Consolidated Electronic Industries

Cuemaster
Cepak

CUEMASTER 900 SERIES

INSTRUCTION MANUAL

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Issue History

1	1973	Original Short Deck
2	Dec.1973	Original Long Deck
3	Dec.1976	Text revision, Operation instructions added, spare parts revised, drawings revised.
4	June 1979	Text revision, Bias enable added, drawings revised

CHAPTER 1 SPECIFICATION

1.1 OPERATIONAL SPECIFICATION

1.1.01 INTRODUCTION :

Cuemaster 900 Series is a fully professional series of cartridge recorders which have been designed to provide within a very compact housing, the reliability and performance which characterize the Cuemaster 750 Series. The incorporation of a direct drive, two speed motor, enables the provision of a number of additional operating features.

Models within the 900 Series are:-

906 - Three cuetone mono replay machine

986 - Three cuetone stereo replay machine

903 - Three cuetone mono record/replay deck

903R - Three cuetone mono record module

983 - Three cuetone stereo record/replay deck

983R - Three cuetone stereo record module

The 903 and 903R are interconnected via a loom to allow all recording and monitoring functions to be achieved.

The 983 and 983R are interconnected in the same manner.

1.1.02 POWER SUPPLY REQUIREMENTS :

200 to 260 Volts)
100 to 130 Volts) 50 Hz. or 60 Hz.

1.1.03 TAPE DRIVE :

Direct drive from a hysteresis synchronous motor. The motor is fed from a special winding on the power transformer enabling operation at any supply voltage and frequency likely to be met. Two speeds, 7.5 i.p.s. and 22.5 i.p.s. (fast forward) are standard.

1.1.04 PRESSURE ROLLER MECHANISM :

A full travel solenoid and toggle crank mechanism is provided with controllable air damping for both up and down stroke to give minimum audible operating noise. The solenoid is fed from a special supply which gives high starting pull with low hold in power, using a non-dissipative cutback circuit. The solenoid "drop out" time is less than 35mSec. ensuring accurate cueing even if stop cue is approached at Fast Forward Speed.

1.1.05 TAPE HEADS :

Laminated core Nortronics heads are used for record and playback. A dummy head is used in the record position to ensure correct tape guidance in 906 and 986 machines.

The heads are mounted in a precision machined one piece block mount with three stainless steel tape guides. The head mount has provision for precision azimuth adjustment of the two heads and a screw for positive locking of the azimuth setting.

Since it is not possible to shield the heads in a cartridge machine adequately from stray magnetic fields, a stray field compensating circuit is provided. The stray field compensating coil mounted above the replay head picks up a similar amount of hum to the head and injects it antiphase into the programme play channel. This renders the machine substantially immune to stray field pick-up.

1.1.06 TRANSPORT PERFORMANCE :

1. Speed - 7.50 ips (19.05 cm/sec) and 22.5 ips (fast forward).
2. Speed Accuracy - ± 0.2% at 7.5 ips.
3. Inherent wow and flutter - less than 0.1% R.M.S. total.
4. Wow and flutter with well wound cartridge less than 0.2%.
5. Start delay - less than 0.1 second.
6. Stop Delay - less than .035 second.

1.1.07 ELECTRONIC COMPONENTS :

All components are currently available types. Silicon semi-conductors are used throughout. Printed circuit boards are fibreglass epoxy based, with hard gold contacts.

1.1.08 FRONT PANEL CONTROL FUNCTIONS:- REPLAY DECK

1. The toggle switch at lower left of the front panel switches mains power to the deck. When power is on, but no cartridge loaded the STOP button at upper centre of the panel is illuminated.

2. When a cartridge is correctly loaded, the READY lamp at upper right of the panel is illuminated and the motor runs at 7.5 ips.

3. Pressing the START button at lower right of the panel brings up the solenoid, extinguishes the STOP light and illuminates the START lamp. The START button is then locked out so that subsequent operation of it has no effect.

4. Pressing the STOP button releases the solenoid, stops the tape, extinguishes the START lamp and lights the STOP lamp. In addition, if the motor was running at fast forward speed, it is returned to normal speed.

1.1.08 FRONT PANEL CONTROL FUNCTIONS:- REPLAY DECK (CONT'D)

5. Pressing the FAST FORWARD button at upper left of the panel while the machine is running (START lamp lit) increases the capstan speed to 22.5 ips and lights the FAST FORWARD lamp.

6. While in fast forward the audio signal is muted. If the operator requires to edit the programme content, he simply pushes the START button again, which returns the tape speed to 7.5 ips and "de-mutes" the audio. This feature is only a front panel control and is not remoted.

1.1.09 FRONT PANEL CONTROL FUNCTIONS:- RECORD MODULE

1. To select RECORD mode, the RECORD push button on the lower left of the panel must be depressed simultaneously with the START button on the deck. When RECORD is selected, the red RECORD push button is illuminated, the bias oscillator runs, and record programme on the line input socket appears on the record head.

2. Pressing the PLAY button, located directly beneath the RECORD button stops the recording of programme by turning off the bias oscillator and placing a short across the record head. Recording can also be stopped by pressing the STOP button on the deck.

3. If the RECORD button is pressed before the START button, a STOP cue will be automatically recorded on the tape, but if the reverse order is selected, no cue will be recorded.

4. The VU meter displays either cue level, bias level, record level or play level as selected by the four interlocked push buttons below the meter. The record level control(s) on the lower right of the record module panel should be adjusted when recording for an average of OVU with the meter displaying record level. This will then give the same replay level, with the meter displaying replay level. Selecting bias does not give a VU level, but a zero indicator shows that the bias level setting is correct. The same applies for cue. The calibration mark on the RECORD GAIN control(s) is the unity gain position, i.e. the signal level at the line output socket, when replaying, will be the same as the level on the line input socket when the material was recorded.

5. A headphone monitor with separate GAIN control is located on the lower middle of the panel. It is used to monitor the same signal displayed on the VU meter(s).

6. On the stereo machine - 980 series - extreme rotation anti-clockwise energises a channel lockout switch on that channel only, and, hence, programme on the other channel can be recorded without destroying programme on the "locked out" channel.

1.1.09 FRONT PANEL CONTROL FUNCTIONS:- RECORD MODULE (CONT'D)

7. A RECORD LOCKOUT push button on the left of the VU meter locks out record mode. When pushed "in" record mode cannot be selected by the RECORD push button.

8. Cuetones can be recorded in either RECORD or PLAY modes by pushing the appropriate buttons. On mono machines - 900 series - programme erase is automatic in RECORD mode and either CUE or PROGRAMME erase is selectable in play mode by using the ERASE push button and the selector switch located beside it.

   In the stereo machine - 980 series - since combined record/erase heads are not available in three track configuration, programme erase is not available, but cue erase is available in play mode by applying a high bias level to the cue record head.

1.1.10 REAR PANEL FUNCTIONS:- DECK

1. Line output jack.
2. Auxiliary cue output multi pin socket.
3. Remote control and monitoring multi-pin socket.
4. A.C. mains power inlet.
5. D.C. fuse (1 amp.)
6. A.C. fuse (1 amp.)
7. Automatic fast forward inhibit switch.
8. Record module connector multi-pin socket. (903 and 983 only).

1.1.11 REAR PANEL FUNCTIONS:- RECORD MODULE

1. Deck connector multi-pin socket. (903 and 983 only).
2. Line input jack.
3. Remote control multi-pin socket.
4. Line input impedance selector switch. (600 ohm. or 10K ohm. bridging).

1.1.12 MK III 900 SERIES CHANGES :

900 Series machines have now been modified to comply with the draft 1975 NAB specification which allows more versatile use of cartridge equipment. The changes made are:-

1. Automatic fast forward now occurs at the END of the AUXI cue (150 Hz.).

2. Provision has been made to record cues longer than ½ second by depressing the AUXI cue record button as long as required. A short stab on the button will still record a ½ second AUXI tone burst. This allows a long end of message cue (AUXI) to be recorded a few seconds before the actual end of message as a warning to the announcer, or to give an automatic cross-fade signal to start another machine before the message finishes, e.g. Automated Radio Stations, Telecine preroll.

1.1.12 MK III 900 SERIES CHANGES (CONT'D)

3. The output of the cue channel preamplifier has also been remoted to RC13 to allow a 3.5 KHz. Frequency Shift Key (FSK) decoder to log information contained on the cue track. This FSK signal will appear at a level of about -10 dBm at RC13.

   Note that all other cues will also appear at RC13 at a level of -6 dBm.

4. The 983R and 903R record modules have also been modified to allow FSK logging information to be recorded on the cue track via RRC13.

   Recording requirements are about 20 micro-amps. current source or 1 Volt RMS into a 47 K resistor.

   The FSK coder output is adjusted to give a reading of -5 VU on the VU meter when the cue selector button is depressed and FSK information is being recorded.

   Note that if a cue replay level in excess of 0 VU for logging tones will cause interaction with the 1 to 3 KHz stop cue sensing filter, so it is most important that the recording of logging information is at the specified NAB level of 25 to 40 nWb/m (-5 to -2 VU) (0 VU is the nominal replay level of the other three cue tones).

1.1.13 HINTS ON RECORDING CARTRIDGES :

1. Always use bulk erased cartridges to record new material. Although automatic programme erase is a standard feature of the mono 903/903R recorder, it is advisable to use a bulk erased cartridge for recording new material to ensure the integrity of the cue track throughout the tape.

2. Always return to PLAY mode at the end of message and BEFORE the end of tape. Failure to do so can cause the transport to run through the stop cue at the start of the tape. Bias on the cue head can partially erase the stop cue (4 to 8 dB) to such a level that it will fail to be recognised. If machine does cue off even when left in RECORD mode, the resultant damage to the stop cue level can cause loss in tightness of ON AIR presentation on subsequent replaying of the cartridge on another machine whose stop cue sensitivity is somewhat lower than the original recording machine. The effect is sometimes confused with slow sensing and stopping time where on a "tightly cued" cartridge the machine will stop into the programme material instead of before it as originally recorded.

3. Always record stop cues at the same time the programme is being recorded to ensure tight control of cue to programme gap. The auxilliary cues may be recorded, or repositioned, on the second or subsequent passes in PLAY mode without affecting the programme tracks.

1.2 PERFORMANCE SPECIFICATION

1.2.01 LINE OUTPUT/INPUT :

1. Low impedance output is fully floating and intended to drive a 600 ohm line on load.

2. The output is capable of feeding a 600 ohm load at a maximum level of + 20 dBm at all audio frequencies. Output impedance is typically 100 ohms.

3. Playback gain is preset according to the standards chosen for operation. Normally this is 0 VU equivalent to + 8 dBm under steady test tone conditions.

4. Line input 8 dBm nominal, 20 dBm maximum. Fully floating 600 ohm or 10 kohm.

1.2.02 EQUALIZATION :

1. Cue Track conforms to 1975 NAB standard.

2. Programme Track can be supplied with CCIR, IEC or NAB standard compensation.

1.2.03 FREQUENCY RESPONSE :

Replay and record/replay

± ½ dB 50 Hz to 12 kHz

± 3 dB 40 Hz to 15 kHz

all with respect to 1 kHz.

Phase error on stereo machines is dependant on cartridges used, but typically 99% of cartridges used give less than 80 degrees error at 15 kHz.

1.2.04 DISTORTION :

Less than 0.5% (amplifier only) at + 16 dBm output and 1 kHz.

Less than 2.5% overall using Audio 17 lube tape at peak recorded level (320 nW/m).

1.2.05 SIGNAL TO NOISE RATIO (NORMAL SETUP) :

320 nW/m reference wide band measurement.

MONO - Better than 59 dB with respect to reference level
57 dB with bulk erased tape, 54 dB with bias applied.

STEREO - Better than 57 dB without tape, 55 dB with bulk erased tape, 52 dB with bias applied.

1.2.06 AUXILIARY CUE CAPABILITY :

150 Hz, 1 kHz and 8 kHz cue capabilities are standard. 1 kHz is the standard stop cue whilst the 150 Hz cue automatically initiates fast forward at the end of the tone unless inhibited by means of a rear panel switch. In record mode, automatic fast forward is also inhibited

1.2.07 CUE TO PROGRAMME CROSSTALK:

Better than 50 dB for each cuetone except stereo 986, 983 150 Hz. tone 45dB

1.2.08 REMOTE CONTROL FUNCTIONS: (RC)

Remote control and monitoring lines are provided as follows:

Remote control connector -

1. Ready Lamp (return to 24 volts).
2. Start lamp (return Start Lamp to 24 volts).
3. Fast Forward Lamp (return to RC2).
4. Fast Forward Control (return to Earth).
5. Stop Button and Lamp (return Stop Button to Earth and Lamp to 24 Volts).
6. Auto Fast Forward inhibit (return to Earth).
7. Earth (common).
8. 24 Volt supply (up to 300 mA).
9. Start Button (return to RC1).
10. Normally open Aux. 1 Relay Contact.
11. Wiper " " "
12. Normally Closed " " "
13. Cue Channel Output.
14. Normally open Aux. 2 Relay Contact.
15. Wiper " " "
16. Normally Closed " " "
17. Spare
18. Spare
19. Spare

The contact rating for the auxiliary relays is 50v, 200 mA, AC/DC.

1.2.09 AUDIO OUTLET CONNECTOR:

Cannon XLP - 3 - 32

1 Earth
2) Balanced Audio Output, fully floating.
3)

Mating Plug XLP - 3 - 11

1.2.10 POWER INLET CONNECTOR:

Cannon XLR - LNE - 11C

1.2.11 RECORD INPUT PLUG:

Cannon XLP - 3 - 31

1 Earth
2) Balanced Audio Input, fully floating.
3)

Mating Plug XLP - 3 - 12

1.2.12 RECORD REMOTE CONTROL: (RRC)

1. Record Switch Return to "HOT" Side of Start Switch
2. Play Switch Return to Earth
3. Record Monitor Return to Earth (24v Lamp)
4. Play Monitor Return to Earth (24v Lamp)
5. Earth
6. 24 Volt Supply
7. Stop Cue Trigger Return to Earth (1kHz)
8. AUX 1 Cue Trigger Return to Earth (150 Hz)
9 AUX 2 Cue Trigger Return to Earth (8 kHz)
10. Stop Cue Monitor " " (24v Lamp)
11. AUX 1 Cue " " " " "
12. AUX 2 Cue " " " " "
13. Record Lockout Return to Earth to Lockout
14. FSK logging input.
15. Bias Enable

1.2.13 RECORD INTER CONNECTION PLUG (RP)

	MONO	STEREO
1.	Start Bistable	Start Bistable
2.	Start Switch	Start Switch
3.	Ready	Ready
4.	24 Volt Supply	24 Volt Supply
5.	Earth	Earth
6.	Stop Cue Monitor	Stop Cue Monitor
7.	AUX 1 " "	AUX 1 " "
8.	AUX 2 " "	AUX 2 " "
9	Stop Inhibit	Stop Inhibit
10.	Programme Monitor	Channel 1 Monitor
11.	Cue Monitor	Cue Monitor
12.	Cue Record Head	Cue Record Head
13.	Programme Record Head	Channel 1 Record Head
14.	Cue Erase Head	Spare
15.	Programme Erase Head	Channel 2 Record Head
16.	Cue Earth	Cue Head Earth
17.	Programme Earth	Programme Heads Earth
18.	Polarizing Pin	Polarizing Pin
19	Spare	Channel 2 Monitor
20.	Fast Forward Inhibit	Fast Forward Inhibit

CHAPTER 2 DETAILED CIRCUIT DESCRIPTION

2.1 PROGRAMME CHANNEL:

2.1.01 PREAMPLIFIER:

The preamplifier is a dual channel low noise integrated operational amplifier type uA739 one channel being used for each of the programme preamplifiers.

Considering only Channel 1 Preamplifier Resistors R28, RV5 and Capacitor C15 form the equalizing components for the programme channel. Biasing of the preamplifier is controlled by resistor dividing network R23 and R24. This holds the positive (high impedance) input (Pin 5) at approximately 8 volts. As the negative input to the preamplifier is also returned to this 8 volt bias supply the output bias voltage will also be at 8 volts plus any voltage required to feed the input offset bias, which for the uA739 is between zero and 6 millivolts.

In this circuit configuration the output bias voltage should be between 6 and 10 volts. However, typical bias values would be 8 volts ± 1 volt.

Stray field pick up coil L1 is located directly above the programme head. In this position, it receives approximately the same stray field (from motor, power transformer and external equipment) as the programme head. This signal is injected in "series" anti-phase with the programme head (level controlled by RV4), to effectively cancel out extraneous stray fields.

Preset potentiometer RV5 is used to control the H.F. response.

The output level of the preamplifier is controlled by RV6.

2.1.02 AUDIO SWITCH:

Q6 is an audio field effect transistor (FET) switch which is used to isolate the programme amplifier when the machine is in the "stop" condition or when in the FAST FORWARD mode.

The audio switch is controlled by the bias on the gate of the P. channel F.E.T. When the gate voltage is high (above +10 volts) the source-gate resistance is very large (approx. 100 megohms). This effectively isolates the two amplifiers from each other.

When the gate control voltage (on PB24) is low (below 1 volt) diode CR3 is reverse biased allowing R39 to connect the F.E.T. gate to earth. This causes a low source drain resistance (approx. 1 Kohm) hence allowing recorded material before the programme head to appear at the audio output socket.

2.1.03 PROGRAMME AMPLIFIER:

The programme amplifier is a low distortion, low noise, high output level, complimentary symmetry amplifier with a balanced 600 ohm output.

Biasing is controlled by R33 and R 34 so that the common emitter (TP4) voltage (Vo) is:

$$\frac{Vo}{R33} \times \frac{R34}{+\ R34} = 1.2 \text{ volts} \quad \text{giving VO} = 12\text{v}$$

The distortion of the amplifier at + 20 dBm output is typically 0.2% and the signal to noise ratio at + 16 dBm is typically 70dB.

The gain of the amplifier is: $\frac{R33}{R31}$

2.2 CUE CHANNEL:

2.2.01 CUE PREAMPLIFIER

Transistors Q11 and Q12 form a high gain frequency compensated amplifier, the characteristics of which cause cue tones recorded at NAB levels to be replayed at approximately - 6dBm for all cue frequencies. Potentiometer RV7 controls the gain of the cue amplifier.

Biasing is controlled by voltage divider resistors R20 and R21. This same voltage should appear at the collector of Q12, i.e. 12 volts.

2.2.02 CUE FILTERS:

The output of the equalized cue amplifier is connected to the three cuetone "active" filters, all of the Salen and Key type.

The 1 kHz cue detector (Stop cue) is a 1 kHz high pass filter followed by 3 kHz low pass filter forming a band pass filter.

The Aux 1 cue detector is a 150 Hz low pass filter and the Aux.2 cue detector is a 8 kHz high pass filter.

The cue amplifier's overall band pass characteristic gives, in effect, three band pass filters.

The characteristics of the three filters are as follows (input at T.P.3 = 0 dB).

Filter	Frequency						
	50Hz	150Hz	450Hz	1kHz	3kHz	8kHz	24kHz
Stop	-55dB	-35	-10	+10	+4	-14	-34
Aux.1	0dB	+ 8	-15	-30	-40	-50	-60
Aux.2	-60dB	-50	-40	-34	-12	+ 8	+ 1

TABLE 1 CUE FILTER RESPONSES

It will be noticed that the "stop" cue filter is 6dB down at 3kHz with respect to 1 kHz. This is essential as the 1 kHz tone recorded at 7½ i.p.s. must be recognised as a "stop" cue even at fast forward speed (22½ i.p.s.) where the stop cue frequency is 3 kHz and the level is 6dB higher than its 7½ i.p.s. value.

2.2.03 TRANSPORT CONTROL:

Transistors Q18 and Q19 form a bistable multivibrator which can be triggered into either stable state by earthing the collectors of Q18 or Q19 (Start or Stop push buttons).

Transistor Q30 in the emitter of Q19 controls the transport solenoid L2.

The cartridge micro-switch serves two functions -

(i) Prevents the Start function being energized unless a cartridge is inserted into the machine.

(ii) Starts the transport motor when the cartridge is inserted (via relay RLE).

Automatic fast forward mode is selected when AUXI cue (150 Hz) is detected provided the rear panel INHIBIT switch has not been energized. Manual fast forward is selected by the front panel FAST FORWARD push button or by earthing remote control pin RC4, provided a cartridge has been inserted and the transport solenoid has been energized (START lamp is ON).

2.2.04 STOP CUE DETECTION:

Transistor Q15 detects the presence of a "Stop" cue when its level is above 0.6 volts peak (-6 dBm). When a stop cue is detected transistor Q15 turns ON Q17 which then turns Q18 ON and Q19 OFF provided guard timer transistor Q16 is ON.

Since Q19 controls the pressure roller solenoid transistor Q30, the transport will stop.

The guard timer transistor Q16 is normally held ON by resistor R50, but is turned OFF for 1½ seconds after the transport has started to allow the previous stop cue tone to pass without affecting the transport. The guard time is controlled by R50 and C31.

The preamplifier output is normally set to give an output of -6 dBm at 1 kHz and 7½ i.p.s., hence any cue signal with an amplified output voltage greater than -6 dBm and a frequency of between 700 Hz and 4 kHz will stop the transport running provided the signal is present for more than 15 milliseconds and the guard time has elapsed (1½ seconds).

2.2.05 SOLENOID CONTROL:

The pressure roller solenoid L2 is a fast release type designed to drop out 35 milliseconds after a cue tone is sensed.

Capacitor C28 and diode CR10 are used to absorb and hold the solenoid energy when Q30 is turned off. This allows solenoid current to be quickly reduced to zero without overrating the voltage on Q30.

2.2.06 AUX. 1 CUE DETECTION:

The AUX 1 cue detector transistor Q21 detects a 150 Hz cue when the cue level is above -6 dBm at the emitter of Q20. Transistor Q22 is turned ON by Q21, which in turn energizes relay RLB. Changeover contacts are available at the remote control socket.

NOTE: On record machines, the wiper (RC11) is returned to 24 volts to enable record module monitoring to occur.

2.2.07 AUTOMATIC FAST FORWARD:

Transistor 22 also turns ON SCR1 via R5, C69 and Q23 at the end of the AUX 1 cue provided rear panel "Fast Forward Inhibit" slide switch has not been operated. SCR1 remains ON even after the AUX 1 tone has disappeared, hence RLD is energized, which in turn energizes the high speed motor windings and de-energizes the slow speed winding by allowing Triac 1 to conduct while Triac 2 gate and cathode are shorted, i.e. Triac 2 will switch off.

SCR1 is reset when the transport solenoid is released, or start button is pushed.

2.2.08 AUX. 2 CUE DETECTOR

The Aux. 2 cue detector transistor Q25 detects an 8 kHz cue when the cue level at the emitter of Q24 is above -6dBm. Q26 amplifies the detected signal and operates RLC whose changeover contacts are available at the remote control socket. On record machines the wiper is connected to 24 volts.

2.3 POWER SUPPLY:

The 24 volt regulated power supply uses three transistors to accomplish regulation.

Zener diode CR18 forms a basic 12 volt reference connected to the emitter of Q27, the output voltage is sampled by resistive divider R87 and R88 and compared with the reference voltage.

Consider that the regulated supply suddenly has additional load placed on it, causing the supply voltage to fall. The divider R87 and R88 sense this fall and remove base drive from Q27. This reduced Q27 collector current and hence increases base current for transistor Q28 which in turn increases the drive to the main pass transistor Q29, thus restoring the original regulated voltage to the 24 volt supply rail.

2.3.01 POWER SUPPLY SPECIFICATION:

Regulated Voltage	- 24 Volts
Maximum Current	- 1 Amp.
Short Circuit Current	- 3 to 5 Amps.
Fuse Rating	- 1 Amp.
Regulation at 1 Amp.	- 50 millivolts
Ripple at 200mA	- 5 millivolts Peak to Peak

2.4 MOTOR SUPPLY:

To minimise Radio Frequency interference the motor is controlled by zero crossover switched triacs. The motor has two separate windings viz:

one 12 pole winding (slow) corresponding to 7½ i.p.s. and

one 4 pole winding (fast forward) corresponding to 22½ i.p.s.

Each speed has its own independent control.

Relay E is controlled by the cartridge microswitch. When unenergized both triac gates are shorted to their cathodes and hence the motor does not operate.

When Relay E is energized by insertion of a cartridge in the machine, contact RLE1 allows 90 degree phase leading current to fire Triac 1 via its gate, R94 and C58.

Note: The gate current is at its maximum when the voltage across the triac is at its minimum (zero voltage switching).

Triac 2 is prevented from switching ON because the normally closed contact of RLD1 diverts all control current from C57 away from the

gate of Triac 2. When "fast forward" is initiated RLD1 changes over, shorting the gate of Triac 1 and allowing Triac 2 to fire at the next zero voltage crossover point. Since gate drive is lost from Triac 1, it will switch off when the triac current passes through zero.

The motor is rated for operation from 117 volts, but is run from the 110 volt tapping of the power transformer to reduce power dissipation.

2.5 RECORD CIRCUIT: (CHANNEL 2 COMPONENTS INDICATED IN BRACKETS)

2.5.01 GENERAL DESCRIPTION:

The Cuemaster 900 Series record modules (903R and 983R) house all the necessary electronics to convert a record/replay deck to a record/replay machine.

The module is designed to fit into the righthand slot of a twin 900 Series housing. The appropriate recording deck (903 or 983) is housed in the lefthand slot and is interconnected to the 903R or 983R via a "flying" loom.

2.5.02 THE RECORD/PLAY BISTABLE:

There are eight controls to and from the bistable:

1. RECORD/PLAY push buttons.
2. PLAY Reset at the end of message. This control comes from the START/STOP bistable which injects a resetting pulse (5 msec) into the base of Q32. The effect of this is to return the RECORD/PLAY bistable to the PLAY mode whenever the transport is stopped. This is used as a safeguard to prevent double recording.
3. Record lockout line in the collector circuit of Q32 prevents the RECORD mode being selected when rear panel terminal RC12 is earthed, or front panel record lockout button is pressed in.

   Note: This line also prevents the 1 kHz, 150 Hz and 8 kHz Cue Record Oscillators from operating, and locks out the Cue Erase function.

4. The cartridge lockout line, in the base circuit of Q32 prevents selection of Record mode unless a cartridge has been correctly loaded.

   Note: The cartridge lockout line also prevents starting of the motor and operation of the transport solenoid.

5. Bias oscillator control. This line from the collector of Q33 to the base of Q34 controls the operation of the 100 kHz bias oscillator, once START mode has been selected.
6. Field Effect Transistor Q24 (Q30) bypasses the programme record head in the play mode, allowing bias to be used for recording or erasing cuetones without reaching the programme record heads.
7. Resistor R28 from the collector of Q33 provides control for the 1 kHz Cue Record Oscillator Timer if RECORD mode is energized before START mode. If RECORD mode is energized after START mode, no 1 kHz stop cue is recorded.

8. Relay Contact C1 operates front panel RECORD/PLAY push button lights and remote RECORD indication.

2.5.03 BIAS OSCILLATOR:

In order to minimize recorded distortion, a high frequency bias is applied to the record heads with the recorded signals.

A push-pull Class C oscillator (Q49, Q50 and L3) is used to generate a low distortion high voltage bias signal at 100 kHz.

The oscillator has a controlled rise and fall time to eliminate recorded "Clicks".

The oscillator is energized whenever RECORD and START modes are selected or CUE ERASE button is pressed. Transistors Q34 and Q48 control the switching of the oscillator and C16 controls the rise and fall time of the bias envelope.

2.5.04 CUE TRACK RECORD:

Parallel resonant circuit L5 and C42 remove bias from the Cue Signal Line. The three Cuetone Record Oscillators provide current feed of their respective frequency signals through a 47k preset potentiometer into the Cue Record Head Signal Line.

Optimum bias for the Cue Head is adjusted by C41.

2.5.05 PROGRAMME HEAD DRIVER:

The head driver consists of a fully equalized circuit providing feedback controlled current drive to the programme track of the record head with independent flat gain trim and wide range high frequency trim to allow for variations in tape types, bias erasure, head wear and head characteristics.

Transistor Q22 (Q28) and associated components form a 1.6mA constant current source of approximately 50 kohm. impedance.

Transistor Q21 (Q27) is a compensated voltage amplifier which feeds head driver transistor Q23 (Q29). Trim-pot RV2 (RV5) adjusts the quiescent voltage on the collector of Q23 (Q29).

Trim-pot RV1 (RV4) adjusts the high frequency boost current required to give a flat playback response. Typical boost of this trim-pot is 6 dB at 10 kHz.. Mid band gain of Q21 (Q27) is -6 dB.

Head drive current at mid band frequencies is:

$$I_H = \frac{V \text{ input}}{13} \text{ mA}$$

Resonant trap L4 (L11) and C9 (C23) isolates the 50v P-P bias signal on the record head from the Programme Head Driver.

Optimum bias is adjusted by trim capacitor C34 (C35).

2.5.06 1 kHz CUE RECORD TIMER AND OSCILLATOR:

Transistors Q51 and Q52 form a monostable multivibrator with a period of about 500 ms. Q52 is the power supply control for 1 kHz Cue Record Oscillator. Diode CR7 prevents operation of the timer when the record lockout line is energized.

The 1 kHz oscillator is a tuned collector oscillator (tuned by coil L2a and C22). Secondary coil L2b provides both positive feedback to transistor Q53 and output voltage sufficient to drive the Cue Record Head. Record drive is controlled by trim-pot RV3.

Note: Since C22 is a polarized tantalum capacitor, the return supply voltage of L2a is 10 volts to keep the D.C. voltage across C22 in the polarized direction.

2.5.07 CUE/PROGRAMME ERASE - MONO MACHINES:

Relay F selects which track is erased. When F is not energized, bringing up bias in either RECORD or PLAY-PROG-ERASE mode will erase programme track.

When F is energized in PLAY-CUE-ERASE or recording a cue in the PLAY mode Cue erase head will be selected and cue track erasure will occur.

2.5.08 CUE ERASE - STEREO MACHINES:

As three track "combo" (erase/record) heads are unavailable at the present time, cue erasing is achieved by using a high bias level on the cue record head. The approximate levels to which a cuetone recorded to NAB levels are erased are:

8 kHz	-	100%	(50dB)
1 kHz	-	99%	(34dB)
150 Hz	-	95%	(26dB)

This level of erasure is quite acceptable since most cuetone detectors do not operate over a range of more than 12dB.

Cue erase button SW5 energizes the bias oscillator via diode CR11 if the record bistable is in the PLAY mode and none of the cue record buttons are pressed. Contact F1 applies full bias to the cue record head causing tape erasure.

Pressing a cue record button while erasing will cause Relay F to drop out and the selected cuetone will be recorded with normal bias conditions. When this cue record button is released erasure will resume.

2.5.09 CUE RECORD IN THE PLAY MODE:

Provision has been made to record any of the three cuetones in the play mode. If the 1 kHz (AUX1, AUX2) button is pushed, the appropriate monostable is energized to record that cuetone. Bias is automatically energized via control diode CR21 (CR12, CR17).

2.6 MONITOR CIRCUIT (BRACKETS INDICATED CHANNEL 2 COMPONENTS)

2.6.01 RECORD INPUT BUFFER:

Input transformers are terminated with 10 kohm potentiometers giving a 10 kohm input impedance. A 600 ohm termination is achieved by switching in 680 ohm resistors. Q20 (Q26) is a high input impedance unity gain buffer amplifier presenting a low drive impedance to the programme head driver input. Output from Q20 (Q26) is also used to drive the meter amplifier and monitor headphones when Record Monitor Switch is selected.

2.6.02 METER MONITOR AMPLIFIER:

Q54 and Q55 (Q62 and Q63) form an NPN-PNP feedback pair with a gain of 20dB, the output of which drives the VU meter and phones monitor amplifier via RV20 (RV23).

Inputs to the amplifier can be selected from Record input level by selecting:

Play output level by selecting:	SW8A (B)
	SW7A (B)
Bias level by selecting:	SW9A (B)
Cue output by selecting:	SW10A (B)

2.6.03 HEADPHONE MONITOR AMPLIFIER:

Q56 (Q61) forms a 6dB phones amplifier with an output impedance of 1 kohm. Virtually any impedance headphones may be used.

2.7 AUXILIARY CUE RECORD OSCILLATORS:

Operation of both auxiliary cue record oscillators is the same and hence AUX Cue 1 circuit only is described.

Transistors Q42 and Q43 form a monostable multivibrator with a period of about 500 ms. AUX Cue 1 record button SW9A triggers the monostable so that transistor Q43 conducts for the timing period, or as long as SW9A is depressed, supplying power to the 150 Hz oscillator circuit.
The oscillator is a tuned collector circuit with frequency determined by coil L8a and C43. Coil L8b provides positive feedback to the base of Q44 as well as sufficient signal to the cue record head via AUX. cue record level control RV6.

During the timing period of the monostable, transistor Q43 conducts and via diode CR12 causes the bias oscillator to generate bias for recording the cuetone. This allows for cuetone recording when the machine is in the PLAY mode.

Diode CR13 grounds the collector of Q42, and prevents cue oscillator operation when the record lockout line is activated.

CHAPTER 3 ALIGNMENT PROCEDURES

3.1 PRELIMINARY CHECK LIST:

3.1.01 With the main switch on check that the DC supply rail is between 22 and 25 volts and the STOP lamp is lit.

3.1.02 Insert a cartridge in the cartridge slot, check that the READY light is lit and that the motor turns.

3.1.03 Push the START button - check that START lamp lights and the STOP lamp extinguishes, the pressure roller solenoid operates and the tape is drawn past the heads at 7½ inches/second.

3.1.04 Push the FAST FORWARD push button and check that the FAST FORWARD lamp lights and the tape speeds up to 22½ inches/second.

3.1.05 Push the STOP button and check that the solenoid releases, the tape stops, the motor reverts to low speed, the FAST FORWARD and START lamps extinguish and the STOP lamp lights.

3.1.06 Remove the cartridge, check that the READY light extinguishes and the motor stops.

3.2 PROGRAMME CHANNEL ALIGNMENT ; (BRACKETS INDICATE CHANNEL 2 COMPONENTS)

3.2.01 Demagnatize the play head, ensure the play head height is correct, dummy head is vertical and mechanical alignment of solenoid, motor and pressure roller is correct (Chapter 4).

Note: Turn off power before demagnetizing heads.

3.2.02 Insert an azimuth alignment tape (15 kHz tone) in the cartridge slot and push the START button.

3.2.03 With a suitable A.C. Voltmeter and 600 ohm load plugged into the audio output, set the azimuth to peak the output on the meter. This is achieved by slackening the azimuth locking screw (3/32 inch Allen Key) and rotating the azimuth adjusting screw (5/64 inch Allen Key).

Note: Beware of secondary peaks on either side of the true azimuth setting.

3.2.04 Using a standard Cuemaster alignment tape (IEC 750 for IEC or CCIR compensation or NAB 750 for NAB compensation) check the overall frequency response (±2dB 50 Hz to 12 kHz and ± 3dB 40 Hz to 15 kHz).

Set H.F. potentiometer RV5 (RV2) to give a flat response.

Note: RV5 has about 3 times the effect at 15 kHz than it does at 1 KHz.

3.2.05 Set up the reference level (0 VU) on the alignment tape to + 8dBm using potentiometer RV6 (RV3).

3.2.06 Using a blank cartridge (no tape) in the cartridge slot energize the START button and adjust stray field cancellation potentiometer RV4 (RV1) to give minimum output noise.

Note: The position of the stray field cancellation coil may need to be shifted to obtain maximum "hum" cancellation. The noise level should be less than - 42dBm, i.e. a signal to noise ratio of 58 dB with respect to peak recorded level (+ 16 dBm).

3.2.07 Check that the noise level is less than -50dBm when in the Fast Forward mode or transport is stopped.

3.2.08 Insert a cartridge recorded with 0 VU at 1 kHz and energize the START button. The audio output level should be + 8dBm. Energize the FAST FORWARD button. Audio should be cut off with a resulting output level of less than -40dBm.

3.3 CUE CHANNEL ALIGNMENT:

3.3.01 Ensure mechanical alignment is correct, play head is demagnetized and azimuth has been set up as per 3.2.03.

3.3.02 Using NAB 900 or IEC 900 test tapes monitor the output of the cue amplifier at Test point 5. Set the cue gain potentiometer to give a level at T.P. 5 of -6dBm ± 3dB at the three cuetone frequencies.

Notes:

1. The rear panel INHIBIT switch must be set to "IN" to prevent the machine from going into the fast forward mode when AUX.1 cue (150 Hz) has ended.
2. Test point 7 in the 1 kHz cue filter must be earthed to prevent the transport from "cueing out" on the 1 kHz stop cue.

3.3.03 Remove Test Point 7 "earth" and keep the rear panel INHIBIT switch in the IN position. Using the above cartridge check that:

1. When a 1 kHz cuetone is being played, the guard timer allows the transport to run between 1 and 2 seconds after start button has been pressed before stopping.
2. The 150 Hz cuetone operates AUX.1 relay RLB.
3. The 8 kHz cuetone operates AUX.2 relay RLC.

3.3.04 Put the rear panel INHIBIT switch into the OUT position and use the above test tape. After the 150 Hz cuetone has ended, the motor should speed up to 22½ i.p.s. (3 times normal speed) and remain there until the "stop" cuetone at the start of the tape releases the solenoid, stops the tape and returns the motor to its normal speed (7½ i.p.s.)

3.4 DETAILED CUE FILTER CHECKS:

3.4.01 Tape a short piece of wire across head gaps (i.e. vertically) and feed a 600 ohm oscillator into the wire. This will generate a constant flux in the head.

3.4.02 Monitor cue output at TP5 and adjust input to give a level of about -20dBm at TP5.

3.4.03 Using the table below measure the response of the three cuetone filters at Test Point 7 (stop cue) Test Point 10 (AUX.1 cue) and Test Point 12 (AUX.2 cue)

Note: The responses on the table are in dB with respect to the voltage at Test Point 5 and indicate the tolerances required.

Cuetone & Test Point	Frequency						
	50Hz	150Hz	450Hz	1kHz	3kHz	8kHz	24kHz
Stop TP5	≮-20	≮-20	≮-10	+6±2dB	+2±2dB	≮-12	≮-20
AUX.1 TP8	≮+1	+6±2dB	≮-12	≮-20	≮-20	≮-20	≮-20
AUX.2 TP12	≮-20	≮20	≮-20	≮-20	≮-10	+6±2dB	≮+2

3.4.04 Push cartridge microswitch and start the transport.

3.4.05 Set the oscillator frequency to 1kHz and increase the level at Test Point 5 until the machine cues off. This level should be between -16dBm and -10dBm.

3.4.06 Set the oscillator frequency to 150Hz and increase the level at TP5 until Relay RLB operates. this level should be between -16dBm and -10dBm.

3.4.07 Set the oscillator frequency to 8kHz and increase the level at TP5 until Relay RLC operates. This level should be between -16dBm and -10dBm.

3.4.08 Replace Cue head plug.

3.4.09 To check the drop out time of the solenoid a specially prepared cartridge is required viz. Record stop cuetones (1kHz) at the appropriate level every 3 to 4 seconds on a 30 second cartridge. Using a triggered oscilloscope correct the "Y" amplifier input to the cue channel output (Test Point 5). Set the C.R.O. trigger level so that it triggers on the replayed cuetone.

Note: Do not "free run" the time base.

Set the C.R.O. time base to 10 milliseconds per centimeter and start the transport. After about 3 seconds the transport will stop when the prerecorded stop cue arrives at the replay head. This signal will trigger the time base and some time later (the "dropout" time) the replayed signal will drop to zero. This "dropout" time

as measured on the C.R.O. should be between 20 and 35 milliseconds.

Note: The solenoid pole adjustment can vary this time from one extreme to the other (see Chapter 4).

RECORD CHANNEL

3.5 BIAS OSCILLATOR:

3.5.01 With an empty cartridge in place in the deck, energize both Run and Record functions, which should bring the bias oscillator on.

3.5.02 Using suitable measuring equipment set oscillator frequency to 100 kHz ± 500 Hz, measuring from TP7.

3.5.03 Check that output level at Test Point 6 is 38 volts RMS ± 4 volts.

3.5.04 Check that bias envelope builds up and decays with a time constant of between 5 and 15 milliseconds and is free from abrupt changes in level during rise and fall phases.

3.5.05 Check that bias is not generated when either Record or Start functions is energized alone.

3.5.06 With START function energized, and RECORD function de-energized, i.e. play mode, check that Cue Erase button brings bias on at about the same level (within ± 2 volt RMS) as before and that bias signal is coupled directly to Cue Track Erase Head winding.

3.5.07 Check that bias is generated when the Cue Erase button is pushed in the play mode and the Cue Erase Relay (F3) is not energized in the Record mode.

3.5.08 Check that TP14 is at earth potential at all times, except when RECORD mode is selected and rotary switch SW16 on record gain pot RV9 is in the on position, when the potential should be in excess of 15 volts. Similar potential should also exist at TP17 when RECORD is selected and SW13 is in the on position.

Check that with RECORD and START energized, that bias voltage on RH7 (Record Head Connector) can be increased to greater than 40 volts P-P before distortion occurs, and that FET Q24 reduces bias to less than 2 volts, P-P when switch SW13 is in the off position.

Note: A low capacitance probe is required (less than 5PF) to make these measurements.

Similar figures apply to RH2 and Q30 for channel 2.

Note the above provisions allow either channel 1 or channel 2 to be independently recorded without erasing information on the other channel, by rotating the unwanted channel record gain potntiometer to its fully anti-clockwise position (to operate the potentiometer switch SW13 or SW14.)

3.5.09 Energise RECORD and START functions, select Bias VU meter function (SW4) and adjust bias level preset pot (RV12) to give 0 VU indication on meter.

3.6 CUE TONE OSCILLATORS:

3.6.01 Connect Test Point 10 to earth (this brings on the 1 kHz Cue Oscillator continuously), and set 1 kHz drive preset (RV3) pot to minimum position (wiper earthed). Check that bias is also being generated.

3.6.02 While monitoring from Test Point 11, tune 1 kHz oscillator potcore L2 to 1 kHz ± 50 Hz.

3.6.03 Check that emitter wave form of Q53 has a clearly defined dip in the top of about 15 to 30% of the amplitude of the projected sinusoid form.

3.6.04 Check that output level at Test Point 11 is between 4 and 8 volts P-P.

3.6.05 Release Test Point 10 and check that oscillator is keyed for 0.3 to 0.7 seconds when Stop Cue button is pressed.

3.6.06 Operate Record Lockout function and check that the oscillator can be brought on momentarily by earthing Test Point 10, but not by pressing the Stop Cue Record button.

3.6.07 Connect Test Point 26 to earth (Auxiliary Cue Record Board) to bring on 150 Hz oscillator continuously and set 150 Hz drive preset pot (RV6) to minimum position. Check that bias is also being generated.

3.6.08 While monitoring from Test Point 24 tune 150 Hz oscillator potcore L8 for 150 Hz ± 5Hz output.

3.6.09 Adjust oscillator level preset pot (RV7) so that Q44 emitter wave form has a similar dip to that in the 1 kHz oscillator (3.6.03 above).

3.6.10 Recheck output frequency, adjust if necessary, and check that output level at Test Point 24 is between 4 to 8 volts P-P.

3.6.11 Release Test Point 26 and check that the oscillator is keyed as in 3.6.05 above when AUX. Cue 1 button is pressed.

3.6.12 Connect Test Point 28 to earth to bring on 8 kHz Cue oscillator and set 8 kHz drive pot (RV8) to minimum position. Check that bias is generated.

3.6.13 While monitoring from Test Point 27, set the frequency to 8 kHz ± 500 Hz using 8 kHz oscillator potcore (L9) tuning slug.

3.6.14 Check that Q47 emitter wave form is similar shape to the 1 kHz oscillator wave form (3.6.03 above).

3.6.15 Check that output level at Test Point 27 is between 4 - 8 volts P-P.

3.6.16 Release Test Point 28 and check that the oscillator is keyed as in 3.6.05 above, when AUX.Cue 2 button is pressed.

3.6.17 Carry out the record lockout test (3.6.06), checking by earthing Test Point 28.

PROGRAMME RECORD FUNCTION:

3.7 RECORD INPUT BUFFER AND HEAD DRIVER BASIC SETUP:

3.7.01 Check that input bridge/termination switch (SW11 and SW12) changes input impedance from 600 ohms to a nominal 10,000 ohms.

3.7.02 While monitoring the emitters of Q20 and Q26, check that frequency response from line input at maximum setting of Record gain controls (RV9 and RV15) at a level of 0dBm is flat within ± 0.5dBm with respect to 1 kHz from 30 Hz to 15 Hz.

3.7.03 With same settings, check that clipping level is in excess of 6 volts peak to peak at 1 kHz.

3.7.04 While monitoring Test Point 12 and 15, adjust Q21 and Q27 emitter, preset pots (RV2 and RV5) to give 12 volts D.C. at each point.

3.8 PROGRAMME OVERALL ALIGNMENT:

Note: Perform replay alignment before commencing 3.8. Ensure line outputs are terminated with 600 ohms.

3.8.01 Set H.F. boost presets (RV1 & RV4) to minimum position, insert empty cartridge in deck and bring on Record and Start functions. Adjust both record gain pots to minimum without turning the switch to the off position.

3.8.02 While monitoring from Test Points 12 & 15, adjust programme bias traps L4 & L11 for minimum residual bias with programme bias feed trimmers C34 & C35 approximately one half engaged. Residual bias level should not exceed 2 volts Peak to Peak at this point.

3.8.03 Place an erased cartridge in the deck and while monitoring the play channel line output, feed a 1 kHz signal into the line inputs at 0dBm and adjust record gains RV9 & RV15 to give approximately 0dBm line output.

3.8.04 Adjust Programme Bias Trimmers C34 & C35 to give maximum play channel output. Readjust record gains RV9 & RV15 to give +8dBm play channel output. Readjust C34 & C35 if necessary to peak the play channel outputs.

3.8.05 With record gains RV9 & RV15 as set in 3.8.04, select Record monitor function (SW1a & b) and adjust record level preset pots on monitor board (RV11 & RV17) to give 0 VU meter indication.

3.8.06 With input bridging switch in the 600 ohms position, feed a 1 kHz signal into the line inputs at +8dBm level, as indicated by an A.C. volt meter, connected to the line inputs. Select RECORD mode and START mode and adjust the record gain potentiometers to give +8dBm at the line outputs. This setting gives unity overall gain (0 VU in, 0 VU out). Loosen the record gain knob locking nuts (accessible by removal of plastic cover on front of knob) and adjust the knob position so the white index line is opposite the vertical black line on the front panel. Tighten nuts and replace covers.

3.8.07 Set Record gain pots RV9 & RV15 to maximum position and check that input level required to give +8dBm line output at 1 kHz is less than -8dBm.

3.8.08 Adjust the record head azimuth to give in phase signals at some suitably high frequency (10-15 kHz) using a Lissajous figure on a C.R.O. screen. Adjust H.F. boost pots (RV1 & RV4) to give the same output at 10 kHz as produced by the standard test tape at this frequency, relative to 1 kHz. Note on mono machines peak output at 15 kHz.

3.8.09 Check that overall frequency response at this level is within ±2dB from 50 Hz to 12 kHz with respect to 1 kHz and within ±3dB from 40 Hz to 15 kHz.

3.8.10 Set oscillator frequency to 1 kHz and adjust input level so line output is +16dBm and check that overall harmonic distortion is not greater than 2.5% RMS total. Increase level to give +20dBm line output and check that overall distortion is less than 4% total.

3.8.11 Remove input signal source and leave input termination on 600 ohms. Check that residual noise outputs from play channels is more than 52dB below 16dBm peak level for stereo, and 54 dB for mono

3.8.12 Readjust output to +8dBm at 1 kHz and readjust monitor function as in 3.8.05 above, if necessary.

3.9 CUE TRACK RECORD FUNCTION:

3.9.01 Bring on Start and Record functions and while monitoring from Test Point 8, with Cue bias trimmer (C41) set to approximately maximum capacitance, tune Cue Track Bias Trap L5 for minimum residual bias. (Less than 2v P-P).

3.9.02 Connect Test Point 10 to earth to bring 1 kHz oscillator continuously on. With erased cartridge in place, and machine in the START mode, adjust 1 kHz drive, preset pot (RV3) to give -20dBm output at Test Point 5 on replay board, adjust Cue Track bias trimmer (C41) for maximum output at Test Point 5 (Cue Play Amp Output). After setting bias, adjust drive pot for -6dBm at Test Point 5. Free Test Point10.

3.9.03 Connect Test Point 26 to earth to bring 150 Hz oscillator continuously

on and with erased cartridge in place adjust 150 Hz drive pot to give -6dBm output at Test Point 5 on replay board.

3.9.04 Connect Test Point 28 to earth to bring 8 kHz oscillator continuously on then adjust 8 kHz drive pot to give -6dBm output at Test Point 5 on replay board.

3.9.05 Check that the Cue Erase erases 150 Hz cue at least 90%, 1 KHz cue at least 95% and 8 kHz cue at least 99% on stereo machines and complete erasure on mono machines.

3.9.06 Check that pressing any of the cue record buttons with the cue erase button pressed, results in a satisfactorily recorded cuetone, while in the PLAY mode.

3.10 OVERALL CHECKS:

3.10.01 Check that all front panel functions operate as intended and that the audible monitor and gain control operates.

3.10.02 Check that all inputs and outputs are fully floating.

3.10.03 Check that all remote control and monitoring functions operate correctly.

3.10.04 Check that Auxiliary Cue Outputs operate correctly.

3.10.05 Check that machine does not "cue off" immediately after a stop cue is recorded.

3.10.06 Check that transport does not automatically "fast forward" when an AUX1 tone is recorded.

CHAPTER 4 MECHANICAL SET UP PROCEDURE

4.1 INTRODUCTION

The 906 machine incorporates several precision mechanical components. A correct understanding of their operation and method of adjustment is essential for effective maintenance and running repairs to the machines. This chapter is devoted to these aspects.

4.2 DISASSEMBLY OF THE MACHINE

Serviceability of Cuemaster 906 was a primary design requirement since it is intended for use in consoles and racks as well as table mounting. For this reason, all electronic and mechanical components are attached to the deck, so the whole deck assembly can be partly or fully withdrawn from its housing without using tools. This facilitates normal daily head cleaning and monthly lubrication as well as full alignment checks.

All incoming and outgoing plugs are the "lock in" type so the machine will operate when partly withdrawn from its housing.

Note: When the machine is delivered, two transport screws are used to lock the deck to the housing. These 4BA x 3/8" screws are located at the rear of the machine housing on the slide returns. Removal of these screws allows the deck assembly to be withdrawn from its housing.

The Precision Head Mount Assembly, pressure roller solenoid, programme channel electronics, cue channel electronics, and power supply power transistor are located on the top of the deck.

On the underside of the deck is the direct drive capstan motor, power transformer, audio output transformer, solenoid power supply, 24 volt regulated power supply, and the two speed motor supply.

4.3 THE SOLENOID:

The solenoid is a full travel device which draws the pressure roller, via the toggle and crank mechanism, from below deck level to the full upright position and maintains it firmly pressed against the capstan. To reduce audible operating noise, pneumatic damping of forward and return strokes is employed. The armature is a close tolerance fit in the solenoid bore, resulting in very little air leakage when the armature is drawn in or released quickly.

A needle valve at the rear of the solenoid controls the release of air when the armature is drawn in. Screwing the needle in restricts air release and increases the cushioning of the pull in stroke. Unscrewing it allows air to escape more easily and reduces the cushioning effect.

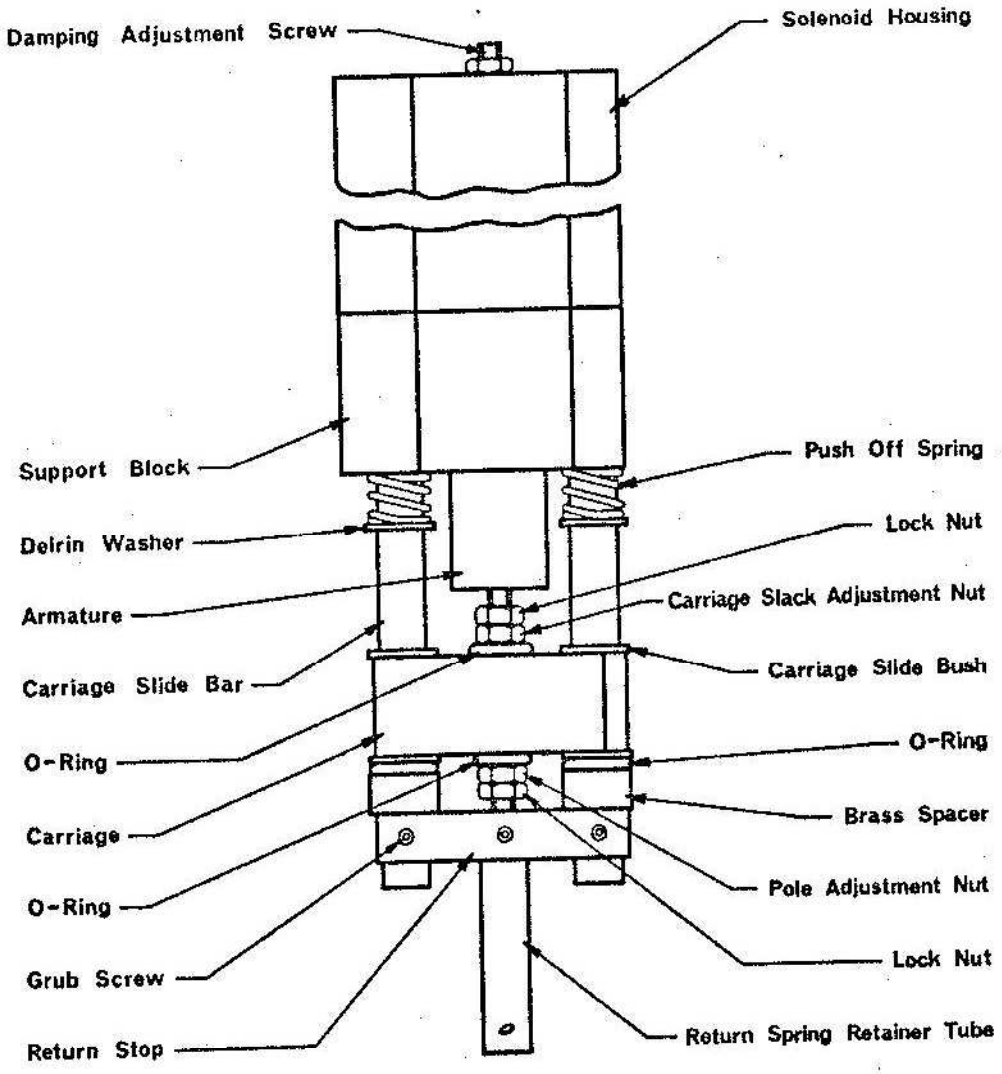
4.3.01 ARMATURE POLING:

If the solenoid has been removed from the machine, it will be necessary when re-installing, to ensure that the pressure roller shaft is precisely vertical (± 1 degree), when the solenoid carriage is drawn in. This precaution should be taken to prevent the need for readjustment due to interruption between poling and pressure roller settings. This is done as per section 4.3.03.

Adjustment of the pole position is carried out by rotating the adjusting nuts on the screw, coupling the armature to the solenoid carriage.

Note: Before adjusting poling, remove damping by unscrewing the Damping adjustment screw.

Loosen the lock nuts on the armature screws and back off the Carriage Slack Adjustment Nut. Operate the START and STOP buttons several times while activating the Cartridge Microswitch manually. If the armature produces a sharp metallic sound when drawn in, the Pole Adjustment Nut must be turned clockwise (viewing from the front of the machine) to draw the armature away from the poling position.



CUEMASTER SOLENOID

The armature should be set to a position such that the force required to pull the armature/carriage assembly away from its closed position is from 4 lb. to 10 lb. The correct position having been found, adjust the Carriage Slack Adjustment Nut, so the carriage has minimum back and forward movement.

Note: Excessive slack will result in noisy operation. Compression of "O" rings can result in carriage mis-alignment which causes binding on the slide bars.

The lock nuts should then be screwed up, taking care that the Pole Adjustment and Slack Adjustment nuts are not rotated in the process.

4.3.02 DAMPING ADJUSTMENT:

Note: Before adjusting damping, ensure that the brake spring inside the cartridge to be used is not deformed or excessively heavy.

Insert the cartridge and loosen the lock nut on the Damping Adjustment Screw at the rear of the solenoid. Operate the START and STOP buttons several times while adjusting the screw, until the solenoid pulls in positively and remains in firmly with minimum noise.

4.3.03 PRESSURE ROLLER POSITION IN RELATION TO CARRIAGE AND CAPSTAN:

If the solenoid has been removed from the machine, it is important when re-installing that the correct position is found before finally tightening the solenoid mounting screws. This position is such that with the Solenoid Carriage pressed hard against the Push Off Springs the pressure roller is parallel to the capstan and is dimpled .015" - .020". This results in a contact distance between pressure roller and capstan of between 1/16" and 3/32" of the pressure roller circumference.

If the motor has been removed from the machine, it is essential that it be correctly re-installed. Tighten the three mounting screws until they just "nip".

Adjust motor position so that with the pressure roller vertical, there is .015" to .020" dimple in the pressure roller.

Do not alter the toggle arm with respect to the cross-shaft as this will result in the pressure roller shaft and capstan not being parallel when the solenoid is drawn in, causing the tape to be driven up or down between the capstan and pressure roller.

4.3.04 PRESSURE ROLLER DOWN POSITION:

If the solenoid has been removed and replaced, it may be necessary to adjust the pressure roller return position so that, with the solenoid unenergized, the pressure roller rests just below deck level. Loosen the two grub screws securing the Return Stop to the ends of the carriage slides and slide the Return Stop until the pressure roller is just below the deck. Retighten the screws.

4.3.05 SOLENOID DROP-OUT TIME:

With the solenoid adjusted as above, the drop-out time should be below 35mS. A typical figure is 30mS. This can be measured by connecting an internally triggered C.R.O. to the cue channel output

(TP5). A pre-recorded tape is used which has 1 kHz stop cues recorded at 3 - 5 second intervals.

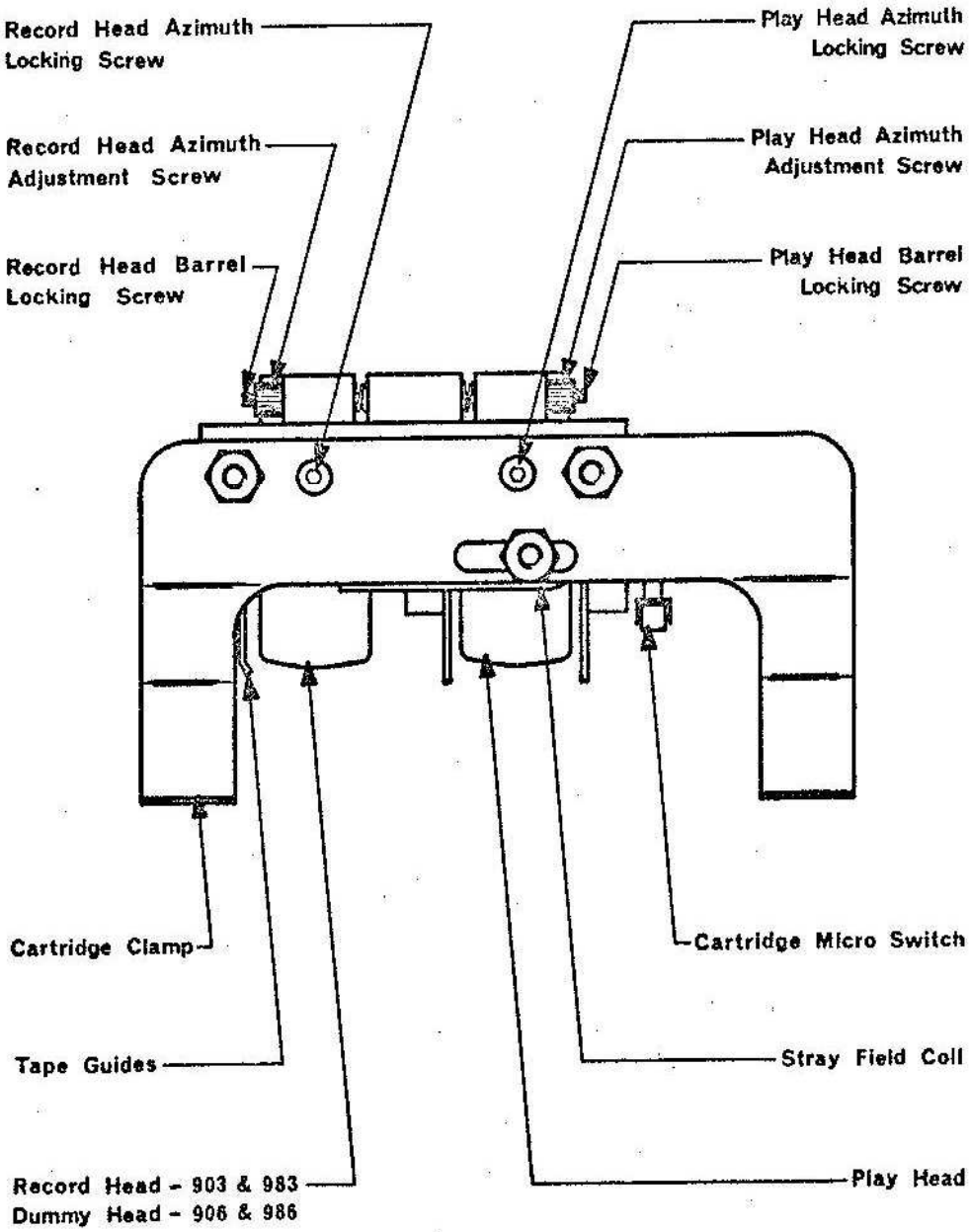
Operation of the START button will run the tape. When a cue pulse is reached the C.R.O. will be triggered and a 1 kHz signal will appear on the screen until the tape stops. The duration of the signal, from the cue pulse to the solenoid release is a drop-out time.

If the drop-out time is excessive, the hold in force of the solenoid can be decreased by very small adjustments until satisfactory time is achieved. Hold in force must be in excess of 3 lb.

4.4 HEAD MOUNT ADJUSTMENTS:

The head mount must not be removed from the deck since its position with respect to the capstan has been precisely checked. The cartridge clamp, however, may be removed if required.

Azimuth adjustments are carried out by loosening the azimuth locking screws on top of the head mount and adjusting the azimuth adjusting screws at the rear. See Section 3.2 for details of adjustments.



CUEMASTER HEAD MOUNT
(Top view)

4.4.01 HEAD ASSEMBLY:

To remove a head, first unsolder all connections of the appropriate head leads. Remove the cartridge clamp and, using a .050" Allen Key, unscrew the small grub screw securing the head mounting barrel in the azimuth arm at the rear of the head mount. The head and head mounting barrel can then be withdrawn from the front after slackening the azimuth locking screw.

To replace a head, first pass the head leads through the barrel taking care not to damage the shielding. Screw the barrel firmly onto the head mount casing.

Note: Distortion of the head casing or head mounting barrel during this process could result in the heads being out of square with the deck face and also pole height variations in relation to the tape guides.

Insert the head mounting barrel into the head mounts and azimuth arm with head identification number facing upward and adjust the azimuth arm to approximately mid position of its range. With the head casing held firmly against the head mount face, rotate the head to a position as near to vertical as can be determined visually and tighten the azimuth locking screw. With the azimuth arm held firmly against the rear of the head mount, tighten the barrel to azimuth arm locking screw.

Check that the head face is perpendicular to the deck surface. Also check pole height with relationship to tape path. This can be checked visually by running a cartridge without its cover and comparing pole height in relation to tape edge. Small variations observed by this method are probable distortion of the head case. This can usually be corrected by gentle pressure to the top or bottom of the head casing.

4.5 REGULAR MAINTENANCE:

4.5.01 Clean head and pressure roller and capstan every four hours of actual playing time using a soft cloth dipped in methylated spirits.

4.5.02 Lubricate pressure roller bearing cross-shaft and solenoid toggle link with two drops each of light machine oil every 1,000 hours of operation, or every three months. Take care not to leave any oil on the pressure roller rubber.

4.5.03 Lubricate motor ball bearings by stripping and repacking with a light grease every six months or 2,000 hours operation. Keep grease well away from roughened section at the top of the capstan shaft.

4.5.04 Strip and thoroughly clean solenoid armature and slide bars every year.

Note: Do not lubricate these components, as the lubrication tends to pick up dust and cause faulty operation of the solenoid. See section 4.3 for solenoid realignment procedure.

CHAPTER 5

SPARE PARTS LISTING

	CUEMASTER 906, 903, 986, 983,	PART NUMBER
	DESCRIPTION	
	FRONT PANEL ASSEMBLY	
	Ready Light	083098
	Push Button Unit	083099
	Green Lens	083102
	Red Lens	083108
	Yellow Lens	083118
	Lamp - P/B	083101
	Mains, Toggle Switch	083075
	REAR PANEL ASSEMBLY	
	Audio O/P Socket	082065
	Mains I/P Socket	082027
	Slide Switch	083026
	Fuse Holder	082910
	19 Pin Socket	082188
	P.C.B. & MECHANICAL ASSEMBLY	
	26 Pin P.C.B. Connector	082077
	16 Pin P.C.B. Connector	082074
	Motor Supply P.C.B. - Assy.	40-848
	Power Supply P.C.B. - Assy.	40-831
	Power Transformer TP5689	04031
906,903	Output Transformer TA2536	04315
986,983	Output Transformer OT837 "A"	04321
	42H UMC Motor (Large)	21-031
906	Head Mount Kit - Assy.	23-756
903	Head Mount Kit _ Assy.	23-757
986	Head Mount Kit - Assy.	23-758
983	Head Mount Kit - Assy.	23-759
	Cartridge Clamp	11-757
906,903	Mono Play Board P.C.B. - Assy. NAB	40-841
906,903	Mono Play Board P.C.B. - Assy. IEC	40-842
986,983	Stero Play Board P.C.B. - Assy. NAB	40-843
986,983	Stero Play Board P.C.B. - Assy. IEC	40-844

	LILLIPUT LAMPS	084030
903R	TOGGLE SWITCH	083075
903R	VU METER	070012
983R	VU METER	070015
903R	METER ESCUTCHEON	13-067
	STOP INHIBIT P.C.B. - ASSY.	40-849
903R	MONITOR P.C.B. - ASSY.	40-846
983R	MONITOR P.C.B. - ASSY.	40-847
	PUSH BUTTON UNIT (LARGE)	083099
	RED LENS	083108
	BLUE LENS	083106
	LAMP	083101
	KNOB)	09021
	COVER PLATE) GAIN CONTROL	09022
	FIGURE DIAL)	09023
	NUT COVER	09024
	PHONES SOCKET	082194

REAR PANEL

	SLIDE SWITCH	083026
	CANNON SOCKET	082431
	19 PIN SOCKET	082202
	15 PIN SOCKET	082189

P.C.B. & MECHANICAL ASSEMBLY

	INPUT TRANSFORMER TA2535	04316
983R	32 PIN P.C.B. CONNECTOR	082072
903R	26 PIN P.C.B. CONNECTOR	082077
	9 PIN P.C.B. CONNECTOR	082070
	22 PIN P.C.B. CONNECTOR	082196
	AUX. CUE REC. P.C.B. - ASSY.	40-818
983R	RECORD P.C.B. - ASSY. NAB	40-821
983R	RECORD P.C.B. - ASSY. IEC	40-822
903R	RECORD P.C.B. - ASSY. NAB	40-823
903R	RECORD P.C.B. - ASSY. IEC	40-824
903R	7 PIN HEAD CONNECTOR	082054

	SOLENOID ASSY.	40-526
	PRESSURE ROLLER	23-1028
	CARTRIDGE GUIDE L.H.	11-776
	CARTRIDGE GUIDE R.H.	11-758

HEAD MOUNT KIT

	HEAD MOUNT BODY	23-643
	H'BACKING COIL - ASSY.	23-528
	MICROSWITCH	083076
	7 PIN CONNECTOR	082054
	4 PIN CONNECTOR	082201
906, 903	PLAY HEAD	05119
986, 983	PLAY HEAD	05116
906, 986	DUMMY HEAD	16-434
903	RECORD HEAD	05134
983	RECORD HEAD	05115

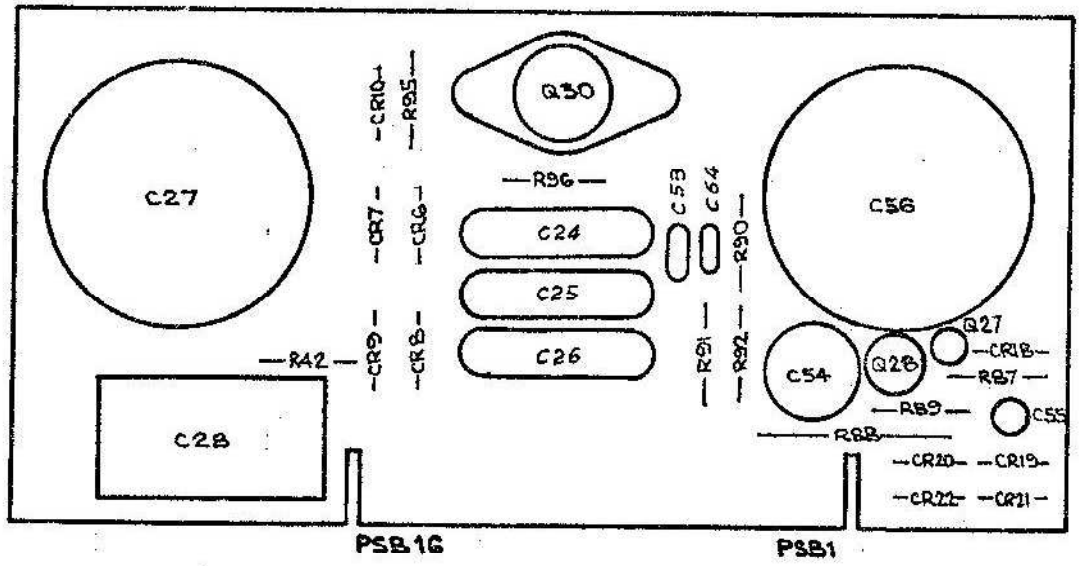
DECK PLATE ASSEMBLY

	CROSS-SHAFT	16-123
	TOGGLE ARM	16-089
	PRESSURE ROLLER SHAFT	16-387

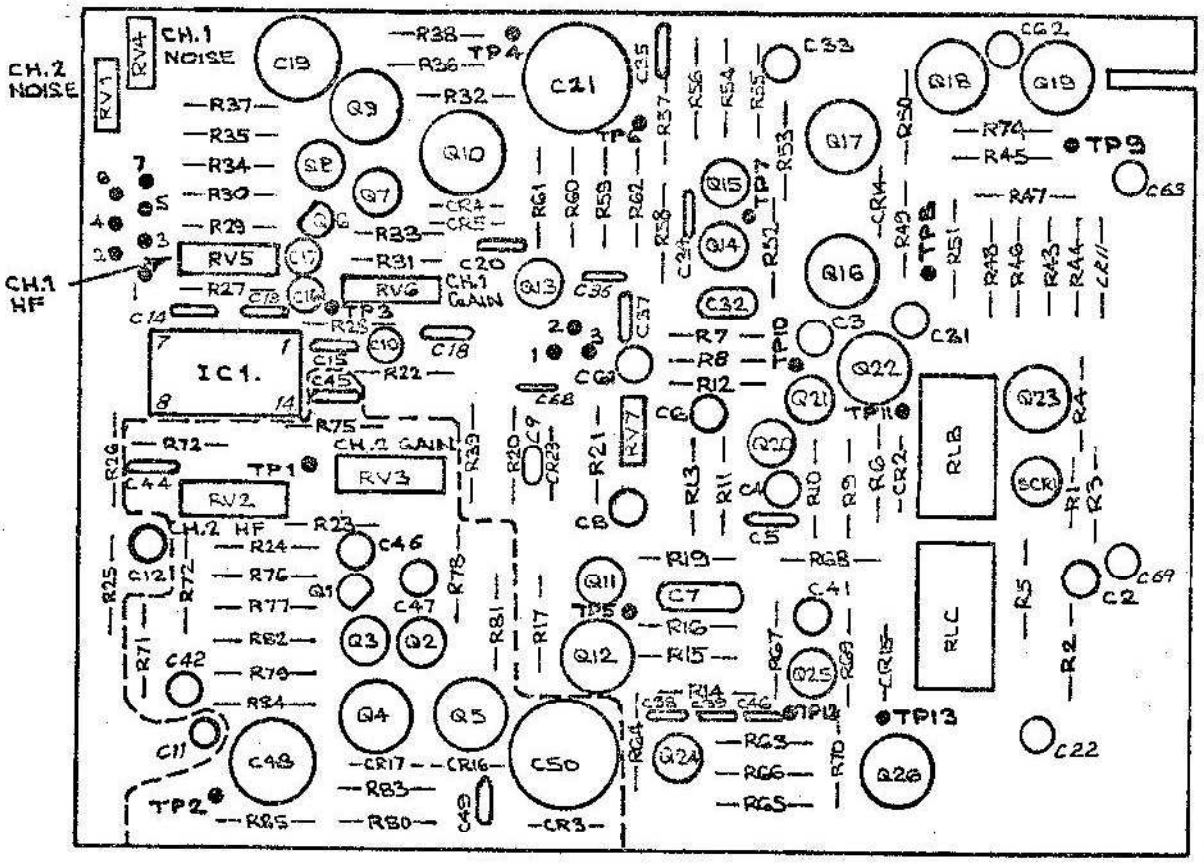
CUEMASTER 903R, 983R

FRONT PANEL

	ISOSTAT SWITCH (2 WIDE)	083113
	ISOSTAT SWITCH (3 WIDE)	083114
903R	SWITCH BUTTON (GREY)	083091
	SWITCH BUTTON (RED)	083092
983R	SWITCH BUTTON (BLACK)	083090
	LAMP HOLDER	085025
	RED LENS	085026
	AMBER LENS	085027



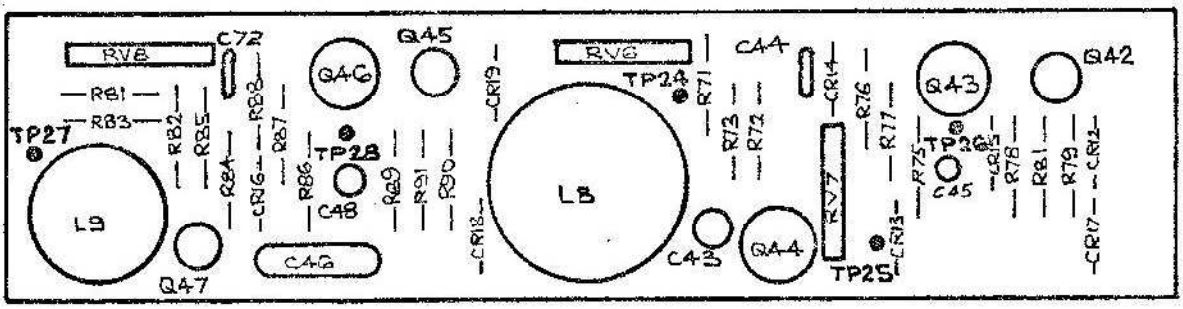
LOCATION OF COMPONENTS
(TOP VIEW) CUEMASTER 900
POWER SUPPLY BOARD. 40-831
(BLANK BOARD 28-026)



LOCATION OF COMPONENTS
(TOP VIEW.) CUEMASTER 980
PLAY BOARD. 40-843 N.A.B.
40-844 I.E.C.

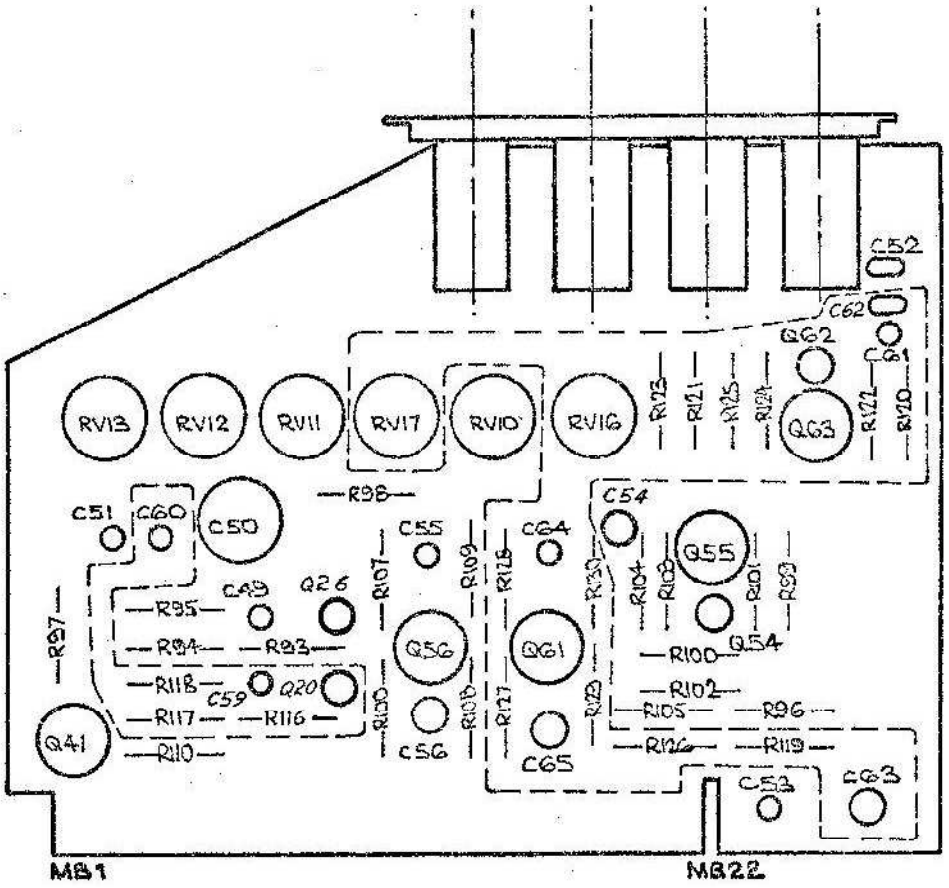
COMPONENTS INSIDE DOTTED
LINE ARE OMITTED ON 900
PLAY BOARD 40-841 N.A.B.
40-842 I.E.C.

(BLANK BOARD 28-037)



LOCATION OF COMPONENTS.
(TOP VIEW.) CHEMASTER 583R
AUX. CUE RECORD BOARD. 40-818

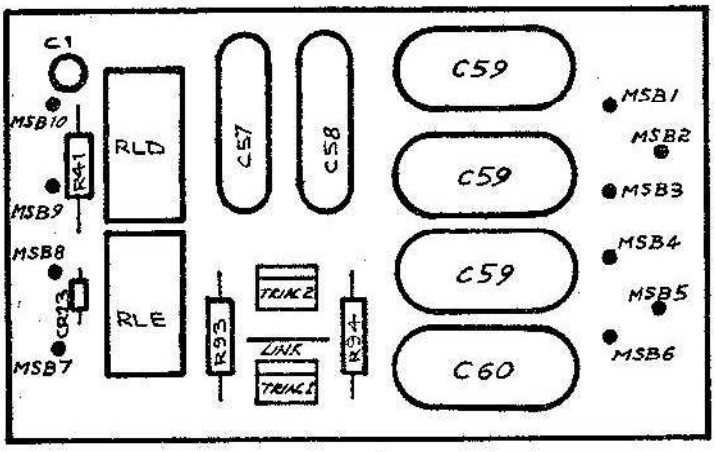
(BLANK BOARD 28-019)



LOCATION OF COMPONENTS
(TOP VIEW.) CUEMASTER 983R
MONITOR BOARD. 40-847

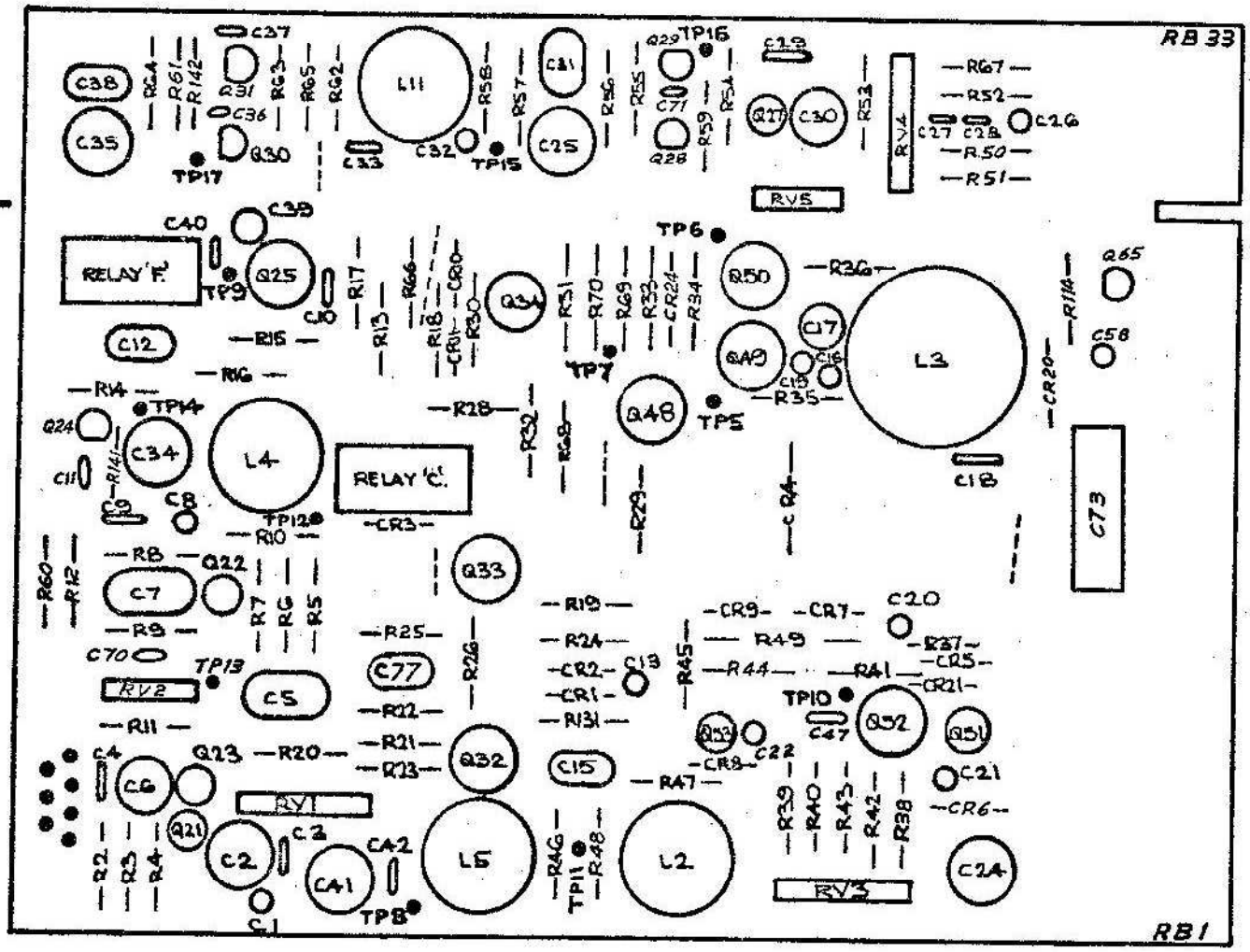
COMPONENTS INSIDE DOTTED
LINES ARE OMITTED ON 903R
MONITOR BOARD. 40-846

(BLANK BOARD 28-039)



LOCATION OF COMPONENTS
(TOP VIEW) CUEMASTER 900
MOTOR SUPPLY BOARD. 40-848

(BLANK BOARD 28-040)



LOCATION OF COMPONENTS
(TOP VIEW.) CUEMASTER 983R
RECORD BOARD. 40-821 N.A.B.
40-822 I.E.C.

SECTION INDICATED IS OMITTED
FOR 903R RECORD BOARD. 40-823 N.A.B.
40-824 I.E.C.

BLANK BOARD 28-068

FAST FORWARD. 150 Hz AUX. 1 FILTER. CUE AMPLIFIER. CHANNEL 1 AMPLIFIER.

SOLENOID SUPPLY. STOP/START BISTABLE. STOP FILTER. (1 kHz) AUX. 2 FILTER. (8 kHz) CHANNEL 2 AMPLIFIER.

24 V. SUPPLY. MOTOR SUPPLY.

AUDIO OUTPUT SOCKET CH. 1.

AUDIO OUTPUT SOCKET CH. 2.

* CR11 OMITTED & SHORTED IN REPLAY MACHINES.

NOTE: (UNLESS OTHERWISE SPECIFIED.)
N.P.N. TRANSISTORS - BC 318 B P.N.P. TRANS - PN 4355 } OR EQUIVALENTS.
DIODES - IN 914

(24) - D.C. VOLTS. (B) - A.C. VOLTS. { MEASURED WITH 20,000 Ω/V METER. MACHINE IN STOP MODE & CART. INSERTED

RC - REMOTE CONTROL. RP - RECORD PLUG.
PB - PLAY BOARD PIN. PSB - POWER SUPPLY BOARD
PH - PLAY HEAD PLUG. QH - CUE HEAD PLUG.
MSB - MOTOR SUPPLY BOARD

FOR 906/903 MACHINES, CH. 2 COMPONENTS ARE OMITTED. FOR 906/986 MACHINES, REC. PLUG IS OMITTED.

✱ COMPENSATION COMPONENTS.	C15	C45	R28	R75
MONO NAB	·0082	–	220K	–
STER NAB	·0047	·0047	330K	330K
MONO IEC	·0082	–	680K	–
STER IEC	·0047	·0047	820K	820K

DRAWN: 9.8.73 J. Cockram. CHECKED: T.H. PK

15A ANDERSON RD, THORNBURY, VIC.

C.M. 900 SERIES REPLAY CIRCUITRY. 3

23-686 ISSUE - A-A

FOR 903R UNITS CHANNEL 2 COMPONENTS ARE OMITTED & ERASE CIRCUITS MODIFIED AS PER DOTTED LINES.

RECORD AMP. CH. 1.

RECORD AMP. CH. 2.

RECORD/PLAY BISTABLE.

BIAS OSCILLATOR

FAST FWD. INHIBIT.

24 V. SUPPLY.

CARTRIDGE LOCKOUT.

STOP CUE OSCILLATOR.

ERASE CONTROL.

STOP INHIBIT

BIAS MONITOR.

REF. DRG. '23-695' FOR SECTION 'B' OF CIRCUIT.

NOTE: (UNLESS OTHERWISE SHOWN.)
ALL N.P.N. TRANSISTORS BC 318 B
ALL P.N.P. " " PN 4355
ALL DIODES 1N 914

VOLTAGES MEASURED WITH RECORD MODE SELECTED & RECORDING 1 KHz CUE TONE.

(12) DC VOLTAGES.

△40 AC VOLTAGE.

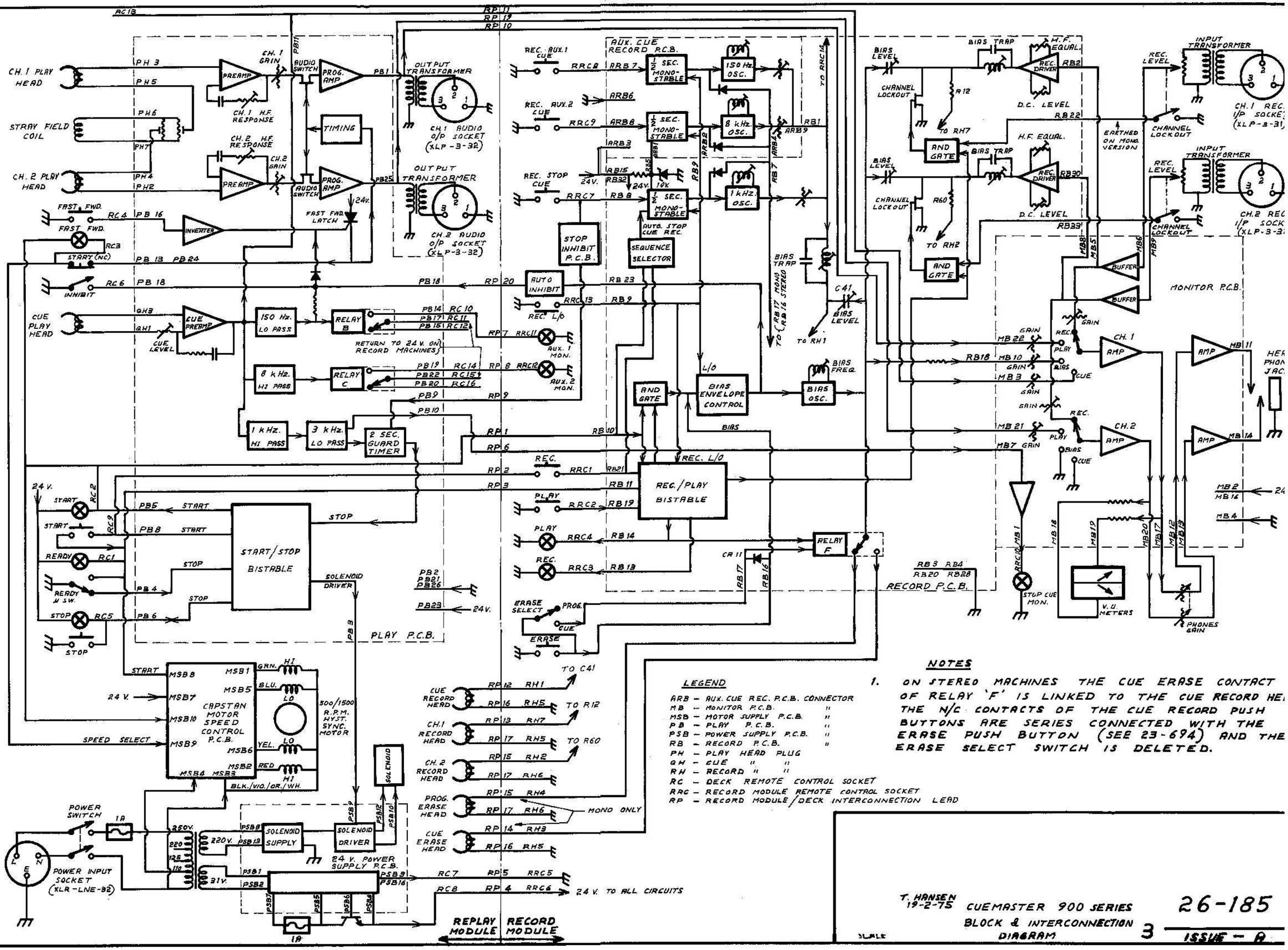
ARB. AUX RECORD BOARD PIN.
RRC REMOTE CONTROL PLUG. (RECORD)
RP. RECORD INTERCONNECTION PLUG.
MB. MONITOR BOARD PIN
RB. RECORD BOARD PIN.
RH. RECORD HEAD PLUG.

ISSUE	
'P'	REMOTE CONT. PLUG P/C W/PS 'RC' 25-2-74
'O'	C/N 455 30.12.75. C/N 462 R143, R144 & C77 ADDED T.H.
'N'	C/N 406, 407, 408 R.M. RP9 WAS TO START BISTABLE. R141 & R142 WERE 150 K. C75 & C76 ADDED. C15 WAS .1 MF C16 WAS 35 V. T.H. P.Kay
'M'	4-12-17. C/N 326 I.S. C22, C23, C74 ADDED. T.H. RB24 - RB35 ADDED RRC15 ADDED. P.Kay
'L'	C/N 18-9-75 C73, R141 & R142 ADDED C11 & C16 WERE 15pF 100 V WKG. C15 WAS .1 MF C/N 242 18-3-76 T.H.
'K'	R46 ADDED G. THOMPSON.
'P'	C/N 476 & 0052 14-4-79 C76 DELETED (15pF) WAS ACROSS C35 C34, 35 & 41 WERE 7-45pF P.Kay

J. Cochrane 6-12-73
T. HANSEN P.K.

CUEMASTER 903R CIRCUIT LAYOUT SECTION "A" 3

ISSUE - P
23694



LEGEND

ARB – AUX. CUE REC. P.C.B. CONNECTOR
MB – MONITOR P.C.B. "
MSB – MOTOR SUPPLY P.C.B. "
PB – PLAY P.C.B. "
PSB – POWER SUPPLY P.C.B. "
RB – RECORD P.C.B. "
PH – PLAY HEAD PLUG
QH – CUE " "
RH – RECORD " "
RC – DECK REMOTE CONTROL SOCKET
RRC – RECORD MODULE REMOTE CONTROL SOCKET
RP – RECORD MODULE/DECK INTERCONNECTION LEAD

NOTES

1. ON STEREO MACHINES THE CUE ERASE CONTACT OF RELAY 'F' IS LINKED TO THE CUE RECORD HE THE N/C CONTACTS OF THE CUE RECORD PUSH BUTTONS ARE SERIES CONNECTED WITH THE ERASE PUSH BUTTON (SEE 23-694) AND THE ERASE SELECT SWITCH IS DELETED.

T. HANSEN 19-2-75

CUEMASTER 900 SERIES BLOCK & INTERCONNECTION DIAGRAM

26-185

3

ISSUE – A

SCALE