ORDER NO. VRD25/8/2013

Service Manual

General Description
Adjustment Procedures
Block / Schematic Diagrams
Exproded Views / Parts List

Panasonic VHS

Portable Video Cassette Recorder

NV-180 E EG B

AC Adaptor

VW-A18 E B

Wired Remote Controller

VW-R17E

Plug In AC Adaptor

VW-A11 E B

NV-180

VW-A18

VW-R17

VW-A11

Panasonic

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P.O. Box 288, Central Osaka Japan

INTRODUCTION

By implementing a large number of latest technological developments from a wide range of diverse fields, Panasonic succeeded in making this new portable VTR NV-180 a standard in terms of low weight, compact dimensions and overall operation.

This service manual contains these technical information which will allow service technicians to understand and service the Panasonic Portable PAL VHS Video Tape Recorder NV-180, AC Adaptor VW-A18, Plug in AC Adaptor VW-A11 and wired Remote Controller VW-R17. The new NV-180 features a new 2-double-video-head system that allows Super Still, Super Still Advance playback without jitter and distortion and Super Fine Slow Motion with 1/5th of normal playback speed which can even be adjusted between 1/3rd and 1/25th via the remote control unit. Cue & Review, insert, editing, audio dubbing, tape time remaining indicator and Multi-Function Display.

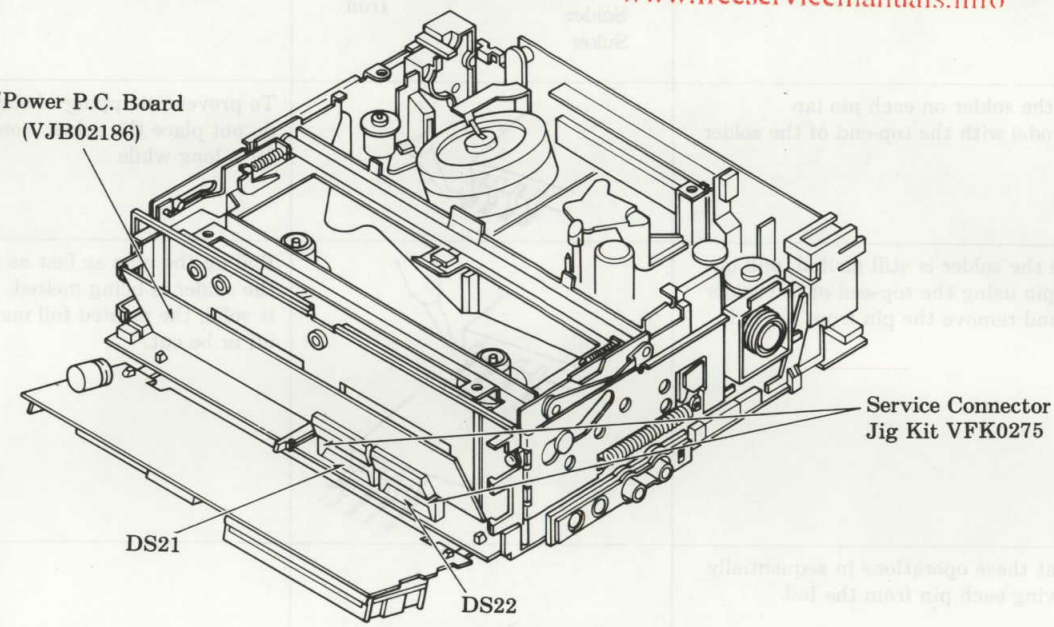
These features in addition to the basic PAL VHS format make the unit an ideal one for your culture and entertainment.

Technical Information

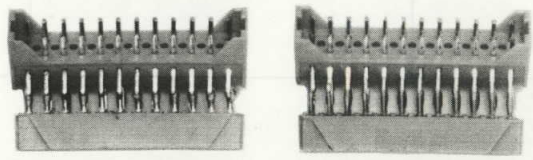
Subject: Service Connector JIG KIT (VFK0275)

We are pleased to inform you that we shall soon introduce the new portable video cassette recorder NV-180 in the market. Regarding this model, this service connector Jig Kit is necessary to check the Servo/Power P.C. board (VJB02186). Therefore, please place an order for this Jig Kit (VFK0275), and distribute this Jig Kit to your local branches and dealers.

* **Procedure for use**



Connection of Jig Kit (VFK0275)



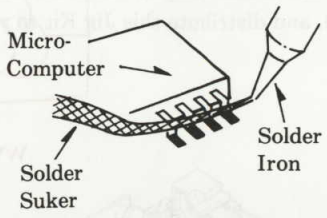
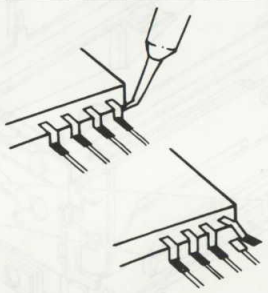
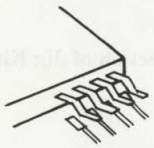
Service Connector Jig Kit (VFK0275)

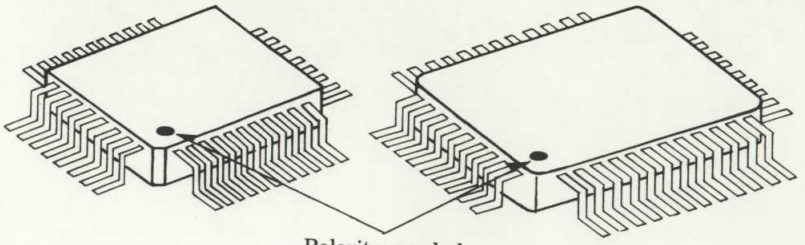
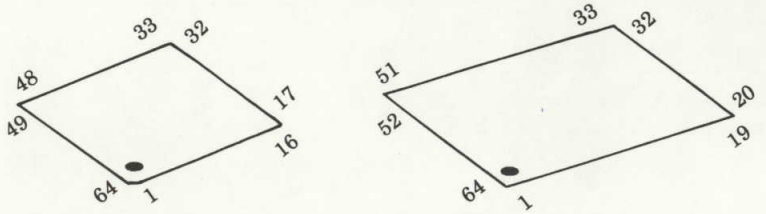
1. Remove the Servo/Power P.C. board (VJB02186) from Main P.C. board (VJB02184).
2. Connect the Service Connector Jig Kit (VFK0275) to connector DS21 and DS22 of Main P.C. board.
3. Reconnect the Servo/Power P.C. board (VJB02186) to Service Connector Jig Kit (VFK0275)

By using this connector Jig Kit, Servo/Power P.C. board is slanted by 45 degrees.

Subject: Method of replacing the FLAT Package-type Micro-computer

The flat package-type micro-computer has the different form from any of the conventional micro-computers because of smaller size and lighter weight newly provided. The replacing method is described below, which will help you to effectively perform services when replacing it.

Procedures in replacing the flat package-type micro-computer		Precautions
Removal		
Before removing the micro-computer from the P.C. board, absorb the solders deposited on the pins using a clean solder sucker shown in the drawing so that the residual solder will be minimized.		Use the solder iron (model VFK0248) specified for use with chip parts. Make sure to connect a 240 V-AC transformer (model VFK0249) to the solder iron which is designed for use with 100 V of the AC voltage.
Melt the solder on each pin (an electrode) with the top-end of the solder iron.		To prevent stripping of the printed foil, do not place the solder iron on any pin for a long while.
While the solder is still melted, pull up each pin using the top-end of the solder iron and remove the pin from the foil.		Pull up the pins as fast as possible while the solder is being melted. If the solder is solid, the printed foil may either drop off or be cut.
Repeat these operations in sequentially removing each pin from the foil.		

Installation of a new micro-computer	
First, evenly apply the solder element to the foil surface where the pins must be soldered.	 Polarity symbols
Properly determine the positions of the foil and pins by correctly aligning the polarity symbols, then secure the micro-computer in position.	 Correctly align the positions of these polarity symbols with the coner-cut portion as well as the polarity symbol on the printed circuit board.
Solder all pins to properly connect to the foil.	

SPECIFICATIONS

Solder Iron: VFK0248

Rate: 100 V—15 W

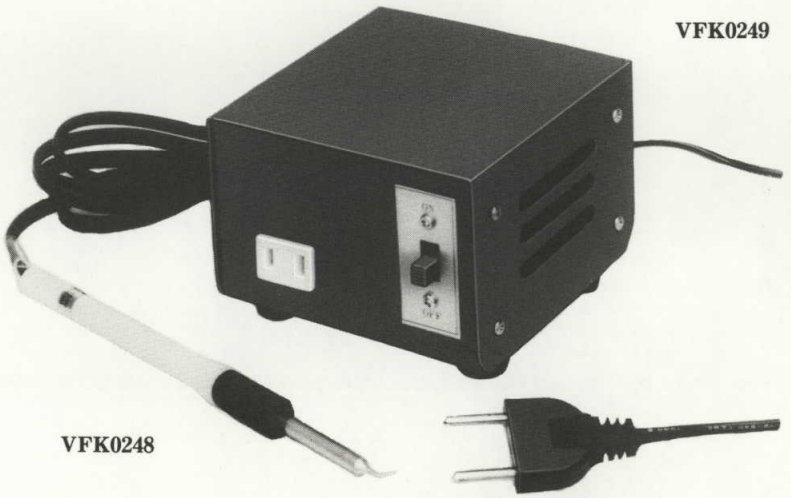
Insulation Resistance: 100 MΩ

Max. Temp.: 400 °C

Transformer: VFK0249

INPUT: 240 V AC

OUTPUT: 100 V AC
0.3 A



VFK0249

VFK0248

Memo

Portable Video Cassette Recorder

NV-180 E EG B

SPECIFICATIONS

Power Source:	DC 12V
Power Consumption:	Approx. 6.8W at Play mode
Video Recording System:	2 rotary heads, helical scanning system
Tape Speed:	23.39mm/s
Tape Format:	Tape width 12.7mm high density tape
Record/Playback Time:	240min. with NV-E240
FF/REW Time:	Less than 5.0min. with NV-E180
VIDEO	
Television System:	CCIR: 625 lines, 50 fields PAL colour signal
Modulation System:	Luminance: FM azimuth recording Colour signal: converted subcarrier phase shift recording
Input Level:	LINE IN (BNC): 1.0Vp-p, 75Ω TUNER/CAMERA: 1.0Vp-p, 75Ω
Output Level:	LINE OUT (BNC): 1.0Vp-p, 75Ω terminated RF Modulated: UHF channel 36 (±4), 76.0dBμ, 75Ω terminated
AUDIO	
Input Level:	MIC IN (M3): −70dB, more than 4700Ω terminated LINE IN (Phono jack): more than −10dB, 100kΩ (MIC jack+Adaptor) terminated TUNER/CAMERA: more than −20dB, 4700Ω terminated
Output Level:	LINE OUT (Phono jack): −8±2dB, 600Ω Earphone: −22dB, 200Ω terminated
Audio Track:	1 track
Video Horizontal Resolution:	more than 240 lines
Signal-to-Noise Ratio:	Video: more than 43dB Audio: more than 43dB
Audio Frequency Response:	80Hz—10kHz
Operating Room Temperature:	0°C—40°C
Operating Humidity:	10%—80%
Weight:	2.7kg (with internal battery pack)
Dimensions:	215(W)×69.5(H)×263(D)mm
Standard Accessories:	1 pc. Video Cassette Tape (NV-180E/B only) 2 pcs. DIN-RF coaxial cable 1 pc. Audio Input Attenuator 1 pc. Earphone 1 pc. Carrying Case 1 pc. Shoulder Belt
Optional Accessories:	Video cassette tape: NV-E240 Approx. 344m, 240min. NV-E180 Approx. 258m, 180min. NV-E120 Approx. 174m, 120min. NV-E60 Approx. 88m, 60min. Battery Pack, VW-VB30E/VW-VB31E Video Tuner/Timer Adaptor, VW-ET180E/B/EO AC Adaptor, VW-A18E/B Wireless Remote Controller, VW-R17E Wired Remote Controller, VW-R18E Plug In AC Adaptor, VW-A11E/B Car Battery Cord, VW-AC18E Video Camera Microphone

Weight and dimensions shown are approximate.
Specifications are subject to change without notice.

CONTENTS

REMARKS: NV-180EG West Germany model only

This set can be used for special recording/playback of SECAM colour signal.
SECAM tapes which have been recorded on specified SECAM-VHS recorder can be played back in black-white on this set.

SECTION 1
GENERAL DESCRIPTION

1-1. FEATURES

❶ Compact, Lightweight and Portable
This portable VHS VTR is tremendously versatile in recording with a camera, and very light in weight—only 2.3kg excluding a battery.

❷ Multi-Function Display
Whenever an operation button is pressed, the activated function is immediately indicated on this easy-to-see Multi-Function Display. It shows you at a glance, in what operation mode the VTR is.

❸ Three-Way Power Operation
You can operate the VTR and camera by using three power sources:
Battery pack, AC adaptor, or car battery cord (all optional).

❹ Multi-Motion Playback
In addition to normal playback, you can quickly review and cue recorded tapes as well as enjoy super still, super still advance, and super fine slow-motion viewing.

❺ Insert Editing
The Insert Editing allows you to insert new pictures onto a pre-recorded tape. To complete tape editing you can add the sound with the audio dubbing function.

1-2. CONTROLS & COMPONENTS

❶ Reset Button
Push the reset button to reset the Counter of Multi-Function Display to "0000".

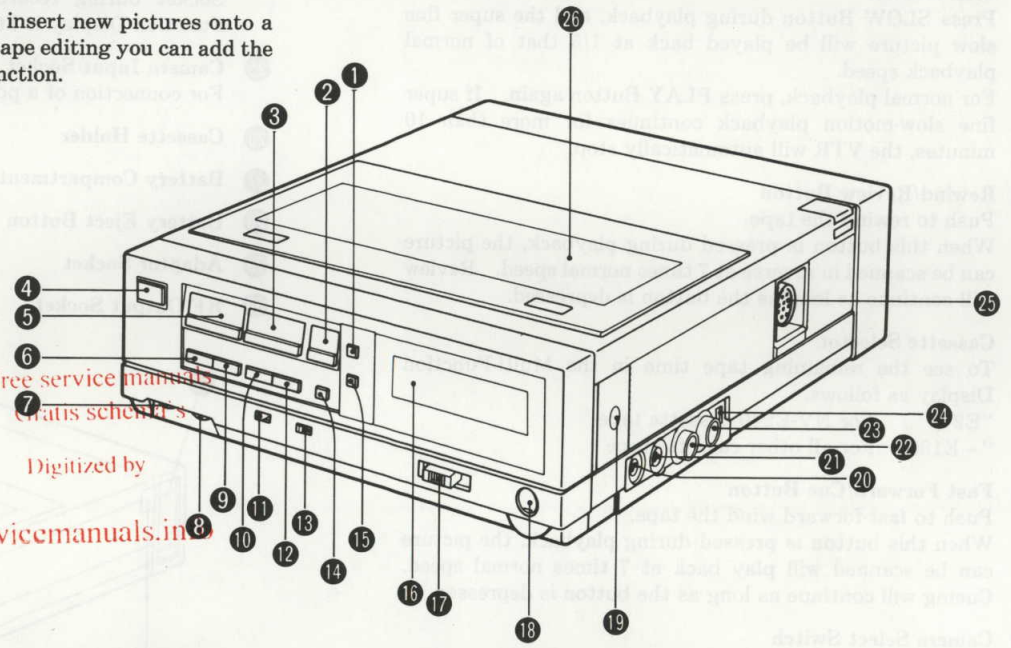
❷ Record Button
Push together with Play Button to start recording.

❸ Play Button
Push to play back a recorded tape.

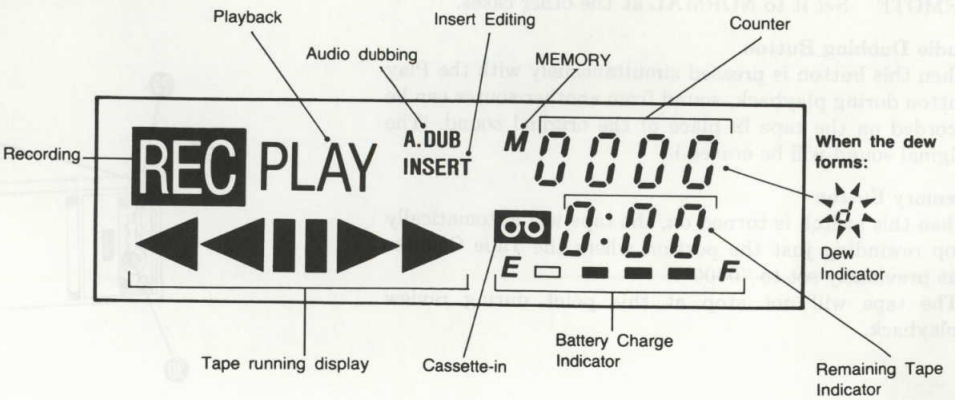
❹ Eject Button
Press this button to remove the cassette.

❺ Stop Button
Push to stop the tape.

❻ Pause/Still Button
Push to temporarily stop the tape during recording in order to avoid recording unwanted material, or to view a paused picture during playback. Push again to release the tape from pause.



⓰ Multi-Function Display



⑦ Tracking Control

Noise Picture

Tape recorded on another machine show noise or a streaky playback picture, rotate this control slowly in either direction until the picture is clear. The control should normally be kept in the "FIX" position.

⑧ Slow Tracking Control

When noise appears during multi-motion playback (still-frame, super still advance, or super fine slow-motion), activate the slow playback mode and turn the Slow Tracking Control clockwise or counterclockwise to reduce the noise.

- During multi-motion playback using tapes recorded on other VTR the Slow Tracking Control may not significantly reduce noise.
- Multi-motion playback may cause some distortion in the upper parts of the picture, but this is normal and does not indicate a trouble.
- When the picture rolls vertically, adjust the TV's vertical hold control.

⑨ Slow Button

Press SLOW Button during playback, and the super fine slow picture will be played back at 1/5 that of normal playback speed.
For normal playback, press PLAY Button again. If super fine slow-motion playback continues for more than 10 minutes, the VTR will automatically stop.

⑩ Rewind/Review Button

Push to rewind the tape.
When this button is pressed during playback, the picture can be scanned in reverse at 7 times normal speed. Review will continue as long as the button is depressed.

⑪ Cassette Selector

To see the remaining tape time in the Multi-Function Display as follows.
"E240".....For NV-E240 cassette tape
"~E180"...For all other cassette tape

⑫ Fast Forward/Cue Button

Push to fast-forward wind the tape.
When this button is pressed during playback, the picture can be scanned will play back at 7 times normal speed. Cueing will continue as long as the button is depressed.

⑬ Camera Select Switch

When camera recording, this switch must be set to REMOTE. Set it to NORMAL at the other cases.

⑭ Audio Dubbing Button

When this button is pressed simultaneously with the Play Button during playback, sound from another source can be recorded on the tape in place of the original sound. (The original sound will be erased.)

⑮ Memory Button

When this switch is turned on, the tape will automatically stop rewinding just the portion where the Tape Counter was previously set to "0000".

- The tape will not stop at this point during review playback.

⑯ Multi-Function Display

⑰ VTR ON/OFF Switch

This switch is used to turn the VTR deck on and off.

⑱ Remote Control Socket

For connecting the Wired Remote Control Unit.

⑲ Shoulder Strap Holder

Connect the Sholder Strap to the Holder.

⑳ Microphone Input Socket

For Connecting an Audio Input Attenuator (included). This is useful for recording and audio dubbing.

㉑ Audio Output Socket

For connecting an audio cable of a TV monitor, a component audio system, or another VTR.

㉒ Video Output Socket

For connection to a TV monitor or another Video Cassette Recorder. Not used with an ordinary TV.

㉓ Video Input Socket

For connecting the video cable of a video camera or an output video signal of another VTR.

㉔ RF OUT/LIGHT Switch

When using the Battery Pack or the Plug-in AC Adaptor, set this switch to "ON" to monitor through the RF OUT Socket during recording. If set to "ON", the Multi-Function Display is lit.

㉕ Camera Input Socket

For connection of a portable video camera.

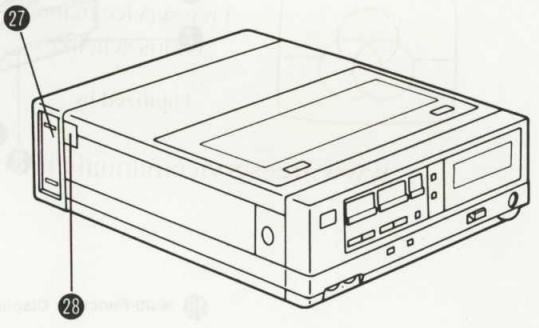
㉖ Cassette Holder

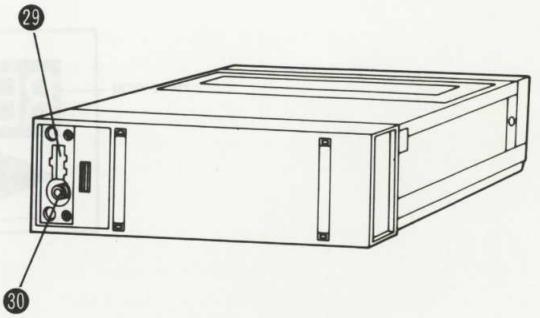
㉗ Battery Compartment

㉘ Battery Eject Button

㉙ Adaptor Socket

㉚ RF Output Socket





SECTION 2
ADJUSTMENT PROCEDURES

2-1. MECHANICAL ADJUSTMENT PROCEDURES

The model NV-180 uses the FT Mechanical Chassis. Therefore, please refer to the Service Manual FT chassis (Order No. VRD-8405-529) for main mechanical adjustments.

2-1-1. DISASSEMBLY FLOWCHART

This flowchart indicates disassembly steps of the cabinet parts and the P.C. Boards in order to find the items necessary for servicing.
When reassembling, perform the steps in the reverse order.
The bottom plate can be removed individually.

Note:

1. When removing the cabinet, work with care so as not to break the locking portions.

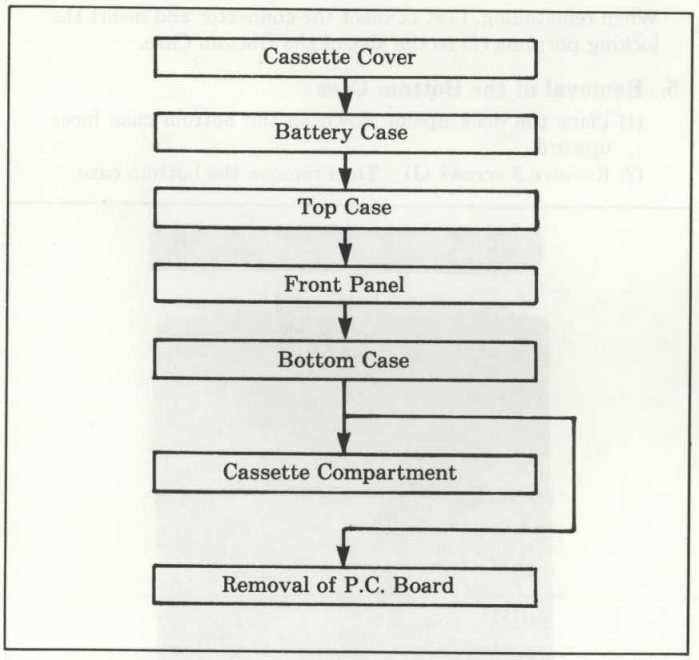


Fig. 1 Disassembly Flowchart

2-1-2. DISASSEMBLY METHOD

Notes:

a. Place the cloth or any other soft materials under the P.C. Boards or deck for preventing them being damaged while servicing.
b. When reinstalling, ensure the connectors are connected and any electrical components are not damaged.
c. Do not supply power to the deck during working except removal of the cassette cover.

1. Removal of the Cassette Cover

Supply power to the deck and turn it on. Then press the EJECT button to raise the cassette up holder.
Remove 2 rubber covers and 2 screws (A). Then carefully lift and pivot the front portion to remove.
Pay attention so as not to damage the locking portions (B).

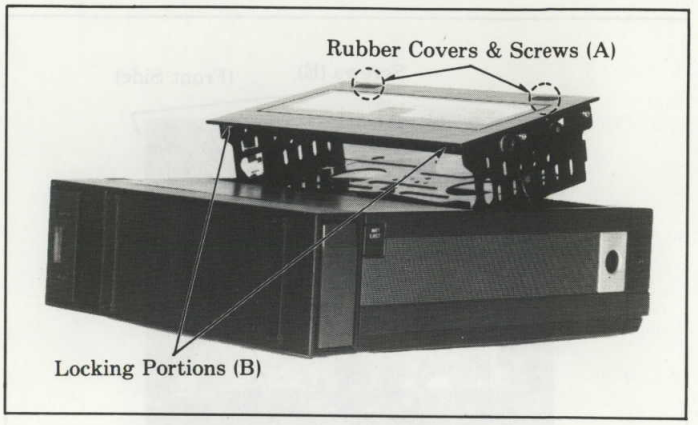


Fig. 2 Removal of the Cassette Cover

Note:

When reinstalling, first lock the locking portions (B).

2. Removal of Battery Case

(1) First confirm that the battery is not inside the battery compartment.
If it is, remove the battery.
(2) Place the deck upside down so the bottom case faces upward.
(3) Remove 2 screws (C), and hold both right and left ends of the battery case. Then carefully lift and pivot the top portion of the battery case.

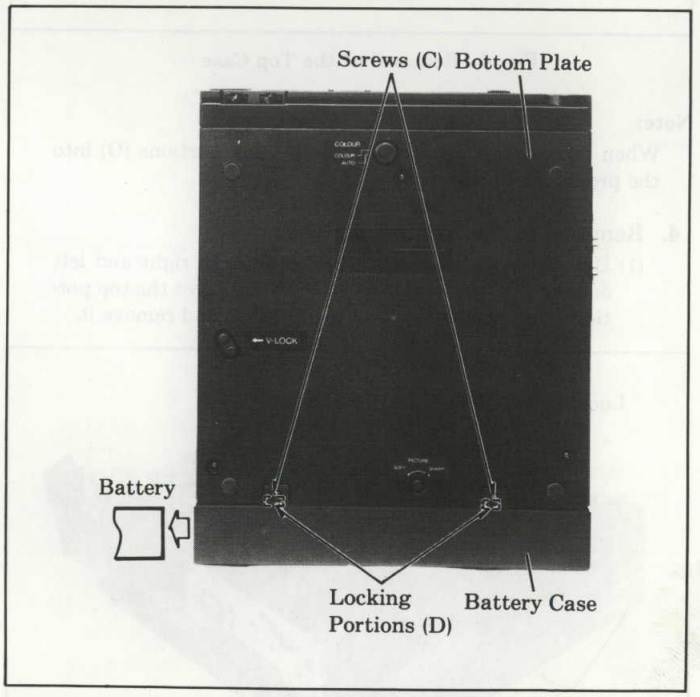


Fig. 3 Removal of the Battery

Note:

When reinstalling, first insert the locking portions (D) into the slot of the top case.

3. Removal of the Top Case

(1) Remove the 2 screws (E) on the front panel.
(2) Remove the 4 screws (F) on the top case. Then remove the top case by lifting the rear portion and pay attention so as not to damage the locking portions (G).

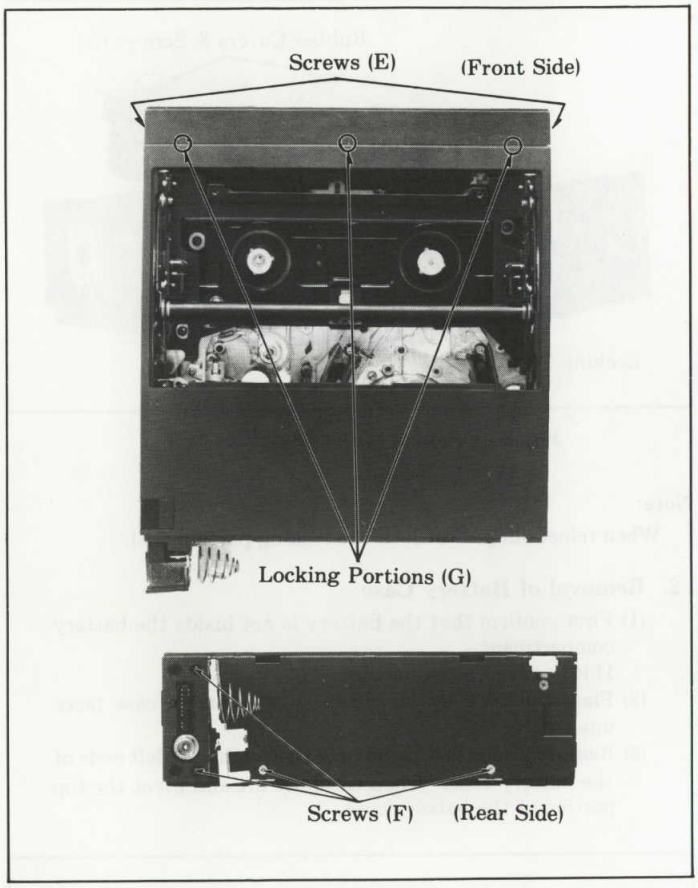


Fig. 4 Removal of the Top Case

Note:
When reinstalling, first insert the locking portions (G) into the projection of the front panel.

4. Removal of the Front Panel

(1) Unlock a locking tab (H) and hold both right and left ends of the front panel, then carefully pivot the top portion to unlock the locking portions (I) and remove it.

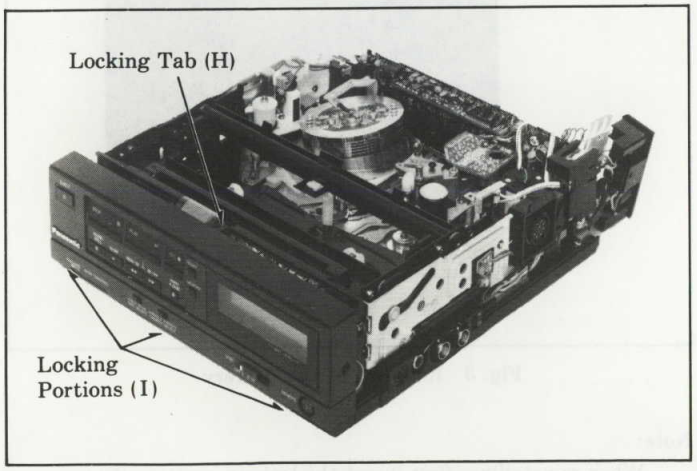


Fig. 5 Removal of the Front Panel-(1)

(2) Pull the portion (P) of the connector FS63 and disconnect a flexible connector FS63, and remove the front panel.

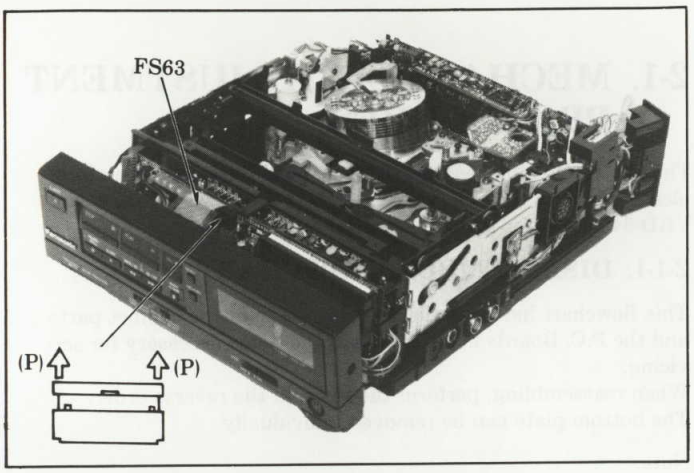


Fig. 6 Removal of the Front Panel-(2)

Note:
When reinstalling, first connect the connector and insert the locking portions (I) to the slot of the Bottom Case.

5. Removal of the Bottom Case

(1) Place the deck upside down so the bottom case faces upward.
(2) Remove 3 screws (J). Then remove the bottom case.

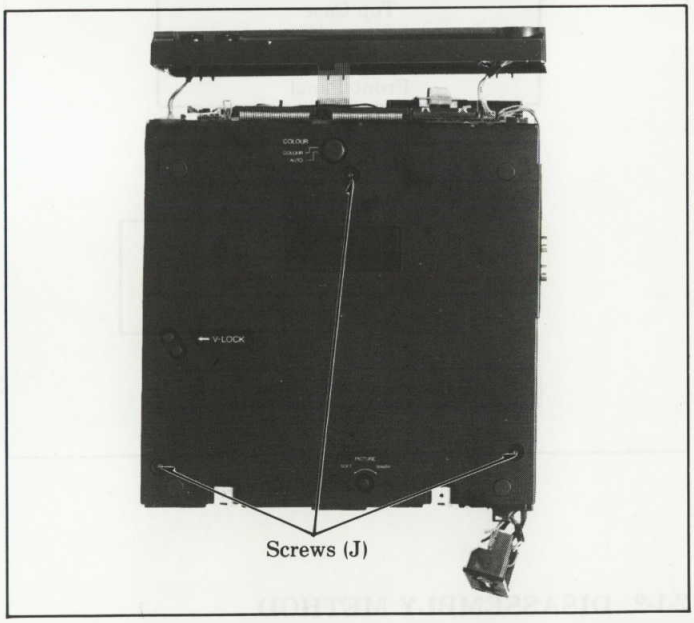


Fig. 7 Removal of the Bottom Case

6. Removal of the Cassette Compartment

(1) Remove 2 screws (K) and remove 5 screws (L) on the chassis.
(2) Eject the cassette up holder and disconnect a connector P218. Then remove the cassette up holder by lifting the front portion.

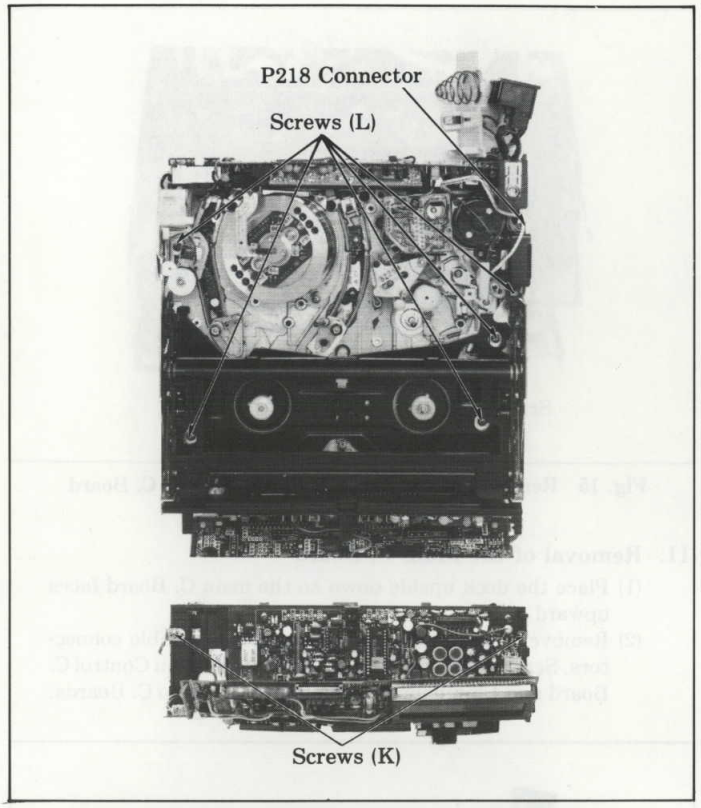


Fig. 8 Removal of the Cassette Compartment-(1)

(3) Remove the supply photo TR unit, removing a screw (M).

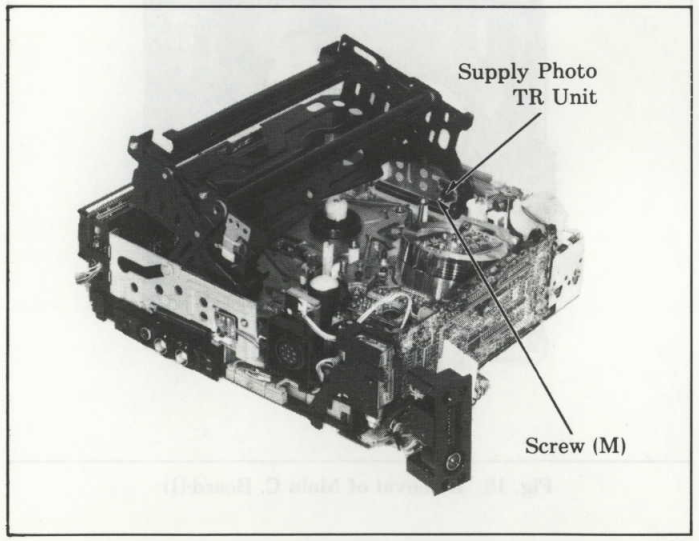


Fig. 9 Removal of the Cassette Compartment-(2)

Note:

When reinstalling, first insert the back portion of the cassette compartment.

(4) If you want to eject the cassette compartment having a cassette tape without the electrical power, push (N) portion of the cassette lock lever, inside of Mechanical Chassis with small screwdriver.

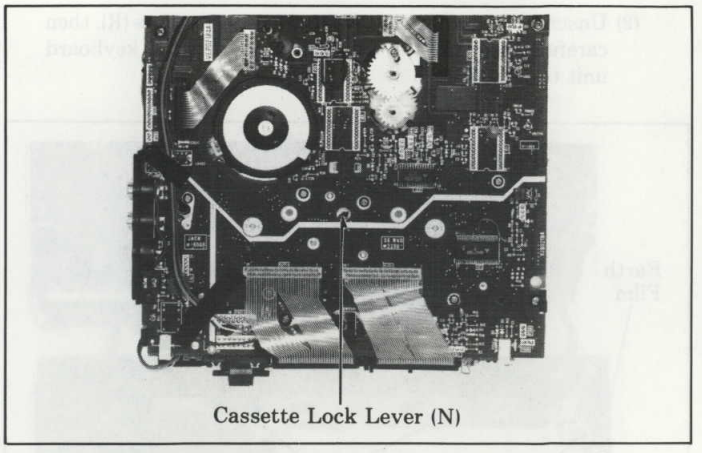


Fig. 10 Removal of the Cassette Compartment-(3)

7. Removal of the Luminance/Chrominance & Audio C. Board

(1) Remove 2 screws (O).
(2) Disconnect 2 direct connectors P33 and P34.
(3) Remove a shield case and disconnect 2 connectors P41 and P32.

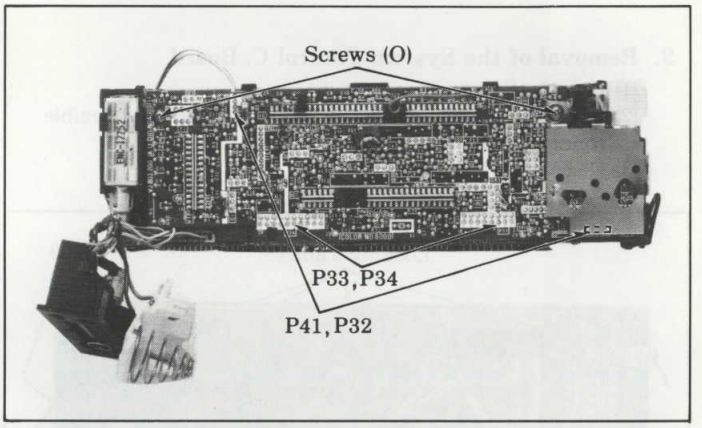


Fig. 11 Removal of the Luminance/Chrominance & Audio C. Board

Note:

Do not damage the Fine Integrated Circuit during removal of the Luminance/Chrominance & Audio C. Board.

8. Removal of the Key Board Unit

(1) Pull the (P) portion. Then disconnect the flexible connector FS63.

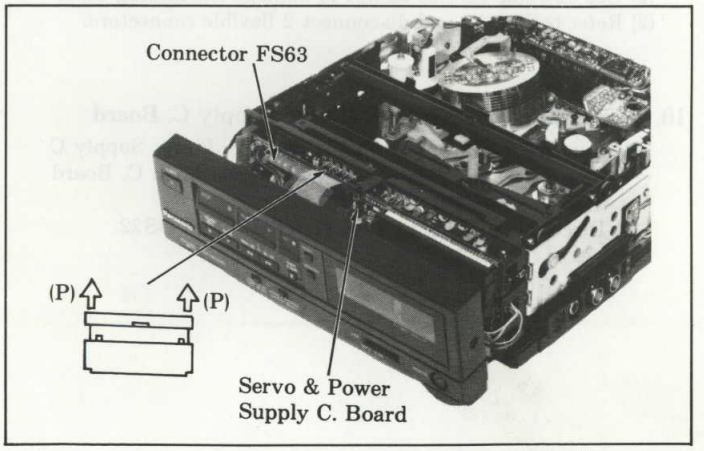


Fig. 12 Removal of the Key Board Unit-(1)

(2) Unscrew the two screws (Q) and loosen 2 screws (R), then carefully tear off the earth film and lift the keyboard unit to remove.

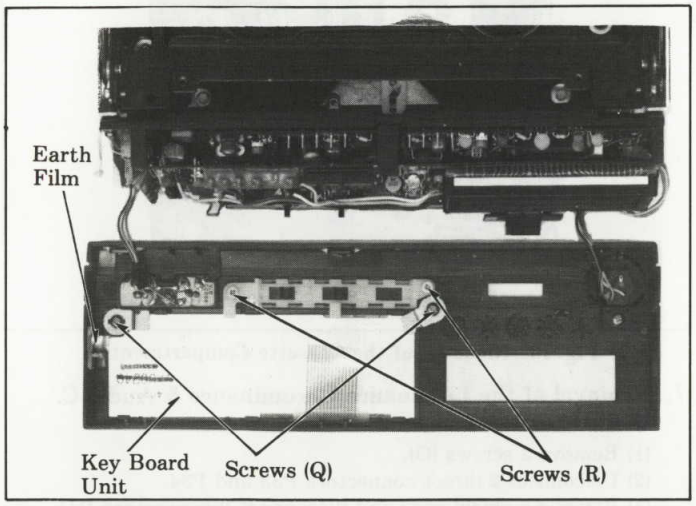


Fig. 13 Removal of the Key Board Unit-(2)

9. Removal of the System Control C. Board

(1) Unlock the 5 locking tabs (S).
(2) Disconnect the connectors P203, P601, P602 and flexible connectors FS61 and FS62.
(3) Disconnect 2 hinges.

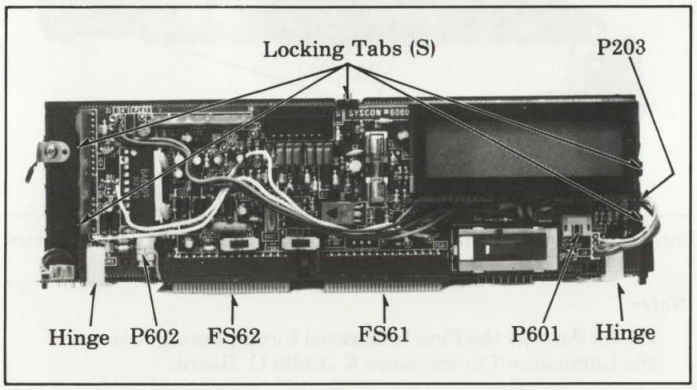


Fig. 14 Removal of the System Control C. Board

Notes:

(1) Use extreme care so as not to damage the locking tabs.
(2) Refer to Fig. 12 and disconnect 2 flexible connectors.

10. Removal of the Servo & Power Supply C. Board

(1) Remove 3 screws (T) on the Servo & Power Supply C. Board. Then remove 5 screws on the Main C. Board. (Refer to Fig. 16)
(2) Disconnect 2 direct connectors DS21 and DS22.

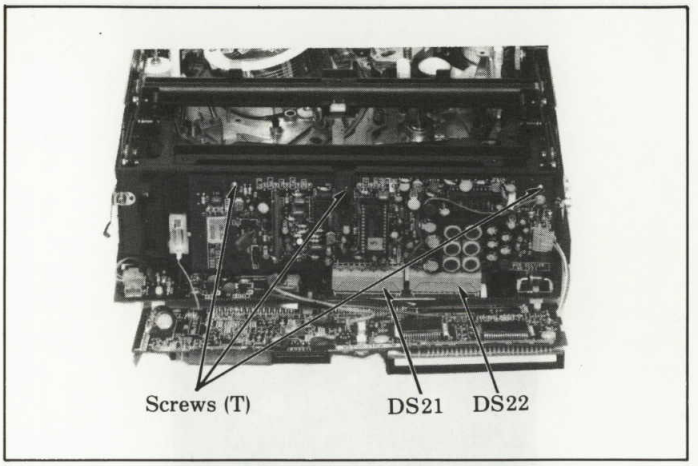


Fig. 15 Removal of the Servo & Power Supply C. Board

11. Removal of the Main C. Board

(1) Place the deck upside down so the main C. Board faces upward.
(2) Remove 5 screws (U) and disconnect a flexible connectors, Servo & Power Supply C. Board, System Control C. Board and Luminance/Chrominance & Audio C. Boards.

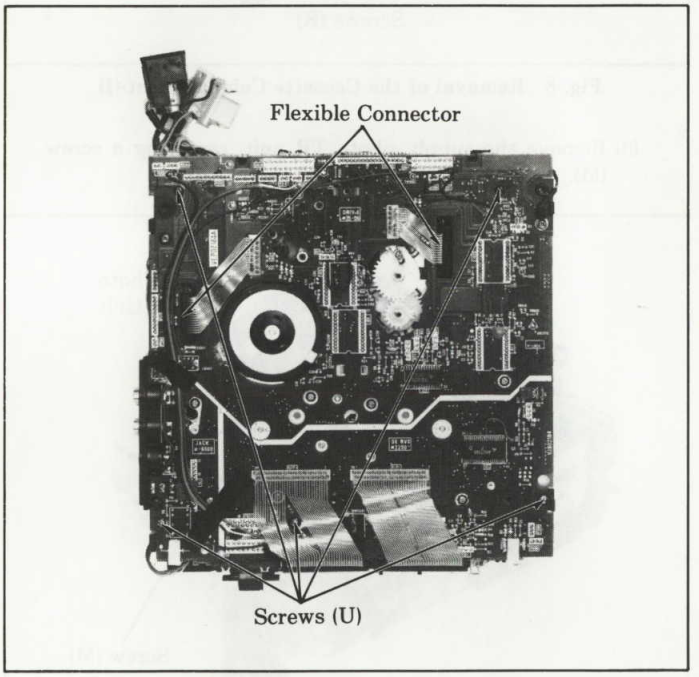


Fig. 16 Removal of Main C. Board-(1)

Note:

Refer to item 7, 9, 10 and remove the C. Boards.

(4) Place the deck upside down so the chassis faces upward.
(5) Disconnect 12 connectors P207 ~ P214, P216 ~ P218 and P221. Then lift a chassis.

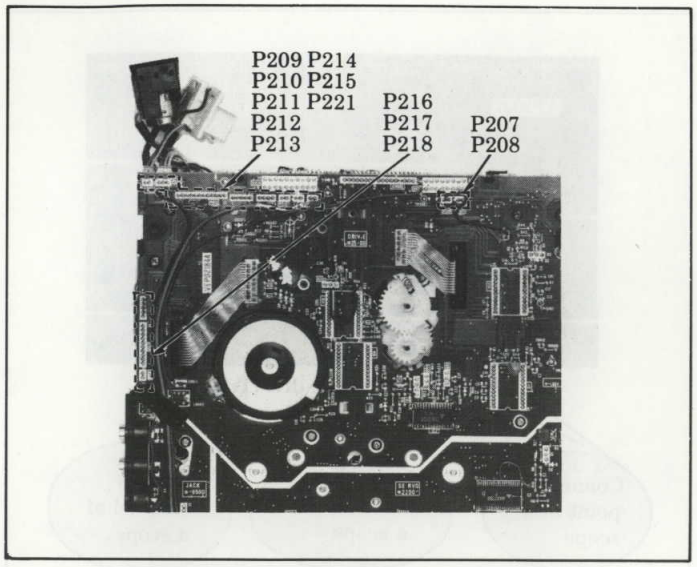


Fig. 17 Removal of Main C. Board-(2)

2-1-3. REMOVING THE UPPER CYLINDER UNIT

First, remove two screws as shown in Fig. 18. Then unsolder 8 of the soldered portions indicated by arrows on the Upper Cylinder, and finally remove the Upper Cylinder.

Note:

Soldered portion can be easily removed by using solder sucking wire, etc.

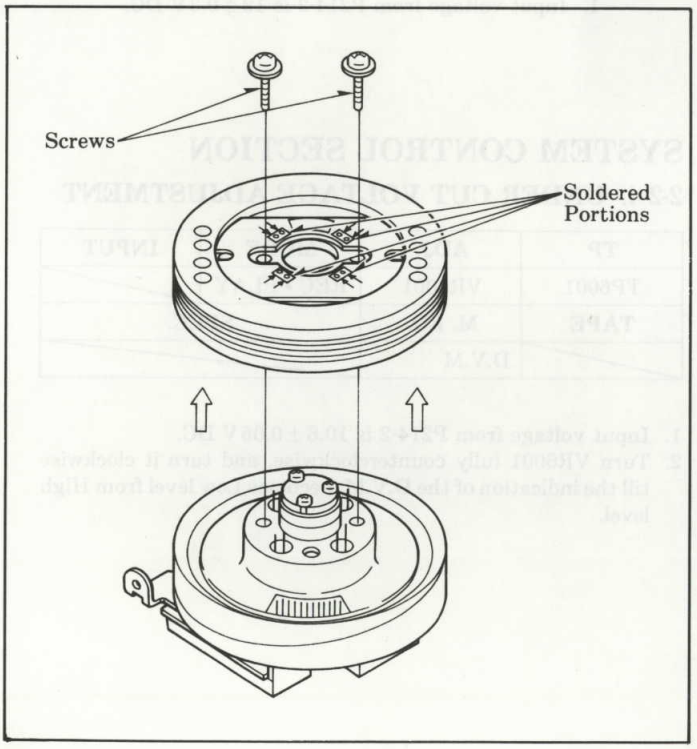


Fig. 18

CAUTION

Do not loose the 3 small screws on the top of the cylinder as shown in Fig. 19.

If these 3 small screws are loosed, cylinder motor is broken and it can not remake.

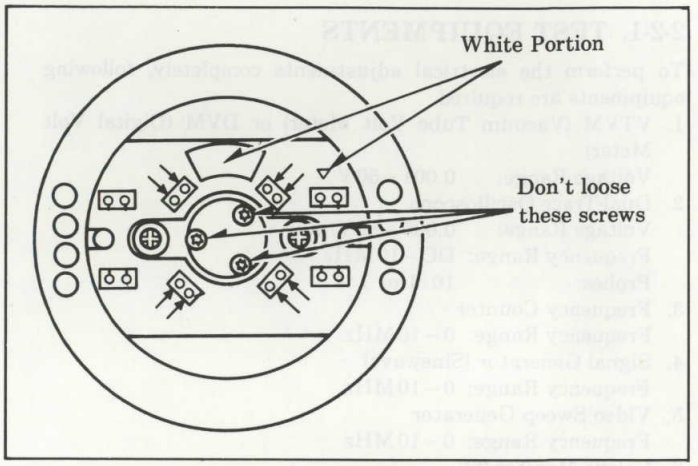


Fig. 19

2-1-4. REINSTALLING THE UPPER CYLINDER

The Upper Cylinder unit can be reinstalled by reversing the removal procedure.

However, when upper cylinder is installing, it is extremely-carefull so that white portion of P.C. board of upper cylinder correctly match the white portion of bottom cylinder as shown in Fig. 20.

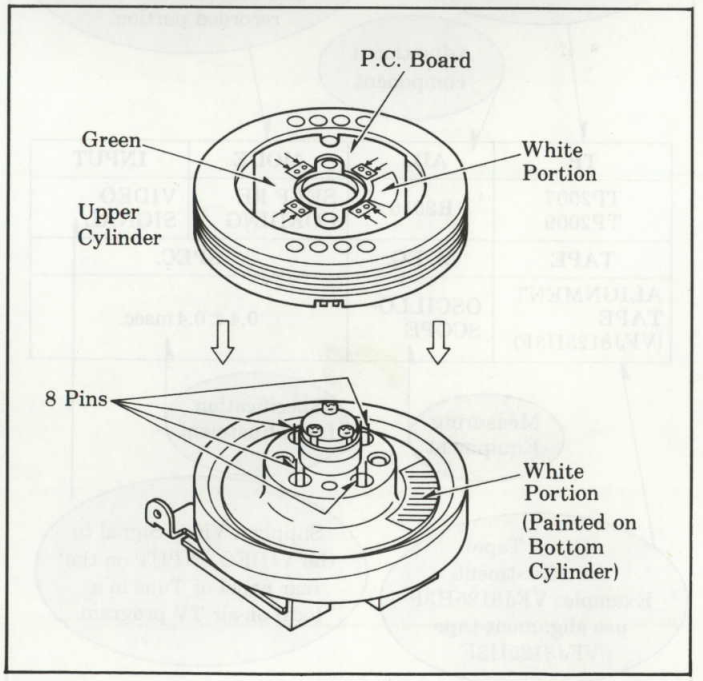


Fig. 20

Note:

If the Upper Cylinder Unit is reversely installed, no colour will appear when playing back a pre-recorded tape.

2-2. ELECTRICAL ADJUSTMENT PROCEDURES

This section provides complete electrical adjustment procedures which may be required for electronic circuits of VHS Portable Video Cassette Recorder NV-180.

2-2-1. TEST EQUIPMENTS

To perform the electrical adjustments completely, following equipments are required.

1. VTVM (Vacuum Tube Volt Meter) or DVM (Digital Volt Meter)
   Voltage Range: 0.001 ~ 50 V
2. Dual-Trace Oscilloscope
   Voltage Range: 0.005 ~ 50 V/div.
   Frequency Range: DC ~ 10 MHz
   Probes: 10 : 1 or 1 : 1
3. Frequency Counter
   Frequency Range: 0 ~ 10 MHz
4. Signal Generator (Sinewave)
   Frequency Range: 0 ~ 10 MHz
5. Video Sweep Generator
   Frequency Range: 0 ~ 10 MHz
6. Colour Monitor TV
7. Plastic Tip Driver
8. VHS Alignment Tape (VFJ8125H3F)

2-2-2. HOW TO READ THE ADJUSTMENT PROCEDURES

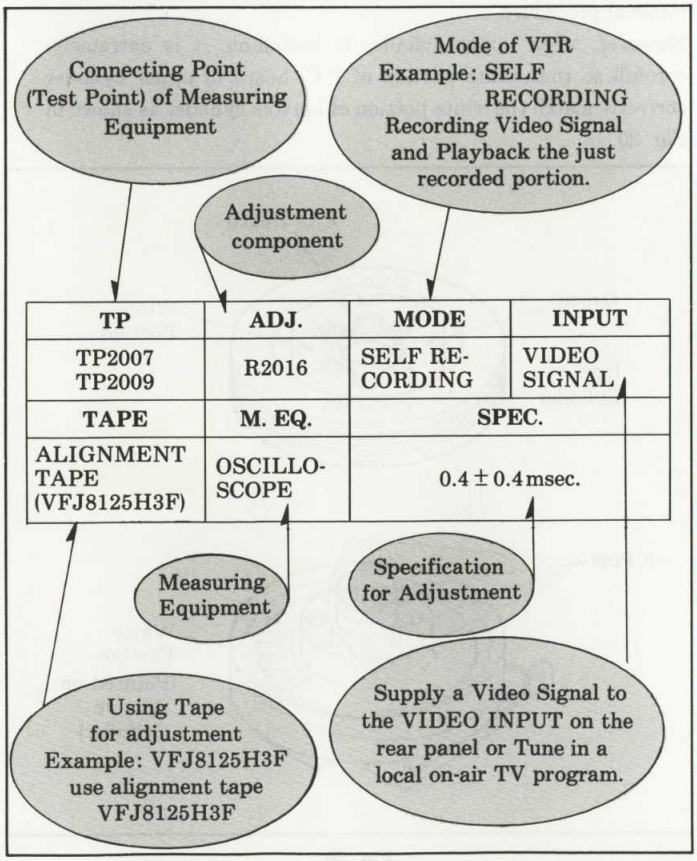


Fig. 21

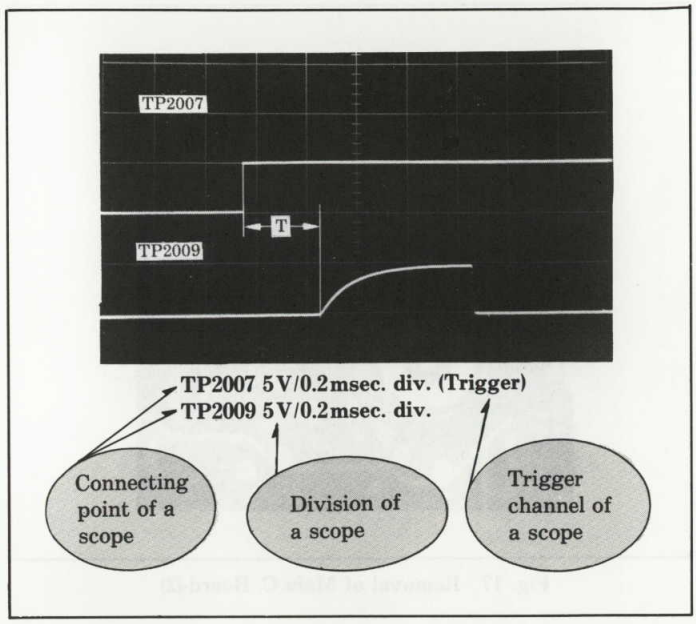


Fig. 22

POWER SUPPLY SECTION

2-2-3. REG +5 V ADJUSTMENT

TP	ADJ.	MODE	INPUT
TP1003	R1003	STOP	
TAPE	M. EQ.	SPEC.	
	D.V.M	5.1 ± 0.1 V	

1. Input voltage from P214-2 is 12 ± 0.3 V DC.

SYSTEM CONTROL SECTION

2-2-4. UNDER CUT VOLTAGE ADJUSTMENT

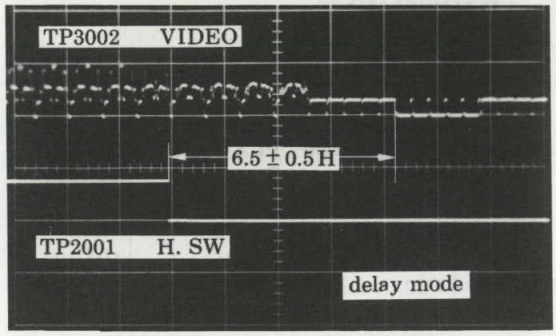
TP	ADJ.	MODE	INPUT
TP6001	VR6001	REC • PLAY	
TAPE	M. EQ.	SPEC.	
	D.V.M		

1. Input voltage from P214-2 is 10.6 ± 0.05 V DC.
2. Turn VR6001 fully counterclockwise, and turn it clockwise till the indication of the D.V.M. becomes Low level from High level.

SERVO SECTION

2-2-5. PG SHIFTER ADJUSTMENT

TP	ADJ.	MODE	INPUT
TP2001 TP3002	VR2001	PLAY	
TAPE	M. EQ.	SPEC.	
ALIGNMENT TAPE (VFJ8125H3F)	OSCILLO-SCOPE	6.5 ± 0.5 H	



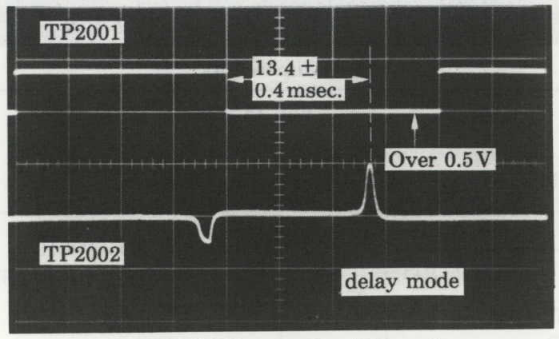
TP3002 2 V/0.1 msec. div.
TP2001 5 V/0.1 msec. div. (Trigger)

Fig. 23

2-2-6. TRACKING FIX ADJUSTMENT

TP	ADJ.	MODE	INPUT
TP2001 TP2002	VR2002	SELF RE-CORDING	VIDEO SIGNAL
TAPE	M. EQ.	SPEC.	
BLANK TAPE	OSCILLO-SCOPE	T = 13.4 ± 0.4 msec.	

1. TRACKING VR is center fix position.
2. Play back the just recorded portion.
3. Adjust VR2002 for 13.4 ± 0.4 msec. as shown below.



TP2001 5 V/5 msec. div. (Trigger)
TP2002 5 V/5 msec. div.

Fig. 24

2-2-7. FINE SLOW SPEED ADJUSTMENT

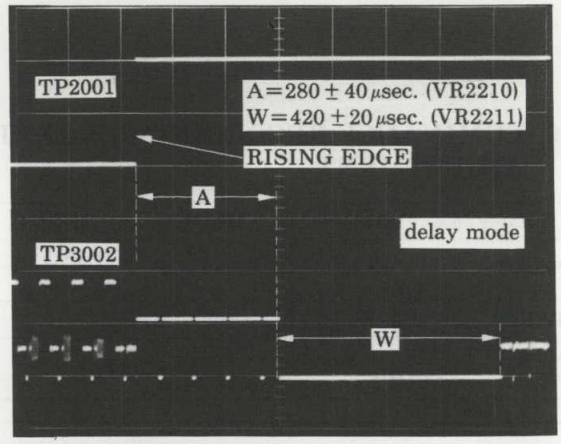
TP	ADJ.	MODE	INPUT
TP2015	VR2013	PLAY • STILL (SELF RE-CORDING)	
TAPE	M. EQ.	SPEC.	
BLANK TAPE	FREQUEN-CY COUNTER	650 ± 15 Hz	

1. SLOW TRACKING VR is center fix position.
2. Play back the just recorded portion.
3. Connect a jumper wire between TP2501 and the GND after making the deck in STILL mode.

2-2-8. ARTIFICIAL V-SYNC ADJUSTMENT

TP	ADJ.	MODE	INPUT
TP2001 TP3002	VR2210 VR2211	STILL (SELF RE-CORDING	VIDEO SIGNAL
TAPE	M. EQ.	SPEC.	
BLANK TAPE	OSCILLO-SCOPE	A = 285 ± 40 μsec. W = 420 ± 20 μsec.	

1. Play back the just recorded portion and make the deck in STILL mode.



TP2001 5 V/100 μsec. div. (Trigger)
TP3002 2 V/100 μsec. div.

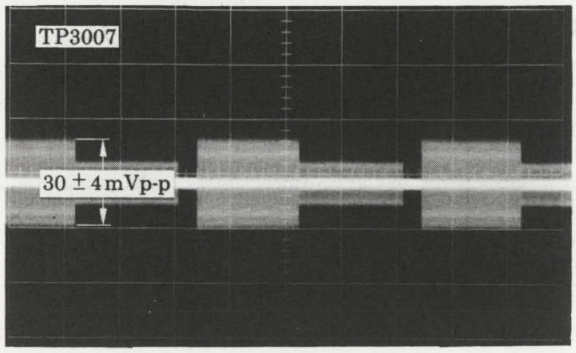
Fig. 25

LUMINANCE, CHROMINANCE SECTION

2-2-9. CONFIRMATION OF CHROMINANCE RECORDING CURRENT

TP	ADJ.	MODE	INPUT
TP3007		REC • PLAY	VIDEO SIGNAL
TAPE	**M. EQ.**	**SPEC.**	
BLANK TAPE	OSCILLO-SCOPE	30 ± 4 mVp-p	

1. Turn VR3001 so that the Y-REC CURRENT becomes minimum.
2. After this adjustment, readjust Y-REC CURRENT (VR3001).

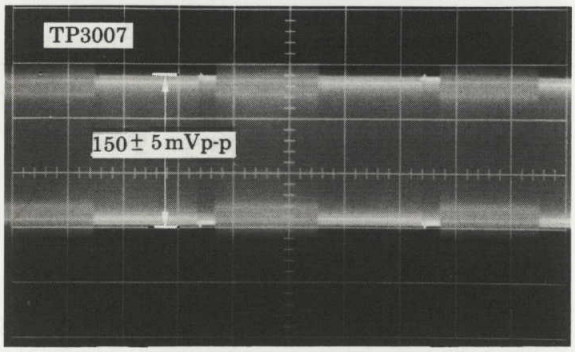


TP3007 20 mV/5 msec. div.

Fig. 26

2-2-10. LUMINANCE RECORDING CURRENT ADJUSTMENT

TP	ADJ.	MODE	INPUT
TP3007	VR3001	REC • PLAY	VIDEO SIGNAL
TAPE	**M. EQ.**	**SPEC.**	
BLANK TAPE	OSCILLO-SCOPE	150 ± 5 mVp-p	



TP3007 50 mV/5 msec. div.

Fig. 27

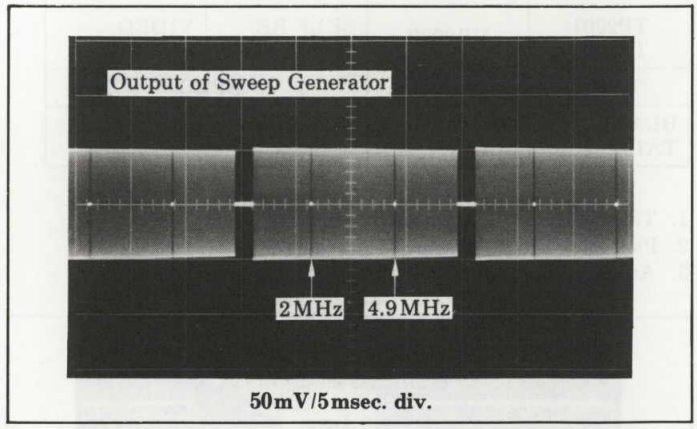
2-2-11. PICTURE VR ADJUSTMENT

TP	ADJ.	MODE	INPUT
TP3501	VR3504	STOP	
TAPE	**M. EQ.**	**SPEC.**	
	V.T.V.M	2.0 ± 0.1 V	

2-2-12. HEAD AMP PEAK FREQUENCY ADJUSTMENT

TP	ADJ.	MODE	INPUT
TP3001	(FOR R′, L′ HEAD) C3035, C3036 VR3005, VR3006	PLAY	VIDEO SWEEP TP3010
TP3001	(FOR R, L HEAD) C3031, C3032 VR3007, VR3008	PLAY (TP317—TP3013 Short)	VIDEO SWEEP TP3011
TAPE	**M. EQ.**	**SPEC.**	
BLANK TAPE	VIDEO SWEEP OSCILLO-SCOPE	PEAK is 4.9 MHz portion (2 MHz : 4.9 MHz = 2 : 3)	

1. Set the marker of sweep generator output at 2 MHz and 4.9 MHz.



50 mV/5 msec. div.

Fig. 28

2. Supply sweep generator output to TP3010.

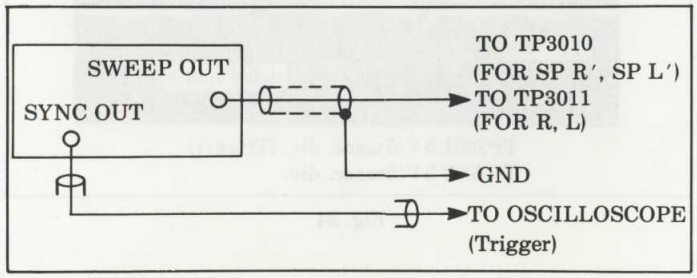
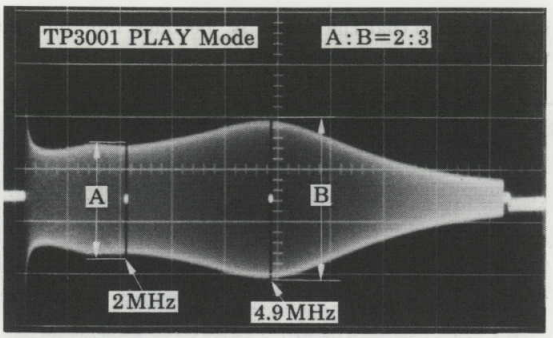


Fig. 29

3. Connect the oscilloscope to TP3001.
4. Adjust VR3005 (Q-SP R′) and VR3006 (Q-SP L′) for the envelopes of both channels as shown below 2MHz : 4.9MHz (2 : 3) in PLAY mode.

Note 1:

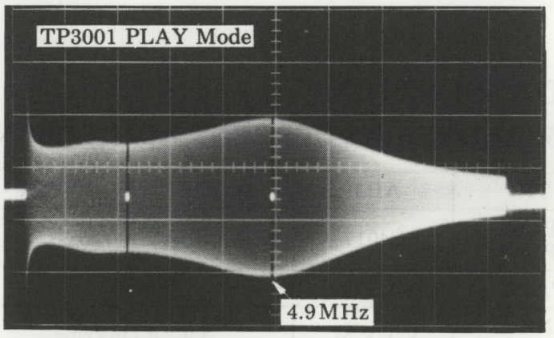
Any level of sweep generator output will be OK, but if waveform is distorted, decrease the output of sweep generator.



TP3001 0.1V/2msec. div.

Fig. 30

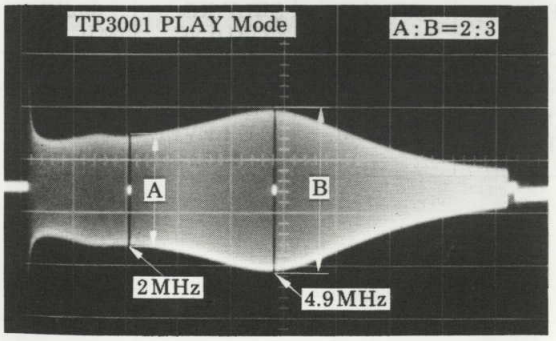
5. Adjust C3035 (PEAK-SP R′) and C3036 (PEAK-SP L′) so that the peak points become 4.9MHz in PLAY mode as shown below.



TP3001 0.1V/2msec. div.

Fig. 31

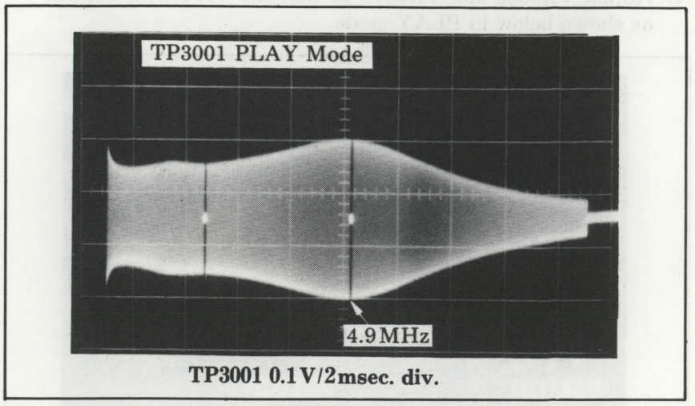
6. Supply sweep generator to TP3011.
7. Connect a jumper wire between TP3017 and TP3013 and adjust VR3007 (Q-R) and VR3008 (Q-L) for the envelope in PLAY mode as shown below at TP3001.
Regarding with output level of sweep generator, refer to note 1.



TP3001 0.1V/2msec. div.

Fig. 32

8. Adjust C3031 (PEAK-L) and C3032 (PEAK-R) so that the peak point becomes 4.9MHz in PLAY mode as shown below.



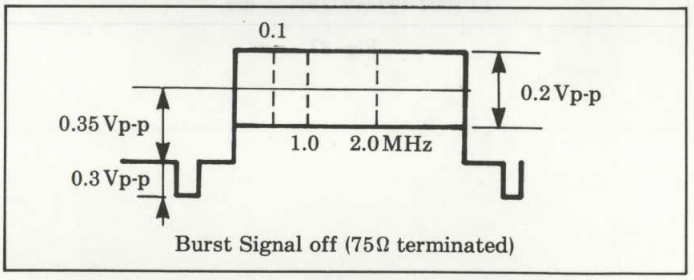
TP3001 0.1V/2msec. div.

Fig. 33

2-2-13. HEAD AMP FREQUENCY RESPONSE ADJUSTMENT

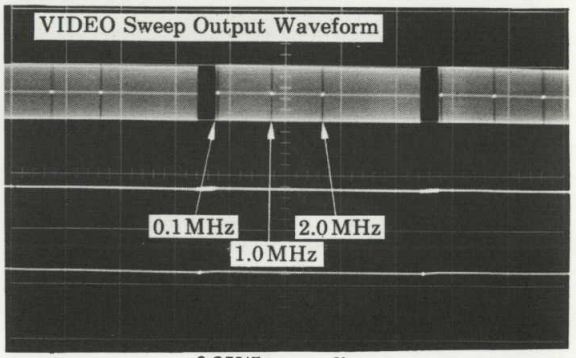
TP	ADJ.	MODE	INPUT
TP3002	(PLAY) VR3005 VR3006 (PLAY • STILL) VR3007 VR3008	PLAY, PLAY • STILL (SELF RECORDING)	VIDEO SWEEP
TAPE	**M. EQ.**	**SPEC.**	
BLANK TAPE	VIDEO SWEEP, OSCILLOSCOPE		

1. Set the sweep generator output as shown below.



Burst Signal off (75Ω terminated)

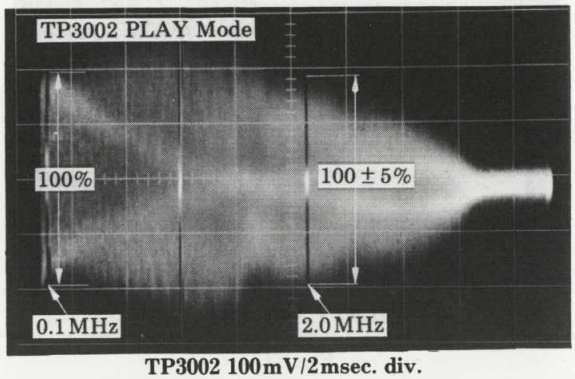
Fig. 34



0.2V/5msec. div.

Fig. 35

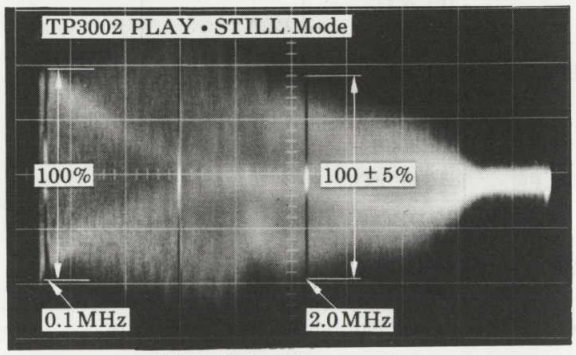
2. PICTURE VR ADJUSTMENT is completed.
3. Play back the just recorded portion.
4. Adjust VR3005 and VR3006 so that the waveforms become as shown below in PLAY mode.



TP3002 100 mV/2 msec. div.

Fig. 36

5. Make the deck in PLAY • STILL mode.
6. Adjust VR3007 (Q-R) and VR3008 (Q-L) so that the waveform in PLAY • STILL mode becomes as shown below.



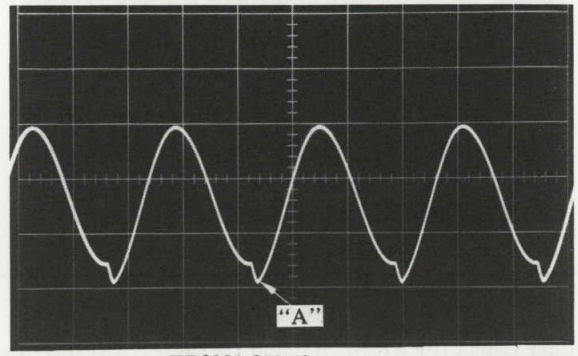
TP3002 100 mV/2 msec. div.

Fig. 37

2-2-14. SECAM KILLER ADJUSTMENT

TP	ADJ.	MODE	INPUT
TP8001	T8501	REC • PLAY	SECAM SIGNAL
TAPE	M. EQ.	SPEC.	
BLANK TAPE	OSCILLO-SCOPE		

1. Adjust T8501 so that the point "A" becomes minimum peak on the waveform as shown below.



TP8001 2 V/50 μsec. div.

Fig. 38

AUDIO SECTION

2-2-15. AUDIO BIAS CURRENT ADJUSTMENT

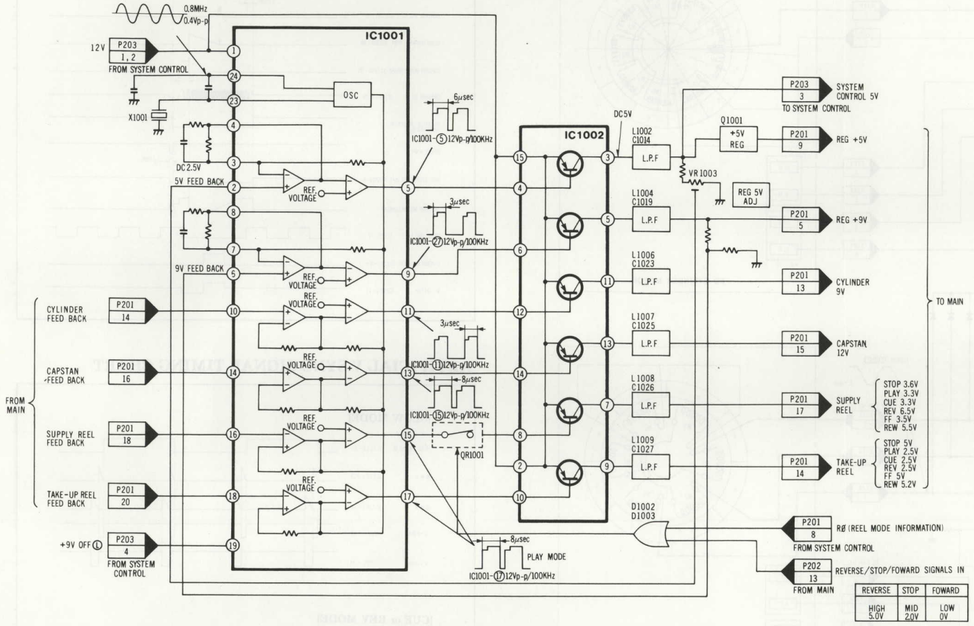
TP	ADJ.	MODE	INPUT
TP4002 TP4003	C4017	REC • PLAY	
TAPE	M. EQ.	SPEC.	
BLANK TAPE	V.T.V.M.	3.9 ± 0.1 mVrms	

2-2-16. AUDIO PLAYBACK LEVEL ADJUSTMENT

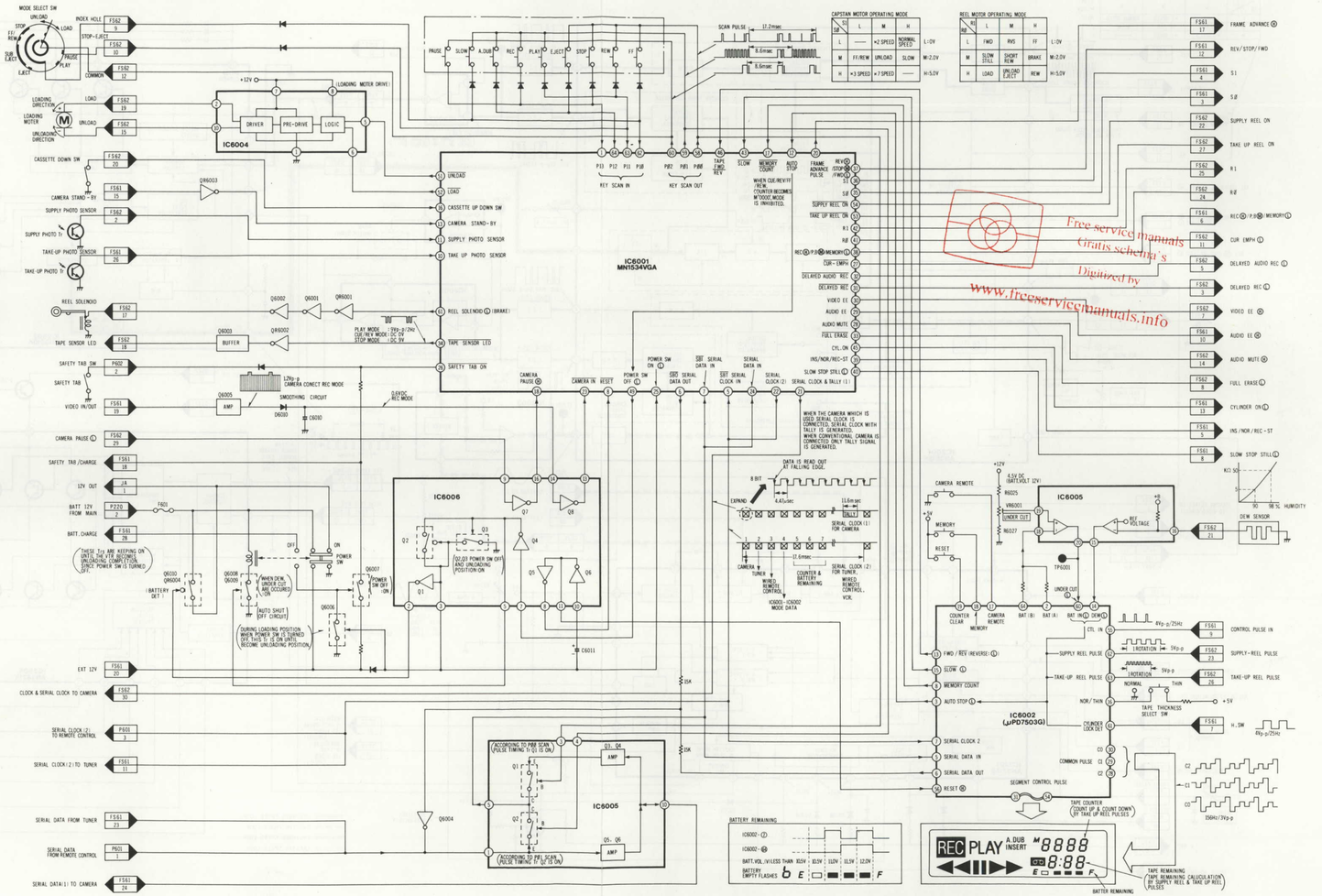
TP	ADJ.	MODE	INPUT
LINE OUT	VR4001	PLAY SELF RE-CORDING	1 kHz, −60 dBV (MIC IN)
TAPE	M. EQ.	SPEC.	
BLANK TAPE	V.T.V.M.	E-E LEVEL ±0.5 dB (E-E LEVEL= 410 ± 90 mVrms)	

SECTION 3
BLOCK AND SCHEMATIC DIAGRAM

3-1. A.V.R. BLOCK DIAGRAM

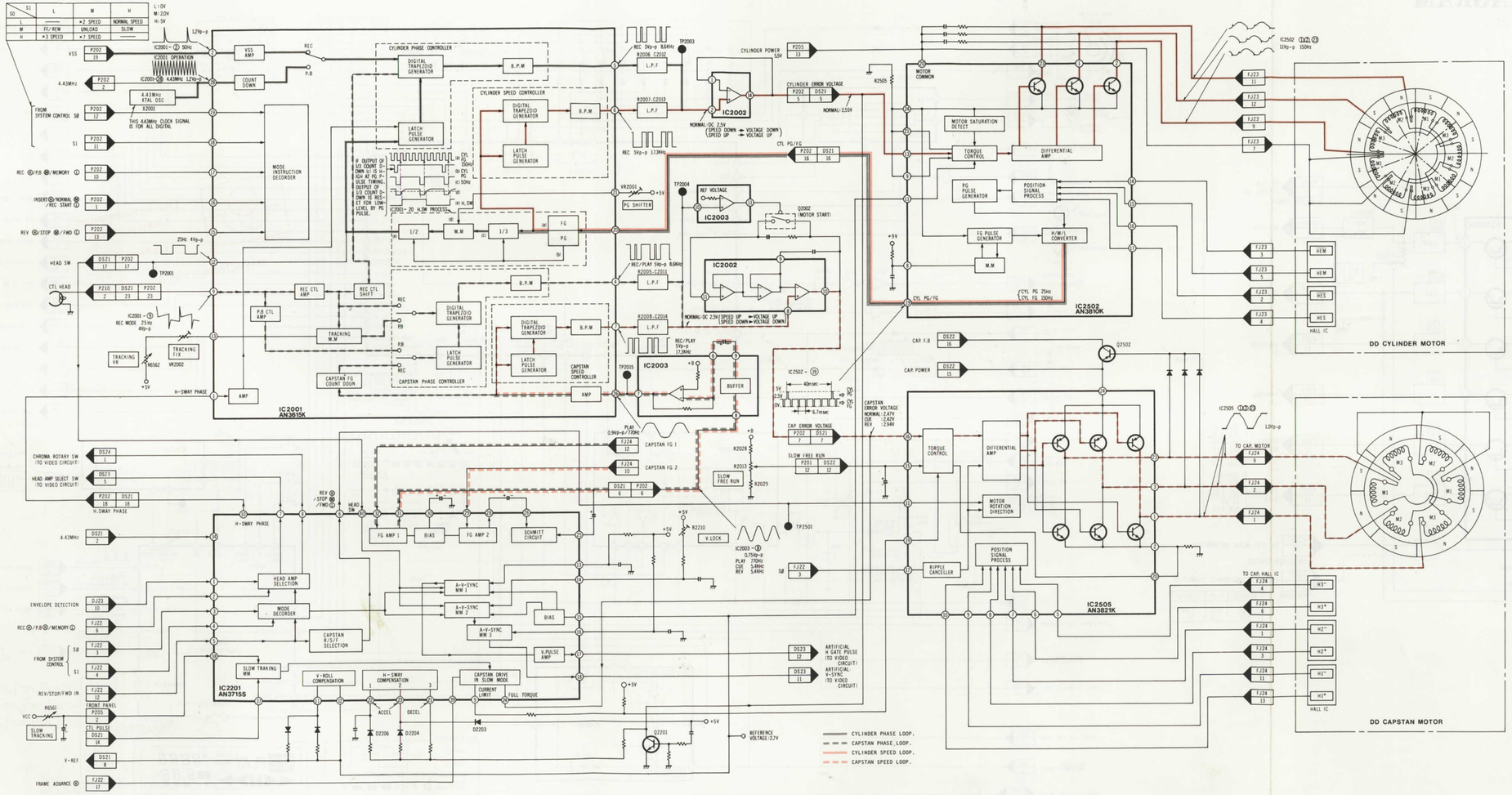


3-2. SYSTEM CONTROL BLOCK DIAGRAM

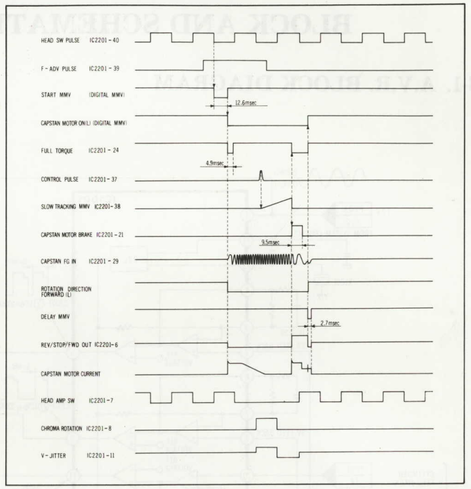


Next Page:
MAIN SERVO Section

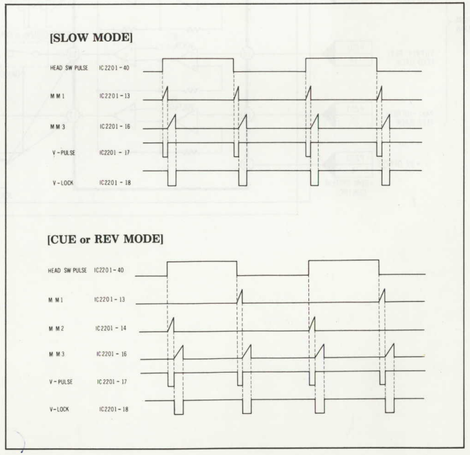
3-3. MAIN SERVO BLOCK DIAGRAM



SLOW MODE TIMING CHART

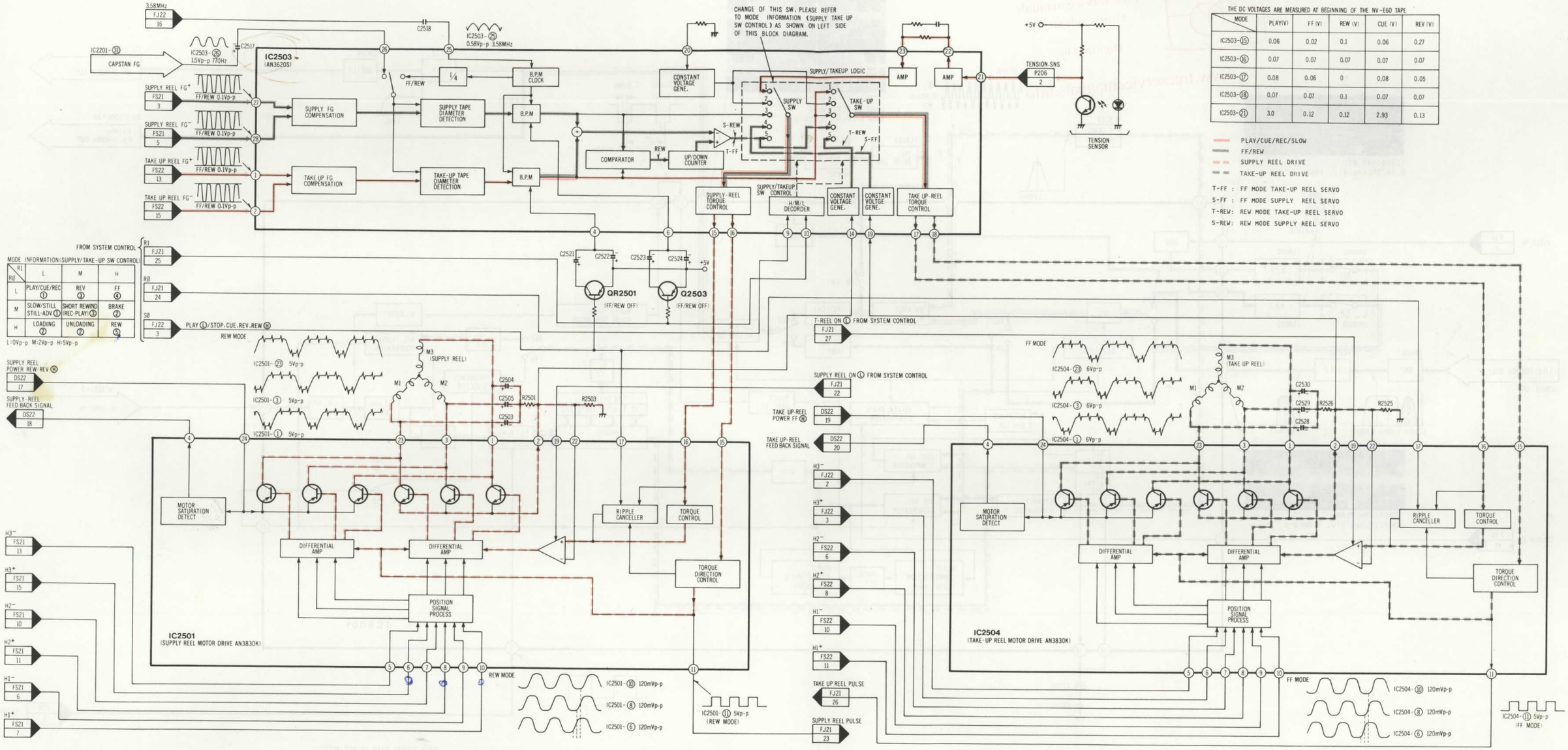


ARTIFICIAL V-SYNC SIGNAL TIMING CHART



3—2

3-4. REEL SERVO BLOCK DIAGRAM



THE DC VOLTAGES ARE MEASURED AT BEGINNING OF THE NV-E60 TAPE

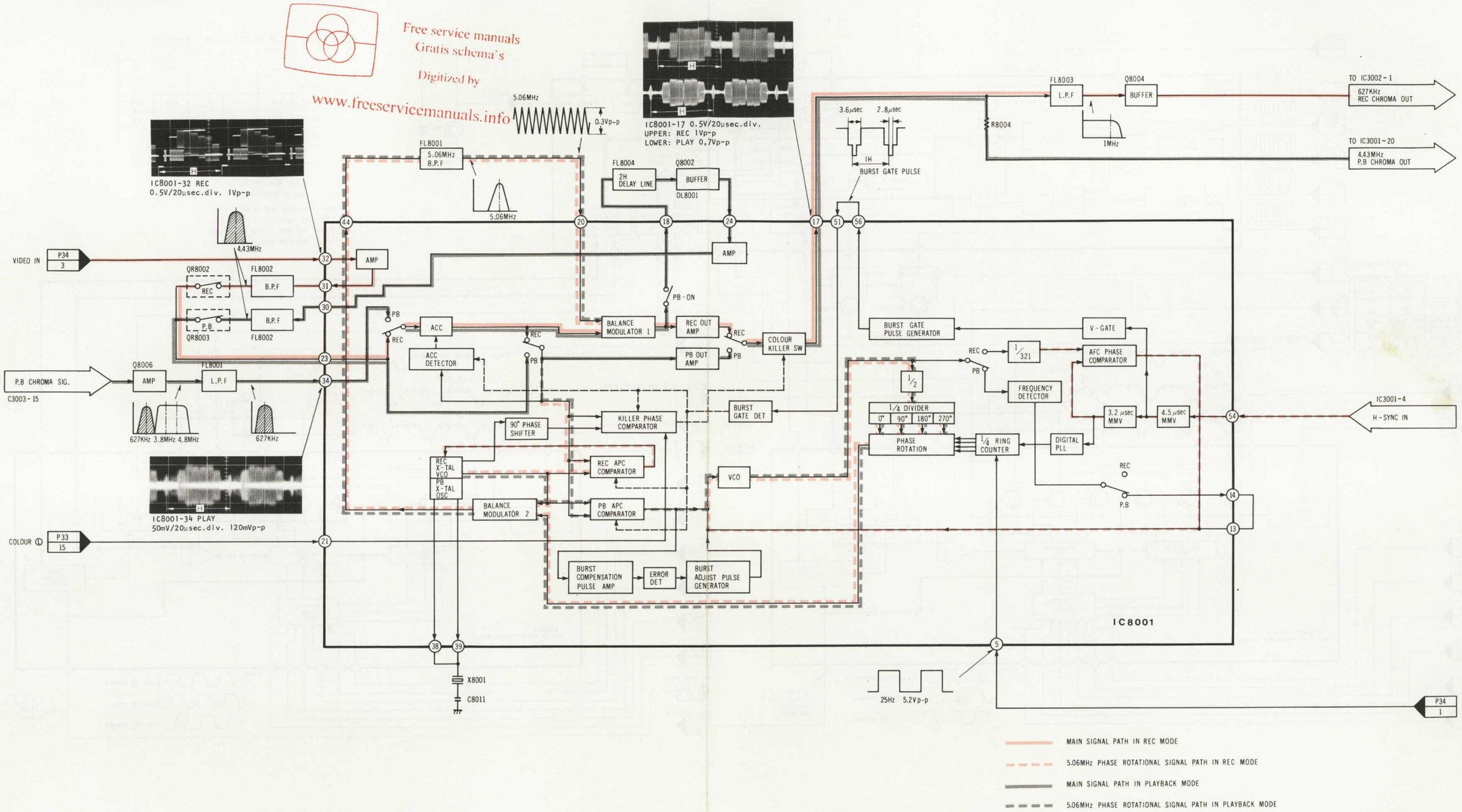
MODE	PLAY(V)	FF (V)	REW (V)	CUE (V)	REV (V)
IC2503-15	0.06	0.02	0.1	0.06	0.27
IC2503-16	0.07	0.07	0.07	0.07	0.07
IC2503-17	0.08	0.06	0	0.08	0.05
IC2503-18	0.07	0.07	0.1	0.07	0.07
IC2503-21	3.0	0.12	0.12	2.93	0.13

PLAY/CUE/REC/SLOW
FF/REW
SUPPLY REEL DRIVE
TAKE-UP REEL DRIVE

T-FF : FF MODE TAKE-UP REEL SERVO
S-FF : FF MODE SUPPLY REEL SERVO
T-REW: REW MODE TAKE-UP REEL SERVO
S-REW: REW MODE SUPPLY REEL SERVO

3—3

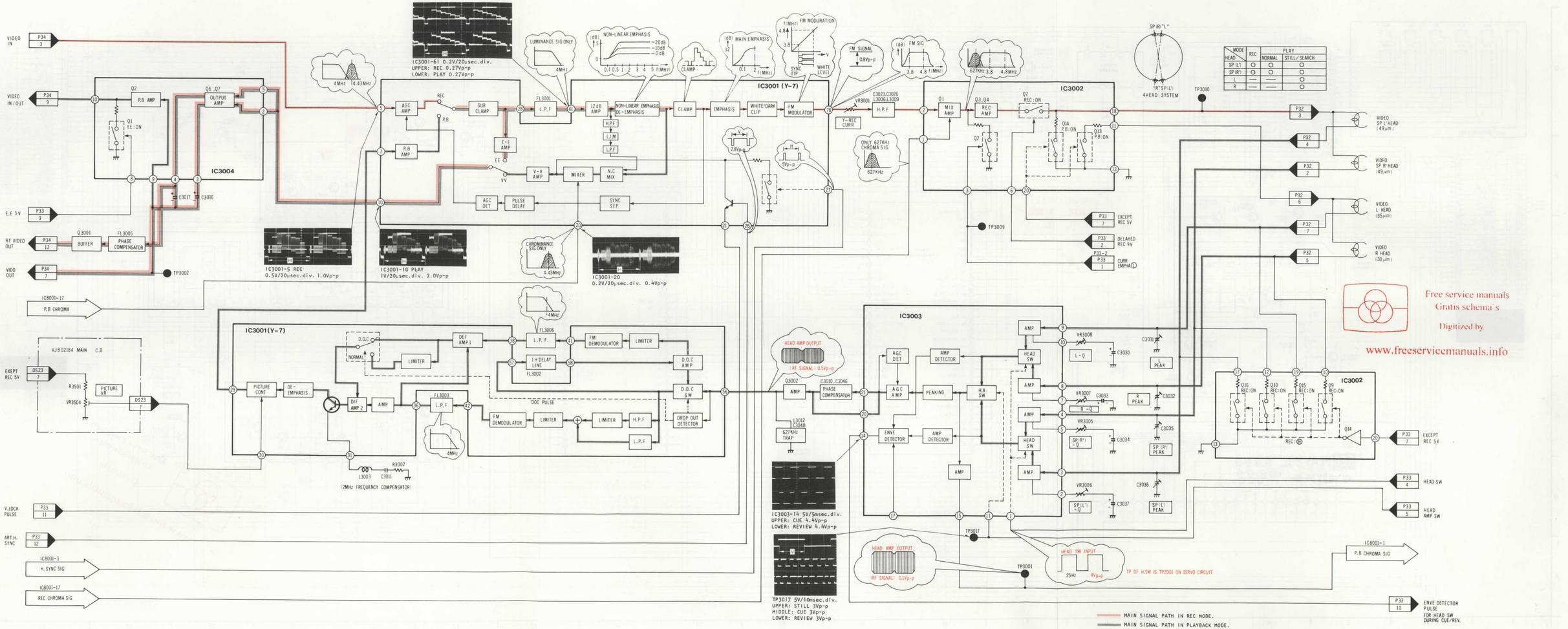
3-5. CHROMINANCE PROCESS BLOCK DIAGRAM



Back Page:
REEL SERVO Section

3—4

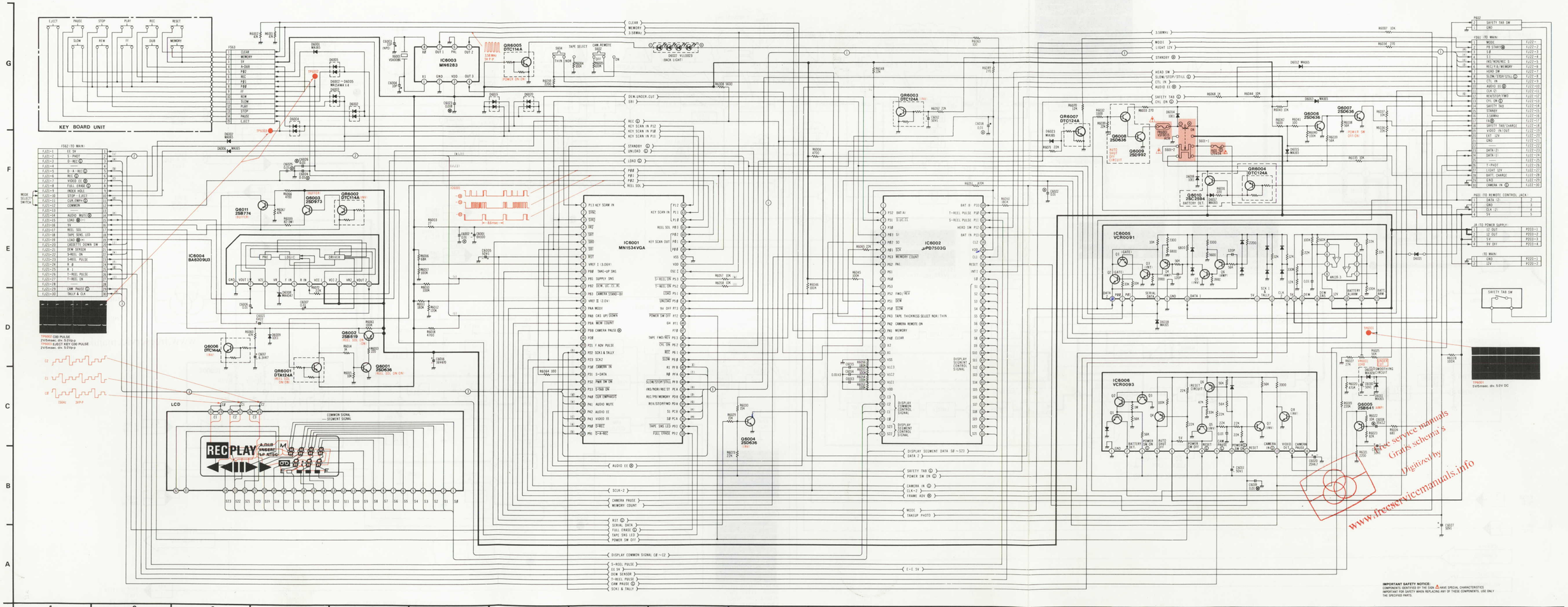
3-6. LUMINANCE PROCESS BLOCK DIAGRAM



3—5

Next Page:
SYSTEM CONTROL Section

3-7. SYSTEM CONTROL SCHEMATIC DIAGRAM

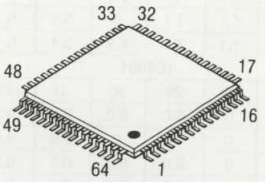


3—6

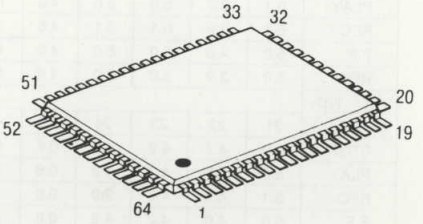
ICs & TRANSISTORs INFORMATION

SYSTEM CONTROL SCHEMATIC	
Transistor	
Q6001	C-5
Q6002	D-5
Q6003	F-4
Q6004	C-10
Q6005	C-17
Q6006	G-17
Q6007	G-17
Q6008	F-14
Q6009	F-14
Q6010	F-15
Q6011	E-3
Transistor & Resistor	
QR6001	C-4
QR6002	F-4
QR6003	G-11
QR6004	F-16
QR6005	G-7
QR6006	D-3
QR6007	G-14
Integrated Circuit	
IC6001	E-8
IC6002	E-12
IC6003	G-6
IC6004	E-3
IC6005	E-14
IC6006	C-14
Test Point	
TP6001	D-17
TP6002	G-4
TP6003	F-3
Adjustment	
VR6001	D-17
Connector	
FS61	H-19
FS62	F-1
FS63	G-3
JA	E-19
P601	F-19
P602	H-19

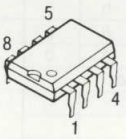
ADDRESS INFORMATION



MN1534VGA



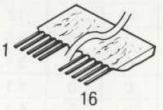
μPD7503G102



MN6283

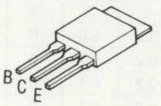
BA6209U3

VCR6091

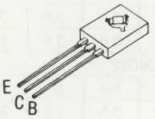


VCR0093

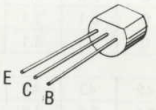
2SB641
2SB819
2SD636
2SD973



2SD992



2SC2594



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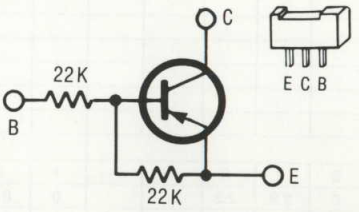
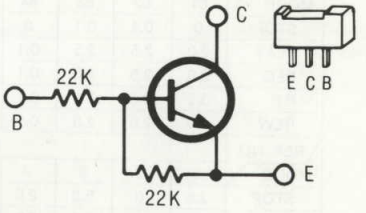
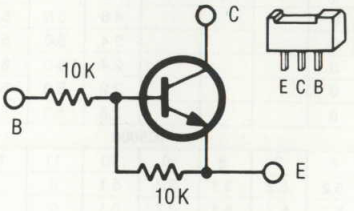


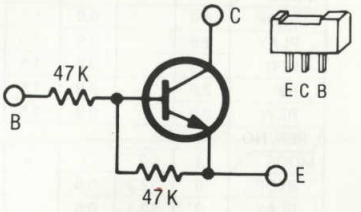
DTA124A



DTC124A



DTC114A



DTC144A

SYSTEM CONTROL ICs DC VOLTAGE CHART

REF. NO.	IC6001																			
MODE	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
STOP	5.0	4.0	5.0	5.0	4.7	0.2	4.6	0	0	0	5.1	5.1	5.2	2.1	0	0	5.1	0	0	0
PLAY	5.1	3.9	5.0	5.0	4.6	0.6	4.2	0	3.1	4.8	5.1	5.1	5.2	2.1	0	0	5.1	0	0	0
REC	5.1	3.9	5.1	5.1	4.6	0.3	4.2	5.1	0	5.1	5.1	5.1	5.2	2.1	0	0	5.1	0	0	0
F.F	5.0	4.0	5.0	5.0	4.6	0.4	4.3	5.1	3.1	0	5.1	5.1	5.2	2.1	0	0	5.1	0	0	0
REW	5.0	3.9	5.0	5.0	4.6	0.4	4.2	5.1	3.1	4.9	5.1	5.1	5.2	2.1	0	0	5.1	0	0	0

REF. NO.	IC6001																			
MODE	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40
STOP	5.0	4.7	4.2	4.6	0.6	2.1	5.0	0	5.0	5.0	9.6	9.3	9.6	9.6	4.8	0	2.1	5.0	2.1	0
PLAY	5.0	4.6	4.2	4.2	0.6	2.1	0	0	0	0	9.6	9.4	9.6	9.5	0	5.0	0	2.1	2.1	5.0
REC	5.1	4.7	4.2	3.9	0.6	2.1	5.0	0	5.0	5.0	0.1	0.2	0.1	9.5	0.1	5.0	0.1	5.0	0.1	5.0
F.F	5.0	4.6	4.2	4.2	0.6	2.1	5.0	0	5.0	5.0	9.1	9.2	9.2	0.1	4.9	0	2.1	5.0	2.1	0
REW	5.0	4.6	4.2	4.3	0.6	5.1	5.0	0	5.0	5.0	9.1	9.2	9.1	0.1	4.9	0	2.1	5.0	2.1	0

REF. NO.	IC6001																			
MODE	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60
STOP	2.1	5.0	5.1	4.6	5.0	0	0	0	5.2	0	0	0	5.0	5.0	2.9	5.0	0	0.9	1.5	0.7
PLAY	0	0	5.1	5.0	0	5.1	0	0	5.2	0	0	0	0	0	2.9	5.0	0	0.9	1.5	0.7
REC	0.1	0.1	5.1	0.1	0	5.1	0	0	5.2	0	0	0	0	0	2.9	5.1	0	0.9	1.5	0.7
F.F	0	5.0	5.1	5.0	5.0	5.1	0	0	5.2	0	0	0	0	0	2.9	5.0	0	0.9	1.5	0.7
REW	5.0	5.0	5.1	5.0	5.0	0	0	0	5.2	0	0	0	0	0	2.9	5.0	0	0.9	1.5	0.7

REF. NO.	IC6001			
MODE	61	62	63	64
STOP	5.0	1.1	1.2	5.0
PLAY	5.0	1.1	5.1	5.0
REC	5.1	1.1	5.1	5.1
F.F	5.0	1.1	1.1	5.0
REW	5.0	1.1	1.1	5.0

REF. NO.	IC6002																			
MODE	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
STOP	0	0.2	5.0	0	3.7	3.8	4.6	5.0	5.0	0	0	5.0	5.1	4.9	5.1	5.2	0	0	0	2.5
PLAY	0	0.2	5.1	0	4.3	2.0	4.6	5.0	5.1	0	0	5.1	5.1	4.9	5.1	5.2	0	0	0	2.5
REC	0	0.2	5.1	0	3.8	2.0	4.7	5.0	5.1	0	0	5.1	5.1	4.9	5.1	5.2	0	0	0	2.5
F.F	0	0.2	5.1	0	4.3	2.0	4.6	5.1	5.1	0	0	5.1	5.1	4.9	5.1	5.2	0	0	0	2.5
REW	0	0.2	5.1	0	4.3	2.0	4.6	5.1	5.1	0	0	5.1	0	4.9	5.1	5.2	0	0	0	2.5

REF. NO.	IC6002																			
MODE	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40
STOP	2.6	0	2.1	3.0	4.0	5.0	0	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5
PLAY	2.6	0	2.1	3.1	4.1	5.1	3.6	3.6	3.6	3.6	3.6	3.6	3.6	3.7	3.6	3.6	3.6	3.6	3.6	3.6
REC	2.6	0	2.2	3.1	4.0	5.1	3.6	3.6	3.6	3.6	3.6	3.6	3.6	3.6	3.6	3.6	3.6	3.6	3.6	3.6
F.F	2.6	0	2.1	3.1	4.0	5.1	3.5	3.6	3.6	3.6	3.6	3.6	3.6	3.6	3.6	3.6	3.6	3.6	3.6	3.6
REW	2.6	0	2.1	3.1	4.0	5.1	3.5	3.6	3.6	3.6	3.6	3.6	3.6	3.6	3.6	3.6	3.6	3.6	3.6	3.6

REF. NO.	IC6002																			
MODE	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60
STOP	3.6	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.6	0.1	0	2.7	5.0	2.4	5.1
PLAY	3.6	3.6	3.6	3.6	3.6	3.6	3.6	3.6	3.6	3.6	3.6	3.6	3.6	3.6	2.3	0	2.7	5.1	2.4	5.1
REC	3.6	3.6	3.6	3.6	3.6	3.6	3.6	3.6	3.6	3.6	3.6	3.6	3.6	3.6	0	0	2.7	5.1	2.4	5.1
F.F	3.6	3.6	3.6	3.6	3.6	3.6	3.6	3.6	3.6	3.6	3.6	3.6	3.5	3.6	0	0	2.7	5.1	2.4	5.1
REW	3.6	3.6	3.6	3.6	3.6	3.6	3.6	3.6	3.6	3.6	3.6	3.6	3.6	3.6	0	0	2.7	5.1	2.4	5.1

REF. NO.	IC6002			
MODE	61	62	63	64
STOP	0	0.1	0.1	0
PLAY	2.0	2.5	2.5	0.1
REC	2.0	2.5	2.5	0.1
F.F	3.9	2.6	2.6	0.1
REW	3.9	2.6	2.6	0.1

REF. NO.	IC6003							
MODE	1	2	3	4	5	6	7	8
STOP	2.5	0	5.2	2.6	2.7	0	2.9	2.3
PLAY	2.5	0	5.2	2.6	2.7	0	2.9	2.3
REC	2.5	0	5.2	2.6	2.7	0	2.9	2.3
F.F	2.5	0	5.2	2.6	2.7	0	2.9	2.3
REW	2.5	0	5.2	2.6	2.7	0	2.9	2.3

REF. NO.	IC6004									
MODE	1	2	3	4	5	6	7	8	9	10
STOP	0	0.5	0.9	0.4	0	0	12.4	12.4	0.9	0.5
PLAY	0	0.6	0.9	0.4	0	0	12.3	12.3	0.9	0.6
REC	0	0.6	0.9	0.4	0	0	12.3	12.3	0.9	0.6
F.F	0	0.6	0.9	0.4	0	0	12.3	12.3	0.9	0.5
REW	0	0.5	0.9	0.4	0	0	12.3	12.3	0.9	0.5

REF. NO.	IC6005																			
MODE	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
STOP	4.6		0.9	1.5	4.2	0				4.6	5.0	5.0	4.7	5.2	4.9	0	12.4	3.8	3.9	5.1
PLAY	2.8		0.9	1.5	4.2	0				2.4	5.0	5.0	4.7	5.2	4.9	0	12.3	3.8	4.1	5.1
REC	4.6		0.9	1.5	4.2	0				2.4	5.0	5.0	4.7	5.2	4.9	0	12.3	3.8	4.0	5.1
F.F	2.9		0.9	1.5	4.2	0				2.9	5.0	5.0	4.6	5.2	4.9	0	12.3	3.8	3.9	5.0
REW	2.9		0.9	1.5	4.2	0				2.8	5.0	5.0	4.6	5.2	4.9	0	12.3	3.8	4.0	5.1

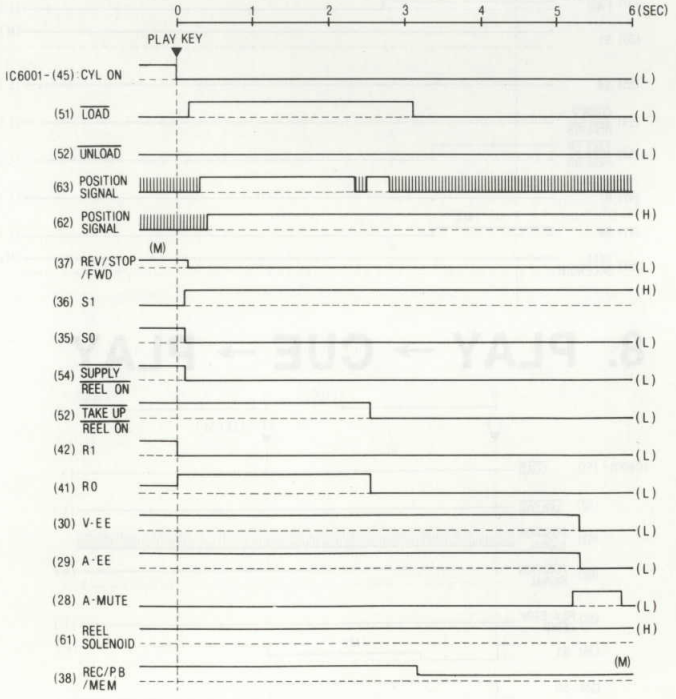
REF. NO.	IC6006																			
MODE	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16				
STOP	0	12.3	0.6		0	5.2	5.2	5.1	3.7	5.1	0		4.2	0		0				
PLAY	0	12.3	0.6		0	5.2	5.2	5.1	3.7	5.1	0		4.2	0		0				
REC	0	12.3	0.6		0	5.2	5.2	5.1	3.7	5.1	0		4.2	0		0				
F.F	0	12.3	0.6		0	5.2	5.2	5.1	3.7	5.1	0		4.2	0		0				
REW	0	12.3	0.6		0	5.2	5.2	5.1	3.7	5.1	0		4.2	0		0				

SYSTEM CONTROL TRANSISTORs DC VOLTAGE CHART

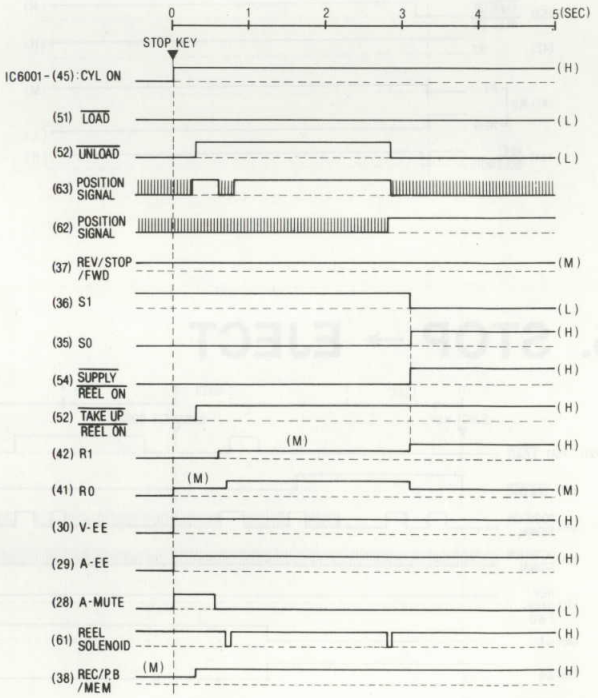
REF. NO.	Q6001			Q6002			Q6003			Q6004			Q6005			Q6006		
MODE	E	C	B	E	C	B	E	C	B	E	C	B	E	C	B	E	C	B
STOP	0	11.9	0	12.4	0	11.9	0	12.4	0	0	1.0	0.6	5.0	0.1	4.5	0	0	0.3
PLAY	0	11.8	0	12.3	0	11.8	0.1	12.3	0.1	0	3	0.3	0	0	0	0	0	0.3
REC	0	11.8	0	12.3	0	11.8	0.1	12.3	0.1	0	3	0.3	5.1	0.1	4.5	0	0	0.3
F.F	0	11.8	0	12.3	0	11.8	9.0	12.3	9.6	0	3	0.3	5.0	0.1	4.5	0	0	0.3
REW	0	11.8	0	12.3	0	11.8	9.0	12.3	9.6	0	3	0.3	5.0	0.2	4.5	0	0	0.3
REF. NO.	Q6007			Q6008			Q6009			Q6010			Q6011					
MODE	E	C	B	E	C	B	E	C	B	E	C	B	E	C	B	E	C	B
STOP	0	10.2	0	0	12.4	0	0	12.4	0	12.4	12.4	12.1	9.6	1.3	11.3			
PLAY	0	3.7	0	0	12.3	0	0	12.3	0	12.3	12.3	12.0	9.6	1.3	11.2			
REC	0	3.7	0	0	12.3	0	0	12.3	0	12.3	12.3	12.0	9.6	1.3	11.2			
F.F	0	10.2	0	0	12.3	0	0	12.3	0	12.3	12.3	12.0	9.6	1.3	11.2			
REW	0	10.2	0	0	12.3	0	0	12.3	0	12.3	12.3	12.0	9.6	1.3	11.2			
REF. NO.	QR6001			QR6002			QR6003			QR6004			QR6005			QR6006		
MODE	E	C	B	E	C	B	E	C	B	E	C	B	E	C	B	E	C	B
STOP	5.2	0	4.9	9.6	0	9.6	0	5.2	0	12.4	12.1	12.3	0	0.1	5.2	0	5.2	0
PLAY	5.2	0	5.0	9.6	0	9.5	0	5.2	0	12.3	12.0	12.3	0	0.1	5.2	0	5.2	0
REC	5.2	0	5.0	9.6	0.1	9.5	0	5.2	0	12.3	12.0	12.3	0	0.1	5.2	0	5.2	0
F.F	5.2	0	5.0	9.6	9.6	0.1	0	5.2	0	12.3	12.0	12.2	0	0.1	5.2	0	5.2	0
REW	5.2	0	5.0	9.6	9.6	0.1	0	5.2	0	12.3	12.0	12.2	0	0.1	5.2	0	5.2	0

MICROPROCESSOR IC6001 (MN1534VGA)
MODE BY MODE TIMING CHART

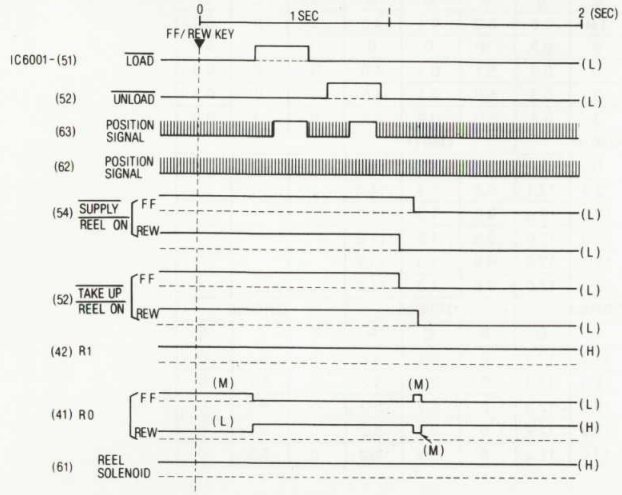
1. STOP → PLAY



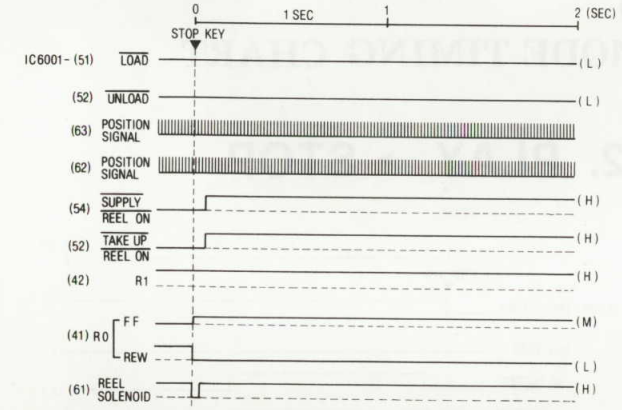
2. PLAY → STOP



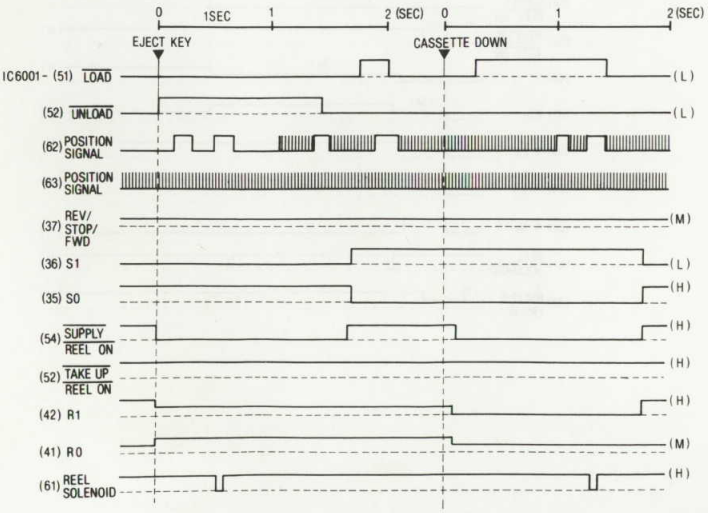
3. STOP → FF/REW



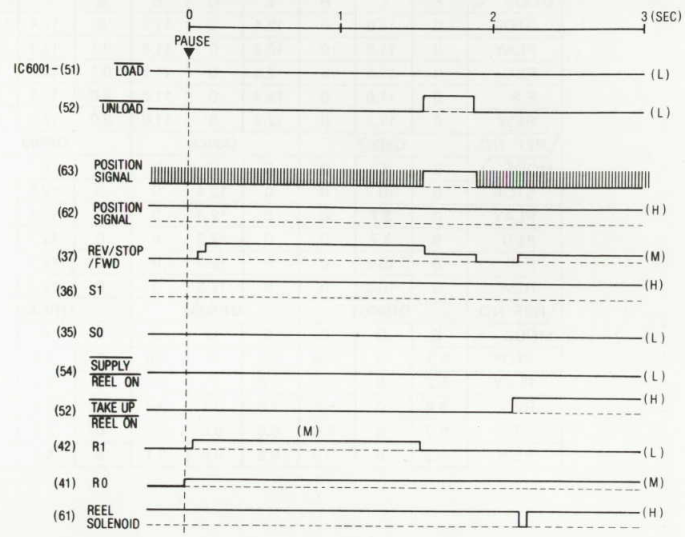
4. FF/REW → STOP



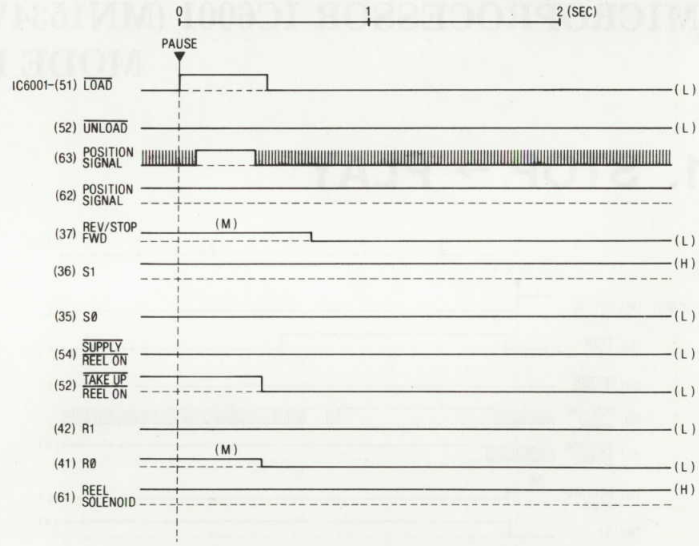
5. STOP → EJECT



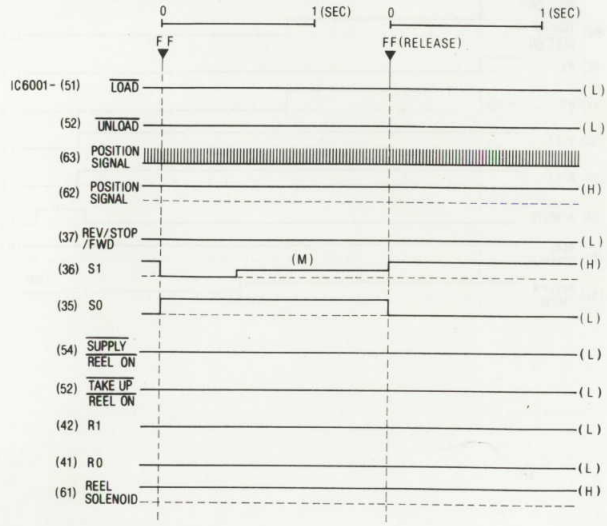
6. REC•PLAY → REC•PAUSE



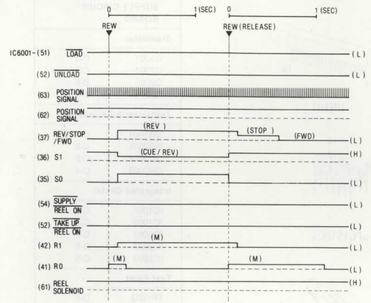
7. REC•PAUSE → REC•PLAY



8. PLAY → CUE → PLAY



9. PLAY → REVIEW → PLAY



SYSTEM CONTROL CIRCUIT BOARD	
Transistor	
Q6001	B-2
Q6002	B-2
Q6003	B-2
Q6004	A-1
Q6005	B-2
Q6006	B-3
Q6007	B-4
Q6008	B-7
Q6009	B-7
Q6010	B-4
Q6011	B-2
Transistor & Resistor	
QR6001	B-4
QR6002	B-2
QR6003	B-3
QR6004	B-4
QR6005	B-1
QR6006	B-1
QR6007	B-2
Integrated Circuit	
IC6001	B-5
IC6002	A-7
IC6003	B-3
IC6004	B-1
IC6005	B-1
IC6006	A-2
Test Point	
TP6001	A-2
TP6002	A-3
TP6003	A-3
Adjustment	
VR6001	A-2

ADDRESS INFORMATION

3-8. SYSTEM CONTROL CIRCUIT BOARD (VEP06218A)

P602 (TO SAFETY TAB)

1	GND
2	SAFETY TAB SW

FS62 (TO MAIN)

1	EE 5V	16	9V
2	S-PHOTO	17	REEL SOL
3	D-REC (L)	18	TAPE SENS LED
4	———	19	LOAD (M) (+)
5	D-A-REC (L)	20	CASSETE DOWN SW
6	REC (L)	21	DEW SENSOR
7	VIDEO EE (H)	22	S-REEL ON
8	FULL ERASE (L)	23	S-REEL PULSE
9	INDEX HOLE	24	PØ
10	STOP-EJECT	25	R1
11	CUR.EMPH (L)	26	T-REEL PULSE
12	COMMON	27	T-REEL ON
13	———	28	———
14	AUDIO MUTE (H)	29	CAM.PAUSE
15	LOAD (M) (−)	30	TALLY & CLK

FS63

1	CLEAR	9	FF
2	MEMORY	10	REW
3	5V	11	SLOW
4	A.DUB	12	PLAY
5	PØ2	13	STOP
6	REC	14	PAUSE
7	PØ1	15	EJECT
8	PØØ		

FS61 (TO MAIN)

1	MODE	16	3.58MHz
2	PB START (M)	17	FA (H)
3	SØ	18	SAFETY TAB/CHARGE
4	S1	19	VIDEO IN/OUT
5	INS/NOR/REC S	20	EXT 12V
6	REC/PB/MEM	21	GND
7	HEAD SW	22	———
8	SSS (L)	23	DATA (2)
9	CTL IN	24	DATA (1)
10	AUDIO EE (H)	25	———
11	CLK (2)	26	T-PHOTO
12	REV/STOP/FWD	27	LIGHT 12V
13	CYL ON (L)	28	BATT CHARGE
14	SAFETY TAB	29	GND
15	STAND BY	30	CAMERA IN (L)

P601 (TO REMOTE CONTROL JACK)

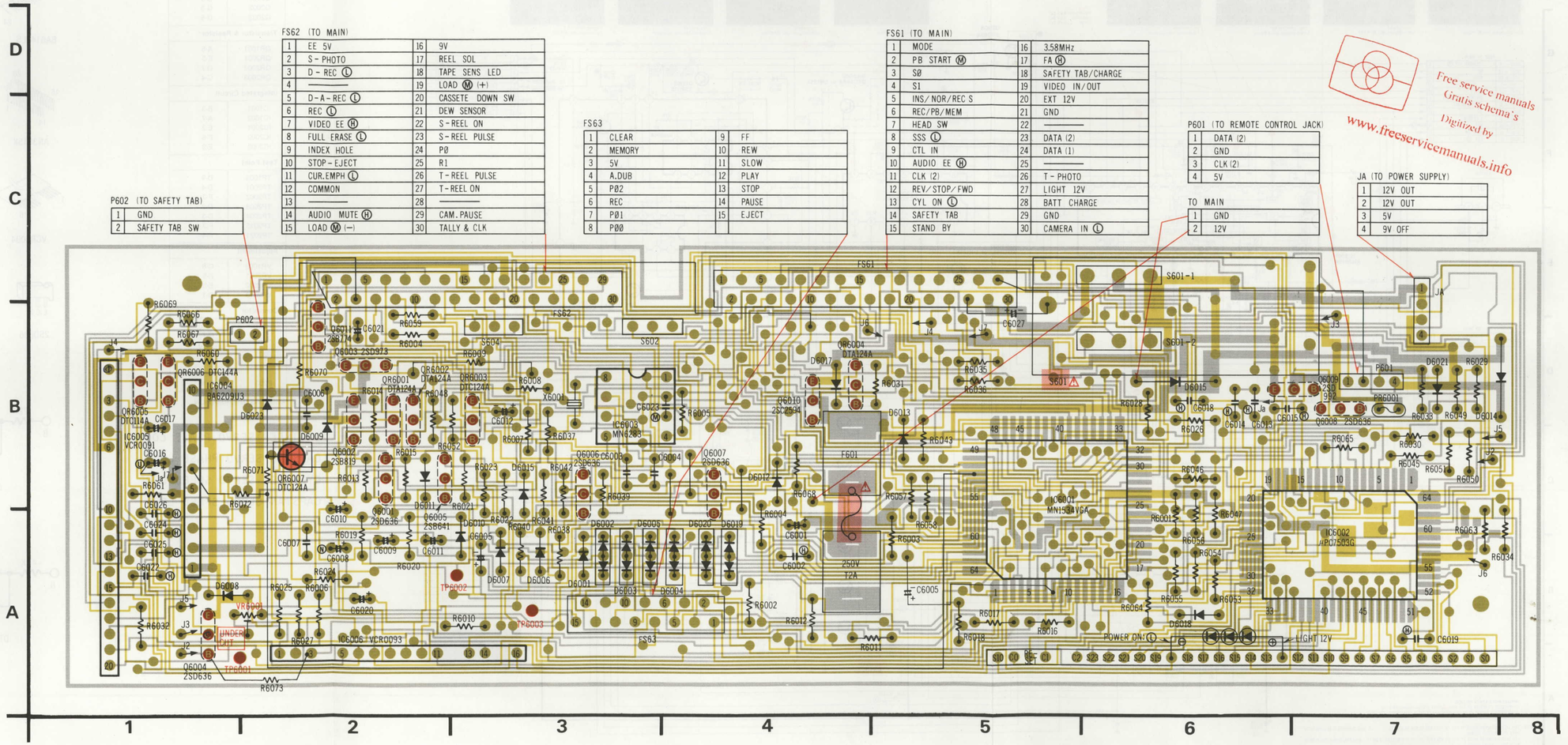
1	DATA (2)
2	GND
3	CLK (2)
4	5V

TO MAIN

1	GND
2	12V

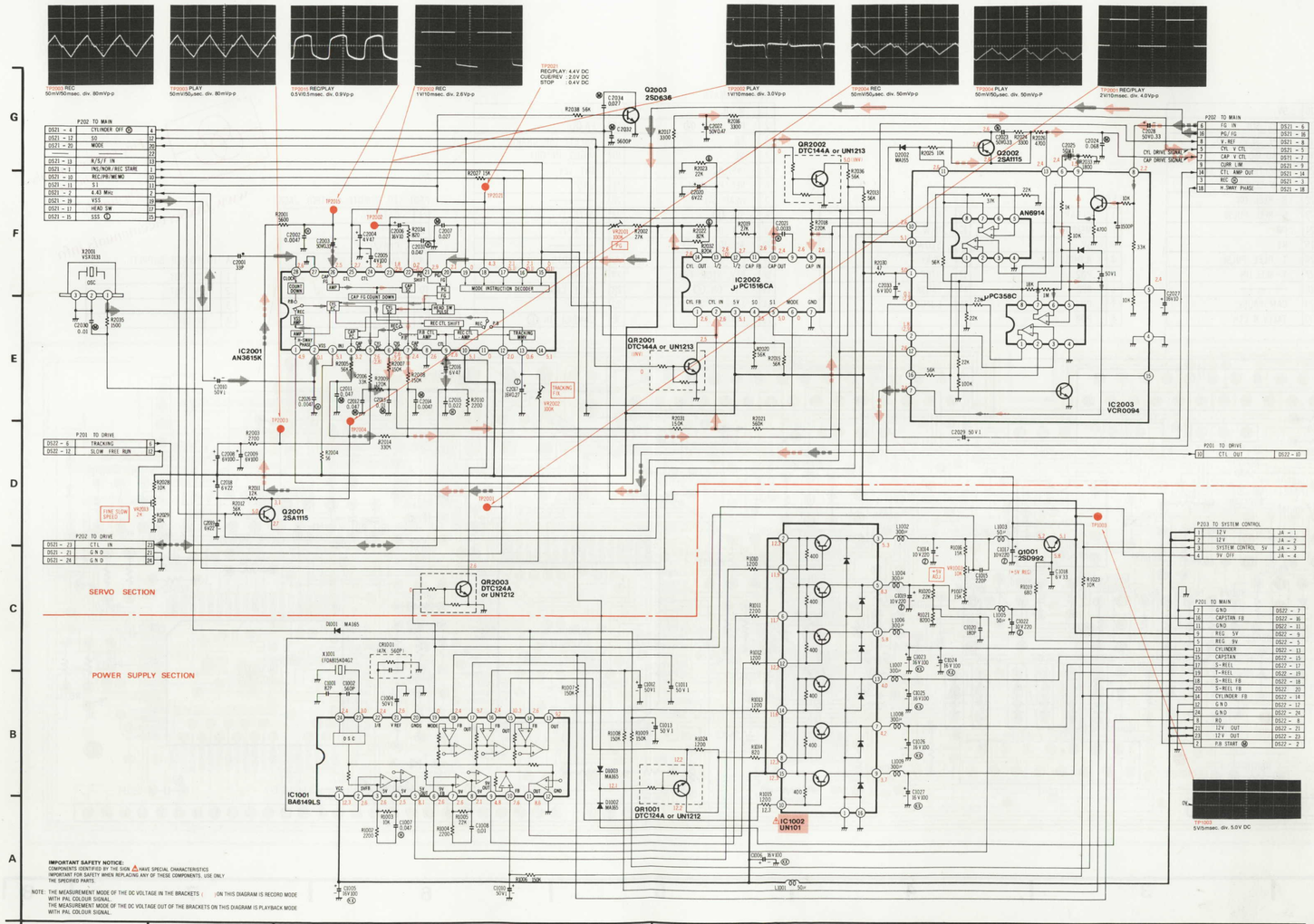
JA (TO POWER SUPPLY)

1	12V OUT
2	12V OUT
3	5V
4	9V OFF



Next Page:
SERVO (1) & POWER SUPPLY Section

3-9. SERVO (1) & POWER SUPPLY SCHEMATIC DIAGRAM

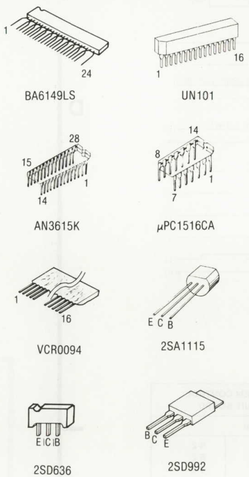


SERVO (1) & POWER SUPPLY SCHEMATIC	
Transistor	
Q1001	D-8
Q2001	D-3
Q2002	G-8
Q2003	G-5
Transistor & Resistor	
QR1001	A-6
QR2001	E-5
QR2002	G-7
QR2003	C-4
Integrated Circuit	
IC1001	B-3
IC1002	A-7
IC2001	E-2
IC2002	F-6
IC2003	E-9
Test Point	
TP1003	D-9
TP2001	D-4
TP2002	F-3
TP2003	D-2
TP2004	D-3
TP2015	F-3
TP2021	F-4
Adjustment	
VR1003	C-8
VR2001	F-5
VR2002	E-5
VR2013	D-1
Connector	
P201	C-10
	D-1
	D-10
P202	D-1
	G-1
	G-10
P203	D-10

ADDRESS INFORMATION

CYLINDER SERVO PHASE LOOP
CAPSTAN SERVO PHASE LOOP
CYLINDER SERVO SPEED LOOP
CAPSTAN SERVO SPEED LOOP

ICs & TRANSISTORs INFORMATION

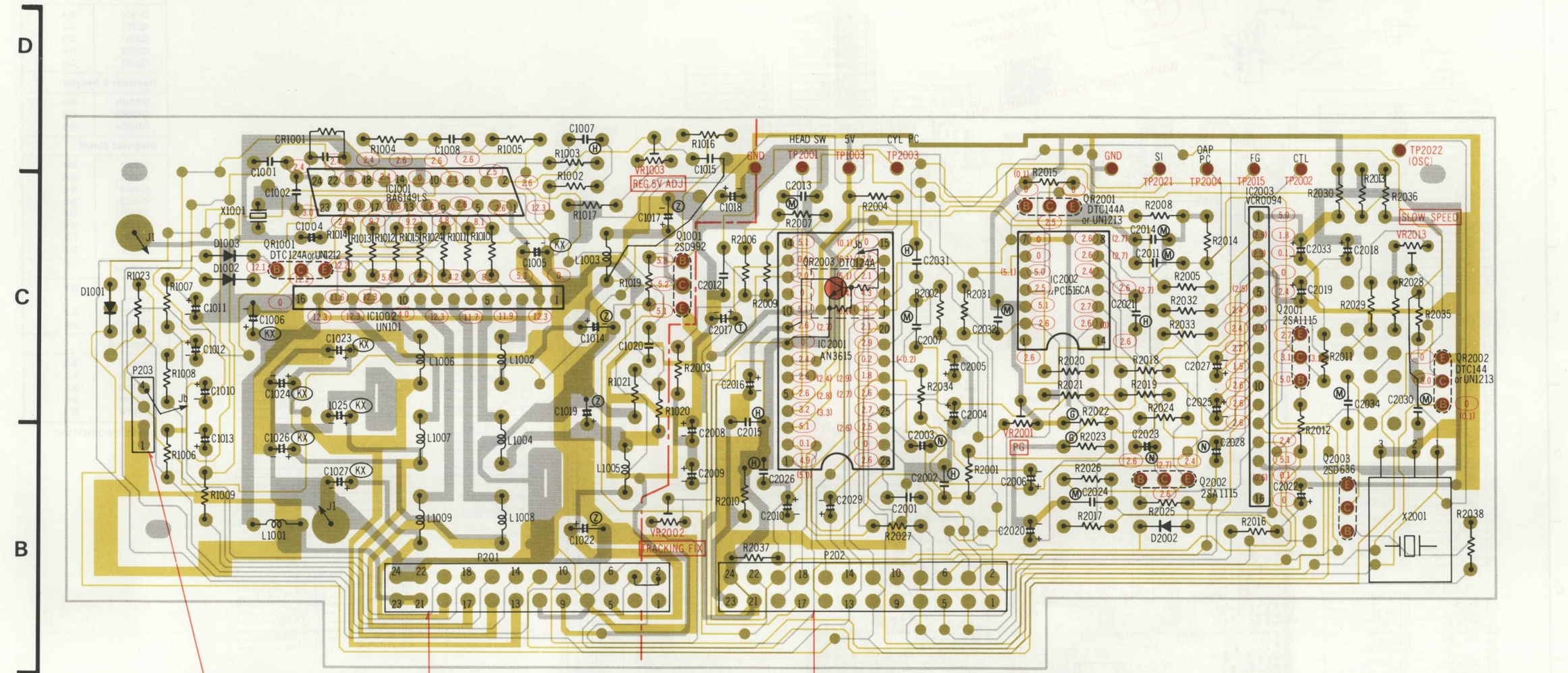


SERVO (1) & POWER SUPPLY CIRCUIT BOARD	
Transistor	
Q1001	C-3
Q2001	C-5
Q2002	B-5
Q2003	B-6
Transistor & Resistor	
QR1001	C-1
QR2001	C-5
QR2002	C-6
QR2003	C-4
Integrated Circuit	
IC1001	C-2
IC1002	C-2
IC2001	C-4
IC2002	C-5
IC2003	C-5
Test Point	
TP1003	D-4
TP2001	D-4
TP2002	C-5
TP2003	D-4
TP2004	C-5
TP2015	C-5
TP2021	C-5
TP GND	D-3
TP GND	D-5
Adjustment	
VR1003	D-3
VR2001	C-4
VR2002	B-3
VR2013	C-6

ADDRESS INFORMATION

3—12

3-10. SERVO (1) & POWER SUPPLY CIRCUIT BOARD (VEP02183A)



P203 (TO POWER SUPPLY)

1	12V
2	12V
3	SYSTEM CONTROL 5V
4	9V OFF

P201 (TO MAIN)

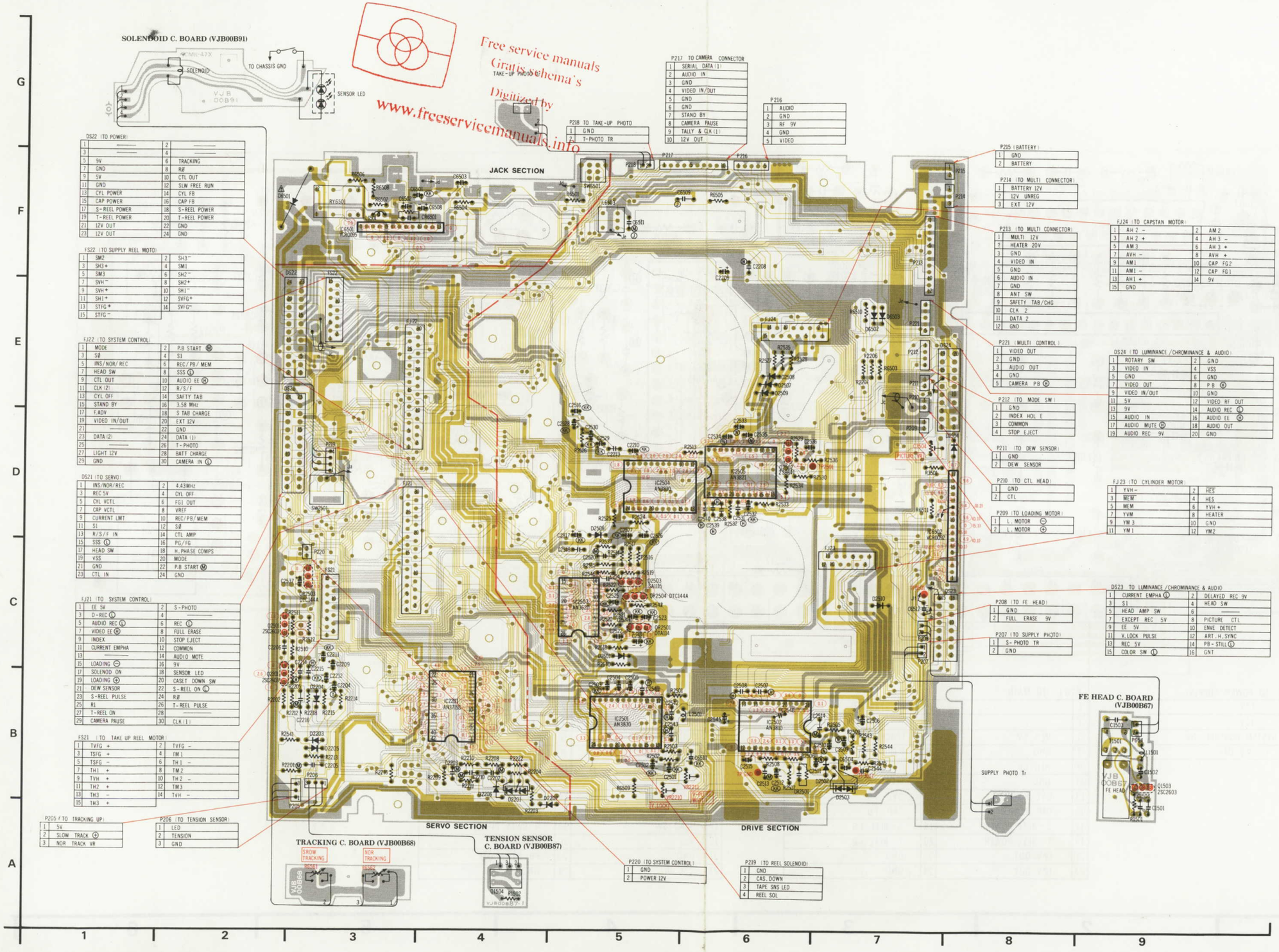
1		2	PB START Ⓜ
3		4	
5	REG 9V	6	TRACKING
7	GND	8	RØ
9	REG 5V	10	CTL OUT
11	GND	12	SLOW FREE RUN
13	CYL POWER	14	CYL FB
15	CAP POWER	16	CAP FB
17	S-REEL POWER	18	S-REEL FB
19	T-REEL POWER	20	T-REEL FB
21	12V OUT	22	GND
23	12V OUT	24	GND

P202 (TO MAIN)

1	Ins/Nor/Rec	2	4.43MHz
3	REC Ⓗ 5V	4	CYL OFF Ⓗ
5	CYL VCTL	6	FG IN
7	CAP VCTL	8	V REF
9	CURRENT LIMIT	10	REC/PB/MEM
11	S1	12	SØ
13	R/S/F IN	14	CTL AMP OUT
15	SSS Ⓛ	16	PG/FG
17	HEAD SW	18	H SWAY PHASE
19	Vss	20	MODE
21	GND	22	PB START Ⓜ
23	CTL IN	24	GND

3—13

3-11. MAIN [Servo (2), Drive, Jack, Picture VR] CIRCUIT BOARD (VEP02184A)



MAIN [SERVO (2), DRIVE JACK & PICTURE VR] CIRCUIT BOARD	
Transistor	
Q1503	G-4
Q2201	B-2
Q2501	C-2
Q2502	D-6
Q2503	C-5
Transistor & Resistor	
QR2501	C-5
QR2503	C-3
QR2504	C-5
Integrated Circuit	
IC2201	B-4
IC2501	B-5
IC2502	B-6
IC2503	B-5
IC2504	D-5
IC2505	D-6
IC6501	F-3
IC6502	D-7
Test Point	
TP2501	D-7
TP3017	
TP3501	C-7
TP GND	B-6
Adjustment	
R6561	A-3
R6562	A-3
VR2210	A-5
VR2211	B-6
VR3504	B-7

ADDRESS INFORMATION

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SERVO (1) & POWER SUPPLY Section

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MAIN ICs DC VOLTAGE CHART

REF. NO.	IC2201																							
MODE	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
STOP	0	5.0	4.9	0	2.1	2.1	4.4	0.1	2.5	0.7	2.1	0.7	0	0	2.5	0	2.7	0.1	0.6	5.0	4.3	4.1	4.8	0.7
PLAY	4.5	2.1	0.1	5.0	0	0	0.1	2.6	2.5	1.1	2.2	1.1	0	0	2.5	0	2.7	0.1	1.1	5.0	2.5	4.8	4.8	0
REC	0.1	5.1	0.1	5.0	0.1	0	0.1	2.6	2.5	0.7	2.1	0.6	0	0	2.5	0	2.7	0.1	0.6	5.1	2.0	4.8	4.9	2.4
F.F	0	5.0	4.9	0	2.1	2.1	4.4	0.1	2.5	0.6	2.0	0.6	0	0	2.5	0	2.7	0.1	0.5	5.0	4.3	4.1	4.8	0.6
REW	0	5.0	4.9	0	2.1	2.1	4.4	0.1	2.5	0.8	2.2	0.8	0	0	2.5	0	2.7	0.1	0.8	5.0	4.3	4.1	4.8	0.6

REF. NO.	IC2201																	
MODE	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42
STOP	1.6	1.6	0	2.9	2.3	3.1	2.7	2.3	5.1	2.5	1.7	0	2.1	0	0	0	5.1	0
PLAY	1.6	1.6	0	2.9	2.3	3.1	2.7	2.3	0	2.5	1.7	0	2.1	0	0	2.0	5.1	0
REC	1.6	1.6	0	2.9	2.4	3.1	2.7	2.4	5.1	2.5	1.8	0	2.0	0	0	2.0	5.1	0
F.F	1.6	1.6	0	2.9	2.3	3.1	2.7	2.3	5.1	2.5	1.7	0	2.1	0	0	0	5.1	0
REW	1.6	1.6	0	2.9	2.3	3.1	2.7	2.3	5.1	2.5	1.7	0	5.1	3.1	5.0	0	5.1	0

REF. NO.	IC2501																							
MODE	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
STOP	1.5	0	1.5	2.4	1.9	1.8	1.8	1.9	1.9	1.9	0.1	5.1	5.1	3.1	5.0	0.2	4.9	0	5.0	0	0	0	1.5	3.6
PLAY	0.8	0	0.8	2.4	1.9	1.9	1.9	1.9	1.9	1.9	2.5	2.5	5.1	3.1	0.1	0	0.1	0.5	0	0	0.6	0.1	0.8	3.3
REC	0.8	0.1	0.8	2.4	1.9	1.9	1.9	1.9	1.9	1.9	2.5	2.5	5.1	3.1	0.1	0	0.1	0.5	0	0	0.6	0	0.8	3.3
F.F	1.9	0	1.9	2.4	1.9	1.9	1.9	1.9	1.9	1.9	2.6	2.5	5.1	3.1	0.1	0	4.9	0.5	0	0	0.6	0	1.9	4.2
REW	2.6	0.1	2.6	2.5	1.9	1.9	1.9	1.9	1.9	1.9	2.6	2.5	5.1	3.1	0.1	0.1	4.9	0.6	0	0	0.6	0.1	2.5	5.4

REF. NO.	IC2502																							
MODE	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
STOP	5.0	5.0	3.5	3.3	0.1	0	9.5	5.4	9.2	0.7	2.6	0	4.5	1.7	1.2	2.8	2.8	0	2.4	5.0	0	0	5.0	0
PLAY	5.3	5.3	3.5	3.3	0.1	0.1	9.5	2.4	8.3	0.9	2.7	0	2.6	1.4	1.3	2.7	2.7	0	2.1	5.6	0.1	0	5.3	0.1
REC	5.3	5.3	3.5	3.3	0.1	0.1	9.5	2.4	8.3	0.9	2.7	0	2.6	1.4	1.3	2.7	2.7	0	2.1	5.5	0.1	0	5.3	0.1
F.F	4.8	4.8	3.5	3.3	0	0	9.5	5.4	9.2	0.7	2.7	0	4.5	1.7	1.2	2.8	2.8	0	2.4	4.1	0	0	4.1	0
REW	4.8	4.8	3.5	3.3	0	0	9.5	5.4	9.2	0.7	2.6	0	4.5	1.7	1.2	2.8	2.7	0	2.4	5.7	0	0	5.6	0

REF. NO.	IC2503																							
MODE	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
STOP	1.2	1.3	0	0.3	0.3	0.3	0.3	0	2.1	5.0	2.2	2.9	5.1	0	0.3	0.1	0.1	5.0	0	2.6	0.2	0	2.6	3.2
PLAY	1.3	0	0	2.8	2.8	3.0	3.0	0	0	0	2.2	2.9	5.1	0.1	0	0.1	0.1	0.1	0.1	2.6	2.8	2.8	2.6	2.6
REC	1.3	1.3	0	2.9	2.8	3.1	3.0	0	0.1	0.1	2.2	2.9	5.1	0.1	0	0.1	0.1	0.1	0.1	2.6	2.8	2.8	2.7	2.6
F.F	1.3	1.3	0	2.3	2.2	0.3	0.4	0	0	5.0	2.2	2.9	5.1	0	0	0.1	0.1	0.1	0.1	2.6	0.2	0	2.6	3.2
REW	1.3	1.3	0	2.4	2.3	0.3	0.3	0	5.0	5.0	2.2	2.9	5.1	0.1	0.1	0.1	0	0.1	0	2.6	0.2	0	2.6	3.2

REF. NO.	IC2503																							
MODE	25	26	27	28																				
STOP	2.6	2.6	1.2	1.3																				
PLAY	2.6	2.6	1.3	1.3																				
REC	2.6	2.6	1.3	1.3																				
F.F	2.6	2.6	1.3	1.3																				
REW	2.6	2.6	1.3	1.3																				

REF. NO.	IC2504																							
MODE	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
STOP	1.6	0	1.6	2.4	1.9	2.0	2.0	1.9	1.9	1.9	0.1	0.1	5.1	3.1	5.0	0.1	4.9	0	5.0	0	0.1	0	1.6	3.5
PLAY	1.8	0.1	1.8	1.8	2.0	2.0	2.0	2.0	2.0	2.0	2.5	2.5	5.1	3.1	0.1	0.1	0.1	0.5	0	0	0.6	0.1	1.8	3.9
REC	1.8	0.1	1.8	2.5	2.0	2.0	2.0	2.0	2.0	2.0	2.5	2.5	5.1	3.2	0.1	0.1	0.1	0.5	0	0	0.6	0.1	1.8	3.9
F.F	3.3	0.1	3.3	2.5	1.9	1.9	1.9	1.9	2.0	2.0	2.5	2.5	5.1	3.1	0.1	0.1	4.9	0.6	0	0	0.6	0.1	3.3	6.9
REW	2.3	0	2.3	2.4	1.9	1.9	1.9	1.9	2.0	2.0	2.6	2.5	5.1	3.1	0.1	0	4.9	0.4	0	0	0.5	0	2.7	5.9

REF. NO.	IC2505																							
MODE	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
STOP	2.6	0	2.6	0	1.6	1.5	1.4	1.6	1.5	1.5	2.1	0.1	5.1	3.1	2.5	0.7	4.9	0.5	0.4	0	0	0.1	2.6	12.3
PLAY	2.2	0.1	2.2	0	1.5	1.5	1.5	1.5	1.5	1.5	0	0	5.1	3.1	2.5	2.4	0.1	0.5	0.4	0.1	0	0.5	2.2	4.1
REC	2.2	0	2.2	0	1.5	1.5	1.5	1.5	1.5	1.5	0	0	5.1	3.1	2.5	2.4	0.1	0.5	0.4	0	0	0.5	2.2	4.1
F.F	2.6	0	2.6	0	1.6	1.5	1.4	1.6	1.5	1.5	2.1	0.3	5.1	3.1	2.5	0.6	4.9	0.5	0.4	0	0	0.1	0	12.2
REW	2.6	0	2.6	0	1.6	1.5	1.4	1.6	1.5	1.5	2.1	0.3	5.1	3.1	2.5	0.7	4.9	0.5	0.4	0	0	0.1	2.6	12.1

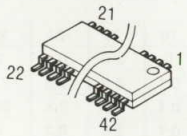
REF. NO.	IC6501																							
MODE	1	2	3	4	5	6	7	8	9	10	11	12	13											
STOP	9.6	12.4	4.6	4.2	0.2	9.6	0	9.6	3.3	0.5	1.0	6.6	0											
PLAY	9.6	12.4	0	4.2	0.2	9.6	0	9.6	3.2	0.5	1.0	6.6	0											
REC	9.6	12.4	0.1	4.2	0.2	9.6	0	9.6	3.3	0.5	1.0	6.6	0											
F.F	9.6	12.4	4.6	4.2	0.2	9.6	0	9.6	3.3	0.5	1.0	6.6	0											
REW	9.6	12.4	4.6	4.2	0.2	9.6	0	9.6	3.3	0.5	1.0	6.6	0											

REF. NO.	IC6502																							
MODE	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17							
STOP	0	−0.1	0	5.1	5.1	4.6	4.9	5.0	5.0	9.6	0	9.3	0.2	9.6	0	9.6	0.7							
PLAY	0	−0.1	0	5.1	0.3	4.6	4.9	0	0	9.6	0	9.4	0.3	9.6	0.3	9.6	0.7							
REC	0	5.1	0	5.1	2.5	0.1	0.1	5.0	5.1	0.1	9.5	0.2	9.5	3.3	9.6	9.6	0.7							
F.F	0	−0.1	0	5.1	5.1	4.6	4.9	5.0	5.0	9.6	0	9.3	0.1	9.6	0.1	9.6	0.7							
REW	0	−0.1	0	5.0	5.1	4.6	4.9	5.0	5.0	9.6	0	9.3	0	9.6	0.1	9.6	0							

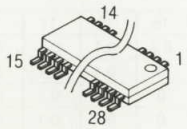
MAIN TRANSISTORs DC VOLTAGE CHART

REF. NO. / MODE	Q2201								
	E	C	B						
STOP	0	4.4	0						
PLAY	0	2.6	0						
REC	0	2.6	0						
F.F	0	4.4	0						
REW	0	4.4	0						
REF. NO. / MODE	Q2501			Q2502			Q2503		
	E	C	B	E	C	B	E	C	B
STOP	0	4.3	0	7.7	7.6	7.0	5.1	4.6	5.0
PLAY	1.8	4.3	2.5	2.8	2.6	2.2	5.1	5.1	4.5
REC	1.8	4.3	2.5	2.8	2.6	2.3	5.1	5.1	4.5
F.F	1.8	4.3	2.5	7.6	7.6	7.0	5.1	5.2	4.9
REW	1.8	4.3	2.5	7.6	7.6	7.0	5.1	3.7	4.9
REF. NO. / MODE	QR2501			QR2503			QR2504		
	E	C	B	E	C	B	E	C	B
STOP	5.1	2.4	5.0	0	5.1	0	0	0	5.0
PLAY	5.1	5.1	3.9	0	0	5.0	0	2.8	0
REC	5.1	5.1	4.0	0	0	5.0	0	2.7	0
F.F	5.1	2.9	5.0	0	5.1	0	0	0	5.0
REW	5.1	2.9	5.0	0	5.1	0	0	0	5.0

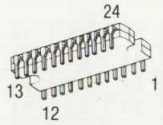
ICs & TRANSISTORs INFORMATION



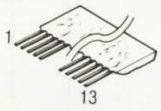
AN3715S



AN3620S

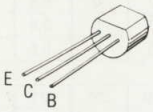


AN3810K
AN3821K
AN3830K



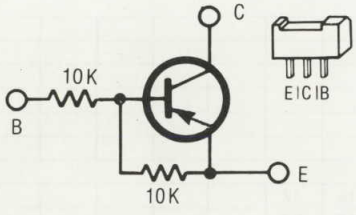
VCR0095

VCR0092

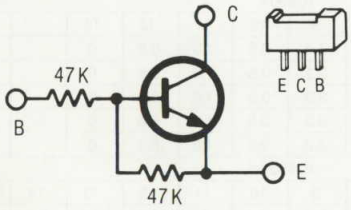


2SC2603
2SA1115
2SD2603A

2SB641



DTA114A

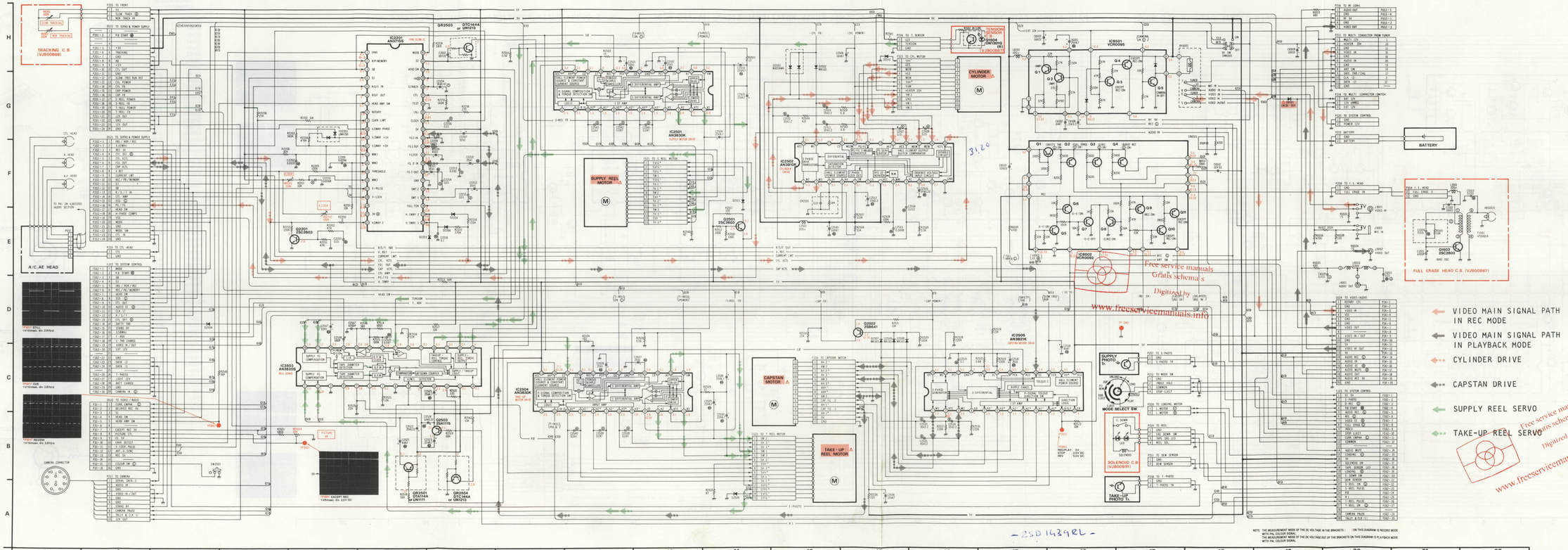


DTC144A

MAIN [SERVO (2), DRIVE, JACK & PICTURE VR] SCHEMATIC	
Transistor	
Q1503	E-21
Q2201	E-5
Q2501	E-11
Q2502	C-13
Q2503	B-7
Transistor & Resistor	
QR2501	A-6
QR2503	H-7
QR2504	A-7
Integrated Circuit	
IC2201	H-6
IC2501	G-10
IC2502	F-12
IC2503	C-5
IC2504	C-8
IC2505	C-14
IC6501	H-17
IC6502	E-16
Test Point	
TP2501	B-16
TP3017	B-7
TP3501	B-5
TP GND	D-17
Adjustment	
R6561	H-1
R6562	H-1
VR2210	E-5
VR2211	F-5
VR3504	B-5
Connector	
DS21	F-2
DS22	H-2
DS23	C-2
DS24	D-20
FJ21	C-20
FJ22	E-2
FJ24	C-12
FS21	F-10
FS22	B-11
FS23	H-23
P205	H-2
P206	H-13
P207	C-17
P208	F-20
P209	C-17
P210	E-2
P211	B-17
P212	C-17
P213	H-20
P214	G-20
P215	G-20
P216	H-20
P217	A-2
P218	A-17
P219	B-17
P220	G-20
P221	F-20
P654	F-21

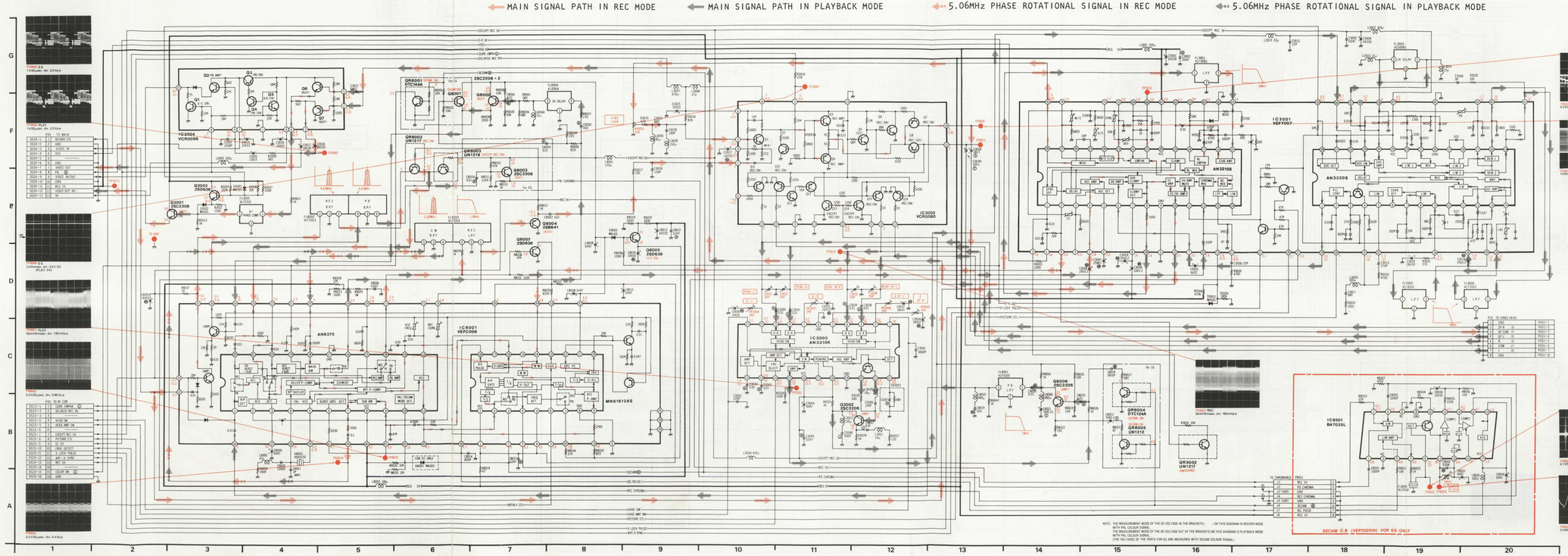
ADDRESS INFORMATION

3-12. MAIN [Servo (2), Drive, Jack, Picture VR] SCHEMATIC DIAGRAM



3—17

3-13. LUMINANCE & CHROMINANCE SCHEMATIC DIAGRAM

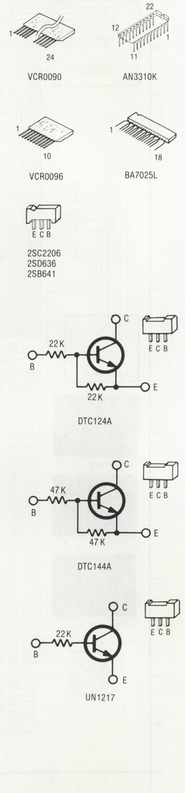


Back Page:
MAIN Section

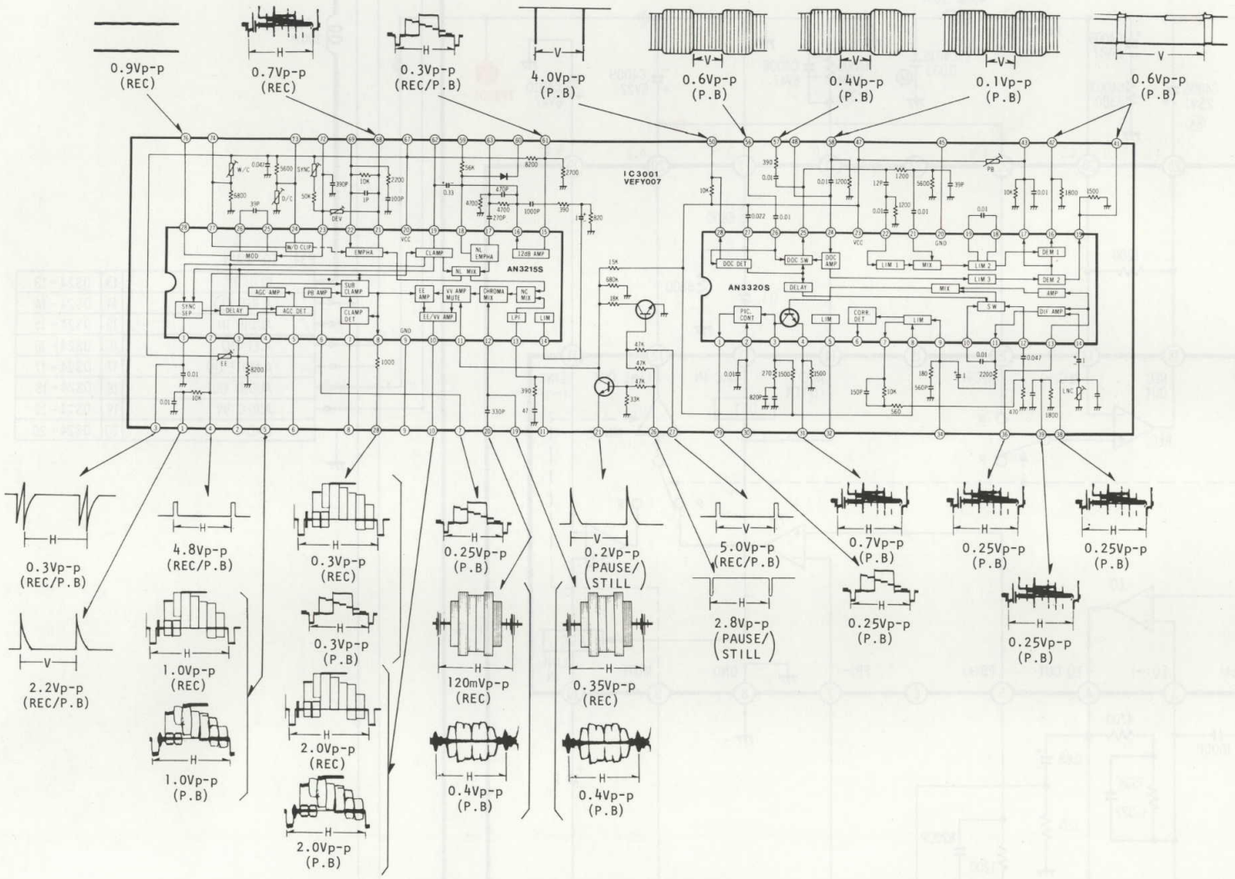
LUMINANCE & CHROMINANCE SCHEMATIC	
Transistor	
Q3001	E-3
Q3002	B-11
Q3003	E-3
Q8001	F-6
Q8002	F-7
Q8003	F-7
Q8004	E-8
Q8005	D-9
Q8006	B-14
Q8007	D-7
Transistor & Resistor	
QR3002	B-16
QR8001	G-6
QR8002	F-6
QR8003	F-6
QR8004	B-15
QR8005	B-15
Integrated Circuit	
IC3001	F-17
IC3002	E-12
IC3003	C-11
IC3004	F-3
IC8001	C-6
IC8501	B-18
Test Point	
TP3001	C-11
TP3002	F-5
TP3007	D-11
TP3009	G-11
TP3010	F-13
TP3011	F-13
TP3012	G-15
TP3013	E-2
TP8003	B-5
TP8004	B-5
TP8008	A-19
TP8501	A-19
TP GND	E-2
Adjustment	
C3031	D-10
C3032	D-11
C3035	D-11
C3036	D-12
VR3001	F-9
VR3005	D-12
VR3006	D-12
VR3007	D-11
VR3008	D-11
T8501	A-19
Connector	
P32	D-20
P33	B-1
P34	F-1
P8501	A-17

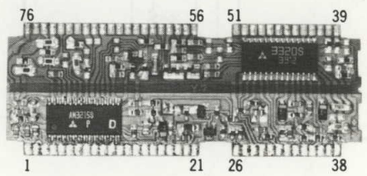
ADDRESS INFORMATION

ICs & TRANSISTORs INFORMATION



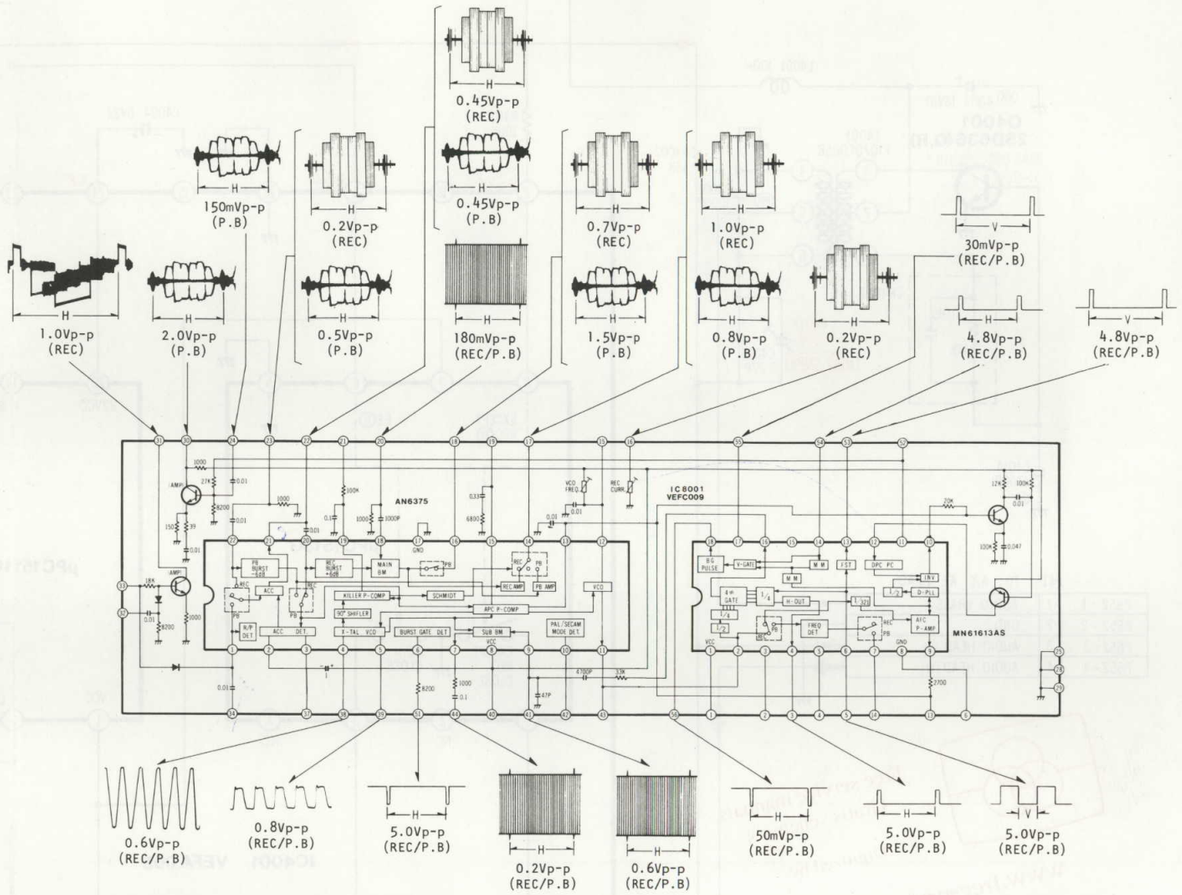
VEFY007

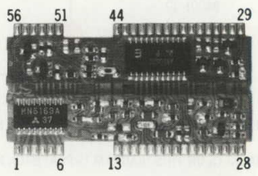




VEFY007

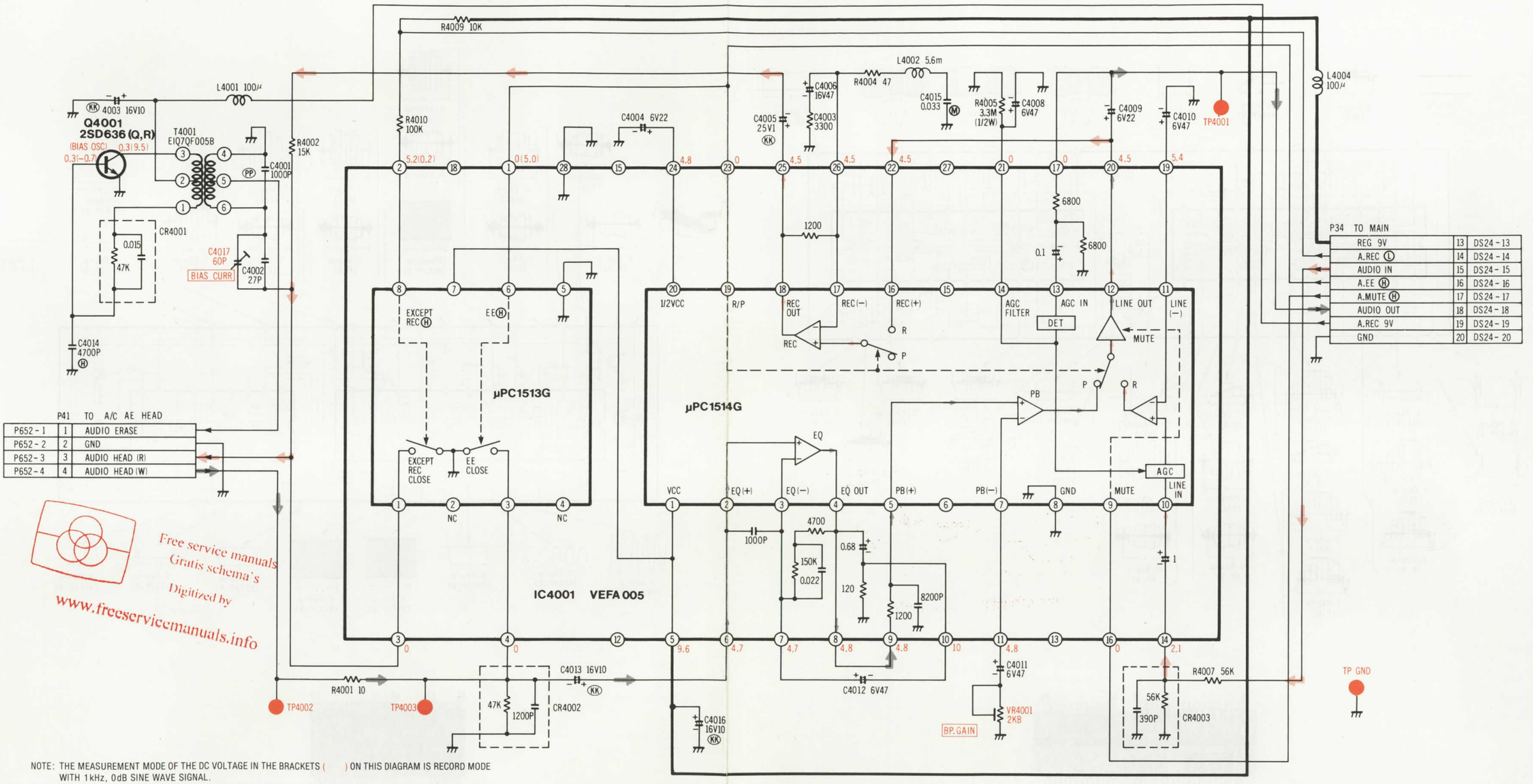
VEFC009





VEFC009

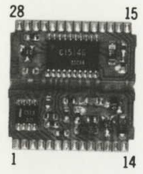
3-14. AUDIO SCHEMATIC DIAGRAM



NOTE: THE MEASUREMENT MODE OF THE DC VOLTAGE IN THE BRACKETS ( ) ON THIS DIAGRAM IS RECORD MODE WITH 1kHz, 0dB SINE WAVE SIGNAL.
THE MEASUREMENT MODE OF THE DC VOLTAGE OUT OF THE BRACKETS ON THIS DIAGRAM IS PLAYBACK MODE WITH 1kHz, 0dB SINE WAVE SIGNAL.

ICs & TRANSISTORs INFORMATION

2SD636



MAIN SIGNAL PATH IN REC MODE

MAIN SIGNAL PATH IN PLAYBACK MODE

Back Page:
LUMINANCE, CHROMINANCE Section

3—20

3-15. LUMINANCE, CHROMINANCE & AUDIO CIRCUIT BOARD (VEP03200A: NV-180E/B)/(VEP03200B: NV-180EG) /SECAM CIRCUIT BOARD (VEP03201A)

LUMINANCE CHROMINANCE & AUDIO CIRCUIT BOARD	
Transistor	
Q3001	A-2
Q3002	C-6
Q3003	B-2
Q4001	C-1
Q8001	B-5
Q8002	B-5
Q8003	A-5
Q8004	B-4
Q8005	B-3
Q8006	B-6
Q8007	B-3
Transistor & Resistor	
QR3002	C-3
QR8001	B-5
QR8002	A-5
QR8003	A-5
QR8004	B-6
QR8005	B-6
Integrated Circuit	
IC3001	C-3
IC3002	A-7
IC3003	B-7
IC3004	B-2
IC4001	B-1
IC8001	A-4
IC8501	D-6
Test Point	
TP3001	C-6
TP3002	A-2
TP3007	B-7
TP3009	A-6
TP3010	B-7
TP3011	A-6
TP3012	B-3
TP3013	B-3
TP4001	A-1
TP4002	C-2
TP4003	C-2
TP8003	A-4
TP8004	A-4
TP8008	D-7
TP8501	D-7
TP GND	C-2
TP GND	A-1
Adjustment	
C3031	A-6
C3032	A-7
C3035	B-7
C3036	B-7
C4017	C-1
VR3001	B-2
VR3005	A-7
VR3006	B-7
VR3007	B-7
VR3008	B-6
VR4001	A-2
T8501	D-7

ADDRESS INFORMATION

P41 (TO A/C AE HAED)

1	AUDIO ERASE
2	GND
3	AUDIO HEAD (R)
4	AUDIO HEAD (W)

P34 (TO MAIN)

1	ROTARY CTL	10	REG 5V
2	GND	11	VIDEO OUT (RF)
3	V. IN	12	9V
4	VSS	13	A.REC Ⓛ
5	———	14	AUDIO IN
6	GND	15	A. EE Ⓗ
7	V. OUT	16	A.MUTE Ⓗ
8	PB Ⓗ	17	AUDIO OUT
9	V. IN / OUT	18	A. REC 9V
10	GND	29	GND

P33 (TO MAIN)

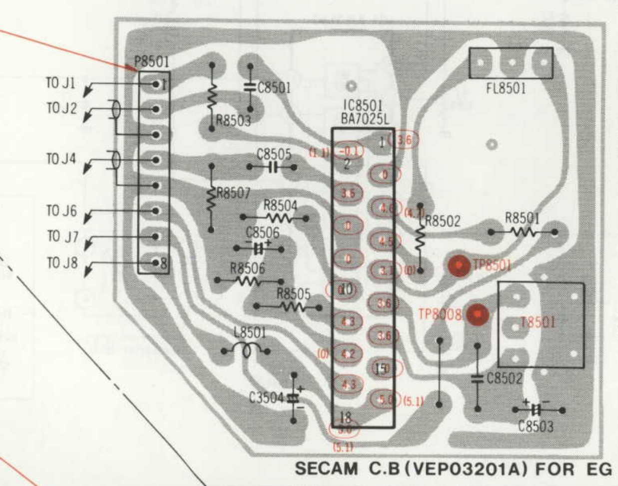
1	CURR EMPMA Ⓛ	9	EE 5V
2	DELAYED REC 9V	10	ENVE DETECT
3	———	11	V. LOCK. PULSE
4	HEAD SW	12	ART. H. SYNC
5	HEAD AMP SW	13	REC 5V
6	———	14	———
7	EXCEPT REC 5V	15	COLOR SW Ⓛ
8	PICTURE CTL	16	GND

P8501 (TO CHROMINANCE)

1	REC 5V
2	PB CHROMA
3	GND
4	REC CHROMA
5	GND
6	SECAM Ⓗ
7	BG. PULSE
8	REG 5V

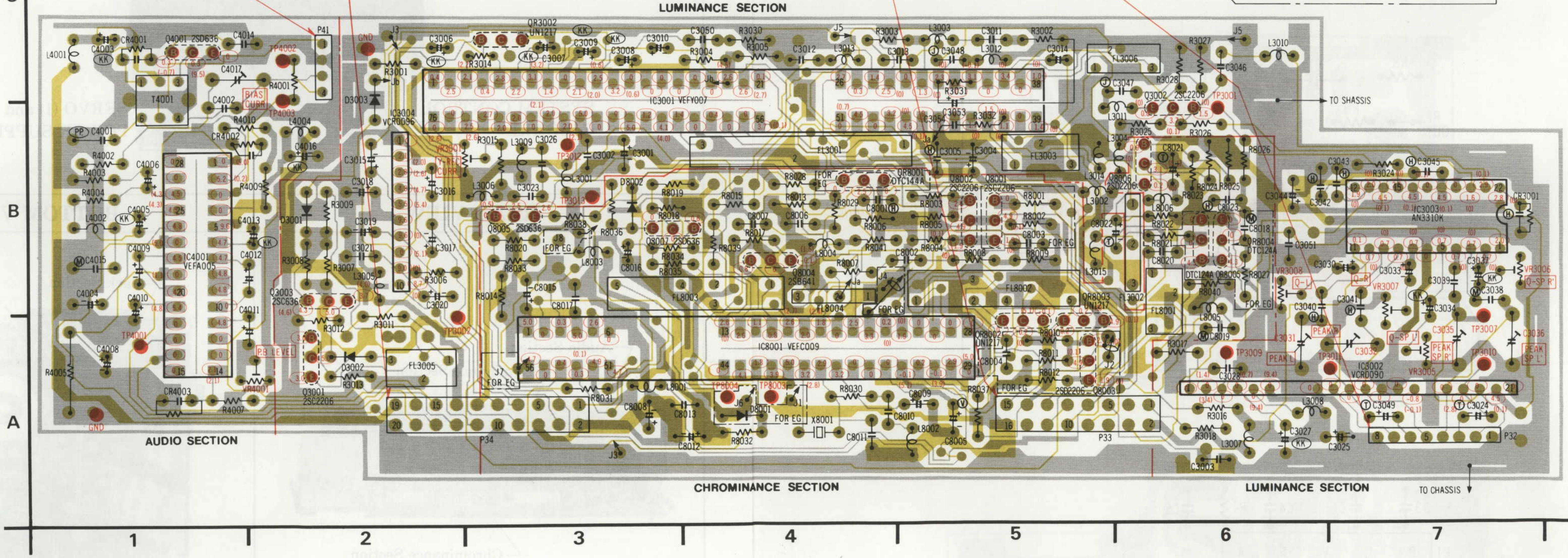
P32 (TO VIDEO HEAD)

1	GND
2	SP R' (S)
3	SP COM (F)
4	SP L' (S)
5	R (S)
6	COM (F)
7	L (S)
8	GND



SECAM C.B (VEP03201A) FOR EG

LUMINANCE SECTION



AUDIO SECTION

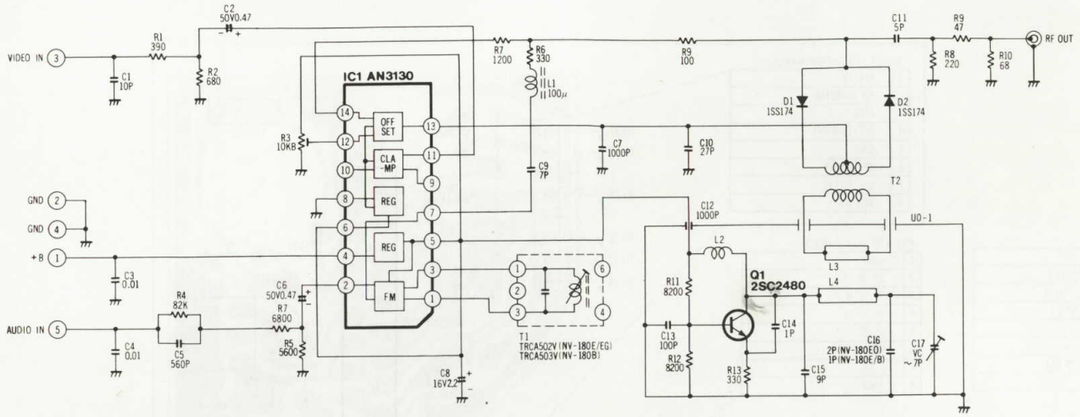
CHROMINANCE SECTION

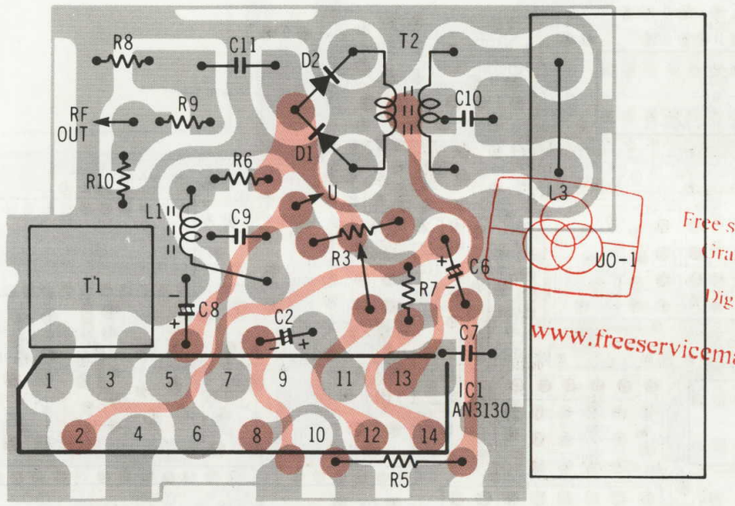
LUMINANCE SECTION

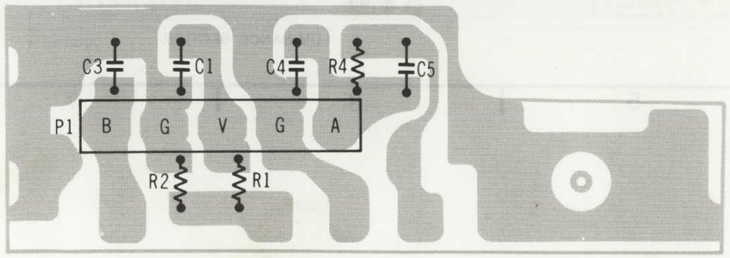
TO CHASSIS

3-16. RF CONVERTER SCHEMATIC DIAGRAM & CIRCUIT BOARD

—UNIT No. ENC17751— —UNIT No. ENC17752—



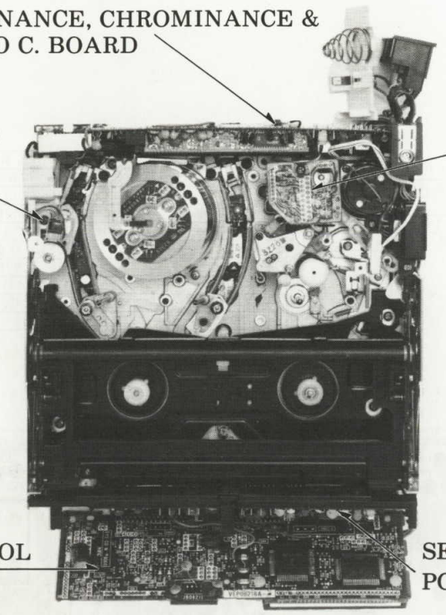




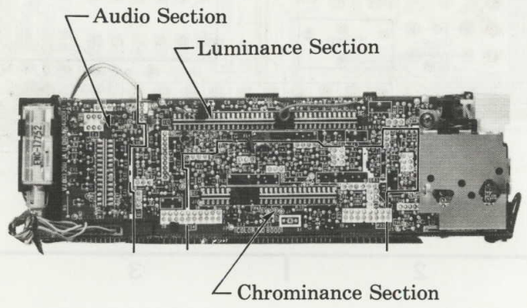
Back Page:
LUMINANCE, CHROMINANCE & AUDIO Section

3-17. CIRCUIT BOARD LAYOUT

TOP VIEW

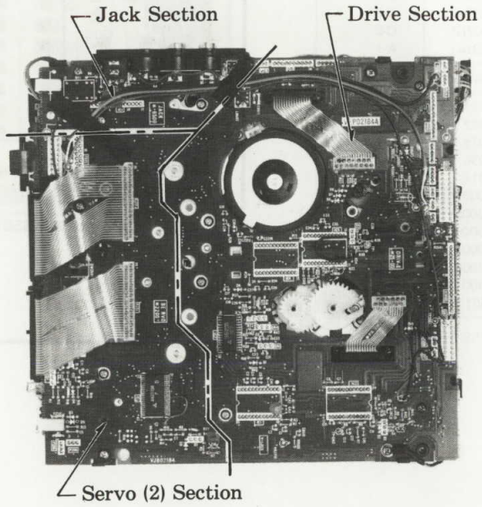


REAR VIEW



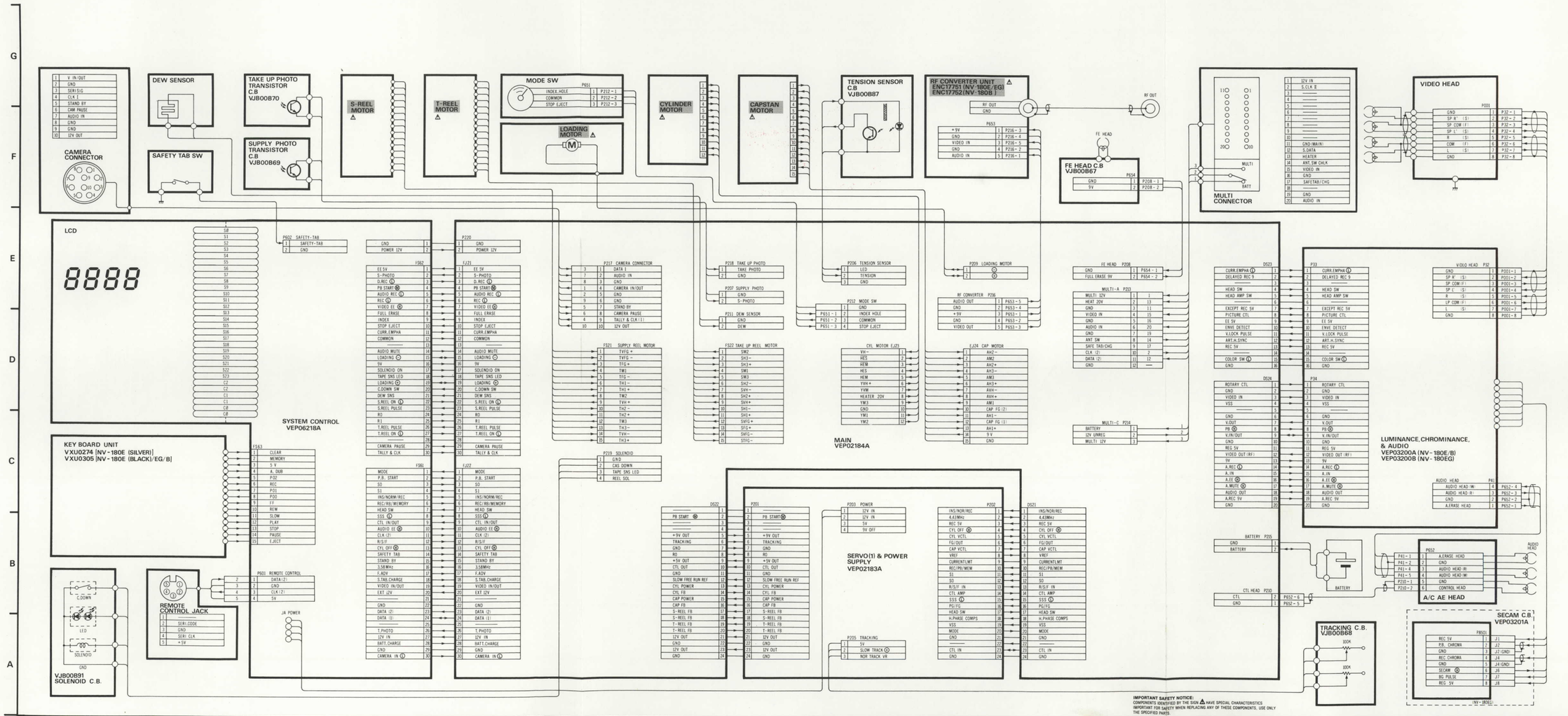
[LUMINANCE, CHROMINANCE & AUDIO C. BOARD]

BOTTOM VIEW



[MAIN C. BOARD]

3-18. INTERCONNECTION SCHEMATIC DIAGRAM

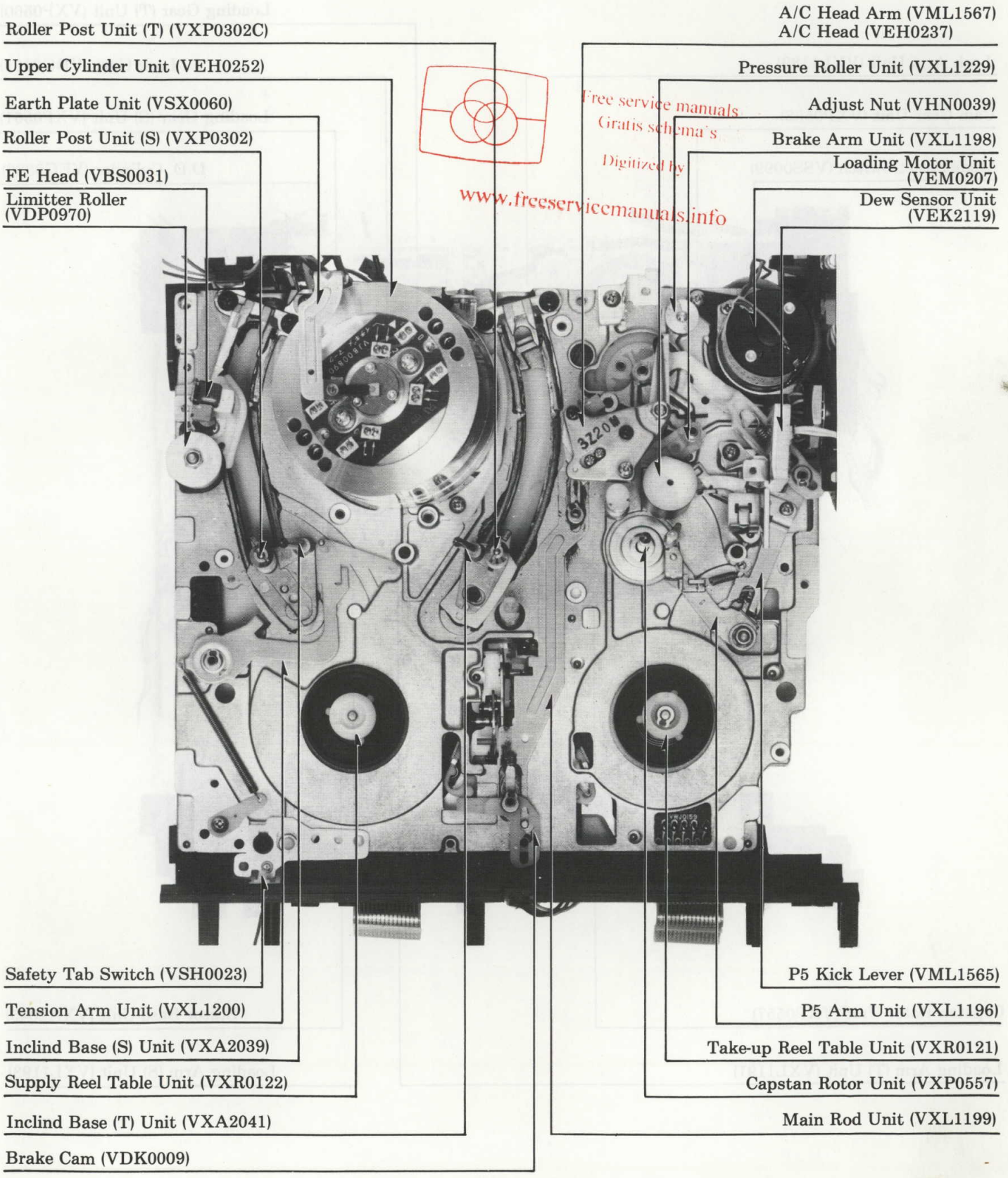


3—23

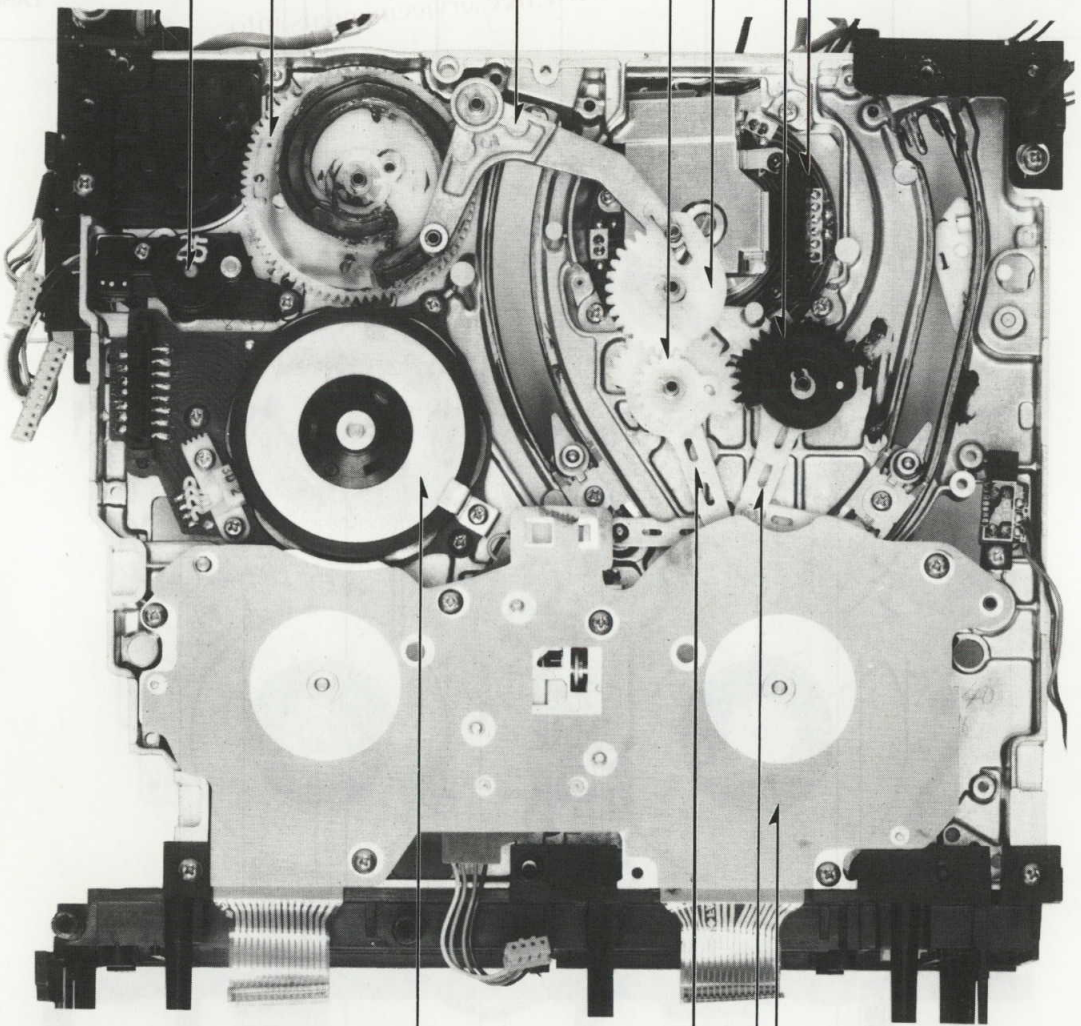
SECTION 4
EXPLODED VIEWS AND PARTS LIST

4-1. INNER PARTS LOCATION

TOP VIEW

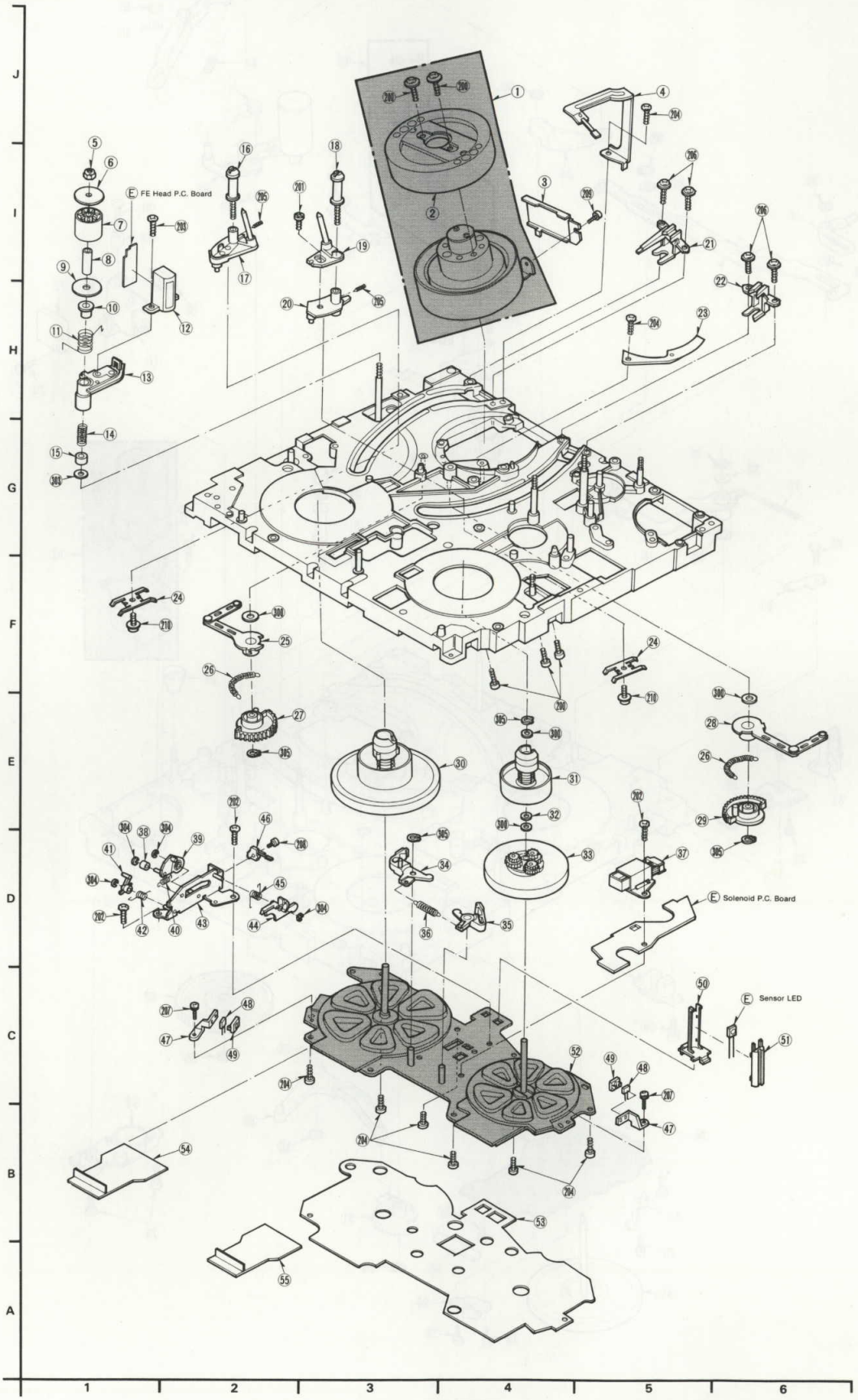


BOTTOM VIEW

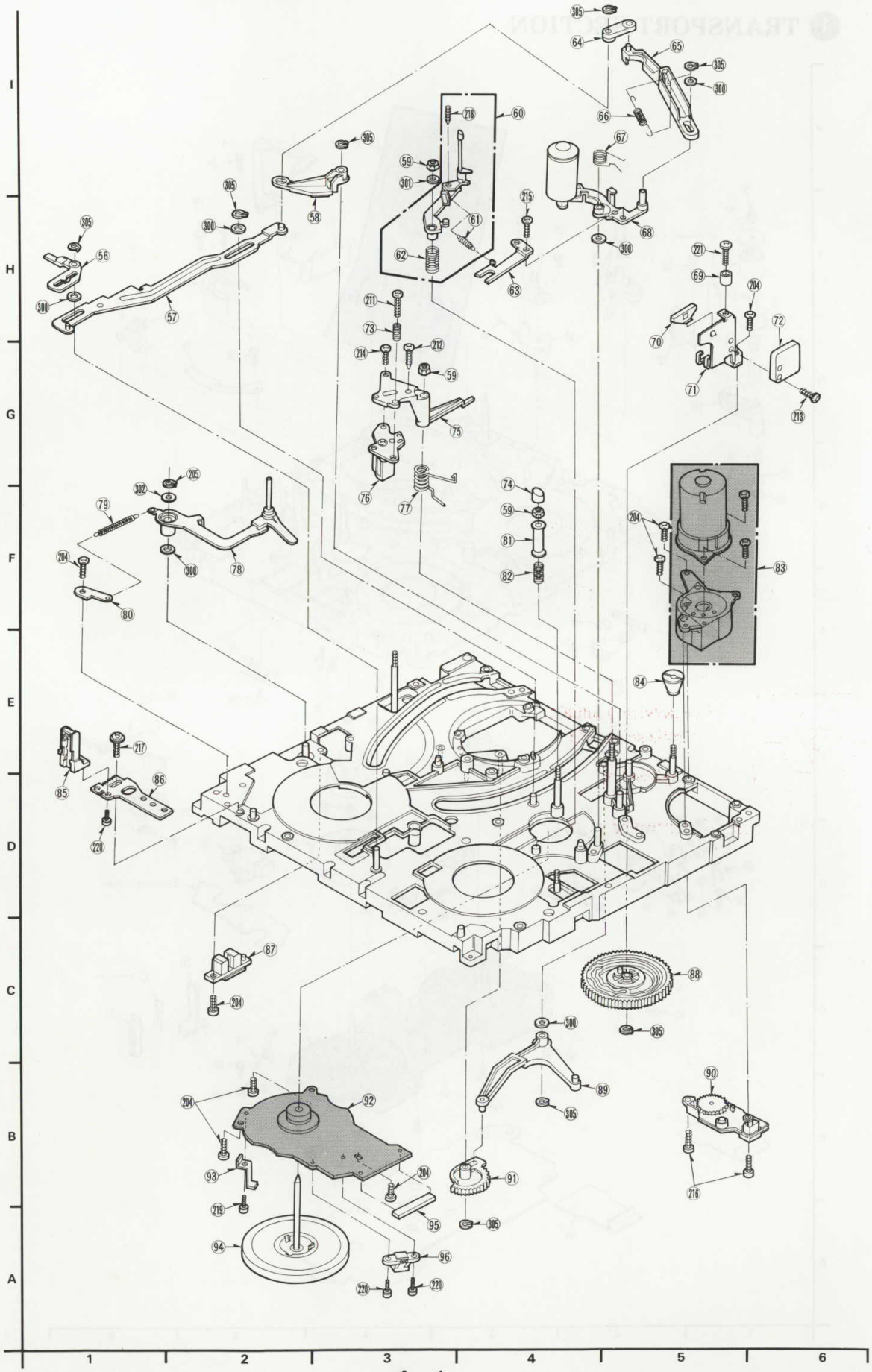


4-2. EXPLODED VIEW

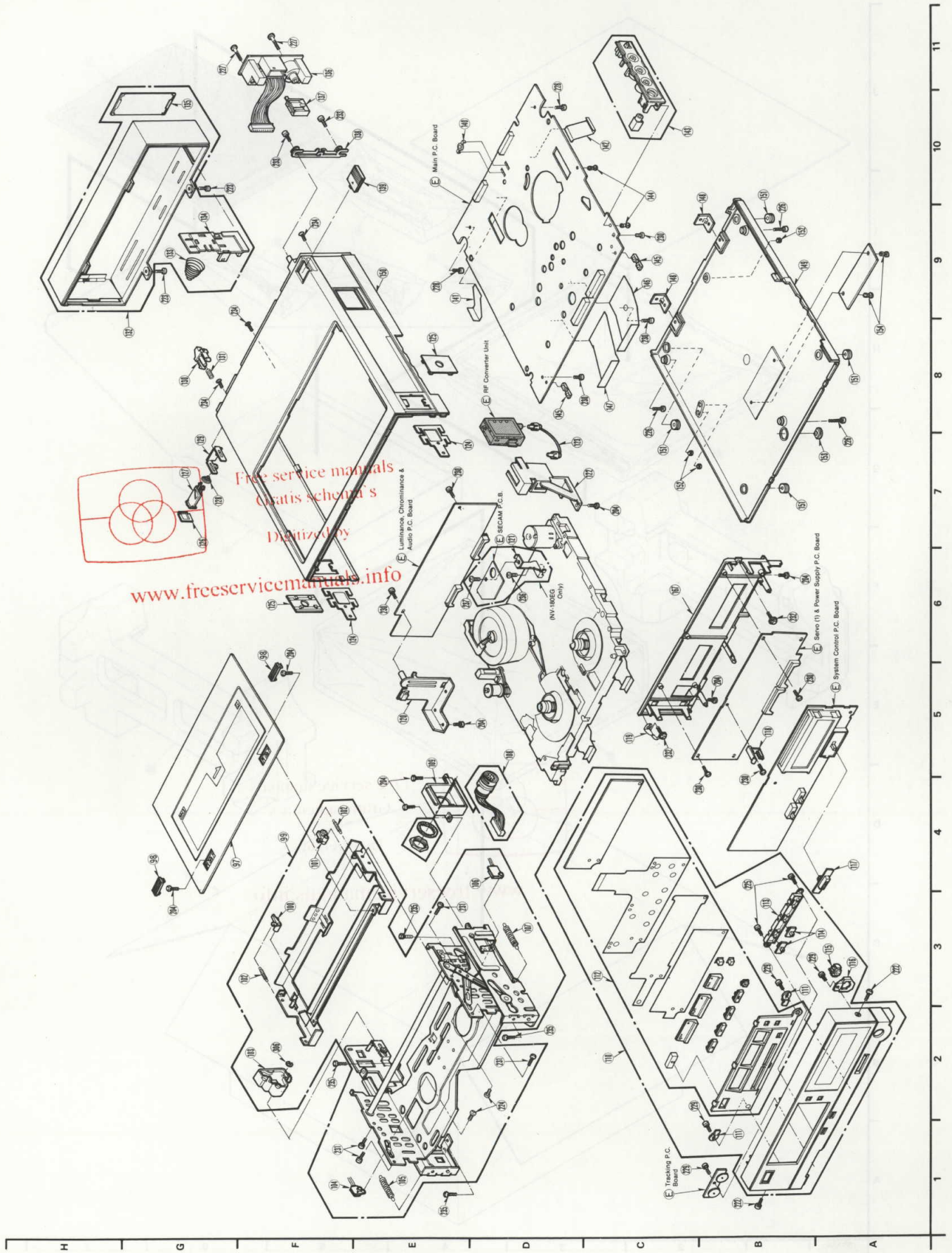
❶ TRANSPORT SECTION



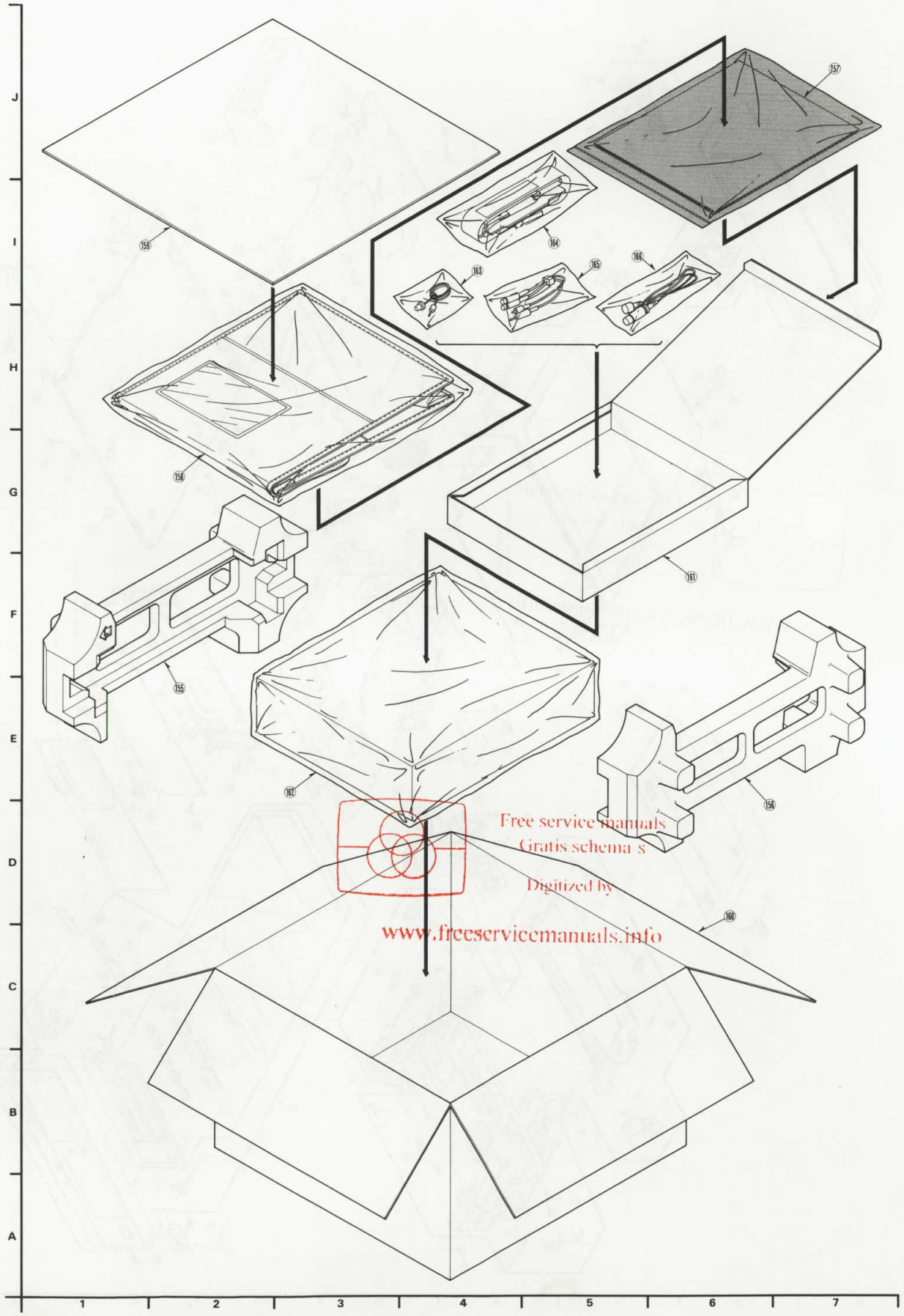
❷ MOVING MECHANISM SECTION



❸ CHASSIS PARTS, CASSETTE UP MECHANISM & CASING PARTS SECTION



4 PACKING PARTS SECTION



070-473561

4-3. MECHANICAL REPLACEMENT PARTS LIST

Notes: 1. * Be sure to make your orders of replacement parts according to this list.
2. IMPORTANT SAFETY NOTICE
Components identified with the mark ⚠ have the special characteristics for safety. When replacing any of these components, use only the same type.

Ref. No.		Part No.	Part Name & Description	Pcs / Set	Remarks
1(1)		VEG0336	Cylinder Unit	1	⚠
2(1)		VEH0252	Upper Cylinder Unit	1	
3(1)		VSC1142	Shield Board	1	
4(1)		VSX0060	Earth Plate Unit	1	
5(1)		VHN0023	Nut	1	
6(1)		VMX0692	Upper Limiter	1	
7(1)		VDP0970	Limiter Roller	1	
8(1)		VMX0288	Collar (B)	1	
9(1)		VMX0679	Lower Limiter	1	
10(1)		VDB0721	Limiter Stand	1	
11(1)		VMB1231	FE Head Lever Spring	1	
12(1)		VBS0031	FE Head	1	
13(1)		VML1569	FE Head Lever	1	
14(1)		VMB1239	Limiter Spring	1	
15(1)		VMX0680	Collar (A)	1	
16(1)		VXP0302A	Roller Post Unit (S)	1	
17(1)		VXA2039	Inclind Base (S) Unit	1	
18(1)		VXP0302C	Roller Post Unit (T)	1	
19(1)		VXA2041	Inclind Base (T) Unit	1	
20(1)		VXA2042	Shaft Holder (T) Unit	1	
21(1)		VMD0613	Post Stopper (S)	1	
22(1)		VMD0614	Post Stopper (T)	1	
23(1)		VMD0609	Inclind Support	1	
24(1)		VMA6422	Shaft Holder Plate	2	
25(1)		VXL1193	Loading Arm (S) Unit	1	
26(1)		VMB1232	Loading Spring	2	
27(1)		VXP0561	Loading Gear (S) Unit	1	
28(1)		VXL1191	Loading Arm (T) Unit	1	
29(1)		VXP0560	Loading Gear (T) Unit	1	
30(1)		VXR0122	Supply Reel Table Unit	1	
31(1)		VXR0121	Takeup Reel Table Unit	1	
32(1)		VMX0708D	Thrust Washer	1	
33(1)		VXP0564	Takeup Rotor Unit	1	
34(1)		VXZ0173	Main Brake (S) Unit	1	
35(1)		VXZ0174	Main Brake (T) Unit	1	
36(1)		VMB1241	Brake Spring	1	
37(1)		VJJ0066	Keep Solenoid	1	
38(1)		VDP0969	Lock Roller	1	
39(1)		VXA2035	Lock Board Unit	1	
40(1)		VMB1227	Lock Board Spring	1	
41(1)		VML1562	Lock Lever (B)	1	
42(1)		VMB1225	Lock Lever (B) Spring	1	
43(1)		VXA2034	Lock Plate Unit	1	
44(1)		VML1561	Lock Lever (A)	1	
45(1)		VMB1226	Lock Lever (A) Spring	1	
46(1)		VSH0019	Reef Switch	1	
47(1)		VMD0611	FG Support (1)	2	
48(1)		HW-300B	Hall IC	2	
49(1)		VMD0621	FG Support (2)	2	
50(1)		VMX0682	LED Holder (R)	1	
51(1)		VMX0683	LED Holder (L)	1	
52(1)		VXA2045	Stator Base Unit	1	⚠
53(1)		VMZ0565	Insulate Sheet	1	
54(1)		VWJ0158	Supply Reel Motor FPC	1	
55(1)		VWJ0159	Takeup Reel Moter FPC	1	
56(2)		VDK0009	Brake Cam	1	
57(2)		VXL1199	Main Rod Unit	1	
58(2)		VXL1198	Brake Arm Unit	1	
59(2)		VHN0023	Nut	3	
60(2)		VXL1196	P5 Arm Unit	1	
61(2)		VMB1237	Pin Pressure Spring	1	
62(2)		VMB1299	P5 Spring	1	

Ref. No.		Part No.	Part Name & Description	Pcs / Set	Remarks
63(2)		VML1565	P5 Kick Lever	1	
64(2)		VML1563	Guide Lever	1	
65(2)		VMM0130	Pinch Rod	1	
66(2)		VMB1228	Pressure Spring	1	
67(2)		VMB1238	Pinch Arm Spring	1	
68(2)		VXL1229	Pressure Roller Unit	1	
69(2)		VDB0740	Stopper Boss	1	
70(2)		VMA6413	Opener Cover	1	
71(2)		VMA6421	Opener Angle	1	
72(2)		VEK2119	Dew Sensor Unit	1	
73(2)		VMB0935	Adjust Spring	1	
74(2)		VMD0619	P4 Post Cap	1	
75(2)		VML1567	A/C Head Arm	1	
76(2)		VEH0237	A/C Head	1	
77(2)		VMB1240	A/C Head Height Spring	1	
78(2)		VXL1200	Tension Arm Unit	1	
79(2)		VMB1230	Tension Arm Spring	1	
80(2)		VMD0604	Tension Arm Spring Tie (C)	1	
81(2)		VMX0681	Post Sleeve	1	
82(2)		VMB1239	Limiter Spring	1	
83(2)		VEM0207	Loading Motor Unit	1	⚠
84(2)		VHN0039	Adjust Nut	1	
85(2)		VSH0023	Safety Tab Switch	1	
86(2)		VMA6414	Safety Tab Base	1	
87(2)		VEK2116	Tension Sensor Unit	1	
88(2)		VXP0562	Cam Gear Unit	1	
89(2)		VXL1189	Lock Arm Unit	1	
90(2)		VSS0099	Mode Select SW	1	
91(2)		VDG0161	Lock Gear	1	
92(2)		VEK2113	Capstan Stator Unit	1	⚠
93(2)		VMA6470	Stopper	1	
94(2)		VXP0557	Capstan Rotor Unit	1	
95(2)		VJS1403	Capstan Stator Connector	1	
96(2)		VBK0041	MR. FG Sensor	1	
97(3)		VGP1002	Cassette Cover	1	NV-180E(Silver)
97(3)		VGP1051	Cassette Cover	1	NV-180E(Black)/EG/B
98(3)		VGK1212	Cassette Cover Cap	2	NV-180E(Silver)
98(3)		VGK1222	Cassette Cover Cap	2	NV-180E(Black)/EG/B
99(3)		VXA2037	Cassette Compartment Unit	1	
100(3)		VXL1225	Cassette Pressure Lever	1	
			(L)		
101(3)		VXL1226	Cassette Pressure Lever	1	
			(R)		
102(3)		VMB1222	Cassette Support Spring	2	
103(3)		VDG0169	Damper	1	
104(3)		VXA2121	Supply Photo Tr Unit	1	
105(3)		VMB1224	Holder Spring (L)	1	
106(3)		VXA2122	Takeup Photo Tr Unit	1	
107(3)		VMB1223	Holder Spring (R)	1	
108(3)		VEK2118	Camera Connector Unit	1	
109(3)		VJH0295	Camera Terminal	1	
110(3)		VYP0980	Front Panel Unit	1	NV-180E(Silver)
110(3)		VYP1065	Front Panel Unit	1	NV-180E(Black)/EG/B
111(3)		VMA6402	Key Board Support Angle	2	
112(3)		VXU0274	Key Board Unit	1	NV-180E(Silver)
112(3)		VXU0305	Key Board Unit	1	NV-180E(Black)/EG/B
113(3)		VGQ0664	Mode Select Knob Angle	1	
114(3)		VGU1170	Mode Select Knob	2	NV-180E(Silver)
114(3)		VGU1571	Mode Select Knob	2	NV-180E(Black)/EG/B
115(3)		VEK2123	Remote Control Jack Unit	1	
116(3)		VGQ0608	Remote Control Jack Mount	1	
			Angle		
117(3)		VGU1292	Power Switch Button Unit	1	
118(3)		VJF0188	P. C. Board Support Piece	1	
119(3)		VMC0055	Earth Spring (A)	1	
120(3)		VMD0600	Back Frame (L)	1	

Ref. No.		Part No.	Part Name & Description	Pcs / Set	Remarks
121(3)		VMA6489	SECAM P. C. Board Angle	1	NV-180EG
122(3)		VMD0599	Back Frame (R)	1	
123(3)		VEE0991	RF Converter Cable Unit	1	
124(3)		VMA6401	Belt Support Angle	2	
125(3)		VGK1211	Belt Holder	2	
126(3)		VGU1348	Battery Eject Button (A)	1	
127(3)		VGQ0614	Battery Eject Button (B)	1	
128(3)		VMB1220	Battery Eject Spring	1	
129(3)		VMA6400	Eject Button Angle	1	
130(3)		VGQ0609	Battery Stopper	1	
131(3)		VMB1221	Battery Stopper Spring	1	
132(3)		VYK0690	Battery Case Unit	1	NV-180E(Silver)
132(3)		VYK0763	Battery Case Unit	1	NV-180E(Black)/EG/B
133(3)		VMB1219	Battery Spring	1	
134(3)		VJF0189	Battery Catcher	1	
135(3)		VYF0443	Multi Door Unit	1	
136(3)		VEK2195	Multi Connector Unit	1	
137(3)		VEK2192	Multi Switch Unit	1	
138(3)		VMP0450	Multi Jack Angle	1	
139(3)		VKF0332	RF Converter Cover	1	NV-180E(Silver)
139(3)		VKF0426	RF Converter Cover	1	NV-180E(Black)/EG/B
140(3)		VMX0699	Spacer	1	
141(3)		VWJ0157	Main Board FPC (A)	1	
142(3)		VWJ0155	Main Board FPC (B)	1	
143(3)		VEJ0330	Jack Board Unit	1	
144(3)		VHN0011	Rivet	2	
145(3)		VKC0124	Hinge	2	
146(3)		VWJ0161	Main Board FPC (C)	1	
147(3)		VWJ0160	Main Board FPC (D)	1	
148(3)		VMA6399	Bottom Case Angle	2	
149(3)		VKM0347	Bottom Case	1	
150(3)		VKM0267	Top Case	1	NV-180E(Silver)
150(3)		VKM0346	Top Case	1	NV-180E(Black)/EG/B
151(3)		VKA0038	Foot Rubber	4	
152(3)		VMG0312	Rubber Cap (A)	3	
153(3)		VMG0318	Rubber Cap (B)	1	
154(3)		VHN0030	Rivet	2	
155(4)		VPN0984	Cushion (L)	1	
156(4)		VPN0983	Cushion (R)	1	
157(4)		VQF1203	Fan Bag Kit	1	NV-180E ⚠
157(4)		VQF1204	Fan Bag Kit	1	NV-180EG ⚠
157(4)		VQF1205	Fan Bag Kit	1	NV-180B ⚠
158(4)		VFC0032	Carrying Case	1	NV-180E(Silver)
158(4)		VFC0036	Carrying Case	1	NV-180E(Black)/EG/B
159(4)		VPN1095	Upper Cushion	1	
160(4)		VPG1663	Packing Case	1	NV-180E(Silver)
160(4)		VPG1769	Packing Case	1	NV-180E(Black)
160(4)		VPG1664	Packing Case	1	NV-180EG
160(4)		VPG1665	Packing Case	1	NV-180B
161(4)		VPK0360	Accessory Case	1	
162(4)		VPF0210	Polyethylene Bag	1	
163(4)		VBE0003	Earphone	1	
164(4)		VFB0053	Shoulder Belt	1	
165(4)		VJP1431	Audio Cable	1	
166(4)		VJA0130	DIN-RF Cable	2	
167(3)		VMD0598	Front Frame	1	
			Screws		
200(1)		VHD0081		5	
201(1)		VHD0162		1	
202(1,2)		XSN26+4		3	
203(1)		XTN26+6G		1	
204(1,2,3)		XTV26+6F		24	
205(1)		XXEV0004		2	
206(1)		XYE26+BF8FZ		4	
207(1)		XYN2+C4		2	

Ref. No.		Part No.	Part Name & Description	Pcs / Set	Remarks
208(1)		XYN2+E6		1	
209(1)		XYN2+F5		1	
210(1)		XYN26+F5		1	
211(2)		VHD0077		1	
212(2)		VHD0144		1	
213(2)		XSN26+8		1	
214(2)		XSN26+8FZ		1	
215(2)		XSN26+4		1	
216(2)		XTV26+8F		2	
217(2)		XYE26+BF6FZ		1	
218(2)		XYE2C3FP		1	
219(2)		XYN26+C4		1	
220(2)		XYN26+C5		3	
221(2)		XTN26+10F		1	
222(3)		XTB26+4FFC		2	NV-180E(Silver)
222(3)		XTB26+4FFZ		2	NV-180E(Black)/EG/B
223(3)		XTB26+4FFZ		2	
224(3)		XTN2+6G		2	
225(3)		XTS23+6J		2	
226(3)		XTV26+10FFZ		4	
227(3)		XTV26+12FFZ		2	
228(3)		XTV26+6FR		2	
229(3)		XTV26+6J		4	
230(3)		XTV26+6JR		8	
231(3)		XYN26+C6		4	
232(3)		XYN26+F6		2	
233(3)		XTV26+6S		2	
234(3)		XSS26+5		3	
235(3)		XYE26+BF8		4	
236(3)		XTV26+6F		1	NV-180EG
237(3)		XTV26+6FR		1	NV-180EG
			Washers & Rings		
300(1,2)		XWGV3D6G		11	
301(2)		XWGV3D5G		1	
302(2)		XWGV3D7G		1	
303(1)		XUC15FP		4	
304(1,2)		XUEV3VW		13	
305(3)		XUC25FP		1	

4-4. ELECTRICAL REPLACEMENT PARTS LIST

Notes: 1. • Be sure to make your orders of replacement parts according to this list.
2. IMPORTANT SAFETY NOTICE
Components identified with the mark ⚠ have the special characteristics for safety. When replacing any of these components, use only the same type.
3. Unless otherwise specified,
All resistors are in OHMS (Ω), 1/4W ± 5% carbon. K=1,000Ω, M=1,000KΩ. All capacitors are in MICROFARADS (μF), ± 10% P=μμF.

Ref. No.		Part No.	Part Name & Description	Pcs / Set	Remarks
		VEP02183A	Servo (1) & Power Supply	1	
			Board Unit		
		VEP02184A	Main [Servo (2), Drive,	1	
			Jack & Picture VR] P.C.		
			Board		
		VEP03200A	Luminance, Chrominance &	1	NV-180E/B
			Audio P.C. Board Unit		
		VEP03200B	Luminance, Chrominance &	1	NV-180EG
			Audio P.C. Board Unit		
		VEP03201A	SECAM P.C. Board Unit	1	NV-180EG
		VEP06218A	System Control P.C. Board	1	
			Unit		
		ENC17751	RF Converter Unit	1	NV-180E/EG ⚠
		ENC17152	RF Converter Unit	1	NV-180B ⚠
		VJB00B67	FE Head P.C. Board	1	
		VJB00B68	Tracking P.C. Board	1	
		VJB00B87	Tension Sensor P.C. Board	1	
		VJB00B91	Solenoid P.C. Board	1	
			Miscellaneous		
		LN59	LED Sensor	1	
		VMX0682	LED Holder (R)	1	
		VMX0683	LED Holder (L)	1	
		XBA2C20TR0	Fuse 250V 2.0A	1	⚠
		VJF0188	P.C. Board Support Piece	1	
		VJH0295	Camera Terminal	1	
		VSC1184	Head Amp Shield Case (B)	1	
		VBS0031	FE Head	1	

Ref. No.		Part No.	Part Name & Description	Pcs / Set	Remarks
		VEP02183A	Servo (1) & Power Supply		
			P.C. Board Unit		
			(Power Supply Section)		
			Integrated Circuits		
IC1001		BA6149LS		1	Liner
IC1002		UN101		1	Switching ⚠
			Transistor		
Q1001		2SD992		1	(K,L,M)
			Combination Parts		
			(Transistor & Resistor)		
QR1001		DTC124A		1	or UN1212
			Diodes		
D1001-1003		MA165		3	
			Resistors		
R1002		ERDS2TJ222	2.2K	1	
R1003		ERDS2TJ103	10K	1	
R1004		ERDS2TJ222	2.2K	1	
R1005		ERDS2TJ223	22K	1	
R1006-1009		ERDS2TJ154	150K	4	
R1010		ERDS2TJ122	1.2K	1	
R1011		ERDS2TJ222	2.2K	1	
R1012,1013		ERDS2TJ122	1.2K	2	
R1014		ERDS2TJ821	820	1	
R1015		ERDS2TJ122	1.2K	1	
R1016,1017		ERDS2TJ153	15K	2	
R1019		ERDS2TJ681	680	1	
R1020		ERDS2TJ223	22K	1	
R1021		ERDS2TJ822	8.2K	1	
R1023		ERDS2TJ103	10K	1	
R1024		ERDS2TJ122	1.2K	1	
			Variable Resistor		
VR1003		EVML3GA00B14	10K	1	
			Capacitors		
C1001		ECCF1H820K	Ceramic 50V 470P	1	
C1002		ECKF1H561K	Ceramic 50V 560P	1	
C1004		ECEA1HKS010	Electrolytic 50V 1	1	
C1005,1006		ECEA1CK101	Electrolytic 16V 100	2	
C1007		VCYE1E473MR	Semiconductor 25V 0.047	1	
C1008		ECKF1H103ZF	Ceramic 50V 0.01	1	
C1010-1013		ECEA1HKS010	Electrolytic 50V 1	4	
C1014		ECEA1AK221	Electrolytic 10V 220	1	
C1015		ECKF1H221KB	Ceramic 50V 220P	1	
C1017		ECEA1AK221	Electrolytic 10V 220	1	

Ref. No.		Part No.	Part Name & Description	Pcs / Set	Remarks
C1018		ECEA0JKS330	Electrolytic 6.3V 33	1	
C1019		ECEA1AK221	Electrolytic 10V 220	1	
C1020		ECKF1H181KB	Ceramic 50V 180P	1	
C1022		ECEA1AK221	Electrolytic 10V 220	1	
C1023-1027		ECEA1CK101	Electrolytic 16V 100	5	
			Coils		
L1001		VLQ0128		1	
L1002		VLQ0129	290μH	1	
L1003		VLQ0128		1	
L1004		VLQ0129	290μH	1	
L1005		VLQ0128		1	
L1006-1009		VLQ0129	290μH	4	
			Combination Parts		
			(Capacitor & Resistor)		
CR1001		EXED561K473C	560P 47K	1	
			Crystal Oscillator		
X1001		VSX0136		1	
			(Servo (1) Section)		
			Integrated Circuits		
IC2001		AN3615K		1	
IC2002		μPC1516CA		1	
IC2003		VCR0094		1	
			Transistors		
Q2001,2002		2SA1115		2	(E,F)
Q2003		2SD636		1	(Q,R,S)
			Combination Parts		
			(Transistor & Resistor)		
QR2001,2002		DTC144A		2	or UN1213
QR2003		DTC124A		1	or UN1212
			Diode		
D2002		MA165		1	

Ref. No.		Part No.	Part Name & Description	Pcs / Set	Remarks
			Resistors		
R2001		ERDS2TJ562	5.6K	1	
R2002		ERDS2TJ273	27K	1	
R2003		ERDS2TJ272	2.7K	1	
R2004		ERDS2TJ560	56	1	
R2005		ERDS2TJ563	56K	1	
R2006		ERDS2TJ333	33K	1	
R2007,2008		ERDS2TJ154	150K	2	
R2009		ERDS2TJ124	120K	1	
R2010		ERDS2TJ222	2.2K	1	
R2011		ERDS2TJ123	12K	1	
R2012,2013		ERDS2TJ563	56K	2	
R2014		ERDS2TJ334	330K	1	
R2015		ERDS2TJ563	56K	1	
R2016,2017		ERDS2TJ332	3.3K	2	
R2018		ERDS2TJ224	220K	1	
R2019		ERDS2TJ273	27K	1	
R2020		ERDS2TJ563	56K	1	
R2021		ERDS2TJ564	560K	1	
R2022,2023		EROS2CKG2202	Metal 22K	2	
R2024		ERDS2TJ332	3.3K	1	
R2025		ERDS2TJ103	10K	1	
R2026		ERDS2TJ472	4.7K	1	
R2027		ERDS2TJ153	15K	1	
R2028,2029		ERDS2TJ103	10K	2	
R2030		ERDS2TJ470	47	1	
R2031		ERDS2TJ154	150K	1	
R2032		ERDS2TJ824	820K	1	
R2033		ERDS2TJ182	1.8K	1	
R2034		ERDS2TJ821	820	1	
R2035		ERDS2TJ152	1.5K	1	
R2036		ERDS2TJ563	56K	1	
R2038		ERDS2TJ563	56K	1	
			Variable Resistors		
VR2001,2002		EVML3GA00B15	100K	2	
VR2013		EVML3GA00B23	2K	1	
			Capacitors		
C2001		ECCF1H330K	Ceramic 50V 33P	1	
C2002		VCYE1E472MR	Semiconductor 25V 4700P	1	
C2003		ECEA1HSNR33	Electrolytic 50V 0.33	1	
C2004		ECEA0GKS470	Electrolytic 4V 47	1	
C2005		ECEA0GKS101	Electrolytic 4V 100	1	
C2006		ECEA1CKS100	Electrolytic 16V 10	1	
C2007		ECQB1H273KZ	Mylar 50V 0.027	1	
C2008,2009		ECEA0JKS101	Electrolytic 6.3V 100	2	
C2010		ECEA1HKS010	Electrolytic 50V 1	1	
C2011,2012		ECQV1H473JZ	Mylar 50V 0.047	2	
C2013		ECQB1H103KH	Mylar 50V 0.01	1	
C2014		ECQB1H472KH	Mylar 50V 4700P	1	
C2015		VCYE1C223MR	Semiconductor 16V 0.022	1	
C2016		ECEA0JKS470	Electrolytic 6.3V 47	1	
C2017		ECSF16ER27	Tantalum 16V 0.27	1	
C2018-2020		ECEA0JKS220	Electrolytic 6.3V 22	3	
C2021		VCYE1E332MR	Semiconductor 25V 3300P	1	
C2022		ECEA1HKSR47	Electrolytic 50V 0.47	1	
C2023		ECEA1HSNR33	Electrolytic 50V 0.33	1	
C2024		ECQV1H683JZ	Mylar 50V 0.068	1	
C2025		ECEA1HKS010	Electrolytic 50V 1	1	
C2026		VCYE1E472MR	Semiconductor 25V 4700P	1	
C2027		ECEA1CKS100	Electrolytic 16V 10	1	
C2028		ECEA1HSNR33	Electrolytic 50V 0.33	1	

Ref. No.	Part No.	Part Name & Description	Pcs / Set	Remarks
C2029	ECEA1HKS010	Electrolytic 50V 1	1	
C2030	ECQB1H103KH	Mylar 50V 0.01	1	
C2031	VCYE1C473MR	Semiconductor 16V 0.047	1	
C2032	ECQB1H562KH	Mylar 50V 5600P	1	
C2033	ECEA0JKS101	Electrolytic 6.3V 100	1	
C2034	ECQB1H273KZ	Mylar 50V 0.027	1	
		Crystal Oscillator		
X2001	VSX0131		1	
		Connectors		
P201,202	VJP1411	12P	2	
P203	VJP1244	4P	1	
	VEP02184A	Main [Servo (2), Drive, Jack & Picture VR] P.C. Board Unit		
		(Servo (2) Section)		
		Integrated Circuit		
IC2201	AN3715S		1	
		Transistor		
Q2201	2SC2603		1	(E2F)
		Diodes		
D2201	MA156		1	
D2203,2204	MA165		2	
D2206	MA165		1	
		Resistors		
R2201,2202	ERDS2TJ473	47K	2	
R2203	ERDS2TJ564	560K	1	
R2204	ERDS2TJ474	470K	1	
R2206	ERDS2TJ273	27K	1	
R2207	ERDS2TJ153	15K	1	
R2208	ERDS2TJ823	82K	1	
R2209	ERDS2TJ104	100K	1	
R2210	ERDS2TJ103	10K	1	

Ref. No.	Part No.	Part Name & Description	Pcs / Set	Remarks
R2211	ERDS2TJ333	33K	1	
R2212	ERDS2TJ124	120K	1	
R2213	ERDS2TJ563	56K	1	
R2214	ERDS2TJ332	3.3K	1	
R2215	ERDS2TJ564	560K	1	
R2216	ERDS2TJ271	270	1	
R2218	ERDS2TJ124	120K	1	
R2222	ERDS2TJ274	270K	1	
		Variable Resistors		
VR2210,2211	EVN3ACA00B15	100K	2	
		Capacitors		
C2201	ECQB1H562KH	Mylar 50V 5600P	1	
C2202	ECQB1H332KH	Mylar 50V 3300P	1	
C2203	ECQB1H682KH	Mylar 50V 6800P	1	
C2204	ECSF16ER47X	Tantalum 16V 0.47	1	
C2205	ECQB1H103KH	Mylar 50V 0.01	1	
C2206	VCYE1C103MR	Semiconductor 16V 0.01	1	
C2207	ECEA1HKS010	Electrolytic 50V 1	1	
C2208	VCYE1C333MR	Semiconductor 16V 0.033	1	
C2209	ECEA0GKS470	Electrolytic 6.3V 47	1	
C2210-2212	ECEA1EKK010	Electrolytic 25V 1	3	
C2213	VCYE1C333MR	Semiconductor 16V 0.033	1	
C2214,2215	VCYE1C103MR	Semiconductor 16V 0.01	2	
C2216	ECQV1H104JZ	Mylar 50V 0.1	1	
		(Drive Section)		
		Integrated Circuits		
IC2501	AN3830K		1	
IC2502	AN3810K		1	
IC2503	AN3620S		1	
IC2504	AN3830K		1	
IC2505	AN3821K		1	
		Transistors		
Q2501	2SC2603		1	(E2F)
Q2502	2SB641		1	(Q,R,S)
Q2503	2SA1115		1	(E,F)
		Combination Parts (Transistor & Resistor)		
QR2501	DTA114A		1	or UN1111
QR2503,2504	DTC144A		2	or UN1213
		Diodes		
D2501,2502	MA165		2	
D2503	MA154WA		1	
D2504	MA165		1	
D2506-2510	MA165		5	

Ref. No.		Part No.	Part Name & Description	Pcs / Set	Remarks
			Resistors		
R2501		ERDS2TJ120	12	1	
R2502		ERDS2TJ102	1K	1	
R2503		ERDS2TJR56	0.56	1	
R2505		ERDS2TJR56	0.56	1	
R2506		ERDS2TJ333	33K	1	
R2507		ERDS2TJ124	120K	1	
R2508		ERDS2TJ104	100K	1	
R2509		ERDS2TJ6R8	6.8	1	
R2510		ERDS2TJ332	3.3K	1	
R2511		ERDS2TJ101	100	1	
R2512		ERDS2TJ332	3.3K	1	
R2513		ERDS2TJ103	10K	1	
R2514		ERDS2TJ682	6.8K	1	
R2515		ERDS2TJ334	330K	1	
R2516		ERDS2TJ223	22K	1	
R2517		ERDS2TJ333	33K	1	
R2518		ERDS2TJ563	56K	1	
R2519		ERDS2TJ683	68K	1	
R2520		ERDS2TJ223	22K	1	
R2521		ERDS2TJ123	12K	1	
R2522		ERDS2TJ221	220	1	
R2524		ERDS2TJ561	560	1	
R2525		ERDS2TJR56	0.56	1	
R2526		ERDS2TJ120	12	1	
R2527,2528		ERDS2TJ224	220K	2	
R2529		ERDS2TJ104	100K	1	
R2530		ERDS2TJ223	22K	1	
R2531		ERDS2TJ103	10K	1	
R2532		ERDS2TJR68	0.68	1	
R2533		ERDS2TJ332	3.3K	1	
R2534		ERDS2TJ223	22K	1	
R2535		ERDS2TJ224	220K	1	
R2536		ERDS2TJ221	220	1	
R2537		ERDS2TJ820	82	1	
R2540		ERDS2TJ820	82	1	
R2542		ERDS2TJ153	15K	1	
R2543		ERDS2TJ563	56K	1	
R2544,2545		ERDS2TJ6R8	6.8	2	
R2546		ERDS2TJ563	56K	1	
			Capacitors		
C2501,2502		ECEA1EKK010	Electrolytic 25V 1	2	
C2503-2505		ECEA1EKK4R7	Electrolytic 25V 4.7	3	
C2506		ECEA1CKS470	Electrolytic 16V 47	1	
C2507,2508		VCYE1C103MR	Semiconductor 16V 0.01	2	
C2509-2511		ECEA1VSN2R2	Electrolytic 35V 2.2	3	
C2512		ECEA1EKK3R3	Electrolytic 25V 3.3	1	
C2513		ECQB1H682KH	Mylar 50V 6800P	1	
C2514		ECQB1H123KZ	Mylar 50V 0.012	1	
C2515		ECEA1EKKR22	Electrolytic 25V 0.22	1	
C2516		ECEA0GKS470	Electrolytic 4V 47	1	
C2517		ECEA1EKK010	Electrolytic 25V 1	1	
C2518		ECKF1H101KB	Ceramic 50V 100P	1	
C2520		ECQV1H473JZ	Mylar 50V 0.047	1	
C2521		ECEA0JKS470	Electrolytic 6.3V 47	1	
C2522		ECEA1EKKR22	Electrolytic 25V 0.22	1	
C2523		ECEA1EKK4R7	Electrolytic 25V 4.7	1	
C2524		ECEA1EKKR22	Electrolytic 25V 0.22	1	
C2525		ECEA1EKK4R7	Electrolytic 25V 4.7	1	
C2526,2527		ECEA1EKK010	Electrolytic 25V 1	2	
C2528-2530		ECEA1EKK4R7	Electrolytic 25V 4.7	3	
C2531		VCYE1C104MR	Semiconductor 16V 0.1	1	
C2532		ECEA1EKK010	Electrolytic 25V 1	1	

Ref. No.		Part No.	Part Name & Description	Pcs / Set	Remarks
C2533-2535		ECEA1VSN2R2	Electrolytic 35V 2.2	3	
C2536		ECEA1AKS470	Electrolytic 10V 47	1	
C2537		ECEA1CKK100	Electrolytic 16V 10	1	
C2538-2543		VCYE1C473MR	Semiconductor 16V 0.047	6	
C2545		ECEA1CKS470	Electrolytic 16V 47	1	
C2546		VCYE1C103MR	Semiconductor 16V 0.01	1	
C2547		ECKF1H472ZF	Ceramic 50V 4700P	1	
			Coil		
L2501		VLQEL05F221K	220μH	1	
			Switch		
SW2501		ESD14126		1	
			Combination Parts		
			(Capacitor & Resistor)		
CR2501		EXED103Z183C	0.01 18K	1	
			(Picture VR Section)		
			Resistor		
R3501		ERDS2TJ682	6.8K	1	
			Variable Resistor		
VR3504		EVN3ACA00B24	20K	1	
			(Jack Section)		
			Integrated Circuit		
IC6501		VCR0095		1	
IC6502		VCR0092		1	
			Diodes		
D6501		ERC81004		1	
D6502,6503		MA165		2	
			Resistors		
R6501		ERDS2TJ750	75	1	
R6503		ERDS2TJ681	680	1	
R6504		ERDS2TJ750	75	1	
R6505		ERDS2TJ681	680	1	
R6506		ERDS2TJ472	4.7K	1	
R6507		ERDS2TJ104	100K	1	
R6508		ERDS2TJ331	330	1	
R6509		ERDS2TJ472	4.7K	1	
R6510		ERDS2TJ750	75	1	
R6511		ERDS2TJ392	3.9K	1	

Ref. No.	Part No.	Part Name & Description	Pcs / Set	Remarks
		Capacitors		
C6501	ECEA1EKK4R7	Electrolytic 25V 4.7	1	
C6502	ECEA0JKS470	Electrolytic 6.3V 47	1	
C6503	ECEA1CKS220	Electrolytic 16V 22	1	
C6504	ECEA1CKS100	Electrolytic 16V 10	1	
C6508	ECEA1EKK3R3	Electrolytic 25V 3.3	1	
C6509	ECQV1H153JZ	Mylar 50V 0.015	1	
C6510	ECEA1AKS330	Electrolytic 10V 33	1	
C6511	ECQV1H103JZ	Mylar 50V 0.01	1	
C6512	ECEA1AKS330	Electrolytic 10V 33	1	
		Coils		
L6501	VLQEL05F101	100μH	1	
L6503	EIR7QF004B	0.004μH	1	
		Combination Parts		
		(Capacitor & Resistor)		
CR6501	EXED391K472C	390P 4.7K	1	
		Relay		
RY6501	VSY2036		1	
		Connectors		
P205,206	VJP1243	3P	2	
P207-211	VJP1229	2P	5	
P212	VJP1231	4P	1	
P213	VJP1252	12P	1	
P214	VJP1243	3P	1	
P215	VJP1242	2P	1	
P216	VJP1232	5P	1	
P217	VJP1237	10P	1	
P218	VJP1229	2P	1	
P219	VJP1231	4P	1	
P220	VJP1242	2P	1	
		Miscellaneous		
	VHN0011	Rivet	2	
	VEP03200A/B	Luminance, Chrominance		
		Audio P.C. Board Unit		
		(Luminance Section)		

Ref. No.	Part No.	Part Name & Description	Pcs / Set	Remarks
		Integrated Circuit		
IC3003	AN3310K		1	
IC3002	VCR0090		1	
IC3004	VCR0096		1	
		P.C.B. Ass'y		
IC3001	VEFY007		1	
		Transistors		
Q3001,3002	2SC2206		2	(B,C)
Q3003	2SD636		1	(Q,R,S)
		Combination Circuit		
		(Transistor & Resistor)		
QR3002	UN1217		1	
		Diodes		
D3001-3003	MA165		3	
		Resistors		
R3001	ERDS2TJ332	3.3K	1	
R3002	ERDS2TJ122	1.2K	1	
R3003	ERDS2TJ472	4.7K	1	
R3004	ERDS2TJ474	470K	1	
R3005	ERDS2TJ394	390K	1	
R3006	ERDS2TJ561	560	1	
R3007	ERDS2TJ334	330K	1	
R3008	ERDS2TJ823	82K	1	
R3009	ERDS2TJ104	100K	1	
R3011	ERDS2TJ102	1K	1	
R3012	ERDS2TJ152	1.5K	1	
R3013	ERDS2TJ102	1K	1	
R3014	ERDS2TJ393	39K	1	
R3015	ERDS2TJ471	470	1	
R3016	ERDS2TJ823	82K	1	
R3017	ERDS2TJ331	330	1	
R3018	ERDS2TJ223	22K	1	
R3024	ERDS2TJ152	1.5K	1	
R3025	ERDS2TJ102	1K	1	
R3026	ERDS2TJ681	680	1	
R3027	ERDS2TJ121	120	1	
R3028	ERDS2TJ102	1K	1	
R3030	ERDS2TJ472	4.7K	1	
R3031	ERDS2TJ271	270	1	
R3032	ERDS2TJ153	15K	1	
		Variable Resistors		
VR3001	EVML3GA00B13	1K	1	
VR3005-3008	EVML3GA00B13	1K	4	

Ref. No.	Part No.	Part Name & Description	Pcs / Set	Remarks
		Capacitors		
C3001	ECEA0JK221	Electrolytic 6.3V 220	1	
C3002	VCYE1C473MR	Semiconductor 16V 0.047	1	
C3003	ECKF1H221KB	Ceramic 50V 220P	1	
C3004	ECEA0JK221	Electrolytic 6.3V 220	1	
C3005	VCYE1C473MR	Semiconductor 16V 0.047	1	
C3006	ECEA1EKK3R3	Electrolytic 25V 3.3	1	
C3007	ECEA1EKK4R7	Electrolytic 25V 4.7	1	
C3008	ECEA1EKK2R2	Electrolytic 25V 2.2	1	
C3009	ECEA1EKK3R3	Electrolytic 25V 3.3	1	
C3010	ECEA0JKS220	Electrolytic 6.3V 22	1	
C3011	ECCF1H680K	Ceramic 50V 68P	1	
C3012	ECCF1H220K	Ceramic 50V 22P	1	
C3013	ECKF1H271J	Ceramic 50V 270P	1	
C3014	ECEA1EKK3R3	Electrolytic 25V 3.3	1	
C3015	ECEA0JKS220	Electrolytic 6.3V 22	1	
C3016,3017	ECEA0JK221	Electrolytic 6.3V 220	2	
C3018,3019	ECEA1AJS330	Electrolytic 10V 33	2	
C3020	ECEA1AKS220	Electrolytic 10V 22	1	
C3021	ECKF1H102KB	Ceramic 50V 1000P	1	
C3023	ECCF1H680K	Ceramic 50V 68P	1	
C3024	ECSF1CD105	Tantalum 16V 1	1	
C3025	ECEA1AKS330	Electrolytic 10V 33	1	
C3026	ECKF1H181KB	Ceramic 50V 180P	1	
C3027	ECEA1CKK100	Electrolytic 16V 10	1	
C3028	ECKF1H121KB	Ceramic 50V 120P	1	
C3030	ECEA1CKK100	Electrolytic 16V 10	1	
C3031,3032	ECV1ZW90X64	Trimmer 500V 90P	2	
C3033,3034	ECEA1CKK100	Electrolytic 16V 10	2	
C3035,3036	ECV1ZW90X64	Trimmer 500V 90P	2	
C3037	ECEA1CKK100	Electrolytic 16V 10	1	
C3038-3043	VCYE1C103MR	Semiconductor 16V 0.01	6	
C3044	ECEA0JKS470	Electrolytic 6.3V 47	1	
C3045	VCYE1C473MR	Semiconductor 16V 0.047	1	
C3046	ECKF1H151KB	Ceramic 50V 150P	1	
C3047	ECCF1H820J	Ceramic 50V 82P	1	
C3048	VCKF1H431J	Semiconductor 50V 430P	1	
C3049	ECSF1CD105	Tantalum 16V 1	1	
C3050	ECCF1H220K	Ceramic 50V 22P	1	
C3051	ECKF1H102KB	Ceramic 50V 1000P	1	
C3053	ECEA1CKK100	Electrolytic 16V 10	1	
C3054	ECCF1H050K	Ceramic 50V 5P	1	
		Coils		
L3001	VLQEL05F101K	100μH	1	
L3002	VLQEL05F471K	470μH	1	
L3003	VLQEL05F101K	100μH	1	
L3004	VLQEL05F471K	470μH	1	
L3005	VLQEL05F101K	100μH	1	
L3006	VLQEL05F820K	82μH	1	
L3007	VLQEL05F471K	470μH	1	
L3008	VLQEL05F270K	27μH	1	
L3009	VLQEL05F151K	150μH	1	
L3010	VLQEL05F180K	18μH	1	
L3011	VLQEL05F150K	15μH	1	
L3012	VLQEL05F151K	150μH	1	
L3013	VLQEL05F220K	22μH	1	
L3014,3015	VLQEL05F150K	15μH	2	

Ref. No.	Part No.	Part Name & Description	Pcs / Set	Remarks
		Combination Parts		
		(Capacitor & Resistor)		
CR3001	EXED473M683C	0.047 68K	1	
		Filters		
FL3001	VLF0311		1	
FL3002	VLD0065		1	
FL3003	VLF0312		1	
FL3005	VLF0316		1	
FL3006	VLF0312		1	
		(Audio Section)		
		P.C.B. Ass'y		
IC4001	VEFA005		1	
		Transistor		
Q4001	2SD636		1	(Q,R)
		Resistors		
R4001	ERDS2TJ100	10	1	
R4002	ERDS2TJ153	15K	1	
R4003	ERDS2TJ332	3.3K	1	
R4004	ERDS2TJ470	47	1	
R4005	ERDS1TJ335S	3.3M	1	
R4007	ERDS2TJ563	56K	1	
R4009	ERDS2TJ103	10K	1	
R4010	ERDS2TJ104	100K	1	
		Variable Resistor		
VR4001	EVML3GA00B23	2K	1	
		Capacitors		
C4001	ECQP1102JZ	Mylar 100V 1000P	1	
C4002	ECCD2H270K	Ceramic 500V 27P	1	
C4003	ECEA1CKK100	Electrolytic 16V 10	1	
C4004	ECEA0JKS220	Electrolytic 6.3V 22	1	
C4005	ECEA1EKK010	Electrolytic 25V 1	1	
C4006	ECEA1CKS470	Electrolytic 16V 47	1	
C4008	ECEA0JKS470	Electrolytic 6.3V 47	1	
C4009	ECEA0JKS220	Electrolytic 6.3V 22	1	
C4010-4012	ECEA0JKS470	Electrolytic 6.3V 47	3	
C4013	ECEA1CKK100	Electrolytic 6.3V 10	1	
C4014	VCYE1E472MR	Semiconductor 25V 4700P	1	
C4015	ECQV1H333JZ	Mylar 50V 0.033	1	
C4016	ECEA1CKK100	Electrolytic 16V 10	1	
C4017	ECV1ZW60X64	Trimmer 500V 60P	1	
		Coils		
L4001	VLQEL05F101K	100μH	1	
L4002	VLQEL07F562J	5.6mH	1	
L4004	VLQEL05F101K	100μH	1	

Ref. No.	Part No.	Part Name & Description	Pcs / Set	Remarks
		Combination Parts		
		(Capcitor & Resistor)		
CR4001	EXED153M473C	0.015 47K	1	
CR4002	EXED122K473C	1200P 47K	1	
CR4003	EXED391K563	390P 56K	1	
		Transformer		
T4001	EIQ7QF005B		1	
		(Chrominance Section)		
		P.C.B. Ass'y		
IC8001	VEFC009		1	
		Transistors		
Q8001	2SC2206		1	(B,C) NV-180EG
Q8002	2SC2206		1	(B,C)
Q8003	2SC2206		1	(B,C) NV-180EG
Q8004	2SB641		1	(Q,R,S)
Q8005	2SD636		1	(Q,R,S)
Q8006	2SC2206		1	(B,C)
Q8007	2SD636		1	(Q,R,S)
		Combination Parts		
		(Transistor & Resistor)		
QR8001	DTC144A		1	or UN1213 NV-180EG
QR8002,8003	UN1217		2	
QR8004,8005	DTC124A		1	or UN1212 NV-180EG
		Diodes		
D8001,8002	MA165		2	
		Resistors		
R8001	ERDS2TJ103	10K	1	NV-180EG
R8002	ERDS2TJ393	39K	1	NV-180EG
R8003	ERDS2TJ333	33K	1	
R8004	ERDS2TJ332	3.3K	1	
R8005	ERDS2TJ393	39K	1	
R8006	ERDS2TJ681	680	1	
R8007	ERDS2TJ271	270	1	
R8008	ERDS2TJ821	820	1	
R8009	ERDS2TJ221	220	1	
R8010	ERDS2TJ473	47K	1	NV-180EG
R8011	ERDS2TJ104	100K	1	NV-180EG
R8012	ERDS2TJ102	1K	1	NV-180EG
R8013	ERDS2TJ562	5.6K	1	

Ref. No.	Part No.	Part Name & Description	Pcs / Set	Remarks
R8014	ERDS2TJ470	47	1	
R8015	ERDS2TJ122	1.2K	1	
R8017	ERDS2TJ102	1K	1	
R8018,8019	ERDS2TJ562	5.6K	2	
R8020	ERDS2TJ822	8.2K	1	
R8021	ERDS2TJ820	82	1	NV-180EG
R8022	ERDS2TJ151	150	1	
R8023	ERDS2TJ103	10K	1	
R8024	ERDS2TJ102	1K	1	
R8025	ERDS2TJ333	33K	1	
R8026	ERDS2TJ102	1K	1	
R8027	ERDS2TJ681	680	1	NV-180EG
R8028	ERDS2TJ123	12K	1	
R8029	ERDS2TJ105	1M	1	
R8030	ERDS2TJ182	1.8K	1	
R8031	ERDS2TJ123	12K	1	
R8032	ERDS2TJ103	10K	1	
R8033	ERDS2TJ333	33K	1	
R8034	ERDS2TJ273	27K	1	
R8035	ERDS2TJ821	820	1	
R8036	ERDS2TJ104	100K	1	
R8037	ERDS2TJ102	1K	1	
R8038	ERDS2TJ473	47K	1	
R8039,8040	ERDS2TJ102	1K	2	
R8041	ERDS2TJ561	560	1	
		Capacitors		
C8001,8002	VCYE1C103MR	Semiconductor 16V 0.01	2	
C8003,8004	VCYE1C103MR	Semiconductor 16V 0.01	2	NV-180EG
C8005	ECEA1CKK100	Electrolytic 16V 10	1	
C8006	ECQV1H223JZ	Mylar 50V 0.022	1	
C8007	VCYE1C103MR	Semiconductor 16V 0.01	1	
C8008,8009	ECEA0JKS470	Electrolytic 6.3V 47	2	
C8010	ECKF1H102KB	Ceramic 50V 1000P	1	
C8011	ECCF1H030CC	Ceramic 50V 3P	1	
C8012	ECEA0JK221	Electrolytic 6.3V 220	1	
C8013	VCYE1C473MR	Semiconductor 16V 0.047	1	
C8015	ECEA0JKS470	Electrolytic 6.3V 47	1	
C8016	ECEA1CKK100	Electrolytic 16V 10	1	
C8017	VCYE1C473MR	Semiconductor 16V 0.047	1	
C8018	ECQB1H182KH	Mylar 50V 1800P	1	
C8019	ECQB1H103KH	Mylar 50V 0.01	1	
C8020	VCYE1C103MR	Semiconductor 16V 0.01	1	
C8021	ECSF1VZ154	Tantalum 35V 0.15	1	
C8022	ECSF1VZ104	Tantalum 35V 0.1	1	NV-180EG
C8023	VCYE1C103MR	Semiconductor 16V 0.01	1	
		Coils		
L8001	VLQEL05F101K	100μH	1	
L8002	VLQEL05F470K	47μH	1	
L8003	VLQEL05F101K	100μH	1	
L8004	VLQEL05F150K	15μH	1	
L8005,8006	VLQEL05F681K	680μH	2	
		Filters		
FL8001	VLF0315		1	
FL8002	VLF0313		1	
FL8003	VLF0314		1	
FL8004	VLD0064		1	

Ref. No.	Part No.	Part Name & Description	Pcs / Set	Remarks
		Crystal Oscillator		
X8001	VSX0132		1	
		Connectors		
P32	VJP1235	8P	1	
P33	VJP1409	16P	1	
P34	VJP1410	20P	1	
P41	VJP1231	4P	1	
		Miscellaneous		
	VSC1195	Audio Shield Board	1	
	VSC1183	Head Amp Shield Case (A)	1	
	VSC1185	Head Amp Shield Case (C)	1	
	VMZ0581	Head Amp Shield Case	1	
		Barrier		
	VEP03201A	SECAM P.C. Board Unit		NV-180EG
		Integrated Circuit		
IC8501	BA7025L		1	
		Resistors		
R8501	ERDS2TJ103	10K	1	
R8502	ERDS2TJ102	1K	1	
R8503	ERDS2TJ223	22K	1	
R8504	ERDS2TJ390	39	1	
R8505	ERDS2TJ222	2.2K	1	
R8506	ERDS2TJ154	150K	1	
R8507	ERDS2TJ472	4.7K	1	
		Capacitors		
C8501	ECKF1H102KB	Ceramic 50V 1000P	1	
C8502	ECQV1H563JZ	Mylar 50V 0.056	1	
C8503,8504	ECEA0JKS470	Electrolytic 6.3V 47	2	
C8505	ECKF1H102KB	Ceramic 50V 1000P	1	
C8506	ECEA1AKS330	Electrolytic 10V 33	1	
		Coil		
L8501	VLQEL05F101K	100μH	1	

Ref. No.	Part No.	Part Name & Description	Pcs / Set	Remarks
		Filter		
FL8501	VLF0143		1	
		Connector		
P8501	VJP1235	8P	1	
	VEP06218A	System Control P.C. Board Unit		
		Integrated Circuits		
IC6001	MN1534VGA		1	
IC6002	μPD7503G		1	
IC6003	MN6283		1	
IC6004	BA6209U3		1	
IC6005	VCR0091		1	
IC6006	VCR0093		1	
		Transistors		
Q6001	2SD636		1	(Q,R,S)
Q6002	2SB819		1	(Q,R,S,A,U)
Q6003	2SD973		1	(Q,R,S)
Q6004	2SD636		1	(Q,R,S)
Q6005	2SB641		1	(Q,R,S)
Q6006-6008	2SD636		3	(Q,R,S)
Q6009	2SD992		1	(K,L,M)
Q6010	2SC2594		1	
Q6011	2SB774		1	
		Combination Parts (Transistor & Resistor)		
QR6001,6002	DTA124A		2	
QR6003	DTC124A		1	
QR6004	DTA124A		1	or UN1112
QR6005	DTC114A		1	or UN1211
QR6006	DTC144A		1	or UN1213
QR6007	DTC124A		1	or UN1212
		Diodes		
D6001	MA165		1	
D6002-6005	MA154WA		4	
D6006,6007	MA165		2	
D6008	MA4047		1	
D6009	10E1		1	
D6010-6013	MA165		4	

Ref. No.	Part No.	Part Name & Description	Pcs / Set	Remarks
D6014	10E1		1	
D6015	MA165		1	
D6016	10E1		1	
D6017,6018	MA165		2	
D6019,6020	MA154WA		2	
D6021	MA165		1	
D6023	MA165		1	
		Resistors		
R6001,6002	ERDS2TJ473	47K	2	
R6003	ERDS2TJ270	27	1	
R6004,6005	ERDS2TJ104	100K	2	
R6006	ERDS2TJ472	4.7K	1	
R6007	ERDS2TJ103	10K	1	
R6008	ERDS2TJ562	5.6K	1	
R6009	ERG1ANJ820	Metal Oxide 1W 82	1	
R6010	ERDS2TJ104	100K	1	
R6011	ERDS2TJ184	180K	1	
R6012	ERDS2TJ124	120K	1	
R6013	ERDS2TJ221	220	1	
R6014	ERDS2TJ102	1K	1	
R6015	ERDS2TJ103	10K	1	
R6016	ERDS2TJ683	68K	1	
R6017	ERDS2TJ104	100K	1	
R6018	ERDS2TJ472	4.7K	1	
R6019	ERDS2TJ224	220K	1	
R6020	ERDS2TJ474	470K	1	
R6021	ERDS2TJ222	2.2K	1	
R6022	ERDS2TJ103	10K	1	
R6023	ERDS2TJ823	8.2K	1	
R6024	ERDS2TJ681	680	1	
R6025	ERDS2TJ563	56K	1	
R6027	ERDS2TJ273	27K	1	
R6028	ERDS2TJ104	100K	1	
R6029,6030	ERDS2TJ153	15K	2	
R6031	ERDS2TJ221	220	1	
R6032	ERDS2TJ332	3.3K	1	
R6033,6034	ERDS2TJ271	270	1	
R6035	ERDS2TJ103	10K	1	
R6036	ERDS2TJ223	22K	1	
R6037	ERDS2TJ103	10K	1	
R6038,6039	ERDS2TJ563	56K	2	
R6040,6041	ERDS2TJ104	100K	2	
R6042	ERDS2TJ562	5.6K	1	
R6043,6044	ERDS2TJ103	10K	2	
R6045,6046	ERDS2TJ104	100K	2	
R6048	ERDS2TJ223	22K	1	
R6049	ERDS2TJ271	270	1	
R6050	ERDS2TJ184	180K	1	
R6051	ERDS2TJ474	470K	1	
R6052	ERDS2TJ223	22K	1	
R6053-6055	ERDS2TJ104	100K	3	
R6056	ERDS2TJ184	180K	1	
R6057,6058	ERDS2TJ103	10K	2	
R6059	ERDS2TJ222	2.2K	1	
R6060	ERDS2TJ473	47K	1	
R6061	ERDS2TJ104	100K	1	
R6063,6064	ERDS2TJ101	100	2	
R6065	ERDS2TJ223	22K	1	
R6066	ERDS2TJ472	4.7K	1	
R6067	ERDS2TJ473	47K	1	
R6068	ERDS2TJ102	1K	1	
R6069	ERDS2TJ223	22K	1	
R6070	ERDS2TJ123	12K	1	
R6071-6073	ERDS2TJ223	22K	3	

Ref. No.	Part No.	Part Name & Description	Pcs / Set	Remarks
		Variable Resistor		
VR6001	EVML3GA00B14	1K	1	
		Capacitors		
C6001	ECEA0JKS101	Electrolytic 6.3V 100	1	
C6002	ECKF1H103ZF	Ceramic 50V 0.01	1	
C6003	ECCF1H330KC	Ceramic 50V 33P	1	
C6004	ECFC1H100DC	Ceramic 50V 10P	1	
C6005	ECEA1H010	Electrolytic 50V 1	1	
C6006,6007	ECKF1H103ZF	Ceramic 50V 0.01	2	
C6008	ECEA1VSN2R2	Electrolytic 35V 2.2	1	
C6009-6012	ECEA1HKS010	Electrolytic 50V 1	4	
C6013-6015	ECKF1H103ZF	Ceramic 50V 0.01	3	
C6016	ECEA1CU471	Electrolytic 16V 470	1	
C6017	ECEA0GKS470	Electrolytic 4V 47	1	
C6018,6019	ECKF1H103ZF	Ceramic 50V 0.01	2	
C6020	ECEA1EKS4R7	Electrolytic 25V 4.7	1	
C6021	ECEA0JKS220	Electrolytic 6.3V 22	1	
C6022	VCYE1C103MR	Semiconductor 16V 0.01	1	
C6023	ECQB1H183KH	Mylar 50V 0.018	1	
C6024-6026	VCYE1C103MR	Semiconductor 16V 0.01	3	
C6027	ECEA1HKS010	Electrolytic 50V 1	1	
		Crystal Oscillator		
X6001	VSX0086		1	
		Switches		
SW601	EMR2521		1	⚠
SW602	VSS0101		1	
SW604	VSS0101		1	
		Connectors		
P601	VJP1244	4P	1	
P602	VJP1242	2P	1	
		Miscellaneous		
PR1	VSF0015A08	IC Protector	1	⚠
	VHN0040	Rivet	2	
	VJF0190	Fuse Holder	2	⚠
	EDD073K22A3	LED	1	
	LN0408CP3	Back Light	1	
	VMD0601	Display Case	1	
	VMD0602	Display Case (Bottom)	1	
	VSQ0344	Zebra Rubber	1	
	XTNV14+5Z	Screw	6	
	XTNV14+8Z	Screw	1	

Ref. No.	Part No.	Part Name & Description	Pcs / Set	Remarks
	ENC17751/	RF Converter Unit		
	ENC17752			
		Integrated Circuit		
IC1	AN3130		1	
		Transistor		
Q1	2SC2480		1	
		Diodes		
D1,2	1SS86		2	or 1SS174
		Resistors		
R1	ERJ6GCSJ391	Chip 390	1	
R2	ERJ6GCSJ681	Chip 680	1	
R3	EVN3ACA00B14	Variable 10K	1	
R4	ERJ6GCSJ823	Chip 82K	1	
R5	ERDS2TJ562	5.6K	1	
R6	ERJ6GCSJ331	Chip 330	1	
R7	ERJ6GCSJ122	Chip 1.2K	1	
R8	ERJ6GCSJ221	Chip 220	1	
R9	ERJ6GCSJ560	Chip 56	1	
R10	ERJ6GCSJ680	Chip 68	1	
		Connector		
P1	VJB1143	5P	1	
	NOTE:			
	The Capacitors, Filters, Transformers for the RF Converter Unit are not available as spare parts.			
	VJB00B67	FE Head P.C. Board	1	
		Transistor		
Q1503	2SC2603A		1	
		Resistor		
R1501	ERDS2TJ333	33K	1	
		Capacitors		
C1501	ECKF1H472ZF	Ceramic 50V 4700P	1	
C1502	ECEA1CKS100	Electrolytic 16V 10	1	

Ref. No.	Part No.	Part Name & Description	Pcs / Set	Remarks
C1503	ECQV1H333JZ	Mylar 50V 0.033	1	
C1504	VCYF1C103MR	Semiconductor 16V 0.01	1	
		Coil		
L1501	VLQEL05F221K	220μH	1	
		Transformer		
T1501	VTD0014		1	
		Connector		
P654	VJP1229	2P	1	
	VJB00B68	Tracking P.C. Board		
		Resistors		
R6561,6562	EVLB6AA00B15	Variable 100K	2	
	VJB00B87	Tension Sensor P.C. Board		
Q1504	ON1301	Photo Caprier	1	(Q) ..... R1502 is ERDS2TJ102 or (R) ... R1502 is ERDS2TJ182
		Resistor		
R1502	ERDS2TJ102	1K	1	In case Q1504 is ON1301 (Q)
R1502	ERDS2TJ182	1.8K	1	In case Q1504 is ON1301 (R)

AC Adaptor

VW-A18EB

SPECIFICATIONS

Power Source:	220/240 V AC 50/60 Hz
Power Consumption:	40 W
Output:	12 V DC, 1.2 A
	12 V DC, 1.4 A for battery charge
	20 V DC, 0.15 A for HEATER (VTR MODE)
Weight:	2.6 kg
Dimensions:	87(W) × 69(H) × 238(D) mm

Weight and dimensions shown are approximate.

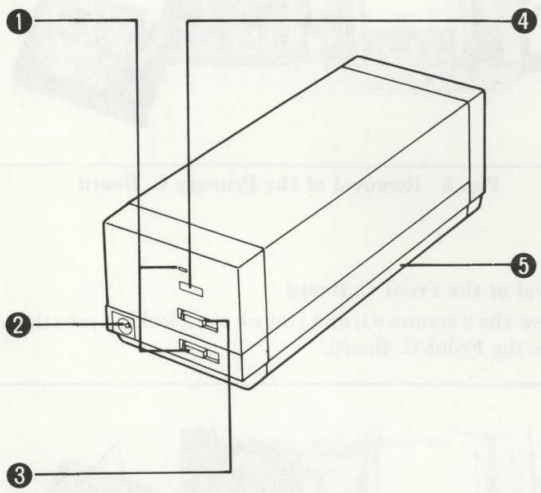
Specifications are subject to change without notice.

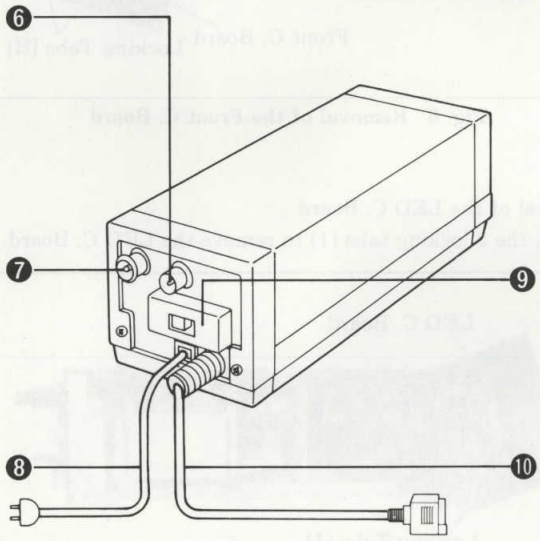
CAUTION: FOR USE WITH VIDEO TAPE RECORDER, MODEL NV-180.

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

CONTENTS

1. CONTROLS AND COMPONENTS





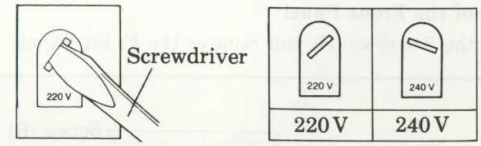
1 Operation Switch with indicator lamp
Set to "OPERATE" to turn the unit on.

2 Battery Pack Charging Socket
Used for charging the battery pack.

3 TV/VTR Selector Switch
VTR: Used to play back a video cassette.
TV: Used to watch TV.

4 Charging Indicator Lamp
Lights up when the battery pack is charged. When charging is completed, this lamp goes off.

5 Voltage Selector
Ensure that the selector is set at the same indication as the local mains voltage before plugging.



Voltage Selector

Note:
Power Switch must be off and Power Cord disconnected from mains prior to changing the voltage selector.

6 RF Output Socket
Connect it to TV.

7 RF Input Socket
Connect it to an antenna.

8 Mains Cord
For connection to an ordinary mains.

9 POWER ON/OFF Switch
Switching on applies power to the unit. To switch off this unit completely, set to "OFF".

10 Adaptor Cable
Connect to the VTR's adaptor socket.

2. DISASSEMBLY METHOD

1. **Removal of the Top Case**
Unscrew the 2 screws (A) and remove the Top Case.

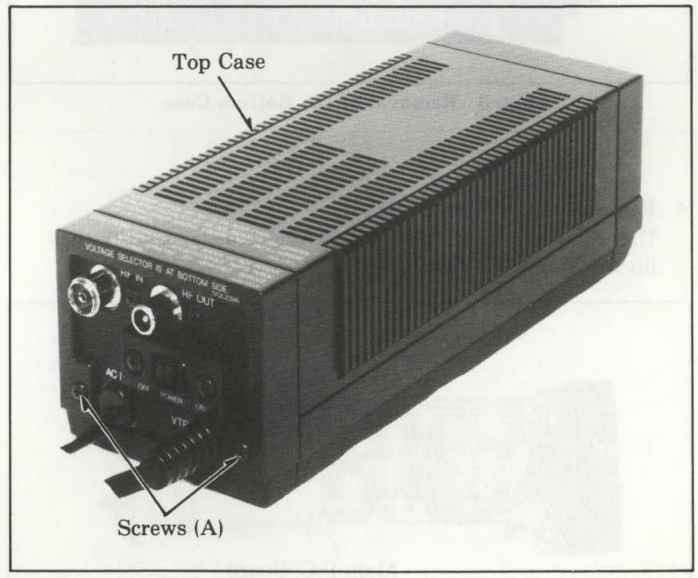


Fig. 1 Removal of the Top Case

2. **Removal of the Front Panel**
Unscrew the 2 screws (B) and remove the Front Panel.

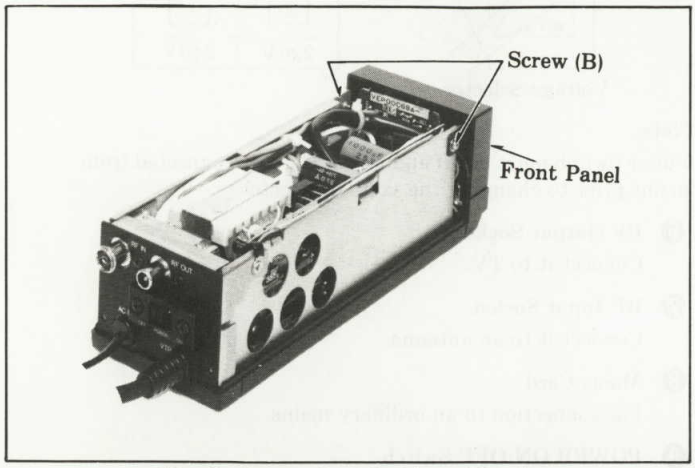


Fig. 2 Removal of the Front Panel

3. **Removal of the Bottom Case**
Unscrew the 4 screws (C) and remove the Bottom Case.

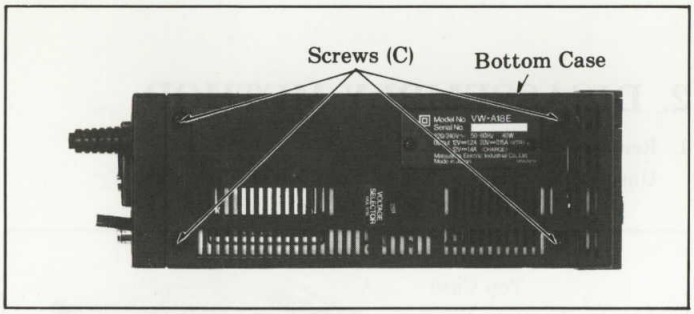


Fig. 3 Removal of the Bottom Case

4. **Removal of the Main C. Board**
Unscrew 3 screws (D) and remove the cord clamper (E), then lift the Main P.C. Board.

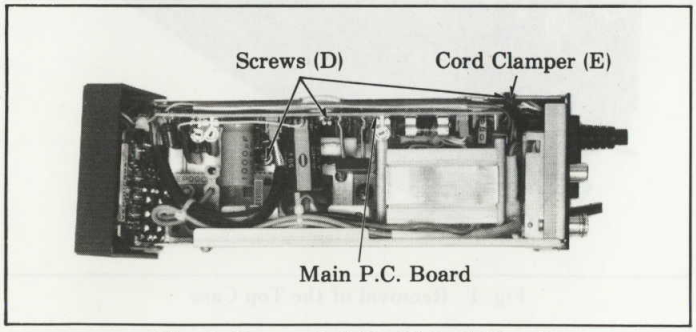


Fig. 4 Removal of the Main C. Board

5. **Removal of the Primary C. Board**
Unscrew the screw (F) and lift the Primary C. Board.

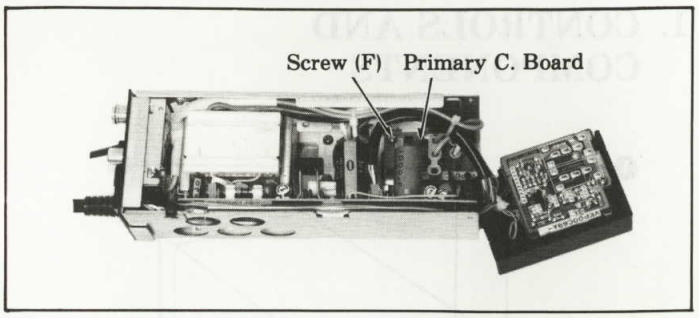


Fig. 5 Removal of the Primary C. Board

6. **Removal of the Front C. Board**
Unscrew the 2 screws (G) and Unlock the 2 locking tabs (H) to remove the Front C. Board.

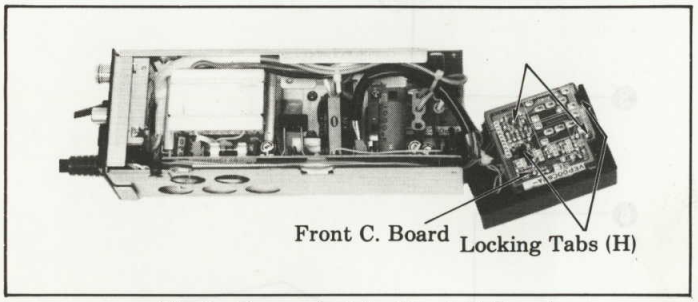


Fig. 6 Removal of the Front C. Board

7. **Removal of the LED C. Board**
Unlock the 2 locking tabs (I) to remove the LED C. Board.

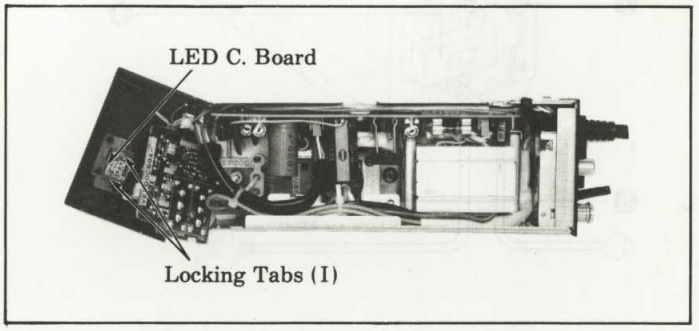


Fig. 7 Removal of the LED C. Board

3. ELECTRICAL ADJUSTMENT PROCEDURES

This section provides complete electrical adjustment procedures which may be required for electronic circuit of the AC Adaptor VW-A18.

3-1. TEST EQUIPMENTS

To perform the electrical adjustments completely, following equipments are required.

1. D.V.M. (Digital Volt Meter)
   Voltage Range: 0.001 ~ 50 V
2. Oscilloscope
   Voltage Range: 0.005 ~ 50 V/div.
3. DC A.M. (DC Ammeter)
   Current Range: 0 ~ 10 A
4. DC V.M. (DC Voltmeter)
   Voltage Range: 0 ~ 20 V
5. Plastic Tip Driver
6. Resistor (11Ω/120 W)
7. DC Power Supply (5 A/20 V)
8. Resistor (5Ω variable/200 W)

3-2. POWER SUPPLY OUTPUT VOLTAGE ADJUSTMENT

TP	ADJ.	MODE	INPUT
MULTI CONNECTOR -(1) (+) -(11) (−)	VR01	POWER SUPPLY	
TAPE	**M. EQ.**	**SPEC.**	
	D.V.M	13.85 ± 0.5 V	

1. Connect a jumper wire between pin (1) and pin (17) of the Multi Connector for make the unit in power supply mode.
2. Connect the resistor (11Ω/120 W) between pin (1) and pin (11) of the Multi Connector.

3-3. INCIPIENT CHARGE CURRENT AND SCHMITT VOLTAGE ADJUSTMENT

TP	ADJ.	MODE	INPUT
MULTI CONNECTOR -(1) (+) -(11) (−)	VR02 VR03	CHARGE	
TAPE	**M. EQ.**	**SPEC.**	
	DC AM D.V.M.	I = 1.40 − 0.002 (25 − t) ± 0.02 A (VR02) V = − 0.03 t + 16.05 ± 0.1 V (VR03) t: Ambient temperature [0°C]	

1. Make the connection as shown below.

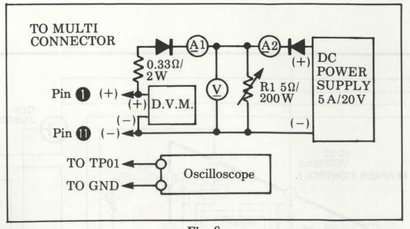
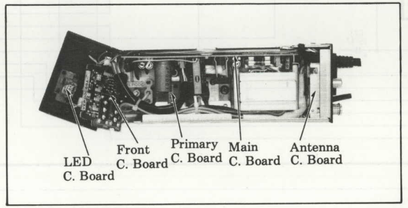


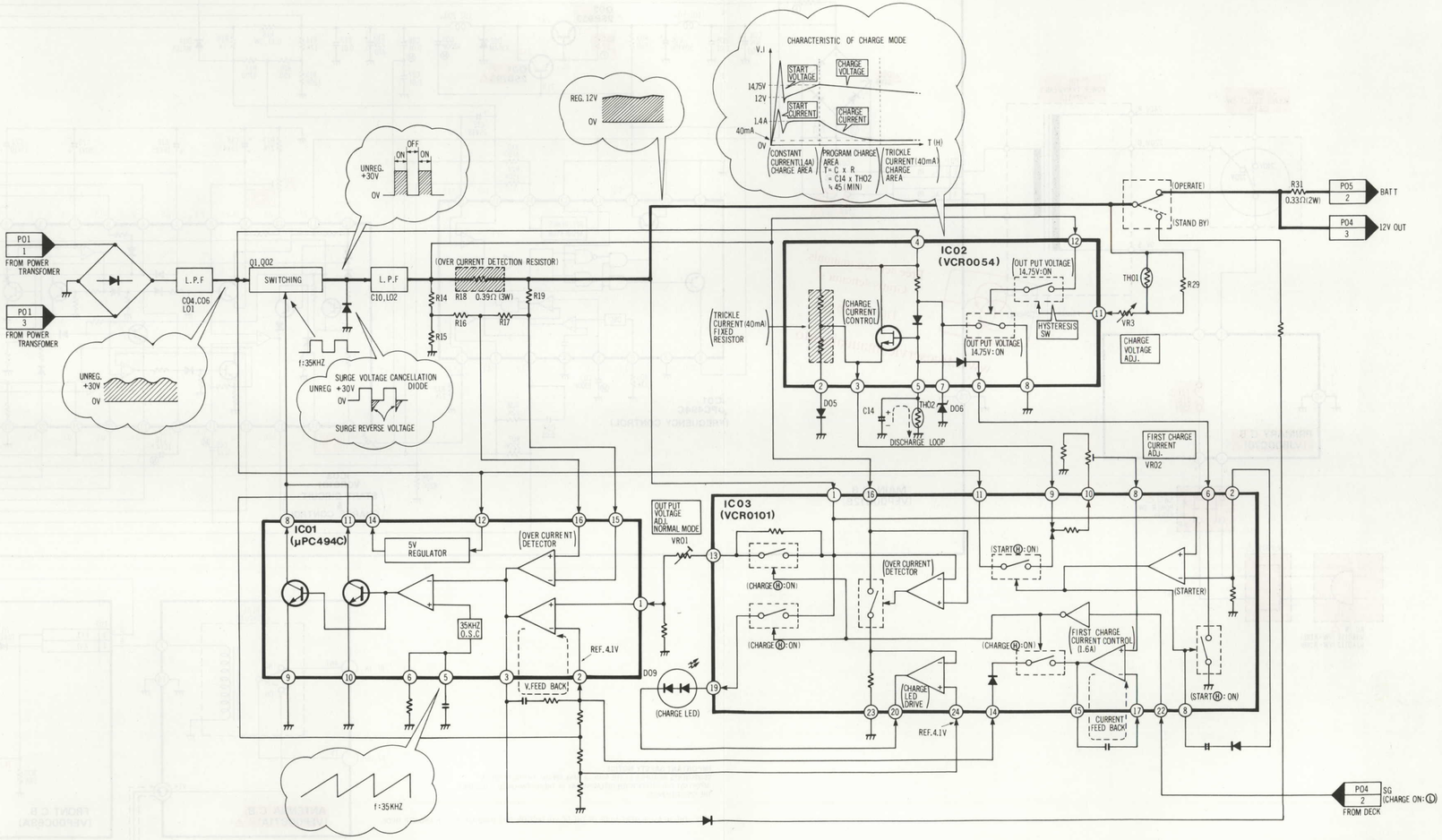
Fig. 8

2. Adjust the output of the DC power supply so that the indication of the DC V.M. becomes 14.0 V and adjust R1 so that the indication of the DC A.M. (A2) becomes 3.0 [A].
3. Adjust VR02 so that the indication of the DC A.M. (A1) becomes 1.40 − 0.002 (25 − t) ± 0.02 [A].
4. Adjust the output level of the DC power supply till the indication of the oscilloscope becomes "Low" (about 0.5 V) from "High" (about 15.0 V).
5. If the value which was read in item 4 is not − 0.03 t ± 16.05 ± 0.1 V, turn VR03 clockwise or counterclockwise.

4. CIRCUIT BOARD LAYOUT

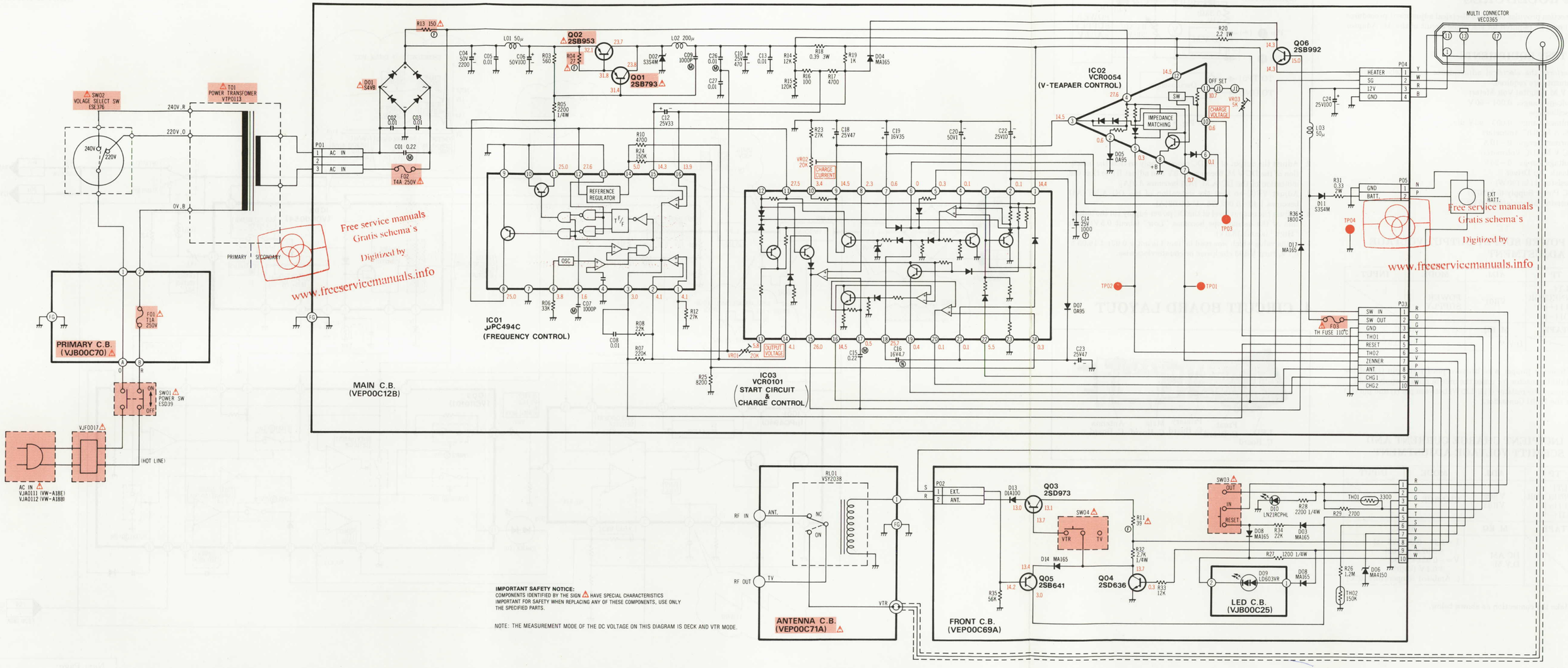


5. BLOCK DIAGRAM



Next Page:
SCHEMATIC DIAGRAM

6. SCHEMATIC DIAGRAM



IMPORTANT SAFETY NOTICE:
COMPONENTS IDENTIFIED BY THE SIGN ⚠ HAVE SPECIAL CHARACTERISTICS IMPORTANT FOR SAFETY WHEN REPLACING ANY OF THESE COMPONENTS, USE ONLY THE SPECIFIED PARTS.

NOTE: THE MEASUREMENT MODE OF THE DC VOLTAGE ON THIS DIAGRAM IS DECK AND VTR MODE.

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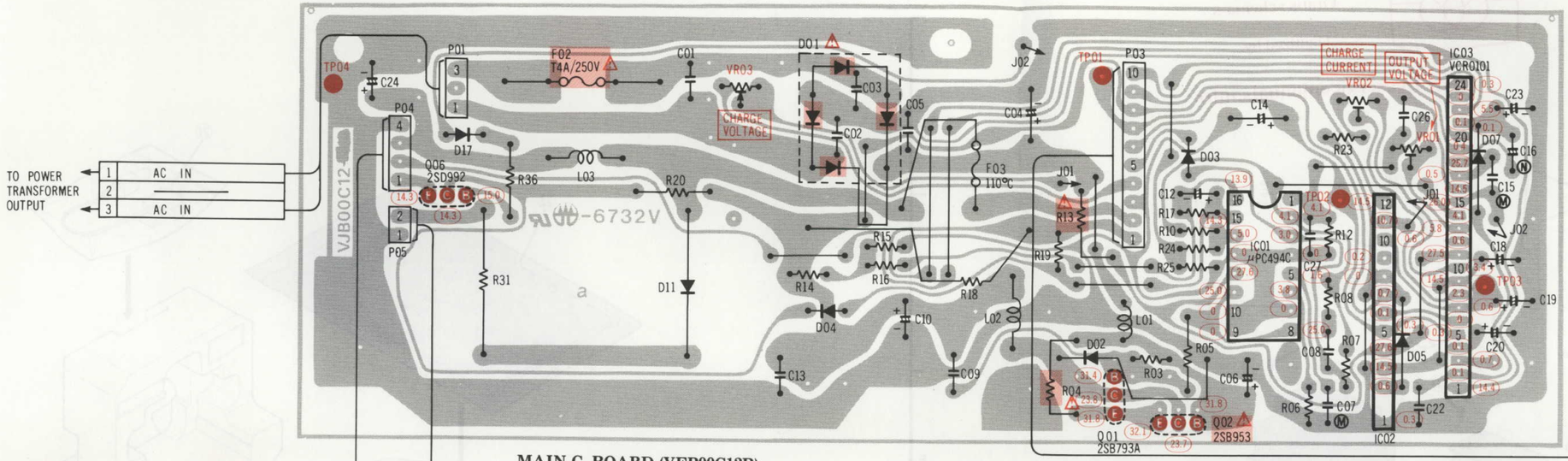
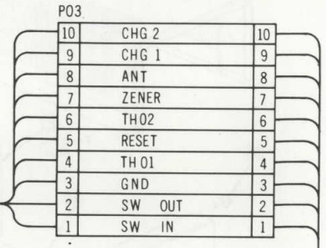
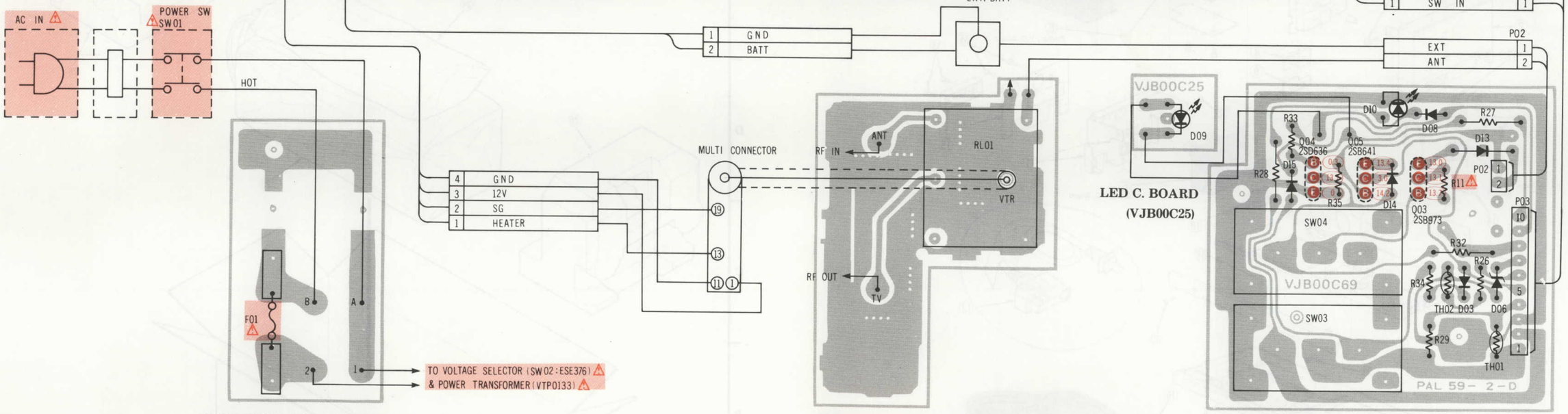
7. CIRCUIT BOARDS



MAIN C. BOARD (VEP00C12B)





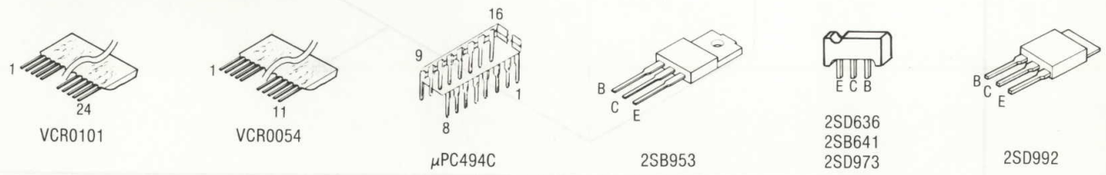
PRIMARY C. BOARD (BJB00C70)

ANTENNA C. BOARD (VEP00C71A) ⚠

LED C. BOARD (VJB00C25)

FRONT C. BOARD (VEP00C69A)

ICs & TRANSISTORs INFORMATION



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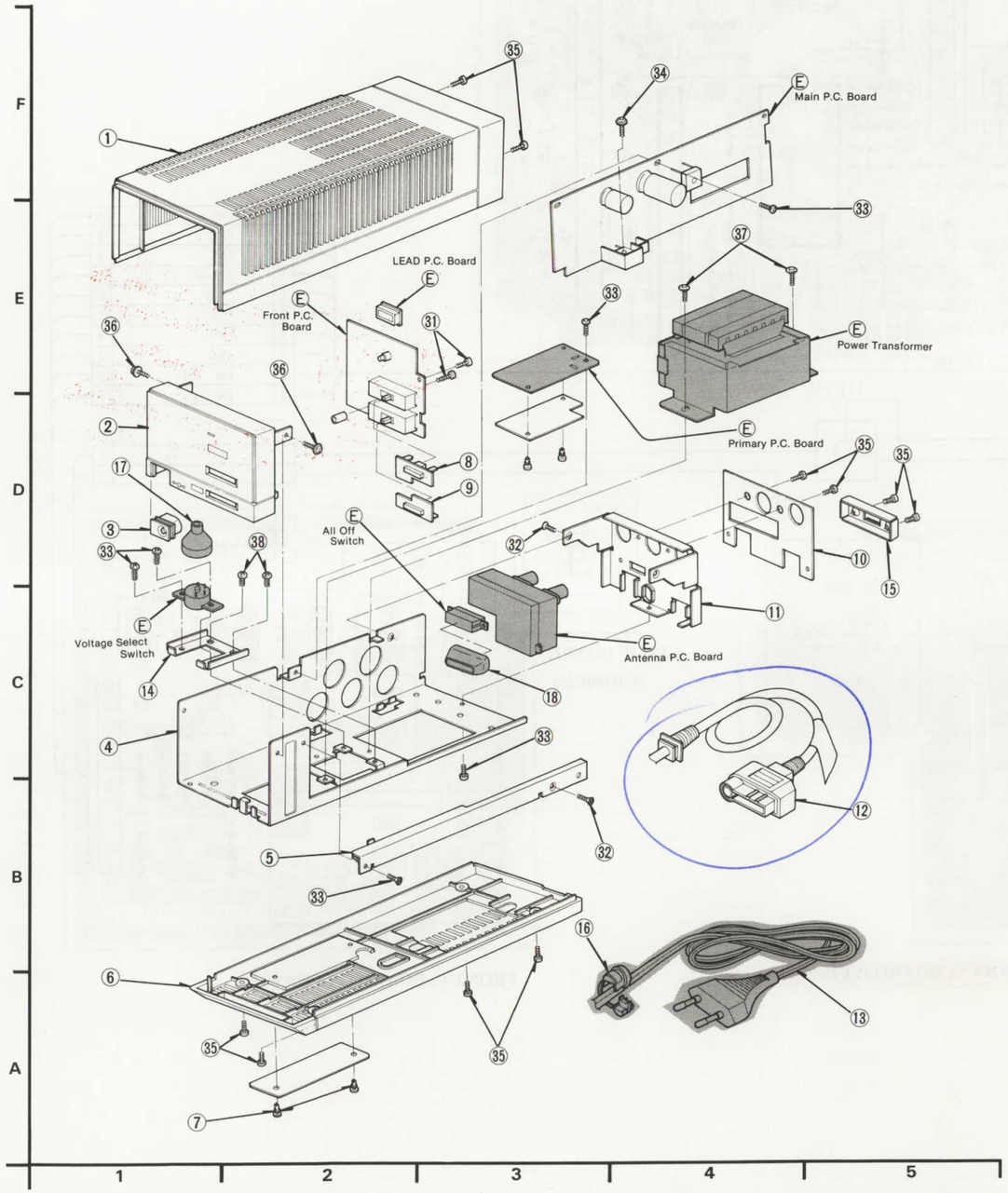
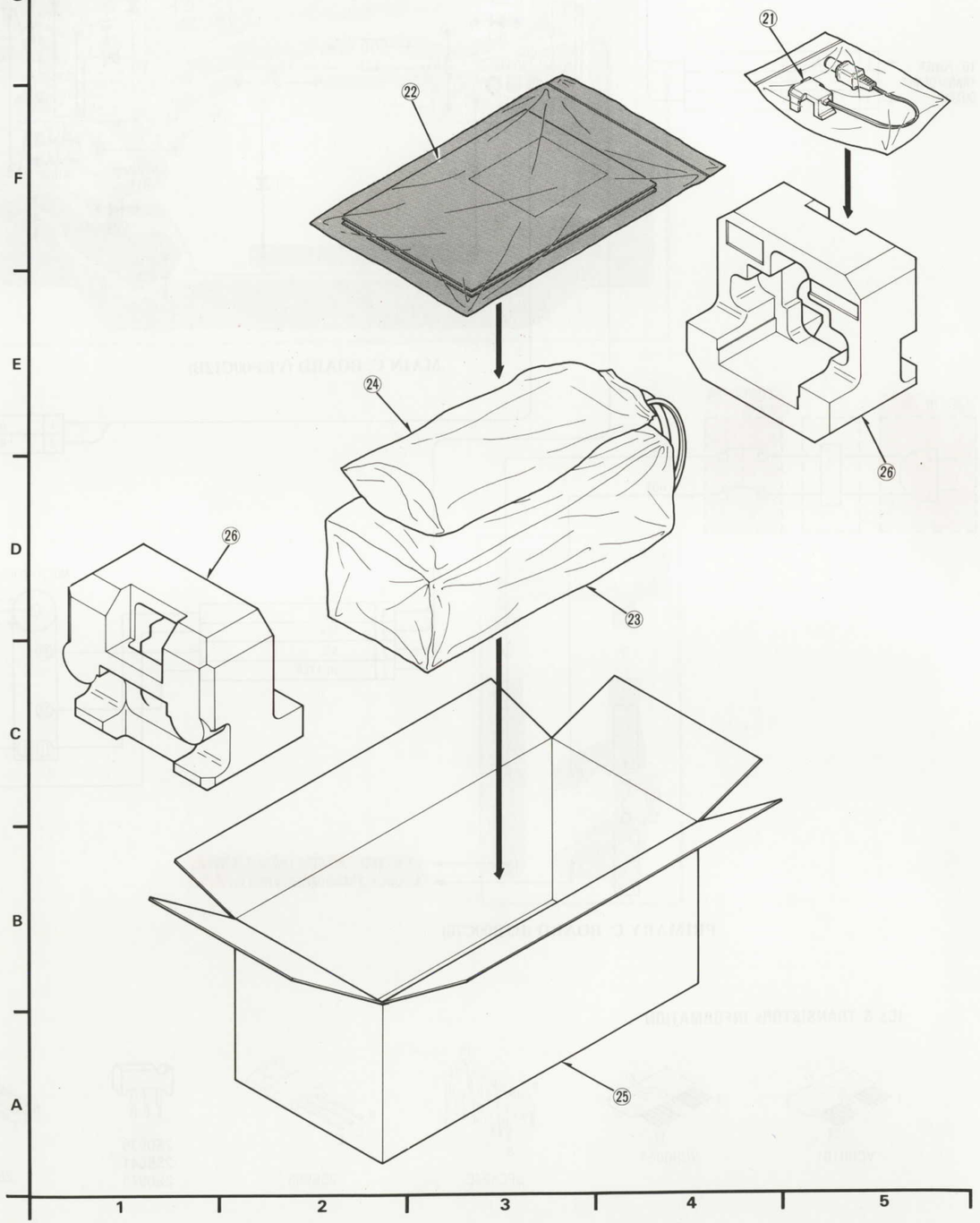
8. EXPLODED VIEWS

❶ CHASSIS & FRAME SECTION



Back Page:
CIRCUIT BOARD

❷ PACKING PARTS SECTION



9. MECHANICAL REPLACEMENT PARTS LIST

Notes: 1. * Be sure to make your orders of replacement parts according to this list.
2. IMPORTANT SAFETY NOTICE
Components identified with the mark ⚠ have the special characteristics for safety. When replacing any of these components, use only the same type.

Ref. No.		Part No.	Part Name & Description	Pcs / Set	Remarks
1(1)		VKM0270	Top Case	1	VW-A18E (Silver)
1(1)		VKM0351	Top Case	1	VW-A18E (Black)/B
2(1)		VYP0991	Front Panel Unit	1	VW-A18E (Silver)
2(1)		VYP1069	Front Panel Unit	1	VW-A18E (Black)/B
3(1)		VJS1036	External Socket	1	
4(1)		VMK0238	Chassis	1	
5(1)		VMP0418	Reinforcement Angle	1	
6(1)		VKM0316	Bottom Case	1	
7(1)		VHN0011	Nylon Latch	2	
8(1)		VGU1192	Antenna Switch Knob	1	
9(1)		VGU1191	Power Switch Knob	1	
10(1)		VGH0236	Rear Name Plate	1	
11(1)		VJH0308	Rear Frame	1	
12(1)		VEC0365	Multi Connector Unit	1	
13(1)		VJA0111	AC Cord	1	VW-A18E ⚠
13(1)		VJA0112	AC Cord	1	VW-A18B ⚠
14(1)		VMA6416	Voltage Selector Angle	1	
15(1)		VMP0484	All Off Switch Angle	1	
16(1)		VJF0017	AC Cord Bushing	1	⚠
17(1)		VMX0399	Voltage Selector Cover	1	⚠
18(1)		VMZ0580	All Off Switch Cover	1	⚠
21(2)		VJA0180	Battery Catcher	1	
22(2)		VQF1213	Fan Bag Kit	1	VW-A18E ⚠
22(2)		VQF1260	Fan Bag Kit	1	VW-A18B ⚠
23(2)		VPF0201	Polyethylene Bag	1	
24(2)		VPF0202	Polyethylene Bag (Cord)	1	
25(2)		VPG1674	Packing Case	1	VW-A18E (Silver)
25(2)		VPG1791	Packing Case	1	VW-A18E (Black)
25(2)		VPG1772	Packing Case	1	VW-A18B
26(2)		VPN0988	Cushion	2	
			Screws		
31(1)		XTV3+6J		2	
32(1)		XSS3+6FS		2	
33(1)		XTV3+6FS		6	
34(1)		XYN3+F8S		1	
35(1)		XSB3+6FZS		10	
36(1)		XYN3+B6FS		2	
37(1)		XTT4+5FS		2	
38(1)		XTN3+5FS		2	

10. ELECTRICAL REPLACEMENT PARTS LIST

Notes: 1. * Be sure to make your orders of replacement parts according to this list.
2. IMPORTANT SAFETY NOTICE
Components identified with the mark ⚠ have the special characteristics for safety. When replacing any of these components, use only the same type.
3. Unless otherwise specified,
All resistors are in OHMS (Ω), 1/4W ± 5% carbon. K=1,000Ω, M=1,000KΩ. All capacitors are in MICROFARADS (μF), ± 10% P=μμF.

Ref. No.		Part No.	Part Name & Description	Pcs / Set	Remarks
		VEP00C12B	Main P.C. Board Unit	1	
		VEP00C69A	Front P.C. Board Unit	1	
		VEP00C71A	Antenna P.C. Board Unit	1	⚠
		VJB00C25	LED P.C. Board	1	
		VJB00C70	Primary P.C. Board	1	⚠
T01		VTP0113	Power Transformer	1	⚠
SW01		ESD3990S	All OFF Switch	1	⚠
SW02		ESE376	Voltage Select Switch	1	⚠
		VJK4	Clamper	1	
		VEP00C12B	Main P.C. Board Unit	1	
			Integrated Circuit		
IC01		μPC494C		1	
IC02		VCR0054		1	
IC03		VCR0101		1	
			Transistors		
Q01		2SB793A		1	
Q02		2SB953		1	(P,Q,V,B,V,T)
Q06		2SD992		1	⚠
			Diodes		
D01		S4VB		1	⚠
D02		S3S4MF3		1	
D04		MA165		1	
D05		0A95		1	
D07		0A95		1	
D11		S3S4MF1		1	
D17		MA165		1	

Ref. No.		Part No.	Part Name & Description	Pcs / Set	Remarks
			Resistors		
RO3		ERDS2TJ561	560	1	
RO4		ERQ14AJ270	Fuse 27	1	⚠
RO5		ERD25TJ222	2.2K	1	
RO6		ERDS2TJ333	33K	1	
RO7		ERDS2TJ224	220K	1	
RO8		ERDS2TJ223	22K	1	
R10		ERDS2TJ472	4.7K	1	
R12		ERDS2TJ273	27K	1	
R13		ERQ14AJ151	Fuse 150	1	⚠
R14		ERDS2TJ123	12K	1	
R15		ERDS2TJ124	120K	1	
R16		ERDS2TJ101	100	1	
R17		ERDS2TJ472	4.7K	1	
R18		ERF3AKR39	Cement 3W 0.39	1	
R19		ERDS2TJ102	1K	1	
R20		ERX1SJ2R2	Metal 1W 2.2	1	
R23		ERDS2TJ273	27K	1	
R24		ERDS2TJ154	150K	1	
R25		ERDS2TJ822	8.2K	1	
R30		ERDS2TJ101	100	1	
R31		ERX2ANJR33	Metal 2W 0.33	1	
R36		ERD25TJ182	1.8K	1	
			Variable Resistors		
VRO1,02		EVN50AA00B24	20K	2	
VRO3		EVN50AA00B53	5K	1	
			Capacitors		
CO1		ECQV1H224JZ	Mylar 50V 0.22	1	
CO2,03		ECKF1H103ZF	Ceramic 50V 0.01	2	
CO4		ECEA1HU222	Electrolytic 50V 2200	1	
CO5		ECKF1H103ZF	Ceramic 50V 0.01	1	
CO6		ECEA1HG101S	Electrolytic 50V 100	1	
CO7		ECQM1H102KV	Mylar 50V 1000P	1	
CO8		ECKF1H103ZF	Ceramic 50V 0.01	1	
CO9		ECQM1H102KV	Mylar 50V 1000P	1	
C10		ECEA1EG471S	Electrolytic 25V 470	1	
C12		ECEA1ES330	Electrolytic 25V 33	1	
C13		ECKF1H103ZF	Ceramic 50V 0.01	1	
C14		ECEA1EM102T	Electrolytic 25V 1000	1	
C15		ECQV1H224JZ	Mylar 50V 0.22	1	
C16		ECEA1EN4R7S	Electrolytic 25V 4.7	1	
C18		ECEA1ES470	Electrolytic 25V 47	1	
C19		ECEA1CS330	Electrolytic 16V 33	1	
C20		ECEA1HS010	Electrolytic 50V 1	1	
C22		ECEA1ES100	Electrolytic 25V 10	1	
C23		ECEA1ES470	Electrolytic 25V 47	1	
C24		ECEA1ES101	Electrolytic 25V 100	1	
C26		ECQV1H103JZ	Mylar 50V 0.01	1	
C27		ECKF1H103ZF	Ceramic 50V 0.01	1	
			Coils		
LO1		VLQ0098	50μH	1	
LO2		ELC15E001	200μH	1	
LO3		VLQ0131	50μH	1	

Ref. No.		Part No.	Part Name & Description	Pcs / Set	Remarks
			Connectors		
PO1		VJP1142	3P	1	
PO3		VJP1146	10P	1	
PO4		VJP1221	4P	1	
PO5		VJP1148	2P	1	
			Fuses		
FO2		XBA2C40TR0	250V 4A	1	⚠
FO3		VSF0038	TH Fuse 110°C	1	
			Miscellaneous		
		VSC1121	Shield Case	1	
		TJC6320	Fuse Holder	2	⚠
		VEP00C69A	Front P.C. Board Unit		
			Transistors		
QO3		2SD973		1	
QO4		2SD636		1	or 2SC1684
QO5		2SB641		1	or 2SA564
			Diodes		
DO3		MA165		1	
DO6		MA4150M		1	
DO8		MA165		1	
D10		LN21RCPHL	LED	1	
D13		D1A100		1	
D14,15		MA165		2	
			Resistors		
R11		ERQ14AJ390	Fuse 39	1	⚠
R26		ERDS2TJ125	1.2M	1	
R27		ERD25TJ122	1.2K	1	
R28		ERD25TJ222	2.2K	1	
R29		ERDS2TJ272	2.7K	1	
R32		ERD25TJ272	2.7K	1	
R33		ERDS2TJ123	12K	1	
R34		ERDS2TJ223	22K	1	
R35		ERDS2TJ563	56K	1	
			Connector		
PO2		VJP1148	2P	1	
			Switches		
SW03,04		ESD27170		2	

Ref. No.		Part No.	Part Name & Description	Pcs / Set	Remarks
			Miscellaneous		
		KL04	LED Spacer	1	
		WZTC03B12	Tube	1	
		VEP00C71A	Antenna P.C. Board Unit	1	⚠
		VJB00C25	LED P.C. Board		
			Diode		
D09		LD603VR	LED	1	
		VJB00C70	Primary P.C. Board		⚠
			Fuse		
F01		XBA2C10TR0	250V 1A	1	⚠
			Miscellaneous		
		TJC6320	Fuse Holder	2	⚠
		VMZ0561	Barrier	2	⚠
		VHN0011	Nylon Latch	2	
		VMZ0429	Fuse Cover	1	⚠

Wired Remote Controller

VW-R17E

SPECIFICATIONS

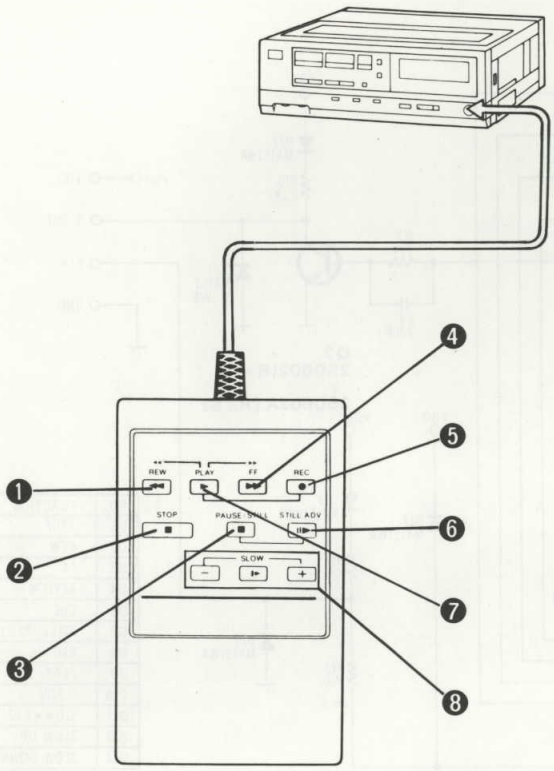
Weight:	175 g
Dimensions:	62(W) × 14(H) × 101(D) mm
Cable Length:	Approx. 5 m

Weight and dimensions shown are approximate.

Specifications are subject to change without notice.

CONTENTS

1. CONTROLS AND COMPONENTS



❶ **Rewind/Review Button**

Press this button to rewind tape. During the play mode pressing this button will allow you to view the tape in reverse at about 7 times the recorded tape speed.

❷ **STOP Button**

Press this button to stop the tape.

❸ **PAUSE/STILL Button**

Press this button to temporarily stop the tape movement in either the recording or playback mode. During playback, a super still picture is produced when the pause is in use. Press again to release pause.

❹ **Fast Forward/Cue Button**

Press this button to move the tape forward rapidly.
During the play mode pressing this button will allow you to view the tape in the forward direction at about 7 times the recorded tape speed.

❺ **REC Button**

Recording is started by pressing this button and the PLAY Button at the same time.

❻ **STILL ADV Button**

During viewing of super still picture, press this button to advance the picture one frame at a time.
Slow motion effects are obtainable by holding down the STILL ADV button (about 1/17 speed of normal playback).

❼ **PLAY Button**

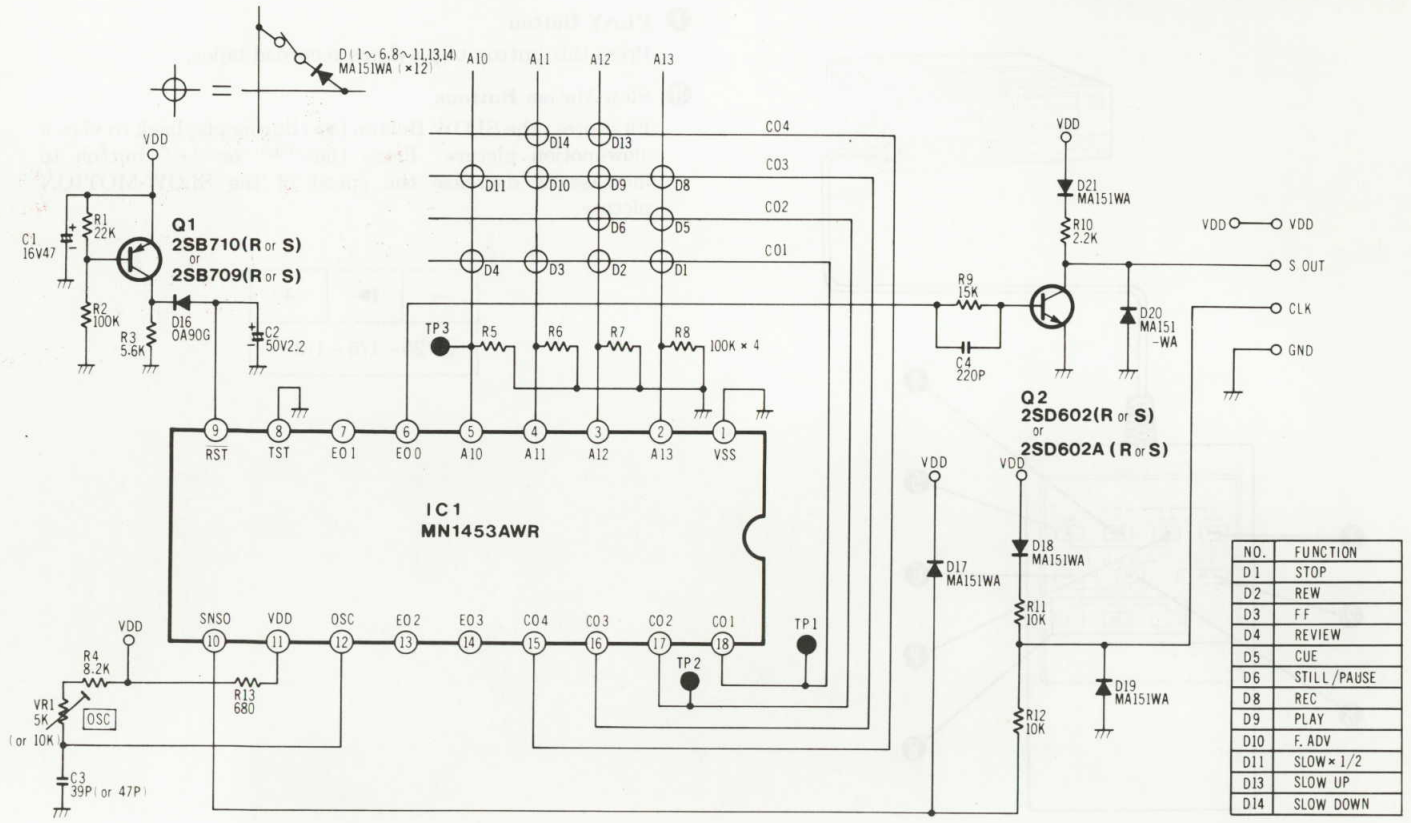
Press this button to playback recorded tapes.

❽ **Slow-Motion Buttons**

First press the SLOW Button (▮▶) during playback to view a slow-motion picture. Press the "+" or "−" button to increase or decrease the speed of the SLOW-MOTION picture.

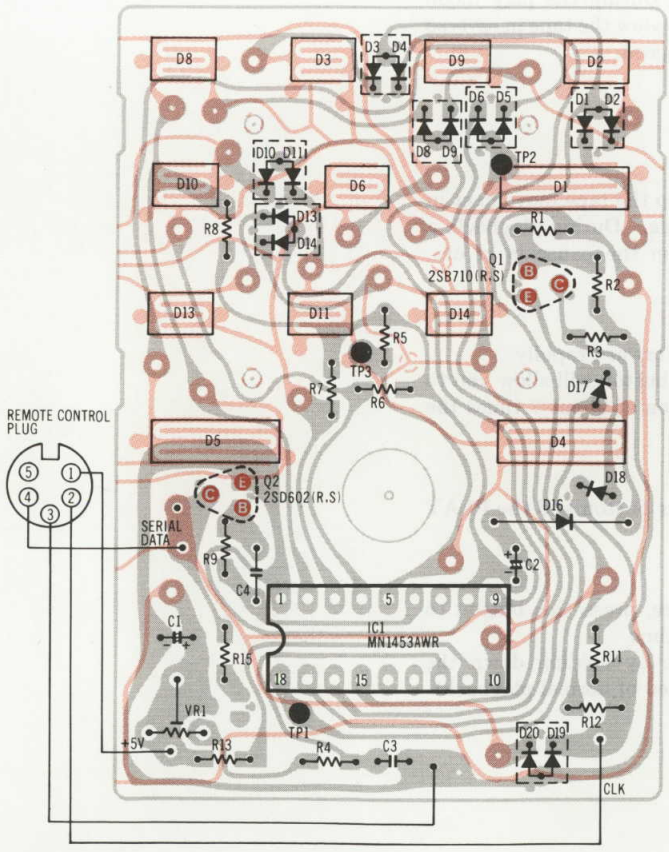
−	▮▶	+
1/25 ~ 1/5 ~ 1/3		

2. SCHEMATIC DIAGRAM



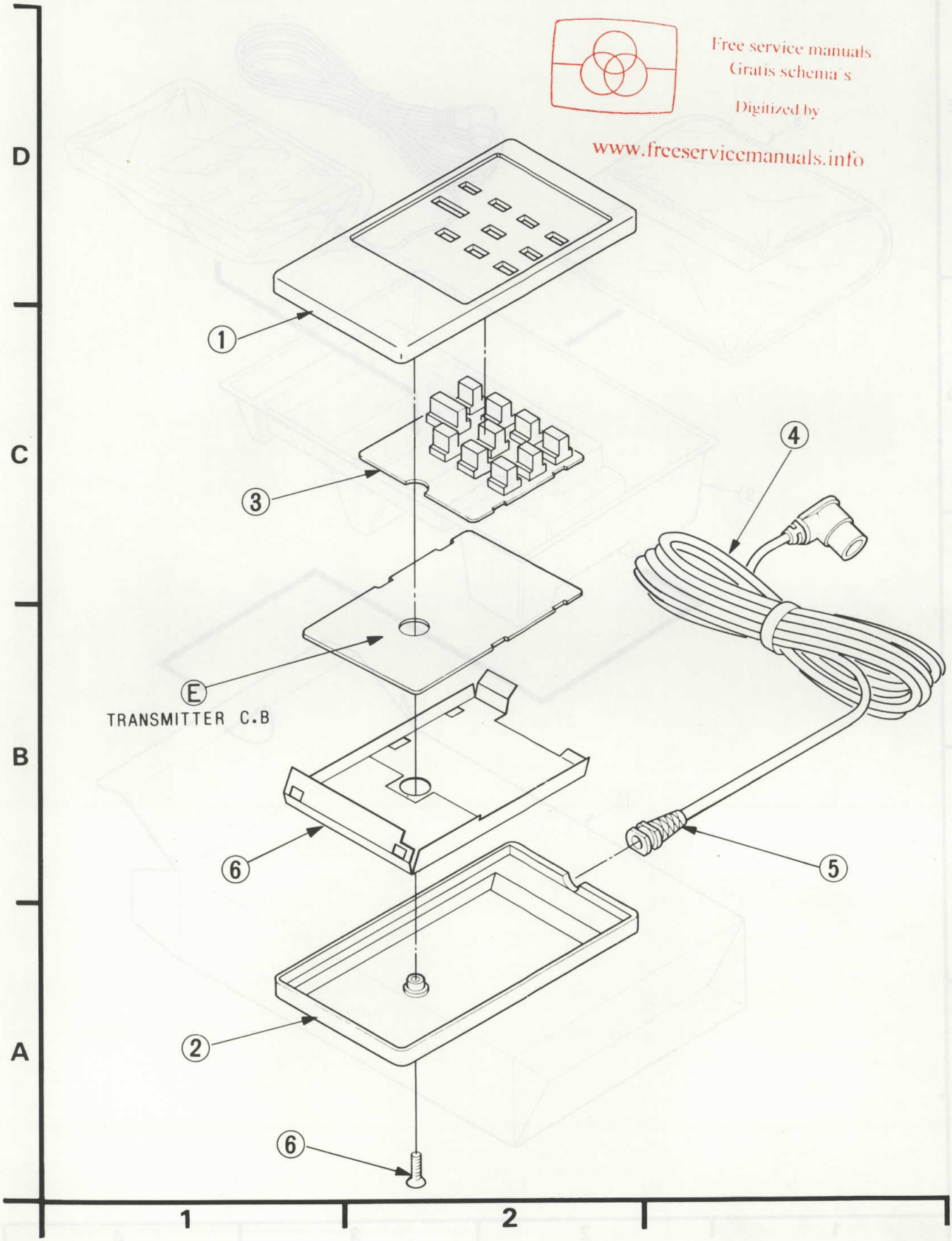
NO.	FUNCTION
D1	STOP
D2	REW
D3	FF
D4	REVIEW
D5	CUE
D6	STILL/PAUSE
D8	REC
D9	PLAY
D10	F. ADV
D11	SLOW × 1/2
D13	SLOW UP
D14	SLOW DOWN

3. CIRCUIT BOARD

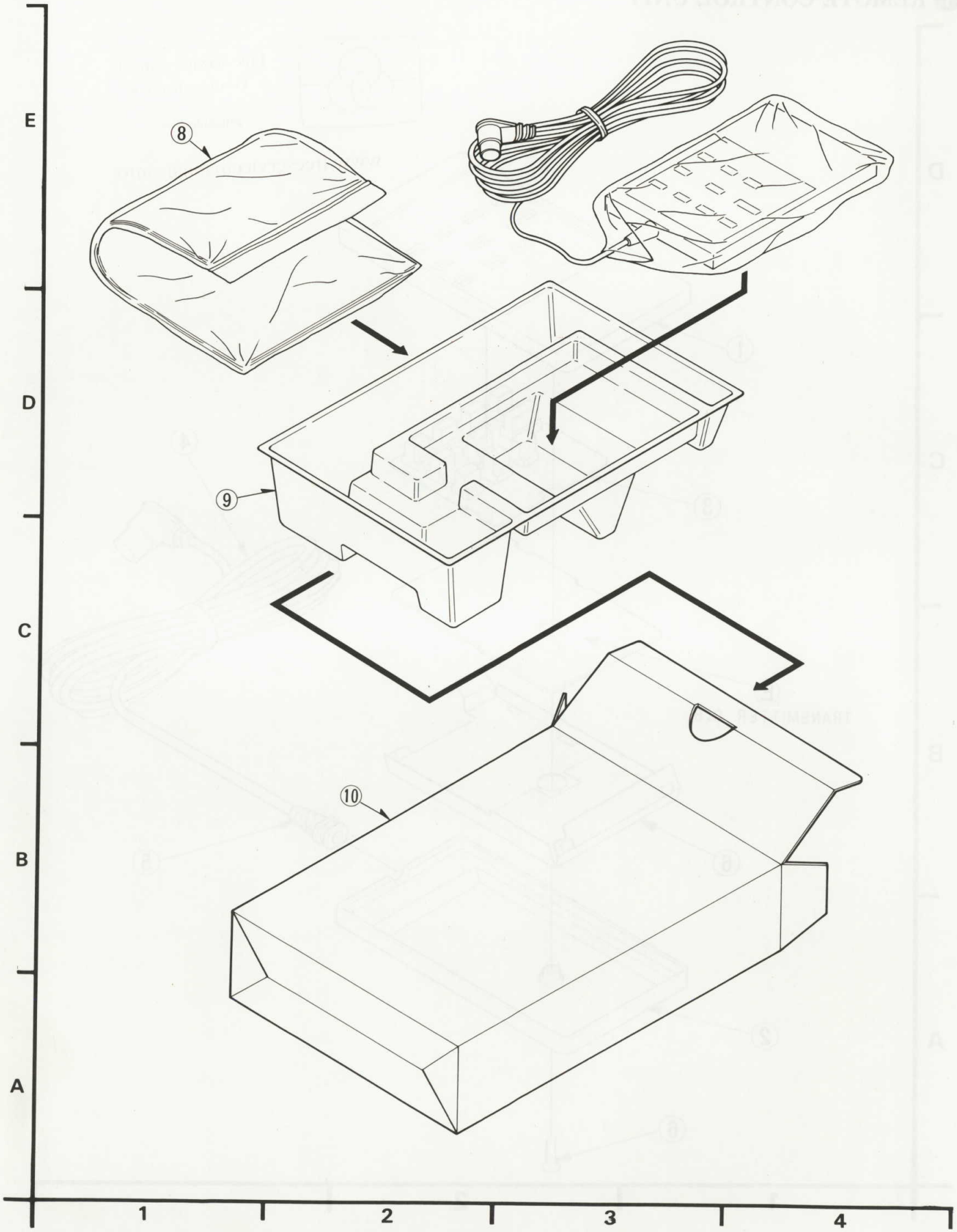


4. EXPLODED VIEW

❶ REMOTE CONTROL UNIT



❷ PACKING PARTS SECTION



5. MECHANICAL REPLACEMENT PARTS LIST

Notes: 1. • Be sure to make your orders of replacement parts according to this list.
2. IMPORTANT SAFETY NOTICE
Components identified with the mark ⚠ have the special characteristics for safety. When replacing any of these components, use only the same type.

Ref. No.		Part No.	Part Name & Description	Pcs / Set	Remarks
1(1)		VYK0757	Top Case Unit	1	
2(1)		VYK0758	Bottom Case Unit	1	
3(1)		VGU1671	Rubber Contact	1	
4(1)		VJA0244	Cord Unit	1	
5(1)		VJF0134	Cord Bushing	1	
6(1)		VXA2145	Shield Board Unit	1	
7(1)		VSS26+10FC	Screw	1	
8(2)		VQF1223	Fan Bag Kit	1	
9(2)		VPN0819	Cushion	1	
10(2)		VPK0375	Packing Case	1	

6. ELECTRICAL REPLACEMENT PARTS LIST

Notes: 1. • Be sure to make your orders of replacement parts according to this list.
2. IMPORTANT SAFETY NOTICE
Components identified with the mark ⚠ have the special characteristics for safety. When replacing any of these components, use only the same type.
3. Unless otherwise specified,
All resistors are in OHMS (Ω), 1/4W ± 5% carbon. K=1,000Ω, M=1,000KΩ. All capacitors are in MICROFARADS (μF), ± 10% P=μμF.

Ref. No.		Part No.	Part Name & Description	Pcs / Set	Remarks
		VEP2211	Wired Remote Controller	1	
			P.C. Board Unit		
			Integrated Circuit		
IC1		MN1453AWR		1	
			Transistors		
Q1		2SB710			(R,S) or
					2SB710A (R,S) or
					2SB709(R,S)
Q2		2SD602		1	(R,S) or
					2SB602A (R,S)
			Diodes		
D1-6		MA151WA		3	
D8-11		MA151WA		2	
D13,14		MA151WA		1	
D16		0A90G		1	
D17,18		MA151WA		2	
D19,20		MA151WA		1	or MA152WA
D21		MA151WA		1	
			Resistors		
R1		ERJ8GCSJ223	Chip 22K	1	
R2		ERJ8GCSJ104	Chip 100K	1	
R3		ERJ8GCSJ562	Chip 5.6K	1	
R4		ERJ8GCSJ822	Chip 8.2K	1	
R5-8		ERJ8GCSJ104	Chip 100K	4	
R9		ERJ8GCSJ153	Chip 15K	1	
R10		ERJ8GCSJ222	Chip 2.2K	1	
R11,12		ERJ8GCSJ103	Chip 10K	2	
R13		ERJ8GCSJ681	Chip 680	1	
			Variable Resistors		
VR1		EVNB4AA00B53	5K	1	
			Capacitors		
C1		ECEA1CK470	Electrolyitc 16V 47	1	
C2		ECEA1HK2R2	Electrolytic 50V 2.2	1	
C3		ECCF1H470JU	Ceramic 50V 47P	1	
C4		ECKF1H221KB	Ceramic 50V 220P	1	

Plug In AC Adaptor

VW-A11 E B

SPECIFICATIONS

Power Source:	100 ~ 240 V AC, 50/60 Hz
Power Consumption:	25 W
DC OUT:	12 V 1.2 A
Weight:	0.35 kg
Dimensions:	24(W) × 62(H) × 182(D) mm

Weight and dimensions shown are approximate.
Specifications are subject to change without notice.

CONTENTS

1. ELECTRICAL ADJUSTMENT PROCEDURES

This section provides complete electrical adjustment procedures which may be required for electrical circuit of the Plug In AC Adaptor VW-A11.

1-1 TEST EQUIPMENTS

To perform the electrical adjustments completely, following equipments are required.

1. D.V.M. (Digital Volt Meter)
   Voltage Range: 0.01 ~ 50 V
2. DC A.M. (DC Ammeter)
   Current Range: 0 ~ 10 A
3. Resistor (20Ω variable/5 W)
4. Resistor (470Ω/1 W)

1-2. OUTPUT VOLTAGE ADJUSTMENT

TP	ADJ.	MODE	INPUT
ELECTRODE (+), (−)	VR202	POWER SUPPLY	
TAPE	M. EQ.	SPEC.	
	D.V.M DC A.M.	13.5 ± 0.5 V	

1. Make the connection as shown below.

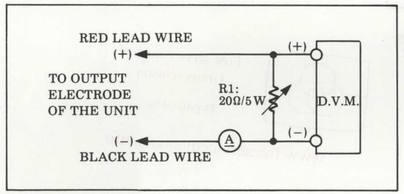


Fig. 1

2. Adjust R1 (20Ω variable/5 W) so that the indication of the DC A.M. is 1.2 A.
3. Adjust VR202 so that the indication of the D.V.M. is 13.5 ± 0.5 V.

Note:
After making this adjustment, readjust the CHARGE VOLTAGE (VR201).

1-3. CHARGE VOLTAGE ADJUSTMENT

TP	ADJ.	MODE	INPUT
PLUG CORD (+), (−)	VR201	CHARGE	
TAPE	M. EQ.	SPEC.	
	D.V.M. DC A.M.	$-\frac{3}{100}t+15.45$ (V) t: Ambient Temperature (°C)	

1. Connect the Battery Charging Cord to the socket of this unit and make the connection as shown below.

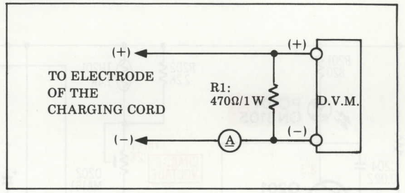
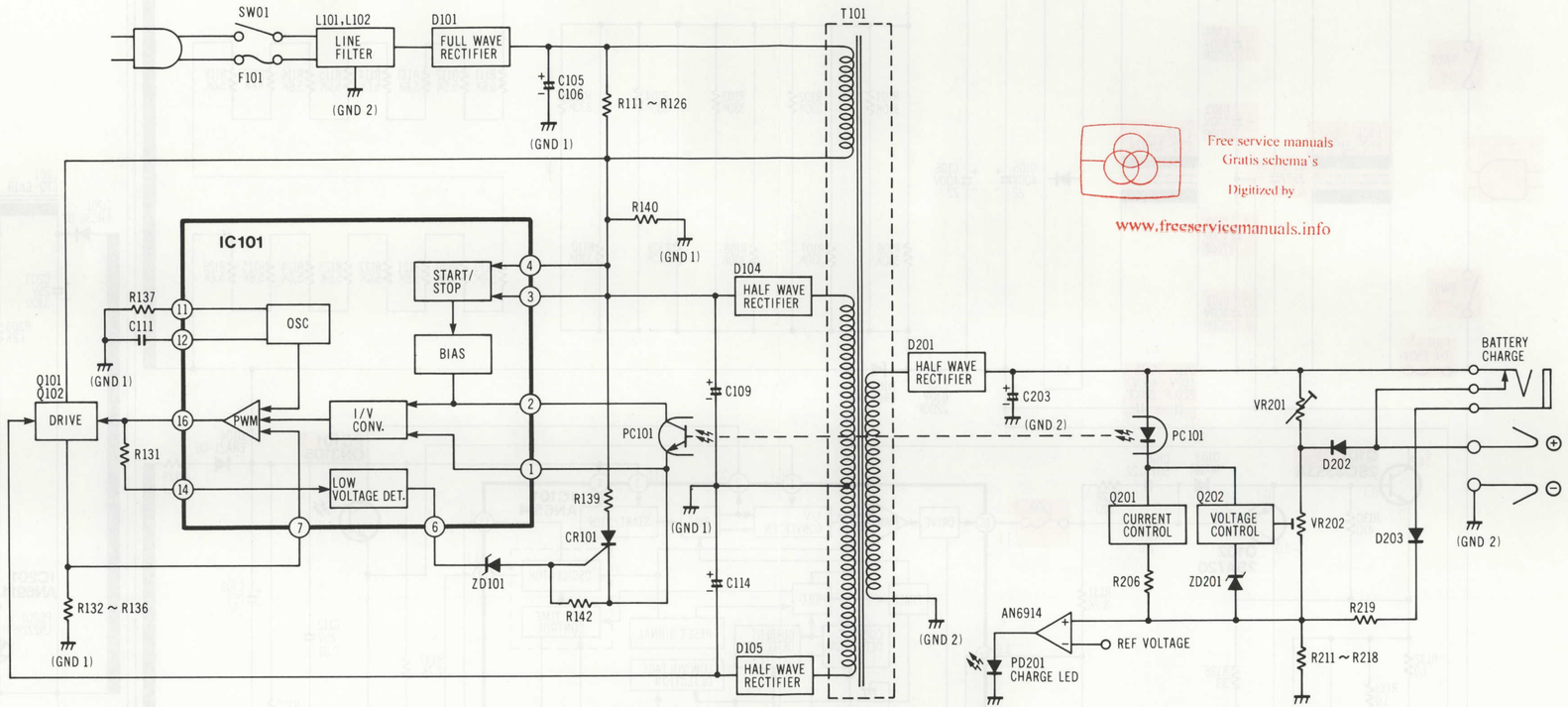


Fig. 2

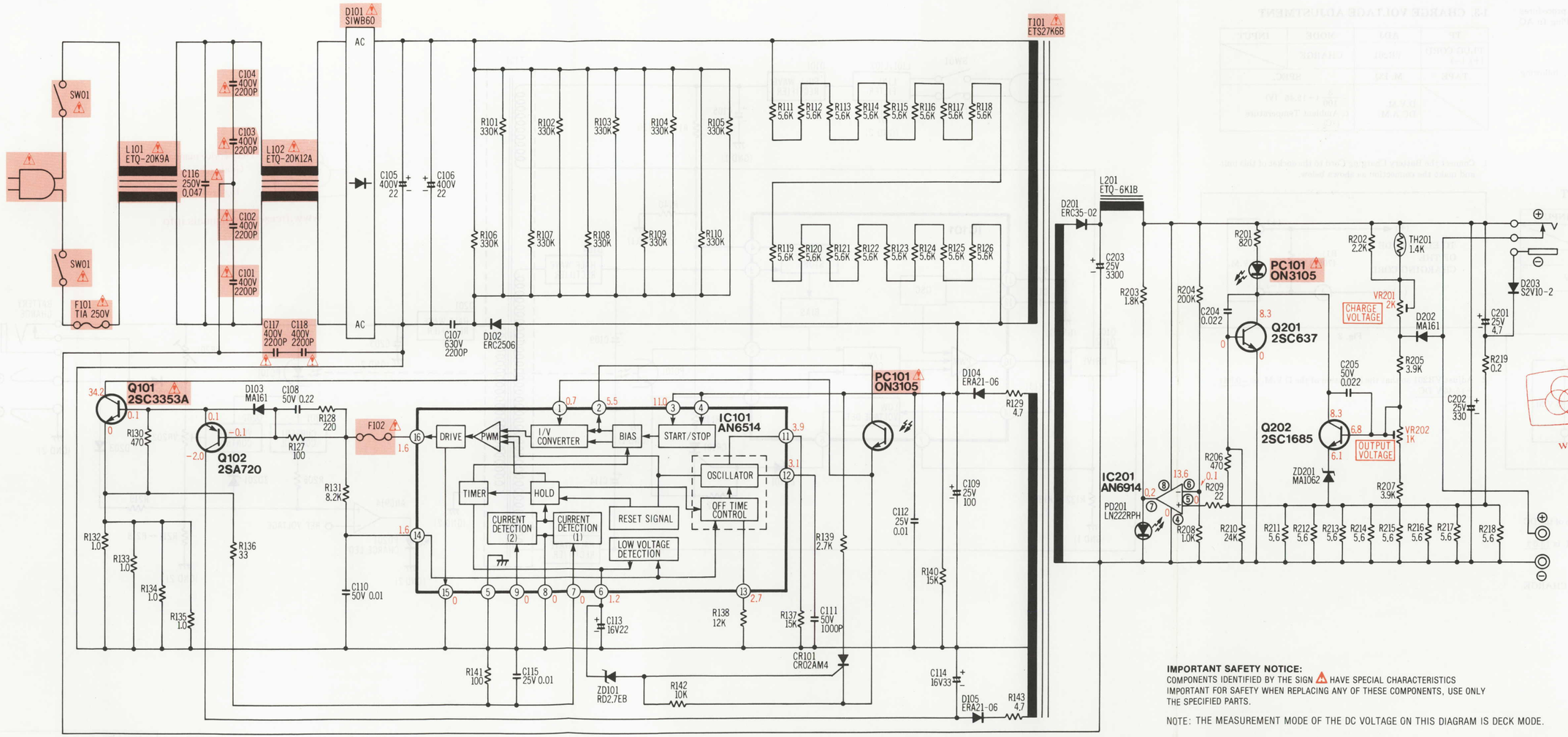
2. Adjust VR201 so that the indication of the D.V.M. is −0.03t +15.45 V DC.

2. BLOCK DIAGRAM



Next Page:
SCHEMATIC DIAGRAM

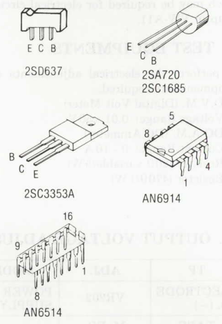
3. SCHEMATIC DIAGRAM



IMPORTANT SAFETY NOTICE:
COMPONENTS IDENTIFIED BY THE SIGN ⚠ HAVE SPECIAL CHARACTERISTICS
IMPORTANT FOR SAFETY WHEN REPLACING ANY OF THESE COMPONENTS, USE ONLY THE SPECIFIED PARTS.

NOTE: THE MEASUREMENT MODE OF THE DC VOLTAGE ON THIS DIAGRAM IS DECK MODE.

ICs & TRANSISTORs INFORMATION



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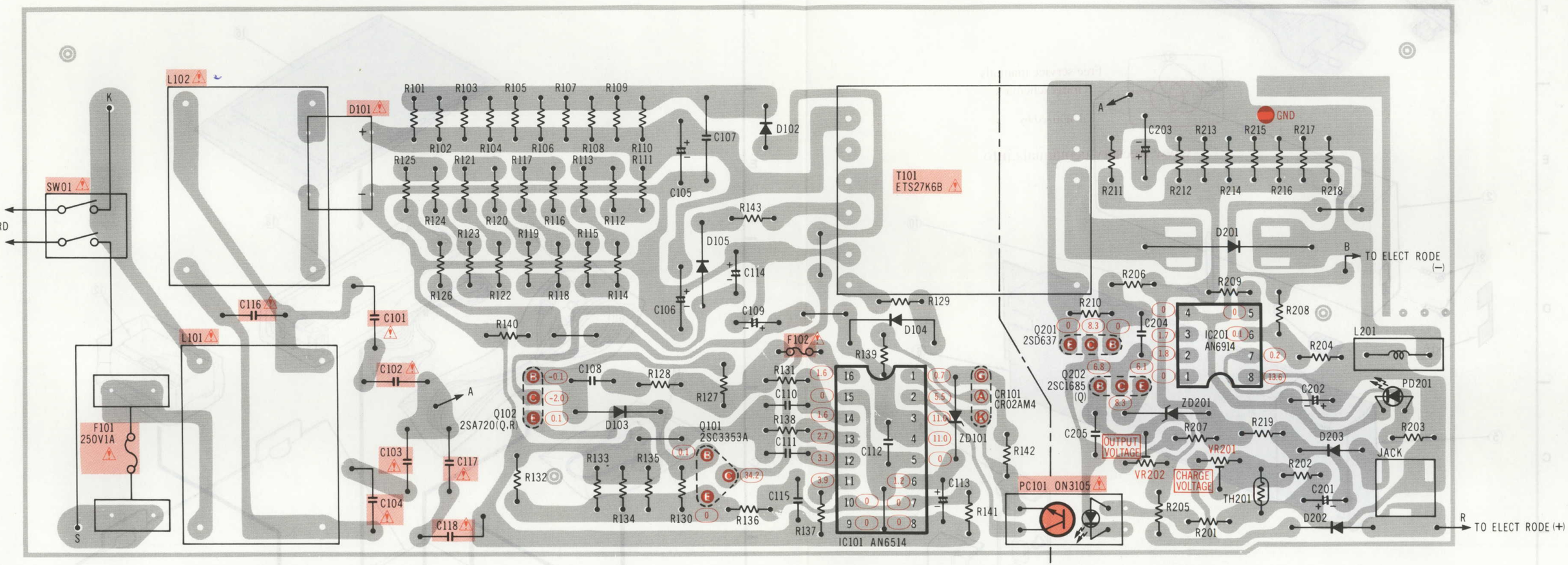
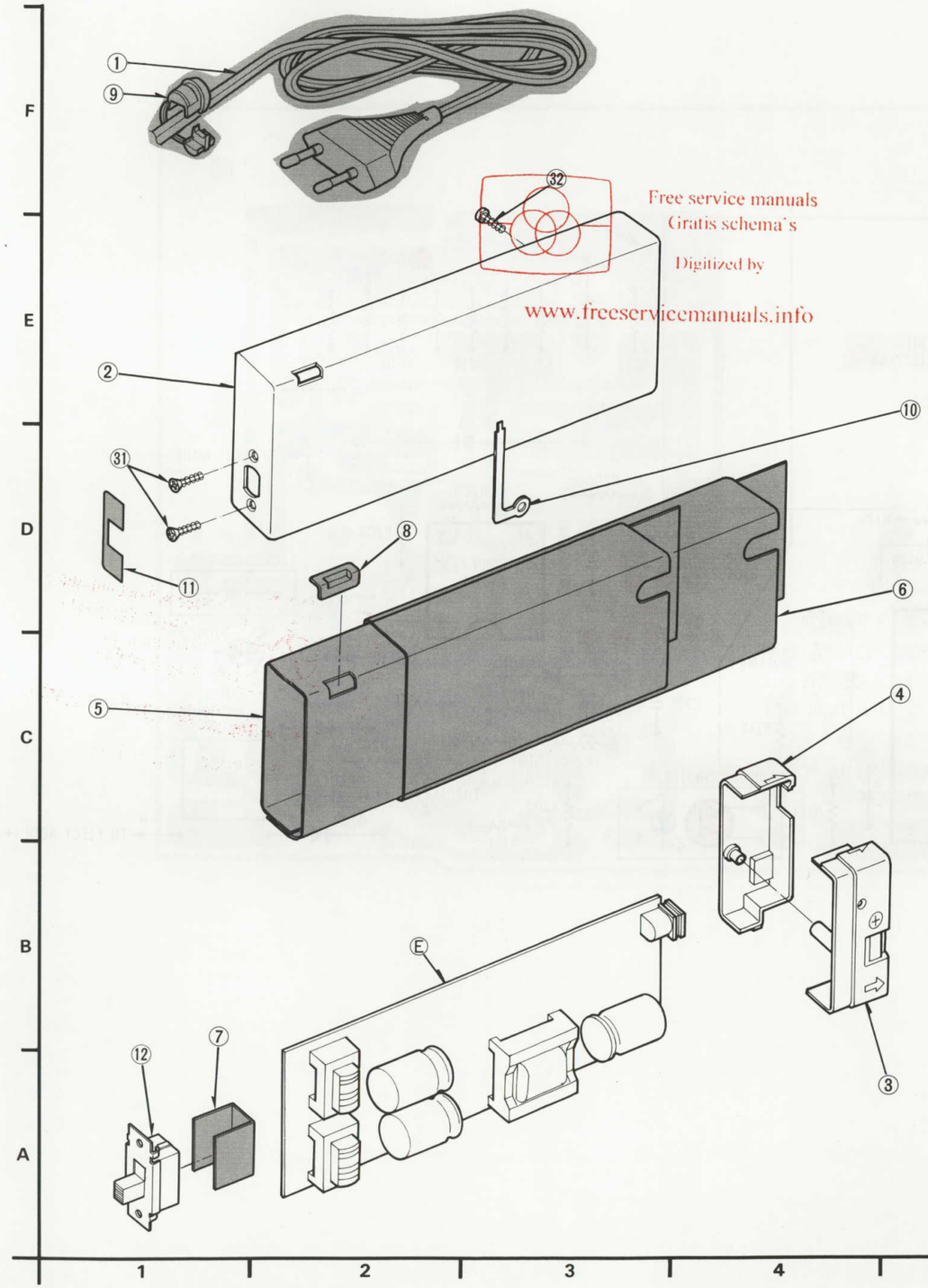
4. CIRCUIT BOARD



— 3 —

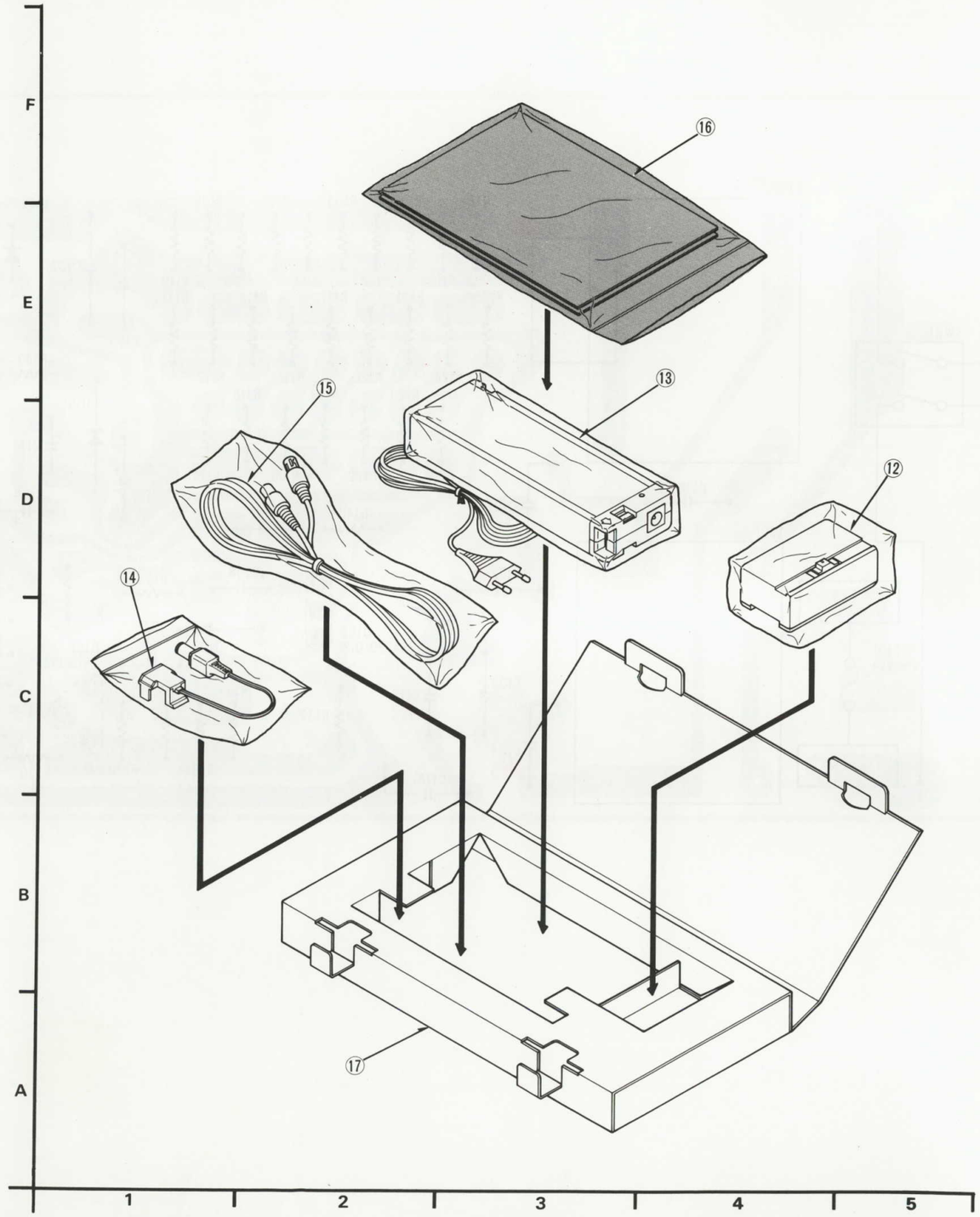
5. EXPLODED VIEWS

❶ CHASSIS & FRAME SECTION



Back Page:
CIRCUIT BOARD

❷ PACKING PARTS SECTION



6. MECHANICAL REPLACEMENT PARTS LIST

Notes: 1. * Be sure to make your orders of replacement parts according to this list.
2. IMPORTANT SAFETY NOTICE
Components identified with the mark ⚠ have the special characteristics for safety. When replacing any of these components, use only the same type.

Ref. No.		Part No.	Part Name & Description	Pcs / Set	Remarks
1(1)		VJA0111	AC Cord	1	VW-A11E ⚠
1(1)		VJA0112	AC Cord	1	VW-A11B ⚠
2(1)		VYK0776	Case Unit	1	VW-A11E
2(1)		VYK0775	Case Unit	1	VW-A11B
3(1)		VKM0295	Cover (A)	1	
4(1)		VKM0296	Cover (B)	1	
5(1)		VMZ0595	Insulator (C)	1	⚠
6(1)		VMZ0596	Insulator (D)	1	⚠
7(1)		VMZ0597	Insulator (E)	1	⚠
8(1)		VMZ0574	Insulator (B)	1	⚠
9(1)		VJF0017	Cord Bushing	1	⚠
10		VJR0116	Earth Angle	1	
11(1)		VQL1919	Switch Label	1	⚠
12(2)		ESE3553	Antenna Select Switch	1	
13(2)		XZB12X23C05	Polyethylene Bag	1	
14(2)		VJA0180	Battery Charging Cord	1	
15(2)		VJA0242	Antenna Cable	1	
16(2)		VQF1253	Fan Bag Kit	1	VW-A11E ⚠
16(2)		VQF1254	Fan Bag Kit	1	VW-A11B ⚠
17(2)		VPG1785	Packing Case	1	VW-A11E
17(2)		VPG1786	Packing Case	1	VW-A11B
			Screw		
31(1)		XSS3+5S		2	
32(1)		XTS3+16BFYJS		1	

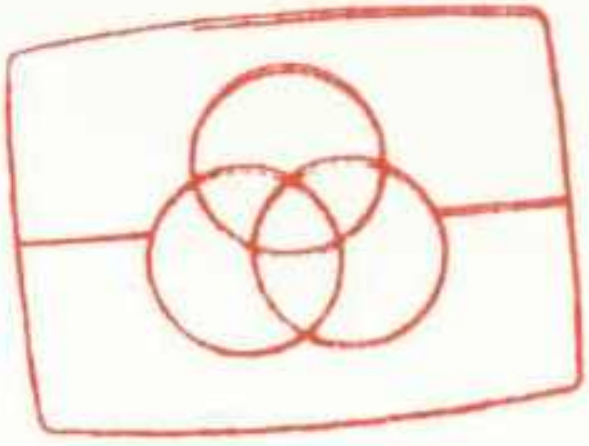
7. ELECTRICAL REPLACEMENT PARTS LIST

Notes: 1. * Be sure to make your orders of replacement parts according to this list.
2. IMPORTANT SAFETY NOTICE
Components identified with the mark ⚠ have the special characteristics for safety. When replacing any of these components, use only the same type.
3. Unless otherwise specified,
All resistors are in OHMS (Ω), 1/4W ± 5% carbon. K=1,000Ω, M=1,000KΩ. All capacitors are in MICROFARADS (μF), ± 10% P=μμF.

Ref. No.		Part No.	Part Name & Description	Pcs / Set	Remarks
		VEP21071A	Plug In AC Adaptor	1	
			P.C. Board Unit		
			Integrated Circuits		
IC101		AN6514		1	
IC201		AN6914		1	
			Transistors		
Q101		2SC3353A		1	⚠
Q102		2SA710		1	(Q,R)
Q201		2SD637		1	(Q)
Q202		2SC1685		1	(Q)
			Diodes		
D101		SIWB60	600V 0.6A	1	⚠
D102		ERC25-06	600V 1.2A	1	
D103		MA161	50V 0.1A	1	
D104,105		ERA21-06	600V 0.5A	2	
D201		ERC35-02	200V 2.5A	1	
D202		MA161	50V 0.1A	1	
D203		S2V10		1	
			Zener Diodes		
ZD101		RD2.7EB		1	
ZD201		MA1062		1	
			Photo Diode		
PD201		LN222RPH		1	
			Resistors		
R101-110		ERD25TLJ334	Chip 330K	10	
R111-126		ERD25TLJ562	Chip 5.6K	16	
R127		ERD25TLJ101	Chip 100	1	
R128		ERD25TLJ221	Chip 220	1	
R129		ERD25TLJ4R7	Chip 4.7	1	
R130		ERD25TLJ471	Chip 470	1	
R131		ERD25TLJ822	Chip 8.2K	1	
R132-135		ERD25TLJ1R0	Chip 1	4	
R136		ERD25TLJ330	Chip 33	1	
R137		ERD25TLJ153	Chip 15K	1	
R138		ERD25TLJ123	Chip 12K	1	
R139		ERD25TLJ272	Chip 2.7K	1	
R140		ERD25TLJ153	Chip 15K	1	
R141		ERD25TLJ101	Chip 100	1	
R142		ERD25TLJ103	Chip 10K	1	
R143		ERQ14LK4R7	Fuse 0.25W 4.7	1	
R201		ERD25TLJ821	Chip 820	1	
R202		ERD25TLJ222	Chip 2.2K	1	
R203		ERD25TLJ182	Chip 1.8K	1	

Ref. No.	Part No.	Part Name & Description	Pcs / Set	Remarks
R204	ERD25TLJ204	Chip 200K	1	
R205	ERD25TLJ392	Chip 3.9K	1	
R206	ERD25TLJ471	Chip 470	1	
R207	ERD25TLJ392	Chip 3.9K	1	
R208	ERD25TLJ102	Chip 1K	1	
R209	ERD25TLJ220	Chip 22	1	
R210	ERD25TLJ243	Chip 24K	1	
R211-218	ERD25TLJ5R6	Chip 5.6	8	
R219	ERQ14LKR20	Fuse 0.2	1	
		Variable Resistors		
VR201	EVN38CA00B23	2K	1	
VR202	EVN38CA00B13	1K	1	
		Capacitors		
C101-104	VCC0010	Ceramic 400V 2200P	4	⚠
C105,106	ECEA2GS220	Electrolytic 400V 22	2	
C107	ECQF6222KZ	Mylar 630V 2200P	1	
C108	VCF0023	Mylar 50V 0.022	1	
C109	ECEA1EU101	Electrolytic 25V 100	1	
C110	VCF0024	Mylar 50V 0.01	1	
C111	VCF0025	Mylar 50V 1000P	1	
C112	VCC0012	Ceramic(Chip) 25V 0.01	1	
C113	ECEA1CS220	Electrolytic 16V 22	1	
C114	ECEA1CG330S	Electrolytic 16V 33	1	
C115	VCC0012	Ceramic(Chip) 25V 0.01	1	
C116	ECQE2A473MW	Mylar 250V 0.047	1	
C117,118	VCC0010	Ceramic 400V 2200P	1	⚠
C201	ECEA1ES4R7	Electrolytic 25V 4.7	1	
C202	ECEA1EU331	Electrolytic 25V 330	1	
C203	ECEA1EU332	Electrolytic 25V 3300	1	
C204,205	VCF0023	Mylar 50V 0.022	2	
		Coils		
L101	ETQ20K9A	Cholk	1	⚠ 56.-
L102	ETQ20K12A	Cholk 36,27	1	⚠
L201	ETQ6K1B	Cholk	1	
		Thyristor		
CR101	CR02AM4		1	
		Thermistor		
TH201	ERTD2FFL142S		1	
		Photo Coupler		
PC101	ON3105		1	
		Transformer		
T101	ETS27K6B		1	⚠
		Switch		
SW01	ESD3997	31,07	1	

Ref. No.	Part No.	Part Name & Description	Pcs / Set	Remarks
		Fuses		
F101	ET1A250V	1A 250V	1	⚠
F102	VSF0034	132°C 5A	1	⚠
		Miscellaneous		
	VJF0141	Fuse Holder	2	⚠
	VJJ0070	Jack	1	
	VSC0998	Heat Sink (A)	1	
	VSC1223	Heat Sink (B)	1	
	XSN3+10	Screw	1	for Q101
	XNG3	Nut	1	for Q101
	XWA3	Washer	1	for Q101
	VMZ0578	Insulator	1	
	VMA6497	F102 Hold Angle	1	



Panasonic

MATSUSHITA ELECTRIC

Printed in Japan

ORDER NO. VRD-8405-579

Training Manual

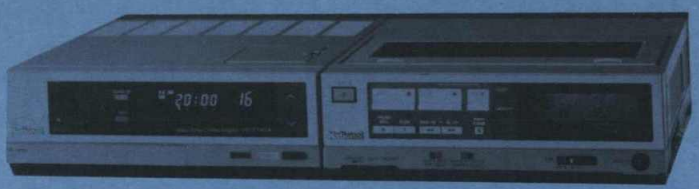
Video Cassette Recorder

VHS

PAL

Technical Descriptions

NV-180



National/Panasonic

Matsushita Electric Trading Co., Ltd.
P.O. Box 288, Central Osaka Japan

INTRODUCTION

This training manual contains the description of new circuits allowing service technicians to understand the NATIONAL/PANASONIC compact and lightweight portable VHS video tape recorder model NV-180, tuner/timer VW-ET180 for TV program recording, plug-in AC adaptor VW-A11, and AC adaptor VW-A18. The main luminance/chrominance circuits of the NV-180 are identical to those of the NV-600 or NV-380EM.

The new NV-180 employs a new 2-double-video-head system featuring super still, super still advance playback without jitter or distortion, super fine slow motion with 1/5 of normal playback speed which can be adjusted between 1/3 and 1/25 via the remote control unit, 7-times speed cue and review, insert editing, audio dubbing, tape time remaining indicator, camera remote control capability, and multi-function display.

The VW-ET180 features 14-day/8 program recording capability plus a daily and weekly function, one-touch timer recording with standby function, single-cord connection to the NV-180, and battery charging function. The combination of these features with the VHS format make the NV-180 an ideal video tape recorder for education, recreation, and entertainment.

CONTENTS

1. GENERAL DESCRIPTION

1.1 Introduction of New Technology

NATIONAL/PANASONIC has succeeded in making a compact, lightweight, and overall operation by implementing a large number of the latest technological developments. Some of the outstanding new technologies are as follows:

1) Development of a new head amp IC AN3310 and luminance IC VFY007. The AN3310 is a head amp IC exclusively for the 2-double-video-head system. Due to this advanced system, the picture is perfectly clear and free from distortion and jitter, not only in normal playback but also in super still, super still advance, and super fine slow. Moreover, the noise distortion in cue/review is further reduced. Optimum RF envelope signals are obtained from the video track during trick playback due to the active tuning head SW in this IC.
   The operation of each block in luminance IC VFY007 is the same as that of conventional luminance ICs.
   New IC is constructed by only one IC.
2) A new direct-drive video head is employed in the NV-180. Use of a hydro-dynamic bearing DD cylinder has resulted in reduced thickness and accurate rotation.
3) Development of a new direct-drive reel motor and reel servo IC. Use of the DD reel motor and reel servo IC has resulted in reduced thickness and accurate rotation control.

1) Trick Playback and 2-Double-Video Head lead

The location of the 2-double-video head is shown in Fig. 1—1. As shown in Fig. 1—1, the structure of each head results in the pairs of R'49μm, L35μm, and L'49μm, R30μm.
In the recording mode, the R'49μm and L'49μm heads are used to record the tape. The resultant track pattern is shown in Fig. 1—2. In the playback mode, the same heads (R' and L') are used and traces the same track pattern. However, in the trick playback mode, all 4 heads are used.

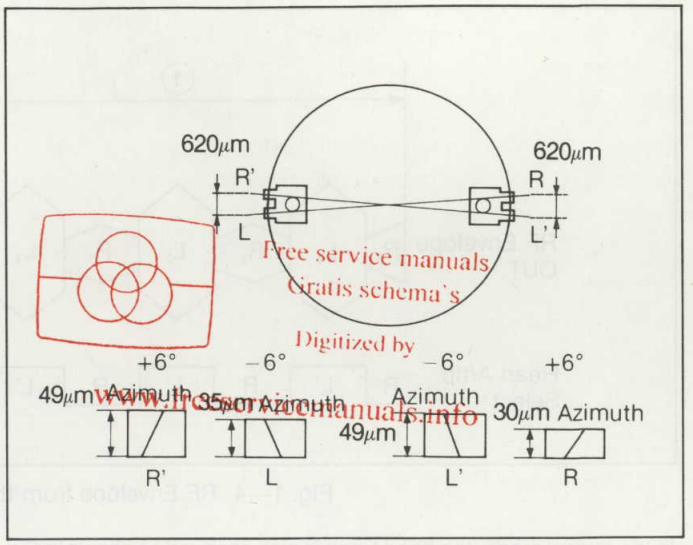


Fig. 1—1 2-Double-Video Head

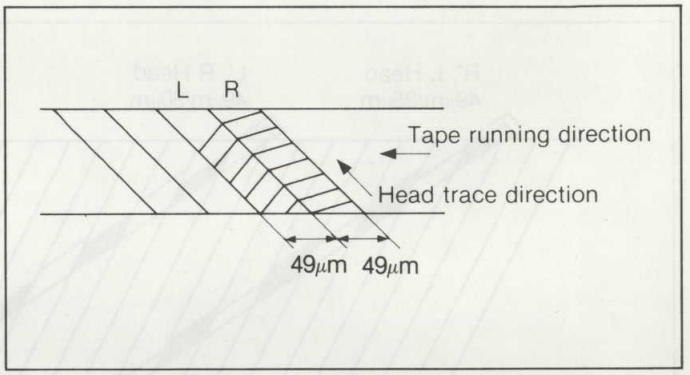


Fig. 1—2 Track Pattern

Speed Search Mode (cue/review)

Let's assume that track R is recorded with the +6° azimuth R' head and that track L is recorded with the −6° azimuth L' head. The signal recorded on track R can be picked up only on the R or R' head (+6° azimuth head), and the signal on track L can be picked up only on the L or L' head (+6° azimuth head).
In the cue mode, the tape speed increases and the direction of the head trace changes as shown in Fig. 1—3. Therefore, with conventional heads, when head R traces the track, the signal on track L cannot be picked up. A 2-double-head is used to resolve this. When the head reaches track L, the head changes to head L and can thus also pick up track L. In other words, when double head L' and R traces track L, head L' is used, and when double head L' and R traces track R, head R is used due to the head Amp. Switching pulse.
The RF envelope for the cue mode is shown in Fig. 1—4.

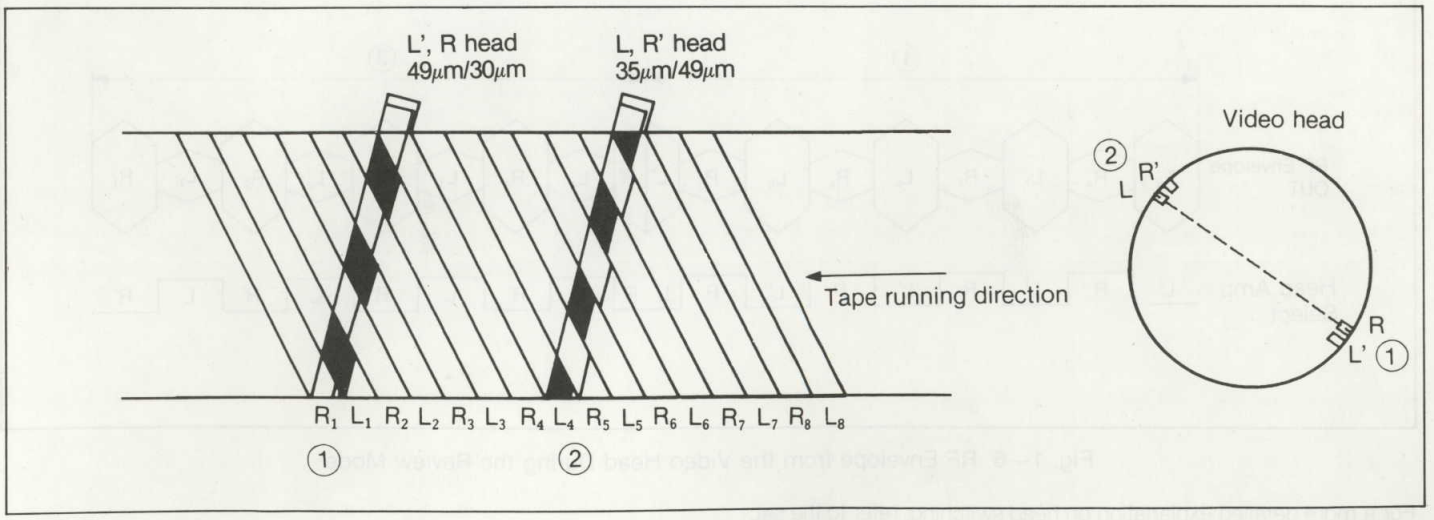


Fig. 1—3 Head Time of CUE Mode

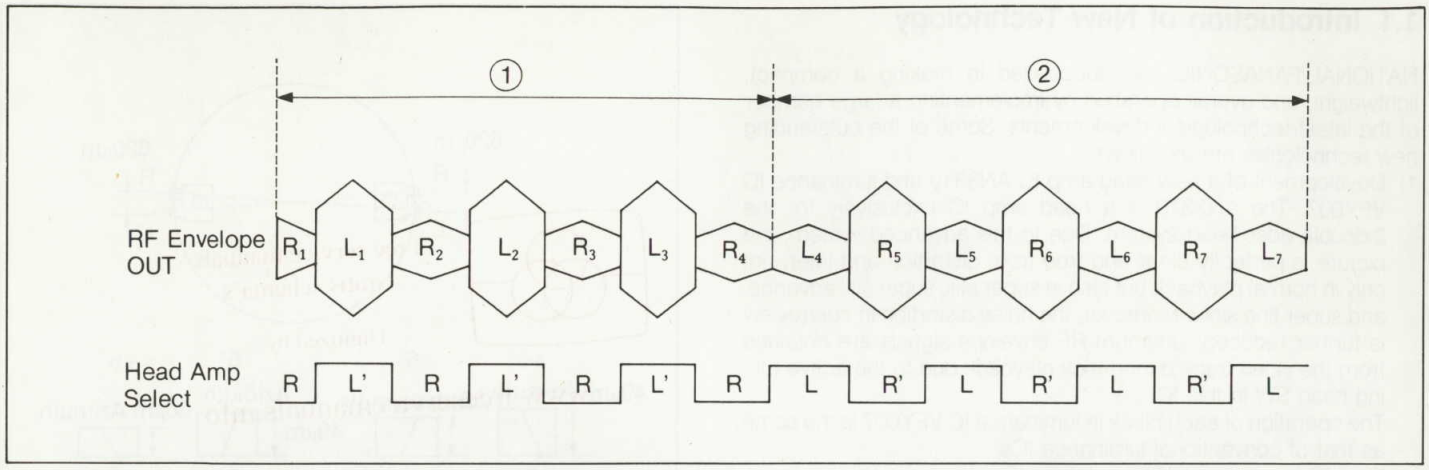


Fig. 1—4 RF Envelope from the Video Head During the Cue Mode

In the review mode, the head trace is also changed as shown in Fig. 1—5. Head switching is performed as in the cue mode. The RF envelope for the review mode is shown in Fig. 1—6.

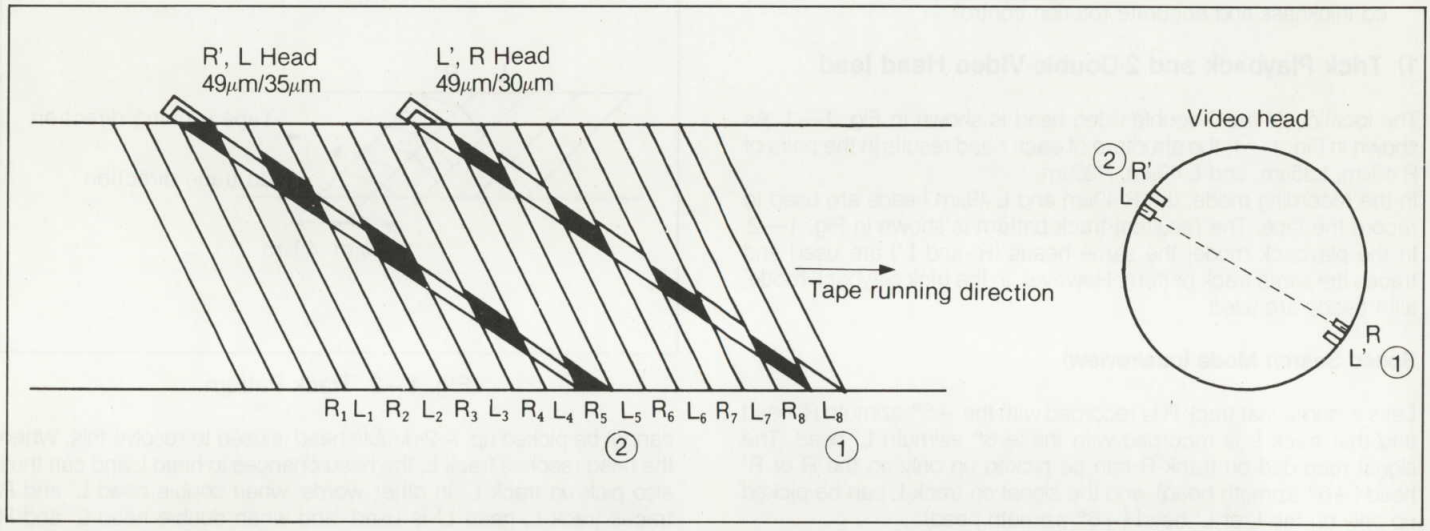


Fig. 1—5 Head Trace for the Review Mode

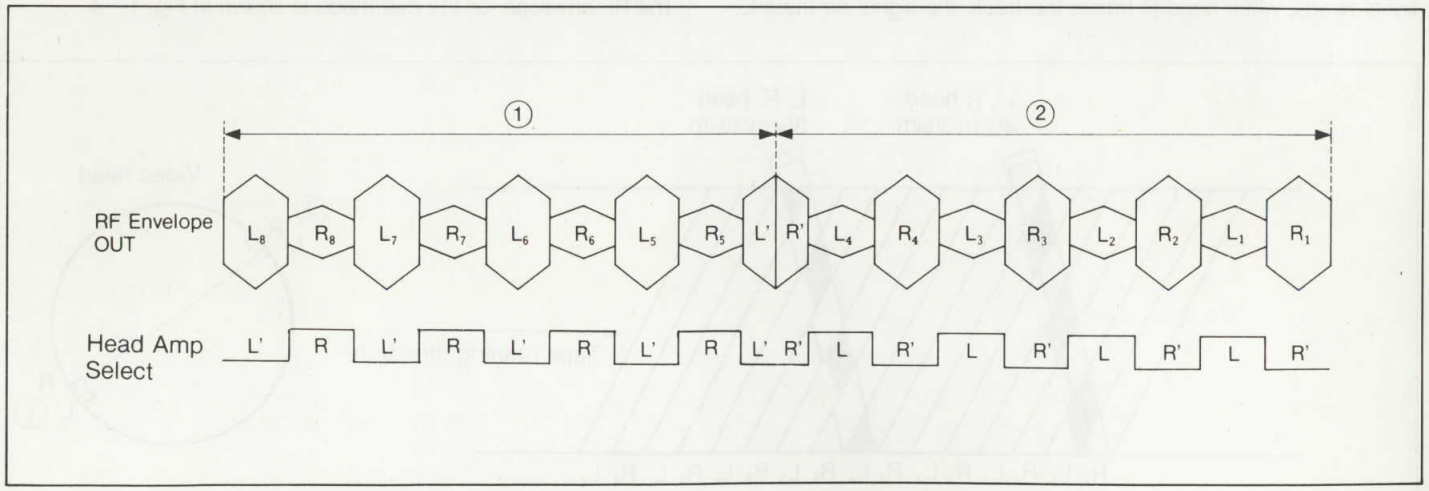


Fig. 1—6 RF Envelope from the Video Head During the Review Mode

For a more detailed explanation on head switching, refer to the section on luminance.

Super Still Mode

The principle of super still is the same as in conventional 3-head systems.
During the still mode, conventional 2-head VTRs play back the recorded track corresponding to one frame (2 fields) using the right and left head each having a different azimuth angle. Thus when fast moving pictures are played back in the still mode, the contents of the video signals between the right and left tracks vary, causing the picture to flutter. (refer to Fig. 1—7)

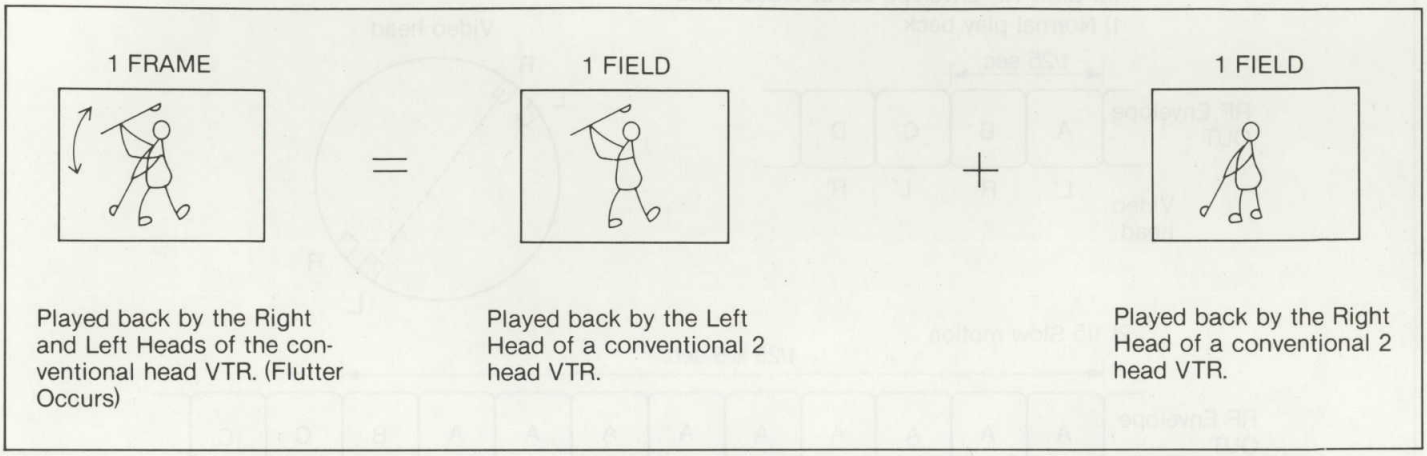


Fig. 1—7 Conventional 2-head VTR Still Mode

The NV-180 plays back one field picture using head L having an azimuth angle identical to head L', thus causing no flutter to appear in the playback pictures in the still and slow modes. (refer to Fig. 1—8)

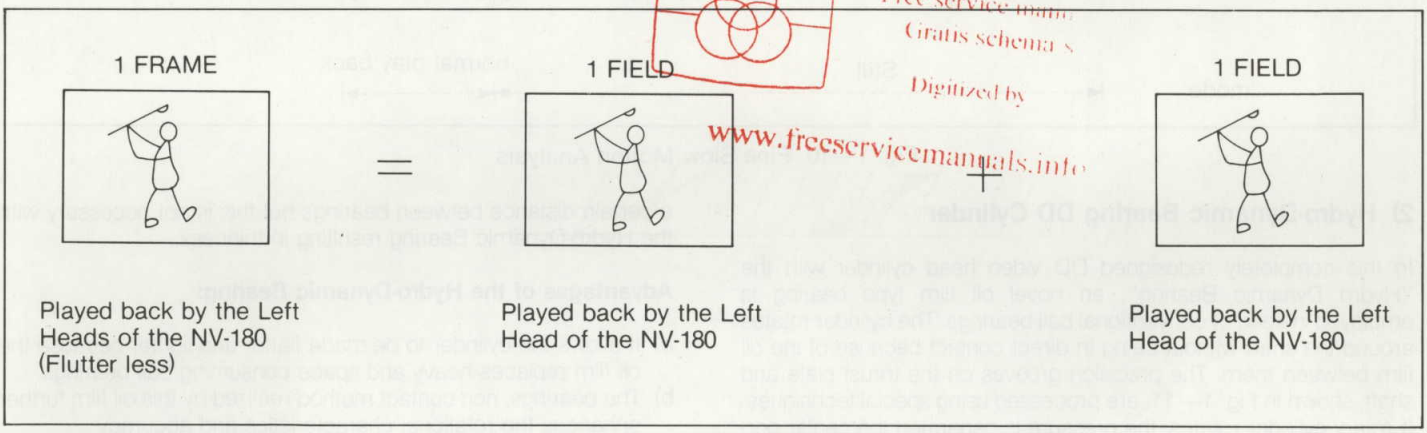


Fig. 1—8 NV-180 Still Mode

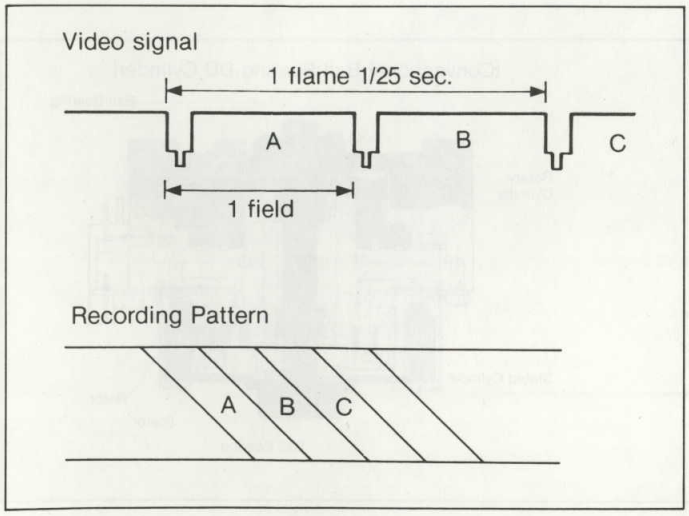


Fig. 1—9

Super Fine Slow Mode

When the slow button is pressed during the play mode, the VTR enters the fine slow mode with a speed 1/5 of normal playback. The basic principle of the slow mode is described below.

The playback speed is determined by the time it takes to playback 1 frame signal (1/25 second) recorded on tape. Therefore, for 1/5 speed slow motion, 1 frame signal (tracks A, B) must be played back in 1/25 x 5 seconds.

As can be seen from the RF envelope out of the video head shown in Fig. 1—10, the 1/5 slow motion consists of repeating the still playback (1-4) and normal playback (5).
In other words, the 1/5 slow motion is performed by playing back 4 frames in still playback and 1 frame in normal playback.
The 1/3 to 1/25 speed slow motion, adjustable via the remote control unit is also based on the same principle.
For more details, refer to the section on the servo.

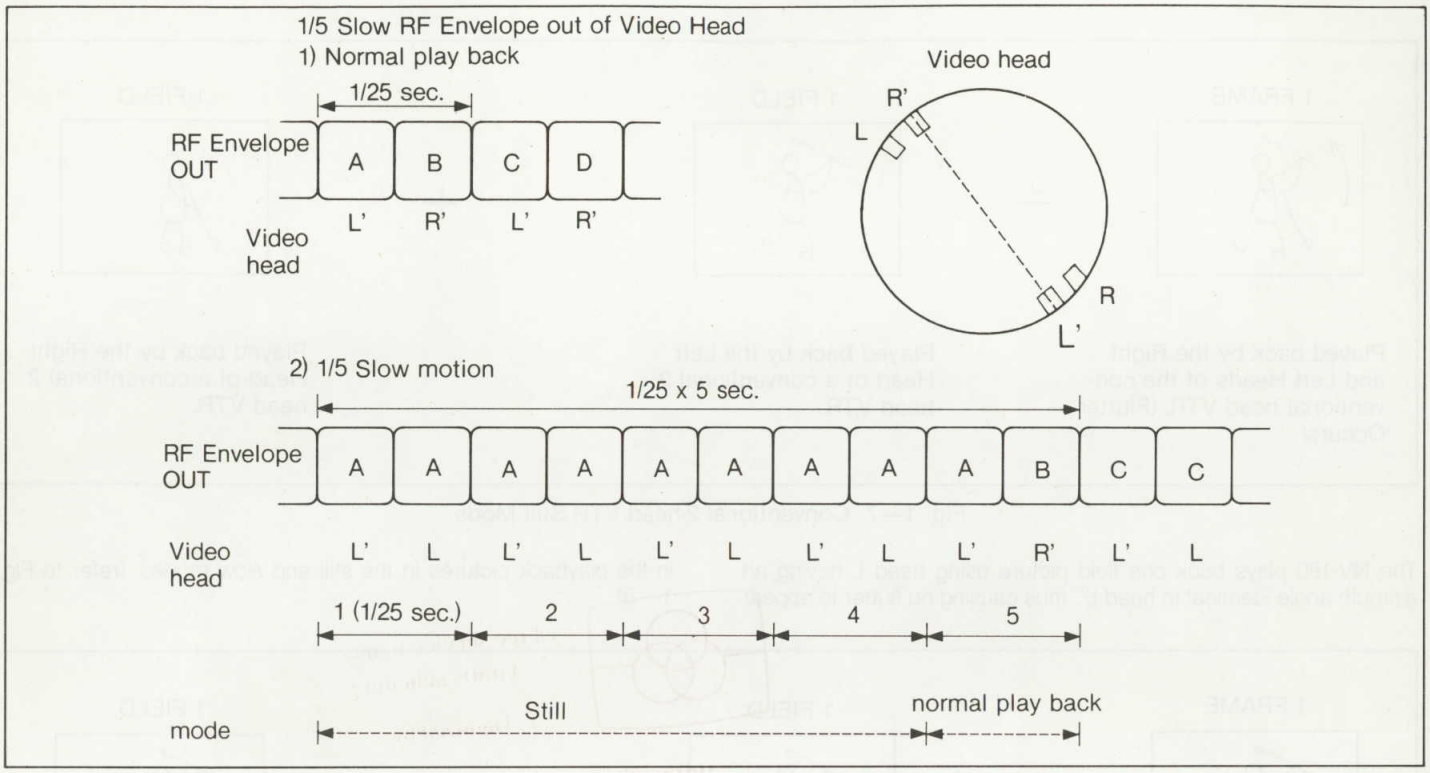


Fig. 1—10 Fine Slow Motion Analysis

2) Hydro-Dynamic Bearing DD Cylinder

In this completely redesigned DD video head cylinder with the "Hydro Dynamic Bearing", an novel oil film type bearing is employed instead of conventional ball bearings. The cylinder rotates around the shaft without being in direct contact because of the oil film between them. The precision grooves on the thrust plate and shaft, shown in Fig. 1—11, are processed using special techniques. If rotary cylinder rotates, the pressure is generated the center portion of shaft due to groove, Therefore, rotary cylinder can be got the accurate rotation with non-contact, Conventional ball bearings need a certain distance between bearings but this is not necessary with the Hydro-Dynamic Bearing resulting in thinness.

Advantages of the Hydro-Dynamic Bearing:

a) It allows the cylinder to be made flatter and lighter because the oil film replaces heavy and space consuming ball bearings.
b) The bearings, non-contact method realized by this oil film further enhances the rotational characteristics and accuracy.
c) The durability is very high since bearing friction is eliminated.

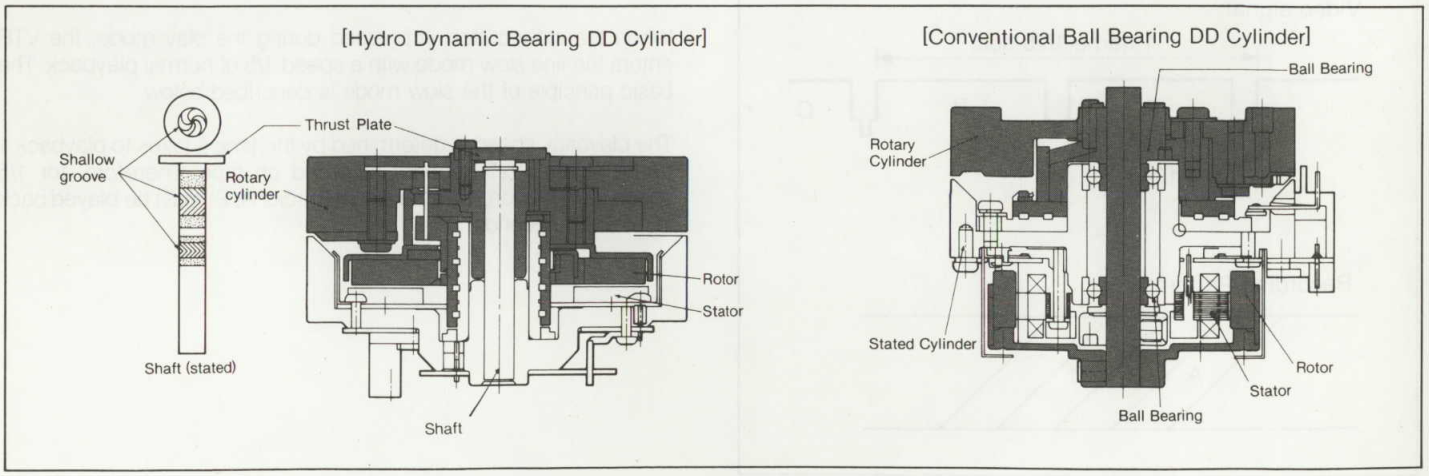


Fig. 1—11 Hydro Dynamic Bearing

3) DD Reel Motor and Reel Servo

In addition to the conventional National/Panasonic DD motors for the capstan and head cylinder, the use of these flat DD motors for both the take-up and supply reels has achieved not only a saving in space and weight through the elimination of the belt drive, but also adds to the precision of the tape transport of the reel servo is described in the following.

When in the PLAY/REC PLAY/CUE mode, the tension servo is used for constant tension.

The tension servo controls the supply reel motor torque by moving the tension post. A highly accurate tape tension is obtained due to this tension servo. The constitution of the tension servo is shown in Fig. 1—12.

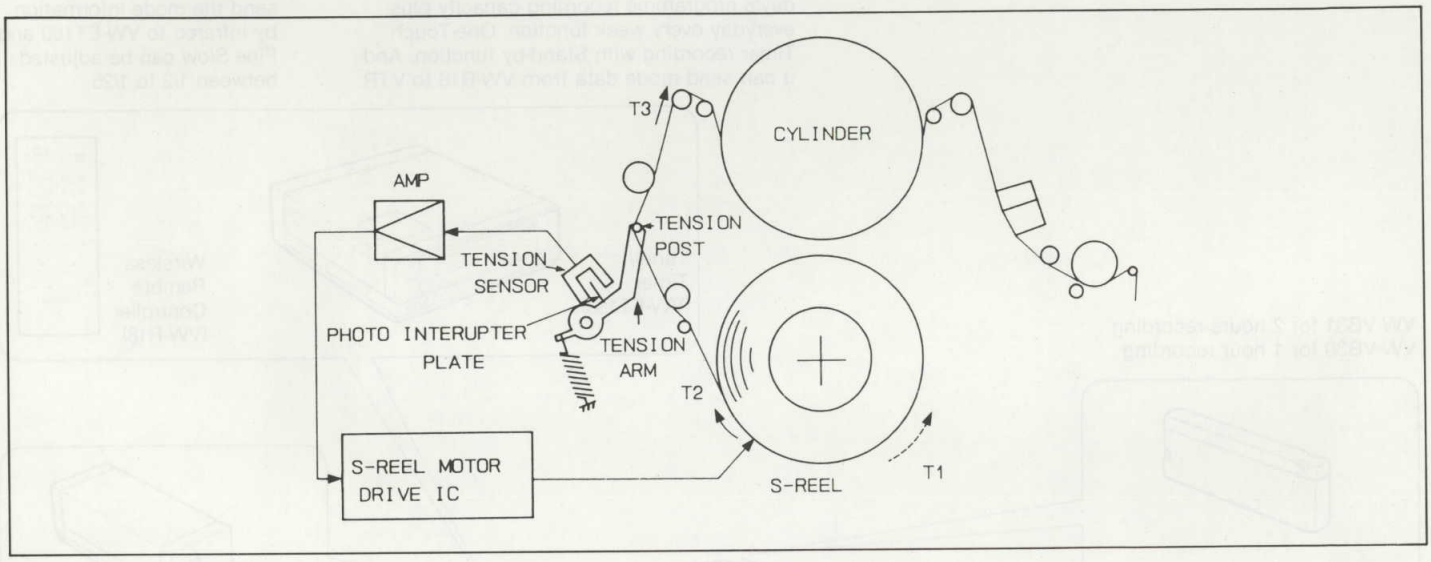


Fig. 1—12 Tension Servo Constitution

Normally, a torque is applied to the supply-reel motor to maintain a constant tension.

If excess tape tension is applied to the tension post, the tension post moves to the right. The tension sensor detects this movement and the reel servo controls the torque in the T2 direction by reducing the tape tension as shown in Fig. 1—12.

The converse is also true. If the tape tension is insufficient, the reel motor is controlled in the T1 direction to keep the tape tension constant. At this time, the take-up reel detects the diameter of the tape already taken-up and controls for a torque which is proportional to the diameter.

In the FF/REW/REVIEW modes, the supply/take-up reel motor is controlled by a torque which is proportional to the tape diameter or by a constant torque depending on the tape diameter detection as shown in Fig. 1—13. For a more detailed explanation on the tape tension control, refer to the section on the servo.

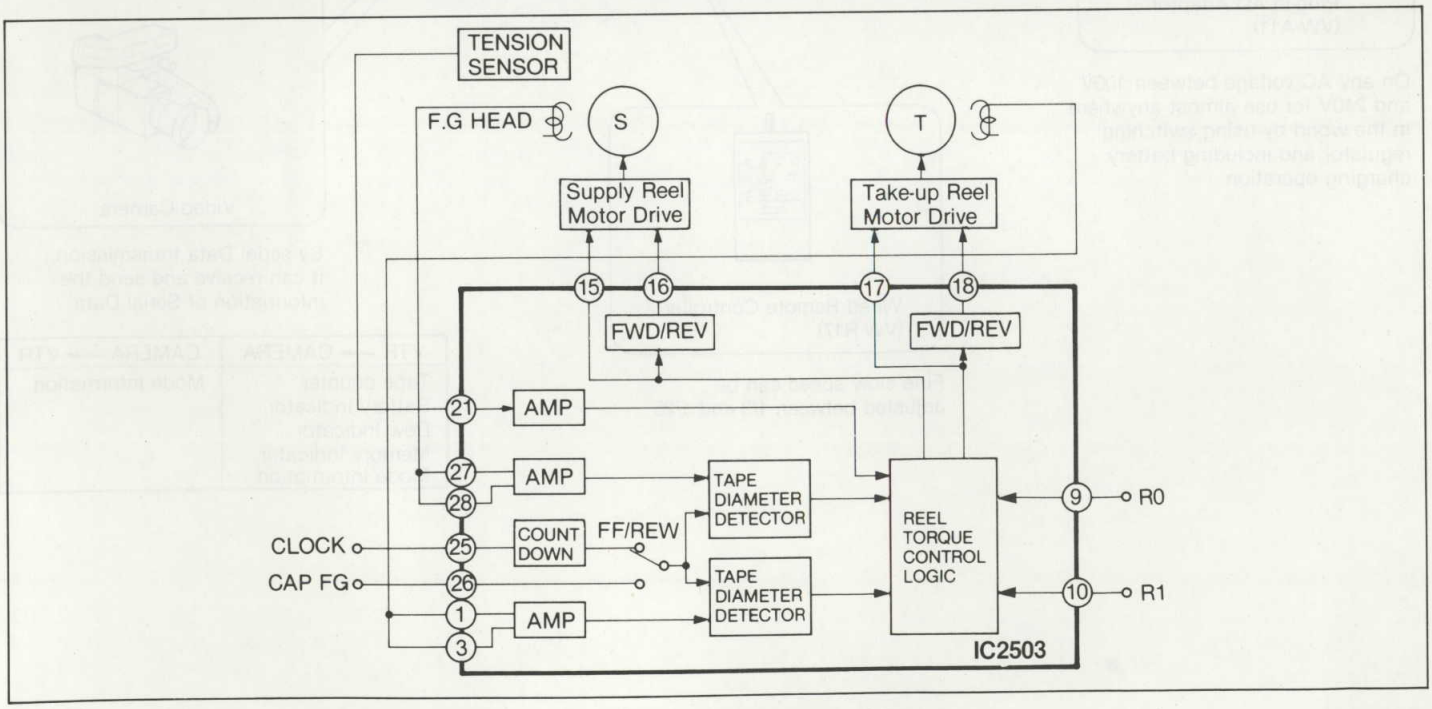


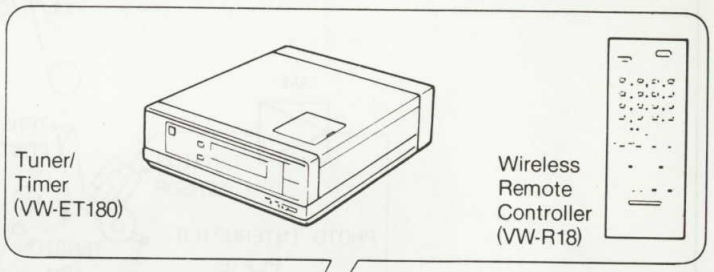
Fig. 1—13 Simplified Block Diagram of Reel Servo

1.2 System Operation

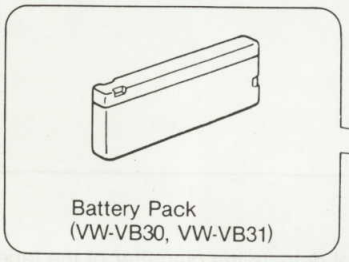
The new portable NV-180 has many practical applications depending on the accessory equipment. The portable system and its operation are described below.

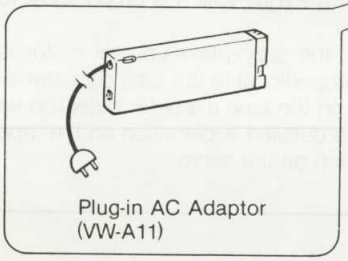
For TV programme recording, featuring 14 day/8 programme recording capacity plus everyday every week function, One-Touch Timer recording with Stand-by function. And it can send mode data from VW-R18 to VTR.

This Remote Controller can send the mode information by infrared to VW-ET180 and Fine Slow can be adjusted between 1/3 to 1/25

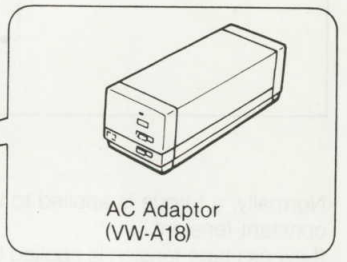


VW-VB31 for 2 hours recording
VW-VB30 for 1 hour recording

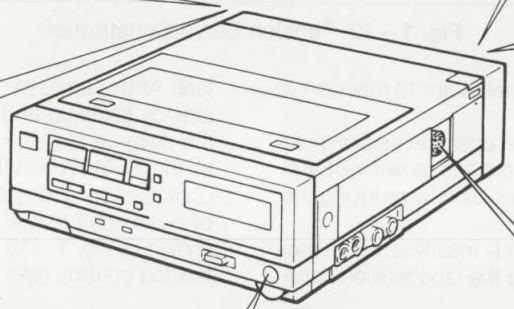


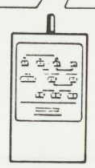


On any AC voltage between 100V and 240V for use almost anywhere in the world by using switching regulator and including battery charging operation

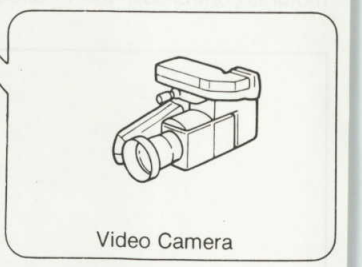


For operation of the VTR on AC 110-130/180-260V by switching regulator, and including Battery changing function





Fine slow speed can be adjusted between 1/3 and 1/25



By serial Data transmission, it can receive and send the information of Serial Data

VTR → CAMERA	CAMERA → VTR
Tape counter Battery Indicator Dew Indicator Memory Indicator Mode Information	Mode Information

2. LUMINANCE CIRCUIT

A new Luminance FIC VFY007 and Head Amp IC AN3310 have been developed and adopted for this model, but each block inside the Luminance FIC has the same operation as the conventional Luminance circuit of the current model VTR.
Therefore, for information regarding the Luminance circuit except for the New head Amp circuit and conventional Low noise frequency canceller, please refer to the current model Training Manual.
The Block Diagram of Luminance circuit is shown in Fig. 2—1.

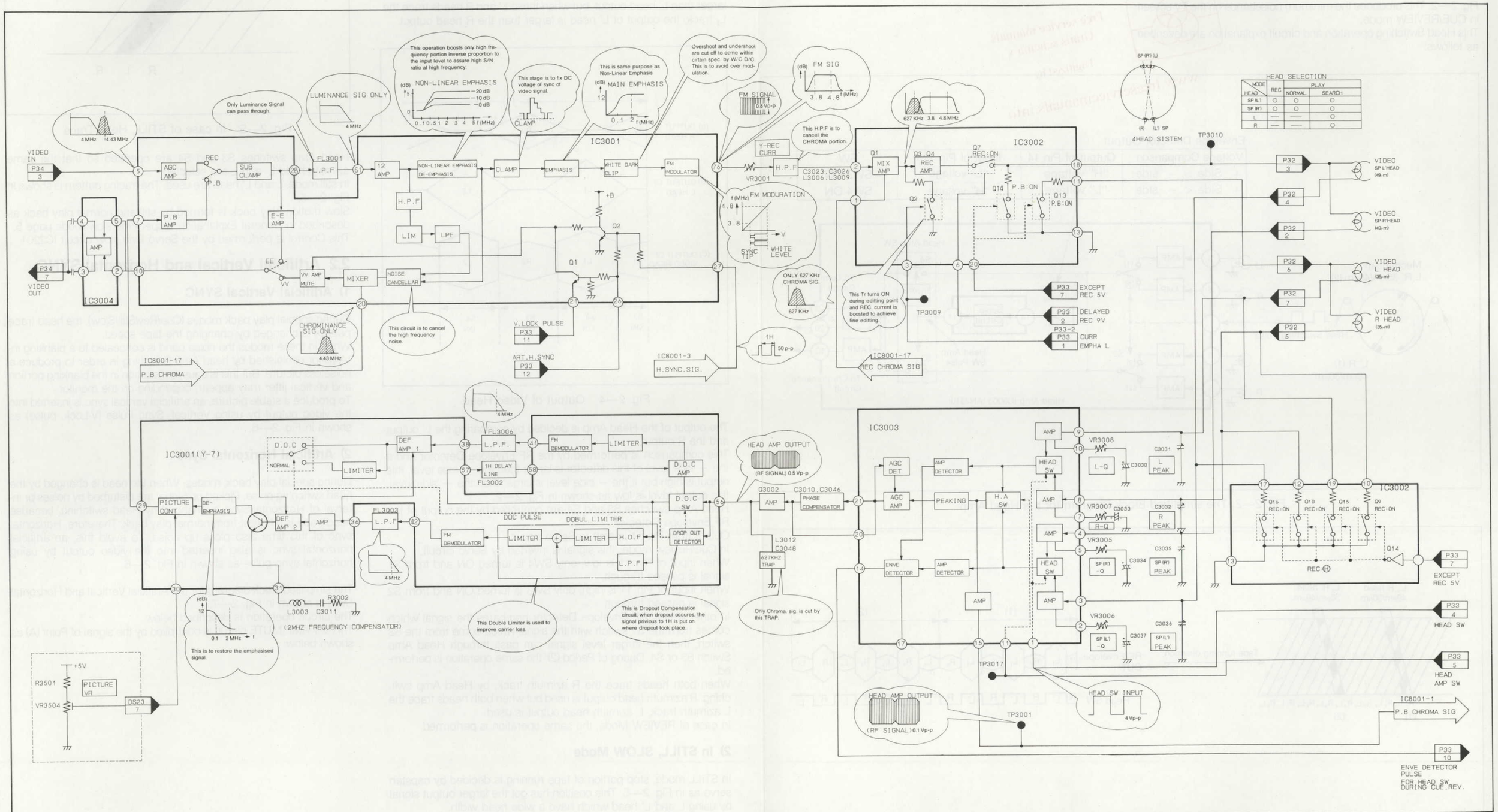


Fig. 2—1 The Block Diagram of Luminance circuit.

2.1 Head Amp Circuit

This new Head Amp Integral Circuit, AN3310 has been developed for 2-double-Video-head system.
In CUE/REVIEW mode, the head amp switch circuit is controlled by the Envelope Detector in the Integrated circuit AN3310 as shown in Fig. 2—2. This produces the minimum noisebands on the TV screen in CUE/REVIEW mode.
This Head Switching operation and circuit explanation are described as follows:

1) In CUE Mode

The simplified block diagram of the Head Amp switching circuit is shown in Fig. 2—2 and in CUE mode, the head trace is shown in Fig. 2—3, the output signal which is switched (RF envelope) is shown in Fig. 2—3.

Envelope Detector Output

Voltage Comparison	Output of Pin 14	Input of Pin 11	SW
+ Side > − side	"H" voltage	"L" voltage	SW3 ON
+ Side < − side	"L" voltage	"H" voltage	SW4 ON

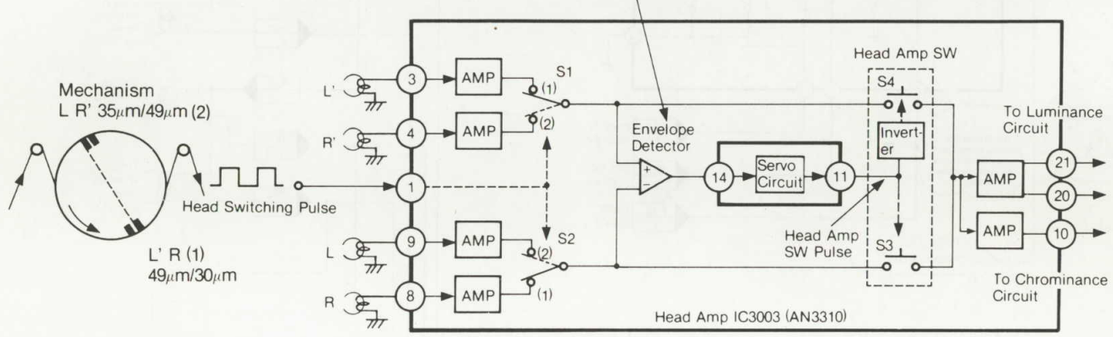


Fig. 2—2 The simplified Block Diagram for the Head Amp

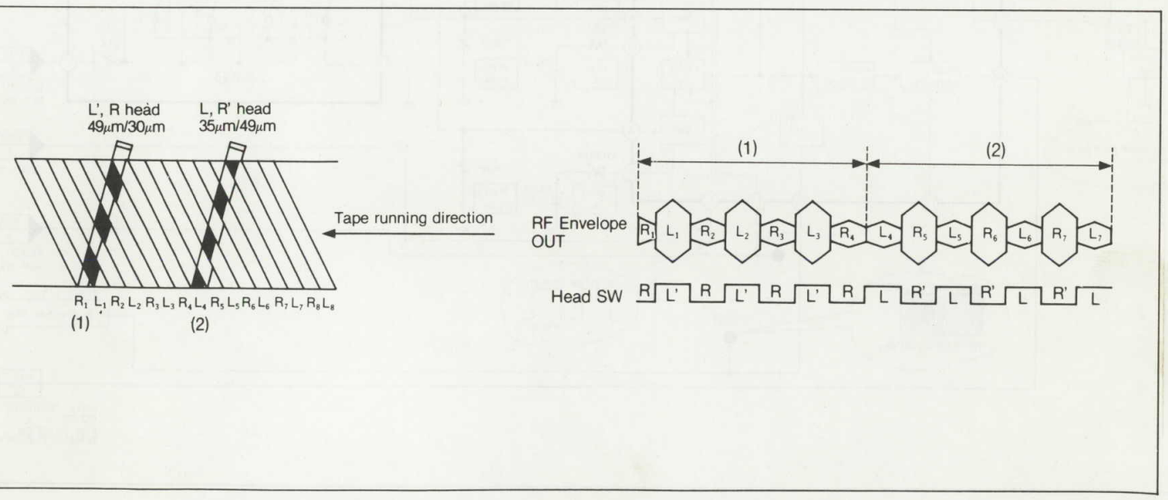


Fig. 2—3 In case of CUE Mode, Head Trace and RF Envelope Signal Output.

Period (1), (the period that the L' and R heads trace the recorded track) S1, S2 of IC3003 are turned (1) side by the head switching pulse.
Both outputs of these L' and R heads become as shown in Fig. 2—4 (a), (b).
When these head L', R trace the R_1 track the output of R head is larger than L' head output, but when these L' and R heads trace the L_1 track, the output of L' head is larger than the R head output.

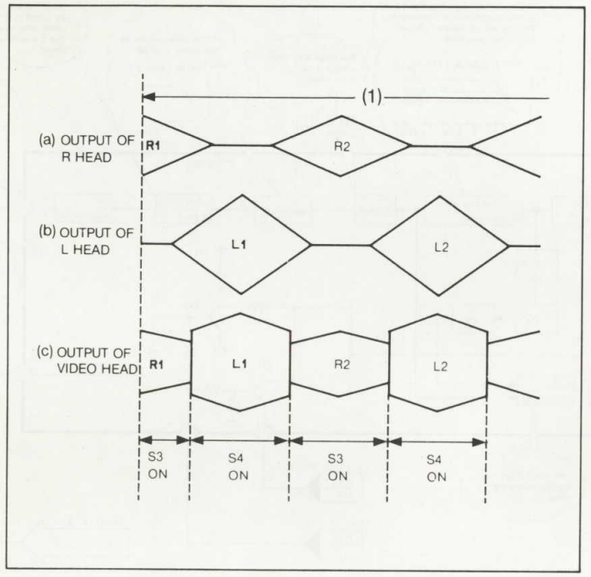


Fig. 2—4 Output of Video Head

The output of the Head Amp is decided by comparing the L' output and the R output.
This comparison is performed by the RF Envelope Detector and if the + side level of this detector is larger than the − side level, this output is high but if the − side level is larger than the + side level, this output level is low as shown in Fig. 2—2.
Head Amp switches S3 and S4 are controlled by the output of the RF Envelope Detector.
Output from Pin 14 is sent to Servo circuit.
In Cue/Review mode, this signal is inverted by Servo circuit.
When input of Pin 11 is low, only SW4 is turned ON and from S1 signal is passed through.
When input of Pin 11 is high, only SW3 is turned ON and from S2 signal is passed through.
In other words, RF Envelope Detector compares the signal which comes from the S1 switch with the signal which come from the S2 switch, then the larger level signal can pass through Head Amp Switch S3 or S4. During of Period (2), the same operation is performed.
When both heads trace the R azimuth track, by Head Amp switching, R azimuth head output is used but when both heads trace the L azimuth track, L azimuth head output is used.
In case of REVIEW Mode, the same operation is performed.

2) In STILL, SLOW Mode

In STILL mode, stop portion of tape running is decided by capstan servo as in Fig. 2—5. This position has got the larger output signal by using L and L' head which have a wide head width.
For an explanation on why the same azimuth head is used, please refer to General Explanation; Super Still mode page 5.

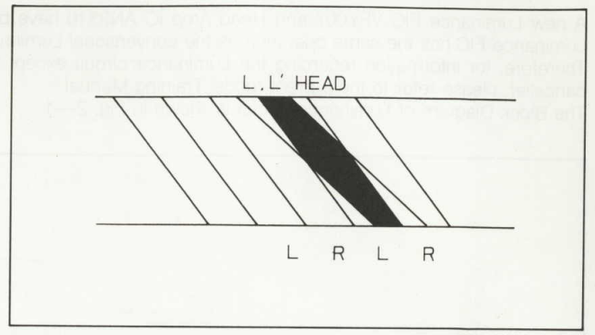


Fig. 2—5 In case of STILL, Head Trace

Head Amp switches S3 and S4 are operated so that the same azimuth head L' and L are selected.
In still mode, L and L' head are used. The tracing pattern is shown in Fig. 2—5.
Slow motion play back is formed by still and normal play back as described in General Explanation; Super Fine slow mode page 5.
This Control is performed by the Servo Fine slow circuit IC2201.

2.2 Artificial Vertical and Horizontal SYNC

1) Artificial Vertical SYNC

During special play back modes (Cue/Rev/Still/Slow), the head trace pattern is changed by changing the tape speed.
When in these modes the noise band is concealed to a blanking interval or diminished by head Amp Switching in order to produce a noiseless picture. But this is causes distortion in the blanking portion and vertical jitter may appear, depending on the monitor.
To produce a stable picture, an artificial vertical sync is inserted into the video output by using Vertical. Sync Pulse (V-Lock, pulse) as shown in Fig. 2—6.

2) Artificial Horizontal Sync

During special play back, modes. When the head is changed by the head switching pulse, Picked up Signal are disturbed by noises or interval of Horizontal-Sync is changed by Head switching, because head trace is different from normal play back. Therefore, Horizontal sync of this time also picks up noise. To avoid this, an artificial horizontal sync is also inserted into the video output by using horizontal sync pulse as shown in Fig. 2—6.

The simplified block diagram for the Artificial Vertical and Horizontal Sync is shown in Fig. 2—7.
The circuit operation is described below.
This V-V AMP MUTE circuit is controlled by the signal of Point (A) as shown below:

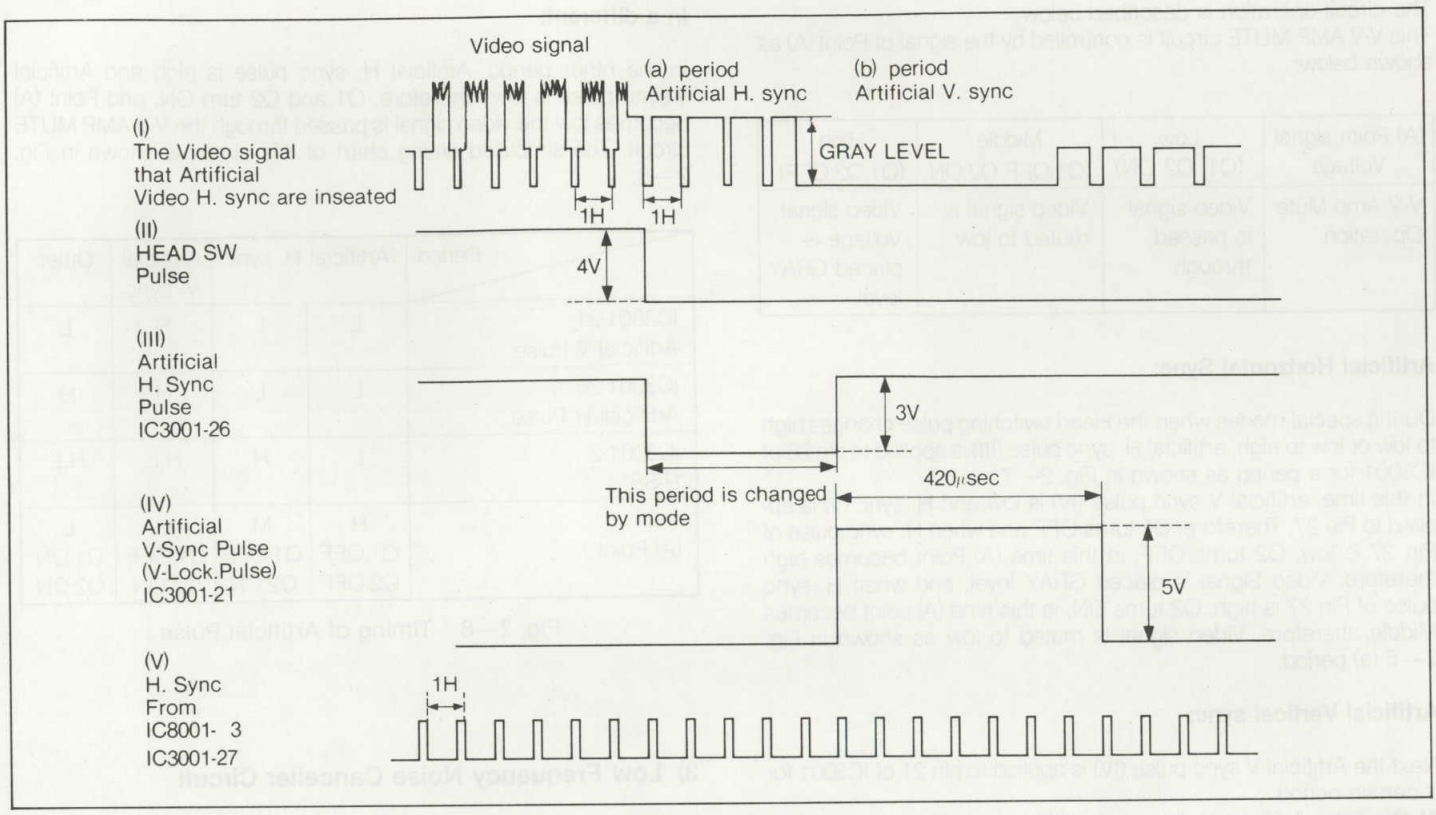


Fig. 2—6 Artificial Vertical and Horizontal sync.

The simplified block diagram for the Artificial Vertical and Horizontal Sync is shown in Fig. 2—7.

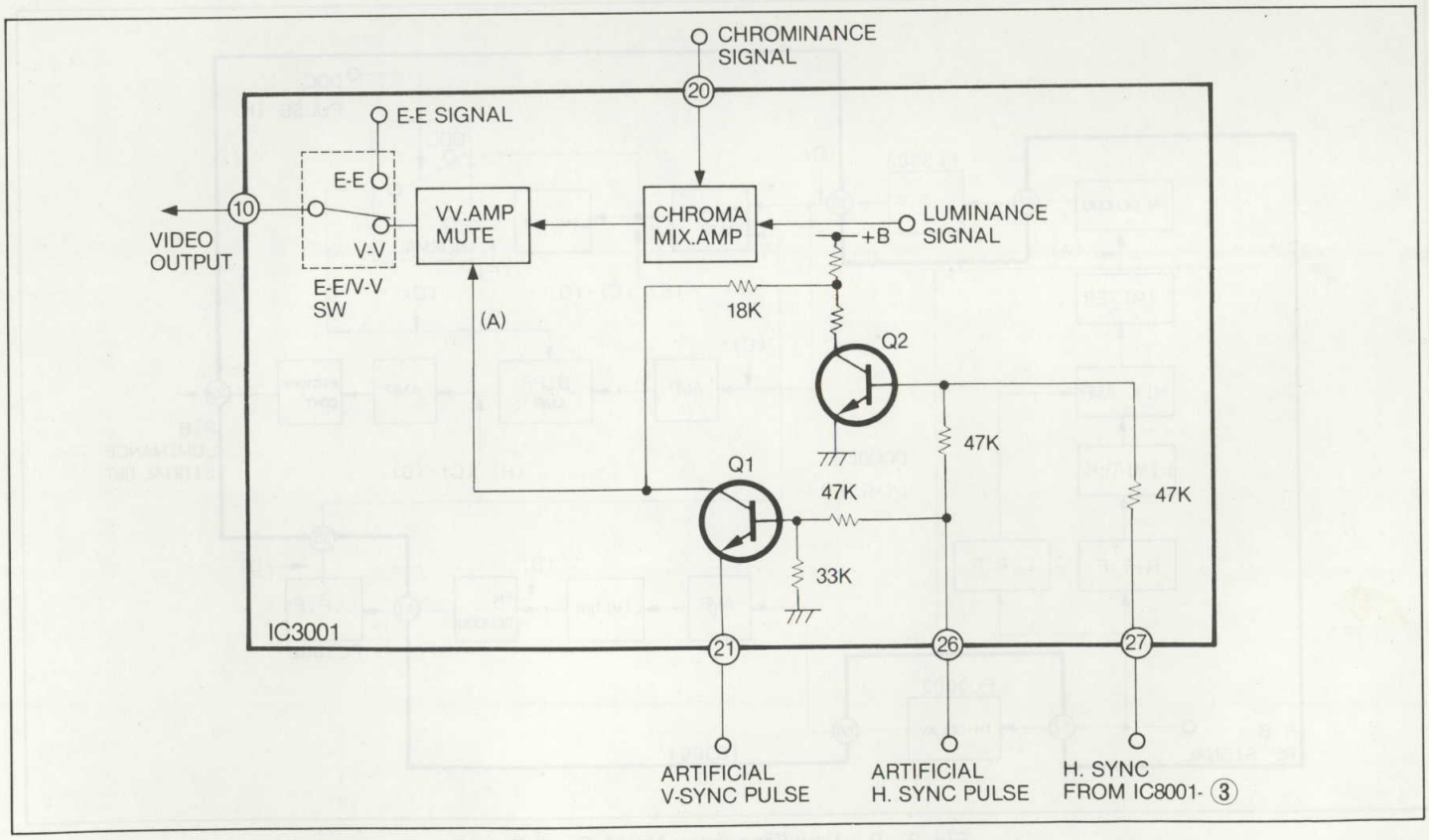


Fig. 2—7 Simplified Block Diagram for Vertical and Horizontal Sync Input

The circuit operation is described below.
This V-V AMP MUTE circuit is controlled by the signal of Point (A) as shown below:

(A) Point signal Voltage	Low (Q1, Q2 ON)	Middle (Q1:OFF Q2:ON	High (Q1,Q2:OFF)
V-V Amp Mute Operation	Video signal is passed through	Video signal is muted to low	Video signal Voltage is placed GRAY level

Artificial Horizontal Sync:

During special modes when the Head switching pulse changes high to low or low to high, artificial H. sync pulse (III) is applied to pin 26 of IC3001 for a period as shown in Fig. 2—7.
In this time, artificial V sync pulse (IV) is low and H. sync (V) is applied to Pin 27. Therefore, Q1 turns OFF and when H. sync pulse of Pin 27 is low, Q2 turns OFF, in this time (A) Point becomes high therefore, Video Signal is placed GRAY level, and when H. sync pulse of Pin 27 is high, Q2 turns ON, in this time (A) point becomes Middle, therefore, Video signal is muted to low as shown in Fig. 2—6 (a) period.

Artificial Vertical sync:

Next the Artificial V sync pulse (IV) is applied to pin 21 of IC3001 for a certain period.
At this time, Artificial H. sync pulse (III) is high. Therefore, the Q1 transistor turns OFF, but Q2 turns ON. As a result, Point (A) goes to the middle and the Artificial V-sync is inserted to video output as shown in Fig. 2—6 (b) period.

In a different:

In the other period, Artificial H. sync pulse is high and Artificial V-sync pulse is low. Therefore, Q1 and Q2 turn ON. and Point (A) becomes low the video signal is passed through the V-V AMP MUTE circuit. The simplified timing chart of this circuit is shown in Fig. 2—8.

Period	Artificial H. sync		Artificial V. sync	Other
IC3001-21 Artificial V Pulse	L	L	H	L
IC3001-26 Artificial H Pulse	L	L	H	H
IC3001-2 H-SS	L	H	H,L	H,L
(A) Point	H Q1:OFF Q2:OFF	M Q1:OFF Q2:ON	M Q1:OFF Q2:ON	L Q1:ON Q2:ON

Fig. 2—8 Timing of Artificial Pulse

3) Low Frequency Noise Canceller Circuit

During play back, this circuit is used to improve the overall signal to noise ratio, especially in the low frequency components, and eliminates the switching noise from the Dropout Compensation Circuit.

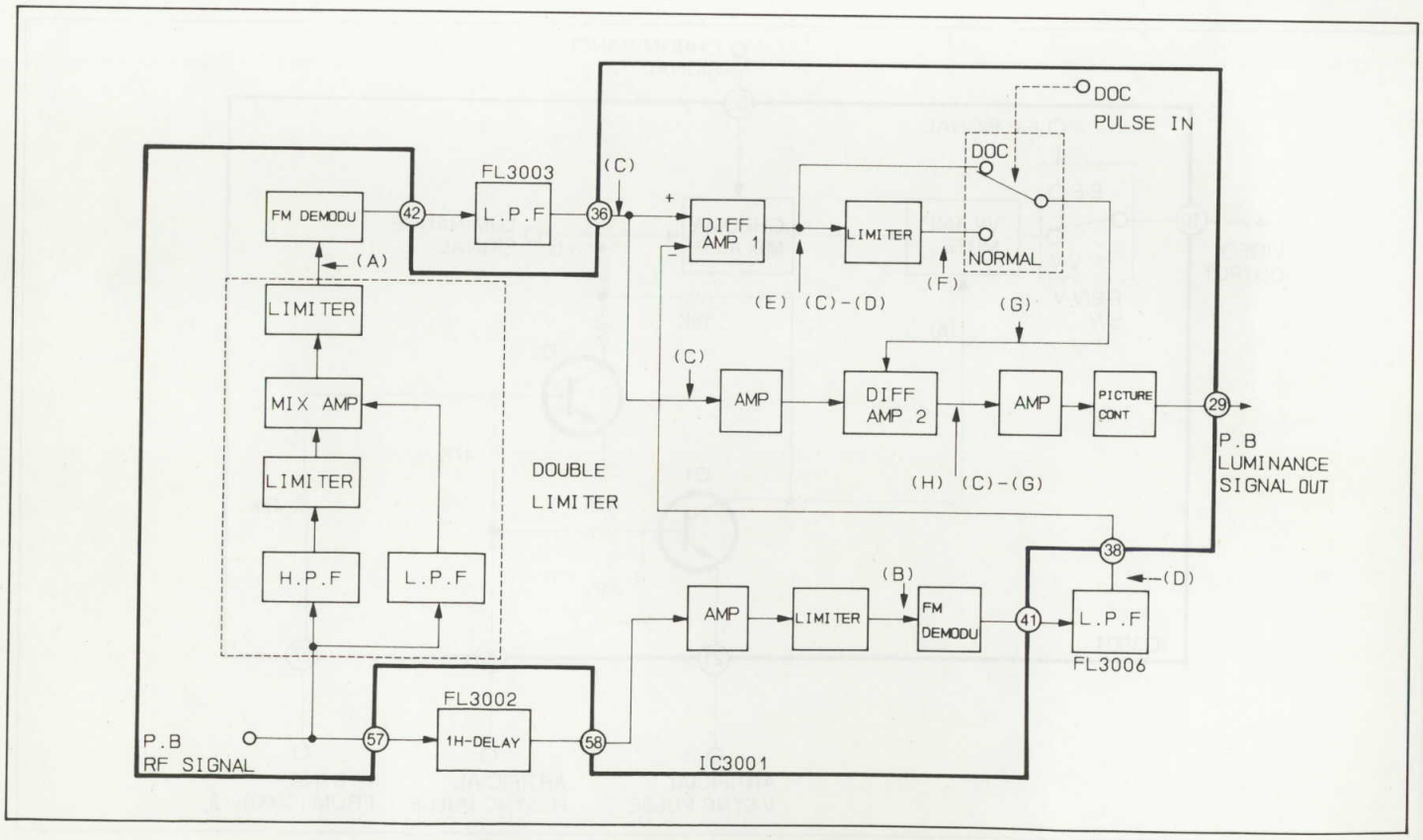


Fig. 2—9 Low Frequency Noise Canceller

The simplified Block Diagram of the Low Frequency Noise Canceller is shown in Fig. 2—9. If any dropout occurs while playing back FM signals, the dropout compensator including the IH delay line (FL3002) is utilized, but in this time, the switching noise is generated on the RF signal (A) as shown in Fig. 2—9.
To eliminate this noise, the Low Frequency Noise Canceller is available.
This RF signal including a switching noise, is split two paths.
The RF signal of one path is the signal which passes through the 1H Delay line (FL3002) and Limiter (B) and demodulated to on AM signal (D).

The other path's signal passes the double limiter and is demodulated to AM signal (C).
These normal and 1H delayed signals are put into Differential Amplifier 1 (DIFF AMP 1).
As a result output signals become only noise components (E) when dropout occurs, noise (E) is limited by Limiter (F), but when dropout doesn't occur, noise (E) is passed through by DOC pulse (G).
The Differential Amplifier 2 (DIFF 2) subtracts the noise signal (G) from the normal signal (C).
As a result, a pure signal, free from all the noise components , can be output from the Differential Amplifier IC3001 Pin 29.

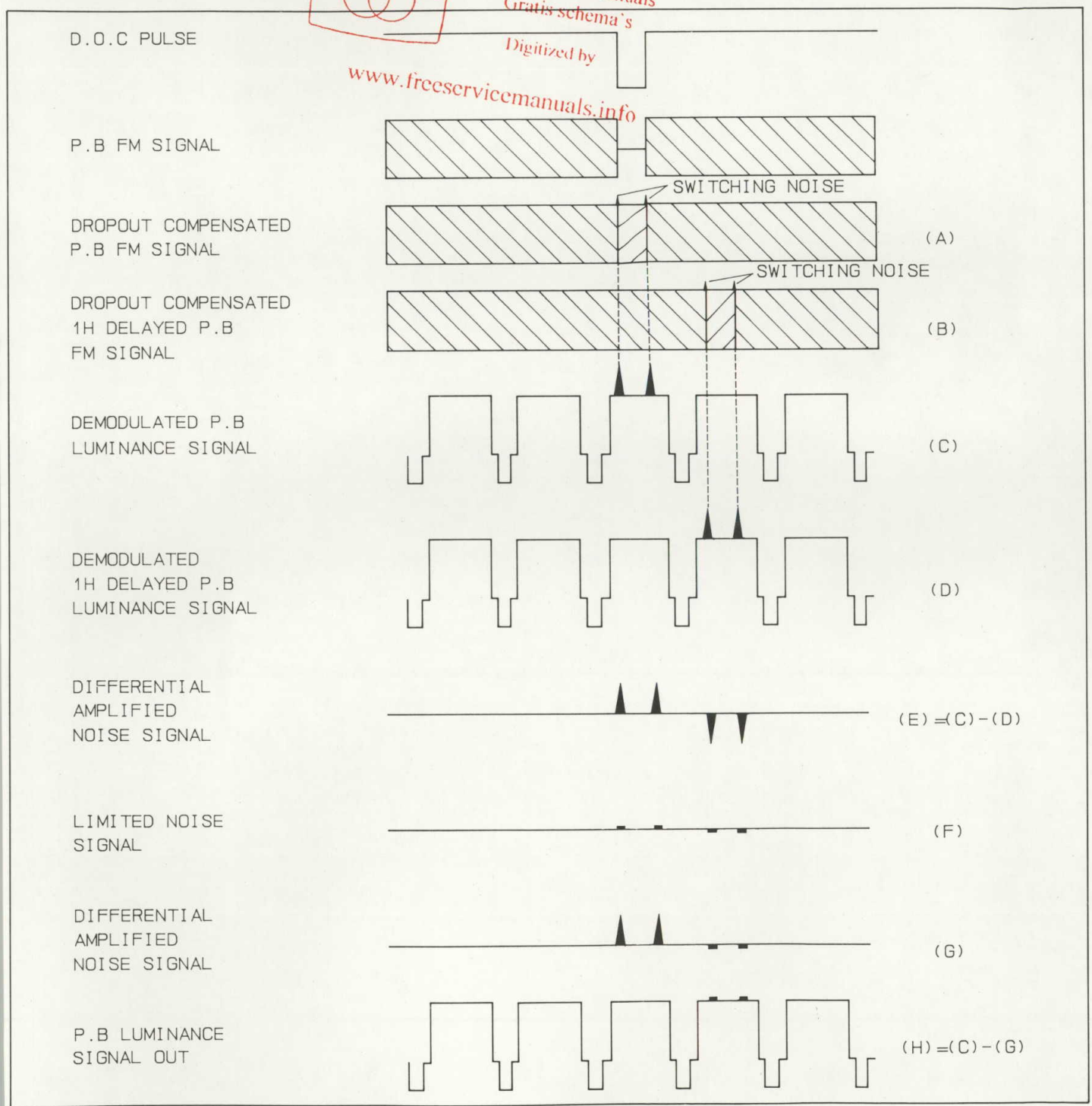


Fig. 2—10 Low Frequency Noise Cancellation

MEMO

3. SERVO CIRCUIT

3.1 General Description

The servo section consists of Cylinder servo, Capstan Servo, Reel servo and Slow Still which realize high quality, sophisticated picture. Though the new digital servo system is adapted for this model, there is no remarkable change from the old digital servo system.
For the detail of the digital servo, refer to the description of servo section for NV-100, the old portable VCR.
However, the Reel servo system for controlling the tape tension is quite new and realizes very stabilized tape travel for the high quality picture. Besides, this 4 head system is available to reproduce the Noise-less Cue/Review picture and Fine-Slow picture by selecting the specific heads by a micro-processor automatically.
Each technology will be explained one by one.

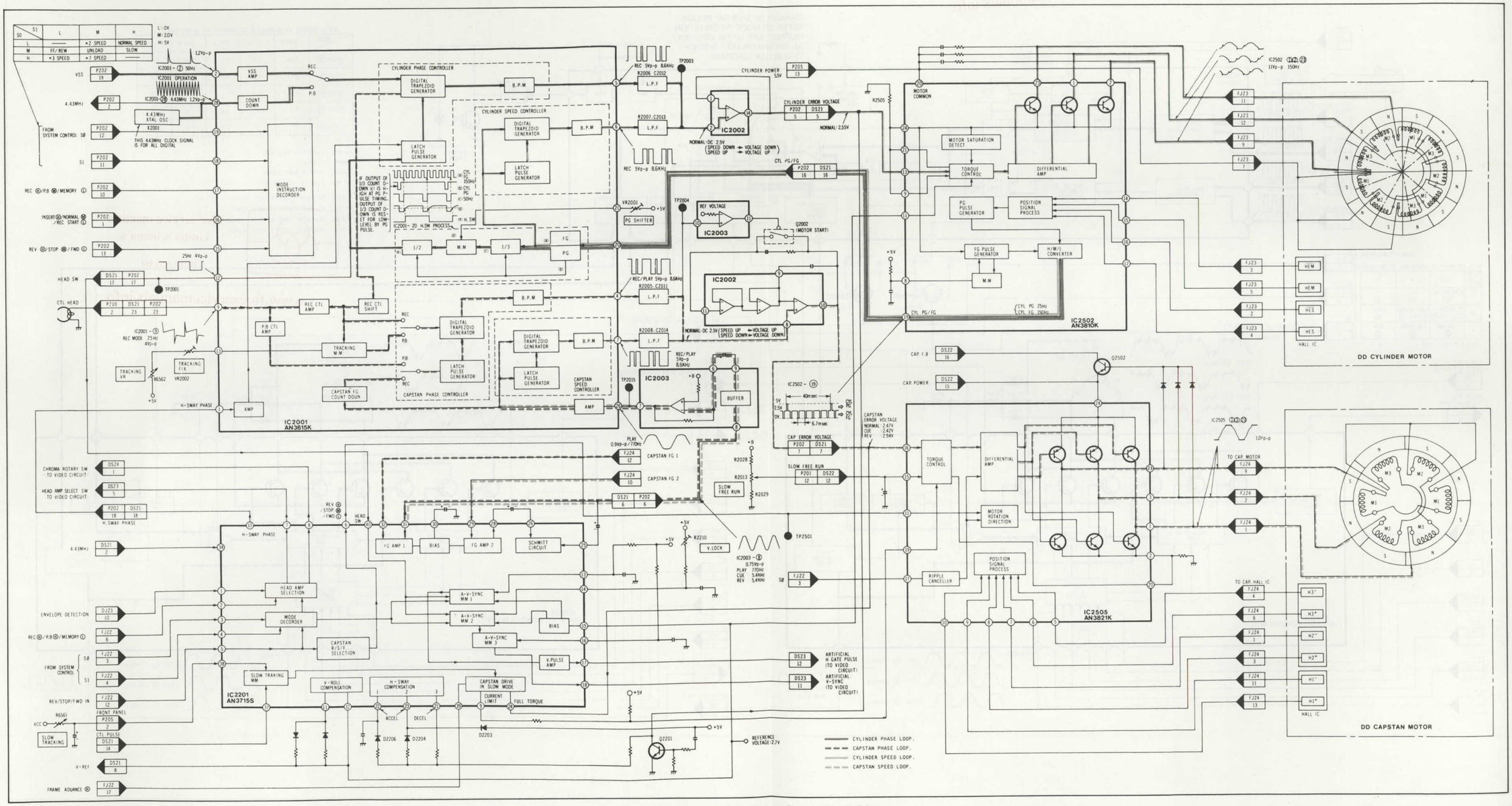
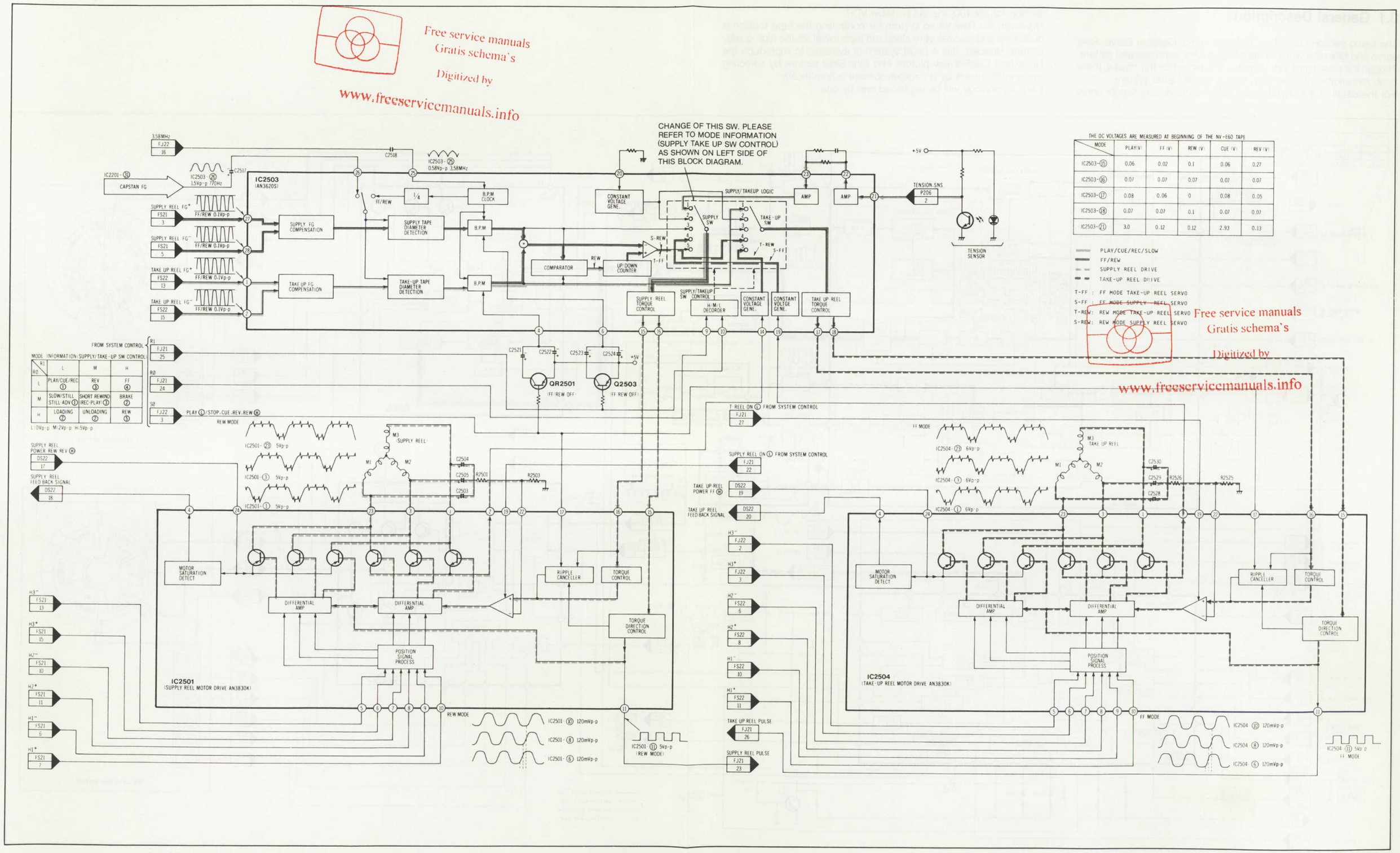


Fig. 3—1 Cylinder and Capstan Servo Block Diagram



THE DC VOLTAGES ARE MEASURED AT BEGINNING OF THE NV-E60 TAPE

MODE	PLAY(V)	FF (V)	REW (V)	CUE (V)	REV (V)
IC2503-⑮	0.06	0.02	0.1	0.06	0.27
IC2503-⑯	0.07	0.07	0.07	0.07	0.07
IC2503-⑰	0.08	0.06	0	0.08	0.05
IC2503-⑱	0.07	0.07	0.1	0.07	0.07
IC2503-㉑	3.0	0.12	0.12	2.93	0.13

Fig. 3—2 Reel Servo Block Diagram

3.2 Cylinder Servo Circuit

The simplified block diagram for the Cylinder servo circuit is shown in Fig. 3—3.
As Fig. 3—3 shows, the construction of Cylinder servo circuit is almost the same as the old one except "Bit Pattern Modulator", so called B.P.M.
The other portions are exactly the came as the old one, therefore, the differences between them will be explained mainly.

1) Cylinder Speed Comparator

The Cylinder Speed Comparator controls the cylinder motor speed exactly at 1,500 rpm through the cylinder FG signal (150Hz), which will be explained later in detail.
This cylinder FG signal is applied to the Digital Trapezoid Generator and Latch pulse Generator which produce in return 8 bit digital error data representing the speed error.
And then the output of this circuit is sent to the next B.P.M circuit.

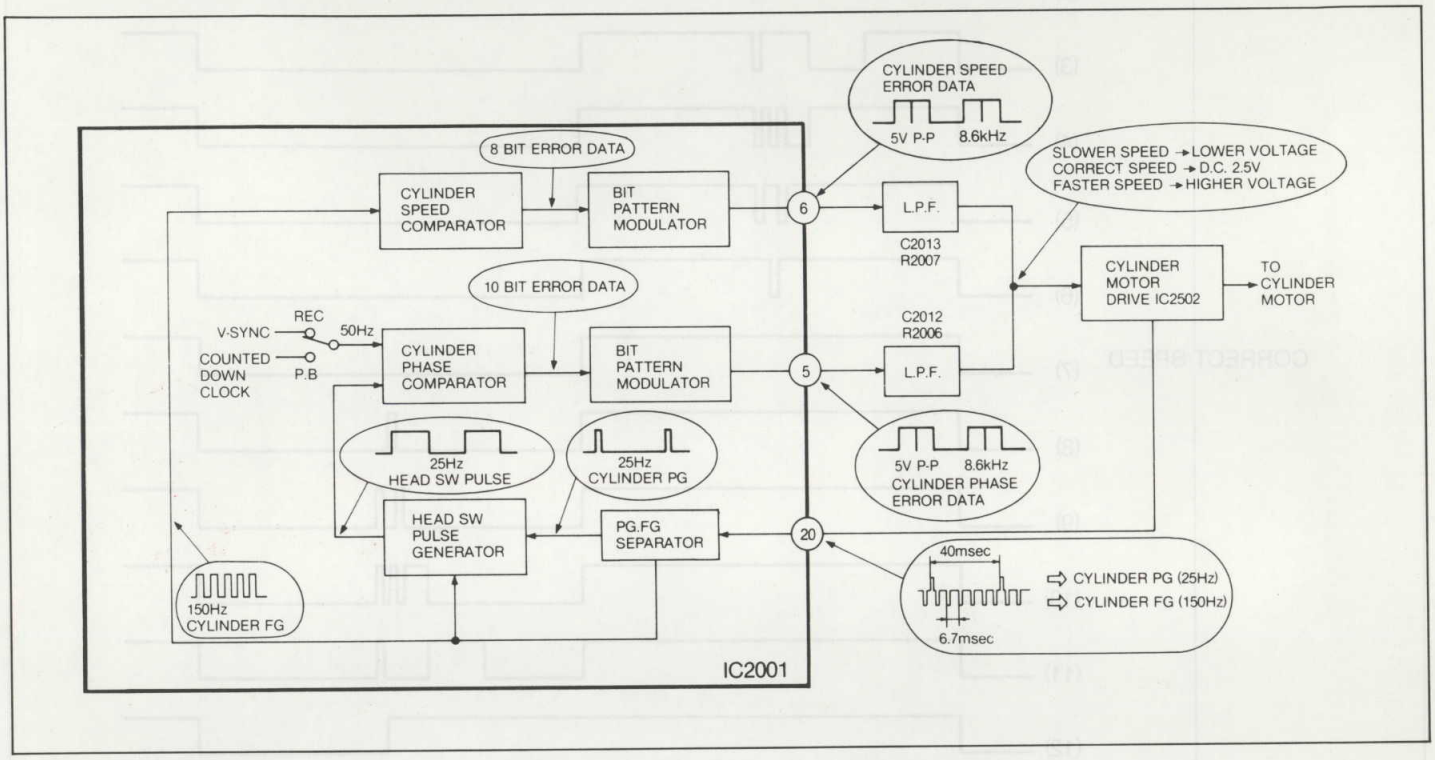


Fig. 3—3 Cylinder Servo Block Diagram

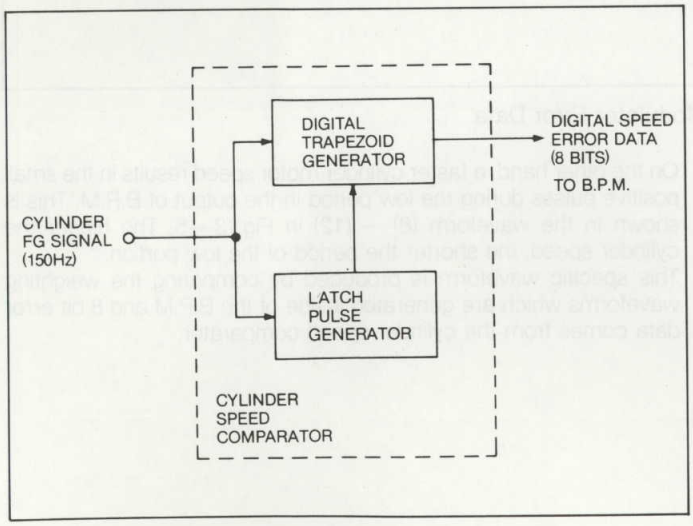


Fig. 3—4 Digital Speed Comparator

2) Cylinder Speed B.P.M.

If the 8 bit speed error data are directly applied, tremendous output terminals (pins of the IC) would be necessary. Therefore, the 8 bit speed error data should be converted beforehand into the specific pulse by the B.P.M. (Bit Pattern Modulator). Suppose that the cylinder is rotating just at the preset speed (1500 rpm). Then, B.P.M produces 50%-50% square waveform, with frequency of just 8.6kHz as shown on the waveform (7) in Fig. 3—5.

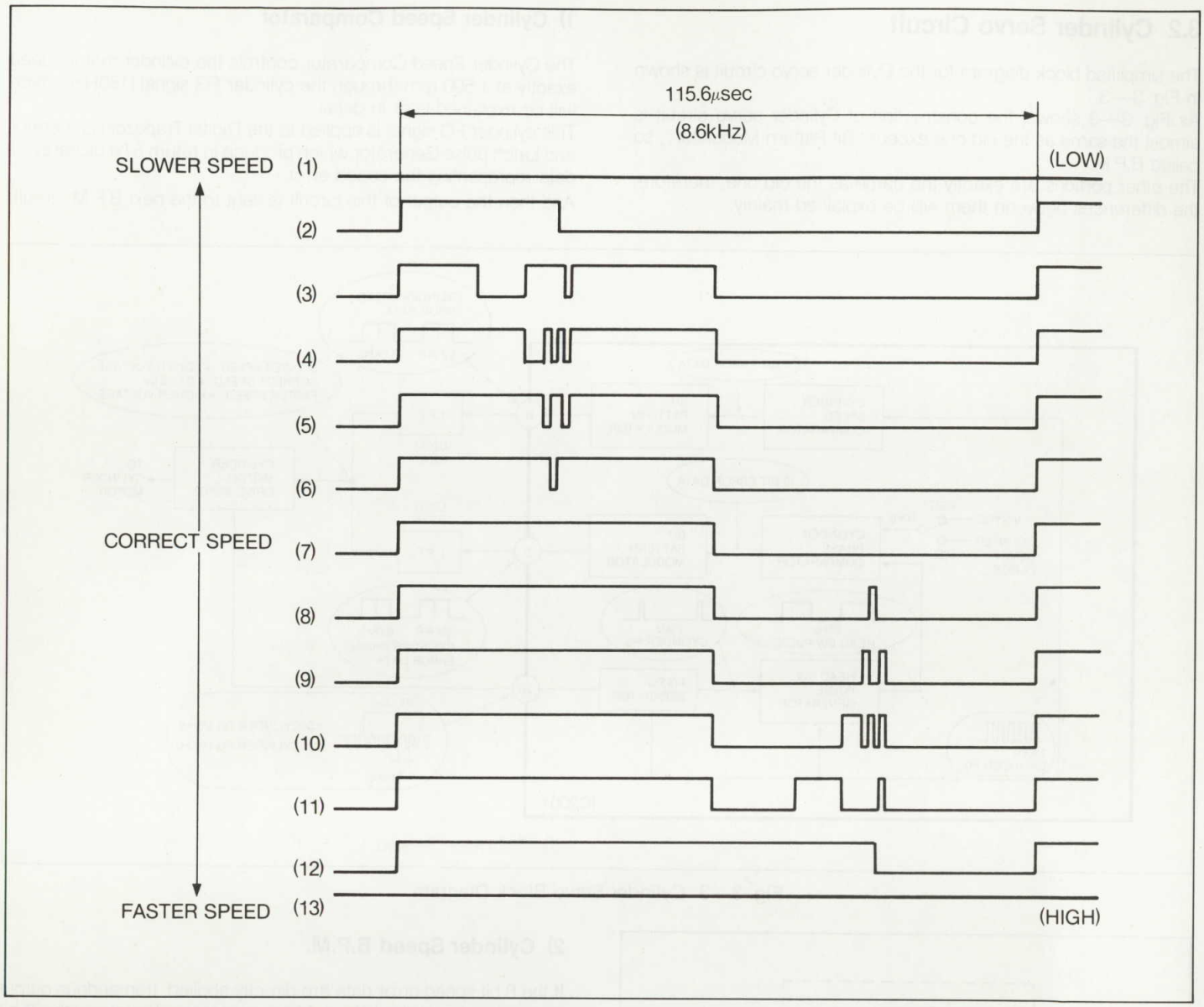


Fig. 3—5 Bit Pattern Modulator Error Data

If the cylinder motor speed decreases, the cylinder FG signal frequency is also dropped down slightly and this causes the change of digital speed error data. By this error data, B.P.M produces the appropriate square waveform (shown on the waveform (2) ~ (6) in Fig. 3—5.) which corresponds to the speed. When the cylinder motor speed decreases slightly, the center of high portion only drops for a very short time as shown on the waveform (5) or (6) in Fig. 3—5. The shorter the cylinder speed the shorter the period of the high portion.

On the other hand, a faster cylinder motor speed results in the small positive pulses during the low period in the output of B.R.M. This is shown in the waveform (8) ~ (12) in Fig. 3—5. The higher the cylinder speed, the shorter the period of the low portion.
This specific waveform is produced by comparing the weighting waveforms which are generated inside of the B.P.M and 8 bit error data comes from the cylinder speed comparator.

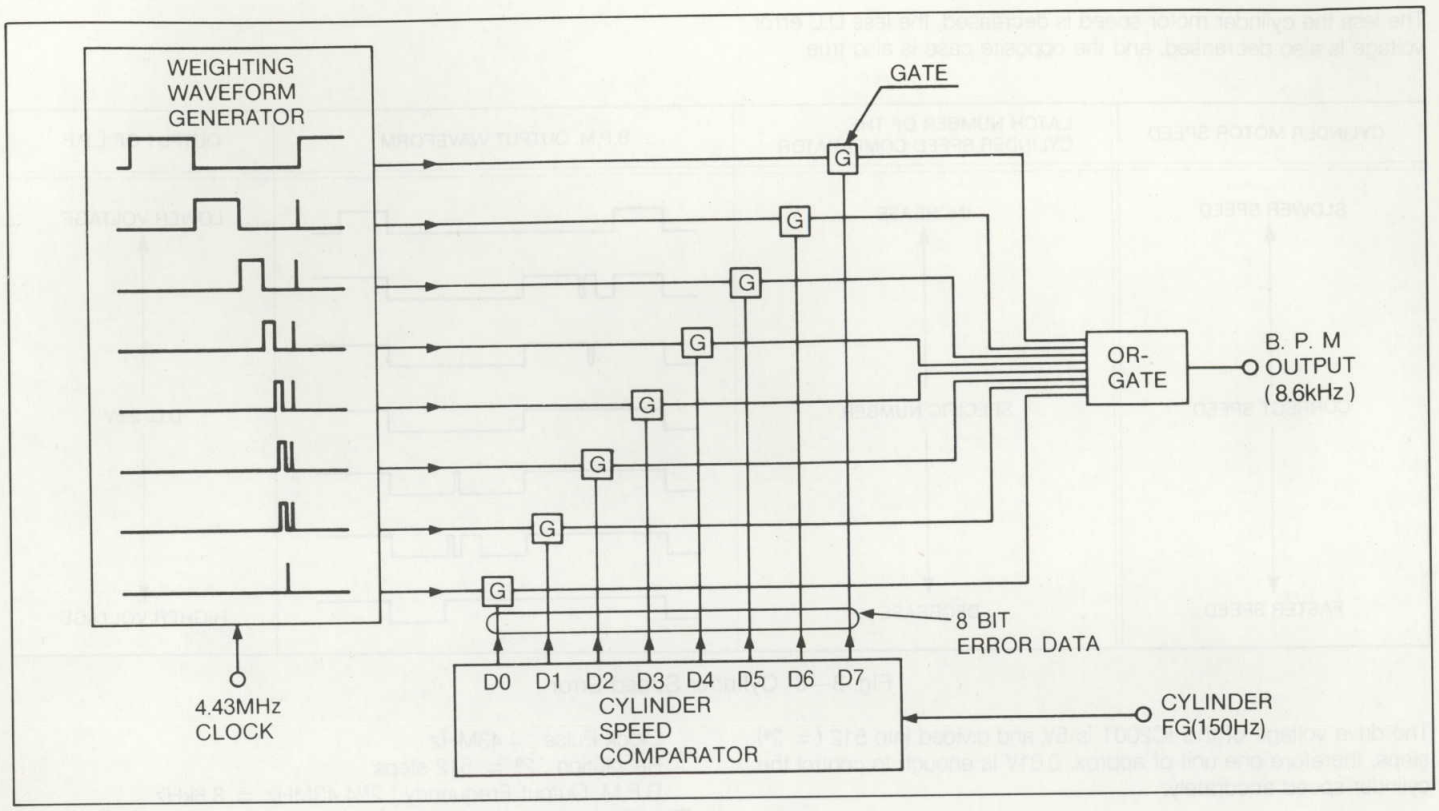


Fig. 3—6 B.P.M Circuit

Thanks of these weighting waveforms, the parallel 8 bit error data are converted into the weighted square pulse corresponding to the cylinder speed error. On the other hand, this circuit is driven by the clock pulse (4.43MHz), and the B.P.M output frequency is presented as follows.

Clock Pulse : 4.43MHz

Resolution: $2^9 = 512$ steps

B.P.M Output Frequency $2^9/4.43MHz = 8.6kHz$

Thus, B.P.M circuit produces the specific square waveform as shown in Fig. 3—5 by insertion of small negative or positive going pulse during high or low period so as to control the D.C voltage for a cylinder motor, and the frequency of B.P.M (IC2001-6) is 8.6kHz at any time, independent of the cylinder speed error data, and then this signal is applied to L.P.F.

3) Cylinder Speed L.P.F. (Low Pass Filter)

The output of the B.P.M. is converted into D.C. voltage by the low pass filter composed of R2007 and C2013, and mixed with the output from cylinder phase.

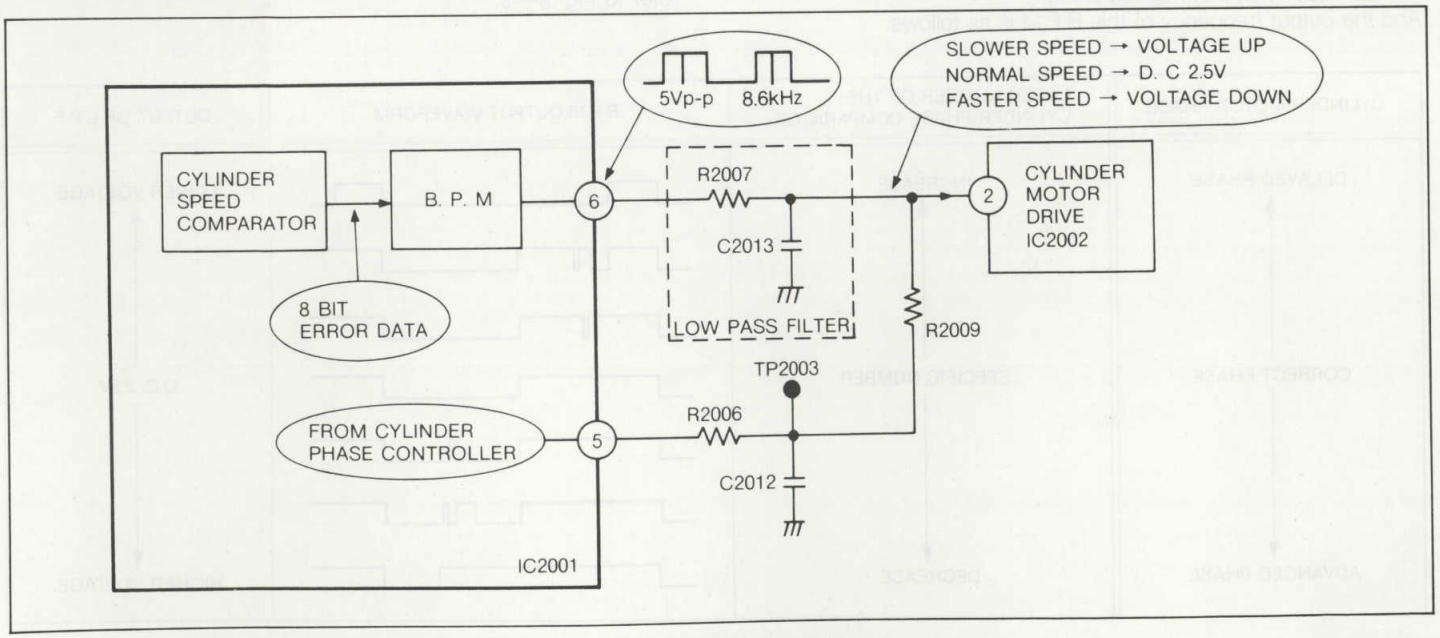


Fig. 3—7 Low Pass Filter

The less the cylinder motor speed is decreased, the less D.C error voltage is also decreased, and the opposite case is also true.

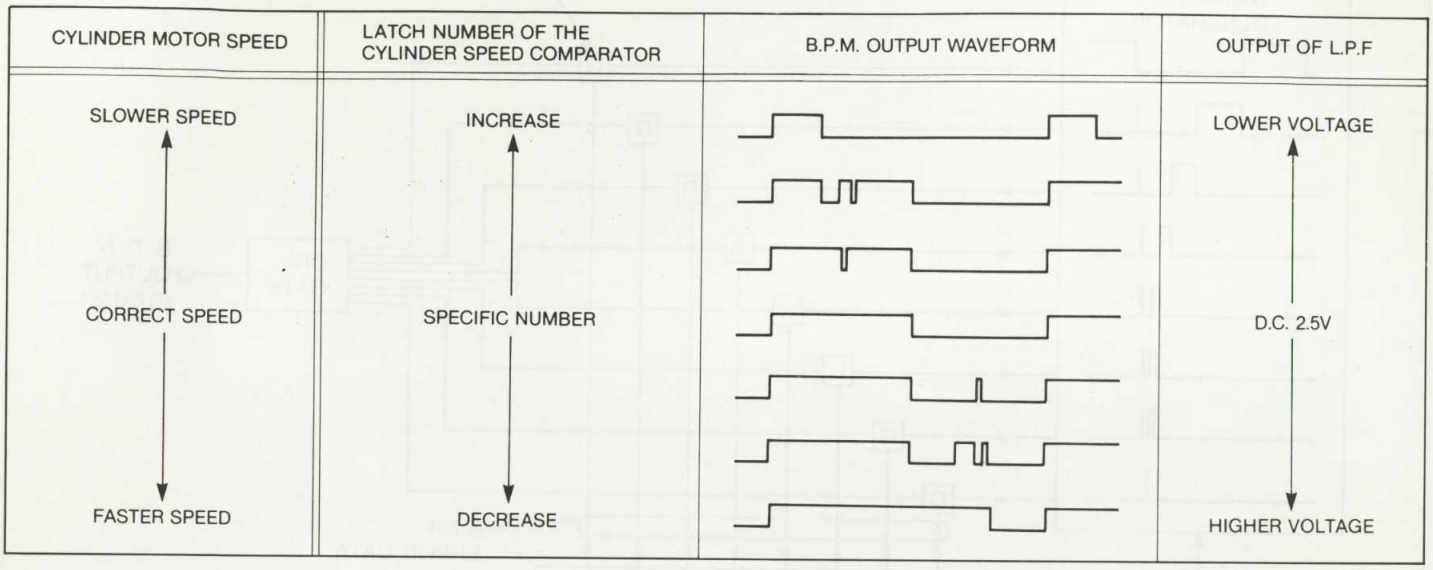


Fig. 3—8 Cylinder Speed Error

The drive voltage of this IC2001 is 5V and divided into 512 (= 2^9) steps, therefore one unit of approx. 0.01V is enough to control the cylinder speed accurately.

Finally, the D.C. error voltage is amplified by the operational amplifier in IC2002 and sent to pin 13 of IC2502 to control the cylinder motor torque. These circuits are almost the same as the old one of NV-100.

4) Cylinder Phase Comparator

Refer to the description for NV-100.

5) Cylinder Phase B.P.M.

It can control the cylinder phase very precisely and very finely as well as used in Cylinder speed B.P.M.
And the output frequency of this B.P.M is as follows.

Clock Pulse : 4.43MHz
Resolution : 2^9 = 512 steps
B.P.M. Output Frequency : 2^9/4.43MHz = 8.6kHz
Therefore, the less the cylinder motor phase is delayed, the less the D.C. error voltage is decreased.
To the contrary, the more the cylinder motor phase is advanced, the name the D.C. error voltage is increased.

6) Cylinder Phase L.P.F. (Low Pass Filter)

The output of B.P.M for cylinder phase control is applied to the L.P.F which is constructed by R2006 and C2012 and the D.C error voltage for cylinder phase is produced.
This voltage can be monitored at TP2003, and then mixed with the D.C. error voltage for cylinder speed control through R2009. For the cylinder phase error voltage.
refer to Fig. 3—9.

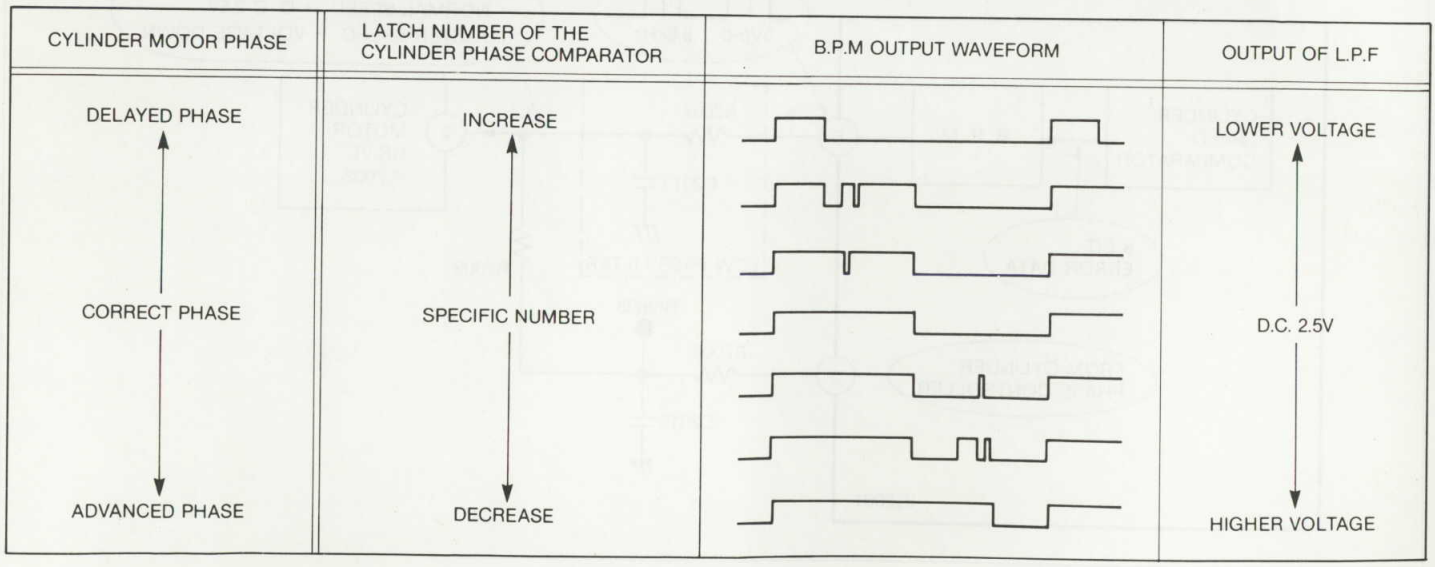


Fig. 3—9 Cylinder Phase Error

7) Changing The Cylinder Playback Mode Speed In Trick

In case of trick playback mode, the tape speed is changed as follows.
Cue Mode: Tape speed is increased.
(X7 Normal Playback Speed)
Rev Mode: Tape movement is changed to reverse direction and its speed is increased.
(X7 Normal Playback Speed)
Slow Mode: Tape speed is decreased.
Pause Mode: Tape is stopped.

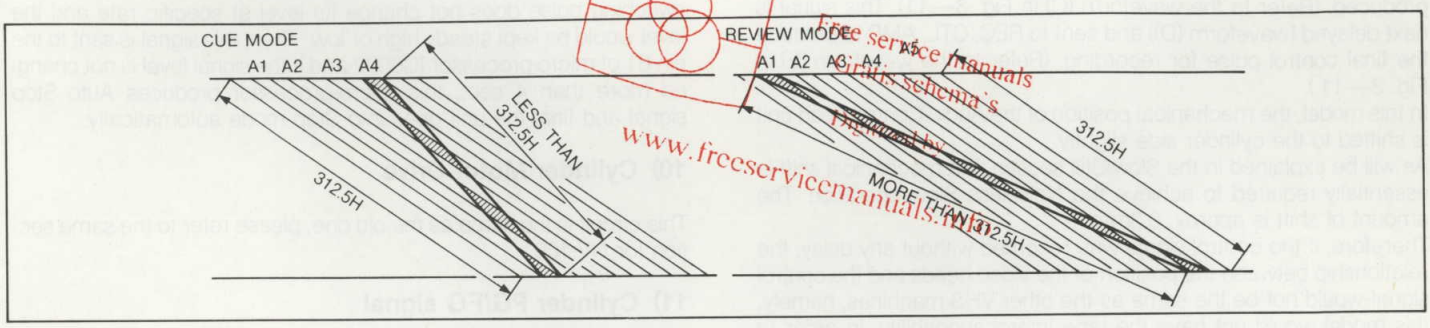


Fig. 3—10 Track Pattern in Cue and Review Mode

As you already know, in the normal record or playback process, each video head picks up 1 field or 312.5H (Horizontal Lines) information from the tape and the horizontal sync frequency is 15.625kHz.
In the Cue mode, since the tape runs 7 times faster than normal speed in forward direction, if the cylinder motor rotation would not be compensated, the relative head to tape speed would be decreased and as the result, the horizontal syc frequency would also be decreased. So the playback picture would then be disturbed horizontally on a TV monitor. To avoid this, the cylinder motor speed should be increased slightly. In the review mode, just conversely, the cylinder must be rotated slower than normal. Also, in Slow or Pause mode, the head to tape speed should be decreased slightly in order to keep the steady relative speed.
These operation are performed inside of the IC2001 by changing the N.P. (Number of Preset : refer to detail explanation for NV-100) depending on the mode.

8) Producing the Control Pulse

There is one more function associated with the cylinder servo operation which must be mentioned before proceeding with capstan servo.
Basically in the record mode, the control signal should be synchronized with the vertical sync of the incoming video signal to keep the recorded tape pattern steady and since the head switching pulse synchronizes with vertical sync signal, the control pulse is produced from head switching pulse and its duty cycle should be 60% to 40% for the VHS standard.

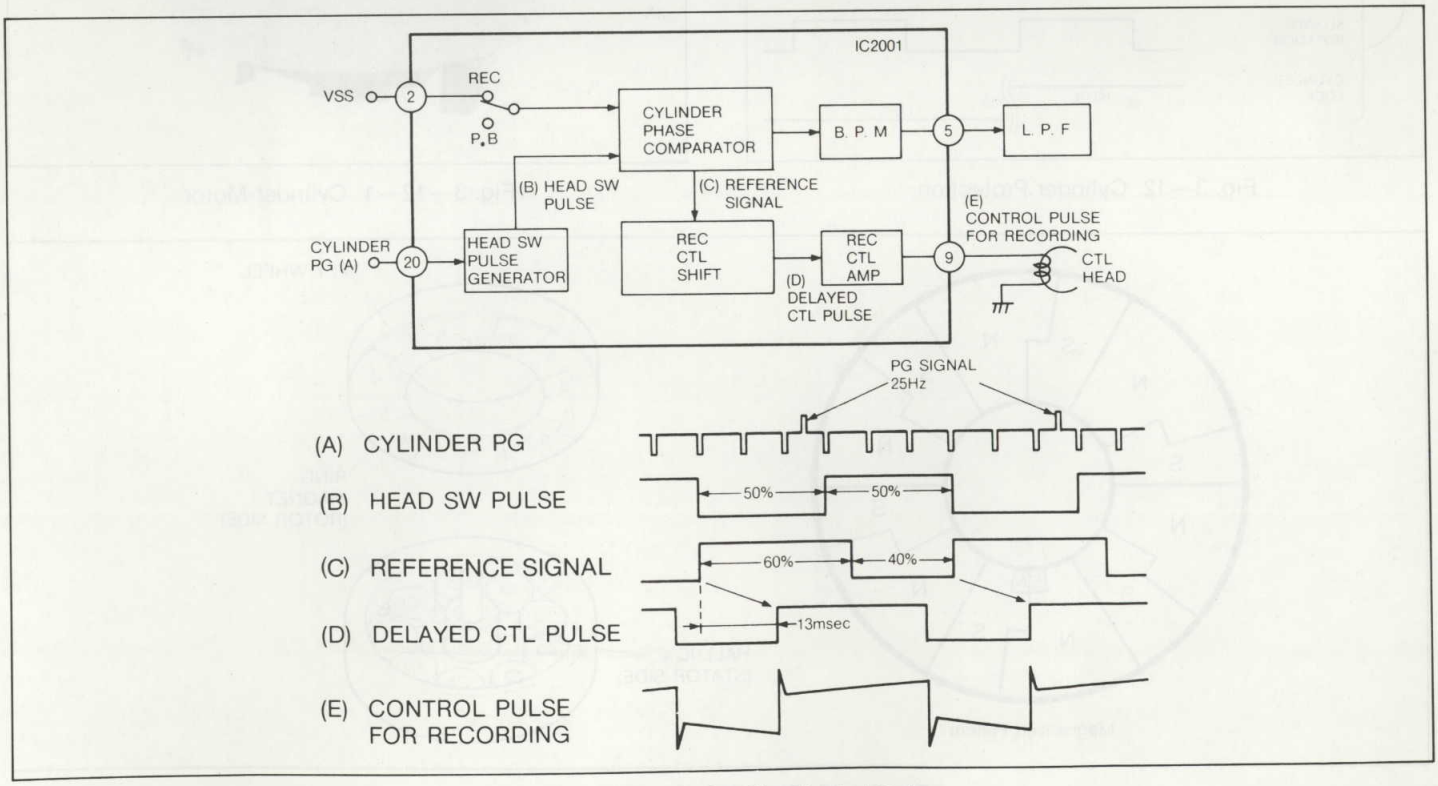


Fig. 3—11 Producing the Control Pulse

The cylinder motor drive circuit produces cylinder PG/FG signal at pin 19 of IC2502 and applies it to pin 20 of IC2001. From this signal, the head switching pulse is produced by being extracted only the cylinder PG (25Hz) signal, and more detailed explanation will be given later. (Refer to the waveform (A) and (B) in Fig. 3—11)
Then, this head switching pulse is applied to cylinder phase comparator, and the reference signal with 60% – 40% duty cycle is produced. (Refer to the waveform (C) in Fig. 3—11). This signal is next delayed (waveform (D)) and sent to REC, CTL, AMP to produce the final control pulse for recording. (Refer to the waveform (E) in Fig. 3—11.)
In this model, the mechanical position of the Audio/Control head unit is shifted to the cylinder side slightly.
As will be explained in the Slow/Still section, the mechanical shift is essentially required to achieve the Noiseless Slow operation. The amount of shift is approx. 0.3mm.
Therefore, if the control signal was recorded without any delay, the relationship between the position of the video heads and the control signal would not be the same as the other VHS machines, namely, this model would not have the tape interchangeability. In order to satisfy the needs of interchangeability, the control signal must be delayed before being recorded, and the delay amount requested is 13m sec. This delay operation is performed inside of the IC2001 by the digital monostable multivibrator.

9) Cylinder protection

The cylinder protection circuit detects the cylinder motor rotation. If the cylinder ought to be spinning, but is not actually, the cylinder protection circuit stop the unit. To detect this condition, head switching pulse is used.

Normally, since IC2502 and IC2001 produce the 25Hz head switching pulse, which can be observed at TP2001.
However, now, supposing that the cylinder lock is occured, the head switching pulse does not change its level at specific rate and the level would be kept steady high or low. Then, this signal is sent to the pin 61 of micro-processor IC6002 and if the signal level is not changed more than 4 sec., this micro-processor produces Auto Stop signal and final the unit goes into Stop mode automatically.

10) Cylinder Motor Drive

This circuit is the same as the old one, please refer to the same section for NV-100.

11) Cylinder PG/FG signal

Cylinder PG/FG signal is produced by the signal from the position detector and represents the actual cylinder position or cylinder phase.
First of all, hall IC's mounted on the stator side of cylinder motor pick up the actuall position by observing the magnetized pattern on the ring magnet (rotor side) as shown in Fig. 3—13.

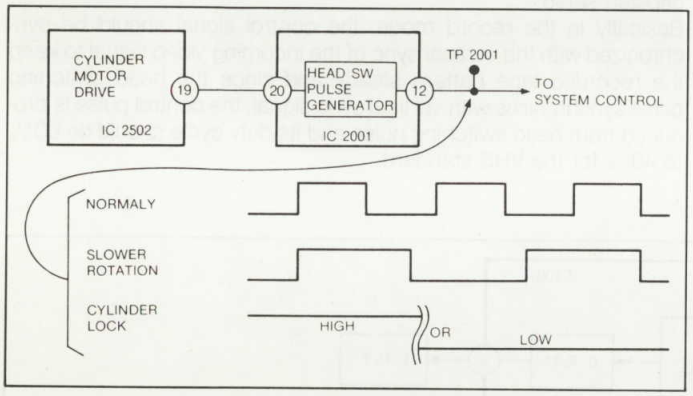


Fig. 3—12 Cylinder Protection

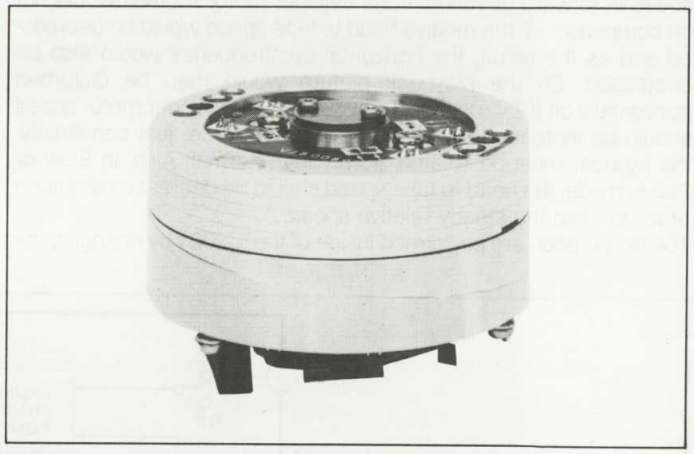


Fig. 3—12—1 Cylinder Motor

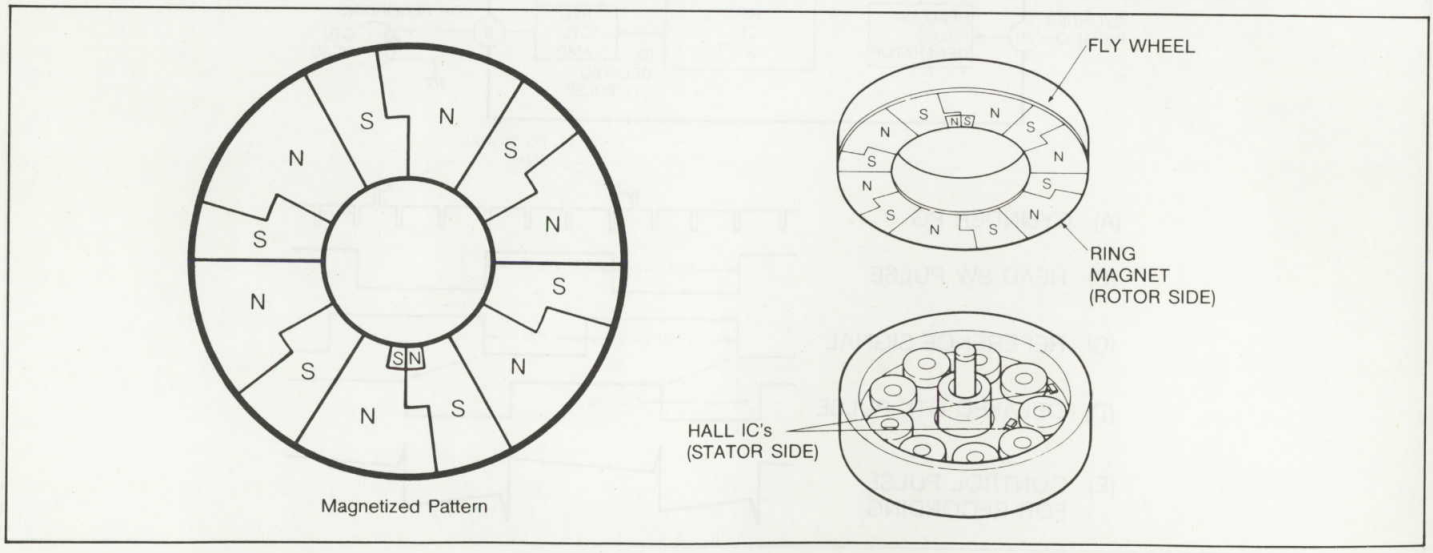


Fig. 3—13 Ring Magnet and Hall IC's

Since two hall IC's are located separately, one is outside and the other is inside, each hall IC picks up different signal corresponding to the magnetized pattern as shown in Fig. 3—14.

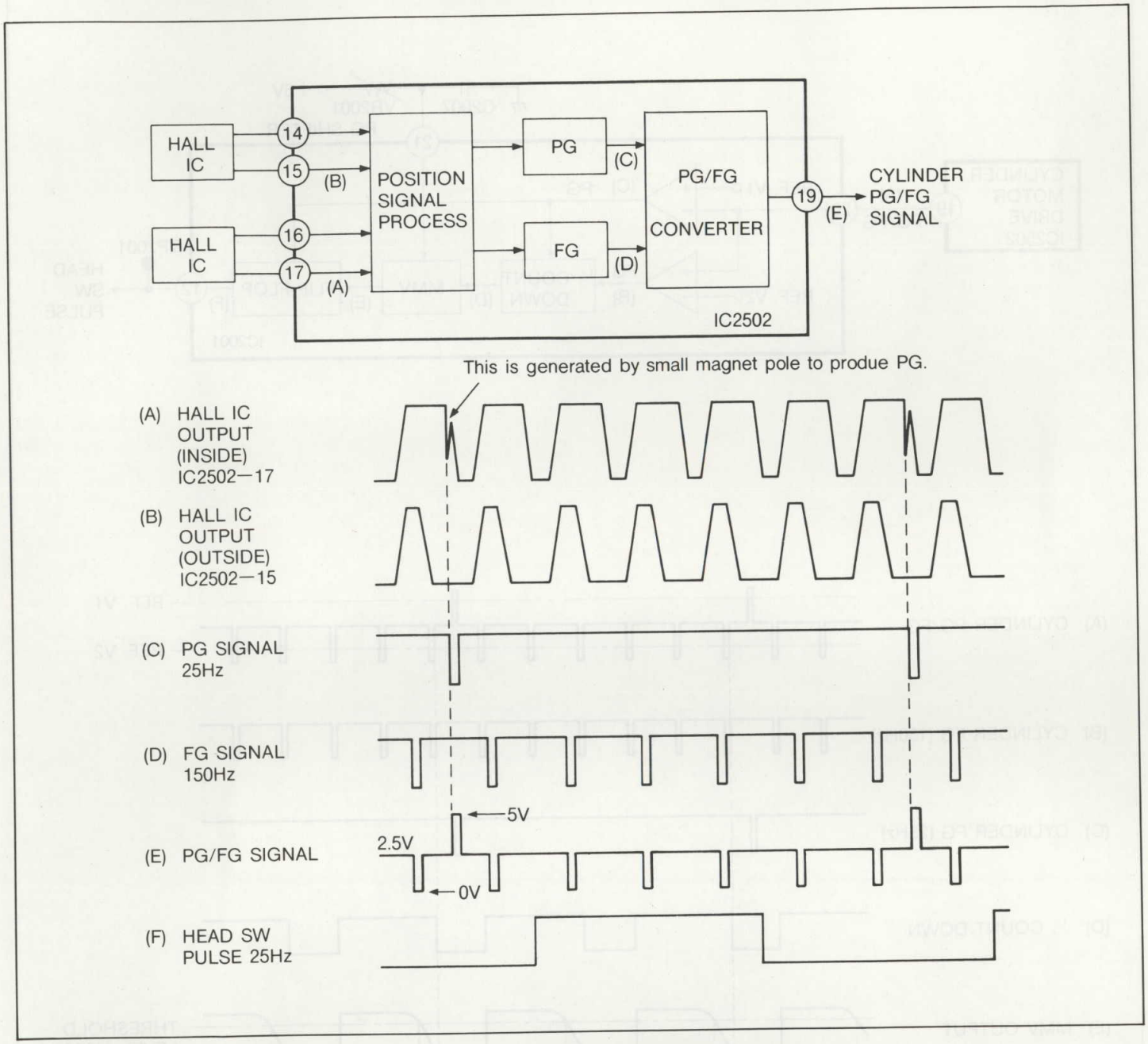


Fig. 3—14 Cylinder PG/FG signal

Cylinder PG signal is produced by inside hall IC. On the inside magnet, a small pair of poles is added for producing of PG signal, and inside hall IC picks up this small pole and cylinder PG signal is extracted.
This signal is used to detect the head position and head switching signal is produced. On the other hand, the outside hall IC picks up the signal from outside ring magnet and by the position signal process circuit the cylinder FG signal is produced. This signal is used to control the cylinder speed comparator, because it represent the actual cylinder speed. These cylinder PG signal and FG signals are mixed as shown on waveform (E) in Fig. 3—14.
By using the mixed waveform, we can reduce excessive wiring.
Finally this signal is applied to pin 20 of IC2001 in order to produce the head switching pulse.

12) Head Switching Pulse

How to produce head switching pulse is exactly the same as the old portable NV-100. Since the cylinder PG signal and FG signal are mixed in the cylinder motor drive circuit, they must be separated in IC2001.
The signal sent to pin 20 of IC2001 are then applied to two comparators, which have the reference voltage to extract PG and FG signal as show in Fig. 3—15.
Ferther operations are quite the same as NV-100.

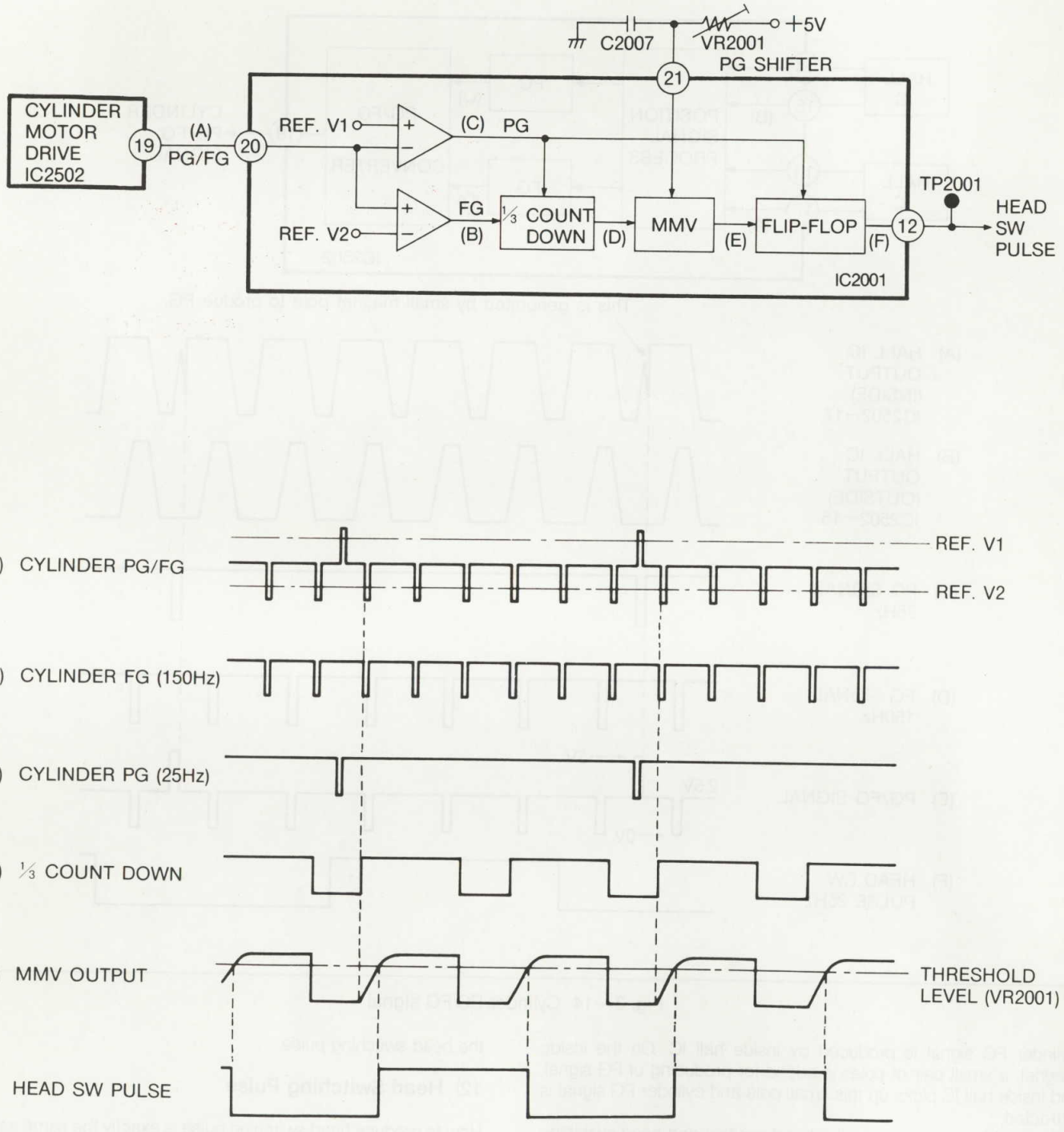


Fig. 3—15 Head Switching Pulse Generator

3.3 Capstan Servo Circuit

The simplified block diagram for the Capstan servo circuit is shown in Fig. 3—16.

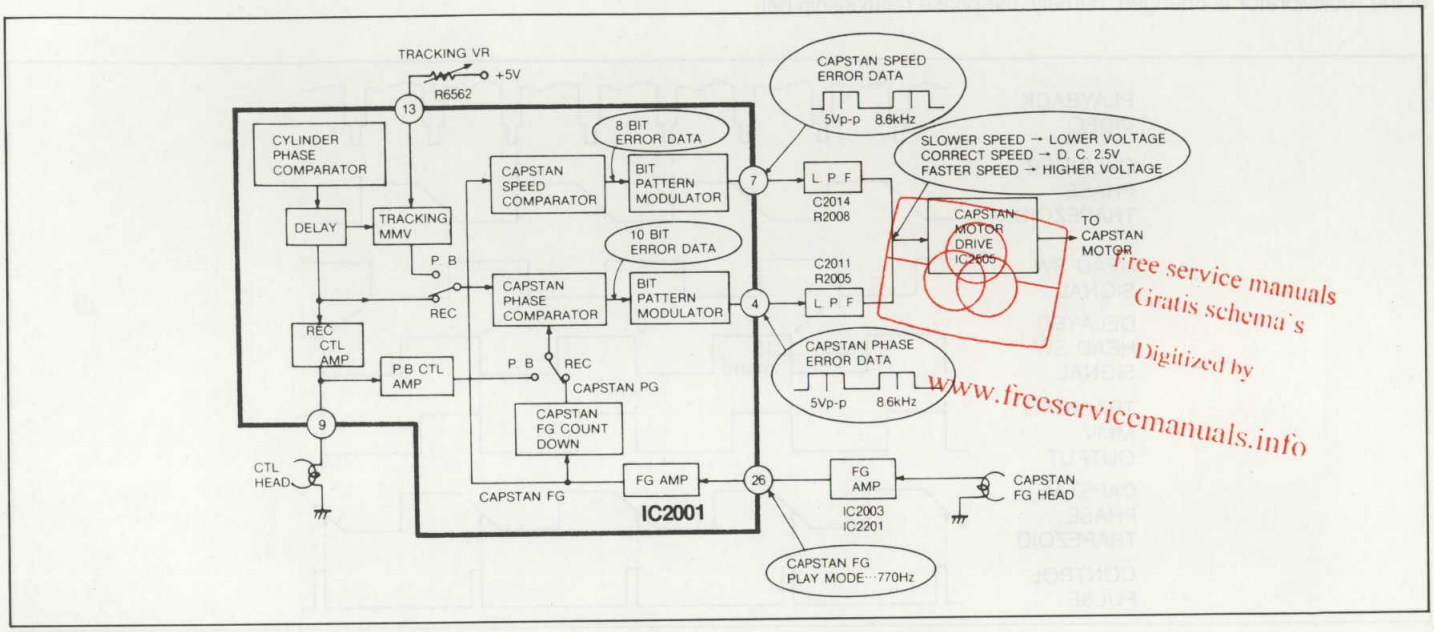


Fig. 3—16 Capstan Servo Block Diagram

As Fig. 3—16. shows, the construction of Capstan servo circuit is almost the same as previous one except "Bit Pattern Modulation", so called B.P.M. and "Rec Control Pulse Shift".
The other portions are exactly the same as the previous one, therefore only the differences between then will be explained mainly.

1) Capstan FG

The capstan FG signal is used for capstan speed control in the recording and playback modes, and for the production of capstan PG signal.
The capstan FG signal is picked up by the capstan FG head which faces to magnetized capstan rotor and is frequency is set as follows.

Play Mode : 770Hz---------(normal speed)
Cue Mode : 5.4kHz---------(X7 fast forward)
Review Mode : 5.4kHz----------(X7 fast reverse)

2) Capstan Speed Comparator

3) Capstan Speed B.P.M.

4) Capstan Speed L.P.F.

5) Capstan Phase Comparator

6) Capstan Phase B.P.M.

7) Capstan Phase L.P.F.

These captioned items are all based on the explanation for each item of the cylinder section.

8) Head Switching Delay

In order to keep the proper relationship between the cylinder and capstan servo, the delayed head switching signal is used as the reference signal of the capstan phase control in the playback mode as shown in Fig. 3—17.

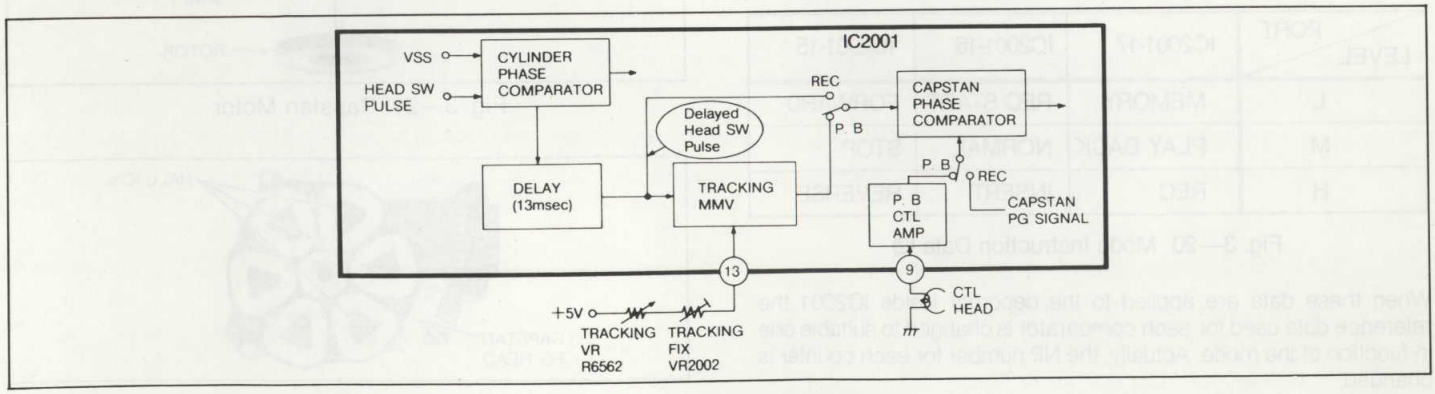


Fig. 3—17 Head Switching Delay

The head switching pulse is applied to Delay circuit via the cylinder phase comparator and delayed for 13 msec.
Then this delayed signal is sent to the playback tracking monostable multivibrator as the triger pulse.
By turning the Tracking Control on the front panel, the time constant of the multivibrator is changed, namely, the phase relationship between the cylinder motor and capstan motor is changed.
Therefore, even if the tape is recorded by the other VHS recorders, this model can playback properly the tape by its interchangeability.
The capstan phase control timing in playback mode is shown in Fig. 3—18.

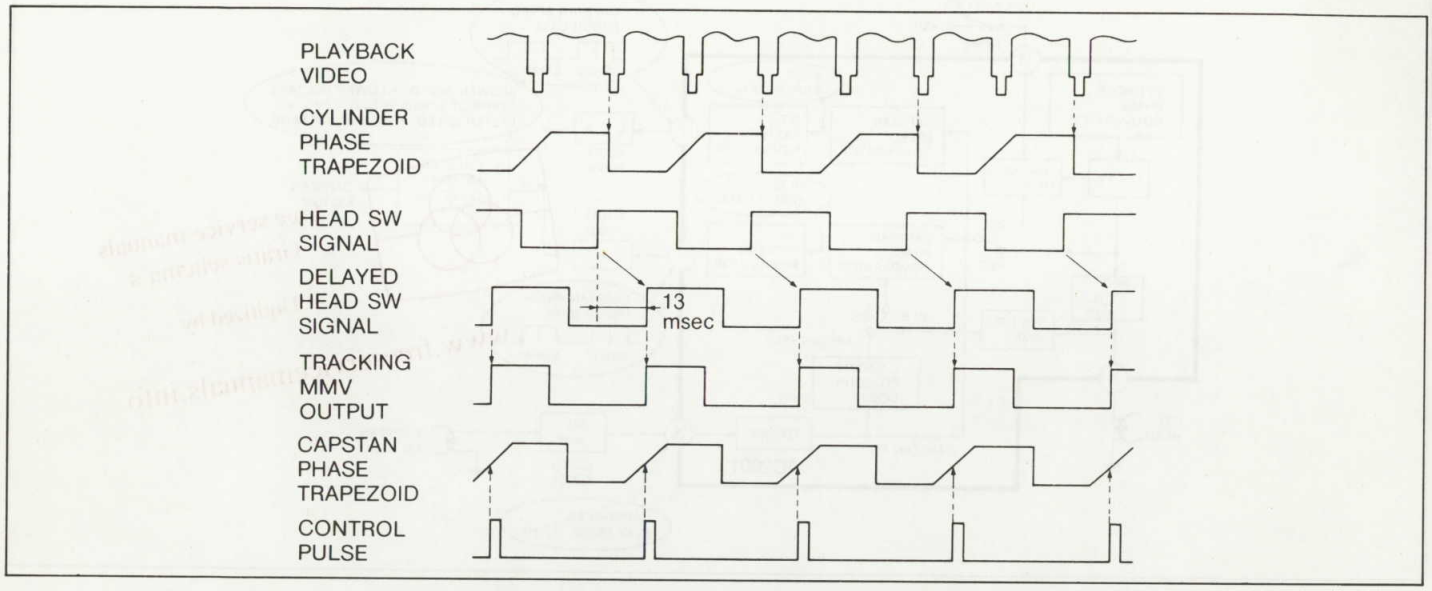


Fig. 3—18 Capstan Phase Control Timing in Playback Mode

9) Capstan Motor Control in Trick Playback Mode

In order to change the tape speed, the capstan servo loop gain should be changed in the trick playback mode, Cue, Review, Slow and Still. First, the characteristics of the capstan speed and phase comparators should be changed.
The capstan speed data is applied as the mode instruction data to IC2001 as mode instruction data from the System Control Circuit (Refer to Fig. 3—19.)

S0 \ S1	L	M	H
L	———	———	NORMAL SPEED
M	FF/REW	———	SLOW
H	X3 SPEED	X7 SPEED	———

Fig. 3—19 Mode Instruction Data (1)

LEVEL \ PORT	IC2001-17	IC2001-16	IC2001-15
L	MEMORY	REC START	FORWARD
M	PLAY BACK	NORMAL	STOP
H	REC	INSERT	REVERSE

Fig. 3—20 Mode Instruction Data (2)

When these data are applied to the decorder inside IC2001 the reference data used for each comparator is changed to suitable one in function of the mode. Actually, the NP number for each counter is changed.
For the detail of the speed and phase comparators and NP number, refer to the Digital Speed and the Phase Comparators section for NV-100.
Following by these mode instruction data, the capstan motor rotates at the specific speed and phase. In Cue or Review mode, system control circuit produces SO "H" (High) and S1 "M" (Middle) signals and the capstan motor rotates/times faster than the normal speed. At the same time, the voltage at pin 15 of IC2001 goes high to instruct the capstan reverse mode.

10) Capstan Motor drive

Though the miniaturized capstan motor is developed for weight reduction the drive circuit and its principle driving is exactly the same as the old model NV-100.

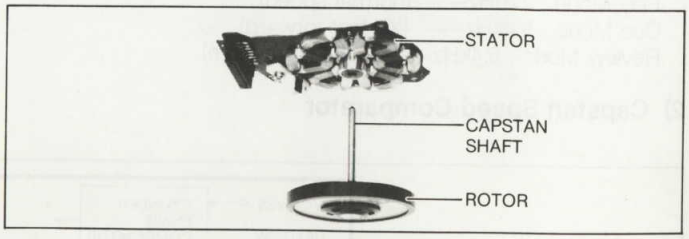


Fig. 3—21 Capstan Motor

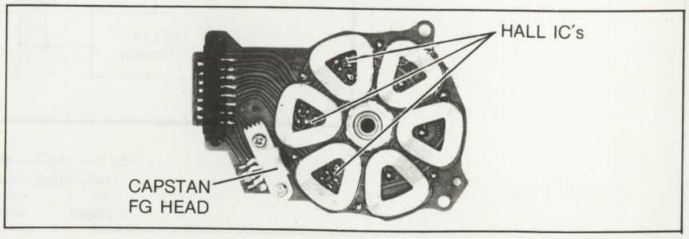


Fig. 3—22 Capstan Motor Stator

3.4 Trick Playback

1) Video Head

This model has 2 head bases on the upper head cylinder, however each video head base has two video head as show in Fig. 3—23. The azimuth and the gap width of each head are shown in Fig. 3—24. In the normal record and playback modes. L' and R' head pair is used for the both functions, and L and R head are used in trick playback, Review, Slow and Still as shown in Fig. 3—25.

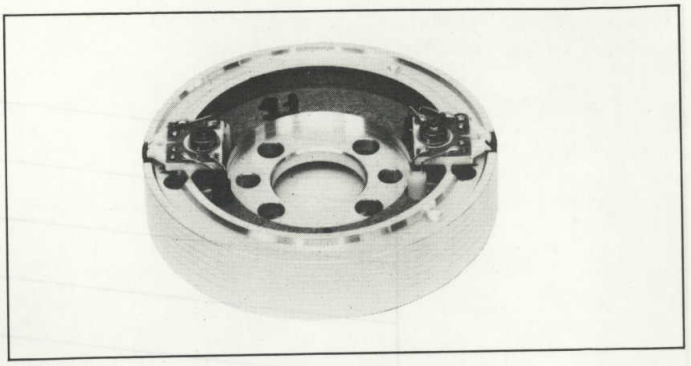


Fig. 3—23 Upper Head Cylinder

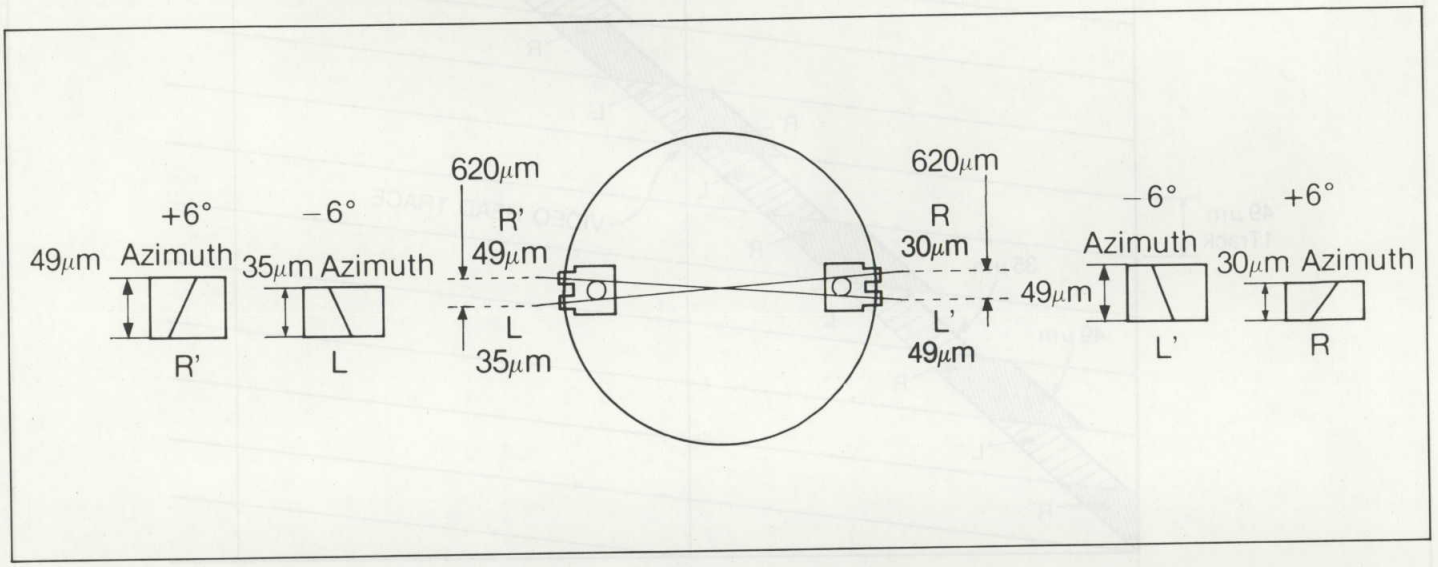


Fig. 3—24 Double Azimuth Head

MODE	REQUIRED VIDEO HEADS
RECORDING PLAYBACK	L' , R'
CUE/REW	L', R' , L , R
SLOW	L' , L , R'
STILL	L' , L

Fig. 3—25 Head Selection

As shown in Fig. 3—24, the L head and R' head are located on the same head base and is head pair has a small distance between the both heads which is equal to the double length of one horizontal period of video signal on the tape pattern. One track length can be determined by the following equation.

$$\text{Track length} = \frac{\text{Cylinder Diameter} \times \pi}{2}$$

$$= \frac{62 \times \pi}{2}$$

$$= 97.39\text{mm}$$

There are 312.5 horizontal periods recorded on each track and one horizontal period length is;

$$\text{One Horizotal Period Length} = \frac{\text{Track Length}}{312.5}$$

$$= \frac{97.39}{312.5}$$

$$= 0.312\text{mm}$$

$$\fallingdotseq 310\mu\text{m}$$

Therefore, the distance between 2 video heads on the same base is approx. 620μm.

As explained later, these video heads are switched or selected according to the mode in order to get a larger envelope. If this distance between the video heads was not double horizontal period, skew will take place when the heads are switched. To prevent this skew, the video heads distance on the same head base should be equal to the double length of one horizontal signal on the tape pattern.

2) Cue, Review Mode

The head amp outputs from R'-L head pair and L'-R head pair in Cue or Review Mode are shown in Fig. 3—25.

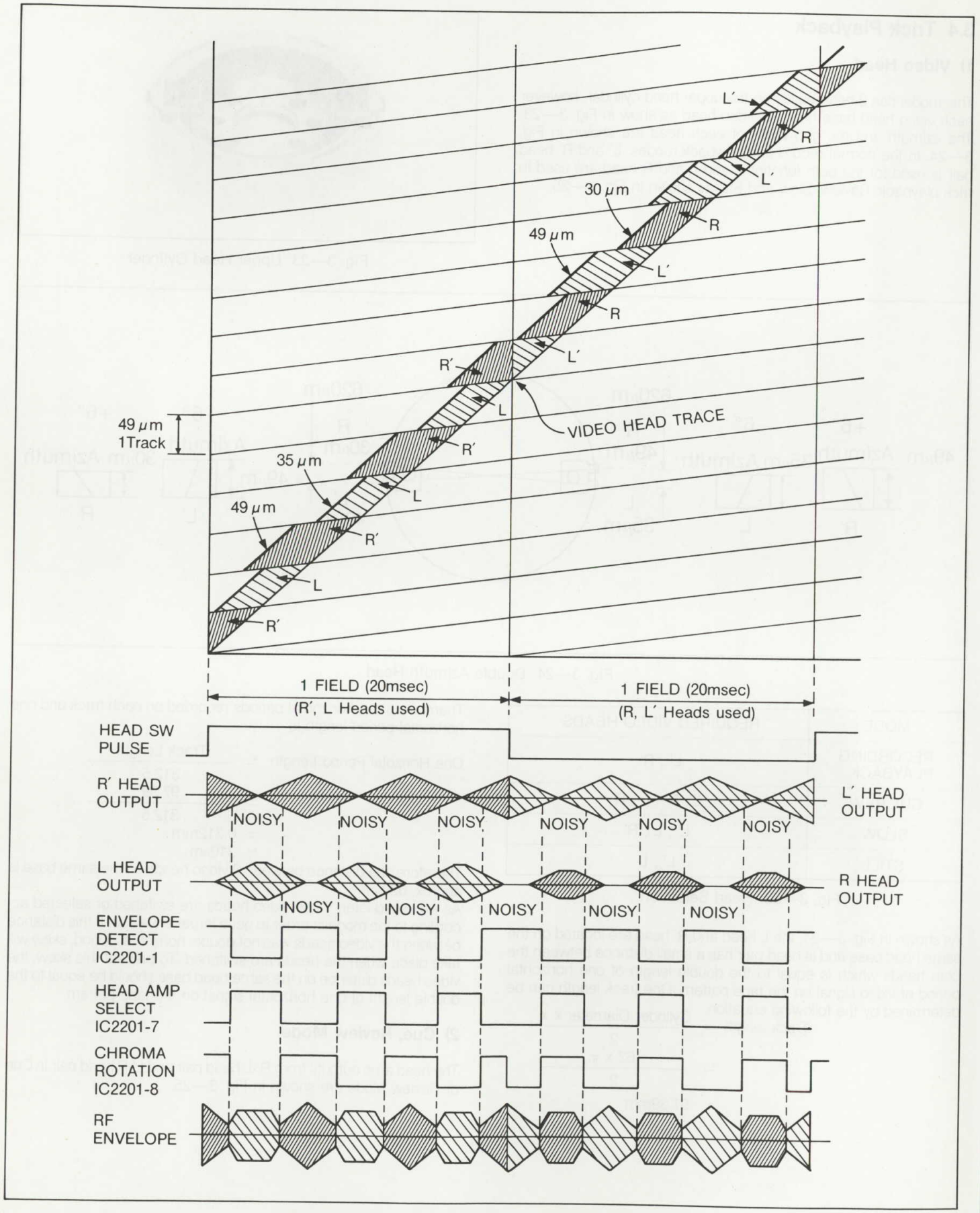


Fig. 3—26 Video Head Movement during Cue/Rev Mode

It shows that the R'-L head pair traces first field by selecting either head and the L'-R head pair traces the next field alternatively. If the R' head output only was used for the first field, no output portion would produce noise band on the TV monitor, and the width is so wide, that the picture would be very noisy. The switching of head pair and substitution is performed to reduce the noise on the picture.

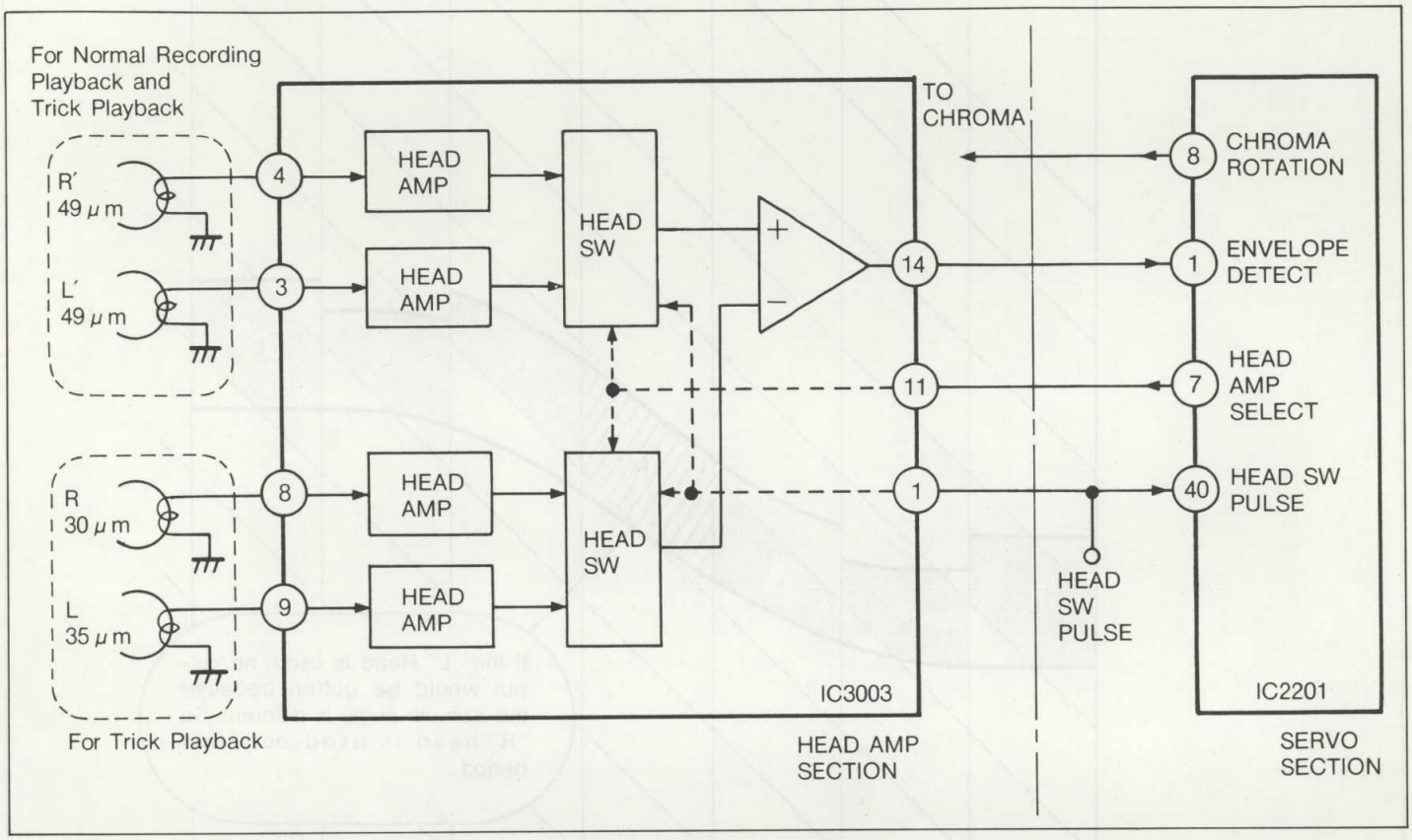


Fig. 3—27 Head Amp Selection

INPUT		OUTPUT		
HEAD SW PULSE IC2201-40	ENVELOPE DETECT IC2201-1	HEAD AMP SELECT IC2201-7	CHROMA ROTATION IC2201-8	ACTIVATED VIDEO HEAD
H	L	H	L	L
H	H	L	H	R'
L	L	H	H	R
L	H	L	L	L'

Fig. 3—28 Video Head Selection

As shown in Fig. 3—27 each pair of heads are connected to each head amplifier circuits. The output levels from each head amplifier are comparated in the luminance circuit.
If the output of L', R' head pair is bigger than the output of L, R head pair, the high voltage signal is applied to pin 1 of IC2201 from the luminance circuit.
If the output of L, R head pair is reversely bigger than the output of L', R' head pair, the low signal is produced and sent to IC2201. For information about the comparator, please refer to the video circuit explanation.
The microprocessor (IC2201:AN3715S) detects which envelope is bigger, L', R' head pair or that of the L, R head pair.
Then this microprocessor controls the head amplifier circuit so that the bigger output is processed. This is performed by the head amp select signal from pin 7 of IC2201. By using both pairs of head outputs, a continuous output RF envelope is produced as shown in Fig. 3—26.
Thus, the noise band width becomes narrow, and the noise on the picture is reduced. When the selected pair of heads are changed, the chrominance vector rotation has to be changed accordingly.
This is performed by the signal from pin 8 of IC2201. This rotation select signal is decided by the combination of the head switching signal and the head amp select signal as shown in Fig. 3—28.

3) Slow Mode

To achieve noiseless slow, the tape movement should be controlled, so that the video heads trace is shown in Fig. 3—29.

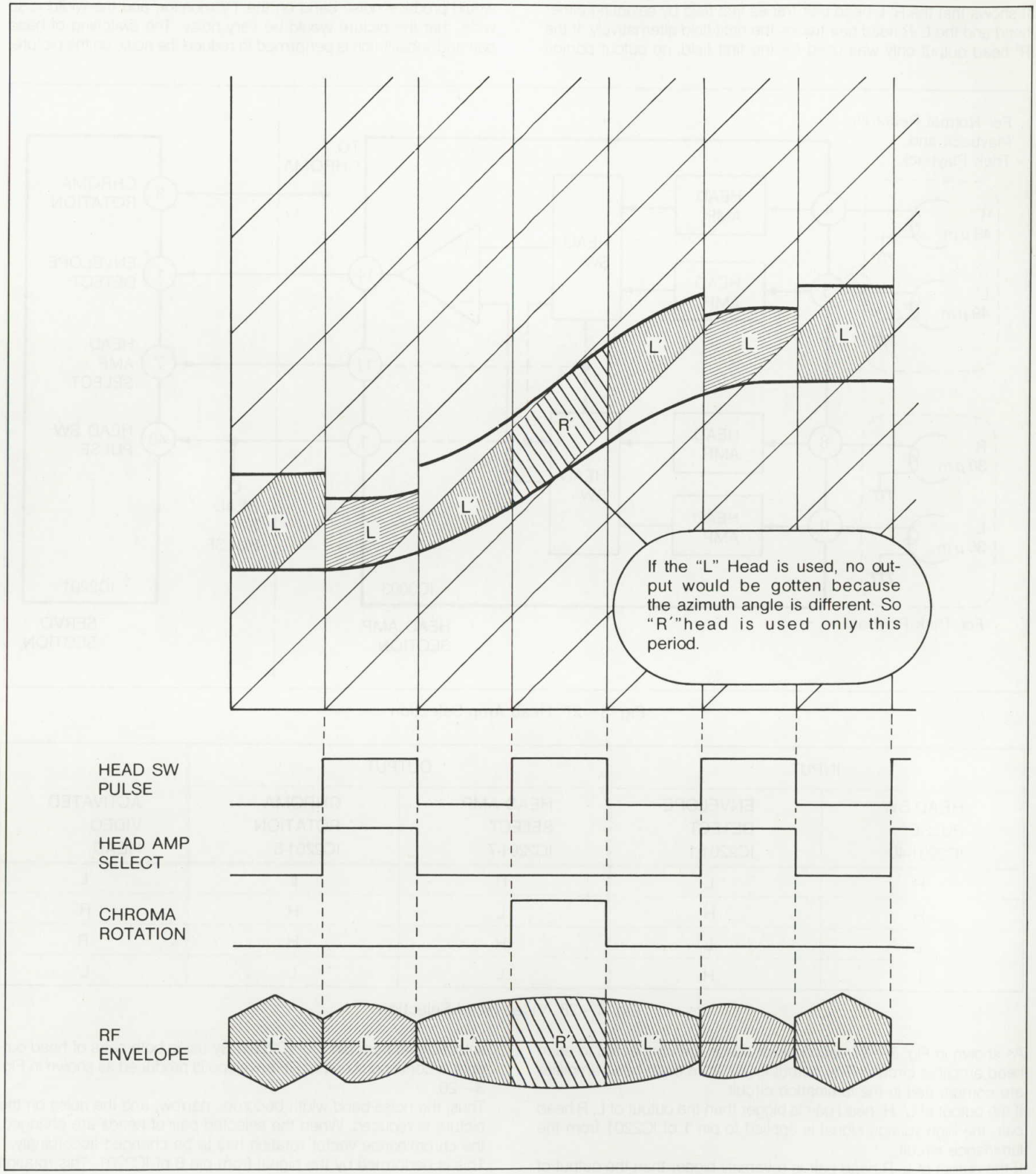


Fig. 3—29 Video Head Movement during Slow Mode

When the tape speed is controlled periodically as shown in Fig. 3—29, since the L and L' head pair is used normally in stopping portion of capstan motor, there is only one portion in which no signal would be gotten because of difference of azimuth angle.
So only in this period "R" head is used in place of "L" head in order to get larger envelope.
These complicated control is performed by the microprocessor IC2201:AN3715S and the following processes are required in order to control slow operation.

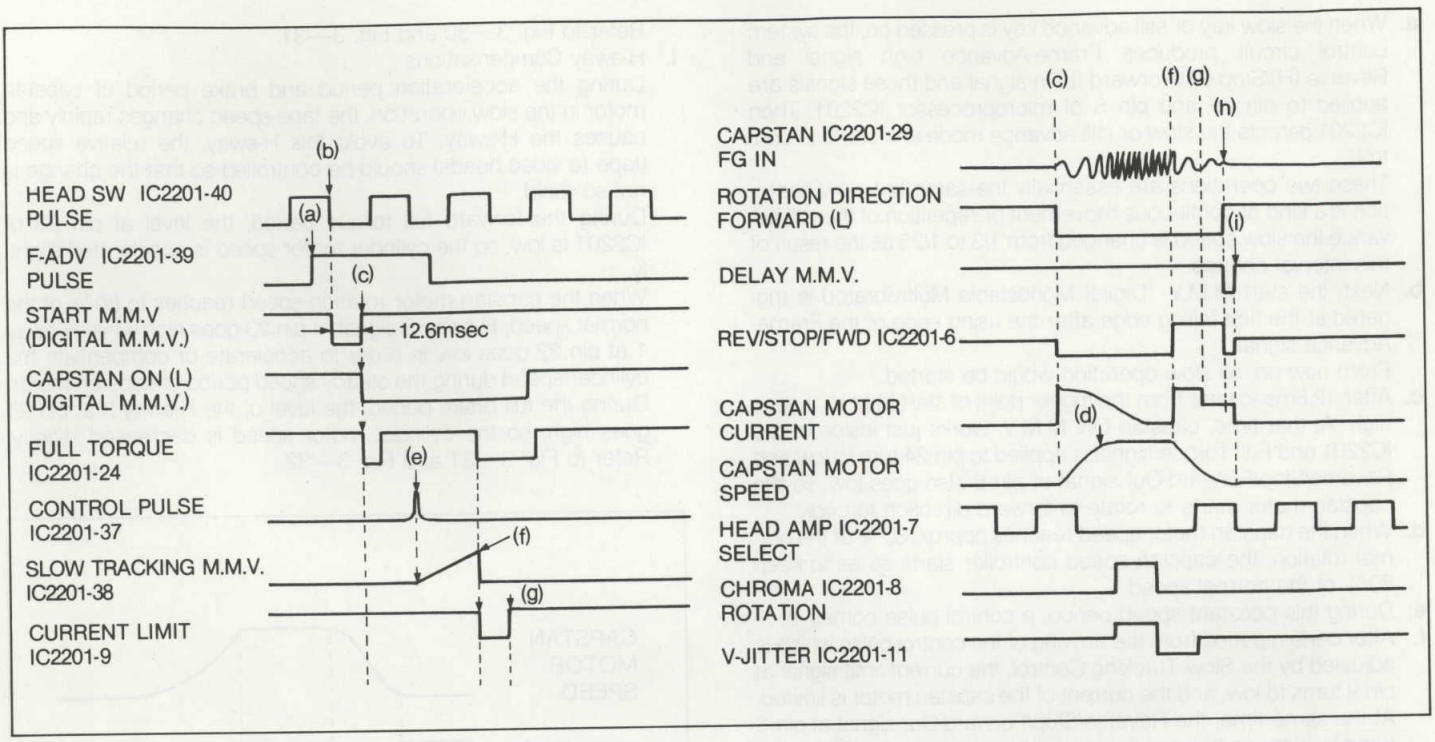


Fig. 3—30 Slow Timing Chart

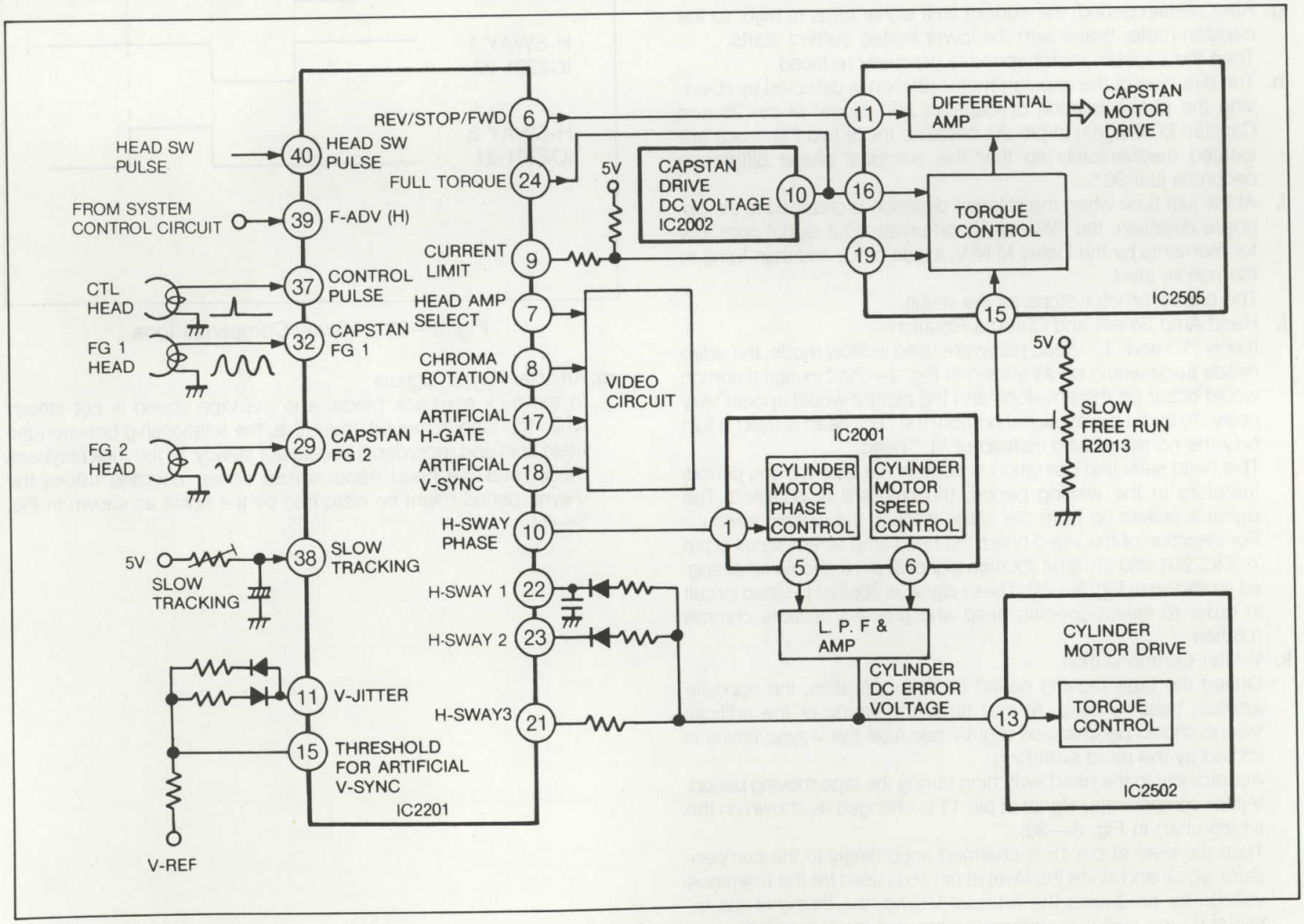


Fig. 3—31 Slow Block Diagram

a. When the slow key or still advance key is pressed on, the system control circuit produces Frame-Advance high signal and Reverse (H)/Stop (M)/Forward (L)-In signal and these signals are applied to pin 39 and pin 5 of microprocessor IC2201. Then IC2201 detects the slow or still advance mode and starts to control.
These two operations are essentially the same but slow operation is a kind of continuous movement or repetition of the still advance the slow speed is changed from 1/3 to 1/25 as the result of this interval change.

b. Next, the start M.M.V. (Digital Monostable Multivibrator) is triggered at the first falling edge after the rising edge of the Frame-Advance signal.
From now on, all slow operation would be started.

c. After 12.6msec later from the trigger point of start M.M.V., it goes high. At that time, capstan ON M.M.V. works just inside of the IC2201 and Full Torque signal is applied to pin 24 turn to low and Reverse/Stop/Forward-Out signal at pin 6 also goes low, so the capstan motor starts to rotate in forward direction forcedly.

d. When the capstan motor speed reaches approx. 80% of the normal rotation, the capstan speed controller starts so as to keep 80% of the normal speed.

e. During this constant speed period, a control pulse comes in.

f. After certain period from the arriving of the control pulse which is adjusted by the Slow Tracking Control, the current limit signal at pin 9 turns to low, and the current of the capstan motor is limited. At the same time, the Reverse/Stop/Forward-Out signal at pin 6 turns to high, so the capstan motor brake action starts with the current limit.

g. After certain period, the current limit signal turns to high, so the capstan motor brake with the lower limited current starts. Then the capstan motor speed is gradually reduced.

h. The direction of the capstan motor rotation is detected by observing the phase relation of Capstan FG1 signal at pin 25 and Capstan FG2 signal at pin 26, because these two FG heads are located mechanically so that the electrical phase difference becomes just 90°.

i. At the just time when the rotation direction is changed to the opposite direction, the Reverse/Stop/Forward-Out signal goes low for moments by the Delay M.M.V. inside of IC, and then turns to the middle level.
The capstan motor stops as the result.

j. Head Amp Select and Chroma Rotation.
If only "L" and "L'" head pair were used in Slow mode, the video heads trace would be as shown in Fig. 3—29. No signal portion would occur on the envelope and the picture would appear very noisy. To avoid the no signal portion, the "R'" head is used in just only the no signal field instead of "L" head.
This head selection operation is done in the tape moving period, therefore in the waiting period, the field still is obtained. The signal is picked up from the same track in the waiting period.
For selection of the video head, the head amp select signal at pin 7 of IC2201 and chroma rotation signal at pin 8 should be changed as shown in Fig. 3—30. These signal is applied to video circuit in order to select specific head and process suitable chroma rotation.

k. V-Jitter Compensation
During the tape moving period in slow operation, the opposite azimuth head is used. At that time, the timing of the artificial V-sync should be changed slightly because the V-sync timing is shifted by the head switching.
Accordingly to the head switching during the tape moving period, V-jitter compensator signal at pin 11 is changed as shown on the timing chart in Fig. 3—30.
Then the level at pin 15 is changed accordingly to the compensator signal and since the level at pin 15 is used for the reference voltage for producing the artificial V-sync, the timing of the artificial V-sync signal is changed to prevent the V-dancing.
Refer to Fig. 3—30 and Fig. 3—31.

l. H-sway Compensations
During the acceleration period and brake period of capstan motor in the slow operation, the tape speed changes rapidly and causes the H-sway. To avoid this H-sway, the relative speed (tape to video heads) should be controlled so that the change is not so rapid.
During the forward full torque period, the level at pin 23 of IC2201 is low, so the cylinder motor speed is accelerated slightly.
When the capstan motor rotation speed reaches to 80% of the normal speed, H-sway 2 signal at pin 23 goes high while H-sway 1 at pin 22 goes low in order to accelerate or compensate the cylinder speed during the steady speed period of capstan motor.
During the full brake period, the level of the H-sway 3 at pin 21 goes high, so the cylinder motor speed is decreased slightly.
Refer to Fig. 3—31 and Fig. 3—32.

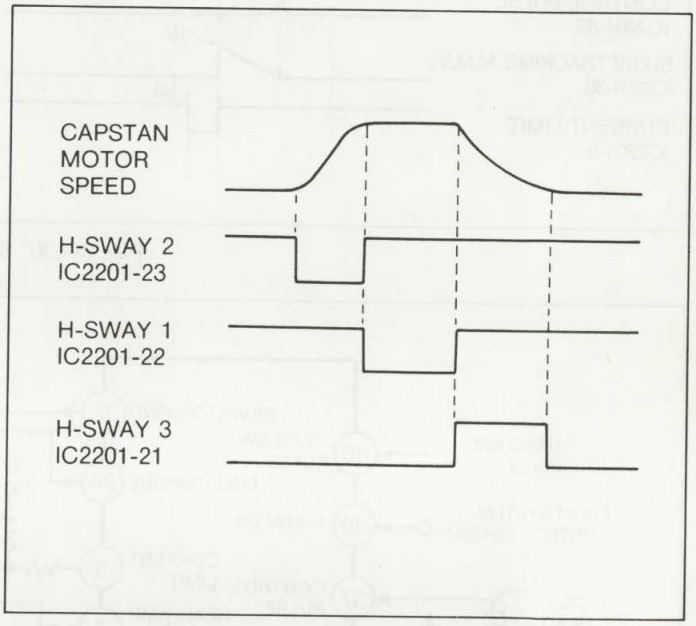


Fig. 3—32 H-Sway Compensations

m. Artificial V-sync Signals
In the trick playback mode, and the tape speed is not steady while the tape is moved, therefore, the relationship between the head spin and recorded tracks is not steady. In the trick playback mode, and the head trace across some recorded tracks the V-sync period might be disturbed by the noise as shown in Fig. 3—34.

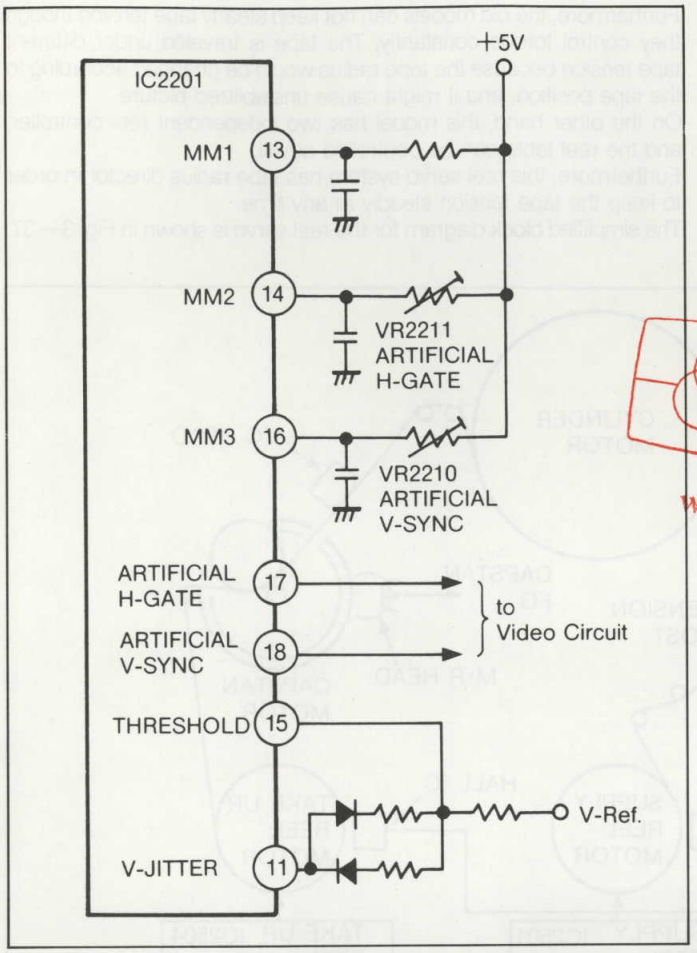


Fig. 3—33 Artificial V-sync Signals Block Diagram

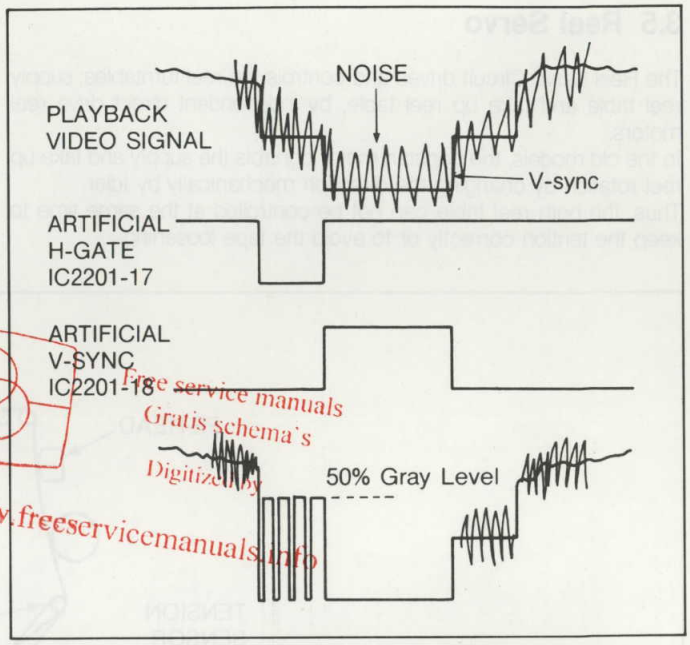


Fig. 3—34 Artificial V-sync Signals

The clear picture can be seen also by inserting this portion.
Besides artificial V-sync signal, the artificial H-gate signal is also inserted to lock horizontally.
These insertions are performed in the video circuit.
Fig. 3—35 and Fig. 3—36 show the actual waveform in each mode.
The "L" head and "L" head are used mainly in slow or still mode.
These two heads are not located just 180° on the upper head cylinder, so therefore, a different monostable multivibrator MM 1 and MM 2 are used.

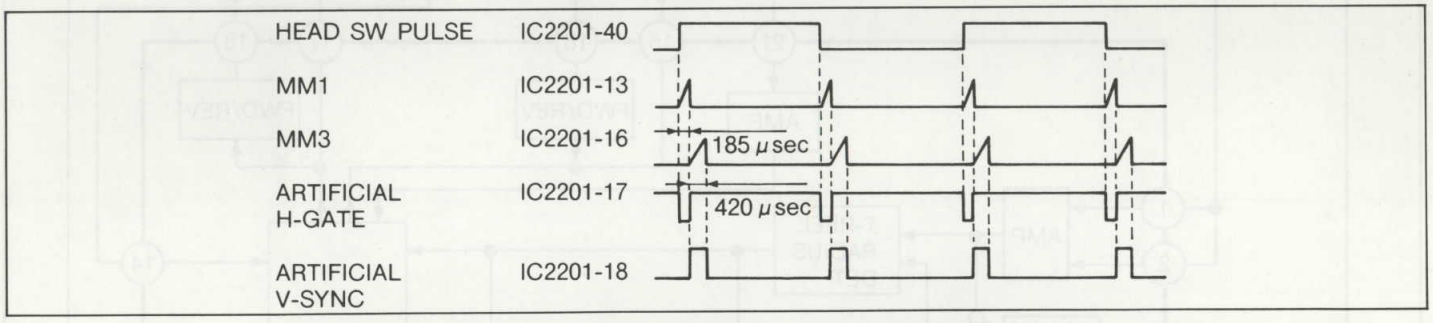


Fig. 3—35 Artificial V-sync — Cue/Review Mode

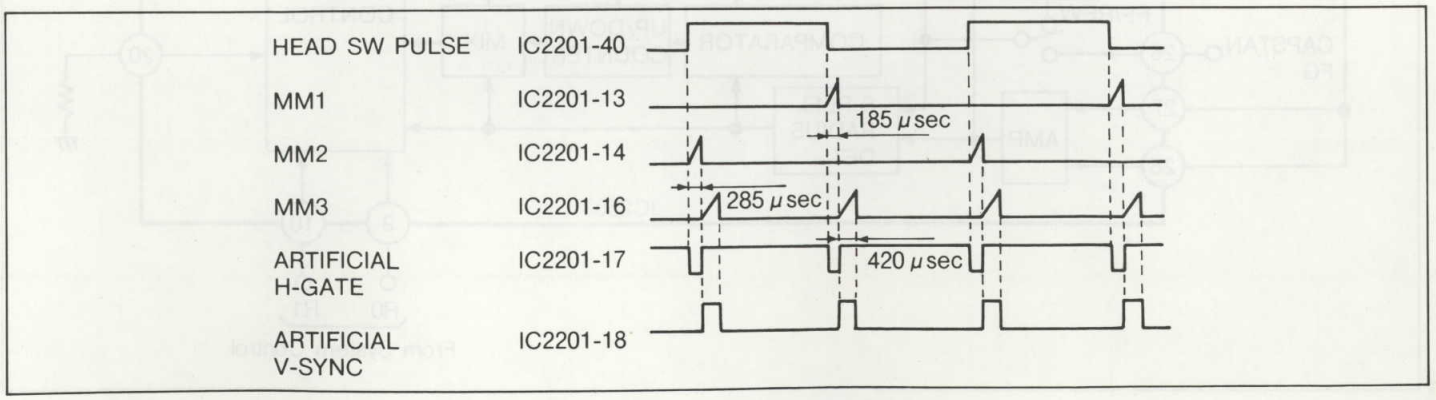


Fig. 3—36 Artificial V-sync — Slow/Still Mode

3.5 Reel Servo

The Reel Servo Circuit drives and controls the reel turntables; supply reel table and take up reel table, by independent direct drive reel motors.
In the old models, the capstan motor controls the supply and take up reel rotation by changing the direction mechanically by Idler.
Thus, the both reel table can not be controlled at the same time to keep the tention correctly or to avoid the tape loosening.

Furthermore, the old models can not keep steady tape tension though they control torque constantly. The tape is traveled under different tape tension because the tape radius would be changed according to the tape position, and it might cause unstabilized picture.
On the other hand, this model has two independent reel controller, and the reel table can be controlled at will.
Furthermore, this reel servo system has tape radius director in order to keep the tape tension steadly at any time.
The simplified block diagram for the reel servo is shown in Fig. 3—37.

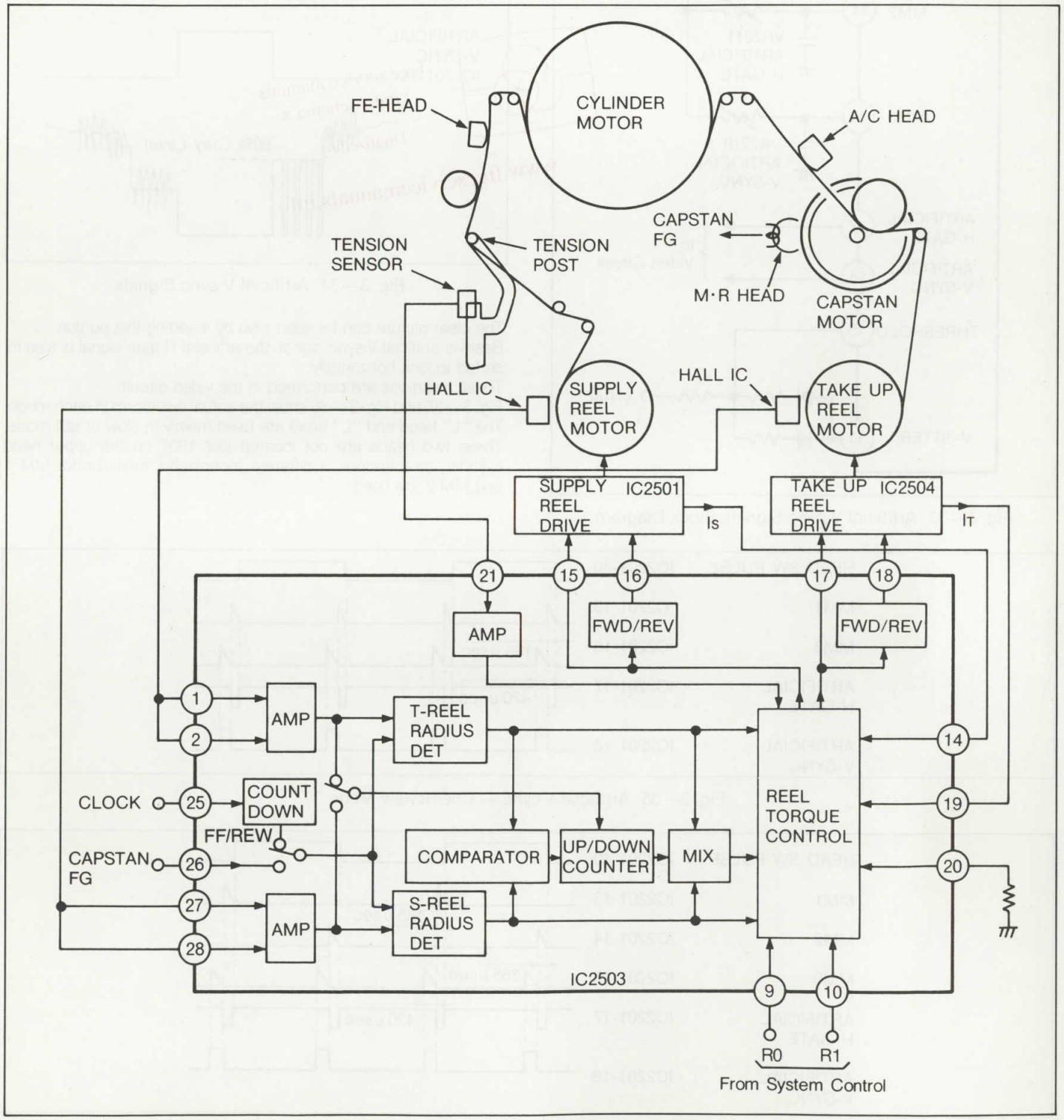


Fig. 3—37 Reel Servo Block Diagram

This circuit consists of the reel servo IC (IC2503), supply reel drive IC (IC2501) and take up reel driver IC (IC2504).

1) Reel Torque Control

For the reel torque control, following signals are supplied to the reel servo IC (IC2503).
1. Tension Sensor signal (IC2503-21)
2. Capstan FG signal (IC2503-26)
3. Take up Reel FG signal (IC2503-1,2)
4. Supply Reel FG signal (IC2503-27,28)
5. Take up Reel Motor current (IC2503-19)
6. Supply Reel Motor current (IC2503-14)
7. Mode signal R0, R1 (IC2503-9,10)

And for the torque control, following signals are supplied to reel motor drive IC's (IC2501 and IC2504) from IC2503.
1. Supply Reel Control current (IC2503-15)
2. Take up Reel Control current (IC2503-17)
3. Supply Reel Direction signal (IC2503-16)
4. Take up Reel Direction signal (IC2503-18).

In order to achieve the smooth tape movement in each mode, the supply reel motor and take up reel motor are driven as is described below.

Tension Sensor and Tape Tension Control In Play and Cue mode

Tape tension should be kept properly and constantly to pick up the video signal from the tape or to keep the steady picture.
The tension sensor detects the tape tension and its signal is applied to the reel Servo IC (IC2503-21) and fed back to control the supply reel motor as shown in Fig. 3—38.

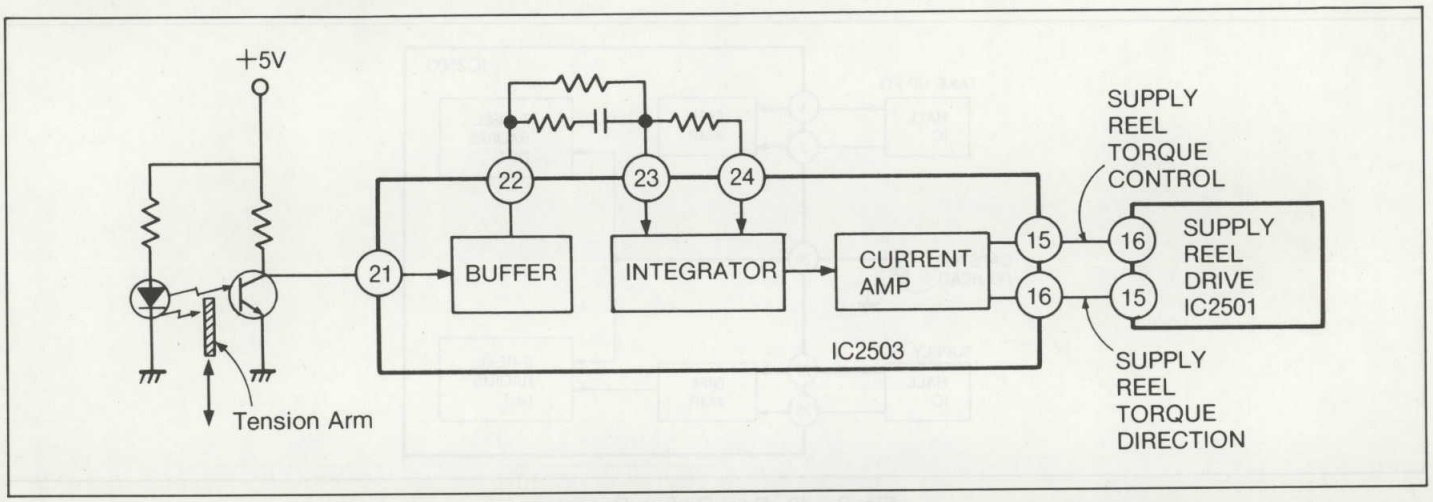


Fig. 3—38 Tension Sensor Control

The construction of tension sensor is shown in Fig. 3—39.

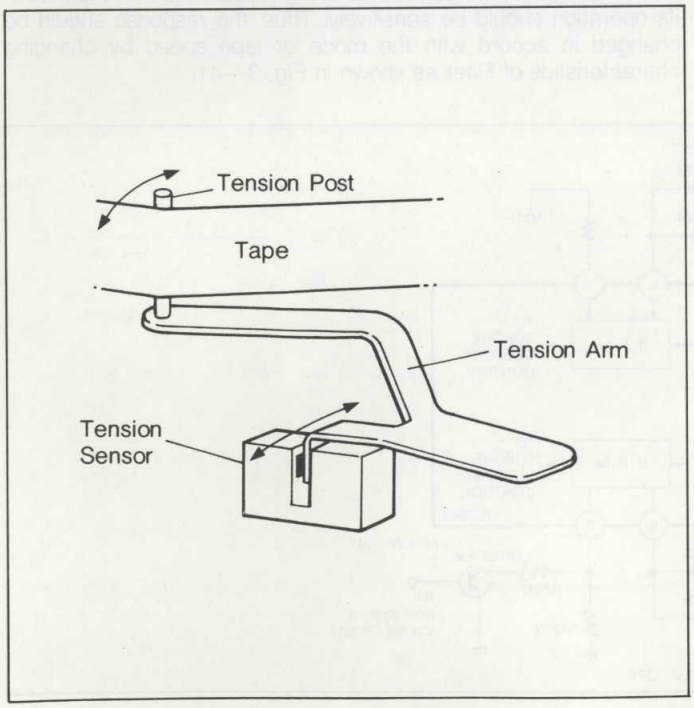


Fig. 3—39 Tension Sensor

This mechanism has the tension sensor beside the tension arm, and it is a kind of photo interrupter.
During the play or cue mode, the angle of the tension arm interrupts the light from the LED mounted on the tension sensor unit.
Then the output level of photo transistor in the photo interrupter is varied accordingly to the position of tension arm, which is moved in accord with the tape tension. So finally, the tape tension is converted into electric signal and supplied to IC2503-21 to control the supply reel motor torque.
The supply reel motor torque is changed keep the tape tension at constant level.
In play or cue mode, the tension signal from tension sensor is applied to IC2503-21 and processed by buffer, integration circuit and current amplifier. This output is then sent to the supply reel motor to control the torque correctly. IC2501-16 receives the supply reel torque signal and IC2501-15 receives the supply reel torque direction.

Reel Radius Detection

In play or cue mode, the tape is driven by the capstan motor and the take up reel has to wind the sending tape under steady tension. The take up reel of the old model winds in such manner that the torque is constant, therefore, the actual tape tension is changed according to the tape position; in the beginning porsion, the reel radius is smaller and the actual wound tape tension might be bigger and not suitable for the play or cue mode.
Reversely, the bigger the reel radius become, the smaller the actual wound tape tension become.
The reel torque should be changed in function of the reel radius which should be detected in order to realize uniform tape tension.

Each reel radius is calculated from each reel FG signal supply reel FG and take up reel FG which represent the reel rotation speed as follows. (Capstan Shaft Diameter) x (Capstan Rotation Number) = (Supply Wound Reel Radius) x (Supply Reel → Rotation Number) = (Take up Wound Reel Radius) x (Take up Reel → Rotation Number)
Capstan Rotation Number, Supply Reel Rotation Number and Take up Reel Rotation Number can be detected by capstan FG frequency, Supply Reel FG frequency and take up Reel FG frequency.
Finally, the following eqatious are required to calculate the reel radius.

$$Ds = \frac{fc}{fs} Ks.\ Dc$$

$$Dt = \frac{fc}{ft} Kt.\ Dc$$

Ds: Supply Reel Radius
fs: Supply FG frequency
Ks: Supply FG Gear Ratio
Dt: Take up Reel Radius
ft: Take up FG frequency
Kt: Take up FG Gear Ratio
fc: Capstan FG frequency
Dc: Capstan Shaft Radius

Thus, the supply reel radius is determined by the ratio of the capstan FG frequency and the supply reel FG frequency, while the take up reel radius is calculated by the ratio of the capstan FG frequency and the take up reel FG frequency.

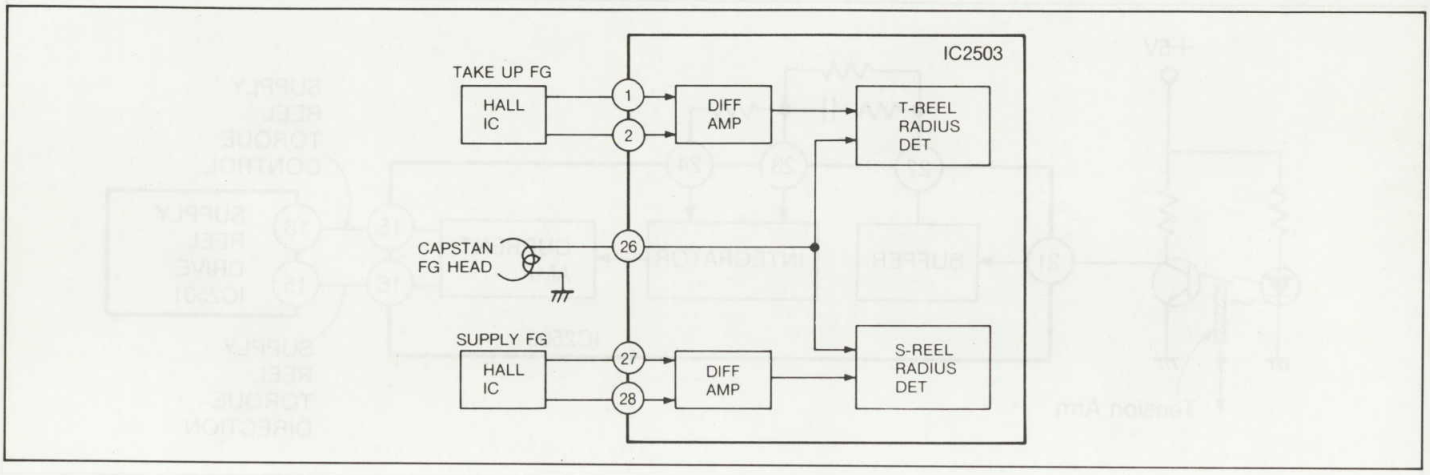


Fig. 3—40 Reel Radius Detector

This operation is performed normally in Play, Cue and Rev mode, however in Still or Slow mode, the reel radius is held inside of the IC because the tape is not so moved, and when the Still or Slow mode is released, the held radius is re-used.

Filter of Torque Current

In FF/REW mode, the tape moves at high speed and the response of its operation should be sensitively. Thus, the response should be changed in accord with the mode or tape speed by changing characteristics of Filter as shown in Fig. 3—41.

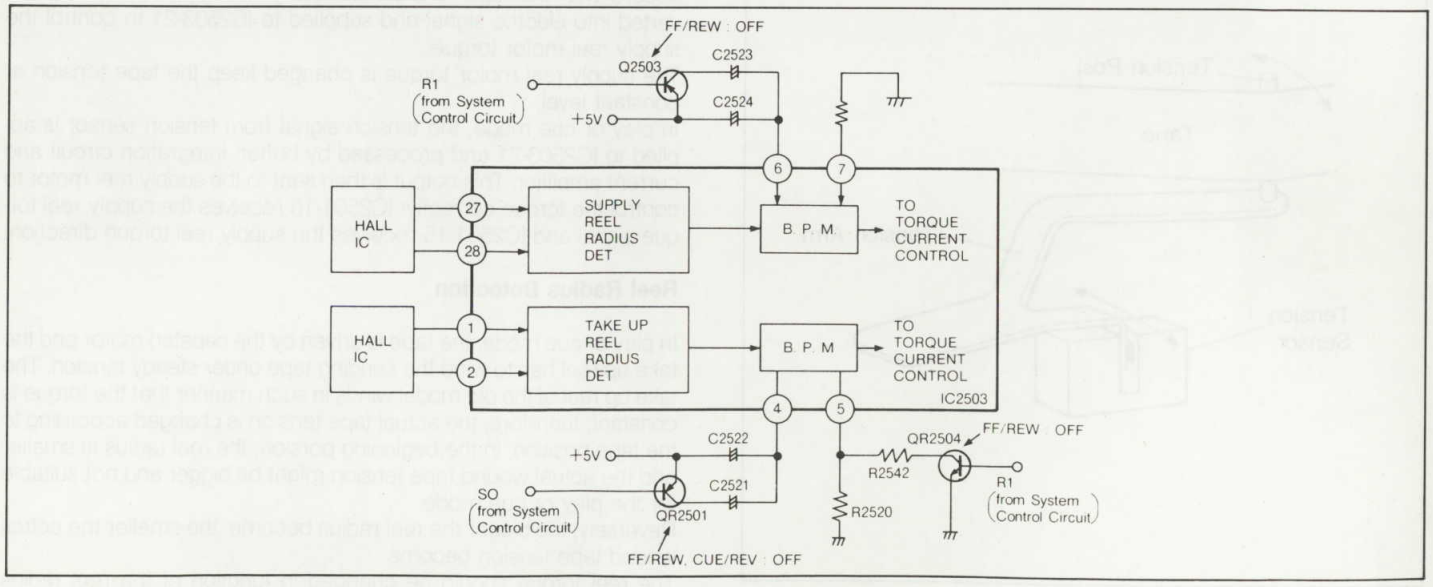


Fig. 3—41 Filter of Torque Current

In normal playback mode the capacitors C2522 and C2521 and C2521 at pin 4 of IC2503 work as a filter of the torque current output of take up side, which determine its response.
But in FF/REW, CUE/REW mode, "SO" high signal is applied from system control circuit, QR2501 turns off and a capacitor C2522 only is connected so as to change the response sensitively.
In FF/REW mode, where "R1" high signal is supplied from system control circuit also, QR2504 turns on and resistors R2520 and R2542 are connected to the ground, therefore, the more sensitive response would be given in FF/REW mode.
On the other hand, two capacitors C2524 and C2523 are connected to supply side in normal playback mode.
In FF/REW mode, "R1" high signal produced from system control circuit is sent to the base of Q2503, turning it off and the capacitor C2524 only is connected to improve the total response in FF/REW mode.
For the detail of "SO" signal and "R1" signal refer to the explanation for system control circuit.

Torque Control Selection

The torque control current outputs at pin 15 of IC2503 for supply reel and at pin 17 for take up reel are determined by the input signals for torque control. As explained before, there are several control methods which are selected according to the mode so as to keep the most suitable condition for its operation and mode instruction data "R0" and "R1" from the system control circuit are used to select them. Refer to Fig. 3—42 and Fig. 3—43.

R0 \ R1	LOW	MIDDLE	HIGH
LOW	PLAY REV	FF	
MIDDLE	SLOW STILL	———	Brake
HIGH	Loading	Unloading	REW

Fig. 3—42 Mode Instruction Data

Mode \ Motor	Supply Reel Motor	Take up Reel Motor
PLAY and CUE	The constant tension is kept by the Tension sensor.	The torque is controlled so as to be in proportion to the radius of the take up reel.
REV	The torque is controlled so as to be in proportion to the radius of the supply reel.	The torque is controlled so as to be in proportion to the radius of the take up reel.
FF	The torque is controlled according to the take up reel motor current.	The speed control of the take up reel motor is performed so that the sum of the torques of both reel motors is constant.
REW	The speed control of the supply reel motor is performed so that the sum of the torques of both reel motors in constant.	The torque is controlled according to the supply reel motor current.
SLOW	The same as PLAY mode.	The same as PLAY mode. But the reel radius data is kept at the previous data.
Loading	The back tension is applied by the constant torque.	Mechanical Lock.
Unloading	The back tension is applied by the constant torque.	Mechanical Lock.
Brake	FF mode: Counter Clockwise Torque REW mode: Clockwise Torque	FF mode: Counter Clockwise Torque REW mode: Clockwise Torque

Fig. 3—43 Torque Control in Each Mode

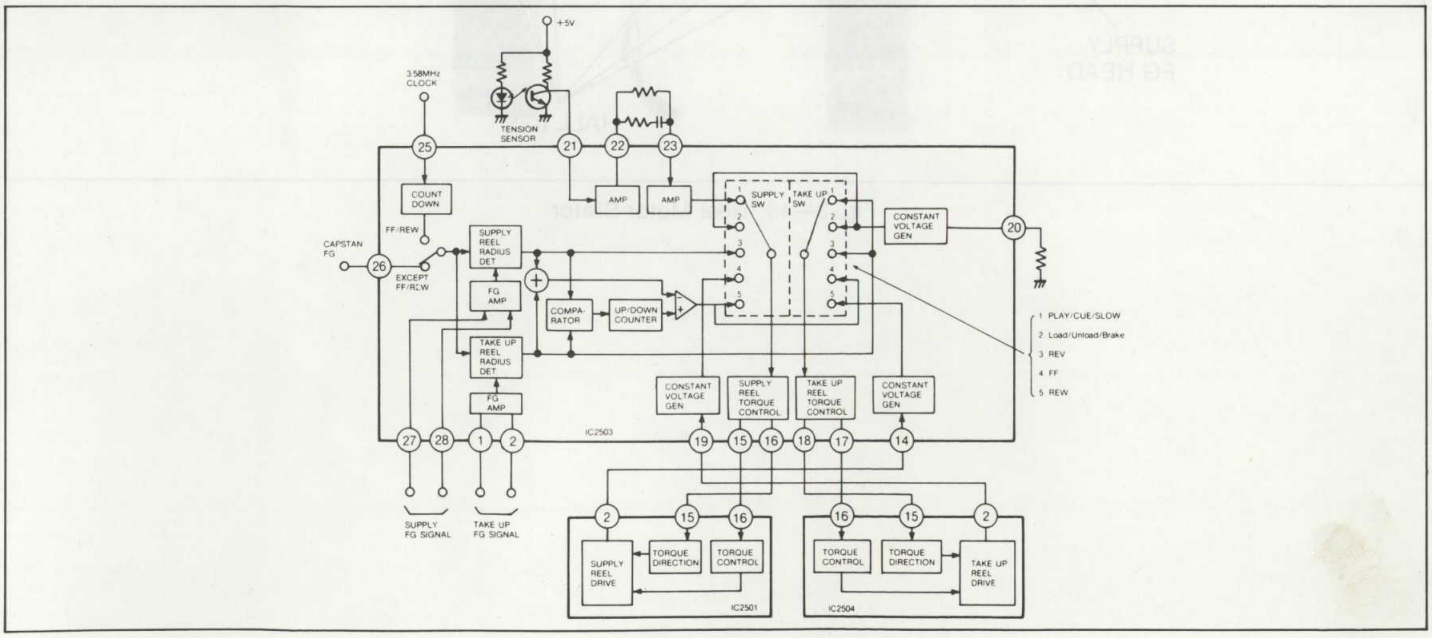


Fig. 3—44 Torque Control Block Diagram

Reel Motor Drive

The reel motor also uses a brushless and eight poles direct drive motor as used for the cylinder and capstan motor.

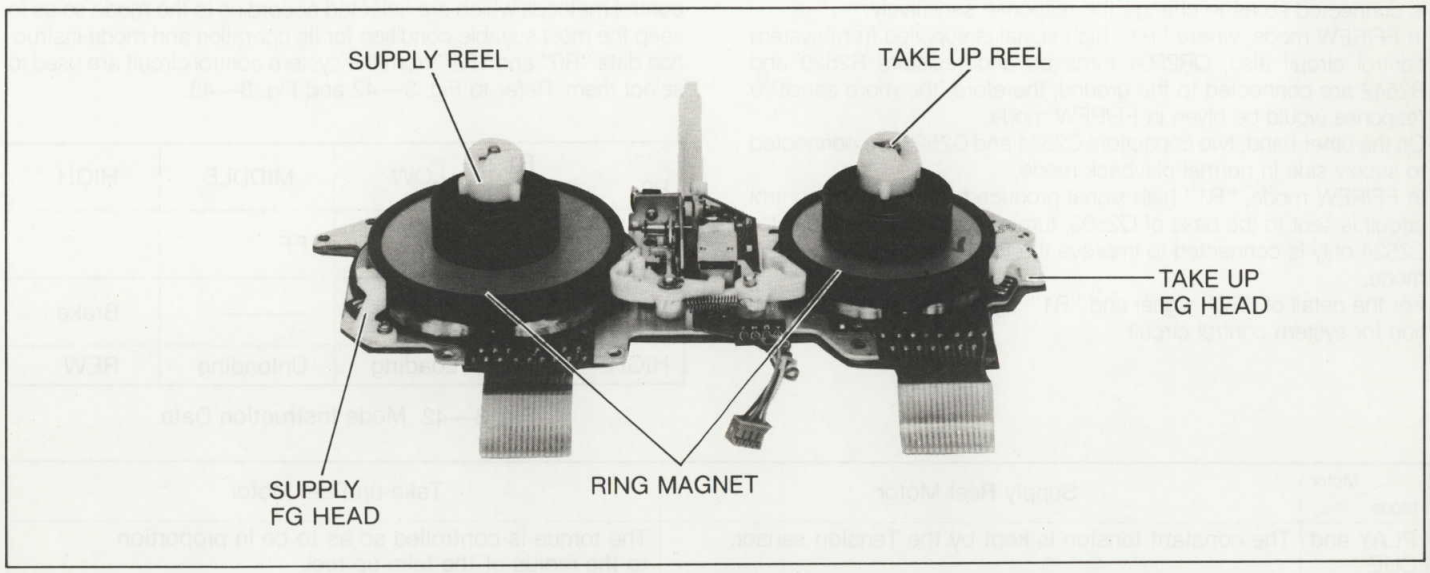


Fig. 3—45 Reel Motor

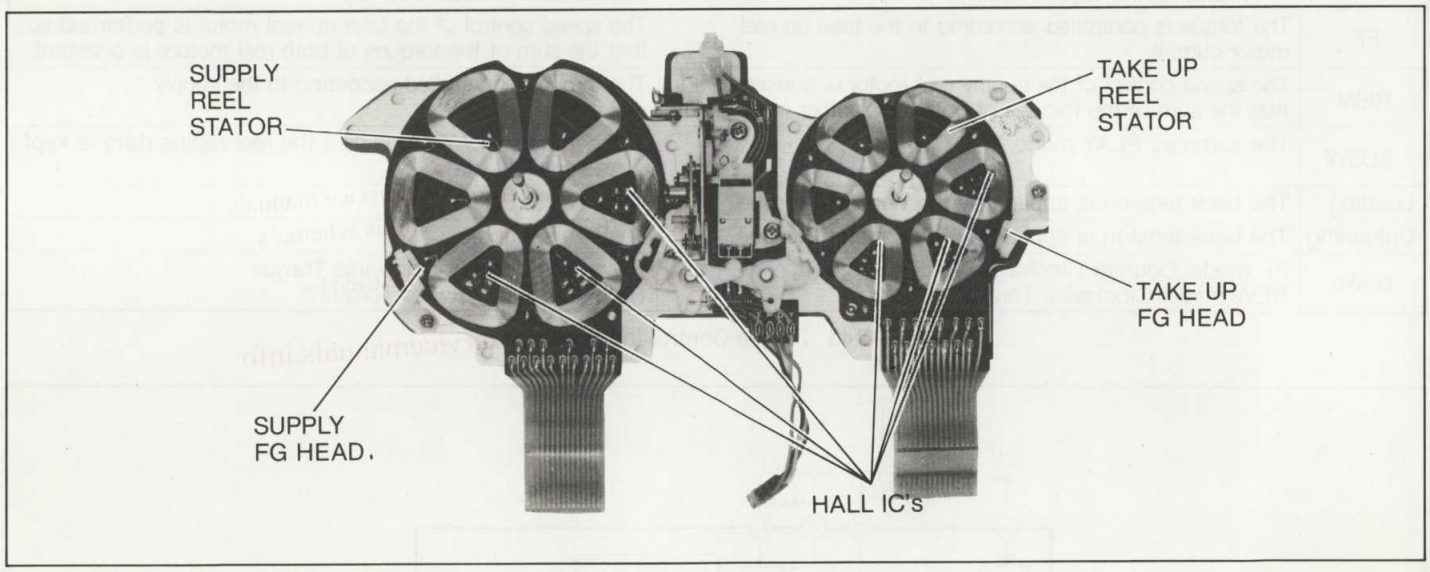


Fig. 3—46 Reel Motor Stator

4. SYSTEM CONTROL CIRCUIT

4.1 General Description

The main purpose of the system control section is to drive the mechanism is accordance with the front panel key operation using the microprocessors as follows.

IC6001: MN1534VGA
IC6002; μPD7503G

In addition to controlling the transport, the system control circuit also performs the following functions.

1) Key Matrix Circuit

The actual VCR uses the key Matrix circuit in order to sense what operation keys are pressed.
To sense the mode, microprocessor IC6001 makes three scan pulses. IC6001 has four input ports to receive the scan pulses.
If one of operation key is pressed, one of three Scan Pulses are fed back to one of the four input ports of microprocessor IC6001.
Therefore, the microprocessor can detect what operation keys are pressed, and the mode information is applied to the mechanism control and the LCD drive microprocessor IC6002 : μPD7503G as shown in Fig. 4—1.

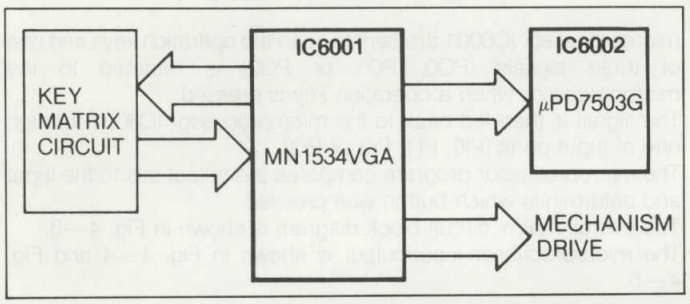


Fig. 4—1 Microprocessors

2) Mode Select Switch

Since the loading motor position of the tape sets the mechanical status of the deck, accurate sensing of the mechanical status is needed, according to the movement of the loading motor. The Mode Select Switch enables accurate sensing to take place. The Mode Select Switch has six positions (EJECT, SUB EJECT, FF/REW, STOP, PAUSE and PLAY)
The mechanical position is always detected by the "Mode Select Switch" so that the mechanism movement is worked correctly.

3) Automatic Stop Function (Safety features)

If any of several undesirable conditions occur, this unit automatically goes switches to stop mode, and the power switch is turned off, if necessary.

Under Cut

If the power (normally 12V-DC) falls below 10.5V, the unit will automatically shut off.

Dew Sensor

If there is excessive humidity inside the unit, the dew detector will stop the unit.

Cylinder Lock

If the DD Head Cylinder does not rotate during operation, the unit will switch to unloading condition or stop.

Reel Sensor

If Reel rotation stops during the operation so that the reel motors move, the unit will stop.

Supply Sensor

When a tape reaches the end in Fast Forward, CUE or PLAY (Record) modes, a supply photo Transistor receives infrared light through the translucent tape attached to the end of the video tape and the unit will stop.

Take-up Sensor

When a tape is rewinding to the beginning (Rewind or Review mode), the unit will stop.

Cassette compartment Down Detector

If the Cassette Compartment is not completely lowered, the unit will stop.

Power Interrupt

a) If a power failure happens during recording or playback, the tape stops instantly and the tape remains inside the unit.
When the power resumes, the unit will unload and stops.
b) During any operation, if the power switch is turned off, the unit will be placed in stop mode.

Timer Set

When a tuner unit is connected to the deck with the Timer Record Switch pressed "ON", the unit will stop.

Memory Stop

The rewind or fast fowered action will stop if "0000" is reached on the counter.

Safety Tab Detect

When a tape has a broken tab, the cassette tape cannot record.

4) LCD Display Drive

Whenever an operation button is pressed, the activated function is immediately indicated on LCD display by the microprocessor IC6002. It shows at a glance, in what operation mode the NV-180 is.

5) Tape Counter Operation

When the reel table is rotated during PLAY, REC, FF/REW, CUE/REVIEW or SLOW modes, the microprocessor IC6002 increases or decreases the number of the Counter Display on LCD Display.

6) Mechanism Control

A. Power Switch ON/OFF circuit.
When the power switch is turned OFF during loading mode, the power voltage is kept until unloading is completed.
B. Motor Drive Circuit
There are 5 motors in this unit, controlled by the microprocessor IC6001.

7) Data Transmission

When the accessory unit (programable Tuner, Video Camera, wired Remocon) is connected to the VCR, serial data transmission is used for communication between both pieces of equipment.
Serial data transmission is also used between IC6001 and IC6002. The data mode is exchanged between both pieces.

8) Remaining Tape Indicator

In the PLAY or REC mode, the remaining tape time is indicated on the LCD Display.
The IC6002 microprocessor counts the Take-up and Supply Reel Pulse, and indicates the remaining tape time.

9) Short Rewind Operation for Add-on Recording

When the pause key is pressed during recording, a short rewind operation is performed for 1.2 sec and then the unit waits for the next pause key input. The sequence for Add-On Recording is as follows.
(A) Pause key is pressed during recording.
(B) Short Rewind runs for 1.4 sec.
(C) The loading motor runs in the UNLOAD Direction and the Mode Select switch moved toward the PAUSE position until it is reached.
(D) The unit is now in the REC. PAUSE mode.
(E) The pause key is pressed again to release the pause.
(F) Short playback (1.0 sec) begins for synchronization between the playback control pulse and the vertical sync. of the incoming Video.
(G) Add on recording begins.
This process is performed by the System Control and Servo Circuit.

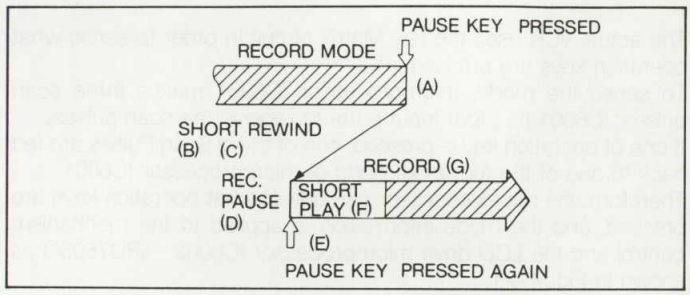


Fig 4—2 Add-on Record

4.2 Detail Description

1) Key Matrix Circuit

A key matrix circuit is used to select the desired mode when an operation key is pressed.
As previously stated, this system Control Circuit utilizes two microprocessors, the key sensing operation being performed by the microprocessor IC6001: MN1534VGA.
Pulses from the key scan output ports (PO0, PO1, PO2) of the microprocessor IC6001 are sent to scan the operation keys and one of three signals (PO0, PO1 or PO2) is returned to the microprocessor when a operation key is pressed.
The signal is then fed back to the microprocessor IC6001 through one of Input ports (PI0, PI1, PI2 or PI3).
The microprocessor program compares the output bits to the input and determines which button was pressed.
The overall matrix circuit block diagram is shown in Fig. 4—3.
The microprocessor input/output is shown in Fig. 4—4 and Fig. 4—5.

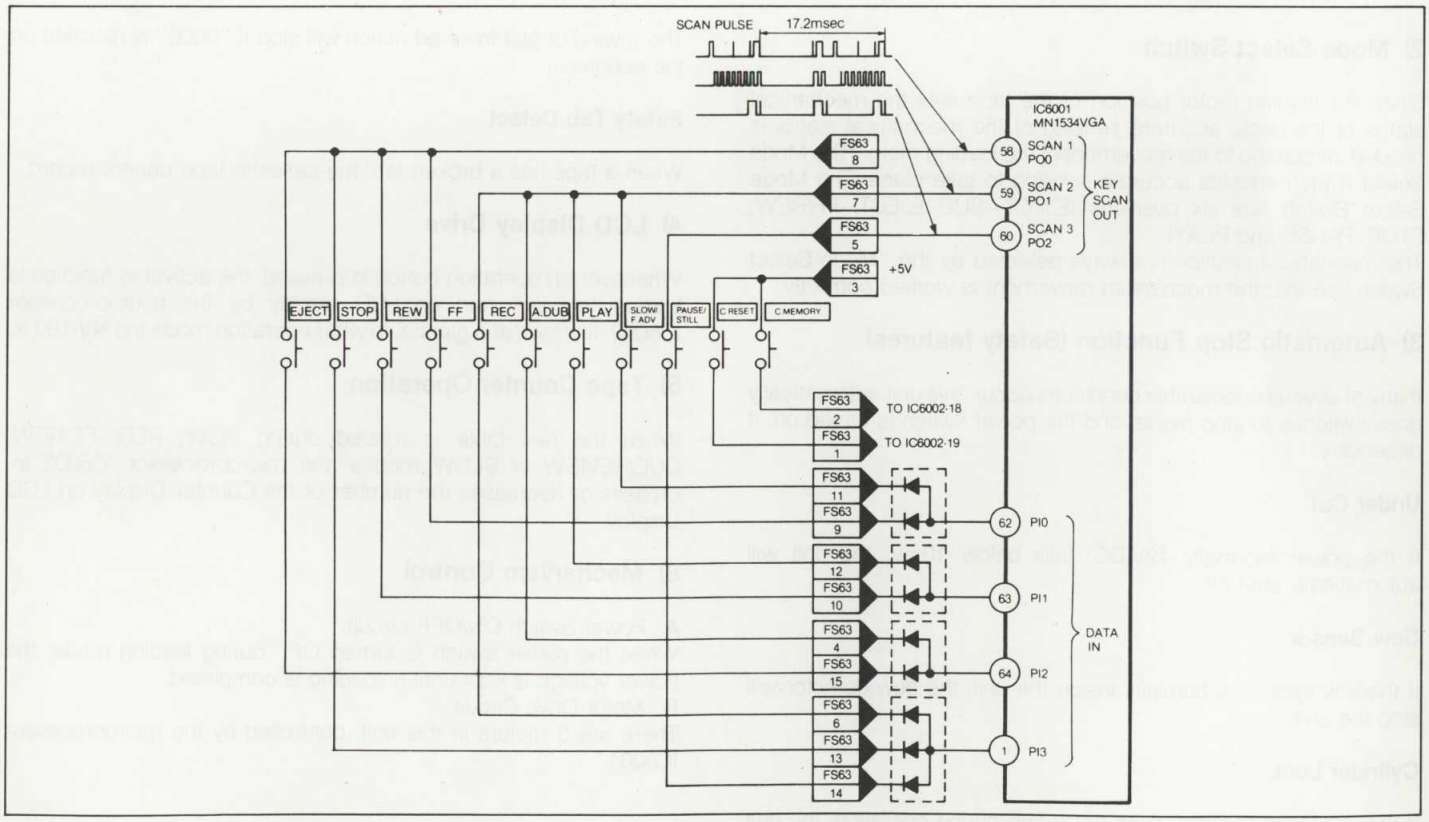


Fig. 4—3 Key Matrix Block Diagram

INPUT / OUTPUT	PI0 (Pin 62)	PI1 (Pin 63)	PI2 (Pin 64)	PI3 (Pin 1)
PO0 (Pin 58)	F.F.	REW	EJECT	STOP
PO1 (Pin 59)	SLOW/F.ADV	PLAY	A. DUB	REC
PO2 (Pin 60)	———	———	———	PAUSE

Fig. 4—4. Key Matrix of Microprocessor IC6001

INPUT / OUTPUT	PIN 18 (IC6001)	PIN 19 (IC6002)
+5 V (Pin 3 of FS63)	C. MEMORY	C. RESET

Fig. 4—5 Key Matrix of Microprocessor

For example, when the FF key is pressed, the PO0 output signal from the microprocessor MN1534VGA is sent to the PI0 input port of same microprocessor.
It is recognized as a request for Fast Forward, and the mechanism control signal for FF appears on the microprocessor IC6001 as shown in Fig. 4—6. The mechanism control will be described in greater detail later.

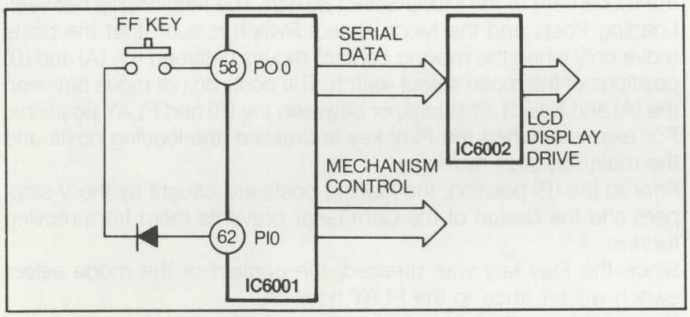


Fig. 4—6 Simplified Function Diagram

In the microprocessor, there is key priority as shown in Fig. 4—7. For example, when the EJECT key and PLAY key are pressed at the same time, the EJECT key is recognized by the microprocessor IC6001.

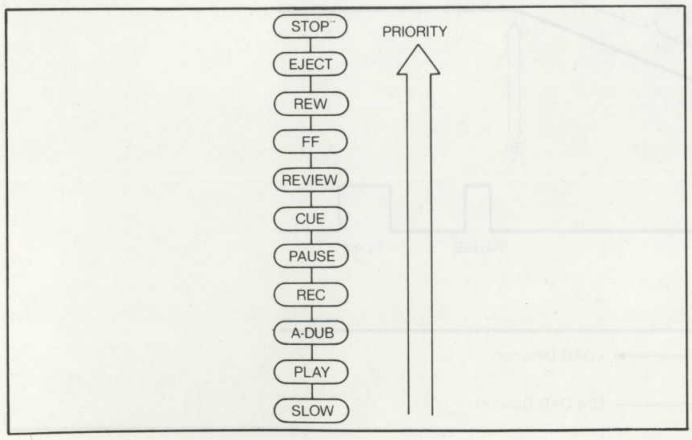


Fig. 4—7 Key Priority

2) Mode Select Switch

As previously stated, the Mode Select Switch detects the mechanism position (Gear and Loading motor) so that the mechanism movement works correctly.
The mode select switch is located under the chassis and is driven by the loading motor.
The location of the Mode Select Switch is shown in Fig. 4—8.

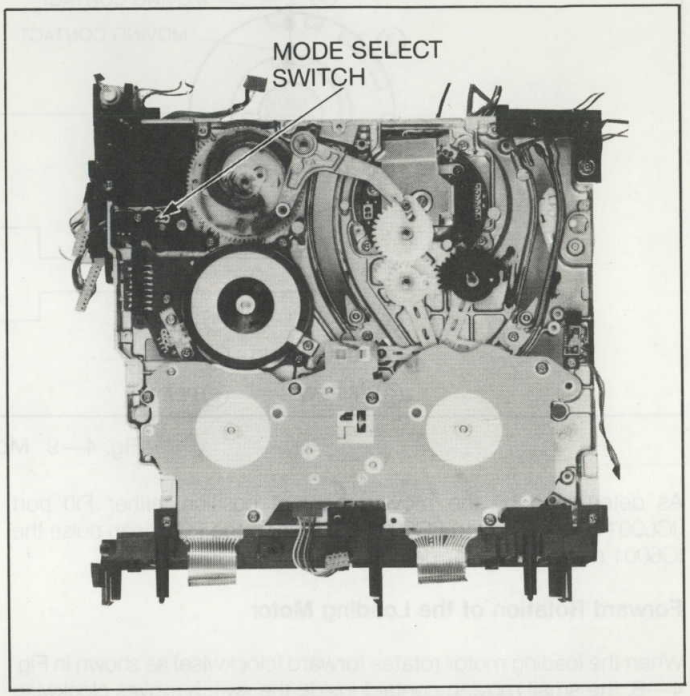


Fig. 4—8 Location of Mode Select Switch

The two moving contacts in the Mode Select Switch rotate between a common terminal and fixed terminals:
The function and construction of the Mode Select Switch is shown in Fig. 4—9.

The common signal is applied to the common terminal of the Mode Select Switch, and if moving contact is contacted the fixed terminals, common signal is returned back to the microprocessor IC6001 and this signal indicates the mechanism status.
The common signal utilized is the PO2 scan pulse from IC6001-60.

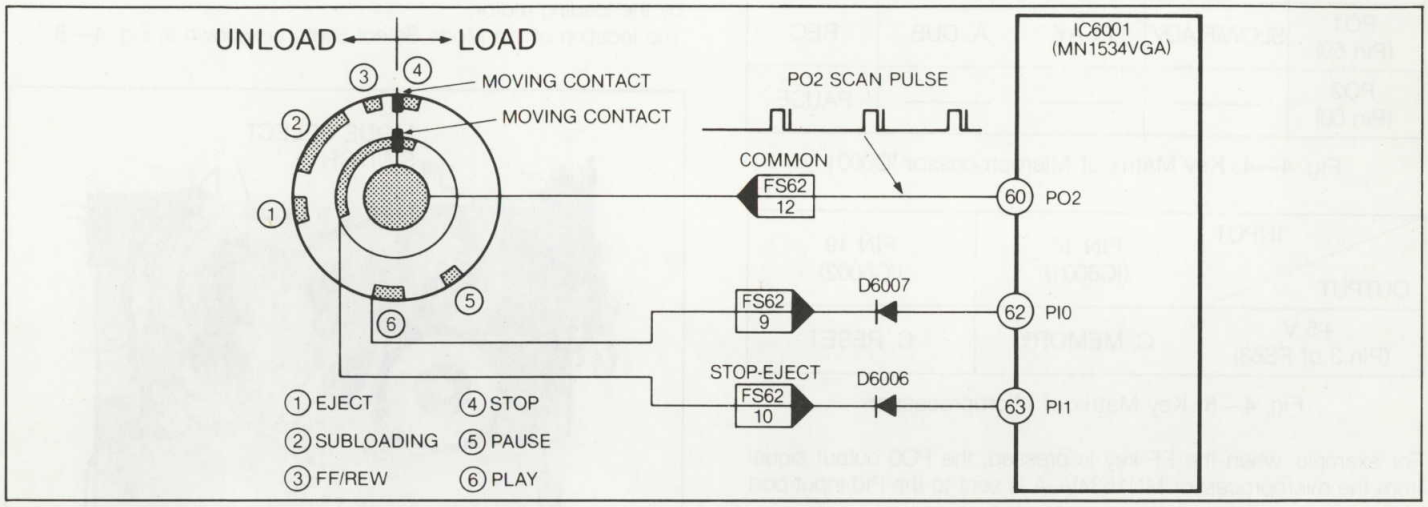


Fig. 4—9 Mode Select Switch

As determined by the moving contact position, either PI0 port (IC6001-62) or P11 port (IC6001-63) receive the PO2 scan pulse the IC6001 microprocessor detects the mechanism position.

Forward Rotation of the Loading Motor

When the loading motor rotates forward (clockwise) as shown in Fig. 4—8, the small moving contact inside the switch moves clockwise via the sub cam gear.

Reverse Rotation of the Loading Motor

When the loading motor rotates in reverse (counterclockwise) as shown in Fig. 4—9, the small contact inside the switch moves counterclockwise via the sub cam gear.

LOAD and UNLOAD Movement

As shown in Fig. 4—10, the Portable VCR loading posts move with the movement of the Mode Select Switch. The relationship between Loading Posts and the Mode Select Switch is such that the posts move only when the moving contact moves between the (A) and (B) positions of the mode select switch. The posts do not move between the (A) and EJECT Positions, or between the (B) and PLAY positions. For example, when the Play key is pressed, the loading posts and the main rod start moving.
Prior to the (B) position, the loading posts are caught by the V stoppers and the design of the Cam Gear prevents them from moving further.
Since the Play key was pressed, the contact of the mode select switch will advance to the PLAY position.
During this period, the tension post and other parts of the mechanism will move to suitable positions to be ready for the playback operation when the mode select switch reaches the PLAY position.

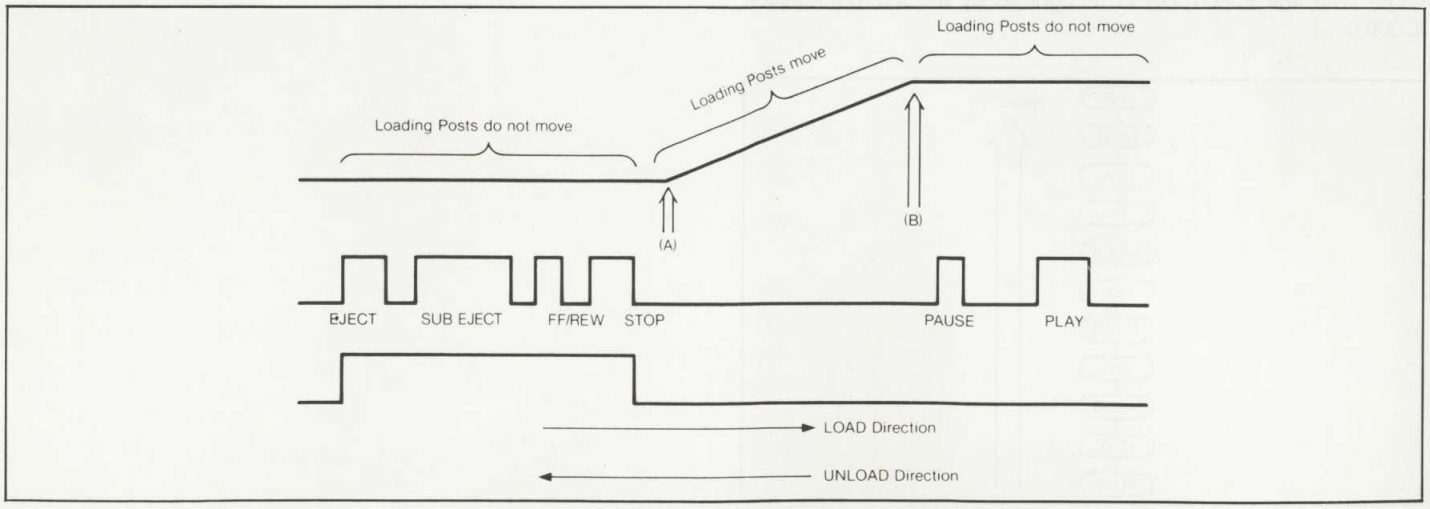


Fig. 4—10 LOAD and UNLOAD Movement

3) Auto Stop Function (Safety Features)

Safety functions are required in the event that any of several undesirable events occur.
To detect these, or Auto Stop Function is available. The overall safety device block diagram is shown in Fig. 4—11.

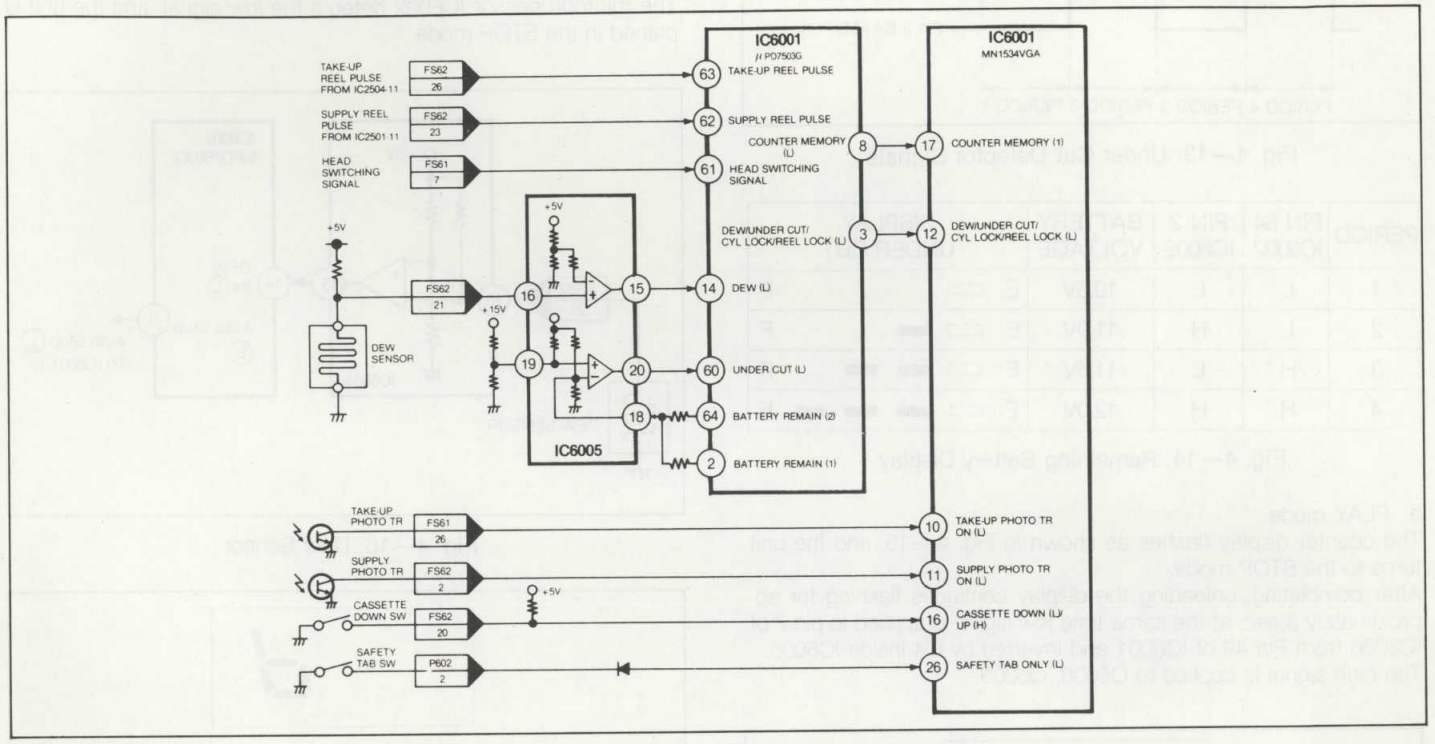


Fig. 4—11 Overall Block Diagram of Safety Device

Under Cut

When the battery voltage falls below 10.5 V, an automatic shut off circuit is activated. The unit will be placed in the STOP mode, the power switch automatically turned off, and all further operations inhibited.
When an AC adaptor or a tuner unit is connected to the deck, +12V DC regulator is applied. If a battery is used, the voltage is not constant because during battery operation, the voltage gradually falls as the battery charge is consumed.
Detecting the remaining battery charge is done by a comparator. The +12V from the battery is applied to the positive terminal of the comparator IC6005 = 19 through the resistive divider as shown in Fig. 4—12.
The other inputs of the comparator come from pin 2 and 64 of a microprocessor (IC6002:μPD7503G).
The output from pin 2 and 64 of IC6002 are as shown in Fig. 4—13, 4—14.
The voltage at the negative terminal of the comparator depends on the combination of outputs from pin 2 and 64 of the microprocessor, and this voltage is used as the reference voltage.
The divided battery voltage is compared with the reference voltage. If the battery voltage is bigger than the reference voltage, the comparator will produce a high signal, and this signal fed back to the microprocessor IC6002:μPD7503G.
When the high signal is fed back to the microprocessor, the microprocessor detects the remaining battery charge.
For example, if the high signal is not fed back during period 3 , the microprocessor generates the period 2 signals.
If the high signal is fed back during period 2, the battery voltage is between 11.0 ~ 11.5 V, and two rectangles are illuminated on the counter display screen.
If the battery voltage falls below 10.5 V, the comparator output is low. When this condition continues for more than 1 sec, the microprocessor (IC6002:μPD7503G) produces the under cut low signal of pin 3 of the microprocessor IC6002 in order to prevent over-discharge of the battery.
This low signal is applied to the microprocessor IC6001-2:MN1534VGA. Then the microprocessor IC6002 produces the mechanism control signals which are required for the STOP operation and will be turn off the power switch.
Utilizing the above signals, the following operation is performed.

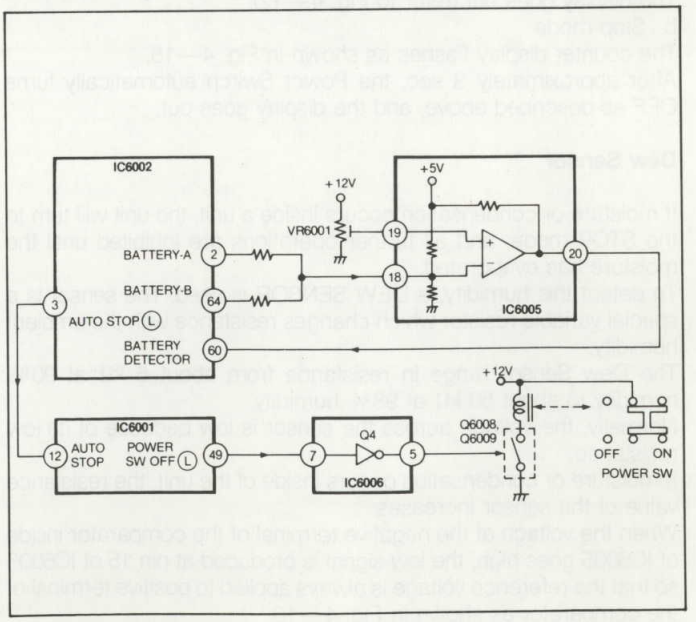


Fig. 4—12. Under Cut Detector

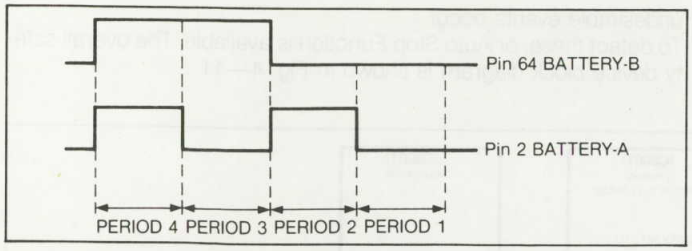


Fig. 4—13. Under Cut Detector Signals

PERIOD	PIN 64 IC6002	PIN 2 IC6002	BATTERY VOLTAGE	DISPLAY UNDER CUT
1	L	L	10.5V	E F
2	L	H	11.0V	E F
3	H	L	11.5V	E F
4	H	H	12.0V	E F

Fig. 4—14. Remaining Battery Display

a. PLAY mode
The counter display flashes as shown in Fig. 4—15, and the unit turns to the STOP mode.
After completing, unloading the display continues flashing for approximately 3 sec, at the same time low signal is applied to pin 7 of IC6006 from Pin 49 of IC6001 and inverted by Q4 inside IC6006.
The high signal is applied to Q6008, Q6009.

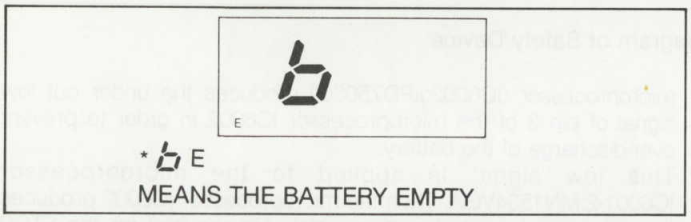


Fig. 4—15. Battery Empty Indication

Therefore, the solenoid is ON and the power switch is turned OFF. The display goes out (refer to Fig. 4—12).
b. Stop mode
The counter display flashes as shown in Fig. 4—15.
After approximately 3 sec, the Power Switch automatically turns OFF as described above, and the display goes out.

Dew Sensor

If moisture or condensation occurs inside a unit, the unit will turn to the STOP mode, and all further operations are inhibited until the moisture has evaporated.
To detect this humidity, a DEW SENSOR is used. The sensor is a special variable resistor which changes resistance with the ambient humidity.
The Dew Sensor range in resistance from about 5 kΩ at 90% humidity to about 50 kΩ at 98% humidity.
Normally, the voltage across the sensor is low because of its low resistance.
If moisture or condensation occurs inside of the unit, the resistance value of the sensor increases.
When the voltage at the negative terminal of the comparator inside of IC6005 goes high, the low signal is produced at pin 15 of IC6005 so that the reference voltage is always applied to positive terminal of the comparator as shown in Fig. 4—16.
The low signal is applied to pin 14 of the microprocessor IC6002, so that the IC6002 microprocessor detects the condition and the Mode Display (LCD) is illuminates "d" mark. As shown in Fig. 4—17.
The low signal is then produced at pin 3 of the microprocessor IC6002 and it is sent to pin 12 of the microprocessor IC6001.
The microprocessor IC6002 detects the low signal, and the unit is placed in the STOP mode.

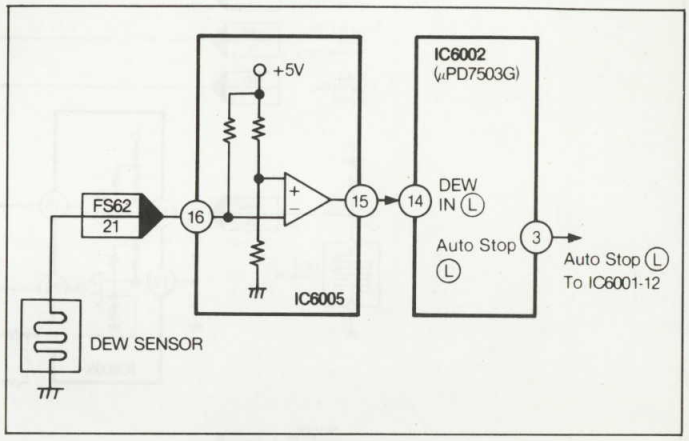


Fig. 4—16. Dew Sensor

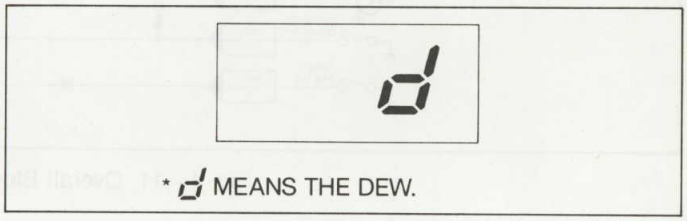


Fig. 4—17. Dew Indication

Cylinder Lock

The Cylinder Protection Circuit detects the cylinder motor rotation. If the cylinder ought to be spinning but is not, the Cylinder Protection Circuit stops the unit.
When the cylinder motor is rotating normally, the Head Switching signal is produced by the Servo Circuit.
The signal is sent to pin 61 of the microprocessor IC6002 (μPD7503G).
The microprocessor IC6002 detects the Head Switching signal and it counts the Head Switching signals.

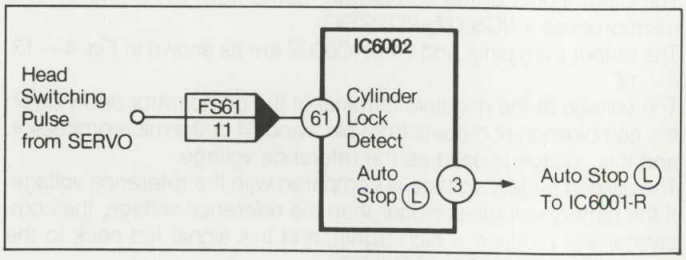


Fig. 4—18. Cylinder Lock

Reel Sensor

The reel sensor detects the reel rotation.
If for any reason, the reel ought to be turning but is not, the unit is placed in the STOP mode.
When the Reel Table is rotated, each Reel Pulse is produced inside Reel Motor drive IC.

They are applied to the microprocessor IC6002-62, 63. If the Reel Motor cannot rotate for any reason, the Reel Pulses are not applied to the microprocessor IC6002.
As a result, the low signal is produced at pin 3 of the microprocessor IC6002 and is applied to the microprocessor IC6001.
The unit will then be placed in the STOP mode.

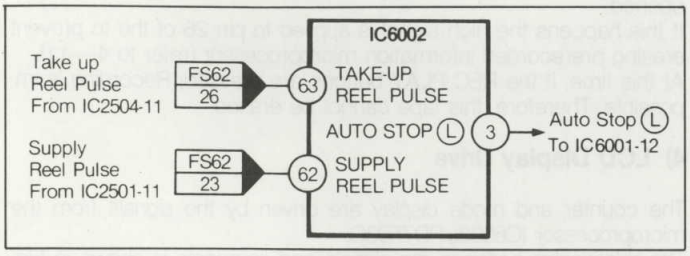


Fig. 4—19. Reel Sensor

Supply Sensor

The Supply Sensor (supply phototransistor) and the Take up Sensor (take up phototransistor) are located as shown in Fig. 4—20.
The Supply Sensor in Fig. 4—20 is the phototransistor for the supply side.
When the tape reaches the end during play, record or fast forward light from the sensor LED will strike the Supply Phototransistor, turning it on.
The low signal is applied to pin 11 of the microprocessor IC6001.
The microprocessor IC6001 detects the low signal and produces the unloading signal, starting the unloading operation.
After unloading completion, the microprocessor places the unit in the rewind mode.
However, when utilizing the timer recording, the automatic rewind operation is not performed.

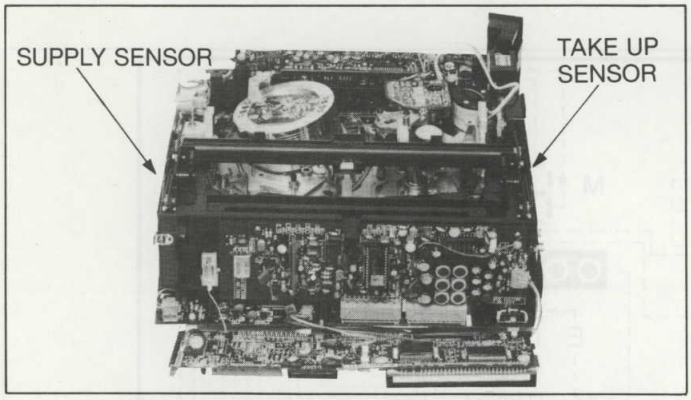


Fig. 4—20 Supply Sensor/Take up Sensor

Take-up Sensor

See Fig. 4—20 take-up sensor is the phototransistor for the take up side.
When the tape reaches the beginning during rewind, light from the sensor LED strikes the Supply Phototransistor, turning it on.
The low signal is applied to pin 10 of the microprocessor as shown in Fig. 4—11.
The unit is placed into the STOP mode.
Approximately 0.5 sec after unloading completion, a short FF action is performed just until the take up sensor is blinded by the magnetic tape.
This action is needed to prevent excessive tension from being applied to the tape in the Loading operation. If a cassette in which the translucent leader appears is inserted to the unit, the unit will suddenly go into FF mode. When the take-up photo transistor is blinded by the magnetic tape, the unit is stopped.

Cassette Compartment-Down Detector

The Cassette Compartment Down Detect Switch is located on center of the chassis as shown in Fig. 4—21.
If the cassette compartment is not pressed completely down, all operations are inhibited to prevent tape damage.
When the cassette compartment is pressed down completely, the Cassette Compartment Down Detect Switch is closed.
In this case, the low signal is produced by the Cassette Compartment Down Detect Switch and it is sent to pin 16 of the microprocessor IC6001 as show in Fig. 4—11.
When the cassette compartment is ejected or it is not pressed down completely, the high signal is applied to the microprocessor IC6001 so any further operation is inhibited.

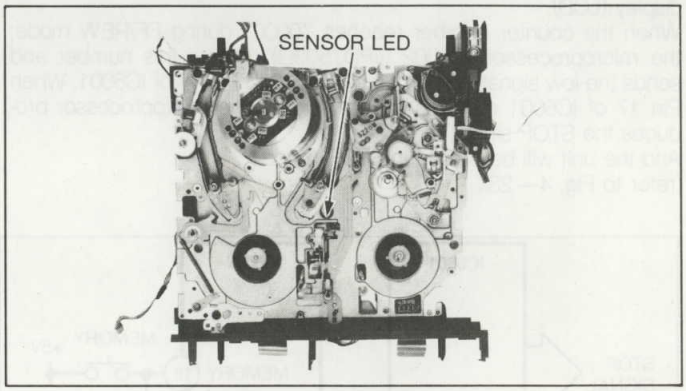


Fig. 4—21 Sensor Led

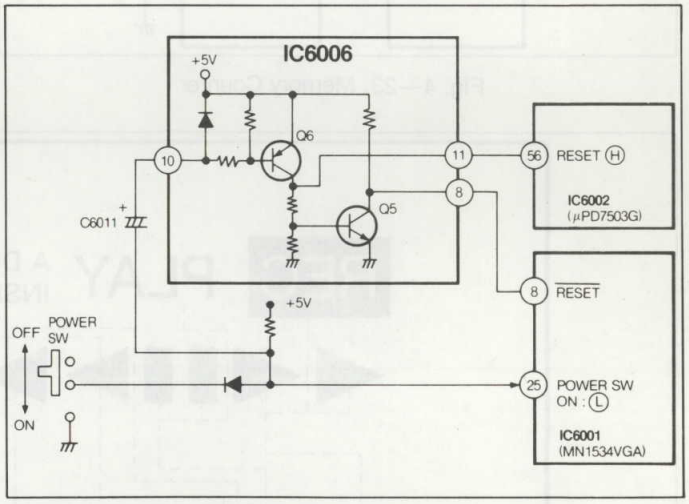


Fig. 4—22 Power Interrupt

Power Interrupt

a) When a power failure happens during recording or playback, the tape instantly stops and the tape remains inside the unit. When the power resumes, the Q6 inverter inside of IC6006 is momentarily turned ON, charging C6011. Then the RESET input, Pin 56 of IC6002 detects the reset high signal from Q6 inside of IC6006. For microprocessor the IC6001 the reset pulse is inverted by Q5 inside of IC6006 and the reset low signal is applied to pin 8 of IC6001.
Therefore, microprocessors IC6001 and IC6002 are reset, and the unit is returned to STOP mode.
(refer to Fig. 4—22)
b) During any operation, if the power switch is turned OFF a high signal is applied to Pin 25 of IC6001, and the unit is placed in the STOP mode.
For more detail, refer to the Mechanism control section [item 4.2 6)]

Timer Set

When tuning unit is connected and the Timer Recording Switch on the front panel of the tuning unit is pressed (after setting for unattended recording), the unit is placed in the STOP mode, regardless of its previous mode.
The information from the Timer Set is sent by serial Data Transmission.

Memory Stop

When the memory button of the counter is turned on, the rewind or fast forward action will stop if 0000 is reaches on the counter.
When the memory button is pressed, the high signal (+5V) is applied to Pin 18 of IC6002 and the "M" mark is displayed on the counter display (LCD).
When the counter number reaches "0000" during FF/REW mode, the microprocessor IC6002 (μPD7503G) detects this number and sends the low signal from Pin 8 of IC6002 to Pin 17 of IC6001. When Pin 17 of IC6001 receives the low signal, the microprocessor produces the STOP signal.
And the unit will be placed in STOP mode.
(refer to Fig. 4—23).

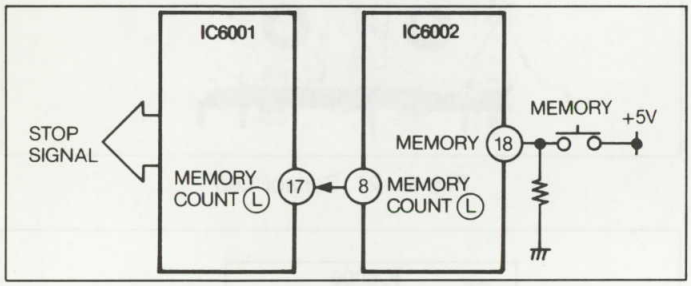


Fig. 4—23. Memory Counter

Safety Tab Detector

This circuit prevents accidental erasure when a pre-recorded tape is played back.
Normally (when the tab is not broken), the Safety Tab Switch inside the deck is closed.
If the tab of the Cassette Tape is broken, the Safety Tab Switch is opened.
If this happens the high signal is applied to pin 26 of the to prevent erasing prerecorded information microprocessor (refer to 4—11).
At this time, if the REC PLAY buttons are pressed, Recording is impossible. Therefore, this tape cannot be erased.

4) LCD Display Drive

The counter and mode display are driven by the signals from the microprocessor IC6002:μPD7503G.
The relationship between the signals and segments is shown in Fig. 4—24, 4—25.
Each segment is displayed by the combination of COM0—COM2 signals and the S0 — S12 signals.
To drive the LCD (Liquid Crystal Display), an AC signal is used. If a DC signal was used, the liquid crystal would evaporate, causing air cells to form.
The voltage difference between COM and S signals is applied to each segment. If this voltage difference exceeds +3V, the segment is displayed (segment turns to black).
If the voltage difference is approx. ±1V, the segment is not displayed (segment is translucent as shown in Fig. 4—26. The COM signals (COM0, COM1 and COM2) are shown in Fig. 4—27.
For example, when "0" is displayed in the first counter (right side), the signals as shown in Fig. 4—28 are applied.
The relationship between the signals and display are shown in Fig. 4—29.

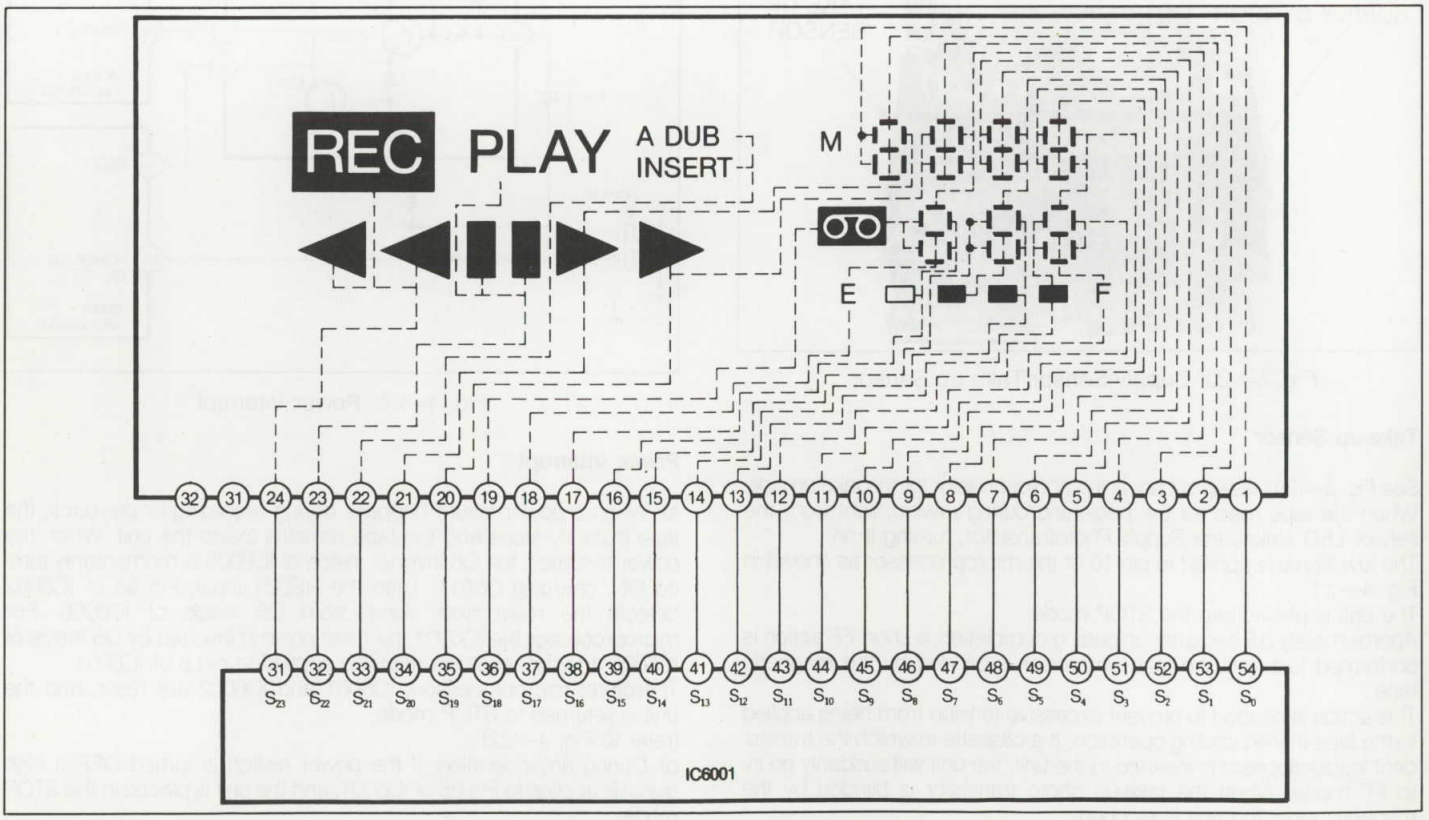


Fig. 4—24 Segment

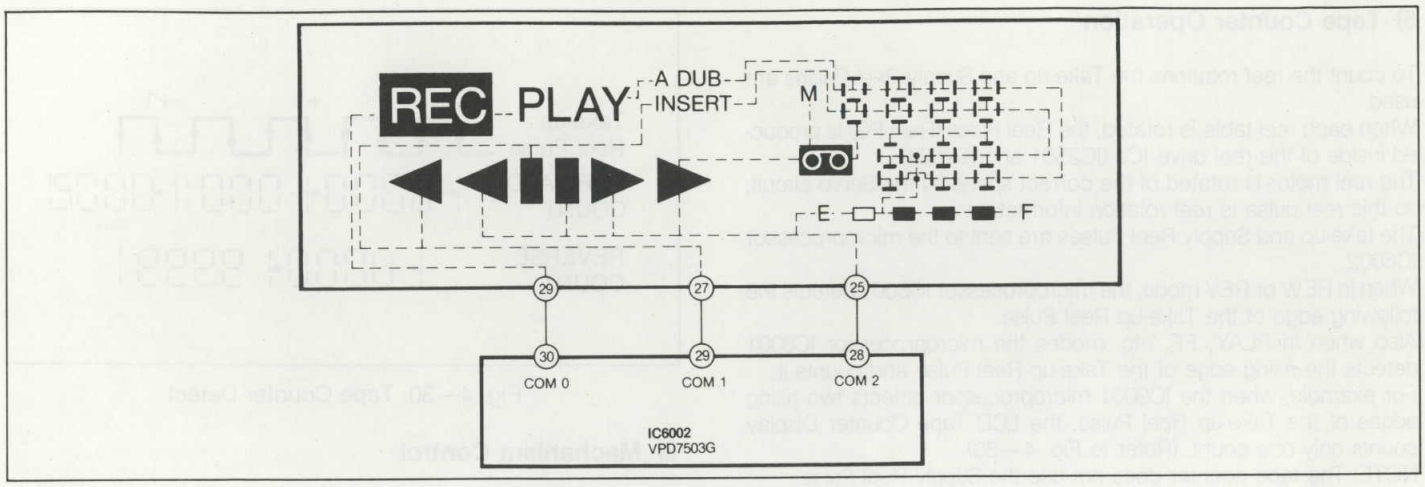


Fig. 4—25 Common

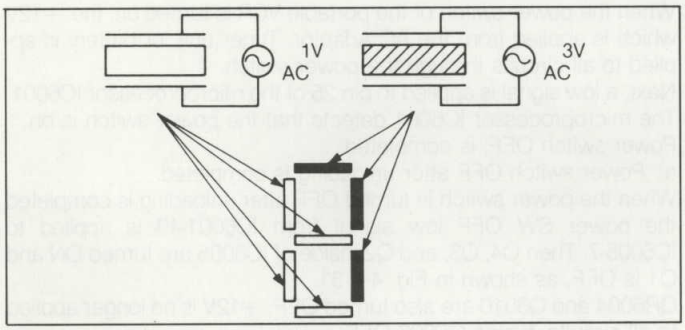


Fig. 4—26.LCD Drive

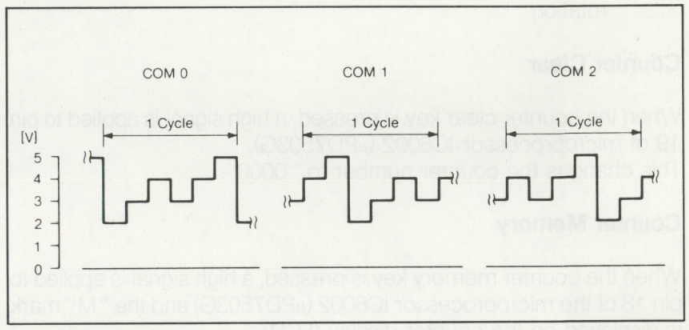


Fig. 4—27. COM 0 ~ COM 2 Signals

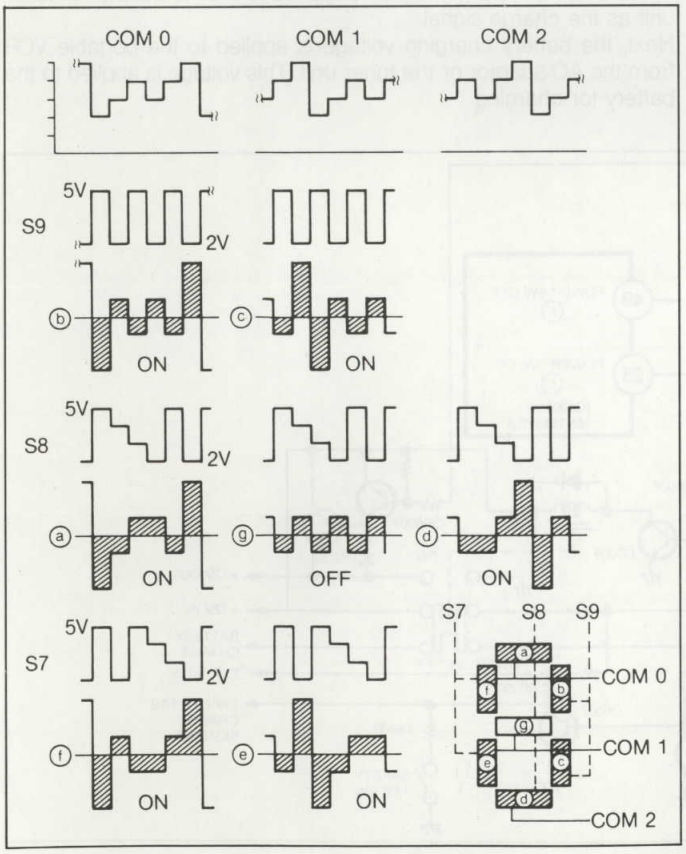


Fig. 4—28. "0" Display

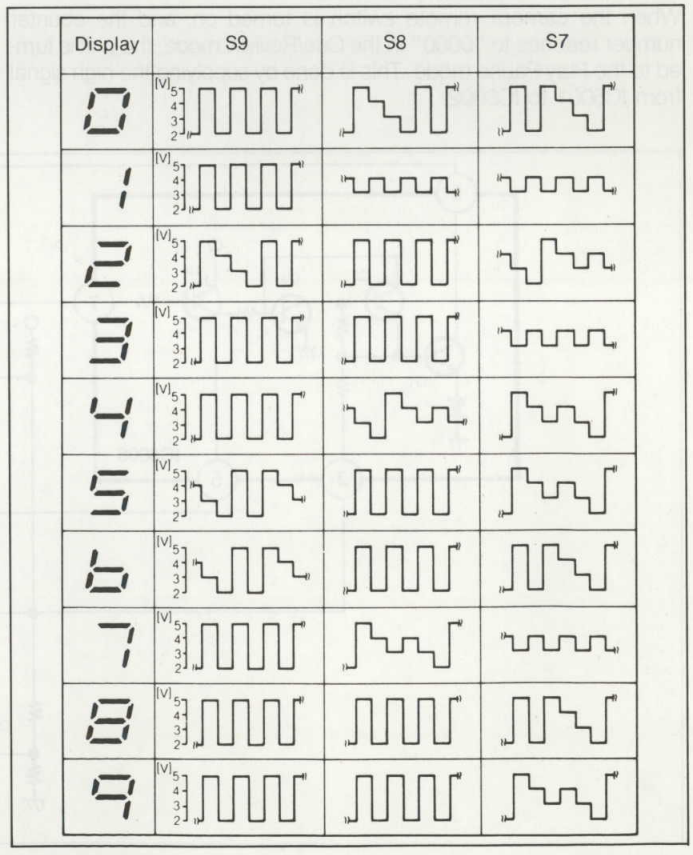


Fig. 4—29

5) Tape Counter Operation

To count the reel rotations the Take-up and Supply Reel Pulses are used.
When each reel table is rotated, the Reel Pulse (Reel FG) is produced inside of the reel drive ICs (IC2501 and IC2504).
The reel motor is rotated of the correct speed by the Servo circuit, so this reel pulse is reel rotation information.
The take-up and Supply Reel Pulses are sent to the microprocessor IC6002.
When in REW or REV mode, the microprocessor IC6001 detects the following edge of the Take-up Reel Pulse.
Also when in PLAY, FF, etc. modes the microprocessor IC6001 detects the rising edge of the Take-up Reel Pulse and counts it.
For example, when the IC6001 microprocessor detects two rising edges of the Take-up Reel Pulse, the LCD Tape Counter Display counts only one count. (Refer to Fig. 4—30).
NOTE: The tape counter does not use the Supply Reel Pulse.
To count the reel rotation, only the Take-up Reel Pulse is detected by the IC6002 microprocessor to count the reel rotation.

Counter Clear

When the counter clear key is pressed, a high signal is applied to pin 19 of microprocessor IC6002 (μPD7503G).
This changes the counter number to "0000".

Counter Memory

When the counter memory key is pressed, a high signal is applied to pin 18 of the microprocessor IC6002 (μPD7503G) and the "M" mark is displayed on the counter display (LCD).
Then when the counter number reaches "0000" in the FF/REW mode, the unit is placed STOP mode.
When the camera remote switch is turned on, and the counter number reaches to "0000" in the Cue/Review mode, the unit is turned to the Play Pause mode. This is done by supplying the high signal from IC6001 to IC6002.

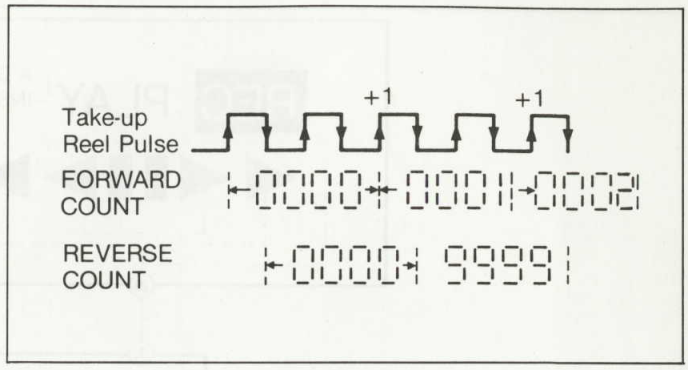


Fig. 4—30 Tape Counter Detect

6) Mechanism Control

Power Switch ON/OFF Circuit

When the power switch of the portable VCR is turned on, the +12V which is applied from the AC Adaptor, Tuner unit, or battery is applied to all circuits through the power switch.
Next, a low signal is applied to pin 25 of the microprocessor IC6001.
The microprocessor IC6001 detects that the power switch is on.
Power switch OFF: is completed.
a. Power switch OFF after unloading is completed.
When the power switch is turned OFF after unloading is completed the power SW OFF low signal from IC6001-49 is applied to IC6005-7. Then Q4, Q3, and Q2 inside of IC6005 are turned ON and Q1 is OFF, as shown in Fig. 4—31.
QR6004 and Q6010 are also turned OFF. +12V is no longer applied to all circuits, tuning Q6006 OFF.
EXT +12V is applied to the base of Q6041 via Power SW, and turned ON. Therefore a low signal is applied to the AC adaptor or tuner unit as the charge signal.
Next, the battery charging voltage is applied to the portable VCR from the AC adaptor or the tuner unit. This voltage is applied to the battery for charging.

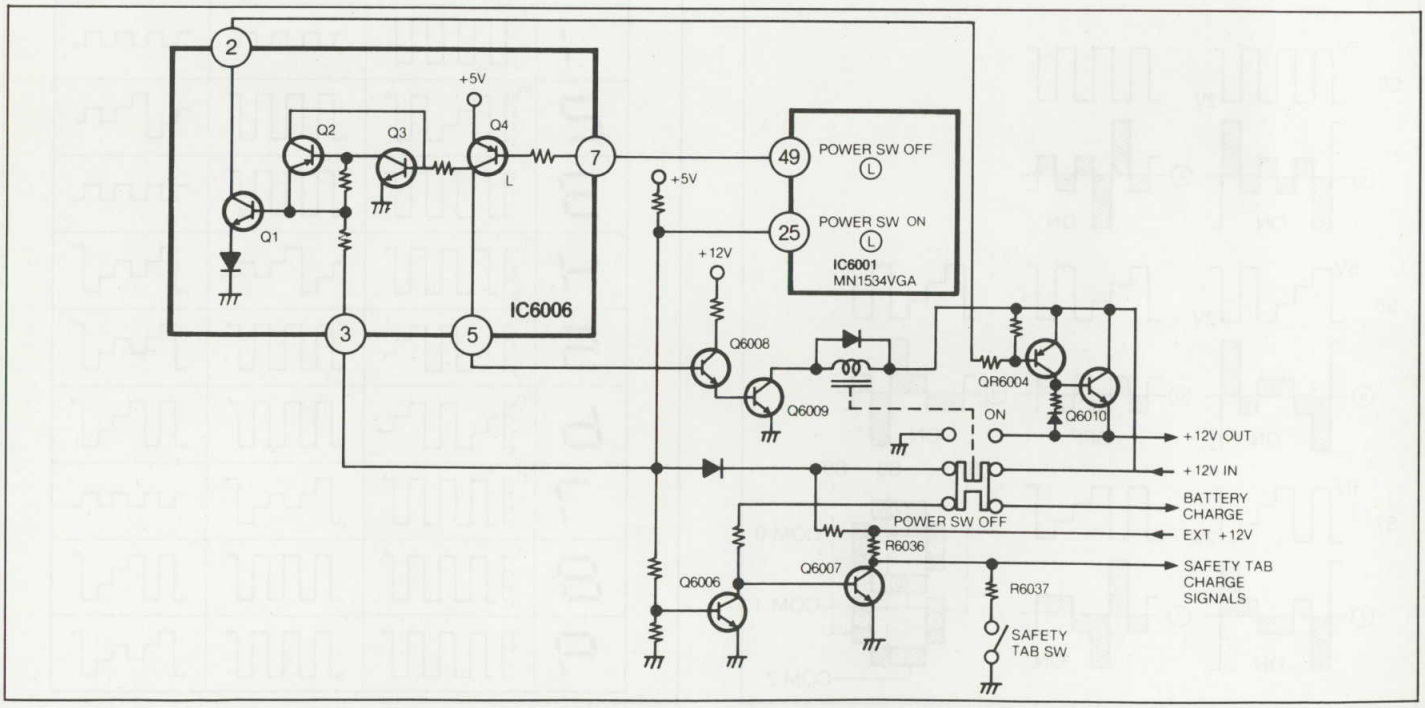


Fig. 4—31 Power SW ON/OFF Circuit

b. Power Switch OFF after loading completion
When the power switch is turned off after loading completion, the unit should, of course, unload fully, then switch the power off.
At the time when the power switch is just turned off, +5V and +12V are still applied to the circuit, so the transistors Q1 inside of IC6005, QR6004 and Q6010 turn on the +12V is applied to the circuit through Q6010, instead of the power switch for the unloading operation. During unloading, Q6007 turns off.
The unit is not placed in the battery charge mode, even though the power switch is off.
After unloading completion, the microprocessor IC6001 MN1534VGA produces the low signal at pin 49.
The transistors inside of IC6005, Q4, Q3 and Q2 are turned on by this signal.
The next transistors inside IC6005, Q1, QR6004, and Q6010 turn off.
The +12V supply is cut off.
Auto Stop Operation:
In the following situations the power switch of the portable VCR is turned off automatically.
*Under Cut
*High Dew Condition
*Cylinder Lock
Under any of these circumstances, the low signal is produced at pin 49 of the microprocessor IC6001:MN1534VGA, then applied to Pin 7 of IC6005.
The transistors Q4 inside of IC6005, Q6008 and Q6009 turn on, and current flows through the coil cf the power switch. The power switch is turned off by this current. (refer to 4—31)

Motor Drive

a. Loading Motor Drive Circuit
The loading motor is needed not only to load the mechanism, but to move the mode select switch in the LOAD or UNLOAD directions. Refer to section 4, 2, 2), Mode Select Switch section.
For a LOAD operation a loading motor LOAD low signal is supplied from the microprocessor pin 52 of IC6001 MN1534VGA, to SW1 and SW2.
These are turned on, so +12V (Loading Motor Drive Voltage) is applied to the Loading Motor through pin 10 of IC6004, to rotates the loading motor in the LOAD direction.
For an UNLOAD operation a loading motor UNLOAD low signal is sent to pin 6 of IC6004.
SW2 and SW4 are turned on, so +12V is applied to the loading motor through pin 2 of IC6004, to rotates the loading motor in the UNLOAD direction. (refer to Fig. 4—32)

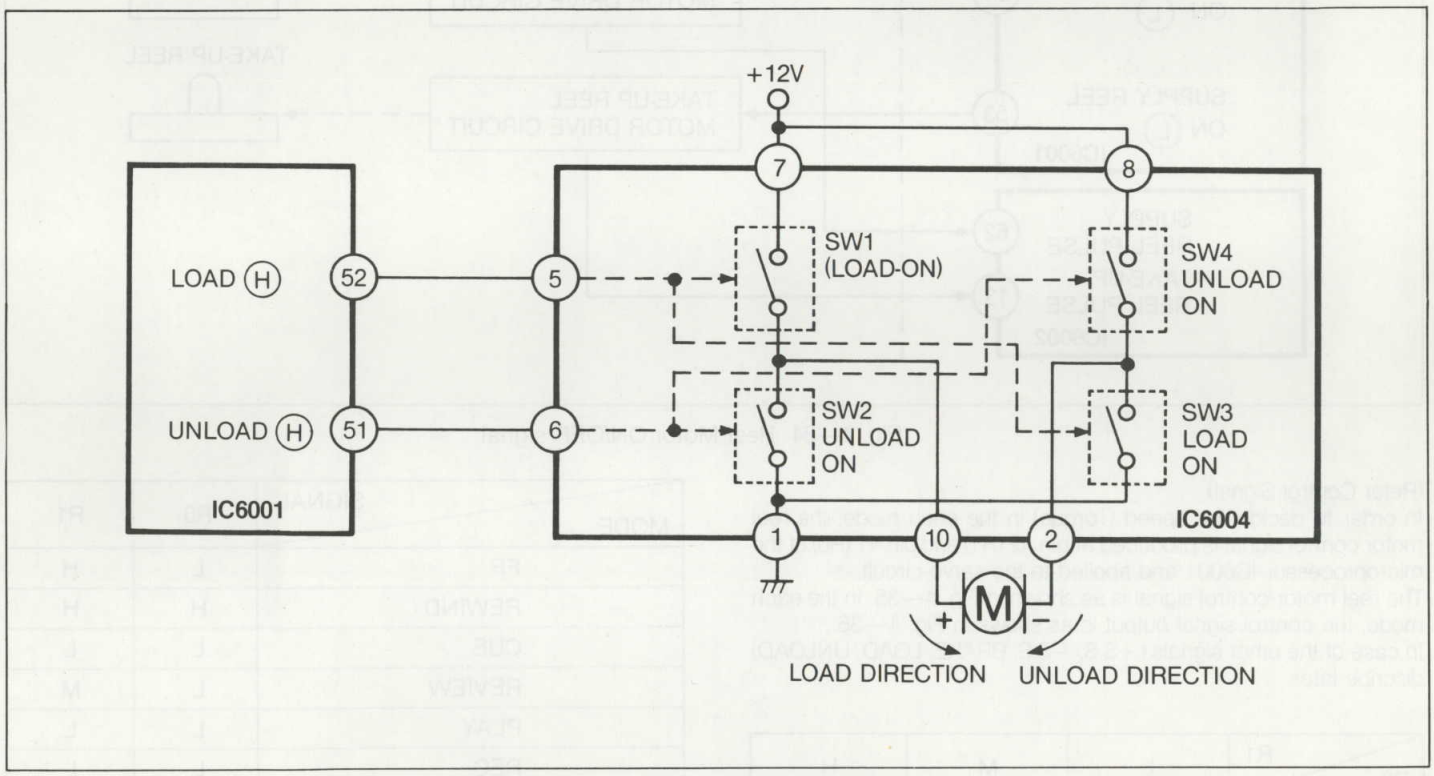


Fig. 4—32 Loading Motor Drive

b. Capstan Motor Drive signal
In order to decide the speed in the each mode, the capstan motor speed signals are produced and applied to the servo circuit.
The capstan motor drive signals are applied from pin 35 (S0) and pin 36 (S1) of the microprocessor IC6001 as the three voltage level signals.
The capstan motor speed signals are as shown in Fig. 4—33.

S0 \ S1	L	M	H
L	SLOW/STILL	———	X1 (NORMAL)
M	F.F /REW	UNLOAD	———
H	———	CUE/REV	———

Fig. 4—33 Capstan Motor Drive Signal

c. Reel Motor Drive
(Reel Motor ON/OFF Circuit)
In case of this unit, the DD (Direct Drive) Reel Motor is used. To drive the DD Reel Motor, there are two drive ICs, and one IC controls the Reel Motor rotation.
The SUPPLY REEL ON low signal is sent to the Servo circuit from pin 54 of the microprocessor IC6001 and TAKE-UP REEL ON low signal is also sent to the Servo circuit from pin 53 of the microprocessor IC6001. (Refer to Fig. 4—34).
In addition, when the reel table is rotated by the drive circuit, the reel motor position signal is produced, and is fed back to the microprocessor IC6002 (pin 62 and pin 63 of IC6002).
This signal is used to detect the Reel Lock condition and to drive the Tape Counter Display.

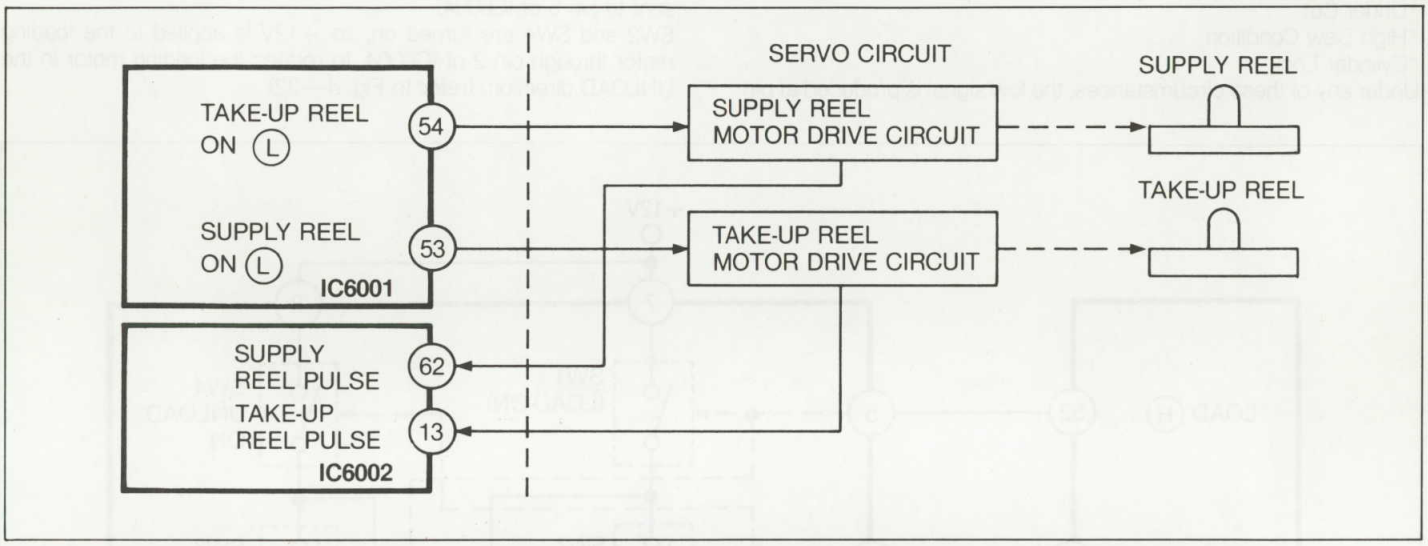


Fig. 4—34 Reel Motor ON/OFF signal

(Refer Control Signal)
In order to decide the speed (Torque) in the each mode, the reel motor control signal is produced at pin 42 (R1) and pin 41 (R0) of the microprocessor IC6001 and applied to the servo circuit.
The reel motor control signal is as shown in Fig. 4—35. In the each mode, the control signal output is as shows in Fig. 4—36.
In case of the other signals (+S.S, −S.S, BRAKE, LOAD, UNLOAD) discribe later.

R0 \ R1	L	M	H
L	FORWARD	REVERSE	FF
M	+S.S.	−S.S.	BRAKE
H	LOAD	UNLOAD/ EJECT	REW

Fig. 4—35 Reel Motor Control Signal

MODE \ SIGNAL	R0	R1
FF	L	H
REWIND	H	H
CUE	L	L
REVIEW	L	M
PLAY	L	L
REC	L	L
SLOW	M	L
F. ADV	M	L

Fig. 4—36 Reel Motor Control Signal Combination

*LOAD
For example, whent the PLAY button is pressed during Stop mode, the loading motor is rotated in the load direction, so that the loading posts are moved until loading completion.
In this time, the Take-up reel table is braked by the main bracket but the Supply reel table is rotate in the forward direction because of wind a tape to the Cylinder unit.
Then, the microprocessor IC6001 sends R1 (L) and R0 (H) signal to the servo circuit.
Therefore, the Supply reel motor speed is determined by signal from the microprocessor IC6001.
*UNLOAD
For example, when the STOP key is pressed during PLAY mode, the loading motor is rotate in the unload direction.
In this time, the loading posts are moved until loading completion, so the tape is winded to a cassette tape by the Supply reel table.
In case of this, the Supply reel table speed is determined by R1 and R2 signals.
When the EJECT key is pressed, the supply reel table is performed same action.
*BRAKE
For example, during FF/REW mode, when the STOP key is pressed, the reel motor should be braked soon.
Namely, when the reel motor speed is decreased, R0 (M) and R1 (H) signals are produced on the microprocessor and is sent to the Servo circuit, and both reel tables are braked.
Of course, the Main Brake is reached to the both reel tables, and the reel table is braked.
*−S.S/+S.S (SLOW, STILL)
Normally, −S.S. signal is not used for control the reel motor speed. However, for example, when the REW key is pressed during PLAY mode, the unit goes into Review mode.
Then, R1 and R0 control becomes:
FORWARD → +S.S → −S.S → REVERSE
When mode of the unit changes to next mode, the reel motor FG signal frequency changes, too.
In this time, the reel motor drive IC can not detect the reel motor FG signal.
In order to it condition, the reel motor speed is not kept correctly, namely wrong action would be performed.
To compensate the wrong action, −S.S and +S.S signal is applied to the servo circuit, and the reel motor speed is kept by these signals.
c. Reel Motor Brake Operation
The reel motor brake is performed by two brake system.
One is a electrical brake system, the other is a mechanical brake system.
About electrical brake system, is described in Reel Motor Control Signal section.
In this section, the mechanical brake system is described.
The Main Brake mechanism illustration is shown in Fig. 4—37.
For example, when the STOP key is pressed during FF or REW mode, the Reel Motor should be stopped quickly.
The main brakes are controlled by the REEL SOL ON low signal (Pulse) from pin 61 of the microprocessor IC6001.
If the low pulse is sent from pin 61 of IC6001 to base of the QR6001.
Then, Q6001 and Q6002 are turned on, so the +12V is applied to Reel Solenoid.
To the high signal (+12V), the Main Brakes are reached to both reel tables.
Therefore, the reel table is stopped quickly.
In case of release the main brake, the reel solenoid is moved by the main rod.
In addition, there is the other case for the main brake combination.
For example, when the STOP key is pressed during PLAY mode, the Supply reel table must put away into a cassette tape.
In this time, the Take-up reel table is locked by the REEL SOL ON low signal and the Supply reel table is not locked by the main rod.
About this case, more detail description is described in Mode by Mode section.

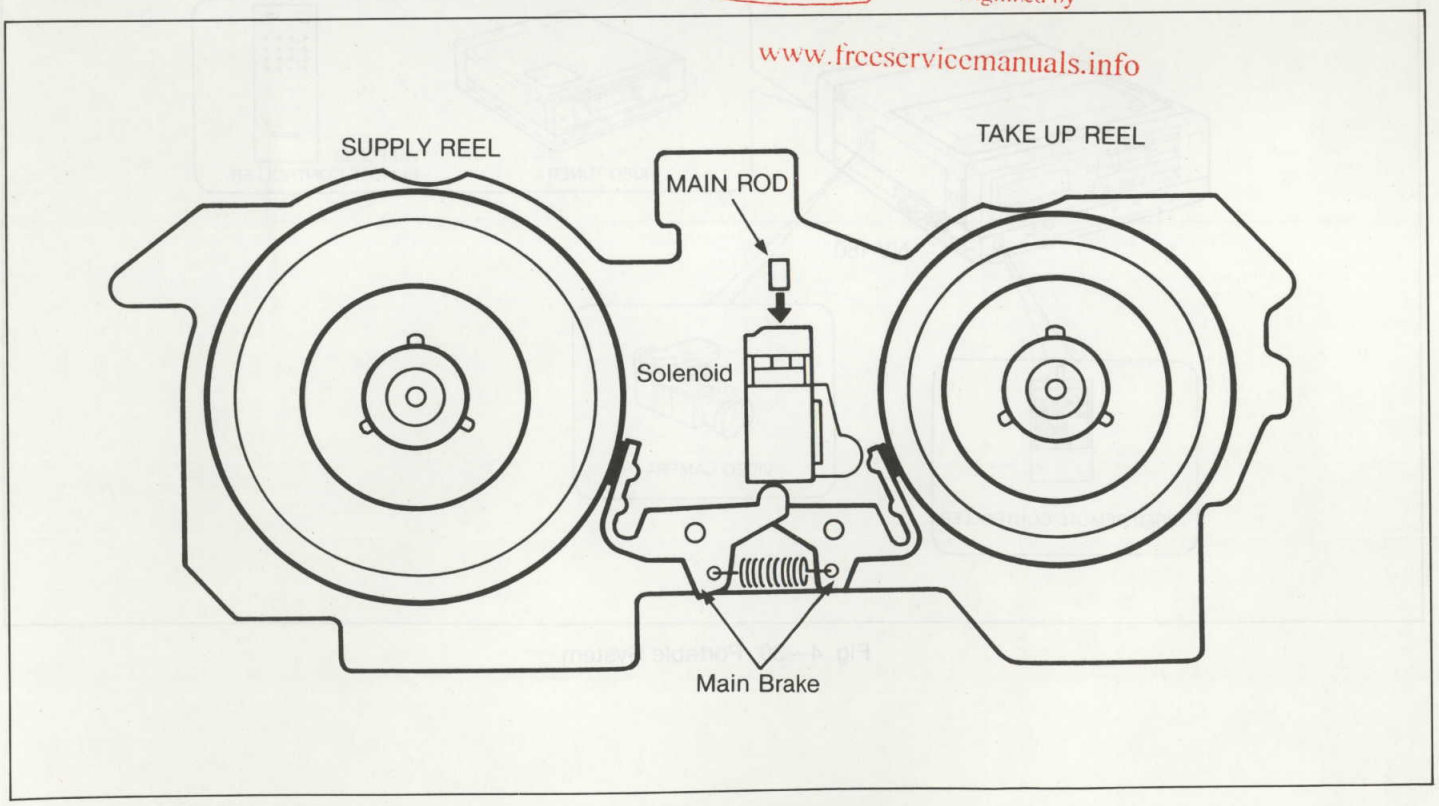


Fig. 4—37 Main Brake Mechanism

7) Data Transmission

Data Transmission between IC6001 and IC6002.

The system control circuit consists of two microprocessors:
IC6001 : MN1534VGA
IC6002 : μPD7503G
The IC6001 MN1534VGA microprocessor is used for
(1) Key matrix Scanning
(2) Loading Motor drive
(3) Safety detection features
(4) Supply and Reading of Serial Data
(5) Producing Mechanism Drive Signal
(6) Producing Circuit Control Signal
(7) Detecting Mechanism Condition
The microprocessor IC6002 (μPD7503G) is used for
(1) Safety detection features
(2) Iluminating the mode display
When the Safety detection is done by the microprocessor IC6001 the Safety information must be sent to the microprocessor IC6001. This way, if any safety detector is activated (DEW, UNDER CUT, CYL LOCK and REEL LOCK), the microprocessor detects the conditions and the low signal from pin 3 of the microprocessor IC6002 is applied to pin 12 of the microprocessor IC6001.
Then the unit in placed in the STOP mode by microprocessor IC6001.
The mode information which indicates the LCD Display; is mainly supplied to the microprocessor IC6002. The microprocessor IC6002 drives the LCD Display.
The other information is sent to the microprocessor IC6002 by Serial Data Transmission.
(Refer to Fig. 4—38).

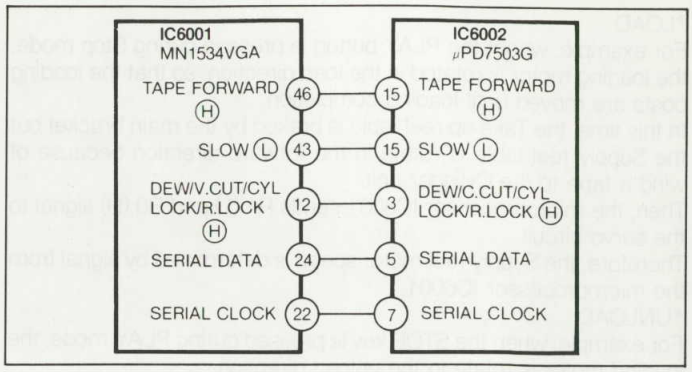


Fig. 4—38. Data Transmission

Serial Data Transmission

When the portable VCR is used as in the following, data transmission should be performed between each piece of equipment.
Each piece of equipment has microprocessor. The system decides the mode in each microprocessor, which means the microprocessors must exchange the data between each other. To exchange the data, serial data transmission is used (refer to Fig. 4—39).
In this case, some information is converted into 8 bit logic data.
This 8 bit data is sent beginning with a MSB (Most-significant bit) and ending with a LSB (Left-significant bit) as shown in Fig. 4—40.
To send the serial data accurately, the timing control signal is applied to the microprocessors, which is called the SERIAL CLOCK".
The supply of data is triggered by the falling edge of the serial clock.
The reading of data is performed at the rising edge of the serial clock.

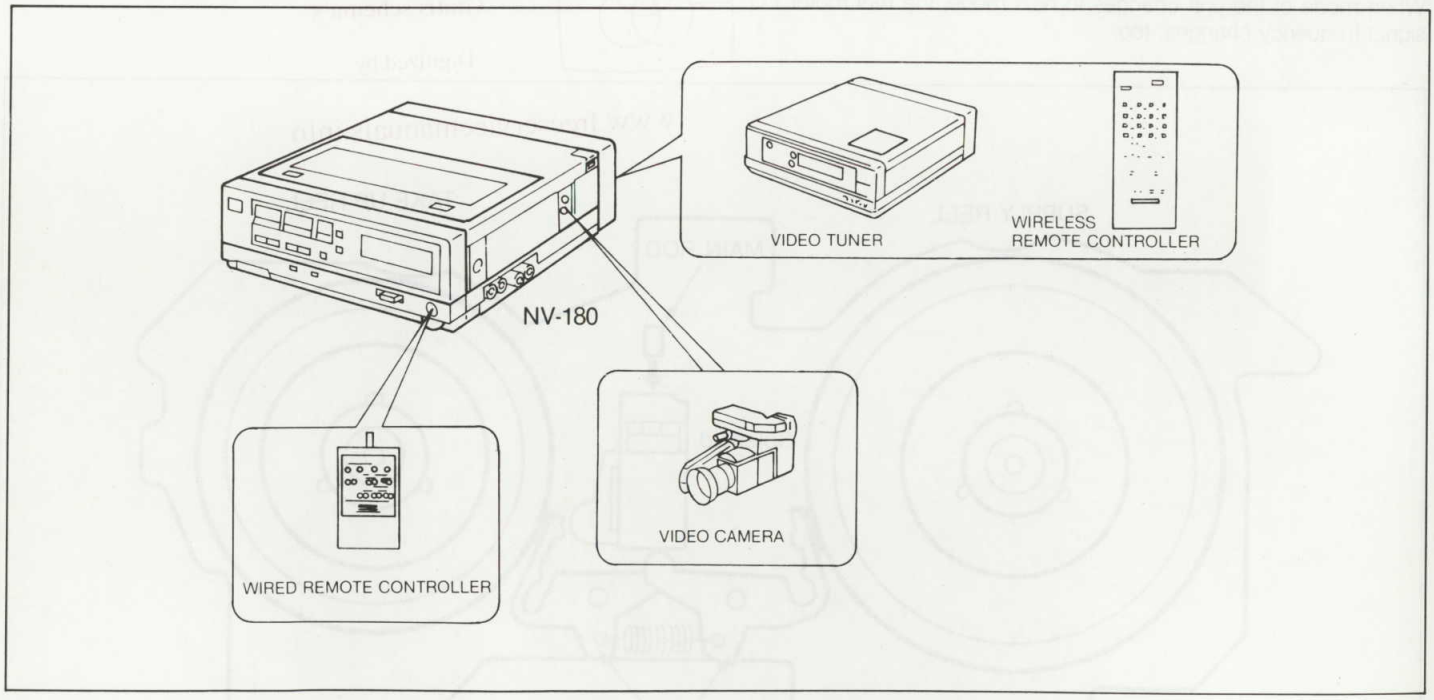


Fig. 4—39 Portable System

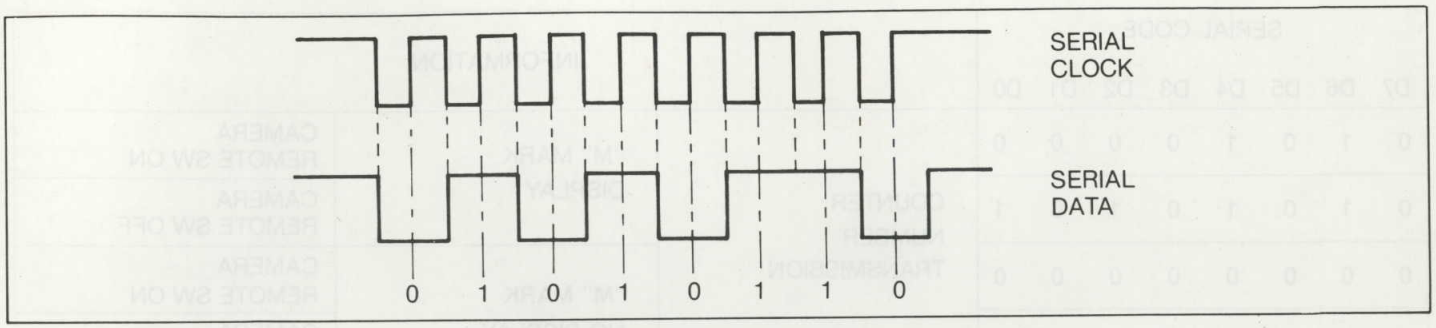


Fig. 4—40 Serial Data

a. Serial Clock
This clock signal is a reference signal which is used to control the timing of the data transmission in each microprocessor.
The serial clock signal is produced by microprocessor IC6001 MN1534VGA, and is applied to the other microprocessors.
There are two kinds of serial clock signals as shown in Fig. 4—41.
(1) SERIAL CLOCK 1
(2) SERIAL CLOCK 2
Serial clock 1 is used for the microprocessor in the camera, and Serial clock 2 is used for all other equipment (except the camera).
Both serial clocks have seven transmissions, and each transmission consists of 8 bit pulses.
During each transmission, the 8 bit serial data is exchanged as shown in Fig. 4—42.
The difference between serial clock 1 and 2 is the tally signal.
Serial clock 1 has the tally signal to connect with current model cameras.
The tally signal will be described later.

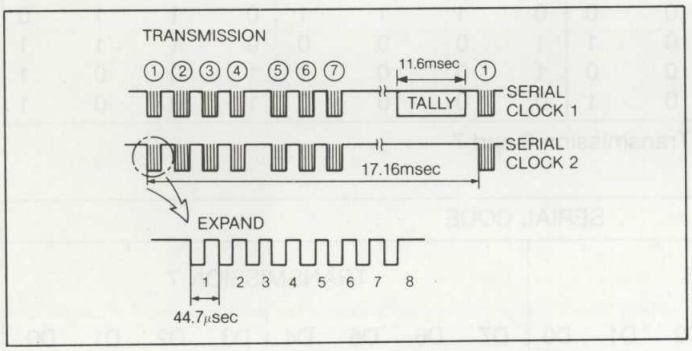


Fig. 4—41 Serial Clock

No.	DATA		TRANSMISSION
1	CAMERA	→	VCR
2	TUNER	→	VCR
3	WIRED REMOTE CONTROLLER	→	VCR
4	MN1534VGA	→	μPD7503G
5	VCR	→	CAMERA
6	VCR	→	CAMERA
7	VCR	→	CAMERA

Fig. 4—42 Transmission 1-7

b. Serial Data
In serial transmission, all information is coded to an 8 bit digital signal. Fig. 4—43 show the serial codes which are used during transmissions 1, 2 and 3.
Fig. 4—44 shows the relationship between the serial data and information during transmission 5.
Fig. 4—45, 4—46 show the serial codes which are used during transmission 6 and 7.

SERIAL CODE	MODE	SERIAL CODE	MODE
00000000	STOP	00001010	PLAY
00000010	REW	00001100	FRAME ADVANCE
00000011	FF	00001111	SLOW
00000100	REVIEW	00101110	SLOW SPEED UP
00000101	CUE	00101111	SLOW SPEED DOWN
00000110	STILL/ PAUSE	10010111	TIMER SET
00001000	REC	10011001	TIMER ON

Fig. 4—43 Serial Data for Transmission 1, 2 and 3

SERIAL CODE								INFORMATION		
D7	D6	D5	D4	D3	D2	D1	D0			
0	1	0	1	0	0	0	0	COUNTER NUMBER TRANSMISSION	"M" MARK DISPLAY	CAMERA REMOTE SW ON
0	1	0	1	0	1	0	1			CAMERA REMOTE SW OFF
0	0	0	0	0	0	0	0		"M" MARK NO DISPLAY	CAMERA REMOTE SW ON
0	0	0	0	0	1	0	1			CAMERA REMOTE SW OFF
1	1	1	1	0	0	0	0	REMAINING BATTERY TRANSMISSION	CAMERA REMOTE SW ON	
1	1	1	1	0	1	0	1		CAMERA REMOTE SW OFF	

Fig. 4—44. Serial Data for Transmission 5

COUNTER NUMBER (EXAMPLE)				SERIAL DATA													
				TRANSMISSION 6								TRANSMISSION 7					
				D7	D6	D5	D4	D3	D2	D1	D0	D7	D6	D5	D4	D3	D2	D1	D0
3	2	1	0	0	0	1	1	0	0	1	0	0	0	0	1	0	0	0	0
4	3	2	1	0	1	0	0	0	0	1	1	0	0	1	0	0	0	0	1
5	4	3	2	0	1	0	1	0	1	0	0	0	0	1	1	0	0	1	0
6	5	4	3	0	1	1	0	0	1	0	1	0	1	0	0	0	0	1	1
7	6	5	4	0	1	1	1	0	1	1	0	0	1	0	1	0	1	0	0
8	7	6	5	1	0	0	0	0	1	1	1	0	1	1	0	0	1	0	1
9	8	7	6	1	0	0	1	1	0	0	0	0	1	1	1	0	1	1	0
0	9	8	7	0	0	0	0	1	0	0	1	1	0	0	0	0	1	1	1
1	0	9	8	0	0	0	1	0	0	0	0	1	0	0	1	1	0	0	1
2	1	0	9	0	0	1	0	0	0	0	1	0	0	0	0	1	0	0	1

Fig. 4—45. Serial Data for Transmission 6 and 7

L.C.D. DISPLAY	SERIAL CODE															
	TRANSMISSION 6								TRANSMISSION 7							
	D7	D6	D5	D4	D3	D2	D1	D0	D7	D6	D5	D4	D3	D2	D1	D0
E □ F	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
E □ ■ F	1	1	1	1	1	1	1	1	1	1	1	1	0	0	0	0
E □ ■ ■ F	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0
E □ ■ ■ ■ F	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0
(UNDER CUT)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Fig. 4—46. Serial Data for Transmissions 6 and 7 (2)

c. Serial data transmission route (Portable VCR)
The system control circuit of the portable VCR has two microprocessors.
IC6001 : MN1534VGA
IC6002 : μPD7503G
IC6001 is used for mechanism control, and to send the serial data mode information.
IC6002 is used for the LCD drive, counter control, battery power remaining operation and tape remaining operation.
(Programmable Tuner)
The microprocessor in the tuner produces serial data.
But, there is no line through which the serial data is applied to the microprocessor of the tuner.
Only two types information have to be applied to the timer circuit in the tuner from the portable VCR.
These are the Power SW and Safety SW signals. This information is applied to the tuner as a DC level, not serial data.
The signals from the luminance circuit, clock (delayed rec) and the ANT change are applied to the tuner circuit.
The Colour Camera can send serial data transmission.
The Serial data is exchanged between the microprocessors in the Colour Camera and the portable VCR.
Wired Remote Controller
The wired remote controller also has a microprocessor, and the microprocessor applies some data to the VCR. However no data is applied to the wired remote controller from the VCR.
The circuit of serial data transmission is shown in Fig. 4—47.

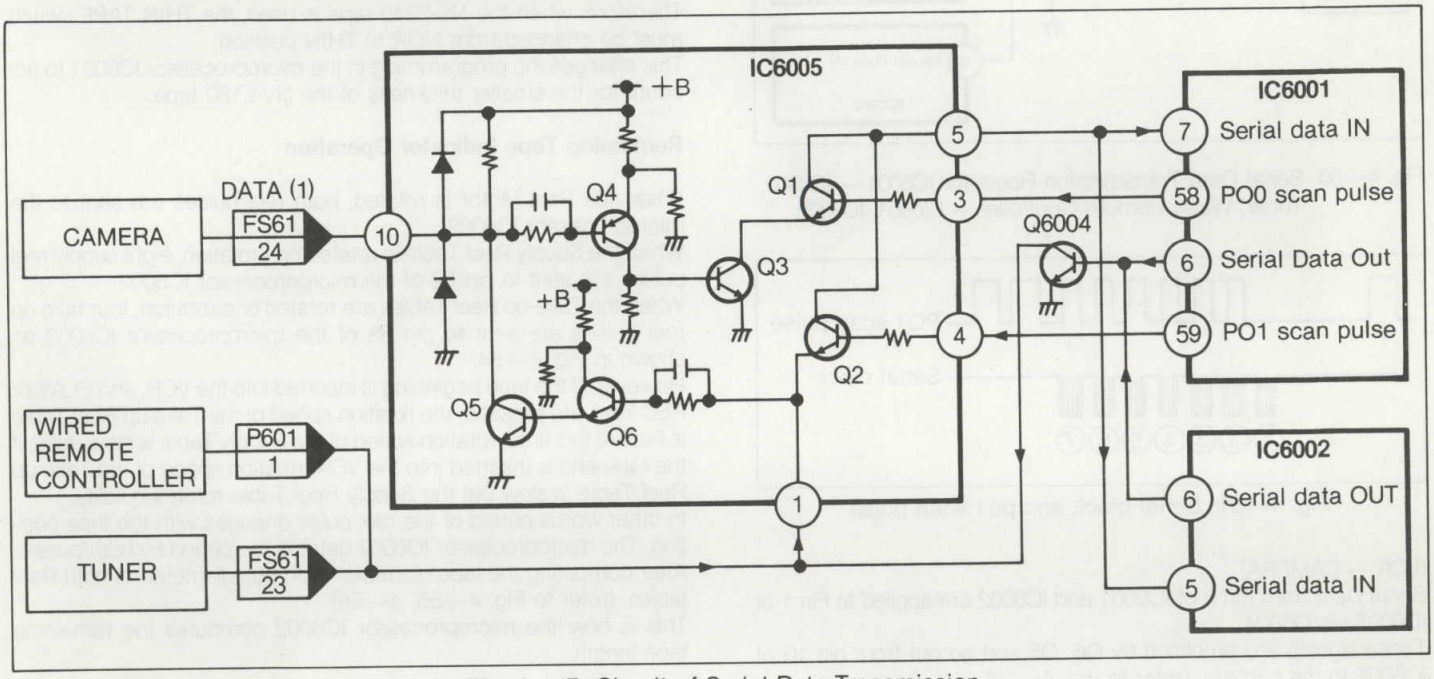


Fig. 4—47 Circuit of Serial Data Transmission

(CAMERA → VCR)
Serial Data from the CAMERA to the VCR is only mode data when the CAMERA REMOTE CONTROLLER is used. The serial data from the CAMERA is applied to Pin 10 of IC6005.
Its signal is amplified by 23 and 24 and then comes into the emitter and goes out from the collector, PO0 Scan Pulse is applied to Pin 3 of IC6005. PO0 scan pulse timing is synchronized with the CAMERA DATA as shown in Fig. 4—48.
The data signal goes out from 5 pin of IC6005 and is applied to Pin 7 of IC6001 and Pin 5 of IC6002.
(refer to Fig. 4—49)

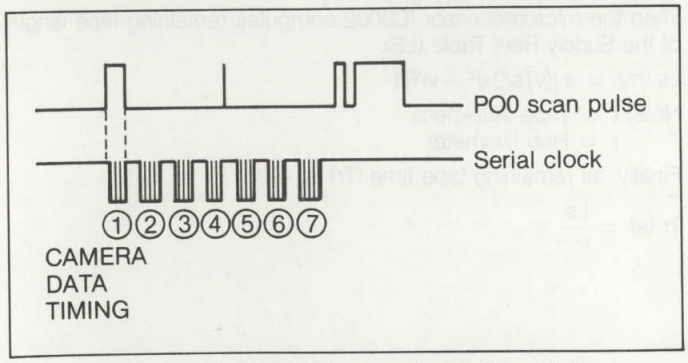


Fig. 4—48 Serial Clock and PO0 Scan Pulse

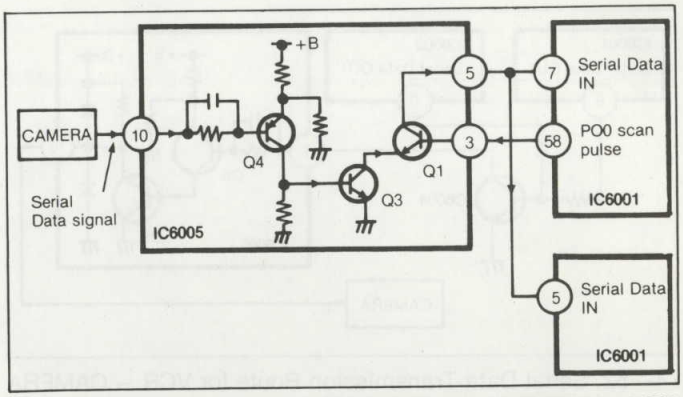


Fig. 4—49 Serial Data Transmission Route for CAMERA → VCR

(IC6001:MN1534VGA → IC6002:μPD7503G/TUNER, WIRED REMOTE CONTROLLER → IC6001, IC6002)
Serial Data of IC6001 → IC6002 and WIRED REMOTE CONTROLLER → IC6001, IC6002 are only mode data.
serial Data of Tuner → IC6001, IC6002 are mode data from the wireless Remote controller, Timer set and Timer Rec.
Serial Data of IC6001 is applied to pin 1 of IC6005 via Q6004, and Serial Data of the Remote Controller and Tuner is also applied to pin 1 of IC6005.

These data signal go out from Pin 5 via Q2, when PO1 scan pulse is applied to the base of Q2. PO1 scan pulse timing is synchronized with except the CAMERA DATA as shown Fig. 4—51.
These data signals are applied to Pin 7 of IC6001 and Pin 5 of IC6002. (refer to Fig. 4—50).

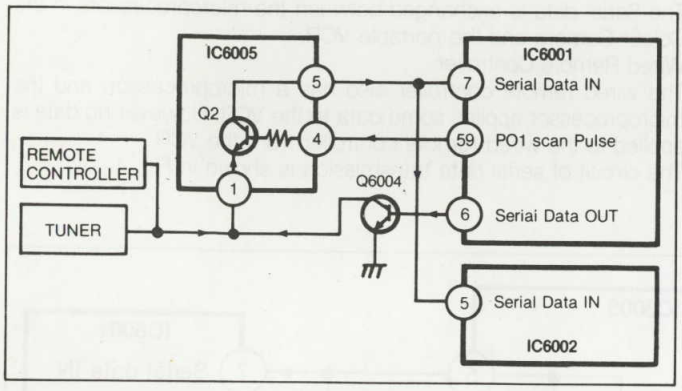


Fig. 4—50 Serial Data Transmission Route for IC6001 → IC6002, Tuner, Wired Remote Controller → IC6001, IC6002.

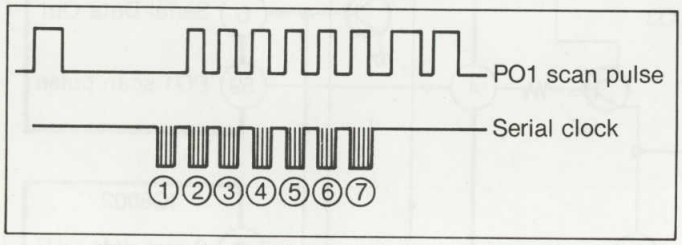


Fig. 4—51. Serial clock and po1 scan pulse

(VCR → CAMERA)
Serial Data from Pin 6 of IC6001 and IC6002 are applied to Pin 1 of IC6005 via Q6004.
These signals are amplified by Q6, Q5 and go out from pin 10 of IC6005 to the camera. (refer to Fig. 4—52)

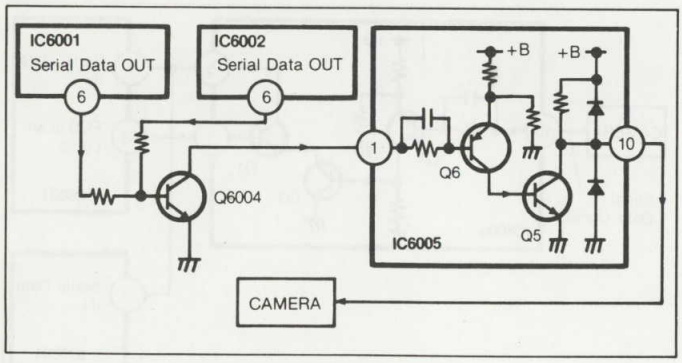


Fig. 4—52. Serial Data Transmission Route for VCR → CAMERA

8) Remaining Tape Indicator

During recording and normal playback, remaining tape time is displayed on the LCD Display automatically after 10 to 40 seconds.

Remaining Tape Time Display

When PLAY or REC key is pressed, the unit is placed in PLAY or REC mode.
At this time, the remaining tape time indicator is activated. After 10 to 40 seconds, the remaining tape time is displayed on the LCD Display.
For example a display of "1:30" indicates that the tape time remaining is 1 hour 30 minutes.
Note that the display "C" signifies that the remaining tape time is being calculated.
When the remaining tape time is less than 5 minutes, the numeral display flashes on and off for a few seconds and the tape remaining display disappears.

Thin Tape Switch

Microprocessor detects the tape hub diameter and calculates the tape remaining.
But the tape thickness of NV-E240 tape is different from other tapes. Therefore, when the NV-E240 tape is used, the THIN TAPE switch must be changed from NOR to THIN position.
This changes the programming in the microprocessor IC6001 to account for the smaller thickness of the NV-E180 tape.

Remaining Tape Indicator Operation

When the Reel Motor is rotated, both reel pulses are sent to the microprocessor IC6002.
When the Supply Reel Table is rotated one rotation, eight supply reel pulses are sent to pin 62 of the microprocessor IC6002.
When the Take-up Reel Tables are rotated one rotation, four take-up reel pulses are sent to pin 63 of the microprocessor IC6002 as shown in Fig. 4—54.
However, if the tape beginning is inserted into the VCR, and PLAY or REC keys are pressed, the rotation speed of the Take-up Reel Table is fast. At this time, rotation speed of the Supply Table is slow. Also, if the tape end is inserted into the VCR, rotation speed of the Take-up Reel Table is slow but the Supply Reel Table rotates quickly.
In other words period of the reel pulse changes with the tape position. The microprocessor IC6002 detects the period by both pulses. After computing the tape diameter (With hub diameter) of both Reel tables. (refer to Fig. 4—55, 4—56)
This is how the microprocessor IC6002 computes the remaining tape length.

$$Rs = \frac{vTs}{2\pi}$$

$$Rt = \frac{vTt}{2\pi}$$

Note = v: Tape Speed, Ts : Period of Supply reel, Tt : Period of Take up reel.

The microprocessor IC6002 calculates the tape winding area of both Reel Tables.

$$S\ (mm^2) = \pi (Rs^2 + Rt^2)$$
$$= \frac{v^2}{4\pi} (Ts^2 + Tt^2)$$

The microprocessor IC6002 calculates this data and classified four kinds of tapes (refer to Fig. 4—56.)
Then the microprocessor IC6002 computes remaining tape length of the Supply Reel Table (LS).

$$Ls\ (m) = \pi [(vTs/2\pi)^2 - vr^2]/t$$

Note; t = Tape Thickness
r = Hub Diameter

Finally, all remaining tape time (Tr) is;

$$Tr\ (s) = \frac{Ls}{v}$$

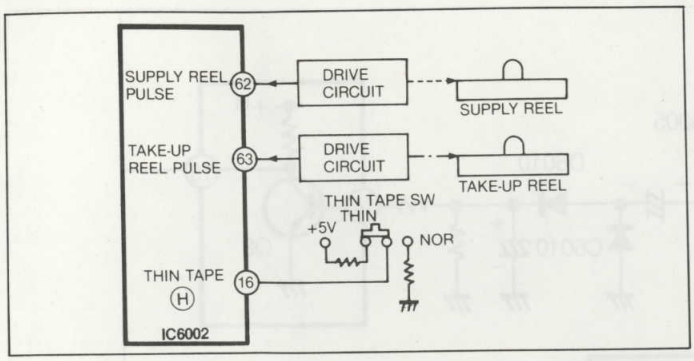


Fig. 4—53. Tape remaining circuit

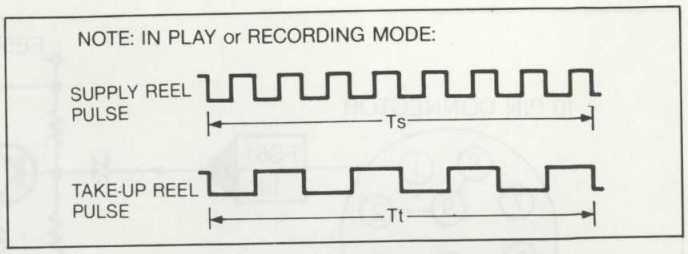


Fig. 4—54. Supply And Take-up Reel Pulses

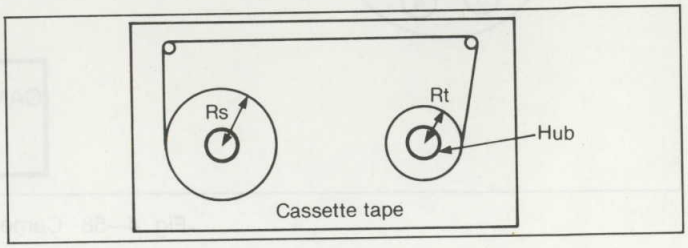


Fig. 4—55. Tape Diameter Detect

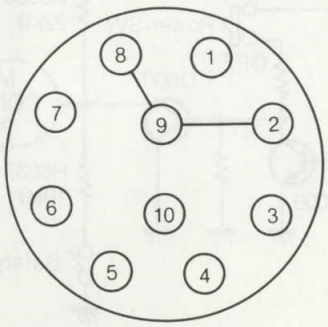
ITEMS / TAPE	Total Length (m)	Hub Diameter (mm)	Tape Thickness (μm)	Tape Area (mm^2)
NV-E240	340 ~ 346	26 (Small)	15.1 ~ 16.1	6228 ~ 6644
NV-E180	258 ~ 261	26 (Small)	17 ~ 20.8	5693 ~ 6502
NV-E120	173 ~ 176	26 (Small)	17 ~ 20.8	3998 ~ 4734
NV-E60	88 ~ 91	62 (Big)	17 ~ 20.8	7495 ~ 7970

Fig. 4—56. Remaining Tape Areas For Various Tapes

9) The connection between the VCR and the Camera

Connecting with WVP-A1, A2, 100 series colour camera.

The WVP-A1, A2, 100 series colour camera are connected to the portable VCR through the 10 pin connector. The signals which are exchanged between the VCR and WVP-A1, A2, 100 series colour camera are assigned as shown in Fig. 4—57.



Pin	CAMERA	DIRECTION
1	Video OUT (REC) Video IN (P.B)	VCR ⟷ CAMERA
2	GND	VCR → CAMERA
3	Serial Data	VCR ⟷ CAMERA
4	Serial Clock	VCR → CAMERA
5	Stand by SW "ON" Ⓗ	VCR ← CAMERA
6	CAMERA PAUSE Ⓛ	VCR ← CAMERA
7	Audio OUT	VCR ← CAMERA
8	GND	VCR → CAMERA
9	GND	VCR → CAMERA
10	+12V	VCR → CAMERA

Fig. 4—57. 10 Pin-Signals-WVP-A1,A2,100 Series Color Camera

(Connection Detection)
When the camera is connected to the 10 pin connector, the video signal is applied to the base of transistor Q6005 via connector FS61-19.
Only the sync pulse is amplified by Q6005 and rectified by D6010, C6010. Then a high signal is applied to the base of Q8 inside of the transistor via pin 3 of IC6006. This signal is inverted by Q8 therefore, a low signal is applied to pin 23 of IC6001.
The microprocessor detects the connection of the camera. When the camera is not connected a high signal is applied to Pin 23 of IC6001. (refer to Fig. 4—58)

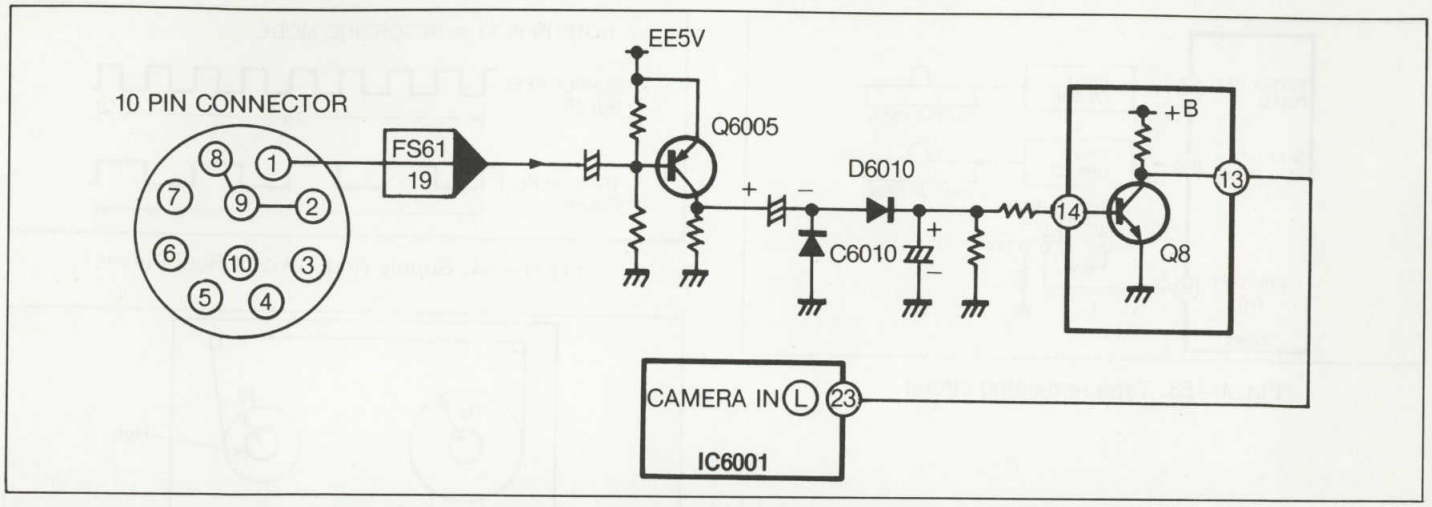


Fig. 4—58 Camera Connection Detection

To detect which type of camera is connected, the microprocessor observes the voltage at Pin 3 of 10 pin connector.
If an WVP-A1, A2, 100 series colour camera is connected with the portable VCR and the power switch is turned ON, a low signal is applied to the VCR for 200 msec (Serial data STOP mode) via Pin 3 of the 10 pin connector.
This low signal is applied to Pin 7 of IC6001. Serial data transmission section. refer to 4.2 7) −C) − (CAMERA → VCR)
If a normal camera (except WVP-A1, A2, 100 series) is connected with the 10 pin connector, a high signal is applied to Pin 7 of IC6001.
*For information on Serial data, refer to serial data transmission section 7)—(b).

10) Connection Between VCR and the Tuner

The VCR control signals for timer recording are applied to the portable VCR as serial data. Refer to Fig. 4—42. The data transmission from the tuner to the VCR is performed during transmission 2. The data is coded as shown in Fig. 4—43, 4—44 and 238.
The serial data transmission method is used only for sending data from the TUNER to the portable VCR.
Data is transmitted from the wireless remote controller to the VCR. The tuner receives infrared rays from the wireless remote controller, and decodes this information. Then, the signals from the wireless remote controller are applied to the VCR as serial data. The information from the VCR to the TUNER is sent at a DC level.
The following information should be applied to the TUNER.
(1) Power SW ON or OFF
(2) Safety SW ON or OFF
(3) ANT SW and CH Lock

Power SW ON or OFF

When the power the SW is turned OFF, the Tuner unit has to work to charge the battery.
The EXT 12V is applied to the base of Q6007, turning it ON.

The voltage at Pin 17 Multi connector is low, and this low signal is used as a charge signal inside the tuner. (refer to Fig. 4—59)

Safety SW ON or OFF

When the safety tab of the cassette is broken, timer recordings are inhibited.
At this time, the safety switch turns OFF, and transistor Q6006 turns ON.
The voltage at the base of Q6007 is low, turning it OFF.
Approx. 12V DC is applied to the Tuner through R6036 and Multi connector pin 17.

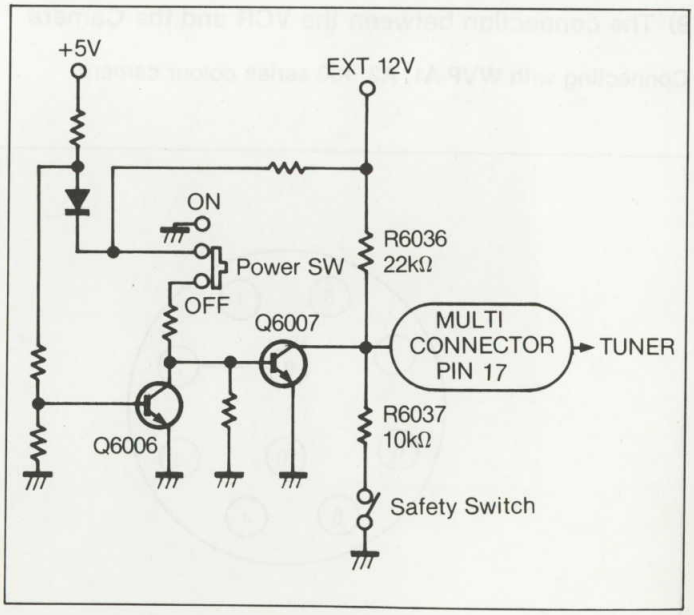


Fig. 4—59. Power and Safety Tad Circuit

PIN 17 OF MULTI CONNECTOR	INFORMATION
Less than 0.3V	POWER SW OFF
Approx. 3.5V	POWER SW ON, Safety Tab is attached
More than 11.7V	POWER SW ON, Safety Tab is removed

Fig. 4—60 —1 Power and Safety Tab Signals

On the other hand, when the safety tab is not broken, the safety switch turns ON.
The external 12V is divided by resistor dividers R6036 and R6037.
So, approx. 3.75V is applied to the tuner through 17 of the multi connector.
The voltage which is applied to the Tuner via Pin 17 of the multi connector has three steps, as follows:

ANT SW and CH Lock

The ANT SW (TV/VTR) select signal and CH LOCK signal are applied from the VCR to the tuner.
When the playback key is pressed, the ANT SW should be changed to the VTR side. VV high signal is sent to the base of Q7 inside IC6502 turning it ON.
The +5V are divided by R6779 (15kΩ) and 1kΩ resistor inside IC6502.
The output voltage is approx. 0.3V DC from Multi connector Pin 14.
This signal is used to change the ANT SW to the VTR side.
In the record mode with the tape running, the selected channel should be locked.
This is done by the delayed REC High signal which is sent to Q8 inside of IC6502, turning it ON. The +5V is divided by R6779 (15kΩ) and 15kΩ resistor inside IC6502, so approx. 2.5V is applied to the channel select circuit as the channel lock signal. (refer to Fig. 4—60)

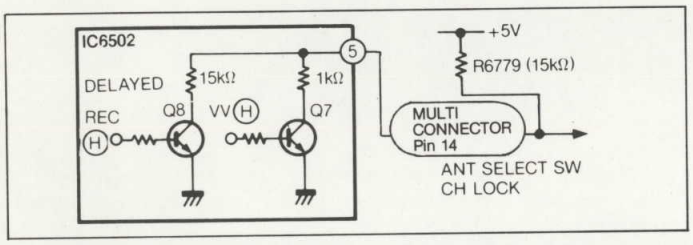


Fig. 4—60 ANT Select and Channel Lock Signals

11) Connection Between VCR and Wired Remote Controller

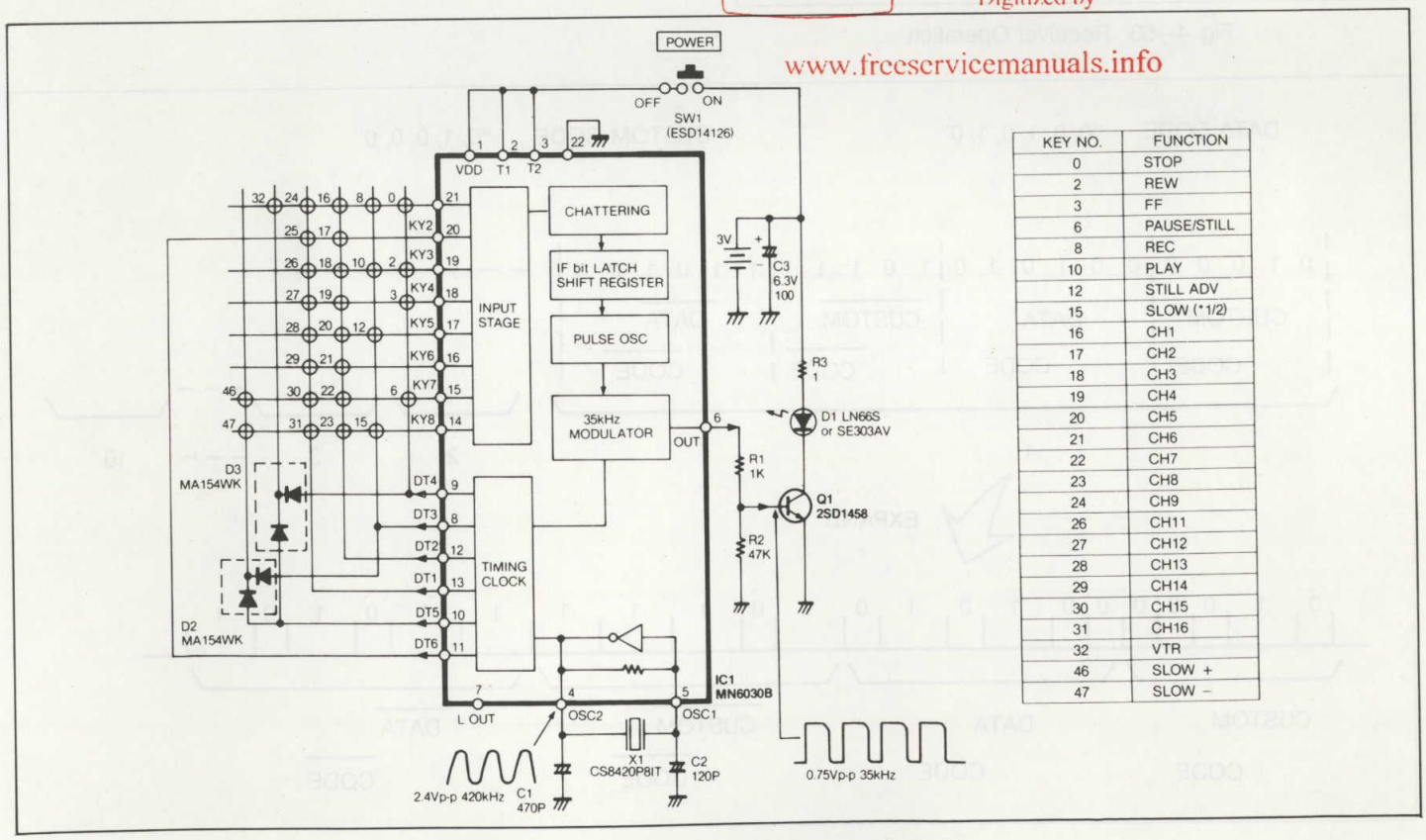
When, the wired remote controller is connected with the VCR, the mode signal which depends on the pressed key, is applied to the VCR as serial data, via the 5 pin jack.
This data is transmitted during transmission 3, refer to Fig. 4—42.

12) WIRELESS REMOTE CONTROLLER

When the tuner unit is connected with the portable VCR, the wireless remote controller can be used.
The remote controlled transmitter decodes the keyboard information to the data code. After this, the transmitter modulates the coded data to infrared rays, and it is applied to the receiver, which is located on the front panel of the tuner unit. The microprocessor inside the tuner converts it from infrared rays to serial data, and supplies it to the portable VCR for control.

Transmitter

The transmitter generates an 11 bit pulse in its LSI (MN6030B) and outputs this signal after it has been converted into light pulses by an infrared LED. A Block diagram of the LSI (MN6030B) is shown in Fig. 4—61.
An oscillator, which consists of a crystal connected to an internal inverter, is activated by pressing the key. A clock signal generated by the oscillator enters the timing pulse generator where the signal is counted down, and then it is fed to the key input signal control circuit, through the key matrix.
Following a process that inhibits chattering and concurrent key pressing, a 10 bit signal is latched by the latch resistor and is sent to the pulse generator.



KEY NO.	FUNCTION
0	STOP
2	REW
3	FF
6	PAUSE/STILL
8	REC
10	PLAY
12	STILL ADV
15	SLOW (*1/2)
16	CH1
17	CH2
18	CH3
19	CH4
20	CH5
21	CH6
22	CH7
23	CH8
24	CH9
26	CH11
27	CH12
28	CH13
29	CH14
30	CH15
31	CH16
32	VTR
46	SLOW +
47	SLOW −

Fig. 4—61 Circuit of Infrared Remote Controller

The signal modulated by a 37.9 kHz carrier is sent out from IC1 pin 6 and drives the infrared LED D1. The "1" and "0" data is modulated as shown in Fig. 4—58.
The 11 bit data is constructed by the 5 bit custom code and 6 bit data code.
The custom code is "01000" for this portable VCR. For the data code, the lower 6 bits of the serial code are used. (See Fig. 4—39) First, the custom and data codes are applied, then the inverted signals are applied as shown in Fig. 4—59.

Receiver

The infrared remote control receiver consists of (1) a shaper that shapes the light pulses into a square wave signal, and (2) microprocessor that reads the shaped square signal.
The microprocessor changes the custom code from 5 bit to 2 bit as shown in Fig. 4—63.
The 8 bit serial code is divided, and is applied to the portable VCR during transmission 2.

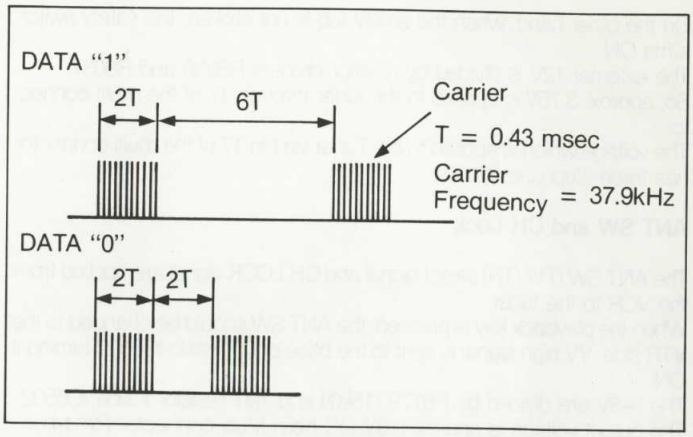


Fig. 4—62 "H" and "L" Signals

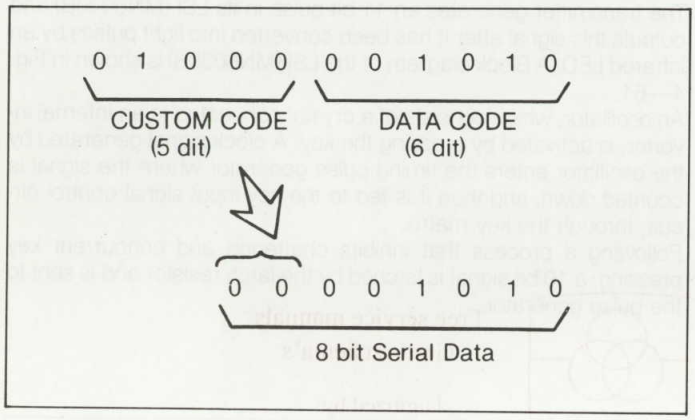


Fig. 4—63 Receiver Operation

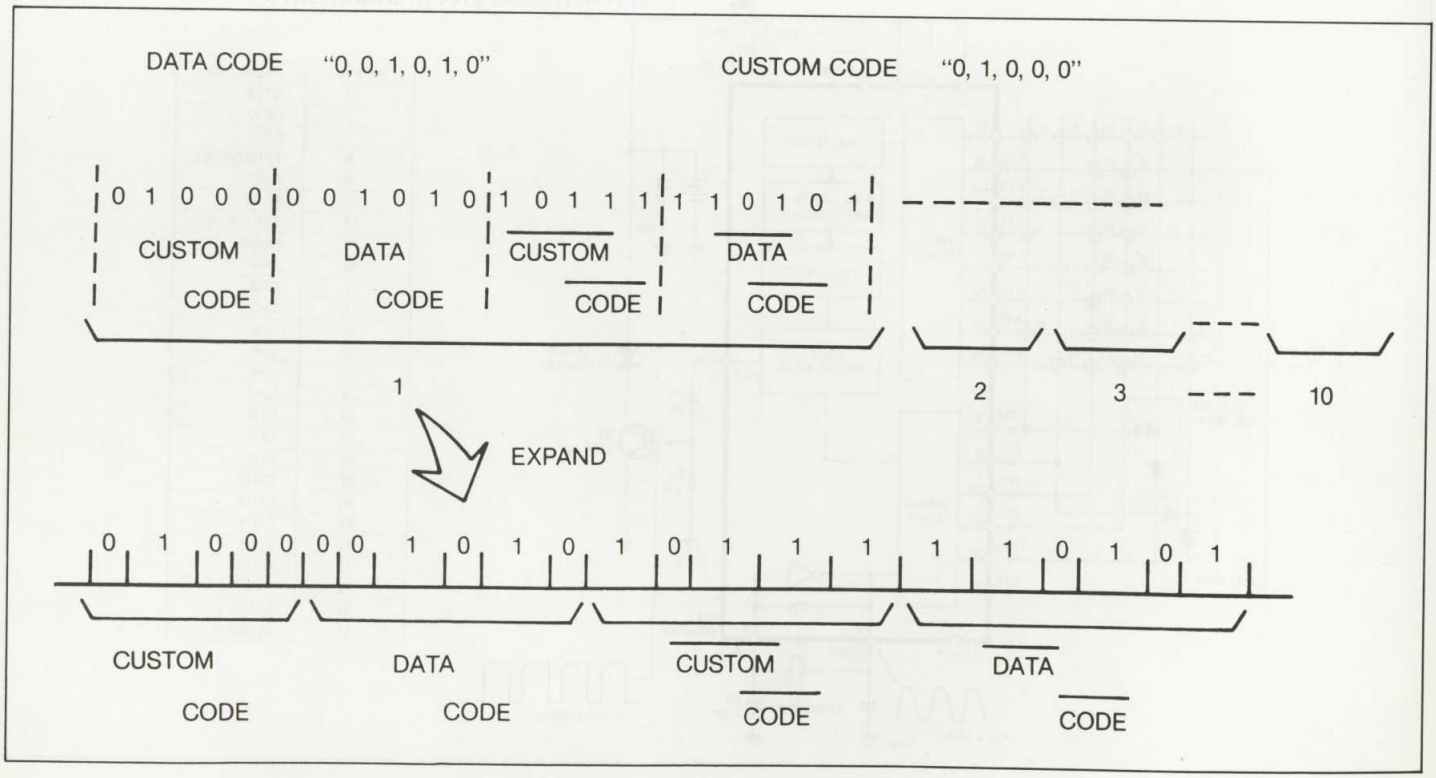


Fig. 4—64 Transmitter Output

4.3 Mode by Mode

1) Stop → Play Operation (Loading)

This section describes the operation and function of the major electrical signals and mechanical parts during the loading operation.

Loading is performed by moving of Cam Gear during Play and Recording mode.
The Main Rod, Pressure Roller and P5 Arm are moved by the Cam Gear. The "r" represents radius between the center of Cam Gear and Pin of Main Rod.

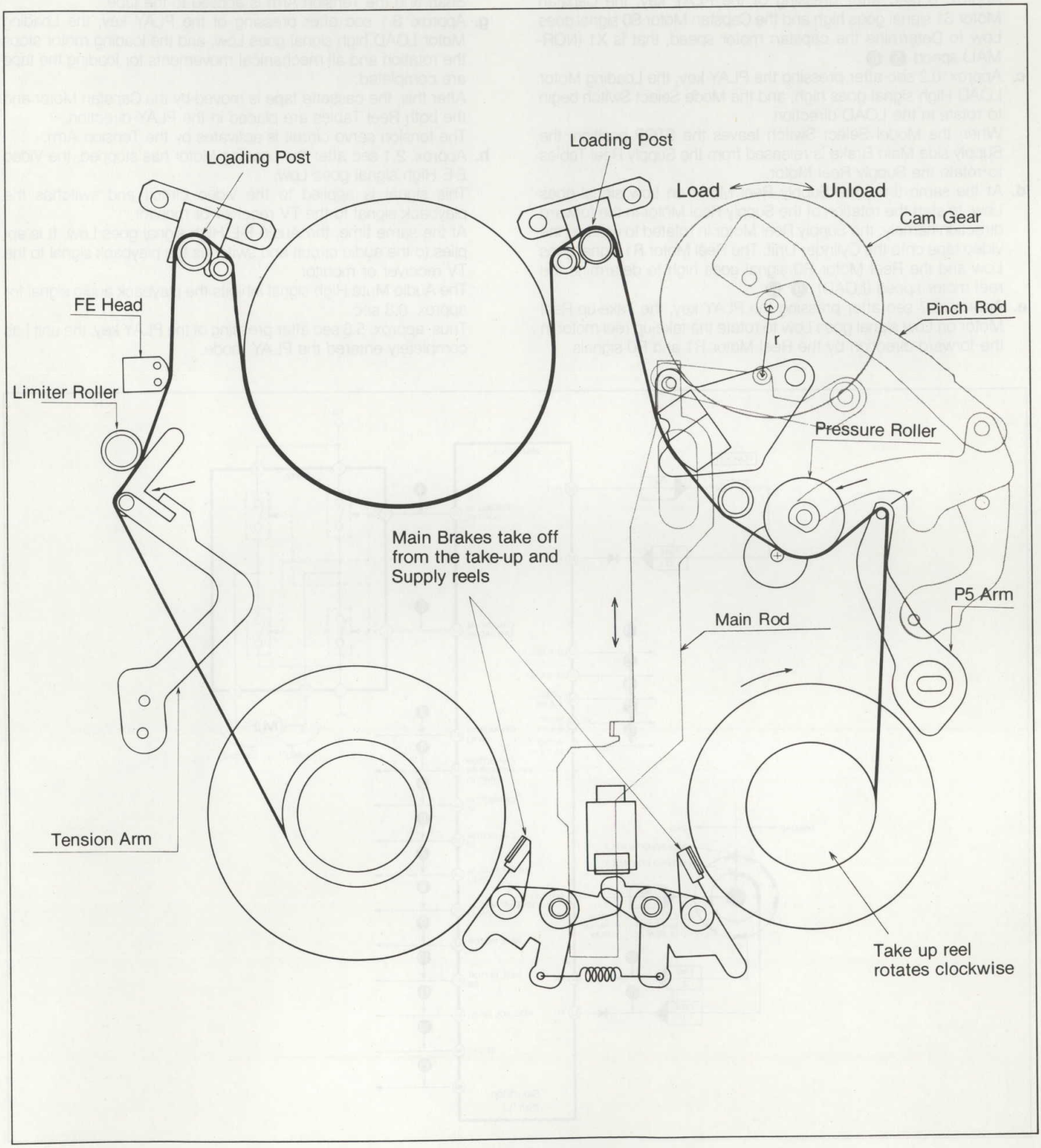


Fig. 4—65 Stop → Play Mechanism operation

a. During the STOP mode, when the PLAY key is pressed the microprocessor detects the PLAY key pulse ❸ .
At the same time, the Cylinder Motor on Low signal goes Low to start the cylinder rotation.

b. Approx. 0.2 sec after the pressing the PLAY key, the Capstan Motor REV (H)/STOP (M)/FWD (L) signal goes Low to start the capstan motor in the forward direction.
Approx. 0.1sec after pressing of the PLAY key, the Capstan Motor S1 signal goes high and the Capstan Motor S0 signal goes Low to Determine the capstan motor speed, that is X1 (NORMAL) speed ❺ ❻ .

c. Approx. 0.2 sec after pressing the PLAY key, the Loading Motor LOAD High signal goes high, and the Mode Select Switch begin to rotate in the LOAD direction.
When the Model Select Switch leaves the STOP position, the Supply side Main Brake is released from the Supply Reel Tables to rotate the Supply Reel Motor.

d. At the same time, the Supply Reel Motor on Low signal goes Low, to start the rotation of the Supply Reel Motor in the forward direction namely, the Supply Reel Motor in rotated to wind up the video tape onto the Cylinder Unit. The Reel Motor R1 signal goes Low and the Reel Motor R0 signal goes high to determine the reel motor speed (LOAD) ❾ ❿ .

e. Approx. 2.7 sec after pressing the PLAY key, the Take-up Reel Motor on Low signal goes Low to rotate the take-up reel motor in the forward direction by the Reel Motor R1 and R0 signals.
At this time, the Loading Posts reaches out to the V Stopper (Loading completion condition).

f. When the Mode Select Switch reaches the REC PAUSE position, the Supply side Main Bake reaches out to the Supply Reel Table. Then, both Main Brakes (Supply and Take-up side Main Brakes) are released from both Reel Tables.
In addition to this the Pressure Roller reaches out to the Capstan Shaft and the Tension Arm is applied to the tape.

g. Approx. 3.1 sec after pressing of the PLAY key, the Loading Motor LOAD high signal goes Low, and the loading motor stops the rotation and all mechanical movements for loading the tape are completed.
After this, the cassette tape is moved by the Capstan Motor and the both Reel Tables are placed in the PLAY direction.
The tension servo circuit is activates by the Tension Arm.

h. Approx. 2.1 sec after the Loading Motor has stopped, the Video E-E High signal goes Low.
This signal is applied to the video circuit and switches the playback signal to the TV receiver or monitor.
At the same time, the Audio E-E High signal goes Low. It is applies to the audio circuit and switches the playback signal to the TV receiver or monitor.
The Audio Mute High signal inhibits the playback audio signal for approx. 0.8 sec.
Thus, approx. 5.8 sec after pressing of the PLAY key, the unit has completely entered the PLAY mode.

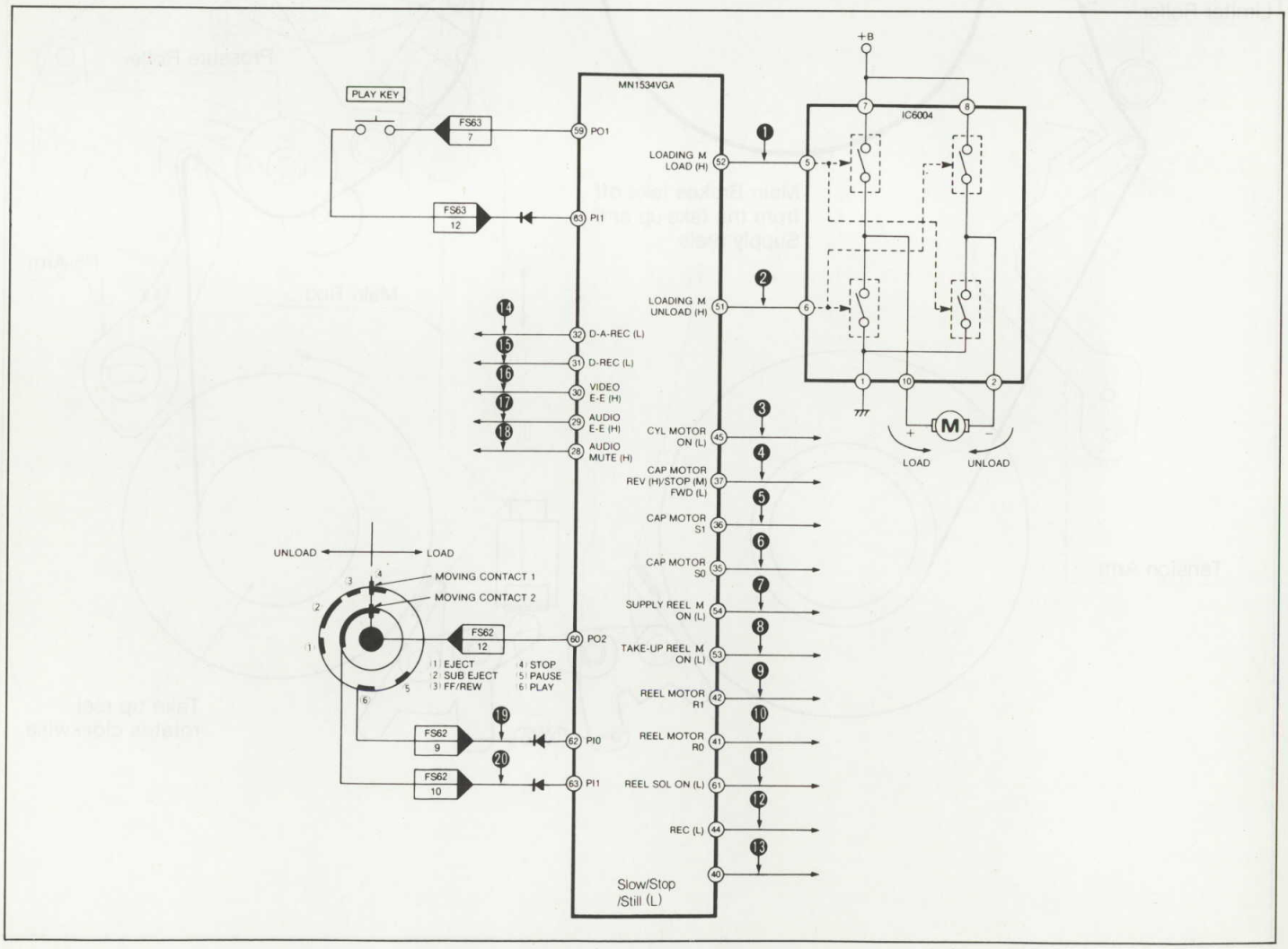


Fig. 4—66 Stop → Play

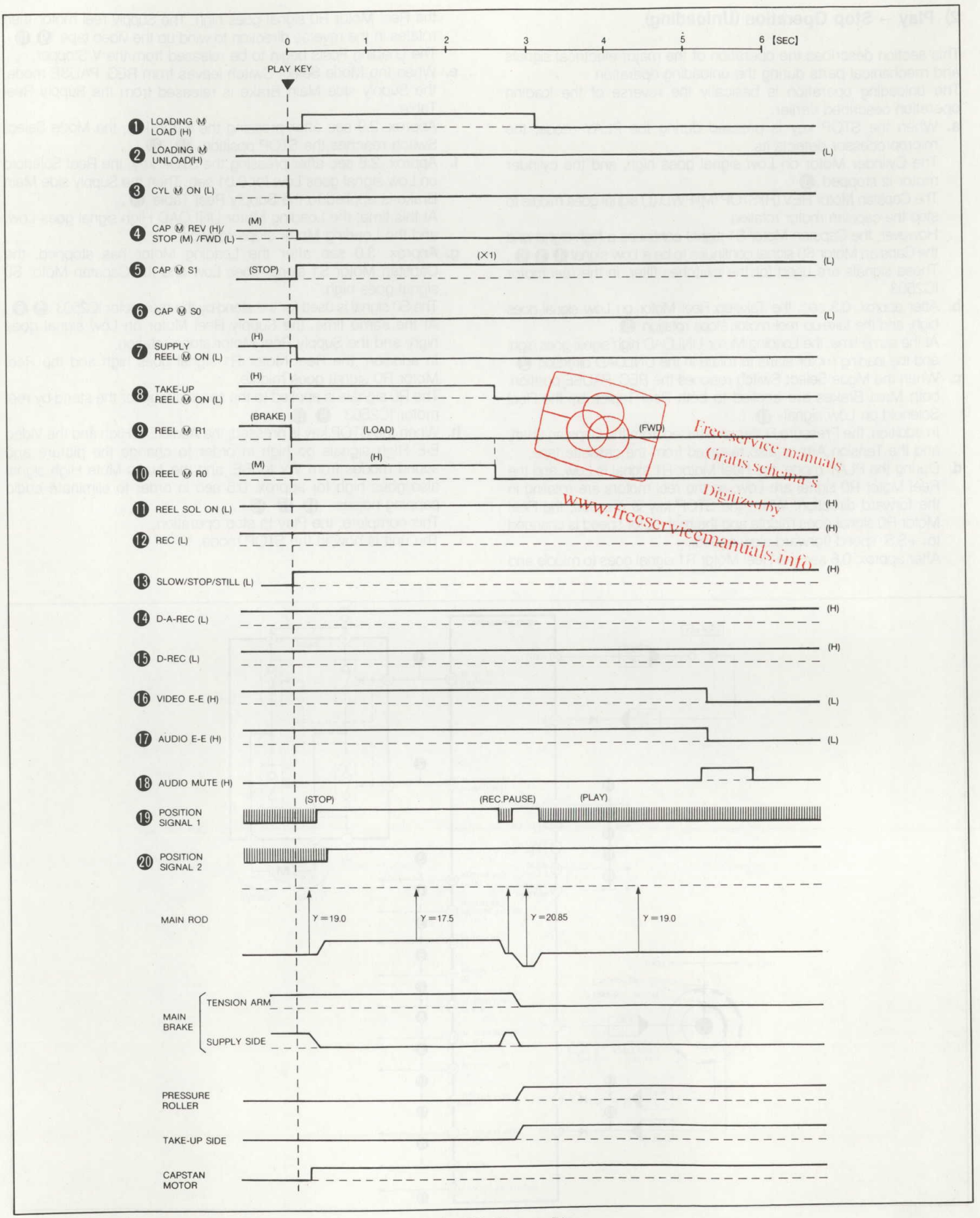


Fig. 4—67 Stop → Play

2) Play → Stop Operation (Unloading)

This section describes the operation of the major electrical signals and mechanical parts during the unloading operation.
The unloading operation is basically the reverse of the loading operation described earlier.

a. When the STOP key is pressed during the PLAY mode, the microprocessor detects its.
The Cylinder Motor on Low signal goes high, and the cylinder motor is stopped ❸ .
The Capstan Motor REV (H)/STOP (M)/FWD (L) signal goes middle to stop the capstan motor rotation.
However, the Capstan Motor S1 signal continues a high signal and the Capstan Motor S0 signal continues to be a Low signal ❹ ❺ ❻ .
These signals are used for the switches filter, in the reel motor IC2503.

b. After approx. 0.3 sec, the Take-up Reel Motor on Low signal goes high, and the take-up reel motor stops rotation ❽ .
At the same time, the Loading Motor UNLOAD high signal goes high, and the loading motor starts to rotate in the UNLOAD direction ❷ .

c. When the Mode Select Switch reaches the REC. PAUSE position, both Main Brakes are applied to both Reel Tables by the Reel Solenoid on Low signal ⓫ .
In addition, the Pressure Roller is released from the Capstan Shaft, and the Tension Arm is also released from the cassette tape.

d. During the PLAY mode, the Reel Motor R1 signal is Low, and the Reel Motor R0 signal are Low, so the reel motors are rotating in the forward direction. When the STOP key is pressed, the Reel Motor R0 signal goes middle and the reel motor speed is changed to +S.S. speed (forward slow speed).
After approx. 0.6 sec the Reel Motor R1 signal goes to middle and the Reel Motor R0 signal goes high. The Supply reel motor then rotates in the reverse direction to wind up the video tape ❾ ❿ .
The Loading Posts begin to be released from the V Stopper.

e. When the Mode Select Switch leaves from REC. PAUSE mode, the Supply side Main Brake is released from the Supply Reel Table.
Approx. 2.9 sec after pressing the STOP key, the Mode Select Switch reaches the STOP position ⓳ ⓴ .

f. Approx. 2.8 sec after pressing the STOP key, the Reel Solenoid on Low signal goes Low for 0.01 sec. Then the Supply side Main Brake is applied to the Supply Reel Table ⓫ .
At this time, the Loading Motor UNLOAD High signal goes Low, and the Loading Motor stops rotation.

g. Approx. 3.0 sec after the Loading Motor has stopped, the Capstan Motor S1 signal goes Low and the Capstan Motor S0 signal goes high.
The S0 signal is used for the stand-by the reel motor IC2503 ❺ ❻ .
At the same time, the Supply Reel Motor on Low signal goes high, and the Supply Reel Motor stops rotation.
In addition, the Reel Motor R1 signal goes high and the Reel Motor R0 signal goes middle.
The R0 signals is applied to the servo circuit for the stand-by reel motor IC2503 ❾ ❿ .

h. When the STOP key is pressed, the Audio E-E High and the Video E-E High signals go high in order to change the picture and sound modes from V-V to E-E, and the Audio Mute High signal also goes high for approx. 0.5 sec in order to eliminate audio papping noises ⓰ ⓱ ⓲ .
This complete, the Play to stop operation.
The unit is now in the STOP mode.

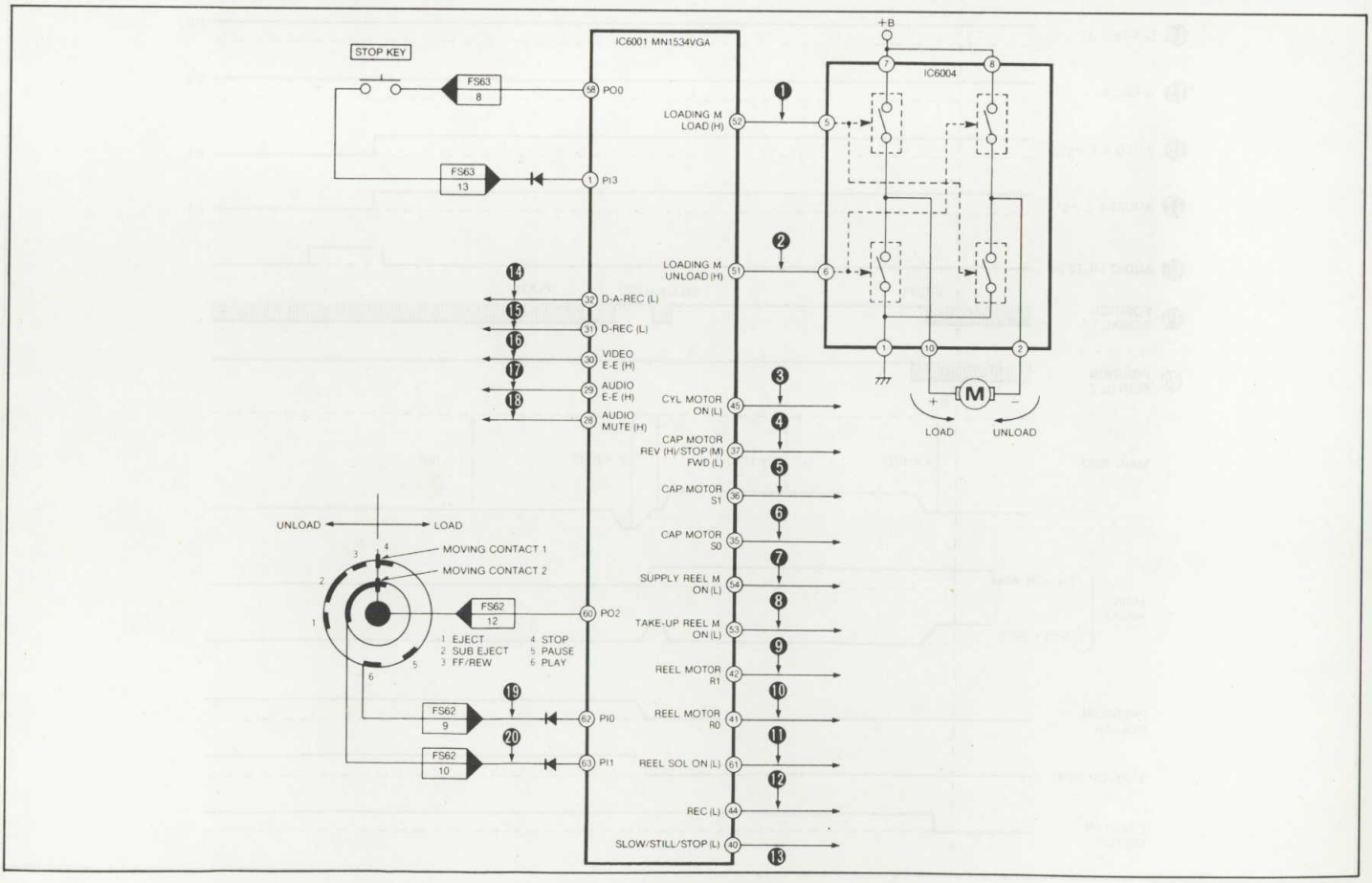


Fig. 4—68 Play → Stop

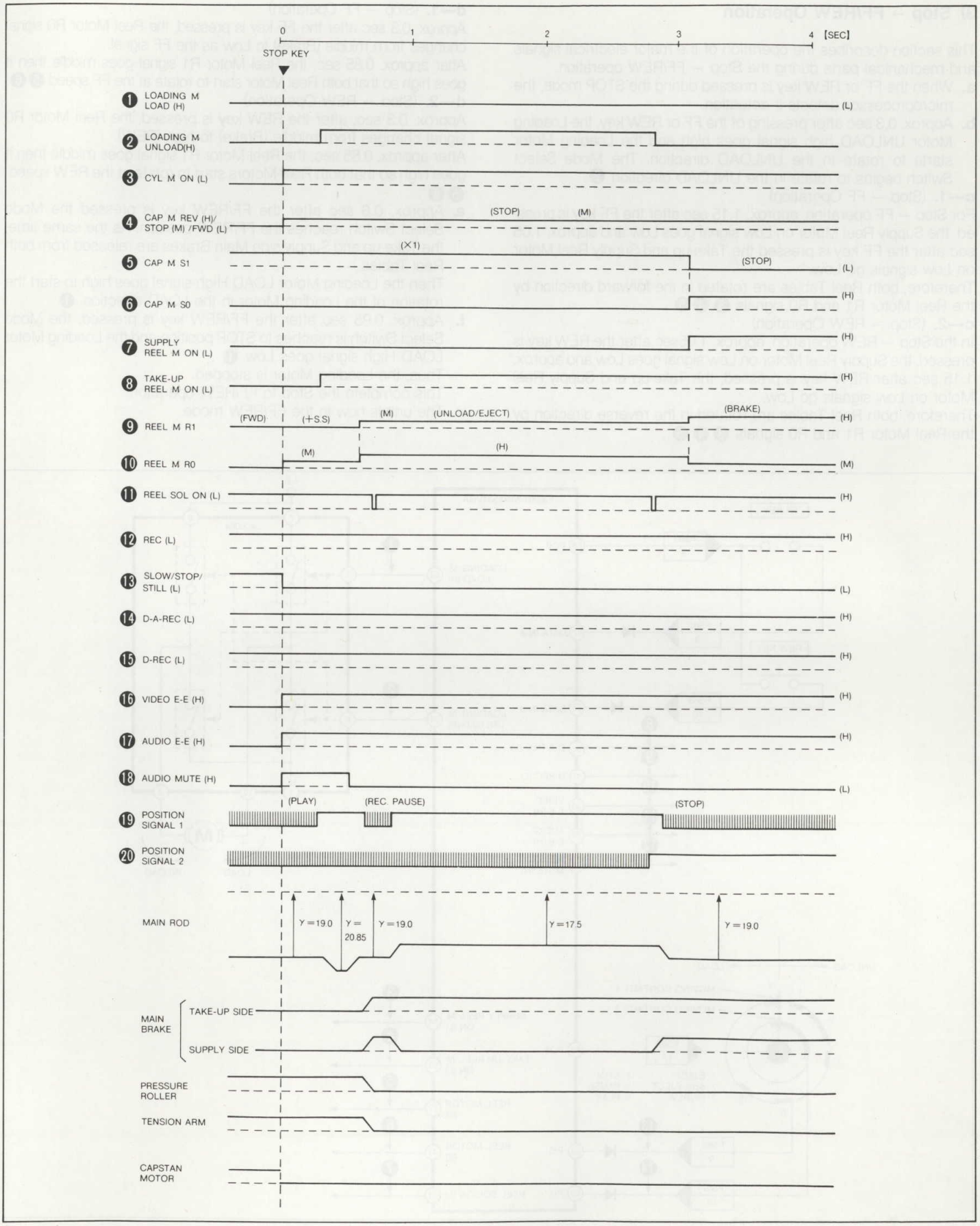


Fig. 4—69 Play → Stop

3) Stop → FF/REW Operation

This section describes the operation of the major electrical signals and mechanical parts during the Stop → FF/REW operation.

a. When the FF or REW key is pressed during the STOP mode, the microprocessor detects it actuation.

b. Approx. 0.3 sec after pressing of the FF or REW key, the Loading Motor UNLOAD high signal goes high and the Loading Motor starts to rotate in the UNLOAD direction. The Mode Select Switch begins to rotate in the UNLOAD direction ❷ .

c—1. (Stop → FF Operation)
For Stop → FF operation, approx. 1.15 sec after the FF key is pressed, the Supply Reel Motor on Low signal goes Low and approx. 1.05 sec after the FF key is pressed the Take-up and Supply Reel Motor on Low signals go Low.
Therefore, both Reel Tables are rotated in the forward direction by the Reel Motor R1 and R0 signals ❸ ❹ ❺ .

c—2. (Stop → REW Operation)
In the Stop → REW operation, approx. 1.05sec after the REW key is pressed, the Supply Reel Motor on Low signal goes Low and approx. 1.15 sec after REW key is pressed, the Take-up and Supply Reel Motor on Low signals go Low.
Therefore, both Reel Tables are rotated in the reverse direction by the Reel Motor R1 and R0 signals ❸ ❹ ❺ .

d—1. (Stop → FF Operation)
Approx. 0.3 sec after the FF key is pressed, the Reel Motor R0 signal changes from middle (Brake) to Low as the FF signal.
After approx. 0.85 sec, the Reel Motor R1 signal goes middle then it goes high so that both Reel Motor start to rotate at the FF speed ❺ ❻.

d—2. (Stop → REW Operation)
Approx. 0.3 sec, after the REW key is pressed, the Reel Motor R0 signal changes from middle (Brake) to high (REW).
After approx. 0.85 sec, the Reel Motor R1 signal goes middle then it goes high so that both Reel Motors start to rotate at the REW speed ❺ ❻ .

e. Approx. 0.6 sec after the FF/REW key is pressed the Mode Select Switch reaches the FF/REW position. As the same time, the Take-up and Supply side Main Brakes are released from both Reel Tables.
Then the Loading Motor LOAD High signal goes high to start the rotation of the Loading Motor in the LOAD direction ❶ .

f. Approx. 0.95 sec after the FF/REW key is pressed, the Mode Select Switch is reaches to STOP position and the Loading Motor LOAD High signal goes Low ❶ .
Thus, the Loading Motor is stopped.
This complete the Stop to FF/REW operation.
The unit is now in the FF/REW mode.

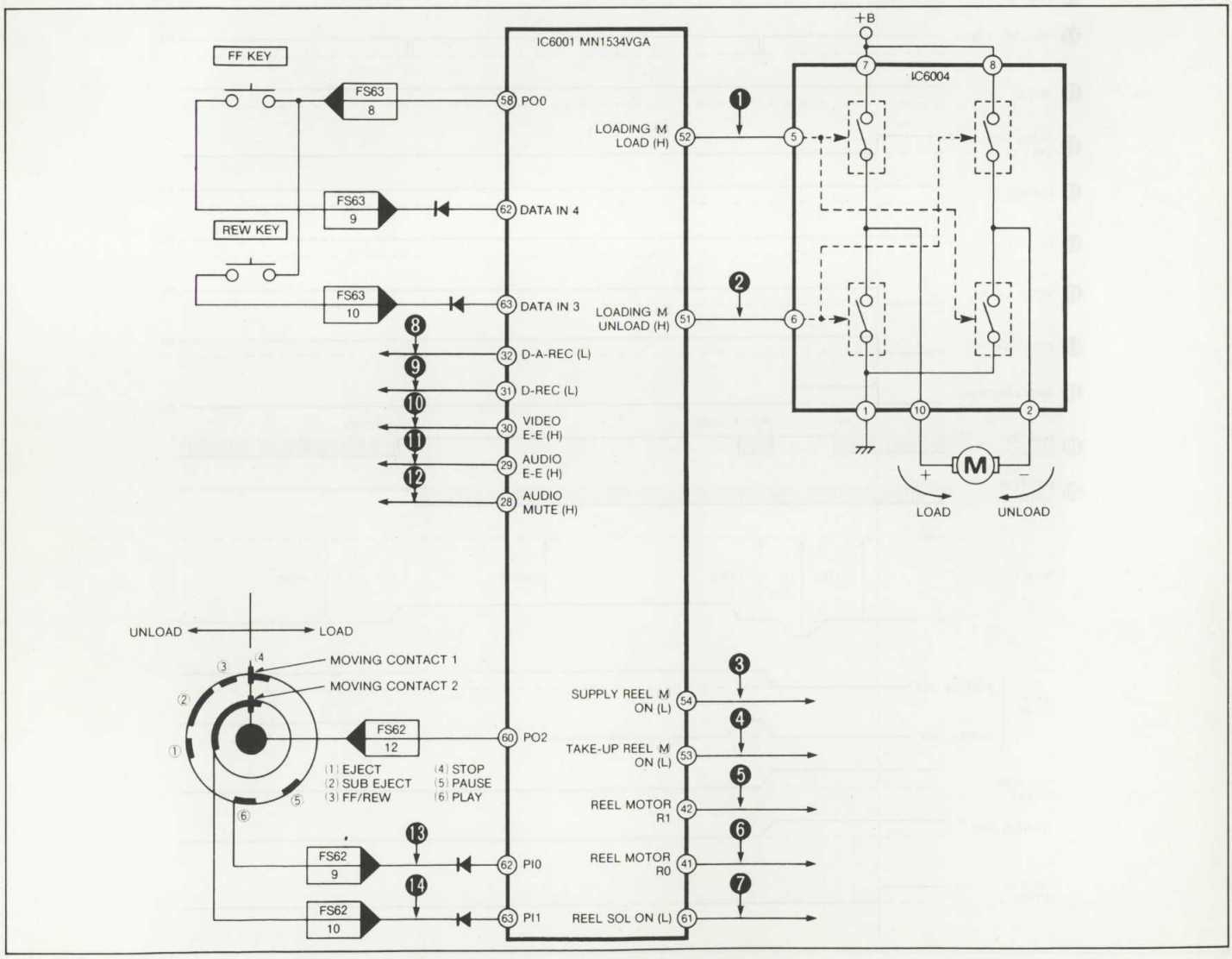


Fig. 4—70 Stop → FF/REW

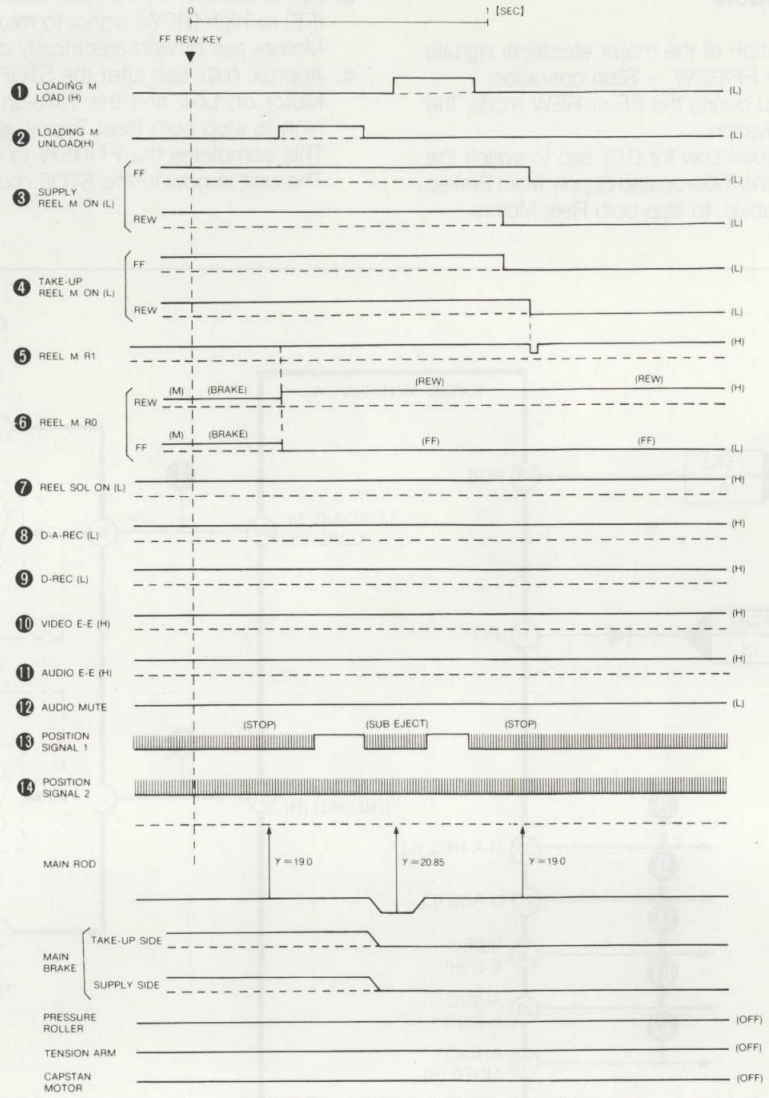


Fig. 4—71 Stop → FF/REW

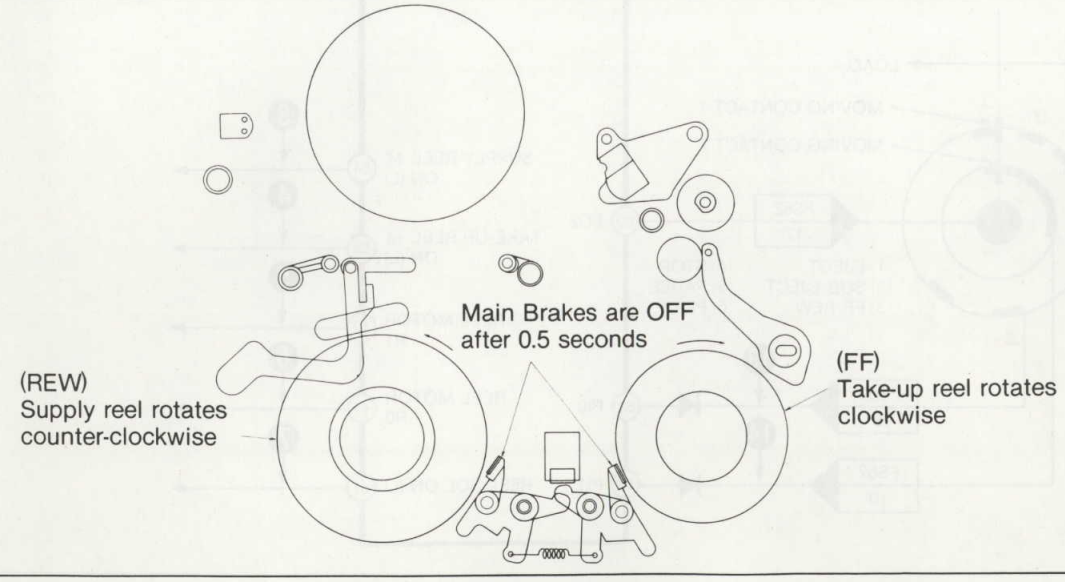


Fig. 4—72 Stop → FF/REW

4) FF/REW → STOP Operation

This section describes the operation of the major electrical signals and mechanical parts during the FF/REW → Stop operation.

a. When the STOP key is pressed during the FF or REW mode, the microprocessor detects its activation.
The Reel SOL on Low signal goes Low for 0.01 sec to switch the Reel Solenoid turning it on. So, the Take-up and Supply Main Brakes are applied to the both Reel Tables, to stop both Reel Motors.

b. At the same time, the Reel Motor R0 signal changes from a Low (FF) or high (REW) signal to middle (BRAKE), and the both Reel Motors are broken electrically disconnected ❻ .

c. Approx. 0.07 sec after the STOP key is pressed the Supply Reel Motor on Low and the Take-up Reel Motor on Low signals go high to stop both Reel Tables ❸ ❹ .
This completes the FF/REW to stop operation.
The unit is now in the STOP mode.

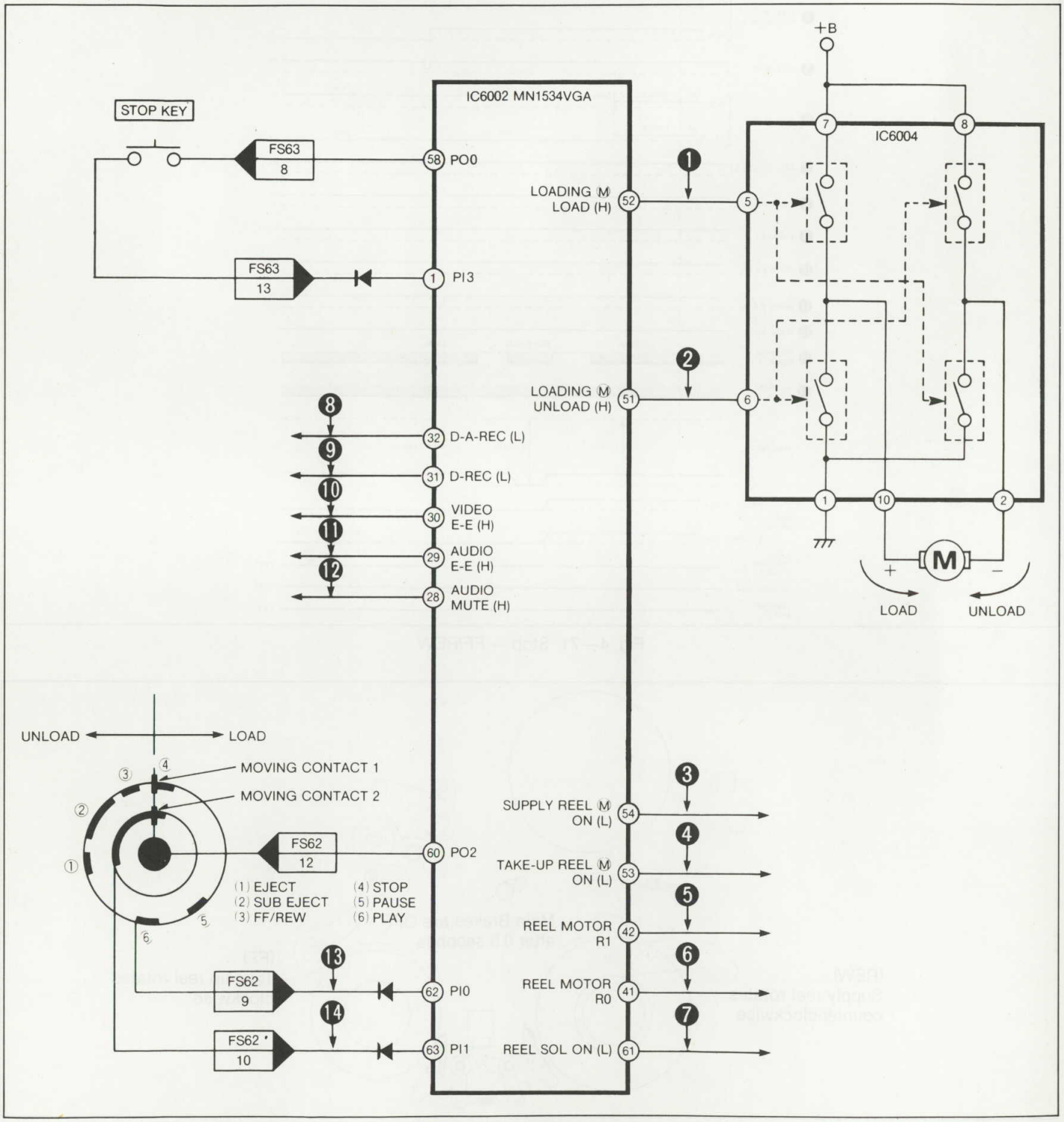


Fig. 4—73 FF/REW → Stop

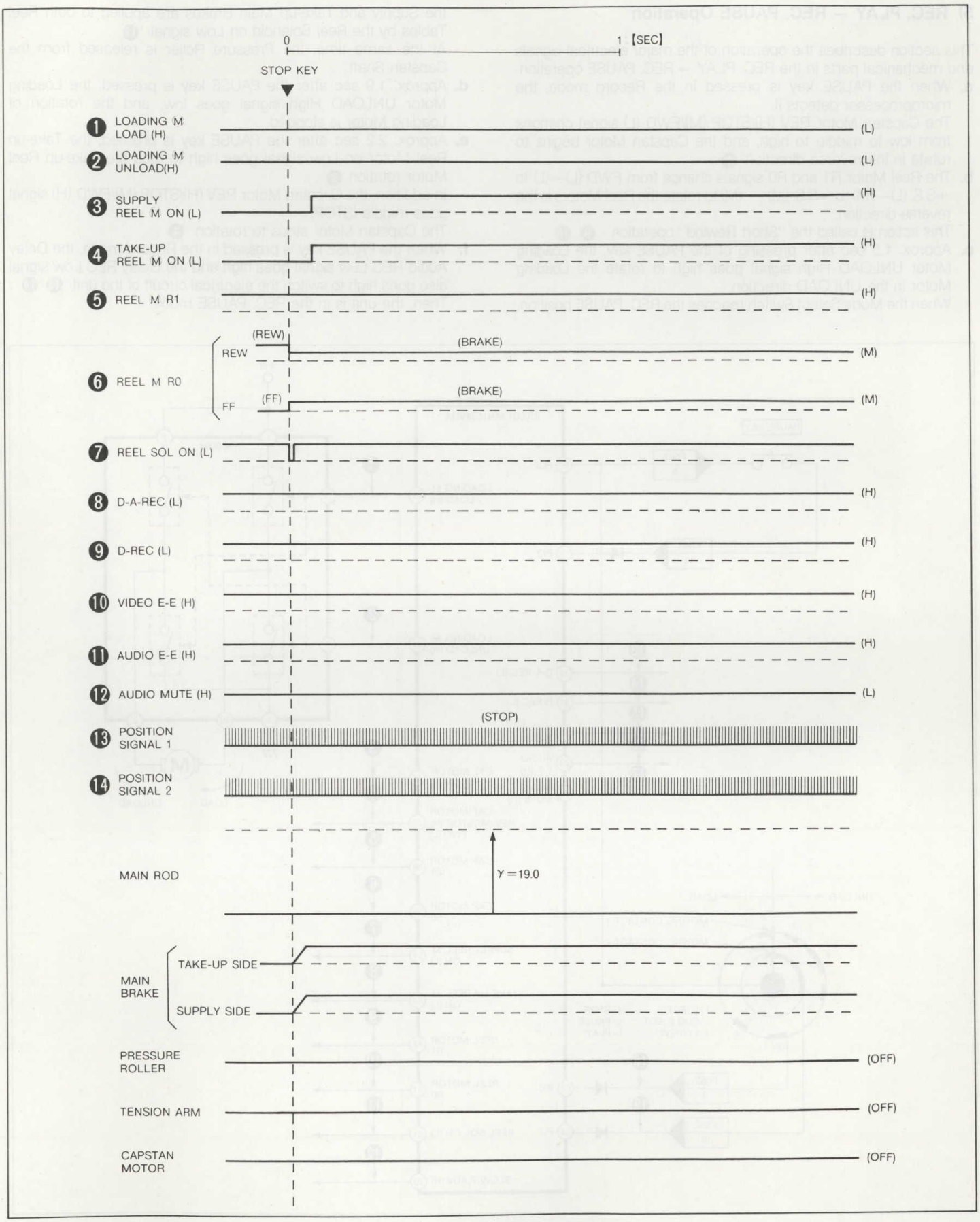


Fig. 4—74 FF/REW → Stop

5) REC. PLAY → REC. PAUSE Operation

This section describes the operation of the major electrical signals and mechanical parts in the REC. PLAY → REC. PAUSE operation.

a. When the PAUSE key is pressed in the Record mode, the microprocessor detects it.
The Capstan Motor REV (H)/STOP (M)/FWD (L) signal changes from low to middle to high, and the Capstan Motor begins to rotate in the reverse direction ❹ .

b. The Reel Motor R1 and R0 signals change from FWD (L)—(L) to +S.S. (L)—(M) to −S.S. (M) — (M) to rotate the Reel Motors in the reverse direction.
This action is called the "Short Rewind" operation ❾ ❿ .

c. Approx. 1.5 sec after pressing of the PAUSE key, the Loading Motor UNLOAD High signal goes high to rotate the Loading Motor in the UNLOAD direction.
When the Mode Select Switch reaches the REC. PAUSE position, the Supply and Take-up Main Brakes are applied to both Reel Tables by the Reel Solenoid on Low signal ⓫ .
At the same time, the Pressure Roller is released from the Capstan Shaft.

d. Approx. 1.9 sec after the PAUSE key is pressed, the Loading Motor UNLOAD High signal goes low, and the rotation of Loading Motor is stopped.

e. Approx. 2.2 sec after the PAUSE key is pressed, the Take-up Reel Motor on Low signal goes high to stop the Take-up Reel Motor rotation ❽ .
In addition, the Capstan Motor REV (H)/STOP (M)/FWD (H) signal goes middle (STOP)
The Capstan Motor stops to rotation ❹ .

f. When the PAUSE key is pressed in the Record mode, the Delay Audio REC Low signal goes high and the Delay REC Low signal also goes high to switch the electrical circuit of the unit ⓭ ⓮ .
Then, the unit is in the REC. PAUSE mode.

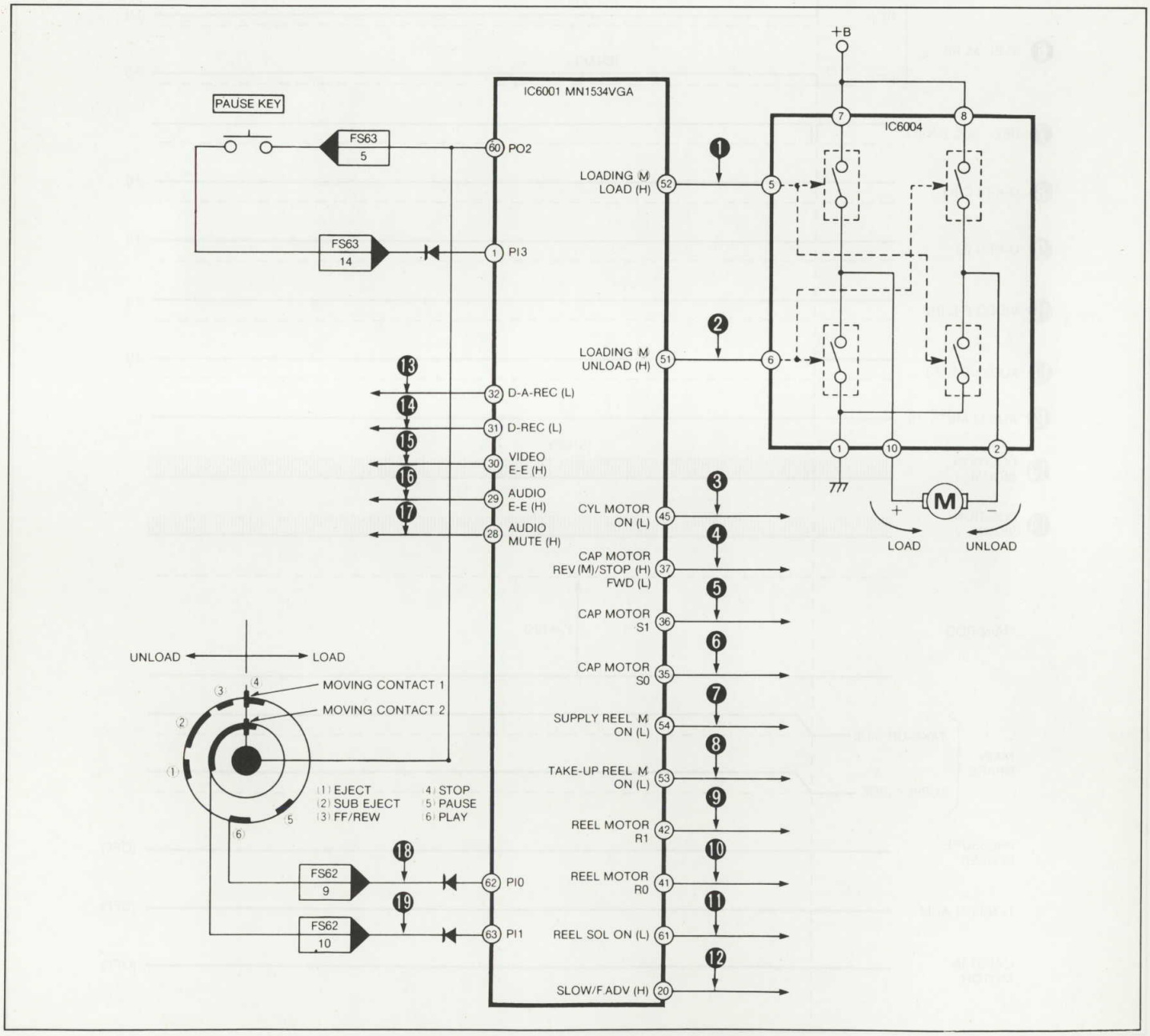


Fig. 4—75 REC. PLAY → REC. PAUSE

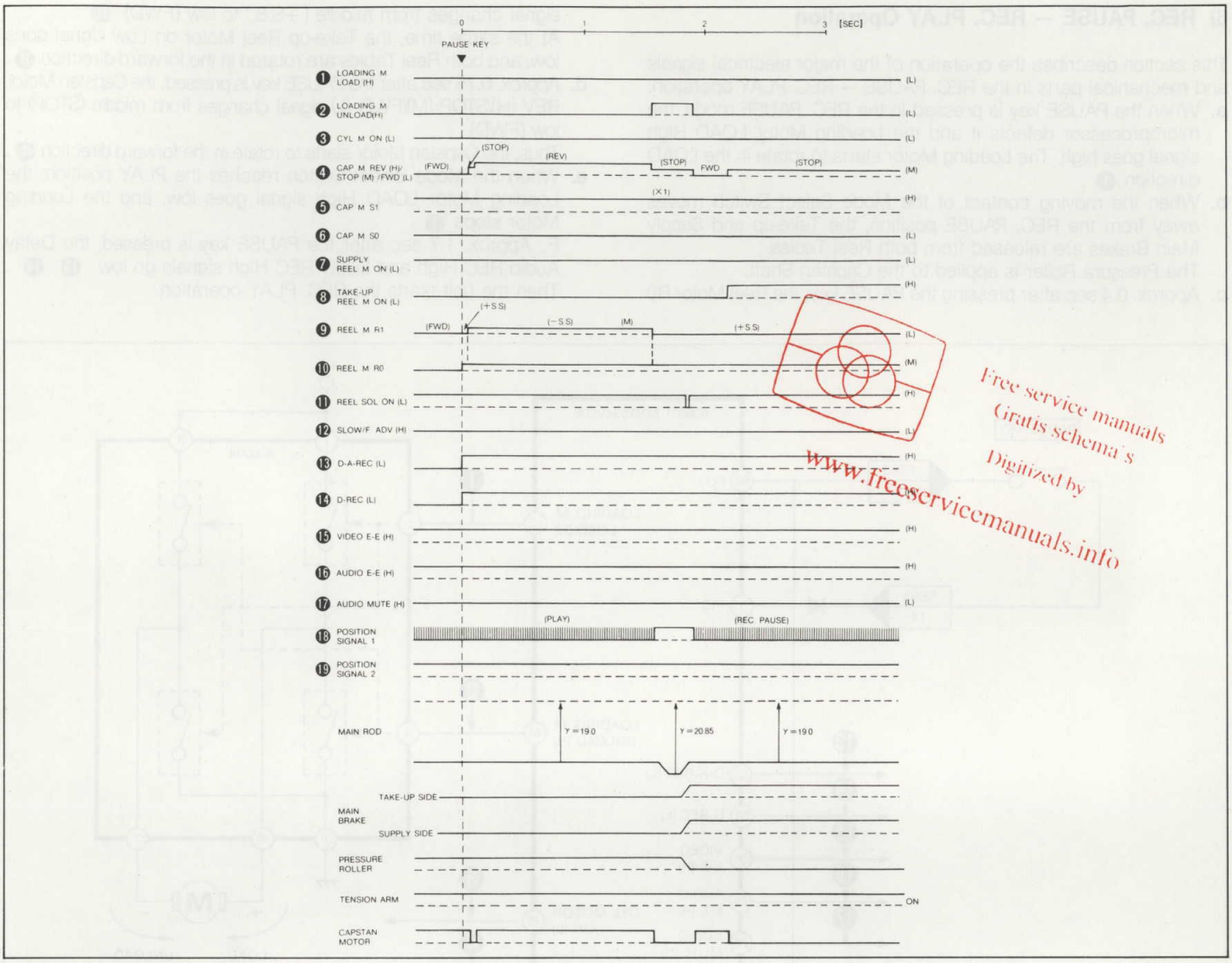


Fig. 4—76 REC. PLAY → REC. PAUSE

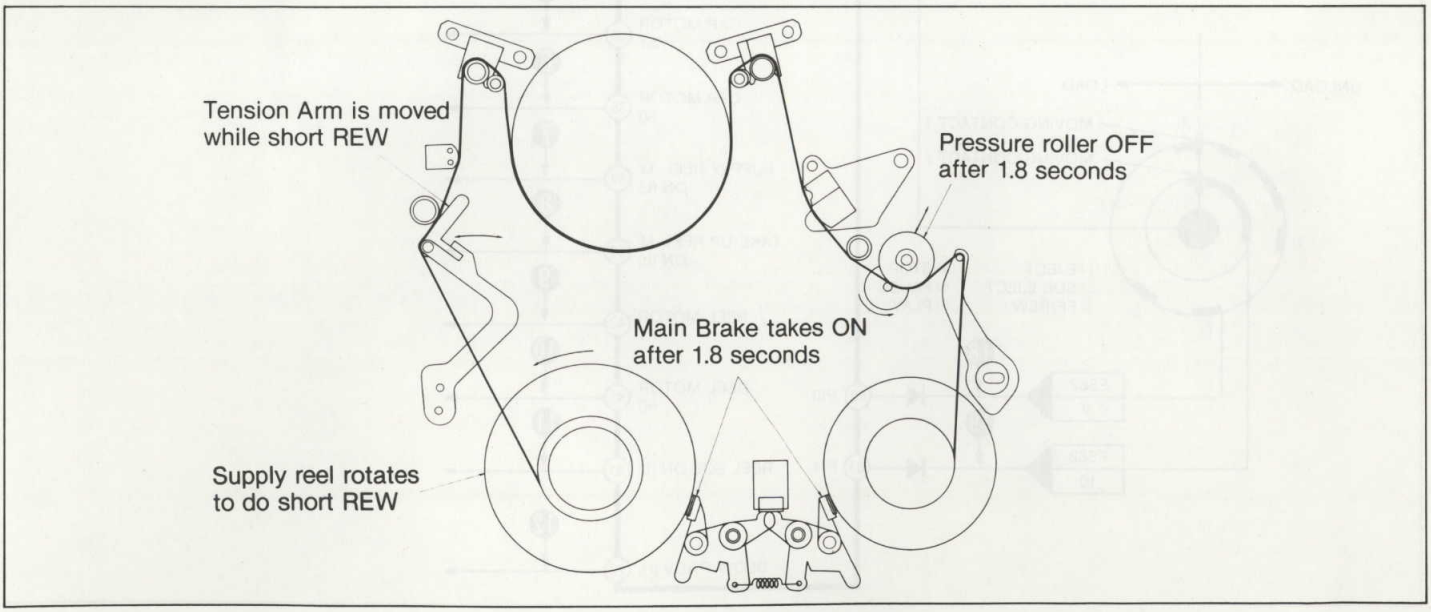


Fig. 4—77 REC. PLAY → REC. PAUSE

6) REC. PAUSE → REC. PLAY Operation

This section describes the operation of the major electrical signals and mechanical parts in the REC. PAUSE → REC. PLAY operation.

a. When the PAUSE key is pressed in the REC. PAUSE mode, the microprocessor detects it and the Loading Motor LOAD High signal goes high. The Loading Motor starts to rotate in the LOAD direction ❶ .

b. When the moving contact of the Mode Select Switch moves away from the REC. PAUSE position, the Take-up and Supply Main Brakes are released from both Reel Tables.
The Pressure Roller is applied to the Capstan Shaft.

c. Approx. 0.4 sec after pressing the PAUSE key, the Reel Motor R0 signal changes from middle (+S.S.) to low (FWD) ❿ .
At the same time, the Take-up Reel Motor on Low signal goes low, and both Reel Tables are rotated in the forward direction ❽ .

d. Approx. 0.75 sec after the PAUSE key is pressed, the Capstan Motor REV (H)/STOP (M)/FWD (L) signal changes from middle (STOP) to low (FWD).
Thus, the Capstan Motor starts to rotate in the forward direction ❹ .

e. When the Mode Select Switch reaches the PLAY position, the Loading Motor LOAD High signal goes low, and the Loading Motor stops ❶ .
F. Approx. 1.7 sec after the PAUSE key is pressed, the Delay Audio REC High and Delay REC High signals go low. ⓭ ⓮ .
Then the unit starts the REC. PLAY operation.

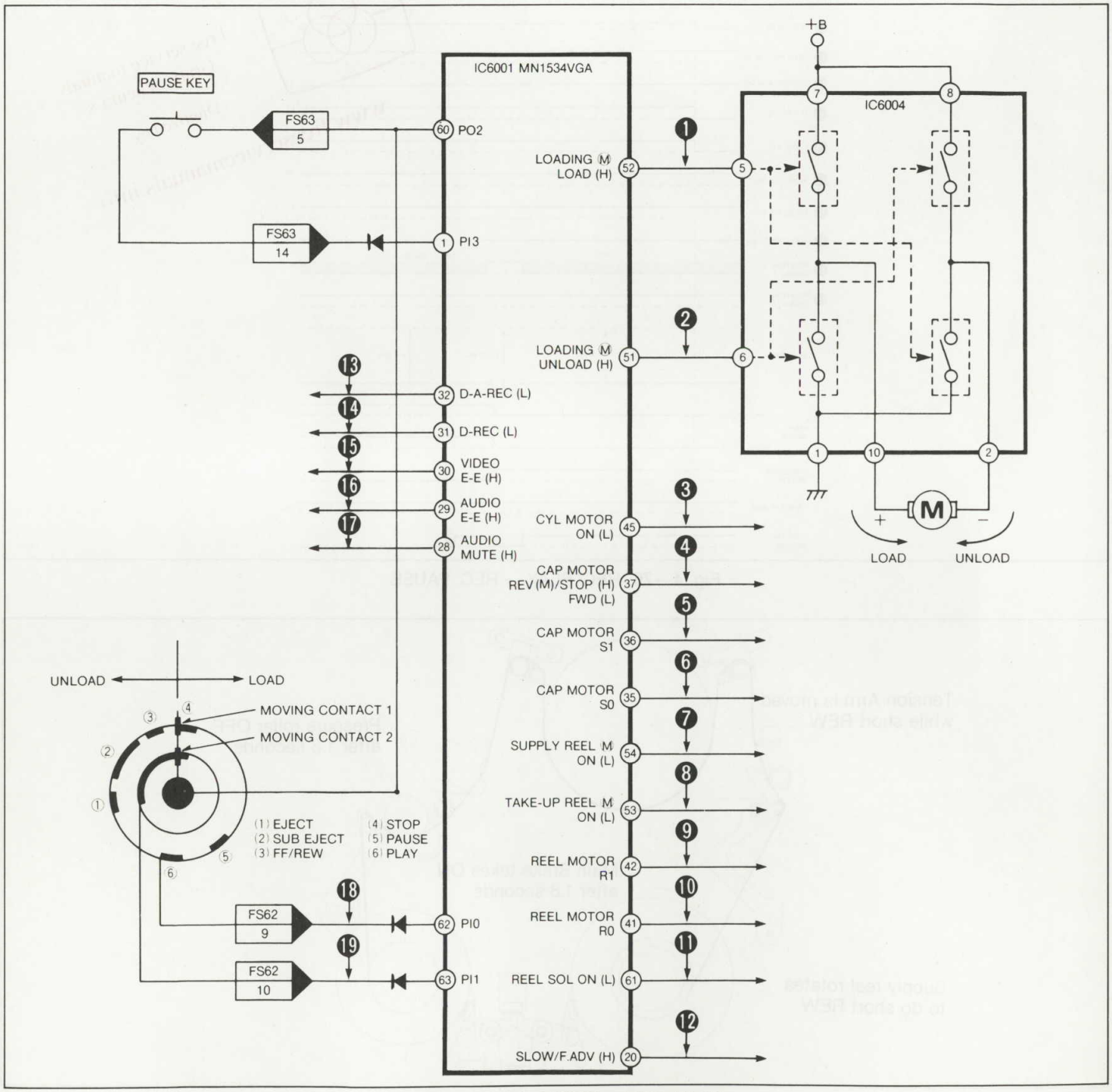


Fig. 4—78 REC. PAUSE → REC. PLAY

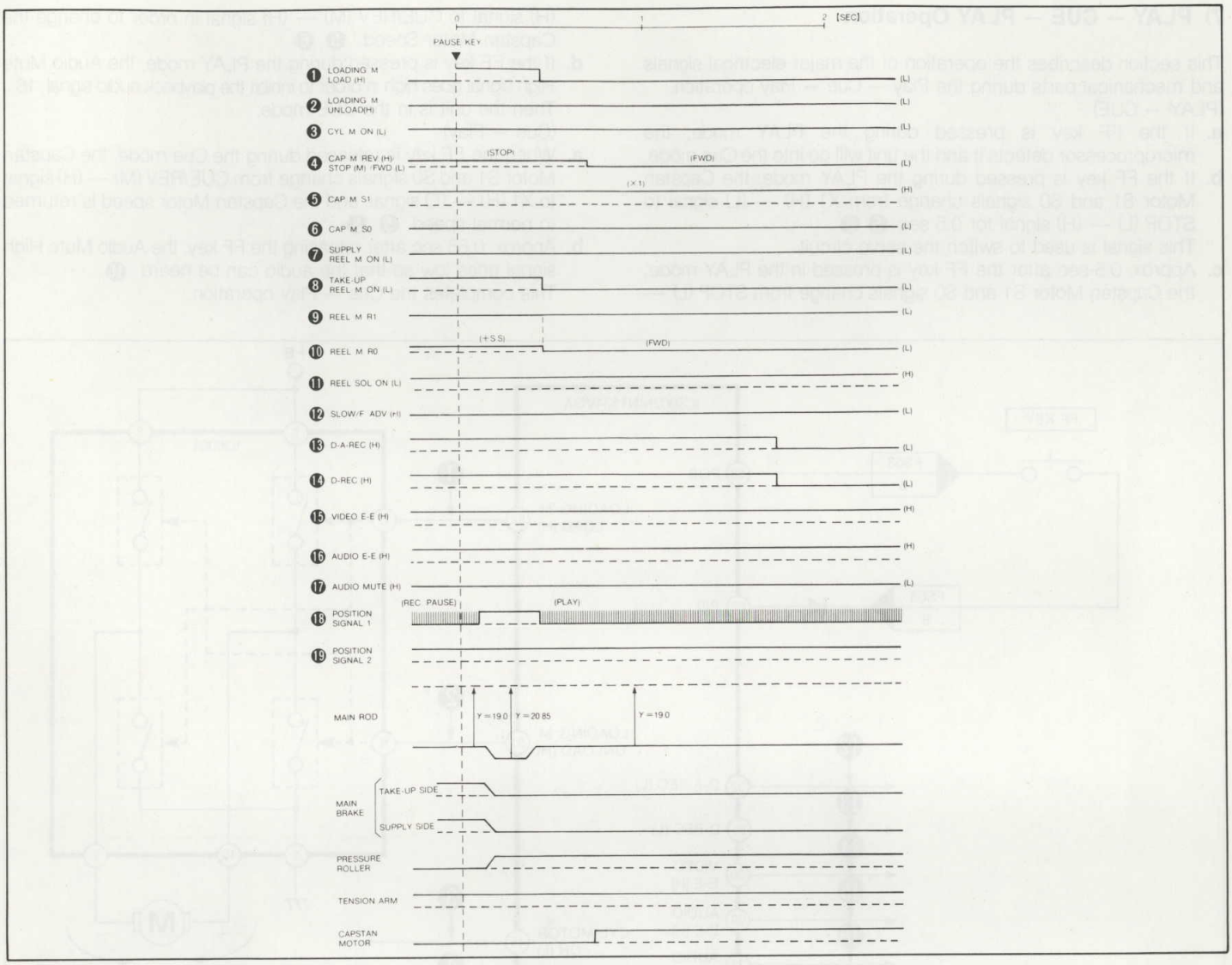


Fig. 4—79 REC. PAUSE → REC. PLAY

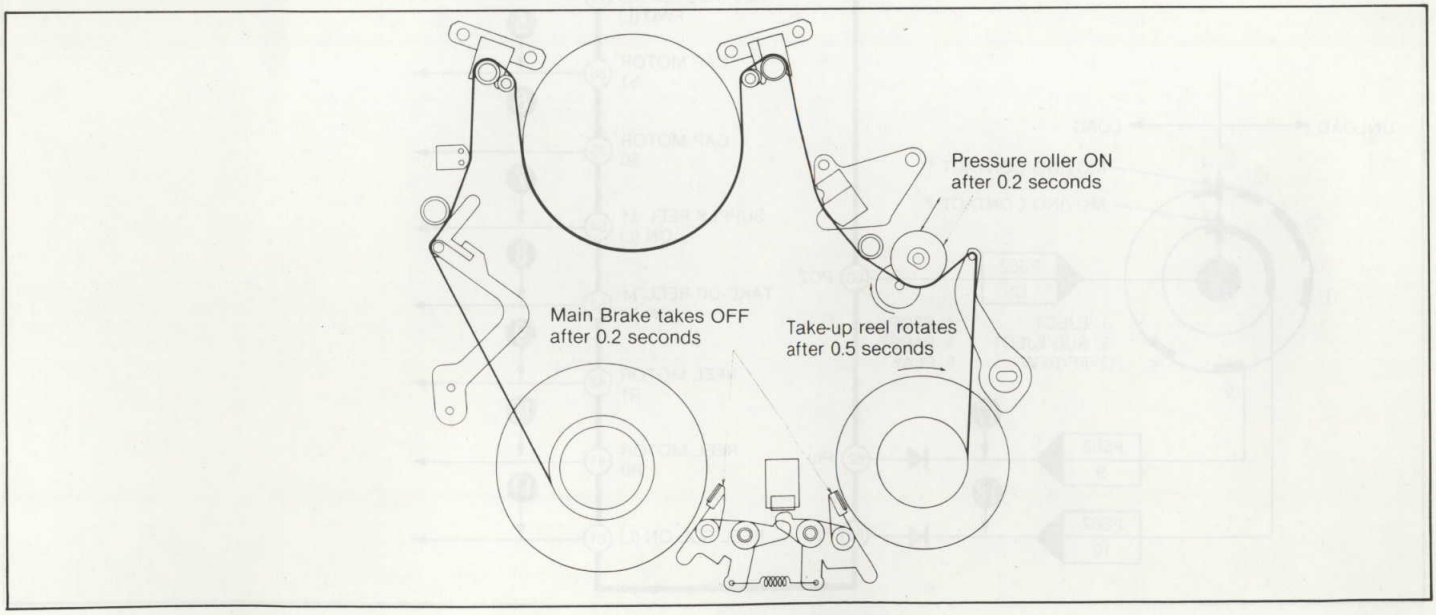


Fig. 4—80 REC. PAUSE → REC. PLAY

7) PLAY → CUE → PLAY Operation

This section describes the operation of the major electrical signals and mechanical parts during the Play → Cue → Play operation.

(PLAY → CUE)

a. If the FF key is pressed during the PLAY mode, the microprocessor detects it and the unit will go into the Cue mode.

b. If the FF key is pressed during the PLAY mode, the Capstan Motor S1 and S0 signals change from X1 (H) — (L) signal to STOP (L) — (H) signal for 0.5 sec ❺ ❻.
This signal is used to switch the servo circuit.

c. Approx. 0.5 sec after the FF key is pressed in the PLAY mode, the Capstan Motor S1 and S0 signals change from STOP (L) — (H) signal to CUE/REV (M) — (H) signal in order to change the Capstan Motor Speed ❺ ❻.

d. If the FF key is pressed during the PLAY mode, the Audio Mute High signal goes high in order to inhibit the playback audio signal ⑯. Then the unit is in the CUE mode.

(Cue → Play)

a. When the FF key is released during the Cue mode, the Capstan Motor S1 and S0 signals change from CUE/REV (M) — (H) signal to X1 (H) — (L) signal, and the Capstan Motor speed is returned to normal speed ❺ ❻.

b. Approx. 0.65 sec after releasing the FF key, the Audio Mute High signal goes low so that the audio can be heard ⑯.
This completes the Cue → Play operation.

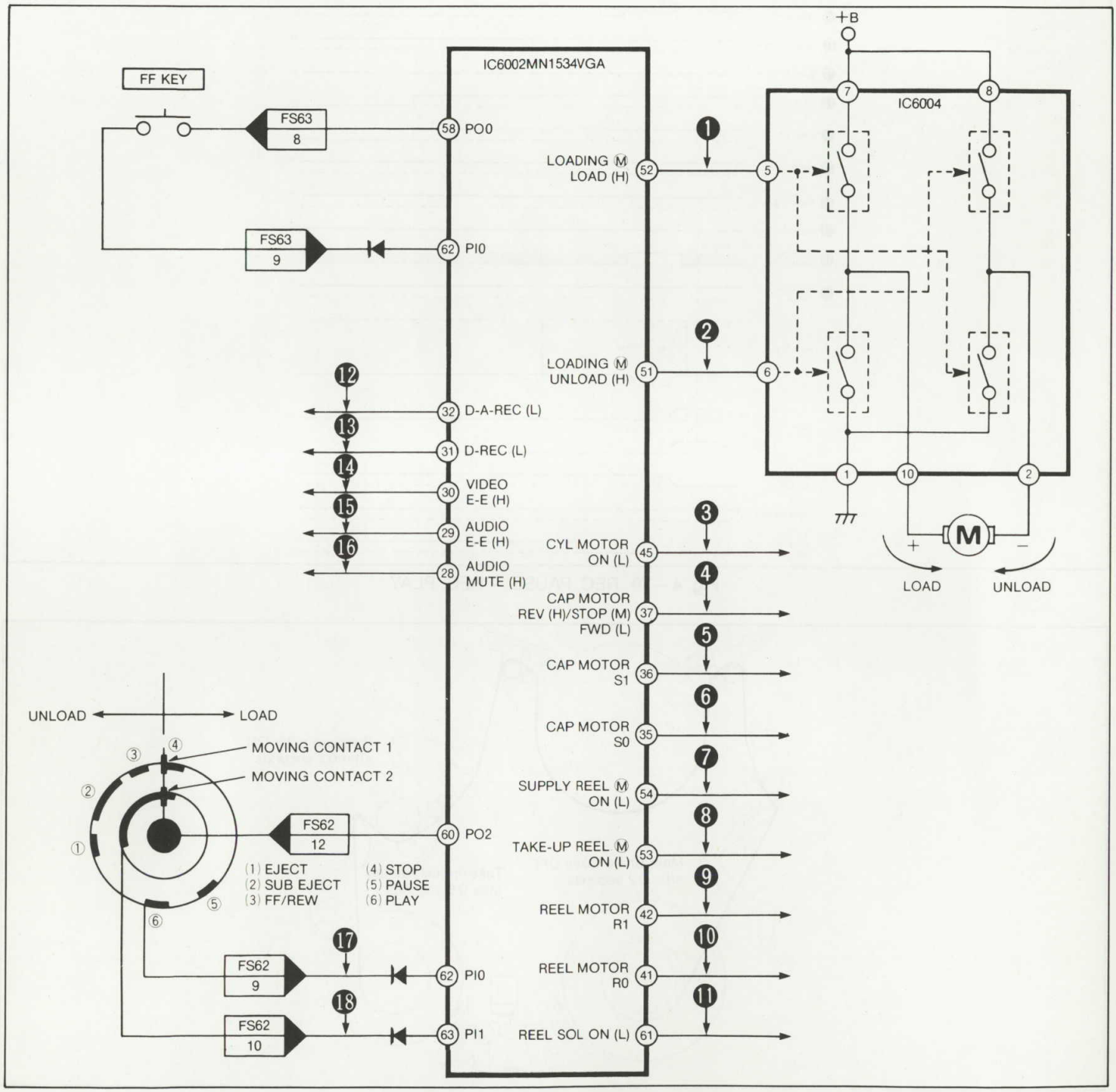


Fig. 4—81 PLAY → CUE → PLAY

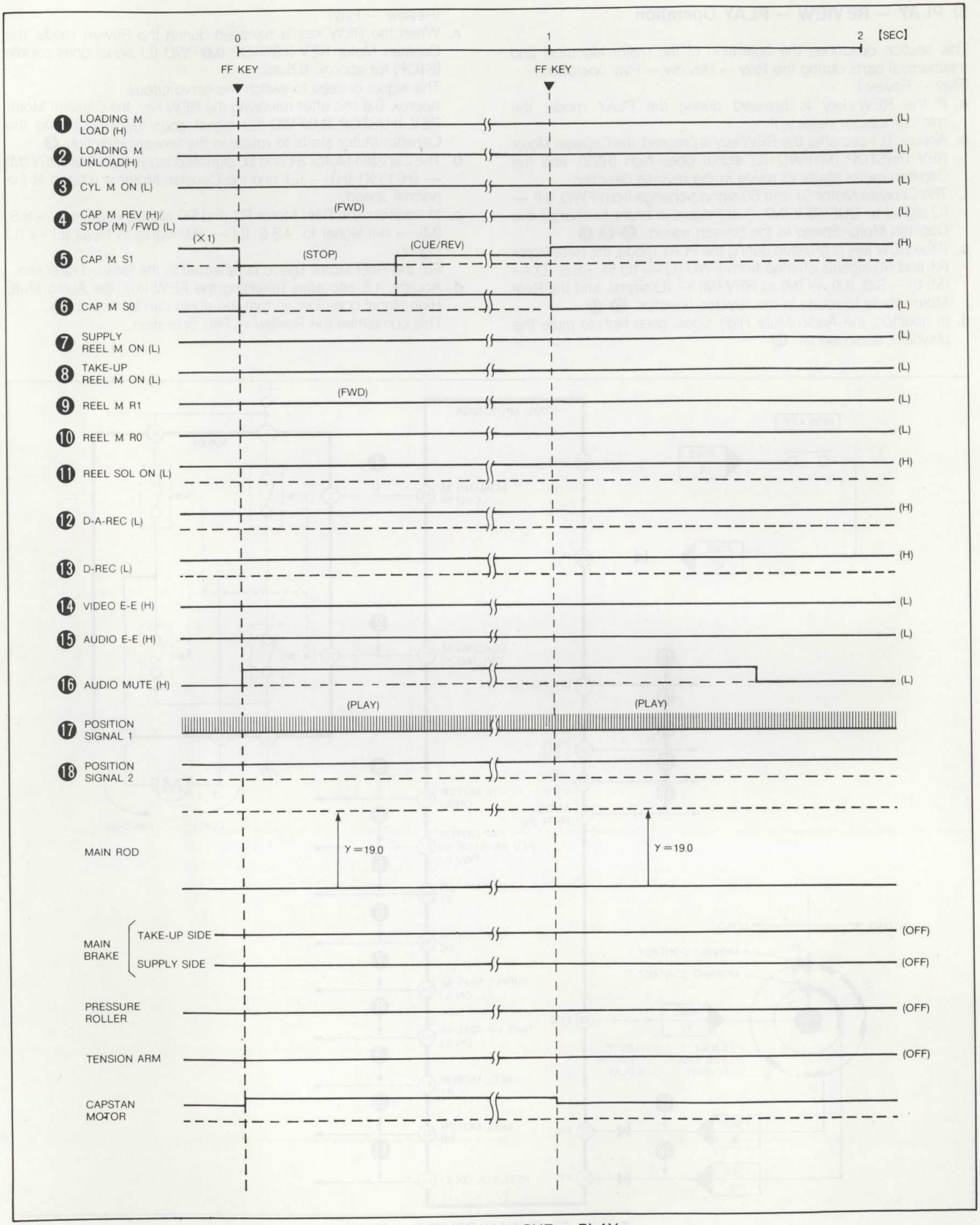


Fig. 4—82 PLAY → CUE → PLAY

8) PLAY → REVIEW → PLAY Operation

This section describes the operation of the major electrical and mechanical parts during the Play → Review → Play operation.

(Play → Review)

a. If the REW key is pressed during the PLAY mode, the microprocessor detects it.

b. Approx. 0.1 sec after the REW key is pressed, the Capstan Motor REV (H)/STOP (M)/FWD (L) signal goes high (REV), and the Capstan motor starts to rotate in the reverse direction.
The Capstan Motor S1 and S0 signals change from FWD. (H) — (L) signal to CUE/REV (M) — (L) signal in order to change the Capstan Motor Speed to the Search speed ❹ ❺ ❻ .

c. If the REW key is pressed during the PLAY mode, the Reel Motor R1 and R0 signals change from FWD (L) — (L) to +S.S. (L) — (M) to −S.S. (M) — (M) to REV (M) — (L) signal, and the Reel Motor starts to rotate in the reverse direction ❾ ❿ .

d. In addition, the Audio Mute High signal goes high to mute the playback audio signal ⓰ .

(Review → Play)

a. When the REW key is released during the Review mode, the Capstan Motor REV (H)/STOP (M)/FWD (L) signal goes middle (STOP) for approx. 0.5 sec.
This signal is used to switch the servo circuit.
Approx. 0.6 sec after releasing the REW key, the Capstan Motor REV (H)/STOP (M)/FWD (L) signal goes low (FWD) and the Capstan Motor starts to rotate in the forward direction ❹ .

b. The Capstan Motor S1 and S0 signals change from CUE/REV (M) — (H) to X1 (H) — (L), and the Capstan Motor is rotated at the normal speed.

c. In addition, the Reel Motor R1 and R0 signals change to −S.S. (M) — (M) signal to +S.S. (L) — (M) signal to FWD (L) — (L) signal.
So, the Reel Motor speed is detected in the forward direction.

d. Approx. 1.5 sec after releasing the REW key, the Audio Mute High signal goes low so that the audio can be heard ⓰ .
This completes the Review → Play operation.

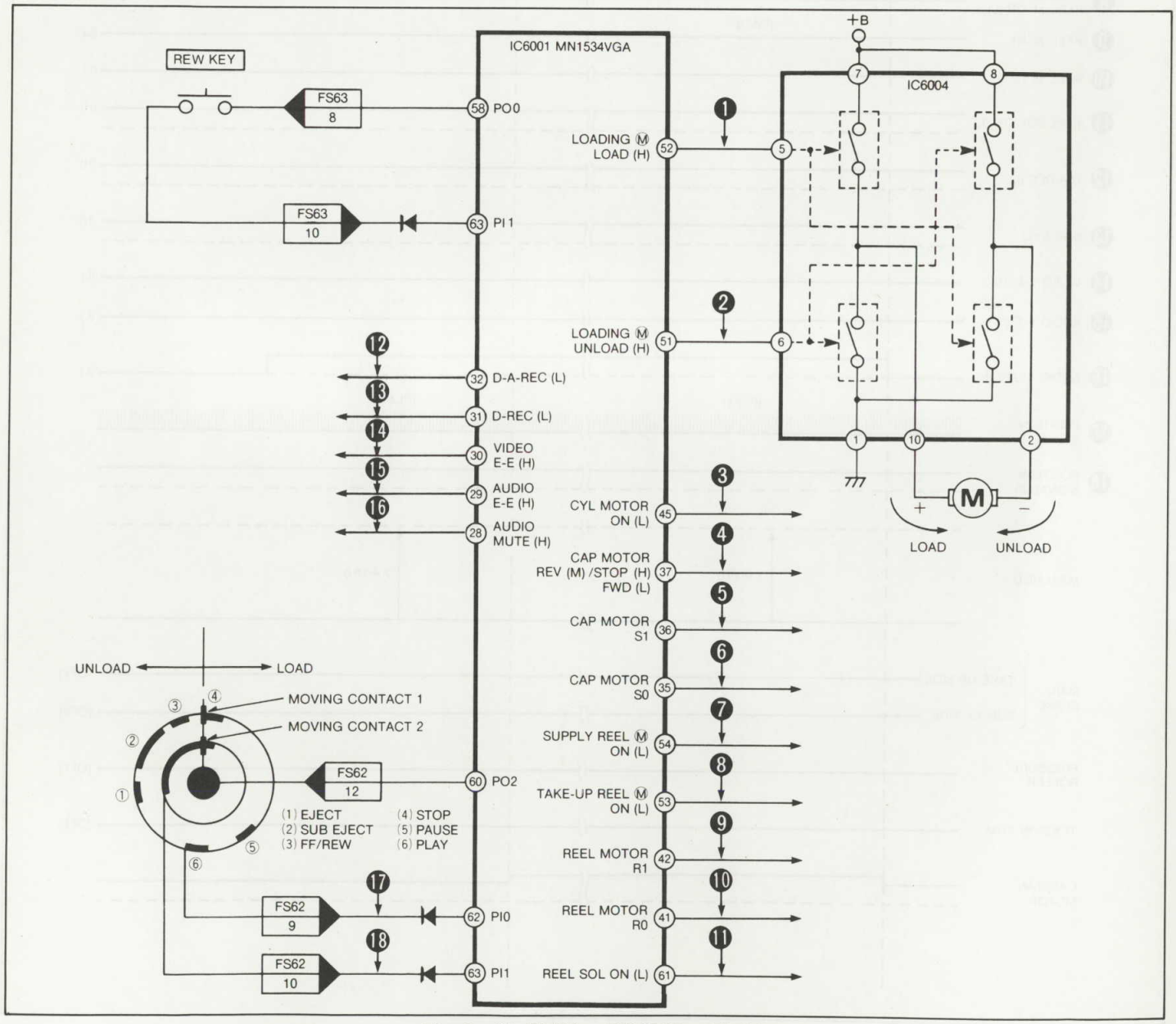


Fig. 4—83 PLAY → REVIEW → PLAY

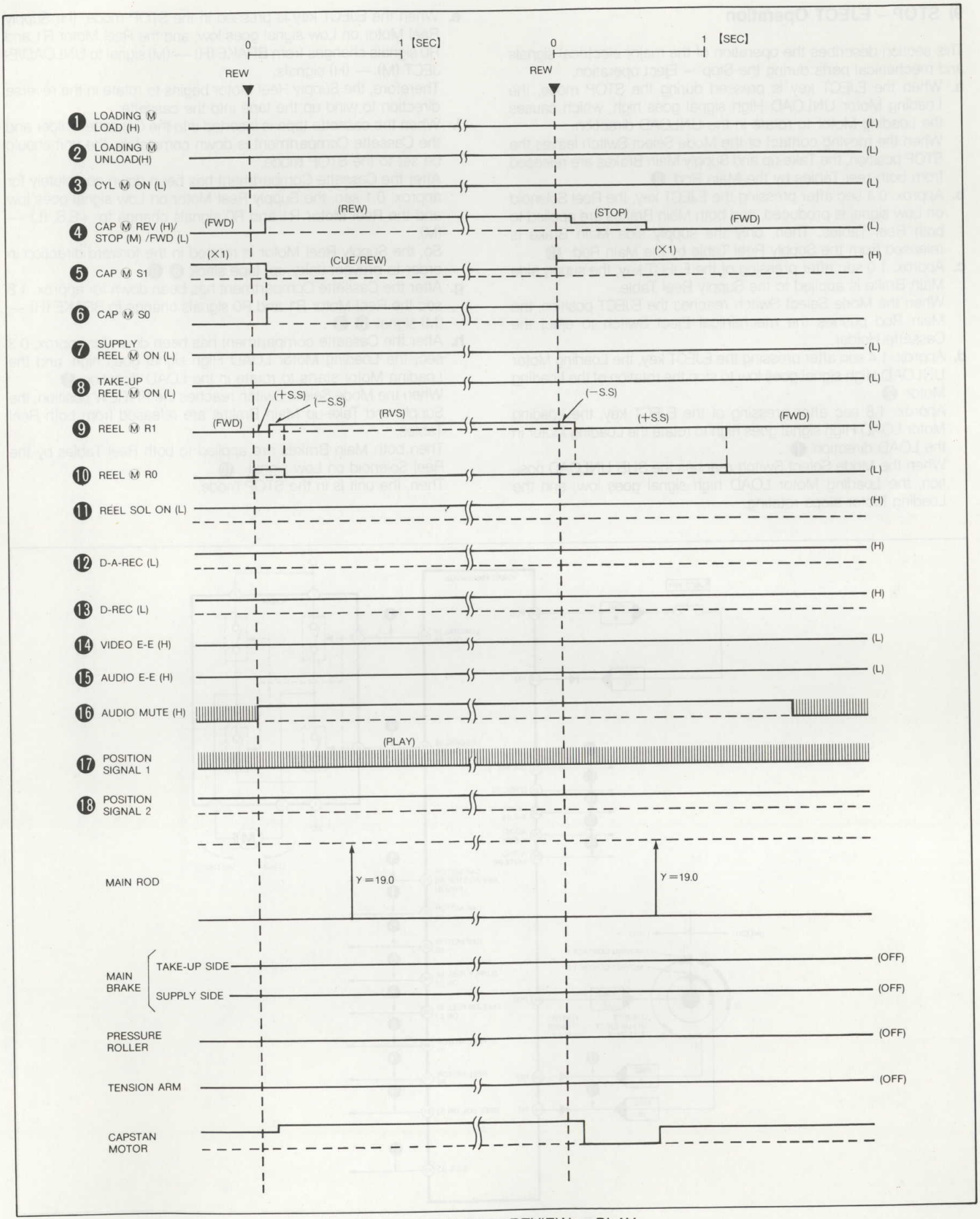


Fig. 4—84 PLAY → REVIEW → PLAY

9) STOP→ EJECT Operation

This section describes the operation of the major electrical signals and mechanical parts during the Stop → Eject operation.

a. When the EJECT key is pressed during the STOP mode, the Loading Motor UNLOAD High signal goes high, which causes the Loading Motor to rotate in the UNLOAD direction.
When the moving contact of the Mode Select Switch leaves the STOP position, the Take-up and Supply Main Brakes are released from both reel Tables by the Main Rod ❷ .

b. Approx. 0.4 sec after pressing the EJECT key, the Reel Solenoid on Low signal is produced, and both Main Brakes are applied to both Reel Tables. Then, only the supply side Main Brake is released from the Supply Reel Table by the Main Rod ⑩ .

c. Approx. 1.0 sec after pressing of the EJECT key, the supply side Main Brake is applied to the Supply Reel Table.
When the Mode Select Switch reaches the EJECT position, the Main Rod pushes the mechanical Eject Switch to eject the Cassette Holder.

d. Approx. 1.4 sec after pressing the EJECT key, the Loading Motor UNLOAD High signal goes low to stop the rotation of the Loading Motor ❷ .
Approx. 1.8 sec after pressing of the EJECT key, the Loading Motor LOAD High signal goes high to rotate the Loading Motor in the LOAD direction ❶ .
When the Mode Select Switch reaches the SUB UNLOAD position, the Loading Motor LOAD high signal goes low, and the Loading Motor stops rotating.

e. When the EJECT key is pressed in the STOP mode, the Supply Reel Motor on Low signal goes low, and the Reel Motor R1 and R0 signals changes from BRAKE (H) — (M) signal to UNLOAD/EJECT (M) — (H) signals.
Therefore, the Supply Reel Motor begins to rotate in the reverse direction to wind up the tape into the cassette.

f. When the cassette tape is inserted into the Cassette Holder and the Cassette Compartment is down completely, the unit should be set to the STOP mode.
After the Cassette Compartment has been down completely for approx. 0.1 sec, the Supply Reel Motor on Low signal goes low and the Reel Motor R1 and R0 signals change to +S.S. (L) — (M).
So, the Supply Reel Motor is rotated in the forward direction in order to prevent (take up) tape slack ❽ ❾ .

g. After the Cassette Compartment has been down for approx. 1.8 sec the Reel Motor R1 and R0 signals change to BRAKE (H) — (M) signal ❽ ❾ .

h. After the Cassette compartment has been down for approx. 0.3 sec, the Loading Motor LOAD High signal goes high, and the Loading Motor starts to rotate in the LOAD direction ❶ .
When the Mode Select Switch reaches the FF/REW position, the Supply and Take-up Main Brakes are released from both Reel Tables.
Then both Main Brakes are applied to both Reel Tables by the Reel Solenoid on Low signal ⑩ .
Then, the unit is in the STOP mode.

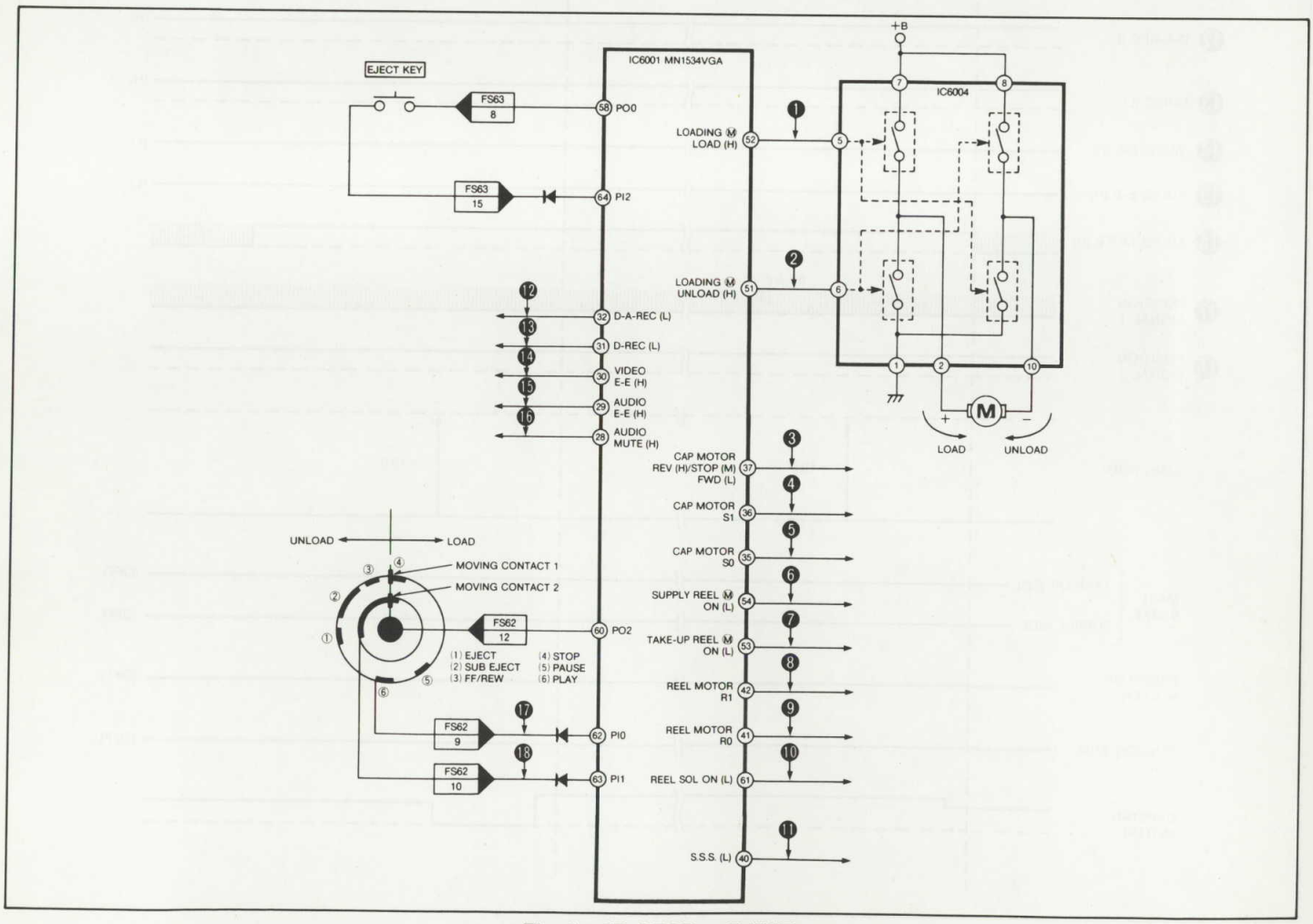


Fig. 4—85 STOP → EJECT

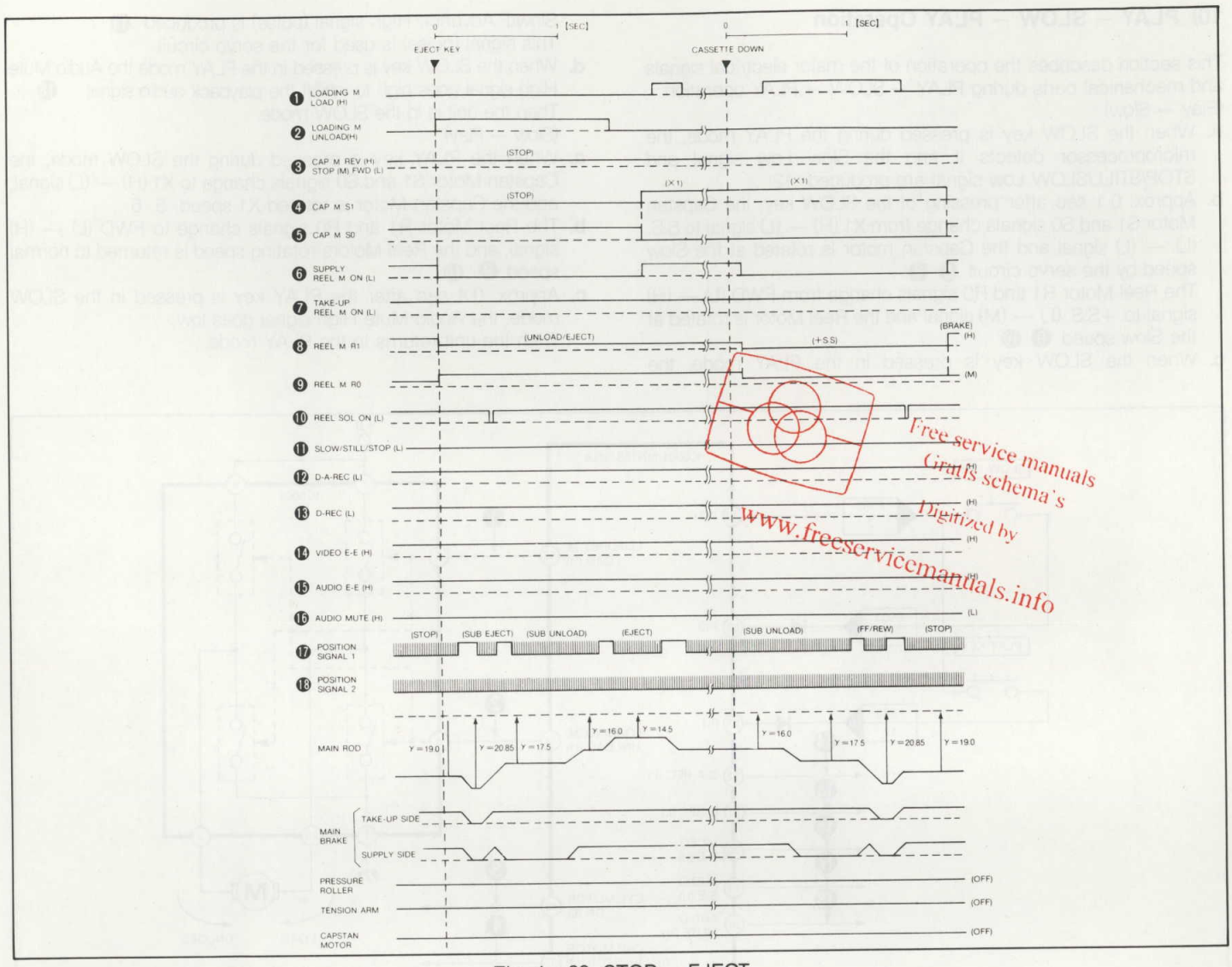


Fig. 4—86 STOP → EJECT

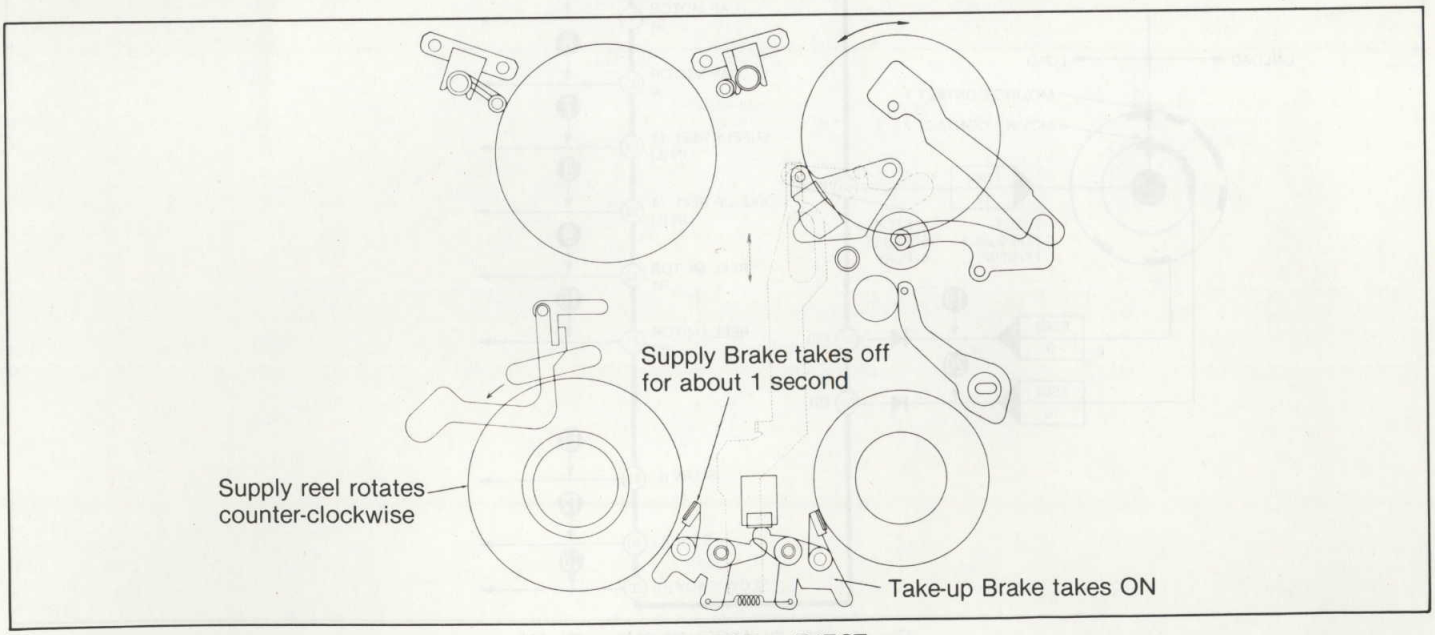


Fig. 4—87 STOP → EJECT

10) PLAY → SLOW → PLAY Operation

This section describes the operation of the major electrical signals and mechanical parts during PLAY → SLOW → PLAY operation.

(Play → Slow)

a. When the SLOW key is pressed during the PLAY mode, the microprocessor detects it and the Slow Low signal and STOP/STILL/SLOW Low signal are produced 12 .

b. Approx. 0.1 sec after pressing of the SLOW key, the Capstan Motor S1 and S0 signals change from X1 (H) — (L) signal to S.S. (L) — (L) signal and the Capstan motor is rotated at the Slow speed by the servo circuit ❺ ❻ .
The Reel Motor R1 and R0 signals change from FWD (L) — (H) signal to +S.S. (L) — (M) signal and the Reel Motor is rotated at the Slow speed ❾ ❿ .

c. When the SLOW key is pressed in the PLAY mode, the Slow/F.Advance High signal (pulse) is produced ⓭ .
This signal (pulse) is used for the servo circuit.

d. When the SLOW key is pressed in the PLAY mode the Audio Mute High signal goes high to inhibit the playback audio signal ⓲ .
Then the unit is in the SLOW mode.

(Slow → Play)

a. When the PLAY key is pressed during the SLOW mode, the Capstan Motor S1 and S0 signals change to X1 (H) — (L) signal, and the Capstan Motor is rotated X1 speed 5 6 .

b. The Reel Motor R1 and R0 signals change to FWD (L) — (H) signal, and the Reel Motors rotating speed is returned to normal speed ❾ ❿ .

c. Approx. 0.4 sec after the PLAY key is pressed in the SLOW mode, the Audio Mute High signal goes low.
Then the unit returns to the PLAY mode.

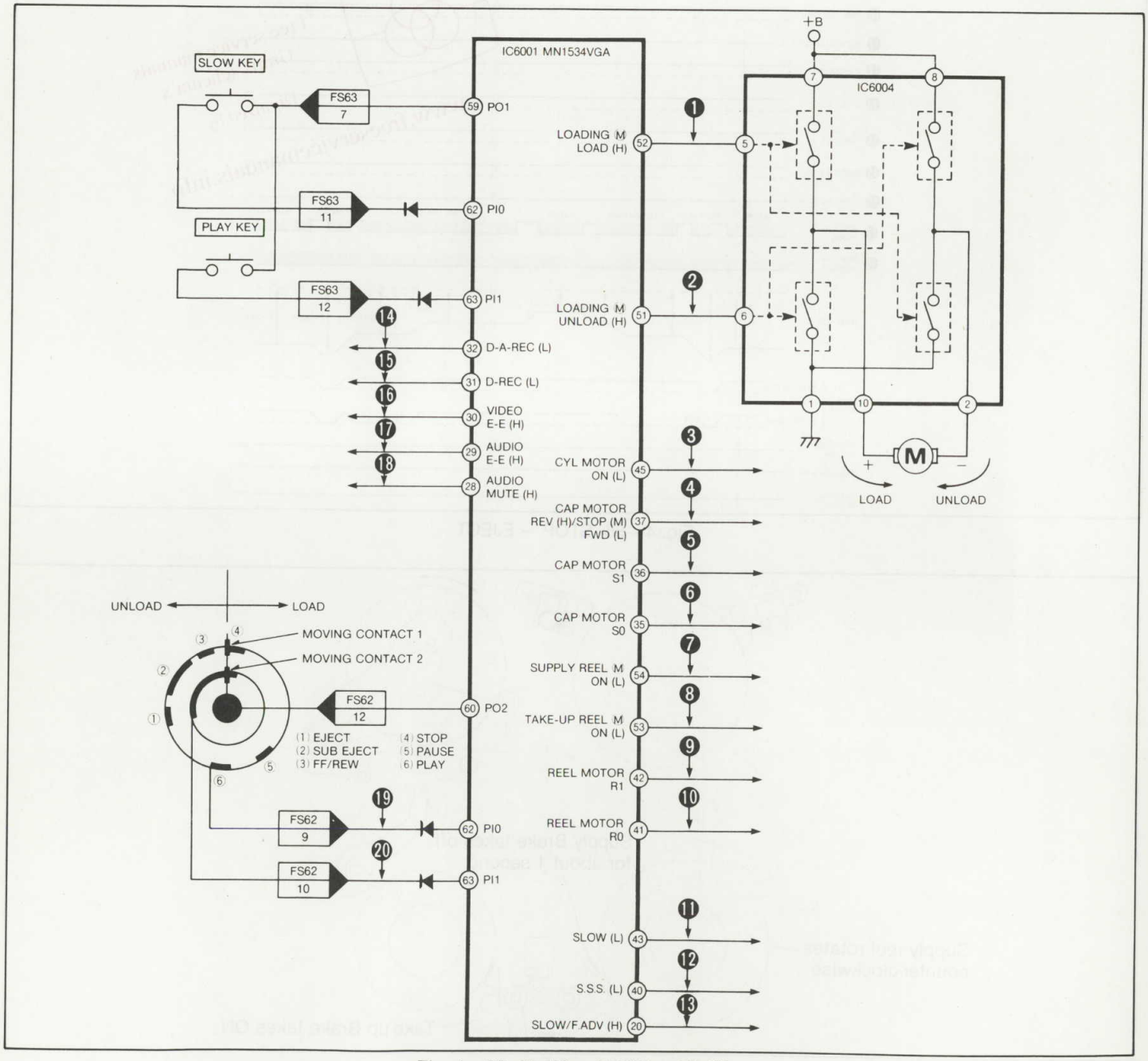


Fig. 4—88 PLAY → SLOW → PLAY

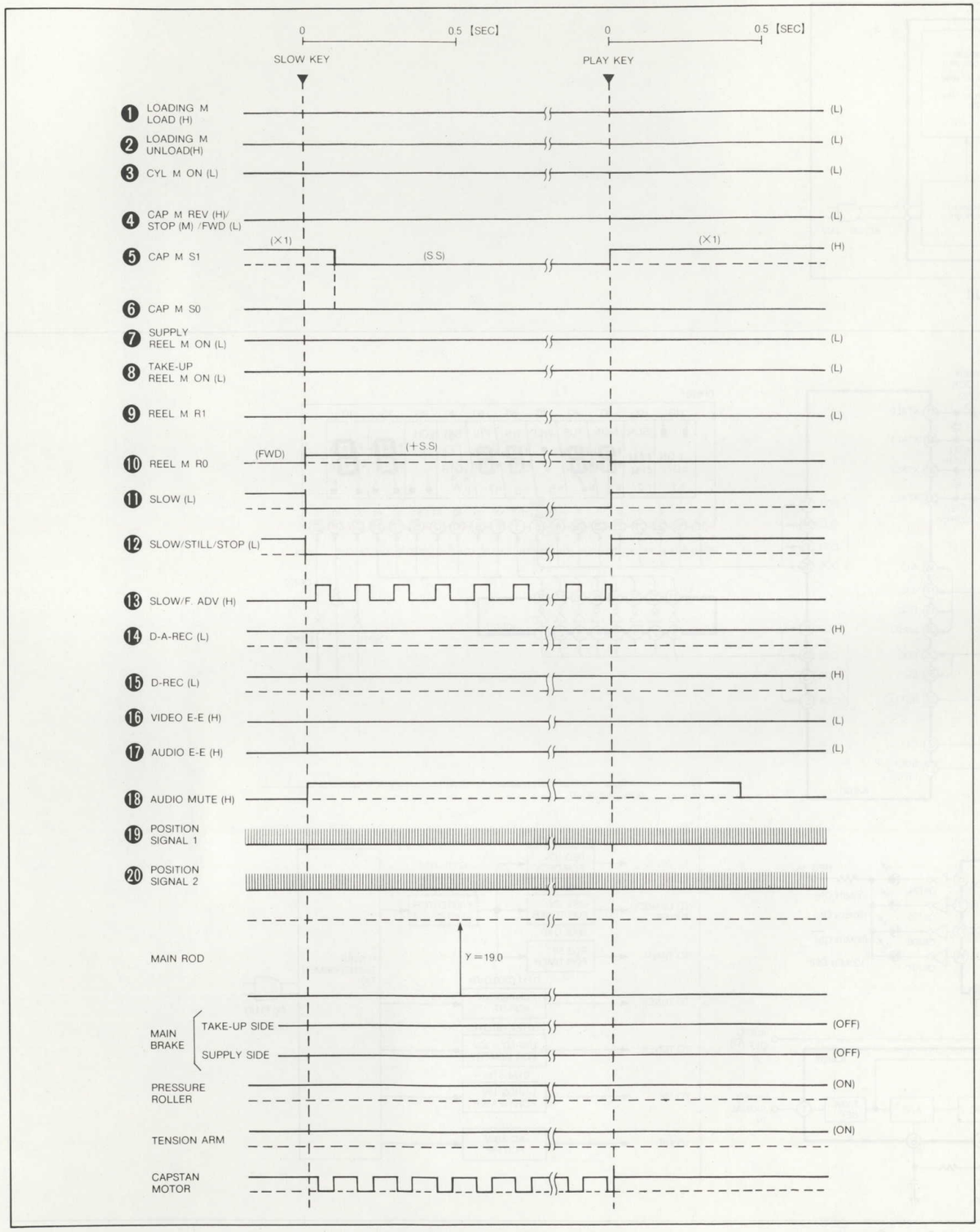


Fig. 4—89 PLAY → SLOW → PLAY

MEMO

5. TUNER CIRCUIT

The simplified block diagram for the Tuner circuit is shown in Fig. 5—1 and a detailed block diagram is shown in Fig. 5—2.
As these block diagrams show, the Tuner circuit consists of three main parts; Programmable Timer circuit (IC6723, Key Matrix circuit and Display circuit), Synthesizer Tuner circuit (IC6723, Key Matrix circuit, Non-volatile Memory circuit, Synthesizer Tuner circuit) and Power circuit.

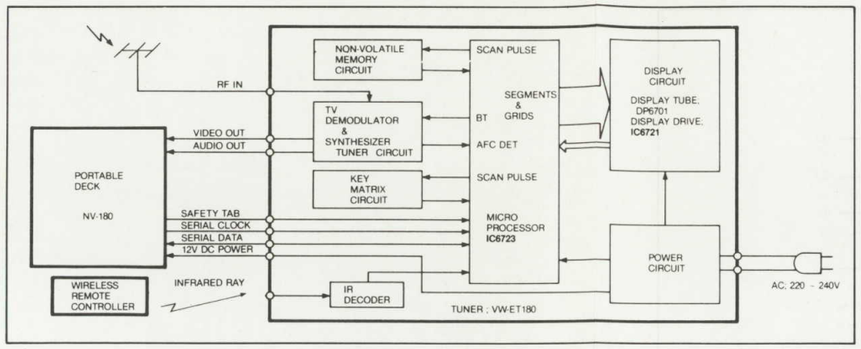


Fig. 5—1 Simplified Block Diagram of Tuner Circuit

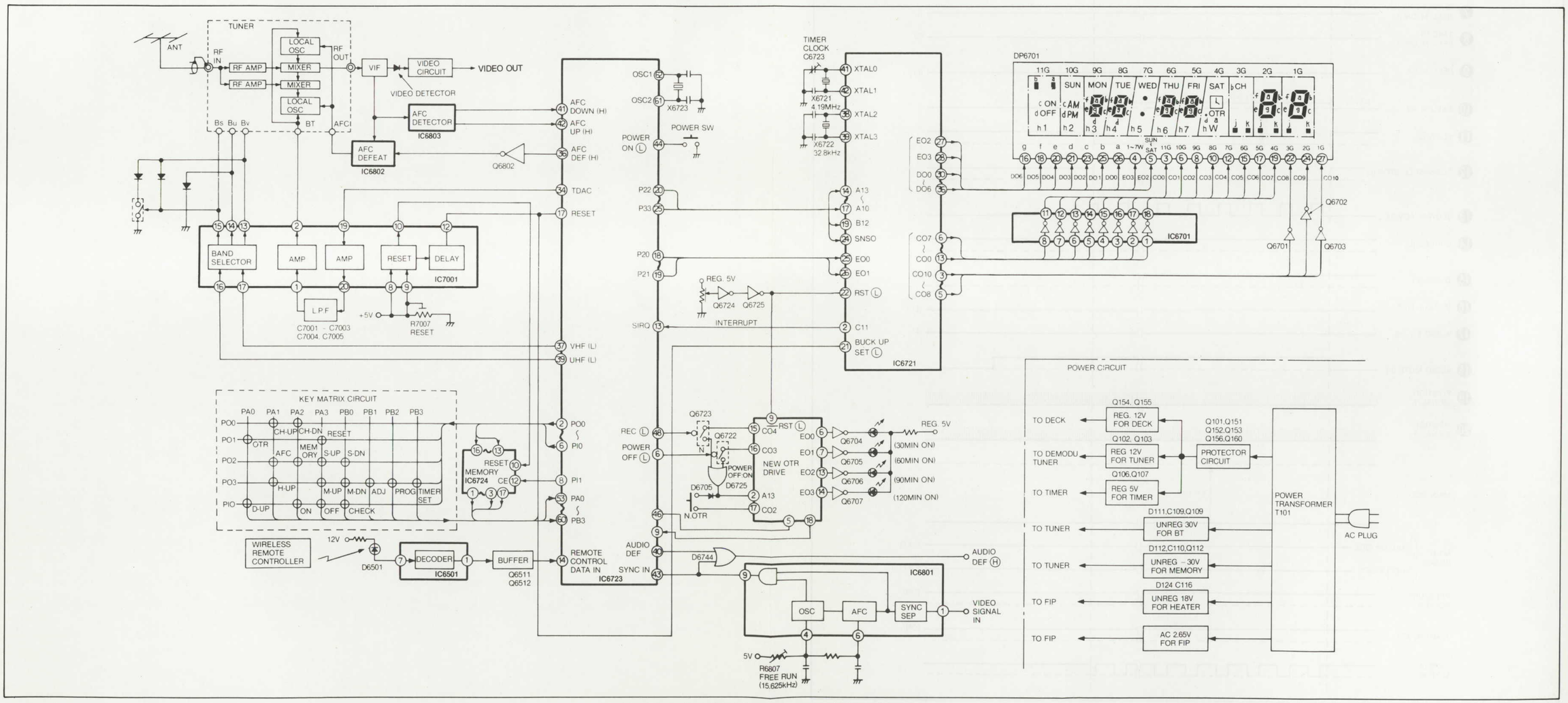


Fig. 5—2 Detailed Block Diagram of Tuner Circuit

5.1 Programmable Timer Circuit

The simplified block diagram for the programmable timer circuit is shown in Fig. 5—3.
This circuit consists of two microprocessors, IC6723 and IC6721.

Microprocessor IC6723 detects the timer key, channel tuning and remote control information.
IC6721 generates the segment and grid signals according to the time count, and the key information from microprocessor IC6723.

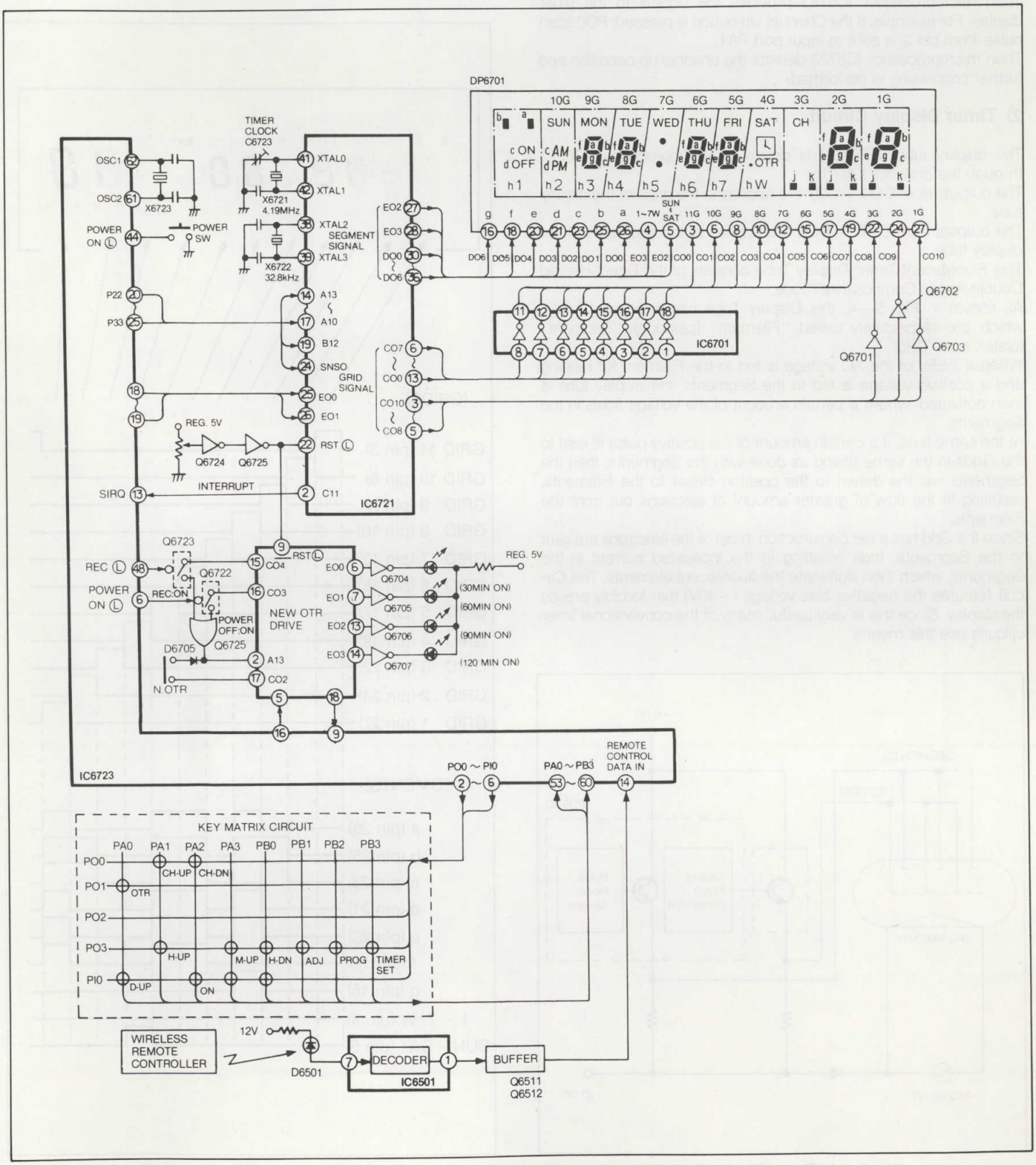


Fig. 5—3 Programmable Timer Block Diagram

1) Timer Operation Switch Circuit

Each of the timer operation switches is connected to input ports PA0 ~ PB3 of microprocessor IC6723.
When one of the operation switches is pressed, the scan pulse is returned to input port PA0 ~ PB3.
Then microprocessor IC6723 provides the signals to the timer display. For example, if the Channel Up button is pressed, PO0 scan pulse from pin 2 is sent to input port PA1.
Then microprocessor IC6723 detects the channel up condition and further processing is performed.

2) Timer Display Circuit

The display tube (DP6701) is driven by microprocessor IC6721 through the drive IC, IC6701.
The outputs from CO0 ~ CO7 are applied to the grids of the display tube.
The outputs from DO0 ~ DO6 are applied to the segments of the display tube.
This Fluorescent Timer Display Tube consists of the Direct-Heated Double-Anode Compositive Triode.
As shown in Fig. 5—4, this Display Tube has three electrodes, which are respectively called "Filament" (cathode), "Segment" (plate), and "Grid".
When a 2.65V of the AC voltage is fed to the Filament for heating and a positive voltage is fed to the Segments, the display tube is then activated, where a certain amount of the voltage flows in the Segments.
At the same time, if a certain amount of the positive pulse is sent to the Grids in the same timing as done with the Segments, then the Segments will the drawn to the position closer to the Filaments, resulting in the flow of greater amount of electrons out from the Filaments.
Since the Grid has a net construction, most of the electrons are sent to the Segments, thus resulting in the increased current in the Segments, which then illuminate the fluorescent elements. This Circuit features the negative bias voltage (−40V) that forcibly erases the display. Since this is very useful, many of the conventional timer circuits use this means.

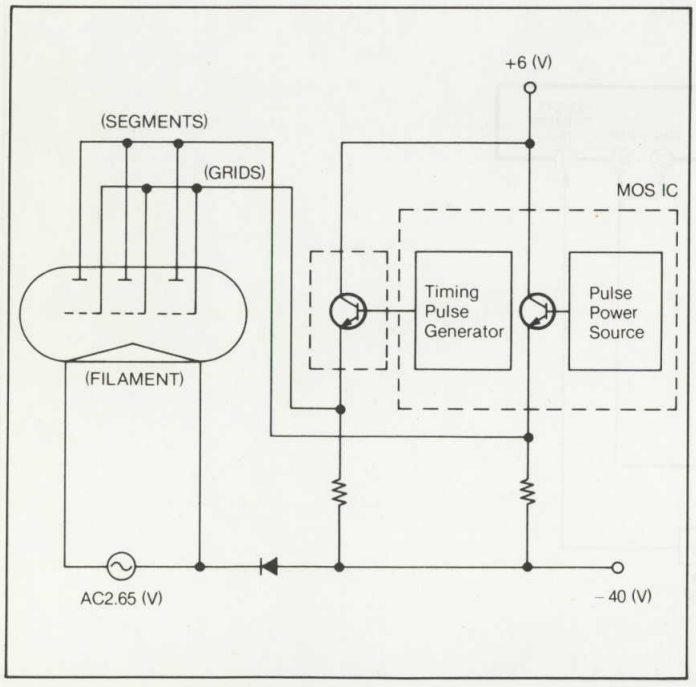


Fig. 5—4 Timer Display Tube

The "High" signal is applied to each grid in sequence, so the segments are illuminated once during 7.813 msec (128kHz). However, the display feels continually for the human eyes. What numbers are illuminated, which depends on the signals from DO0-DO6 ports of the master microprocessor.
The grids of the display tube is shown in Fig. 5—5.

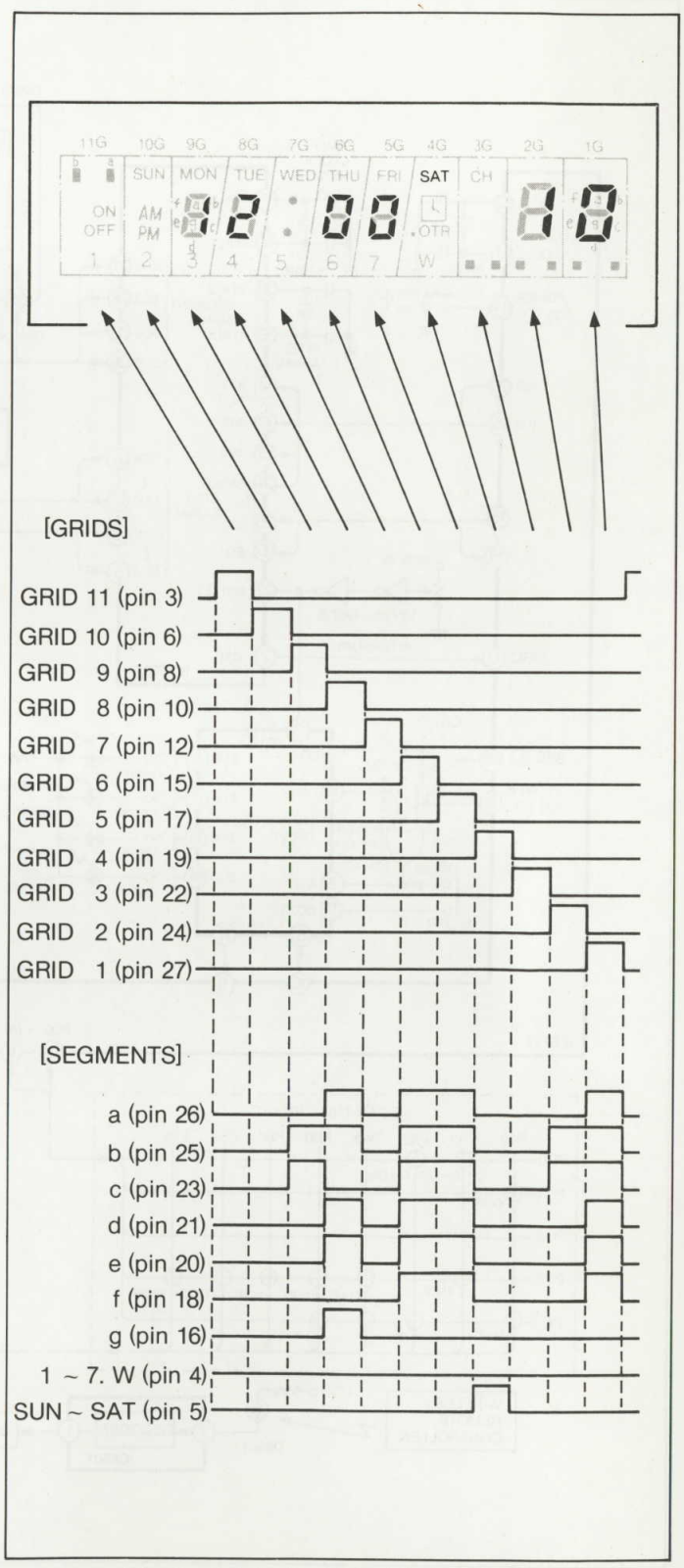


Fig. 5—5 Display Tube Timing Chart

5.2 Synthesizer Tuner Circuit

There are two kinds in the synthesizer systems available; one is the PLL synthesizer and the other the voltage synthesizer. This model uses the voltage synthesizer, and so the description of the PLL synthesizer will be deleted from the present description.
A combination of the voltage synthesizer and Non-volatile memory enables the user to optionally select any of the needed output voltages corresponding to the desired channel by merely operating one volume, and as a result, it has become possible to have the unit memorize any of the channel data needed. Since this method does not necessarily provide the preset volumes corresponding to the numbers of the channels otherwise needed for any of the conventional units, the preset operation can easily be performed using the combination of the voltage synthesizer and non-volatile memory.

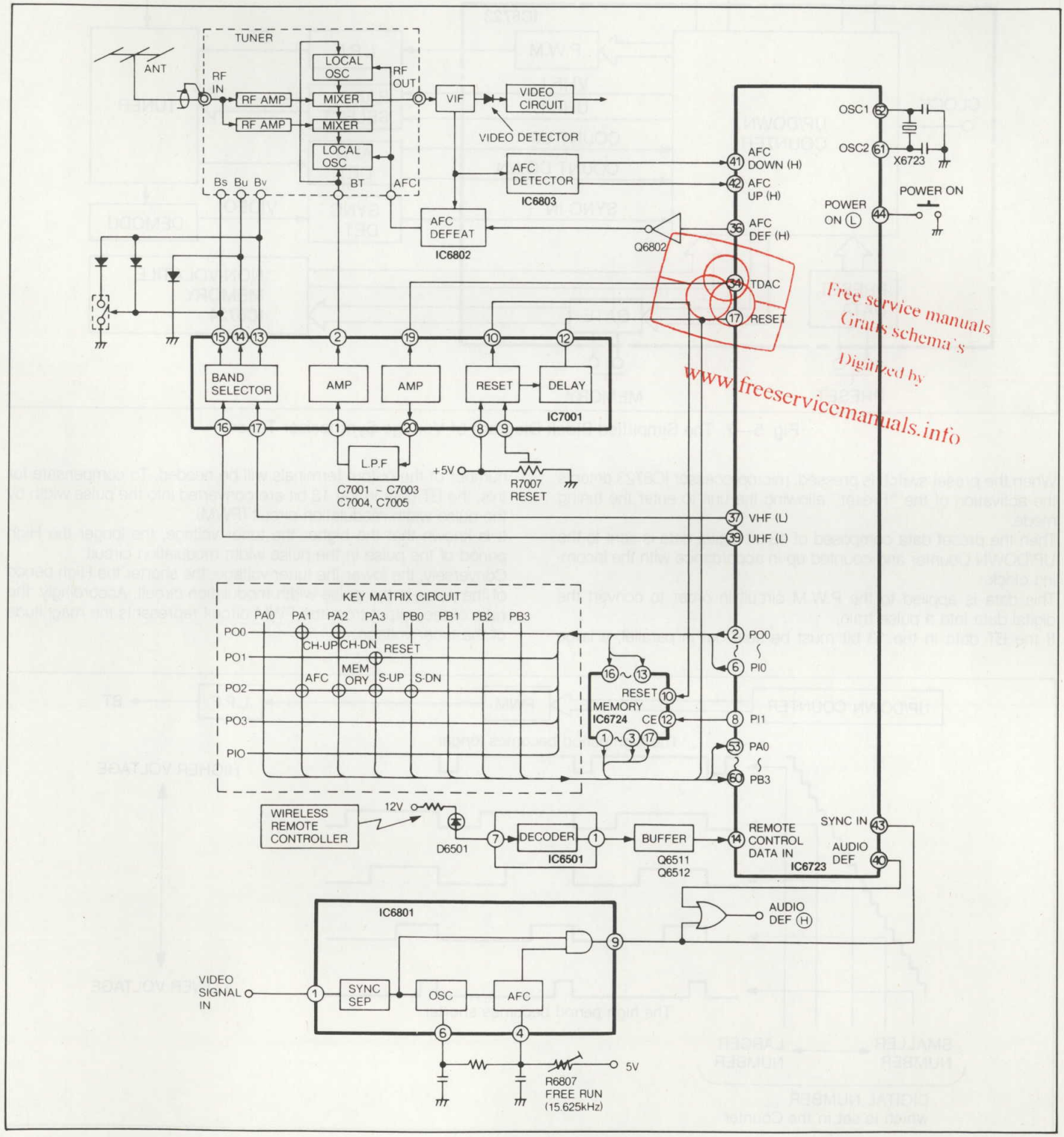


Fig. 5—6 Synthesizer Tuner Block Diagram

1) Tuner Setting

The simplified block diagram for the synthesizer tuner is shown in Fig. 5—7.

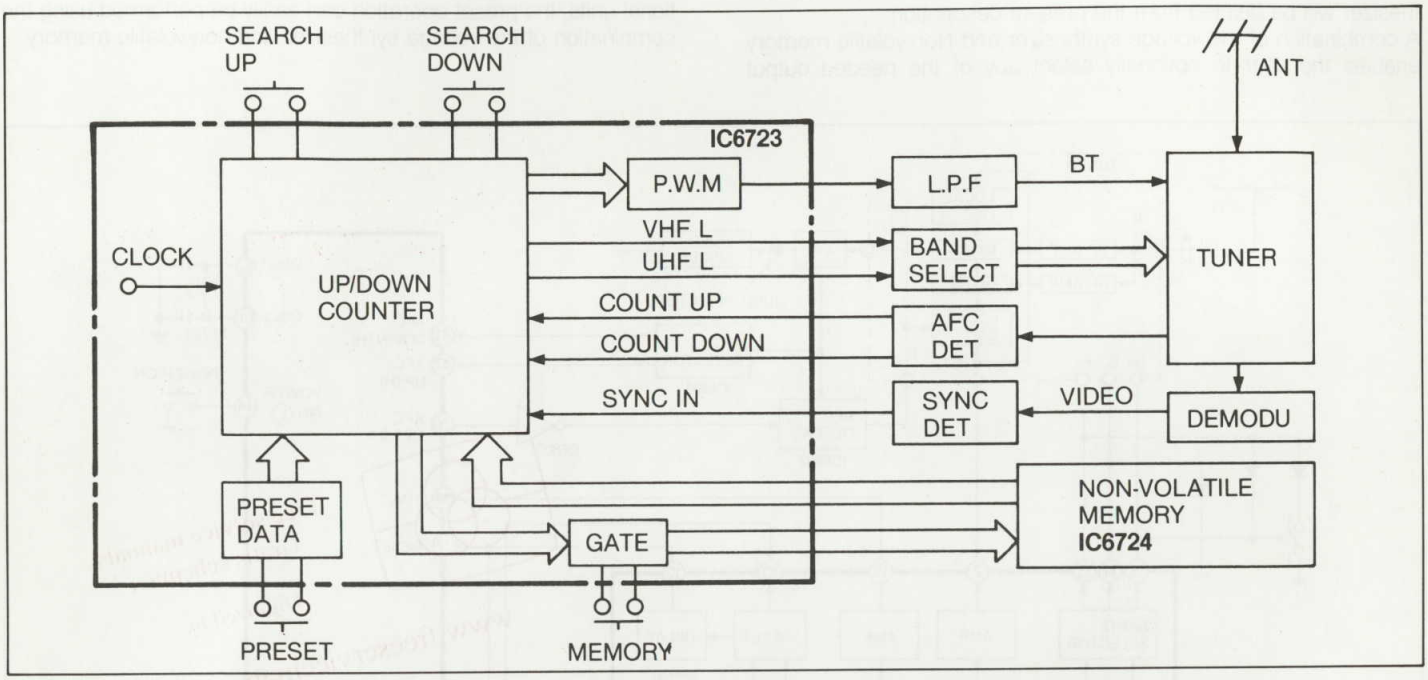


Fig. 5—7 The Simplified Block Diagram of Voltage Synthesizer Tuner

When the preset switch is pressed, microprocessor IC6723 detects the activation of the "Preset" allowing the unit to enter the tuning mode.
Then the preset data composed of 13 bit digital data is sent to the UP/DOWN Counter and counted up in accordance with the incoming clock.
This data is applied to the P.W.M circuit in order to convert the digital data into a pulse train.
If the BT data in the 13 bit must be sent out in parallel, a large number of the output terminals will be needed. To compensate for this, the BT data in the 13 bit are converted into the pulse width by the pulse width modulation circuit (PWM).
It is known that the higher the tuner voltage, the longer the High period of the pulse in the pulse width modulation circuit.
Conversely, the lower the tuner voltage, the shorter the High period of the pulse in the pulse width modulation circuit. Accordingly, the ratio of the output from the PWM circuit represents the magnitude of the tuner voltage.

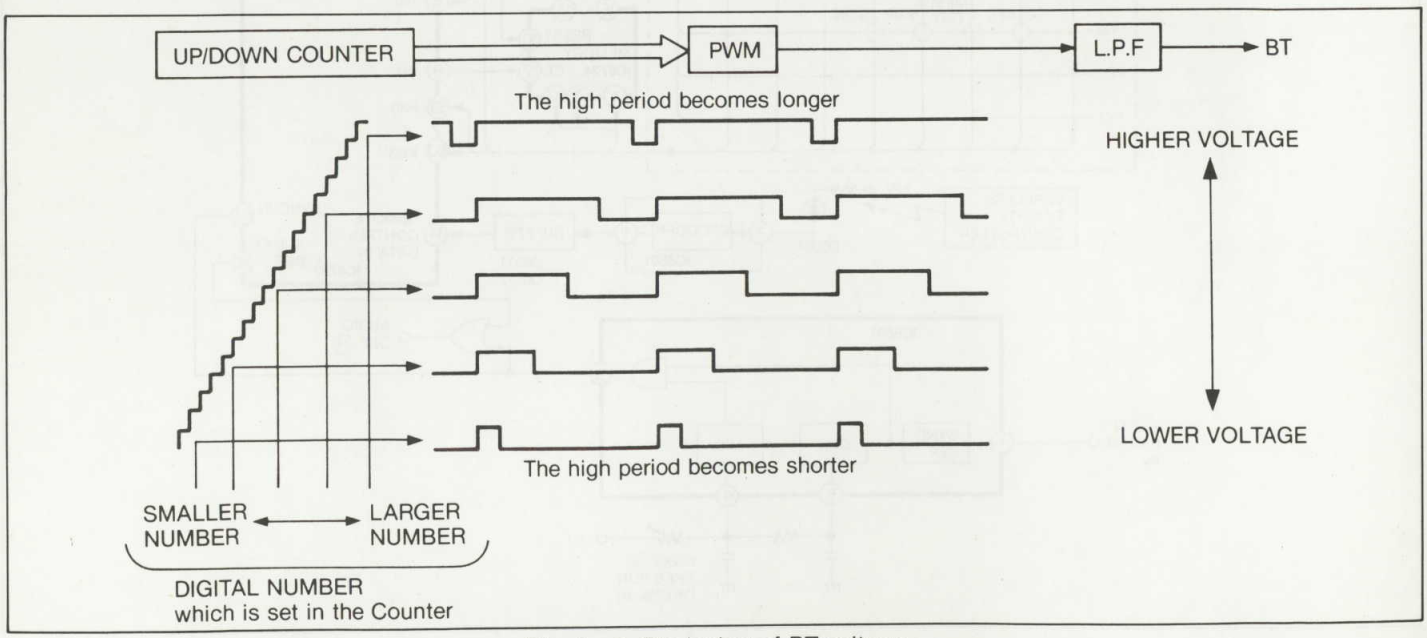


Fig. 5—8 Producing of BT voltage

sent to L.P.F in order C voltage as the BT signal which is applied to in Tuner circuit.

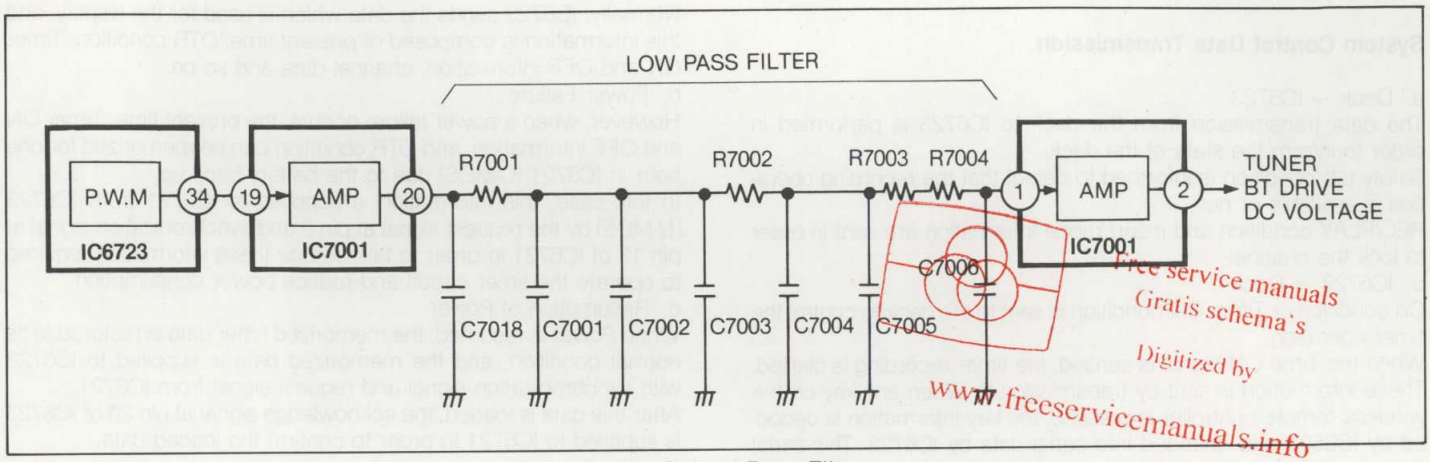


Fig. 5—9 Low Pass Filter

If a specific channel is tuned, the sync detector is able to extract the sync signal from the tuned video signal. This sync signal, which indicates proper tuning, is finally supplied to the UP/DOWN Counter to stop the frequency search.
Therefore, this synthesizer circuit can tune a specific channel automatically.
Then if the search up button is pressed, the counter counts up till the next channel to be tuned and is stopped by the next tuned sync signal.
Besides the above, if the "Memory" key is pressed, the gate allows the data to pass which is set on the UP/DOWN Counter to the Memory IC, IC6724, and memorized.
Thus the desired channels are tuned automatically and registrated in the "Non-volatile Memory".

2) Channel Selection

If the appropriate channel is selected, the B.T data which is memorized in the non-volatile memory IC, IC6724, is sent to the P.W.M circuit through the UP/DOWN Counter. Actually, the clock pulse is not applied to the counter, so the counting operation is not performed.
Then the P.W.M circuit produces a specific pulse corresponding to the memorized number, and is converted into a D.C. voltage as a BT voltage in order to control the Local Oscillator.
Therefore the Tuner circuit roughly tunes the specified canvel which is memorized in the Non-volatile memory.
For precise tuning, the AFC signal finely controls the Local frequency.

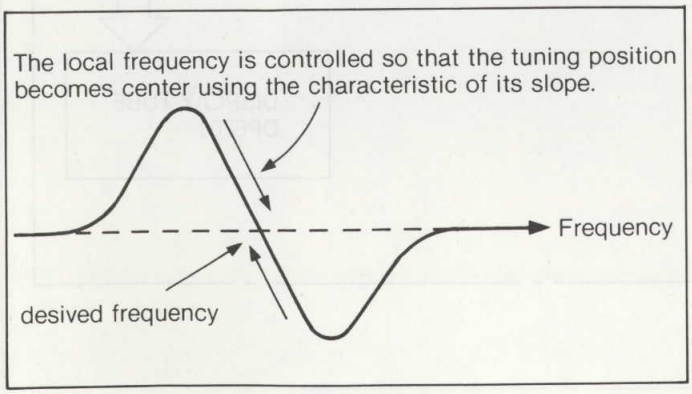


Fig. 5—10 AFC Tuning

3) Memory

All the tuner BT voltage data will be written in IC6724, a 256 bit N-MOS non-volatile memory. The non-volatile memory itself is an IC which inhibits either erasing or rewriting operation unless rewriting is electrically performed. When the terminal of IC6724-pin 10 becomes High, all the internal operations of IC6724 are reset, inhibiting all external instructions.
Conversely, when the RESET terminal becomes Low, all operations can be performed in IC6724.
The tuner BT voltage data can be written in the non-volatile memory only when the RESET terminal remains Low. When the RESET terminal is Low, a pulse out from the microprocessor IC6723-pin 8 is sent to the CE (Chip Enable) terminal. Then, using the edge portion of the pulse, both the RAM address data and tuner BT voltage data are sequentially sent from IC6723-pins 2 through to IC6724-pins 13 through 16.

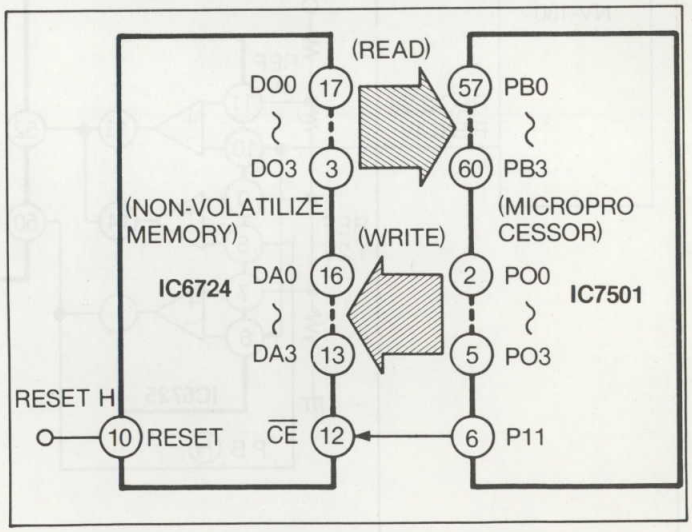


Fig. 5—11 Tuner BT Data Transmission Circuit

4) Data Transmission

Many kinds of data transmissions are performed as shown below.

System Control Data Transmission

a. Deck → IC6723
The data transmission from the deck to IC6723 is performed in order to inform the state of the deck.
Safety tab condition is informed to detect that the recording operation is available or not.
REC/PLAY condition and Insert mode information are sent in order to lock the channel.
b. IC6723 → Deck
On condition or Timer Set condition is sent to the deck to control the timer operation.
When the Time ON signal is sensed, the timer recording is started. These information is sent by transmission 2. When any key on the wireless remote controller is pressed, the key information is decoded by IC6501 and changed into serial data by IC6723. This serial data is applied to the deck by transmission 2.

Timer Data Transmission

a. Normal Case
Normally, IC6723 sends the data which is used for the display, and this information is composed of present time, OTR condition, Timer ON and OFF information, channel data and so on.
b. Power Failure
However, when a power failure occurs, the present time. Timer ON and OFF information, and OTR condition can be memorized for one hour in IC6721 (C-MOS) due to the battery back up.
In this case, this information is supplied to IC6721 from IC6723 (N-MOS) by the request signal at pin 2 and synchronization signal at pin 13 of IC6721 in order to take refuge these information required to operate the timer circuit and reduce power consumption.
c. Resumption of Power
When Power is resumed, the memorized timer data is restored to its normal condition, and the memorized data is supplied to IC6723 with synchronization signal and request signal from IC6721.
After this data is loaded, the acknowledge signal at pin 20 of IC6723 is supplied to IC6721 in order to confirm the loaded data.

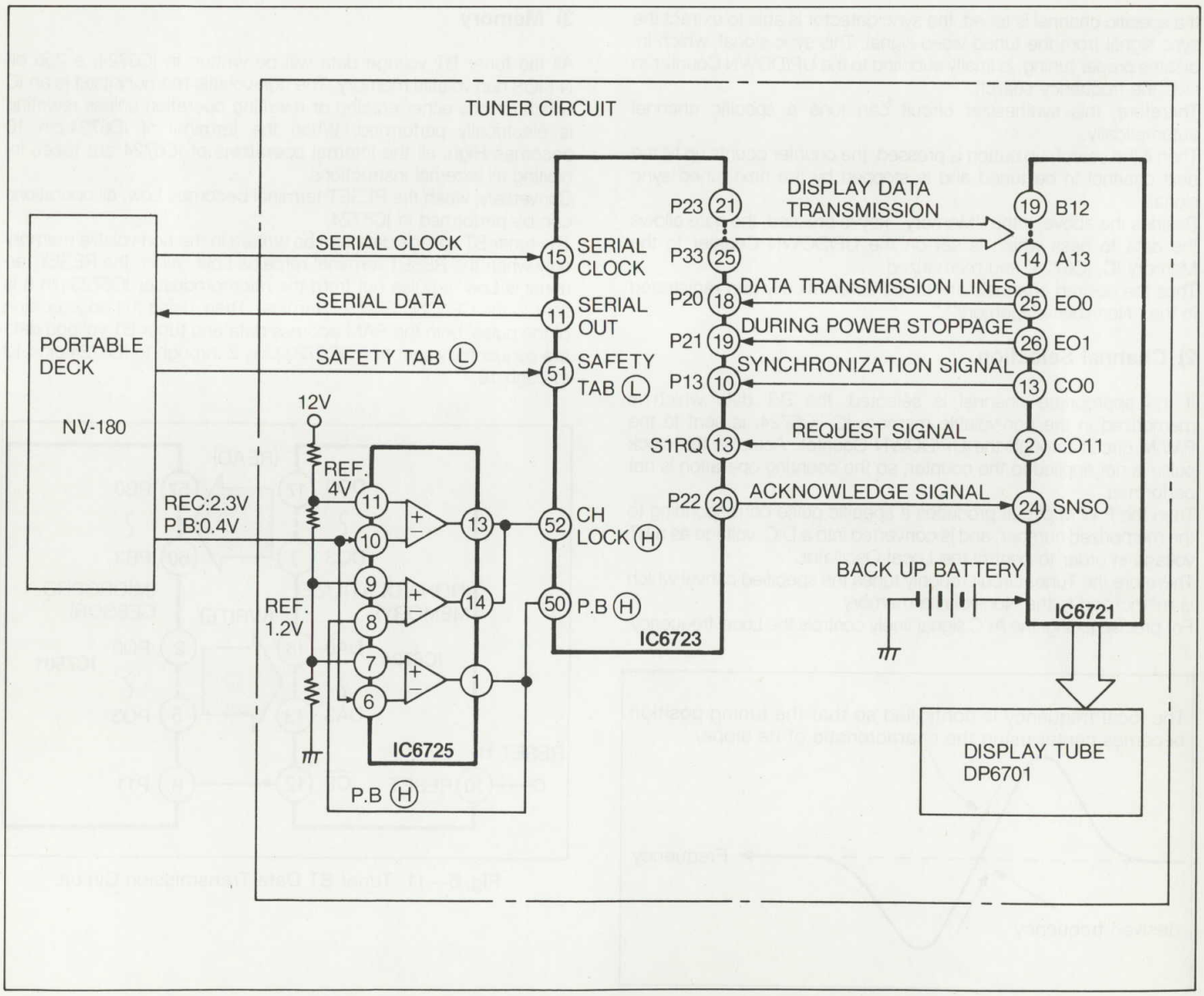


Fig. 5—12 Data Transmission

6. AC Adaptor

This AC Adaptor employs a switching regulator to supply a stable +12V to the VCR.
It also has a battery charge function.
The simplified Block Diagram is shown Fig. 6—1.

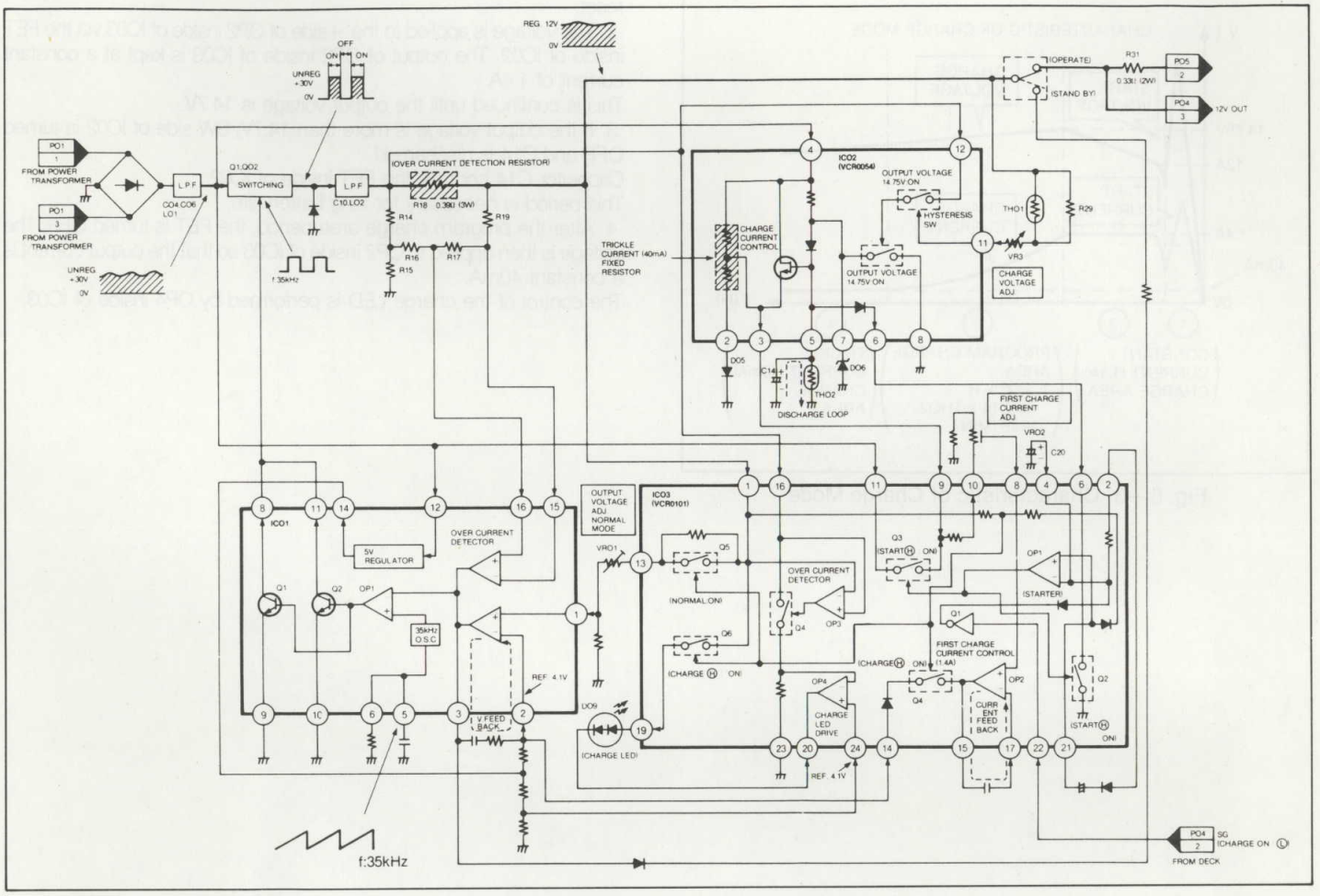


Fig. 6—1 Simplified Block Diagram of AC Adaptor

6.1 Switching Regulator Circuit

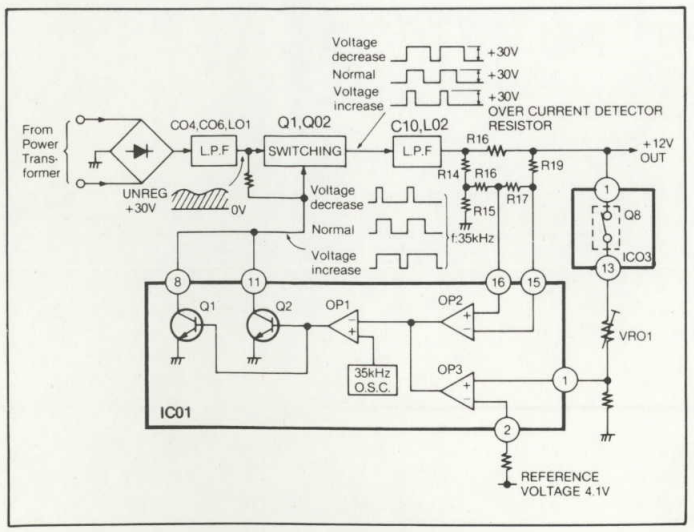


Fig. 6—2 Regulator Circuit

The simplified Switching Regulator Circuit is shown in Fig. 6—2.

The +30V UNREG signal which is smoothed by L.P.F (C04, C06, L01) is sent to the switching circuit (Q1, Q2)
And the output of the switching circuit is converted to a 35kHz/+30V UNREG signal.
This signal is smoothed by L.P.F Cl0, L02 and converted to a +12V REG signal.
If +12V out is increased, the output of OP3 is increased. Therefore, the duty of the OP1 output is changed so that the positive pulse is decreased.
Out of IC01-8, 11 the Pulse is changed so that the positive Pulse is increased, therefore, the +12V out is decreased.
The converse is also true.
If a current of more than 3A flows through R16, OP2 inside of IC01 is turned ON and the pulse is not sent to the switching circuit, therefore, +12V is cut.

6.2 Charge mode

Characteristic of the charge mode is shown in Fig. 6—3.

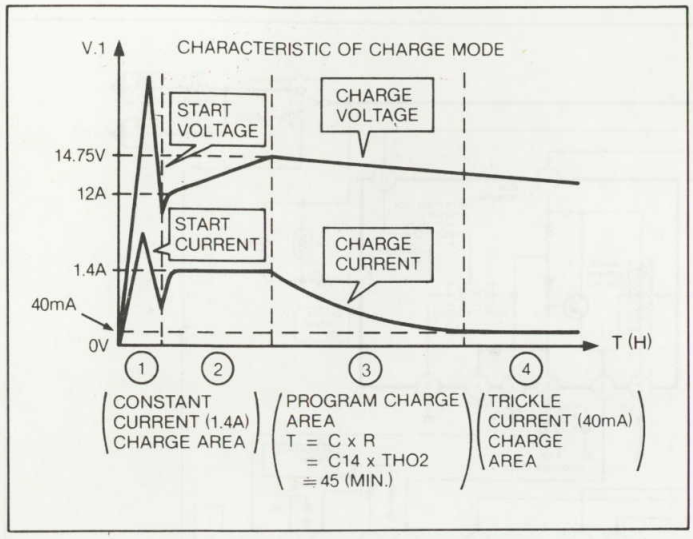


Fig. 6—3 Characteristic of Charge Mode

1 When a battery is inserted into the AC Adaptor during the charge mode, a certain voltage is applied to battery.
A Charge ON signal is applied to Q1 inside of IC03 and inverted.
During this time, a Positive Pulse is generated from OP1 to charge C20.
Due to this pulse, a certain voltage is applied to the battery, and C14 is reset.

2 The voltage is applied to the +side of OP2 inside of IC03 via the FET inside of IC02. The output of OP2 inside of IC03 is kept at a constant current of 1.4A.
This is continued until the output voltage is 14.7V.

3 If the output voltage is more than 14.7V, SW side of IC02 is turned OFF and C14 is discharged.
Capacitor C14 controls the FET inside of IC02.
This period is necessary for long battery life.

4 After the program charge area period, the FET is turned OFF. The voltage is then applied to OP2 inside of IC03 so that the output current is a constant 40mA.
The control of the charge LED is performed by OP4 inside of IC03.

7. Plug in AC Adaptor

The simplified block diagram is shown in Fig. 7—1.

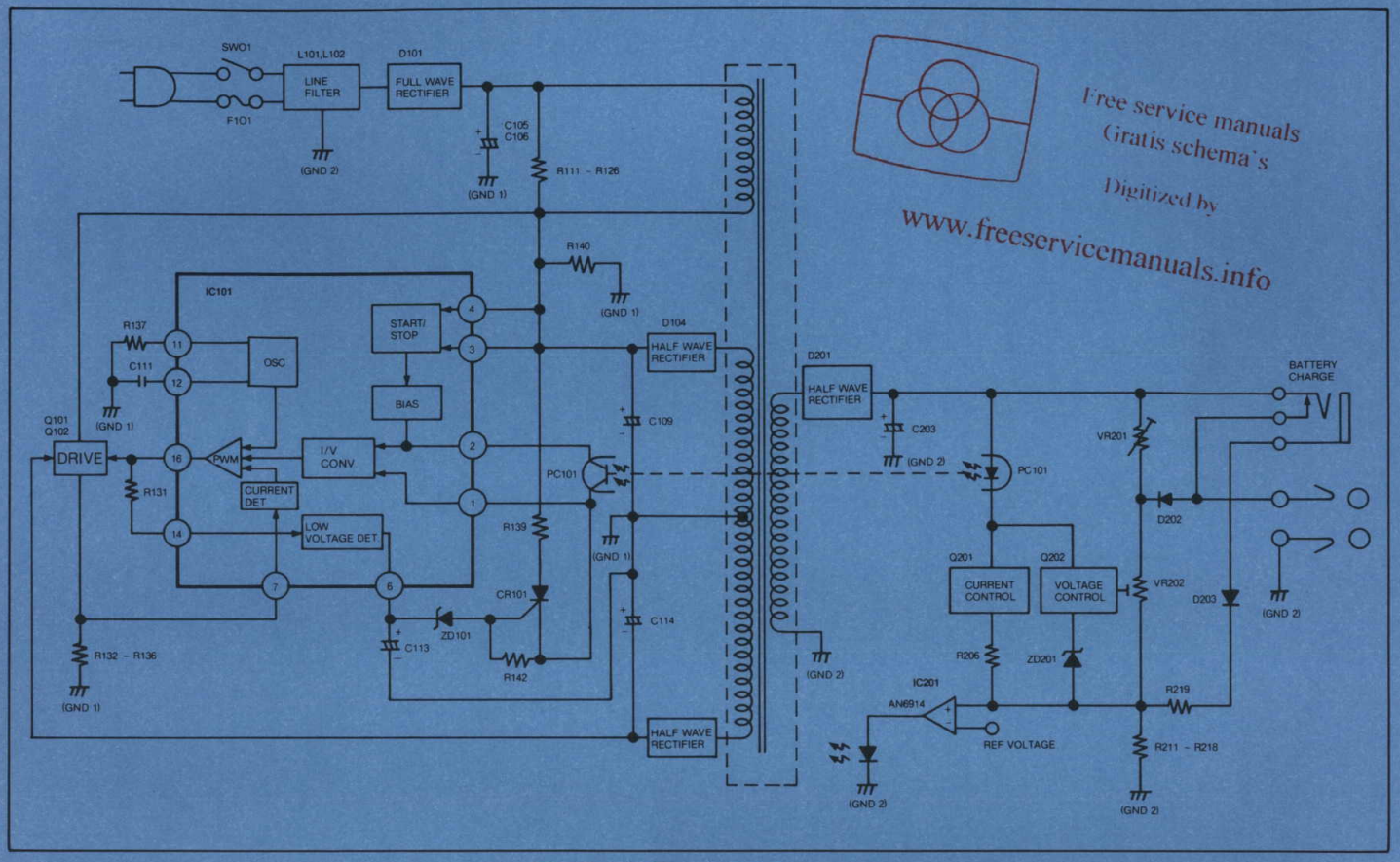


Fig. 7—1 Plug in AC Adaptor

7.1 Switching Regulator

The Input AC voltage is rectified by Line Filter L101, L102, Full wave Rectifier D101 and capacitor C105, C106.
This voltage which is rectified is then changed into a high frequency pulse by IC101.
This signal is rectified by D201, L201, C203 into a stable +12V.
The Output of IC101-16 is a switching pulse which drives Q101, Q102.
If the output of the secondary transformer increases, the collector current of Q202 increases, and the output of photo diode PC101 increases.
Then this output is sent to P101 on the Primary side.
Photo transistor P101 on the Primary side receives the signal and sends the DC signal to I / V CONV. inside of IC101 to compare it with the reference signal.
The pulse width of the output of IC101 is decreased.
Therefore, the output from the secondary side of the transformer is decreased.
The converse is also true.
In such a way, a stable +12V is supplied to VCR.
If an over current occurs due to a short etc, IC101-6 generates a DC voltage, which charges C113.
If the voltage of C113 becomes higher than the voltage of ZD101, CR101 is turned ON.
The bias voltage of IC101 is shorted, so that the operation of IC101 stops and the output of Plug in AC Adaptor becomes "0".

7.2 Charging Operation

The Output operation is the same as the switching regulator operation, but the output voltage is a little higher than that of the regulator. This is determined by VR201.
The Output current of the initial charging operation is limited to 1.0A.
If the output current becomes higher than 1.0A, the base voltage of Q201 is increased and output of photo diode PC101 is increased.
Therefore, the output of IC101 is decreased, and the output voltage is controlled at 1.0A.
The charge lamp LED RD201 is controlled by IC001.
If the output current becomes small, the output of IC201 is OFF and the charge LED is turned off.

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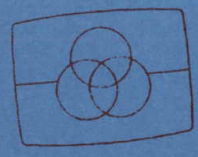

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