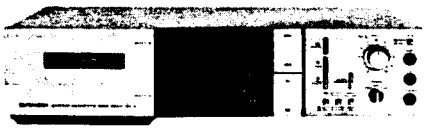
PIONEER®

Service Manual

CIRCUIT & MECHANISM DESCRIPTIONS



The photo shows the model CT-5.

ORDER NO.
ARP-002-0

STEREO CASSETTE TAPE DECK

CT-5
CT-4

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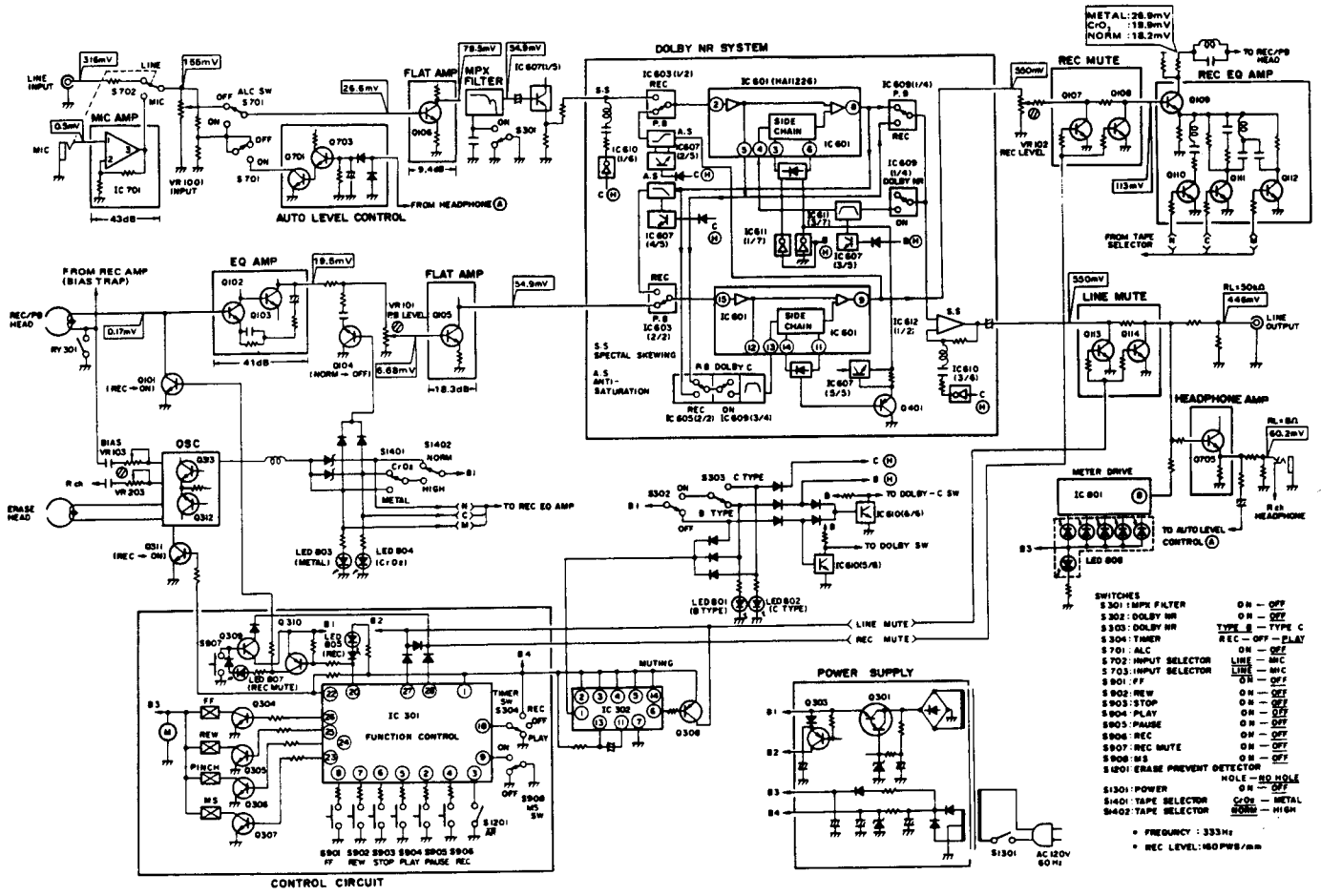
 Printed in Japan

1. CT-5

Block Diagram



Refer to the block diagram for circuit details.

1.1 SIGNAL PATHS

Playback Mode

The output signal from the REC/PB head is passed via the equalizer amplifier (Q102/Q103), a flat amplifier (Q105) and a bilateral switch (IC603) to the 2nd processor stage pin 15 of HA11226) of the Dolby NR processor. The decoded output (from pin 9 of HA11226) is passed via a transistor switch (IC607) and the bilateral switch (IC603) to the 1st processor stage (pin 2 of HA11226). The output from this stage (pin 8 of HA11226) is then passed to the LINE OUTPUT via another bilateral switch, a buffer amplifier (IC612) and the line muting circuit (Q113/Q114).

Recording Mode

The LINE INPUT or MIC signal (mic amplifier output) is passed via the INPUT level control (VR110), a flat amplifier (Q106), the MPX filter, a transistor switch (IC607) and a bilateral switch (IC603) to the 1st processor stage (pin 2 of HA11226) of the Dolby NR processor. The encode output (from pin 8 of HA11226) is passed via the bilateral switch (IC603) to the 2nd processc stage (pin 15 of HA11226). The output from this stage (HA11226 pin 9) is then passed to the REC/PB head via the REC muting circuit (Q107/Q108), a recording amplifier (Q109) and a bias trap.

1.2 DOLBY NR PROCESSOR

The CT-4 and CT-5 both feature type B and type C Dolby NR processors.

The type C Dolby NR system enables noise to be reduced by up to 20dB at frequencies above 1kHz. The basic operating principles are the same as for the type B Dolby NR system, the major difference lying in the use of two separate processor stages (a high level stage and a low level stage connected in series). Switching to a type B Dolby NR processor also enables type B encoded

tapes to be played. Block diagrams for encoding and decoding operations are outlined in Figs. 1-1 and 1-2 respectively. The corresponding input/output frequency response curves are shown in Fig. 1-3.

The REC signal is passed through a spectral skewing circuit (see Fig. 1-1) which is an LC resonator with an for at 20kHz, and designed to prevent low to mid-range decoding error (high level leakage) due to high level signals.

The REC signal is then applied to the 1st processor stage (high level stage) where it is divided into 2 signals, the main signal being passed directly to adder A, while the main signal is passed via SCF-1 (side chain filter), amplifier B and overshoot suppressor C before being applied to adder A where the main and sub signals are recombined.

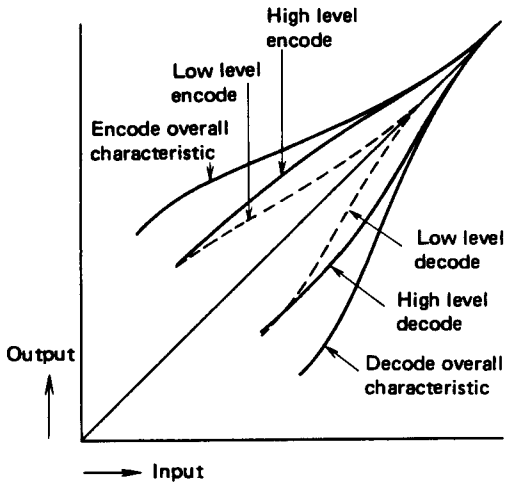


Fig. 1-3 Input/Output characteristic

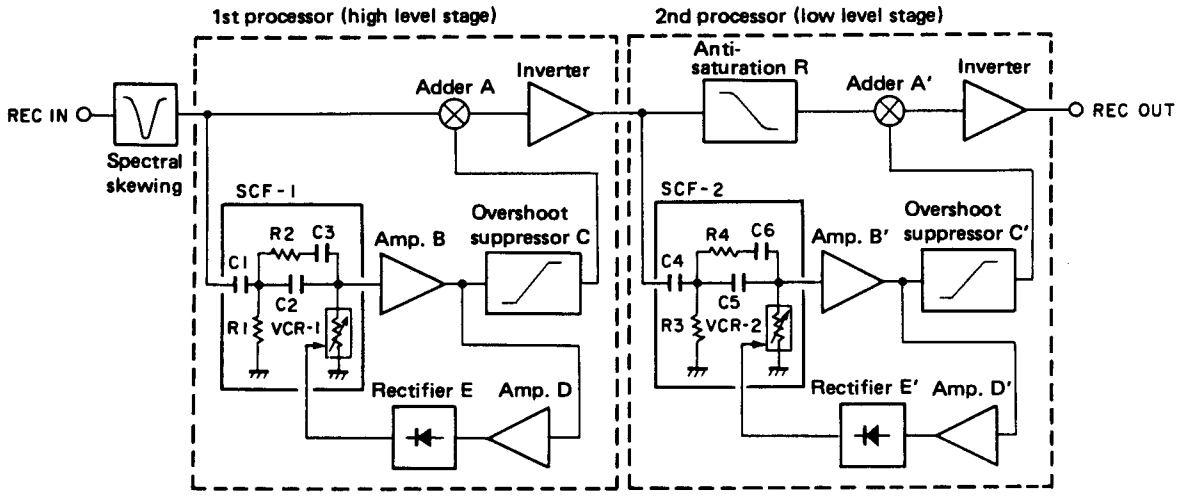


Fig. 1-1 Block diagram for encoding operation

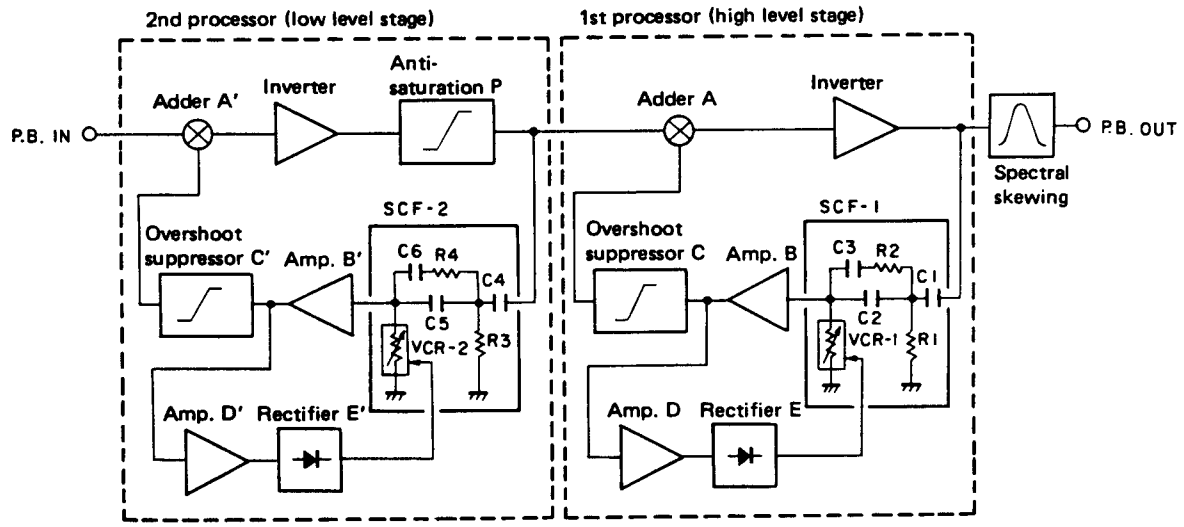


Fig. 1-2 Block diagram for decoding operation

In addition, the amplifier B output is applied to rectifier E (non-linear integrating type) via amplifier D, the rectified output being applied to VCR-1 (voltage control resistor) of SCF-1. This SCF is a variable high-pass filter where the frequency response is varied according to the VCR value. The VCR value is increased under low level conditions, and the SCF-1 turnover frequency is determined by C1/R1. The level of the adder A output will thus be 10dB higher than the main signal level (around 1.5kHz), and the dynamic range will be contracted. The VCR value will drop when the VCR control voltage exceeds the threshold value, and the SCF-1 turnover frequency will be increased by C2/C3/R2/VCR-1, thereby attenuating low to mid-range signals in the sub-signal. And since the sub to main signal ratio is lower at higher input signal frequencies, the degree of dynamic range contraction is smaller.

The adder A output is applied to the 2nd processor stage (low level stage) where the signal whose dynamic range was compressed in the 1st compressor stage is added. In order to further compress the dynamic range in this 2nd processor stage, the threshold level of the 2nd processor VCR-2 control voltage is set below the corresponding level of the 1st processor stage. The 2nd processor stage also includes an anti-saturation circuit R. The purpose of this circuit is to effect the same improvements as the spectral skewing circuit.

During playback (see Fig. 1-2), the same basic circuitry is used as in recording mode, but with the 1st and 2nd processor stages in the reverse order. Since the circuit starts from the output of the inverter (sub-signal output), a negative feedback loop is formed with the sub-signal being subtracted from the main signal in adder A. And since the sub-signal path operation is exactly the same as during recording mode, the decoding and encoding characteristics complement each other. Furthermore, the anti-saturation P and spectral skewing characteristics during decoding are the exact opposite of the corresponding characteristics during encoding. Consequently, a flat frequency response is maintained at all levels after all phases of the encoding and decoding opperations are completed.

1.3 CONTROL CIRCUITS

The CT-5 control circuits are incorporated in the 1-chip control IC PM9002, thereby enabling this tape deck to be operated by "feather-touch" operation. In addition to tape drive mechanism control functions, this IC also includes music search (MS), auto-stop and timer start functions. See Fig. 1-4 for the PM9002 pin layout, Fig. 1-5 for the PM9002 block diagram, and Figs. 1-6 and 1-7 for the output pin changes and timing during each deck operation mode.

Mechanical operations as a result of circuit operations are outlined under the section on mechanical operations on page 8.

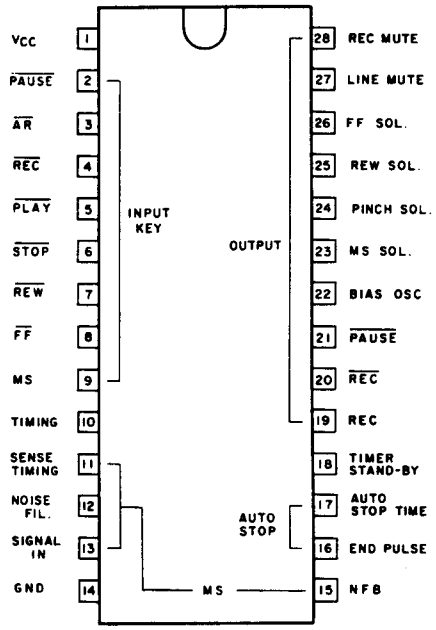


Fig. 1-4 PM9002 pin layout

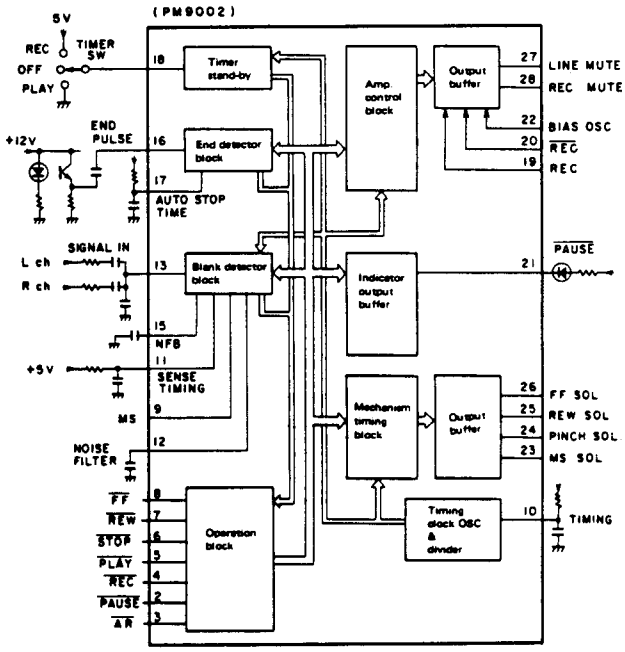


Fig. 1-5 PM9002 block diagram

When the Power Switch is Switched on

When the power switch is switched on, +5V is applied to pin 1 (Vcc) of IC301. Then during this increase in voltage at pin 1 from 0V to +5V (approximately between 0.6V and 2.4V), the internal IC reset circuit is activated, resulting in the deck being set to stop mode. This stop mode status is maintained for at least 4 seconds (approx.), and during this time no other mode can be activated.

Playback Mode

When the PLAY switch is pressed (ON), pin 5 ($\overline{\text{PLAY}}$) of IC301 is switched to "L" level while pin 24 (PINCH SOL.) is switched to "H" level. Q306 is consequently turned on via R312, thereby activating the pinch solenoid SL3. In addition, pin 27 (LINE MUTE) of IC301 is opened 416ms after the PLAY switch is switched on, thereby cancelling line muting for start of playback mode.

REC Mode

When a cassette half with the erasure prevention tabs intact is loaded, pin 3 ($\overline{\text{AR}}$) of IC301 is switched to "H" level, thereby enabling the shift to recording mode.

When the REC switch is then pressed, pin 4 ($\overline{\text{REC}}$) of IC301 is switched to "L" level, followed by pin 20 ($\overline{\text{REC OUT}}$) also being switched to "L" level. The REC indicator lamp is turned on, and Q310 also turned on (thereby switching the signal path to recording mode). And since pin 19 (REC OUT) of this IC is open, reed relay RY101 is switched off and a recording current subsequently passed to the head. Pin 24 is also switched to "H" level, resulting in Q306 being turned on via R312, and the pinch solenoid thus being activated for start of tape transport.

Pin 22 (BIAS OSC) of IC301 is opened 52ms after the REC switch is switched on, thereby starting up the bias oscillator circuit. Pin 27 (LINE MUTE) and pin 28 (REC MUTE) of IC301 are both opened 416ms after the REC switch is switched on, thereby cancelling both line and recording muting for start of recording mode.

Fast Forward Mode

When the FF switch is switched on, pin 8 ($\overline{\text{FF}}$) of IC301 is switched to "L" level, followed by pin 26 (FF SOL.) being switched to "H" level 416ms later. Q304 is consequently turned on and the FF solenoid activated for start of fast forward mode.

Rewind Mode

When the REW switch is switched on, pin 7 ($\overline{\text{REW}}$) of IC301 is switched to "L" level, followed by pin 25 (REW SOL.) being switched to "H" level 416ms later. Q305 is thereby turned on, resulting in activation of the REW solenoid for start of rewind mode.

PAUSE Mode

Pause mode in this tape deck is cancelled by pressing the PAUSE switch again. During PLAY/PAUSE mode, pressing the PLAY switch will not effect a change of mode. Likewise, pressing the REC switch during REC/PAUSE mode will not alter that mode. Note, however, that pressing the PLAY switch during REC/PAUSE mode will switch the deck to PLAY/PAUSE mode, and pressing the REC switch during PLAY/PAUSE mode will switch the deck to REC/PAUSE mode.

If the PAUSE switch is pressed during stop mode, pin 2 ($\overline{\text{PAUSE}}$) and pin 21 ($\overline{\text{PAUSE}}$) of IC301 are both switched to "L" level, resulting in the PAUSE indicator lamp being turned on.

When the PLAY and PAUSE switches are pressed together, pin 21 ($\overline{\text{PAUSE}}$) of IC301 is switched to "L" level, again resulting in the PAUSE indicator lamp being turned on. Pin 27 (LINE MUTE) is switched to "H" level, thereby muting the signal path.

When the REC and PAUSE switches are pressed together, pin 20 (REC OUT) and pin 21 ($\overline{\text{PAUSE}}$) are switched to "L" level, resulting in the REC and PAUSE indicator lamps being turned on, and the signal path being switched to recording mode. Furthermore, pin 27 (LINE MUTE) is opened and although an output signal is applied to the LINE OUTPUT, REC muting is applied due to pin 28 (REC MUTE) being switched to "H" level.

Music Search (MS) Operation

When the FF or REW switch is pressed with the MS switch on, a blank section of unrecorded tape between tunes is detected, tape transport stopped, and the deck then started up again in playback mode.

When the FF switch is pressed with the MS switch on, pin 24 (PINCH SOL.) of IC301 is switched to "H" level for a period of 312ms, thereby activating the pinch solenoid SL3 which lifts the head towards the tape.

Pin 23 (MS SOL.) is switched to "H" level 260ms after the FF switch is pressed, resulting in Q307 being turned on via R313 and the MS solenoid SL4 being activated. After completing the "power assist" operation, the head base is set in the MS position. Then 416ms after pressing the

FF switch, the FF solenoid SL1 is activated, and the tape transport started in fast forward mode. During this fast forward motion, a "fast forward playback" signal is applied to pin 13 (SIGNAL IN) of IC301 in order to detect blank sections of tape. If there is a break of about 84ms in this playback signal, IC301 is switched to playback mode for immediate playback of the tape from the stopped position.

The operational steps are similar when the REW switch is pressed.

Auto-Stop Circuit

This circuit is used in switching the mechanism drive control IC301 (PM9002) to stop mode when tape transport is halted. Tape transport detection involves a photo-interrupter system where a beam of light is interrupted at intervals by rotating blades coupled by belt to the take-up reel.

- **During tape transport:**

The photo-interrupter output is applied to pin 16 (END PULSE) of IC301, resulting in the capacitor (C318) connected to pin 17 (AUTO STOP TIME) being charged up and discharged repeatedly. The potential at pin 17 is consequently kept below a threshold voltage, thereby preventing activation of auto-stop mode.

- **When tape transport is halted:**

When tape transport comes to a halt and the take-up reel stops turning, the photo-interrupter output is no longer applied to pin 16 (END PULSE) of IC301. The ponential of the capacitor (C318) connected to pin 17 (AUTO STOP TIME) consequently increases, and when the threshold voltage is exceeded, IC301 is switched to stop mode and the tape transport mechanism put into stop status.

Timer Start Mode

TIMER REC, TIMER PLAY and OFF modes are obtained by setting the potential of pin 18 (TIMER) of IC301 to Vcc, GND and open respectively.

- **TIMER REC**

The tape deck is put into recording mode automatically at the time set by timer. When a cassette half with the erasure prevention tabs intact is loaded, and the power switch switched on with the TIMER switch (S304) in the TIMER REC position, recording mode is started about 4 seconds after the power is switched on. If, however, a a cassette half without erasure prevention tabs is loaded, the deck remains in stop mode.

- **TIMER PLAY**

The tape deck is put into playback mode automatically at the time set by timer. If the TIMER switch (S304) is set to the TIMER PLAY position and the power switch left on, the tape deck will be started up in playback mode about 4 seconds after the power is switched on.

- **TIMER OFF**

No timer start operations are performed when the TIMER switch is left in the OFF position.

Normal operation MS : OFF

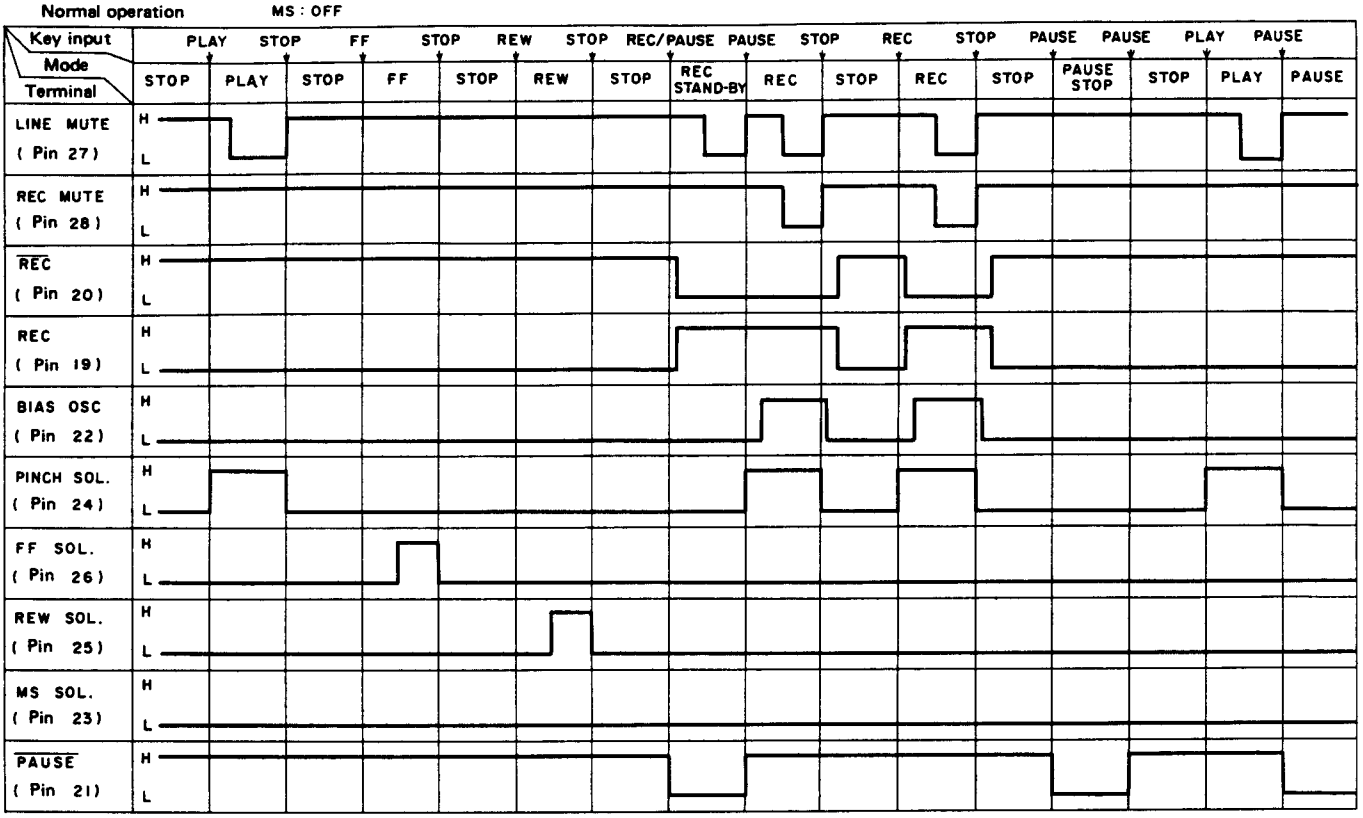


Fig. 1-6 PM9002 Timing chart (MS switch : OFF)

Normal operation MS SW : ON Direct change

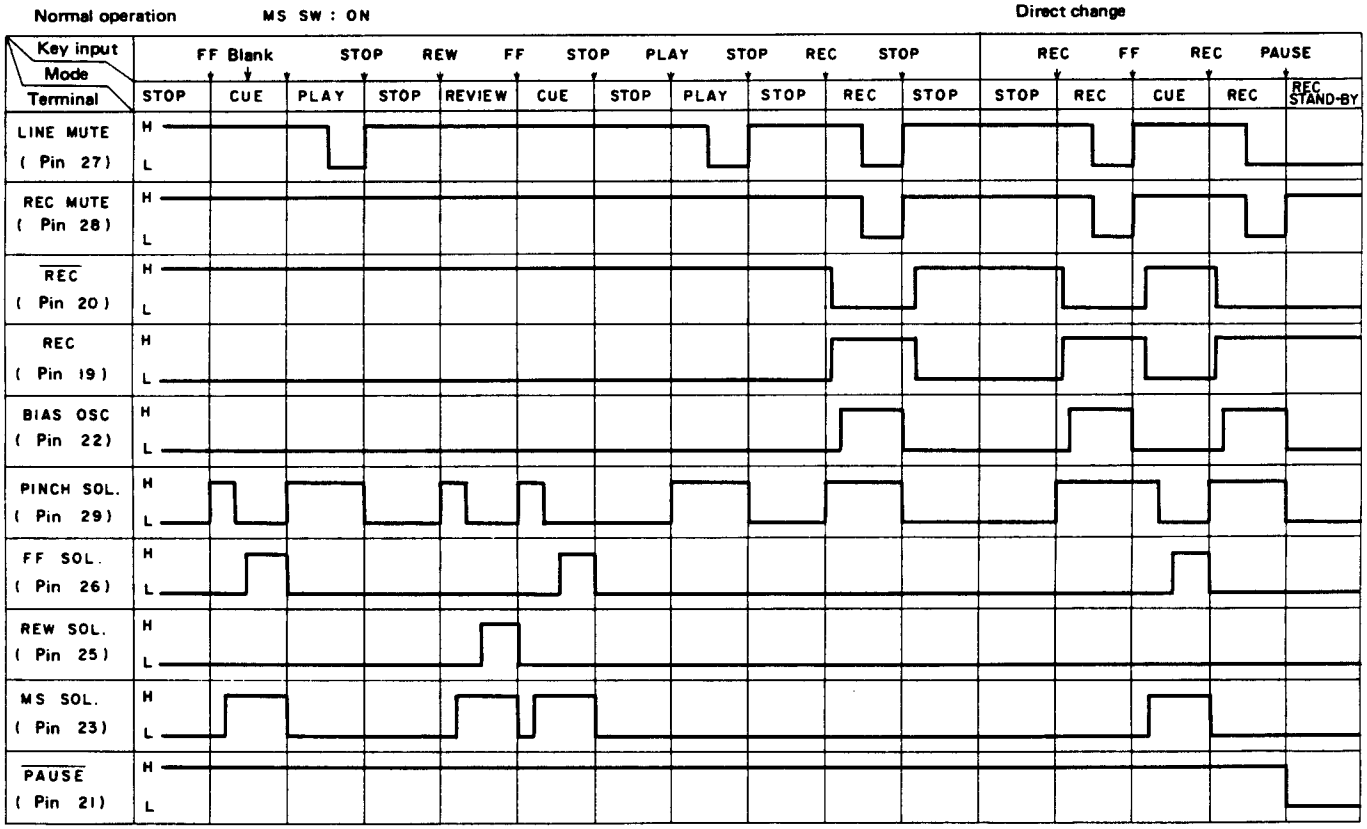


Fig. 1-7 PM9002 Timing chart (MS switch: ON)

1.4 MECHANISM DESCRIPTIONS

Playback Operation

Movement of the head base (where the recording/playback and erase heads are mounted) during playback mode in the CT-5 employs the capstan rotational force.

- **STOP operation (Fig. 1-8)**

Fig. 1-8 outlines the head base drive mechanism during stop mode. The operating lever (A) presses down on the cam (C) due to the action of the operating lever spring (B). This cam is joined to a cam gear (D) which is turned in a clockwise direction. Solenoid P is not activated at this time, and with the cam gear stopper (G) checked by the hook of the gear lever (F) due to the action of the gear lever return spring (E), the cam gear remains stationary.

The flywheel is belt-driven by the capstan motor counter-clockwise together with the capstan gear.

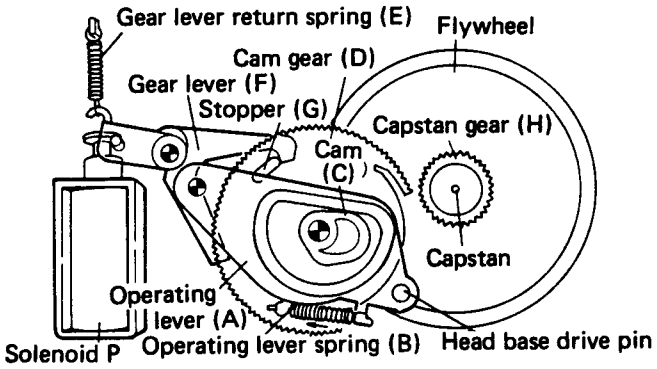


Fig. 1-8 STOP operation

- **STOP → PLAY operation (Fig. 1-9)**

1. Solenoid P is activated ❶ , and the gear lever (F) hood is released from the stopper (G) ❷ .
2. The operating lever (A) presses down on the cam (C) under pressure of the operating lever spring (B) ❸ , the cam gear (D) rotates ❹ and engages the capstan gear (H) ❺ .

- **STOP → PLAY operation (Fig. 1-10)**

3. The cam gear (D) continues to rotate due to rotation of the capstan gear (H) ❻ , resulting in the cam (C) pushing the operating lever (A) upwards ❼ .
4. Once the cam (C) has passed the position of maximum upward thrust, the cam gear (D) disengages from the capstan gear (H) ❽ .

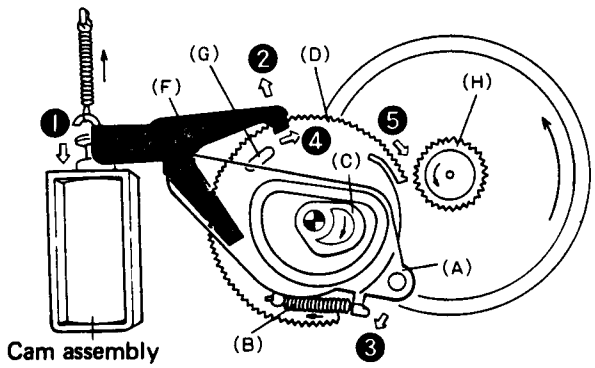


Fig. 1-9 STOP → PLAY operation

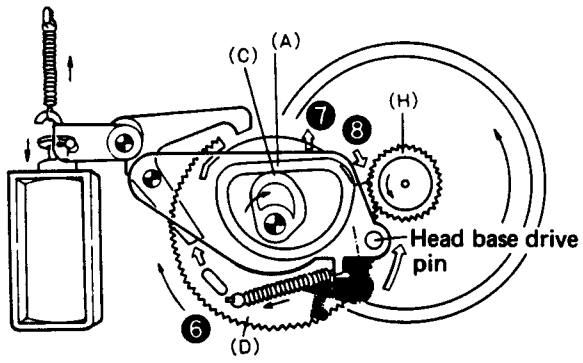


Fig. 1-10 STOP → PLAY operation

- **STOP → PLAY operation (Fig. 1-11)**

5. Due to the operating lever spring (B), the operating lever (A) presses against the cam (C) ❾ , resulting in the stopper (G) meeting the arm of the gear lever (F) ❿ . The cam gear (D) is thereby stopped, and the operating lever (A) remains in that position (playback mode).

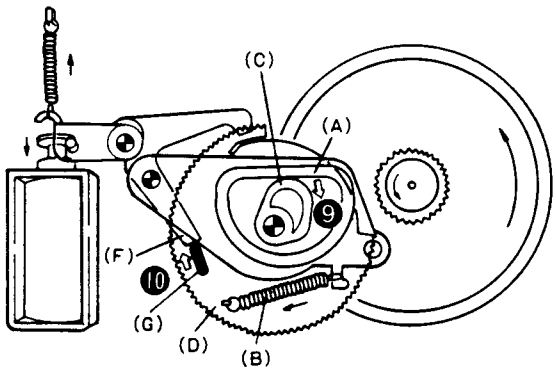


Fig. 1-11 STOP → PLAY operation

General Mechanism Movements

The operating lever (A) head base pin is raised during playback mode (see Fig. 1-10), thereby lifting the head base through the action of the HB drive spring. At the same time, the pinch pressure spring is also raised, thereby pressing the pinch roller against the capstan. And since the brake plate is also lifted, the reel brake is released, resulting in pressure being applied to the idler arm, and the TU idler thereby transferring the drive gear rotation to the TU reel (this drive gear being belt-driven by the capstan motor). (See Fig. 1-12).

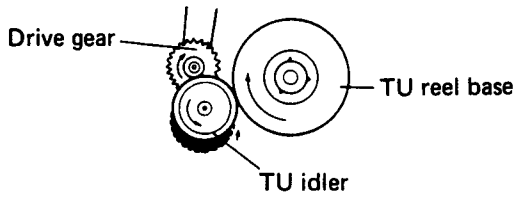


Fig. 1-12 Generation of take-up torque

- **PLAY → STOP operation (Fig. 1-13)**

1. When solenoid P is released ⓫ , the arm of the gear lever (F) is released from the stopper (G) by the gear lever return spring (E) ⓬ .
2. The operating lever (A) is then forced againsts the cam (C) by the operating lever spring (B) ⓭ , resulting in the cam gear (D) turning ⓮ and the head base drive pin being lowered ⓯ .
3. When the stopper (G) catches against the hook of the gear lever (F), the mechanism stops in the same state as outlined in Fig. 1-8 (stop mode).

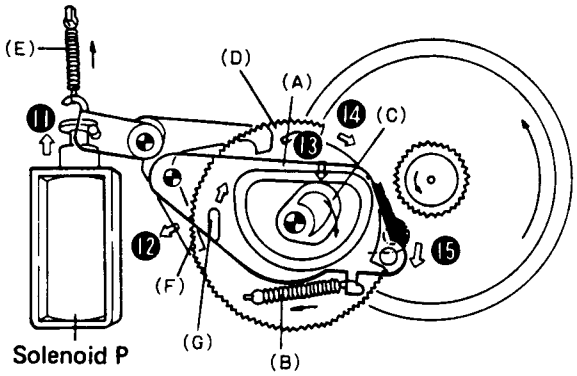


Fig. 1-13 PLAY → STOP operation

Fast Forward Mode

When solenoid F is activated in Fig. 1-14, the drive arm is moved to the right, and the drive gear on the arm engages the idler gear, resulting in rotation of the TU reel (the drive gear being belt-driven by the capstan motor). At the same time, the drive gear arm bracket pin pushes the break plate up, thereby releasing the reel brake.

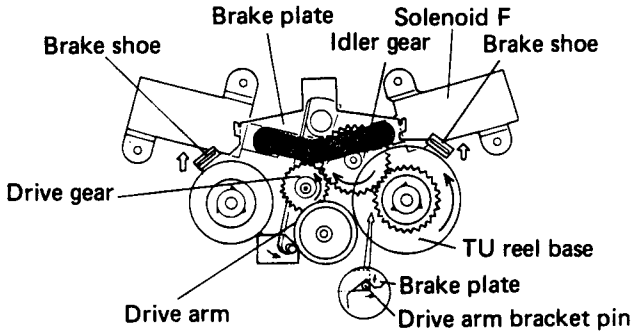


Fig. 1-14 Fast forward operation

Rewind Mode

When solenoid R in Fig. 1-15 is activated, the drive arm is moved to the left, and the drive gear on the arm engages the supply reel gear, resulting in rotation of the supply reel. At the same time, the pin at the tip of the drive arm presses the brake plate up, thereby releasing the reel brake.

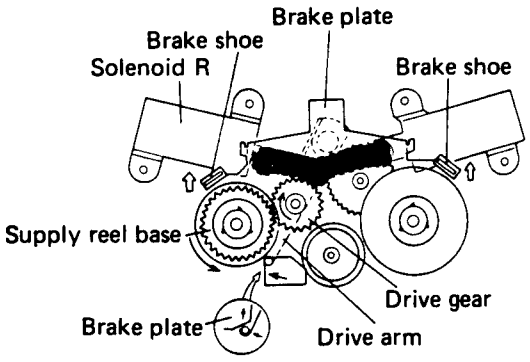
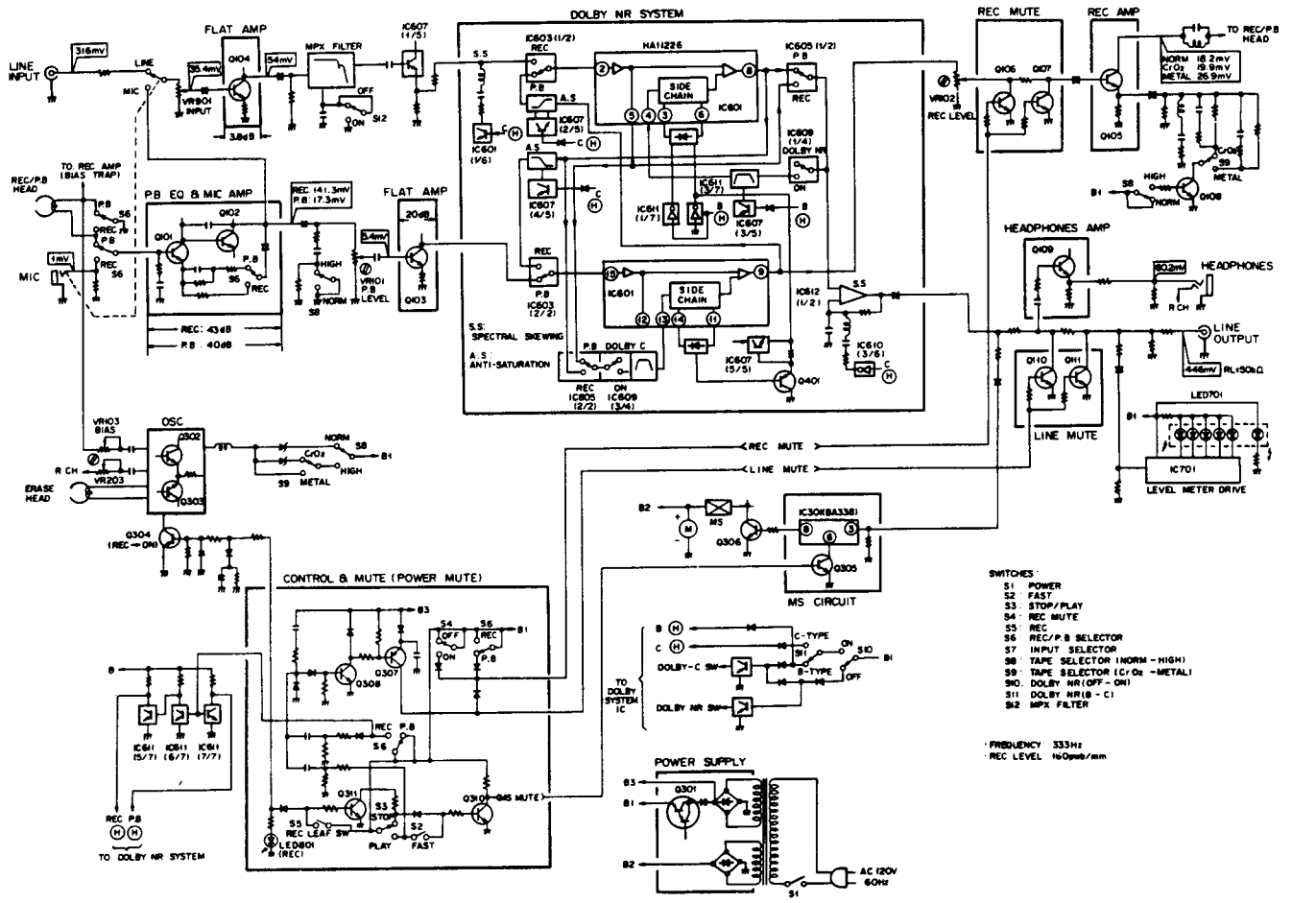


Fig. 1-15 Rewind operation

2. CT-4

Block Diagram



Refer to the block diagram for circuit details.

2.1. SIGNAL PATHS

Playback Mode

The signal from the REC/PB head is passed via the equalizer amplifier (Q101/Q102), a flat amplifier (Q103) and a bilateral switch (IC603) to the 2nd processor stage of the Dolby NR processor (pin 15 of HA11226). The decoded output (pin 9 of HA11226) is applied to the 1st processor stage of the Dolby NR processor via a transistor switch (IC607) and the bilateral switch (IC603). The output from the Dolby NR processor (pin 8 of HA11226) is then passed via another bilateral switch (IC605), a buffer amplifier (IC612) and line muting circuit (Q110/Q111) to the LINE OUTPUT.

Recording Mode

The LINE INPUT signal is passed via the INPUT SELECTOR switch (S7), INPUT level control (VR901), a flat amplifier (Q104), the MPX filter, a transistor switch (IC607) and a bilateral switch (IC603), finally being applied to 1st processor stage of the Dolby NR processor (pin 2 of HA11226). The encoded output (from pin 8 of HA11226) is then applied to the 2nd processor stage (pin 15 of HA11226) via the bilateral switch (IC603). The Dolby NR processor output (pin 9 of HA11226) is then applied to the REC/PB head via the REC mute circuit (Q106/Q107), the recording amplifier (Q105) and a bias trap.

2.2 MUTING CIRCUIT

Muting when the power switch is switched on

When the power switch is switched on, current flows from D301 to Q308 via R317, C324 and R325. Q308 is turned on only while C324 is being charged up, resulting in a drop in the base voltage of Q307. This transistor is consequently turned on, followed by the line muting circuit Q110/Q111 being turned on to connect the signal line to ground.

Muting when the power switch is switched off

When the power switch is switched off, the charge on C332 is discharged via Q307, R334 and D309, Q307 being turned on only during this discharge period. This again results in the line muting circuit Q110/Q111 being turned on to connect the signal line to ground.

Stop Mode Muting

When the tape drive mechanism is in stop status, the PLAY switch S3 is in the STOP position, resulting in +B (12V) being applied to R327 via PLAY switch S3 and R321. Q308 is consequently turned on, resulting in Q307 and Q110/Q111 being turned on (in the same way as when the power switch is switched on), thereby connecting the signal line to ground.

Muting when Switching from Stop to Playback Mode

When the tape drive mechanism is switched to playback mode from stop mode, the PLAY switch is put into the PLAY position, resulting in +B (12V) being applied to D308 via S3, R326 and C326. This also results in Q307, Q110 and Q111 being turned on and the signal line being connected to ground. Since Q308 remains on only while C326 is being discharged, noise generated by the switching action is muted.

Muting when Switching from Stop to Recording Mode

When the tape drive mechanism is switched to recording mode from stop mode, the PLAY switch S3 is set to the PLAY position, and the REC/PB SELECTOR switch S6 to the REC position. +B (12V) is consequently applied to D308 via S6, R323 and C325. Q308 is thereby turned on, followed by Q307 and Q110/Q111 being turned on to connect the signal line to ground. Q308 remains on only while C325 is being discharged, thereby muting the switching noise generated by the switching action.

Furthermore, Q106 and Q107 are also turned on as a result of Q308 and Q307 being turned on [via D313 and R128 (R228)], thereby activating the REC mute circuit.

REC/PAUSE Mode Muting Cancellation

If the PAUSE switch is pressed during recording mode, the PLAY switch S3 is returned to the STOP position with the REC switch in the ON position. Therefore, +B (12V) is applied to R322 via REC switch S5, resulting in Q311 being turned on, but Q308 and Q307 left off. Hence, LINE muting is not applied.

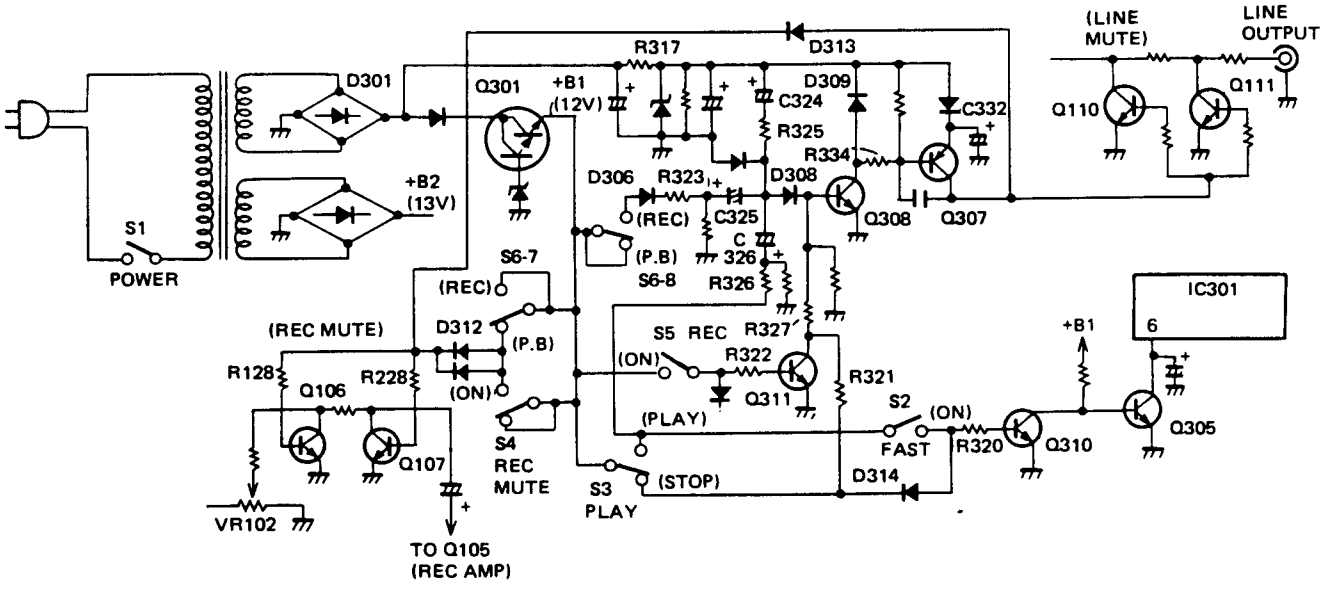


Fig. 2-1 Muting circuit

Music Search Mode Muting

During Music search mode, the PLAY switch S3 is set to the PLAY position and the FF switch S2 to the ON position. +B (12V) is therefore applied to R327 via S3, S2 D314 and R321. Q308, Q307, Q110 and Q111 are consequently turned on, thereby muting the signal line during this music search mode.

2.3 MUSIC SEARCH MODE

The music search function detects blank sections of tape (or at least 4 seconds) during fast forward and rewind modes, and subsequently stops the tape automatically at the start of a particular piece of music. The BA336 block diagram is outlined in Fig. 2-2.

1. Press the PLAY switch and the fast forward or rewind switch. The PLAY switch S3 will be set to the PLAY position and the FF (or REW) switch S2 to the ON position. +B (12V) will consequently be applied to R320 via S3 and S2, resulting in Q310 being turned on.
2. The Q305 base voltage is decreased when Q310 is turned on, resulting in Q305 being turned off. Pin 6 (MUTING) of IC301 is consequently switched to "H" level (music search mode start).
3. The playback signal from the REC/PB head is applied via the equalizer/mic amplifier, flat amplifier, MPX filter and the Dolby NR processor to pin 3 (IN) of IC301 (BLANK DETECTOR). This BLANK DETECTOR IC (BA336) is described in further detail in a later section.
4. When the level of the signal applied to IC301 pin 3 (IN) falls below the input detection level, and output pulse is obtained from pin 8 (OUT) of this IC. Q306 is turned on momentarily by this pulse signal, resulting in activation of the MS solenoid, thereby cancelling the fast forward mode (FF switch set to OFF position) and starting playback mode.
5. Q310 is turned off when the FF switch is set to the OFF position, resulting in pin 6 (MUTING) of IC301 being switched to "L" level (music search mode stop).

IC301 (BA336) Music Search Operation

BA336 is an IC designed to detect blank sections of tape between sections of recorded music. Major component parts include a preamplifier stage with a limiter, comparator, flip-flop and driver stages. See the block diagram in Fig. 2-2.

1. The input audio signal applied to pin 3 (IN) of BA336 is amplified by the preamplifier, and then compared with a reference voltage (Vref) in the comparator (I). If the level of the input signal falls below the input detector level (due to a blank section of tape or a section recorded at low level), the potential at pin 2 (SENSE TIMING) will start to increase at a rate determined by the C320/R314 time constant. When a voltage equal to 1/2 Vcc is reached, the output of the blank section detection time setting comparator III) is inverted.
2. Upon inversion of this output, the potential at pin 1 (PULSE WIDTH) starts to increase at a rate determined by the C321/R313 time constant. When a voltage equal to 1/2 Vcc is reached, the pulse width setting comparator (III) is inverted. Pin 8 (OUT) is switched to "H" level during the interval from when the blank section detection time setting comparator (II) is inverted up to when the pulse width setting comparator (III) is inverted. Q306 is turned on while pin 8 is at "H" level, resulting in activation of the MS solenoid.
3. When the power switch is switched on, and when the muting circuit is switched off, a fixed interval reset pulse is generated. This pulse resets the BA336 flip-flop circuit, thereby preventing the output of an output pulse. (The purpose of C318 connected to pin 6 is to prevent tune selection operation until circuit stability has been attained after switching the power switch on). The flip-flop is set by application of subsequent input signals, resulting in tune selection operation being put into standby mode where output pulse signals can be obtained each time a blank section of tape is detected.

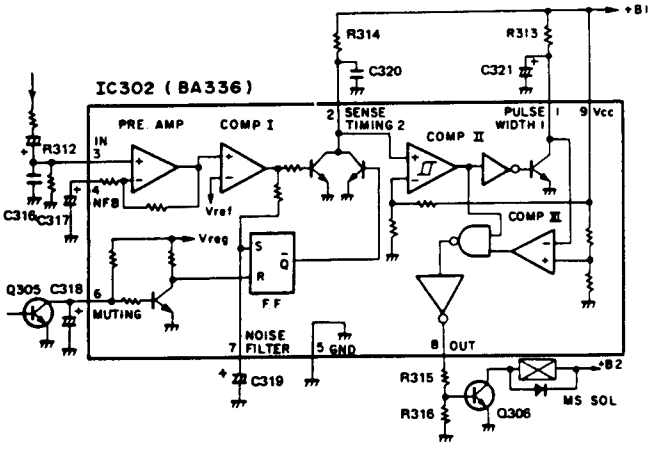


Fig. 2-2 BA336 block diagram

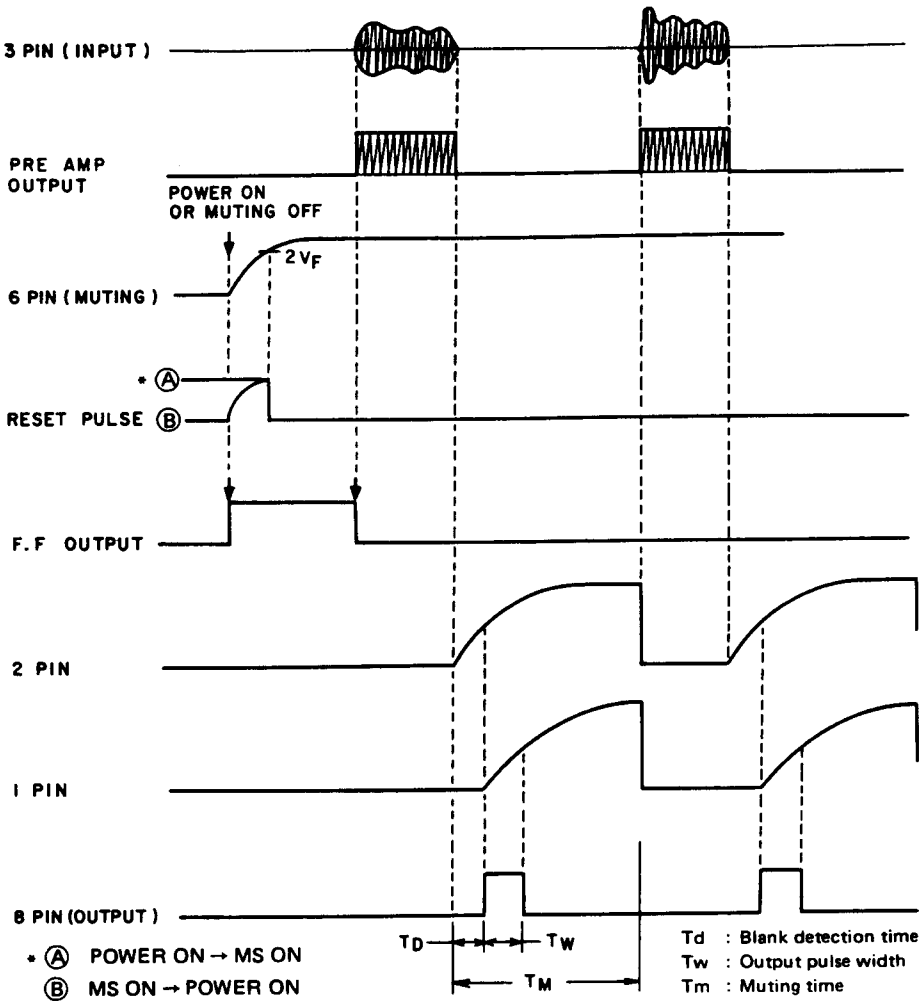


Fig. 2-3 BA336 Timing chart

2.4 MECHANISM DESCRIPTION

The mechanical portion of the CT-4 uses separate power assist mechanisms for the PLAY and REC system for light-touch operation. A mechanical tape-stop and MS (Music Search) function is also built-in.

- **STOP mode (Fig. 2-4)**

Fig 2-4 shows the PLAY and REC power assist mechanisms in the stop mode. In this status, the cam gear stopper A is making contact with gear lever A, so the cam gear and capstan gear (flywheel) are not meshed. (When the power switch is ON, the motor continues rotating, driving the capstan gear via the belt).

- **STOP → PLAY operation (Fig. 2-5)**

1. When the PLAY button is pressed down, the shape of the button forces gear lever A in the ① direction. Also, at the same time, gear lever B travels in the ① direction, and gear lever A and cam gear stopper A are disengaged.
2. The cam gear is forced in the direction ② by the trigger spring. Consequently, it starts rotating in the direction ② (CCW) and meshes with the capstan gear (flywheel).
3. As the capstan gear and cam gear are now engaged, the force transmitted by the motor and flywheel rotate the cam gear further, until stopper C makes contact with gear lever B. It stops in that position. At this point, the capstan gear and cam gear are no longer meshed (See Fig. 2-6).
4. Now, the projection on the cam gear boss is forcing the brake-plate down in the direction ③ , and braking force is released from the reel carrier.
5. Also, the cam shape of the cam gear is moving the action lever in the ④ direction.

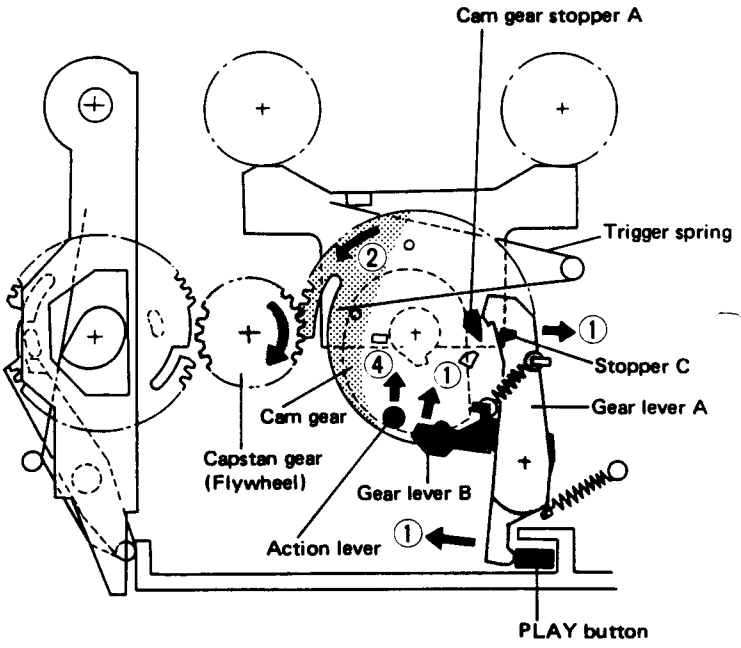


Fig. 2-5 STOP → PLAY operation

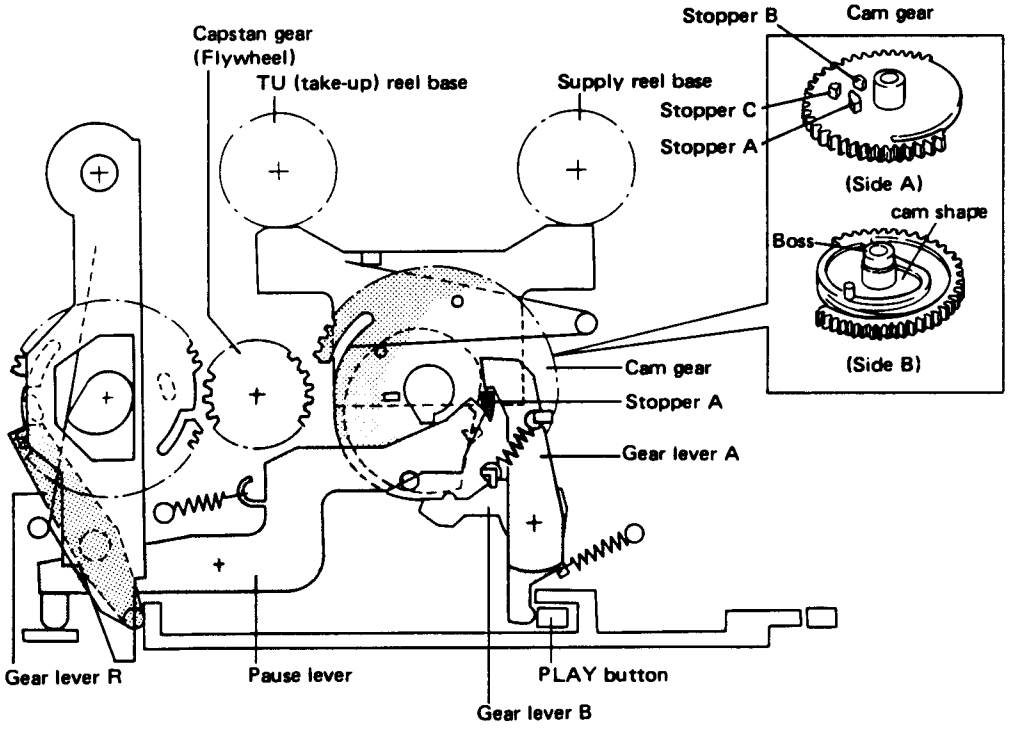


Fig. 2-4 STOP mode

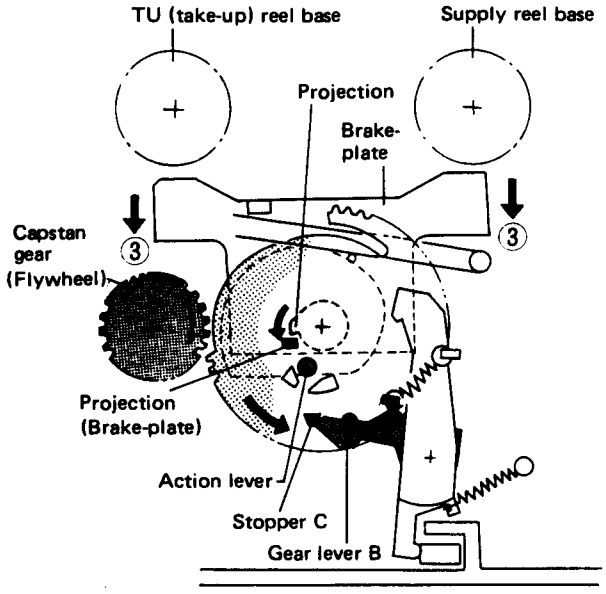


Fig. 2-6 STOP → PLAY operation

6. The head base is lifted by the action of this action lever, placing it in the PLAY position and throwing the PLAY switch to the PLAY side. (See Fig. 2-7). This action also presses down on the pinch roller pressure spring causing pressure contact between the pinch roller and capstan, and starting tape travel.

7. At the same time, the TU (take-up) idler is forced up into contact with the take-up reel carrier to start it rotating, and the PLAY mode is entered.

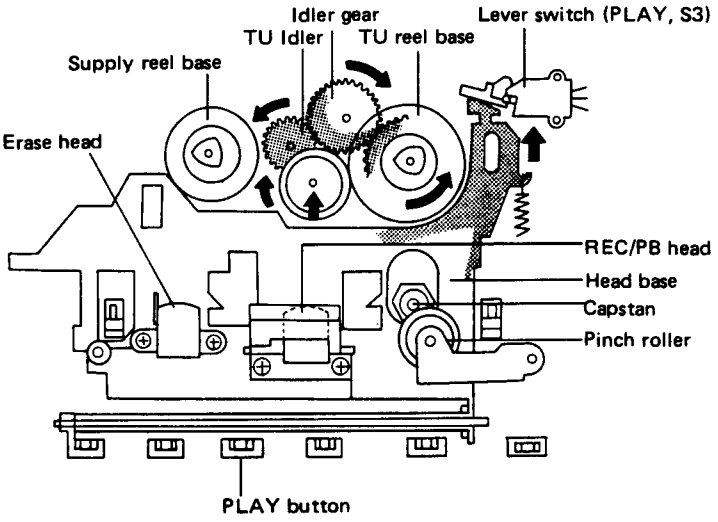


Fig. 2-7 PLAY operation

- **PLAY → STOP operation (Fig. 2-8)**

1. When the STOP button is pressed, the PLAY button lock is released, and the force of gear spring A returns gear lever A and B in the direction ⑤ . This action separates cam gear stopper C from gear lever B.

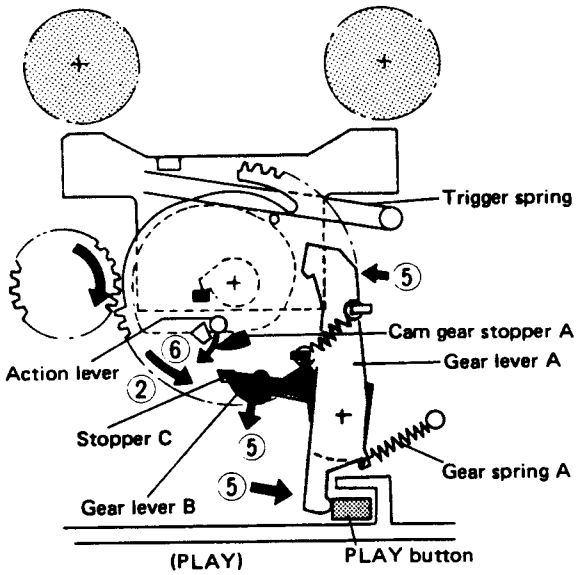


Fig. 2-8 PLAY → STOP operation

2. As cam gear stopper C moves away from gear lever B, the compression force of the trigger spring rotates the cam gear in the direction ② until stopped by contact between cam gear stopper A and gear lever A (See Fig. 2-9).
3. This rotating action releases the brake-plate from the projection on the cam gear boss. The brake-plate is returned to its up position by the force of the trigger spring, stopping the rotation of the feed and take-up reel carriers.
4. At the same time, the shape of the cam (machined on the upper surface of the cam gear) returns the operation lever in the ⑥ direction, releasing the pressure contact the pinch roller and TU idler are placing on the reel carriers. The head base also returns to the STOP position, and the PLAY switch is thrown to the STOP side, completing entry into the STOP mode.

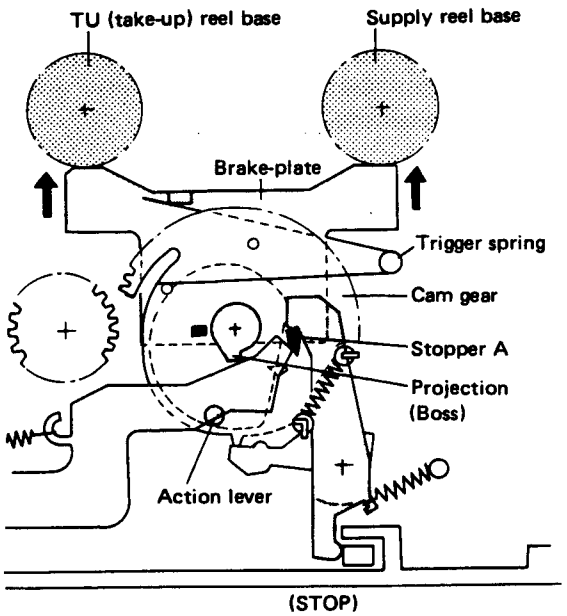


Fig. 2-9 PLAY → STOP operation

- **PLAY → PLAY/PAUSE → PAUSE release (Fig. 2-11)**

1. When the PAUSE button is pressed (unit in PLAY mode), the cam on the PAUSE button moves the pause lever in the ⑦ direction.
2. The pause lever pushes gear lever B up in the ⑧ direction, releasing the cam gear stopper C. The cam gear starts rotating in the ⑨ direction, stopping at the point cam gear stopper A makes contact with the pause lever tip.
3. The rotation of the cam gear causes the brake plate, pinch roller, TU idler, head base, and PLAY switch to all return to the STOP position, entering the PAUSE mode.

PAUSE mode release:

4. Once again pressing the PAUSE button releases the pause ratchet mechanism, and the pause button (presently in contact with the return spring) returns to its original position.
5. Since the pause lever is moved in the ⑩ direction by the pause return spring, stopper A on the cam gear is released from the pause lever.
6. The force of the trigger spring moves the cam gear in the ⑨ direction and starts meshing the cam gear with the capstan gear. From this point, all operations are the same as in the PLAY mode, and tape travel is re-started.

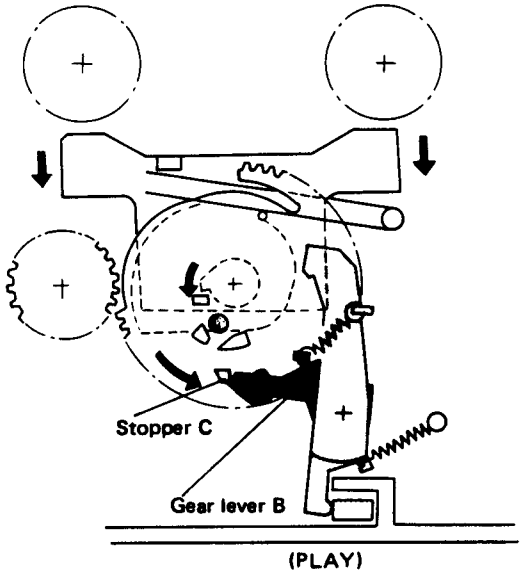


Fig. 2-10 PLAY → PAUSE operation 1

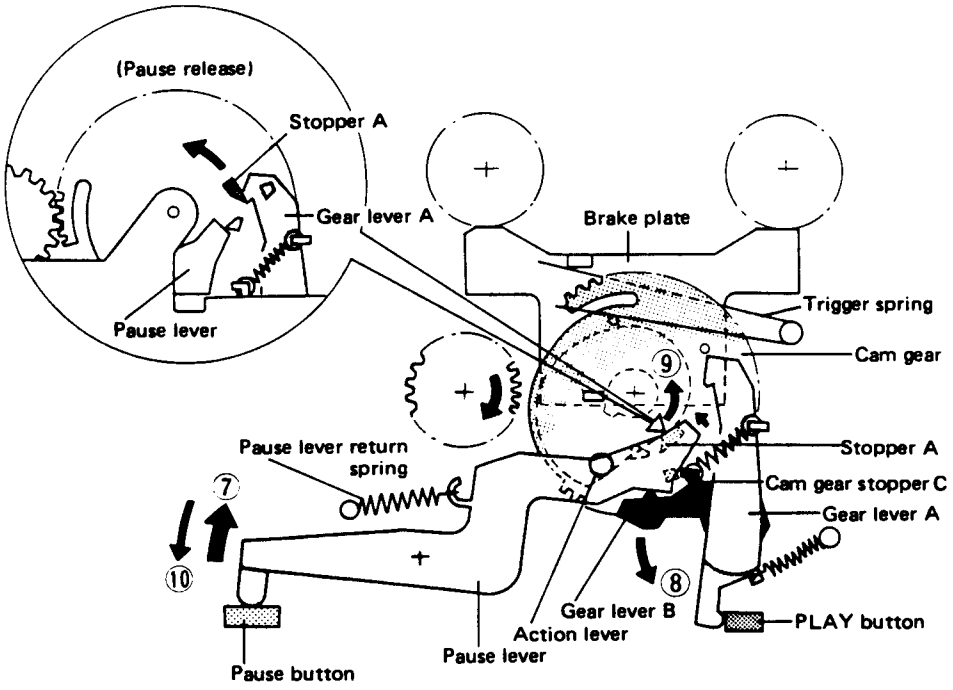


Fig. 2-11 PLAY → PAUSE operation 2

- **REC operation (Fig. 2-12, 13)**

1. When the REC button is pressed, the cam on the REC button moves the REC connection arm in the ① direction, gear lever R in the ② direction, and gear lever A in the ③ direction.
2. With the movement of gear lever R, stopper A on cam gear R is released from gear lever R, cam gear forced down by the pressure exerted by trigger spring R, and starts rotating in the ④ direction. It then commences to mesh with the capstan gear.

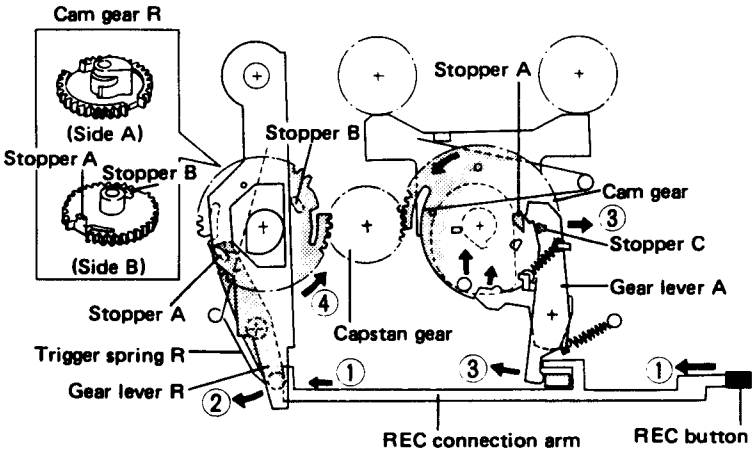


Fig. 2-12 STOP → REC operation

3. As cam gear R becomes meshed with the capstan gear, cam gear R continues rotating until stopper B (on cam gear R) makes contact with gear lever R, stopping it in that position.
4. At this time, the shape of the cam on cam gear R causes the REC action lever to move in a ⑤ direction, pressing on the REC action plate (Fig. 2-13)

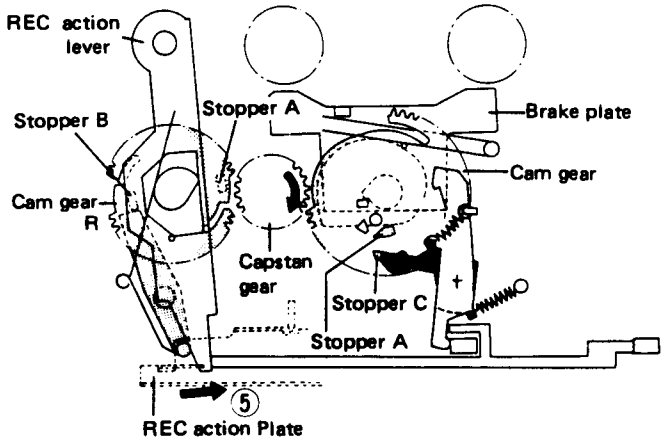


Fig. 2-13 STOP → REC operation

5. The function of the REC action plate is to throw the REC switch and REC/PLAY switch to the REC side.
6. Also, as gear lever A becomes released from stopper A on the cam gear (noted in step 1. before), the cam gear meshes with the capstan gear to start tape travels, and as the PLAY switch is also thrown to the PLAY side, the REC mode is entered.

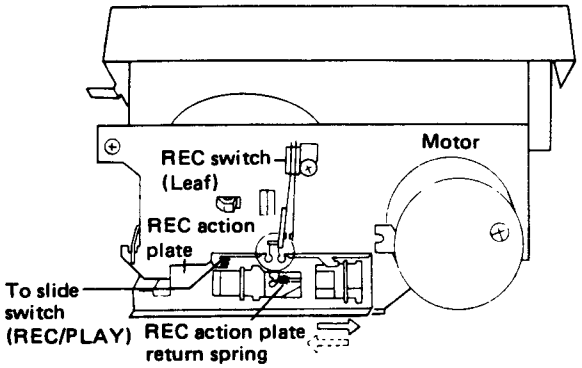


Fig. 2-14 STOP → REC operation (REC switch ON)

- **REC → REC/PAUSE → PAUSE release**

1. In going from REC to PAUSE, all operations are as outlined in "• PLAY → PLAY/PAUSE mode". In other words, when the REC switch and the REC/PLAY switch remain on the REC side, tape travel is stopped by only the PLAY switch being thrown to the STOP side.
2. PAUSE release also conforms to the operations out-lined in "• PLAY → PLAY/PAUSE → release". Here, the PLAY switch is thrown to the PLAY side, and re-starting tape travel causes entry into the REC mode.

- **REC → STOP operation (Fig. 2-15)**

1. When the STOP button is pressed releasing the REC button lock, the trigger spring R returns the REC connection arm and gear lever R in the ⑥ direction, breaking contact with stopper B on cam gear R.
2. The REC action plate return spring (See Fig. 2-14) rotates cam gear R in a ⑦ direction, and starts meshing it with the capstan gear.
3. Cam gear R continues to rotate until stopper A (on cam gear R) makes contact with gear lever R, stopping it in the former position of stopper B.
4. The shape of the cam on cam gear R returns the REC action lever and REC action plate (See Fig. 2-14) to the STOP position, and throws the REC switch and REC/PLAY switch to the PLAY side.

5. Also, the action of gear lever A returning to the STOP position throws the PLAY switch to the STOP side, halting tape travel.

In the REC → STOP cycle, meshing of cam gear R and the capstan gear is controlled by the switch timing of the PLAY and REC/PLAY switches.

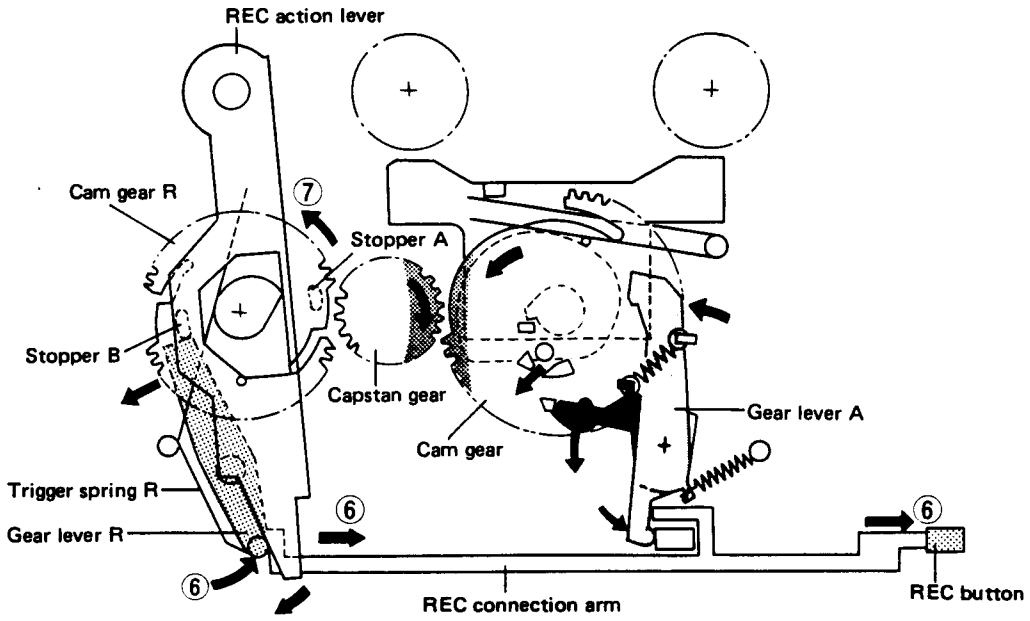


Fig. 2-15 REC → STOP operation

- **FF (or REW) operation (Fig. 2-16, 17)**

When the FF (or REW) button is pressed, joint R (L) moves in the direction of ① , pressing down (① direction) on the FF (REW) action plate. At the same time, the lever switch is thrown to the ON position.

Next, the brake-plate is pressed down by the FF (REW) action plate, and at this time the driving arm is forced in the ③ (or ④) direction to start the reel base rotating in the FF (or REW) mode.

At the same time, gear lever C moves in the ⑤ direction and the head base (HB) lock lever moves in the ⑥ (or ⑦) direction. (This procedure also applies to MS operations).

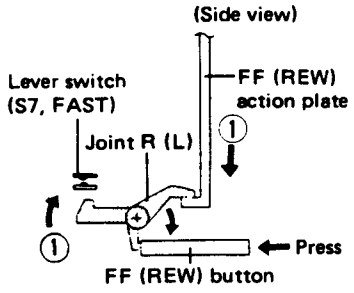


Fig. 2-16 FF (REW) operation

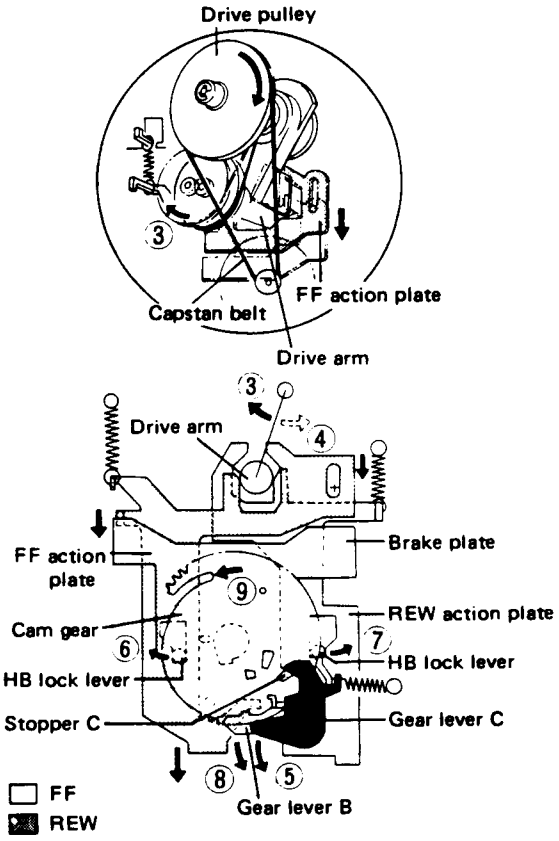


Fig. 2-17 FF (REW) operation

- **Music Search (MS) operation (Fig. 2-16, 17)**

1. When the FF (or REW) button is pressed in the PLAY mode, the action of gear lever C returns gear lever B in the ⑧ direction to free stopper C on the cam gear.
2. The cam gear rotates in the ⑨ direction until stopped by cam gear stopper C making contact with gear lever C.
3. Also, the rotation of the cam gear causes the operation lever to return to the STOP position, moving the pinch roller away from the capstan and releasing pressure contact from the TU idler.
4. At the same time, the head base returns toward the down position, but the HB lock lever acts as a stop, holding it half way between the PLAY and STOP position. At this time, the PLAY switch also remains in the PLAY position.
5. The action of joint R (L) throws the lever switch to the ON side, and the driving arm moving in the ③ (or ④) direction starts reel base rotation in the FF (or REW) mode.
6. When the tape blank detector circuit locates a non-recorded section of the tape, the MS solenoid is activated, pulling the lock plate in the direction of ⑩ (See Fig. 2-18).
7. The draw stroke of the MS solenoid is set so that only the FF (REW) button lock is released. The PLAY button remains in the locked position.
8. The above description covers the mechanical operations as the unit goes from MS detection mode to STOP to PLAY. MS operations are terminated when play begins again at the beginning of a music selection.

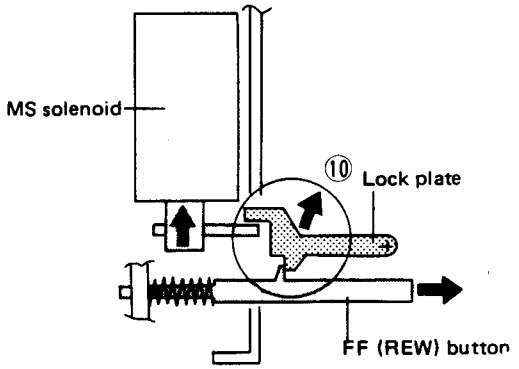


Fig. 2-18 FF (REW) button release

- **AUTO-STOP operation (Fig. 2-19, 20)**

1. In each of the previously covered operation cycles, when the brake-plate is moved in the direction of ⑪ , the detector lever is pulled in the ⑫ direction by the force of the link return spring. As the cam gear rotates, pin (A) on the detector lever makes contact with cam (A) or cam (B) on the cam gear.
2. The cam gear normally turns with motor rotation, and with each revolution of the cam gear, the detector lever is moved to a center position relative to cam (A) (PLAY, REC, FF) or cam (B) (REW).
3. After the detector lever has been moved to the center position, if the reel base is still rotating, the friction torque of the detector disc again moves it to the right (in REW) or left (in PLAY, REC, FF). When the take-up reel base is rotating, the friction torque of the detector disc is generated by the rubbing action of the detector spring and detector felt placed between the idler gear and the detector disc, and this torque exerts its froce in the opposite direction of take-up reel rotation. This friction torque is used to move the detector lever to the right (or left). As long as the reel base continues to rotate, the back and forth motion of the detector lever will also continue.

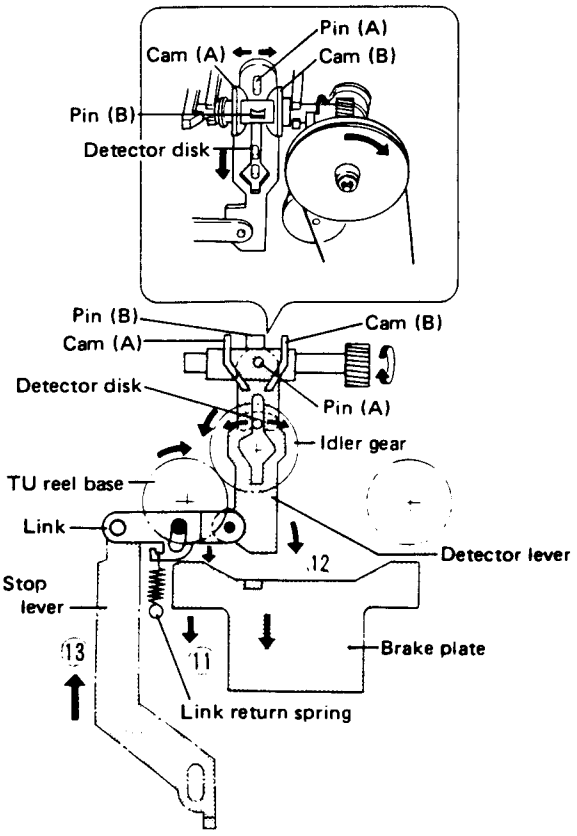


Fig. 2-19 Auto-stop operation

4. When the tape is fully taken up and the reel stops, the shape of the cam (on the cam gear) and the friction torque of the detector disc act to position the detector lever in the center position.
5. Next, the cam gear continues to rotate, so pin (B) of the cam gear presses pin (A) of the detector lever.
6. The detector lever, being moved by the cam gear, moves the stop lever (via the coupling link) in the direction of (13) and pulls the lock plate in the (14) direction to release the button lock. All mechanism are returned to STOP mode.

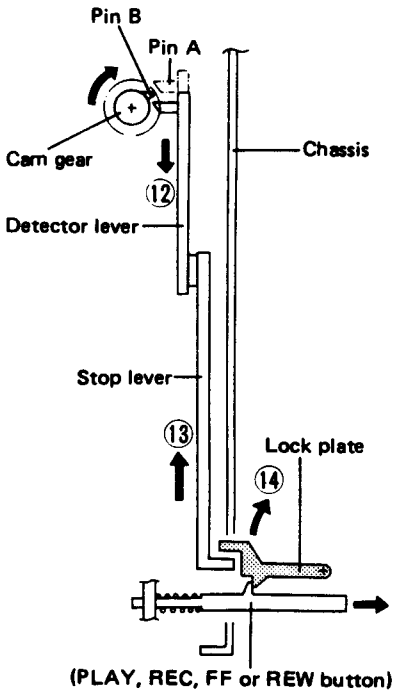
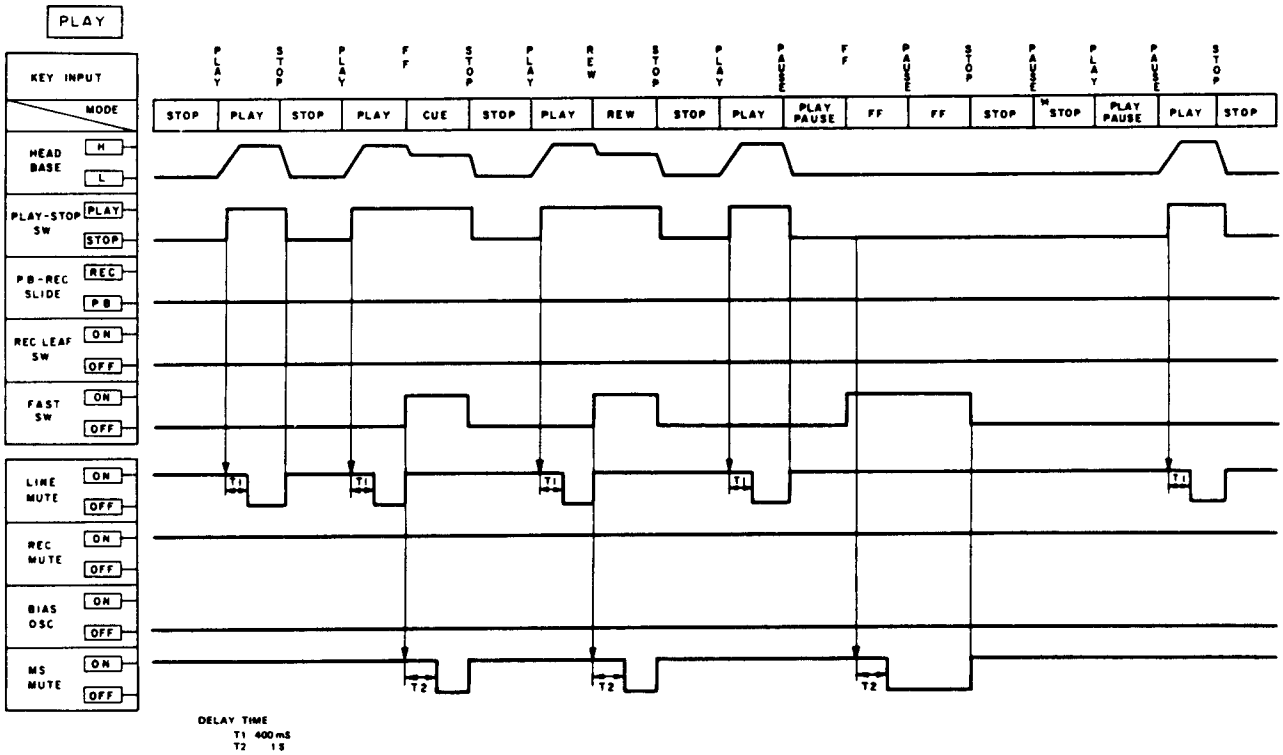
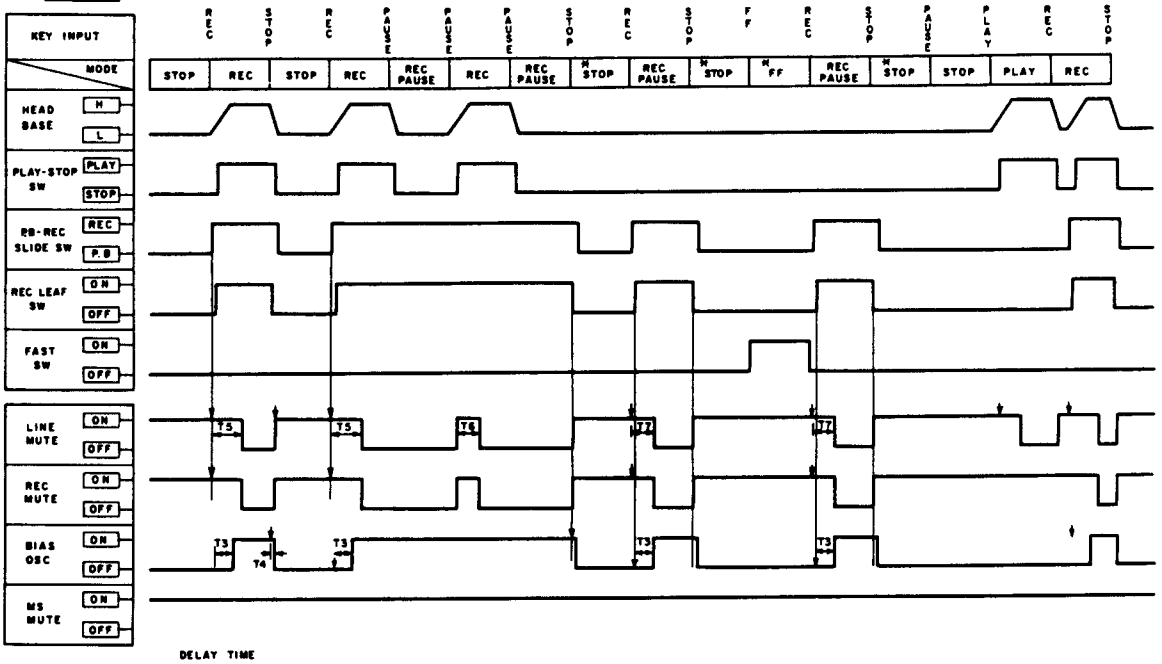


Fig. 2-20 Auto-stop operation

2.5 TIMING CHART



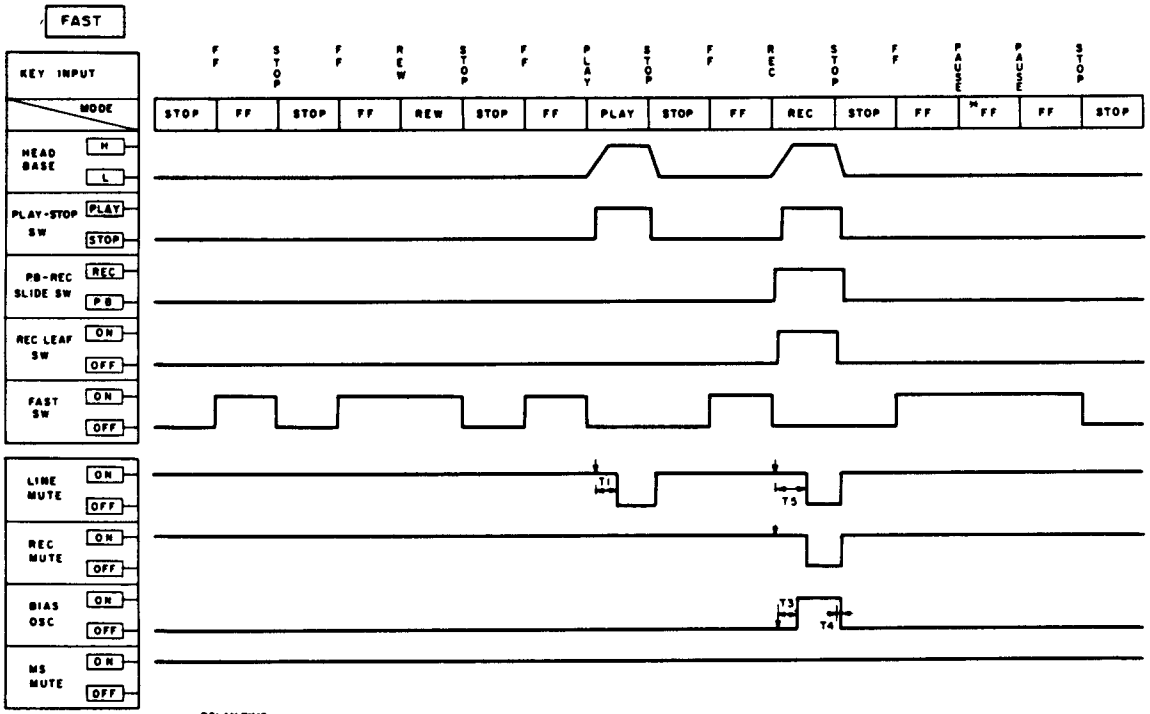
REC



DELAY TIME

T3	25 mS
T4	15 mS
T5	800 mS
T6	400 mS
T7	400 mS

FAST



DELAY TIME

T1	400mS
T3	25mS
T4	15mS
T5	800mS