

CRAIG®

W460

Road-Rated™ AM/FM Stereo Cassette Player



Custom designed for

DE LOREAN MOTOR CARS LTD

SPECIFICATIONS

"The specifications for this product were determined and are presented in accordance with specification standards established by the Ad Hoc Committee of Car Stereo Manufacturers."

FM TUNER	
Usable Sensitivity	20.2 dBf (2.8 μ V/75 Ω)
50 dB Quieting Sensitivity	18.3 dBf (2.25 μ V/75 Ω)
Frequency Response	30 to 15,000 Hz, +0, -13 dB
Capture Ratio	1.5 dB
Alternate Channel Selectivity	50 dB
Stereo Separation	30 dB at 1000 Hz 20 dB at 100 Hz 20 dB at 10,000 Hz
Image Response Ratio	45 dB
IF Response Ratio	80 dB
RF Intermodulation	70 dB
AM Suppression	60 dB
Spurious Response ($f_s + \frac{1}{2} IF$)	75 dB
Total Harmonic Distortion (65 dBf)	0.3%
Signal/Noise Ratio (65 dBf)	55 dB
Tuning Range	87.9-107.9 MHz
AM TUNER	
Sensitivity (20 dB S/N)	30 μ V
AGC Figure of Merit	45 dB
Image Response Ratio (1400 kHz)	55 dB
Adjacent Channel Selectivity	32 dB
RF Overload (10% THD)	5 V
Signal/Noise Ratio	45 dB
Whistle Modulation	36 dB
Tuning Range	530-1610 kHz

AUDIO	
Power Output	12 W per channel into 4 ohms, 20 to 20,000 Hz, at 5% THD
Minimum Recommended Load Impedance	4 ohms
Tone Action	± 8 dB at 100 Hz and 10,000 Hz
Total Harmonic Distortion (1000 Hz)	1.5% at rated output
Damping Factor	20
TAPE	
Frequency Response	40 to 10,000 Hz, +0, -5 dB
Wow and Flutter	0.15% wrms
Stereo Separation	50 dB
Signal/Noise Ratio (A-Weighted)	
Dolby Off—120 μ s:	55 dB
70 μ s:	56 dB
Dolby On—120 μ s:	63 dB
70 μ s:	64 dB
Crosstalk	50 dB
Speed (+2, -1%)	4.76 cm/s (1 $\frac{1}{8}$ in/s)
Fast-Forward Time (C-60)	100 s
Rewind Time (C-60)	100 s
Equalization	3180/120 μ s and 3180/70 μ s

Description and data
subject to change without notice

PARTS PRICE LIST

Ref. No.	CRAIG KEY No.	DESCRIPTION	MFR's SUGG RET. PRICE
MECHANISM			
1	NSP	Main Chassis	----
2	T690332	Assy, Auto Load Gear Set	8.00
3	W460323	Assy, Drive Pulley/Gears	7.00
4	T640460	Reel Base, Forward	2.45
5	T640258	Assy, Reverse Pinch Roller	1.50
6	T640259	Assy, Forward Pinch Roller	1.50
7	T640205	Flywheel, Forward	2.70
8	T640206	Flywheel, Reverse	2.70
9	T640251	Assy, Cam Gear	1.50
10	T640382	Lock Plate, Cam Gear	.70
11	T690380	Lock Plate, Head Slide	.65
12	T690381	Slide Plate	1.45
13	T690382	Slide Plate, Eject	1.55
14	T690383	Slide Plate	1.90
15	T640461	Reel Base, Reverse	2.00
16	W460341	Push Lever, F. Fwd	1.15
17	W460342	Push Lever, Rew	1.15
18	NSP	Bkt, Cassette Housing	----
19	W460343	Assy, Head Slide	3.20
20	W460344	Lever, Reverse	1.15
21	W460380	Slide Plate, Solenoid Plunger	1.20
22	W460345	Lever, Solenoid Plunger	.65
23	W460381	Housing, Cassette	4.50
24	NSP	Mtg Bkt, Head Sw PCB & Slide	----
25	NSP	Wire Clamp	----
26	W460266	Base, Flywheel	.65
27	W460382	Slide Plate, Head Select Sw	.50
28	T640348	Lock Plate, F.Fwd/Rew	.70
29	T690343	Lever, Cassette Lock	3.40
30	NSP	Guide Plate, F.Fwd/Rew Levers	----
31	T640231	Special Wshr, Lock Lever	.25
32	W460346	Lever, Motor Sw Actuator	.70
33	NSP	Mtg Bkt, Auto Load Gear Set	----
34	W460395	Mtg Bkt, Drive Pulley/Gears	.40
35	NSP	Mtg Bkt, PCB	----
36	W460347	Lever, Head Slide	.35
37	NSP	Wshr	----
38	T640212	Shaft, Pinch Roller Spr	.45
39	T640232	Spacer, Head Base	.30
40	T690232	Collar, Cassette Base	.25
41	T690233	Collar, Slide Plate	.25
42	T640233	Collar, Eject Plate	.25
43	T690235	Collar, Cassette Housing	.25
44	T640234	Collar, Rewind Lever	.25
45	T640235	Collar, Cassette Housing	.25
46	T640236	Roller, Rewind Lever	.25
47	T640237	Collar, Solenoid Plunger	.25
48	T640238	Collar, F.Fwd Arm	.30
49	W460231	Collar, Cassette Housing	.25
50	W460232	Spacer	.25
51	W460233	Collar, Motor Sw Lever	.25
52	T641231	Spacer, Head Base	.25
53	W460234	Azimuth Nut	.45
54	T640352	Arm, Lock (Plastic)	.50
55	W460348	Arm, Loading	1.50
56	T640208	B E L T, Drive	.80
57	T640311	Pulley, Motor	.30
58	T690270	Spr, Eject	.30
59	T690271	Spr, Slide Plate	.30
60	T690272	Spr, Head Base	.25
61	T690274	Spr, Cassette Auto Load Assy	.25
62	T640272	Spr, Pinch Rollers	.25
63	T690275	Spr, Lock Plate	.25
64	T640278	Spr, Eject Solenoid Plunger	.25
65	T640280	Spr, Fast Wind Switch	.25
66	T690277	Spr, F.F/Rew Lever Return(R)	.25
67	W460270	Spr, Drive Pulley/Gears Assy	.25
68	W460271	Spr, Lock Plate Arm	.35
69	W460272	Spr, F.F/Rew Lever Return (L)	.30
70	T601097	Spr, Azimuth Adjust	.25
71	T607273	Spr, Flywheel Base	.25
72	T606236	Wshr, Reel Bases (Orange)	.25
73	T606237	Wshr, Flywheels/Cam Gear	.25
74	T606238	Ret Wshr, Reel Bases	.25
76	T640800	Fiber, Detector Sw	.25
77	T601041	Motor Cushion	.25
78	W460706	Insulator	.25
79	3137049	Thrust Wshr	.25
80	W460420	Guide, Cassette Housing	.85
201	W460503	H E A D	31.95
202	W460500	M O T O R	16.50
203	T640530	Slide Sw, Head Change	1.85
204	W460530	Push Sw, F.Fwd	2.00
205	T690531	Micro Sw, RADIO/TAPE	3.00
206	T641598	S O L E N O I D	3.80
206A	-----	Plate(part of Ref #206)	----
207	T601101	Detector Switch	1.75
208	W460521	PCB, Head Switching w/Comp	9.05

NSP: Non-Serviceable Part

Ref. No.	CRAIG KEY No.	DESCRIPTION	MFR's SUGG RET. PRICE
ASSEMBLY			
101	NSP	Lug Washer	----
102	W460050	Cabinet Bottom, Panel	2.30
103	W460051	Cabinet Top Panel	2.30
104	NSP	Main Frame, Cabinet	----
105	W460396	Mtg Bkt, Nose Piece/Cont PCB	1.95
106	W460052	Cabinet, Back Panel	2.00
107	NSP	Shield Casing	----
108	NSP	Bkt, Heatsink	----
109	W460383	Frame, Cass Door	1.15
110	S601038	Wshr, Cont Shaft Locator	.30
111	S601028	Clamp, Pwr/SP Harness	.30
112	R200380	Clamp, Ant Cord	.60
113	NSP	Heat Sink	----
114	NSP	Ext Stud, Chassis To Back Panel	----
115	W460712	Shaft, Cassette Door	.60
116	W460010	Nosepiece(Front Excutechon)	4.20
117	W460061	Panel, Control Button(Overlay)	1.70
118	W460083	Trimplate	2.80
119	W460415	Assy, Mask w/Dome Contacts	5.20
120	W460026	Button, LD/FM/ST/DX/Pre-Set/MEMO	.40
121	W460027	Button, Dolby/MTL/Tape Direction	.40
122	W460028	Button, Rew/F.Fwd	.45
123	W460086	Lens, Display	.80
124	W460029	Knob, Treb-Bass/Fader	1.00
125	W460030	Knob, VOL/TUNING	1.00
126	R200102	Label, DOLBY	.25
127	NSP	Label, Model I.D.	----
128	NSP	Label, Tuning Range	----
129	W460709	Insulator, Top Cab(Plastic Sheet)	1.70
130	T690800	Veil(Fiber Screen)	.30
131	W460384	Frame/Spacer, Display	.25
132	W460707	Insulator, Bottom Cab(Plastic Sheet)	.70
133	W460708	Insulator, Shield(Fiber)	.25
134	NSP	Insulator, Filter PCB (Fiber)	----
135	NSP	Insulator	----
136	W460431	Pad, Display Door(small)	.25
137	W460432	Pad, Display Door(large)	.25
138	W460710	Insulator, Synthesizer PCB	.30
139	NSP	Shrink Tubing	----
140	NSP	Spacer, Control	----
141	W460273	Spr, Display/Cassette Door	.25
142	W460621	FPC Lead	7.00
301	PG5532TX	LED, (Green) Tape Direction	1.45
302	PR2434D	LED, LD/FM/ST/DX(Red)	1.15
303	PG2434DX	LED, (Green) DOLBY/MTL	1.70
304	Ay2434D	LED, (Yellow) Memo	1.70
305	BU441YK	LED Display	35.70
306	W460531	Slide Sw,	1.30
307	W460620	Assy, 9P Conn W/Wires ONLY(unit side)	3.00
308	W460607	Assy, Ant So w/Cable	3.85
309	T690570	Cont, VOL/TREB/BASS w/Sw	15.35
310	W460570	Cont, Manual Tune/Scan/Fader	8.55
311	W460516	Assy, Cont Synthesizer/FM/Driver/AMP PCB	141.65
312	W460517	Assy, AM PCB	41.40
313	W460518	Assy, Pre-Amp/Motor Gov PCB	35.50
314	W460519	Assy, Keyboard PCB	16.30
315	W460520	Assy, Filter PCB w/Comp	8.00

Ref. No.	CRAIG KEY No.	DESCRIPTION	MFR's SUGG RET. PRICE
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COILS, TRIMMERS, & XFORMERS

L381	T615672	Choke Coil	1.50
L382	W460670	Choke Coil	2.10
L401,403	W460671	Coil, FM RF	1.40
L402	W460672	Coil, 5.6mH	.80
L404	W460673	Coil, Trap	.65
L431	W460674	Coil, FM OSC	1.40
L451	W460675	Coil, FM Phase	1.15
L501,502	W460676	Coil, Trap 40mH	1.60
L601	W460677	Coil, AM	1.55
L602	W460678	Coil, AM RF	1.55
L603	W460679	Coil, AM OSC	1.55
L802	W460647	OSC Block	5.55
T401	W460641	IFT, FM	1.55
T451	W460642	IFT, FM	1.60
T601	W460643	IFT, AM	1.70
T602,652	W460644	IFT, AM	1.70
T651	W460645	IFT, AM	1.70
T653	W460646	IFT, AM	1.70
C404,408	W460680	Trimmer, 10pF	.80
C614,616	W460681	Trimmer, 20pF	.80
C619	W460682	Trimmer, 11pF	.80
CF601	W460684	Ceramic Filter	4.80
CF451,452	W460683	Ceramic Filter	1.60
X801	W460722	Crystal, 4.5MHz	5.60

Ref. No.	CRAIG KEY No.	DESCRIPTION	MFR's SUGG RET. PRICE
SEMICONDUCTORS			
D101, 201 102, 103, 131, 132, 202, 203, 231, 232, 301, 351, 352, 353, 357, 501, 502, 503, 504, 801, 802, 806~815, 821, 841, 901	1N34A	Diode	.60
D354, 355, 356, 381	1S1588	Diode	1.35
D601, 602, 651, 652	S1B0102	Diode	.55
D603~605	1S188FM	Diode	.60
D401, 402, 431	SVC321	Varactor Diode	4.90
D831, 832	SVC202	Varactor Diode	1.80
D902	DFA05C	Diode	1.05
D903, 904	AY2434D	LED, Memory Ind (Yellow)	1.70
D905, 906	PG5532TX	LED, Tape Direction Ind (Green)	1.60
D907, 908, 909, 910	PG2434DX	LED, Dolby/MTL Ind (Green)	1.70
DP1	PR2434D	LED, LD/FM/ST/DX Ind (Red)	1.15
IC151, 152	BU441YK	LED, Tuning Display	35.70
IC301	μPC1185H	I.C., AMP	8.65
IC302	TA7325P	I.C., Pre-Amp	2.90
IC331	HA11226	I.C., Dolby	13.35
IC351	RC4558D	I.C., Driver AMP	3.00
IC352	CX065	I.C., Motor Regulator	5.00
IC451	NE555P	I.C., Switching	2.90
IC501	HA12412	I.C., FM IF	8.75
IC601	LA3370	I.C., FM MPX	5.65
IC801	LA1130	I.C., AM	5.20
IC802	μPB533AC	I.C., Pre-Scaler	13.55
IC803	μPD1701C0B	L. S. I., Microcomputer	29.95
IC804	μPA53C	I.C., LED Digit Drive	3.65
IC805	BA618	I.C., Segment Drive	5.15
IC901	μPC78L05	I.C., Voltage Regulator	2.80
IC902, 903, 904	μPD4050C	I.C., Control	2.90
Q101, 201	μPD4013C	I.C., Control	3.90
Q131, 132, 133, 231, 232, 233, 453, 501, 601, 605, 672, 674, 901, 902, 903	2SA733	Transistor	.95
Q351	2SC536	Transistor	3.80
Q352, 353	2SC1449	Transistor	1.50
Q402	2SC2001	Transistor	1.15
Q432, 451, 452, 652	2SC668	Transistor	2.30
Q602, 604, 631, 606, 651	2SC930	Transistor	1.50
Q603	2SK212	F.E.T.	1.50
Q671, 673	2SK161	F.E.T.	1.30
Q802, 804, 806, 807, 808, 809, 810, 811, 812, 813	2SD879	Transistor	1.50
Q814	2SC2021	Transistor	1.00
Q815	2SD439	Transistor	1.50
Z351	2SK104	F.E.T.	.65
Z671, 672	WZ075	Zener Diode	.75
Z801	WZ096	Zener Diode	.45
Z802	XZ051	Zener Diode	.50
Z803	WZ150	Zener Diode	1.35
Z804	XZ090	Zener Diode	1.60
	RD4.7EB	Zener Diode	.45
MISCELLANEOUS ELECTRICAL			
FPC1	W460621	FPC Lead	7.00
J401	W460607	Ant Receptacle	3.85
N601	T687550	Neon Lamp	1.00
P301	W460608	5P Conn, Base Post	.60
P302	W460609	8P Conn, Base Post	.85
P303	W460612	9P Conn, Pwr/SPkrs (Car Side)	3.00
	3149120	Shell, 9P Conn So	.65
	3149123	Pin, 9P Conn So	.25
P601	W460610	10P Conn, Base Post	1.05
R108, 208	W460590	Semi-Fixed Resistor, 20k Ohm	.75
R306	T607590	Semi-Fixed Resistor, 10k "	.75
R351	T684590	Semi-Fixed Resistor, 50k "	.70
R459, 501	H221592	Semi-Fixed Resistor, 20k "	.70

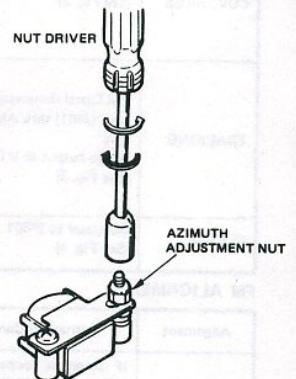
Ref. No.	CRAIG KEY No.	DESCRIPTION	MFR's SUGG RET. PRICE
MISC ELECTRICAL (cont)			
R877	H221590	Semi-Fixed Resistor, 100k Ohm	.70
R506	H361590	Semi-Fixed Resistor, 10k "	.75
RY401	W460718	Relay (L13)	7.15
S1	Assy- See Ref #119 or #314	Dome Sw, FM	----
S2		Dome Sw, ST,	----
S3		Dome Sw, DX,	----
S4		Dome Sw, LOUD	----
S5		Dome Sw, MTL	----
S6		Dome Sw, DOLBY	----
S7		Dome Sw, Tape Direction	----
S8		Dome Sw, Memory	----
S9~14		Dome Sw, Pre-Set Stations	----
S301		T640530	Slide Sw, Head Change
S302	W460530	Push Sw, F.Fwd	2.00
S303	T601101	Detector Sw	1.75
S801	W460531	Slide Sw, Test Set Up	1.30
S802	-----	Push Sw, Scan/Hold (see Fader)	----
S803	-----	Rotary Sw, Manual Tune "	----
S804	-----	Eject Sw (See VOL Cont)	----
SK301	W460621	5P Conn Plug	1.70
SK302	W460622	8P Conn Plug	3.70
SK303	W460620	9P Conn w/Wire	3.00
	3149121	Shell, 9P Conn Plug	.65
	3149122	Pin, 9P Conn Plug	.25
SK401	W460623	10P Conn Plug	5.60
SK801	W460611	16P FPC Conn So	2.25
VR101, 102, 103, 201, 202, 203, 301	T690570	Cont, TREBLE/BASS/BAL/VOL/ EJECT Sw/PWR ON-OFF Sw	15.35
S304, 305 VR104, 204, S802, 803	W460570	Cont, FADER/MANUAL TUNE/SCAN & Hold Sw	10.95

SUBJECT TO CHANGE WITHOUT NOTICE. USE ALL AVAILABLE NUMBERS AND COMPLETE DESCRIPTION WHEN ORDERING, INCLUDING MODEL NUMBER. THESE PRICES REVISED AS OF 7-3-81

TAPE DRIVE ADJUSTMENT

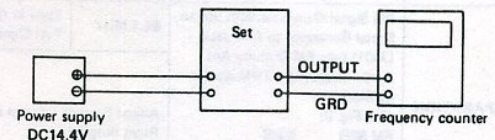
Head Azimuth Adjustment

Load the unit with a 6.3 kHz test tape.
Set the Volume and Tone controls to the maximum position and Balance control to the mechanical center.
Turn Azimuth adjustment nut for maximum output on the VTVM connected to the audio output.



Tape Speed Adjustment

Load the unit with a 3 kHz test cassette.
Take a frequency counter reading. It should be 3 kHz.
If not, adjust the R351.



Required advancement or retardation of tape speed is given by the following formula.

$$\frac{3000 - fx}{3000} \times 100 = X\%$$

fx = counter displayed value.

X = required value in percentage.

ALIGNMENT PROCEDURE

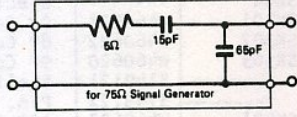
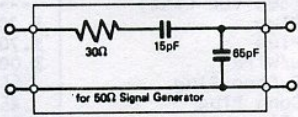
INSTRUMENTS REQUIRED

- IF Generator Scope
- AM Signal Generator
- FM Signal Generator
- FM Stereo Generator
- Sweep Generator
- Marker Generator
- Frequency Counter
- DC Meter
- Output Meter (VTVM)
- Oscilloscope
- AM Dummy Ant.
- FM Dummy Ant.

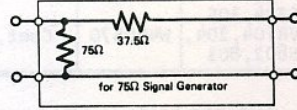
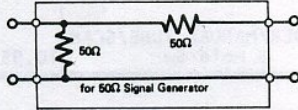
IMPORTANT

- Use non-metallic tools for the following adjustments.
- Generator signal level should be kept as low as possible to avoid signal clipping or saturation.
- RF generator signal should be modulated 30% by 400 kHz sine-wave signal.
- To ensure proper generator-to-receiver impedance matching, connect appropriate dummy antenna between generator and receiver.
- Do not put negative sides of L and R channels together, as this may result in damaging the unit.
- Test instrument negative sides of L and R channels should not be put together.
- Negative side of battery must be isolated from negative sides of speakers and test instrument L and R channels.

AM Dummy Antenna



FM Dummy Antenna



AM ALIGNMENT

Alignment	Instrument Connection	Generator Frequency	Dial Setting	Adjustment	Step
IF	IF Generator Scope RF output to Ant. Jack (J401). TP to IF Generator Scope input. (See Fig. 1)	450 kHz	High end	T601 and T602 for maximum and symmetric waveform.	1
BAND COVERAGE	DC meter to T601 (P601 8). (See Fig. 2)	530 kHz	Low end	AM OSC. Coil (L603) for 1.3V.	2
		1620 kHz	High end	AM OSC. Trimmer (C619) for 8V or 8.5V.	3
		Repeat Steps 2 and 3 two or three times for best result to obtain 1.3V or 8V.			4
TRACKING	AM Signal Generator to ANT. Jack (J401) thru AM Dummy Ant. Audio output to VTVM. (See Fig. 3)	1400 kHz	Tune in to Test Signal	Ant. Trimmer (C614) and RF Trimmer (C616) for maximum output.	5
		600 kHz	Tune in to Test Signal	Ant. Coil (L601) and RF Coil (L602) for maximum output.	6
		Repeat Steps 5 and 6 two or three times for maximum output.			7
IF STOP	DC Meter to (P601 7). (See Fig. 4)	1000 kHz	Tune in to Test Signal	IFT. T651, T652 and T653 for maximum output (DC).	8

FM ALIGNMENT

Alignment	Instrument Connection	Generator Frequency	Dial Setting	Adjustment	Step
IF	IF Generator Scope RF output to Ant. Jack (J401). FM IF TP1 to IF Generator Scope input. (See Fig. 5)	10.7 MHz	Quiet area near high end	T401 and T451 for maximum and best symmetric waveform	1
BAND COVERAGE	DC Meter to (C01). (See Fig. 6)	107.9 MHz	High end	FM OSC Coil (L431) for 10V	2
19 kHz FREQ.	FM TP2 to Frequency counter. (See Fig. 7)	No input signal is required. Use a Frequency counter with the impedance greater than 100 kΩ.		R506 for 19 kHz ±100 Hz	3
SEPARATION	FM Signal Generator with Stereo Signal Generator to Ant. Jack (J401) thru FM Dummy Ant. Audio output to VTVM and/or oscilloscope. (See Fig. 8) FM SSG 60dB Modulation 400 Hz 30% Pilot 7.5 kHz Main 15 kHz	98.1 MHz	Tune in to Test Signal	R501 for best separation	4
		Adjust Balance Control so as to obtain balanced Left and Right outputs.			

NOTE FOR FM IF ALIGNMENT

After Step 1 alignment, connect DC Meter to C23. Set FM Signal Generator to 98.10 MHz 1mV and tune in the unit. Ascertain that the voltage values to the Signal Generator frequency 98.10 MHz ±75 kHz is 4V (high) and ±150 kHz is 0V (low) at C23. Failure to meet these values may require readjustment of T451.

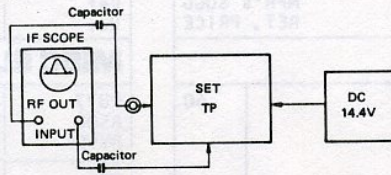


Fig. 1

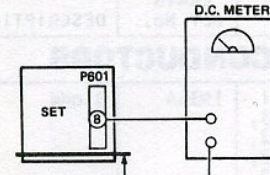


Fig. 2

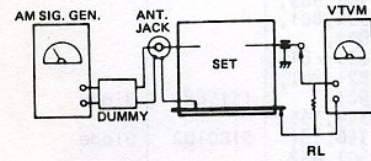


Fig. 3

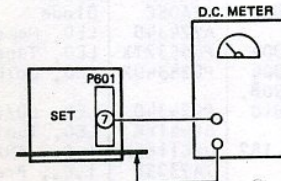


Fig. 4

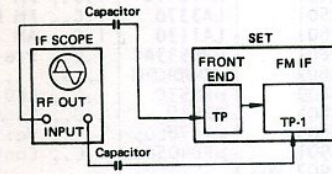


Fig. 5

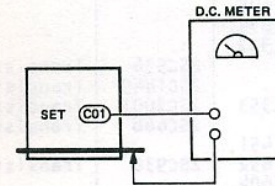


Fig. 6

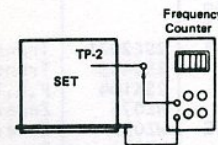


Fig. 7

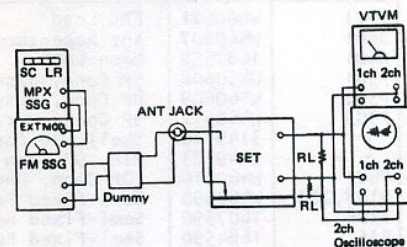
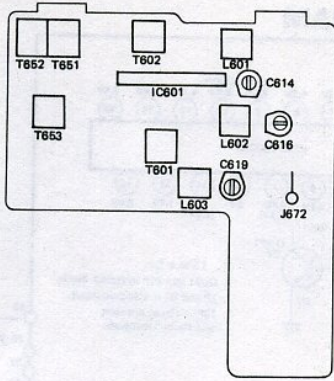
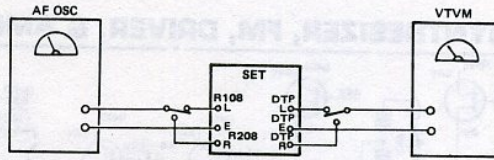


Fig. 8

ALIGNMENT POINTS

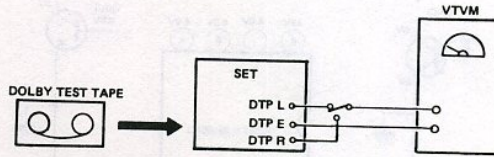
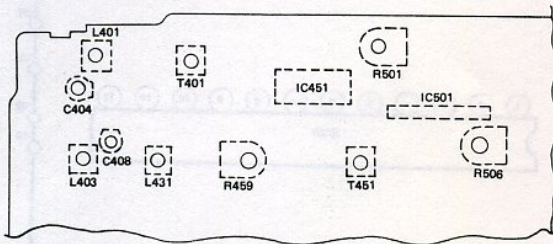


DOLBY NR LAW ADJUSTMENT



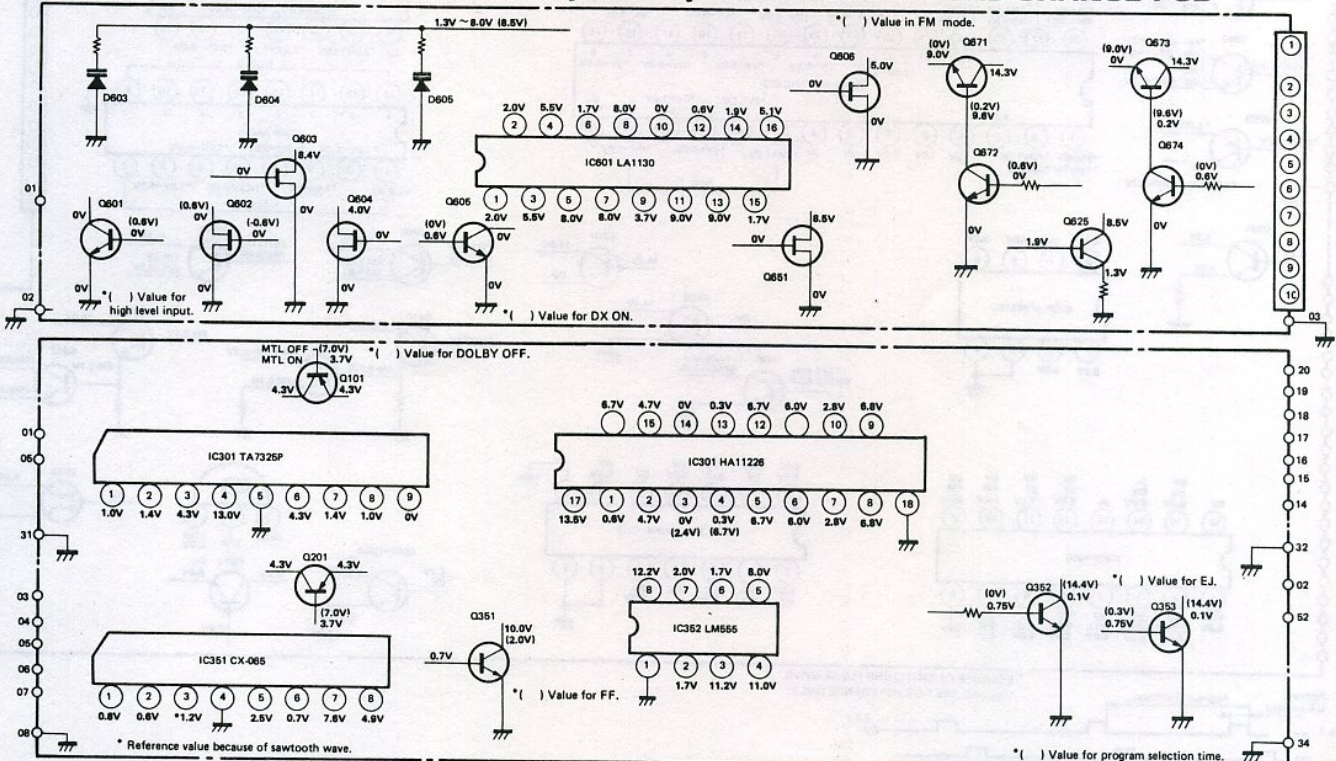
Inject 5 kHz signal to the DOLBY input so as to obtain -22.4 dB at the DOLBY output. With the DOLBY switch turn ON and OFF, adjust R306 and obtain -8 dB level difference at the DOLBY output.

DOLBY NR LEVEL ADJUSTMENT



Insert the DOLBY LEVEL TEST TAPE to the unit. Adjust R108, R208 so as to obtain 0 ±1 dB level at the DOLBY output.

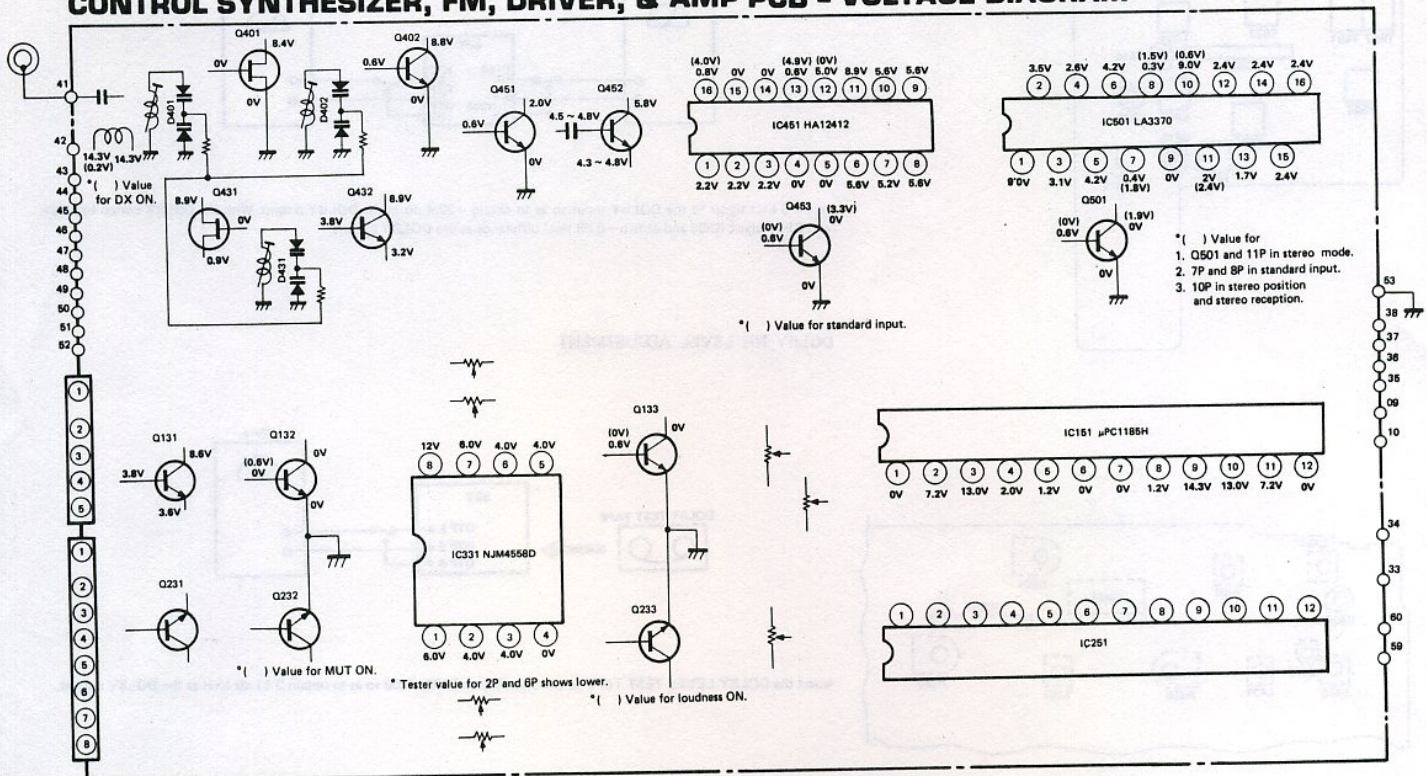
VOLTAGE DIAGRAM - AM, PRE-AMP, DOLBY, MOTOR GOV & HEAD CHANGE PCB



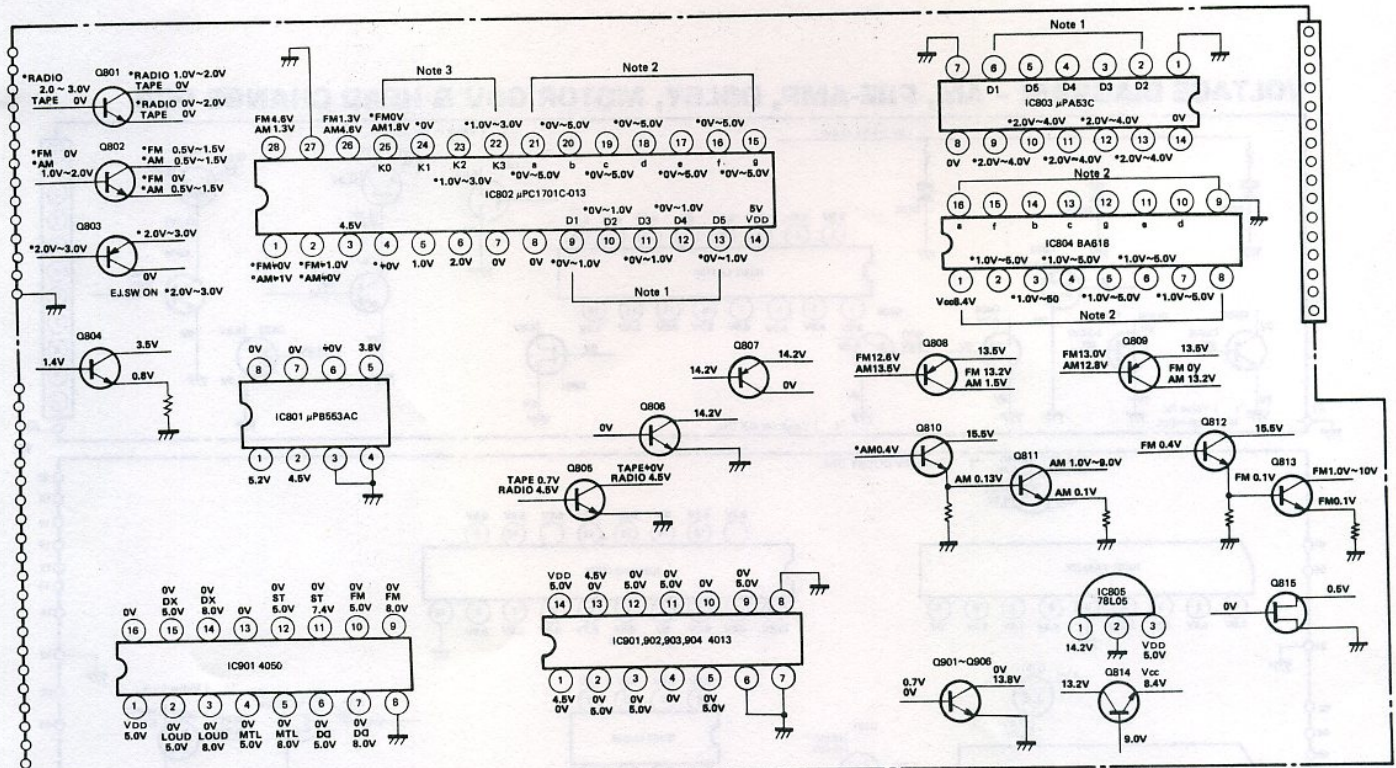
* Range of the tester for measurement.
 0 ~ 2V 2.5V range
 2 ~ 10V 10V range
 above 10V .. 50V range

* () Value for program selection time.

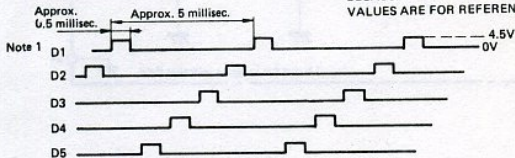
CONTROL SYNTHESIZER, FM, DRIVER, & AMP PCB - VOLTAGE DIAGRAM



* Range of the tester for measurement.
 0 ~ 2V 2.5V range
 2 ~ 10V 10V range
 above 10V ... 50V range



* BECAUSE OF SWITCHING PULSE WAVE.
 VALUES ARE FOR REFERENCE ONLY.



Note 2 Output for display segment (pulse wave).
 Note 3 Key input terminal (pulse wave).