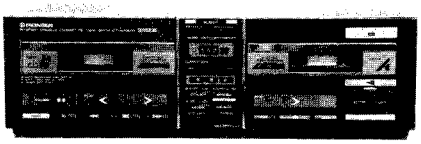
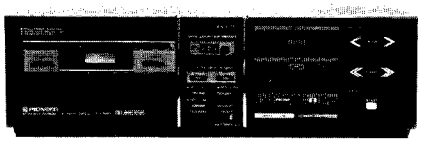
PIONEER®

Service Manual

CIRCUIT & MECHANISM DESCRIPTIONS



• CT-X700W



• CT-X500

STEREO DOUBLE CASSETTE TAPE DECK

CT-X700W

STEREO CASSETTE TAPE DECK

CT-X500

MC-Service

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1. OUTLINE OF TAPE TRANSPORT MECHANISM OPERATION

The tape transport mechanism includes three motors — the main motor for driving the capstans in both directions, the reel motor for driving the reels, and an assist motor for setting the playback, rewind, and other transport modes.

The operations described below apply to the CT-X500 deck and the deck B part (reverse playback and reverse recording function) of the CT-X700W deck. Operation of the deck A part (one-way playback function) of the CT-X700W is based on the same transport mechanism as the CT-X500 and CT-X700W deck B, but is equipped with a fixed playback-only head (that is, it has no head rotation mechanism). Nor is it equipped with a reverse direction capstan or leader tape detector. The tape transport detector mechanism in deck A consists of an LED/phototransistor reel base rotation sensor mounted below the right hand reel base.

The tape transport mechanism can be divided into the following three major sections.

1.1 CAPSTAN DRIVE SYSTEM

The capstan drive system consists of a main belt passed around the forward and reverse direction capstan flywheels in the manner shown in Fig. 1.1. Both capstans are thus driven by the main motor.

1.2 REEL BASE DRIVE SYSTEM

Employing the rotational torque generated in the direction of rotation, the reel drive system drives the take-up reel by coupling either reel drive gear (d) or (e) to F/R gear (b) which can be shifted either left or right, and which is in turn intermeshed with gear (a) mounted on the reel motor shaft.

The rotational direction of the motor is changed by altering the polarity of the applied voltage, while the tape transport speed (that is, the take-up torque during playback and fast forward modes) is changed by altering the level of the voltage applied to the motor.

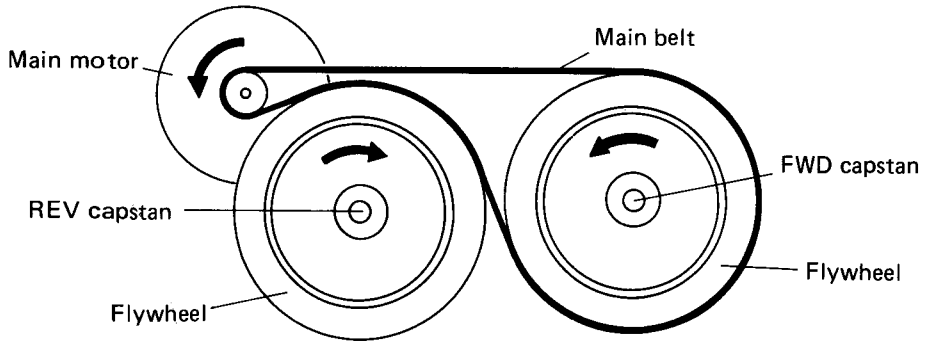


Fig. 1.1 Capstan drive system

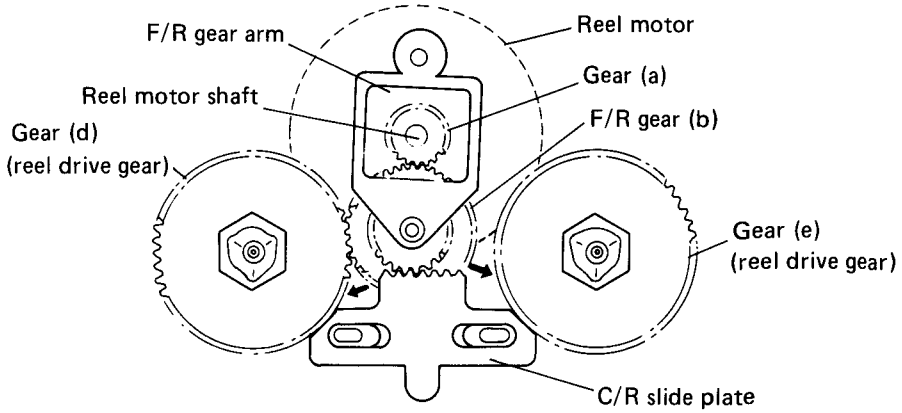


Fig. 1.2 Reel drive system

1.3 MODE CONTROL SYSTEM

The assist gear is driven by the assist motor via a decelerating worm gear. No. 1 cam which controls the rotating head, No. 2 cam which sets the playback, fast forward, music search, and other operational modes, and the three No. 3 cams which control the brake lever are mounted at the bottom of the assist gear. (The three No. 3 cams are cam (a) for cancelling forward playback mode, cam (b) for cancelling reverse playback mode, and cam (c) for cancelling fast forward and rewind modes). Four leaf contacts mounted at the top of the assist gear are designed to make contact with code patterns (see Fig. 1.3) which correspond to the different operational modes. As the assist gear rotates, the relative positions of the leaf switches in respect to the code patterns are varied, thereby resulting in different voltage combinations at the output terminals incorporated in the pattern. In other words, "mode codes" are generated at the terminals and are subsequently passed to a control IC which controls the operation mode by determining whether or not the corresponding assist gear cam has been rotated to the position of the desired operation.

• Stop (forward) mode

The mode control cam drive system as seen from the rear is shown in Fig. 1.4, and the same system as seen from the front is shown in Fig. 1.5.

(1) No. 3 cam (a), (b), and (c) on the assist gear are as shown in the diagram. Since the triangular bulge of the brake lever is moved away from the cam, the tip of the brake lever is engaged with the reel drive gear, thereby applying brake action and preventing the reel drive gear from rotating.

(2) No. 1 cam mounted at the bottom of the assist gear is in the position indicated in the diagram. The switching slide plate is shifted to the left, and the head is set to the position for forward direction recording and playback.

(3) No. 2 cam is in the position shown in the diagram, and the slide base (R) drive hook makes contact with the left hand tip of the cam. As can be seen in Fig. 1.5, the slide base and head base are lowered when this hook is in this position. The head and pinch roller, therefore, are moved back away from the tape.

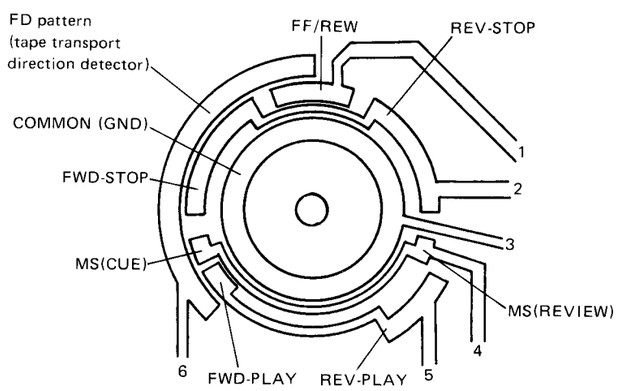


Fig. 1.3 Conductor code pattern

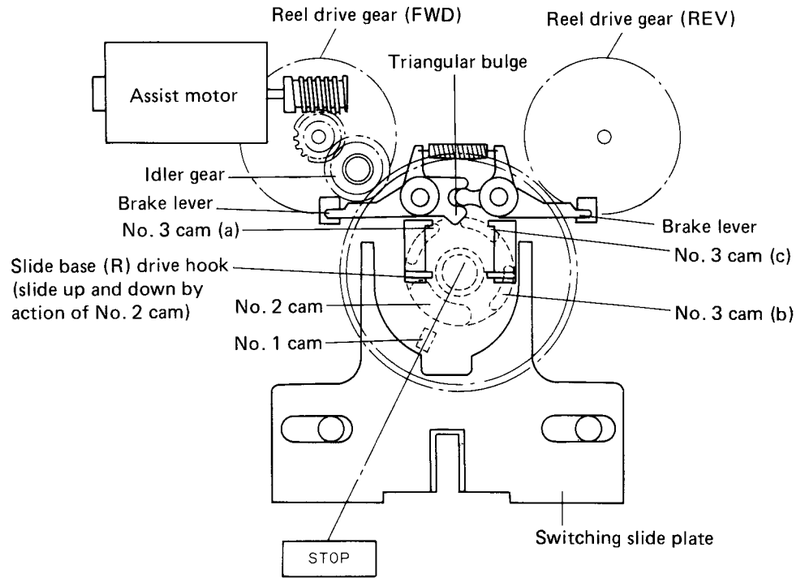


Fig. 1.4 Stop mode (FWD) (view from rear)

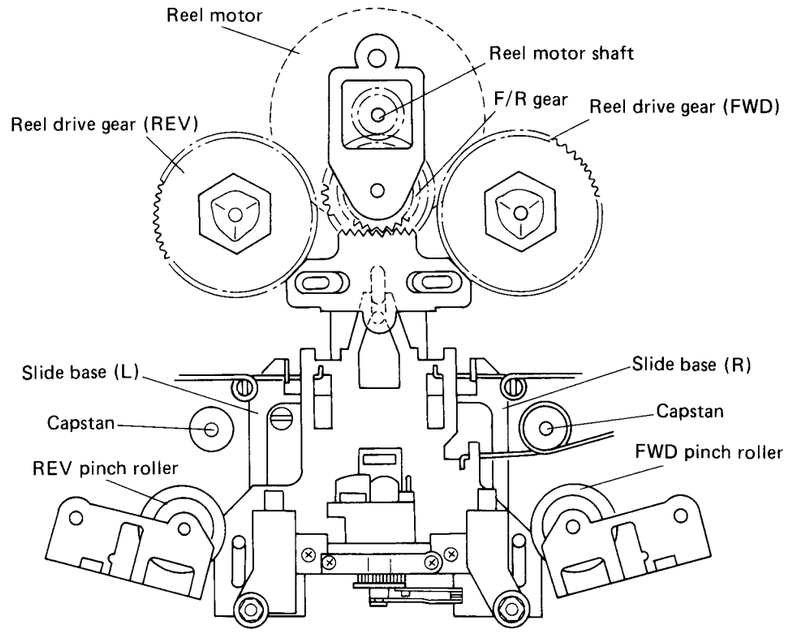


Fig. 1.5 Stop mode (FWD) (view from front)

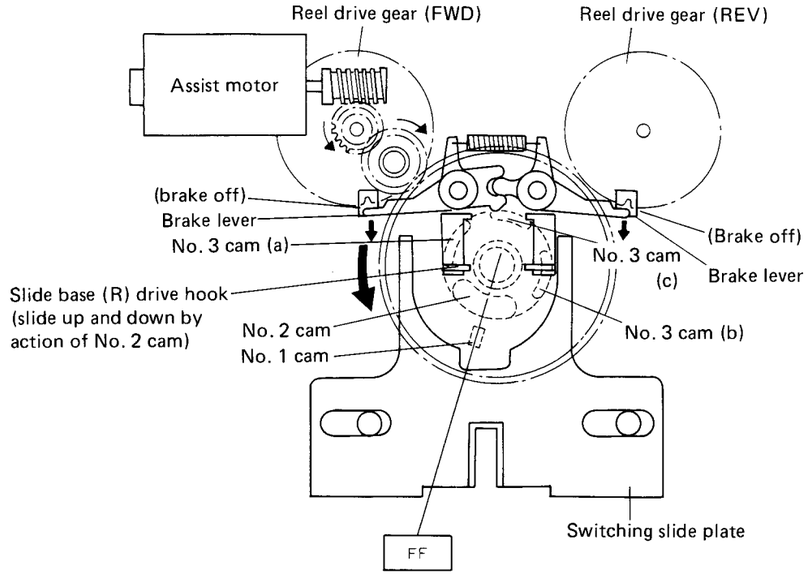


Fig. 1.6 Fast forward mode (view from rear)

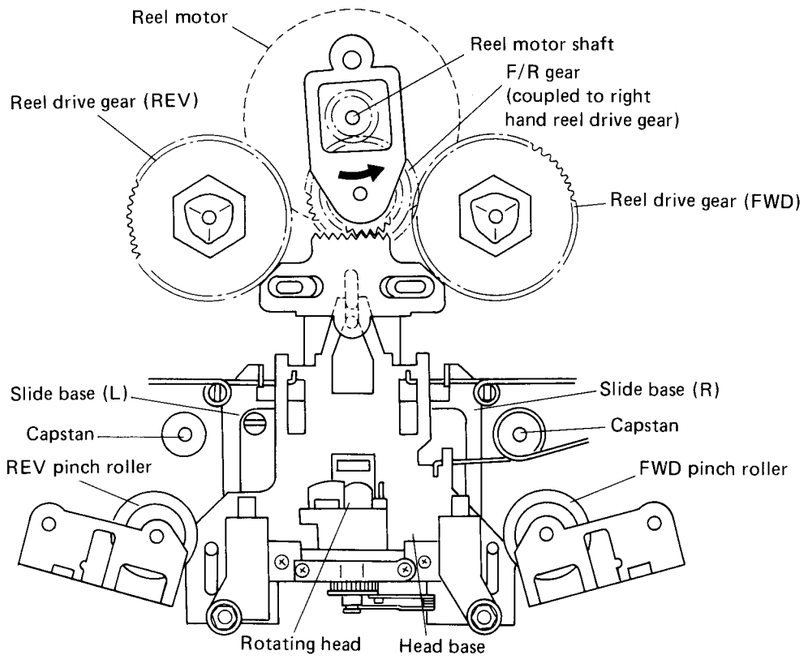


Fig. 1.7 Fast forward mode (view from front)

- **Fast forward mode**

(1) When the FF key is pressed, the control IC instructs the assist motor to drive the assist gear in the direction indicated by the arrow in Fig. 1.6.
(2) As a result, the assist gear No. 3 cam (c) for cancelling fast forward/rewind mode pushes the brake lever triangular bulge upwards. The brake, therefore, is disengaged as indicated in the diagram.
(3) When the assist gear rotates to the position indicated in the diagram, the mode code for fast forward mode is generated by the code pattern (described earlier). This code is detected by the control IC which in turn generates a command to instruct that the voltage applied to the assist motor be switched off. The assist motor is consequently stopped, and fast forward mode is set.
(4) Since No. 2 cam on the assist gear rotates counter clockwise, the drive hook on slide base (R) does not move, and the head and pinch roller remain in the same position (out of contact with the tape).
(5) When the control IC detects fast forward mode, it generates a command to instruct that a high voltage (with polarity corresponding to fast forward mode) be applied to the reel motor, resulting in the motor being rotated at high speed in the forward direction. The F/R gear is swung over to the right by this rotation to engage the right hand reel drive gear, resulting in the tape being wound onto the right hand reel in fast forward mode.

- **Playback mode (FWD)**

(1) When the PLAY key is pressed, the control IC generates a command to instruct that the assist gear be driven in the direction of the arrow shown in Fig. 1.8.
(2) As a result of the assist gear rotation, cam No. 2 pushes the hook of slide base (R) upwards.
(3) When the assist gear reaches the position shown in the diagram, the code pattern generates a mode code corresponding to playback (FWD) mode. And when the control IC subsequently detects that playback (FWD) mode has been set, the assist motor is stopped.
(4) In this cam position:
  (a) The brake is disengaged since No. 3 cam (a) for cancelling forward playback mode is in the non-braking position as indicated in the diagram.
  (b) The pinch roller is moved upwards to make contact with the capstan since the slide base (R) drive hook is shifted to the uppermost position (PLAY) (see Fig. 1.9). The head base is also shifted upwards (by SB spring action), and is subsequently positioned at the "chassis outside" section with the head making contact with the tape.

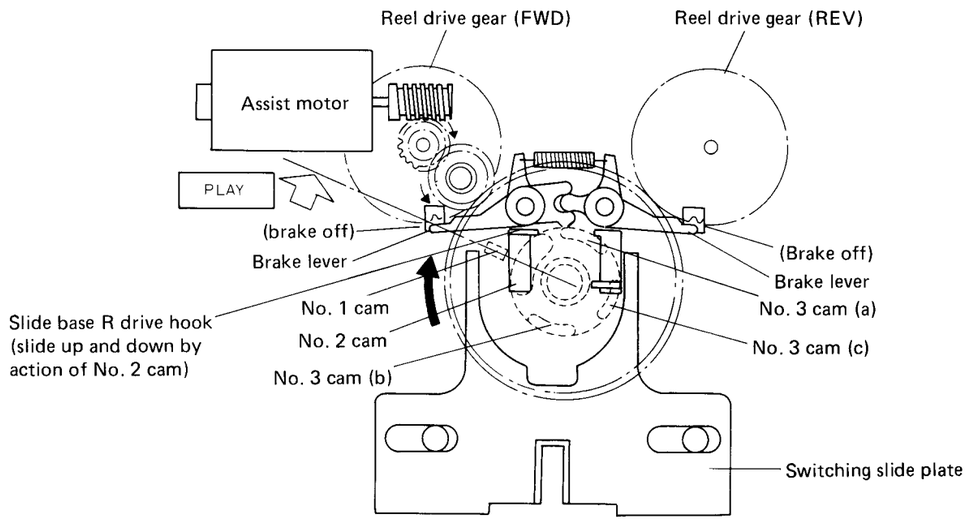


Fig. 1.8 Playback (FWD) mode (view from rear)

(c) The control IC generates a command to specify that the power supply polarity and voltage required for playback (FWD) mode be applied to the reel motor. As a result, the reel motor is rotated in the forward direction upon reception of a voltage corresponding to playback speed. The F/R gear is swung over to the right by this rotation to engage the right hand take-up gear, resulting in the tape being transported in playback mode.

- **Forward music search mode**

(1) When the MS and ►► keys are pressed in stop (FWD) mode the control IC instructs that the assist motor be rotated in the direction which results in the assist gear being rotated clockwise as indicated in Fig. 1.10. During this rotation, the slide base (R) drive hook is pushed upwards by cam No. 2, resulting in the pinch roller and head being shifted upwards.

(2) Since No. 3 cam (a) for cancelling playback (FWD) mode is in contact with the triangular bulge of the brake lever, the brake is switched off.

(3) As soon as the rotating assist gear leaf contact is disconnected from the edge of the stop code pattern, a command instructing the assist motor to rotate in the reverse direction is generated by the control IC. After the assist motor and assist gear rotation is consequently reversed, and the edge of the stop code pattern is detected again, a command instructing the reel motor to rotate at high speed in the forward direction is generated by the control IC.

(4) The F/R gear is swung to the right hand side by the high speed foward rotation of the reel motor, and is consequently engaged with the forward direction take-up reel to commence tape take-up.
Since the head base has been dropped below the playback position by reverse rotation of the assist gear as described in (3) above, the knobs A and B are slipped out of the corresponding holes A' and B' in this condition. (During playback mode, A and B fit into A' and B' respectively to prevent the C/R slide plate from shifting to left or right). The C/R slide plate, therefore, becomes free to move, and is subsequently shifted to the left by reel motor rotational torque.

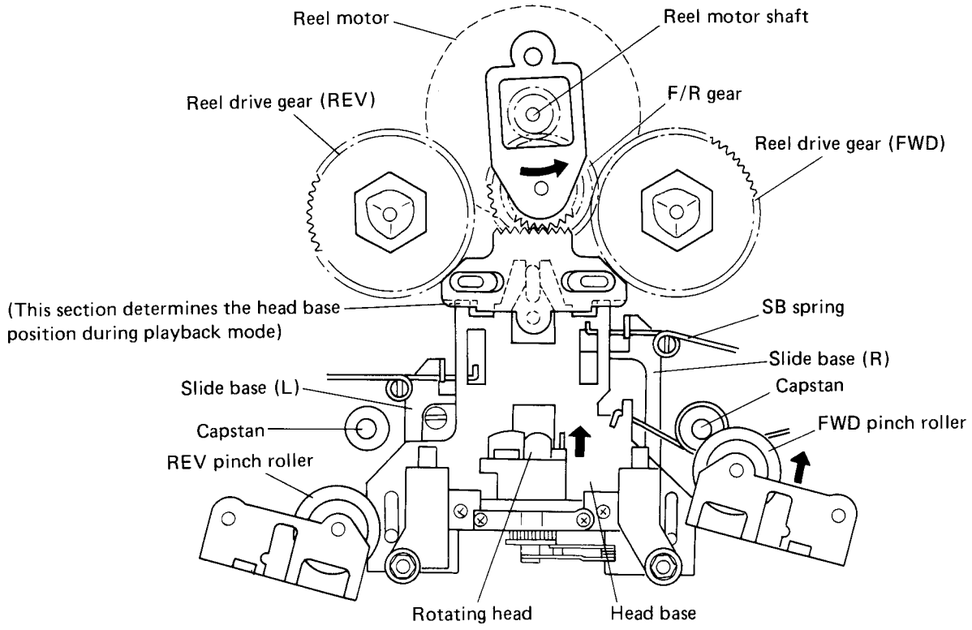


Fig. 1.9 Playback (FWD) mode (view from front)

(5) At the same time that the C/R slide plate is shifted to the left, a pulse voltage is applied to the assist motor to rotate the assist gear clockwise again. As a result, the slide base (R) drive hook and the interlinked head base are again lifted. Since the C/R slide plate knobs A and B have already been shifted to the left, the head base is lifted with the two knobs pressed against positions A'' and B'' — they do not slip back into the holes A' and B'. The FWD music search mode is thereby set.

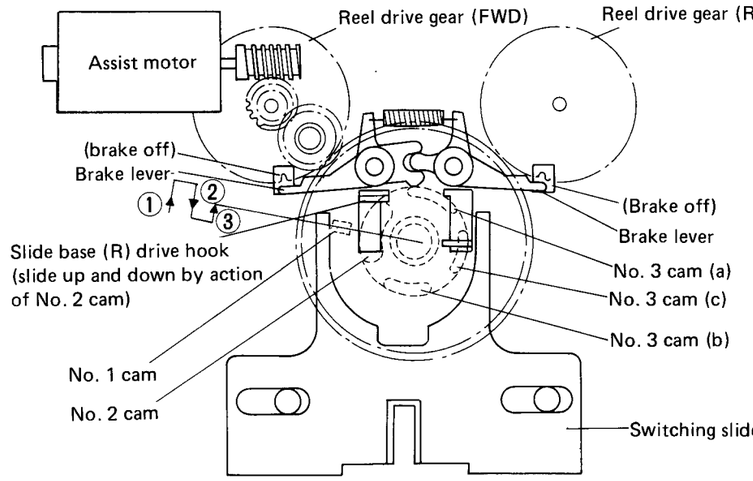


Fig. 1.10 FWD music search mode (view from rear)

(6) In this condition, the pinch roller is separated from the capstan, and the head is in light contact with the tape.
Since the leaf contact detects the MS code pattern, and a command is generated instructing that the voltage applied to the assist motor be stopped, slide base (R) is shifted to a position just slightly above the position where the head base was stopped, thereby pushing the head base up a little further by spring action.

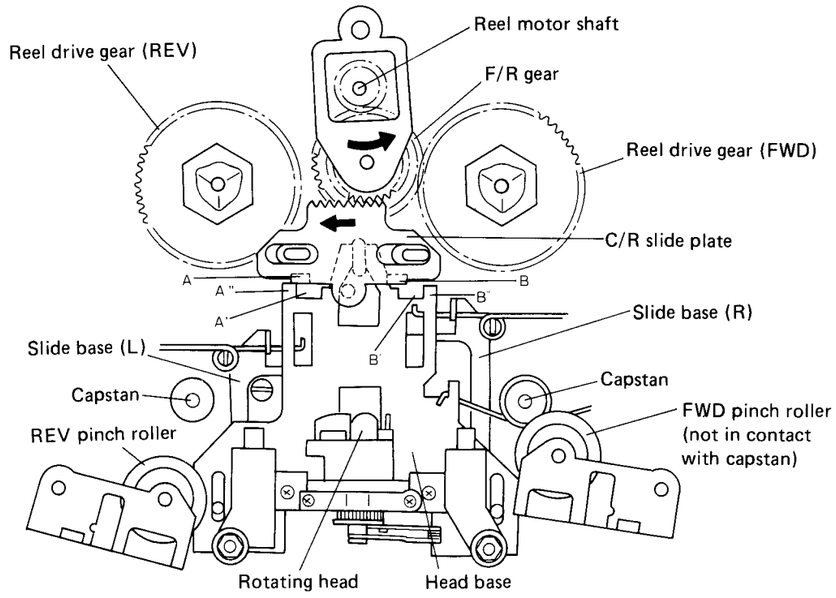


Fig. 1.11 FWD music search mode (view from front)

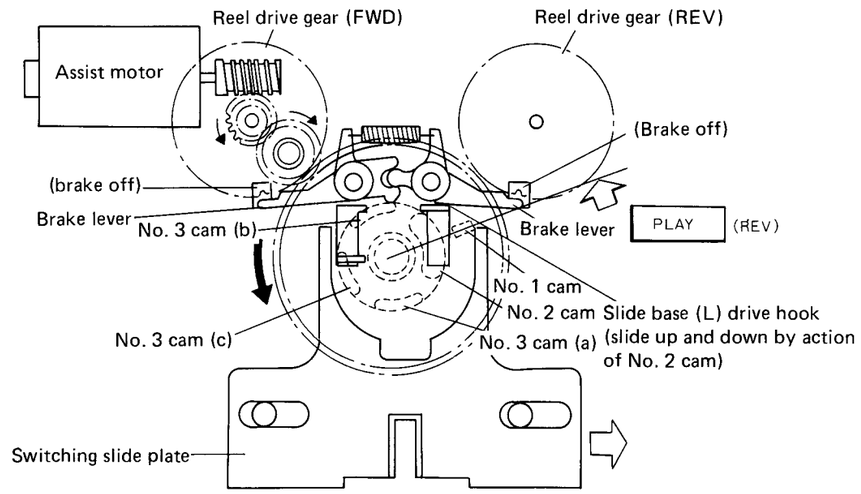


Fig. 1.12 Playback (REV) mode (view from rear)

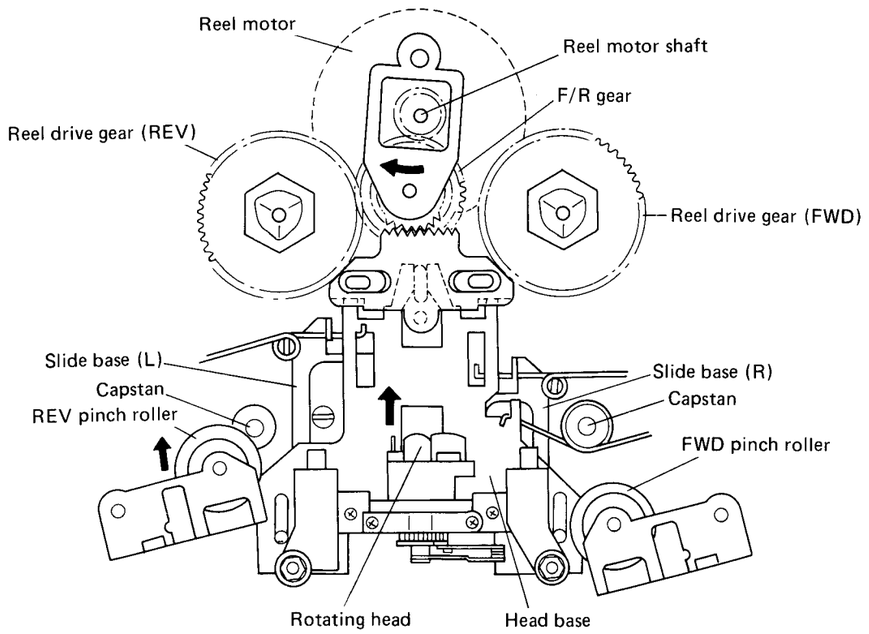


Fig. 1-13 Playback (REV) mode (view from front)

- **Playback (REV) mode**

(1) When the PLAY (REV) key is pressed in FWD stop mode, the control IC instructs the assist motor to rotate in the direction which ensures that the assist gear rotates counter clockwise from the STOP position shown in Fig. 1.4.

(2) No. 1 and No. 2 cams also rotate together with the assist gear. No. 1 cam slides the switching slide plate to the right, thereby turning the rotating head through 180° into position for reverse playback mode. (see "Head Rotation" for further details on actual rotation of the head).

(3) As another result of assist gear rotation, the drive hook of slide base (L) is pushed upwards by No. 2 cam.

(4) When the assit gear reaches the position indicated in Fig. 1.12, the code pattern (described earlier) generates the mode code for playback (REV) mode. And after the setting of this mode has been detected by the control IC, the assist motor is stopped.

(5) In this cam position:

(a) The brake is disengaged since No. 3 cam (b) for cancelling reverse playback mode is in the non-braking position as indicated in Fig. 1.12.

(b) The pinch roller is moved upwards to make contact with the REV capstan since the slide base (L) drive hook is shifted to the uppermost position (PLAY) (see Fig. 1.13). The head base is also pushed upwards by the upward shift of the REV pinch roller and slide base, thereby making contact with the tape.

(c) The control IC generates a command to specify that the power supply polarity and voltage required for playback (REV) mode be applied to the reel motor. As a result, the reel motor is rotated in the reverse direction upon reception of a voltage corresponding to the playback speed. The F/R gear is swung over to the left by this rotation to engage the left hand take-up gear, resulting in the tape being transported in playback (REV) mode.

- **Stop (REV) mode**

(1) If the STOP key is pressed during reverse playback mode, the assist motor is instructed by the control IC to rotate in the direction which ensures that the assist gear rotates clockwise. In addition, the reel motor is stopped.

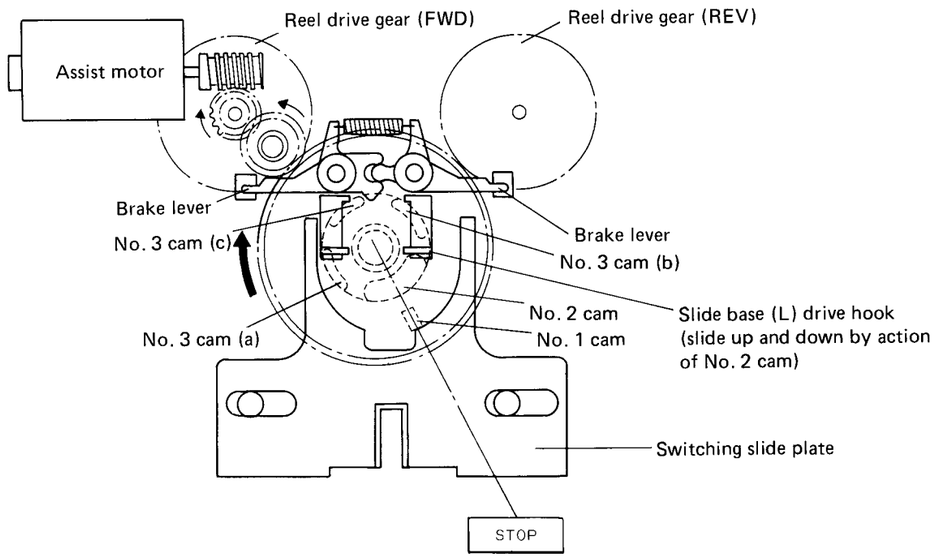


Fig. 1.14 Change from playback to stop (REV) mode (view from rear)

(2) No. 2 cam is also shifted downwards during this assist gear rotation, resulting in the slide base (L) drive hook being lowered. Consequently, the REV pinch roller and head base are lowered, and when the assist gear reaches the STOP position shown in Fig. 1.14, a stop mode code is generated by the code pattern. The assist motor is then stopped by the control IC after the IC receives the stop mode code.

(3) No. 3 cam is also rotated at this time, resulting in the triangular bulge of the brake lever separating from cam (b) (for cancelling reverse playback mode). The reel brake is thus applied and the take-up reel is stopped immediately.

- **Pause mode**

In mechanical terms, pause mode is identical to stop mode and has, therefore, not been described separately.

- **Rewind mode**

(1) When the STOP key is pressed in stop (REV) mode, the assist gear is rotated clockwise to the REW position shown in Fig. 1.15 where the rewind mode code is generated by the mode pattern. The assist motor is stopped by the control IC after the mode code is received by the IC.

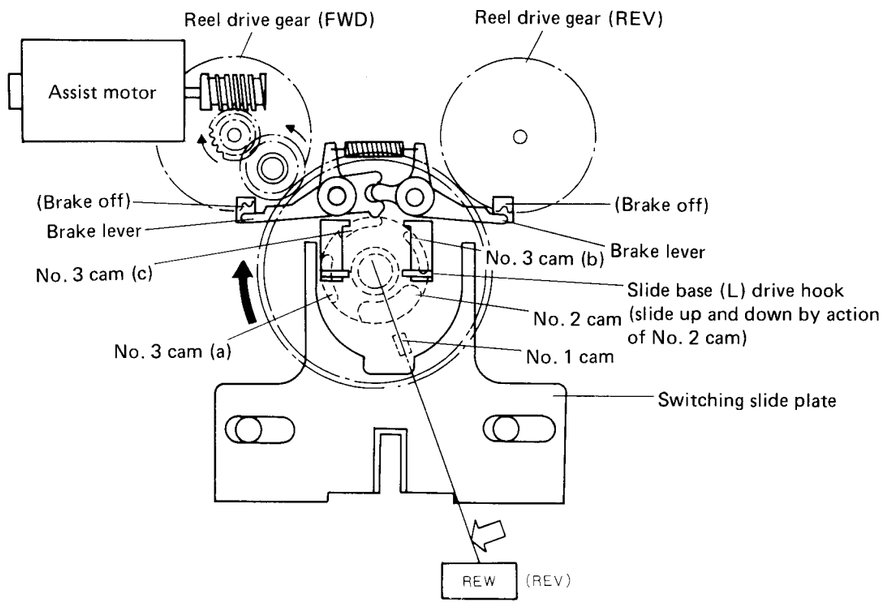


Fig. 1.15 Rewind mode (view from rear)

(2) In this status, the brake lever is raised by No. 3 cam (c) for cancelling fast forward/rewind mode, thereby releasing the brake.

(3) As soon as the rewind mode code is received by the control IC, the reel motor is rotated at high speed in the REW direction. The F/R gear is swung over to the left to engage the left hand reel gear, thereby rotating the left hand take-up reel to rewind the tape.

(4) Since there is no movement of the slide base (L) drive hook, the pinch roller and head remain in the stop mode positions.

- **Reverse music search mode**

The operation is symmetrically opposite to the forward music search mode operation. Apart from the fact that, (a) the direction of tape transport is reversed, (b) the pinch roller is raised towards the REV capstan, (c) the F/R gear is swung to the left to drive the left hand reel gear, and (d) the C/R slide plate and the assist gear cams are shifted to the right in the opposite direction (to the forward mode), the basic operation is the same as in forward music search mode.

- **Direct mode switching**

The mode switching operations described so far have mainly referred to switching from stop mode. These decks, however, are capable of direct mode switching from forward to reverse playback and other modes without a separate STOP key operation. Since the mode code pattern output is monitored constantly by the control IC, the IC is aware of the current tape transport status at all times. Therefore, when a mode change is desired, the control IC ensures that the change is made in the minimum number of steps.

For example, if a change to rewind mode is desired during fast forward mode, the control IC is aware of the fact that fast forward is the current mode and that the head and pinch rollers have been lowered. To switch to rewind mode, the assist gear is rewound to the stop mode position where the brake is applied. The gear is then shifted immediately to the rewind mode position and the reel motor rotated in the reverse direction, resulting in the F/R gear being swung to the left to engage the left hand reel gear for start of rewind mode.

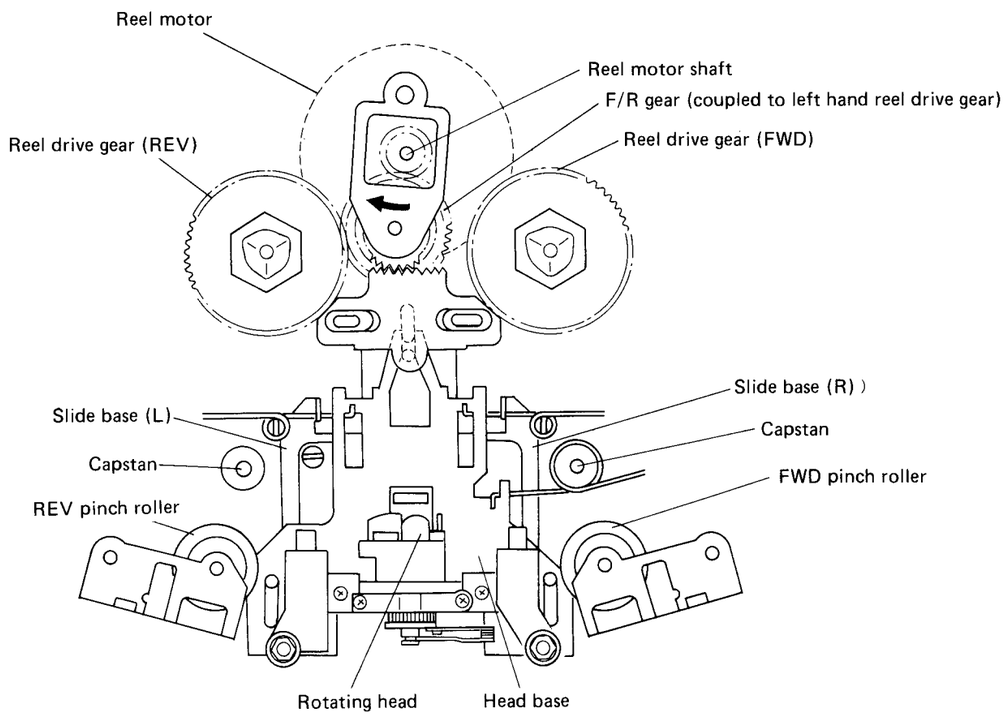


Fig. 1.16 Rewind mode (view from front)

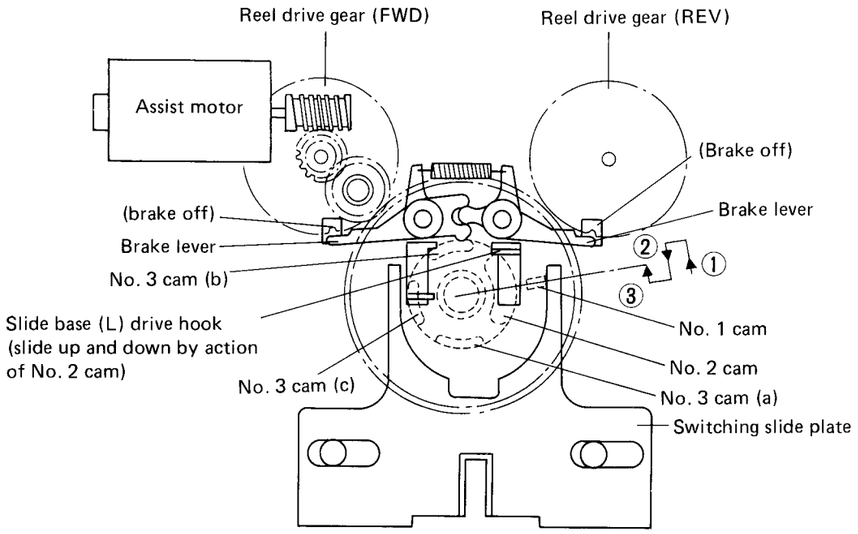


Fig. 1.17 Reverse music search mode (view from rear)

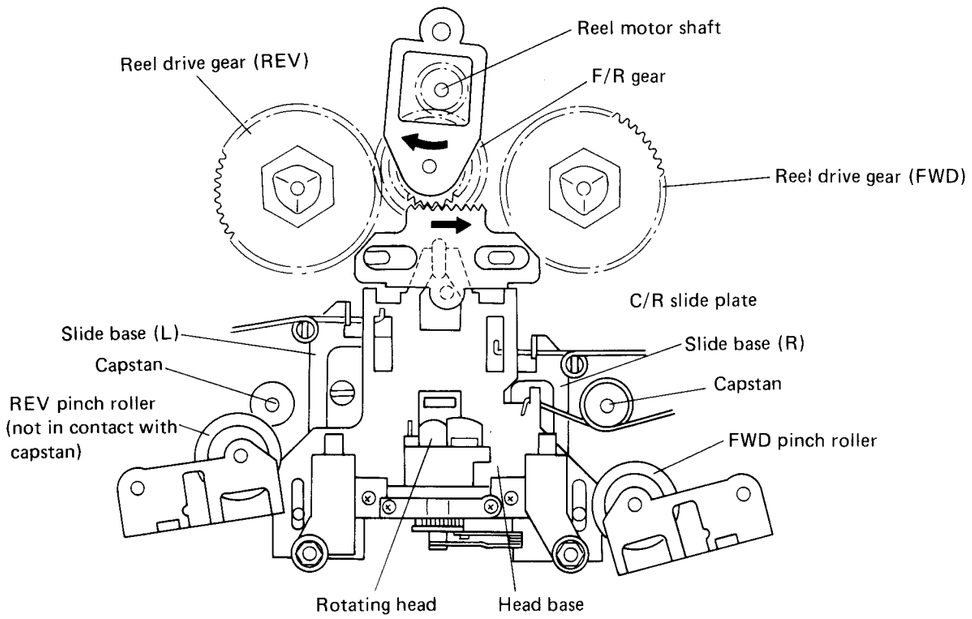


Fig. 1.18 Reverse music search mode (view from front)

- **Rotating head switching**

(1) When No. 1 cam on the assist gear is rotated clockwise, the switching slide plate is slide to the left (or to the right when the assist gear is rotated counter clockwise). This action results in a lever positioned in a slit in the switching slide plate being pushed to the left (right) to switch the direction of the rotating head.
(2) When the switching slide plate is moved to the right as shown in Fig. 1.19, the tip of the rotating head switching lever is also pushed to the right since the lever is passed through a slit in the sliding plate. As a result, the sector gear is turned counter clockwise, and the rotating head intermeshed with this gear is rotated through 180° to be set in the forward recording/playback position.
(3) To set the head in the reverse recording/playback position, the switching slide plate is slide across to the left.
(4) The purpose of the spring is to achieve a snap action when setting the head, and to maintain the head constantly in the correct position.

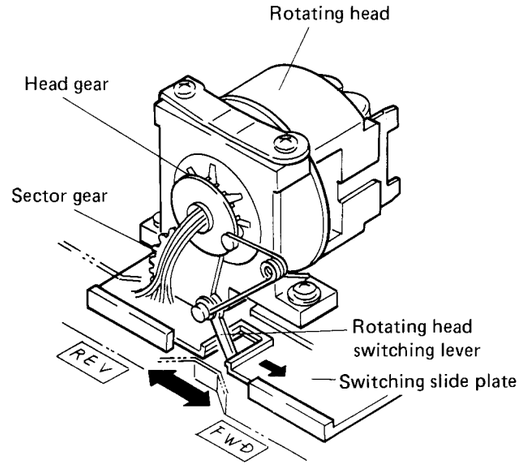


Fig. 1.19 Switching of the rotating head

- **Leader tape detector (for auto-stop and quick reverse)**

A leader tape detector sensor system consisting of an LED and a photo-sensitive cell has been mounted inside the tape guide on the left hand side of the head. As can be seen from the sensor configuration diagram in Fig. 1.20, light is beamed from the LED onto the cassette tape through an optical fiber tube, and reflected light is beamed back through another optical fiber tube to the photo-sensitive cell.

While magnetically coated tape is being passed in front of the optical fiber tubes,the light beam is absorbed and is not reflected back to the photo-sensitive cell. Therefore, there is no photo-sensitive cell output. When the end of the tape is reached, and the opaque white or transparent leader tape is passed in front of the optical fiber tubes, the LED beam of light is passed through the leader tape and is reflected by a reflector (located on the other side of the tape) back into photo-sensitive cell, resulting in an output from that cell. This output is passed to the control IC where it is used in a number of different operations including auto reverse and repeat playback. The decision which determines which end of the tape has been reached is based on the mode code pattern.

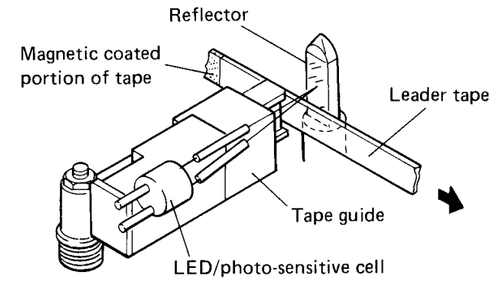
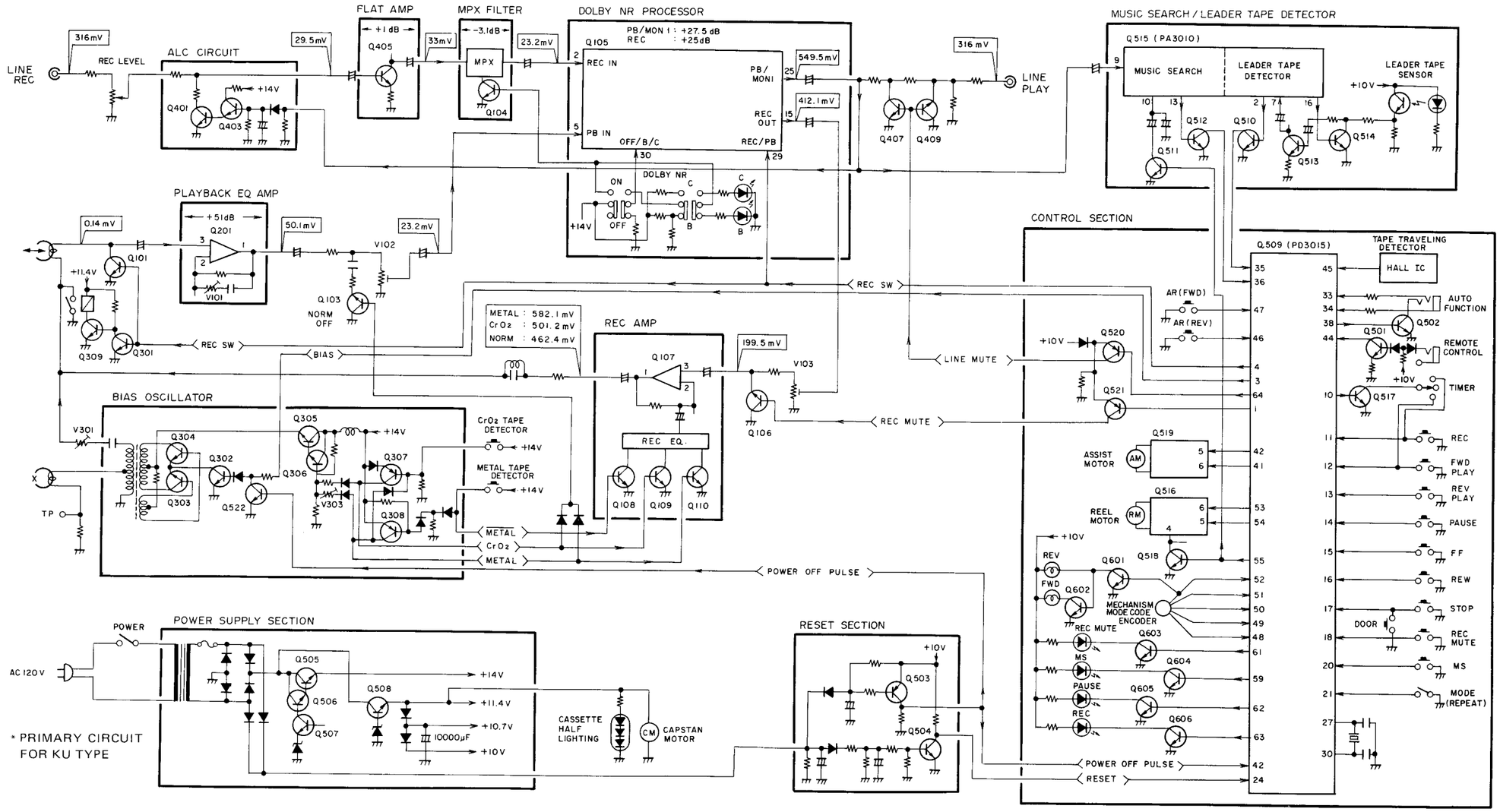


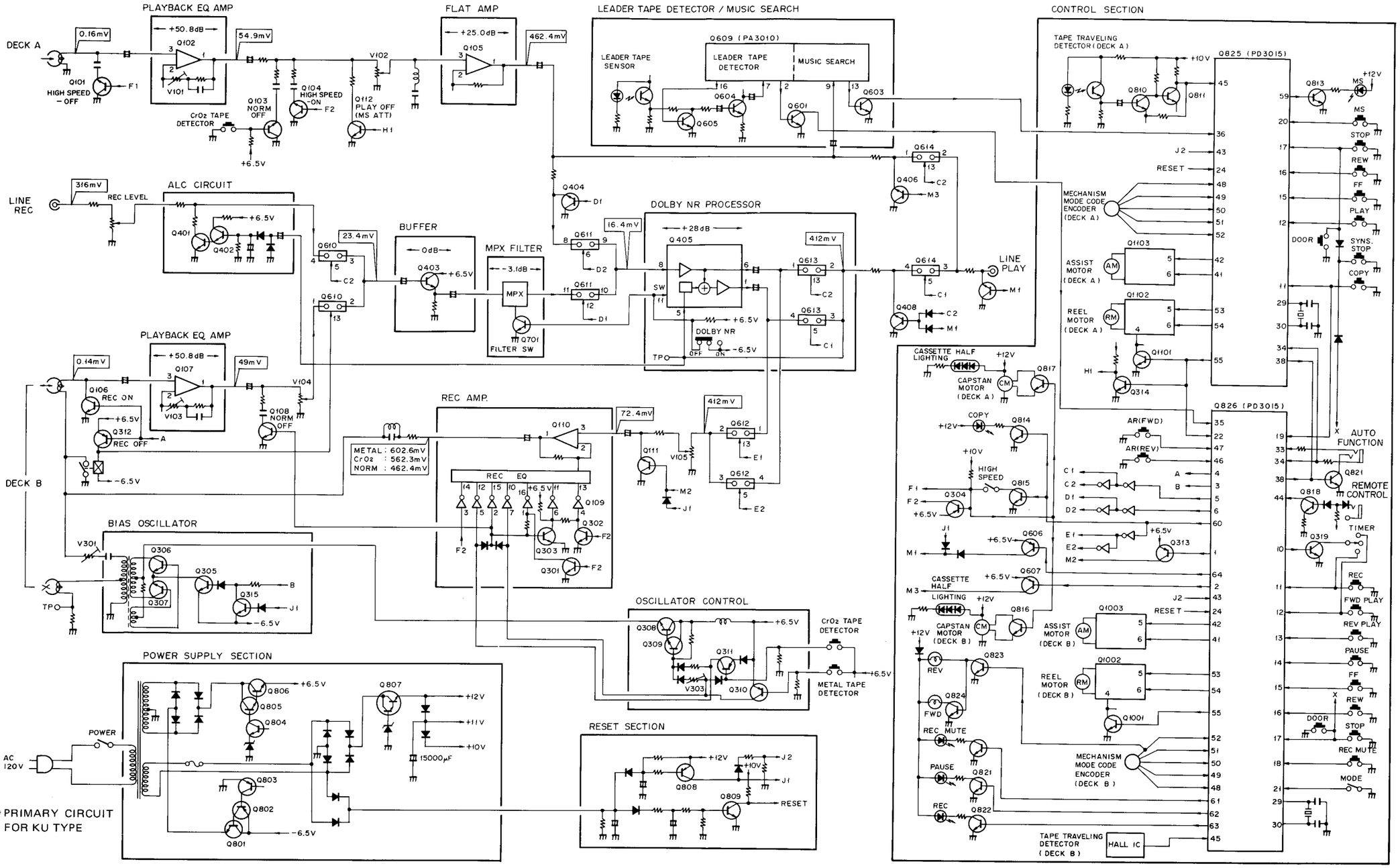
Fig. 1.20 Leader tape detector mechanism

2. BLOCK DIAGRAM

2.1 BLOCK DIAGRAM FOR CT-X500



2.2 BLOCK DIAGRAM FOR CT-X700W



3. IC DATA

BA6109 (BA6209)
(Motor driver)

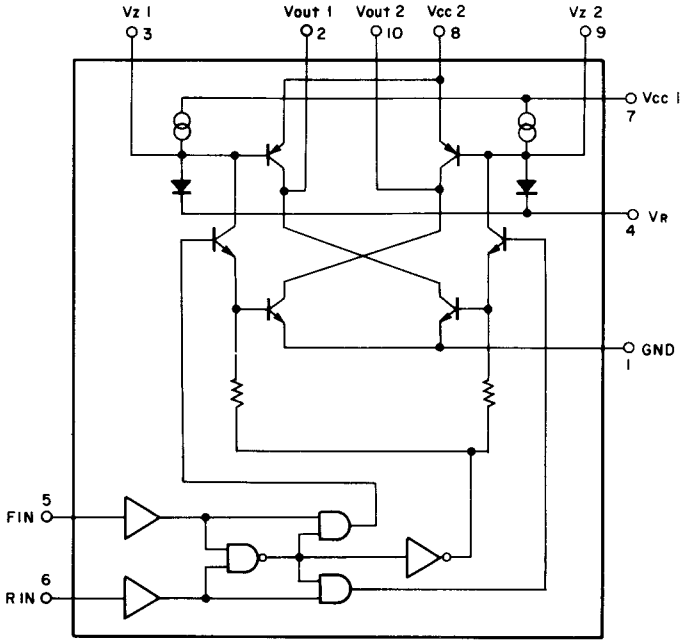


Fig. 3-1 Equivalent circuit of BA6109 (BA6209)

Pin No.	Symbol	I/O	Description	
1	GND		GND	
2	VOUT1	OUT	Motor output (1)	
3	Vz1		Output drive (1)	
4	VR		Output voltage setting	
5	F IN	IN	Input which sets V OUT 1 to "H"	"L" → 0.7V or less
6	R IN	IN	Input which sets V OUT 2 to "H"	"H" → 2V or greater
7	VCC1		+B	
8	VCC2		Power supply	
9	Vz2		Output drive (2)	
10	VOUT2	OUT	Motor output (2)	

Fig. 3-2 BA6109 (BA6209) pin description

Motor Current Direction	INPUT		OUTPUT			
	FIN	RIN	VZ1	V OUT2	VZ2	V OUT2
No current flow	H	H	H	L	H	L
⑲ → ②	L	H	H	L	L	H
② → ⑲	H	L	L	H	H	L
No current flow	L	L	H	L	H	L

Fig. 3-3 Truth table of BA6109 (BA6209)

PD3015 (System Control)

- **See pages 34 thru 41 for details**

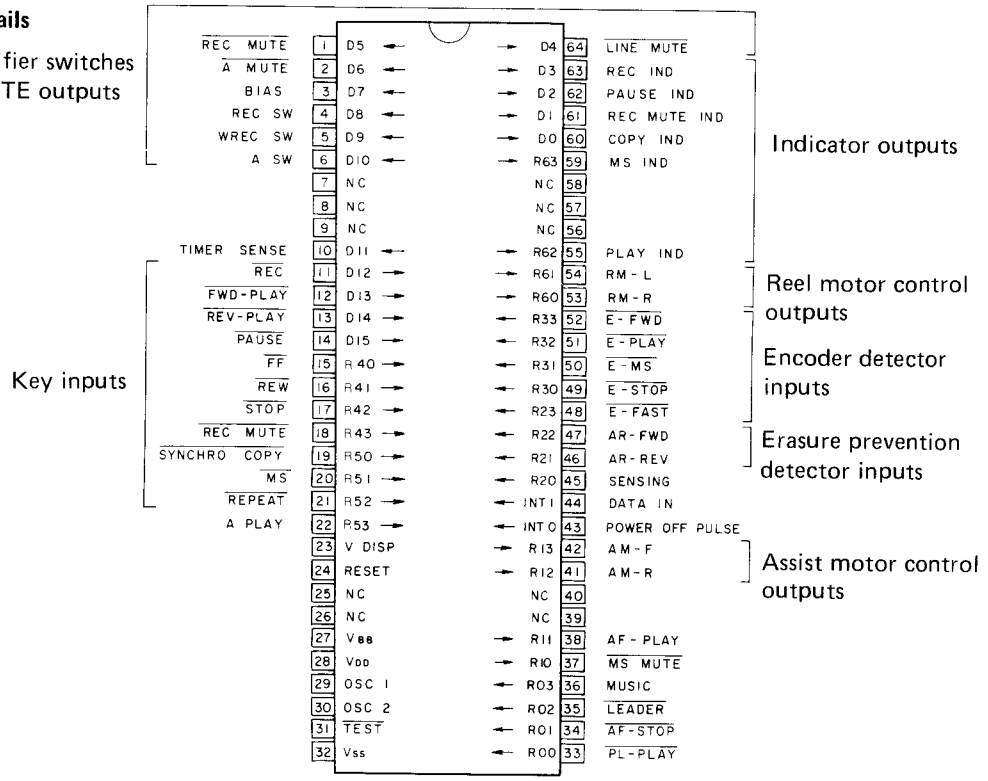


Fig. 3.4 PD3015 pin layout

Pin no.	Pin name	Function name	I/O	Active	Function
1	D 5	REC MUTE	Output	L	Recording muting output
2	D 6	A MUTE	Output	L	A muting output
3	D 7	BIAS	Output	H	Bias oscillator output
4	D 8	REC SW	Output	H	Recording mode switch output
5	D 9	W REC SW	Output	H	W recording mode switch output
6	D 10	A SW	Output	H	A SW mode switch output
7	<NC>	<NC>			
8	<NC>	<NC>			
9	<NC>	<NC>			
10	D 11	TIMER SENSE	Output	H	Timer recording and playback sensing
11	D 12	REC	Input	L	REC key input
12	D 13	FWD-PLAY	Input	L	FWD-PLAY key input
13	D 14	REV-PLAY	Input	L	REV-PLAY key input
14	D 15	PAUSE	Input	L	PAUSE key input
15	R 40	FF	Input	L	FF key input
16	R 41	REW	Input	L	REW key input
17	R 42	STOP	Input	L	STOP key input
18	R 43	REC MUTE	Input	L	REC MUTE key input
19	R 50	SYNCHRO COPY	Input	L	COPY key input
20	R 51	MS	Input	L	MS key input

Fig. 3.5A PD 3015 pin description – 1/2

Pin no.	Pin name	Function name	I/O	Active	Function
21	R 52	$\overline{\text{REPEAT}}$	Input	L	REPEAT switch input
22	R 53	A PLAY	Input	H	Playback mode input
23	V_{DISP}				Ground pin
24	RESET				CPU reset pin
25	<NC>	<NC>			
26	<NC>	<NC>			
27	V_{BB}				Ground pin
28	V_{DD}				Ground pin
29	OSC 1				CPU oscillator
30	OSC 2				CPU oscillator
31	$\overline{\text{TEST}}$				Connection to power supply pin (+10V)
32	V_{SS}				Power supply pin (+10V)
33	R 00	$\overline{\text{P L-PLAY}}$	Input	L	Turntable operation input
34	R 01	$\overline{\text{AF-STOP}}$	Input	L	Auto function stop input
35	R 02	$\overline{\text{LEADER}}$	Input	L	Leader tape end detection input
36	R 03	MUSIC	Input	H	Input for detection of blank tape between tunes
37	R 10	$\overline{\text{MS MUTE}}$	Output	L	Muting output pin used during detection of blank tape between tunes
38	R 11	AF-PLAY	Output	H	Auto function play output
39	<NC>	<NC>			
40	<NC>	<NC>			
41	R12	AM-R	Output	H	Assist motor control output
42	R13	AM-F	Output	H	Assist motor control output
43	INT 0	POWER OFF PULSE	Input	↑	Power off interrupt processing input
44	INT 1	DATA IN	Input	↑	Remote control signal input
45	R 20	SENSING	Input	↑↓	Sensing input for end detection processing
46	R 21	AR-REV	Input	H	Erasure prevention detection reverse input
47	R 22	AR-FWD	Input	H	Erasure prevention detection forward input
48	R 23	$\overline{\text{E-FAST}}$	Input	L	Encoder detection input
49	R 30	$\overline{\text{E-STOP}}$	Input	L	Encoder detection input
50	R 31	$\overline{\text{E-MS}}$	Input	L	Encoder detection input
51	R 32	$\overline{\text{E-PLAY}}$	Input	L	Encoder detection input
52	R 33	$\overline{\text{E-FWD}}$	Input	L	Encoder detection input
53	R 60	RM-R	Output	H	Reel motor control output
54	R 61	RM-L	Output	H	Reel motor control output
55	R 62	PLAY IND	Output	H	PLAY indicator output
56	<NC>	<NC>			
57	<NC>	<NC>			
58	<NC>	<NC>			
59	R 63	MS IND	Output	H	MS indicator output
60	D 0	COPY IND	Output	H	COPY indicator output
61	D 1	REC MUTE IND	Output	H	REC MUTE indicator output
62	D 2	PAUSE IND	Output	H	PAUSE indicator output
63	D 3	REC IND	Output	H	REC indicator output
64	D 4	$\overline{\text{LINE MUTE}}$	Output	L	Line muting output

Fig. 3.5B PD3015 pin description – 2/2

PA3010-01 (Detection of leader tape and blank portion of tape between tunes)

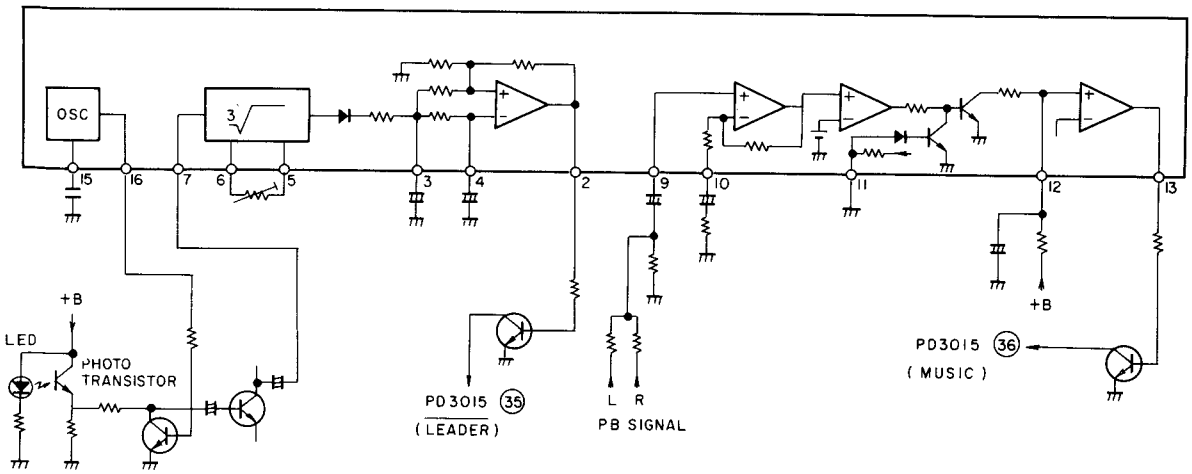


Fig. 3-6 PA3010-01 Block diagram

Pin No.	Pin name	I/O	Function
1	GND		Gound pin
2	SENSING OUT	Output	L (≤ 0.5V) when at magnetic portion of tape, H (4.9V) when at leader portion of tape
3	SENSING T2		Output of pulse to pin 2 according to difference in time constants as determined by capacitors connected to T1 and T2.
4	SENSING T1		
5	VR2		Leader tape detector sensitivity compensatory adjustment connection
6	VR1		
7	SENSING IN	Input	Input from leader tape detector photo-sensitive transistor.
8	Vcc 1		+12V power supply
9	MS IN	Input	Playback signal input used in detecting blank portion of tape between tunes. "Recorded tune" if above -73dBv.
10	MS GAIN		Blank tape detector sensitivity setting
11	MS MUTE	Input	Input for stopping MS operation. Not detected above 1.6V.
12	MS T		Connection to capacitor for setting blank tape detection time
13	MS OUT	Output	Blank tape detector output pin. L output during tune, and H output when between tunes.
14	Vcc 2		+5V power supply
15	OSC C		External oscillator capacitor for deciding oscillator frequency
16	OSC OUT	Output	Oscillator output (2kHz pulse)

Fig. 3-7 PA3010-01 Pin description

HA12045 (Dolby B noise reduction system)

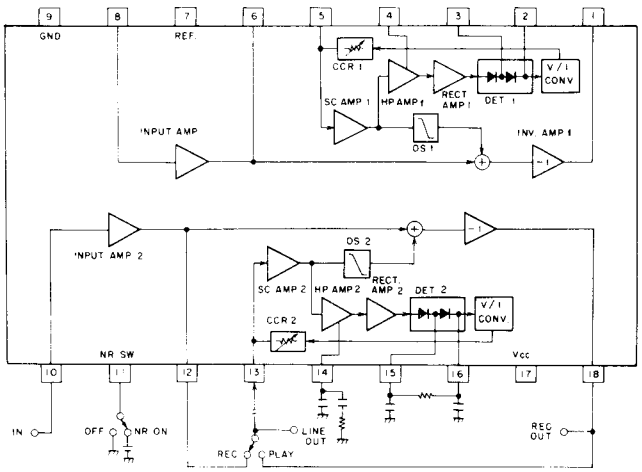


Fig. 3-8 HA12045 Block diagram

Pin Description

Pin No.	I/O	Name	Description
1	Output	REC OUT 1	Inv. amp. output.
2	–	DET1-2	Detector filter.
3	–	DET1-1	Detector filter.
4	–	HPF1	Filter network (1).
5	Input	VCR1	Side chain amp. input (1).
6	Output	MONI. OUT1	Input amp. output (1).
7	Output	REF	Reference voltage output.
8	Input	INPUT 1	Audio input (1).
9	–	GND	Ground.
10	Input	INPUT 2	Audio input (2).
11	Input	NR SW	Noise reduction switch (High active).
12	Output	MONI. OUT2	Input amp. output (2).
13	Input	VCR2	Side chain amp. input (2).
14	–	HPF2	Filter network (2).
15	–	DET2-1	Time constant terminal
16	–	DET2-2	
17	–	Vcc	DC power.
18	Output	REC OUT 2	Inv. amp. output.

Fig. 3-9 HA12045 Pin description

HA12058NT (Dolby B/C noise reduction system)

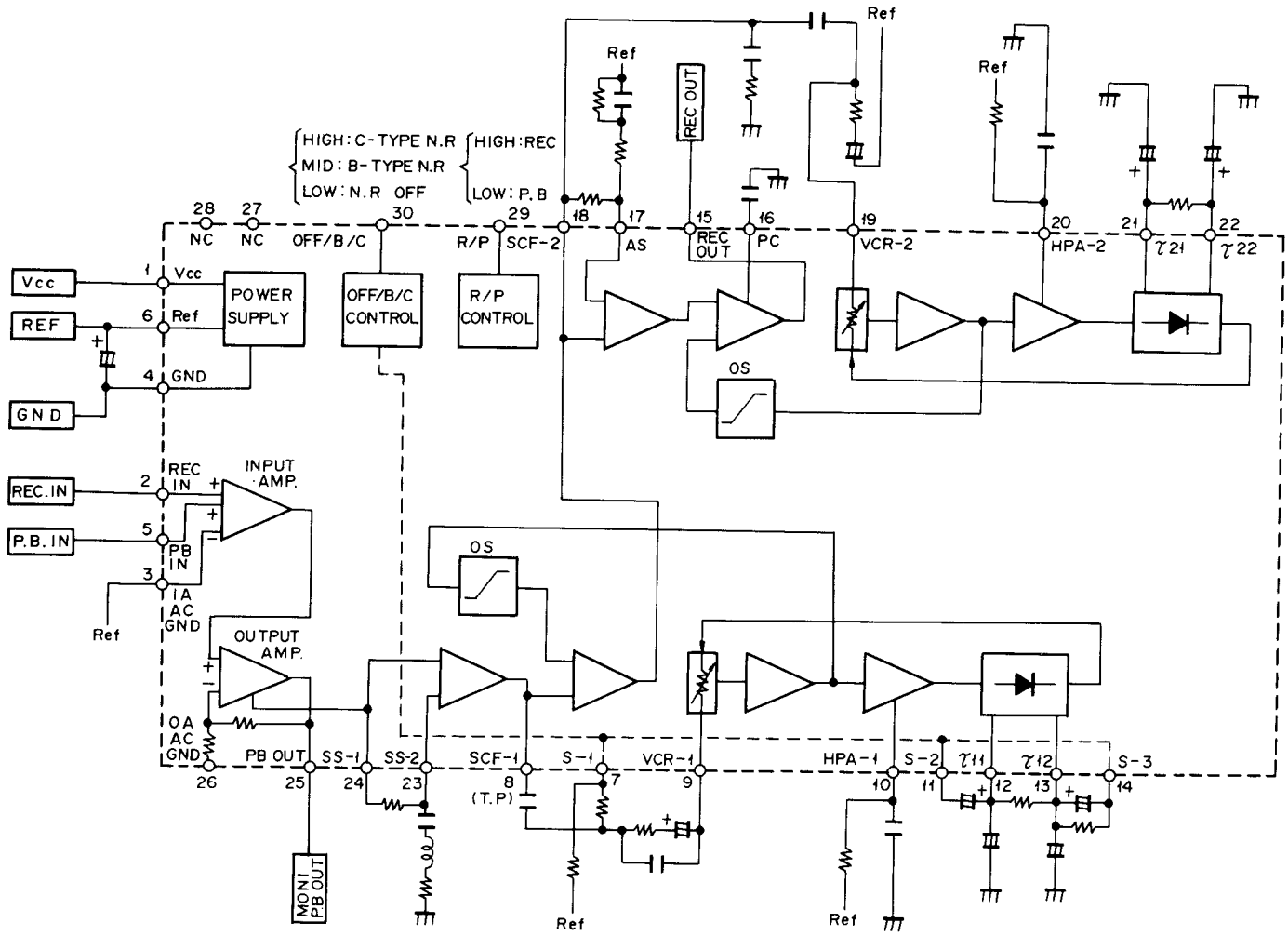


Fig. 3-10 HA12058NT block diagram

Pin No.	Pin Name	Description
1	Vcc	DC power.
2	REC IN	Recording system signal input.
3	IA AC GND	Input amp inversion input.
4	GND	Ground.
5	PB IN	Playback system signal input.
6	REF	Reference pin.
7	S-1	High level stage side chain filter selector switch.
8	SCF-1	High level stage side chain filter terminal.
9	VCR-1	High level stage VCR terminal.
10	HPA-1	High level stage high-pass amp output.
11	S-2	Time constant selector switch.
12	T11	High level stage time constant terminal.
13	T12	
14	S-3	Time constant selector switch.
15	REC OUT	Encoder output.
16	P.C.	Phase compensation capacitor.
17	AS	Anti-saturation network.
18	SCF-2	Low level stage side chain filter terminal.
19	VCR-2	Low level stage VCR terminal.
20	HPA-2	Low level stage high-pass amp output.
21	T21	Low level stage time constant terminal.
22	T22	
23	SS2	Spectrum skewing terminal.
24	SS-1	
25	PB OUT	Monitor & decoder output.
26	OA AC GND	Output amp invert input.
27	NC	(Open)
28	NC	(Open)
29	R/P	Recording/playback selector. H (3.5–6.0V): REC, L (0–1.0V): PLAY.
30	OFF/B/C	Noise reduction switch. H (11–14V): C-type, M (7.4–7.8V): B-type, L (0–3.0V): OFF

Fig. 3-11 HA12058NT pin description

4. CIRCUIT DESCRIPTIONS

4.1 OUTLINE OF MAJOR SECTIONS

Audio Signal Section

	CT-X500	CT-X700W
Playback equalizer amplifier	Low-noise IC (M5220L)	Low-noise IC (M5220L) for both deck A and deck B
Flat amplifier	Single amplifier transistor with bootstrap circuit in line input	Operational amplifier IC (M5218L) and single emitter-follower transistor
Dolby NR section	Type B/C Dolby NR IC (HA12058NT)	Type B Dolby NR IC (HA12045)
Recording amplifier	Operational amplifier IC (NJM4558D equivalent)	Operational amplifier IC (M5218L)
Other	Limiter type automatic level control in line input	Same as CT-X500

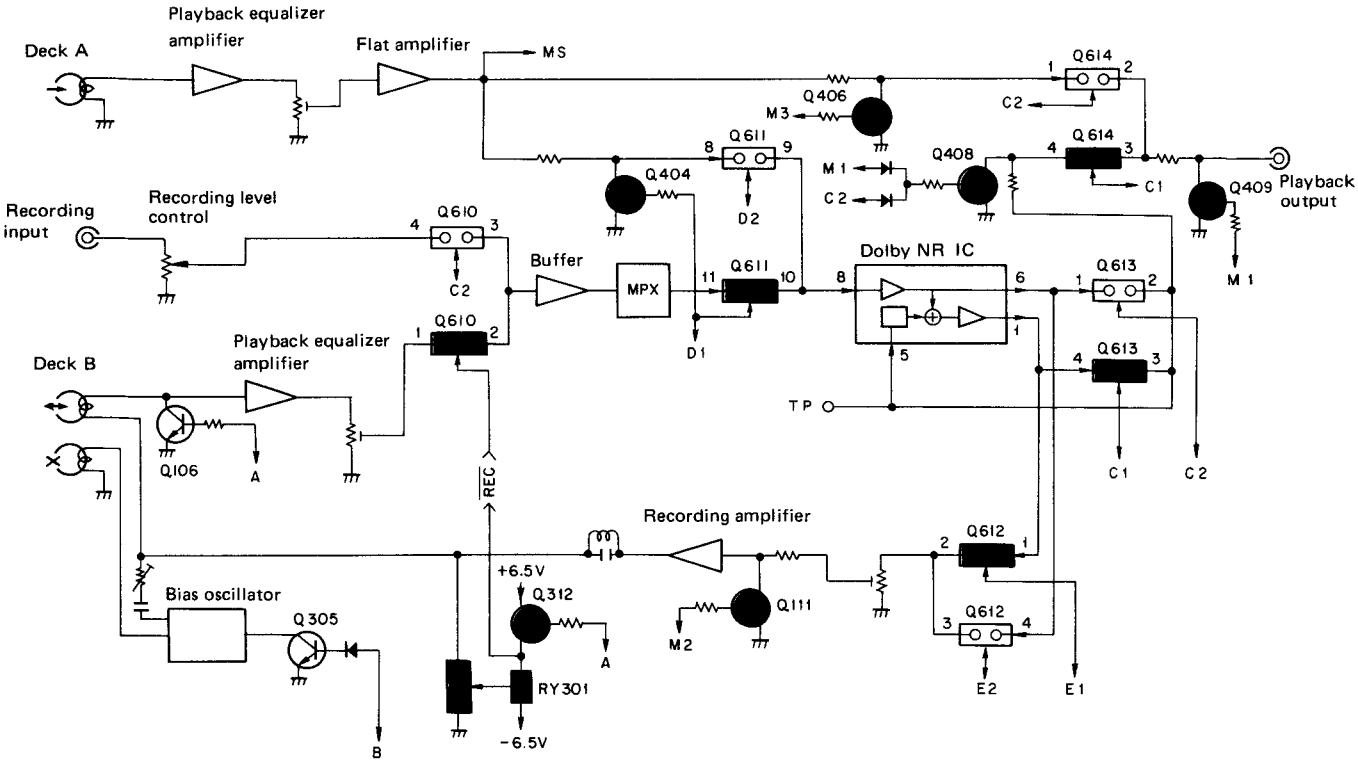
Control Section

	CT-X500	CT-X700W
System control section	64-pin microcomputer (PD3015) used in control of new tape transport mechanism and signal system. Mode switching of the tape transport mechanism is executed by assist motor, while the actual tape transport operations are controlled by feedback of digital signals to the PD3015.	Deck A and deck B controlled by separate PD3015 ICs. Electronic switching IC (TC4066BP equivalent) used in audio signal system switching. Signal system is controlled by the deck B PD3015.
Leader tape detector	Optical leader tape detector system based on PD3010. The LED is switched on by DC, and after detection by photo-sensitive transistor, AC waveform is generated by 2kHz switching in the PA3010.	Deck B same as CT-X500. Deck A not equipped with leader tape detector.
Tape transport detector	Electromagnetic tape end detector consisting of magnetic disk and Hall IC installed in the tape counter section.	Deck B same as CT-X500. Deck A equipped with optical detector system consisting of LED and photo-sensitive transistor below the reel base.
Music search circuit	Based on PA3010	Based on PA3010.
Motor drive circuit	Constant voltage drive by BA6109 (reel motor drive IC) and BA6209 (assist motor drive IC) upon reception of PD3015 output.	Decks A and B same as the CT-X500.
Remote control section	Remote control encoded signal received from external unit (infrared remote control signal received from F-X700), and instruction deciphered by PD3015.	Remote control feature in deck B only — same system as in the CT-X500.

4.2 SIGNAL ROUTES (CT-X700W)

Deck A: STOP
Deck B: STOP

- The deck A route is also the same in fast forward and rewind modes.
- The deck B route is also the same in fast forward, rewind, stop/pause, and playback/pause modes.



- See Fig. 4-3-13 on page 41 for details on the Q826 control output.

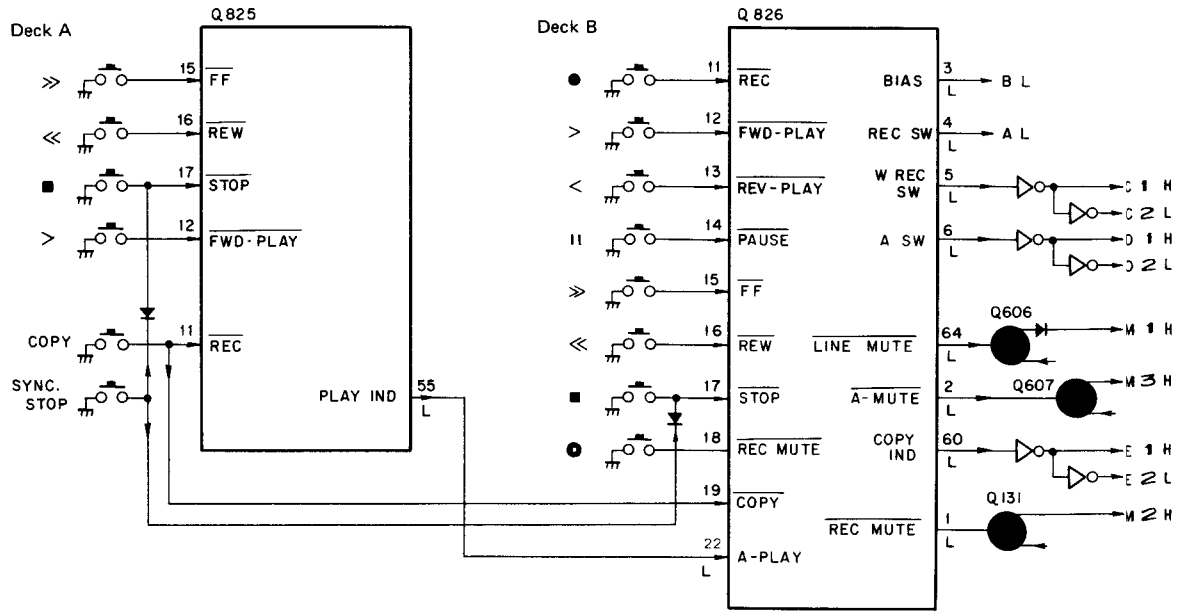


Fig. 4-2-1 CT-X700W signal route
Deck A: STOP, Deck B: STOP

Deck A: PLAY
Deck B: STOP

- The deck B route is also the same in fast forward, rewind, stop/pause, and playback/pause modes.

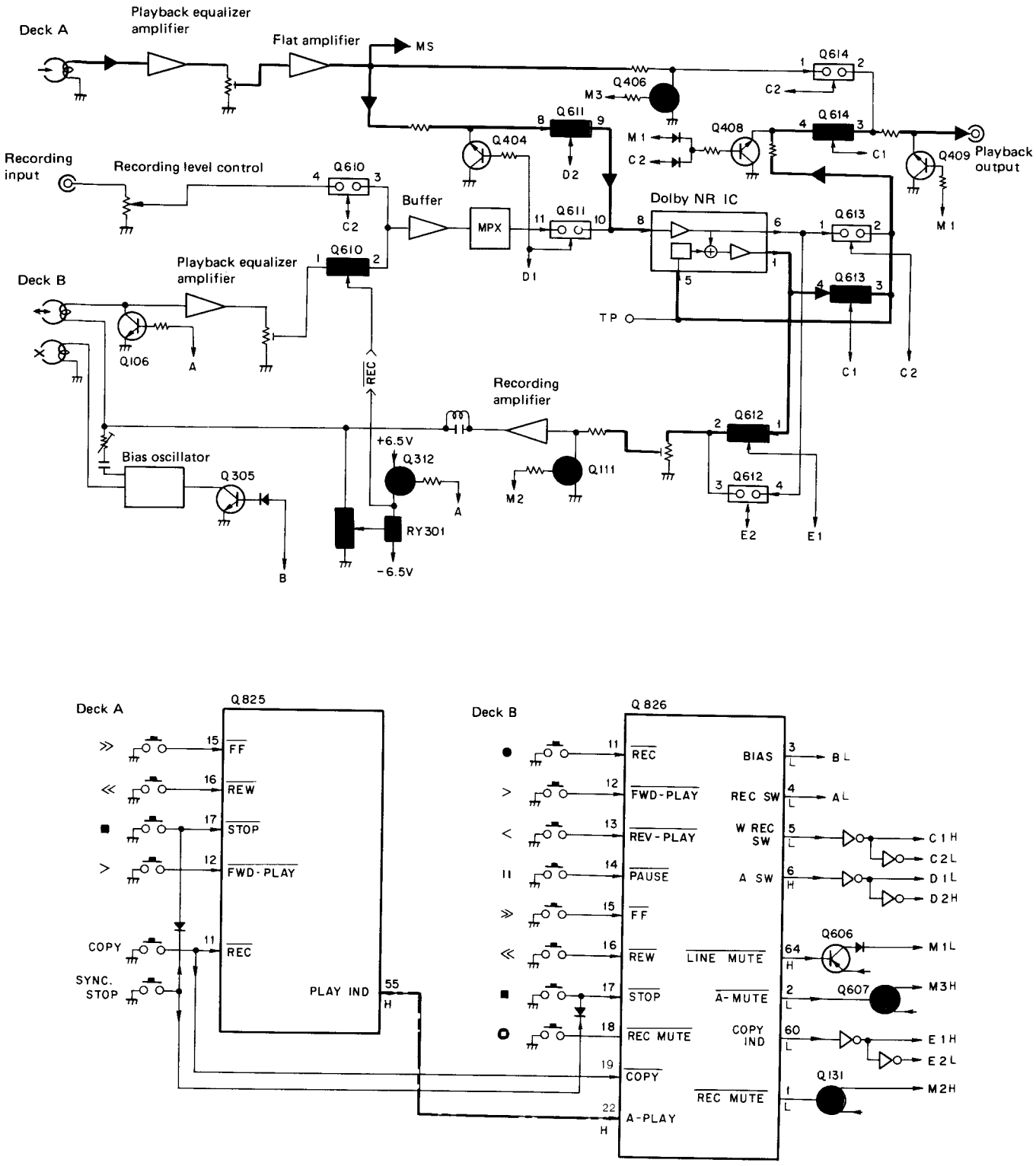
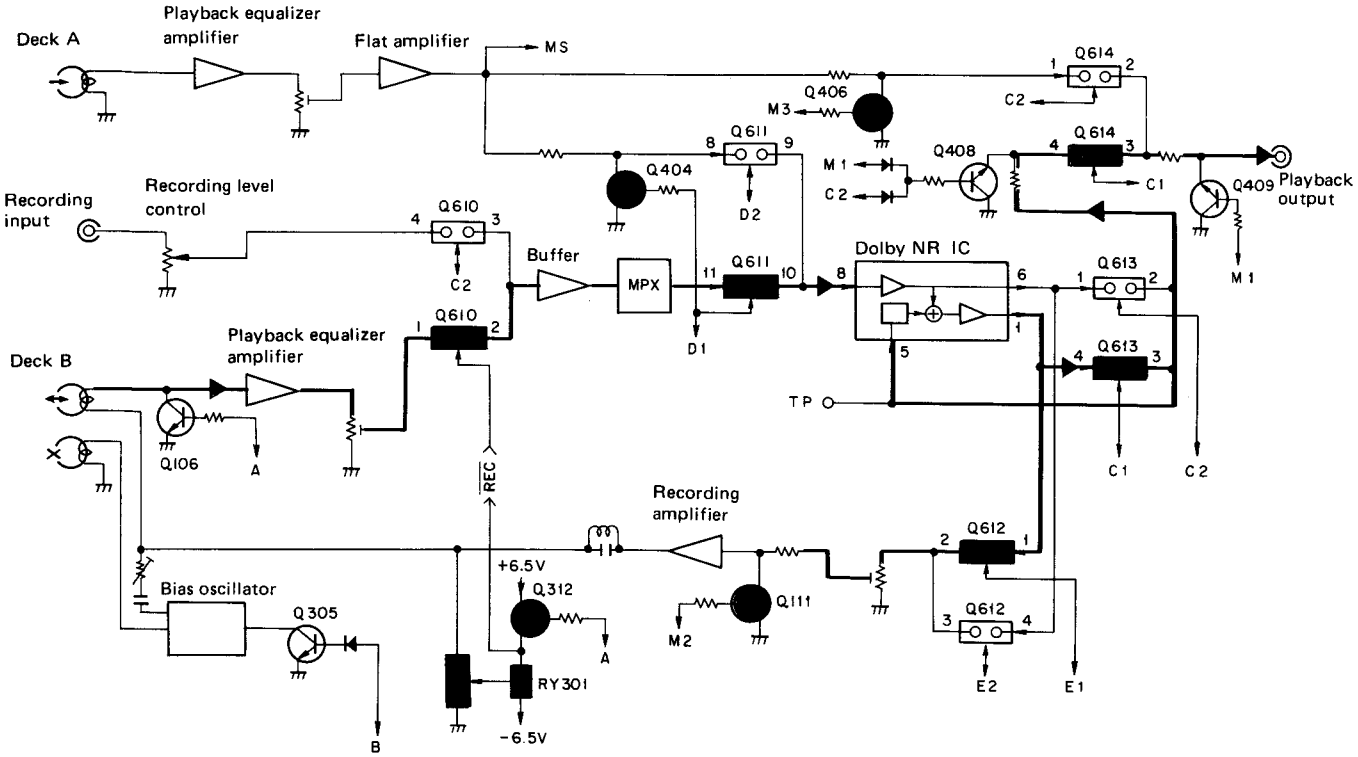


Fig. 4-2-2 CT-X700W signal route
Deck A: PLAY, Deck B: STOP

Deck A: STOP
Deck B: PLAY

- The deck A route is also the same in fast forward and rewind modes.



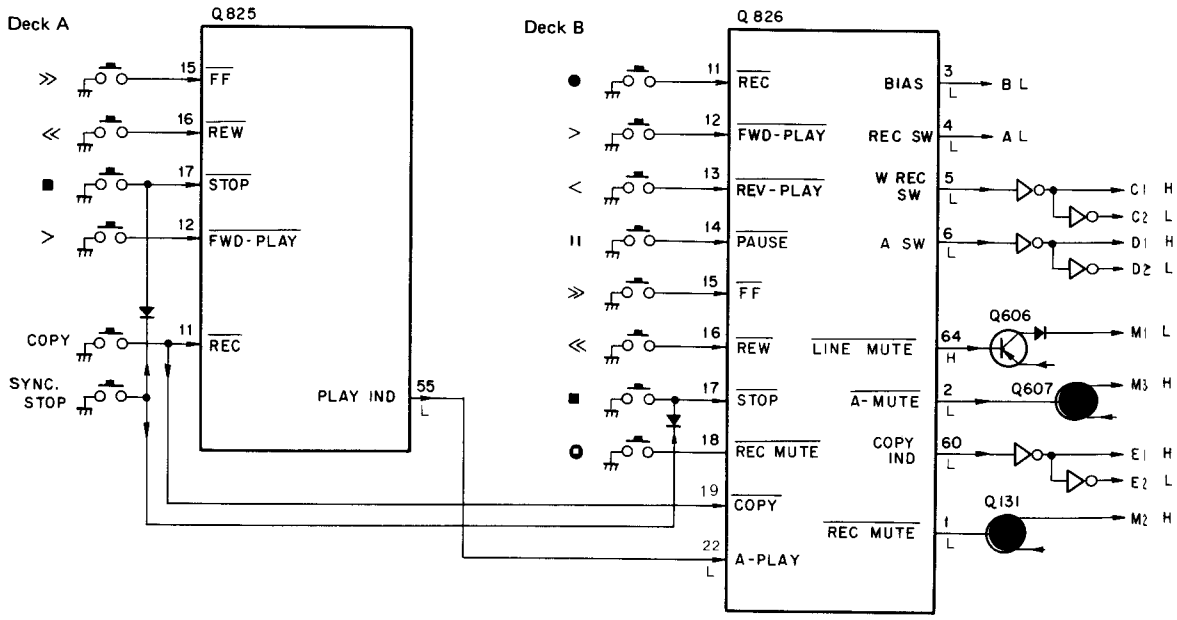
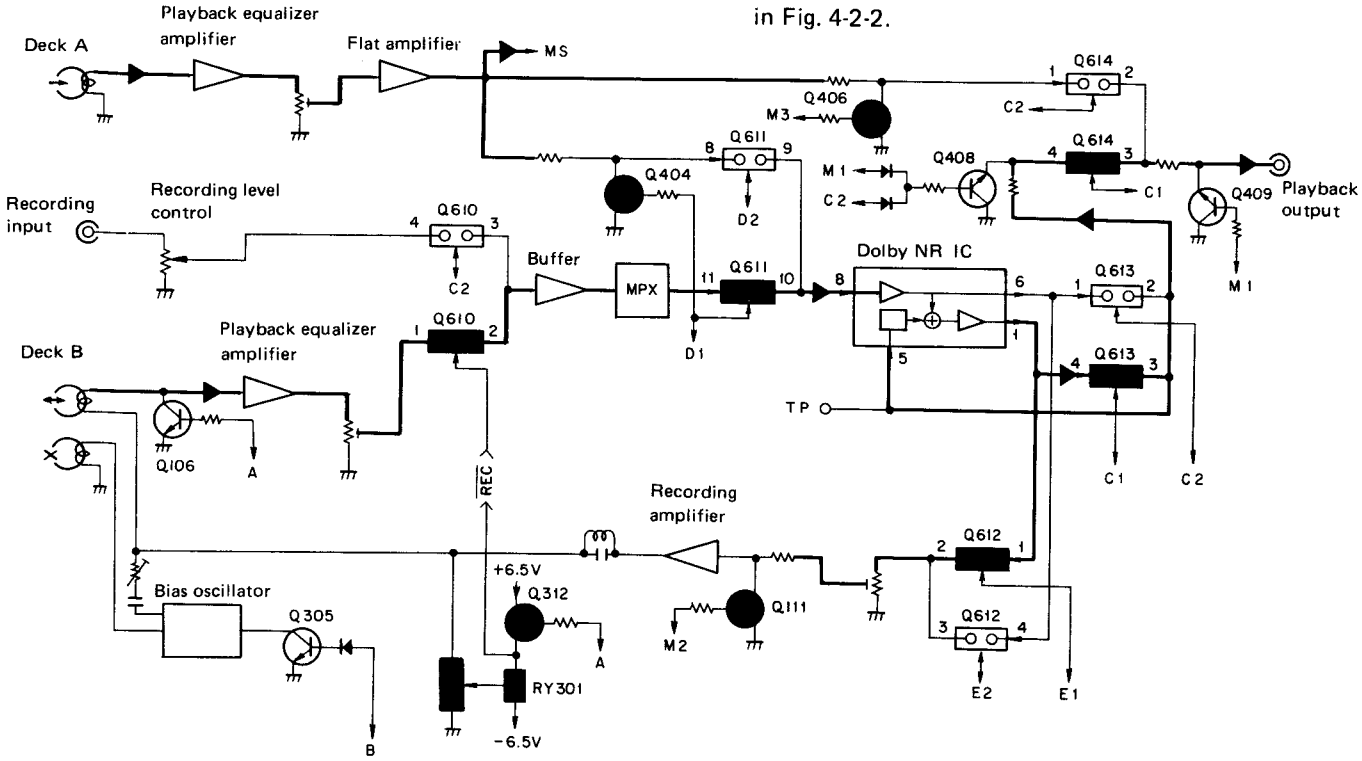


Fig. 4-2-3 CT-X700W signal route
Deck A: STOP, Deck B: PLAY

Deck A: PLAY
Deck B: PLAY

- The deck B playback signal output is obtained at the LINE PLAY terminals.
- If deck B is switched to playback/pause mode by pressing the PAUSE key during playback mode, the deck A playback signal output is obtained via the route shown in Fig. 4-2-2.



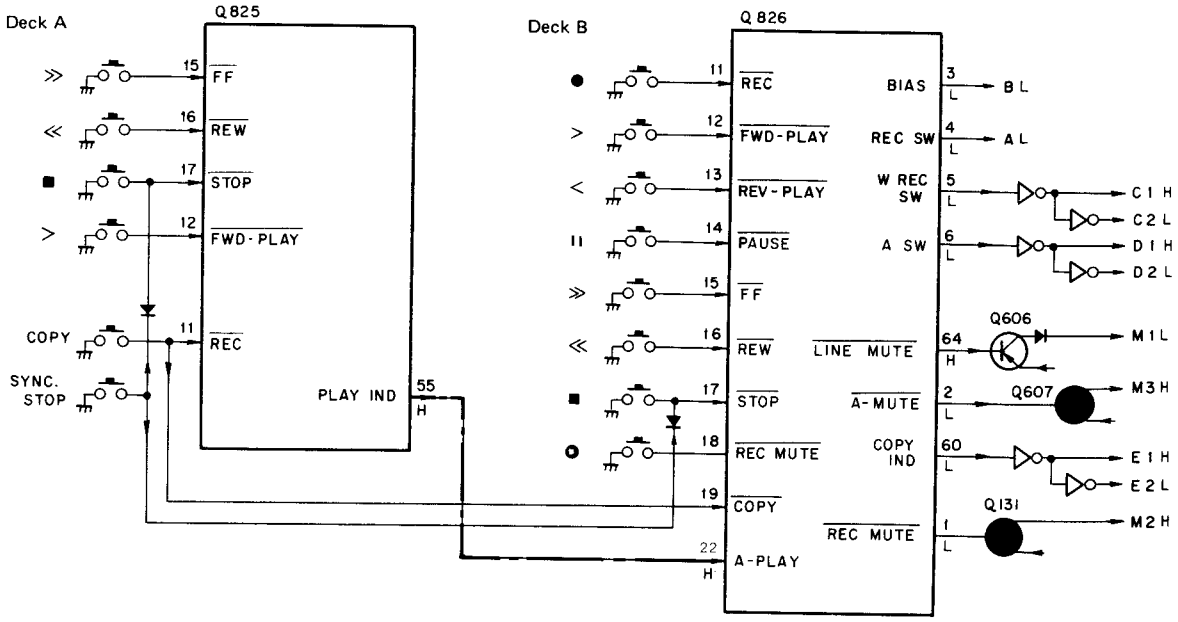
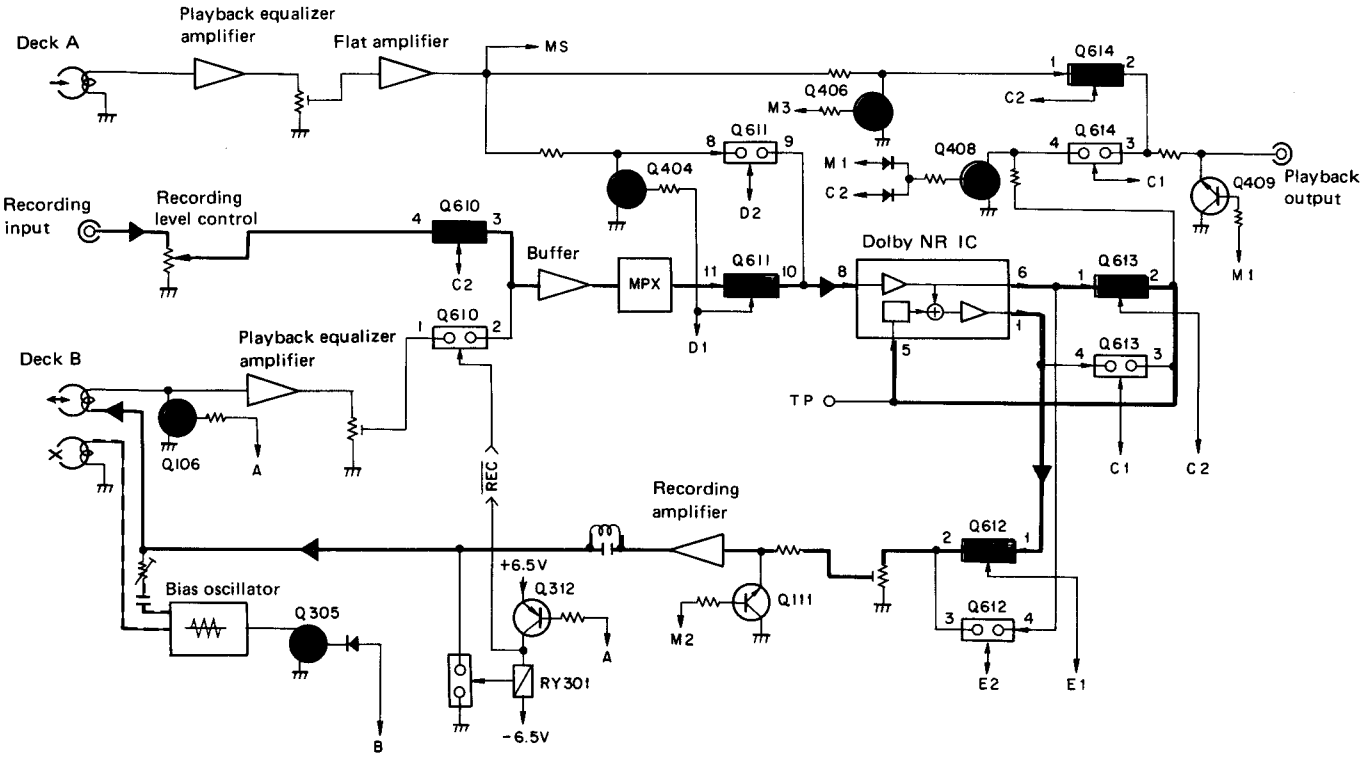


Fig. 4.2.4 CT-X700W signal route
Deck A: PLAY, Deck B: PLAY

Deck A: STOP
Deck B: REC

- No output appears at the LINE PLAY terminals.
- The deck A route is also the same in fast forward and rewind modes.



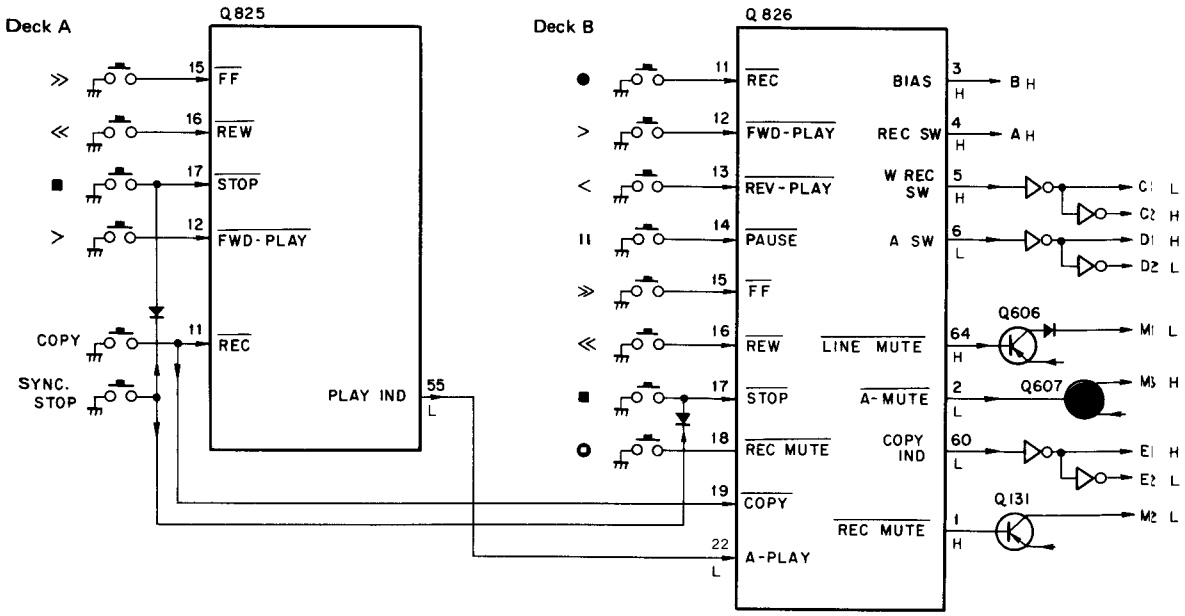


Fig. 4.2.5 CT-X700W signal route
Deck A: STOP, Deck B: REC

Deck A: PLAY
Deck B: REC

- Although the deck A playback signal output appears at the LINE PLAY terminals, it canot be decoded by the Dolby NR system.

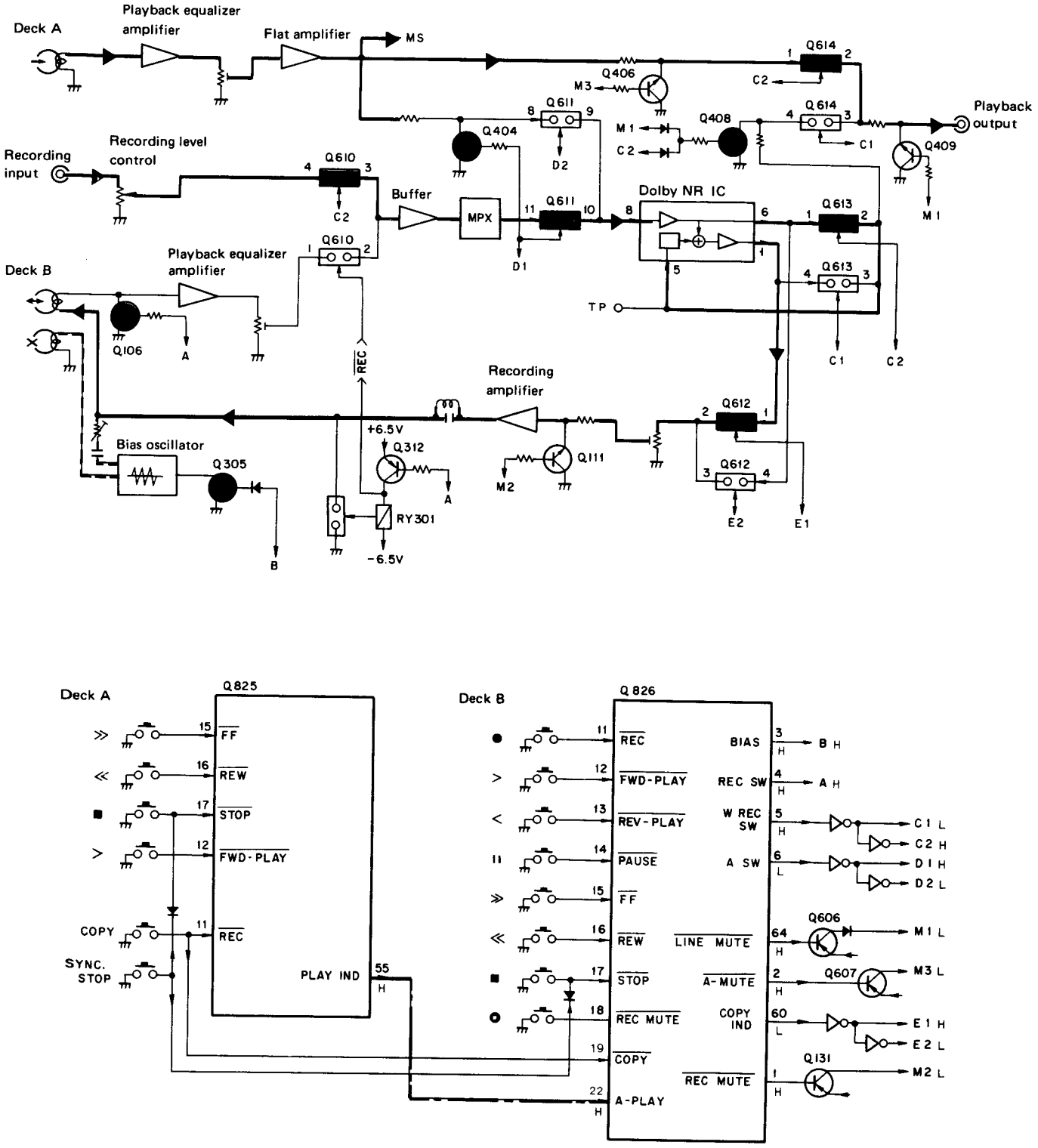
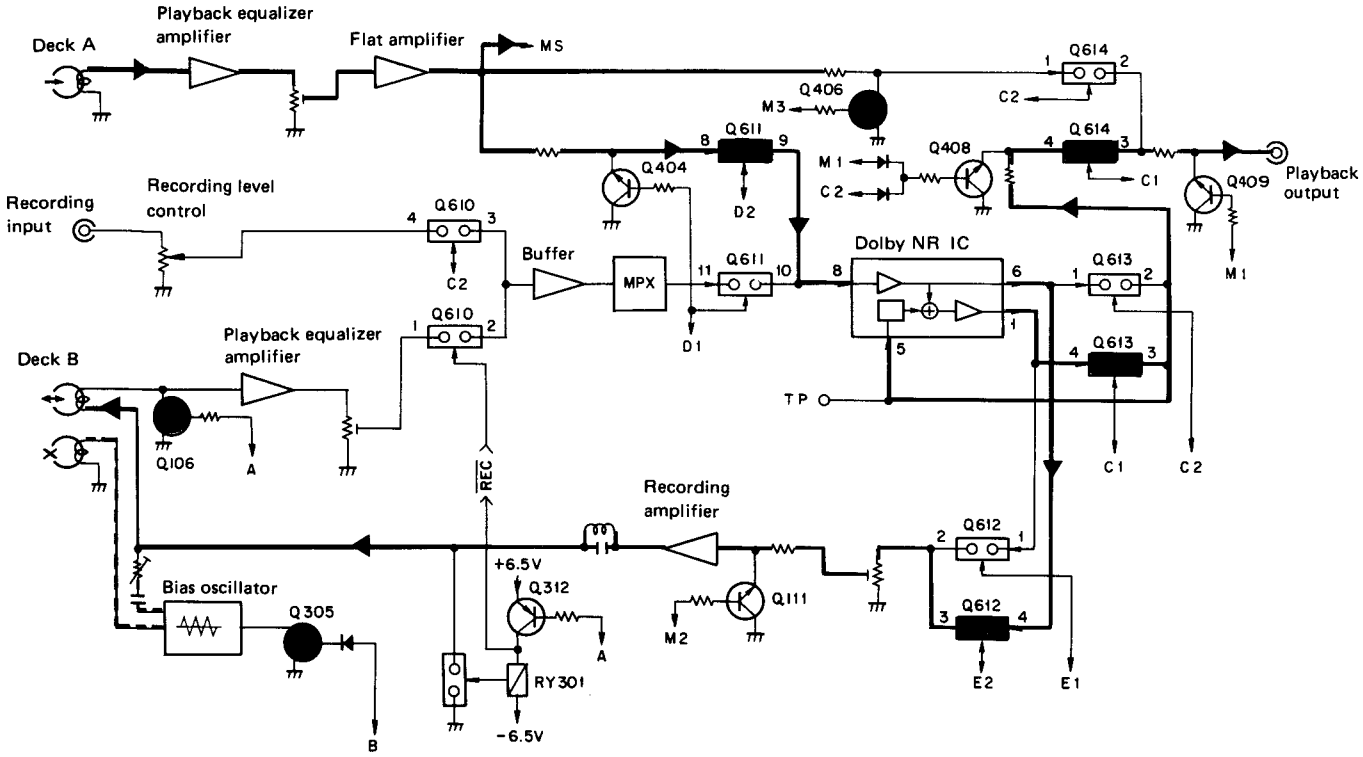


Fig. 4-2-6 CT-X700W signal route
Deck A: PLAY, Deck B: REC

COPY

- The deck A playback signal output appears at the LINE PLAY terminals (and can be decoded by the Dolby NR system.
- The deck A output is recorded directly in deck B (without Dolby NR decoding or encoding).



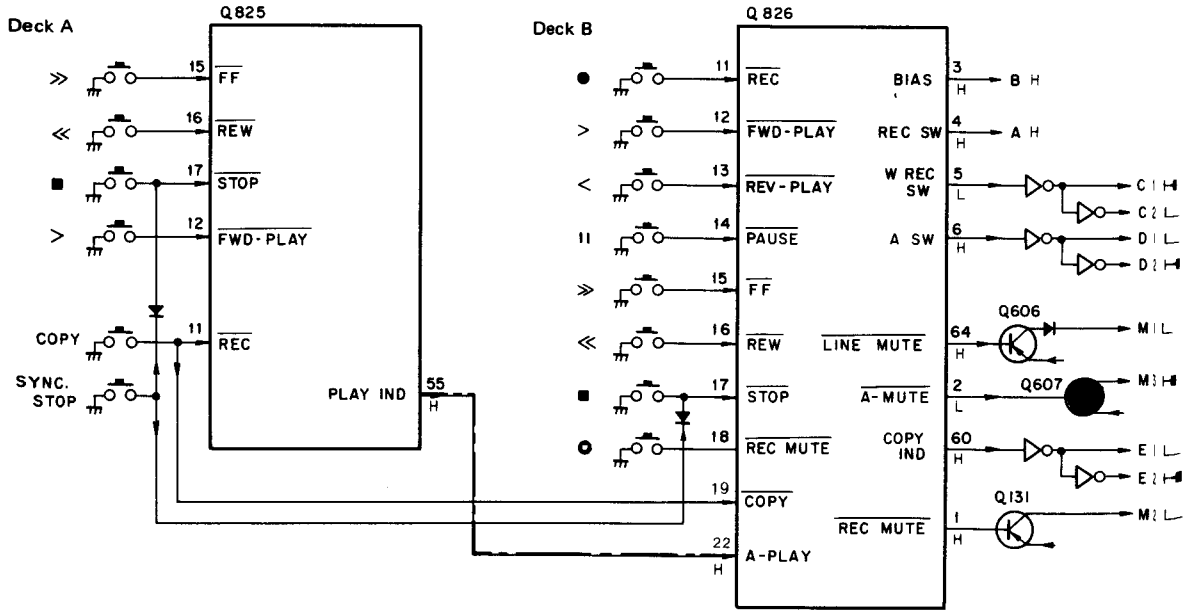


Fig. 4-2-7 CT-X700W signal route
Copy mode (deck A: PLAY, Deck B: REC)

4.3 SYSTEM CONTROL IC SPECIFICATIONS

The PD3015 microcomputer controls the signal routes and the tape transport mechanism by a triple motor drive system which includes an assist motor.

Two of these microcomputers are used independently in decks A and B of the CT-X700W. And since the deck A component is only used for one-way playback purposes, pins not required for this operation are not used in this deck. In copy mode and other interlinked operations, the required inputs are applied to both microcomputers, the system being controlled by the deck B control IC with the deck A PLAY IND output pin connected to the deck B A-PLAY input pin. Also note that the playback operation in deck A SYNC. COPY mode is executed with the control IC in recording mode.

1. System clock

(1) The system clock is generated by a built-in ceramic resonator oscillating at a frequency of 400 kHz.
(2) All subsequent times in the following specifications are based on the system clock frequency of 400 kHz.

2. Key input reception conditions

(1) Misoperation due to external noise and chattering during key input reception is avoided by setting the key input sampling time to 10 ms.
(2) Although key inputs can be received during mechanism assist operations (tape transport mechanism mode switching operations), the corresponding operation is not executed until the assisted operation has been completed. The STOP key input, however, is accepted immediately.
(3) If more than one key input is received during an assist operation, only the last key input is valid.

3. Erasure prevention function

(1) The tape transport is stopped if a REC key input is applied when the AR-FWD (forward anti-recording) pin is at H level (recording inhibited).
(2) The same applies to the AR-REV pin.
(3) If the REV-PLAY and REC keys are pressed together during a forward mode when the AR-REV pin is at H level (recording inhibited), the tape transport is stopped after the direction has been changed. Likewise, if the FWD-PLAY and REC keys are pressed together during a reverse mode when the AR-FWD pin is at H level, tape transport is again stopped after the direction has been changed.

4. Operation key inputs

(1) Output of tape transport mechanism and signal route control signals is obtained according to the operation key input.
(2) If the tape transport mechanism has not been changed to the specified mode within five seconds after the relevant assist operation has been commenced, the mechanism is reverted to stop mode.
(3) And if the tape transport mechanism is not correctly returned to stop mode within another five seconds, all outputs are switched off.
(4) Multiple key operations
- Pressing of two keys (including cases where a second key is pressed while the first key is still depressed)
  (a) The STOP key has priority over all other keys.
  (b) The FF key has priority over the PAUSE key.
  (c) The REW key also has priority over the PAUSE key.
  (d) The FWD-PLAY and REC keys are of identical priority, and execute their respective functions when pressed. The same applies to the FWD-PLAY and PAUSE keys.
  (e) The REV-PLAY and REC keys are of identical priority, and execute their respective functions when pressed. The same applies to the REV-PLAY and PAUSE keys.
  (f) The PAUSE and REC keys are of identical priority, and execute their respective functions when pressed.
  (g) See paragraph 8, "REC MUTE functions" for details relating to the REC MUTE key.
- Pressing of three or more keys
  Pressing of three or more keys at the same time results in tape transport being switched to stop mode.

5. ONE REC operation

(1) Recording mode is set by pressing the REC key (without pressing the PLAY key at the same time).
(2) Pressing the REC key during stop/pause or playback/pause mode results in a switch to recording/pause mode.

6. Pause operations (pause mode cancellation)

(1) Pause mode is cancelled by pressing the PAUSE key a second time.
(2) Pause mode can also be cancelled by prssing the STOP, FF, or REW key.
(3) The SYNCHRO COPY key can also be used to cancel pause mode (CT-X700W).

7. Timer functions

(1) Initialization (also applicable to initialization when timer function is not used)
The tape transport mechanism is kept in stop mode for at least four seconds after the power is switched on (from the moment that the RESET pin level is switched from H to L). No key input is accepted during this period.

(2) Timer operation
Timer sensing processing is executed four seconds after the power is switched on. Subsequent operation conforms with the timer mode selector setting.

(3) Timer sensing processing
1) During the "a" interval shown in Fig. 4-3-1, a check is made to see whether the STOP, FF, REW, FWD-PLAY, REV-PLAY, REC, REC MUTE, or PAUSE key has been pressed.
2) During the "b" interval, the TIMER SENSE output is switched to H level, and a check is made to see whether the FWD-PLAY or REC port has been switched to L level.
3) The same check executed during the "a" interval is repeated during the "c" interval.
4) Timer operation is stopped if pressing of a key is detected by the check executed during the "a" and "c" intervals.
5) If the tape transport mechanism is in forward status when the FWD-PLAY port is at L level during the "b" interval, the mechanism is switched to reverse playback mode.
6) If the REC port is at L level during the "b" interval, the tape transport mechanism is switched to forward recording mode if in forward status, or to reverse recording mode if in reverse status.
7) If the timer sensing processing results in an impossible mode, the processing is repeated a second time. If the second processing also results in an impossible mode, the transport mechanism is switched to stop mode - that is, standby mode waiting for the next key input.

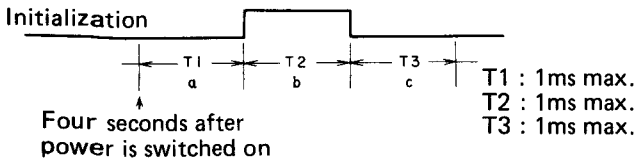


Fig. 4-3-1 Timer sensing processing

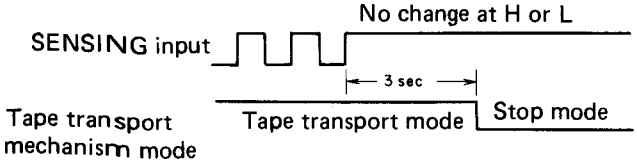


Fig. 4-3-2 Sensing end detection

8. Recording mute function (AUTO SPACE MUTE)

(1) If the REC MUTE key is pressed during recording or recording/pause mode, the tape transport is switched to recording mute mode for 4.5 seconds, and then to recording/pause mode. (AUTO SPACE MUTE=blank portion of tape between tunes).

(2) The REC MUTE indicator blinks on and off (in 640 msec cycles) during this 4.5 second interval.

(3) If the REC MUTE key is kept depressed for longer than 4.5 seconds during recording or recording/pause mode, the recording mute mode is maintained continuously (normal recording mute) until the REC MUTE key is released again. The tape transport mechanism is then stopped in recording/pause mode.

(4) The REC MUTE indicator remains on (continuously) during normal recording mute mode.

(5) If the PAUSE key is pressed during auto space mute mode, the recording mute mode is switched to recording/pause mode.

(6) If the REC key is pressed during auto space mute mode, the recording mute mode is switched to recording mode.

(7) If the PLAY key is pressed during auto space mute mode, the auto space mute mode is continued without any change. (The PLAY key input is not accepted).

(8) If the REC and REC MUTE keys are pressed together, the tape transport mechanism is switched to recording mode, and then to auto space mute mode after completion of the tape transport mechanism assist operation.

9. Tape end detector function

(1) Tpae transport detector
If there is no change in the SENSING input for three seconds while the tape is moving (in playback, recording, fast forward, rewind, cue, or review mode), the tape transport mechanism control interprets the condition as "tape end", and consequently proceeds to tape end processing.

(2) Leader tape detector
(a) If the LEADER input is switched to L level during playback or recording mode, the tape transport mechanism control interprets the condition as "leader tape", and consequently proceeds to tape end processing. (Tape end processing following leader tape detection is not executed in fast forward, rewind, cue, or review mode).
(b) Tape end processing is not executed if the LEADER input is switched to L level within three seconds after the deck is switched to playback, recording, or recording mute mode.

10. Tape end processing

(1) Reverse mode selector
Repeat mode (⟲) (REPEAT pin at L level) and single mode (⇄) (REPEAT pin at H level) are selected by switching the reverse mode selector.

(2) End processing when leader tape is detected See Fig. 4-3-3.

(3) End processing when tape transport mode is detected See Fig. 4-3-4.

(4) After the tape has completed four cycles in playback, forward cue, or reverse review repeat mode, the tape transport mechanism conforms with the reverse recording processing.

11. Music search function (reverse mode MS in CT-X500 only)

(1) The MS key is a set/reset type where the on and off status is reversed each time the key is pressed. (The key is off when the power is first switched on).

(2) This key input can be received at any time. The MS indicator lights up when the key is switched on, and goes off again when the key is switched off.

(3) The beginning of a particular tune is located during cue and review modes (see Fig. 4-3-5). During forward cue and reverse review modes, the tune beginning is detected at the leading edge on the MUSIC input pin. The current forward cue or reverse review mode is continued for another 280 msec following detection of the leading edge, the mode then being switched to forward review (from forward cue) or to reverse cue (from reverse review) until a trailing edge input is applied to the MUSIC pin. This results in the mode being finally switched to playback mode.

(4) In forward review and reverse cue modes, on the other hand, input of a trailing edge input to the MUSIC pin results in detection of the beginning of a tune and subsequent switching to playback mode.

MS	Reverse mode	Mode prior to end processing	End processing
OFF	→ ←	FF, REW	Not executed
		PLAY, REC	Not executed
	⟲	FF, REW, REV-REC	Not executed
		PLAY, FWD-REC	Reversed (if AR-REV pin is at H level, however, forward recording is switched to reverse stop mode)
ON	→ ←	CUE, REVIEW	Not executed
		PLAY, REC	Not executed
	⟲	CUE, REVIEW, REV-REC	Not executed
		PLAY, FWD-REC	Reversed (if AR-REV pin is at H level, however, forward recording is switched to reverse stop mode)
ON or OFF	→ ←	SPACE MUTE	Not executed
		NORMAL REC MUTE	Not executed
	⟲	FWD SPACE MUTE	REV-REC/PAUSE
		FWD NORMAL REC MUTE	REV NORMAL REC MUTE
		REV SPACE MUTE	Not executed
		REV NORMAL REC MUTE	Not executed

Fig. 4-3-3 End processing when leader tape is detected

MS	Reverse mode	Mode prior to end processing	End processing
OFF	→ ←	FF, REW, PLAY, REC	STOP
	⟲	FF, REW, REV-REC	STOP
		PLAY, FWD-REC	Reversed (if AR-REV pin is at H level, however, forward recording is switched to reverse stop mode)
ON	→ ←	CUE, REVIEW	STOP
		PLAY, REC	STOP
	⟲	FWD-CUE	REV-REVIEW
		REV-REVIEW	FWD-CUE
		FWD-REVIEW, REV-CUE	STOP
		PLAY, FWD-REC	Reversed (if AR-REV pin is H level, however, forward recording is switched to reverse stop mode)
		REV-REC	STOP
ON or OFF	→ ←	SPACE MUTE	STOP
		NORMAL REC MUTE	STOP
	⟲	FWD SPACE MUTE	REV-REC/PAUSE
		FWD NORMAL REC MUTE	REV NORMAL REC MUTE
		REV SPACE MUTE	STOP
		REV NORMAL REC MUTE	STOP

Fig. 4-3-4 End processing when tape transport is detected

(5) If the MUSIC pin input is kept at L level for at least 12 seconds by pressing the MS key during playback mode, the transport mechanism is switched to cue mode (if forward) or review mode (if reverse) to skip to the beginning of the next tune. (Skip function)
(6) If the end of the tape is reached during forward cue or reverse review mode, and the REPEAT pin input level is L, a change in direction is executed. The mode is switched to reverse review if the direction change is from forward to reverse, or to forward cue if from reverse to forward, the new mode being continued until the beginning of the next tune is detected.
(7) If the PAUSE key is pressed to switch the transport mechanism to pause/playback mode while the internal timer is counting 12 seconds with the MUSIC input pin at L level during playback mode, the counting operation is suspended temporarily, and is continued again when playback mode is resumed by cancelling pause mode.
(8) When playback, cue, or review mode is started by pressing the MS key as described for the above music search operation, the detection operation does not actually commence until 160 msec afterwards (that is, 160 msec after the reel motor has been activated).
(9) If cue or review mode is started during copy, recording, recording/pause, or recording mute mode, the tape transport mechanism is switched to stop mode once the beginning of a tune is detected.

Note:
FWD denotes that the head is in position for forward playback, and REW denotes that the head is in position for reverse playback. CUE denotes tape transport from left to right, and REV denotes tape transport from right to left.

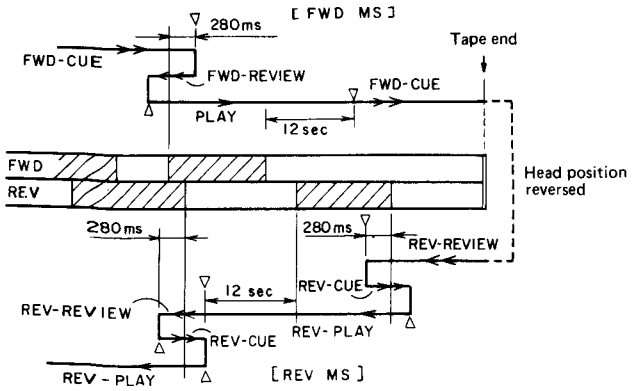


Fig. 4-3-5 Music search operation

12. Auto function

(1) Auto function stop
a. The tape transport mechanism is stopped by a trailing edge input applied to the AF STOP pin.
b. AF STOP can only be received during playback mode.
c. AF STOP cannot be received during the first 300 msec after output of AF PLAY.
(2) Auto function play
a. The AF PLAY output is at H level while the tape transport mechanism is in playback mode (excluding playback/pause, stop/-pause, recording mute, and recording/pause).
b. There is no AF PLAY output during copy mode.

13. Player (turntable) synchro function

(1) The tape transport mechanism is switched to recording mode when the PL-PLAY input trailing edge is detected during recording/pause auto space mute mode.
(2) If a PL-PLAY input leading edge is detected during recording mode, the mechanism is switched to recording/pause mode 4.5 seconds later.
(3) The PL-PLAY input is not accepted during copy mode.

14. Synchro copy function

(1) If the SYNCHRO COPY key is pressed while the STOP key is not being pressed, the COPY IND output is switched to H level.
(2) At the same time, the transport mechanism is switched to recording mode if the AR input is at L level. If the AR input is at H level, on the other hand, the mechanism is switched to stop mode. And if not switched to recording mode within 500 msec, the COPY IND output is switched to L level.
(3) If the A-PLAY input fails to switch to H level within 500 msec after the COPY IND output is switched to H, that output is again switched to L level.
(4) If the COPY IND output is at H level during recording mode, the PL-PLAY input is disregarded.
(5) If the COPY IND output is at H level during recording mode, and the A-PLAY input is switched to L level, or if a key is pressed to activate a mode apart from recording, recording/pause, and recording/mute, the COPY IND output is switched to L level.

15. Indicator outputs

See Fig. 4-3-6

Indicator output / Operation mode	PLAY	PAUSE	REC	REC MUTE
STOP	L	L	L	L
STOP/PAUSE	L	H	L	L
FF or CUE	L	L	L	L
REW or REVIEW	L	L	L	L
PLAY	H	L	L	L
PLAY/PAUSE	H	H	L	L
REC	H	L	H	L
REC/PAUSE	H	H	H	L
REC MUTE	H	L	H	H/L (H)

- L: indicator off, H: indicator on, H/L: blinking.
- The REC MUTE indicator blinks on and off during auto space muting, and remains on during normal recording muting mode.

Fig. 4-3-6 Indicator outputs

16. Power off processing

(1) When a pulse (leading edge) is applied to the POWER OFF PULSE pin, the $\overline{\text{LINE MUTE}}$ and and $\overline{\text{REC MUTE}}$ outputs are swithced to L level irrespective of the current tape transport mode. (See Fig. 4-3-7).

(2) When a pulse (leading edge) is applied to the POWER OFF PULSE pin, each IND output is switched off (L) 20 ms later, and the tape transport is switched to stop mode irrespective of the current mode. Additional key inputs are inhibited for a period of three seconds.

(3) This power off processing function has priority over the remote control signal processing function.

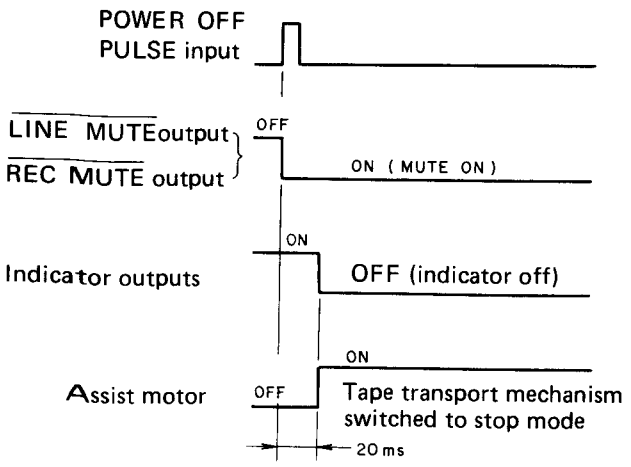


Fig. 4-3-7 Power off processing

17. Motor control outputs

(1) Assist motor
See Fig. 4-3-8.

(2) Reel motor
See Fig. 4-3-9.

Output port	①	②	③	④
AM-F	L	H	L	H
AM-R	L	L	H	H

① Stop when in motor-open condition.
② Assist transport mechanism to forward playback direction.
③ Assist transport mechanism to reverse playback direction.
④ Apply electromagnetic brake to the assist motor (motor-shorted condition).

Fig. 4-3-8 Assist motor control

Output port	①	②	③	④
RM-R	L	H	L	H
RM-L	L	L	H	H

① Stop when in motor-open condition.
② Rotate reel motor in fast forward, cue, forward playback, and forward recording mode direction.
③ Rotate reel motor in rewind, review, reverse, playback, and reverse recording mode direction.
④ Apply electromagnetic brake to the reel motor (motor-shorted condition).

Fig. 4-3-9 Reel motor control

18. Remote control signal processing function

- Infrared wireless remote control signals are received by the F-X700 and are applied to the DATA IN pin after removal of the carrier.
- When the prescribed serial input signal is applied to the DATA IN, the tape transport mechanism and signal system are controlled by the same processing as for a key input.

(1) Input conditions (after the carrier has been removed from the input signal)
   a. The signal format is as determined by the μPD6102G IC (see Fig. 4-3-10).
   b. Only when a specified custom code (component code) is applied to the DATA IN pin, the tape transport mechanism and signals are controlled according to the data code (command code) following the custom code.
   c. If a remote control signal is applied during an assisted mechanism operation, that input signal is not accepted and processed until the assisted operation has been completed.
   d. A check is made for a STOP key input during the remote control signal leader code interval, the remote control signal being disregarded if the STOP key input is on (L level).

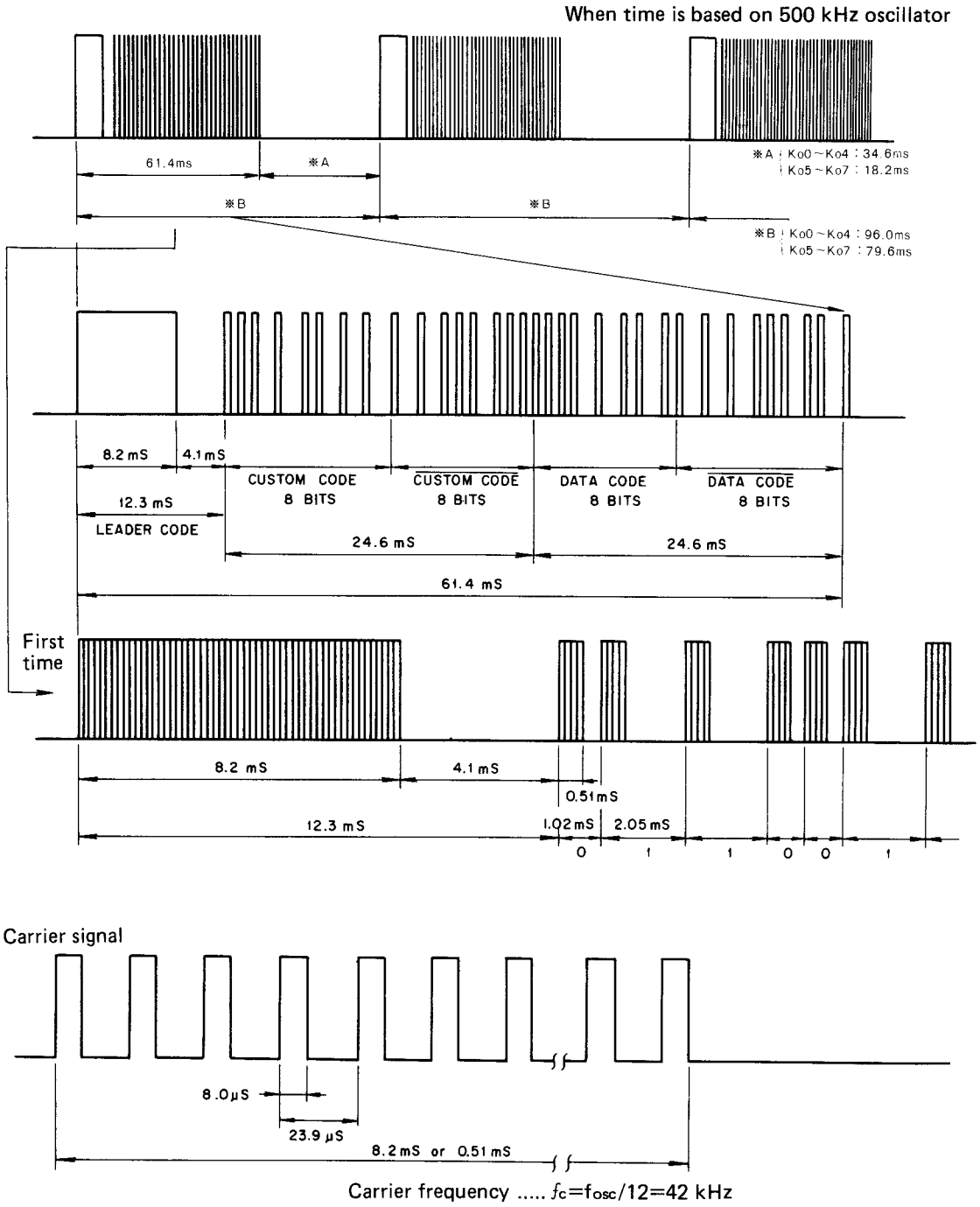


Fig. 4-3-10 Remote control signal format

(2) Input processing (tolerance of up to ±15% permitted in all times)
   a. The leading edge of the input signal is detected at the DATA IN pin.
   b. After leader code H level is detected, the validity of that code is determined by the period of time that the H level is maintained (approx. 12.3 msec).
   c. Custom code and data code "1" and "0" logical decisions are based on data pulse intervals (approx. 1.02 msec for "0", and approx. 2.05 msec for "1").

(3) Control processing
   a. If the remote control signal is valid, the control can be shifted to any of eight types of control mode (see Fig. 4-3-12).
   b. Execution of the control is identical to that when the same type of key input is applied.
   c. At the same time as this execution, a check is also made to see that a signal has been applied to the DATA IN pin. If it is found that the signal has been stopped (100 msec min.), the system is put into standby mode to wait for the input of another remote control signal.
   d. If the data in the first remote control signal is invalid, a second item of data is monitored, and subsequently executed if valid.
   e. If the second item of data is also invalid, a third item is monitored. This process is subsequently repeated.

19. Other operations

(1) In order to prevent encoder input chattering, the encoder input is rechecked after completion of the assisted mechanism operation.
(2) The REC MUTE indicator also blinks on and off when REC MUTE is used during copy operations.
(3) Tape transport mode initialization
Irrespective of the encoder position, forward stop mode is set when in forward direction, and reverse stop mode is set when in reverse direction.
(4) Although the generation of an abnormal condition in an assisted operation results in a change to stop mode, all outputs are switched off if the change to stop mode cannot be attained.
(5) If two specified keys are pressed during an assist operation, and one of the keys is released

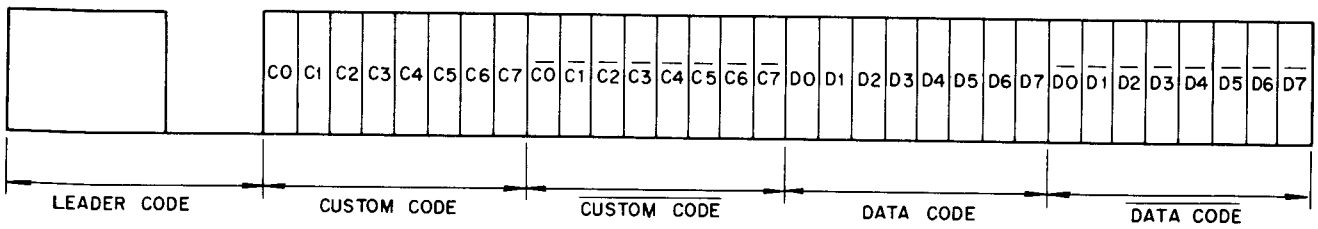


Fig. 4-3-11 Remote control signal data configuration

Custom code

	C0	C1	C2	C3	C4	C5	C6	C7
(A6)	0	1	1	0	0	1	0	1

Data code

0 : ⎍⎍

1 : ⎍‾⎍

- Custom code and data code 1/0 logical decisions are based on data pulse intervals.

Logic format

	D0	D1	D2	D3	D4	D5	D6	D7	Control mode	Remarks
K17	0	0	0	0	1	0	0	0	FF	
K18	1	0	0	0	1	0	0	0	REW	
K19	0	1	0	0	1	0	0	0	REC MUTE	
K21	0	0	1	0	1	0	0	0	REC	
K22	1	0	1	0	1	0	0	0	REV-PLAY	
K23	0	1	1	0	1	0	0	0	STOP	
K24	1	1	1	0	1	0	0	0	FWD-PLAY	
K25	0	0	0	1	1	0	0	0	PAUSE	

Fig. 4-3-12 Remote control signal code

before that assist operation is completed, completion of the first assist operation is followed by start of the second assist operation.

(6) Although the current assist operation is followed by the next assist operation when a key is pressed during the current operation, the MUTE output is not cancelled udring the change.

(7) "Completion of an assisted tape transport operation" is the point of time at the start of application of the last electromagnetic brake to the assist motor.

(8) FF refers to rapid tape transport from left to right, REW refers to rapid tape transport from right to left, CUE refers to rapid tape transport from left to right in the MS position, and REVIEW refers to rapid tape trnsport from right to left in the MS position.

(9) When two specified keys are pressed, the final mode is the same irrespective of which key was pressed first and which key was released first.

(10) The deck A PLAY IND output is connected to the A-PLAY input, and the various control outputs are obtained with the addition of the deck A operation mode conditions.

(11) The end processing following the start of normal recording mute mode is executed immediately since the 4.5 seconds has already elapsed.

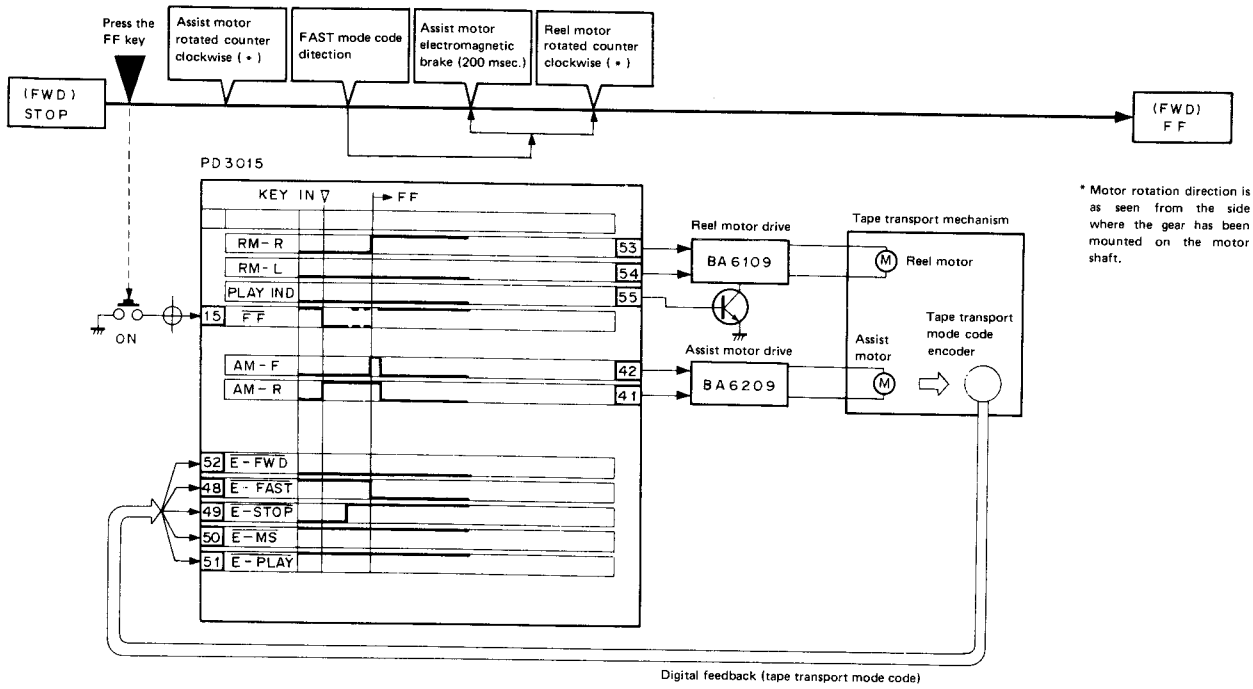
Condition		Control output pin / Tape transport mode	BIAS	REC SW	W REC SW	A SW	$\overline{A}$ $\overline{MUTE}$	$\overline{REC}$ $\overline{MUTE}$	$\overline{LINE}$ $\overline{MUTE}$
COPY IND :L	A PLAY :L	STOP	L	L	L	L	L	L	L
		STOP/PAUSE	L	L	L	L	L	L	L
		FF	L	L	L	L	L	L	L
		REW	L	L	L	L	L	L	L
		PLAY	L	L	L	L	L	L	H
		PLAY/PAUSE	L	L	L	L	L	L	L
		REC	H	H	H	L	L	H	H
		REC/PAUSE	H	H	H	L	L	L	H
		REC MUTE	H	H	H	L	L	L	H
	A PLAY :H	STOP	L	L	L	H	L	L	H
		STOP/PAUSE	L	L	L	H	L	L	H
		FF	L	L	L	H	L	L	H
		REW	L	L	L	H	L	L	H
		PLAY	L	L	L	L	L	L	H
		PLAY/PAUSE	L	L	L	H	L	L	H
		REC	H	H	H	L	H	H	H
		REC/PAUSE	H	H	H	L	H	L	H
		REC MUTE	H	H	H	L	H	L	H
COPY IND :H		REC	H	H	L	H	L	H	H
		REC PAUSE	H	H	L	H	L	L	H
		REC MUTE	H	H	L	H	L	L	H

Fig. 4-3-13 Tape transport modes and corresponding control outputs

4.4 ASSISTED MECHANICAL OPERATION TIMING

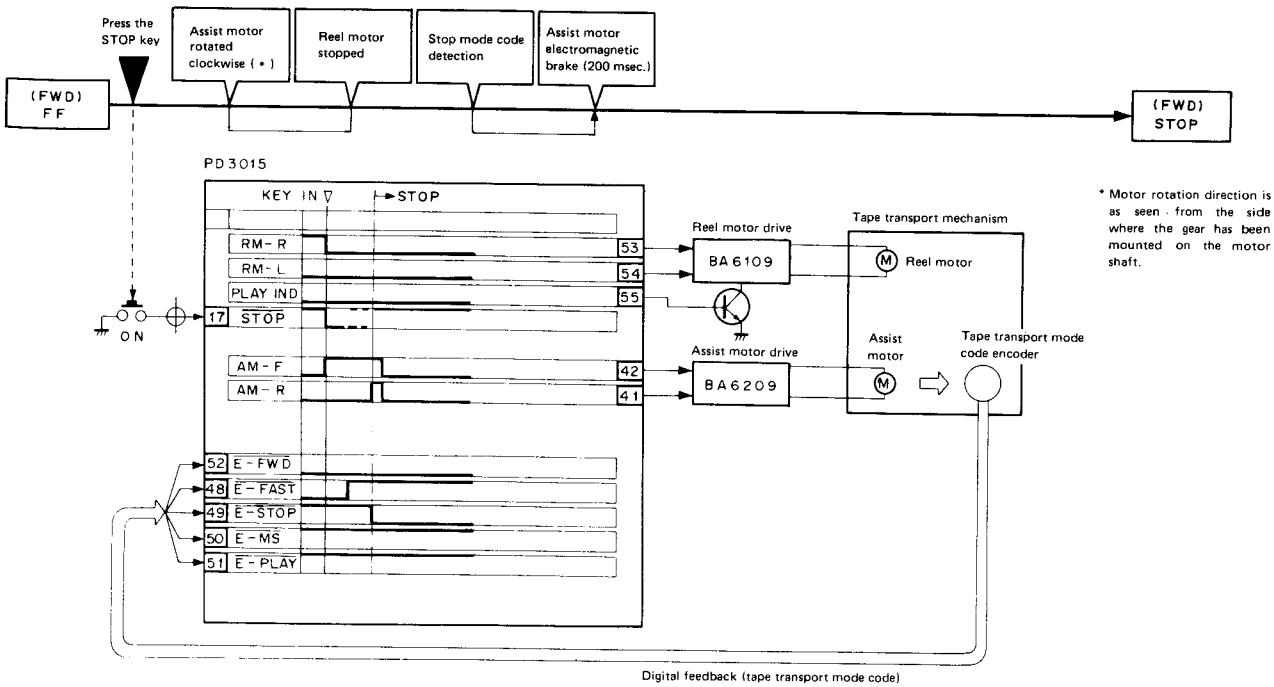
(FWD) : Head is in position for forward playback mode.
(REV) : Head is in position for reverse playback mode.
FF, CUE : Tape transport from left to right.
REW, REVIEW : Tape transport from right to left.

STOP → FF
(FWD) (FWD)



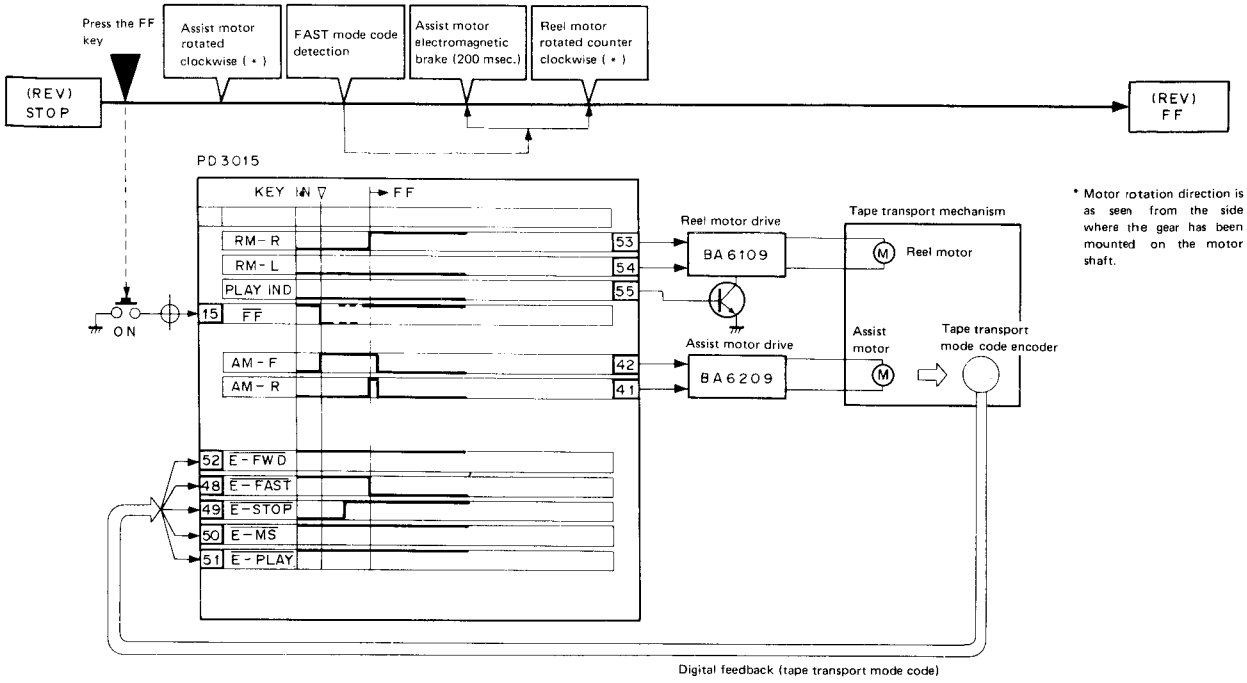
* Motor rotation direction is as seen from the side where the gear has been mounted on the motor shaft.

FF → STOP
(FWD) (FWD)

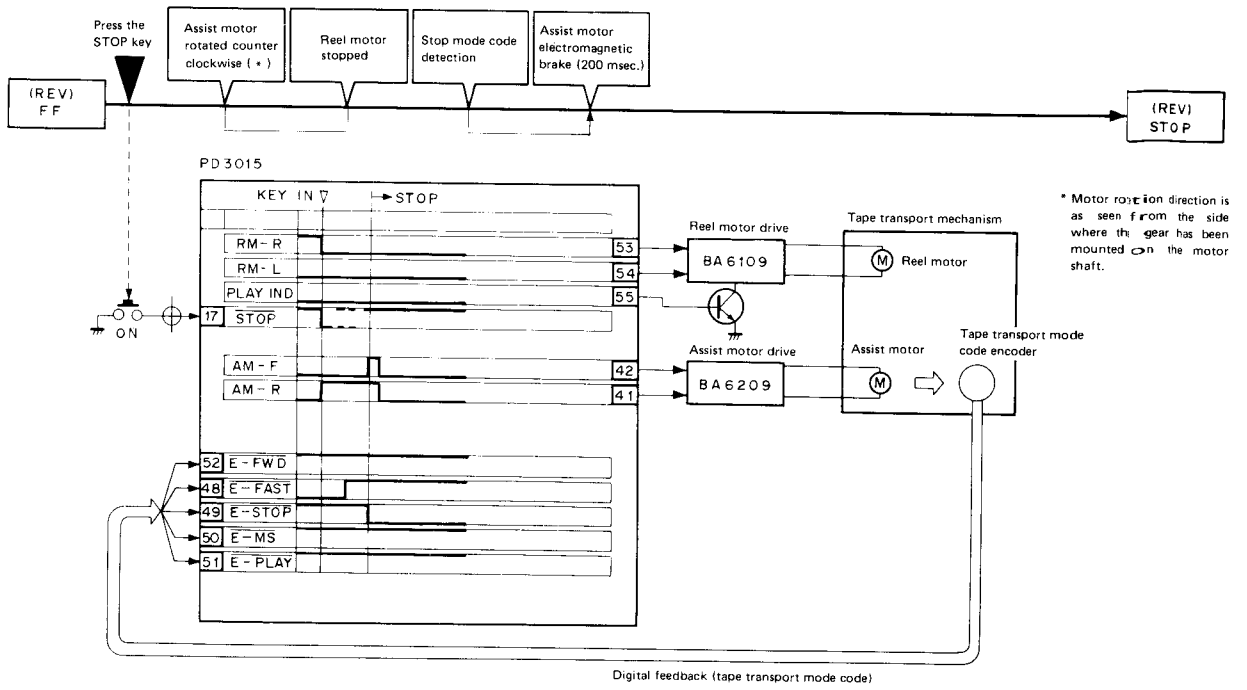


* Motor rotation direction is as seen from the side where the gear has been mounted on the motor shaft.

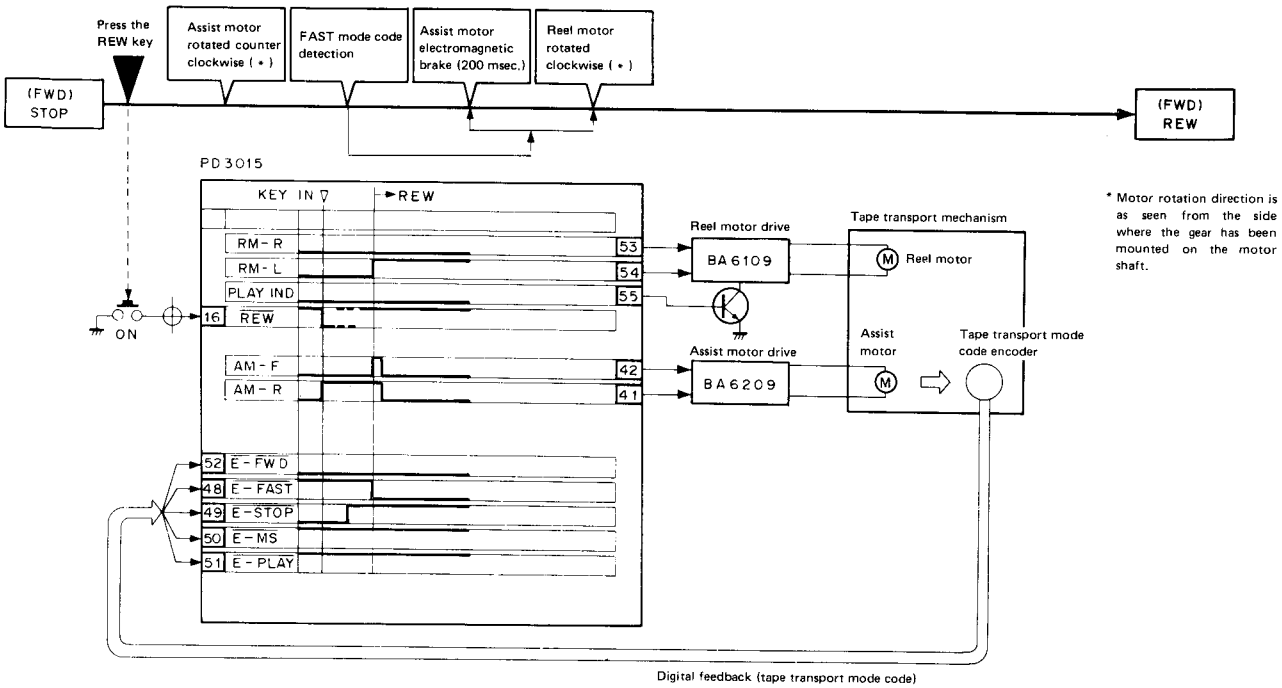
STOP (REV) → FF (REV)



FF (REV) → STOP (REV)

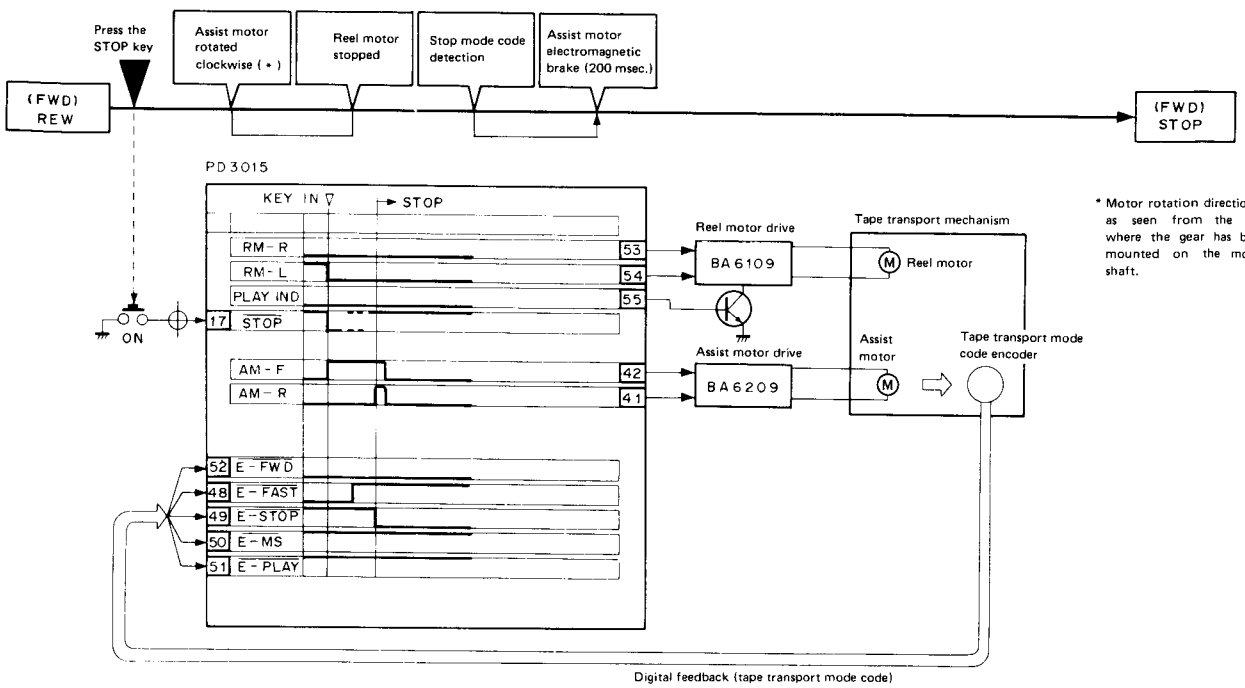


STOP (FWD) → REW (FWD)



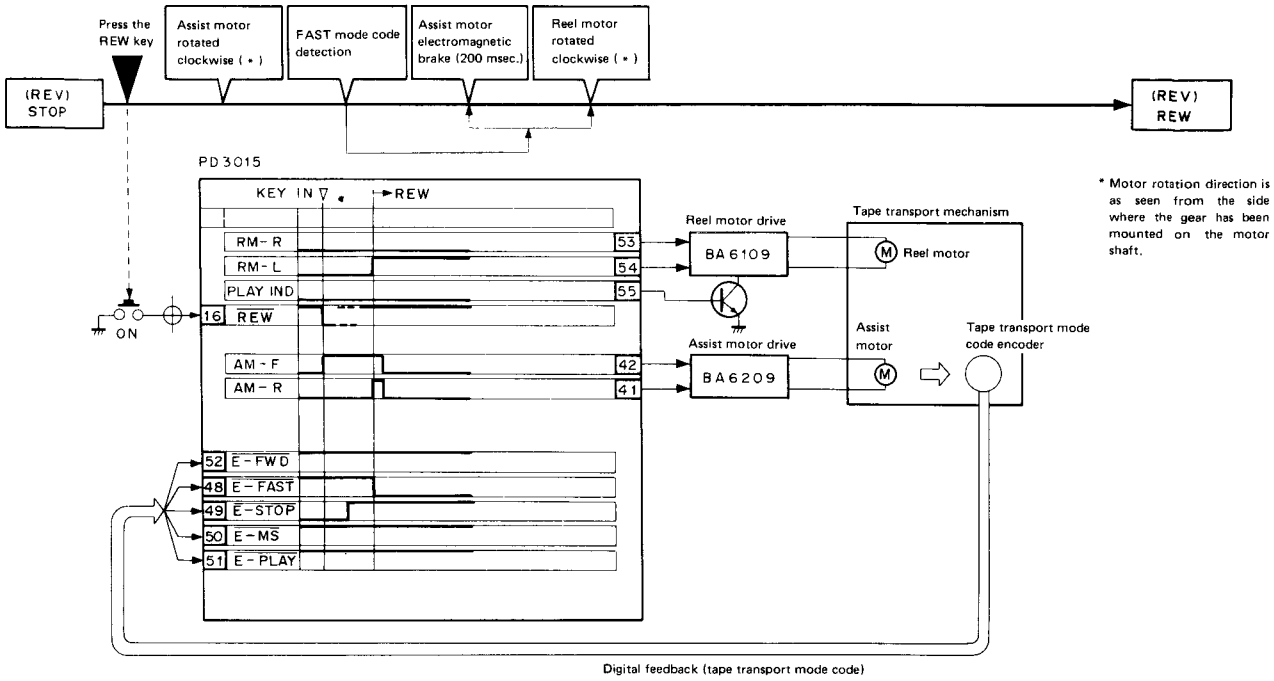
* Motor rotation direction is as seen from the side where the gear has been mounted on the motor shaft.

REW (FWD) → STOP (FWD)



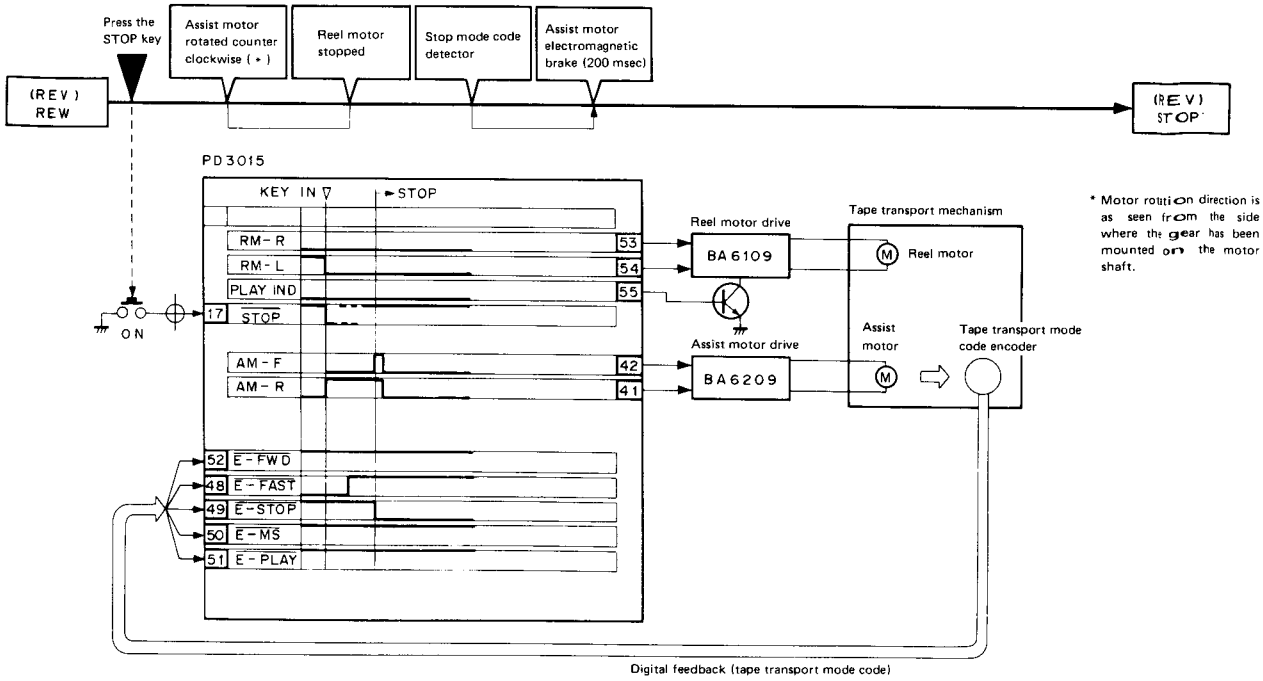
* Motor rotation direction is as seen from the side where the gear has been mounted on the motor shaft.

STOP (REV) → REW (REV)



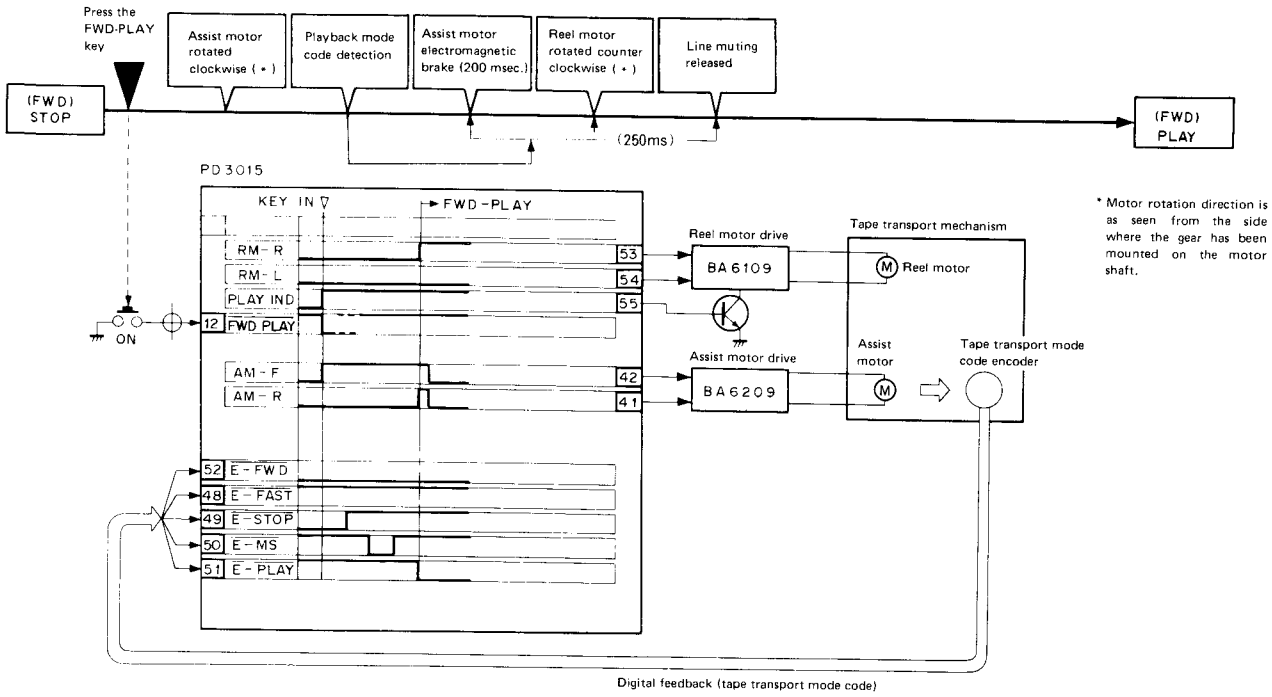
* Motor rotation direction is as seen from the side where the gear has been mounted on the motor shaft.

REW (REV) → STOP (REV)



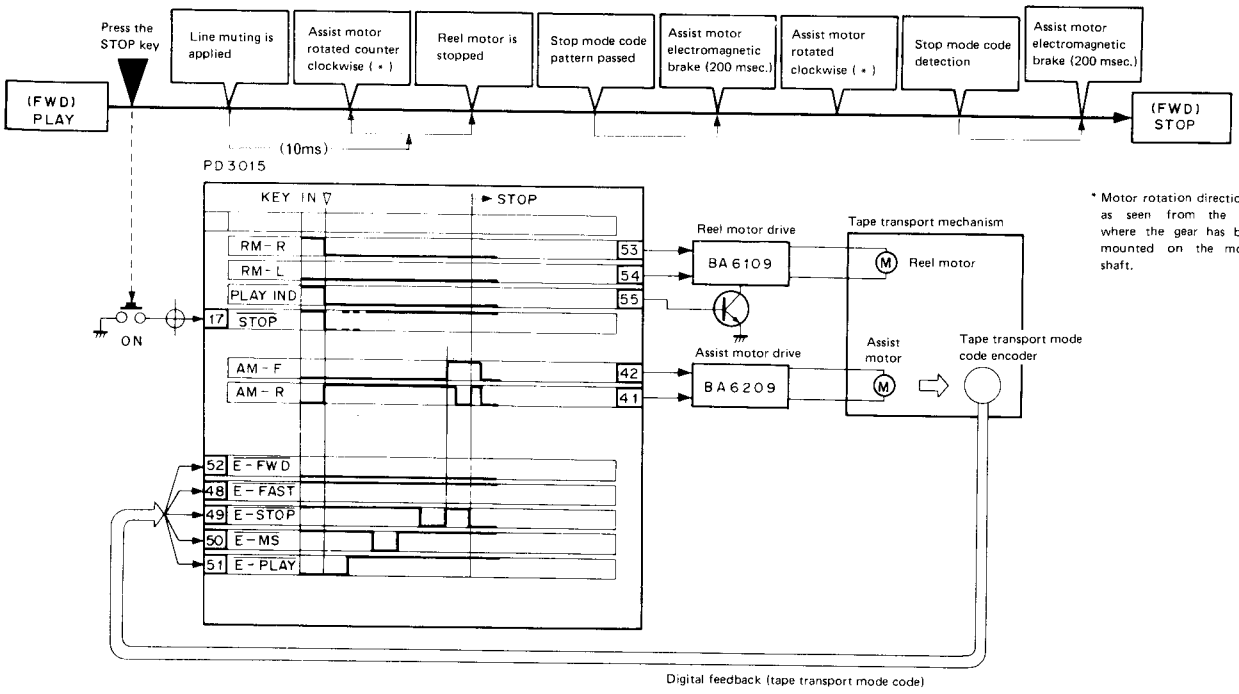
* Motor rotation direction is as seen from the side where the gear has been mounted on the motor shaft.

STOP (FWD) → PLAY (FWD)



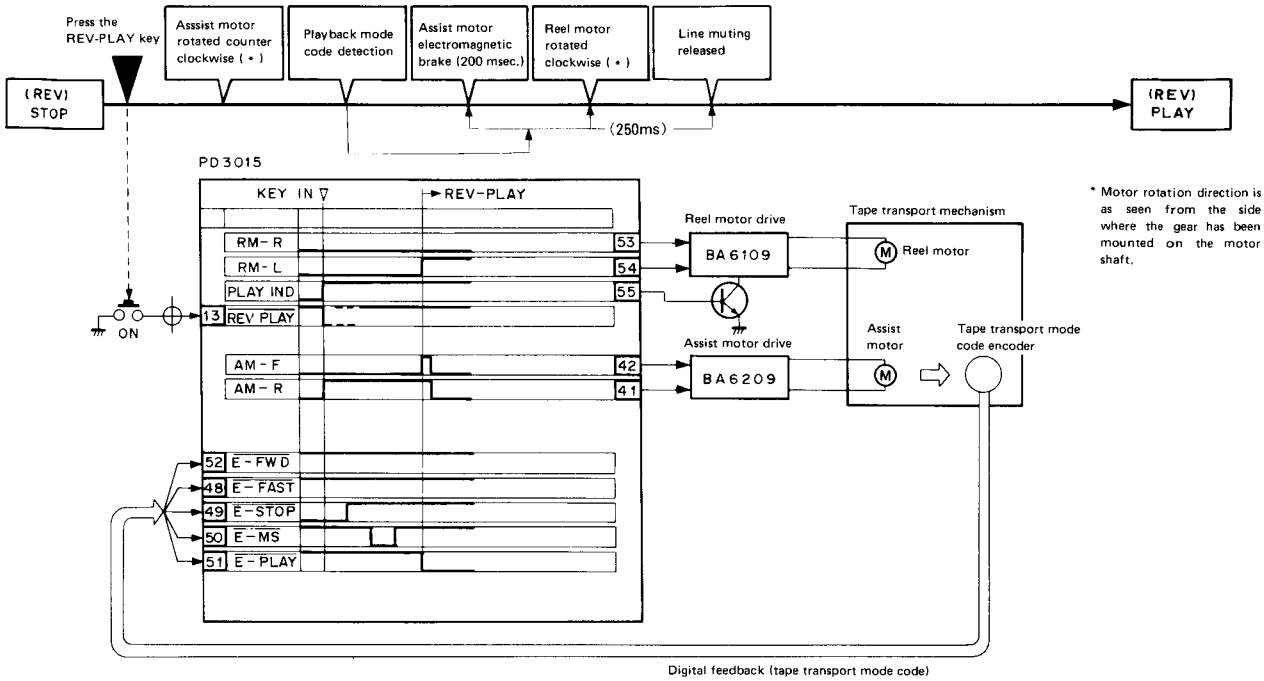
* Motor rotation direction is as seen from the side where the gear has been mounted on the motor shaft.

PLAY (FWD) → STOP (FWD)

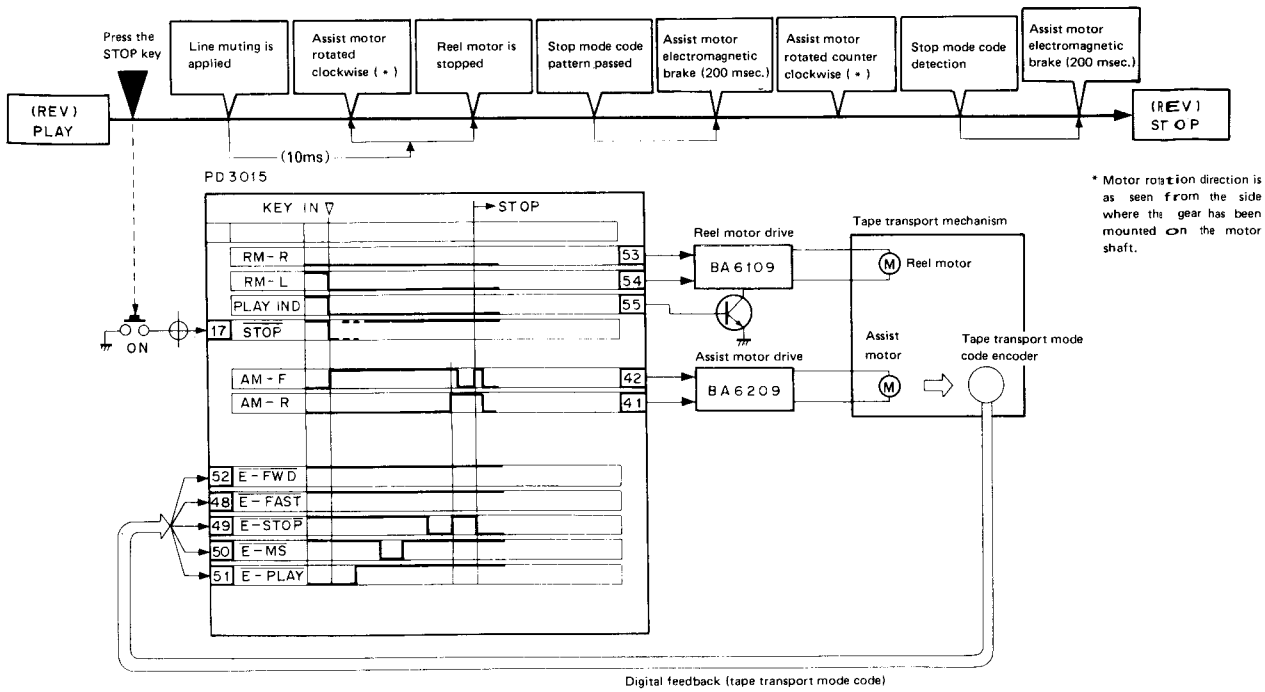


* Motor rotation direction is as seen from the side where the gear has been mounted on the motor shaft.

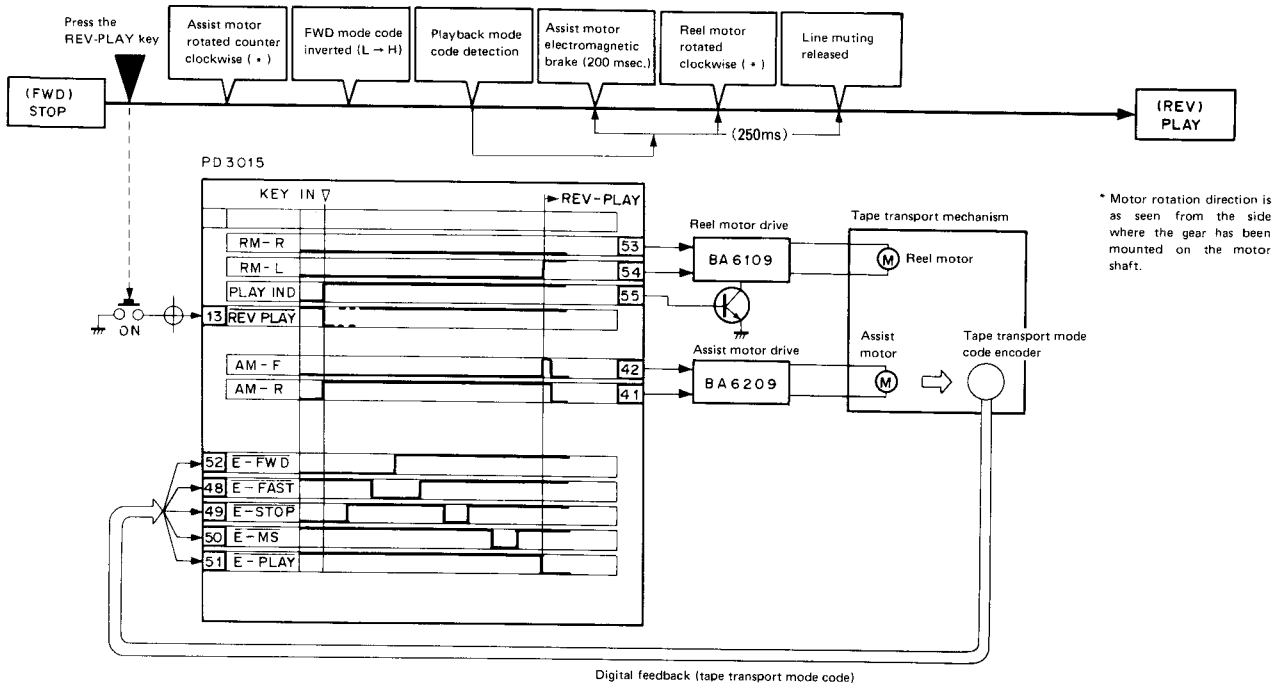
STOP (REV) → PLAY (REV)



PLAY (REV) → STOP (REV)

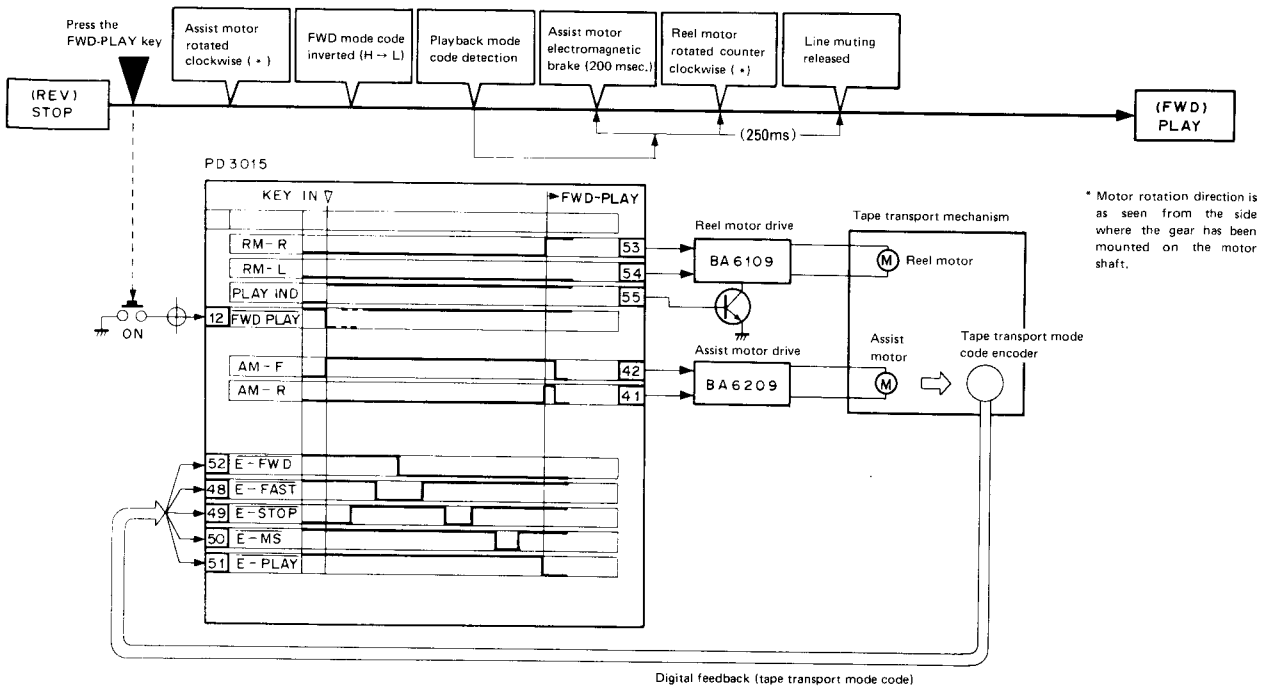


STOP (FWD) → PLAY (REV)



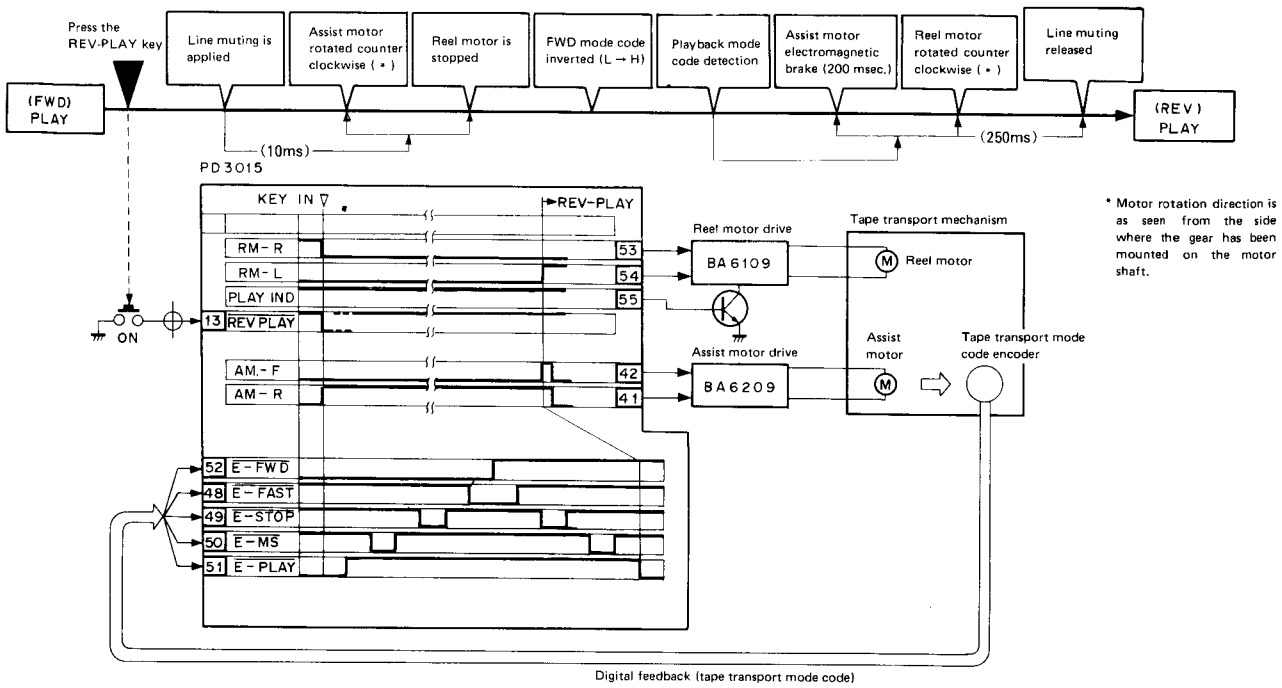
* Motor rotation direction is as seen from the side where the gear has been mounted on the motor shaft.

STOP (REV) → PLAY (FWD)



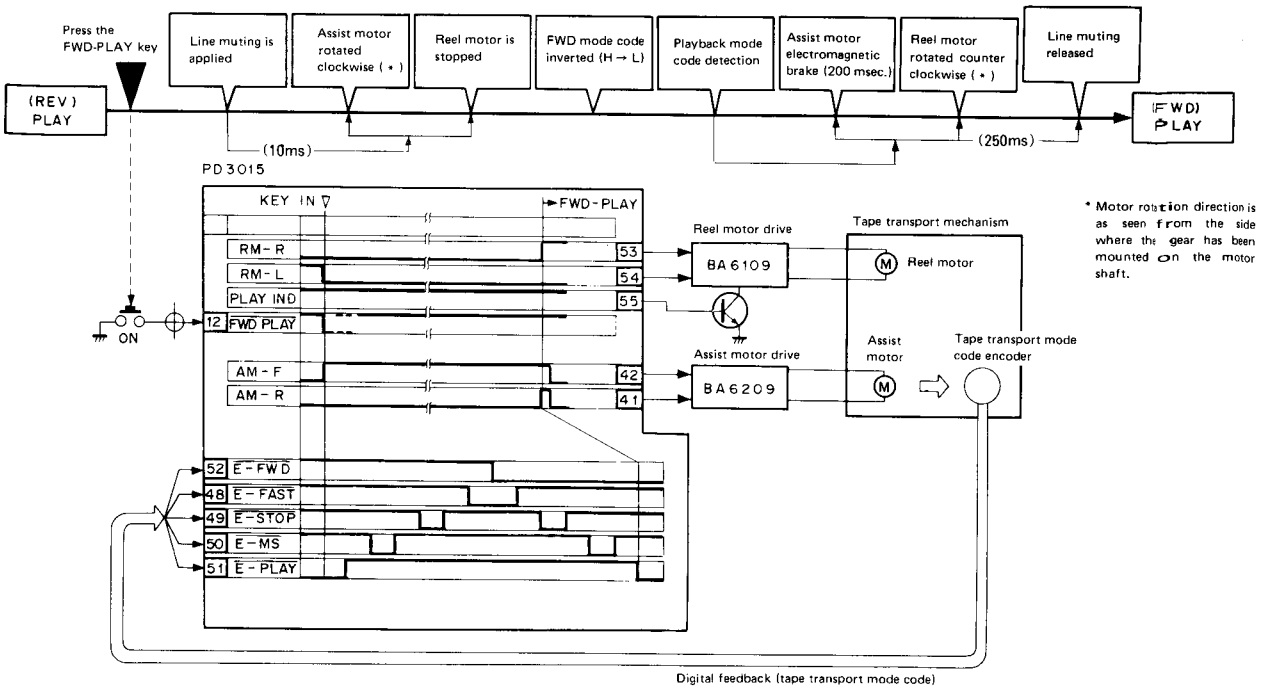
* Motor rotation direction is as seen from the side where the gear has been mounted on the motor shaft.

PLAY (FWD) → PLAY (REV)



* Motor rotation direction is as seen from the side where the gear has been mounted on the motor shaft.

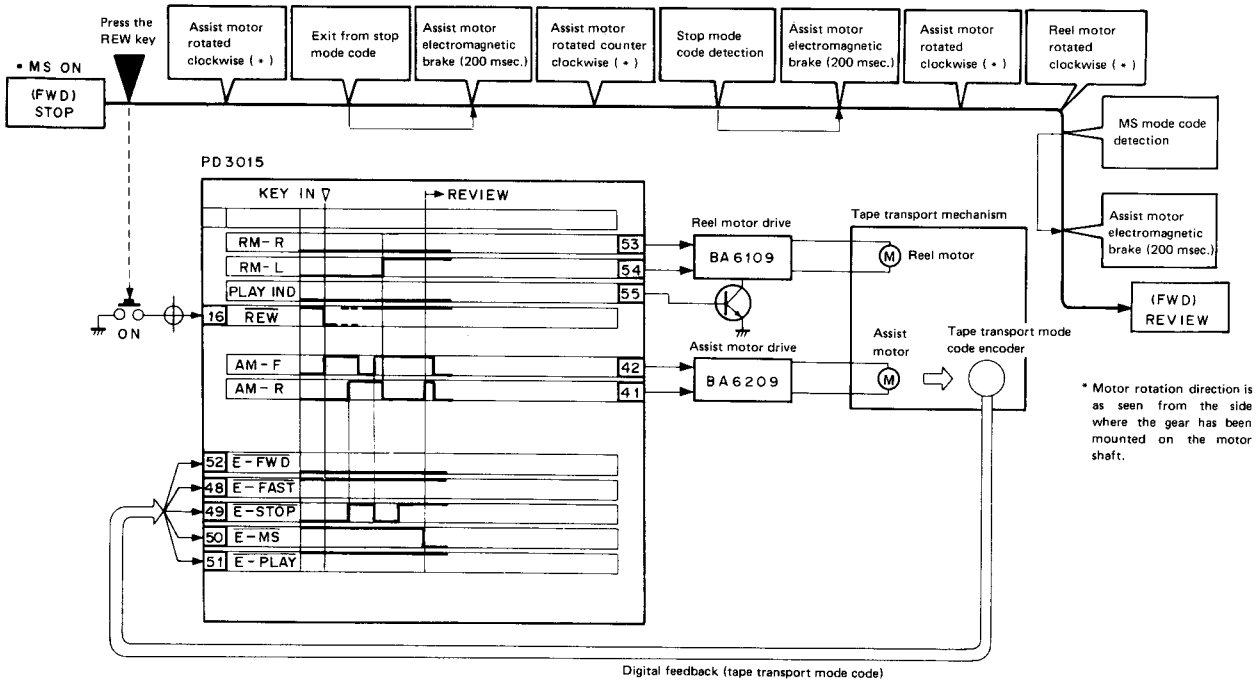
PLAY (REV) → PLAY (FWD)



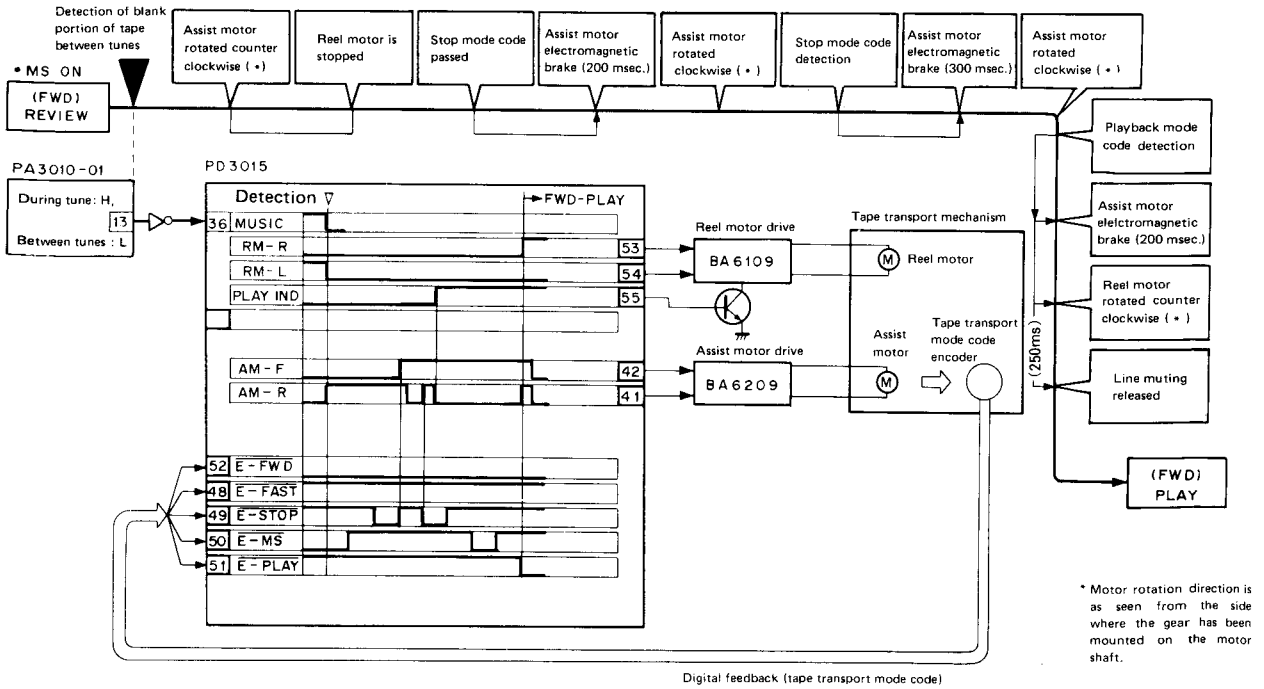
* Motor rotation direction is as seen from the side where the gear has been mounted on the motor shaft.

MS (REVIEW) (FWD)

STOP (MS-ON) —REW→ REVIEW —Detection of blank portion between tunes→ PLAY



* Motor rotation direction is as seen from the side where the gear has been mounted on the motor shaft.

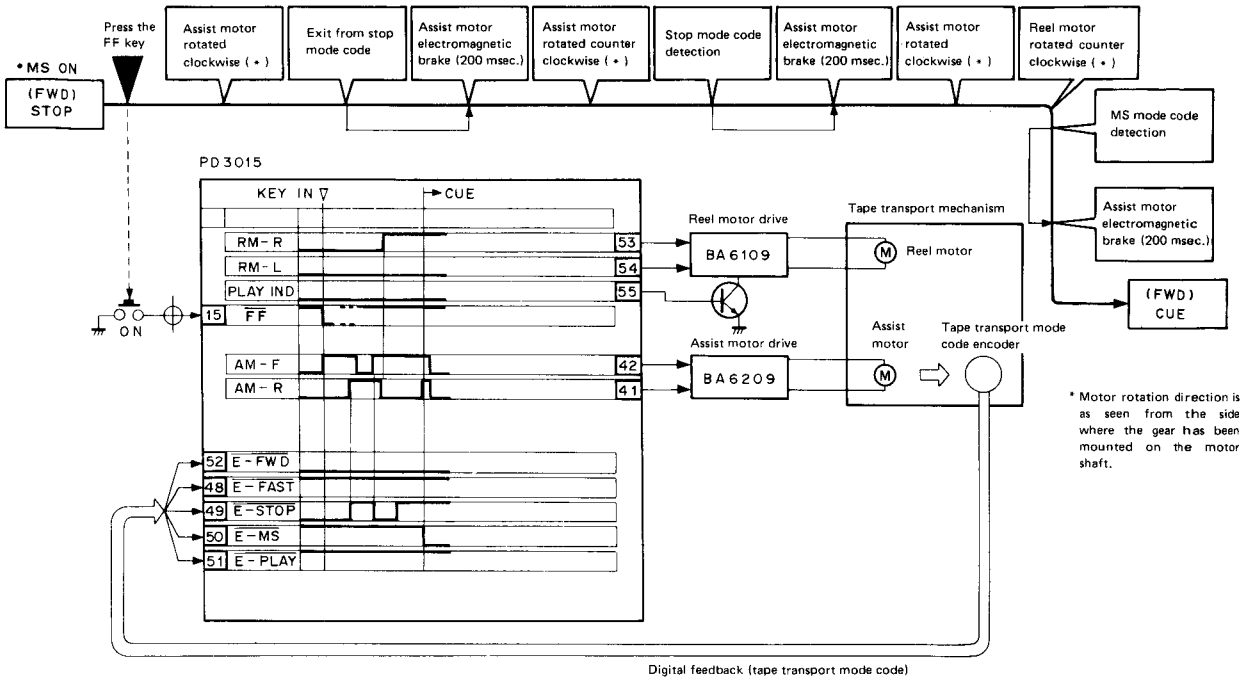


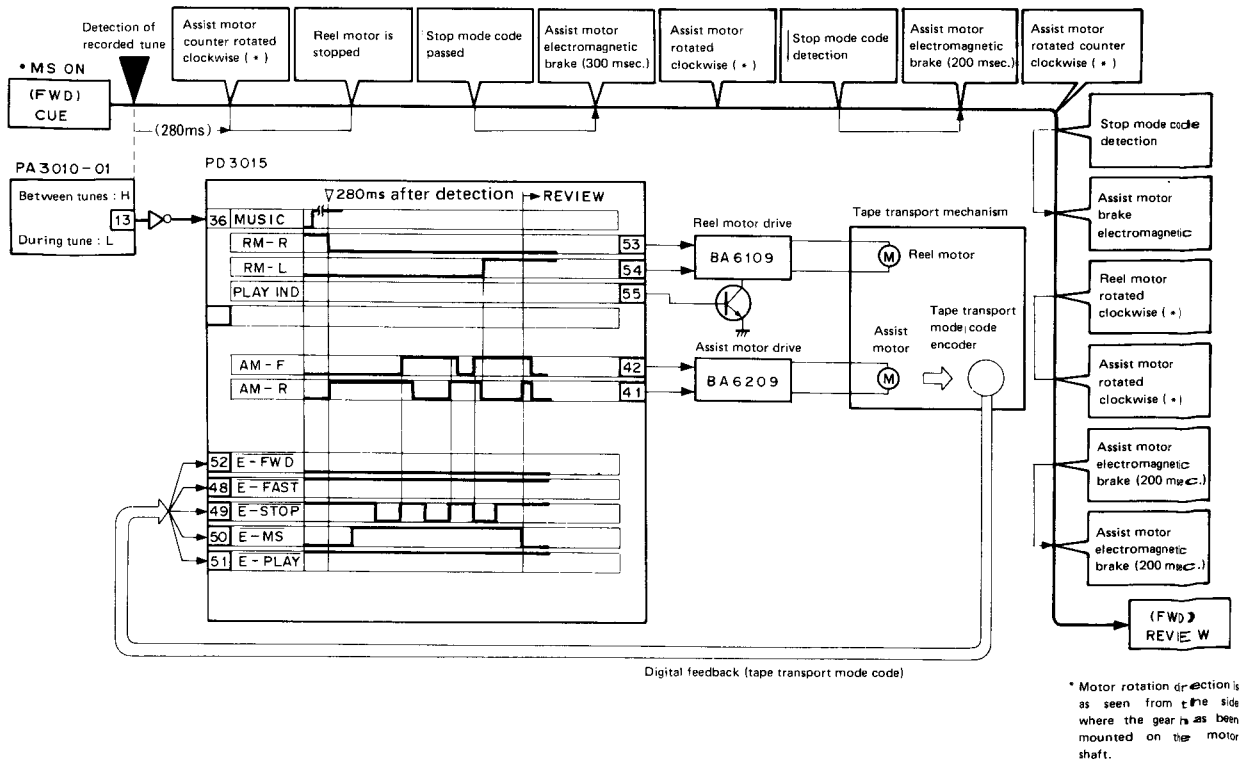
* Motor rotation direction is as seen from the side where the gear has been mounted on the motor shaft.

MS (CUE) (FWD)

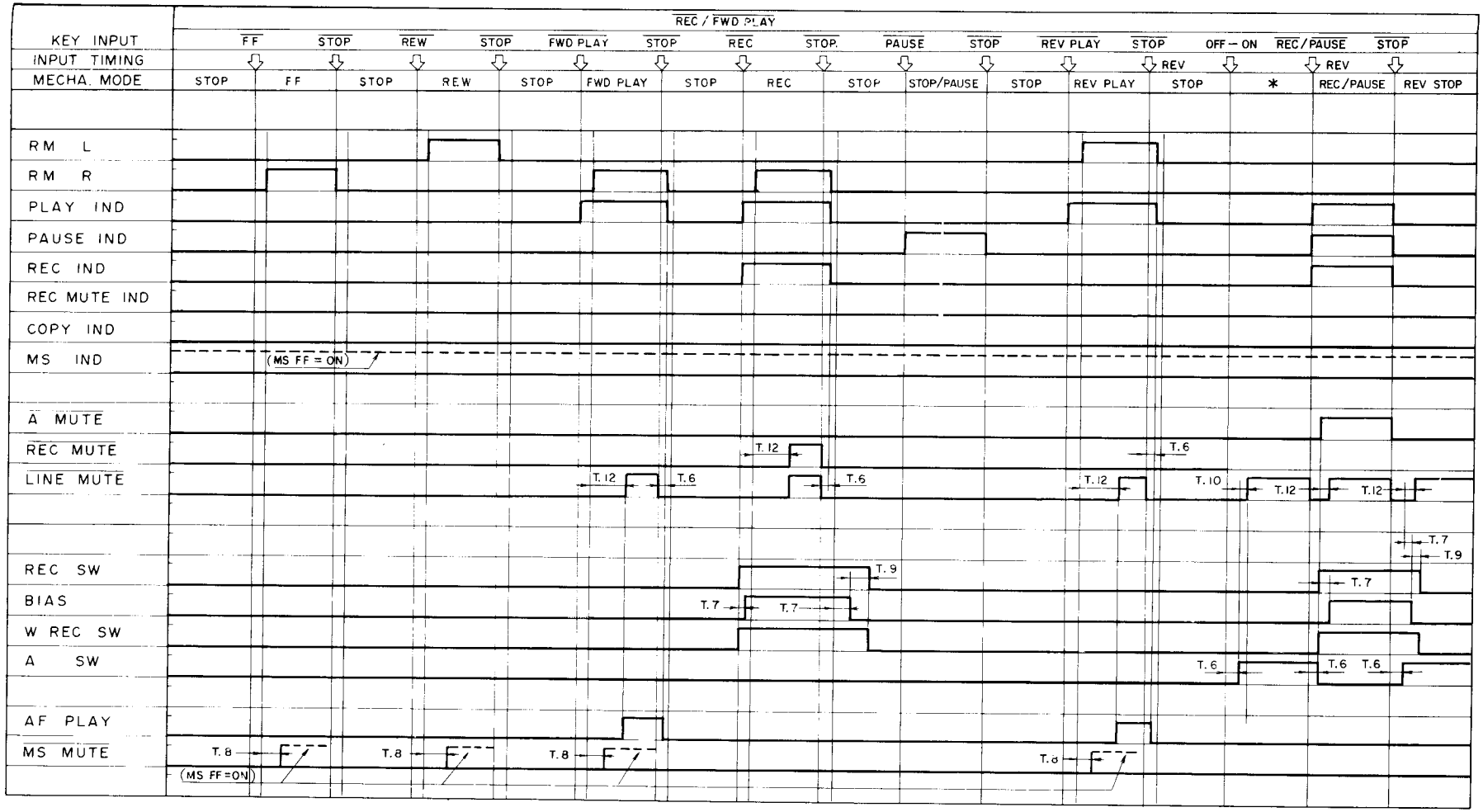
STOP (MS-ON) → FF ▽ → CUE → Tune detection ▽ → CUE (280ms) → REVIEW → Detection of blank portion between tunes ▽ → PLAY

(See p.50 below)





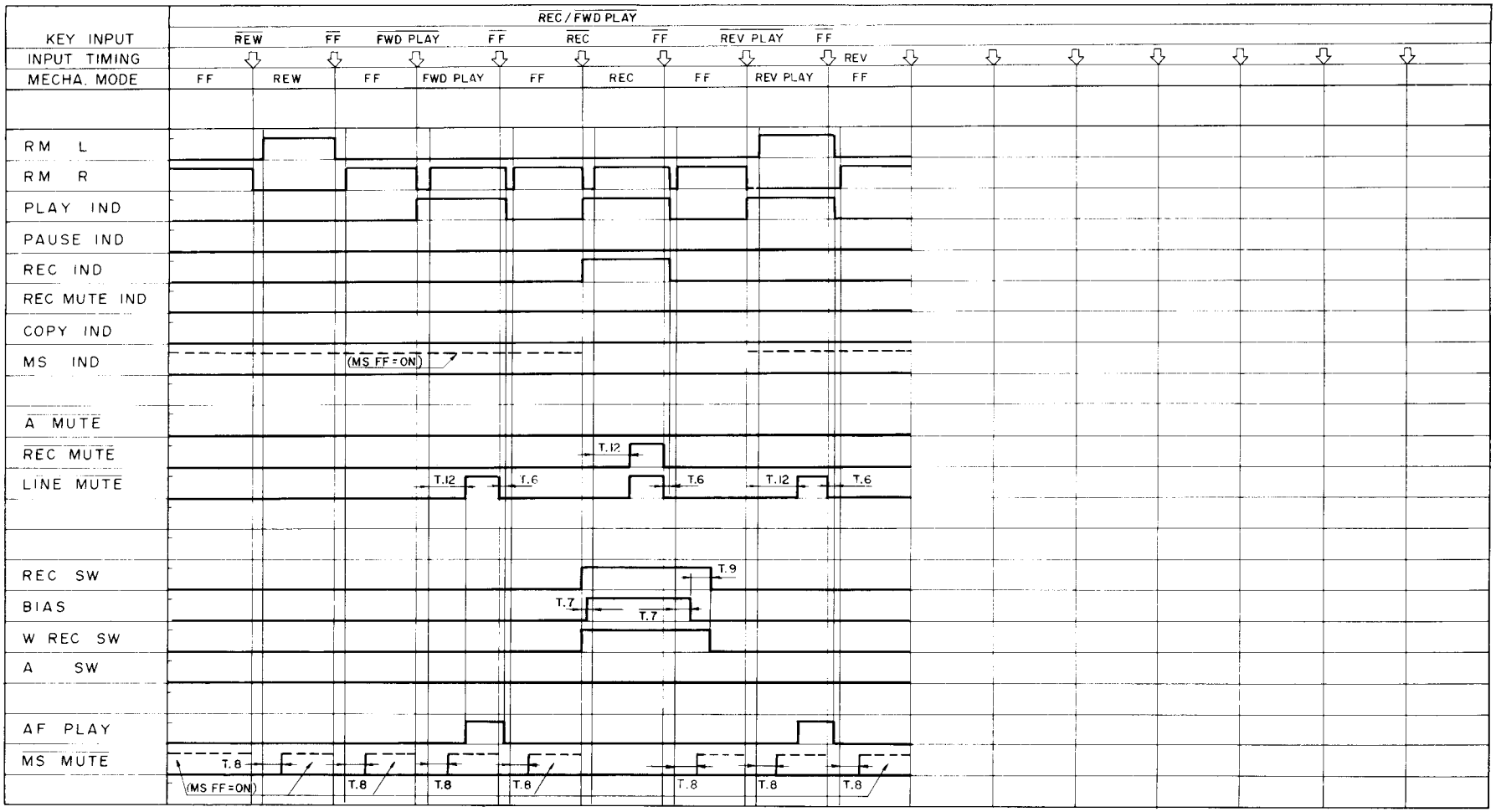
4.5 TIMING CHART



TIMING [mS]

T. 1		T. 8	110
T. 2		T. 9	60
T. 3		T.10	500
T. 4		T.11	160
T. 5		T.12	250
T. 6	10	T.13	
T. 7	40	T.14	

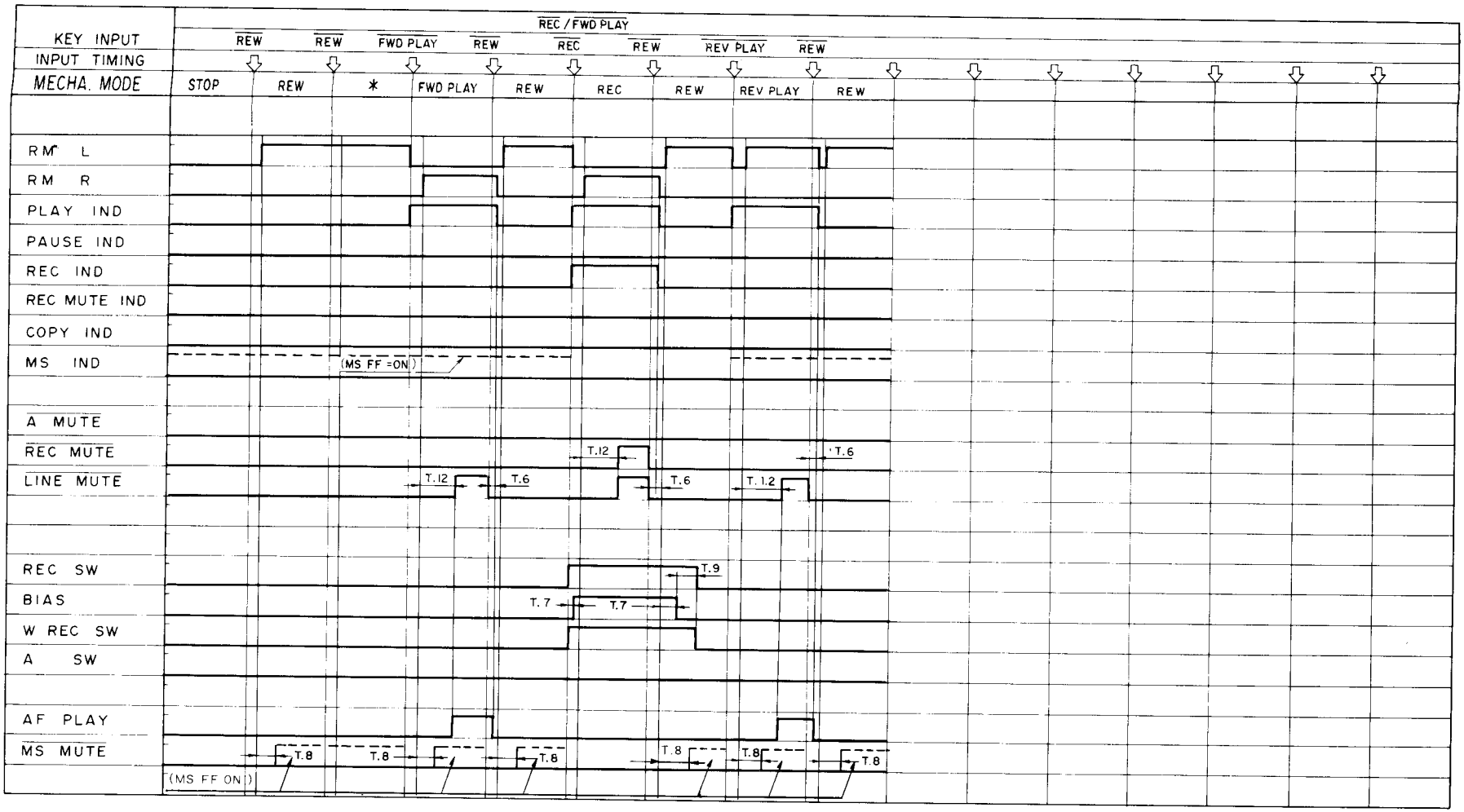
COPY FF : OFF
MS FF : OFF
A. PLAY : OFF



TIMING (mS)

T. 1		T. 8	110
T. 2		T. 9	60
T. 3		T.10	500
T. 4		T.11	160
T. 5		T.12	250
T. 6	10	T.13	
T. 7	40	T.14	

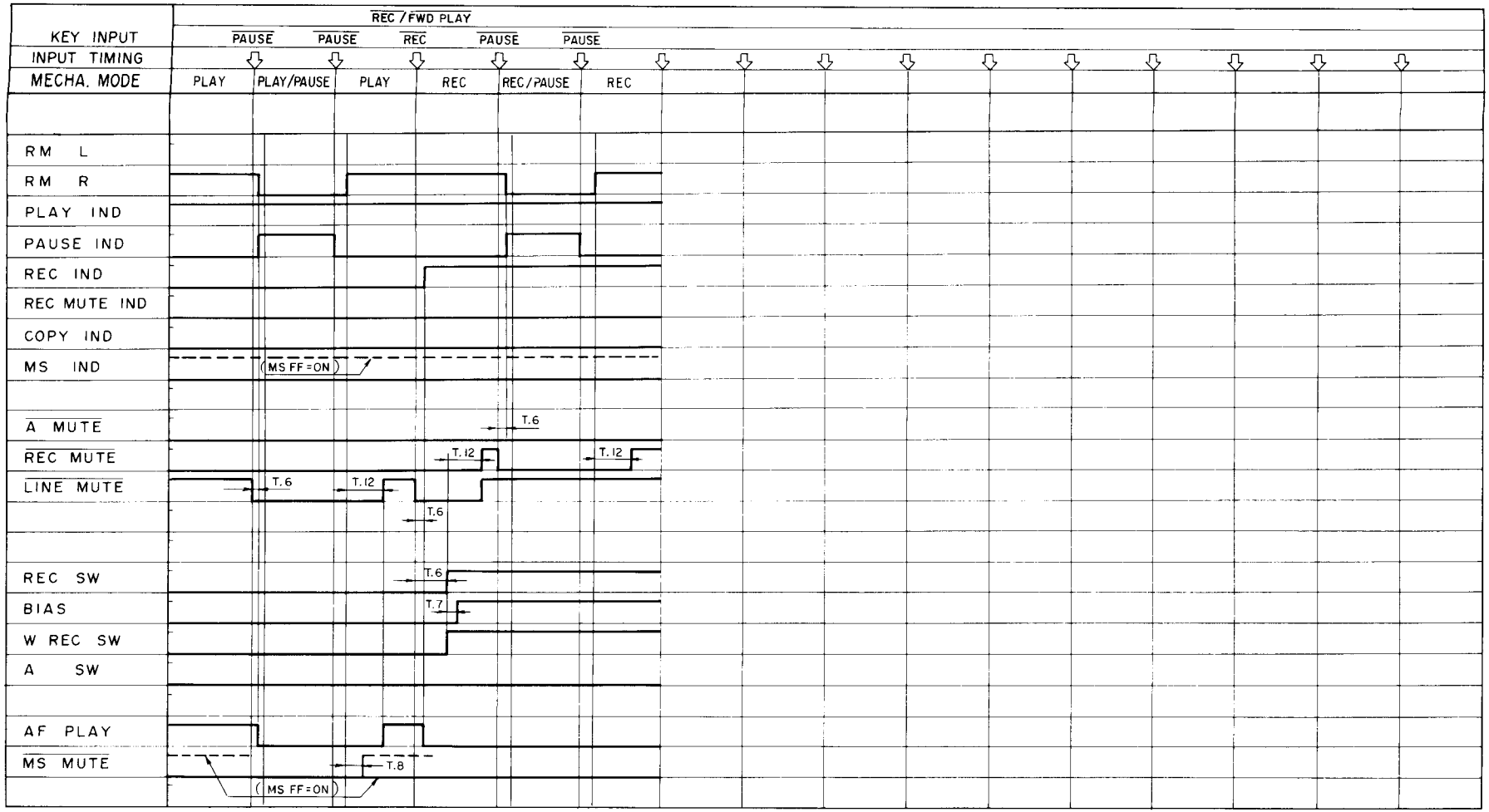
COPY FF : OFF
MS FF : OFF
A. PLAY : OFF



TIMING [mS]

T. 1		T. 8	110
T. 2		T. 9	60
T. 3		T.10	500
T. 4		T.11	160
T. 5		T.12	250
T. 6	10	T.13	
T. 7	40	T.14	

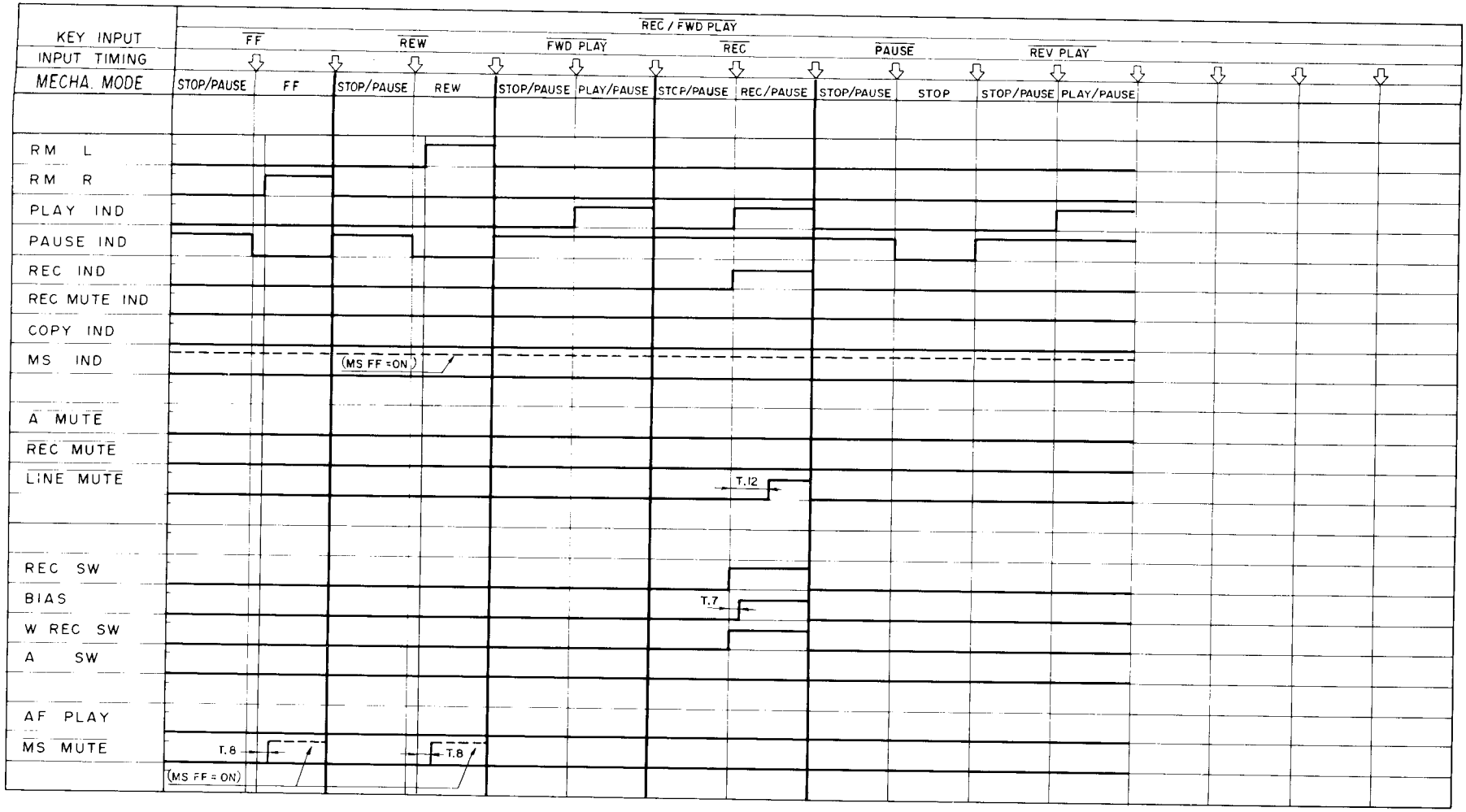
COPY FF : OFF
MS FF : OFF
A. PLAY : OFF



TIMING [mS]

T. 1		T. 8	110
T. 2		T. 9	
T. 3	300	T.10	500
T. 4		T.11	
T. 5		T.12	250
T. 6	10	T.13	
T. 7	40	T.14	

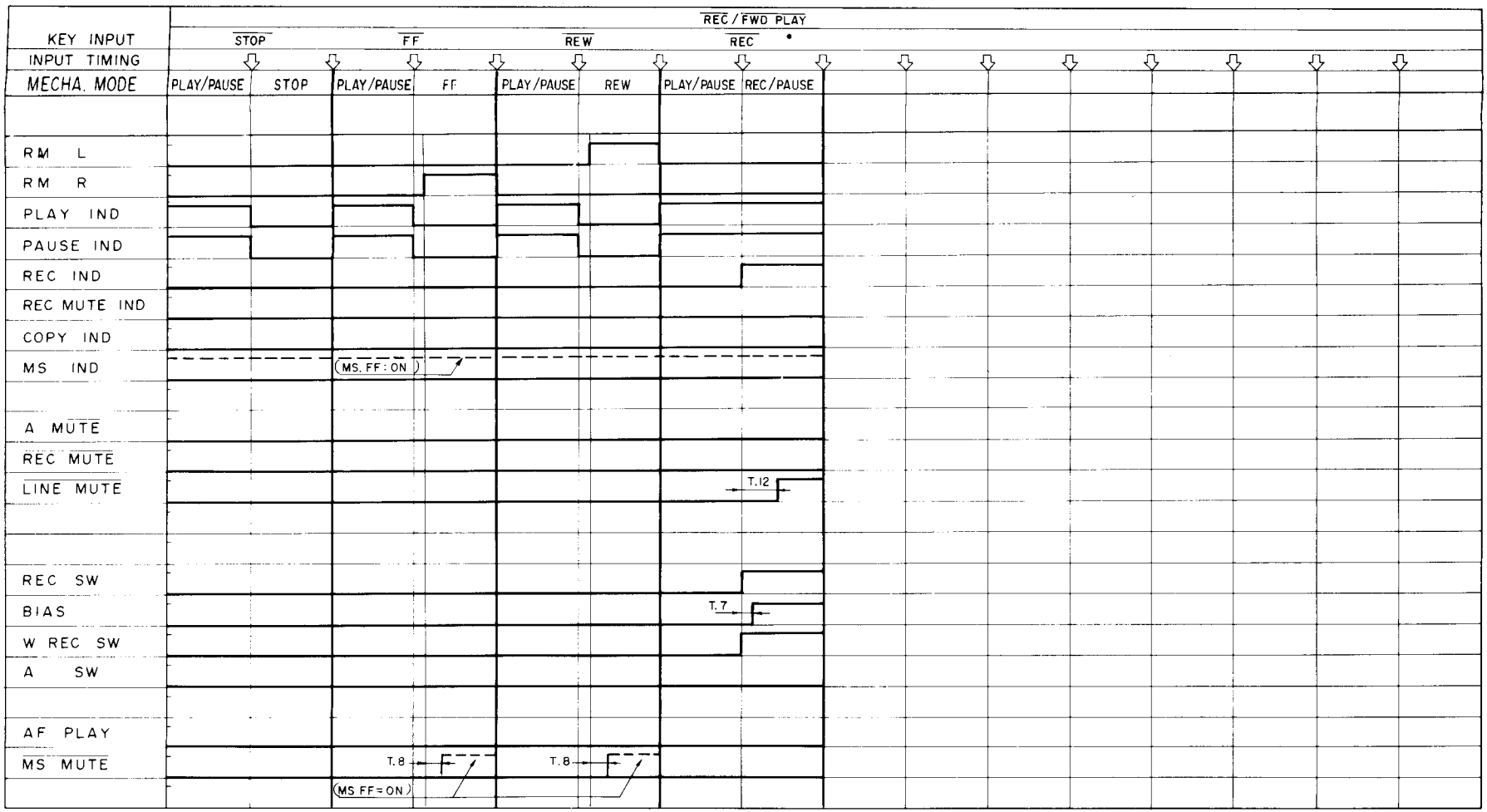
COPY FF : OFF
MS FF : OFF
A. PLAY : OFF



TIMING (mS)

T. 1		T. 8	110
T. 2		T. 9	
T. 3		T.10	500
T. 4		T.11	160
T. 5		T.12	250
T. 6		T.13	
T. 7		T.14	

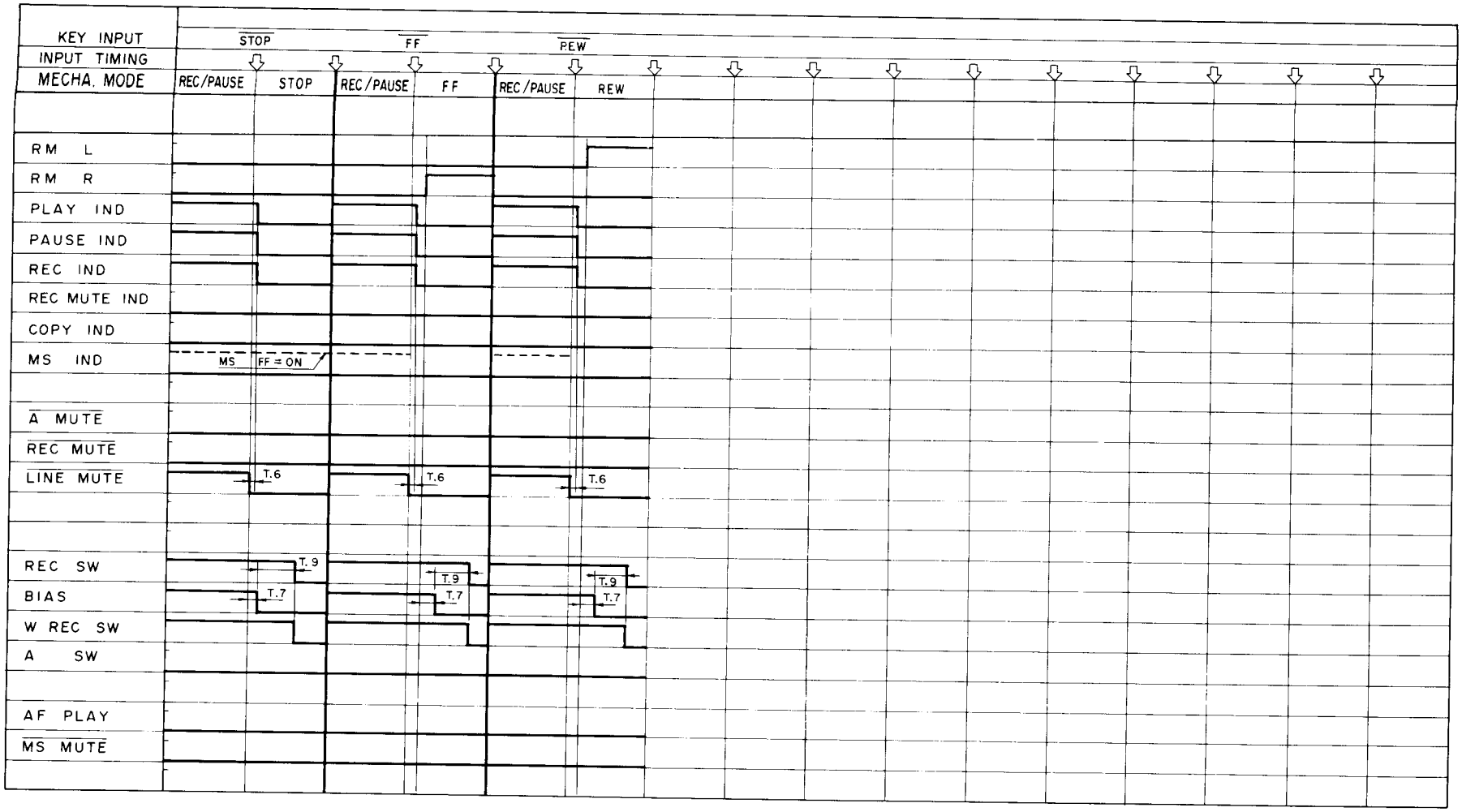
COPY FF : OFF
MS FF : OFF
A. PLAY : OFF



TIMING [mS]

T. 1		T. 8	110
T. 2		T. 9	
T. 3		T.10	500
T. 4		T.11	160
T. 5		T.12	250
T. 6		T.13	
T. 7		T.14	

COPY FF : OFF
MS FF : OFF
A. PLAY : OFF



TIMING [mS]

T. 1		T. 8	110
T. 2		T. 9	60
T. 3		T.10	500
T. 4		T.11	160
T. 5		T.12	
T. 6	10	T.13	
T. 7	40	T.14	

COPY FF : OFF
MS FF : OFF
A. PLAY : OFF