the output of the Bias Amplifier is capable of driving the record head to very a high biasing level, bias is automatically removed when the slave unit is not recording to prevent head overheating. This automatic mute facility can be manually defeated for service and alignment.

A functional block diagram of the Audio section is illustrated in Figure 5-1.

5.1.2 Transport Subsystem

The Transport function is basically the same on both the slaves and master. This function includes all necessary electro-mechanical elements necessary to handle tape motion. Transports are identical except that the Master contains the System Control, Clock, and Auto-Rewind/Cue option boards. Both transports are based on a phase-locked-loop servo system for precision control of the capstan, supply, and takeup motors.

Functionally, the Transport subsystem consists of two major elements, the capstan tape drive servo system, and the supply and takeup reel tension servo system. Both are controlled by the Control subsystem. The capstan servo system is a phase-locked loop system referenced to the master clock system timing signal. A tachometer unit mounted on the capstan motor provides speed feedback information to the loop comparator. Any out of sync condition produces an error voltage which is amplified and used to control the current of the capstan motor driver circuit. This method allows accurate and reliable operation at virtually any desired speed, determined by the master clock frequency.

Tape tension is maintained by the supply and takeup reel tension servo system. A moveable tension arm assemblies connected to photo-potentiometers for position sensing, are used to control their respective supply and takeup motors. This technique provides accurate tension control of the tape for optimum head to tape contact.

Together, the tension and capstan servo system also eliminate the need for the pinch roller used in conventional transport design. This dramatically extends the life of master tapes, which are subject to greatest wear in a high speed duplicating system.

A functional block diagram of the transport system is illustrated in Figure 5-2.

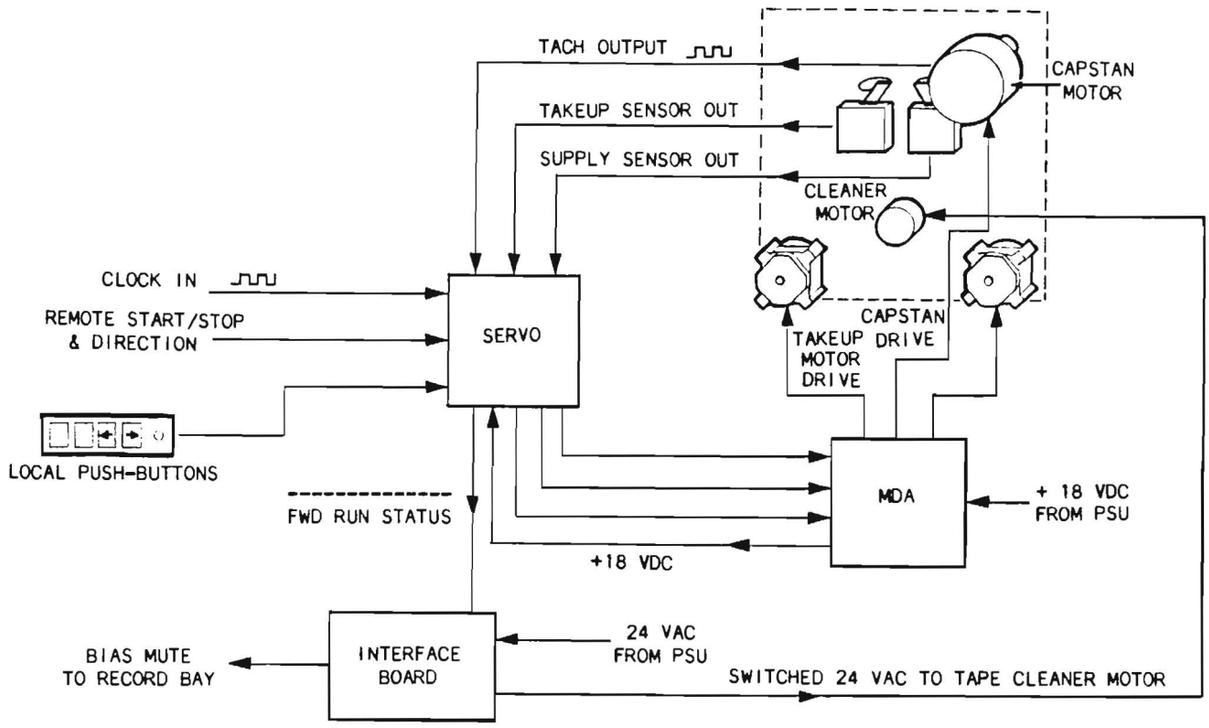


Figure 5-2, Transport System Functional Block Diagram

5.1.3 Control Subsystem

The Control function includes all transport control logic, master Auto-Cue control, and fiber-optic communications system linking all system units. This function can be further divided into the Master control, and Slave control subsections.

The Master control subsection provides:

A. A master clock timing signal for precise speed control of the capstan motors

B. A master equalization command that selects one of two equalization networks dedicated to two of the three operating speeds (Hi or Low)

C. System start/stop commands

D. Mono or stereo format selection commands to the slaves.

These four signals are combined (time-division multiplexed) together by the master control transmitter unit which feeds the signals to the system on a single fiber-optic cable "daisy-chained" to all units.

The Slave control functions are handled by Fiber-Optic transceivers in each system unit, which demultiplex the master control signals, and re-transmit the master signal "downstream" to the next slave in the system. Figure 5-3A illustrates the Master control, while Figure 5-3B illustrates the Slave control functional block diagram.

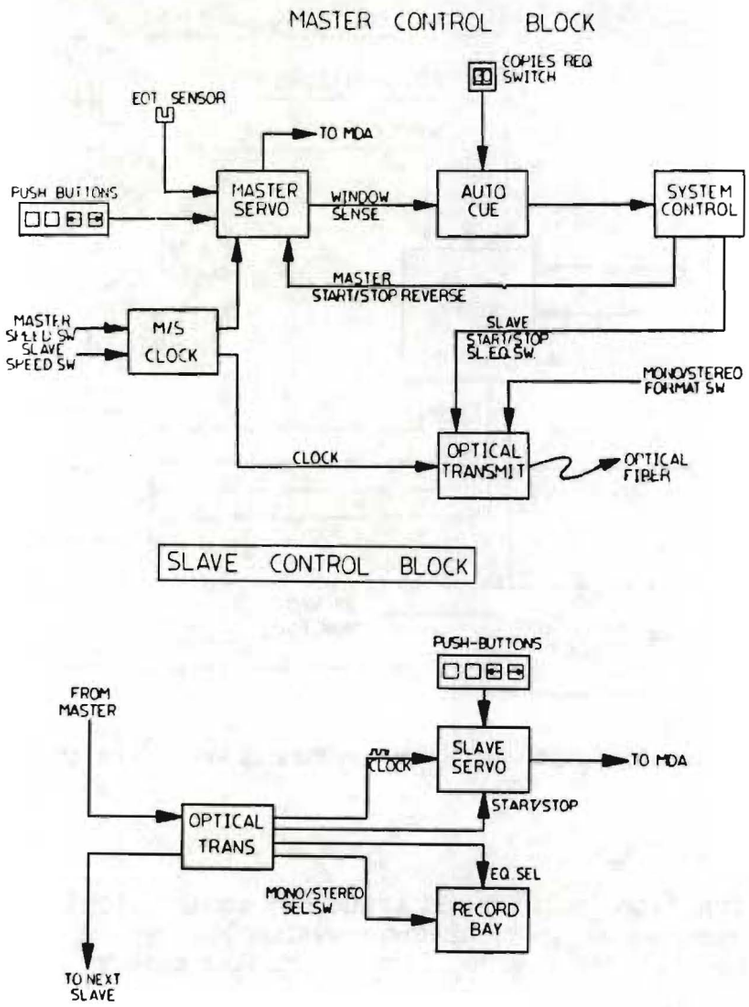


Figure 5-3, Master and Slave Control System Functional Block Diagram

5.2 Audio System

5.2.1 General

High-speed duplicator electronics differ from low-speed system electronics in that the high frequency response required must extend beyond the audio range by a factor equal to the ratio of the original tape speed to the master playback speed. For example, a 7.5 IPS master tape with material in the frequency range from 50 Hz to 18 kHz reproduced at 240 IPS will yield signals in the frequency range from 1600 to 576 kHz. This bandwidth and high-frequency limit dictates careful system design.

Both master and slave audio electronics are designed with a frequency response flat to 1.5 MHz using ultra-low noise active and passive components.

5.2.2 Master Audio Section

5.2.2.1 General

The Master Audio section provides the reproduce, system record bus drive, and level monitoring functions. These functions are performed by four boards, three of which are located in the master console electronics chassis:

1. Reproduce Heads and Preamp Board
2. Reproduce Amplifier and Equalizer
3. Audio Level Meter Boards
4. DC Voltage Regulator

5.2.2.2 Reproduce Heads and Preamp Board

High quality ferrite heads are used in the master, and are provided in the format appropriate to the master tape. The reproduce Preamplifier board is located directly behind the reproduce head in order to minimumize cable capacitance. Two channels are provided, each having a flat frequency characteristic to 1.5 MHz (unequalized), and a nominal gain of 30 dB.

Ultra-low noise op-amps having a slew rate of over 400 V/us are used.

5.2.2.3 Reproduce Amplifier

The Reproduce Amplifier provides equalization and amplification of the audio from the Preamp board to a level suitable for driving the slave record bus. It also drives the VU Meter Board. Two equalization networks are provided for two of the three available system speeds.

5.2.2.4 VU Meter Board

The VU Meter board provides a relative indication of the master audio output level to the slave record bus. It contains two channels of LED-type level indicators arranged in two groups, a 10-segment yellow lower portion, and a 4-segment red upper portion. Each segment corresponds to approximately 3 dB. The indicators are driven by an op-amp having its amplification variable through a gain control.

5.2.2.5 DC Voltage Regulator

The DC Voltage Regulator board is located in the master electronics chassis and provides a regulated DC operating voltage to the reproduce circuits. It also provides isolation of the reproduce electronics from the common master power supply.

5.2.3 Slave Audio Section

5.2.3.1 General

The Slave Audio section provides the record and bias functions. These functions are performed by four boards located in the slave electronics chassis:

1. Record Heads
2. Record Amplifier and Equalizer
3. Bias Oscillator
4. Bias Amplifier
5. DC Voltage Regulator

5.2.3.2 Record Head

High-performance ferrite heads are used as the record head. A BNC connector is provided at the rear of the head assembly to monitor bias current. The connector is located across a 10 ohm resistor which is between ground and the "cold" side of the head winding.

5.2.3.3 Record Amplifier and Equalizer

The Record Amplifier provides equalization and current gain of the audio from the master to drive the record head. Two equalization networks are provided for two of the three available system speeds.

5.2.3.4 Bias Oscillator

The Bias Oscillator board uses a 3.5 MHz crystal oscillator in an A.G.C. stabilized oscillator circuit. A separate oscillator is located in each slave record electronics chassis.

In multi-channel configurations, a single Bias Oscillator is used, feeding a Bias Amplifier board dedicated to each channel.

5.2.3.5 Bias Amplifier

A Bias Amplifier board is associated with each of the record amplifiers. Descrete voltage and current gain stages are used to satisfy the bias drive requirements of the record head.

The record amplifier output signal is combined with the bias through an L/C impedance matching and trap network.

5.2.3.6 DC Voltage Regulator Board

The DC Voltage Regulator board is located in the slave electronics chassis and provides a regulated DC operating voltage to the record circuits. It also provides isolation of the record electronics from common slave power supply.

5.3 Transport System

5.3.1 General

The AS200-A Transport system is based on a DC servo-controlled transport motor drive system. The logic design uses all CMOS devices interfaced to control switching via opto-couplers for reliable operation. All gain stages employ high speed linear stages to further enhance system performance.

Both Master and Slaves are identical employing DC, permanent magnet type motors (except tape lifters are provided on the master). The transport system consists of four major functional sections:

1. Motor Drive Amplifier
2. Tension Sensor Board
3. Control Switch Assembly
4. Tape Cleaner Motor

5.3.2 Motor Drive Amplifier

The Motor Drive Amplifier (MDA) provides all analog motor drive power circuits dedicated to the supply, takeup and capstan motors. The board is attached to a large heat-sink, which is in turn, mounted to the deck beneath the transport. It receives its control inputs from the Servo board (Control Subsystem).

5.3.3 Tension Sensor Board

The Tension Sensor Board is part of the tape tension monitoring system which controls the Supply and Takeup drive systems. It consists of a tension arm assembly containing an LED and photosensor. The photosensor feeds a small PC board that amplifies a tension error signal, which is in turn applied to the servo system.

5.3.4 Control Switch Assembly

The Control Switch assembly is a membrane-type switch panel mounted flush on the transport. It provides local control of all logical transport functions including Forward, Rewind, and READY and STOP. Manual activation of these controls overrides any commands from the master. A CAPSTAN SYNC LED is also provided on the panel to indicate when the capstan servo system is locked to the system master clock.

5.3.5 Tape Cleaner Motor

The Tape Cleaner Drive system is basically the cleaner tape drive motor. A small low speed clock-type motor, it operates the takeup spindle for the tape cleaner fabric. It operates from 24 VDC provided by the power supply. The motor runs only during normal tape motion.

5.4 Control System

5.4.1 General

The Control System includes all transport control logic, master Auto-Cue functions, and fiber-optic communications system linking the master to the system slaves. Combining both master and slave control functions, 6 circuit boards are involved:

1. Master/Slave Clock
2. System Control Board
3. Servo Board
4. Auto-Cue/Rewind Board
5. Fiber-optic Control System
6. DC Voltage Regulator

5.4.2 Master/Slave Clock

The Master/Slave Clock board provides the master system timing signal for control of the capstan system in both Master and Slave transports. Mounted in the master electronics chassis, the board derives the clock signal from a crystal controlled 60 kHz reference oscillator. From the oscillator, the signal is fed to a series of cascaded binary counters where, depending on the Master and Slave Speed select switches, the final outputs are "gated through" at frequencies of 15 KHz @ 240 ips, 7.5 KHz @ 120 ips, and 3.75 KHz @ 60 ips.

The master clock buffered output supplies reference pulses only to the master transport control board. The slave clock buffered outputs are derived independently of the master clock output.

A VCO provides a second frequency source of approximately 20 KHz used to drive the master deck capstan in the high-speed rewind mode. The VCO frequency is ramped up to approximately 20 KHz in a controlled manner by charging a capacitor with a switched op-amp. This ramping assures a smooth capstan start and gentle tape handling when engaging the master transport. This ramp frequency gradually increases to an approximate tape speed of 480 ips.

5.4.3 System Control Board

The System Control Board is located in the master electronics chassis and provides Start/Stop control, equalization selection, and Auto-Cue Start/Stop control of all system slaves.

5.4.4 Servo Board

The Servo board combines contains four major functional sections:

1. Capstan Servo Section
2. Supply Servo Section
3. Take-up Servo Section
4. Control Logic

The Capstan Servo Section consists of a phase comparator which compares the capstan motor tachometer output to the system master clock signal. Any resultant error voltage is filtered and used to control the Motor Driver Amplifier board in the Transport section.

The Supply Servo section is functionally similar to the Capstan Servo section, except that the error voltage produced is derived from the output of the tension position sensor arm assembly (photo-potentiometer value). This error voltage, in turn, controls the supply motor amplifier to produce a motor drive current directly proportional to the error voltage (tension sensor position).

The Take-up Servo section is identical to the Supply Servo section, but dedicated to the take-up motor.

The Control Logic section interprets incoming Start/Stop commands, local transport push-button inputs, and changes the state of the capstan, supply and takeup servos to obtain the desired transport operation (forward, or rewind).

5.4.5 Auto-Cue/Rewind Board (Optional)

The Auto-Cue/Rewind board enables automatic cycling of the master tape, and control of the slave units from transparent "windows" at the beginning and end of the master tape. An external photo-detector in the tape path on the master transport allows the board to sense the window in the tape. When the master is in the MANUAL mode, a photo-detector signal causes the transport to stop. A SYSTEM START command starts the Auto-Cue operation.

The Auto-Cue board consists of two major functional sections: an Auto-Cue logic section, and an Event Counter section.

As mentioned previously, a trigger pulse is generated each time a window in the tape passes the photocell. The first pulse starts the slaves into Record. The second stops the slaves and puts the master transport into Rewind. The third pulse is ignored by the system except as a count-down pulse to the Event Counter section. The fourth pulse puts the master into Play (provided the mode switch is in the CONTINUOUS position). If the mode switch is in the 1 CYCLE position, the fourth pulse causes the master transport to Stop.

The Event Counter section is a two-digit BCD down-counter that receives its count pulse from the Auto-Cue logic. Each of the two readouts may be preset by front panel thumbwheel switches.

5.4.6 Fiber-Optic Control System

The Fiber-Optic Control System consists of a transmitter in the master, and a transceiver in the slaves. The Master optical transmitter provides clock pulse transmission to slaves, mode control, equalization selection, and start/stop commands multiplexed together on the fiber-optic system control bus. Each Slave optical transceiver unit de-multiplexes these signals to operate its respect slave unit.

Operation of the system is based on the master system clock pulse chain for the selected speed. Each clock pulse (on the fiber-optic system control bus) is approximately 3 uS in duration, with a repetition rate determined by the selected slave operating speed. Following the trailing edge of the first clock pulse are three additional 3 uS "slots" dedicated to the following control functions:

Slot #	Function
1	Start/Stop Command
2	Mono/Stereo Mode Select
3	Equalization (Hi or Low) Select

As each time slot occurs, the logical level (high or low) is sampled to determine the status of the dedicated function. This information is continuously repeated following every system clock pulse. Any change in command status therefore, is received and decoded in one clock cycle.

5.4.7 DC Voltage Regulator

The DC Voltage Regulator board is located in either the master or slave electronics chassis and provides a regulated DC operating voltage to the control circuits. It also provides isolation of the control electronics from common unit power supply.

APPENDICES

ACCURATE SOUND CORPORATION

3515 Edison Way, Menlo Park, CA 94025
(415) 365-2843 Telex: 34-8327

MANUFACTURING
PROFESSIONAL EQUIPMENT SALES AND SERVICE
STUDIO DESIGN
CONSULTING

Recommended spare parts stock to support a two master, twenty slave AS200A duplicator.

This list of spare parts is intended to support the above mentioned system. It assumes that common electronic parts are already available at the customers' location.

PART	Number required	Unit price	Total price
Power supply	1	$ 975.00	$ 975.00
Servo PCB	3	$ 997.00	$2991.00
Interface PCB	3	$ 35.00	$ 105.00
Tension sensor SUP	2	$ 435.00	$ 870.00
Tension sensor T/U	2	$ 435.00	$ 870.00
End of tape sensor	5	$ 29.50	$ 147.50
Regulate, slave	2	$ 253.00	$ 506.00
Regulate, logic	1	$ 230.00	$ 230.00
Regulate, signal	1	$ 245.00	$ 245.00
Bias osc PCB	2	$ 150.00	$ 300.00
Bias amp PCB	4	$ 300.00	$1200.00
Record PCB	4	$ 500.00	$2000.00
Reproduce PCB	1	$ 425.00	$ 425.00
VU meter PCB	1	$ 535.00	$ 535.00
System control PCB	1	$ 500.00	$ 500.00
M/S clock PCB	1	$ 450.00	$ 450.00
Auto-cue PCB	1	$ 995.00	$ 995.00
Pre-amp PCB	1	$ 400.00	$ 400.00
Optical TX assy	1	$ 315.00	$ 315.00
Optical TX/RX assy	2	$ 340.00	$ 680.00
Bearings	20	$ 11.00	$ 220.00
Capstan motor	2	$ 750.00	$1500.00
Supply reel motor	2	$ 195.00	$ 390.00
Take-up reel motor	2	$ 195.00	$ 390.00
Tape cleaner motor	1	$ 42.00	$ 42.00
Rotating guide assy	1	$ 130.00	$ 130.00
Head assy mono record	10	$1000.00	$10000.00
Head assy stereo "	10	$1100.00	$11000.00
Head assy mono/stereo	10	$1400.00	$14000.00
Head assy mono replay	1	$1800.00	$ 1800.00
Head assy stero "	1	$1900.00	$ 1900.00
Optical fiber 4' long	5	$ 15.00	$ 75.00
BNC cables 4' long	5	$ 17.00	$ 87.00
Cleaner tape	2 packs/48 rolls	$ 144.00	$ 288.00

We strongly recommend that the initial spares purchase include head assymblies.

The total price for this recommended spares package, including head assymblies, is $41761.50.

An alternate spares package would substitute head stacks for complete head assymblies for a reduction in cost.

Heads mono record	10	$ 295.00	$2950.00
Heads stereo "	10	$ 375.00	$3750.00
Head mono replay	1	$ 395.00	$ 395.00
Head stereo "	1	$ 490.00	$ 490.00

This would result in a total spares package cost of $24646.50.

ACCURATE SOUND CORPORATION

HEAD PRE-AMP
PARTS LIST

10-18-85

Loc#	Description	Quantity	Specifications
R3,6	Resistor	2	1k 1/4w 1%
R2,5	"	2	1.43k 1/4w 1%
R1,4	"	2	15k 1/4w 1%
C4,10	Capacitor	2	330pf
C5,11	"	2	.1uf Mono
C1,2,7,8	"	4	1uf 35v Tantalum
C3,9	"	2	3.3uf 35v Tantalum
C6,12	"	2	15uf 35v Tantalum
IC1,2	I.C.	2	AH0013MA (OEI)

ACCURATE SOUND CORPORATION

REPRODUCE BOARD
PARTS LIST

10-18-85

Loc#	Description	Quantity	Specifications
R2,3,4,5	Resistor	4	5.1 ohm 1/2w 5%
R7,9	"	2	10 ohm 1/4w 5%
R16	"	1	15 ohm 1/4w 5%
R13	"	1	100 ohm 1/4w 5%
R6,8	"	2	1.2k 1/4w 5%
R10	"	1	3k 1/4w 5%
R1,11,12, 19,30	"	5	10k 1/4w 5%
R14,15,17	"	3	100k 1/4w 5%
R18	"	1	220k 1/4w 5%
R20,21 23,25	Potentiometer	4	10k (89PR10K)
R22,24	"	2	1 meg (89PR1MEG) sub 2 meg
C9	Capacitors	1	.01uf
C3,4,5,6,7	"	5	.1uf
C1,2,15	"	3	2.2uf
C11	"	1	10uf
C8,10	"	2	22uf
C14	"	1	.001uf
C12,13	Mica Capacitor	2	1000pf
CR1,2	Diode	2	1N4148
Q6	Transistor	1	2N3904
Q5	"	1	2N3906
Q1,2	"	2	2N5320
Q3,4	"	2	2N5322
Q7	"	1	2N5460
Q9	"	1	2N5406
Q8,10	"	2	MPF-108
U1	I.C.	1	CA3100E
	I.C. Socket	1	8-Pin Augat 208-AG49D
	Transistor Heat Sink	4	Wakefield 207CB
	Transistor Pad	4	
	ADC Jack	1	PC934 (Black)

ACCURATE SOUND CORPORATION

AUDIO LEVEL METER (LED)
PARTS LIST

10-18-85

Loc#	Description	Quantity	Specifications
R1,5,6,9	Resistor	4	1k 1/4w 5%
R2,7	"	2	30k 1/4w 5%
R4,10,14,15 16,17,18,19 20,21	"	10	100k 1/4w 5%
R11,24	"	2	13k 1/4w 5%
R12,13,22,23	"	4	5.1k 1/4w 5%
C3,4,5,6,7,8,9 10,14,15,21 22,23,24,26	Capacitor	15	.01uf 100v
C11,13,16,17	"	4	.22uf 100v
C12,18,19,20	"	4	.47uf 100v
C1,2,25	"	3	2.2uf 35v
U3,4	I.C.	2	TL084CN
U1,2	"	2	LM741CN
U5,6,7,8	"	4	LM3915N
DS1,3	Display Bar Graph	2	HLMP-2620
DS2,4	"	2	MV53164
D5,7	Diode	2	1N751
D6,8	"	2	1N753A
D1,2,3,4	"	4	1N4148
R25,26	Potentiometer	2	10k
R3,8	"	2	100K
U5,6,7,8	I.C. Socket	4	18-pin
U3,4	"	2	14-pin
U1,2	"	2	8-pin
DS2,4	Right Angle Socket	2	20-pin
DS1,2	"	2	16-pin
DS4	Elevator Socket	1	20-pin
DS3	"	1	16-pin

ACCURATE SOUND CORPORATION

RECORD BOARD
(7.5 - 15 ips)
PARTS LIST

10-18-85

Loc#	Description	Quantity	Specifications
R7	Resistor	1	2.7k 1/4w 2%
R8	"	1	10k 1/4w 2%
R9	"	1	12K 1/4W 2%
R12,20	"	2	5.1k 1/4w 2%
R13,14	"	2	62k 1/4w 2%
R15	"	1	47k 1/4w 2%
R16,19,29	"	3	10 ohm 1/4w 2%
R21	"	1	1k 1/4w 2%
R22	"	1	7.87k 1/4w 2%
R23,26	"	2	1.2k 1/4w 2%
R24,25	"	2	20 ohm 1/4w 2%
R27,28	"	2	5.1 ohm 1/2w 5%
C1	Capacitor	1	820pf
C2	"	1	4.7uf 35v
C3,4	"	2	.01uf 100v
C5,6,11	"	3	56pf
C7,8	"	2	33pf
C9	"	1	.001uf
C10	"	1	6.8uf 35v
C12,13,16 17,19,21	"	6	.1uf
C14	"	1	10pf
C15	"	1	24pf
C20,22	"	2	2.2uf 35v
R1,2	Potentiometer	2	10k
R3,4	"	2	25k
R5,6	"	2	100k
R10,11	"	2	100k
R18	"	1	200 ohm
K1,2,3	Relay	3	RSD-12V (Aromat)
C23	Trimmer Capacitor	1	GZP 30100
L1,2	Choke	1	5.6Mhz
L3	"	1	22Uh
U1,2	I.C.	1	CA3100E
Q2	"	1	2N3906
Q1,3	"	2	2N3904
Q4	"	1	2N5320
Q5	"	1	2N5322
CR1	"	1	IN4003
FB1,2,3	Ferrite Beads	3	
	I.C. Socket	2	8-pin
	Transistor Pads	2	

ACCURATE SOUND CORPORATION

BIAS AMPLIFIER
PARTS LIST

10-18-85

Loc#	Description	Quantity	Specifications
R1	Potentiometer	1	10k
R2	Resistor	1	100k 1/4w 5%
R3	"	1	3k 1/4 5%
R4	"	1	100 ohm 1/4w 5%
C1,3	Capacitor	2	1uf 35v Tantalum
C2,7,8,9	"	4	.1uf 50v Mono
C4	"	1	220pf Mica
C6	"	1	91pf Mica
Q1,5	I.C.	2	2N3906
Q2	"	1	TIP-120
Q3	"	1	IRF-512
Q4	"	1	2N3904
U1	"	1	CD4069B
L1	Choke	1	22uh
T1	Transformer	1	
	I.C. Socket	1	14-pin
	Heatsink	1	
C5	Trimmer Capacitor		

ACCURATE SOUND CORPORATION

BIAS OSCILLATOR
PARTS LIST

10-18-85

Loc#	Description	Quantity	Specifications
R3,4,5	Resistor	3	51 ohm 1/4w 5%
R2	"	1	510 ohm 1/4w 5%
R1	"	1	1 meg 1/4w 5%
C3,4,5,6,8	Capacitor	5	.1uf 50v Mono
C9	"	1	2.2uf 35v Tantalum
Q1	I.C.	1	2N3904
U1,2,3,4	"	4	CD4069B
U5	"	1	TIL111
SW1	Switch	1	MTM106D-RA (Alco)
	I.C. Socket	1	14-pin
	"	1	6-pin
	Crystal	1	3.5Mhz

ACCURATE SOUND CORPORATION

REGULATOR BOARD
- SLAVE -
PARTS LIST

10-18-85

Description	Quantity	Specifications
Capacitor	2	2.2uf 25v Tantalum
"	2	2.2uf 35v "
Voltage Regulator	1	LM320K-15
"	1	LM240K-15
Diode	1	IN4005
Relay	1	R10-E2-W2-V700-24VDC (AMF)

ACCURATE SOUND CORPORATION

SYSTEM CONTROL BOARD
PARTS LIST

10-18-85

Loc#	Description	Quantity	Specifications
R2,3	Resistor	2	560 ohm 1/4w 5%
R10,11,20,21	"	4	1K ohm 1/4w 5%
R9,18,19,23,26	"	5	3.3K 1/4w 5%
R15	"	1	22K 1/4w 5%
R1,4,5,6,7,8,12, 13,14,16,17,22,25	"	13	100K 1/4w 5%
R24	"	1	220K 1/4w 5%
C5,12,14	Capacitors	3	100pf 500V
C1,2,4,8,9,15, 16,17,18	"	9	.01uf 100V
C3,6,7,10,11	"	5	.1uf 50V
C13,19,20	"	3	2.2uf 25V
DS1,2	LED	2	RED LED
CR1	IC	1	1N4001
U3,4,5,8,9	"	5	DS3632N
U12,13	"	2	CD4001B
U2,14	"	2	CD4011B
U10	"	1	CD4013B
U15	"	1	CD4023B
U6,7	"	2	CD4071BE
U1,11	"	2	CD14538B
U16	"	1	CD40106B/74C14N
	IC Socket	5	8pin
	"	9	14pin
	"	2	16pin
S1,2	Switches	2	MPS-103F-RA Alco
S3,4	"	2	MTM106D-RA Alco

ACCURATE SOUND CORPORATION

AUTO CUE COUNTER
PARTS LIST

10-18-85

Loc#	Description	Quantity	Specifications
R1	Resistor	1	110k 1/4w 5%
R2,10,13	"	3	100k 1/4w 5%
R3,4,5,9	"	4	10k 1/4w 5%
R6	"	1	51k 1/4w 5%
R7,8	"	2	6.2k 1/4w 5%
R11	"	1	20k 1/4w 5%
R12,14	"	2	39k 1/4w 5%
R15,16,17	"	3	10k 1/4w 5%
R18	"	1	200k 1/4w 5%
RP1,2	Resisotor Pack	2	14-pin DIP
RP3	"	1	10-pin DIP
C1	Capacitor	1	10uf 35v
C2,3,4,5	"	4	.1uf 50v
C6,9,10,11	"	4	.1uf 50v
C7,8	"	2	.0022uf 100v
U1	I.C.	1	LM339N
U2,11	"	2	74C32N
U3,12,13	"	3	74C04N
U4	"	1	74C221N
U5	"	1	74C160N
U6	"	1	74C42N
U7,8	"	2	74C192N
U9,10	"	2	74C48N
CR1,2,3,4	Diodes	4	1N4148
DS1,2	Display Segment	2	5082-7613 H.P.
S1	Switch DPDT	1	TT21PG-RA-1 (Alco)
U1,2,3	I.C. Socket	3	14-pin
U11,12,13	"	3	14-pin
U4,5,6,7	"	4	16-pin
U8,9,10	"	3	16-pin

ACCURATE SOUND CORPORATION

FIBER OPTIC TRANSCEIVER
PARTS LIST

10-18-85

Loc#	Description	Quantity	Specifications
R2	Resistor	1	470k 1/4w 2%
R3,15	Potentiometer	2	50k
R4,10	Resistor	2	8.2k 1/4w 2%
R5	Potentiometer	1	25k
R6,7	Resistor	2	1k 1/4w 2%
R8,9	"	2	270 ohm 1/4w 2%
R11	"	1	470 ohm 1/4w 2%
R12	"	1	100k 1/4w 2%
R13	"	1	110 ohm 1/4w 2%
R16	Potentiometer	1	100k
R17	Resistor	1	39k 1/4w 2%
C1,2,3,5,7,9 11,12,13,15 16,17,18,20	Capacitor	1	.01uf
C14	"	1	1000pf
C4,21,22	"	3	100pf
C6,8,10	"	3	2.2uf 35v
C19	"	1	6.8uf 35v
U5,2,7	I.C.	3	40107BE
U1,4,9	"	3	4098B
U10,11	"	2	TIL111
U8	"	1	4093B
U3,6	"	2	4013B
Q1,2	Transistor	2	2N3904
VR1	Voltage Regulator	1	MC7808CT
VR2	"	1	MC7808CT
OPT1	Optical Receive	1	HFBR2501
OPT2	Optical Transmit	1	HFBR1501
	I.C. Socket	1	6-pin
	"	1	8-pin
	"	1	14-pin
	"	1	16-pin
	D-Connector	1	DP25P

ACCURATE SOUND CORPORATION

OPTICAL ISOLATOR BOARD
PARTS LIST

10-18-85

Loc#	Description	Quantity	Specifications
R1	Resistor	1	180 ohm 1/4w 5%
Q1,2	I.C.	2	2N3904
U1,2	"	2	TIL111
D1,2,3,4	"	4	IN4002
	6-pin Connector	1	09-72-1061 (Molex)

ACCURATE SOUND CORPORATION

SERVO BOARD
PARTS LIST

10-18-85

Loc#	Description	Quantity	Specifications
R110,111,108 109	Resistor	4	27 ohm 1/4w 5%
R99,100	"	2	100 ohm 1/4w 5%
R37,88	"	2	1k 1/4w 5%
R93,94	"	2	1k 1/4w 2%
R15,56,57	"	3	2k 1/4w 5%
R12	"	1	2.4k 1/4w 5%
R20,104	"	2	4.3k 1/4w 5%
R14,38,55,58	"	4	4.7k 1/4w 5%
R35	"	1	5.1k 1/4w 5%
R86,102	"	2	5.1k 1/4w 2%
R29	"	1	6.8k 1/4w 5%
R9,10,11,19 27,41	"	5	8.2k 1/4w 5%
R85,101	"	2	8.2k 1/4w 2%
R18,23,25,26 61,62	"	5	10k 1/4w 5%
R63,89	"	2	10k 1/4w 2%
R66,82	"	2	20k 1/4w 2%
R21	"	1	22k 1/4w 5%
R68,79	"	2	22k 1/4w 2%
R87,92	"	2	24k 1/4w 2%
R97	"	1	30k 1/4w 2%
R13	"	1	51k 1/4w 5%
R32	"	1	68k 1/4w 2%
R31,33,34,36,45 46,47,48,51,59 60,64,65,75,83 84,90,91	"	18	100k 1/4w 1%
R54	"	1	120k 1/4w 5%
R40,42,43,44 52,53	"	6	200k 1/4w 2%
R16,69,103	"	3	220k 1/4w 2%
R30,72,76	"	3	270k 1/4w 5%
R80	"	1	300k 1/4w 2%
R71,77	"	2	430k 1/4w 5%
R39	"	1	430k 1/4w 2%
R49	"	1	470k 1/4w 2%
R67,81	"	2	910k 1/4w 2%
R50,70,73,74 78	"	5	1meg 1/42 2%
R95,96	"	2	300 ohm 1/2w 5%
R4,5,6,7,8	"	5	820 ohm 1/2w 5%
C17	Capacitor	1	22pf 500v 5%
C34,35	"	2	100pf 500v 5%

Loc#	Description	Quantity	Specifications
C31	Capacitor	1	470pf 500v 5%
C25,32	"	2	910pf 500v 5%
C22	"	1	1000pf 500v 5%
C28	"	1	.0022uf 100v 10%
C47	"	1	.0047uf 100v 10%
C49	"	1	.0068uf 100v 10%
C1,2,3,6,7 10,16,18,20 36,44,57,71	"	13	.01uf 100v 20%
C23	"	1	.033uf 100v 10%
C52	"	1	.068uf 100v 10%
C4,5,9,11,12 14,21,24,26 27,29,33,38 40,42,46,48 51,53,54,56 59	"	22	.1uf 50v 20%
C30	"	1	.1uf 100v 10%
C8,19,39,43	"	4	1uf 35v 10%
C37,41	"	2	2.2uf 35v 20%
C13	"	1	4.7uf 16v 20%
CR1,2,3	I.C.	3	1N4001
CR4,5,6,7,8 9,10,11,12 13,14,15,16 17	"	14	IN4148
Q1	"	1	TIP-115
Q2,3,4,8	"	4	2N3904
Q5,9	"	2	2N3906
Q7	"	1	MPS-A06
Q6	"	1	MPS-A56
REG1	Voltage Regulator	1	7808C
REG2	"	1	7805C
REG3	"	1	79MO8C
U7,12	I.C.	2	CD4001B
U8,19,20	"	3	CD4011B
U9,10,16	"	3	CD4013B
U6	"	1	CD4023B
U2	"	1	CD4049UB
U13	"	1	CD4070B
U18	"	1	CD40106B
U1,2,4,5,17 27	"	6	DS3632
U15	"	1	MC14538B
U23,25	"	2	DG201A
U11	"	1	LM339
U21,22,24,26	"	4	TL084CN
U14	"	1	74C95N
U28	"	1	MC14490
	I.C. Socket	6	8-pin
	"	17	14-pin
	"	5	16-pin
J7	Connector	1	3428-2202 (3M)

Loc#	Description	Quantity	Specifications
	4-pin Connector	6	09-72-1041 (Molex)
	6-pin "	2	09-72-1061 (Molex)
	8-pin "	1	09-72-1081 (Molex)
	10-pin "	1	09-72-1101 (Molex)
	12-pin "	2	09-72-1121 (Molex)
VR1,3,4	Potentiometer	3	10k
VR2	"	1	100k

ACCURATE SOUND CORPORATION

MOTOR DRIVE AMPLIFIER
PARTS LIST

10-18-85

Loc#	Description	Quantity	Specifications
R1,3	Resistor	2	5.1k 1/4w 5%
R4	"	1	2.5 ohm 5w 3%
R2,5	"	2	.25 ohm 2w 10%
R7,8	"	2	.10 ohm 5w 10%
C1,3	Capacitor	2	2.2uf 35v
C2	"	1	.1uf 50v
Q1,2,7	Transistor	3	2N5057
Q3,5	"	2	2N3904
Q4,6	"	2	MPS-A20
Q8	"	1	2N6050
CR1	Diode	1	1N4001
K1,2	Relay	2	
K1,2	Relay Socket	2	
J12,13	18-pin Male	2	Molex
Q1,2,7,8	Transistor Socket	4	
	Heat Sink		

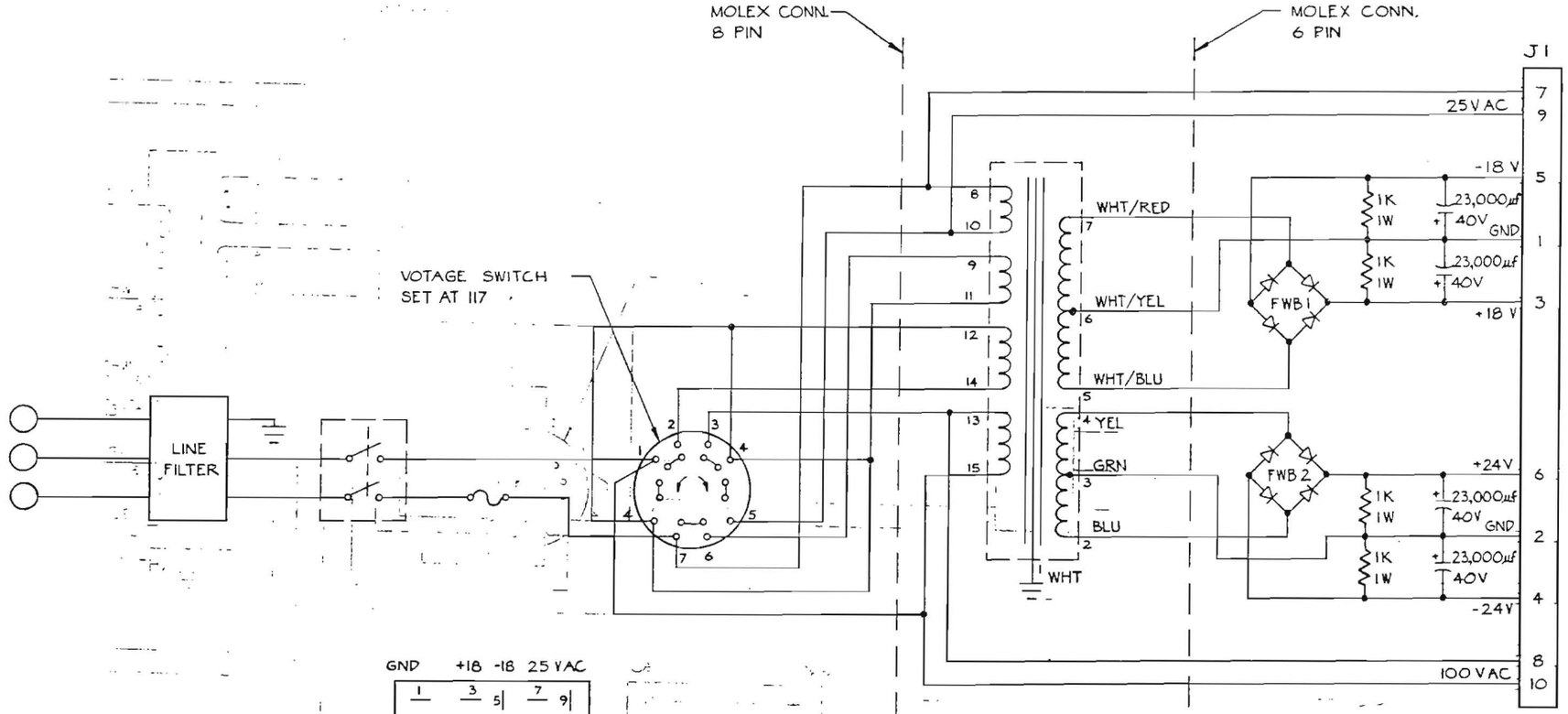
ACCURATE SOUND CORPORATION

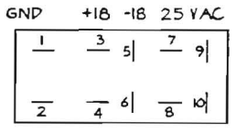
FIBER OPTIC TRANSMITTER
PARTS LIST

10-18-85

Loc#	Description	Quantity	Specifications
R2,5	Resistor	2	560 ohm 1/4w 5%
R10,14,16,18	"	4	5.1k 1/4w 1%
R13,20	"	2	47k 1/4w 2%
R1	"	1	270 ohm 1/4w 5%
R19	"	1	110 ohm 1/2w 2%
R6,9	"	2	1k 1/2w 2%
R11,12,15,17	Potentiometer	4	50k
C1,4,12	Capacitor	3	.1uf
C14,15,16,18	"	4	100pf
C2,3	"	2	2.2uf 25v Tantalum
C13,17	"	2	.01uf
U7,9,12	I.C.	3	4098B
U1,4	"	2	TIL111
U11	"	1	40107BE
U6	"	1	4093B
U5	"	1	4077B
U8	"	1	4027B
REG1	Voltage Regulator	1	7805
CR1	Diode	1	IN4148
OPT1	Optical Transmitter	1	HFBR1501
	D-Connector	1	DB25P
	I.C. Socket	4	6-pin
	"	1	8-pin
	"	3	14-pin
	"	4	16-pin

REVISIONS			
LTR	DESCRIPTION	DATE	APPROVED

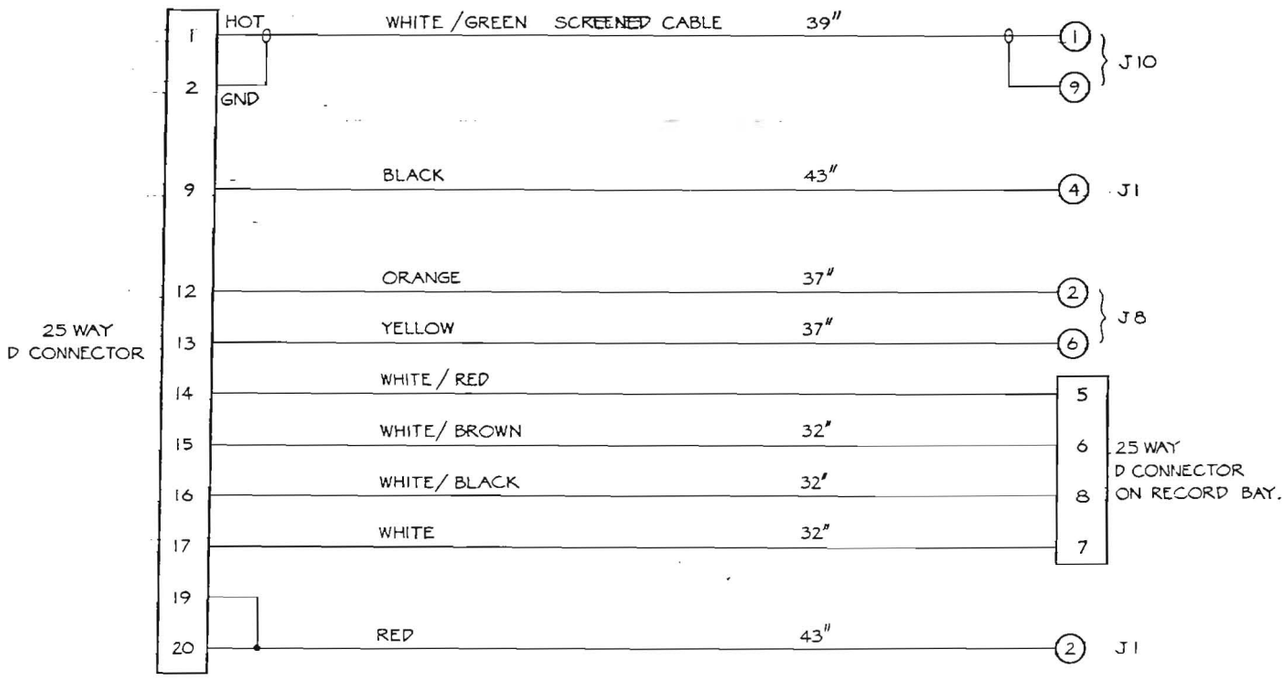




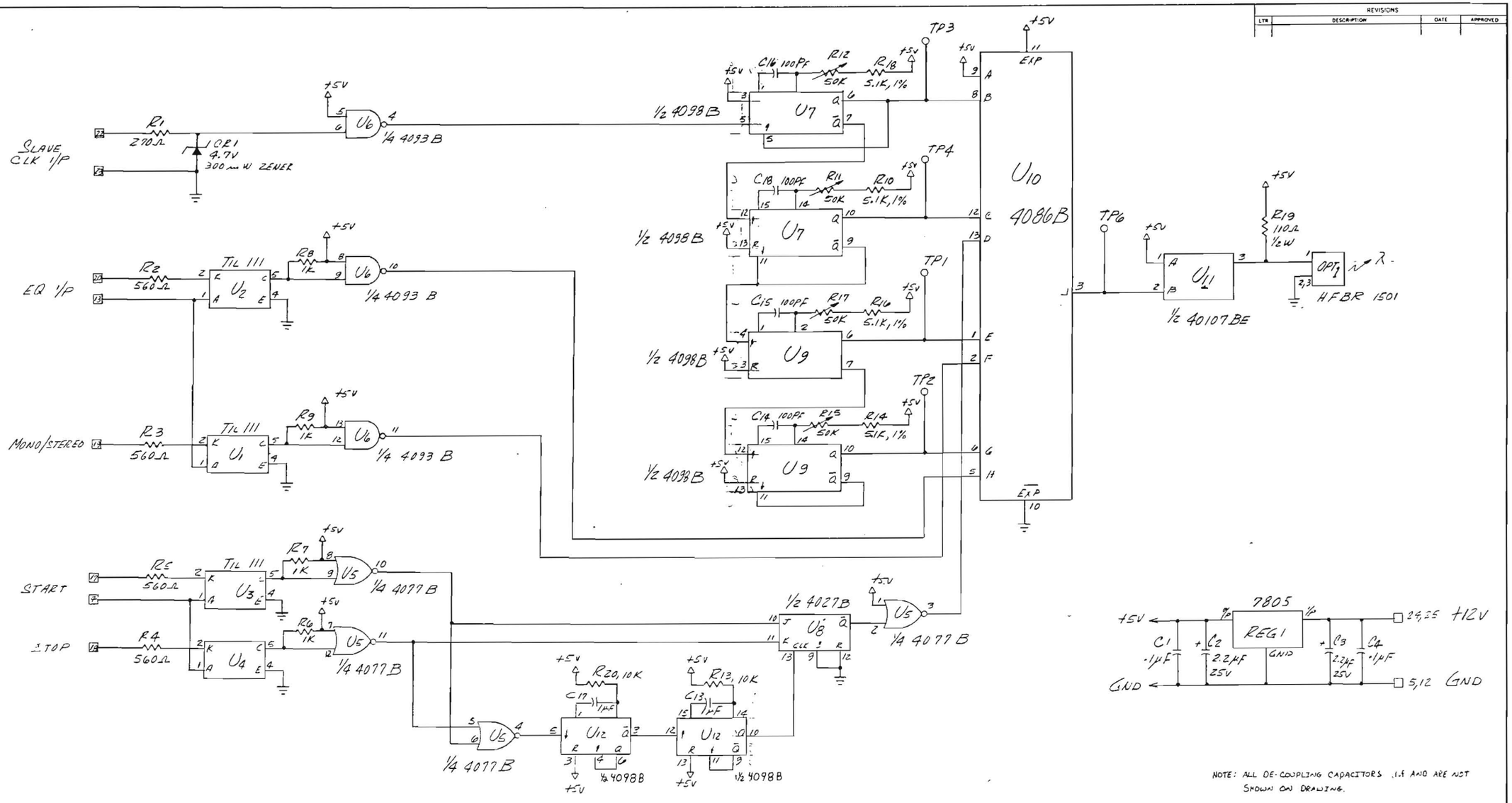
VIEW FROM OUTSIDE (FEMALE)
10PIN PSU PLUG
SCALE : NONE

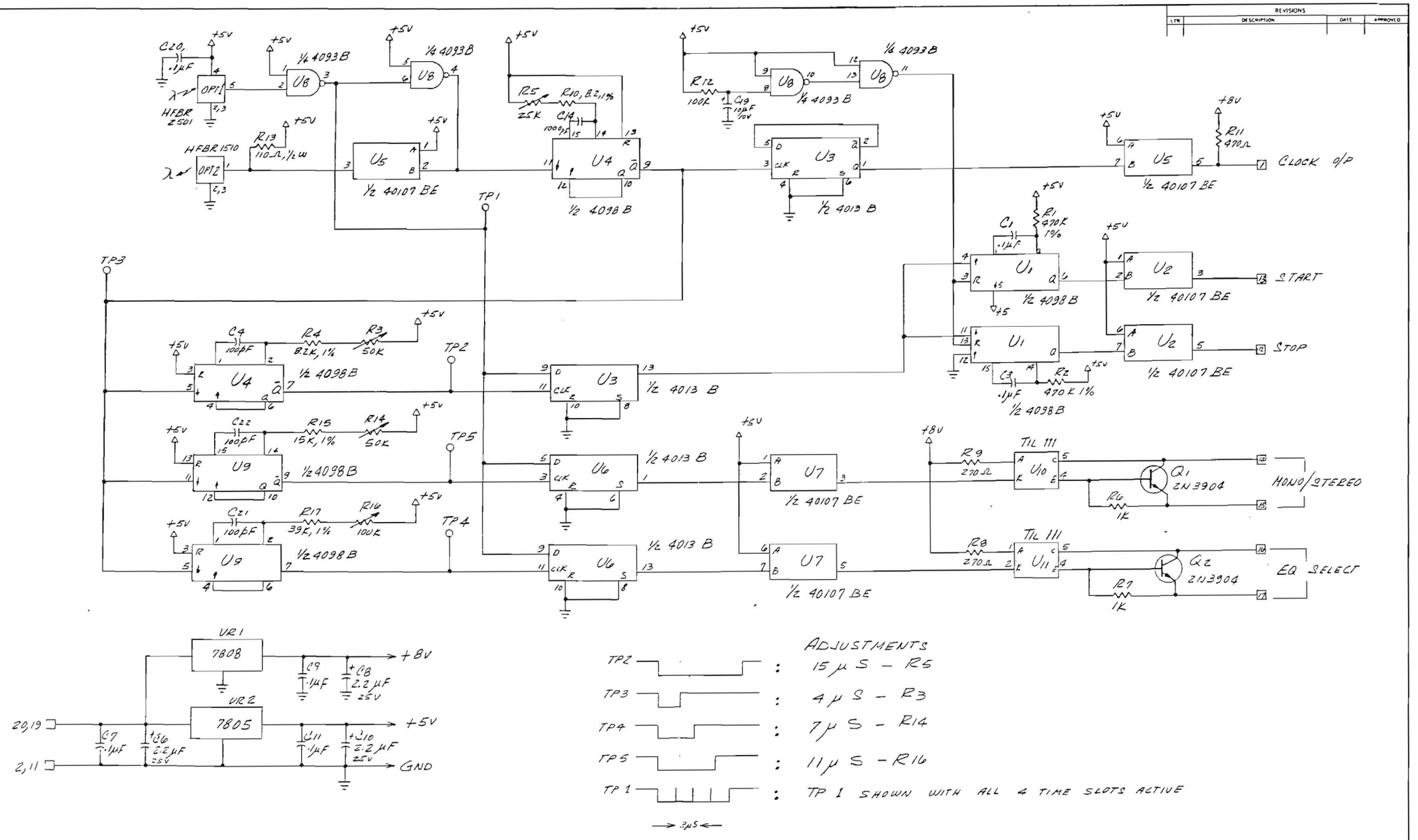
TOLERANCES UNLESS OTHERWISE SPECIFIED FRACTIONS DEC ANGLES ± ± ±		ACCURATE SOUND CORP. MENLO PARK, CA. 94025	
APPROVALS	DATE	POWER SUPPLY SCHEM.	
DRAWN	10/17/85		
CHECKED		SCALE	SIZE C DRAWING NO.
		DO NOT SCALE DRAWING	SHEET

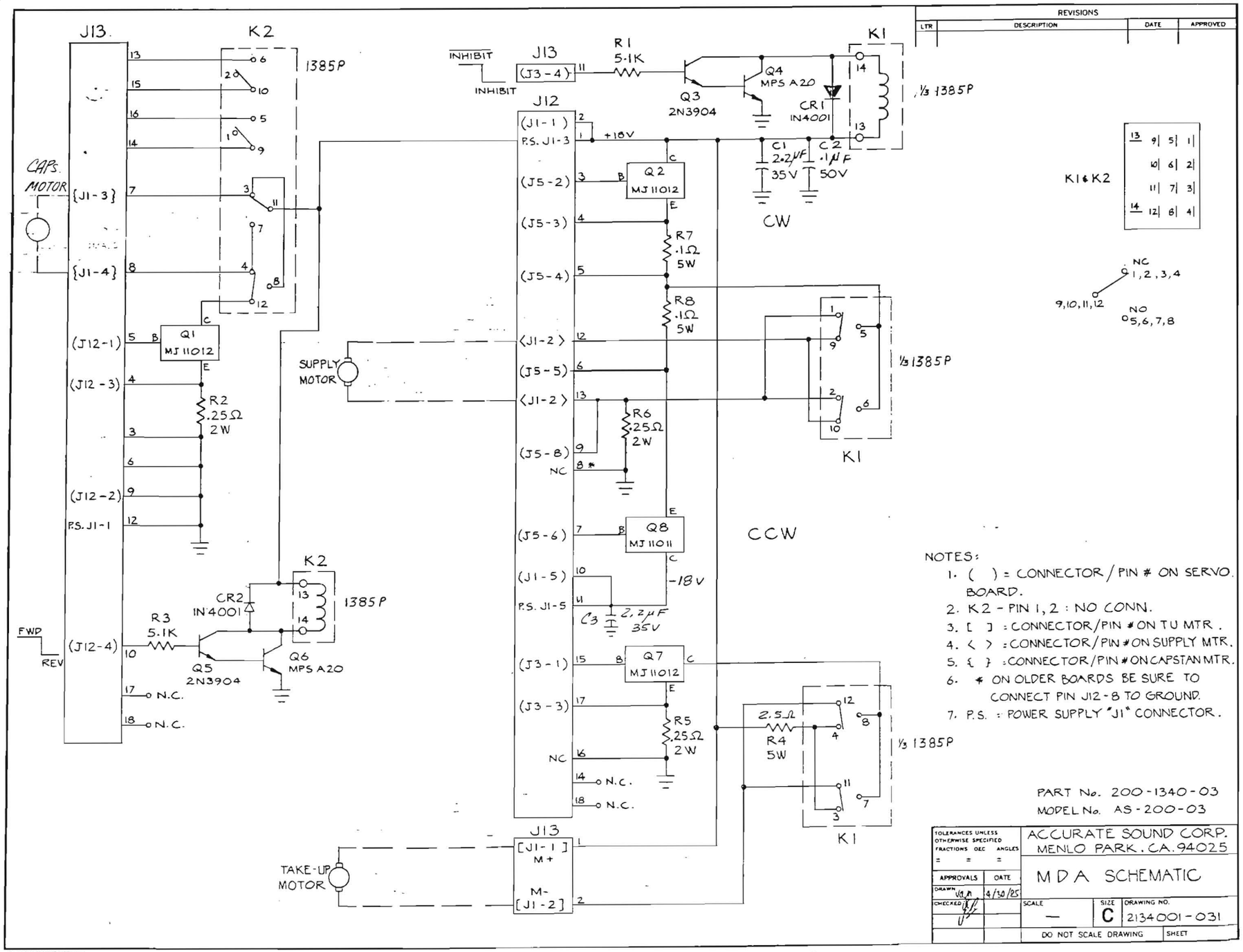
REVISIONS			
LTR	DESCRIPTION	DATE	APPROVED



TOLERANCES UNLESS OTHERWISE SPECIFIED FRACTIONS DEC ANGLES ± ± ±		ACCURATE SOUND CORP. MENLO PARK, CA. 94025
APPROVALS	DATE	FIBER OPTIC CONTROL
DRAWN Vg Hall	6.16.85	
CHK [illegible]	5/17/85	SCALE / SIZE C / DRAWING NO
		DO NOT SCALE DRAWING / SHEET


REVISIONS
LTR DESCRIPTION DATE APPROVED
SLAVE CLK I/P
R1 270Ω
1 OR1 4.7V 300mW ZENER
+5V
U6 1/4 4093B
1/2 4098B
U7
C16 100PF
R12 50K
R18 5.1K, 1%
TP3
U10 4086B
EXP
EXP
EQ I/P
R2 560Ω
TIL 111
U2
R8 1K
U6 1/4 4093B
C18 100PF
R11 50K
R10 5.1K, 1%
TP4
MONO/STEREO
R3 560Ω
TIL 111
U1
R9 1K
U6 1/4 4093B
C15 100PF
R17 50K
R16 5.1K, 1%
TP1
1/2 4098B
U9
START
RE 560Ω
TIL 111
U3
R7 1K
U5 1/4 4077B
C14 100PF
R15 50K
R14 51K, 1%
TP2
1/2 4098B
U9
STOP
R4 560Ω
U4
R6 1K
U5 1/4 4077B
1/2 4027B
U8
U5 1/4 4077B
R20, 10K
C17 1μF
R13, 10K
C13 1μF
U5 1/4 4077B
U12
1/2 4098B
U12
1/2 4098B
TP6
U11
1/2 40107BE
R19 110Ω 1/2W
OPTO
HFBR 1501
7805
REG1
GND
C1 .1μF
C2 2.2μF 25V
C3 2.2μF 25V
C4 .1μF
+5V
GND
24,25 +12V
5,12 GND
NOTE: ALL DE-COUPLING CAPACITORS .1μF AND ARE NOT SHOWN ON DRAWING.
TOLERANCES UNLESS OTHERWISE SPECIFIED
FRACTIONS DEC ANGLES
APPROVALS DATE
DRAWN AJ
CHECKED
ACCURATE SOUND
OPTICAL REMOTE CONTROL TRANSMIT
SIZE D
DRAWING NO
SCALE
DO NOT SCALE DRAWING
SHEET


REVISIONS
LTR DESCRIPTION DATE APPROVED
C20, .1µF
OPT1
HFBR 2501
HFBR 1510
OPT2
R13 110Ω, ½ W
+5V
¼ 4093B
U8
U5
½ 40107 BE
R25 25K
R10, 8.2, 1%
C14 100pF
U4
½ 4098 B
R12 100K
C19 10µF 10V
U3
½ 4013 B
R11 470Ω
+8V
CLOCK o/p
TP1
TP3
TP2
TP5
TP4
C1 .1µF
R1 470K 1%
U1
½ 4098 B
U2
START
STOP
C3 .1µF
R2 470K 1%
C4 100pF
R4 8.2K, 1%
R3 50K
C22 100pF
R15 15K, 1%
R14 50K
U9
C21 100pF
R17 39K, 1%
R16 100K
U6
U7
TIL 111
U10
U11
R9 270Ω
R8 270Ω
Q1 2N3904
Q2 2N3904
R6 1K
R7 1K
HOND/STEREO
EQ SELECT
VR1 7808
VR2 7805
20,19
2,11
C7 .1µF
C8 2.2µF 25V
C9 .1µF
C10 2.2µF 25V
C11 .1µF
C12 2.2µF 25V
GND
ADJUSTMENTS
TP2 : 15µS - R5
TP3 : 4µS - R3
TP4 : 7µS - R14
TP5 : 11µS - R16
TP1 : TP 1 SHOWN WITH ALL 4 TIME SLOTS ACTIVE
3µS
LAST DESIG USED
R17
Q2
U11
U22
VR2
OPT2
ACCURATE SOUND
OPTICAL REMOTE CONTROL TRANCEIVE
APPROVALS DATE
5/15/92
SCALE
D
DO NOT SCALE DRAWING
SHEET



REVISIONS			
LTR	DESCRIPTION	DATE	APPROVED

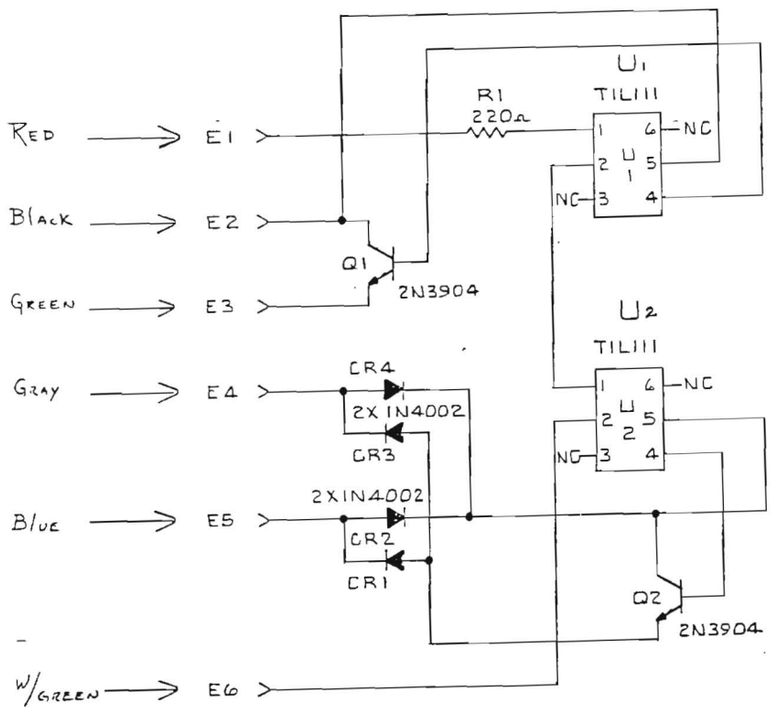
NOTES:

1. ( ) = CONNECTOR / PIN # ON SERVO BOARD.
2. K2 - PIN 1, 2 : NO CONN.
3. [ ] : CONNECTOR/PIN # ON TU MTR.
4. < > : CONNECTOR/PIN # ON SUPPLY MTR.
5. { } : CONNECTOR/PIN # ON CAPSTAN MTR.
6. * ON OLDER BOARDS BE SURE TO CONNECT PIN J12-8 TO GROUND.
7. P.S. : POWER SUPPLY "J1" CONNECTOR.

PART No. 200-1340-03
MODEL No. AS-200-03

TOLERANCES UNLESS OTHERWISE SPECIFIED FRACTIONS DEC ANGLES = = =	ACCURATE SOUND CORP. MENLO PARK, CA. 94025	
APPROVALS / DATE	MDA SCHEMATIC	
DRAWN VAN 4/30/25		
CHECKED	SCALE —	SIZE C / DRAWING NO. 2134001-031
	DO NOT SCALE DRAWING	SHEET

REVISIONS			
LTR	DESCRIPTION	DATE	APPROVED



TOLERANCES UNLESS OTHERWISE SPECIFIED		
FRACTIONS	DEC	ANGLES
±	±	±

APPROVALS	DATE
DRAWN R.C.	9-20-85
CHECKED	11/19/86

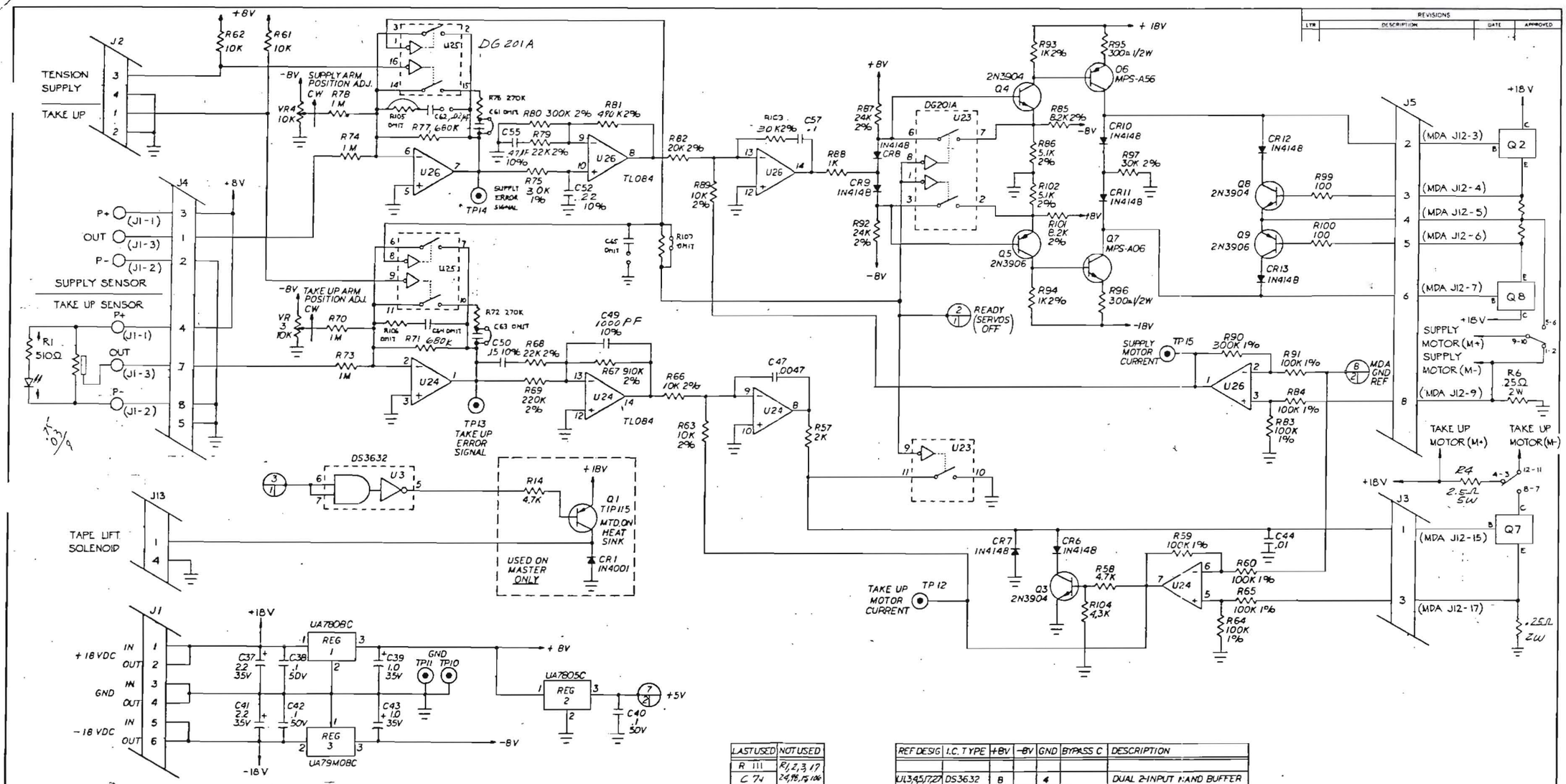
ACCURATE SOUND CORP

SCHEMATIC

AS200 INTERFACE BD.

SCALE | SIZE C | DRAWING NO. 200526000D41

DO NOT SCALE DRAWING | SHEET 1 OF 1



LAST USED	NOT USED
R 111	R1,2,3,17
C 74	24,98,75,106
U 28	C45,58,
CR 17	60,64-71
J 13	
VR 4	
REG 3	
Q 9	
JMP 2	JMP 1
TP 17	

REF DESIG	I.C. TYPE	+8V	-8V	GND	BYPASS C	DESCRIPTION
U13,45,17,27	DS3632	8		4		DUAL 2-INPUT NAND BUFFER
U2	CD4049UB	1		8	.01	HEX INVERTING BUFFER
U6	CD4023B	14		7		TRIPLE 3 INPUT NAND
U7,12	CD4001B	14		7		QUAD 2 INPUT NOR
U8,19,20	CD4011B	14		7		QUAD 2 INPUT NAND
U9,10,16	CD4013B	14		7	.01	DUAL D-TYPE FLIP-FLOP
U11	LM339	3		12	.1	QUAD COMPARATOR
U13	CD4070B	14		7		QUAD EXCLUSIVE OR
U14	74C95N	4		11	.01	4 BIT L/R SHIFT REGISTER
U15	MC14538B	16		8	.01	DUAL MONOMULTIVIBRATOR
U18	CD4010B	14		7		HEX SCHMITT TRIGGER
U21,22,24,26	TL084CN	4	11		.1EA RAIL	QUAD OP-AMP
U23,25	DG201A	13	4	5	.1EA RAIL	QUAD ANALOG SWITCH

NOTE: All DE-COUPLING CAPACITORS .1uf AND ARE NOT SHOWN ON DRAWING.

REVISIONS			
LTR	DESCRIPTION	DATE	APPROVED

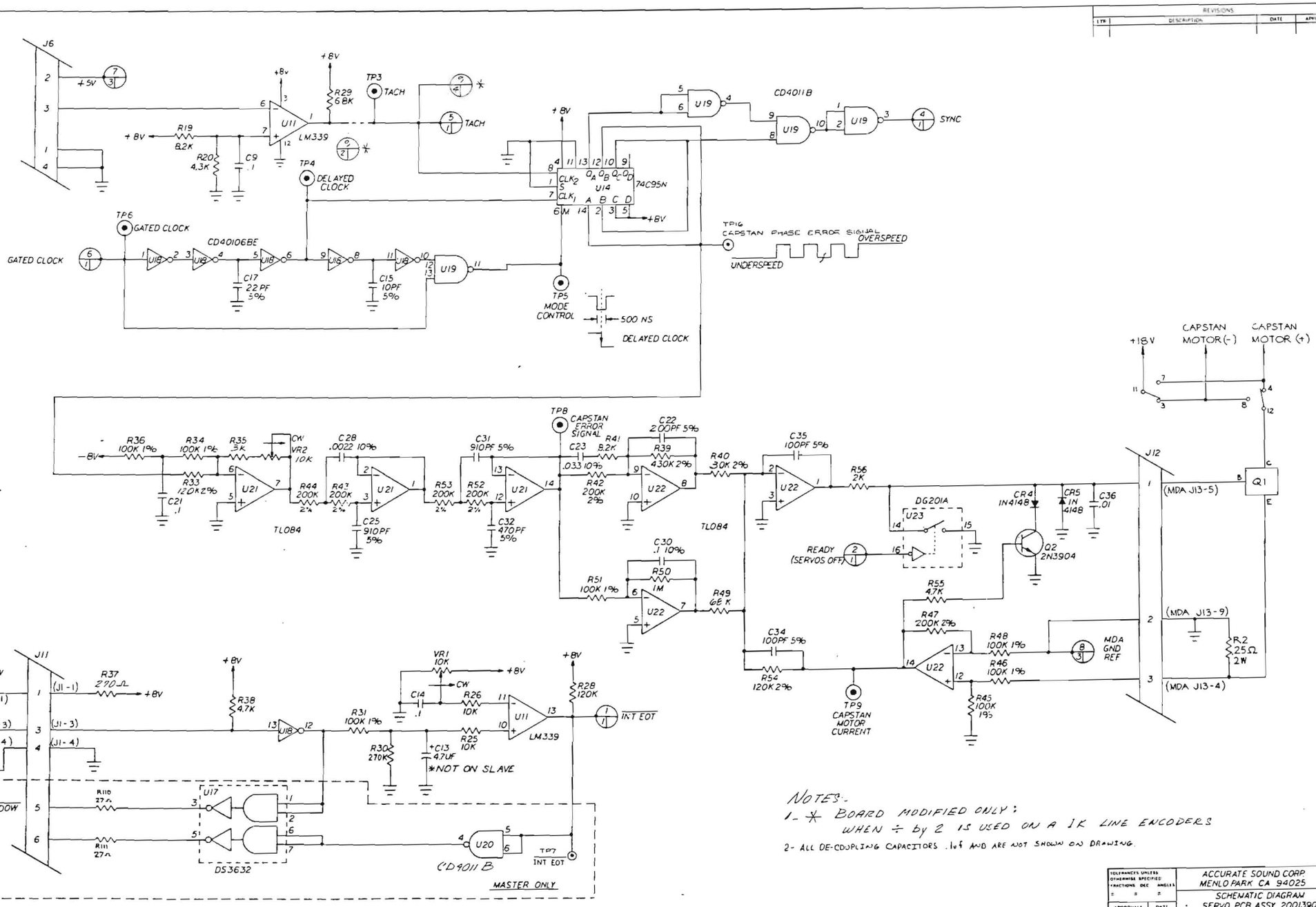
TOLERANCES UNLESS OTHERWISE SPECIFIED
FRACTIONS DEC ANGLES
APPROVALS DATE
DRAWN NJC 6-5-84
CHECKED

ACCURATE SOUND CORP.
MENLO PARK, CA. 94025

SCHEMATIC DIAGRAM
SERVO PCB ASSY 2001390-01
TAKE UP AND SUPPLY REEL

SCALE - SIZE D DRAWING NO 2139001-013-04

DO NOT SCALE DRAWING SHEET 3 OF 3

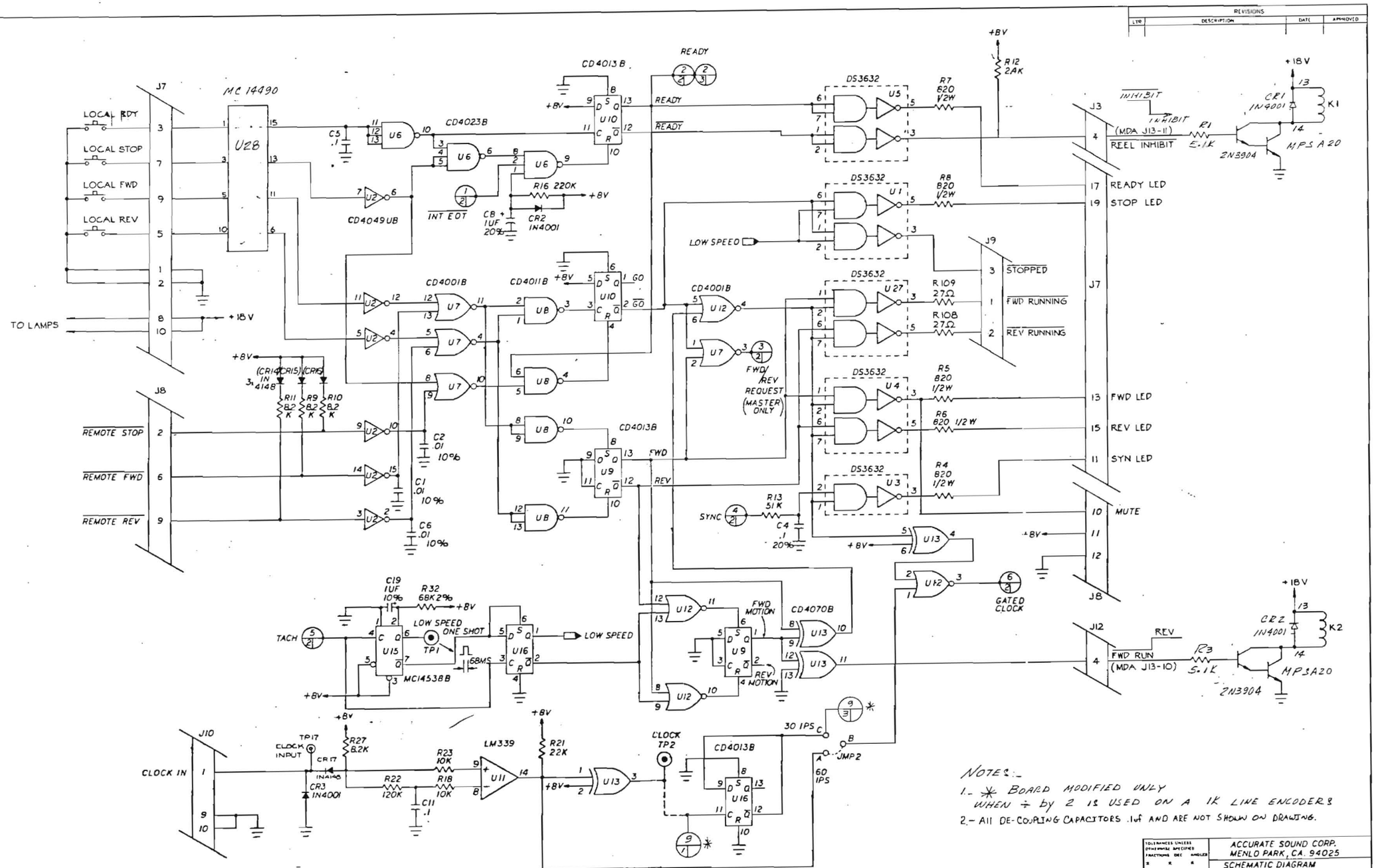


NOTES:-

1- ✳ BOARD MODIFIED ONLY:
WHEN ÷ by 2 IS USED ON A 1K LINE ENCODERS

2- ALL DE-COUPLING CAPACITORS .1uF AND ARE NOT SHOWN ON DRAWING.

TOLERANCES UNLESS OTHERWISE SPECIFIED FRACTIONS DEC ANGLES ± ± ±	ACCURATE SOUND CORP MENLO PARK CA 94025	
APPROVALS DATE	SCHEMATIC DIAGRAM · SERVO PCB ASSY 2001390-01 CAPSTAN SERVO AND TAPE SENSE	
DRAWN NIC 6-5-84	SCALE	SIZE D DRAWING NO 2139001-013 04
CHECKED	DO NOT SCALE DRAWING	SHEET 2 OF 3



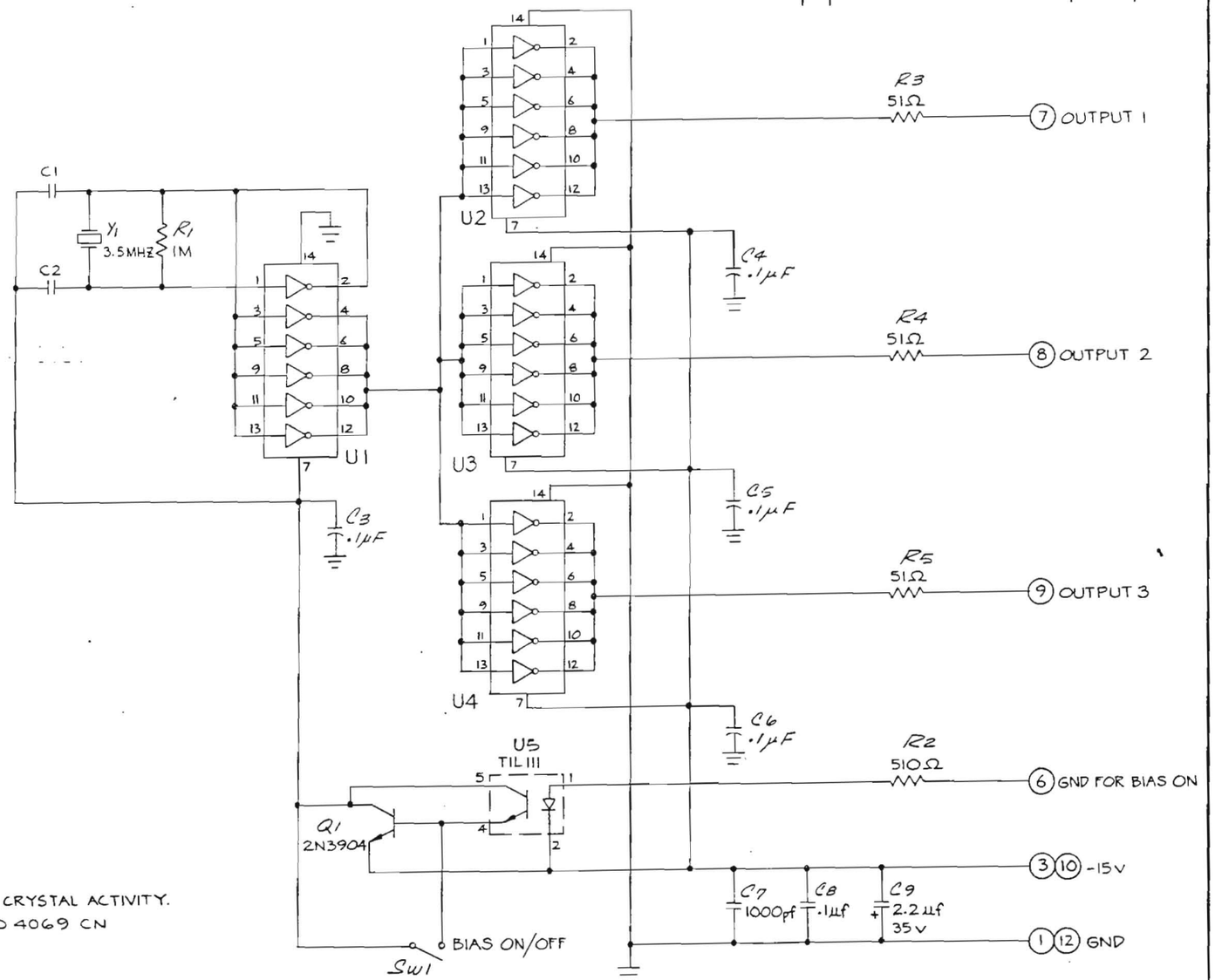
NOTES:-

1.- * BOARD MODIFIED ONLY WHEN ÷ by 2 IS USED ON A 1K LINE ENCODER.

2.- ALL DE-COUPLING CAPACITORS .1uf AND ARE NOT SHOWN ON DRAWING.

TOLERANCES UNLESS OTHERWISE SPECIFIED FRACTIONS DEC ANGLES X .X ±	ACCURATE SOUND CORP. MENLO PARK, CA. 94025
APPROVALS DATE	SCHEMATIC DIAGRAM SERVO PCB ASSY 2001390-01 TRANSPORT CONTROL LOGIC
DRAWN NJC 6-5-84	
CHECKED	SCALE — SIZE D — DRAWING NO 2139001-013-04
DO NOT SCALE DRAWING	SHEET 1 OF 3

REVISIONS			
LTR	DESCRIPTION	DATE	APPROVED



NOTES:

1. USE OF C1 & C2 DEPEND ON CRYSTAL ACTIVITY.
2. U1, U2, U3, U4 ARE CD 4069 CN

TOLERANCES UNLESS OTHERWISE SPECIFIED		
FRACTIONS	DEC	ANGLES
±	±	±

APPROVALS	DATE
DRAWN VKM	8/23/85
CHECKED	5/17/86

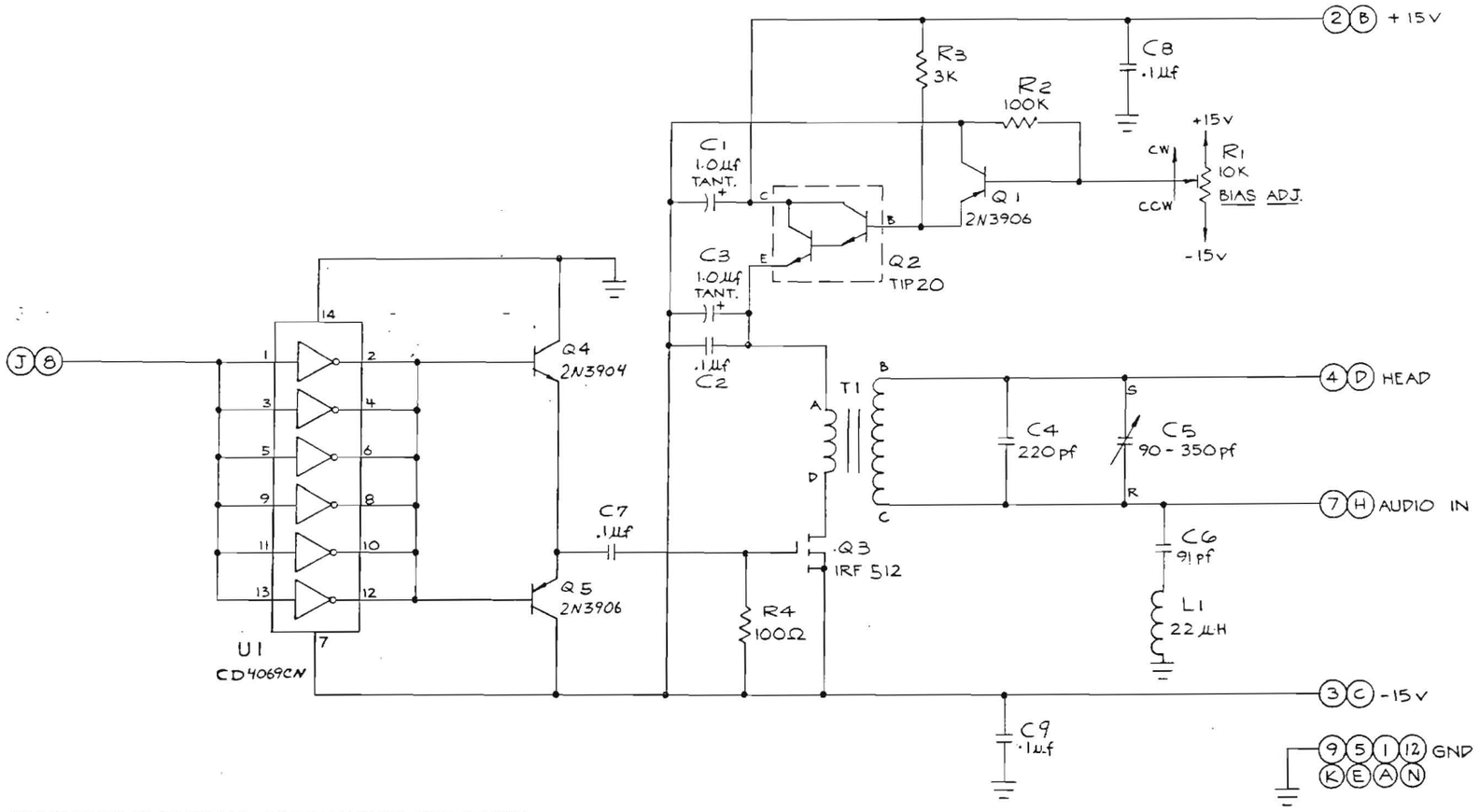
ACCURATE SOUND CORP.
MENLO PARK, CA.

BIAS OSCILLATOR

SCALE | SIZE C | DRAWING NO.

DO NOT SCALE DRAWING | SHEET

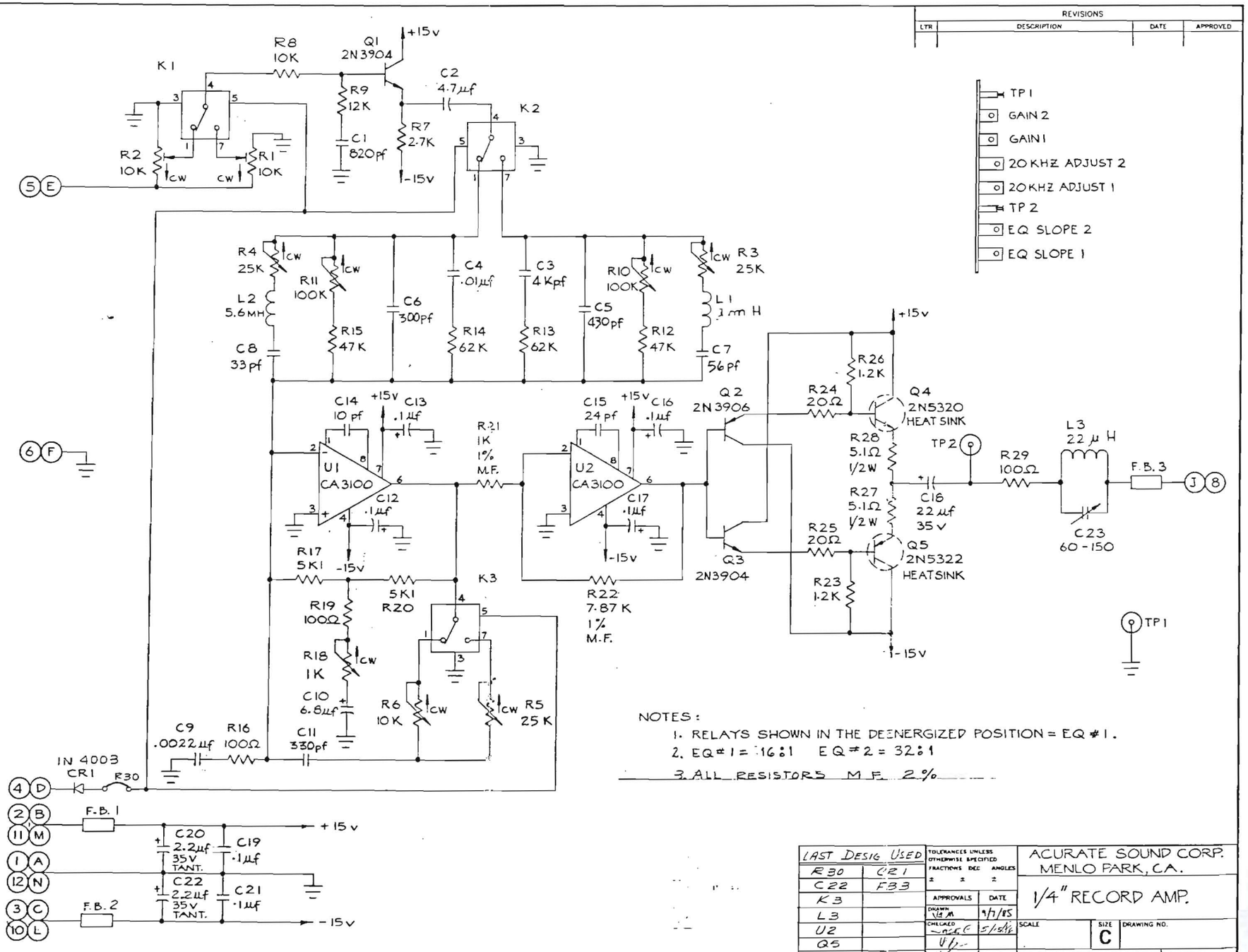
REVISIONS			
LTR	DESCRIPTION	DATE	APPROVED



NOTES:

1. T1 - SECONDARY IS 28 TURNS #24 ENAMELED WIRE EVENLY WOUND TO COVER AMIDON T50-2 TOROID CORE. PRIMARY IS 5 TURNS #24 INSULATED HOOKUP WIRE WOUND OVER SECONDARY AND SPACED TO COVER CORE.

TOLERANCES UNLESS OTHERWISE SPECIFIED FRACTIONS DEC ANGLES ± ± ±	ACCURATE SOUND CORP. MENLO PARK, CA.	
APPROVALS	DATE	BIAS AMPLIFIER
DRAWN VLM	8/25/15	
CHECKED	5/11/16	SCALE / SIZE C / DRAWING NO.
		DO NOT SCALE DRAWING / SHEET



NOTES:

1. RELAYS SHOWN IN THE DEENERGIZED POSITION = EQ # 1.
2. EQ # 1 = 16:1 EQ # 2 = 32:1
3. ALL RESISTORS M.F. 2%

LAST DESIG USED	
R30	C21
C22	F.B.3
K3	
L3	
U2	
Q5	

TOLERANCES UNLESS OTHERWISE SPECIFIED
FRACTIONS DEC ANGLES
± ± ±

APPROVALS	DATE
DRAWN VB M	9/7/85
CHECKED	5/10/86

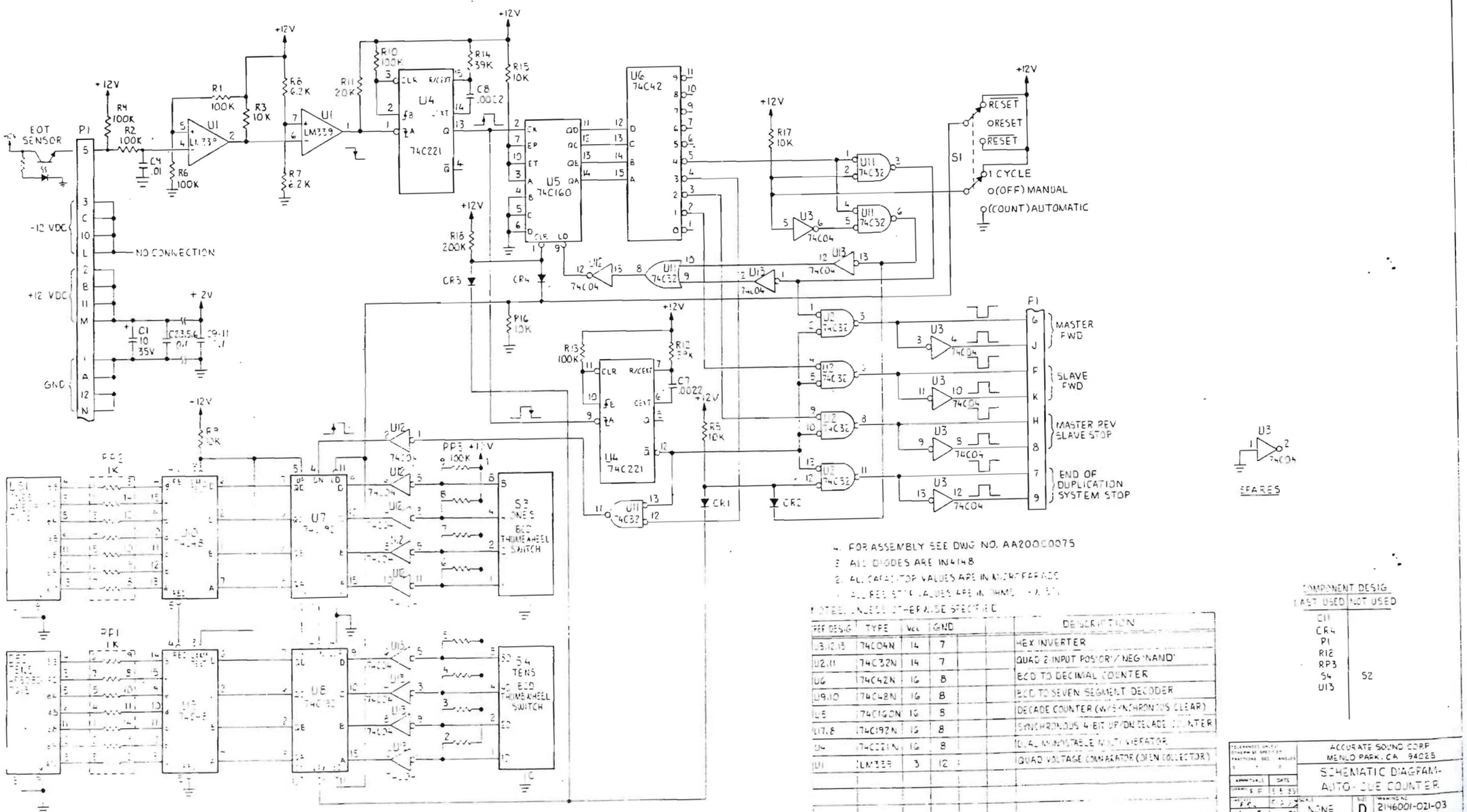
ACURATE SOUND CORP.
MENLO PARK, CA.

1/4" RECORD AMP.

SCALE | SIZE C | DRAWING NO.

DO NOT SCALE DRAWING | SHEET

REVISIONS			
LTR	DESCRIPTION	DATE	APPROVED
A	CHANGED U11-8,9,10,11,12,13	5-9-83	K. Johnson
B	ADDED CR3, CR4, & R17	83-5-13	K. Johnson
C	CHANGED REF DESIGNATIONS	83-5-24	K. Johnson
D	CHANGED CAP VALUES PATT-B	83-6-17	K. Johnson
E	CHANGED R1 FROM 3K	83-7-5	K. Johnson
F	NEW PRINT RUN	84-6-27	WIC
G	"	84-12-3	WIC



4. FOR ASSEMBLY SEE DWG NO. AA200C0075
3. ALL DIODES ARE IN4148
2. ALL CAPACITOR VALUES ARE IN MICROFARADS
1. ALL RESISTOR VALUES ARE IN OHMS ±5%

UNLESS OTHERWISE SPECIFIED

REF DESIG	TYPE	Vcc	GND		DESCRIPTION
U3,12,13	74C04N	14	7		HEX INVERTER
U2,11	74C32N	14	7		QUAD 2 INPUT POSOR'/NEG'NAND'
U6	74C42N	16	8		BCD TO DECIMAL COUNTER
U9,10	74C48N	16	8		BCD TO SEVEN SEGMENT DECODER
U5	74C160N	16	8		DECADE COUNTER (W/SYNCHRONOUS CLEAR)
U7,8	74C192N	16	8		SYNCHRONOUS 4 BIT UP/DN DECADE COUNTER
U4	74C221N	16	8		DUAL MONOSTABLE MULTIVIBRATOR
U1	LM339	3	12		QUAD VOLTAGE COMPARATOR (OPEN COLLECTOR)

COMPONENT DESIG	
LAST USED	NOT USED
C11	
CR4	
P1	
R16	
RP3	
S4	S2
U13	

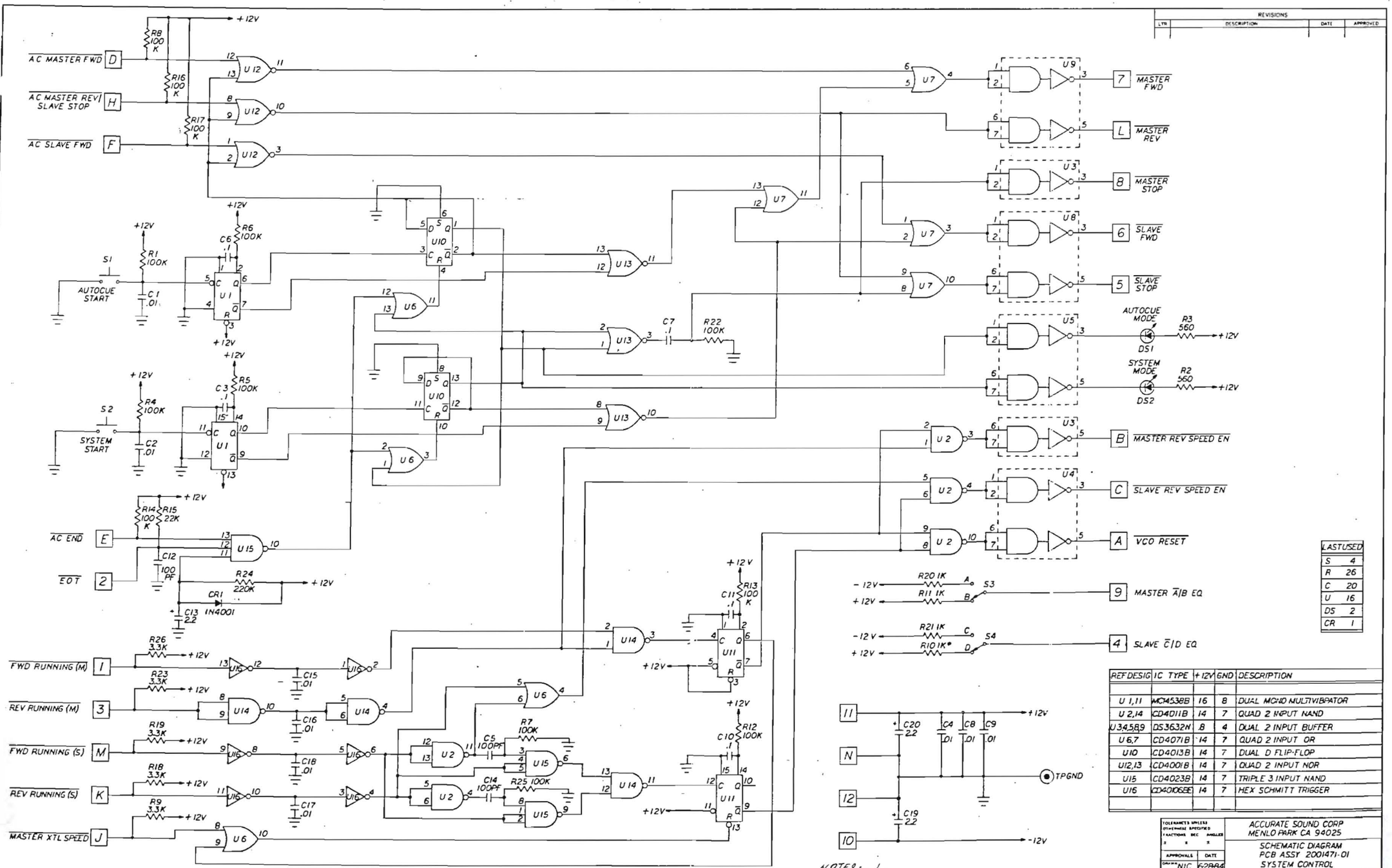
ACCURATE SOUND CORP.
MENLO PARK, CA 94025

SCHEMATIC DIAGRAM-
AUTO-CUE COUNTER

DRAWN	DATE
K.F.	5-6-83
APPROVED	DATE
Jose C	5-16-86

SIZE D | DRAWING NO. 2146001-021-03

DO NOT SCALE DRAWING | SHEET 1 OF 1



LAST USED	
S	4
R	26
C	20
U	16
DS	2
CR	1

REF DESIG	IC TYPE	+12V	GND	DESCRIPTION
U 1,11	MC14538B	16	8	DUAL MONO MULTIVIBRATOR
U 2,14	CD4011B	14	7	QUAD 2 INPUT NAND
U3,4,5,8,9	DS3632N	8	4	DUAL 2 INPUT BUFFER
U 6,7	CD4071B	14	7	QUAD 2 INPUT OR
U10	CD4013B	14	7	DUAL D FLIP-FLOP
U12,13	CD4001B	14	7	QUAD 2 INPUT NOR
U15	CD4023B	14	7	TRIPLE 3 INPUT NAND
U16	CD4010BE	14	7	HEX SCHMITT TRIGGER

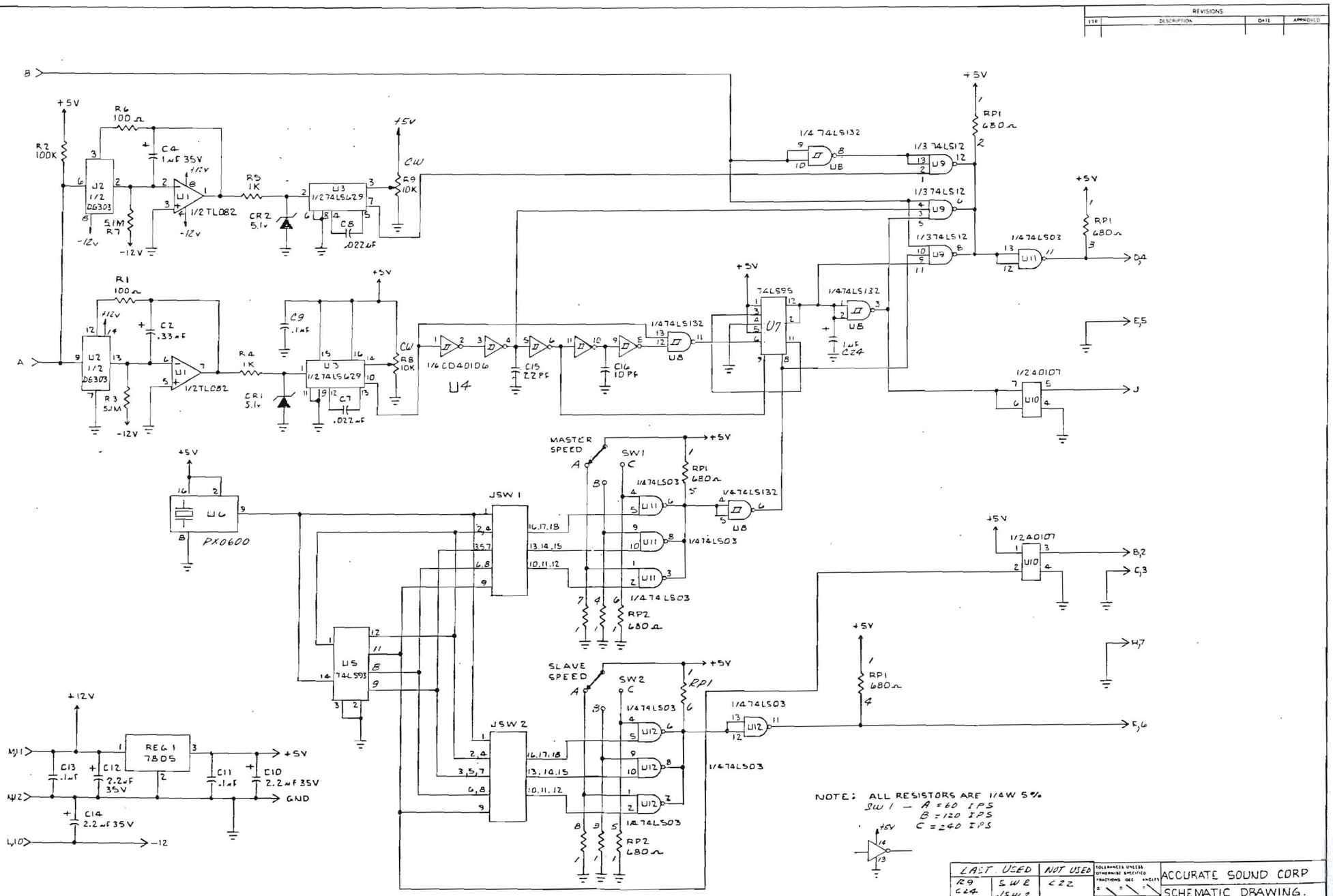
NOTES:-
1. ALL CAPACITORS VALUE ARE IN µF
2. + 12D DELETED FOR NEW SYSTEMS

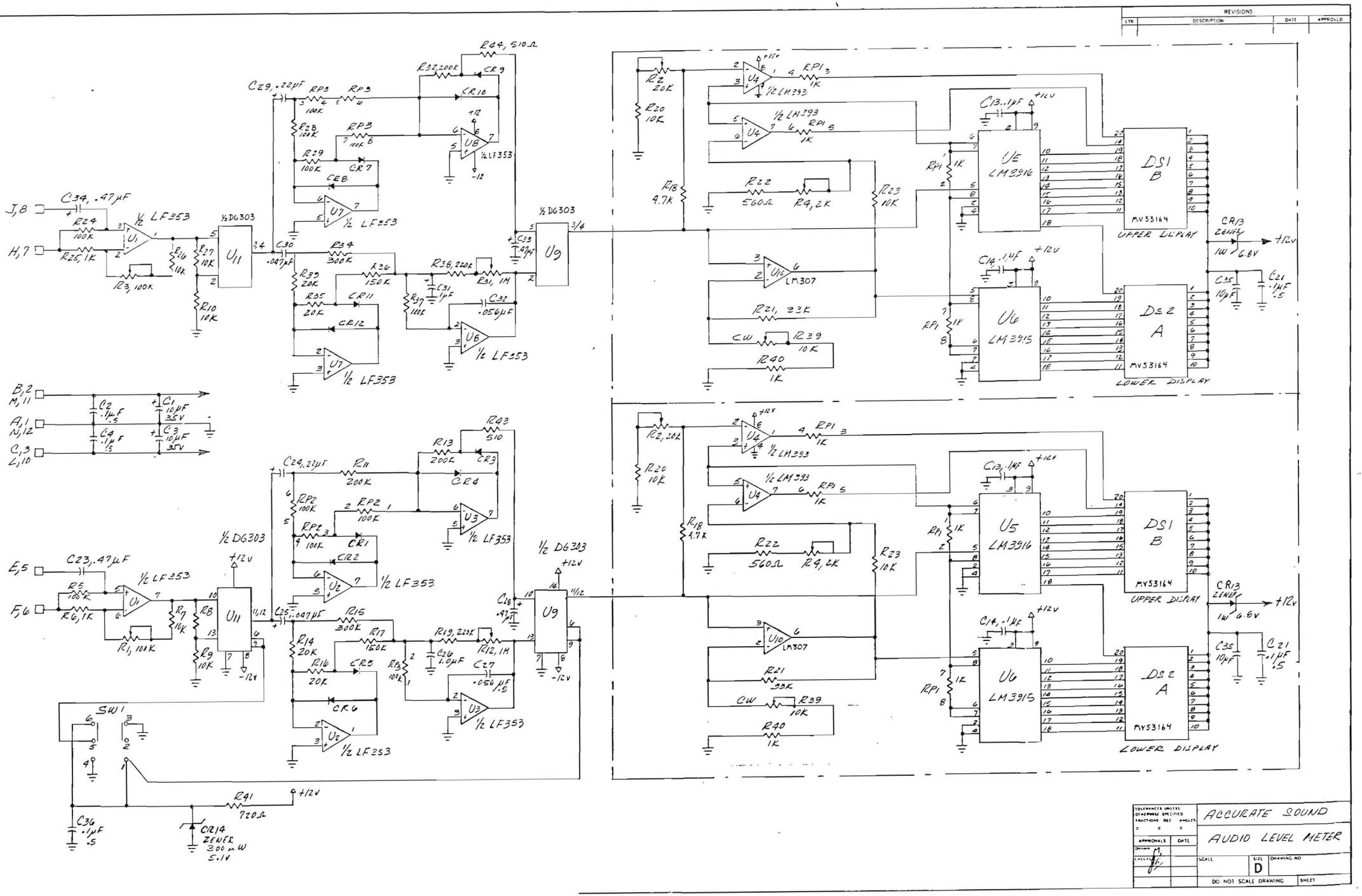
REVISIONS			
LTR	DESCRIPTION	DATE	APPROVED

ACCURATE SOUND CORP
MENLO PARK CA 94025

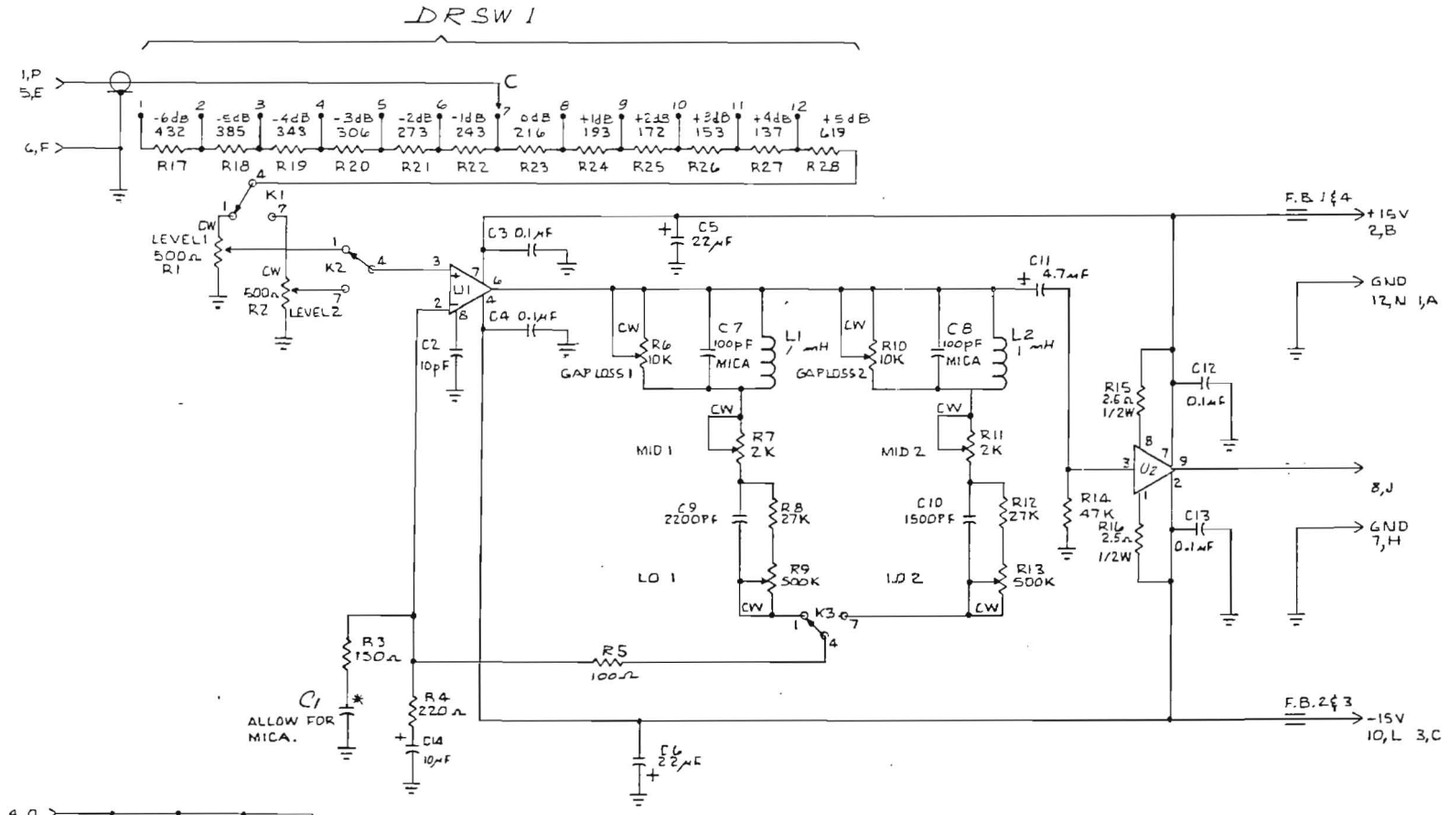
SCHEMATIC DIAGRAM
PCB ASSY 2001471-01
SYSTEM CONTROL

DRAWN NIC 62884
SIZE D
DRAWING NO 2147101-011-03
SHEET 1 OF 1
DO NOT SCALE DRAWING


REVISIONS
LTR DESCRIPTION DATE APPROVED
B
A
+5V
-12V
+12V
R2 100K
R6 100Ω
C4 1uF 35V
U2 1/2 DG303
U1 1/2 TL082
R7 5.1M
R5 1K
CR2 5.1v
U3 1/2 74LS629
C8 .022uF
CW
R9 10K
R1 100Ω
C2 .33uF
R3 5.1M
R4 1K
CR1 5.1v
C7 .022uF
C9 .1uF
R8 10K
U4 1/6 CD4010
C15 22PF
C16 10PF
74LS95
U7
1/4 74LS132
U8
1uF C24
RP1 680Ω
1/4 74LS08
U9
1/3 74LS12
U11
1/4 74LS03
D,4
E,5
1/2 40107
U10
J
U6 PX0600
MASTER SPEED
SW1
JSW1
RP2 680Ω
U5 74LS393
SLAVE SPEED
SW2
JSW2
B,2
C,3
H,7
E,6
REG1 7805
C13 .1uF
C12 2.2uF 35V
C11 .1uF
C10 2.2uF 35V
C14 2.2uF 35V
GND
NOTE: ALL RESISTORS ARE 1/4W 5%
SW1 — A = 60 IPS
B = 120 IPS
C = 240 IPS
LAST USED
R9
C24
V12
RP2
CR2
REG1
NOT USED
SW2
JSW2
C22
ACCURATE SOUND CORP
SCHEMATIC DRAWING.
AS200A CLOCK BD
SIZE D
DRAWING NO 2005260000061
DO NOT SCALE DRAWING
SHEET 1 OF 1


REVISIONS
LTR DESCRIPTION DATE APPROVED
J,8
H,7
C34, .47µF
½ LF353
½DG303
U11
C30 .047µF
R24 100K
R25, 1K
R3, 100K
R26 16K
R27 10K
R10 10K
R44, 510Ω
R32, 200K
CR9
C29, .22µF
RP3 100K
CR10
R28 100K
R29 100K
CR7
CR8
U7
½ LF353
U8
½ LF353
+12
-12
R34 300K
R36 150K
R33 20K
R35 20K
CR11
CR12
R37 1MΩ
C31 1µF
R38, 220K
R31, 1M
C32 .056µF
U8
½ LF353
U7
½ LF353
½DG303
U9
3/4
C33 .47µF
B,2 M,11
A,1 N,12
C,3 L,10
C2 .1µF .5
C4 .1µF .5
C1 10µF 35V
C3 10µF 35V
E,5
F,6
C23, .47µF
½ LF353
U1
R5 100K
R6, 1K
R1, 10K
R7 16K
R8
R9 10K
U11
+12V
-12V
½ DG303
C24, .22µF
R11 200K
R43 510
R13 200K
CR4
CR3
RP2 100K
CR1
CR2
U2
½ LF353
U3
½ LF353
C25, .047µF
R15 300K
R17 150K
R14 20K
R16 20K
CR5
CR6
U2
½ LF353
R19, 223K
R12, 1M
C26 1.0µF
C27 .056µF .5
R18 100K
U3
½ LF353
½ DG303
U9
C28 .47µF
11/12
SW1
R41 720Ω
C36 .1µF .5
CR14 ZENER 300mW 5.1V
R2 20K
R20 10K
R18 4.7K
U4
½ LM393
RP1 3 1K
RP1 5 1K
R22 560Ω
R4, 2K
R23 10K
U1C LM307
R21, 33K
CW R39 10K
R40 1K
C13, .1µF
C14, .1µF
U5 LM3916
U6 LM3915
RP1 1K
DS1 B
DS2 A
MV53164
UPPER DISPLAY
LOWER DISPLAY
CR13 ZENER 1W 6.8V
+12V
C35 10µF
C21 .1µF .5
R2, 20K
R20 10K
R18 4.7K
R22 560Ω
R4, 2K
R23 10K
U10 LM307
R21 33K
CW R39 10K
R40 1K
C13, .1µF
C14, .1µF
U5 LM3916
U6 LM3915
DS1 B
DS2 A
MV53164
UPPER DISPLAY
LOWER DISPLAY
CR13 ZENER 1W 6.8V
+12V
C35 10µF
C21 .1µF .5
TOLERANCES UNLESS OTHERWISE SPECIFIED
FRACTIONS DEC ANGLES
APPROVALS DATE
DRAWN
ENGR
ACCURATE SOUND
AUDIO LEVEL METER
SCALE
SIZE D
DRAWING NO
DO NOT SCALE DRAWING
SHEET

REVISIONS			
LTR	DESCRIPTION	DATE	APPROVED



NOTES: UNLESS OTHERWISE SPECIFIED.

1. RESISTORS ARE 1/4 W ±5% C.C.
2. ALL POTENTIOMETERS 3/4" 10 TURNS
3. C7,8,9,10 WILL VARI ACCORDING TO SPEED OF TAPE RUN.
4. U_1 – HA 2625
   U_2 – HA 2630
5. * C_1 56 pF TYP (ADJUST ON TEST)

LAST DESIG. USED	
C14	L2
R28	
U2	
L3	
CR1	
FB 4	
DRSW1	

TOLERANCES UNLESS OTHERWISE SPECIFIED: FRACTIONS DEC ANGLES ± ± °

APPROVALS	DATE
DRAWN R.C.	4.14.86
CHECKED	5/14/86

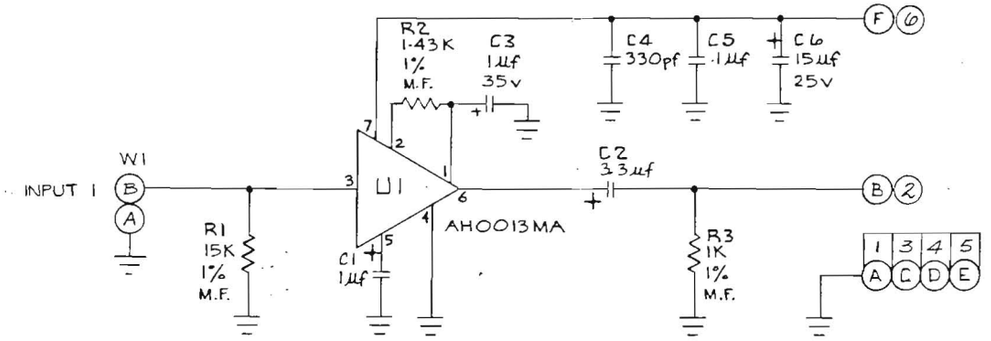
ACCURATE SOUND CORP

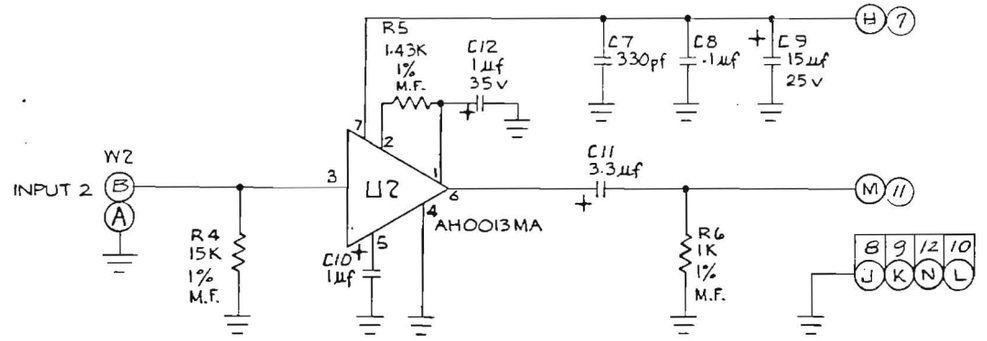
SCHEMATIC DRAWING REPRODUCE P.C.B.

SCALE | SIZE D | DRAWING NO. 200526000D51

DO NOT SCALE DRAWING | SHEET 1 of 1

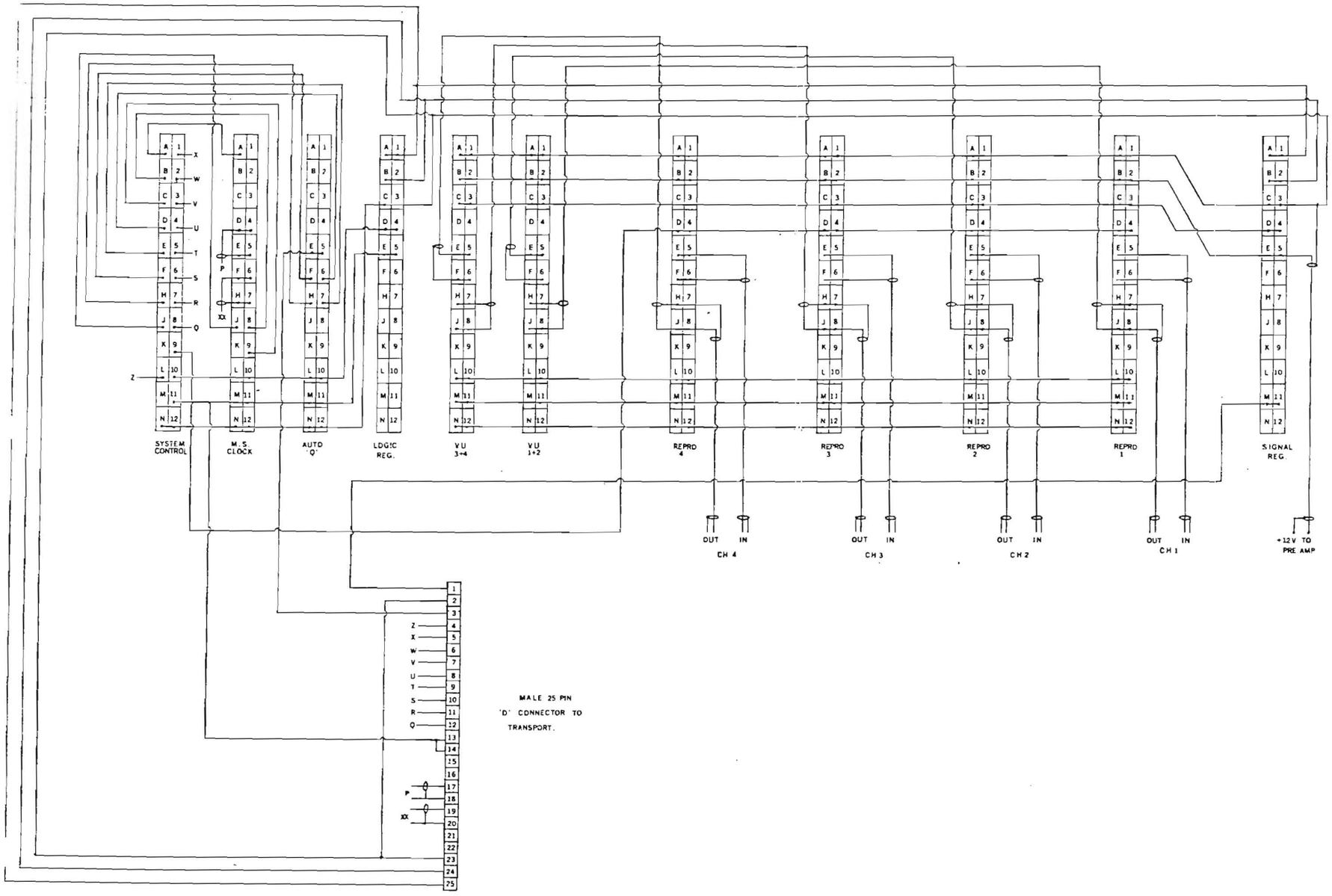
REVISIONS			
LTR	DESCRIPTION	DATE	APPROVED





TOLERANCES UNLESS OTHERWISE SPECIFIED FRACTIONS ± DEC ± ANGLES ±			ACCURATE SOUND CORP. MENLO PARK, CA.
	APPROVALS	DATE	SCHEMATIC DRAWING
	DRAWN RC	8/85	HEAD PRE-AMP 2-CH
	CHECKED	4-14-86	SCALE / SIZE C / DRAWING NO. 200526000021
20ED26-1			DO NOT SCALE DRAWING / SHEET 1 OF 1
USED ON			

REVISIONS			
LTR	DESCRIPTION	DATE	APPROVED



TOLERANCES UNLESS OTHERWISE SPECIFIED		ACCURATE SOUND CORP MENLO PARK, CA.		
FRACTIONS DEC ANGLES				
APPROVALS	DATE	REPRODUCE ASSEMBLY		
DRAWN				
CHECKED	10/1/85	SCALE N/A	SIZE D	DRAWING NO 20006100
		DO NOT SCALE DRAWING		SHEET