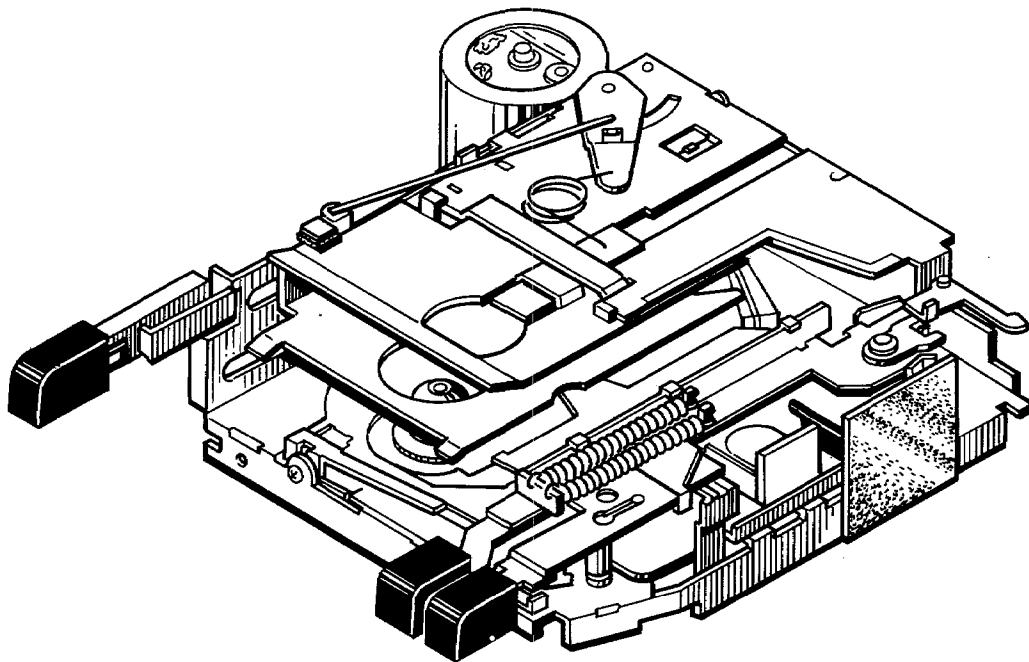


Technical Guide

Vol. 19

AUTO-REVERSE CASSETTE DECK (DECK 61X)



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OPERATION OF AUTO-REVERSE MECHANISM

This deck is a full-logic control cassette deck with the sequence-drive mechanism controlled by a microcomputer.

1. OUTLINE OF MECHANISM(DECK 61X)

A bi-directional motor and three solenoids (S1 ~ S3) are employed in order to achieve the operations of the mechanism. The power of the motor is also used to load or eject cassette tape. There are seven sensors (such as switch) which enable the microcomputer to control the conditions of the mechanism operation.

● Principle of Operation

1. When S3 is on with S1 and S2 off:

The torque of the motor is transmitted to EJECT mechanism when the motor rotates in counterclockwise direction, or to LOAD mechanism when it rotates in clockwise direction.

2. When S3 is off and the motor rotates in counterclockwise direction:

The torque of the motor is transmitted to reel base and flywheels. The tape runs after setting in PLAY, FF or REW mode.

3. When S3 is off and the motor rotates in clockwise direction:

The torque of the motor is transmitted to cam to change the mechanism operation mode. Mechanism changeover, which was done by pressing the lever in the past, is now done by the power drive system. Table 1-1 shows the operations of the motor and the solenoids at each mode.

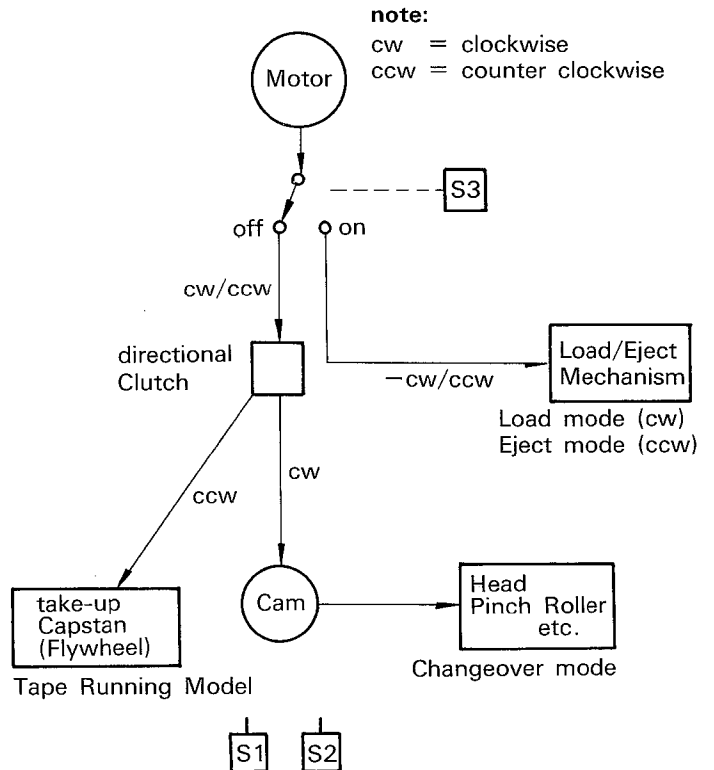


Fig. 1-1 Block diagram of mechanism

Solenoid	Changeover mode	Play	F/FF R/REW	F/REW R/FF	Load	Eject
S1	X	1	0	1	0	0
S2	X	1	1	0	0	0
S3	0	0	0	0	1	1
Motor	CW	CCW	CCW	CCW	CW	CCW
M1	1	0	0	0	1	0
M2	0	1	1	1	0	1

Table 1-1 Operation of the motor and the solenoids.

* There must be 100 msec. interval stop during changes of the direction of the motor between clockwise and counterclockwise.

2. OPERATION OF MICROCOMPUTER FOR LOGIC CONTROL

The microcomputer controls all the mechanism except time constant selection of tape equalizer (120, 70 μ sec.) and

mode selection of noise reduction (Dolby-B). Fig. 2-1 shows block diagram of the deck control system.

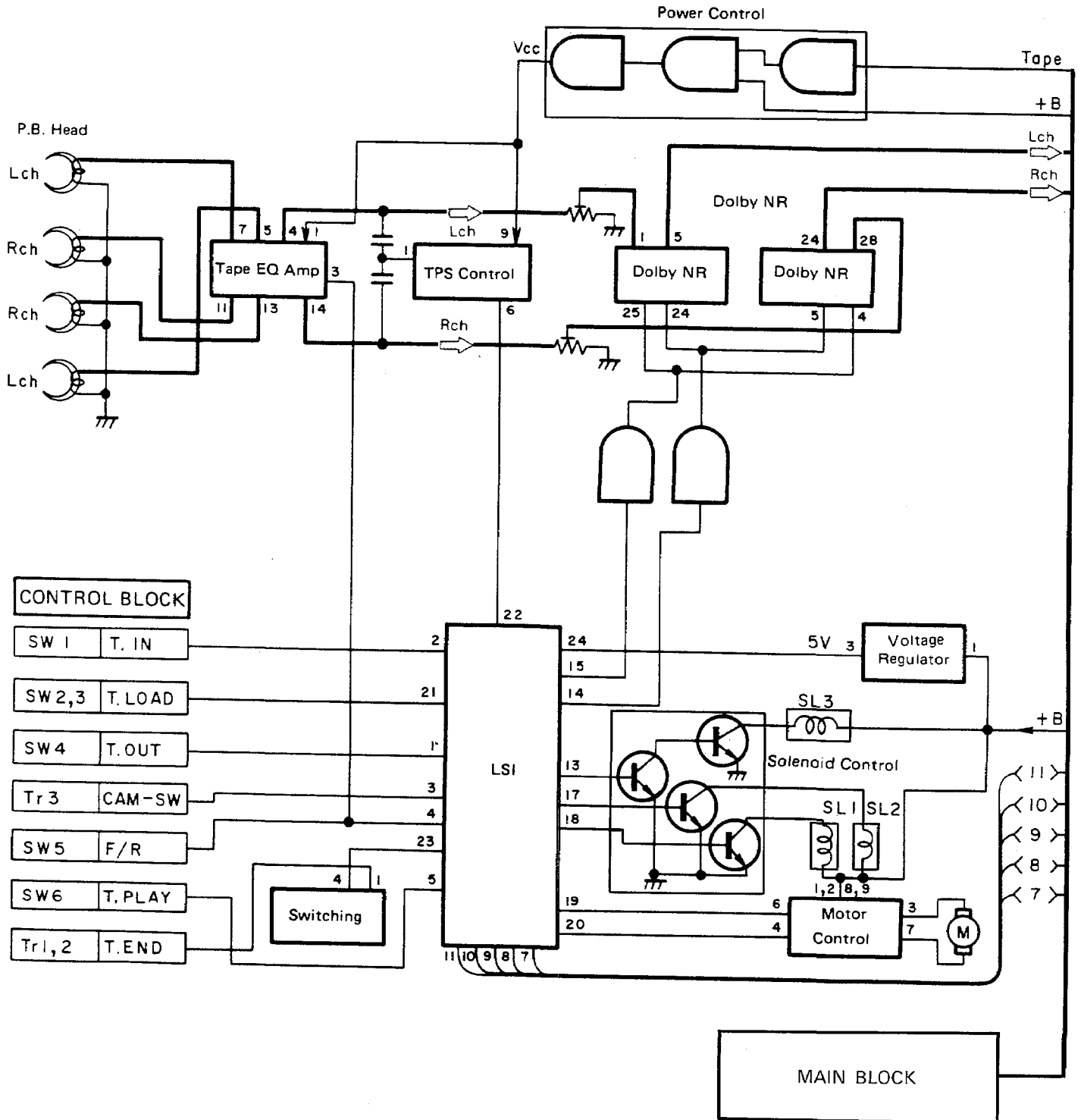


Fig. 2-1 Block Diagram of the Deck Control System

3. OPERATION OF THE SENSORS

1. TIN (Tape in Switch)

To indicate whether or not a cassette is inserted, TIN states:

- 0 : A cassette tape has been inserted.
- 1 : No cassette tape has been inserted.

TIN remains 0 as long as a tape is inside the mechanism. If TIN changes to 1 during loading, play, FF, or REW operation, it is changed to eject operation.

2. TLD (Tape Loading Switch)

This switch detects whether the cassette tape has been set in the play position.

(The switch consists of two switches connected in series.)

- 0 : Cassette tape is in the play position.
- 1 : Cassette tape is not in the play position.

TLD is used for detecting completion of loading operation. If TLD does not change to 0 in about 2.5 seconds after the tape is loaded, it is changed to eject operation.

3. TOUT (Tape Out Switch)

TOUT detects whether or not the cassette tape has been ejected.

- 1 : Cassette tape has been ejected.
- 0 : Cassette tape has not been ejected.

This switch is used for detecting the completion of eject operation, and triggers motor off. If TOUT does not change to 1 in about 2.5 seconds after the ejection is completed, it is changed to loading operation.

4. CAM (CAM Sensor)

CAM detects the position of the cam gear, and indicates completion of the change mode.

- 1 : Change mode has not been completed.
- 0 : Change mode has been completed.

This sensor is used for completing the change mode, and triggers motor rotating direction change. If CAM does not change to 0 in about 2.5 seconds after the change mode is in effect, the fault mode follows. If CAM changes to 1 during loading, eject, play, FF, or REW operation, the change mode follows.

5. A/B (F/R Switch)

This switch detects side A or B play.

- 0 : Side A
- 1 : Side B

6. TPLY (Tape Play Switch)

TPLY detects whether the mechanism is in the play mode.

- 1 : Not in the play mode
- 0 : In the play mode

This switch detects the position of the head chassis. It changes to 1 if the play mode is interrupted by vibration or other cause. In this case, the change mode follows to play the tape again. It also detects the position of cam gear in the change mode.

7. TEND (Tape End Sensor)

(for auto reverse)

Pulses are generated by the rotation of the take-up reel. TEND is used for tape end detection. If no pulse is generated for about 1.2 seconds or more during play, FF, or REW operation, the change mode follows to change the program.

Mode Sensor	PLAY	FF/REW	LOAD	EJECT	Change mode	Initializing
TIN	0	0	0 Motor drive trigger	(0)	(0)	1
TLD	(0)	(0)	1 0 : Change mode trigger	(1)	(0)	(1)
TOUT	(0)	(0)	0	0 1 : motor off trigger	(0)	1
CAM	0	0	0	0	1 0 : End trigger	0
A/B	(0 or 1)	(0 or 1)	0 or 1	(0 or 1)	0 ↔ 1	0 or 1
TPLY	0	(1)	1	1	PRG 0 → 1 → 0	(1)
TEND	Pulse	Pulse	(1)	(1)	(1)	(0)

Table 3-1 Sensors versus Modes

Parentheses indicate information independent of the prevailing mode.

The value in the parentheses indicates the value as a mode but has no direct relation to the operation of micro-computer.

4. CHANGE MODE OPERATION THEORY

In the change mode, solenoid S_3 turns off, the motor runs in clockwise direction, motor power is conveyed to the cam gear, and the piston movement of the cam gear arm drives the mechanism to effect a change. The cam gear makes one turn in about 1.2 seconds.

Three sensors, the CAM sensor, A/B switch, and TPLY

switch, operate with the cam gear. These switches operate with the rotation of the cam switch as shown in Fig. 4-1.

The locations of the switches in the deck mechanism are shown in Fig. 4-2. Switch operations in playing side A and side B are shown in Fig. 4-3 and 4-4.

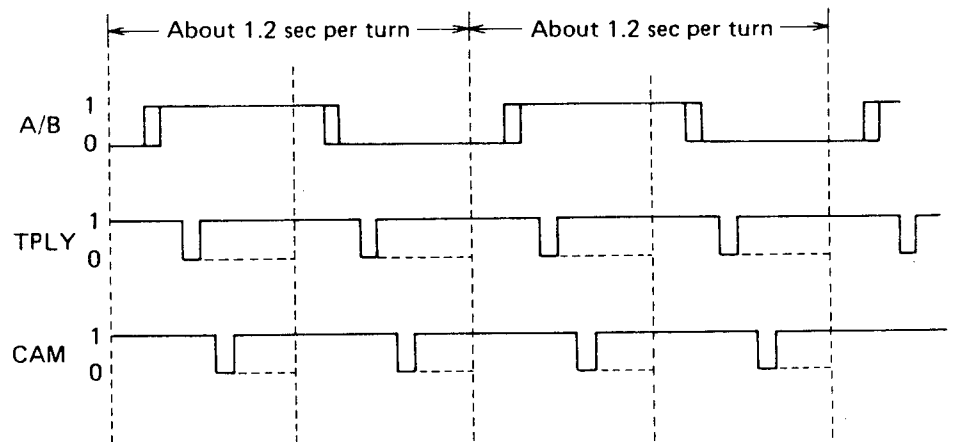
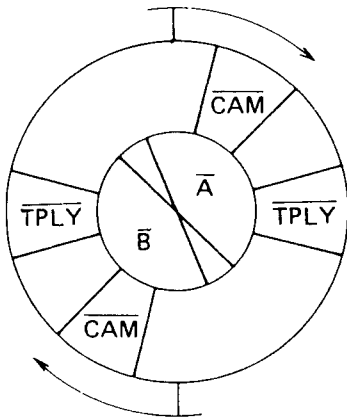


Fig. 4-1 Change mode timing chart

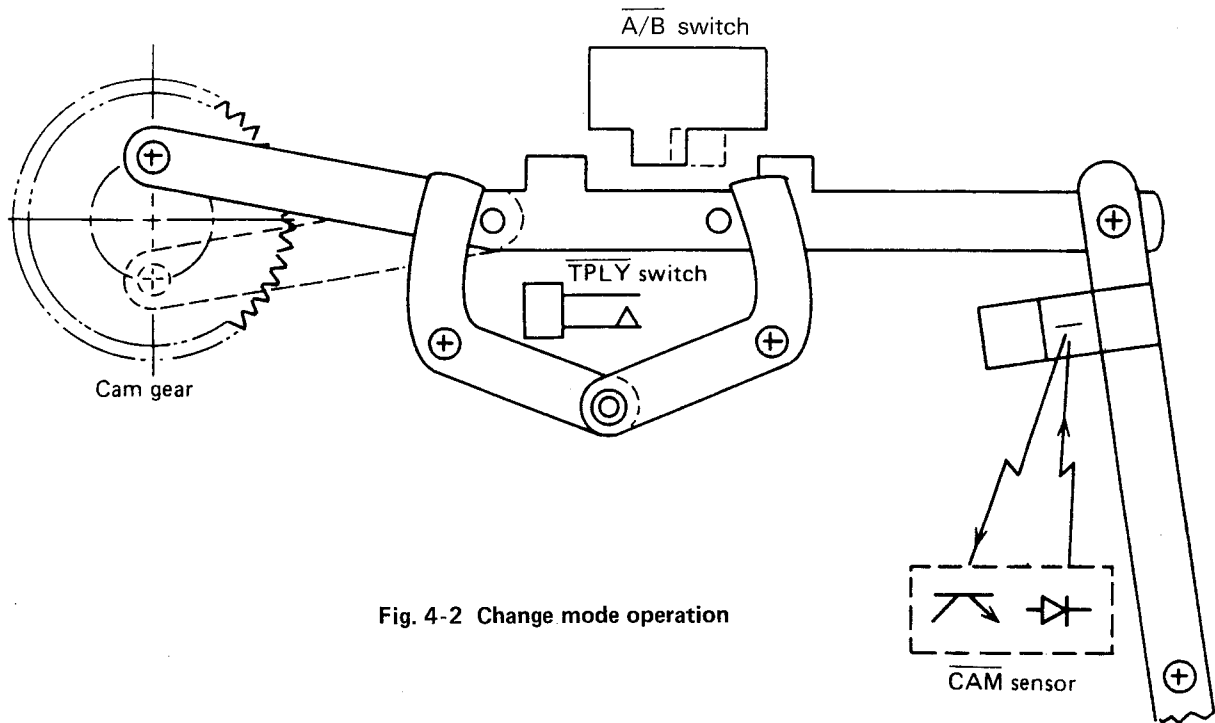


Fig. 4-2 Change mode operation

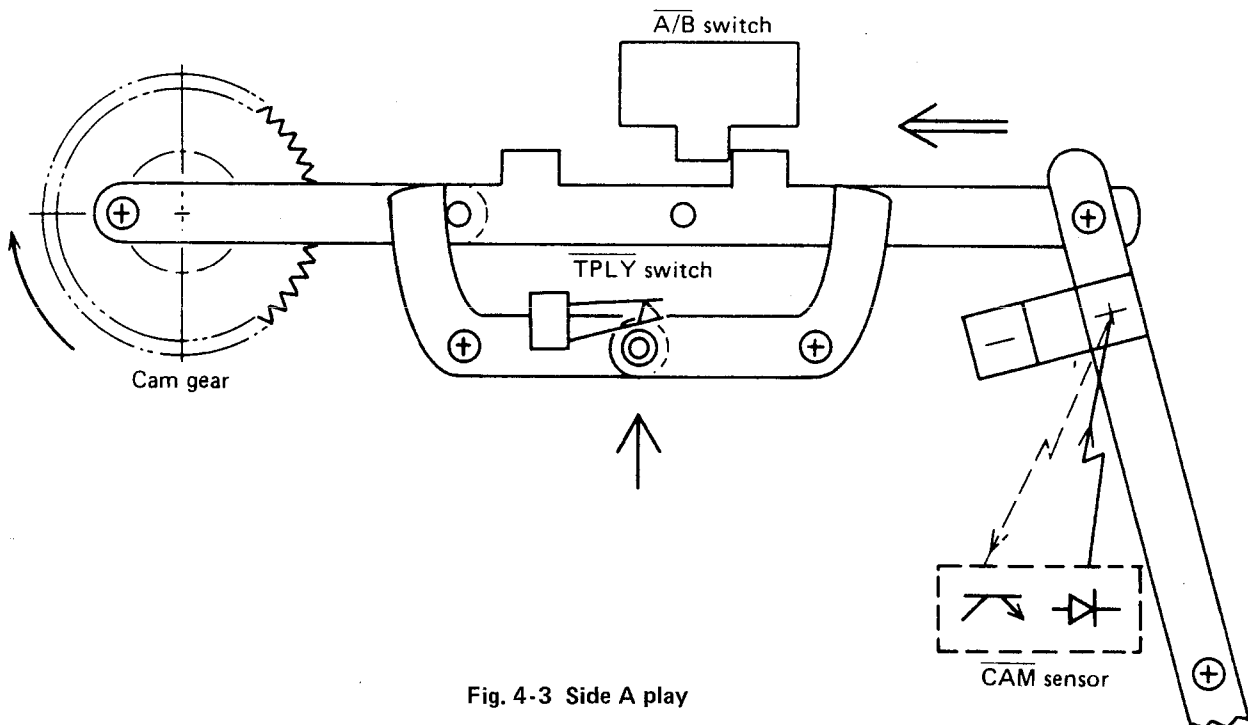


Fig. 4-3 Side A play

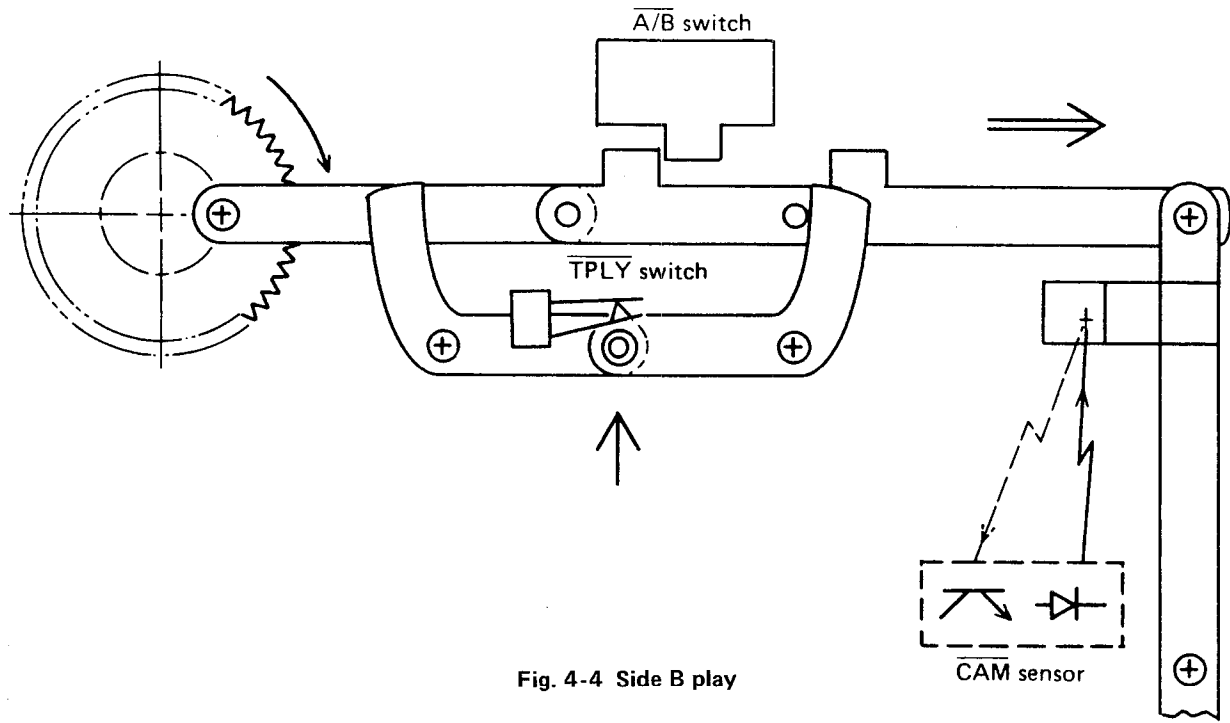


Fig. 4-4 Side B play

5. OPERATION

1. One Directional Clutch

The one directional clutch is mounted on the motor for transmitting torque in many ways depending on the rotating direction of the motor.

- (1) When the motor runs clockwise, the torque is transmitted not to the motor pulley but to gear 1 and gear 2. The torque is effective for selecting any of the following modes: Play, FF, REW, program selection, program loading.
- (2) When the motor runs counterclockwise, the torque is transmitted not to gear 2 but to the motor pulley and gear 1. The torque drives the flywheels and reel base, and puts the tape in the play, FF or REW mode.

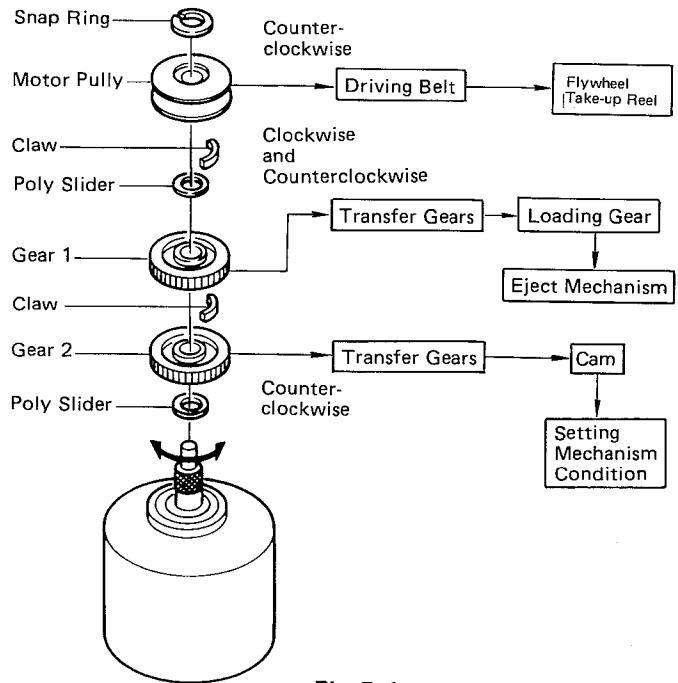


Fig. 5-1

2. Tape Transport

(1) Head/Pinch Roller Control Mechanism

Gear 2 on the motor drives the cam and, depending on whether S_1 and S_2 that control the head and pinch roller are ON or OFF, activates drive arm to select the play, FF, REW, or wait mode.

(2) Program Change/Program Control Mechanism

Program change from side A to side B or vice versa depends on the movement of the cam.

(3) Load/Eject Control Mechanism

When S_3 turns on, the motor conveys torque to the loading gear. If the motor runs clockwise, the load mode is selected. If the motor runs counterclockwise, the eject mode is selected.

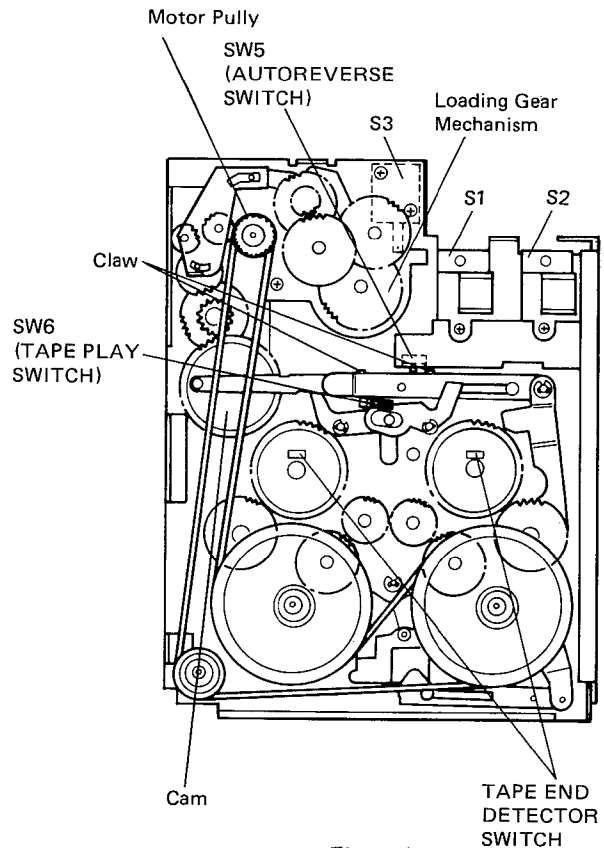


Fig. 5-2

3. Stop Mode

- (1) When no cassette tape is inserted, S_1 and S_2 are OFF, the two drive arms are not moving, the idle gears are not in contact with the reel bases, and the playback head is not moved forward from the original position. The deck is in the stop mode.

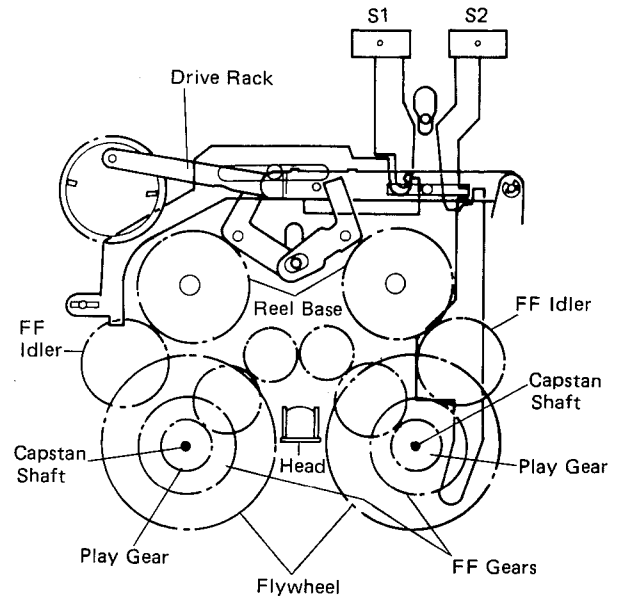


Fig. 5-3

4. Play Mode

- (1) If a cassette tape is inserted into the deck when power is on, or if power is switched on when a cassette tape has already been in the deck, the play mode starts.
- (2) At the same time, SW6 is OFF and caused the micro-computer to turn S_1 and S_2 ON to rotate the motor clockwise. The motor drives the gears and the cam so that the drive rack moves straight.

The straight movement of the drive rack raises pin 1 to move the playback head and pinch roller, head chassis ass'y forward to contact the cassette tape. As the pinch roller comes in contact with the cassette tape, the play gear attached on the flywheel of the capstan (A) comes into mesh with the play idler (A) to convey the power to the play idler (B) to drive the take-up reel. When pin 1 rises, SW6 is on, the motor stops and resumes running again in counterclockwise direction after changing mode is completed. The deck begins playing the tape.

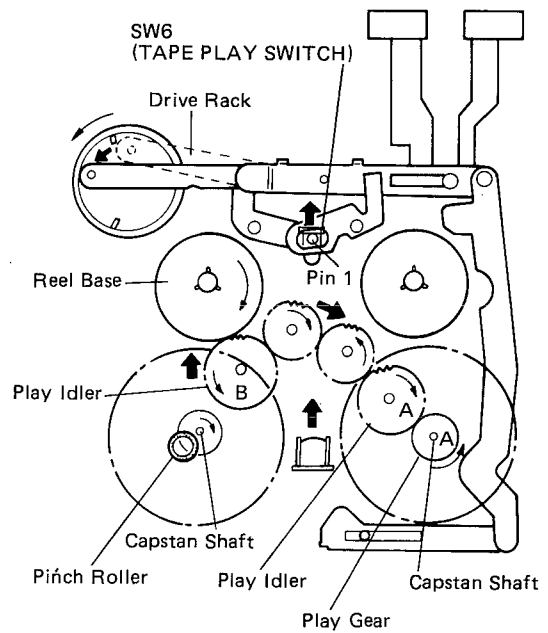


Fig. 5-4

5. REW Mode at the forward playing

- Depress the REW button.
- The REW switch turns on.
- S_1 and S_2 turn off. (Change mode)
- The motor runs clockwise.
- S_1 turns on.
- S_2 and S_3 are off.
- The drive arm moves to bring the REW idle gear into contact with the reel base and REW gear.
- The motor stops and starts running again counter-clockwise.
- The reel base starts running.

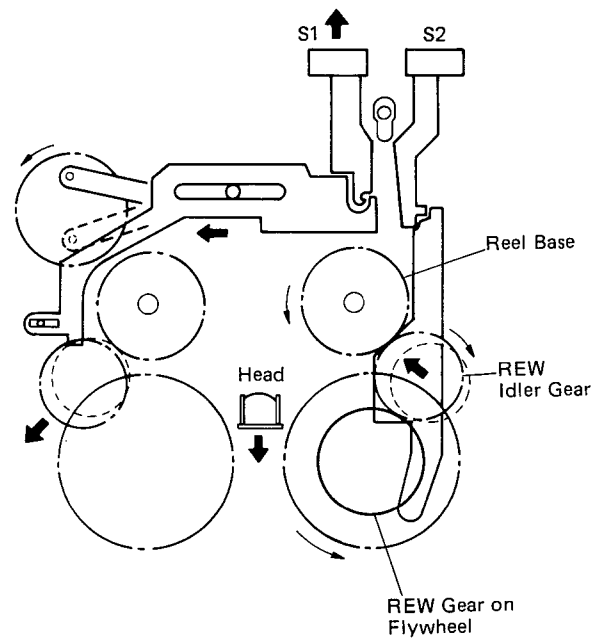


Fig. 5-5

6. FF Mode at the forward playing

- Depress the FF button.
- The FF switch turns on.
- S_1 and S_2 turn off. (Change mode)
- The motor runs clockwise.
- S_2 turns on.
- S_1 and S_3 are off.
- The drive arm moves to bring the FF idle gear into contact with the reel base and FF gear.
- The motor stops and starts running again counter-clockwise.
- The reel base starts running.

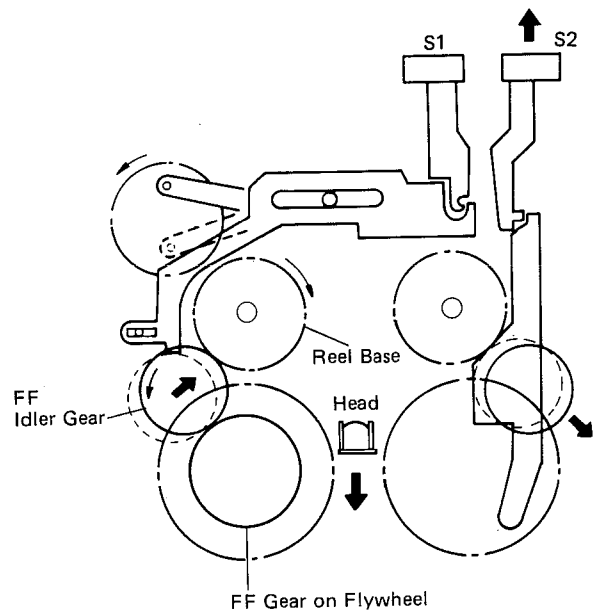


Fig. 5-6

7. Program Selector

- Depress the PRG button.
- The PRG switch turns on.
- S_1 and S_2 turn off. (Change mode)
- The motor runs clockwise.
- The cam turns 180° to move the drive rack from the left end to the right end or vice versa.
- The playback head and pinch roller move away from the cassette tape, and the pinch roller on the opposite side and the head contact the tape again. The play idler opposite to the play idler that was engaged with take-up reel now comes into mesh with the opposite take-up reel. (Forward/reverse detection is controlled by the microcomputer as the claw moves SW5.)
- The motor stops. S_1 and S_2 turn on. The motor starts running again in counterclockwise direction. The deck plays the other side of the cassette tape.

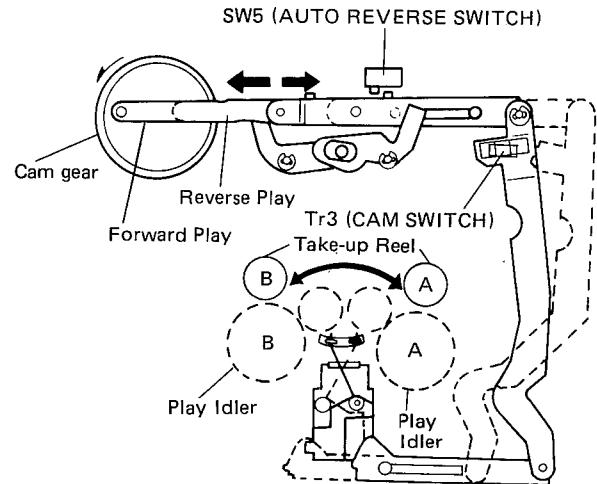


Fig. 5-7

8. Cassette Loading

- When a cassette tape is inserted into the deck, SW1 and S_3 turn on respectively. The motor runs in clockwise direction. The cassette tape held by the hook is loaded to be in the "tape in" state. SW3 turns on. This completes the tape loading. The tape lowers to turn SW2 on.
- S_3 turns off to start the play mode. If SW1 is not on, that is, if a tape is deformed by high temperature is inserted, or if a tape is not properly inserted, for example, the tape will be ejected.

Cassette Elevating Mechanism

When the arm with a hook moves inward, pin 1 pushes the cassette pressure plate down. At the same time, pin 2 is pushed down to lower pin 3 so that the lift plate is lowered by the spring force (refer to Fig. 5-10). These operations cause the cassette tape to be set in position.

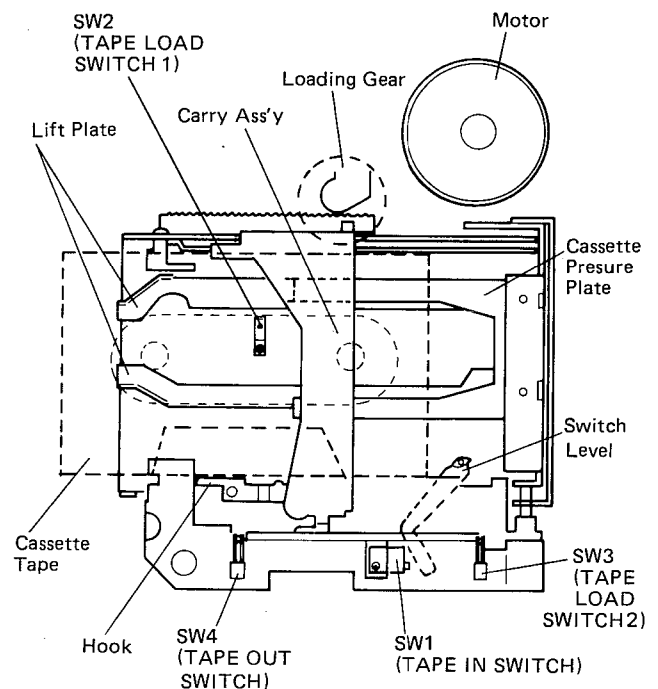
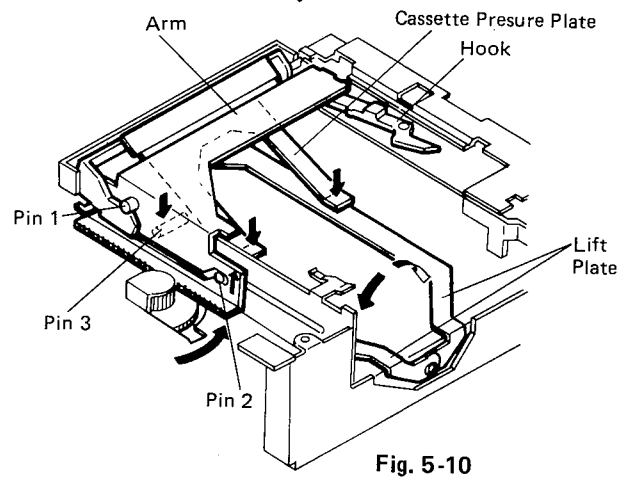
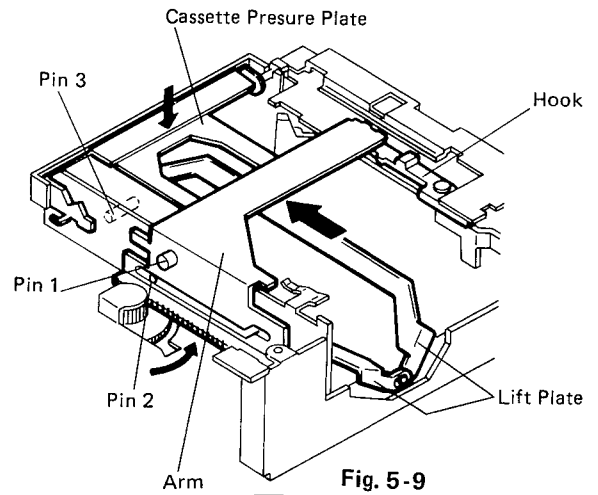


Fig. 5-8

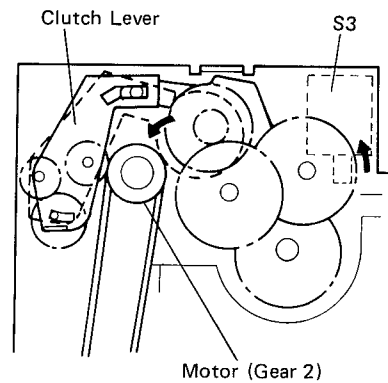
9. Eject

- Depress the EJECT button while the cassette tape is being played.
- S_1 and S_2 turn off. The motor stops. (Change mode)
- S_3 turns on. The motor starts running again in counterclockwise direction. SW2 turns off, and then SW3, SW1 and SW4 turn off in this order to eject the cassette tape.

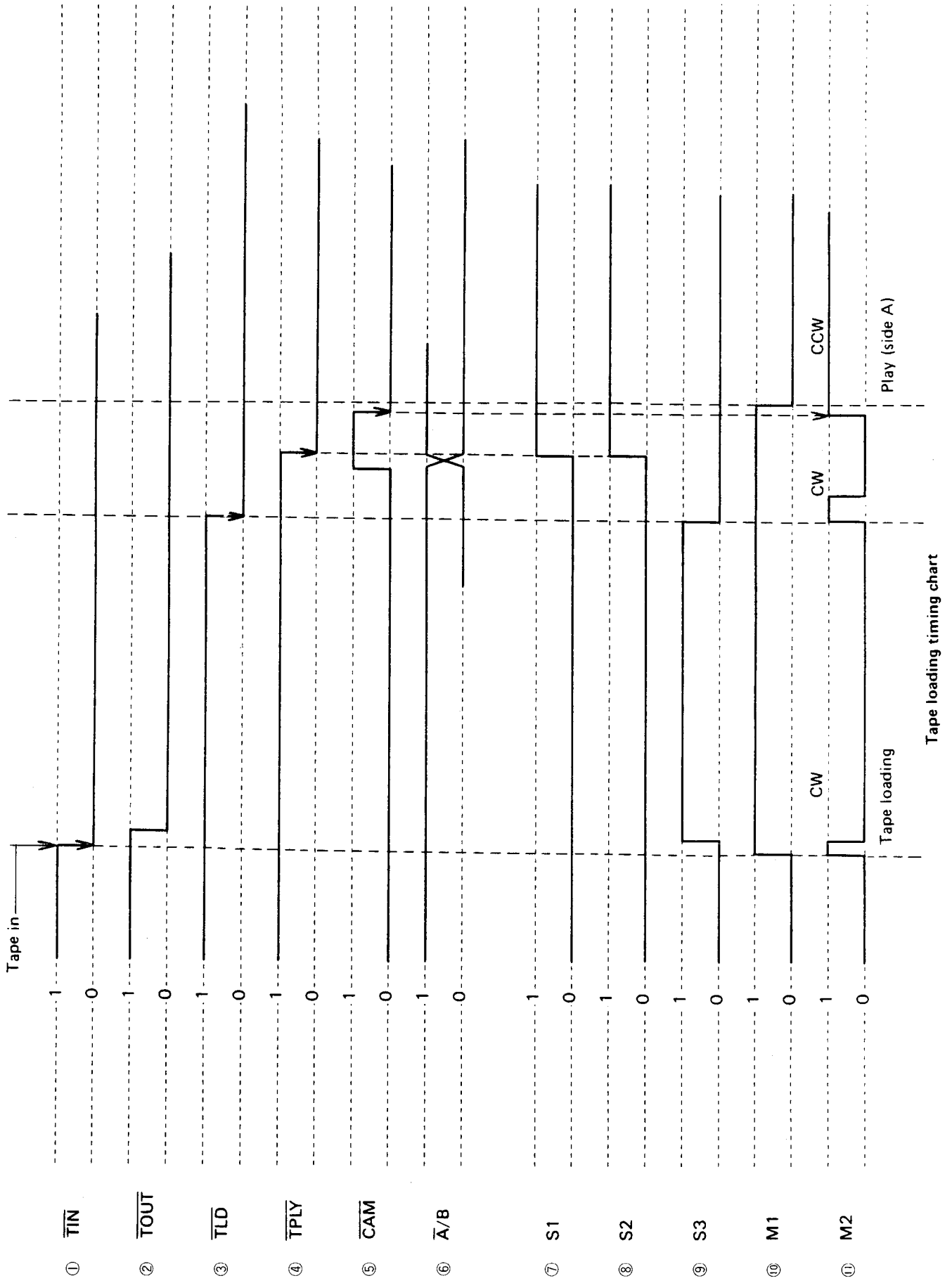


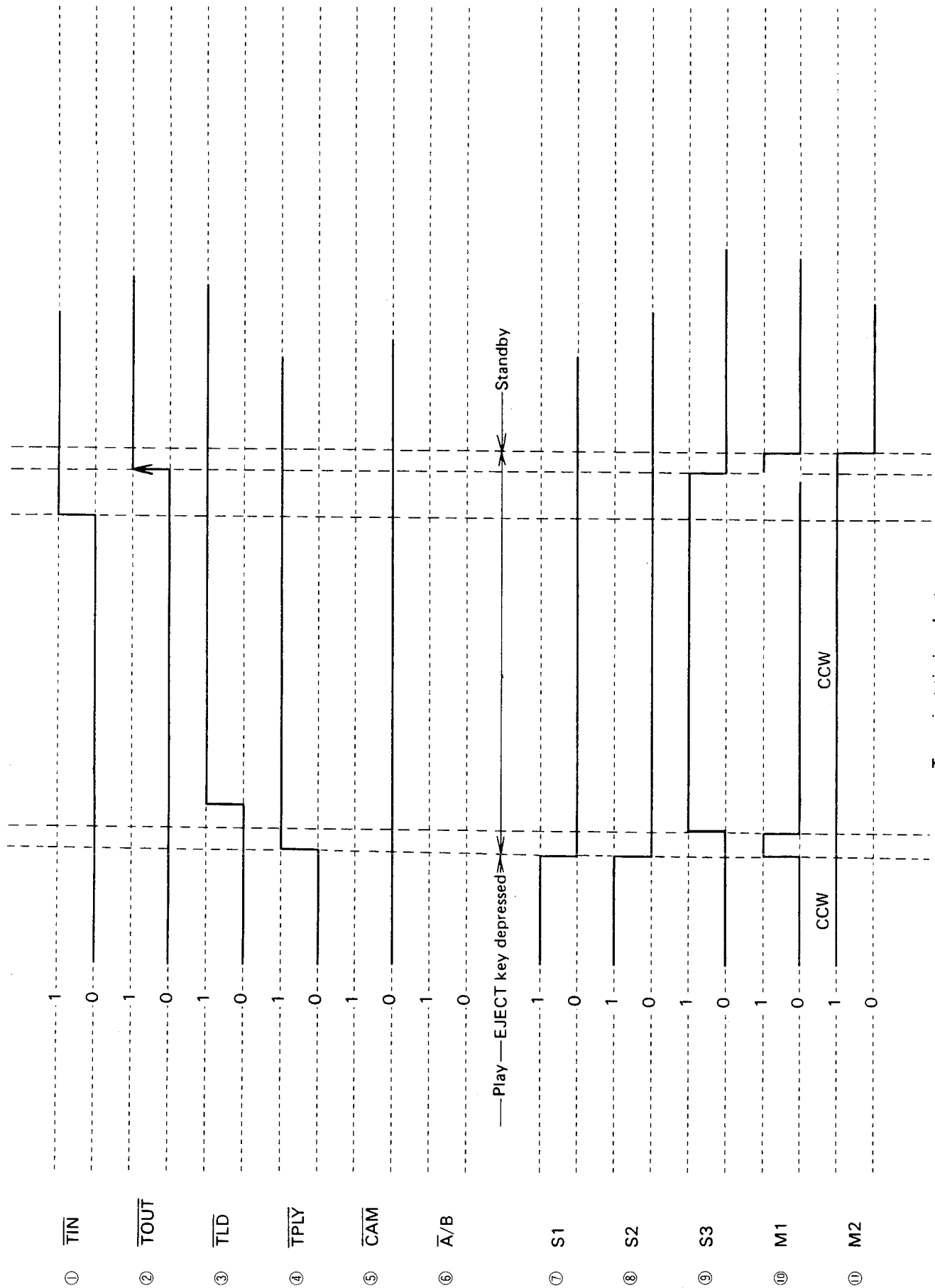
10. Loading Gear and Clutch

When S_3 turns on, the clutch lever moves as shown in the sketch so that the loading gear engages gear 1 of the motor. This conveys the rotating force to the loading gear to load or eject the cassette tape.

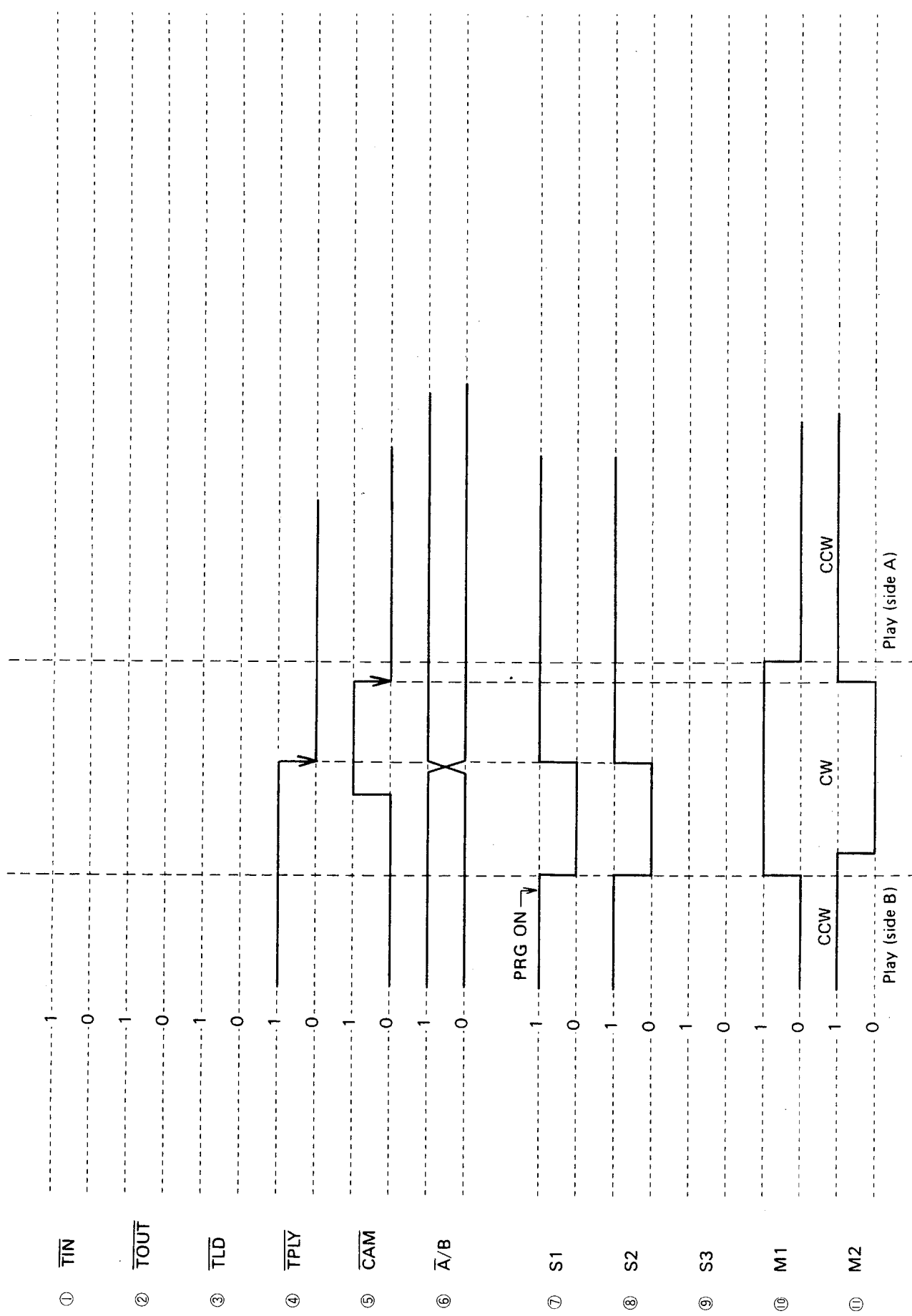


6. TIMING CHART

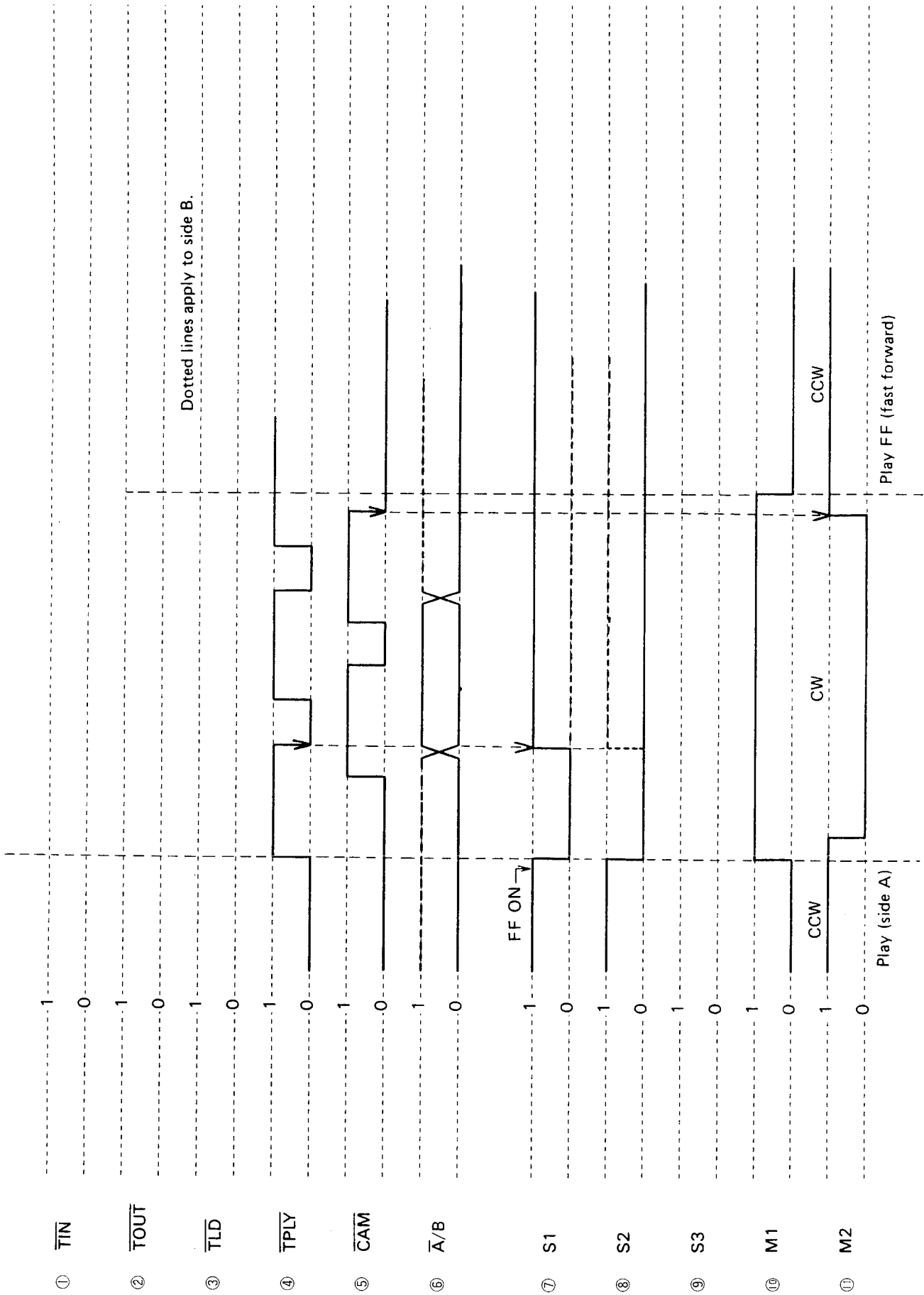




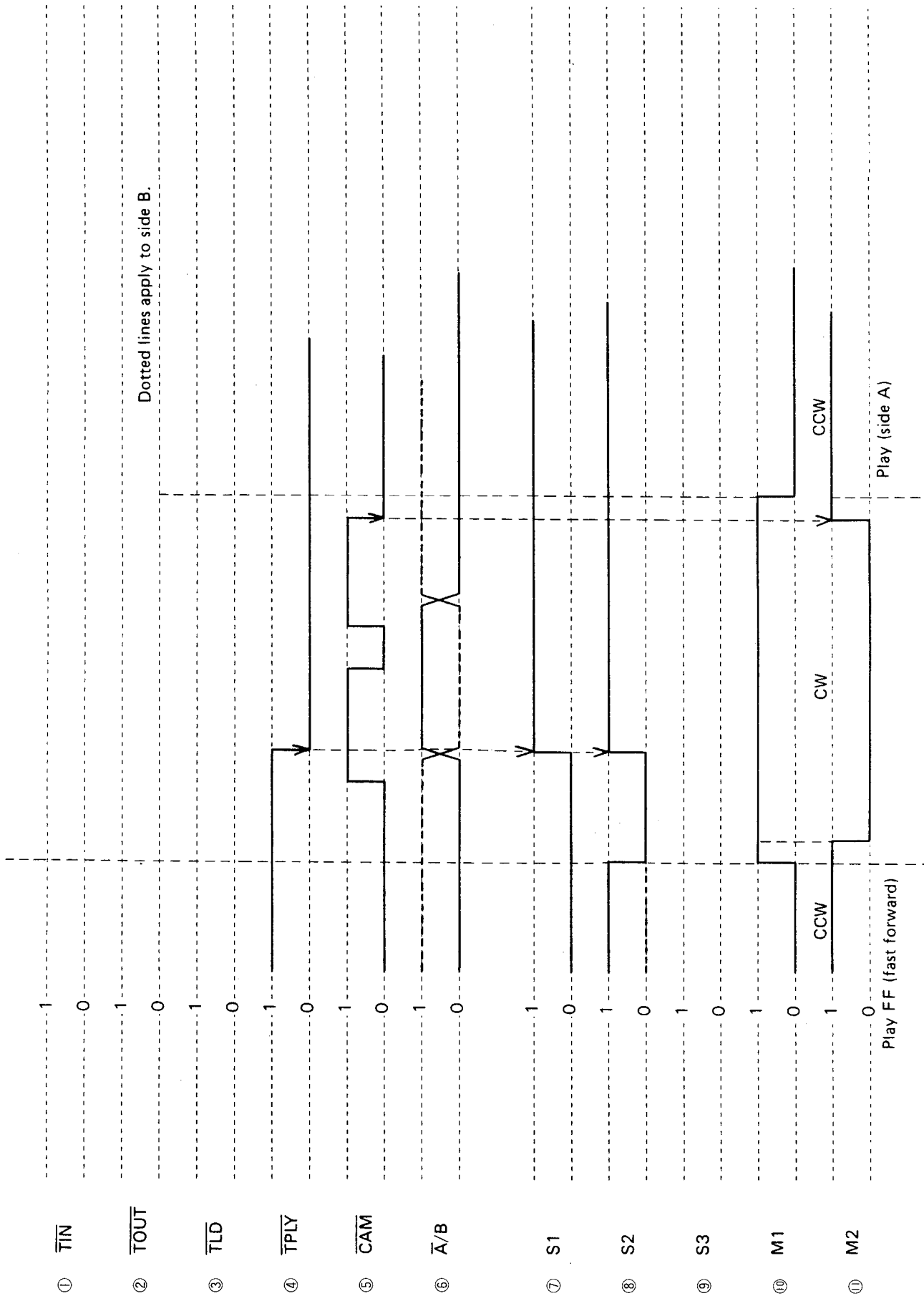
Tape eject timing chart



Program change (B → A) timing chart



Side A play → FF timing chart



FF → STOP (PLAY) timing chart (Side A)

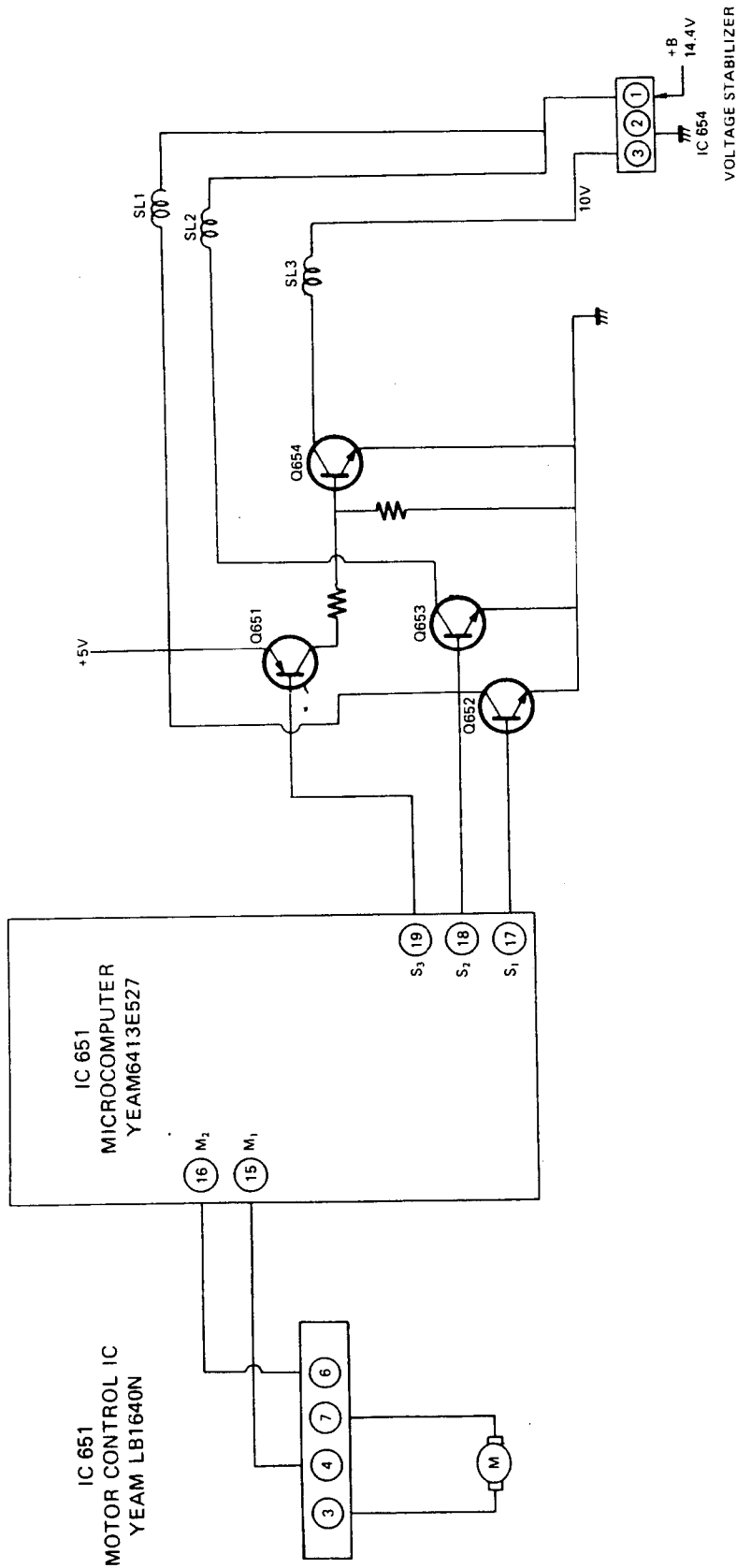
7. MICROCOMPUTER YEAM6413E527

- Names of terminals and descriptions of the functions

Pin No.	Port	Name	In/Out	Description
1	PD0	T-IN	Input	<ul style="list-style-type: none"> Tape IN (SW1) The signal of this terminal indicates whether cassette tape is inserted into the mechanism or not. 0 = Cassette tape is inserted. 1 = Cassette tape is not inserted. This signal triggers Load mode operation.
2	PD1	CAM	Input	<ul style="list-style-type: none"> CAM (CAM Signal Tr3) The signal of this terminal indicates position of cam. 0 = Changeover mode is completed. 1 = Changeover mode is not completed. This signal is used for detecting completion of changeover mode operation.
3	PD2	T-PLAY	Input	<ul style="list-style-type: none"> Tape Play (SW6) The signal of this terminal indicates position of cam and whether the mechanism is at PLAY mode or not. 0 = At PLAY mode. 1 = Not at PLAY mode. At changeover mode, the signal indicates timing of control signals for the solenoids. At PLAY mode, it indicates that the mechanism is at PLAY mode.
4	PD3	MS	Input	<ul style="list-style-type: none"> Silent Detector This signal of this terminal indicates whether there is sound on the tape or not. 0 = The tape is silent (between one music and another). 1 = There is sound on the tape. The signal is used for detecting music interval at TPS, SCAN, or REP mode operation.
5	EXtal	EXtal	Input	<ul style="list-style-type: none"> External Clock Input Terminal

Pin No.	Port	Name	In/Out	Description															
6	Xtal	Xtal	Input Output	<ul style="list-style-type: none"> Terminal for connecting resonance circuit of the internal clock oscillator. 															
7	$\overline{\text{INT}}$	T-END	Input	<ul style="list-style-type: none"> Tape End Detector The signal of this terminal indicates pulse which accords with the rotation of reel base. This is used for detecting auto-reverse operation. 															
8	$\overline{\text{RES}}$	CE	Input	<ul style="list-style-type: none"> Reset 															
9	PE0	Forward/ Reverse	Output	<ul style="list-style-type: none"> F/R 0 = Reverse Play. 1 = Forward Play. 															
10	PE1	FF		<ul style="list-style-type: none"> FF 0 = At FF mode. 1 = Not at FF mode. 															
11	PE2	REW	LED Drive	<ul style="list-style-type: none"> REW 0 = At REW mode. 1 = Not at REW mode. 															
12	PE3	MUTE	Output	<ul style="list-style-type: none"> Mute This is an output of mute signal which prevents noise during changeovers of the mechanism. 0 = MUTE off (at PLAY mode). 1 = MUTE on (not at PLAY mode). 															
13	TEST		Input	<ul style="list-style-type: none"> Test terminal of this LSI. It is usually connected to V_{ss} (GND). 															
14	V _{ss}			<ul style="list-style-type: none"> Ground 															
15	PF0	$\overline{\text{M1}}$	Output	<ul style="list-style-type: none"> Motor Control Output <table border="1"> <thead> <tr> <th></th> <th>Wait</th> <th>CCW</th> <th>CW</th> <th>Stop</th> </tr> </thead> <tbody> <tr> <td>$\overline{\text{M}}_1$</td> <td>0</td> <td>0</td> <td>1</td> <td>1</td> </tr> <tr> <td>$\overline{\text{M}}_2$</td> <td>0</td> <td>1</td> <td>0</td> <td>1</td> </tr> </tbody> </table>		Wait	CCW	CW	Stop	$\overline{\text{M}}_1$	0	0	1	1	$\overline{\text{M}}_2$	0	1	0	1
	Wait	CCW	CW		Stop														
$\overline{\text{M}}_1$	0	0	1	1															
$\overline{\text{M}}_2$	0	1	0	1															
16	RF1	$\overline{\text{M2}}$	Output																
17	PF2	S1	Output	<ul style="list-style-type: none"> Solenoid Control Output <table border="1"> <thead> <tr> <th></th> <th>Play</th> <th>A-FF B-REW</th> <th>A-REW B-FF</th> <th>Wait MOde</th> </tr> </thead> <tbody> <tr> <td>S₁</td> <td>1</td> <td>0</td> <td>1</td> <td>0</td> </tr> <tr> <td>S₂</td> <td>1</td> <td>1</td> <td>0</td> <td>0</td> </tr> </tbody> </table>		Play	A-FF B-REW	A-REW B-FF	Wait MOde	S ₁	1	0	1	0	S ₂	1	1	0	0
	Play	A-FF B-REW	A-REW B-FF		Wait MOde														
S ₁	1	0	1	0															
S ₂	1	1	0	0															
18	PF3	S2	Output																
19	PG0	S3	Output	<ul style="list-style-type: none"> Solenoid Control Output <table border="1"> <thead> <tr> <th></th> <th>Load Eject</th> <th>Other Modes</th> </tr> </thead> <tbody> <tr> <td>$\overline{\text{S}}_3$</td> <td>0</td> <td>1</td> </tr> </tbody> </table>		Load Eject	Other Modes	$\overline{\text{S}}_3$	0	1									
	Load Eject	Other Modes																	
$\overline{\text{S}}_3$	0	1																	
20	V _{DD}	Power in	Input	<ul style="list-style-type: none"> Power Supply (+5V) 															
21	PA0	T-LOAD	Input	<ul style="list-style-type: none"> Tape Load (SW3) The signal of this terminal indicates whether cassette tape is at PLAY position or not. 0 = Cassette tape is at PLAY position. 1 = Cassette tape is not at PLAY position. This signal is used for detecting the completion of LOAD mode operation. 															
22	PA1	T-OUT	Input	<ul style="list-style-type: none"> Tape Out (SW4) The signal of this terminal indicates whether cassette tape is ejected or not. 0 = Cassette tape is not ejected. 1 = Cassette tape is ejected. This signal is used for detecting the completion of EJECT mode operation. 															
23	PA2	Forward/ Reverse	Input	<ul style="list-style-type: none"> Forward/Reverse Detection (SW5) 0 = Forward Play. 1 = Reverse Play 															
24	PA3		Input	<ul style="list-style-type: none"> Input Terminal of Initial Data 															
25	PC0	CLOCK	Input	<ul style="list-style-type: none"> Serial Input 															
26	PC1	DATA																	
27	PC2	STROBE																	
28	PC3	Pause			<ul style="list-style-type: none"> Pause Input 														

8. OPERATION OF AUTO-REVERSE MECHANISM AND SOLENOIDS



SOLENOIDS (SL1 ~ SL3) OPERATION TABLE

	PLAY	A-FF B-REW	A-REW B-FF	WAIT MODE
S ₁	1	0	1	0
S ₂	1	1	0	0

	LOAD EJECT	OTHER MODES
S ₃	0	1

MOTOR OPERATION TABLE

	WAIT	CCW	CW	STOP
M ₁	0	0	1	1
M ₂	0	1	0	1

9. LSI YEAMPD82C43G

- Names of terminals and descriptions

Pin No.	Port	In/Out	Name	Pin No.	Port	In/Out	Name
1	P72	Output	Tape Out	13	P42	Output	S3
2	P71	Input	Tape In	14	P50	Output	B
3	P60	Input	CAM	15	P43	Output	C
4	P63	Input	A/B	16	P51	Output	METAL
5	P62	Input	Tape Play	17	P52	Output	S2
6	CS	—	CS	18	P52	Output	S1
7	PROG	Input	PROG	19	P40	Output	M2
8	P23			20	P41	Output	M1
9	P22			21	P70	Input	TLD
10	P21			22	P73	Input	MS (TPS)
11	P20			23	P61	Input	T. END
12	GND	—	GND	24			Vcc