STEREO TAPE DECK

TC-765

UK Model
AEP Model
US Model
Canadian Model
PX Model

SUPPLEMENT

File this supplement with the service manual.

Subject: Circuit Description

No. 1
November, 1977

The system control circuits of this tape recorder are activated by pushing the Feather-Touch operation buttons and control three kinds of movement for four solenoids along with the voltage applied to the operating lamps and the reel motor.

Circuit descriptions are listed in the following order.

SONY®
SERVICE MANUAL

1. Action of IC701 (CX738) (Refer to Fig. 1)

Pushing any of the function buttons grounds the actuating circuit of IC701 (terminals ⑨ to ⑬) and the output from terminals ② to ⑦ controls each mode. (Output occurs when terminals ⑨ to ⑬ are at less than 4.5 V.)

Fig. 1 indicates the output in each mode by a logic value.

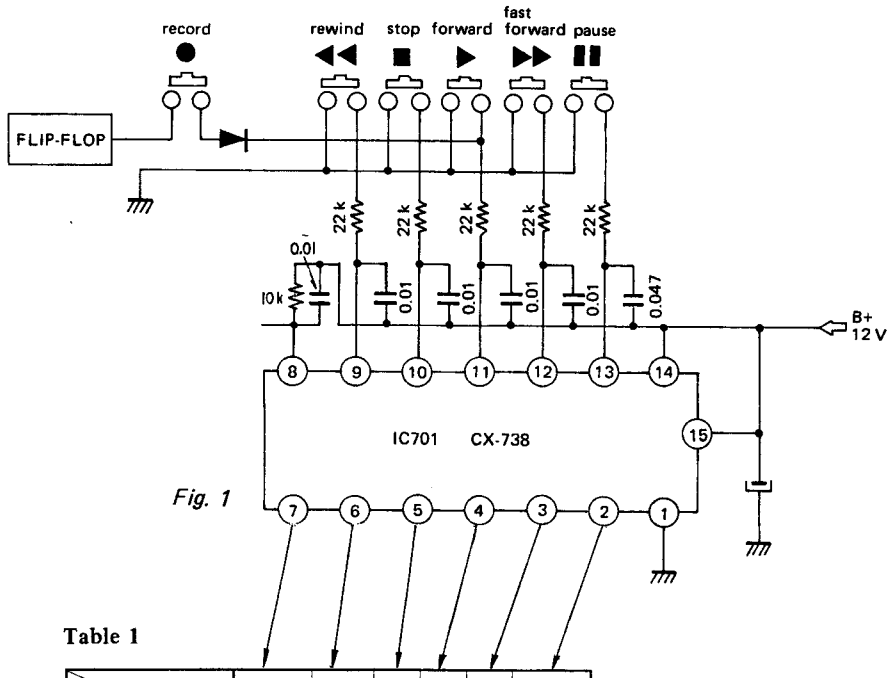


Fig. 1

Table 1

Mode \ Output	Brake	▶D*1	▶	◀◀	▶▶	II	
STOP	0	0	0	0	0	0	
Forward	1 or 0	1	1	0	0	HOLD	*2
Fast Forward	1	0	0	0	1	HOLD	
Rewind	1	0	0	1	0	HOLD	
Forward/PAUSE	1	1	1	1	0	0	*3
	1					1	

0: 0V output
1: 12V output
HOLD: Previous mode condition does not change.

*1. ▶D represents DELAY Forward.
*2. If PAUSE is 0 (previous condition), Brake becomes 1.
If PAUSE is 1 (previous condition), Brake becomes 0.
*3. In Forward mode, if PAUSE button is pressed, the solenoid is de-energized and the brake is operated.

2. Action when switched from Fast Forward (▶▶) or Rewind (◀◀) to Forward (▶). (Refer to Fig. 2)

- Action of IC701

⑪▶ (Input) ——→ ⑤▶ (Output)--→lamp lights
DEL D
⑧▶ (Input: ON)→⑥▶(Output)--→tape transport

1. When switched from fast forward or rewind to forward, the output of terminal ⑤, determined by the input of terminal ⑪, puts Q719 in the ON state and the forward lamp lights.
2. Also, since the supply reel motor has been revolving at high speed, it does not stop immediately and there is an output from FG.
3. Q748 is negative-biased by the output from FG, so that it is in the OFF condition, B+ voltage is applied to terminal ⑧ and there is no output from terminal ⑥(Path).
4. The revolution of the supply reel motor quickly slows down and stops. When this happens, the output from FG becomes zero, Q748 returns to the ON state. Terminal ⑧is grounded and terminal ⑥ outputs the control signal and forward motion starts.
(Once in forward, there will be no influence from terminal ⑧ until again switching to fast forward or rewind.)

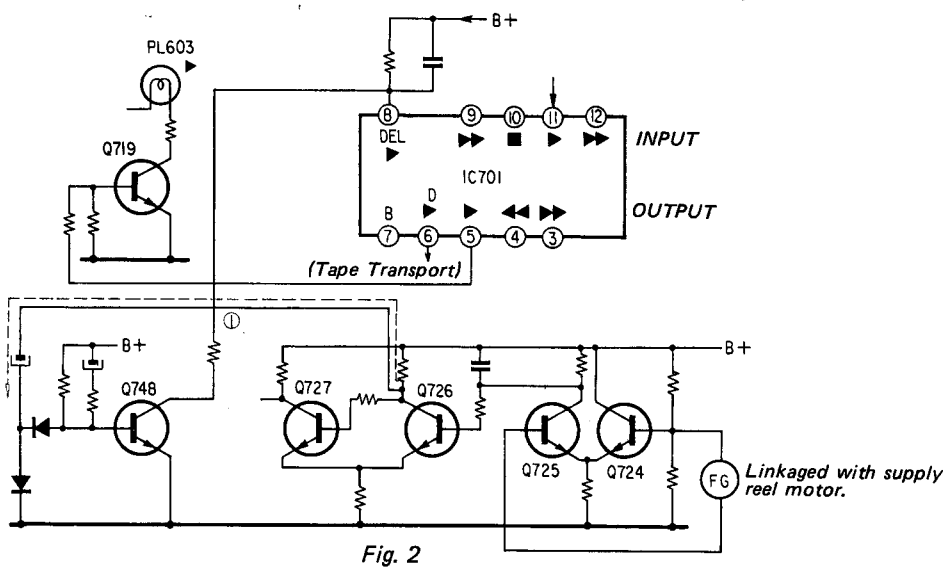


Fig. 2

3. Power Supply Section (Refer to Fig. 3)

The power supply section consists of the following four kinds of circuits.

1. Power supply (12V) for lamps, IC701, and solenoid hold.
2. Regulated power supply (24V) for record and playback amplifiers.
3. Regulated power supply (24V: adjustment required) for headphone amplifier, bias oscillator, and system control section.
4. Power supply for solenoid initial-energization.

(There is a regulator in the audio amplifier section.)

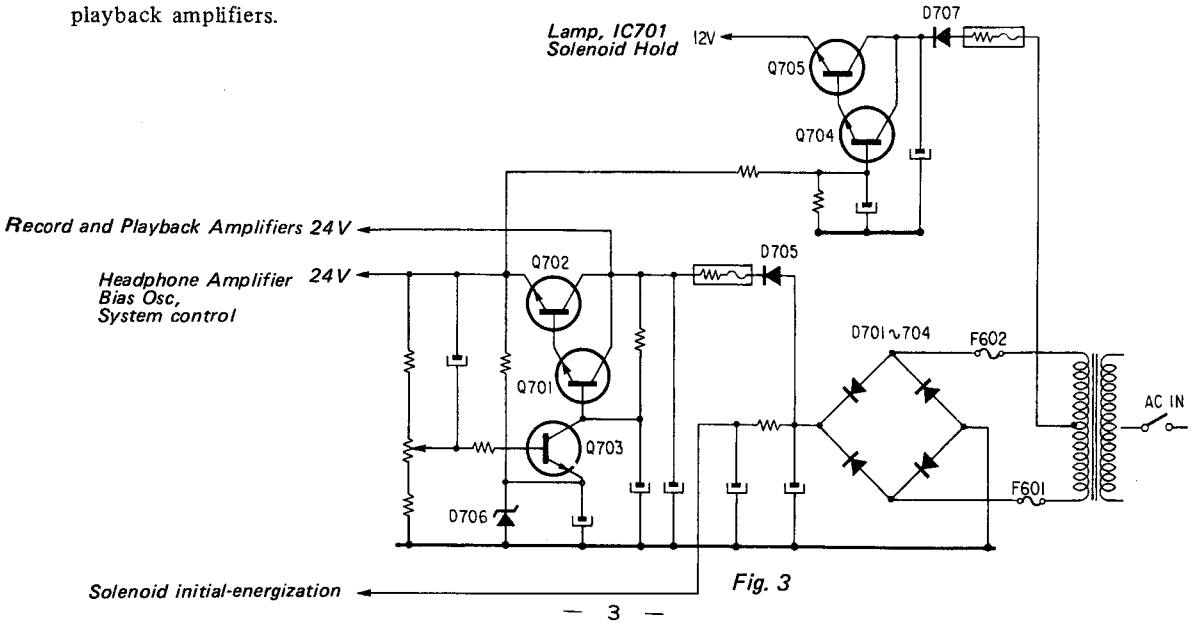


Fig. 3

4. High Voltage Power Supply for Solenoid Initial-Energization (Refer to Fig. 4)

The solenoids need a high voltage during pulling, but a low voltage is adequate for hold.

1. When stopped or during tape transport, Q706 is ON and Q707, 708 are in the OFF state providing a 12V power supply for solenoid hold.
2. In the hold condition, as the signal PAUSE (H) enters point Ⓐ from IC701, Q718 goes to the ON state and the (+) side of C710 at +24V suddenly drops to zero potential so that the (-) side (point Ⓒ) becomes -24V. Then the signal passes through R712 and D708 where it is discharged at a time constant of R712 x C710.
3. Though Q706 was ON, as the PAUSE signal enters point Ⓐ, point Ⓒ becomes -24V which creates an OFF state. As a result, Q707, 708 are in the ON state and provide a high voltage power supply for solenoid initial-energization.
   (In this case, turning on playback muting. Refer to page 11.)
4. When C710 has completed discharging, Q706 goes to the ON state and Q707, 708 go to OFF. The solenoid power supply returns to +12V for hold use.

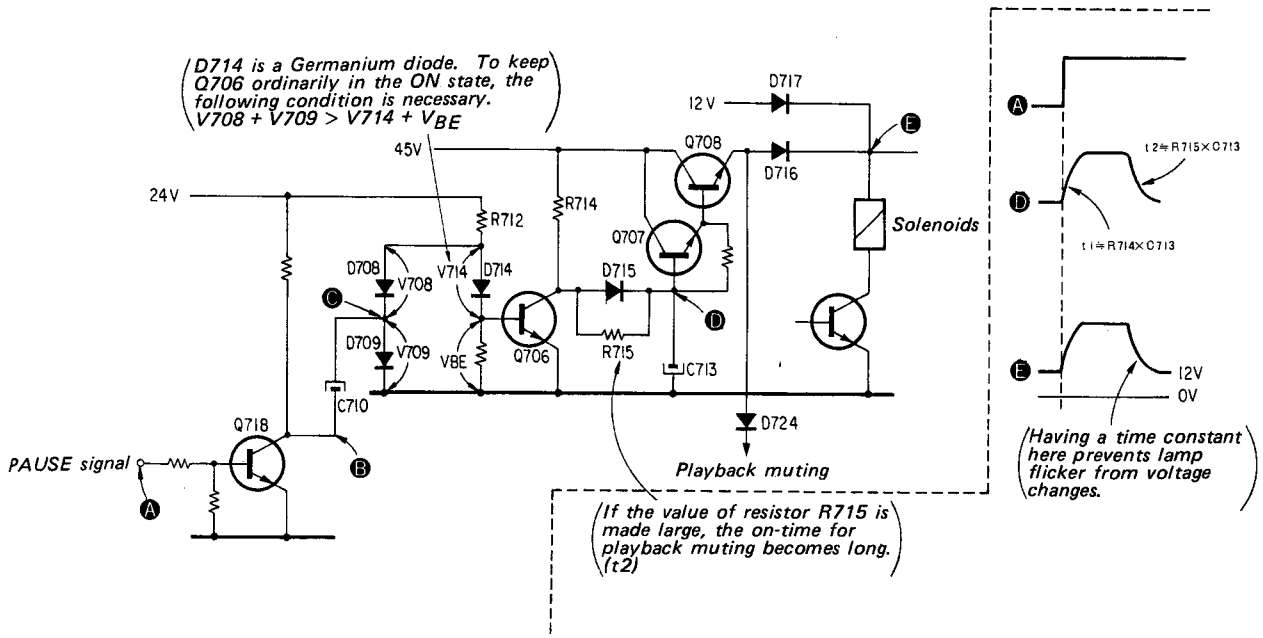


Fig. 4

5. Reel Motor Starting Circuit (Refer to Fig. 5)

When switching from STOP to forward or from PAUSE to forward the Reel Motor (M601, 602) cannot start up right away. (Especially true when using a 10-inch reel.)

For this reason, the torque of the Reel Motor (M601, 602) is greater at starting than during running.

1. With the IC701 output ▶D, Q712 (for solenoid drive) goes ON and C740 causes Q737 to go OFF for an instant. (The operation is the same as the solenoid initial-energizing.)
2. When Q737 goes OFF, Q733 goes ON and the signal passes through R794 and D742 to add to Q736. This permits Q736 saturation and about 50V is applied to the supply reel motor (M601) for starting it. (Path ①)
3. For the take-up reel motor (M602), as Q737 turns OFF, Q738 turns ON and energizes relay (RY702) which supplies 70V from the power transformer for motor starting. (Path ②)
4. When discharge at the time constant determined by R803 and C740 is finished, Q737 returns to the ON state and Q738 turns OFF releasing the relay (RY702).
5. Q733 gradually goes OFF at the time constant determined by R792 and C735. Afterwards, the supply reel motor (M601) changes to tension-regulator operation and the take-up reel motor (M602) becomes constant-torque operation.
6. D753 grounds Q739 base bias supplied through Q733, R793 and D743 to prevent short-circuiting of the 70V and 50V of the power transformer through Q739 and the diode bridge during starting of the take-up reel motor. The reason for Q733 having a time constant prevents tension arm vibration caused by voltage variation when the starting operation changes to the running operation.

6. Tension Regulator Circuit

If motor torque is uniformly constant, the back tension torque of tape transport becomes stronger as tape winding diameter becomes smaller. This causes variations in the tape speed, tape-to-head contact, level and frequency characteristics.

Hence, in order to keep tape tension constant, even when tape winding diameter changes, a tension regulator circuit (including a mechanical tension regulator) is employed to control the torque of the supply reel motor.

1. Since the tape speed is constant in the forward mode, as the amount of tape on the supply reel decreases, the revolution speed of the supply reel (frequency of FG) increases. In other words, FG generates the signal of frequency in inverse proportion to the radius of the remaining tape.
2. By rectifying the signal, dc voltage in inverse proportion to the radius of the remaining tape is obtained.
3. If the supply reel motor torque is constant, tape tension at the supply reel exit will be in inverse proportion to the tape amount. In other words, to maintain constant tape tension a motor torque which is proportional to the tape amount is the best.
4. Hence, by using the dc voltage obtained in 2., constant tape tension is achieved.

(Please refer to the next page for tension set-up and circuit operation.)

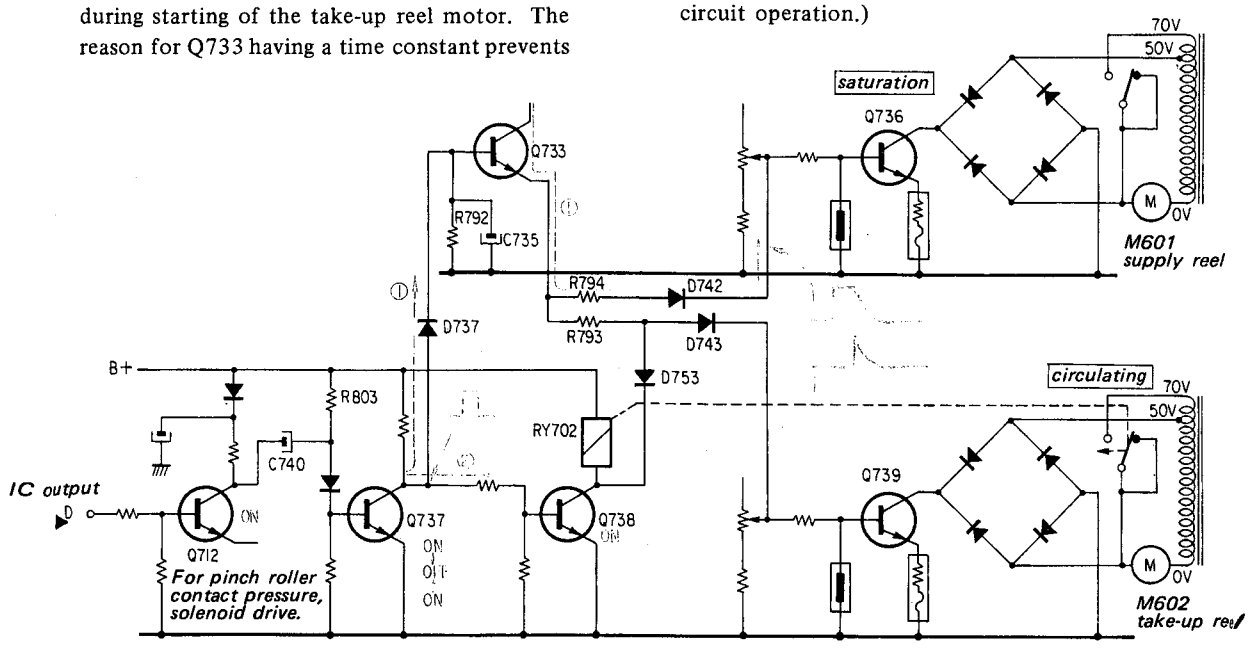


Fig. 5

7. Tape Tension Set-up and Circuit Operation

(Refer to Figs. 6, 7)

In order to make tape tension constant, torque at the start of tape winding (slow revolution) must be increased and torque near the end of tape winding (fast revolution) must be decreased.

1. At a slow revolution speed, the pulse interval is long so that the dc voltage output ❾ becomes high; hence supply reel motor torque becomes large.
2. At a fast revolution speed, the pulse interval is short so that the DC voltage output becomes low making the supply reel motor torque small.
3. Even if the tape speed is varied, if the radius of the remaining tape is the same, the back tension has to be the same. Therefore, when changing from 9.5 cm (3¾ ips) to 19 cm/s (7½ ips) with switch (S602-1), Q730 is turned ON and half cycle of the input signal to switching transistor (Q731) is turned OFF to produce the specified torque.

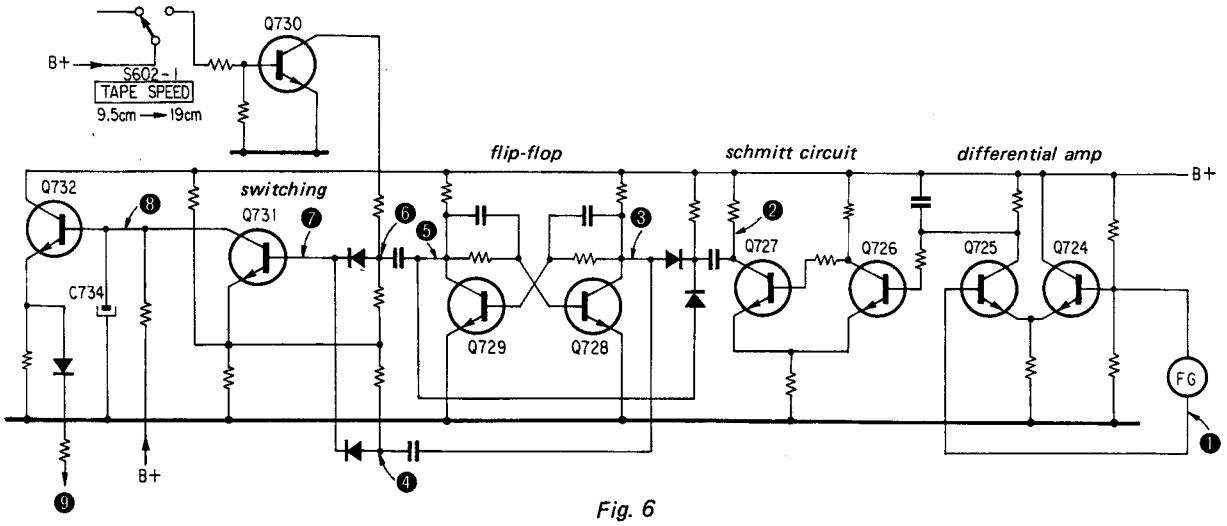


Fig. 6

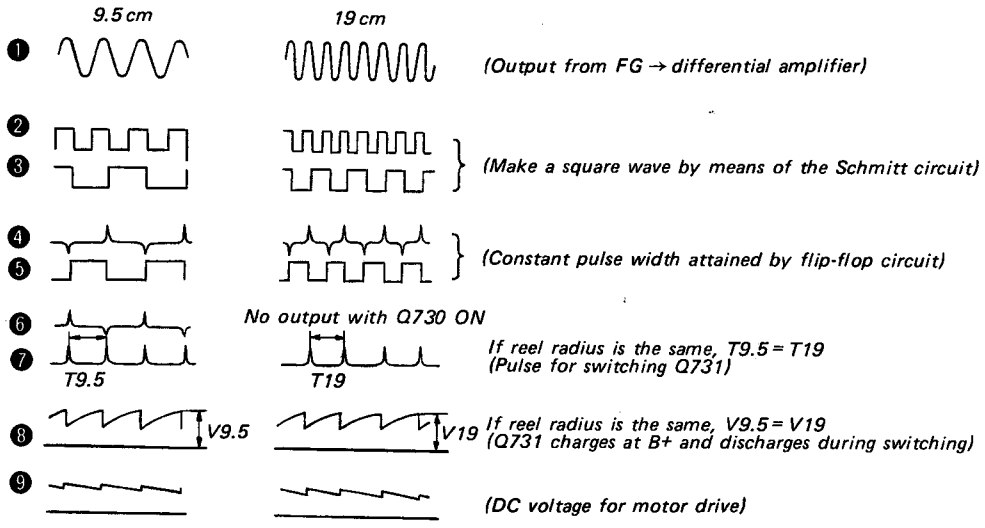


Fig. 7

8. Mechanical Tension Regulator

(Refer to Figs. 8, 9)
(Tension value at the tension arm part.)

In tape transport, the tension arm mechanically regulates the tape tension. In this section the tension arm is explained.

1. As the radius of the tape amount on the supply reel changes, also changes resulting in tension value variation.
   (The tension arm itself moves, but this is not considered in this explanation. Also, the tape contact at the tape guide is constant meaning no change in the tension value.)
2. The relationship between the tension value (TA) at the entry point of the tension arm and the back tension (TB) is as shown in Fig. 9. Thus from the end of a 7-inch reel tape to the start of a 10-inch reel tape the mechanical tension will be about 1.3 (experimental value) times the variation that occurs.
3. If such mechanical tension is used, a tension relative to the radius of the tape amount is obtained and the tape tension is regulated. With only this change, however, back tension will not be sufficient.

That is why this tape recorder uses both a tension regulator circuit and a mechanical tension regulator to produce the proper constant back tension.

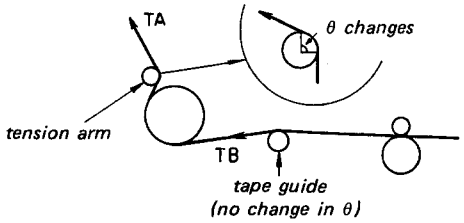


Fig. 8

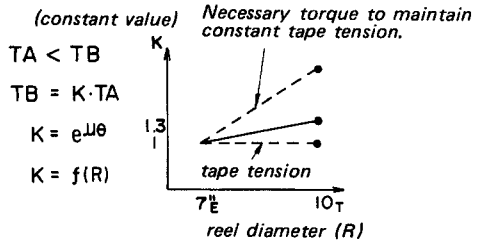


Fig. 9

9. Reel Motor Drive Circuit

(Refer to Figs. 10, 11)

The take-up reel motor operates under constant torque and the supply reel motor is controlled by a tension regulator circuit. Reel motors are driven in the following way.

1. As the base current of the drive transistor is changed, the impedance between the collector and the emitter varies and the voltage supplied to the motor varies to change the motor torque. By utilizing this relationship, the motor torque can be controlled. (Refer to Fig. 10)
2. The characteristics of this drive transistor are indicated in Fig. 11. The variation of collector current I_C relative to collector-emitter voltage V_{CE} is not sinusoidal, but produces a square wave that causes unnecessary vibration in the motor.
3. Therefore, a bridge rectifier circuit is used to supply full-wave-rectified current to the base of the drive transistor and raise base current I_B making collector current I_C closer to a sine wave to drive the motor.

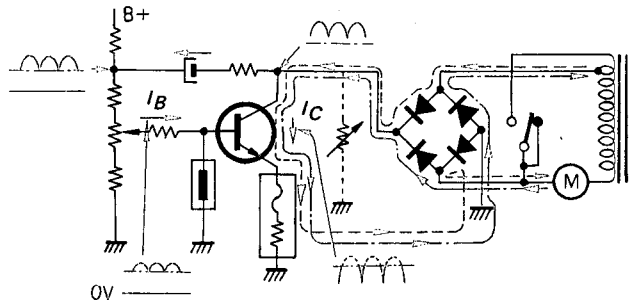


Fig. 10

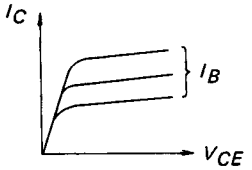


Fig. 11

10. Back Tension Set-up in Rewind Mode

(Refer to Fig. 12)

When adjusting (RV703) and setting up forward take-up tension, rewind back tension is automatically decided. (fixed)

In addition, as determined by reel size, the switching of impedance (R) as seen from the drive transistor (Q739) side takes place.

1. The set-up of R for each mode is shown in Table 2.

Table 2

S601	FWD	REW
10½	∞	R603//(R604 + R605)
7	R605	R603//R605

2. The values for R603, 604 and 605 are determined to obtain the desired rewind back tension in the situation where the forward take-up tension is adjusted (RV703).

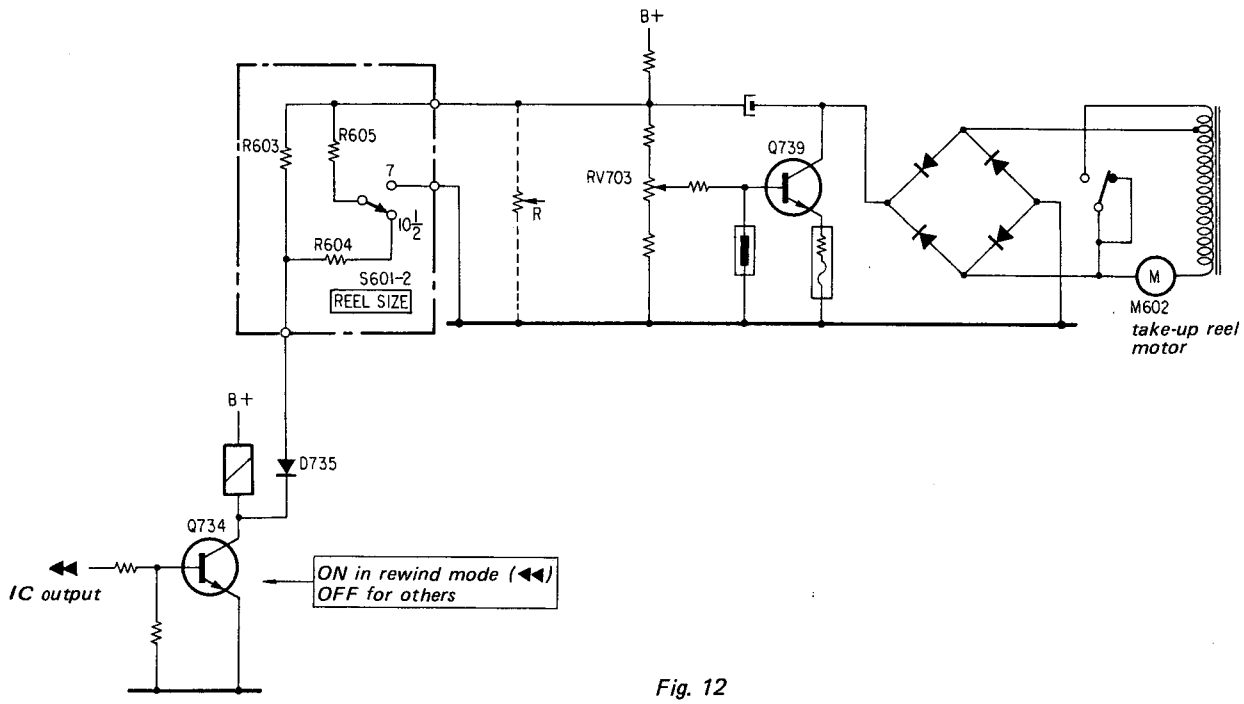


Fig. 12

11. Back Tension Set-up in the Fast Forward Mode
(Refer to Fig. 13)

When adjusting (RV702) and setting up the forward back tension, the fast forward back tension is automatically decided. (fixed)

1. The fast forward (▶▶) output from IC701 passes through D740 and R791 and is added to the base of Q735. (path ①)
   - Q735 base voltage becomes

$$\left[\begin{array}{c}\text{IC Output}\\(\blacktriangleright\blacktriangleright)\\\text{about 12V}\end{array}\right] \times \frac{\text{R601 (R602)}}{\text{R791} + \text{R601 (R602)}} \text{ (V).}$$

   ( ): For 7-inch reel.
2. In addition, this output is passed through R601 (R602) connected to REEL SIZE selecting switch (S601-1) and then grounded through D734 and Q720. (Path ②)
3. The values for R791, R601 and R602 are determined to obtain the desired fast forward back tension in the situation where the forward back tension is adjusted.

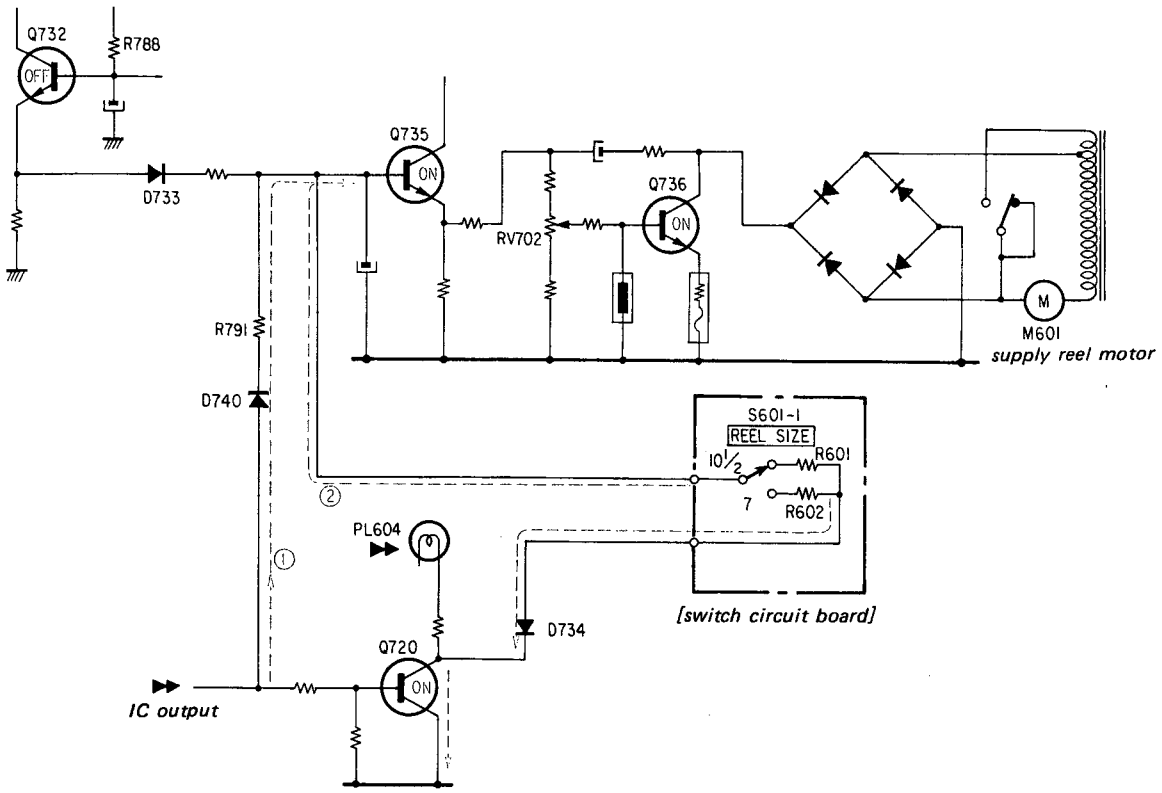


Fig. 13

12. STOP Circuit (Refer to Fig. 14)
(Shut-Off Circuit)

1. When the tape has finished winding, or when slack, tension arm micro-switch (S605, 606) is closed adding 24V to Q723 through R756. (Path ①)
2. Because of this, Q723 is turned ON activating the IC701 input.
3. When AC is ON, Q722 slowly goes to the ON state as determined by time constant of R751 and C717. (Refer to TIMER-activated operation)
   To supplement this, while Q722 is OFF, Q723 is ON and the STOP input of IC701 is activated. (Path ②)

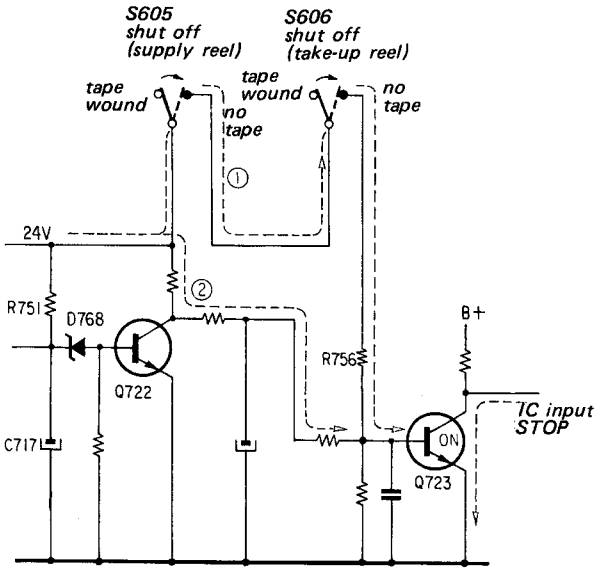


Fig. 14

13. TIMER-Activated Operation (Refer to Fig. 15)

1. With TIMER switch (S603) ON, when the POWER switch (S604) is turned on, the voltage at point Ⓐ supplied through D726 and B+ voltage (+24V) rise after 0.2 to 0.5 seconds.
2. At this time, C717 is charged through R751 and the charged voltage turns on zener diode D768 after 5 seconds determined by a time constant of R751 and C717, and then turns on Q722.
3. As a result of 2., the (+) side of C719 becomes −5 to −6V and passing through S603, D766 and 767 are turned ON to produce the record and forward signals for the Record or Playback modes.

(The circuit containing D726, 727, C716 and R750 makes C717 quickly discharged, when the power supply is turned off.)

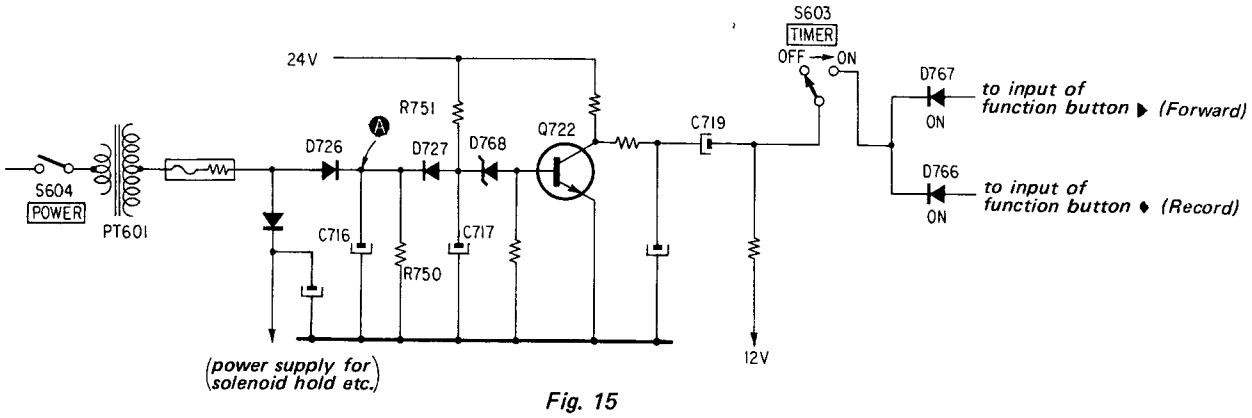


Fig. 15

14. Playback Muting (Refer to Fig. 16)

During the solenoid initial-energization period, playback muting is operated for click sound prevention, but depending on the switching mode, the muting time is changed. (Path ①)

(According to time constant of R712 and C710–712 on the solenoid initial-energization circuit.)

forward (▶)⟶ PAUSE (⏸) : about 0.4 seconds
STOP (■)⟶ forward (▶) : about 0.2 seconds
PAUSE (⏸)⟶ forward (▶) : about 0.2 seconds

Muting time at the switching period from forward mode to PAUSE mode is longer than other switching period. This is to prevent noise caused by slight movement of tape when tension arm moves at the time just changed into PAUSE mode.

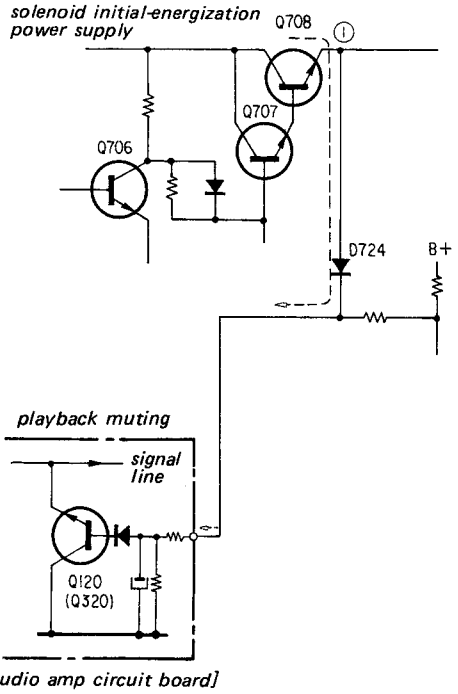


Fig. 16

15. Record Muting (Refer to Fig. 17)

Record muting is operated by turning Q106 (Q306) of the audio amp circuit ON.

1. In playback mode, the record mode switch S103 (S303) adds B+ to Q103 (Q303) turning it ON and record muting is operated. (Path ①)
2. In the situation where the Record and Forward buttons are not pressed, with the REC MODE switch set to the record position, Q744 of the flip-flop circuit is OFF and B+ through D759 turns ON Q741, which turns ON Q106 (Q306) to activate record muting. (Path ②)
3. When the record and forward buttons are pressed and remote control RM-30 is used, when record muting switch is ON, B+ turns ON Q741 through D760, which turns ON Q106 (Q306) to activate record muting. (Path ③)

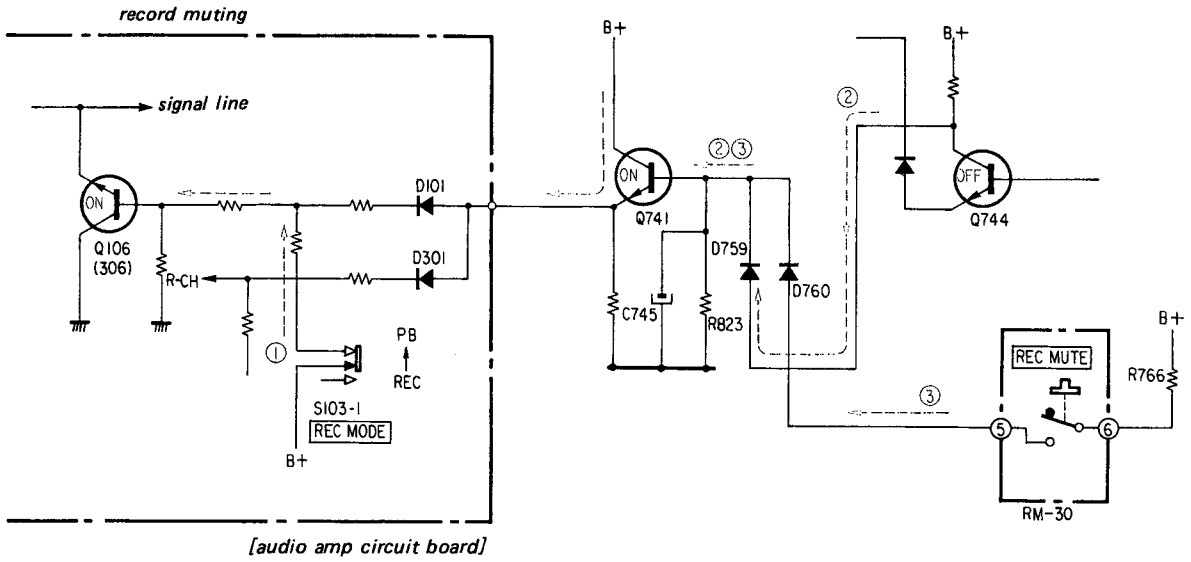


Fig. 17

16. REC MONITOR MUTE Circuit
(Refer to Fig. 18)
(ON and OFF for LINE OUT)

The REC MONITOR MUTE switch (S607), located on the rear panel, is turned ON to prevent howling during recording.

1. This circuit, by turning OFF Q507 of the Audio Amp section, cuts off the LINE OUT signal.
2. During ordinary operation, Q740 is OFF because Q722 is ON.
3. With the REC MONITOR MUTE switch (S607) set to the OFF position, B+ turns ON Q507 through S607, which activates relay (RY501) and the LINE OUT signal comes out. (Path ①)
4. Also, in playback (Q744 is OFF) mode, B+ goes through the TAPE side of the MONITOR switch (S104-2) to turn ON Q507 and the LINE OUT signal comes out. (Path ②)
(When S104-2 is set to the SOURCE position, or when in record mode Q744 turns ON not to supply B+, this circuit is cut off.)
5. With S607 ON, the signal comes out from LINE OUT only when the MONITOR switch is set to the TAPE position in playback mode.

With the MONITOR switch set to TAPE position, when POWER switch is turned ON, LINE OUT signal is muted to prevent a click noise. That is because Q722 is not turned ON for the period determined by the time constant of the Q722 base circuit. In this period Q740 turns ON and accordingly Q507 turns OFF to cut off LINE OUT circuit. Since Q744 also turns OFF, B+ voltage through MONITOR switch S104-2 coming from Q744 collector is ground through D769 and Q740 to prevent B+ from applying to the Q507 base. (Path ③)

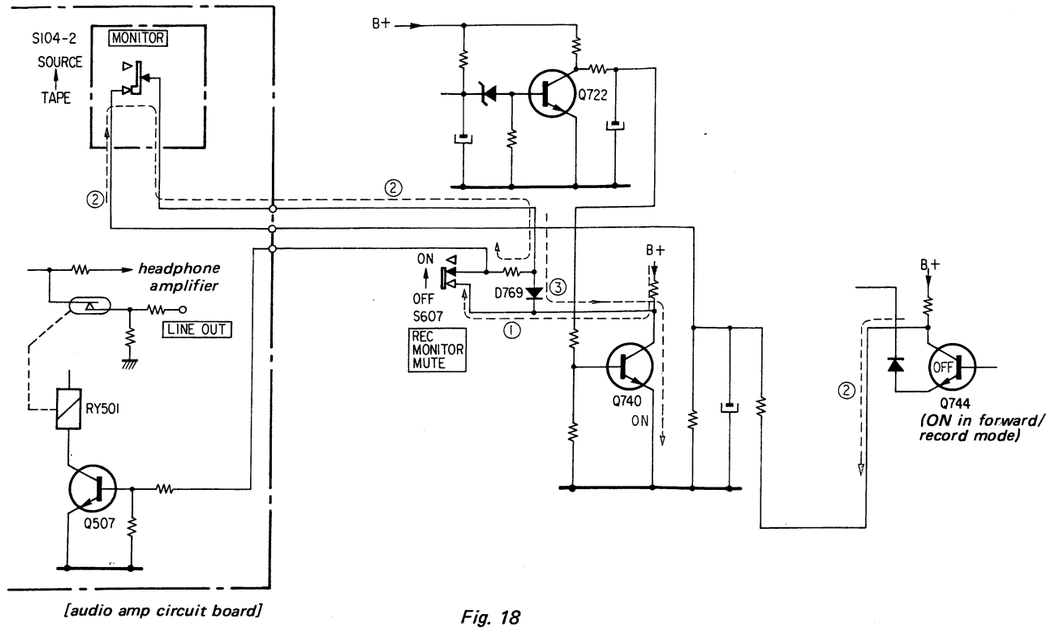


Fig. 18

17. Power Supply for Record Bias Oscillator
(Refer to Fig. 19)

1. When the REC MODE switch (S103-1 or S303-1) is set to REC position, B+ is supplied to the bias oscillator circuit. (Path ①)
2. By pushing the record (●) and forward (▶) buttons, the base of Q745 is grounded. (Path ②)
3. In FWD mode, Q719 turns ON and the emitter of Q744 is grounded. (Path ③)
4. By 3., the flip-flop circuit consisting of Q744, 745 becomes ON for Q744 and OFF for Q745.
5. The non-stable multivibrator circuit, consisting of Q746, 747, repeatedly turns ON and OFF the REC lamp (PL601) due to the difference in collector load resistance.
6. With Q744 in the ON state, the Q747 base is grounded through D762, Q744, D761 and Q719. Q747 turns OFF and Q746 ON in the stable condition and the lamp stops turning on and off and lights up continuously. (Paths ④ and ⑤)
7. With Q744 in the ON state, Q741 goes to OFF and REC muting is released.
8. In forward operation, Q743 turns ON and Q744 ON, Q742 turns OFF, which supplies B+ to the bias oscillator circuit and the bias oscillator circuit operates. (Path ⑥)

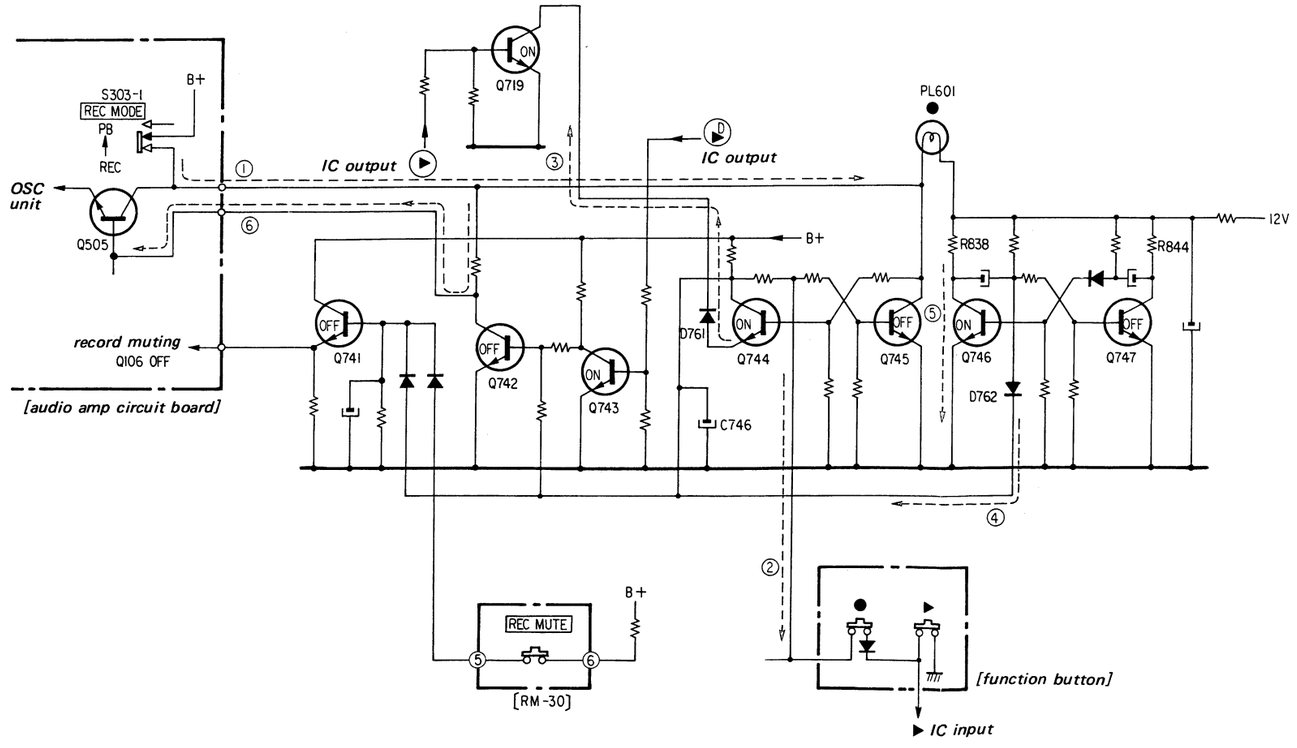
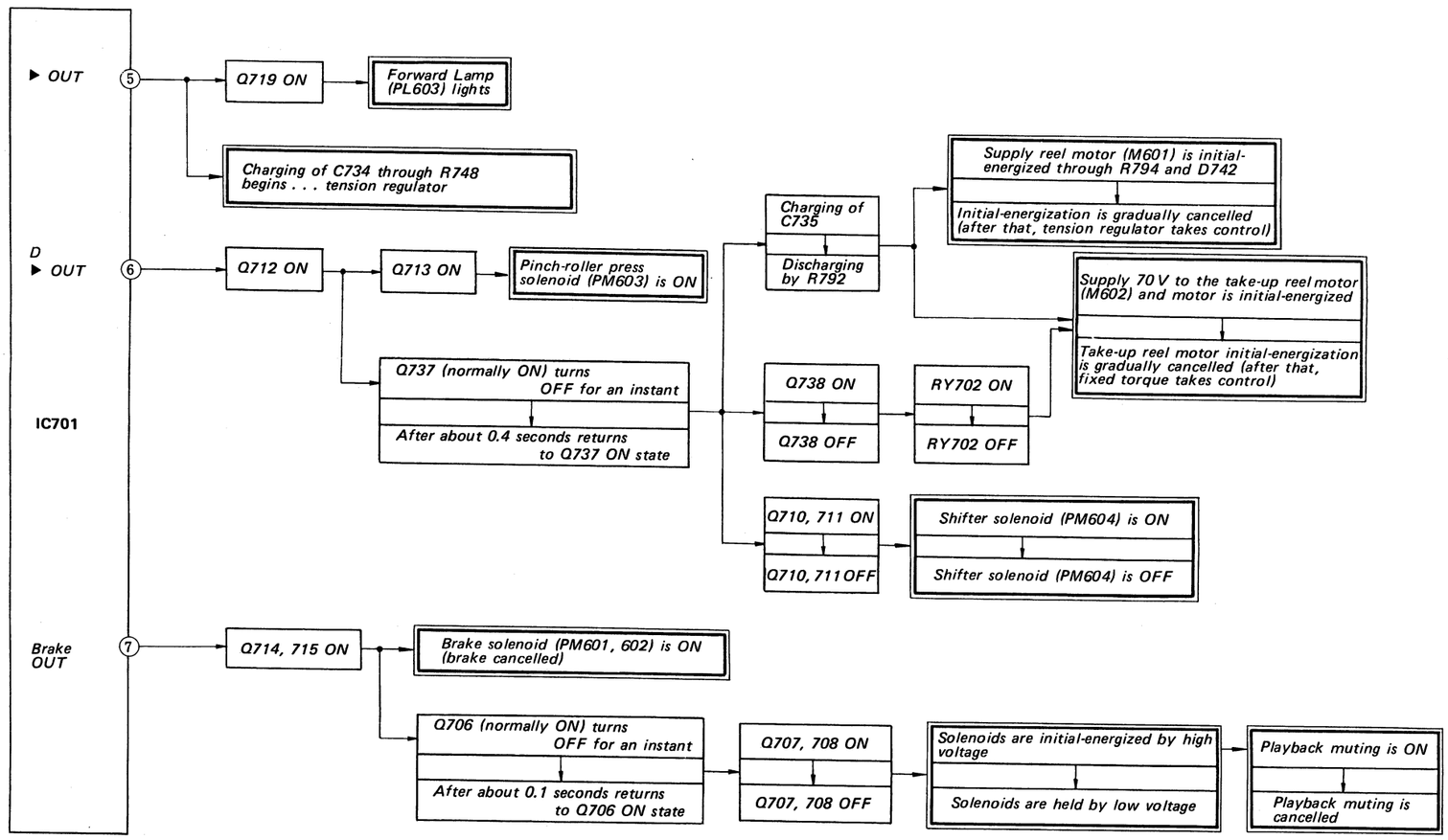


Fig. 19

18. Function Button Action Flow Chart

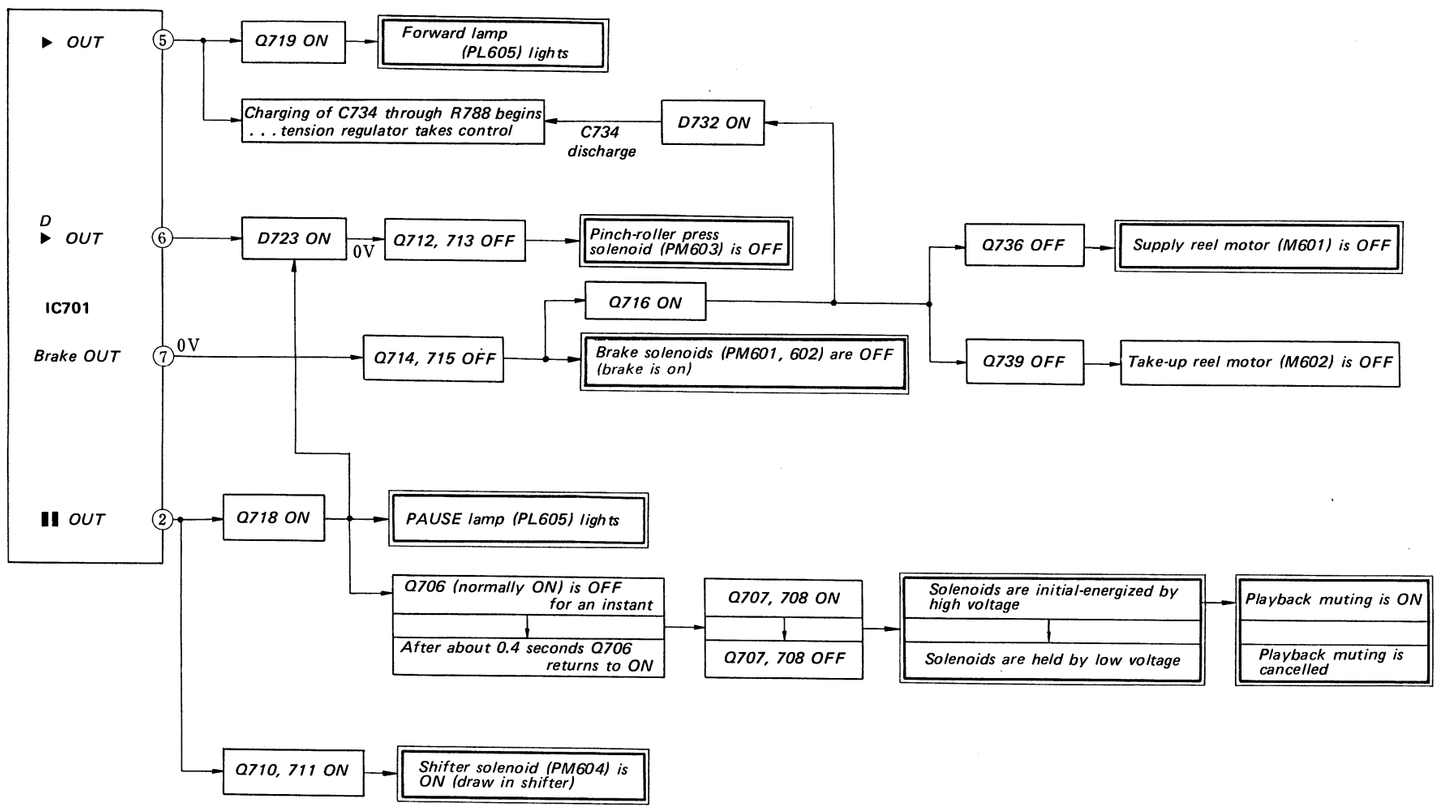
[Function Button Action Flow Chart 1]

- STOP (■) → Forward (▶)
- Forward/PAUSE (⏸, ▶) → Forward (▶)
- ▭: indicates final action



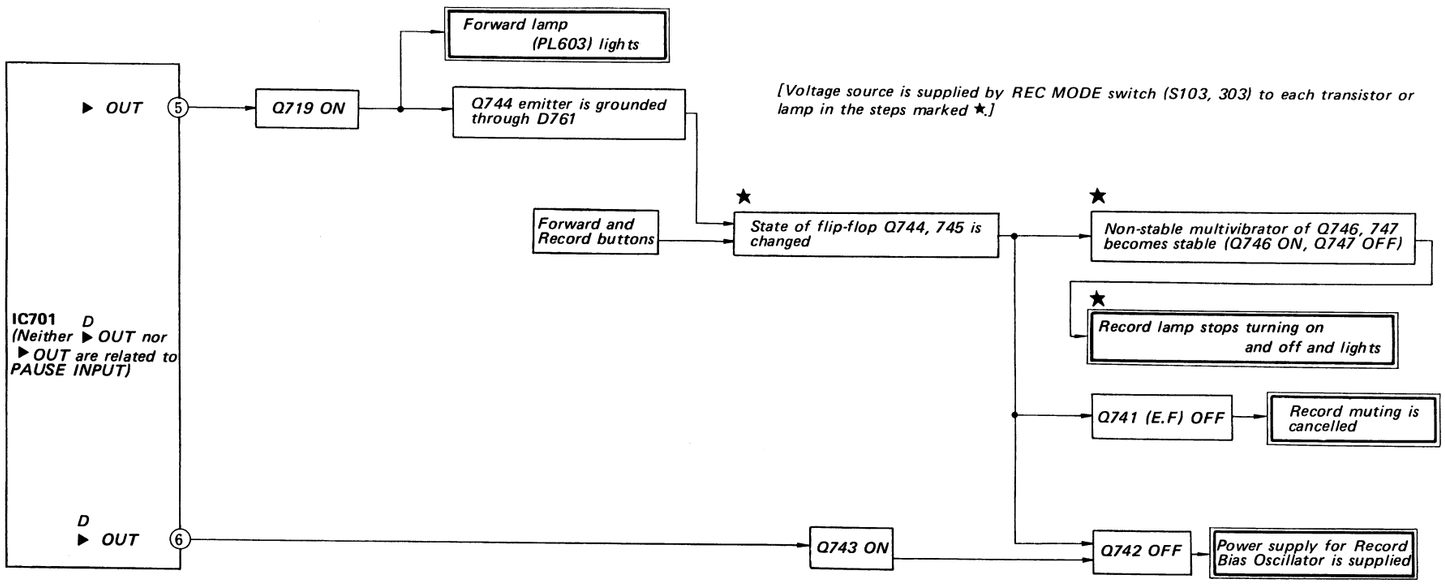
[Function Button Action Flow Chart 2]

- Forward (▶) → Forward/PAUSE (⏸, ▶)
- ▭: indicates final action



[Function Button Action Flow Chart 3]

- Record/Forward (●, ▶)
- Record/Forward/PAUSE (●, ▶, ❚❚)
- ▭: indicates final action



Forward mode and Record mode

○ [ ] : final action

○ ----- and [ ]: temporary action

【SWITCH BOARD】

【SYSTEM CONTROL BOARD】

【FUNCTION SWITCH BOARD】

【FUSE BOARD】

PAUSE mode

○ □ : final action
○ ---- and [ ] : temporary action

【SWITCH BOARD】
【SYSTEM CONTROL BOARD】
【FUNCTION SWITCH BOARD】
【FUSE BOARD】

S601 REEL SIZE 10/2 → 7
S602 TAPE SPEED 19cm 7 1/2→9.5cm 3 3/4
S603 TIMER OFF→ON

Q732 2SC1364 EMITTER FOLLOWER
Q731 2SC1364 SWITCHING
Q730 2SC1364 SWITCHING
Q729,728 2SC1364 FLIP-FLOP
Q727,726 2SC1364 SCHMIDT TRIGGER CIRCUIT
Q725,724 2SC1364 DIFFERENTIAL AMP
D728~733 IT40
D732 SIB01-02
D708~713,715 IT40
D714 IT22
Q704 2SC1364 STABILIZING SUPPLY
Q705 2SC1061 STABILIZING SUPPLY
Q706 2SC1364 SWITCHING
Q707 2SC1364 SOLENOID POWER SUPPLY
Q708 2SC1061 SOLENOID POWER SUPPLY
D716,717 SIB01-02
D734~741,748 IT40
Q733 2SC1364 EMITTER FOLLOWER
Q734 2SC1364 RELAY DRIVER
Q735 2SC1364 EMITTER FOLLOWER
Q736 2SC867 MOTOR DRIVER
D744~747 SIB01-02
D603,602 SIB01-02
D718~720 IT40
D707 SIB01-02
D742,743,749~754 IT40
Q709 2SC1364 SWITCHING
Q710,712,714 2SC1364 SOLENOID DRIVER
Q711,713,715 2SC1475 SOLENOID DRIVER
Q716,737 2SC1364 SWITCHING
Q738 2SC1364 RELAY DRIVER
Q739 2SC867 MOTOR DRIVER
D755~758 SIB01-02
D723~725 IT40
Q717 2SC1364 SWITCHING
Q718~720 2SC1364 LAMP DRIVER
D726,727 IT40
Q722,723 2SC1364 SWITCHING
D768 EQA01-11
IC701 CX738 SYSTEM CONTROL
IC701 (A~H : IN, 1~7 : OUT)
D766,767 IT40
D601 IT40
Q740 2SC1364 SWITCHING
Q741 2SC1364 EMITTER FOLLOWER
Q742,743 2SC1364 SWITCHING
Q744,745 2SC1364 FLIP-FLOP
Q746,747 2SC1364 ASTABLE MULTIVIBRATOR
Q748 2SC1364 SWITCHING
D759~765 IT40
Q701,703 2SC1364 STABILIZING POWER SUPPLY
Q702 2SC1061 STABILIZING POWER SUPPLY
D706 EQA01-11R
D705 SIB01-02
D701~704 SIB01-02
D769 1S1555
M601 IC638R SUPPLY REEL
M602 IC638R TAKE-UP REEL
CN601 REMOTE CONTROL
F602 2.5A
F601 2.5A
PLAYBACK MUTING ON
PLAYBACK MUTING OFF
REC MONITOR MUTE
STOP
BRAKE ON

Fast Forward mode

: final action

and : temporary action

【SWITCH BOARD】

【SYSTEM CONTROL BOARD】

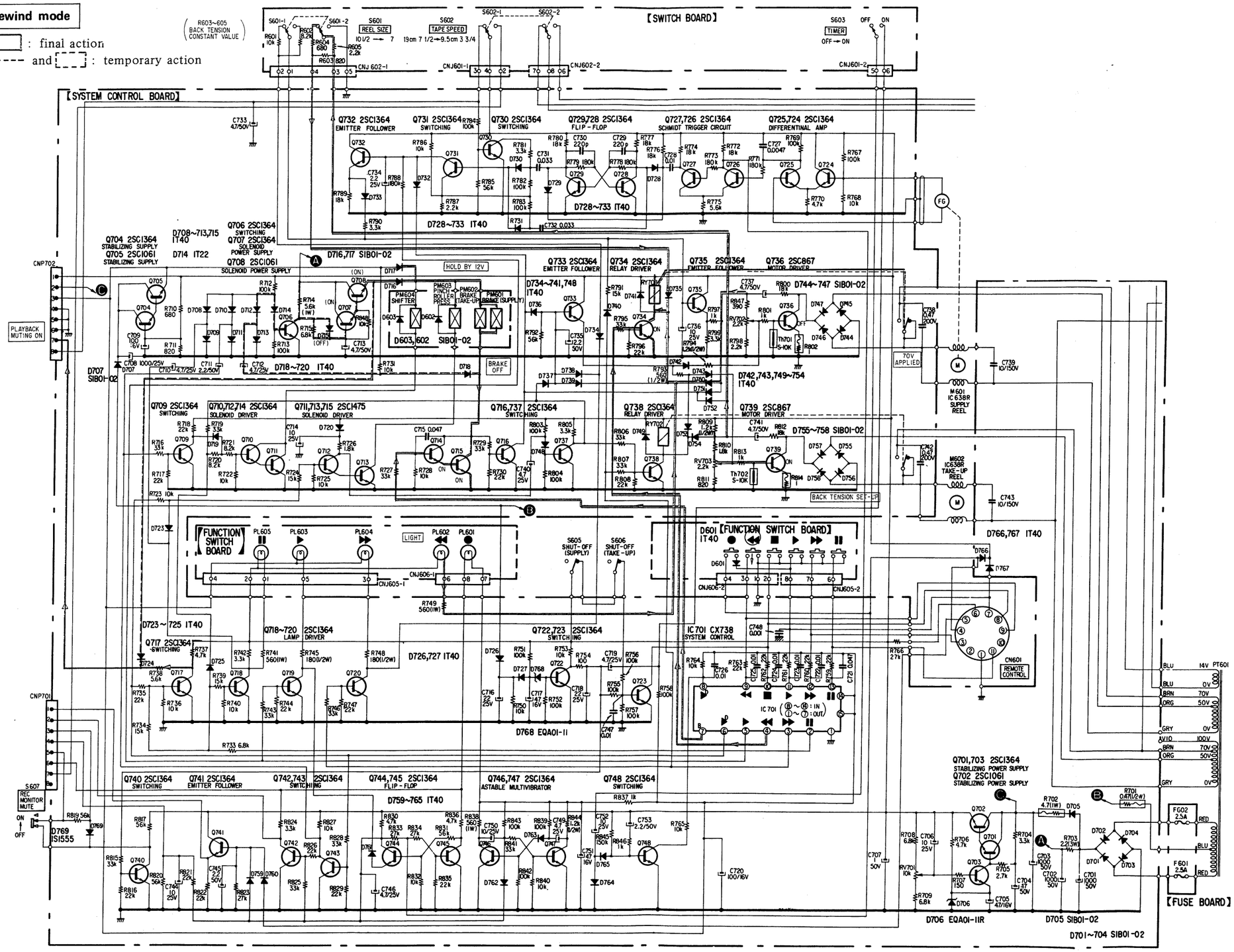
【FUNCTION SWITCH BOARD】

【FUSE BOARD】

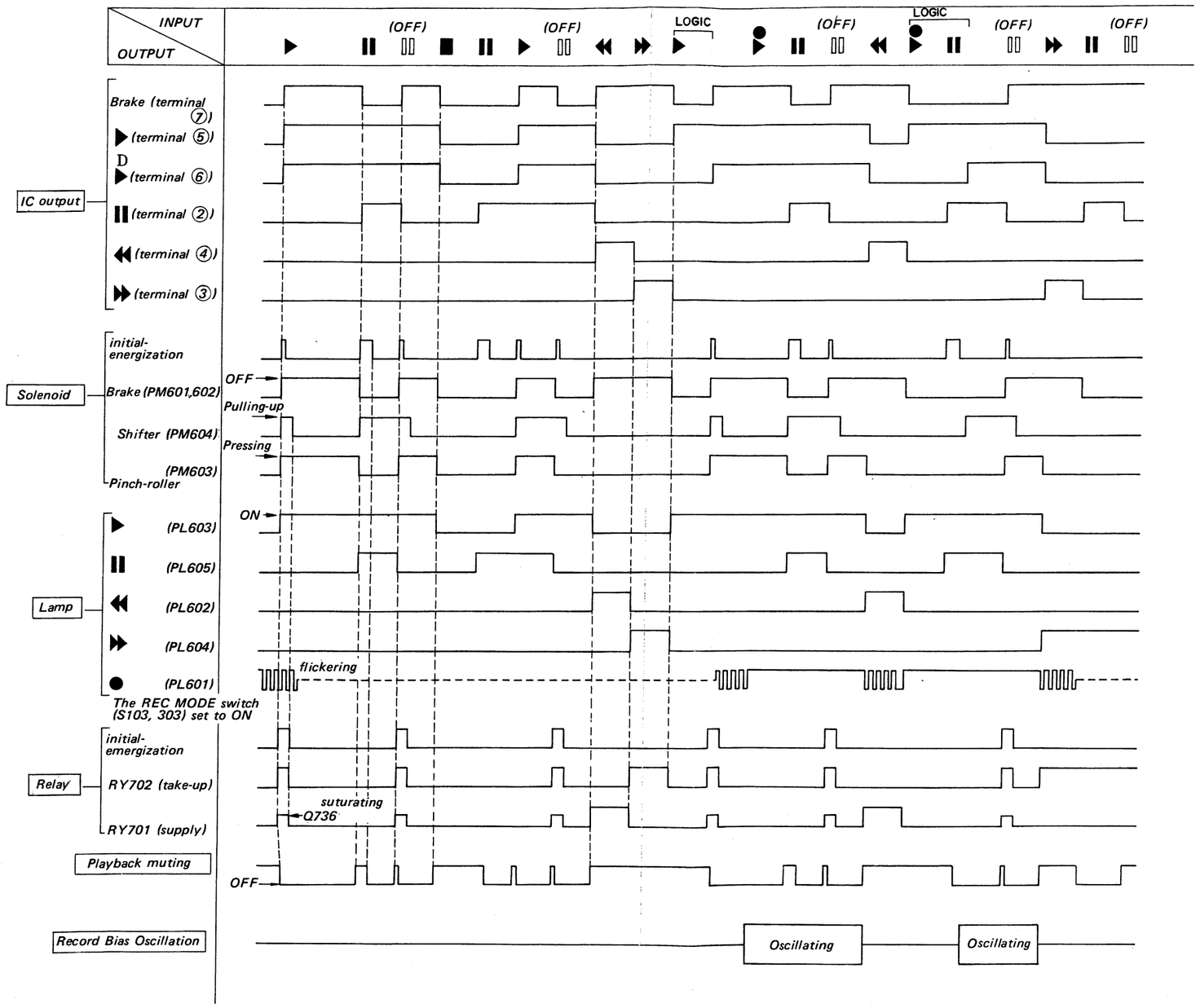
Rewind mode

○ [ ] : final action

○ ----- and [ ] : temporary action



20. Function Button Action Time Chart



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