

# SCHEMATIC OF THE HEATHKIT® TIME-VOLTAGE MODULE MODEL IOA-4200

NOTES:


1. REFER TO THE CIRCUIT BOARD X-RAY VIEWS FOR THE PHYSICAL LOCATION OF PARTS.
2. REFER TO THE COMPONENT IDENTIFICATION SECTION FOR THE TOLERANCE AND RATING OF COMPONENTS SHOWN ON THE SCHEMATIC.
3. ALL CAPACITOR VALUES ARE IN  $\mu\text{F}$  UNLESS OTHERWISE INDICATED.
4. ALL RESISTORS ARE 1/4-WATT, 5% UNLESS OTHERWISE SPECIFIED. ALL RESISTOR VALUES ARE IN OHMS ( $k=1000$ ,  $M=1,000,000$ ).
5. ALL SWITCHES ARE SHOWN IN THE "OUT" POSITION.

6. ALL GROUND SYMBOLS, POWER SUPPLY CONNECTIONS, CONTROL SIGNALS, ETC. WITH A DASHED OUTLINE ARE REFERENCED TO THE "A/D GND" CONNECTOR. ALL OTHER GROUND SYMBOLS ETC. ARE REFERENCED TO THE "CHASSIS GND" CONNECTOR.


7.  INDICATES POWER GROUND.

8.  INDICATES LOW-NOISE GROUND. 

9.  INDICATES A WIRE CONNECTION TO THE CIRCUIT BOARD.

10.  INDICATES A WIRE CONNECTION BETWEEN CIRCUIT BOARDS.


11.  INDICATES A TEST POINT OR TEST CONNECTOR.

12.  INDICATES A CIRCUIT BOARD FOIL SOLDER PAD.

13.  INDICATES PART OF CALIBRATION ASSEMBLY (100-1807).

14.  WITH A NUMBER, INDICATES A SWITCH OR COMPONENT LUG CONNECTION.

15.  WITH A LETTER, INDICATES A TEST POINT LOCATION FOR "INITIAL TESTS".

16.  INDICATES A WAVEFORM LOCATION. REFER TO THE "WAVEFORMS" SECTION OF THE MANUAL.

17. CIRCUIT COMPONENT NUMBERS ARE IN THE FOLLOWING GROUPS:
  - 1000-1099 PARTS ON THE MODULE MAIN BOARD IN CIRCUITRY REFERENCED TO THE "CHASSIS GND" CONNECTOR.
  - 1100-1199 PARTS ON THE MODULE MAIN BOARD IN CIRCUITRY REFERENCED TO THE "A/D GND" CONNECTOR.
  - 1200-1299 PARTS ON THE MODULE DISPLAY BOARD.


18.  INDICATES VOLTAGE FOR ANY CONTROL SETTING WITH THE "OFF" SWITCH PUSHED IN.

19.  INDICATES A VOLTAGE DEPENDENT ON THE DTP CONTROL SETTING WITH "T" FUNCTION SELECTED AND  $\Delta$  DELAY CONTROL AT CCW.

20.  INDICATES A VOLTAGE DEPENDENT ON THE  $\Delta$  DELAY CONTROL SETTING WITH "T" FUNCTION SELECTED AND DTP CONTROL AT CCW.

21.  INDICATES A VOLTAGE FOR ANY CONTROL SETTING WITH "T" SWITCH PUSHED IN.


22.  INDICATES AN APPROXIMATE VOLTAGE DEPENDENT ON THE A TIMEBASE SWITCH SETTING.

23.  VOLTAGE IS +5.5 VDC WITH TRACKING SWITCH PUSHED IN.

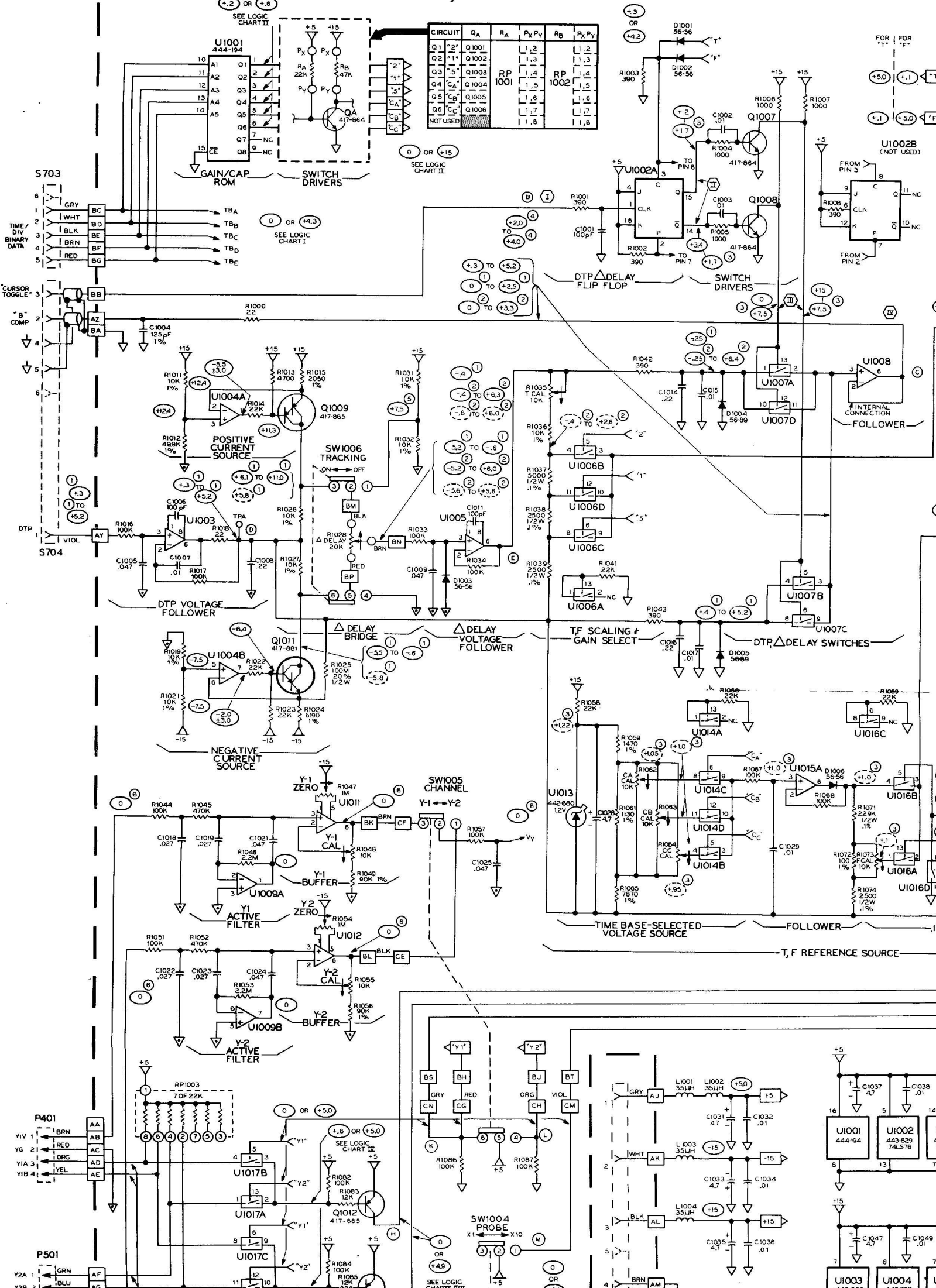
24.  INDICATES A VOLTAGE DEPENDENT ON THE Y1 (OR Y2) INPUT VOLTAGE. VOLTAGES SHOWN ARE FOR Y1 (OR Y2) INPUT SWITCH SET TO "GND" POSITION.

25.  INDICATES A VOLTAGE DEPENDENT ON THE A/D (U1103) INPUT VOLTAGE.

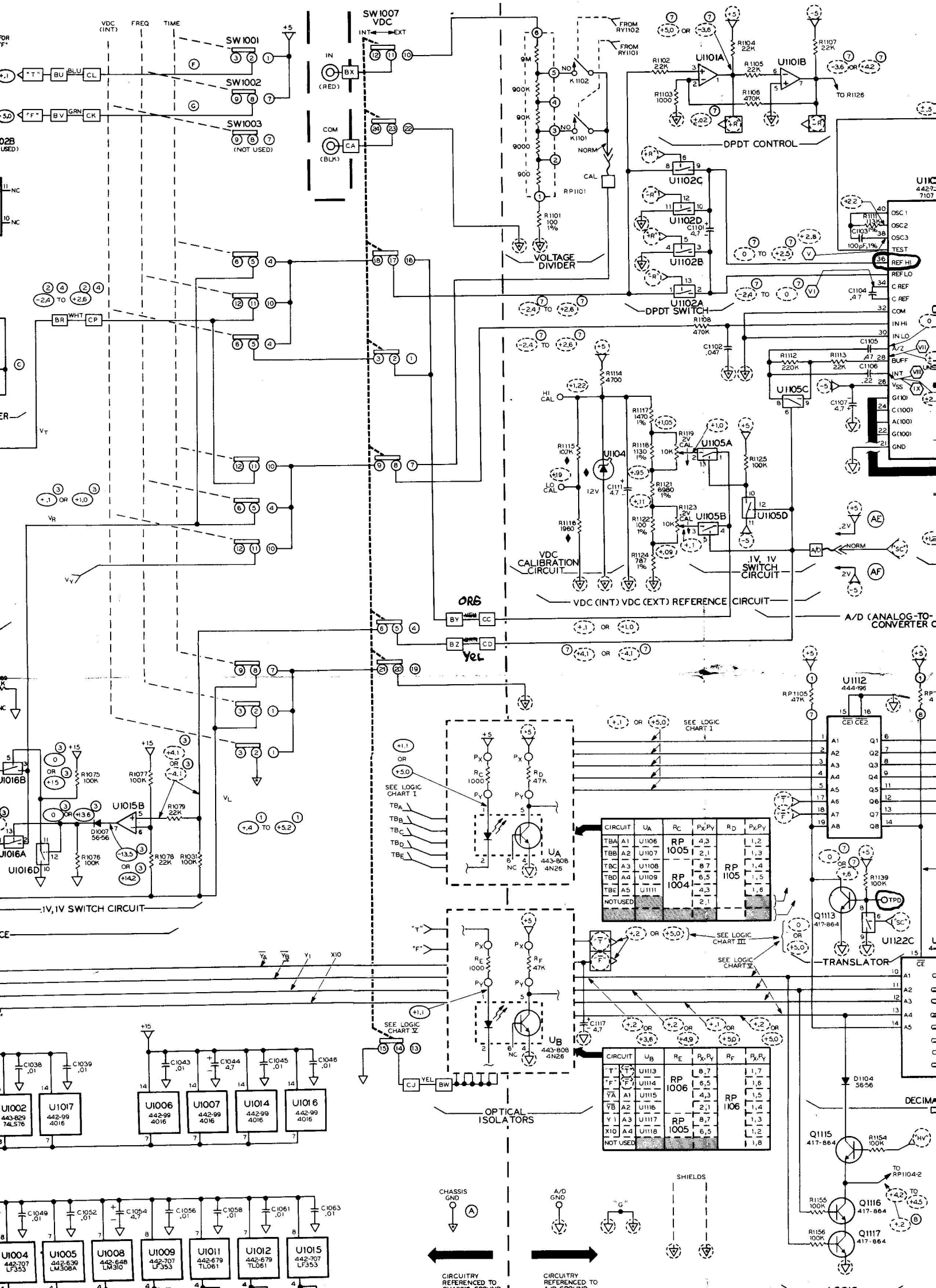
26.  INDICATES A VOLTAGE FOR "ON" OR "OFF" DISPLAY SEGMENTS.

27.  VOLTAGE WHEN "ENABLED" FOR EXT VDC FUNCTION RANGE GROUPS: I. E., 2/20 OR 200/2000.

NOTE: ALL VOLTAGES WERE MEASURED AT NOMINAL (120VAC) LINE VOLTAGE WITH A 10M $\Omega$  (OR HIGHER) INPUT IMPEDANCE DC VOLT METER. VOLTAGES ARE MEASURED WITH RESPECT TO THE APPROPRIATE GROUND CIRCUIT (SEE NOTE 6). VOLTAGES MAY VARY  $\pm 10\%$  EXCEPT AS SHOWN.



CIRCUIT		Q <sub>A</sub>	R <sub>A</sub>	P <sub>A</sub> , P <sub>B</sub> , P <sub>Y</sub>	R <sub>B</sub>	P <sub>X</sub> , P <sub>Y</sub>
Q1	"2"	Q1001	1.2	1.2	1.2	
Q2	"1"	Q1002	1.3	1.3	1.3	
Q3	"5"	Q1003	1.4	1.4	1.4	
Q4	"A"	Q1004	1.5	1.5	1.5	
Q5	"C"	Q1005	1.6	1.6	1.6	
Q6	"C"	Q1006	1.7	1.7	1.7	
Q7	"C"	Q1007	1.8	1.8	1.8	
Q8	"C"	Q1008	1.9	1.9	1.9	
Q9	"C"	Q1009	2.0	2.0	2.0	
Q10	"C"	Q1010	2.1	2.1	2.1	
Q11	"C"	Q1011	2.2	2.2	2.2	
Q12	"C"	Q1012	2.3	2.3	2.3	
Q13	"C"	Q1013	2.4	2.4	2.4	
Q14	"C"	Q1014	2.5	2.5	2.5	
Q15	"C"	Q1015	2.6	2.6	2.6	
Q16	"C"	Q1016	2.7	2.7	2.7	
Q17	"C"	Q1017	2.8	2.8	2.8	
Q18	"C"	Q1018	2.9	2.9	2.9	
Q19	"C"	Q1019	3.0	3.0	3.0	
Q20	"C"	Q1020	3.1	3.1	3.1	
Q21	"C"	Q1021	3.2	3.2	3.2	
Q22	"C"	Q1022	3.3	3.3	3.3	
Q23	"C"	Q1023	3.4	3.4	3.4	
Q24	"C"	Q1024	3.5	3.5	3.5	
Q25	"C"	Q1025	3.6	3.6	3.6	
Q26	"C"	Q1026	3.7	3.7	3.7	
Q27	"C"	Q1027	3.8	3.8	3.8	
Q28	"C"	Q1028	3.9	3.9	3.9	
Q29	"C"	Q1029	4.0	4.0	4.0	
Q30	"C"	Q1030	4.1	4.1	4.1	
Q31	"C"	Q1031	4.2	4.2	4.2	
Q32	"C"	Q1032	4.3	4.3	4.3	
Q33	"C"	Q1033	4.4	4.4	4.4	
Q34	"C"	Q1034	4.5	4.5	4.5	
Q35	"C"	Q1035	4.6	4.6	4.6	
Q36	"C"	Q1036	4.7	4.7	4.7	
Q37	"C"	Q1037	4.8	4.8	4.8	
Q38	"C"	Q1038	4.9	4.9	4.9	
Q39	"C"	Q1039	5.0	5.0	5.0	
Q40	"C"	Q1040	5.1	5.1	5.1	
Q41	"C"	Q1041	5.2	5.2	5.2	
Q42	"C"	Q1042	5.3	5.3	5.3	
Q43	"C"	Q1043	5.4	5.4	5.4	
Q44	"C"	Q1044	5.5	5.5	5.5	
Q45	"C"	Q1045	5.6	5.6	5.6	
Q46	"C"	Q1046	5.7	5.7	5.7	
Q47	"C"	Q1047	5.8	5.8	5.8	
Q48	"C"	Q1048	5.9	5.9	5.9	
Q49	"C"	Q1049	6.0	6.0	6.0	
Q50	"C"	Q1050	6.1	6.1	6.1	
Q51	"C"	Q1051	6.2	6.2	6.2	
Q52	"C"	Q1052	6.3	6.3	6.3	
Q53	"C"	Q1053	6.4	6.4	6.4	
Q54	"C"	Q1054	6.5	6.5	6.5	
Q55	"C"	Q1055	6.6	6.6	6.6	
Q56	"C"	Q1056	6.7	6.7	6.7	
Q57	"C"	Q1057	6.8	6.8	6.8	
Q58	"C"	Q1058	6.9	6.9	6.9	
Q59	"C"	Q1059	7.0	7.0	7.0	
Q60	"C"	Q1060	7.1	7.1	7.1	
Q61	"C"	Q1061	7.2	7.2	7.2	
Q62	"C"	Q1062	7.3	7.3	7.3	
Q63	"C"	Q1063	7.4	7.4	7.4	
Q64	"C"	Q1064	7.5	7.5	7.5	
Q65	"C"	Q1065	7.6	7.6	7.6	
Q66	"C"	Q1066	7.7	7.7	7.7	
Q67	"C"	Q1067	7.8	7.8	7.8	
Q68	"C"	Q1068	7.9	7.9	7.9	
Q69	"C"	Q1069	8.0	8.0	8.0	
Q70	"C"	Q1070	8.1	8.1	8.1	
Q71	"C"	Q1071	8.2	8.2	8.2	
Q72	"C"	Q1072	8.3	8.3	8.3	
Q73	"C"	Q1073	8.4	8.4	8.4	
Q74	"C"	Q1074	8.5	8.5	8.5	
Q75	"C"	Q1075	8.6	8.6	8.6	
Q76	"C"	Q1076	8.7	8.7	8.7	
Q77	"C"	Q1077	8.8	8.8	8.8	
Q78	"C"	Q1078	8.9	8.9	8.9	
Q79	"C"	Q1079	9.0	9.0	9.0	
Q80	"C"	Q1080	9.1	9.1	9.1	
Q81	"C"	Q1081	9.2	9.2	9.2	
Q82	"C"	Q1082	9.3	9.3	9.3	
Q83	"C"	Q1083	9.4	9.4	9.4	
Q84	"C"	Q1084	9.5	9.5	9.5	
Q85	"C"	Q1085	9.6	9.6	9.6	
Q86	"C"	Q1086	9.7	9.7	9.7	
Q87	"C"	Q1087	9.8	9.8	9.8	
Q88	"C"	Q1088	9.9	9.9	9.9	
Q89	"C"	Q1089	10.0	10.0	10.0	
Q90	"C"	Q1090	10.1	10.1	10.1	
Q91	"C"	Q1091	10.2	10.2	10.2	
Q92	"C"	Q1092	10.3	10.3	10.3	
Q93	"C"	Q1093	10.4	10.4	10.4	
Q94	"C"	Q1094	10.5	10.5	10.5	
Q95	"C"	Q1095	10.6	10.6	10.6	
Q96	"C"	Q1096	10.7	10.7	10.7	
Q97	"C"	Q1097	10.8	10.8	10.8	
Q98	"C"	Q1098	10.9	10.9	10.9	
Q99	"C"	Q1099	11.0	11.0	11.0	
Q100	"C"	Q1100	11.1	11.1	11.1	
Q101	"C"	Q1101	11.2	11.2	11.2	
Q102	"C"	Q1102	11.3	11.3	11.3	
Q103	"C"	Q1103	11.4	11.4	11.4	
Q104	"C"	Q1104	11.5	11.5	11.5	
Q105	"C"	Q1105	11.6	11.6	11.6	
Q106	"C"	Q1106	11.7	11.7	11.7	
Q107	"C"	Q1107	11.8	11.8	11.8	
Q108	"C"	Q1108	11.9	11.9	11.9	
Q109	"C"	Q1109	12.0	12.0	12.0	
Q110	"C"	Q1110	12.1	12.1	12.1	
Q111	"C"	Q1111	12.2	12.2	12.2	
Q112	"C"	Q1112	12.3	12.3	12.3	
Q113	"C"	Q1113	12.4	12.4	12.4	
Q114	"C"	Q1114	12.5	12.5	12.5	
Q115	"C"	Q1115	12.6	12.6	12.6	
Q116	"C"	Q1116	12.7	12.7	12.7	
Q117	"C"	Q1117	12.8	12.8	12.8	
Q118	"C"	Q1118	12.9	12.9	12.9	
Q119	"C"	Q1119	13.0	13.0	13.0	
Q120	"C"	Q1120	13.1	13.1	13.1	
Q121	"C"	Q1121	13.2	13.2	13.2	
Q122	"C"	Q1122	13.3	13.3	13.3	
Q123	"C"	Q1123	13.4	13.4	13.4	
Q124	"C"	Q1124	13.5	13.5	13.5	
Q125	"C"	Q1125	13.6	13.6	13.6	
Q126	"C"	Q1126	13.7	13.7	13.7	
Q127	"C"	Q1127	13.8	13.8	13.8	
Q128	"C"	Q1128	13.9	13.9	13.9	
Q129	"C"	Q1129	14.0	14.0	14.0	
Q130	"C"	Q1130	14.1	14.1	14.1	
Q131	"C"	Q1131	14.2	14.2	14.2	
Q132	"C"	Q1132	14.3	14.3	14.3	
Q133	"C"	Q1133	14.4	14.4	14.4	
Q134	"C"	Q1134	14.5	14.5	14.5	
Q135	"C"	Q1135	14.6	14.6	14.6	
Q136	"C"	Q1136	14.7	14.7	14.7	
Q137	"C"	Q1137	14.8	14.8	14.8	
Q138	"C"	Q1138	14.9	14.9	14.9	
Q139	"C"	Q1139	15.0	15.0	15.0	
Q140	"C"	Q1140	15.1	15.1	15.1	
Q141	"C"	Q1141	15.2	15.2	15.2	
Q142	"C"	Q1142	15.3	15.3	15.3	
Q143	"C"	Q1143	15.4	15.4	15.4	
Q144	"C"	Q1144	15.5	15.5	15.5	
Q145	"C"	Q1145	15.6	15.6	15.6	
Q146	"C"	Q1146	15.7	15.7	15.7	
Q147	"C"	Q1147	15.8	15.8	15.8	
Q148	"C"	Q1148	15.9	15.9	15.9	
Q149	"C"	Q1149	16.0	16.0	16.0	
Q150	"C"	Q1150	16.1	16.1	16.1	
Q151	"C"	Q1151	16.2	16.2	16.2	
Q152	"C"	Q1152	16.3	16.3	16.3	
Q153	"C"	Q1153	16.4	16.4	16.4	
Q154	"C"	Q1154	16.5	16.5	16.5	
Q155	"C"	Q1155	16.6	16.6	16.6	
Q156	"C"	Q1156	16.7	16.7	16.7	
Q157	"C"	Q1157	16.8	16.8	16.8	
Q158	"C"	Q1158	16.9	16.9	16.9	
Q159	"C"	Q1159	17.0	17.0	17.0	
Q160	"C"	Q1160	17.1	17.1	17.1	
Q161	"C"	Q1161	17.2	17.2	17.2	
Q162	"C"	Q1162	17.3	17.3	17.3	
Q163	"C"	Q1163	17.4	17.4	17.4	
Q164	"C"	Q1164	17.5	17.5	17.5	
Q165	"C"	Q1165	17.6	17.6	17.6	
Q166	"C"	Q1166	17.7	17.7	17.7	
Q167	"C"	Q1167	17.8	17.8	17.8	
Q168	"C"	Q1168	17.9	17.9	17.9	
Q169	"C"	Q1169	18.0	18.0	18.0	
Q170	"C"	Q1170	18.1	18.1	18.1	
Q171	"C"	Q1171	18.2	18.2	18.2	
Q172	"C"	Q1172	18.3	18.3	18.3	
Q173	"C"	Q1173	18.4	18.4	18.4	
Q174	"C"	Q1174	18.5	18.5	18.5	
Q175	"C"	Q1175				



VDC (INT) FREQ TIME

SW1001 SW1002 SW1003 (NOT USED)

IN (RED) COM (BLK)

TO R1102 TO R1101

TO R1107 TO R1126

TO R1104 TO R1105 TO R1106

TO R1103 TO R1104 TO R1105

TO R1106 TO R1107 TO R1108

TO R1109 TO R1110 TO R1111

TO R1112 TO R1113 TO R1114

TO R1115 TO R1116 TO R1117

TO R1118 TO R1119 TO R1120

TO R1121 TO R1122 TO R1123

TO R1124 TO R1125 TO R1126

TO R1127 TO R1128 TO R1129

TO R1130 TO R1131 TO R1132

TO R1133 TO R1134 TO R1135

TO R1136 TO R1137 TO R1138

TO R1139 TO R1140 TO R1141

TO R1142 TO R1143 TO R1144

TO R1145 TO R1146 TO R1147

TO R1148 TO R1149 TO R1150

TO R1151 TO R1152 TO R1153

TO R1154 TO R1155 TO R1156

TO R1157 TO R1158 TO R1159

TO R1160 TO R1161 TO R1162

TO R1163 TO R1164 TO R1165

TO R1166 TO R1167 TO R1168

TO R1169 TO R1170 TO R1171

TO R1172 TO R1173 TO R1174

TO R1175 TO R1176 TO R1177

TO R1178 TO R1179 TO R1180

TO R1181 TO R1182 TO R1183

TO R1184 TO R1185 TO R1186

TO R1187 TO R1188 TO R1189

TO R1190 TO R1191 TO R1192

TO R1193 TO R1194 TO R1195

TO R1196 TO R1197 TO R1198

TO R1199 TO R1200 TO R1201

TO R1202 TO R1203 TO R1204

TO R1205 TO R1206 TO R1207

TO R1208 TO R1209 TO R1210

TO R1211 TO R1212 TO R1213

TO R1214 TO R1215 TO R1216

TO R1217 TO R1218 TO R1219

TO R1220 TO R1221 TO R1222

TO R1223 TO R1224 TO R1225

TO R1226 TO R1227 TO R1228

TO R1229 TO R1230 TO R1231

TO R1232 TO R1233 TO R1234

TO R1235 TO R1236 TO R1237

TO R1238 TO R1239 TO R1240

TO R1241 TO R1242 TO R1243

TO R1244 TO R1245 TO R1246

TO R1247 TO R1248 TO R1249

TO R1250 TO R1251 TO R1252

TO R1253 TO R1254 TO R1255

TO R1256 TO R1257 TO R1258

TO R1259 TO R1260 TO R1261

TO R1262 TO R1263 TO R1264

TO R1265 TO R1266 TO R1267

TO R1268 TO R1269 TO R1270

TO R1271 TO R1272 TO R1273

TO R1274 TO R1275 TO R1276

TO R1277 TO R1278 TO R1279

TO R1280 TO R1281 TO R1282

TO R1283 TO R1284 TO R1285

TO R1286 TO R1287 TO R1288

TO R1289 TO R1290 TO R1291

TO R1292 TO R1293 TO R1294

TO R1295 TO R1296 TO R1297

TO R1298 TO R1299 TO R1300

TO R1301 TO R1302 TO R1303

TO R1304 TO R1305 TO R1306

TO R1307 TO R1308 TO R1309

TO R1310 TO R1311 TO R1312

TO R1313 TO R1314 TO R1315

TO R1316 TO R1317 TO R1318

TO R1319 TO R1320 TO R1321

TO R1322 TO R1323 TO R1324

TO R1325 TO R1326 TO R1327

TO R1328 TO R1329 TO R1330

TO R1331 TO R1332 TO R1333

TO R1334 TO R1335 TO R1336

TO R1337 TO R1338 TO R1339

TO R1340 TO R1341 TO R1342

TO R1343 TO R1344 TO R1345

TO R1346 TO R1347 TO R1348

TO R1349 TO R1350 TO R1351

TO R1352 TO R1353 TO R1354

TO R1355 TO R1356 TO R1357

TO R1358 TO R1359 TO R1360

TO R1361 TO R1362 TO R1363

TO R1364 TO R1365 TO R1366

TO R1367 TO R1368 TO R1369

TO R1370 TO R1371 TO R1372

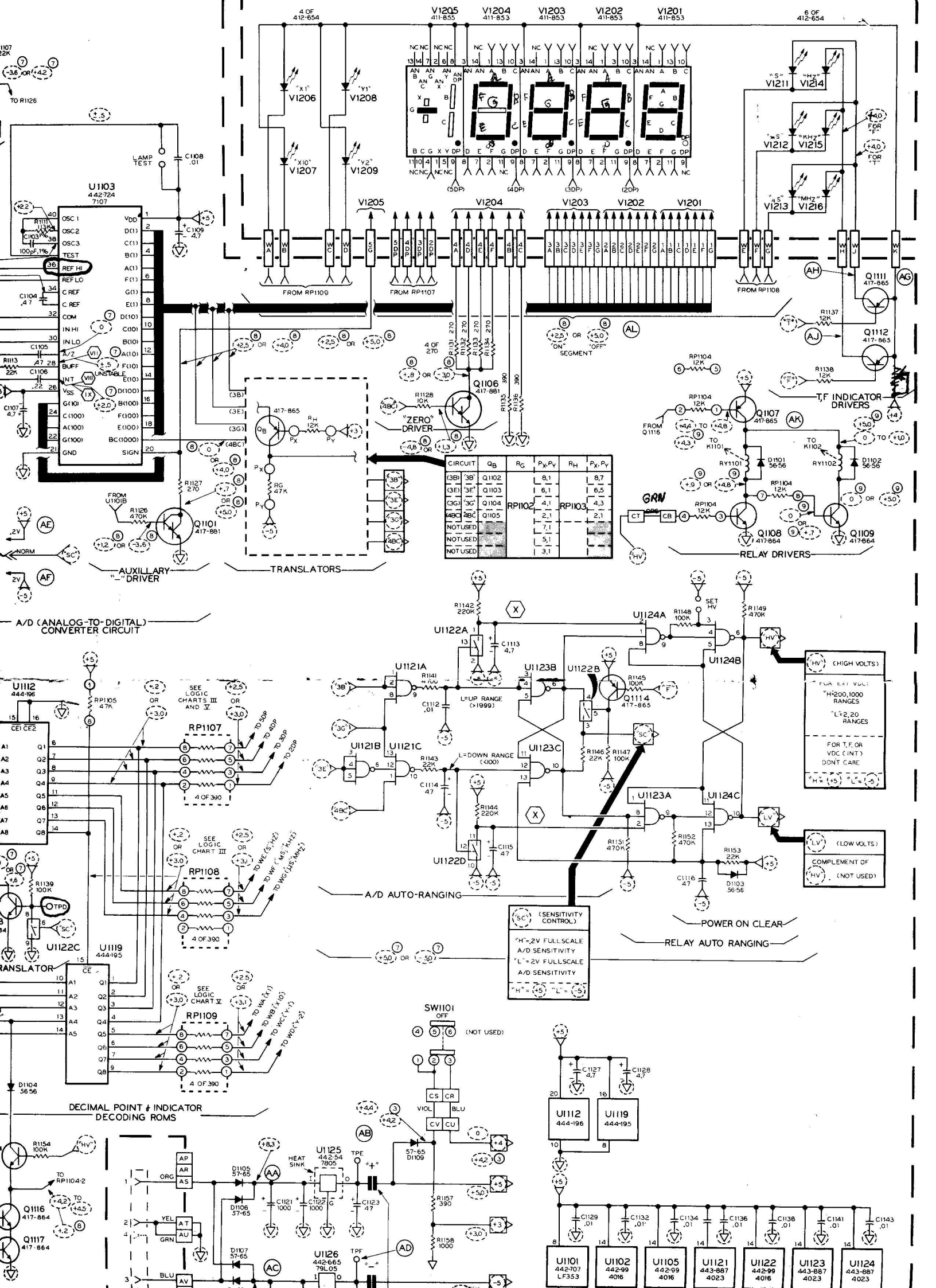
TO R1373 TO R1374 TO R1375

TO R1376 TO R1377 TO R1378

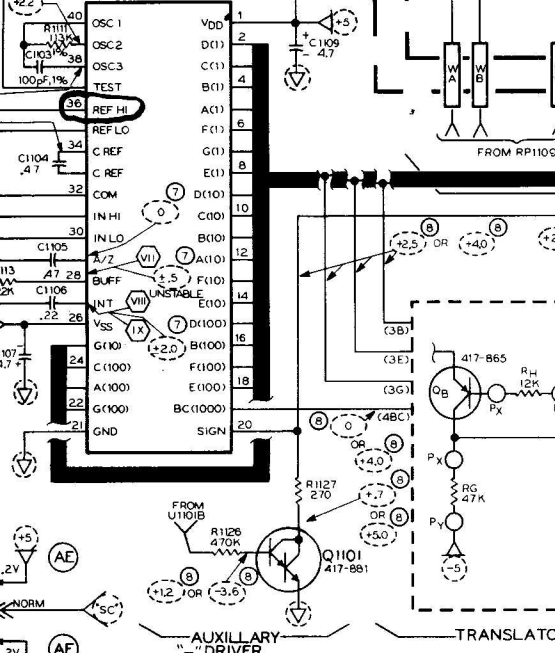
TO R1379 TO R1380 TO R1381

TO R1382 TO R1383 TO R1384

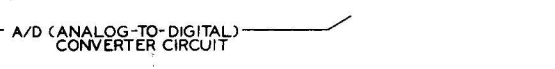
CIRCUITRY REFERENCED TO CHASSIS GND A/D GND SHIELDS



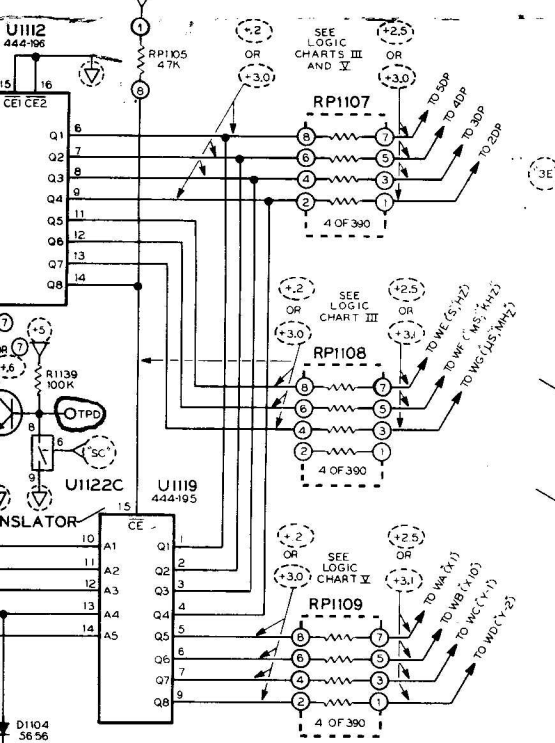
**A/D (ANALOG-TO-DIGITAL) CONVERTER CIRCUIT**



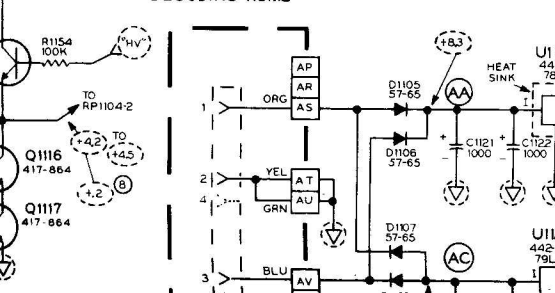
**AUXILIARY DRIVER**



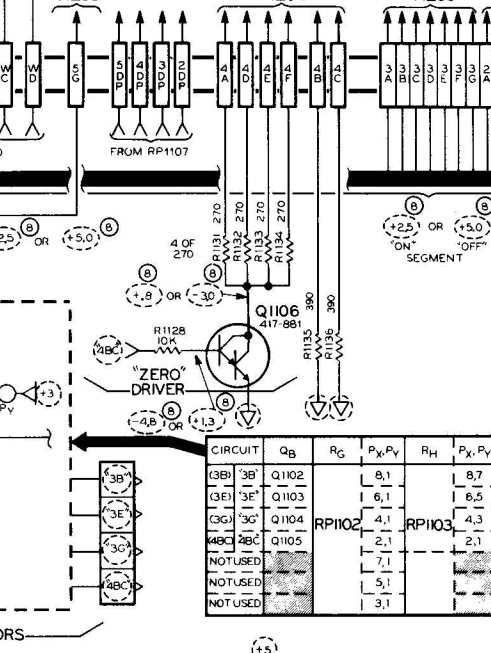
**TRANSLATORS**



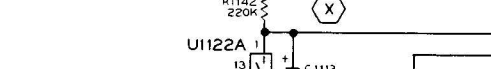
**DECIMAL POINT # INDICATOR DECODING ROMS**



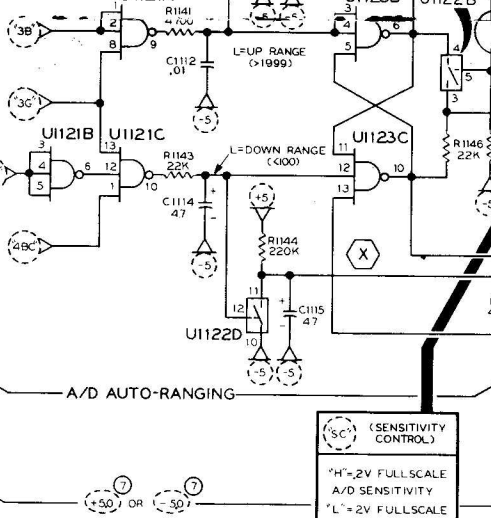
**RELAY DRIVERS**



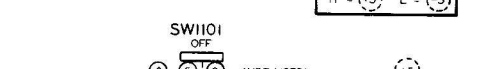
**T.F. INDICATOR DRIVERS**



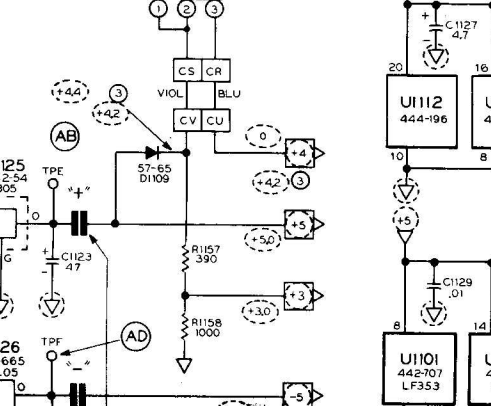
**A/D AUTO-RANGING**



**POWER ON CLEAR**



**RELAY AUTO RANGING**



CIRCUIT	Q <sub>B</sub>	R <sub>G</sub>	P <sub>X</sub> , P <sub>Y</sub>	R <sub>H</sub>	P <sub>X</sub> , P <sub>Y</sub>
(3B)	3B	Q1102	8,1	8,7	
(3E)	3E	Q1103	6,1	6,5	
(3G)	3G	Q1104	4,1	4,3	
(4B)	4B	Q1105	2,1	2,1	
NOT USED			7,1		
NOT USED			5,1		
NOT USED			3,1		

**(HV) (HIGH VOLTS)**

FOR EXT. VOLT:

- \*H=200,1000 RANGES
- \*L=2,20 RANGES

FOR T.F. OR VDC (INT) DONT CARE

\*H=+5 \*L=-5

**(LV) (LOW VOLTS)**

COMPLEMENT OF (HV) (NOT USED)

**(SC) (SENSITIVITY CONTROL)**

\*H=2V FULLSCALE A/D SENSITIVITY

\*L=2V FULLSCALE A/D SENSITIVITY

\*H=+5 \*L=-5

U1101  
442-707  
LF353

U1102  
442-99  
4016

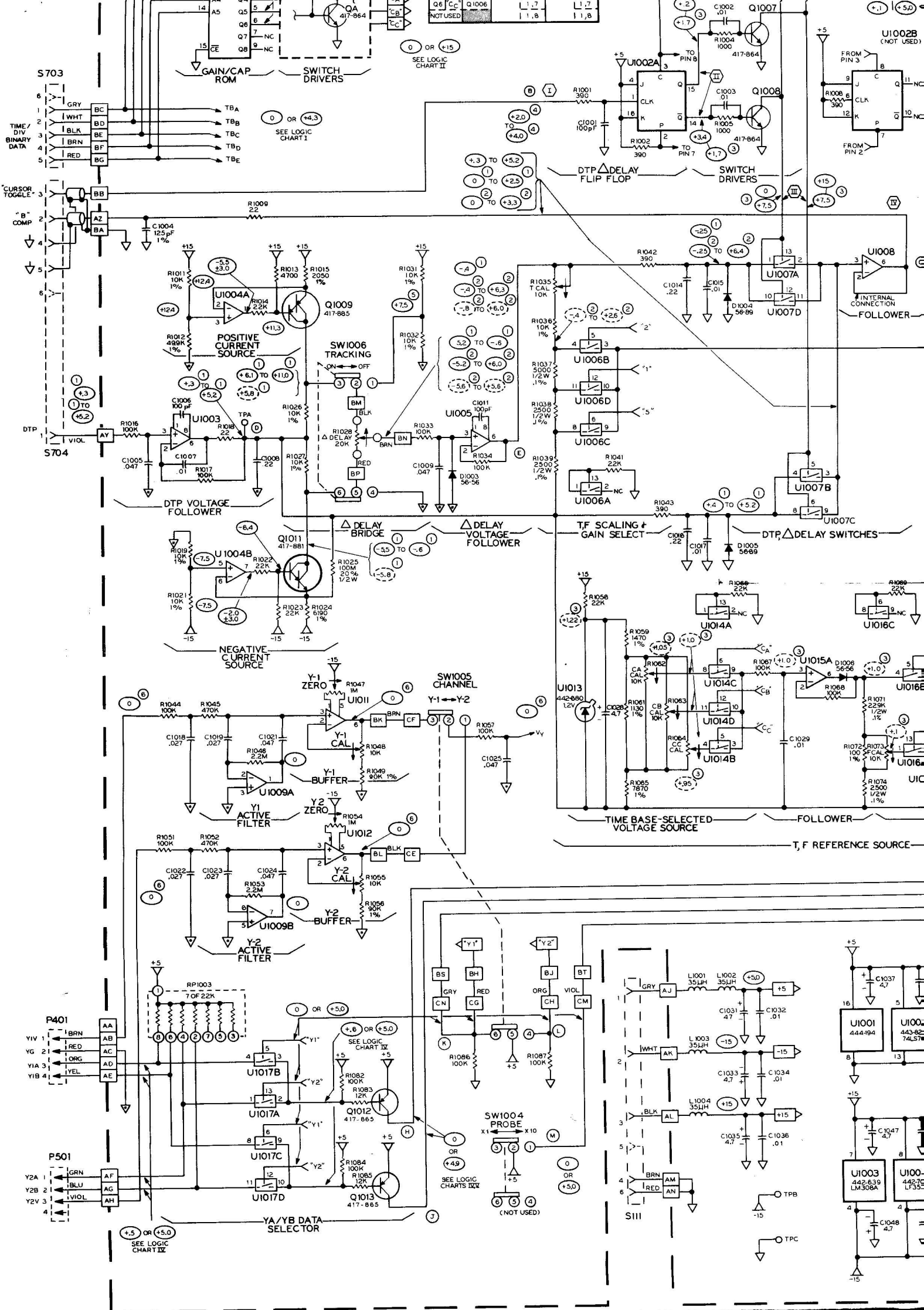
U1105  
442-99  
4016

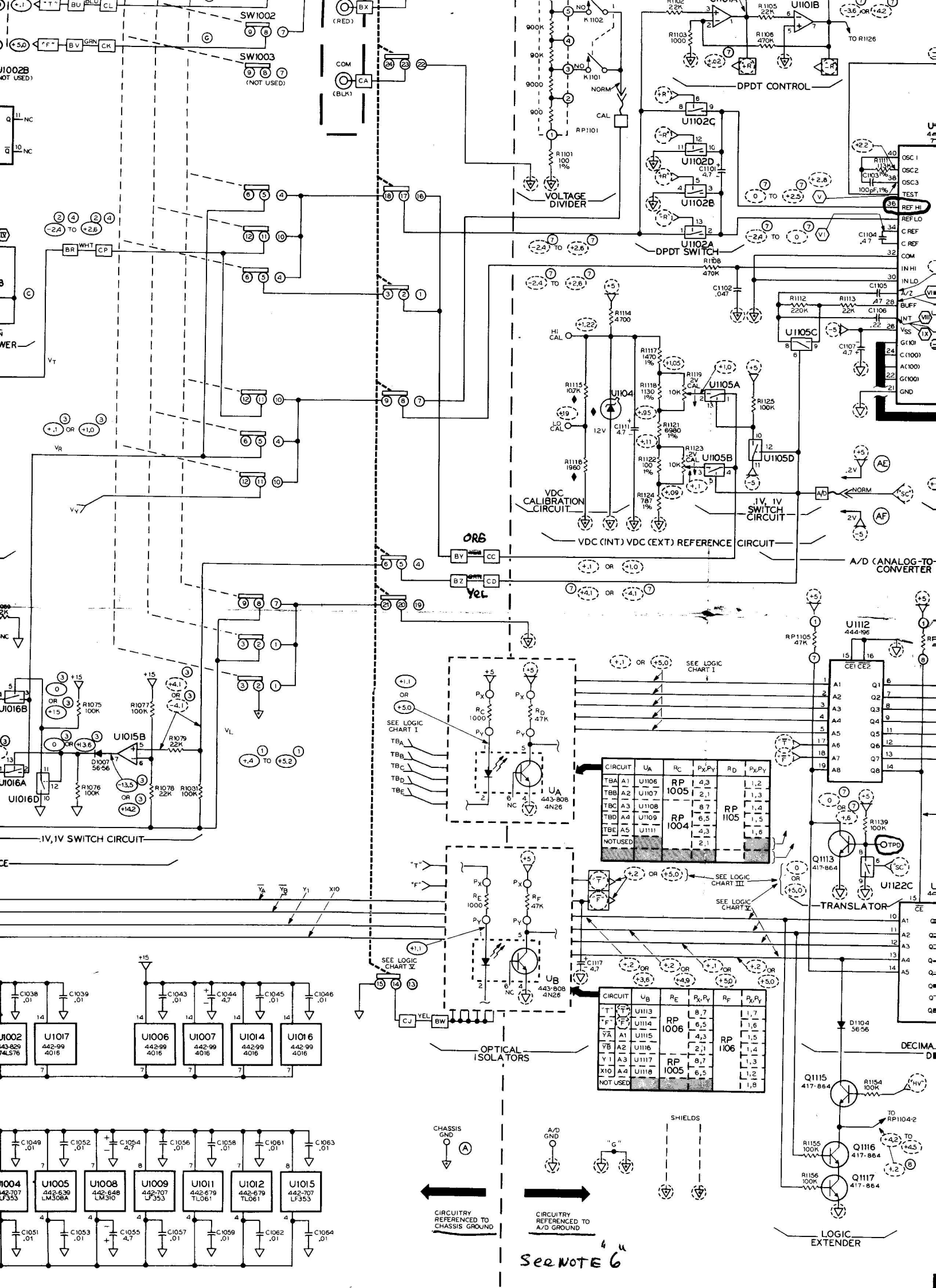
U1121  
443-887  
4023

U1122  
442-99  
4016

U1123  
443-887  
4023

U1124  
443-887  
4023





SEE NOTE 6

