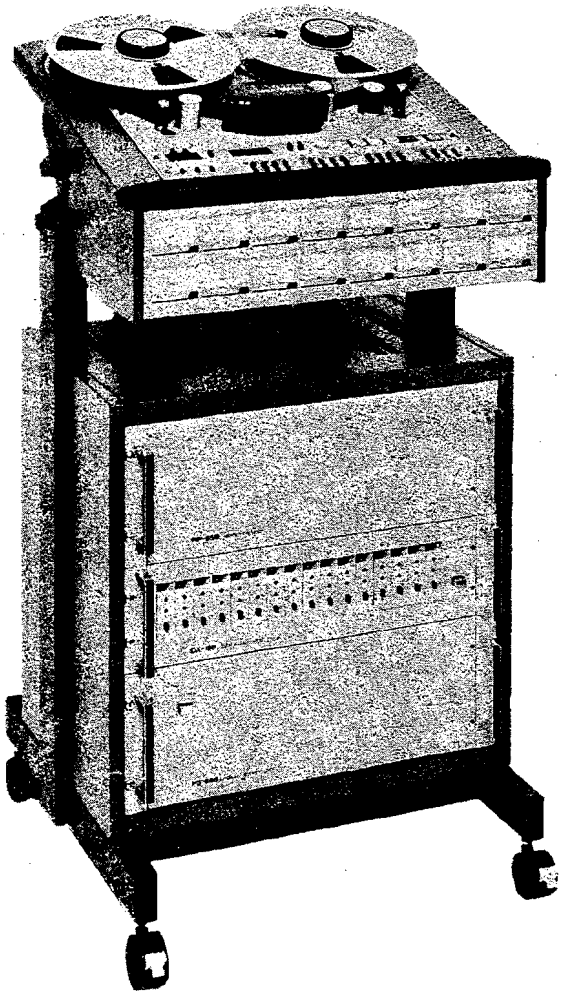
TASCAM

TEAC Production Products

85-16B

16-Track 16-Channel
Master Recorder/Reproducer



OPERATION/MAINTENANCE

5700021000

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8. MAINTENANCE

This tape deck has a Serial Number located on the rear panel. Please record the Model Number and Serial Number and retain them for your records.
Model Number _____
Serial Number _____

WARNING:
TO PREVENT FIRE OR SHOCK HAZARD, DO NOT EXPOSE THIS APPLIANCE TO RAIN OR MOISTURE.

I. INTRODUCTION

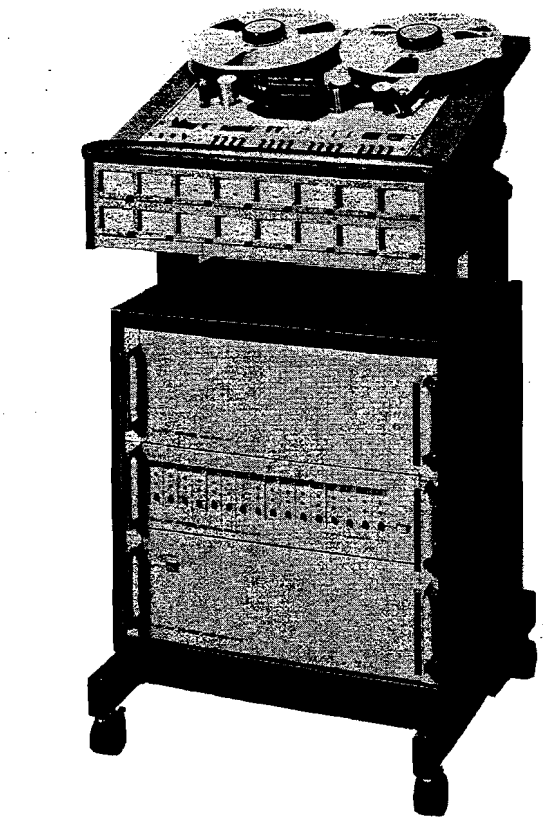
The TASCAM 85-16B is a one inch tape, 16 track 16 channel master recorder/reproducer. This is an upgraded version of the conventional product. A special feature is the Preload Sink function.

Operating controls are all located on the transport control panel and the OUTPUT/FUNCTION SELECTOR UNIT, and simple panel layout allows maximum ease in operation of this multi-track recorder/reproducer.

The record/reproduce amplifier unit consists of a single record amplifier and reproduce amplifier PCB for each channel and these can all be adjusted by simply removing the front panels.

Tape travel is controlled by a full IC logic control system housed in the system control PCB ass'y.

The DX-166 dbx Unit can also be integrated into the 85-16B to make one complete unit. Necessary connecting cables are included with the dbx Unit.



2. SPECIFICATIONS

Tape Format	16 tracks, 1-inch tape width.
Reel Size	10-1/2" maximum, NAB (large) hub only.
Tape Speed	15 inches per second: Variable, ±10% relative to 15 ips.
Speed Accuracy	±0.3% deviation from 15 ips.
Starting Time	Within 1 second for rated speed and 3 seconds to reach RMS flutter of less than 0.05%.
Fast Wind Time	120 seconds for 2,400 feet; Storage wind, 240 sec.
Wow and Flutter	0.03 RMS weighted (NAB); ±0.04% peak weighted (ANSI); (measured with flutter test tape).
Overall Frequency Response	40 Hz - 18,000 Hz ± 3 dB (Sync and Repro mode).
Total Harmonic Distortion (THD)	1% at 0 VU; 1,000 Hz.
Record Electronics Headroom	28 dB or greater above nominal level at 1,000 Hz
Signal-to-Noise	67 dB weighted or 62 dB unweighted with dbx noise reduction bypassed. 87 dB weighted with dbx noise reduction.
Crosstalk (Any Adjacent Tracks)	Better than 45 dB down @ 1,000 Hz.
Erasure Depth	75 dB or greater at 1,000 Hz.
Input	
Level	-10 dB (0.3 V) nominal.
Impedance	50 k ohms; unbalanced.
Line Output	
Level	-10 dB (0.3 V) nominal; +18 dB (8.0 V) max.
Impedance	Greater than 10 kohms; unbalanced.
Connectors	RCA jacks for all inputs and outputs.
Indicators	16 illuminated VU meters.
Record Level Calibration	0 VU referenced to 250 nWb/m (nano Webers per meter) tape flux level.
Equalization	IEC standard (International Electrotechnical Commission), infinity and 35 microsecond time constant.
Bias and Erase Frequency	150,000 Hz.
Motors	2 DC servo-controlled reel motors; direct-drive DC Servo Capstan motor.
Power Mains	120 V AC, 60 Hz, 350 watts (USA/Canada Model) 220 V AC, 50 Hz, 350 watts (Europe Model) 240 V AC, 50 Hz, 350 watts (UK/AUS Model) 100/120/220/240 VAC, 50/60 Hz, 350 watts (General Export Model)
Overall Dimensions	
Assembled Unit	24-1/4" (W) X 40-1/8" (H) X 21-5/8" (D). (615 mm X 1,090 mm X 550 mm).
Net Weight	209 pounds (95 kg).

Standard Equipment	Complete Owner's Manual.
Optional Equipment	Auto Cue System with 6 preset search points (including zero), Remote Control Unit, dbx Noise Reduction Unit, Input Panel, Line Output Amplifier Unit, Cable, etc.

*In these specifications, 0 dB is referenced to 1 volt. Actual voltage levels also are given in parenthesis. To calculate the 0 dB = 0.775 volt reference level (i.e., 0 dBm in a 600-ohm circuit) add 2.2 dB to the listed dB value; i.e., -10 dB re: 1 V = -7.8 dB re: 0.775 V.

Performance was measured with Ampex 456 tape. Changes in specifications and features may be made without notice or obligation.

3. UNPACKING/PACKING and CONNECTIONS

3.1 Unpacking (See page 3-2)

1. Remove the 8 nuts holding the top (7).
2. Remove 4 nuts holding the left and right side panels (6).
3. Remove 2 nuts each at the lower end of the front and rear panels (3).
4. Lift off the top (7), left and right side panels (6), and then the front and rear panels (3).
5. Remove cushions (8), (11), (5), and (12).
6. Take off the plastic sheet covering the 85-16B.

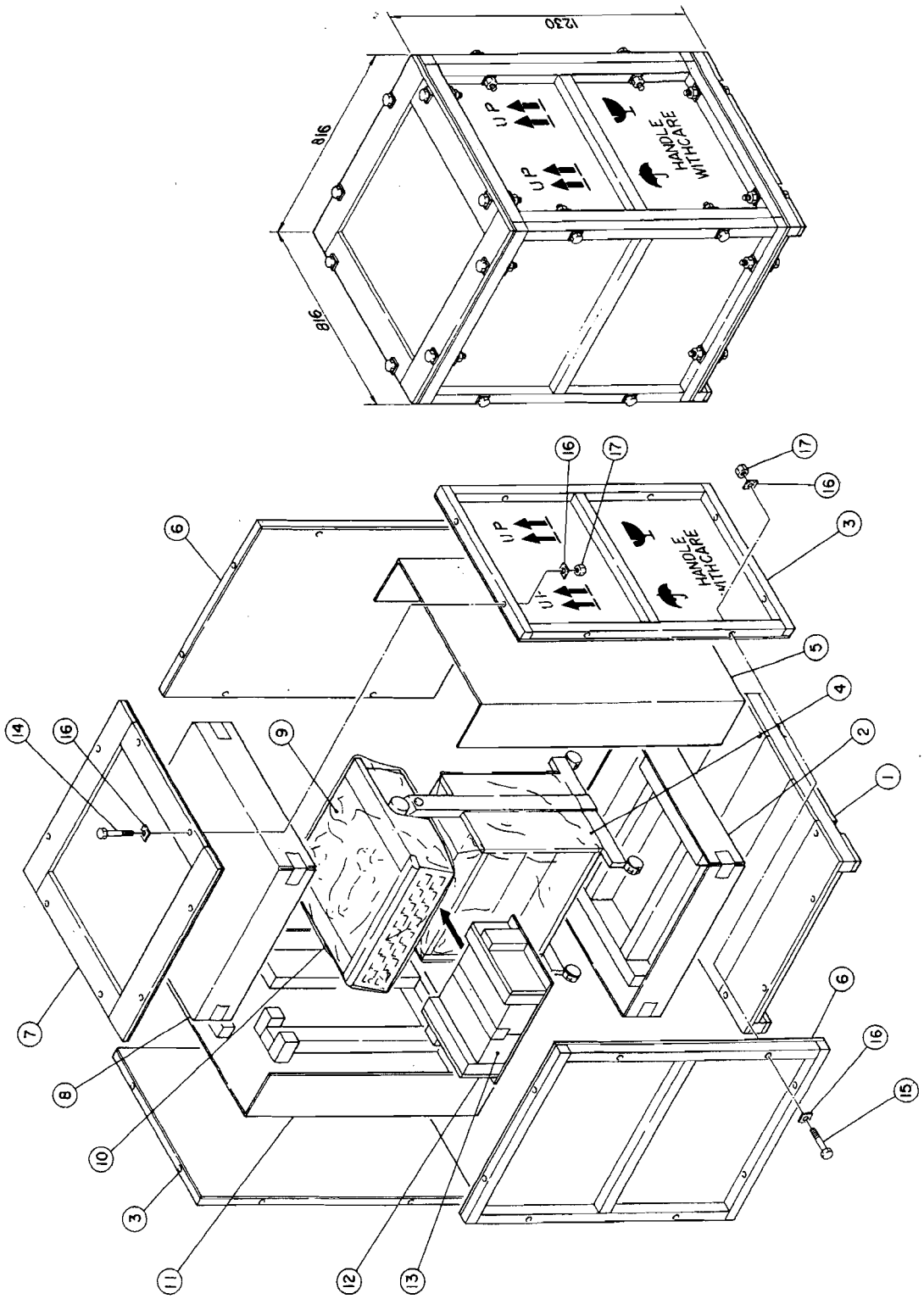
3.2 Packing (See page 3-2)

1. Put the disconnected items – page 3-3 (7) ~ (12) – in cushion (13) and place it under the transport.
2. Wrap the 85-16B with the plastic sheet covering
3. Place cushion (2) on bottom panel (1)
4. Carefully place the 85-16B on the cushion (2) while referring to page 3-2 so as not to mistake the left/right and front/rear relation against the bottom panel.
5. Place cushions (12), (13), (5), and (8) in their proper positions.
6. Position the panels in the order of (3), (6), and (7).
7. Screw the nuts onto the 8 bolts extending from panel (7), 4 nuts each onto the bolts at panels (6), and 2 nuts each at panels (3).

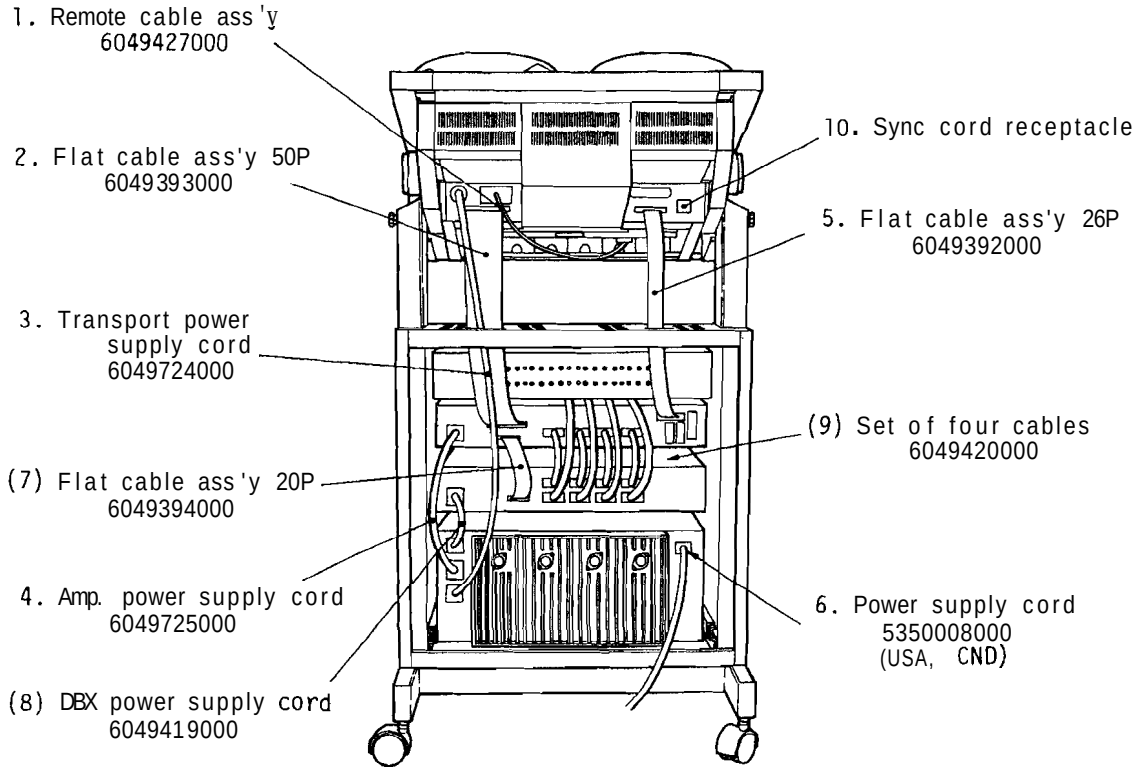
3.3 Connections (See page 3-3)

Before switching on the main power, connect the accessories by following instructions in the diagram.

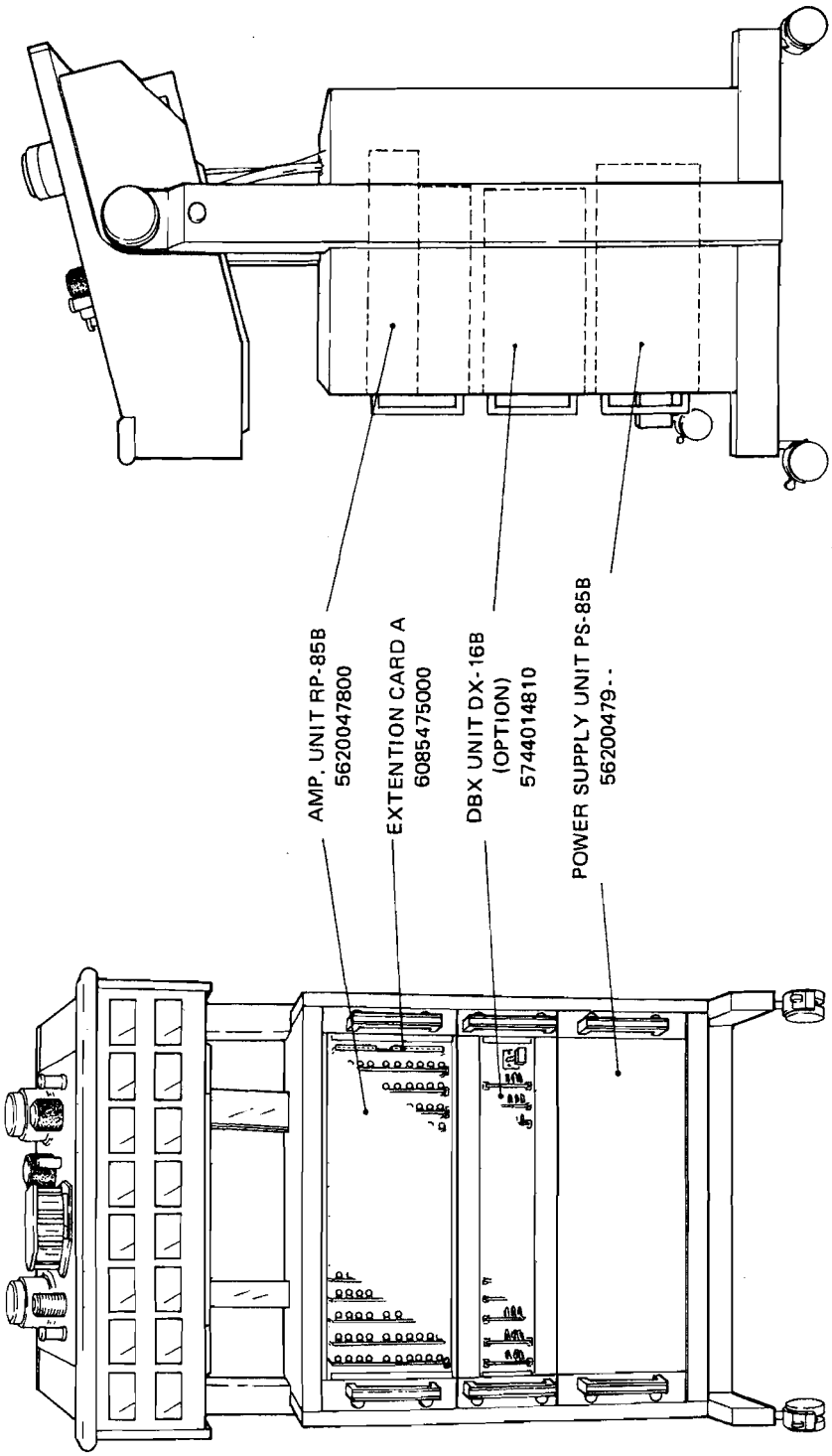
1. The standard model connections are numbered 1 ~ 6.
2. Numbers (7) through (9) are for connecting the DX-16B.
3. Number (10) shows the Sync Cord connection when using Exterior Sync Lock. (Refer to Item 7.7 Exterior Sync Lock.)


1230
816
816
UP
UP
HANDLE WITH CARE
UP
UP
HANDLE WITH CARE
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17

3.3 Connections



Numbers in ( ) indicate accessories for the optional DX-16B. Follow these instructions when connecting the DX-16B.


AMP. UNIT RP-85B
5620047800
EXTENTION CARD A
6085475000
DBX UNIT DX-16B
(OPTION)
5744014810
POWER SUPPLY UNIT PS-85B
56200479--

4. OPTIONAL EQUIPMENT

4.1 Input Panel Units, IP-16 and IP-16A

The nominal input level for the 85-16B is -10 dB, impedance 30 kohms, unbalanced. Please use the following units when it is required to change the input specification.

4.1.1 IP-16, P/N 5640009100

By using the IP-16 at the input, the input level becomes +4dBm/-20dBm, balanced. The +4dBm/-20dBm is selected by a switch. The following diagram shows the method of connecting the Input Panel to the 85-16B.

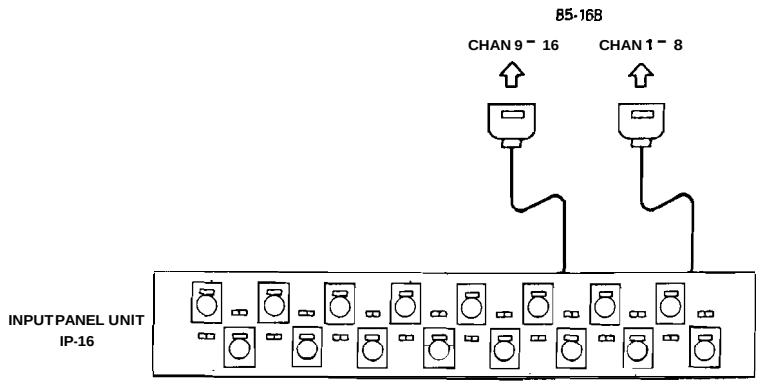


Fig. 4-1

4.1.2 IP-16A, P/N 5640009200

The specified input level of IP-16A is +4dB(v)/1.228v only, unbalanced. Therefore, This unit does not have an input selector switch. The following diagram shows the method of connecting the Input Panel to the 85-16B.

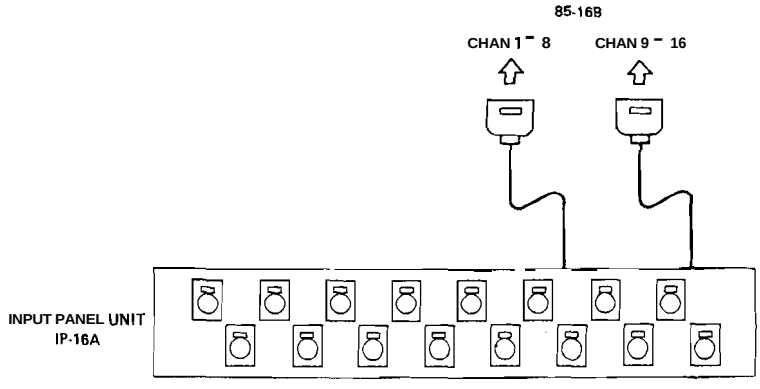


Fig. 4-2

4.2 Line Out Amplifier Units, LA-16 (LA-8 X 2) and CK-163

Output level of the standard type Series 85-16B is -10dB (0.3 V) and the load impedance must be greater than 10 kohms.

To convert the output level to +4dBm into a load impedance of 600 ohms, connect LA-16 (Two Model LA-8 Line Output Amplifier Unit; optional) as shown in diagram below.

CK-163 is the separately sold inter-connecting cable for connecting the LA-16 (LA-8 X 2) to the Series 85-168. Part No. for CK-163 assembly – 5350505300.

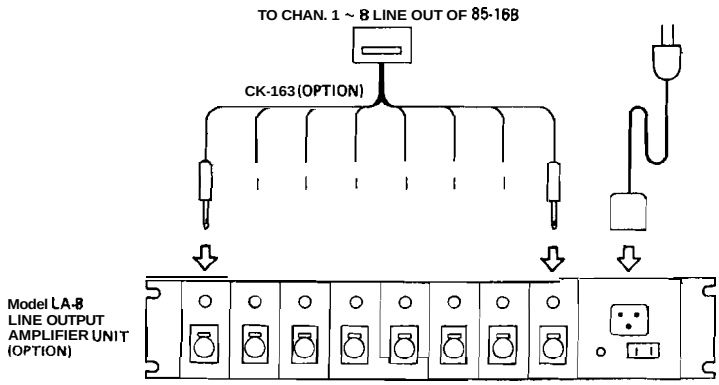


Fig. 4-3-1

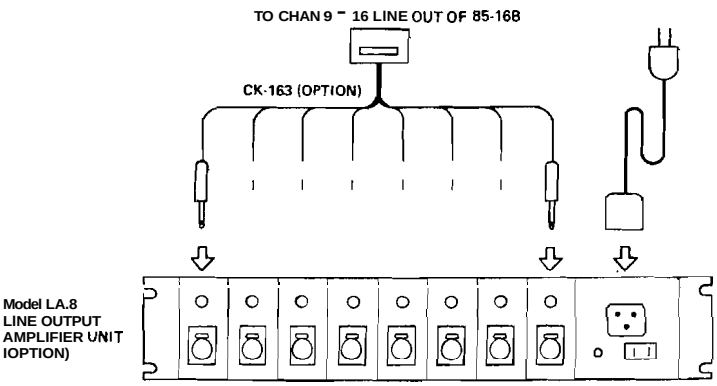


Fig. 4-3-2

4.3 Remote Controls, Model RC-85

4.3.1 General description

The Model RC-85 has a tape counter display, counter reset button and a zero search button. The mounting dimensions are designed for 19-inch rack mounting.

The remote cable which is provided with Model RC-85 is necessary for connecting to the 85-16B. All control signals to and from these units are transmitted through the Function Selector in the 85-16B. The Function Selector, which is removed from the 85-16B is connected to the 85-16B with the remote cable and the Function-Selector then connected to the RC-85 with the short flat cable provided with the unit.

4.3.2 Physical construction

1. Height : 44 mm (1-23/32")
2. Width : 482 mm (19") , including rack mounting angle piece
3. Depth : 117 mm (4.6"), not including connectors and switches
4. Mounting method : 19-inch rack mount, mounting hole pitch -- 32 mm (1-1/4")
5. Weight : Model RC-85 -- 1.5 kg (3.3 lbs)
6. Appearance : See Fig. 4-4.

RC-85

Fig. 4-4

4.3.3 Connecting procedure

1. Remove the Function Selector from the 85-168 and disconnect the cable
2. Install a filler panel in the section which was occupied by the Function Selector.
3. Install the Function Selector and the Model RC-85 on the rack or in a cabinet.
4. Connect the remote cable between the 85-16B and the Function Selector, in place of the cable disconnected in step 1., above.
5. Connect the RC-85 to the Function Selector with the flat cable provided with the unit.
6. See Figure 4-5.

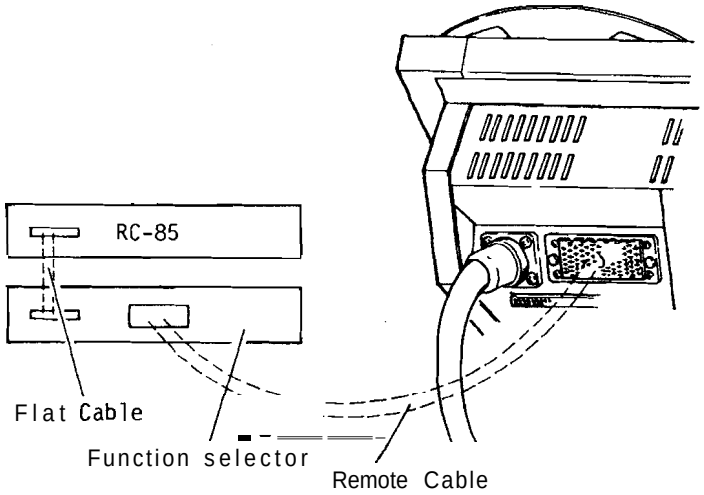


Fig. 4-5

4.3.4 Functions of the Unit

The unit has the same functions as on the 85-16B control panel. One difference is that, although the functional modes will alternate between STOP and EDIT with each push of the STOP button on the 85-16B, this cannot be done from this unit. All control buttons on the 85-16B are functional even with the unit connected.

Four digits of 7-segment fluorescent type, as in the 85-16B, are used for the counter display. The content of the display is always the same as that of the 85-16B and both displays are reset by depressing either button on the 85-16B or RC-85. Even when the 85-168 display is switched to indicate speed, the RC-85 will always display tape time.

The zero search button is connected in parallel with the search switch on the 85-16B.

4.3.5 Circuit configuration

Contains an LSI counter circuit, transistors for display drivers, and peripheral circuitry. Power is supplied from the 85-168 through the remote cable.

4.4 Auto Cue Unit, Model AQ-85B

4.4.1 General description

In addition to regular remote control functions of REC, PLAY, STOP, F.FWD, and RWD, this Unit hits a tape counter, zero search function, and a cue search function with a memory for five locations which are independent from the main system in the 85-16B.

The physical dimensions and method of connecting with the 85-16B are identical for Remote Control Units RC-85.

This Unit is designed for 19-inch rack mounting.

All control signals to and from this Unit are transmitted through the Function Selector in the 85-16B. The Function Selector which is removed from the 85-16B, is connected to the 85-16B with the remote cable and the Function Selector then connected to the Model AQ-85B with a short flat cable. The remote cable and the flat cable are provided with Model AQ-85B.

Remote Cable : Remote Cable Ass'y C (8 meters; 315"), P/N 5350505600

4.4.2 Physical construction

1. Height : 44 mm (1-23/32")
2. Width : 482 mm (19"), including rack mounting angle piece
3. Depth : 117 mm (4.6"), not including connectors and switches
4. Mounting method : 19-inch rack mount, mounting hole pitch -- 32 mm (1-1/4")
5. Weight : 2 kg (4.4 lbs)
6. Appearance : See Fig. 4-6.

AQ-85B

Fig. 4-6

4.4.3 Specifications

1. Control buttons : RECORD
   PLAY
   STOP
   FAST FORWARD (F.FWD)
   REWIND (RWD)
2. Counter display : 4 digits of 7 segment fluorescent tubes, direct time, maximum display -- 99 min. 59 sec., reset is independent from 85-16B.
3. Search modes : Zero search (search towards zero of counter)
   Cue search (search of locations in memory)
4. Number of memories : 5

5. Resolving power of counter and memory :
   1/20 second (although display is 4 digits, internally, this is the smallest unit)
6. Accuracy of search : Less than ±10 cm. (10 cm represents 0.26 sec. at 15 ips)
7. Type of circuit : By micro-processor control
8. Power supply : All power supplied by the 85-166
   +12 V, max. 130 mA
   +15 V, max. 180 mA
   -15 V, max. 80 mA
9. Power consumption : About 5W

4.4.4 Connecting procedure

1. Remove the Function Selector from the 85-16B and disconnect the cable
2. Install a filler panel, provided with this Unit, in the section which was Occupied by the Function Selector.
3. Install the Function Selector and the Model AQ-85B on the rack or in a cabinet.
4. Connect the remote cable between the 85-16B and the Function Selector, in place of the cable disconnected in step 1., above.
5. Connect the AQ-85B to the Function Selector with the flat cable provided with the Unit.
6. See Fig. 4-7.

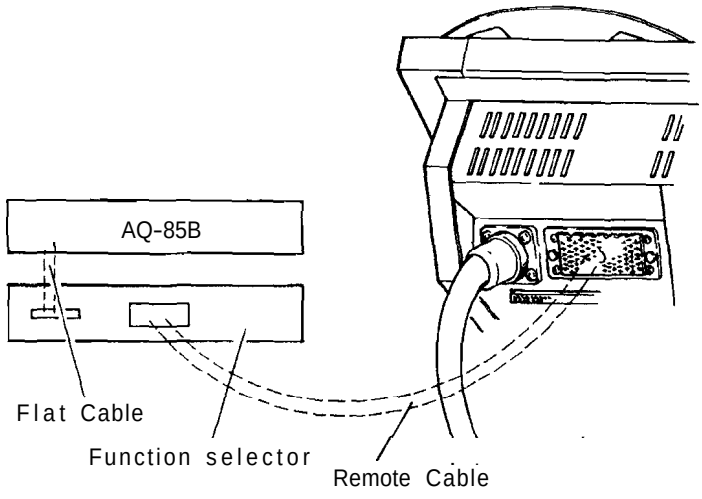


Fig. 4-7

4.4.5 Functions of the Unit

1. Control button
   These buttons have the same functions as the REC, PLAY, STOP, F.FWD, and RWD buttons on the control panel of the 85-16B. Onedifference is that, although the functional modes will alternate between STOP and EDIT with each push of the STOP button on the 85-16B, this cannot be done from this Unit. All control buttons on the 85-16B are functional even with the nit connected.

Counter display

Four digits of 7-segment fluorescent type, the same as in the 85-16B, are used. Readouts are in direct time with maximum 99 minutes and 59 seconds. This counter is independent from the counter in the 85-16B and resetting the counter of each will not affect the other. Even when the 85-16B display is switched to indicate speed, the display on this Unit will not be affected.

This display is also used to indicate the content of the memory (described later).

3. Search modes

a) Function of the buttons

i) SEARCH ZERO

Begins search for location of 00'00" in the AQ-85B counter

ii) SEARCH CUE

When this button is depressed together with one of the MEMORY SELECT buttons, search is begun for the locations previously stored in the memory.

iii) MEMORY SELECT 1~5

These are for selecting one among five locations stored in the cue point memory, and the SEARCH, CUE, STORE, MODIFY UP, and MODIFY DOWN buttons are effective only when depressed with one of the location button. As long as the memory select button is held down (even though any other button may or may not be depressed) the display will indicate the content of the selected memory.

iv) STORE

When this is depressed together with any one of the MEMORY SELECT buttons, the content of the tape time counter at that instant is stored in the selected memory. In doing so, the information previously stored in that memory will be lost.

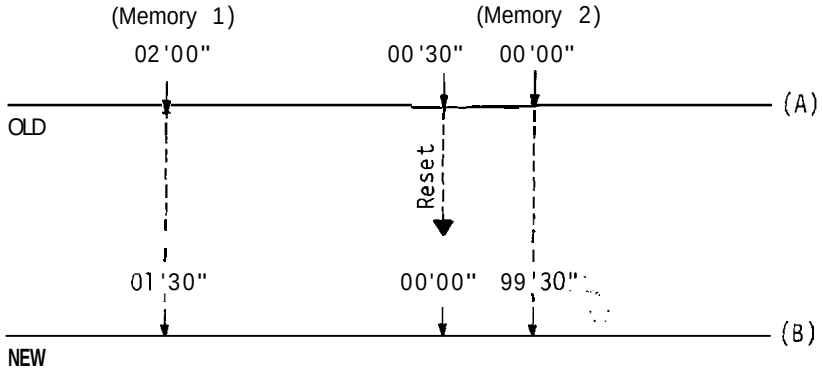
v) MODIFY UP, DOWN

This is for changing the content of the memory.

When one of the MEMORY SELECT buttons is depressed, the content appears on the display. If the UP button is depressed under this condition, the "1 second" digit will increase by one. If the UP button is released and depressed again, it will increase by one second again. If the UP button is held down, after an elapse of about one second the "10 second" digit automatically begins increasing by one about every 0.8 second. If the UP button is held down still longer, the "1 minute" digit will begin increasing by one in the same way. Action of the DOWN button is the same only in the opposite direction.

b) Function of the memory

This memory can store up to five locations of cue search points which are stored or changed by the above-mentioned STORE UP or DOWN buttons. Immediately after power on, all memories will contain OO'QO". The content of the memory corresponds to the absolute locations upon the tape, and this relation is maintained even if the counter is reset.



For example, as shown in Figure A, assuming the content of Memory 1 is 02'00", that of Memory 2 is 00'00" and the AQ-85B reset button is depressed when the tape time counter is indicating 00'30". As shown in Figure B, at this instant the counter will go to 00'00". The absolute location on the tape indicated by Memory 1 corresponds to 01'30" of the new memory value. By the same token, the value of Memory 2 is 99'30". Such conversions are automatically made whenever the counter is reset and the memory content is renewed.

c) Search modes

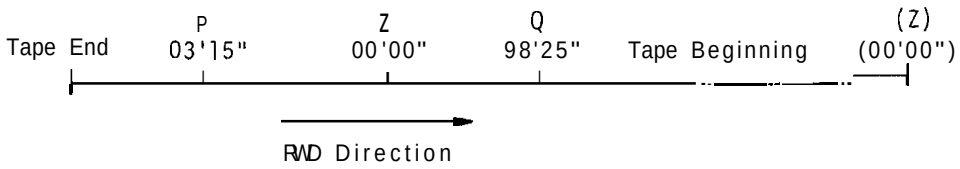
i) Operation

Search is the mode of running the tape towards the desired location and stopping the tape there or immediately going into the PLAY mode from that location.

The AQ-85B has two types of search modes - search zero and search cue. The physical operations are the same except that the objective location is different between the two. Refer to the function of each button for the method of inducing the search mode.

Although the 85-16B contains the zero search function, as each counter is independent the search function is also independent.

The 85-16B can search only in the RWD direction. In other-words, if search is started from point P, the tape will run in search of location Z but if search is started from Q, it will run towards (Z) which is further right, as shown in the diagram.



The AQ-85B, however, looks at the zone-right of Z as "minus" and therefore the tape will correctly run towards point Z regardless to what point "search for zero" is induced.

For a smooth stop at the objective location, the tape speed is reduced in two steps in accordance to distance from the objective location. However, the tape cannot be slowed down sufficiently if the search button is depressed immediately before the objective location during the high speed RWD mode. In this case, the AQ-85B will control the tape in the reverse direction after overrunning the objective point. With the search system in the 85-16B, the tape may sometimes overrun and stop as it is designed to end the search mode by issuing a stop command after passing point Z regardless of what the tape speed may be.

In the AQ-85B, even if the counter is reset or the memory content is changed after inducing the search mode, the tape will search for the objective point (absolute location upon tape) which existed at the instant the search button was depressed. (With the search system in the 85-16B, if the counter is reset during search, that point then becomes the new objective location and a stop command is immediately issued.)

ii) Search to play

If the AQ-85B PLAY button is depressed during the search mode, it is changed to the Search-to-Play Mode which automatically puts the transport in the PLAY mode upon reaching the objective point.

If the 85-16B PLAY button is depressed during search from the AQ-85B, the search mode is cancelled and the transport goes into normal PLAY mode.

During search mode by the 85-16B internal system, depressing the PLAY button in either the AQ-85B or 85-16B puts the transport in the Search-to-Play Mode.

iii) Conditions of priority

With the internal system of the 85-16B, search cannot be induced from F.FWD (F.RWD and spooling in RWD direction) but the AQ-85B system allows search frnm any mode of operation.

During search by the AQ-858, depressing any one of the following buttons will cancel the search mode and go into the mode of the depressed button. Furthermore, the AQ-85B search button is neglected as long as these buttons are held down.

STOP, F.FWD, RWD of the AQ-85B or 85-16B
PLAY, ZERO SEARCH of the 85-16B

iv) Display

The LED (zero or cue) located below the search button is lighted during the search mode by the AQ-856. The lamps of the STOP, F.FWD or RWD control buttons will be lighted in accordance to direction of search and running condition.

During Search-to-Play, the PLAY button lamp will flash in addition to the above.

4.5 DBX Noise Reduction Module, DX-16B

4.5.1 Introduction to the dbx system

Wider dynamic range

In spite of the excellent quality of many open reel tape decks, there have been several limiting factors which restricted the full potential of a tape recording system to faithfully record and reproduce some of the most thrilling live musical performances. One of these factors is the comparatively limited dynamic range of the tape recording medium. While live musical performances may reproduce sounds with a dynamic range of 100 dB or more, the tape system was capable of only 50 dB or 70 dB of dynamic range. The dynamic range of the recording system is the range between the highest level signal recordable on a tape before the tape becomes saturated (usually considered to be about +10 dB) and the inherent noise level of the tape itself (usually considered to be about −50 dB to −60 dB).

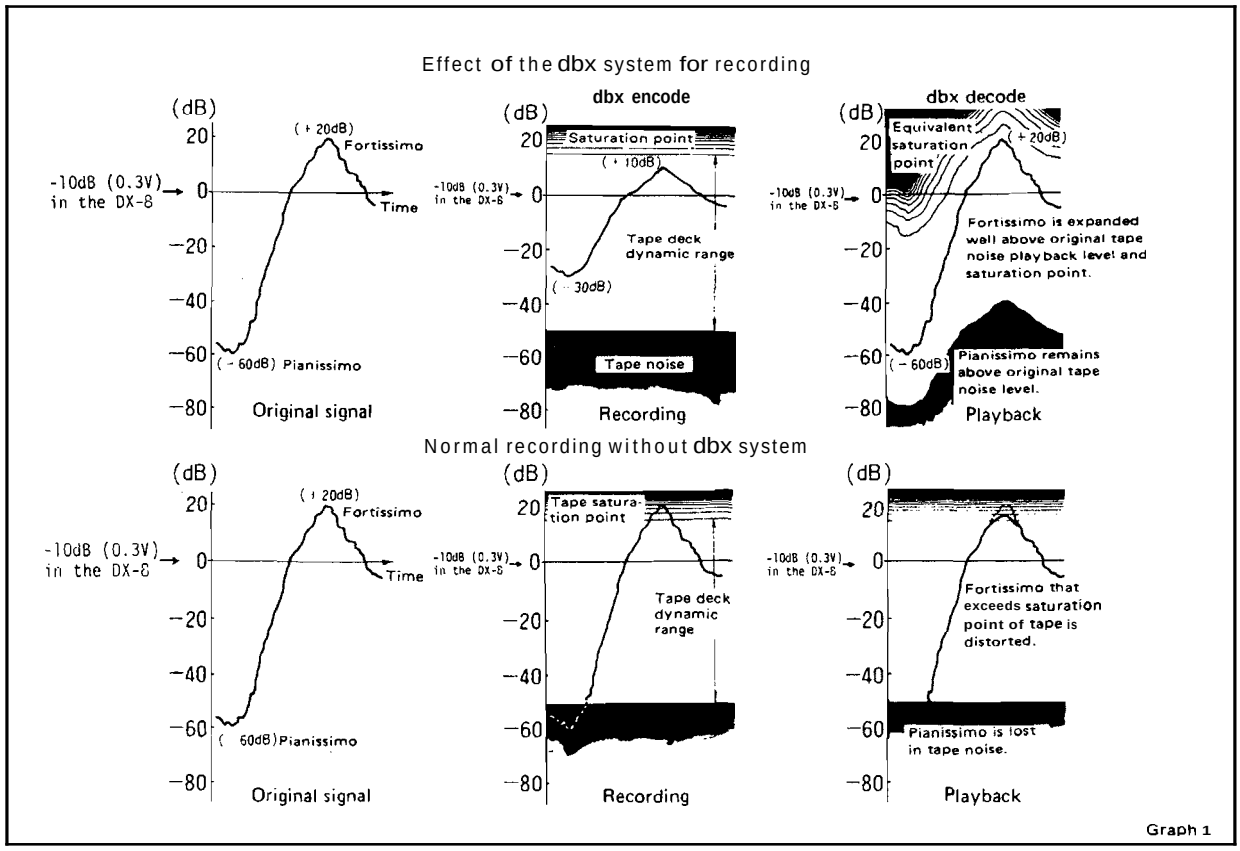
This limited dynamic range results in two undesirable effects. The quieter sounds at −40 dB to −60 dB would be lost in the tape hiss and system noise during recording and playback and the music would lose some of its vital components. Also, at the other limit of the musical range; the high level peaks or transients which could go up to +20 dB were destroyed due to saturation of the tape.

So called compressor-expander systems were developed to increase the dynamic range to improve the signal-to-noise ratio of the tape recording system. However, even though many of these "compander" systems offered some improvements they also had some inefficiencies.

Generally. they were unable to accurately track the wider dynamic range of live musical performances throughout the entire audio frequency range. That is, they could not accurately record and reproduce the music without a considerable degree of "infidelity". Somehow the reproduced sound just did not sound like the original.

The dbx system is a compressor-expander system that has effectively resolved all of the problems many of the other systems had. The dbx system is a compressor-expander system which can increase the recordable dynamic range up to 100 dB and can accurately track throughout the audible frequency range. The compression (encode) function is done at a 2 : 1 ratio which allows you to compress 100 dB of dynamic range of the input signal into 50 dB of dynamic range which is recordable easily by most open-reel tape decks.

During playback the off-the 'tape signal is expanded (decoded) at a complementary 1 : 2 ratio to perfectly restore the 100 dB of dynamic range of the original source. The diagram below shows how a signal with a dynamic range of +20 dB to −60 dB will be compressed during recording to a dynamic range of +10 dB to −30 dB. This range is easily recorded on a quality open-reel tape deck. The high level signals (peaks) will not saturate the tape and the low level signals will not become ensconced in the tape noise. During playback the decoder expands the dynamic range back to the original +20 dB a the high end and to −60 dB at the low end. But as the low level signals are expanded (actually reduced in level the tape noise is also reduced at an equivalent ratio. In actual cases the noise is reduced by up to 30 dB to 40 dB.



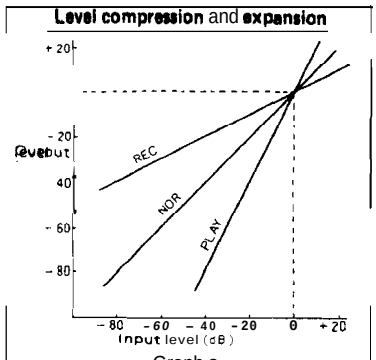
Graph 1

ENCODER end DECODER Operation

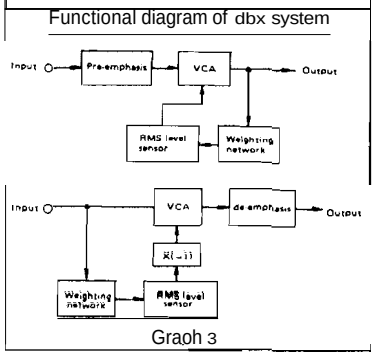
The dbx noise reduction system consists of two sections: an ENCODER unit and a DECODER unit.

ENCODER – The compression ratio of the ENCODER is set for 2 : 1. The input signal is sent first to a pre-emphasis network at the input to the voltage controlled amplifier1 attenuator (VCA). The gain of the VCA is controlled by the output of the **RMS** level sensor. The output of the VCA is fed through a weighting network back to the level sensor and its output in turn is fed back to the VCA and controls the gain of the VCA. The output of the VCA is also sent to the record circuitry.

DECODER – During playback the playback output is sent to the VCA directly and through the pre-emphasis network to the level sensor. The output of the level sensor controls the VCA. Finally the output of the VCA is sent through an output de-emphasis network to the tape tansport output circuitry.



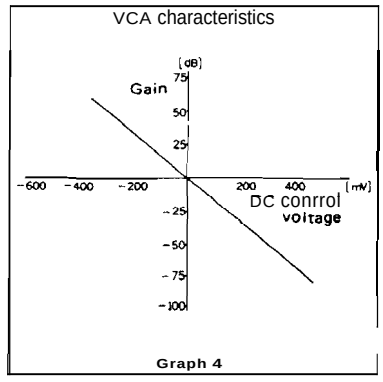
Graph 2



Graph 3

VCA

The VCA, together with the RMS level sensor, is an indispensable part of the dbx system. The amplitude of the VCA output can be controlled logarithmically, or in other words linearly in terms of dB values by means of a controlling supply voltage which controls the gain of the VCA. Utilizing this characteristic of the VCA, the dynamic range of the incoming signal is compressed or expanded in whatever ratio as desired. In the dbx system of the DX-8 the compression ratio is always 2 : 1 (dB value) to any input signal. The actual **RMS** level is accurately detected and controlled in the reverse ratio (1 : 2) to give an overall unity gain to the system. An exclusive circuit of the VCA in the dbx system allows superb control over an exceptionally wide range of –80 dB to +60 dB (20 to 20,000 Hz ±0.5 dB tolerance) with a very low distortion ratio.

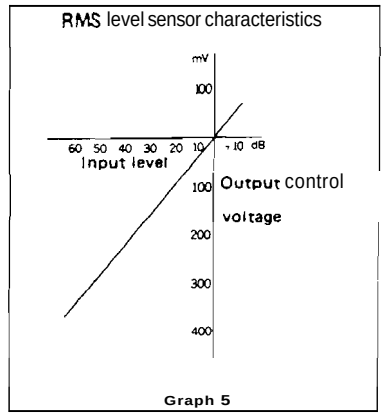


Graph 4

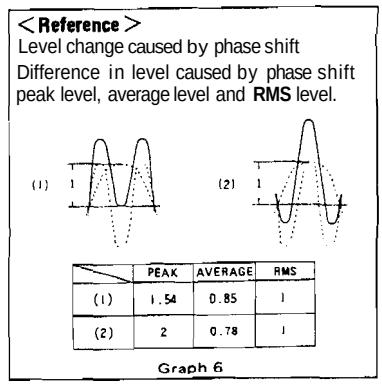
RMS Level Sensor

Another indispensable pan of the dbx system is the RMS level sensor that generates a DC voltage that is proportionate to the incoming signal and controls the amplitude of the VCA output. As indicated by its name the **RMS** level sensor detects the **RMS** (root-mean-square) value of the incoming signal for the following reasons. First of all, to get accurate operation throughout encoding and decoding the operating gain must be complementary. But since the tape recording process comes between the encode and decode process, a level sensor which is not affected by the phase shift of the record-playback operation is necessary. While other types of level sensors such as peak sensing or average value sensors are greatly influenced by phase error, the RMS level sensor is not and therefore is ideally suited for level sensing in the dbx system. Note that if there is a difference in the sensing operation between decoding and encoding the original signal levels cannot be accurately restored. Thus the RMS level sensor is the ideal way to drive the VCA in the dbx system.

By employing advanced electronics technology, the dbx RMS level sensor can perfectly respond to incoming signal of 70 dB or more (140 dB at encoder input) and can sense the true **RMS** value of all audible frequencies.



Graph 5



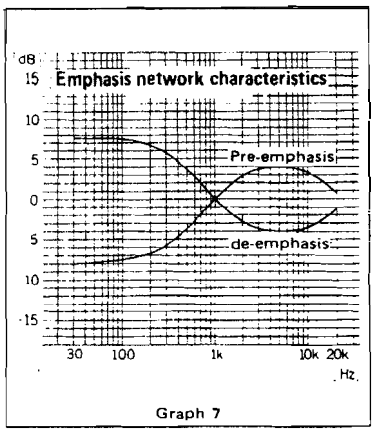
	PEAK	AVERAGE	RMS
(1)	1.54	0.85	1
(2)	2	0.78	1

Graph 6

Pre-emphasis and De-emphasis

The high frequency modulation noise level increases as the level of the input signal increases. This becomes very noticeable. at signal levels above 0 dB. Also variations in the tape coating or in the movement of the tape across the heads which cause "drop-outs or changes in the output level off-the-tape are expanded during decoding and become very noticeable. These two factors result in the so-called "breathing" of the output signal.

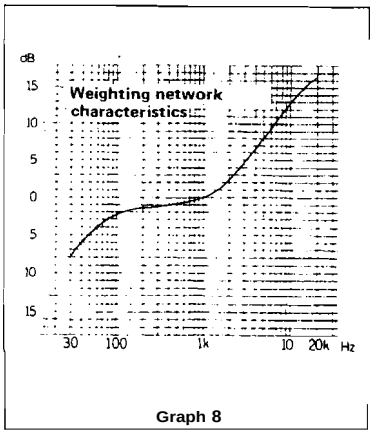
The purpose of the pre-emphasis and de-emphasis networks is to eliminate these changes in level. By adding pre-emphasis in front of the encoder and de-emphasis in back of the decoder approximately 10 dB of noise reduction is achieved at very loud signal levels and the undesirable effects of hiss modulation noise is eliminated.



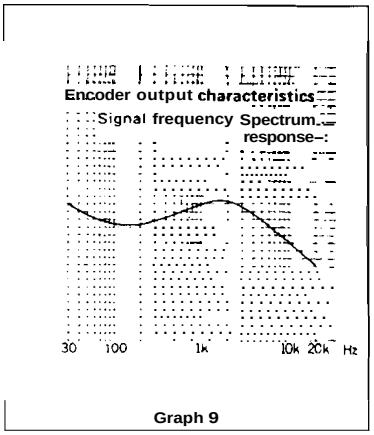
Graph 7

Weighting Networks

The pre-emphasis network also increases the high frequency content of the signal. This could result in saturation of the tape during recording. However a weighting network is employed which varies the sensitivity of the RMS level sensor to preclude the possibility of the high frequencies saturating the tape.



Graph 8

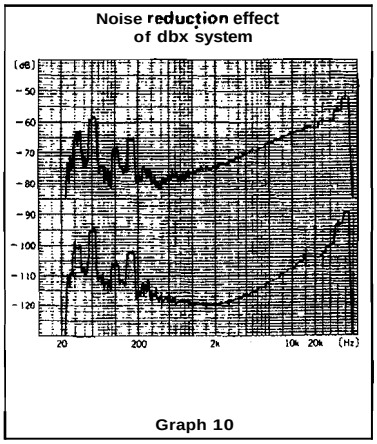


Graph 9

For encoding, high frequency sensitivity is raised to decrease the amplitude of the VCA output and to record the signal below the saturation level of the tape. See graph 8. In decoding. a reverse weighting curve is employed to restore the original level at all frequencies. See graph 9. With these networks high frequency distortion is prevented by controlling the encoding and decoding levels relative to the frequency.

Noise Reduction

The dbx noise reduction system gives effective noise reduction over the entire audible frequency band. The high frequency pre-emphasis before the encoder and subsequent de-emphasis after the decoder provides 10 dB of noise reduction even at louder signal levels where the signal is not compressed. When the high frequencies are very loud, the VCA gain is reduced so that these frequencies will not saturate the tape. The level sensor is also desensitized at very low frequencies which in effect gives low frequency pre-emphasis prior to recording and de-emphasis during decoding which reduces low frequency noises. In addition, the 2 : 1 compression expansion ratio virtually doubles the dynamic range of the tape recorder and can increase the signal to noise ratio by up to 30 dB to 40 dB. Graph 10 below shows the effects of the dbx noise reduction system on system noise over the entire audible frequency range with the dbx system IN and OUT.



Graph 10

Advantages of the dbx System

1. Provides maximum noise reduction in the overall audio range of up to 30 dB to 40 dB.
2. Raises the record saturation point of the tape by 10 dB.
3. Direct compression and expansion method makes special level matching and pilot tones unnecessary.
4. No transient errors are produced between record and playback.
5. Low distortion ratio over complete frequency range.
6. Even though there may be phase shift during the transmission of audio signals, the Level sensor will respond and the system will operate correctly.
7. Frequency characteristics of the transmitted signal will not be altered.

4.5 .2 General description

The DX-16B is exclusively designed for integration into the TASCAM 85-16B Recorder/ Reproducer. Since this system alone will provide approximately 30 dB noise reduction and improve the tape saturation point by about 10 dB, its combined use with the Model 85-16B will give a dynamic range of 100 dB.

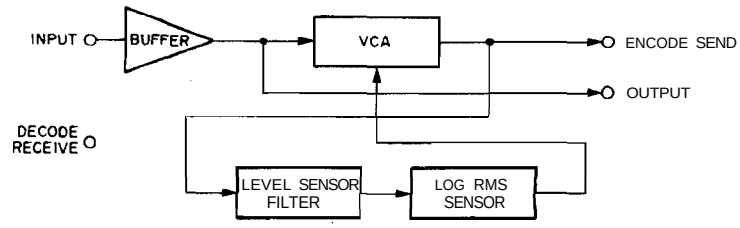
The DX-16B is the switchable type whereby the compression circuit (ENCODE mode) and the expansion circuit (DECODE mode) are selected by electronic switches. Each channel can be independently switched from the DECODE mode to the ENCODE mode by a record mode control signal from the Model 85-16B. When the front panel DBX IN/OUT switch is set to OUT, the noise reduction circuits can be bypassed without changing connections.

4.5.3 Connections

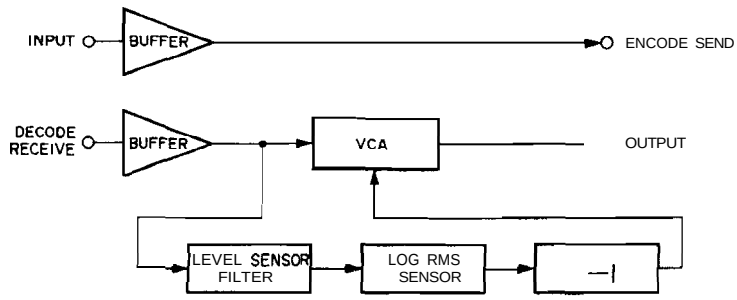
Please refer to the diagram in Item 3.3 for connecting the DX-16B. Connect the accessory parts by instructions numbered (7) through (9) in the diagram.

4.5.4 Block diagram

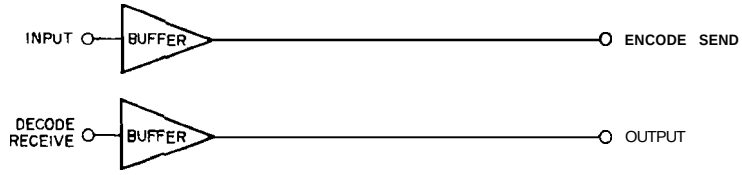
1) Encode mode



2) Decode mode



3) Pass mode



An external ENCODE command selects either the Encode mode or Decode mode. On the other hand, the DBX IN/OUT switch equipped on the DX-16B's panel selects

the Bypass mode for all channels, and the BYPASS switch selects it for a specific channel. The BYPASS switch cancels other commands.

Electronic switches select the mode. No relays are used.

4.5.5 Specification

1.	Number of channels	16, switchable to encode or decode
2.	Input	
	Impedance	Greater than 50 kohms
	Nominal input level	-10 dB (0.3 V)
	Maximum input level	+16 dB (6.3 V)
3.	Output	
	Load impedance	Greater than 10 kohms
	Nominal output level	-10 dB (0.3 V)
	Maximum output level	+16 dB (6.3 V)
4.	Frequency response (back to back)	40 Hz - 20 kHz, ±1 dB 30 Hz - 20 kHz, $^{+1}_{-3}$ dB
5.	Distortion (back to back)	0.3% max. at 1 kHz 0.8% max. at 100 Hz
6.	Effect of the dbx system on recording	A 100 dB dynamic range is possible by the 30 dB noise reduction and 10 dB improvement in the saturation point.

4.5.6 Testing and adjustment

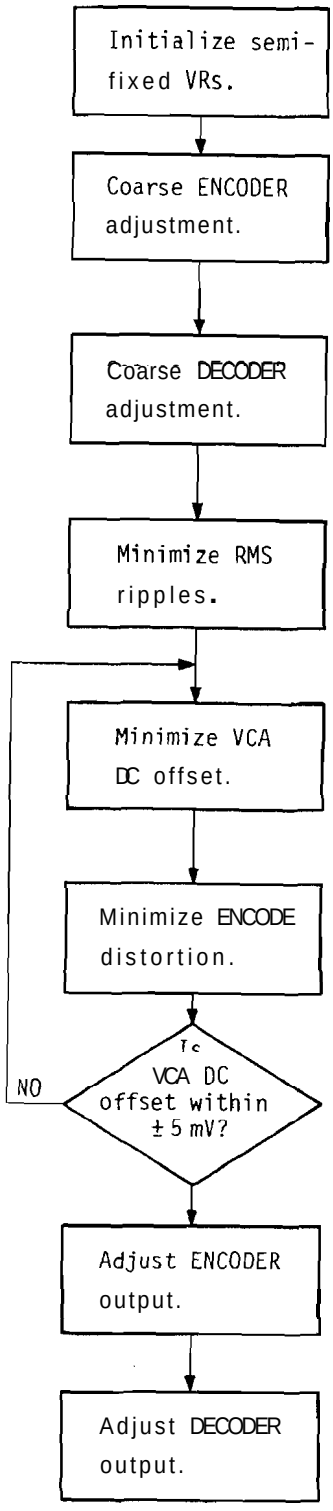
1. DBX AMP terminals

Pin No				
1	INPUT	ENCODER input	Input impedance	100kΩ// 220kΩ// 82PF
2	+15 V	40 mA		
3	DEC RCV	DECODER input	Input impedance	100kΩ// 220kΩ// 82PF
4	-15 V	40 mA		
5	OUTPUT (Load impedance: 33 kΩ)	During BYPASS	DEC RCV buffer output	
		During ENCODE	INPUT buffer output	
		During DECODE	DECODER output	
6	0 V			
7	ENC SEND (Load impedance: 33 kΩ)	During BYPASS	INPUT buffer output	
		During ENCODE	ENCODER output	
		During DECODE	INPUT buffer output	
10	VCA DC OUT	For adjusting VCA DC output (DC output is planning for production model)		
11	$\overline{\text{BYPASS}}$	BYPASS state enters at LOW input. 4.7 kΩ pull-up. Sink current: approx. 3 mA		
12	$\overline{\text{ENC}}$ (REMOTE)	ENCODE state enters at LOW input. 100 kΩ pull-up. Sinkcurrent: approx. 0.15 mA		

2. Semi-fixed variable resistors for adjustment

R11	Adjusts distortion of VCA (ΔVbe of Q6 and Q8)	47 kΩ
R20	Adjusts DC offset of VCA (DC balance of VCA)	1 kΩ
R47	Adjusts RMS ripples (ΔVbe of RMS sensor and OPAMP offset) ...	47 kΩ
R56	Sets ENCODE output	470 kΩ
R67	Sets DECODE output	4.7 kΩ

3. Adjustment procedure



1) Set the five semi-fixed VRs to their middle positions.

2) Put the system in ENCODE mode and apply 1 kHz / -10 dBv (0.3 V) to INPUT. In this condition, adjust R56 so that ENC SEND output is -10 dBv (0.3 V). (Confirm that the red LED is lit.)

3) Put the system in DECODE mode and apply 1 kHz / -10 dBv (0.3 V) to DEC RCV. In this condition, adjust R67 so that OUTPUT is -10 dBv (0.3 V). (Confirm that the green LED is lit.)

4) Put the system in ENCODE mode and apply 100 Hz / -10 dBv (0.3 V) to INPUT. In this condition, adjust R47 so that distortion of ENC SEND output is minimized.

5) Put the system in ENCODE mode and jumper INPUT. Monitoring VCA DC output (at U2-1) on an oscilloscope, adjust R20 so that the offset becomes 0 V.

6) Put the system in ENCODE mode and apply 1 kHz / +10 dBv (3.16 V) to INPUT. In this condition, adjust R11 so that distortion of ENC SEND output is minimized.

7) Put the system in ENCODE mode and jumper INPUT. Monitoring VCA DC output (at U2-1) on an oscilloscope, check that offset is within ±5 mV.

8) Put the system in ENCODE mode and apply 1 kHz / -10 dBv (0.3 V) to INPUT. In this condition, adjust R56 so that ENC SEND output is -10 dBv (0.3 V).

9) Put the system in DECODE mode and apply 1 kHz / -10 dBv (0.3 V) to DEC RCV. In this condition, adjust R67 so that OUTPUT is -10 dBv (0.3 V).

4. Check

1) Linearity check

a. ENCODE When input is 1 kHz in ENCODE mode, the following must be met.

+10 dBv	0 dBv ± 1 dB
-50 dBv	-30 dBv ± 1 dB

b. DECODE When input is 1 kHz in DECODE mode, the following must be met.

0 dBv	+10 dBv ± 1 dB
-30 dBv	-50 dBv ± 1 dB

2) Frequency response check

a. ENCODE When input is -10 dBv in ENCODE mode, the following must be met.

100 Hz	-12.5 dBv ± 1 dB
10 kHz	-14.3 dBv ± 1 dB

b. DECODE When input is -10 dBv in DECODE mode, the following must be met.

100 Hz	-5 dBv ± 1 dB
10 kHz	-2.5 dBv ± 1 dB

3) S/N check (unweighted)

a. ENCODE When input is cut off in ENCODE mode, output should not exceed -54 dBv.

b. DECODE When input is cut off in DECODE mode, output should not exceed -85 dBv.

4) Distortion check (20 Hz ∿ 20 kHz audio filter)

a. ENCODE When input is 1 kHz in ENCODE mode, distortion should not exceed 0.2% at +10 and -30 dBv in input level.

b. DECODE When input is 1 kHz in DECODE mode, distortion should not exceed 0.2% at 0 and -20 dBv in input level.

5. FUNCTION OF CONTROLS

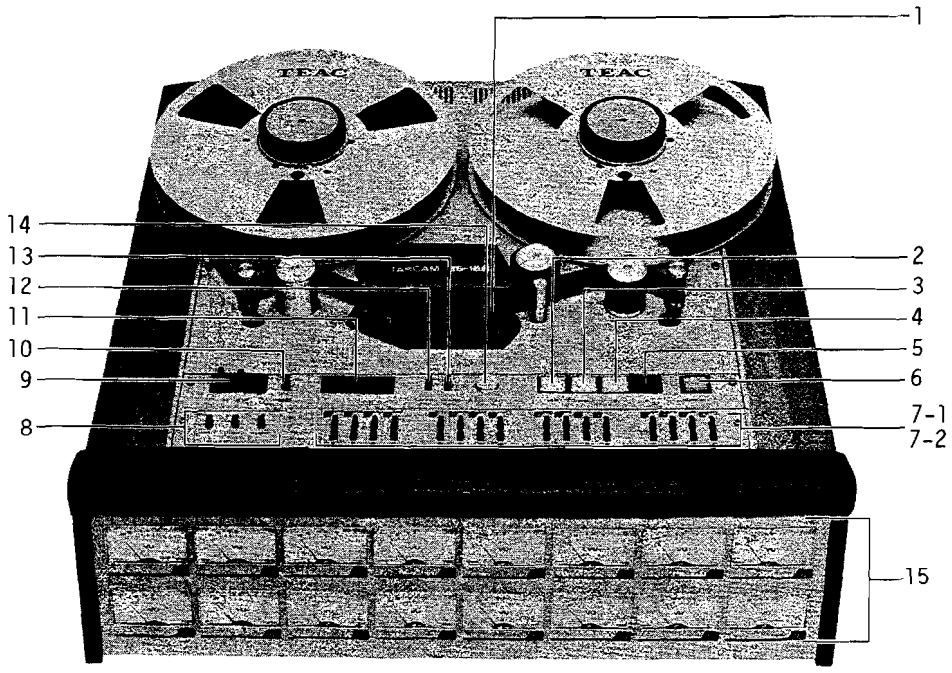


Fig. 5-1

(1) HEAD SHIELD GATE

The head shield gate is manually operated and locks in the open position when pressed down; pressing it down again will release the lock and the shield will pop up.

(2) ≪ button

Will go into the REWIND mode when this is depressed. When the ≪ button is depressed twice, the tape will travel at the storage winding speed (spooling mode).

(3) ≫ button

Will go into the FAST FORWARD mode when this is depressed. When the ≫ button is depressed twice, the tape will travel at the storage winding speed (spooling mode).

(4) ■ button

Will STOP tape when this is depressed. In the stop mode, if the ■ button is depressed again, the transport will go into the EDIT mode. Both reels can then be manipulated to jockey the tape to the desired position.

For a duration of about 5 seconds after POWER ON, the STOP lamp will blink to warn the operator that the transport is not ready for operation. It will be ready for operation when the blinking changes to a steady light.

(5) > button

Depress this for the PLAY mode.

(6) RECORD button

1) With any one or more of the FUNCTION SELECT buttons depressed, these channels will go into the RECORD mode when both the RECORD and > buttons are depressed at the same time.

2) With any one or more of the FUNCTION SELECT buttons depressed and with the machine in the REPRODUCE mode, these channels will be in the RECORD mode as long as the RECORD and > buttons are held depressed at the same time.

3) With one or more of the FUNCTION SELECT buttons depressed and the system in RECORD mode, the system will enter REPRODUCE mode when the RECORD and > buttons are depressed at the same time.

(7) INPUT/SYNC buttons

1) The INPUT/SYNC button switches the output monitor over INPUT and SYNC under the condition that the OUTPUT SELECT button selects SYNC, the RECORD SAFETY button is depressed, and the system is not in RECORD mode.
In RECORD mode, INPUT is selected for the output monitor regardless of the setting of this button.

2) The INPUT/SYNC indicator lights when the button is depressed with the system not in RECORD mode. It goes out when the system transfers from the current mode to RECORD mode.

(8) OUTPUT SELECT buttons

1) When the input button is depressed, the source monitor signal is fed to the line output jack and meter.

2) With the SYNC button depressed, the SYNC monitor works in the following cases.
* The REC SAFETY button is not depressed.
* With the REC SAFETY button depressed, the INPUT/SYNC button selects SYNC and the system is not in RECORD mode.

3) When the REPRO button is depressed, signals picked up by the reproduce head are fed to the line output jacks.

(9) CUE lever

When the CUE lever is shifted to the left, the tape lifter is defeated.

(10) Tape counter RESET button

When the RESET button is depressed, the counter display resets to 00.00. However, when the TIME/SPEED select button is set to TIME (button in up position) depressing the RESET button will have no effect on the counter display, although the content of the counter will be reset to 00.00.

(11) Counter display

This display indicates in minutes and seconds when the SPEED/TIME select button is set to TIME (button in up position).

When this button is set to SPEED (button in down position) the display indicates the tape speed from 85% through 115% with the fixed speed of 15 ips referenced as 100%.

(12) SPEED/TIME

When this button is in the up position, the display functions as a tape counter indicating in minutes and seconds; when in the down position, it indicates the actual tape speed in percent in reference to the fixed speed of 15 ips as 100%.

Even if this button is set to SPEED, when the transport is set to the search mode, the display will change to tape counter but return to the SPEED display when the search mode is cancelled.

(13) SEARCH ZERO button

This function is for returning the tape to the 00.00 position. Regardless of what mode the transport may be in, it will go to the search mode when this button is depressed and stop the tape at 00.00.

When the tape is running in the search mode, the ≪ or ≫ button lamp will light depending on which direction the tape is traveling.

(14) PITCH CONTROL knob

Pulling out this knob activates the pitch control circuit. The range of pitch control is ±10% against the fixed speed of 15 ips.

(15) Meter bridge

Depending on which OUTPUT SELECT button is depressed, the source signal, sync signal or the reproduce signal can be monitored on the meters.

(16) POWER switch

When this switch lever is flipped up, power is applied to all units of the 85-16B. The meter lamps, function LEDs, and the STOP control buttom lamp will light. The stop lamp will blink and the 85-16B will not operate, even if one of the control buttons is depressed, for about 5 seconds after power on.

(17) DBX IN/OUT switch

This switch should be switched OUT if dbx is not required on all 16 channels.

(18) BYPASS buttons (DX-16B is..optional for the 85-16B.)

This button is depressed if any particular channel must bypass the dbx unit. When this button is depressed, the red LED for ENCODE or the green LED for DECODE, will go out.

(19) Transport tilting angle lock pin

The transport can be tilted over a ±30° range from the horizontal. In addition, it can be swung up perpendicular for ease in servicing and checking

the underside of the transport.

To change the angle, pull out the pins on both sides, swing the transport to the desired angle, align the holes and push in the pins. There is no locking hole for the perpendicular position but the transport will stay in this position without falling forward since the rear section is heavier than the front.

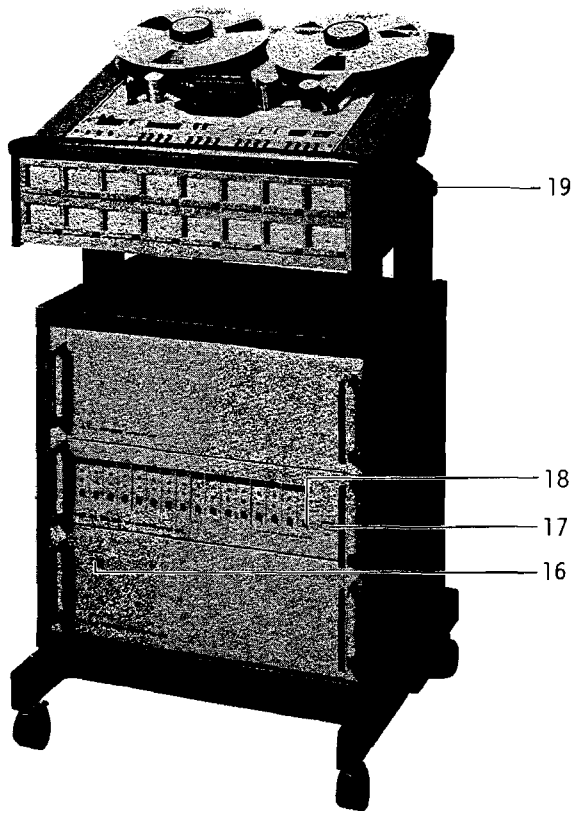


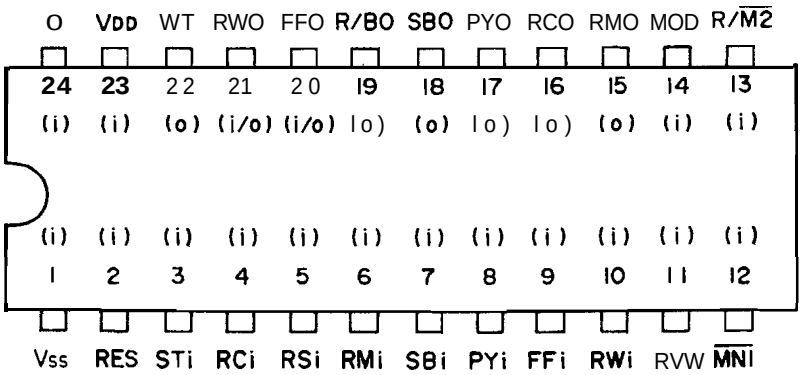
Fig. 5-2

6. THEORY OF OPERATION

6.1 LSI of system control

The LSI used in the 85-16B System Control PCB Assembly is a P channel MOS type 24 pin dual in-line IC containing a system control logic circuit which is specifically designed for tape deck system control applications.

6.1.1 Pin assignments



0 : CLOCK
(i): INPUT
(o): OUTPUT
(i/o): INPUT/OUTPUT

Fig. 6-1

6.1.2 Block diagram

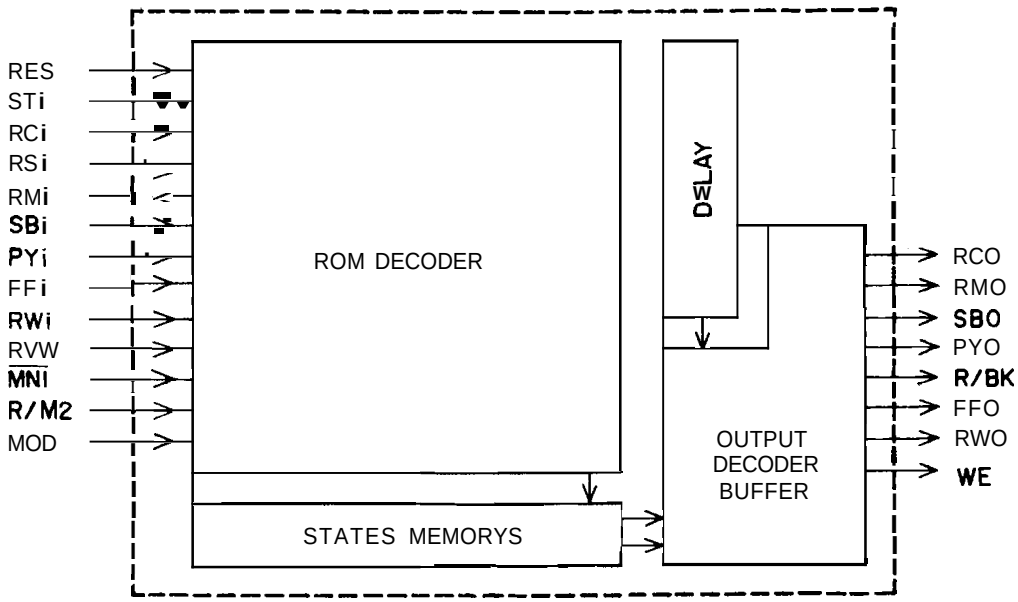


Fig. 6-2

6.1.3 List of input signals

Pin No.	Name of signal	Code
1	Source power supply	Vss
2	RESET INPUT	RES
3	STOP INPUT	STi
4	RECORD INPUT	RCi
5	RECORD SAFETY INPUT	RSi
6	RECORD MUTE INPUT	RMi
7	STAND BY INPUT	SBi
8	PLAY INPUT	PYi
9	FAST FORWARD INPUT	FFi
10	REWIND INPUT	RWi
11	REVIEW INPUT	RVW
12	$\overline{\text{MOTION 1}}$ INPUT	$\overline{\text{MN1}}$
13	REVERSE/$\overline{\text{MOTION 2}}$ INPUT	R/$\overline{\text{M2}}$
14	MODE INPUT	MOD
23	Drain power supply	Vdd
24	Clock	ϕ

6.1.4 List of output signals

Pin No.	Name of signal	Code
15	RECORD MUTE OUTPUT	RMO
16	RECORD OUTPUT	RCO
17	PLAY OUTPUT	PYO
18	STAND BY OUTPUT	SBO
19	REVERSE/BK OUTPUT	R/BO
20	FAST FORWARD OUTPUT	FFO *
21	REWIND OUTPUT	RWO *
22	WAIT OUTPUT	WT

* These are also input pins as well as for output.

6.1.5 General description of the various input/output signals

1) Determination of priority

The operation of this IC is determined by the weight of each input signal and the order of priority is given each signal when more than two inputs are applied at the same time.

For instance, if STi and SBi are input simultaneously, STi is selected

High priority ⟶ Low priority

1. STi 2. SBi 3. PYi 4. REVERSE 5. FFi and RWi

The reason for giving the same priority to FFi and RWi is so that both will be

effective when they are input simultaneously and thus FFO and RWO will be output at the same time.

Thus, pulling the tape from both sides is possible due to the simultaneous input of FFi and RWi.

2) Motion sensing

By applying a "tape running signal" to this IC, when an SBi or PYi is input during FF or REWIND mode of the transport, stopping of tape is detected and then go to the STANDBY or PLAY mode. In other Words, motion sensing is possible.

In this IC, two types of mode can be Selected by switching the MODE input

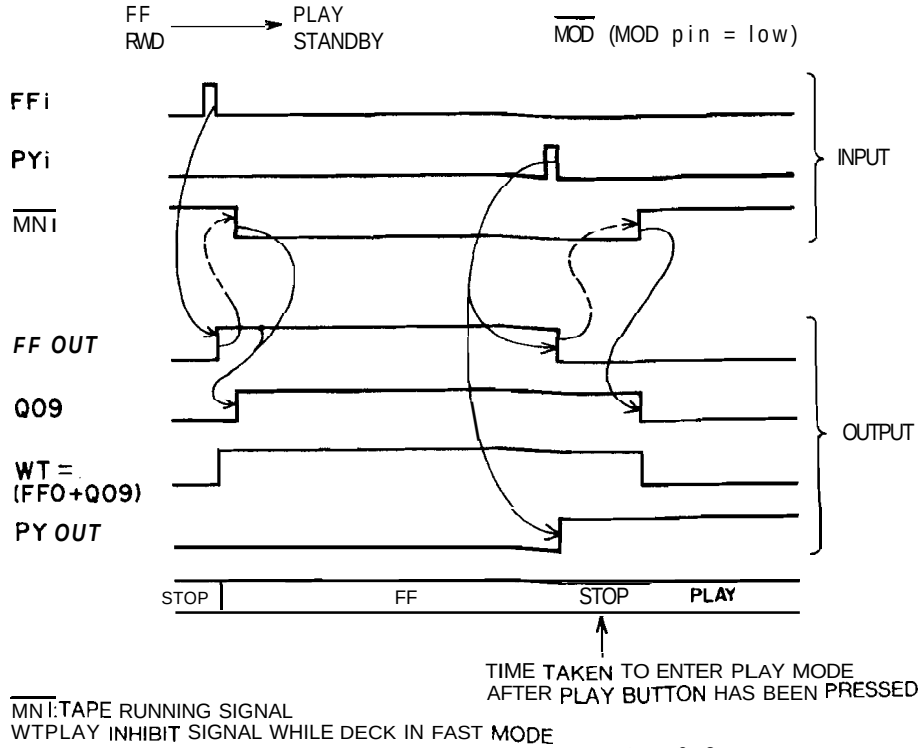
A. Mode 1

This mode is for transports which do not have a tape running detection system or only a tape running detection system without direction sensing. In Mode 1, REVERSE and REVIEW operations are possible.

When changing to standby, play or reverse modes from FF or RWD, the WAIT output signal remains high as long as the tape running signal is applied ($\overline{MNI}$ at low; although SBO or PYO quickly goes high) to the $\overline{MNI}$ pin. By inhibiting $SB\bar{O}$, $PY\bar{O}$ or $R/B\bar{O}$ by this WAIT signal from the external logic, shift to the next operation can be delayed until tape stopping has been detected.

As another feature, the above motion sensing control is possible by wired-OR connection of a foot switch, for example, with the $FF\bar{O}$ and $RW\bar{O}$ pins which are $I/\bar{O}$ terminals, to directly control the transport in FF or RWD modes.

The above operations are expressed in a time chart as follows:



$\overline{MNI}$:TAPE RUNNING SIGNAL
WTPLAY INHIBIT SIGNAL WHILE DECK IN FAST MODE

Fig. 6-3

B. Mode 2

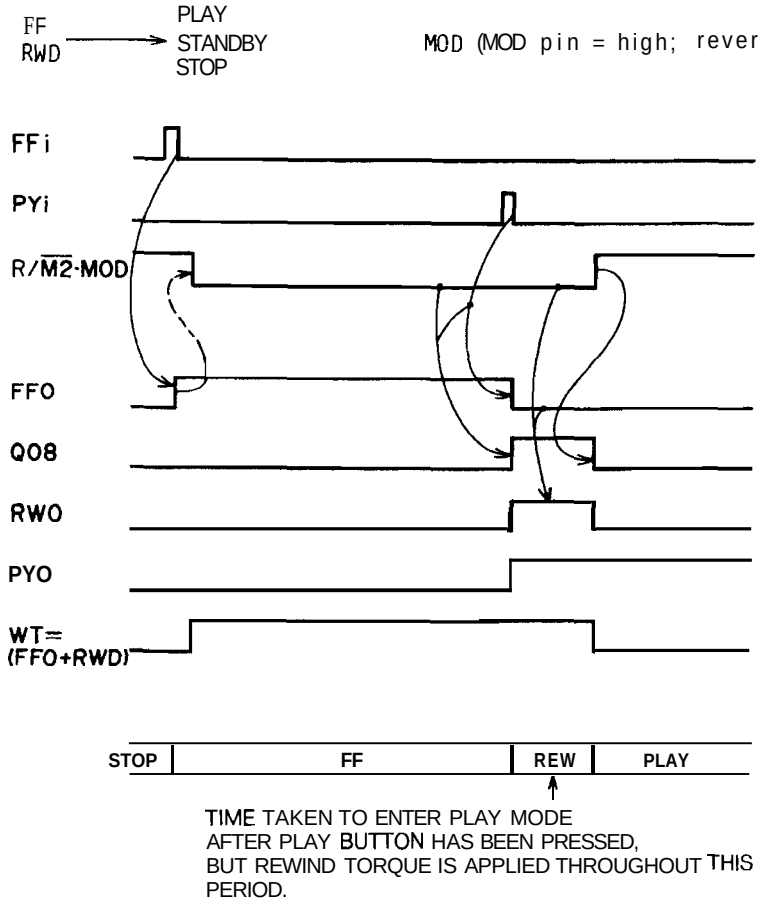
This mode is for transports having tape stop detection and forward/reverse direction detection, and which do not have a REVERSE operation feature.

When changing to standby, play or stop modes from FF or RWD, if the transport is in the FF mode (it should be detecting the FWD direction) a reverse direction signal, REWIND OUT, is output until tape stop is detected.

During the period it is in the reverse direction mode, standby output or play output and FF output or RWD output are simultaneously output but the WAIT signal will also be high during the same period it is in the reverse direction mode. Under this condition, if SBO or PYO is inhibited by the WAIT output signal from external logic, the tape will be decelerated by the reverse direction mode and shift to the next operation is delayed until tape stop is detected.

After detecting tape stop, if a delay during transition to standby or play modes is required, this can be accomplished by introducing a delay in the negative transition of the WAIT signal from the external logic.

The above operations, expressed in a time chart, are as follows:



R/M2-MOD:TAPE RUNNING SIGNAL
WT:PLAY INHIBIT SIGNAL WHILE DECK IN FAST MODE

Fig. 6-4

3) Record delay operation

When entering stop, reverse, FF or rewind modes from REC PLAY or REC STANDBY, SBO or PYO goes low 50msec. after RCO goes low, when the clock frequency is about 40 kHz.

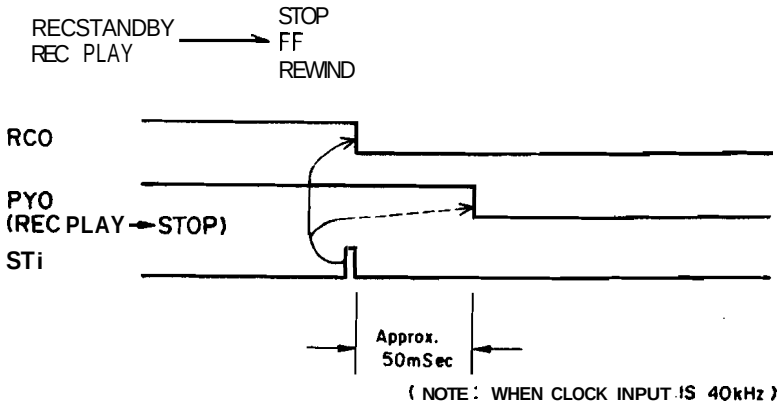


Fig. 6-5

As all input/output signals are high true except for $\overline{MN1}$ and R/$\overline{M2}$ in Mode 2. Output pins are open drain, and must be connected to Vdd through resistors.

A. Input Signals

IC pin No.	Name	Code	Description
1	Source power supply	Vss	The IC power supply voltage should be +10 - +16 V (ripple less than 100 mV).
2	RESET INPUT	RES	This is for resetting all STATE MEMORIES and counters, etc. except for the internal memories for Motion Sensing (F09), Record Delay (F10), and Review (F11). This input is set to high at Initial Power Reset and at Shut off.
3	STOP INPUT	STi	(Priority 1) This is for resetting the LSI internal OPERATION STATE MEMORIES --- Record (F01), Play (F02), Standby (F03), Reverse (F04), FF (F05), Rewind (F06), and Record Mute (F07).
4	RECORD INPUT	RCi	Record play or Record standby signals are applied here. The internal Record memory is set when set conditions are established (Refer to equation).

	RECORD SAFETY INPUT	RSi	This input resets the internal Record memory (F01) and if it is high, the Record memory will not be set. If an RSi is applied during record, the Record memory will be reset.
6	RECORD MUTE INPUT	RMi	This input signal is for inducing Record mute by setting the internal Record mute memory (F07). When set conditions (Refer to equation) for the Record mute memory (F07) are established, RMi goes to high. Until reset conditions for F07 are established, after F07 is set, the output signal RMŌ remains high.
7	STANDBY INPUT	SBi	(Priority 2) This is the Standby operating input (includes REC standby) and when set conditions (Refer to equation) are established, the internal Standby memory (F03) is set. This can also be used for Pause.
8	PLAY INPUT	PYi	(Priority 3) This is the Play operation input (includes REC play) and when set conditions (Refer to equation) are established, the internal Play memory (F02) is set.
9	FAST FORWARD INPUT	FFi	(Priority 5) The Fast Forward operating input which sets the internal FF memory (F05) when set conditions are established (Refer to equation). When both FFi and RWi are input at the same time, F05 and F06 will be set and outputs FFO and RWO will both go high.
10	REWIND INPUT	RWi	(Priority 5) This signal is for Rewind operation which sets the internal Rewind memory (F06) when set conditions are established (Refer to equation). As mentioned above, when RWi and FFi are both input at the same time and F06 and F05 are both set, output signals FFO and RWO will both be high as long as FFi high.

11	REVIEW INPUT	RVW	When the REVIEW INPUT goes high during the PLAY mode (not including REC PLAY and REV PLAY), RWO is output only during the period the REVIEW INPUT is high. Throughout this operation, the REVIEW INPUT signal will not reset the PLAY state memory (F02) nor set the REWIND state memory (F06). The REVIEW state memory is F11. When it returns to the PLAY mode, it undergoes motion sensing control. Although output signals PYO and RWO go high during the REVIEW mode, as the WAIT signal also goes high in the same way as in motion sensing, it is only necessary to inhibit the WAIT signal using PYO. * Effective only in Mode 1.
12	$\overline{\text{MOTION 1}}$ INPUT	$\overline{\text{MN1}}$	This is the input signal from the tape run detecting system and is used for motion sensing operation. Signals applied: In Mode 1: When tape is stopped ---------- High When tape is running ---------- Low In Mode 2: When tape is stopped or tape is running in reverse direction ----- High Tape is running forward --------- Low
13	REVERSE/$\overline{\text{MOTION 2}}$ INPUT	R/$\overline{\text{M2}}$	This input will be --- Reverse input at Mode 1, or $\overline{\text{Motion 2}}$ input at Mode 2 * Reverse input: This is the input signal for Reverse play which sets the internal Reverse states memory (F04) when set conditions (Refer to equation) are established. *$\overline{\text{Motion 2}}$ input: This input signal is used for motion sensing during reverse mode control and is a signal from the tape run detecting system. The signals to be input; During tape stop and forward run of tape ---- High During reverse run of tape ---- Low

			The state memory for reverse mode control is F08.
14	MODE INPUT	MOD	This signal is for switching between Mode 1 and Mode 2, and the signals should be --- Low for Mode 1, and High for Mode 2
23	Drain side power supply	Vdd	This is the IC internal drain side power supply and must be zero volt.
24	CLOCK	ϕ	This is the input signal for synchronizing the IC operation. All operations of the IC are upset if the clock is not applied correctly. The clock is a square wave with a frequency from 30 kHz through 100 kHz (It is generally set at 40 kHz ~ 50 kHz).

B. Output Signals

As for the input signals, please refer to the related equation on the IC internal set conditions in studying the output signals.

IC pin No.	Name	Code	Description
15	RECORD MUTE OUTPUT	RMO	This output signal is used for RECORD MUTE and to inhibit audio signals.
16	RECORD OUTPUT	RCO	This output is to put the transport in the RECORD mode.
17	PLAY OUTPUT	PYO	This output signal puts the transport in PLAY and RECORD PLAY modes.
18	STANDBY OUTPUT	SBO	This signal is for STANDBY and RECORD STANDBY mode.
19	REVERSE/BK OUTPUT	R/BO	Signals from this are: REVERSE OUTPUT (Mode 1) BK OUTPUT (Mode 2) *REVERSE OUTPUT - Signal for REVERSE operation *BK OUTPUT - This output is high during reverse mode control. (Note 1)
20	FAST FORWARD OUTPUT	FFO	Output signal for FF mode. (Note 2)
21	REWIND OUTPUT	RWO	Output signal for REWIND mode. (Note 2)

22	WAIT OUTPUT	WT	This is the control signal for inhibiting the outputs SBO, PYO, and R/BO until end of control. They are under motion sensing control and reverse mode control.

Note (1): Generally, FF/RWD lamps are inhibited during reverse mode.

Note (2): FFO and RWO are 1/0 pins and they are normally the output pins for FF and REWIND modes but motion sensing becomes possible by applying a high level signal here when FFO or RWO is not high. Refer to line 19, page 6-3.

6.1.6 Logical equations of internal functions of the LSI

The following logical equations concern internal functions of the LSI based on the circuit diagram and using the codes in the diagram, which were not described in detail in Item 6.1.5.

Item 1) described the conditional status under which the signals are output and, in Item 2), the set/reset conditions of each state memory within the LSI are described.

All state memories inside the LSI are of the reset priority type which mean that even though a set condition may exist, the memory will not be set if a reset condition exists.

The equations of the internal functions of the LSI are all indicated by AND and OR:

AND is represented by .

OR is represented by +

In the following, the RECORD state memory, FO1, is taken as an example.

$$SO1 = RCi \cdot (PYi + SBi)$$

This means that the set condition is satisfied when PYi or SBi is high and RCi is also high with FO1 in the set condition.

$$RO1 = RES + STi + FFi + RWi + R/\overline{M2} \cdot \overline{MOD} + RSi$$

This means, with FO1 in the reset condition, the reset condition is satisfied by a high level of $R/\overline{M2}$ or RSi for the modes of RES, STi, FFi, RWi, or Mode 1.

1) OUTPUT

$$RCO = Q01$$
$$RYO = Q02 + DL \cdot Q10$$
$$SBO = Q03 + DL \cdot \overline{Q10}$$
$$R/BO = Q04 \cdot \overline{DL} + Q08$$
$$FFO = (Q05 + S05) \cdot \overline{DL} + Q08 \cdot \overline{R/M2}$$
$$RWO = (Q06 + S06 + Q11) \cdot \overline{DL} + Q08 \cdot MN1$$
$$RWO = Q07$$
$$WT = FFO + RWO + Q09$$

2) SET/RESET conditions of the STATES MEMORY in the LSI

F01: RECORD state memory

$S01 = RCi \cdot (PYi + SBi)$

$R01 = RES + STi + FFi + RWi + R/\overline{M2} \cdot \overline{MOD} + RSi$

F02: PLAY state memory

$S02 = PYi$

$R02 = RES + STi + SBi + \overline{PYi} \cdot (FFi + RWi + R/\overline{M2} \cdot \overline{MOD})$

F03: STANDBY state memory

$S03 = SBi$

$R03 = RES + STi + \overline{SBi} \cdot (PYi + FFi + RWi + R/\overline{M2} \cdot \overline{MOD})$

F04: REVERSE state memory

$S04 = R/\overline{M2}$

$R04 = RES + STi + SBi + PYi + \overline{R/\overline{M2}} \cdot (FFi + RWi) + MOD$

F05: FAST FORWARD state memory

$S05 = FFi \cdot \overline{RES} \cdot \overline{STi} \cdot \overline{SBi} \cdot \overline{PYi} \cdot \overline{R/\overline{M2} \cdot \overline{MOD}}$

$R05 = RES + STi + RWi + (MN1 + \overline{R/\overline{M2}} \cdot MOD) \cdot (SBi + PYi + R/\overline{M2} \cdot \overline{MOD})$

F06: REWIND state memory

$S06 = RWi \cdot \overline{RES} \cdot \overline{STi} \cdot \overline{SBi} \cdot \overline{PYi} \cdot \overline{R/\overline{M2} \cdot \overline{MOD}}$

$R06 = RES + STi + FFi + (MN1 + \overline{R/\overline{M2}} \cdot MOD) \cdot (SBi + PYi + R/\overline{M2} \cdot \overline{MOD})$

F07: RECORD MUTE state memory

$S07 = RMi \cdot Q01 \cdot Q02$

$R07 = RES + STi + SBi + PYi + FFi + RWi + RSi + R/\overline{M2} \cdot \overline{MOD}$

F08: Reverse mode control state memory

$S08 = (FF0 + RW0) \cdot (STi + SBi + PYi)$

$R08 = \overline{MN1} \cdot R/\overline{M2} + RES + \overline{MOD}$

F09: Motion sensing state memory

$S09 = MN1 \cdot (FF0 + RW0)$

$R09 = \overline{FF0 + RW0 + MN1} + MOD$

F10: RECORD DELAY state memory

$S10 = Q01 \cdot Q02$

$R10 = Q01 \cdot Q03$

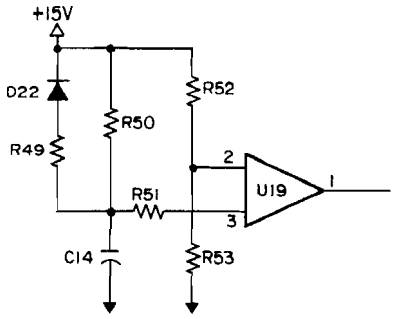
F11: REVIEW state memory

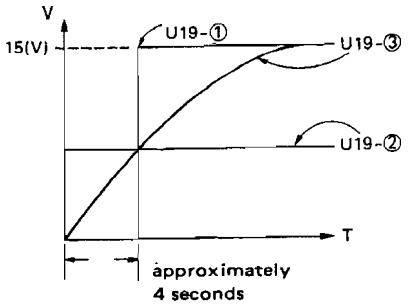
$S11 = MN1$

$R11 = \overline{RVW} + Q01 + \overline{Q02} + MOD$

6.2 Power On Reset and Shut Off

A. Power on reset





The POWER ON RESET signal is output for approximately 4 seconds after the Power is turned on (until the system is stabilized). This signal mutes the audio amplifier and resets the flip-flops, thereby initializing the system.

The Power On Reset circuit generates POWER ON RESET.

Operational amplifier U19 compares the voltage coming to its inverting input pin #2, and divided by R52 and R53 with that supplied from the R50 and C14 integrating circuit and coming to non-inverting input pin #3, and outputs a result at pin #1.

The output voltage at pin #1 is 0 V when input voltage at pin #2 is higher than that at pin #3; otherwise, it is +15 V.

In this system, the condition where input pin #2 is lower than input pin #3 holds for about 4 seconds after power is turned on. During this time, U19 outputs 0 V through pin #1 to announce the Power On Reset state to the whole system.

The POWER ON RESET signal triggers the following steps.

a) POWER ON RESET signal is sent to input pin #13 of the system control PCB assembly U13-11, thereby flashing the STOP lamp.

b) Renamed as ST.P.MUTE signal, it enters the control drive PCB assembly through input pin #13 of U3-11 and drives Q12. Its output is delivered to the tension servo amplifier PCB assembly, which turns off the tension sensor circuit.
The signal coming to U6-4 drives Q4. Its output enters the function selector unit through input pin #8 of U6-10, thereby muting the audio amplifier.

c) The signal entering input pin #13 of the system control PCB assembly U10-11 and exiting through U10-11:
* Resets the Spooling circuit.
* Entering through pin #2(RES) of U11, resets the system control LSI U11.

* Going out through U1-12, resets the flip-flops of the counter PCB assembly, drives Q1 of the control drive PCB assembly, and goes to the remote control unit via the function selector unit.

d) This signal resets the Edit circuit while it comes from the system control PCB assembly U10-11 to input pin #13 of U14-12 and from U14-12 to input pin #1 of U28-3.

e) The signal coming from the system control PCB assembly U14-12 to input pin #2 of U10-3 resets the Zero Search circuit.

B. SHUT OFF

The SHUT OFF junction directs the tape sensor assembly to detect whether or not a tape is mounted, to turn off the capstan motor, and reset the system flip-flops.

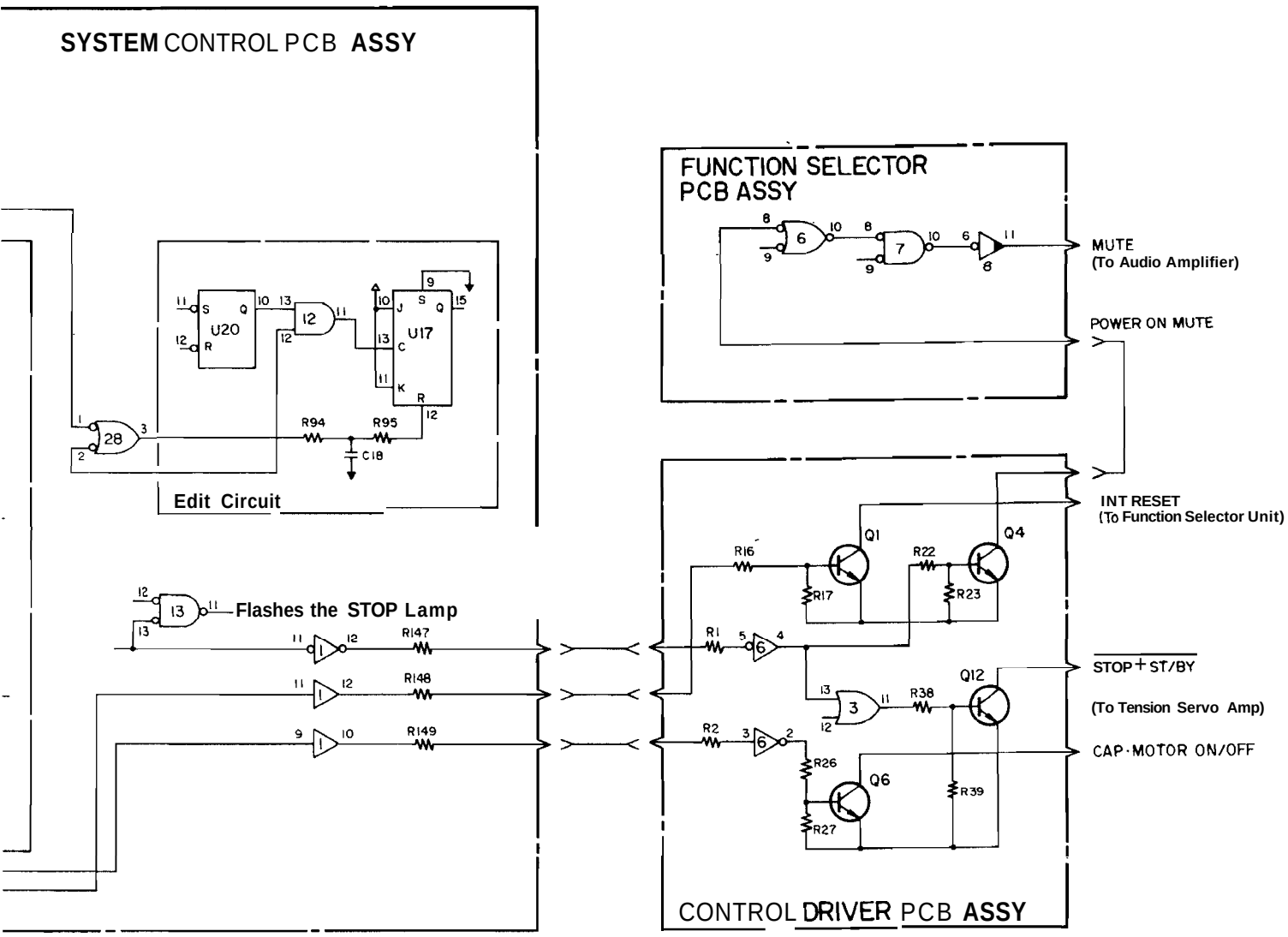
The SHUT OFF command is supplied from a tape sensor consisting of a photodiode and a phototransistor to the system control PCB assembly. When the coated part of tape does not permit light to pass through the tape to the tape sensor, a +15 V signal is input to the system control PCB assembly. When a tape is not mounted or a transparent part of tape is running past the sensor, a 0 V signal is supplied which triggers the SHUT OFF command.

The SHUT OFF signal triggers the following steps.

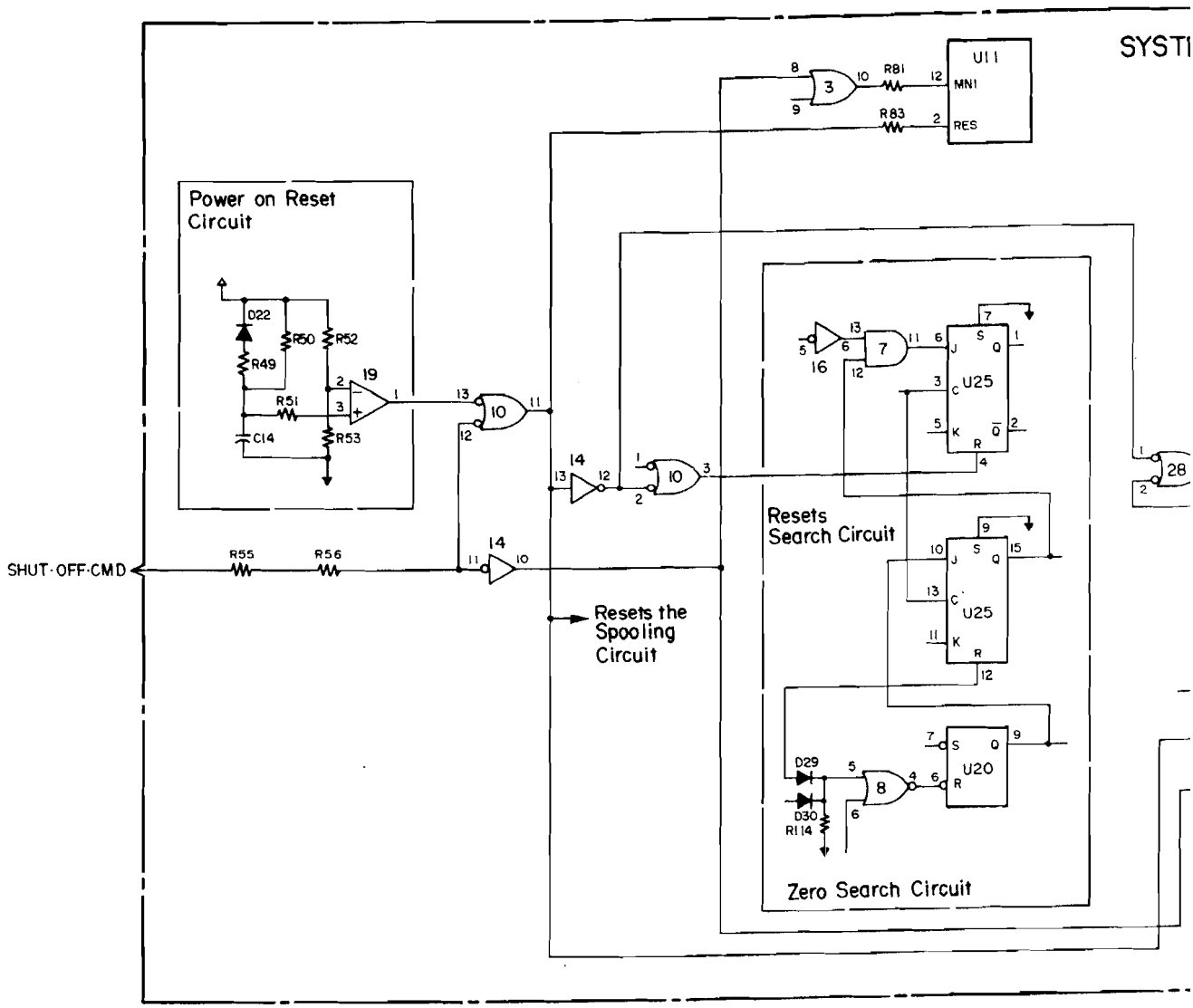
a) The signal output through U14-10 comes into the system control LSI pin #12 (MNI) through pin #11 of U14-10 of the system control PCB assembly. At the same time, the signal output through U1-10 drives Q6 of the control drive PCB assembly which, in turn, outputs a signal to the capstan PCB assembly' to turn off the capstan motor.

b) The signal comes to pin #12 of system control assembly U10-11, and the output developing at U10-11 resets system flip-flops as POWER ON RESET does (in steps c) - e).

The POWER ON RESET and SHUT OFF signals produce the same effects with the exception that POWER ON RESET does not turn off the capstan motor, and the SHUT OFF command neither flashes the STOP lamp nor mutes the audio amplifier.


SYSTEM CONTROL PCB ASSY
U20
U17
12
28
R94
R95
C18
Edit Circuit
13
Flashes the STOP Lamp
R147
R148
R149
FUNCTION SELECTOR
PCB ASSY
6
7
MUTE
(To Audio Amplifier)
POWER ON MUTE
INT RESET
(To Function Selector Unit)
Q1
Q4
R16
R17
R22
R23
R1
Q12
R38
STOP + ST/BY
(To Tension Servo Amp)
R2
R26
Q6
R27
R39
CAP·MOTOR ON/OFF
CONTROL DRIVER PCB ASSY

6.2 Power on reset and shut off



6.3 Play, Rec/play, and Punch In/Out modes

A. Play mode

In the Play mode, the brake is not applied to the takeup and supply reels: one pinch roller is in contact with the capstan, both reels are servo-controlled for tension, the tape is fed at a fixed speed, and the PLAY lamp is lit.

Pin #8 of U7-10 inhibits PYI PLAY input (pin #8 of the system control LSI U11) during zero search. It accepts PLAY CMD and ZERO SEARCH TO PLAY except during that time.

If pin #8 (PYI) turns to high when the system control LSI U11 is not reset, a high level goes out through PYO (pin #17) which triggers the following steps.

1. That signal coming in through pin #6 of U13-4 and going out through U5-15 turns on the PLAY lamp.
2. Another component comes to pin #1 of U12-3 and goes out to the control drive PCB assembly through U4-12 when pin #2 of U12-3 is high level. The control drive PCB assembly:
   * Drives Q7 and Q8 to send the Play mode command to the tension servo amplifier PCB assembly.
   * Supplies signals to input pin #12 of U4-11, pin #11 of U2-12, pin #1 of U1-3 and pin #13 of U1-11 to drive the pinch roller solenoid.

   Input pin #5 of U2-4, R8, C4, R9, pin #5 of U4-4, pin #6, and U4-4 form a circuit which turns off the tension servo circuit with a delay to prevent the tape from running loose when the Play mode has been switched to Stop mode.

   The delay circuit inhibits pin #16 (RCO) and pin #17 (PYO) of the system control LSI U11 for about 0.8 seconds after the tape has stopped running when Fast mode has been switched to Play mode. A low-level signal is sent from pin #2 of U12-3 to pin #17 (PYO) and from pin #5 of U12-4 to pin #16 RCO. In all modes except STOP, input pin #5, 6 of U1-4 of the control driver PCB assembly energizes the brake solenoid to release the brake.

B. Rec/play mode

Rec/play mode has the same conditions as the Play mode except that the REC/REPRO amplifier is in the REC mode and the REC lamp lights, along with the PLAY lamp.

The RCI (pin #4) REC signal input of the system control LSI U11 comes from REC CMD. If REC CMD and PLAY CMD come in simultaneously when input pin #13 of the Punch Out flip-flop U20-11 is low, a high level is output from pin #16 (RCO) of U11 to pin #6 of U12-4. Then a high level is output through U12-4 if input pin #5 of U12-4 is high (not in delay), thereby triggering the following steps.

1. This drives Q3 of the control drive PCB assembly via U4-6 and Q3 delivers a signal to the Function Select unit so that the REC/REPRO amplifier is

controlled depending on the mode of the Function Select unit.

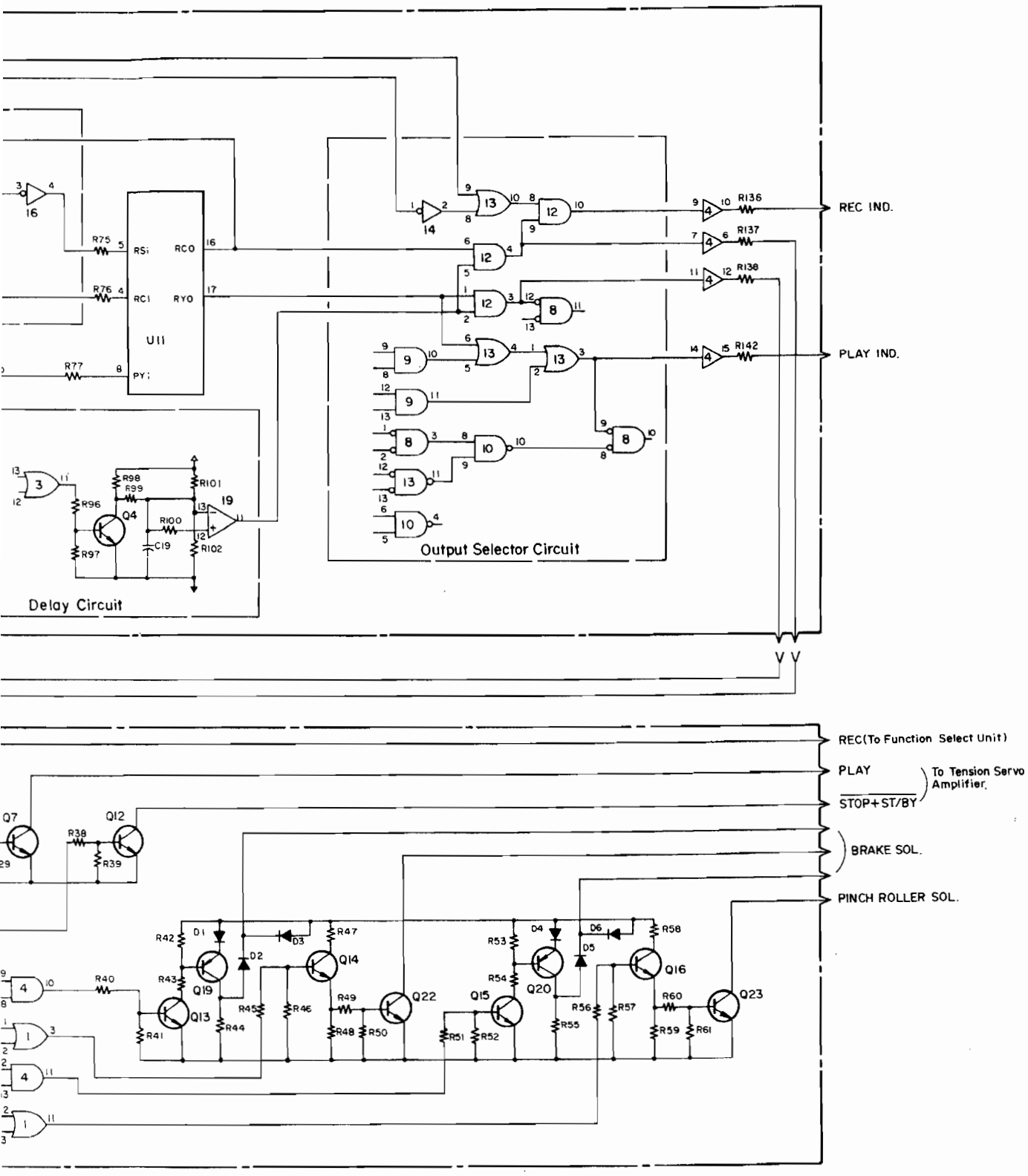
2. The signal comes to input pin #9 of U12-10 and turns on the REC lamp. There are two possible states at this time.
   * The lamp blinks if the REC SAFETY switches of the Function Select unit are off for all channels. Now the system is ready to accept PUNCH IN through the REC SAFETY switch. This state is called REC STANDBY. At this time, no channels are ready for recording.
   * The lamp remains lit when one or more REC SAFETY switches are on. Now the system is in REC mode for those channels for which the REC SAFETY switches are on.

C. PUNCH IN/OUT by REC PLAY button

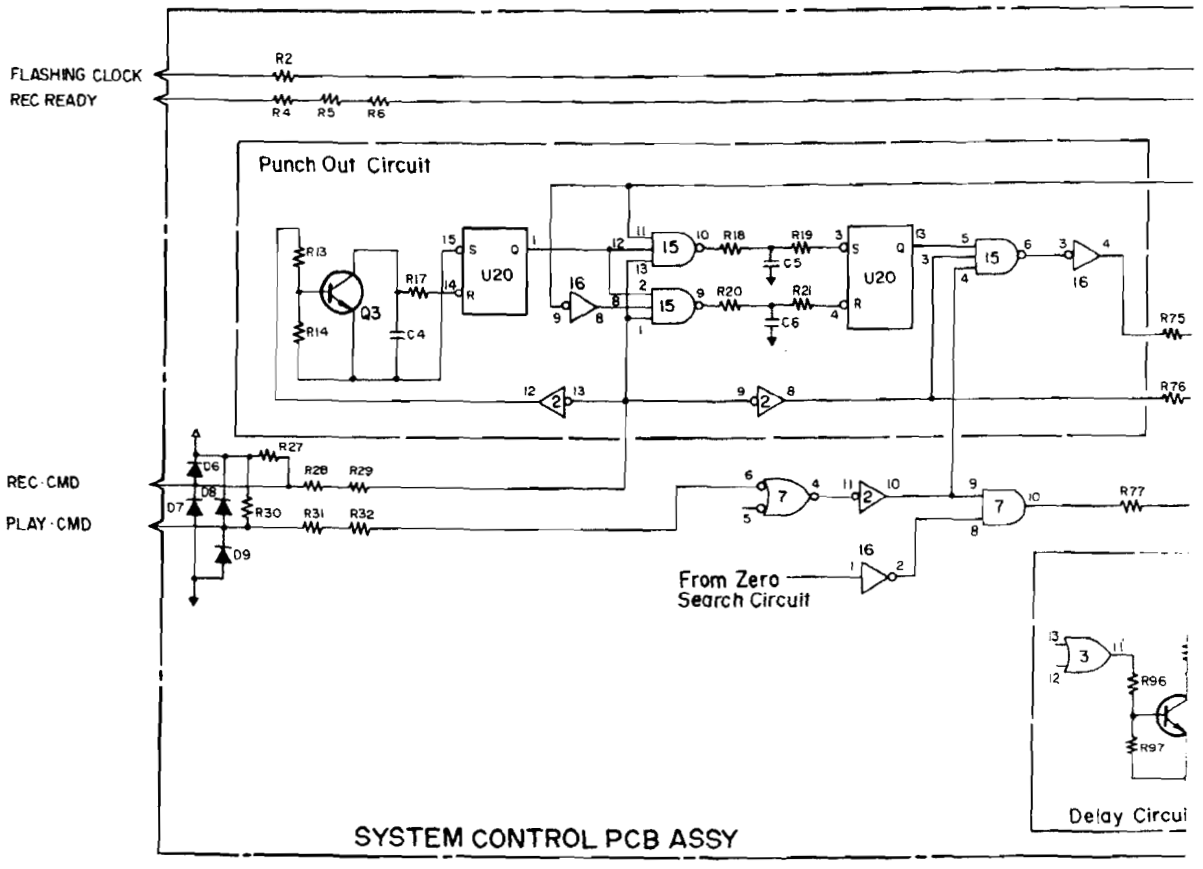
If you press the PLAY and REC buttons simultaneously in Rec Play mode, the mode transfers to Play mode, i.e., it is possible to punch out. To switch Play mode back to Rec Play mode, press the REC and Play buttons simultaneously.

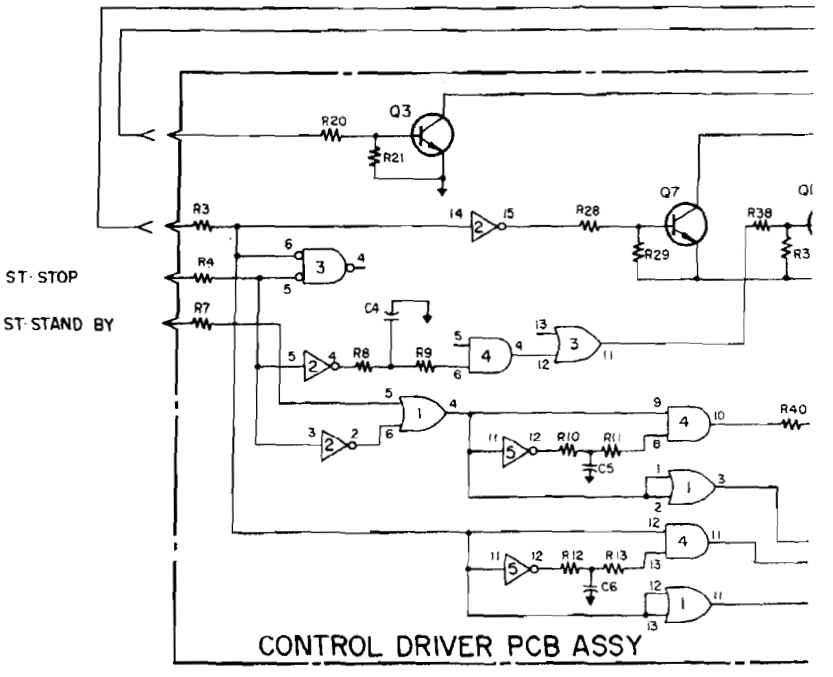
The Punch Out circuit performs Punch Out by turning the RSI (pin #5) REC SAFETY input of the system control LSI U11 to a high level.

The circuit ranging from U2-13 to U20-1 detects whether or not the REC button is really off in order to remove bouncing when the REC button is turned off. Punch Out flip-flops U20-13 are set under the condition that the REC button is completely off, input pin #11, 12, 13 of U15-10, and RCO (pin #16) of LSI U11 are high (in Reclplay mode). If one presses the REC and PLAY buttons simultaneously when the Punch Out flip-flops are set, U15-6 turns to low and U16-3 and 4 invert it, thereby turning RSI (pin #5) of U11 to high. As a result, U11 simply enters Play mode and a low level is output through RCO (pin #16) of U11. As long as the REC button is kept depressed, U15-10 and 9 remain inhibited and the Punch Out flip-flops are ready to accept PUNCH OUT. When the REC button has subsequently been released, input pins #1, #2 and #8 of U15 all turn to high, resetting the Punch Out flip-flops so as to be ready for Punch In.


REC IND.
PLAY IND.
Output Selector Circuit
Delay Circuit
REC(To Function Select Unit)
PLAY
STOP+ST/BY
To Tension Servo Amplifier.
BRAKE SOL.
PINCH ROLLER SOL.

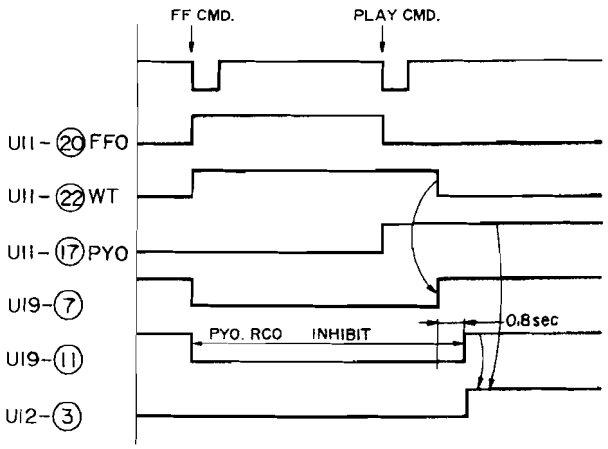
6.3 Record/Play and play modes





6.4 F.FWD and RWD modes

A. F.FWD mode



In F.FWD mode, the braking applied to both reels is released and the tape is fed forward at a high speed.

U2-6 inverts the F.FWD CMD coming from the F.FWD button, and the resulting signal is output to FFI F.FWD input pin #9 of U11 through U7-3. Input pin #1 U7-3 outputs an F.FWD CMD INHIBIT signal which causes RWD CMD to take over instead of F.FWD CMD. In other words, the effect of the RWD button takes priority when it has been depressed together with the F.FWD button. Receiving F.FWD CMD, FFi (pin #9) of LSI U11 outputs a high level through U11-20. This high level triggers the following steps.

1. The signal output through U4-2 to the control drive PCB assembly drives Q8 and Q9 to declare F.FWD mode to the tension servo amplifier PCB assembly.
2. The component which is output from U5-2 to the control drive PCB assembly via U9-3 drives Q28 to light the F.FWD lamp.
3. The signal fixes the Zero Search Master F.F in a reset state via D30 to inhibit the Zero Search command during F.FWD mode.

Receiving the F.FWD CMD, U11 outputs a high level through WT (pin #22) of U11 together with FFO. This high level triggers the following steps.

1. This inhibits ST-STOP at input pin #13 of U8-11 so that Stop mode is inhibited by WT and ST-PLAY (input pin #13 of U8-11).
2. Another component is supplied to input pin #13 of U3-11 to start the delay circuit. Input pin #12 of U3-11 starts the delay circuit during Zero Search to Play. When U3-11 is high (input pin #12 or #13 of U3-11 is high), C19 discharges electricity via Q4 so that U19-11 outputs a low level to inhibit input pin #2 of U12-3 and pin #5 of U12-4. U19-11 outputs a high level in the time interval determined by time constant of R98 and C19 (approx. 0.8 seconds) after U3-11 is set to low.

3. When a high level comes to input pin #12 of U24-11, a phase detector supplies the F-V converter with a MOVE pulse. When a STOP or PLAY command comes in during Fast mode, the tape slows down and the output voltage of the F-V converter rises. This voltage is routed to input pin #5 of U19-7. When the tape speed falls below approximately 15 inches per second, U19-7 outputs a high level (TAPE STOP signal). This signal comes to MNI pin #12 of LSI U11 via input pin #9 of U3-10 and turns WT pin #22 of U11 output to low.

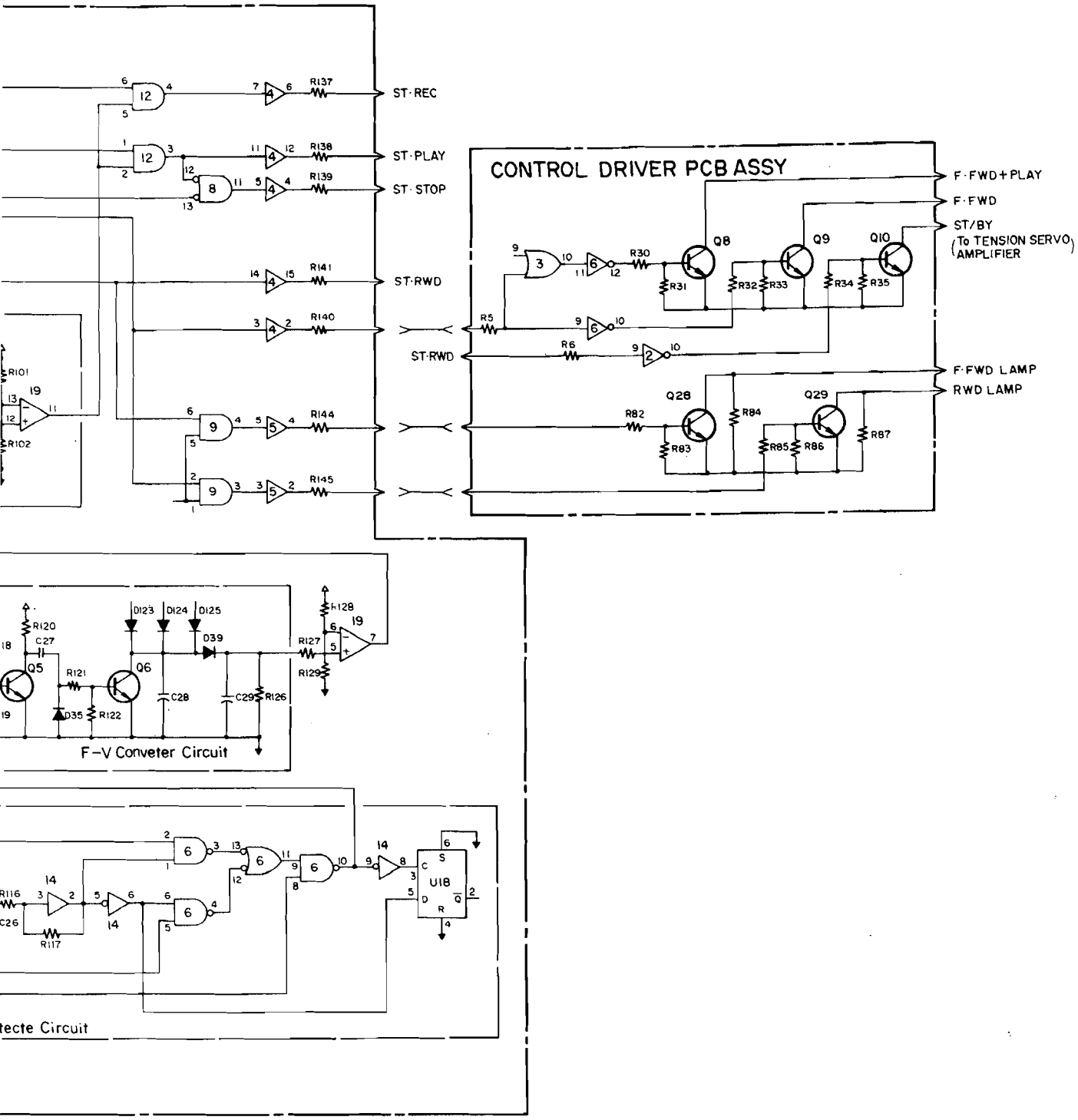
B. RWD mode

RWD mode is the same as F.FWD mode except that the tape travels in the reverse direction and that transfer to RWD mode occurs by a ZERO SEARCH command added to the RWD CMD coming from the RWD button.

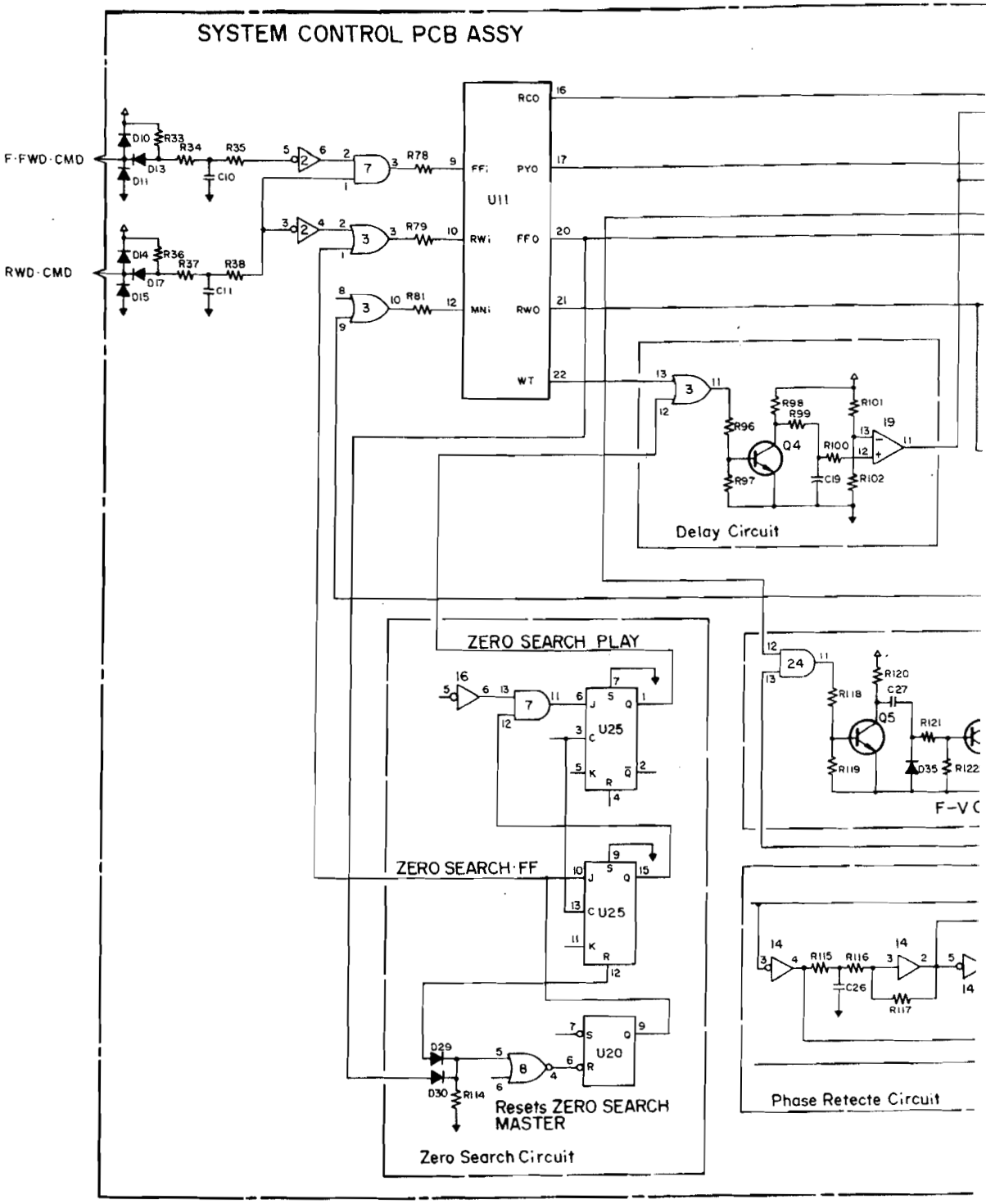
When either input pin #2 of U3-3 (RWD CMD) or pin #1 of U3-3 (ZERO SEARCH command coming from U25-9) turns to high, the output developing at U3-3 comes to RWi pin #10 (RWD) of U11.

Receiving an input at pin #10, the system control LSI U11 turns WT pin #22 to high (as in F.FWD mode) and outputs a high level through RW_O pin #21 of U11. This signal triggers the following steps.

1. The signal comes to the control drive PCB assembly via U4-5, thereby driving Q10 to signal a RWD mode to the tension servo PCB assembly.
2. Another component comes to the control driver PCB assembly via U5-4, thereby driving Q29 to turn on the RWD lamp.


CONTROL DRIVER PCB ASSY
ST·REC
ST·PLAY
ST·STOP
ST·RWD
ST·RWD
F·FWD+PLAY
F·FWD
ST/BY
(To TENSION SERVO AMPLIFIER)
F·FWD LAMP
RWD LAMP
R137
R138
R139
R141
R140
R144
R145
R5
R6
R30
R31
R32
R33
R34
R35
R82
R83
R84
R85
R86
R87
Q8
Q9
Q10
Q28
Q29
R101
R102
R120
C27
Q5
R121
Q6
D35
R122
C28
C29
R126
D123
D124
D125
D39
R128
R127
R129
F-V Conveter Circuit
R116
C26
R117
U18
tecte Circuit

6.4 Fast forward (F.FWD) or Rewind (RWD) mode



6.5 Edit mode

In Edit mode, the tape remains stationary not by braking on both reels but by low voltage applied to reel motors.

When the STOP button has been pressed in Stop mode, it changes to Edit mode. When the button has been pressed in Edit mode, it changes to Stop mode.

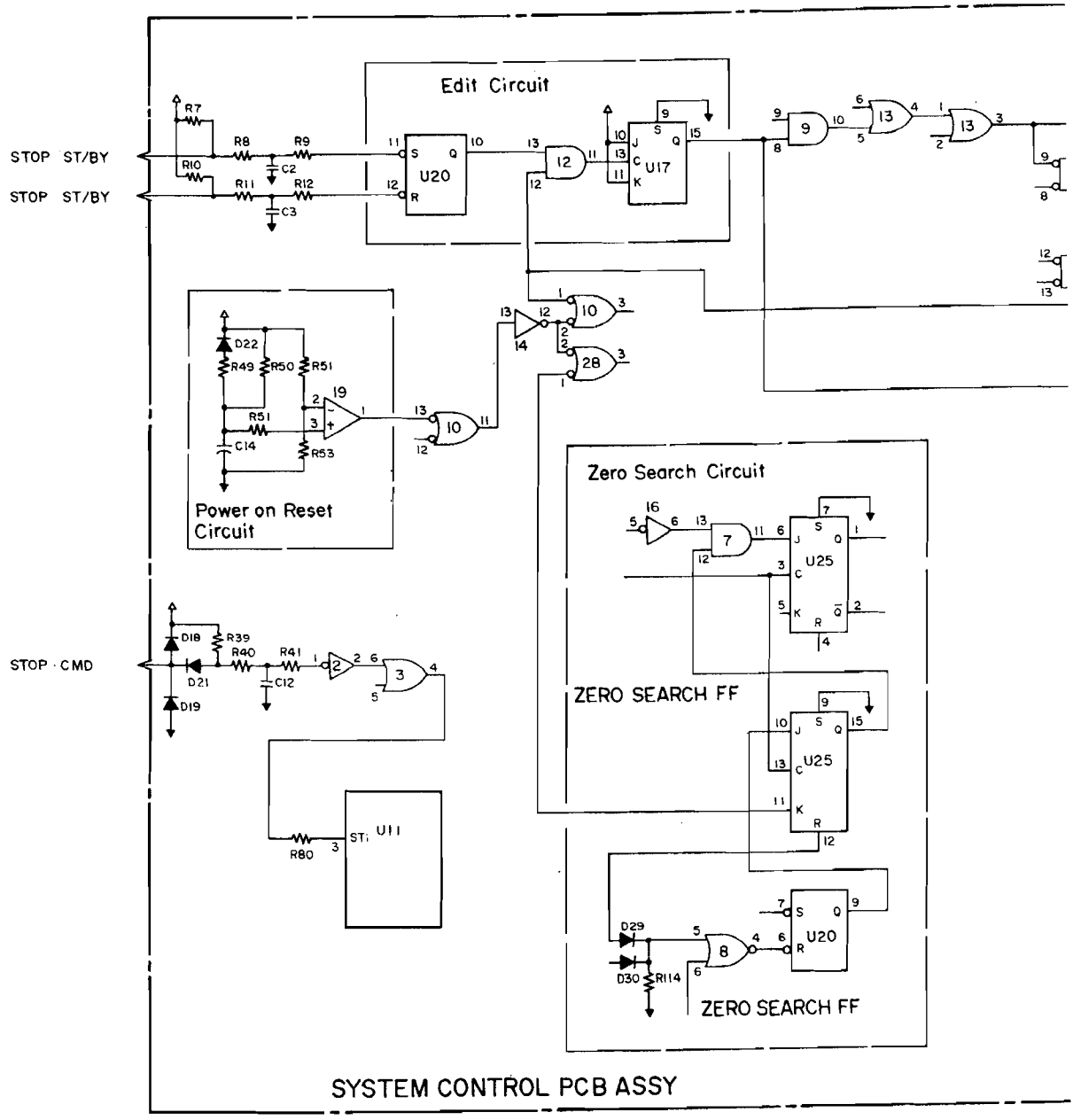
The STOP button controls the switches of two circuits: one for STOP CMD (2) coming to the system control PCB assembly and the other STOP ST/BY (E), (5). STOP ST/BY (E), (5) is the EDIT switch and, therefore, Edit mode may be entered only by operating the STOP button provided on the transport (i.e., impossible by remote control).

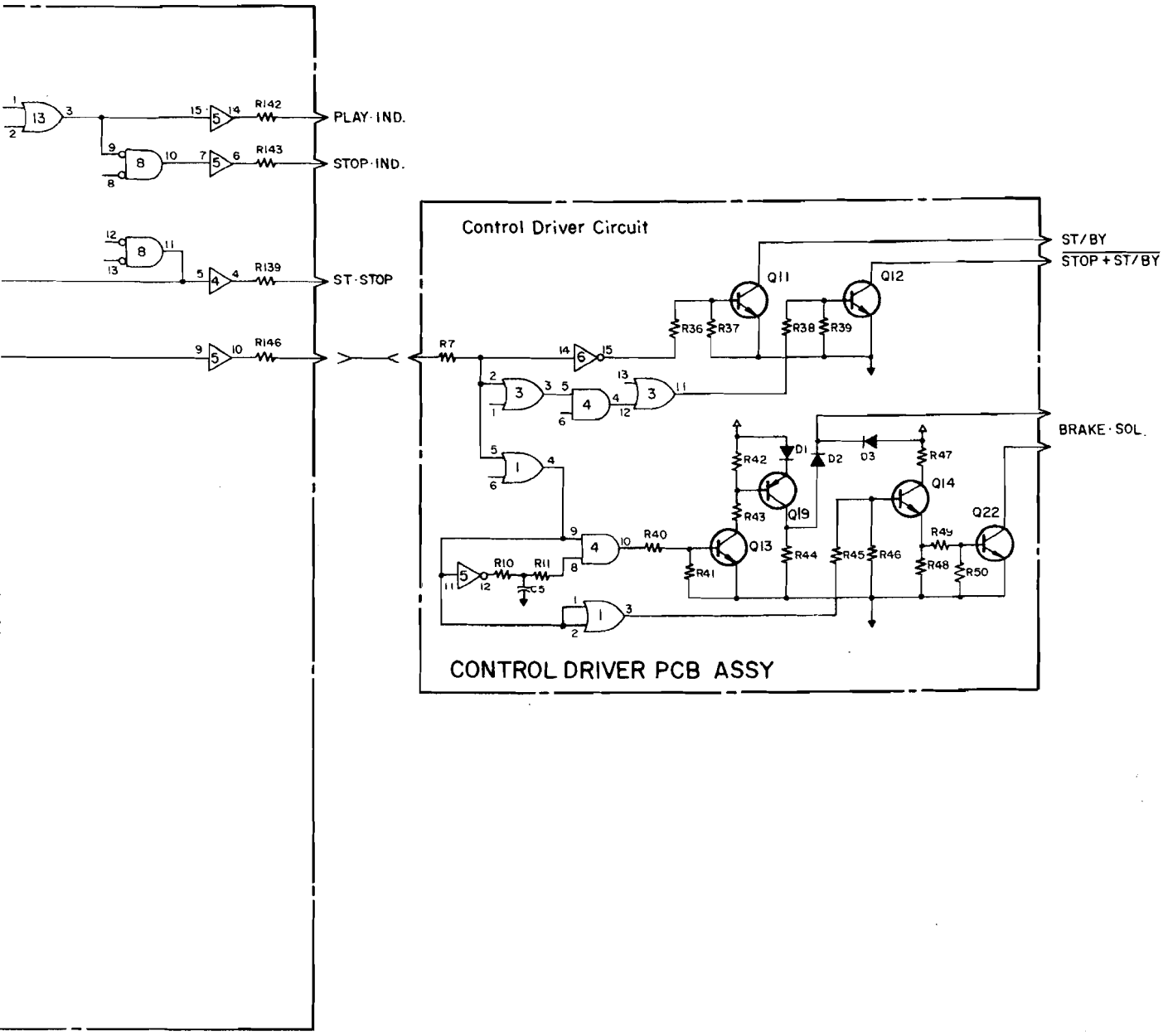
The STOP ST/BY signal is supplied to bouncing R-S flip-flops U20-pin #11 and pin #12 and to J-K flip-flops U17-pin #13, which is wired to become a T flip-flop, so that it turns on and off.

Input pin #12 of U12-11 is an inhibiter which inhibits input to the T flip-flop except in Stop mode. Input pin #1 and 2 of U28-3 reset the T flip-flop during Power On Reset and Shut Off except during Stop mode. R94, C18, and R95 prevent the system from entering Edit mode at the first STOP ST/BY input. In Edit mode, U17-pin #15 outputs a high level which triggers the following steps.

1. Coming to input pin #8 of U9-10, the signal lights the PLAY and STOP lamps alternately.
2. Coming to the control driver PCB assembly via U5-10, the signal:
   - Comes then to input pin #5 of U1-4 and energizes the brake solenoid.
   - Drives Q11 and Q12 to declare Edit mode to the tension servo amplifier PCB assembly.

6.5 EDIT mode

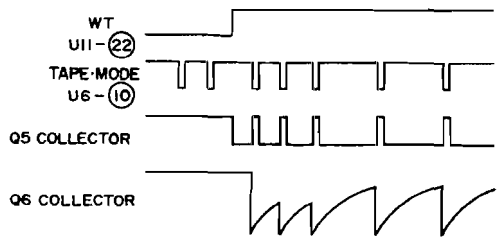

Edit Circuit
STOP ST/BY
STOP ST/BY
R7
R8
R9
R10
R11
R12
C2
C3
U20
U17
Power on Reset Circuit
D22
R49
R50
R51
C14
R53
Zero Search Circuit
U25
ZERO SEARCH FF
U25
ZERO SEARCH FF
STOP CMD
D18
D21
D19
R39
R40
R41
C12
R80
U11
D29
D30
R114
U20
SYSTEM CONTROL PCB ASSY


PLAY·IND.
STOP·IND.
ST·STOP
R142
R143
R139
R146
Control Driver Circuit
ST/BY
STOP+ST/BY
BRAKE·SOL.
Q11
Q12
Q13
Q14
Q19
Q22
D1
D2
D3
R7
R10
R11
R36
R37
R38
R39
R40
R41
R42
R43
R44
R45
R46
R47
R48
R49
R50
C5
CONTROL DRIVER PCB ASSY

Input pin #8, 9 of U6-10 form an AND gate which generates a pulse at the rise of PT1 when the tape is running forward and at its decay when the tape is rewound. Named as TAPE MOVE, this pulse of approximately 100 msec wide is delivered to the F-V converter and for counter PCB assembly and remote control.

Using this pulse as a control trigger, data latch U18-pin #5 (the delayed signal of PT1) latches the direction of tape travel. As a result, U18-pin #2 outputs a high level when the direction of tape travel is FWD and a low level when the direction is RWD.

F-V converter



The F-V converter is controlled by TAPE MOVE coming from the phase detector which the WT signal may inhibit. Therefore, the F-V converter operates when WT is high.

Pulses coming from U24-11 pass through the differential circuit composed of Q5-R120 and C27, and Q6 permits C28 to discharge when the pulse of U6-10 decays. Then voltage rises according to the parameter of an integrating circuit determined by C28, and:

During ordinary Fast mode ---------- R123,
Slow area of Zero Search ---------- R124, or
Middle area of Zero Search or Spooling mode --- R125

Then the signal passes through D39. C29 and R126 smooth out the resulting output. This output voltage varies with the intervals of TAPE MOVE pulses: it is low when the tape speed is high, and high when the tape speed is low.

The F-V converter output varies inversely proportional to tape speed. The reel motor speed is proportional to motor current under constant load. The load of the reel motor is considered as fixed, controlled by the tension servo circuit. The F-V converter output controls the takeup reel in Slow and Middle areas of Zero Search and during Spool mode. The F-V converter output (voltage) is converted to current and supplied to the reel motor. The motor speed is proportional to the F-V converter output under constant load. Thus the tape speed is controlled to fixed speed N determined by the relation between the F-V converter output and the motor speed (see Figure p. 6-29).

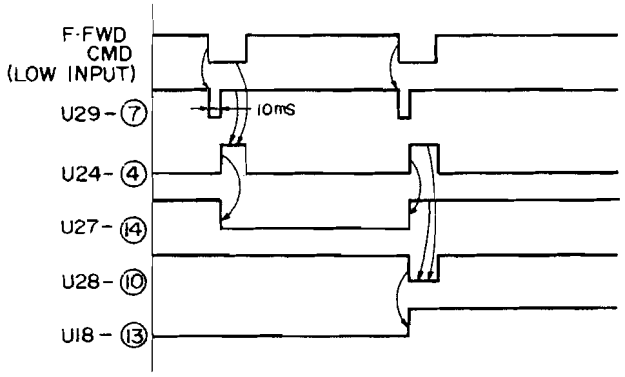
6.6 Spooling mode

In Spooling mode, the transport winds the tape at approximately 80 inches per second. Differences from Fast mode are that the tape speed is controlled and the F.FWD and RWD lamps are lit.

Fast mode transfers to Spooling mode when one presses the F.FWD button (or the RWD button to "spool" in the reverse direction) twice consecutively. To go back to Edit mode from Spooling mode, one must press the STOP or PLAY button. Spooling mode continues even if one presses the RWD button (F.FWD button) during forward (backward) spooling.

Here Spooling mode of the F.FWD direction is described. (Operation is the same even in the RWD direction.)

The F.FWD CMD coming from the F.FWD button enters negative edge-triggered mono-stable multivibrator U29-pin #5. The signal is delayed for about 10 msec, then ANDed with the output signal at U7-3 and input pin #6 of U24-4, and the result is a high level output through U24-4. Thus bouncing of the F.FWD button is removed. Delayed by pin #7 of U29, the signal coming from U24-4, after buffered by U23-6, resets the T flip-flop of RWD mode and goes to F.FWD-mode T flip-flop U27-pin #13. Receiving the input signal, the T flip-flop reverses.



As the F.FWD button has been pressed the second time, a high level develops at U27-pin #14. This signal is ANDed with the output of U24-4 by input pin #8, 9 of U28 and enters Spooling flip-flop U18-pin #8, which outputs a high level through pin #13.

R107, C24, and R111 form a circuit which prevents bouncing.

Since U18 is an R-S flip-flop, Spooling mode continues once it has been entered, until it is reset.

RWD and F.FWD inputs reset associated T flip-flops by input pin #1 of U22-3 and input pin #12 of U22-11 so that the system should not enter Spooling mode as F.FWD and RWD come in alternately.

Spooling mode is reset when

STOP CMD (U3-4),

PLAY CMD (U2-10),

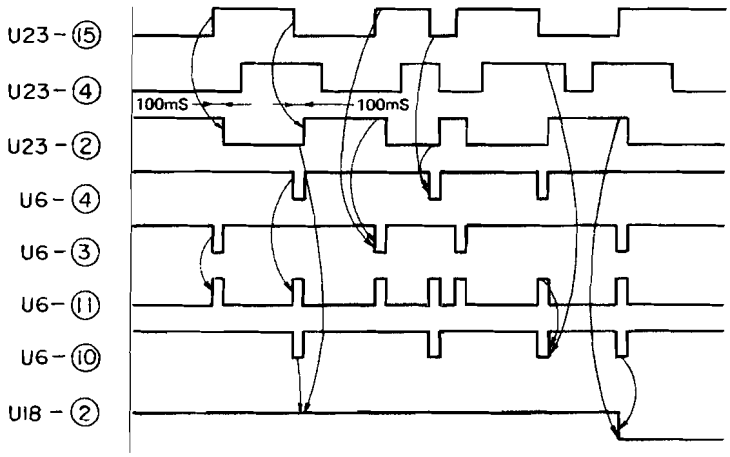
POWER ON RESET and SHUT OFF (U10-11), and

ZERO SEARCH CMD (U25-pin #15)

have been ORed by D31 through D34 and a RESET command is output at U23-10.

The Spooling mode signal coming from U18-pin #12 triggers the following steps.

1. Coming to input pin #5 of U10-4, the signal inhibits U9-(1) and (5) alternately to turn on and off the RWD or F.FWD lamp.
2. Coming to input pin #6 of U22-4, it selects the value of R125 (10 kohms) as the constant of F-V conversion via U26-pin #2.
3. Coming to U22-10, it supplies the tension servo amplifier PCB assembly with the result of F-V conversion via U26-pin #9.



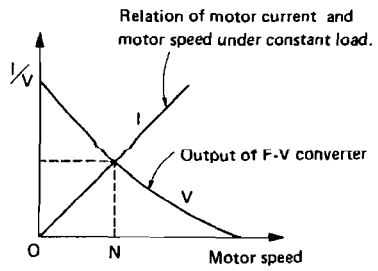
Operation of the phase detector

Photo-interrupter outputs PT1 and PT2 of the tape speed sensor enter the system control PCB assembly.

These signals are waveform-shaped by the Schmidt trigger U23-15 and U23-4 and supplied to a phase detector.

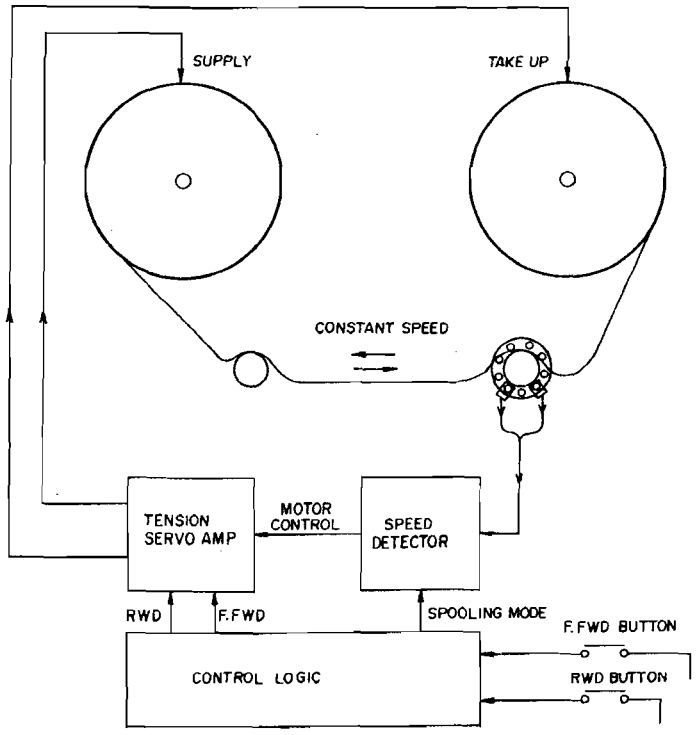
The circuit ranging from input pin #3 of U14-4 to U23-2 delays the PT1 output by approximately 100 msec, then inverts.

1. U6-(1) and (2) AND PT1 output (i.e., U6-3 outputs a pulse of about 100 microsec at the rise of PT1).
2. U14-6 invert signal coming from pin #1 of U6-3 and pin #5, 6 of U6-4 AND the resulting signal (i.e., U6-4 outputs a pulse of about 100 microsec at the decay of PT2).
3. ORing the resulting signals of 1 and 2 above, U6-11 generates pulses at the rise and decay of PT.

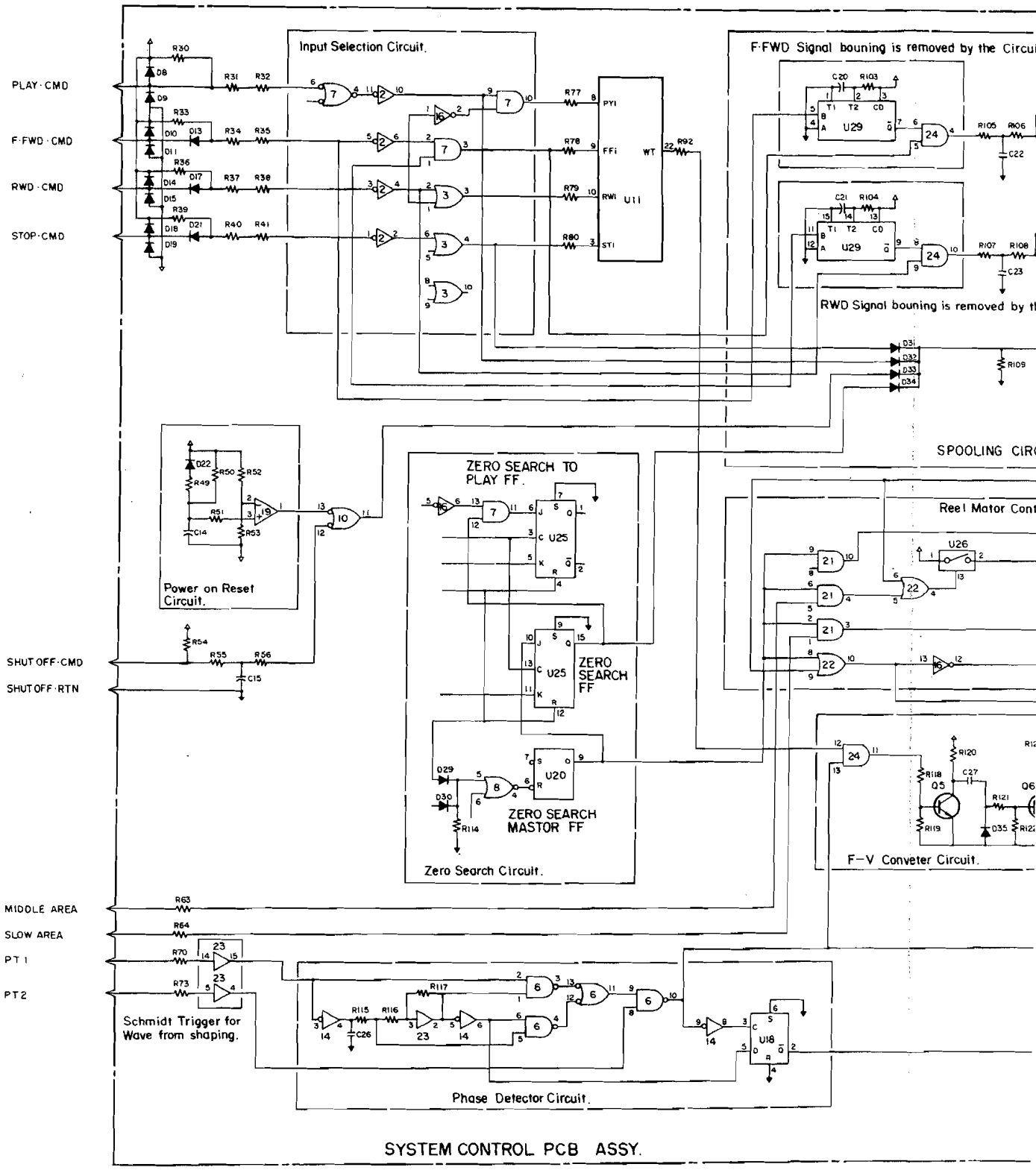


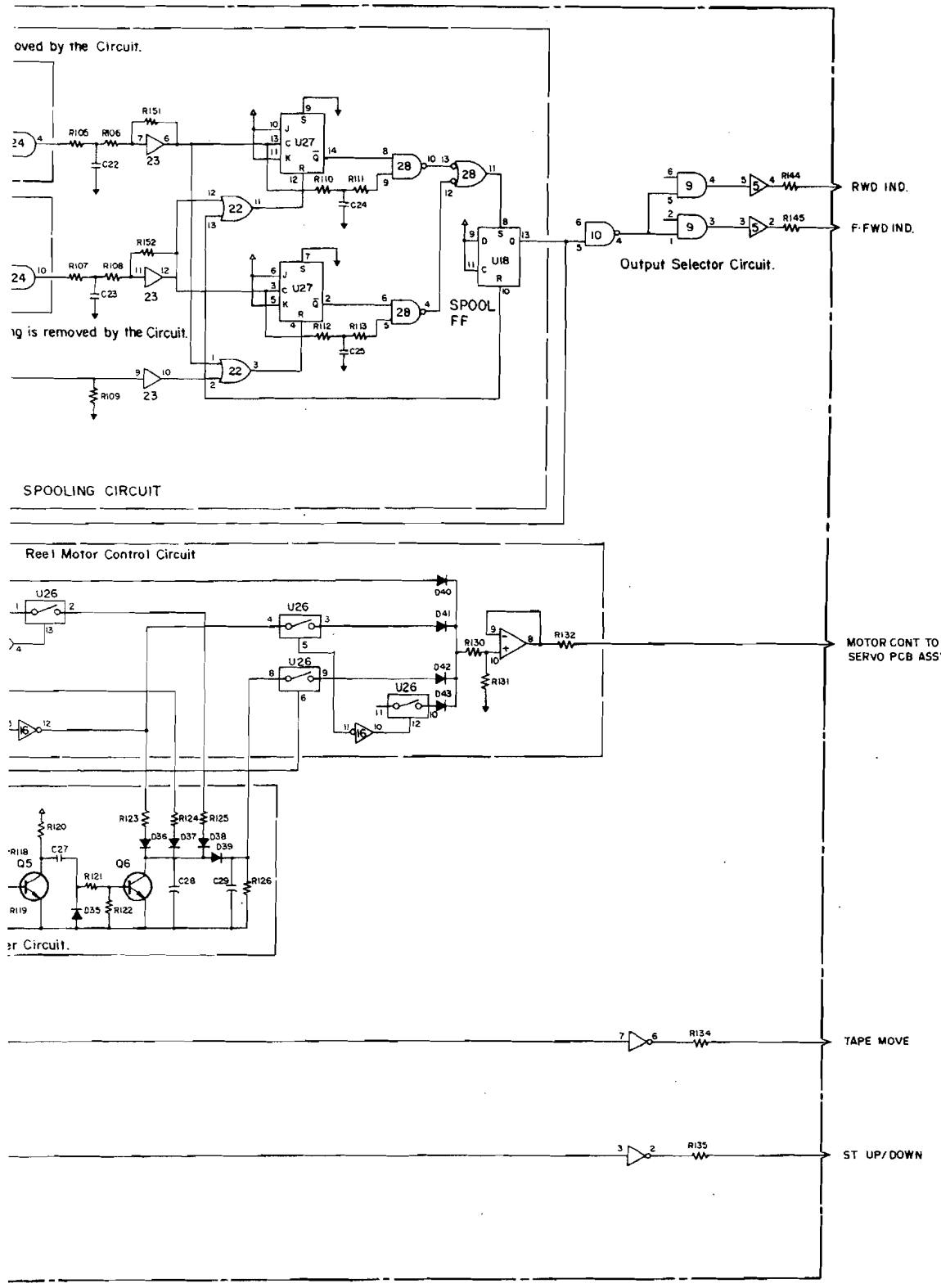
In Spool mode and Slow and Middle areas of Zero Search mode, the high-level of U22-10 switches on U26-pin #8 and 9, and after being buffered by U19-pin #8, 9, and 10, the F-V converter output is supplied to the tension servo amplifier PCB assembly.

(Block diagram)



6.6 SPOOLING mode




oved by the Circuit.
R151
R105
R106
C22
23
U27
28
R110
R111
C24
22
R152
R107
R108
C23
R112
R113
C25
R109
SPOOL FF
U18
10
9
5
R144
R145
RWD IND.
F-FWD IND.
Output Selector Circuit.
ng is removed by the Circuit.
SPOOLING CIRCUIT

Reel Motor Control Circuit
U26
D40
D41
D42
D43
R130
R131
R132
MOTOR CONT TO TENSION SERVO PCB ASSY

R120
R123
R124
R125
D36
D37
D38
D39
C27
Q5
Q6
R121
C28
C29
R126
D35
R122
R119
er Circuit.

R134
TAPE MOVE
R135
ST UP/DOWN

6.7 Search mode

Search mode comes in two kinds: Zero Search activated by the ZERO SEARCH button provided on the transport control panel, and Preset Zero Search activated by the external Auto-Cue unit (AQ-85B). Zero Search by the ZERO SEARCH button is only in the FWD direction, but that by AQ-85B may be in both FWD and RWD directions.

When Search mode has been entered, tape speed is controlled in three steps. Up to 50 seconds before arrival at a target point, the tape travels at the same speed as in Fast mode. Between 50 and 5 seconds before arrival, it runs at the speed of Spool mode, afterwards in Slow speed, so that the tape stops at the desired point without overshooting.

Zero Search mode

When the ZERO SEARCH button has been pressed, ZERO SEARCH CMD comes to the system control PCB assembly. ZERO SEARCH will be accepted except:

1. During F.FWD (U11-pin #20 is high)
2. When POWER ON RESET, SHUT OFF, or F.FWD CMD, RWD CMD and STOP CMD is coming in.

At this time, a high level develops at U20-pin #9.
This signal triggers the following steps.

1. A component coming to input pin #1 of U3-3 turns U11-pin #10 RYi to high to put the system in RWD mode.
2. Another coming to input pin #8 of U7-10 inhibits PLAY CMD.
3. Input to the counter PCB assembly through U1-15 as ST ZERO SEARCH signal, the signal sets the counter (display) to Time mode.
4. A component input to pin #12 of U21-11 is ANDed with the EQUAL signal coming from the counter PCB assembly and the resulting signal resets the Zero Search flip-flop and becomes the U11-pin #3 STi STOP signal. Zero Search will be terminated by the U21-11 output.
5. Components coming to input pin #9, 6, 2 of U21-10, 4, 3 open the AREA signal coming from the counter PCB assembly.
6. A component coming to input pin #8 of U22-10 causes the F-V converter output to go to the tension servo PCB assembly.
7. A component coming to input pin #12 of U7-11 readies the system to accept ZERO SEARCH TO PLAY. U25-(1) through (7) are Zero Search To Play flip-flops which are set when a PLAY command has come during Zero Search. When they are set:
   * Input pin #13 of U9-11 causes the PLAY lamp to blink.
   * Input pin #12 of U9-11 starts a delay circuit.
   * Input pin #5 of U7-4 outputs PLAY CMD.

   PLAY CMD has been inhibited by input pin #8 of U7-10. As soon as U7-(8) turns to high after completion of Zero Search, U21-11 changes U11-pin #8 PYi to high

to switch the system to Play mode. When U11-pin #12 PY0 turns to high, the high-level signal is input to U25-pin #5 to reset the Zero Search To Play flip-flops.

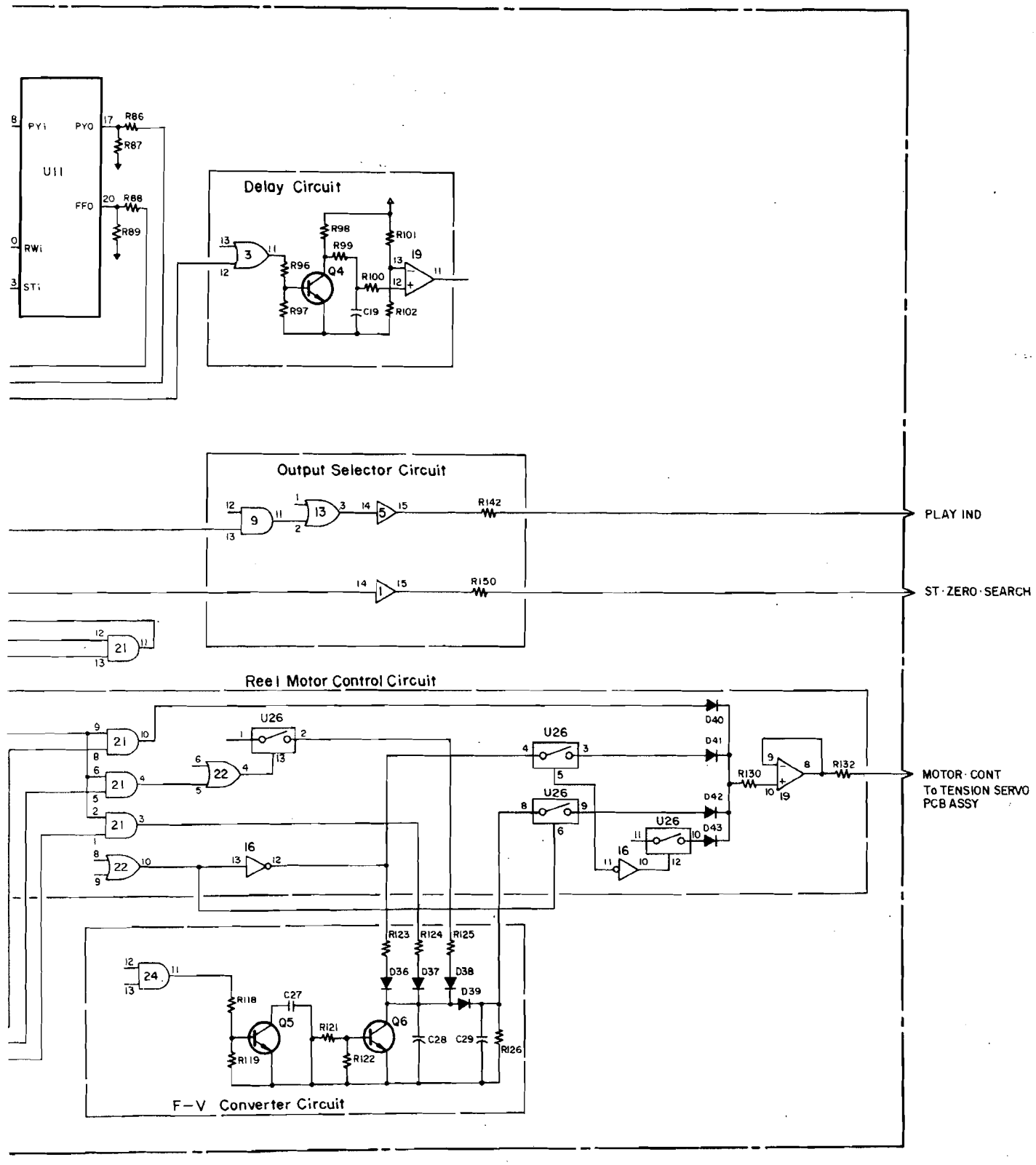
In Zero Search mode, the reel motor is controlled by an AREA signal supplied from the counter PCB assembly as follows.

1. FAST AREA
   This is input 50 seconds before a target and controlled by the high level of U21-10.

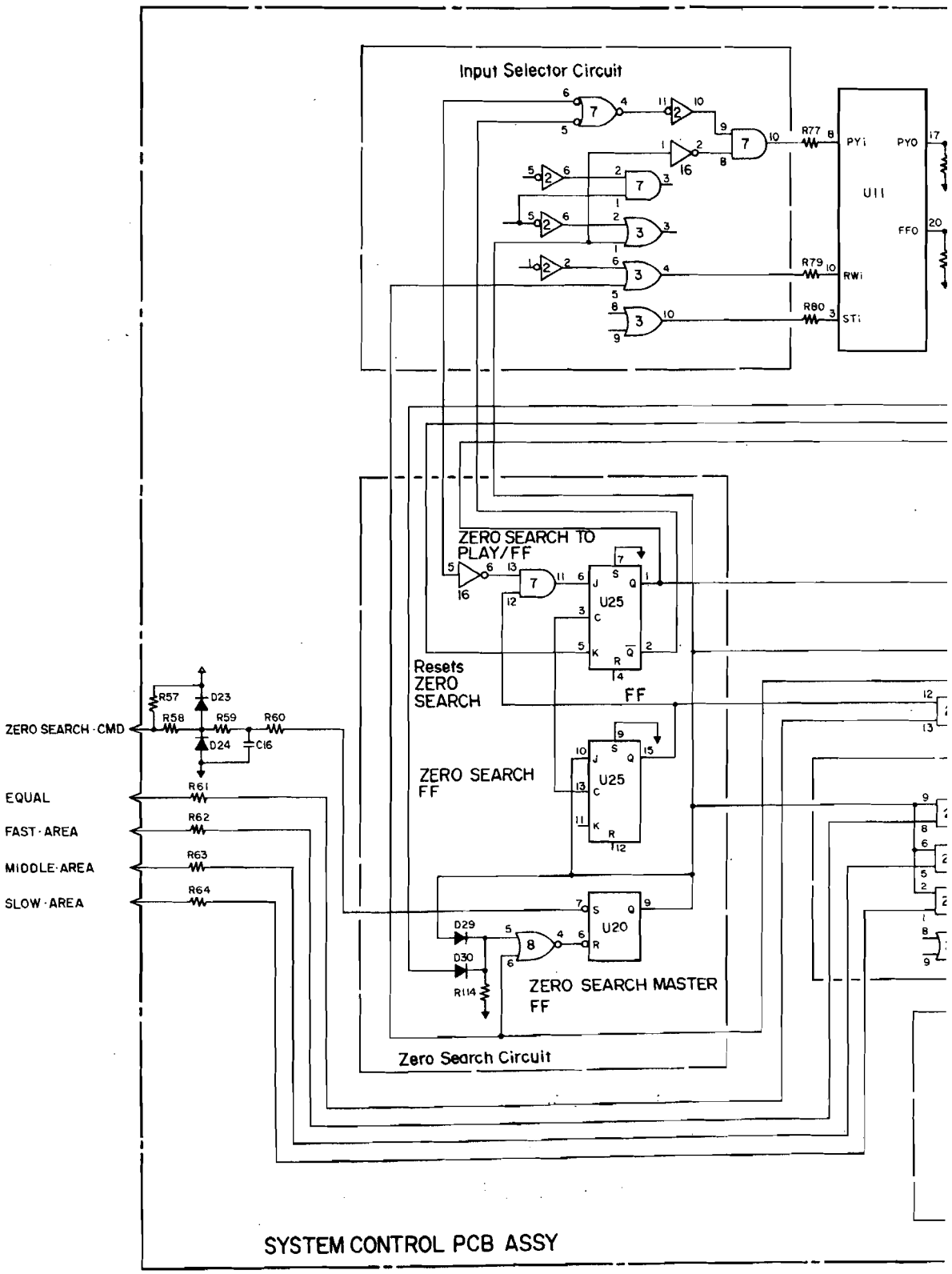
2. MIDDLE AREA
   This is input during the interval between 50 and 5 seconds before the target. During that time, U21-4 and U22-4 open U26-pin #1 and pin #2 and causes the reel motor to run at the Spooling mode speed.

3. SLOW AREA
   This is input from 5 seconds before the target and turns U21-3 to high and selects the parameter of the F-V converter to run the motor at Slow speed.

4. EQUAL
   This is input when the target has been reached and causes U21-11 to reset Zero Search flip-flops and to send a STOP signal to pin #3 (STi) of LSI U11.


U11
PYi
PYO
FFO
RWi
STi
R86
R87
R88
R89
Delay Circuit
R96
R97
R98
R99
Q4
R100
R101
C19
R102
Output Selector Circuit
R142
R150
PLAY IND
ST·ZERO·SEARCH
Reel Motor Control Circuit
U26
D40
D41
D42
D43
R130
R132
MOTOR·CONT
To TENSION SERVO
PCB ASSY
R123
R124
R125
D36
D37
D38
D39
R118
C27
Q5
Q6
R121
R122
C28
C29
R126
F-V Converter Circuit

6.7 SEARCH mode



6.8 Counter PCB assembly

The counter PCB assembly has four basic functions.

1) Counting of tape location
2) Detection of "area" for deceleration of tape on nearing the "0000" point at zero search
3) Percent indication of the capstan motor revolution speed
4) Selection of display (Location or percent)

6.8.1 Counting of tape location

Tape location is counted by U22. This U22 (MK50396) is a six digit synchronous up/down counter LSI and its maximum indication is 99'59"59. Following describes the in/out pins used in the 85-16B (in the 85-16B, only the upper four digits, or in other words, 99'59", are displayed).

* $\overline{\text{SET}}$ (Pin #2)
When a low level is applied to this terminal, the digit strobe pulse which was up to then scanning from MSD (Most Significant Digit) towards LSD (Least Significant Digit) by the scanning oscillator, is locked onto the 6th digit (MSD). The BCD output is also locked onto the contents of the 6th digit (MSD) and the segment out is blanked.

* Count (Pin #36)
This is the count pulse input pin and content of the counter is refreshed each time the leading edge of the count pulse goes from low to high.

* UP/DOWN (Pin #40)
This is the control pin for incrementing or decrementing the content of the counter. It is incremented when a high level is applied, and decremented when a low level is applied.

* CLEAR (Pin #20)
This pin is for clearing (all zero) the content of the counter by the application of a high level.

* LR (Pin #30)
This pin controls loading of data into the internal register of the LSI and when a high level is applied here, the content at REGISTER BCD IN (all zero in the 85-16B) is loaded in the register.

* SCAN (Pin #21)
This pin controls the internal digit scan and the six digits are scanned by the internal scan counter when a square wave is applied here.

* ZERO (Pin #39)
When the content of the counter becomes "all zero" (clearing of all 6 digits; in the 85-16B, only the four MSD are displayed), a high level is output here.

* D1 ~ D6 (Pins #24 ~ #29)
These are the output pins for the digit strobe pulse which are output from the 6th digit (MSD) down towards the 1st digit (LSD) by the internal scan counter.

* BCD OUT (Pins #11 ~ #14)

These are the BCD output pins of the counter. In synchronization with the digit strobe, each digit is converted to BCD and output here.

* Segment a ~ g (Pins #4 ~ #10)

The contents of the counter synchronized digit by digit with the digit strobe pulse, are then decoded into signals for 7 segment displays and output from these pins.

The following describes the overall function of the U22 LSI.

U21-3 is a 2-input NAND gate which acts to select the display mode of the counter. When the TIME/SPEED button on the tape transport control panel is in the up position, the display shows the tape location (time). If in the down position, it displays the capstan motor speed (Refer to Item 6.8.3).

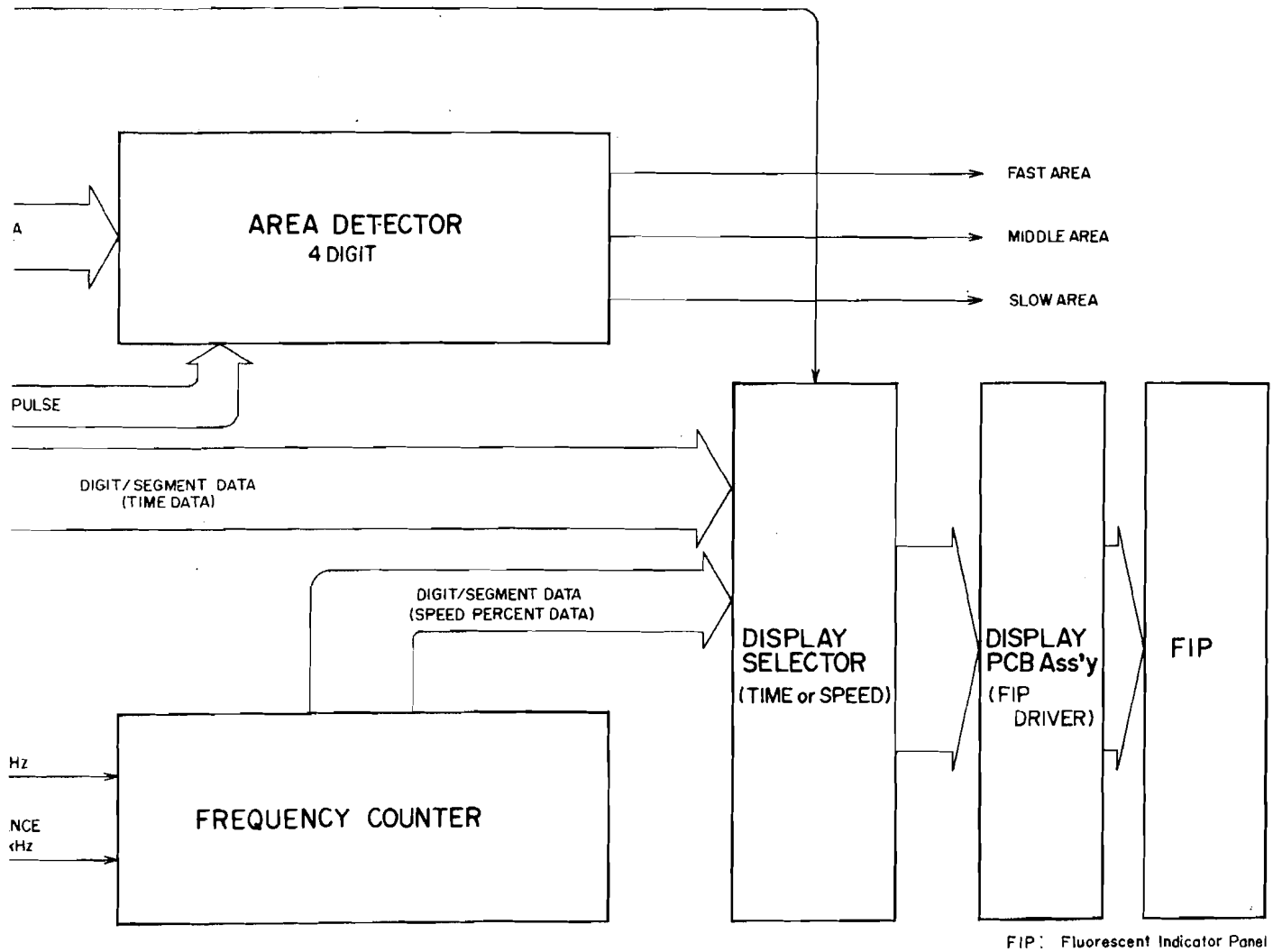
When the TIME/SPEED button is up (indicating TIME), input pin #1 of U21-3 will be receiving a low level signal and therefore, output pin #3 will be high. Due to this, the $\overline{SET}$ input of U22 goes high and the content of U22 is output.

When the TIME/SPEED button is in the down position (indicating SPEED), a high level is applied to input pin #1 of U21-3. In this condition, if the other input pin #2 of U21-3 is also high, then output pin #3 of U21-3 goes low. As a result, the $\overline{SET}$ input of U22 goes low the content of U22 is not output.

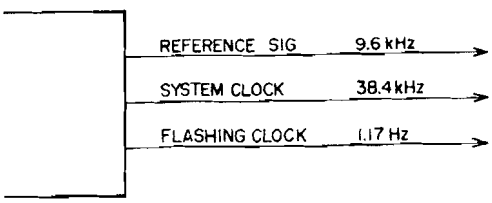
On the other hand, the condition whereby input pin #2 of U21-3 is low and consequently output pin #3 is high, is when the 85-16B enters the ZERO SEARCH mode by depressing the SEARCH ZERO button on the transport control panel. When in this condition, the circuit is designed so that the display is locked for tape location (indicating TIME) regardless of what position the TIME/SPEED button is set.

U17-3 is a 2-input AND gate which is used to prevent the display of the 6th digit when a low level is applied to the $\overline{SET}$ input of U22 (Refer to $\overline{SET}$, pin #2).

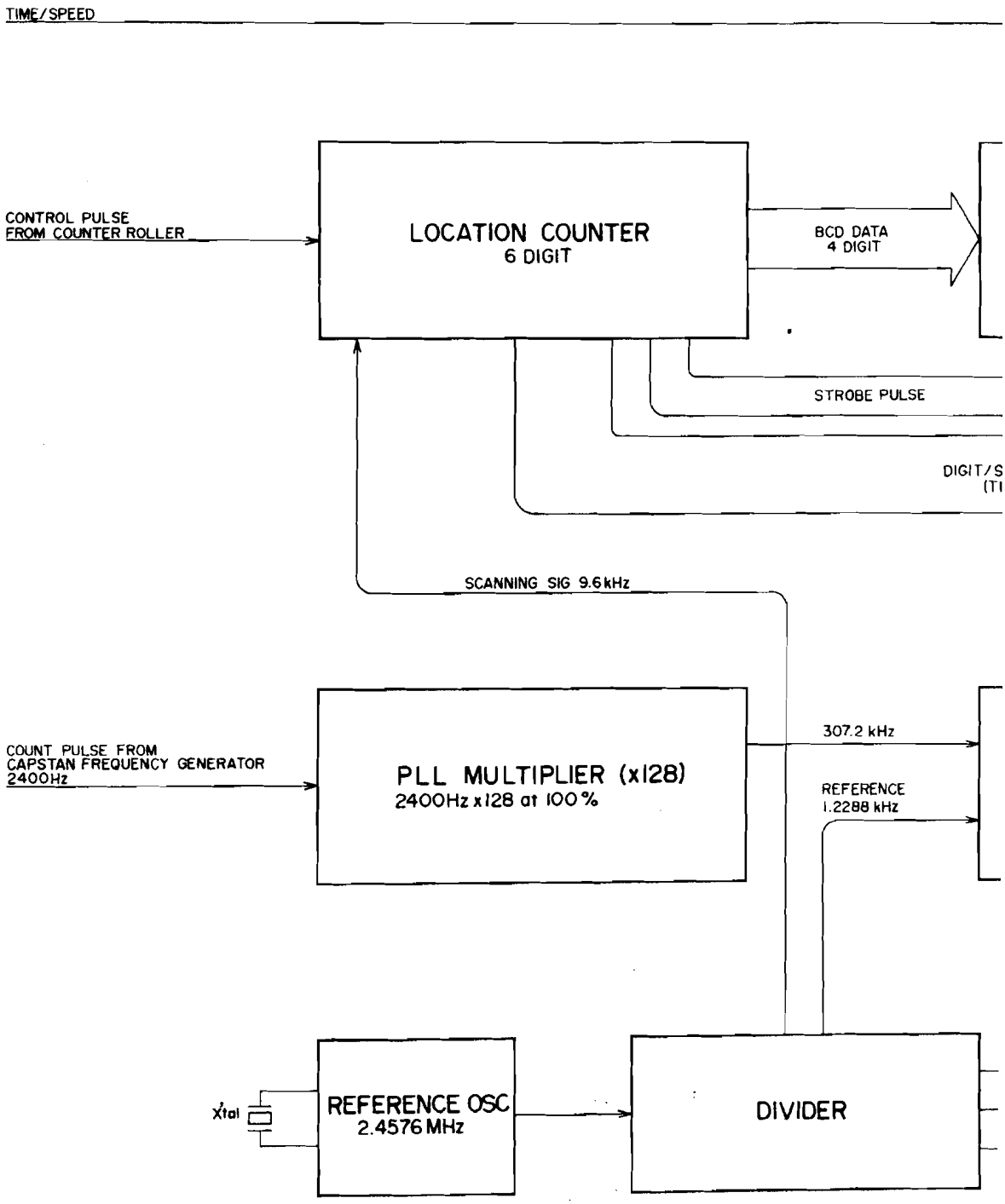
When a low level is applied to the $\overline{SET}$ input of U22, input pin #1 of U17-3 will also be low, and output pin #3 will thus be low regardless to whether the other input pin #2 is high or low.



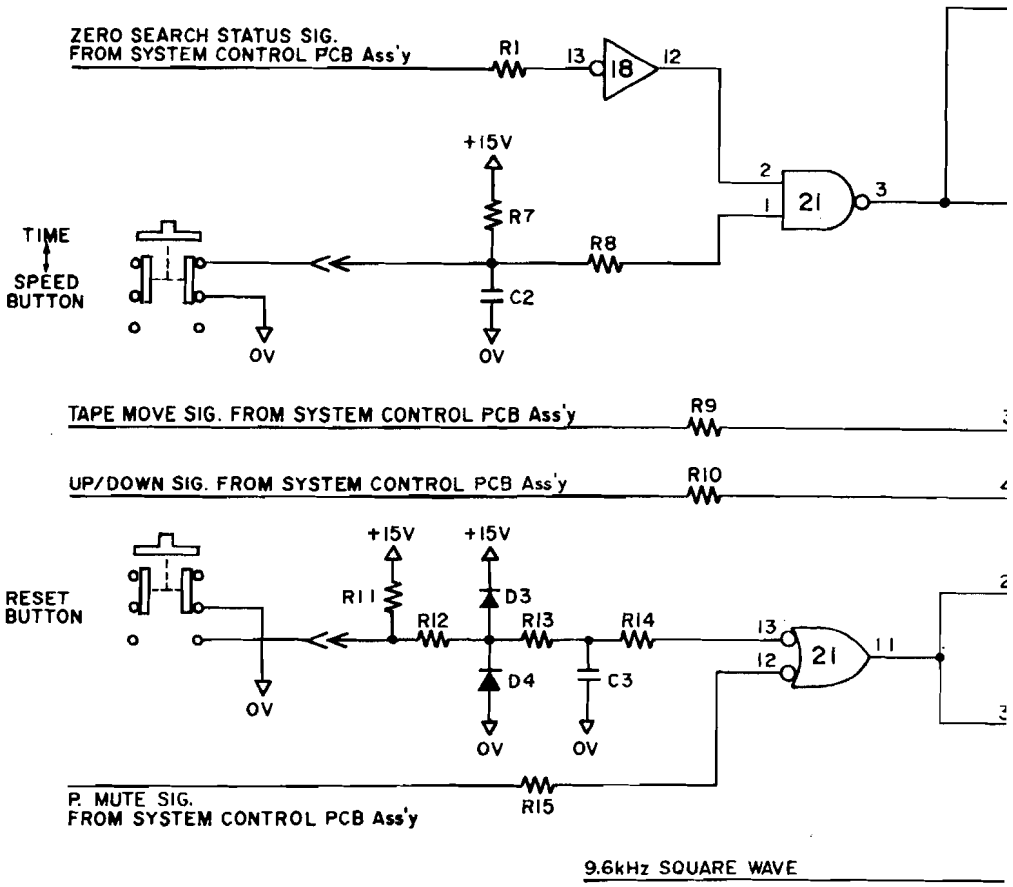
FIP: Fluorescent Indicator Panel

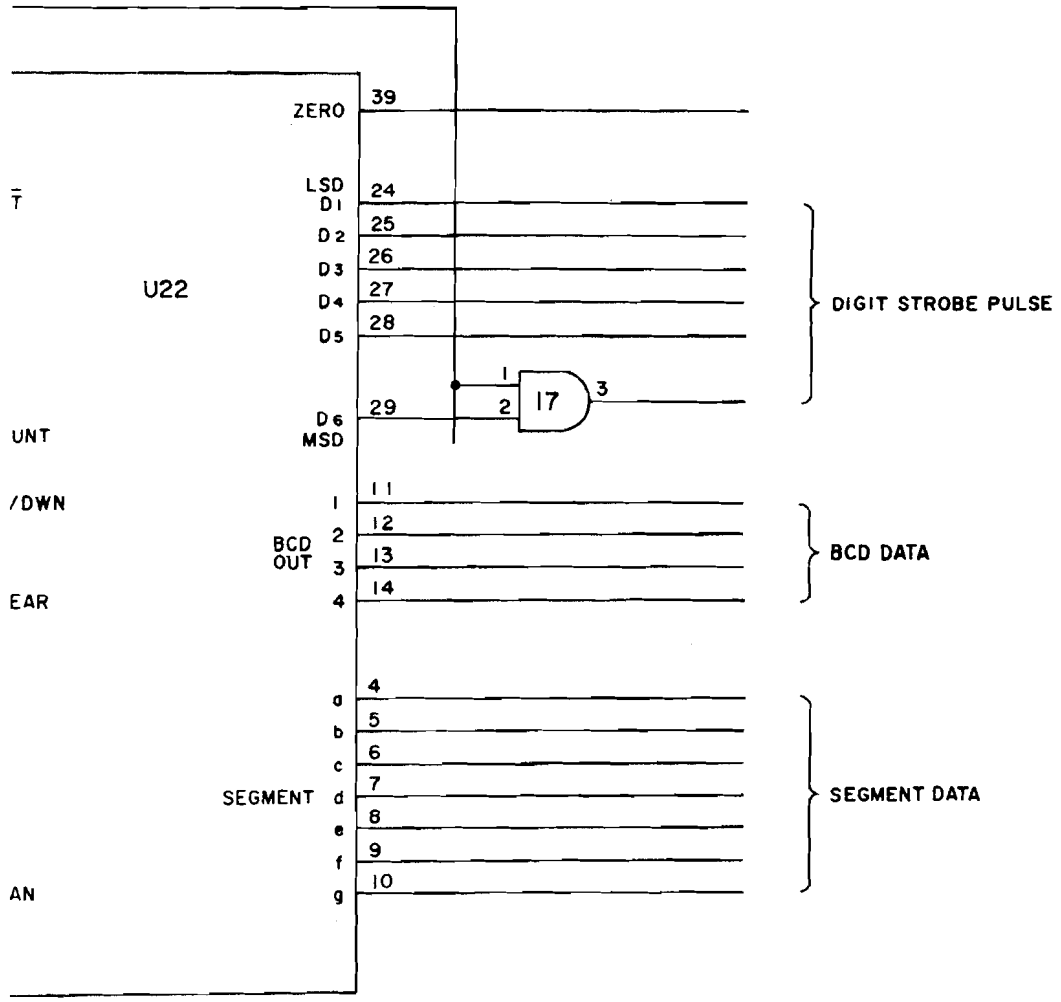


6.8 Counter PCB assembly (Block diagram)



6.8.1 Counter PCB assembly (Location counter)




ZERO
39
LSD
D1
24
D2
25
D3
26
D4
27
D5
28
D6
MSD
29
U22
T
UNT
/DWN
EAR
AN
1
2
17
3
DIGIT STROBE PULSE
BCD
OUT
1
2
3
4
11
12
13
14
BCD DATA
SEGMENT
a
b
c
d
e
f
g
4
5
6
7
8
9
10
SEGMENT DATA

6.8.2 Area detector

The deceleration starting point for the objective "0000" position is detected by this area detector by referring to location data which is output from the location counter, then sends the results to the System Control PCB Assembly which determines tape speed for zero search.

U27, U26, U24, and U23 are 4-bit data latches which latch, digit by digit, the upper 4 digits by strobing the BCD data coming from the location counter. In each of these ICs, data applied to input pins D0, D1, D2, D3 is written in when the CL pin is high, and latched when it is low.

U31, U30, U29, and U28 are 4-bit comparators, and in each IC, the content of inputs A0, A1, A2, A3 and B0, B1, B2, B3 are compared. Outputs are A < B, A = B, and A > B.

U31 is the comparator for the lowest digit and a constant factor representing 5 seconds is constantly applied to input B. For the second digit, a constant factor of either 0 or 5 is repeatedly applied by the digit strobe to input B. Consequently, the 85-16B is designed to detect the 55 seconds through 5 seconds for the MIDDLE AREA, and the 5 second through 0 second for the SLOW AREA (Refer to Table A).

U25 is the data selector in which data applied to either input pins X0, X1, X2, X3 or Y0, Y1, Y2, Y3 is selected by control inputs A and B, and output from its output pins. Now, if a high level is applied to pin #9 (A), data input to pins X0, X1, X2, X3 [in the 85-16B, this will be "1010" ("5")] is output from Z0, Z1, Z2, Z3; if a high level is applied to pin #14 (B), data input to pins Y0, Y1, Y2, Y3 ["0000" ("0")] is output from Z0, Z1, Z2, and Z3.

U17-10, U16-11, U21-4, U16-3, and U21-10 comprise a selector circuit, for producing the conditions shown in Table A, from the compared results from comparators U28 ~ U31.

A digit strobe pulse train (for digit 1) is constantly applied to input pin #9 of the 2 input AND gate U17-10, and when the A > B output (pin #13) of the digital comparator U28 goes high, a pulse train which indicates fast area is output from it.

As a digit strobe pulse train (for digit 2) is constantly applied to input pin #13 of the 2 input AND gate U16-11, when output A > B (pin #13) of the digital comparator U28 goes high, a pulse train indicating above middle area is output.

The digit strobe pulse train (for digit 2) is also constantly applied to input pin #6 of the 2-input AND gate U21-4, and when A = B of U28 goes high, a pulse train indicating low area is output.

The digit strobe pulse train (for digit 2) is constantly applied to input pin #2 of the 2 input NAND gate U16-3, and when the A < B output (pin #12) of U28 goes high, a pulse train is output which indicates low area.

U21-10 is a 2-input NOR gate which inverts each output (pulse train) of U21-4 and U16-3.

U19 and U20 are retriggerable monostable multivibrators for converting the pulse train from the previous stage into a level signal.

U16-4 and U16-10 are 2-input AND gates for producing the final area detect signals for the fast and middle areas (Refer to Table B).

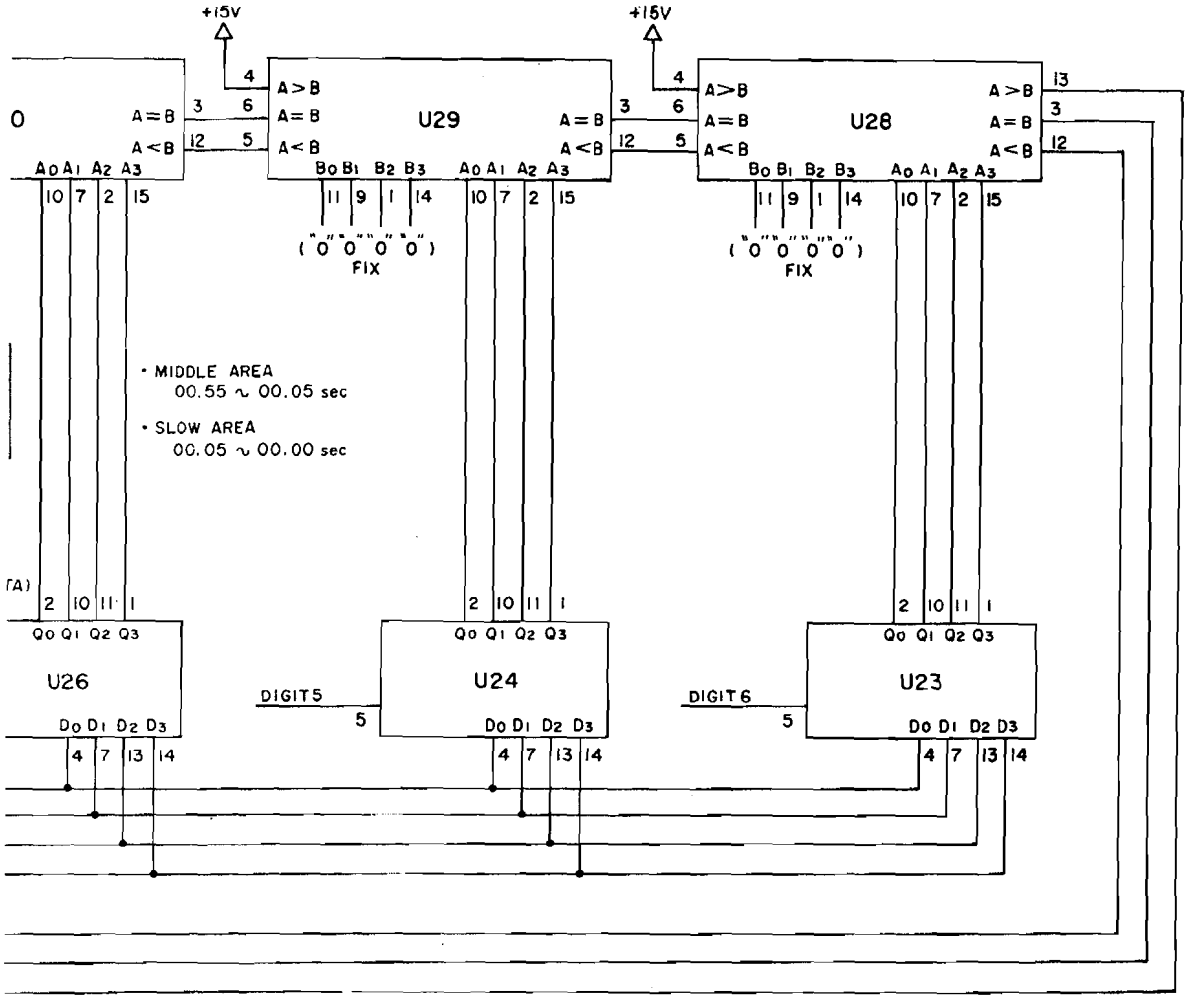
Table A Operation of U17-10, U16-11, U21-4, U16-3

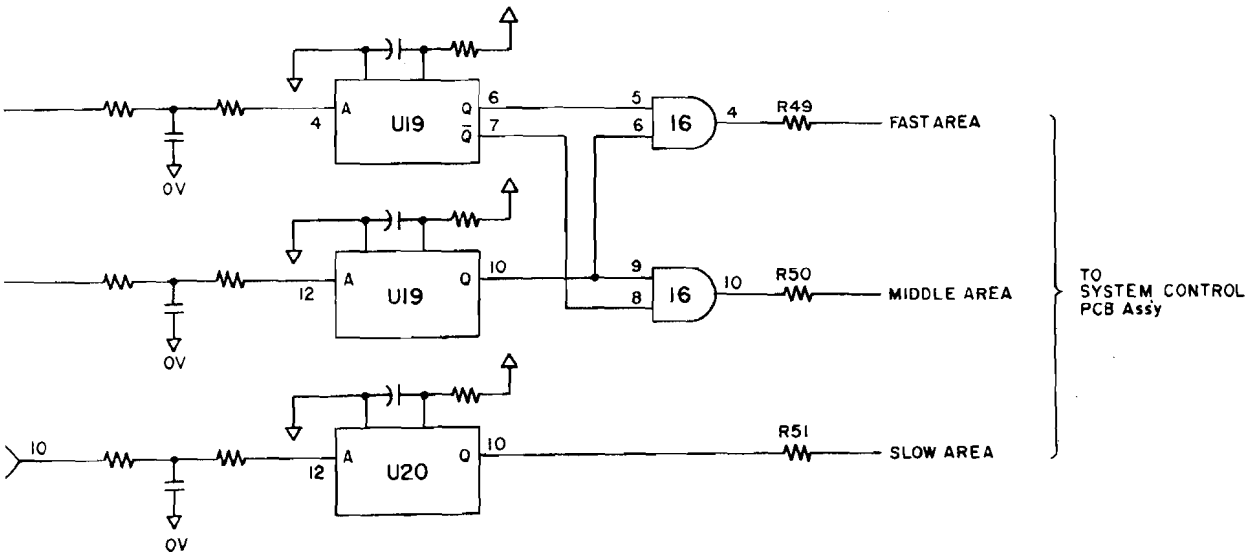
Constant \ Location	0055 sec.	0005 sec.	0000
Digit strobe Digit 1 CONSTANT "55 sec"	* A > B (55 sec)	A < B (55 sec)	A < B (55 sec)
Digit strobe Digit 2 CONSTANT "05 sec"	A > B (5 sec)	* A > B (5 sec)	* A < B (5 sec)

A: Location B: Constant (55 sec. or 5 sec.) *: Used as a detect signal

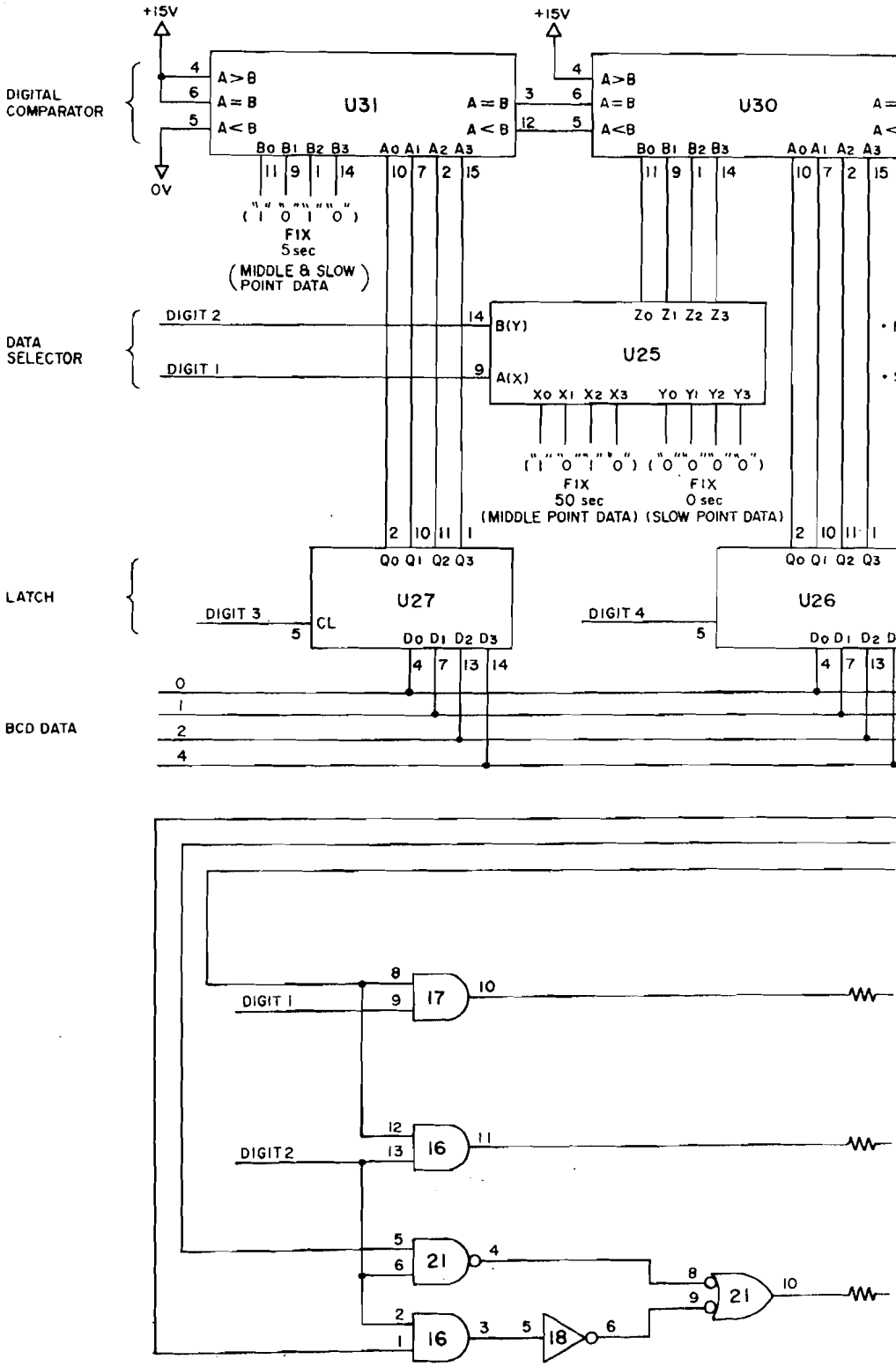
Table B Operation of U19 and U20

Location	0055 sec.	0005 sec.	
U19-6.7	ACTIVE ○	PASSIVE ×	PASSIVE ×
U19-10	ACTIVE ○	ACTIVE ○	PASSIVE ×
U20-10	PASSIVE ×	PASSIVE ×	ACTIVE ○


+15V
+15V
U29
U28
A>B
A=B
A<B
A0 A1 A2 A3
B0 B1 B2 B3
FIX
• MIDDLE AREA
00.55 ~ 00.05 sec
• SLOW AREA
00.05 ~ 00.00 sec
U26
U24
U23
DIGIT5
DIGIT6
Q0 Q1 Q2 Q3
D0 D1 D2 D3


U19
U19
U20
16
16
R49
R50
R51
FAST AREA
MIDDLE AREA
SLOW AREA
0V
TO
SYSTEM CONTROL
PCB Assy

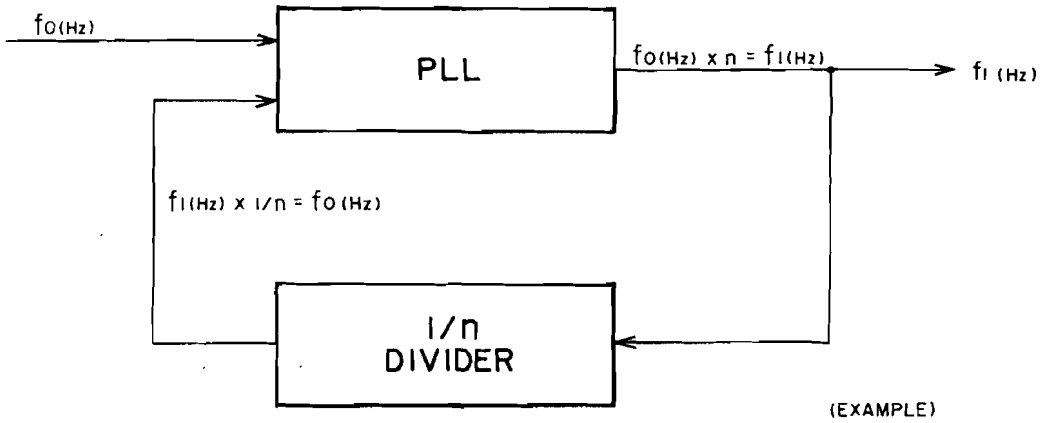
6.8.2 Counter PCB assembly (Area detector)



6.8.3 Percent indicating circuit for the capstan motor speed

The percent indicating circuit for the capstan motor speed comprises the phase lock loop U14, divider U10, crystal oscillator, divider U15, and frequency counter U12.

The capstan motor rotational speed is converted to a frequency signal by the tachogenerator on the motor shaft. This signal is applied to the Capstan Servo Amplifier PCB Assembly which in turn servos the capstan motor at constant speed. At the same time, a square wave (reference 2400 Hz) proportional to the capstan motor revolution is obtained from one point in the Capstan Servo Amplifier PCB Assembly. This signal is applied to one side of the input pair (pin #14) of the Phase Comparator in the U14 Phase Lock Loop. As a result, 307.2 kHz (with 2400 Hz at input) is output from pin #4 of U14. This signal is then frequency divided by 128 by divider U10, and applied to the other input pin (#2) of the Phase Comparator in the U14 Phase Lock Loop. In other words, the 2400 Hz square wave obtained from the capstan servo amplifier PCB assembly, is multiplied 128 times by U14 and U10 to produce 307.2 kHz, which is then applied to frequency counter U12.



(EXAMPLE)

f_o = 1000(Hz)
n = 10
f_i = 1000x10 = 10000(Hz)

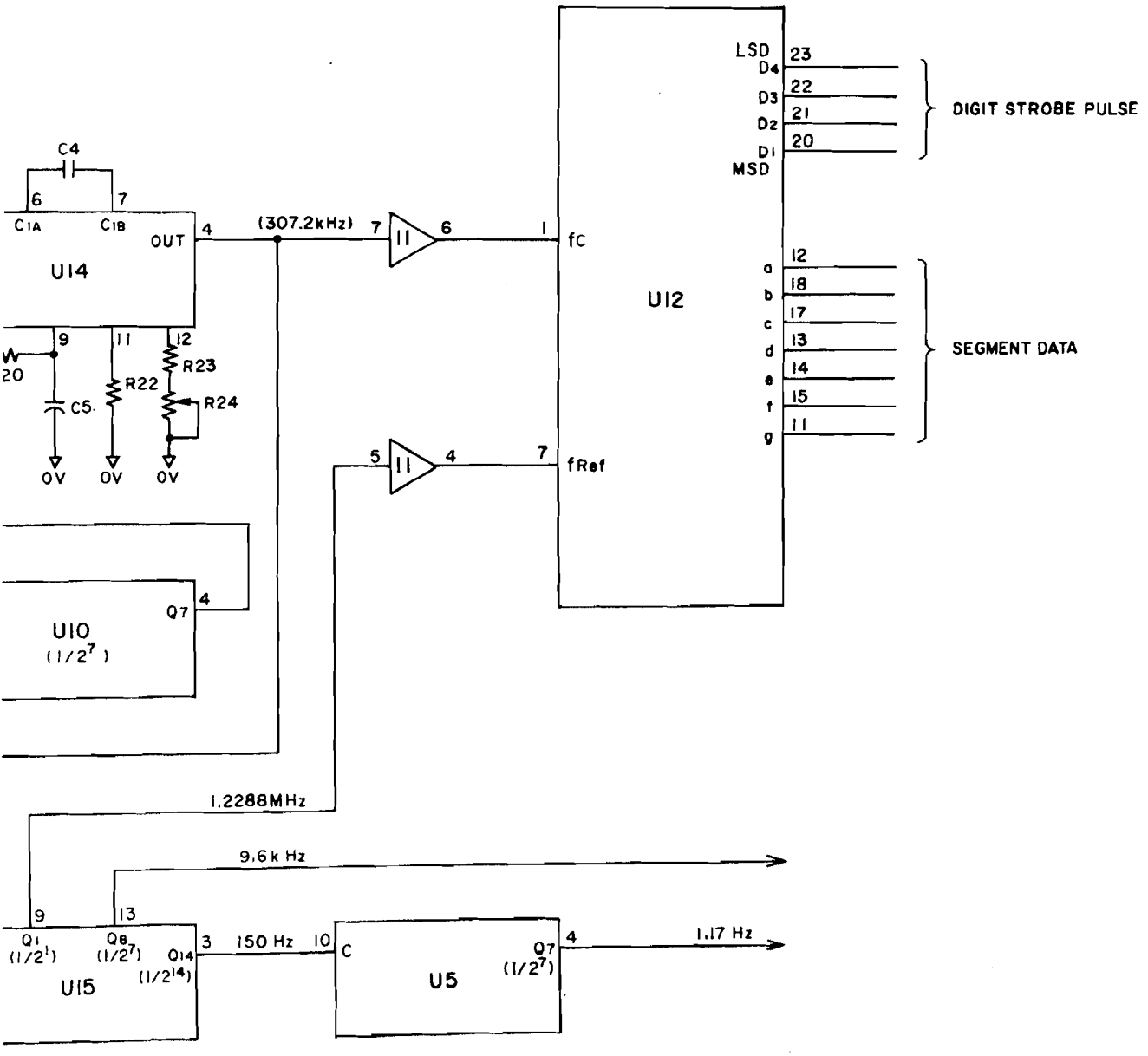
U12 is an IC designed as a frequency counter which counts in Hertz (Hz) the frequency applied to the fc (pin #1) input pin. Another feature of this IC is that the internal gate time can be changed in accordance to the reference frequency applied to the f_{ref} pin (#7) and therefore the desired type of display can be obtained by selecting the proper frequency applied here. In the 85-16B, as the display is designed to indicate 100.0 [%] when the capstan motor standard revolution frequency is 2400 Hz, a reference frequency of 1.2288 MHz is applied to f_{ref} of U12, and 307.2 kHz (2400 Hz X 128) to input pin fc.

Although U18-2 is an inverter, a crystal oscillator is connected to its input and output to make an oscillator circuit which is the main source of various frequen-

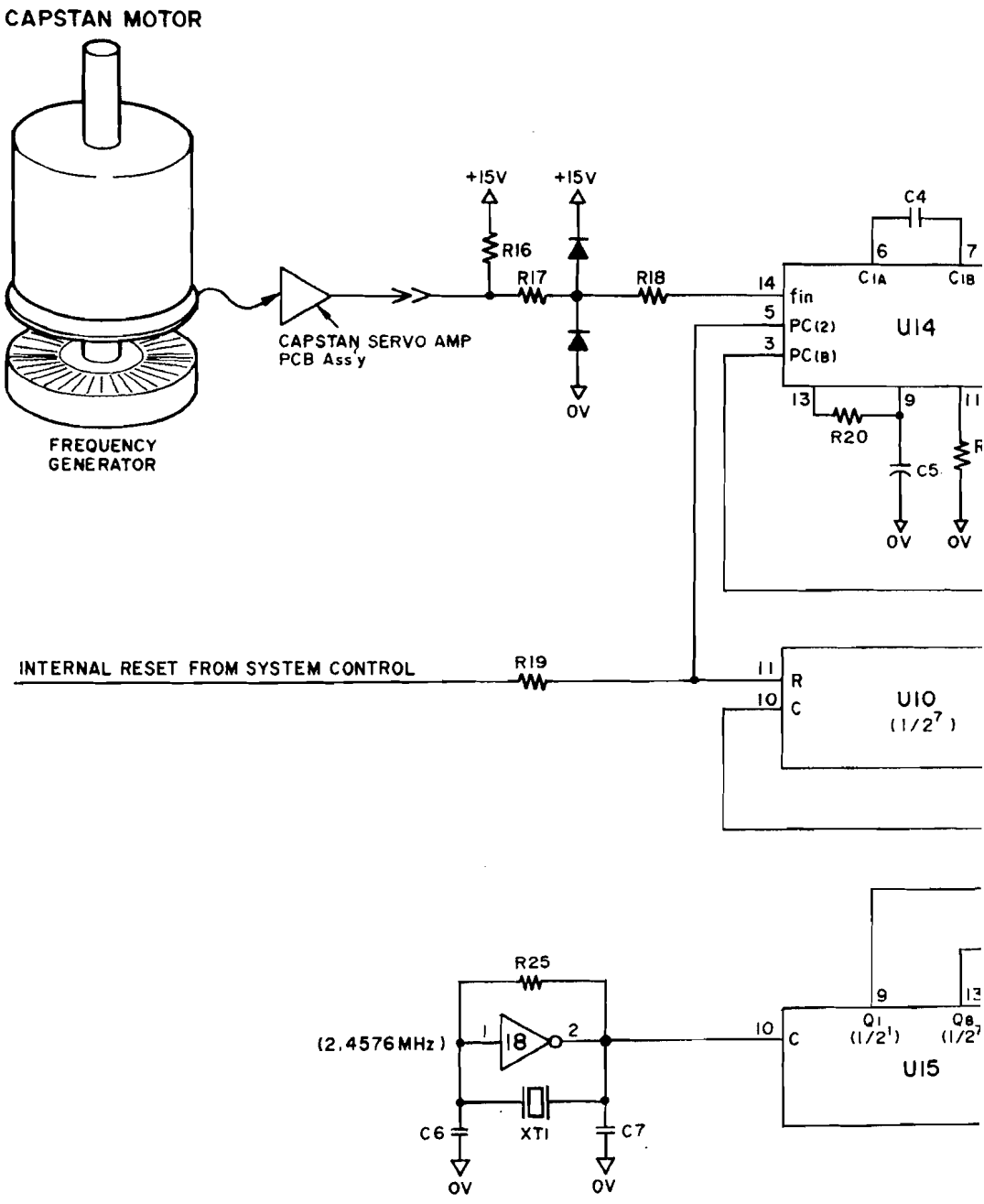
cies for the control and counter circuits of the 85-16B. The oscillating crystal frequency here is 2.4576 MHz.

U15 is a divider and in the 85-16B, divisions of 1/2, 1/256, and 1/16384 are used. The output from the 1/2 pin (#9) is used as the reference frequency of frequency counter U12, and the 1/256 pin (#13) output as the scanning signal of the location counter, clock signal of the system control circuit. Output from the 1/16384 pin (#3), combined with the following stage divider U5, produces 1.17 Hz (flashing clock). In other words, the 150 Hz from the 1/16384 pin is reduced to 1/128 by U5 and output from its #4 pin as 1.17 Hz.

Pin #5 of the phase lock loop U14 and pin #11 of divider U10 are used to prevent unnecessary display during SHUT OFF and POWER ON RESET and thus nothing is displayed until the capstan motor attains constant speed.


C4
6
7
C1A
C1B
OUT
4
U14
(307.2kHz)
7
11
6
1
fC
U12
LSD
D4
D3
D2
D1
MSD
23
22
21
20
DIGIT STROBE PULSE
a
b
c
d
e
f
g
12
18
17
13
14
15
11
SEGMENT DATA
9
11
12
R23
R22
R24
C5
20
0V
0V
0V
5
11
4
7
fRef
Q7
4
U10
(1/2^7)
1.2288MHz
9.6k Hz
9
13
Q1
(1/2^1)
Q8
(1/2^7)
Q14
(1/2^14)
U15
3
150 Hz
10
C
U5
Q7
(1/2^7)
4
1.17 Hz

6.8.3 Counter PCB assembly (Capstan motor speed indicator circuit)



6.8.4 Display switching circuit

This circuit has the function of selecting the content of the display, on the transport control panel, between tape location and capstan motor percent revolution.

As mentioned before, a tape location counter circuit and a frequency counter circuit for the capstan motor revolution percent indication, are included in the Counter PCB Assembly. The content of these circuits are displayed as required by switching the TIME/SPEED display selector on the tape transport control panel.

As the supply voltage is +5 V for the U12 frequency counter used in the capstan motor percent revolution indicating circuit, the outputs are level shifted to +15 volts by transistor arrays U7 and U6.

The selecting signal from the TIME/SPEED display selector is applied to the $\overline{\text{SET}}$ pin (#2) of U22, one side of each input pair of the 2-input AND gate U17-3 and the 2-input NAND gates U13, U8, and U9.

When the $\overline{\text{SET}}$ pin (#2) of U22 is put at low level and input pin #1 of U17-3 also low, tape location is not displayed. Consequently, the capstan motor percent revolution is displayed under this condition.

On the other hand, when one side of the input pairs of U13, U8, and U9 are held at high level, the capstan motor percent revolution is not displayed and thus tape location is displayed.

Diodes D7 ~ D30 are diode OR gates which conduct when the anode is at high level.

U3 and U4 are inverter buffers which convert the high level signals to low level and feed them to the Display PCB Assembly to display the content of each counter.

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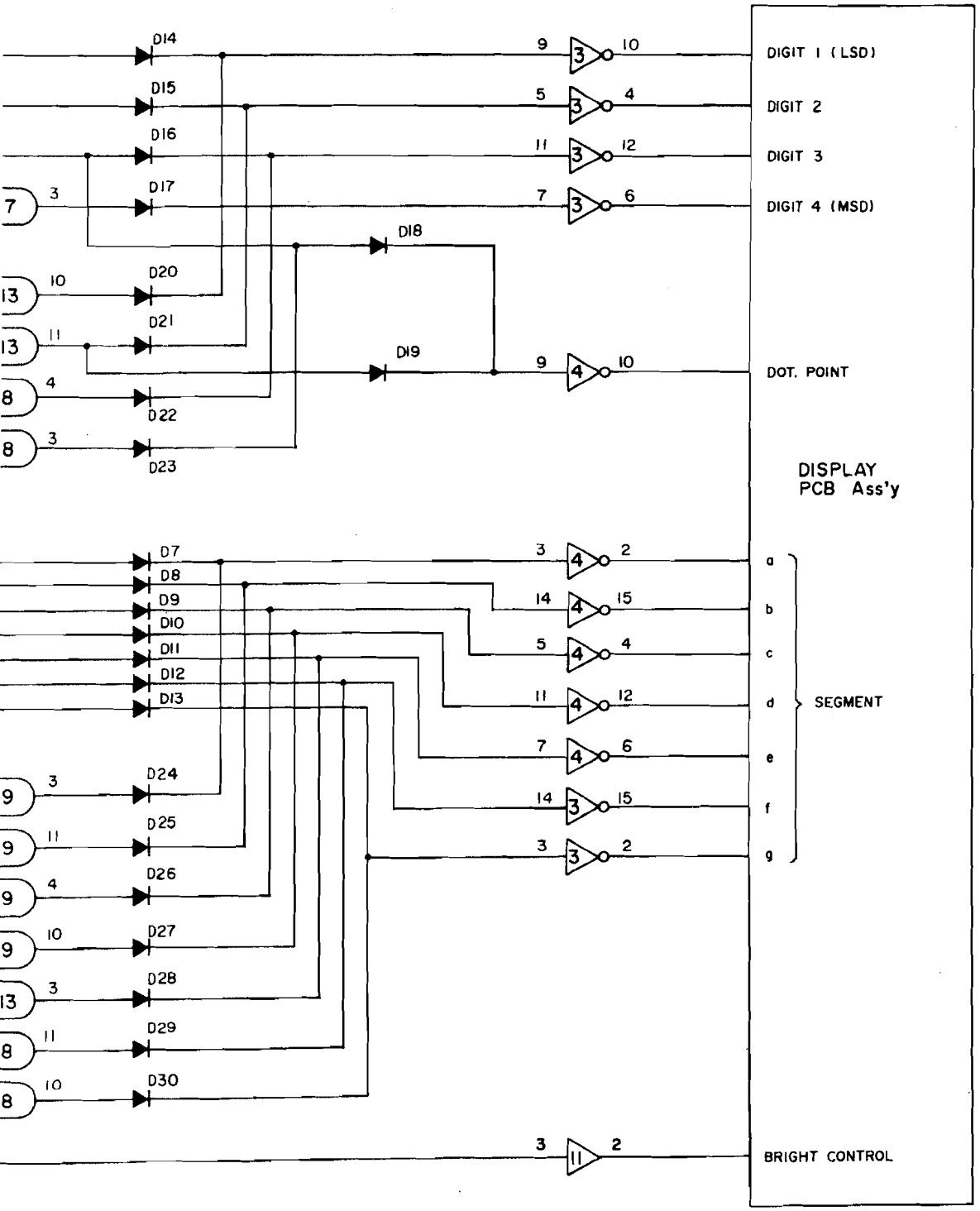
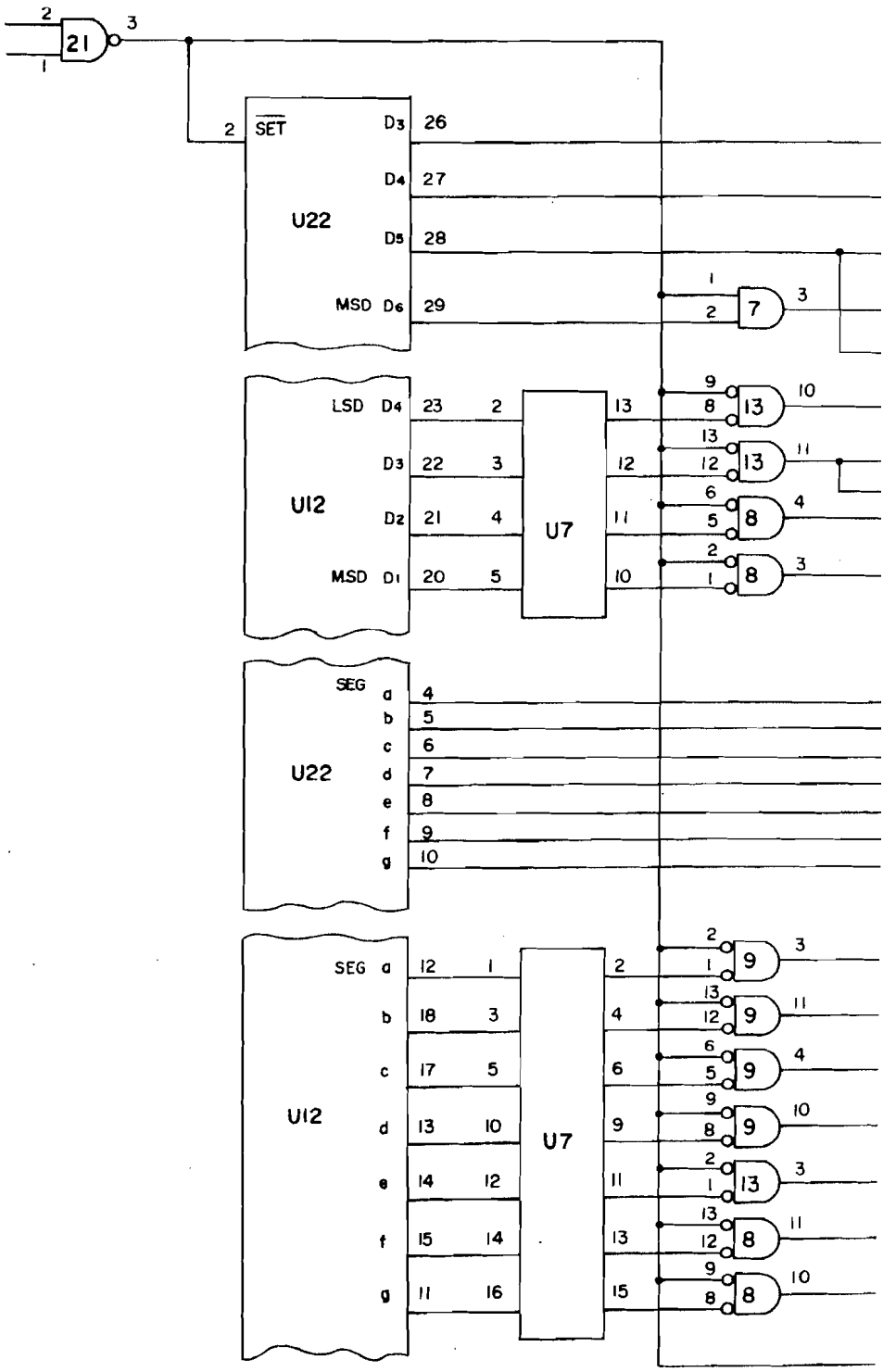

D14
D15
D16
D17
D18
D20
D21
D19
D22
D23
DIGIT 1 (LSD)
DIGIT 2
DIGIT 3
DIGIT 4 (MSD)
DOT. POINT
DISPLAY
PCB Ass'y
D7
D8
D9
D10
D11
D12
D13
D24
D25
D26
D27
D28
D29
D30
a
b
c
d
e
f
g
SEGMENT
BRIGHT CONTROL

6.8.4 Counter PCB assembly (Display change-over)



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6.9 Audio signal control system

6.9.1 Output selector

The output of the REC/REPRO amplifier is controlled by the control signal coming from the output selector switch equipped at the left side of the Function Select switch and by the REC SAFETY and INPUT/SYNC switches equipped at the right side.

INPUT mode

In INPUT mode, the output of the R/P amplifier becomes the input monitor by the Function Select unit and Operation Status ST REC for the transport in the following condition.

1. All channels when output selector switch INPUT of the Function Select unit has been pressed.
2. When output selector switch SYNC of the Function Select unit has been pressed, and:
   a. Channel(s) for which REC SAFETY is on and INPUT/SYNC is at INPUT.
   b. When ST REC signal has been input to channel(s) for which REC SAFETY is on and INPUT/SYNC is at SYNC.

Thus it is possible to switch over INPUT and SYNC monitors by turning on or off the INPUT/SYNC switch when the REC SAFETY switch is on.

The ST REC signal which has passed the Function Select unit comes to R/P amplifier input pin #5 of U1-4 and, after being ANDed with the SAFE/RDY signal which has passed the INPUT/SYNC and FUNCTION switches of each channel, becomes a REC command signal of each channel, while the SYNC signal is inhibited by R/P amplifier input pin #9 of U2-10. At this time, input pin #1 and 2 of U2-3 are high (SYNC and SAFE/RDY signals are present) and the R/P amplifier is in the input monitor state. The INPUT/SYNC and REC SAFETY switches, together with the ST REC signal, control the SAFE/RDY signal to let the system operate as noted above.

SYNC mode

Sync mode is entered when the output of the SYNC head is output from the R/P amplifier and the following conditions are met.

1. The output selector switch of the Function Select unit is depressed, and the REC SAFETY switch is off.
2. The output selector switch of the Function Select unit is depressed, and the REC SAFETY switch is on; the INPUT/SYNC switch is at SYNC; and ST REC signal is not input.

MONITOR will be switched to INPUT if ST REC comes in in this condition. Note that the SAFE/RDY signal of the R/P amplifier is an inhibiter.
When the amplifier is in SYNC mode, U2-10 is high, Q44 is off (not in REC mode), and a high level is output through U2-11.

1. The signal drives Q42, energizes relay K1, and switches the REPRO amplifier

to the SYNC head.

2. It turns on Q12 and switches MONITOR to SYNC.

3. It turns on Q22 and mutes input.

REPRO mode

In REPRO mode, the output of the REPRO head is output through the R/P amplifier. When the output selector button of the Function Select unit is set to REPRO, the REPRO signal comes into the R/P amplifier. This signal turns pin #10 of R/P amplifier U1 to high and triggers the following steps.

1. The signal drives Q13 and makes the REPRO amplifier ready to monitor the REPRO head output.

2. It turns on Q22 and mutes input.

REC mode

In REC mode, U2-4 turns to high when inputs REC and SAFE/RDY of the R/P amplifier are active, and:

* REC mode selector relay K2 is on (to connect the SYNC head to the REC amplifier).
* Q33 and Q34 are driven so that bias and erase signals rise.
  Q25 is on and input signal comes into the REC amplifier.

Now the system is ready to start recording. Starting sequence of REC mode is as follows.

Q34 off → Q44 on → K2 on → Q43 of → Q33 on → Q25 off

Ending sequence of REC mode is as follows.

Q43 on → Q33 off → Q34 on → Q44 off → K2 off

These sequences do not allow click noises to be recorded.

REC mode may be entered by the following procedures.

1. To enter REC mode from STOP or PLAY mode, keep REC SAFETY turned on and press the REC and PLAY buttons of the transport simultaneously.

2. Turn off REC SAFETY and press the REC and PLAY buttons simultaneously so that the system enters REC standby state. Turn on the REC SAFETY button at any time to start recording.

REC mode may be released by the following procedures.

1. Press STOP. STOP mode is entered.

2. Press the REC and PLAY buttons simultaneously. PLAY mode is entered.

3. Turn off REC SAFETY. PLAY mode is entered only for the corresponding channel.

6.9.2 Audio signal electronics

1) Reproduce amplifier

The reproduce amplifier system of the 85-16B is composed of FET input differential

2-stage DC amplifiers, assembled throughout with discrete components. It is the first time such an amplifier has been used in a tape recorder and the circuit is designed for maximum sound quality. Its special characteristics are:

a. The amplifier units (Head amp., EQ amp., Line amp.) are all DC amplifiers with no electrolytic capacitors in the NFB loop. As the internal phase compensation figure is kept to a minimum, the amplifiers have a high slew rate and very low Transient Intermodulation Distortion (TIM).

b. By employing FET's at the input, coupling capacitors were eliminated between the head output and the amplifier input, allowing direct coupling. With no coupling capacitors to introduce distortion, the result is a very clear sound.

c. In order to attain high S/N in the sync reproduce head amplifier, the conventional method was to use an input transformer (IPT). In the 85-16B, a new head amplifier employing dual FET's of super-high g.m. and low noise in the first stage was developed. Compared with IPT types, it has superior S/N, slew rate, TIM distortion, etc.

2) Record amplifier

a. The recording equalizer amplifier is of the FET input differential type. It has eliminated electrolytic capacitors from the NFB loop and by using CR resonant circuits (instead of the LR type) in the equalizer section it was possible to build an amplifier with superior transient response.

b. A large dynamic margin is obtained in the record drive output stage by employing a high output impedance constant current drive circuit with an active load.

Although as few as possible are used, the small number of capacitors used to pass audio signals are all "Audio Capacitors", so-called as they were developed for audio use. Due to this, non-linear and intermodulation distortions are held at extremely low levels.

7. OPERATION

All operating controls of the 85-16B are centered on the forward section of the tape transport top panel and the function select unit located immediately in front of it.

7.1 Tape threading

Thread the tape in the following manner:

1) Place a full reel of tape on the supply reel turntable (left), and an empty reel on the take-up reel turntable (right).
2) Be sure to firmly seat the reels onto the turntable after aligning the turntable pin with one of the slots in the reel center hole and turn the reel clamp knob clockwise to secure the reel firmly.
3) The tape path must be as shown in Figure 7-1.
4) Depress the > button and the tape will be transported at 15 ips.
5) When the > button is depressed while the transport is in the ≪ or ≫ mode, the tape will stop momentarily and then automatically go into the > mode.
6) The head shield gate is manually operating and will be locked in the open position when pressed down; pressing it down again releases the lock and the shield will pop up.

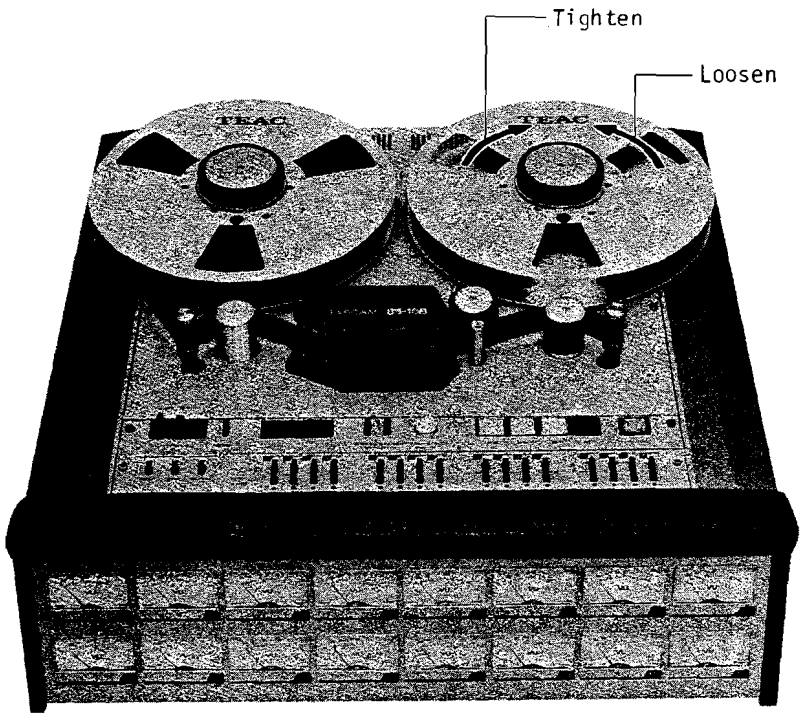


Fig. 7-1

7.2 Tape reproducing

1) Thread tape on transport.
2) Set the PITCH CONTROL as desired - when this control knob is pulled up, the pitch can be controlled ±10 % by rotating the knob either way. When pressed down, the tape speed is fixed at 15 ips.
   Of the two push switches on the left of the pitch control knob, if the left hand button is depressed, the counter display will indicate the tape speed in percent. In other words, it will display 100 at the fixed speed and from 85 through 115 in the pitch control mode.
   Depressing this button while the tape is running in any mode has no effect on the contents of the tape counter.
3) Depress the REPRO button on the OUTPUT SELECT panel.
4) Depress the REPRODUCE button and the tape will be transported at 15 ips or 15 ips ± 10 %.
5) When the REPRODUCE button is depressed while the transport is in the REWIND or FAST FORWARD mode, the tape will stop momentarily and then automatically go into the REPRODUCE mode.
6) Simultaneous pressing of the play (►) and REC buttons will reset the unit from record mode to reproduce mode.

7.3 Recording

1) Thread tape on transport.
2) Set the PITCH CONTROL knob to either fixed tape speed or pitch control mode, as desired.
3) Set the OUTPUT SELECT button to INPUT, SYNC, or REPRO, as desired.
4) Push "IN" the REC safety button for the channel you wish to record on.
5) When the RECORD and REPRO buttons are depressed together, the channels designated in above item 4) will go into the RECORD mode.

7.4 Over-dubbing

1) Depress the SYNC button on the OUTPUT SELECT panel.
2) Of the REC safety button, push "IN" the channel button you wish to record on.
3) When over-dubbing, crosstalk will be minimized if the reproduce channel and record channels are not adjacent to each other but more than one channel apart. When the INPUT/SYNC buttons on those channels that have been set to REC SAFETY (step 2) are set to INPUT, source monitoring at LINE OUT is obtained; setting the INPUT/SYNC buttons to SYNC allows sync head signal monitoring.
4) When the RECORD and REPRODUCE buttons are depressed together, the REC safety "IN" channels will go into the RECORD mode, regardless of the INPUT/SYNC buttons settings, LINE OUTPUT provides source signal monitoring.
5) If it is necessary to change the mode status of any channel from 'reproduce' to 'record', simply depress the desired channel button. The channel thus de-

pressed will immediately change to the record mode, but return to the reproduce mode upon depressing this button "OUT".

6) To monitor sync head signals during a punch-in recording, push the SAFETY button "ON", set the INPUT/SYNC corresponding to desired channels to SYNC, and depress the PLAY button. To punch-in, just simultaneously press the REC and PLAY buttons, which puts the selected channels into REC MODE. And to punch-out, simultaneously depress the REC and PLAY buttons, deactivating the REC MODE.

7) The Series 85-16B has a search cue function to locate the 00.00 position. Of the two buttons at the left of the PITCH CONTROL knob, the right hand button is the SEARCH CUE button.
From any mode the transport is in, the 00.00 position can be located by depressing the SEARCH CUE button.
Also, when the SEARCH CUE button is depressed and then the > button is depressed, the tape on returning to the 00.00 position, will immediately go into the PLAY mode.

7.5 Editing

When in the STOP mode, if the STOP button is depressed a second time, the transport will go into the EDIT mode. The mechanical brakes will then be released and as a constant low voltage will be applied to the reel motors, both reels can be manipulated to jockey the tape to the desired position. In this condition, the PLAY and STOP lamps will blink alternately.

7.6 Tape storage, winding and cueing

When the ≫ or ≪ button is depressed twice, the lamp for the depressed button will blink to indicate that the tape is traveling at the storage winding speed which is slower than the regular REWIND or F.F. speed.
In this condition, when the CUE lever at the extreme left of the panel is shifted to the left, the tape lifter will be defeated to permit quick locating of the cue position.

7.7 Exterior sync lock

On the 85-16B two receptacles are provided for employing SMPTE SYNC, etc. with other equipment.

1) Sync lock receptacle (J-125)
The 85-16B uses a reference signal produced by the internal quartz oscillator to phase lock the capstan motor. The SYNC LOCK RECEPTACLE also has an EXT FREQ IN connector allowing an exterior phase lock; consequently, it also has an IN-EXT connector permitting selection of either the inner reference signal or the exterior one.
J-125 is found on the deck rear panel.

2) Remote receptacle (J-513)

Besides the connector for ordinary remote control, this receptacle has a TAPE MOVE setting allowing output or input of the tach-generator signal for controlling the footage roller, an UP-DOWN setting for signals to indicate the tape transport direction, and a CUE setting to control the tape lifter solenoid.
J-513 is found on the rear panel of the function selector unit.
With these receptacles the 85-16B can be controlled with ease.

8. MAINTENANCE

8.1 Routine maintenance

Problems and downtime in the recorder can be prevented by scheduled checks and maintenance. Periodically follow the check items below:

a) Cleaning the heads and tape guides
   All heads and metal parts in the tape path must be cleaned after each 6 hours of operation or before starting a new recording session.
   TEAC Cleaning Fluid is recommended.

b) Cleaning the pinch roller
   Clean this at least once after each full day of use.
   TEAC Cleaning Fluid is recommended.

c) Cleaning the capstan
   Clean this at the same time the heads are cleaned.
   TEAC Cleaning Fluid is recommended.

d) Demagnetizing of heads and tape guides
   All heads and tape guides should be demagnetized every morning or before starting a recording session. The TEAC Head Demagnetizer or equiv. is recommended.
   1) Before demagnetizing, turn machine OFF!!!
   2) Have all tapes at least 5 or 6 feet away when demagnetizing to prevent the demagnetizer's magnetic field from erasing them.
   3) Slowly move the tip of the demagnetizer up and down in front of each head and slowly move it away (This is suggested because if you pull it away quickly, remagnetizing of the head is possible). Demagnetize the second head and repeat the process, etc.
      After you have repeated this process for all heads, move the demagnetizer an arm's length away, turn it off, and unplug it.

e) Testing the brakes
   See item 8.2.4, p. 8-5.

f) Testing the pinch roller pressure
   See item 8.2.3, p. 8-4.

g) Testing the amplifier
   Thread a blank tape on the Model 85-16B, apply a 1 kHz, -10 dB (0.3 V) signal to the LINE INPUT jack, depress INPUT of the OUTPUT SELECT buttons, make sure the VU meter reads 0 VU, and record this signal. While the deck is still in the record mode, reset the OUTPUT SELECT to REPRO and check that the VU meter reads 0 VU.
   Rewind the above recording to the beginning, set the OUTPUT SELECT to SYNC, and put the machine in the REPRO mode. The VU meters should all read 0 VU.

Record a swept 40 Hz through 18 kHz signal and check the overall frequency response with the VU meter to see that it is within ±3 dB.
Disconnect any equipment plugged into the LINE INPUT, record a length of no signal tape, and reproduce it to check the S/N ratio.
If it is below spec, refer to item 8.2.7, i), p. 8-15.

8.2 Testing and adjustment

8.2.1 Test equipment required

Spring scale		0 ~ 8 lbs. (0 ~ 4 kg.)
		0 ~ 10 ozs. (0 ~ 300 g.)
Flutter meter		Meguro Denpa Sokki Co., Model MK-668B (Japan)
	or -	Mincom Division, 3M Co., Model 8155 (U.S.A.)
Audio oscillator		Hewlett Packard, Model 204C or equivalent
Frequency counter		Range: 0 ~ 1 MHz; sensitivity; 0.1 Vrms; imp.: >1 MΩ, < 25 pF
Bandpass filter		TEAC M-206A or a frequency analyzer
AC voltmeter		Range: -80 dB ~ +40 dB ; Imp.: >1 MΩ, <25 pF (Example: HP400GL)
Oscilloscope		General purpose
Test tapes		TEAC YTT-1244 (for reproduce alignment): Tape speed: 15 ips; reference flux: 250 nWb/m; equalization: IEC; time constant: & 35 msec.
	or -	Magnetic Reference Lab., MRL31J-129: All specs are identical with YTT-1244 except for the reference flux which is 200 nWb/m and thus its reproduce output level will be 2 dB lower.
		For wow and flutter measurement: Standard Tape Lab., #72
Blank tape		Ampex 456 is recommended.
Tape tension gauge (if available)		TENTEL Model T-2-H20-1

8.2.2 *Removing the dress panel*

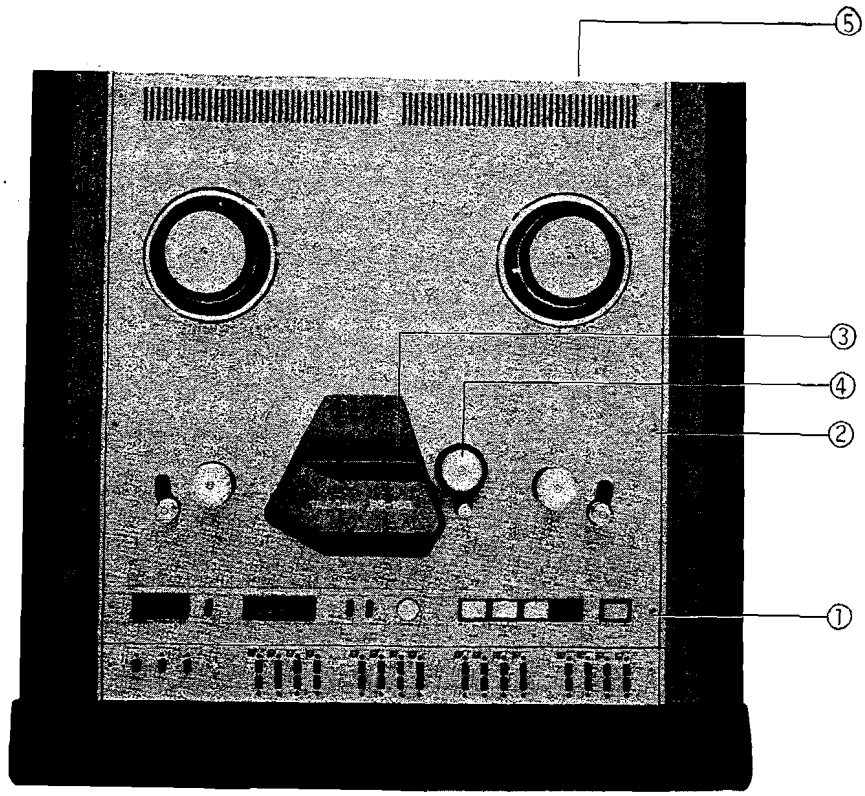


Fig. 8-1

1) Loosen the two screws ①.
2) Loosen and remove the four screws ② and six rear screws ⑤.
3) Loosen and remove the two head housing screws ③.
4) Remove the pinch roller ④.
5) Remove the dress panel.

8.2.3 Pinch roller pressure adjustment

Pinch roller pressure is supplied by the Pinch Roller Pressure Spring only and it is most important that the solenoid plunger be fully bottomed before taking pressure reading.

1) Block the automatic shut-off PHOTO-COUPLER.
2) Attach a suitable spring scale to the pinch roller shaft with a short loop of string.
3) Put the deck in the REPRODUCE mode, and positioning the scale as illustrated, slowly draw it away from the capstan until the pinch roller just stops rotating.

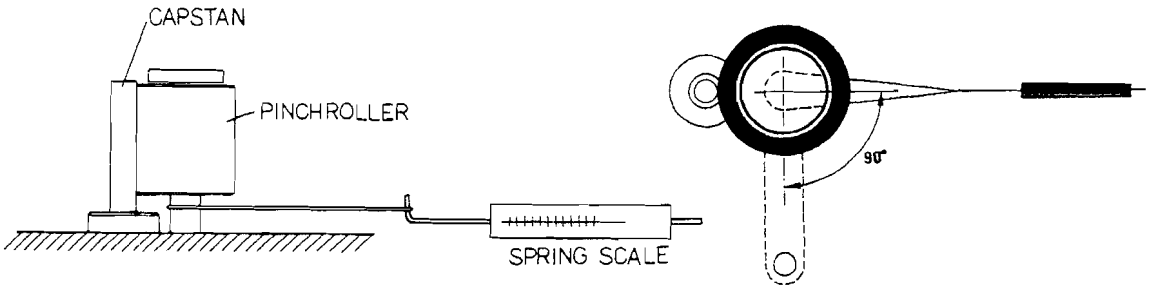


Fig. 8-2

4) The spring scale should indicate 5.5 lbs ~ 6.6 lbs.
5) If the reading is off specification, loosen the 2 screws, Figure 8-3, and reposition the plunger solenoid. As pressure will change greatly with only a slight shift in position, reposition the solenoid in small increments. Shifting the solenoid in the direction of the arrow will increase the pressure.

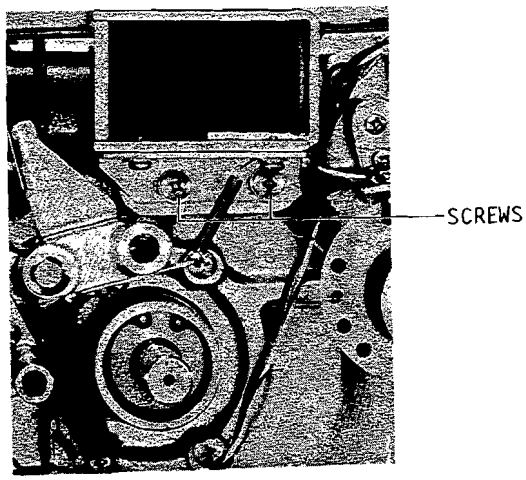


Fig. 8-3

6) After obtaining optimum pressure, securely tighten the 2 screws and make a final check of the pressure.

8.2.4 Brake torque adjustment

Brake torque is applied mechanically. Pressure is set by the variable spring force. Brake measurements and adjustments are made with NO power to the equipment.

1) Place an empty reel on the left reel table, and fasten one end of a 30" length of string to the reel anchor.
2) Wind several turns of the string CCW around the hub and attach a suitable spring scale to the free end of the twine.
3) Take a reading only when the reel is in steady motion since the force required to overcome static friction will produce a false, excessively high initial reading.
4) The reading should be 48.5 ~ 55.5 in-oz (3500 ~ 4000 g-cm).
5) If the item 4) reading is off spec, the spring force must be adjusted.

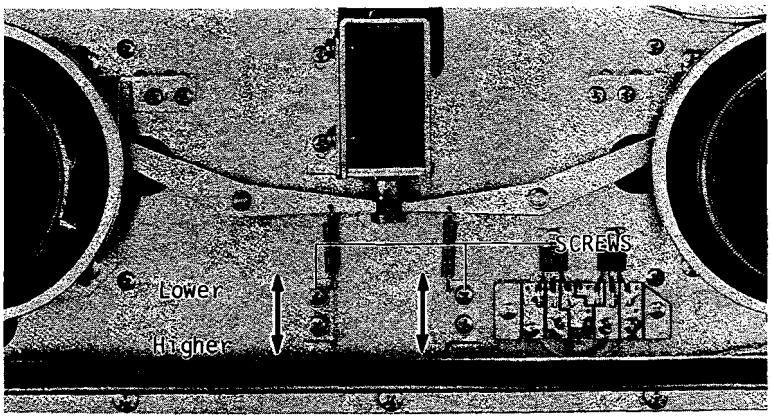
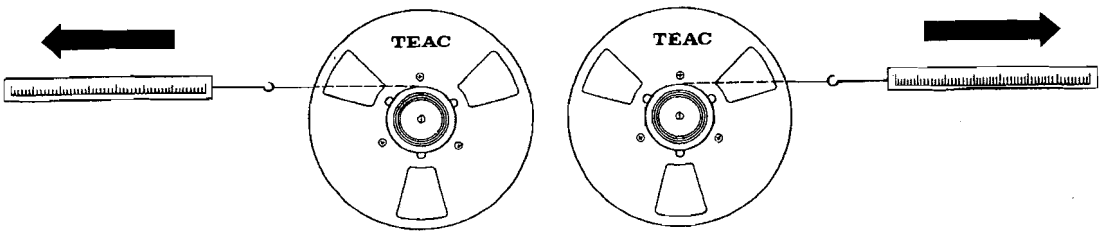


Fig. 8-4

As shown in the above diagram, brake torque is adjusted by loosening the two screws and sliding the Brake Adjusting Plate in direction shown for lower or higher torque, as required.



* Formula for torque calculation

T (in-oz/g-cm) = R x W Whereas - R = Radius of hub (in/cm)
W = (oz/cm)

Fig. 8-5

8.2.5 Capstan servo

1) Servo gear adjustment

Check to see that the clearance between the FG Print Coil and the Servo gear is 0.5 mm. If it is not, the wheel is shifted along its shaft until the clearance between the FG print coil and the servo gear is about 0.5 mm (as shown in Fig. 8-6), after which the wheel is secured.

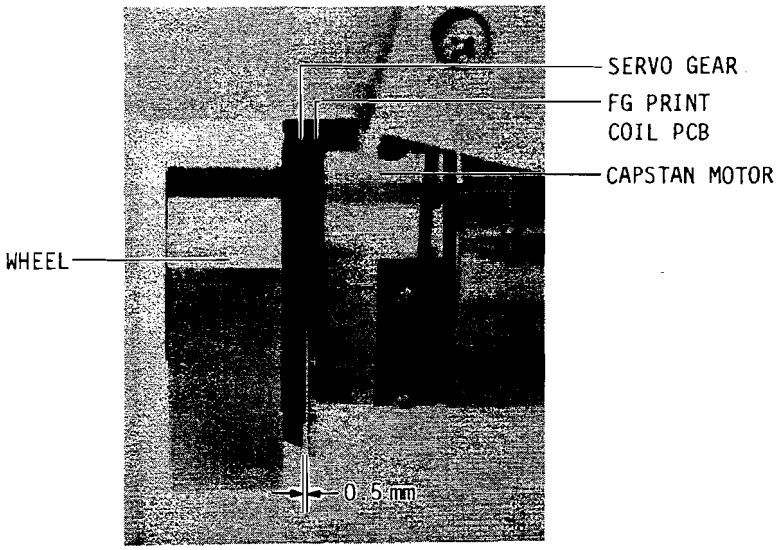


Fig. 8-6

At this point, check the output waveform with an oscilloscope at point (A), Fig. 8-7 of the capstan servo amp. PCB to see that the output is not being clipped. If it is clipping, the clearance between the FG coil and the servo gear is slightly enlarged.

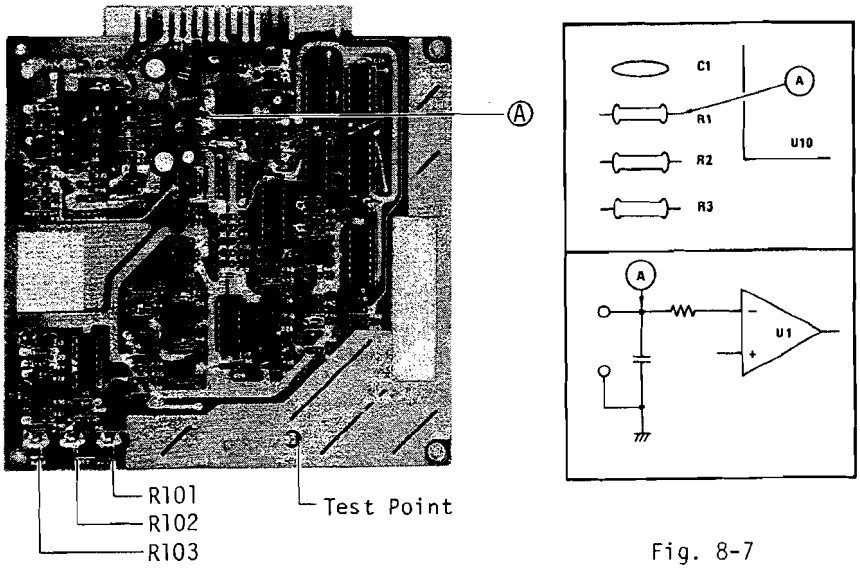


Fig. 8-7

After completing this procedure, to allow easy movement of the FG Print Coil PCB on the Capstan Motor Assembly, the PCB's four mounting screws are loosened with a screwdriver inserted through the two holes in the wheel, as shown in Fig. 8-8 (Fig. 8-8 shows the wheel removed).

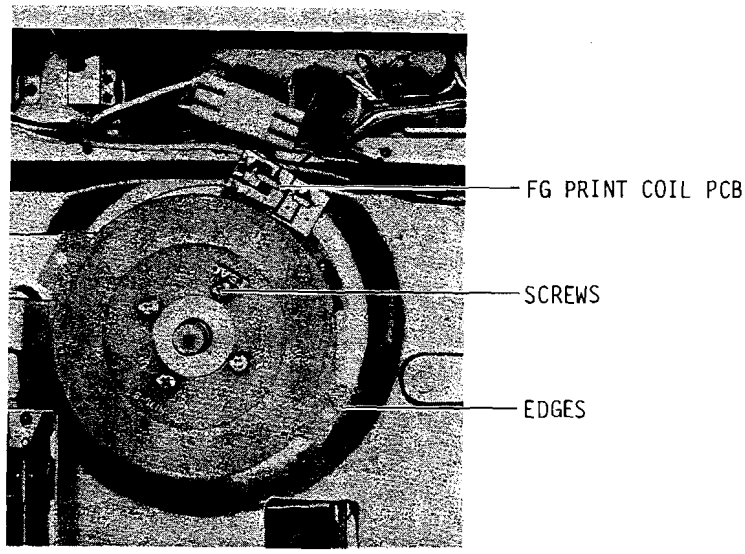


Fig. 8-8

Then, grasp the edge of the FG coil of Fig. 8-8 and carefully move the PCB until the waveform at point (A) shows a minimum of AM components, as shown in Fig. 8-10.

NOTE : The holes by which this PCB is secured allow a limited amount of play. This permits adjustment of the lateral board position, and, as explained above, it should be adjusted for minimum AM components.

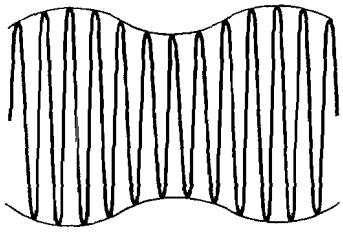


Fig. 8-9

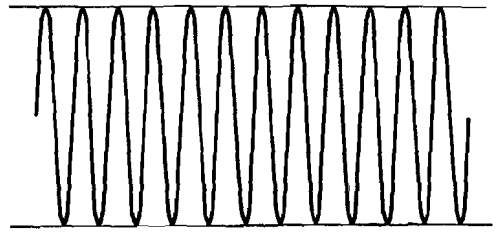


Fig. 8-10

The waveform will be as shown in Fig. 8-9 when there is an excess of AM components and there is a tendency to improved wow and flutter with lower AM. Upon completing the above adjustments, the FG Print Coil PCB is secured by tighting the four mounting screws with a screwdriver inserted through the two holes in the wheel, as shown in Fig. 8-8 (Fig. 8-8 shows the wheel removed).
After securing the PCB, check to see that there is no increase in the AM. If there is only a slight increase, further adjustment is not required.

For the last step, check the two hex screws on the wheel to see that the wheel is securely fixed to the capstan shaft.

2) Servo Amplifier Gain Adjustment

The capstan motor must be run without any load and the trimmer pot R101 set at mid-point of its full rotation, and R103 fully CCW. Then R102 is adjusted to obtain a square wave of 50 % duty on the oscilloscope screen at the test point of this PCB, as shown in Figs. 8-7, 8-11.

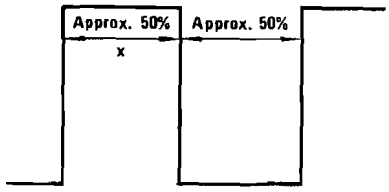


Fig. 8-11

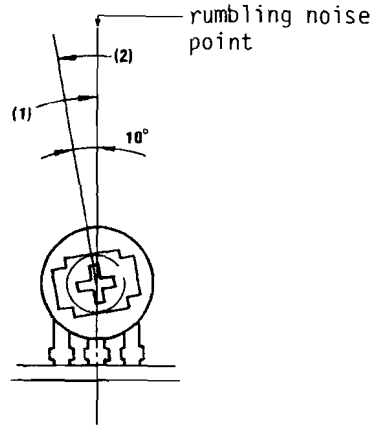


Fig. 8-12

R103 is the gain adjusting pot.

Refer to Fig. 8-12 (arrow 1). Rotate R103 to the right until a rumbling noise appears from the capstan motor. From this position, turn R103 back (arrow 2) by about 10° and set in this position. (Constantly monitor the waveform with the oscilloscope during this adjustment. Distance x, of Fig. 8-11 will become shorter as R103 is rotated CW. Should this distance become nil, adjust R102 so there is always a square wave seen on the oscilloscope.)

3) Pitch Control Adjustment

Switch on the pitch control by pulling up its control knob, set the knob at center of its full rotation, and set the TIME/SPEED switch to SPEED so that the display shows the capstan speed. Set R48, on the Display PCB assembly, at the center of its full rotation, and adjust R49 so that the display speed is between 98 and 102 %, then readjust R48 so that the display indicates 100 %.

For the last step, rotate the Pitch Control Knob to check that the display indicates a speed of less than 90 % at full CCW, and over 110 % at full CW rotation of the control knob.

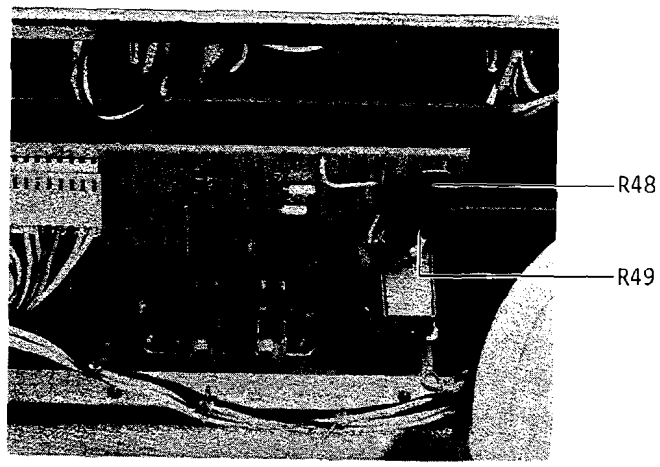


Fig. 8-13

4) Duty adjustment

Connect an oscilloscope to the test point on the Capstan Servo Amplifier PCB to monitor the waveform. Pull up the Pitch Control Knob to switch it on, rotate the knob fully CCW and adjust R102 on the Capstan Servo Amplifier PCB so that duty cycle of the waveform is as shown in Fig. 8-14.

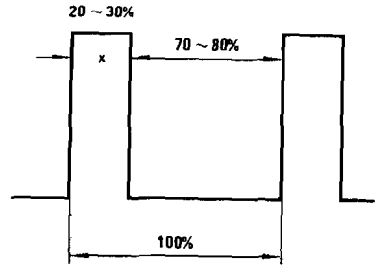


Fig. 8-14

The reason for maintaining this ratio is to guarantee that the PLL remains locked even if the capstan servo reference frequency changes by more than ±10%. (PLL will not be locked if the waveform of Fig. 8-14 changes to a constant level.)

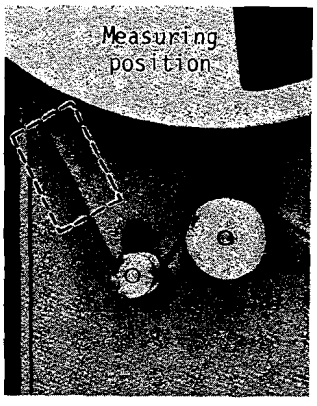
a) Should the ratio x, in Fig. 8-14, become smaller when the pitch control knob is rotated CW, or in other words, when the capstan speed is raised, then rotate R102 CCW to increase x. Next, trim R101 on the Capstan Amplifier PCB in the CCW direction so that x, which was increased before, is made smaller, so that the duty ratio is as shown in Fig. 8-14.

b) Contrary to the initial results in above a), if the ratio increases inverse to that in Fig. 8-14, then R102 is rotated CW to decrease x. Then, R101 is trimmed CW to spread x which was decreased before, so that the duty cycle will again be as shown in Fig. 8-14.

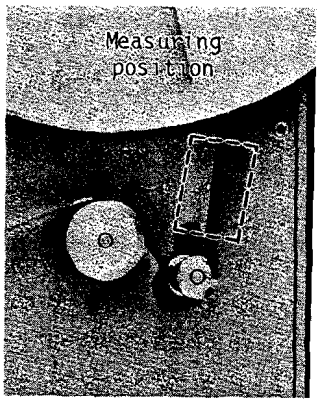
The above a) and b) procedures are repeated several times until the duty cycle is not greatly altered when the capstan speed is changed by means of the pitch control.

8.2.6 Tape tension servo

1) Position and tools for tape tension measurement



Supply side



Takeup side

Fig. 8-15

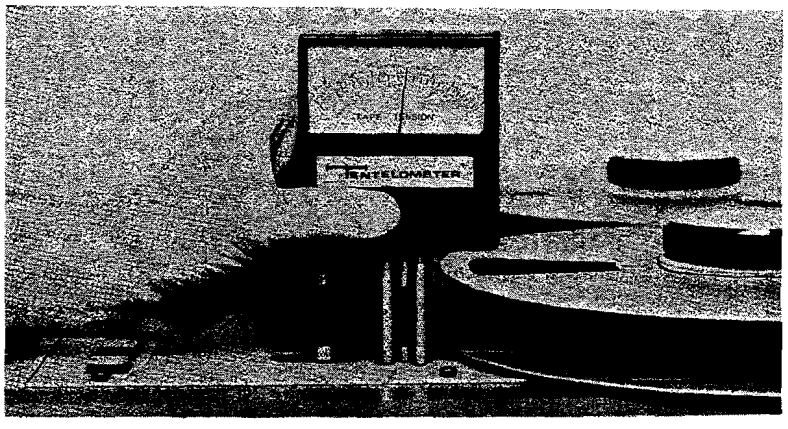


Fig. 8-16

Measuring tool --- Tentelo meter, Model TZ-H20-1

2) PLAY tape tension adjustment

Without any tape on the turntable, depress PLAY and make sure the turntable motor rotates. If it does not rotate, adjust R101 and R202 on the Tension Servo PCB so that it starts rotating (the shut-off must be ON).

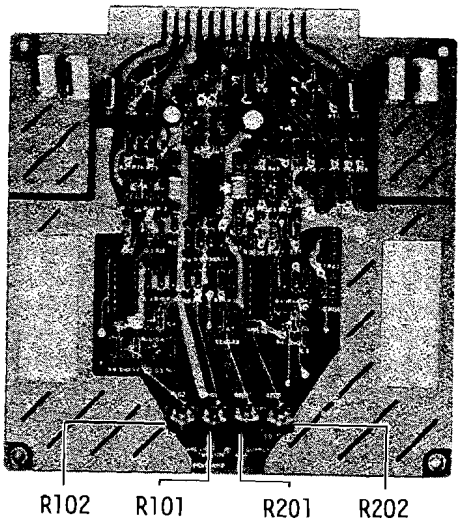
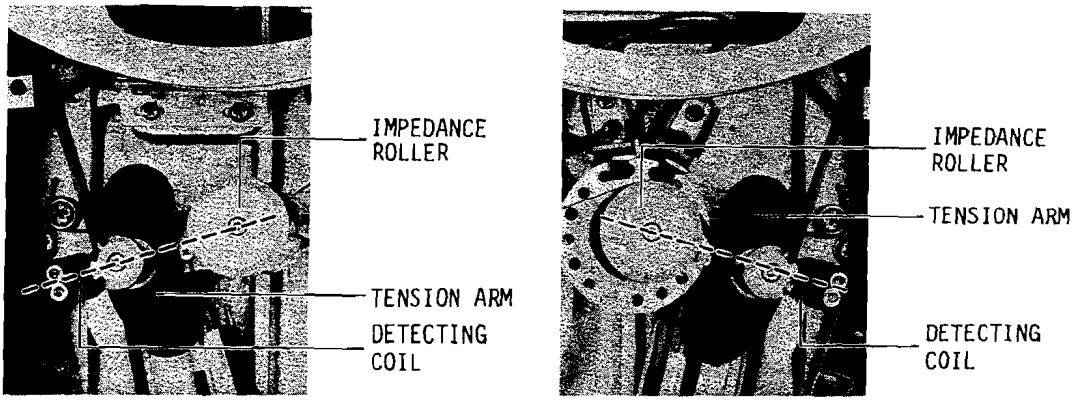


Fig. 8-17

Load tape on the transport, depress PLAY, and set the supply reel side tape tension to 120 gms. by adjusting R201. The take-up side tape tension is temporarily adjusted by R101 so that the tension arm is steadily resting in the position shown in Fig. 8-18.



Supply side

Takeup side

Fig. 8-18

3) Tape

With approximately the same amount of tape on both reels, start tape in FF, then stop tape after about 20 seconds. Measure the time from depressing the STOP button until the tape actually stops, and adjust R101 so that the tape stops within 4 or 5 seconds. (Rotating R101 CW increases stopping time, and decreases with CCW rotation. Tape will not stop if R101 is rotated CW too far. It can be stopped by retarding R101 CCW.)

In the same way, with about equal amounts of tape on both reels, start tape in

RWD and stop it after about 20 seconds. As with above FF, check the stopping time is within 4 or 5 seconds.

4) Adjustment assurance check
Upon completing adjustment of items 1) and 2), rewind tape to the beginning and put transport in PLAY. Making sure the tension arm on the take-up side is not vibrating, measure the tape tension here. If the tension is 200 gms. ± 20 grms., then adjustment is finished.
Next, check that the stopping time is satisfactory as per item 3) above. If it is, this adjustment is finished.

5) Tape tension in the EDIT mode
This is adjusted by trimmer pots R102 and R202 on the Tension Servo PCB. With about the same amount of tape on both reels, the STOP button is depressed twice to put the transport in the EDIT mode. The take-up side tape tension is adjusted by R101 to be about 100 grms, and the supply side tension by R201 to also be about 100 grms. After this, make sure the tape reel does not start to creep at the beginning of the winding and near end of the winding when in the EDIT mode. If it does start to creep, slightly reduce tape tension by trimming CCW, the same amount on R102 and R202, until the creeping stops.

8.2.7 Record/reproduce amplifier checks and adjustments

Checking and adjusting can be most efficiently expedited by successively following to the end each procedure below:

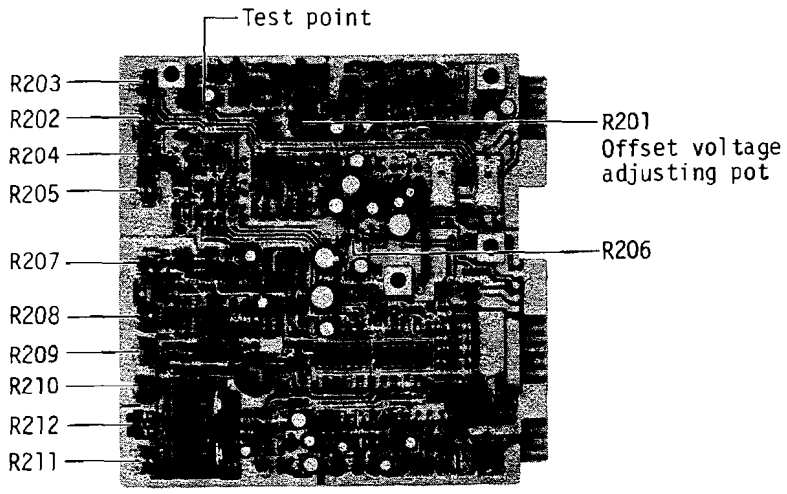


Fig. 8-19

a) Adjusting the Reproduce Preamplifier offset voltage
The Record/Reproduce Amplifier PCB is brought outside by using the extension card (Part No. 60854750) stored in the right hand side of the Record/Reproduce Amplifier Unit.

First, check the DC offset voltage by connecting an oscilloscope probe to the test point shown in the above diagram. The correct voltage is from 0 V to +0.5 V. If this voltage is off spec, adjust the offset voltage pot R201 so that the voltage is within the specified range.
This check and adjustment is necessary only when a new PCB is installed or a particular channel shows excess distortion, and need not be done at daily maintenance.

b) Setting of reproduce level
   1) Connect on AC voltmeter to the OUTPUT 1 RCA phono jack on the rear panel.
   2) Turn on the machine and thread the YTT-1244 test tape.
   3) Reproduce the "Operating level" section (a voice on the tape identifies each section at the beginning).
   4) Switch the OUTPUT on 85-16B to REPRO. Then, adjust the trim pot marked REP LVL (R204, 33 kΩ, Fig. 8-19) so that the AC voltmeter connected to the output reads -10 dB (0.3 V).
   5) Switch the OUTPUT SELECT to SYNC. Then, adjust the trim pot marked SYNC LVL (R205, 33 kΩ, Fig. 8-19) until the AC voltmeter connected to the output reads -10 dB (0.3 V).

c) Meter calibration
   1) When the AC voltmeter reads -10 dB (0.3 V), the meter bridge VU meter should read 0 VU.
   2) If it does not, adjust the trim pot marked METER CAL (R206, 47 kΩ, Fig. 8-19) on the Record/Reproduce Amplifier PCB Ass'y so that the VU meter reads 0 VU.

d) Reproduce frequency response
   1) Rethread the test tape after setting up the levels in all 16 channels. When checking and adjusting the reproduce frequency response, it is more efficient to simultaneously check all 16 channels with the meter bridge VU meters instead of plugging the AC voltmeter into the OUTPUT jacks one channel at a time. To be able to do so, the previous "Meter calibration" must have been completed.
   2) Switch the OUTPUT SELECT to SYNC. Reproduce the phase, azimuth, and frequency response section of the test tape and check for a flat frequency response. If necessary, adjust the trim pot marked SYNC EQ (R202, 2.2 kΩ). Trim the pot so that 10 kHz will be flat against the 1 kHz reference frequency. Then, see if the response is within ±2 dB at 12.5 kHz and 16 kHz.
   3) Switch the OUTPUT SELECT to REPRO. Reproduce the same sections of the test tape and check the response. If adjustment is necessary, trim the pot marked REPRO EQ (R203, 2.2 kΩ).

e) Record calibration
   You can use the REPRO head as a test instrument to check and adjust the record

circuits. Almost all of the following steps involve recording a tone on a tape and reading the reproduce output of the recorder.

NOTE: Do not touch the trim pots set during the previous reproduce adjusting procedures.

1) Begin the record adjustments with the INPUT MON LEVEL trim pot on the Record/Reproduce amplifier card.
   Apply a 1 kHz, -10 dB (0.3 V) signal to LINE INPUT 1.
   Punch the INPUT button of the OUTPUT SELECT buttons. If the VU meter does not read 0 VU, adjust the pot marked IN MON LVL (R207, 10 kΩ, Fig. 8-19).
2) Check and adjust the remaining 15 channels in the same way.

f) Bias level

1) Record a 10 kHz test tone.
2) Set OUTPUT SELECT to REPRO.
3) Adjust the input level so that the VU meter indicates a conveniently read level.
4) The trim pot to adjust is R212, marked BIAS LVL (100 Ω, Fig. 8-19).
5) It is first rotated fully CCW, then slowly rotated CW.
6) The VU meter will slowly rise, reach the peak, then begin to fall again. The trim pot is set 3 dB beyond and below this peak.
7) Should the VU meter scale out during this procedure, reduce the input level slightly and repeat the above procedure.
8) Repeat the same procedures on the remaining 15 channels.

g) Record level

The following adjustments are done only after the reproduce level is set and the bias level set to specification.

1) Put the 85-16B in the record mode and record a 1 kHz, -10 dB (0.3 V) signal.
2) Set the OUTPUT SELECT to REPRO.
3) Adjust the trim pot R208 (10 kΩ) marked REC LEVEL to obtain a 0 VU reading on the meter bridge VU meter.
4) An AC voltmeter plugged into the record channel OUTPUT should indicate -10 dB.
5) If it does not indicate -10 dB, the pot on the Record/Reproduce PCB is out of adjustment and the meter must be recalibrated (Refer to Meter Calibration, item 8.2.7, c), p. 8-13).
6) Rewind the above recorded 1 kHz signal to the beginning, set OUTPUT SELECT to SYNC, reproduce the 1 kHz signal and check for a 0 VU, ±0.5 VU reading on the VU meter.
7) If it does not indicate 0 VU, readjust the reproduce level setting of reproduce level, item 8.2.7, b), p. 8-13.

h) Record equalization

There are two trim pots for Record equalization on the 85-16B. One, marked EQ ◁P▷ R209 (3.3 kΩ), is for shifting the high frequency peak, and the other, marked △P▽ R210 (1 kΩ), is for raising or lowering the peak.

1) Put the 85-16B in the record mode and record a 1 kHz, 0 VU (-10 dB) signal.
2) For a quick check, use the VU meter but for critical adjustments plug an AC voltmeter into the LINE OUTPUT RCA phono jack.
3) Set the OUTPUT SELECT to REPRO and monitor with the VU meter or the AC voltmeter.
4) Then, raise the record frequency to 15 kHz, 0 VU (-10 dB), and check the difference from 1 kHz.
5) This difference should be within ± 2 dB.
6) Should it be off spec, adjust R209.
7) Adjust REC EQ R209 for frequencies from 10 kHz through 15 kHz, and PEAK ADJ R210 for frequencies above 15 kHz.

i) Signal-to-noise ratio measurement

Prior to measurement, demagnetize all heads and tape guides as described in item 8.1.d), p. 8-1.

1) Before signal-to-noise ratio measurement, be sure the item 8.2.7 Record/reproduce amplifier check and adjustments are carried out, and if required, properly adjusted:
2) Connect the AC voltmeter to LINE OUTPUT 1 RCA phono jack on rear panel.
3) Record a short length of 0 VU, 1 kHz signal, then, while still in the recording mode, unplug the oscillator to INPUT L pin jack on rear panel and make another length of no-signal recording.
4) Set OUTPUT SELECT to REPRO.
5) Rewind the recording made in item 3) to the beginning and reproduce it.
6) Making sure the reproduce output of the previously recorded 1 kHz, 0 VU signal is -10 dB, raise the sensitivity of the AC voltmeter and measure the level of the no-signal portion of the tape.
7) With 0 VU as the reference level, the signal-to-noise ratio as measured by the AC voltmeter, should be better than 48 dB.
8) Set OUTPUT SELECT to SYNC.
   Check to see that the same value as obtained at above REPRO is indicated here.
9) If it is off spec:
   * Demagnetize the heads.
   * Check erasure [Refer to item 1), p. 8 - 17].
   * Check and compare measurements of other channels. If they stand up to spec, correct or repair the off spec channel Record/reproduce amplifier PCB's.
   * Check for proper adjustment of the bias trap.
   * Try another tape of the same type number.

j) Bias trap adjustment

Bias trap adjustment is not required except in the following circumstance:

* When the record head is replaced
* When the record/reproduce PC card is replaced

* When there is an increase in bias leakage

Bias traps L1, L2, L3, and L4 are provided in each Record/Reproduce PC cards.

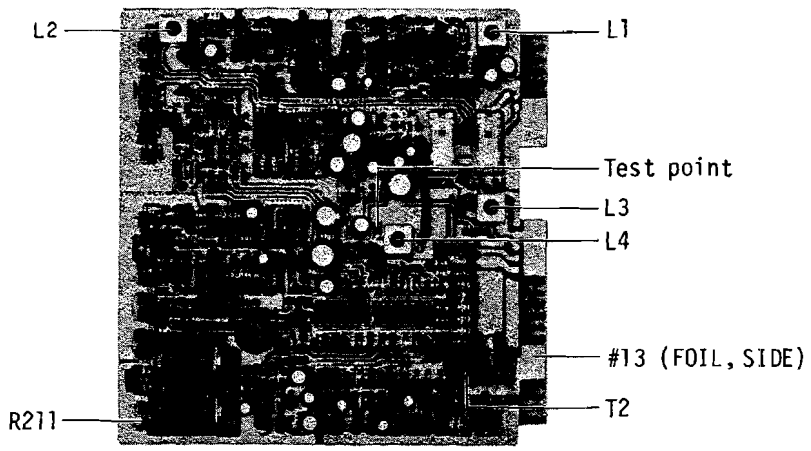


Fig. 8-20

L1 and L2 (Reproduce amplifier)

1) Plug an AC voltmeter (preferably with an oscilloscope in parallel) to the LINE OUTPUT 1 RCA phono jack on rear panel.
2) Carefully remove the Channel 1 record/reproduce card from the 85-16B, install an extender card (Parts No. 60854750) to it, and reinsert it into its original connector.
   NOTE: When removing or replacing the PC card, TURN MACHINE OFF.
3) Block the passage of light in the photo-coupler located at the left of the capstan so that it does not shut off the 85-16B. Punch 'in' the REC safety buttons for all except CHAN 1 and set OUTPUT SELECT to SYNC.
4) Turn ON the 85-16B and put it in the record mode.
5) Raise the AC voltmeter sensitivity and check the bias leakage. It should be better than -30 dB.
6) If it is higher than permissible, adjust L1 for minimum leakage with a non-inductive screwdriver.
7) Then, adjust L2, also for minimum leakage.

L3 and L4 (Record amplifier)

1) Plug an AC voltmeter (preferably with an oscilloscope in parallel) to the LINE OUTPUT 1 RCA phono jack on the rear panel.
2) Carefully remove the channel 1 record/reproduce card from the 85-16B, install an extender card (Parts No. 60854750) to it, and reinsert it into its original connector.
   NOTE: When removing or replacing the PC card, TURN MACHINE OFF.
3) Block the passage of light in the photo-coupler located at the left of the capstan so that it does not shut-off the 85-16B. Punch 'in' the REC safety buttons for all channels and set OUTPUT SELECT to INPUT.

4) Turn ON the 85-16B and put it in the record mode.

5) Raise the AC voltmeter sensitivity and check the bias leakage. It should be better than -30 dB.

6) If it is higher than permissible, adjust L3 for minimum leakage with a non-inductive screwdriver.

7) Bias trap L4 in the output stage of the record amplifier is adjusted as in the following.

8) Connect the GND side of an AC voltmeter or oscilloscope to the chassis and the HOT side to the test point, Fig. 8-20.

9) Put the 85-16B in the record mode and adjust L4 for minimum leakage.

k) Erase current adjustment

1) Set the ERASE LVL pot (R211, 6.8 kΩ) at mid-point between both extremes of rotation.

2) Bring the Record/Reproduce amplifier card out in front by using the extension card (Parts No. 60854750).

3) Connect the hot side of the oscilloscope probe to edge connector pin #13 of the Record/Reproduce amplifier card, and the probe cold side (GND) to the amplifier chassis.

4) Punch 'in' the REC safety button only for the channel which is to be adjusted for correct erase current.

However, if all channels are erased simultaneously, the erase efficiency will deteriorate by about 5 db.

5) Turn ON the 85-16B and put it in the record mode.

6) While monitoring with the oscilloscope, adjust the core of T2 (with a non-inductive hex screwdriver) for maximum signal level.

7) Rotate the erase current adjusting pot marked ERASE LVL (R211, 6.8 kΩ) so that output at the edge connector pin #13 is 200 Vp-p.

l) Erasure

A 1 kHz bandpass filter or frequency analyzer is required for measuring erasure.

1) A test tone of 0 dB (1 kHz) is recorded, the tape rewound to the beginning of this recording, the tape run through a second time in the record mode with the record INPUT shorted, and the residual 1 kHz component measured.

2) It is within spec if the ratio between the initially recorded 1 kHz signal level and that of the erased portion is more than 75 dB.

3) Should erasure be insufficient, slowly rotate CW the trim pot marked ERASE LVL, R211 (6.8 kΩ) until a ratio of 75 dB is obtained.

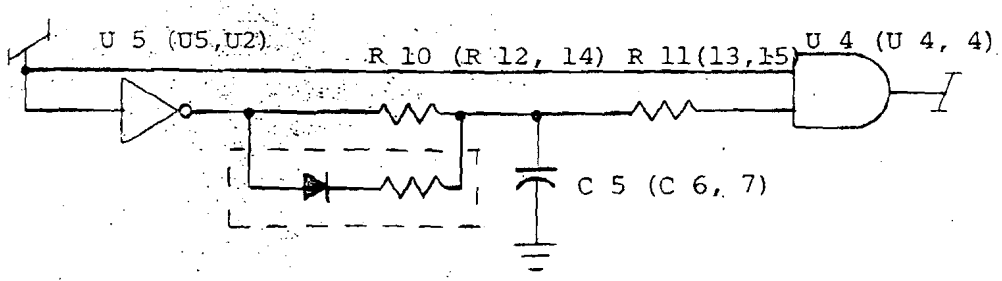
TASCAM SERVICE INFORMATION FROM TEAC

date: FEBRUARY 25, 1983
TA-51

subj: 85-16 (B) AND AQ 85 INTERFACE

TO IMPROVE THE INTERFACE OF THE 85-16(B) AND THE AQ 85, THE FOLLOWING COMPONENTS SHOULD BE ADDED TO THE 85-16 (B) IN THE LOCATIONS DESIGNATED BELOW.

THIS MODIFICATION FACILITATES OPERATION FROM EITHER FAST WIND MODE TO THE SEARCH MODE OR FROM SEARCH MODE TO SEARCH MODE. THE CIRCUIT TO BE MODIFIED IS THE CONTROL DRIVE PCB ASSEMBLY IN THE 85-16 (B).



THERE ARE THREE CIRCUITS TO BE MODIFIED. THE FIRST COMPONENT LISTED IS THE FIRST CIRCUIT, THE TWO IN PARENTHESIS ARE THE OTHER TWO.

COMPONENTS IN THE DOTTED AREA ARE TO BE ADDED. THE DIODE SHOULD BE A 1N914 TYPE SIGNAL DIODE, THE RESISTOR A 1 K Ohm ¼ W TYPE. PART NUMBER FOR THESE COMPONENTS, IF PURCHASED FROM TEAC ARE:

DIODE	1 S 2473 HJ	5143118000
RESISTOR	1 K Ohm, ¼ W	5183082000

mm