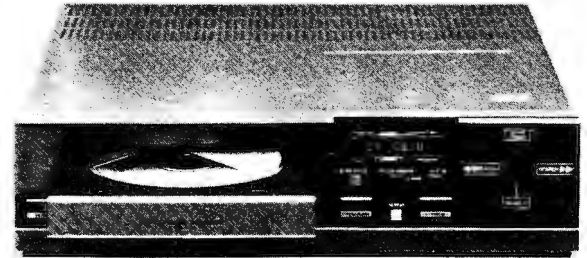


Service
Service
Service



35 491 A12.

Service Manual

COMPACT
disc
DIGITAL AUDIO

CONTENTS

1. Elucidation on the lay-out and table of contents per page.
2. Control buttons and technical specification.
3. Servicing hints.
4. Measurements and adjustments.
5. Exploded views and parts lists of mechanical parts.
6. Block diagram, circuit diagrams, data on PCBs, parts lists of electrical parts and wiring diagram.
7. Faultfinding method.
8. Modifications.
9. Additional information.

Safety regulations require that the set be restored to its original condition and that parts which are identical with those specified be used.

**CLASS 1
LASER PRODUCT**

3122 110 03420

Documentation Technique Service Dokumentation Documentazione di Servizio Huolto-Ohje Manual de Servicio Manual de Servicio



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1. ELUCIDATION ON THE LAYOUT OF THE DOCUMENTATION

The documentation consists of chapters.
The number of the chapter is indicated by the first digit of the page number.
The second digit of the page number is the sequence numbering.

If modifications or supplements require new supplementary or replacement pages, the page number is extended with a third part:

A digit behind the page number indicates that it concerns a supplementary page.

A replacement page is indicated by a letter behind the page number.

Example

3-6 is page 6 of chapter 3

3-6-1 is a supplementary page behind page 3-6

3-6-a is the replacement page of page 3-6 (so page 3-6 can be removed from the documentation).

All pages are provided with a date of issue.

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2. CONTROL BUTTONS

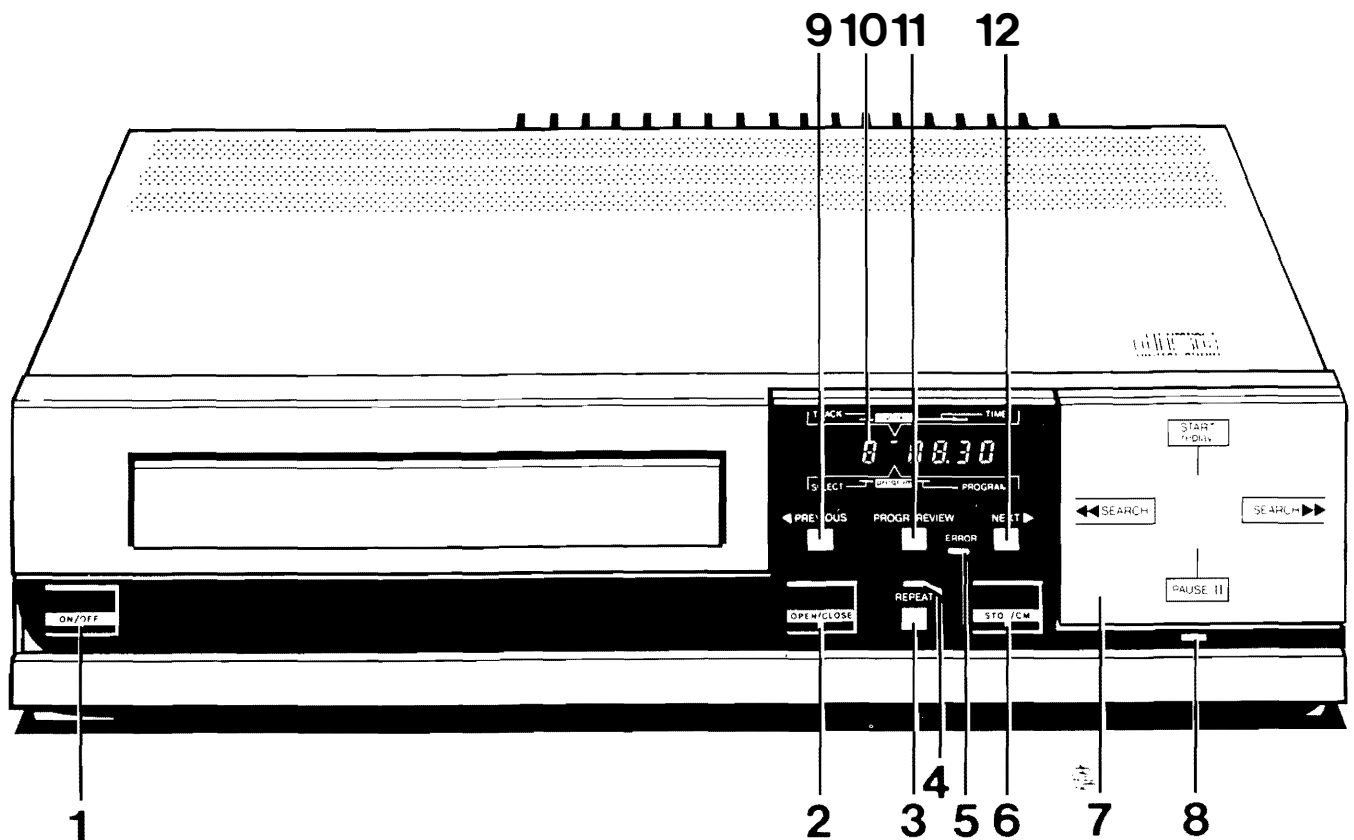


Fig. 1

36 010A

1. 'ON/OFF' key: for switching the player on and off
2. 'OPEN/CLOSE' key: for opening and closing the tray
3. 'REPEAT' key: for repeating a disc or a program
4. 'REPEAT' LED: comes on when you press the REPEAT key
5. 'ERROR' LED: flashes when you make an operating or programming error
6. 'STOP/CM' key: for stopping the playback process prematurely ('STOP') and for clearing a programme ('CM' = Clear Memory)
7. Multi key: for starting playback ('START'), returning to the beginning of a number ('replay'), searching quickly for a passage ('<< SEARCH' and 'SEARCH >>') and holding the beginning of a number or a passage or for interrupting playback ('PAUSE')
8. 'PAUSE' LED: comes on when you depress 'PAUSE'
9. 'PREVIOUS' key: for returning to a previous number during playback and storage of a program
10. Multi-indicator: is capable of showing, after insertion of the disc, the quantity of numbers and the total playing time and indicates, during playback, which number is being played and how much playing time of it has already passed; is used in programming to indicate the numbers you want to store, and shows the numbers stored
11. 'PROGR/REVIEW' key: for storing the numbers of a program and for displaying the program stored
12. 'NEXT' key: for passing over to the next number during playback or storage of a program

TECHNICAL SPECIFICATION

• System	: Compact Disc Digital Audio System	• Channel separation	: ≥ 86 dB
• Mains voltages	: 110 V, 127 V, 220 V, 240 V $\pm 10\%$ (to be changed by changing the transformer connections)	• Channel difference	: < 0.3 dB
	: CD104/01	• Overall harmonic distortion	: $\leq 0.005\%$ (0 dB)
	: 110 V, 127 V, 220 V, 240 V switchable with the help of the voltage adapter	• Intermodulation-distortion	: $\leq 0.005\%$ (0 dB)
	: CD104/07	• De-emphasis	: 0 or 15/50 μ s (switched by the subcode on the disc)
	: 117 V (with a special transformer)	• Dimensions (wxhxd)	: 320x86x300 mm (tray closed)
• Mains frequencies	: 50 Hz, 60 Hz (no conversion required)		: 320x86x450 mm (tray opened)
• Power consumption	: ≤ 30 W	• Weight	: approx. 7 kg
• Frequency range	: 20 Hz $\div$ 20 kHz ± 0.3 dB		
• Output voltage	: max. 2 V _{rms} / ≥ 2.2 k Ω		
• Output impedance	: ≤ 100 Ω		
• S/N ratio	: ≥ 90 dB		

The above specifications apply within a frequency range of 20 Hz $\div$ 20 kHz

SERVICING THE SUPPLY PCB

- Remove the 2 screws E (see Fig. 3).
- When the connectors have been loosened, the supply PCB can be taken out of the set from the rear.

Attention

The Audio cable is soldered to the decoder PCB.

When mounting the supply PCB care should be taken that the PCB falls in the guiding on the frame.

SERVICING THE SERVO PCB AND THE DECODER PCB (see Fig. 3)

- Remove the top cover.
- Remove the 2 screws A on the servo PCB.
- Remove screw B and bracket C.
- Loosen the motor control PCB of the drawer by undoing the 2 screws D.
- When the servo PCB is placed in the service position (see Fig. 4) measurement can be performed on both the servo PCB and the decoder PCB (component side).
- When the decoder PCB has to be taken out of the set, remove the bottom plate and the supply PCB. Then remove the 2 screws at the component side of the decoder PCB and bracket C that is holding the decoder PCB. When the connectors have been unplugged, the decoder PCB can be removed.

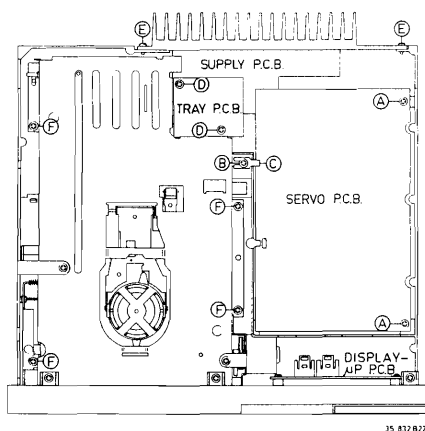


Fig. 3

SERVICING THE TRAY MECHANISM

Demounting the tray mechanism

- Remove the top cover.
- Remove the front.
- Remove the 4 screws F (see Fig. 3).
- Loosen connectors 61 and 64 on the tray control PCB.
- The tray mechanism can now be taken out of the set.
- For repairs the tray mechanism can be made operative outside the set by fixing again connectors 61 and 64 on the drawer control PCB.
- In voltageless condition the drawer can be opened by moving the drawer forward by means of a non-scratching sharp device (for example finger nails) that is placed between front and drawer.

Attention

If, during a repair, the tray mechanism or the tray control PCB has been demounted, the set will not function.

To avoid this the contacts of the tray in-end switch SK2 on the tray control PCB should be interconnected.

Replacing the disc hold-down

- See: Exploded View Tray.
- Place the disc hold-down (item 107) in its highest position (drawer opened as far as possible).
- The disc hold-down can be loosened by bending the 2 lugs on bracket item 508 apart and taking out the disc hold-down.

Replacing the tray motor:

- See: Exploded View Tray.
- Demount the tray mechanism.
- Remove the belt (item 129) from the motor pulley.
- Remove the 2 screws with item no. 119.
- The motor can now be loosened.

Demounting the drawer (item 127) and lifting plate (item 513) assy

See: Exploded View Tray.

- Demount the tray mechanism.
- Remove motor bracket item 509 by undoing the 3 screws on bracket item 509.
- Remove roller item 108 by loosening the spring ring.
- Slide the tray forward and remove it.

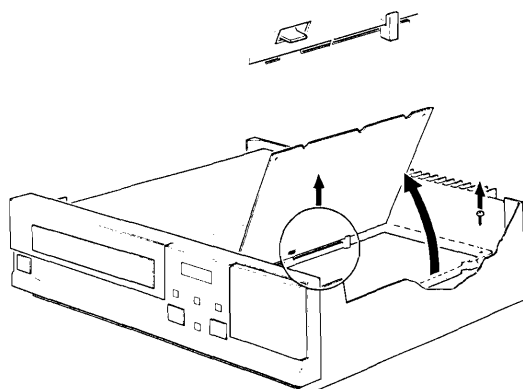


Fig. 4

3. SERVICING HINTS

In order to prevent loose metal objects from getting in the CD mechanism it will be necessary to see to a clean repair station.

Before the player is being used or serviced, the transportation screws should be removed.

These screws have to be reapplied after servicing.

The objective can be cleaned with a blow brush.

For servicing hints for the CD mechanism refer to Service Manuals CDM-0 and CDM-1.

Do not loosen any screws other than those mentioned in the hints.

The player consists of various MOS ICs. Since MOS ICs are generally very sensitive to overload and overvoltage, servicing operations should be performed with the utmost care. For further instructions see the information leaflet in the package of the ICs.

In the player chip components have been applied. For insertion and removal of chip components see the figure below.

The disc should always bed down well on the turntable. For this purpose a disc hold-down has been mounted in a bracket of the drawer mechanism.

When the drawer mechanism has to be demounted for repair, a loose hold-down should be employed.

The set can then function normally.

Code number of the disc hold-down is 4822 532 60906.

For adjustments that have to be performed on the lower side for which the unit should be in the position of normal end use, servicing supports are supplied. These supports can be mounted in the four holes of the frame.

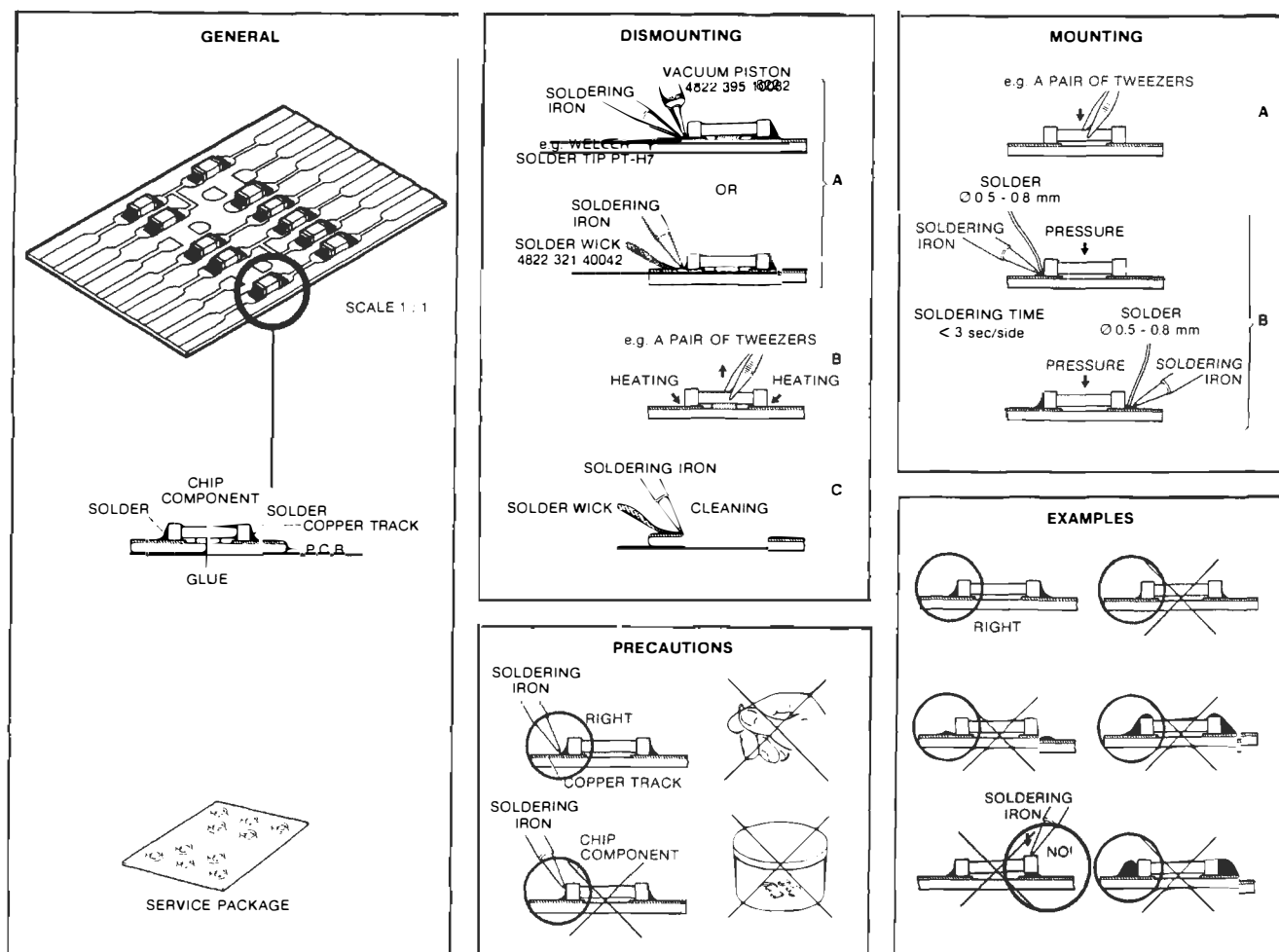


Fig. 2

The servo μ P can be set to the servicing mode to check the switch and display PCB and to separately test the servo systems.

INITIATING SERVICE LOOP A

- Put a disc on the turntable.
- Simultaneously depress the PAUSE, NEXT and STOP keys and hold them depressed while the mains voltage is switched on.
In this situation the laser and focus control are operative and the motor is running.
The light pen stays permanently under the lead-in tracks.
The radial servo system is switched off.
In this service loop the leds and the display can be checked as follows:
- The display will indicate 00—0102 and will increase and shift towards the left.
- If now the SEARCH REVERSE key is depressed, the REPEAT, ERROR and PAUSE leds will light up after two clock strokes of the display and, in the display, the play bar will light up.
The player remains in service loop A.

When the SEARCH REVERSE Key is pressed again the set returns to the previous mode.

INITIATING SERVICE LOOP B

The player can be brought from service loop A to service loop B by pressing the SEARCH FORWARD key. Now the radial servo system has been switched on independently of the P-bit and the sub-code.
In service loop B the display continues to indicate the same as in service loop A, except for the PLAY or PROGRAM bar.
The REPEAT LED will light up to indicate that the set is in service loop B.
After approx 1 minute music can be heard. (The time depends on the length of the running-in track).
From service loop B the set can be brought to the position of normal end use by pressing the START/REPLAY key while the set is displaying one of the musical numbers on the disc.

Remark:
If servo μ P MAB8440/D034 has been built in, no music can be heard after approx 1 minute.
To make this possible the MUTE line to pin 39 of the ERCO can be interrupted and be applied to the +2 power supply voltage.

SERVICE AIDS

Service supports	4822 395 30202
Audio performance test disc	4822 397 30085
Disc without local defects, disc with DO failures, black spots and finger-prints	4822 397 30096
Screwdriver set TORX	
Set straight	4822 395 50145
Set square	4822 395 50132
Disc hold down	4822 532 60906
7 th order filter	4822 395 30204

DEMOUNTING THE TOP COVER

- Remove the 4 screws in the sides.
- Remove the cover from the set by pulling it backwards.

Attention

When mounting the top cover, care should be taken that the top cover is placed correctly in the guidings of the front before mounting the four screws.

DEMOUNTING THE BOTTOM PLATE

- Remove the 3 screws in the bottom plate.
- Pick up the bottom plate at the rear of the set and pull it from the 3 fixing bosses at the front of the set.

REPLACING GLASS FUSE 1451

- Remove the bottom plate.
- Now the fuse on the mains filter PCB is accessible at the lower side via a hole in the frame.
This hole is located between the left side of the set and the Compact Disc mechanism.
When the insulating paper is unfolded the glass fuse becomes visible.

REPLACING THE TRANSFORMER FUSE

- Remove the bottom plate.
- Remove the plastic cap covering the underside of the transformer.
- The transformer fuse is now accessible.
- Replace the screening cap once the fuse has been replaced.

SERVICING THE FRONT

- Demounting the front.
- Remove the top cover.
 - Remove the 3 fixing screws at the upper side and the 3 screws at the lower side of the front.
 - The front can now be removed from the set by pulling it forwards.
 - When the two plugs are removed from the connectors on the operating panel the front can be removed from the set.

Demounting the microprocessor and display PCBs

This is in fact one PCB made up of 2 loose PCBs that are interconnected with ribbon cables.
The microprocessor PCB can be demounted by removing the 2 screws.
When this PCB is turned over, the conductor side of the display PCB becomes visible.
The display PCB can be loosened by undoing the 5 screws on this PCB.

Attention

Some buttons now lie loose in the front. The multi-function button can be demounted by removing the clamping ring at the rear of the front and by undoing the 4 snap connections.

4. MECHANICAL MEASUREMENTS AND ADJUSTMENTS

MECHANICAL MEASUREMENTS AND ADJUSTMENTS TO BE PERFORMED ON THE CDM

- For checking and adjusting the angle setting see the Service Manual of the C.D.M.
- In case of adjustment of the height of the turntable by means of the set screw on the motor shaft, the voltage across resistor 3240 on the servo PCB should be set to 0 Volt.

Note:

For checking and adjusting the angle setting the drawer mechanism has to be demounted.
See sub servicing hints.

MECHANICAL ADJUSTMENTS OF THE TRAY MECHANISM

Adjusting the clearance of the disc (see Fig. 5)

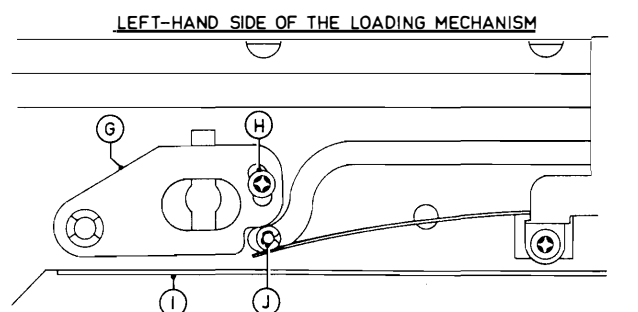


Fig. 5

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The disc may not rub against the black lifting plate (item 513 of the Exploded View Tray).

In case this should happen, the clearance can be adjusted with adjusting plate G and screw H.

With those the height of axis J of the lifting plate can be adjusted.

The adjustment should be performed with the drawer in position 'CLOSE'.

When screw H is loosened, adjusting plate G can be displaced in so far as this is allowed by the slotted hole of adjusting plate G.

If you can hear the disc rubbing, the adjusting plate should be adjusted.

In practice the disc will be adjusted parallel to edge I of the tray chassis.

Adjusting the play of the tray (see Fig. 6)

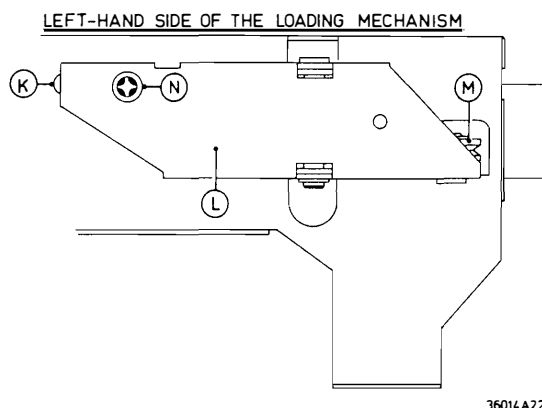


Fig. 6

36014A22

Spiral spring K ensures that bracket L, with wheel M on it, presses against the drawer so that the play of the drawer becomes minimum.

Optimum adjustment is obtained when the distance between screw N and the drawer chassis is adjusted for 0.35 mm.

Adjusting the ornamental front of the drawer (see Fig. 7)

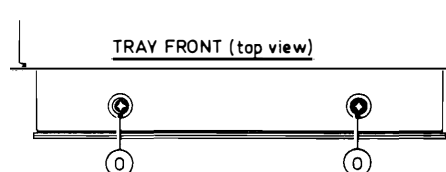


Fig. 7

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The position of the ornamental front of the drawer relative to the front of the set can be adjusted.

By means of screws O both the height and the position left-right can be adjusted.

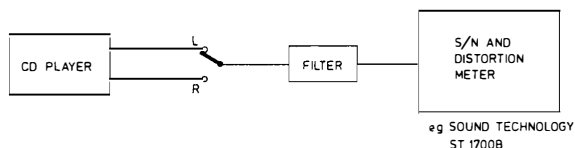
ELECTRICAL MEASUREMENTS AND ADJUSTMENTS**Specification measurement**

Fig. 8

30 459 A12

To measure the specification use can be made of audio test disc 4822 397 30085.

Use a 7th order filter, e.g. 4822 395 30204 (see Fig. 8), to measure:

- Total harmonic distortion (THD).
- Intermodulation distortion.
- Signal-to-noise ratio (S/N).

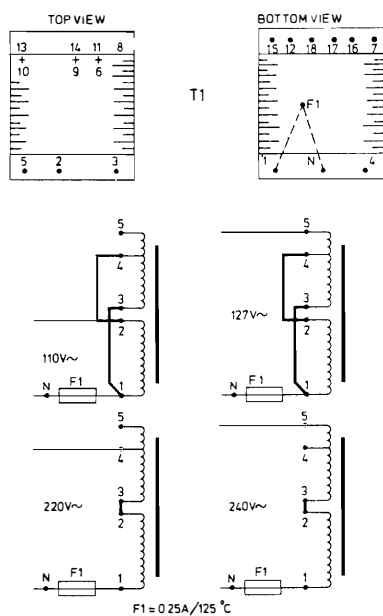
Changing the transformer connections

Fig. 9

36 114 A7

If the unit has to be connected to a mains voltage deviating from that mentioned on the type plate, the transformer connections should be changed as indicated in the figure.

Attention

In case of adaptation to 110 V or 127 V the glass fuse on the mains filter PCB must be changed from 200 mA-T to 400 mA-T.

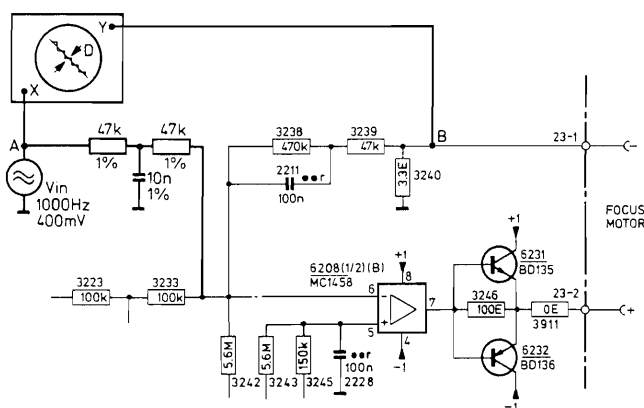
Laser power supply (POS. VOLT. SH.)

For check and preliminary adjustment of the laser supply see Service Manual C.D.M.

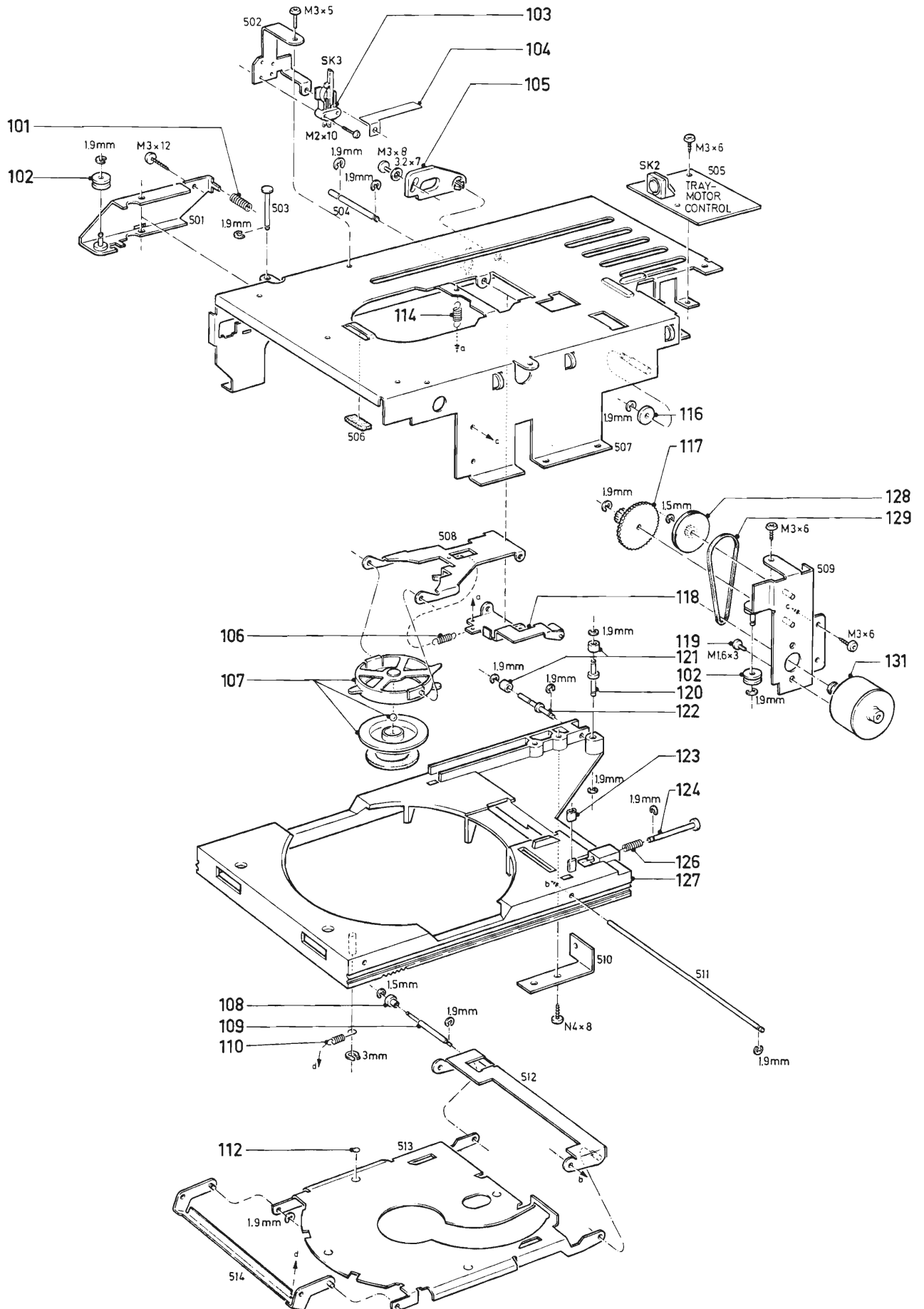
Adjusting the laser supply

Play track 1 of test disc 4822 397 30096 (disc without defects).

Connect a DC voltmeter across resistor 3308 on the servo PCB (= on emitter of transistor 6239 and ground). Adjust the laser power supply with resistor 3180 until the voltage across resistor 3308 is 575 ± 75 mV.

Adjusting the focus bandwidth

EXPLODED VIEW TRAY



TRAY

101	4822 492 51628	119	4822 502 11699
102	4822 528 80977	120	4822 535 91712
103	4822 276 11277	121	4822 532 51521
104	4822 492 63071	122	4822 535 91719
105	4822 466 81483	123	4822 532 51518
106	4822 492 32396	124	4822 535 91711
107	4822 526 10261	126	4822 492 51627
108	4822 532 11114	127	4822 444 40113
109	4822 535 91709	128	4822 528 50177
110	4822 492 32404	129	4822 358 30335
112	4822 466 60965	131	4822 361 20483
114	4822 492 32395		
116	4822 532 51519		
117	4822 522 31777		
118	4822 402 60909		

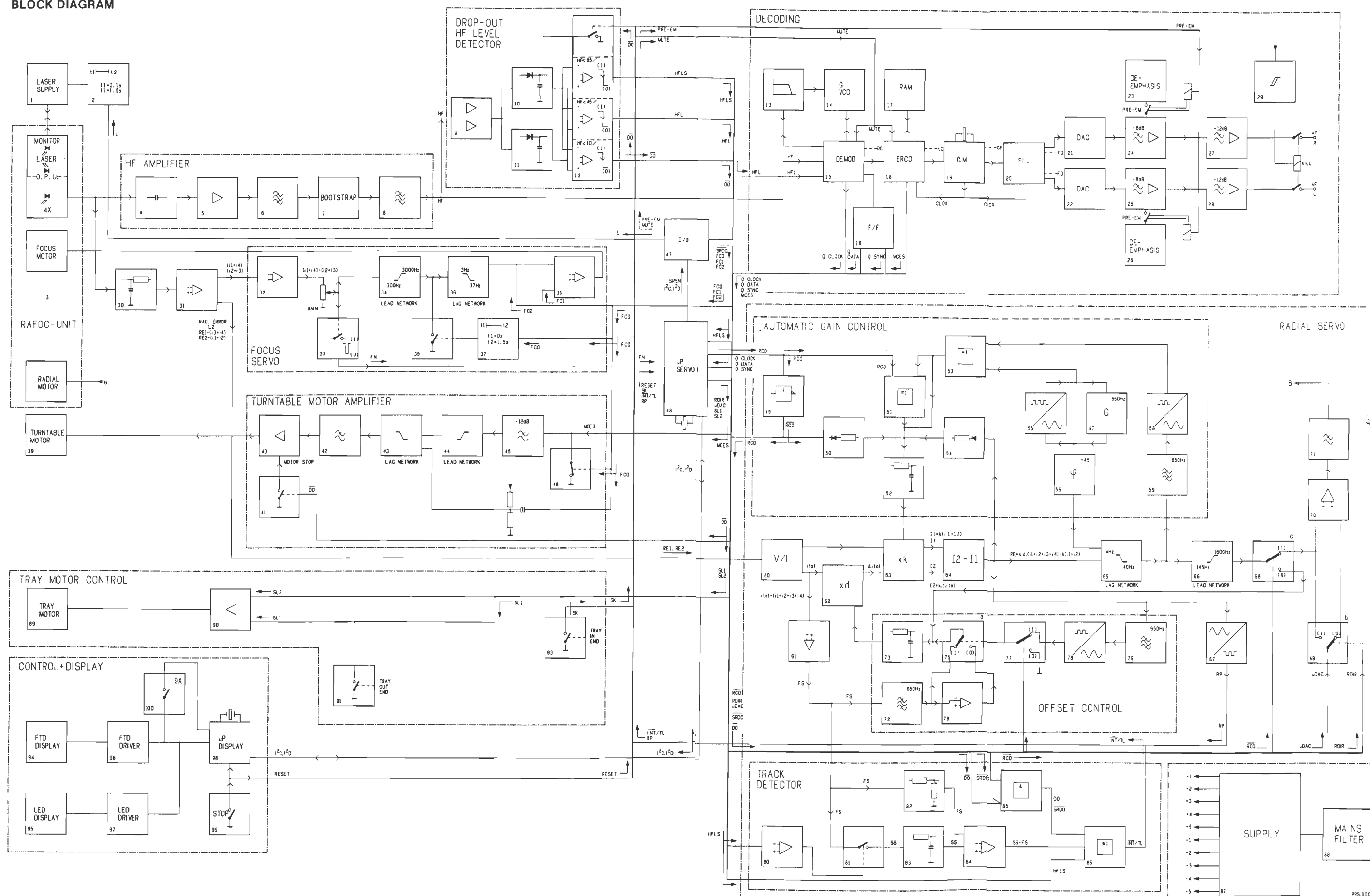
CABINET

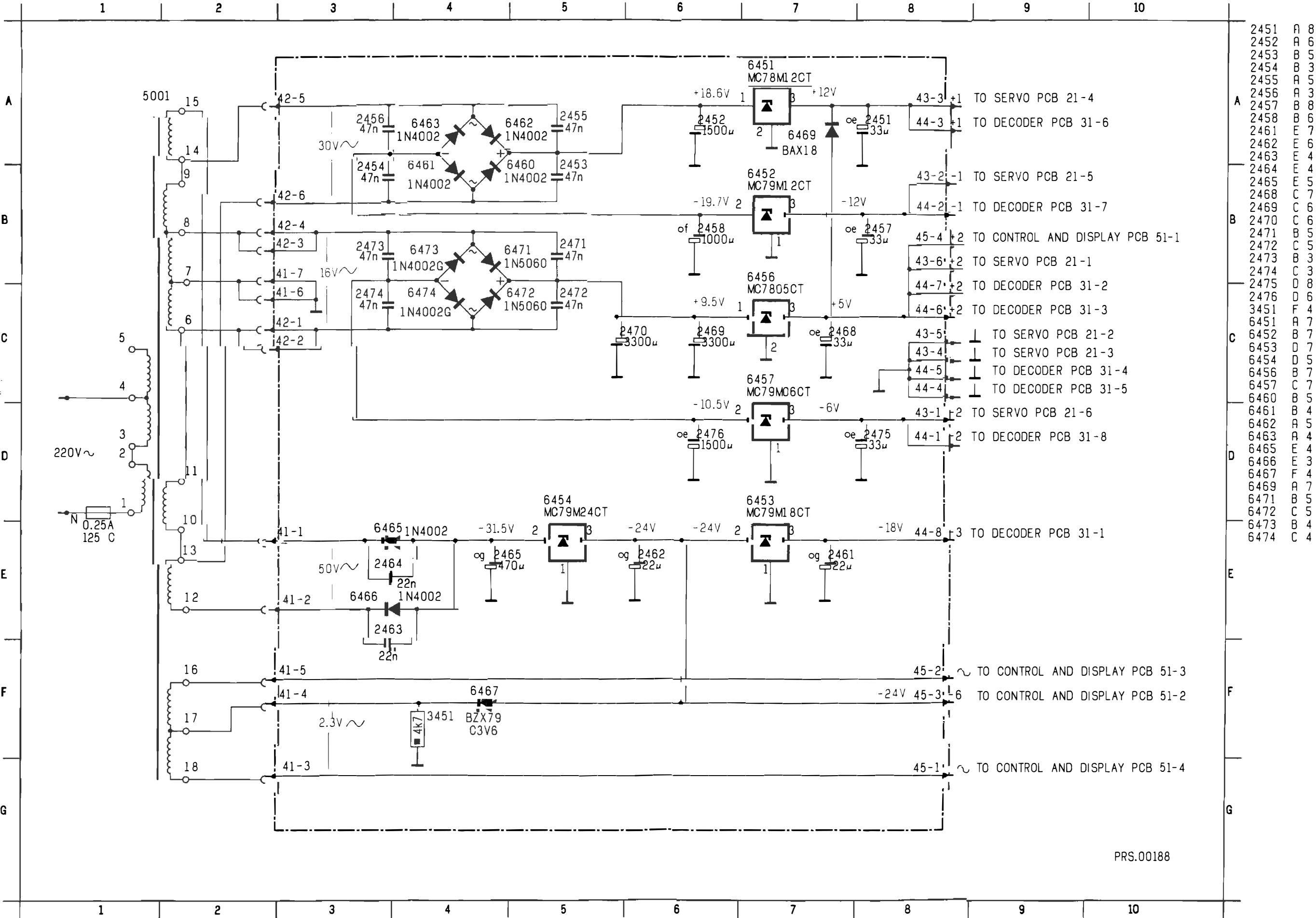
201	4822 492 51626	216	4822 410 23523
202	4822 410 23525	216	4822 410 23971 for CD104/30
203	4822 492 63038	217	4822 443 61296
204	4822 443 40148	217	4822 443 61457 for CD104/30
204	4822 443 40198 for CD104/30	218	4822 276 11262
205	4822 532 10284	219	4822 325 80226
206	4822 443 50451	220	5322 272 10215 for CD104/01
206	4822 443 50572 for CD104/30	221	4822 502 11613
207	4822 450 60411	222	4822 146 20894
208	4822 410 23521	222	4822 146 20897 for CD104/07
209	4822 450 60409	223	4822 255 40181
211	4822 410 23526	224	4822 492 63039
212	4822 410 23524	225	4822 256 30231 for CD104/01
213	4822 410 23522	226	4822 462 40409
214	4822 410 23519		

Note

For mechanical parts of the C.D. mechanism see
Service Manual C.D.M.
Code number turntable motor 4822 361 20484.

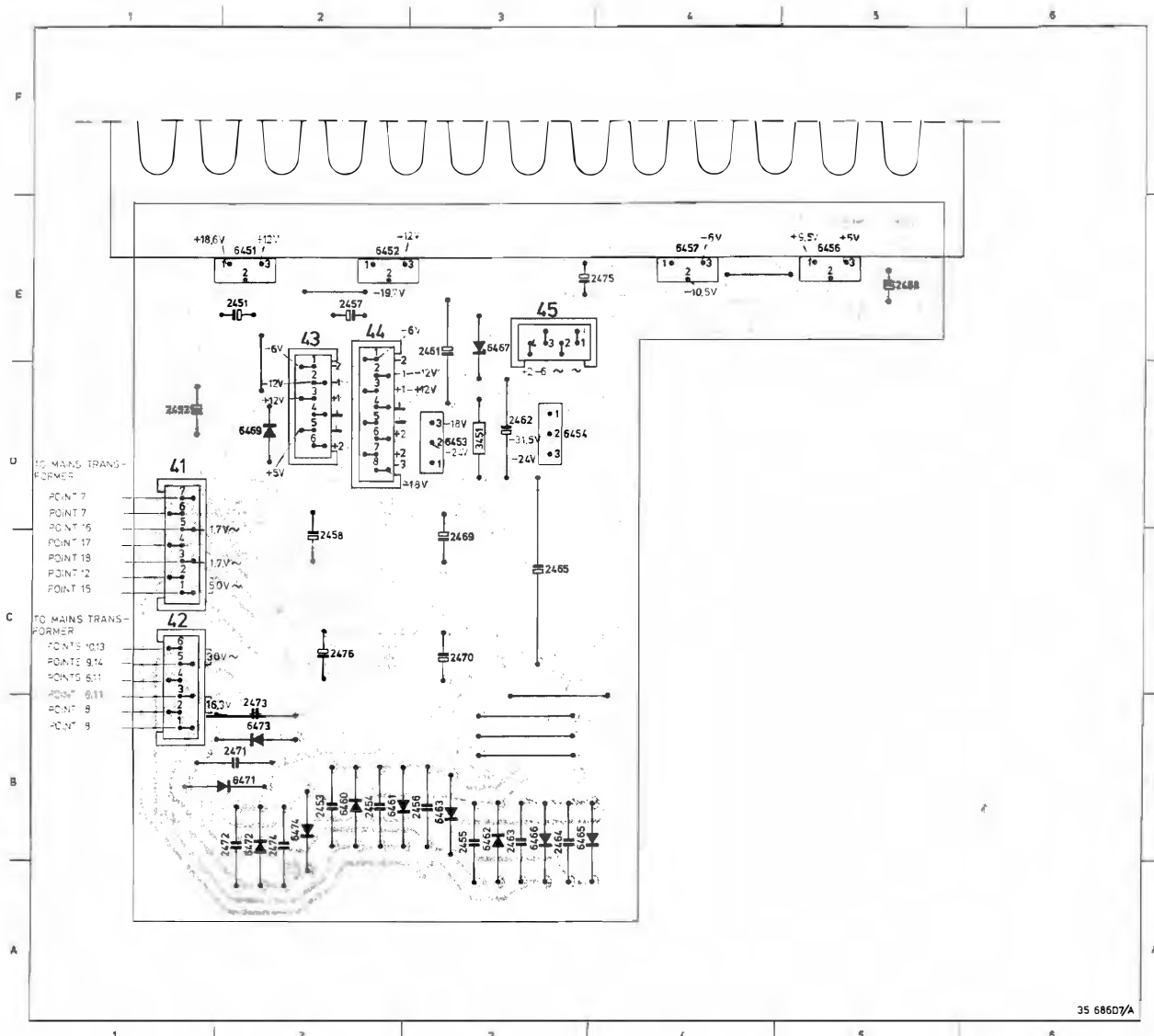






<table border="0"> <tr> <td>MC78M12CT</td> <td>5322 209 86176</td> </tr> <tr> <td>MC79M12CT</td> <td>4822 209 82065</td> </tr> <tr> <td>MC79M18CT</td> <td>4822 209 82054</td> </tr> <tr> <td>MC79M24CT</td> <td>4822 209 82055</td> </tr> <tr> <td>MC7805CT</td> <td>4822 209 80891</td> </tr> <tr> <td>MC79M06CT</td> <td>4822 209 82056</td> </tr> </table>	MC78M12CT	5322 209 86176	MC79M12CT	4822 209 82065	MC79M18CT	4822 209 82054	MC79M24CT	4822 209 82055	MC7805CT	4822 209 80891	MC79M06CT	4822 209 82056	<table border="0"> <tr> <td>2453÷2456 } 2471÷2474 }</td> <td>47 nF- 50 V</td> <td>4822 122 10288</td> </tr> <tr> <td>2463, 2464</td> <td>22 nF-100 V</td> <td>4822 122 10289</td> </tr> <tr> <td>2452, 2476</td> <td>1500 µF- 25 V</td> <td>4822 124 21471</td> </tr> <tr> <td>2469, 2470</td> <td>3300 µF- 16 V</td> <td>4822 124 21469</td> </tr> </table>	2453÷2456 } 2471÷2474 }	47 nF- 50 V	4822 122 10288	2463, 2464	22 nF-100 V	4822 122 10289	2452, 2476	1500 µF- 25 V	4822 124 21471	2469, 2470	3300 µF- 16 V	4822 124 21469
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	Miscellaneous																								
<table border="0"> <tr> <td>1N4002G</td> <td>5322 130 30684</td> </tr> <tr> <td>BAX18A</td> <td>4822 130 31025</td> </tr> <tr> <td>BZX79-C3V6</td> <td>5322 130 34834</td> </tr> <tr> <td>1N5060</td> <td>4822 130 31164</td> </tr> </table>	1N4002G	5322 130 30684	BAX18A	4822 130 31025	BZX79-C3V6	5322 130 34834	1N5060	4822 130 31164	<table border="0"> <tr> <td>Mica washer</td> <td>4822 255 40181</td> </tr> <tr> <td>Spring clip</td> <td>4822 492 63039</td> </tr> <tr> <td>Mains transformer 1009</td> <td>4822 146 20894</td> </tr> <tr> <td>Transf. fuse 125°C/0,25 A</td> <td>4822 252 20007</td> </tr> </table>	Mica washer	4822 255 40181	Spring clip	4822 492 63039	Mains transformer 1009	4822 146 20894	Transf. fuse 125°C/0,25 A	4822 252 20007								
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SUPPLY P.C.B.

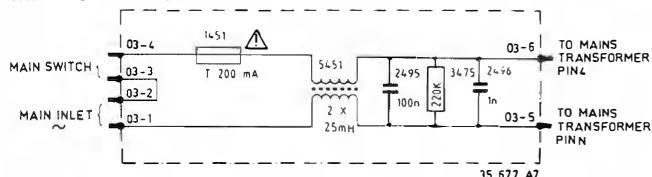


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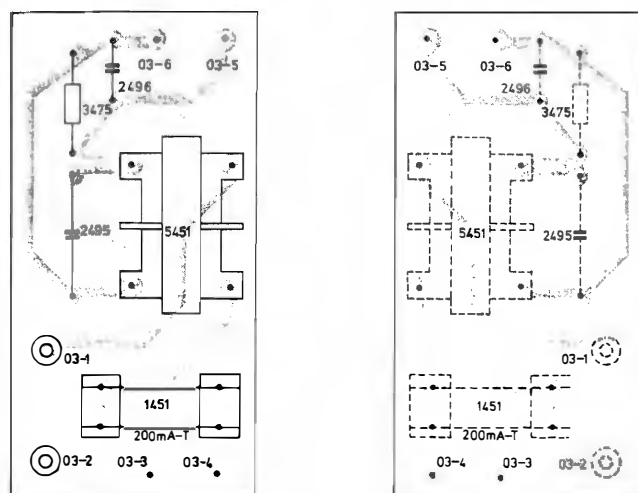
MAINS FILTER

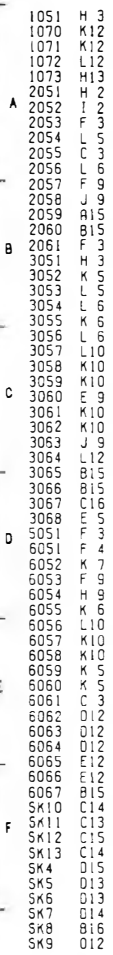
	5451	2x25 mH	4822 157 51576
	2495	100 nF- 250 V	5322 121 44302
	2496	1 nF-1000 V	4822 122 40368
	3475	220 kΩ-VR 25	5322 116 64114
	1451	220/240 V version 200 mA 110/127 V version 400 mA	4822 253 30012 4822 253 30016
Miscellaneous			
Fuse holder springs			4822 492 60063

MAINS FILTER



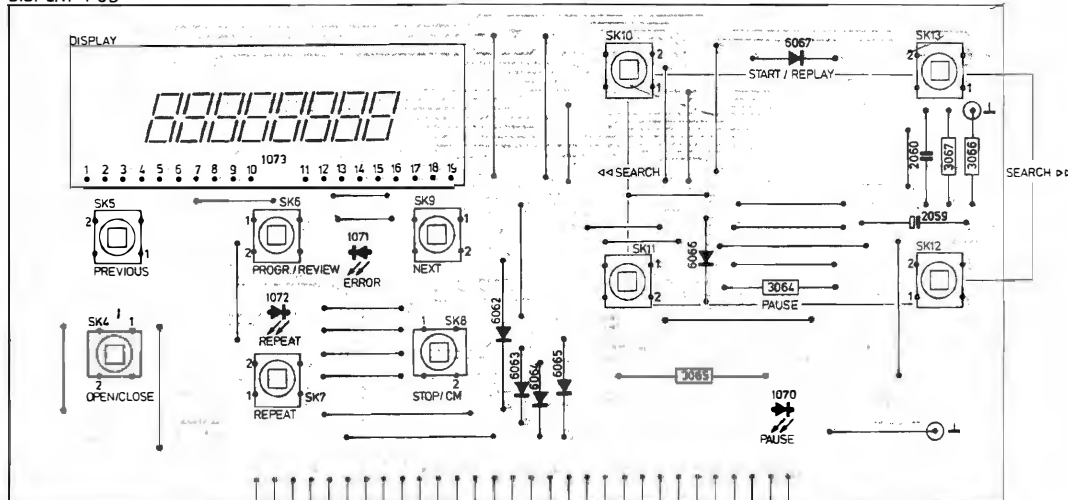
MAINS FILTER P.C.B.



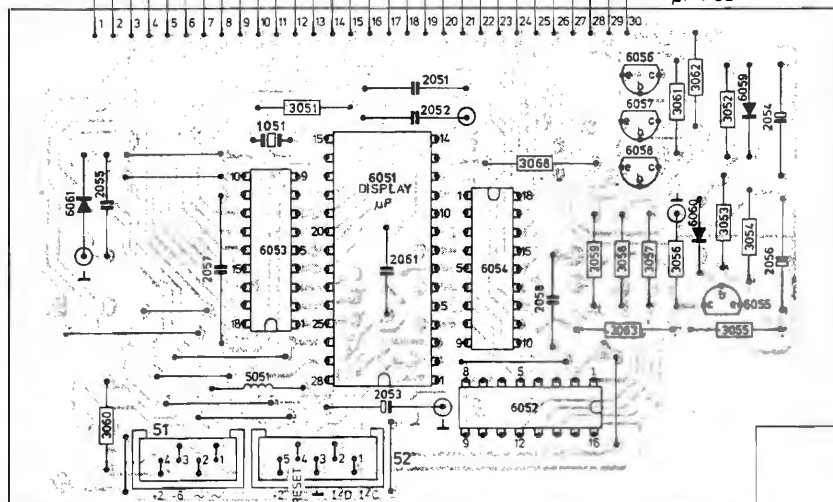


CONTROL + DISPLAY P.C.B.

DISPLAY PCB



μP PCB



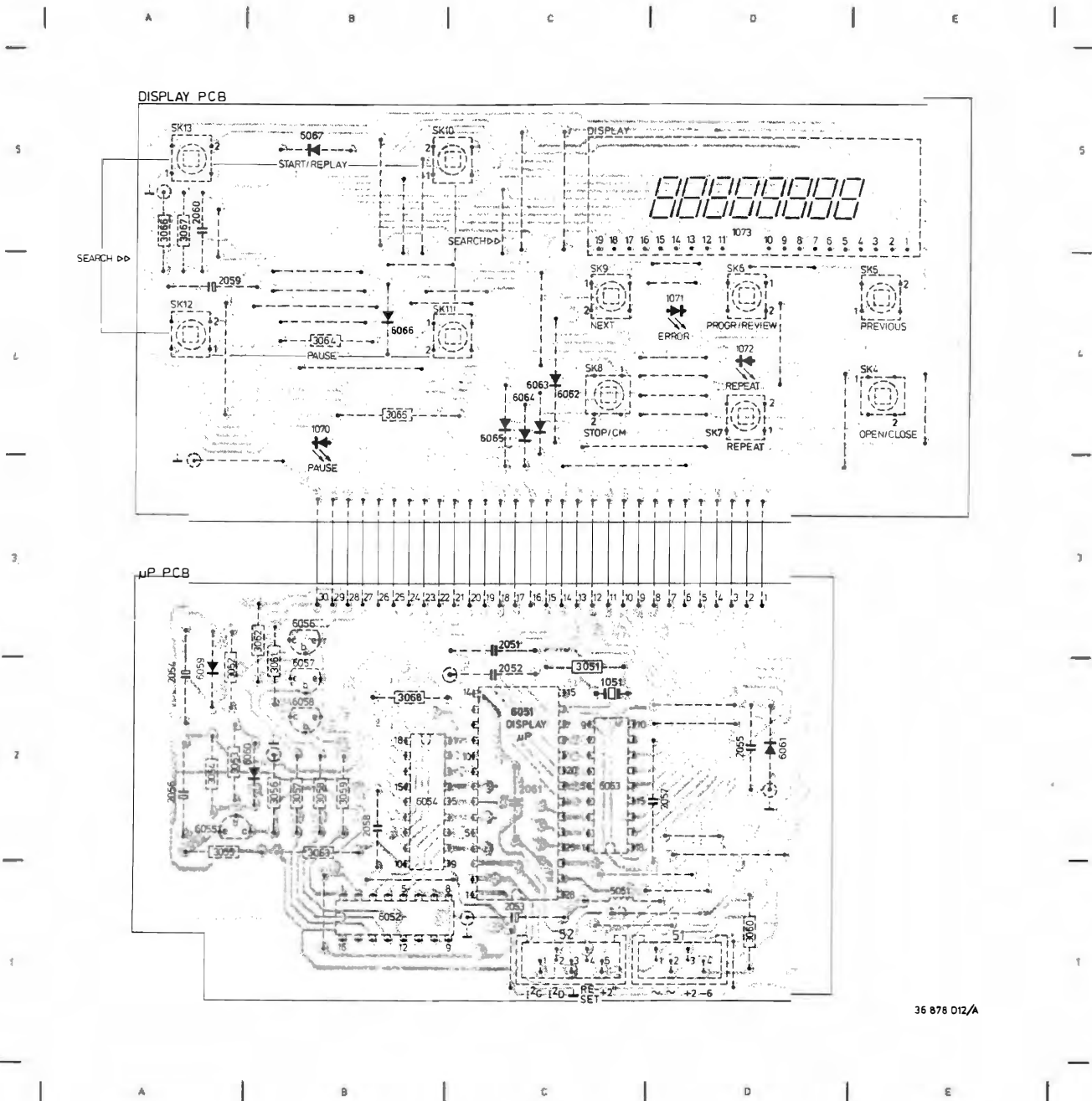
36 875 D12/A

⊕ = SOLDERED ON FOIL SIDE OF THE PCB (↓)

9EH007 BUJ 36 875 C

CONTROL AND DISPLAY

					
6051	MAB8410-B017	4822 209 10906	5051	47 mH	4822 156 20966
6052	HEF40161BP	5322 209 10344			
6053, 6054	LB1240	4822 209 82057			
			2061 47 nF-50 V 4822 122 10288		
BC547C		4822 130 40959			
BC588B		4822 130 44197			
			1070,1072 MV54123 (green) 4822 130 32222		
			1071 MV57123 (red) 4822 130 32301		
BAW62		4822 130 30613	 I.C.		
			IC-socket 28p. 4822 255 40156		



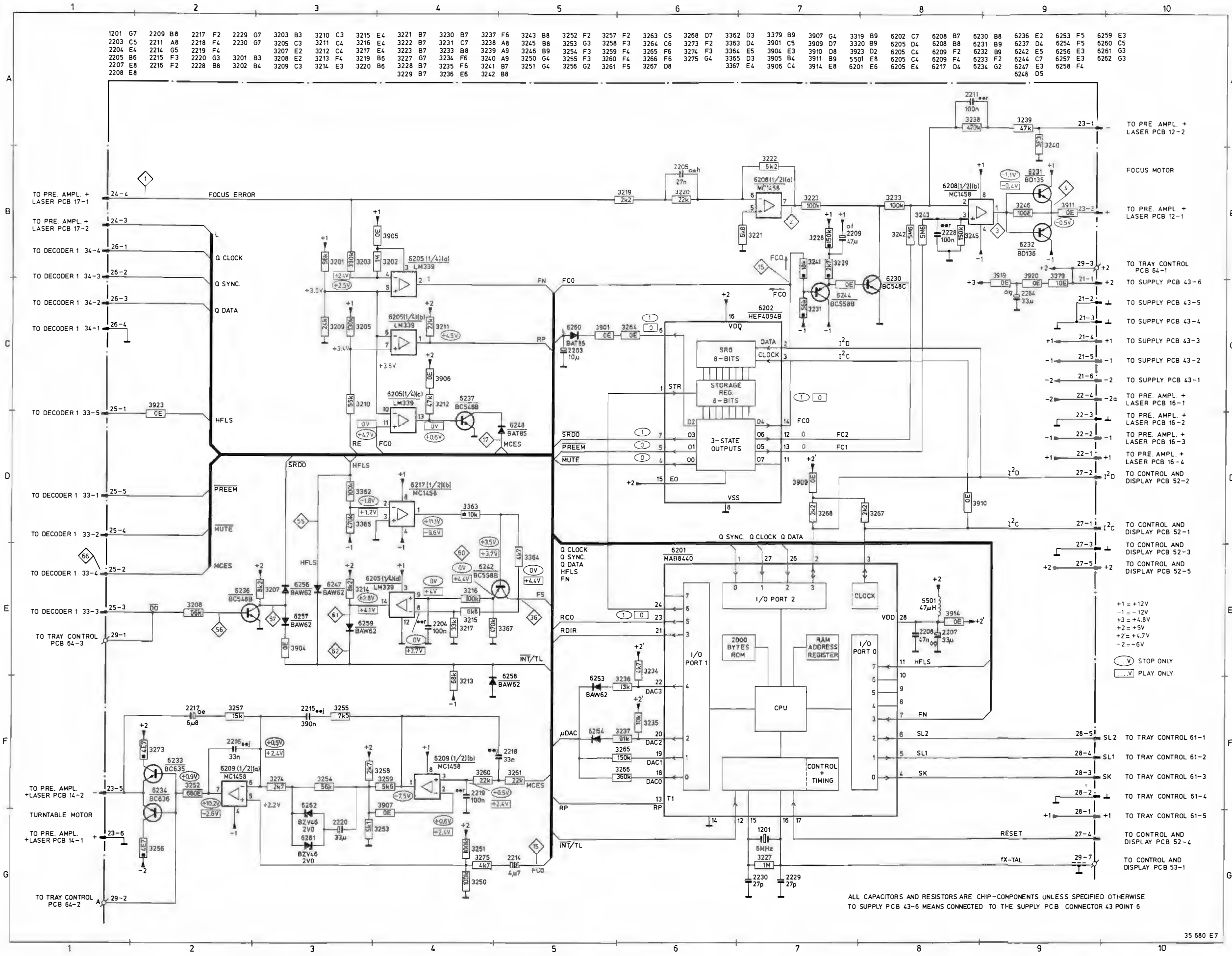
DISPLAY		
1073	FG85CI-5D FTD-Display	4822 130 90182
SK4÷13	Tact switch	4822 276 11276
1051	Quartz cristal	4822 242 70392

1051 C02	2051 C03	2056 A02	2061 C02	3055 A02	3060 D01	3065 B04
1070 B04	2052 C02	2057 D02	3051 C02	3056 B02	3061 B02	3066 A05
1071 D04	2053 C01	2058 B02	3052 A02	3057 B02	3062 B03	3067 A05
1072 D04	2054 A02	2059 A04	3053 A02	3058 B02	3063 B02	3068 B02
1073 D05	2055 D02	2060 A05	3054 A02	3059 B02	3064 B04	5051 C01

6051 C02	6056 B03	6061 D02	6066 B04
6052 B01	6057 B02	6062 C04	6067 B05
6053 C02	6058 B02	6063 C04	
6054 B02	6059 A02	6064 C04	
6055 A02	6060 B02	6065 C04	

1051 C02	2051 C03	2056 E02	2061 C02	3055 E02	3060 B01	3065 D04
1070 D04	2052 C02	2057 B02	3051 C02	3056 D02	3061 D03	3066 E05
1071 B04	2053 C01	2058 D02	3052 E02	3057 D02	3062 D03	3067 E05
1072 B04	2054 E02	2059 A05	3053 E02	3058 D02	3063 D02	3068 D02
1073 B05	2055 B02	2060 E05	3054 E02	3059 D02	3064 D04	5051 C01

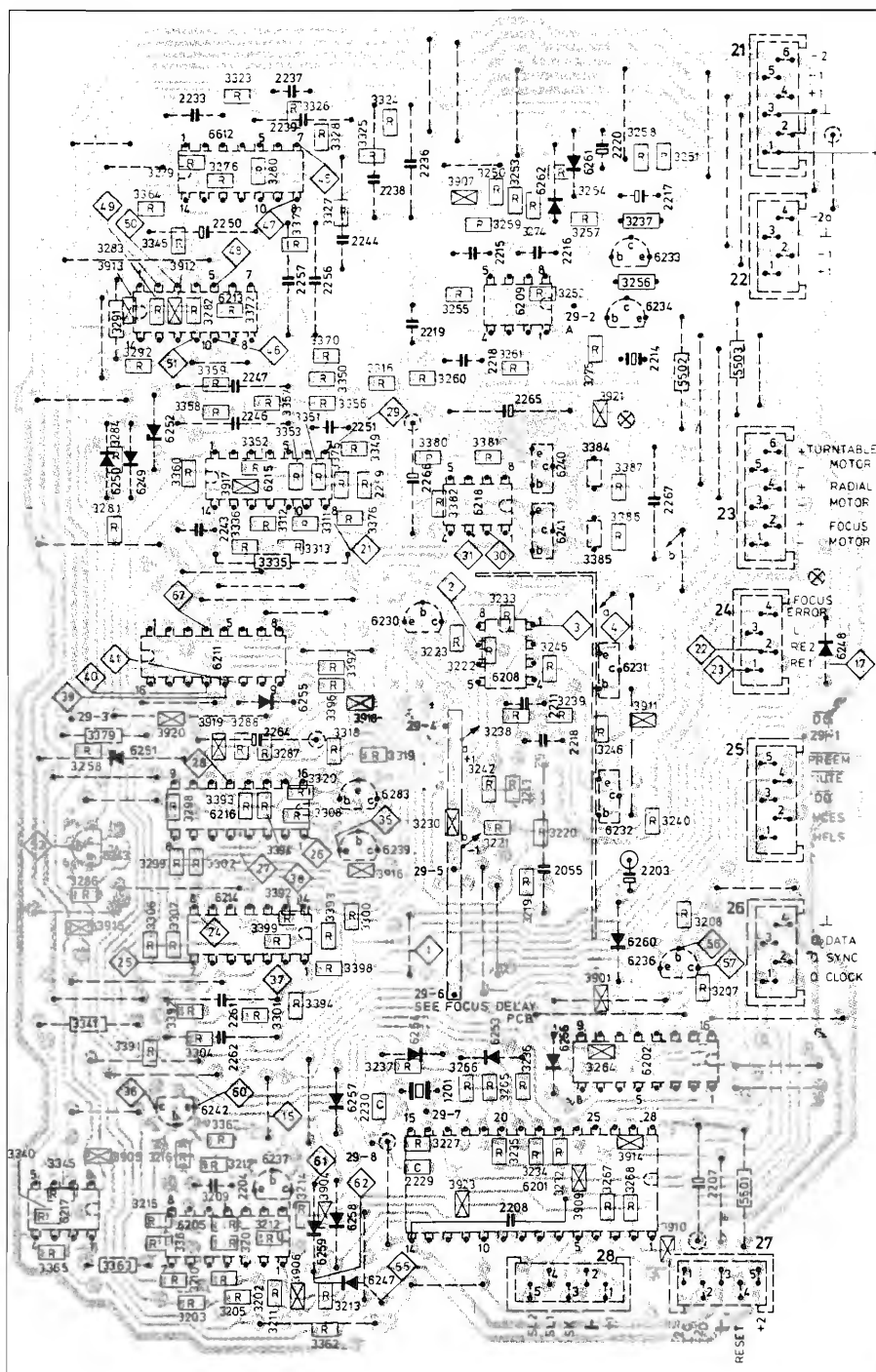
6051 C02	6056 D03	6061 B02	6066 D04
6052 D01	6057 D03	6062 C04	6067 D05
6053 C02	6058 D02	6063 C04	
6054 D02	6059 E03	6064 C04	
6055 E02	6060 D02	6065 C04	



1201 C3	2208 B3	2217 I2	2229 B3	2238 I3	2247 H4	2259 G3	2266 G3	3205 B4	3211 B4	3216 C4	3222 F3	3233 F3	3238 E3
2203 D2	2211 E3	2218 H3	2230 G3	2239 I4	2250 I4	2261 D4	2267 G2	3207 D2	3212 B4	3217 C4	3223 F3	3234 C3	3239 E2
2204 B4	2214 H2	2219 H3	2233 I4	2243 G4	2251 G3	2262 C4	3201 B4	3208 D2	3213 B3	3219 D3	3227 C3	3235 C3	3240 E2
2205 D2	2215 H3	2220 I2	2236 I3	2244 H3	2256 H4	2264 E4	3202 B4	3209 B4	3214 B4	3220 E3	3230 E3	3236 G3	3242 E3
2207 B2	2216 H2	2228 E2	2237 I4	2246 G4	2257 H4	2265 G3	3203 B4	3210 B4	3215 B4	3221 E3	3232 B2	3237 C3	3243 E3
3245 F3	3253 I3	3258 I2	3265 G3	3274 H3	3282 H4	3287 E4	3299 D4	3305 D4	3312 G4	3320 E4	3327 I4	3341 C5	3350 H3
3246 E2	3254 I2	3259 I3	3266 G3	3275 H2	3283 H4	3288 E4	3300 D3	3306 D4	3313 F4	3323 I4	3328 I4	3342 C5	3351 G4
3250 I3	3255 H3	3260 H3	3267 I4	3279 I4	3284 G4	3291 H4	3301 D4	3307 D4	3316 H3	3324 I3	3335 F4	3345 H4	3352 G4
3251 I2	3256 H2	3261 H3	3268 B2	3280 I4	3285 E5	3292 H4	3302 D4	3308 E4	3318 E3	3325 I3	3336 G4	3346 I4	3353 G4
3252 H2	3257 I2	3264 C2	3273 I2	3281 G5	3286 D5	3298 E4	3304 C4	3311 G4	3319 E3	3326 I4	3340 C5	3349 G3	3356 G3
3357 G4	3363 B4	3372 H4	3380 G3	3386 G2	3394 E4	3399 D4	3907 I3	3913 H4	3918 E3	5501 B2	6205 B4	6213 H4	6218 G3
3358 G4	3364 B4	3373 I4	3381 G3	3387 G2	3395 D4	3901 D2	3909 B2	3914 C2	3919 E4	5502 H2	6208 F3	6214 D4	6230 F3
3359 H4	3365 B5	3375 G4	3382 G3	3391 C4	3396 E4	3904 B4	3910 B2	3915 D5	3920 E4	5503 H2	6209 H3	6215 G4	6231 F2
3360 G4	3367 C4	3376 G3	3384 G2	3392 D4	3397 F3	3905 C4	3911 E2	3916 D3	3921 G2	6201 B3	6211 F4	6216 E4	6232 E2
3362 A4	3370 H4	3379 E5	3385 G2	3393 D4	3398 D3	3906 B4	3912 H4	3917 G4	3923 B3	6202 C2	6212 I4	6217 B5	6233 H2
6234 H2	6240 G3	6248 F1	6253 C3	6258 B3									
6236 D2	6241 G3	6249 G4	6254 C3	6259 B4									
6237 C4	6242 C4	6250 G5	6255 F4	6260 D2									
6238 E3	6243 E5	6251 E4	6256 C2	6261 I2									
6239 E3	6247 B3	6252 G4	6257 C3	6262 I3									

SERVO

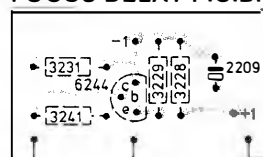
				
MAB8440P/D034	μP	4822 209 10885	0E	chip jumper
HEF4094B		5322 209 14485	2E2	
LM339N		4822 209 80631	3E3	
MC1458N		4822 209 81349	4E7	
			100E	
			120E	
			470E	
			680E	
			820E	
BC548C		4822 130 44196	1k	
BD135		4822 130 40823	1k5	
BD136		4822 130 40824	1k8	
BC635		5322 130 44349	2k2	
BC636		4822 130 44283	2k7	
BC558B		4822 130 44197	3k3	
			3k9	
			4k7	
			5k1	
BAW62		4822 130 30613	5k6	
BAT85		4822 130 31983	6k2	
BZV46-2V0		4822 130 31248	6k8	
			7k5	
			8k2	
			10k	
1201	6 MHz	4822 242 70392	13k	
			15k	
			18k	
			22k	
			24k	
			27k	
5501	47 mH	4822 156 20966	33k	
			36k	
			47k	
			56k	
			68k	
2203	10 μF -10 V	5322 124 14066	75k	
2208	47 nF-50 V	4822 122 10288	82k	
2214	4,7 μF -35 V bip	4822 124 21292	91k	
2220	33 μF -10 V	4822 124 20945	100k	
			120k	
			130k	
			150k	
			180k	
2229, 2230	27 pF	4822 122 31966	220k	
			330k	
	IC		360k	
			470k	
28p		4822 255 40156	1M	
			5M6	
Miscellaneous				
Mica washer for 6231/6232		4822 255 40133		
Spring clip for 6231/6232		4822 255 40128		



②] SOLDERED ON THE COPPERERFOIL (1)

35 689 D7

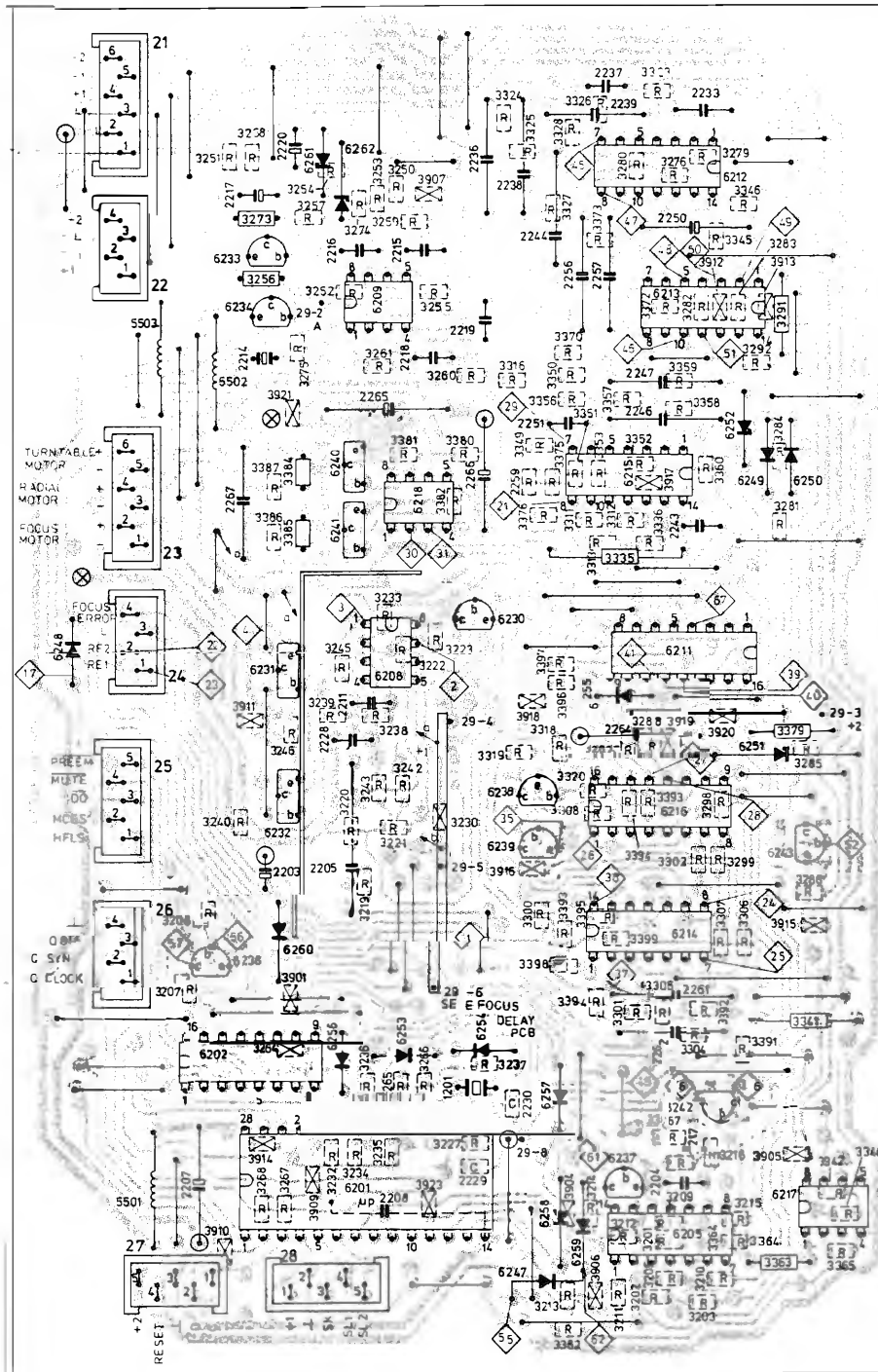
FOCUS DELAY P.C.B.



TO SERVO PCB 29-6 TO SERVO PCB 29-5 TO SERVO PCB 29-4
36 110 A 7

SERVO P.C.B.

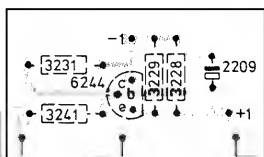
SERVO PCB



⊗ GRIPLET/COPPERTACK CONNECTED TO THE COPPERFOIL ON THE COMPONENT SIDE OF THE PCB
⊙ SOLDERED ON THE COPPERFOIL (1)

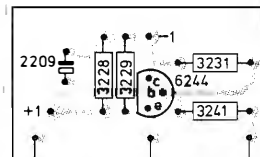
R = CHIP RESISTOR.
C = CHIP CAPACITOR.
X = CHIP JUMPER OR OE

FOCUS DELAY P.C.B.



TO SERVO PCB 29-6
TO SERVO PCB 29-5
TO SERVO PCB 29-4
36110A7

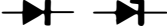
FOCUS DELAY P.C.B.



TO SERVO PCB 29-4
TO SERVO PCB 29-5
TO SERVO PCB 29-6
36111A7

1201 C3	2208 B3	2217 I2	2229 B3	2238 I3	2247 H4	2259 G3	2266 G3	3205 B4	3211 B4	3216 C4	3222 F3	3233 F3	3238 E3
2203 D2	2211 E3	2218 H3	2230 C3	2239 I4	2250 I4	2261 D4	2267 G2	3207 D2	3212 B4	3217 C4	3223 F3	3234 C3	3239 E2
2204 B4	2214 H2	2219 H3	2233 I4	2243 G4	2251 G3	2262 C4	3201 B4	3208 D2	3213 B3	3219 D3	3227 C3	3235 C3	3240 E2
2205 D2	2215 H3	2220 I2	2236 I3	2244 H3	2256 H4	2264 E4	3202 B4	3209 B4	3214 B4	3220 E3	3230 E3	3236 C3	3242 E3
2207 B2	2216 H2	2228 E2	2237 I4	2246 G4	2257 H4	2265 G3	3203 B4	3210 B4	3215 B4	3221 E3	3232 B2	3237 C3	3243 E3
3245 F3	3253 I3	3258 I2	3265 C3	3274 H3	3282 H4	3287 E4	3299 D4	3305 D4	3312 G4	3320 E4	3327 I4	3341 C5	3350 H3
3246 E2	3254 I2	3259 I3	3266 C3	3275 H2	3283 H4	3288 E4	3300 D3	3306 D4	3313 F4	3323 I4	3328 I4	3342 C5	3351 G4
3250 I3	3255 H3	3260 H3	3267 I4	3279 I4	3284 G4	3291 H4	3301 D4	3307 D4	3316 H3	3324 I3	3335 F4	3345 H4	3352 G4
3251 I2	3256 H2	3261 H3	3268 B2	3280 I4	3285 E5	3292 H4	3302 D4	3308 E4	3318 E3	3325 I3	3336 G4	3346 I4	3353 G4
3252 H2	3257 I2	3264 C2	3273 I2	3281 G5	3286 D5	3298 E4	3304 C4	3311 G4	3319 E3	3326 I4	3340 C5	3349 G3	3356 G3
3357 G4	3363 B4	3372 H4	3380 G3	3386 G2	3394 E4	3399 D4	3907 I3	3913 H4	3918 E3	5501 B2	6205 B4	6213 H4	6218 G3
3358 G4	3364 B4	3373 I4	3381 G3	3387 G2	3395 D4	3901 D2	3909 B2	3914 C2	3919 E4	5502 H2	6208 F3	6214 D4	6230 F3
3359 H4	3365 B5	3375 G4	3382 G3	3391 C4	3396 E4	3904 B4	3910 B2	3915 D5	3920 E4	5503 H2	6209 H3	6215 G4	6231 F2
3360 G4	3367 C4	3376 G3	3384 G2	3392 D4	3397 F3	3905 C4	3911 E2	3916 D3	3921 G2	6201 B3	6211 F4	6216 E4	6232 E2
3362 A4	3370 H4	3379 E5	3385 G2	3393 D4	3398 D3	3906 B4	3912 H4	3917 G4	3923 B3	6202 C2	6212 I4	6217 B5	6233 H2
6234 H2	6240 G3	6248 F1	6253 C3	6258 B3									
6236 D2	6241 G3	6249 G4	6254 C3	6259 B4									
6237 C4	6242 C4	6250 G5	6255 F4	6260 D2									
6238 E3	6243 E5	6251 E4	6256 C2	6261 I2									
6239 E3	6247 B3	6252 G4	6257 C3	6262 I3									

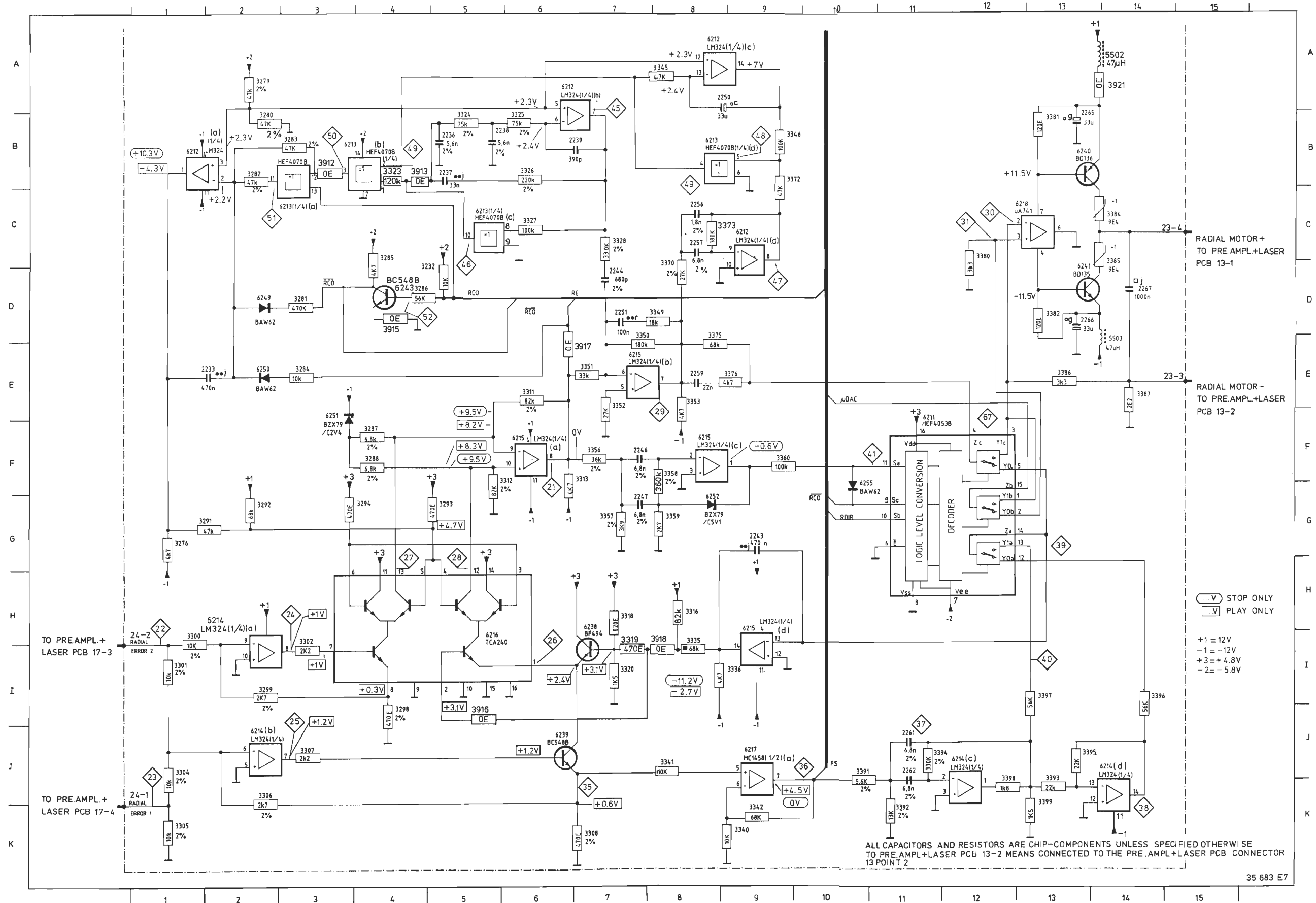
SERVO

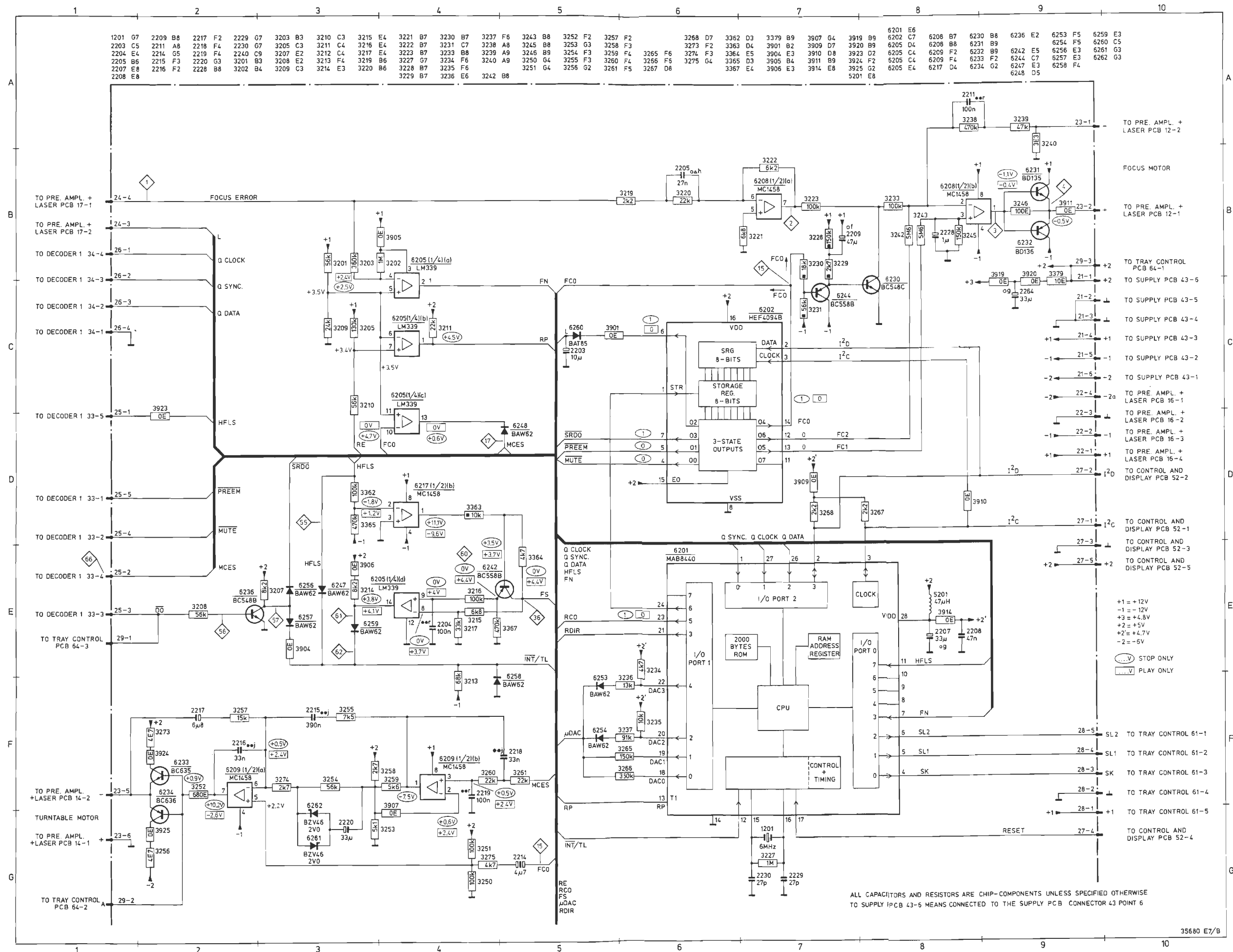
							
HEF4053BP	5322 209 14121	0E	Chip jumper	4822 111 90163			
LM324N	4822 209 80587	2E2		4822 111 90507			
HEF4070BP	4822 209 10265	3E3		4822 111 90447			
TCA240	4822 209 80629	4E7		5322 111 90376			
μA714CN	4822 209 80617	100E		5322 111 90091			
		120E		4822 111 90403			
		470E		4822 111 90217			
		680E		4822 111 90162			
		820E		4822 111 90171			
		1k		5322 111 90171			
BC548B	4822 130 44196	1k5		4822 111 90151			
BF494	4822 130 44195	1k8		5322 111 90101			
BD135	4822 130 40823	2k2		4822 111 90248			
BD136	4822 130 40824	2k7		4822 111 90179			
		3k3		4822 111 90188			
		3k9		4822 116 60156			
		4k7		5322 111 90111			
		5k1		5322 111 90268			
		5k6		5322 111 90114			
BAW62	4822 130 30613	6k2		4822 111 90545			
BZX79-C2V4	4822 130 31253	6k8		4822 111 90544			
BZX79-C5V1	4822 130 34233	7k5		5322 111 90276			
		8k2		5322 111 90118			
		10k		4822 111 90248			
		13k		4822 111 90509			
		15k		4822 111 90196			
		18k		4822 111 90238			
		22k		4822 111 90251			
		24k		4822 111 90512			
		27k		4822 111 90155			
		33k		5322 111 90267			
		36k		4822 111 90514			
		47k		4822 111 90543			
		56k		5322 111 90115			
		68k		4822 111 90202			
		75k		4822 111 90542			
		82k		4822 116 60185			
		91k		5322 111 90277			
		100k		4822 111 90214			
		120k		4822 111 90149			
		130k		4822 111 90511			
		150k		4822 116 60166			
		180k		5322 111 90273			
		220k		4822 111 90197			
		330k		4822 111 90513			
		360k		4822 111 90515			
		470k		4822 111 90161			
3291	47k-SFR16	1M		4822 111 90252			
3384, 3385	PTC 9E4-60 V	5M6		4822 111 90508			

SERVO 2

2233 E 2	2246 F 7	2261 J 11	3276 G 1	3284 E 3	3293 G 5	3304 J 1	3313 F 6	3324 B 5	3340 K 9	3351 E 7	3360 F 9	3380 C 12	3391 J 10	3398 J 12	6212 C 9	6214 H 2	6216 H 5	6243 D 4	3912 B 3
2236 B 5	2247 G 7	2262 J 11	3279 A 2	3285 D 4	3294 G 3	3305 K 1	3316 H 8	3325 B 6	3341 J 8	3352 E 7	3370 D 8	3381 B 13	3392 K 11	3399 K 13	6212 A 8	6214 J 2	6217 J 9	6249 D 2	3913 C 4
2237 B 5	2250 A 8		3282 D 5	3286 D 4	3298 I 4	3306 K 2	3318 H 7	3326 B 6	3342 K 9	3353 E 8	3372 B 9	3382 D 13	3393 J 13	3502 A 13	6213 B 3	6214 J 14	6218 C 13	6250 E 2	
2238 B 5	2251 D 7	2265 B 13	3280 B 2	3287 F 4	3299 I 2	3307 J 3	3319 I 7	3327 C 6	3345 A 8	3356 F 7	3373 C 8	3384 C 13	3394 J 11	3503 E 13	6213 C 5	6215 H 9	6238 I 7	6251 E 3	3915 D 4
2239 B 6	2256 C 8	2266 D 13	3281 D 3	3288 F 4	3300 H 1	3308 K 6	3319 I 7	3328 C 7	3346 B 9	3357 G 7	3375 E 8	3385 C 13	3395 J 13	6211 F 11	6213 B 4	6215 F 8	6239 J 6	6252 G 8	3916 I 5
2243 G 9	2257 E 8	2267 D 14	3282 B 2	3291 G 2	3301 I 1	3311 E 6	3320 I 7	3335 I 8	3349 D 8	3358 F 8	3376 E 9	3386 E 13	3396 I 14	6212 A 6	6213 B 8	6215 F 6	6240 B 13	6255 F 10	3917 E 6
2244 D 7	2259 E 8		3283 B 3	3292 G 2	3302 I 3	3312 F 5	3323 B 4	3336 I 8	3350 E 7	3359 G 8		3387 E 14	3397 I 13	6212 B 1	6214 J 2	6215 F 7	6241 D 13		3918 I 8

3921 A13



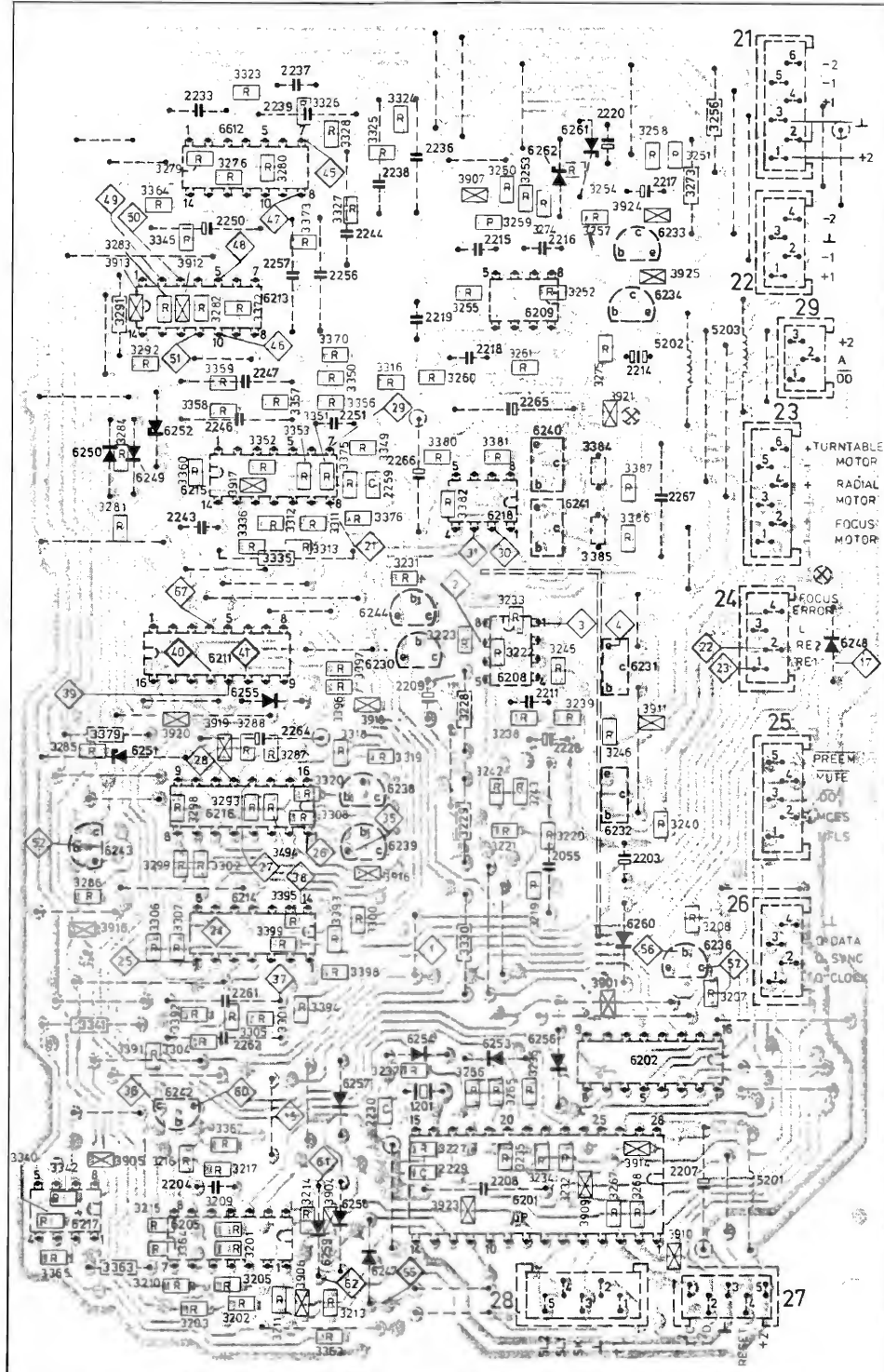


1201	C03	2208	B03	2216	H03	2228	F02	2237	I04	2246	G04	2257	H04	2265	G03	3203	B04	3210	B04	3216	C04	3222	E03	3230	D03	3235	C03
2203	D01	2209	E03	2217	I02	2229	C03	2238	I03	2247	H04	2259	G03	2266	G03	3205	B04	3211	B04	3217	C04	3223	E03	3231	E03	3236	C03
2204	B04	2211	E03	2218	H03	2230	C03	2239	I04	2250	H04	2261	D04	2267	G02	3207	D01	3213	B03	3219	D03	3227	C03	3232	B02	3237	C03
2205	F02	2214	H02	2219	H03	2233	I04	2243	G04	2251	G03	2262	C04	3201	B04	3208	D01	3214	B04	3220	F02	3228	F03	3233	E03	3238	F03
2207	C02	2215	H03	2220	I02	2236	I03	2244	H03	2256	H03	2264	F04	3202	B04	3209	B04	3215	B04	3221	F03	3229	F03	3234	B03	3239	F02
3240	F02	3250	I03	3255	H03	3260	H03	3268	B02	3279	I04	3284	G04	3291	H04	3299	D04	3305	C04	3312	G04	3320	F04	3327	I04	3341	C05
3242	F03	3251	I02	3256	I02	3261	H03	3273	I02	3280	I04	3285	F05	3292	H04	3300	D03	3306	D04	3313	E04	3323	I04	3328	I03	3342	C05
3243	F03	3252	H02	3257	H02	3265	C03	3274	H03	3281	C04	3286	D05	3293	F04	3301	C04	3307	D04	3316	H03	3324	I03	3335	E04	3345	H04
3245	E02	3253	I03	3258	I02	3266	C03	3275	H02	3282	H04	3287	F04	3294	F04	3302	D04	3308	F04	3318	F03	3325	I03	3336	G04	3346	I04
3246	F02	3254	I02	3259	H03	3267	B02	3276	I04	3283	H04	3288	F04	3298	F04	3304	C04	3311	G04	3319	F03	3326	I04	3340	C05	3349	G03
3350	G03	3357	G04	3363	B04	3372	H04	3380	G03	3386	G02	3394	D04	3399	D04	3907	I03	3913	H04	3918	F03	3924	I02	6201	B03	6211	E04
3351	G04	3358	G04	3364	B04	3373	H04	3381	G03	3387	G02	3395	D04	3901	D01	3909	B02	3914	C02	3919	F04	3925	H02	6202	C02	6212	I04
3352	G04	3359	H04	3365	B05	3375	G03	3382	G03	3391	C04	3396	F04	3904	B04	3910	B02	3915	D04	3920	F04	5201	B02	6205	B04	6213	H04
3353	G04	3360	C04	3367	C04	3376	G03	3384	G02	3392	C04	3397	E03	3905	C04	3911	F02	3916	D03	3921	G02	5202	H02	6208	E03	6214	D04
3356	G03	3362	A04	3370	H04	3379	F05	3385	E02	3393	D04	3398	D03	3906	B04	3912	H04	3917	G04	3923	B03	5203	H02	6209	H03	6215	G04
6216	F04	6232	F02	6239	F03	6244	E03	6251	F04	6256	C03	6261	I02														
6217	B05	6233	H02	6240	G03	6247	B03	6252	G04	6257	C03	6262	I03														
6218	G03	6234	H02	6241	G02	6248	E01	6253	C03	6258	B03																
6230	E03	6236	D01	6242	C04	6249	G04	6254	C03	6259	B04																
6231	E02	6238	F03	6243	F04	6250	G05	6255	E04	6260	D01																

SERVO

				
MAB8440P/D041 μP	4822 209 10916	0E	chip jumper	4822 111 90163
HEF4094B	5322 209 14485	2E2		4822 111 90507
LM339N	4822 209 80631	3E3		4822 111 90447
MC1458N	4822 209 81349	4E7		5322 111 90376
		100E		5322 111 90091
BC548C	4822 130 44196	120E		4822 111 90403
BD135	4822 130 40823	470E		4822 111 90217
BD136	4822 130 40824	680E		4822 111 90162
BC635	5322 130 44349	820E		4822 111 90171
BC636	4822 130 44283	1k		5322 111 90092
BC558B	4822 130 44197	1k5		4822 111 90151
		1k8		5322 111 90101
BAW62	4822 130 30613	2k2		4822 111 90248
BZV46-2V0	4822 130 31248	2k7		4822 111 90179
		3k3		4822 111 90188
1201	6 MHz	3k9		4822 116 60156
		4k7		5322 111 90111
5201	47 mH	5k1		5322 111 90268
		5k6		5322 111 90114
2203	10 μF -10 V	6k2		4822 111 90545
2208	47 nF-50 V	6k8		4822 111 90544
2214	4,7 μF -35 V bip	7k5		5322 111 90276
2217	6,8 μF -16 V	8k2		5322 111 90118
2220	33 μF -10 V	10k		4822 111 90248
2228	1 μF -25 V	13k		4822 111 90509
		15k		4822 111 90196
2229,2230	27 pF	18k		4822 111 90238
		22k		4822 111 90251
28p	4822 255 40156	24k		4822 111 90512
		27k		4822 111 90155
Miscellaneous		33k		5322 111 90267
Mica washer for 6231/6232	4822 255 40133	36k		4822 111 90514
Spring clip for 6231/6232	4822 255 40128	47k		4822 111 90543
		56k		5322 111 90115
		68k		4822 111 90202
		75k		4822 111 90542
		82k		4822 116 60185
		91k		5322 111 90277
		100k		4822 111 90214
		120k		4822 111 90149
		130k		4822 111 90511
		150k		4822 116 60166
		180k		5322 111 90273
		220k		4822 111 90197
		330k		4822 111 90513
		360k		4822 111 90515
		470k		4822 111 90161
		1M		4822 111 90252
		5M6		4822 111 90508
				
		3256,3273	4,7 Ω fuse res.	4822 111 50483

SERVO PCB

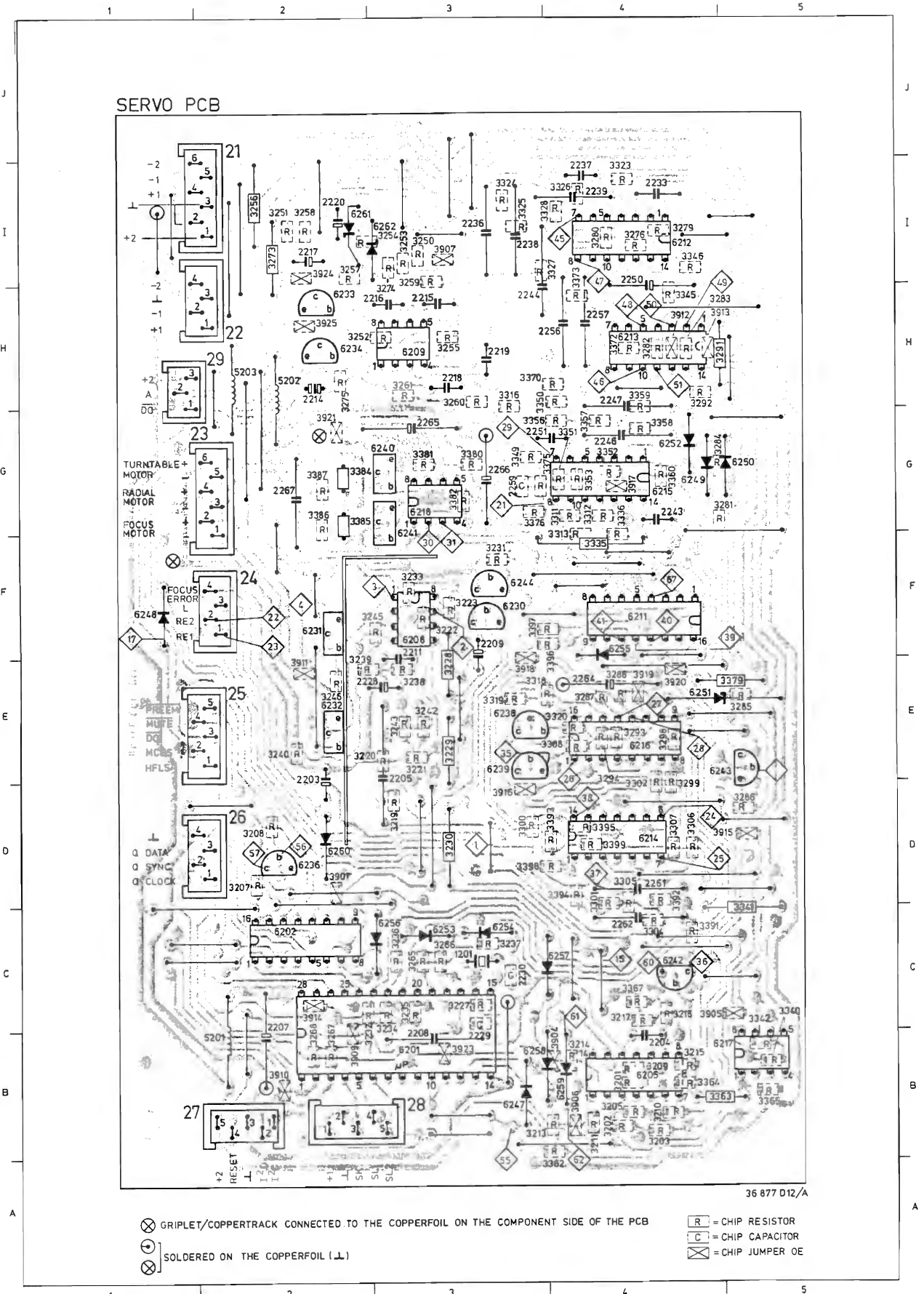


⊗ GRIPLET/COPPERTRACK CONNECTED TO THE COPPERFOIL ON THE COMPONENT SIDE OF THE PCB

⊙ SOLDERED ON THE COPPERFOIL (⊥)

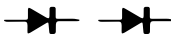
36 880 D12/A

SERVO P.C.B.



1201	C03	2208	B03	2216	H03	2228	E02	2237	I04	2246	G04	2257	H04	2265	G03	3203	B04	3210	B04
2203	E02	2209	F03	2217	I02	2229	B03	2238	I03	2247	H04	2259	G03	2266	G03	3205	B04	3211	B04
2204	B04	2211	F03	2218	H03	2230	C03	2239	I04	2250	I04	2261	D04	2267	G02	3207	D02	3213	B03
2205	E03	2214	H02	2219	H03	2233	I04	2243	G04	2251	G03	2262	C04	3201	B04	3208	D02	3214	B04
2207	C02	2215	H03	2220	I02	2236	I03	2244	H03	2256	H04	2264	E04	3202	B04	3209	B04	3215	B04
3216	C04	3222	F03	3230	D03	3235	C03	3240	E02	3250	I03	3255	H03	3260	H03	3268	B02	3279	I04
3217	C04	3223	F03	3231	F03	3236	C03	3242	E03	3251	I02	3256	I02	3261	H03	3273	I02	3280	I04
3219	D03	3227	C03	3232	B02	3237	C03	3243	E03	3252	H02	3257	I02	3265	C03	3274	H03	3281	G04
3220	E02	3228	E03	3233	F03	3238	E03	3245	F02	3253	I03	3258	B02	3266	C03	3275	H02	3282	H04
3221	E03	3229	E03	3234	C03	3239	E02	3246	E02	3254	I03	3259	I03	3267	B02	3276	I04	3283	H04
3284	G04	3291	H04	3299	D04	3305	D04	3312	G04	3320	E04	3327	I04	3341	C05	3350	H03	3357	G04
3285	E05	3292	H04	3300	D03	3306	D04	3313	F04	3323	I04	3328	I03	3342	C05	3351	G04	3358	G04
3286	D05	3293	E04	3301	D04	3307	D04	3316	H03	3324	I03	3335	F04	3345	H04	3352	G04	3359	H04
3287	E04	3294	E04	3302	D04	3308	E03	3318	E03	3325	I03	3336	G04	3346	I04	3353	G04	3360	G04
3288	E04	3298	E04	3304	C04	3311	G04	3319	E03	3326	I04	3340	C05	3349	G03	3356	G03	3362	B03
3363	B04	3372	H04	3380	G03	3386	G02	3394	D04	3399	D04	3907	I03	3913	H04	3918	E03	3924	I02
3364	B04	3373	I04	3381	G03	3387	G02	3395	D04	3901	D02	3909	B02	3914	C02	3919	E04	3925	H02
3365	B05	3375	G03	3382	G03	3391	C04	3396	E03	3904	B04	3910	B02	3915	D04	3920	E04	5201	B02
3367	C04	3376	G03	3384	G02	3392	D04	3397	F03	3905	C04	3911	E02	3916	D03	3921	G02	5202	H02
3370	H03	3379	E05	3385	G02	3393	D03	3398	D03	3906	B04	3912	H04	3917	G04	3923	B03	5203	H02
6201	B03	6211	F04	6216	E04	6232	E02	6239	E03	6244	F03	6251	E04	6256	C03	6261	I02		
6202	C02	6212	I04	6217	B04	6233	H02	6240	G03	6247	B03	6252	G04	6257	C04	6262	I03		
6205	B04	6213	H04	6218	G03	6234	H02	6241	F03	6248	F01	6253	C03	6258	B03				
6208	F03	6214	D04	6230	F03	6236	D02	6242	C04	6249	G04	6254	C03	6259	B04				
6209	H03	6215	G04	6231	F02	6238	E03	6243	E04	6250	G05	6255	F04	6260	D02				

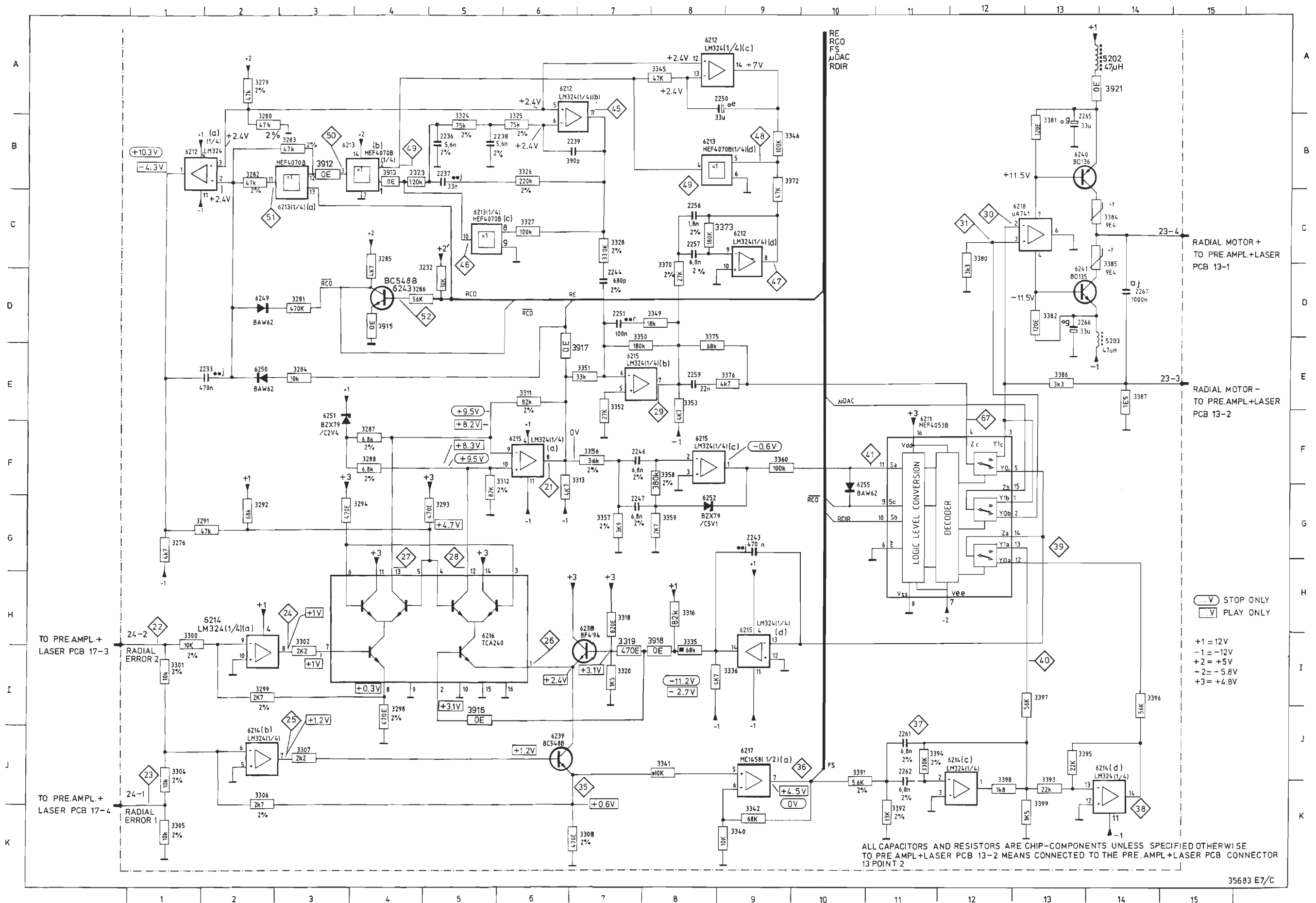
SERVO

							
HEF4053BP		5322 209 14121	0E	Chip jumper	4822 111 90163		
LM324N		4822 209 80587	1E5		4822 111 90381		
HEF4070BP		4822 209 10265	2E2		4822 111 90507		
TCA240		4822 209 80629	3E3		4822 111 90447		
μA714CN		4822 209 80617	4E7		5322 111 90376		
			100E		5322 111 90091		
			120E		4822 111 90403		
			470E		4822 111 90217		
			680E		4822 111 90162		
BC548B		4822 130 44196	820E		4822 111 90171		
BF494		4822 130 44195	1k		5322 111 90171		
BD135		4822 130 40823	1k5		4822 111 90151		
BD136		4822 130 40824	1k8		5322 111 90101		
			2k2		4822 111 90248		
			2k7		4822 111 90179		
			3k3		4822 111 90188		
			3k9		4822 116 60156		
BAW62		4822 130 30613	4k7		5322 111 90111		
BZX79-C2V4		4822 130 31253	5k1		5322 111 90268		
BZX79-C5V1		4822 130 34233	5k6		5322 111 90114		
			6k2		4822 111 90545		
			6k8		4822 111 90544		
			7k5		5322 111 90276		
			8k2		5322 111 90118		
5202, 5203		4822 156 20966	10k		4822 111 90248		
			13k		4822 111 90509		
			15k		4822 111 90196		
			18k		4822 111 90238		
			22k		4822 111 90251		
2236, 2238	5,6 nF-63 V-2%	4822 121 50543	24k		4822 111 90512		
2239	390 pF-630 V-2%	5322 121 54128	27k		4822 111 90155		
2244	680 pF-250 V-2%	5322 121 54174	33k		5322 111 90267		
2246, 2247, } 2257	6,8 nF- 63 V-2%	4822 121 50538	36k		4822 111 90514		
			47k		4822 111 90543		
2261, 2262, } 2256	1,8 nF-160 V-2%	5322 121 54087	56k		5322 111 90115		
			68k		4822 111 90202		
				4822 111 90542			
			82k		4822 116 60185		
			91k		5322 111 90277		
			100k		4822 111 90214		
2259	22 nF	4822 122 31797	120k		4822 111 90149		
			130k		4822 111 90511		
			150k		4822 116 60166		
			180k		5322 111 90273		
			220k		4822 111 90197		
3291	47k-SFR16	4822 116 52284	330k		4822 111 90513		
3384, 3385	PTC 9E4-60 V	4822 116 40031	360k		4822 111 90515		
			470k		4822 111 90161		
			1M		4822 111 90252		
			5M6		4822 111 90508		

SERVO 2

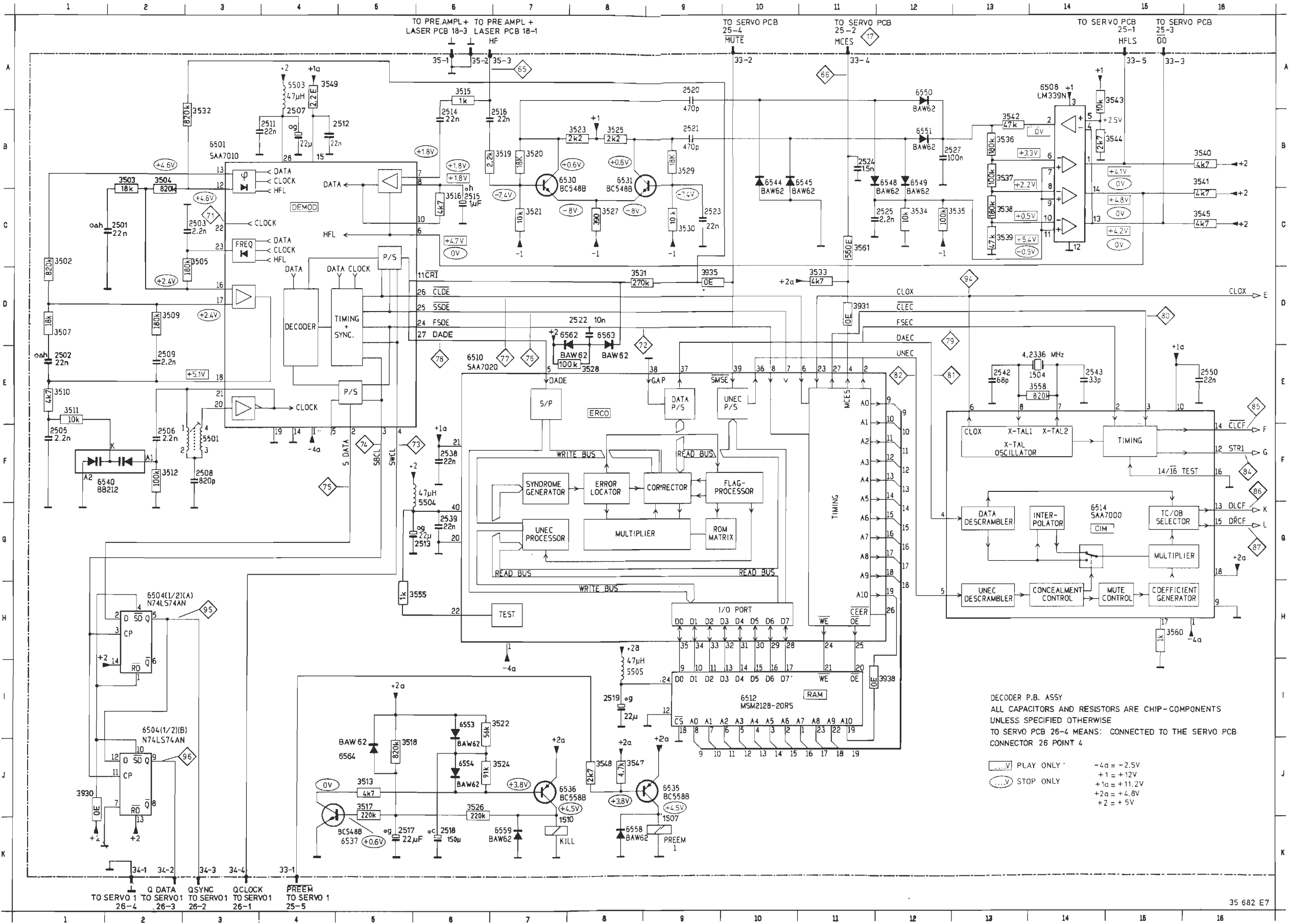
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1984-11-15

2233 E 2	2246 F 7	2261 J11	3276 G 1	3284 E 3	3293 G 5	3304 J 1	3313 F 6	3324 B 5	3340 K 9	3351 E 7	3360 F 9	3380 C 12	3391 J 10	3398 J 12	6212 C 9	6214 H 2	6216 H 5	6243 D 4	3912 B3
2236 B 5	2247 G 7	2262 J11	3279 A 2	3285 D 4	3294 G 3	3305 K 1	3316 H 8	3325 B 6	3341 J 8	3352 E 7	3370 D 8	3381 B 13	3392 K 11	3399 K 13	6212 A 8	6214 J12	6217 J 9	6249 D 2	3913 C4
2237 B 5	2250 A 8			3286 D 4	3298 I 4	3306 K 2	3318 H 7	3326 B 6	3342 K 9	3353 E 8	3372 B 9	3382 D 13	3393 J 13	5202 A 13	6213 B 3	6214 J14	6218 C 13	6250 E 2	
2238 B 5	2251 D 7	2265 B13	3280 B 2	3287 F 4	3299 I 2	3307 J 3	3319 I 7	3327 C 6	3345 A 8	3356 F 7	3373 C 8	3384 C 13	3394 J 11	5203 E 13	6213 C 5	6215 H 9	6238 I 7	6251 E 3	3915 D4
2239 B 6	2256 C 8	2266 D13	3281 D 3	3288 F 4	3300 H 1	3308 K 6	3319 I 7	3328 C 7	3346 B 9	3357 F 7	3375 E 8	3385 C 13	3395 J 14	6211 F 11	6213 B 4	6215 F 8	6239 J 6	6252 G 8	3916 I5
2243 G 9	2257 C 8	2267 D14	3282 B 2	3291 G 2	3301 I 1	3311 E 6	3320 I 7	3335 I 8	3349 D 8	3358 F 8	3376 E 9	3386 E 13	3396 I 14	6212 A 6	6213 B 8	6215 F6	6240 B 13	6255 F 10	3917 E6
2244 D 7	2259 E 8	3232 D5	3283 B3	3292 G 2	3302 I 3	3312 F 5	3323 B 4	3336 I 8	3350 E 7	3359 G 8		3387 E 14	3397 I 13	6212 B 1	6214 J 2	6215 F7	6241 D 13		3918 I8



DECODING 1

1504 E14	2501 C2	2506 F2	2512 B4	2517 K5	2522 D8	2538 F6	3507 D1	3513 J5	3519 B7	3524 J7	3529 B9	3534 C12	3539 C13	3544 B14	3555 H6	3931 D11	5504 F6	6508 A14	6511 B8	6544 B10	6551 B12	6562 D7
1507 K9	2502 E1	2507 B4	2513 G6	2518 K6	2523 C9	2539 G6	3502 C1	3509 D2	3515 A6	3520 B7	3525 B8	3530 C9	3535 C12	3540 C16	3558 E14	3935 D9	5505 I8	6510 E6	6535 J9	6545 B11	6553 I6	6563 D8
1510 K7	2503 C3	2508 F3	2514 B6	2519 I8	2524 B11	2542 E13	3503 B2	3510 E1	3516 C6	3521 C7	3526 J6	3531 D8	3536 B13	3541 C16	3560 H15	3938 I12	6501 B3	6512 I10	6536 J7	6548 B12	6554 J6	6564 J5
		2509 E2	2520 A9	2527 B12	2543 E14		3504 B2	3511 E1	3517 J5	3522 I7	3527 C8	3532 A3	3537 B13	3542 B13	3561 C11	5501 F3	6504 H2	6514 G14	6537 K5	6549 B12	6558 K8	
	2505 F1	2511 B3	2516 B7	2521 B9	2525 C12	2550 E16	3505 C3	3512 F2	3518 J5	3523 B8	3528 E7	3533 D11	3538 C13	3543 A14	3549 A4	3930 J1	5503 A4	6504 I2	6530 B7	6540 F1	6550 A12	6559 K7



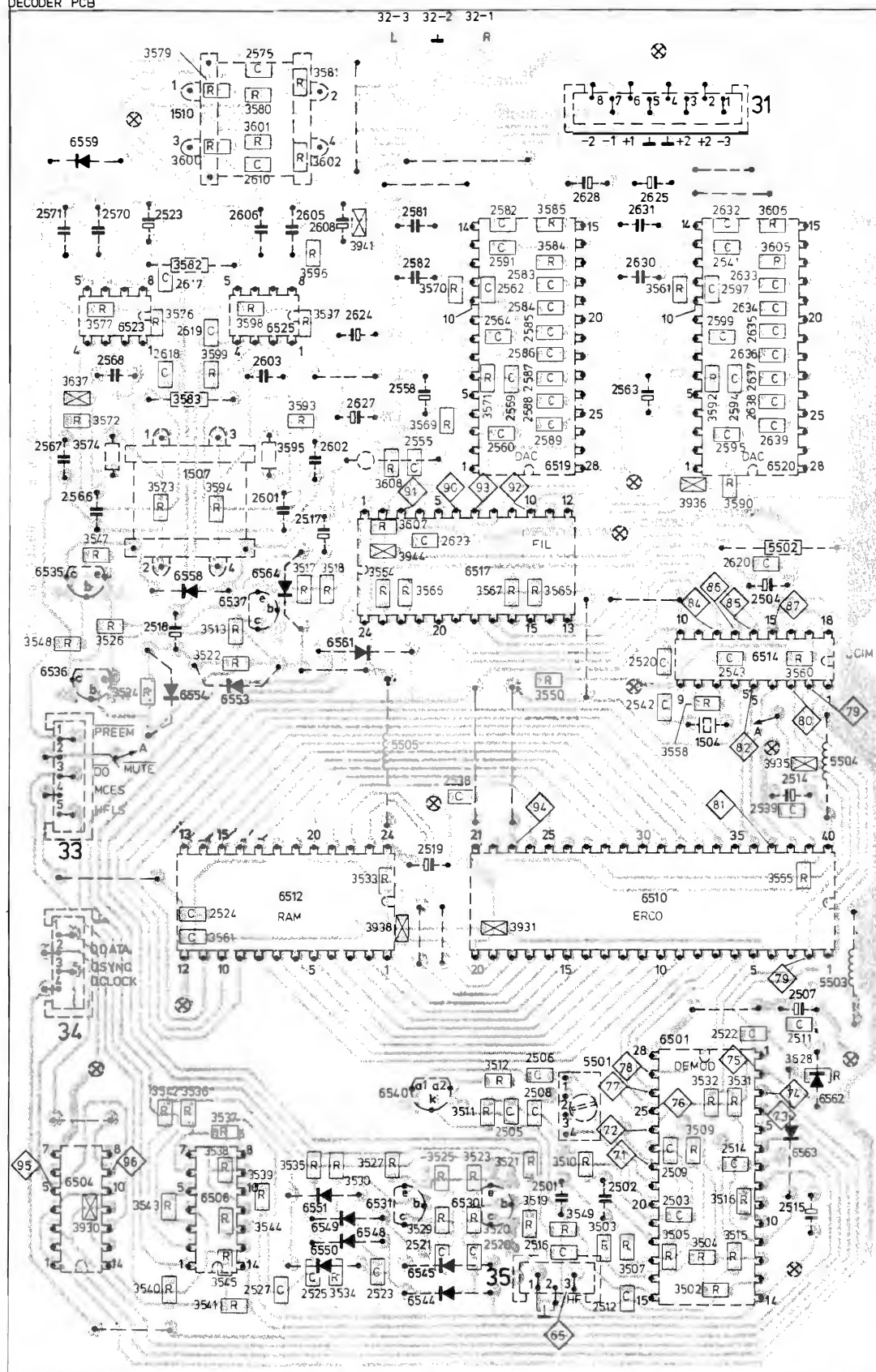
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1510	F5	2505	B3	2511	B1	2516	A3	2521	A4	2527	A5	2550	D2	2562	E3	2570	E6	2581	E4												
2501	B3	2506	B3	2512	A3	2517	D4	2522	B2	2538	C3	2555	E4	2564	E3	2571	E6	2582	E3												
2502	B3	2507	B1	2513	C2	2518	D5	2523	A4	2539	C2	2558	E4	2566	D6	2573	E5	2583	F3												
2584	E3	2589	E3	2597	E2	2605	E4	2618	E5	2625	F2	2632	E2	2637	E2	3503	A3	3510	B3												
2585	E3	2591	E3	2599	E2	2606	E5	2619	E5	2627	E4	2633	E2	2638	E2	3504	A2	3511	B3												
2586	E3	2593	E2	2601	D5	2608	E4	2620	D2	2628	F3	2634	E2	2639	E2	3505	A2	3512	B3												
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2588	E3	2595	E2	2603	E5	2617	E5	2624	E4	2631	E2	2636	E2	3502	A2	3509	B2	3515	A2												
3516	A2	3521	B3	3526	D6	3531	B2	3536	B5	3541	A5	3547	D6	3558	C2	3566	D4	3572	E6												
3517	D4	3522	D5	3527	B4	3532	B2	3537	B5	3542	B5	3548	D6	3560	D1	3567	D3	3573	D5												
3518	D4	3523	B3	3528	B1	3533	C4	3538	B5	3543	A5	3549	A3	3561	C5	3569	E4	3574	E6												
3519	A3	3524	D5	3529	A4	3534	A4	3539	B5	3544	A5	3550	D3	3564	D4	3570	E4	3576	E5												
3520	A3	3525	B4	3530	B4	3535	B4	3540	A5	3545	A5	3555	C2	3565	D3	3571	E3	3577	E6												
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3581	F4	3590	D2	3595	E4	3600	F5	3607	D4	3936	D2	5501	B3	6504	B6	6517	D3	6530	A3												
3582	E5	3591	E2	3596	E4	3601	F5	3608	D4	3937	E6	5503	B1	6508	A5	6519	D3	6531	A4												
3583	E5	3592	E2	3597	E4	3602	F4	3930	A6	3938	C4	5504	C1	6510	C2	6520	D2	6535	D6												
6536	D6	6548	A4	6554	C5	6563	B1																								
6537	D5	6549	A4	6558	D5	6564	D5																								
6540	B4	6550	A4	6559	F6																										
6544	A4	6551	A4	6561	D4																										
6545	A4	6553	C5	6562	B1																										

DECODER

							
SAA7010	DEM0D	4822 209 10857	0E	chip jumper	4822 111 90163		
N74LS74AN		4822 209 80782	2E2		4822 111 90507		
LM339N		4822 209 80631	47E		4822 111 90217		
SAA7020	ERCO	4822 209 10377	82E		4822 116 60158		
MSM2128-20R		4822 209 10379	100E		5322 111 90091		
SAA7000	CIM	4822 209 10375	150E		5322 111 90098		
			390E		5322 111 90138		
			560E		5322 111 90113		
			620E		4822 111 90516		
			1k		5322 111 90092		
BC548B		4822 130 40937	1k8		5322 111 90101		
BC558B		4822 130 44197	2k2		5322 111 90102		
			2k7		4822 111 90179		
			4k7		5322 111 90111		
			10k		4822 111 90249		
			18k		4822 111 90238		
BAW62		4822 130 30613	47k		5322 111 90112		
BB212		4822 130 31129	56k		5322 111 90115		
			91k		5322 111 90277		
			100k		4822 111 90148		
			180k		5322 111 90273		
			220k		4822 111 90197		
1504	X-tal 4.2336 MHz	4822 242 70643	270k		4822 111 90302		
			820k		4822 111 90205		
							
1507,1510	Reed relais	4822 280 20115	33p		4822 122 31756		
			68p		4822 122 31961		
			100p		4822 122 31765		
			470p		4822 122 31727		
			820p		4822 122 31974		
5501	47 μH	4822 156 21155	1n5		4822 122 31781		
5502,5504,5505		4822 156 20966	2n2		4822 122 31644		
			10n		4822 122 31728		
			22n		4822 122 31797		
			100n		4822 122 31947		

DECODER P.C.B.

DECODER PCB



- ⊗ GRIPLET (COPPERTRACK CONNECTED TO COPPERFOIL ON THE COMPONENT SIDE OF THE PCB)
- ⊗⊙ SOLDERED ON THE COPPERFOIL (↓)

- [R] = CHIP RESISTOR
- [C] = CHIP CAPACITOR
- [X] = CHIP JUMPER (OE)

35 688 07



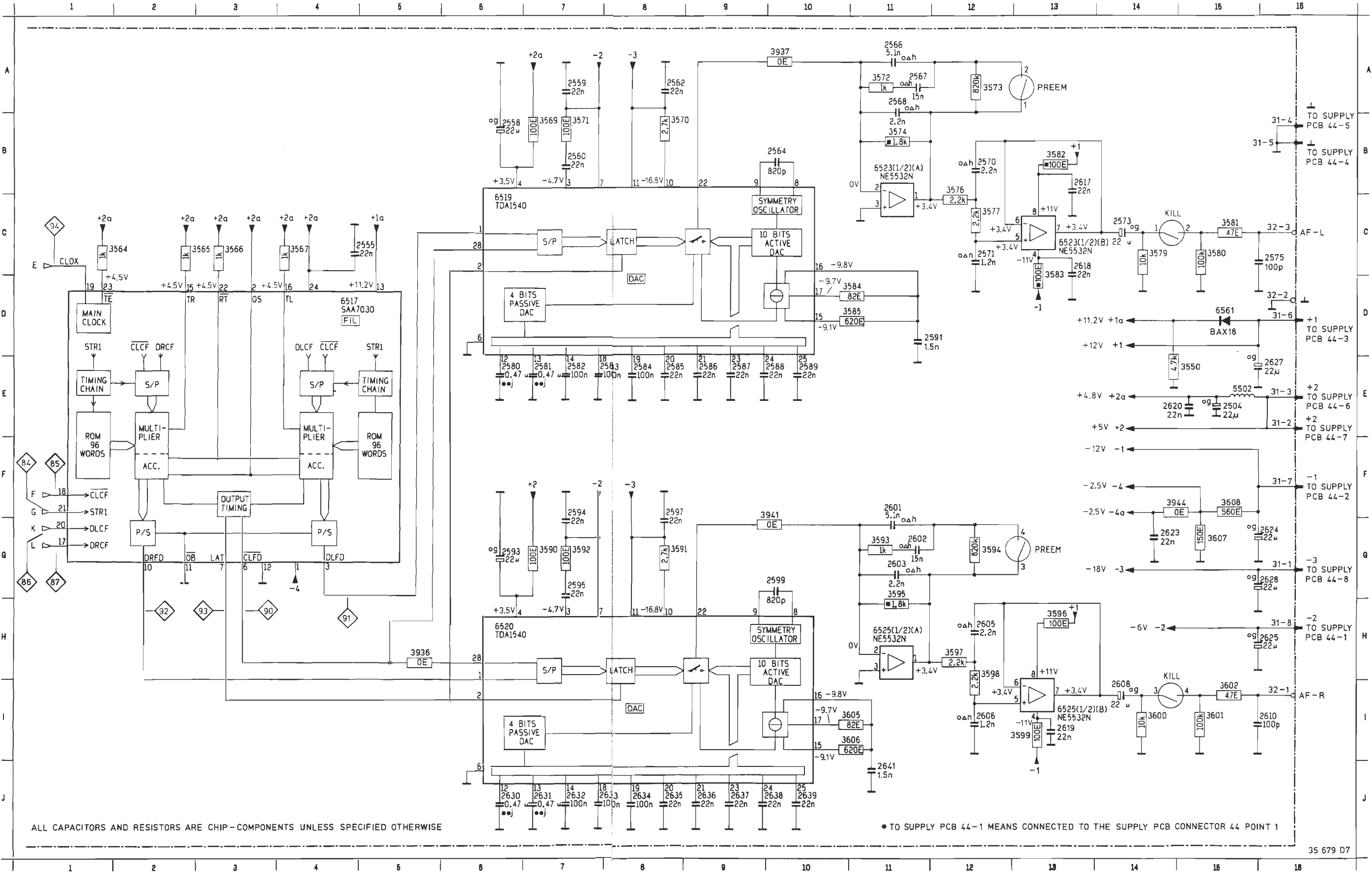
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1507	D5	2504	D2	2509	B2	2515	A1	2520	A3	2525	A4	2543	D2	2560	F3	2568	E6	2580	E4												
1510	F5	2505	B3	2511	B1	2516	A3	2521	A4	2527	A5	2550	D2	2562	E3	2570	E6	2581	E4												
2501	B3	2506	B3	2512	A3	2517	D4	2522	B2	2538	C3	2555	E4	2564	E3	2571	E6	2582	E3												
2502	B3	2507	B1	2513	C2	2518	D5	2523	A4	2539	C2	2558	E4	2566	D6	2573	E5	2583	E3												
2584	E3	2589	E3	2597	E2	2605	E4	2618	E5	2625	F2	2632	E2	2637	E2	3503	A3	3510	B3												
2585	E3	2591	E3	2599	E2	2606	E5	2619	E5	2627	E4	2633	E2	2638	E2	3504	A2	3511	B3												
2586	E3	2593	E2	2601	D5	2608	E4	2620	D2	2628	F3	2634	E2	2639	E2	3505	A2	3512	B3												
2587	E3	2594	E2	2602	E4	2610	F5	2623	D4	2630	E2	2635	E2	2641	E2	3507	A2	3513	D5												
2588	E3	2595	E2	2603	E5	2617	E5	2624	E4	2631	E2	2636	E2	3502	A2	3509	B2	3515	A2												
3516	A2	3521	B3	3526	D6	3531	B2	3536	B5	3541	A5	3547	D6	3558	C2	3566	D4	3572	E6												
3517	D4	3522	D5	3527	B4	3532	B2	3537	B5	3542	B5	3548	D6	3560	D1	3567	D3	3573	D5												
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3579	F5	3584	E3	3593	E4	3598	E5	3605	E2	3931	C3	3941	E4	5505	C4	6512	C4	6523	E5												
3580	F5	3585	E3	3594	D5	3599	E5	3606	E2	3935	C2	3944	D4	6501	B2	6514	D2	6525	E5												
3581	F4	3590	D2	3595	E4	3600	F5	3607	D4	3936	D2	5501	B3	6504	B6	6517	D3	6530	A3												
3582	E5	3591	E2	3596	E4	3601	F5	3608	D4	3937	E6	5503	B1	6508	A5	6519	D3	6531	A4												
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6536	D6	6548	A4	6554	C5	6563	B1																								
6537	D5	6549	A4	6558	D5	6564	D5																								
6540	B4	6550	A4	6559	F6																										
6544	A4	6551	A4	6561	D4																										
6545	A4	6553	C5	6562	B1																										

DECODER

	
SAA7030	4822 209 10378
TDA1540D	4822 209 81453
NE5532N	5322 209 86234
	
BAX18A	4822 130 34121
	
0E	4822 111 90163
2E2	4822 111 90507
47E	4822 111 90217
82E	4822 116 60158
100E	5322 111 90091
150E	5322 111 90098
390E	5322 111 90138
560E	5322 111 90113
620E	4822 111 90516
1k	5322 111 90092
1k8	5322 111 90101
2k2	5322 111 90102
2k7	4822 111 90179
4k7	5322 111 90111
10k	4822 111 90249
18k	4822 111 90238
47k	5322 111 90112
56k	5322 111 90115
91k	5322 111 90277
100k	4822 111 90148
180k	5322 111 90273
220k	4822 111 90197
270k	4822 111 90302
820k	4822 111 90205
	
33p	4822 122 31756
68p	4822 122 31961
100p	4822 122 31765
470p	4822 122 31727
820p	4822 122 31974
1n5	4822 122 31781
2n2	4822 122 31644
10n	4822 122 31728
22n	4822 122 31797
100n	4822 122 31947

DECODING 2

2504 E15	2555 C4	2560 B7	2568 A11	2580 E6	2585 E8	2591 E11	2599 G10	2606 I12	2620 E15	2630 J6	2635 J8	2641 J11	3567 C4	3573 A12	3580 C15	3591 G8	3597 H12	3605 I11	6519 C6	6525 I13	3936 H5
		2562 A8	2570 B12	2581 E7	2586 E9	2593 G6	2601 G11	2608 I14	2623 G14	2631 J7	2636 J9	3550 E15	3569 B7	3574 B11	3581 C15	3592 G7	3598 H12	3606 I11	6520 H6	6561 D15	3937 A10
		2564 B10	2571 C12	2582 E7	2587 E9	2594 G7	2602 G11	2610 I16	2624 G16	2632 J7	2637 J9	3564 C1	3570 B8	3576 B12	3582 D13	3593 G11	3599 I13	3607 G15	6523 B11	5502 E15	3941 F10
	2558 B6	2566 A11	2573 C14	2583 E7	2588 E9	2595 G7	2603 G11	2617 B13	2625 H16	2633 J7	2638 J9	3565 C2	3571 B7	3577 C12	3583 D13	3594 G12	3600 I14	6517 D4	6525 H11		3944 F14
	2559 A7	2567 A11	2575 C16	2584 E8	2589 E10	2597 G8	2605 H12	2619 I13	2628 G16		2639 J10	3566 C3	3572 A11	3579 C14	3584 D11	3595 G11	3601 I15				
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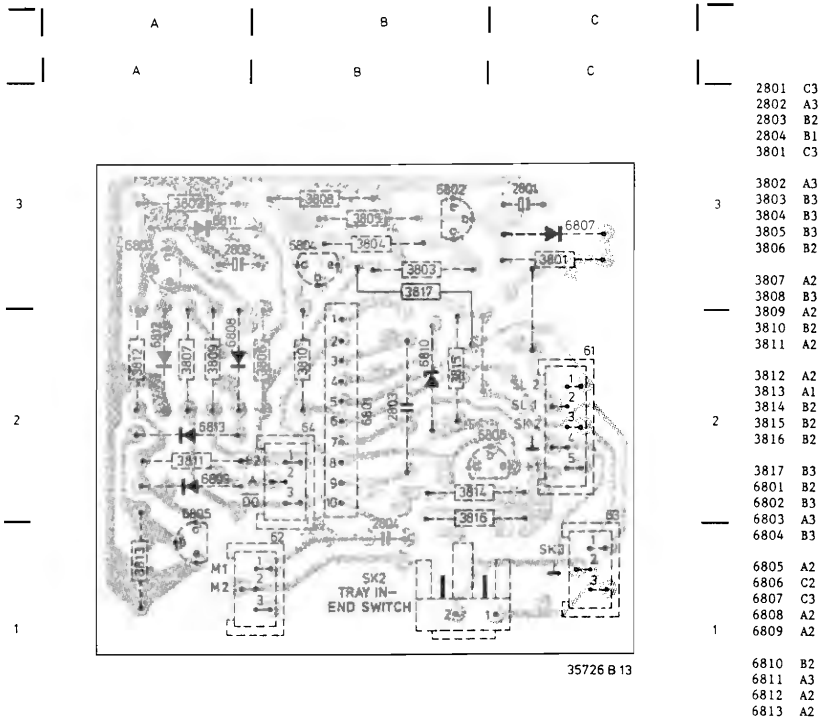
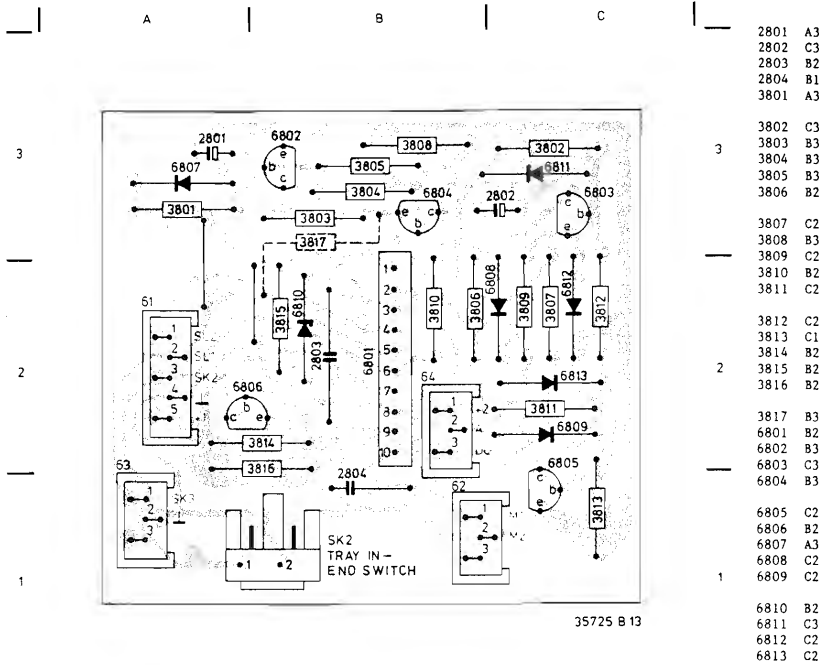


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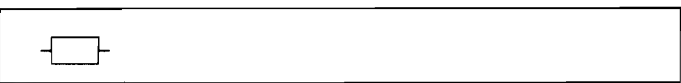
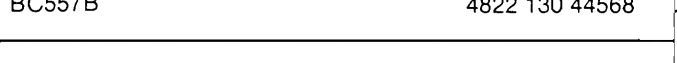
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2802	H 5	3801	D 2	3804	D 3	3807	H 4	3810	D 4	3813	H 7	3816	A 8	6802	D 3	6805	G 7	6808	H 9	6811	H 4		
2803	B 6	3802	H 4	3805	E 3	3808	E 4	3811	C 7	3814	B 7	3817	B 5	6803	H 5	6806	B 8	6809	G 9	6812	H 6		



TRAY CONTROL P.C.B.

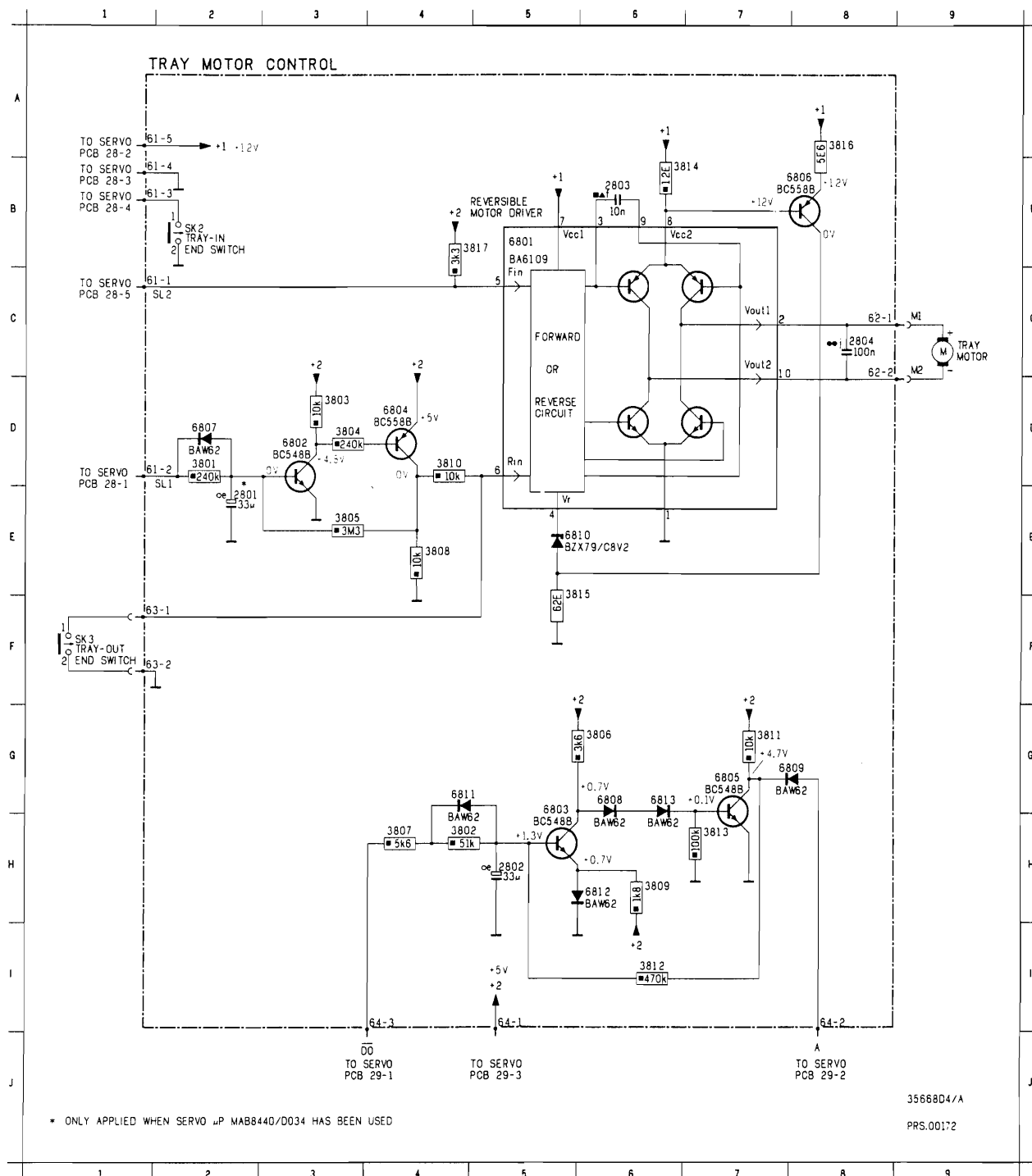


Tray control

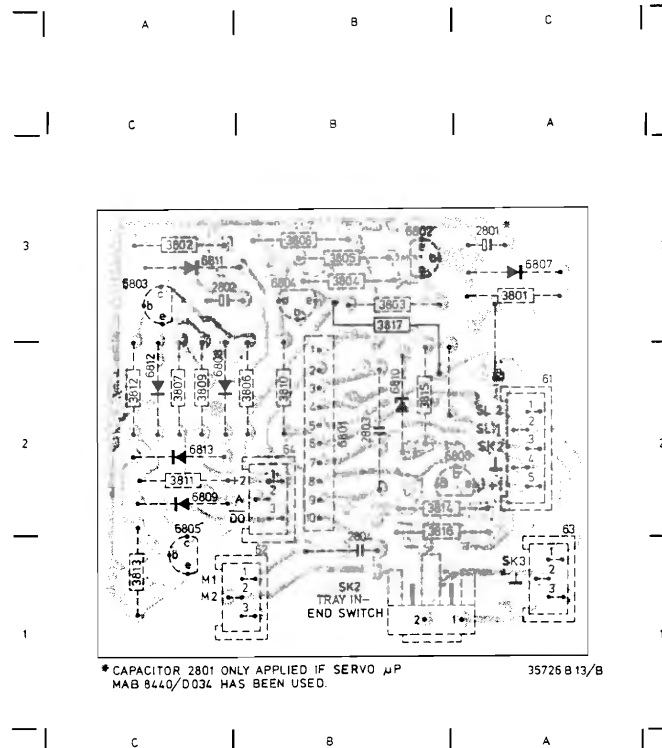
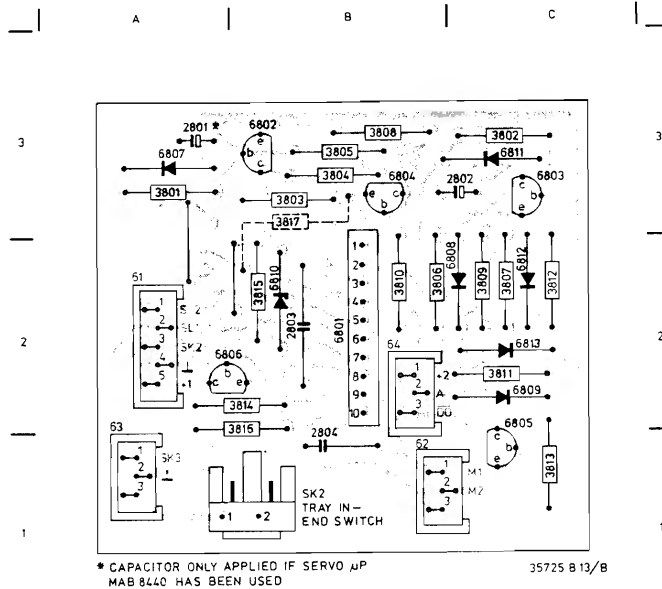
	
6801 BA6109 4822 209 82059	3814 5E6 - NFR25 4822 111 30502 3815 62E - NFR25 4822 111 30529 3816 12E - NFR25 4822 111 30511
	
BC547B 4822 130 40959 BC557B 4822 130 44568	
	SK2 Tact switch 4822 276 10863
BAW62 4822 130 30613 BZX79-C8V2 4822 130 34382	

1984-11-15

2801	E 2	2804	C 8	2803	D 3	2806	G 6	2809	H 6	2812	I 6	2815	E 6	2801	B 5	2804	D 4	2807	D 2	2810	E 6	2813	G 6	\\	G 6
2802	H 5	2801	D 2	2804	D 3	2807	H 4	2810	D 4	2813	H 7	2816	A 8	2802	D 3	2805	G 7	2808	C 6	2811	G 4	SK2	B 2		
2803	B 6	2802	H 4	2805	E 3	2808	E 4	2811	G 7	2814	H 7	2817	B 5	2803	G 5	2806	B 8	2809	C 8	2812	H 6	SK3	F 1		



TRAY CONTROL P.C.B.



2801 A3
2802 C3
2803 B2
2804 B1
3801 A3

3802 C3
3803 B3
3804 B3
3805 B3
3806 B2

3807 C2
3808 B3
3809 C2
3810 B2
3811 C2

3812 C2
3813 C1
3814 B2
3815 B2
3816 B2

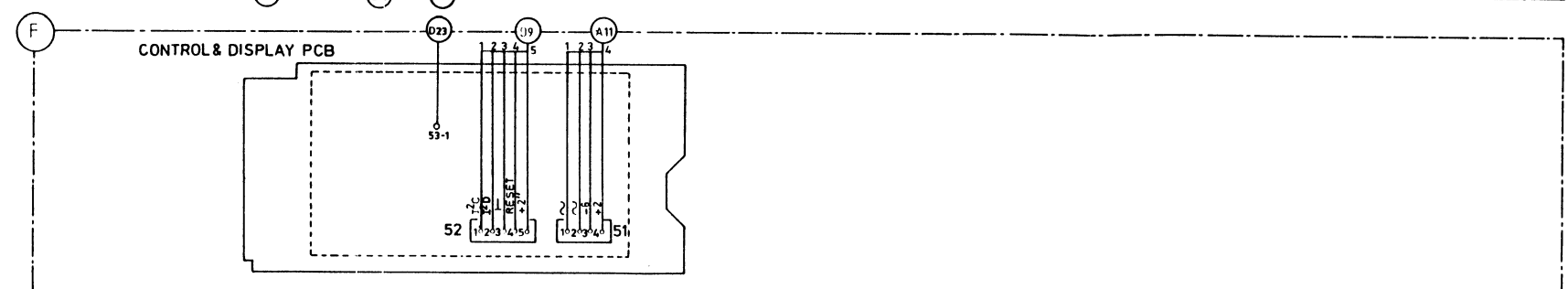
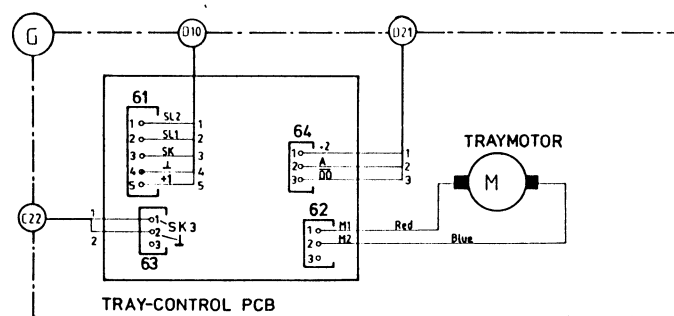
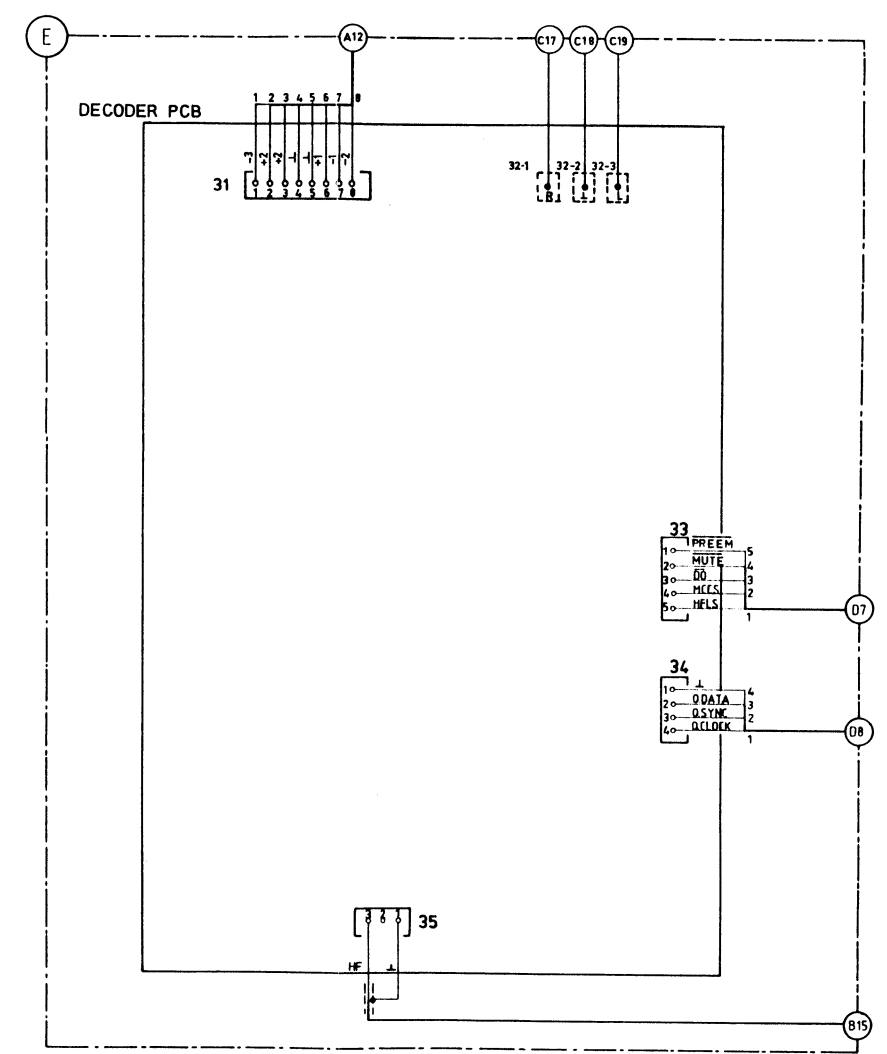
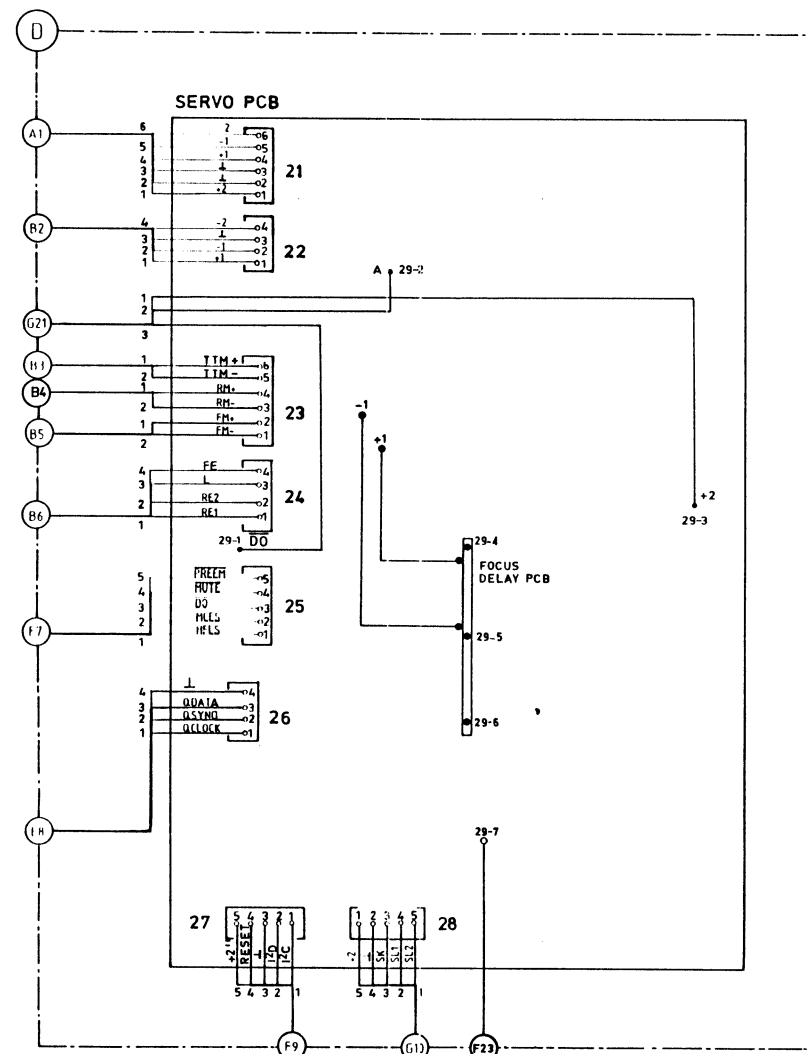
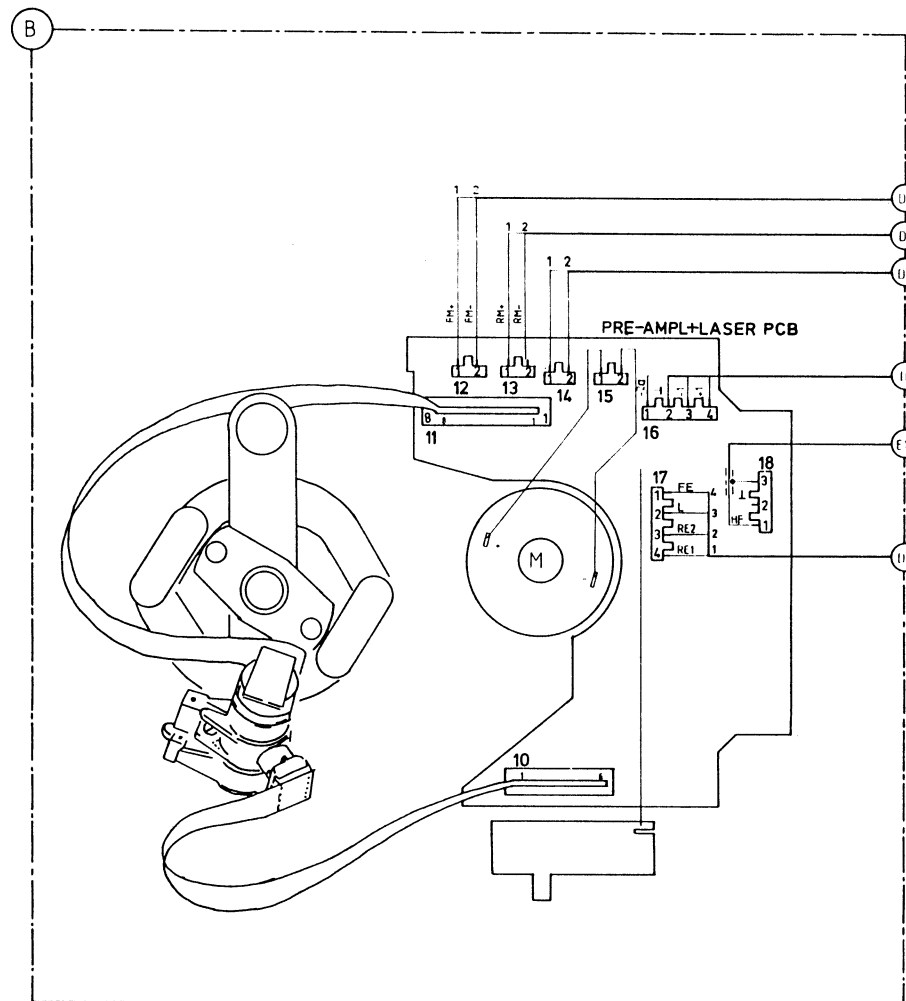
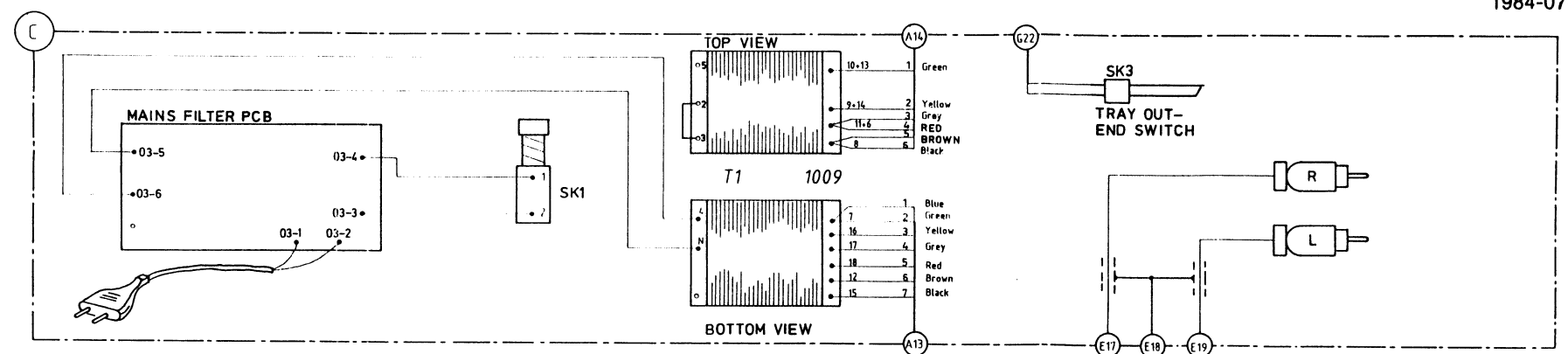
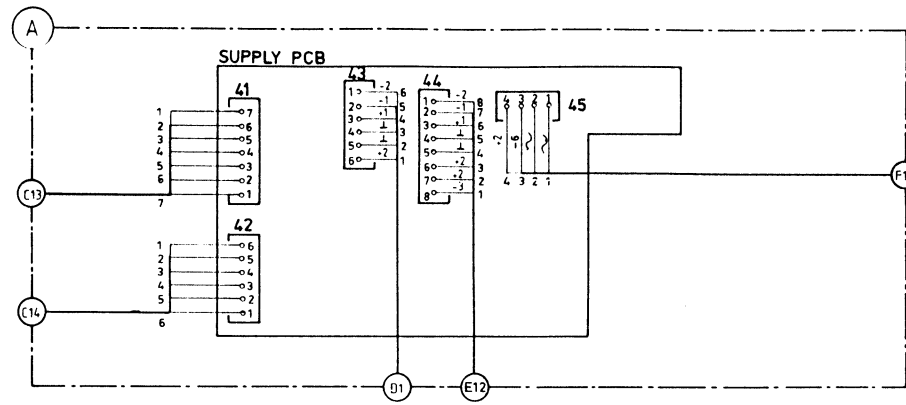
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6801 B2
6802 B3
6803 C3
6804 B3

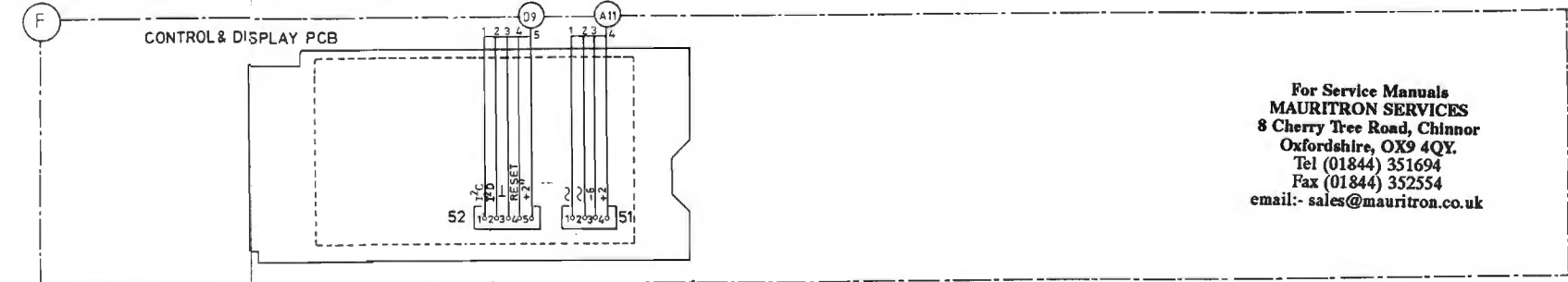
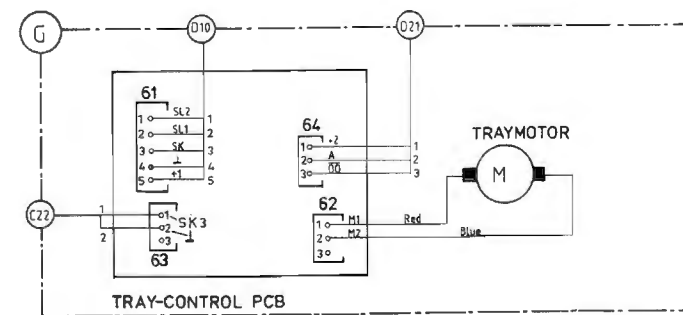
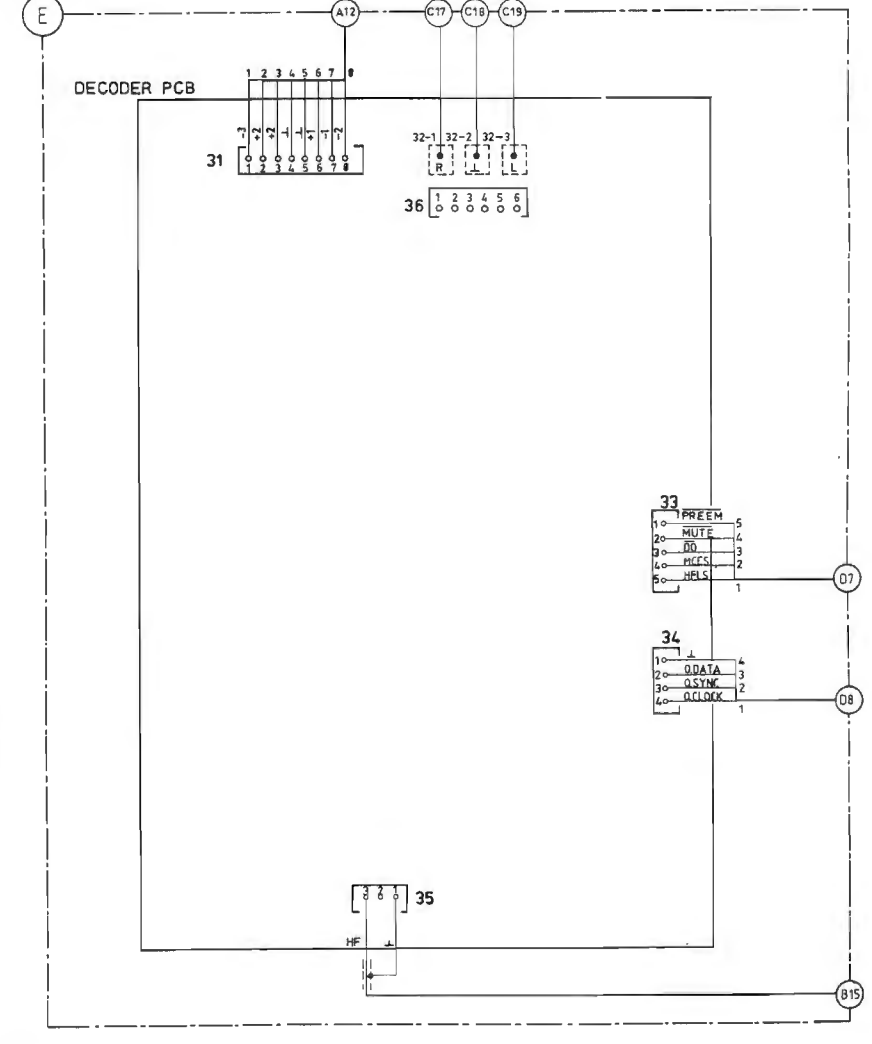
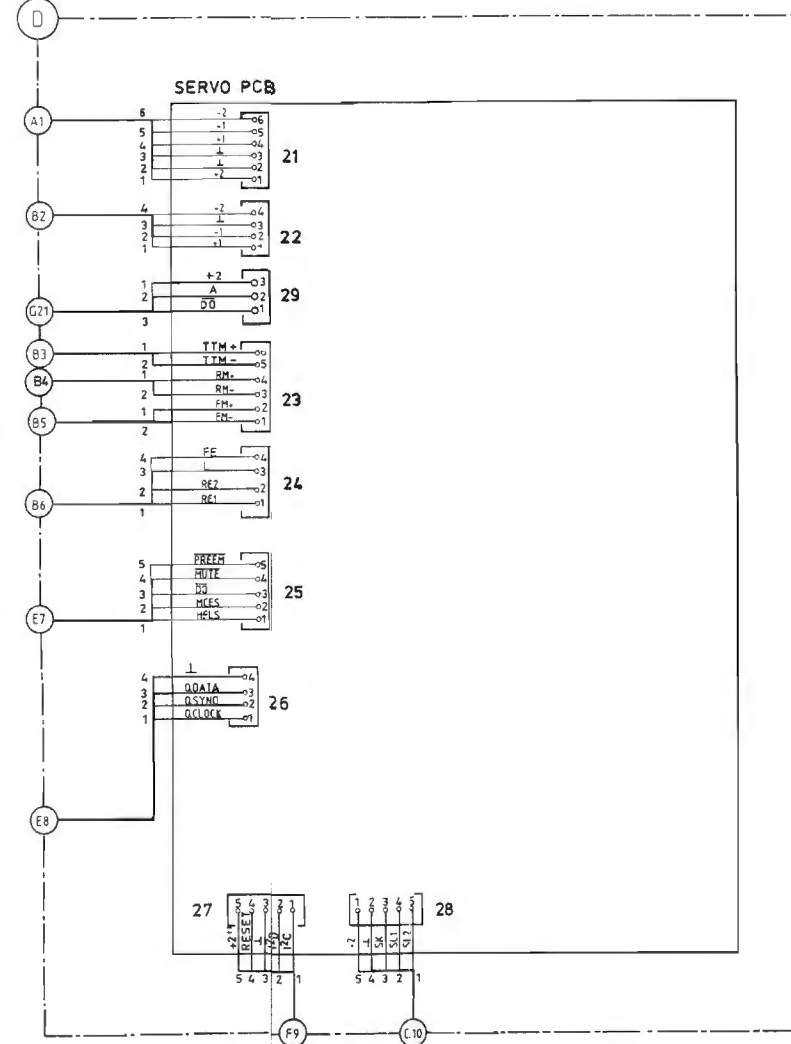
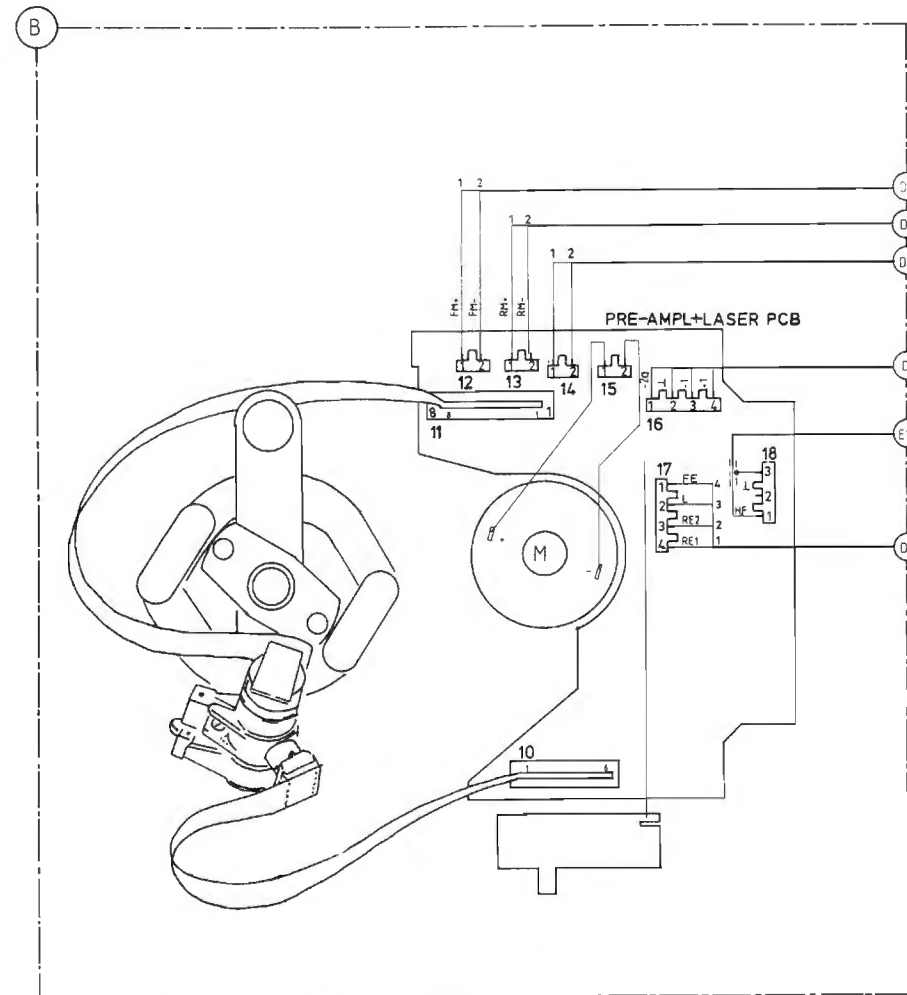
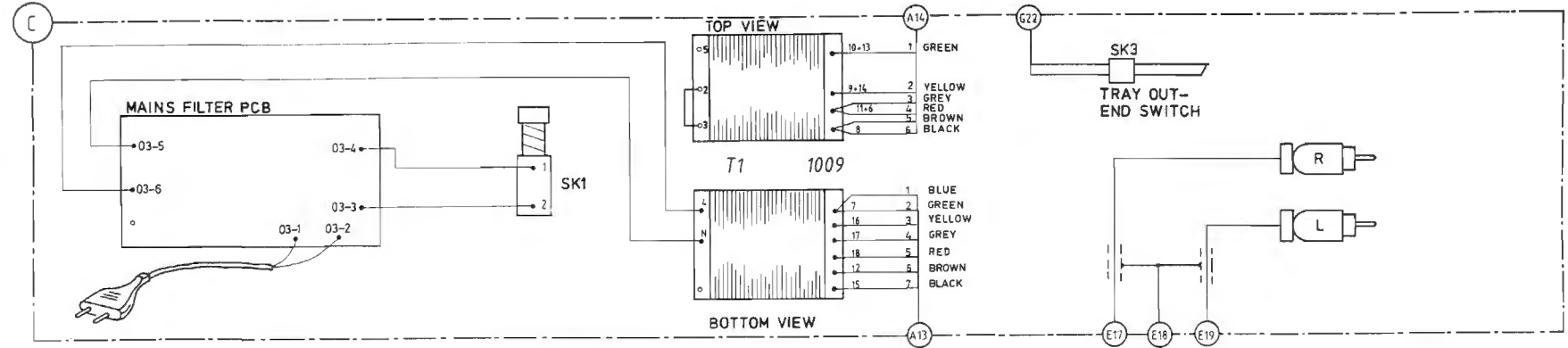
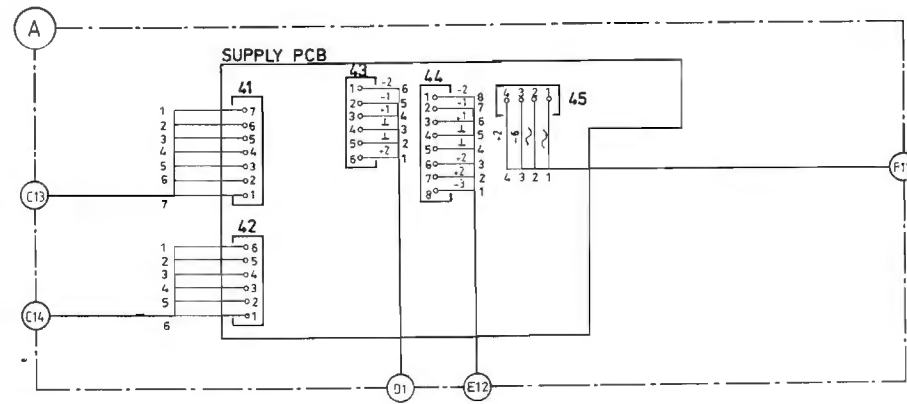
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6806 B2
6807 A3
6808 C2
6809 C2

6810 B2
6811 C3
6812 C2
6813 C2

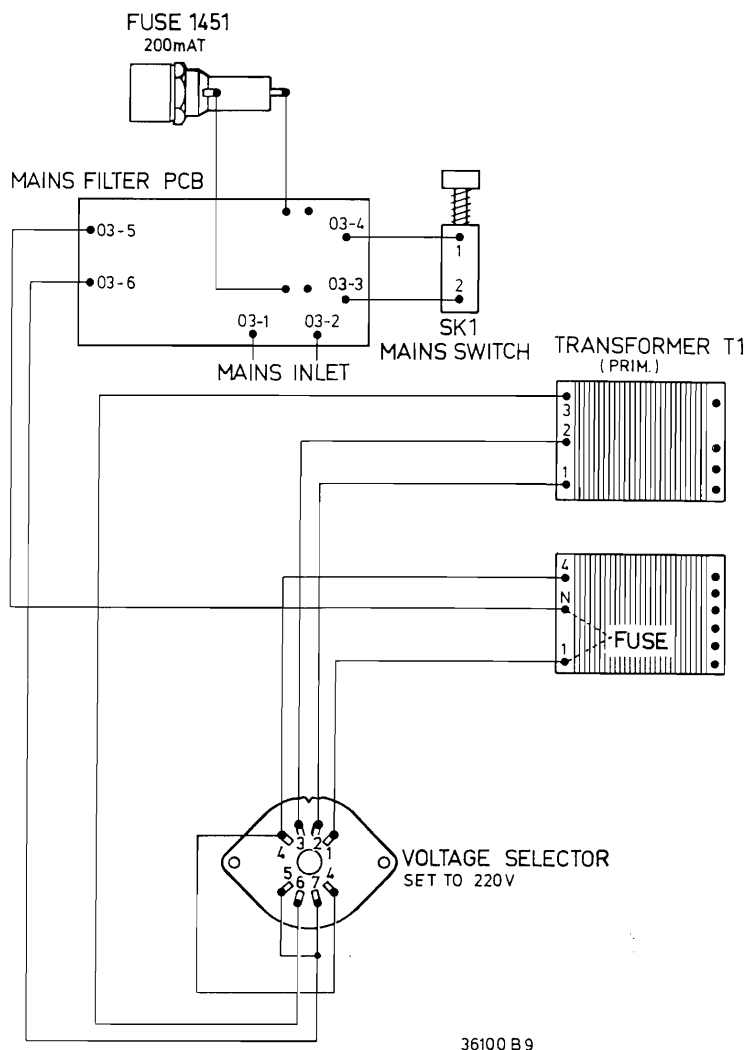
Tray control

6801	BA6109	4822 209 82059	3814	12E - NFR25	4822 111 30511
			3815	62E - NFR25	4822 111 30529
BC548B BC558B			3816	5E6 - NFR25	4822 111 30502
BAW62 BZX79-C8V2			SK2	Tact switch	4822 276 10863





For Service Manuals
MAURITRON SERVICES
8 Cherry Tree Road, Chinnor
Oxfordshire, OX9 4QY.
Tel (01844) 351694
Fax (01844) 352554
email:- sales@mauritron.co.uk



 Carbon film 0.2 W 70°C 5%  Carbon film 0.33 W 70°C 5%  Metal film 0.33 W 70°C 5%  Carbon film 0.5 W 70°C 5%  Carbon film 0.67 W 70°C 5%  Carbon film 1.15 W 70°C 5%	 Ceramic plate Tuning ≤ 120 pF NP.0 2% Others -20/+80%  Polyester flat foil 10%  Metalized polyester flat film 10%  Polyester flat foil small size (Mylar) 10%  Polysterene film/foil 1%  Tubular ceramic  Miniature single  Subminiature tantalum $\pm 20\%$	*a = 2,5 V b = 4 V c = 6,3 V d = 10 V e = 16 V f = 25 V g = 40 V h = 63 V j = 100 V l = 125 V m = 150 V n = 160 V q = 200 V r = 250 V s = 300 V t = 350 V u = 400 V v = 500 V w = 630 V x = 1000 V A = 1,6 V B = 6 V C = 12 V D = 15 V E = 20 V F = 35 V G = 50 V H = 75 V I = 80 V
© Chip component		

 Chips				 Chips 0,125 W				 Chips 0,125 W			
1.5 pF	5%	4822 122 31792		9,1 E	10%	4822 111 90398		9,1 k	5%	4822 111 90373	
1.8 pF	5%	4822 122 32087		10 E	5%	5322 111 90095		10 k	2%	4822 111 90249	
3.3 pF	5%	4822 122 32079		11 E	5%	4822 111 90338		11 k	5%	4822 111 90337	
3.9 pF	5%	4822 122 32081		12 E	5%	4822 111 90551		12 k	2%	4822 111 90253	
4.7 pF	5%	4822 122 32082		13 E	5%	4822 111 90343		13 k	2%	4822 111 90509	
8.2 pF	5%	4822 122 32083		15 E	5%	4822 111 90344		15 k	5%	4822 111 90196	
10 pF	5%	4822 122 31971		16 E	5%	4822 111 90347		16 k	5%	4822 111 90346	
18 pF	5%	4822 122 31769		18 E	5%	5322 111 90139		18 k	5%	4822 111 90238	
22 pF	10%	4822 122 31837		20 E	5%	4822 111 90352		20 k	5%	4822 111 90349	
27 pF	5%	4822 122 31966		22 E	5%	4822 111 90186		22 k	2%	4822 111 90251	
33 pF	5%	4822 122 31756		27 E	5%	4822 116 60186		24 k	2%	4822 111 90512	
39 pF	5%	4822 122 31972		30 E	5%	4822 111 90356		27 k	2%	4822 111 90542	
47 pF	5%	4822 122 31772		33 E	5%	4822 111 90357		30 k	2%	4822 111 90216	
56 pF	5%	4822 122 31967		36 E	5%	4822 111 90359		33 k	5%	5322 111 90267	
68 pF	10%	4822 122 31961		39 E	5%	4822 111 90361		36 k	2%	4822 111 90514	
82 pF	10%	4822 122 31839		43 E	5%	5322 116 90125		39 k	5%	5322 111 90108	
100 pF	5%	4822 122 31765		47 E	5%	4822 111 90217		43 k	5%	4822 111 90363	
120 pF	5%	4822 122 31766		51 E	5%	4822 111 90365		47 k	2%	4822 111 90543	
150 pF	5%	4822 122 31767		56 E	5%	4822 116 60187		51 k	5%	5322 111 90274	
180 pF	2%	4822 122 31794		62 E	5%	4822 111 90367		56 k	2%	4822 111 90573	
220 pF	5%	4822 122 31965		68 E	5%	4822 111 90203		62 k	5%	5322 111 90275	
330 pF	10%	4822 122 31642		75 E	5%	4822 111 90371		68 k	5%	4822 111 90202	
390 pF	5%	4822 122 31771		82 E	5%	4822 116 60158		75 k	2%	4822 111 90574	
470 pF	5%	4822 122 31727		91 E	5%	4822 111 90375		82 k	2%	4822 111 90575	
560 pF	5%	4822 122 31773		100 E	5%	5322 111 90091		91 k	5%	5322 111 90277	
680 pF	5%	4822 122 31775		110 E	5%	4822 111 90335		100 k	2%	4822 111 90214	
820 pF	10%	4822 122 31974		120 E	5%	4822 111 90339		110 k	5%	5322 111 90269	
1 nF	10%	5322 122 31647		130 E	5%	4822 116 60164		120 k	2%	4822 111 90568	
1,2 nF	5%	4822 122 31807		150 E	5%	5322 111 90098		130 k	2%	4822 111 90511	
1,5 nF	10%	4822 122 31781		160 E	5%	4822 111 90345		150 k	5%	5322 111 90099	
2.2 nF	10%	4822 122 31644		180 E	5%	5322 111 90242		160 k	2%	5322 111 90264	
2.7 nF	10%	4822 122 31783		200 E	5%	4822 111 90348		180 k	2%	4822 111 90565	
3.3 nF	10%	4822 122 31969		220 E	5%	4822 111 90178		200 k	5%	4822 111 90351	
4.7 nF	10%	4822 122 31784		240 E	5%	4822 111 90459		220 k	5%	4822 111 90197	
5.6 nF	10%	4822 122 31916		270 E	5%	4822 111 90154		240 k	2%	4822 111 90215	
6.8 nF	10%	4822 122 31976		300 E	5%	4822 111 90156		270 k	5%	4822 111 90302	
10 nF	10%	4822 122 31728		330 E	5%	5322 111 90106		300 k	5%	5322 111 90266	
12 nF	10%	5322 122 31648		360 E	1%	4822 111 90288		330 k	2%	4822 111 90513	
15 nF	10%	4822 122 31782		390 E	5%	5322 111 90138		360 k	2%	4822 111 90515	
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22 nF	10%	4822 122 31797		470 E	5%	5322 111 90109		430 k	5%	4822 111 90168	
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100 nF	20%	4822 122 31947		560 E	5%	5322 111 90113		510 k	5%	4822 111 90364	
				620 E	5%	4822 111 90366		560 k	5%	4822 111 90169	
				680 E	5%	4822 111 90162		620 k	2%	4822 111 90213	
				750 E	5%	4822 111 90438		680 k	2%	4822 111 90106	
				820 E	5%	4822 111 90171		750 k	5%	4822 111 90369	
				910 E	5%	4822 111 90372		820 k	5%	4822 111 90205	
				1 k	5%	5322 111 90092		910 k	5%	4822 111 90374	
				1,1 k	5%	4822 111 90294		1 M	2%	4822 111 90252	
				1,2 k	5%	5322 111 90096		1,1 M	5%	4822 111 90408	
				1,3 k	5%	4822 111 90244		1,2 M	10%	4822 111 90409	
				1,5 k	5%	4822 111 90151		1,3 M	10%	4822 111 90411	
				1,6 k	5%	5322 111 90265		1,5 M	10%	4822 111 90412	
				1,8 k	5%	5322 111 90101		1,6 M	10%	4822 111 90413	
				2 k	5%	4822 111 90165		2 M	10%	4822 111 90415	
				2,2 k	2%	4822 111 90248		2,2 M	10%	4822 111 90185	
				2,4 k	5%	4822 111 90289		2,4 M	10%	4822 111 90416	
				2,7 k	2%	4822 111 90569		2,7 M	10%	4822 111 90417	
				3 k	5%	4822 111 90198		3 M	10%	4822 111 90418	
				3,3 k	5%	4822 111 90157		3,3 M	10%	4822 111 90191	
				3,6 k	5%	5322 111 90107		3,6 M	10%	4822 111 90419	
				3,9 k	2%	4822 111 90571		3,9 M	10%	4822 111 90421	
				4,3 k	5%	4822 111 90167		4,3 M	10%	4822 111 90422	
				4,7 k	5%	5322 111 90111		4,7 M	10%	4822 111 90423	
				5.1 k	5%	5322 111 90268		5.1 M	10%	4822 111 90424	
				5,6 k	2%	4822 111 90572		5,6 M	10%	4822 111 90508	
				6,2 k	5%	5322 111 90116		6,2 M	10%	4822 111 90426	
				6,8 k	2%	4822 111 90544		6,8 M	10%	4822 111 90328	
				7.5 k	5%	4822 111 90276		7.5 M	10%	4822 111 90427	
				8.2 k	5%	5322 111 90118		8.2 M	10%	4822 111 90329	
								9.1 M	10%	4822 111 90428	

FAULTFINDING METHOD

Preface

In course of the development of the troubleshooting guide for the Compact Disc it has become clear that a different approach from the one applied so far was required. For, it is no longer possible to use the classic strategy, i.e. basing the troubleshooting method on a number of possible faults in the unit. Practice has shown that a certain fault, with the associated symptom, can have a wide variety of causes. The reason is that this player incorporates a number of feedback loop configurations — which, moreover, might affect each other — and this impedes the obvious measurements.

The method below divides the player from diagram point of view into nine clearly distinguishable sub-groups and by performing some measurements, the sub-group being in failure can be isolated. Later the defective circuit can be further examined according to the method given.

PRACTICAL HINTS

Test discs

It is important to handle the test discs with great care. For, the troubles (black dots, fingerprints, etc.) are exclusively and unambiguously positioned. Damage can cause additional drop-outs etc. and as a result the conscious fault on this disc is no longer exclusive.

In that case it is no longer possible to check e.g. whether the track detector is working correctly.

Measurements on op-amps

In the electronic circuits of the servo systems op-amps are frequently being applied. These op-amps can be used as amplifiers, as filters, as invertors, as buffers, etc.

In those cases where feedback is applied in one way or the other, the voltage difference at the differential inputs inclines to zero. This applies both to DC and to AC. The cause can be traced back to the properties of an ideal op-amp ($Z_i = \infty$; $G = \infty$; $Z_o = 0$). In practice this means that it is nearly impossible to perform measurements on the inverting and non-inverting inputs of op-amps if one input is directly connected to ground.

In those cases only the output signal will be measurable.

That is why in most cases no AC voltages can be given to the inputs. The DC voltages at the inputs are equal.

Stimulating with „0” and „1”

In the troubleshooting method certain pins should in a number of cases be connected to ground or be connected to the power supply voltage. This way of acting offers the possibility to overrule certain circuits and to stimulate others. In this way the diagnose time can be reduced.

In a number of cases the relevant pins appear to be **op-amp outputs**.

In this respect it should be mentioned that the outputs of the used op-amps are short-circuit protected. This implies that the output of an op-amp can be made low (= usually ground potential) without consequences. On the other hand should be pointed out that it is **not allowed** to connect the **output** of an op-amp directly to the **power supply voltage**.

I/Os of microprocessors should not be connected directly to power supply voltage. These I/Os are allowed to be brought to „0” in case this is mentioned explicitly.

Selection of ground point

It is very important to select a ground point as close as possible to the test point.

Conditions for injecting

- It should be pointed out that injection of levels or signals from a strange source is **never** allowed to occur when the power supply voltage is lacking in the circuit in question.
- Naturally, the injected level is never allowed to exceed the power supply voltage of the circuit in question.

Continuous burning of the laser

- Disconnect plug 24 on the servo PCB and connect pin 24-3 (laser) of the cable connector to ground. Now the focus loop and the radial loop are interrupted as well:
24-1 (RE1 = Radial Error 1), 24-2 (RE2 = Radial Error 2) and 24-4 (FE = Focus Error).
The laser also burns continuously when the set is in service loop A.

Irregular working of the display

Irregular working of the display when the set is opened and playing, might have been caused by incidental body effect in the region of the crystal oscillators. Switching „off” and „on” of the mains voltage will eliminate this effect.

Indication of checkpoint

In the circuit diagram and PCB diagrams the checkpoints have been given a serial number (e.g. ) , to which the troubleshooting method will refer. For oscillograms, amplitudes, time bases and position of set, see tables of checkpoints.

GENERAL CHECKPOINTS

In the detailed troubleshooting method following below a number of general conditions, required for proper functioning of the player, will **not** be repeated. Before starting the detailed troubleshooting method these general points should be checked.

- a. Ensure that disc and objective are clean (remove dust, fingerprints, etc.) and use undamaged discs.
- b. Convince yourself of the presence of the clock frequencies, viz.:
 - 6 MHz for μ P servo (pin 16)
 - 4.233600 MHz for CIM-IC (pin 8)
 - 4.35 MHz for free-running PLL circuit on the DEMOD IC (pin 22) in pos. play
 - 6 MHz for control and display μ P (pin 15)
- c. Check whether all power supply voltages are present and have the correct level.
See PCB drawings.
- d. Check whether the two mutes (KILL and SMSE) are inactive so that data are nowhere interrupted.
KILL = the collector of transistor 6536 on the decoder PCB.
This should go high about 3 seconds after the mains voltage is switched on.
SMSE = pin 39 of the ERCO IC on the decoder PCB.
Normally this pin is high during play and low during search.

- e. Check good working of both microprocessors by means of their built-in self-check program and possible peripheral check program.

Method

Self-check of the servo μ P

- Disconnect points 2, 3 and 17 of the display μ P.
- Interconnect pins 6, 14, 18 and 21 of the socket of the servo μ P.
- When the μ P functions properly, pin 22 should go from "0" to "1" within 1 second after switch-on of the mains voltage.

Self-check of the display μ P

- Take the servo μ P out of its socket and ensure points 2, 3 and 17 of the display μ P are connected.
- Interconnect pins 6, 14, 18 and 21 of the display μ P.
- If the μ P is functioning properly, pin 22 should go from "1" to "0" within 1 second after switch-on of the mains voltage.

Peripheral check

Place disc on turntable and switch off mains voltage.

Initiating service loop A

Ensure that the tray PCB is mounted or that the tray in-end switch (SK2) on the tray PCB is closed when the drawer is closed.

Keep the NEXT, STOP/CM and PAUSE keys depressed during switch-on of the mains voltage. Release the keys after 2 seconds.

Now the player is in the SERVICE LOOP A.

This means that the laser is working, the focusing control is working and the turntable motor is running while the light pin settles itself against the inner stop (i.e. constantly remains in the lead-in tracks).

The radial servo system is switched off.

In this service loop the LEDs and the display can be checked as follows:

The display will indicate 00—0102 and increase towards the left.

If now the SEARCH reverse key is depressed, the REPEAT, ERROR and PAUSE leds will light up after 2 clock strokes of the display. The set remains in service loop A. When the SEARCH reverse key is pressed again, the set will resume the initial position.

Initiating service loop B

Service loop B can be reached from service loop A by pressing the SEARCH forward key. In service loop B the display continues to indicate the same as in service loop A, except for the play/program bar. Furthermore the REPEAT led will light up.

After approx 1 minute music can be heard. (The time depends on the length of the lead-in track).

From service loop B the set can be brought to the position of normal end use by pressing the START/REPLAY key when one of the musical numbers on the disc is being displayed.

If the START/REPLAY key is operated when the display shows a musical number that is not on the disc, the set will stop and two horizontal bars will appear on the display.

- f. Eye pattern

Check on the oscilloscope whether the H.F.-signal — called eye pattern.

Set for this purpose the time basis of the oscilloscope to $0.5 \mu\text{s}$ and check test point $\diamond 65$ (on the decoder PCB).

This picture is fairly stable if PLL circuit is in lock and turntable loop is controlling correctly.

A vibrating or **unstable eye pattern** can be caused by a poor turntable motor, or by bringing the set in **service loop A**.

DETAILED TROUBLESHOOTING METHOD

A number of quick and efficient checks immediately give a definite answer on poorly functioning sections of the player.

To check the servo systems two service loops have been built in μ P 6201.

Before calling in service loop A or service loop B, it should be checked (position power on) whether the bus (clock, data; pin 3 and 2 of μ P 6201 resp.) is free. In other words, checking whether these lines do not have a short circuit to ground or supply voltage (level low or „high“). In such a case the buttons cannot be operated.

For troubleshooting the step-by-step method below is followed.

First step (with disc on turntable)

Bring the player in service loop A.

If one of the conditions for service loop A is not met, the questions below should be answered positively **in the sequence given**.

Mostly this means that when one question has been answered positively, all the preceding circuits, to which the questions refer, are functioning well.

Example: if the eye pattern is present, we may conclude that the laser is working, the laser is in focus and that the turntable motor is running.

Note:

In some situations, certain faults in the radial servo circuit affect the focus servo circuit (e.g. if supply voltage +1 of IC6214 in the radial circuit fails, the focus coil starts oscillating).

To determine if this situation exists, connect point $\diamond 36$ on the servo PCB to ground.

In this way, the influence of the radial servo circuit on the focus servo circuit can be eliminated.

- A. Is the laser giving light?
(Test method: see sub A).
- B. Is the angle disc-light pin within the tolerance, i.e. $90^\circ \pm 0.5^\circ$?
(Test method: see description mentioned in chapter "Mechanical measurements and adjustments" of the C.D.M. manual).
- C. Is the laser giving sufficient light?
(Test method: see sub C).
- D. Does the objective come in focus?
(Test method: see sub D).
- E. Is the turntable motor running and, if so, is it running at the correct speed?
(Test method: see sub E).

If the answers to questions A through E are positive, it should be possible to bring the player in service loop A.

Second step (with disc on turntable)

Bring the player in service loop B.

This means that the eye pattern on point $\diamond 65$ (on the decoder PCB has to be stable, while MCES on point $\diamond 17$ on the servo PCB has to be more stable too).

Note that the set is not only tracking a song in loop B, but also playing the song, provided the digital circuit is working.

If this does not work, return to service loop A and answer the questions below positively in the sequence given.

tween 25 Hz and 60 Hz at 2 V_{pp} by means of an AF generator ($Z_i \leq 600 \Omega$). The exact frequency is player-dependent.

- Select such a frequency that the monitor diodes of the light pin give output signals as indicated on test points $\diamond 5$, $\diamond 6$, $\diamond 7$ and $\diamond 8$.
- Check test points $\diamond 9$, $\diamond 10$, $\diamond 11$ and $\diamond 12$.
- Check test point $\diamond 13$.
- Check test point $\diamond 14$.

Is the same as signal on test point $\diamond 13$ but amplitude is dependent on position of potentiometer R3158.

If all the checks are positive, close focus loop (insert plug 24). Now the focusing circuit should be able to operate. Reconnect transistor 6230.

It should be noted here that the amplitudes on test points $\diamond 5$ through $\diamond 13$ are slightly dependent on the characteristic of the monitor diodes.

Sub. E. IS TURNTABLE MOTOR RUNNING AND, IF SO, IS IT RUNNING AT THE CORRECT SPEED?

Test method (Test points on servo PCB)

- Place disc on turntable and bring set in service loop A.
- If focusing point is found, check whether FCO is low on point $\diamond 15$.

If not, check focus circuit sub D.
If so, proceed.

- Now only power on, disconnect plug 25 on the servo PCB and check MCES= point 2 of cable connector 25 or point $\diamond 66$ on the decoder PCB see figure F.
If not, check DEMOD and ERCO circuit, see sub L.
If so, proceed.
- Reconnect plug 25, disconnect plug 15 on the pre-amplifier PCB and inject a DC signal to the cable connector of the motor or directly to the turntable motor.

The turntable motor should be running now.

(A DC voltage of 2,5 V approximately corresponds with the rpm during scanning of the innermost tracks).

In this condition the player should be brought in service loop A (depress Stop button while mains voltage is switched on).

If DC < 2,5 V Figure G should be visible on test point $\diamond 17$ (servo PCB).

If DC > 2,5 V Figure H should be visible on test point $\diamond 17$.

If so, check turntable control circuit (circuit from point $\diamond 17$ to turntable motor).

If not, check whether MCES is released by means of FCO at pin 13 of IC6205C.

This can be done by disconnecting plug 25 on the servo PCB and measure on point 2 of cable connector 25.

If MCES is working now, check circuit around IC 6205C.

- Reconnect plug 25.
- Take player out of service loop A, depress Power-on button and then Play button and check eye pattern on point $\diamond 65$ (on decoder PCB).
To stabilize the eye pattern, bring light pin above tracks by hand, or by briefly (5 s) depressing Fast Forward button.
If eye pattern on point $\diamond 65$ is not present or unstable, check RF pre-amplifier (see Annex V).
- If eye pattern is correct, proceed.

- Check whether point $\diamond 65$ (= HFLS) on the servo PCB is correct in service loop A (see Figure Y). If not, check HFLS detector circuit (is circuit between point $\diamond 65$ and $\diamond 55$). If so, proceed.

Take player out of service loop A by depressing the power button.

- Check locking-in of PLL circuit of DEMOD-IC. See Annex II. Checking locking-in of PLL circuit.
If PLL is locking-in, proceed.
- Check timing signals on output of DEMOD IC as indicated in sub L.
Is the digital decoder circuit functioning according to specification? If timing signals are correct, proceed.
- If MCES is still not functioning properly, replace the relevant specific digital IC.
- MCES has to be present now.

Sub. F. ARE THE $\overline{DO}$ AND HFLS DETECTORS FUNCTIONING?

Test method (Test points on servo PCB)

- Starting point is:
HFLS = 1 when spot is exactly on track
HFLS = 0 between tracks (e.g. during track jumping)
 $\overline{DO}$ = 0, or $\overline{DO}$ = 1 in case of drop-out
 $\overline{DO}$ = 1, or $\overline{DO}$ = 0 when there is no drop-out.

Approximative method

(applicable in service loop A)

- Place disc on turntable.
- Bring player in service loop A.
- Check whether $\overline{DO}$ (test point $\diamond 57$) is not continuously „high“. Normally test point $\diamond 57$ is „low“; however small spikes of approximately 100mV are present in case of scratches on the disc.
- Check HFLS (test point $\diamond 55$).

Precise method

(can be checked in playing set only)

- Place test sample 5A (4822 397 30096) on turntable.
Switch power on and depress Play button.
- Select track no. 10: Check point $\diamond 55$.
HFLS pulses should be present.
- Select track no. 15: Check point $\diamond 56$.
 $\overline{DO}$ pulses should be present. With this track the HFLS pulses on point $\diamond 55$ should also be present.
- In case of track jumping HFLS pulses are always present on point $\diamond 55$.

Sub. G. IS TRACK DETECTOR FUNCTIONING WELL?

Test method (Test points on servo PCB)

Switch off the offset circuit:

Loosen resistor 3335 (at the side where it is in contact with pin 14 of IC6215).

Mount a 47 k Ω trimming potentiometer between +1 and —1 supply voltage (for example between pins 4 and 11 of IC6215). Connect the wiper of the trimming potentiometer to the loose side of resistor 3335.

- Place a disc on the turntable.
- Bring the set in service loop A.
- Adjust the signal on test point $\diamond 21$ symmetrically round 0V by means of the external 47 k Ω trimming potentiometer. The amplitude of the signal may change during this adjustment.
- Measure F.S. on point $\diamond 36$.

Here too the frequency variation depends on the eccentricity of the disc.

- Check point 60.
- Check point 61. Signal cannot be triggered.
- Check point 62.
- Switch the offset circuit on again.

Sub. H. IS THE RADIAL CONTROL FUNCTIONING PROPERLY?

Attention: The offset circuit (d-multiplier) and the AGC circuit (k-multiplier) are correction circuits. This means that under optimal conditions (new disc, minimum tolerances of components) the set may be working properly even if a fault is present in offset or AGC circuit.

Test method (Testpoints on servo PCB)

- a. Place disc on turntable.
- b. Switch off AGC circuit (k-multiplier) and switch off offset circuit (d-multiplier).

Method:

Switching off AGC circuit: interconnect points 5 and 6 of IC 6216.

Switch off the offset circuit:

Loosen resistor 3335 (at the side where it is in contact with pin 14 of IC6215).

Mount a 47 k Ω trimming potentiometer between +1 and —1 supply voltage (for example between pins 4 and 11 of IC6215). Connect the wiper of the trimming potentiometer to the loose side of resistor 3335.

- Place a disc on the turntable.
 - Bring the set in service loop A.
 - Adjust the signal on test point 21 symmetrically round 0 V by means of the external 47 k Ω trimming pot. The amplitude of the signal may change during this adjustment.
- c. Bring set in service loop B.
At this moment there is a high probability that the set is working.
If so, check b and d factor (see Annexes IV and III).
If not, proceed.
 - d. Bring set in service loop A and check signal on point 21.
The AC-component has to be 12-14 V symmetrically, around a DC level of zero volt.
If this is correct, proceed to e).
If this is not correct check following testpoints
22, 23 : value should be 0.7 V_{pp}
24 : value should be 0.2 V_{pp}
25 : value should be 0.25 V_{pp}
26 : value should be 20 mV_{pp}
27, 28 : value should be 800 mV_{pp}

Note:
The frequency variation strongly depends on the eccentricity of the disc.
If points 22 ÷ 28 are OK, check point 21 again.
If 21 is OK, proceed.
 - e. Check point 29 (is RE +650 Hz).
Value should be 6 V_{pp}. If so, proceed.
When the set is in the normal stand-by position 650 Hz at 300 mV is present on point 29.
 - f. To check radial output stage, do not use a disc, only power on. Inject on points 30 and 31 respectively a sine-

wave signal of 8 to 10 Hz 3 V_{pp}.

Then the radial motor will go back and forth.

At this moment radial tracking must be possible in service loop B.

- Switch the AGC circuit on again.
If the original fault symptom is still present proceed to Annex IV:
Check of the k-factor.
- Switch the offset circuit on again.
If the original fault symptom is still present, proceed to Annex III:
Check of the d-factor.

Sub. I. IS THE P-BIT FUNCTIONING?

Test method (Test points on decoder PCB)

Bring the set in service loop B again. Between 45 and 95 seconds after the beginning of the disc the P-bit (pin 5 of the demod on the decoder PCB) should briefly go "high". This can be measured with an oscilloscope in DC position and 2 V/div.

Sub. J. IS INFORMATION TRANSMISSION SUBCODE FUNCTIONING? (Testpoints on servo and decoder PCB)

Test Method

Bring player in service loop B.

Check if activity is present on the bus (pins 2 and 3 of the μ P IC6201 and 2 and 3 of port extender IC6202), i.e. the signal is not continuously high or low.

If not, check test points 72, 73, 74, 75, 95 and 96 and their interrelations (trigger oscilloscope at point 72).

In order to measure test points 75, 95 and 96 either the STOP or START key have to be depressed.

Sub. K. IS T1 FUNCTIONING, I.E. POLARITY OF RE? (Measure points on servo PCB)

Test method

Bring player in service loop B and measure T1 on pin 13 of μ P servo IC6201.

A square-wave voltage (0-5V) should be measured on this pin. As a result of the frequency variation this square-wave is hard to trigger.

Sub. L. IS THE DIGITAL DECODER CIRCUIT FUNCTIONING ACCORDING TO SPECIFICATION?

Test method (Test points on decoding PCB)

- First condition is that the main motor is running at the correct speed. This implies that the PLL circuit is functioning properly. If not, apply test method sub E.
- Second condition is that the RF pre-amplifier is functioning properly. See for this purpose Annex V — Test method RF pre-amplifier.
- Apart from the data outputs, which can in principle not be measured when the unit is playing, a number of communication lines, responsible for timing, can be measured. In this way it is also possible to isolate faults in the „periphery“ of the specific digital ICs. These signals can be verified with a normal oscilloscope.
To data outputs the following applies:
 - In a playing unit it is only possible to check whether data are **present** or not.
 - In a non-playing unit measurements **can** be performed in a number of cases. See the Tables for this purpose.

F. Are $\overline{DO}$ and HFL detectors functioning?
(test method: see sub F)

G. Is track detector functioning well?
(test method: see sub G)

H. Is the radial control functioning properly?
(test method: see sub H)

If the answers to questions F, G and H are positive, it should be possible to bring the player in service loop B.

Third step (with disc on turntable)

Release the set from service loop B by pressing the START/REPLAY key on the display during playback of a musical number that is present on the disc.

Note that the set is not only tracking a song in loop B, but also playing the song, provided the digital circuit is working.

If this does not work, return to service loop B and answer the question below positively.

I. Is the P-bit functioning?
(test method: see sub I)

J. Is information transmission subcode functioning?
(test method: see sub J)

K. Is T1 functioning, i.e. polarity of RE?
(test method: see sub K)

If the answers to questions I, J and K are positive, it should be possible to bring the player in the Play mode.

Fourth step (with disc on turntable)

If no music is heard in position „play“ answer the last question.

L. Is digital decoder circuit functioning according to specification (test method: see sub L).

Sub. A. IS THE LASER GIVING LIGHT?

Test method

Bring the player in service loop A without placing a disc on the turntable. Now the laser is giving light for an unlimited period of time.

Another method for which the laser gives light during an unlimited period of time and the objective is **standing still**, is disconnecting plug 24 on the servo PCB and connecting point 24-3 of the cable connector to ground. In case of power-on the laser should burn. This is checked with the aid of a light-sensitive component which is slightly screened from ambient light.

Hereafter follow some examples:

- Connect photosensitive diode type BPW34, code number 4822 130 32108, with correct polarity to an **analogue** multimeter (e.g. PM2412) at range 10 k Ω . If the laser is burning, the meter will give virtually full scale deflection.
- Connect LDR, code number 4822 116 10002, to digital multimeter PM2517E. If the laser is burning, the resistance will drop to approx. 8 k Ω .

If the laser is **not** giving any light, proceed to Annex I.

Sub. C. IS THE LASER GIVING SUFFICIENT LIGHT?

Test method (Test points on Pre-amp PCB)

- Interrupt the collector of TS6230 on the servo PCB or ground the -side of electrolytic capacitor 2209. Disconnect

plug 24 on the servo PCB and connect pin 24-3 (laser) of the cable connector to ground.

Now the laser should continue to give light while FE, RE1 and RE2 are interrupted.

- Place disc on turntable and switch power on.
- Directly inject with AF generator ($Z_i \leq 600 \Omega$) to test point $\diamond 1$ FE a sine-wave signal between 25 and 60 Hz (exact frequency is player-dependent) and $2 V_{pp}$.
- Select such a frequency that the monitor diodes of the light pin give output signals as indicated on test points $\diamond 5$, $\diamond 6$, $\diamond 7$ and $\diamond 8$. Amplitude 40 - 80 mV.
- If the amplitude is not sufficient, proceed to Annex I.

Sub. D. IS THE OBJECTIVE COMING INTO FOCUS?

Test method

• No disc on turntable

Switch power on and actuate Play button.

Now the arm should move inwards. Immediately after that the objective should move two times up-and downwards (this happens during searching of the focusing point).

After this the action will stop.

These actions are software-controlled from the servo μP . If this is not working, check μP servo, end stage focus circuit or focus coil.

• With disc on turntable

Quick test procedure:

For a rough check on the working of the focus circuit, proceed as follows:

- place disc on turntable.
- set player in service loop A.
- remove disc from turntable.
- now examine if the objective focuses by bringing a reflective object (e.g. mirror) above it.

Detailed test procedure

- Check TS6230 (on servo PCB) as follows:
Check whether FN becomes, with each passage of the nominal focusing **low for a short period of time**. Only when focusing point FN has been found, FE will be released via TS6230 (base will become negative).
Check whether base of TS6244 is driven low from servo μP (= FCO). If not, check servo μP .
If so, proceed.
- Test focusing circuit as follows:
Interrupt the collector of 6230 on the servo PCB and disconnect plug 24 on the servo PCB. Connect pin 24-3 (laser) of the cable connector to ground.
Now the laser is burning continuously, FE has been released and the focus loop has been interrupted at test point $\diamond 1$ (= FE) on servo PCB, circuit diagram C.

Testing of circuit, between test point $\diamond 1$ and focusing coil
(Test points on servo PCB)

- Directly inject a sine-wave signal of 10 Hz, $2V_{pp}$, to test point $\diamond 1$ by means of an AF generator ($Z_i \leq 600 \Omega$).
- Check visually whether focusing coil — and thus objective too — responds.
- Check whether this voltage is $0.6 V_{pp}$ on test point $\diamond 2$.
- Check whether this voltage is $6 V_{pp}$ on test point $\diamond 3$.
- Check whether this voltage is $5 V_{pp}$ on test point $\diamond 4$.

Testing the subchassis (Test points on Pre Amp PCB, injection point on servo PCB)

- Place a disc on the turntable.
- Directly inject to test point $\diamond 1$ a sine-wave signal be-

Measurements:

DEMODO:

For mode of player (Play, Stop) see Table.

- Check clock on test point 71. Test-point 71 synchronises when PLL is locking in. To check locking-in see Annex II.
- Trigger oscilloscope with signal on point 72 (= FSDE) and measure points 76, 77, 78 and their interrelations.

ERCO:

For mode of player (Play, Stop) see Table.

- Check point 84.
- Check test point 79.
If this is good, trigger oscilloscope with point 79 (=FSEC).
- Measure points 80 and 81 and their interrelations.
- Check UNEC (= test point 82).
Place test disc „test sample 5A” on turntable, select track no. 17 and verify test point 82.

Important:

If UNEC (test point 82) remains continuously „high”, the fault is probably located in the DEMOD IC or the ERCO IC, or the RAM IC.
If the UNEC output is functioning normally, and there still is no music, the fault is probably located in the CIM IC, the FIL IC or the DAC IC.

CIM:

For mode of player (Play, Stop) see Table.

- Check point 84.
- Check test point 84.
If this is good, trigger oscilloscope with point 84 (= STR1 = pin 12 of CIM-IC).
- Measure points 85, 86, 87 and their interrelations.

FIL:

For mode of player (Play, Stop) see Table.

- Check point 84.
- Check test point 84.
If this is good, trigger oscilloscope with point 84 (= STR1)
- Measure point 93.
- Measure points 90, 91 and 92 and their interrelations.

DAC:

In the Play mode the analogue (music) signal is present on the outputs of opamps 6523 (left) and on the outputs of opamps 6525 (right).
If necessary, check KILL relay.

Annex I: LASER IS GIVING NO OR INSUFFICIENT LIGHT

Together with the laser supply and the monitor diode the laser forms a feedback system.
A defect in the laser supply might thus result in destruc-

tion of the laser. Replacement of the laser (= new light pin) will not solve anything. The new laser will also be destroyed since the original fault in the laser supply is still present.

On the other hand it is impossible to check and repair a feedback system when one link is missing.

For this reason the so-called laser simulator 3 is supplied. Code number 4822 395 30229.

This laser simulator consists of a PCB which contains the laser and monitor simulation, a switch to test the On/Off position and a number of sockets.

This PCB can be connected to the laser supply instead of the light pin so that the feedback system is closed.

Repair procedure:

Since the light pin is very sensitive to static charges, care should be taken that during measurements and adjustments of the laser power supply the potentials of the aids and yourself equal the potential of the CD mechanism.

Detach light pin and connect laser simulator as follows: (connections on pre-amp PCB).

Take the flex PCB out of socket 11 and connect the simulator PCB with the socket.

Remove plug 16 and insert it in the socket on the simulator PCB.

Connect the plug with 4 wires to socket 16. Take out plug 17 and insert the plug with 1 wire in socket 17.

- Switch on the mains switch and ensure that the drawer is closed or else that the tray-end-in switch on the tray PCB (Sk2) is depressed.
Now press the play key and check if the L-line of the servo μ P, pin 17-2 on the pre-amplifier PCB, goes 'low'.
- In rest position the current through the laser diode should be ≤ 1 mA. For NEG. VOLT. lasers this can be checked as follows:
Set the switch on the simulator PCB in the OFF position and the mains switch in the ON position.
Turn trimming resistor 3180 counterclockwise (min. R) and measure the voltage across resistor 3194 on the pre-amp. PCB.
On pre-amplifier PCBs with discrete components turn resistor 3180 clockwise (min. R) and measure the voltage across resistor 3194.
The voltage should be ≤ 15 V.

Check of laser supply control

Set the switch on the simulator PCB in the ON position and measure the voltages between points +V and -V on the simulator PCB.

Resistor 3180 clockwise (max. R): $U_{+v-v} = 225 \text{ mV} \pm 45 \text{ mV}$.
On preamplifier PCBs with discrete components resistor 3180 counterclockwise (max. R): $U_{+v-v} = 225 \text{ mV} \pm 45 \text{ mV}$.

R3180 counterclockwise (min. R): $U_{+v-v} = 750 \text{ mV} \pm 150 \text{ mV}$.

On preamplifier PCBs with discrete components resistor 3180 clockwise (min. R): $U_{+v-v} = 750 \text{ mV} \pm 150 \text{ mV}$

Set resistor 3180 in the mid-position.

This is a preliminary adjustment. After the simulator PCB has been removed the laser current must be adjusted.

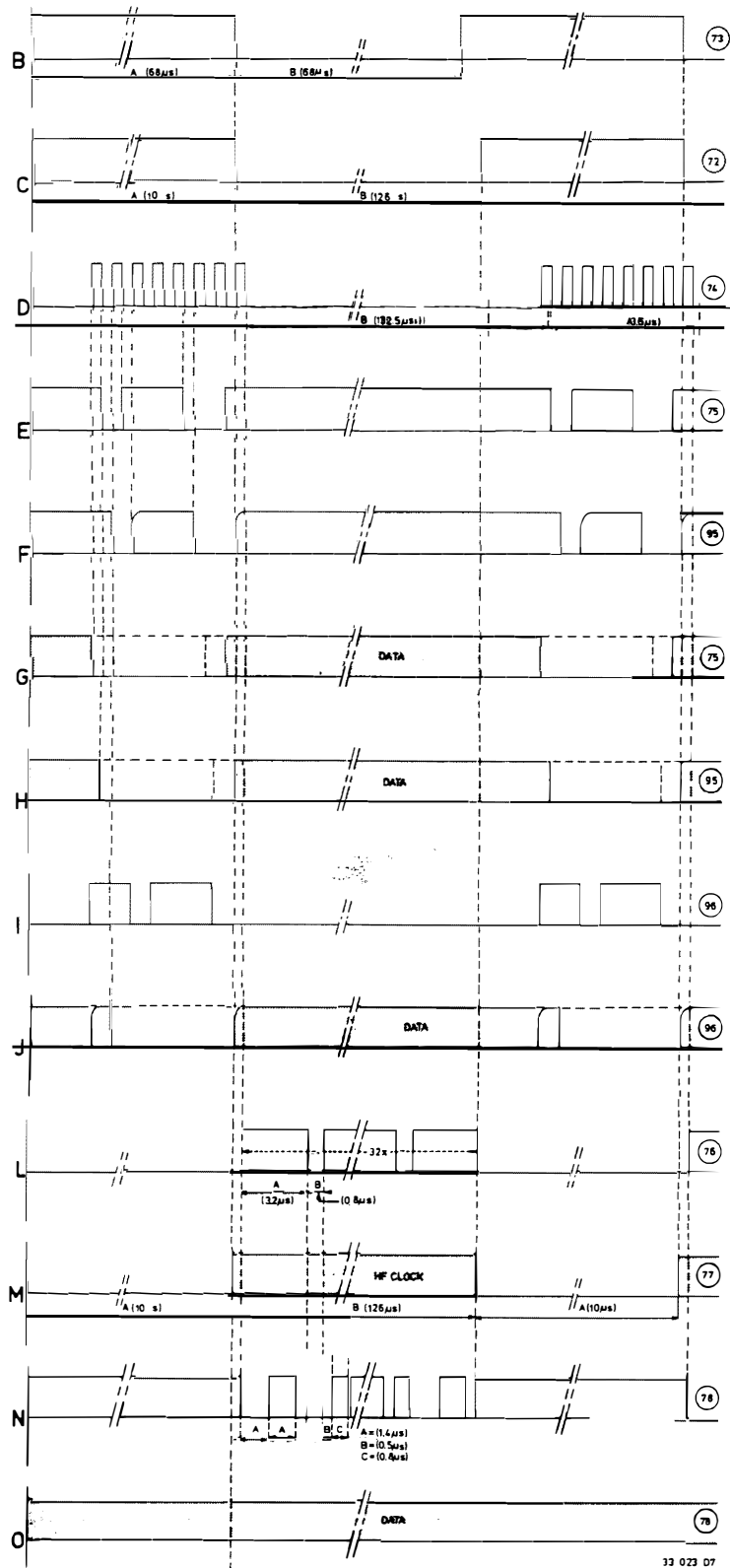
Fine adjustment of laser current

- Playback track 1 of test disc 4822 397 30096 (Disc without defects). Connect a DC voltmeter across resistor 3308 on the SERVO PCB circuit diagram D. Adjust the laser power supply with resistor 3180 until the voltage across resistor 3308 is $575 \text{ mV} \pm 50 \text{ mV}$.

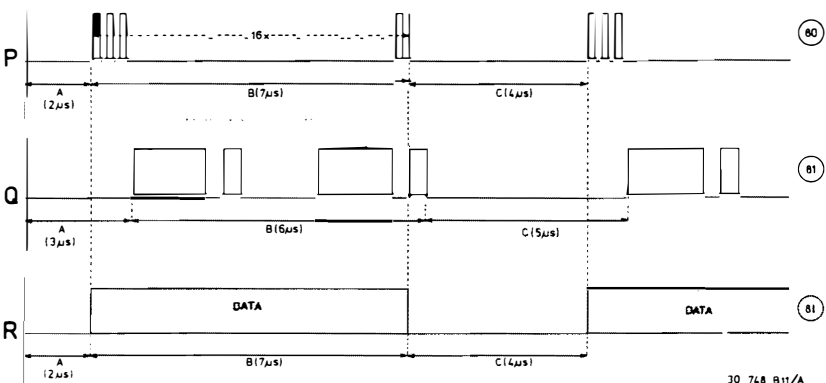
SERVO

Nr.	See	Position	Amplitude	f	Time base
1		see fault finding meth.			
2	P	see fault finding meth.	0.6 Vp-p	10 Hz	
3	P	see fault finding meth.	6 Vp-p	10 Hz	
4	P	see fault finding meth.	5 Vp-p	10 Hz	
5	B	see fault finding meth.	40-80 mV	25-60 Hz	
6	B	see fault finding meth.	40-80 mV	25-60 Hz	
7	B	see fault finding meth.	40-80 mV	25-60 Hz	
8	B	see fault finding meth.	40-80 mV	25-60 Hz	
9	C	see fault finding meth.	-2 V	25-60 Hz	
10	C	see fault finding meth.	-2 V	25-60 Hz	
11	C	see fault finding meth.	-2 V	25-60 Hz	
12	C	see fault finding meth.	-2 V	25-60 Hz	
13	D	see fault finding meth.	-8 V, +8 V	25-60 Hz	
14	D	see fault finding meth.	depends on R3158	25-60 Hz	
15		see fault finding meth.			
17	G	see fault finding meth.	5-0 V		A = 140 μ s
17	H	see fault finding meth.	0-5 V		A = 140 μ s
20		see fault finding meth.			
21	J	see fault finding meth.	12-14 Vp-p		
22	J	see fault finding meth.	0,7 Vp-p		
23	J	see fault finding meth.	0,7 Vp-P		
24	J	see fault finding meth.	0,2 Vp-p		
25	J	see fault finding meth.	0,25 Vp-p		
26	J	see fault finding meth.	20 mVp-p		
27	J	see fault finding meth.	800 mVp-p		
28	J	see fault finding meth.	800 mVp-p		
29	J	see fault finding meth.	6 Vp-p		
29	P	ON	0,3 Vp-p		
30		see fault finding meth.			
31		see fault finding meth.			
32	*	see fault finding meth.			
33	*	see fault finding meth.			
35	J	see fault finding meth.	200 mVp-p		
36	J	see fault finding meth.	2 Vp-p		
37	K	see fault finding meth.	10 Vp-p		
38	K	see fault finding meth.	10 Vp-p		
39	L	see fault finding meth.	0-4 Vp-p		A = 769 μ s B = 769 μ s
40	K	see fault finding meth.	9 Vp-p		A = 769 μ s B = 769 μ s
40	M	see fault finding meth.	0-4 Vp-p		A = 769 μ s B = 769 μ s
41	N	see fault finding meth.	6 Vp-p		A = 769 μ s B = 769 μ s
45	P	ON	9 Vp-p	650 Hz	
46	Q	ON	0-5 V	650 Hz	A = 769 μ s B = 769 μ s
47	P	ON	1,5 Vp-p	650 Hz	
48	P	ON	1 Vp-p	650 Hz	
49	R	ON	0-5 V	650 Hz	
50	S	ON	0-5 V	650 Hz	
51	T	ON	5-0 V	650 Hz	
51	U	service loop B	5 V	650 Hz	
52		see fault finding meth.			
55	Y	service loop A	5-0 V		
55	W	play (with test disc)	5-0 V		
56	W	play (with test disc)	5-0 V		
57		see fault finding meth.			
60	X	service loop A	5-3 V		
61	Y	service loop A	5-0 V		
62	Y	service loop A	5-0 V		
65	A	play	1 Vp-p		
66	F	see fault finding meth.	0,25-2,5 V		A = 140 μ s
66	G	see fault finding meth.	5-0 V		A = 140 μ s
66	H	see fault finding meth.	0-5 V		A = 140 μ s
67	J	see fault finding meth.			

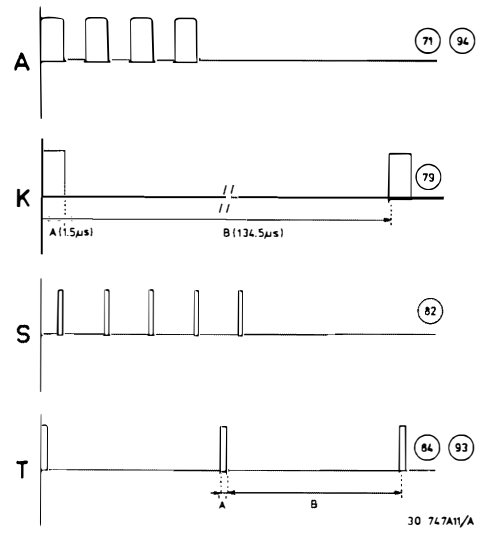
DECODING



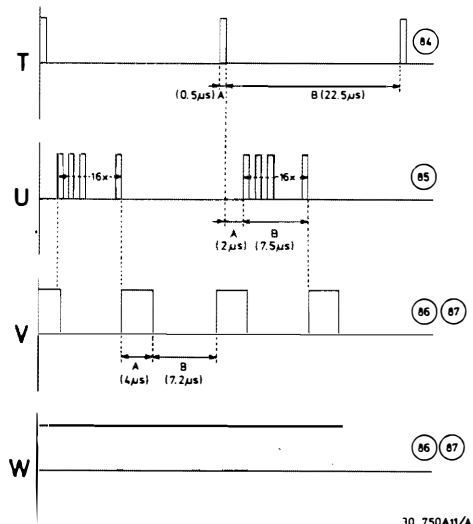
33 023 D7



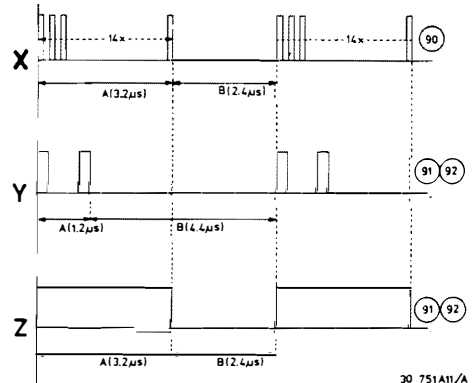
30 748 B11/A



30 747A11/A



30 750A11/A



30 751A11/A

Remark:

It is recommended to use the laser simulator for any measurement in the laser supply, since incidental short-circuits with the test pin can have inconvenient consequences for the laser.

Annex II: CHECKING LOCKING- IN OF PLL CIRCUIT
(Test points on decoding PCB)

First the free-running oscillator should be checked as follows:

- Switch power on, player in pos. play.
- Connect a frequency counter between pin 22 of IC6501 (DEM0D) and $\perp$.
- This frequency should be $4.350 \text{ MHz} \pm 30 \text{ kHz}$.

Attention

This adjustment should be performed immediately after the unit is switched on.

Checking locking-in:

- Insert disc, disconnect plug 14, inject $2.5 V_{dc}$ to the socket of plug 14 on pre-amp PCB and set player in service loop B.
- Variation of the DC round $2.5 V$ should be visible on the oscilloscope (point $\diamond 71$) in the form of a frequency variation. This means that the PLL is locking in.

Annex III: CHECKING d-FACTOR
(Test points on servo PCB)

- Switch off AGC circuit (k-multiplier) and switch off offset circuit (d-multiplier). See sub G and H.

Place disc on turntable and set player in service loop A.

- Check points $\diamond 22$ and $\diamond 23$.
Value should be $0.7 V_{pp}$.
Frequency variation strongly depends on the eccentricity of the disc.
- Check point $\diamond 25$.
Value should be 250 mV_{pp} .
- Check point $\diamond 35$.
Value should be 200 mV_{pp} .
- Check point $\diamond 36$.
Value should be $2 V_{pp}$.
- Check points $\diamond 37$ and $\diamond 38$.
Value should be $10 V_{pp}$.
The signal is more sine-shaped now due to filtering out of 650 Hz .
- Point $\diamond 39$ is hard to measure since switch is in position Y_{oc} and thus connected with input of op-amp 6215. However, a signal of 200 mV_{pp} is present.
- Check point $\diamond 40$.
Value should be $9 V_{pp}$.

Bring the player in service loop B. With a disc on turntable and the AGC and offset-circuits are still switched off.

- Check point $\diamond 41$.
- Check point $\diamond 40$ on beam A of oscilloscope and check point $\diamond 39$ on beam B of oscilloscope while oscilloscope is triggered with point $\diamond 41$.
- Switch on the AGC-circuit and the offset circuit.

Annex IV: CHECKING k-FACTOR
(Test points on Servo PCB)

a. Static

Switch power on **without** depressing the Play button. I.e. $RC0 = \text{high}$; $RC0 = \text{low}$ so switch Y_a is in position 0 and switch Y_c is in position 0.

- Check point $\diamond 45$.
Value should be $9 V_{pp}$.
- Check point $\diamond 46$.
- On point $\diamond 29$ now appears a sine-wave signal of 650 Hz , 300 mV , and $180 - 45 = 135^\circ$ shifted in phase relative to signal on point $\diamond 45$.
- Check point $\diamond 47$.
Value should be $1.5 V_{pp}$.
- Check point $\diamond 48$.
Value should be $1 V_{pp}$.
- Check points $\diamond 49$, $\diamond 50$, $\diamond 51$ and $\diamond 46$ relative to each other.
Amplitudes are $5V$.
- Check integrator IC 6212A.

b. Dynamic

Insert disc, select service loop A and check if the signal on point $\diamond 21$ equals to $7 V_{pp}$.

- Select service loop B.
Now $RC0 = \text{high}$ and $RC0 = \text{low}$.
So switch Y_a is in position 1.
Switch Y_c switches at $f = 650 \text{ Hz}$.
Point $\diamond 52$ is low; so point $\diamond 51$ is in phase point $\diamond 50$.
Now Fig. U should be present on point $\diamond 51$ with duty cycle jittering round 50% .

Annex V: CHECKING RF PRE-AMPLIFIER
(measure points on pre-amp. PCB)

- a. Check DC-voltages on transistors 6103, 6104, 6105, 6109, 6110, 6111.
- b. For checking sensitivity, frequency and delay characteristic, proceed as follows:
 - Take flex PCBs of sockets 10 and 11.
 - Take plugs 18, 17, 12, 13, 14 and 15 out of sockets.

Attention: do not take of plug 16 (= supply!).

- Unscrew PCB to enable injection at the copper side of the PCB.

Checking sensitivity

- Inject $V_{in} = 140 \text{ mV}_{eff}$, 50 kHz on points 102, 101 via $R = 100 \text{ k}\Omega$ and $C = 39 \text{ pF}$ (see Fig. A).
- V_{out} has to be $245 \text{ mV} \pm 2 \text{ dB}$.

Note:

Ensure that injection cord and test cord are identical.

Checking frequency and delay characteristic

- Adjust V_{in} in such a way that $V_{out} = 245\text{ mV} = 0\text{ dB}$ at 50 kHz.
- Between the injected and the measured sine-wave signal the delay should be $450\text{ ns} \pm 50\text{ ns}$ at 300 kHz. This can be measured on the dual beams oscilloscope with V_{in} on beam A and V_{out} on beam B according to Figure B.
- Check frequency and delay characteristic for frequencies given below:

Frequency (kHz)	V_{out} (dB)	Delay (n sec.)	Delay, compared with delay at 300 kHz
1	-15 ± 3	450 ± 50	-50 ± 20
6,3	-2 ± 1		
16	$-0,5 \pm 1$		
50	0		
100	0 ± 1		
200	$+1 \pm 1$		
300	$+1,5 \pm 1$		
500	$+3,5 \pm 1$		
700	$+5,5 \pm 2$		
1000	$+8 \pm 2$		
1600	$+8 \pm 2$		
2000	$+4,5 \pm 3$		

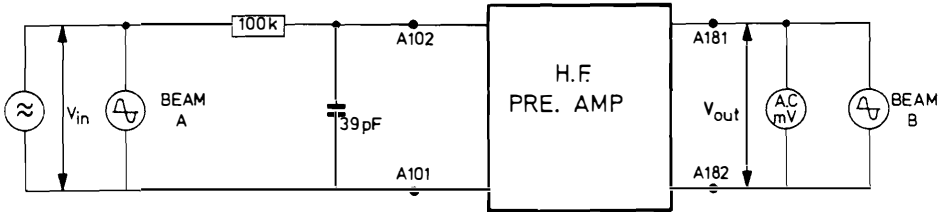


Fig. A

33 393A12

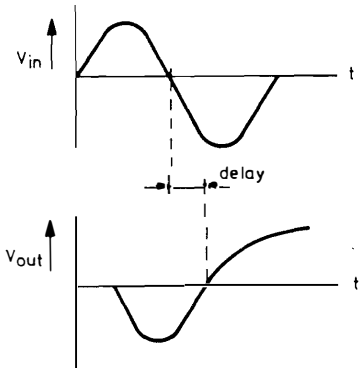
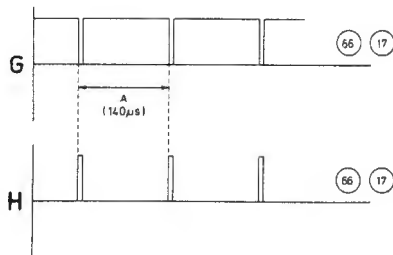
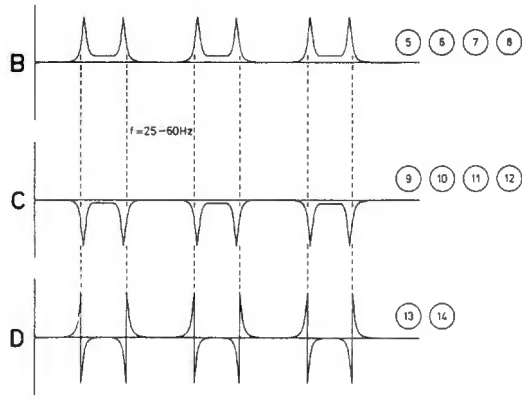


Fig. B

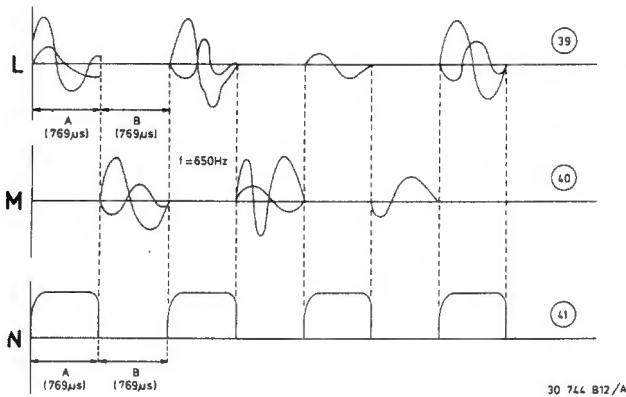
33 394A12

SERVO

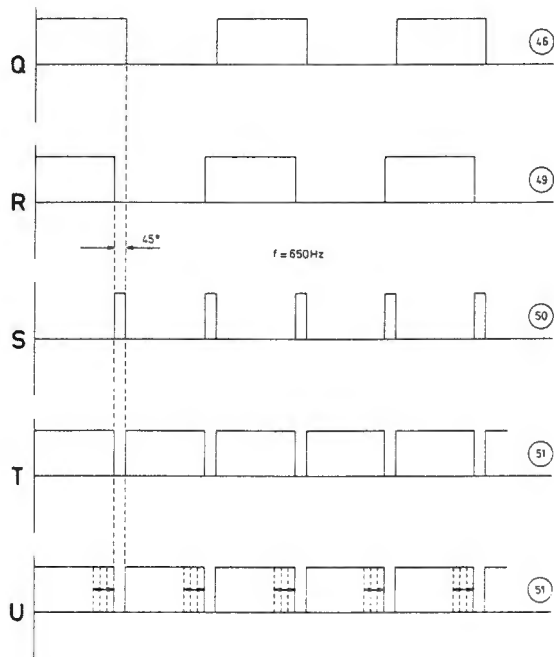
7-7
1984-07-02



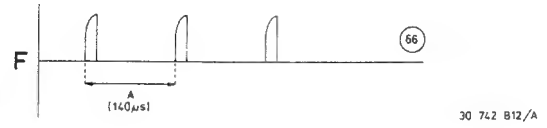
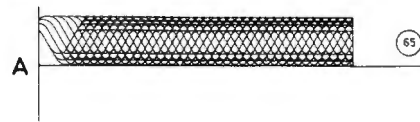
30 743 B12/A



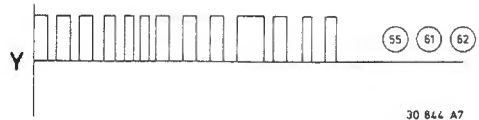
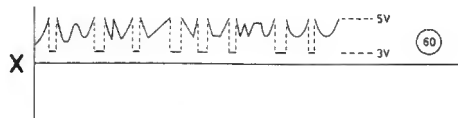
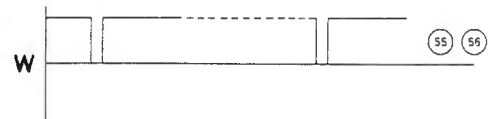
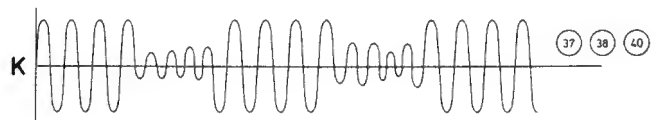
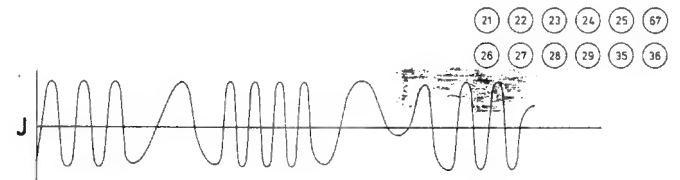
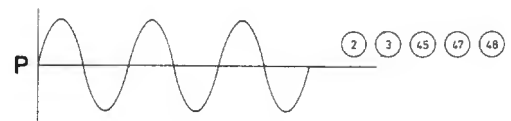
30 744 B12/A



30 745 B12/A



30 742 B12/A



30 844 A7

8 CHANGES

SHEET CHANGES

Introduced with A84-143 of 1984-11-15

Description		Reason
Front sheet		CD104/07/30 added, reference to CDM documentations changed
Table of contents	1-2-a	Table of contents adapted
Technical specification	2-2-a	Specification de-emphasis adapted
Servicing hints	3-1-a	Text adapted
Servicing hints	3-2-a	Text adapted
Mechanical measurements and adjustments	4-1-a	Text adapted
Electrical measurements and adjustments	4-2-a	Text adapted
Exploded view "Tray" and parts list	5-1-a	Drawing + parts lists adapted
Exploded view "cabinet"	5-2-a	Drawing adapted
Block diagram	6-1-a	Drawing adapted
Power supply circuit diagram	6-2-a	Drawing adapted + transformer connection diagram added
PCB drawings	6-3-a	Drawing + parts list adapted
Power supply and mains filter		
Control + display diagram	6-4-a	Diagram adapted to stage of production
Control + display	6-5-a	Drawing + parts list adapted to stage of production
PCBs + parts list		
Servo diagram part 1	6-9-1	Diagram adapted to stage of production
PCB drawing servo	6-9-2	Drawing + parts list adapted to stage of production
PCB drawing servo	6-9-3	Drawing + parts list adapted to stage of production
Servo diagram part 2	6-9-4	Diagram adapted to stage of production
Wiring	6-15-1	Wiring adapted to production
Fault finding method	7-1-a	Text adapted
Fault finding method	7-2-a	Text adapted
Fault finding method	7-3-a	Text adapted
Fault finding method	7-4-a	Text adapted
Fault finding method	7-5-a	Text adapted
Fault finding method	7-8-a	Text adapted

8-2
1984-11-15

COMPONENT CHANGES

Introduced with A84-143 of 1984-11-15

Sheet 5-1 Exploded view "Tray"

See added change sheet 5-1-a

Change:
Spring item number 111 deleted

Reason:
Spring has no function

"Tray" parts list

Change:
Item number 111 deleted

"Cabinet" parts list

Addition:
Components for CD104/07/30 added

Sheet 5-2 Exploded view "cabinet"

See added change sheet 5-2-a

Addition:
Lens item number 205

Reason:
Improve visibility of display

Sheet 6-2 Power supply circuit diagram

See added change sheet 6-2-a

Deleted:
Diode 6468

Reason:
Diode appeared superfluous after safety tests

Sheet 6-3 Power supply PCBs and parts list

See added change sheet 6-3-a

Change:
Diode 6468 deleted and replaced by interconnection

Correction to parts list:
Diode type 1N002G should be 1N4002G
Code number 5322 130 30684 is correct

Sheet 6-4 Control and display diagram

See added addition sheet 6-5-1

Addition:
1051 quartz crystal 6 MHz
2051, 2052 tubular ceramic capacitor 27 pF
3051 resistor 1 M Ω - SFR25
3068 resistor 10 k Ω - SFR25

Reason:
With the introduction of servo microprocessor MAB8440/D041 the display microprocessor gets its own crystal oscillator which takes care of the timing (previous version servo μ P MAB8440/D034). As a result the screened wire to the servo μ P pin 16 will be deleted.

Correction:
2055 tubular ceramic capacitor 22 nF should be 2,2 nF

Remark:
The control and display PCB with these changes has been marked by a round yellow sticker "C"

CS 99 134 GB

Sheet 6-5 Control and display PCBs and parts list

See added addition sheet 6-5-2

Addition to PCB drawings:
1051 quartz crystal 6 MHz
2051, 2052 tubular ceramic capacitors 27 pF
3051 resistor 1 M Ω - SFR25
3068 resistor 10 k Ω - SFR25

Addition to parts list:
IC base 28P 4822 255 40156
1051 quartz crystal 6MHz 4822 242 70392

Remark:
The control and display PCB with these changes has been marked by a round yellow "C" and following

Sheet 6-6 "Servo 1" circuit diagram

See added addition sheet 6-9-1

Change:
2228 will be 1 μ F - 25V solid aluminium capacitor (was 100 nF -63V polyester capacitor)

Reason:
Improvement of the lock-in behaviour through delay in the motion of the focus motor

3203 will be 360 k Ω chip resistor (was 330 k Ω)

Reason:
To improve locking-in

3256 and 3273 will be safety resistors of 4,7 Ω (was 4,7 Ω - SFR25)

Reason:
Improve safety
6201 servo μ P will be MAB8440/D041 was MAB8440/D034

Reason:
Changed programme in view of motor brake circuit

6248 will be diode BAW62 was BAT85

Reason:
Introduction of motor brake circuit

Deleted:
3212 - 3906 - 6237

Reason:
Introduction of motor brake circuit renders these components superfluous

The screened wire from pin 16 of the servo μ P to display μ P pin 15 has also been deleted with the introduction of servo μ P MAB8440/D041

Reason:
Display μ P MAB8410/B017 has its own crystal clock

Addition:
3906 - 3924 - 3925 chip jumper 0 Ω

Reason:
Added in view of adaptation conductor pattern

Correction:
2217 will be solid aluminium capacitor 6,8 μ F - 10V (was electrolytic capacitor 6,8 μ F - 16V)
3264 0E deleted
3241 18 k Ω - SFR25 will be 3230 18 k Ω - SFR25 (correction name)
5501 will be 5201 (name 5501 was double)
6259 will be BAW62 (type designation added)

Remark:
The servo PCB with these changes has been marked by a round yellow sticker "B"

Sheet 6-7 Servo PCB and parts list

See added addition sheet 6-9-2

Change:

Focus delay PCB has been integrated on servo PCBs
Connector 29 added thus adapting the conductor pattern

Correction:

5501, 5502, 5503 will be 5201, 5202 and 5203 (names 5501, 5502 and 5503 were double)

Remark:

The servo PCB with these changes has been marked by a round yellow sticker "B"

Additions to parts list:

MAB8440/D041 servo μ P	4822 209 10916
2217 6,8 μ F - 16V	4822 124 21538
2228 1 μ F - 25V	4822 124 21457
3256, 3273 fuse res. 4,7 Ω	4822 111 50483

Deleted on parts list:

BAT85	4822 130 31983
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Change on parts list:

5501 will be 5201

Sheet 6-8 Servo PCB and parts list

See added addition sheet 6-9-3

Change:

See changes of sheet 6-7

Additions on parts list:

1E5 Chip resistor	4822 111 90381
-------------------	----------------

Change on parts list:

5502, 5503 will be 5202, 5203

Sheet 6-9 "Servo 2" circuit diagram

See added addition sheet 6-9-4

Change:

3387 will be 1,5 Ω chip resistor (was 2,2 Ω)

Reason:

Adaptation as a result of material change for magnets for CDM

Change:

5502, 5503 will be 5202, 5205

Reason:

Correction of double name

Sheet 6-10 "Decoding 1" circuit diagram

As a result of the replacement of coil 5502 by an interconnection all +2a power supply voltage are changed in +2

Sheet 6-11 Decoder on PCB and parts list

Remark:

On the decoder PCB a connector may be present under the AF connection points. This has been done to render the decoder PCB of CD104 also suitable for CD304. The connector in CD304 serves for connection of the headphone PCB.

Deleted on PCB and parts list:

5501 4822 156 21155 (an interconnection will be applied to PCB)

Sheet 6-12 Decoder PCB and parts list

See remark on sheet 6-11

Correction:

Test point 64 on connector 33-3 should be test point 65

Sheet 6-13 "Decoding 2" circuit diagram

Deleted:

Coil 5502 is replaced by an interconnection
All +2a power supply voltages changed in +2 power supply voltage

Sheet 6-14 "Tray control" circuit diagram

See added addition sheet 6-14-1

Change:

6802, 6803 and 6805 will be BC548B (were BC547B)
6804, 6806 will be BC558B (were BC557B)

Reason:

In production BC548B and BC558B are used

3814 will be 12E - NFR25 (was 5E6 - NFR25)

3816 will be 5E6 - NFR25 (was 12E - NFR25)

Reason:

Resistance values of 3814 and 3816 interchanged

Deleted:

2801

Reason:

In servo μ P MAB8440/D041 the delay of SL1 has been provided for in the software.
The delay on the tray PCB will be superfluous then and can be switched off by removing 2801, thus making it possible to use up the stock.
PCBs with this change are marked by a round yellow sticker "A".

Tray control" PCBs

See added addition sheet 6-14-1

Deleted:

2801

Reason:

See sub "circuit diagram"

"Tray control" parts list

Change:

BC547B	will be BC548B	4822 130 44196
BC557B	will be BC558B	4822 130 44197
3814	will be 12E-NFR25	4822 111 30511 (was 5E6)
3816	will be 5E6-NFR25	4822 111 30502 (was 12E)

Sheet 6-15 Wiring

See added addition sheet 6-15-1

Wiring adapted to stage of production

Nr.	See	Position	Amplitude	f	Time base
71	A	play	0-5 V	4,35 MHz	A = 10* μ s B = 126 μ s A = 68 μ s B = 68 μ s A = 3,5 μ s B = 132,5 μ s A = 3,5 μ s B = 132,5 μ s
72	C	stop/play	0-5 V	7,35 kHz	
73	B	stop/play*	0-5 V		
74	D	stop/play	5-0 V	DATA	
75	E	stop	5-0 V		
75	G	play	0-5 V		
76	L	stop/play	0-5 V	DATA	A = 3,2 μ s B = 0,8 μ s A = 10 μ s B = 126 μ s A = 1,4 μ s B = 0,5 μ s C = 0,8 μ s
77	M	stop/play	0-5 V		
78	N	stop	0-5 V		
78	O	play	5 V	DATA	
79	K	stop/play	0-5 V		A = 1,5 μ s B = 134,5 μ s
80	P	stop/play	0-5 V		A = 2 μ s B = 7 μ s C = 4 μ s
81	Q	stop/play	0-5 V	DC	A = 3 μ s B = 6 μ s C = 5 μ s
81	R	play	0-5 V		A = 2 μ s B = 7 μ s C = 4 μ s
82		stop	5 V		
82	S	play with Drop-out test record	0-5 V	DC	
84	T	stop/play	0-5 V		A = 0,5 μ s B = 22,5 μ s
85	U	stop/play	0-5 V		A = 2 μ s B = 7,5 μ s
86	V	stop	0-5 V	DATA	A = 4 μ s B = 7,2 μ s
86	W	play	0-5 V		DATA
87	V	stop	5 V		A = 4 μ s B = 7,2 μ s
87	W	play	5 V	DATA	DATA
90	X	stop/play	0-5 V		A = 3,2 μ s B = 2,4 μ s
91	Y	stop	0-5 V		A = 1,2 μ s B = 4,4 μ s
91	Z	play	0-5 V	4,23 MHz	A = 3,2 μ s B = 2,4 μ s
92	Y	stop	0-5 V		A = 1,2 μ s B = 4,4 μ s
92	Z	play	0-5 V		A = 3,2 μ s B = 2,4 μ s
93	T	stop/play	0-5 V	4,23 MHz	A = 0,4 μ s B = 5,5 μ s
94	A	stop/play	0-5 V		
95	F	stop	5-0 V		
95	H	play	5-0 V	4,23 MHz	
96	I	stop	0-5 V		
96	J	play	5-0 V		

* In pos. stop, signal is only present **after** the set was brought in play mode.

Information

Les pages ci-dessous ont été modifiées/ajoutées afin d'actualiser le manuel de service en fonction de l'état actuel de la production.

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