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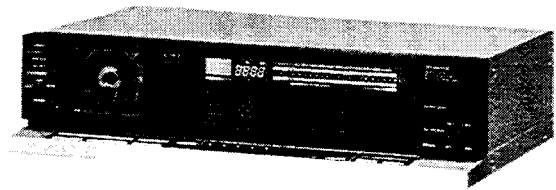
S/M Code No. 83-014
DATE OF ISSUE 5/1983

SERVICE MANUAL

STEREO CASSETTE
DECK

MODEL NO.

AD-F990

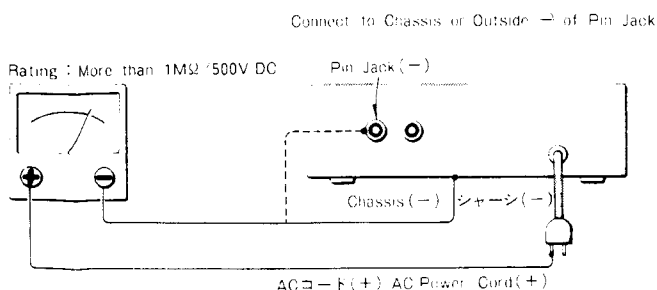


TYPE. H, HU, U, E, K, G

Follow the instructions carefully, which will allow the user to optimise the products' performance and give many years of service.


1. No scratch and melting shall be made to covered lead-wires of an a.c. primary circuit including mains leads.
 2. No illegibility shall be given to the specification plate, the caution labels, the fuse labels and others.
 3. When, on pattern sides of circuit boards, additional repair-parts have been made up, the parts shall be firmly glued to circuit boards or other components, unless the parts can be attached firmly.
 4. The following matters shall be maintained as they are, when repairing.
 - 1) Soldering of lead-wire ends
* Care should be taken of the space distance in an a.c. primary circuit as well as soldering.
 - 2) Wiring and holding of lead-wires with wire-clips and binders
 - 3) Materials of lead-wires
* e.g.; For UL models, lead-wires to be used shall be approved or accepted by the UL.
 - 4) Location of all kinds of insulators
 - 5) Setting of voltage selector switch
* Set the Voltage Selector Switch to 240V, 220V, or 120V, According to your Local Voltage.
 5. After repaired, the insulation resistance or leakage current shall be measured with $500 \pm 5V$ D.C and shall be not less than $1M\Omega$.
5. General instructions for mechanism repair
 - 1) The heads, capstan and pinch roller shall be cleaned of good quality alcohol after repaired, because dirty heads shall cause distorted sounds while dirty capstan and pinch roller shall occur wow/flutter and take-up fault.
 - 2) Lubricants been stained the surfaces of transmitting portion of the belts, idlers, capstan and pinch roller shall be removed, because slippery and faulty tape travel shall be caused.
 - 3) When oiling, only one or two drops shall be applied so as not to run over and be dispersed. Note should be taken of the metal fitting for the capstan and rotating portions of the idlers and pinch roller, especially.
 - 4) E-rings and poly slider washers shall be replaced with new ones, if once those have been removed. — No re-utilization due to unreliability.
 - 5) Regular spare-parts shall always be used for repair, because using irregular parts and tampering with the products shall cause deterioration, malfunction and damage.

Measuring Point



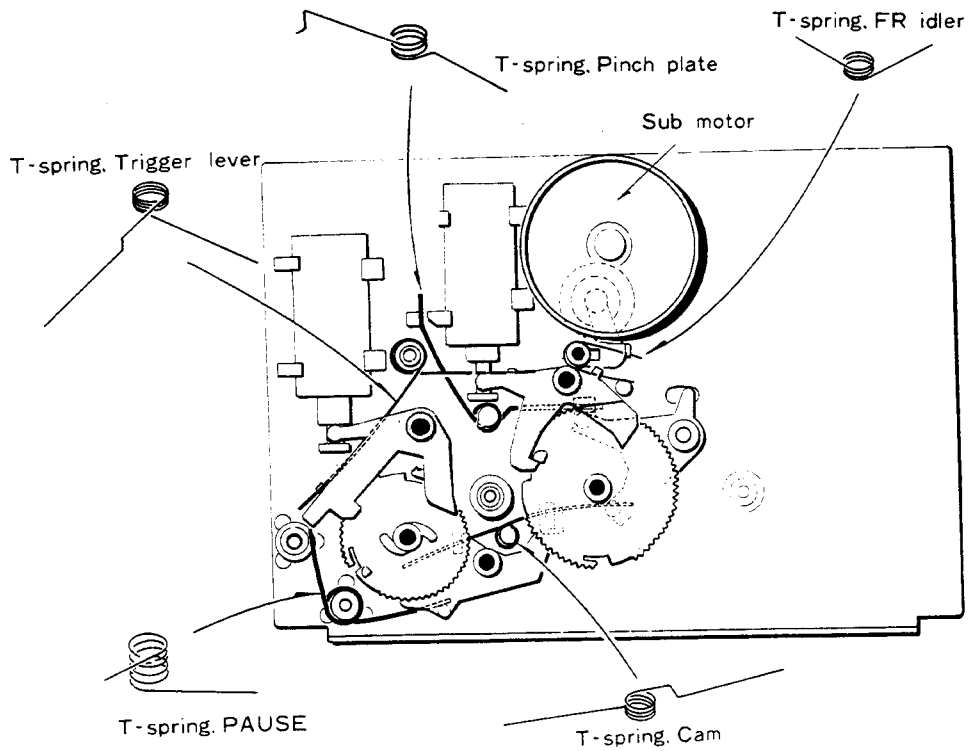
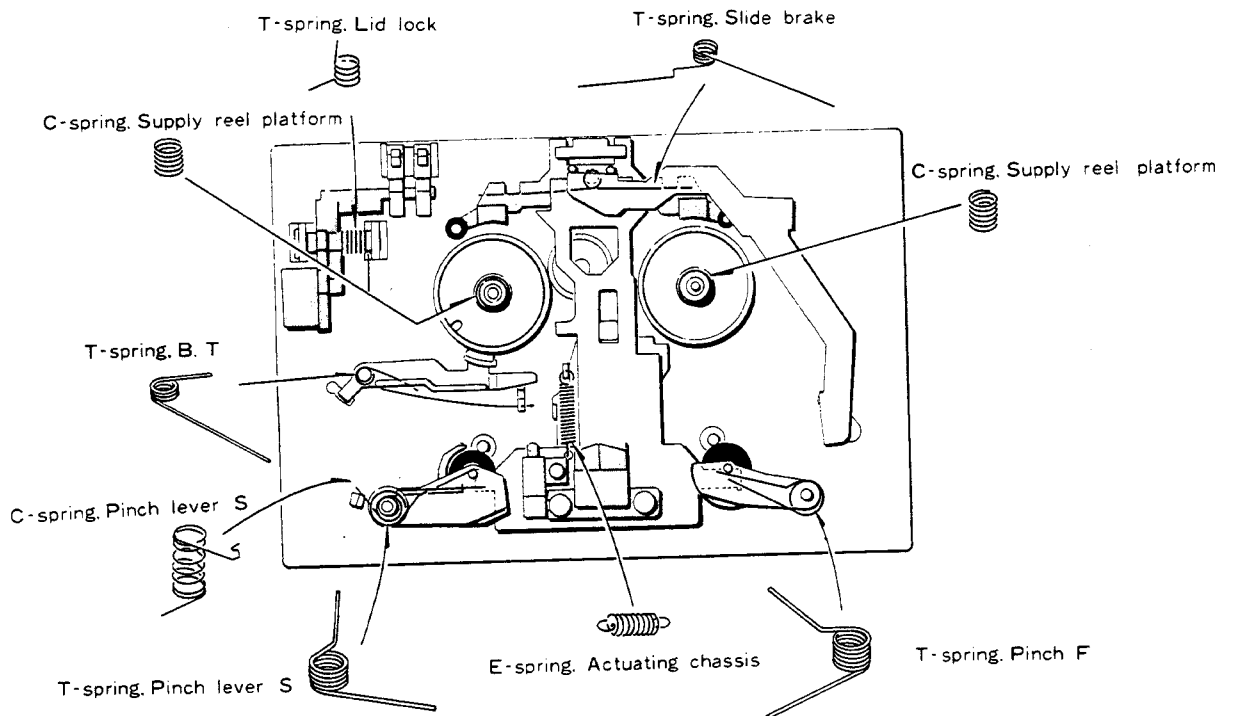
SPECIFICATIONS

Semiconductors:	61ICs, 116 transistors, 1 FET 138 diodes, 20 LED's	More than 48/57 dB (METAL, DOLBY-NR B OFF/ON)
Power supply:	H, HU models AC 120V/220V/240V switchable 50/60 Hz U model AC 120V, 60 Hz E model AC 220V, 50 Hz K, G models AC 240V, 50 Hz	More than 50/59 dB (CrO ₂ , DOLBY-NR B OFF/ON) More than 46/55 dB (NORMAL, DOLBY-NR B OFF/ON) More than 48/64 dB (METAL, DOLBY-NR C OFF/ON) More than 50/60 dB (CrO ₂ , DOLBY-NR C OFF/ON) More than 46/60 dB (NORMAL, DOLBY-NR C OFF/ON)
Power consumption:	40W	
Dimensions:	420(W) x 110(H) x 280(D) mm [16-1/2" x 4-3/8" x 11-1/4"]	Channel separation: (1 kHz, 0VU) More than 30 dB
Weight:	5.5 kg (12.11 lbs)	Cross talk: (1 kHz, 0VU) More than 60 dB
Track type:	4 tracks 2 channels	Erasing ratio: (125 Hz, 0VU + 10 dB, METAL) More than 60 dB
Tape speed:	4.8 cm/s (1-7/8 ips) ± 1.5%	Level drift: (10 kHz) ± 0.5 dB
Wow & flutter:	According to DIN 45500 0.08%	Level indication error: (-20VU) ± 5 dB (-10VU) ± 3 dB (-0VU) ± 1 dB (+2 ~ +6VU) ± 2 dB (+8 ~ +10VU) ± 2 dB
Automatic stop system:	Full auto stop	ADMS time: (ADMS LED light up time) 2.0 ± 0.5s. (POWER ON)
Automatic shut-off action time:	3 ± 1s.	Bias frequency: 85 kHz
Pinch roller pressure:	T side: 350 ± 30 g (3.43 ± 0.29N) S side: 165 ± 15 g (1.61 ± 0.15N)	Frequency response: (0 dB Rec. DOLBY NR C ON) METAL : 20 ~ 20,000 Hz ± 3 dB (-20 dB Rec.) 20 ~ 18,000 Hz ± 3 dB (0 dB Rec.) CrO ₂ : 20 ~ 20,000 Hz ± 3 dB (-20 dB Rec.) 20 ~ 15,000 Hz ± 3 dB (0 dB Rec.) NORMAL : 20 ~ 19,000 Hz ± 3 dB (-20 dB Rec.) 20 ~ 11,000 Hz ± 3 dB (0 dB Rec.)
Take-up torque:	38 ± 10 g-cm (0.37 ± 0.11 mN·m)	DOLBY-NR Effect: (10 kHz, CCIR FILTER) More than 8 dB (DOLBY NR B-type) More than 16 dB (DOLBY NR C-type)
FF & rewind torque:	150 ⁺⁴⁰ ₋₃₀ g-cm (1.47 ^{+0.39} _{-0.29} mN·m)	Motor: DC Servomotor for capstan DC motor for reels
FF & rewind time:	60 ± 10s. (C-60)	Head: DX Combination head (for REC/PB) Double gap semidust head (for erase)
Counter indication error:	0 ± 3 digit (C-60)	Inputs: MIC maximum input sensitivity: 1 mV (200 Ω - 10 kΩ matched) LINE IN maximum input Sensitivity: 50 mV (more than 50 kΩ)
Cassette lid action time:	0.8 ± 0.4s. (at normal temperature)	Outputs: LINE OUT/PLAY standard output level: 0.38V (0VU); suitable load impedance: more than 50 kΩ; Headphones: 8 Ω
Playback output:	540 ± 50 mV	Test tape: METAL TTA-119MX NORMAL TTA-119J CrO ₂ TTA-119G
REC/PB output:	380 mV	
REC/PB distortion:	Less than 1.5% (METAL) Less than 1.5% (CrO ₂) Less than 1.5% (NORMAL) Less than 2.7 mV (NORMAL DOLBY NR OFF) Less than 1.5 mV (NORMAL DOLBY NR B) Less than 1.2 mV (NORMAL DOLBY NR C) Less than 2.0 mV (METAL, CrO ₂ , DOLBY NR OFF) Less than 1.2 mV (METAL, CrO ₂ , DOLBY NR B) Less than 1.0 mV (METAL, CrO ₂ , DOLBY NR C) (WTD-A) Less than 1.2 mV (NORMAL DOLBY NR OFF) Less than 0.6 mV (NORMAL DOLBY NR B) Less than 0.6 mV (NORMAL DOLBY NR C) Less than 1.0 mV (METAL, CrO ₂ , DOLBY NR OFF) Less than 0.5 mV (METAL, CrO ₂ , DOLBY NR B) Less than 0.5 mV (METAL, CrO ₂ , DOLBY NR C) (400 Hz, 0VU)	
Playback noise:	(Unweighted)	
REC/PB SN ratio:	(Unweighted) More than 44/47 dB (METAL, CrO ₂ , DOLBY-NR B OFF/ON) More than 42/45 dB (NORMAL, DOLBY-NR B OFF/ON) More than 44/49 dB (METAL, CrO ₂ , DOLBY-NR C OFF/ON) More than 42/48 dB (NORMAL, DOLBY-NR C OFF/ON)	

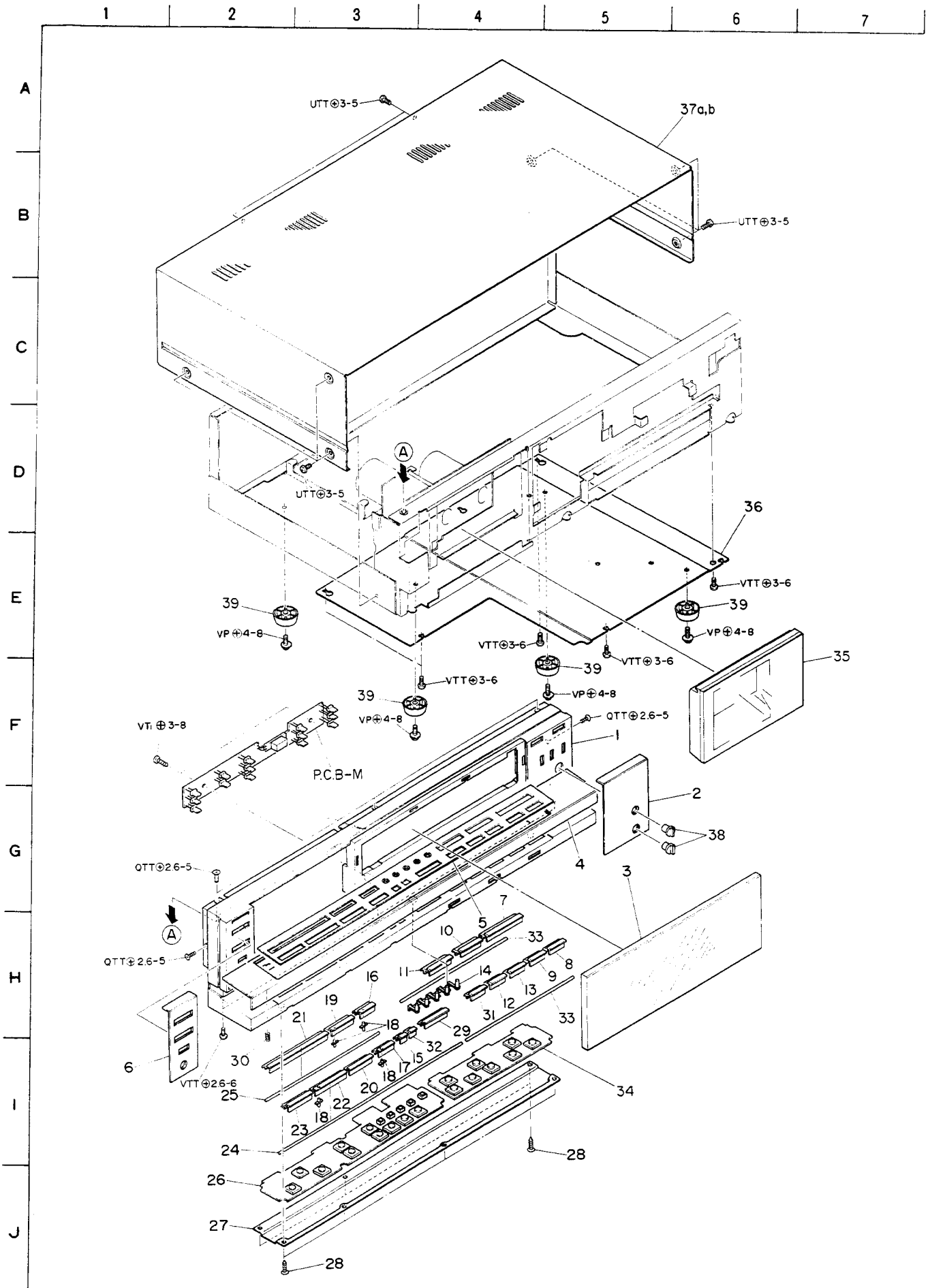
- Specifications and external appearance are subject to change without due to product improvement.
- Noise reduction system manufactured under license from Dolby Laboratories Licensing Corporation.
- Dolby and the  symbol are trademarks of Dolby laboratories Licensing Corporation.
- HX professional originated by BANG & OLUFSEN.

As to the disassembling instructions, refer to the service manual of AD-F660.

SPRING APPLICATION POSITION



EXPLODED VIEW- I



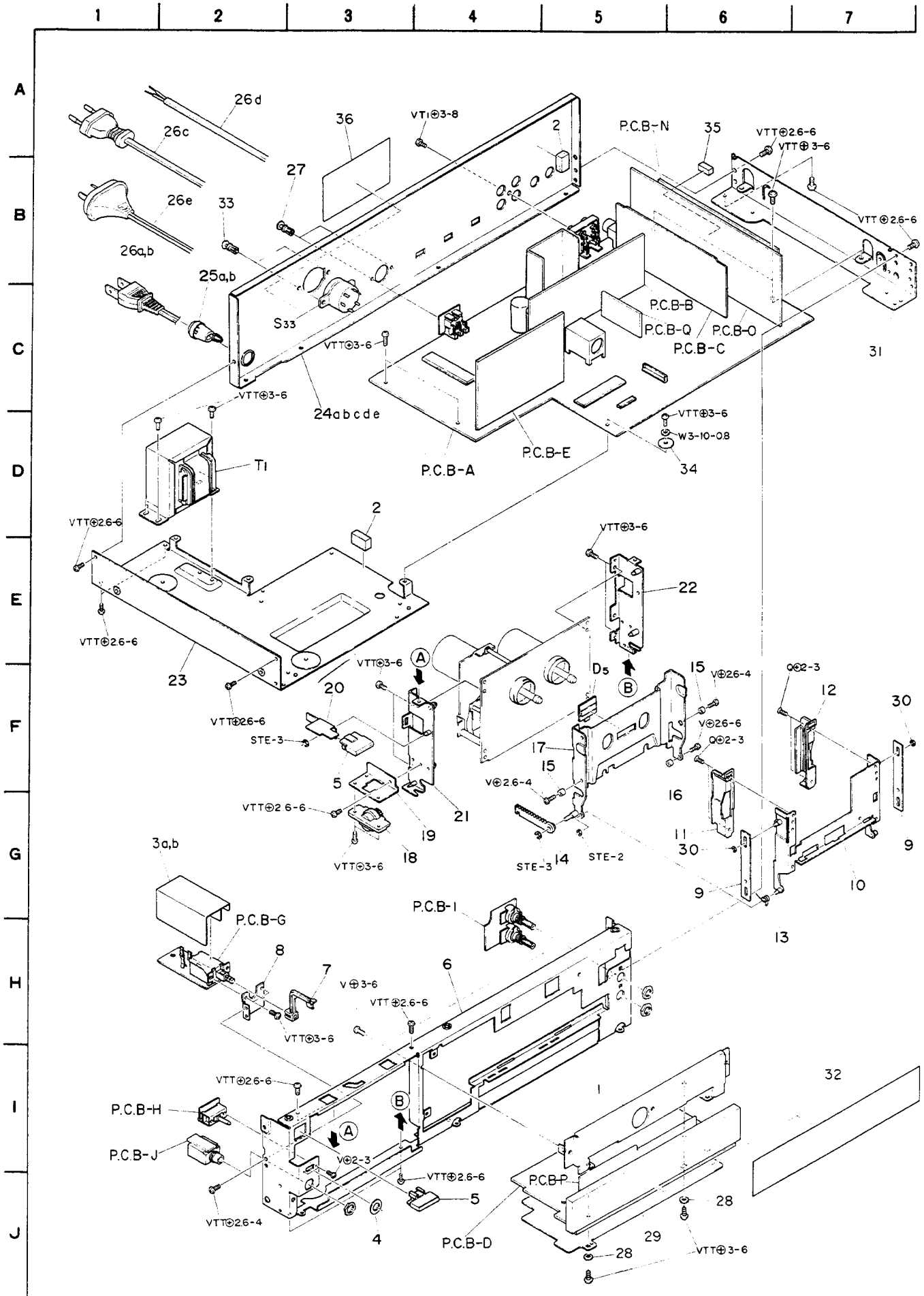
PARTS LIST

MECHANICAL PARTS

■ * mark in this part list shows exclusive part

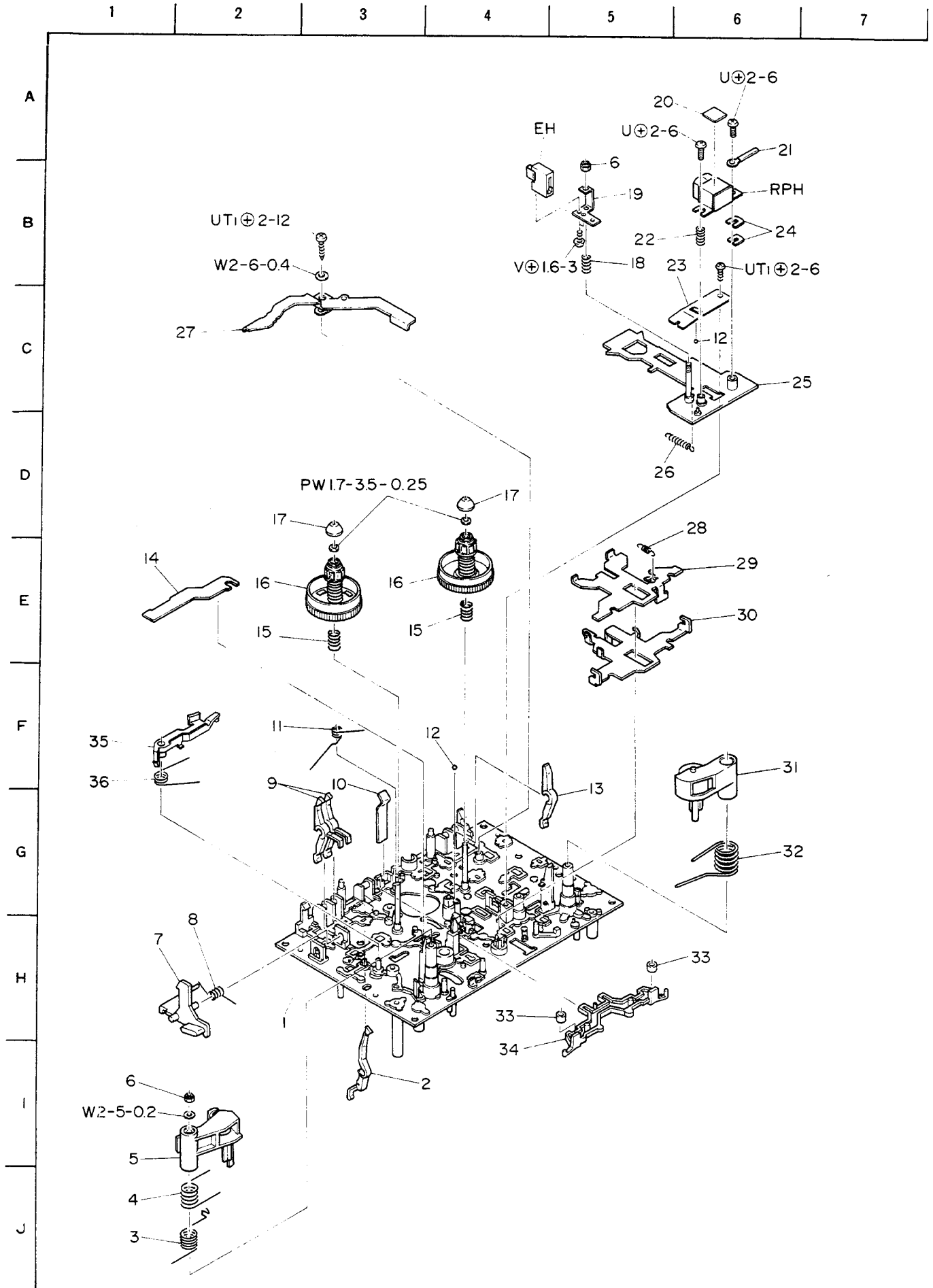
Ref. No.	Part No.	Part No. Changed to	Description	Common Model	Q'ty
1 ~ 34	82-188-055-01		Front cabinet ass'y	*	1
1-1	— — — —		Cabinet, Front	*	1
1-2	82-188-054-01		Panel, Front	*	1
1-3	82-188-053-01		Window, Meter	*	1
1-4	82-188-046-01		Panel, Control	*	1
1-5	82-188-052-01		Panel, Control	*	1
1-6	82-188-003-01		Panel, L, Front	*	1
1-7	82-188-024-01		Touch-key, Auto VR	*	1
1-8	82-188-025-01		Touch-key, UP	*	1
1-9	82-188-026-01		Touch-key, DOWN	*	1
1-10	82-188-027-01		Touch-key, DA	*	1
1-11	82-188-028-01		Touch-key, DM	*	1
1-12	82-188-029-01		Touch-key, DOLBY B	*	1
1-13	82-188-030-01		Touch-key, DOLBY C	*	1
1-14	82-188-034-11		Touch-key, Counter	*	1
1-15	82-188-045-11		Touch-key, MS	*	1
1-16	82-188-020-01		Touch-key, REC MUTE	*	1
1-17	82-188-019-01		Touch-key, REC	*	1
1-18	82-188-037-01		Guide, Light	*	4
1-19	82-188-022-01		Touch-key, PAUSE	*	1
1-20	82-188-017-01		Touch-key, FF	*	1
1-21	82-188-021-01		Touch-key, STOP	*	1
1-22	82-188-016-01		Touch-key, PLAY	*	1
1-23	82-188-018-01		Touch-key, REW	*	1
1-24	82-188-223-01		Shaft A, Touch-key	*	1
1-25	82-188-224-01		Shaft B, Touch-key	*	1
1-26	— — — —		Control key ass'y	*	1
1-27	82-188-033-01		Cabinet A, Bottom	*	1
1-28	87-326-073-01		QT ₁ + 2.6-6		7
1-29	82-188-023-01		Touch-key, CB	*	1
1-30	82-190-215-01		C-spring, Earth	AD-F660	1
1-31	82-188-031-01		Touch-key, DOLBY OFF	*	1
1-32	82-188-038-01		Touch-key, SOURCE	*	1
1-33	82-188-225-01		Shaft C, Touch-key	*	2
1-34	— — — —		Printed circuit board B ass'y	*	1
1-35	82-188-047-01		Cassette window ass'y	*	1
1-36	82-188-056-01		Cabinet, Bottom	*	1
1-37a	82-191-027-01		Cabinet, Steel (H, HU models only)	AD-F770	1
b	82-188-057-01		Cabinet, Steel (E, K, G models only)	*	1
1-38	82-184-034-01		Knob	FX-100	2
1-39	87-085-161-01		Foot		4

EXPLODED VIEW-2



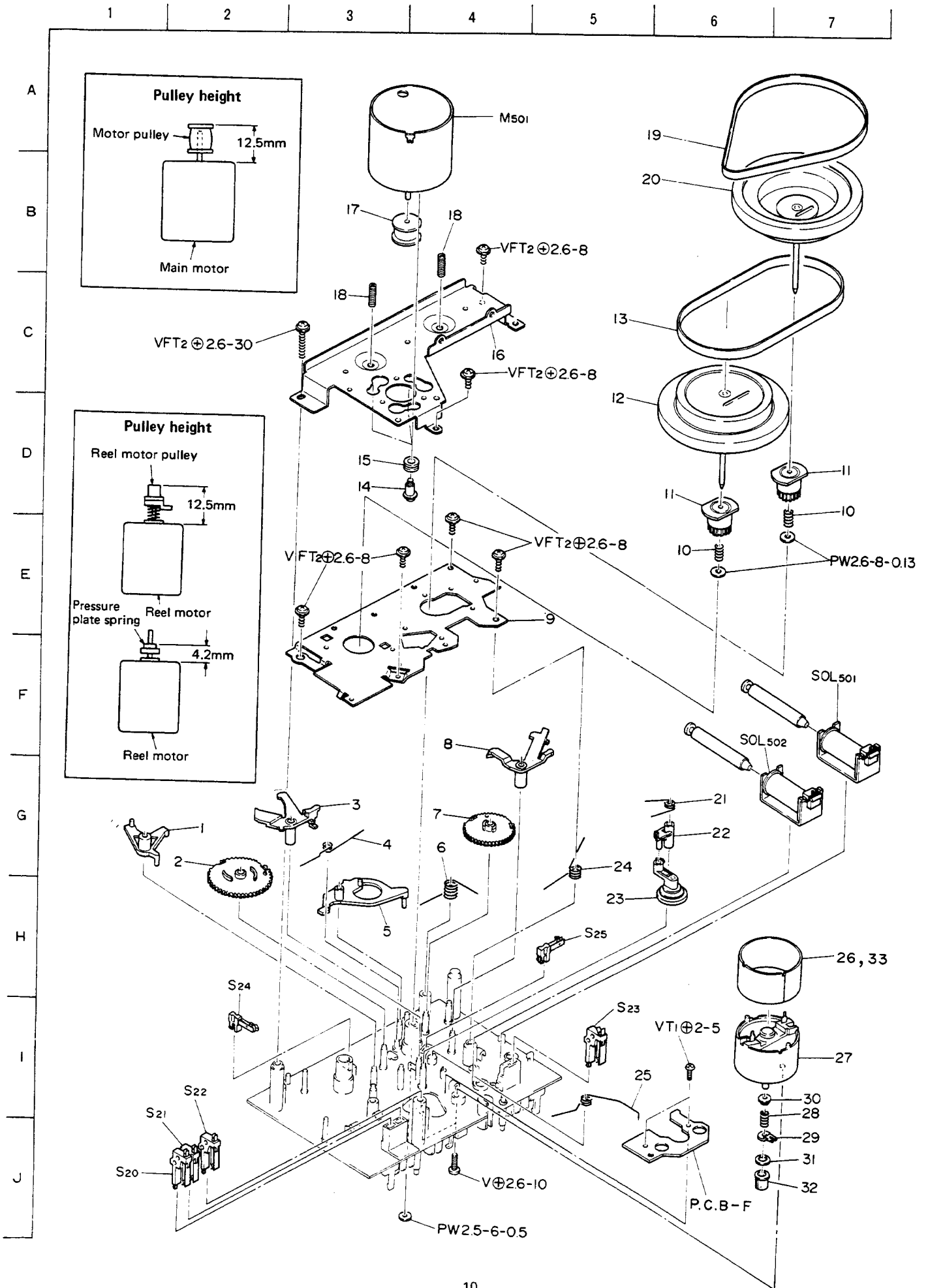
Ref. No.	Part No.	Part No. Changed to	Description	Common Model	Q'ty
2-1	82-188-218-01		FL holder	*	1
2-2	82-190-213-01		G cushion	AD-F660	2
2-3a	82-190-211-11		Cover, Power	AD-F660	1
b	82-190-217-01		Cover, Power	AD-F660	1
2-4	82-422-073-11		Himeron cloth, Blind		1
2-5	82-188-012-01		Push-button, Power	*	2
2-6	82-188-201-01		Front chassis	*	1
2-7	82-757-210-01		Rod	ST-R10	1
2-8	82-162-215-01		Holder, POWER	AD-R500	1
2-9	82-188-210-21		Lever, Cassette box	*	2
2-10	82-188-205-21		Cassette box ass'y	*	1
2-11	82-188-219-01		Holder L, Cassette	*	1
2-12	82-188-220-01		Holder R, Cassette	*	1
2-13	82-188-233-11		T-spring, OPEN	*	1
2-14	82-541-240-11		Lever, Oil-damp		1
2-15	82-188-229-01		Collar, Cassette box lever L	*	2
2-16	82-188-232-01		Collar, Cassette box lever R	*	1
2-17	82-188-039-11		Cassette plate ass'y	*	1
2-18	82-179-228-01		Oil-damper	AD-3800	1
2-19	82-188-211-01		Holder, Oil damp	*	1
2-20	82-188-212-11		Eject slide plate	*	1
2-21	82-188-213-41		Mechanism holder L ass'y	*	1
2-22	82-188-214-21		Mechanism holder R ass'y	*	1
2-23	82-188-204-01		Chassis L, Amp.	*	1
2-24a	82-188-040-01		Panel, Rear (H, HU models only)	*	1
b	82-188-041-01		Panel, Rear (U model only)	*	1
c	82-188-042-01		Panel, Rear (E model only)	*	1
d	82-188-043-01		Panel, Rear (K model only)	*	1
e	82-188-044-01		Panel, Rear (G model only)	*	1
2-25a	87-085-184-01		Cord bushing (H, HU, U models only)		1
b	87-085-185-01		Cord bushing (E, K, G models only)		1
2-26a	87-034-958-01		AC power cord (H, HU models only)		1
b	87-034-578-01		AC power cord (U model only)		1
c	87-034-877-01		AC power cord (E model only)		1
d	87-034-975-01		AC power cord (K model only)		1
e	87-034-892-01		AC power cord (G model only)		1
2-27	87-084-078-01		Nylon rivet 3-4.5		2
2-28	82-191-203-01		Spacer FL	AD-F770	2
2-29	82-188-239-01		FL shield sheet	*	1
2-30	82-190-206-01		STE-2 (Black)	AD-F660	2
2-31	82-188-209-01		Shassis R, Amp.	*	1
2-32	82-191-204-01		Filter	AD-F770	1
2-33	87-085-090-01		Nylon rivet (H, HU models only)		2
2-34	82-140-216-01		G cushion 4-16-2.5		1
2-35	82-756-657-01		Cushion U		1
2-36	82-188-049-01		Name plate, Spec. (U model only)	*	1

EXPLODED VIEW-3



Ref. No.	Part No.	Parts No. Changed to	Description	Common Model	Q'ty
3-1	81-507-201-21		Outsert chassis ass'y		1
3-2	81-505-242-11		Lever, Metal		1
3-3	81-507-228-01		C-spring, Pinch lever S		1
3-4	81-507-217-11		T-spring, Pinch lever S		1
3-5	81-507-207-11		Pinch lever S ass'y		1
3-6	87-081-963-01		Nylon nut M2-3.5		2
3-7	81-505-239-01		Lever, Eject		1
3-8	81-505-273-01		T-spring, Lid lock		1
3-9	81-505-241-21		REC blocking lever		2
3-10	81-505-260-01		P-spring, Pressure cassette		1
3-11	81-505-268-01		T-spring, Slide brake		1
3-12	87-073-005-01		Steel ball 2φ		2
3-13	81-505-240-21		Lever, Cassette sensor		1
3-14	81-505-238-01		Blocking plate, EJECT		1
3-15	81-507-219-01		C-spring, Supply reel platform		2
3-16	81-505-226-11		Take-up reel platform ass'y		2
3-17	82-303-398-01		Cap, Take-up reel platform		2
3-18	82-565-360-01		C-spring, EH		1
3-19	81-507-215-01		Holder, EH		1
3-20	82-188-051-01		Label, Head	*	1
3-21	87-038-056-01		Wire binder		1
3-22	82-307-212-01		C-spring, EH		1
3-23	81-507-224-01		P-spring, Actuating chassis		1
3-24	81-507-227-01		Spacer		2
3-25	81-507-214-21		Actuating chassis ass'y		1
3-26	81-505-265-11		E-spring, Actuating chassis		1
3-27	81-505-307-01		Lever, Brake eject		1
3-28	81-505-266-01		E-spring, APUSE plate		1
3-29	81-505-207-01		Plate, PAUSE		1
3-30	81-507-220-01		Plate, Pinch lever		1
3-31	81-505-210-11		Pinch lever F ass'y		1
3-32	81-505-267-01		T-spring, Pinch F		1
3-33	81-507-229-01		G brake		2
3-34	81-505-236-11		Lever, Slide brake		1
3-35	81-507-222-01		Lever, Back tension		1
3-36	81-507-223-01		T-spring, B.T		1

EXPLODED VIEW-4



Ref. No.	Part No.	Parts No. Changed to	Description	Common Model	Q'ty
4-1	81-505-230-01		Lever, PLAY		1
4-2	81-505-234-01		Gear, PLAY cam		1
4-3	81-505-231-01		Trigger lever, PLAY		1
4-4	81-505-272-01		T-spring, Cam		1
4-5	81-505-308-01		Lever B, PAUSE		1
4-6	81-505-283-01		T-spring, PAUSE lever		1
4-7	81-505-235-01		Gear, PAUSE cam		1
4-8	81-505-233-01		Trigger lever, PAUSE		1
4-9	81-505-204-01		Chassis B, Mechanism		1
4-10	81-505-261-01		C-spring, Flywheel F		2
4-11	81-505-225-01		Gear, Flywheel		2
4-12	81-507-205-01		Flywheel S ass'y		1
4-13	81-507-225-01		Rubber belt B		1
4-14	87-081-483-01		Motor screw, M2.6		3
4-15	87-087-029-01		Rubber cushion		3
4-16	81-507-221-01		Holder, Motor		1
4-17	81-505-245-01		Motor pulley 2-10-6.8		1
4-18	82-565-373-01		Screw, Thrust		2
4-19	81-507-216-01		Rubber belt A		1
4-20	81-507-238-01		Flywheel T ass'y		1
4-21	81-505-282-01		T-spring, FR idler		1
4-22	81-505-254-01		Lever A, FR idler		1
4-23	81-507-231-11		FR idler ass'y		1
4-24	81-505-271-01		T-spring, Trigger lever		1
4-25	81-505-269-01		T-spring, Pinch plate		1
26~33	09-011-038-01		Reel motor ass'y		1
4-26	81-505-606-01		Shield plate		1
4-27	81-505-604-11		Motor, Reel		1
4-28	81-505-290-01		C-spring, FR idler C		1
4-29	81-505-287-11		Lever C, FR idler		1
4-30	81-505-289-01		Pressure plate spring		1
4-31	81-505-292-11		Felt 4.5-7.2-0.8		1
4-32	81-505-320-01		Pulley, Reel motor		1
4-33	81-505-608-01		Shield plate B		1

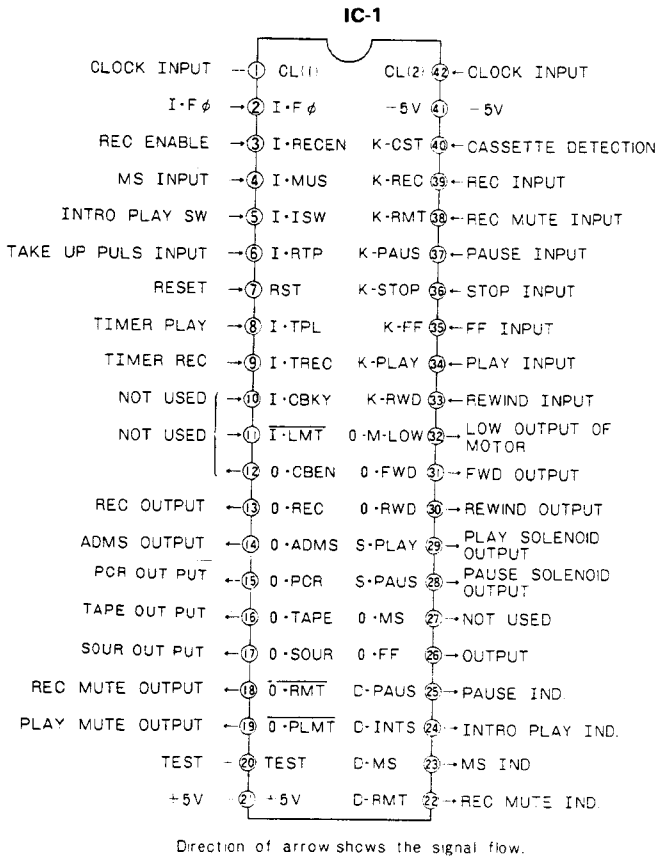
Part No.	Description
87-081-954-01	V+1.6-3
87-081-217-01	V+2-3
87-081-305-01	V+2.6-4
87-267-073-11	V+2.6-6
87-261-075-21	V+2.6-10
87-161-094-21	V+3-6
87-351-034-21	VT ₁ +2-5
87-356-095-01	VT ₁ +3-8
87-081-501-01	VTT+2.6-4
87-081-475-01	VTT+2.6-6

Part No.	Description
87-081-511-01	VTT+3-6
87-251-035-21	U+2-6
87-341-035-21	UT ₁ +2-6
87-341-038-21	UT ₁ +2-12
87-081-919-01	UTT+3-5
87-231-032-21	Q+2-3
87-081-521-01	QTT+2.6-5
87-512-074-01	VFT ₂ +2.6-8
81-505-229-01	VFT ₂ +2.6-30
87-521-170-21	VP+4-8

DESCRIPTION OF MICROCOMPUTER TERMINAL

Description of microcomputer terminal-1

Terminal name IC-1



Terminal functions

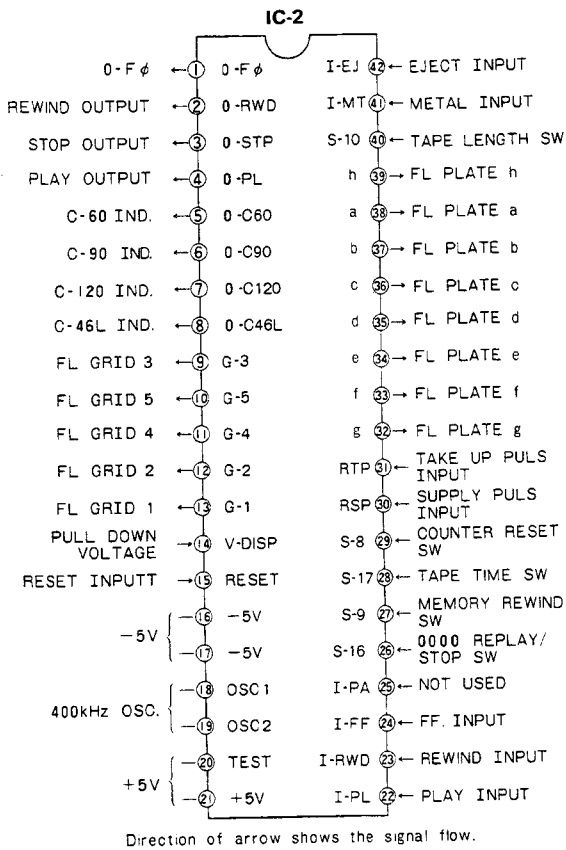
"H": High level, 5V "L": Low level, 0 or -5V [μ PD546C-357]

Pin No.	Terminal symbol	Function
① ④②	CL (1) CL (2)	The clock receives only 400 kHz
②	I · F ϕ	Terminal to inhibit ME.RWD during REC. Set to "L" from "H" when the RWD command is input from the microcomputer.
③	I · RECEN	The terminal is set to "L" and reoceding is not done when the safety tab is broken off.
④	I · MUS	Signal input during INTRO PLAY and MS. Set to "H" for tunes and to "L" between tunes.
⑤	I · ISW	Switch to select the INTRO PLAY and MS. Repeats OFF \rightarrow INTRO PLAY \rightarrow MS \rightarrow OFF.
⑥	I · RTP	Inputs the pulse from the takeup reel disk sensor. For AUTOSTOP.

Pin No.	Terminal symbol	Function
⑦	RST	RESET terminal. Set to "H" instantaneously when power is switched ON; also set to "H" instantaneously when power is switched OFF. Set to "L" in general.
⑧	T · PL	Set to "H" during timer play and recording. Set to "L" during OFF.
⑨	T · REC	
⑩	I · CBKY	KEY REQUEST from the compu-brain. The REC/PLAY, FF and REW keys can be accepted when this pin is set to Hi.
⑪	I · LMT	Input from the compu-brain. Set to Hi during the compu-brain mode. Reads the counter during compu-brain operation.
⑫	O · CBEN	Outputs Hi when the compu-brain operation is possible (when the mechanism is in the STOP mode and recording is possible).
⑬	O · REC	Set to "H" during recording. For erase, bias oscillator.
⑭	O · ADMS	Set to "H" for approx. 1.5 sec during power ON. For ADMS.
⑮	O · RCR	Set to "H" during PLAY, CUE, REV.
⑯	O · TAPE	Set to "H" during REC/PLAY, PLAY, CUE, REV.
⑰	O · SOUR	Set to "H" during REC, REC/PLAY/PAUSE.
⑱	O · RMT	Set to "H" during recording, and "L" during REC-MUTE in recording.
⑲	O · PLMT	Set to "H" during REC/PLAY, CUE/REV to release muting. Set to "L" during INTRO PLAY, MS.
⑳	TEST	Connect to +5V.
㉒ ~ ㉕	D-...	Indication output. Set to "H" during operation.
㉖	O-FF	Set to "H" during FF, CUE.
㉘	S-PAUS	Set to "H" during PAUSE, FF/REW CUE/REV.
㉙	S-PLAY	Set to "H" during PLAY/REC, CUE/REV.
㉚	O-RWD	Set to "H" during RWD/REV.
㉛	O-FWD	Set to "H" during REC/PLAY/FF/CUE.
㉜	O-M-LOW	Set to "H" during PLAY, REC/PLAY.
㉝ ~ ㉞	K-...	Key input. Set to "H" in general. Accepts key input when changed to "L" from "H"

Description of microcomputer terminal-2

Terminal name IC-2



Terminal functions

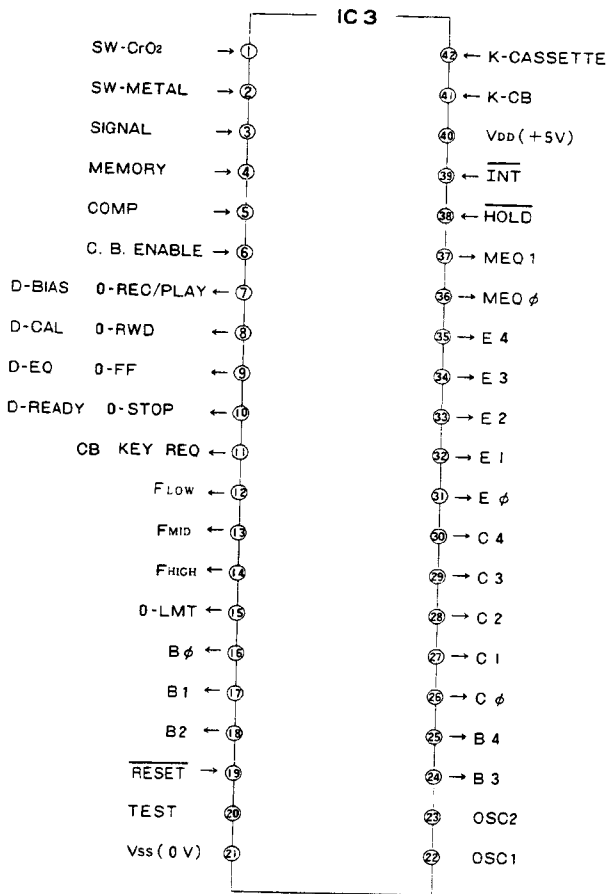
"H": High level, +5 "L": Low level, 0 or -5V

Pin No.	Terminal symbol	Function
①	0-Fφ	This is set to "L" in general and to "H" when 0-RWD, 0-STOP or 0-PL is output. This is used to discriminate between the key inputs of the mechanism controller.
②	0-RWD	"L" is output to perform memory-RWD in the counter mode. Set to "H" in general.
③	0-STP	"L" is output to perform 0000 STOP in the counter mode. Set to "H" in general.
④	0-PL	"L" is output to perform 0000 REPLAY in the counter mode. Set to "H" in general.
⑤ ~ ⑧	0-C...	This is used for TAPE LENGTH indication.
⑨ ~ ⑬	G...	Connected to the FL grid.
⑭	V-DISP	This terminal determines the internal pull-down potential.
⑮	RESET	Internal reset is possible. Reset is applied when this is connected to -5V.

Pin No.	Terminal symbol	Function
⑯, ⑰	-5V	-5V
⑱, ⑲	OSC	This is 400 kHz ceramic oscillator.
⑳, ㉑	+5V	+5V
㉒	I-PL	"H" is input during play, record/play and the remaining minutes and seconds are calculated.
㉓	I-RWD	"H" is input during RWD, and the remaining tape in the RWD direction is calculated.
㉔	I-FF	"H" is input during FF and the remaining tape in the FF direction is calculated.
㉕ ~ ㉙ ④①	S-...	Counter function input switch. Set to "L" in general, and "H" is input when the key is set to ON.
④①	RSP	Inputs the pulse output from the supply reel disk. This is used to measure the time it takes the supply reel disk to complete 1 revolution during play.
④①	RTP	Inputs the pulse output from the take-up reel. This is used for the counter.
④② ~ ④③	a ~ h	Connected to the FL plate.
④①	I-MT	Set to "L" in general and to "H" when METAL TAPE is used. The remaining tape is corrected for the thickness of METAL TAPE.
④②	I-EJ	This is used to reset the counter to "0000" when the cassette is not inserted during the counter mode. The remaining amount is erased during EJECT in the remaining tape mode.

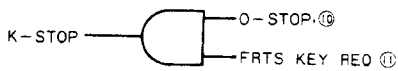
Description of microcomputer terminal-3

Terminal name IC-3



INPUT : K-CB "L" START/RESET
 K-CASSETTE "H" CASSETT ON
 SIGNAL "L" Magnetic coating provided
 C.B. ENABLE "H" C.B. START possible
 MEMORY "H" BACK UP ON

OUTPUT : FRTS KEY REQ. KEY REQ from "H" FRTS
 MEQ φ BIAS DATA φ φ φ φ φ "H"
 MEQ 1 " I I I I I "H"



Terminal functions

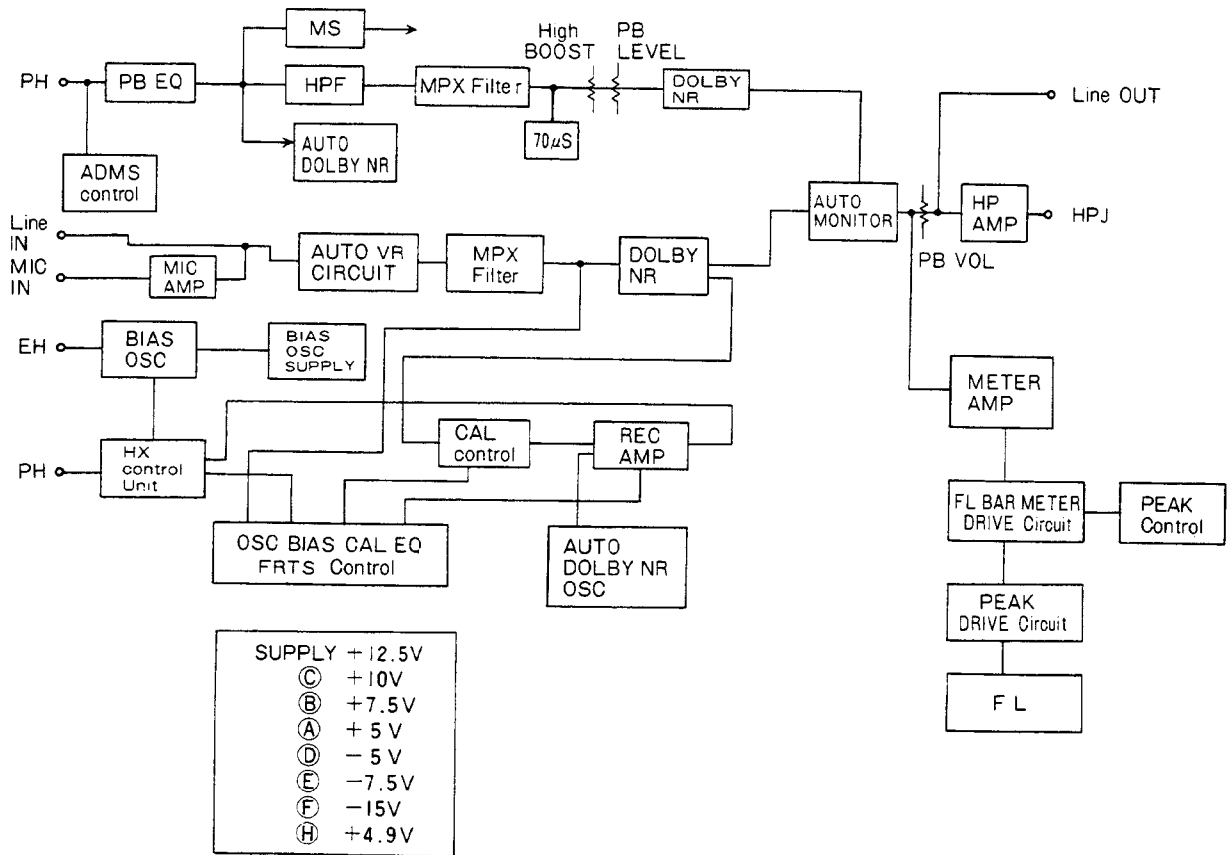
"H": High level 5V, "L": Low level "0V" LC6505C-609

Pin No.	Pin mark	Function
①	SW-Cr	Tape selector logic input
②	SW-MT	WRITE/READ of the compu-brain data to/from memory
③	SIGNAL	Record/Play signal input during the compu-brain adjustment. (Detects the magnetic coating.) "L" shows that the magnetic coating is present.

Pin No.	Pin mark	Function
④	MEMORY	Detects presence/absence of back-up operation. Back-up is present when this pin is set to Hi: Call of compu-brain adjusted data (memory data). Back-up is not present when this pin is set to Lo: Call-up of standard data.
⑤	COMP	Comparison result input during compu-brain adjustment
⑥	CB-EN	Detects possibility of compu-brain. START is possible when this pin is set to Hi.
⑦	D-BIAS/ O-REC/PLAY	Pin 11 is set to Hi and REC/PB key is pressed with pin 7 set to Hi. Bias LED is lit when pin 11 is set to Lo.
⑧	C-CAL/ O-REW	Pin 11 is set to Hi and REW key is pressed when pin 8 is set to Hi. CAL LED is lit when pin 11 is set to Lo.
⑨	D-EQ/O-FF	Pin 11 is set to Hi and FF key is pressed when pin 9 is set to Hi. EQ LED is lit when pin 11 is set to Lo.
⑩	D-READY/ O-STOP	Pin 11 is set to Hi and STOP key is pressed when pin 10 is set to Hi. READY LED is lit when pin 11 is set to Lo.
⑪	KEY REQ	When this pin is set to Hi, the mechanism key is requested from the compu-brain.
⑫	OSL FL	Controls the test tone 400 Hz used during compu-brain.
⑬	OSL FM	Controls the test tone 10 kHz used during compu-brain.
⑭	OSC FH	Controls the test tone 13 kHz used during compu-brain.
⑮	O-LMT	LINE MUTE output. Hi output in general. MUTE on when this output is set to Lo. Set to Lo for approx. 2.5 sec during compu-brain or after power is set to ON.
⑯	Bφ	Compu-brain data output BIAS φ: Set to Hi when 2 ⁰ bit is set.
⑰	B1	Compu-brain data output BIAS 1: Set to Hi when 2 ¹ bit is set.
⑱	B2	Compu-brain data output BIAS 2: Set to Hi when 2 ² bit is set.
⑳	B3	Compu-brain data output BIAS 3: Set to Hi when 2 ³ bit is set.
㉑	B4	Compu-brain data output BIAS 4: Set to Hi when 2 ⁴ bit is set.
⑲	RESET	Reset pin input
⑳	TEST	Connected to the 0V power supply
㉑	Vss	

Pin No.	Pin mark	Function
22	OSC1	This pin supplies external operation clock. Inputs the mechanism control 400 Hz.
23	OSC2	Internal clock oscillating pin attached to the external resonance circuit. Not connected.
26	C ϕ	Compu-brain data output CAL ϕ : Set to Hi when 2 ⁰ bit is set.
27	C1	Compu-brain data output CAL 1: Set to Hi when 2 ¹ bit is set.
28	C2	Compu-brain data output CAL 2: Set to Hi when 2 ² bit is set.
29	C3	Compu-brain data output CAL 3: Set to Hi when 2 ³ bit is set.
30	C4	Compu brain data output CAL 4: Set to Hi when 2 ⁴ bit is set.
31	E ϕ	Compu-brain data output EQ ϕ : Set to Hi when 2 ⁰ bit is set.
32	E1	Compu-brain data output EQ 1: Set to Hi when 2 ¹ bit is set.
33	E2	Compu-brain data output EQ 2: Set to Hi when 2 ² bit is set.
34	E3	Compu-brain data output EQ 3: Set to Hi when 2 ³ bit is set.
35	E4	Compu-brain data output EQ 4: Set to Hi when 2 ⁴ bit is set.
36	MEQ ϕ	Set to Hi when B0, B1, B2, B3, B4 of the data are set to $\phi\phi\phi\phi$ during bias adjustment. To change recording equalizer.
37	MEQ1	Set to Hi when B0, B1, B2, B3, B4 of the data are set to 11111 during bias adjustment. To change recording equalizer.
38	$\overline{\text{HOLD}}$	HOLD mode demand input pin.
39	$\overline{\text{INT}}$	Interruption demand input pin. Not connected.
40	V _{DD}	Power pin. Connected to the back-up capacitor circuit. Approx. 5.3V in general. Approx. 5.6V just after power OFF, and then gradually drops in several hours.
41	K-CB	Compu-brain key. Compu-brain start/reset when this is set to Lo.
42	K-CST	For cassette detection. Set to Hi when a cassette is present.

AD-F990 Block diagram



Circuit description

1. AUTO DOLBY-NR selector system

Outline

The auto Dolby-NR selector system selects the NR position automatically when playing back tapes recorded using this unit.

System

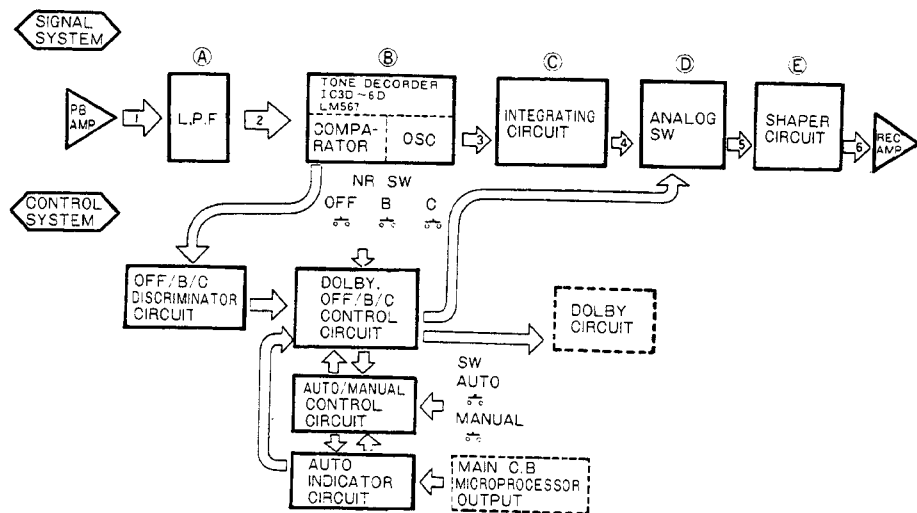
An ultra-low frequency signal (Table 1) is recorded simultaneously when the source signal is recorded on the tape by selecting the DOLBY-NR "AUTO" and then selecting DOLBY-NR "B-TYPE" or "C-TYPE" when recording with this unit.

The presence/absence and type of ultra-low frequency signal are detected during play to determine the NR position.

AUTO	Lch	Rch
OFF	No connect	No connect
B	7 Hz	9 Hz
C	9 Hz	7 Hz

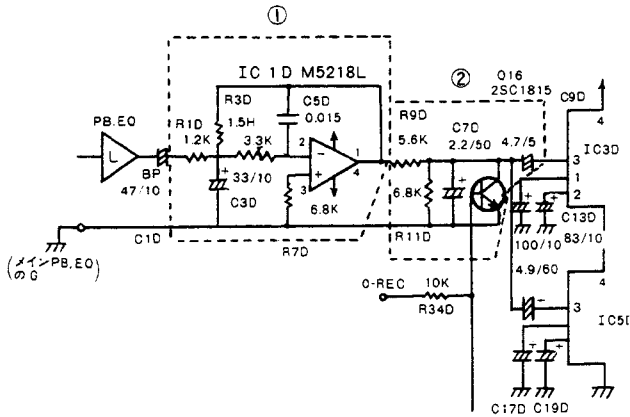
MANUAL	Lch	Rch
OFF, B, C	No connect	No connect

Block diagram



1-1. Description of each block

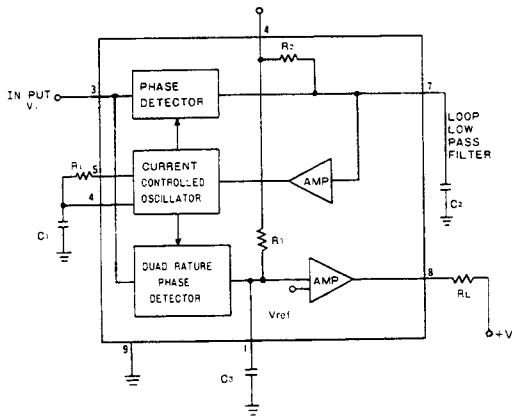
A L.P.F.



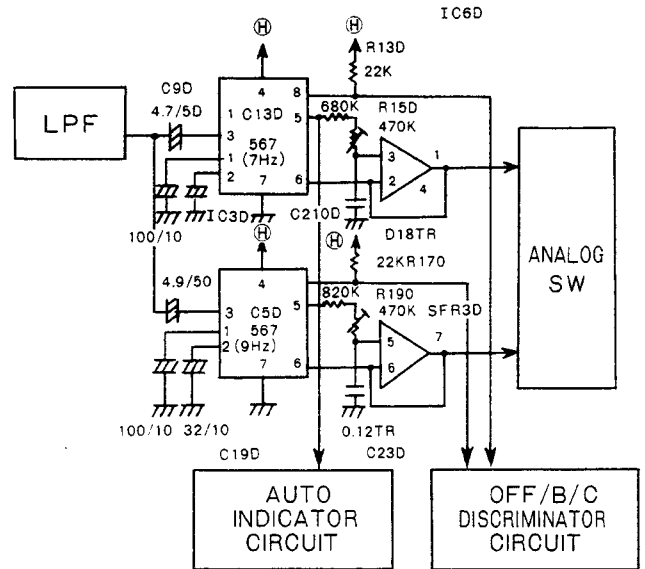
- ① Active filter $f_o = 2.7\text{Hz}$ $Q = 0.69$
 - ② CR filter $f_o = 8.02\text{Hz}$ $Q = 0.278$
 - i) The play signal is not input to IC3D, 5D pin 3 with 0-Rec = "H" during recording.
 - ii) The outputs during playback are: 7 Hz (-15 dBV), 9 Hz (-17 dBV) at IC1D pin 1, and 7 Hz (-23 dBV), 9 Hz (-23 dBV) at IC3D, IC5D pin 3.
- (Note: Measuring instrument = RIKEN FET, CF-300)

B Tone, decoder IC3D, 5D

C Integrating circuit Block diagram IC3D, 5D LM567

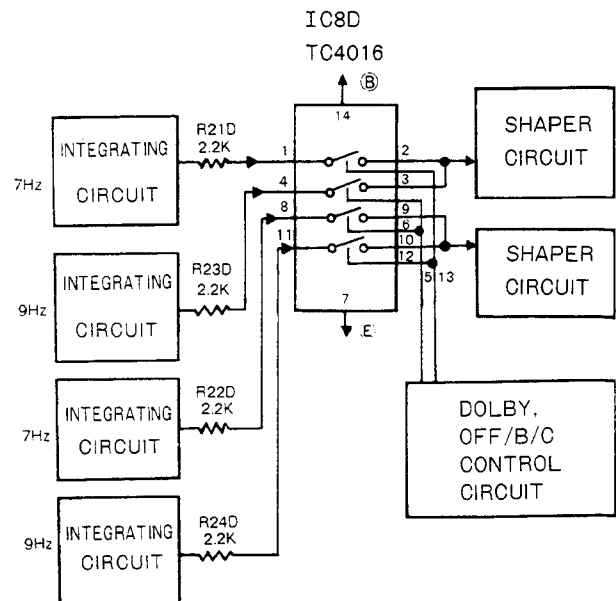


- ① C3D, 5D (pin 3) : Signal inputs
- ② IC3D, 5D (pin 1)C: Externally attached filter
- ③ IC3D, 5D (pin 2)C: Externally attached filter
- ④ IC3D, 5D (pin 8) are output as shown below when the relation between input f and f' of the built-in OSC is as shown below.
 $f = f'$ "L"
 $f \neq f'$ "H"
- ⑤ The oscillation frequency is determined by (R, SFR, C) from IC3D, 5D (pin 5).
- ⑥ Integrated as via IC6D (FET input OP amp).
- ⑦ Another output of the IC3D, 5D (pin 5) is connected to the AUTO indicator circuit and used to flash the AUTO indicator LED.

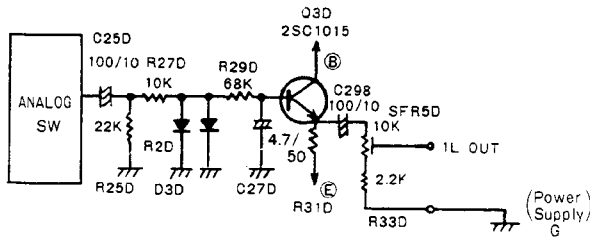


D Analog SW ① Analog SW IC8D

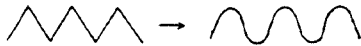
AUTO	(Pin 2,3)	(Pin 9,10)
OFF	No signal	No signal
B	7 Hz	9 Hz
C	9 Hz	7 Hz



E Shaper circuit



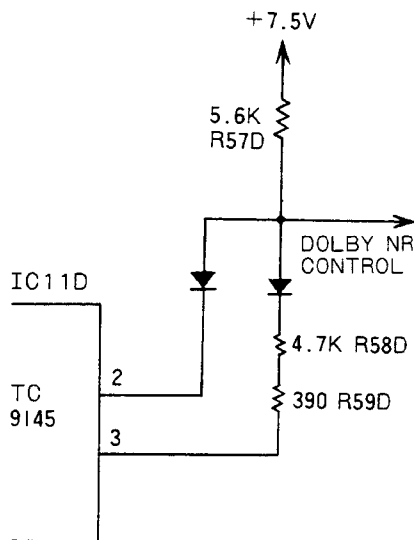
- 1) The analog SW/output signal (integrating waveform) is converted to a sine wave.
Q3D is an emitter-follower.



- 2) The output of the shaper circuit is input to the record amp of the main C.B.
- 3) The ultra-low frequency signal recording level is set to the level so that -26 dB can be obtained at TTA161 as tape playback level.

1-2. Dolby NR circuit NR control

The NR control is controlled by the circuit shown below.



Dolby-NR: IC11D, pin 2 is set to -7.5 V when the Dolby-NR circuit is set to OFF and the NR control is set to approx. -7 V.

Dolby-NR: IC11D, pin 3 is set to approx. -7.5 V when the Dolby-NR circuit is set to "B-TYPE", and the NR control is set to approx. $+0.6$ V.

Dolby-NR: The Dolby-NR control is set to approx. 2 V when the Dolby-NR circuit is set to "C-TYPE" via R57D.

1-3. Description of operation

(1) During recording

1) Auto Dolby-NR B-type

- i) ① (IC14D1/2, pin 7) is set to "H" when the auto SW is set to ON, and ②, "H", ③, "L".
- ii) ②⑥ (IC11D pin 14) is set to "H" with the Dolby-NR SW B-type set to ON, and ③④, "L". The Dolby-NR LED is lit with ③④ set to "L".
- iii) ③ and ③④ are set to "L", ③⑧, "H" and IC8D pins 13, 12 "H". By this, IC8D pins 1 and 2, pins 11 and 12 are activated, and 7 Hz is output to the Lch OUT and 9 Hz, to the Rch OUT.
- iv) AUTO LED is: ⑥ (0-PCR) is set to "L", ⑦, "H", ⑧, "L" and ②, "H", so ⑨ is set to "L", and when ⑨ is set to "L", ⑬ is set to "L" regardless of ⑪, and Q9D emitter is set to "L" and ⑩⑩ (collector) to "L", at the same time, ③ is set to "L", so ③① is set to "L", and Q10D is set to ON and is lit.

2) Auto Dolby-NR C-type

- i) Same as B-type i).
- ii) ②⑦ is set to "H" and ③⑤, "L" with the Dolby-NR SW C-type set to ON. The Dolby-NR LED is lit when ③⑤ is set to "L".
- iii) ③ and ③⑤ are set to "L", ③⑨, "H" and IC8D pin 5, pin 6 are set to "H". By this, IC8D pins 4 and 3, pins 8 and 9 are activated, and 9 Hz is output to Lch OUT and 7 Hz, to Rch OUT.
- iv) Same as B-TYPE iv).

3) Manual Dolby-NR B-Type

- i) ④ is set to "H", ②, "L" and ③ to "H" when the manual SW is set to ON.
- ii) Same as Auto, B-Type ii).
- iii) ③ is set to "H", so both ③⑧, ③⑨ are set to "L" regardless of ③④, ③⑤. All the circuits of IC8D are set open, and no signal is output to Lch OUT and Rch OUT.
- iv) AUTO LED is: ③ is set to "H", so ③① is also set to "H" and Q10D is set to OFF and goes out.

4) Manual Dolby-NR C-Type

- i) Same as 3)-i).
- ii) Same as 3)-ii).
- iii) Same as 3)-iii).
- iv) Same as 3)-iv).

5) Manual Dolby-NR OFF

- i) Same as 3)-i).
- ii) ②⑧ is set to "H" and ③③ to "L" (③④ and ③⑤, "H") when the Dolby-NR SW, OFF position is selected.
- iii) Same as 3)-iii).
- iv) Same as 3)-iv).

Control system During recording

	AUTO B	AUTO C	MANUAL B	MANUAL C	MANUAL OFF
①	(\square)	(\square)	L	L	L
②	H	H	L	L	L
③	L	L	H	H	H
④	L	L	(\square)	(\square)	(\square)
⑤	L	L	L	L	L
⑥	L	L	L	L	L
⑦	L	L	L	L	L
⑧	H	H	H	H	H
⑨	L	L	L	L	L
⑩	L	L	L	L	L
⑪	L	L	L	L	L
⑫	H	H	H	H	H
⑬	L	L	L	L	L
⑭	(\square)	L	(\square)	L	L
⑮	L	(\square)	L	(\square)	L
⑯	L	L	L	L	(\square)
⑰	L	L	L	L	L
⑱	L	L	H	H	H
⑲	H	H	L	L	L
⑳	H	H	H	H	L
㉑	L	H	L	H	H
㉒	H	L	H	L	H
㉓	(\square)	(\square)	(\square)	(\square)	L
㉔	L	L	L	L	L
㉕	H	L	L	L	L
㉖	L	H	L	L	L

- i) ① AUTO (ON), ② OFF (ON): MANUAL OFF
 ii) ① OFF (ON), ② AUTO (ON): aut (OFF). However, it is the same result as MANUAL (OFF).

(2) Common AUTO operation during playback

1) Operation A

Relation between ultra-low frequency signal playback and IC3D, 5D comparator output.

	COLLATION	DOLBY-NR		
		B-TYPE	C-TYPE	OFF
Lch	⑭	L	H	H
	⑮	H	L	H
Rch	⑯	H	L	H
	⑰	L	H	H

⑱, ⑲, 20, 21 are set to ON and "H" when the bases of all transistors are set to "L", so they become the inverted outputs shown in the table below.

2) Operation B

- i) ⑤ 0-MLOW is set to "H" during REC/PB and PLAY, and ⑥ 0-PCR to "H" during PLAY, CUR and REV, and Q11D (2SC1815) base is set to "H" only during PLAY.
 ii) Q11D is set to ON and ⑦ to "L" and ⑧ to "H".
 iii) ② is set to "H" (Refer to RFC) and ③ to "L" during "AUTO" operation.
 iv) When ⑧ is set to "H", the differential waveform is generated at ⑮, and ⑪ at "H" instantaneously drops to "L" via the one-shot multi vibrator-circuit, and then set to "H" after a specified time. (approx. 4 sec)
 v) When ② is set to "H" and ⑧ to "H", ⑨ is set to "H", ⑬ works the same as ⑪ under this condition.

3) Operation C

- i) All the outputs of ⑳, ㉑, ㉒, ㉓, are set to "H" while ⑬ is set to "L". When ⑬ changes from "L" to "H", the inversion outputs of the ⑱ ~ ㉒ inputs are obtained at ㉑ ~ ㉓. This state is equivalent to the table of the basic AUTO operation A shown above.

	COLLATION	IC10D	B-TYPE	C-TYPE	OFF
IN-PUT	㉑	10	L	H	H
	㉒	13	H	L	H
	㉓	12	H	L	H
	㉔	11	L	H	H
OUTPUT		2	L	L	L
		1	L	L	L
		7	H	L	L
		14	L	L	L
		9	L	L	L
		5	L	H	L

(3) Operation during playback

1) Auto Dolby-NR B-type playback

- i) The IC10D output is: only pin 7 is set to "H" ④ to "H", ⑭ to "H", and ⑳ to "L" during the B-type operation due to (2) common operation C. By this, LED B is lit the same as in recording, and the Dolby NR control voltage is applied.
 ii) ④ is set to "H", ⑲ to "H" and Q9D is set to OFF and ⑳ to "L". At the same time, ③ (as shown in (2)-2-iii)) is set to "L", so ⑳ is set to "L", Q10D, ON and AUTO LED is left lit.

2) AUTO Dolby-NR C-TYPE playback

- i) Due to (2) common operation 3), the IC10D output is; only pin 5 is set to "H", and ④ to "H", ⑭ to "H" and ⑳ is set to "L". By this, LED C is lit the same as in recording, and the DOLBY-NR control voltage is applied.
 ii) ④ is set to "H" and ⑲ to "H", and thereafter, the operation is same as in (3)-i), ii).

3) Playback of tape recorded with AUTO Dolby-NR OFF and by other decks.

- i) All the IC10D outputs are set to "L" as shown in (2) common operation 3), the square wave output from IC3D is input to ⑲
 ii) The emitter is set to "H" after a certain time (4 sec) and the square wave shown in i) is input to the base, so Q9D (2SA1015) repeats ON/OFF operation. As a result, ⑳ is set to the square wave with the same period as IC3D and ⑳ is also the same, so the LED lighting Q10D (2SA1015) repeats ON/OFF and the AUTO LED flashes.
 iii) At the same time, the ⑳ output is charged by the C.R. time constant circuit for a certain time (4 sec) and then 28 is set to "H". By this it is set to OFF.

(Note) Q15 (2SC 1815) the collector of which is connected to the CR time constant circuit is set to ON in (3)-1) or in (3)-2) (④ or ④ is set to "H") to perform discharging.

During PLAY

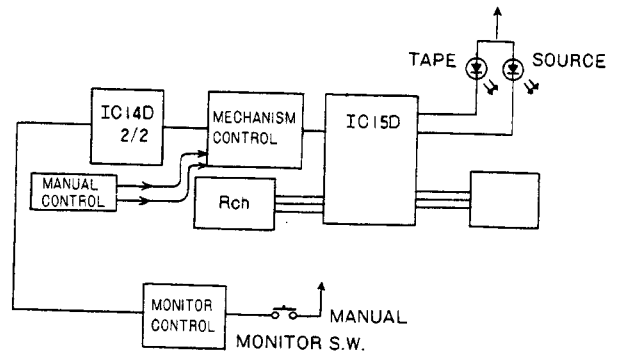
	AUTO B Signal (L:7Hz, R:9Hz)	AUTO C Signal (L:9Hz, R:7Hz)	AUTO OFF (NO Signal)
①	(L)	(L)	(L)
②	H	H	H
③	L	L	L
④	L	L	—
⑤	H	H	H
⑥	H	H	H
⑦	L	L	L
⑧	H	H	H
⑨	H	L	L
⑩	—	—	—
⑪	—	—	—
⑫	—	—	—
⑬	—	—	—
⑭	L	H	H
⑮	H	L	H
⑯	H	L	H
⑰	L	H	H
⑱	H	L	L
⑲	L	H	L
⑳	L	H	L
㉑	H	L	L
㉒	L	H	L
㉓	L	H	H
㉔	H	L	H
㉕	L	H	H
㉖	H	L	L
㉗	L	H	L
㉘	L	L	—
㉙	H	H	— (7Hz)
㉚	L	L	— (7Hz)
㉛	L	L	— (7Hz)
㉜	H	H	— (7Hz)
㉝	H	H	—
㉞	L	H	H
㉟	H	L	H
㊱	H	H	L
㊲	L	L	H

2. AUTO TAPE MONITOR SYSTEM

Outline

The auto tape monitor selects the MONITOR circuit automatically to "TAPE" and "SOURCE" in accordance with the mechanism operation. This system controls the circuit so that it is selected automatically to "TAPE" during PLAY and RECORD/PLAY and to "SOURCE" during independent recording and record-pause by means of output from the microprocessor controlling the mechanism. It is possible to select to TAPE or SOURCE manually by use of the MONITOR switch on the front panel.

Block diagram



2-1 T/S selection

During power ON

- ⑤ is set to "H" until Q13D is set to ON, ⑦ is set to "H", and ⑬ is directly set to "H" via R92D, and ⑨ is set to "H", and ⑪ to "L". → TAPE POSITION
- When ④ 0-SOURCE (during REC and REC-PAUSE) is set to "H" (30m sec) via mechanism control, ⑩ is set to "H" and ⑫ to "L". → SOURCE POSITION
- When ③ 0-TAPE (during PLAY and REC/PLAY) is set to "H" (30m sec) via the mechanism control, ⑨ is set to "H" and ⑪ to "L". → TAPE POSITION
- When the manual T/S SW is set to ON, "H" at ① passes through the differential circuit, ② is set to "H", and IC14D2/2 is the circuit that when ② is changed from "L" to "H", the "L", "H" mode of ⑦, ⑧ is inverted, so it is set in reverse to the state before the T/S SW is pressed. (For example: TAPE → SOURCE)

Note 1. The analog SW (pins 5, 6, 8, pins 9, 11, 12) of IC15D are selected according to the inputs (pins 14, 15).

2. When the mechanism control is operating in other modes than the above, 0-TAPE and 0-SOURCE are not output.

T/S selection

	(POWER ON)	① (T/S (PUSH))	② (T/S (PUSH))	③ (REC/SW ON)	④ (REC+PLAY/SW ON)
①	L	(L)	(L)	L	L
②	L	(L)	(L)	L	L
③	L	L	L	L	(L)
④	L	L	L	(L)	L
⑤	(L)	L	L	L	(L)
⑥	L	L	L	(L)	L
⑦	H	L	H	L	H
⑧	L	H	L	H	L
⑨	(L)	L	(L)	L	(L)
⑩	L	(L)	L	(L)	L
⑪	L	H	L	H	L
⑫	H	L	H	L	H
⑬	(L)	(L)	(L)	L	L

3. Auto REC level by use of electronic VR

Outline

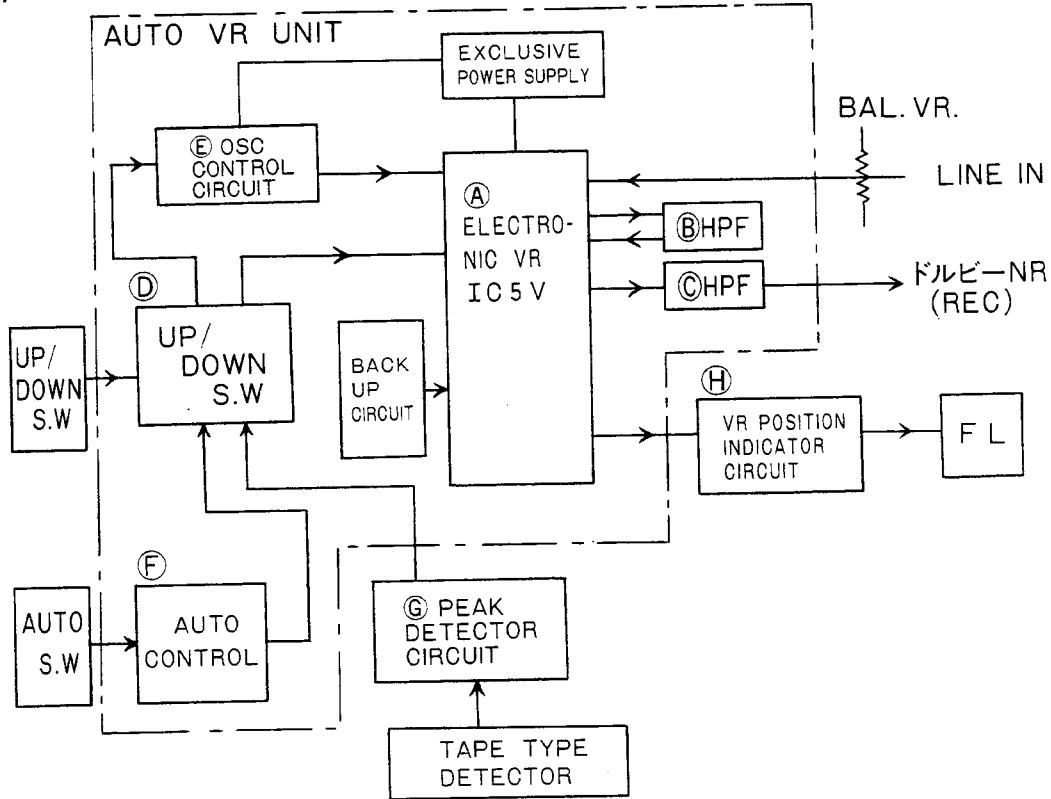
An electronic VR is used to set the record level in this unit. This electronic VR attenuates in 2 dB steps, from 0 dB to -66 dB, and the FL indicator lights in 10 steps corresponding to the attenuation level.

The operation is changed by one step (2 dB) each time the button is pressed and is varied continuously when the button is kept pressed.

Next, the auto REC level is the system to control the above electronic VR operation automatically.

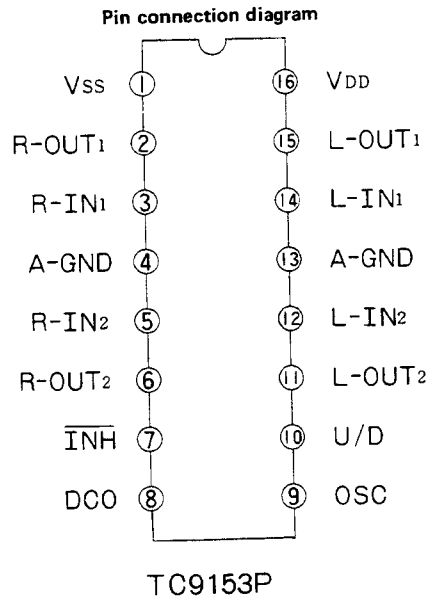
This system sets the recording level to the optimum level matching with the tape used when inputting the maximum level while the automatic switch is pressed.

Block diagram

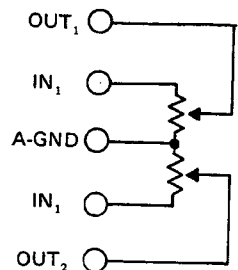
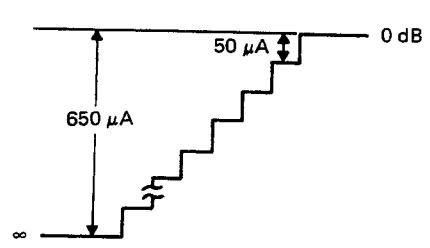
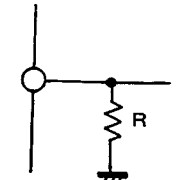
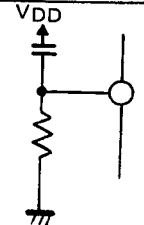


3-1. IC pin description

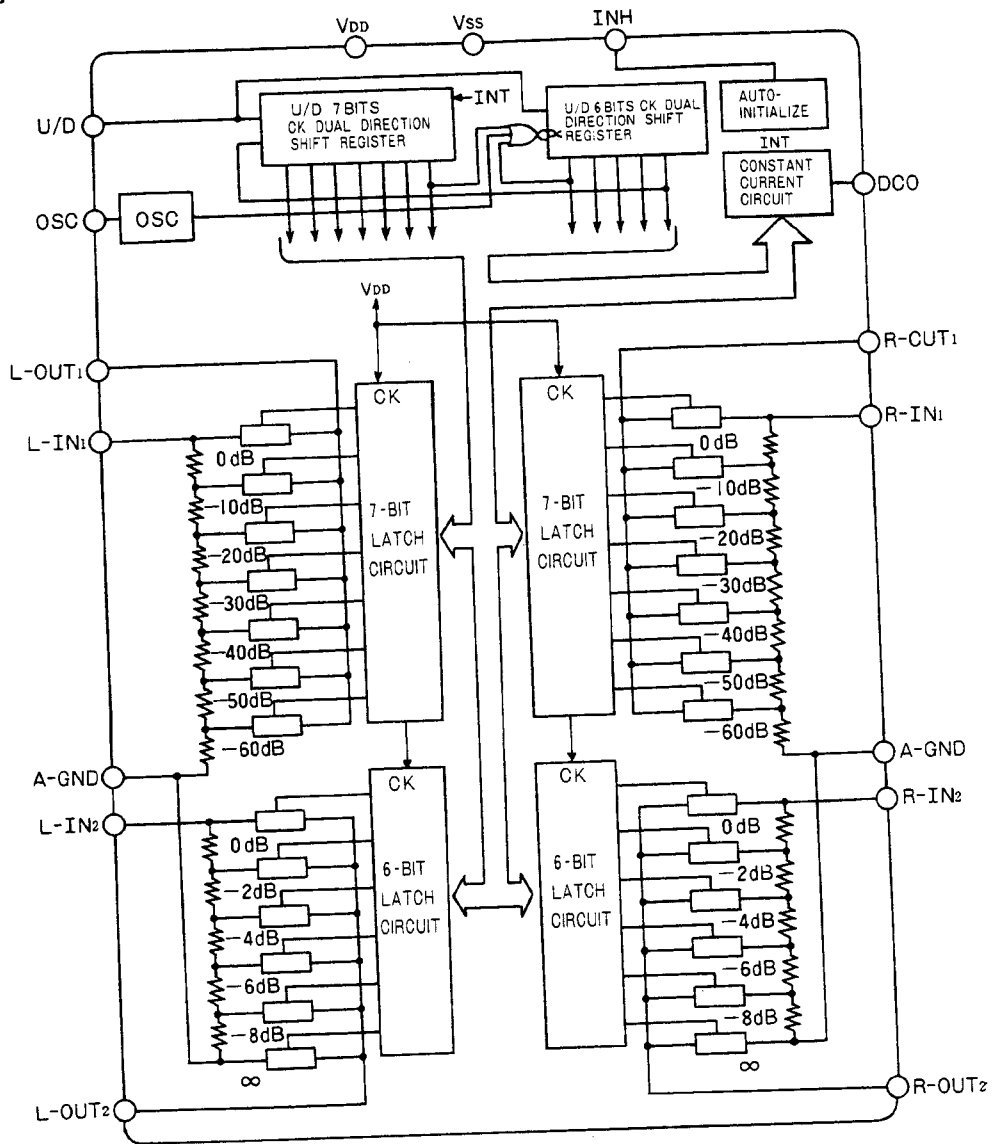
3-1-1. Pin arrangement



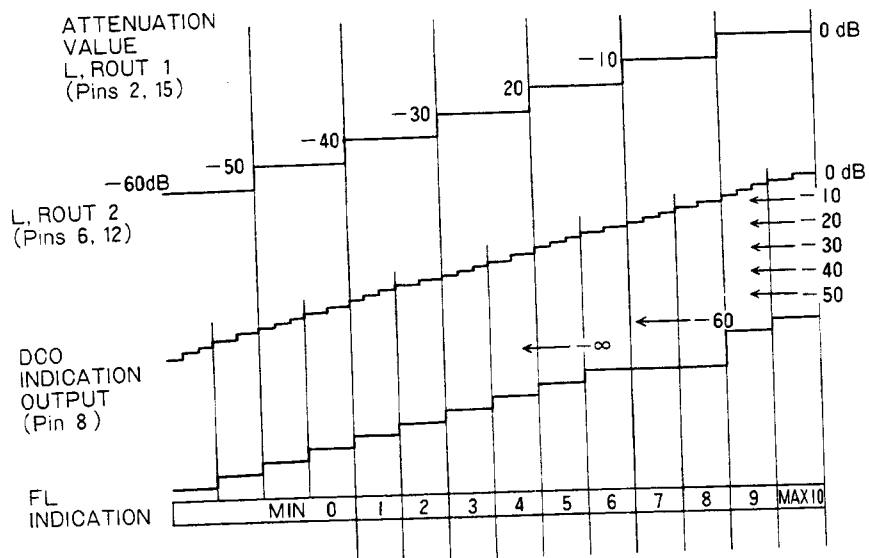
3-1-2. Pin function IC5V

Pin No.	Mark	Function	Remarks
2 15	R-OUT ₁ L-OUT ₁	10 dB-step attenuator outputs Signal applied to IN is attenuated in 7 steps, 0 – 60 dB in 10 dB steps.	<p>L, R Symmetry</p> 
3 14	R-IN ₁ L-IN ₁	10 dB-step attenuator inputs	
4 13	A-GND	GND pins	
5 12	R-IN ₂ L-IN ₂	2 dB-step attenuator inputs	
6 11	R-OUT ₂ L-OUT ₂	2 dB-step attenuator outputs Signal applied to IN is attenuated in 5 steps, 0 – 8 dB in 2 dB steps.	
7	INH	INHIBIT pin When this pin is set to "L", all input/output are shut off setting the INHIBIT mode. (STATE HOLDING) Normal operation in "H" level.	
8	DCO	Attenuation quantity indicator DC current output. Attenuation quantity 0 – ∞ is classified into 13 steps and current of approx. 50 μA/step is output.	  <p>* Attenuation quantity can be made symmetrical to the DC voltage by inserting a resistor between this pin and GND.</p>
9	OSC	Oscillator C.R. connection pin This is the attenuation quantity UP/DOWN control oscillator, and the UP/DOWN speed is determined by its time constant.	

3-1.3. Block diagram (TC 9153P)



3-1.4. IC3V Relation between attenuation value and VR position



3-2. Description of each block

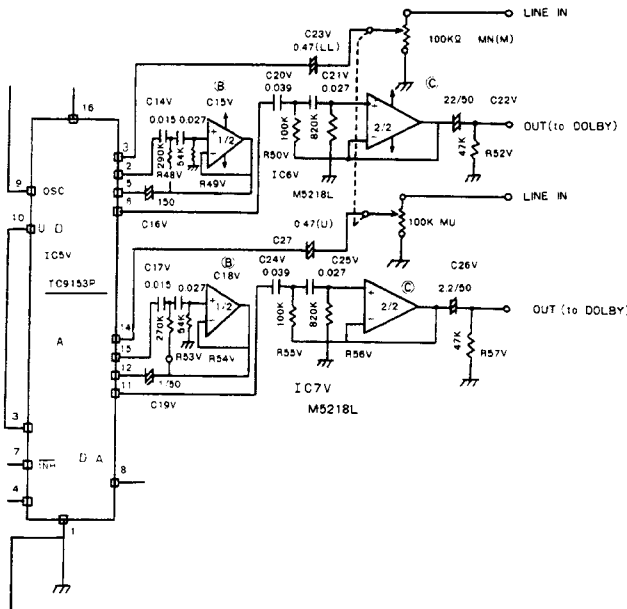
A Electronic VR IC, IC5V

- (1) The outputs (pins 6, 11) are changed by the UP/DOWN SW (1 push/2 dB) to LINE IN (pins 3, 14).
- (2) The UP position indication (pin 8) is changed by DC current output in 13 steps, and 10 steps are indicated by the FL display.
- (3) U/D (pin 10) controls the variation in the DOWN direction when the pin is set to "L", and in the UP direction when the pin is set to "H" or with no input.
- (4) OSC (pin 9) is oscillated via the external CR and the output is changed by 1 step (2 dB) every time the pin changes from "L" to "H".
- (5) INH (pin 7) is set to "H" with power ON and "L" with power OFF. Input/output is inhibited when it is set to "L" to maintain the back-up mode.
- (6) Pins 4, 13 supply 1/2 of the voltage supplied to IC.

B HPF: $f_0 \approx 16$ Q = 0.8 Active filter

This is installed in the IC5V (pins 2, 15) 10 dB-step attenuator output. The HPF is installed so that the low frequency noise component contained in the source is not mixed in the AUTO DOLBY signal (7 Hz, 9 Hz).

C HPF: This is installed in the IC5V (pins 6, 11) 2 dB-step attenuator output for the same purpose as in B.



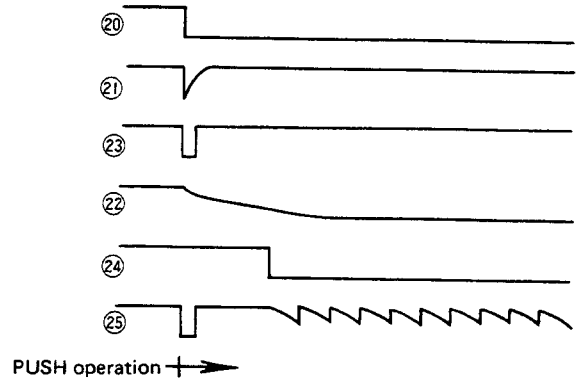
- D UP/DOWN control circuit
 - E OSC control circuit
 - F AUTO control circuit
- Refer to the circuit diagram on the separate sheet.

3-3. Circuit operations

3-3-1. UP operation (MANUAL)

- i) ① is set to "L" with AUTO SW open
- ii) ② is set to "H", ③ to "H" and ④ to "L".
- iii) ② is set to "H" with UP SW pressed, so ⑤ is set to "H".
- iv) ⑫ is set to "H" and ⑭ to "L" regardless of the state of ④.
- v) ⑥ is set to "L" as DOWN SW is set open.
- vi) ② is set to "H", so ⑧ is set to "L", ⑨ to "H" regardless of the condition of ⑦, and 10 to "H", so, ⑪ is set to "L".
- vii) ⑬ is set to "L", and ⑭ to "L" as seen in v), vi), so ⑮ is set to "H".
- viii) IC5V pin 10 has no input and determines the UP direction mode.

- ix) At the same time, ⑤ is set to "H", so ⑱ is set to "H", ⑲ to "L" and Q4V is set to ON and ⑰ to "H" and ⑳ to "L".
- x) When ⑳ is set to "L" from "H" as shown above, ㉑ ~ ㉕ are set as follows and input to TC9153P pin 9.



Continuous operation (when pressed continuously)



3-3-2. DOWN operation (MANUAL)

- i) Same as UP operation
- ii) Same as UP operation
- iii) ⑥ is set to "H" with DOWN SW pressed.
- iv) ⑬ is set to "H" and ⑮ to "L" regardless of the state of 11.
- v) ⑤ is set to "L" as UP SW is open.
- vi) ④ is set to "L" because of ii).
- vii) ⑫ is set to "L", ⑮ to "L" as shown in v), vi), so ⑭ is set to "H".
- viii) IC5V pin 10 is set to "L" and determines the DOWN direction.
- ix) At the same time, as ⑥ is set to "H", ⑱ is set to "H"; it matches the condition during UP operation and the same subsequent operation is done.

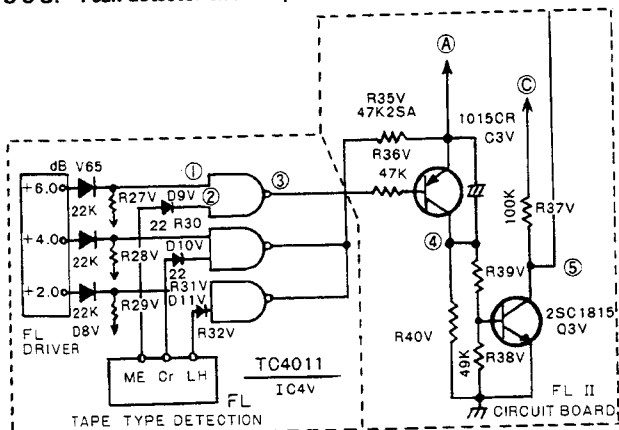
3-3-3. AUTO circuit operation (before peak detection)

- i) 0-REC is set to "L" during REC, and when AUTO SW is pressed, ① is set to "H", ② to "L", ③ is set to \uparrow and ④ to \downarrow . ("H" for a specified time).
- ii) As ② is set to "L", MANUAL UP/DOWN operations are not done, and ⑤, ⑥ are set to "L".
- iii) ⑫ is set to "H" and ⑭ to "L" while ④ is set to "H".
- iv) ⑧ is set "L", ⑨ to "H", ⑩ to "H" and ⑪ to "L" while peak detector circuit G output ⑦ is "H".
- v) ⑬ is set to "L" as shown in ii), iv) and ⑭ to "L" as shown in iii), so ⑮ is set to "H".
- vi) IC5V pin 10 is set to no input, and determined the UP direction mode.
- vii) ② is set to "L" as shown in i), ⑭ to "L" as shown in iii) and ⑯ to "H" and ⑰ to "H".
- viii) 20 is set to "L" becoming the same operation as in x) in the UP operation.

3-3-4. AUTO circuit operation (after peak detection)

- i) When peak detection is done after operation (3), ⑦ is set to "L".
- ii) ② is set to "L", so ⑧ is set to "H", ⑨ to "L".
- iii) Pin 10 is set to  and ⑪ to  (Monostable multivibrator).
- iv) ⑬ is set to "H" and ⑮ to "L" while ⑪ is set to "H".
- v) IC5V pin 10 is set to "L", and determines the DOWN direction mode.
- vi) When the time ⑦ is set to "L" is longer than the time ⑪ is set to "H" in iii), ⑧ being "H" directly sets ⑰ to "H".
- vii) 20 is set to "L" causing the same operation as the continuous operation in x) in the UP operation, and the REC LEVEL drops.
- viii) When REC drops to the point where peak does not appear, ⑦ is set to "H". As a result, ⑧ is set to "L", ⑰ to "L" and 20 is set to "H" and the DOWN operation stops.
- ix) The time ⑦ is set to "L" is shorter than the time ⑪ is set to "H" in iii), ⑰ is set to "H" for the time ⑪ is set to "H", and ⑳ is set to "L".
- x) ㉑ is set to "L" for a certain time, it becomes same as in the 1-push operation is x) in the up operation, and performs 1-step (2 dB) DOWN operation.

3-3-5. Peak detector circuit operation



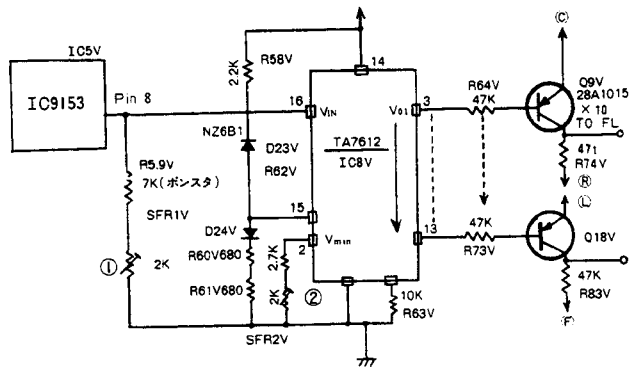
The detection peak values are set to METAL: +6 dB, CrO₂: +4 dB, and NORMAL: +2 dB to set the best level according to the type of tape.

(Example)

AUTO operation with METAL tape

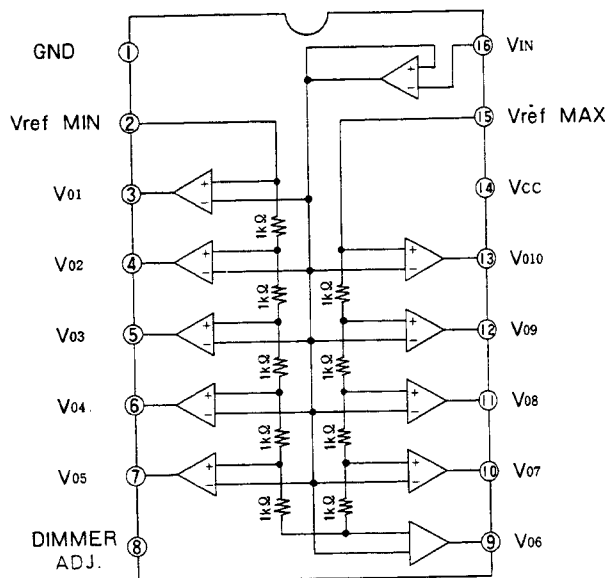
- i) METAL ② is set to "H" by tape type detection
- ii) ① is set to "H" when the peak value exceeds +6 dB.
- iii) ③ is set to "L" Q2V to ON and ④ to "H".
- iv) Q3V is set to ON, ⑤ to "L" and the peak detection circuit output is set to "L". The operation is the same when CrO₂ and NORMAL tapes are used.

3-3-6. VR position indicator circuit operation



- i) IC5V (pin 8) output is 13-step output with DC current. 10 steps from a MAX of these are used to light FLs 1 to 10.
*IC5V (pin 8) output current is uneven, so it is adjusted via SFR1V, (SFR2K), SFR2V, (SFR2K). Max 10 are adjusted by SFR1V, and SFR2V is adjusted at the 20-push point (-40 dB).

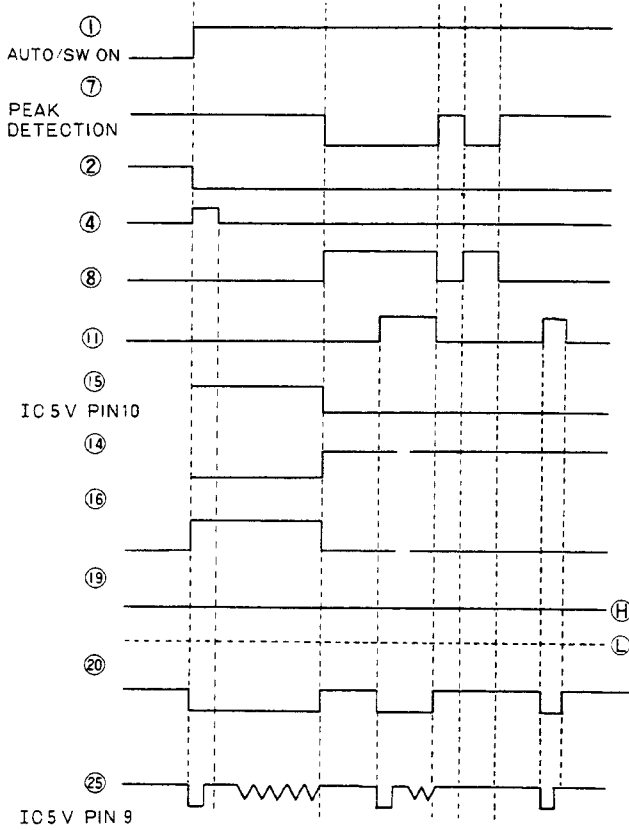
TA7612AP



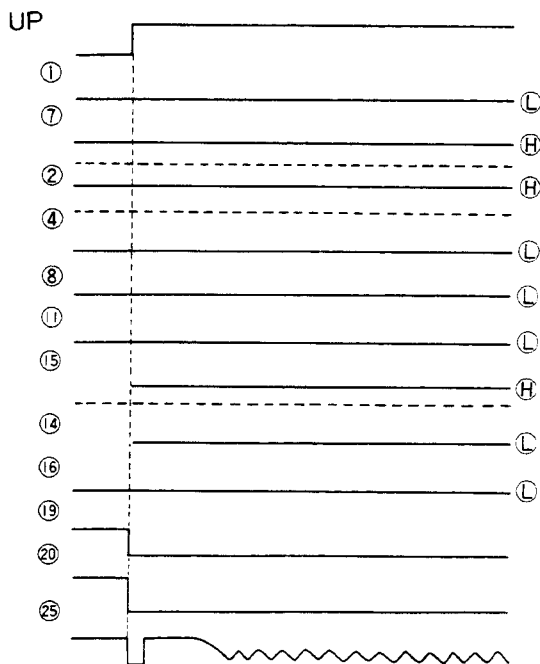
3-4. Outline of operation (Timing chart)

Refer to the separate circuit diagram for the values shown inside the circles.

3-4-1. AUTOMATIC



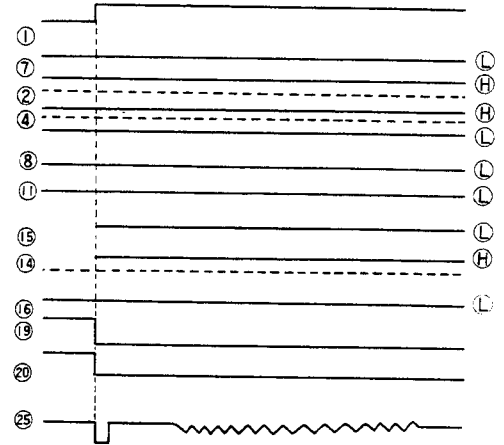
3-4-2. UP



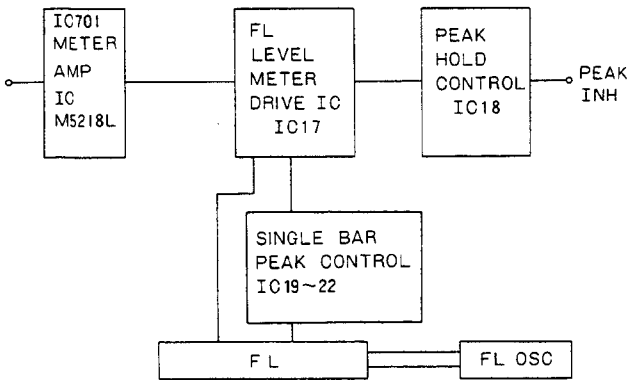
3-4-3. DOWN

*Only known that pins ⑤, ⑥ are UP.

DOWN



4. FL Bar meter circuit



4-1. FL level meter drive IC

The FL level meter drive IC17 dynamically drives 18 points each in 2 (L, R) channels, totalling 36 points, and in addition, is provided with function to peak-hold at levels -8 dB or higher. Relation between the lighting level and IC pins is as follows.

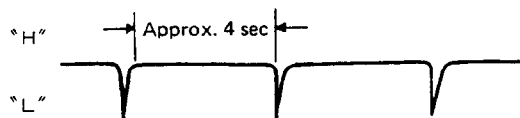
Pin No.	6	7	8	9	10	11	12	13	14	Pin
Lighting level	-20	-15	-10	-8	-6	-4	-3	-2	-1	dB

Pin No.	15	16	17	18	19	20	21	22	23	Pin
Lighting level	0	$+1$	$+2$	$+3$	$+4$	$+5$	$+6$	$+8$	$+10$	dB

The dynamic system is applied to the inputs of IC17 pins 27, 28, and they are selected by operating the internal oscillator via C34. This selection pulse appears at pins ④ and ⑤, and when they are set to "H" (+5V) respectively, the channel of the FL connected to each pin lights.

4-2. Peak hold control section.

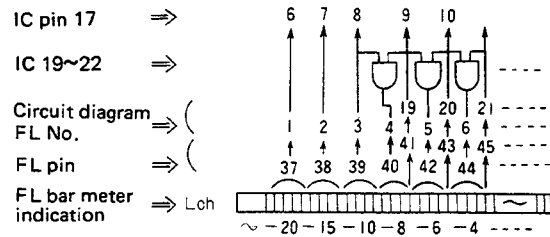
When IC17 pin ⑭ drops to "L" (-15 V), the peak hold is reset and it continues while the pin is set to "H" (0V). This control section generates the pulse as shown below and is set to "L" at the interval of approx. 4 sec and is then reset. This circuit is provided with the PEAK INH (peak inhibit) pin; when this pin is set to "H", Tr is set to ON and the PEAK HOLD keeps the reset mode.



The PEAK INH circuit is peak-reset during the AUTO VR operation, so the pin is set to "H" for the time being.

4-3. Single bar PEAK section

(Relation between the FL bar meter and FL pin)



The bar meter lighting system is as follows.

When IC17 pin ⑥ is set to "H", the FL pin ③⑦ is set to "H" and 4 bars (-20 dB \times 4) of the bar meter indicators are lit simultaneously. When IC17 pin ⑧ is set to "H", 4 bars (-10 dB \times 4) are lit in the same way and both the -15 dB and -20 dB bars are lit at this time. When IC17 pin ⑨ is set to "H", the FL pin ④① is set to "H" and only one bar between -8 dB and -6 dB is lit. Moreover, pin ⑧ is also set to "H" at that time, both inputs of the AND circuit (IC19-IC22) are set to "H" and the outputs are also set to "H".

Then the FL pin ④① is set to "H" to light 3 bars (-8 dB \times 3). One bar has been lit by pin ④①, so 4 bars in total are lit, and then all the bars (-10 dB, -15 dB, -20 dB).

Next, when the input disappears and the unit enters the PEAK HOLD mode, only IC17 pin ⑨ is set to "H", and pins ⑧, ⑦, ⑥, are set to "L".

Only the FL pin ④① is set to "H" at that time, and pins ④②, ③⑧, ③⑦ are set to "L" and only one bar between -8 dB and -6 dB is lit and -8 dB is lit in peak hold.

As for the others, entirely the same operation is applied.

4-4. FL OSC

The FL OSC is composed of the push-pull oscillator (approx. 50 kHz) and supplies to the FL filament pins ① and ⑦⑥

ACCESSORIES/PACKAGE LIST

af. No.	Part No.	Part No. Changed to	Description	Common Model	Q'ty
1	82-188-854-01		Printed indiv., Packing	*	1
2	82-188-852-01		Cushion L, Printed indiv.	*	1
3	82-188-853-01		Cushion R, Printed indiv.	*	1
4	87-051-131-11		Poly-vinyl sack (H, HU, U models only)		1
5	87-051-135-11		Poly-vinyl sack (E, K, G models only)		1
6	87-056-627-01		Poly-vinyl sack		1
7	82-190-855-01		Pad, Auxiliary	AD-F660	1
8	82-188-905-01		Instructions booklet	*	1
9	87-051-171-11		Poly-vinyl sack		1
10	87-056-008-11		Label, AC power cord (K model only)		1
11	87-056-009-51		Distributors list (H, E, K, G models only)		1
12	87-056-045-01		Guarantee card (HU, U models only)		1
13	87-056-057-01		Service station list (HU, U models only)		1
14	87-056-059-01		Guarantee card (G model only)		1
15	87-056-050-01		Safety instruction (U model only)		1
16	87-032-845-01		Siemens plug (H, HU models only)		1
17	87-034-978-01		Connection cord CW-254 BSK		2

ELECTRICAL MAIN PARTS LIST

Symbol No.	Part No.	Description	Symbol No.	Part No.	Description	Symbol No.	Part No.	Description	Symbol No.	Part No.	Description	Symbol No.	Part No.	Description	Symbol No.	Part No.	Description					
« MAIN CIRCUIT BOARD SECTION »												« KEY BOARD-1 CIRCUIT BOARD SECTION »										
PCB-A	*	Main circuit board	D26,27,28,29	88-052-188-11	Diode, 1S188FM			< Capacitors >	△R924	87-029-017-01	< Resistor > 10Ω 1/4W Fuse resistor	PCB-L										
④IC1	82-191-645-01	IC, μPD546C-357	D30,801	87-027-365-01	Diode, S5277B	C28	82-191-665-01	0.022F 5V Super capacitor	C40	87-014-118-01	< Capacitors > 0.015μF PP	D52										
IC4,202	87-027-538-01	IC, μPD4069	D33,34,35, 43,44,45	87-027-097-01	Diode, 1S1555	C205,206	87-014-119-01	0.027μF PP	C44	87-015-141-01	10μF 16V Electrolytic BP	D53										
IC5	87-027-909-01	IC, M54523P	D505	87-027-555-01	Zener diode, HZ-5C2	C209,210, 309,310	87-015-425-01	0.1μF Aluminum solid	« FRTS CIRCUIT BOARD SECTION »													
IC6	87-027-840-01	IC, M54519P	D803, 904	87-027-244-01	Zener diode, 05Z8.2U	C401,402	87-014-049-01	470pF PP	PCB-E	*	FRTS circuit board	④IC3	82-191-643-01	IC, LA6505C-609								
IC11	87-027-429-01	IC, TC4016BP	D901	87-027-815-01	Diode, 1B4B1 (H, HU models only)	C403,404, 515,516	88-707-789-81	0.33μF 100V TF	IC8,9,10	87-027-948-01	IC, M54514AP	Q23~32	89-320-011-01	Transistor, 2SC2001K	S8,9,10,16, 17							
④IC12	87-027-800-01	IC, HD14007UBP	D901	87-020-025-01	Diode, 2B4B1 (U, E, K, G models only)	C411,412	87-014-051-01	560pF PP	Q38,39	89-309-455-61	Transistor, 2SC945L (PQ)	D36	87-027-393-01	Zener diode, HZ4C2	CN10							
IC13,14,15	87-027-235-01	IC, NJM4558D	D901	87-020-025-01	Diode, 2B4B1 (U, E, K, G models only)	C501	87-014-118-01	0.015μF PP	D37,38,39	87-027-219-01	Diode, MA150	CN11										
IC16	87-027-510-01	IC, μPD4001	D902	87-027-475-01	Zener diode, HZ-6B1	C507	87-015-379-01	1μF 50V Electrolytic BP	« AUTO STOP CIRCUIT BOARD SECTION »													
IC201	87-027-949-01	IC, NJM2043S-A	D903,905	87-027-393-01	Zener diode, HZ-4C2	C523,524	87-014-061-01	1500pF PP	PCB-F	81-506-605-01	Auto stop circuit board	CN12										
IC301,401, 402,501, 504	87-027-895-01	IC, M5218L	D906	87-027-469-01	Zener diode, HZ-16-2	C525,526	87-014-055-01	820pF PP	CP501,502	87-027-644-01	Photo sensor, NJL-5141EA	CN13										
IC502,503	87-027-986-01	IC, NJM4560	D910	87-027-364-01	Zener diode, HZ-12A3L	C531,532	87-014-037-01	150pF PP	« SWITCH-1 CIRCUIT BOARD SECTION »													
IC601	87-027-739-01	IC, NJM4556D	L1	82-191-656-01	Coil, 400K 10EZ	« DOLBY-NR 1,2 CIRCUIT BOARD SECTION »			PCB-G	*	Switch-1 circuit board	CN14										
IC901	87-027-919-01	IC, M5230L	L301,302	82-190-629-01	Filter LP, 85K-2	PCB-B, C	82-191-630-01	Dolby-NR unit 3H ass'y	△S26	87-031-753-01	Push-switch (POWER)	CN15										
Q3,4,5,6, 18,33,34, 35,36	89-107-335-61	Transistor, 2SA733K (P)	L303,304	87-030-061-01	Filter LP, 85K	L1,2	82-190-640-01	Dolby-NR 1,2 circuit board	△F1	87-035-219-01	Fuse, "T" 500mA (H, HU models only)	CN16										
Q7,8	89-109-521-01	Transistor, 2SA952 (K)	L501	82-190-666-01	OSC coil, EH	PIN	87-027-918-01	IC, HA12038-01	△F1	87-035-145-01	Fuse, "T" 250mA (E, K, G models only)	CN17										
Q9	89-408-862-01	Transistor, 2SD886 (Q)	L502,503	87-003-051-01	Choke coil, 470μH	PIN	87-005-155-01	Coil, 36mH	△F1	87-035-294-01	Fuse, "T" 500mA (U model only)	CN18										
Q10,11,12, 13,14,15, 16,17,37, 201,202, 203,204, 301,302, 413,504, 505,506, 507,508, 809	89-309-455-61	Transistor, 2SC945L (PQ)	L505,506	82-190-627-01	Coil, F10	C15,16	87-015-617-01	10μF 16V Electrolytic LL	△C918	87-019-110-01	< Capacitors > 0.01μF Spark killer (H, HU models only)	CN19										
Q40,401,402, 403,404, 405,406, 407,408, 409,410, 802,910	89-318-155-01	Transistor, 2SC1815 (GR)	L507,508	82-371-622-01	Coil, 23mH	C21,22,23, 24,45,46	87-015-366-01	0.15μF 10V Aluminum solid	△C918	87-019-112-01	< Capacitors > 0.01μF Spark killer (U, E, K, G models only)	CN20										
Q41	89-110-155-01	Transistor, 2SA1015 (GR)	RY301	87-031-751-01	SW solenoid	« FL CIRCUIT BOARD SECTION »			△C918	87-019-110-01	< Capacitors > 0.01μF Spark killer (H, HU models only)	CN21										
Q45	89-502-465-01	FET, 2SK246GR	J1,2	82-191-648-01	Jack, 6.3φ w/switch (MIC)	PCB-D	*	FL circuit board section	△C918	87-019-112-01	< Capacitors > 0.01μF Spark killer (U, E, K, G models only)	CN22										
Q411,412, 501,502, 803,804, 805,806, 807,808	89-320-011-01	Transistor, 2SC2001K	J3,4,5,6	87-049-055-01	Pin jack, 4P (LINE IN, LINE OUT)	④IC2	82-191-644-01	IC, HD38755A62	« SWITCH-2 CIRCUIT BOARD SECTION »													
Q503	89-108-854-01	Transistor, 2SA885R	J8	87-032-985-01	DIN socket, 8P (REMOTE)	IC17	87-027-920-01	IC, AN6870N	PCB-H	*	Switch-2 circuit board	CN23										
Q509,510	89-321-204-01	Transistor, 2SC2120Y	S2	82-191-655-01	Push-switch (MONITOR)	IC18,4V	87-027-564-01	IC, TC4011BP	S1	82-191-657-01	Slide switch (TIMER)	CN24										
Q901,903, 906	89-210-154-51	Transistor, 2SB1015Y (GR)	S18	87-031-752-01	Slide switch (MPX FILTER)	④IC19,20,21, 22	87-027-565-01	IC, TC4081BP	« VOLUME CIRCUIT BOARD SECTION »													
Q902	89-414-064-51	Transistor, 2SD1416Y (GR)	SFR1	87-021-570-01	Semi-fixed resistor, 100kΩ-B	IC701	87-027-895-01	IC, M5218L	PCB-I	*	Volume circuit board	CN25										
Q904	89-414-064-51	Transistor, 2SA885R (H, HU, U models only)	SFR201,202, SFR203,204	87-021-624-01	Semi-fixed resistor, 50kΩ-B	Q19~21, 701,702, 912V	89-309-455-61	Transistor, 2SC945L (PQ)	VR201	82-191-646-01	Volume 10kΩ-A (OUTPUT LEVEL)	CN26										
Q905	89-414-064-51	Transistor, 2SD1406Y (GR) (H, HU, U models only)	SFR403,404	87-021-687-01	Semi-fixed resistor, 30kΩ-B	Q22	89-318-156-01	Transistor, 2SC1815 (BL)	VR203	82-188-606-01	100kΩ-MW (BALANCE)	CN27										
Q905	89-408-804-51	Transistor, 2SD880GRY (E, K, G models only)	SFR501,502	87-021-622-01	Semi-fixed resistor, 10kΩ-B	Q907,908	89-313-846-01	Transistor, 2SC1384 (R)	CN24	82-188-627-01	Connector ass'y, 6P RBAL	CN28										
Q909	89-406-555-01	Transistor, 2SD655E	PIN1	87-049-279-01	Pin, 9P	D20,21,22, 23,63,64, 65,66,67, 68,70,703, 704,705	87-027-219-01	Diode, MA150	CN31	82-188-624-01	Connector ass'y, 6P PBVR	CN29										
D1~19,24 25,31,32, 40,41,42, 46~49, 201~204, 501,502,503, 507~510, 804,805, 808,809	87-027-219-01	Diode, MA150	PIN2,31 PIN3 PIN4 PIN5,6,8, 13 PIN7 PIN10 PIN11,16,17 PIN15 PIN18 CN19 CN20 CN21 CN28 CN29	87-049-034-01 87-049-143-01 87-049-143-01 82-191-687-01 82-191-689-01 82-191-688-01 82-188-621-01 82-188-638-01	Pin, 9P Pin, 6P Pin, 10P Pin, 12P Pin, 3P Pin, 7P Pin, 8P Pin, 5P Pin, 4P Pin, 3P Connector ass'y, 3P-B Connector ass'y, 3P-A Connector ass'y, 4P Connector ass'y, 3P D-A Connector ass'y, 3P A-OD	< Resistors > 4.7Ω 1/4W Fuse resistor 47Ω 1/4W Fuse resistor	87-029-089-01 87-029-023-01	22Ω 1/4W Fuse resistor 4.7Ω 1/4W Fuse resistor (H, HU, U models only) 10Ω 1/2W Fuse resistor (E, K, G models only) 33Ω 1/2W Fuse resistor (H, HU, U models only) 15Ω 1/4W Fuse resistor (E, K, G models only) 3.3Ω 1/2W Fuse resistor 1.5Ω 1/2W Fuse resistor	« JACK CIRCUIT BOARD SECTION »													
△R505	87-029-089-01	4.7Ω 1/4W Fuse resistor	△R541,542, 901,902	87-029-089-01	22Ω 1/4W Fuse resistor	« KEY BOARD-1 CIRCUIT BOARD SECTION »								PCB-J	*	Jack circuit board	△IC9D					
△R541,542, 901,902	87-029-023-01	47Ω 1/4W Fuse resistor	△R903,904	87-029-007-01	22Ω 1/4W Fuse resistor	PCB-K	82-188-611-01	Printed circuit board B ass'y	△IC9D													
△R903,904	87-029-007-01	22Ω 1/4W Fuse resistor	△R912	87-029-083-01	10Ω 1/2W Fuse resistor	S3,4,27, 28,29,30, 31,32	82-188-612-01	Key board-1 circuit board	IC10D													
△R912	87-029-083-01	10Ω 1/2W Fuse resistor	△R913	87-029-084-01	33Ω 1/2W Fuse resistor	SFR701,702 SFR703	87-031-498-01	Push-switch (D-MANUAL, D-AUTO, OFF, B, C, REC LEVEL, DOWN, UP)	IC11D,15D													
△R913	87-029-084-01	33Ω 1/2W Fuse resistor	△R918 R919	87-029-361-01 87-029-019-01	15Ω 1/4W Fuse resistor (E, K, G models only) 3.3Ω 1/2W Fuse resistor 1.5Ω 1/2W Fuse resistor	PIN12 PIN14 PIN19,20 PIN21 CN6 CN7 CN8 CN30	87-049-050-01 87-049-034-01 87-049-038-01 82-191-688-01 82-191-690-01 82-191-696-01 82-191-698-01 82-188-622-01	Semi-fixed resistor, 10kΩ-B Pin, 6P Pin, 4P Pin, 3P Pin, 4P Connector ass'y, 3P-B Connector ass'y, 7P Connector ass'y, 3P-C Connector ass'y, 3P	IC12D													
△R918 R919	87-029-361-01 87-029-019-01	3.3Ω 1/2W Fuse resistor 1.5Ω 1/2W Fuse resistor							IC13D													
									IC14D													

● Ceramic capacitor

87-018-□□□-01

Capacitor	Parts code
100 P	0 3 2
150 P	0 3 4
180 P	0 3 5
220 P	0 3 6
470 P	0 4 0
1000 P	0 4 4
0.01	0 4 7

Description	Symbol No.	Part No.	Description
◀ KEY BOARD-2 CIRCUIT BOARD SECTION ▶			
>		82-188-610-01	Control key A2 Ass'y
W Fuse resistor	PCB-L	82-190-642-01	Key board-2 circuit board
's >	D52	87-027-922-01	LED, SR206D (PAUSE)
PP	D53	87-027-923-01	LED, SY406D (PLAY)
✓ Electrolytic BP	D54,55	87-027-921-01	LED, SR506D (REC REC MUTE)
.	S2,5,6,7,	87-031-498-01	Push-switch (MONITER T/S
it board	11,12,13,		STOP, PAUSE, REC MUTE,
C-609	14,15,19		REW, PLAY, FF, REC, MS
AP		87-031-642-01	COMPU BRAIN)
2SC2001K	S8,9,10,16,		Tact switch (RESET, MEMO
2SC945L (PQ)	17		REWIND, REPLAY/STOP, TAPE
, HZ4C2		82-190-643-01	Connector ass'y, 8P
50	CN10	82-190-645-01	Connector ass'y, 5P
	CN11	82-191-652-01	Connector ass'y, 6P
	CN12	82-190-651-01	Connector ass'y, 3P
	CN13	82-190-609-01	Connector ass'y, 3P
	CN25		

Description	Symbol No.	Part No.	Description
◀ LED CIRCUIT BOARD SECTION ▶			
ION >	PCB-M	*	LED circuit board
circuit board	D51,60,808	87-027-542-01	LED, LN217RP
, NJL-5141EA			(METAL, C, INTRO)
	D50,56,57,	87-027-543-01	LED, LN317GP (MS, BIAS, CAL,
IN >	58,62,		EQ, NORMAL, B, TAPE)
suit board	807,809		
(POWER)	D59	87-027-819-01	LED, LT-9030N, G3-8 (READY)
30mA	D61,504,806,	87-027-671-01	LED, LN417YP (CrO ₂ , ADMS,
els only)	810		SOURCE, AUTOMATIC)
50mA	CN14	82-191-691-01	Connector ass'y, 4P-A
els only)	CN15	82-188-626-01	Connector ass'y, 5P DLED
30mA (U model only)	CN16	82-191-695-01	Connector ass'y, 5P-B
	CN17	82-191-694-01	Connector ass'y, 5P-A

Description	Symbol No.	Part No.	Description
◀ AUTO VOLUME CIRCUIT BOARD SECTION ▶			
i >	PCB-N	*	Auto volume circuit board
Spark killer	IC1V	87-027-665-01	IC, TC4071BP
els only)	④ IC2V	87-027-298-01	IC, C-MOS4001 NOR
Spark killer	IC3V	87-027-538-01	IC, μPD4069
models only)	IC5V	87-027-988-01	IC, TC9153BP
N >	IC6V,7V	87-027-895-01	IC, M5218L
suit board	Q1V,4V,5V,	89-318-155-01	Transistor, 2SC1815 (GR)
(TIMER)	6V,7V		
V >	D1V,2V,3V,	87-027-219-01	Diode, MA150
it board	5V,12V,13V		
2-A	14V,15V,16V		
EVEL)	17V,18V,19V		
BALANCE)	20V,21V		
s'y, 6P FBAL	D22V	87-027-320-01	Zener diode, HZ-7C2
s'y, 6P PBVR	PIN22	87-049-050-01	Pin, 6P
	PIN23	87-049-274-01	Pin, 4P
	PIN24	87-049-276-01	Pin, 6P
board	PIN30	87-049-273-01	Pin, 3P
PHONES)		87-049-113-01	Pin, 3P
		87-049-114-01	Pin, 4P

Description	Symbol No.	Part No.	Description
◀ AUTO DOLBY-1 CIRCUIT BOARD SECTION ▶			
ITION >	PCB-O	*	Auto dolby-1 circuit board
it board B ass'y	IC1D	87-027-895-01	IC, M5218L
circuit board	IC2D,3D,	87-027-990-01	IC, LM567CN
D-MANUAL,	4D,5D		
F, B, C, REC	IC6D,7D	87-027-987-01	IC, NJM072DH
IN, UP)	IC8D	87-027-429-01	IC, TC4016BP
s'y, 6P	④ IC9D	87-027-564-01	IC, C-MOS TC4011BP
s'y, 7P	IC10D	87-027-657-01	IC, TC4028BP
	IC11D,15D	87-027-917-01	IC, TC9145
	④ IC12D	87-027-565-01	IC C-MOS TC4081BP
	④ IC13D	87-027-298-01	IC, C-MOS4001 NOR
	IC14D	87-027-989-01	IC, TC4027BP

Symbol No.	Part No.	Description
Q1D,2D,3D,	89-318-155-01	Transistor, 2SC1815 (GR)
4D,13D,15D,		
16D		
Q5D,6D,7D,	89-110-155-01	Transistor, 2SA1015 (GR)
8D,9D,10D,		
12D,14D		
D1D	87-027-475-01	Zener diode, HZ-6B1
D2D,3D,4D,	87-027-219-01	Diode, MA150
5D,6D,8D,		
9D,10D,11D,		
13D,14D,15D,		
16D,17D,19D,		
20D,21D,22D,		
24D,25D,26D,		
28D,29D,30D,		
31D,32D,33D,		
34D,35D,36D,		
41D,42D,43D,		
44D		
D18D	87-027-393-01	Zener diode, HZ-4C2
SFR1D,2D,	87-021-749-01	Semi-fixed resistor, 470kΩ-B
3D,4D		
PIN15	87-049-276-01	Pin, 6P
PIN25,27,	87-049-273-01	Pin, 3P
28,29		
PIN26	87-049-044-01	Pin, 7P
	82-188-616-01	Pin, 3P
	82-188-618-01	Pin, 5P
		< Capacitors >
		47μF 10V Electrolytic BP
		0.12μF TF
C2D	87-015-639-01	
C23N,24N	88-707-969-81	

Symbol No.	Part No.	Description
◀ FL-2 CIRCUIT BOARD SECTION ▶		
PCB-P	*	FL-2 circuit board
IC1V	87-027-832-01	IC, TA7612AP
Q2V,3V	89-318-155-01	Transistor, 2SC1815 (GR)
Q9V,10V,11V,	89-110-155-01	Transistor, 2SA1015 (GR)
12V,13V,14V,		
15V,16V,17V,		
18V		
D23V	87-027-475-01	Zener diode, HZ-6B1
SFR1V,2V	87-021-465-01	Semi-fixed resistor, 2kΩ-B
CN23	82-188-625-01	Connector ass'y, 4P FL
	87-049-117-01	Pin, 7P
	87-049-119-01	Pin, 9P
		< Resistor >
		2kΩ
R59V	82-188-640-01	

Symbol No.	Part No.	Description
◀ FILTER CIRCUIT BOARD SECTION ▶		
PCB-Q	*	Filter circuit board
IC203	87-027-895-01	IC, M5218L
CN27	82-188-623-01	Connector ass'y, 4P D-IN
	87-049-119-01	Pin, 9P

Symbol No.	Part No.	Description
◀ MISCELLANEOUS ▶		
△ T1	82-188-644-01	Power transformer (H, HU models only)
△ T1	82-188-643-01	Power transformer (U model only)
△ T1	82-188-642-01	Power transformer (E model only)
△ T1	82-188-641-01	Power transformer (K, G models only)
RPH	87-046-227-11	REC/PB head
EH	87-046-192-01	Erase head
M501	87-045-175-01	DC motor system servo motor
M502	09-011-038-01	Reel motor ass'y

Symbol No.	Part No.	Description
D907	87-027-944-01	LED, SLF301C
△	87-034-958-01	AC power cord (H, HU models only)
△	87-034-578-01	AC power cord (U model only)
△	87-034-877-01	AC power cord (E model only)
△	87-034-975-01	AC power cord (K model only)
△	87-034-892-01	AC power cord (G model only)
△	87-085-184-01	Cord bushing (H, HU, U models only)
△	87-085-185-01	Cord bushing (E, K, G models only)
S20,21,22,	81-505-607-01	Leaf switch (REC, CrO ₂ , METAL, CASSETTE)
23		
S24,25	81-505-601-01	Leaf switch (PLAY, PAUSE)
△ S33	87-031-586-01	Rotary switch (VOLTAGE SELECTOR) (H model only)
CN1	81-505-631-11	Connector ass'y, 9P
CN2	81-507-602-01	Connector ass'y, 6P
CN3	81-505-632-01	Connector ass'y, 10P
CN4	81-507-601-01	Connector ass'y, 12P

△ Safety component symbol

This symbol is given to important parts which serve to maintain the safety of the product, and which are made to conform to special safety specifications. Therefore, when replacing a component with this symbol, make absolutely sure that you use a designated part.

Note: Combination Circuit Board

The parts on the electrical parts list which are indicated by an asterisk (*) are supplied as one single combined circuit board. Therefore, they will not be supplied separately. If this becomes necessary, please order the entire circuit board.

Combination circuit board A 82-188-631-21

PCB-A 82-188-632-21

PCB-G 82-188-630-21

PCB-H 82-188-635-21

PCB-I 82-188-633-21

PCB-J 82-188-634-21

PCB-M 82-188-636-21

Combination circuit board B 82-191-611-21

PCB-D 82-191-612-21

PCB-E 82-191-614-21

Combination circuit board C 82-188-601-21

PCB-N 82-188-602-21

PDB-O 82-188-604-21

PCB-P 82-188-603-21

PCB-Q 82-188-605-21

C-MOS IC handling precaution

The C-MOS IC's construction makes this part susceptible to damage by static electricity and so take sufficient care in regard to following articles.

1. Need to be put on conductive sheet, to be put in a metallic box and to be wrapped by aluminium foil for transportation and deposit.
2. To use solder iron less than 40W (less than 260°C) of power consumption for soldering. But do not overheat more than 10 second.
3. Do not perform a conductivity test with a tester, etc. Refer to the circuit voltages of each part.
4. The ICs on the electrical parts which are indicated by an C-MOS IC symbol mark (④).

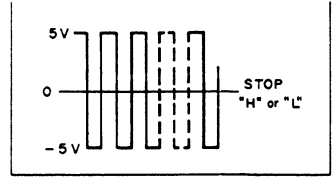
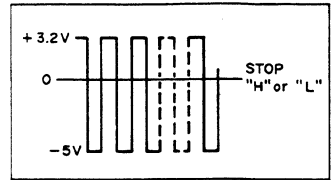
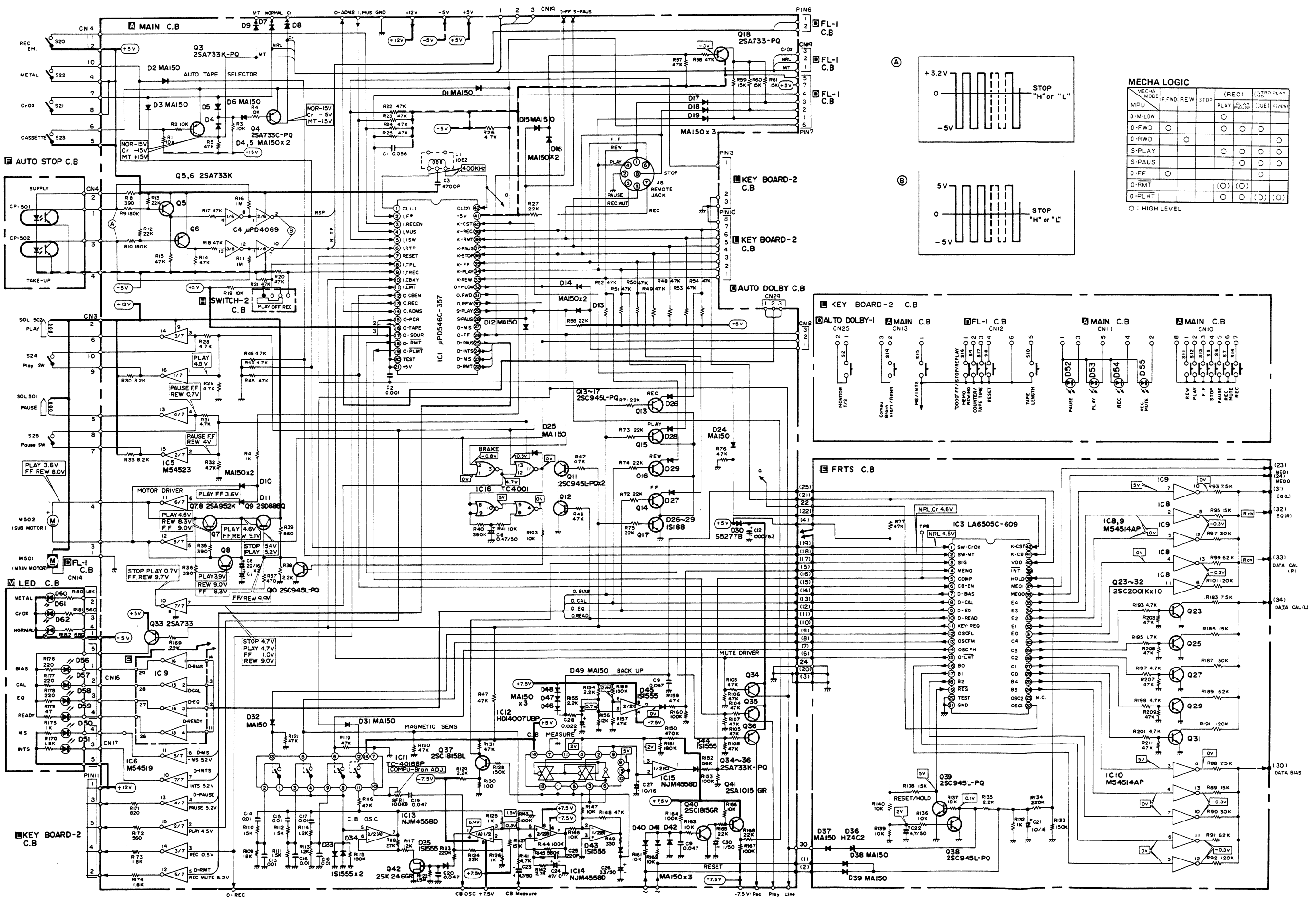
SCHEMATIC DIAGRAM-1

NOTES:

- 1) B (+) power supply B (-) power supply
- 2) Signal path
- Rec path

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16

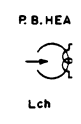
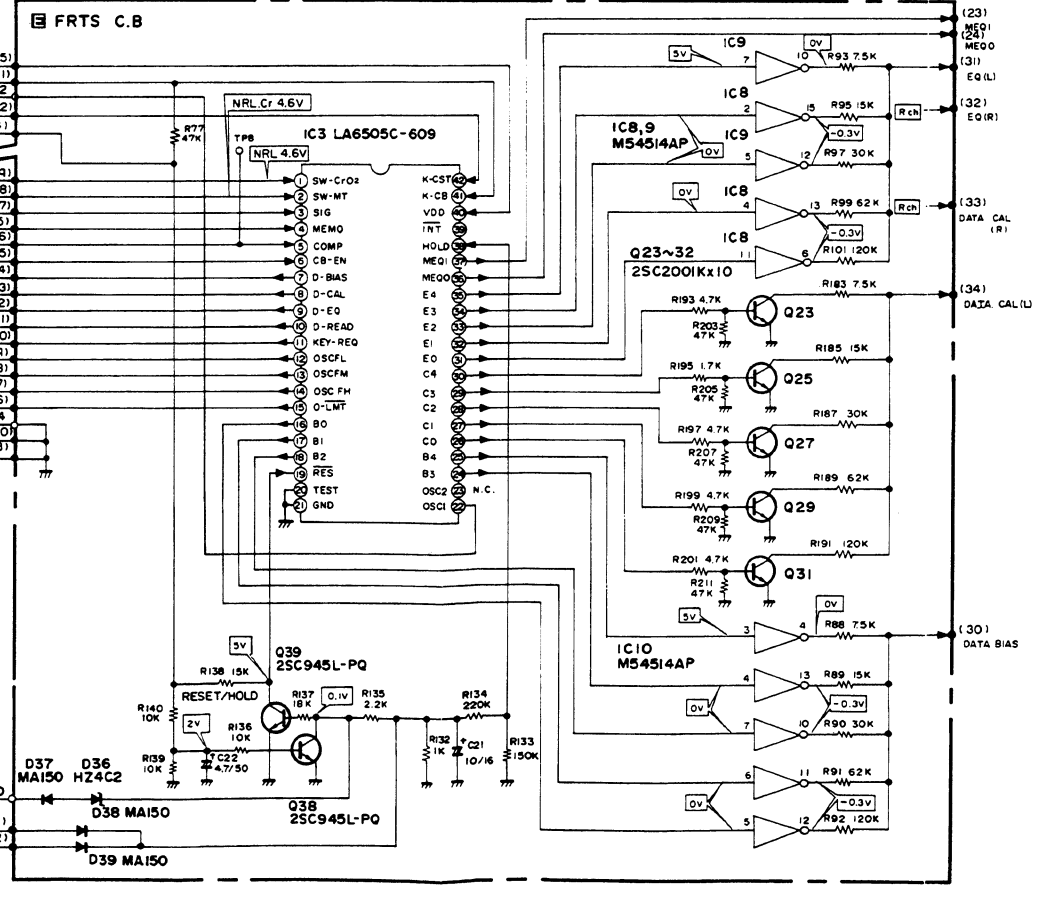
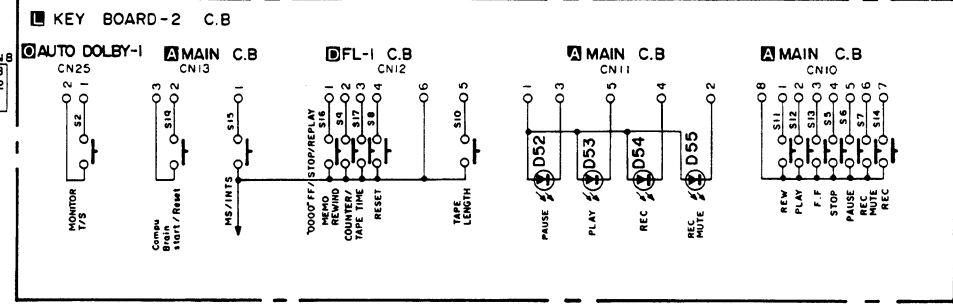
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MECHA LOGIC

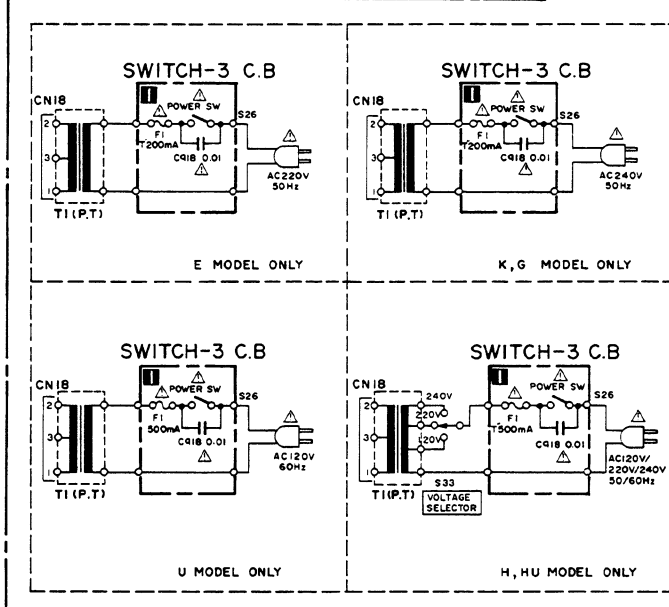
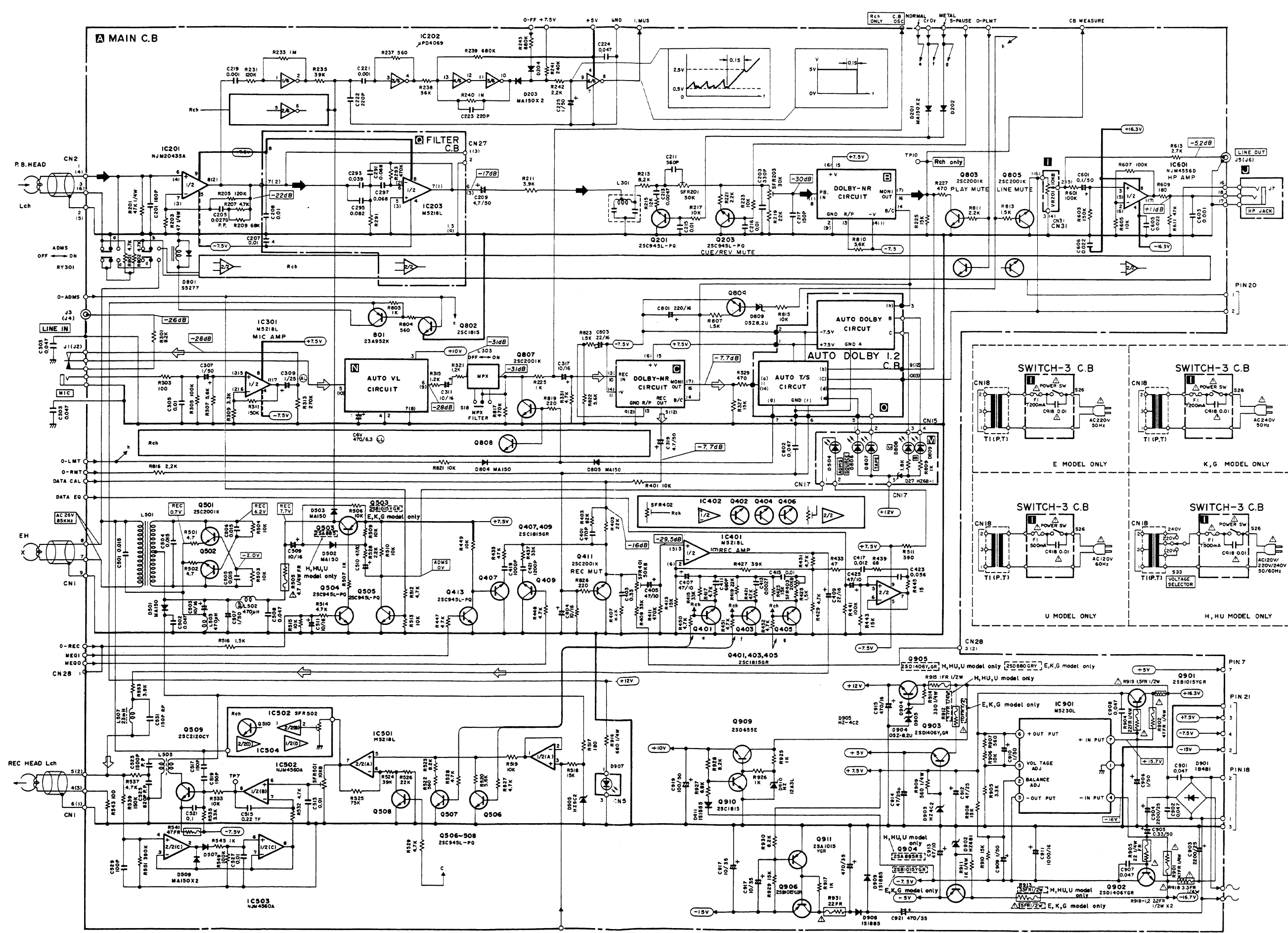
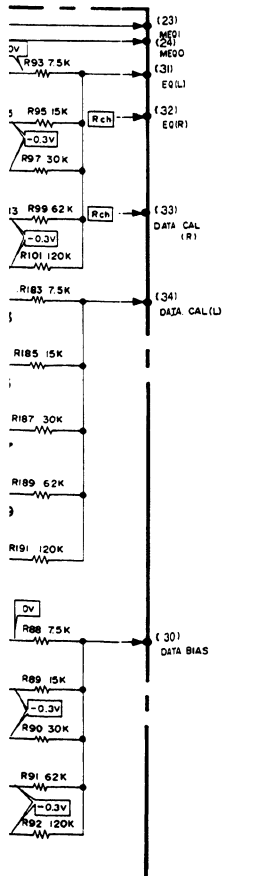
MECHA MODE	FWD	REW	STOP	(REC)	(INTRO PLAY)	(INTS)	REVIEW
0-M-LOW							
0-FWD							
0-RWD							
S-PLAY							
S-PAUS							
0-FF							
0-RMT							
0-PLMT							

O : HIGH LEVEL



(P-)	INTRO PLAY				
PLLY	MARK	(CLE)	REWR		

F.F.	STOP	PAUSE	MUTE	REC
0.0	0.1	0.2	0.3	0.4
0.5	0.6	0.7	0.8	0.9



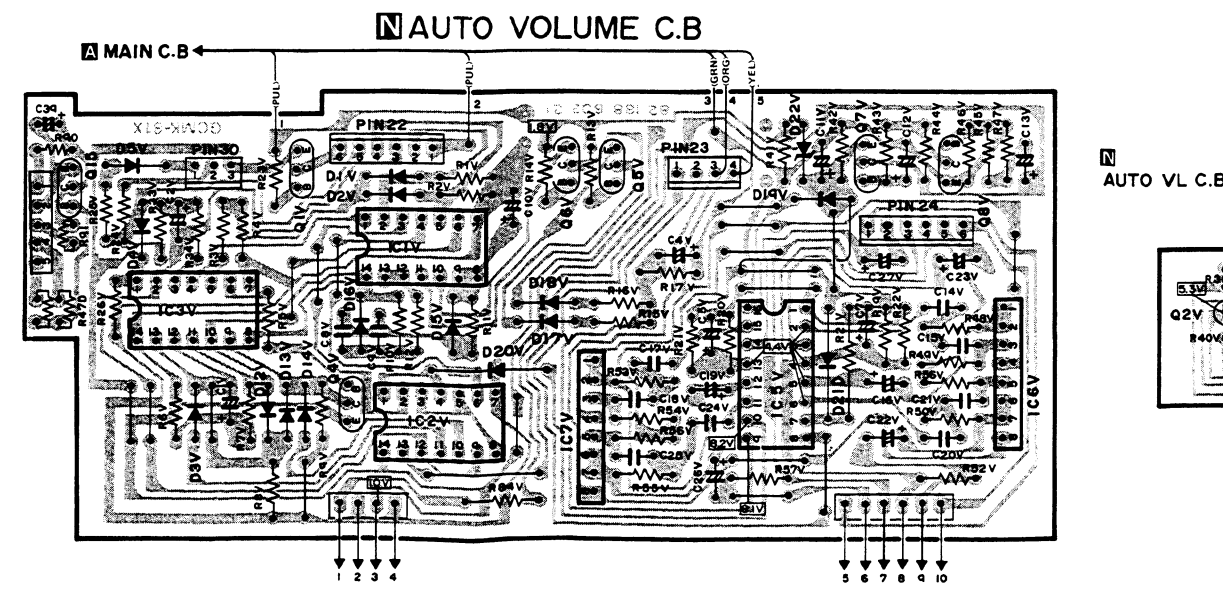
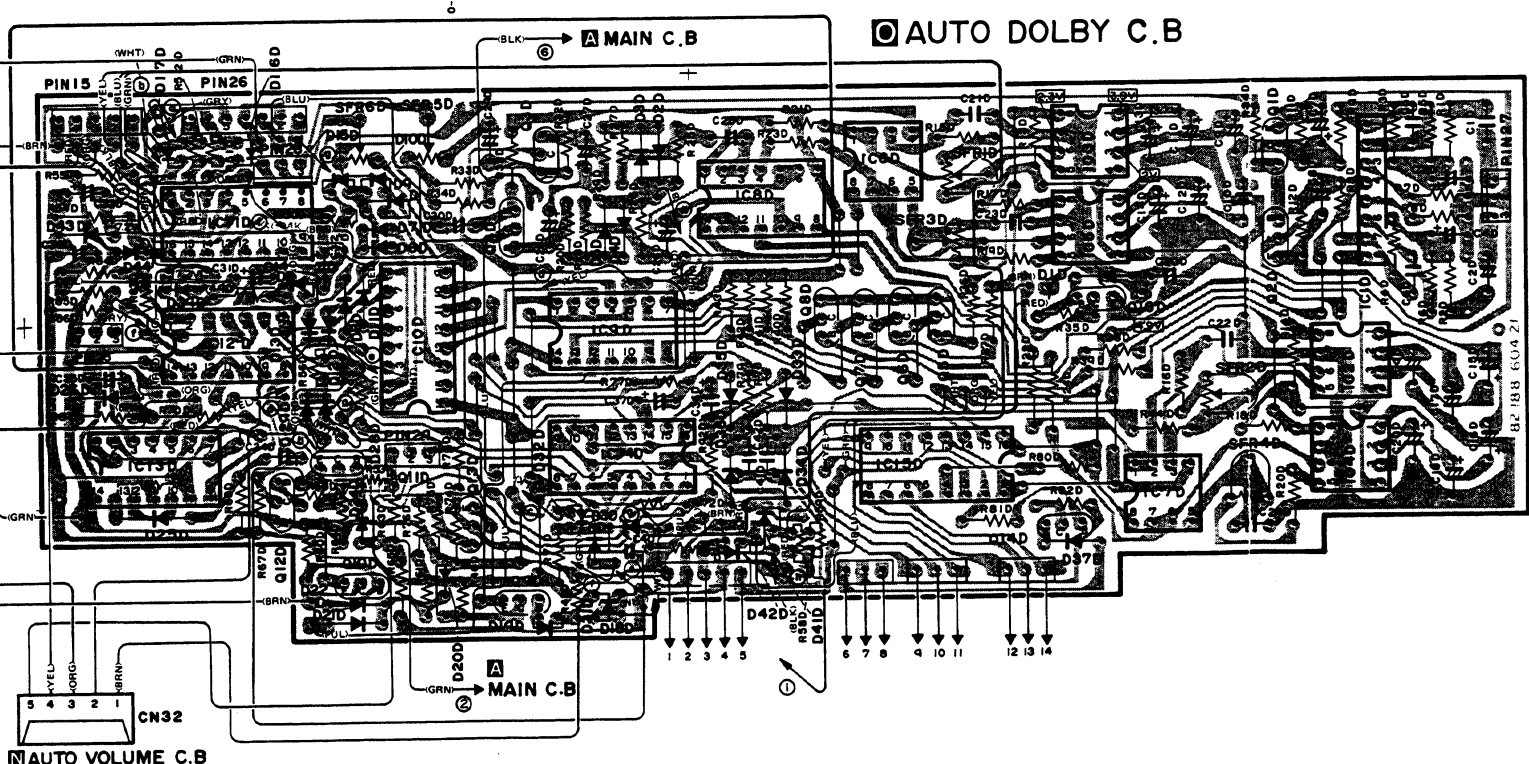
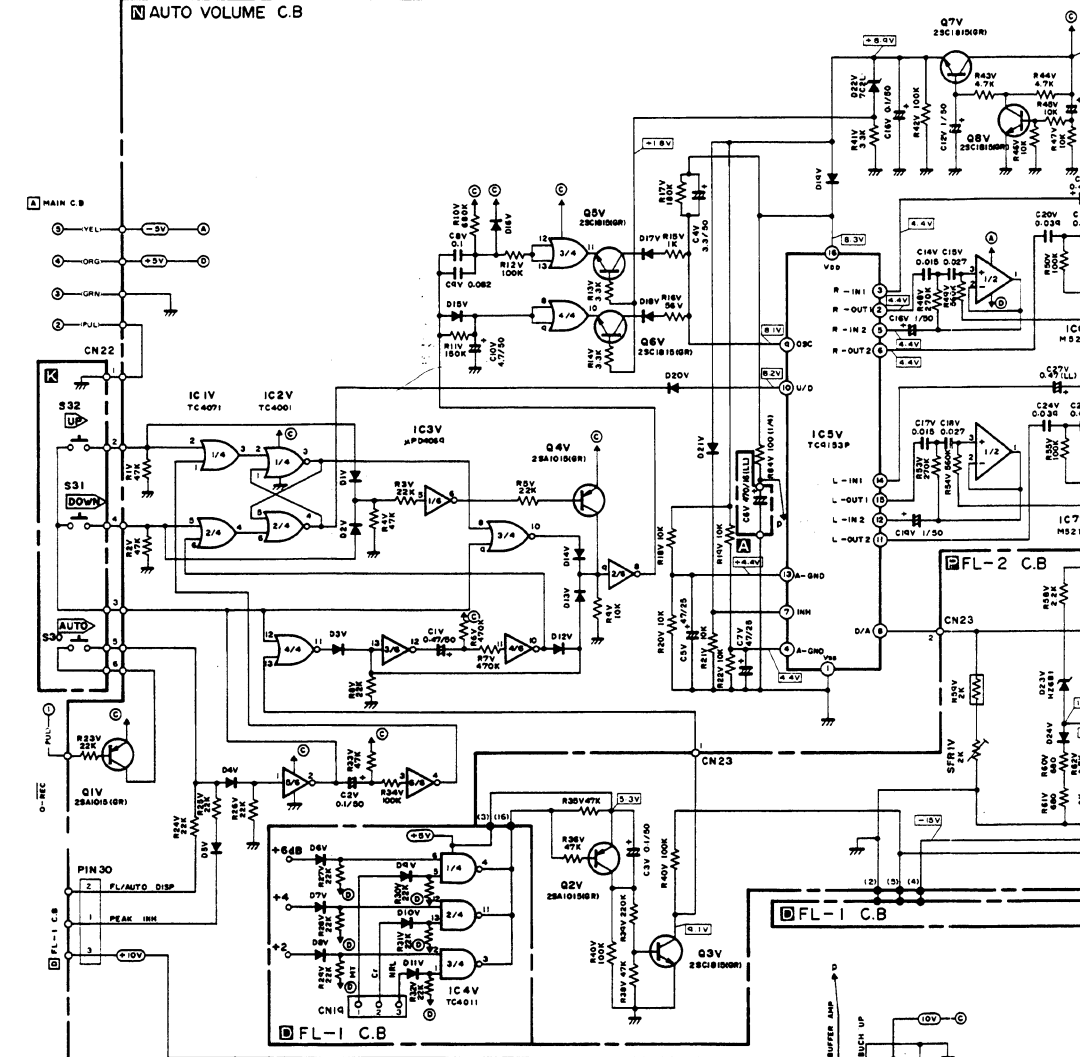
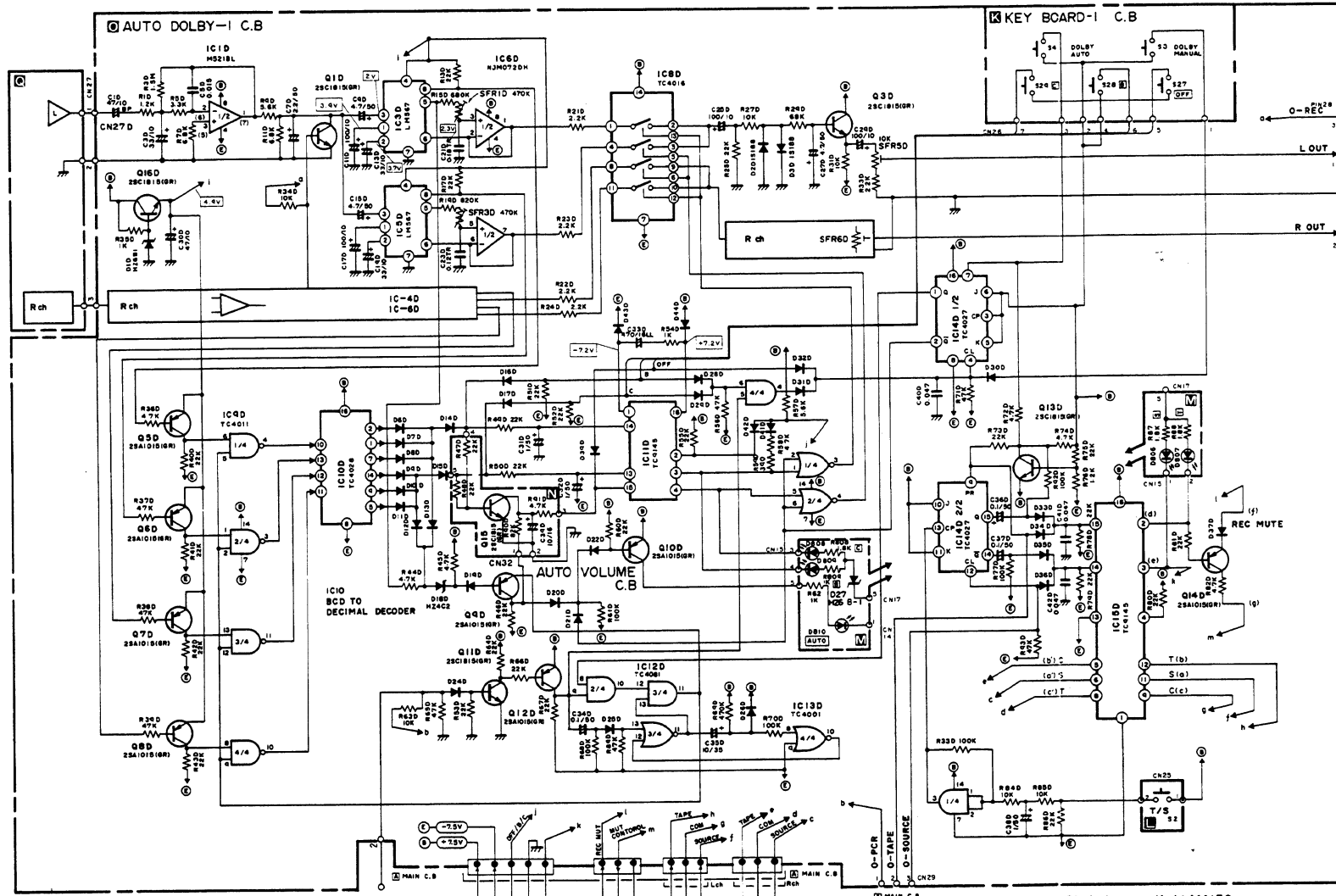
NOTES (1) The voltage is the reference value measured with a tester (20 K ohms/V DC) when there are no signals.

⚠ Safety component symbol
This symbol is given to important parts which serve to maintain safety of the product, and which are made to conform to special

WIRING-1

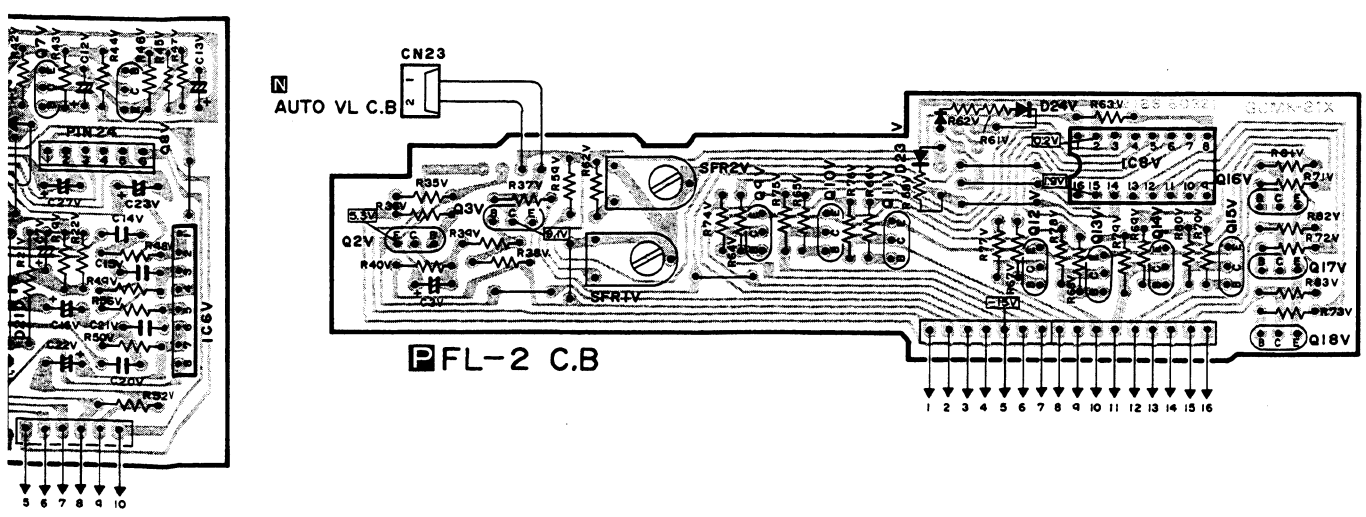
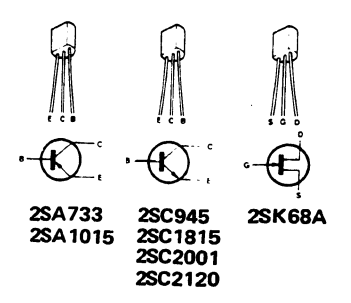
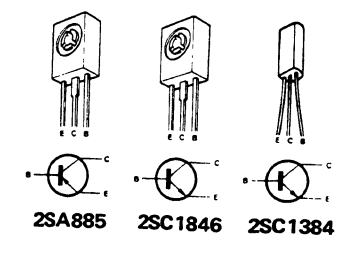
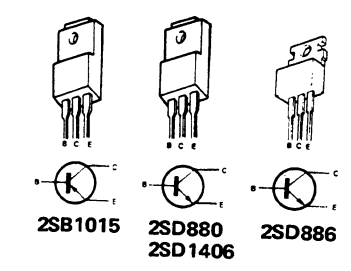
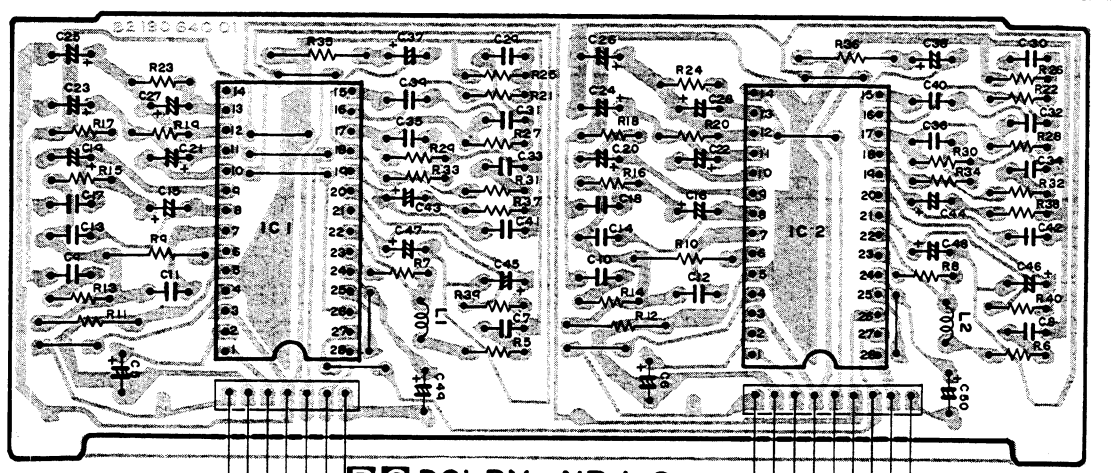
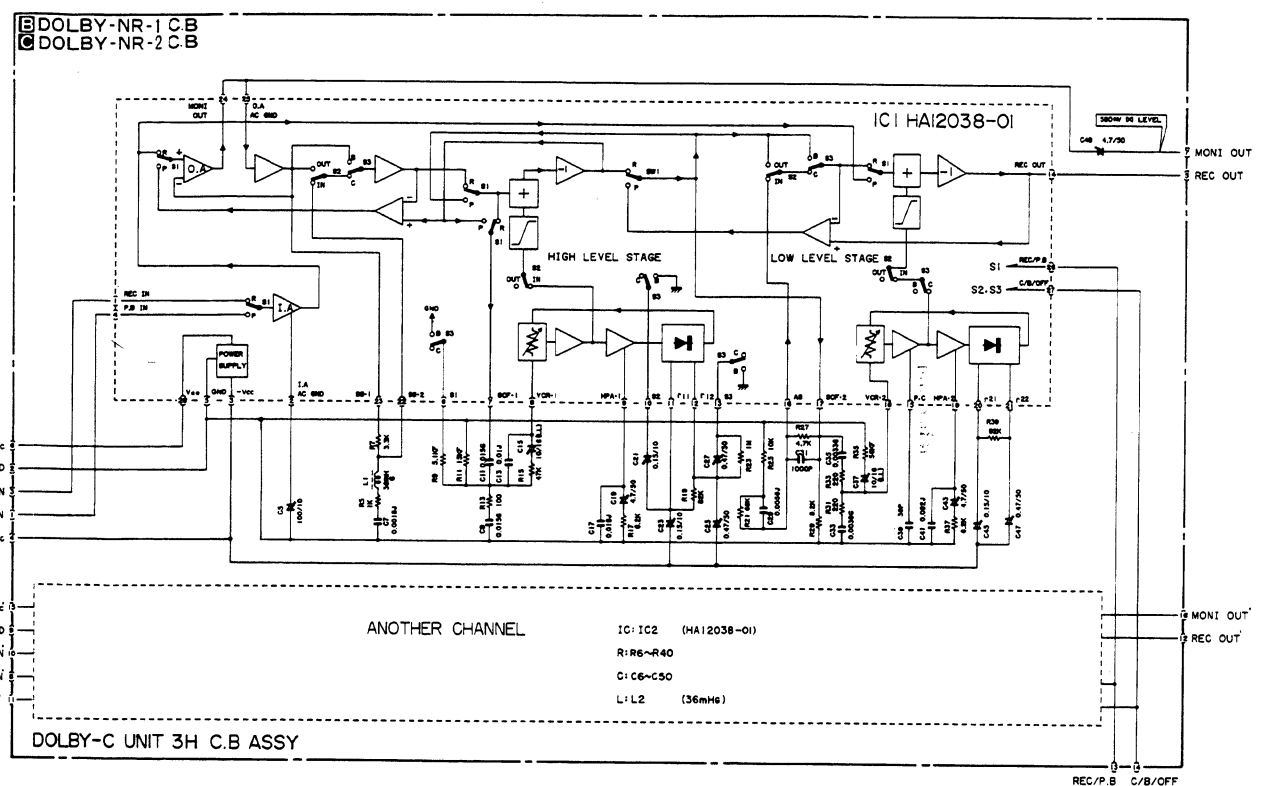
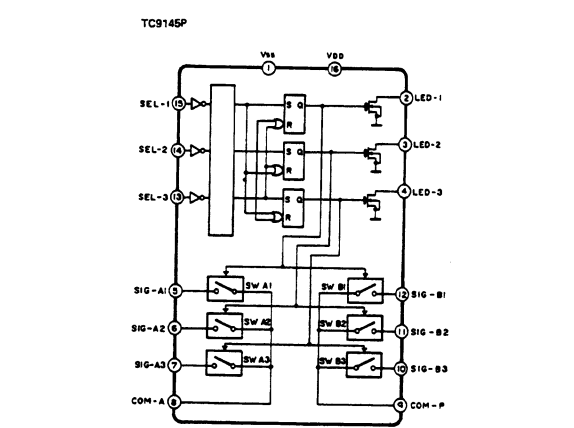
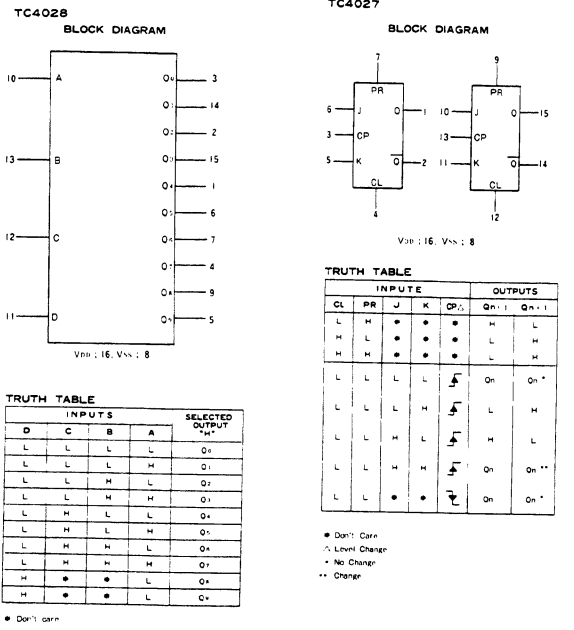
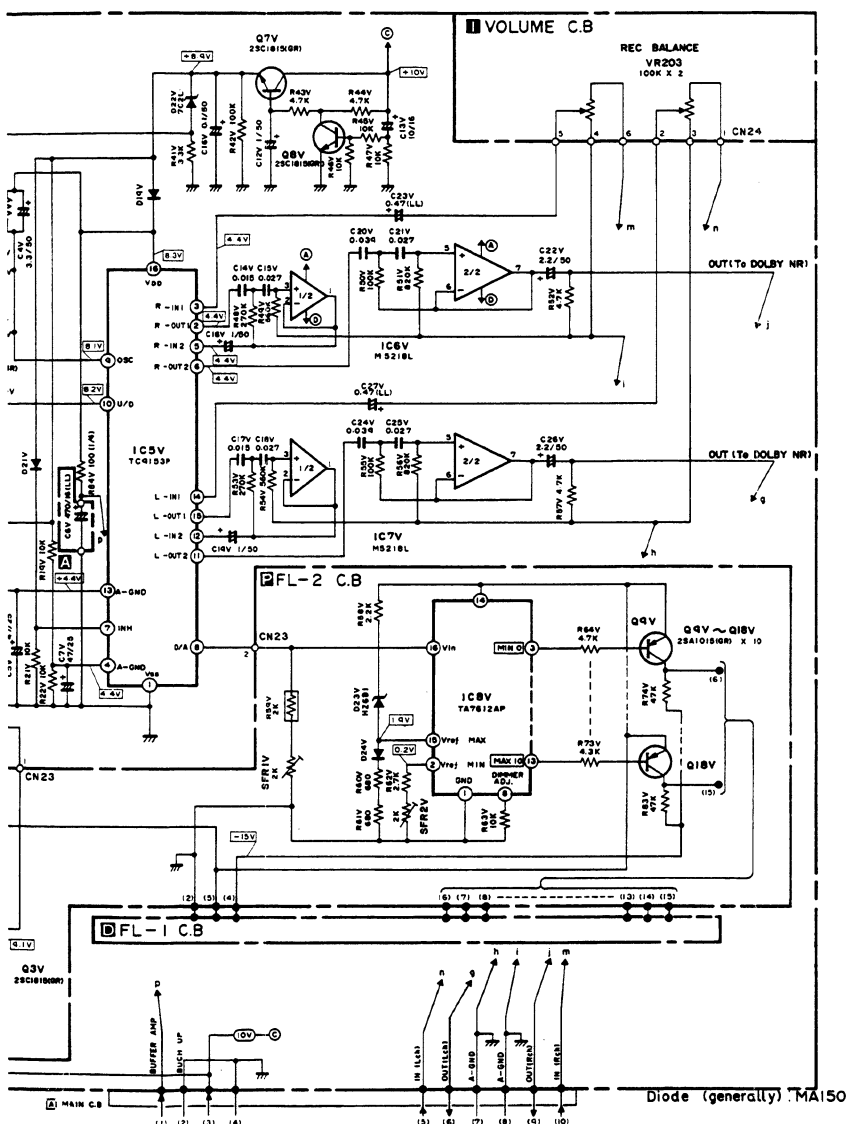
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16

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parts which serve to maintain safety specifications. Therefore, when replacing a component with this symbol, make absolutely sure that you use a designated part.

15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30



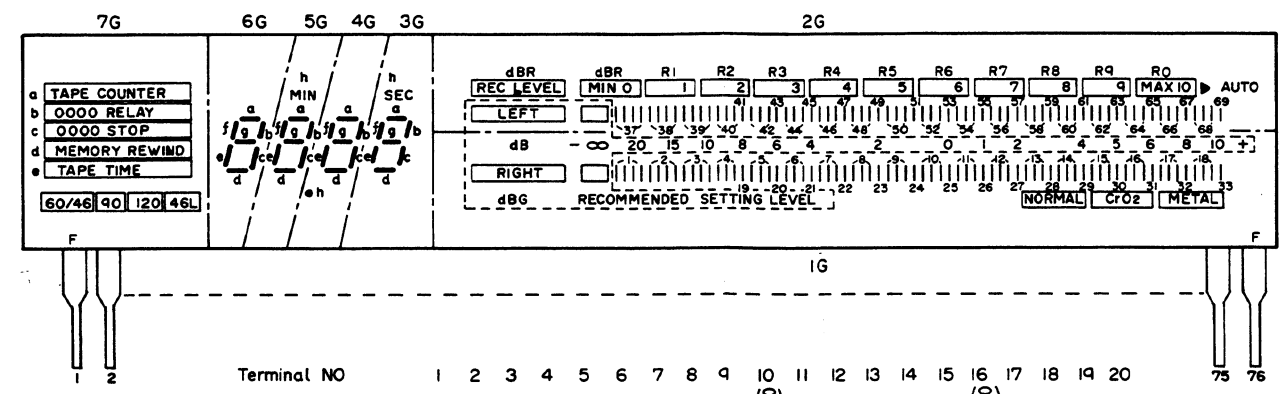
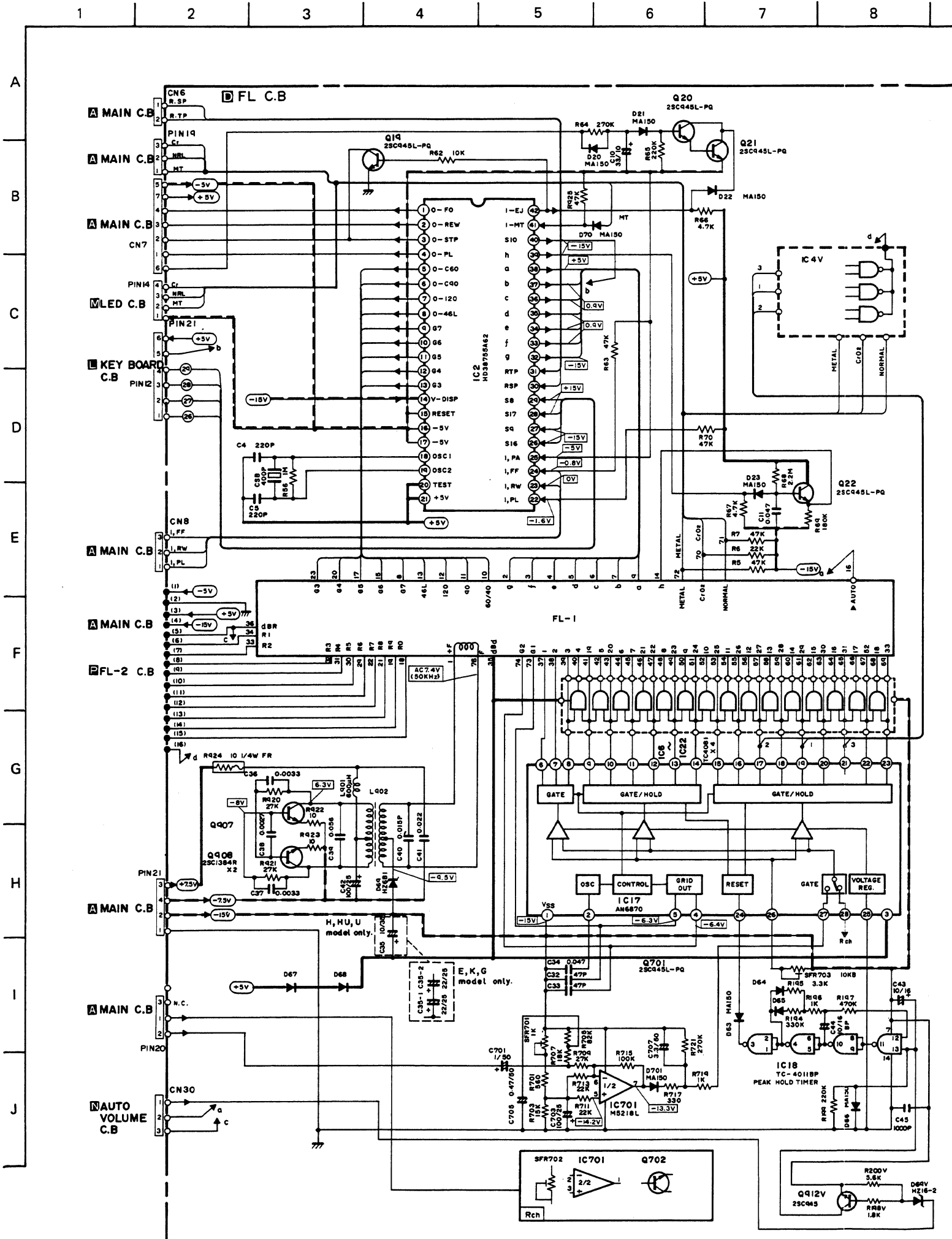
- 1) B (+) power supply
- 2) Signal path
- 3) The voltage is the reference value measured with a tester (20 k-ohms/V DC) when there are no signals. But () is with recording. An asterisk (*) indicates that the value was measured with a vacuum-tube voltmeter during recording.
- 4) Resistors with no designation have a rated power of 1/8W and a tolerance of ±5%.
- 5) Capacitors with no designation have a dielectric strength of less than 50WV.
- 6) The only capacitor tolerance indicated are ±5% (J) and ±10% (K).
- 7) Ceramic capacitor symbols:
 - For temperature compensation (SL)
 - High dielectric constant system (YY)
 - High dielectric constant system (YW, YP, YZ)
 - Semiconductor ceramic
 - For temperature compensation (SH)

- 8) Explanation of symbols
 - Mylar capacitor
 - Aluminum solid capacitor
 - Polypropylene film capacitor
 - Bi-polarized capacitor
 - Low-leakage capacitor
 - Tantalum capacitor
 - Fuse resistor
 - Nonflammable resistor
- ⚠ Safety component symbol
This symbol is given to important parts which serve to maintain the safety of the product, and which are made to conform to special safety specifications. Therefore, when replacing a component with this symbol, make absolutely sure that you use a designated part.
- This schematic diagram is subject to change without notice in the interests of improved performance.

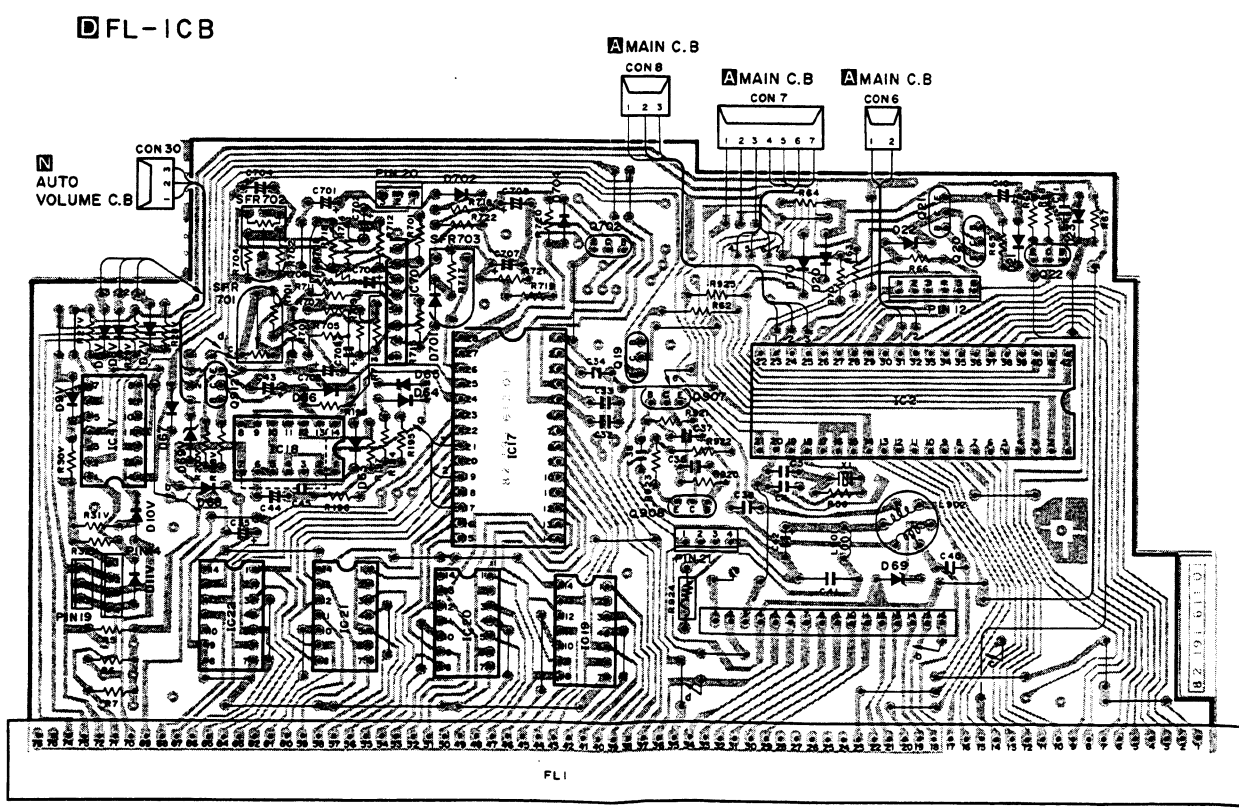
- NOTES:
- 1) B (+) power supply B (-) power supply
 - 2) Signal path
 Rec path, AM signal path.

NOTES (1) The voltage is the reference value measured with a tester (20 K ohms/V DC) when there are no signals.

Safety component symbol
This symbol is given to important parts which serve to r the safety of the product, and which are made to conform to



Terminal NO
24, 25, 26, 27
28, 75
NOT USED



12. Compu Settings: Test poi Adjust Method: Replace resistor Adjust After a resistor
6. Bias OS Settings: Test poi Adjust Method: Adjust +1kHz.
7. Bias OS Settings: Test tap Test poi Adjust Method: Record output
9. LH REC Settings: Test tap Input si Test poi Adjust Method: Supply recordi Then, 1kHz a is +0.5r
5. Meter A Settings: Test pc Adjust Method: Connect the diag Gradually +1.7V. Next, in so that l Gradually +1dB of Then var lights an +10dB.
13. REC V Settings: Adjust Method: Press the D tion it Confi Press 6 sec Then, diagra sequ

onent symbol
iven to important parts which serve to maintain
product, and which are made to conform to special

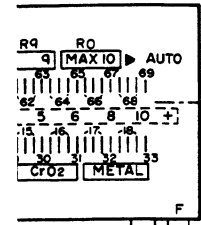
safety specifications. Therefore, when replacing a component with
this symbol, make absolutely sure that you use a designated part.

AD-F990<sup>H,HU,U,
E,K,G</sup>

AD-F990<sup>H,HU,U,
E,K,G</sup>

AIWA®

15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30



20 75 76

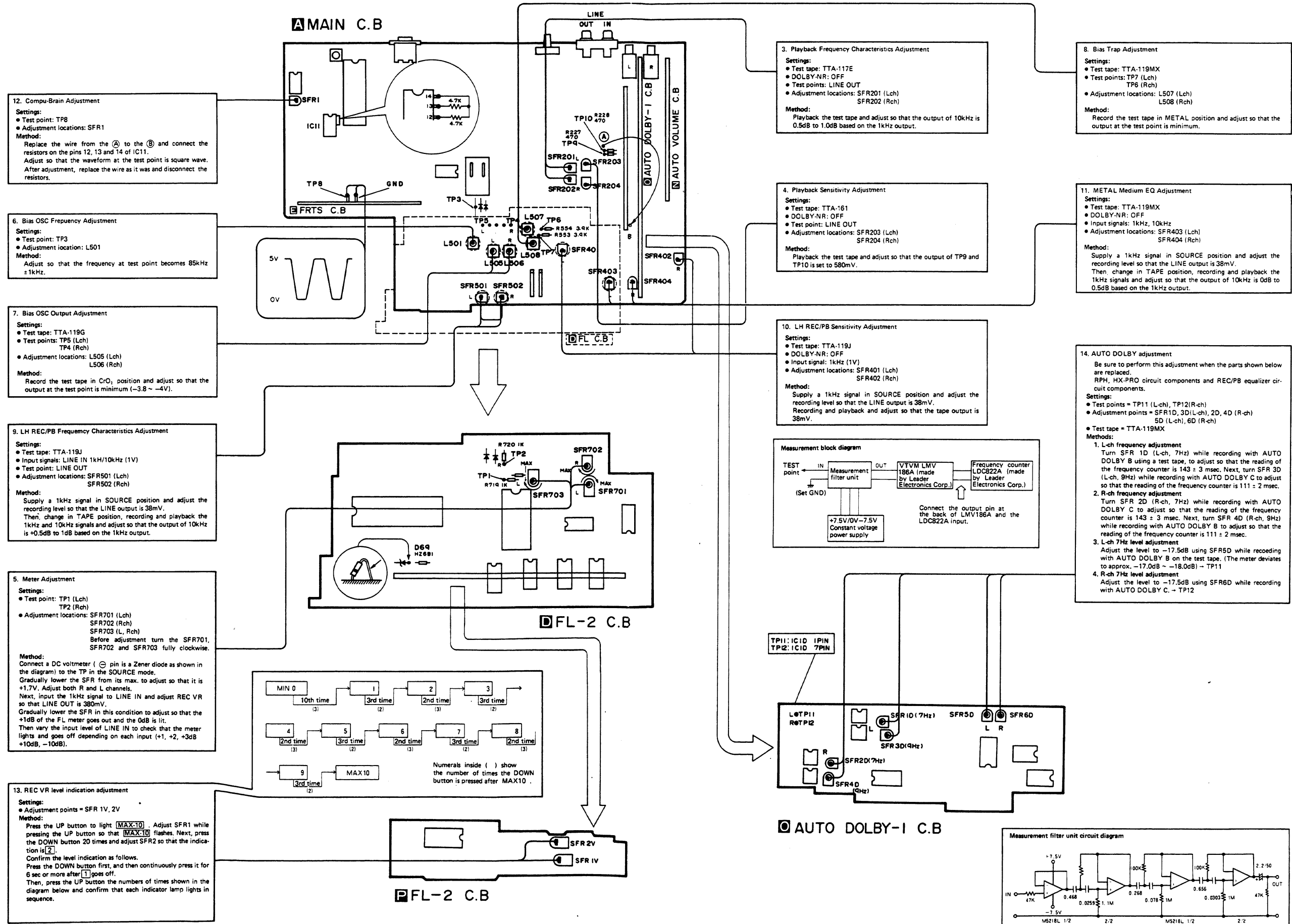
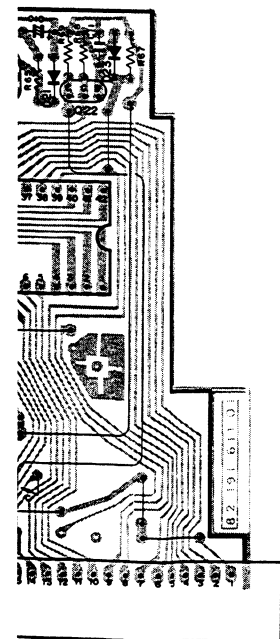
194G

1 40

1 p(4)

1 60

3) p(4)



12. Compu-Brain Adjustment
Settings:
• Test point: TP8
• Adjustment locations: SFR1
Method:
Replace the wire from the (A) to the (B) and connect the resistors on the pins 12, 13 and 14 of IC11.
Adjust so that the waveform at the test point is square wave.
After adjustment, replace the wire as it was and disconnect the resistors.

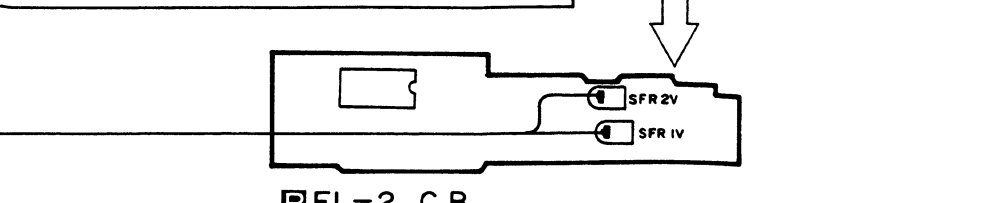
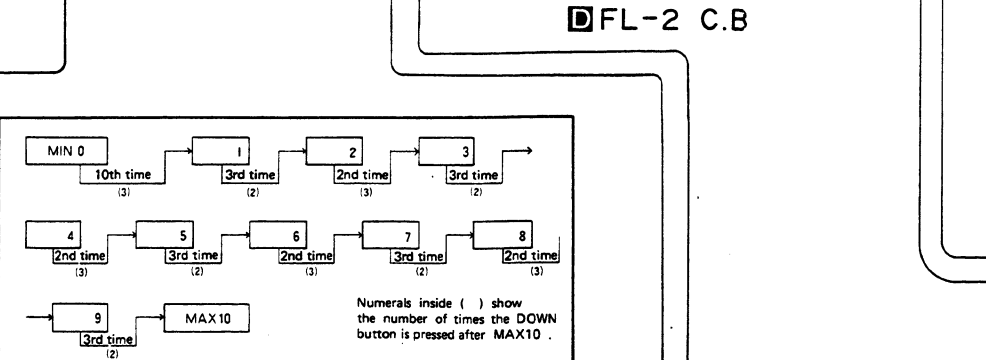
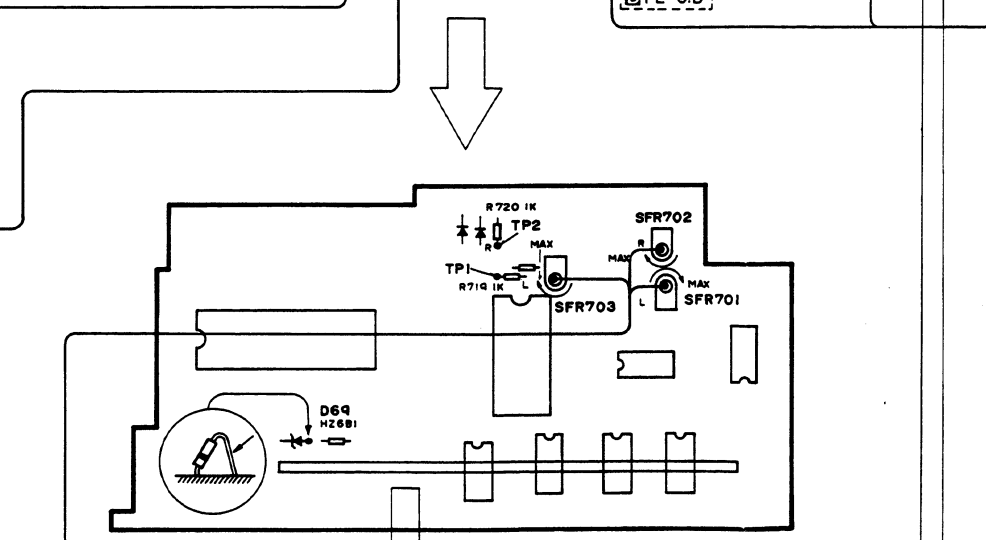
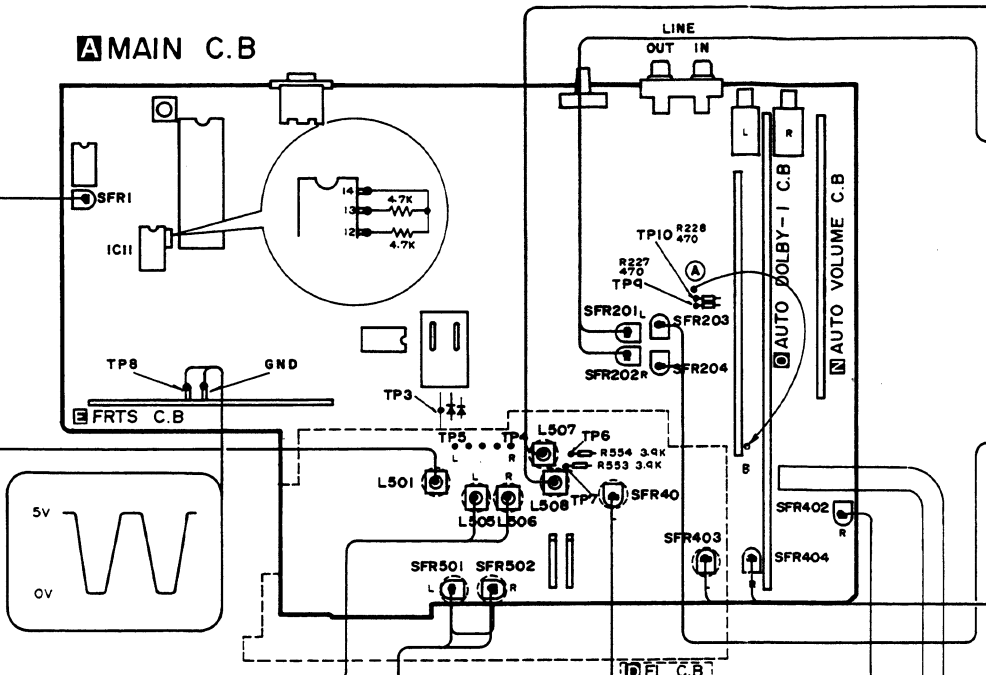
6. Bias OSC Frequency Adjustment
Settings:
• Test point: TP3
• Adjustment location: L501
Method:
Adjust so that the frequency at test point becomes 85kHz ± 1kHz.

7. Bias OSC Output Adjustment
Settings:
• Test tape: TTA-119G
• Test points: TP4 (Lch)
TP4 (Rch)
• Adjustment locations: L505 (Lch)
L506 (Rch)
Method:
Record the test tape in CrO₂ position and adjust so that the output at the test point is minimum (-3.8 ~ -4V).

9. LH REC/PB Frequency Characteristics Adjustment
Settings:
• Test tape: TTA-119J
• Input signals: LINE IN 1kHz/10kHz (1V)
• Test point: LINE OUT
• Adjustment locations: SFR501 (Lch)
SFR502 (Rch)
Method:
Supply a 1kHz signal in SOURCE position and adjust the recording level so that the LINE output is 38mV.
Then, change in TAPE position, recording and playback the 1kHz and 10kHz signals and adjust so that the output of 10kHz is +0.5dB to 1dB based on the 1kHz output.

5. Meter Adjustment
Settings:
• Test point: TP1 (Lch)
TP2 (Rch)
• Adjustment locations: SFR701 (Lch)
SFR702 (Rch)
SFR703 (L, Rch)
Before adjustment turn the SFR701, SFR702 and SFR703 fully clockwise.
Method:
Connect a DC voltmeter (⊖ pin is a Zener diode as shown in the diagram) to the TP in the SOURCE mode.
Gradually lower the SFR from its max. to adjust so that it is +1.7V. Adjust both R and L channels.
Next, input the 1kHz signal to LINE IN and adjust REC VR so that LINE OUT is 380mV.
Gradually lower the SFR in this condition to adjust so that the +1dB of the FL meter goes out and the 0dB is lit.
Then vary the input level of LINE IN to check that the meter lights and goes off depending on each input (+1, +2, +3dB +10dB, -10dB).

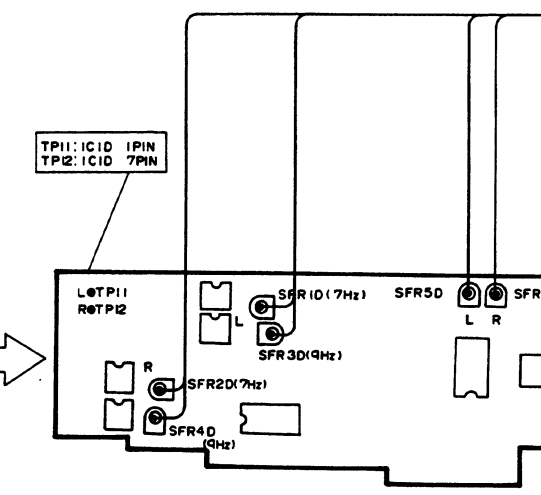
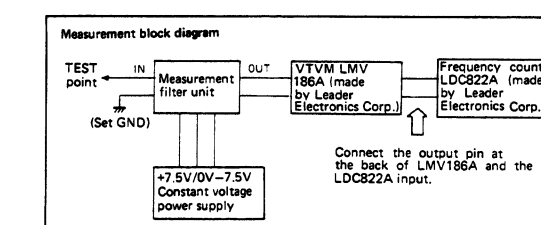
13. REC VR level indication adjustment
Settings:
• Adjustment points = SFR 1V, 2V
Method:
Press the UP button to light MAX10. Adjust SFR1 while pressing the UP button so that MAX10 flashes. Next, press the DOWN button 20 times and adjust SFR2 so that the indication is 2.
Confirm the level indication as follows.
Press the DOWN button first, and then continuously press it for 6 sec or more after 1 goes off.
Then, press the UP button the numbers of the times shown in the diagram below and confirm that each indicator lamp lights in sequence.



3. Playback Frequency Characteristics Adjustment
Settings:
• Test tape: TTA-117E
• DOLBY-NR: OFF
• Test points: LINE OUT
• Adjustment locations: SFR201 (Lch)
SFR202 (Rch)
Method:
Playback the test tape and adjust so that the output of 10kHz is 0.5dB to 1.0dB based on the 1kHz output.

4. Playback Sensitivity Adjustment
Settings:
• Test tape: TTA-161
• DOLBY-NR: OFF
• Test point: LINE OUT
• Adjustment locations: SFR203 (Lch)
SFR204 (Rch)
Method:
Playback the test tape and adjust so that the output of TP9 and TP10 is set to 580mV.

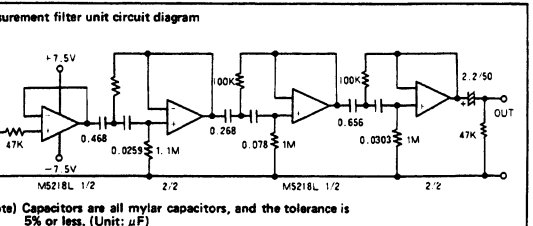
10. LH REC/PB Sensitivity Adjustment
Settings:
• Test tape: TTA-119J
• DOLBY-NR: OFF
• Input signal: 1kHz (1V)
• Adjustment locations: SFR401 (Lch)
SFR402 (Rch)
Method:
Supply a 1kHz signal in SOURCE position and adjust the recording level so that the LINE output is 38mV.
Recording and playback and adjust so that the tape output is 38mV.



8. Bias Trap Adjustment
Settings:
• Test tape: TTA-119MX
• Test points: TP7 (Lch)
TP6 (Rch)
• Adjustment locations: L507 (Lch)
L508 (Rch)
Method:
Record the test tape in METAL position and adjust so that the output at the test point is minimum.

11. METAL Medium EQ Adjustment
Settings:
• Test tape: TTA-119MX
• DOLBY-NR: OFF
• Input signals: 1kHz, 10kHz
• Adjustment locations: SFR403 (Lch)
SFR404 (Rch)
Method:
Supply a 1kHz signal in SOURCE position and adjust the recording level so that the LINE output is 38mV.
Then, change in TAPE position, recording and playback the 1kHz signals and adjust so that the output of 10kHz is 0dB to 0.5dB based on the 1kHz output.

14. AUTO DOLBY adjustment
Be sure to perform this adjustment when the parts shown below are replaced.
RPH, HX-PRO circuit components and REC/PB equalizer circuit components.
Settings:
• Test points = TP11 (L-ch), TP12 (R-ch)
• Adjustment points = SFR1D, 3D (L-ch), 2D, 4D (R-ch)
5D (L-ch), 6D (R-ch)
• Test tape = TTA-119MX
Methods:
1. L-ch frequency adjustment
Turn SFR 1D (L-ch, 7Hz) while recording with AUTO DOLBY B using a test tape, to adjust so that the reading of the frequency counter is 143 ± 3 msec. Next, turn SFR 3D (L-ch, 9Hz) while recording with AUTO DOLBY C to adjust so that the reading of the frequency counter is 111 ± 2 msec.
2. R-ch frequency adjustment
Turn SFR 2D (R-ch, 7Hz) while recording with AUTO DOLBY C to adjust so that the reading of the frequency counter is 143 ± 3 msec. Next, turn SFR 4D (R-ch, 9Hz) while recording with AUTO DOLBY B to adjust so that the reading of the frequency counter is 111 ± 2 msec.
3. L-ch 7Hz level adjustment
Adjust the level to -17.5dB using SFR5D while recording with AUTO DOLBY B on the test tape. (The meter deviates to approx. -17.0dB ~ -18.0dB) - TP11
4. R-ch 7Hz level adjustment
Adjust the level to -17.5dB using SFR6D while recording with AUTO DOLBY C. - TP12



Note) Capacitors are all mylar capacitors, and the tolerance is 5% or less. (Unit: μF)

NOTES (1) Earth pattern. Others pattern
(2) The voltage is the reference value measured with a tester (20 K ohms/V DC) when there are no signals.

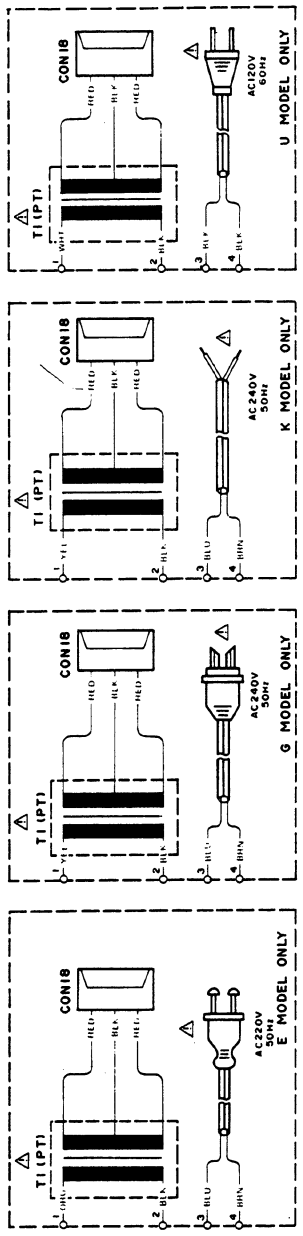
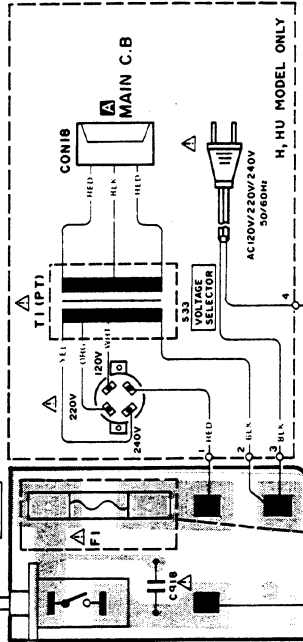
Safety component symbol
This symbol is given to important parts which serve to maintain the safety of the product, and which are made to conform to special safety specifications.
Therefore, when replacing a component with this symbol, make absolutely sure that you use a designated part.

WIRING-3

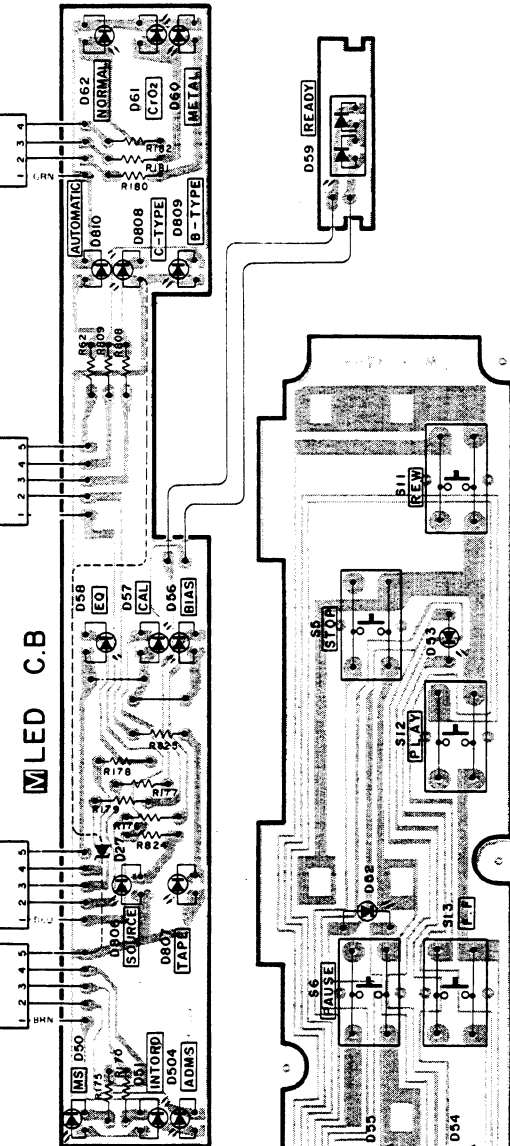
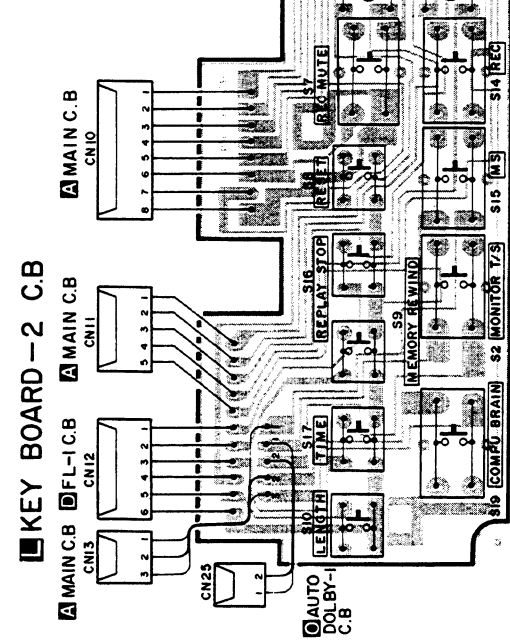
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16

A
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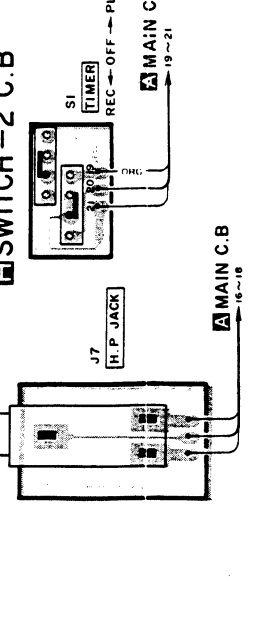
SWITCH-3 C.B.



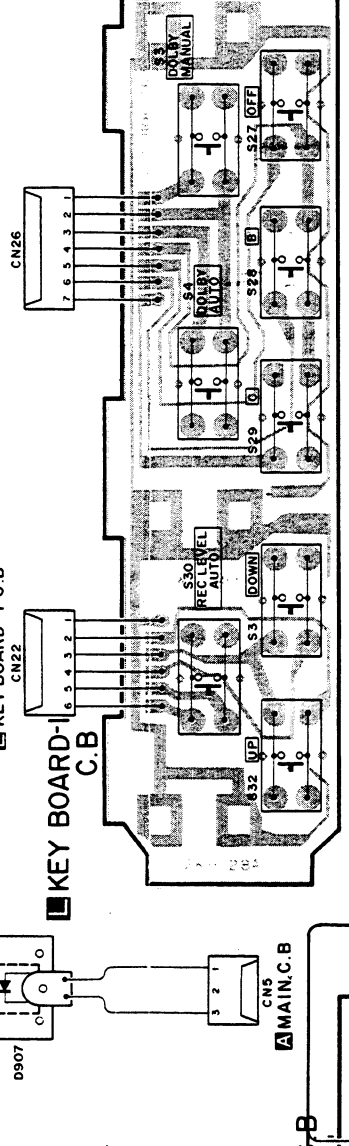
KEY BOARD-2 C.B.



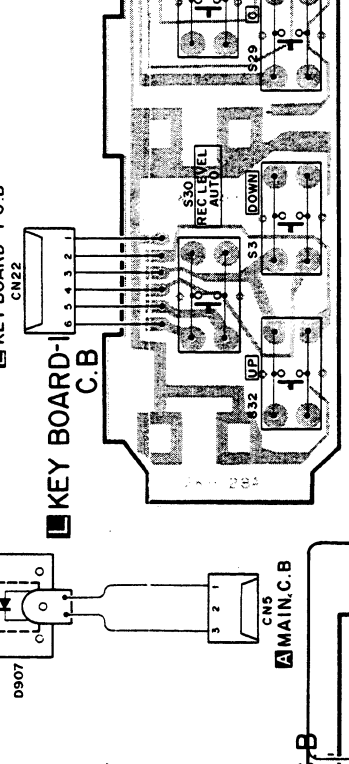
JACK C.B.



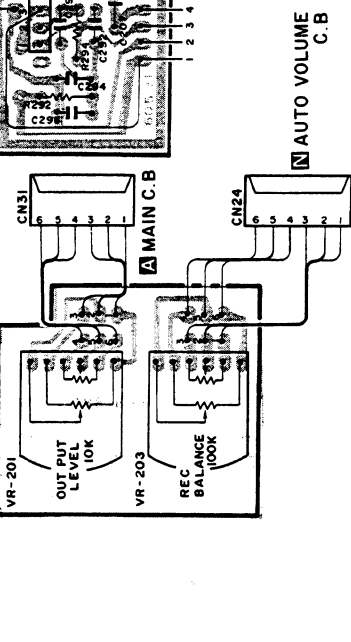
AUTO DOLBY-1 C.B.



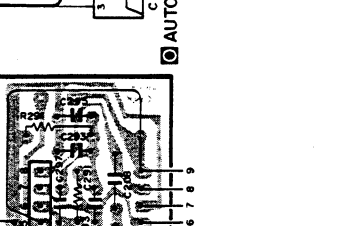
KEY BOARD-1 C.B.



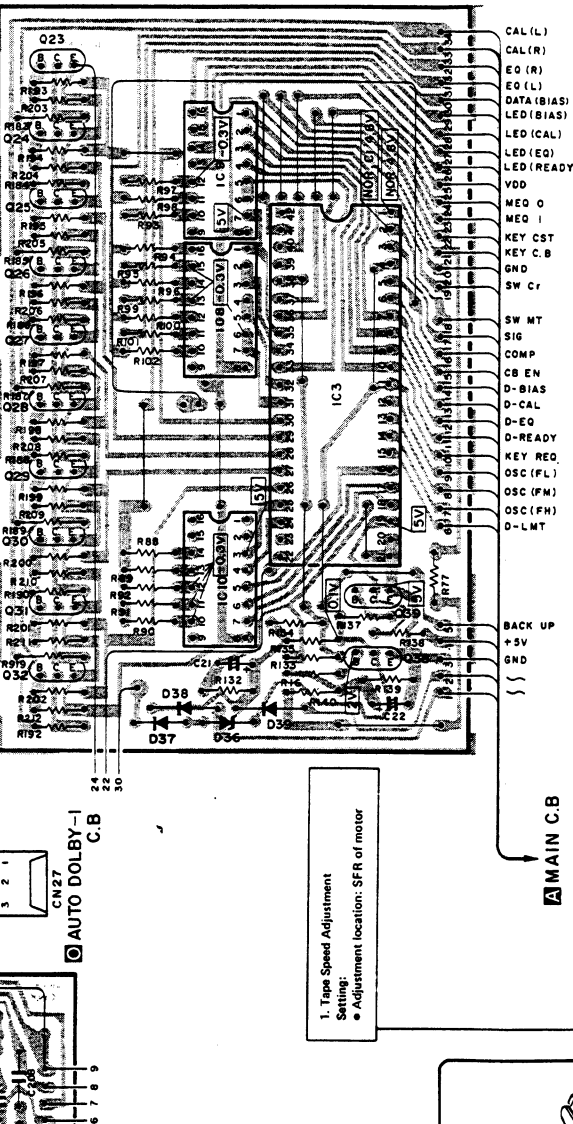
VOLUME C.B.



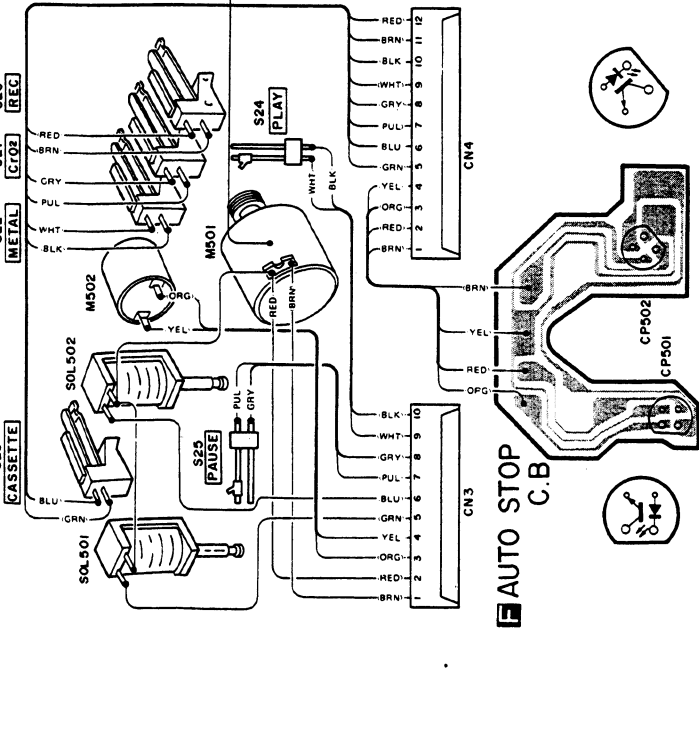
FILTER C.B.



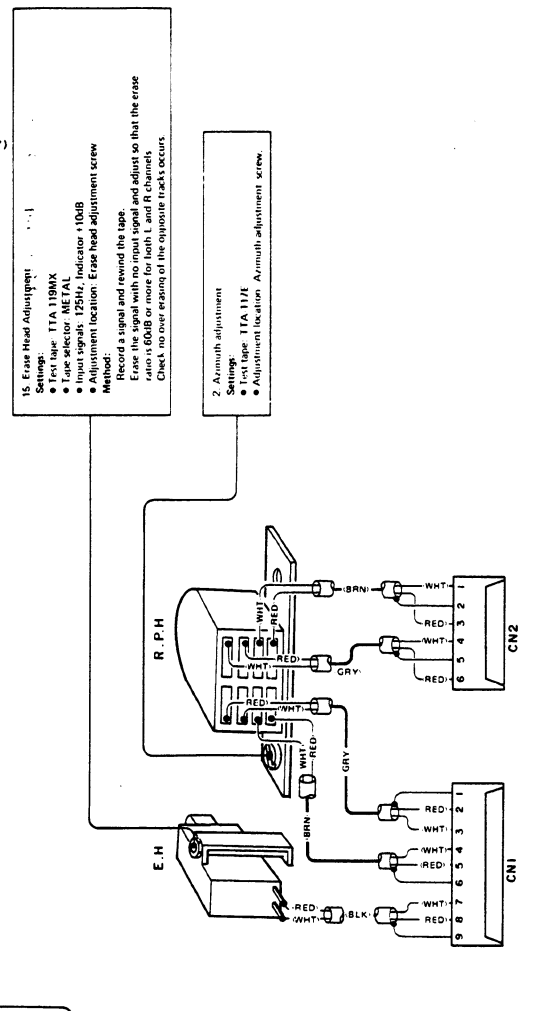
FRTS C.B.



1. Tape Speed Adjustment
Setting:
Adjustment location: SFR of motor



AUTO STOP C.B.



15. Erase Head Adjustment
Settings:
• Test tape: TTA 158MX
• Input speed: 175Hz, Indicator: +10dB
• Adjustment location: Erase head adjustment screw
Method:
Record a signal and rewind the tape.
Adjust the adjustment screw until the erase ratio is 60dB or more for both L and R channels.
Check for over erasing of the opposite tracks.

2. Armature adjustment
Settings:
• Test tape: TTA 11/E
• Adjustment location: Armature adjustment screw



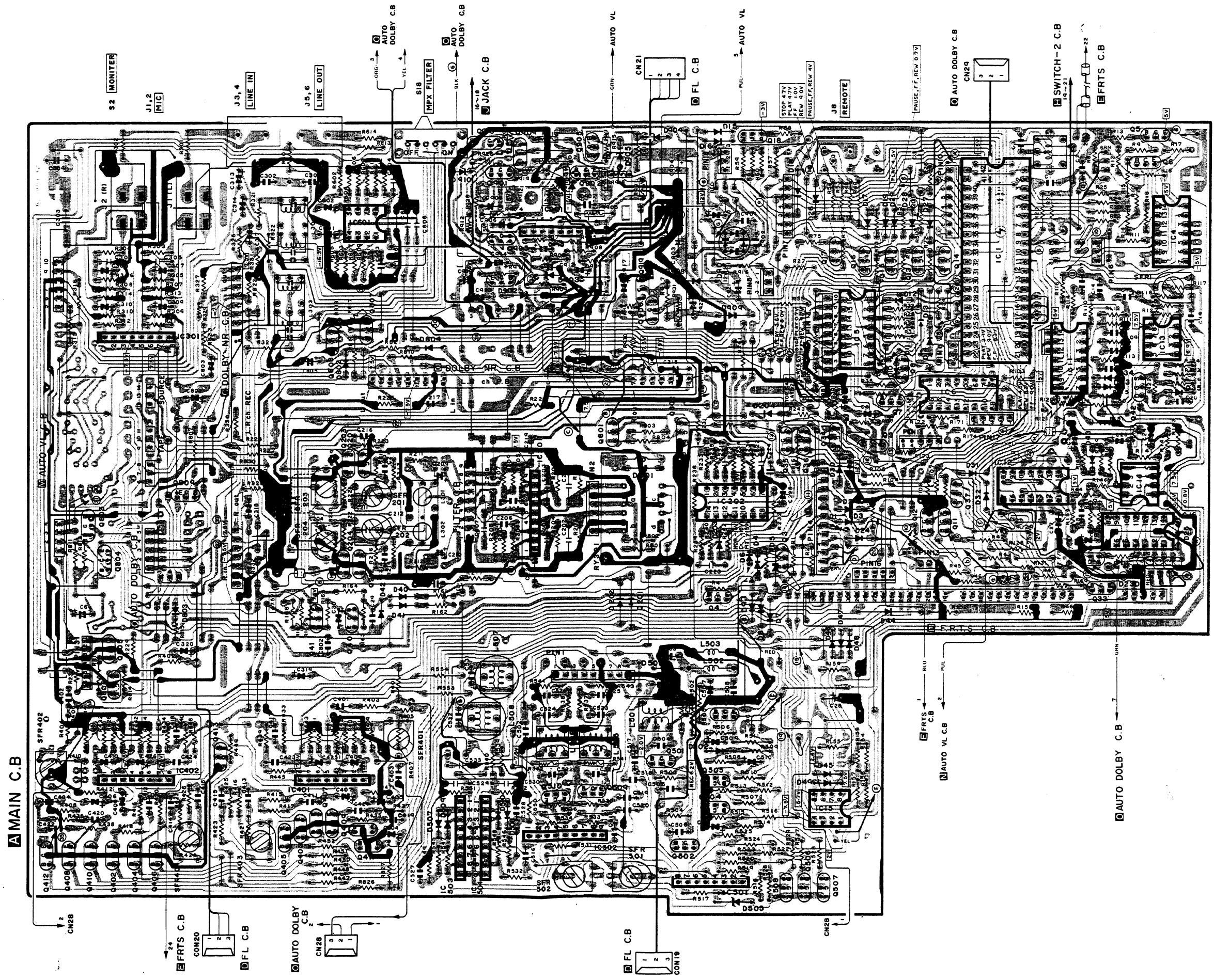
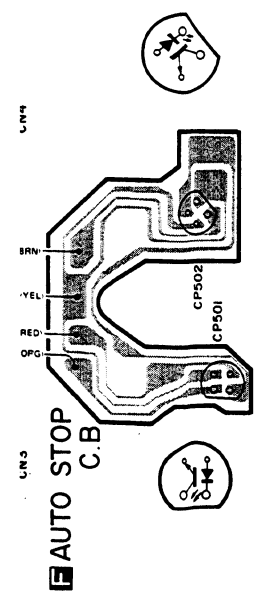
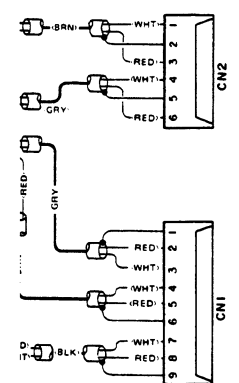
When replacing a component with this one, be absolutely sure that you use a de-

C-MOS IC handling precaution
 The C-MOS IC's construction makes this part susceptible to damage by static electricity and so take sufficient care in regard to following articles.

1. Need to be put on conductive sheet, to be put in a metallic box and to be wrapped by aluminium foil for transportation and deposit.
2. To use solder iron less than 40W (less than 260°C) of power consumption for soldering. But do not overheat more than 10 second.

3. Do not perform a conductivity test with a tester, etc. Refer to the circuit voltages of each part.
4. The ICs on the electrical parts which are indicated by an C-MOS IC symbol mark (Ⓢ).

15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
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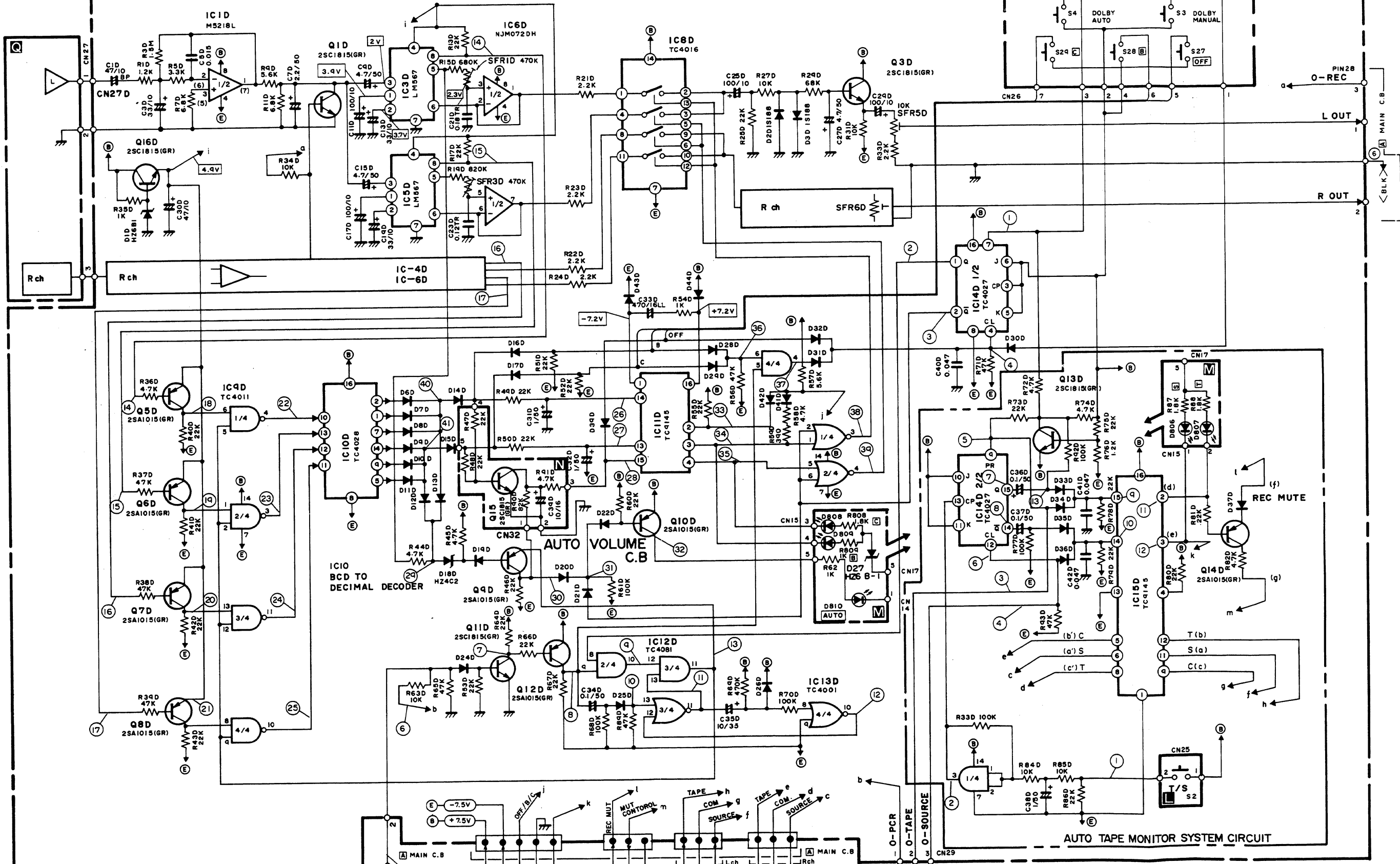
A
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J

Identification Nos. such as 1, etc. in the diagram:
Nos. inside : AUTO TAPE MONITOR SYSTEM circuit explanatory identification Nos.
Others : AUTO DOLBY NR SELECTOR SYSTEM identification Nos.

DESCRIPTION OF AUTO DOLBY CIRCUIT, AND AUTO TAPE MONITOR CIRCUIT

AUTO DOLBY-I C.B

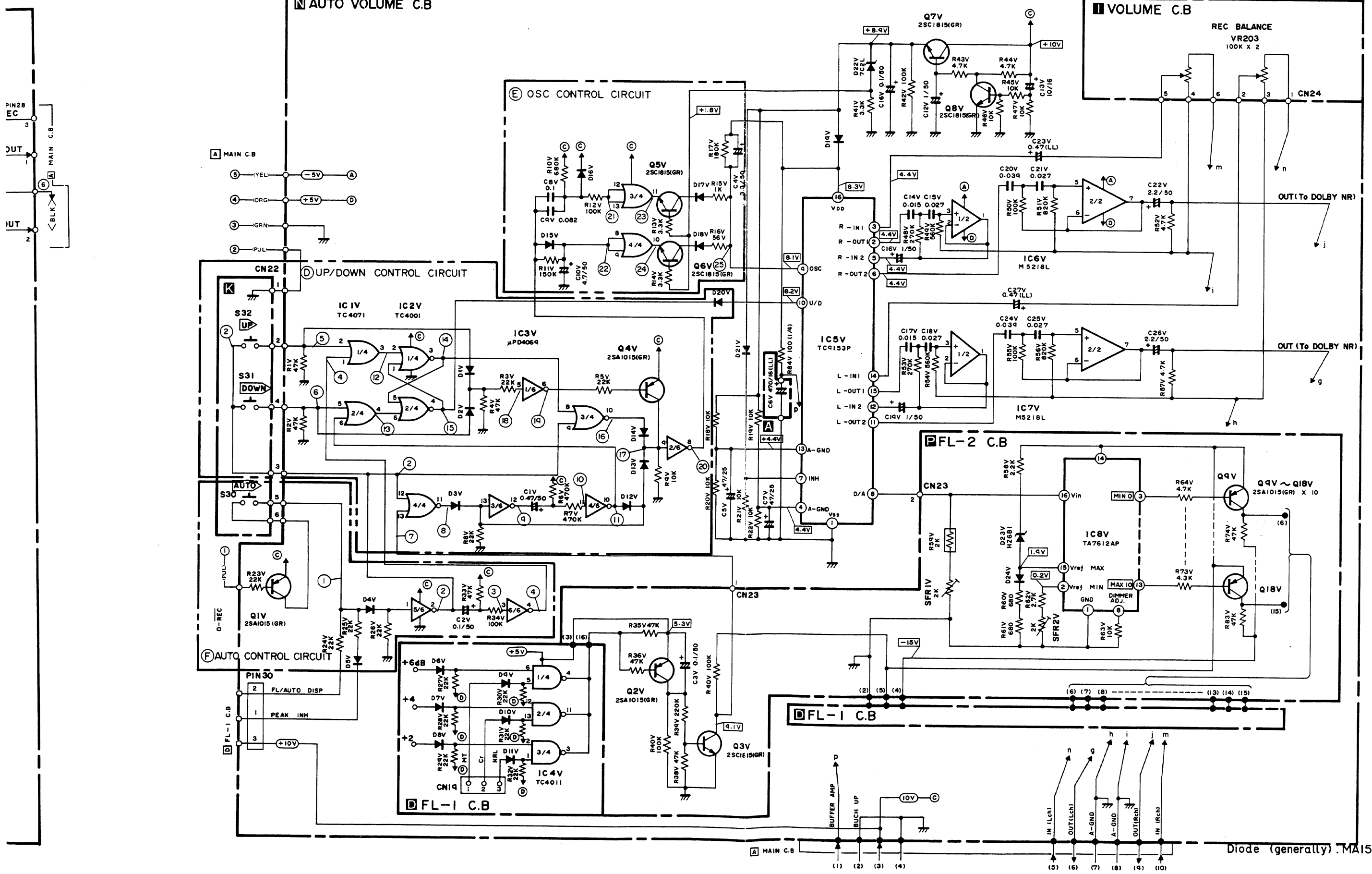
KEY BOARD-I C.B



Diode (generally): MA150

1 Nos.

DESCRIPTION OF AUTO VL CIRCUIT, AND THE TIMING CHART CIRCUIT



Diode (generally) .MA150