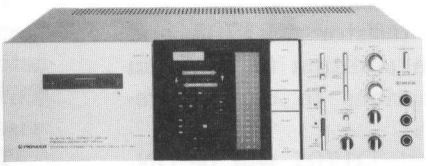
PIONEER®

Service Manual

CIRCUIT DESCRIPTIONS



Shown the photo is model CT-9R

ORDER NO.
ARP-050-0

Quartz-PLL Direct Drive/Ribbon Sendust Head
STEREO CASSETTE TAPE DECK

CT-9R
CT-8R

- This service manual refers to the circuit descriptions. For the mechanism discription, please see service manual of the CT-7R (ARP-001-0).

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1. CIRCUIT DESCRIPTIONS

1.1 PLAYBACK FLOW

The signal picked up by the playback head is amplified by the equalization amplifiers, Q1701 and Q1703. At the same time, frequency response is corrected.

The output from the equalization amplifiers is level-adjusted by variable resistor VR1703 and then applied to Q1705. In addition to being an amplifier, Q1705 also functions to correct frequency response.

When normal tape is used, Q1707 will be ON, and the combination of Q1701, Q1703, and Q1705 will set equalization to 120μs. For metal or CrO_2 tape, Q1707 will remain OFF and equalization will be 70μs.

The output from Q1705 is applied to pin 15 of IC601 (HA11226) in the Dolby circuit. Here, it is passed out pin 9. This output is then applied to pin 15 of IC602 and output from pin 9. The output signal from IC602 passes via the MONITOR switch to LINE OUTPUT. (A description of the Dolby circuit will be presented later.)

1.2 RECORDING FLOW

The signal input to the microphone jack is first amplified by the mic amplifier, IC1501 (NJM-4558D), then passed via the INPUT selector switch to the INPUT volume. Level is adjusted by the INPUT volume and the signal is then applied to the flat amp IC1701 (NJM4558D). The amplified signal is then passed through the MPX filter and into the Dolby circuit. In the Dolby circuit, it is passed through Q608, IC602 (HA11226), and IC601 (HA11226) before input to the recording amplifier. From the recording amp, it is applied to the recording head.

1.3 CONTROL CIRCUIT

The control circuitry of this unit is contained in CPU PD6006, expansion IC PM3001, and IC PA3010 used in the MS function. The key signals applied to PD6006 are transmitted to PM3001 as 16-bit serial data, and PM3001 then uses this data to control the various circuits.

When a mode key is activated, the 16-bit serial data transmission is output from pin 5 of PD6006. This is shown in Fig. 1-1. Also a clock pulse is output from pin 7. (Data and clock pulse transmission occurs once each time the key is activated.)

The 16-bit serial data is applied to pin 3 of the expansion IC, PM3001, and the leading edge of the clock pulse is read into the shift register of PM 3001 through pin 2.

After both read events are completed, a STB (strobe) pulse is applied to pin 1, and PM3001 then starts transmitting control signals from its various output pins in accordance with which key was activated. (Refer to Fig. 1-3.)

The following sections will describe the various circuit operations occurring when a mode key is activated. Operations will be described for the FWD direction of travel. (Except where otherwise specified, the pin nos. will be for PM3001.)

The DOLBY MUTE circuit shown in the signal path diagram (Fig. 1-1) turns Q313 ON to mute all circuits only when the position of the Dolby switch is changed.

1. STOP Mode Key ON —Power switch ON

Mechanism

The 16-bit serial data transmission from PD6006 will cause pin 7 and 8 of PM3001 to go high, turning SOL L and R OFF. The mechanism will thus be placed in a STOP status.

Motor

Pin 4 and 5 will be low, and the reel motor will be in a STOP status.

Signal Path and other circuits

When pin 9 is high, Q621, Q311, and Q1603 are all ON. This causes LINE OUTPUT and the headphone amp to be muted. If pin 11 also goes high, Q309 is turned ON, placing the REC AMP input at a ground potential. When pins 12 and 13 go low, Q302 turns OFF, stopping the bias oscillator circuit, and extinguishing the REC IND. Muting is applied to all circuits in a STOP status.

2. PLAY Mode Key ON

Mechanism

Pin 7 and 8 of PM3001 go low, activating SOL L and R. (Refer to the timing chart in Fig. 1-5.) This places the mechanism in the PLAY mode.

Motor

Pin 4 goes to a low level, while pin 5 is held at a middle (M) level, causing RM R (reel-motor R) to start turning.

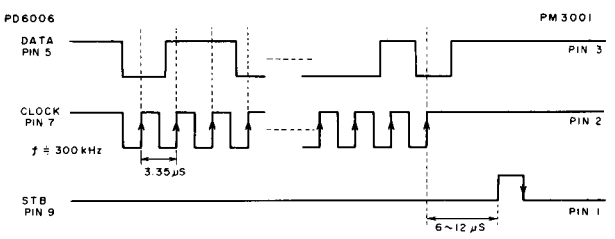


Fig. 1-1 PD6006 Data output

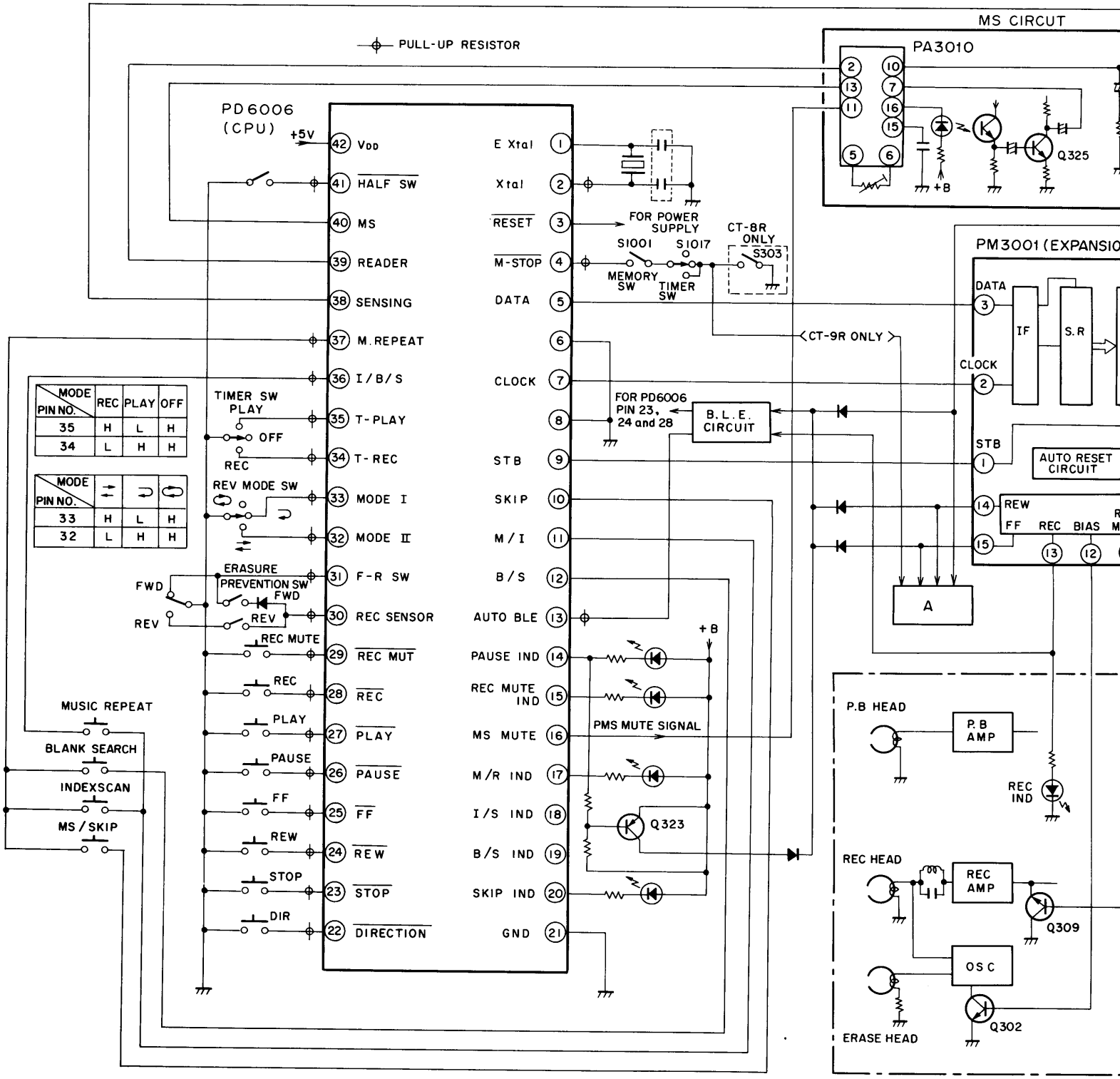
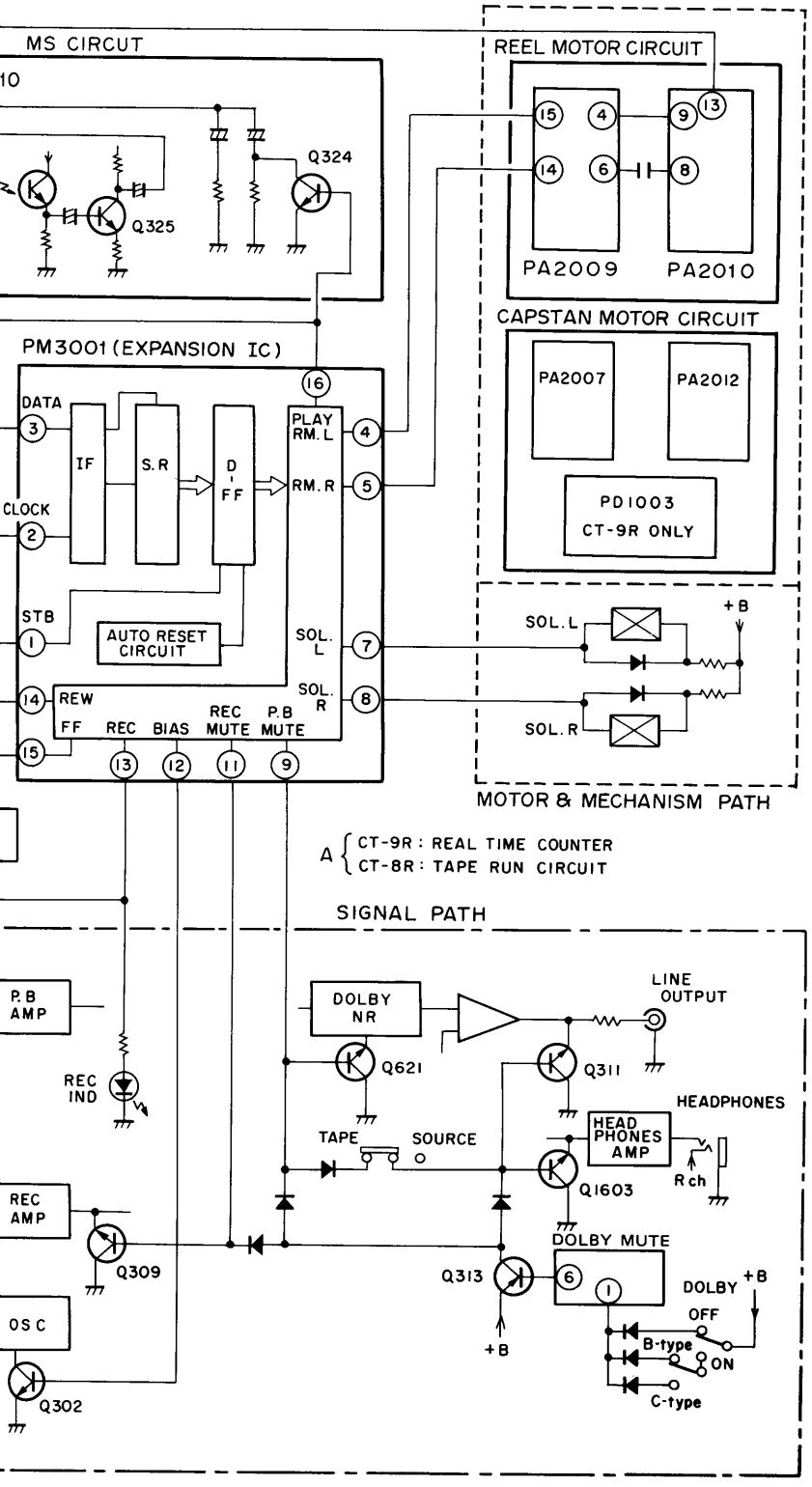


Fig. 1-2 Control system block diagram



Signal Path and other circuits

When pin 9 goes low, Q621, Q311 and Q1603 turn OFF, enabling sound to be output from LINE OUTPUT and at the headphone jack. When pin 16 goes high, Q324 turns ON and the time constant of the blank detector circuit enters the PLAY mode. Pins 11, pin 12 and pin 13 are in the same state as STOP key ON.

3. FF Mode Key ON

Mechanism

Pin 7 goes high and pin 8 goes low. This turns SOL L OFF and SOL R ON, placing the mechanism in a PAUSE status.

Motor

Pin 4 goes low and pin 5 goes high, placing RM L in a STOP status and causing RM R to turn.

Signal Path and other circuits

Same as in the STOP status.

4. REW Mode Key ON

Mechanism

Pin 7 goes high and pin 8 goes low. This turns SOL L OFF and SOL R ON, placing the mechanism in a PAUSE status.

Motor

Pin 4 goes high and pin 5 goes low. This turns RM L ON and places RM R in a STOP status.

Signal Path and other circuits

Same as in the STOP status.

5. REC/PLAY Mode Key ON

Mechanism

Same as PLAY Mode Key ON.

Motor

Same as PLAY Mode Key ON.

Signal Path and other circuits

When pin 9 is low, Q621, Q311, and Q1603 are turned OFF enabling output from LINE OUTPUT and the headphone jack. If pin 11 also goes low, muting is lifted from the REC AMP allowing the signal to be recorded on the tape. When pins 12 and 13 go high, Q302 is turned ON activating the bias oscillator and applying erase current to the erase head and bias to the recording head. The REC IND (LED) is also illuminated.

6. PAUSE Mode Key ON (in STOP status)

Mechanism

Pin 7 and 8 both go high, turning SOL L and R OFF and placing the mechanism in a STOP status.

Motor

Same as STOP status.

Signal Path and other circuits

Same as STOP status. (The PAUSE LED is illuminated however.)

7. PAUSE Mode Key ON (in PLAY status)

Mechanism

Pin 7 goes high, and pin 8 goes low. This turns SOL L OFF and SOL R ON, placing the mechanism in a PAUSE status.

Motor

Same as STOP status.

Signal Path

Same as STOP status. (PAUSE LED is illuminated however.)

8. REC/PLAY PAUSE Mode Key ON

Mechanism

Pin 7 goes high, and pin 8 goes low. This turns SOL L OFF and SOL R ON, placing the mechanism in a PAUSE status.

Motor

Same as STOP status.

Signal Path and other circuits

When pin 9 is high, Q621, Q311 and Q1603 are all ON. This causes LINE OUTPUT and the headphone amp to be muted. If pin 11 also goes high, Q309 is turned ON, placing the REC AMP input at a ground potential. When pins 12 goes low, Q302 turns OFF, stopping the bias oscillator circuit. Pin 13 goes high, causing the REC IND to illuminate.

9. Direction Key ON (in STOP status)

Mechanism

Pin 7 goes low for a 275msec interval, and pin 8 goes high. This causes SOL L to turn ON for only 275msec, and since SOL R is OFF, the mechanism goes through a direction operation from FWD-STOP to REV-STOP.

Motor

Same as STOP status.

Signal Path and other circuits

Same as STOP status.

Pin No.	MODE / FUNCTION	STOP		▷▷ FF		◁◁ REW		PLAY		REC/PLAY		STOP PAUSE		PLAY PAUSE		REC/PLAY PAUSE	
		FWD	REV	FWD	REV	FWD	REV	FWD	REV	FWD	REV	FWD	REV	FWD	REV	FWD	REV
4	RM. L	L (OFF)		L		H		L	M	L	M	L		L		L	
5	RM. R	L (OFF)		H		L		M	L	M	L	L		L		L	
6	HEAD SW	L (P.B MODE)		L		L		L		H		L		L		H	
7	SOL. L	H (OFF)		H	L	H	L	L		L		H		H	L	H	L
8	SOL. R	H (OFF)		L	H	L	H	L		L		H		L	H	L	H
9	P.B. MUTE	H (ON)		H		H		L		L		H		H		H	
10	LINE MUTE	H (ON)		H		H		L		L		H		H		L	
11	REC MUTE	H (ON)		H		H		H		L		H		H		H	
12	BIAS	L (OFF)		L		L		L		H		L		L		L	
13	REC	L (OFF)		L		L		L		H		L		L		H	
14	REW IND	L (OFF)		L		H		L		L		L		L		L	
15	FF IND	L (OFF)		H		L		L		L		L		L		L	
16	PLAY IND	L (OFF)		L		L		H		H		L		L		L	
PD6006 14	PAUSE IND	H (OFF)		H		H		H		H		L		L		L	

Fig. 1-3 PM3001 Output state by mode

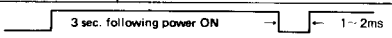
Pin No.	Symbol	I/O Status	Description		Applicable Model	
					CT-9R	CT-8R
1	E xtal	—	Used by internal quartz oscillator  Pin 2 – GND		O	O
2	Xtal	—	External circuit terminal f = 3.58MHz		O	O
3	RESET	IN	CPU reset input (effective low, normally high)		O	O
4	M-STOP	IN	Memory STOP input (effective low)		O	O
5	DATA	OUT	DATA output to PM3001	Serial output to PM3001	O	O
6			NC			
7	CLOCK	OUT	CLOCK output to PM3001		O	O
8			NC			
9	STB	OUT	STB output to PM3001		O	O
10	SKIP	OUT	SKIP key scan output	KEY SCAN output	O	O
11	M/I	OUT	MUSIC REPEAT, INDEX SCAN key scan output		O	O
12	B/S	OUT	BLANK SEARCH key scan output		O	O
13	AUTO BLE	OUT	AUTO BLE start output 		O	O
14	PAUSE IND	OUT	PAUSE indicator output (effective low)	Indicator output	O	O
15	REC MUTE IND	OUT	REC MUTE indicator output (effective low)		O	O
16	MS MUTE	OUT	MS MUTE output, PA3010 MS signal MUTE output (low level while reel motor turning during blank detector operation		O	O
17	M/R IND	OUT	MUSIC REPEAT indicator output (effective low)	Indicator output	O	O
18	I/S IND	OUT	INDEX SCAN indicator output (effective low)		X	X
19	B/S IND	OUT	BLANK SEARCH indicator output (effective low)		X	X
20	SKIP IND	OUT	SKIP indicator output (effective low)		O	O
21	GND		GND		O	O
22	DIRECTION	IN	DIR (direction) key input	Mode key input	O	O
23	STOP	IN	STOP key input		O	O
24	REW	IN	REW key input		O	O
25	FF	IN	FF key input		O	O
26	PAUSE	IN	Pause key input		O	O
27	PLAY	IN	PLAY key input		O	O
28	REC	IN	REC/PLAY key input		O	O
29	REC MUT	IN	REC MUTE key input		O	O
30	REC Sensor	IN	REC sensor switch input (enabled low, disabled high)	Mechanism SW input	O	O
31	F-R SW	IN	FWD/REV sensor switch input (FWD: L; REV: H)		O	O
32	MODE I	IN	Mode selector switch input	Mode selector SW input	O	O
33	MODE II	IN			O	O
34	T-REC	IN	Timer REC switch input	Timer mode SW input	O	O
35	T-PLAY	IN	Timer PLAY switch input		O	O
36	I/B/S	IN	INDEX SCAN, BLANK SEARCH, SKIP key input	Key matrix input	O	O
37	M.REPEAT	IN	MUSIC REPEAT key input		O	O
38	SENSING	IN	Sensing pulse input (from PA2010 pin) ←Reel turning		O	O
39	LEADER	IN	Tape leader pulse detector input (from pin 2, PA3010) ←Tape leader detected		O	O
40	MS	IN	Blank signal input (H level between selection in PLAY, FF, REW; L level during selection; H level all other times)		O	O
41	HALF SW	IN	Cassette loading switch input (Loaded: L ; Unloaded: H)		O	O
42	VDD		+5V power source		O	O

Fig. 1-4 PD6006 Pin description

Timing chart 1

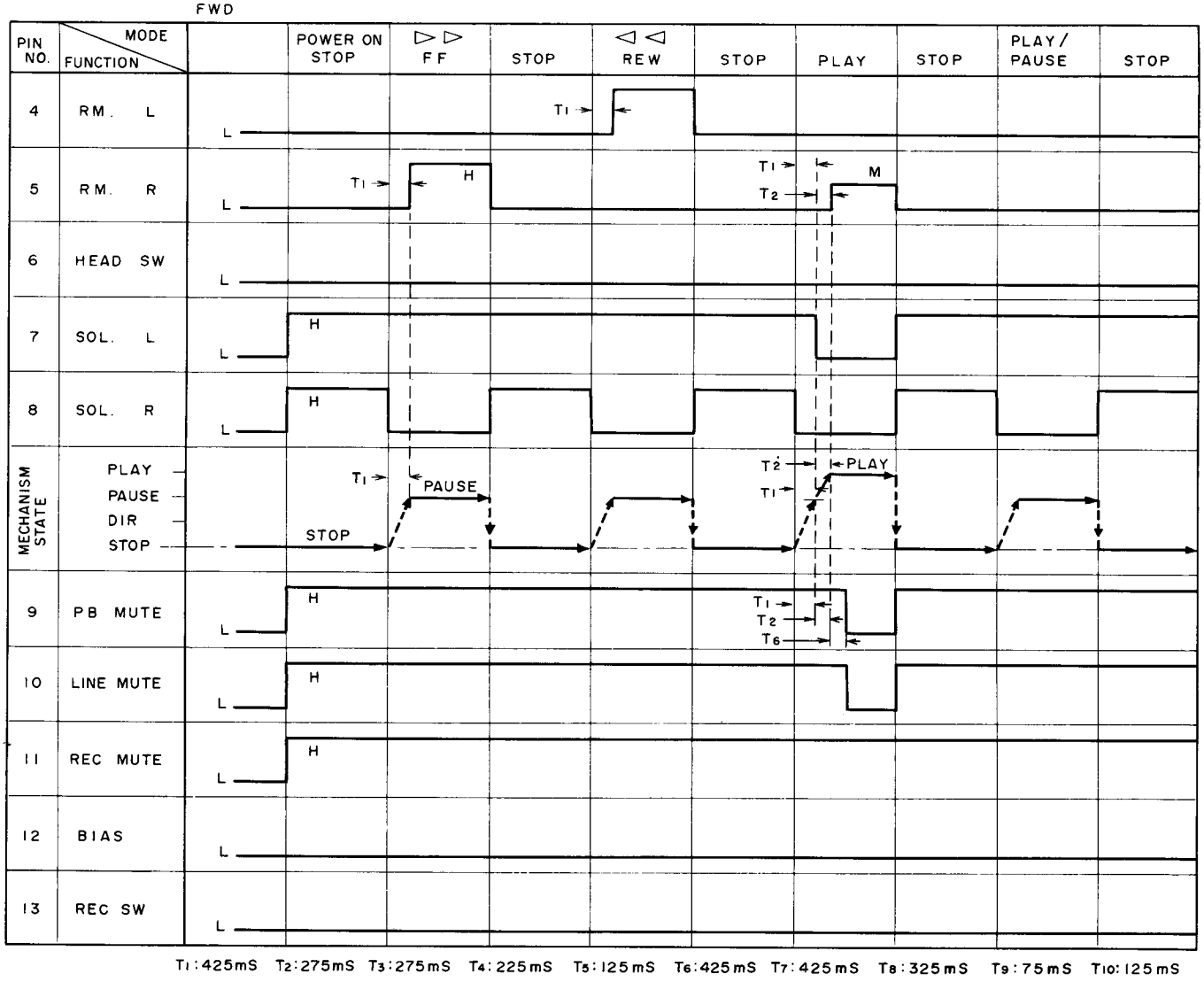


Fig. 1-5 Timing chart of PM3001, 1

Timing chart 2

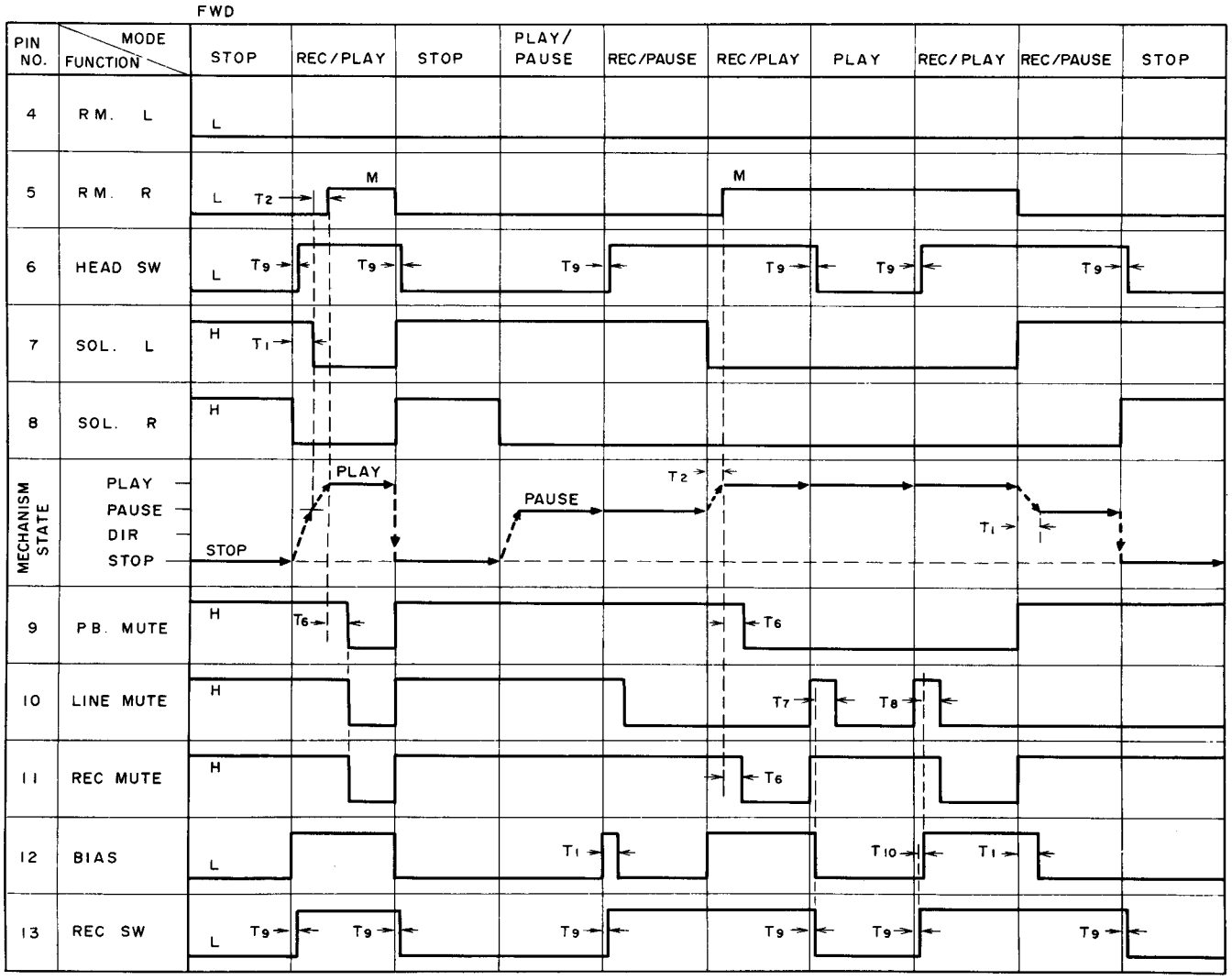


Fig. 1-6 Timing chart of PM3001, 2

Timing chart 3

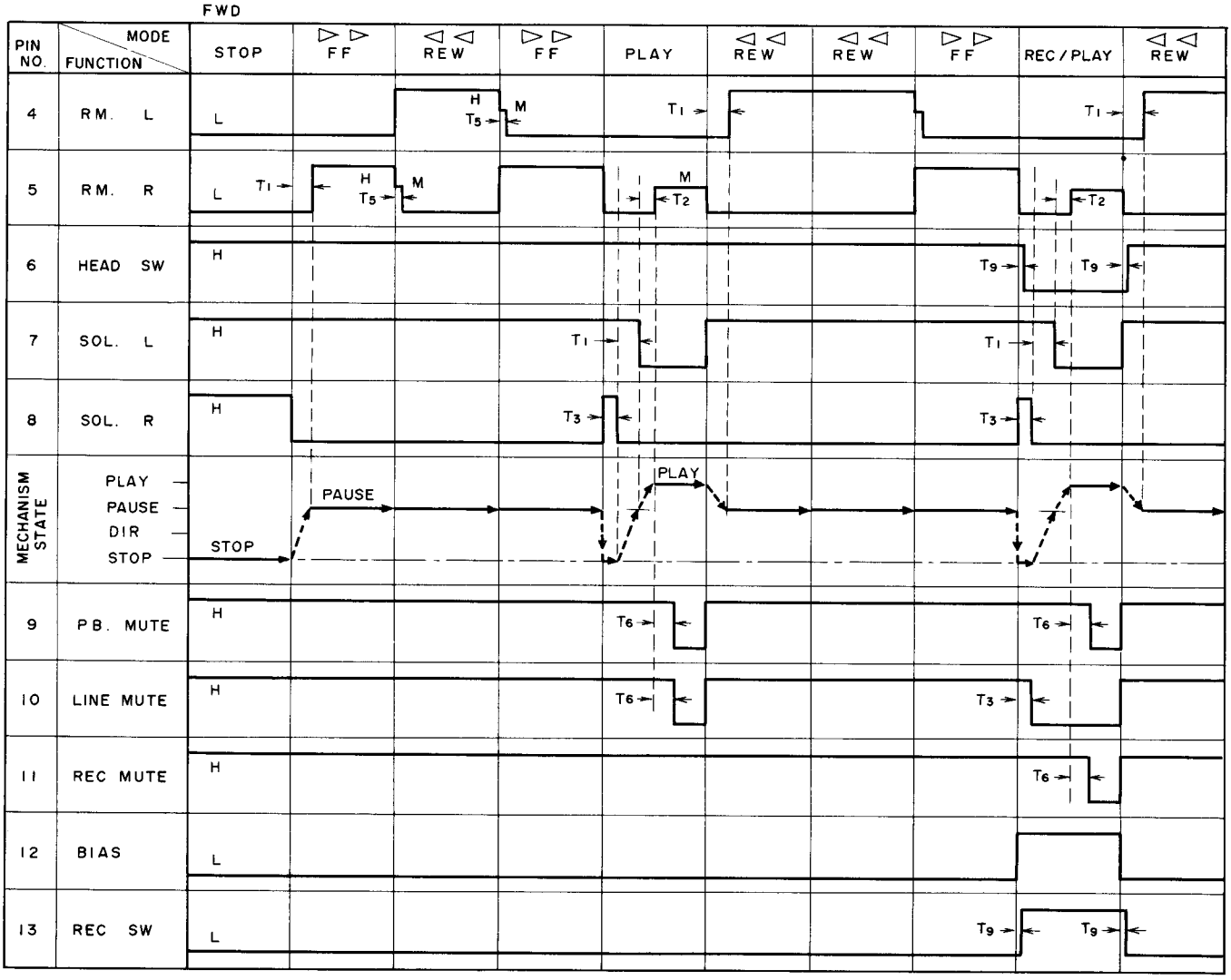


Fig. 1-7 Timing chart of PM3001, 3

Timing chart 4

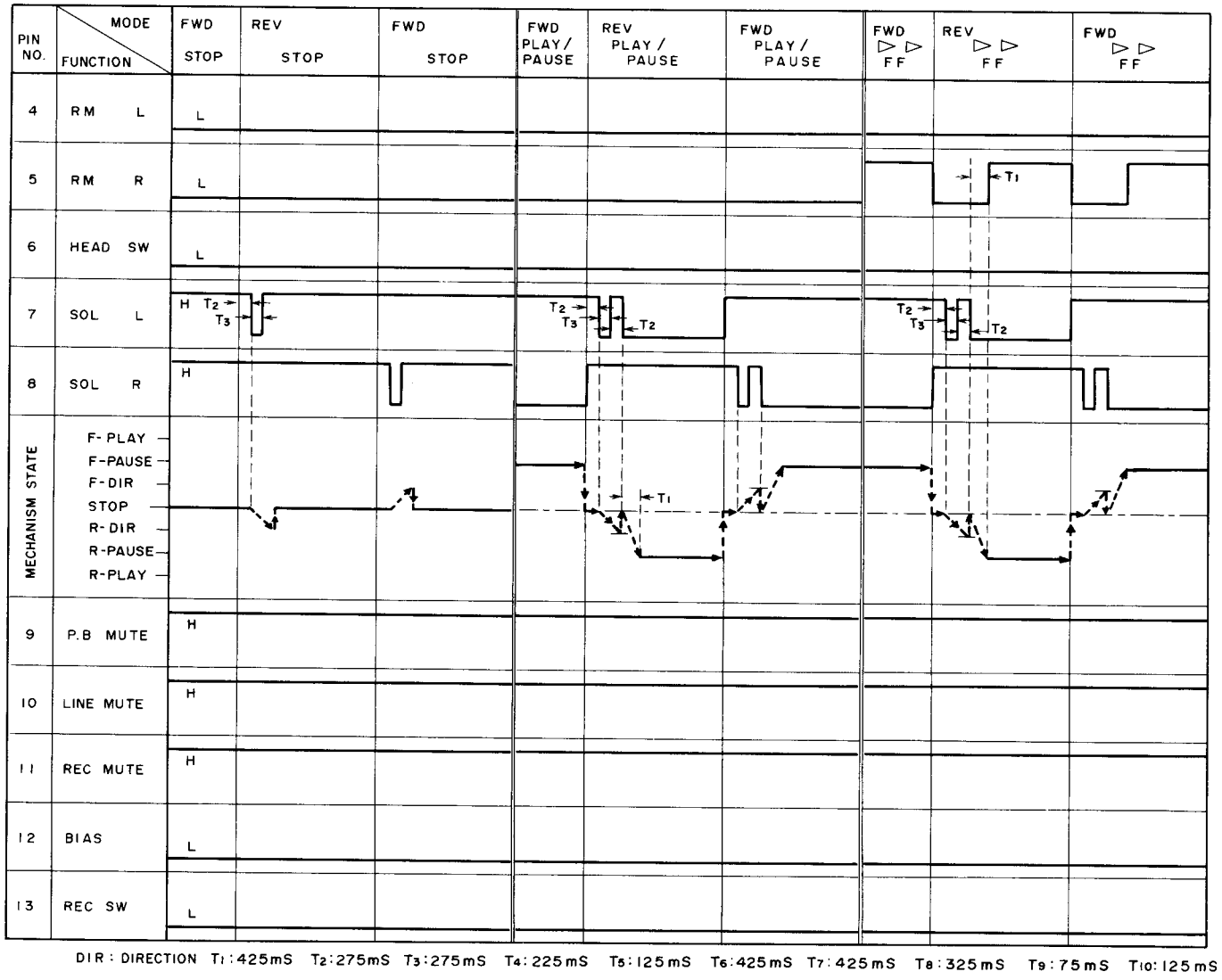


Fig. 1-8 Timing chart of PM3001, 4

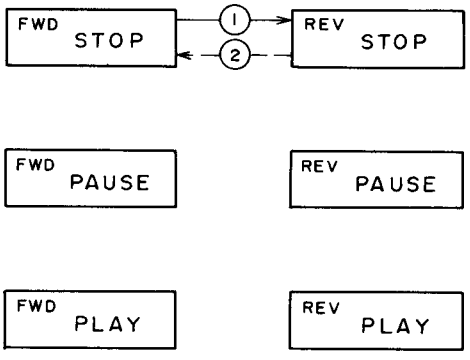


Fig. 1-9 Direction operation (in STOP status)

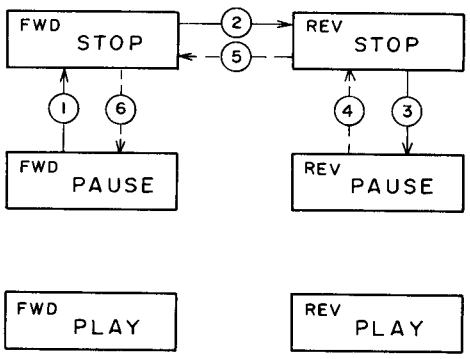


Fig. 1-10 Direction operation (in PAUSE, FF and REW status)

Timing chart 5

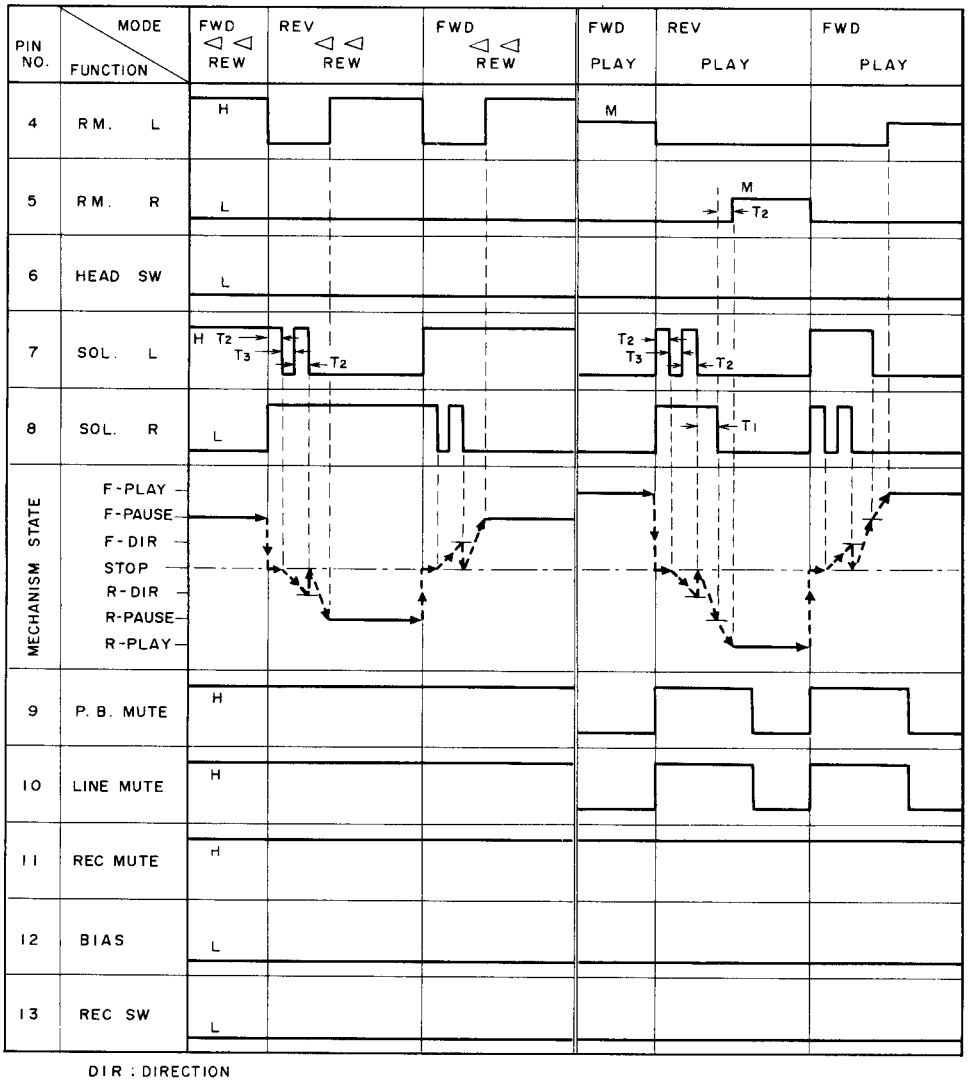


Fig. 1-11 Timing chart of PM3001, 5

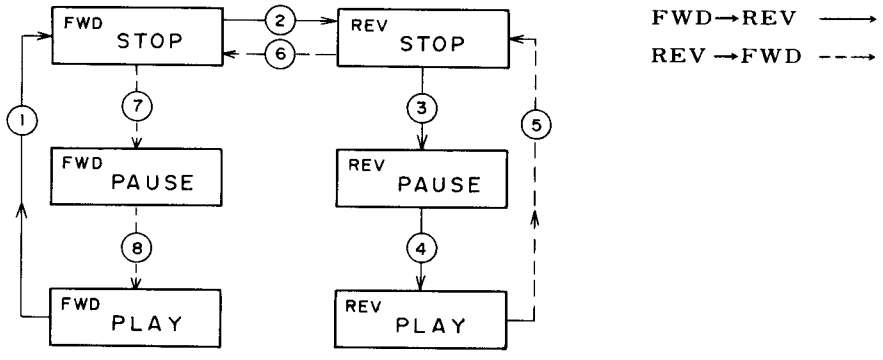


Fig. 1-12 Direction operation (in PLAY status)

1.4 TAPE LEADER DETECTOR CIRCUIT

The tape leader detection circuit functions in the auto-reverse mode to detect the point of transition from the coated portion to the leader portion of the tape. It then directs the mechanism to reverse the direction of travel, or places the unit in a STOP status when this event occurs from the fast-forward (FF) or rewind (REW) mode.

The detector uses an optical system based on an infrared LED whose emission is picked up by a phototransistor. The circuit is activated by detecting a difference in the amount of light passed by the coated portion of tape, and the amount passed by the transparent leader.

The output from pin 16 of PA3010 is converted to light by the LED, and passes through the path shown in Fig. 1-13 to be picked up by the phototransistor. During tape travel, the amount of light received by the phototransistor is quite small, so the input level at pin 7 is held low. This causes the charge and voltage at pin 3 and 4 to also be held low, presenting a low logic input to the + and - terminals of comparator. This results in a low output from pin 2. But as the transparent leader passes into the light path, the amount of light picked up by the phototransistor suddenly increases the input to pin 7. This causes pin 3 to snap high, consequently applying a high input to the + terminal of the comparator. Output from pin 2 then goes high. As pin 3 goes high, the capacitor connected to pin 4 starts charging, raising the input level to the — terminal of the comparator. When the level of the — terminal reaches that of the + terminal, the output from the comparator snaps from high to low, and the output pulse taken from pin 2 appears as shown in Fig. 1-15.

CPU PD 6006 uses this output pulse to control the various mechanisms performing the mechanical functions of auto-reverse and automatic stop.

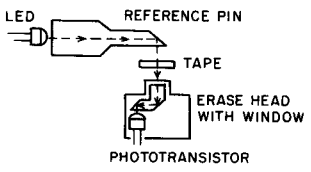


Fig. 1-13 Tape leader detector section

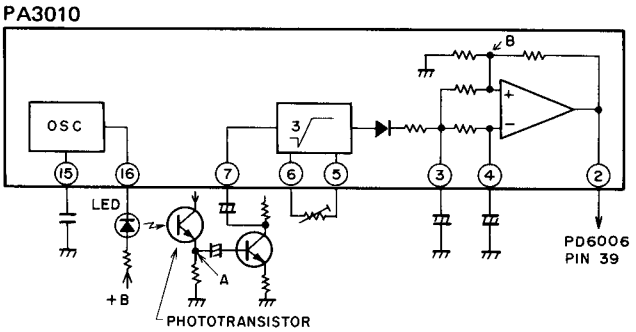


Fig. 1-14 Tape leader detector circuit

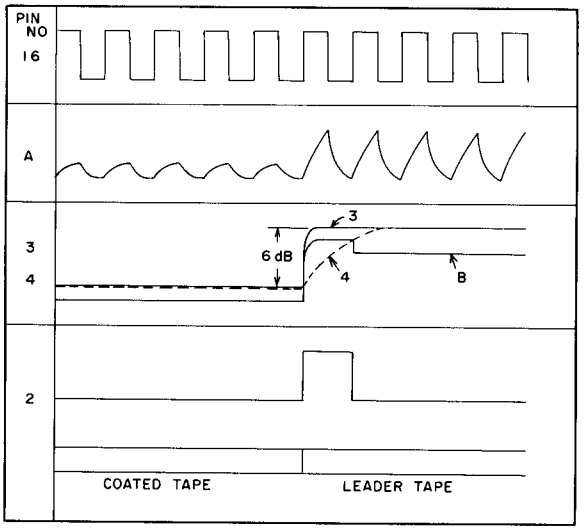


Fig. 1-15 Tape leader detector waves

1.5 END SENSOR CIRCUIT

Since CT-9R and CT-8R are equipped with a tape leader detector circuit, they go into a STOP status or go through a direction operation before reaching the point where the end sensor cirucit is activated, so normally the end sensor circuit will not operate. However, where there is no leader on the cassette tape, or where there is an insufficient difference in the infrared transmission factor between the coated portion and leader portion of the tape, or in case the reel motor stops rotating before the tape leader is detected, the end sensor circuit is then activated.

When the reel motor starts turning, a sensing pulse is transmitted from pin 13 of IC PA2010 (used to control the reel motor) to pin 38 of PD6006. (This pulse is taken from the Hall element and shaped into a square wave by PA2010.) When this pulse is maintained at either a low (L) or high (H) level for a period exceeding three seconds, PD6006 interprets that to mean the end of the tape and thus switches to the next mode of operation.

If the mechanism is in the fast-forward (FF), rewind (REW), or record-playback (REC/PLAY) mode, the next mode entered is STOP. If it is presently in the PLAY mode and the ⇄ reverse mode switch is selected, it also enters the STOP mode. But if ⟲, ⟳ are selected, if first goes through a direction operation, then into a PLAY status.

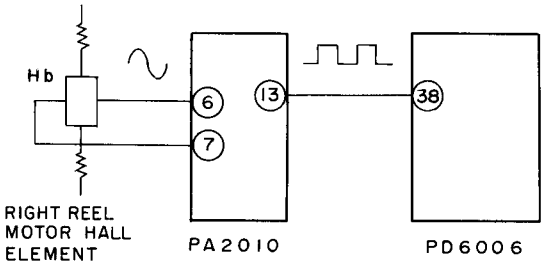


Fig. 1-16 End sensor diagram

1.6 BLANK DETECTOR IC PA3010 OPERATION

When the function key is placed ON, and the reel motor starts turning, pin 16 of PD6006 goes to a low level. When pin 16 goes low, pin 11 of the blank detector IC (PA3010) also goes low, lifting MS (Music Search) muting and commencing MS operations.

As MS MUTE is lifted, the signal is first amplified, then applied to pin 9, and its level is determined by the comparator in the next stage. Comparator output at point A is as shown in the Fig. 1-18.

This output is used to turn Tr1 ON, and this in turn allows capacitor C connected to pin 12 to dump its charge through Tr1. Thus, pin 13 goes to a low level.

When there is no input signal present, Tr1 turns OFF, capacitor C starts recharging, and approximately 70msec later, a high level is output from pin 13.

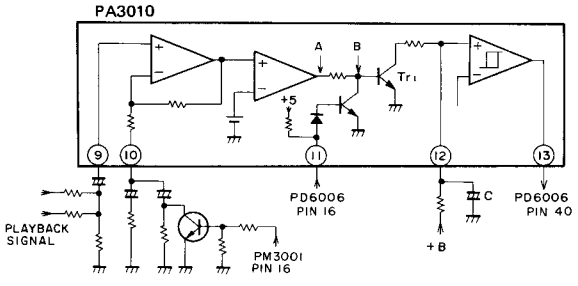


Fig. 1-17 Blank detector circuit

Consequently, when an input signal is present, pin 13 is at a low level, and no signal produces a high output. This output is used by each of the function operations (MS/SKIP, INDEX SCAN, BLANK SEARCH, MUSIC REPEAT).

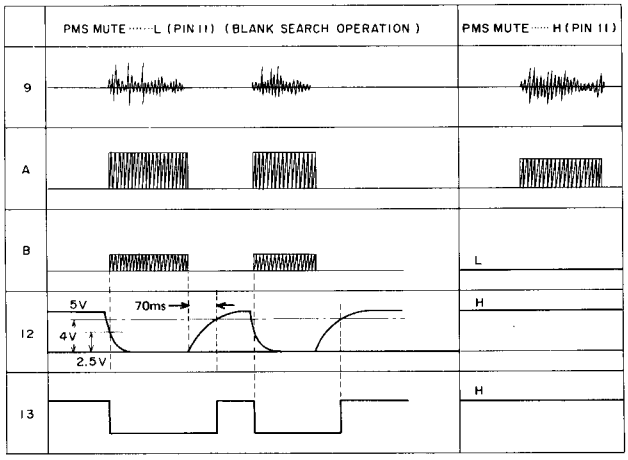


Fig. 1-18 Blank detector waves

1.7 FUNCTION KEY OPERATION

The various functions (MS/SKIP, INDEX SCAN, BLANK SEARCH, MUSIC REPEAT) are activated by placing the respective key to the ON position.

The timing chart for the pulses output from pins 10, 11, and 12 of CPU PD6006 are shown in Fig. 1-19. As a function key is placed in the ON position, a pulse train is input to either pin 36 or 37 of the CPU. The CPU then determines the timing of the pulse train, and starts operation of the selected mode accordingly.

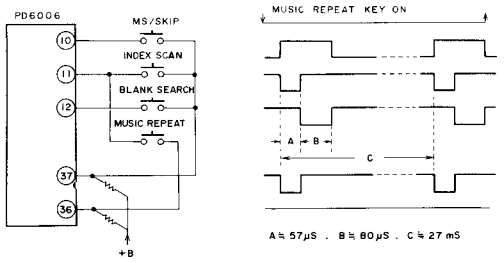


Fig. 1-19 Function key diagram

1. MS/SKIP Operation

When the MS/SKIP Key is placed ON, the FF (▷▷) key is activated, and when the beginning of a music selection is located, pin 13 of PA3010 drops from high to low. The trailing edge of the pulse effecting the level drop at the PD6006 pin sets the REWIND mode and rewinds the tape back to the beginning of the selection, and enters the PLAY mode.

At the end of the selection, if the unrecorded section of the tape (functioning to change the output from pin 13 from low to high) holds the level continuously high for over 8 seconds, PD6006 then selects the FF mode, continuing in that mode until the beginning of the next selection drops the level at pin 13 low. It then rewinds (◁◁) back out to the beginning of the selection, and enters the PLAY mode.

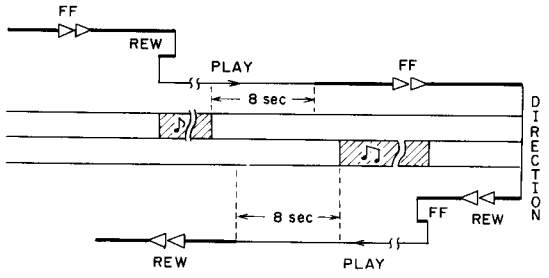


Fig. 1-20 MS/SKIP operation

2. INDEX SCAN Operation

When INDEX SCAN is activated, if the unit is operating in the FWD direction, the FF (▷▷) mode is entered; if in REV, REW (◁◁) is entered. The unit then cycles through a search operation to locate the beginning of a selection, then goes into the PLAY mode. Playback of the selection starts and continues for the 7 seconds that pin 13 of PA3010 is held low.

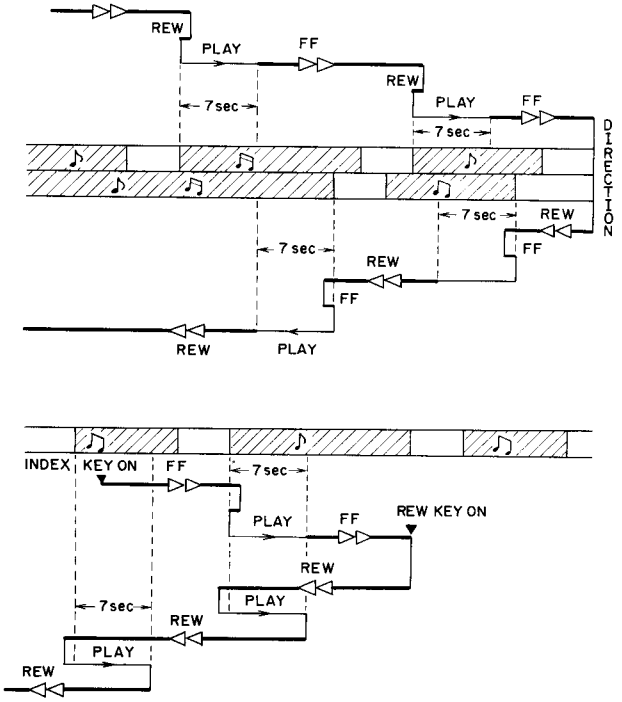


Fig. 1-21 INDEX SCAN operation

After this 7 seconds has elapsed, it once again returns to the FF or REW mode and cycles through another search operation until all selections on the tape are thus indexed.

If the tape should end while the unit is in FWD FF, or REV REW, either the STOP status would be entered, or a direction operation would allow search to continue, depending on the reverse mode switch setting.

When in INDEX SCAN operation, REW KEY (FF KEY in REV direction) is placed ON, INDEX SCAN is operated in REW mode as shown in Fig. 1-21.

3. BLANK SEARCH Operation

When the BLANK SEARCH key is placed ON, if the unit is operating in the FWD direction, the search is started in the FF (▷▷) mode; if operating in REV, it is started in the REW (◁◁) mode.

When input to the blank detector (output by pin 13 of PA3010) is held high for 8 seconds, or when the tape end sensor is detected, the present direction of travel is reversed, and the tape returns to the position where input to the blank detector snapped from high to low.

From this position, the unit reenters the PLAY mode until a point is reached where the input at the blank detector is maintained at a continuously high level for 4 seconds. It then goes into a STOP status, completing the operation.

As shown in Fig. 1-22 (3), in case of the unrecorded tape, the tape returns to the tape end in REW mode after the search had been done for 8 seconds in FF mode.

When detecting the tape end, the tape travels the leader tape portion for 0.8 seconds in FF mode and then goes into a STOP.

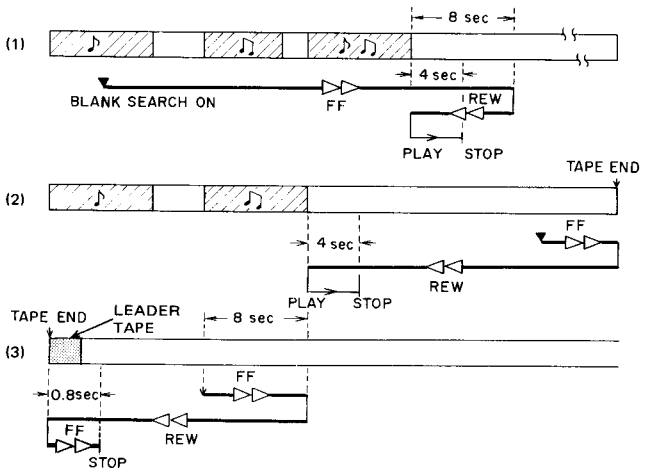


Fig. 1-22 BLANK SEARCH operation

4. MUSIC REPEAT Operation

When the MUSIC REPEAT key is placed ON while the unit is presently in the PLAY status, the present music selection (or the next if unrecorded tape selections) continues to completion, then the output from pin 13 of PA3010 goes from low to high. After the output of pin 13 has been held high for 2.5 seconds, the unit returns to the beginning of that selection and repeats playback.

This operation may be repeated for the same selection for up to 8 times, after which MUSIC REPEAT is cleared and a STOP status entered.

The STOP status will also be entered in case the end sensor is activated.

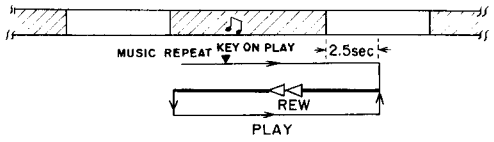


Fig. 1-23 MUSIC REPEAT operation

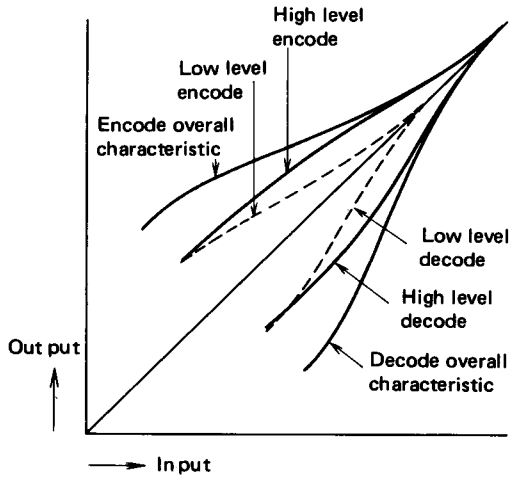


Fig. 1-24 Input/Output characteristic

1.8 DOLBY NR PROCESSOR

The CT-9R and CT-8R 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. 1-25 and 1-26 respectively. The corresponding input/output frequency response curves are shown in Fig. 1-24.

The REC signal is passed through a spectral skewing circuit (see Fig. 1-25) 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.

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 (se Fig. 1-26), 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 de-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.

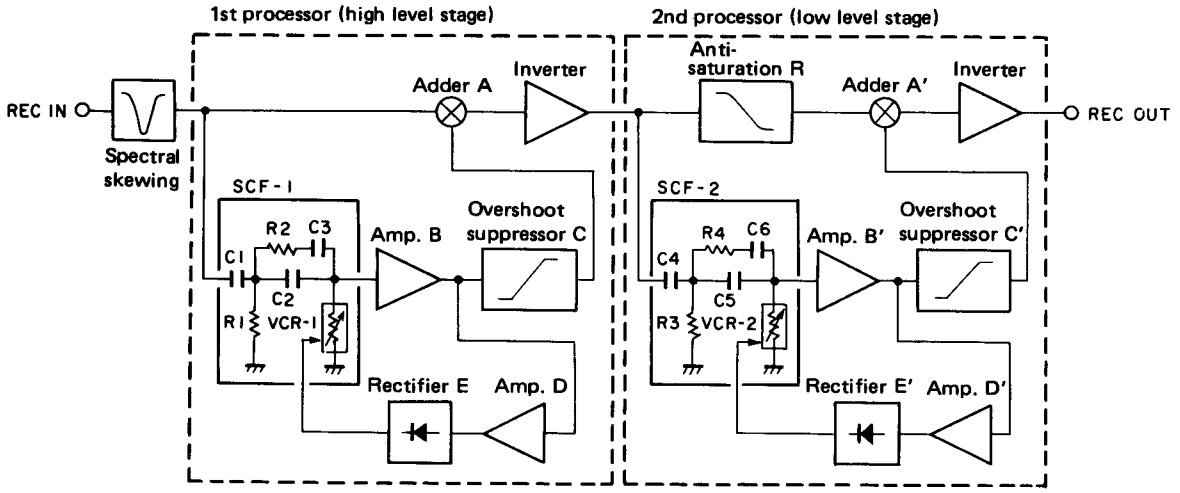


Fig. 1-25 Block diagram for encoding operation

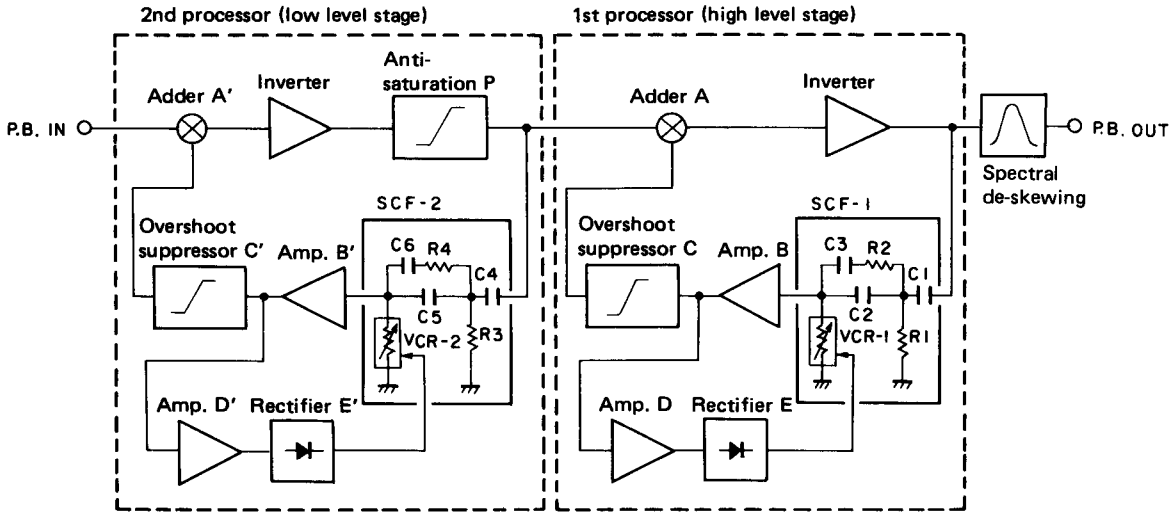


Fig. 1-26 Block diagram for decoding operation

1.9 AUTO BLE CIRCUIT

Auto BLE provides the function of setting bias, recording level and equalization to obtain the ideal recording characteristics exhibited by the various type formulations. Operation is fully automatic.

When the AUTO key is pressed, a signal is transmitted from PD4010 to control IC PD6006 in initiating mechanism operation and coarse-adjust recording level. It then shifts to bias adjustment. Bias is set by detecting the ideal current, determined by subjecting the 1kHz tone oscillator signal to record/playback at 16 step levels of intensity and selecting which of the 16 bias strengths is best. The resistance of the bias circuit is set accordingly.

This adjustment cycle may be repeated up to four times. Then after equalization has been set, the tape is rewound to the starting position. The complete adjustment process requires from 10 to 20 seconds.

In case one of the adjustments is impossible for AUTO BLE to make, it is automatically disabled. The tape is then rewound and standard values are set.

The detection method used for each value adjustment consists of passing the record/playback signal through the Lch and Rch rectifier circuits and comparing them (with comparators) with an analog voltage obtained from a CPU digital signal passed through the D/A converter. These circuits are contained in PM9001.

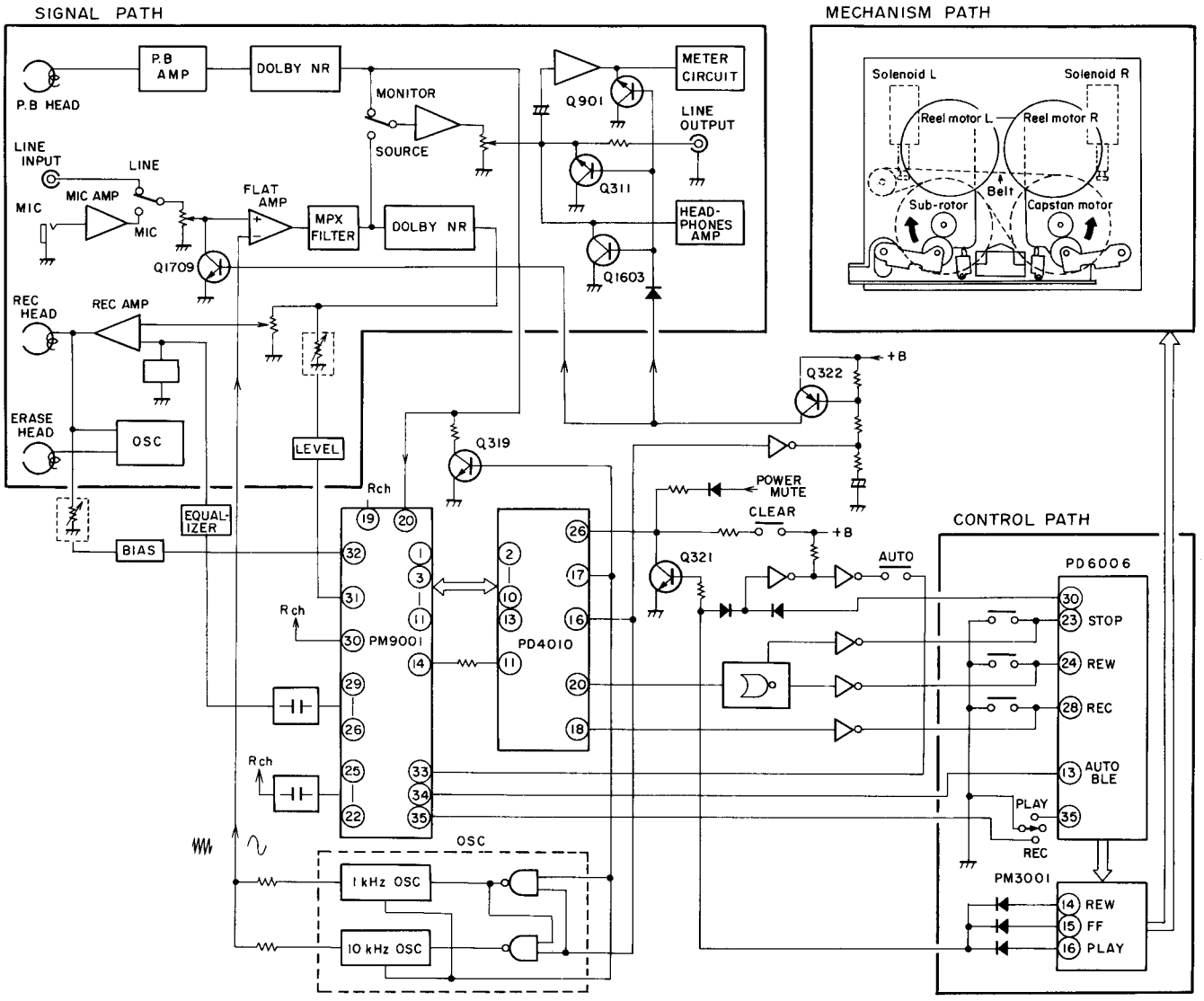


Fig. 1-27 B.L.E. circuit block diagram

1.10 REAL TIME COUNTER

The CT-9R uses a Hall element sensor to detect the rotational speed of the reel carrier, and inputs a pulse signal to PD6008 for use by the tape counter and real time counter.

Tape Counter Function

- **Tape counter set to "0000" at the time power is turned ON.**

1. When the power switch is turned ON, Q1206 is ON during the 100ms interval required for current to pass through +B, R1214, R1215 and charge C1218.
2. Q1206 being ON also turns Q1207 ON, and its collector is at a low level.
3. This low signal is applied to pin 3 of IC904 (PD6008). Pin 13 thru 18 of IC904 are high, and pin 19 is low.
4. This output is passed to LED 1101 via the inverting amplifier of IC905 (M54517P), setting the display to "0000".
5. Thus, the tape counter restarts from "0000" at the time power is applied to the unit.

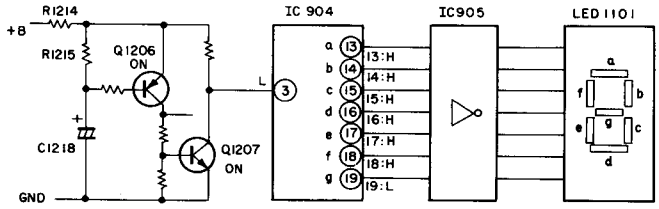


Fig. 1-28 Tape counter function

- **Tape counter increment/decrement "nnnn"**

1. As shown in Fig. 1-29, the Hall voltage generated by the Hall element (H252 : HB) built into the right reel carrier is applied to pins 16 and 17 of IC202 (PA2010) and is output from pin 13.
2. This output is applied to pin 32 of IC904 (PD6008).
3. At the same time, the voltage generated by Hall element (H251 : HA) is applied to pins 5 and 6 of IC903 (NJM2903) and is output from pin 7.
4. This output is applied to pin 30 of IC904.
5. Signal input to pins 30 and 32 cause segment data to be transmitted by pins 13 thru 19 (active high), and digital data to be transmitted by pins 26 thru 29. This changes the numerical display of the tape counter.
6. When the tape is traveling in the FWD direction, the pulse shown in Fig. 1-29 is applied with each turn of the reel, causing the counter to increase.
7. When the tape is traveling in the REV direction, the pulse shown in Fig. 1-29 is applied with each turn of the reel, causing the counter to decrease.

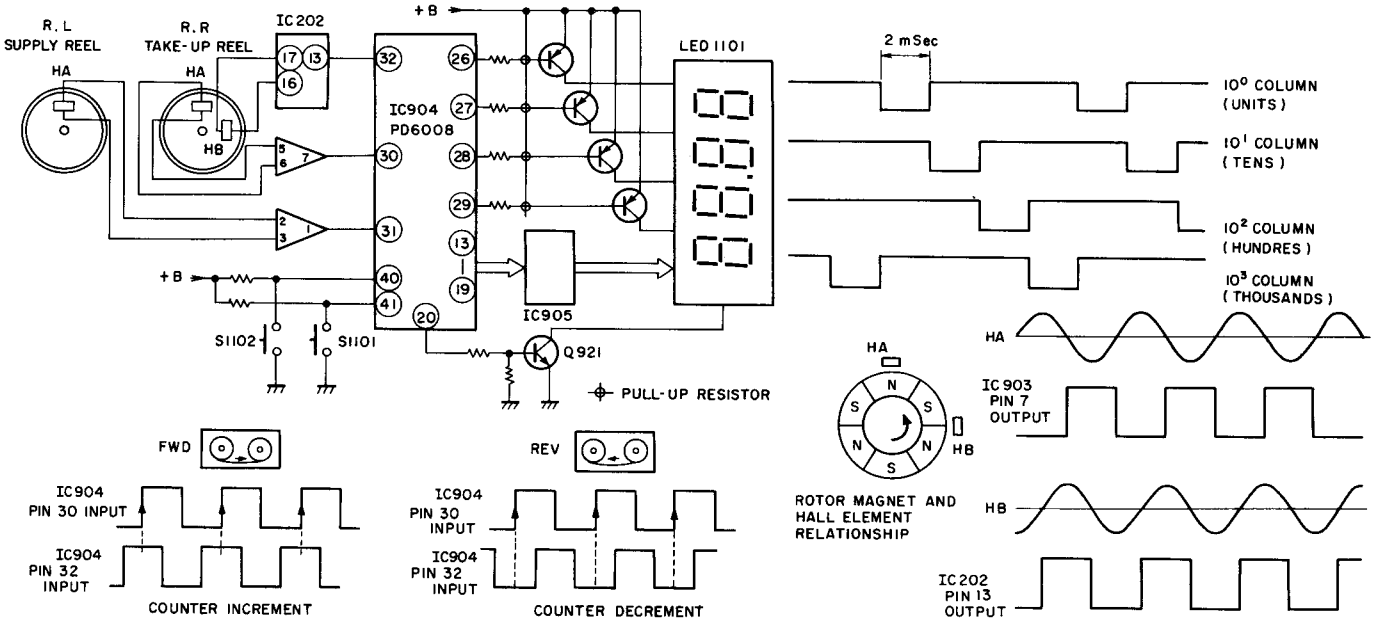


Fig. 1-29 Tape counter increment/decrement "nnnn"

- **Counter reset**

1. When the counter reset switch (S1101) is placed ON, pin 41 of IC904 (PD6008) drops to a low level, and pins 13 thru 18 go high, with pin 19 low.
2. Thus, when S1101 is held down, the tape counter unconditionally resets the counter to "0000". However, real time operations by IC904 continues, and when S1101 is released, the counter will once again indicate real time.

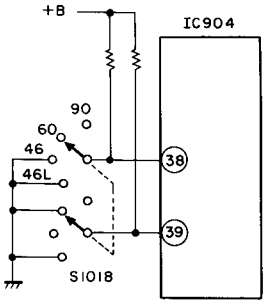
Real Time Counter Function

When the Counter/Mode switch (S1102) is placed ON, the counter can be switched to eigher tape counter or real time counter operation.

1. Placing S1102 ON causes pin 40 of IC904 (PD6008) to drop low.
2. This causes a high output from pin 20 to turn Q921 ON, illuminating the LED1101 dot indicator.
3. If the tape is traveling, voltage generated by the right reel carrier Hall element (HA : H251) is input to pins 5 and 6 of IC903 (NJM2903), and output is obtained from pin 7.
4. At the same time, voltage generated by the Hall element (HA : H253) of the left reel carrier is applied to pins 2 and 3 of IC903, with output from pin 1.
5. The outputs noted in 3 and 4 above are applied to pins 30 and 31 of IC904 (PD6008) where they are processed to obtain data on the amount of tape time remaining. This data is output from pins 13 thru 19, and 26 thru 29.
6. During the few second interval that data processing is taking place in step 5 above, there is no data present in IC904, and this causes the output from pin 20 to vacillate between high and low, switching Q921 ON and OFF causing the dot indicator to blink. This reports initial data acquisition.
7. During the time the dot indicator is blinking, the numerical display will show preliminary data, switching to an accurate display of the calculation result a few seconds later.
8. As the processed data is stored in IC904, pin 20 will be locked high and Q921 will remain ON keeping the dot indicator illuminated. This reports the fact that the counter is indicating real time.
9. Remaining tape time is continually processed during tape travel to update the counter.
10. The unit indicated by the counter during the PLAY mode is seconds. In the FAST mode, 10 second units are shown.
11. If during tape travel, the STOP or PAUSE mode is entered, the counter will hold the value at the point of entry.
12. When the tape reaches the "00.00" point on the counter, the "00.00" display will be held for approximately 30 seconds to account for slight differences in tape length (even though the tape may continue traveling).

- **TAPE CAPACITY switch**

The TAPE CAPACITY switch (S1018) is used to allow for various tape lengths to be processed for the tape time remaining display. Switching S1018 ON and OFF produces the logic levels at pins 38 and 39 of IC904 (PD6008) shown in Fig. 1-30.



TAPE	IC904	
	38	39
C-90	H	H
C-60	H	L
C-46	L	H
C-46L	L	L

Fig. 1-30 Tape capacity switch

- **Tape travel direction indicator**

LED indicators are provided so that the operator can determine whether the tape is traveling in the FWD or REV direction.

1. During the FWD mode of travel, the output signal waveforms from pins 9 thru 12 of IC904 (PD6008) are as shown in Fig. 1-33.
2. These signals cycle through Q914 thru Q916, turning them ON and OFF, thereby illuminating D1 thru D3 to indicate the forward direction of tape travel.
3. During the REV mode of travel, the output signal waveforms from pins 9 thru 12 of IC904 (PD6008) are as shown in Fig. 1-34.
4. These signals cycle through Q914 thru Q916, turning them ON and OFF, thereby illuminating D4 thru D6 to indicate the reverse direction of tape travel.
5. The blinking rate of D1 thru D6 is determined by the mode the mechanism is in, and this information is received through pins 33 thru 37 of IC904.

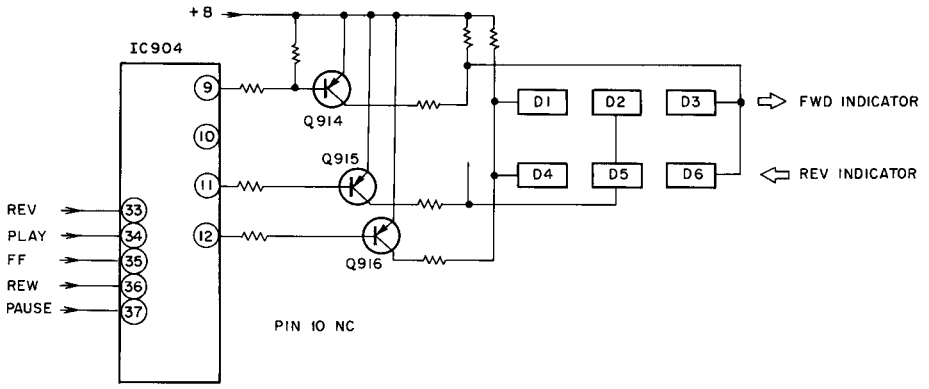


Fig. 1-31 Tape travel direction indicator

MECHANISM MODE		PD6008 PIN No.							
		INPUT PIN					OUTPUT PIN		
		33	34	35	36	37	9	11	12
FWD	STOP	L	H	H	H	H	H	H	H
	FF	L	H	L	H	H	SEE FIG. 1-33A=60mS		
	REW	L	H	H	L	H	SEE FIG. 1-34A=60mS		
	PLAY	L	L	H	H	H	SEE FIG. 1-33A=500mS		
	REC	L	L	H	H	L			
	PLAY PAUSE	L	L	H	H	L	H	H	H
	REC PAUSE	L	L	H	H	L			
	PAUSE	L	H	H	H	L			
REV	STOP	H	H	H	H	H	H	H	H
	FF	H	H	L	H	H	SEE FIG. 1-33A=60mS		
	REW	H	H	H	L	H	SEE FIG. 1-34A=60mS		
	PLAY	H	L	H	H	H	SEE FIG. 1-34A=500mS		
	PLAY PAUSE	H	L	H	H	L	H	H	H
	PAUSE	H	H	H	H	L			

Fig. 1-32 PD6008 input/output table

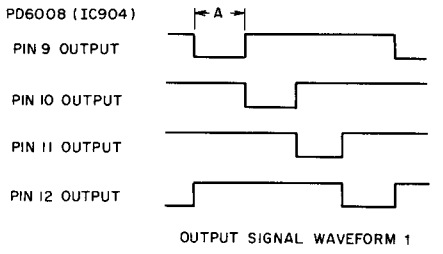


Fig. 1-33 Output signal waveform 1

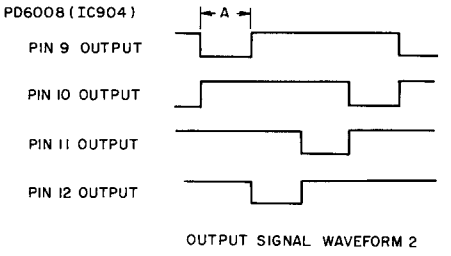


Fig. 1-34 Output signal waveform 2

- **Memory stop**

When the MEMORY switch (S1001) is placed ON, the tape may be moved ahead or backed up in the fast mode, automatically stopping when it reaches "0000" on the tape counter.

Also, when the counter indicates real time, the tape can be moved in the fast mode to the point equivalent to "0000", where it is automatically stopped.

1. When the tape is in the fast travel mode, a low level output is produced from pin 25 of IC904 (PD6008) when the tape counter reaches "0000".
2. This output passes via the TIMER switch (S1017), and S1001 to IC310 (PD6006), where it is applied to pin 4.
3. The low input at pin 4 signals the program written into IC310 to place the mechanism in the STOP mode.
4. However, if one of the MS/SKIP, MUSIC REPEAT, BLANK SEARCH or INDEX SCAN switches is activated, IC310 will not transmit a STOP command even with a low input present at pin 4.

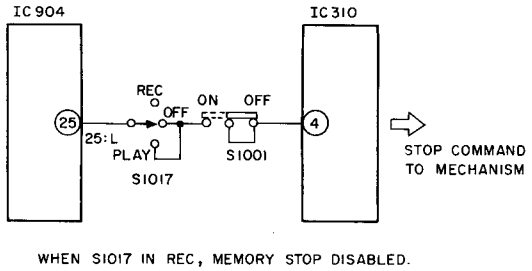


Fig. 1-35 Memory stop

1.11 CAPSTAN MOTOR CIRCUIT

The rotational speed of the capstan motor is determined by the frequency output of the full cycle integral type variable reactance frequency generator (FG) built into the rotor. This unit converts the frequency of 362.5 rpm to 725Hz. Voltage at this frequency output is approximately 30mV rms, and this value is amplified by approximately 40dB by the FG amp section of PA2007. This circuit (PA2007) also functions to shape the waveform output by the FG.

The next stage consists of a sample-and-hold F-V converter designed to convert the frequency output occurring through one complete cycle into an equivalent voltage. This voltage is applied to pin 11 of PA2007 as the speed control signal in the from of a DC voltage.

The voltage output from pin 11 (PA2007) is passed, along with the reference voltage from pin 12 to PA2012 and input into pin 7 and pin 6 respectively. There it is used to control the current fed to the motor and reduce fluctuations in the rotating speed.

The motor is a 4-phase type with Hall elements electrically phased 90° apart. The Hall elements serve to detect the positioning of the rotor magnets, and activate the various coils via the composite positioning circuit (PA2012), providing maximum efficiency and rotational torque.

CT-9R Reference Frequency Generator Circuit

The CT-9R uses a crystal oscillator as a reference frequency generator increasing the rotational accuracy of the capstan motor.

The reference frequency (7.4283MHz) produced by the crystal oscillator is divided 1/5120 by the divider IC in PD1003 and output as 1450.8398Hz from pin 15. This signal is input into pin 8 of the control IC PA2007. There, it is once again divided by 1/2 to produce the 725.41992Hz phase control reference frequency.

1.12 REEL MOTOR CIRCUIT

The reel motor uses the same drive method as the capstan motor; 4-phase, electrically phased 90° apart. Hall elements are used to detect the positioning of the rotor magnets and activate the various coils via the PA2010 position detection signal composite circuit to provide rotational torque and maximum efficiency.

The reel motor is controlled by the PM3001 control signal applied to pins 15 and 14 on PA2009. The various signal combinations (shown in Fig. 1-36) are used to activate the different operational modes and control the direction and speed of the motor.

The signal output from the right reel motor (MR) Hall element is waveform-shaped into a square-wave pulse and taken from pin 13 of PA2010 for use as the tape end sensor and tape counter signal. (CT-9R only)

MODE	INPUT (PA2009)		REEL MOTOR OPERATIONAL MODES
	ML; PIN 15	MR; PIN 14	
STOP	L	L	Both reel motors stopped
F-PLAY	L	M	Right reel motor constant current drive
R-PLAY	M	L	Left reel motor constant current drive
FF	L	H	Right reel motor fixed speed drive
REW	H	L	Left reel motor Fixed speed drive
REW-FF	M	H	Right reel motor max
FF-REW	H	M	Left reel motor max

Fig. 1-36 Reel motor operational modes

Capstan Motor Block Diagram

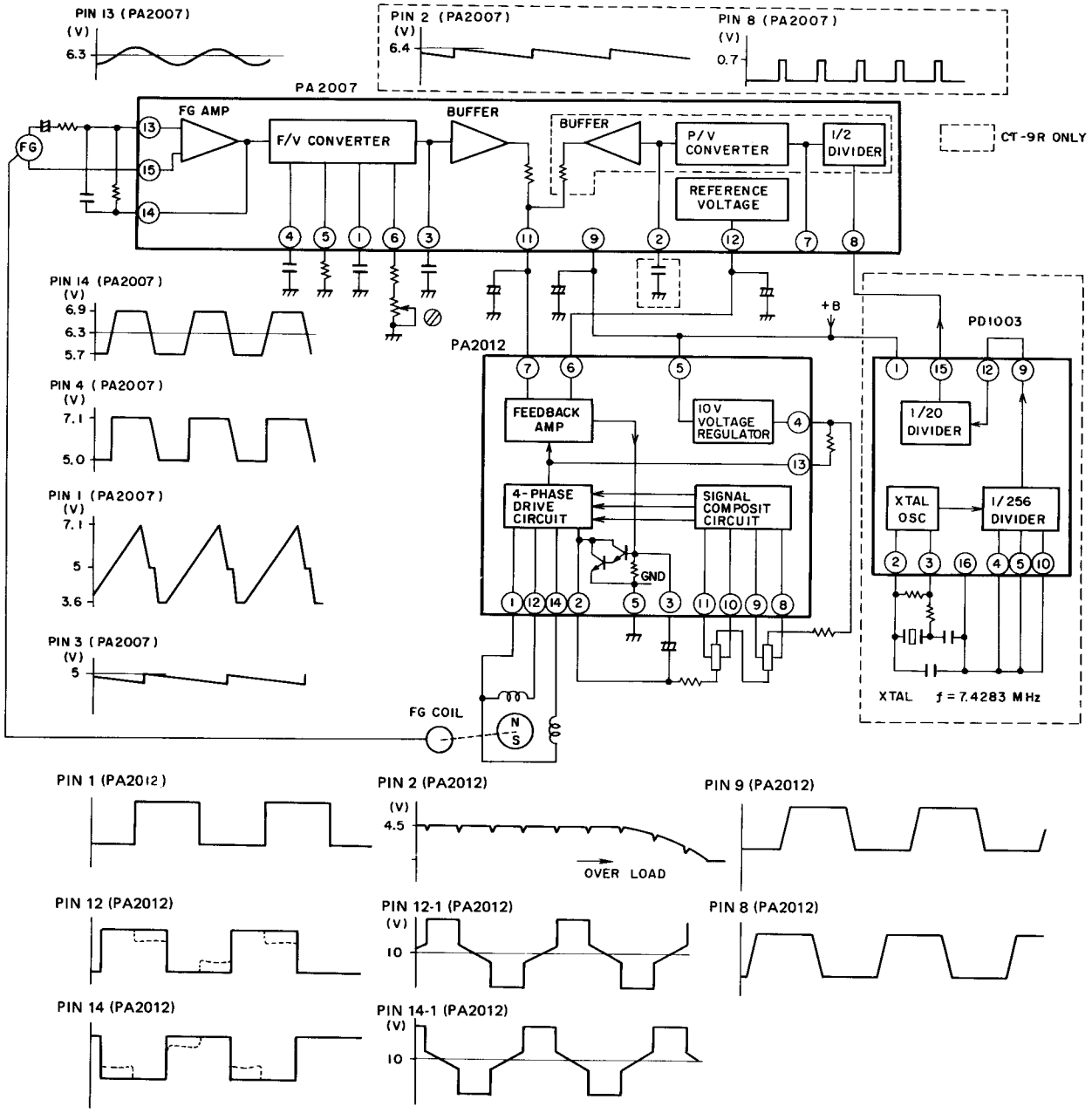


Fig. 1-37 Capstan motor block diagram

Reel Motor Block Diagram

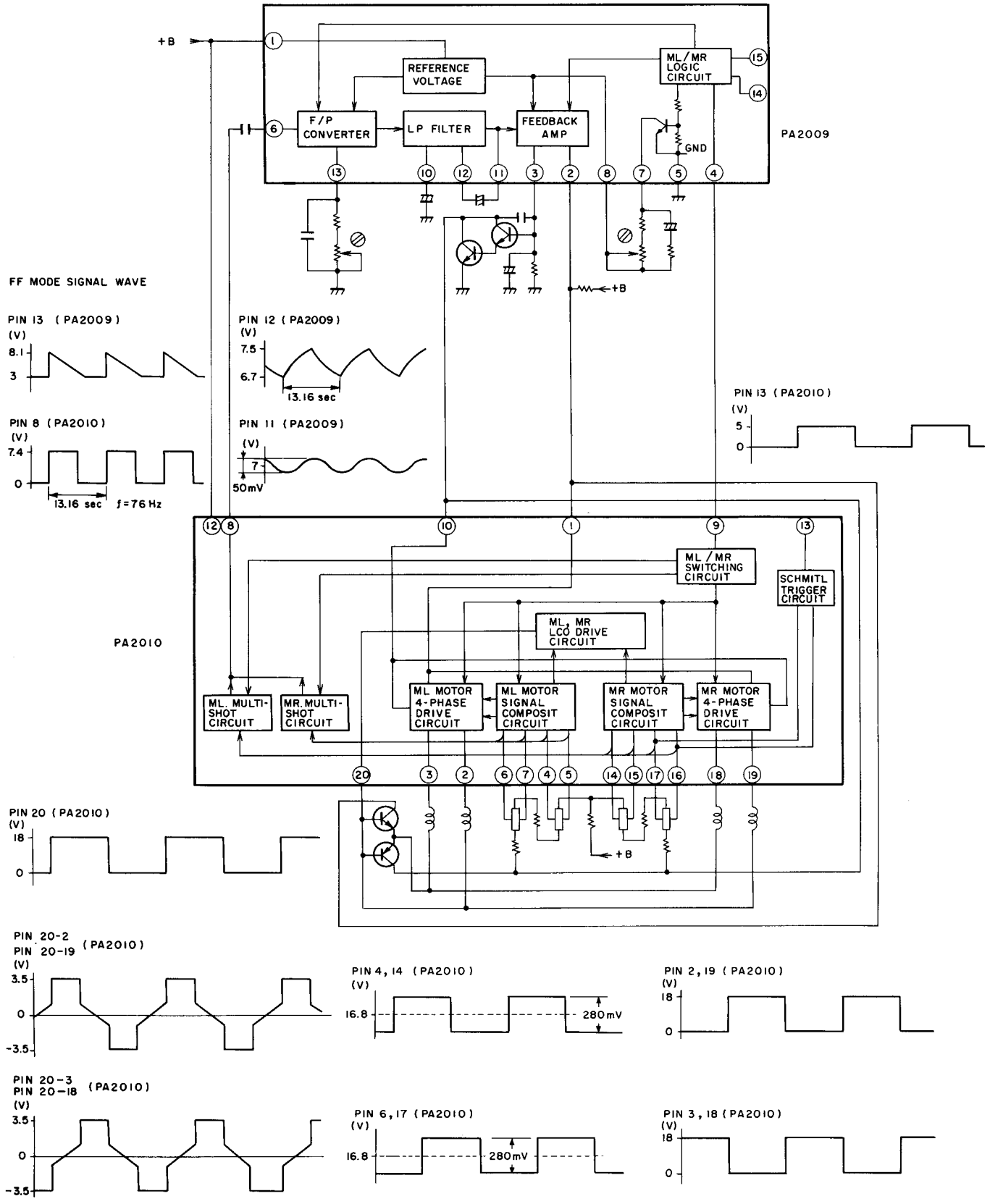


Fig. 1-38 Reel motor block diagram