

VLBA Technical Report No. 8

VLBA FOCUS-ROTATION CONTROL SYSTEM

VOLUME II
DRAWINGS

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2500 A.D. 80186 Cross Assembler - Version 4.00g

 Input Filename : FK.asm
 Output Filename : FK.obj

```

1
2           ; FOCUS AXIS FOR VLBA ANTENNAS
3           ; WRITTEN BY: WAYNE M. KOSKI
4           ; LAST REVISION: DECEMBER 01, 1989
5           ;
6           ; THINGS TO DO AND GENERAL NOTES:
7           ;
8           ; 1. THIS SECTION OF CODE WILL BE THE MAIN RUNNING
9           ;    ROUTINES AND SHALL EXCLUDE THE INTERRUPT ROUTINES
10          ;    WHICH SHALL BE IN THE OTHER EPROM.
11          ; 2. ROTATION AXIS SHOULD LOOK SIMILAR TO FOCUS AT
12          ;    PRESENT.
13          ; 3. THIS VERSION UPDATES TO THE NEW F/R CONTROLLER MODULE.
14
15          ASSUME CS:CODE, DS:DSEG
16
17          .OUTPUT 2500AD
18          .OPTIONS H
19
20
21          ; 80188 INTERNAL PORTS FOR CONTROL AND GUIDANCE
22
23
24
25          ; 80188 INTERRUPT CONTROL / STATUS REGISTERS
26
27          0000:FF22      BOI: .EQUAL OFF22H           ;END OF INTERRUPT REGISTER
28          0000:FF24      POLL: .EQUAL OFF24H         ;INTERRUPT POLL REGISTER
29          0000:FF26      POLLS: .EQUAL OFF26H        ;INTERRUPT POLL STATUS REGISTER
30          0000:FF28      MASK: .EQUAL OFF28H         ;INTERRUPT MASK REGISTER
31          0000:FF2A      PMASK: .EQUAL OFF2AH        ;INTERRUPT PRIORITY MASK REGISTER
32          0000:FF2C      ISR: .EQUAL OFF2CH          ;INTERRUPT IN SERVICE REGISTER
33          0000:FF2E      IRR: .EQUAL OFF2EH          ;INTERRUPT REQUEST REGISTER
34          0000:FF30      ICSR: .EQUAL OFF30H         ;INTERRUPT CONTROL STATUS REGISTER
35          0000:FF32      ITCR: .EQUAL OFF32H         ;INTERRUPT TIMER CONTROL REGISTER
36          0000:FF34      IDOCR: .EQUAL OFF34H        ;INTERRUPT DMA 0 CONTROL REGISTER
37          0000:FF36      ID1CR: .EQUAL OFF36H        ;INTERRUPT DMA 1 CONTROL REGISTER
38          0000:FF38      INTOCR: .EQUAL OFF38H       ;INT 0 CONTROL REGISTER
39          0000:FF3A      INT1CR: .EQUAL OFF3AH        ;INT 1 CONTROL REGISTER
40          0000:FF3C      INT2CR: .EQUAL OFF3CH        ;INT 2 CONTROL REGISTER
41          0000:FF3E      INT3CR: .EQUAL OFF3EH        ;INT 3 CONTROL REGISTER
42
43

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44          ;      80188 TIMER CONTROL REGISTERS
45
46      0000:FF50      TOCOUT: .EQUAL 0FF50H          ;TIMER 0 COUNT REGISTER
47      0000:FF52      TOMAXA: .EQUAL 0FF52H          ;TIMER 0 MAXIMUM COUNT A REGISTER
48      0000:FF54      TOMAXB: .EQUAL 0FF54H          ;TIMER 0 MAXIMUM COUNT B REGISTER
49      0000:FF56      TOMODE: .EQUAL 0FF56H          ;TIMER 0 MODE REGISTER
50      0000:FF58      T1COUT: .EQUAL 0FF58H          ;TIMER 1 COUNT REGISTER
51      0000:FF5A      T1MAXA: .EQUAL 0FF5AH          ;TIMER 1 MAXIMUM COUNT A REGISTER
52      0000:FF5C      T1MAXB: .EQUAL 0FF5CH          ;TIMER 1 MAXIMUM COUNT B REGISTER
53      0000:FF5E      T1MODE: .EQUAL 0FF5EH          ;TIMER 1 MODE REGISTER
54      0000:FF60      T2COUT: .EQUAL 0FF60H          ;TIMER 2 COUNT REGISTER
55      0000:FF62      T2MAXA: .EQUAL 0FF62H          ;TIMER 2 MAXIMUM COUNT A REGISTER
56      0000:FF66      T2MODE: .EQUAL 0FF66H          ;TIMER 2 MODE REGISTER
57
58
59          ;      80188 CHIP SELECT CONTROL REGISTERS
60
61      0000:FFA0      UMCS: .EQUAL 0FFA0H          ;80188 INTERNAL UPPER MEMORY CHIP
62                                     ;SELECT CONTROL BLOCK REGISTER
63      0000:FFA2      LMCS: .EQUAL 0FFA2H          ;80188 INTERNAL LOWER MEMORY CHIP
64                                     ;SELECT CONTROL BLOCK REGISTER
65      0000:FFA4      PACS: .EQUAL 0FFA4H          ;80188 INTERNAL PERIPHERAL CHIP
66                                     ;SELECT CONTROL BLOCK REGISTER
67      0000:FFA6      MMCS: .EQUAL 0FFA6H          ;80188 INTERNAL MIDDLE MEMORY
68                                     ;START ADDRESS REGISTER
69      0000:FFA8      MPCS: .EQUAL 0FFA8H          ;80188 INTERNAL MIDDLE MEMORY CHIP
70                                     ;SELECT CONTROL BLOCK REGISTER
71
72
73          ;      80188 DMA CHANNEL CONTROL REGISTERS
74
75      0000:FFC0      DOSPL: .EQUAL 0FFC0H          ;DMA 0 SOURCE POINTER LSB REGISTER
76      0000:FFC2      DOSPM: .EQUAL 0FFC2H          ;DMA 0 SOURCE POINTER MSB REGISTER
77      0000:FFC4      DODPL: .EQUAL 0FFC4H          ;DMA 0 DESTINATION POINTER LSB REGISTER
78      0000:FFC6      DODPM: .EQUAL 0FFC6H          ;DMA 0 DESTINATION POINTER MSB REGISTER
79      0000:FFC8      DOTC: .EQUAL 0FFC8H          ;DMA 0 TRANSFER COUNT REGISTER
80      0000:FFCA      DOMODE: .EQUAL 0FFCAH          ;DMA 0 MODE REGISTER
81      0000:FFD0      DISPL: .EQUAL 0FFD0H          ;DMA 1 SOURCE POINTER LSB REGISTER
82      0000:FFD2      DISPM: .EQUAL 0FFD2H          ;DMA 1 SOURCE POINTER MSB REGISTER
83      0000:FFD4      DIDPL: .EQUAL 0FFD4H          ;DMA 1 DESTINATION POINTER LSB REGISTER
84      0000:FFD6      DIDPM: .EQUAL 0FFD6H          ;DMA 1 DESTINATION POINTER MSB REGISTER
85      0000:FFD8      DITC: .EQUAL 0FFD8H          ;DMA 1 TRANSFER COUNT REGISTER
86      0000:FFDA      DIMODE: .EQUAL 0FFDAH          ;DMA 1 MODE REGISTER
87
88
89          ;      80188 INTERNAL I/O RELOCATION REGISTER
90
91      0000:FFFF      RELOC: .EQUAL 0FFFFH          ;I/O RELOCATION REGISTER
92
93
94          ;      80188 INITIAL VALUES FOR INTERNAL REGISTERS
95
96      0000:007D      LMBS: .EQUAL 007DH          ;LOWER MEMORY BLOCK SIZE = 2K
97      0000:81BD      MMBS: .EQUAL 81BDH          ;MIDDLE MEMORY BLOCK SIZE = 8K
98      0000:03FD      MMST: .EQUAL 03FDH          ;MIDDLE MEMORY START POSITION = 8K
99      0000:003D      PST: .EQUAL 003DH          ;PERIPHERAL START ADDRESS = 0
100     0000:FFBD      UMBS: .EQUAL 0FFBDH          ;UPPER MEMORY BLOCK SIZE = 2K

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101
102
103
104           ;      EXTERNAL PORTS FOR CONTROLLING THE FOCUS AXIS
105
106           0000:0000      PIPTA: .EQUAL 0           ;PROM 1 PORT A
107           0000:0001      PIPTB: .EQUAL 1           ;PROM 1 PORT B
108           0000:0002      PIPTAD: .EQUAL 2          ;PROM 1 PORT A DIRECTION
109           0000:0003      PIPTBD: .EQUAL 3          ;PROM 1 PORT B DIRECTION
110           0000:0080      P2PTA: .EQUAL 128        ;PROM 2 PORT A
111           0000:0081      P2PTB: .EQUAL 129        ;PROM 2 PORT B
112           0000:0082      P2PTAD: .EQUAL 130       ;PROM 2 PORT A DIRECTION
113           0000:0083      P2PTBD: .EQUAL 131       ;PROM 2 PORT B DIRECTION
114           0000:0100      RAMTC: .EQUAL 256         ;RAM TIMER AND CONTROL
115           0000:0101      RAMPTA: .EQUAL 257        ;RAM PORT A
116           0000:0102      RAMPTB: .EQUAL 258        ;RAM PORT B
117           0000:0103      RAMPTC: .EQUAL 259        ;RAM PORT C
118           0000:0104      RAMTLO: .EQUAL 260        ;RAM TIMER LOW
119           0000:0105      RAMTHI: .EQUAL 261        ;RAM TIMER HIGH
120           0000:0180      APEXRQ: .EQUAL 384        ;APEX REQ
121           0000:0182      APEXRS: .EQUAL 386        ;APEX RESPONSE
122           0000:0182      POSM: .EQUAL 386          ;POSITION MSB
123           0000:0181      POSL: .EQUAL 385          ;POSITION LSB
124           0000:0184      VELM: .EQUAL 388          ;VELOCITY MSB
125           0000:0183      VELL: .EQUAL 387          ;VELOCITY LSB
126           0000:0186      ANAH: .EQUAL 390          ;ANALOGS MSB
127           0000:0185      ANAL: .EQUAL 389          ;ANALOGS LSB
128           0000:0187      DISCR: .EQUAL 391         ;FOC DISCRETES
129           0000:018B      RELADD: .EQUAL 395        ;GET RELATIVE ADDRESS
130           0000:018C      COMML: .EQUAL 396         ;CONTROL VALUE LSB
131           0000:018D      COMMH: .EQUAL 397         ;CONTROL VALUE MSB
132           0000:018E      DEVACK: .EQUAL 398        ;DEVICE ACKNOWLEDGE
133           0000:018F      MONL: .EQUAL 399          ;MONITOR DATA MSB
134           0000:0190      MONM: .EQUAL 400          ;MONITOR DATA LSB
135           0000:0191      ADL: .EQUAL 401           ;READ A/D LSB
136           0000:0192      ADH: .EQUAL 402           ;READ A/D MSB
137           0000:0193      SEMCT: .EQUAL 403         ;SELECT MOTOR CURRENT/TORQUE
138           0000:0194      STCNV: .EQUAL 404         ;START A/D CONVERT
139           0000:0195      NODESW: .EQUAL 405        ;READ MODE SWITCH
140           0000:0196      LTCHDA: .EQUAL 406        ;LATCH DRIVE D/A
141           0000:0197      BDRRL1: .EQUAL 407        ;BDS3 ERROR LSB #1
142
143
144
145           0000:0000      DSEG:  SEGMENT
146
147           ;      DATA STORAGE
148
149           0000:2000      ORG      2000H
150
151           0000:2000      MEMST: .EQUAL $
152
153           ;      MONITOR STORAGE
154
155           0000:2000      POSCEC: .BLKB 2           ;POSITION COMMAND ECHO
156           0000:2002      POSD: .BLKB 2            ;CURRENT POSITION DATA
157           0000:2004      ERROR: .BLKB 2           ;POSCEC-POSD

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158 0000:2006          SYSTEM: .BLKB 2          ;SYSTEM PARAMETERS
159 0000:2008          FAUL1:  .BLKB 2          ;FAULT BITS SET 1
160 0000:200A          FAUL2:  .BLKB 2          ;FAULT BITS SET 2
161 0000:200C          ANAFL:  .BLKB 2          ;ANALOG FAULT FLAGS
162
163           0000:200E          ANADT:  .EQUAL $          ;ANALOG STORAGE IS HERE
164
165 0000:200E          GND1:   .BLKB 2          ;GND
166 0000:2010          GND2:   .BLKB 2          ;GND
167 0000:2012          GND3:   .BLKB 2          ;GND
168 0000:2014          VEL:    .BLKB 2          ;FOCUS VELOCITY
169 0000:2016          V15P:  .BLKB 2          ;+15V/2
170 0000:2018          V15N:  .BLKB 2          ;-15V/2
171 0000:201A          V5:    .BLKB 2           ;+5V
172 0000:201C          V10P:  .BLKB 2          ;+10V
173 0000:201E          MTEMP1: .BLKB 2          ;MOUNT TEMP 1
174 0000:2020          V10N:  .BLKB 2          ;-10V
175 0000:2022          MTEMP2: .BLKB 2          ;MOUNT TEMP 2
176 0000:2024          BTEMP:  .BLKB 2          ;BIN TEMP
177
178 0000:2026          SERVER: .BLKB 2
179 0000:2028          VRL1:  .BLKB 2
180 0000:202A          X22:   .BLKB 2
181 0000:202C          X23:   .BLKB 2
182 0000:202E          X24:   .BLKB 2
183 0000:2030          X25:   .BLKB 2
184 0000:2032          X26:   .BLKB 2
185 0000:2034          X27:   .BLKB 2
186 0000:2036          X28:   .BLKB 2
187 0000:2038          X29:   .BLKB 2
188 0000:203A          X30:   .BLKB 2
189 0000:203C          X31:   .BLKB 2
190 0000:203E          X32:   .BLKB 2
191
192
193           ;          TEMPORARY STORAGE
194
195 0000:2040          RAC:    .BLKB 1          ;RELATIVE CONTROL ADDRESS
196 0000:2041          CONL:  .BLKB 1          ;CONTROL VALUE LSB
197 0000:2042          CONM:  .BLKB 1          ;CONTROL VALUE MSB
198 0000:2043          ACKF:  .BLKB 1          ;ACKNOWLEDGE FLAG
199 0000:2044          COMTMP: .BLKB 2          ;TEMPORARY COMMAND STORAGE
200 0000:2046          ADVAL: .BLKB 2          ;A/D TEMPORARY STORAGE
201 0000:2048          SPEED: .BLKB 1          ;RAMP LEVEL
202 0000:2049          BREAK1: .BLKB 2          ;RAMP UP BREAK POINT
203 0000:204B          BREAK2: .BLKB 2          ;RAMP DOWN BREAK POINT
204 0000:204D          POSDOD: .BLKB 2          ;OLD POSITION
205 0000:204F          SCRLST: .BLKB 2          ;LAST 500US POSITION
206 0000:2051          SCRCNT: .BLKB 2          ;SCREW COUNT
207 0000:2053          EXTTHR: .BLKB 1          ;EXTERNAL TROUBLE TIMER
208 0000:2054          DEL:   .BLKB 2          ;FILTER DELTA
209 0000:2056          FIL:   .BLKB 1          ;FILTER FAIL FLAG
210 0000:2057          FILOVR: .BLKB 1          ;MAX FILTER FAILURE COUNT
211 0000:2058          PHASEA: .BLKB 1          ;CURRENT SENSOR LEVEL
212 0000:2059          SCWIGN: .BLKB 1
213 0000:205A          RANDOM: .BLKB 2          ;RANDOM NUMBER GENERATOR
214 0000:205C          SECCHC: .BLKB 1          ;SECOND CHANCE FOR 2ND SCREW

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215
216             ;          FLAGS
217
218             0000:205D      FLAGST: .EQUAL $
219
220             0000:205D      RESCMD: .BLKB 1
221             0000:205E      NAPATV: .BLKB 1
222             0000:205F      NAPREQ: .BLKB 1
223             0000:2060      DRVREQ: .BLKB 1
224             0000:2061      MANOVR: .BLKB 1
225             0000:2062      BDSRST: .BLKB 1
226             0000:2063      DRVONE: .BLKB 1
227             0000:2064      ADFLAG: .BLKB 1
228             0000:2065      BFLAG: .BLKB 1
229             0000:2066      TFLAGO: .BLKB 1
230             0000:2067      TFLAG1: .BLKB 1
231             0000:2068      TFLAG2: .BLKB 1
232             0000:2069      DRVOPF: .BLKB 1
233             0000:206A      DRVATV: .BLKB 1
234             0000:206B      RAMPOS: .BLKB 2
235             0000:206D      DIR: .BLKB 1
236             0000:206E      LDIR: .BLKB 1
237
238             0000:0012      ENDFLG: .EQUAL $-FLAGST
239
240
241             ENDS
242
243
244             ;          PROGRAM EQUATES
245
246             0000:2100      STCK: .EQUAL 2100H           ;STACK LOCATION
247             0000:A766      DOVAL: .EQUAL 0A766H        ;DMA 0 CONTROL VALUE
248             0000:00E8      MASKV: .EQUAL 00E8H        ;DMA 0, INTO, TIMER ENABLE
249             0000:0A00      LOW: .EQUAL 00A00H         ;LOW VALUE
250             0000:F200      HIGH: .EQUAL 0F200H        ;HIGH VALUE
251             0000:001C      CONRAM: .EQUAL 28          ;STARTING RAMP VALUE
252
253             ;          GLOBAL LIST
254
255             GLOBAL INITAL, RSCMD
256             EXTERNAL DSETUP:WORD, TSETUP:WORD, TSET1:WORD
257
258             ;          PROGRAM ENTERS HERE AFTER RESET ROUTINE (AS IF BY MAGIC)
259
260             FF80:0000      ORG      OFF80:0000H
261
262
263             FF80:0000      INITAL:
264             FF80:0000      BC 00 21      MOV      SP,STCK           ;SET STACK POINTER
265
266             ;          LETS INITIALIZE MORE 80188 CHIP SELECT LOGIC
267
268             FF80:0003      BA A2 FF      MOV      DX,LMCS         ;SET UP LOWER MEMORY BLOCK
269             FF80:0006      B8 7D 00      MOV      AX,LMBS        ;TO 2K
270             FF80:0009      EF
271             FF80:000A      BA A8 FF      MOV      DX,MPCS        ;NOW SET MIDDLE MEMORY BLOCK TO

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272 FF80:000D B8 BD 81      MOV     AX,MMBS           ;2K AND I/O MAPPED PCS LINES
273 FF80:0010 EF           OUT     DX,AX
274 FF80:0011 BA A6 FF      MOV     DX,MMCS         ;SET MIDDLE MEMORY TO START AT
275 FF80:0014 B8 FD 03      MOV     AX,MMST         ;8K
276 FF80:0017 EF           OUT     DX,AX
277 FF80:0018 BA A4 FF      MOV     DX,PACS         ;SET UP THE PERIPHERAL ADDRESS
278 FF80:001B B8 3D 00      MOV     AX,PST          ;TO START AT 0
279 FF80:001E EF           OUT     DX,AX
280
281 ; LETS INITIALIZE PORTS AND PORT VALUES
282
283 FF80:001F B8 FF FF      MOV     AX,OFFFHH       ;EPROM 1 PORT A, B = OUTPUT
284 FF80:0022 E7 02      OUT     PIPTAD,AX
285 FF80:0024 B8 FF 07      MOV     AX,07FFH        ;UPPER NYBBLE = INPUT
286 FF80:0027 E7 82      OUT     P2PTAD,AX
287 FF80:0029 BA 00 01      MOV     DX,RAMTC        ;NOW DO RAM'S I/O
288 FF80:002C EE           OUT     DX,AL           ;SET TO OUTPUT
289 FF80:002D 33 C0      XOR     AX,AX           ;CLEAR ACC
290 FF80:002F E7 00      OUT     PIPTA,AX        ;CLEAR EPROM 1 PORTS A AND B
291 FF80:0031 E7 80      OUT     P2PTA,AX        ;CLEAR EPROM 2 PORTS A AND B
292 FF80:0033 42           INC     DX               ;POINT TO RAM PORT A
293 FF80:0034 EF           OUT     DX,AX           ;CLEAR RAM PORTS A AND B
294 FF80:0035 42           INC     DX
295 FF80:0036 EF           OUT     DX,AX           ;CLEAR PORT C TOO
296 FF80:0037 BA 93 01      MOV     DX,SEMCT        ;CLEAR LIGHTS
297 FF80:003A EE           OUT     DX,AL
298
299 ; NOW LETS SET UP THE DMA 0 CHANNEL
300
301 FF80:003B BE 00 00      MOV     SI,OFFSET DSETUP ;POINT TO TABLE
302 FF80:003E BA C0 FF      MOV     DX,DOSPL        ;SET UP SOURCE POINTER
303 FF80:0041 B9 06 00      MOV     CX,6
304 FF80:0044 6F           DSET: OUTSW
305 FF80:0045 83 C2 02      ADD     DX,2
306 FF80:0048 E2 FA      LOOP   DSET
307
308 ; NOW LETS INITIALIZE THE TIMERS
309
310 FF80:004A E8 47 06      CALL   TMROFF
311
312 ; NOW LETS ZERO MEMORY
313
314 FF80:004D 32 C0      XOR     AL,AL
315 FF80:004F B9 00 01      MOV     CX,256          ;256 LOCATIONS
316 FF80:0052 BF 00 20      MOV     DI,OFFSET MEMST ;START OF INDEX
317 FF80:0055 F3 AA      REP STOS BYTE PTR MEMST
318
319
320 ; NOW LETS TURN ON THE INTERRUPTS
321
322 FF80:0057 BA 28 FF      MOV     DX,MASK         ;LETS TURN ON DMA, INTO, TIMER
323 FF80:005A B8 E8 00      MOV     AX,MASKV        ;INTERRUPTS
324 FF80:005D EF           OUT     DX,AX
325 FF80:005E BA 38 FF      MOV     DX,INTOCR       ;SET INTO PRIORITY
326 FF80:0061 B8 00 00      MOV     AX,0            ;HIGHEST PRIORITY
327 FF80:0064 EF           OUT     DX,AX
328 FF80:0065 FB           STI

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329
330 ; LETS RESET THE BDS3 SERVO AMPLIFIERS
331
332 FF80:0066 E8 9A 05 CALL BDS3RS ;INITIATE RESET
333
334 ; LETS JUST WAIT FOR THREE SECONDS FOR THINGS TO SETTLE
335
336 FF80:0069 B9 03 00 MOV CX,3 ;THREE SECONDS TOTAL
337 FF80:006C E8 04 06 CALL DELAY
338
339 ; NOW LETS WAIT FOR THE THREE PHASE
340
341 PHASE:
342 FF80:006F B8 00 80 MOV AX,8000H ;TURN ON 3 PHASE
343 FF80:0072 E7 00 OUT PIPTA,AX
344 FF80:0074 B9 03 00 MOV CX,3 ;THREE SECONDS TOTAL
345 FF80:0077 C6 06 67 20 00 PH301: MOV TFLAG1,0 ;SET TIMER FLAG = 0K
346 FF80:007C BA 97 01 MOV DX,BDERL1 ;GET BDS3 INFO
347 FF80:007F EC PH302: IN AL,DX
348 FF80:0080 25 01 00 AND AX,01H ;TEST FOR BUS FAULT
349 FF80:0083 75 11 JNZ THREX ;EXIT IF OK
350 FF80:0085 F6 06 67 20 01 TEST TFLAG1,1 ;TIME OUT?
351 FF80:008A 74 F3 JZ PH302 ;LOOP UNTIL TIME OUT
352 FF80:008C E2 E9 LOOP PH301 ;UNTIL THREE SEC HAVE PASSED
353 FF80:008E 80 0E 0A 20 01 OR FAUL2,01H ;SET BDS3 DEAD FLAG
354 FF80:0093 E9 D9 FF JMP PHASE ;IF BUS FAULT
355
356 THREX:
357 FF80:0096 E8 FB 05 CALL TMROFF ;STOP TIMERS
358 FF80:0099 C6 06 0A 20 00 MOV FAUL2,0 ;RESET BDS3 DEAD FLAG
359 FF80:009E
360
361 ; SERIAL NUMBER / SOFTWARE REVISION
362
363 FF80:009E C7 06 26 20 03 06 MOV WORD PTR SERVER,0603H
364
365 ; LETS DO ONE DSTOR PRIOR TO ENTRY
366
367 FF80:00A4 E8 2F 04 CALL DSTOR
368
369
370 ; HERE WE ARE INTO THE MAIN PROGRAM
371
372
373 BOSS:
374 FF80:00A7 8B 0E 5A 20 MOV CX,RANDOM ;LETS DELAY A BIT
375 FF80:00AB E2 FE WAIT: LOOP WAIT ;TO KILL APEX SYNCING
376 FF80:00AD BC 00 21 MOV SP,STCK ;LETS SET UP STACK POINTER
377 FF80:00B0 F6 06 08 20 01 TEST FAUL1,1 ;APEX OK?
378 FF80:00B5 74 03 JZ NEXT ;IF OK
379 FF80:00B7 E9 A4 00 JMP RSCMD ;IF APEX BROKE
380 FF80:00BA NEXT:
381 FF80:00BA F6 06 6A 20 01 TEST DRVATV,1 ;DRIVE ACTIVE?
382 FF80:00BF 74 06 JZ NEXT0 ;IF NOT
383 FF80:00C1 E8 CC 00 CALL CHKDRV ;IF ACTIVE
384 FF80:00C4 E9 E0 FF JMP BOSS
385 FF80:00C7 NEXT0:

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386 FF80:00C7 BA 95 01      MOV    DX,MODESW      ;GET MODE SWITCH
387 FF80:00CA EC              IN     AL,DX          ;GET INFO
388 FF80:00CB F6 D0      NOT    AL              ;INVERT AL
389 FF80:00CD 3C FF      CMP    AL,OFFH       ;A = OFFH?
390 FF80:00CF C6 06 59 20 00    MOV    SCWIGN,0      ;ASSUME ON
391 FF80:00D4 75 05      JNZ   BOSS1          ;IF ON
392 FF80:00D6 C6 06 59 20 01    MOV    SCWIGN,1      ;ELSE TURN OFF
393 FF80:00DB E8 F8 03      BOSS1: CALL   DSTOR        ;LETS GET APEX DATA
394 FF80:00DE F6 06 61 20 01    TEST   MANOVR,1      ;MANUAL OVERRIDE?
395 FF80:00E3 74 07      JZ    NEXT1A         ;IF OVERRIDE
396 FF80:00E5 80 0E 06 20 08    OR     SYSTEM,8      ;MANUAL OVER RIDE FLAG
397 FF80:00EA EB 09      JMP   SHORT NEXT1
398 FF80:00EC E4 81      NEXT1A: IN     AL,P2PTB   ;IN LOCAL?
399 FF80:00EE 24 20      AND   AL,20H
400 FF80:00F0 75 03      JNZ   NEXT1          ;IF NOT
401 FF80:00F2 E9 75 02      JMP   LOCAL          ;IF LOCAL
402 FF80:00F5
403 FF80:00F5 F6 06 62 20 01    TEST   BDSRST,1      ;RESET BDS3 SERVO AMP
404 FF80:00FA 74 14      JZ    NEXT2          ;IF NOT
405 FF80:00FC C6 06 62 20 00    MOV    BDSRST,0      ;RESET REQUEST
406 FF80:0101 E8 FF 04      CALL  BDS3RS         ;DO IT
407 FF80:0104 B9 01 00      MOV    CX,1          ;WAIT 1 SEC
408 FF80:0107 E8 69 05      CALL  DELAY
409 FF80:010A E8 87 05      CALL  TMROFF         ;STOP TIMERS
410 FF80:010D E9 97 FF      JMP   BOSS
411 FF80:0110
412 FF80:0110 F6 06 5D 20 01    TEST   RESCMD,1      ;SOFT RESET?
413 FF80:0115 74 03      JZ    NEXT3          ;IF NOT
414 FF80:0117 E9 38 00      JMP   CMDRS          ;IF RRESET
415 FF80:011A
416 FF80:011A F6 06 5E 20 01    TEST   NAPATV,1      ;IN NAP?
417 FF80:011F 74 08      JZ    NEXT4          ;IF NOT
418 FF80:0121 C6 06 60 20 00    MOV    DRVREQ,0      ;IF NAP, KILL ALL REQ
419 FF80:0126 E9 7E FF      JMP   BOSS           ;IF NAP, GOTO BOSS
420 FF80:0129
421 FF80:0129 F6 06 60 20 01    TEST   DRVREQ,1      ;DRIVE REQUEST?
422 FF80:012E 74 06      JZ    NEXT5          ;IF NO DRIVE REQUEST
423 FF80:0130 E8 B0 00      CALL  DRVINT         ;IF DRIVE REQUEST
424 FF80:0133 E9 71 FF      JMP   BOSS
425 FF80:0136
426 FF80:0136 F6 06 5F 20 01    TEST   NAPREQ,1      ;NAP REQUEST?
427 FF80:013B 75 03      JNZ   NEXT6          ;IF NO NAP REQUEST
428 FF80:013D E9 67 FF      JMP   BOSS
429 FF80:0140
430 FF80:0140 C6 06 5F 20 00    MOV    NAPREQ,0      ;REMOVE NAP REQUEST
431 FF80:0145 C6 06 5E 20 FF    MOV    NAPATV,OFFH   ;SET NAP ACTIVE
432 FF80:014A 80 0E 06 20 01    OR     SYSTEM,1      ;SET NAP FLAG
433 FF80:014F E9 55 FF      JMP   BOSS           ;END OF MAIN ROUTINE
434
435 FF80:0152
436 FF80:0152 81 26 08 20 1F FC    CMDRS: AND   WORD PTR FAUL1,0FC1FH ;CLEAR CERTAIN FAULTS
437 FF80:0158 81 26 06 20 FE FF    AND   WORD PTR SYSTEM,OFFFEH ;CLEAR NAP
438 FF80:015E
439 FF80:015E 81 26 06 20 F5 FF    RSCMD: AND   WORD PTR SYSTEM,OFFF5H ;CLEAR LOCAL, OVER RIDE
440 FF80:0164 BC 00 21      MOV    SP,STCK       ;RESET STACK
441 FF80:0167 C6 06 69 20 01    MOV    DRVOFF,1      ;TURN OFF DRIVE
442 FF80:016C F6 06 6A 20 01    TEST   DRVATV,1      ;DRIVING?

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443 FF80:0171 74 03 JZ RSCMD1 ;IF NOT DRIVING
444 FF80:0173 E9 31 FF JMP BOSS ;IF STILL DRIVING
445 FF80:0176 32 C0 RSCMD1: XOR AL,AL ;NOW ZERO FLAGS
446 FF80:0178 B9 12 00 MOV CX,ENDFLG ;NUMBER OF FLAG LOCATIONS
447 FF80:017B BF 5D 20 MOV DI,OFFSET FLAGST ;START OF FLAGS
448 FF80:017E F3 AA REP STOS BYTE PTR FLAGST
449 FF80:0180 E8 C7 04 CALL BRKOFF ;ENGAGE BRAKE
450 FF80:0183 C6 06 5D 20 00 MOV RESCMD,0 ;KILL RESET REQUEST
451 FF80:0188 B8 00 00 MOV AX,0 ;KILL LIGHTS
452 FF80:018B E7 80 OUT P2PTA,AX
453 FF80:018D E9 17 FF JMP BOSS
454
455 FF80:0190 CHKDRV:
456 FF80:0190 FE 0E 53 20 DEC BYTE PTR EXTMR ;DEC SAFETY TIMER
457 FF80:0194 75 01 JNZ CHKDRO ;IF OK
458 FF80:0196 CC INT 3 ;DO TIMER THIS WAY
459 FF80:0197 F6 06 60 20 01 CHKDRO: TEST DRVREQ,1 ;NEW REQUEST
460 FF80:019C 75 01 JNZ CHKDR1 ;IF REQUEST
461 FF80:019E C3 RET ;IF NOT
462 FF80:019F C6 06 60 20 00 CHKDR1: MOV DRVREQ,0 ;KILL REQUEST
463 FF80:01A4 8B 1E 00 20 MOV BX,POSCEC ;BUT TEST FOR CLOSE
464 FF80:01A8 2B 1E 44 20 SUB BX,COMTMP
465 FF80:01AC C6 06 65 20 00 MOV BFLAG,0 ;ASSUME IN BOUND
466 FF80:01B1 2E 62 1E D4 06 BOUND BX,CS:CLSETAB ;CLOSE?
467 FF80:01B6 F6 06 65 20 01 TEST BFLAG,1
468 FF80:01BB 75 07 JNZ CHKDR2 ;IF NOT CLOSE
469 FF80:01BD C7 06 44 20 00 00 MOV WORD PTR COMTMP,0 ;FOR DRIVE OK
470 FF80:01C3 C3 RET ;IF CLOSE
471 FF80:01C4 C6 06 69 20 01 CHKDR2: MOV DRVOFF,1 ;TURN OFF DRIVE
472 FF80:01C9 C6 06 60 20 01 MOV DRVREQ,1 ;RETAIN REQUEST
473 FF80:01CE F6 06 6A 20 01 TEST DRVATV,1 ;DRIVING?
474 FF80:01D3 74 01 JZ CHKDR3 ;IF STOPPED
475 FF80:01D5 C3 RET ;IF STILL DRIVING
476 FF80:01D6 32 C0 CHKDR3: XOR AL,AL ;NOW ZERO FLAGS
477 FF80:01D8 B9 12 00 MOV CX,ENDFLG ;NUMBER OF FLAG LOCATIONS
478 FF80:01DB BF 5D 20 MOV DI,OFFSET FLAGST ;START OF FLAGS
479 FF80:01DE F3 AA REP STOS BYTE PTR FLAGST
480 FF80:01E0 E8 67 04 CALL BRKOFF ;ENGAGE BRAKE
481
482 FF80:01E3 DRVINT:
483 FF80:01E3 C6 06 60 20 00 MOV DRVREQ,0 ;KILL REQUEST
484 FF80:01E8 80 3E 5C 20 02 CMP BYTE PTR SECCHC,2 ;SECOND SCREW FAILED TWICE?
485 FF80:01ED 74 08 JE DRVSTP ;IF EQUAL
486 FF80:01EF F7 06 08 20 00 18 TEST WORD PTR FAUL1,1800H ;E-STOP, DRIVE LOCKOUT?
487 FF80:01F5 74 01 JZ DRVCNT ;IF OK
488 FF80:01F7 C3 DRVSTP: RET ;ELSE DON'T DRIVE
489 FF80:01F8 32 C0 DRVCNT: XOR AL,AL ;CLEAR ALL DRIVE FLAGS
490 FF80:01FA B9 05 00 MOV CX,OFFSET FLAGST+ENDFLG-DRVATV
491 FF80:01FD BF 6A 20 MOV DI,OFFSET DRVATV
492 FF80:0200 F3 AA REP STOS BYTE PTR DRVATV
493 FF80:0202 C7 06 08 20 00 00 MOV WORD PTR FAUL1,0 ;CLEAR FAULTS
494 FF80:0208 C7 06 0A 20 00 00 MOV WORD PTR FAUL2,0
495 FF80:020E 8B 1E 44 20 MOV BX,COMTMP ;MAKE TEMP COMMAND ACTUAL COMMAND
496 FF80:0212 89 1E 00 20 MOV POSCEC,BX
497 FF80:0216 C7 06 44 20 00 00 MOV WORD PTR COMTMP,0
498 FF80:021C E8 B7 02 CALL DSTOR
499

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;LOCAL SETUP ENTERS HERE
500
501
502 FF80:021F          LOCTST:
503 FF80:021F 80 3E 5C 20 02      CMP     BYTE PTR SECCHC,2      ;SECOND SCREW FAILED TWICE?
504 FF80:0224 74 08              JE     LOCSTP                  ;IF EQUAL
505 FF80:0226 F7 06 08 20 00 18      TEST   WORD PTR FAUL1,1800H   ;E-STOP, DRIVE LOCKOUT?
506 FF80:022C 74 01              JZ     LOCCNT                  ;IF OK
507 FF80:022E C3                          LOCSTP: RET                    ;ELSE DON'T DRIVE
508 FF80:022F 80 3E 0A 20 48      LOCCNT: CMP    FAUL2,48H      ;NORMAL BDS3?
509 FF80:0234 74 01              JZ     DRVINO                  ;IF OK
510 FF80:0236 C3                          RET                             ;ELSE DO NOTHING
511 FF80:0237 8B 1E 04 20      DRVINO: MOV    BX,ERROR        ;GET ERROR
512 FF80:023B C6 06 65 20 00      MOV    BFLAG,0
513 FF80:0240 2E 62 1E D4 06      BOUND  BX,CS:CLSETAB         ;CHECK FOR NEARNESS
514 FF80:0245 F6 06 65 20 01      TEST   BFLAG,1
515 FF80:024A 75 01              JNZ   DRVIN1                  ;IF NOT NEAR
516 FF80:024C C3                          RET                             ;IF NEAR
517 FF80:024D A0 08 20      DRVIN1: MOV    AL,FAUL1       ;GET LIMIT INFO
518 FF80:0250 F6 06 6D 20 01      TEST   DIR,1                  ;TEST DIRECTION
519 FF80:0255 74 05              JZ     DRVIN2                  ;IF POSITIVE
520 FF80:0257 24 06              AND    AL,6                    ;DOWN LIMIT?
521 FF80:0259 74 06              JZ     DRVIN3
522 FF80:025B C3                          RET                             ;IF IN DOWN LIMIT
523 FF80:025C 24 18      DRVIN2: AND    AL,24          ;UP LIMIT?
524 FF80:025E 74 01              JZ     DRVIN3
525 FF80:0260 C3                          RET                             ;IF IN UP LIMIT
526 FF80:0261 A0 6D 20      DRVIN3: MOV    AL,DIR
527 FF80:0264 A2 6E 20      MOV    LDIR,AL
528 FF80:0267 BA 00 00      MOV    DX,0                    ;SET UP FOR DIVIDE
529 FF80:026A A1 04 20      MOV    AX,ERROR                ;GET ERROR
530 FF80:026D F6 06 6E 20 01      TEST   LDIR,1                 ;TEST FOR NEGATIVE
531 FF80:0272 74 02              JZ     DRVIN4                  ;IF POSITIVE
532 FF80:0274 F7 D8      DRVIN4: NEG    AX              ;MAKE ABSOLUTE VALUE
533 FF80:0276 50              PUSH   AX                      ;SAVE ERROR
534 FF80:0277 B9 64 00      MOV    CX,100                  ;DIVIDE BY 100
535 FF80:027A F7 F1      DIV    CX
536 FF80:027C 52              PUSH   DX
537 FF80:027D 50              PUSH   AX
538 FF80:027E 52              PUSH   DX
539 FF80:027F B9 07 00      MOV    CX,7                    ;FIRST BREAK VALUE
540 FF80:0282 F7 E1      MUL    CX
541 FF80:0284 8B D8      MOV    BX,AX                    ;STORE HERE
542 FF80:0286 58              POP    AX                       ;NOW REMAINDER
543 FF80:0287 F7 E1      MUL    CX
544 FF80:0289 B9 64 00      MOV    CX,100                  ;ADJUST
545 FF80:028C F7 F1      DIV    CX
546 FF80:028E 03 D8      ADD    BX,AX
547 FF80:0290 75 03      JNZ   DRVIN5                  ;ZERO?
548 FF80:0292 BB 01 00      MOV    BX,1                    ;MAKE ONE IF ZERO
549 FF80:0295 F6 06 06 20 02      DRVIN5: TEST   SYSTEM,2        ;IN MANUAL?
550 FF80:029A 74 08              JZ     DRVING                   ;IF NOT
551 FF80:029C 83 FB 3C      CMP    BX,60                    ;>60?
552 FF80:029F 72 03      JC     DRVING                   ;IF LESS
553 FF80:02A1 BB 3C 00      MOV    BX,60                    ;SET MAX RAMP
554 FF80:02A4 A1 02 20      DRVING: MOV    AX,POSD
555 FF80:02A7 A3 4D 20      MOV    POSDOD,AX               ;OLD POS = CURRENT
556 FF80:02AA A3 4F 20      MOV    SCRLST,AX               ;500US POSITION

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557 FF80:02AD C7 06 51 20 00 00      MOV    WORD PTR SCRCNT,0      ;SCREW COUNT = 0
558 FF80:02B3 C6 06 57 20 00      MOV    FILOVR,0
559 FF80:02B8 C6 06 56 20 00      MOV    FIL,0
560 FF80:02BD F6 06 6E 20 01      TEST   LDIR,1                ;CHECK DIRECTION
561 FF80:02C2 74 02                JZ     DRVIN7                ;IF POSITIVE
562 FF80:02C4 F7 DB                NEG    BX
563 FF80:02C6 03 C3                DRVIN7: ADD   AX,BX           ;STORE FIRST BREAK POINT
564 FF80:02C8 A3 49 20                MOV    BREAK1,AX
565 FF80:02CB 58                POP    AX
566 FF80:02CC B9 5A 00                MOV    CX,90                 ;NOW SECOND BREAK VALUE
567 FF80:02CF F7 E1                MUL    CX
568 FF80:02D1 8B D8                MOV    BX,AX                 ;STORE HERE
569 FF80:02D3 58                POP    AX                     ;NOW REMAINDER
570 FF80:02D4 F7 E1                MUL    CX
571 FF80:02D6 B9 64 00                MOV    CX,100                ;ADJUST
572 FF80:02D9 F7 F1                DIV    CX
573 FF80:02DB 03 D8                ADD    BX,AX
574 FF80:02DD 58                POP    AX                     ;RESTORE ERROR
575 FF80:02DE F6 06 06 20 02        TEST   SYSTEM,2             ;IN MANUAL?
576 FF80:02E3 74 0C                JZ     DRVIN8                ;IF NOT
577 FF80:02E5 2B C3                SUB    AX,BX                 ;FIND DIFFERENCE
578 FF80:02E7 3D 41 00                CMP    AX,65                 ;>65?
579 FF80:02EA 72 05                JC     DRVIN8                ;IF LESS
580 FF80:02EC 03 D8                ADD    BX,AX                 ;GET ERROR BACK IN BX
581 FF80:02EE 83 EB 41                SUB    BX,65                 ;MAKE BREAK 65 COUNTS LESS
582 FF80:02F1 A1 02 20                DRVIN8: MOV   AX,POSD
583 FF80:02F4 F6 06 6E 20 01        TEST   LDIR,1                ;CHECK DIRECTION
584 FF80:02F9 74 02                JZ     DRVIN9                ;IF POSITIVE
585 FF80:02FB F7 DB                NEG    BX
586 FF80:02FD 03 C3                DRVIN9: ADD   AX,BX           ;SECOND BREAK POINT
587 FF80:02FF A3 4B 20                MOV    BREAK2,AX
588 FF80:0302 C7 06 28 20 00 00      MOV    WORD PTR VEL1,0      ;INITIAL VEL = 0
589 FF80:0308 E8 0D 03                CALL   BRKON                 ;TURN ON BRAKE
590 FF80:030B E5 00                IN     AX,P1PTA              ;GET CURRENT DATA
591 FF80:030D 25 00 F0                AND    AX,0F000H            ;JUST CURRENT STATUS
592 FF80:0310 BB 1C 00                MOV    BX,CONRAM            ;START DRIVE AT 130mV
593 FF80:0313 F6 06 6E 20 01        TEST   LDIR,1                ;NEGATIVE?
594 FF80:0318 75 02                JNZ   DRVINA                ;IF POSITIVE
595 FF80:031A F7 DB                NEG    BX                     ;SET NEGATIVE
596 FF80:031C 81 E3 FF 0F        DRVINA: AND   BX,OFFFH        ;STRIP UNWANTED BITS
597 FF80:0320 0B C3                OR     AX,BX                 ;MERGE
598 FF80:0322 E7 00                OUT    P1PTA,AX             ;SEND IT
599 FF80:0324 BA 96 01                MOV    DX,LTCHDA            ;LATCH IT
600 FF80:0327 EE                OUT    DX,AL
601 FF80:0328 80 CC 10                OR     AH,10H                ;ENABLE DRIVE
602 FF80:032B E7 00                OUT    P1PTA,AX
603 FF80:032D C6 06 48 20 1E        MOV    SPRED,30             ;SET SPEED VALUE
604 FF80:0332 C7 06 6B 20 00 00      MOV    WORD PTR RAMPOS,0    ;SET RAMP UP
605 FF80:0338 BA 66 FF                MOV    DX,T2MODE            ;NOW START TIMER 2
606 FF80:033B B8 01 E0                MOV    AX,0E001H
607 FF80:033E EF                OUT    DX,AX
608 FF80:033F C6 06 6A 20 01        MOV    DRVATV,1             ;SET DRIVE ACTIVE
609 FF80:0344 E5 80                IN     AX,P2PTA              ;GET CURRENT LIGHTS
610 FF80:0346 25 97 FF                AND    AX,OFF97H            ;STRIP IT
611 FF80:0349 F6 06 06 20 02        TEST   SYSTEM,2             ;IN MANUAL?
612 FF80:034E 75 02                JNZ   DRVINB                ;IF MANUAL
613 FF80:0350 0C 08                OR     AL,8                  ;SET CMD LIGHT

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614 FF80:0352 F6 06 6E 20 01      DRVINB: TEST   LDIR,1           ;NEGATIVE?
615 FF80:0357 74 06                JZ    DRVINC     ;IF POSITIVE
616 FF80:0359 0D 20 00                OR    AX,32      ;SET DOWN LIGHT
617 FF80:035C E9 03 00                JMP    DRVIND
618 FF80:035F 0D 40 00      DRVINC: OR    AX,64      ;SET UP LIGHT
619 FF80:0362 E7 80      DRVIND: OUT   P2PTA,AX  ;SEND IT
620 FF80:0364 C6 06 53 20 19      MOV    EXTMR,25   ;INITIALIZE TIMER
621 FF80:0369 C3                RET
622
623 FF80:036A                LOCAL:
624 FF80:036A 80 0E 06 20 02      OR    SYSTEM,2   ;SET MANUAL FLAG
625 FF80:036F F6 06 61 20 01      TEST   MANOVR,1  ;MANUAL OVERRIDE?
626 FF80:0374 74 12                JZ    LOCLB      ;IF NOT
627 FF80:0376 F6 06 6A 20 01      TEST   DRVATV,1  ;DRIVE ACTIVE?
628 FF80:037B 75 03                JNZ   LOCLA      ;IF NOT OFF
629 FF80:037D E9 27 FD                JMP    BOSS
630 FF80:0380 C6 06 69 20 01      LOCLA: MOV   DRVOFF,1 ;SHUT DOWN
631 FF80:0385 E9 E2 FF                JMP    LOCAL
632 FF80:0388 BC 00 21      LOCLB: MOV   SP,STCK ;SET STACK
633 FF80:038B F6 06 08 20 01      TEST   FAUL1,1   ;APEX OK?
634 FF80:0390 74 03                JZ    LC1        ;IF APEX OK
635 FF80:0392 E9 C9 FD                JMP    RSCMD     ;IF APEX BROKE
636 FF80:0395 F6 06 6A 20 01      LC1:  TEST   DRVATV,1 ;DRIVE ACTIVE?
637 FF80:039A 75 3A                JNZ   LC1B      ;IF ACTIVE
638 FF80:039C E8 37 01      CALL   DSTOR     ;GET DATA
639 FF80:039F BA 95 01      MOV    DX,MODESW ;GET MODE SWITCH
640 FF80:03A2 EC                IN    AL,DX     ;GET INFO
641 FF80:03A3 F6 D0                NOT   AL         ;INVERT AL
642 FF80:03A5 3C FF                CMP   AL,OFFH   ;A = OFFH?
643 FF80:03A7 C6 06 59 20 00      MOV    SCWIGN,0  ;ASSUME ON
644 FF80:03AC 75 05                JNZ   LOCLC     ;IF ON
645 FF80:03AE C6 06 59 20 01      MOV    SCWIGN,1  ;ELSE TURN OFF
646 FF80:03B3 B4 00      LOCLC: MOV   AH,0   ;SET AH=0
647 FF80:03B5 C6 06 65 20 00      MOV    BFLAG,0  ;SET BFLAG=0
648 FF80:03BA 2E 62 06 D8 06      BOUND AX,CS:MANRG ;MODE SWITCH IN RANGE?
649 FF80:03BF F6 06 65 20 01      TEST   BFLAG,1  ;OUT OF BOUNDS?
650 FF80:03C4 74 03                JZ    LC1A      ;IF IN RANGE
651 FF80:03C6 B8 00 00      MOV    AX,0     ;PROCESS=NORMAL
652 FF80:03C9 03 C0      LC1A: ADD   AX,AX   ;AX*2
653 FF80:03CB 8B D8      MOV    BX,AX    ;BX = INDEX
654 FF80:03CD 2E 8B 87 DC 06      MOV    AX,CS:MANTBL[BX] ;GET ROUTINE
655 FF80:03D2 FF D0      CALL   AX       ;DO ROUTINE
656 FF80:03D4 EB 07                JMP    SHORT LC1C
657 FF80:03D6 FE 0E 53 20      LC1B: DEC   BYTE PTR EXTMR ;DEC SAFETY TIMER
658 FF80:03DA 75 01                JNZ   LC1C      ;IF OK
659 FF80:03DC CC                INT   3         ;DO TIMER THIS WAY
660 FF80:03DD E5 80      LC1C: IN    AX,P2PTA ;GET SWITCH STATUS
661 FF80:03DF F6 C4 80      TEST   AH,128   ;DRIVE UP?
662 FF80:03E2 75 03                JNZ   LC2       ;NOT DRIVE UP
663 FF80:03E4 E9 2C 00                JMP    LUP       ;DRIVE UP
664 FF80:03E7 F6 C4 40      LC2:  TEST   AH,64   ;DRIVE DOWN
665 FF80:03EA 75 03                JNZ   LC3       ;NOT DRIVE DOWN
666 FF80:03EC E9 59 00                JMP    LDWN      ;DRIVE DOWN
667 FF80:03EF F6 06 6A 20 01      LC3:  TEST   DRVATV,1 ;DRIVE ACTIVE?
668 FF80:03F4 74 08                JZ    LC4        ;IF NOT ACTIVE
669 FF80:03F6 C6 06 69 20 01      MOV    DRVOFF,1 ;SET DRIVE OFF
670 FF80:03FB E9 6C FF                JMP    LOCAL

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671 FF80:03FE F6 C4 20 LC4: TEST AH,32 ;STILL IN LOCAL
672 FF80:0401 74 03 JZ LC5 ;IF IN LOCAL
673 FF80:0403 E9 58 FD JMP RSCMD ;LEAVE IF NOT IN LOCAL
674 FF80:0406 32 C0 LC5: XOR AL,AL ;CLEAR ALL DRIVE FLAGS
675 FF80:0408 B9 05 00 MOV CX,OFFSET FLAGST+ENDFLG-DRVATV
676 FF80:040B BF 6A 20 MOV DI,OFFSET DRVATV
677 FF80:040E F3 AA REP STOS BYTE PTR DRVATV
678 FF80:0410 E9 57 FF JMP LOCAL
679
680 FF80:0413 LUP:
681 FF80:0413 F6 06 6A 20 01 TEST DRVATV,1 ;ALREADY RUNNING?
682 FF80:0418 74 0F JZ LUP1 ;IF NOT MOVING
683 FF80:041A F6 06 6A 20 02 TEST DRVATV,2 ;MOVING UP?
684 FF80:041F 75 05 JNZ LUP2 ;ALREADY GOING UP
685 FF80:0421 C6 06 69 20 01 MOV DRVOFF,1 ;KILL DRIVE
686 FF80:0426 E9 41 FF JMP LOCAL
687 FF80:0429 C7 06 00 20 00 F2 LUP1: MOV WORD PTR POSCEC,HIGH ;SET UPPER BOUNDARY
688 FF80:042F E8 A4 00 CALL DSTOR ;GET DATA
689 FF80:0432 A1 02 20 MOV AX,POSD ;GET CURRENT POSITION
690 FF80:0435 3D 00 F2 CMP AX,HIGH ;< DRIVE LIMITS
691 FF80:0438 72 03 JC LUP3 ;IF LESS
692 FF80:043A E9 2D FF JMP LOCAL
693 FF80:043D E8 DF FD LUP3: CALL LOCTST ;SET UP DRIVE PARAMETERS
694 FF80:0440 80 0E 6A 20 02 OR DRVATV,2
695 FF80:0445 E9 22 FF JMP LOCAL
696
697 FF80:0448 LDWN:
698 FF80:0448 F6 06 6A 20 01 TEST DRVATV,1 ;ALREADY RUNNING?
699 FF80:044D 74 0F JZ LDWN1 ;IF NOT MOVING
700 FF80:044F F6 06 6A 20 04 TEST DRVATV,4 ;MOVING DOWN?
701 FF80:0454 75 05 JNZ LDWN2 ;ALREADY GOING DOWN
702 FF80:0456 C6 06 69 20 01 MOV DRVOFF,1 ;KILL DRIVE
703 FF80:045B E9 0C FF LDWN2: JMP LOCAL
704 FF80:045E C7 06 00 20 00 0A LDWN1: MOV WORD PTR POSCEC,LOW ;SET LOWER BOUNDARY
705 FF80:0464 E8 6F 00 CALL DSTOR ;GET DATA
706 FF80:0467 A1 02 20 MOV AX,POSD ;GET CURRENT POSITION
707 FF80:046A 3D 00 0A CMP AX,LOW ;> DRIVE LIMITS
708 FF80:046D 73 03 JNC LDWN3 ;IF LESS
709 FF80:046F E9 F8 FE JMP LOCAL
710 FF80:0472 E8 AA FD LDWN3: CALL LOCTST ;SET UP DRIVE PARAMETERS
711 FF80:0475 80 0E 6A 20 04 OR DRVATV,4 ;SET DOWN FLAG
712 FF80:047A E9 ED FE JMP LOCAL
713
714 FF80:047D NORMIT:
715 FF80:047D E8 CA 01 CALL BRKOFF ;TURN OFF BRAKE
716 FF80:0480 E9 06 00 JMP ZERDA ;ZERO D/A
717
718 FF80:0483 NEGDA:
719 FF80:0483 BB 00 08 MOV BX,800H ;SET -10V
720 FF80:0486 E9 09 00 JMP SETDA
721
722 FF80:0489 ZERDA:
723 FF80:0489 BB 00 00 MOV BX,0 ;SET 0V
724 FF80:048C E9 03 00 JMP SETDA
725
726 FF80:048F POSDA:
727 FF80:048F BB FF 07 MOV BX,7FFH ;SET +10V

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728 FF80:0492          SETDA:
729 FF80:0492 E5 00          IN      AX,P1PTA          ;GET CURRENT STATUS
730 FF80:0494 25 00 F0      AND     AX,0F000H        ;JUST STATUS
731 FF80:0497 0B C3          OR      AX,BX            ;MERGE
732 FF80:0499 E7 00          OUT     P1PTA,AX         ;SEND IT
733 FF80:049B BA 96 01      MOV     DX,LTCHDA        ;NOW LATCH IT IN
734 FF80:049E EE            OUT     DX,AL
735 FF80:049F C3          RET
736
737 FF80:04A0 E5 80          NRGAD: IN      AX,P2PTA          ;GET PORT 2
738 FF80:04A2 25 F8 FF      AND     AX,0FFF8H        ;STRIP OLD A/D REQ
739 FF80:04A5 0D 03 00      OR      AX,3              ;REQUEST -10V
740 FF80:04A8 EB 12          JMP     SHORT READAD
741
742 FF80:04AA E5 80          ZERAD: IN      AX,P2PTA          ;GET PORT 2
743 FF80:04AC 25 F8 FF      AND     AX,0FFF8H        ;STRIP OLD A/D REQ
744 FF80:04AF 0D 04 00      OR      AX,4              ;REQUEST 0V
745 FF80:04B2 EB 08          JMP     SHORT READAD
746
747 FF80:04B4 E5 80          POSAD: IN      AX,P2PTA          ;GET PORT 2
748 FF80:04B6 25 F8 FF      AND     AX,0FFF8H        ;STRIP OLD A/D REQ
749 FF80:04B9 0D 02 00      OR      AX,2              ;REQUEST +10V
750
751 FF80:04BC C6 06 64 20 00      READAD: MOV     ADFLAG,0          ;RESET FLAG
752 FF80:04C1 E7 80          OUT     P2PTA,AX
753 FF80:04C3 BA 94 01      MOV     DX,STCNV
754 FF80:04C6 EE            OUT     DX,AL
755 FF80:04C7 FB            STI
756 FF80:04C8 F6 06 64 20 01      READA1: TEST    ADFLAG,1          ;ANALOG READY?
757 FF80:04CD 74 F9          JZ      READA1            ;IF NOT
758 FF80:04CF A1 46 20      MOV     AX,ADVAL          ;GET CURRENT VELOCITY
759 FF80:04D2 A3 28 20      MOV     VBL1,AX           ;SAVE VELOCITY
760 FF80:04D5 C3          RET
761
762 FF80:04D6          DSTOR:
763 FF80:04D6 32 C0          XOR     AL,AL
764 FF80:04D8 BA 80 01      MOV     DX,APEXRQ        ;GET APEX DATA
765 FF80:04DB EE            OUT     DX,AL
766 FF80:04DC 83 C2 02      ADD     DX,2              ;POINT TO APEXRS
767 FF80:04DF B9 0C 00      MOV     CX,12            ;12 TRIALS
768 FF80:04E2          DSTOR1:
769 FF80:04E2 EC            IN      AL,DX            ;SEE IF DATA READY
770 FF80:04E3 24 C0          AND     AL,0COH          ;STRIP DATA
771 FF80:04E5 3C 80          CMP     AL,80H           ;LOOK FOR PATTERN
772 FF80:04E7 74 0A          JZ      DSTOR2            ;IF READY
773 FF80:04E9 E2 F7          LOOP   DSTOR1            ;IF NOT
774 FF80:04EB 80 0E 08 20 01      OR      FAUL1,1          ;SET APEX DEAD
775 FF80:04F0 E9 C9 00      JMP     DSTOR6            ;SKIP APEX GATHERING
776 FF80:04F3          DSTOR2:
777 FF80:04F3 80 26 08 20 FE      AND     FAUL1,0FEH        ;SET APEX OK
778 FF80:04F8 4A          DEC     DX
779 FF80:04F9 ED            IN      AX,DX            ;GET POSITION
780 FF80:04FA 8B D8          MOV     BX,AX            ;PUT INTO BX
781 FF80:04FC C1 E3 02      SHL     BX,2              ;GET RID OF RESPONSE BITS
782 FF80:04FF 83 C2 02      ADD     DX,2              ;POINT TO NEXT SECTION
783 FF80:0502 ED            IN      AX,DX            ;GET NEXT INFO
784 FF80:0503 C0 C4 02      ROL     AH,2              ;GET FINAL POSITION

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785 FF80:0506 80 E4 03 AND AH,03 ;PREPARE TO MERGE
786 FF80:0509 0A DC OR BL,AH ;MERGE BITS
787 FF80:050B 89 1E 02 20 MOV POSD,BX ;SAVE POSITION
788 FF80:050F A1 00 20 MOV AX,POSCCK
789 FF80:0512 2B C3 SUB AX,BX ;GET ERROR
790 FF80:0514 C6 06 6D 20 00 MOV DIR,0 ;ASSUME POSITIVE
791 FF80:0519 73 05 JNC DSTO2A ;IF POSITIVE
792 FF80:051B C6 06 6D 20 01 MOV DIR,1 ;SET NEGATIVE
793 FF80:0520
DSTO2A:
794 FF80:0520 A3 04 20 MOV ERROR,AX ;STORE IT HERE
795 FF80:0523 ED IN AX,DX ;GET VELOCITY
796 FF80:0524 8A F8 MOV BH,AL ;SAVE PARTIAL DATA
797 FF80:0526 C1 E8 02 SHR AX,2
798 FF80:0529 25 FF 0F AND AX,OFFFH ;STRIP UPPER NYBBLE
799 FF80:052C A3 14 20 MOV VEL,AX ;SAVE VELOCITY
800 FF80:052F 83 C2 02 ADD DX,2 ;POINT TO ANALOGS
801 FF80:0532 ED IN AX,DX ;GET DATA
802 FF80:0533 C1 E8 02 SHR AX,2 ;SHIFT INTO POSITION
803 FF80:0536 C0 CF 02 ROR BH,2 ;SHIFT PARTIAL
804 FF80:0539 81 E3 00 C0 AND BX,0C000H ;PREPAR TO MERGE
805 FF80:053D 0B D8 OR BX,AX ;SAVE FOR FURTHER PROCESSING
806 FF80:053F 83 C2 02 ADD DX,2 ;POINT TO DISCRETE INFO
807 FF80:0542 EC IN AL,DX ;GET DATA
808 FF80:0543 24 3F AND AL,3FH ;ONLY DISCRETES
809 FF80:0545 80 26 06 20 FB AND SYSTEM,OFBH ;ASSUME BRAKE NOT RELEASED
810 FF80:054A A8 10 TEST AL,16 ;SEE IF BRAKE IS RELEASED
811 FF80:054C 74 05 JZ DSTOR3
812 FF80:054E 80 0E 06 20 04 OR SYSTEM,4 ;SET BRAKE RELEASE
813 FF80:0553 A2 58 20 DSTOR3: MOV PHASEA,AL ;LOAD CURRENT SCREW LEVEL
814 FF80:0556 80 26 58 20 20 AND PHASEA,32 ;MASK IT
815 FF80:055B 24 0F AND AL,0FH ;SET LIMIT INFO
816 FF80:055D D0 E0 SHL AL,1
817 FF80:055F 80 26 08 20 E1 AND FAUL1,0E1H ;CLEAR LIMIT FAULTS
818 FF80:0564 08 06 08 20 OR FAUL1,AL
819 FF80:0568 8B D3 MOV DX,BX ;SAVE TABLE
820 FF80:056A 81 CB 0F 00 OR BX,0FH ;MAKE IT LIKE STANDARD ANALOG
821 FF80:056E 81 E2 0F 00 AND DX,0000FH ;DEVELOP TABLE ADDRESS
822 FF80:0572 01 16 5A 20 ADD RANDOM,DX ;DEVELOP RANDOM NUMBER
823 FF80:0576 81 26 5A 20 3F 00 AND WORD PTR RANDOM,3FH
824 FF80:057C FE 06 5A 20 INC RANDOM
825 FF80:0580 87 D3 XCHG DX,BX
826 FF80:0582 83 FB 03 CMP BX,3
827 FF80:0585 7E 35 JLE DSTOR6
828 FF80:0587 83 EB 04 SUB BX,4
829 FF80:058A 8B CB MOV CX,BX ;SAVE ANALOG POINTER IN C
830 FF80:058C 83 C1 01 ADD CX,1 ;PLUS 1 FOR BIT PLACEMENT
831 FF80:058F D1 E3 SHL BX,1
832 FF80:0591 89 97 0E 20 MOV ANADT[BX],DX ;SAVE ANALOG DATA
833 FF80:0595 D1 E3 SHL BX,1 ;NOW FOR BOUND CHECK
834 FF80:0597 C6 06 65 20 00 MOV BFLAG,0 ;BOUND FLAG = 0K
835 FF80:059C 2E 62 97 A4 06 BOUND DX,CS:ANATAB[BX] ;CHECK ANALOG BOUNDS
836 FF80:05A1 B8 00 80 MOV AX,8000H ;ASSUME FAIL
837 FF80:05A4
DSTOR4:
838 FF80:05A4 D1 C0 ROL AX,1 ;PLACE FLAG BIT
839 FF80:05A6 E2 FC LOOP DSTOR4
840 FF80:05A8 F6 06 65 20 01 TEST BFLAG,1 ;BOUND OK?
841 FF80:05AD 75 09 JNZ DSTOR5 ;IF BAD

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842 FF80:05AF F7 D0 NOT AX ;SET OK
843 FF80:05B1 21 06 0C 20 AND ANAFL,AX ;STRIP BAD ANALOG FLAG
844 FF80:05B5 E9 04 00 JMP DSTOR6
845 FF80:05B8 DSTOR5:
846 FF80:05B8 09 06 0C 20 OR ANAFL,AX ;SET BAD ANALOG FLAG
847 FF80:05BC DSTOR6:
848 FF80:05BC E5 80 IN AX,P2PTA ;GET LED STATUS
849 FF80:05BE 25 6F FE AND AX,0FE6FH ;KILL ALL LIGHTS
850 FF80:05C1 F6 06 06 20 04 TEST SYSTEM,4 ;IS BRAKE RELEASED?
851 FF80:05C6 74 03 JZ DSTOR7 ;IF NOT
852 FF80:05C8 0D 10 00 OR AX,16 ;SET BRAKE LED ON
853 FF80:05CB DSTOR7:
854 FF80:05CB 8B 1E 08 20 MOV BX,FAUL1 ;NOW DO DOWN LIMIT
855 FF80:05CF 81 E3 06 00 AND BX,6
856 FF80:05D3 74 03 JZ DSTOR8 ;IF SET LIGHT LED
857 FF80:05D5 0D 80 00 OR AX,128 ;SET DOWN LIMIT LED ON
858 FF80:05D8 DSTOR8:
859 FF80:05D8 8B 1E 08 20 MOV BX,FAUL1 ;NOW DO UP LIMIT
860 FF80:05DC 81 E3 18 00 AND BX,24
861 FF80:05E0 74 03 JZ DSTOR9 ;IF SET LIGHT LED
862 FF80:05E2 0D 00 01 OR AX,256 ;SET UP LIMIT LED ON
863 FF80:05E5 DSTOR9:
864 FF80:05E5 E7 80 OUT P2PTA,AX
865 FF80:05E7 BA 97 01 MOV DX,BDR1L1 ;GET 100 STUFF
866 FF80:05EA EC IN AL,DX
867 FF80:05EB F6 D0 NOT AL
868 FF80:05ED A2 0A 20 MOV FAUL2,AL ;SAVE IN FAUL2
869 FF80:05F0 81 26 08 20 FF E7 AND WORD PTR FAUL1,0E7FFH ;STRIP OUT FAULTS
870 FF80:05F6 E5 80 IN AX,P2PTA ;GET E-STOP, DRIVE LOCKOUT
871 FF80:05F8 25 00 18 AND AX,1800H ;STRIP JUNK
872 FF80:05FB 80 F4 10 XOR AH,10H ;INVERT DRIVE LOCKOUT
873 FF80:05FE 09 06 08 20 OR WORD PTR FAUL1,AX ;MERGE
874 FF80:0602 C3 RET
875
876 FF80:0603 BDS3RS:
877 FF80:0603 E5 00 IN AX,P1PTA ;GET CONTROL PORT
878 FF80:0605 0D 00 20 OR AX,2000H ;DO RESET
879 FF80:0608 E7 00 OUT P1PTA,AX
880 FF80:060A B9 01 00 MOV CX,1 ;DELAY 1 SEC
881 FF80:060D E8 63 00 CALL DELAY
882 FF80:0610 E5 00 IN AX,P1PTA ;GET CONTROL PORT AGAIN
883 FF80:0612 25 FF DF AND AX,0DFFFH ;KILL RESET
884 FF80:0615 E7 00 OUT P1PTA,AX
885 FF80:0617 C3 RET
886
887 FF80:0618 BRKON:
888 FF80:0618 E5 00 IN AX,P1PTA ;GET CONTROL PORT
889 FF80:061A 0D 00 40 OR AX,4000H ;RELEASE THE BRAKE
890 FF80:061D E7 00 OUT P1PTA,AX ;DO IT
891 FF80:061F C6 06 67 20 00 MOV TFLAG1,0 ;SET TIMER FLAG = 0K
892 FF80:0624 E8 5E 00 CALL SEC1 ;1 SEC
893 FF80:0627 E8 AC FE BRKON1: CALL DSTOR ;GET UPDATE
894 FF80:062A F6 06 06 20 04 TEST SYSTEM,4 ;BRAKE FREE?
895 FF80:062F 75 10 JNZ BRKON2 ;IF FREE CONTINUE
896 FF80:0631 F6 06 67 20 01 TEST TFLAG1,1 ;TIMED OUT?
897 FF80:0636 74 EF JZ BRKON1 ;IF NOT
898 FF80:0638 81 0E 08 20 00 01 OR WORD PTR FAUL1,256 ;SET BRAKE FAULT

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899 FF80:063E E9 1D FB          JMP      RSCMD          ;RESET COMMAND
900 FF80:0641                    BRKON2:
901 FF80:0641 81 26 08 20 FF FE          AND      WORD PTR FAUL1,0FEFFH ;CLEAR BRAKE FAULT
902 FF80:0647 E9 4A 00          JMP      THROFF         ;STOP TIMER
903
904 FF80:064A                    BRKOFF:
905 FF80:064A E5 00          IN       AX,P1PTA       ;GET CONTROL PORT
906 FF80:064C 25 FF BF          AND      AX,0BFFFH      ;ENGAGE THE BRAKE
907 FF80:064F E7 00          OUT      P1PTA,AX       ;DO IT
908 FF80:0651 C6 06 67 20 00          MOV      TFLAG1,0       ;SET TIMER FLAG = OK
909 FF80:0656 E8 2C 00          CALL    SEC1            ;1 SEC
910 FF80:0659 E8 7A FE          BRKOF1: CALL    DSTOR       ;GET UPDATE
911 FF80:065C F6 06 06 20 04          TEST    SYSTEM,4        ;BRAKE FREE?
912 FF80:0661 74 31          JZ       THROFF         ;IF FREE CONTINUE
913 FF80:0663 F6 06 67 20 01          TEST    TFLAG1,1       ;TIMED OUT?
914 FF80:0668 74 EF          JZ       BRKOF1        ;IF NOT
915 FF80:066A 81 0E 08 20 00 01          OR      WORD PTR FAUL1,256 ;SET BRAKE FAULT
916 FF80:0670 E9 EB FA          JMP      RSCMD         ;RESET COMMAND
917
918 FF80:0673 E8 0F 00          DELAY:  CALL    SEC1     ;START TIMER FOR 1 SECOND
919 FF80:0676 C6 06 67 20 00          DELA1:  MOV      TFLAG1,0   ;RESET TFLAG
920 FF80:067B F6 06 67 20 01          DELA2:  TEST    TFLAG1,1   ;TIME OUT?
921 FF80:0680 74 F9          JZ       DELA2         ;WAIT
922 FF80:0682 E2 F2          LOOP    DELA1         ;UNTIL TIME HAS PASSED
923 FF80:0684 C3          RET
924
925 FF80:0685                    SEC1:
926 FF80:0685 BA 5E FF          MOV      DX,T1MODE      ;ENABLE TIMER1 FIRST
927 FF80:0688 B8 09 E0          MOV      AX,0E009H
928 FF80:068B EF          OUT      DX,AX
929 FF80:068C BA 66 FF          MOV      DX,T2MODE      ;NOW TIMER2
930 FF80:068F B8 01 C0          MOV      AX,0C001H
931 FF80:0692 EF          OUT      DX,AX
932 FF80:0693 C3          RET
933
934 FF80:0694                    THROFF:
935 FF80:0694 BE 00 00          MOV      SI,OFFSET TSETUP ;POINT TO TABLE
936 FF80:0697 BA 50 FF          MOV      DX,TOCOUT       ;POINT TO SOURCE POINTER
937 FF80:069A B9 0C 00          MOV      CX,12
938 FF80:069D 6F          TSET:   OUTSW
939 FF80:069E 83 C2 02          ADD      DX,2
940 FF80:06A1 E2 FA          LOOP    TSET
941 FF80:06A3 C3          RET
942 FF80:06A4
943
944 ;          TABLES FOR BOUND CHECKS
945
946
947 FF80:06A4 0080          ANATAB: .WORD 8000H      ;GND1
948 FF80:06A6 FF7F          .WORD 7FFFH
949 FF80:06A8 0080          .WORD 8000H      ;GND2
950 FF80:06AA FF7F          .WORD 7FFFH
951 FF80:06AC 0080          .WORD 8000H      ;GND3
952 FF80:06AE FF7F          .WORD 7FFFH
953 FF80:06B0 0080          .WORD 8000H      ;FOCUS VELOCITY
954 FF80:06B2 FF7F          .WORD 7FFFH
955 FF80:06B4 0080          .WORD 8000H      ;+15V/2

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956 FF80:06B6 FF7F .WORD 7FFFH
957 FF80:06B8 0080 .WORD 8000H ; -15V/2
958 FF80:06BA FF7F .WORD 7FFFH
959 FF80:06BC 0080 .WORD 8000H ; +5V
960 FF80:06BE FF7F .WORD 7FFFH
961 FF80:06C0 0080 .WORD 8000H ; +10V
962 FF80:06C2 FF7F .WORD 7FFFH
963 FF80:06C4 0080 .WORD 8000H ; GND
964 FF80:06C6 FF7F .WORD 7FFFH
965 FF80:06C8 0080 .WORD 8000H ; -10V
966 FF80:06CA FF7F .WORD 7FFFH
967 FF80:06CC 0080 .WORD 8000H ; MOUNT TEMP 2
968 FF80:06CE FF7F .WORD 7FFFH
969 FF80:06D0 0080 .WORD 8000H ; BIN TEMP
970 FF80:06D2 FF7F .WORD 7FFFH
971
972 FF80:06D4 CLSXTAB:
973 FF80:06D4 F4FF .WORD 0FFF4H ; 12 COUNTS BEFORE WE MOVE
974 FF80:06D6 0C00 .WORD 0000CH
975
976 FF80:06D8 MANRG:
977 FF80:06D8 0000 .WORD 0 ; MODES 0 - 4 ACTIVE
978 FF80:06DA 0700 .WORD 7
979
980 ; MODE SWITCH ENTRY CONTROL
981
982 FF80:06DC MANTBL:
983 FF80:06DC 7D04 .WORD NORMIT
984 FF80:06DE 1806 .WORD BRKON
985 FF80:06E0 8304 .WORD NEGDA
986 FF80:06E2 8904 .WORD ZERDA
987 FF80:06E4 8F04 .WORD POSDA
988 FF80:06E6 A004 .WORD NEGAD
989 FF80:06E8 AA04 .WORD ZERAD
990 FF80:06EA B404 .WORD POSAD
991
992
993 FF80:07F0 ORG 07F0H
994
995 ; THIS AREA IS RESERVED FOR RESET PARAMETERS. CANNOT BE LARGER THEN 16 BYTES
996
997 FF80:07F0 BA A0 FF MOV DX,UMCS ; MAKE UPPER MEMORY 2K BLOCK
998 FF80:07F3 B8 BD FF MOV AX,UMBS
999 FF80:07F6 EF OUT DX,AX
1000 FF80:07F7 EA 00 00 80 FF JMP FAR INITIAL ; ENTER INTO LOWER EPROM SECTION
1001
1002 FF80:07FC END

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Lines Assembled : 1002

Assembly Errors : 0


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44      0000:FF3A      INT1CR: .EQUAL  OFF3AH      ;INT 1 CONTROL REGISTRAR
45      0000:FF3C      INT2CR: .EQUAL  OFF3CH      ;INT 2 CONTROL REGISTRAR
46      0000:FF3E      INT3CR: .EQUAL  OFF3EH      ;INT 3 CONTROL REGISTRAR
47
48
49      ;      80188 TIMER CONTROL REGISTRARS
50
51      0000:FF50      TOCOUT: .EQUAL  OFF50H      ;TIMER 0 COUNT REGISTRAR
52      0000:FF52      TOMAXA: .EQUAL  OFF52H      ;TIMER 0 MAXIMUM COUNT A REGISTRAR
53      0000:FF54      TOMAXB: .EQUAL  OFF54H      ;TIMER 0 MAXIMUM COUNT B REGISTRAR
54      0000:FF56      TOMODE: .EQUAL  OFF56H      ;TIMER 0 MODE REGISTRAR
55      0000:FF58      T1COUT: .EQUAL  OFF58H      ;TIMER 1 COUNT REGISTRAR
56      0000:FF5A      T1MAXA: .EQUAL  OFF5AH      ;TIMER 1 MAXIMUM COUNT A REGISTRAR
57      0000:FF5C      T1MAXB: .EQUAL  OFF5CH      ;TIMER 1 MAXIMUM COUNT B REGISTRAR
58      0000:FF5E      T1MODE: .EQUAL  OFF5EH      ;TIMER 1 MODE REGISTRAR
59      0000:FF60      T2COUT: .EQUAL  OFF60H      ;TIMER 2 COUNT REGISTRAR
60      0000:FF62      T2MAXA: .EQUAL  OFF62H      ;TIMER 2 MAXIMUM COUNT A REGISTRAR
61      0000:FF66      T2MODE: .EQUAL  OFF66H      ;TIMER 2 MODE REGISTRAR
62
63
64      ;      80188 CHIP SELECT CONTROL REGISTRARS
65
66      0000:FFA0      UMCS:   .EQUAL  OFFA0H      ;80188 INTERNAL UPPER MEMORY CHIP
67      ;SELECT CONTROL BLOCK REGISTRAR
68      0000:FFA2      LMCS:   .EQUAL  OFFA2H      ;80188 INTERNAL LOWER MEMORY CHIP
69      ;SELECT CONTROL BLOCK REGISTRAR
70      0000:FFA4      PACS:   .EQUAL  OFFA4H      ;80188 INTERNAL PERIPHERAL CHIP
71      ;SELECT CONTROL BLOCK REGISTRAR
72      0000:FFA6      MMCS:   .EQUAL  OFFA6H      ;80188 INTERNAL MIDDLE MEMORY
73      ;START ADDRESS REGISTRAR
74      0000:FFA8      MPSC:   .EQUAL  OFFA8H      ;80188 INTERNAL MIDDLE MEMORY CHIP
75      ;SELECT CONTROL BLOCK REGISTRAR
76
77
78      ;      80188 DMA CHANNEL CONTROL REGISTRARS
79
80      0000:FFC0      DOSPL:  .EQUAL  OFFC0H      ;DMA 0 SOURCE POINTER LSB REGISTRAR
81      0000:FFC2      DOSPM:  .EQUAL  OFFC2H      ;DMA 0 SOURCE POINTER MSB REGISTRAR
82      0000:FFC4      DODPL:  .EQUAL  OFFC4H      ;DMA 0 DESTINATION POINTER LSB REGISTRAR
83      0000:FFC6      DODPM:  .EQUAL  OFFC6H      ;DMA 0 DESTINATION POINTER MSB REGISTRAR
84      0000:FFC8      DOTC:   .EQUAL  OFFC8H      ;DMA 0 TRANSFER COUNT REGISTRAR
85      0000:FFCA      DOMODE: .EQUAL  OFFCAH      ;DMA 0 MODE REGISTRAR
86      0000:FFD0      D1SPL:  .EQUAL  OFFD0H      ;DMA 1 SOURCE POINTER LSB REGISTRAR
87      0000:FFD2      D1SPM:  .EQUAL  OFFD2H      ;DMA 1 SOURCE POINTER MSB REGISTRAR
88      0000:FFD4      D1DPL:  .EQUAL  OFFD4H      ;DMA 1 DESTINATION POINTER LSB REGISTRAR
89      0000:FFD6      D1DPM:  .EQUAL  OFFD6H      ;DMA 1 DESTINATION POINTER MSB REGISTRAR
90      0000:FFD8      D1TC:   .EQUAL  OFFD8H      ;DMA 1 TRANSFER COUNT REGISTRAR
91      0000:FFDA      D1MODE: .EQUAL  OFFDAH      ;DMA 1 MODE REGISTRAR
92
93
94      ;      80188 INTERNAL I/O RELOCATION REGISTRAR
95
96      0000:FFFE      RELOC:  .EQUAL  OFFFEH      ;I/O RELOCATION REGISTRAR
97
98
99      ;      80188 INITIAL VALUES FOR INTERNAL REGISTRARS
100

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101      0000:007D      LMBS: .EQUAL 007DH      ;LOWER MEMORY BLOCK SIZE = 2K
102      0000:81BD      MMBS: .EQUAL 81BDH      ;MIDDLE MEMORY BLOCK SIZE = 8K
103      0000:03FD      MMST: .EQUAL 03FDH      ;MIDDLE MEMORY START POSITION = 8K
104      0000:003D      PST:  .EQUAL 003DH      ;PERIPHERAL START ADDRESS = 0
105      0000:FFBD      UMBS: .EQUAL 0FFBDH     ;UPPER MEMORY BLOCK SIZE = 2K
106
107
108
109      ;      EXTERNAL PORTS FOR CONTROLLING THE ROTATION AXIS
110
111      0000:0000      P1PTA: .EQUAL 0      ;PROM 1 PORT A
112      0000:0001      P1PTB: .EQUAL 1      ;PROM 1 PORT B
113      0000:0002      P1PTAD: .EQUAL 2      ;PROM 1 PORT A DIRECTION
114      0000:0003      P1PTBD: .EQUAL 3      ;PROM 1 PORT B DIRECTION
115      0000:0080      P2PTA: .EQUAL 128     ;PROM 2 PORT A
116      0000:0081      P2PTB: .EQUAL 129     ;PROM 2 PORT B
117      0000:0082      P2PTAD: .EQUAL 130    ;PROM 2 PORT A DIRECTION
118      0000:0083      P2PTBD: .EQUAL 131    ;PROM 2 PORT B DIRECTION
119      0000:0100      RAMTC: .EQUAL 256     ;RAM TIMER AND CONTROL
120      0000:0101      RAMPTA: .EQUAL 257    ;RAM PORT A
121      0000:0102      RAMPTB: .EQUAL 258    ;RAM PORT B
122      0000:0103      RAMPTC: .EQUAL 259    ;RAM PORT C
123      0000:0104      RAMTLO: .EQUAL 260    ;RAM TIMER LOW
124      0000:0105      RAMTHI: .EQUAL 261    ;RAM TIMER HIGH
125      0000:0180      APEXREQ: .EQUAL 384   ;APEX REQ
126      0000:0182      APEXRS: .EQUAL 386   ;APEX RESPONSE
127      0000:0182      POSM: .EQUAL 386     ;POSITION MSB
128      0000:0181      POSL: .EQUAL 385     ;POSITION LSB
129      0000:0184      VELM: .EQUAL 388     ;VELOCITY MSB
130      0000:0183      VELL: .EQUAL 387     ;VELOCITY LSB
131      0000:0186      ANAH: .EQUAL 390     ;ANALOGS MSB
132      0000:0185      ANAL: .EQUAL 389     ;ANALOGS LSB
133      0000:0187      DISCR: .EQUAL 391    ;FOC DISCRETES
134      0000:018B      RELADD: .EQUAL 395    ;GET RELATIVE ADDRESS
135      0000:018C      COMML: .EQUAL 396    ;CONTROL VALUE LSB
136      0000:018D      COMMM: .EQUAL 397    ;CONTROL VALUE MSB
137      0000:018E      DEVACK: .EQUAL 398   ;DEVICE ACKNOWLEDGE
138      0000:018F      MONL: .EQUAL 399     ;MONITOR DATA MSB
139      0000:0190      MONM: .EQUAL 400     ;MONITOR DATA LSB
140      0000:0191      ADL: .EQUAL 401      ;READ A/D LSB
141      0000:0192      ADH: .EQUAL 402      ;READ A/D MSB
142      0000:0193      SEMCT: .EQUAL 403    ;SELECT MOTOR CURRENT/TORQUE
143      0000:0194      STCNV: .EQUAL 404    ;START A/D CONVERT
144      0000:0195      MODESW: .EQUAL 405   ;READ MODE SWITCH
145      0000:0196      LTCHDA: .EQUAL 406   ;LATCH DRIVE D/A
146      0000:0197      BDERL1: .EQUAL 407   ;BDS3 ERROR LSB #1
147      0000:0198      BDERM1: .EQUAL 408   ;BDS3 ERROR MSB #1
148
149
150      0000:0000      DSEG: SEGMENT
151
152      ;      DATA STORAGE
153
154      0000:2000      ORG 2000H
155
156      0000:2000      MEMST: .EQUAL $
157

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158           ;      MONITOR STORAGE
159
160 0000:2000   POSCRC: .BLKB 2           ;POSITION COMMAND ECHO
161 0000:2002   POSD: .BLKB 2           ;CURRENT POSITION DATA
162 0000:2004   ERROR: .BLKB 2         ;POSCRC-POSD
163 0000:2006   SYSTEM: .BLKB 2       ;SYSTEM PARAMETERS
164 0000:2008   FAUL1: .BLKB 2        ;FAULT BITS SET 1
165 0000:200A   FAUL2: .BLKB 2        ;FAULT BITS SET 2
166 0000:200C   ANAFL: .BLKB 2        ;ANALOG FAULT FLAGS
167
168           0000:200E   ANADT: .EQUAL $           ;ANALOG STORAGE IS HERE
169
170 0000:200E   GND1: .BLKB 2           ;GND
171 0000:2010   GND2: .BLKB 2           ;GND
172 0000:2012   GND3: .BLKB 2           ;GND
173 0000:2014   VEL: .BLKB 2           ;ROTATION VELOCITY
174 0000:2016   V15P: .BLKB 2         ;+15V/2
175 0000:2018   V15N: .BLKB 2         ;-15V/2
176 0000:201A   V5: .BLKB 2           ;+5V
177 0000:201C   V10P: .BLKB 2         ;+10V
178 0000:201E   MTEMP1: .BLKB 2       ;MOUNT TEMP 1
179 0000:2020   V10N: .BLKB 2         ;-10V
180 0000:2022   MTEMP2: .BLKB 2       ;MOUNT TEMP 2
181 0000:2024   BTEMP: .BLKB 2        ;BIN TEMP
182
183 0000:2026   SERVER: .BLKB 2        ;SERIAL/VERSION
184 0000:2028   VEL1: .BLKB 2
185 0000:202A   X22: .BLKB 2
186 0000:202C   X23: .BLKB 2
187 0000:202E   X24: .BLKB 2
188 0000:2030   X25: .BLKB 2
189 0000:2032   X26: .BLKB 2
190 0000:2034   X27: .BLKB 2
191 0000:2036   X28: .BLKB 2
192 0000:2038   X29: .BLKB 2
193 0000:203A   X30: .BLKB 2
194 0000:203C   X31: .BLKB 2
195 0000:203E   X32: .BLKB 2
196
197           ;      TEMPORARY STORAGE
198
199 0000:2040   RAC: .BLKB 1           ;RELATIVE CONTROL ADDRESS
200 0000:2041   CONL: .BLKB 1         ;CONTROL VALUE LSB
201 0000:2042   CONM: .BLKB 1         ;CONTROL VALUE MSB
202 0000:2043   ACKF: .BLKB 1         ;ACKNOWLEDGE FLAG
203 0000:2044   COMTMP: .BLKB 2       ;TEMPORARY COMMAND STORAGE
204 0000:2046   ADVAL: .BLKB 2        ;A/D TEMPORARY STORAGE
205 0000:2048   SPEED: .BLKB 1        ;RAMP LEVEL
206 0000:2049   BREAK1: .BLKB 2       ;RAMP UP BREAK POINT
207 0000:204B   BREAK2: .BLKB 2       ;RAMP DOWN BREAK POINT
208 0000:204D   POSDOD: .BLKB 2       ;OLD POSITION
209 0000:204F   EXTTMR: .BLKB 1       ;EXTERNAL SAFETY TIMER
210 0000:2050   RANDOM: .BLKB 2       ;RANDOM NUMBER STORAGE
211
212
213           ;      FLAGS
214

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215          0000:2052          FLAGST: .EQUAL $
216
217 0000:2052          RESCMD: .BLKB 1
218 0000:2053          NAPATV: .BLKB 1
219 0000:2054          NAPREQ: .BLKB 1
220 0000:2055          DRVREQ: .BLKB 1
221 0000:2056          MANOVR: .BLKB 1
222 0000:2057          BDSRST: .BLKB 1
223 0000:2058          DRVONE: .BLKB 1
224 0000:2059          ADFLAG: .BLKB 1
225 0000:205A          BFLAG: .BLKB 1
226 0000:205B          TFLAG0: .BLKB 1
227 0000:205C          TFLAG1: .BLKB 1
228 0000:205D          TFLAG2: .BLKB 1
229 0000:205E          DRVOFF: .BLKB 1
230 0000:205F          DRVATV: .BLKB 1
231 0000:2060          RAMPOS: .BLKB 2
232 0000:2062          DIR: .BLKB 1
233 0000:2063          LDIR: .BLKB 1
234
235          0000:0012          ENDFLG: .EQUAL $-FLAGST
236
237                                ENDS
238
239
240          ;          PROGRAM EQUATES
241
242          0000:2100          STCK: .EQUAL 2100H          ;STACK LOCATION
243          0000:A766          DOVAL: .EQUAL 0A766H          ;DMA 0 CONTROL VALUE
244          0000:00E8          MASKV: .EQUAL 00E8H          ;DMA 0, INTO, TIMER ENABLE
245          0000:001C          CONRAM: .EQUAL 28          ;?? REV/SEC CONVERGE LEVEL
246          0000:8A00          LOW: .EQUAL 00A00H .XOR. 8000H          ;LOW VALUE
247          0000:7200          HIGH: .EQUAL 0F200H .XOR. 8000H          ;HIGH VALUE
248
249                                LIST ON
250
251          ;          EXTERNAL REFERENCES
252
253          GLOBAL DSETUP, TSETUP, TSET1, CLSETAB
254          EXTERNAL          INITAL:FAR, RSCMD:FAR
255
256
257          0000:0000          ORG          0000H
258
259          0000:0000 0000 0000          TYPE0: .LONG          INITAL          ;DIVIDE ERROR EXCEPTION
260          0000:0004 0000 0000          TYPE1: .LONG          INITAL          ;SINGLE STEP EXCEPTION
261          0000:0008 5000 0000          TYPE2: .LONG          NMI          ;NMI
262          0000:000C B001 0000          TYPE3: .LONG          THR2          ;BREAKPOINT INTERRUPT
263          0000:0010 0000 0000          TYPE4: .LONG          INITAL          ;INTO EXCEPTION
264          0000:0014 9D00 0000          TYPE5: .LONG          BOUND          ;ARRAY BOUND EXCEPTION
265          0000:0018 0000 0000          TYPE6: .LONG          INITAL          ;UNUSED OPCODE EXCEPTION
266          0000:001C 0000 0000          TYPE7: .LONG          INITAL          ;ESC OPCODE EXCEPTION
267          0000:0020 0000 0000          TYPE8: .LONG          INITAL          ;TIMER 0 INTERRUPT
268          0000:0024 0000 0000          TYPE9: .LONG          INITAL          ;RESERVED
269          0000:0028 AE00 0000          TYPE10: .LONG          DMA0          ;DMA 0
270          0000:002C 0000 0000          TYPE11: .LONG          INITAL          ;DMA 1
271          0000:0030 8101 0000          TYPE12: .LONG          INTO          ;INT 0 INTERRUPT

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272 0000:0034 0000 0000 TYPE13: .LONG INITIAL ;INT 1 INTERRUPT
273 0000:0038 0000 0000 TYPE14: .LONG INITIAL ;INT 2 INTERRUPT
274 0000:003C 0000 0000 TYPE15: .LONG INITIAL ;INT 3 INTERRUPT
275 0000:0040 0000 0000 TYPE16: .LONG INITIAL ;RESERVED
276 0000:0044 0000 0000 TYPE17: .LONG INITIAL ;RESERVED
277 0000:0048 9F01 0000 TYPE18: .LONG TMR1 ;TIMER 1 INTERRUPT
278 0000:004C B001 0000 TYPE19: .LONG TMR2 ;TIMER 2 INTERRUPT
279
280 ; NMI INTERRUPT IS LOCATED HERE AFTER TABLE
281
282 ; THIS INTERRUPT IS USED TO SEND MONITOR DATA TO
283 ; THE STANDARD INTERFACE.
284 0000:0050
285 0000:0050 NMI:
286 0000:0050 50 PUSH AX ;SAVE REGISTARS, ETC
287 0000:0051 52 PUSH DX
288 0000:0052 53 PUSH BX
289 0000:0053 FF 36 5A 20 PUSH BFLAG
290 0000:0057 C6 06 5A 20 00 MOV BFLAG,0 ;RELATIVE ADDRESS TEST
291 0000:005C BA 8B 01 MOV DX,RELADD ;GET RELATIVE ADDRESS
292 0000:005F EC IN AL,DX
293 0000:0060 B4 00 MOV AH,0
294 0000:0062 2E 62 06 62 05 BOUND AX,CS:MONRG ;RELATIVE ADDRESS IN RANGE?
295 0000:0067 F6 06 5A 20 01 TEST BFLAG,1
296 0000:006C 74 07 JZ NMI1 ;IF OK
297 0000:006E 80 0E 08 20 40 OR FAUL1,64 ;SET MONITOR FAULT FLAG
298 0000:0073 EB 19 JNP SHORT NEXIT ;EXIT ROUTINE
299 0000:0075 NMI1:
300 0000:0075 2E 2B 06 62 05 SUB AX,CS:MONRG ;SUBTRACT OFFSET
301 0000:007A 03 C0 ADD AX,AX ;TIMES 2
302 0000:007C 8B D8 MOV BX,AX ;BX IS NOW THE INDEX VALUE
303 0000:007E 8B 87 00 20 MOV AX,MEMST[BX] ;GET MONITOR DATA
304 0000:0082 BA 8F 01 MOV DX,MONL ;SEND IT
305 0000:0085 EF OUT DX,AX
306 0000:0086 4A DEC DX
307 0000:0087 EE OUT DX,AL ;SEND DEVICE AKNOWLEDGE
308 0000:0088 81 26 08 20 BF FF AND WORD PTR FAUL1,OFFBFH ;RESET MONITOR FAULT FLAG
309 0000:008E B8 02 00 NEXIT: MOV AX,2 ;SPECIFIC ROI
310 0000:0091 BA 22 FF MOV DX,ROI
311 0000:0094 EF OUT DX,AX
312 0000:0095 8F 06 5A 20 POP BFLAG ;RESTORE REGISTARS, ETC
313 0000:0099 5B POP BX
314 0000:009A 5A POP DX
315 0000:009B 58 POP AX
316 0000:009C CF IRET
317
318 ; THIS INTERRUPT SETS THE OUT OF BOUNDS FLAG
319
320 0000:009D BOUND:
321 0000:009D 50 PUSH AX ;SAVE REGISTARS
322 0000:009E 52 PUSH DX
323 0000:009F C6 06 5A 20 01 MOV BFLAG,1 ;SET OUT OF BOUNDS FLAG
324 0000:00A4 B8 05 00 MOV AX,5 ;SPECIFIC ROI
325 0000:00A7 BA 22 FF MOV DX,ROI
326 0000:00AA EF OUT DX,AX
327 0000:00AB 5A POP DX ;RESTORE REGISTARS
328 0000:00AC 58 POP AX

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329 0000:00AD CF IRET
330
331 ; THIS INTERRUPT COMPLETES THE PROCESSING OF A COMMAND
332 ; INPUTTED FROM THE STANDARD INTERFACE
333
334 0000:00AE DMA0:
335 0000:00AE 50 PUSH AX ;SAVE REGISTARS, ETC
336 0000:00AF 52 PUSH DX
337 0000:00B0 51 PUSH CX
338 0000:00B1 53 PUSH BX
339 0000:00B2 56 PUSH SI
340 0000:00B3 FF 36 5A 20 PUSH BFLAG
341 0000:00B7 C6 06 5A 20 00 MOV BFLAG,0 ;ASSUME IN BOUNDS
342 0000:00BC 8A 1E 40 20 MOV BL,RAC ;GET RELATIVE ADDRESS
343 0000:00C0 B7 00 MOV BH,0 ;STRIP UPPER NYBBLE
344 0000:00C2 2E 62 1E 48 05 BOUND BX,CS:CMDRG ;VALID COMMAND?
345 0000:00C7 F6 06 5A 20 01 TEST BFLAG,1 ;IN BOUND?
346 0000:00CC 74 08 JZ DMA01 ;IF OK
347 0000:00CE 80 0E 08 20 20 OR FAUL1,32 ;SET COMMAND INVALID
348 0000:00D3 E9 8B 00 JMP DEXIT
349 0000:00D6 DMA01:
350 0000:00D6 81 26 08 20 DF FF AND WORD PTR FAUL1,OFFDFH ;CLEAR COMMAND INVALID
351 0000:00DC 2E 2B 1E 48 05 SUB BX,CS:CMDRG ;SUBTRACT OFFSET
352 0000:00E1 03 DB ADD BX,BX ;TIMES 2
353 0000:00E3 2E 8B 87 4C 05 MOV AX,CS:CMDTBL[BX] ;GET NEW PROGRAM POINT
354 0000:00E8 FF E0 JMP AX ;GO THERE
355
356 ; THE NEXT FIVE ROUTINES ARE THE COMMAND PROCESSING ENTRY POINTS
357
358 0000:00EA POSCMD:
359 0000:00EA A1 41 20 MOV AX,CONL ;GET COMMANDED POSITION
360 0000:00ED 35 00 80 XOR AX,8000H ;FOR BOUND TEST
361 0000:00F0 2E 62 06 66 05 BOUND AX,CS:POSRG ;POSITION WITHIN RANGE?
362 0000:00F5 35 00 80 XOR AX,8000H ;UNDO AFTER TEST
363 0000:00F8 F6 06 5A 20 01 TEST BFLAG,1
364 0000:00FD 74 07 JZ POSCM1 ;IF IN RANGE
365 0000:00FF 80 0E 08 20 80 OR FAUL1,128 ;SET OPERATOR FAULT
366 0000:0104 EB 5B JMP SHORT DEXIT
367 0000:0106 80 26 08 20 7F POSCM1: AND FAUL1,7FH ;RESET OPERATOR FAULT
368 0000:010B A3 44 20 MOV COMTMP,AX ;SAVE COMMANDED POSITION HERE
369 0000:010E C6 06 55 20 01 MOV DRVREQ,1 ;SET DRIVE REQUEST
370 0000:0113 C6 06 58 20 00 MOV DRVONE,0 ;CLEAR SECOND TRY FLAG
371 0000:0118 EB 47 JMP SHORT DEXIT
372
373 0000:011A RECMD:
374 0000:011A C6 06 52 20 01 MOV RECMD,1 ;SET SOFT RESET REQUEST
375 0000:011F EB 40 JMP SHORT DEXIT
376
377 0000:0121 NAPCMD:
378 0000:0121 F6 06 41 20 01 TEST CONL,1 ;TEST FOR SET / RESET
379 0000:0126 75 0C JNZ NAPCM1
380 0000:0128 C6 06 53 20 00 MOV NAPATV,0 ;IF CLEAR NAP
381 0000:012D 80 26 06 20 FE AND SYSTEM,OFFEH
382 0000:0132 EB 2D JMP SHORT DEXIT
383 0000:0134 F6 06 53 20 01 NAPCM1: TEST NAPATV,1 ;ALREADY NAPPED?
384 0000:0139 75 26 JNZ DEXIT
385 0000:013B C6 06 54 20 01 MOV NAPREQ,1 ;SET NAP REQUEST

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386 0000:0140 EB 1F          JMP     SHORT DEXIT
387
388 0000:0142          MANCMD:
389 0000:0142 F6 06 41 20 01      TEST   CONL,1          ;TEST FOR SET / RESET
390 0000:0147 75 0C          JNZ   MANCM1
391 0000:0149 C6 06 56 20 00      MOV   MANOVR,0        ;IF CLEAR OVER RIDE
392 0000:014E 80 26 06 20 F7      AND   SYSTEM,OF7H
393 0000:0153 EB 0C          JMP   SHORT DEXIT
394 0000:0155 C6 06 56 20 01      MANCM1: MOV  MANOVR,1     ;SET MANUEL OVER-RIDE
395 0000:015A EB 05          JMP   SHORT DEXIT
396
397 0000:015C C6 06 57 20 01      BDSCMD: MOV  BDSRST,1   ;SET BDS3 SERVO RESET
398
399 0000:0161 BE 56 05          DEXIT: MOV  SI,CS:OFFSET DSETUP ;RE-INITIALIZE DMA 0
400 0000:0164 BA C0 FF          MOV   DX,DO SPL
401 0000:0167 B9 06 00          MOV   CX,6
402 0000:016A 6F          DSET: OUTSW
403 0000:016B 83 C2 02          ADD   DX,2
404 0000:016E K2 FA          LOOP  DSET
405 0000:0170 B8 0A 00          MOV   AX,10           ;SPECIFIC EO1
406 0000:0173 BA 22 FF          MOV   DX,EO1
407 0000:0176 EF          OUT   DX,AX
408 0000:0177 8F 06 5A 20          POP   BFLAG           ;RESTORE REGISTARS, ETC
409 0000:017B 5E          POP   SI
410 0000:017C 5B          POP   BX
411 0000:017D 59          POP   CX
412 0000:017E 5A          POP   DX
413 0000:017F 58          POP   AX
414 0000:0180 CF          IRET
415
416          ; THIS INTERRUPT ROUTINE LOADS THE ANALOG TO DIGITAL VALUES
417          ; AFTER CONVERSION
418
419 0000:0181          INTO:
420 0000:0181 50          PUSH  AX              ;SAVE REGISTARS
421 0000:0182 52          PUSH  DX
422 0000:0183 BA 91 01          MOV   DX,ADL         ;GET A/D VALUE
423 0000:0186 ED          IN    AX,DX
424 0000:0187 C1 E8 04          SHR   AX,4           ;PUT INTO POSITION
425 0000:018A 35 00 08          XOR   AX,0800H      ;TWOS COMPLEMENT
426 0000:018D A3 46 20          MOV   ADVAL,AX      ;STORE HERE
427 0000:0190 C6 06 59 20 01      MOV   ADFLAG,1     ;SET ADFLAG
428 0000:0195 B8 0C 00          MOV   AX,12        ;SPECIFIC EO1
429 0000:0198 BA 22 FF          MOV   DX,EO1
430 0000:019B EF          OUT   DX,AX
431 0000:019C 5A          POP   DX             ;RESTORE REGISTARS
432 0000:019D 58          POP   AX
433 0000:019E CF          IRET
434
435 0000:019F          THRI:
436 0000:019F 50          PUSH  AX              ;SAVE REGISTARS
437 0000:01A0 52          PUSH  DX
438 0000:01A1 C6 06 5C 20 01      MOV   TFLAG1,1     ;SET TIMER 1 FLAG
439 0000:01A6 B8 08 00          MOV   AX,8         ;SPECIFIC EO1
440 0000:01A9 BA 22 FF          MOV   DX,EO1
441 0000:01AC EF          OUT   DX,AX
442 0000:01AD 5A          POP   DX             ;RESTORE REGISTARS

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443 0000:01AE 58 POP AX
444 0000:01AF CF IRET
445
446 0000:01B0 TMR2:
447 0000:01B0 50 PUSH AX ;SAVE REGISTARS
448 0000:01B1 53 PUSH BX
449 0000:01B2 51 PUSH CX
450 0000:01B3 52 PUSH DX
451 0000:01B4 FF 36 5A 20 PUSH BFLAG
452 0000:01B8 C6 06 4F 20 19 MOV EXTMR,25 ;RESET TIMER
453 0000:01BD F6 06 5F 20 01 TEST DRVATV,1
454 0000:01C2 75 06 JNZ GO
455 0000:01C4 E8 6D 03 CALL TMR0FF
456 0000:01C7 E9 4D 02 JMP TMR2EX
457 0000:01CA F6 06 5E 20 01 GO: TEST DRVOFF,1 ;GO INTO SHUTDOWN?
458 0000:01CF 74 03 JZ TMR21 ;IF NOT SHUT DOWN
459 0000:01D1 E9 E9 01 JMP OFFIT ;IF SHUT DOWN
460 0000:01D4 E4 81 TMR21: IN AL,P2PTB ;GET E-STOP, DRIVE LOCKOUT
461 0000:01D6 24 18 AND AL,18H ;STRIP JUNK
462 0000:01D8 34 10 XOR AL,10H ;INVERT DRIVE LOCKOUT
463 0000:01DA 74 03 JZ TMR210 ;IF OK
464 0000:01DC E9 15 02 JMP OFFIT3 ;ELSE QUIT
465 0000:01DF E8 C0 02 TMR210: CALL DSTOR ;GET LATEST DATA
466 0000:01E2 BA 87 01 MOV DX,DISCR ;POINT TO DISCRETES
467 0000:01E5 EC IN AL,DX ;GET INFO
468 0000:01E6 F6 06 63 20 01 TEST LDIR,1 ;TEST DIRECTION
469 0000:01EB 74 07 JZ TMR21A ;IF POSITIVE
470 0000:01ED 24 0C AND AL,0CH ;CCW LIMIT?
471 0000:01EF 74 0A JZ TMR22
472 0000:01F1 E9 C9 01 JMP OFFIT ;IF IN CCW LIMIT
473 0000:01F4 24 03 TMR21A: AND AL,3 ;CW LIMIT?
474 0000:01F6 74 03 JZ TMR22
475 0000:01F8 E9 C2 01 JMP OFFIT ;IF IN CW LIMIT
476 0000:01FB A0 62 20 TMR22: MOV AL,DIR ;GET DIRECTION
477 0000:01FE 3A 06 63 20 CMP AL,LDIR ;EQUAL?
478 0000:0202 74 08 JZ TMR22A ;IF EQUAL
479 0000:0204 C6 06 60 20 06 MOV RAMPOS,6 ;KILL ALL BUT CONVERGE
480 0000:0209 E9 15 00 JMP VERGIT ;GOTO CONVERGE
481 0000:020C 80 3E 48 20 0A TMR22A: CMP BYTE PTR SPEED,10 ;MOTION ANALYSIS?
482 0000:0211 75 03 JNZ TMR23 ;IF NOT
483 0000:0213 E9 15 02 JMP MOTION
484 0000:0216 8B 1E 60 20 TMR23: MOV BX,RAMPOS ;GET CURRENT RAMP
485 0000:021A 2E 8B 87 6E 05 MOV AX,CS:RAMPTL[BX] ;GET INDEX
486 0000:021F FF E0 JMP AX ;GO THERE
487
488 0000:0221 VERGIT:
489 0000:0221 8B 1E 04 20 MOV BX,ERROR ;ARE WE CLOSE?
490 0000:0225 C6 06 5A 20 00 MOV BFLAG,0 ;SET IN BOUNDS
491 0000:022A 2E 62 1E 44 05 BOUND BX,CS:CLSETAB ;CLOSE?
492 0000:022F F6 06 5A 20 01 TEST BFLAG,1
493 0000:0234 75 35 JNZ VERGI1 ;IF NOT
494 0000:0236 E5 00 IN AX,P1PTA ;FINAL RAMP TO STOP
495 0000:0238 50 PUSH AX ;SAVE IT
496 0000:0239 25 FF 0F AND AX,OFFFH ;JUST RAMP VALUE
497 0000:023C BB 04 00 MOV BX,4 ;PREPARE TO DECREASE
498 0000:023F F6 06 63 20 01 TEST LDIR,1 ;CHECK DIRECTION
499 0000:0244 74 02 JZ VERGI0 ;IF POSITIVE

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500 0000:0246 F7 DB          NEG BX          ;IF NEGATIVE
501 0000:0248 2B C3          VERGIO: SUB AX,BX
502 0000:024A 25 FF 0F          AND AX,OFFFH   ;JUST RAMP VALUE
503 0000:024D 5B                POP BX         ;RESTORE
504 0000:024E 81 E3 00 F0       AND BX,0F000H ;JUST CONTROL
505 0000:0252 3D 00 00         CMP AX,0       ;DONE?
506 0000:0255 75 09           JNE VERGIA     ;NOT DONE
507 0000:0257 81 26 08 20 FF FD AND WORD PTR FAUL1,0FDFH ;RESET DRIVE FAULT FLAG
508 0000:025D E9 94 01         JMP OFFIT3     ;COMPLETE
509 0000:0260 0B C3          VERGIA: OR AX,BX ;MERGE
510 0000:0262 E7 00          OUT PIPTA,AX  ;SEND NEW RAMP
511 0000:0264 BA 96 01       MOV DX,LTCHDA ;NOW LATCH D/A
512 0000:0267 EE                OUT DX,AL     ;NEW RAMP COMPLETE
513 0000:0268 E9 AC 01       JMP TMR2EX
514
515 0000:026B          VERGI1:
516 0000:026B A0 62 20       MOV AL,DIR    ;CHECK FOR DIRECTION SWITCH
517 0000:026E 3A 06 63 20    CMP AL,LDIR
518 0000:0272 75 07           JNE VERGIB    ;WE OVER SHOT
519 0000:0274 BA 96 01       MOV DX,LTCHDA ;NOW LATCH D/A
520 0000:0277 EE                OUT DX,AL     ;OLD RAMP COMPLETE
521 0000:0278 E9 9C 01       JMP TMR2EX    ;IF NOT SWITCHED
522 0000:027B E5 00          VERGIB: IN AX,PIPTA ;FINAL RAMP TO STOP
523 0000:027D 50                PUSH AX       ;SAVE IT
524 0000:027E 25 FF 0F          AND AX,OFFFH  ;JUST RAMP VALUE
525 0000:0281 BB 04 00       MOV BX,4      ;PREPARE TO DECREASE
526 0000:0284 F6 06 63 20 01 TEST LDIR,1   ;CHECK DIRECTION
527 0000:0289 74 02           JZ VERGIC    ;IF POSITIVE
528 0000:028B F7 DB          NEG BX         ;IF NEGATIVE
529 0000:028D 2B C3          VERGIC: SUB AX,BX
530 0000:028F 25 FF 0F          AND AX,OFFFH  ;JUST RAMP VALUE
531 0000:0292 5B                POP BX         ;RESTORE
532 0000:0293 81 E3 00 F0       AND BX,0F000H ;JUST CONTROL
533 0000:0297 50                PUSH AX       ;SAVE NEW RAMP
534 0000:0298 0B C3          OR AX,BX      ;MERGE
535 0000:029A E7 00          OUT PIPTA,AX  ;SEND NEW RAMP
536 0000:029C BA 96 01       MOV DX,LTCHDA ;NOW LATCH D/A
537 0000:029F EE                OUT DX,AL     ;NEW RAMP COMPLETE
538 0000:02A0 58                POP AX        ;RESTORE NEW RAMP
539 0000:02A1 3D 00 00       CMP AX,0      ;DONE?
540 0000:02A4 74 03           JE VERGI2     ;DONE
541 0000:02A6 E9 6E 01       JMP TMR2EX
542
543 0000:02A9          VERGI2:
544 0000:02A9 F6 06 58 20 01 TEST DRVONE,1 ;ON SECOND TRY?
545 0000:02AE 75 1A           JNZ VERGI3    ;IF SECOND TRY
546 0000:02B0 C6 06 58 20 01 MOV DRVONE,1  ;SET SECOND TRY FLAG
547 0000:02B5 C6 06 5F 20 00 MOV DRVATV,0  ;SET DRIVE TO NON ACTIVE
548 0000:02BA C6 06 55 20 01 MOV DRVREQ,1  ;RESTART COMMAND
549 0000:02BF 8B 1E 00 20    MOV BX,POSCEC ;GET COMTMP = POSCEC
550 0000:02C3 89 1E 44 20    MOV COMTMP,BX
551 0000:02C7 E9 2A 01       JMP OFFIT3    ;LEAVE
552 0000:02CA          VERGI3:
553 0000:02CA 81 0E 08 20 00 02 OR WORD PTR FAUL1,200H ;SET DRIVE FAULT
554 0000:02D0 E9 21 01       JMP OFFIT3    ;STOP
555
556 0000:02D3 C6 06 5A 20 00 ZIPUP: MOV BFLAG,0 ;RESET BOUND FLAG

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557 0000:02D8 FE 0E 48 20      DEC    SPEED
558 0000:02DC 75 34          JNZ    ZIPUP2      ;IF NO CHANGE IN RAMP
559 0000:02DE C6 06 48 20 14      MOV    SPEED,20   ;RESET SPEED
560 0000:02E3 E5 00          IN     AX,P1PTA   ;GET CURRENT RAMP POINT
561 0000:02E5 50          PUSH   AX         ;SAVE IT
562 0000:02E6 25 FF 0F      AND    AX,OFFFH   ;STRIP CONTROL NYBBLE
563 0000:02E9 BB 04 00      MOV    BX,4       ;DO NEXT RAMP STEP
564 0000:02EC F6 06 63 20 01      TEST   LDIR,1     ;NEGATIVE?
565 0000:02F1 74 02          JZ     ZIPUP1     ;IF POSITIVE
566 0000:02F3 F7 DB          NEG    BX         ;REVSRE SIGN
567 0000:02F5 03 C3      ZIPUP1: ADD    AX,BX ;NEW RAMP
568 0000:02F7 25 FF 0F      AND    AX,OFFFH   ;STRIP UPPER NYBBLE
569 0000:02FA C1 C0 04      ROL    AX,4       ;ROTATE FOR BOUND TEST
570 0000:02FD 2E 62 06 6A 05      BOUND  AX,CS:RAMPLM
571 0000:0302 C1 C8 04      ROR    AX,4       ;PUT BACK
572 0000:0305 5B          POP    BX         ;GET OLD CONTROL BITS
573 0000:0306 81 E3 00 F0      AND    BX,0F000H  ;STRIP OLD RAMP
574 0000:030A 0B C3      OR     AX,BX      ;MERGE
575 0000:030C E7 00          OUT   PIPTA,AX   ;SEND NEW RAMP
576 0000:030E BA 96 01      MOV    DX,LTCHDA ;NOW LATCH D/A
577 0000:0311 EE          OUT   DX,AL      ;NEW RAMP COMPLETE
578 0000:0312 F6 06 5A 20 01      ZIPUP2: TEST  BFLAG,1 ;OUT OF BOUNDS?
579 0000:0317 75 13          JNZ   ZIPUP3     ;IF OUT
580 0000:0319 A1 02 20      MOV    AX,POSD   ;CURRENT POSITION
581 0000:031C F6 06 63 20 01      TEST   LDIR,1   ;CHECK DIRECTION
582 0000:0321 75 11          JNZ   ZIPUP4     ;IF NEGATIVE
583 0000:0323 3B 06 49 20      CMP    AX,BREAK1 ;RAMP INTO MAIN?
584 0000:0327 73 03          JNC   ZIPUP3     ;GO INTO MAIN
585 0000:0329 E9 EB 00      JMP    TMR2EX    ;NOPE
586 0000:032C 80 06 60 20 02      ZIPUP3: ADD  RAMPOS,2 ;GO INTO MAIN
587 0000:0331 E9 E3 00      JMP    TMR2EX    ;NOW LEAVE
588 0000:0334 3B 06 49 20      ZIPUP4: CMP  AX,BREAK1 ;RAMP INTO MAIN?
589 0000:0338 72 F2          JC     ZIPUP3     ;GO INTO MAIN
590 0000:033A E9 DA 00      JMP    TMR2EX    ;NOPE
591
592 0000:033D      MAINNY:
593 0000:033D FE 0E 48 20      DEC    SPEED
594 0000:0341 75 05          JNZ   MAINNO     ;FOR MOTION ANALYSIS
595 0000:0343 C6 06 48 20 14      MOV    SPEED,20  ;RESET SPEED
596 0000:0348 A1 02 20      MAINNO: MOV   AX,POSD ;CURRENT POSITION
597 0000:034B F6 06 63 20 01      TEST   LDIR,1   ;CHECK DIRECTION
598 0000:0350 75 0F          JNZ   MAINN2     ;IF NEGATIVE
599 0000:0352 3B 06 4B 20      CMP    AX,BREAK2 ;MAIN INTO RAMP DOWN?
600 0000:0356 73 02          JNC   MAINN1     ;GO INTO RAMP DOWN
601 0000:0358 EB 0D          JMP    SHORT MAINN3 ;NOPE
602 0000:035A 80 06 60 20 02      MAINN1: ADD  RAMPOS,2 ;SET RAMP DOWN
603 0000:035F EB 06          JMP    SHORT MAINN3 ;NOW LEAVE
604 0000:0361 3B 06 4B 20      MAINN2: CMP  AX,BREAK2 ;MAIN INTO RAMP DOWN?
605 0000:0365 72 F3          JC     MAINN1     ;GO INTO RAMP DOWN
606 0000:0367 BA 96 01      MAINN3: MOV  DX,LTCHDA ;NOW LATCH D/A
607 0000:036A EE          OUT   DX,AL      ;OLD RAMP COMPLETE
608 0000:036B E9 A9 00      JMP    TMR2EX    ;DONE
609
610 0000:036E FE 0E 48 20      ZIPDWN: DEC   SPEED
611 0000:0372 75 46          JNZ   ZIPDN3     ;IF NO CHANGE IN RAMP
612 0000:0374 C6 06 48 20 14      MOV    SPEED,20  ;RESET SPEED
613 0000:0379 E5 00          IN     AX,P1PTA  ;GET CURRENT RAMP POINT

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614 0000:037B 50          PUSH  AX          ;SAVE IT
615 0000:037C 25 FF 0F          AND  AX,OFFFH    ;STRIP CONTROL NYBBLE
616 0000:037F BB 04 00          MOV  BX,4        ;DO NEXT RAMP STEP
617 0000:0382 F6 06 63 20 01    TEST LDIR,1      ;NEGATIVE?
618 0000:0387 74 02          JZ   ZIPDN1      ;IF POSITIVE
619 0000:0389 F7 DB          NEG  BX          ;REVSRE SIGN
620 0000:038B 2B C3          ZIPDN1: SUB AX,BX  ;NEW RAMP
621 0000:038D 25 FF 0F          AND  AX,OFFFH    ;STRIP UPPER NYBBLE
622 0000:0390 5B          POP  BX          ;GET OLD CONTROL BITS
623 0000:0391 74 15          JZ   ZIPDN2      ;IF ZERO
624 0000:0393 81 E3 00 F0      AND  BX,0F000H   ;STRIP OLD RAMP
625 0000:0397 0B C3          OR   AX,BX       ;MERGE
626 0000:0399 E7 00          OUT  PIPTA,AX    ;SEND NEW RAMP
627 0000:039B BA 96 01          MOV  DX,LTCHDA   ;NOW LATCH D/A
628 0000:039E EE          OUT  DX,AL       ;NEW RAMP COMPLETE
629 0000:039F F6 06 63 20 01    TEST LDIR,1      ;CHECK DIRECTION
630 0000:03A4 74 02          JZ   ZIPDN2      ;IF POSITIVE
631 0000:03A6 F7 D8          NEG  AX          ;INVERT FOR CHECK
632 0000:03A8 25 FF 0F          ZIPDN2: AND AX,OFFFH ;CURRENT RAMP
633 0000:03AB 3D 1C 00          CMP  AX,CONRAM   ;RAMP INTO CONVERGE?
634 0000:03AE 73 67          JNC  THR2EX      ;NOPE
635 0000:03B0 C6 06 48 20 01    MOV  SPEED,1     ;RESET SPEED
636 0000:03B5 80 06 60 20 02    ADD  RAMPOS,2    ;KILL RAMP DOWN
637 0000:03BA E9 5A 00          ZIPDN3: JMP  THR2EX ;NOW LEAVE
638
639 0000:03BD E5 00          OFFIT: IN  AX,PIPTA ;GET CURRENT RAMP POINT
640 0000:03BF FE 0E 48 20          DEC  SPEED
641 0000:03C3 75 27          JNZ  OFFIT2      ;IF NO CHANGE IN RAMP
642 0000:03C5 C6 06 48 20 14    MOV  SPEED,20    ;RESET SPEED
643 0000:03CA 50          PUSH AX          ;SAVE IT
644 0000:03CB 25 FF 0F          AND  AX,OFFFH    ;STRIP CONTROL NYBBLE
645 0000:03CE BB 04 00          MOV  BX,4        ;DO NEXT RAMP STEP
646 0000:03D1 F6 06 63 20 01    TEST LDIR,1      ;NEGATIVE?
647 0000:03D6 74 02          JZ   OFFIT1      ;IF POSITIVE
648 0000:03D8 F7 DB          NEG  BX          ;REVSRE SIGN
649 0000:03DA 2B C3          OFFIT1: SUB AX,BX  ;NEW RAMP
650 0000:03DC 25 FF 0F          AND  AX,OFFFH    ;STRIP UPPER NYBBLE
651 0000:03DF 5B          POP  BX          ;GET OLD CONTROL BITS
652 0000:03E0 81 E3 00 F0      AND  BX,0F000H   ;STRIP OLD RAMP
653 0000:03E4 0B C3          OR   AX,BX       ;MERGE
654 0000:03E6 E7 00          OUT  PIPTA,AX    ;SEND NEW RAMP
655 0000:03E8 BA 96 01          MOV  DX,LTCHDA   ;NOW LATCH D/A
656 0000:03EB EE          OUT  DX,AL       ;NEW RAMP COMPLETE
657 0000:03EC 25 FF 0F          OFFIT2: AND AX,OFFFH ;CURRENT RAMP
658 0000:03EF 3D 00 00          CMP  AX,0        ;GOT TO 0?
659 0000:03F2 75 23          JNE  THR2EX      ;NOPE
660 0000:03F4 E8 3D 01          OFFIT3: CALL THROFF ;KILL TIMER
661 0000:03F7 B8 00 C0          MOV  AX,0C000H   ;KILL DRIVE
662 0000:03FA E7 00          OUT  PIPTA,AX
663 0000:03FC B8 08 00          MOV  AX,8        ;SPECIFIC ROI
664 0000:03FF BA 22 FF          MOV  DX,ROI
665 0000:0402 EF          OUT  DX,AX
666 0000:0403 E8 EA 00          CALL BRKOFF      ;KILL BRAKE
667 0000:0406 C6 06 5F 20 00    MOV  DRVATV,0    ;KILL DRIVE ACTIVE FLAG
668 0000:040B C6 06 5E 20 00    MOV  DRVOFF,0    ;KILL DRIVE OFF FLAG
669 0000:0410 E5 80          IN   AX,P2PTA
670 0000:0412 25 97 FF          AND  AX,OFF97H   ;KILL SPECIFIC LIGHTS

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671 0000:0415 E7 80          OUT    P2PTA,AX
672 0000:0417 B8 08 00      THR2EX: MOV   AX,8          ;SPECIFIC ROI
673 0000:041A BA 22 FF          MOV    DX,ROI
674 0000:041D EF          OUT    DX,AX
675 0000:041E B8 03 00      MOV    AX,3          ;AGAIN
676 0000:0421 EF          OUT    DX,AX
677 0000:0422 8F 06 5A 20    POP    BFLAG
678 0000:0426 5A          POP    DX          ;RESTORE REGISTARS
679 0000:0427 59          POP    CX
680 0000:0428 5B          POP    BX
681 0000:0429 58          POP    AX
682 0000:042A CF          IRRBT
683
684 0000:042B          MOTION:
685 0000:042B FB          STI          ;ENABLE INTERRUPTS
686 0000:042C E5 80          IN     AX,P2PTA      ;GET PORT 2
687 0000:042E 25 F8 FF          AND    AX,OFFF8H    ;STRIP OLD A/D REQ
688 0000:0431 0D 01 00      OR     AX,1          ;REQUEST VELOCITY
689 0000:0434 E7 80          OUT    P2PTA,AX
690 0000:0436 BA 94 01      MOV    DX,STCNV     ;START CONVERSION
691 0000:0439 EE          OUT    DX,AL
692 0000:043A C6 06 59 20 00    MOV    ADFLAG,0     ;RESET FLAG
693 0000:043F FE 0E 48 20      DEC    SPRED        ;UPDATE SPRED
694 0000:0443 BA 97 01      MOV    DX,BDERL1    ;GET SERVO AMP FAULTS
695 0000:0446 ED          IN     AX,DX
696 0000:0447 F7 D0          NOT    AX          ;COMPLEMENT THEM
697 0000:0449 A3 0A 20      MOV    FAUL2,AX     ;SAVE IT
698 0000:044C 25 FD FD          AND    AX,OPDFDH    ;IGNORE FOLDBACK
699 0000:044F 74 08          JZ     MOTIO1       ;ANY PROBLEMS?
700 0000:0451 C6 06 5E 20 01    MOV    DRVOFF,1     ;YES, SO KILL DRIVE
701 0000:0456 E9 BE FF          JMP    THR2EX
702 0000:0459          MOTIO1:
703 0000:0459 8B 1E 02 20      MOV    BX,POSD      ;GET CURRENT POSITION
704 0000:045D A1 4D 20      MOV    AX,POSDOD    ;GET OLD POSITION
705 0000:0460 89 1E 4D 20      MOV    POSDOD,BX    ;CURRENT = OLD
706 0000:0464 2B D8          SUB    BX,AX        ;GET DIFFERENCE
707 0000:0466 79 02          JNS    MOTIO2       ;IF POSITIVE
708 0000:0468 F7 DB          NEG    BX          ;MAKE POSITIVE
709 0000:046A 8B 16 28 20      MOTIO2: MOV    DX,VBL1     ;GET PREVIOUS VELOCITY
710 0000:046E B1 14          MOV    CL,20        ;PRELOAD DIVIDE VALUE
711 0000:0470 F6 06 59 20 01    MOTIO3: TEST   ADFLAG,1     ;ANALOG READY?
712 0000:0475 74 F9          JZ     MOTIO3       ;IF NOT
713 0000:0477 A1 46 20      MOV    AX,ADVAL     ;GET CURRENT VELOCITY
714 0000:047A F6 C4 08      TEST   AH,8         ;MINUS?
715 0000:047D 74 02          JZ     MOTIO4       ;IF MINUS
716 0000:047F F7 D8          NEG    AX          ;MAKE POSITIVE
717 0000:0481 25 FF 0F      MOTIO4: AND    AX,OFFFH    ;STRIP UNWANTED BITS
718 0000:0484 F6 F1          DIV    CL          ;DIVIDE BY 20
719 0000:0486 B4 00          MOV    AH,0         ;KILL REMAINDER
720 0000:0488 A3 28 20      MOV    VBL1,AX     ;CURRENT = PREVIOUS
721 0000:048B 03 C2          ADD    AX,DX        ;ADD IN PREVIOUS VELOCITY
722 0000:048D 83 C3 04      ADD    BX,4         ;4 COUNT SLOP
723 0000:0490 3B C3          CMP    AX,BX        ;OK MOTION?
724 0000:0492 7E 0B          JLE   MOTIO5       ;IF OK
725 0000:0494 C6 06 5E 20 01    MOV    DRVOFF,1
726 0000:0499 81 0E 08 20 00 04 OR     WORD PTR FAUL1,1024 ;SET MOTION FAULT
727 0000:049F E9 75 FF          MOTIO5: JMP    THR2EX

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728
729 0000:04A2          DSTOR:
730 0000:04A2    32 C0          XOR    AL,AL
731 0000:04A4    BA 80 01          MOV    DX,APEXRQ          ;GET APEX DATA
732 0000:04A7    EE              OUT    DX,AL
733 0000:04A8    83 C2 02          ADD    DX,2              ;POINT TO APEXRS
734 0000:04AB    B9 0C 00          MOV    CX,12            ;12 TRIALS
735 0000:04AE          DSTOR1:
736 0000:04AE    EC              IN     AL,DX              ;SEE IF DATA READY
737 0000:04AF    24 C0          AND    AL,0COH          ;STRIP DATA
738 0000:04B1    3C 80          CMP    AL,80H          ;LOOK FOR PATTERN
739 0000:04B3    74 0A          JZ     DSTOR2          ;IF READY
740 0000:04B5    E2 F7          LOOP  DSTOR1          ;IF NOT
741 0000:04B7    80 0E 08 20 01  OR     FAUL1,1          ;SET APEX DEAD
742 0000:04BC    E9 30 00          JMP    DSTOR3          ;SKIP APEX GATHERING
743 0000:04BF          DSTOR2:
744 0000:04BF    80 26 08 20 FE  AND    FAUL1,0FEH      ;SET APEX OK
745 0000:04C4    4A              DEC    DX
746 0000:04C5    ED              IN     AX,DX              ;GET POSITION
747 0000:04C6    8B D8          MOV    BX,AX            ;PUT INTO BX
748 0000:04C8    C1 E3 02          SHL   BX,2              ;GET RID OF RESPONSE BITS
749 0000:04CB    83 C2 02          ADD    DX,2              ;POINT TO NEXT SECTION
750 0000:04CE    ED              IN     AX,DX              ;GET NEXT INFO
751 0000:04CF    C0 C4 02          ROL   AH,2              ;GET FINAL POSITION
752 0000:04D2    80 E4 03          AND    AH,03            ;PREPARE TO MERGE
753 0000:04D5    0A DC          OR     BL,AH              ;MERGE BITS
754 0000:04D7    89 1E 02 20      MOV    POSD,BX          ;SAVE POSITION
755 0000:04DB    A1 00 20          MOV    AX,POSCBC
756 0000:04DE    2B C3          SUB    AX,BX              ;GET ERROR
757 0000:04E0    C6 06 62 20 00  MOV    DIR,0            ;ASSUME POSITIVE
758 0000:04E5    73 05          JNC   DSTO2A          ;IF POSITIVE
759 0000:04E7    C6 06 62 20 01  MOV    DIR,1            ;SET NEGATIVE
760 0000:04EC    A3 04 20          DSTO2A: MOV    ERROR,AX        ;STORE IT HERE
761 0000:04EF    C3              DSTOR3: RET
762
763
764 0000:04F0          BRKOFF:
765 0000:04F0    K5 00          IN     AX,P1PTA          ;GET CONTROL PORT
766 0000:04F2    25 FF BF          AND    AX,0BFFFH        ;ENGAGE THE BRAKE
767 0000:04F5    K7 00          OUT    P1PTA,AX          ;DO IT
768 0000:04F7    C6 06 5C 20 00  MOV    TFLAG1,0         ;SET TIMER FLAG = OK
769 0000:04FC    E8 26 00          CALL  SEC1              ;1 SEC
770 0000:04FF    E8 A0 FF          BRKOF1: CALL  DSTOR          ;GET UPDATE
771 0000:0502    BA 87 01          MOV    DX,DISCR          ;POINT TO BRAKE DISCRETES
772 0000:0505    EC              IN     AL,DX              ;GET INFO
773 0000:0506    A8 10          TEST   AL,16            ;BRAKE FREE?
774 0000:0508    74 12          JZ     BRKOF2          ;IF FREE CONTINUE
775 0000:050A    F6 06 5C 20 01  TEST   TFLAG1,1         ;TIMED OUT?
776 0000:050F    74 EE          JZ     BRKOF1          ;IF NOT
777 0000:0511    81 0E 08 20 00 01  OR     WORD PTR FAUL1,256 ;SET BRAKE FAULT
778 0000:0517    EA 00 00 00 00  JMP    FAR RSCMD        ;RESET COMMAND
779 0000:051C          BRKOF2:
780 0000:051C    81 26 08 20 FF FE  AND    WORD PTR FAUL1,0FEFFFH ;CLEAR BRAKE FAULT
781 0000:0522    E9 0F 00          JMP    TMROFF          ;STOP TIMER
782
783 0000:0525          SEC1:
784 0000:0525    BA 5E FF          MOV    DX,T1MODE        ;ENABLE TIMER1 FIRST

```

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785 0000:0528 B8 09 E0          MOV    AX,0E009H
786 0000:052B EF                OUT    DX,AX
787 0000:052C BA 66 FF          MOV    DX,T2MODE          ;NOW TIMER2
788 0000:052F B8 01 C0          MOV    AX,0C001H
789 0000:0532 EF                OUT    DX,AX
790 0000:0533 C3                RET
791
792 0000:0534          TMROFF:
793 0000:0534 BE 76 05          MOV    SI,OFFSET CS:TSETUP ;POINT TO TABLE
794 0000:0537 BA 50 FF          MOV    DX,TOCOUT          ;POINT TO SOURCE POINTER
795 0000:053A B9 0C 00          MOV    CX,12
796 0000:053D 6F                TSET: OUTSW
797 0000:053E 83 C2 02          ADD    DX,2
798 0000:0541 E2 FA            LOOP   TSET
799 0000:0543 C3                RET
800 0000:0544
801          ;      TABLE SECTION FOR BOUND
802
803 0000:0544          CLSETAB:
804 0000:0544 FCFF          .WORD OFFFCH          ;4 COUNTS BEFORE WE MOVE
805 0000:0546 0400          .WORD 00004H
806
807 0000:0548          CMDRG:
808 0000:0548 3000          .WORD 48
809 0000:054A 3400          .WORD 52
810
811 0000:054C          CMDTBL:
812 0000:054C EA00          .WORD POSCMD
813 0000:054E 2101          .WORD NAPCMD
814 0000:0550 4201          .WORD MANCMD
815 0000:0552 5C01          .WORD BDSCMD
816 0000:0554 1A01          .WORD RECMD
817
818 0000:0556          DSETUP:
819 0000:0556 8B01          .WORD RBLADD
820 0000:0558 0000          .WORD 0
821 0000:055A 4020          .WORD RAC
822 0000:055C 0000          .WORD 0
823 0000:055E 0400          .WORD 4
824 0000:0560 66A7          .WORD DOVAL
825
826 0000:0562          MONRG:
827 0000:0562 3000          .WORD 48
828 0000:0564 4F00          .WORD 79
829
830 0000:0566          POSRG:
831 0000:0566 008A          .WORD LOW          ;SOFTWARE LIMITS
832 0000:0568 0072          .WORD HIGH
833
834 0000:056A          RAMPLM:
835 0000:056A 00BA          .WORD 0BA00H          ;RAMP LIMITS
836 0000:056C 0046          .WORD 04600H
837
838 0000:056E D302          RAMPTL: .WORD ZIPUP          ;RAMP ENTRY
839 0000:0570 3D03          .WORD MAINNY
840 0000:0572 6E03          .WORD ZIPDWN
841 0000:0574 2102          .WORD VERGIT

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842
843 0000:0576          TSETUP:
844 0000:0576 0000      .WORD 0
845 0000:0578 0000      .WORD 0
846 0000:057A 0000      .WORD 0
847 0000:057C 0040      .WORD 16384      ;TIMER 0 IS NOT USED
848 0000:057E 0000      TSET1: .WORD 0
849 0000:0580 D007      .WORD 2000      ;1 SEC DELAY
850 0000:0582 0000      .WORD 0
851 0000:0584 0040      .WORD 16384      ;TIMER 1 IS READY TO GO
852 0000:0586 0000      .WORD 0
853 0000:0588 E202      .WORD 690      ;552uS TIMER
854 0000:058A 0000      .WORD 0
855 0000:058C 0040      .WORD 16384      ;TIMER 2 IS READY ALSO
856
857 0000:058E          END
```

Lines Assembled : 857

Assembly Errors : 0

2500 A.D. 80186 Cross Assembler - Version 4.00g

 Input Filename : RE.asm
 Output Filename : RE.obj

```

1
2           ;      ROTATION AXIS FOR VLBA ANTENNAS
3           ;      WRITTEN BY:      WAYNE M. KOSKI
4           ;      LAST REVISION:  DECEMBER 01, 1989
5           ;
6           ;      THINGS TO DO AND GENERAL NOTES:
7           ;
8           ;      1. THIS SECTION OF CODE WILL BE THE MAIN RUNNING
9           ;      ROUTINES AND SHALL EXCLUDE THE INTERRUPT ROUTINES
10          ;      WHICH SHALL BE IN THE OTHER EPROM.
11          ;      2. ROTATION AXIS SHOULD LOOK SIMILAR TO FOCUS AT
12          ;      PRESENT.
13          ;      3. THIS VERSION UPDATES TO THE NEW F/R CONTROLLER MODULE.
14 0000:0000
15          ASSUME CS:CODE, DS:DSEG
16
17          .OUTPUT 2500AD
18          .OPTIONS H
19
20
21          ;      80188 INTERNAL PORTS FOR CONTROL AND GUIDANCE
22
23
24
25          ;      80188 INTERRUPT CONTROL / STATUS REGISTARS
26
27          0000:FF22      ROI:      .EQUAL 0FF22H      ;END OF INTERRUPT REGISTAR
28          0000:FF24      POLL:     .EQUAL 0FF24H      ;INTERRUPT POLL REGISTAR
29          0000:FF26      POLLS:    .EQUAL 0FF26H      ;INTERRUPT POLL STATUS REGISTAR
30          0000:FF28      MASK:     .EQUAL 0FF28H      ;INTERRUPT MASK REGISTAR
31          0000:FF2A      PMASK:    .EQUAL 0FF2AH      ;INTERRUPT PRIORITY MASK REGISTAR
32          0000:FF2C      ISR:      .EQUAL 0FF2CH      ;INTERRUPT IN SERVICE REGISTAR
33          0000:FF2E      IRR:      .EQUAL 0FF2EH      ;INTERRUPT REQUEST REGISTAR
34          0000:FF30      ICSR:     .EQUAL 0FF30H      ;INTERRUPT CONTROL STATUS REGISTAR
35          0000:FF32      ITCR:     .EQUAL 0FF32H      ;INTERRUPT TIMER CONTROL REGISTAR
36          0000:FF34      IDOCR:    .EQUAL 0FF34H      ;INTERRUPT DMA 0 CONTROL REGISTAR
37          0000:FF36      ID1CR:    .EQUAL 0FF36H      ;INTERRUPT DMA 1 CONTROL REGISTAR
38          0000:FF38      INTOCR:   .EQUAL 0FF38H      ;INT 0 CONTROL REGISTAR
39          0000:FF3A      INT1CR:   .EQUAL 0FF3AH      ;INT 1 CONTROL REGISTAR
40          0000:FF3C      INT2CR:   .EQUAL 0FF3CH      ;INT 2 CONTROL REGISTAR
41          0000:FF3E      INT3CR:   .EQUAL 0FF3EH      ;INT 3 CONTROL REGISTAR
42
43

```

```

44 ; 80188 TIMER CONTROL REGISTARS
45
46 0000:FF50 TOCOUT: .EQUAL 0FF50H ;TIMER 0 COUNT REGISTER
47 0000:FF52 TOMAXA: .EQUAL 0FF52H ;TIMER 0 MAXIMUM COUNT A REGISTER
48 0000:FF54 TOMAXB: .EQUAL 0FF54H ;TIMER 0 MAXIMUM COUNT B REGISTER
49 0000:FF56 TOMODE: .EQUAL 0FF56H ;TIMER 0 MODE REGISTER
50 0000:FF58 T1COUT: .EQUAL 0FF58H ;TIMER 1 COUNT REGISTER
51 0000:FF5A T1MAXA: .EQUAL 0FF5AH ;TIMER 1 MAXIMUM COUNT A REGISTER
52 0000:FF5C T1MAXB: .EQUAL 0FF5CH ;TIMER 1 MAXIMUM COUNT B REGISTER
53 0000:FF5E T1MODE: .EQUAL 0FF5EH ;TIMER 1 MODE REGISTER
54 0000:FF60 T2COUT: .EQUAL 0FF60H ;TIMER 2 COUNT REGISTER
55 0000:FF62 T2MAXA: .EQUAL 0FF62H ;TIMER 2 MAXIMUM COUNT A REGISTER
56 0000:FF66 T2MODE: .EQUAL 0FF66H ;TIMER 2 MODE REGISTER
57
58
59 ; 80188 CHIP SELECT CONTROL REGISTARS
60
61 0000:FFA0 UMCS: .EQUAL 0FFA0H ;80188 INTERNAL UPPER MEMORY CHIP
62 ;SELECT CONTROL BLOCK REGISTER
63 0000:FFA2 LMCS: .EQUAL 0FFA2H ;80188 INTERNAL LOWER MEMORY CHIP
64 ;SELECT CONTROL BLOCK REGISTER
65 0000:FFA4 PACS: .EQUAL 0FFA4H ;80188 INTERNAL PERIPHERAL CHIP
66 ;SELECT CONTROL BLOCK REGISTER
67 0000:FFA6 MMCS: .EQUAL 0FFA6H ;80188 INTERNAL MIDDLE MEMORY
68 ;START ADDRESS REGISTER
69 0000:FFA8 MPCS: .EQUAL 0FFA8H ;80188 INTERNAL MIDDLE MEMORY CHIP
70 ;SELECT CONTROL BLOCK REGISTER
71
72
73 ; 80188 DMA CHANNEL CONTROL REGISTARS
74
75 0000:FFC0 DOSPL: .EQUAL 0FFC0H ;DMA 0 SOURCE POINTER LSB REGISTER
76 0000:FFC2 DOSPM: .EQUAL 0FFC2H ;DMA 0 SOURCE POINTER MSB REGISTER
77 0000:FFC4 DODPL: .EQUAL 0FFC4H ;DMA 0 DESTINATION POINTER LSB REGISTER
78 0000:FFC6 DODPM: .EQUAL 0FFC6H ;DMA 0 DESTINATION POINTER MSB REGISTER
79 0000:FFC8 DOTC: .EQUAL 0FFC8H ;DMA 0 TRANSFER COUNT REGISTER
80 0000:FFCA DOMODE: .EQUAL 0FFCAH ;DMA 0 MODE REGISTER
81 0000:FFD0 D1SPL: .EQUAL 0FFD0H ;DMA 1 SOURCE POINTER LSB REGISTER
82 0000:FFD2 D1SPM: .EQUAL 0FFD2H ;DMA 1 SOURCE POINTER MSB REGISTER
83 0000:FFD4 D1DPL: .EQUAL 0FFD4H ;DMA 1 DESTINATION POINTER LSB REGISTER
84 0000:FFD6 D1DPM: .EQUAL 0FFD6H ;DMA 1 DESTINATION POINTER MSB REGISTER
85 0000:FFD8 D1TC: .EQUAL 0FFD8H ;DMA 1 TRANSFER COUNT REGISTER
86 0000:FFDA D1MODE: .EQUAL 0FFDAH ;DMA 1 MODE REGISTER
87
88
89 ; 80188 INTERNAL I/O RELOCATION REGISTER
90
91 0000:FFF8 RELOC: .EQUAL 0FFF8H ;I/O RELOCATION REGISTER
92
93
94 ; 80188 INITIAL VALUES FOR INTERNAL REGISTARS
95
96 0000:007D LMBS: .EQUAL 007DH ;LOWER MEMORY BLOCK SIZE = 2K
97 0000:81BD MMBS: .EQUAL 81BDH ;MIDDLE MEMORY BLOCK SIZE = 8K
98 0000:03FD MMST: .EQUAL 03FDH ;MIDDLE MEMORY START POSITION = 8K
99 0000:003D PST: .EQUAL 003DH ;PERIPHERAL START ADDRESS = 0
100 0000:FFBD UMBS: .EQUAL 0FFBDH ;UPPER MEMORY BLOCK SIZE = 2K

```

```

101
102
103
104           ;      EXTERNAL PORTS FOR CONTROLLING THE ROTATION AXIS
105
106           0000:0000      P1PTA: .EQUAL 0           ;PROM 1 PORT A
107           0000:0001      P1PTB: .EQUAL 1           ;PROM 1 PORT B
108           0000:0002      P1PTAD: .EQUAL 2          ;PROM 1 PORT A DIRECTION
109           0000:0003      P1PTBD: .EQUAL 3          ;PROM 1 PORT B DIRECTION
110           0000:0080      P2PTA: .EQUAL 128         ;PROM 2 PORT A
111           0000:0081      P2PTB: .EQUAL 129         ;PROM 2 PORT B
112           0000:0082      P2PTAD: .EQUAL 130        ;PROM 2 PORT A DIRECTION
113           0000:0083      P2PTBD: .EQUAL 131        ;PROM 2 PORT B DIRECTION
114           0000:0100      RAMTC: .EQUAL 256         ;RAM TIMER AND CONTROL
115           0000:0101      RAMPTA: .EQUAL 257         ;RAM PORT A
116           0000:0102      RAMPTB: .EQUAL 258         ;RAM PORT B
117           0000:0103      RAMPTC: .EQUAL 259         ;RAM PORT C
118           0000:0104      RAMTLO: .EQUAL 260         ;RAM TIMER LOW
119           0000:0105      RAMTHI: .EQUAL 261         ;RAM TIMER HIGH
120           0000:0180      APEXRQ: .EQUAL 384        ;APEX REQ
121           0000:0182      APEXRS: .EQUAL 386        ;APEX RESPONSE
122           0000:0182      POSM: .EQUAL 386          ;POSITION MSB
123           0000:0181      POSL: .EQUAL 385          ;POSITION LSB
124           0000:0184      VELM: .EQUAL 388          ;VELOCITY MSB
125           0000:0183      VELL: .EQUAL 387          ;VELOCITY LSB
126           0000:0186      ANAH: .EQUAL 390          ;ANALOGS MSB
127           0000:0185      ANAL: .EQUAL 389          ;ANALOGS LSB
128           0000:0187      DISCR: .EQUAL 391         ;FOC DISCRETES
129           0000:018B      RELADD: .EQUAL 395         ;GET RELATIVE ADDRESS
130           0000:018C      COMML: .EQUAL 396         ;CONTROL VALUE LSB
131           0000:018D      COMMH: .EQUAL 397         ;CONTROL VALUE MSB
132           0000:018E      DEVACK: .EQUAL 398        ;DEVICE ACKNOWLEDGE
133           0000:018F      MONL: .EQUAL 399          ;MONITOR DATA MSB
134           0000:0190      MONH: .EQUAL 400          ;MONITOR DATA LSB
135           0000:0191      ADL: .EQUAL 401           ;READ A/D LSB
136           0000:0192      ADH: .EQUAL 402           ;READ A/D MSB
137           0000:0193      SEMCT: .EQUAL 403         ;SELECT MOTOR CURRENT/TORQUE
138           0000:0194      STCNV: .EQUAL 404         ;START A/D CONVERT
139           0000:0195      MODESW: .EQUAL 405        ;READ MODE SWITCH
140           0000:0196      LTCHDA: .EQUAL 406        ;LATCH DRIVE D/A
141           0000:0197      BDERL1: .EQUAL 407        ;BDS3 ERROR LSB #1
142           0000:0198      BDERM1: .EQUAL 408        ;BDS3 ERROR MSB #1
143
144
145           0000:0000      DSEG: SEGMENT
146
147           ;      DATA STORAGE
148
149           0000:2000      ORG      2000H
150
151           0000:2000      MEMST: .EQUAL $
152
153           ;      MONITOR STORAGE
154
155           0000:2000      POSCEC: .BLKB 2           ;POSITION COMMAND ECHO
156           0000:2002      POSD: .BLKB 2           ;CURRENT POSITION DATA
157           0000:2004      ERROR: .BLKB 2           ;POSCEC-POSD

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158 0000:2006          SYSTEM: .BLKB 2          ;SYSTEM PARAMETERS
159 0000:2008          FAUL1:  .BLKB 2          ;FAULT BITS SET 1
160 0000:200A          FAUL2:  .BLKB 2          ;FAULT BITS SET 2
161 0000:200C          ANAFL:  .BLKB 2          ;ANALOG FAULT FLAGS
162
163           0000:200E  ANADT:  .EQUAL $          ;ANALOG STORAGE IS HERE
164
165 0000:200E          GND1:  .BLKB 2          ;GND
166 0000:2010          GND2:  .BLKB 2          ;GND
167 0000:2012          GND3:  .BLKB 2          ;GND
168 0000:2014          VEL:    .BLKB 2          ;ROTATION VELOCITY
169 0000:2016          V15P:  .BLKB 2          ;+15V/2
170 0000:2018          V15N:  .BLKB 2          ;-15V/2
171 0000:201A          V5:    .BLKB 2           ;+5V
172 0000:201C          V10P:  .BLKB 2          ;+10V
173 0000:201E          MTEMP1: .BLKB 2          ;MOUNT TEMP 1
174 0000:2020          V10N:  .BLKB 2          ;-10V
175 0000:2022          MTEMP2: .BLKB 2          ;MOUNT TEMP 2
176 0000:2024          BTEMP:  .BLKB 2          ;BIN TEMP
177
178 0000:2026          SERVER: .BLKB 2          ;SERIAL/VERSION
179 0000:2028          VEL1:  .BLKB 2
180 0000:202A          X22:   .BLKB 2
181 0000:202C          X23:   .BLKB 2
182 0000:202E          X24:   .BLKB 2
183 0000:2030          X25:   .BLKB 2
184 0000:2032          X26:   .BLKB 2
185 0000:2034          X27:   .BLKB 2
186 0000:2036          X28:   .BLKB 2
187 0000:2038          X29:   .BLKB 2
188 0000:203A          X30:   .BLKB 2
189 0000:203C          X31:   .BLKB 2
190 0000:203E          X32:   .BLKB 2
191
192
193           ;          TEMPORARY STORAGE
194
195 0000:2040          RAC:    .BLKB 1          ;RELATIVE CONTROL ADDRESS
196 0000:2041          CONL:  .BLKB 1          ;CONTROL VALUE LSB
197 0000:2042          CONM:  .BLKB 1          ;CONTROL VALUE MSB
198 0000:2043          ACKF:  .BLKB 1          ;ACKNOWLEDGE FLAG
199 0000:2044          COMTMP: .BLKB 2          ;TEMPORARY COMMAND STORAGE
200 0000:2046          ADVAL: .BLKB 2          ;A/D TEMPORARY STORAGE
201 0000:2048          SPEED: .BLKB 1          ;RAMP LEVEL
202 0000:2049          BREAK1: .BLKB 2          ;RAMP UP BREAK POINT
203 0000:204B          BREAK2: .BLKB 2          ;RAMP DOWN BREAK POINT
204 0000:204D          POSDOD: .BLKB 2          ;OLD POSITION
205 0000:204F          EXTTHR: .BLKB 1          ;EXTERNAL TROUBLE TIMER
206 0000:2050          RANDOM: .BLKB 2          ;RANDOM NUMBER STORAGE
207
208           ;          FLAGS
209
210           0000:2052  FLAGST: .EQUAL $
211
212 0000:2052          RESCMD: .BLKB 1
213 0000:2053          NAPATV: .BLKB 1
214 0000:2054          NAPREQ: .BLKB 1

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```

215 0000:2055      DRVRRQ: .BLKB 1
216 0000:2056      MANOVR: .BLKB 1
217 0000:2057      BDSRST: .BLKB 1
218 0000:2058      DRVONE: .BLKB 1
219 0000:2059      ADFLAG: .BLKB 1
220 0000:205A      BFLAG: .BLKB 1
221 0000:205B      TFLAG0: .BLKB 1
222 0000:205C      TFLAG1: .BLKB 1
223 0000:205D      TFLAG2: .BLKB 1
224 0000:205E      DRVOFF: .BLKB 1
225 0000:205F      DRVATV: .BLKB 1
226 0000:2060      RAMPOS: .BLKB 2
227 0000:2062      DIR: .BLKB 1
228 0000:2063      LDIR: .BLKB 1
229
230          0000:0012      KNDFLG: .EQUAL $-FLAGST
231
232                      ENDS
233
234
235          ;          PROGRAM EQUATES
236
237          0000:2100      STCK: .EQUAL 2100H          ;STACK LOCATION
238          0000:A766      DOVAL: .EQUAL 0A766H          ;DMA 0 CONTROL VALUE
239          0000:00E8      MASKV: .EQUAL 00E8H          ;DMA 0, INTO, TIMER ENABLE
240          0000:0A00      LOW: .EQUAL 00A00H          ;LOW VALUE
241          0000:F200      HIGH: .EQUAL 0F200H          ;HIGH VALUE
242          0000:0004      CONRAM: .EQUAL 4          ;STARTING RAMP VALUE
243
244          ;          GLOBAL LIST
245
246          GLOBAL INITAL, RSCMD
247          EXTERNAL DSETUP:WORD, TSETUP:WORD, TSET1:WORD
248
249          ;          PROGRAM ENTERS HERE AFTER RESET ROUTINE (AS IF BY MAGIC)
250
251          FF80:0000      ORG      OFF80:0000H
252
253
254          FF80:0000      INITAL:
255          FF80:0000      BC 00 21      MOV      SP,STCK          ;SET STACK POINTER
256
257          ;          LETS INITIALIZE MORE 80188 CHIP SELECT LOGIC
258
259          FF80:0003      BA A2 FF      MOV      DX,LMCS          ;SET UP LOWER MEMORY BLOCK
260          FF80:0006      B8 7D 00      MOV      AX,LMBS          ;TO 2K
261          FF80:0009      EF          OUT      DX,AX
262          FF80:000A      BA A8 FF      MOV      DX,MPCS          ;NOW SET MIDDLE MEMORY BLOCK TO
263          FF80:000D      B8 BD 81      MOV      AX,MMBS          ;2K AND I/O MAPPED PCS LINES
264          FF80:0010      EF          OUT      DX,AX
265          FF80:0011      BA A6 FF      MOV      DX,MMCS          ;SET MIDDLE MEMORY TO START AT
266          FF80:0014      B8 FD 03      MOV      AX,MMST          ;8K
267          FF80:0017      EF          OUT      DX,AX
268          FF80:0018      BA A4 FF      MOV      DX,PACS          ;SET UP THE PERIPHERAL ADDRESS
269          FF80:001B      B8 3D 00      MOV      AX,PST          ;TO START AT 0
270          FF80:001E      EF          OUT      DX,AX
271

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272 ; LETS INITIALIZE PORTS AND PORT VALUES
273
274 FF80:001F B8 FF FF MOV AX,0FFFFH ;EPROM 1 PORT A, B = OUTPUT
275 FF80:0022 E7 02 OUT PIPTAD,AX
276 FF80:0024 B8 FF 07 MOV AX,07FFH ;UPPER NYBBLE = INPUT
277 FF80:0027 E7 82 OUT P2PTAD,AX
278 FF80:0029 BA 00 01 MOV DX,RAMTC ;NOW DO RAM'S I/O
279 FF80:002C EE OUT DX,AL ;SET TO OUTPUT
280 FF80:002D 33 C0 XOR AX,AX ;CLEAR ACC
281 FF80:002F E7 00 OUT PIPTA,AX ;CLEAR EPROM 1 PORTS A AND B
282 FF80:0031 E7 80 OUT P2PTA,AX ;CLEAR EPROM 2 PORTS A AND B
283 FF80:0033 42 INC DX ;POINT TO RAM PORT A
284 FF80:0034 EF OUT DX,AX ;CLEAR RAM PORTS A AND B
285 FF80:0035 42 INC DX
286 FF80:0036 EF OUT DX,AX ;CLEAR PORT C TOO
287 FF80:0037 BA 93 01 MOV DX,SEMCT ;CLEAR LIGHTS
288 FF80:003A EE OUT DX,AL
289
290 ; NOW LETS SET UP THE DMA 0 CHANNEL
291
292 FF80:003B BE 00 00 MOV SI,OFFSET DSETUP ;POINT TO TABLE
293 FF80:003E BA C0 FF MOV DX,DOSPL ;SET UP SOURCE POINTER
294 FF80:0041 B9 06 00 MOV CX,6
295 FF80:0044 6F DSET: OUTSW
296 FF80:0045 83 C2 02 ADD DX,2
297 FF80:0048 E2 FA LOOP DSET
298
299 ; NOW LETS INITIALIZE THE TIMERS
300
301 FF80:004A E8 1F 06 CALL THROFF
302
303 ; NOW LETS ZERO MEMORY
304
305 FF80:004D 32 C0 XOR AL,AL
306 FF80:004F B9 00 01 MOV CX,256 ;256 LOCATIONS
307 FF80:0052 BF 00 20 MOV DI,OFFSET MEMST ;START OF INDEX
308 FF80:0055 F3 AA REP STOS BYTE PTR MEMST
309
310
311 ; NOW LETS TURN ON THE INTERRUPTS
312
313 FF80:0057 BA 28 FF MOV DX,MASK ;LETS TURN ON DMA, INTO, TIMER
314 FF80:005A B8 E8 00 MOV AX,MASKV ;INTERRUPTS
315 FF80:005D EF OUT DX,AX
316 FF80:005E BA 38 FF MOV DX,INTOCR ;SET INTO PRIORITY
317 FF80:0061 B8 00 00 MOV AX,0 ;HIGHEST PRIORITY
318 FF80:0064 EF OUT DX,AX
319 FF80:0065 FB STI
320
321 ; LETS RESET THE BDS3 SERVO AMPLIFIERS
322
323 FF80:0066 E8 72 05 CALL BDS3RS ;INITIATE RESET
324 FF80:0069
325 ; LETS JUST WAIT FOR THREE SECONDS FOR THINGS TO SETTLE
326
327 FF80:0069 B9 03 00 MOV CX,3 ;THREE SECONDS TOTAL
328 FF80:006C E8 DC 05 CALL DELAY

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329
330 ; NOW LETS WAIT FOR THE THREE PHASE
331
332 PHASE:
333 FF80:006F      MOV    AX,8000H      ;TURN ON 3 PHASE
334 FF80:0072      OUT    PIPTA,AX
335 FF80:0074      MOV    CX,3          ;THREE SECONDS TOTAL
336 FF80:0077      PH301: MOV    TFLAG1,0      ;SET TIMER FLAG = OK
337 FF80:007C      MOV    DX,BDRRL1    ;GET BDS3 INFO
338 FF80:007F      PH302: IN     AX,DX
339 FF80:0080      NOT    AX            ;INVERT
340 FF80:0082      AND    AX,0101H     ;TEST FOR BUS FAULTS
341 FF80:0085      JZ     THREX        ;EXIT IF OK
342 FF80:0087      TEST   TFLAG1,1     ;TIME OUT?
343 FF80:008C      JZ     PH302        ;LOOP UNTIL TIME OUT
344 FF80:008E      LOOP  PH301        ;UNTIL THREE SEC HAVE PASSED
345 FF80:0090      MOV    FAUL2,AX     ;SET BDS3 DEAD FLAG
346 FF80:0093      JMP    PHASE        ;IF BUS FAULT
347
348 THREX:
349 FF80:0096      CALL  TMROFF        ;STOP TIMERS
350 FF80:0099      MOV    WORD PTR FAUL2,0 ;CLEAR BDS3 DEAD FLAG
351
352
353 ; SERIAL NUMBER / REVISION
354
355 FF80:009F      MOV    WORD PTR SERVER,0603H
356
357 ; LETS DO ONE DSTOR PRIOR TO ENTRY
358
359 FF80:00A5      CALL  DSTOR
360
361
362 ; HERE WE ARE INTO THE MAIN PROGRAM
363
364
365 BOSS:
366 FF80:00A8      MOV    CX,RANDOM    ;GET RANDOM DELAY
367 FF80:00AC      WAIT: LOOP  WAIT    ;DELAY
368 FF80:00AE      MOV    SP,STCK     ;LETS SET UP STACK POINTER
369 FF80:00B1      TEST   FAUL1,1     ;APEX OK?
370 FF80:00B6      JZ     NEXT        ;IF OK
371 FF80:00B8      JMP    RSCMD       ;IF APEX BROKE
372 FF80:00BB      NEXT:
373 FF80:00BB      TEST   DRVATV,1    ;DRIVE ACTIVE?
374 FF80:00C0      JZ     NEXT0       ;IF NOT
375 FF80:00C2      CALL  CHKDRV       ;IF ACTIVE
376 FF80:00C5      JMP    BOSS
377 FF80:00C8      NEXT0:
378 FF80:00C8      CALL  DSTOR        ;LETS GET APEX DATA
379 FF80:00CB      TEST   MANOVR,1    ;MANUAL OVERRIDE?
380 FF80:00D0      JZ     NEXT1A      ;IF NOT OVER RIDE
381 FF80:00D2      OR     SYSTEM,8    ;MANUAL OVER RIDE FLAG
382 FF80:00D7      JMP    SHORT NEXT1
383 FF80:00D9      NEXT1A: IN     AL,P2PTB ;IN LOCAL?
384 FF80:00DB      AND    AL,20H
385 FF80:00DD      JNZ   NEXT1        ;IF NOT

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386 FF80:00DF E9 71 02          JMP     LOCAL          ;IF LOCAL
387 FF80:00E2                NEXT1:
388 FF80:00E2 F6 06 57 20 01        TEST   BDSRST,1       ;RESET BDS3 SERVO AMP?
389 FF80:00E7 74 14                JZ     NEXT2          ;IF NOT
390 FF80:00E9 C6 06 57 20 00        MOV    BDSRST,0       ;RESET REQUEST
391 FF80:00EE E8 EA 04                CALL   BDS3RS         ;DO IT
392 FF80:00F1 B9 01 00                MOV    CX,1           ;WAIT 1 SEC
393 FF80:00F4 E8 54 05                CALL   DELAY
394 FF80:00F7 E8 72 05                CALL   TMROFF         ;STOP TIMERS
395 FF80:00FA E9 AB FF                JMP    BOSS
396 FF80:00FD                NEXT2:
397 FF80:00FD F6 06 52 20 01        TEST   RESCMD,1       ;SOFT RESET?
398 FF80:0102 74 03                JZ     NEXT3          ;IF NOT
399 FF80:0104 E9 38 00                JMP    CMDRS          ;IF RESET
400 FF80:0107                NEXT3:
401 FF80:0107 F6 06 53 20 01        TEST   NAPATV,1       ;IN NAP?
402 FF80:010C 74 08                JZ     NEXT4          ;IF NOT
403 FF80:010E C6 06 55 20 00        MOV    DRVREQ,0       ;IF NAP, KILL REQ
404 FF80:0113 E9 92 FF                JMP    BOSS           ;IF NAP, GOTO BOSS
405 FF80:0116                NEXT4:
406 FF80:0116 F6 06 55 20 01        TEST   DRVREQ,1       ;DRIVE REQUEST?
407 FF80:011B 74 06                JZ     NEXT5          ;IF NO DRIVE REQUEST
408 FF80:011D E8 B0 00                CALL   DRVINT         ;IF DRIVE REQUEST
409 FF80:0120 E9 85 FF                JMP    BOSS
410 FF80:0123                NEXT5:
411 FF80:0123 F6 06 54 20 01        TEST   NAPREQ,1       ;NAP REQUEST?
412 FF80:0128 75 03                JNZ    NEXT6          ;IF NO NAP REQUEST
413 FF80:012A E9 7B FF                JMP    BOSS
414 FF80:012D                NEXT6:
415 FF80:012D C6 06 54 20 00        MOV    NAPREQ,0       ;REMOVE NAP REQUEST
416 FF80:0132 C6 06 53 20 FF        MOV    NAPATV,OFFH    ;SET NAP ACTIVE
417 FF80:0137 80 0E 06 20 01        OR     SYSTEM,1       ;SET NAP FLAG
418 FF80:013C E9 69 FF                JMP    BOSS           ;END OF MAIN ROUTINE
419
420 FF80:013F                CMDRS:
421 FF80:013F 81 26 08 20 1F FC        AND    WORD PTR FAUL1,0FC1FH ;CLEAR CERTAIN FAULTS
422 FF80:0145 81 26 06 20 FE FF        AND    WORD PTR SYSTEM,OFFFEH ;CLEAR NAP
423 FF80:014B                RSCMD:
424 FF80:014B 81 26 06 20 F5 FF        AND    WORD PTR SYSTEM,OFFF5H ;CLEAR LOCAL, OVER RIDE
425 FF80:0151 BC 00 21                MOV    SP,STCK        ;RESET STACK
426 FF80:0154 C6 06 5E 20 01        MOV    DRVOFF,1       ;TURN OFF DRIVE
427 FF80:0159 F6 06 5F 20 01        TEST   DRVATV,1       ;DRIVING?
428 FF80:015E 74 03                JZ     RSCMD1         ;IF NOT DRIVING
429 FF80:0160 E9 45 FF                JMP    BOSS           ;IF STILL DRIVING
430 FF80:0163                RSCMD1:
431 FF80:0163 32 C0                XOR    AL,AL          ;NOW ZERO FLAGS
432 FF80:0168 B9 12 00                MOV    CX,ENDFLG      ;NUMBER OF FLAG LOCATIONS
433 FF80:016B F3 AA                REP STOS BYTE PTR FLAGST ;START OF FLAGS
434 FF80:016D E8 B2 04                CALL   BRKOFF         ;ENGAGE BRAKE
435 FF80:0170 C6 06 52 20 00        MOV    RESCMD,0       ;KILL RESET REQUEST
436 FF80:0175 B8 00 00                MOV    AX,0           ;KILL LIGHTS
437 FF80:0178 E7 80                OUT   P2PTA,AX
438 FF80:017A E9 2B FF                JMP    BOSS
439
440 FF80:017D                CHKDRV:
441 FF80:017D FE 0E 4F 20                DEC   BYTE PTR EXTMR   ;DEC SAFETY TIMER
442 FF80:0181 75 01                JNZ   CHKDRO          ;IF OK

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443 FF80:0183 CC INT 3 ;DO TIMER THIS WAY
444 FF80:0184 F6 06 55 20 01 CHKDR0: TEST DRVREQ,1 ;NEW REQUEST
445 FF80:0189 75 01 JNZ CHKDR1 ;IF REQUEST
446 FF80:018B C3 RET ;IF NOT
447 FF80:018C C6 06 55 20 00 CHKDR1: MOV DRVREQ,0 ;KILL REQUEST
448 FF80:0191 8B 1E 00 20 MOV BX,POSCXC ;BUT TEST FOR CLOSE
449 FF80:0195 2B 1E 44 20 SUB BX,COMTMP
450 FF80:0199 C6 06 5A 20 00 MOV BFLAG,0 ;ASSUME IN BOUND
451 FF80:019E 2E 62 1E AC 06 BOUND BX,CS:CLSETAB ;CLOSE?
452 FF80:01A3 F6 06 5A 20 01 TEST BFLAG,1
453 FF80:01A8 75 07 JNZ CHKDR2 ;IF NOT CLOSE
454 FF80:01AA C7 06 44 20 00 00 MOV WORD PTR COMTMP,0 ;FOR DRIVE OK
455 FF80:01B0 C3 RET ;IF CLOSE
456 FF80:01B1 C6 06 5E 20 01 CHKDR2: MOV DRVOFF,1 ;TURN OFF DRIVE
457 FF80:01B6 C6 06 55 20 01 MOV DRVREQ,1 ;RETAIN REQUEST
458 FF80:01BB F6 06 5F 20 01 TEST DRVATV,1 ;DRIVING?
459 FF80:01C0 74 01 JZ CHKDR3 ;IF STOPPED
460 FF80:01C2 C3 RET ;IF STILL DRIVING
461 FF80:01C3 32 C0 CHKDR3: XOR AL,AL ;NOW ZERO FLAGS
462 FF80:01C5 B9 12 00 MOV CX,ENDFLG ;NUMBER OF FLAG LOCATIONS
463 FF80:01C8 BF 52 20 MOV DI,OFFSET FLAGST ;START OF FLAGS
464 FF80:01CB F3 AA REP STOS BYTE PTR FLAGST
465 FF80:01CD E8 52 04 CALL BRKOFF ;ENGAGE BRAKE
466
467 FF80:01D0
468 FF80:01D0 C6 06 55 20 00 MOV DRVREQ,0 ;KILL REQUEST
469 FF80:01D5 F7 06 08 20 00 18 TEST WORD PTR FAUL1,1800H ;E-STOP, DRIVE LOCKOUT?
470 FF80:01DB 74 01 JZ DRVCNT ;IF OK
471 FF80:01DD C3 RET
472 FF80:01DE 32 C0 DRVCNT: XOR AL,AL ;CLEAR ALL DRIVE FLAGS
473 FF80:01E0 B9 05 00 MOV CX,OFFSET FLAGST+ENDFLG-DRVATV
474 FF80:01E3 BF 5F 20 MOV DI,OFFSET DRVATV
475 FF80:01E6 F3 AA REP STOS BYTE PTR DRVATV
476 FF80:01E8 C7 06 08 20 00 00 MOV WORD PTR FAUL1,0 ;CLEAR FAULTS
477 FF80:01EE C7 06 0A 20 00 00 MOV WORD PTR FAUL2,0
478 FF80:01F4 8B 1E 44 20 MOV BX,COMTMP ;MAKE TEMP COMMAND ACTUAL COMMAND
479 FF80:01F8 89 1E 00 20 MOV POSCXC,BX
480 FF80:01FC C7 06 44 20 00 00 MOV WORD PTR COMTMP,0
481 FF80:0202 E8 AC 02 CALL DSTOR
482
483 ;LOCAL SETUP ENTERS HERE
484
485 FF80:0205
486 FF80:0205 F7 06 08 20 00 18 LOCTST: TEST WORD PTR FAUL1,1800H ;E-STOP, DRIVE LOCKOUT?
487 FF80:020B 74 01 JZ LOCCNT ;IF OK
488 FF80:020D C3 RET
489 FF80:020E 81 3E 0A 20 48 48 LOCCNT: CMP WORD PTR FAUL2,4848H ;NORMAL BDS3?
490 FF80:0214 74 01 JZ DRVINO ;IF OK
491 FF80:0216 C3 RET ;ELSE DO NOTHING
492 FF80:0217 8B 1E 04 20 DRVINO: MOV BX,ERROR ;GET ERROR
493 FF80:021B C6 06 5A 20 00 MOV BFLAG,0
494 FF80:0220 2E 62 1E AC 06 BOUND BX,CS:CLSETAB ;CHECK FOR NEARNESS
495 FF80:0225 F6 06 5A 20 01 TEST BFLAG,1
496 FF80:022A 75 01 JNZ DRVIN1 ;IF NOT NEAR
497 FF80:022C C3 RET ;IF NEAR
498 FF80:022D A0 08 20 DRVIN1: MOV AL,FAUL1 ;GET LIMIT INFO
499 FF80:0230 F6 06 62 20 01 TEST DIR,1 ;TEST DIRECTION

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500 FF80:0235 74 05          JZ     DRVIN2          ;IF POSITIVE
501 FF80:0237 24 18          AND    AL,24           ;CCW LIMIT?
502 FF80:0239 74 06          JZ     DRVIN3
503 FF80:023B C3              RET                    ;IF IN CCW LIMIT
504 FF80:023C 24 06          DRVIN2: AND    AL,6     ;CW LIMIT?
505 FF80:023E 74 01          JZ     DRVIN3
506 FF80:0240 C3              RET                    ;IF IN CW LIMIT
507 FF80:0241 A0 62 20        DRVIN3: MOV    AL,DIR
508 FF80:0244 A2 63 20        MOV    LDIR,AL
509 FF80:0247 BA 00 00        MOV    DX,0           ;SET UP FOR DIVIDE
510 FF80:024A A1 04 20        MOV    AX,ERROR       ;GET ERROR
511 FF80:024D F6 06 63 20 01    TEST   LDIR,1         ;TEST FOR NEGATIVE
512 FF80:0252 74 02          JZ     DRVIN4         ;IF POSITIVE
513 FF80:0254 F7 D8          NEG    AX              ;MAKE ABSOLUTE VALUE
514 FF80:0256 50              DRVIN4: PUSH   AX      ;SAVE ERROR
515 FF80:0257 B9 64 00        MOV    CX,100         ;DIVIDE BY 100
516 FF80:025A F7 F1          DIV    CX
517 FF80:025C 52              PUSH   DX
518 FF80:025D 50              PUSH   AX
519 FF80:025E 52              PUSH   DX
520 FF80:025F B9 0C 00        MOV    CX,12          ;TIMES 12
521 FF80:0262 F7 E1          MUL    CX
522 FF80:0264 8B D8          MOV    BX,AX          ;STORE HERE
523 FF80:0266 58              POP    AX              ;NOW REMAINDER
524 FF80:0267 F7 E1          MUL    CX
525 FF80:0269 B9 64 00        MOV    CX,100         ;ADJUST
526 FF80:026C F7 F1          DIV    CX
527 FF80:026E 03 D8          ADD    BX,AX
528 FF80:0270 A1 02 20        MOV    AX,POSD
529 FF80:0273 A3 4D 20        MOV    POSDOD,AX     ;OLD POS = CURRENT
530 FF80:0276 75 03          JNZ   DRVIN5         ;ZERO?
531 FF80:0278 BB 01 00        MOV    BX,1           ;IF ZERO
532 FF80:027B F6 06 06 20 02    DRVIN5: TEST   SYSTEM,2 ;IN MANUAL?
533 FF80:0280 74 08          JZ     DRVIN6         ;IF NOT
534 FF80:0282 83 FB 3C        CMP    BX,60          ;>60?
535 FF80:0285 72 03          JC     DRVIN6         ;IF LESS
536 FF80:0287 BB 3C 00        MOV    BX,60          ;SET MAX RAMP
537 FF80:028A F6 06 63 20 01    DRVIN6: TEST   LDIR,1  ;CHECK DIRECTION
538 FF80:028F 74 02          JZ     DRVIN7         ;IF POSITIVE
539 FF80:0291 F7 DB          NEG    BX
540 FF80:0293 03 C3          DRVIN7: ADD    AX,BX   ;FIRST BREAK POINT
541 FF80:0295 A3 49 20        MOV    BREAK1,AX
542 FF80:0298 A1 04 20        MOV    AX,ERROR       ;GET ERROR
543 FF80:029B F6 06 63 20 01    TEST   LDIR,1         ;TEST FOR NEGATIVE
544 FF80:02A0 74 02          JZ     DRVIN8         ;IF POSITIVE
545 FF80:02A2 F7 D8          NEG    AX              ;MAKE ABSOLUTE VALUE
546 FF80:02A4 B9 28 00        DRVIN8: MOV    CX,40   ;SET SMALL DELTA
547 FF80:02A7 3D 00 10        CMP    AX,1000H       ;LARGER DELTA?
548 FF80:02AA 72 0B          JC     DRVIN9         ;IF SMALL
549 FF80:02AC B9 3C 00        MOV    CX,60          ;SET MEDIUM DELTA
550 FF80:02AF 3D 00 30        CMP    AX,3000H       ;SMALL DELTA?
551 FF80:02B2 72 03          JC     DRVIN9         ;IF MEDIUM
552 FF80:02B4 B9 50 00        MOV    CX,80          ;ELSE SET LARGE
553 FF80:02B7 58              DRVIN9: POP    AX     ;NOW SECOND BREAK POINT
554 FF80:02B8 F7 E1          MUL    CX
555 FF80:02BA 8B D8          MOV    BX,AX          ;STORE HERE
556 FF80:02BC 58              POP    AX              ;NOW REMAINDER

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557 FF80:02BD F7 E1 MUL CX
558 FF80:02BF B9 64 00 MOV CX,100 ;ADJUST
559 FF80:02C2 F7 F1 DIV CX
560 FF80:02C4 03 D8 ADD BX,AX
561 FF80:02C6 58 POP AX ;RESTORE ERROR
562 FF80:02C7 F6 06 06 20 02 TEST SYSTEM,2 ;IN MANUAL?
563 FF80:02CC 74 0C JZ DRVINA ;IF NOT
564 FF80:02CE 2B C3 SUB AX,BX ;FIND DIFFERENCE
565 FF80:02D0 3D 41 00 CMP AX,65 ;>65?
566 FF80:02D3 72 05 JC DRVINA ;IF LESS
567 FF80:02D5 03 D8 ADD BX,AX ;GET ERROR IN BX
568 FF80:02D7 83 EB 41 SUB BX,65 ;MAKE BREAK 65 COUNTS LESS
569 FF80:02DA A1 02 20 DRVINA: MOV AX,POSD
570 FF80:02DD F6 06 63 20 01 TEST LDIR,1 ;CHECK DIRECTION
571 FF80:02E2 74 02 JZ DRVINEB ;IF POSITIVE
572 FF80:02E4 F7 DB NEG BX
573 FF80:02E6 03 C3 DRVINEB: ADD AX,BX ;SECOND BREAK POINT
574 FF80:02E8 A3 4B 20 MOV BREAK2,AX
575 FF80:02EB C7 06 28 20 00 00 MOV WORD PTR VEL1,0 ;INITIAL VEL = 0
576 FF80:02F1 E8 FC 02 CALL BRKON ;TURN ON BRAKE
577 FF80:02F4 E5 00 IN AX,P1PTA ;GET CURRENT DATA
578 FF80:02F6 25 00 F0 AND AX,0F000H ;JUST CURRENT STATUS
579 FF80:02F9 BB 04 00 MOV BX,CONRAM ;START DRIVE AT 10mV
580 FF80:02FC F6 06 63 20 01 TEST LDIR,1 ;NEGATIVE?
581 FF80:0301 74 02 JZ DRVINC ;IF POSITIVE
582 FF80:0303 F7 DB NEG BX ;SET NEGATIVE
583 FF80:0305 81 E3 FF 0F DRVINC: AND BX,0FFFH ;STRIP UNWANTED BITS
584 FF80:0309 0B C3 OR AX,BX ;MERGE
585 FF80:030B E7 00 OUT P1PTA,AX ;SEND IT
586 FF80:030D BA 96 01 MOV DX,LTCHDA ;LATCH IT
587 FF80:0310 EE OUT DX,AL
588 FF80:0311 80 CC 10 OR AH,10H ;ENABLE DRIVE
589 FF80:0314 E7 00 OUT P1PTA,AX
590 FF80:0316 C6 06 48 20 1E MOV SPEED,30 ;SET RAMP VALUE
591 FF80:031B C7 06 60 20 00 00 MOV WORD PTR RAMPOS,0 ;SET RAMP UP
592 FF80:0321 BA 66 FF MOV DX,T2MODE ;NOW START TIMER 2
593 FF80:0324 B8 01 E0 MOV AX,0E001H
594 FF80:0327 EF OUT DX,AX
595 FF80:0328 C6 06 5F 20 01 MOV DRVATV,1 ;SET DRIVE ACTIVE
596 FF80:032D E5 80 IN AX,P2PTA ;GET CURRENT STATUS
597 FF80:032F 25 97 FF AND AX,0FF97H ;STRIP IT
598 FF80:0332 F6 06 06 20 02 TEST SYSTEM,2 ;IN MANUAL?
599 FF80:0337 75 02 JNZ DRVIND ;IF MANUAL
600 FF80:0339 0C 08 OR AL,8 ;SET CMD LIGHT
601 FF80:033B F6 06 63 20 01 DRVIND: TEST LDIR,1 ;NEGATIVE?
602 FF80:0340 74 06 JZ DRVINE ;IF POSITIVE
603 FF80:0342 0D 20 00 OR AX,32 ;SET CCW LIGHT
604 FF80:0345 E9 03 00 JMP DRVINF
605 FF80:0348 0D 40 00 DRVINE: OR AX,64 ;SET CW LIGHT
606 FF80:034B E7 80 DRVINF: OUT P2PTA,AX ;SEND IT
607 FF80:034D C6 06 4F 20 19 MOV EXTTHR,25 ;INITIALIZE TIMER
608 FF80:0352 C3 RET
609
610 FF80:0353 LOCAL:
611 FF80:0353 80 0E 06 20 02 OR SYSTEM,2 ;SET LOCAL FLAG
612 FF80:0358 F6 06 56 20 01 TEST MANOVR,1 ;MANUAL OVERRIDE?
613 FF80:035D 74 12 JZ LOCLB ;IF NOT

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614 FF80:035F F6 06 5F 20 01 TEST DRVATV,1 ;DRIVE ACTIVE?
615 FF80:0364 75 03 JNZ LOCLA ;IF NOT OFF
616 FF80:0366 E9 3F FD JMP BOSS
617 FF80:0369 C6 06 5E 20 01 LOCLA: MOV DRVOFF,1 ;SHUT DOWN
618 FF80:036E E9 E2 FF JMP LOCAL
619 FF80:0371 BC 00 21 LOCLB: MOV SP,STCK ;SET STACK
620 FF80:0374 F6 06 08 20 01 TEST FAUL1,1 ;APEX OK?
621 FF80:0379 74 03 JZ LC1 ;IF APEX OK
622 FF80:037B E9 CD FD JMP RSCMD ;IF APEX BROKE
623 FF80:037E F6 06 5F 20 01 LC1: TEST DRVATV,1 ;DRIVE ACTIVE?
624 FF80:0383 75 2C JNZ LC1B ;IF ACTIVE
625 FF80:0385 E8 29 01 CALL DSTOR ;GET INFO
626 FF80:0388 BA 95 01 MOV DX,MODESW ;GET MODE SWITCH
627 FF80:038B EC IN AL,DX ;GET INFO
628 FF80:038C F6 D0 NOT AL ;INVERT AL
629 FF80:038E B4 00 MOV AH,0 ;SET AH=0
630 FF80:0390 C6 06 5A 20 00 MOV BFLAG,0 ;SET BLAG=0
631 FF80:0395 2E 62 06 B0 06 BOUND AX,CS:MANRG ;MODE SWITCH IN RANGE?
632 FF80:039A F6 06 5A 20 01 TEST BFLAG,1 ;OUT OF BOUNDS?
633 FF80:039F 74 03 JZ LC1A ;IF IN RANGE
634 FF80:03A1 B8 00 00 MOV AX,0 ;PROCESS-NORMAL
635 FF80:03A4 03 C0 LC1A: ADD AX,AX ;AX*2
636 FF80:03A6 8B D8 MOV BX,AX ;BX = INDEX
637 FF80:03A8 2E 8B 87 B4 06 MOV AX,CS:MANTBL[BX] ;GET ROUTINE
638 FF80:03AD FF D0 CALL AX ;DO ROUTINE
639 FF80:03AF EB 07 JMP SHORT LC1C
640 FF80:03B1 FE 0E 4F 20 LC1B: DEC BYTE PTR EXTMR ;DEC SAFETY TIMER
641 FF80:03B5 75 01 JNZ LC1C ;IF OK
642 FF80:03B7 CC INT 3 ;DO TIMER THIS WAY
643 FF80:03B8 E5 80 LC1C: IN AX,P2PTA ;GET SWITCH STATUS
644 FF80:03BA F6 C4 80 TEST AH,128 ;DRIVE CW?
645 FF80:03BD 75 03 JNZ LC2 ;NOT DRIVE CW
646 FF80:03BF E9 2C 00 JMP LUP ;DRIVE CW
647 FF80:03C2 F6 C4 40 LC2: TEST AH,64 ;DRIVE CCW
648 FF80:03C5 75 03 JNZ LC3 ;NOT DRIVE CCW
649 FF80:03C7 E9 59 00 JMP LDWN ;DRIVE CCW
650 FF80:03CA F6 06 5F 20 01 LC3: TEST DRVATV,1 ;DRIVE ACTIVE?
651 FF80:03CF 74 08 JZ LC4 ;IF NOT ACTIVE
652 FF80:03D1 C6 06 5E 20 01 MOV DRVOFF,1 ;SET DRIVE OFF
653 FF80:03D6 E9 7A FF JMP LOCAL
654 FF80:03D9 F6 C4 20 LC4: TEST AH,32 ;STILL IN LOCAL
655 FF80:03DC 74 03 JZ LC5 ;IF IN LOCAL
656 FF80:03DE E9 6A FD JMP RSCMD ;LEAVE IF NOT IN LOCAL
657 FF80:03E1 32 C0 LC5: XOR AL,AL ;CLEAR ALL DRIVE FLAGS
658 FF80:03E3 B9 05 00 MOV CX,OFFSET FLAGST+ENDFLG-DRVATV
659 FF80:03E6 BF 5F 20 MOV DI,OFFSET DRVATV
660 FF80:03E9 F3 AA REP STOS BYTE PTR DRVATV
661 FF80:03EB E9 65 FF JMP LOCAL
662
663 FF80:03EE LUP:
664 FF80:03EE F6 06 5F 20 01 TEST DRVATV,1 ;ALREADY RUNNING?
665 FF80:03F3 74 0F JZ LUP1 ;IF NOT MOVING
666 FF80:03F5 F6 06 5F 20 02 TEST DRVATV,2 ;MOVING CW?
667 FF80:03FA 75 05 JNZ LUP2 ;ALREADY GOING CW
668 FF80:03FC C6 06 5E 20 01 MOV DRVOFF,1 ;KILL DRIVE
669 FF80:0401 E9 4F FF LUP2: JMP LOCAL
670 FF80:0404 C7 06 00 20 00 F2 LUP1: MOV WORD PTR POSCEC,HIGH ;SET UPPER BOUNDARY

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671 FF80:040A E8 A4 00          CALL  DSTOR          ;GET DATA
672 FF80:040D A1 02 20          MOV   AX,POSD       ;GET CURRENT POSITION
673 FF80:0410 3D 00 F2          CMP   AX,HIGH       ;< DRIVE LIMITS
674 FF80:0413 72 03          JC    LUP3          ;IF LESS
675 FF80:0415 E9 3B FF          JMP   LOCAL
676 FF80:0418 E8 EA FD          LUP3: CALL  LOCTST       ;SET UP DRIVE PARAMETERS
677 FF80:041B 80 0E 5F 20 02      OR    DRVATV,2
678 FF80:0420 E9 30 FF          JMP   LOCAL
679
680 FF80:0423          LDWN:
681 FF80:0423 F6 06 5F 20 01      TEST  DRVATV,1       ;ALREADY RUNNING?
682 FF80:0428 74 0F          JZ    LDWN1         ;IF NOT MOVING
683 FF80:042A F6 06 5F 20 04      TEST  DRVATV,4       ;MOVING CCW?
684 FF80:042F 75 05          JNZ   LDWN2         ;ALREADY GOING CCW
685 FF80:0431 C6 06 5E 20 01      MOV   DRVOFF,1      ;KILL DRIVE
686 FF80:0436 E9 1A FF          LDWN2: JMP   LOCAL
687 FF80:0439 C7 06 00 20 00 0A    LDWN1: MOV   WORD PTR POSCEC,LOW ;SET LOWER BOUNDARY
688 FF80:043F E8 6F 00          CALL  DSTOR          ;GET DATA
689 FF80:0442 A1 02 20          MOV   AX,POSD       ;GET CURRENT POSITION
690 FF80:0445 3D 00 0A          CMP   AX,LOW        ;> DRIVE LIMITS
691 FF80:0448 73 03          JNC   LDWN3         ;IF LESS
692 FF80:044A E9 06 FF          JMP   LOCAL
693 FF80:044D E8 B5 FD          LDWN3: CALL  LOCTST       ;SET UP DRIVE PARAMETERS
694 FF80:0450 80 0E 5F 20 04      OR    DRVATV,4       ;SET CCW FLAG
695 FF80:0455 E9 FB FE          JMP   LOCAL
696
697
698 FF80:0458          NORMIT:
699 FF80:0458 E8 C7 01          CALL  BRKOFF        ;TURN OFF BRAKE
700 FF80:045B E9 06 00          JMP   ZERDA         ;ZERO D/A
701
702 FF80:045E          NEGDA:
703 FF80:045E BB 00 08          MOV   BX,800H       ;SET -5V
704 FF80:0461 E9 09 00          JMP   SETDA
705
706 FF80:0464          ZERDA:
707 FF80:0464 BB 00 00          MOV   BX,0          ;SET 0V
708 FF80:0467 E9 03 00          JMP   SETDA
709
710 FF80:046A          POSDA:
711 FF80:046A BB FF 07          MOV   BX,7FFH       ;SET +5V
712 FF80:046D          SETDA:
713 FF80:046D E5 00          IN    AX,P1PTA      ;GET CURRENT STATUS
714 FF80:046F 25 00 F0          AND   AX,0F000H     ;JUST STATUS
715 FF80:0472 0B C3          OR    AX,BX         ;MERGE
716 FF80:0474 E7 00          OUT   P1PTA,AX      ;SEND IT
717 FF80:0476 BA 96 01          MOV   DX,LTCHDA     ;NOW LATCH IT IN
718 FF80:0479 EE          OUT   DX,AL
719 FF80:047A C3          RET
720
721 FF80:047B E5 80          NEGAD: IN    AX,P2PTA      ;GET PORT 2
722 FF80:047D 25 F8 FF          AND   AX,OFFF8H     ;STRIP OLD A/D REQ
723 FF80:0480 0D 03 00          OR    AX,3          ;REQUEST -10V
724 FF80:0483 EB 12          JMP   SHORT READAD
725
726 FF80:0485 E5 80          ZERAD: IN    AX,P2PTA      ;GET PORT 2
727 FF80:0487 25 F8 FF          AND   AX,OFFF8H     ;STRIP OLD A/D REQ

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728 FF80:048A 0D 04 00 OR AX,4 ;REQUEST OV
729 FF80:048D EB 08 JMP SHORT READAD
730
731 FF80:048F E5 80 POSAD: IN AX,P2PTA ;GET PORT 2
732 FF80:0491 25 F8 FF AND AX,OFFF8H ;STRIP OLD A/D REQ
733 FF80:0494 0D 02 00 OR AX,2 ;REQUEST +10V
734
735 FF80:0497 C6 06 59 20 00 READAD: MOV ADFLAG,0 ;RESET FLAG
736 FF80:049C E7 80 OUT P2PTA,AX
737 FF80:049E BA 94 01 MOV DX,STCNV ;START CONVERSION
738 FF80:04A1 EE OUT DX,AL
739 FF80:04A2 FB STI ;ENABLE INTERRUPTS
740 FF80:04A3 F6 06 59 20 01 READA1: TEST ADFLAG,1 ;ANALOG READY?
741 FF80:04A8 74 F9 JZ READA1 ;IF NOT
742 FF80:04AA A1 46 20 MOV AX,ADVAL ;GET CURRENT VELOCITY
743 FF80:04AD A3 28 20 MOV VEL1,AX ;SAVE VELOCITY
744 FF80:04B0 C3 RET
745
746 FF80:04B1 DSTOR:
747 FF80:04B1 32 C0 XOR AL,AL
748 FF80:04B3 BA 80 01 MOV DX,APEXRQ ;GET APEX DATA
749 FF80:04B6 EE OUT DX,AL
750 FF80:04B7 83 C2 02 ADD DX,2 ;POINT TO APEXRS
751 FF80:04BA B9 0C 00 MOV CX,12 ;12 TRIALS
752 FF80:04BD DSTOR1:
753 FF80:04BD EC IN AL,DX ;SEE IF DATA READY
754 FF80:04BE 24 C0 AND AL,0COH ;STRIP DATA
755 FF80:04C0 3C 80 CMP AL,80H ;LOOK FOR PATTERN
756 FF80:04C2 74 0A JZ DSTOR2 ;IF READY
757 FF80:04C4 E2 F7 LOOP DSTOR1 ;IF NOT
758 FF80:04C6 80 0E 08 20 01 OR FAUL1,1 ;SET APEX DEAD
759 FF80:04CB E9 C6 00 JMP DSTOR6 ;SKIP APEX GATHERING
760 FF80:04CE DSTOR2:
761 FF80:04CE 80 26 08 20 FE AND FAUL1,0FEH ;SET APEX OK
762 FF80:04D3 4A DEC DX
763 FF80:04D4 ED IN AX,DX ;GET POSITION
764 FF80:04D5 8B D8 MOV BX,AX ;PUT INTO BX
765 FF80:04D7 C1 E3 02 SHL BX,2 ;GET RID OF RESPONSE BITS
766 FF80:04DA 83 C2 02 ADD DX,2 ;POINT TO NEXT SECTION
767 FF80:04DD ED IN AX,DX ;GET NEXT INFO
768 FF80:04DE C0 C4 02 ROL AH,2 ;GET FINAL POSITION
769 FF80:04E1 80 E4 03 AND AH,03 ;PREPARE TO MERGE
770 FF80:04E4 0A DC OR BL,AH ;MERGE BITS
771 FF80:04E6 89 1E 02 20 MOV POSD,BX ;SAVE POSITION
772 FF80:04EA A1 00 20 MOV AX,POSCEC
773 FF80:04ED 2B C3 SUB AX,BX ;GET ERROR
774 FF80:04EF C6 06 62 20 00 MOV DIR,0 ;ASSUME POSITIVE
775 FF80:04F4 73 05 JNC DSTO2A ;IF POSITIVE
776 FF80:04F6 C6 06 62 20 01 MOV DIR,1 ;SET NEGATIVE
777 FF80:04FB DSTO2A:
778 FF80:04FB A3 04 20 MOV ERROR,AX ;STORE IT HERE
779 FF80:04FE ED IN AX,DX ;GET VELOCITY
780 FF80:04FF 8A F8 MOV BH,AL ;SAVE PARTIAL DATA
781 FF80:0501 C1 E8 02 SHR AX,2
782 FF80:0504 25 FF 0F AND AX,OFFFH ;STRIP UPPER NYBBLE
783 FF80:0507 A3 14 20 MOV VEL,AX ;SAVE VELOCITY
784 FF80:050A 83 C2 02 ADD DX,2 ;POINT TO ANALOGS

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785 FF80:050D ED IN AX,DX ;GET DATA
786 FF80:050E C1 E8 02 SHR AX,2 ;SHIFT INTO POSITION
787 FF80:0511 C0 CF 02 ROR BH,2 ;SHIFT PARTIAL
788 FF80:0514 81 E3 00 C0 AND BX,0C000H ;PREPAR TO MERGE
789 FF80:0518 0B D8 OR BX,AX ;SAVE FOR FURTHER PROCESSING
790 FF80:051A 83 C2 02 ADD DX,2 ;POINT TO DISCRETE INFO
791 FF80:051D EC IN AL,DX ;GET DATA
792 FF80:051E 24 1F AND AL,1FH ;ONLY DISCRETES
793 FF80:0520 80 26 06 20 FB AND SYSTEM,0FBH ;ASSUME BRAKE NOT RELEASED
794 FF80:0525 A8 10 TEST AL,16 ;SEE IF BRAKE IS RELEASED
795 FF80:0527 74 05 JZ DSTOR3
796 FF80:0529 80 0E 06 20 04 OR SYSTEM,4 ;SET BRAKE RELEASE
797 FF80:052E 24 0F DSTOR3: AND AL,0FH ;SET LIMIT INFO
798 FF80:0530 D0 E0 SHL AL,1
799 FF80:0532 80 26 08 20 E1 AND FAUL1,0E1H ;CLEAR LIMIT FAULTS
800 FF80:0537 08 06 08 20 OR FAUL1,AL
801 FF80:053B 8B D3 MOV DX,BX ;SAVE TABLE
802 FF80:053D 81 CB 0F 00 OR BX,0FH ;MAKE IT LIKE STANDARD ANALOG
803 FF80:0541 81 E2 0F 00 AND DX,0000FH ;DEVELOP TABLE ADDRESS
804 FF80:0545 01 16 50 20 ADD RANDOM,DX ;DEVELOP NEW NUMBER
805 FF80:0549 81 26 50 20 3F 00 AND WORD PTR RANDOM,3FH
806 FF80:054F FE 06 50 20 INC RANDOM
807 FF80:0553 87 D3 XCHG DX,BX
808 FF80:0555 83 FB 03 CMP BX,3
809 FF80:0558 7E 08 JLE DSTO3A
810 FF80:055A 83 EB 04 SUB BX,4
811 FF80:055D 83 FB 03 CMP BX,3
812 FF80:0560 7E 32 JLE DSTOR6 ;OUT OF RANGE
813 FF80:0562 8B CB DSTO3A: MOV CX,BX ;SAVE ANALOG POINTER IN C
814 FF80:0564 83 C1 01 ADD CX,1 ;PLUS 1 FOR BIT PLACEMENT
815 FF80:0567 D1 E3 SHL BX,1
816 FF80:0569 89 97 0E 20 MOV ANADT[BX],DX ;SAVE ANALOG DATA
817 FF80:056D D1 E3 SHL BX,1 ;NOW FOR BOUND CHECK
818 FF80:056F C6 06 5A 20 00 MOV BFLAG,0 ;BOUND FLAG = OK
819 FF80:0574 2E 62 97 7C 06 BOUND DX,CS:ANATAB[BX] ;CHECK ANALOG BOUNDS
820 FF80:0579 B8 00 80 MOV AX,8000H ;ASSUME FAIL
821 FF80:057C DSTOR4:
822 FF80:057C D1 C0 ROL AX,1 ;PLACE FLAG BIT
823 FF80:057E E2 FC LOOP DSTOR4
824 FF80:0580 F6 06 5A 20 01 TEST BFLAG,1 ;BOUND OK?
825 FF80:0585 75 09 JNZ DSTOR5 ;IF BAD
826 FF80:0587 F7 D0 NOT AX ;SET OK
827 FF80:0589 21 06 0C 20 AND ANAFL,AX ;STRIP BAD ANALOG FLAG
828 FF80:058D E9 04 00 JMP DSTOR6
829 FF80:0590 DSTOR5:
830 FF80:0590 09 06 0C 20 OR ANAFL,AX ;SET BAD ANALOG FLAG
831 FF80:0594 DSTOR6:
832 FF80:0594 E5 80 IN AX,P2PTA ;GET LED STATUS
833 FF80:0596 25 6F FE AND AX,0FE6FH ;KILL ALL LIGHTS
834 FF80:0599 F6 06 06 20 04 TEST SYSTEM,4 ;IS BRAKE RELEASED?
835 FF80:059E 74 03 JZ DSTOR7 ;IF NOT
836 FF80:05A0 0D 10 00 OR AX,16 ;SET BRAKE LED ON
837 FF80:05A3 DSTOR7:
838 FF80:05A3 8B 1E 08 20 MOV BX,FAUL1 ;NOW DO CCW LIMIT
839 FF80:05A7 81 E3 18 00 AND BX,24
840 FF80:05AB 74 03 JZ DSTOR8 ;IF SET LIGHT LED
841 FF80:05AD 0D 80 00 OR AX,128 ;SET CCW LIMIT LED ON

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842 FF80:05B0          DSTOR8:
843 FF80:05B0 8B 1E 08 20      MOV    BX,FAUL1          ;NOW DO CW LIMIT
844 FF80:05B4 81 E3 06 00      AND    BX,6
845 FF80:05B8 74 03                      JZ     DSTOR9           ;IF SET LIGHT LED
846 FF80:05BA 0D 00 01      OR     AX,256           ;SET CW LIMIT LED ON
847 FF80:05BD          DSTOR9:
848 FF80:05BD E7 80          OUT    P2PTA,AX
849 FF80:05BF BA 97 01      MOV    DX,BDRRL1       ;GET IDD STUFF
850 FF80:05C2 ED                      IN     AX,DX
851 FF80:05C3 F7 D0          NOT    AX               ;COMPLEMENT
852 FF80:05C5 A3 0A 20      MOV    FAUL2,AX        ;SAVE IN FAUL2
853 FF80:05C8 81 26 08 20 FF E7    AND    WORD PTR FAUL1,0E7FFH ;STRIP OUT FAULTS
854 FF80:05CE E5 80          IN     AX,P2PTA        ;GET E-STOP, DRIVE LOCKOUT
855 FF80:05D0 25 00 18      AND    AX,1800H        ;STRIP JUNK
856 FF80:05D3 80 F4 10      XOR    AH,10H          ;INVERT DRIVE LOCKOUT
857 FF80:05D6 09 06 08 20    OR     WORD PTR FAUL1,AX ;MERGE
858 FF80:05DA C3                      RET
859
860 FF80:05DB          BDS3RS:
861 FF80:05DB E5 00          IN     AX,P1PTA        ;GET CONTROL PORT
862 FF80:05DD 0D 00 20      OR     AX,2000H        ;DO RESET
863 FF80:05E0 E7 00          OUT    P1PTA,AX
864 FF80:05E2 B9 01 00      MOV    CX,1            ;DELAY 1 SEC
865 FF80:05E5 E8 63 00      CALL   DELAY
866 FF80:05E8 E5 00          IN     AX,P1PTA        ;GET CONTROL AGAIN
867 FF80:05EA 25 FF DF      AND    AX,0DFFFH      ;KILL RESET
868 FF80:05ED E7 00          OUT    P1PTA,AX
869 FF80:05EF C3                      RET
870
871 FF80:05F0          BRKON:
872 FF80:05F0 E5 00          IN     AX,P1PTA        ;GET CONTROL PORT
873 FF80:05F2 0D 00 40      OR     AX,4000H        ;RELEASE THE BRAKE
874 FF80:05F5 E7 00          OUT    P1PTA,AX       ;DO IT
875 FF80:05F7 C6 06 5C 20 00    MOV    TFLAG1,0       ;SET TIMER FLAG = OK
876 FF80:05FC E8 5E 00      CALL   SEC1           ;1 SEC
877 FF80:05FF E8 AF FE      BRKON1: CALL  DSTOR        ;GET UPDATE
878 FF80:0602 F6 06 06 20 04    TEST   SYSTEM,4       ;BRAKE FREE?
879 FF80:0607 75 10          JNZ    BRKON2         ;IF FREE CONTINUE
880 FF80:0609 F6 06 5C 20 01    TEST   TFLAG1,1       ;TIMED OUT?
881 FF80:060E 74 EF          JZ     BRKON1         ;IF NOT
882 FF80:0610 81 0E 08 20 00 01  OR     WORD PTR FAUL1,256 ;SET BRAKE FAULT
883 FF80:0616 E9 32 FB      JMP    RSCMD          ;RESET COMMAND
884 FF80:0619          BRKON2:
885 FF80:0619 81 26 08 20 FF FE    AND    WORD PTR FAUL1,0FEFFH ;CLEAR BRAKE FAULT
886 FF80:061F E9 4A 00      JMP    TMROFF         ;STOP TIMER
887
888 FF80:0622          BRKOFF:
889 FF80:0622 E5 00          IN     AX,P1PTA        ;GET CONTROL PORT
890 FF80:0624 25 FF BF      AND    AX,0BFFFH      ;ENGAGE THE BRAKE
891 FF80:0627 E7 00          OUT    P1PTA,AX       ;DO IT
892 FF80:0629 C6 06 5C 20 00    MOV    TFLAG1,0       ;SET TIMER FLAG = OK
893 FF80:062E E8 2C 00      CALL   SEC1           ;1 SEC
894 FF80:0631 E8 7D FE      BRKOFF1: CALL  DSTOR        ;GET UPDATE
895 FF80:0634 F6 06 06 20 04    TEST   SYSTEM,4       ;BRAKE FREE?
896 FF80:0639 74 31          JZ     TMROFF         ;IF FREE CONTINUE
897 FF80:063B F6 06 5C 20 01    TEST   TFLAG1,1       ;TIMED OUT?
898 FF80:0640 74 EF          JZ     BRKOFF1        ;IF NOT

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899 FF80:0642 81 0E 08 20 00 01      OR      WORD PTR FAUL1,256      ;SET BRAKE FAULT
900 FF80:0648 E9 00 FB                  JMP      RSCMD                  ;RESET COMMAND
901
902 FF80:064B E8 0F 00      DELAY: CALL SEC1                ;START TIMER FOR 1 SECOND
903 FF80:064E C6 06 5C 20 00  DELA1: MOV  TFLAG1,0            ;RESET TFLAG
904 FF80:0653 F6 06 5C 20 01  DELA2: TEST TFLAG1,1          ;TIME OUT?
905 FF80:0658 74 F9                  JZ      DELA2                  ;WAIT
906 FF80:065A E2 F2                  LOOP   DELA1                  ;UNTIL TIME HAS PASSED
907 FF80:065C C3                      RET
908
909 FF80:065D                      SEC1:
910 FF80:065D BA 5E FF      MOV     DX,TIMODE             ;ENABLE TIMER1 FIRST
911 FF80:0660 B8 09 R0      MOV     AX,0R009H
912 FF80:0663 EF                      OUT     DX,AX
913 FF80:0664 BA 66 FF      MOV     DX,T2MODE            ;NOW TIMER2
914 FF80:0667 B8 01 C0      MOV     AX,0C001H
915 FF80:066A EF                      OUT     DX,AX
916 FF80:066B C3                      RET
917
918 FF80:066C                      TMROFF:
919 FF80:066C BK 00 00      MOV     SI,OFFSET TSETUP      ;POINT TO TABLE
920 FF80:066F BA 50 FF      MOV     DX,TOCOUT            ;POINT TO SOURCE POINTER
921 FF80:0672 B9 0C 00      MOV     CX,12
922 FF80:0675 6F                      TSET: OUTSW
923 FF80:0676 83 C2 02      ADD     DX,2
924 FF80:0679 E2 FA      LOOP   TSET
925 FF80:067B C3                      RET
926 FF80:067C
927
928 ;      TABLES FOR BOUND CHECKS
929
930
931 FF80:067C 0080      ANATAB: .WORD 8000H           ;GND
932 FF80:067E FF7F      .WORD 7FFFH
933 FF80:0680 0080      .WORD 8000H           ;GND
934 FF80:0682 FF7F      .WORD 7FFFH
935 FF80:0684 0080      .WORD 8000H           ;GND
936 FF80:0686 FF7F      .WORD 7FFFH
937 FF80:0688 0080      .WORD 8000H           ;ROTATION VELOCITY
938 FF80:068A FF7F      .WORD 7FFFH
939 FF80:068C 0080      .WORD 8000H           ;+15V/2
940 FF80:068E FF7F      .WORD 7FFFH
941 FF80:0690 0080      .WORD 8000H           ;-15V/2
942 FF80:0692 FF7F      .WORD 7FFFH
943 FF80:0694 0080      .WORD 8000H           ;+5V
944 FF80:0696 FF7F      .WORD 7FFFH
945 FF80:0698 0080      .WORD 8000H           ;+10V
946 FF80:069A FF7F      .WORD 7FFFH
947 FF80:069C 0080      .WORD 8000H           ;GND
948 FF80:069E FF7F      .WORD 7FFFH
949 FF80:06A0 0080      .WORD 8000H           ;-10V
950 FF80:06A2 FF7F      .WORD 7FFFH
951 FF80:06A4 0080      .WORD 8000H           ;MOUNT TEMP 2
952 FF80:06A6 FF7F      .WORD 7FFFH
953 FF80:06A8 0080      .WORD 8000H           ;BIN TEMP
954 FF80:06AA FF7F      .WORD 7FFFH
955

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956 FF80:06AC          CLSXTAB:
957 FF80:06AC  F8FF          .WORD  0FFF8H          ;8 COUNTS BEFORE WE MOVE
958 FF80:06AE  0800          .WORD  00008H
959
960 FF80:06B0          MANRG:
961 FF80:06B0  0000          .WORD  0                ;MODES 0 - 4 ACTIVE
962 FF80:06B2  0700          .WORD  7
963
964          ;      MODE SWITCH ENTRY CONTROL
965
966 FF80:06B4          MANTBL:
967 FF80:06B4  5804          .WORD  NORMIT
968 FF80:06B6  F005          .WORD  BRKON
969 FF80:06B8  5E04          .WORD  NEGDA
970 FF80:06BA  6404          .WORD  ZERDA
971 FF80:06BC  6A04          .WORD  POSDA
972 FF80:06BE  7B04          .WORD  NEGAD
973 FF80:06C0  8504          .WORD  ZERAD
974 FF80:06C2  8F04          .WORD  POSAD
975
976
977 FF80:07F0          ORG      07F0H
978
979          ;THIS AREA IS RESERVED FOR RESET PARAMETERS.  CANNOT BE LARGER THEN 16 BYTES
980
981 FF80:07F0  BA A0 FF          MOV     DX,UMCS          ;MAKE UPPER MEMORY 2K BLOCK
982 FF80:07F3  B8 BD FF          MOV     AX,UMBS
983 FF80:07F6  EF                OUT     DX,AX
984 FF80:07F7  EA 00 00 80 FF    JMP     FAR INITIAL      ;ENTER INTO LOWER EPROM SECTION
985
986 FF80:07FC          END

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Lines Assembled : 986

Assembly Errors : 0


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44      0000:FF3A      INT1CR: .EQUAL 0FF3AH      ;INT 1 CONTROL REGISTER
45      0000:FF3C      INT2CR: .EQUAL 0FF3CH      ;INT 2 CONTROL REGISTER
46      0000:FF3E      INT3CR: .EQUAL 0FF3EH      ;INT 3 CONTROL REGISTER
47
48
49      ;      80188 TIMER CONTROL REGISTARS
50
51      0000:FF50      TOCOUT: .EQUAL 0FF50H      ;TIMER 0 COUNT REGISTER
52      0000:FF52      TOMAXA: .EQUAL 0FF52H      ;TIMER 0 MAXIMUM COUNT A REGISTER
53      0000:FF54      TOMAXB: .EQUAL 0FF54H      ;TIMER 0 MAXIMUM COUNT B REGISTER
54      0000:FF56      TOMODE: .EQUAL 0FF56H      ;TIMER 0 MODE REGISTER
55      0000:FF58      T1COUT: .EQUAL 0FF58H      ;TIMER 1 COUNT REGISTER
56      0000:FF5A      T1MAXA: .EQUAL 0FF5AH      ;TIMER 1 MAXIMUM COUNT A REGISTER
57      0000:FF5C      T1MAXB: .EQUAL 0FF5CH      ;TIMER 1 MAXIMUM COUNT B REGISTER
58      0000:FF5E      T1MODE: .EQUAL 0FF5EH      ;TIMER 1 MODE REGISTER
59      0000:FF60      T2COUT: .EQUAL 0FF60H      ;TIMER 2 COUNT REGISTER
60      0000:FF62      T2MAXA: .EQUAL 0FF62H      ;TIMER 2 MAXIMUM COUNT A REGISTER
61      0000:FF66      T2MODE: .EQUAL 0FF66H      ;TIMER 2 MODE REGISTER
62
63
64      ;      80188 CHIP SELECT CONTROL REGISTARS
65
66      0000:FFA0      UMCS: .EQUAL 0FFA0H      ;80188 INTERNAL UPPER MEMORY CHIP
67      ;SELECT CONTROL BLOCK REGISTER
68      0000:FFA2      LMCS: .EQUAL 0FFA2H      ;80188 INTERNAL LOWER MEMORY CHIP
69      ;SELECT CONTROL BLOCK REGISTER
70      0000:FFA4      PACS: .EQUAL 0FFA4H      ;80188 INTERNAL PERIPHERAL CHIP
71      ;SELECT CONTROL BLOCK REGISTER
72      0000:FFA6      MMCS: .EQUAL 0FFA6H      ;80188 INTERNAL MIDDLE MEMORY
73      ;START ADDRESS REGISTER
74      0000:FFA8      MPCS: .EQUAL 0FFA8H      ;80188 INTERNAL MIDDLE MEMORY CHIP
75      ;SELECT CONTROL BLOCK REGISTER
76
77
78      ;      80188 DMA CHANNEL CONTROL REGISTARS
79
80      0000:FFC0      DOSPL: .EQUAL 0FFC0H      ;DMA 0 SOURCE POINTER LSB REGISTER
81      0000:FFC2      DOSPM: .EQUAL 0FFC2H      ;DMA 0 SOURCE POINTER MSB REGISTER
82      0000:FFC4      DODPL: .EQUAL 0FFC4H      ;DMA 0 DESTINATION POINTER LSB REGISTER
83      0000:FFC6      DODPM: .EQUAL 0FFC6H      ;DMA 0 DESTINATION POINTER MSB REGISTER
84      0000:FFC8      DOTC: .EQUAL 0FFC8H      ;DMA 0 TRANSFER COUNT REGISTER
85      0000:FFCA      DOMODE: .EQUAL 0FFCAH      ;DMA 0 MODE REGISTER
86      0000:FFD0      D1SPL: .EQUAL 0FFD0H      ;DMA 1 SOURCE POINTER LSB REGISTER
87      0000:FFD2      D1SPM: .EQUAL 0FFD2H      ;DMA 1 SOURCE POINTER MSB REGISTER
88      0000:FFD4      D1DPL: .EQUAL 0FFD4H      ;DMA 1 DESTINATION POINTER LSB REGISTER
89      0000:FFD6      D1DPM: .EQUAL 0FFD6H      ;DMA 1 DESTINATION POINTER MSB REGISTER
90      0000:FFD8      D1TC: .EQUAL 0FFD8H      ;DMA 1 TRANSFER COUNT REGISTER
91      0000:FFDA      D1MODE: .EQUAL 0FFDAH      ;DMA 1 MODE REGISTER
92
93
94      ;      80188 INTERNAL I/O RELOCATION REGISTER
95
96      0000:FFFE      RELOC: .EQUAL 0FFFEH      ;I/O RELOCATION REGISTER
97
98
99      ;      80188 INITIAL VALUES FOR INTERNAL REGISTARS
100

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101      0000:007D      LMBS: .EQUAL 007DH      ;LOWER MEMORY BLOCK SIZE = 2K
102      0000:81BD      MMBS: .EQUAL 81BDH      ;MIDDLE MEMORY BLOCK SIZE = 8K
103      0000:03FD      MMST: .EQUAL 03FDH      ;MIDDLE MEMORY START POSITION = 8K
104      0000:003D      PST:  .EQUAL 003DH      ;PERIPHERAL START ADDRESS = 0
105      0000:FFBD      UMBS: .EQUAL 0FFBDH     ;UPPER MEMORY BLOCK SIZE = 2K
106
107
108
109      ;      EXTERNAL PORTS FOR CONTROLLING THE FOCUS AXIS
110
111      0000:0000      PIPTA: .EQUAL 0      ;PROM 1 PORT A
112      0000:0001      PIPTB: .EQUAL 1      ;PROM 1 PORT B
113      0000:0002      PIPTAD: .EQUAL 2      ;PROM 1 PORT A DIRECTION
114      0000:0003      PIPTBD: .EQUAL 3      ;PROM 1 PORT B DIRECTION
115      0000:0080      P2PTA: .EQUAL 128     ;PROM 2 PORT A
116      0000:0081      P2PTB: .EQUAL 129     ;PROM 2 PORT B
117      0000:0082      P2PTAD: .EQUAL 130    ;PROM 2 PORT A DIRECTION
118      0000:0083      P2PTBD: .EQUAL 131    ;PROM 2 PORT B DIRECTION
119      0000:0100      RAMTC: .EQUAL 256     ;RAM TIMER AND CONTROL
120      0000:0101      RAMPTA: .EQUAL 257     ;RAM PORT A
121      0000:0102      RAMPTB: .EQUAL 258     ;RAM PORT B
122      0000:0103      RAMPTC: .EQUAL 259     ;RAM PORT C
123      0000:0104      RAMTLO: .EQUAL 260     ;RAM TIMER LOW
124      0000:0105      RAMTHI: .EQUAL 261     ;RAM TIMER HIGH
125      0000:0180      APEXRQ: .EQUAL 384     ;APEX REQ
126      0000:0182      APEXRS: .EQUAL 386     ;APEX RESPONSE
127      0000:0182      POSM: .EQUAL 386     ;POSITION MSB
128      0000:0181      POSL: .EQUAL 385     ;POSITION LSB
129      0000:0184      VELM: .EQUAL 388     ;VELOCITY MSB
130      0000:0183      VELL: .EQUAL 387     ;VELOCITY LSB
131      0000:0186      ANAH: .EQUAL 390     ;ANALOGS MSB
132      0000:0185      ANAL: .EQUAL 389     ;ANALOGS LSB
133      0000:0187      DISCR: .EQUAL 391     ;FOC DISCRETES
134      0000:018B      RELADD: .EQUAL 395     ;GET RELATIVE ADDRESS
135      0000:018C      COMML: .EQUAL 396     ;CONTROL VALUE LSB
136      0000:018D      COMMM: .EQUAL 397     ;CONTROL VALUE MSB
137      0000:018E      DEVACK: .EQUAL 398     ;DEVICE ACKNOWLEDGE
138      0000:018F      MONL: .EQUAL 399     ;MONITOR DATA MSB
139      0000:0190      MONM: .EQUAL 400     ;MONITOR DATA LSB
140      0000:0191      ADL: .EQUAL 401     ;READ A/D LSB
141      0000:0192      ADH: .EQUAL 402     ;READ A/D MSB
142      0000:0193      SEMCT: .EQUAL 403     ;SELECT MOTOR CURRENT/TORQUE
143      0000:0194      STCNV: .EQUAL 404     ;START A/D CONVERT
144      0000:0195      MODESW: .EQUAL 405     ;READ MODE SWITCH
145      0000:0196      LTCHDA: .EQUAL 406     ;LATCH DRIVE D/A
146      0000:0197      BDERL1: .EQUAL 407     ;BDS3 ERROR LSB #1
147
148
149
150      0000:0000      DSEG: SEGMENT
151
152      ;      DATA STORAGE
153
154      0000:2000      ORG      2000H
155
156      0000:2000      MENST: .EQUAL $
157

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158                                     ;      MONITOR STORAGE
159
160 0000:2000      POSCEC: .BLKB 2      ;POSITION COMMAND ECHO
161 0000:2002      POSD: .BLKB 2      ;CURRENT POSITION DATA
162 0000:2004      ERROR: .BLKB 2     ;POSCEC-POSD
163 0000:2006      SYSTEM: .BLKB 2    ;SYSTEM PARAMETERS
164 0000:2008      FAUL1: .BLKB 2     ;FAULT BITS SET 1
165 0000:200A      FAUL2: .BLKB 2     ;FAULT BITS SET 2
166 0000:200C      ANAFL: .BLKB 2     ;ANALOG FAULT FLAGS
167
168           0000:200E      ANADT: .EQUAL $      ;ANALOG STORAGE IS HERE
169
170 0000:200E      GND1: .BLKB 2      ;GND
171 0000:2010      GND2: .BLKB 2      ;GND
172 0000:2012      GND3: .BLKB 2      ;GND
173 0000:2014      VEL: .BLKB 2       ;FOCUS VELOCITY
174 0000:2016      V15P: .BLKB 2      ;+15V/2
175 0000:2018      V15N: .BLKB 2      ;-15V/2
176 0000:201A      V5: .BLKB 2        ;+5V
177 0000:201C      V10P: .BLKB 2      ;+10V
178 0000:201E      MTEMP1: .BLKB 2    ;MOUNT TEMP 1
179 0000:2020      V10N: .BLKB 2      ;-10V
180 0000:2022      MTEMP2: .BLKB 2    ;MOUNT TEMP 2
181 0000:2024      BTEMP: .BLKB 2     ;BIN TEMP
182
183 0000:2026      SERVER: .BLKB 2
184 0000:2028      VEL1: .BLKB 2
185 0000:202A      X22: .BLKB 2       ;OCCURANCE COUNT
186 0000:202C      X23: .BLKB 2       ;COUNT WITHIN OCCURANCE
187 0000:202E      X24: .BLKB 2
188 0000:2030      X25: .BLKB 2
189 0000:2032      X26: .BLKB 2
190 0000:2034      X27: .BLKB 2
191 0000:2036      X28: .BLKB 2
192 0000:2038      X29: .BLKB 2
193 0000:203A      X30: .BLKB 2
194 0000:203C      X31: .BLKB 2
195 0000:203E      X32: .BLKB 2
196
197                                     ;      TEMPORARY STORAGE
198
199 0000:2040      RAC: .BLKB 1        ;RELATIVE CONTROL ADDRESS
200 0000:2041      CONL: .BLKB 1      ;CONTROL VALUE LSB
201 0000:2042      CONM: .BLKB 1      ;CONTROL VALUE MSB
202 0000:2043      ACKF: .BLKB 1      ;ACKNOWLEDGE FLAG
203 0000:2044      COMTMP: .BLKB 2    ;TEMPORARY COMMAND STORAGE
204 0000:2046      ADVAL: .BLKB 2     ;A/D TEMPORARY STORAGE
205 0000:2048      SPRED: .BLKB 1     ;RAMP LEVEL
206 0000:2049      BREAK1: .BLKB 2    ;RAMP UP BREAK POINT
207 0000:204B      BREAK2: .BLKB 2    ;RAMP DOWN BREAK POINT
208 0000:204D      POSDOD: .BLKB 2    ;OLD POSITION
209 0000:204F      SCRLST: .BLKB 2    ;LAST 500US POSITION
210 0000:2051      SCRCNT: .BLKB 2    ;SCREW COUNT
211 0000:2053      EXTTMR: .BLKB 1    ;EXTERNAL SAFETY TIMER
212 0000:2054      DEL: .BLKB 2      ;FILTER DELTA
213 0000:2056      FIL: .BLKB 1      ;FILTER FAIL FLAG
214 0000:2057      FILOVR: .BLKB 1    ;FILTER FAILURE COUNTER

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215 0000:2058          PHASEA: .BLKB 1          ;CURRENT SCREW SENSOR LEVEL
216 0000:2059          SCWIGN: .BLKB 1
217 0000:205A          RANDOM: .BLKB 2         ;RANDOM NUMBER
218 0000:205C          SECCHC: .BLKB 1         ;SECOND CHANCE FOR 2ND SCREW
219
220                      ;      FLAGS
221
222          0000:205D          FLAGST: .EQUAL $
223
224 0000:205D          RESCMD: .BLKB 1
225 0000:205E          NAPATV: .BLKB 1
226 0000:205F          NAPREQ: .BLKB 1
227 0000:2060          DRVREQ: .BLKB 1
228 0000:2061          MANOVR: .BLKB 1
229 0000:2062          BDSRST .BLKB 1
230 0000:2063          DRVONE: .BLKB 1
231 0000:2064          ADFLAG: .BLKB 1
232 0000:2065          BFLAG: .BLKB 1
233 0000:2066          TFLAG0: .BLKB 1
234 0000:2067          TFLAG1: .BLKB 1
235 0000:2068          TFLAG2: .BLKB 1
236 0000:2069          DRVOFF: .BLKB 1
237 0000:206A          DRVATV: .BLKB 1
238 0000:206B          RAMPOS: .BLKB 2
239 0000:206D          DIR: .BLKB 1
240 0000:206E          LDIR: .BLKB 1
241
242          0000:0012          ENDFLG: .EQUAL $-FLAGST
243
244                      ENDS
245
246
247                      ;      PROGRAM EQUATES
248
249          0000:2100          STCK: .EQUAL 2100H          ;STACK LOCATION
250          0000:A766          DOVAL: .EQUAL 0A766H          ;DMA 0 CONTROL VALUE
251          0000:00E8          MASKV: .EQUAL 00E8H          ;DMA 0, INTO, TIMER ENABLE
252          0000:001C          CONRAM: .EQUAL 28          ;?? REV/SEC CONVERGE LEVEL
253          0000:8A00          LOW: .EQUAL 00A00H .XOR. 8000H          ;LOW VALUE
254          0000:7200          HIGH: .EQUAL 0F200H .XOR. 8000H          ;HIGH VALUE
255
256                      LIST ON
257
258                      ;      EXTERNAL REFERENCES
259
260          GLOBAL DSETUP, TSETUP, TSET1, CLSETAB
261          EXTERNAL INITIAL:FAR, RSCMD:FAR
262
263
264          0000:0000          ORG      0000H
265
266          0000:0000  0000 0000          TYPE0: .LONG  INITIAL          ;DIVIDE ERROR EXCEPTION
267          0000:0004  0000 0000          TYPE1: .LONG  INITIAL          ;SINGLE STEP EXCEPTION
268          0000:0008  5000 0000          TYPE2: .LONG  NMI              ;NMI
269          0000:000C  B001 0000          TYPE3: .LONG  TMR2            ;BREAKPOINT INTERRUPT
270          0000:0010  0000 0000          TYPE4: .LONG  INITIAL          ;INTO EXCEPTION
271          0000:0014  9D00 0000          TYPE5: .LONG  BOUND           ;ARRAY BOUND EXCEPTION

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272 0000:0018 0000 0000      TYPE6: .LONG  INITIAL          ;UNUSED OPCODE EXCEPTION
273 0000:001C 0000 0000      TYPE7: .LONG  INITIAL          ;ESC OPCODE EXCEPTION
274 0000:0020 0000 0000      TYPE8: .LONG  INITIAL          ;TIMER 0 INTERRUPT
275 0000:0024 0000 0000      TYPE9: .LONG  INITIAL          ;RESERVED
276 0000:0028 AE00 0000      TYPE10: .LONG  DMA0            ;DMA 0
277 0000:002C 0000 0000      TYPE11: .LONG  INITIAL         ;DMA 1
278 0000:0030 8101 0000      TYPE12: .LONG  INTO           ;INT 0 INTERRUPT
279 0000:0034 0000 0000      TYPE13: .LONG  INITIAL         ;INT 1 INTERRUPT
280 0000:0038 0000 0000      TYPE14: .LONG  INITIAL         ;INT 2 INTERRUPT
281 0000:003C 0000 0000      TYPE15: .LONG  INITIAL         ;INT 3 INTERRUPT
282 0000:0040 0000 0000      TYPE16: .LONG  INITIAL         ;RESERVED
283 0000:0044 0000 0000      TYPE17: .LONG  INITIAL         ;RESERVED
284 0000:0048 9F01 0000      TYPE18: .LONG  TMR1           ;TIMER 1 INTERRUPT
285 0000:004C B001 0000      TYPE19: .LONG  TMR2           ;TIMER 2 INTERRUPT
286
287 ; NMI INTERRUPT IS LOCATED HERE AFTER TABLE
288
289 ; THIS INTERRUPT IS USED TO SEND MONITOR DATA TO
290 ; THE STANDARD INTERFACE.
291 0000:0050
292 0000:0050      NMI:
293 0000:0050 50          PUSH  AX          ;SAVE REGISTARS, ETC
294 0000:0051 52          PUSH  DX
295 0000:0052 53          PUSH  BX
296 0000:0053 FF 36 65 20  PUSH  BFLAG
297 0000:0057 C6 06 65 20 00  MOV   BFLAG,0    ;RELATIVE ADDRESS TEST
298 0000:005C BA 8B 01      MOV   DX,RELADD  ;GET RELATIVE ADDRESS
299 0000:005F EC          IN    AL,DX
300 0000:0060 B4 00      MOV   AH,0
301 0000:0062 2E 62 06 FA 05  BOUND AX,CS:MONRG ;RELATIVE ADDRESS IN RANGE?
302 0000:0067 F6 06 65 20 01  TEST  BFLAG,1
303 0000:006C 74 07      JZ    NMI1        ;IF OK
304 0000:006E 80 0E 08 20 40  OR    FAUL1,64    ;SET MONITOR FAULT FLAG
305 0000:0073 EB 19      JMP   SHORT NEXIT ;EXIT ROUTINE
306 0000:0075      NMI1:
307 0000:0075 2E 2B 06 FA 05  SUB   AX,CS:MONRG ;SUBTRACT OFFSET
308 0000:007A 03 C0      ADD   AX,AX       ;TIMES 2
309 0000:007C 8B D8      MOV   BX,AX       ;BX IS NOW THE INDEX VALUE
310 0000:007E 8B 87 00 20  MOV   AX,MEMST[BX] ;GET MONITOR DATA
311 0000:0082 BA 8F 01      MOV   DX,MONL     ;SEND IT
312 0000:0085 EF          OUT   DX,AX
313 0000:0086 4A          DEC  DX
314 0000:0087 EE          OUT  DX,AL        ;SEND DEVICE ACKNOWLEDGE
315 0000:0088 81 26 08 20 BF FF  AND  WORD PTR FAUL1,OFFBFH ;RESET MONITOR FAULT FLAG
316 0000:008E B8 02 00      NEXIT: MOV   AX,2        ;SPECIFIC EOI
317 0000:0091 BA 22 FF      MOV   DX,EOI
318 0000:0094 EF          OUT  DX,AX
319 0000:0095 8F 06 65 20  POP  BFLAG        ;RESTORE REGISTARS, ETC
320 0000:0099 5B          POP  BX
321 0000:009A 5A          POP  DX
322 0000:009B 58          POP  AX
323 0000:009C CF          IRET
324
325
326 ; THIS INTERRUPT SETS THE OUT OF BOUNDS FLAG
327
328 0000:009D      BOUND:

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329 0000:009D 50          PUSH  AX          ;SAVE REGISTARS
330 0000:009E 52          PUSH  DX
331 0000:009F C6 06 65 20 01      MOV   BFLAG,1    ;SET OUT OF BOUNDS FLAG
332 0000:00A4 B8 05 00            MOV   AX,5        ;SPECIFIC EOI
333 0000:00A7 BA 22 FF            MOV   DX,EOI
334 0000:00AA EF              OUT   DX,AX
335 0000:00AB 5A              POP   DX          ;RESTORE REGISTARS
336 0000:00AC 58              POP   AX
337 0000:00AD CF              IRET
338
339 ;              THIS INTERRUPT COMPLETES THE PROCESSING OF A COMMAND
340 ;              INPUTTED FROM THE STANDARD INTERFACE
341
342 0000:00AE          DMA0:
343 0000:00AE 50          PUSH  AX          ;SAVE REGISTARS, ETC
344 0000:00AF 52          PUSH  DX
345 0000:00B0 51          PUSH  CX
346 0000:00B1 53          PUSH  BX
347 0000:00B2 56          PUSH  SI
348 0000:00B3 FF 36 65 20      PUSH  BFLAG
349 0000:00B7 C6 06 65 20 00      MOV   BFLAG,0    ;ASSUME IN BOUNDS
350 0000:00BC 8A 1E 40 20      MOV   BL,RAC      ;GET RELATIVE ADDRESS
351 0000:00C0 B7 00            MOV   BH,0        ;STRIP UPPER NYBBLE
352 0000:00C2 2E 62 1E DC 05      BOUND BX,CS:CMDRG ;VALID COMMAND?
353 0000:00C7 F6 06 65 20 01      TEST  BFLAG,1    ;IN BOUND?
354 0000:00CC 74 08            JZ   DMA01        ;IF OK
355 0000:00CE 80 0E 08 20 20      OR   FAUL1,32    ;SET COMMAND INVALID
356 0000:00D3 E9 8B 00            JMP  DEXIT
357 0000:00D6          DMA01:
358 0000:00D6 81 26 08 20 DF FF      AND   WORD PTR FAUL1,OFFDFH ;CLEAR COMMAND INVALID
359 0000:00DC 2E 2B 1E DC 05      SUB   BX,CS:CMDRG ;SUBTRACT OFFSET
360 0000:00E1 03 DB            ADD   BX,BX       ;TIMES 2
361 0000:00E3 2E 8B 87 E0 05      MOV   AX,CS:CMDTBL[BX] ;GET NEW PROGRAM POINT
362 0000:00E8 FF E0            JMP  AX           ;GO THERE
363
364 ;              THE NEXT FIVE ROUTINES ARE THE COMMAND PROCESSING ENTRY POINTS
365
366 0000:00EA          POSCMD:
367 0000:00EA A1 41 20            MOV   AX,CONL    ;GET COMMANDED POSITION
368 0000:00ED 35 00 80            XOR   AX,8000H   ;FOR BOUND TEST
369 0000:00F0 2E 62 06 FE 05      BOUND AX,CS:POSRG ;POSITION WITHIN RANGE?
370 0000:00F5 35 00 80            XOR   AX,8000H   ;UNDO AFTER TEST
371 0000:00F8 F6 06 65 20 01      TEST  BFLAG,1
372 0000:00FD 74 07            JZ   POSCM1      ;IF IN RANGE
373 0000:00FF 80 0E 08 20 80      OR   FAUL1,128   ;SET OPERATOR FAULT
374 0000:0104 EB 5B            JMP  SHORT DEXIT
375 0000:0106 80 26 08 20 7F      POSCM1: AND   FAUL1,7FH   ;RESET OPERATOR FAULT
376 0000:010B A3 44 20            MOV   COMTHP,AX  ;SAVE COMMANDED POSITION HERE
377 0000:010E C6 06 60 20 01      MOV   DRVREQ,1   ;SET DRIVE REQUEST
378 0000:0113 C6 06 63 20 00      MOV   DRVONE,0   ;CLEAR SECOND TRY FLAG
379 0000:0118 EB 47            JMP  SHORT DEXIT
380
381 0000:011A          RECMD:
382 0000:011A C6 06 5D 20 01      MOV   RESCMD,1   ;SET SOFT RESET REQUEST
383 0000:011F EB 40            JMP  SHORT DEXIT
384
385 0000:0121          NAPCMD:

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386 0000:0121 F6 06 41 20 01      TEST    CONL,1          ;TEST FOR SET / RESET
387 0000:0126 75 0C                JNZ     NAPCM1
388 0000:0128 C6 06 5E 20 00      MOV     NAPATV,0       ;IF CLEAR NAP
389 0000:012D 80 26 06 20 FE      AND     SYSTEM,0FEH
390 0000:0132 EB 2D                JMP     SHORT DEXIT
391 0000:0134 F6 06 5E 20 01      NAPCM1: TEST    NAPATV,1      ;ALREADY NAPPED?
392 0000:0139 75 26                JNZ     DEXIT
393 0000:013B C6 06 5F 20 01      MOV     NAPREQ,1       ;SET NAP REQUEST
394 0000:0140 EB 1F                JMP     SHORT DEXIT
395
396 0000:0142          MANCMD:
397 0000:0142 F6 06 41 20 01      TEST    CONL,1          ;TEST FOR SET / RESET
398 0000:0147 75 0C                JNZ     MANCM1
399 0000:0149 C6 06 61 20 00      MOV     MANOVR,0       ;IF CLEAR OVER RIDE
400 0000:014E 80 26 06 20 F7      AND     SYSTEM,0F7H
401 0000:0153 EB 0C                JMP     SHORT DEXIT
402 0000:0155 C6 06 61 20 01      MANCM1: MOV     MANOVR,1      ;SET MANUCL OVER-RIDE
403 0000:015A EB 05                JMP     SHORT DEXIT
404
405 0000:015C C6 06 62 20 01      BDSCMD: MOV     BDSRST,1      ;SET BDS3 SRRVO RESET
406
407 0000:0161 BE BE 05      DEXIT: MOV     SI,CS:OFFSET DSETUP ;RE-INITIALIZE DMA 0
408 0000:0164 BA C0 FF      MOV     DX,DOSPL
409 0000:0167 B9 06 00      MOV     CX,6
410 0000:016A 6F          DSET: OUTSW
411 0000:016B 83 C2 02      ADD     DX,2
412 0000:016E E2 FA          LOOP   DSET
413 0000:0170 B8 0A 00      MOV     AX,10          ;SPECIFIC ROI
414 0000:0173 BA 22 FF      MOV     DX,ROI
415 0000:0176 EF          OUT    DX,AX
416 0000:0177 8F 06 65 20      POP     BFLAG          ;RESTORE REGISTARS, RTC
417 0000:017B 5E          POP    SI
418 0000:017C 5B          POP    BX
419 0000:017D 59          POP    CX
420 0000:017E 5A          POP    DX
421 0000:017F 58          POP    AX
422 0000:0180 CF          IRET
423
424          ; THIS INTERRUPT ROUTINE LOADS THE ANALOG TO DIGITAL VALURS
425          ; AFTER CONVERSION
426
427 0000:0181          INTO:
428 0000:0181 50          PUSH   AX              ;SAVE REGISTARS
429 0000:0182 52          PUSH   DX
430 0000:0183 BA 91 01      MOV     DX,ADL          ;GET A/D VALUE
431 0000:0186 ED          IN     AX,DX
432 0000:0187 C1 E8 04      SHR    AX,4            ;PUT INTO POSITION
433 0000:018A 35 00 08      XOR    AX,0800H        ;TWS COMPLEMENT
434 0000:018D A3 46 20      MOV     ADVAL,AX        ;STORE HERE
435 0000:0190 C6 06 64 20 01  MOV     ADFLAG,1        ;SET ADFLAG
436 0000:0195 B8 0C 00      MOV     AX,12          ;SPECIFIC ROI
437 0000:0198 BA 22 FF      MOV     DX,ROI
438 0000:019B EF          OUT    DX,AX
439 0000:019C 5A          POP    DX              ;RESTORE REGISTARS
440 0000:019D 58          POP    AX
441 0000:019E CF          IRET
442

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443 0000:019F          TMR1:
444 0000:019F 50          PUSH  AX          ;SAVE REGISTRARS
445 0000:01A0 52          PUSH  DX
446 0000:01A1 C6 06 67 20 01      MOV   TFLAG1,1    ;SET TIMER 1 FLAG
447 0000:01A6 B8 08 00            MOV   AX,8        ;SPECIFIC ROI
448 0000:01A9 BA 22 FF            MOV   DX,ROI
449 0000:01AC EF              OUT   DX,AX
450 0000:01AD 5A          POP   DX          ;RESTORE REGISTRARS
451 0000:01AE 58          POP   AX
452 0000:01AF CF              IRET
453
454 0000:01B0          TMR2:
455 0000:01B0 50          PUSH  AX          ;SAVE REGISTRARS
456 0000:01B1 53          PUSH  BX
457 0000:01B2 51          PUSH  CX
458 0000:01B3 52          PUSH  DX
459 0000:01B4 FF 36 65 20      PUSH  BFLAG
460 0000:01B8 C6 06 53 20 19      MOV   EXTMR,25
461 0000:01BD F6 06 6A 20 01      TEST  DRVATV,1
462 0000:01C2 75 06          JNZ   GO
463 0000:01C4 E8 01 04          CALL  TMR0FF
464 0000:01C7 E9 E2 02          JMP   TMR2EX
465 0000:01CA F6 06 69 20 01      GO:  TEST  DRVOFF,1    ;GO INTO SHUTDOWN?
466 0000:01CF 74 03          JZ    TMR21       ;IF NOT SHUT DOWN
467 0000:01D1 E9 7E 02          JMP   OFFIT       ;IF SHUT DOWN
468 0000:01D4 E4 81          TMR21: IN   AL,P2PTB  ;GET E-STOP, DRIVE LOCKOUT
469 0000:01D6 24 18          AND   AL,18H     ;STRIP JUNK
470 0000:01D8 34 10          XOR   AL,10H    ;INVERT DRIVE LOCKOUT
471 0000:01DA 74 03          JZ    TMR210     ;IF EVERYTHING OK
472 0000:01DC E9 AA 02          JMP   OFFIT3     ;ELSE KILL DRIVE
473 0000:01DF E8 54 03          TMR210: CALL  DSTOR   ;GET LATEST DATA
474 0000:01E2 BA 87 01          MOV   DX,DISCR  ;POINT TO DISCRETES
475 0000:01E5 EC              IN    AL,DX      ;GET INFO
476 0000:01E6 F6 06 6E 20 01      TEST  LDIR,1    ;TEST DIRECTION
477 0000:01EB 74 07          JZ    TMR21A     ;IF POSITIVE
478 0000:01ED 24 03          AND   AL,3      ;DOWN LIMIT?
479 0000:01EF 74 0A          JZ    TMR21B     ;IF NOT
480 0000:01F1 E9 5E 02          JMP   OFFIT     ;IF IN DOWN LIMIT
481 0000:01F4 24 0C          TMR21A: AND   AL,0CH  ;UP LIMIT?
482 0000:01F6 74 03          JZ    TMR21B     ;IF NOT
483 0000:01F8 E9 57 02          JMP   OFFIT     ;IF IN UP LIMIT
484 0000:01FB F6 06 59 20 01      TMR21B: TEST  SCWIGN,1 ;IGNORE?
485 0000:0200 74 03          JZ    TMR2BB     ;NO
486 0000:0202 E9 7C 00          JMP   TMR22     ;YES
487 0000:0205 EC              TMR2BB: IN   AL,DX  ;GET SCREW LEVEL
488 0000:0206 24 20          AND   AL,32     ;JUST SCREW INFO
489 0000:0208 30 06 58 20      XOR   PHASEA,AL ;TRANSITION?
490 0000:020C A2 58 20          MOV   PHASEA,AL ;UPDATE
491 0000:020F 74 09          JZ    TMR21C     ;IF NO TRANSITION
492 0000:0211 C7 06 51 20 00 00  MOV  WORD PTR SCRCNT,0 ;SCREW COUNT 0
493 0000:0217 E9 67 00          JMP   TMR22     ;CONTINUE
494 0000:021A A1 4F 20          TMR21C: MOV   AX,SCRLST ;GET LAST OK POSITION
495 0000:021D 2B 06 02 20      SUB   AX,POSD   ;DEVELOP DELTA
496 0000:0221 C6 06 65 20 00      MOV   BFLAG,0  ;FOR BOUND CHECK
497 0000:0226 2E 62 06 EA 05      BOUND AX,CS:DELTA ;IN BOUNDS?
498 0000:022B F6 06 65 20 01      TEST  BFLAG,1
499 0000:0230 74 1C          JZ    TMR2CC     ;IF IN BOUNDS

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500 0000:0232 C6 06 56 20 01      MOV     FIL,1          ;SET FIL BLOWN
501 0000:0237 A1 54 20      MOV     AX,DEL         ;GET LAST OK DELTA
502 0000:023A FE 06 57 20      INC     FILOVR         ;INC FILTER NUMBER FAIL COUNT
503 0000:023E 80 3E 57 20 0A      CMP     FILOVR,10     ;TOO MANY?
504 0000:0243 75 0E      JNZ     TMR2CD         ;IF NOT
505 0000:0245 81 0E 08 20 00 0A      OR      WORD PTR FAUL1,00A00H ;SET FAULT
506 0000:024B E9 3B 02      JMP     OFFIT3         ;MAJOR PROBLEM
507 0000:024E C6 06 56 20 00      TMR2CC: MOV    FIL,0     ;RESET FIL
508 0000:0253 01 06 51 20      TMR2CD: ADD    SCRCNT,AX ;ADD IN DELTA
509 0000:0257 A3 54 20      MOV     DEL,AX        ;UPDATE DELTA
510 0000:025A A1 02 20      MOV     AX,POSD       ;UPDATE POSITION
511 0000:025D A3 4F 20      MOV     SCRLST,AX
512 0000:0260 C6 06 65 20 00      MOV     BFLAG,0       ;SET IN BOUNDS
513 0000:0265 A1 51 20      MOV     AX,SCRCNT
514 0000:0268 2E 62 06 0E 06      BOUND   AX,CS:SCREW   ;WITHIN +/- 38 COUNTS
515 0000:026D F6 06 65 20 01      TEST    BFLAG,1      ;IN BOUNDS?
516 0000:0272 74 0D      JZ      TMR22         ;IF OK
517 0000:0274 81 0E 08 20 00 82      TMR21D: OR     WORD PTR FAUL1,8200H ;SET FAULT BITS
518 0000:027A FE 06 5C 20      INC     SECCHC        ;INC SECOND CHANCE
519 0000:027E E9 08 02      JMP     OFFIT3         ;KILL DRIVE
520 0000:0281 F6 06 56 20 01      TMR22: TEST   FIL,1     ;BAD AREA
521 0000:0286 74 03      JZ      TMR220
522 0000:0288 E9 21 02      JMP     TMR2EX
523 0000:028B A0 6D 20      TMR220: MOV    AL,DIR   ;GET DIRECTION
524 0000:028E 3A 06 6E 20      CMP     AL,LDIR       ;EQUAL?
525 0000:0292 74 08      JZ      TMR22A        ;IF EQUAL
526 0000:0294 C6 06 6B 20 06      MOV     RAMPOS,6
527 0000:0299 E9 15 00      JMP     VERGIT        ;GOTO CONVERGE
528 0000:029C 80 3E 48 20 0A      TMR22A: CMP    BYTE PTR SPRED,10 ;MOTION ANALYSIS?
529 0000:02A1 75 03      JNZ     TMR23         ;IF NOT
530 0000:02A3 E9 1A 02      JMP     MOTION
531 0000:02A6 8B 1E 6B 20      TMR23: MOV    BX,RAMPOS ;GET CURRENT RAMP
532 0000:02AA 2E 8B 87 06 06      MOV     AX,CS:RAMPTL[BX] ;GET INDEX
533 0000:02AF FF E0      JMP     AX             ;GO THERE
534 0000:02B1
535 0000:02B1      VERGIT:
536 0000:02B1 8B 1E 04 20      MOV     BX,ERROR      ;ARE WE CLOSE?
537 0000:02B5 C6 06 65 20 00      MOV     BFLAG,0       ;SET IN BOUNDS
538 0000:02BA 2E 62 1E D8 05      BOUND   BX,CS:CLSETAB ;CLOSE?
539 0000:02BF F6 06 65 20 01      TEST    BFLAG,1
540 0000:02C4 75 3A      JNZ     VERGI1        ;IF NOT
541 0000:02C6 E5 00      IN      AX,P1PTA     ;FINAL RAMP TO STOP
542 0000:02C8 50      PUSH    AX            ;SAVE IT
543 0000:02C9 25 FF 0F      AND     AX,OFFFH      ;JUST RAMP VALUE
544 0000:02CC BB 04 00      MOV     BX,4          ;PREPARE TO DECREASE
545 0000:02CF F6 06 6E 20 01      TEST    LDIR,1        ;CHECK DIRECTION
546 0000:02D4 75 02      JNZ     VERGIO        ;IF POSITIVE
547 0000:02D6 F7 DB      NEG     BX            ;IF NEGATIVE
548 0000:02D8 2B C3      VERGIO: SUB    AX,BX
549 0000:02DA 25 FF 0F      AND     AX,OFFFH      ;JUST RAMP VALUE
550 0000:02DD 5B      POP     BX            ;RESTORE
551 0000:02DE 81 E3 00 F0      AND     BX,0F000H     ;JUST CONTROL
552 0000:02E2 3D 00 00      CMP     AX,0          ;DONE?
553 0000:02E5 75 0E      JNE     VERGIA        ;NOT DONE
554 0000:02E7 81 26 08 20 FF FD      AND     WORD PTR FAUL1,0FDFFH ;RESET DRIVE FAULT FLAG
555 0000:02ED C6 06 5C 20 00      MOV     BYTE PTR SECCHC,0 ;CLEAR 2ND SCREW SECOND CHANCE
556 0000:02F2 E9 94 01      JMP     OFFIT3        ;COMPLETE

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557 0000:02F5 0B C3          VERGIA: OR      AX,BX          ;MERGE
558 0000:02F7 E7 00          OUT      P1PTA,AX        ;SEND NEW RAMP
559 0000:02F9 BA 96 01        MOV      DX,LTCHDA      ;NOW LATCH D/A
560 0000:02FC EE           OUT      DX,AL          ;NEW RAMP COMPLETE
561 0000:02FD E9 AC 01        JMP      TMR2EX
562
563 0000:0300          VERGI1:
564 0000:0300 A0 6D 20        MOV      AL,DIR         ;CHECK FOR DIRECTION SWITCH
565 0000:0303 3A 06 6E 20    CMP      AL,LDIR
566 0000:0307 75 07          JNE      VERGIB         ;WE OVER SHOT
567 0000:0309 BA 96 01        MOV      DX,LTCHDA      ;NOW LATCH D/A
568 0000:030C EE           OUT      DX,AL          ;OLD RAMP COMPLETE
569 0000:030D E9 9C 01        JMP      TMR2EX         ;IF NOT SWITCHED
570 0000:0310 E5 00          VERGIB: IN      AX,P1PTA  ;FINAL RAMP TO STOP
571 0000:0312 50          PUSH     AX             ;SAVE IT
572 0000:0313 25 FF 0F        AND      AX,OFFFH       ;JUST RAMP VALUE
573 0000:0316 BB 04 00        MOV      BX,4           ;PREPARE TO DECREASE
574 0000:0319 F6 06 6E 20 01  TEST     LDIR,1         ;CHECK DIRECTION
575 0000:031E 75 02          JNZ      VERGIC        ;IF POSITIVE
576 0000:0320 F7 DB          NEG      BX             ;IF NEGATIVE
577 0000:0322 2B C3          VERGIC: SUB     AX,BX
578 0000:0324 25 FF 0F        AND      AX,OFFFH       ;JUST RAMP VALUE
579 0000:0327 5B          POP      BX             ;RESTORE
580 0000:0328 81 E3 00 F0    AND      BX,0F000H     ;JUST CONTROL
581 0000:032C 50          PUSH     AX             ;SAVE NEW RAMP
582 0000:032D 0B C3          OR      AX,BX          ;MERGE
583 0000:032F E7 00          OUT      P1PTA,AX      ;SEND NEW RAMP
584 0000:0331 BA 96 01        MOV      DX,LTCHDA      ;NOW LATCH D/A
585 0000:0334 EE           OUT      DX,AL          ;NEW RAMP COMPLETE
586 0000:0335 58          POP      AX             ;RESTORE NEW RAMP
587 0000:0336 3D 00 00        CMP      AX,0           ;DONE?
588 0000:0339 74 03          JE      VERGI2         ;DONE
589 0000:033B E9 6E 01        JMP      TMR2EX
590
591 0000:033E          VERGI2:
592 0000:033E F6 06 63 20 01  TEST     DRVONE,1      ;ON SECOND TRY?
593 0000:0343 75 1A          JNZ      VERGI3        ;IF SECOND TRY
594 0000:0345 C6 06 63 20 01  MOV      DRVONE,1      ;SET SECOND TRY FLAG
595 0000:034A C6 06 6A 20 00  MOV      DRVATV,0      ;SET DRIVE TO NON ACTIVE
596 0000:034F C6 06 60 20 01  MOV      DRVREQ,1      ;RESTART COMMAND
597 0000:0354 8B 1E 00 20    MOV      BX,POSCEC     ;GET COMTMP = POSCEC
598 0000:0358 89 1E 44 20    MOV      COMTMP,BX
599 0000:035C E9 2A 01        JMP      OFFIT3        ;LEAVE
600 0000:035F          VERGI3:
601 0000:035F 81 0E 08 20 00 02  OR      WORD PTR FAUL1,200H ;SET DRIVE FAULT
602 0000:0365 E9 21 01        JMP      OFFIT3        ;STOP
603
604 0000:0368 C6 06 65 20 00  ZIPUP: MOV      BFLAG,0      ;RESET BOUND FLAG
605 0000:036D FE 0E 48 20    DEC      SPEED
606 0000:0371 75 34          JNZ      ZIPUP2        ;IF NO CHANGE IN RAMP
607 0000:0373 C6 06 48 20 14  MOV      SPEED,20      ;RESET SPEED
608 0000:0378 E5 00          IN      AX,P1PTA      ;GET CURRENT RAMP POINT
609 0000:037A 50          PUSH     AX             ;SAVE IT
610 0000:037B 25 FF 0F        AND      AX,OFFFH       ;STRIP CONTROL NYBBLE
611 0000:037E BB 04 00        MOV      BX,4           ;DO NEXT RAMP STEP
612 0000:0381 F6 06 6E 20 01  TEST     LDIR,1         ;NEGATIVE?
613 0000:0386 75 02          JNZ      ZIPUP1        ;IF POSITIVE

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614 0000:0388 F7 DB                NEG    BX                ;REVESRE SIGN
615 0000:038A 03 C3                ZIPUP1: ADD   AX,BX      ;NEW RAMP
616 0000:038C 25 FF 0F                AND    AX,OFFFH        ;STRIP UPPER NYBBLE
617 0000:038F C1 C0 04                ROL    AX,4            ;ROTATE FOR BOUND TEST
618 0000:0392 2E 62 06 02 06        BOUND  AX,CS:RAMPLM
619 0000:0397 C1 C8 04                ROR    AX,4            ;PUT BACK
620 0000:039A 5B                    POP    BX                ;GET OLD CONTROL BITS
621 0000:039B 81 E3 00 F0            AND    BX,0F000H        ;STRIP OLD RAMP
622 0000:039F 0B C3                OR     AX,BX            ;MERGE
623 0000:03A1 E7 00                OUT   P1PTA,AX         ;SEND NEW RAMP
624 0000:03A3 BA 96 01                MOV   DX,LTCHDA        ;NOW LATCH D/A
625 0000:03A6 EE                    OUT   DX,AL            ;NEW RAMP COMPLETE
626 0000:03A7 F6 06 65 20 01        ZIPUP2: TEST  BFLAG,1    ;OUT OF BOUNDS?
627 0000:03AC 75 13                JNZ   ZIPUP3           ;IF OUT
628 0000:03AE A1 02 20                MOV   AX,POSD          ;CURRENT POSITION
629 0000:03B1 F6 06 6E 20 01        TEST  LDIR,1           ;CHECK DIRECTION
630 0000:03B6 75 11                JNZ   ZIPUP4           ;IF NEGATIVE
631 0000:03B8 3B 06 49 20            CMP   AX,BREAK1        ;RAMP INTO MAIN?
632 0000:03BC 73 03                JNC   ZIPUP3           ;GO INTO MAIN
633 0000:03BE E9 EB 00                JMP   TMR2EX           ;NOPE
634 0000:03C1 80 06 6B 20 02        ZIPUP3: ADD   RAMPOS,2   ;SET MAIN
635 0000:03C6 E9 E3 00                JMP   TMR2EX           ;NOW LEAVE
636 0000:03C9 3B 06 49 20            ZIPUP4: CMP   AX,BREAK1  ;RAMP INTO MAIN?
637 0000:03CD 72 F2                JC    ZIPUP3           ;GO INTO MAIN
638 0000:03CF E9 DA 00                JMP   TMR2EX           ;NOPE
639
640 0000:03D2                MAINNY:
641 0000:03D2 FE 0E 48 20            DEC   SPEED            ;FOR MOTION ANALYSIS
642 0000:03D6 75 05                JNZ   MAINNO           ;RESET SPEED
643 0000:03D8 C6 06 48 20 14        MOV   SPRED,20        ;CURRENT POSITION
644 0000:03DD A1 02 20            MAINNO: MOV   AX,POSD    ;CHECK DIRECTION
645 0000:03E0 F6 06 6E 20 01        TEST  LDIR,1           ;IF NEGATIVE
646 0000:03E5 75 0F                JNZ   MAINN2           ;MAIN INTO RAMP DOWN?
647 0000:03E7 3B 06 4B 20            CMP   AX,BREAK2        ;GO INTO RAMP DOWN
648 0000:03EB 73 02                JNC   MAINN1           ;NOPE
649 0000:03ED EB 0D                JMP   SHORT MAINN3     ;SET RAMP DOWN
650 0000:03EF 80 06 6B 20 02        MAINN1: ADD   RAMPOS,2   ;NOW LEAVE
651 0000:03F4 EB 06                JMP   SHORT MAINN3     ;MAIN INTO RAMP DOWN?
652 0000:03F6 3B 06 4B 20            MAINN2: CMP   AX,BREAK2  ;GO INTO RAMP DOWN
653 0000:03FA 72 F3                JC    MAINN1           ;NOW LATCH D/A
654 0000:03FC BA 96 01            MAINN3: MOV   DX,LTCHDA  ;OLD RAMP COMPLETE
655 0000:03FF EE                    OUT   DX,AL            ;DONE
656 0000:0400 E9 A9 00                JMP   TMR2EX
657
658 0000:0403 FE 0E 48 20            ZIPDWN: DEC  SPEED
659 0000:0407 75 46                JNZ   ZIPDN3           ;IF NO CHANGE IN RAMP
660 0000:0409 C6 06 48 20 14        MOV   SPRED,20        ;RESET SPEED
661 0000:040E E5 00                IN    AX,P1PTA         ;GET CURRENT RAMP POINT
662 0000:0410 50                    PUSH  AX                ;SAVE IT
663 0000:0411 25 FF 0F                AND   AX,OFFFH        ;STRIP CONTROL NYBBLE
664 0000:0414 BB 04 00                MOV   BX,4            ;DO NEXT RAMP STEP
665 0000:0417 F6 06 6E 20 01        TEST  LDIR,1           ;NEGATIVE?
666 0000:041C 75 02                JNZ   ZIPDN1           ;IF POSITIVE
667 0000:041E F7 DB                NEG   BX                ;REVESRE SIGN
668 0000:0420 2B C3                ZIPDN1: SUB   AX,BX      ;NEW RAMP
669 0000:0422 25 FF 0F                AND   AX,OFFFH        ;STRIP UPPER NYBBLE
670 0000:0425 5B                    POP   BX                ;GET OLD CONTROL BITS

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671 0000:0426 74 15          JZ      ZIPDN2          ;IF ZERO
672 0000:0428 81 E3 00 F0    AND     BX,0F000H      ;STRIP OLD RAMP
673 0000:042C 0B C3          OR      AX,BX          ;MERGE
674 0000:042E E7 00          OUT     P1PTA,AX      ;SEND NEW RAMP
675 0000:0430 BA 96 01    MOV     DX,LTCHDA     ;NOW LATCH D/A
676 0000:0433 EE          OUT     DX,AL         ;NEW RAMP COMPLETE
677 0000:0434 F6 06 6E 20 01    TEST   LDIR,1        ;CHECK DIRECTION
678 0000:0439 75 02          JNZ     ZIPDN2        ;IF POSITIVE
679 0000:043B F7 D8          NEG     AX            ;INVERT FOR CHECK
680 0000:043D 25 FF 0F          ZIPDN2: AND    AX,OFFFH  ;CURRENT RAMP
681 0000:0440 3D 1C 00    CMP     AX,CONRAM     ;RAMP INTO CONVERGE?
682 0000:0443 73 67          JNC     TMR2EX       ;NOPE
683 0000:0445 C6 06 48 20 01    MOV     SPEED,1      ;RESET SPEED
684 0000:044A 80 06 6B 20 02    ADD     RAMPOS,2     ;SET CONVERG
685 0000:044F E9 5A 00          ZIPDN3: JMP     TMR2EX  ;NOW LEAVE
686
687 0000:0452 E5 00          OFFIT: IN      AX,P1PTA ;GET CURRENT RAMP POINT
688 0000:0454 FE 0E 48 20    DEC     SPEED        ;
689 0000:0458 75 27          JNZ     OFFIT2       ;IF NO CHANGE IN RAMP
690 0000:045A C6 06 48 20 14    MOV     SPEED,20     ;RESET SPEED
691 0000:045F 50          PUSH   AX            ;SAVE IT
692 0000:0460 25 FF 0F          AND     AX,OFFFH     ;STRIP CONTROL NYBBLE
693 0000:0463 BB 04 00    MOV     BX,4         ;DO NEXT RAMP STEP
694 0000:0466 F6 06 6E 20 01    TEST   LDIR,1        ;NEGATIVE?
695 0000:046B 75 02          JNZ     OFFIT1       ;IF POSITIVE
696 0000:046D F7 DB          NEG     BX            ;REVERSE SIGN
697 0000:046F 2B C3          OFFIT1: SUB    AX,BX   ;NEW RAMP
698 0000:0471 25 FF 0F          AND     AX,OFFFH     ;STRIP UPPER NYBBLE
699 0000:0474 5B          POP     BX            ;GET OLD CONTROL BITS
700 0000:0475 81 E3 00 F0    AND     BX,0F000H    ;STRIP OLD RAMP
701 0000:0479 0B C3          OR      AX,BX        ;MERGE
702 0000:047B E7 00          OUT     P1PTA,AX     ;SEND NEW RAMP
703 0000:047D BA 96 01    MOV     DX,LTCHDA     ;NOW LATCH D/A
704 0000:0480 EE          OUT     DX,AL         ;NEW RAMP COMPLETE
705 0000:0481 25 FF 0F          OFFIT2: AND    AX,OFFFH ;CURRENT RAMP
706 0000:0484 3D 00 00    CMP     AX,0         ;GOT TO 0?
707 0000:0487 75 23          JNE     TMR2EX       ;NOPE
708 0000:0489 E8 3C 01    OFFIT3: CALL   THROFF  ;KILL TIMER
709 0000:048C B8 00 C0    MOV     AX,0C000H    ;KILL DRIVE
710 0000:048F E7 00          OUT     P1PTA,AX     ;
711 0000:0491 B8 08 00    MOV     AX,8         ;SPECIFIC ROI
712 0000:0494 BA 22 FF    MOV     DX,ROI       ;
713 0000:0497 EF          OUT     DX,AX        ;
714 0000:0498 E8 E9 00    CALL   BRKOFF       ;KILL BRAKE
715 0000:049B C6 06 6A 20 00    MOV     DRVATV,0     ;KILL DRIVE ACTIVE FLAG
716 0000:04A0 C6 06 69 20 00    MOV     DRVOFF,0    ;KILL DRIVE OFF FLAG
717 0000:04A5 E5 80          IN      AX,P2PTA     ;
718 0000:04A7 25 97 FF          AND     AX,OFF97H    ;KILL SPECIFIC LIGHTS
719 0000:04AA E7 80          OUT     P2PTA,AX     ;
720 0000:04AC B8 08 00    TMR2EX: MOV     AX,8   ;SPECIFIC ROI
721 0000:04AF BA 22 FF    MOV     DX,ROI       ;
722 0000:04B2 EF          OUT     DX,AX        ;
723 0000:04B3 B8 03 00    MOV     AX,3         ;AGAIN
724 0000:04B6 EF          OUT     DX,AX        ;
725 0000:04B7 8F 06 65 20    POP     BFLAG        ;
726 0000:04BB 5A          POP     DX            ;RESTORE REGISTARS
727 0000:04BC 59          POP     CX            ;

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728 0000:04BD 5B POP BX
729 0000:04BE 58 POP AX
730 0000:04BF CF IRET
731
732 0000:04C0 MOTION:
733 0000:04C0 FB STI ;ENABLE INTERRUPTS
734 0000:04C1 E5 80 IN AX,P2PTA ;GET PORT 2
735 0000:04C3 25 F8 FF AND AX,OFFF8H ;STRIP OLD A/D REQ
736 0000:04C6 0D 01 00 OR AX,1 ;REQUEST VELOCITY
737 0000:04C9 E7 80 OUT P2PTA,AX
738 0000:04CB BA 94 01 MOV DX,STCNV ;START CONVERSION
739 0000:04CE EE OUT DX,AL
740 0000:04CF C6 06 64 20 00 MOV ADFLAG,0 ;RESET FLAG
741 0000:04D4 FE 0E 48 20 DEC SPEED ;UPDATE SPEED
742 0000:04D8 BA 97 01 MOV DX,BDERL1 ;GET SERVO AMP FAULTS
743 0000:04DB EC IN AL,DX
744 0000:04DC F6 D0 NOT AL ;COMPLEMENT THEM
745 0000:04DE A2 0A 20 MOV FAUL2,AL ;STORE THEM
746 0000:04E1 24 FD AND AL,OFDH ;IGNORE FOLDBACK
747 0000:04E3 74 08 JZ MOTI01 ;ANY PROBLEMS?
748 0000:04E5 C6 06 69 20 01 MOV DRVOFF,1 ;YES, SO KILL DRIVE
749 0000:04EA E9 BF FF JMP TMR2EX
750 0000:04ED MOTI01:
751 0000:04ED 8B 1E 02 20 MOV BX,POSD ;GET CURRENT POSITION
752 0000:04F1 A1 4D 20 MOV AX,POSDOD ;GET OLD POSITION
753 0000:04F4 89 1E 4D 20 MOV POSDOD,BX ;CURRENT = OLD
754 0000:04F8 2B D8 SUB BX,AX ;GET DIFFERENCE
755 0000:04FA 79 02 JNS MOTI02 ;IF POSITIVE
756 0000:04FC F7 DB NEG BX ;MAKE POSITIVE
757 0000:04FE 8B 16 28 20 MOTI02: MOV DX,VBL1 ;GET PREVIOUS VELOCITY
758 0000:0502 B1 19 MOV CL,25 ;PRELOAD DIVIDE VALUE
759 0000:0504 F6 06 64 20 01 MOTI03: TEST ADFLAG,1 ;ANALOG READY?
760 0000:0509 74 F9 JZ MOTI03 ;IF NOT
761 0000:050B A1 46 20 MOV AX,ADVAL ;GET CURRENT VELOCITY
762 0000:050E F6 C4 08 TEST AH,8 ;MINUS?
763 0000:0511 74 02 JZ MOTI04 ;IF MINUS
764 0000:0513 F7 D8 NEG AX ;MAKE POSITIVE
765 0000:0515 25 FF 0F MOTI04: AND AX,OFFFH ;STRIP UNWANTED BITS
766 0000:0518 F6 F1 DIV CL ;DIVIDE BY 20
767 0000:051A B4 00 MOV AH,0 ;KILL REMAINDER
768 0000:051C A3 28 20 MOV VBL1,AX ;CURRENT = PREVIOUS
769 0000:051F 03 C2 ADD AX,DX ;ADD IN PREVIOUS VELOCITY
770 0000:0521 83 C3 04 ADD BX,4 ;4 COUNT SLOP
771 0000:0524 3B C3 CMP AX,BX ;OK MOTION?
772 0000:0526 7E 0B JLE MOTI05 ;IF OK
773 0000:0528 C6 06 69 20 01 MOV DRVOFF,1
774 0000:052D 81 0E 08 20 00 04 OR WORD PTR FAUL1,1024 ;SET MOTION FAULT
775 0000:0533 E9 76 FF MOTI05: JMP TMR2EX
776
777 0000:0536 DSTOR:
778 0000:0536 32 C0 XOR AL,AL
779 0000:0538 BA 80 01 MOV DX,APEXRQ ;GET APEX DATA
780 0000:053B EE OUT DX,AL
781 0000:053C 83 C2 02 ADD DX,2 ;POINT TO APEXRS
782 0000:053F B9 0C 00 MOV CX,12 ;12 TRIALS
783 0000:0542 DSTOR1:
784 0000:0542 EC IN AL,DX ;SEE IF DATA READY

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785 0000:0543 24 C0          AND    AL,0COH          ;STRIP DATA
786 0000:0545 3C 80          CMP    AL,80H          ;LOOK FOR PATTERN
787 0000:0547 74 0A          JZ     DSTOR2          ;IF READY
788 0000:0549 E2 F7          LOOP   DSTOR1          ;IF NOT
789 0000:054B 80 0E 08 20 01 OR     FAUL1,1          ;SET APEX DEAD
790 0000:0550 E9 30 00          JMP    DSTOR3          ;SKIP APEX GATHERING
791 0000:0553          DSTOR2:
792 0000:0553 80 26 08 20 FE AND    FAUL1,0FEH      ;SET APEX OK
793 0000:0558 4A          DEC    DX
794 0000:0559 ED          IN     AX,DX           ;GET POSITION
795 0000:055A 8B D8          MOV    BX,AX           ;PUT INTO BX
796 0000:055C C1 E3 02          SHL   BX,2             ;GET RID OF RESPONSE BITS
797 0000:055F 83 C2 02          ADD   DX,2             ;POINT TO NEXT SECTION
798 0000:0562 ED          IN     AX,DX           ;GET NEXT INFO
799 0000:0563 C0 C4 02          ROL   AH,2             ;GET FINAL POSITION
800 0000:0566 80 E4 03          AND   AH,03            ;PREPARE TO MERGE
801 0000:0569 0A DC          OR     BL,AH            ;MERGE BITS
802 0000:056B 89 1E 02 20      MOV    POSD,BX         ;SAVE POSITION
803 0000:056F A1 00 20          MOV    AX,POSCEC
804 0000:0572 2B C3          SUB   AX,BX            ;GET ERROR
805 0000:0574 C6 06 6D 20 00  MOV   DIR,0            ;ASSUME POSITIVE
806 0000:0579 73 05          JNC   DSTO2A           ;IF POSITIVE
807 0000:057B C6 06 6D 20 01  MOV   DIR,1            ;SET NEGATIVE
808 0000:0580 A3 04 20          DSTO2A: MOV   ERROR,AX       ;STORE IT HERE
809 0000:0583 C3          DSTOR3: RET
810
811
812 0000:0584          BRKOFF:
813 0000:0584 E5 00          IN     AX,P1PTA        ;GET CONTROL PORT
814 0000:0586 25 FF BF AND    AX,0BFFFH        ;ENGAGE THE BRAKE
815 0000:0589 E7 00          OUT   P1PTA,AX         ;DO IT
816 0000:058B C6 06 67 20 00  MOV   TFLAG1,0         ;SET TIMER FLAG = OK
817 0000:0590 E8 26 00          CALL  SEC1             ;1 SEC
818 0000:0593 E8 A0 FF BRKOF1: CALL  DSTOR          ;GET UPDATE
819 0000:0596 BA 87 01          MOV   DX,DISCR         ;POINT TO BRAKE DISCRETES
820 0000:0599 EC          IN     AL,DX           ;GET INFO
821 0000:059A A8 10          TEST  AL,16            ;BRAKE FREE?
822 0000:059C 74 12          JZ    BRKOP2           ;IF FREE CONTINUE
823 0000:059E F6 06 67 20 01  TEST  TFLAG1,1         ;TIMED OUT?
824 0000:05A3 74 EE          JZ    BRKOF1           ;IF NOT
825 0000:05A5 81 0E 08 20 00 01 OR    WORD PTR FAUL1,256 ;SET BRAKE FAULT
826 0000:05AB EA 00 00 00 00  JMP    FAR RSCMD        ;RESET COMMAND
827 0000:05B0          BRKOF2:
828 0000:05B0 81 26 08 20 FF FE AND   WORD PTR FAUL1,0FEFFH ;CLEAR BRAKE FAULT
829 0000:05B6 E9 0F 00          JMP    TMROFF          ;STOP TIMER
830
831 0000:05B9          SEC1:
832 0000:05B9 BA 5E FF          MOV   DX,T1MODE        ;ENABLE TIMER1 FIRST
833 0000:05BC B8 09 E0          MOV   AX,0E009H
834 0000:05BF EF          OUT   DX,AX
835 0000:05C0 BA 66 FF          MOV   DX,T2MODE        ;NOW TIMER2
836 0000:05C3 B8 01 C0          MOV   AX,0C001H
837 0000:05C6 EF          OUT   DX,AX
838 0000:05C7 C3          RET
839
840 0000:05C8          TMROFF:
841 0000:05C8 BE 12 06          MOV   SI,OFFSET CS:TSETUP ;POINT TO TABLE

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842 0000:05CB BA 50 FF          MOV    DX,TOCOUT          ;POINT TO SOURCE POINTER
843 0000:05CE B9 0C 00          MOV    CX,12
844 0000:05D1 6F                TSET:  OUTSW
845 0000:05D2 83 C2 02          ADD    DX,2
846 0000:05D5 E2 FA            LOOP   TSET
847 0000:05D7 C3                RET
848 0000:05D8
849 ;          TABLE SECTION FOR BOUND
850
851 0000:05D8          CLSETAB:
852 0000:05D8 FCFF          .WORD 0FFFCH          ;4 COUNTS BEFORE WE MOVE
853 0000:05DA 0400          .WORD 00004H
854
855 0000:05DC          CMDRG:
856 0000:05DC 1000          .WORD 16
857 0000:05DE 1400          .WORD 20
858
859 0000:05E0          CMDTBL:
860 0000:05E0 EA00          .WORD POSCMD
861 0000:05E2 2101          .WORD NAPCMD
862 0000:05E4 4201          .WORD MANCMD
863 0000:05E6 5C01          .WORD BDSCMD
864 0000:05E8 1A01          .WORD RECMD
865
866 0000:05EA          DELTA:
867 0000:05EA F4FF          .WORD -12
868 0000:05EC 0C00          .WORD 12
869
870 0000:05EE          DSETUP:
871 0000:05EE 8B01          .WORD RELADD
872 0000:05F0 0000          .WORD 0
873 0000:05F2 4020          .WORD RAC
874 0000:05F4 0000          .WORD 0
875 0000:05F6 0400          .WORD 4
876 0000:05F8 66A7          .WORD DOVAL
877
878 0000:05FA          MONRG:
879 0000:05FA 1000          .WORD 16
880 0000:05FC 2F00          .WORD 47
881
882 0000:05FE          POSRG:
883 0000:05FE 008A          .WORD LOW          ;SOFTWARE LIMITS
884 0000:0600 0072          .WORD HIGH
885
886 0000:0602          RAMPLM:
887 0000:0602 00BA          .WORD 0BA00H          ;RAMP LIMITS
888 0000:0604 0046          .WORD 04600H
889
890 0000:0606          RAMPTL:
891 0000:0606 6803          .WORD ZIPUP          ;RAMP ENTRY
892 0000:0608 D203          .WORD MAINNY
893 0000:060A 0304          .WORD ZIPDWN
894 0000:060C B102          .WORD VERGIT
895
896 0000:060E          SCREW:
897 0000:060E CEFF          .WORD -50          ;SECOND SCREW LIMITS
898 0000:0610 3200          .WORD 50

```

```
899
900 0000:0612          TSETUP:
901 0000:0612 0000      .WORD 0
902 0000:0614 0000      .WORD 0
903 0000:0616 0000      .WORD 0
904 0000:0618 0040      .WORD 16384      ;TIMER 0 IS NOT USED
905 0000:061A 0000      TSET1: .WORD 0
906 0000:061C D007      .WORD 2000      ;1 SEC DELAY
907 0000:061E 0000      .WORD 0
908 0000:0620 0040      .WORD 16384      ;TIMER 1 IS READY TO GO
909 0000:0622 0000      .WORD 0
910 0000:0624 B202      .WORD 690      ;552uS TIMER
911 0000:0626 0000      .WORD 0
912 0000:0628 0040      .WORD 16384      ;TIMER 2 IS READY ALSO
913
914 0000:062A          END
```

Lines Assembled : 914

Assembly Errors : 0

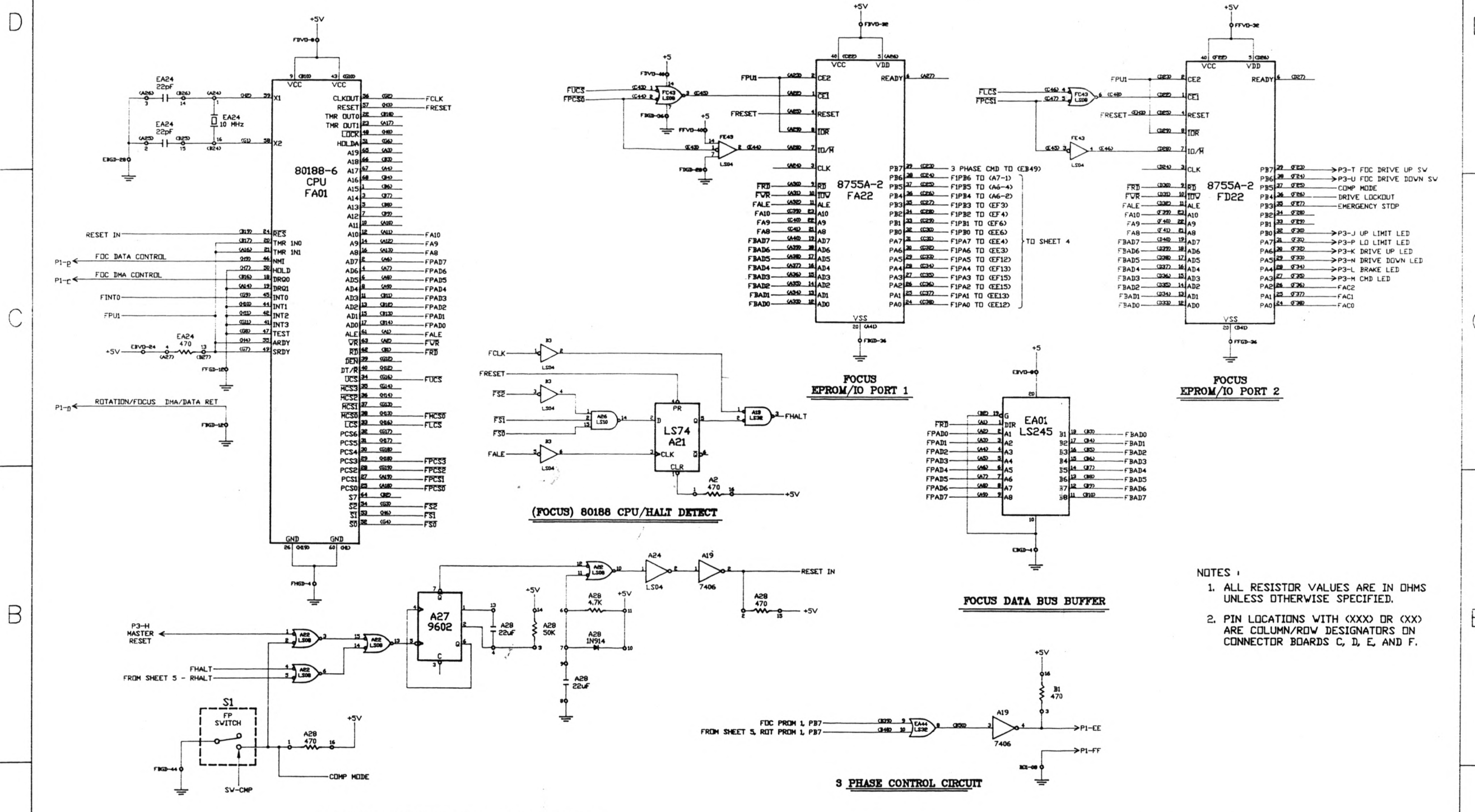
VOLUME II DRAWINGS LIST

The following is a list of the F-R Control System drawings included in Volume II. Fabrication drawings are not included. The drawings are ordered as shown in the list.

D55007K001	F-R Control System Block Diagram
D55007W001	F-R Control System Cable Structure
C52502M012	Pedestal Room NRAO Equipment Layout
D55007A002	S101 F-R Controller Module Assembly
D55007S004	S101 F-R Controller Module Schematic
D55007A003	S102 Apex Interface Module Assembly
D55007S006	S102 Apex Interface Module Schematic
D55007A004	S103 F-R Switching Module Assembly
D55007S002	S103 F-R Switching Module Schematic
D55007A020	S103 F-R Switching Module Resolver Excitor Assembly
C55007S017	S103 F-R Switching Module Resolver Excitor Schematic
C55007A021	S103 F-R Switching Module Brake V*I Mon PCB Assembly
D55007S008	S103 F-R Switching Module Brake V*I PCB Schematic
D55007A005	S104 F-R Interface Assembly
D55007S003	S104 F-R Interface Schematic
A55002B002	Standard Interface PCB Assembly, Model D
C55002S004	Standard Interface Schematic, Model D
D55007A006	F-R Power Supply Module Assembly
D55007S001	F-R Power Supply Module Schematic
D55007A022	Servo Amplifier Chassis Assembly
D55007S010	Servo Amplifier Chassis Schematic
A55007W004	Servo Amplifier Chassis Wire List
B55007S019	Motor Overload Relay-Emergency Stop Functional Ckt
D55007A023	Servo Amplifier Power Supply Module Assembly
D55007S011	Servo Amplifier Power Supply Module Schematic
D55007A024	Focus Servo Amplifier Module Assembly
D55007S012	Focus Servo Amplifier Module Schematic
C55007S005	IDD MC2 Board Schematic
B55007S018	Power Switching Circuit Schematic Diagram
A55007D001	IDD Servo Amplifier Phase Modulator Timing Diagram
D55007A025	Rotation Servo Amplifier Module Assembly
D55007S013	Rotation Servo Amplifier Module Schematic
D55007A020	Rotation Backlash Controller Module Assembly
D55007S009	Rotation Backlash Controller Module Schematic
C55007S007	Isolation Transformer Box Schematic
D55007A001	Isolation Transformer Box Assembly

D55007S014	Apex Control Junction Box Schematic
D55007A008	Apex Control Junction Box Assembly
C55007S015	Apex Motor Junction Box Schematic
D55007A007	Apex Motor Junction Box Assembly
D55007A009	Pedestal Room Control Junction Box Assembly
D55007W003	Apex To Ped Room Signal Cable Diagram
A55007W005	F-R Control Bins Wire List
C55007A029	Rotation Limit Switch-Resolver Alignment
C55007A030	Focus Limit Switch-Resolver Alignment

REV	DATE	DRAWN BY	APPR'D BY	DESCRIPTION
A	9-87	ANDREATTA		MINOR CORRECTIONS J
B	12-89	ANDREATTA		REDRAWN WITH ACAD J



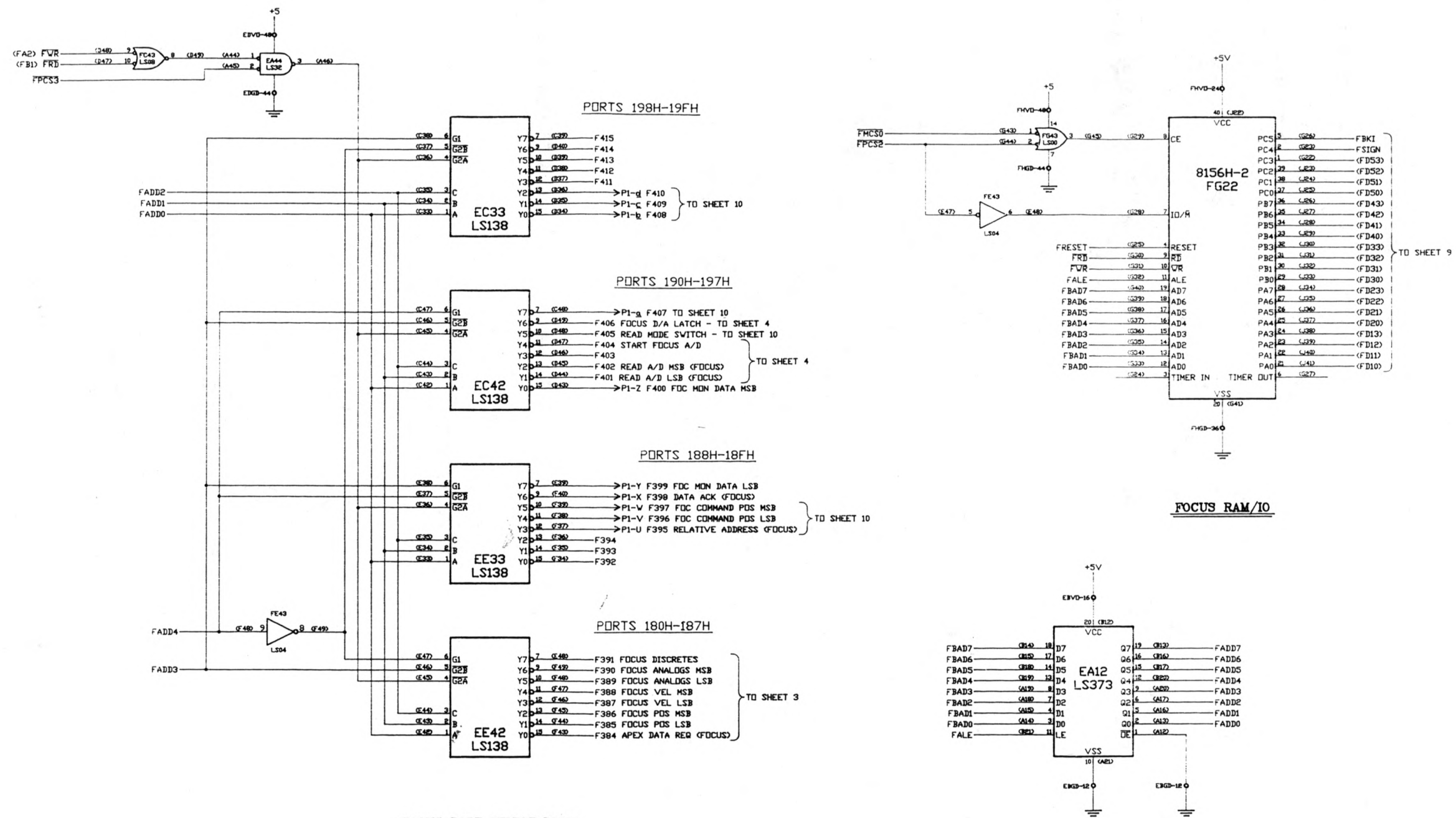
- NOTES :
1. ALL RESISTOR VALUES ARE IN OHMS UNLESS OTHERWISE SPECIFIED.
 2. PIN LOCATIONS WITH (XXX) OR (XX) ARE COLUMN/ROW DESIGNATORS ON CONNECTOR BOARDS C, D, E, AND F.

FOCUS 80188 CPU
FOCUS EPROM/IO PORT/DATA BUS BUFFER

ACAD : S101SK-1

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES		V L B A	S101 F-R CONTROLLER	NATIONAL RADIO ASTRONOMY OBSERVATORY SOCORRO, NEW MEXICO 87801	
TOLERANCES : ANGLES : 3 PLACE DECIMALS (.000) : 2 PLACE DECIMALS (.00) : 1 PLACE DECIMALS (.1) :				T E	S101 F-R CONTROLLER MODULE SCHEMATIC
MATERIAL :		F-R CONTROLLER MODULE SCHEMATIC		DESIGNED BY KOSKI	DATE 7-87
FINISH :		SHEET NUMBER 1 of 10		APPROVED BY	DATE
D55007A002 MODULE ASS'Y		DRAWING NUMBER D55007S004		REV. B SCALE	
NEXT ASSEMBLY		DWG. TYPE			

REV	DATE	DRAWN BY	APPRVD BY	DESCRIPTION
A	9-87	ANDREATTA		MINDR CORRECTIONS J
B	12-89	ANDREATTA		REDRAWN WITH ACAD J



FOCUS PORT SELECT LOGIC

FOCUS ADDRESS LATCH

**FOCUS PORT SELECT LOGIC
FOCUS RAM/IO**

ACAD : S101SK-2

D55007A002	MODULE ASS'Y
NEXT ASSEMBLY	DWG. TYPE

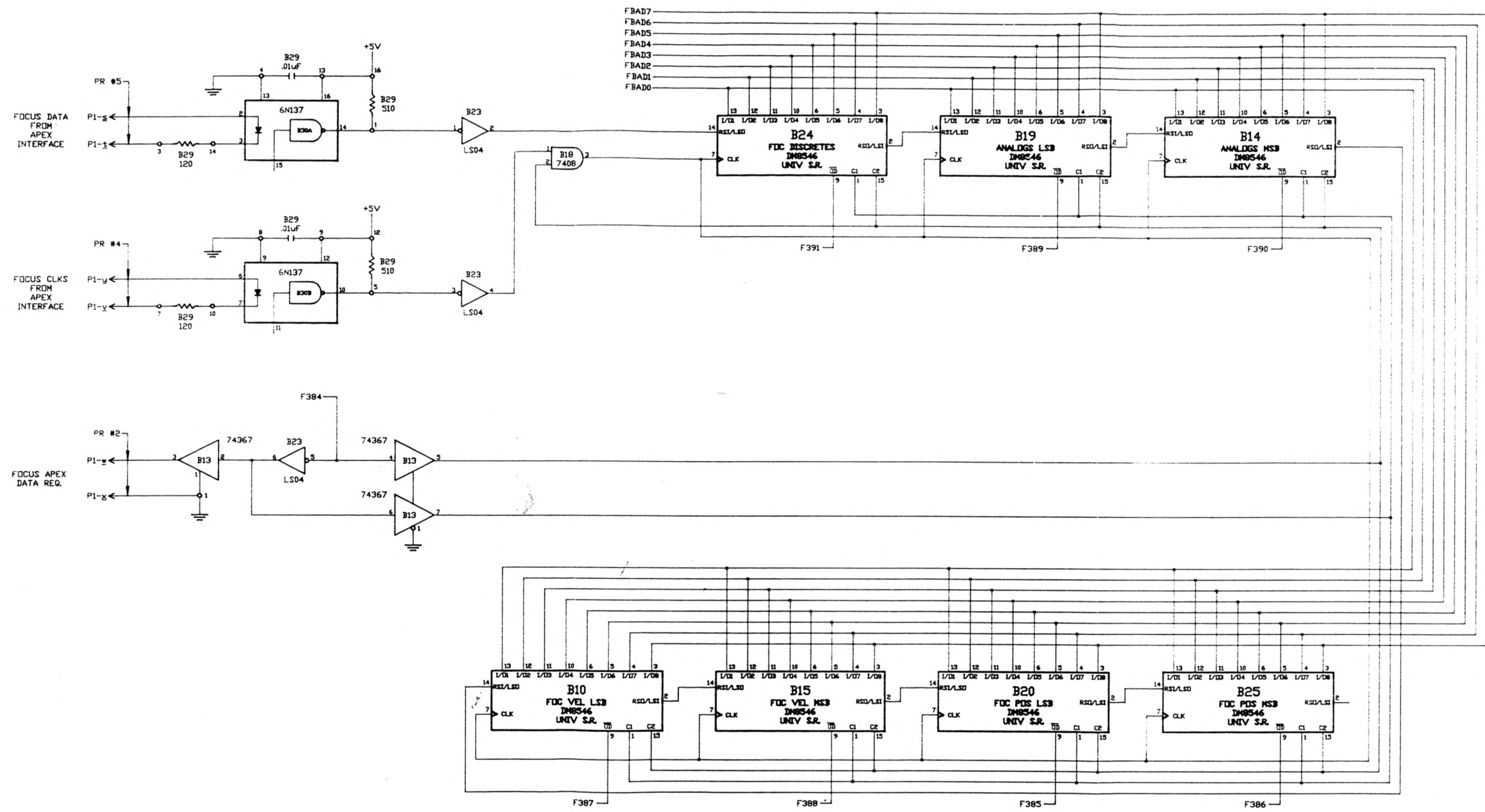
UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES	
TOOLERANCES : ANGLES ±	---
3 PLACE DECIMALS (.000) ±	---
2 PLACE DECIMALS (.100) ±	---
1 PLACE DECIMALS (.1) ±	---
MATERIAL :	---
FINISH :	---

V L B A	P R O J E C T I O N	S101 F-R CONTROLLER	
		S101 F-R CONTROLLER MODULE SCHEMATIC	
T I T L E		SHEET NUMBER	2 of 10
		DRAWING NUMBER	D55007S004

NATIONAL RADIO ASTRONOMY OBSERVATORY SOCORRO, NEW MEXICO 87801	
DRAWN BY ANDREATTA	DATE 7-87
DESIGNED BY KOSKI	DATE 7-87
APPROVED BY	DATE
REV. B	SCALE

PROPERTY OF NRAO

REV	DATE	DRAWN BY	APPRVD BY	DESCRIPTION
A	9-87	ANDREATA		MINDR CORRECTIONS J
B	12-89	ANDREATA		REDRAWN WITH ACAD J



FOCUS APEX INTERFACE

FOCUS APEX INTERFACE

UNLESS OTHERWISE SPECIFIED
DIMENSIONS ARE IN INCHES
TOLERANCES : ANGLES ± _____
3 PLACE DECIMALS (.000) ± _____
2 PLACE DECIMALS (.00) ± _____
1 PLACE DECIMALS (.0) ± _____

MATERIAL : _____
FINISH : _____

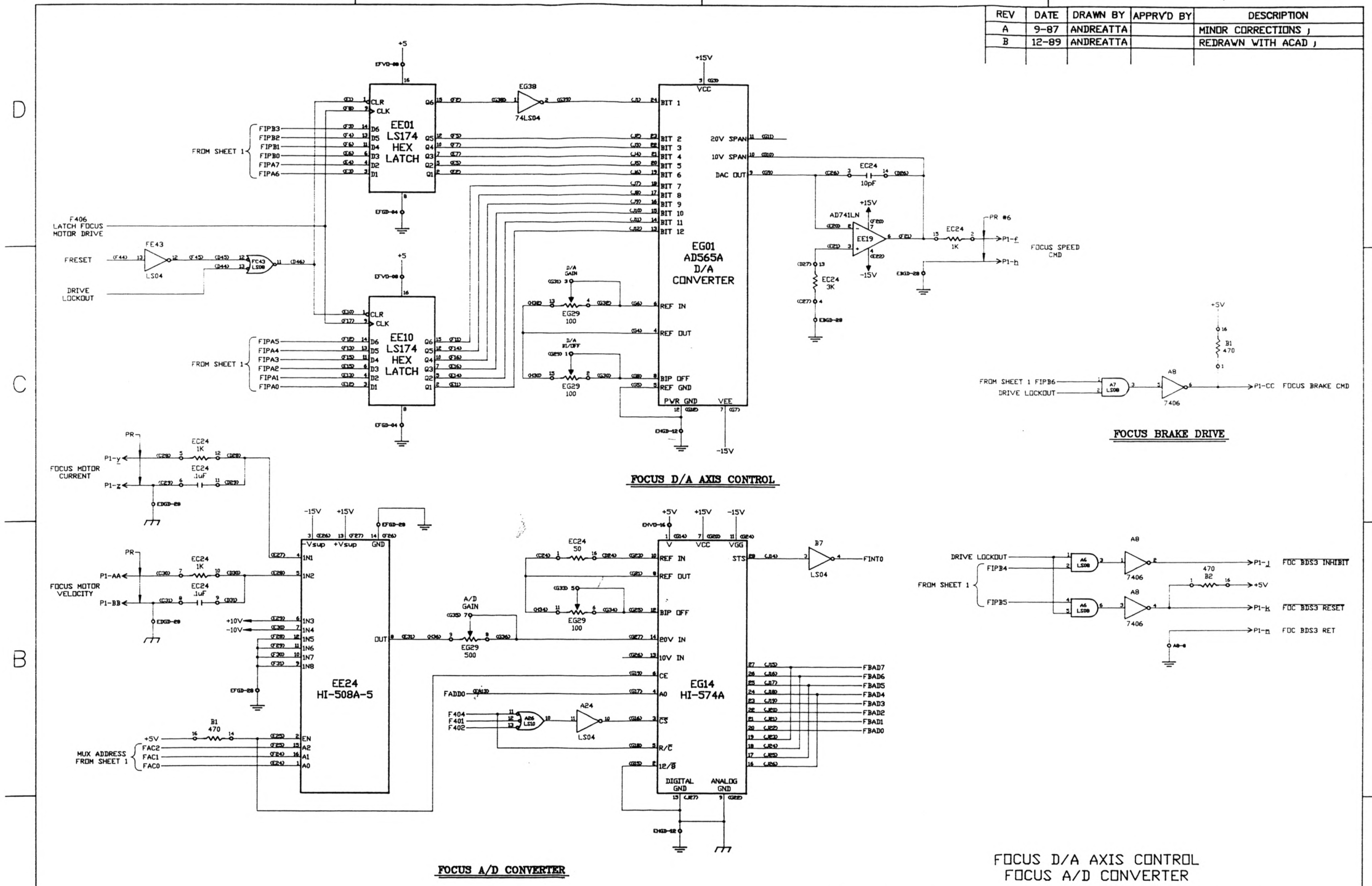
D55007A002	MODULE ASS'Y
NEXT ASSEMBLY	DWG. TYPE

V L B A	S101
	F-R CONTROLLER
T I L E	S101
	F-R CONTROLLER
	MODULE SCHEMATIC
SHEET NUMBER	3 of 10
DRAWING NUMBER	D55007S004

NATIONAL RADIO ASTRONOMY OBSERVATORY SOCORRO, NEW MEXICO 87801	
DRAWN BY ANDREATA	DATE 7-87
DESIGNED BY KOSKI	DATE 7-87
APPROVED BY	DATE
REV. B	SCALE

PROPERTY OF NRAO

REV	DATE	DRAWN BY	APPRVD BY	DESCRIPTION
A	9-87	ANDREATA		MINOR CORRECTIONS J
B	12-89	ANDREATA		REDRAWN WITH ACAD J



FOCUS D/A AXIS CONTROL

FOCUS A/D CONVERTER

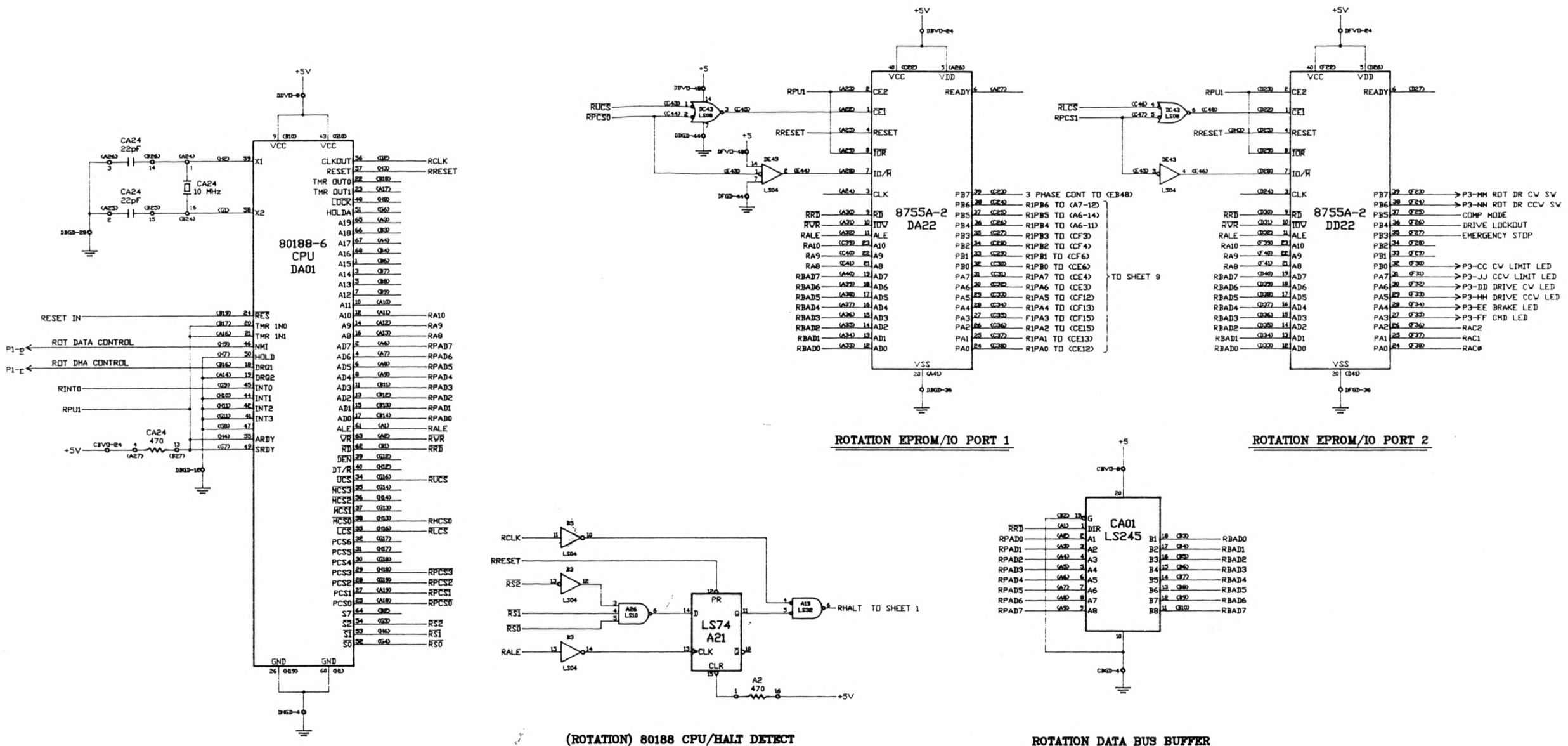
**FOCUS D/A AXIS CONTROL
FOCUS A/D CONVERTER**

ACAD : S101SK-4

PROPERTY OF NRAO

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES TOLERANCES : ANGLES ± _____ 3 PLACE DECIMALS (.000) ± _____ 2 PLACE DECIMALS (.00) ± _____ 1 PLACE DECIMALS (.0) ± _____		V L B A	S101 F-R CONTROLLER	NATIONAL RADIO ASTRONOMY OBSERVATORY SOCORRO, NEW MEXICO 87801	
MATERIAL : _____		T I T L E	S101 F-R CONTROLLER MODULE SCHEMATIC	DRAWN BY ANDREATA	DATE 7-87
FINISH : _____				DESIGNED BY KOSKI	DATE 7-87
D55007A002 NEXT ASSEMBLY	MODULE ASS'Y DWG. TYPE			APPROVED BY	DATE
		SHEET NUMBER	4 of 10	DRAWING NUMBER	D55007S004
		REV.	B	SCALE	

REV	DATE	DRAWN BY	APPRVD BY	DESCRIPTION
A	9-87	ANDREATA		MINOR CORRECTIONS J
B	12-89	ANDREATA		REDRAWN WITH ACAD J



ROTATION 80188 CPU/HALT DETECT

ROTATION EPROM/IO PORT 1

ROTATION EPROM/IO PORT 2

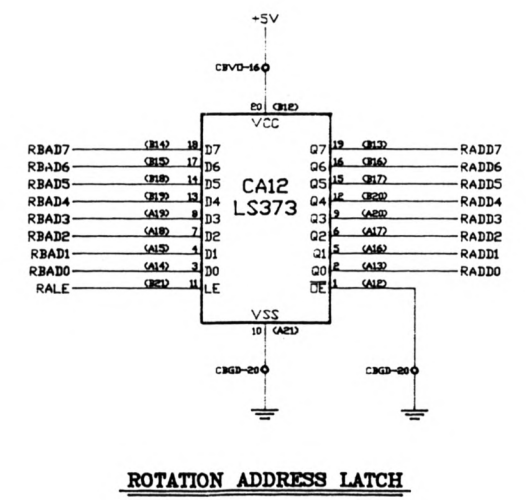
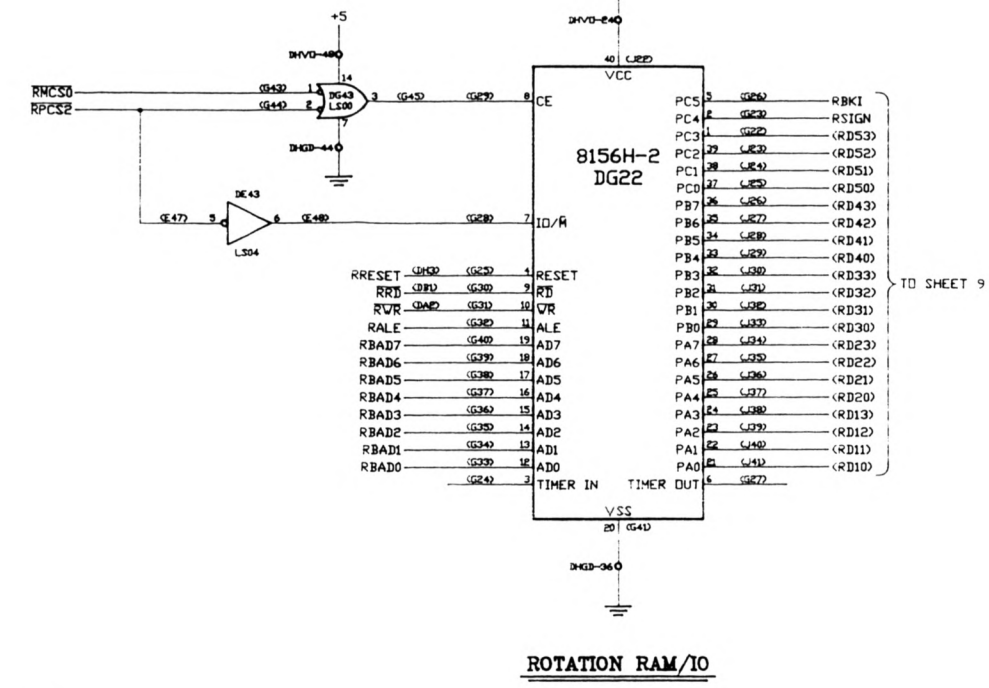
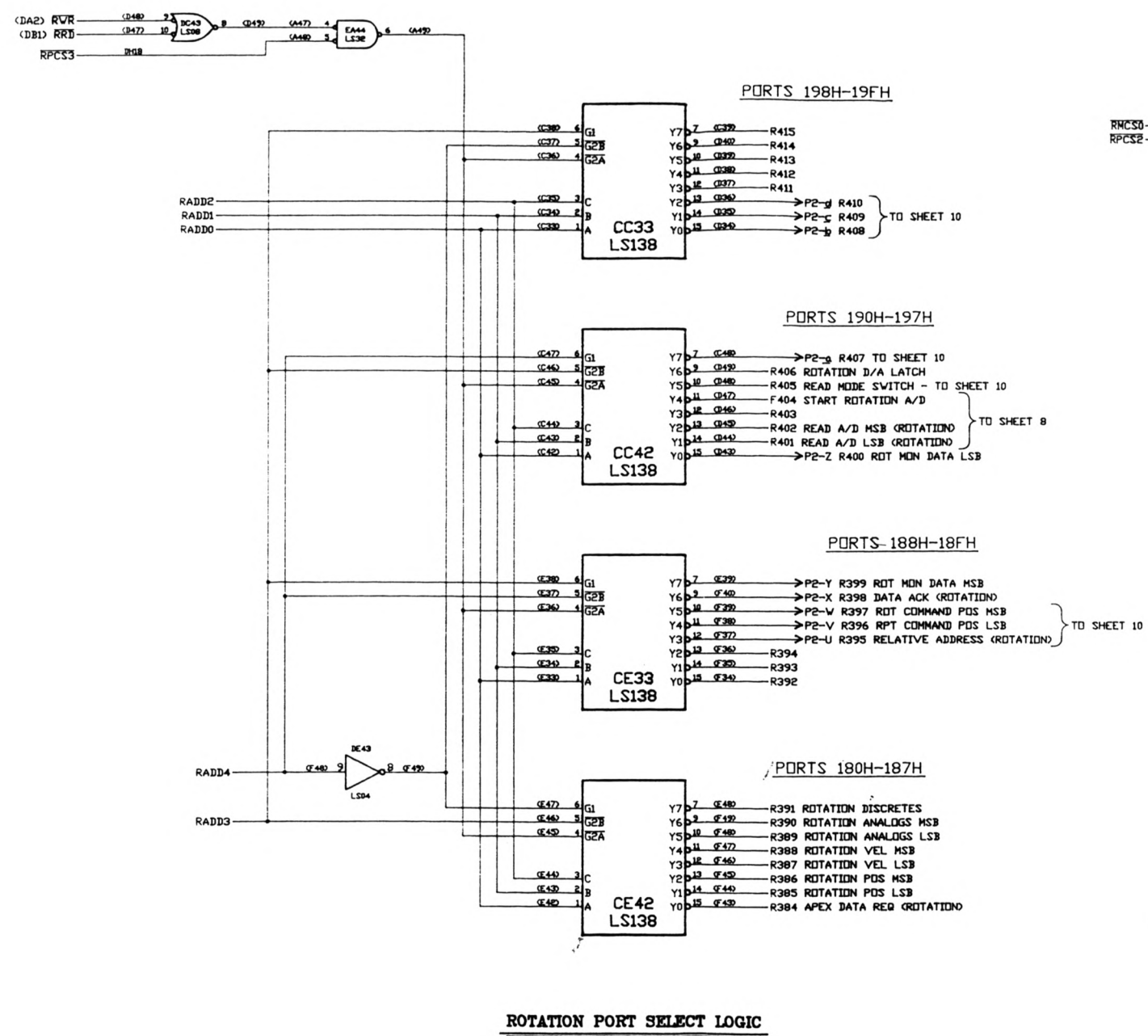
ROTATION DATA BUS BUFFER

ROTATION 80188 CPU
ROTATION EPROM/IO PORT/DATA BUS BUFFER

ACAD : S101SK-5

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES		V L B A	S101 F-R CONTROLLER	NATIONAL RADIO ASTRONOMY OBSERVATORY SOCORRO, NEW MEXICO 87801	
TOLERANCES : ANGLES ± _____				DRAWN BY ANDREATA DATE 7-87	
3 PLACE DECIMALS (.000) ± _____		S101 F-R CONTROLLER MODULE SCHEMATIC		DESIGNED BY KOSKI DATE 7-87	
2 PLACE DECIMALS (.00) ± _____		MATERIAL : _____		APPROVED BY _____ DATE _____	
1 PLACE DECIMALS (.X) ± _____		FINISH : _____		SHEET NUMBER 5 of 10 DRAWING NUMBER D55007S004 REV. B SCALE _____	
D55007A002	MODULE ASS'Y				
NEXT ASSEMBLY	DWG. TYPE				

REV	DATE	DRAWN BY	APPRVD BY	DESCRIPTION
A	9-87	ANDREATTA		MINOR CORRECTIONS J
B	12-89	ANDREATTA		REDRAWN WITH ACAD J



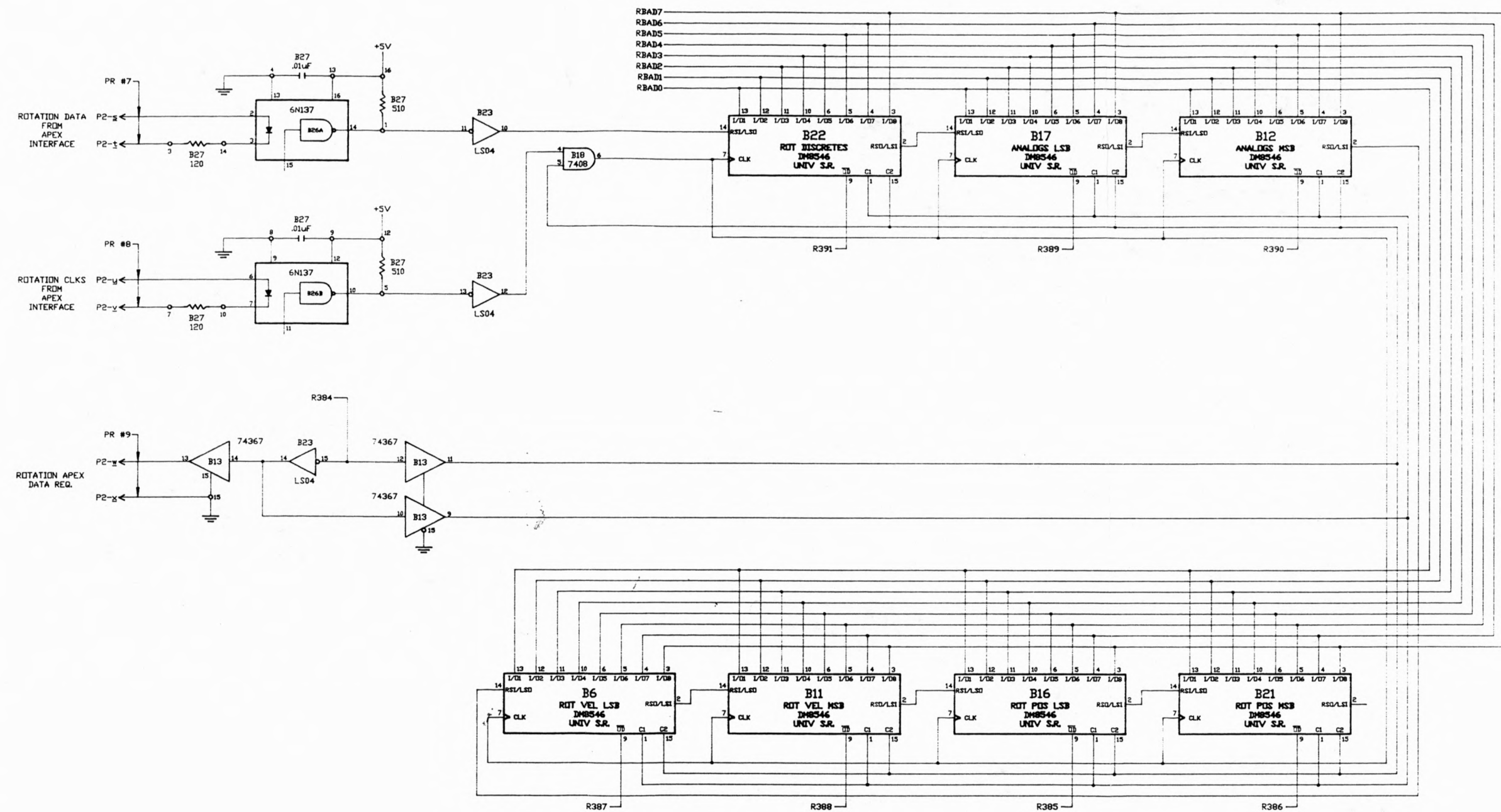
ROTATION PORT SELECT LOGIC
ROTATION RAM/IO

ACAD : S101SK-6

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES	TOLERANCES : ANGLES ±	---
	3 PLACE DECIMALS (.000) ±	---
	2 PLACE DECIMALS (.00) ±	---
	1 PLACE DECIMALS (.X) ±	---
MATERIAL :		
FINISH :		
D55007A002	MODULE ASS'Y	
NEXT ASSEMBLY	DWG. TYPE	

V L B A	S101 F-R CONTROLLER	NATIONAL RADIO ASTRONOMY OBSERVATORY SOCORRO, NEW MEXICO 87801	
		DRAWN BY ANDREATTA	DATE 7-87
I T E	S101 F-R CONTROLLER MODULE SCHEMATIC	DESIGNED BY KOSKI	DATE 7-87
		APPROVED BY	DATE
SHEET NUMBER	6 of 10	DRAWING NUMBER	D55007S004
REV.	B	SCALE	

REV	DATE	DRAWN BY	APPR'VD BY	DESCRIPTION
A	9-87	ANDREATTA		MINOR CORRECTIONS J
B	12-89	ANDREATTA		REDRAWN WITH ACAD J



ROTATION APEX INTERFACE

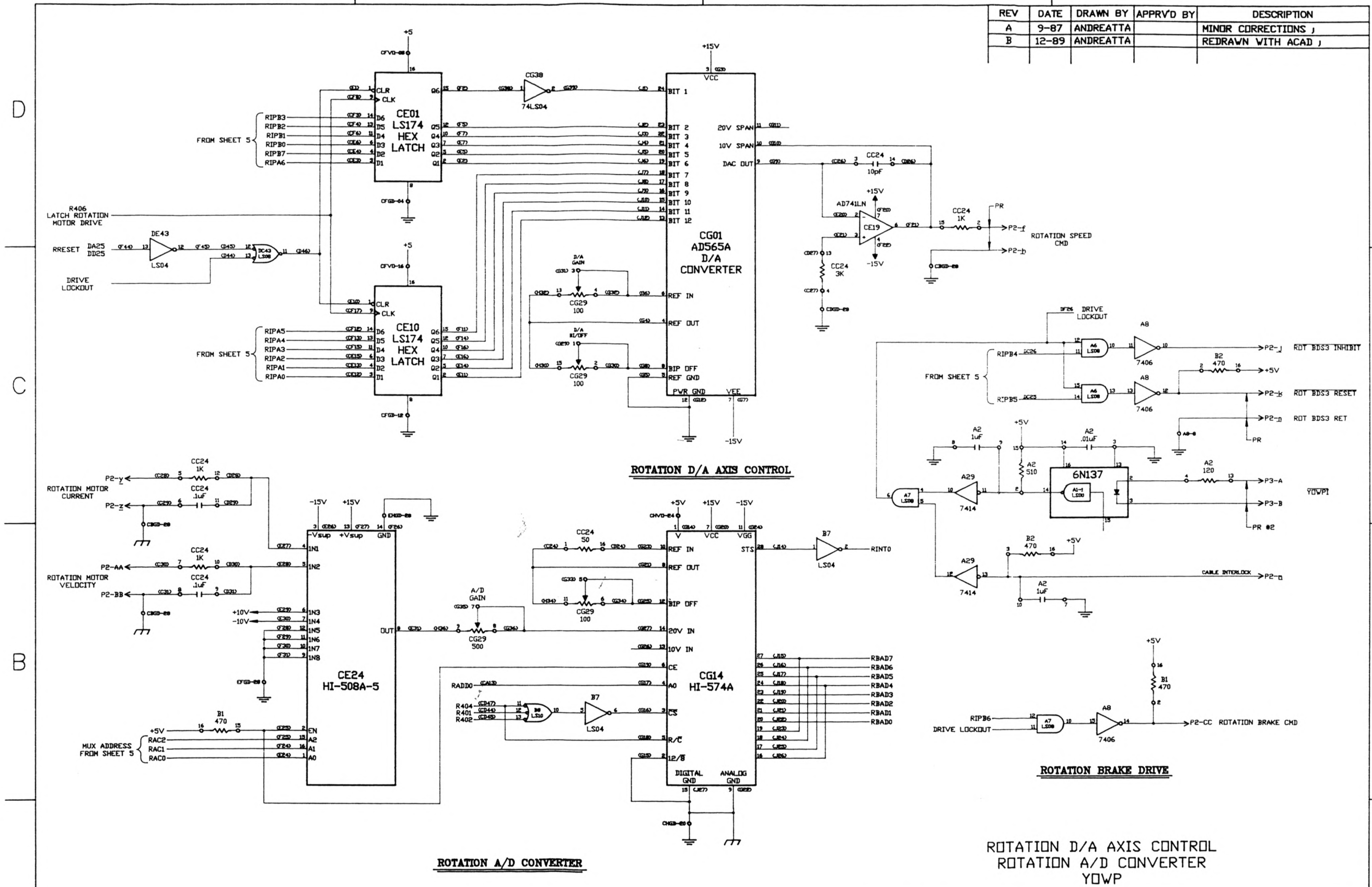
ROTATION APEX INTERFACE

ACAD : S101SK-7

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES		V L B A	S101 F-R CONTROLLER	NATIONAL RADIO ASTRONOMY OBSERVATORY SOCORRO, NEW MEXICO 87801	
TOLERANCES : ANGLES = — 3 PLACE DECIMALS (.000) = — 2 PLACE DECIMALS (.00) = — 1 PLACE DECIMALS (.0) = —				DRAWN BY ANDREATTA DATE 7-87	
MATERIAL : —		T E	S101 F-R CONTROLLER MODULE SCHEMATIC	DESIGNED BY KOSKI DATE 7-87	
FINISH : —				APPROVED BY DATE	
D55007A002	MODULE ASS'Y	SHEET	7 of 10	DRAWING	D55007S004
NEXT ASSEMBLY	DWG. TYPE	NUMBER		REV.	B SCALE —

PROPERTY OF INRAO

REV	DATE	DRAWN BY	APPR'D BY	DESCRIPTION
A	9-87	ANDREATTA		MINOR CORRECTIONS J
B	12-89	ANDREATTA		REDRAWN WITH ACAD J

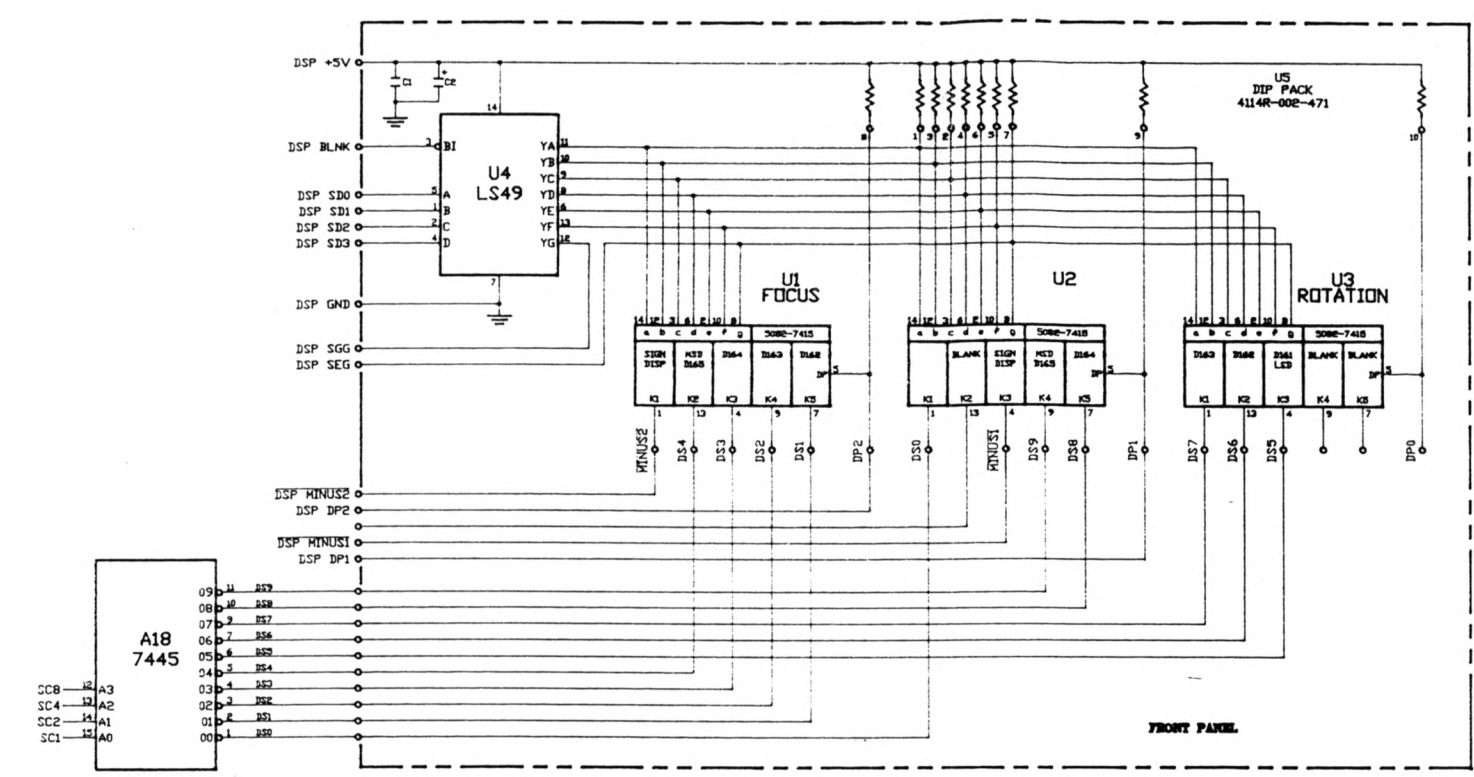


ACAD : S101SK-8

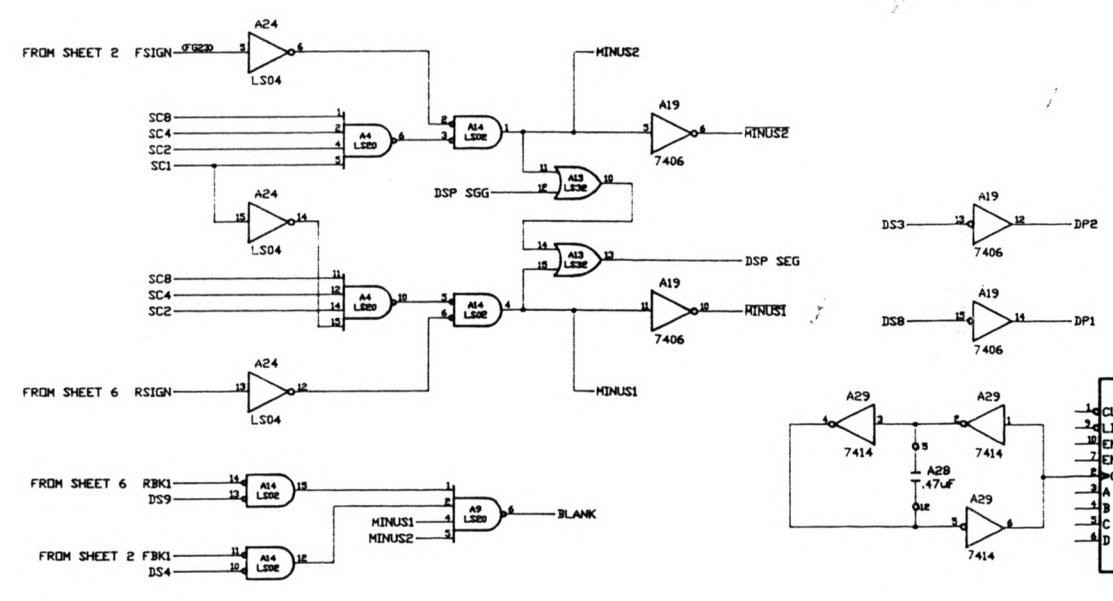
UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES	TOLERANCES : ANGLES ±	---
	3 PLACE DECIMALS (.000) ±	---
	2 PLACE DECIMALS (.00) ±	---
	1 PLACE DECIMALS (.0) ±	---
MATERIAL :		
FINISH :		
D55007A002	MODULE ASS'Y	
NEXT ASSEMBLY	DWG. TYPE	

V L B A	S101 F-R CONTROLLER	NATIONAL RADIO ASTRONOMY OBSERVATORY SOCORRO, NEW MEXICO 87801	
	S101 F-R CONTROLLER MODULE SCHEMATIC		
I T E	SHEET NUMBER 8 of 10	DRAWN BY ANDREATTA	DATE 7-87
		DESIGNED BY KOSKI	DATE 7-87
DRAWING NUMBER D55007S004		APPROVED BY	DATE
REV. B		SCALE	

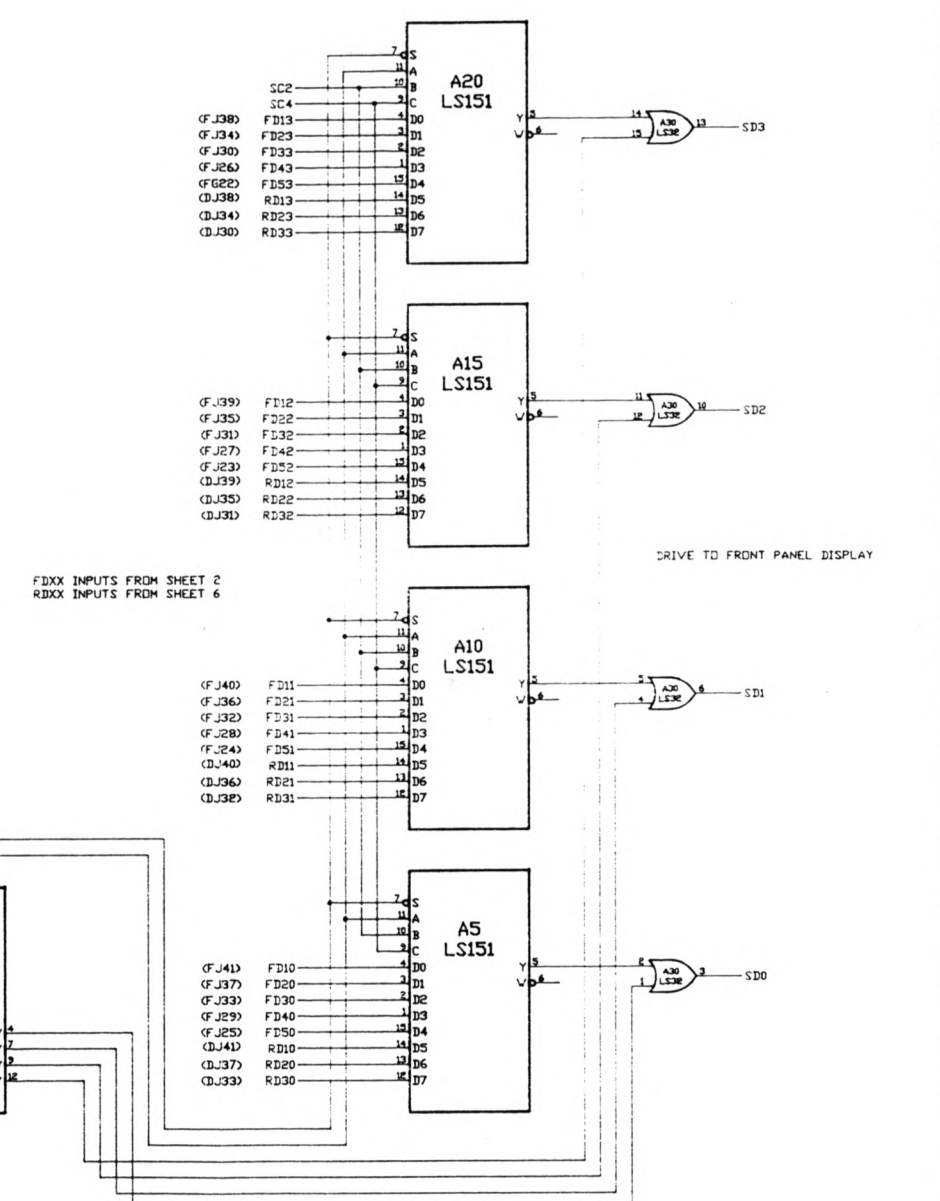
REV	DATE	DRAWN BY	APPRVD BY	DESCRIPTION
A	9-87	ANDREATTA		MINDR CORRECTIONS J
B	12-89	ANDREATTA		REDRAWN WITH ACAD J



FRONT PANEL DISPLAY



DISPLAY CONTROL LOGIC



DISPLAY SWITCHING LOGIC

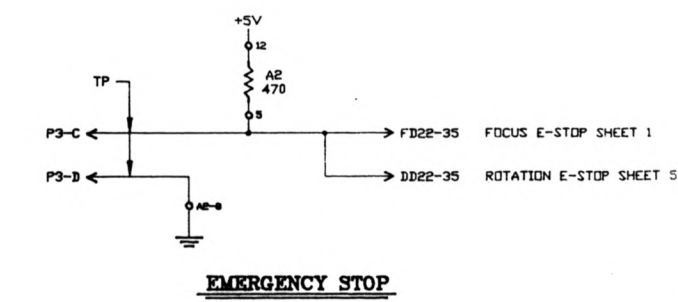
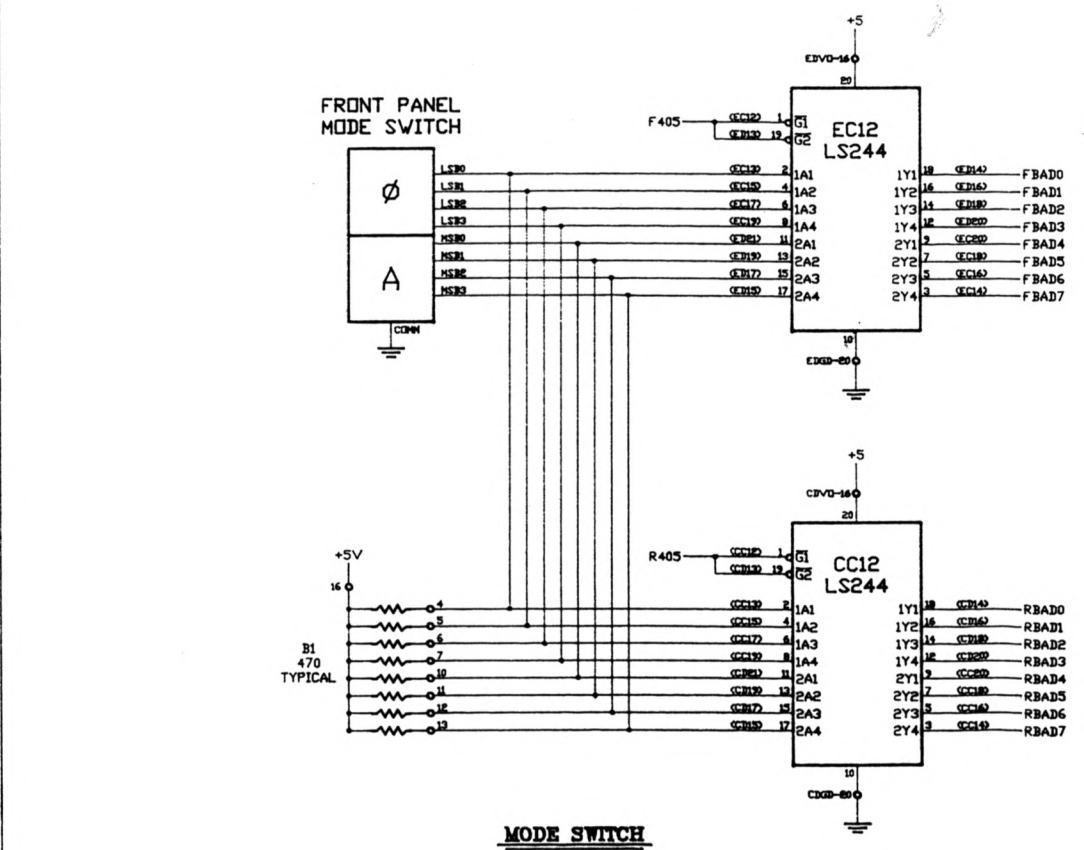
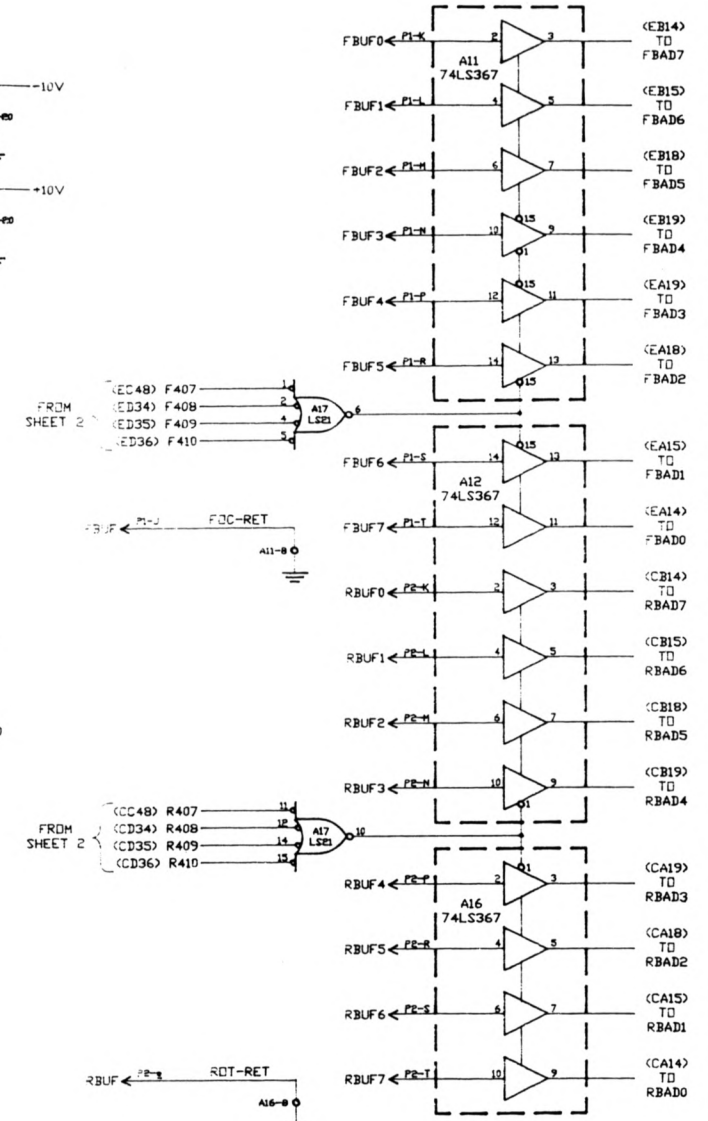
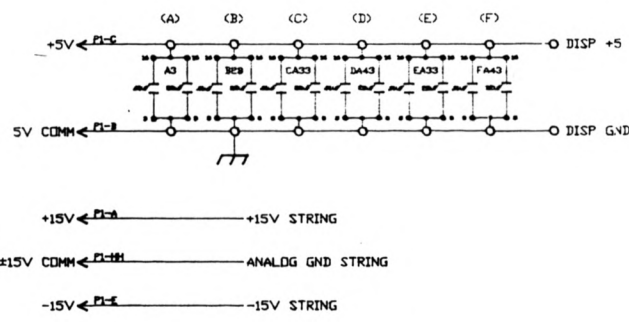
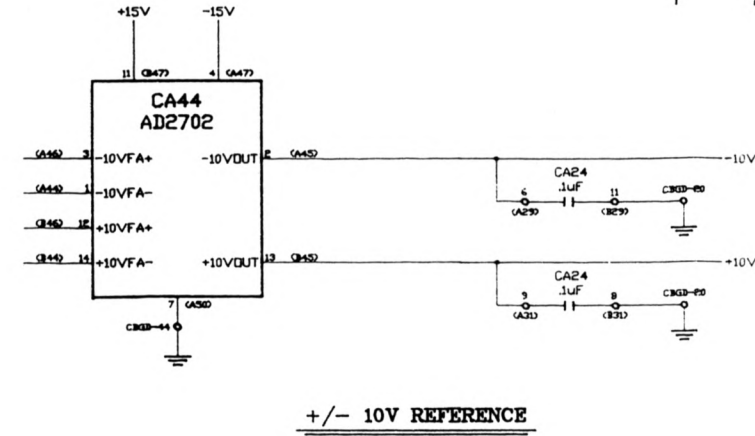
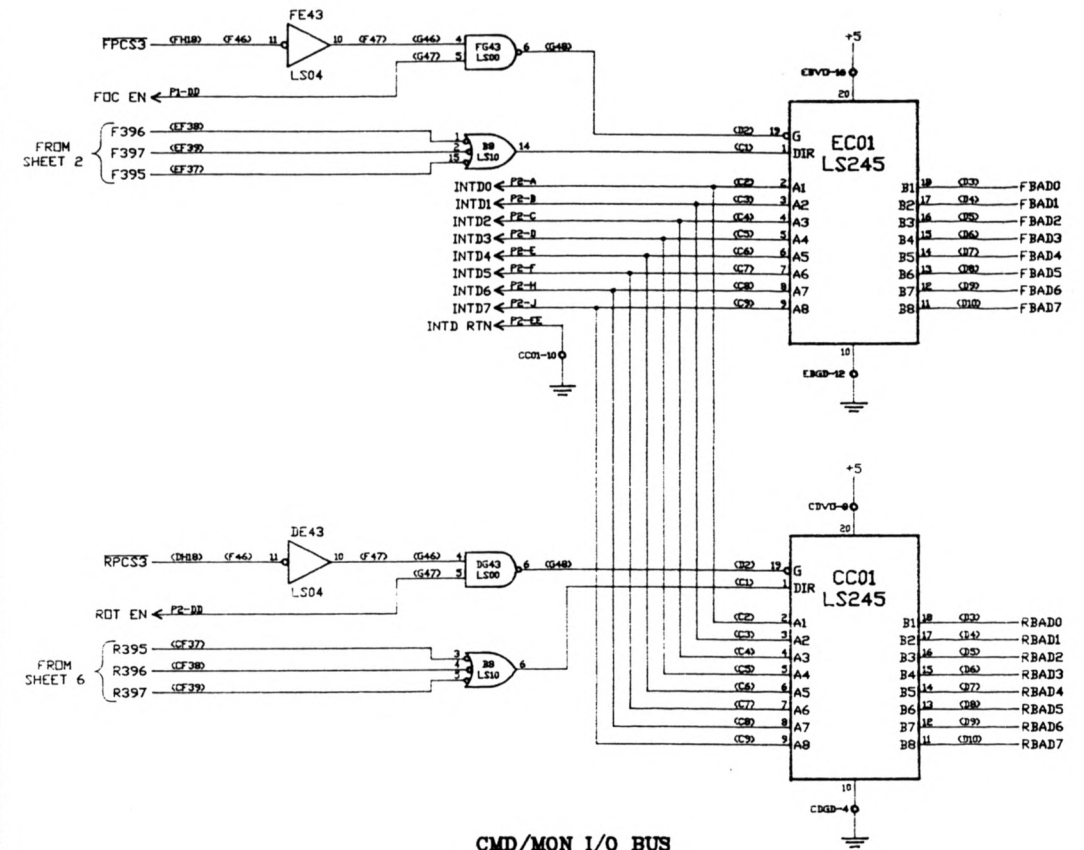
**FRONT PANEL DISPLAY
DISPLAY SWITCHING LOGIC
DISPLAY CONTROL LOGIC**

ACAD : S101SK-9

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES TOLERANCES : ANGLES : — 3 PLACE DECIMALS (.000) : — 2 PLACE DECIMALS (.00) : — 1 PLACE DECIMALS (.X) : —		V L B A P S101 F-R CONTROLLER	NATIONAL RADIO ASTRONOMY OBSERVATORY SOCORRO, NEW MEXICO 87801	
MATERIAL : —			DRAWN BY ANDREATTA	DATE 7-87
FINISH : —		S101 F-R CONTROLLER MODULE SCHEMATIC		
DESIGNED BY KOSKI		DATE 7-87		
APPROVED BY		DATE		
SHEET NUMBER 9 of 10		DRAWING NUMBER D55007S004		
REV. B		SCALE —		

PROPERTY OF NRAO

REV	DATE	DRAWN BY	APPRVD BY	DESCRIPTION
A	9-87	ANDREATTA		MINOR CORRECTIONS J
B	12-89	ANDREATTA		REDRAWN WITH ACAD J

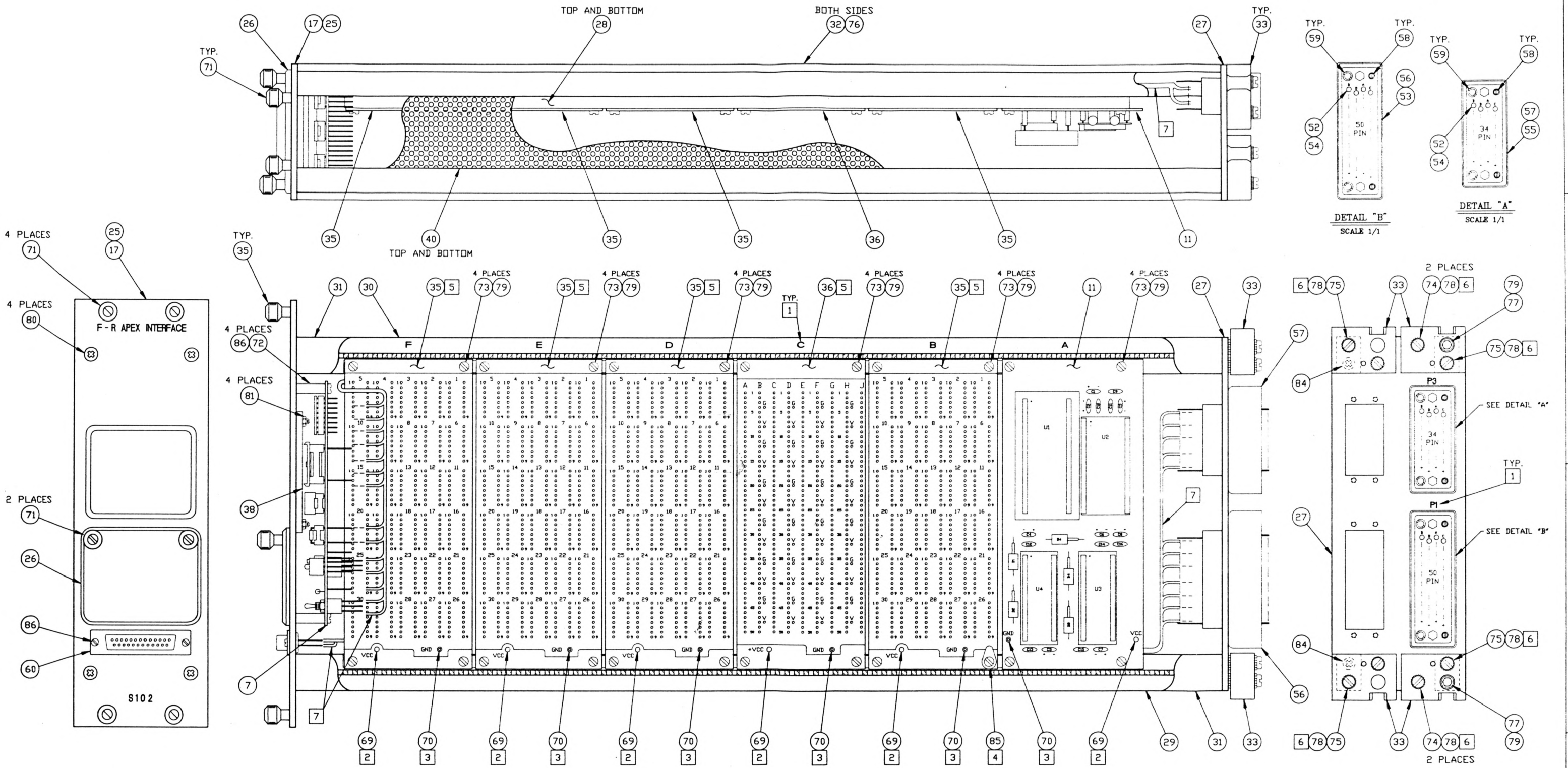


CMD/MON I/O BUS
MODE SWITCH
+/- 10V REFERENCE
SERVO DISCRETES INPUT LOGIC
MODULE POWER WIRING

ACAD : S101SK10

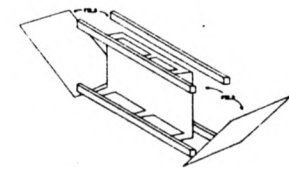
UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES		V L B A	S101 F-R CONTROLLER	NATIONAL RADIO ASTRONOMY OBSERVATORY SOCORRO, NEW MEXICO 87801	
TOLERANCES : ANGLES ± _____				DRAWN BY ANDREATTA	DATE 7-87
3 PLACE DECIMALS (.000) ± _____		T I T L E	S101 F-R CONTROLLER MODULE SCHEMATIC	DESIGNED BY KOSKI	DATE 7-87
2 PLACE DECIMALS (.00) ± _____				APPROVED BY	DATE
1 PLACE DECIMALS (.0) ± _____					
MATERIAL : _____		FINISH : _____		SHEET NUMBER 10 of 10 DRAWING NUMBER D55007S004 REV. B SCALE _____	
D55007A002 MODULE ASS'Y		NEXT ASSEMBLY DWG. TYPE			

REV	DATE	DRAWN BY	APPRVD BY	DESCRIPTION
A	2-90	ANDREATTA		REVISED RESOLVER TO DIGITAL PCB



NOTES :

- MARKING SHALL BE .125 HIGH, LEGIBLE AND PERMANENT, LOCATED APPROXIMATELY AS SHOWN.
- SOLDER POWER TERMINAL (ITEM #69) TO POWER PLANE. (WIRE WRAP SIDE OF ITEM #11, #35, AND #36)
- SOLDER GND TERMINAL (ITEM #70) TO GROUND PLANE. (COMPONENT SIDE OF ITEM #11, #35, AND #36)
- SOLDER "SOLDER LUG" (ITEM #85) TO GROUND PLANE AND PLACE UNDER SCREW HEAD AS SHOWN.
- INSTALL IC'S INTO UNIVERSAL IC PANEL (ITEM #36) AND 16 X 32 IC PANEL (ITEM #35) USING DWG. #A55007A016.
- WHERE TWO WASHERS (ITEM #78) ARE REQUIRED, PLACE ONE UNDER THE SCREW HEAD AND THE OTHER BETWEEN THE GUIDE BLOCK (ITEM #33) AND REAR PANEL (ITEM #27).
- DRESS WIRE HARNESS PATH TO PERMIT FRONT AND REAR PANELS TO BE FOLDED OUTWARD FROM TOP. (SEE FIGURE)



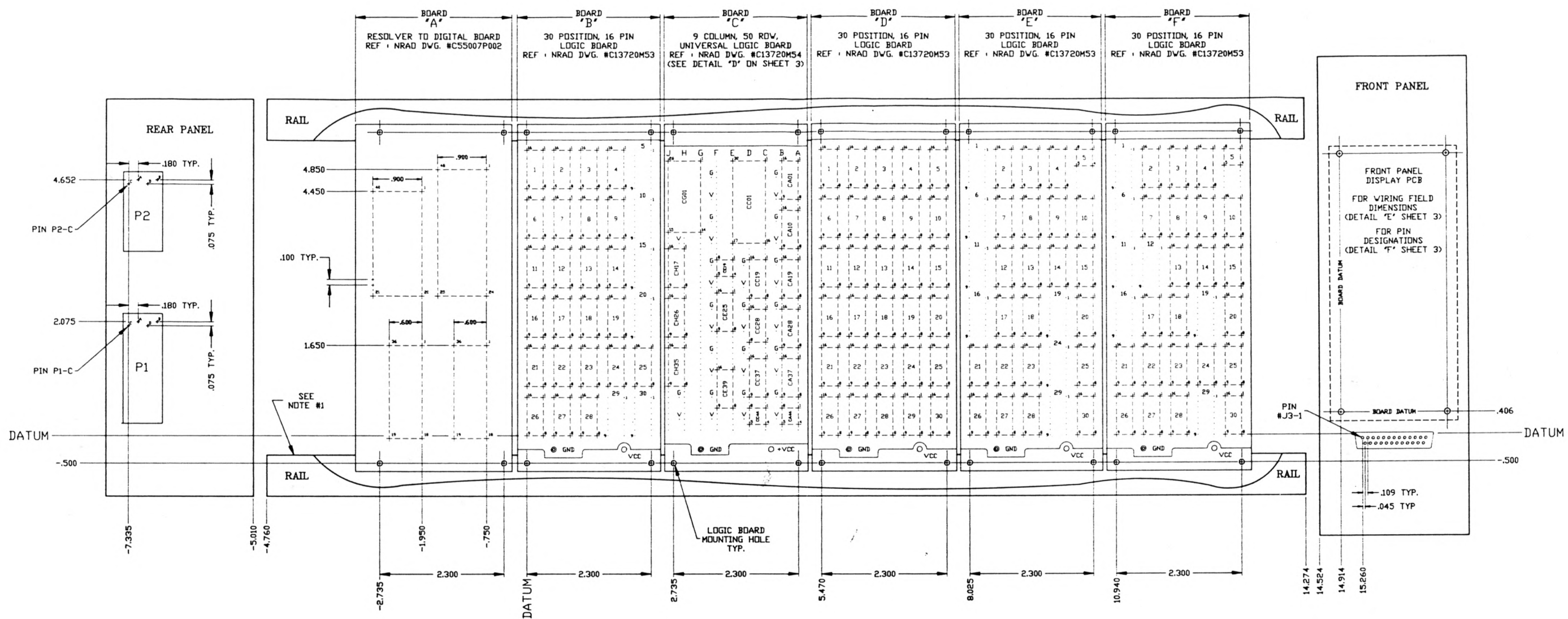
ACAD : S102ASY1

BOM - #A55007B003

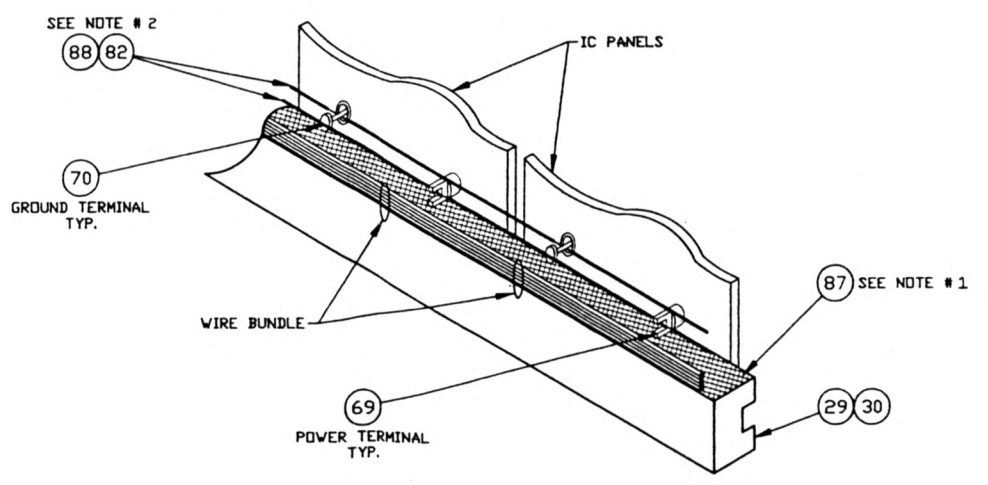
UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES	
TOLERANCES - ANGLES :	_____
3 PLACE DECIMALS (.000) :	.005
2 PLACE DECIMALS (.00) :	_____
1 PLACE DECIMALS (.0) :	_____
MATERIAL :	_____
FINISH :	_____
NEXT ASSEMBLY :	DWG. TYPE

V L B A	S102	NATIONAL RADIO ASTRONOMY OBSERVATORY SOCORRO, NEW MEXICO 87801	DATE	9-87
	APEX INTERFACE		DRAWN BY	ANDREATTA
I E	S102	SHEET NUMBER 1 of 3	DRAWING NUMBER	D55007A003
	APEX INTERFACE MODULE ASSEMBLY		DESIGNED BY	WEBER
		APPROVED BY	DATE	
		REV. A	SCALE 1/1	

REV	DATE	DRAWN BY	APPRVD BY	DESCRIPTION
A	2-90	ANDREATTA		REVISED RESOLVER TO DIGITAL PCB



- NOTES :
1. KAPTON TAPE (ITEM #87) SHALL RUN THE FULL LENGTH OF THE RAILS (ITEM #29 AND #30). SEE DETAIL "C".
 2. POWER AND GROUND BUS WIRING SHALL BE ON THE WIRE WRAP SIDE OF THE UNIVERSAL IC PANEL AND THE 16 X 30 IC PANELS (ITEMS #35 AND #36).

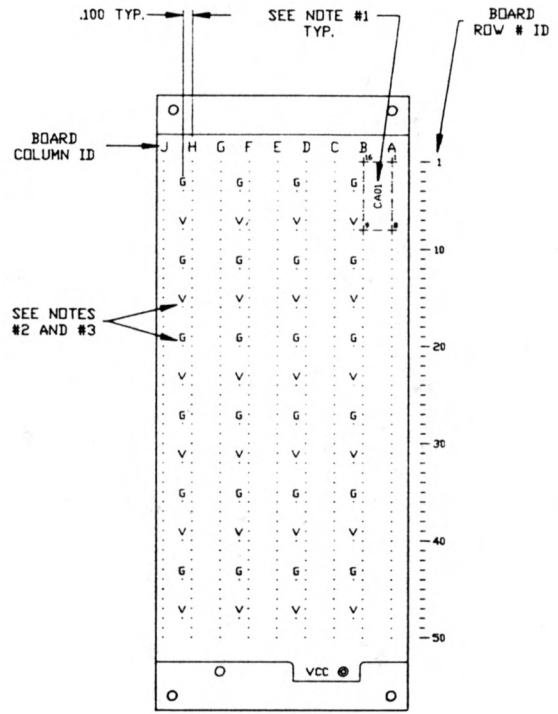


DETAIL "C"
SCALE 1/1

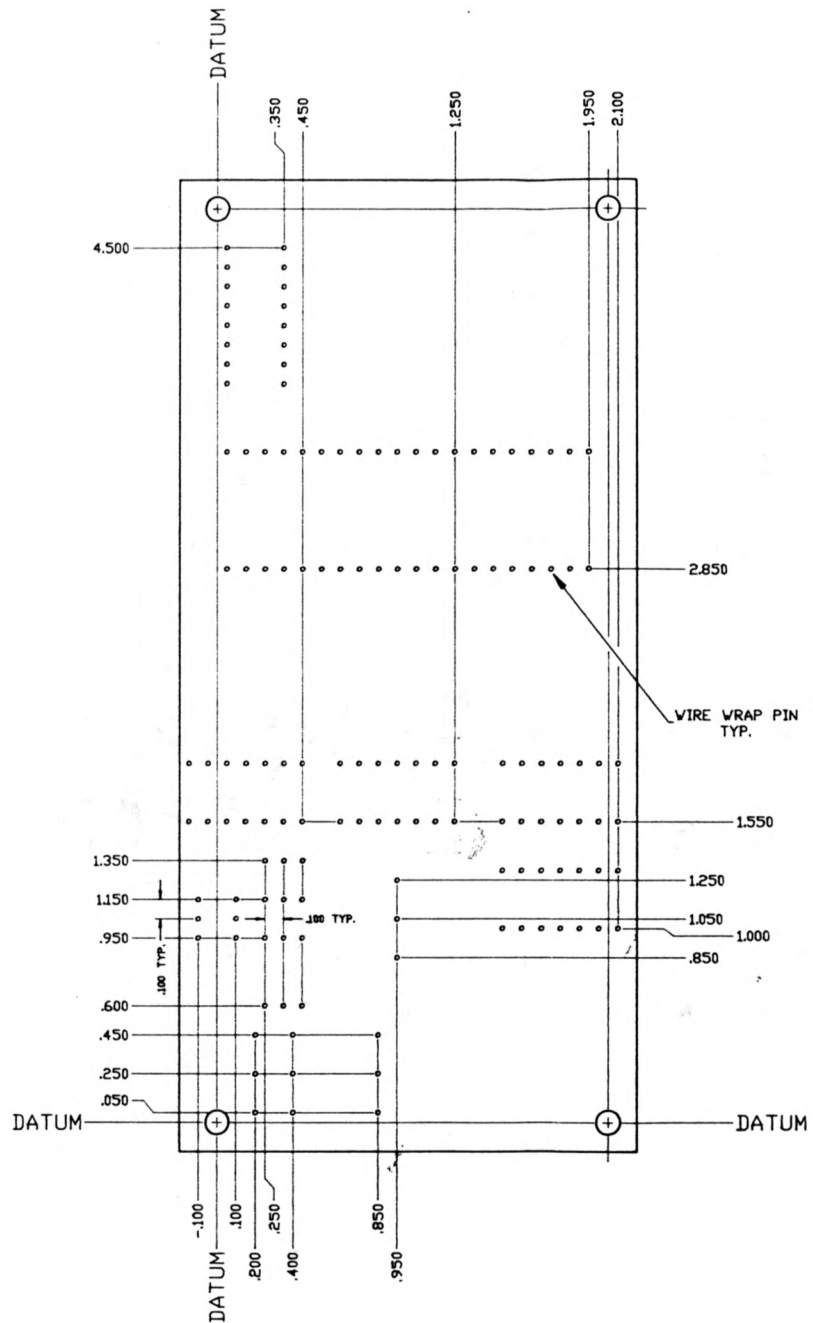
BOM - #A55007B003

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES		V L B A	S102 APEX INTERFACE	NATIONAL RADIO ASTRONOMY OBSERVATORY SOCORRO, NEW MEXICO 87801			
TOLERANCES: ANGLES #	---			DRAWN BY	ANDREATTA	DATE	9-87
3 PLACE DECIMALS (.000) #	.005			DESIGNED BY	WEBER	DATE	9-87
1 PLACE DECIMALS (.00) #	---			APPROVED BY		DATE	
MATERIAL :		S102 APEX INTERFACE MODULE ASSEMBLY		SHEET	2 of 3		
FINISH :				DRAWING	D55007A003		
NEXT ASSEMBLY		DWG. TYPE		REV.	A		
				SCALE	1/1		

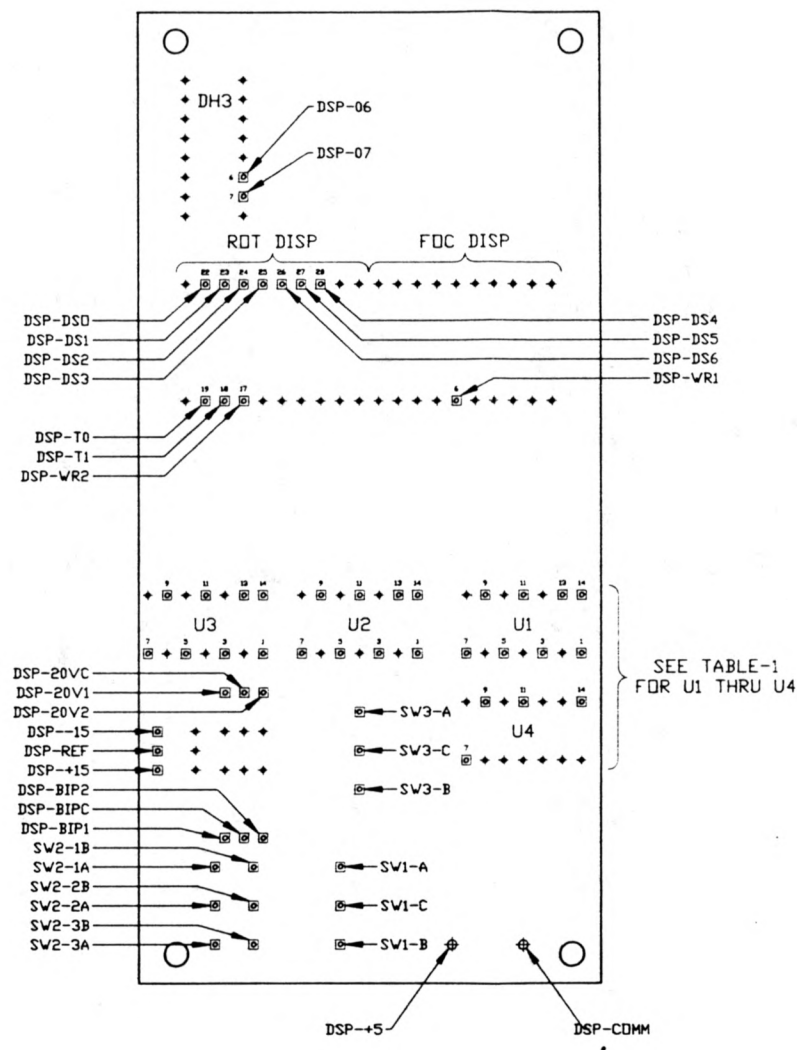
REV	DATE	DRAWN BY	APPRVD BY	DESCRIPTION
A	2-90	ANDREATA		REVISED RESOLVER TO TO DIGITAL PCB



DETAIL "D"
SCALE 1/1



DETAIL "E"
SCALE 2/1



DETAIL "F"
SCALE 2/1

TABLE-1

U1-1	DSP-L11
U1-2	DSP-L12
U1-3	DSP-UL2
U1-7	DSP-ULG
U1-9	DSP-SP1
U1-11	DSP-FACTV
U1-13	DSP-UL1
U1-14	DSP-U1+5
U2-1	DSP-SP2
U2-3	DSP-ACTV
U2-5	DSP-IP2
U2-7	DSP-ULG
U2-9	DSP-M6
U2-11	DSP-M4
U2-13	DSP-M1
U2-14	DSP-U2+5
U3-1	DSP-SP5
U3-3	DSP-CV1
U3-5	DSP-CV2
U3-7	DSP-ULG
U3-9	DSP-CCV2
U3-11	DSP-CCV1
U3-13	DSP-RACTV
U3-14	DSP-U3+5
U4-7	DSP-U4G
U4-9	DSP-SP4
U4-11	DSP-SP3
U4-14	DSP-U4+5

- NOTES :
- PIN #1 LOCATION ID = X X X X
 X → ROW #
 X → COLUMN
 X → BOARD LOCATION
 - VCC AND GND PIN LOCATIONS FOR BOARDS 'B', 'D', 'E', AND 'F' ARE AS FOLLOWS :
 COLUMNS B, D, F, AND H
 VCC PINS : 8, 16, 24, 32, 40, AND 48
 GND PINS : 4, 12, 20, 28, 36, AND 44
 - TYPICAL WIRE LIST VCC AND GND PIN LOCATION ID = X X XX - XX
 X → PIN #
 VD=VCC, GN=GND
 X → COLUMN
 X → BOARD LOCATION

BOM - #A55007B003

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES
 TOLERANCES - DIMENSIONS :
 3 PLACE DECIMALS (.000) : .005
 2 PLACE DECIMALS (.00) :
 1 PLACE DECIMALS (.0) :

V L B A
 S102 APEX INTERFACE

NATIONAL RADIO ASTRONOMY OBSERVATORY
 SOCORRO, NEW MEXICO 87801

MATERIAL :
 FINISH :

S102 APEX INTERFACE MODULE ASSEMBLY

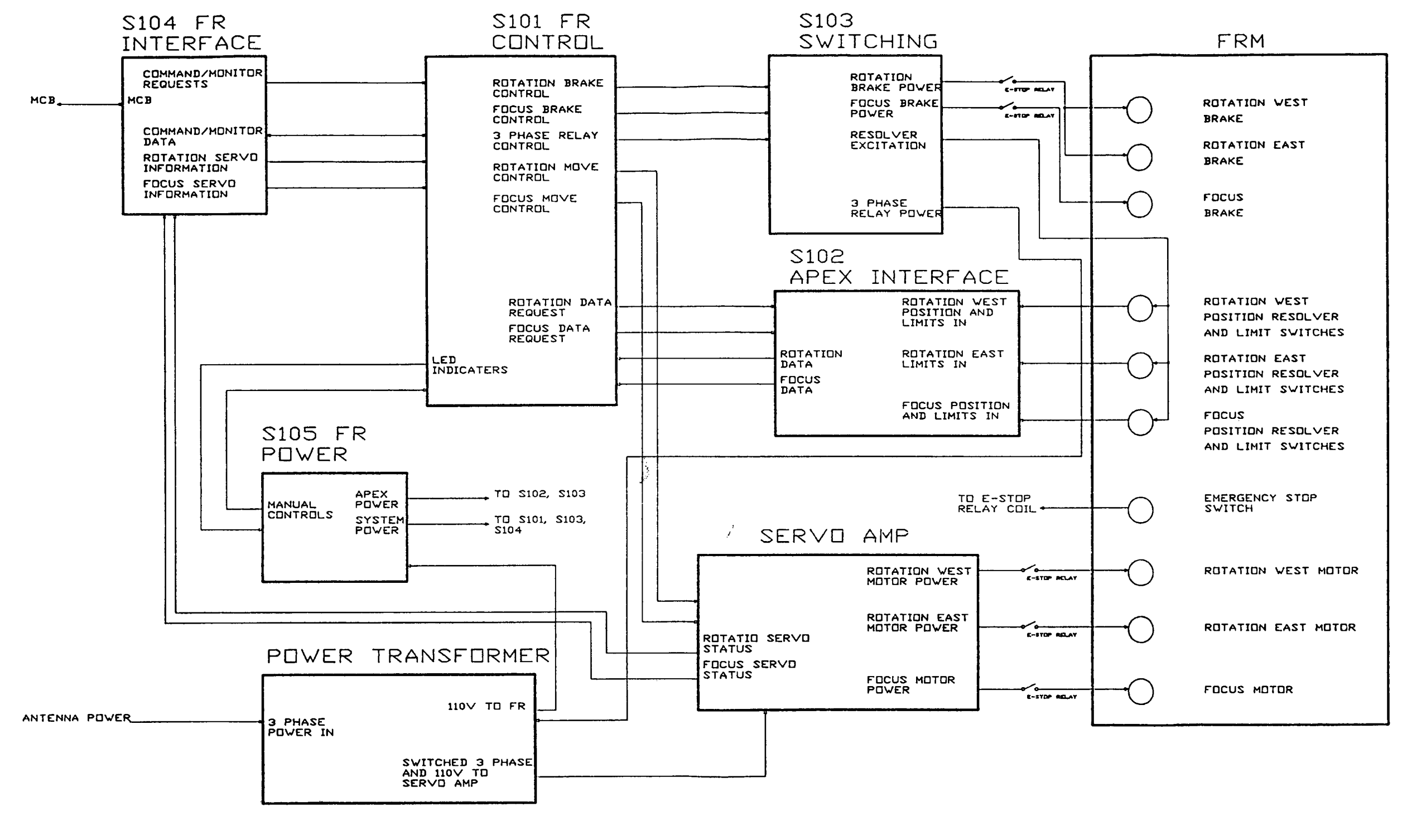
DRAWN BY ANDREATA DATE 9-87
 DESIGNED BY WEBER DATE 9-87
 APPROVED BY DATE

NEXT ASSEMBLY DWG. TYPE

REV	DATE	DRAWN BY	APPRVD BY	DESCRIPTION

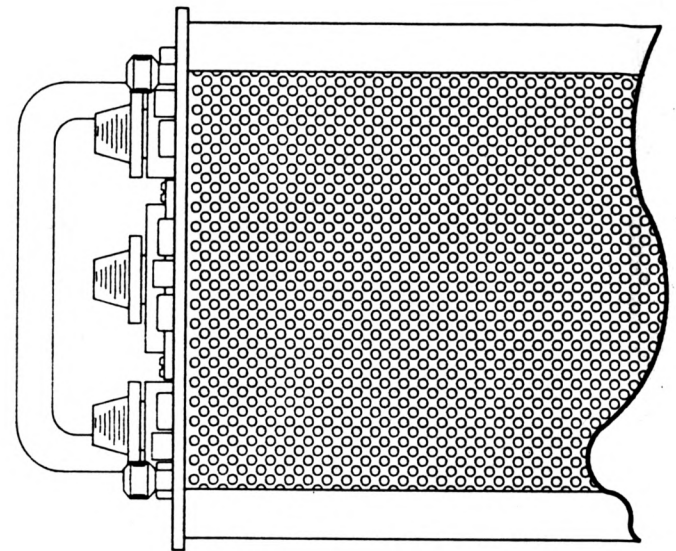
D
C
B
A

C
C
E
A



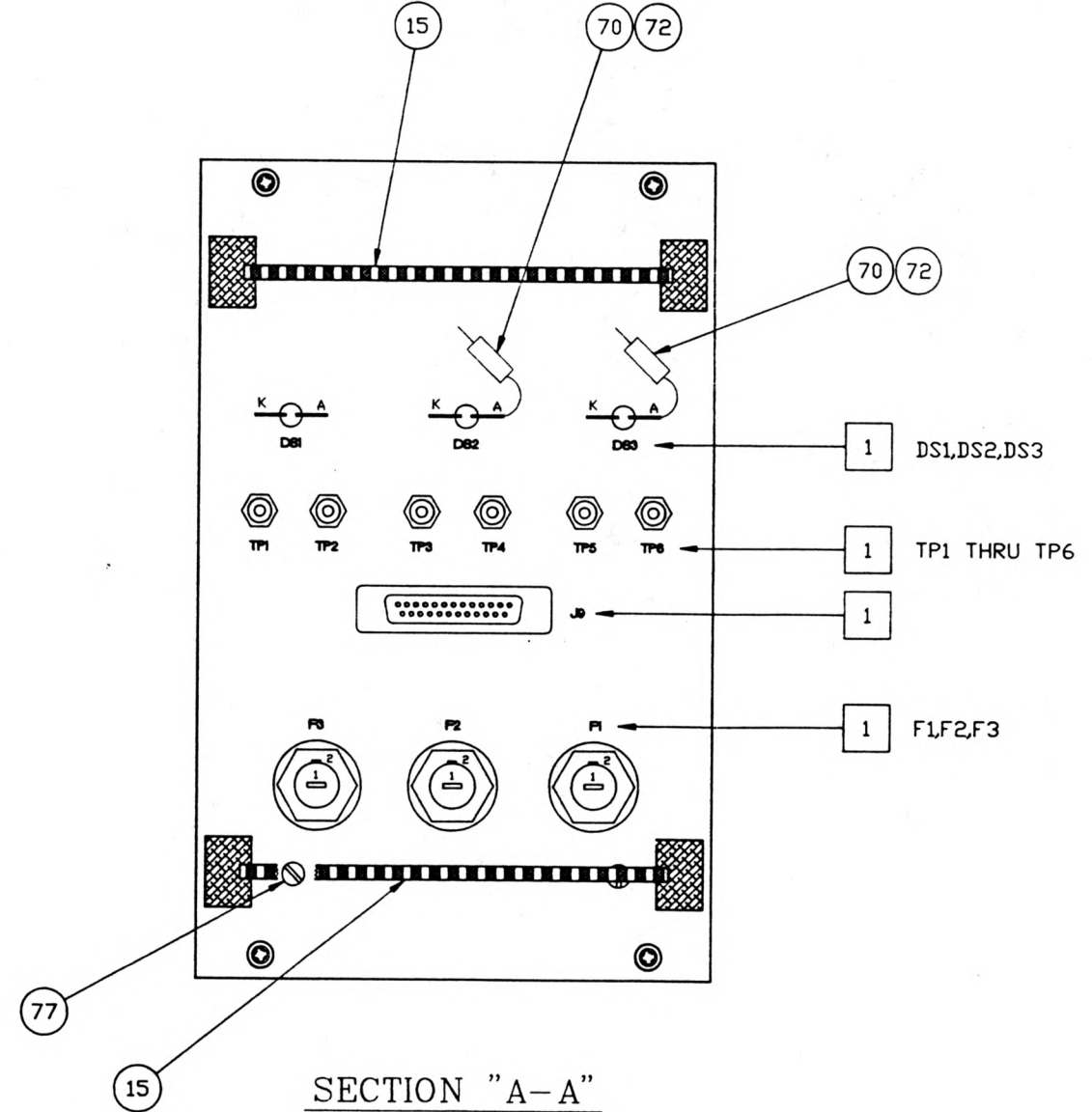
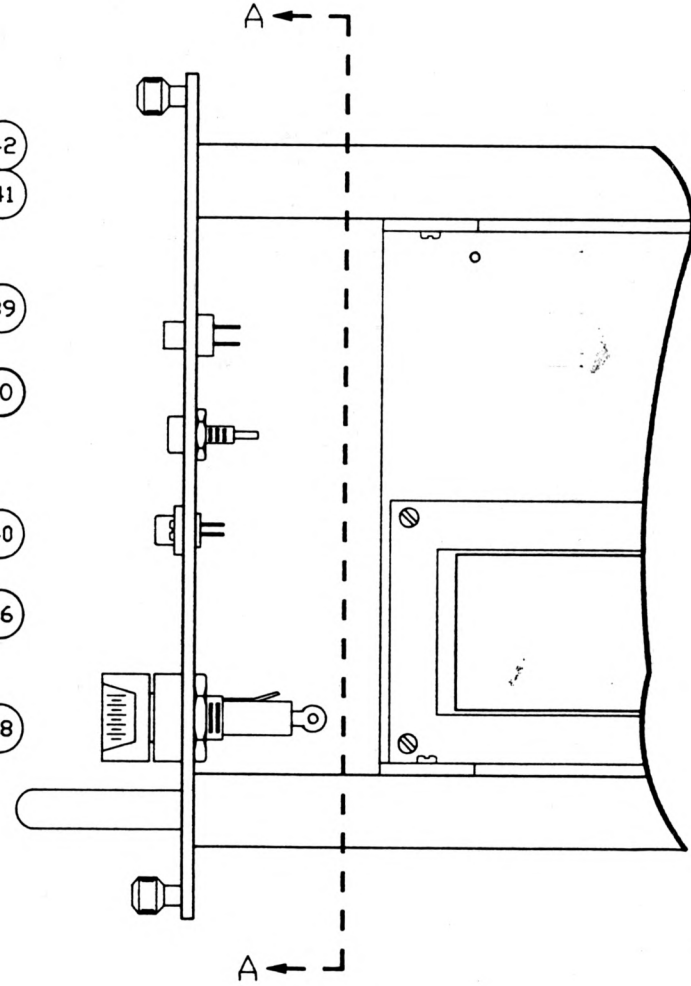
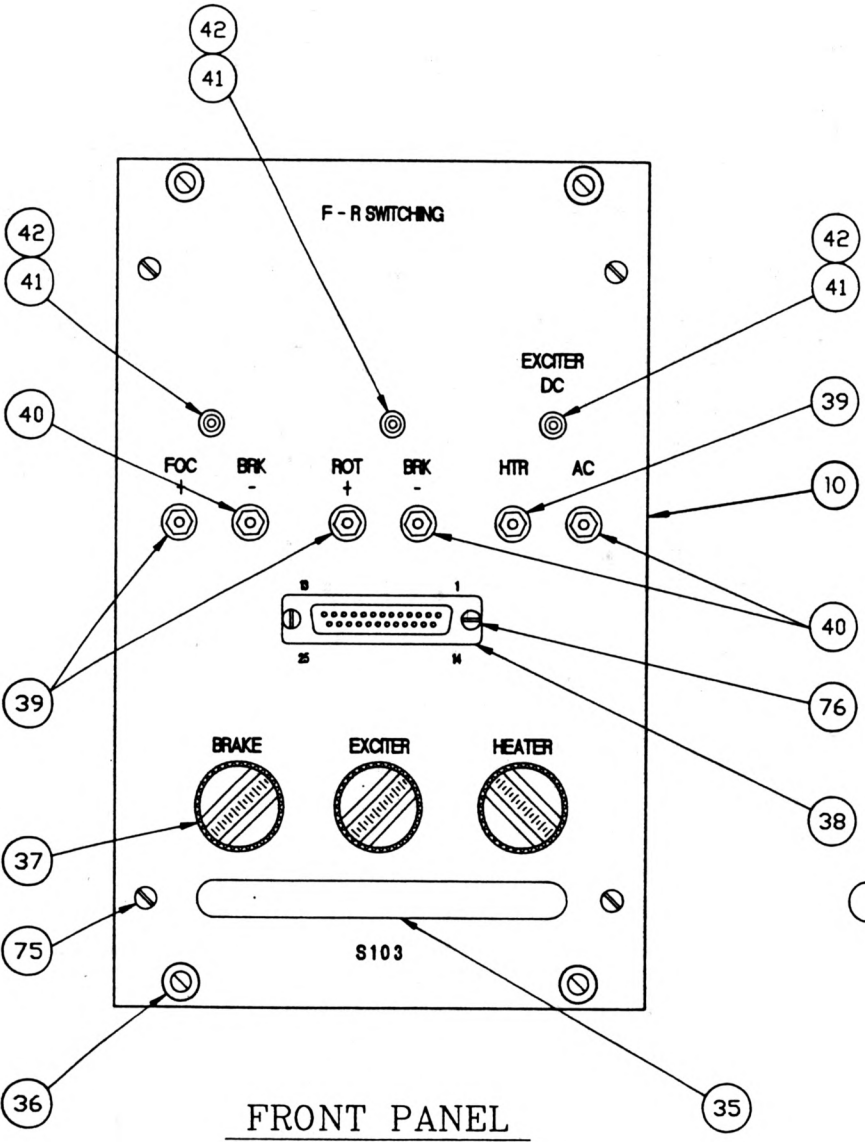
ACAD : FRBLOCKD

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES		V L B A T E	F-R SYSTEM	NATIONAL RADIO ASTRONOMY OBSERVATORY SOCORRO, NEW MEXICO 87801	
TOLERANCES : ANGLES ±	---			DRAWN BY KOSKI	DATE 1-90
3 PLACE DECIMALS (.000) ±	---			DESIGNED BY STAFF	DATE 1-90
3 PLACE DECIMALS (.00) ±	---			APPROVED BY	DATE
1 PLACE DECIMALS (.0) ±	---	F-R SYSTEM BLOCK DIAGRAM		SCALE	---
MATERIAL :	---	SHEET NUMBER	1 of 1	DRAWING NUMBER	C55007K001
FINISH :	---	REV.	---	SCALE	---
NEXT ASSEMBLY	DWG. TYPE				



NOTES :

- 1 MARK DESIGNATIONS IN LOCATIONS SHOWN WITH INDELIBLE INK OR TRANSFERS.



ACAD : S103ASY1

B.O.M. - *A55007B004

UNLESS OTHERWISE SPECIFIED
DIMENSIONS ARE IN INCHES
TOLERANCES: ANGLES ±
3 PLACE DECIMALS - .XXX ±
2 PLACE DECIMALS - .XX ±
1 PLACE DECIMALS - .X ±

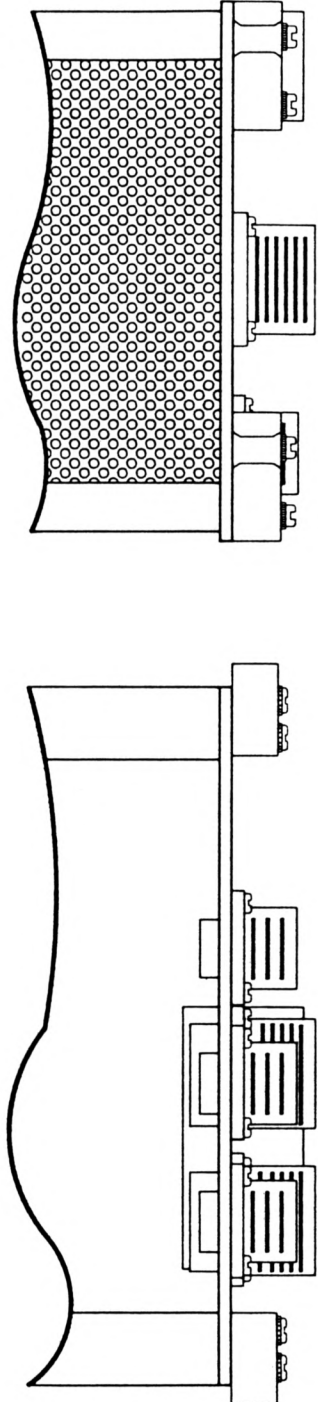
V
L
B
A
S103
F-R SWITCHING
MODULE ASSEMBLY

NATIONAL RADIO
ASTRONOMY
OBSERVATORY
SOCORRO, NEW MEXICO 87801

MATERIAL:	
FINISH:	
NEXT ASSY	USED ON

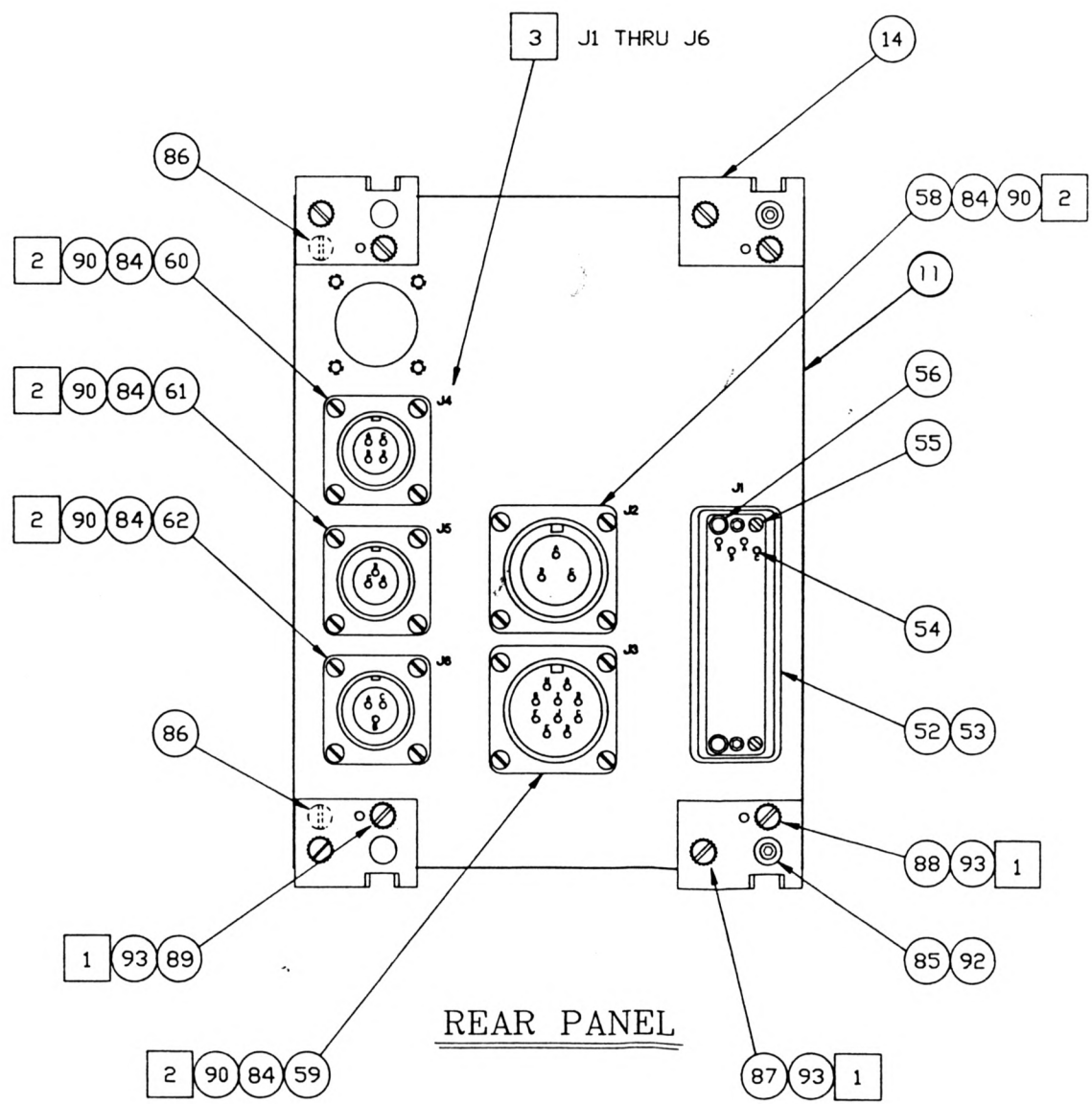
DESIGNED BY	ANDRE ATTA	DATE	1-88
DESIGNED BY	WEBER	DATE	1-88
APPROVED BY		DATE	

SHEET NUMBER	1 OF 4	DRAWING NUMBER	D55007A004	REV.	SCALE	1:1
--------------	--------	----------------	------------	------	-------	-----



NOTES :

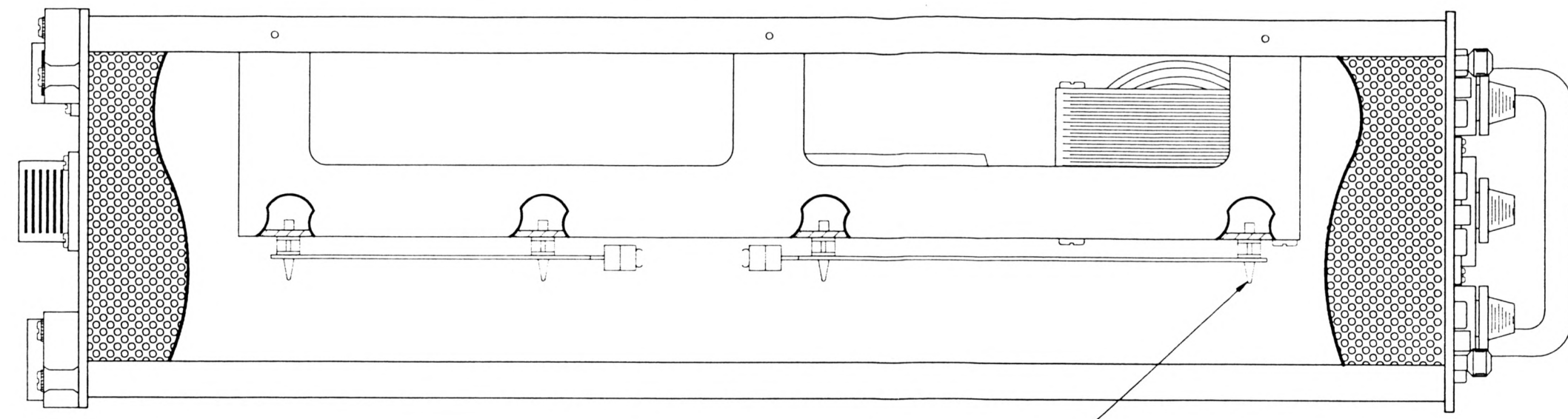
- 1 INSTALL ITEM #93 UNDER SCREW HEAD AND BETWEEN BLOCK AND PANEL.
- 2 INSTALL KEYING AS SHOWN.
- 3 MARK DESIGNATION IN LOCATIONS SHOWN ON BOTH SIDES OF PANEL WITH INDELIBLE INK OR TRANSFERS.



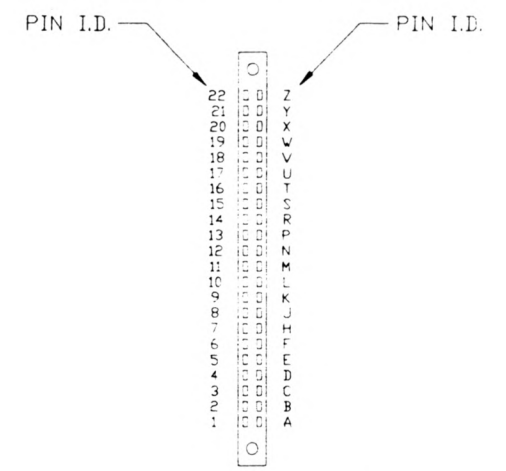
ACAD : S103ASY2

B.O.M - *A55007B004

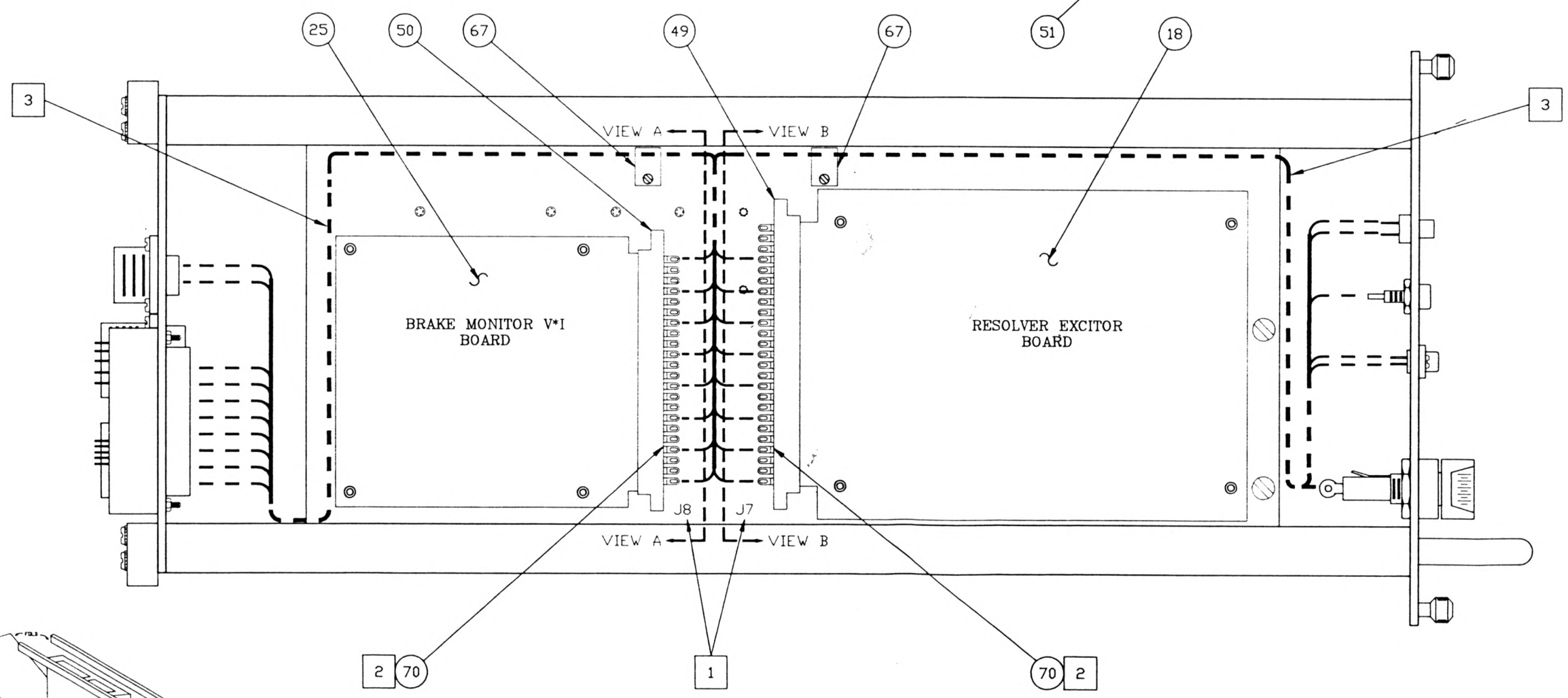
UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES TOLERANCES: ANGLES = — 3 PLACE DECIMALS :XXX = — 2 PLACE DECIMALS :XX = — 1 PLACE DECIMALS :X = —	S103 F-R SWITCHING	NATIONAL RADIO ASTRONOMY OBSERVATORY <small>SOCORRO, NEW MEXICO 87801</small>	
	S103 F-R SWITCHING MODULE ASSEMBLY	DRAWN BY ANDRETTA	DATE 1-88
	MATERIAL: _____	DESIGNED BY WEBER	DATE 1-88
	FINISH: _____	APPROVED BY _____	DATE _____
NEXT ASSY _____ USED ON _____	SHEET NUMBER 2 OF 4 DRAWING NUMBER D55007A004	REV. _____ SCALE 1:1	



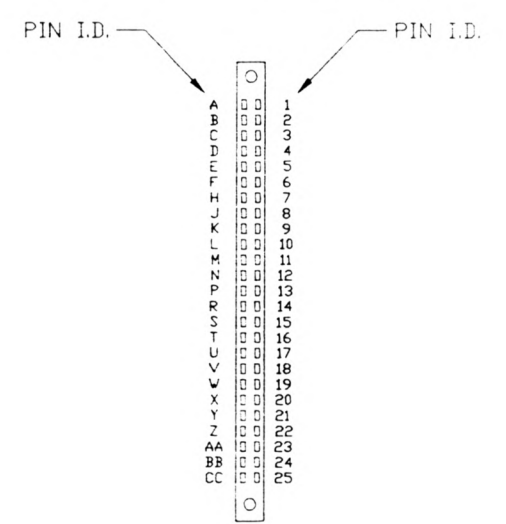
BRAKE MONITOR V*I



VIEW "A-A"



RESOLVER EXCITOR



VIEW "B-B"

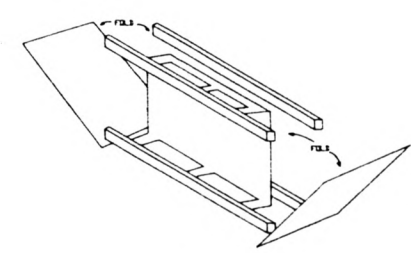


FIGURE "1"

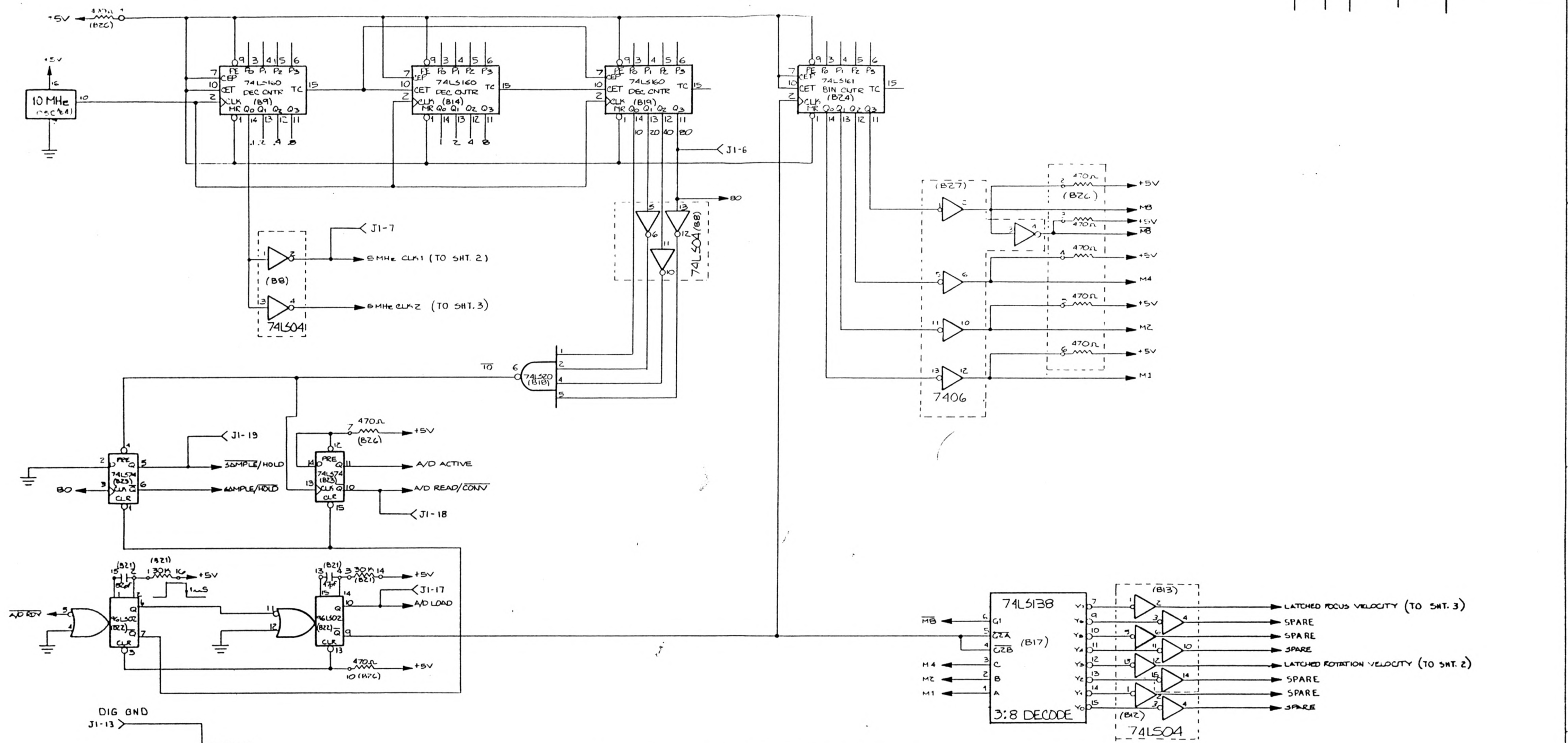
NOTES :

- 1 MARK DESIGNATIONS IN LOCATIONS SHOWN WITH INDELIBLE INK OR TRANSFERS.
- 2 INSTALL HEAT SHRINK TUBING (ITEM #70) ON ALL WIRED TERMINALS FOR J7 AND J8.
- 3 DRESS WIRE HARNESS PATH TO PERMIT FRONT AND REAR PANELS TO BE FOLDED OUTWARD FROM TOP TO PERMIT ACCESS TO FRONT AND REAR PANEL COMPONENTS. (SEE FIGURE "1")

B.O.M. - *A55007B004

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES TOLERANCES - ANGLES ± 3 PLACE DECIMALS - .XXX ± 2 PLACE DECIMALS - .XX ± 1 PLACE DECIMALS - .X ±	V	S103	NATIONAL RADIO ASTRONOMY OBSERVATORY SOCORRO, NEW MEXICO 87801
	L	F-R SWITCHING	
	A		
MATERIAL		DESIGNED BY WEBER	DATE 1-88
FINISH		APPROVED BY	DATE
NEXT ASSY	USED ON	SHEET NUMBER 3 OF 4	DRAWING NUMBER DS5007A004

REV	DATE	DRW BY	APP BY	DESCRIPTION
A	4-83	ANDREATA		MINOR CORRECTIONS



WIRE LIST SIGNAL
(PREFIX A)

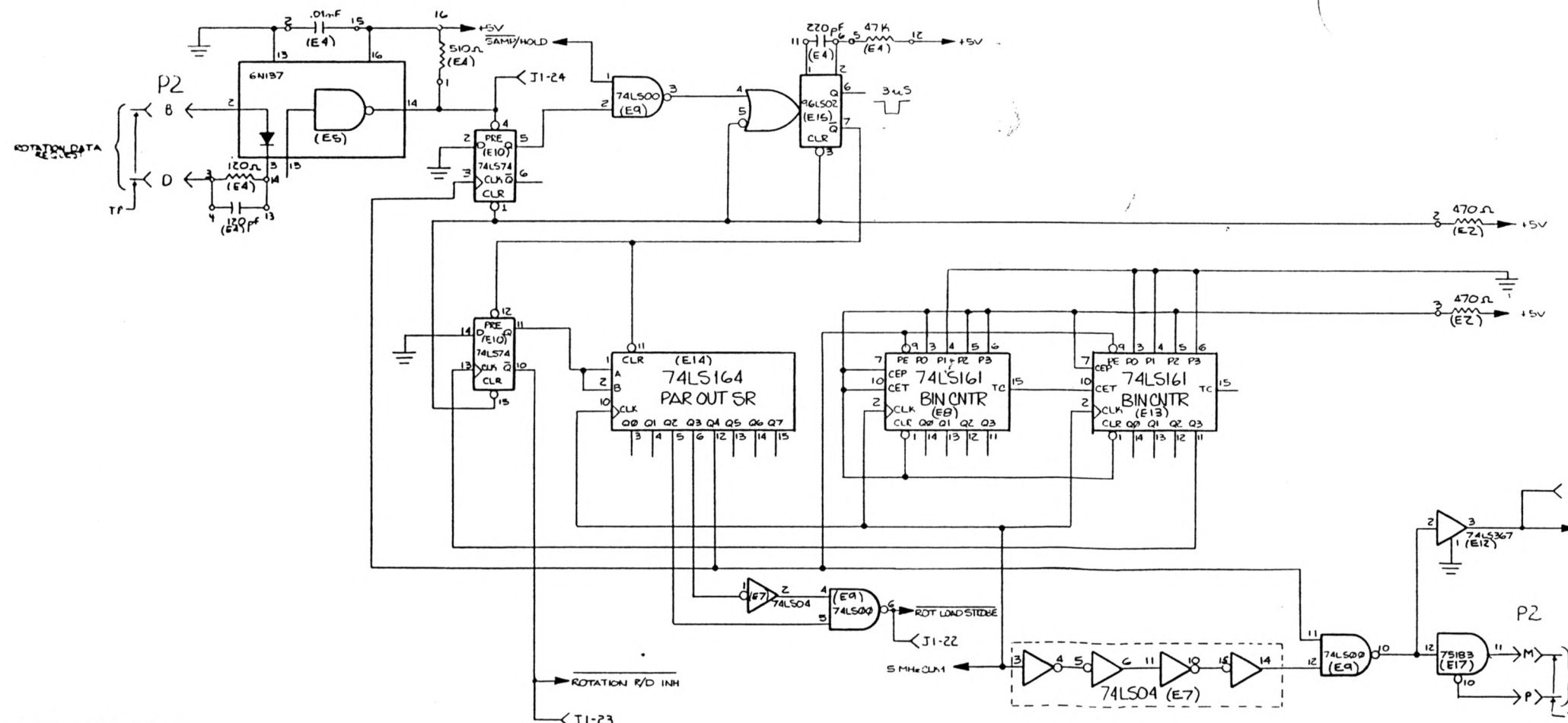
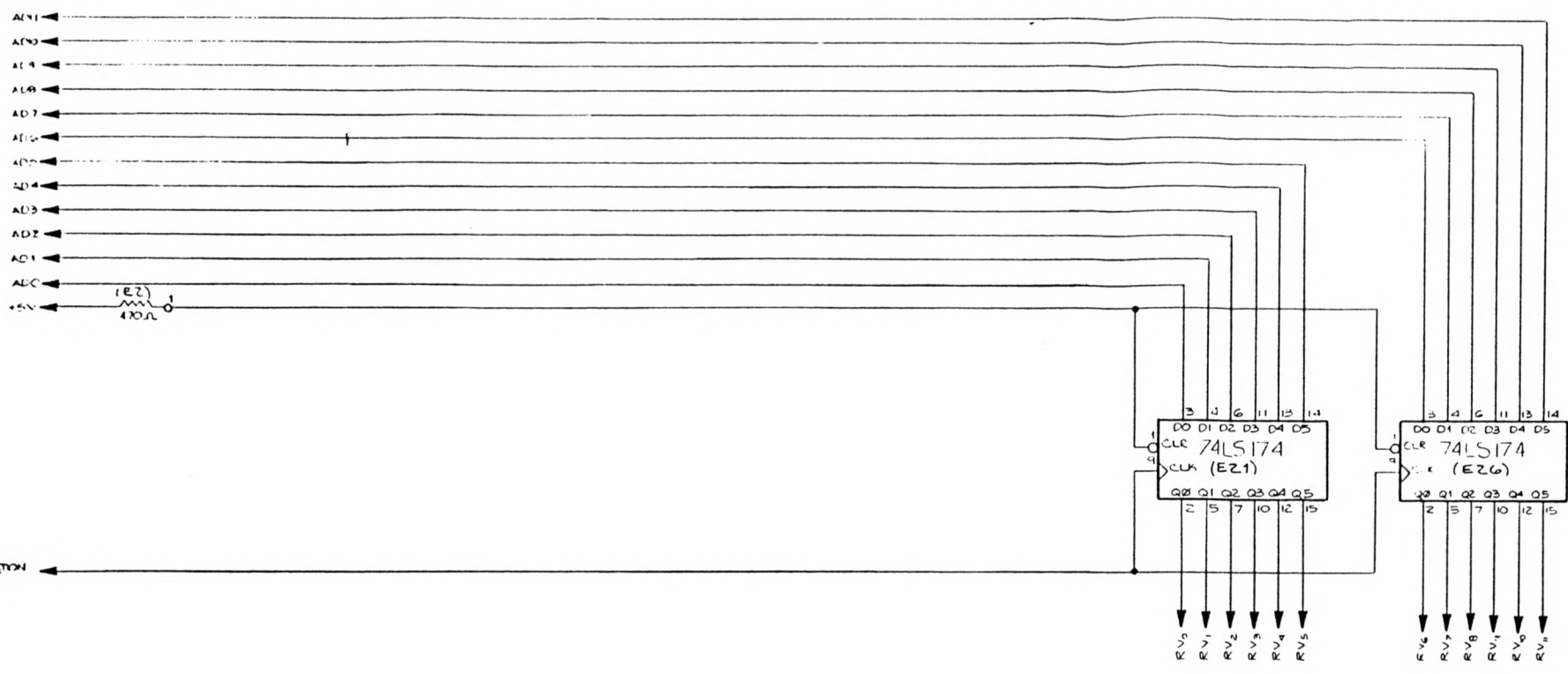
INDEX	
CIRCUIT	SHEET
TIME BASE AND ANALOG-DIGITAL CONTROL	1
ROTATION UNLOAD & MOTOR TORQUE/VELOCITY STORAGE	2
FOCUS	3
ROTATION STORAGE/TRANSFER DATA TO S101 MODULE	4
FOCUS	5
ANALOG TO DIGITAL CONVERTER	6
ANALOG TO DIGITAL STORAGE	6
±10 VOLTS CIRCUIT	6
YOWP CONTROL	6
FOCUS & ROTATION LIMIT INHIBITS	6
ROTATION RESOLVER TO DIGITAL CONVERTER	7
FOCUS	7
F/R MOUNT TEMPERATURE BUFFER	7
C/W TEMPERATURE BUFFER	7
DIGITAL DISPLAY TO ASCII CONVERTER	7
ROTATION DISPLAY CONTROL	7
FRONT PANEL DISPLAY BOARD	7

TIME BASE AND ANALOG-DIGITAL CONTROL

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES TOLERANCES: ANGLES ± 3 PLACE DECIMALS (XXX) ± 7 PLACE DECIMALS (XXX) ± 1 PLACE DECIMALS (X) ±	S102	NATIONAL RADIO ASTRONOMY OBSERVATORY BOSTON, MASS 02138
MATERIAL:	APEX INTERFACE LOGIC DIAGRAM	DESIGNED BY: JEFF COLE CHECKED BY: DATE APPROVED BY: DATE
FINISH:	SHEET 1 OF 9 DRAWING NUMBER: D550075006 REV A	SCALE:

NEXT ASSY	USED ON
-----------	---------

REV	DATE	DESIGNED BY	APPROVED BY	DESCRIPTION
A	4-88	ANDREATA		MINOR CORRECTIONS



WIRE LIST SIGNAL
(PREFIX B)

ROTATION UNLOAD AND MOTOR TORQUE/VELOCITY STORAGE

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES
 TOLERANCES: ANGLES ±
 3 PLACE DECIMALS (.XXX) ±
 2 PLACE DECIMALS (.XX) ±
 1 PLACE DECIMALS (.X) ±

NATIONAL RADIO ASTRONOMY OBSERVATORY
 8000RD, NEW MEXICO 87004

5102

APEX INTERFACE LOGIC DIAGRAM

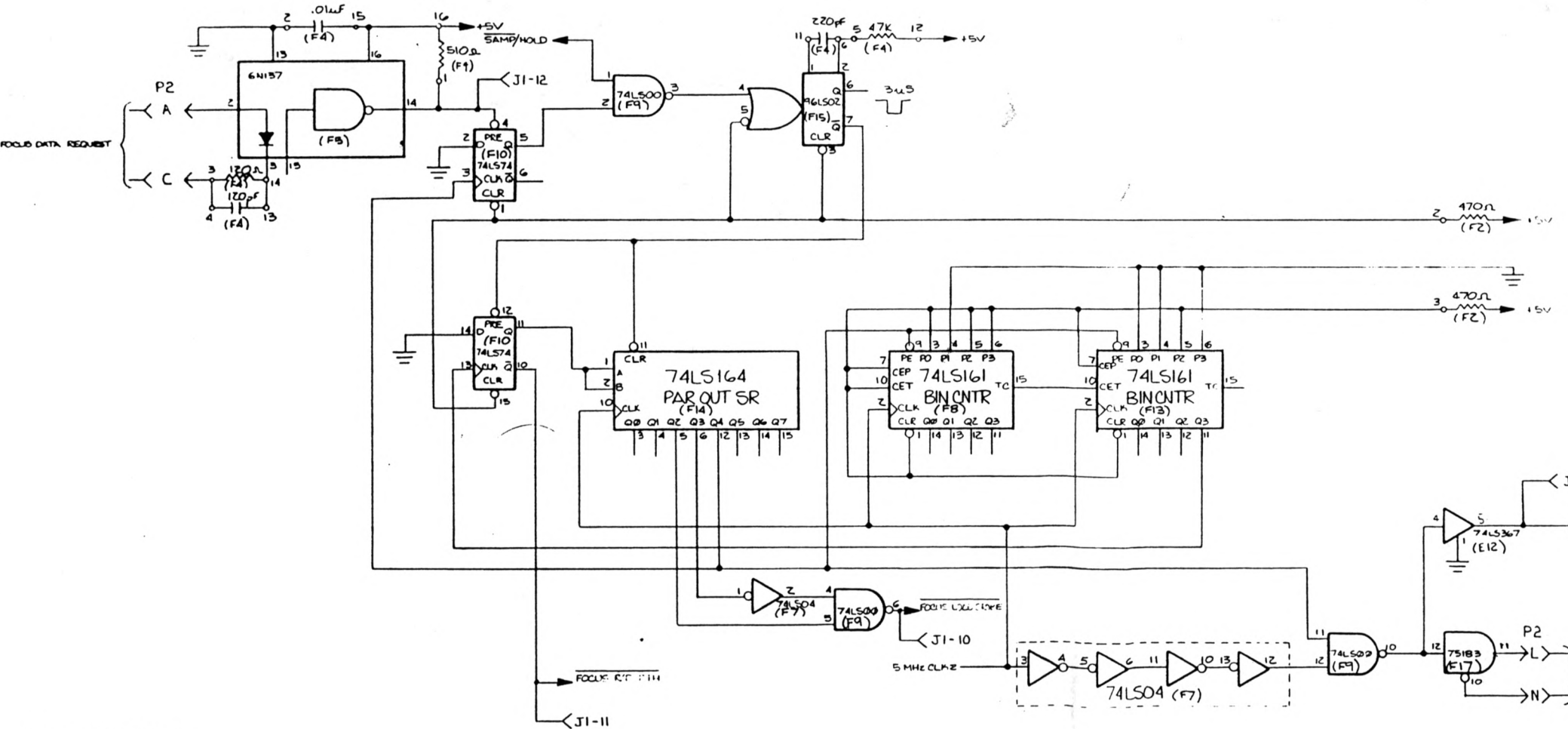
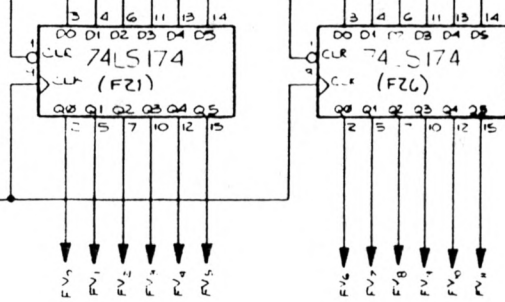
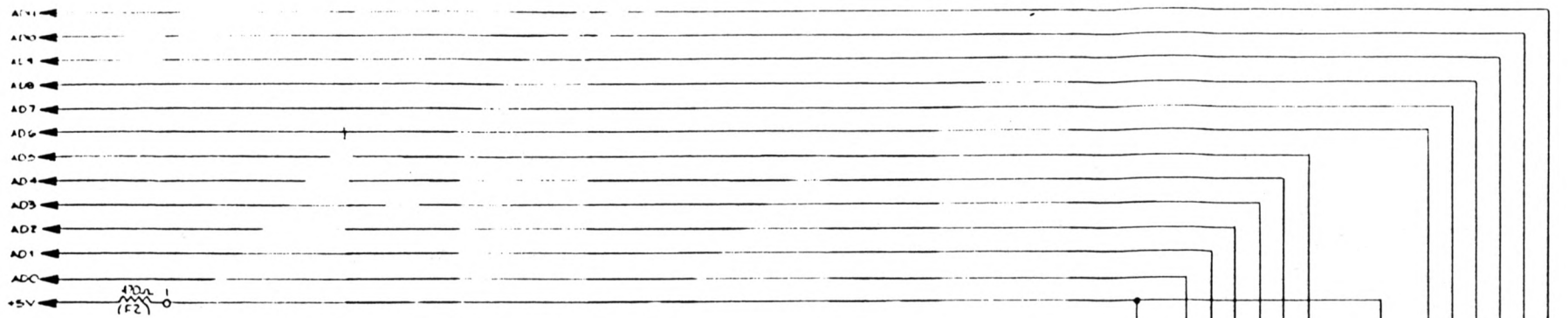
DESIGNED BY: DATE: _____
 DRAWN BY: DATE: _____
 APPROVED BY: DATE: _____

FINISH: _____

SHEET 2 of 9 DRAWING NUMBER: D550075006 REV A SCALE: _____

NEXT ASSY	USED ON

REV	DATE	DRAWN BY	APPROV BY	DESCRIPTION
A	4/83	ANUREATHA		MINOR CORRECTIONS



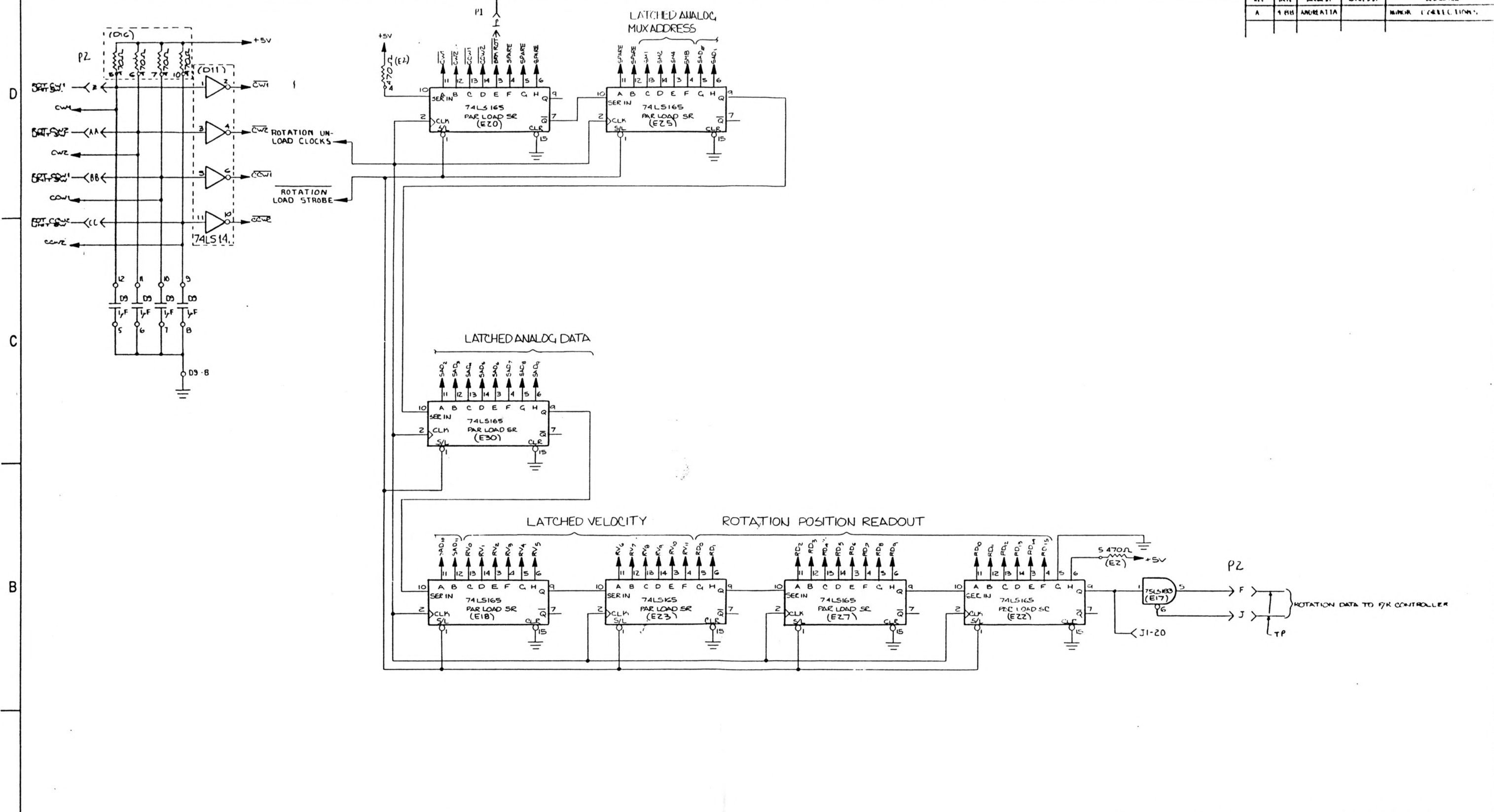
WIRE LIST SIGNAL
(PREFIX C)

FOCUS UNLOAD AND MOTOR TORQUE/VELOCITY STORAGE

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES TOLERANCES: ANGLES ± 3 PLACE DECIMALS (EXC): ± 7 PLACE DECIMALS (EXC): ± 1 PLACE DECIMALS (EXC): ±	V L B A S10Z	NATIONAL RADIO ASTRONOMY OBSERVATORY <small>RECORDING LIGHT MIRROR SYSTEM</small>
MATERIAL:	APEX INTERFACE LOGIC DIAGRAM	DATE: _____ DESIGNED BY: _____ APPROVED BY: _____
FINISH:		SHEET 3 OF 9 DRAWING NUMBER: 05,50015006 REV: A

NEXT ASSY	USED ON
-----------	---------

REV	DATE	DESIGNED BY	APPROVED BY	DESCRIPTION
A	9 88	ANDREATA		MINOR CORRECTIONS



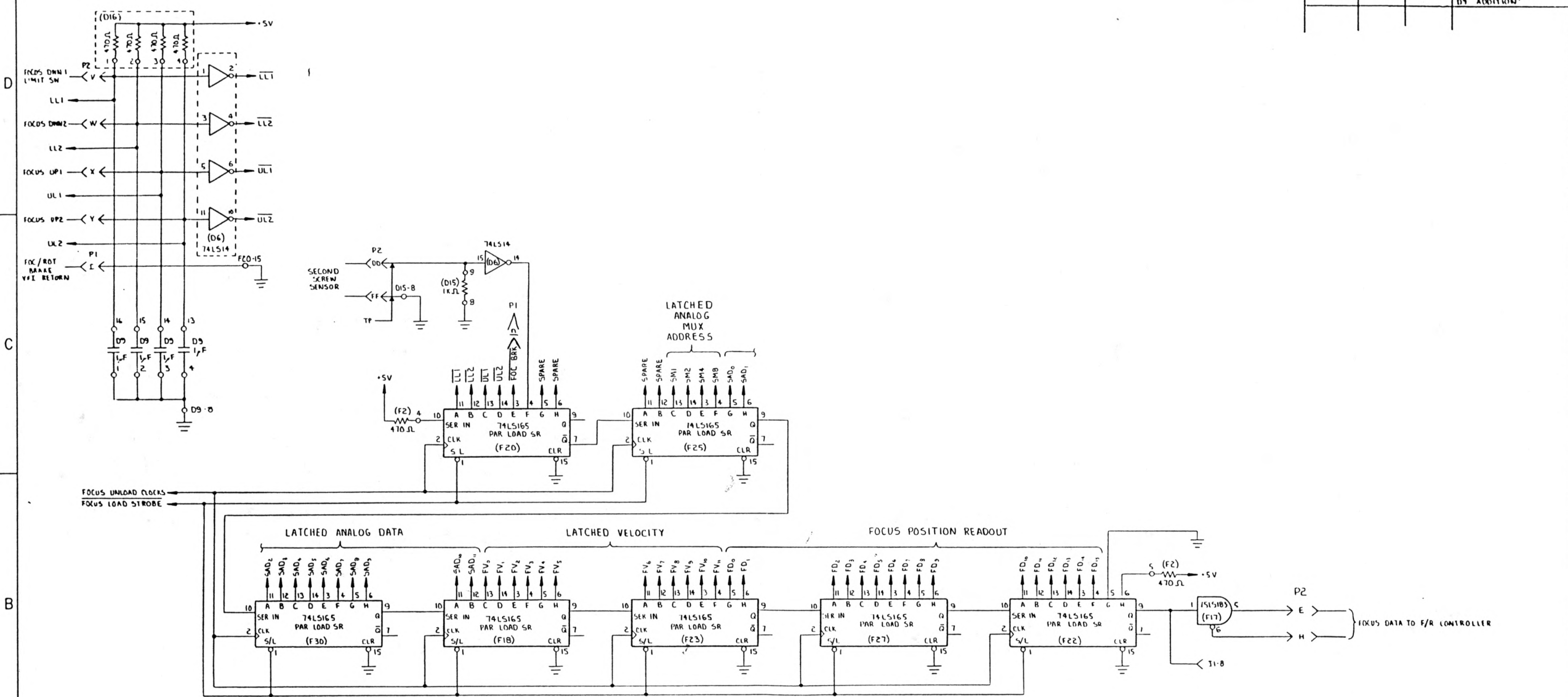
WIRE LIST SIGNAL
(PREFIX D)

ROTATION STORAGE/TRANSFER DATA TO S101 MODULE

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES TOLERANCES: ANGLES ± 3 PLACE DECIMALS (XXX) ± 2 PLACE DECIMALS (XX) ± 1 PLACE DECIMALS (X) ±	V L B A	S102		NATIONAL RADIO ASTRONOMY OBSERVATORY	
		MATERIAL:		DRAWING NUMBER: D550075006	
		FINISH:		REV A	
		NEXT ASSY		USED ON	

DRAWING NO. 511-4447-1

REV.	DATE	ISSUED BY	APPROVED BY	DESCRIPTION
A	1-89	AKKREATA		LIMIT SWITCH FILTER BY ADDITION



WIRE LIST SIGNAL
(PREFIX E)

FOCUS STORAGE / TRANSFER DATA TO S101

UNLESS OTHERWISE SPECIFIED
DIMENSIONS ARE IN INCHES
TOLERANCES: ANGLES ± —
3 PLACE DECIMALS (X, Y, Z) ± —
2 PLACE DECIMALS (R, R1) ± —
1 PLACE DECIMALS (R2) ± —

V
L
B
C
S102
APEX INTERFACE

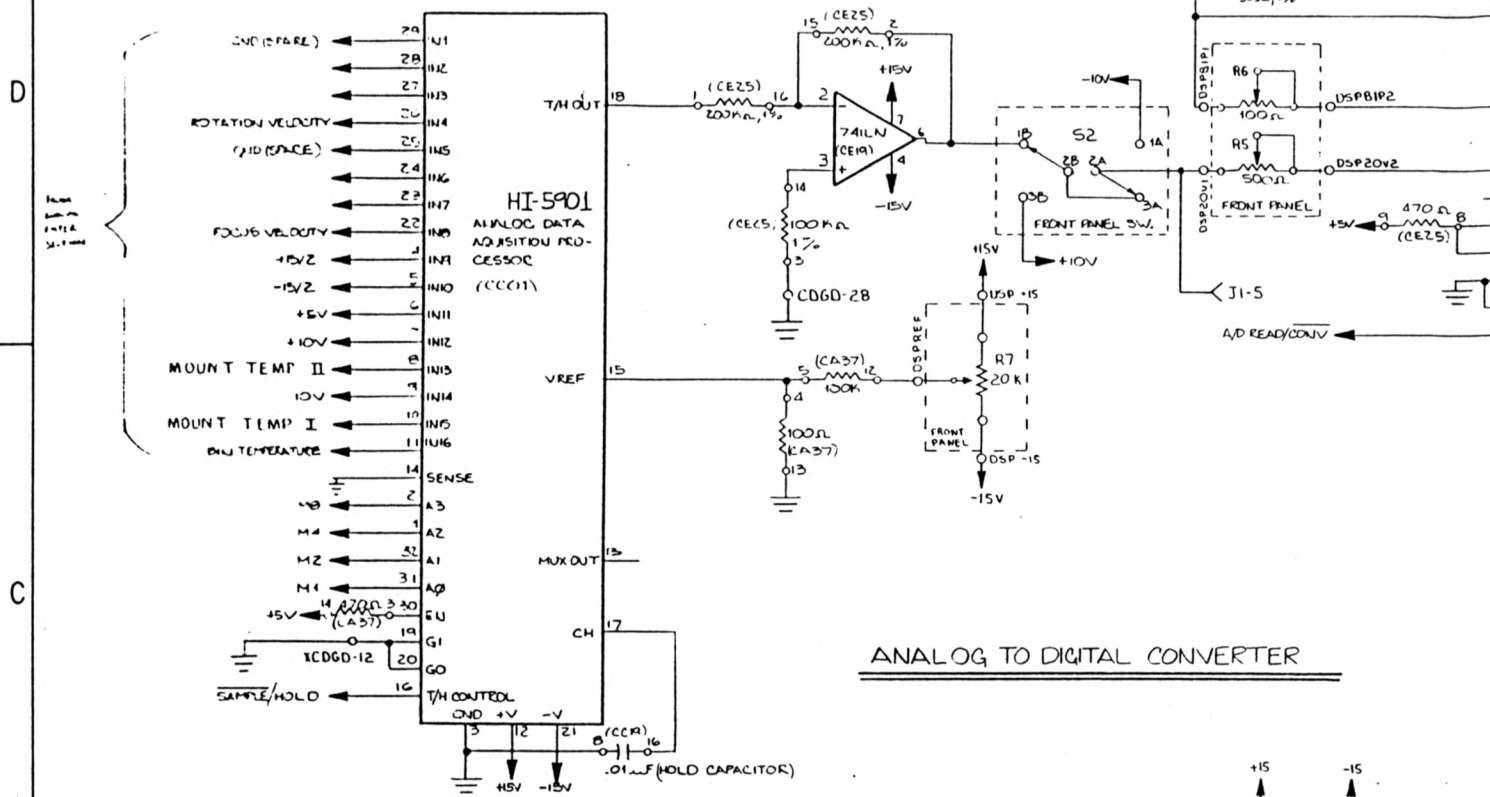
NATIONAL RADIO
ASTRONOMY
OBSERVATORY
SOCOMMO NEW MEXICO STATE

S102
APEX INTERFACE
LOGIC DIAGRAM

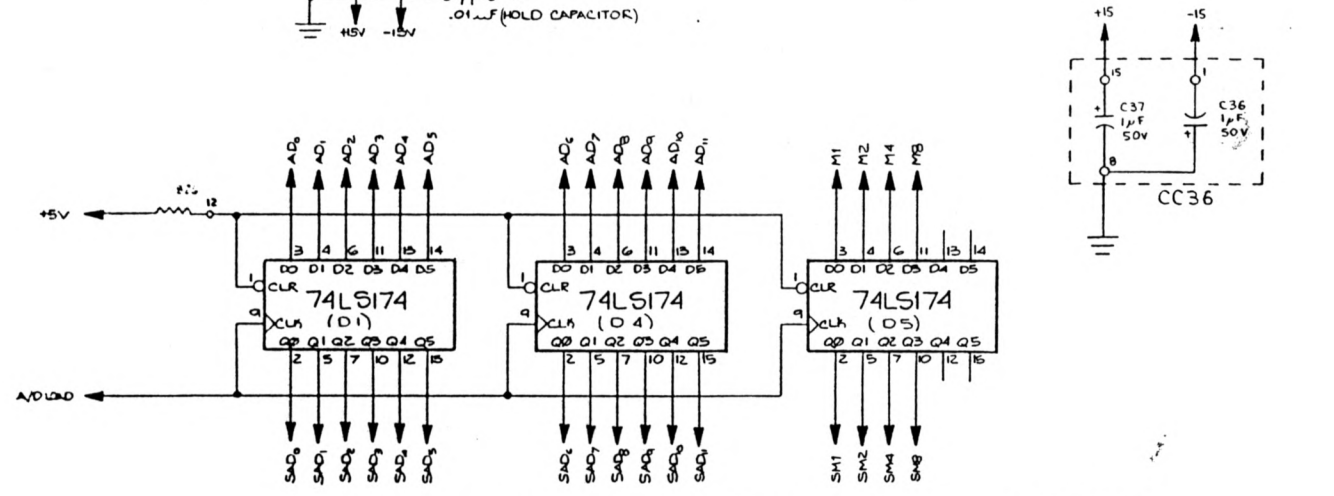
DESIGNED BY: J. COLE
DATE: 4-86
APPROVED BY: _____
DATE: _____

MATERIAL:	
FINISH:	
NEXT ASSY:	USED ON

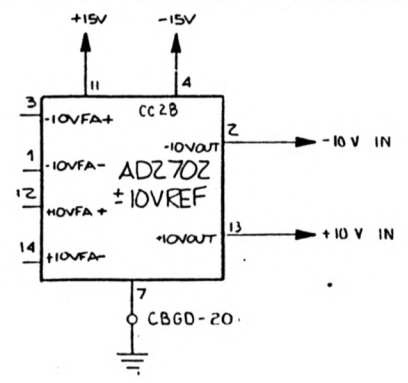
REV	DATE	DRAWN BY	APPROVED BY	DESCRIPTION
A	4 RR	AKURATA		MINOR CORRECTIONS



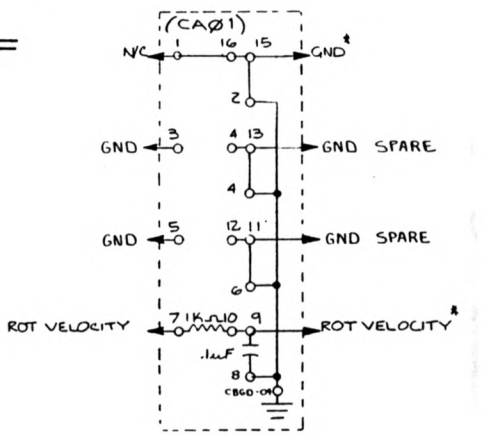
ANALOG TO DIGITAL CONVERTER



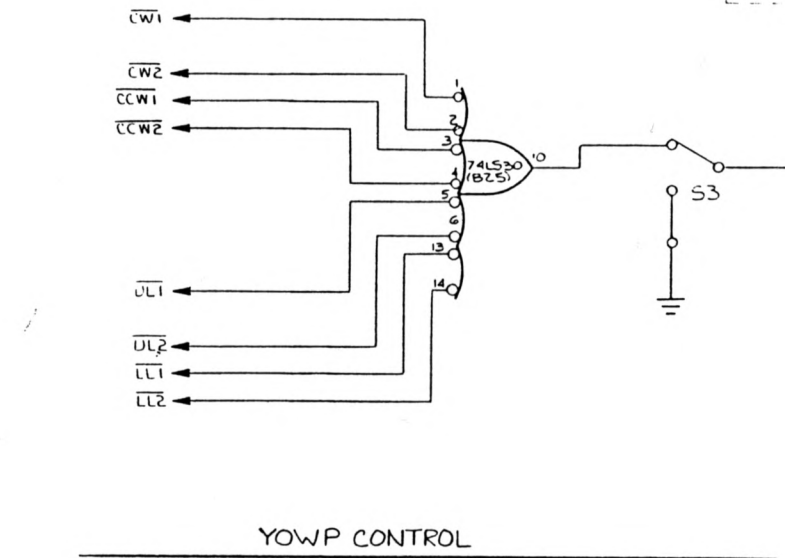
ANALOG TO DIGITAL STORAGE



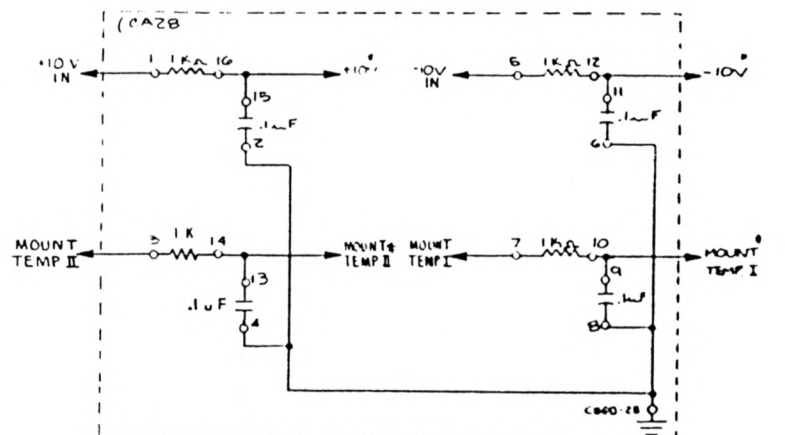
±10 VOLT CIRCUITS



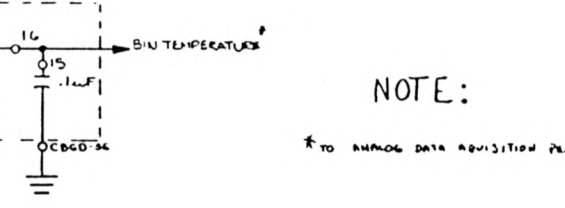
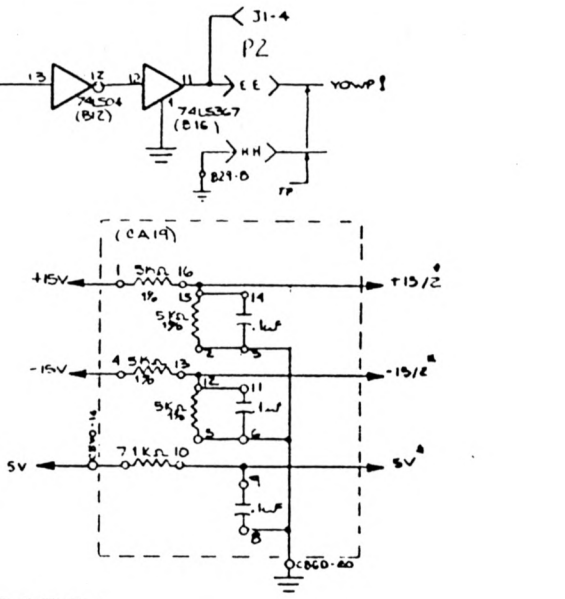
ANALOG FILTER SECTION



YOWP CONTROL



ANALOG FILTER SECTION



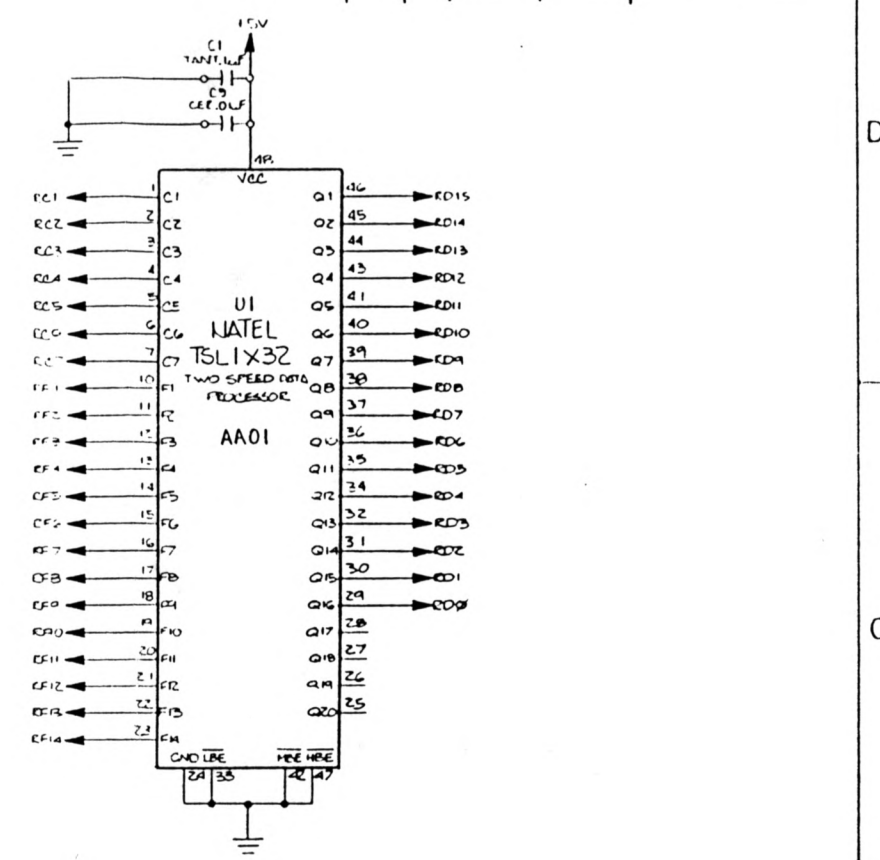
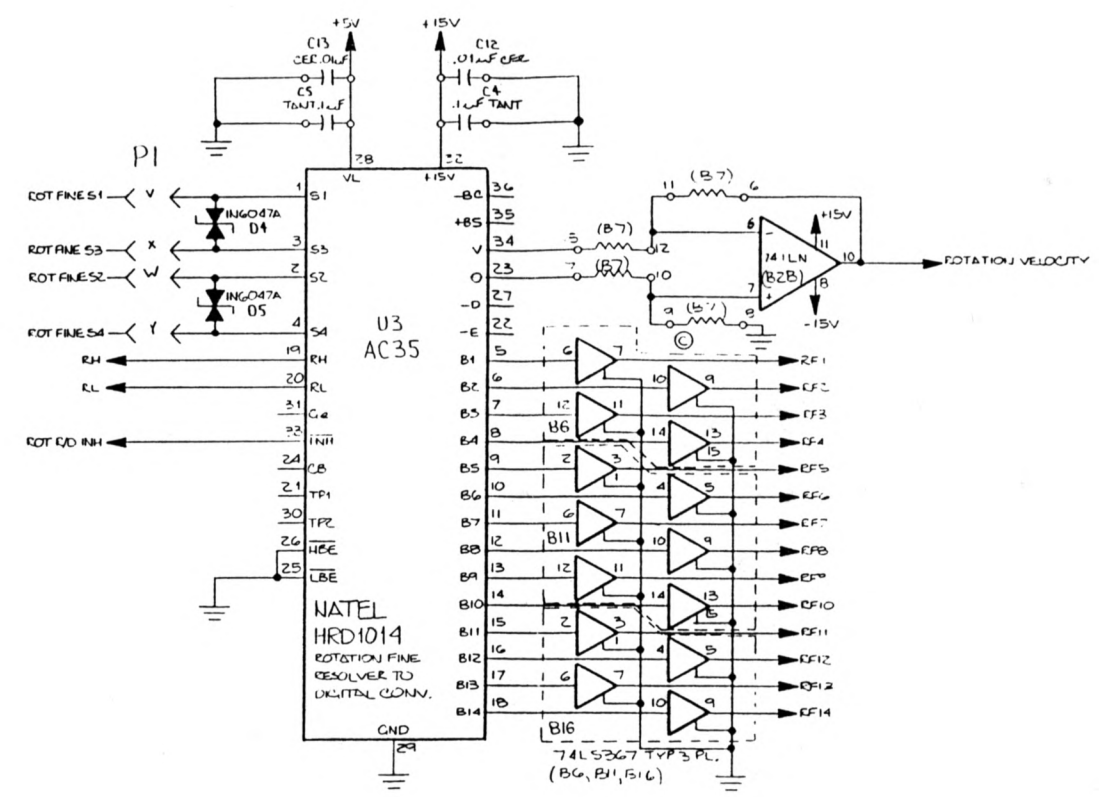
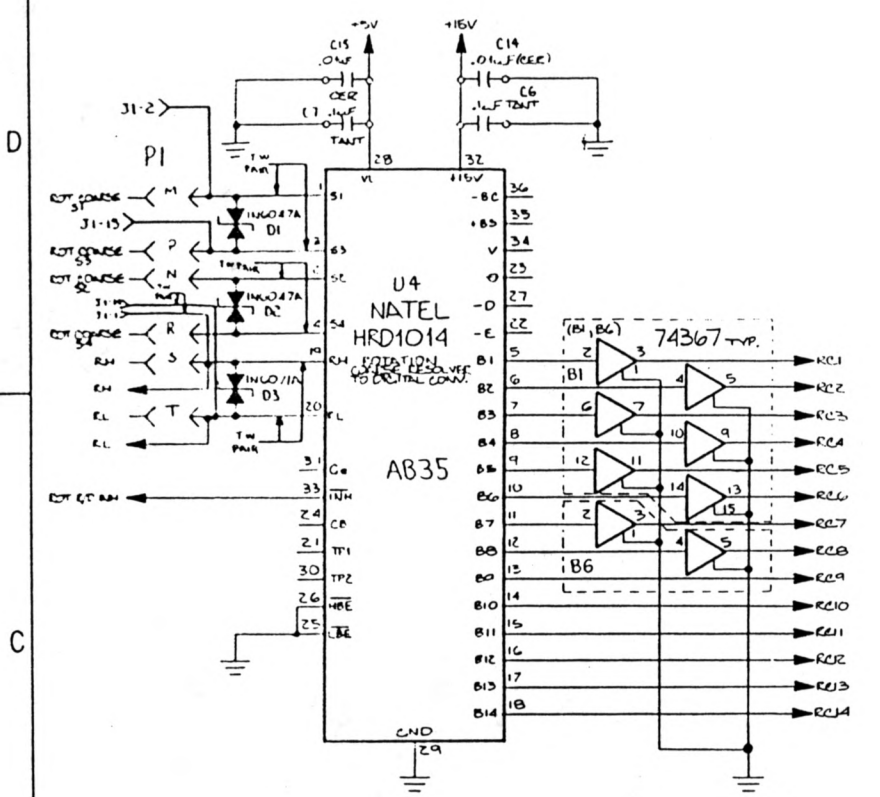
NOTE:

* TO ANALOG DATA ACQUISITION PRE-PROCESSOR

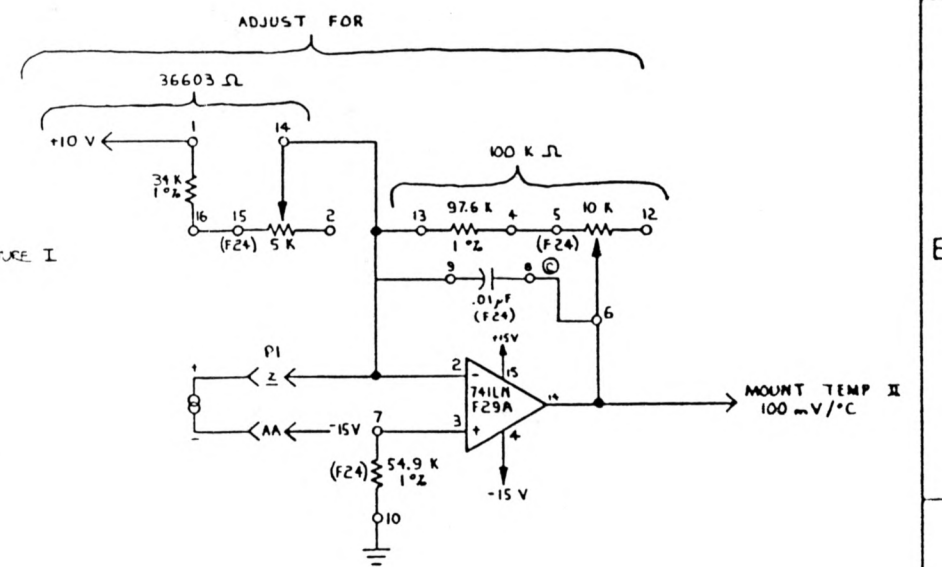
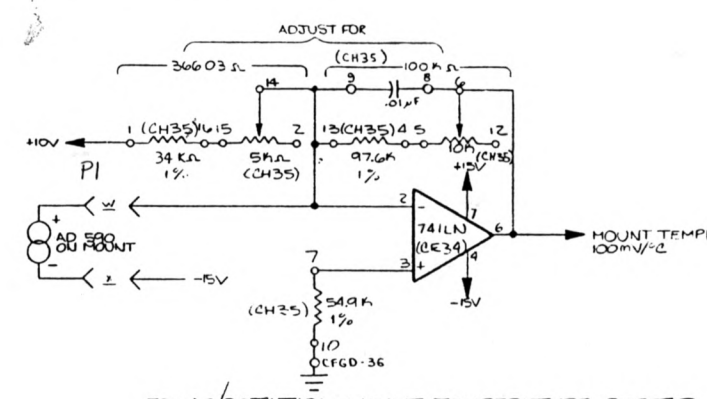
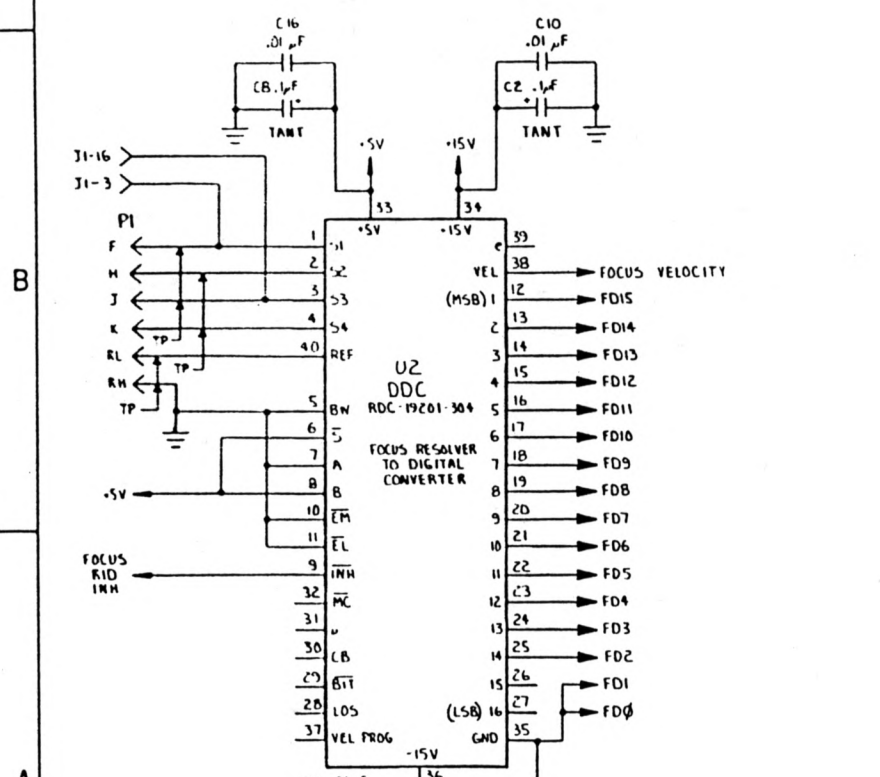
WIRE LIST SIGNAL (PREFIX F)

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES TOLERANCES: ANGLES ± 3 PLACE DECIMALS (.XXX) ± 2 PLACE DECIMALS (.XX) ± 1 PLACE DECIMALS (.X) ±		S102	NATIONAL RADIO ASTRONOMY OBSERVATORY BODDINGTON, WEST WILSHIRE, AUSTRALIA
MATERIAL:			
FINISH:		APEX INTERFACE LOCAL DIAGRAM	
NEXT ASSY	USED ON	SHEET NUMBER 0009	DRAWING NUMBER D550075006 REV A SCALE

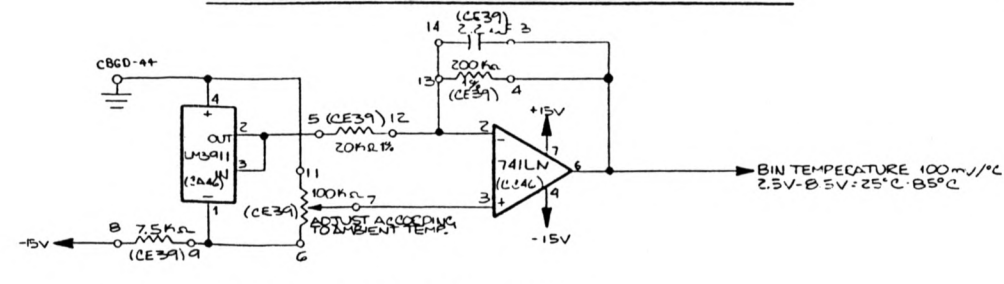
REV	DATE	DESIGN BY	APPROV BY	DESCRIPTION
A	1 88	ANIREATA		MINOR CORRECTIONS



ROTATION RESOLVER TO DIGITAL CONVERTER



FOCUS/ROTATION MOUNT TEMPERATURE BUFFER



BIN TEMPERATURE BUFFER

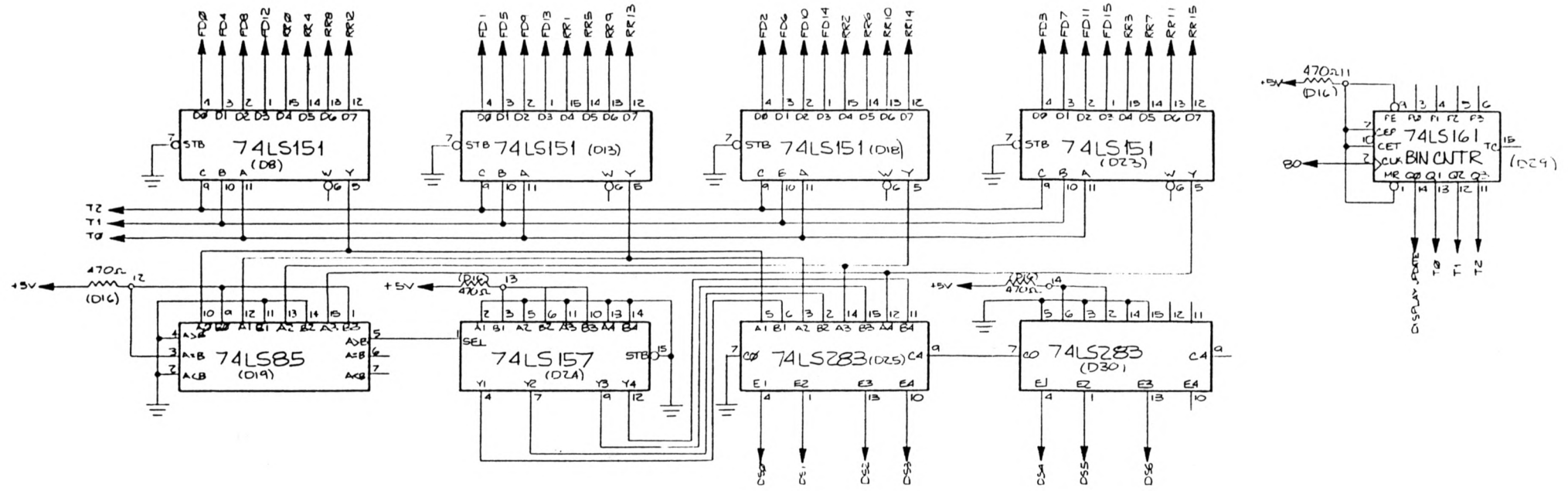


FOCUS RESOLVER TO DIGITAL CONVERTER

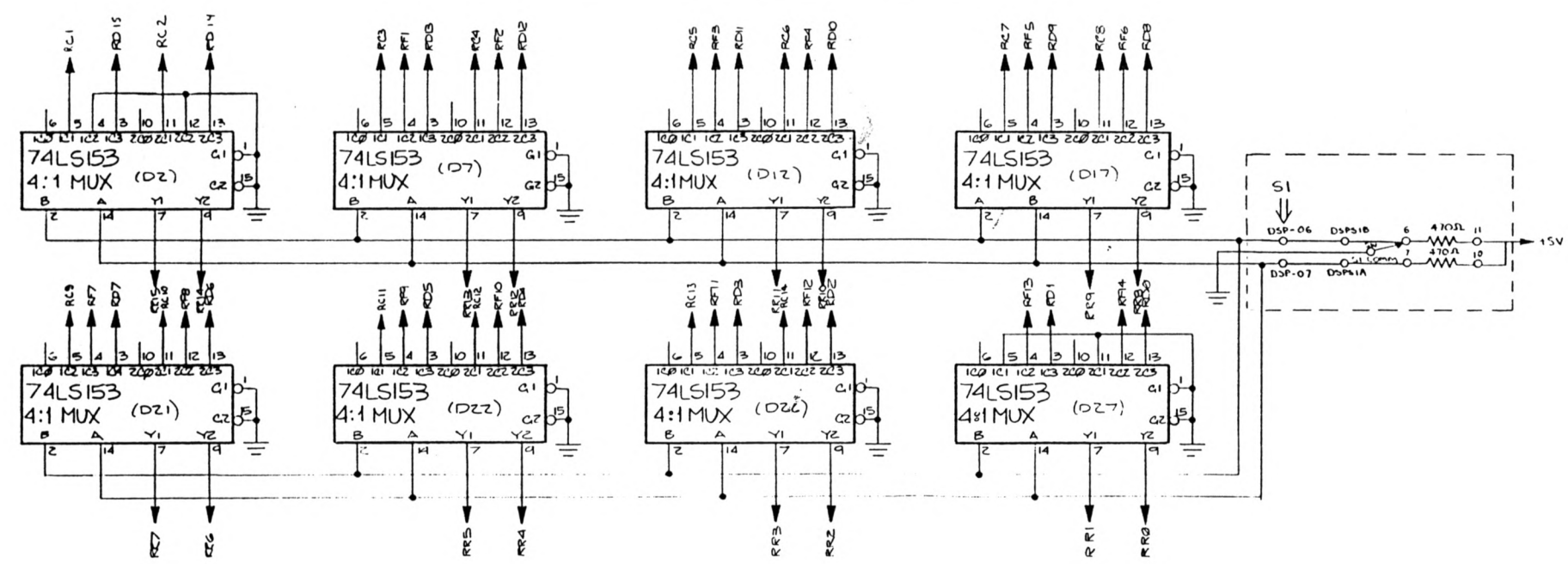
WIRE LIST SIGNAL (PREFIX G)

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES TOLERANCES: ANGLES ± 3 PLACE DECIMALS (XXX): ± 2 PLACE DECIMALS (XX): ± 1 PLACE DECIMALS (X): ±		S102		NATIONAL RADIO ASTRONOMY OBSERVATORY BODDING NEW ME 2-100 1-1961	
MATERIAL:		APEX INTERFACE LOGIC DIAGRAM		DATE: 1-88 BY: J-BK	
FINISH:		DRAWING NUMBER: D550073.006		DATE: BY: W. PROSKI	
NEXT ASSY:		SHEET NUMBER: 7 of 9		SCALE:	
USED ON:		DRAWING NUMBER: D550073.006		REV: A	

REV	DATE	DRAWN BY	APPROVED BY	DESCRIPTION
A	4-83	ANDRETTA		MINOR CORRECTIONS



DISPLAY DIGITAL TO ASCII CONVERTER

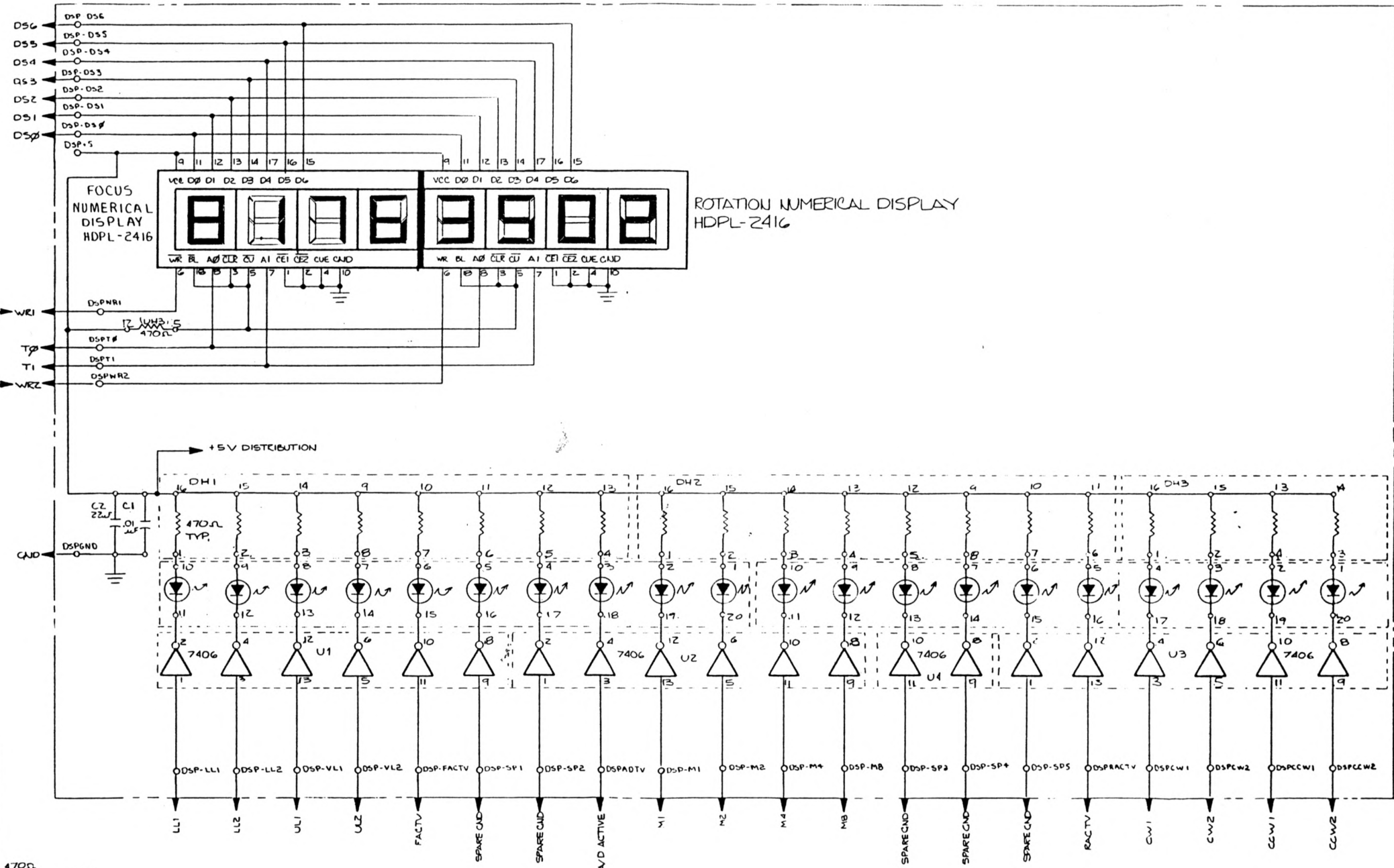


ROTATION DISPLAY CONTROL

WIRE LIST SIGNAL
(PREFIX H)

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES TOLERANCES: ANGLES ± 3 PLACE DECIMALS I.XXX: ± 2 PLACE DECIMALS I.XX: ± 1 PLACE DECIMALS I.X: ±	5102	NATIONAL RADIO ASTRONOMY OBSERVATORY BODDING AVE SE - CO - MN
	APEX INTERFACE LOGIC DIAGRAM	
MATERIAL:		
FINISH:		
NEXT ASSY:	USED ON:	SHEET NUMBER: 2029 DRAWING NUMBER: D550075006 REV: A SCALE:

REV	DATE	DRAWN BY	APPROVED BY	DESCRIPTION
A	1 08	AMRETTA		MINOR CORRECTIONS



FRONT PANEL DISPLAY BOARD

WIRE LIST SIGNAL
(PREFIX I)

NEXT ASSY	USED ON
-----------	---------

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES TOLERANCES: ANGLES ± 3 PLACE DECIMALS (LXX): ± 2 PLACE DECIMALS (LXI): ± 1 PLACE DECIMALS (LX): ±		S102		NATIONAL RADIO ASTRONOMY OBSERVATORY	
MATERIAL:		APEX INTERFACE LOGIC DIAGRAM		DRAWN BY: [Signature] CHECKED BY: [Signature] APPROVED BY: [Signature]	
FINISH:		SHEET 6 OF 9		PART NUMBER: D550075006 REV. A	

4

3

2

1

REV	DATE	DRAWN BY	APPROV'D BY	DESCRIPTION
A	2-88	ANDREATIA		ADDED PARTS # 37, 38, AND 39;

D

D

C

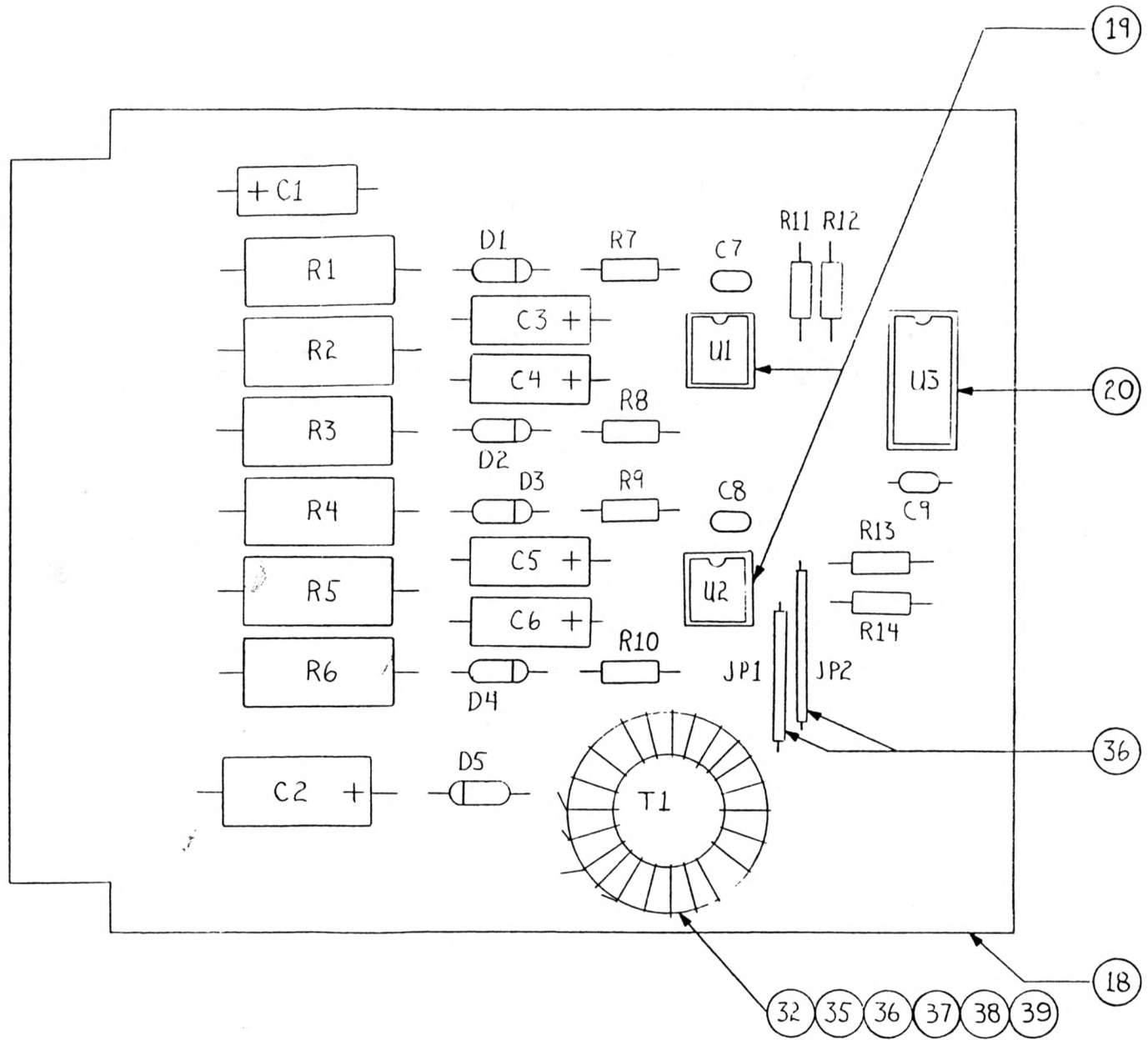
C

B

B

A

A



BOM - *A55007B012

UNLESS OTHERWISE SPECIFIED
DIMENSIONS ARE IN INCHES
TOLERANCES: ANGLES ± —
3 PLACE DECIMALS (.XXX): ± —
2 PLACE DECIMALS (.XX): ± —
1 PLACE DECIMALS (.X): ± —

MATERIAL: _____

FINISH: _____

NEXT ASSY	USED ON

F-R MODULE AND
ELECTRONICS
SIO3 BRAKE V&I MONITOR
PCB ASSEMBLY

NATIONAL RADIO
ASTRONOMY
OBSERVATORY
SOCORRO, NEW MEXICO 87801

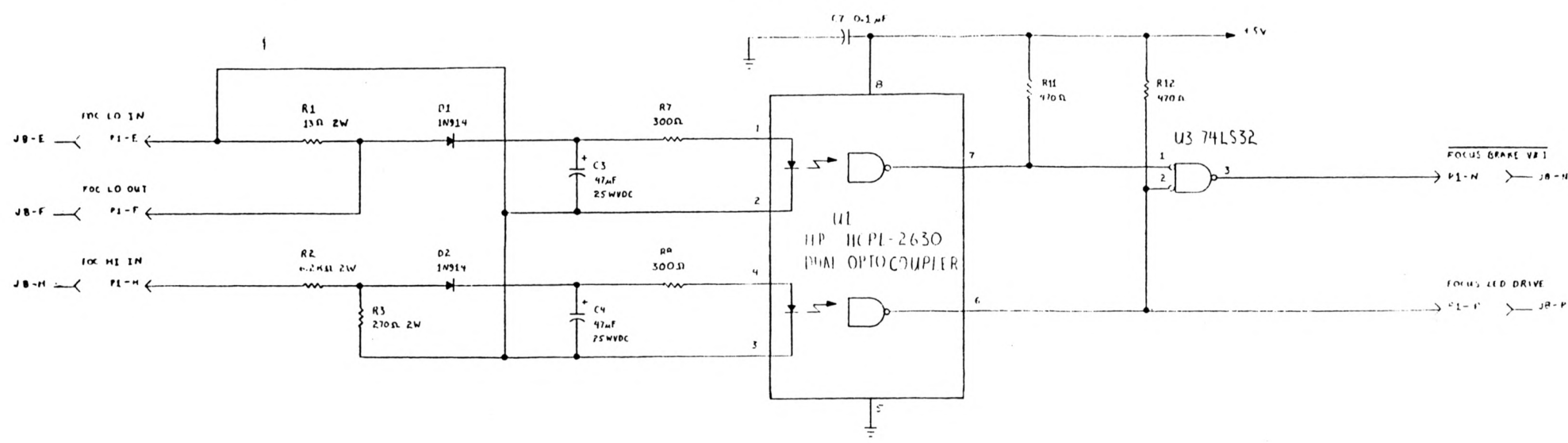
DRAWN BY W. KOSKI	DATE 1/21/88
DESIGNED BY W. KOSKI	DATE 1/21/88
APPROVED BY	DATE

SHEET NUMBER 1/1 DRAWING NUMBER C55007A021 REV. A SCALE 2:1

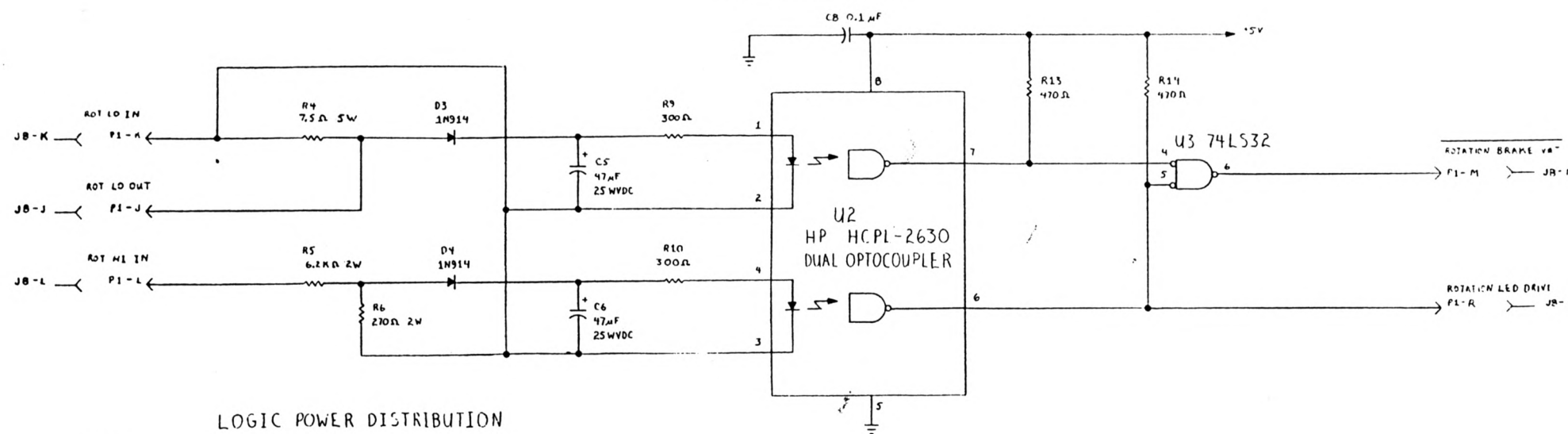
BRUNING 44-231 44427-2

REV	DATE	DRAWN BY	APPROVED BY	DESCRIPTION

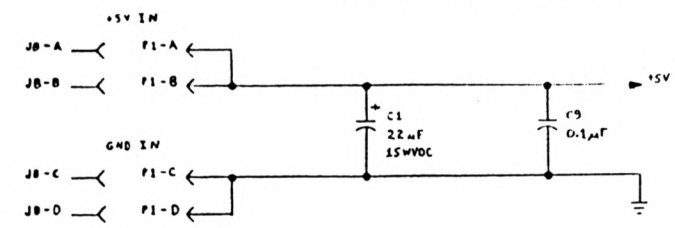
FOCUS BRAKE V&I



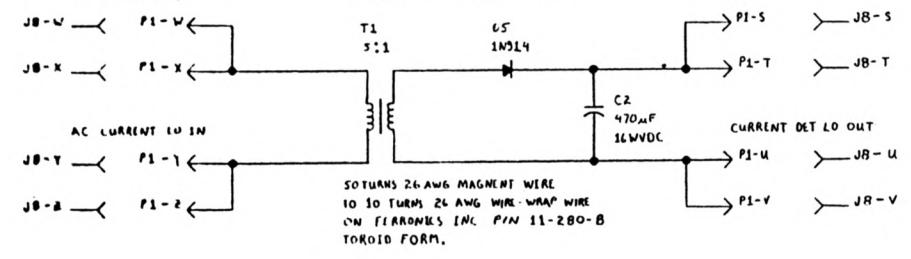
ROTATION BRAKE V&I



LOGIC POWER DISTRIBUTION



CURRENT TRANSFORMER

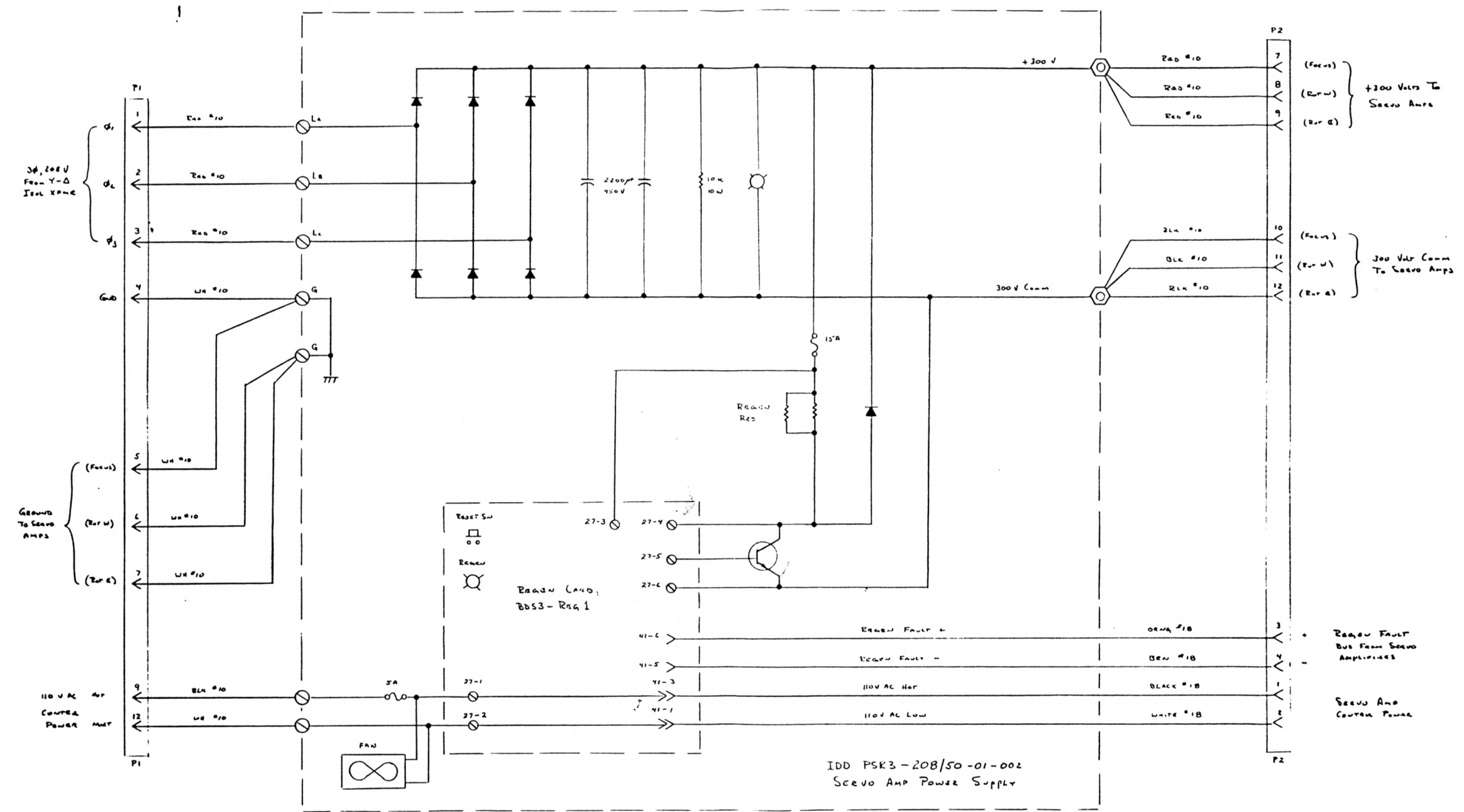


UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES TOLERANCES: ANGLES ± 3 PLACE DECIMALS, X-RAY ± 7 PLACE DECIMALS, X-RAY ± 1 PLACE DECIMALS, X-RAY ±	DESIGNED BY W. R. J. S. I.	DATE: 11-88
	APPROVED BY	DATE
	MATERIAL:	
	FINISH:	

NATIONAL RADIO ASTRONOMY OBSERVATORY
 5103 BRAKE V&I MONITOR BOARD SCHEMATIC
 SHEET 1/1 DRAWING NUMBER D550075008 REV - SCALE

NEXT ASSY	USED ON
-----------	---------

REV	DATE	DRAWN BY	APPROVED BY	DESCRIPTION



3ø, 300V
From Y-D
Isol X-PAC

GROUND
TO GROUND
AMPS

110 V AC Hot
COUNTER
POWER MET

+300 VOLT TO
SERVO AMPS

300 VOLT COMM
TO SERVO AMPS

RESET FAULT +
RESET FAULT -
SERVO AMP
COUNTER POWER

IDD PSK3-208/50-01-002
SERVO AMP POWER SUPPLY

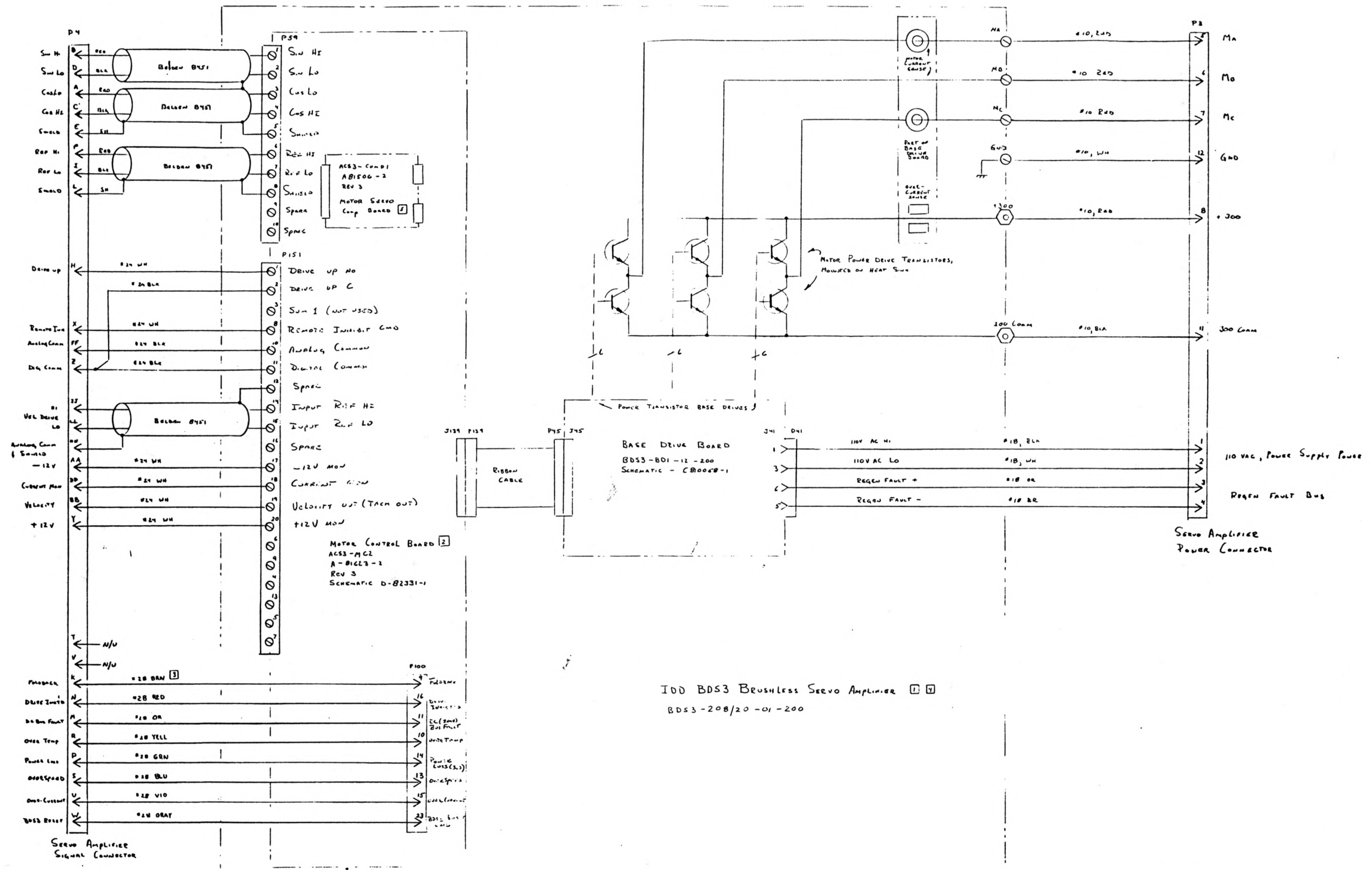
REFERENCE DRAWINGS: Power Supply Assy - D55007A023
Power Supply BOM - A55007B015

Hand-Drawn By Weene

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES TOLERANCES: ANGLES ± 3 PLACE DECIMALS (XXX) ± 7 PLACE DECIMALS (XXX) ± 1 PLACE DECIMALS (XX) ±	VLBA F-R SYSTEM		NATIONAL RADIO ASTRONOMY OBSERVATORY <small>ROCKWELL AEROSPACE BUILDING #7800</small>	
	SERVO AMP POWER SUPPLY SCHEMATIC			
	DRAWN BY: D. Weene DATE: 4/1/80	DESIGNED BY: DATE:		APPROVED BY: DATE:
	MATERIAL: FINISH:	SHEET NUMBER: 1/1 DRAWING NUMBER: D550075011		REV: SCALE:

NEXT ASSY	USED ON

REV	DATE	DRAWN BY	APPROVED BY	DESCRIPTION
A	7/2/88	WJ		CONNECTIONS FOR THE SERVO AMPLIFIER MODULE SCHEMATIC

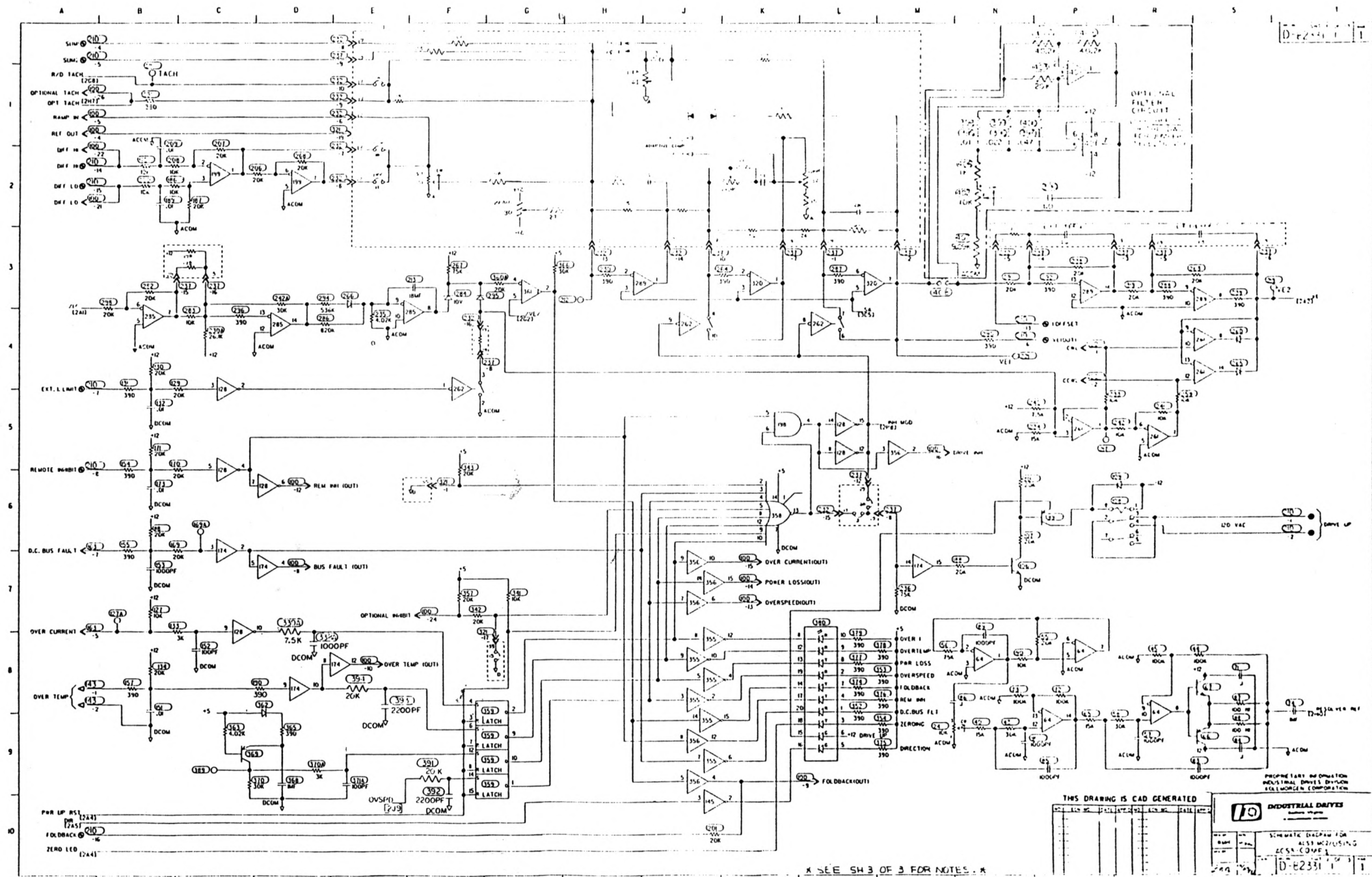


IDD BDS3 Brushless Servo Amplifier [1] [2]
BDS3-208/20-01-200

Hand-Drawn by WEBER

- NOTES
- [1] SEE IDD MANUAL M-8507
 - [2] MOTOR CONTROL BOARD IS ACS3-MC2, A-81623-2, REV 3, SCHEMATIC D-82331. DO NOT USE MCI BOARD SCHEMATIC IN M-8507 MANUAL
 - [3] THIS WIRE IS RIBBON CABLE, ITEM # 35 IN BOM ASS007B016. USE EXIMP AINS 201611-1, ITEM #42 IN BOM ASS007B016
 - [4] ASSY DWG: D85007A001; ASSY BOM: ASS007B016
 - [5] FOCUS SERVO AMPLIFIER COMPENSATION CONVENTION IS DEFINED BY IDD # 20/3105A2-01-110. DO NOT INTERCHANGE FOCUS & ROTATION COMPENSATION BONDS (OR ACS3-MC2 BOARDS) BETWEEN FOCUS & ROTATION BDS3'S

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES TOLERANCES: ANGLES ± 3 PLACE DECIMALS (XXX) ± 2 PLACE DECIMALS (XX) ± 1 PLACE DECIMALS (X) ±		VLBA F-R Servo Amp Cassis		NATIONAL RADIO ASTRONOMY OBSERVATORY GOLDEN, NEW MEXICO 87001	
MATERIAL:		Focus Servo Amp Module Schematic		DESIGNED BY D. WEISS	DATE 11/02
FINISH:				DRAWN BY	DATE
NEXT ASSY		USED ON		APPROVED BY	DATE
				SHEET NUMBER 1/1	DRAWING NUMBER D85007B016



D

C

B

A

BRUNING 44 231 44427.2

REV	DATE	DRAWN BY	APPROVED BY	DESCRIPTION

UNLESS OTHERWISE SPECIFIED
DIMENSIONS ARE IN INCHES
TOLERANCES: ANGLES ± —
3 PLACE DECIMALS (.XXX): ± —
2 PLACE DECIMALS (.XX): ± —
1 PLACE DECIMALS (.X): ± —

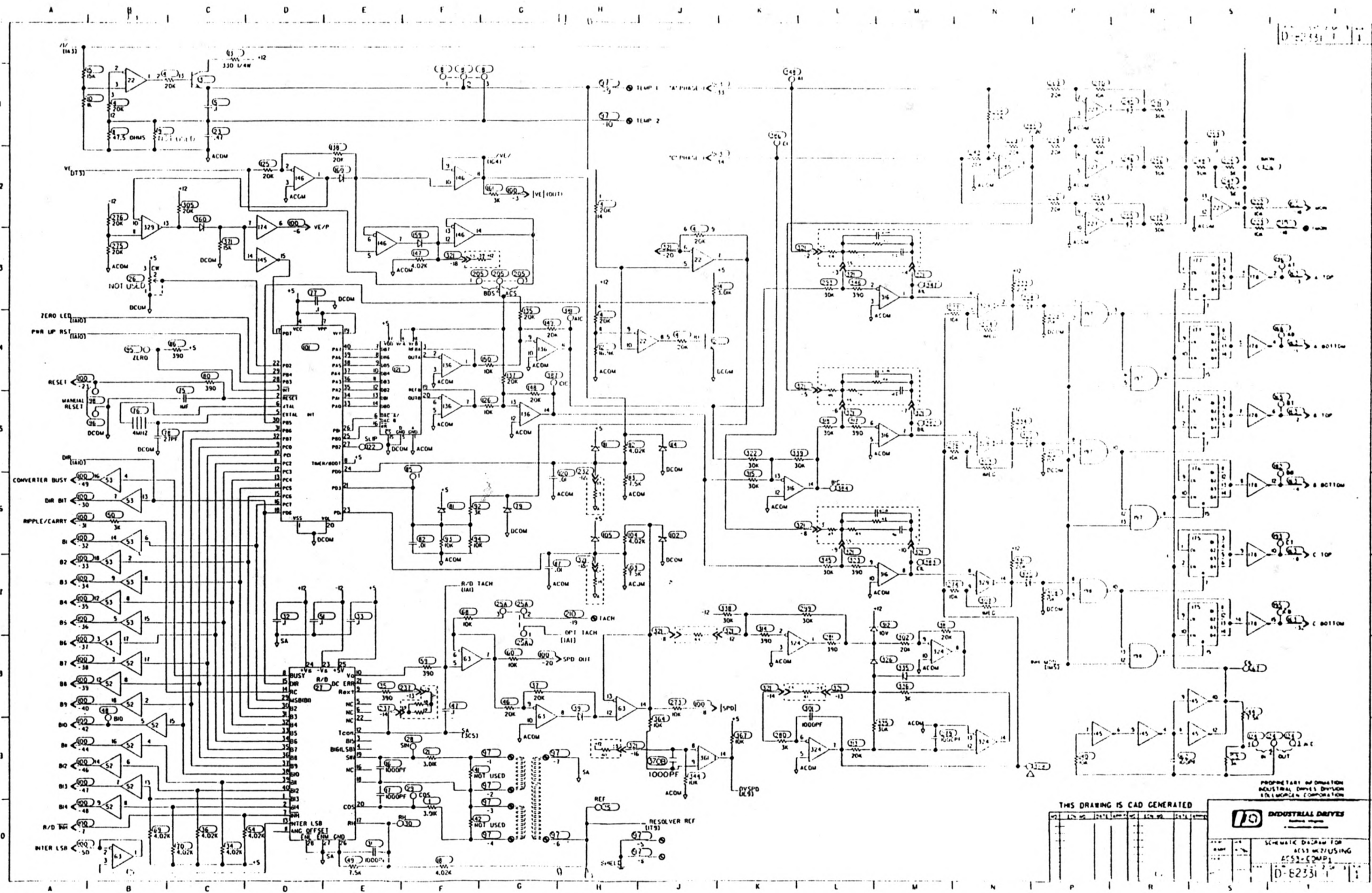
PROJECT: VLBA F-R
SERVO AMP CHASSIS
TITLE: SBD3 SERVO AMP
MC2 CONTROL LOGIC
BOARD

NATIONAL RADIO
ASTRONOMY
OBSERVATORY
SOCORRO, NEW MEXICO 87801

DRAWN BY ANDREATA	DATE 12-87
DESIGNED BY WEBER	DATE 12-87
APPROVED BY	DATE

MATERIAL:	
FINISH:	
NEXT ASSY	USED ON

SHEET NUMBER 1 OF 3 DRAWING NUMBER C550075005 REV. SCALE —



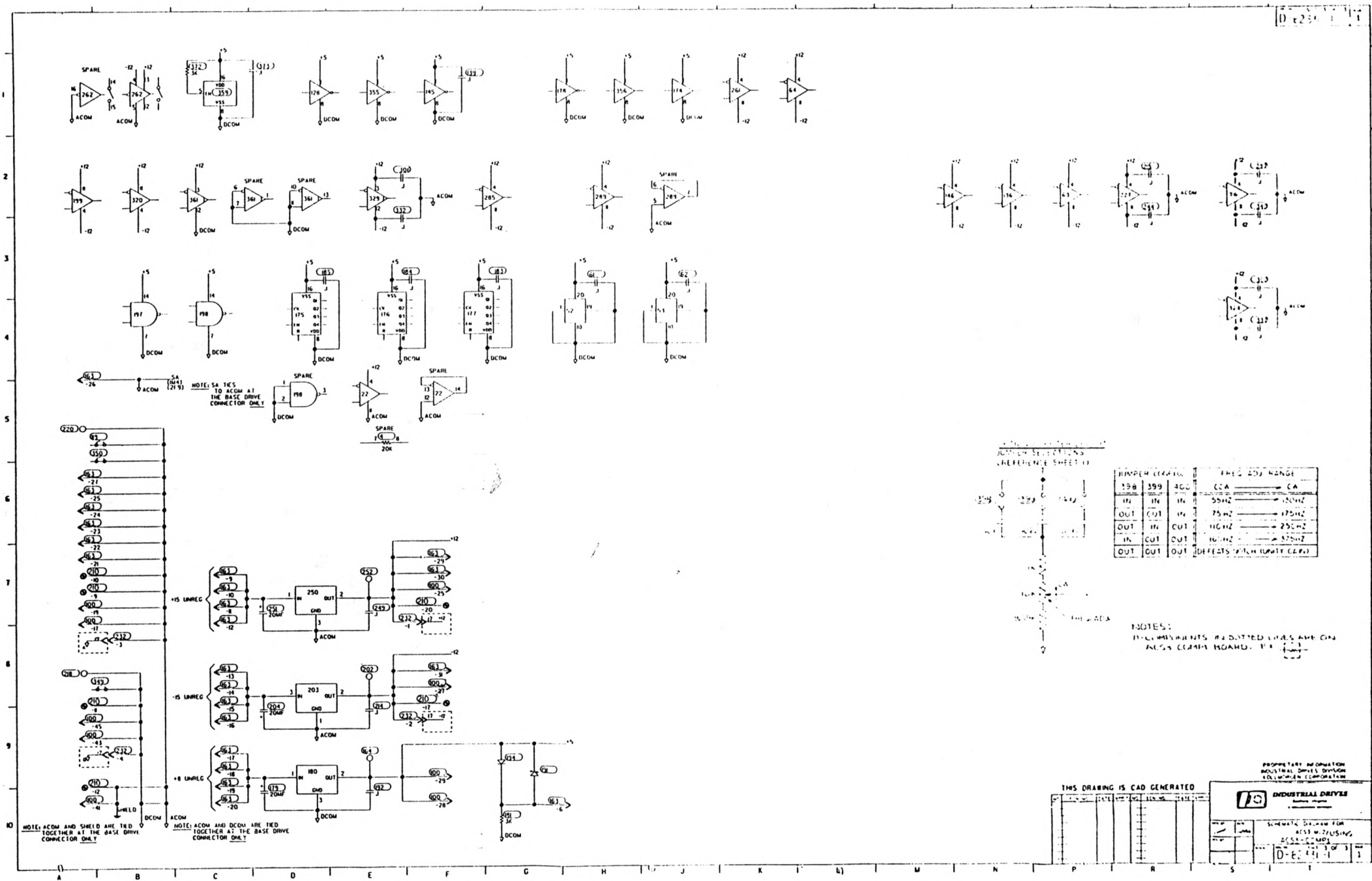
BRUNING 44-231-44427-2

UNLESS OTHERWISE SPECIFIED
DIMENSIONS ARE IN INCHES
TOLERANCES: ANGLES ±
3 PLACE DECIMALS (.XXX): ±
2 PLACE DECIMALS (.XX): ±
1 PLACE DECIMALS (.X): ±
MATERIAL: _____
FINISH: _____

V L B A PROJECT
VLBA F-R
SERVO AMP CHASSIS
SBD3 SERVO AMP
MC2 CONTROL LOGIC
BOARD

NATIONAL RADIO
ASTRONOMY
OBSERVATORY
SOCORRO, NEW MEXICO 87801
DRAWN BY ANDREATA
DATE 12-87
DESIGNED BY WEBER
DATE 12-87
APPROVED BY _____
DATE _____
SHEET NUMBER 2 OF 3
DRAWING NUMBER C550075005
REV. _____
SCALE -

NEXT ASSY	USED ON



FUNCTIONS AND LOGIC SYMBOLS REFERENCE SHEET 11

SYMBOL	FUNCTION	SYMBOL	FUNCTION
[Symbol]	AND	[Symbol]	OR
[Symbol]	NAND	[Symbol]	XOR
[Symbol]	NOT	[Symbol]	Buffer

NOTES:
 DIMENSIONS IN DOTTED LINES ARE ON
 ALSO CHECK BOARD: 11

THIS DRAWING IS CAD GENERATED

INDUSTRIAL DRIVES
 Schematic Diagram for
 SBD3 SERVO AMP
 MC2 CONTROL LOGIC BOARD

BRUNING 44 231 44427 2

UNLESS OTHERWISE SPECIFIED
 DIMENSIONS ARE IN INCHES
 TOLERANCES: ANGLES ± —
 3 PLACE DECIMALS (.XXX): ± —
 2 PLACE DECIMALS (.XX): ± —
 1 PLACE DECIMALS (.X): ± —

V L B A
 P R O J E C T
 V L B A F-R
 S E R V O A M P C H A S S I S
 S B D 3 S E R V O A M P
 M C 2 C O N T R O L L O G I C
 B O A R D

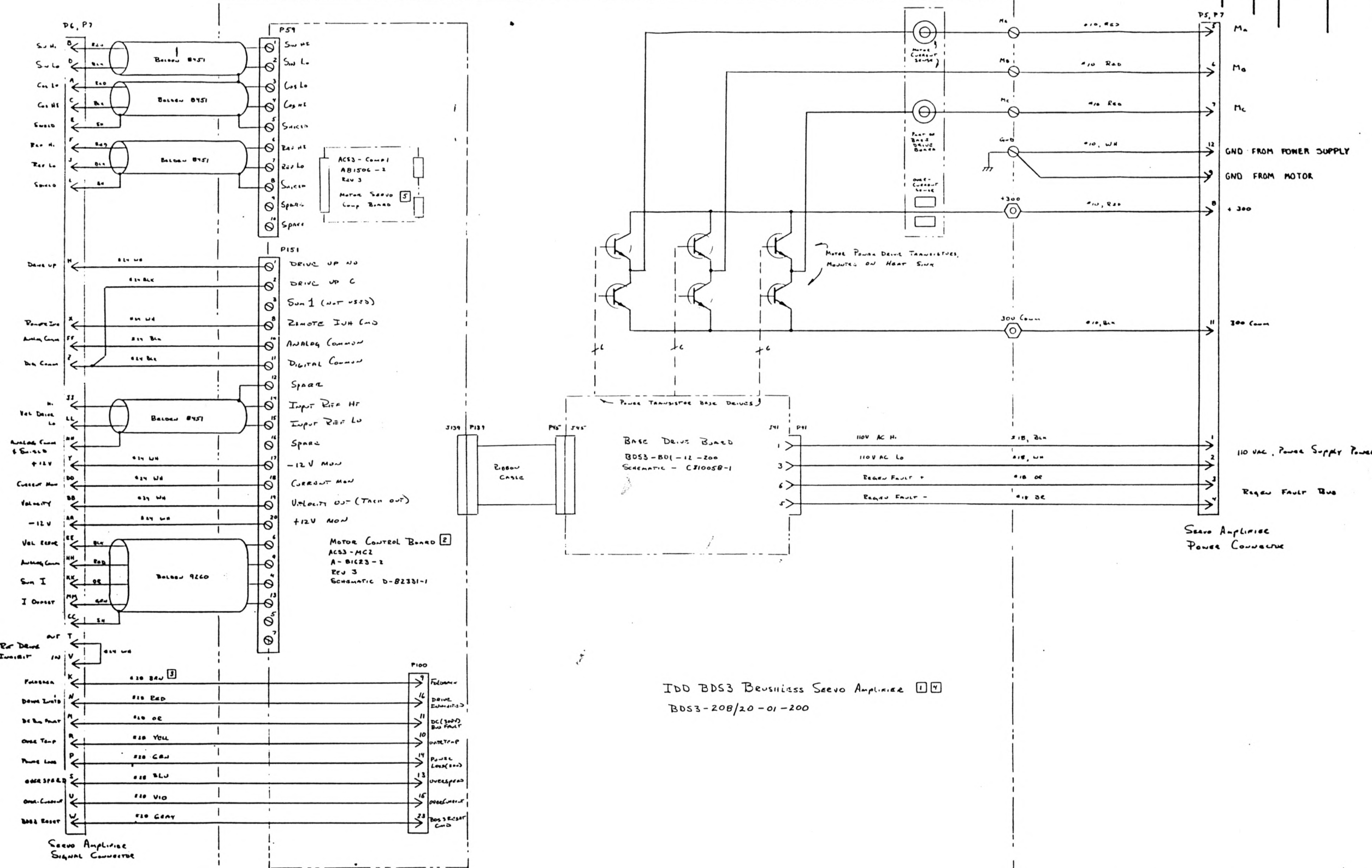
NATIONAL RADIO
 ASTRONOMY
 OBSERVATORY
 SOCORRO, NEW MEXICO 87801

DRAWN BY ANDREATTA	DATE 12-87
DESIGNED BY WEBER	DATE 12-87
APPROVED BY	DATE

NEXT ASSY	USED ON

MATERIAL: _____
 FINISH: _____

REV	DATE	DRAWN BY	APPROVED BY	DESCRIPTION
A	7/1/71	D. W. RUM		Codepage for 1/1/71 3rd wire added, added 2nd wire above 2nd wire



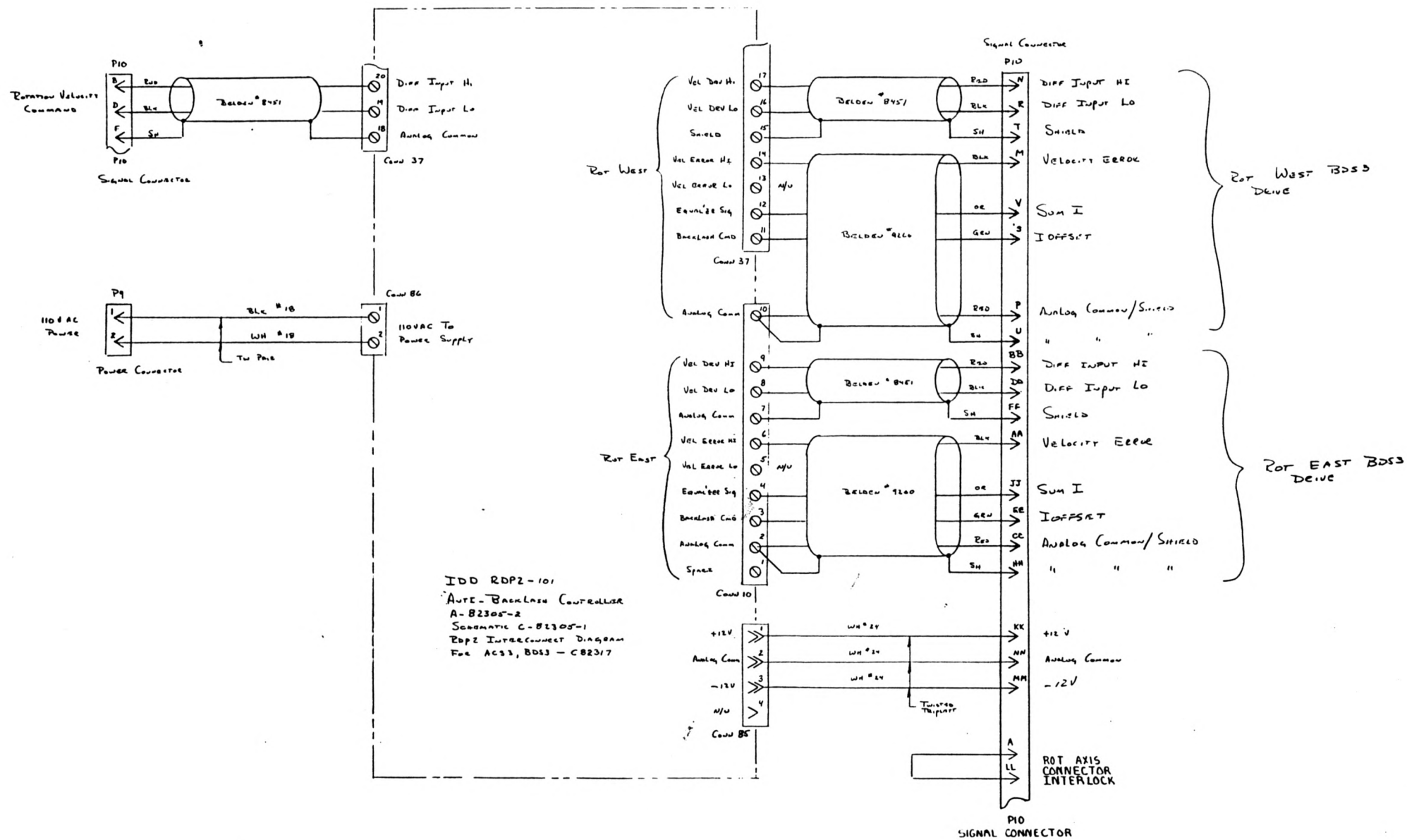
IDD BDS3 Brushless Servo Amplifier [1] [2]
BDS3-208/20-01-200

- Notes:
- [1] See IDD Manual M-8507
 - [2] Motor Control Board is ACS3-MC2, A-81623-2, Rev 3, Schematic D-82331. DO NOT USE MCI Bored Schematic in M-8507 Manual
 - [3] This Wire is Ribbon Cable, Item # 36 in Bom AS5007B017. Use CRIMP PINS 2016H-1, ITEM #42 in Bom AS5007B017
 - [4] Ass'y DWG: DS5007A055; Ass'y BOM: AS5007B017
 - [5] Rotational Servo Amplifier Compensation Compensation is Derived by IDD# 12/2/82#1 GM-457. Do Not Interchange Fuses & Rotational Compensation Boards (on ACS3-MC2 Boards) Between Fuses & Rotational BDS3.

Hand-Drawn By Weber

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES TOLERANCES: ANGLES ± 3 PLACE DECIMALS (XXX): ± 2 PLACE DECIMALS (XX): ± 1 PLACE DECIMALS (X): ±		V L B A VLBA F-R Servo Amp Cassis	NATIONAL RADIO ASTRONOMY OBSERVATORY GOLDEN, NEW MEXICO 87038
MATERIAL:			
FINISH:		DATE BY	DATE BY
NEXT ASSY USED ON		APPROVED BY	DATE
SHEET 1/1		ISSUE NUMBER	REV A

REV	DATE	DRAWN BY	APPROVED BY	DESCRIPTION
A	1/1/80	D. MOORE		CONTROL FOR ROT AXIS DRIVE



IDD RDP2-101
 AUTE-BACKLASH CONTROLLER
 A-82305-2
 SCHEMATIC C-82305-1
 EXP. INTERCONNECT DIAGRAM
 FOR ACS, BDS3 - C82317

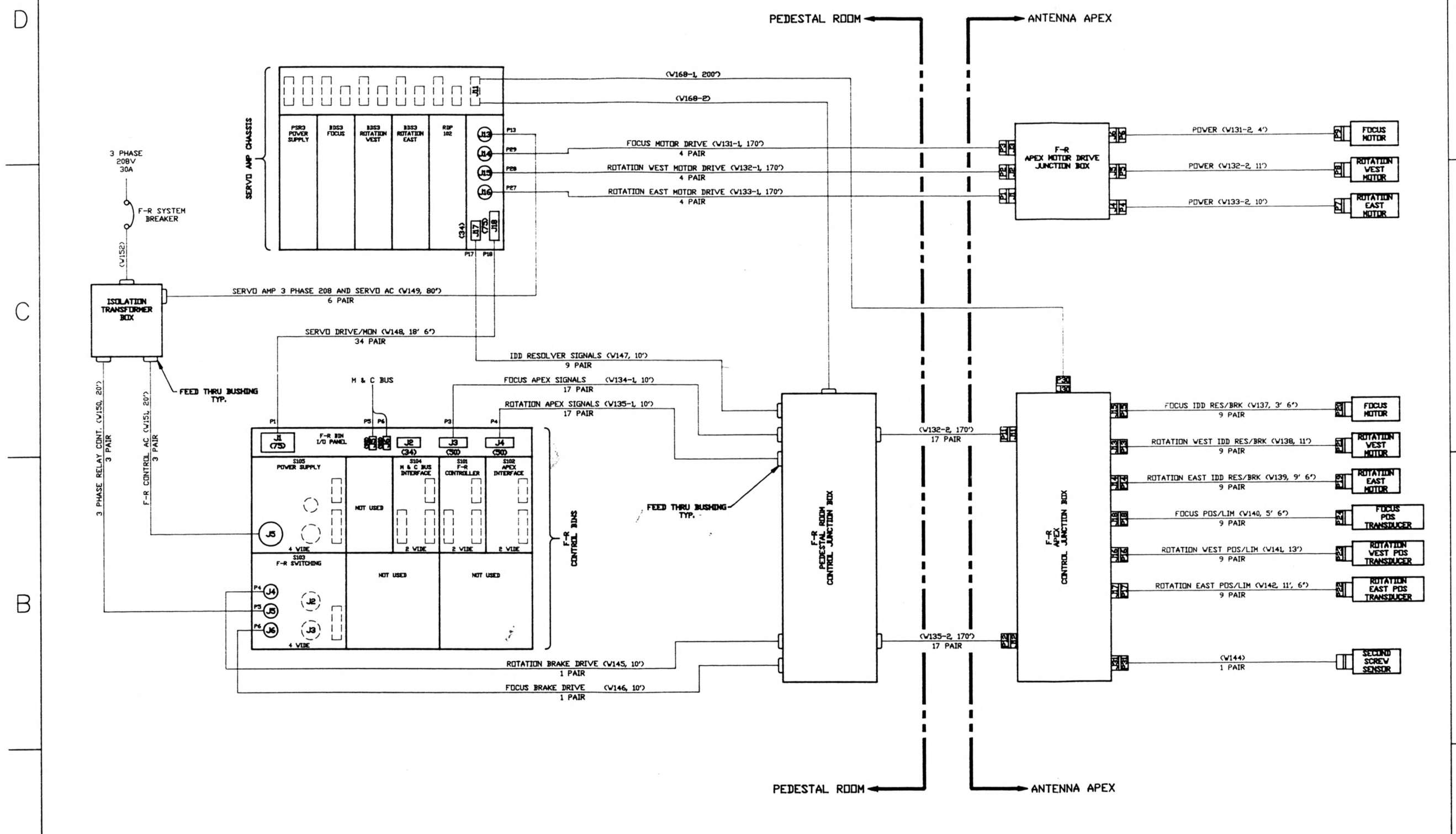
NOTES: 1 ASSOCIATED DRAWINGS: MODULE ASST - D65007A026 ; MODULE TBOM - A65007B018

HAND-DRAWN BY WENSE

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES TOLERANCES: ANGLES ± 3 PLACE DECIMALS (XXX) ± 2 PLACE DECIMALS (XX) ± 1 PLACE DECIMALS (X) ±	VLBA F-R Servo Amp Control	NATIONAL RADIO ASTRONOMY OBSERVATORY BOSTON, MASS 02126-0001 DRAWN BY D. MOORE CHECKED BY APPROVED BY DATE	
	Rotation Drive Aut. Backlash Controller Motor Schematic		DATE
			DATE
			DATE
MATERIAL:			
FINISH:			
SHEET NUMBER 1/1	DRAWING NUMBER D65007A026	REV. A	

NEXT ASSY	USED ON

REV	DATE	DRAWN BY	APPRVD BY	DESCRIPTION
D	1-90	ANDREATTA		REDRAWN WITH ACAD J



ACAD : FRCABLST

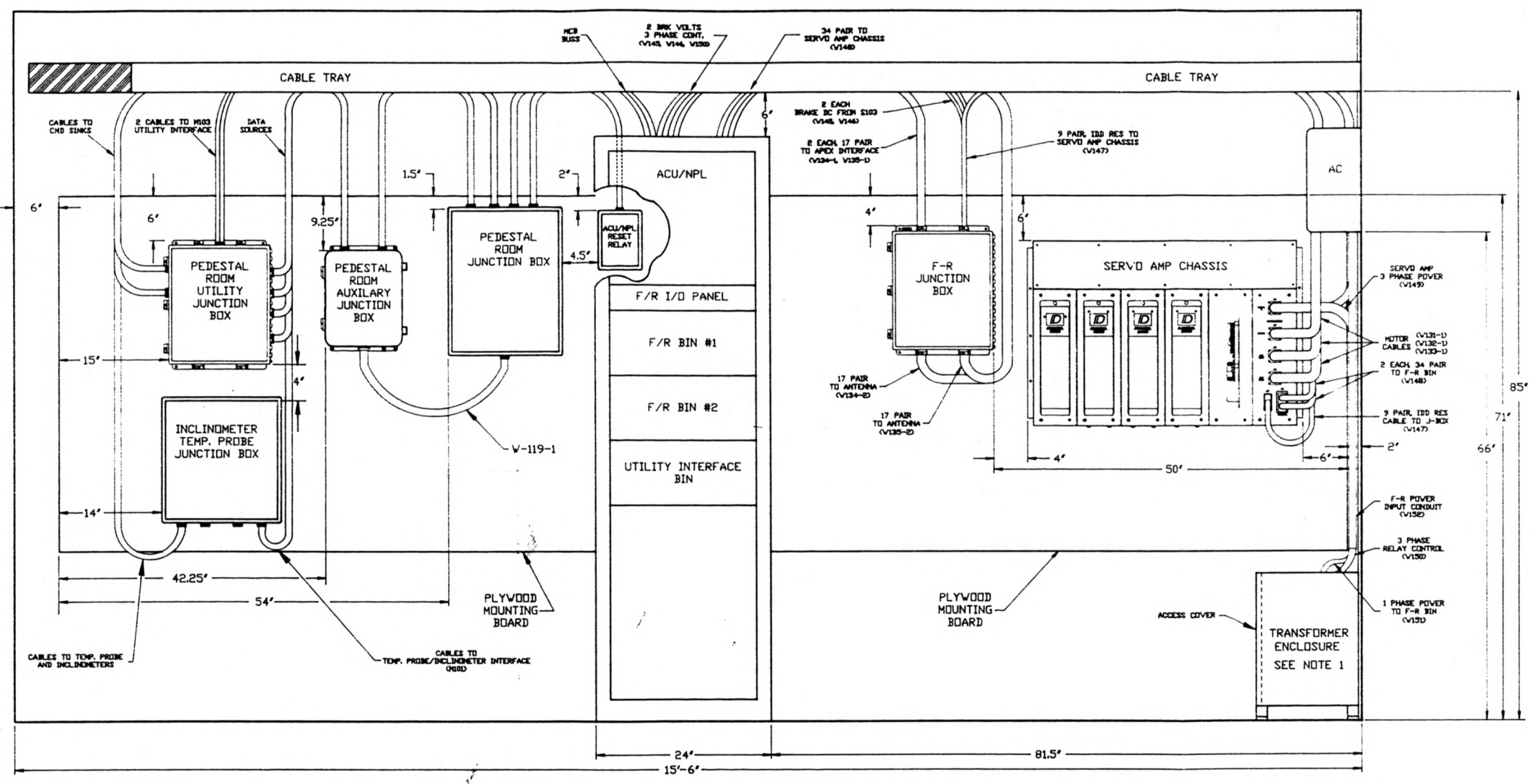
UNLESS OTHERWISE SPECIFIED
DIMENSIONS ARE IN INCHES
TOLERANCES : ANGLES ±
3 PLACE DECIMALS (.000) ±
2 PLACE DECIMALS (.00) ±
1 PLACE DECIMALS (.1) ±

V L B A	F-R SYSTEM	NATIONAL RADIO ASTRONOMY OBSERVATORY SOCORRO, NEW MEXICO 87801	
		DRAWN BY WEBER	DATE 4-87
F-R SYSTEM CABLE STRUCTURE WIRING DIAGRAM		DESIGNED BY WEBER	DATE 4-87
		APPROVED BY	DATE
SHEET NUMBER	1 of 1	DRAWING NUMBER	D55007W001
		REV. D	SCALE

NEXT ASSEMBLY	DWG. TYPE

PROPERTY OF NRAO

REV	DATE	DRAWN BY	APPR'D BY	DESCRIPTION
A	5-89	ANDREATA		ADDED PEDESTAL ROOM AUXILIARY JUNCTION BOX



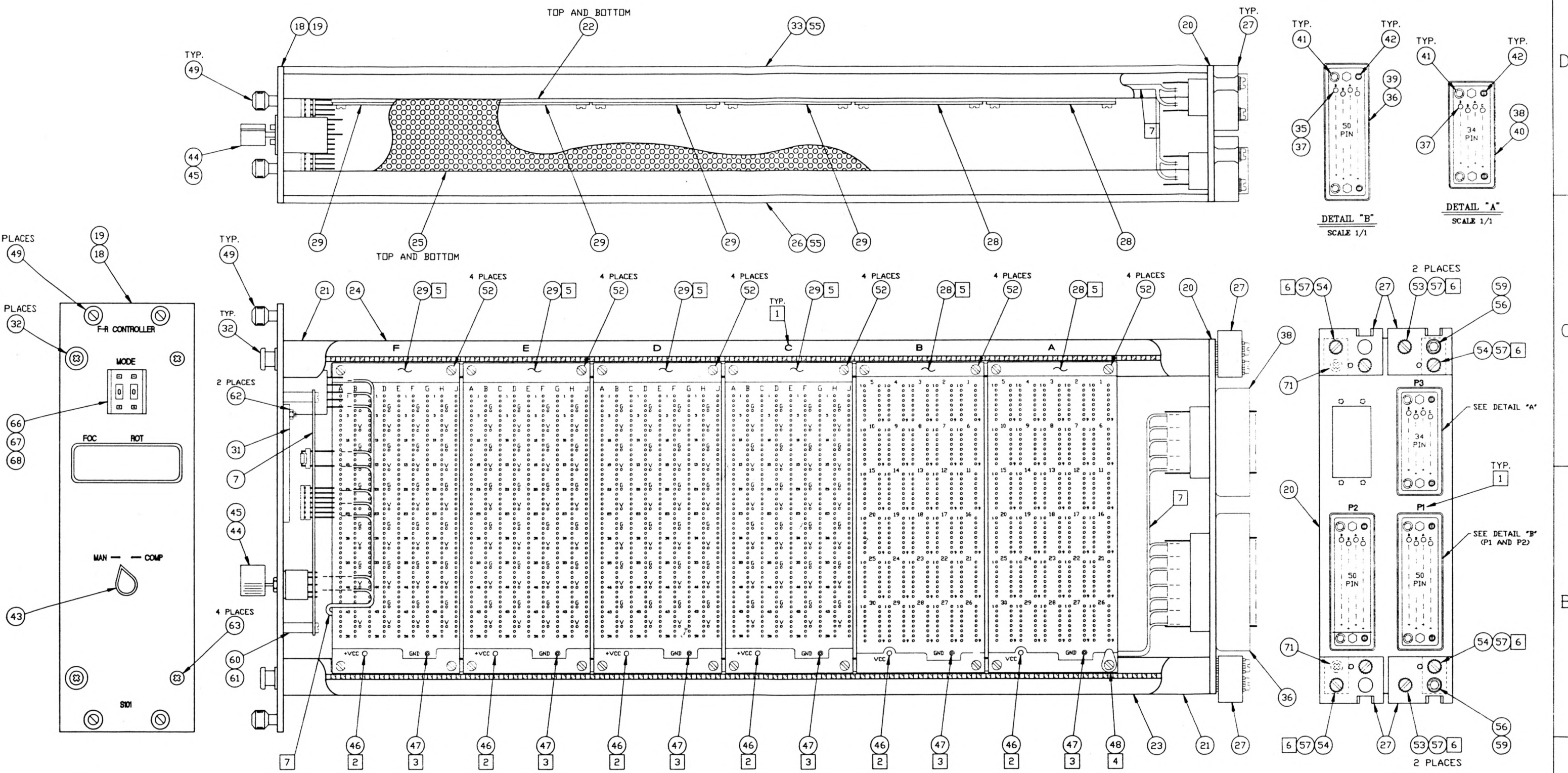
RIGHT HAND WALL LAYOUT
SCALE : .1" = 1"

- NOTES :
1. INSTALL ISOLATION TRANSFORMER IN CORNER WITH ACCESS COVER ORIENTAION AS SHOWN.

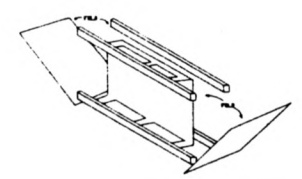
ACAD : PEDRMLY1

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES TOLERANCES : ANGLES ± _____ 3 PLACE DECIMALS (.000) ± _____ 2 PLACE DECIMALS (.00) ± _____ 1 PLACE DECIMALS (.0) ± 1/2"	V L B A	P E D E S T A L R O O M	25 METER ANTENNA	NATIONAL RADIO ASTRONOMY OBSERVATORY SOCORRO, NEW MEXICO 87801
			25 METER ANTENNA PEDESTAL ROOM NRAD EQUIPMENT LAYOUT	
MATERIAL : _____	SHEET NUMBER 1 of 1		DRAWING NUMBER C52502M012	REV. A SCALE _____
FINISH : _____	NEXT ASSEMBLY		DWG. TYPE	

REV	DATE	DRAWN BY	APPRVD BY	DESCRIPTION
A	2-90	ANDREATA		MINOR CORRECTIONS



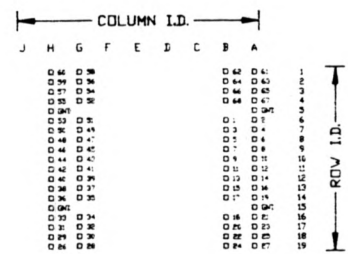
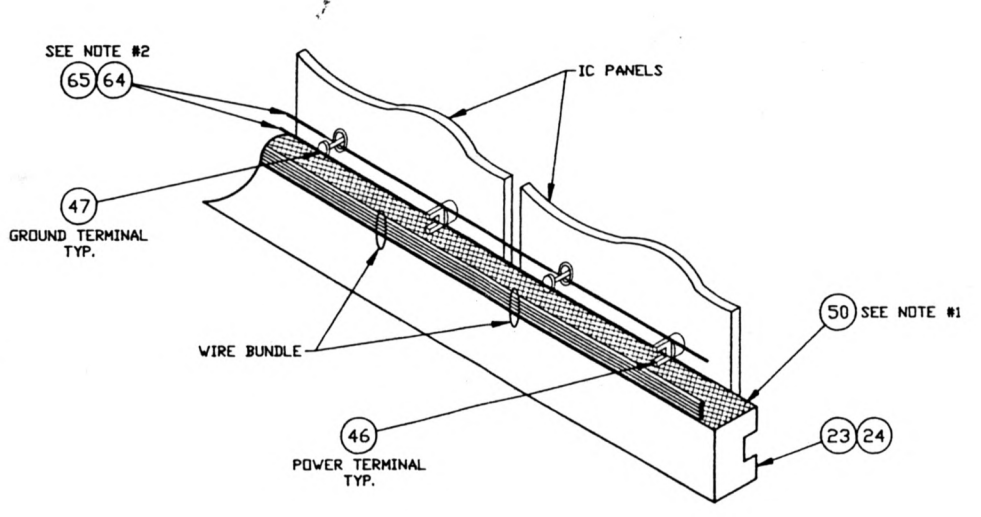
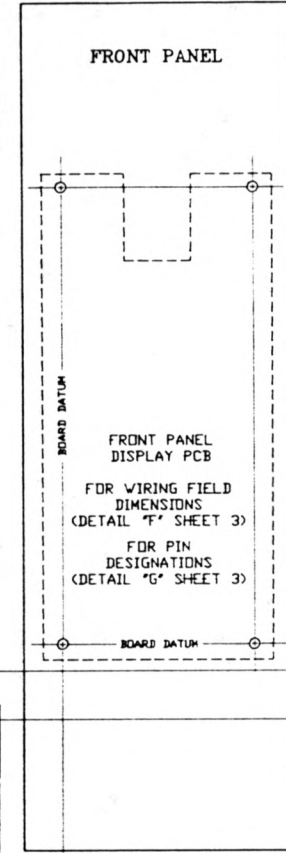
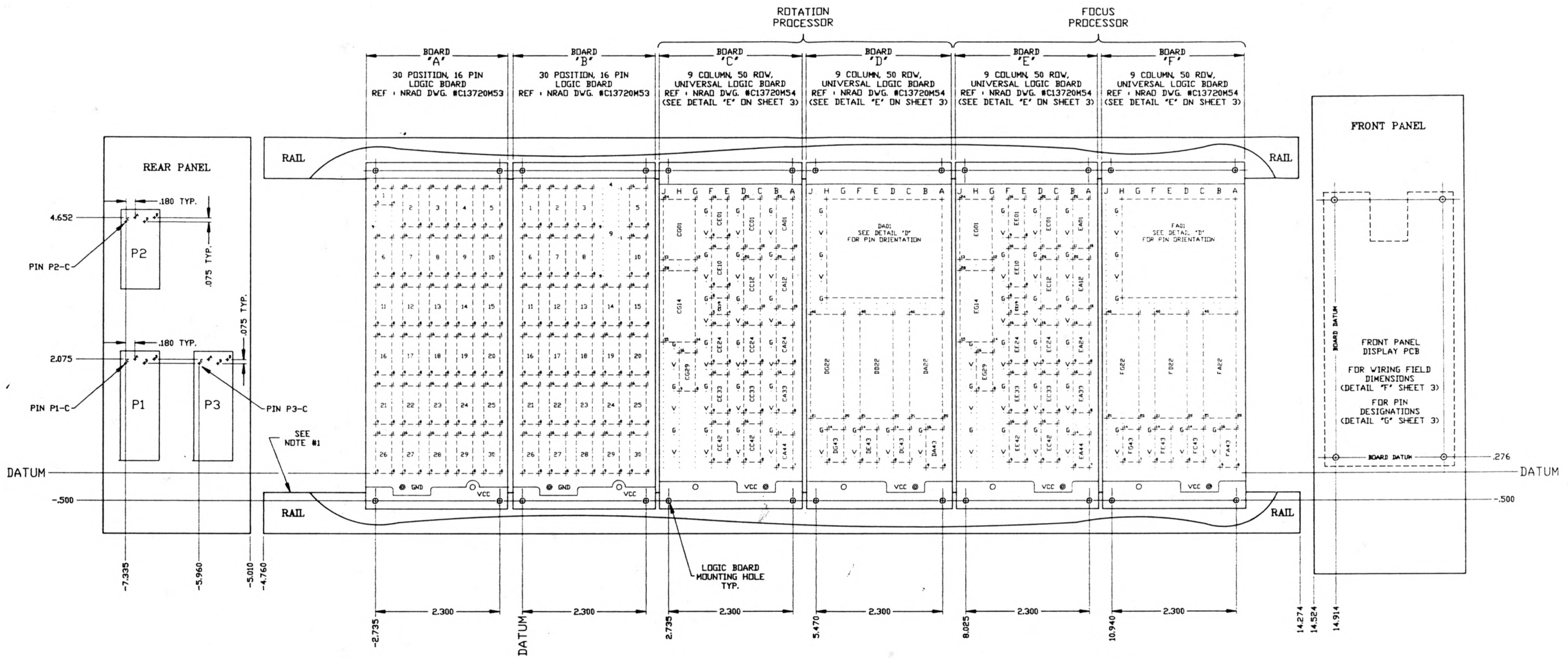
- NOTES :
- MARKING SHALL BE .125 HIGH, LEGIBLE AND PERMANENT, LOCATED APPROXIMATELY AS SHOWN.
 - SOLDER POWER TERMINAL (ITEM #46) TO POWER PLANE. (WIRE WRAP SIDE OF ITEM #28, AND #29)
 - SOLDER GND TERMINAL (ITEM #47) TO GROUND PLANE. (COMPONENT SIDE OF ITEM #28, AND #29)
 - SOLDER "SOLDER LUG" (ITEM #48) TO GROUND PLANE AND PLACE UNDER SCREW HEAD AS SHOWN.
 - INSTALL IC'S INTO UNIVERSAL IC PANEL (ITEM #29) AND 16 X 32 IC PANEL (ITEM #28) USING DWG. #A55007A013.
 - WHERE TWO WASHERS (ITEM #57) ARE REQUIRED, PLACE ONE UNDER THE SCREW HEAD AND THE OTHER BETWEEN THE GUIDE BLOCK (ITEM #27) AND REAR PANEL (ITEM #20).
 - DRESS WIRE HARNESS PATH TO PERMIT FRONT AND REAR PANELS TO BE FOLDED OUTWARD FROM TOP. (SEE FIGURE)



BOM - #A55007B002

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES		V L P		S101		NATIONAL RADIO ASTRONOMY OBSERVATORY	
TOLERANCES - ANGLES -		LOC	BY	REV	DATE	SOCORRO, NEW MEXICO 87801	
3 PLACE DECIMALS (LIFT) -	.005				8-87		
1 PLACE DECIMALS (LIFT) -					8-87		
1 PLACE DECIMALS (LIFT) -							
MATERIAL :		S101 F-R CONTROLLER		DRAWN BY ANDREATA		DATE 8-87	
FINISH :		S101 F-R CONTROLLER MODULE ASSEMBLY		DESIGNED BY WEBER		DATE 8-87	
				APPROVED BY		DATE	
SHEET NUMBER 1 OF 3	DRAWING NUMBER D55007A002	REV A		SCALE 1/1			

REV	DATE	DRAWN BY	APPRVD BY	DESCRIPTION
A	2-90	ANDREATTA		MINOR CORRECTIONS



- NOTES:
- KAPTON TAPE (ITEM #50) SHALL RUN THE FULL LENGTH OF THE RAILS (ITEM #23 AND #24). SEE DETAIL 'C'.
 - POWER AND GROUND BUS WIRING SHALL BE ON THE WIRE WRAP SIDE OF THE UNIVERSAL IC PANEL AND THE 16 X 30 IC PANELS (ITEMS #28 AND #29).

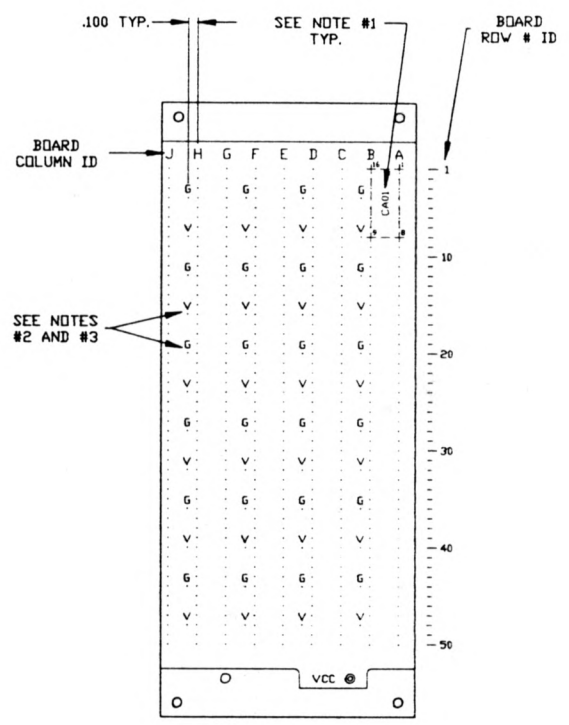
DETAIL "C"
SCALE 1/1

DETAIL "D"
SCALE 1/1

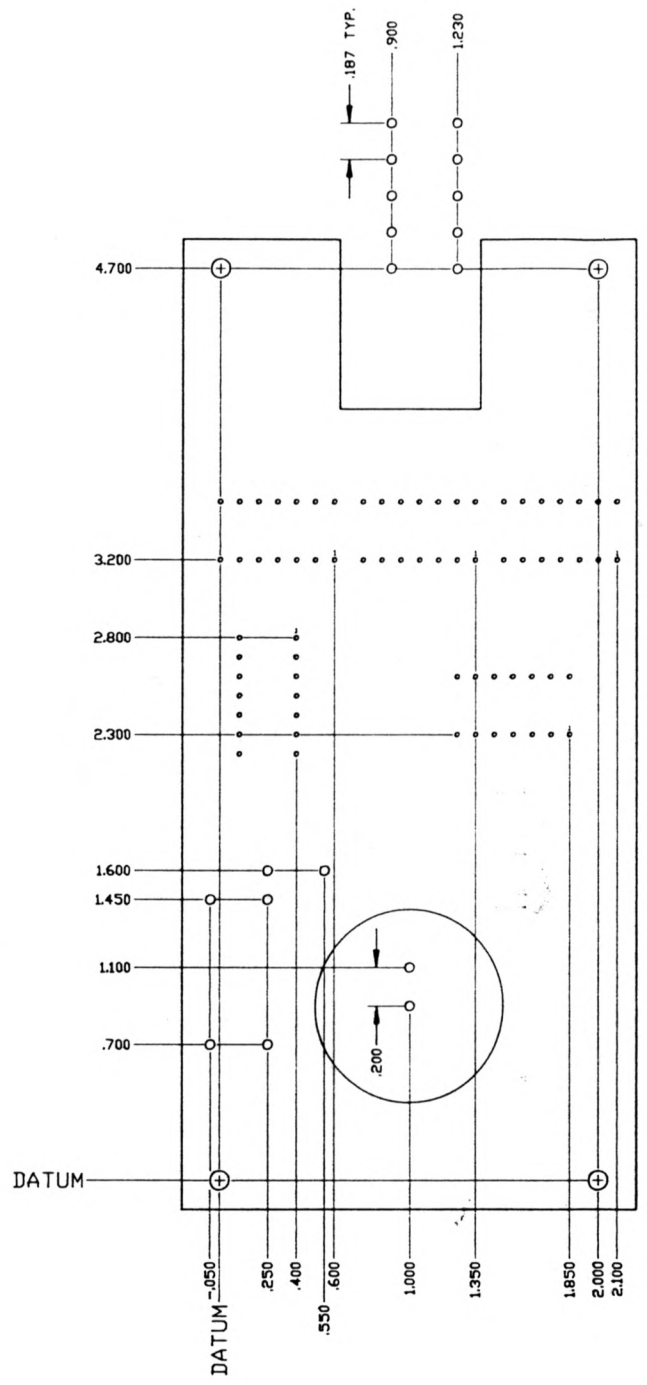
BOM - #A55007B002

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES		V	S101	NATIONAL RADIO ASTRONOMY OBSERVATORY SOCORRO, NEW MEXICO 87801
TOLERANCES - ANGLES		L	F-R CONTROLLER	
3 PLACE DECIMALS (XXX)	.005	B		
2 PLACE DECIMALS (XX)		A		
MATERIAL:		V	S101	DRAWN BY ANDREATTA DATE 8-87
FINISH:		L	F-R CONTROLLER	DESIGNED BY WEBER DATE 8-87
		B	MODULE	APPROVED BY DATE
		A	ASSEMBLY	
SHEET NUMBER 2 of 3	DRAWING NUMBER D55007A002	REV. A	SCALE 1/1	

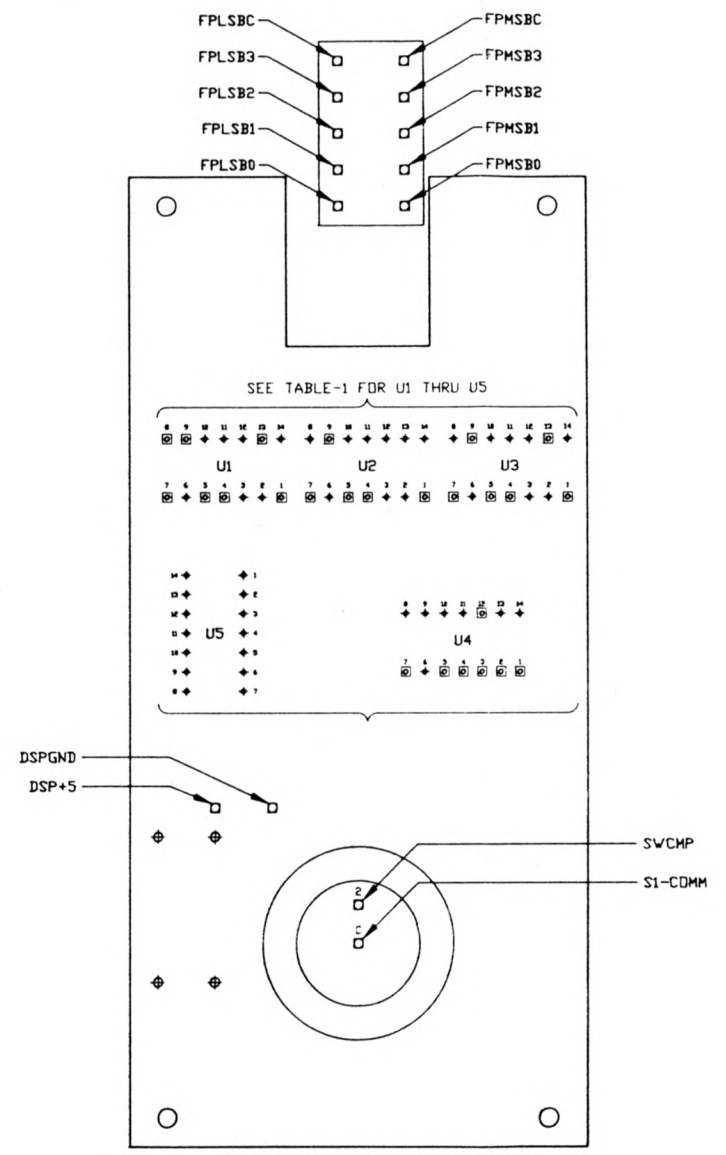
REV	DATE	DRAWN BY	APPR'VD BY	DESCRIPTION
A	2-90	ANDREATTA		REVISED RESOLVER TO TD DIGITAL PCB



DETAIL "E"
SCALE 1/1



DETAIL "F"
SCALE 2/1



DETAIL "G"
SCALE 2/1

TABLE-1

U1-1	DSPIN2
U1-4	DSPIN3
U1-5	DSPIN2
U1-7	DSPIN1
U1-9	DSPIN2
U1-13	DSPIN4
U2-1	DSPIN0
U2-5	DSPIN1
U2-7	DSPIN8
U2-9	DSPIN2
U3-1	DSPIN7
U3-4	DSPIN5
U3-8	DSPIN6
U3-13	DSPIN6
U4-1	DSPIN1
U4-2	DSPIN2
U4-3	DSPINK
U4-4	DSPIN3
U4-5	DSPIN0
U4-7	U4COMM
U4-12	DSPIN6

NOTES :

- PIN #1 LOCATION ID = X X X X
- VCC AND GND PIN LOCATIONS FOR BOARDS 'C' THRU 'F' ARE AS FOLLOES :
 COLUMNS B, D, F, AND H
 VCC PINS : 8, 16, 24, 32, 40, AND 48
 GND PINS : 4, 12, 20, 28, 36, AND 44
- TYPICAL WIRE LIST VCC AND GND PIN LOCATION ID = X X XX - XX

□ = POINT TO BE WIRED

BOM - #A55007B002

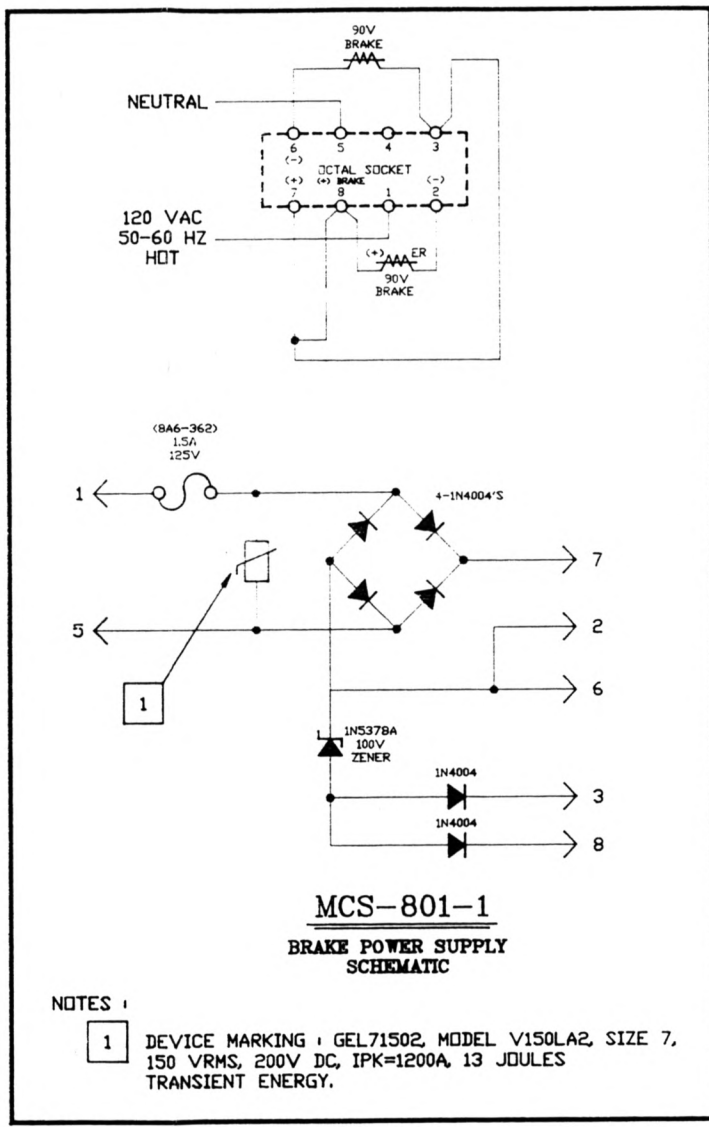
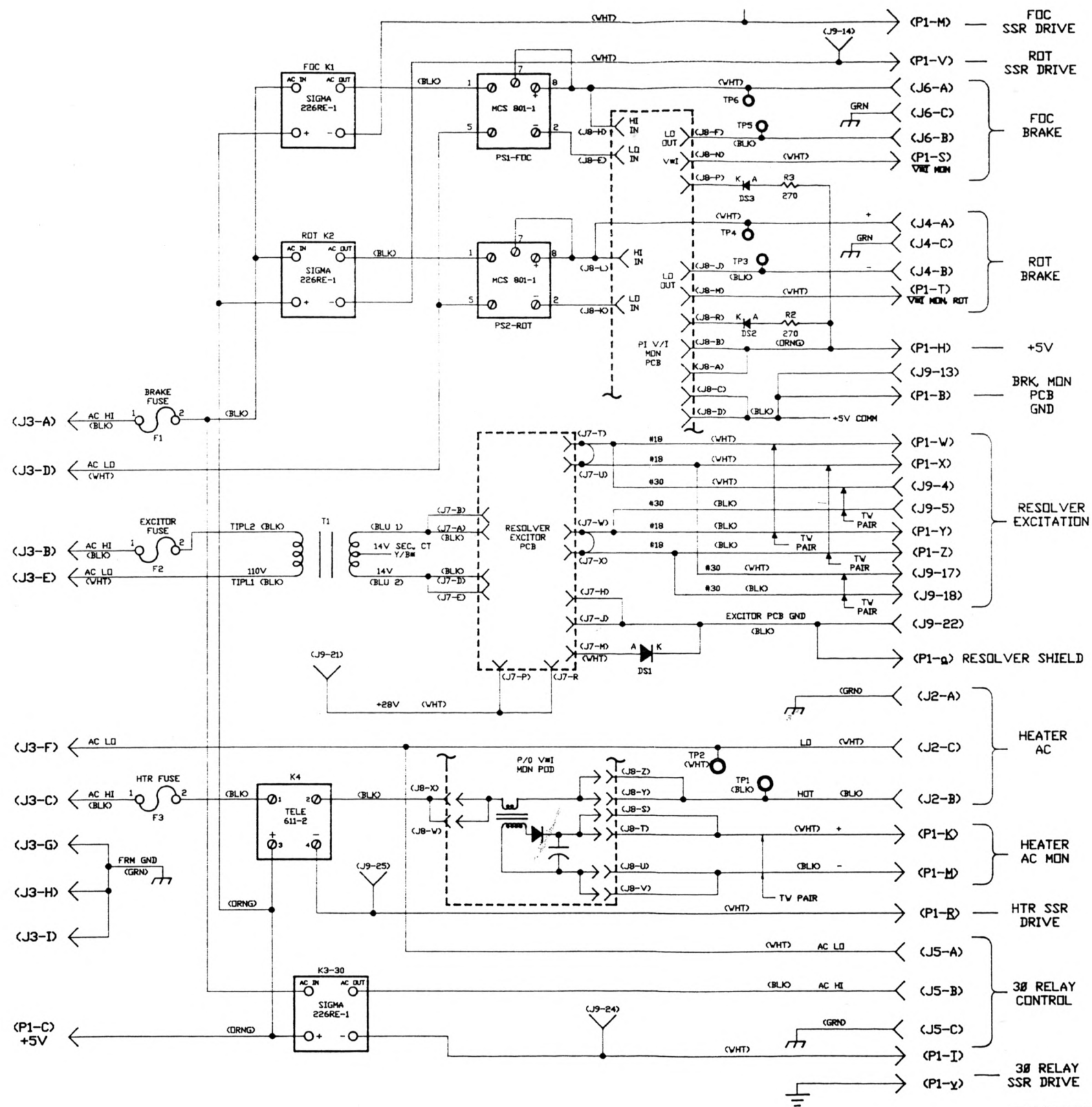
UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES TOLERANCES : ANGLES # 3 PLACE DECIMALS (.XXX) # 2 PLACE DECIMALS (.XX) # 1 PLACE DECIMALS (.X) #	V L B A	S101	NATIONAL RADIO ASTRONOMY OBSERVATORY SOCORRO, NEW MEXICO 87801
		F-R CONTROLLER	
MATERIAL :		S101	DESIGNED BY ANDREATTA
FINISH :		F-R CONTROLLER	DATE 8-87
		MODULE	DESIGNED BY WEBER
		ASSEMBLY	APPROVED BY
SHEET NUMBER 3 of 3	DRAWING NUMBER D55007A002	REV. A	SCALE 1/1

REV	DATE	DRAWN BY	APPR'VD BY	DESCRIPTION

REV	DATE	DRAWN BY	APPRVD BY	DESCRIPTION
A	8-88	ANDREATTA		MINOR CORRECTIONS

J2 : M3102A18-5S
 J3 : MS3102A18-1P
 J4 : MS3102A14S-2S
 J5 : MS3102A14S-7S
 J6 : MS3102A14S-7S
 P1 : AMP50 PIN #201358-3 AND
 PIN HOOD AMP #202394-2

D
C
B
A



ACAD : S103SK-1

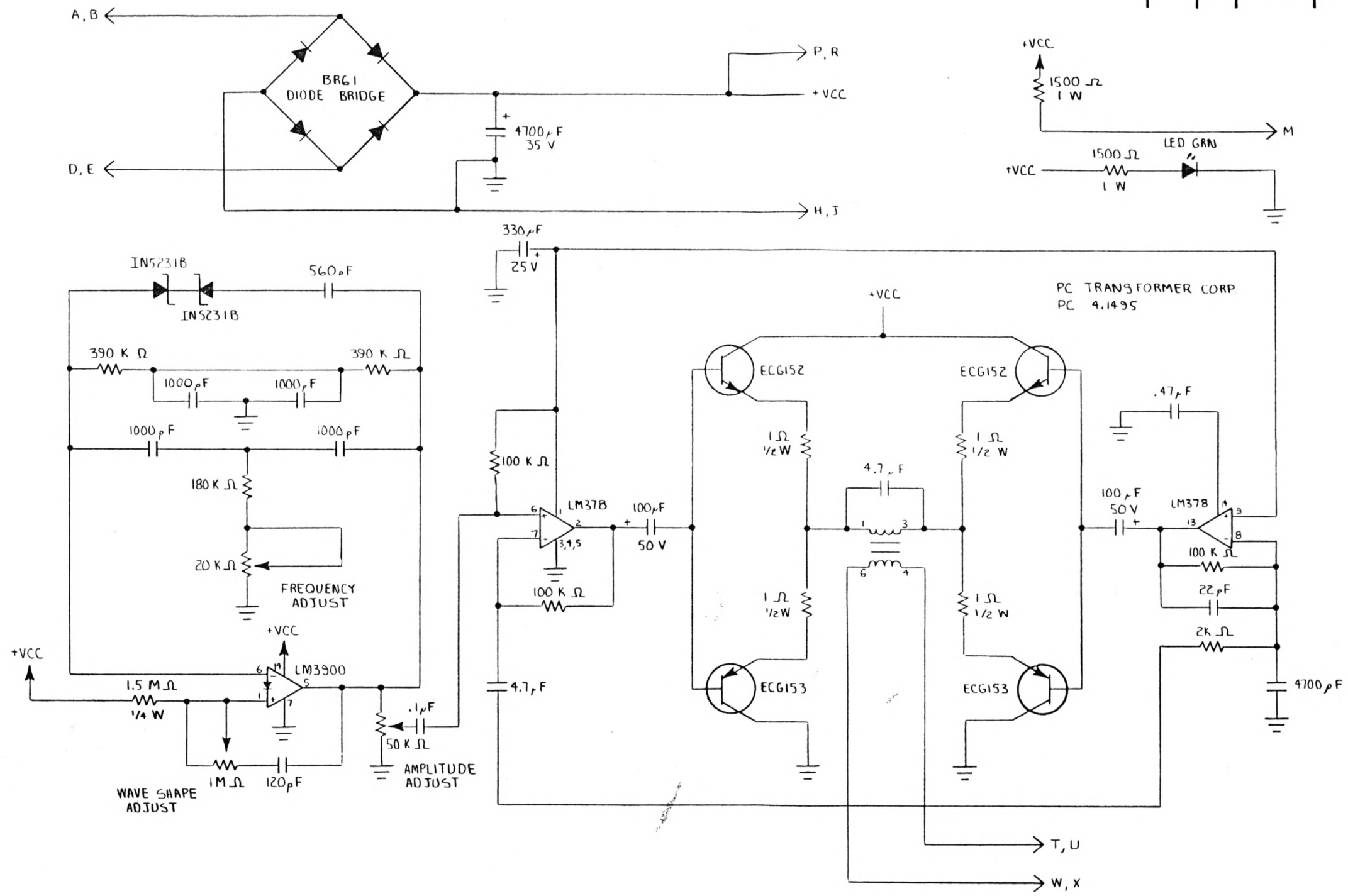
UNLESS OTHERWISE SPECIFIED
 DIMENSIONS ARE IN INCHES
 TOLERANCES : ANGLES =
 3 PLACE DECIMALS (.000) =
 2 PLACE DECIMALS (.00) =
 1 PLACE DECIMALS (.1) =

MATERIAL :	
FINISH :	
ASSEMBLY	ASSEMBLY
NEXT ASSEMBLY	DWG. TYPE

V L B A	S103 F-R SWITCHING
T E	S103 F-R SWITCHING MODULE SCHEMATIC DIAGRAM
SHEET NUMBER	1 of 1
DRAWING NUMBER	D55007S002

NATIONAL RADIO ASTRONOMY OBSERVATORY SOCORRO, NEW MEXICO 87801	
DRAWN BY ANDREATTA	DATE 2-88
DESIGNED BY KOSKI	DATE 2-87
APPROVED BY	DATE
REV. A	SCALE

PROPERTY OF INRAO



UNLESS OTHERWISE SPECIFIED
DIMENSIONS ARE IN INCHES
TOLERANCES: ANGLES ± —
3 PLACE DECIMALS (.XXX): ± —
2 PLACE DECIMALS (.XX): ± —
1 PLACE DECIMALS (.X): ± —

V P
L R
A
PROJECT
SIO3
F-R SWITCHING
SIO3
RESOLVER EXCITOR
PCB SCHEMATIC

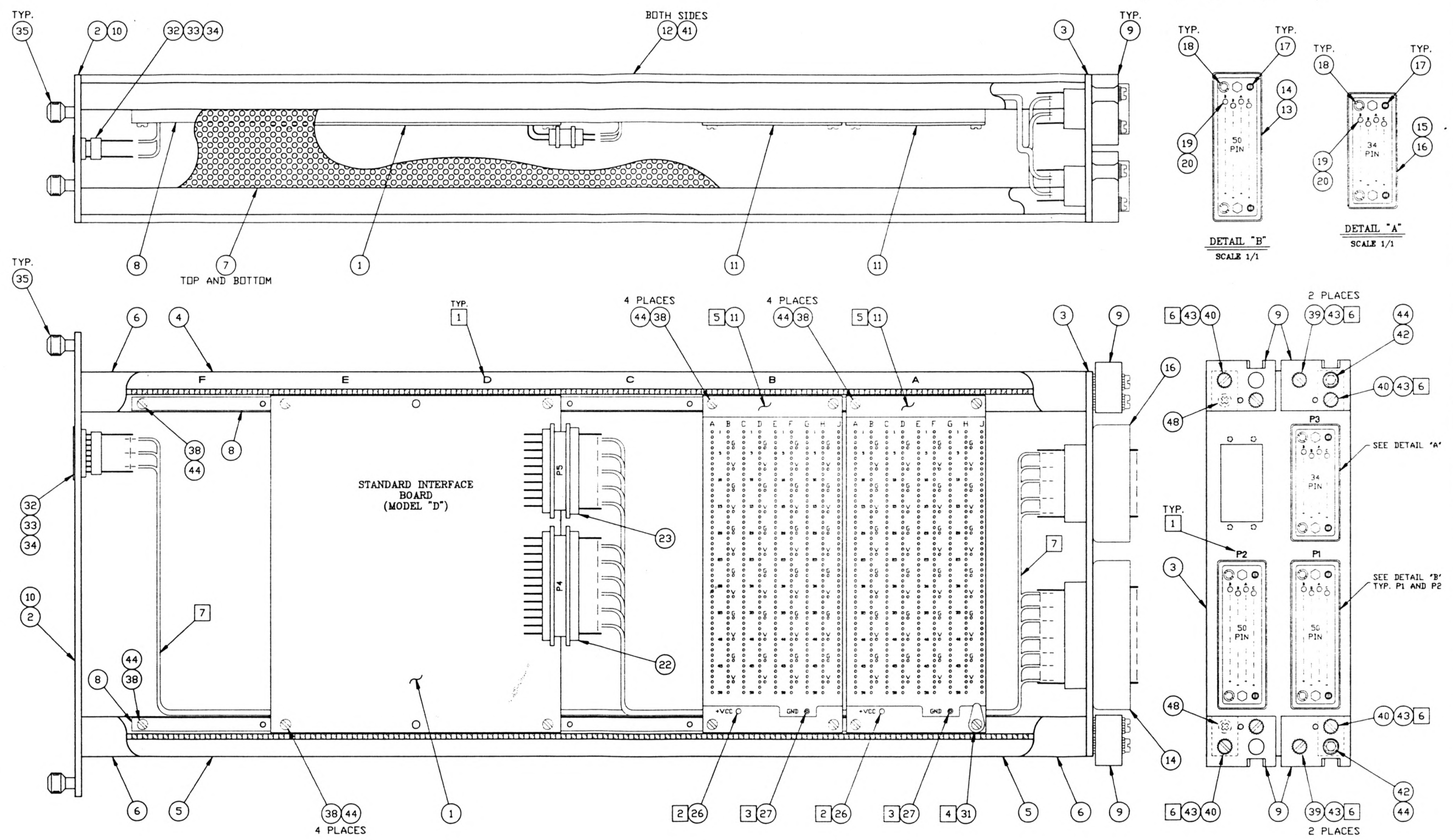
NATIONAL RADIO
ASTRONOMY
OBSERVATORY
SOCORRO, NEW MEXICO 87801

DRAWN BY ANDREATA	DATE 3-89
DESIGNED BY WEBER	DATE
APPROVED BY	DATE

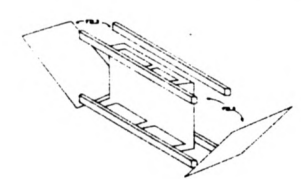
MATERIAL:	
FINISH:	
NEXT ASSY	USED ON

BRUNING 44-231 44427-2

REV	DATE	DRAWN BY	APPRVD BY	DESCRIPTION
A	2-90	ANDREATTA		ADDED LED DISPLAY ON FRONT PANEL



- NOTES :
1. MARKING SHALL BE .125 HIGH, LEGIBLE AND PERMANENT, LOCATED APPROXIMATELY AS SHOWN.
 2. SOLDER POWER TERMINAL (ITEM #26) TO POWER PLANE. (WIRE WRAP SIDE OF ITEM #11)
 3. SOLDER GND TERMINAL (ITEM #27) TO GROUND PLANE. (COMPONENT SIDE OF ITEM #11)
 4. SOLDER "SOLDER LUG" (ITEM #31) TO GROUND PLANE AND PLACE UNDER SCREW HEAD AS SHOWN.
 5. INSTALL IC'S INTO UNIVERSAL IC PANEL (ITEM #11) USING NRAD DWG. #A55007A018.
 6. WHERE TWO WASHERS (ITEM #43) ARE REQUIRED, PLACE ONE UNDER THE SCREW HEAD AND THE OTHER BETWEEN THE GUIDE BLOCK (ITEM #9) AND REAR PANEL (ITEM #3).
 7. DRESS WIRE HARNESS PATH TO PERMIT FRONT AND REAR PANELS TO BE FOLDED OUTWARD FROM TOP. (SEE FIGURE)



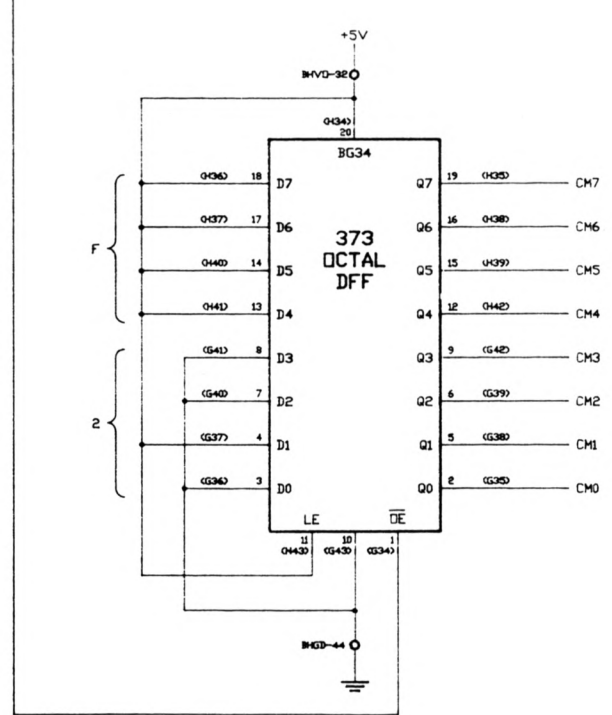
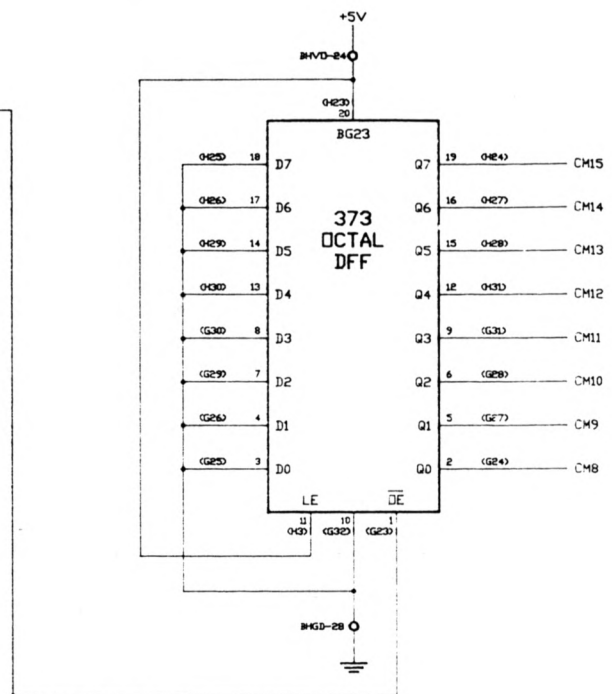
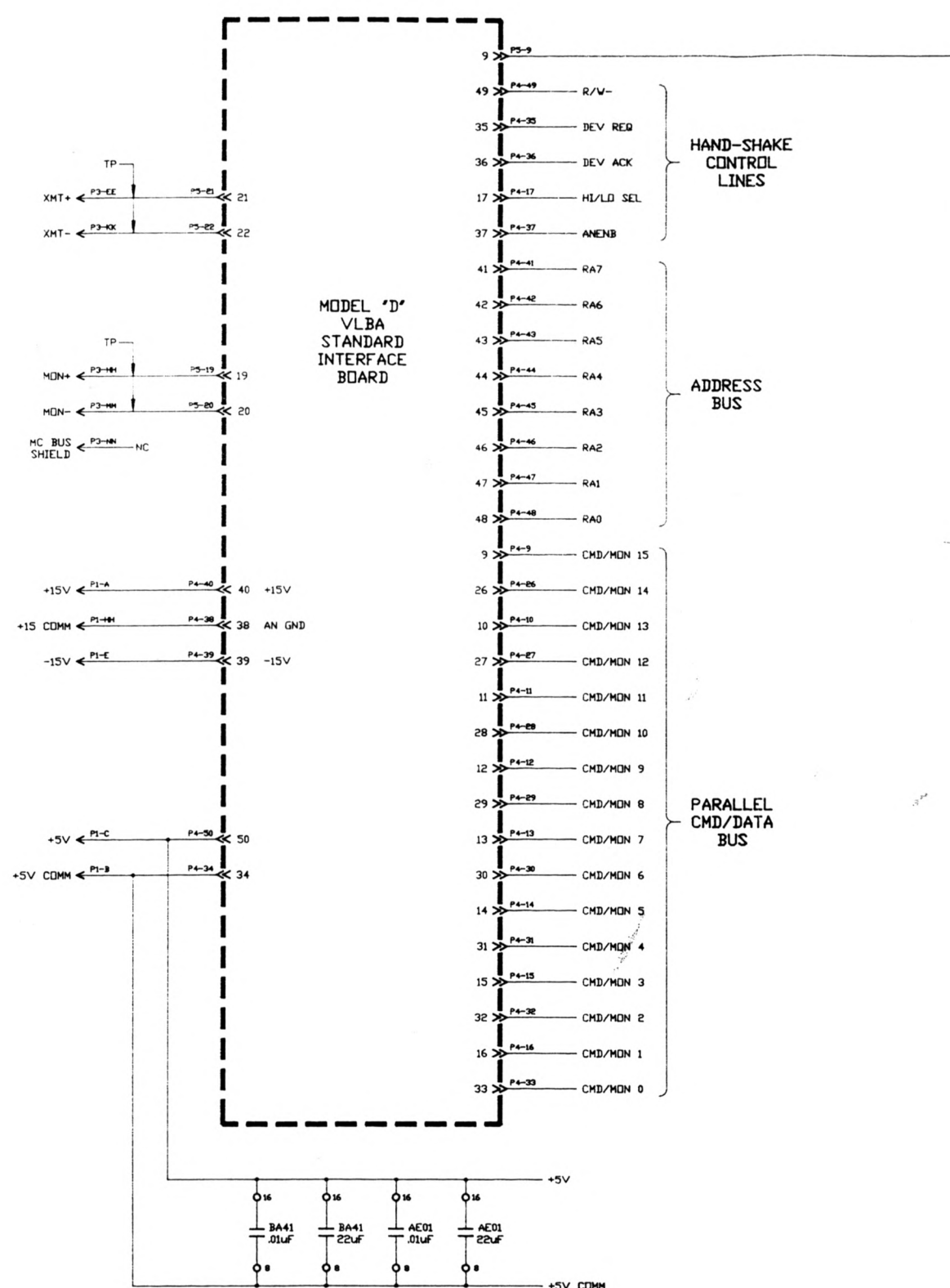
BOM - #A55007B005

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES	
TOLERANCES - ANGLES #	—
3 PLACE DECIMALS (.000) #	.005
2 PLACE DECIMALS (.00) #	—
1 PLACE DECIMALS (.0) #	—
MATERIAL :	—
FINISH :	—

V	P	S104		NATIONAL RADIO ASTRONOMY OBSERVATORY	
L	B	F-R INTERFACE		SOCORRO, NEW MEXICO 87801	
A		S104		DESIGNED BY ANDREATTA	DATE 12-87
		F-R INTERFACE MODULE ASSEMBLY		DESIGNED BY WEBER	DATE 12-87
				APPROVED BY	DATE
SHEET NUMBER	1 of 2	DRAWING NUMBER	D55007A005	REV. A	SCALE 1/1

REV	DATE	DRAWN BY	APPRVD BY	DESCRIPTION
B	1-90	ANDREATTA		REDRAWN WITH ACAD J

D
C
B
A



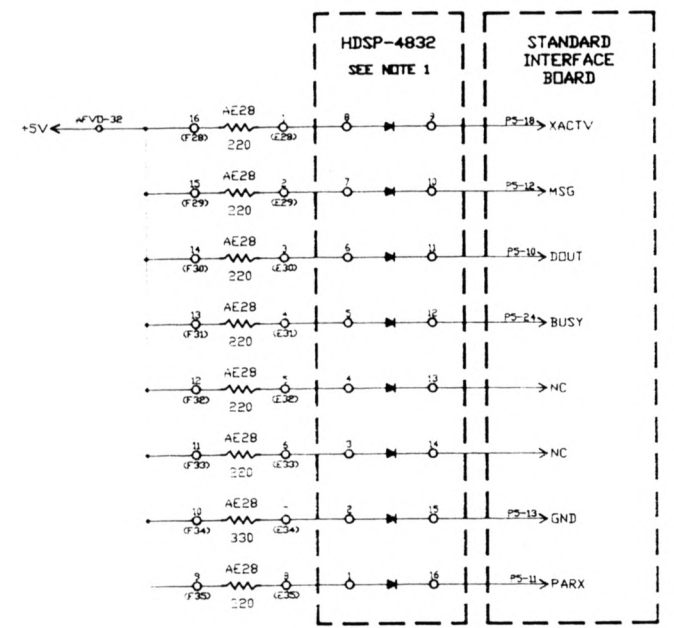
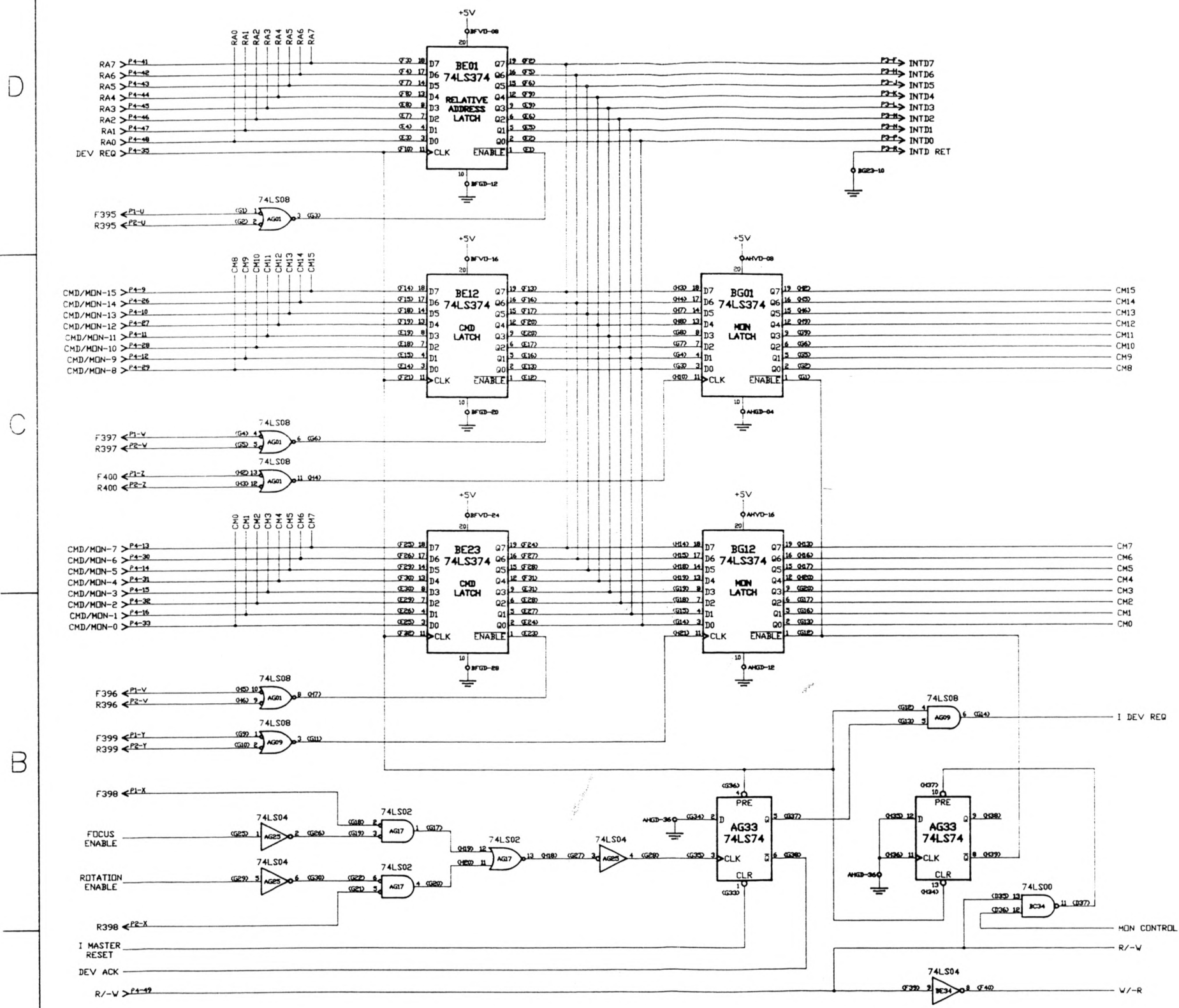
- NOTES:
1. P1 CONN PARALLEL I/O
 2. P2 CONN PARALLEL I/O
 3. P3 CONN SERIAL I/O
 4. P4 CONN INTERFACE BOARD
 5. P5 CONN INTERFACE BOARD

ID CODE LOGIC

ACAD : S104SK-1

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES		V L B A	S104 F-R SWITCHING	NATIONAL RADIO ASTRONOMY OBSERVATORY SOCORRO, NEW MEXICO 87801		
TOLERANCES: ANGLES ±	---			DATE	7-87	
3 PLACE DECIMALS (.000) ±	---	S104 F-R SWITCHING MODULE SCHEMATIC DIAGRAM	DESIGNED BY	KOSKI	DATE	7-87
2 PLACE DECIMALS (.00) ±	---		APPROVED BY		DATE	
1 PLACE DECIMALS (.0) ±	---		MATERIAL : _____		FINISH : _____	
D55007A005 ASSEMBLY		SHEET NUMBER 1 of 5		DRAWING NUMBER D55007S003		
NEXT ASSEMBLY DWG. TYPE		REV. B		SCALE		

REV	DATE	DRAWN BY	APPRVD BY	DESCRIPTION
B	1-90	ANDREATTA		REDRAWN WITH ACAD



NOTES:
 1. THE HDSP-4832 DISPLAY HAS THE FIRST TWO L.E.D.'S CUT OFF TO MAKE AN 8 POSITION DISPLAY.

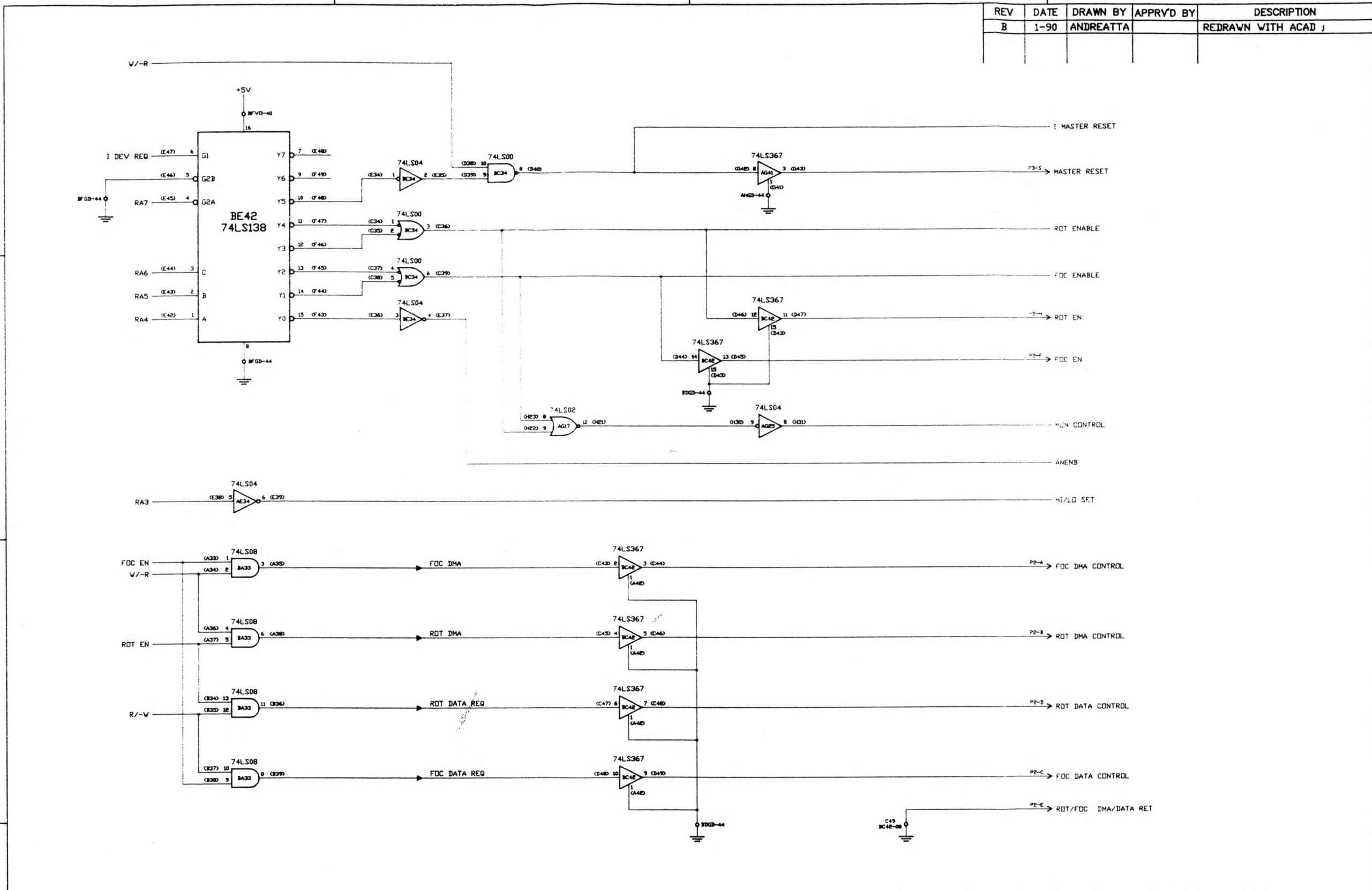
BUFFER REGISTERS

ACAD : S104SK-2

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES		V L B A	S104 F-R SWITCHING	NATIONAL RADIO ASTRONOMY OBSERVATORY SOCORRO, NEW MEXICO 87801	
TOLERANCES: ANGLES ±				DATE	DATE
3 PLACE DECIMALS (.000) ±				7-87	7-87
2 PLACE DECIMALS (.00) ±					
1 PLACE DECIMALS (.0) ±					
MATERIAL:		S104 F-R SWITCHING MODULE SCHEMATIC DIAGRAM		DESIGNED BY KOSKI	DATE
FINISH:				APPROVED BY	DATE
D55007A005	ASSEMBLY	SHEET NUMBER 2 of 5		DRAWING NUMBER	D55007S003
NEXT ASSEMBLY	DWG. TYPE	REV. B		SCALE	

REV	DATE	DRAWN BY	APPR'D BY	DESCRIPTION
B	1-90	ANDREATA		REDRAWN WITH ACAD

D
C
B
A



DMA AND DIRECT READ CONTROL LOGIC

ACAD : S104SK-3

UNLESS OTHERWISE SPECIFIED
DIMENSIONS ARE IN INCHES
TOLERANCES : ANGLES ±
3 PLACE DECIMALS (.XXX) ±
2 PLACE DECIMALS (.XX) ±
1 PLACE DECIMALS (.X) ±

V
L
B
A

S104
F-R SWITCHING

NATIONAL RADIO
ASTRONOMY
OBSERVATORY
SOCORRO, NEW MEXICO 87801

MATERIAL :
FINISH :

S104
F-R SWITCHING
MODULE
SCHEMATIC DIAGRAM

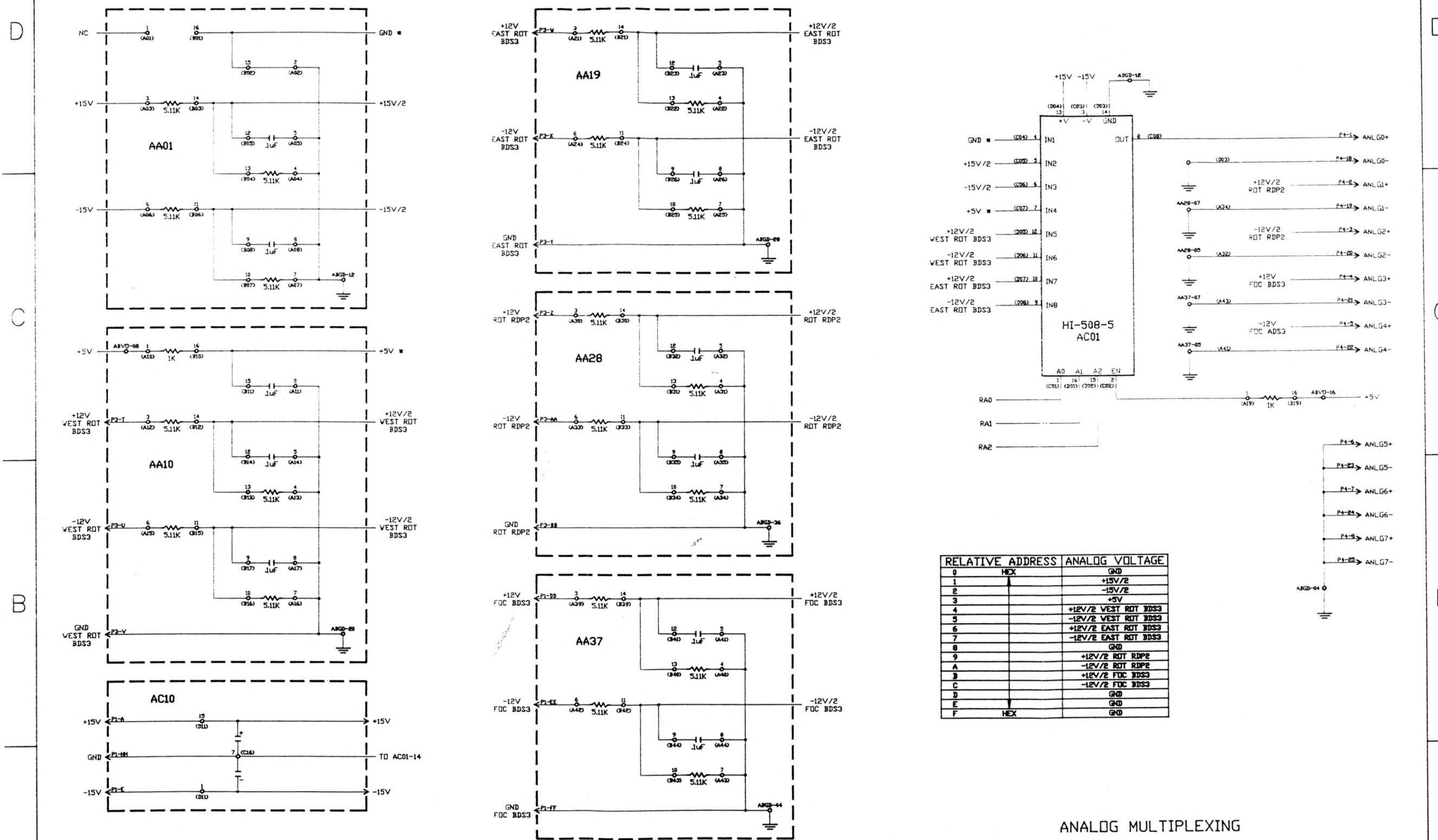
DRAWN BY ANDREATA	DATE 7-87
DESIGNED BY KOSKI	DATE 7-87
APPROVED BY	DATE

D55007A005	ASSEMBLY
NEXT ASSEMBLY	DWG. TYPE

SHEET NUMBER 3 of 5	DRAWING NUMBER D55007S003	REV. B	SCALE
---------------------	---------------------------	--------	-------

PROPERTY OF NRAO

REV	DATE	DRAWN BY	APPR'D BY	DESCRIPTION
B	1-90	ANDREATTA		REDRAWN WITH ACAD



ACAD : S104SK-5

ANALOG MULTIPLEXING

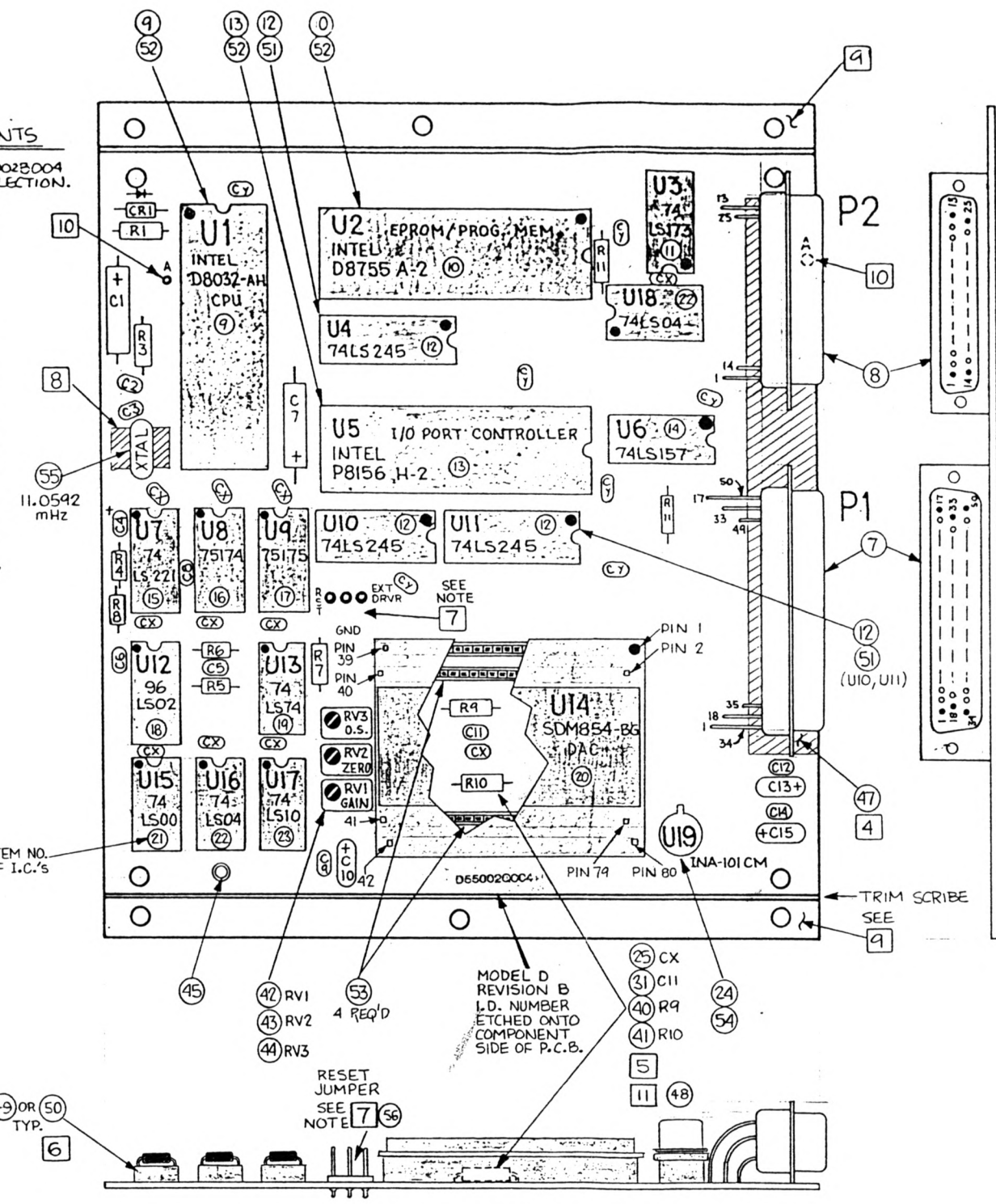
UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES		V L B A	P S104 F-R SWITCHING	NATIONAL RADIO ASTRONOMY OBSERVATORY SOCORRO, NEW MEXICO 87801	
TOLERANCES : ANGLES #				DRAWN BY ANDREATTA	DATE 7-87
3 PLACE DECIMALS (.000) #		MATERIAL :		DESIGNED BY KOSKI	DATE 7-87
2 PLACE DECIMALS (.00) #		FINISH :		APPROVED BY	DATE
1 PLACE DECIMALS (.X) #		D55007A005 ASSEMBLY		SHEET 5 of 5	
NEXT ASSEMBLY		DWG. TYPE		DRAWING NUMBER D55007S003	
				REV. B	SCALE

D
C
B
A

DISCRETE COMPONENTS

REFER TO B.O.M. A55002B004 FOR PROPER DEVICE SELECTION.

ITEM	VALUE	QTY
C1, C7	22µF	25
C2, C3	50pF	26
C4, C5	2.2µF	27
C6	220pF	28
C8, C9	0.1µF	29
C10, C13, C15	1µF	30
C11, C12, C14	.01µF	31
ALL "Cx"	.01µF	31
ALL "Cy"	.1µF	29
R1	4.7K	32
R2, R7	1K	33
R3, R11	470Ω	34
R4	51K	35
R5	39K	36
R6	15K	37
R8	12K	38
R9	24K	39
R10	240Ω	40
⊗ 1/8W OTHERS 1/4W		
RV1	100Ω POT	42
RV2	50Ω POT	43
RV3	1KΩ POT	44
CR1	1N914, SIM.	46



NOTES:

- THIS BOARD, MODEL D, REV. B, SUPERCEDES VLBA STANDARD INTERFACE BOARD D55000Q002 (IMPLIED REV. A) DEC. 1985
 - MODEL D BOARDS ARE FOR DIFFERENTIAL ANALOG HANDLING. (MODEL S BOARDS ARE SINGLE-ENDED VERSIONS)
 - P.C.B. IS ETCHED FROM 2-OUNCE COPPER (SPEC.) BOARDS
 - PLACE KAPTON 1KV DIELECTRIC TAPE (ITEM 47) ALONG COMPONENT SIDE AS SHOWN BEFORE CONNECTOR INSTALLATION FOR ISOLATION BETWEEN POWER TRACES AND CONNECTOR SHELL.
 - ITEMS 31, 40, 41 (R9, R10, C11) ARE MOUNTED ON COMPONENT SIDE, COVERED (HIDDEN) BY U14 WHEN INSTALLED.
 - ALL I.C.'S ARE SOCKETED. NOTE ORIENTATIONS.
 - USER MUST PROVIDE DESIRED CPU/BUS RESET CODING BY USING MIDGE FEMALE JUMPER HEADER (ITEM *57).
LINK RST-TO-GND FOR EXTERNAL SWITCH RESET VIA P2-23
LINK RST-TO-EXT DRV FOR EXTERNAL BUS RESET (SYSTEM RESET) VIA P2-5 (RST+) & P2-6 (RST-)
- WARNING!** POWER-ON RESET ENABLED IN BOTH CODING MODES. NO LINK INHIBITS ALL RESETS, INCLUDING POWER-ON RESET
- PLACE KAPTON TAPE (ITEM 47) UNDER CRYSTAL TO ISOLATE TRACES FROM METAL CRYSTAL ENCLOSURE.
 - BOARD DIMENSIONS FOR MOUNTING ON STD. NRAO MODULE RAILS. BOARD EDGES (TOP & BOTTOM) MAY BE TRIMMED OFF FOR MOUNTING INSIDE THE RAILS OR OTHER APPLICATION. TRIM WHERE SHOWN. DO NOT EXCEED, OR DAMAGE TO TRACES WILL RESULT.
 - TWO PLATED VIAS MARKED "A" (ZONE 2/D AND 4/D) USED TO:
a) WHEN CONNECTED TOGETHER BY SOLDERING WIRE, PLACES CPU PORT TERM "P1.7" ONTO P2-7 FOR USER APPLICATION
b) "A" AT ZONE 2/D CAN BE USED TO ADD ANY DESIRED SIGNAL TO P2-7 FOR USER APPLICATION OR TESTING. (P2 PIN 7 IS A SPARE, UNCOMMITTED PIN FOR SUCH USE)
 - A PIECE OF YELLOW WIRE-WRAP WIRE SHALL BE USED INSTEAD OF R10 B.O.M. (ITEM *41).

ASSEMBLY STEPS

- CLEAN & INSPECT BOARDS FOR ANY BAD TRACES, PLUGGED HOLES, etc
- INSTALL & SOLDER I.C. SOCKETS: (NOTE ORIENTATIONS):
14-PIN AT _U13 _U15 _U16 _U17 _U18 ITEM 49 5 REQ
16-PIN AT _U3 _U6 _U7 _U8 _U9 _U12 ITEM 50 6 REQ
20-PIN AT _U4 _U10 _U11 ITEM 51 3 REQ
40-PIN AT _U1 _U2 _U5 ITEM 52 3 REQ
20-PIN STRIP SOCKETS TO MAKE SOCKET FOR U14 ITEM 53 4 REQ
- PLACE KAPTON TAPE (ITEM 47) WHERE REQ'D - SEE NOTES 4 AND 8
- INSTALL & SOLDER CONNECTORS P1 AND P2 (ITEMS 7 AND 8)
- INSTALL & SOLDER _XTAL-1 _RV1 _RV2 _RV3 _U19 SOCKET
- INSTALL & SOLDER DISCRETE COMPONENTS WHERE SHOWN, USING TABLE ZONE 4/D AND B.O.M.
- INSTALL RESET JUMPER FOR DESIRED MODE - SEE NOTE 7 ABOVE
- CLEAN BOARD TO REMOVE SOLDER FLUX; INSPECT FOR COLD SOLDER JOINTS, SPLASHES BETWEEN TRACES, etc.
- INSTALL I.C.'S INTO SOCKETS - NOTE ORIENTATIONS.
- WRITE SERIAL NUMBER ON BOARD.

SUPPORTING DOCUMENTATION (REV. B VERSIONS)

C550025004	SCHEMATIC (LOGIC) DIAGRAM
A55002B004	BILL OF MATERIALS (B.O.M.)
D55002Q004	P.C.B. ARTWORK 2:1 SCALE
C55002P004	P.C.B. DRILL DRAWING
A55001N001	VLBA MONITOR & CONTROL BUS SPECIFICATION
A55001N002	VLBA MONITOR & CONTROL STANDARD INTERFACE SPECIFICATION

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES
TOLERANCES: ANGLES ±
3 PLACE DECIMALS (.XXX): ±
2 PLACE DECIMALS (.XX): ±
1 PLACE DECIMALS (.X): ±

VLBA STANDARD
INTERFACE BOARD
MODEL D
ASSEMBLY

NATIONAL RADIO
ASTRONOMY
OBSERVATORY
SOCORRO, NEW MEXICO 87801

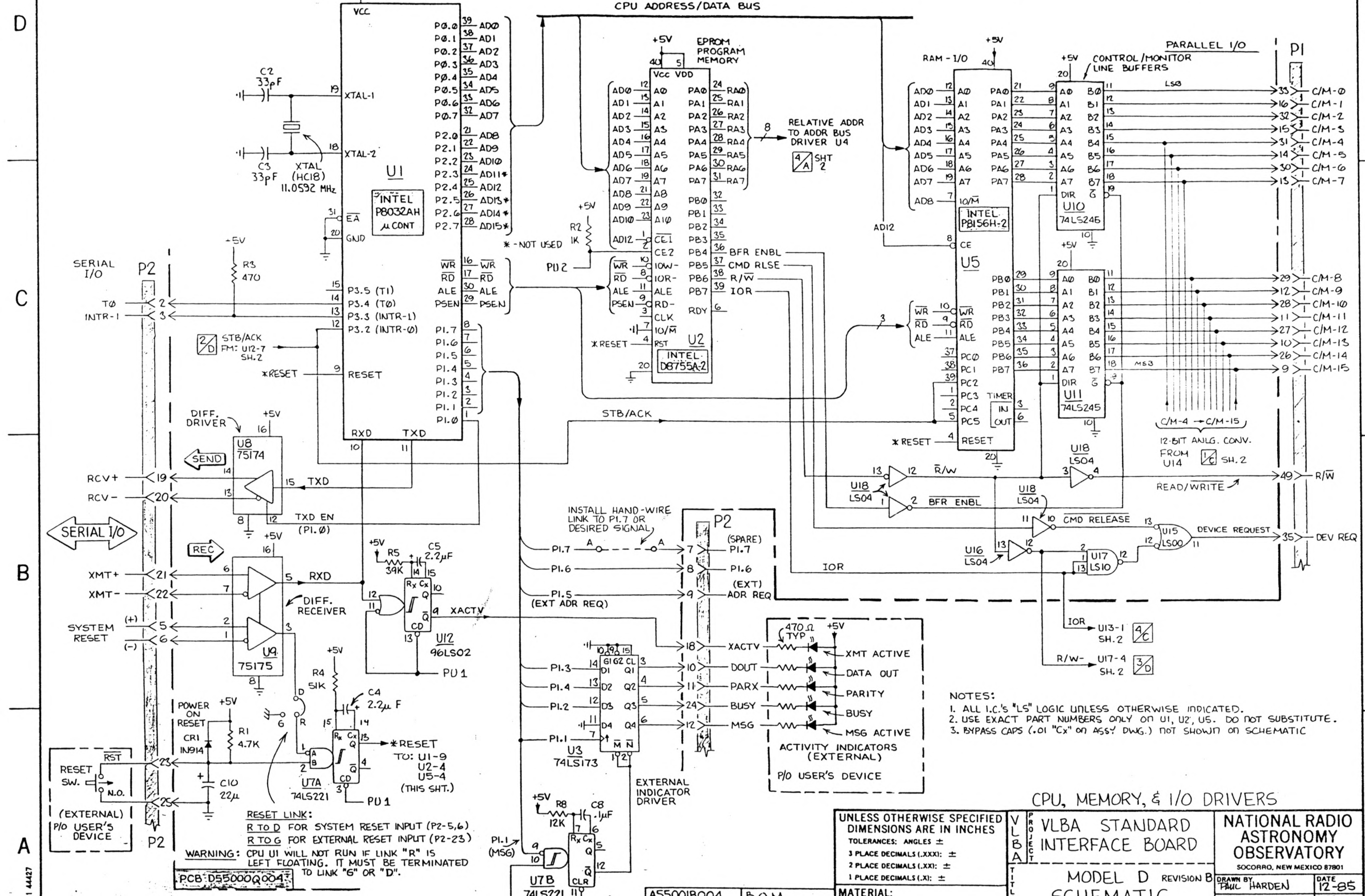
DRAWN BY Paul Harden DATE 12-85
DESIGNED BY Dave Weber DATE 5-84
APPROVED BY DATE

C550025004	SCHEMATIC
D55002Q004	PCB ARTWORK 2X
A55002B004	B.O.M.
NEXT ASSY	USED ON

MATERIAL:
FINISH:

BRUNING 44-231 44427-2

REV.	DATE	DRAWN BY	APPROVED BY	DESCRIPTION
A	12-85	Paul Harden		REDRAWN TO REFLECT REV. B BOARD CONFIGURATION.
B	2-90	ANDREATA		MINOR CORRECTIONS;



- NOTES:
1. ALL I.C.'S "LS" LOGIC UNLESS OTHERWISE INDICATED.
 2. USE EXACT PART NUMBERS ONLY ON U1, U2, U5. DO NOT SUBSTITUTE.
 3. BYPASS CAPS (.01 "Cx" ON ASSY DWG.) NOT SHOWN ON SCHEMATIC

NOTE: THIS CIRCUIT (MODEL D REV. B) SUPERCEDES PREVIOUS VERSIONS UNDER DWG. NO. C55001S002 (OR C55000S002)

RESET LINK:
 R TO D FOR SYSTEM RESET INPUT (P2-5,6)
 R TO G FOR EXTERNAL RESET INPUT (P2-23)
 WARNING: CPU U1 WILL NOT RUN IF LINK "R" IS LEFT FLOATING. IT MUST BE TERMINATED TO LINK "G" OR "D".

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES
 TOLERANCES: ANGLES ±
 3 PLACE DECIMALS (.XXX): ±
 2 PLACE DECIMALS (.XX): ±
 1 PLACE DECIMALS (.X): ±

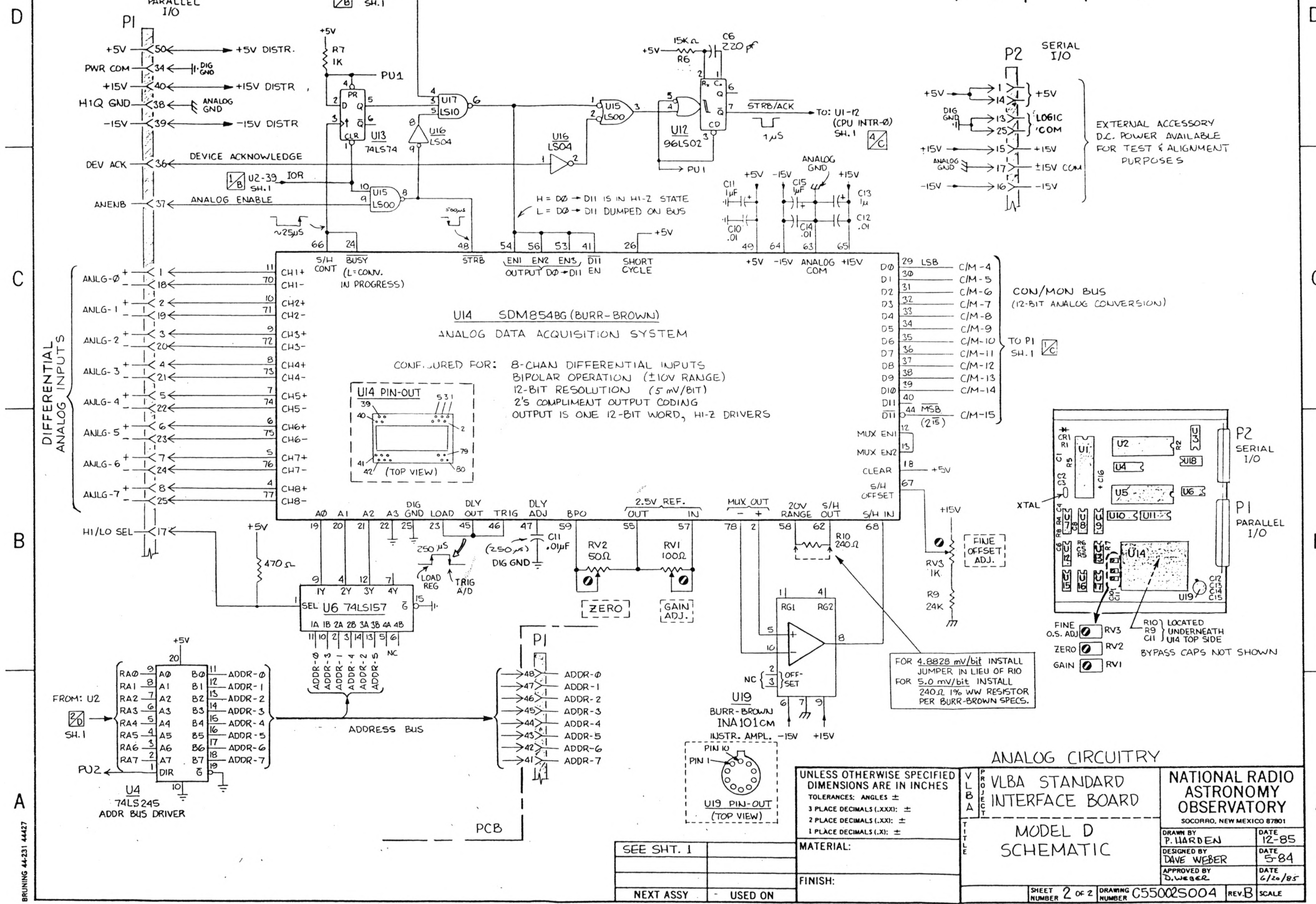
CPU, MEMORY, & I/O DRIVERS

V L B A PROJECT	VLBA STANDARD INTERFACE BOARD	NATIONAL RADIO ASTRONOMY OBSERVATORY SOCORRO, NEW MEXICO 87801
MODEL D	REVISION B	DATE 12-85
SCHEMATIC		DESIGNED BY DAVE WEBER DATE 5-84
		APPROVED BY D. WEGE DATE 2/20/85
SHEET NUMBER 1 OF 2	DRAWING NUMBER C55002S004	REV. B SCALE

AS500IB004	B.O.M.	MATERIAL:
C5500IA004	ASBY DWG	FINISH:
C5500IQ004	PCB ARTWORK	
NEXT ASSY	USED ON	

BRUNING 44-231 44427

REV.	DATE	DRAWN BY	APPROVED BY	DESCRIPTION
A	12-85	HARDEN		SEE SHEET 1
B	2-90	ANDREATA		MINOR CORRECTIONS



BRUNING 44-231 44427

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES
 TOLERANCES: ANGLES ±
 3 PLACE DECIMALS (.XXX): ±
 2 PLACE DECIMALS (.XX): ±
 1 PLACE DECIMALS (.X): ±

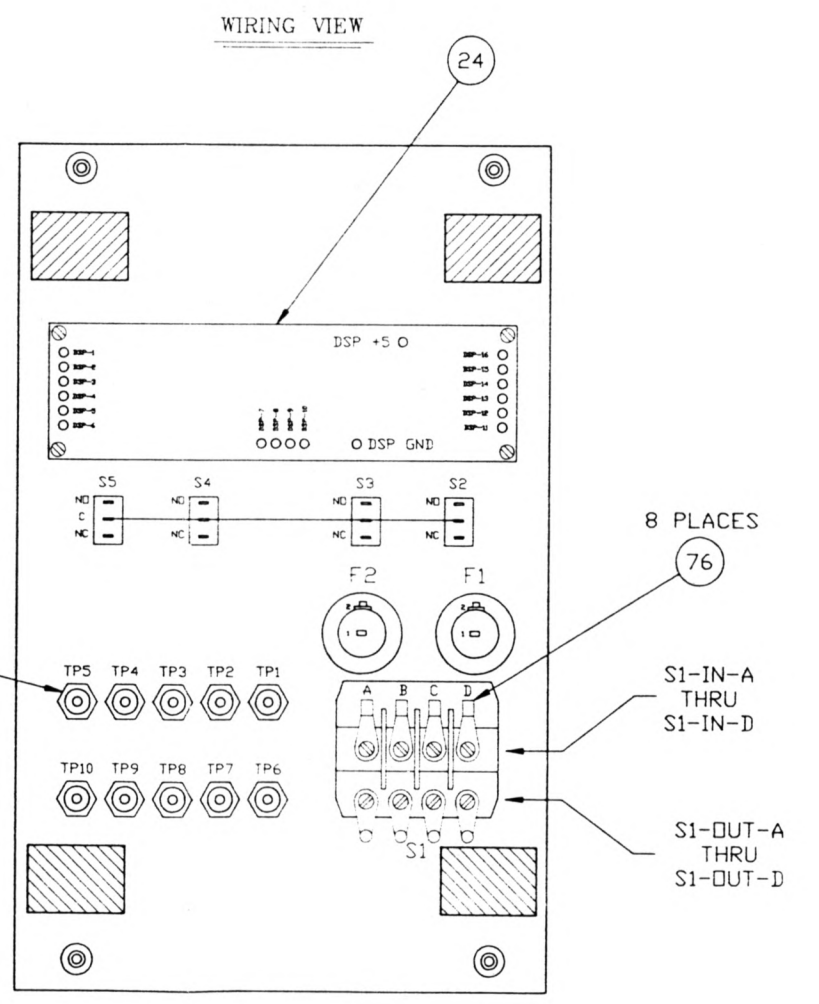
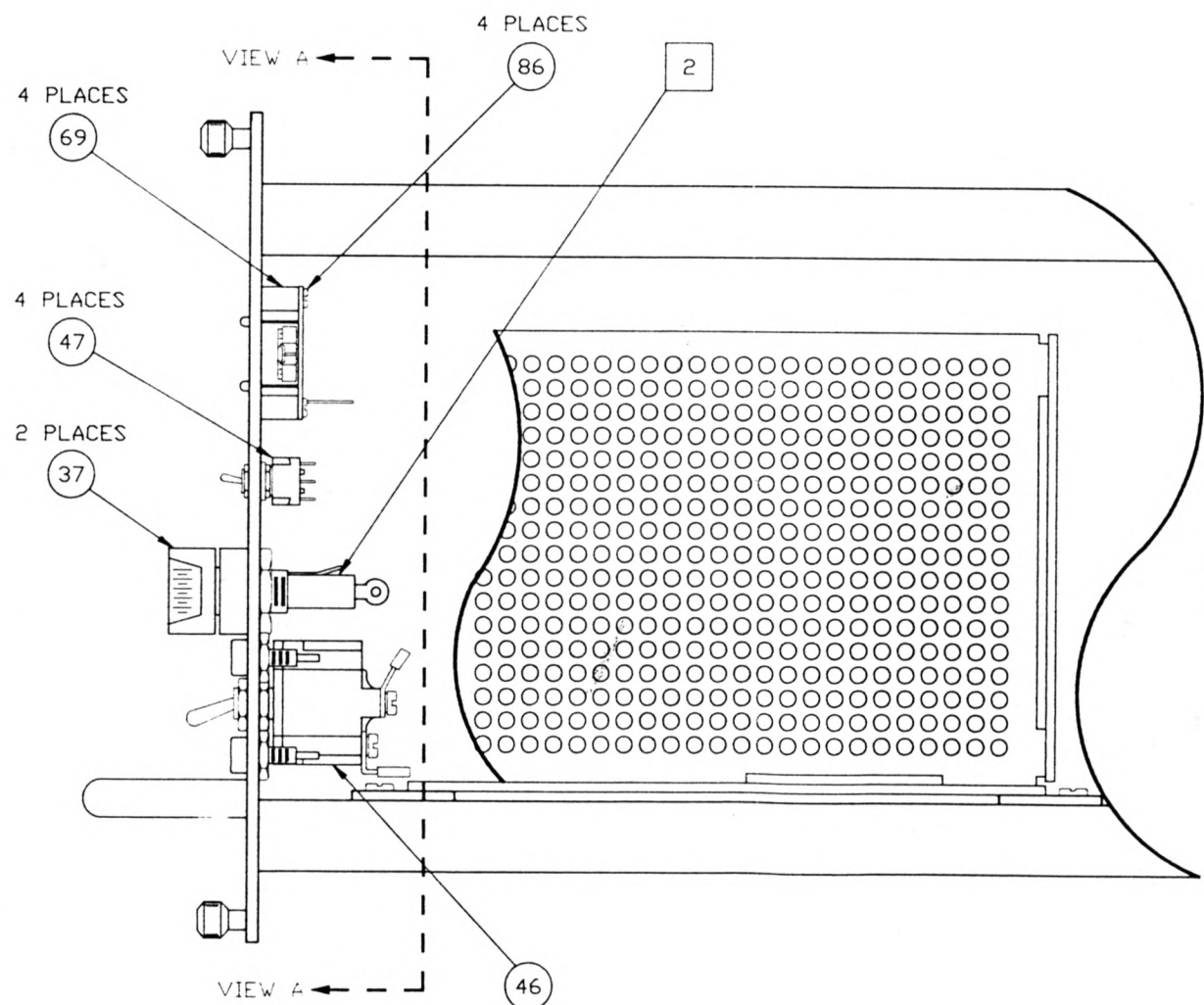
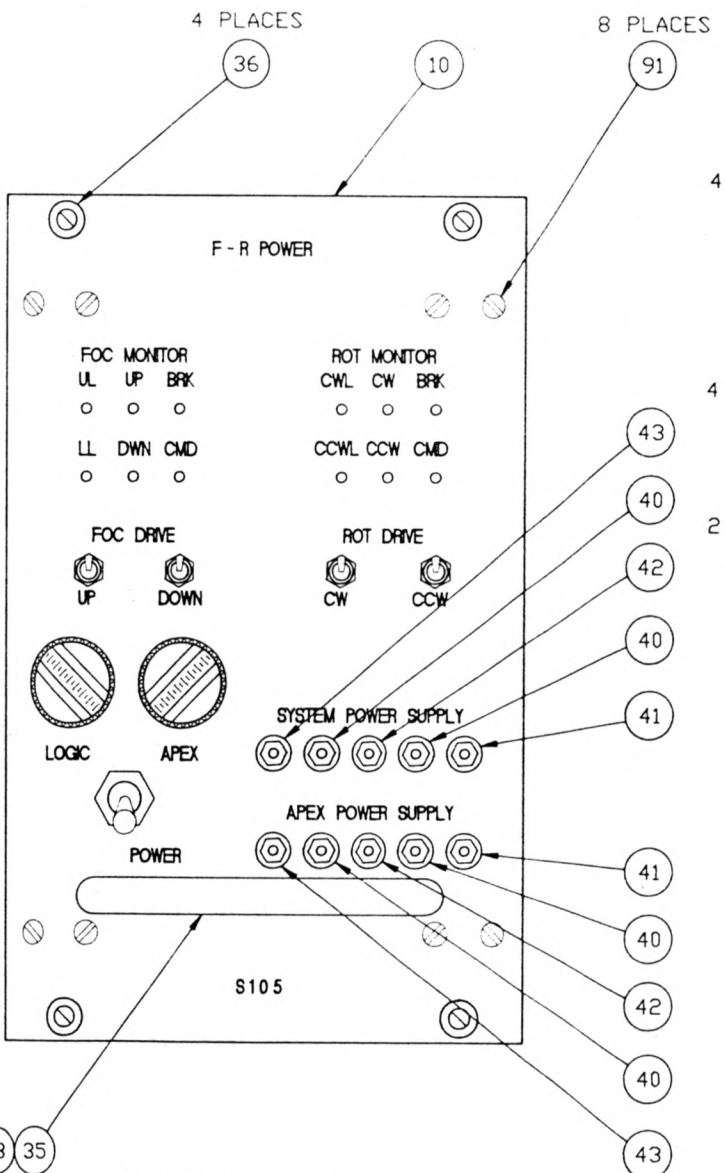
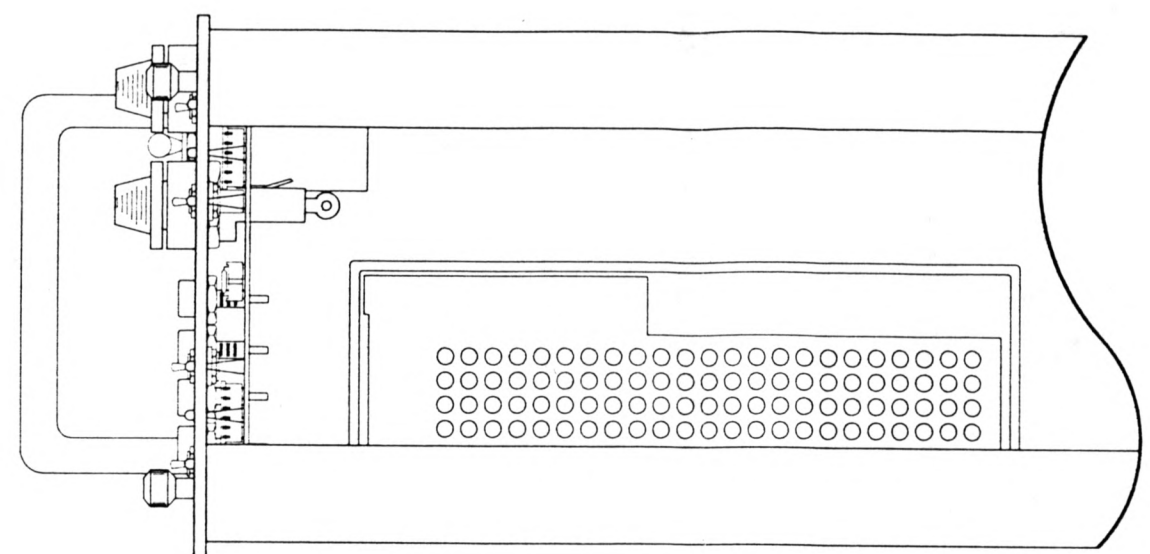
V L B A PROJECT TITLE
 VLBA STANDARD INTERFACE BOARD
 MODEL D SCHEMATIC

NATIONAL RADIO ASTRONOMY OBSERVATORY
 SOCORRO, NEW MEXICO 87801
 DRAWN BY P. HARDEN DATE 12-85
 DESIGNED BY DAVE WEBER DATE 5-84
 APPROVED BY D. WEBER DATE 6/20/85

SEE SHT. 1	
NEXT ASSY	USED ON

MATERIAL:	
FINISH:	

SHEET NUMBER 2 OF 2	DRAWING NUMBER C55002S004	REV B	SCALE
---------------------	---------------------------	-------	-------



FRONT PANEL

VIEW "A-A"

NOTES :

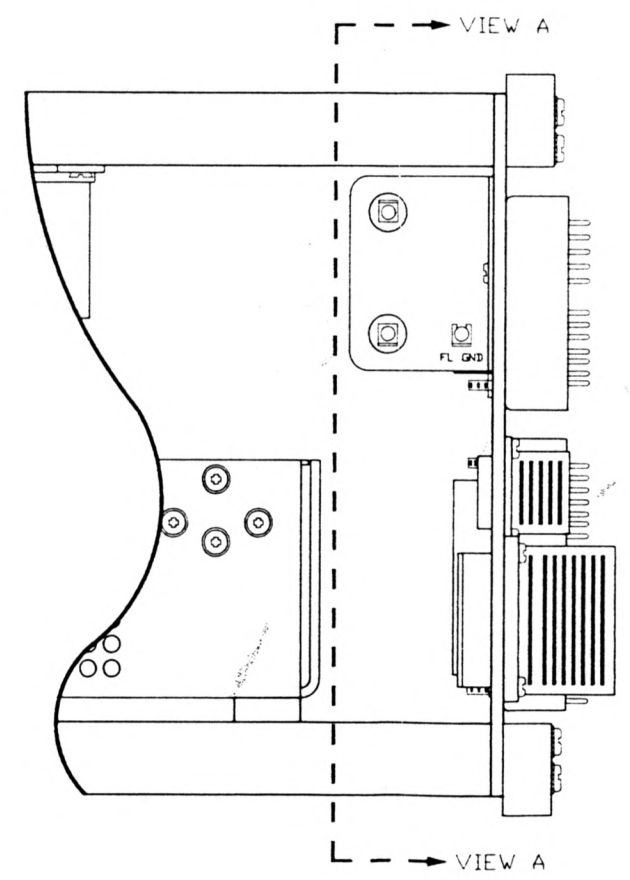
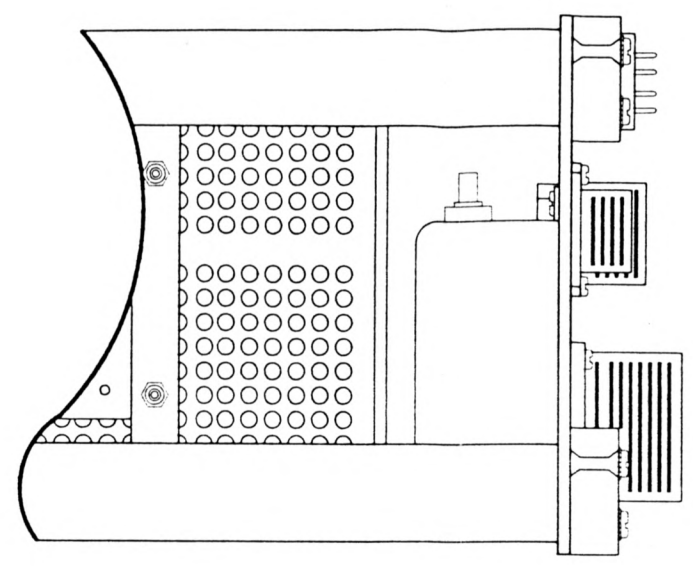
- 1 USE HEAT SHRINK TUBING (ITEM #72) OVER TP1 THRU TP10 AFTER SOLDERING. (SEE WIRE LIST A55007W16, SHEET 5, LINE 90)(TYP).
- 2 USE HEAT SHRINK TUBING (ITEM #70) OVER FUSE HOLDERS AFTER SOLDERING.

ACAD : S105ASY1

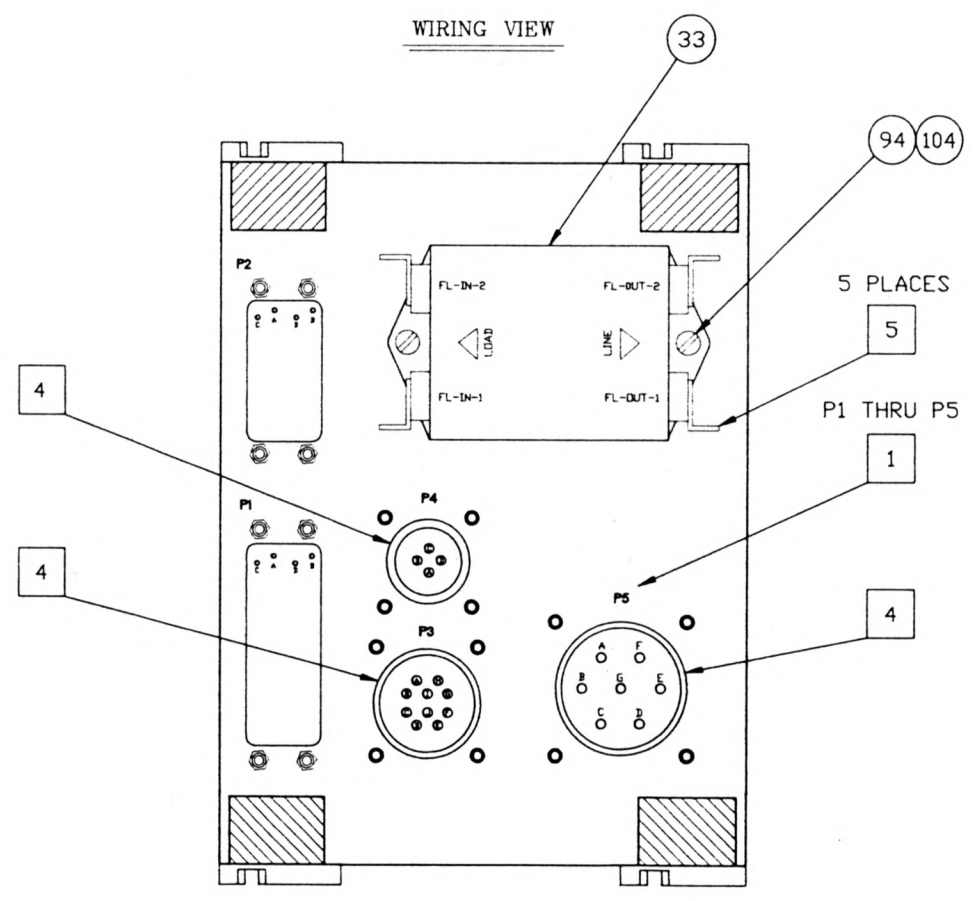
B.O.M. - #A55007B006

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES TOLERANCES ANGLES = 3 PLACE DECIMALS .XXX ± 2 PLACE DECIMALS .XX ± 1 PLACE DECIMALS .X ±	V L B U I A	S105 F-R POWER	NATIONAL RADIO ASTRONOMY OBSERVATORY SOCORRO, NEW MEXICO 87801
MATERIAL:		S105 F-R POWER MODULE ASSEMBLY	DRAWN BY ANDRETTA DATE 1-88
FINISH:			DESIGNED BY KOSKI DATE 1-88
			APPROVED BY DATE

NEXT ASSY	USED ON



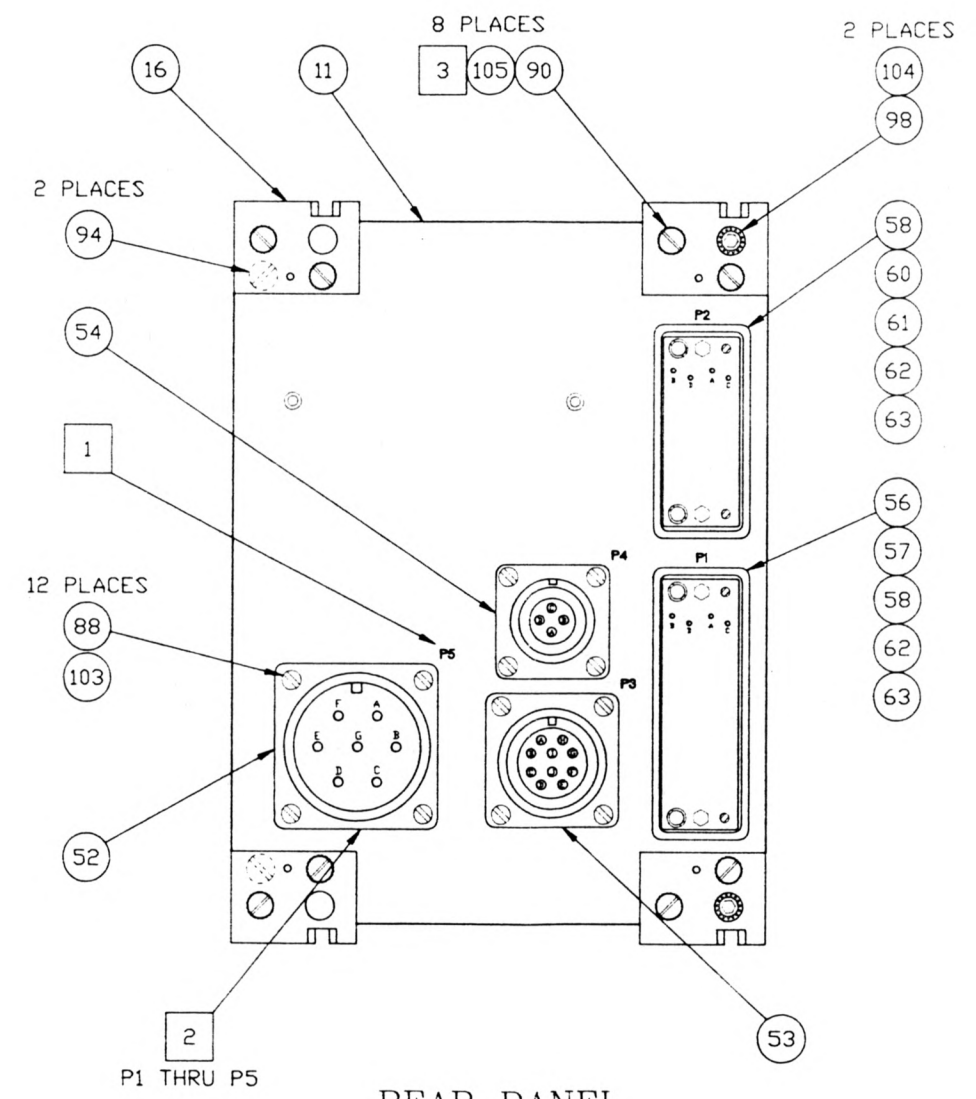
WIRING VIEW



VIEW "A-A"

NOTES :

- 1 MARK DESIGNATIONS IN LOCATIONS SHOWN WITH INDELIBLE INK OR TRANSFERS.
- 2 INSTALL KEYING AS SHOWN.
- 3 INSTALL EXTERIOR TOOTH LOCK WASHER (ITEM #105) UNDER SCREW HEADS AND BETWEEN BLOCK AND PANEL.
- 4 USE HEAT SHRINK TUBING (ITEM #72) ON P3,P4, AND P5 CONTACTS AFTER SOLDERING.
- 5 USE HEAT SHRINK TUBING (ITEM #71) ON FILTER TERMINALS AFTER SOLDERING.

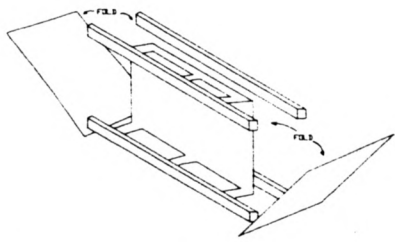
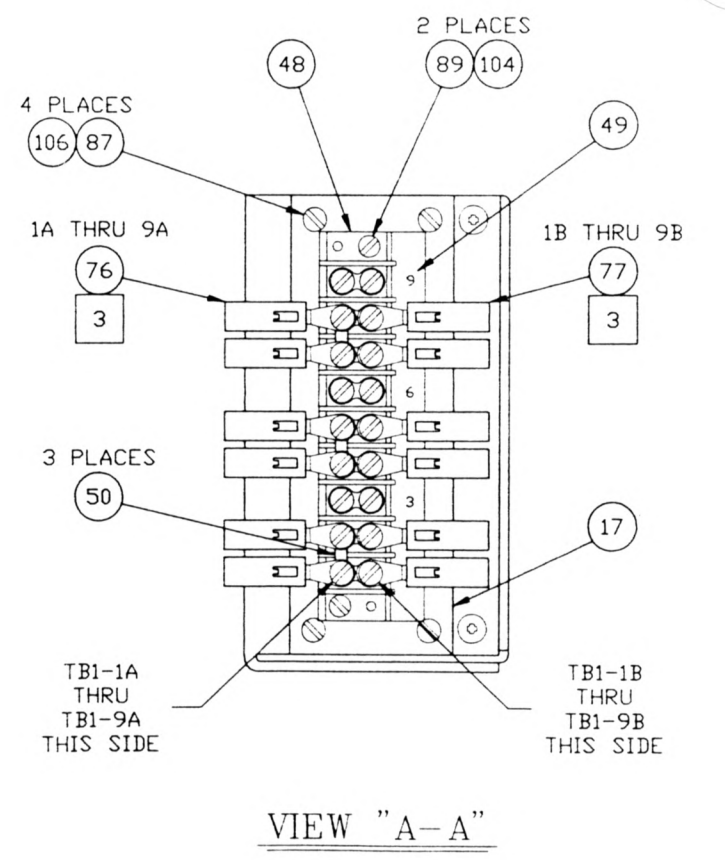
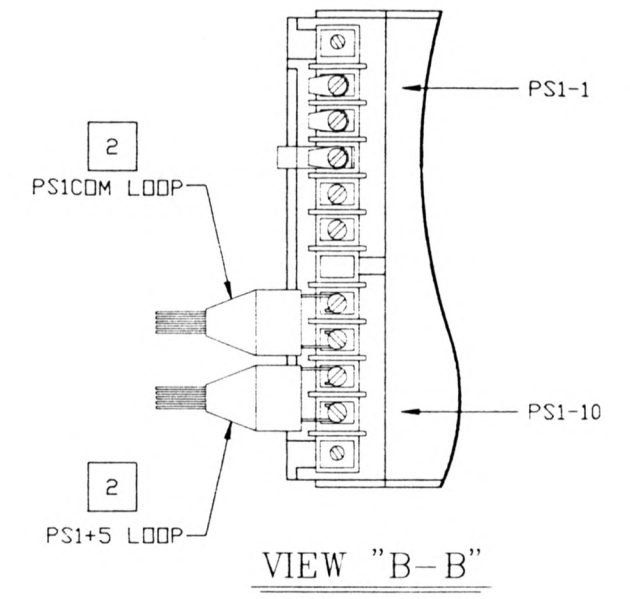
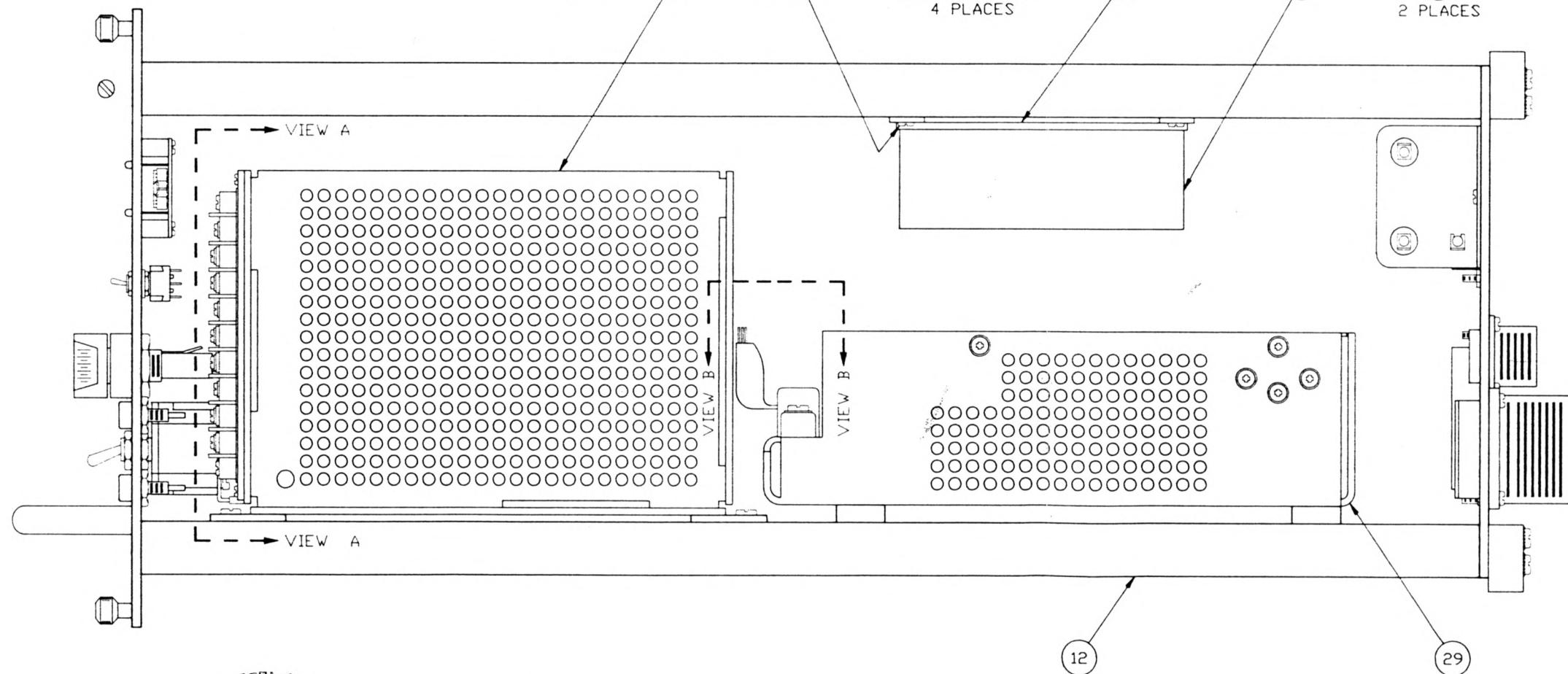
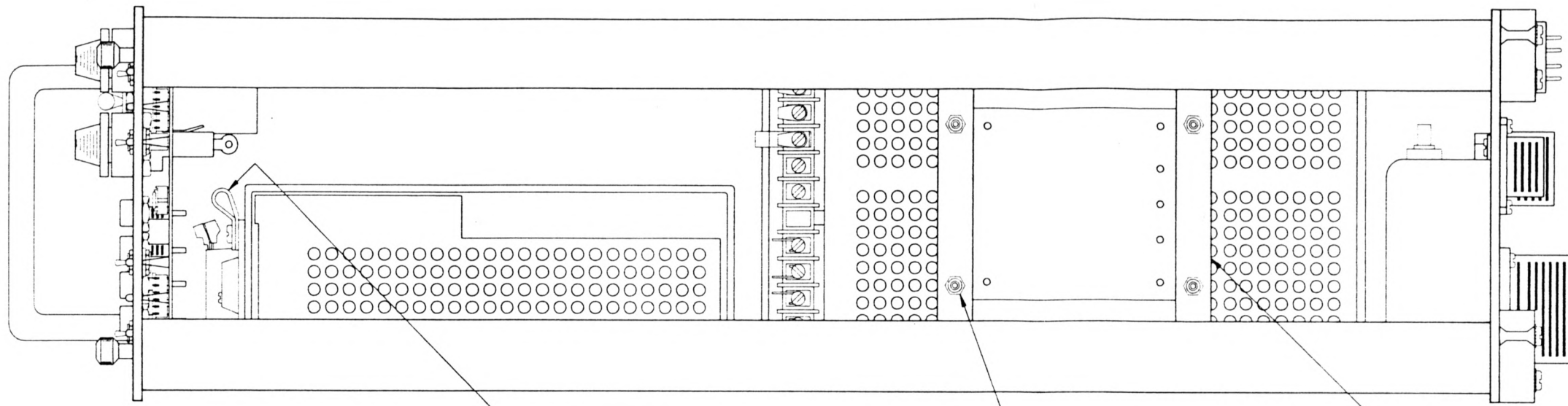


REAR PANEL

ACAD : S105ASY2

B.O.M. - #A55007E006

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES		V L B A	S105 F-R POWER	NATIONAL RADIO ASTRONOMY OBSERVATORY SOCORHO NEW MEXICO 87801		
TOLERANCES ANGLES =					DATE	1-88
1 PLACE DECIMALS .XXX =					DESIGNED BY	KOSKI
2 PLACE DECIMALS .XX =					APPROVED BY	
1 PLACE DECIMALS X =		S105 F-R POWER MODULE ASSEMBLY		DATE		
MATERIAL		DRAWING NUMBER		D55007A006		
FINISH		SHEET NUMBER		2 OF 5		
NEXT ASSY	USED ON	DRAWING NUMBER		D55007A006		
				REV.	SCALE 1:1	



- NOTES :
- 1 COUNTERSINK PS3 MTG. BRACKET (ITEM #32) FOR #6-32 FLAT HEAD SCREW.
 - 2 SEE WIRE LIST #A55007W016, SHEET 9, WIRE 190, NOTE.
 - 3 AS SPECIFIED ON WIRE LIST #A55007W016.

ACAD : S105ASY3

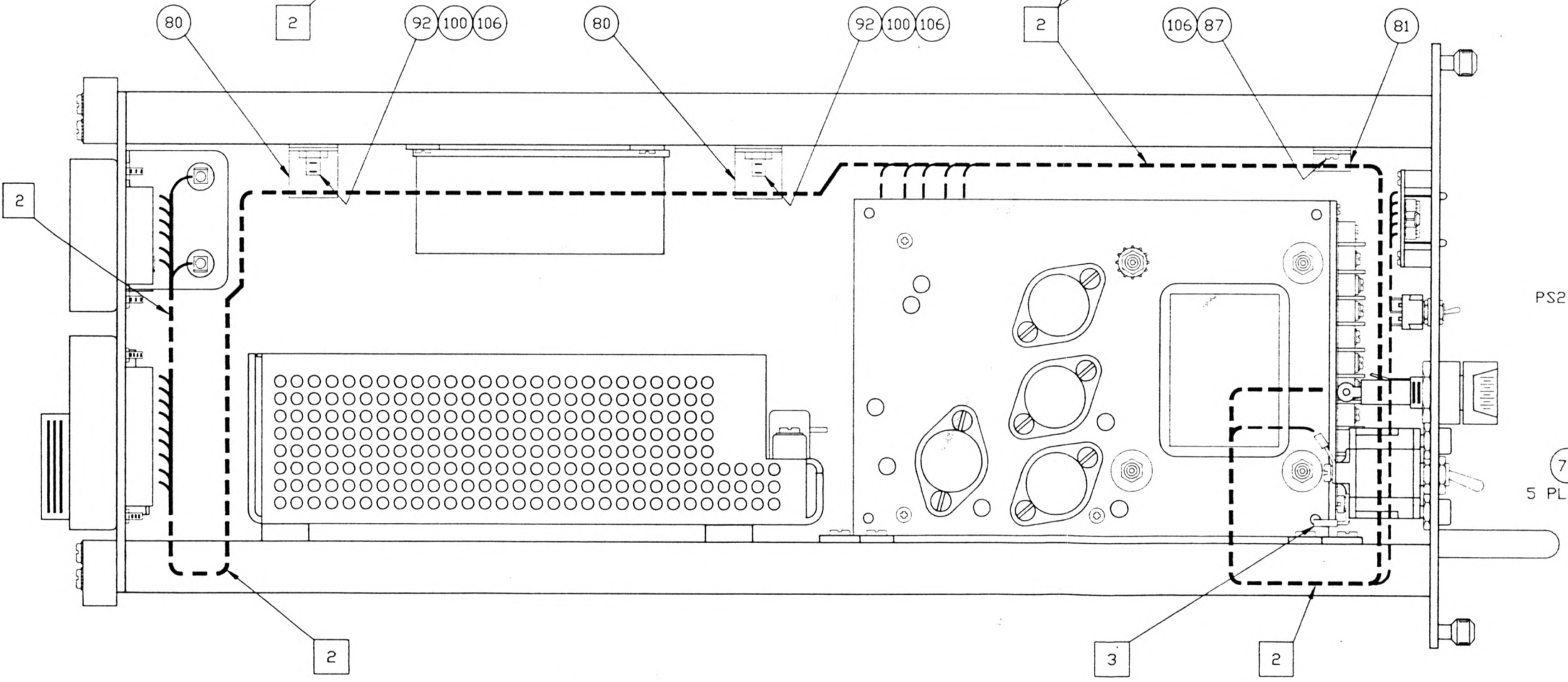
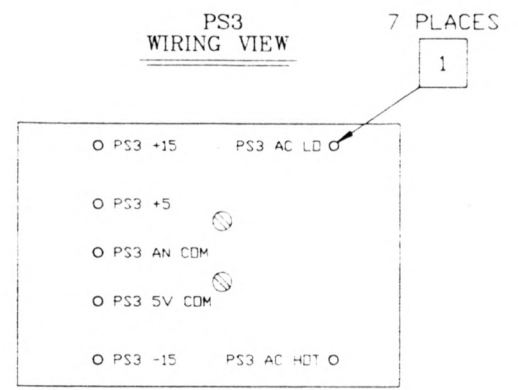
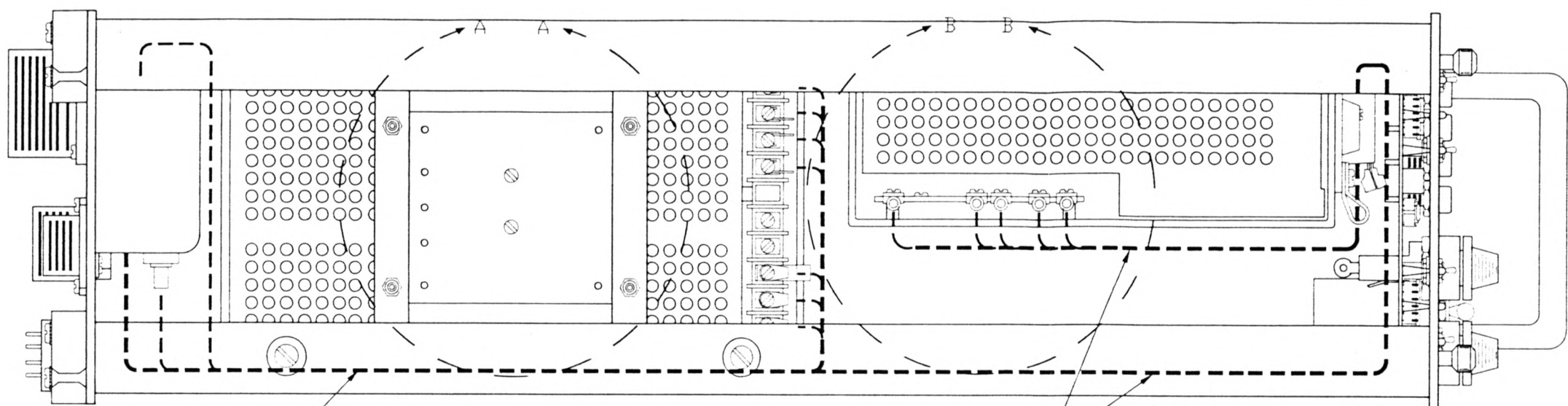
FIGURE "1"

BOM -#A55007B006

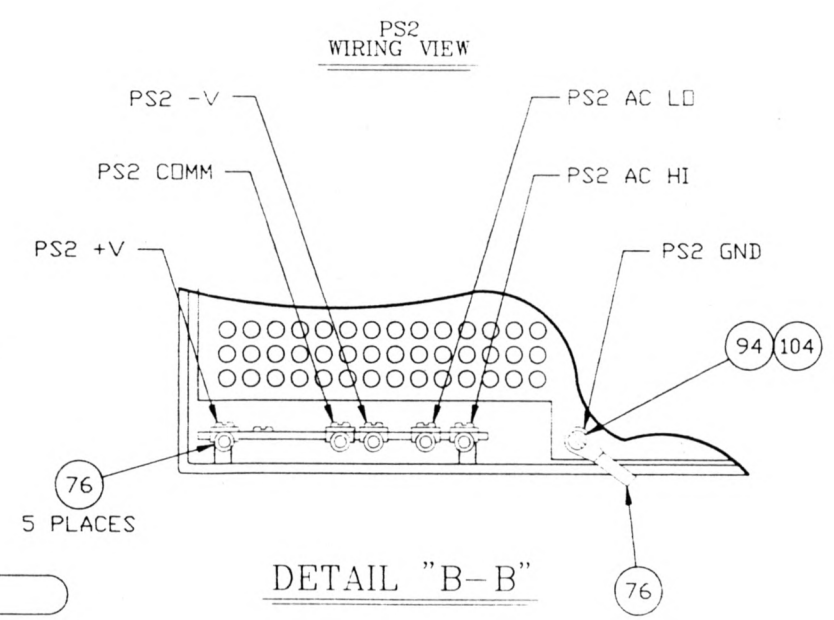
UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES TOLERANCES: ANGLES ± — 3 PLACE DECIMALS: XXX ± — 2 PLACE DECIMALS: XX ± — 1 PLACE DECIMALS: X ± —	V L B A J	S105	DATE
		F-R POWER	1-88
MATERIAL: _____	FINISH: _____	S105	DATE
		F-R POWER	1-88
MODULE ASSEMBLY		DESIGNED BY	DATE
		APPROVED BY	DATE
NEXT ASSY	USED ON	SHEET NUMBER 3 OF 5	DRAWING NUMBER A55007A006
		REV.	SCALE 1:1

NATIONAL RADIO ASTRONOMY OBSERVATORY
SOCORRO, NEW MEXICO 87801

DRAWN BY ANDREATTA
DESIGNED BY KOSKI
APPROVED BY



DETAIL "A-A"



DETAIL "B-B"

- NOTES :
- 1 USE HEAT SHRINK TUBING (ITEM #71) AFTER SOLDERING WIRES ON PS3.
 - 2 DRESS WIRE HARNESS PATH TO PERMIT FRONT AND REAR PANELS TO BE FOLDED OUTWARD FROM TOP TO PERMIT ACCESS TO FRONT AND REAR PANEL COMPONENTS. (SEE FIGURE "1")
 - 3 ON S1-OUT-A THRU S1-OUT-D BEND LUGS (ITEM #76) UP AS SHOWN.

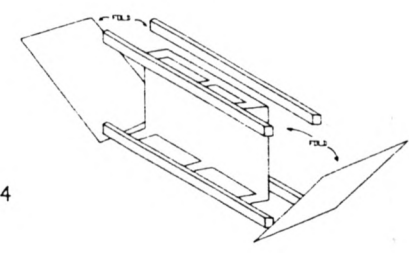


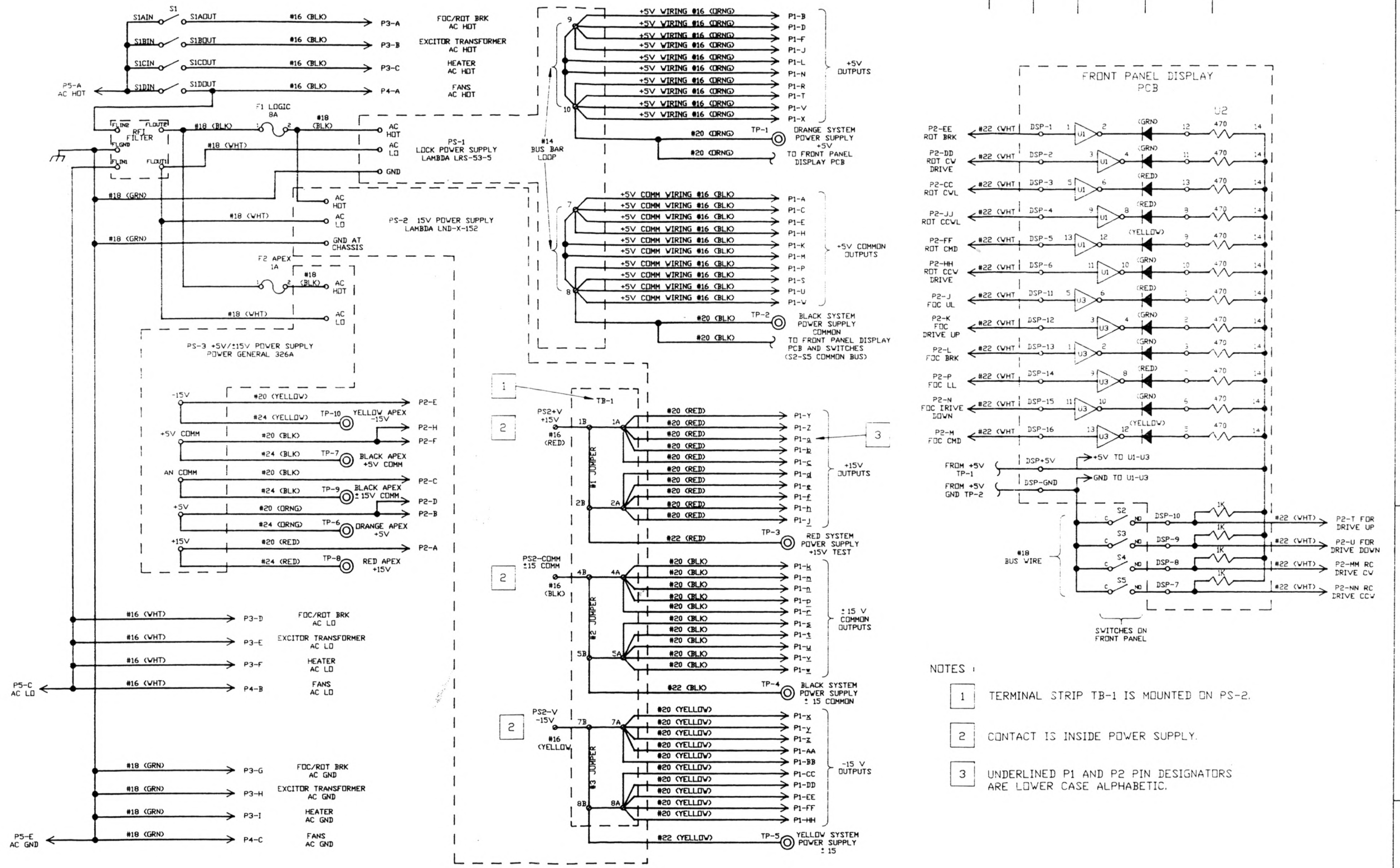
FIGURE "1"

ACAD : S105ASY4

B.O.M. - *A55007B006

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES		V L B A	S105 F-R POWER	NATIONAL RADIO ASTRONOMY OBSERVATORY	
TOLERANCES	ANGLES			SOCIETY NEW MEXICO 87801	
3 PLACE DECIMALS - AX				DESIGNED BY	DATE
2 PLACE DECIMALS - AP				ANDREATTA	1-88
1 PLACE DECIMALS - X		DESIGNED BY	DATE		
		KOSKI	1-88		
		APPROVED BY	DATE		
MATERIAL		S105 F-R POWER MODULE ASSEMBLY			
FINISH					
		SHEET NUMBER	DRAWING NUMBER		
		4 OF 5	055007A006		
		REV.	SCALE: 1		

REV	DATE	DRAWN BY	APPR'VD BY	DESCRIPTION

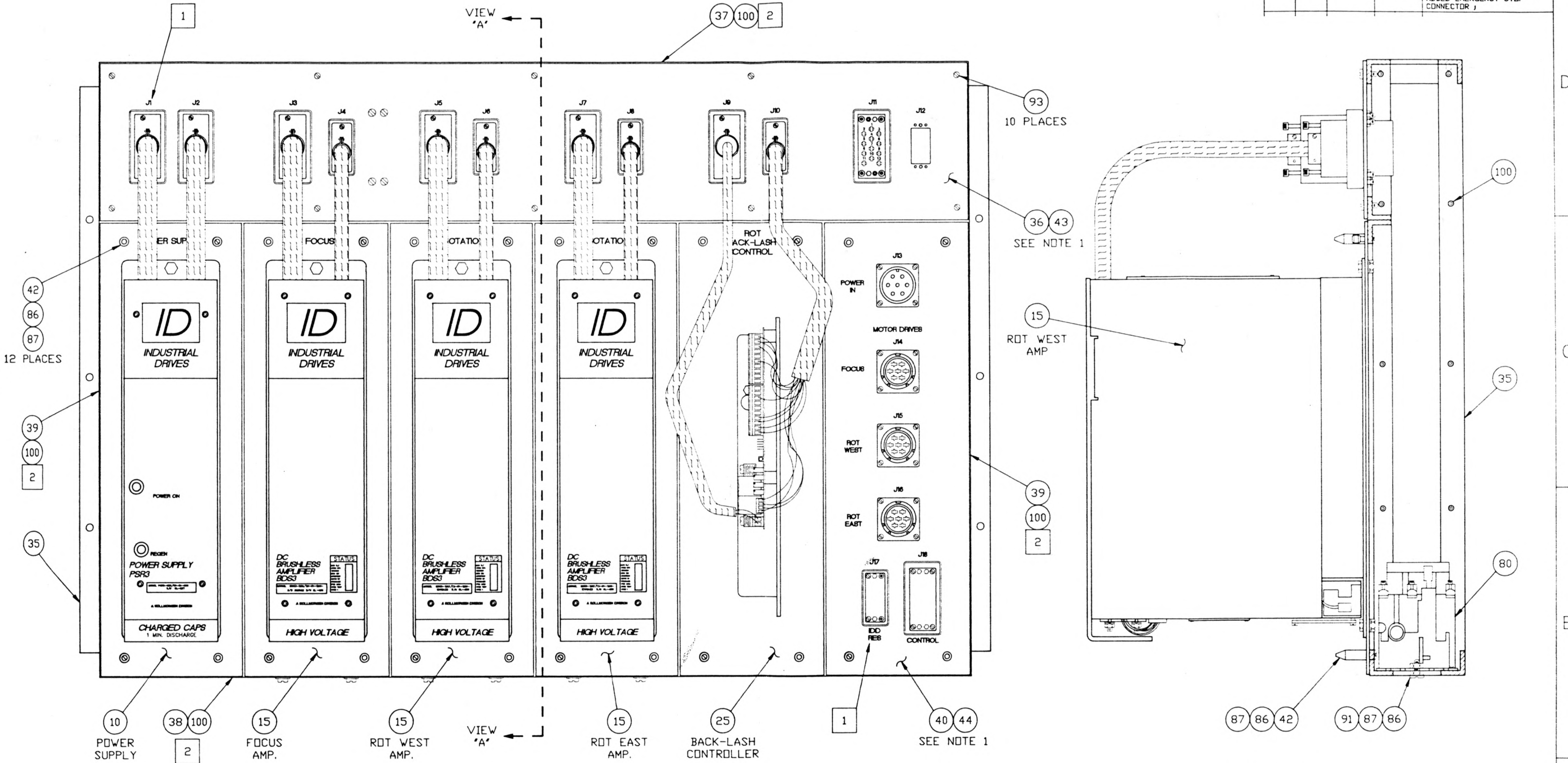


- NOTES:
- 1 TERMINAL STRIP TB-1 IS MOUNTED ON PS-2.
 - 2 CONTACT IS INSIDE POWER SUPPLY.
 - 3 UNDERLINED P1 AND P2 PIN DESIGNATORS ARE LOWER CASE ALPHABETIC.

ACAD S105SK-1

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES		V L B A	S105 F-R POWER	NATIONAL RADIO ASTRONOMY OBSERVATORY SOCORRO, NEW MEXICO 87801	
TOLERANCES: ANGLES ±	---			DRAWN BY ANDREATTA	DATE 2-88
3 PLACE DECIMALS (.000) ±	---	S105 F-R POWER MODULE SCHEMATIC DIAGRAM		DESIGNED BY WEBER	DATE 2-87
2 PLACE DECIMALS (.00) ±	---	MATERIAL: _____		APPROVED BY	DATE
1 PLACE DECIMALS (.X) ±	---	FINISH: _____		SHEET NUMBER 1 of 1	
D55007A006 NEXT ASSEMBLY		ASSEMBLY DWG. TYPE		DRAWING NUMBER D55007S001	
				REV.	SCALE

REV	DATE	DRAWN BY	APPRVD BY	DESCRIPTION
A	5-90	ANDREATTA		ADDED 3 PHASE CONTACTS ; ADDED EMERGENCY STOP CONNECTOR ;



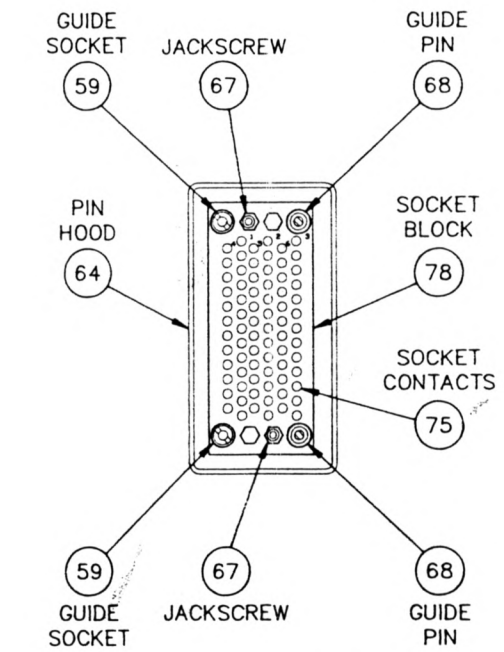
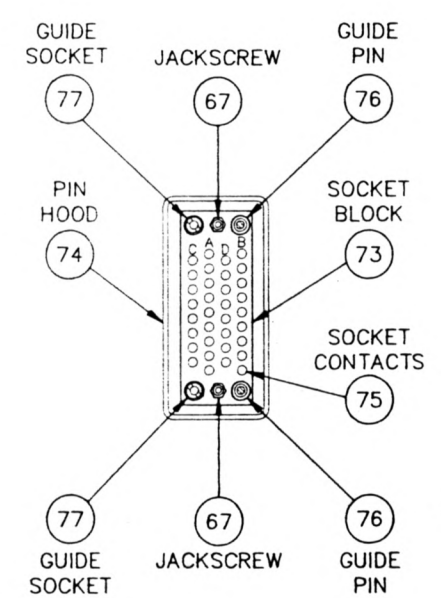
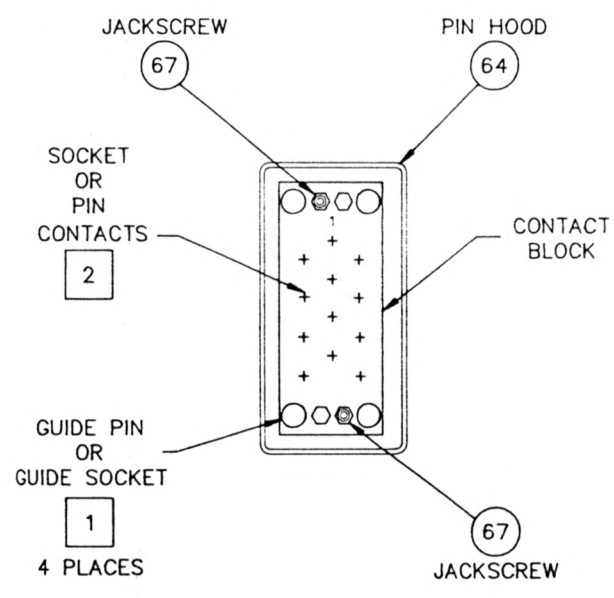
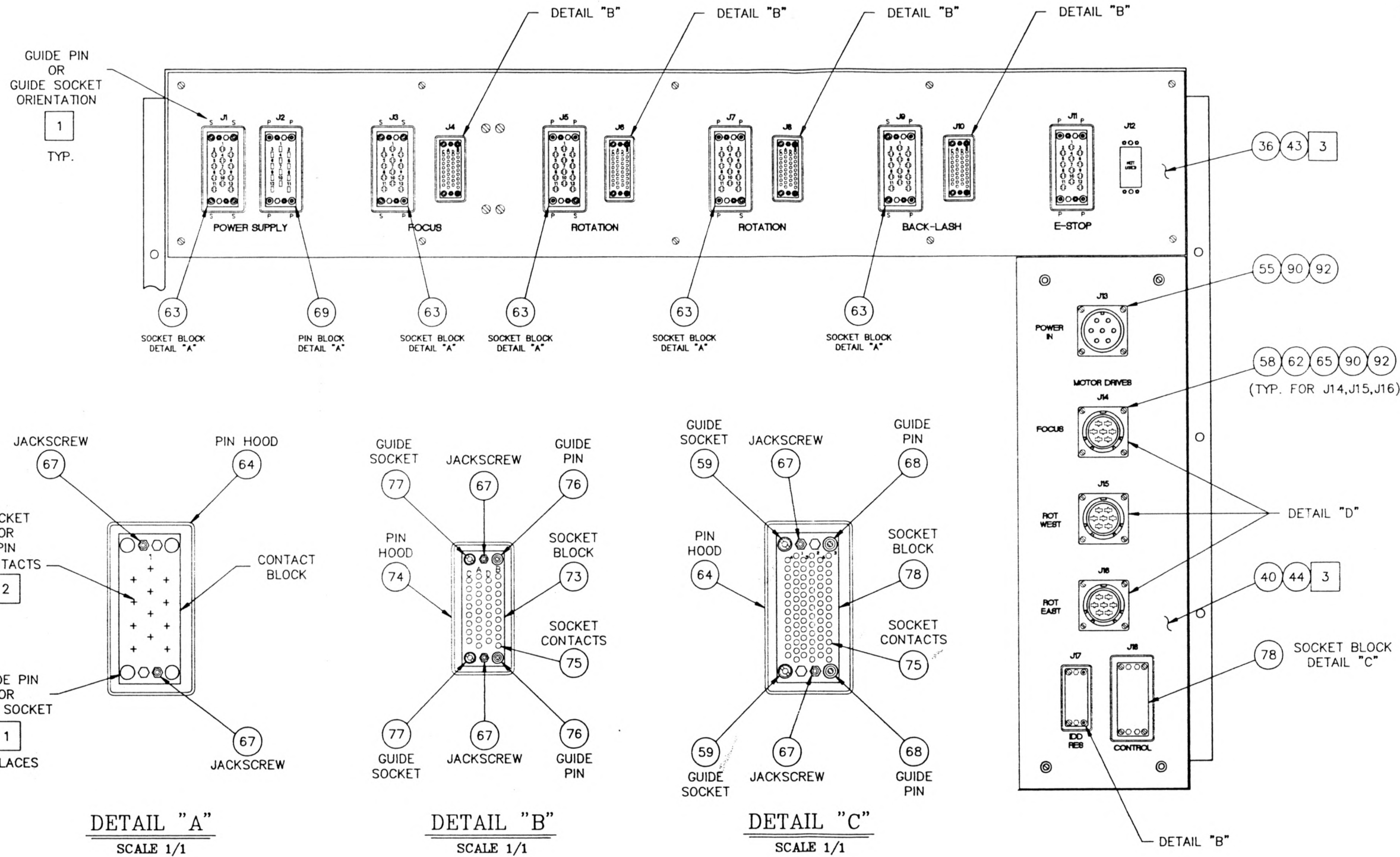
- NOTES :
- 1 AMPLIFIER CONNECTOR PANEL AND I/O CONNECTOR PANEL TO BE SILKSCREENED BEFORE ASSEMBLY.
 - 2 BOTTOM, TOP, AND SIDE PLATES (ITEM #38, #37, #39) ARE ATTACHED TO CHASSIS FRAME WITH 1/8" PDP RIVETS (ITEM #100).

VIEW "A-A"

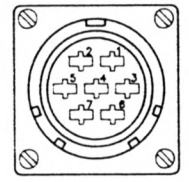
BOM - #A55007B014

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES		V L B A	FOCUS ROTATION	NATIONAL RADIO ASTRONOMY OBSERVATORY SOCORRO, NEW MEXICO 87801	
TOLERANCES - ANGLES -				DRAWN BY ANDREATTA	DATE 3-88
3 PLACE DECIMALS (.001) -				DESIGNED BY WEBER	DATE 3-88
2 PLACE DECIMALS (.01) -				APPROVED BY	DATE
1 PLACE DECIMALS (.1) -		MATERIAL :		SHEET NUMBER 1 of 3	
FINISH :		DRAWING NUMBER D55007A022		REV. A SCALE 1/2	
NEXT ASSEMBLY		DWG. TYPE			

REV	DATE	DRAWN BY	APPRVD BY	DESCRIPTION
A	5-90	ANDREATA		ADDED 3 PHASE CONTACTS ; ADDED EMERGENCY STOP CONNECTOR ;



KEYING CONFIGURATION



KEYING SOCKETS	J14	J15	J16
5	P	P	E
6	P	E	P
7	E	P	P

P=KEYING PLUG (ITEM #62)
E=CAVITY EMPTY

DETAIL "D"
SCALE 1/1

NOTES :

- USE EITHER P=GUIDE PIN (ITEM #68) OR S=GUIDE SOCKET (ITEM #59) IN ADJACENT CORNER OF CONTACT BLOCK.
- FOR PIN BLOCK USE PIN CONTACT (ITEM #70) AND FOR SOCKET BLOCK USE SOCKET CONTACT (ITEM #65, #10-8 AWG) AND (ITEM #66, #16-12 AWG) APPROPRIATE FOR WIRE SIZES SPECIFIED IN WIRE LIST #A55007W004.
- AMPLIFIER CONNECTOR PANEL (ITEM #36) AND I/O CONNECTOR PANEL (ITEM #40) TO BE SILKSCREENED BEFORE ASSEMBLY.

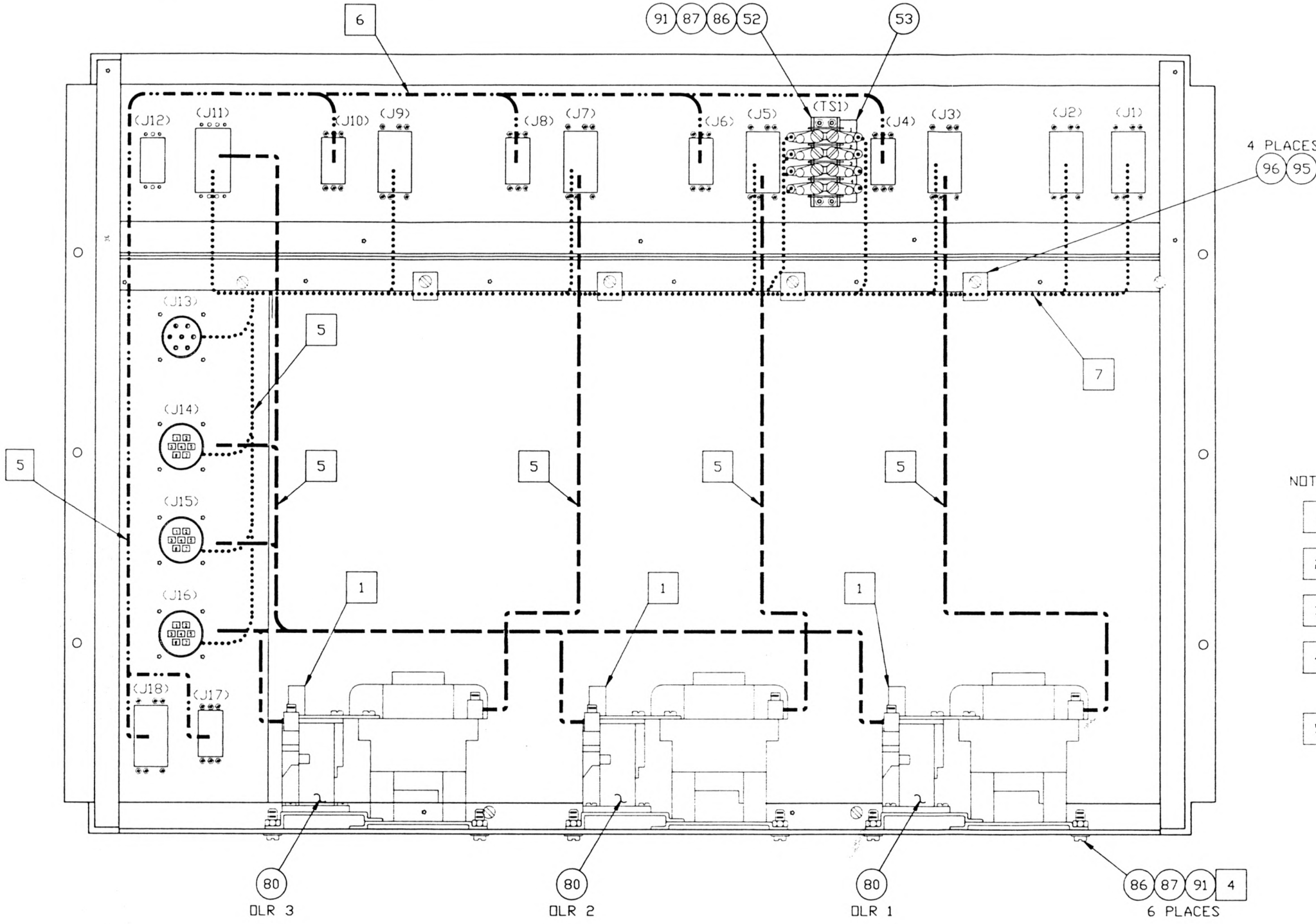
BOM - #A55007B014

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES
TOLERANCES : ANGLES #
3 PLACE DECIMALS (ASD) #
2 PLACE DECIMALS (ASD) #
1 PLACE DECIMALS (ASD) #

V L B A	FOCUS ROTATION	NATIONAL RADIO ASTRONOMY OBSERVATORY SOCORRO, NEW MEXICO 87801
DRAWN BY	ANDREATA	DATE 3-88
DESIGNED BY	WEBER	DATE 3-88
APPROVED BY		DATE
SHEET NUMBER	2 of 3	DRAWING NUMBER D55007A022
REV.	A	SCALE 1/2

MATERIAL :	
FINISH :	
NEXT ASSEMBLY	DWG. TYPE

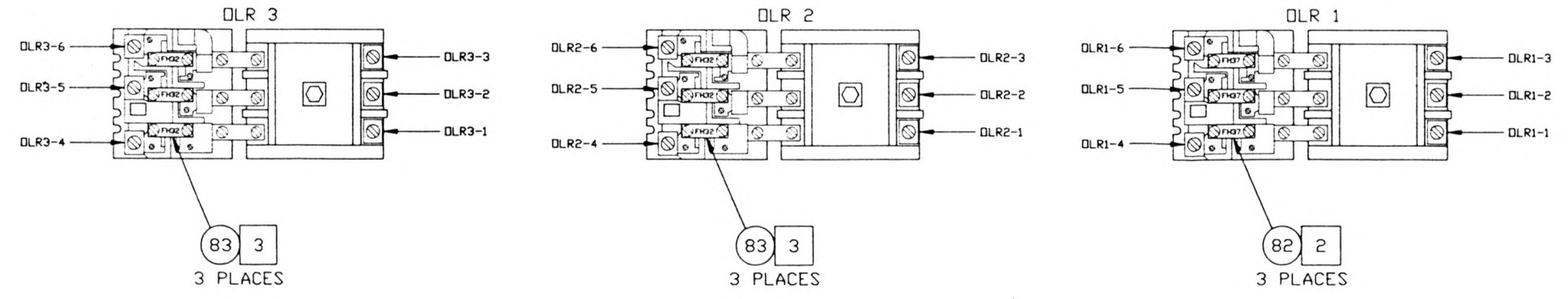
REV	DATE	DRAWN BY	APPRVD BY	DESCRIPTION
A	5-90	ANDREATA		ADDED 3 PHASE CONTACTS ; ADDED EMERGENCY STOP CONNECTOR ;



HARNES LEGEND	
	= MOTOR POWER HARNES
	= DC AND AC POWER HARNES
	= SIGNAL WIRE HARNES

NOTES :

- 1 BEFORE INSTALLATION IN CHASSIS, SET RELAY RESET PLUNGER TO 'AUTO RESET' POSITION. (SEE RELAY DATA SHEET)
- 2 INSTALL 3 FOCUS MOTOR HEATERS, 'FH 37', (ITEM #82) IN DLR1.
- 3 INSTALL 3 ROTATION HEATERS, 'FH 32', (ITEM #83) IN DLR2 AND DLR3.
- 4 USE A #10 NUT (ITEM #91) BETWEEN RELAY AND BOTTOM PANEL FOR A SPACER AND INSTALL 2nd NUT AND LOCK WASHER (ITEM #87) TO SECURE RELAY TO SCREW (ITEM #86). (SEE SHEET 1, VIEW 'A-A')
- 5 DRESS HARNES PATH WITH APPROXIMATE ROUTING SHOWN. (SEE HARNES LEGEND)



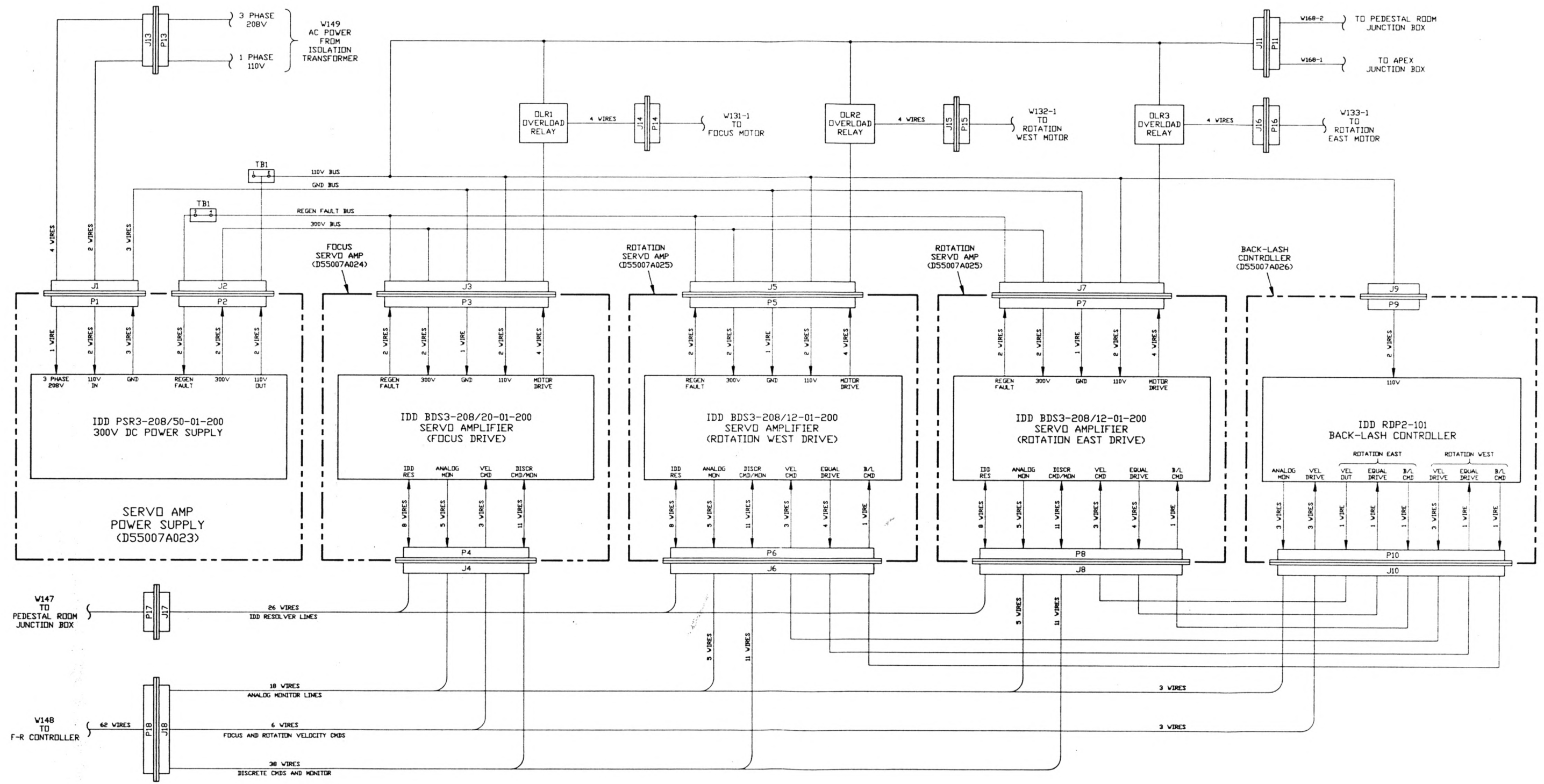
RELAY TOP VIEW
NOT TO SCALE

BOM - #A55007B014

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES	
TOLERANCES - ANGLES :	—
3 PLACE DECIMALS (.000) :	—
2 PLACE DECIMALS (.01) :	—
1 PLACE DECIMALS (.1) :	—
MATERIAL :	—
FINISH :	—

V L B A	FOCUS ROTATION	NATIONAL RADIO ASTRONOMY OBSERVATORY SOCORRO, NEW MEXICO 87801
T E	FOCUS ROTATION SERVO CHASSIS ASSEMBLY	DRAWN BY ANDREATA DATE 3-88 DESIGNED BY WEBER DATE 3-88 APPROVED BY DATE
SHEET NUMBER	3 of 3	DRAWING NUMBER D55007A022
REV.	A	SCALE 1/2

REV.	DATE	DRAWN BY	APPROVED BY	DESCRIPTION
A	1-90	ANDREATA		REDRAWN WITH ACAD



NOTES :
 1. FOR CABLE STRUCTURE DETAILS SEE NRAD DWG #D55007W001.

ACAD : CHASSK-1

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES		SERVO AMP CHASSIS F-R SYSTEM IDD SERVO AMP CHASSIS SCHEMATIC	NATIONAL RADIO ASTRONOMY OBSERVATORY <small>SOCORRO, NEW MEXICO 87801</small>	
TOLERANCES: ANGLES ± —			DRAWN BY: WEBER DATE: 2-88	DESIGNED BY: WEBER DATE: 2-88
3 PLACE DECIMALS (.XXX): ± —			APPROVED BY: _____ DATE: _____	SHEET NUMBER 1 OF 1 DRAWING NUMBER D55007S010 REV. A SCALE —
2 PLACE DECIMALS (.XX): ± —			MATERIAL: _____ FINISH: _____	
1 PLACE DECIMALS (.X): ± —		NEXT ASSY: _____ USED ON: _____		

SERVO AMPLIFIER CHASSIS WIRE LIST

NOTES:

- 1) WIRING DATA FOR THIS WIRE LIST IS ABSTRACTED FROM DRAWING A550074004
- 2) SHEET NUMBERS IN THIS WIRE LIST DIFFER FROM THOSE IN A 550074004
- 3) A550074004 SHEETS 26 - 41 ARE NOT INCLUDED IN THIS WIRE LIST SINCE THEY ARE AMP CONNECTOR CONTACT LAYOUT-SIGNAL ASSIGNMENT AND COMPONENT TERMINAL SKETCHES. SHEET 2 OF THIS WIRE LIST DEPICTS THE AMP CONNECTOR CONTACT LAYOUTS.
- 4) THE LOCATION OF THE CONNECTORS ON THE CHASSIS IS DEFINED BY ASSEMBLY DRAWING D55007A022. OVERLOAD RELAY TERMINAL LAYOUT IS DEFINED BY D55007A022.

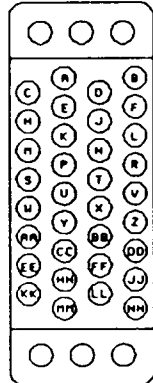
COVER AND NOTES SHEET

SERVO AMPLIFIER CHASSIS WIRE LIST

SHEET 1 OF 14

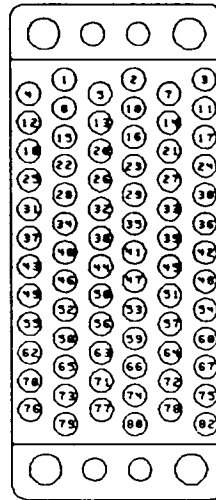
SIGNAL CONNECTORS

34 SOCKETS



J4, J6, J8
J10, J17

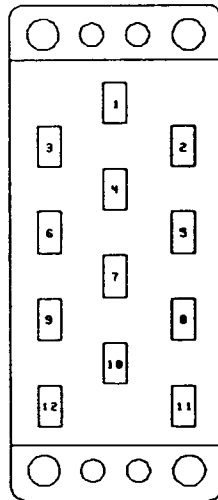
75 SOCKETS



J18

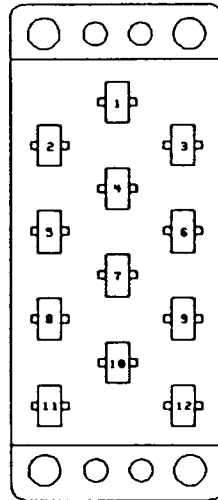
POWER CONNECTORS

12 PINS



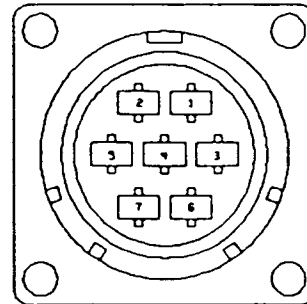
J2

12 SOCKETS



J1, J3, J5
J7, J9, J11

7 SOCKETS



J14, J15, J16

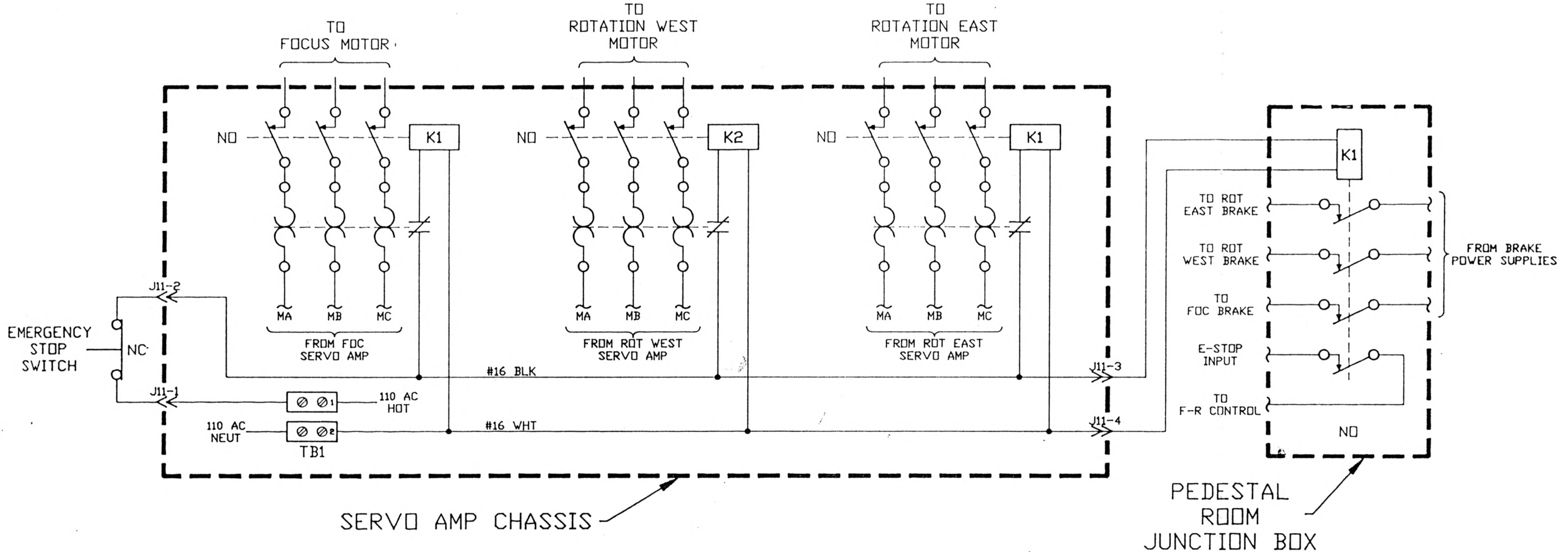
PIN	FUNCTION	TYPE	FROM	TO
1	FOCUS ANALOG DRIVE HI	TP/4 RED		J4-JJ
4	FOCUS ANALOG DRIVE LO	TP/1 BLK		J4-LL
8	SHIELD FOR 1/4			J4-NN
5	FOCUS BDS3 ANALOG COMMON		J4-FF	
2	FOCUS BDS3 +12		J4-Y	
10	FOCUS BDS3 -12		J4-AA	
3	FOCUS MOTOR CURRENT		J4-DD	
7	FOCUS MOTOR VELOCITY		J4-BB	
11	FOCUS BDS3 DIG COMM		J4-Z	
13	FOCUS BDS3 INHIBIT			J4-X
14	FOCUS BDS3 RESET			J4-W
12	FOCUS DRIVE UP (OK)		J4-H	
15	FOCUS FOLDBACK		J4-K	
16	FOCUS BUS FAULT		J4-M	
17	FOCUS DRIVE INHIBITED		J4-N	
18	FOCUS BDS3 POWER LOSS		J4-P	
20	FOCUS BDS3 OVERTEMP		J4-R	
21	FOCUS BDS3 OVER CURRENT		J4-U	
22	FOCUS BDS3 OVERSPEED		J4-S	
28	ROTATION ANALOG DRIVE HI	TP/31 RED		J10-B
31	ROTATION ANALOG DRIVE LO	TP/28 BLK		J10-D
34	SHIELD FOR 28/31			J10-F
32	ROTATION WEST ANALOG COMM		J6-FF	
29	ROT WEST BDS3 +12		J6-Y	
35	ROT WEST BDS3 -12		J6-AA	
30	ROT WEST MOTOR CURRENT		J6-DD	
33	ROT WEST MOTOR VELOCITY		J6-BB	
36	ROT WEST BDS3 DIG COMM		J6-Z	
38	ROT WEST BDS3 INHIBIT			J10-A
39	ROT WEST BDS3 RESET			J6-W, J8-W
37	ROT WEST DRIVE UP (OK)		J6-H	
40	ROTATION WEST FOLDBACK		J6-K	
41	ROTATION WEST BUS FAULT		J6-M	
42	ROT WEST DRIVE INHIBITED		J6-N	
43	ROT WEST BDS3 POWER LOSS		J6-P	
44	ROT WEST BDS3 OVERTEMP		J6-R	
45	ROT WEST OVER CURRENT		J6-U	
46	ROT WEST BDS3 OVERSPEED		J6-S	
CHASSIS CONTROL/MONITOR I/O			CONN J18	AMP 75
SERVO AMPLIFIER CHASSIS WIRE LIST			SHEET 3 OF 14	

PIN	FUNCTION	TYPE	FROM	TO
	J1 - PSR3 AC POWER IN			
1	LINE A	#10 BLK	J13-A	
2	LINE B	#10 BLK	J13-B	
3	LINE C	#10 BLK	J13-C	
4	GND	#10 WHT	J13-E	
5	GND - FOCUS BDS3	#10 WHT		J3-12
6	GND - ROT WEST BDS3	#10 WHT		J5-12
7	GND - ROT EAST BDS3	#10 WHT		J7-12
8				
9	115 VAC CONTROL POWER	#16 BLK	J13-F	
10				
11				
12	CONTROL POWER NEUTRAL	#16 WHT	J13-G	
	J2 - PSR3 DC POWER OUT			
1	115 VAC CONTROL POWER	#16 BLK		TB1-1
2	CONTROL POWER NEUTRAL	#16 WHT		TB1-2
3	REGEN FAULT+	#16 ORANGE		TB1-3
4	REGEN FAULT-	#16 BROWN		TB1-4
5				
6				
7	FOCUS BDS3 +300 VDC	#10 RED		J3-8
8	ROT WEST BDS3 +300 VDC	#10 RED		J5-8
9	ROT EAST BDS3 +300 VDC	#10 RED		J7-8
10	FOCUS BDS3 +300 RETURN	#10 BLK		J3-11
11	ROT WEST BDS3 +300 RETURN	#10 BLK		J5-11
12	ROT EAST BDS3 +300 RETURN	#10 BLK		J7-11
	J3 - FOCUS BDS3 POWER			
1	115 VAC CONTROL POWER	#16 BLK	TB1-1	
2	CONTROL POWER NEUTRAL	#16 WHT	TB1-2	
3	REGEN FAULT+	#16 ORANGE	TB1-3	
4	REGEN FAULT-	#16 BROWN	TB1-4	
5	MOTOR DRIVE PHASE A	#10 RED		OLR1-1
6	MOTOR DRIVE PHASE B	#10 RED		OLR1-2
7	MOTOR DRIVE PHASE C	#10 RED		OLR1-3
8	FOCUS BDS3 +300 VDC	#10 RED	J2-7	
9	GND - FOCUS MOTOR	#10 BLK		J14-4
10				
11	FOCUS BDS3 +300 RETURN	#10 BLK	J2-10	
12	GND - FOCUS BDS3	#10 WHT	J1-5	
MODULE POWER CONNECTORS			CONN J1, J2, J3	AMP 12
SERVO AMPLIFIER CHASSIS WIRE LIST			SHEET 10 OF 14	

PIN	FUNCTION	TYPE	FROM	TO
	J5 - ROT WEST BDS3 POWER			
1	115 VAC CONTROL POWER	#16 BLK	TB1-1	
2	CONTROL POWER NEUTRAL	#16 WHT	TB1-2	
3	REGEN FAULT+	#16 ORANGE	TB1-3	
4	REGEN FAULT-	#16 BROWN	TB1-4	
5	MOTOR DRIVE PHASE A	#10 RED		OLR2-1
6	MOTOR DRIVE PHASE B	#10 RED		OLR2-2
7	MOTOR DRIVE PHASE C	#10 RED		OLR2-3
8	ROT WEST BDS3 +300 VDC	#10 RED	J2-8	
9	GND - ROT WEST MOTOR	#10 BLK		J15-4
10				
11	ROT WEST BDS3 +300 RETURN	#10 BLK	J2-11	
12	GND - ROT WEST BDS3	#10 WHT	J1-6	
	J7 - ROT EAST BDS3 POWER			
1	115 VAC CONTROL POWER	#16 BLK	TB1-1	
2	CONTROL POWER NEUTRAL	#16 WHT	TB1-2	
3	REGEN FAULT+	#16 ORANGE	TB1-3	
4	REGEN FAULT-	#16 BROWN	TB1-4	
5	MOTOR DRIVE PHASE A	#10 RED		OLR3-1
6	MOTOR DRIVE PHASE B	#10 RED		OLR3-2
7	MOTOR DRIVE PHASE C	#10 RED		OLR3-3
8	ROT EAST BDS3 +300 VDC	#10 RED	J2-9	
9	GND - ROT EAST MOTDR	#10 BLK		J16-4
10				
11	ROT EAST BDS3 +300 RETURN	#10 BLK	J2-12	
12	GND - ROT EAST BDS3	#10 WHT	J1-7	
	J9 - RDP2 115 VAC POWER			
1	115 VAC CONTROL POWER	#16 BLK	TB1-1	
2	CONTROL POWER NEUTRAL	#16 WHT	TB1-2	
3				
4				
5				
6				
7				
8				
9				
10				
11				
12				
MODULE POWER CONNECTORS			CONN J5, J7, J9	AMP 12
SERVO AMPLIFIER CHASSIS WIRE LIST			SHEET 11 OF 14	

PIN	FUNCTION	TYPE	FROM	TO
	J14 - FOCUS MOTOR DRIVE			
1	MOTOR DRIVE PHASE A	#10 RED	OLR1-4	
2	MOTOR DRIVE PHASE B	#10 RED	OLR1-5	
3	MOTOR DRIVE PHASE C	#10 RED	OLR1-6	
4	GND - FOCUS MOTOR	#10 BLK	J3-9	
5				
6				
7				
	J15 - ROT WEST MOTOR DRIVE			
1	MOTOR DRIVE PHASE A	#10 RED	OLR2-4	
2	MOTOR DRIVE PHASE B	#10 RED	OLR2-5	
3	MOTOR DRIVE PHASE C	#10 RED	OLR2-6	
4	GND - ROT WEST MOTOR	#10 BLK	J5-9	
5				
6				
7				
	J16 - ROT EAST MOTOR DRIVE			
1	MOTOR DRIVE PHASE A	#10 RED	OLR3-4	
2	MOTOR DRIVE PHASE B	#10 RED	OLR3-5	
3	MOTOR DRIVE PHASE C	#10 RED	OLR3-6	
4	GND - ROT EAST MOTOR	#10 BLK	J7-9	
5				
6				
7				
MOTOR POWER CONNECTORS J14, J15, J16				AMP 7
SERVO AMPLIFIER CHASSIS WIRE LIST				SHEET 13 OF 14

REV	DATE	DRAWN BY	APPR'D BY	DESCRIPTION



SERVO AMP CHASSIS

PEDESTAL ROOM JUNCTION BOX

ACAD : ESTOPSK1

UNLESS OTHERWISE SPECIFIED
DIMENSIONS ARE IN INCHES

TOLERANCES : ANGLES ± _____
 3 PLACE DECIMALS (.XXX) ± _____
 2 PLACE DECIMALS (.XX) ± _____
 1 PLACE DECIMALS (.X) ± _____

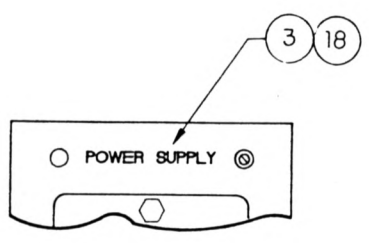
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FINISH : _____

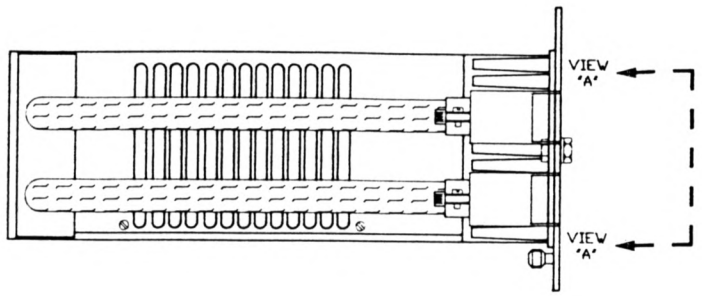
NEXT ASSEMBLY	DWG. TYPE

V L B A	PROJECT FOCUS ROTATION
T I T L E	FOCUS ROTATION MOTOR OVERLOAD RELAY AND EMERGENCY STOP SCHEMATIC DIAGRAM
SHEET NUMBER	1 of 1
DRAWING NUMBER	B55007S019

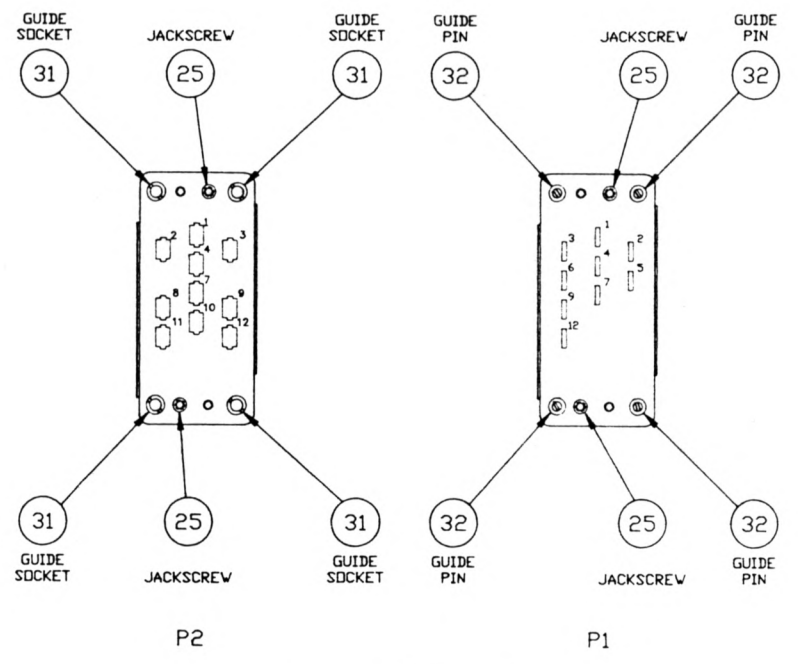
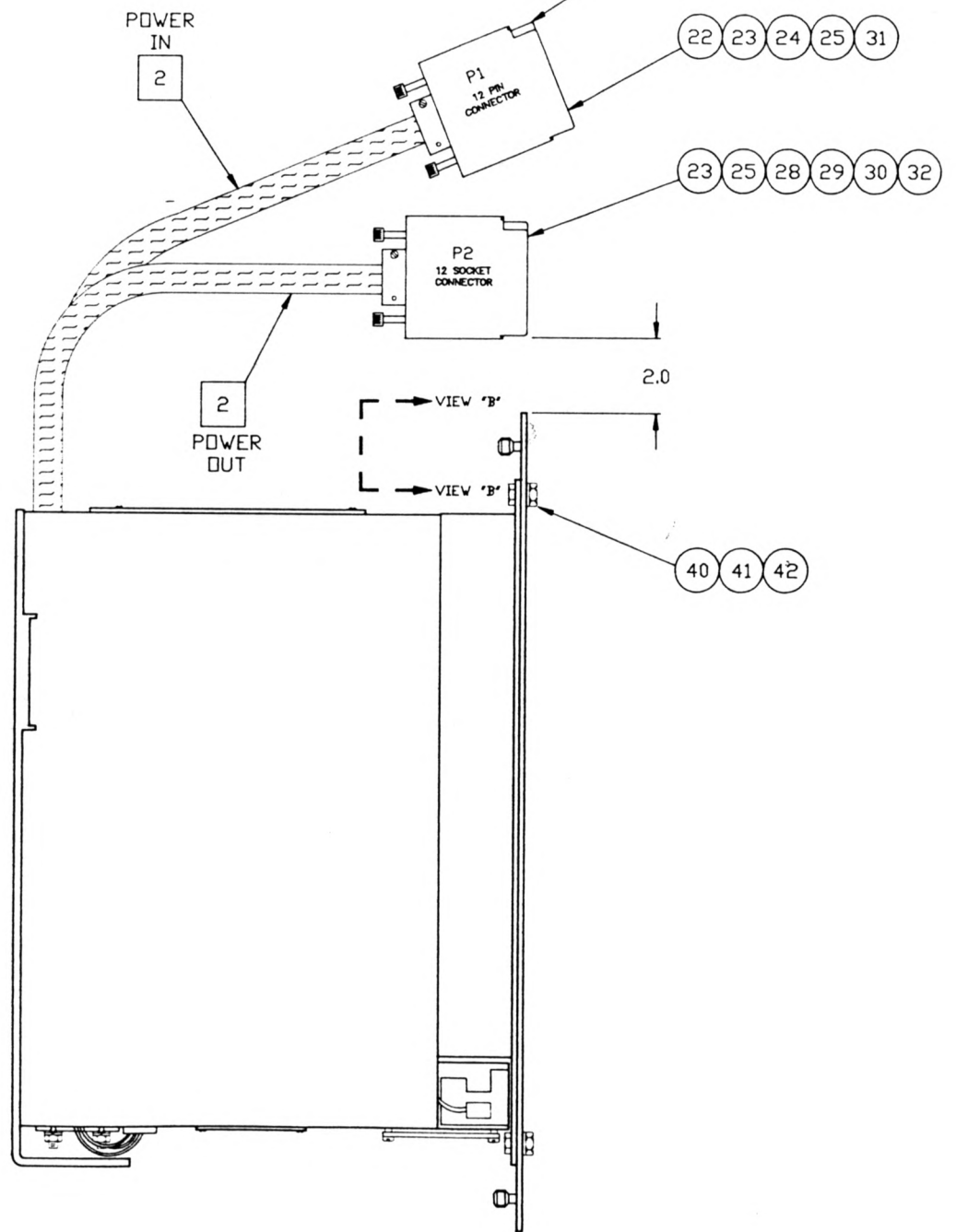
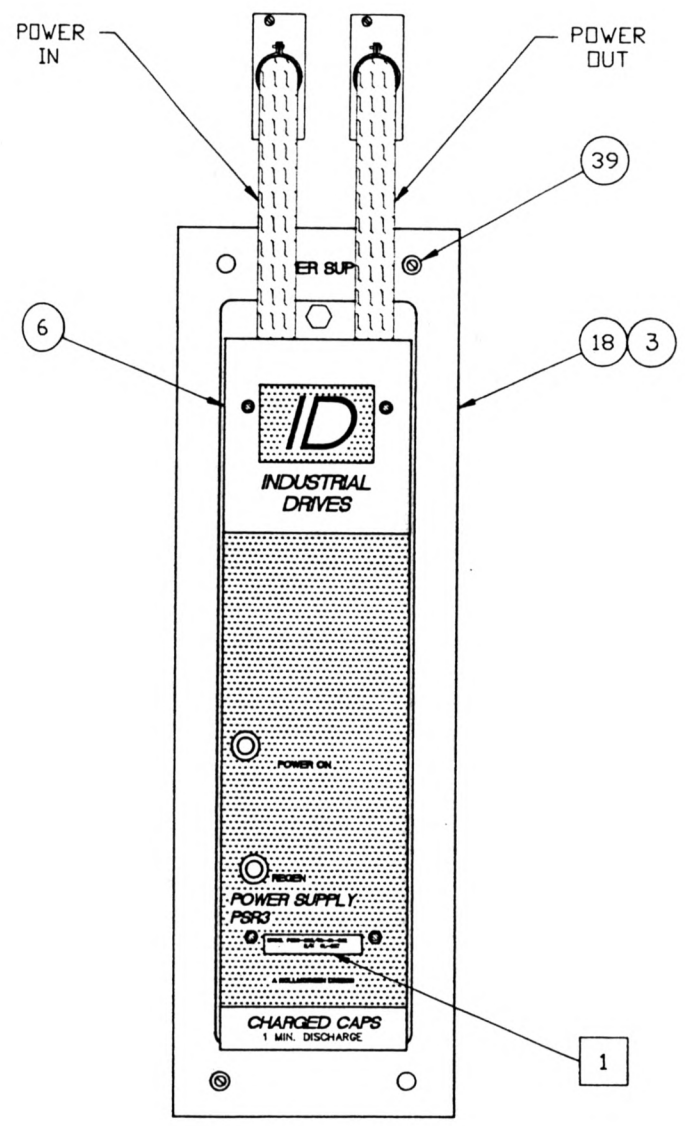
NATIONAL RADIO ASTRONOMY OBSERVATORY SOCORRO, NEW MEXICO 87801	
DRAWN BY ANDREATTA	DATE 5-90
DESIGNED BY WEBER	DATE 5-90
APPROVED BY	DATE
REV.	SCALE



VIEW "B-B"
SCALE 1/2



ROTATED UP TO ILLUSTRATE COVER ASSEMBLY



VIEW "A-A"
SCALE 1/1

NOTES :

- 1 USE PSR3-208/50-01-002 (SERVO AMPLIFIER) ONLY.
- 2 LACE SIGNAL AND POWER CABLES FOR NEATNESS.

ACAD : PSR3PQWA

B.O.M. - *A55007B015

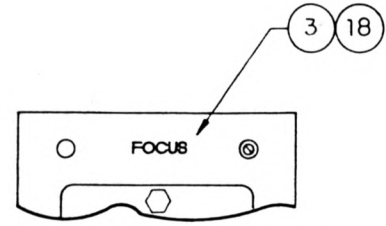
UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES
 TOLERANCES ANGLES = —
 3 PLACE DECIMALS .XXX = —
 2 PLACE DECIMALS .XX = —
 1 PLACE DECIMALS .X = .1

F-R SERVO CHASSIS
 F-R SERVO POWER SUPPLY ASSEMBLY

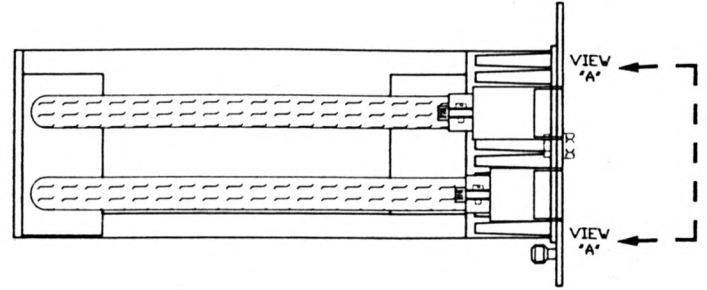
NATIONAL RADIO ASTRONOMY OBSERVATORY
 SOCORRO, NEW MEXICO 87801

D55007A022	CHASSIS ASSY	FINISH:		SHEET NUMBER 1 OF 1	DRAWING NUMBER D55007A023	REV.	SCALE 1:2

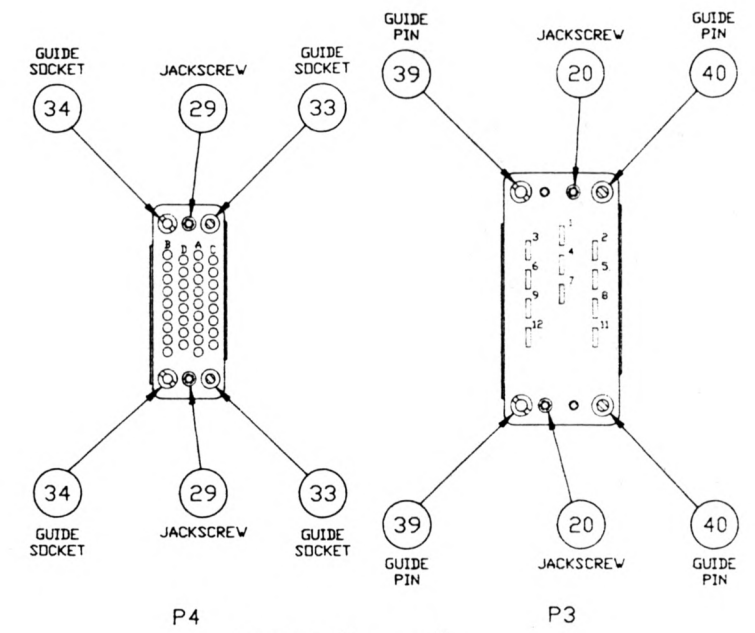
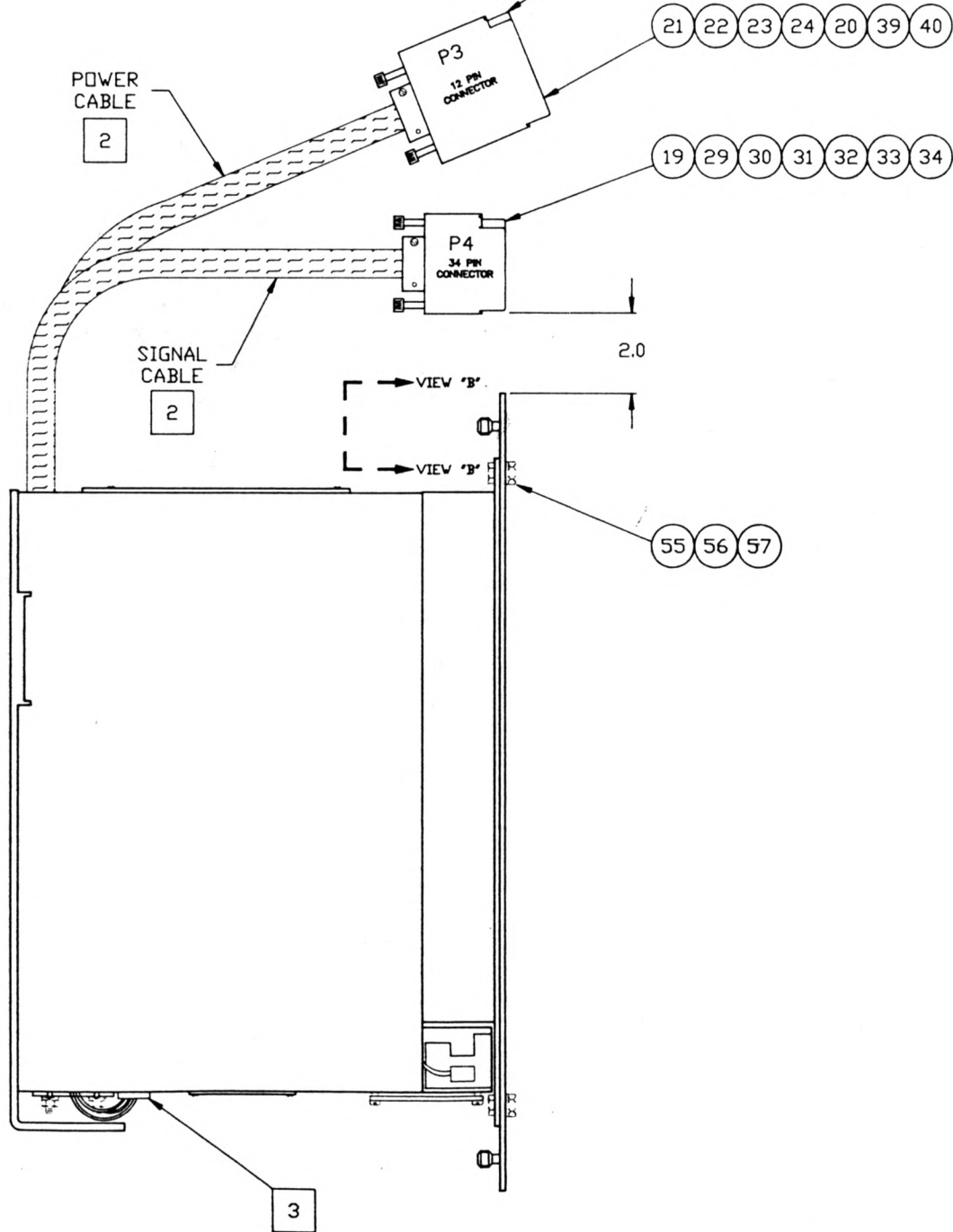
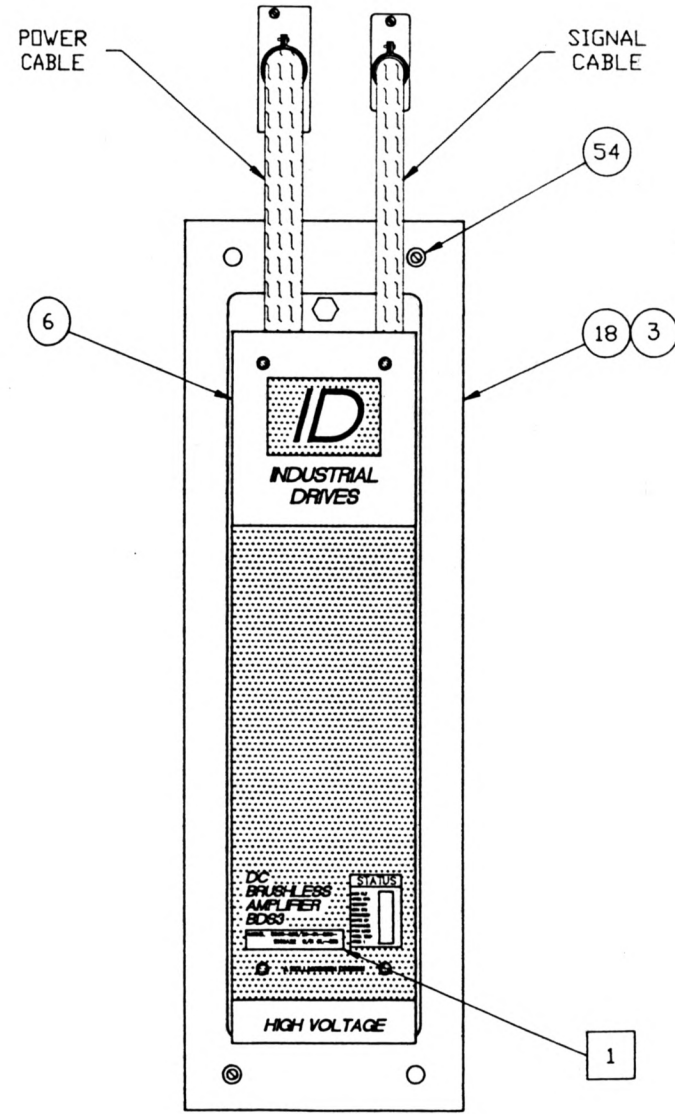
DRAWN BY ANDREATTA	DATE 2-88
DESIGNED BY WEBER	DATE 2-88
APPROVED BY	DATE



VIEW "B-B"
SCALE 1/2



ROTATED UP TO ILLUSTRATE COVER ASSEMBLY



VIEW "A-A"
SCALE 1/1

NOTES :

- 1 USE BDS3-208/20-01-200-2102A22 (SERVO AMPLIFIER) ONLY.
- 2 LACE SIGNAL AND POWER CABLES FOR NEATNESS.
- 3 TUCK DANGLING CONNECTOR INSIDE AMPLIFIER CASE.

ACAD : BDS3FOCA

B.O.M. -#A55007B016

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES
 TOLERANCES: ANGLES = -
 3 PLACE DECIMALS: XXX = -
 2 PLACE DECIMALS: XX = -
 1 PLACE DECIMALS: X = -

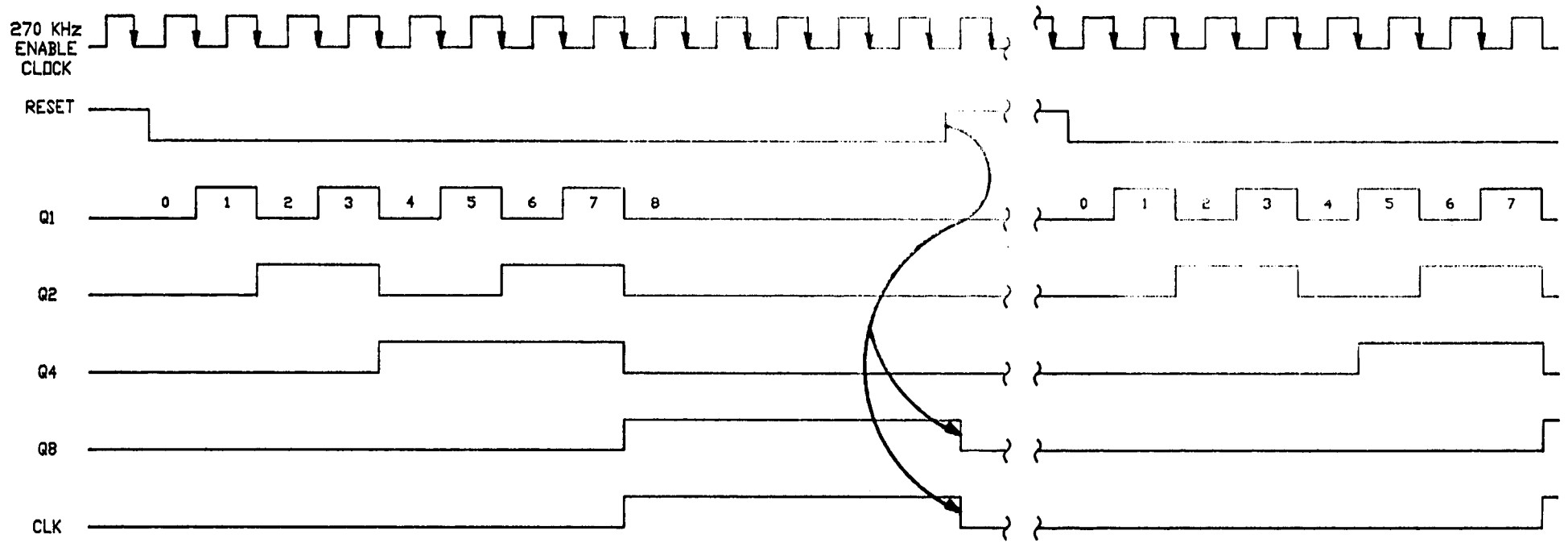
V L B A
 F-R SERVO CHASSIS
 F-R FOCUS SERVO AMPLIFIER ASSEMBLY

NATIONAL RADIO ASTRONOMY OBSERVATORY
 SOCORRO, NEW MEXICO 87801
 DRAWN BY: ANDREATTA DATE: 3-88
 DESIGNED BY: WEBER DATE: 3-88
 APPROVED BY: DATE:

D55007A022	CHASSIS ASSY	FINISH: _____	SHEET NUMBER 1 OF 1	DRAWING NUMBER D55007A024	REV. SCALE 1:2
NEXT ASSY	USED ON				

REV	DATE	DRAWN BY	APPRV'D BY	DESCRIPTION

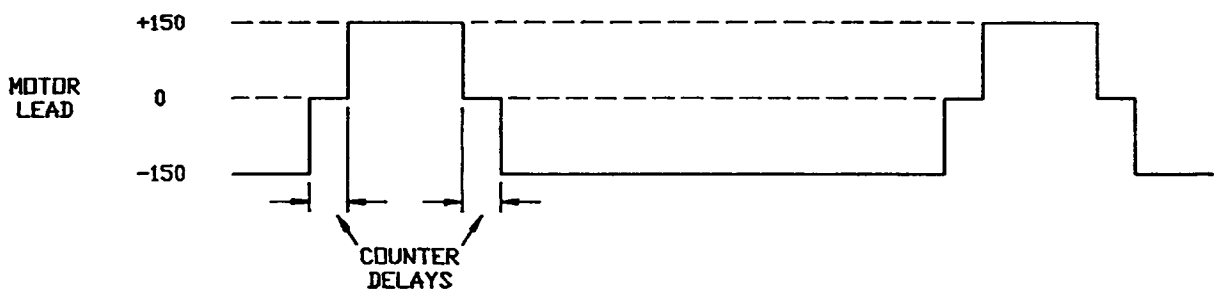
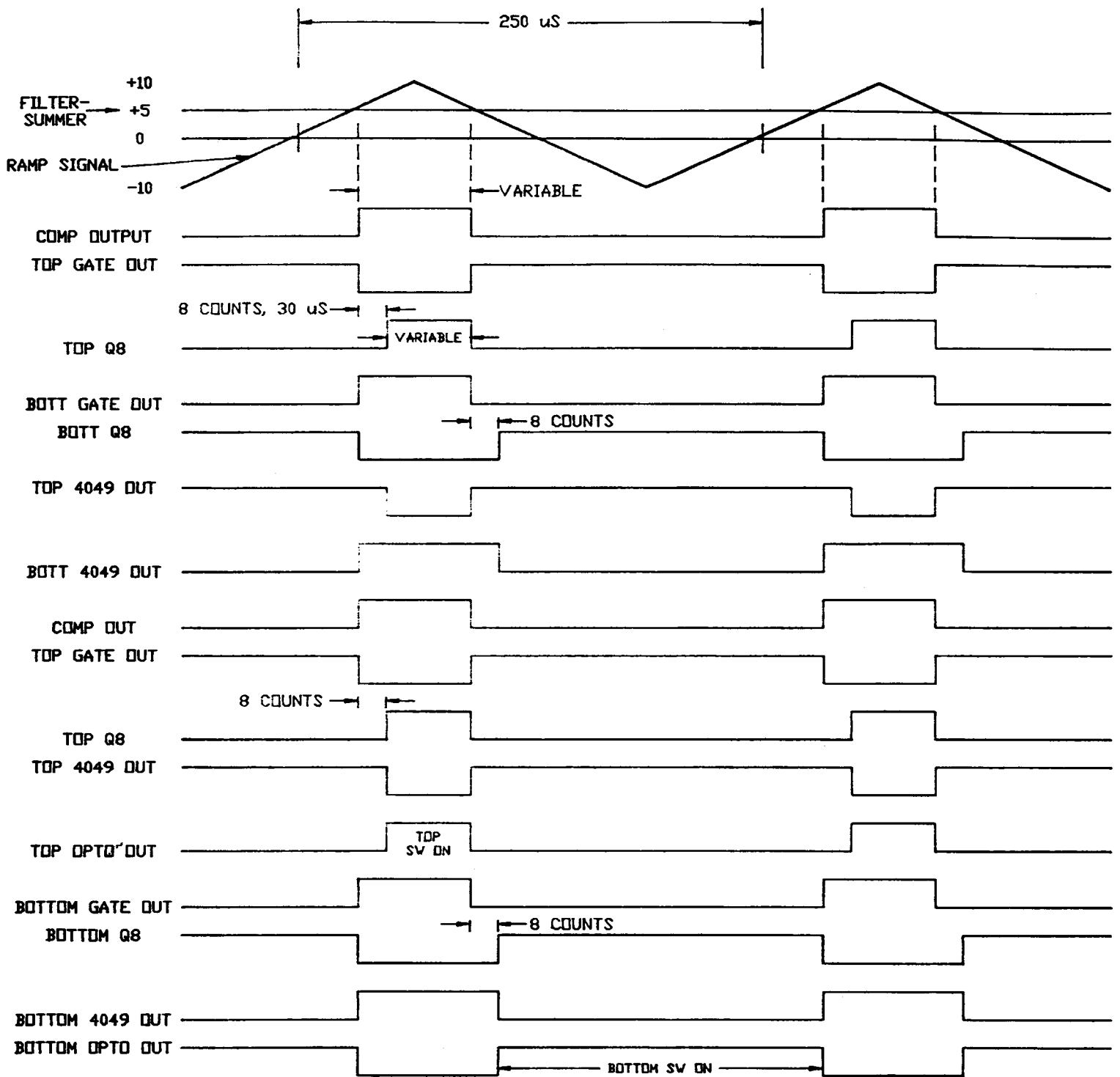
V L B A	PROJECT FOCUS ROTATION	NATIONAL RADIO ASTRONOMY OBSERVATORY SOCORRO, NEW MEXICO 87801			
		TITLE	FOCUS ROTATION IDD BDS3 SERVO AMP PHASE MODULATOR TIMING DIAGRAM	DRAWN BY ANDREATA	DATE 5-90
DESIGNED BY WEBER	DATE 5-90				
APPROVED BY	DATE				
SHEET NUMBER	1 of 3	DRAWING NUMBER	A55007D001	REV.	SCALE —
NEXT ASSEMBLY	DWG. TYPE				

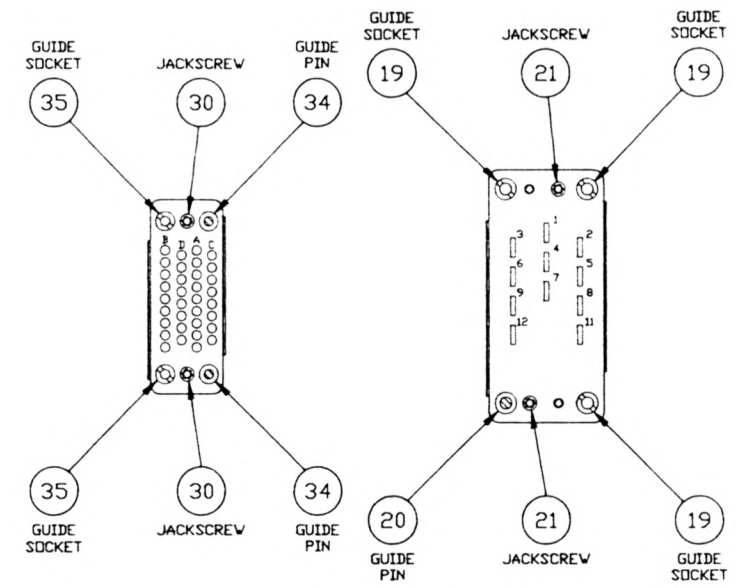
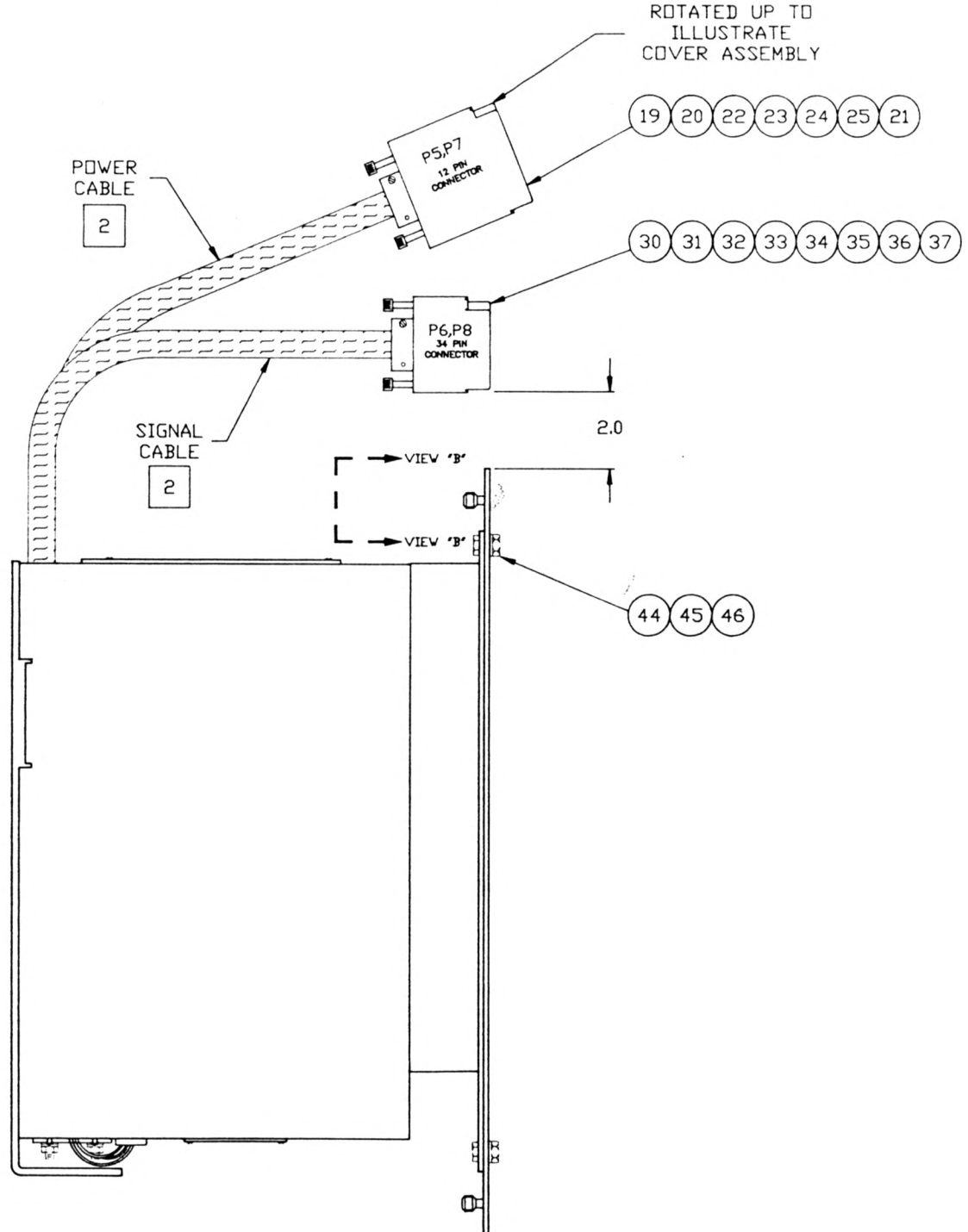
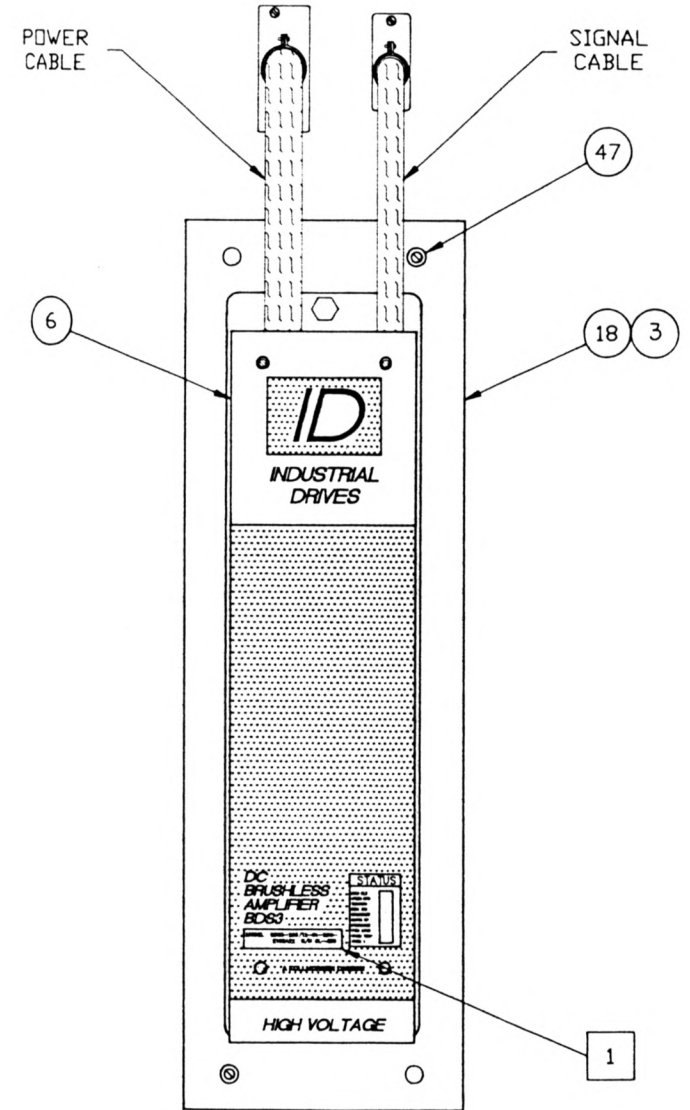
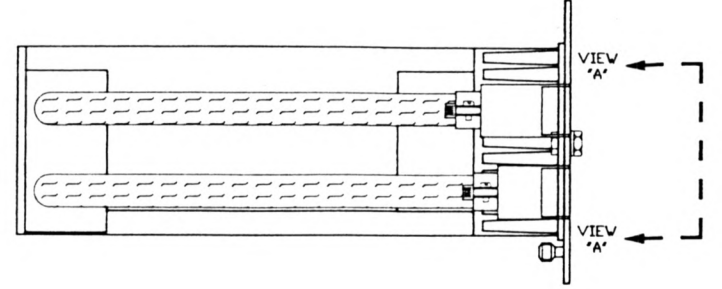
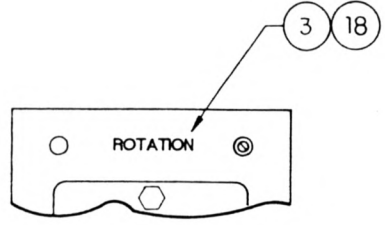


DWG. NO. A55007D001

SHT. NO. 2 OF 3

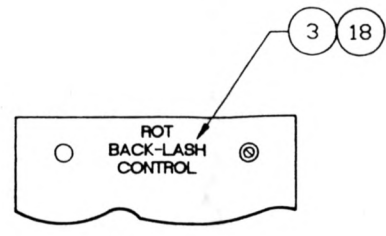
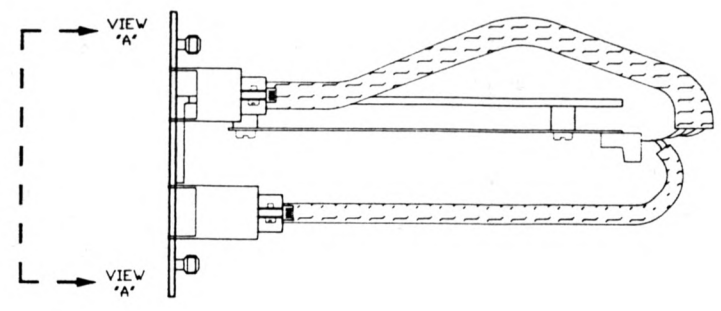
REV.



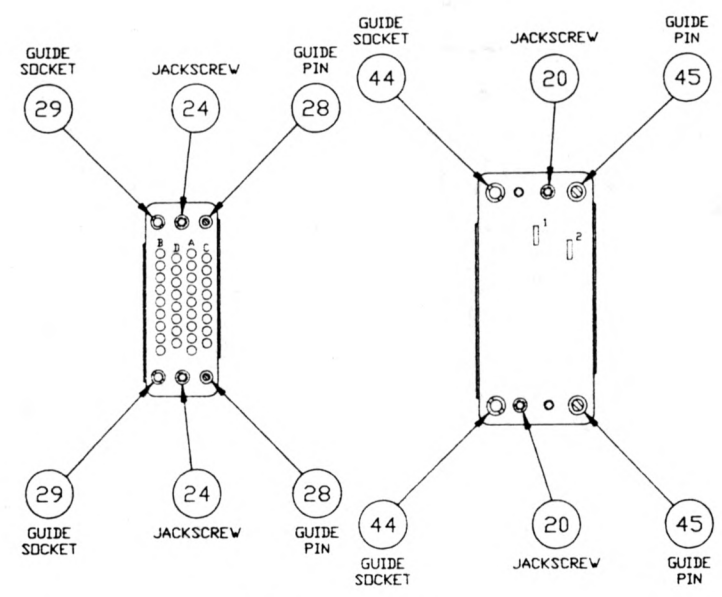


- NOTES :
- 1 USE BDS3-208/12-01-200-2102A22 (SERVO AMPLIFIER) ONLY.
 - 2 LACE SIGNAL AND POWER CABLES FOR NEATNESS.

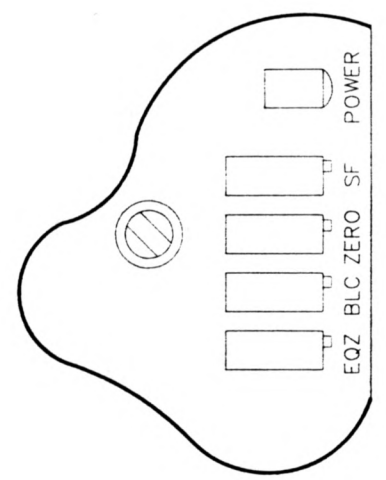
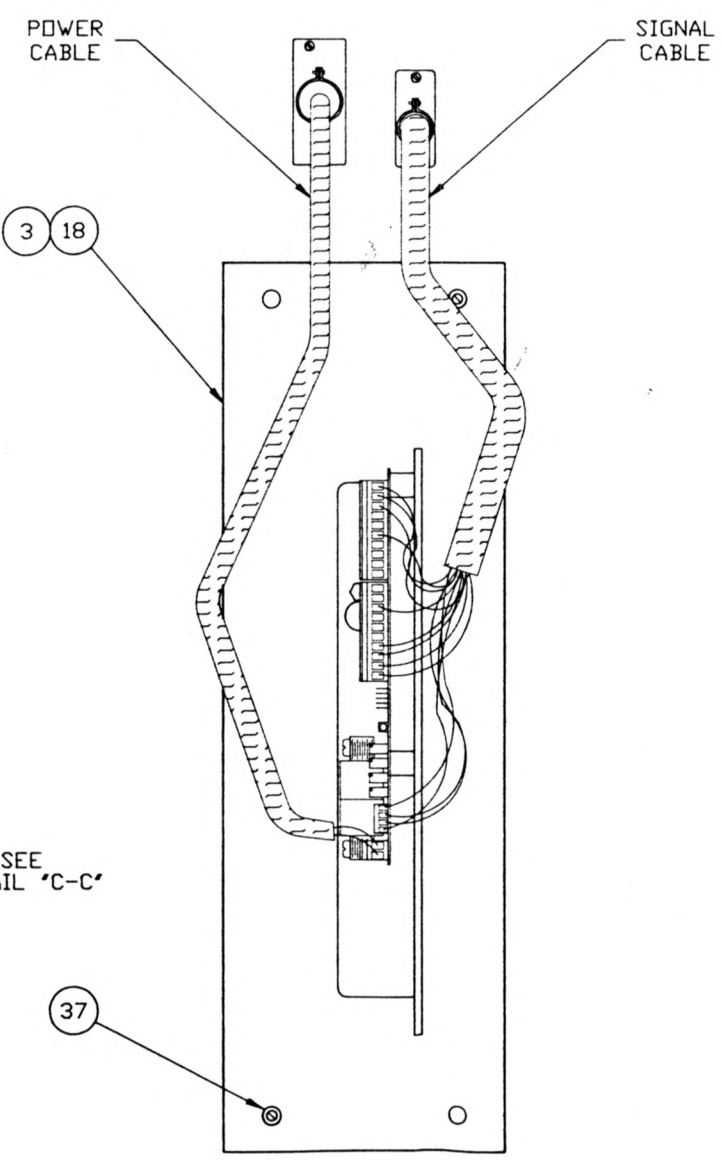
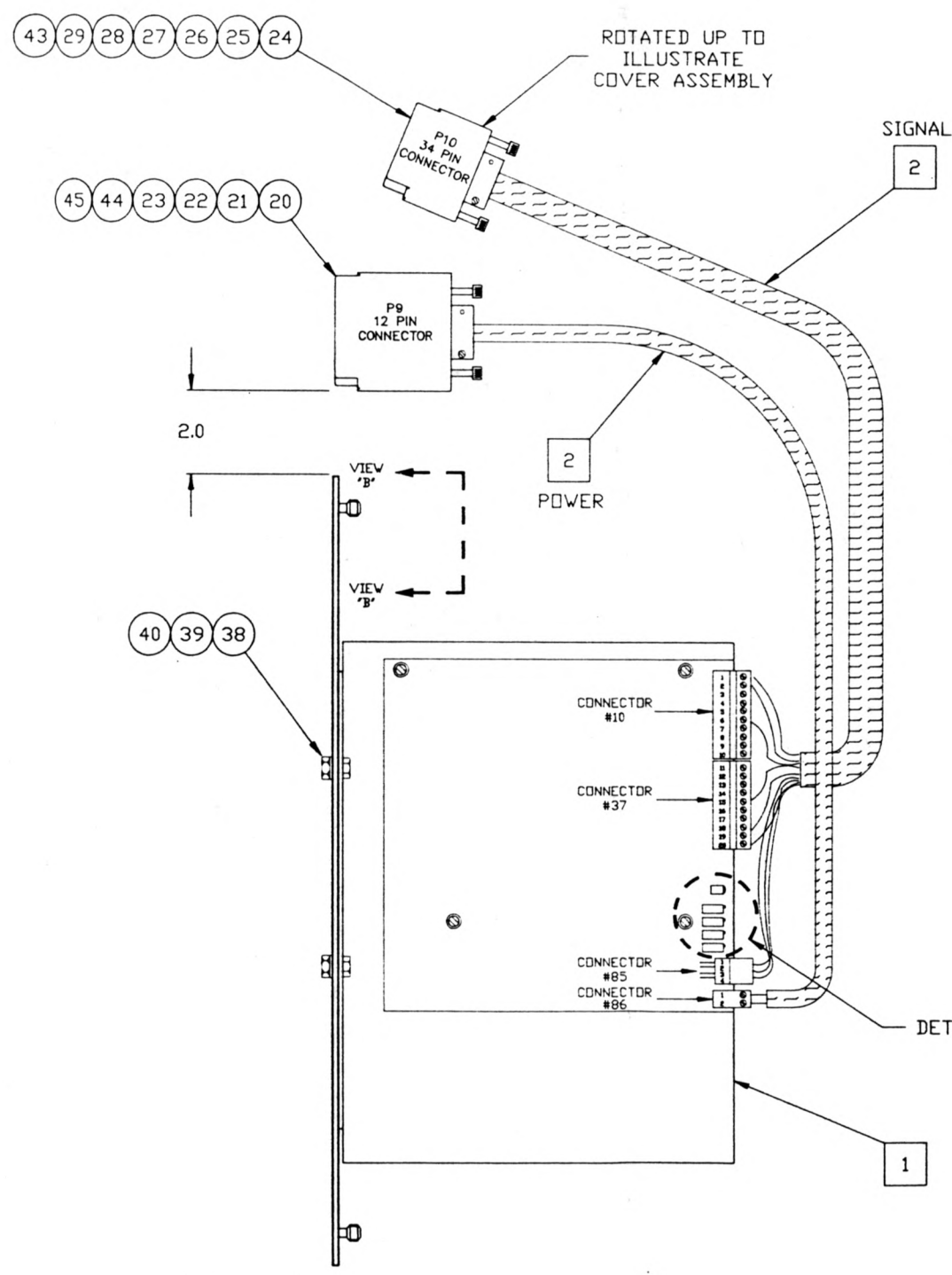
B.O.M. - #A55007B011		UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES		NATIONAL RADIO ASTRONOMY OBSERVATORY	
TOLERANCES	ANGLES	F-R SERVO CHASSIS		SOCORRO, NEW MEXICO 87801	
3 PLACE DECIMALS : .XXX	=	F-R ROTATION SERVO AMPLIFIER ASSEMBLY		DRAWN BY	DATE
7 PLACE DECIMALS : .XXXXXX	=			ANDREATTI	3-88
1 PLACE DECIMALS : .X	=			DESIGNED BY	DATE
				WEBER	3-88
				APPROVED BY	DATE
D55007A022	CHASSIS ASSY	FINISH:		SHEET NUMBER	1 OF 1
NEXT ASSY	USED ON			DRAWING NUMBER	D55007A025
				REV.	SCALE 1:2



VIEW "B-B"
SCALE 1/2



VIEW "A-A"
SCALE 1/1



DETAIL "C-C"
SCALE 2/1

NOTES :

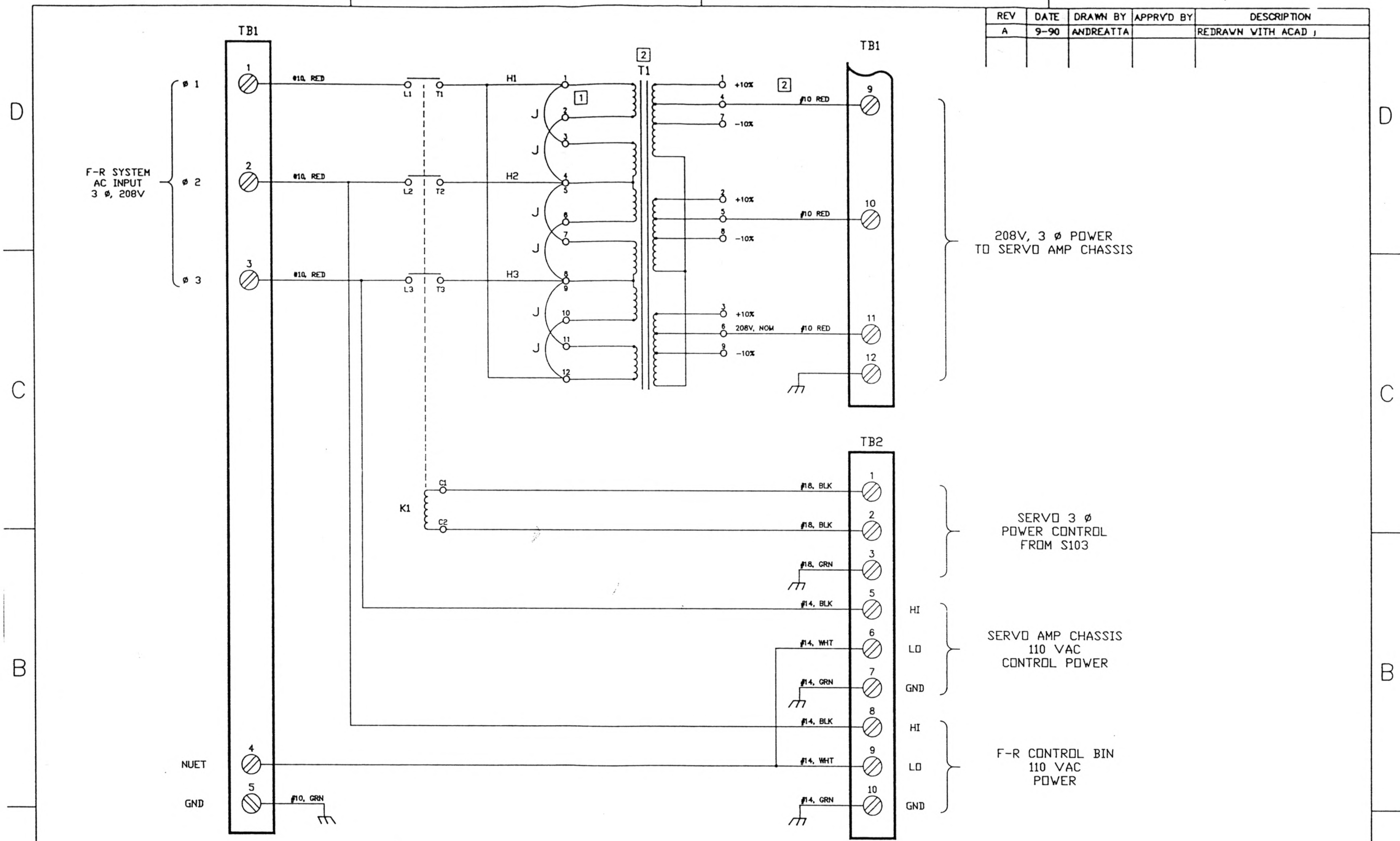
- 1 USE RDP2-101 (BACK-LASH CONTROLLER) ONLY
- 2 LACE SIGNAL AND POWER CABLES FOR NEATNESS.

ACAD : FRRSBLCA

B.O.M. - *A55007B009

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES		V L B A	F-F SERVC CHASSIS	NATIONAL RADIO ASTRONOMY OBSERVATORY SOCOMHO, NEW MEXICO 87801	
TOLERANCES	ANGLES				DATE
3 PLACE DECIMALS .XXX	—				2-BB
2 PLACE DECIMALS .XX	—				DATE
1 PLACE DECIMALS .X	.1	APPROVED BY	DATE		
MATERIAL		F-R ROTATION BACK-LASH CONTROLLER ASSEMBLY			
D55007A02Z	CHASSIS ASSY	FINISH			
NEXT ASSY	USED ON				
SHEET NUMBER 1 OF 1		DRAWING NUMBER	D55007A020	REV. SCALE 1/2	

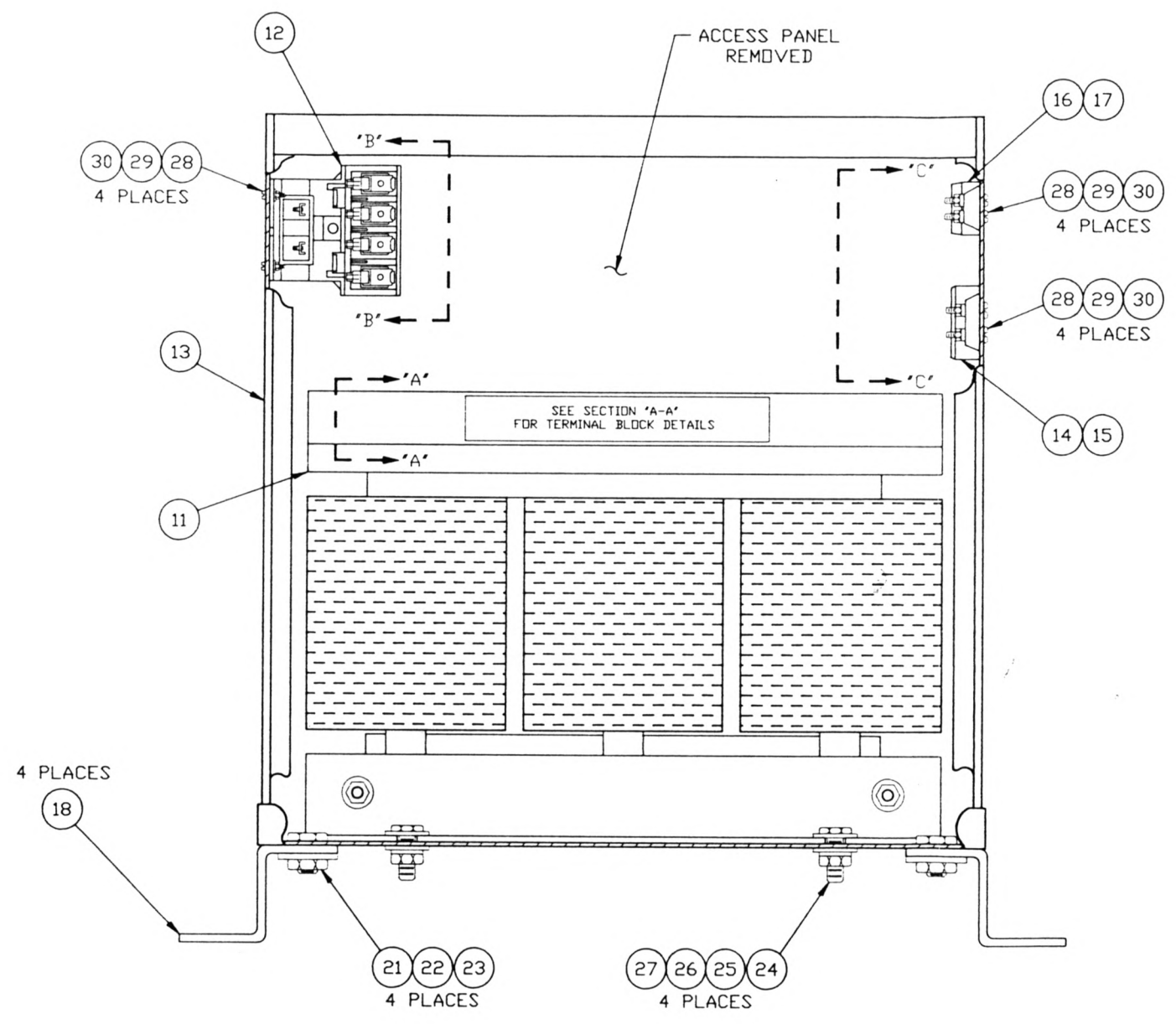
REV	DATE	DRAWN BY	APPRVD BY	DESCRIPTION
A	9-90	ANDRETTA		REDRAWN WITH ACAD



- NOTES :
- JUMPERS SHOWN FOR 208V, 3 Ø POWER SOURCE.
 - OUTPUT TAPS SHOWN FOR NORMAL 208V SOURCE POWER. SET TAPS HIGHER OR LOWER AS REQUIRED TO OBTAIN ABOUT 300 VDC FROM PSR3.
 - T1 PART NO. IS TR3-230/030-16-00 FROM INDUSTRIAL DRIVES OR MAGNETIC TECHNOLOGIES.

ACAD : ISOTRNSK

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES		V L P B A	F-R SYSTEM	NATIONAL RADIO ASTRONOMY OBSERVATORY SOCORRO, NEW MEXICO 87801	
TOLERANCES : ANGLES	---			DATE	2-88
3 PLACE DECIMALS (.000)	---	T I T L E	F-R SYSTEM ISOLATION TRANSFORMER BOX SCHEMATIC DIAGRAM	DESIGNED BY	DATE
2 PLACE DECIMALS (.00)	---			APPROVED BY	DATE
1 PLACE DECIMALS (.0)	---			SHEET NUMBER 1 of 1 DRAWING NUMBER C55007S007 REV. A SCALE	
MATERIAL :	---	NEXT ASSEMBLY DWG. TYPE			
FINISH :	---				



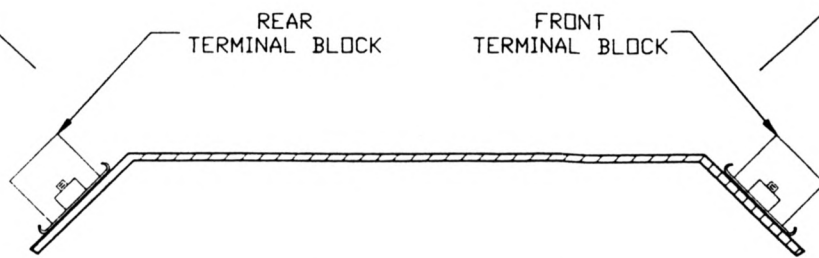
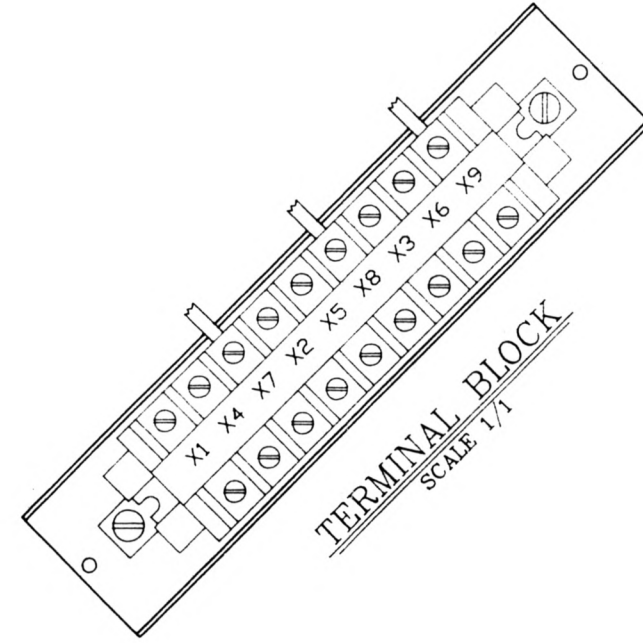
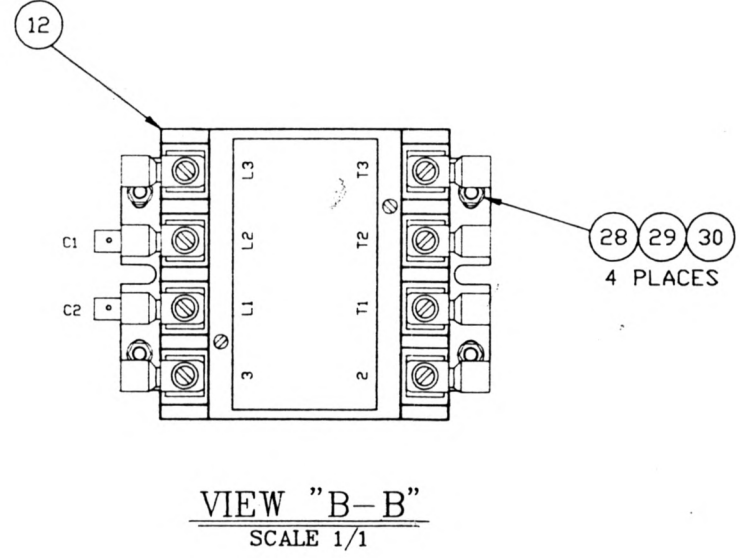
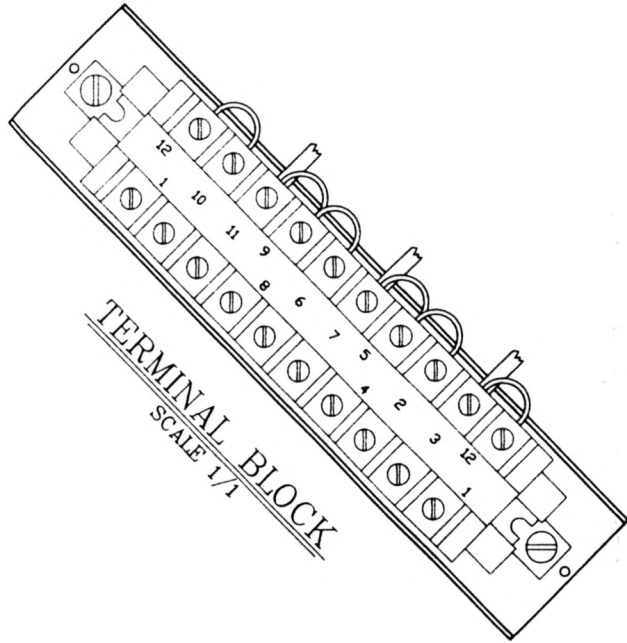
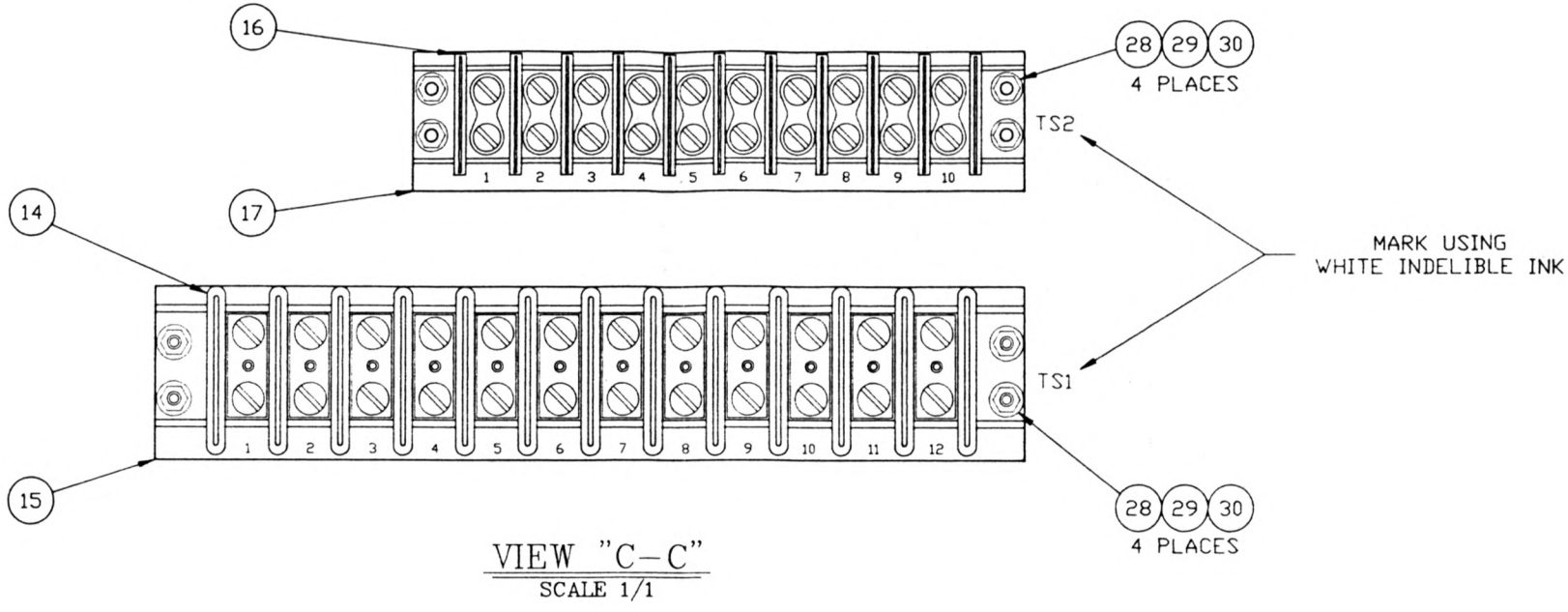
FRONT VIEW
SCALE 1/2

ACAD - ISTRAY1

B.O.M. - #A55007B019

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES		V L B A	F-R SERVO	NATIONAL RADIO ASTRONOMY OBSERVATORY	
TOLERANCES: ANGLES ±				SOCORRO, NEW MEXICO 87801	
3 PLACE DECIMALS: .XXX ±				ISOLATION TRANSFORMER ASSEMBLY	
2 PLACE DECIMALS: .XX ±				DRAWN BY ANDREATTA	DATE 4-88
1 PLACE DECIMALS: .X ±		DESIGNED BY WEBER	DATE 4-88		
MATERIAL _____		APPROVED BY	DATE	SHEET NUMBER: 1 OF 2	
FINISH: _____				DRAWING NUMBER: D55007A001	REV SCALE: 1:2
NEXT ASSY	USED ON				

NOTE :
1. RING LUGS ARE NOT PICTURED ON TS1 AND TS2, TO SHOW TERMINAL LOCATIONS.



ACAD : ISTMRAY2

B.O.M. - "A55007B019"

UNLESS OTHERWISE SPECIFIED
DIMENSIONS ARE IN INCHES
TOLERANCES: ANGLES ± —
3 PLACE DECIMALS (XXX): ± —
2 PLACE DECIMALS (XX): ± —
1 PLACE DECIMALS (X): ± —

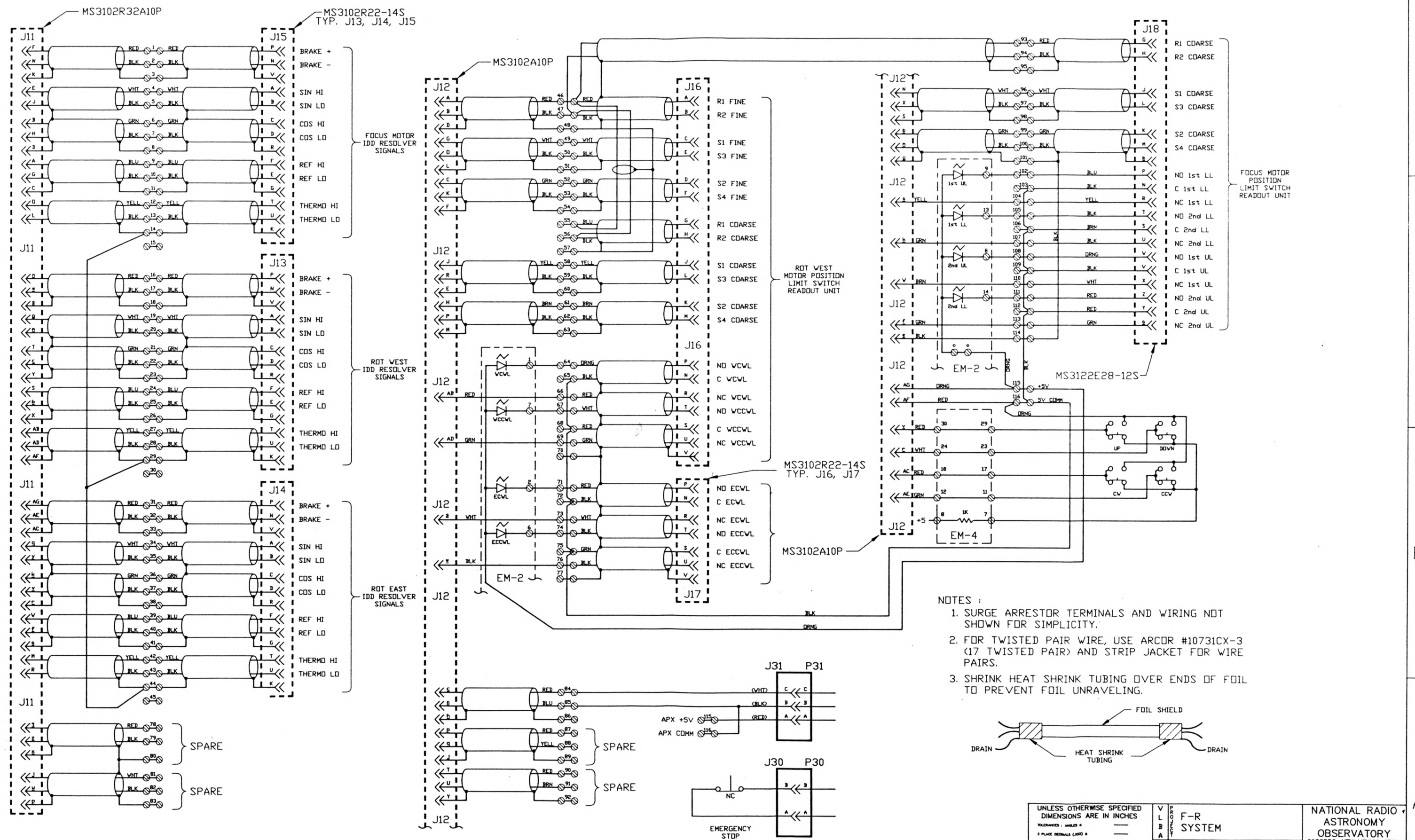
MATERIAL	
FINISH	
NEXT ASSY	USED ON

V
L
B
A
F-R
SERVO
ISOLATION
TRANSFORMER
ASSEMBLY

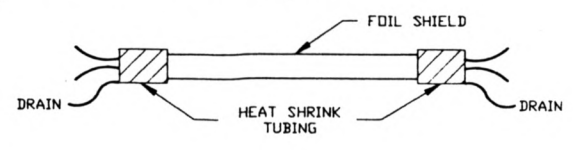
NATIONAL RADIO
ASTRONOMY
OBSERVATORY
SOCORHO, NEW MEXICO 87801

DRAWN BY ANDRETTA	DATE 4-85
DESIGNED BY WEBER	DATE 4-85
APPROVED BY	DATE

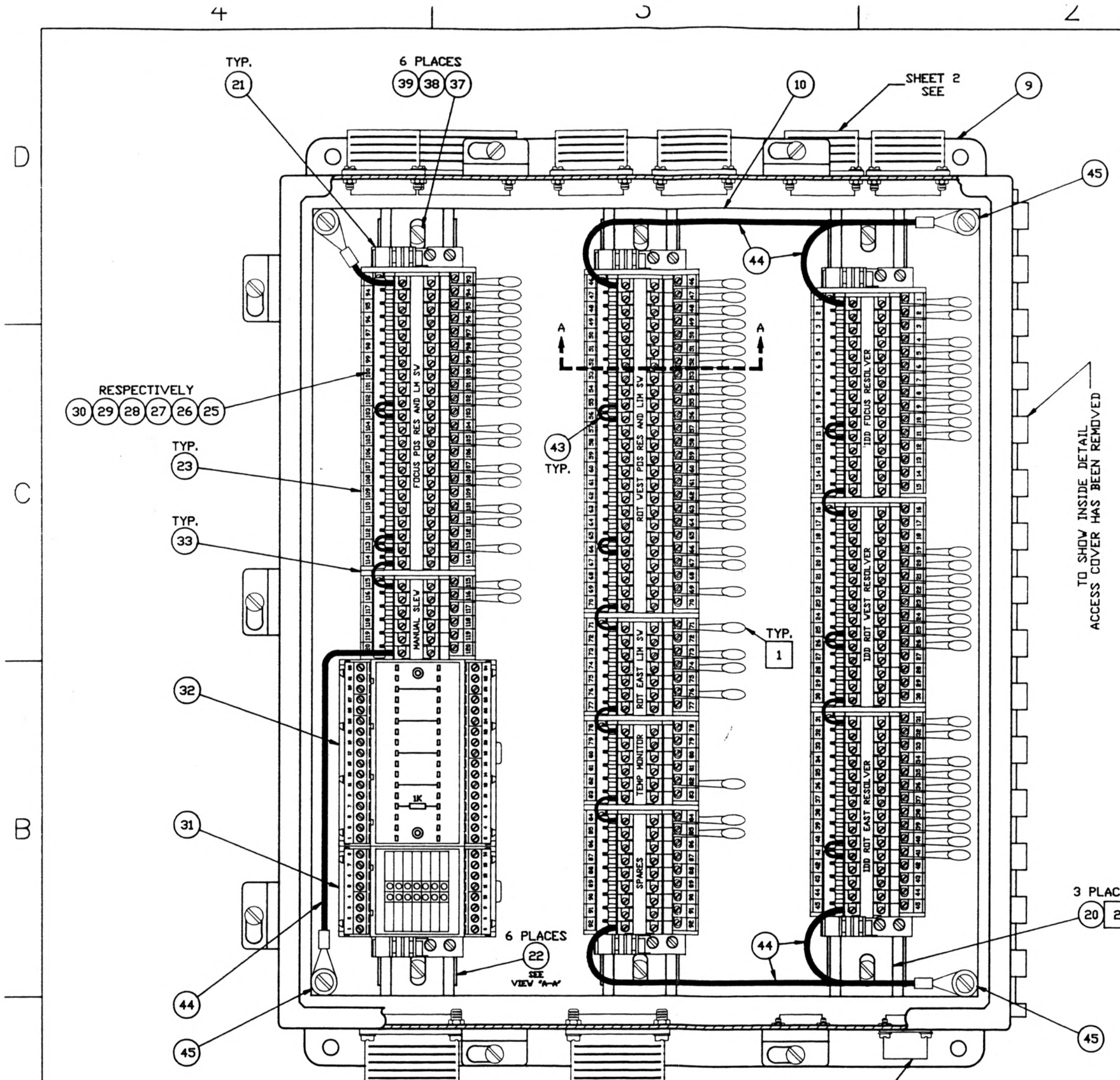
REV	DATE	DRAWN BY	APPRVD BY	DESCRIPTION
A	3-90	ANDREATTA		KINDR CORRECTION AND ADDITIONS



- NOTES :
1. SURGE ARRESTOR TERMINALS AND WIRING NOT SHOWN FOR SIMPLICITY.
 2. FOR TWISTED PAIR WIRE, USE ARCOR #10731CX-3 (17 TWISTED PAIR) AND STRIP JACKET FOR WIRE PAIRS.
 3. SHRINK HEAT SHRINK TUBING OVER ENDS OF FOIL TO PREVENT FOIL UNRAVELING.

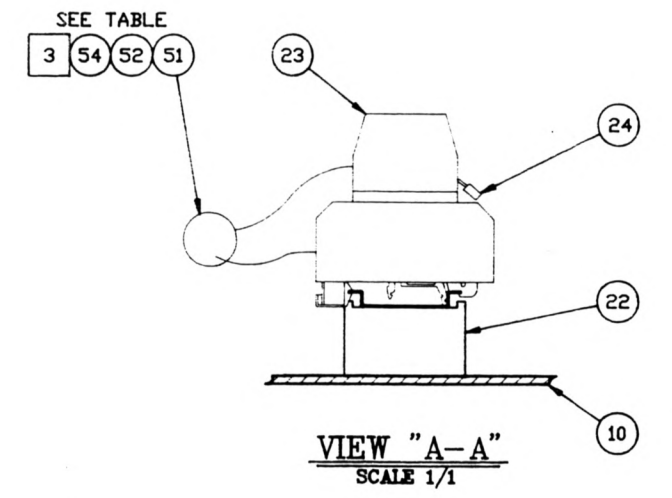


UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES		V L B A F-R SYSTEM F-R SYSTEM APEX CONTROL JUNCTION BOX SCHEMATIC	NATIONAL RADIO ASTRONOMY OBSERVATORY SOCORRO, NEW MEXICO 87801	
TOLERANCES: ANGLES #			DRAWN BY ANDREATTA	DATE 8-88
3 PLACE DECIMALS (LSD) #			DESIGNED BY WEBER	DATE 8-88
1 PLACE DECIMALS (LSD) #			APPROVED BY	DATE
MATERIAL:		FINISH:	SHEET NUMBER 1 of 1	DRAWING NUMBER D55007S014
D55007A008 ASSEMBLY		EMERGENCY STOP	REV. A	SCALE
NEXT ASSEMBLY DWG. TYPE				



REV	DATE	DRAWN BY	APPRVD BY	DESCRIPTION
A	2-89	ANDREATTA		ADDED ITEM #54 AND NOTE #3
B	2-90	ANDREATTA		REMOVED ITEM #53 AND APEX SLEW CONTROL SWITCHES ; ADDED EMERGENCY STOP, FOCUS UP/DOWN, AND ROTATION UP/DWN SWITCHES ;

SURGE ARRESTOR TABLE		
SURGE ARRESTOR	ITEM	TERMINALS
V56ZA3, 45VDC, 35VRMS	51	4 THRU 11, 19 THRU 26, 34 THRU 41, 46 THRU 63, AND 93 THRU 101
V12ZA2, 8VDC, 6VRMS	52	64, 66, 67, 69, 71, 73, 74, 76, 82, 84, 85, 102, 104, 105, 107, 108, 110, 111, 113, 115, 116,
V150 LA 20B	54	1, 2, 31, 32



- 1 SEE VIEW 'A-A' AND SURGE ARRESTOR TABLE.
- 2 CUT RAILS TO 14.75" WITH SLOT ORIENTATION AS SHOWN.
- 3 TIE ALL CABLE TWISTED PAIR SHIELD TERMINALS TO GND BUS (I.E. TOP TIER TERMINALS) WITH A #16 BLACK WIRE INSTEAD OF SURGE ARRESTORS.

ACAD: ACJBASY1

FRONT VIEW
SCALE 1/1

BOM - #A55007B007

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES
 TOLERANCES: ANGLES ± _____
 3 PLACE DECIMALS (.000) ± _____
 2 PLACE DECIMALS (.00) ± _____
 1 PLACE DECIMALS (.0) ± _____

MATERIAL: _____
 FINISH: _____

V	L	B	A	F-R SYSTEM
T	E			F-R SYSTEM APEX CONTROL JUNCTION BOX ASSEMBLY

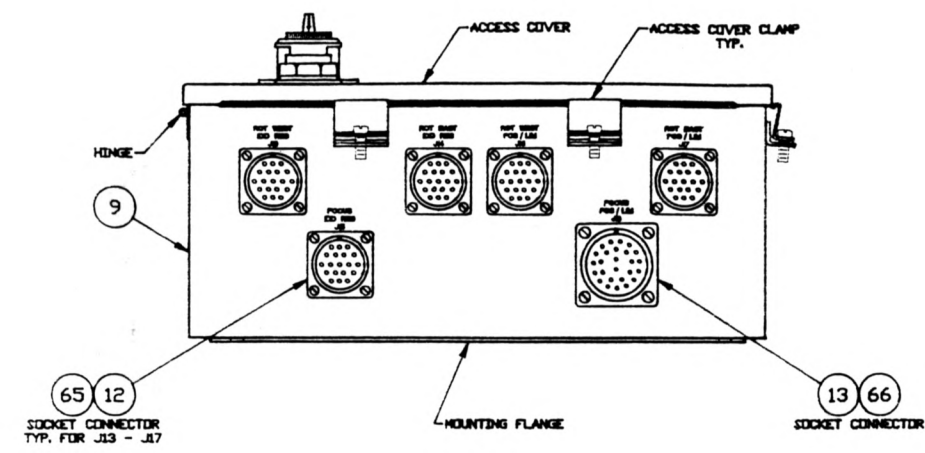
NATIONAL RADIO ASTRONOMY OBSERVATORY SOCORRO, NEW MEXICO 87801	
DRAWN BY ANDREATTA	DATE 8-88
DESIGNED BY WEBER	DATE 8-88
APPROVED BY	DATE

SHEET NUMBER 1 of 2	DRAWING NUMBER D55007A008	REV. B	SCALE 1/1
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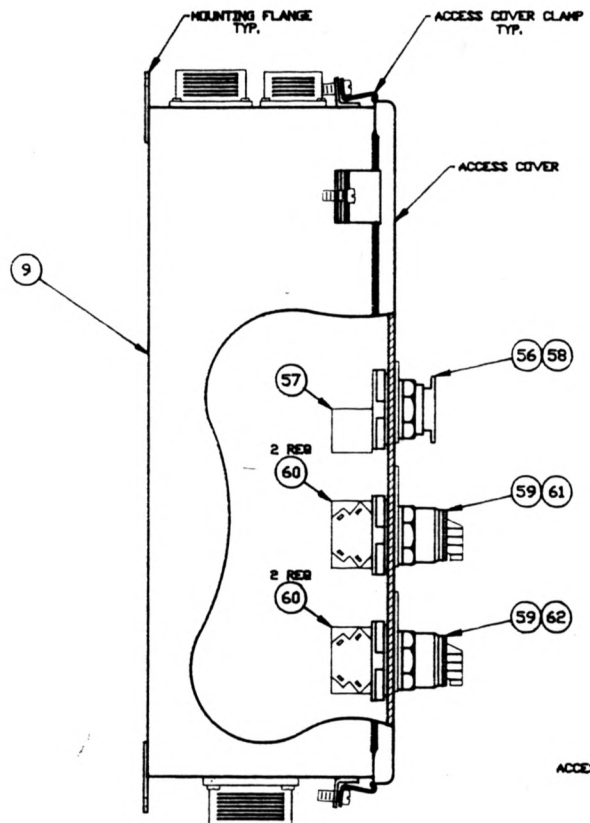
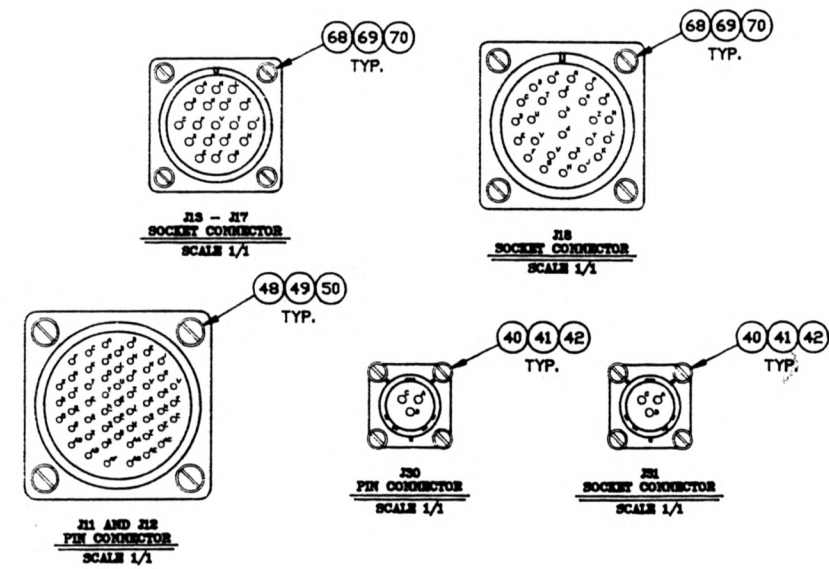
D55007M034	BOX DETAILS
D55007S014	SCHEMATIC
NEXT ASSEMBLY	DWG. TYPE

PROPERTY OF NRAO

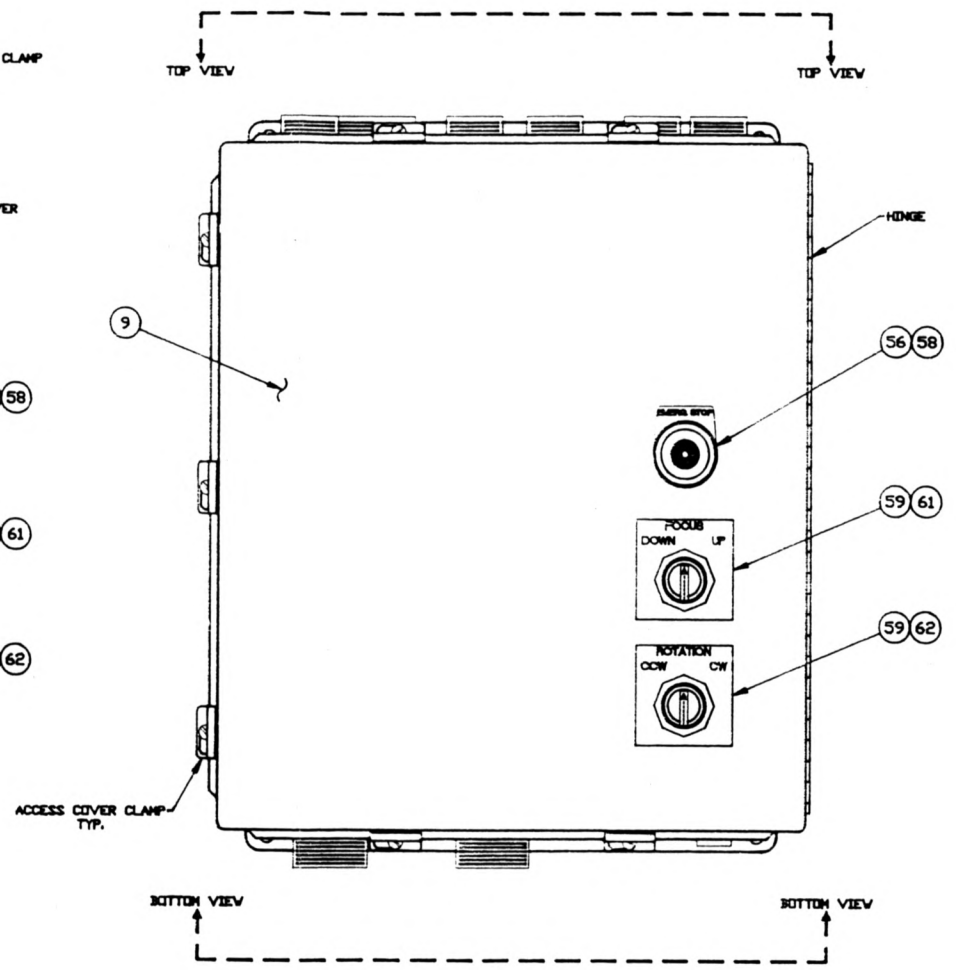
REV	DATE	DRAWN BY	APPRVD BY	DESCRIPTION
A	2-89	ANDREATTA		SEE SHEET #1
B	2-90	ANDREATTA		ADDED FRONT VIEW ; SEE SHEET #1 ;



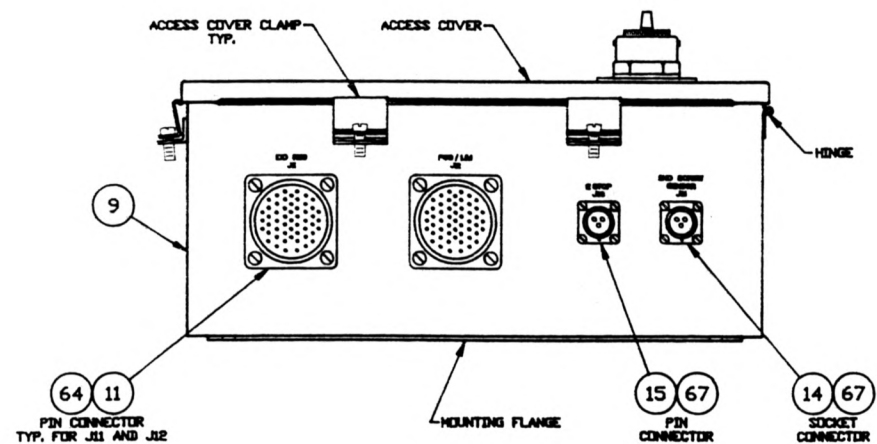
TOP VIEW
SCALE 1/2



SIDE VIEW
SCALE 1/2



FRONT VIEW
SCALE 1/2



BOTTOM VIEW
SCALE 1/2

BOM - #A55007B007

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES
TOLERANCES : ANGLES ± —
3 PLACE DECIMALS (.000) ± —
2 PLACE DECIMALS (.00) ± —
1 PLACE DECIMALS (.1) ± —

V L P
L B A
F-R SYSTEM
F-R SYSTEM
APEX CONTROL JUNCTION BOX ASSEMBLY

NATIONAL RADIO ASTRONOMY OBSERVATORY
SOCORRO, NEW MEXICO 87801
DRAWN BY ANDREATTA DATE 8-88
DESIGNED BY WEBER DATE 8-88
APPROVED BY DATE

D55007M034	BOX DETAILS
D55007S014	SCHEMATIC
NEXT ASSEMBLY	DWG. TYPE

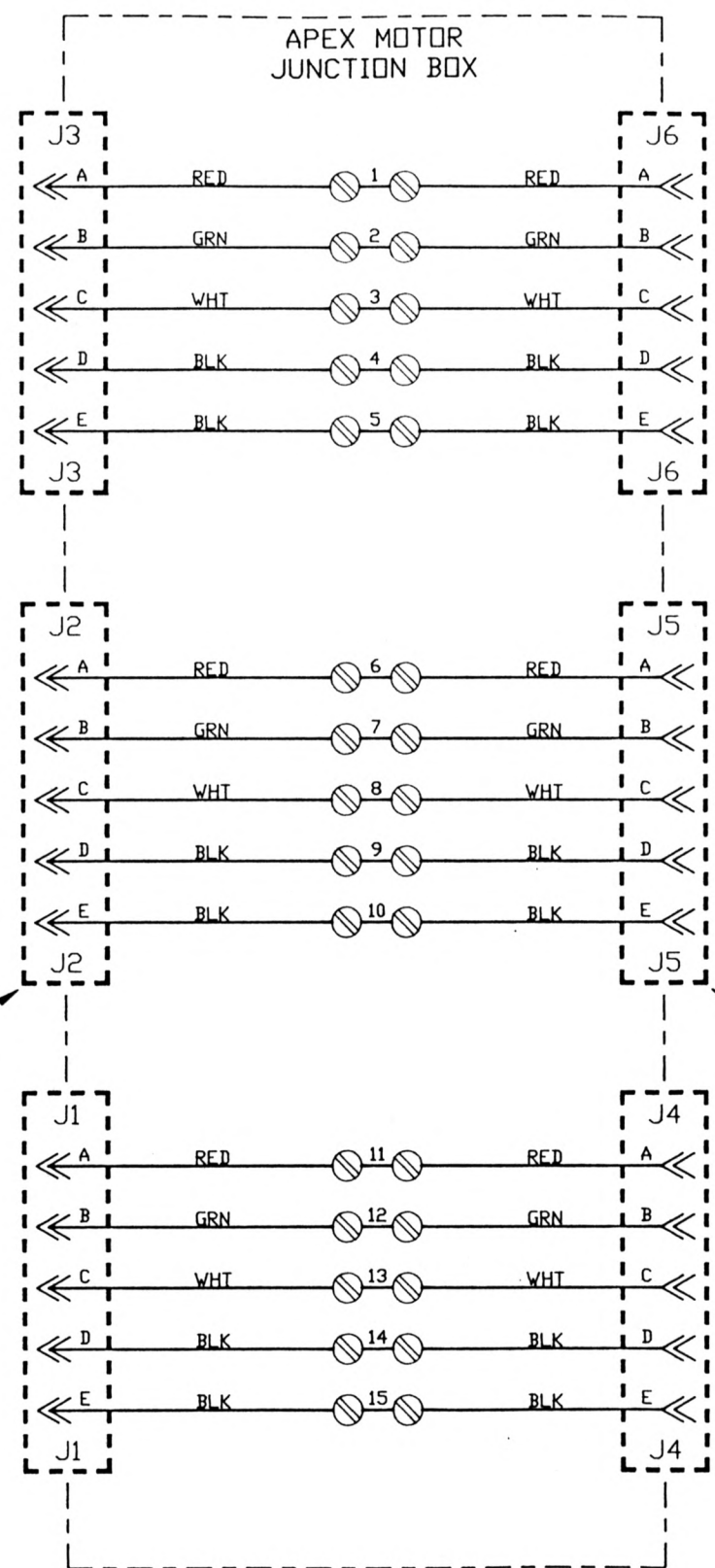
MATERIAL :
FINISH :

SHEET NUMBER 2 of 2	DRAWING NUMBER D55007A008	REV. B	SCALE 1/2
---------------------	---------------------------	--------	-----------

ACAD : ACJBASY2

PROPERTY OF INAO

REV	DATE	DRAWN BY	APPR'D BY	DESCRIPTION



MS3102R24-10P
TYP. J1, J2, J3

MS3102R24-10S
TYP. J4, J5, J6

- NOTES :
1. SURGE ARRESTOR TERMINALS AND WIRING NOT SHOWN FOR SIMPLICITY.
 2. ALL WIRE IS #10 AWG, 600V PVC INSULATION.
 3. FOR TWISTED PAIR WIRE, USE ARCOR #10713CX-1 CABLE AND STRIP JACKET.

D
C
B
A

D
C
B
A

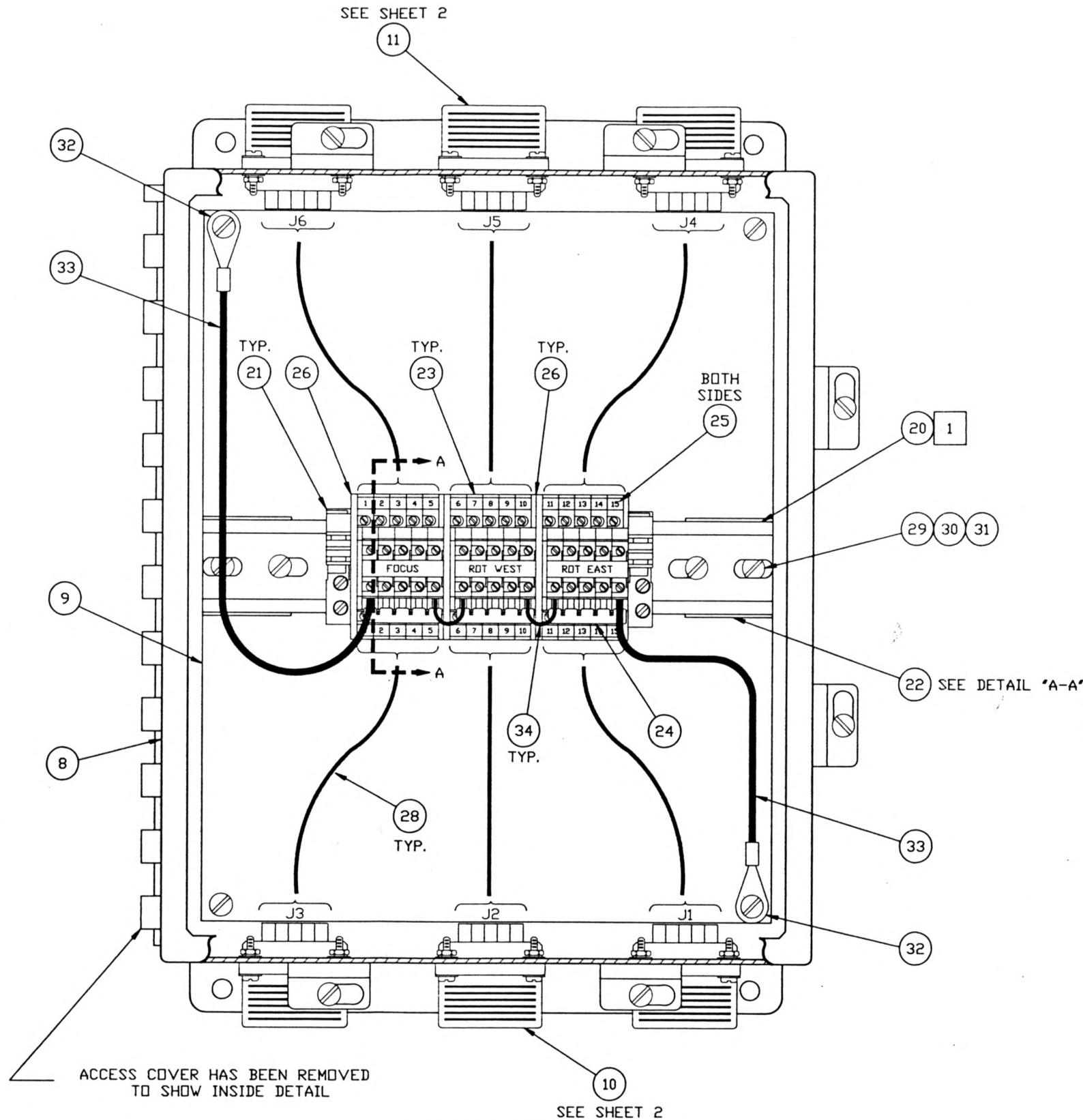
ACAD : AMJBOXSK

D55007A007	ASSEMBLY
NEXT ASSEMBLY	DWG. TYPE

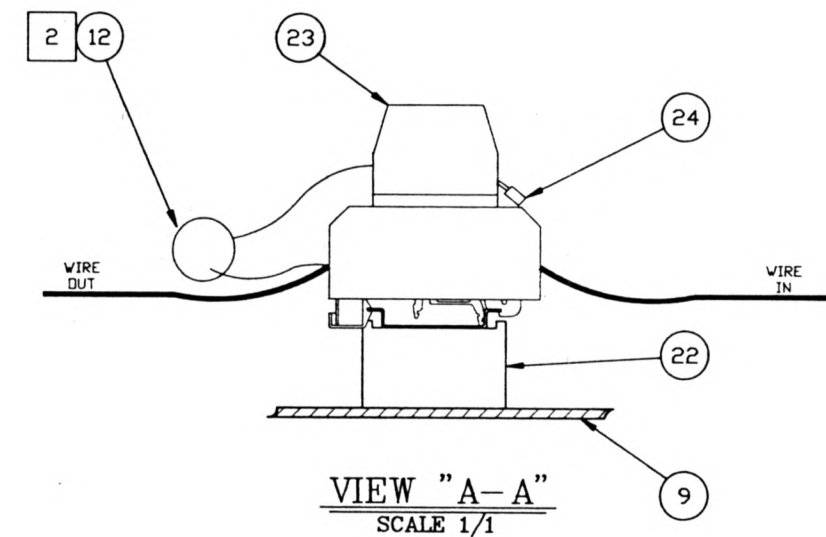
UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES		V L B A T I T L E	F-R SYSTEM F-R SYSTEM APEX MOTOR JUNCTION BOX SCHEMATIC	NATIONAL RADIO ASTRONOMY OBSERVATORY SOCORRO, NEW MEXICO 87801	
TOLERANCES : ANGLES ±	---			DRAWN BY ANDREATTA	DATE 8-88
3 PLACE DECIMALS (.000) ±	---			DESIGNED BY WEBER	DATE 8-88
2 PLACE DECIMALS (.00) ±	---			APPROVED BY	DATE
1 PLACE DECIMALS (.0) ±	---	FINISH : _____		SHEET NUMBER 1 of 1	DRAWING NUMBER C55007S015
MATERIAL : _____		REV.		SCALE	

PROPERTY OF NRAO

REV	DATE	DRAWN BY	APPRVD BY	DESCRIPTION
A	2-89	ANDREATTA		ADDED NOTE #2
B	4-90	ANDREATTA		MINDR CORRECTIONS



FRONT VIEW
SCALE 1/1

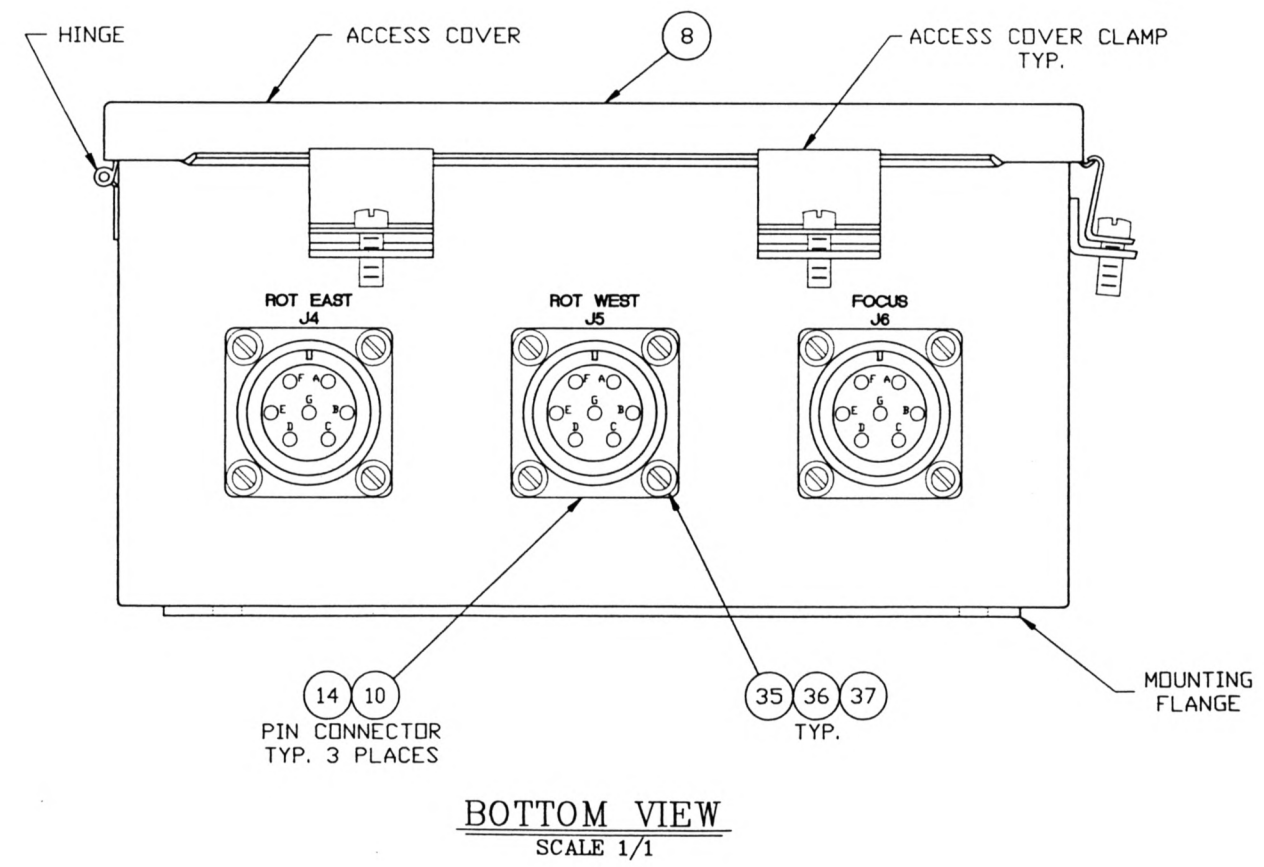
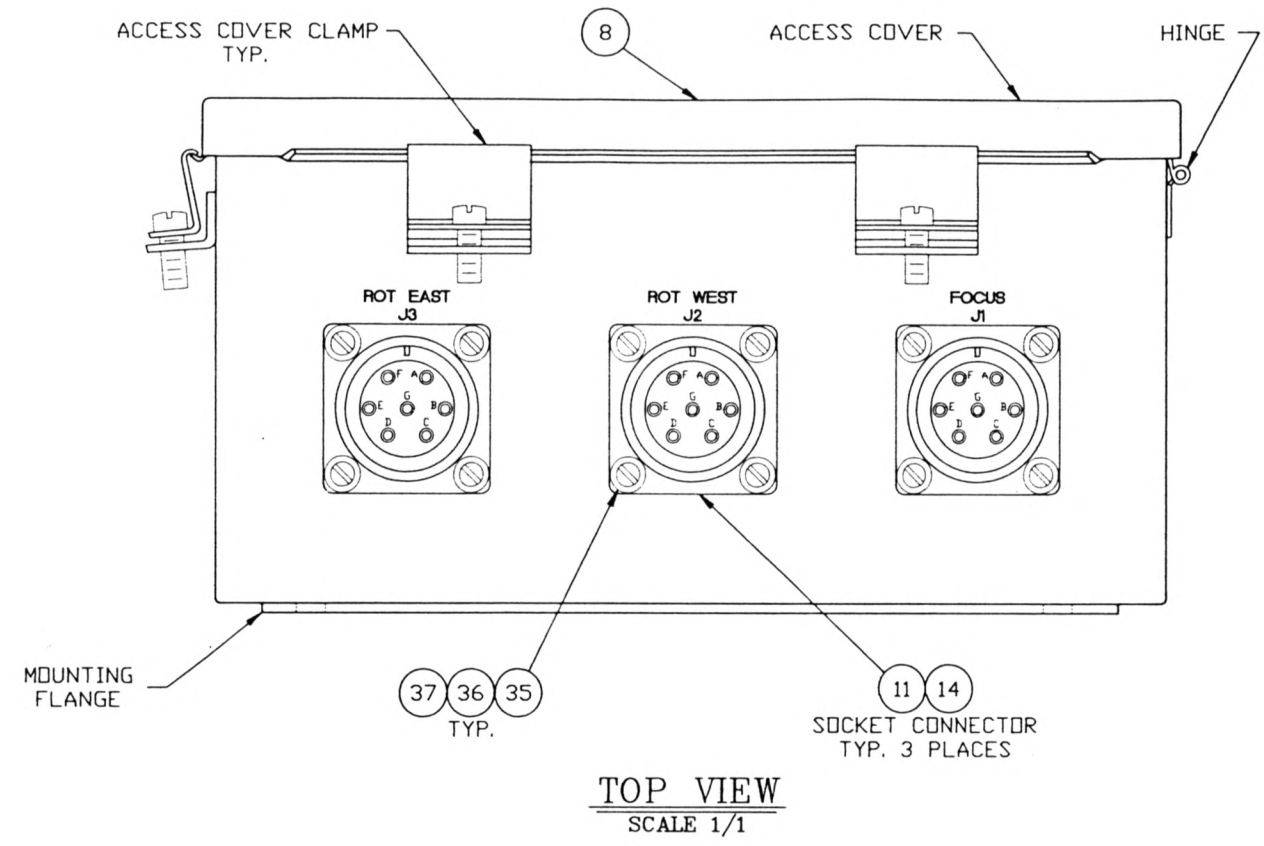


VIEW "A-A"
SCALE 1/1

- 1 CUT RAILS TO 8.94' WITH SLOT ORIENTATION AS SHOWN.
- 2 AT SHIELD POINTS TIE A #16 BLACK WIRE TO GND TERMINAL (TIER 2) IN PLACE OF A SURGE ARRESTOR. SURGE ARRESTOR IS GE #V230LA20A.

BOM - #A55007B001		UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES		V L B A		F-R SYSTEM		NATIONAL RADIO ASTRONOMY OBSERVATORY SOCORRO, NEW MEXICO 87801	
TOLERANCES: ANGLES 0		3 PLACE DECIMALS (.000)		2 PLACE DECIMALS (.00)		1 PLACE DECIMALS (.0)		DRAWN BY ANDREATTA DATE 8-88	
MATERIAL:		FINISH:		F-R SYSTEM APEX MOTOR JUNCTION BOX ASSEMBLY		DESIGNED BY WEBER DATE 6-88		APPROVED BY DATE	
D55007M033 BOX DETAILS		C55007S015 SCHEMATIC		NEXT ASSEMBLY DWG. TYPE		SHEET NUMBER 1 of 2 DRAWING NUMBER D55007A007		REV. B SCALE 1/1	

REV	DATE	DRAWN BY	APPRVD BY	DESCRIPTION
A	2-89	ANDREATA		ADDED NOTE #2
B	4-90	ANDREATA		MINOR CORRECTIONS



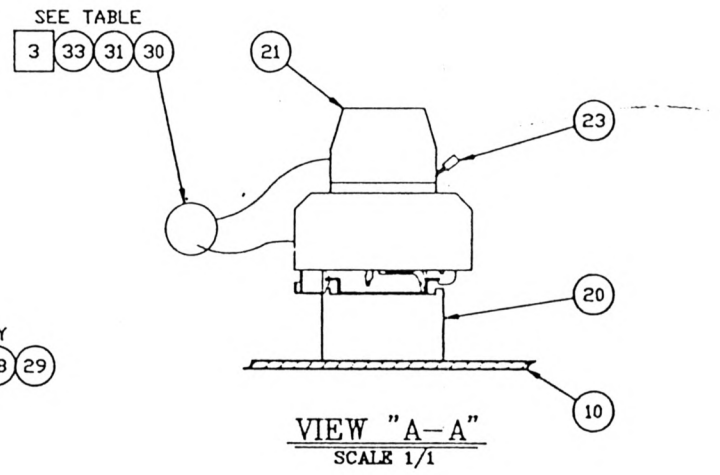
ACAD : AMJBASY2

BOM - #A55007B001

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES		V L B A	F-R SYSTEM	NATIONAL RADIO ASTRONOMY OBSERVATORY SOCORRO, NEW MEXICO 87801	
TOLERANCES : ANGLES #	---			DRAWN BY ANDREATA	DATE 8-88
2 PLACE DECIMALS (.000 #)	---			DESIGNED BY WEBER	DATE 6-88
1 PLACE DECIMALS (.00 #)	---			APPROVED BY	DATE
MATERIAL :	---	F-R SYSTEM APEX MOTOR JUNCTION BOX ASSEMBLY		SHEET NUMBER 2 of 2	DRAWING NUMBER D55007A007
FINISH :	---			REV. B	SCALE 1/1
D55007M033	BOX DETAILS				
C55007S015	SCHEMATIC				
NEXT ASSEMBLY	DWG. TYPE				

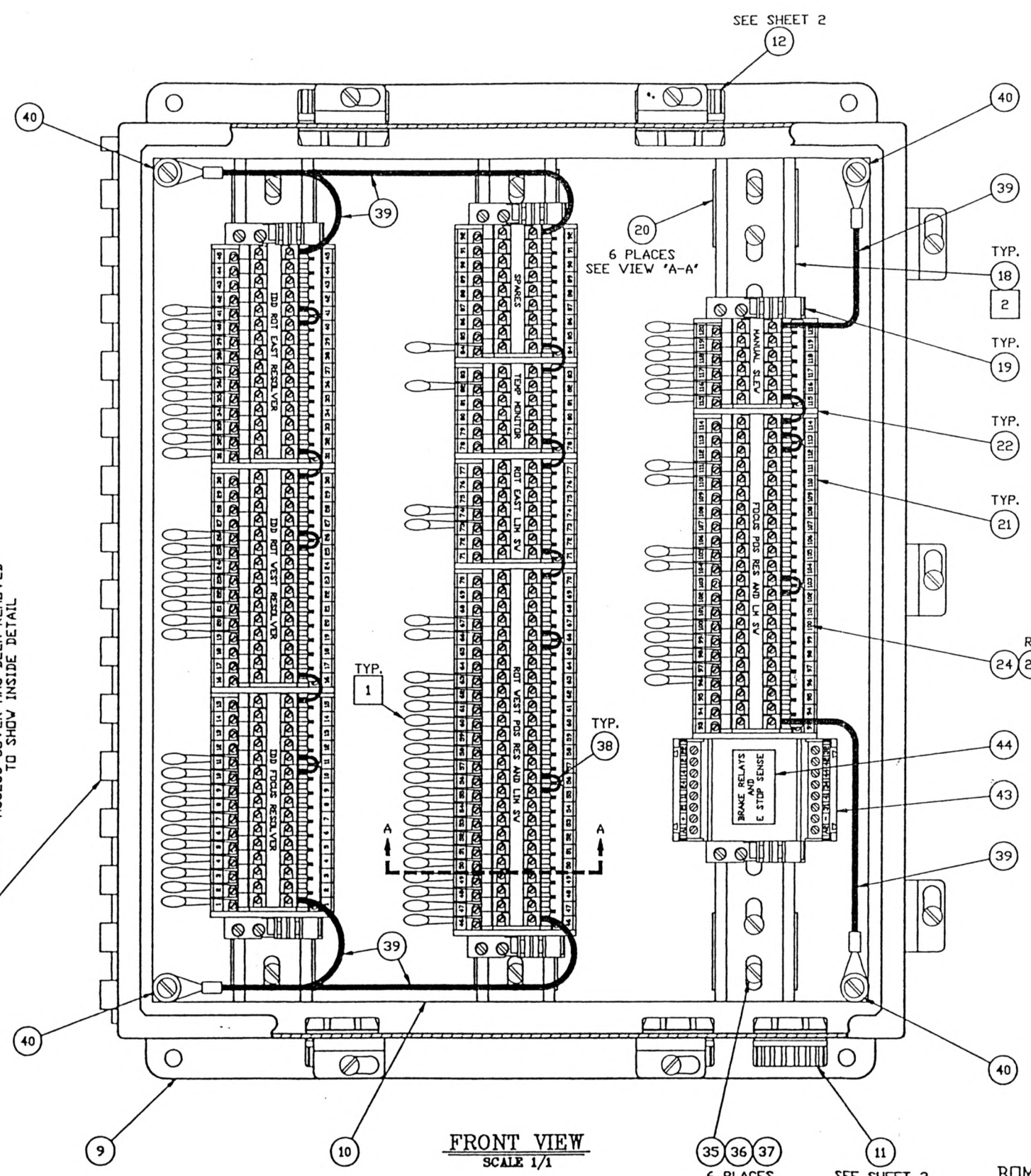
REV	DATE	DRAWN BY	APPRVD BY	DESCRIPTION
B	1-90	ANDREATTA		ADDED BRAKE RELAYS AND E STOP SENSE ; DELETED ITEM #32 ; REDRAWN WITH ACAD ;

SURGE ARRESTOR TABLE		
SURGE ARRESTOR	ITEM	TERMINALS
V56ZA3, 45VDC, 35VRMS	30	4 THRU 11, 19 THRU 26, 34 THRU 41, 46 THRU 63, AND 96 THRU 101
V12ZA2, 8VDC, 6VRMS	31	66, 67, 73, 74, 82, 84, 104, 105, 110, 111, 115 THRU 120
V150 LA 20B	33	1 THRU 3, 31 THRU 33



- 1 SEE VIEW "A-A" AND SURGE ARRESTOR TABLE.
- 2 CUT RAILS TO 14.75" WITH SLOT ORIENTATION AS SHOWN.
- 3 TIE ALL CABLE TWISTED PAIR SHIELD TERMINALS TO GND BUS (I.E. TOP TIER TERMINALS) WITH A #16 BLACK WIRE INSTEAD OF SURGE ARRESTORS.

ACCESS COVER HAS BEEN REMOVED TO SHOW INSIDE DETAIL



6 PLACES SEE SHEET 2

BOM - #A55007B013

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES
 TOLERANCES : ANGLES 0
 2 PLACE DECIMALS (.00) 0
 3 PLACE DECIMALS (.000) 0
 4 PLACE DECIMALS (.0000) 0

D55007W003	CABLE DIAGRAM
D55007M018	MECHANICAL
NEXT ASSEMBLY	DWG. TYPE

MATERIAL :
 FINISH :
 1

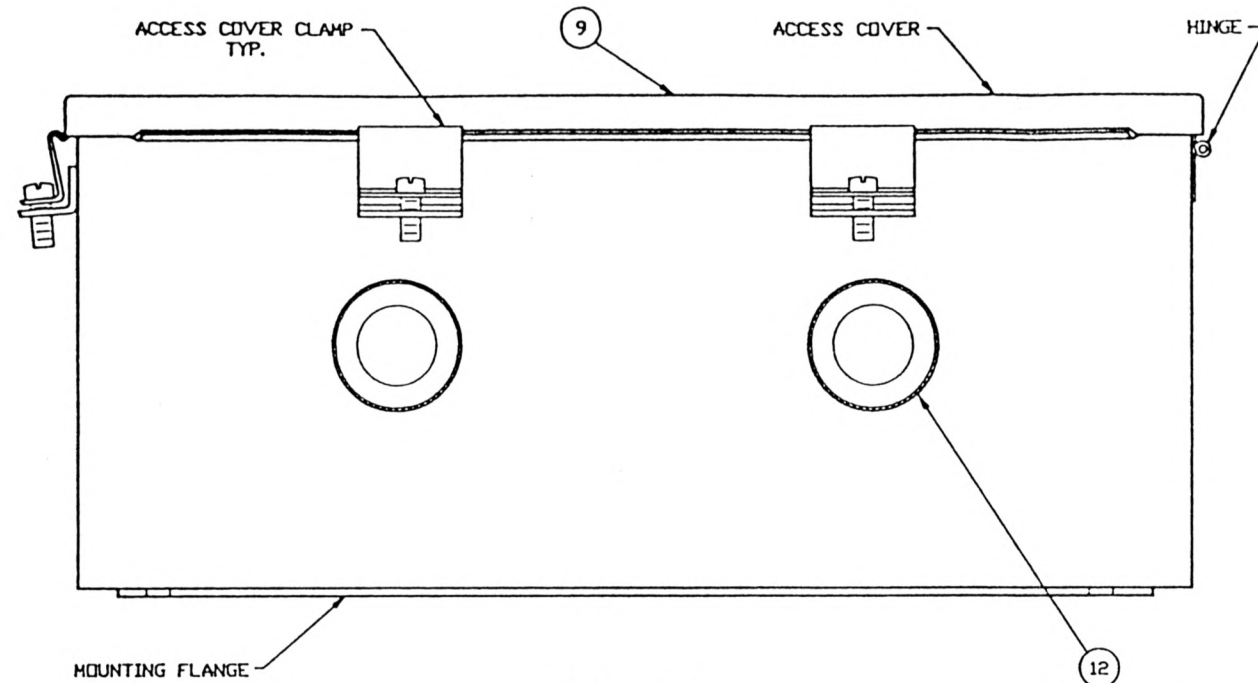
V L B A
 F-R SYSTEM
 F-R SYSTEM
 PEDESTAL ROOM
 JUNCTION BOX
 ASSEMBLY

NATIONAL RADIO ASTRONOMY OBSERVATORY
 SOCORRO, NEW MEXICO 87801
 DRAWN BY ANDREATTA DATE 8-88
 DESIGNED BY WEBER DATE 6-88
 APPROVED BY DATE

SHEET NUMBER 1 of 2 DRAWING NUMBER D55007A009 REV. B SCALE 1/1

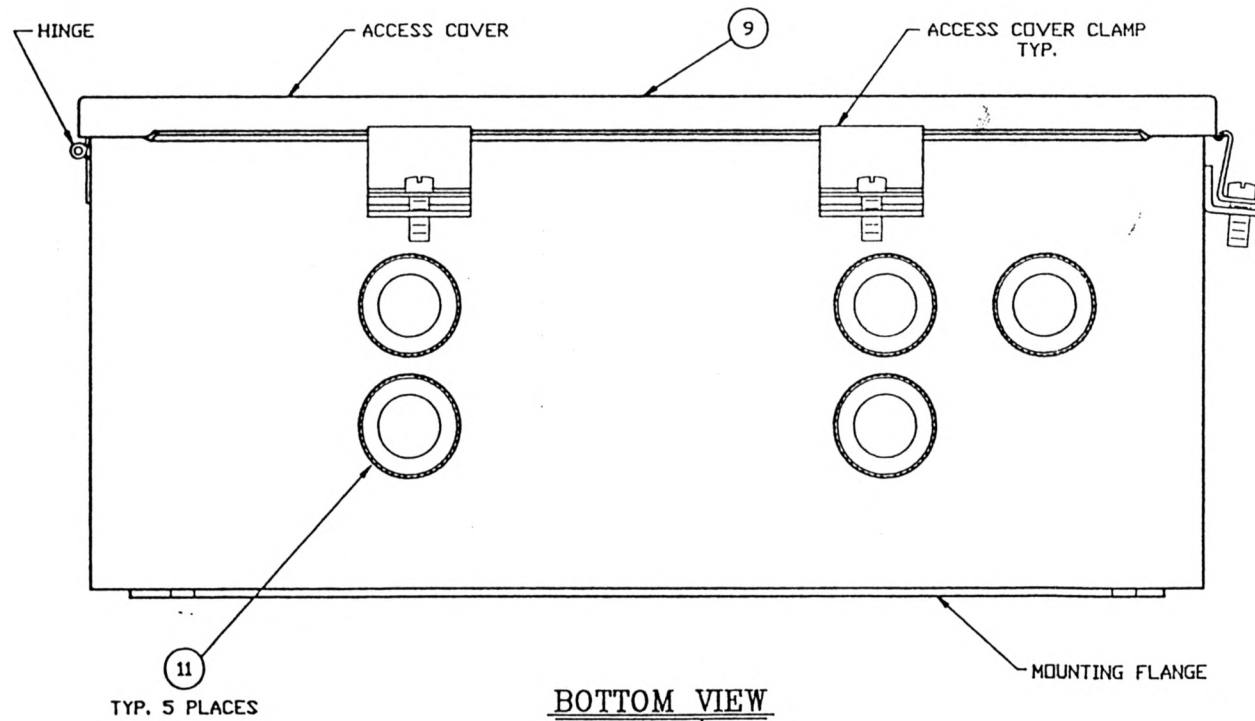
REV	DATE	DRAWN BY	APPRVD BY	DESCRIPTION
A	1-90	ANDREATA		SEE SHEET 1

D



TOP VIEW
SCALE 1/1

C



BOTTOM VIEW
SCALE 1/1

B

A

ACAD : PRJBASY2

BOM - #A55007B013

UNLESS OTHERWISE SPECIFIED
DIMENSIONS ARE IN INCHES
TOLERANCES : ANGLES ±
3 PLACE DECIMALS (.000) ±
2 PLACE DECIMALS (.00) ±
1 PLACE DECIMALS (.1) ±

V
L
B
A

F-R
SYSTEM

I
T
E

F-R SYSTEM
PEDESTAL ROOM
JUNCTION BOX
ASSEMBLY

NATIONAL RADIO
ASTRONOMY
OBSERVATORY
SOCORRO, NEW MEXICO 87801

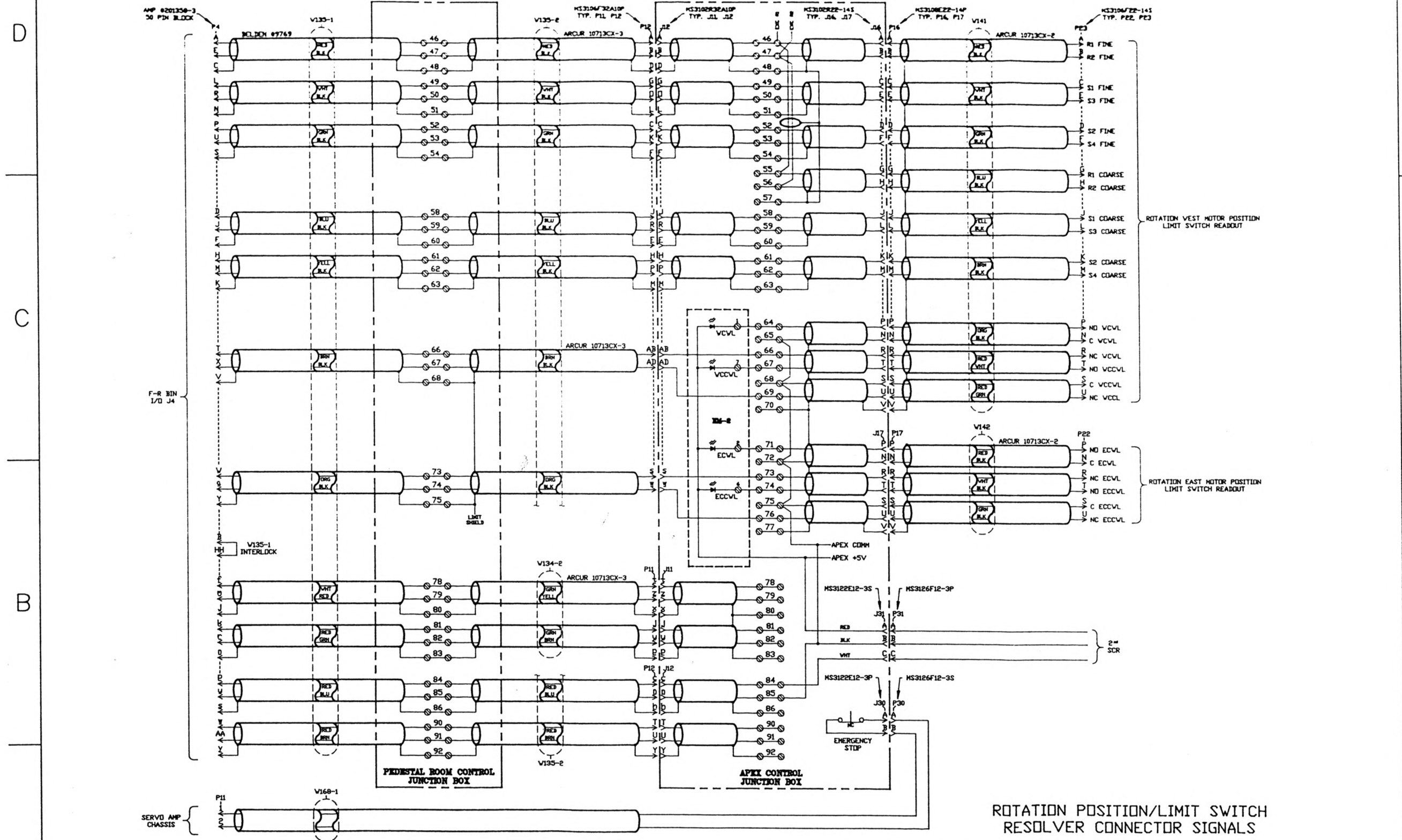
DRAWN BY ANDREATA	DATE 8-88
DESIGNED BY WEBER	DATE 6-88
APPROVED BY	DATE

D55007W003	CABLE DIAGRAM
D55007M018	MECHANICAL
NEXT ASSEMBLY	DWG. TYPE

MATERIAL :
FINISH :

SHEET NUMBER 2 of 2	DRAWING NUMBER D55007A009	REV. A	SCALE 1/1
---------------------	---------------------------	--------	-----------

REV	DATE	DRAWN BY	APPRVD BY	DESCRIPTION
E	1-90	ANDREATTA		REDRAWN WITH ACAD



ROTATION POSITION/LIMIT SWITCH RESOLVER CONNECTOR SIGNALS

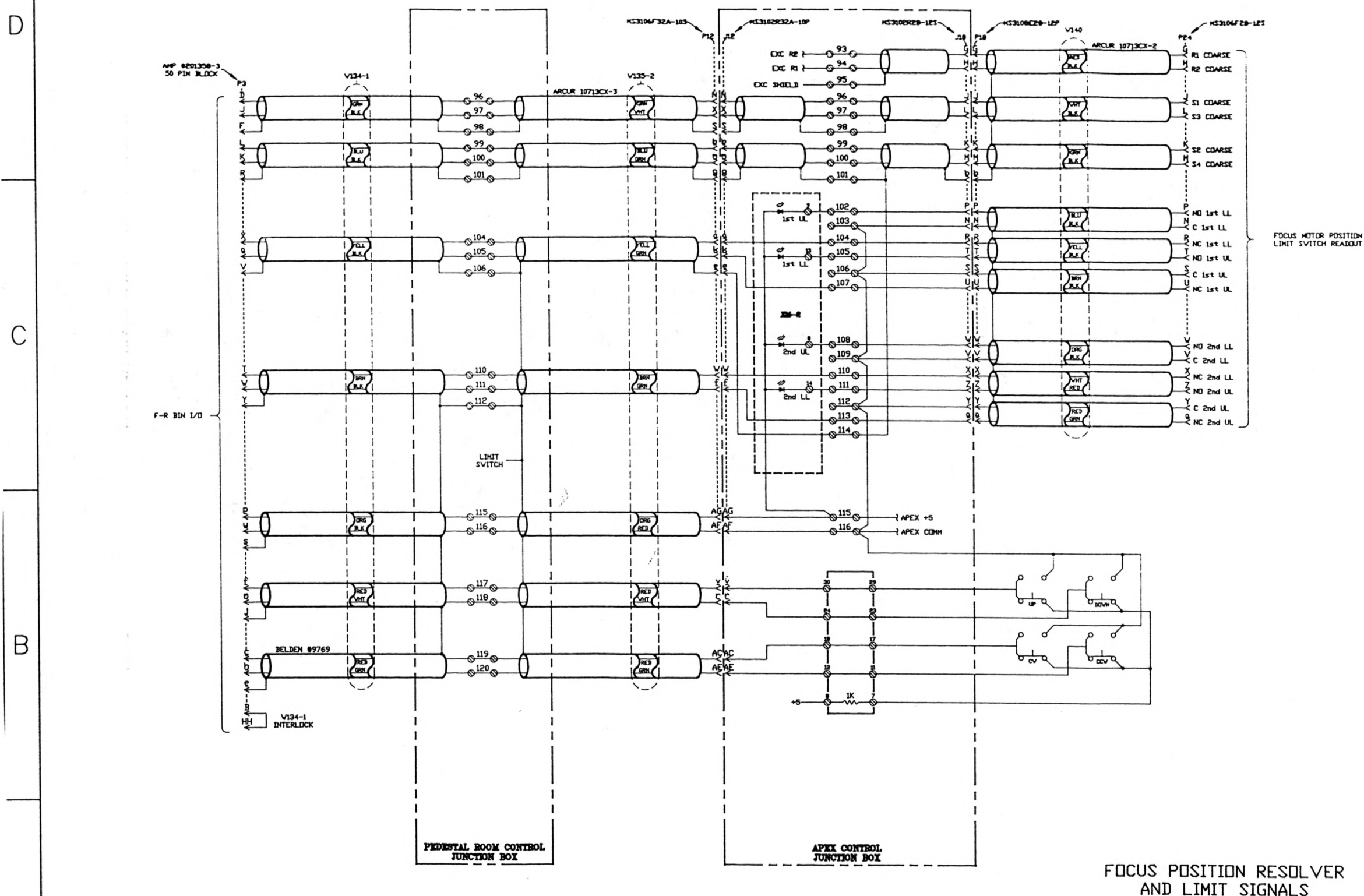
ACAD APXPED-1

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES
 TOLERANCES: ANGLES ± _____
 3 PLACE DECIMALS (.000) ± _____
 2 PLACE DECIMALS (.00) ± _____
 1 PLACE DECIMALS (.1) ± _____
 MATERIAL: _____
 FINISH: _____

V L B A T E	F-R SYSTEM	NATIONAL RADIO ASTRONOMY OBSERVATORY SOCORRO, NEW MEXICO 87801	
	F-R SYSTEM APEX TO PEDESTAL ROOM SIGNALS CABLE DIAGRAM	DRAWN BY WEBER	DATE 4-87
		DESIGNED BY WEBER	DATE 4-87
		APPROVED BY	DATE
SHEET NUMBER	1 of 3	DRAWING NUMBER	D55007W003
NEXT ASSEMBLY	DWG. TYPE	REV.	E
		SCALE	

PROPERTY OF NRAO

REV	DATE	DRAWN BY	APPRVD BY	DESCRIPTION
E	1-90	ANDREATA		REDRAWN WITH ACAD



FOCUS POSITION RESOLVER
AND LIMIT SIGNALS

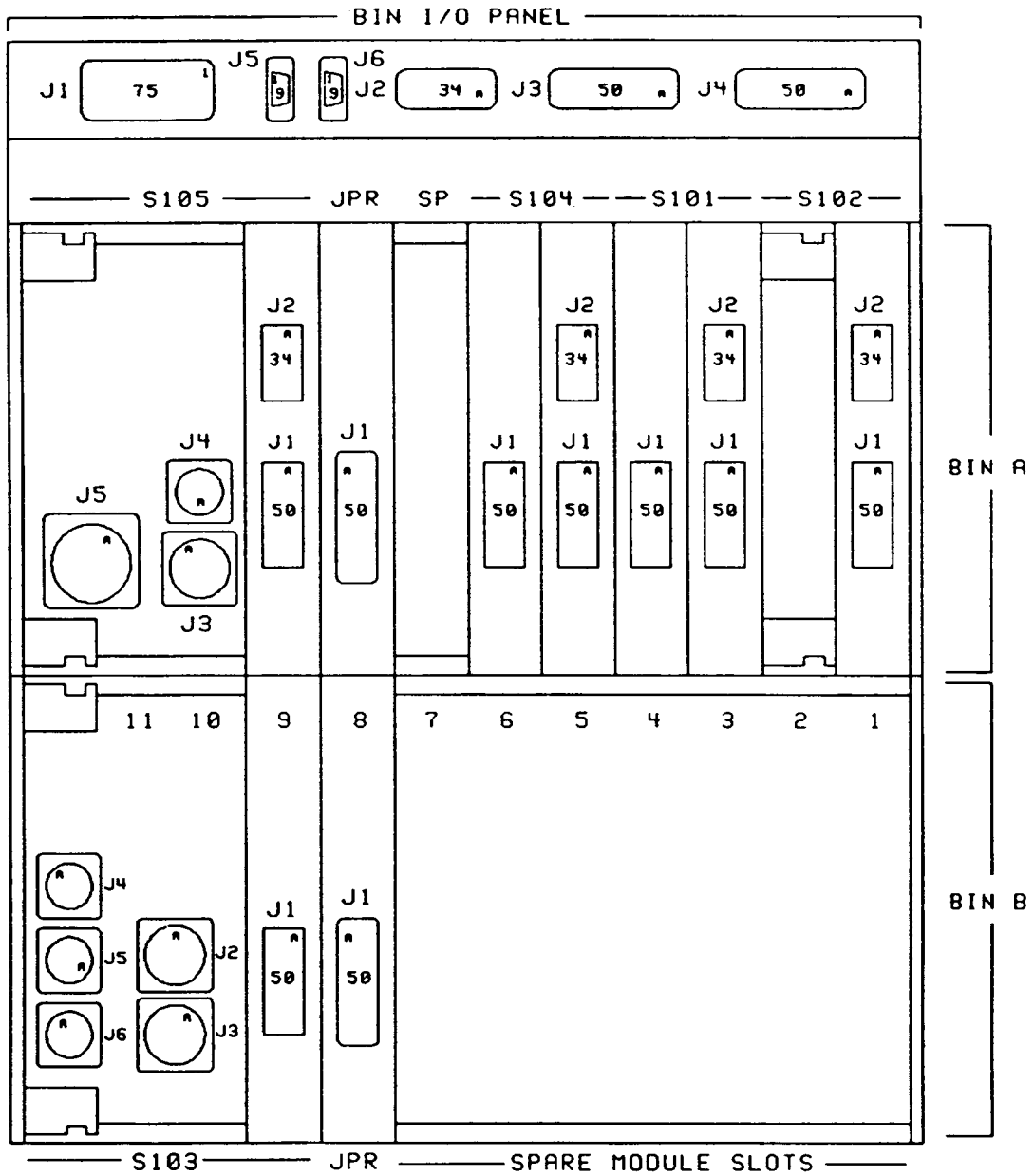
ACAD : APXPED-2

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES		V L B A P E T E R S O N S	F-R SYSTEM	NATIONAL RADIO ASTRONOMY OBSERVATORY SOCORRO, NEW MEXICO 87801		
TOLERANCES : ANGLES ± _____				DRAWN BY WEBER		DATE 4-87
3 PLACE DECIMALS (.000) ± _____				DESIGNED BY WEBER		DATE 4-87
2 PLACE DECIMALS (.00) ± _____				APPROVED BY		DATE
1 PLACE DECIMALS (.0) ± _____		MATERIAL : _____		SHEET NUMBER 2 of 3		
FINISH : _____		DRAWING NUMBER D55007V003		REV. E SCALE _____		
NEXT ASSEMBLY	DWG. TYPE					

F-R BIN WIRE LIST

NOTES:

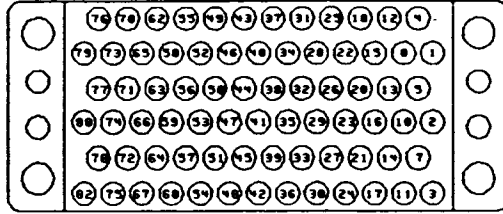
- 1) WIRING DATA FOR THIS WIRE LIST IS ABSTRACTED FROM DRAWING A550074005
- 2) SHEET NUMBERS IN THIS WIRE LIST DIFFER FROM THOSE IN A 550074005
- 3) A550074005 SHEETS 31 - 42 ARE NOT INCLUDED IN THIS WIRE LIST SINCE THEY ARE AMP CONNECTOR CONTACT LAYOUT-SIGNAL ASSIGNMENT SHEETS. THESE SHEETS ARE REPLACED BY WIRE LIST SHEET 2 WHICH DEPICTS THE CONTACT LAYOUT OF ALL AMP BIN I/O AND MODULE CONNECTORS.
- 4) LOWER CASE CONTACTS FOR AMP 50 CONTACT CONNECTORS ARE DESIGNATED BY UPPER CASE CHARACTERS WITH A DASH SUFFIX. FOR EXAMPLE, A_ AND K_ DENOTE LOWER CASE A AND K.



NOTES:
 CABLES NOT SHOWN
 JPR IS THE BIN-TO-BIN JUMPER CONNECTOR

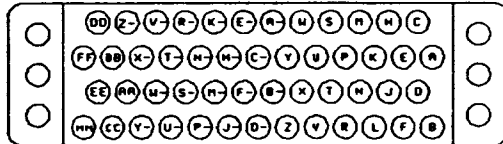
BIN I/O CONNECTORS

75 CONTACTS



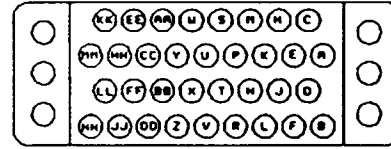
I/O-J1

50 CONTACTS*



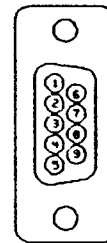
I/O-J3, I/O-J4

34 CONTACTS



I/O-J2

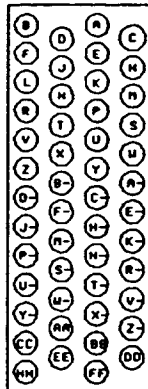
9 CONTACT "D"



I/O-J5, I/O-J6

MODULE I/O CONNECTORS

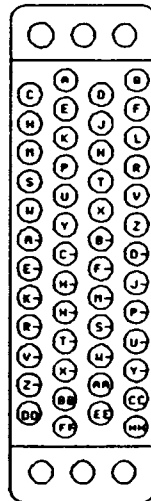
50 CONTACTS*



BIN A

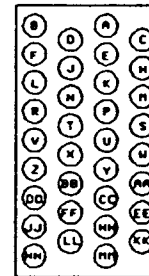
BIN B

1-J1, 3-J1 9-J1
4-J1, 5-J1
6-J1, 9-J1



JPR-J1

34 CONTACTS



BIN A

1-J2, 3-J2
5-J2, 9-J2

* CONTACT DESIGNATORS WITH A DASH SUFFIX ARE LOWER CASE LETTERS

PIN	FUNCTION	TYPE	FROM	TO
A	APEX INT +15V	RED, #18	A-9J2-A	
B	APEX INT +5V GND	BLACK, #16	A-8J1-B, A-9J2-F	
C	APEX INT +5V	ORANGE, #16	A-8J1-H, A-9J2-B	
D				
E	APEX INT -15V	YELLOW, #18	A-9J2-E	
F	FOCUS S1	TP/J #26, RED	I/O-J3-D	
H	FOCUS S2	TP/K #26, RED	I/O-J3-K	
J	FOCUS S3	TP/F #26, BLK	I/O-J3-J	
K	FOCUS S4	TP/H #26, BLK	I/O-J3-L	
L				
M	ROTATION COARSE S1	TP/P #26, RED	I/O-J4-D	
N	ROTATION COARSE S2	TP/R #26, RED	I/O-J4-H	
P	ROTATION COARSE S3	TP/M #26, BLK	I/O-J4-J	
R	ROTATION COARSE S4	TP/N #26, BLK	I/O-J4-M	
S	APEX RH	TP/T #26, RED	A-8J1-W	
T	APEX RL	TP/S #26, BLK	A-8J1-Y	
U				
V	ROTATION FINE S1	TP/X #26, RED	I/O-J4-L	
W	ROTATION FINE S2	TP/Y #26, RED	I/O-J4-P	
X	ROTATION FINE S3	TP/V #26, BLK	I/O-J4-R	
Y	ROTATION FINE S4	TP/Y #26, BLK	I/O-J4-U	
Z				
A_				
B_				
C_				
D_				
E_				
F_				
H_				
J_				
K_				
M_				
N_	FOCUS BRAKE V*I	26 WW	A-8J1-S	
P_	ROTATION BRAKE V*I	26 WW	A-8J1-T	
R_	FOC/ROT BRAKE V*I RETURN	26 WW	A-8J1-U	
S_				
T_				
U_				
V_				
W_	AD590 TEMP1+	26 WW	I/O-J4-F_	
X_	AD590 TEMP1-	26 WW	I/O-J4-M_	
Y_				
MODULE S102		BIN A	CONN 1-J1	AMP 50
F-R BIN WIRE LIST				SHEET 4 OF 39

PIN	FUNCTION	TYPE	FROM	TO
A	+15V	RED, #18	A-9J1-Z	
B	+5V GND	BLK, #16	A-9J1-E	
C	+5V	ORNG, #16	A-9J1-F	
D				
E	-15V	YELL, #18	A-9J1-Y_	
F				
H				
J	F-RET	26WW	A-5J1-J	
K	FBF0	26WW	A-5J1-K	
L	FBF1	26WW	A-5J1-L	
M	FBF2	26WW	A-5J1-M	
N	FBF3	26WW	A-5J1-N	
P	FBF4	26WW	A-5J1-P	
R	FBF5	26WW	A-5J1-R	
S	FBF6	26WW	A-5J1-S	
T	FBF7	26WW	A-5J1-T	
U	F395	26WW	A-5J1-U	
V	F396	26WW	A-5J1-V	
W	F397	26WW	A-5J1-W	
X	F398	26WW	A-5J1-X	
Y	F399	26WW	A-5J1-Y	
Z	F400	26WW	A-5J1-Z	
A_	F407	26WW	A-5J1-A_	
B_	F408	26WW		
C_	F409	26WW		
D_	F410	26WW		
E_				
F_	FOCUS SPEED COMMAND	TP/H_ #26 RED		I/O-J1-1
H_	FOCUS SPEED COMMAND RET	TP/F_ #26 RED		I/O-J1-4
J_	FOCUS BDS3 INHIBIT	26WW		I/O-J1-13
K_	FOCUS BDS3 RESET	26WW		I/O-J1-14
M_	FOCUS BDS3 RETURN	26WW		I/O-J1-11
N_	ROT/FOC DMA/DATA RETURN	26WW	A-6J1-E	
P_	FOCUS DATA CONTROL	26WW	A-6J1-C	
R_	FOCUS DMA CONTROL	26WW	A-6J1-A	
S_	FOCUS DATA	TP/T_ 26WW WHT	A-1J2-E	
T_	FOCUS DATA RETURN	TP/S_ 26WW BLK	A-1J2-H	
U_	FOCUS CLOCK	TP/V_ 26WW WHT	A-1J2-L	
V_	FOCUS CLOCK RETURN	TP/U_ 26WW BLK	A-1J2-N	
W_	FOCUS DATA REQUEST	TP/X_ 26WW WHT		A-1J2-A
X_	FOCUS DATA REQUEST RET	TP/W_ 26WW BLK		A-1J2-C
Y_	FOCUS MOTOR CURRENT	TP/Z 26WW WHT	I/O-J1-3	
MODULE S101		BIN A	CONN 3-J1	AMP 50
F-R BIN WIRE LIST			SHEET 7 OF 39	

PIN	FUNCTION	TYPE	FROM	TO
A	INTD0	26WW	A-5J2-P	
B	INTD1	26WW	A-5J2-N	
C	INTD2	26WW	A-5J2-M	
D	INTD3	26WW	A-5J2-L	
E	INTD4	26WW	A-5J2-K	
F	INTD5	26WW	A-5J2-J	
H	INTD6	26WW	A-5J2-H	
J	INTD7	26WW	A-5J2-F	
K	RBUF0	26WW	A-6J1-K	
L	RBUF1	26WW	A-6J1-L	
M	RBUF2	26WW	A-6J1-M	
N	RBUF3	26WW	A-6J1-N	
P	RBUF4	26WW	A-6J1-P	
R	RBUF5	26WW	A-6J1-R	
S	RBUF6	26WW	A-6J1-S	
T	RBUF7	26WW	A-6J1-T	
U	R395	26WW		A-6J1-U
V	R396	26WW		A-6J1-V
W	R397	26WW		A-6J1-W
X	R398	26WW		A-6J1-X
Y	R399	26WW		A-6J1-Y
Z	R400	26WW		A-6J1-Z
A_	R407	26WW		A-6J1-A_
B_	R408	26WW		A-6J1-B_
C_	R409	26WW		
D_	R410	26WW		
E_	R-RET	26WW		A-6J1-J
F_	ROTATION SPEED COMMAND	TP/H_ 26 RED		I/O-J1-28
H_	ROTATION SPEED CMD RET	TP/F_ 26 BLK		I/O-J1-31
J_	ROTATION BDS3 INHIBIT	26WW		I/O-J1-38
K_	ROTATION BDS3 RESET	26WW		I/O-J1-39
M_	CABLE INTERLOCK	26WW	I/O-J4-HH	
N_	ROTATION BDS3 RETURN	26WW		I/O-J1-36
P_	ROTATION DATA CONTROL	26WW	A-6J1-D	
R_	ROTATION DMA CONTROL	26WW	A-6J1-B	
S_	ROTATION DATA	TP/T_ 26WW WHT	A-1J2-F	
T_	ROTATION DATA RETURN	TP/S_ 26WW BLK	A-1J2-J	
U_	ROTATION CLOCK	TP/R_ 26WW WHT	A-1J2-M	
V_	ROTATION CLOCK RETURN	TP/U_ 26WW BLK	A-1J2-P	
W_	ROTATION DATA REQUEST	TP/X_ 26WW WHT		A-1J2-B
X_	ROTATION DATA REQUEST RET	TP/W_ 26WW BLK		A-1J2-D
Y_	ROTATION MOTOR CURRENT	TP/Z_ 26WW WHT	I/O-J1-30	
MODULE S101		BIN A	CONN 4-J1	AMP 50
F-R BIN WIRE LIST			SHEET 10 OF 39	

PIN	FUNCTION	TYPE	FROM	TO
A	+15V	RED, #18	A-9J1-Y	
B	+5V GND	BLACK, #16	A-9J1-C	
C	+5V	ORANGE, #16	A-9J1-D	
D				
E	-15V	YELLOW, #18	A-9J1-X ₋	
F				
H				
J	F-RET	26W		A-3J1-J
K	FBF0	26W		A-3J1-K
L	FBF1	26W		A-3J1-L
M	FBF2	26W		A-3J1-M
N	FBF3	26W		A-3J1-N
P	FBF4	26W		A-3J1-P
R	FBF5	26W		A-3J1-R
S	FBF6	26W		A-3J1-S
T	FBF7	26W		A-3J1-T
U	F395	26W	A-3J1-U	
V	F396	26W	A-3J1-V	
W	F397	26W	A-3J1-W	
X	F398	26W	A-3J1-X	
Y	F399	26W	A-3J1-Y	
Z	F400	26W	A-3J1-Z	
A ₋	F407	26W	A-3J1-A ₋	
B ₋	F408	26W		
C ₋	F409	26W		
D ₋	FOCUS BUS FAULT	26W	I/O-J1-16	
E ₋	FOCUS FOLDBACK	26W	I/O-J1-15	
F ₋	FOCUS OVERTEMP	26W	I/O-J1-20	
H ₋	FOCUS DRIVE UP	26W	I/O-J1-12	
J ₋	FOCUS OVER CURRENT	26W	I/O-J1-21	
K ₋	FOCUS POWER LOSS	26W	I/O-J1-18	
M ₋	FOCUS INHIBIT	26W	I/O-J1-17	
N ₋	FOCUS OVERSPEED	26W	I/O-J1-22	
P ₋	FOCUS RETURN	26W	I/O-J1-11	
R ₋				
S ₋				
T ₋				
U ₋				
V ₋				
W ₋				
X ₋				
Y ₋				
MODULE S104		BIN A	CONN 5-J1 AMP 50	
F-R BIN WIRE LIST			SHEET 12 OF 39	

PIN	FUNCTION	TYPE	FROM	TO
A	FOCUS DMA CONTROL	26WU		A-3J1-R ₋
B	ROTATION DMA CONTROL	26WU		A-4J1-R ₋
C	FOCUS DATA CONTROL	26WU		A-3J1-P ₋
D	ROTATION DATA CONTROL	26WU		A-4J1-P ₋
E	ROT/FOC DMA/DATA RETURN	26WU		A-3J1-N ₋
F	FOCUS ENABLE	26WU		A-3J1-DD
H	ROTATION ENABLE	26WU		A-4J1-DD
J	R-RET	26WU		A-4J1-E ₋
K	RBUF0	26WU		A-4J1-K
L	RBUF1	26WU		A-4J1-L
M	RBUF2	26WU		A-4J1-M
N	RBUF3	26WU		A-4J1-N
P	RBUF4	26WU		A-4J1-P
R	RBUF5	26WU		A-4J1-R
S	RBUF6	26WU		A-4J1-S
T	RBUF7	26WU		A-4J1-T
U	R395	26WU	A-4J1-U	
V	R396	26WU	A-4J1-V	
W	R397	26WU	A-4J1-W	
X	R398	26WU	A-4J1-X	
Y	R399	26WU	A-4J1-Y	
Z	R400	26WU	A-4J1-Z	
A ₋	R407	26WU	A-4J1-A ₋	
B ₋	R408	26WU	A-4J1-B ₋	
C ₋				
D ₋	ROTATION WEST BUS FAULT	26WU	I/O-J1-41	
E ₋	ROTATION WEST FOLDBACK	26WU	I/O-J1-40	
F ₋	ROTATION WEST OVERTEMP	26WU	I/O-J1-44	
H ₋	ROTATION WEST DRIVE UP	26WU	I/O-J1-37	
J ₋	ROTATION WEST OVER CURRENT	26WU	I/O-J1-45	
K ₋	ROTATION WEST POWER LOSS	26WU	I/O-J1-43	
M ₋	ROTATION WEST INHIBIT	26WU	I/O-J1-42	
N ₋	ROTATION WEST OVERSPEED	26WU	I/O-J1-46	
P ₋	ROTATION WEST RETURN	26WU	I/O-J1-36	
R ₋	ROTATION EAST BUS FAULT	26WU	I/O-J1-66	
S ₋	ROTATION EAST FOLOBACK	26WU	I/O-J1-65	
T ₋	ROTATION EAST OVERTEMP	26WU	I/O-J1-71	
U ₋	ROTATION EAST DRIVE UP	26WU	I/O-J1-62	
V ₋	ROTATION EAST OVER CURRENT	26WU	I/O-J1-72	
W ₋	ROTATION EAST POWER LOSS	26WU	I/O-J1-70	
X ₋	ROTATION EAST INHIBIT	26WU	I/O-J1-67	
Y ₋	ROTATION EAST OVERSPEED	26WU	I/O-J1-73	
MODULE S104		BIN A	CONN 6-J1 AMP 50	
F-R BIN WIRE LIST			SHEET 15 OF 39	

PIN	FUNCTION	TYPE	FROM	TO
A				
B	APEX INT +5 CND	BLACK. #16	A-9J2-F	A-1J1-B
C	+5V	ORANGE. #16	A-9J1-B	
D				
E				
F				
H	APEX INT +5V	ORANGE. #16	A-9J2-B	A-1J1-C
J				
K				
L				
M	FOCUS BRAKE COMMAND	26WW	A-3J1-CC	
N				
P				
R				
S	FOCUS BRAKE V*I	26WW		A-1J1-N ₋
T	ROTATION BRAKE V*I	26WW		A-1J1-P ₋
U	FOC/ROT BRAKE V*I RETURN	26WW		A-1J1-R ₋
V	ROTATION BRAKE COMMAND	26WW	A-4J1-CC	
W	APEX RH	TP/Y 26 RED		A-1J1-S
X	RESOLVER EXCITATION +	TP/Z 26 RED		I/O-J4-A
Y	APEX RL	TP/W 26 BLK		A-1J1-T
Z	RESOLVER EXCITATION -	TP/X 26 BLK		I/O-J4-E
A ₋	RESOLVER SHIELD	SHIELD		I/O-J4-C
B ₋	APEX RH RL	SHIELD		
C ₋				
D ₋				
E ₋				
F ₋				
H ₋				
J ₋				
K ₋				
M ₋				
N ₋				
P ₋				
R ₋				
S ₋				
T ₋	3-PHASE CONTROL	TP/U ₋ 26WW WHT	A-3J1-EE	
U ₋	3-PHASE CONTROL RETURN	TP/T ₋ 26WW BLK	A-3J1-FF	
V ₋				
W ₋				
X ₋				
Y ₋				
MODULE BIN A JUMPER BIN A CONN 8-J1 AMP 50				
F-R BIN WIRE LIST			SHEET 17 OF 39	

PIN	FUNCTION	TYPE	FROM	TO
A	+5V GND			
B	+5V	ORANGE, #16		A-8J1-C
C	+5V GND	BLACK, #16		A-5J1-B
D	+5V	ORANGE, #16		A-5J1-C
E	+5V GND	BLACK, #16		A-3J1-B
F	+5V	ORANGE, #16		A-3J1-C
H	+5V GND			
J	+5V			
K	+5V GND			
L	+5V			
M	+5V GND			
N	+5V			
P	+5V GND			
R	+5V			
S	+5V GND			
T	+5V			
U	+5V GND			
V	+5V			
W	+5V GND	BLACK, #16		I/O-J1-27
X	+5V			
Y	+15V	RED, #18		A-5J1-A
Z	+15V	RED, #18		A-3J1-A
A ₋	+15V			
B ₋	+15V			
C ₋	+15V			
D ₋	+15V			
E ₋	+15V			
F ₋	+15V			
H ₋	+15V			
J ₋	+15V			
K ₋	+/- 15V GND	BLACK, #16		A-5J1-HH
M ₋	+/- 15V GND	BLACK, #16		A-3J1-HH
N ₋	+/- 15V GND			
P ₋	+/- 15V GND			
R ₋	+/- 15V GND			
S ₋	+/- 15V GND			
T ₋	+/- 15V GND			
U ₋	+/- 15V GND			
V ₋	+/- 15V GND			
W ₋	+/- 15V GND			
X ₋	-15V	YELLOW, #18		A-5J1-E
Y ₋	-15V	YELLOW, #18		A-3J1-E
MODULE S105		BIN A	CONN 9-J1	AMP 50
F-R BIN WIRE LIST				SHEET 19 OF 39

PIN	FUNCTION	TYPE	FROM	TO
A				
B	APEX INT +5V GND	BLACK. #16	A-8P1-B	B-8P1-B
C	+5V	ORANGE. #16	A-8P1-C	B-8P1-C
D				
E				
F				
H	APEX INT +5V	ORANGE. #16	A-8P1-H	B-8P1-H
J				
K				
L				
M	FOCUS BRAKE COMMAND	WHITE. #16	A-8P1-M	B-8P1-M
N				
P				
R				
S	FOCUS BRAKE V*I	WHITE. #16	B-8P1-S	A-8P1-S
T	ROTATION BRAKE V*I	WHITE. #16	B-8P1-T	A-8P1-T
U	FOC/ROT BRAKE V*I RETURN	BLACK. #16	B-8P1-U	A-8P1-U
V	ROTATION BRAKE COMMAND	WHITE. #16	A-8P1-V	B-8P1-V
W	APEX RH	TP/Y 26 RED	B-8P1-W	A-8P1-W
X	RESOLVER EXCITATION+	TP/Z 26 RED	B-8P1-X	A-8P1-X
Y	APEX RL	TP/W 26 BLK	B-8P1-Y	A-8P1-Y
Z	RESOLVER EXCITATION-	TP/X 26 BLK	B-8P1-Z	A-8P1-Z
A_	RESOLVER SHIELD	SHIELDS	B-8P1-A_	A-8P1-A_
B_				
C_				
D_				
E_				
F_				
H_				
J_				
K_				
M_				
N_				
P_				
R_				
S_				
T_	3-PHASE CONTROL	TP/U_ WHT #16	A-8P1-T_	B-8P1-T_
U_	3-PHASE CONTROL RETURN	TP/T_ BLK #16	A-8P1-U_	B-8P1-U_
V_				
W_				
X_				
Y_				
MODULE BIN A/B JUMPER BIN A/B CONN 8-P1 AMP 50				
F-R BIN WIRE LIST SHEET 22 OF 39				

PIN	FUNCTION	TYPE	FROM	TO
A				
B	APEX INT +5V GND	BLACK. #16		B-9J1-B
C	+5V	DRANCE. #16		B-9J1-C
D				
E				
F				
H	APEX INT +5V	DRANGE. #16		B-9J1-H
J				
K				
L				
M	FOCUS BRAKE COMMAND	26WU		B-9J1-M
N				
P				
R				
S	FOCUS BRAKE V*I	26WU	B-9J1-S	
T	ROTATION BRAKE V*I	26WU	B-9J1-T	
U	FOC/ROT BRAKE V*I RETURN	26WU	B-9J1-U	
V	ROTATION BRAKE COMMAND	26WU		B-9J1-V
W	APEX RH	TP/Y 26 RED	B-9J1-W	
X	RESOLVER EXCITATION+	TP/Z 26 RED	B-9J1-X	
Y	APEX RL	TP/W 26 BLK	B-9J1-Y	
Z	RESOLVER EXCITATION-	TP/X 26 BLK	B-9J1-Z	
A_	RESOLVER SHIELD	SHIELD	B-9J1-A_	
B_				
C_				
D_				
E_				
F_				
H_				
J_				
K_				
M_				
N_				
P_				
R_				
S_				
T_	3-PHASE CONTROL	TP/U_ 26WU WHT		B-9J1-R_
U_	3-PHASE CONTROL RETURN	TP/T_ 26WU BLK		B-9J1-U_
V_				
W_				
X_				
Y_				
MODULE BIN B JUMPER		BIN B	CONN 8-J1	AMP 50
F-R BIN WIRE LIST				SHEET 24 OF 39

PIN	FUNCTION	TYPE	FROM	TO
A				
B	APEX INT +5V GND	BLACK, #16	B-8J1-B	
C	+5V	ORANGE, #16	B-8J1-C	
D				
E				
F				
H	APEX INT +5V	ORANGE, #16	B-8J1-H	
J				
K				
L				
M	FOCUS BRAKE COMMAND	26W	B-8J1-M	
N				
P				
R				
S	FOCUS BRAKE V*I	26W		B-8J1-S
T	ROTATION BRAKE V*I	26W		B-8J1-T
U	FOC/ROT BRAKE V*I RETURN	26W		B-8J1-U
V	ROTATION BRAKE COMMAND	26W	B-8J1-V	
W	APEX RH	TP/Y 26 RED		B-8J1-W
X	RESOLVER EXCITATION+	TP/Z 26 RED		B-8J1-X
Y	APEX RL	TP/U 26 BLK		B-8J1-Y
Z	RESOLVER EXCITATION-	TP/X 26 BLK		B-8J1-Z
A_	RESOLVER SHIELD	SHIELDS		B-8J1-A_
B_				
C_				
D_				
E_				
F_				
H_				
J_				
K_	HEATER MONITOR+			
M_	HEATER MONITOR-			
N_				
P_				
R_	HEATER COMMAND			
S_				
T_	3-PHASE CONTROL	TP/U_ 26W WHT	B-8J1-T_	
U_	3-PHASE CONTROL RETURN	TP/T_ 26W BLK	B-8J1-U_	
V_				
W_				
X_				
Y_				
MODULE S103		BIN B	CONN 9-J1 AMP 50	
F-R BIN WIRE LIST			SHEET 26 OF 39	

PIN	FUNCTION	TYPE	FROM	TO
1	FOCUS SPEED COMMAND	TP/4 #26 RED	A-3J1-F_	
2	FOCUS +12V	26WW		A-5J1-DD
3	FOCUS MOTOR CURRENT	TP/5 26WW WHT		A-3J1-Y_
4	FOCUS SPEED COMMAND RET	TP/1 #26 BLK	A-3J1-H_	
5	FOCUS ANALOG GND	TP/3,7 26WW BLK	A-5J1-FF	A-3J1-2_A-3J1-88
7	FOCUS MOTOR VELOCITY	TP/5 26WW BLK		A-3J1-AA
8	SHIELD FOR 1/4			CHASSIS GND
10	FOCUS -12V	26WW		A-5J1-EE
11	FOCUS RETURN	26WW	A-3J1-M_	A-5J1-P_
12	FOCUS DRIVE UP	26WW		A-5J1-H_
13	FOCUS BDS3 INHIBIT	26WW	A-3J1-J_	
14	FOCUS BDS3 RESET	26WW	A-3J1-K_	
15	FOCUS FOLDBACK	26WW		A-5J1-E_
16	FOCUS BUS FAULT	26WW		A-5J1-D_
17	FOCUS INHIBIT	26WW		A-5J1-M_
18	FOCUS POWER LOSS	26WW		A-5J1-K_
20	FOCUS OVERTEMP	26WW		A-5J1-F_
21	FOCUS OVER CURRENT	26WW		A-5J1-J_
22	FOCUS OVERSPEED	26WW		A-5J1-N_
23				
24				
25				
26				
27	CABLE INTERLOCK IN	BLACK, #16	A-9J1-U	
28	ROTATION SPEED COMMAND	TP/31 #26 RED	A-4J1-F_	
29	ROTATION WEST +12V	26WW		A-5J2-T
30	ROT WEST MOTOR CURRENT	TP/32 26WW WHT		A-4J1-Y_
31	ROT SPEED COMMAND RET	TP/28 #26 BLK	A-4J1-H_	
32	ROTATION WEST ANALOG GND	TP/30,33 #26 BLK	A-5J2-V	A-4J1-2_A-4J1-88
33	ROT WEST MOTOR VELOCITY	TP/32 26WW WHT		A-4J1-AA
34	SHIELD FOR 28/31			CHASSIS GND
35	ROTATION WEST -12V	26WW		A-5J2-U
36	ROTATION WEST RETURN	26WW	A-4J1-M_	A-6J1-P_
37	ROTATION WEST DRIVE UP	26WW		A-6J1-H_
38	ROTATION BDS3 INHIBIT	26WW	A-4J1-J_	
39	ROTATION BDS3 RESET	26WW	A-4J1-K_	
40	ROTATION WEST FOLDBACK	26WW		A-6J1-E_
41	ROTATION WEST BUS FAULT	26WW		A-6J1-D_
42	ROTATION WEST INHIBIT	26WW		A-6J1-M_
43	ROTATION WEST POWER LOSS	26WW		A-6J1-K_
44	ROTATION WEST OVERTEMP	26WW		A-6J1-F_
45	ROTATION WEST OVER CURRENT	26WW		A-6J1-J_

BIN I/O

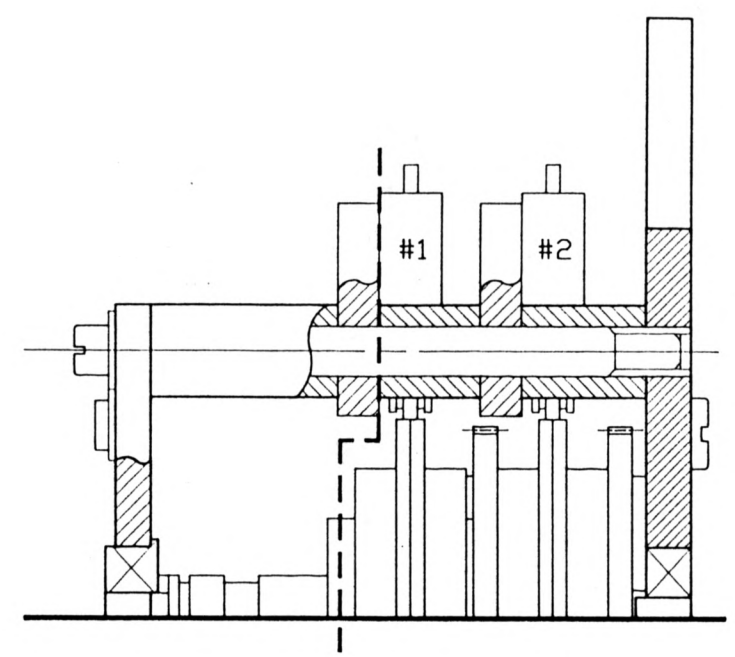
CONN I/O-J1 AMP 75

F-R BIN WIRE LIST

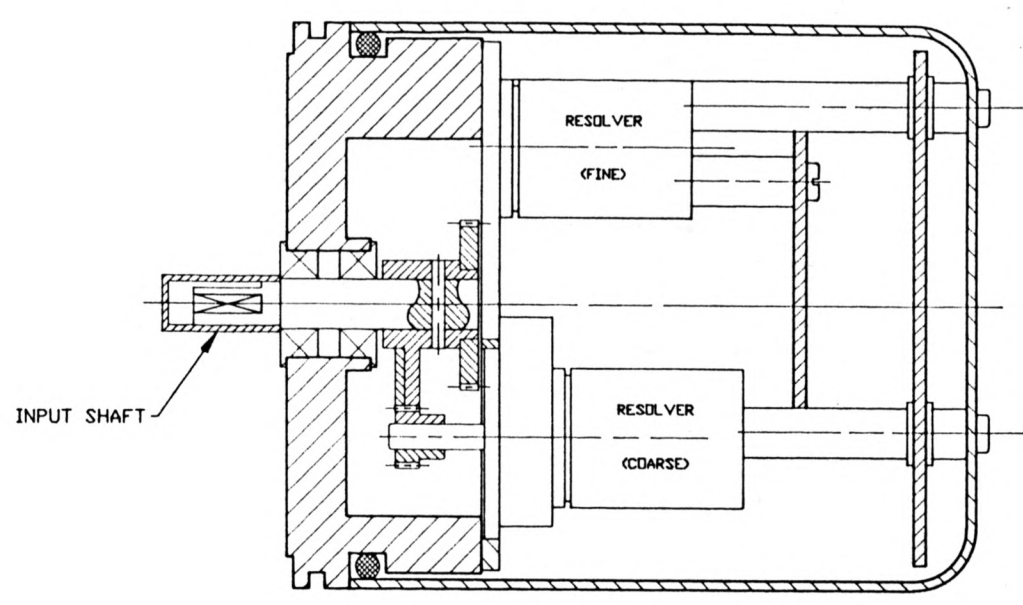
SHEET 28 OF 39

PIN	FUNCTION	TYPE	FROM	TO
A				
B	CABLE INTERLOCK IN	26WU		
C				
D	FOCUS S1	TP/J #26 RED		A-1J1-F
E				
F	SHIELD FOR D/J	SHIELD		
H				
J	FOCUS S3	TP/D #26 BLK		A-1J1-J
K	FOCUS S2	TP/L #26 RED		A-1J1-H
L	FOCUS S4	TP/K #26 BLK		A-1J1-K
M				
N				
P				
R	SHIELD FOR K/L	SHIELD		
S				
T	FOCUS DOWN 2 LIMIT	26WU		A-1J2-W
U				
V	SHIELD FOR X/A_			CHASSIS GND
W	FOCUS UP 2 LIMIT	26WU		A-1J2-Y
X	FOCUS DOWN 1 LIMIT	26WU		A-1J2-V
Y	SHIELD FOR T/W			CHASSIS GND
Z				
A_	FOCUS UP 1 LIMIT	26WU		A-1J2-X
B_	SHIELD FOR Z/D_			CHASSIS GND
C_	APEX ROT DRV CW SWITCH	26WU		I/O-J2-N
D_				
E_	SHIELD FOR C_/H_			CHASSIS GND
F_	APEX FOCUS DRV UP SWITCH	26WU		I/O-J2-D
H_	APEX ROT DRV Ccw SWITCH	26WU		I/O-J2-T
J_	SHIELD FOR F_/M_			CHASSIS GND
K_				
M_	APEX FOCUS DRV DOWN SWITCH	26WU		I/O-J2-J
N_				
P_	APEX +5V	ORANGE, #16	A-9J2-D	
R_				
S_	SHIELD FOR P_/U_			CHASSIS GND
T_				
U_	APEX +5V GND	BLACK, #16	A-9J2-H	
V_				
W_				
X_				
Y_				
BIN I/O			CONN I/O-J3 AMP 50	
F-R BIN WIRE LIST			SHEET 31 OF 39	

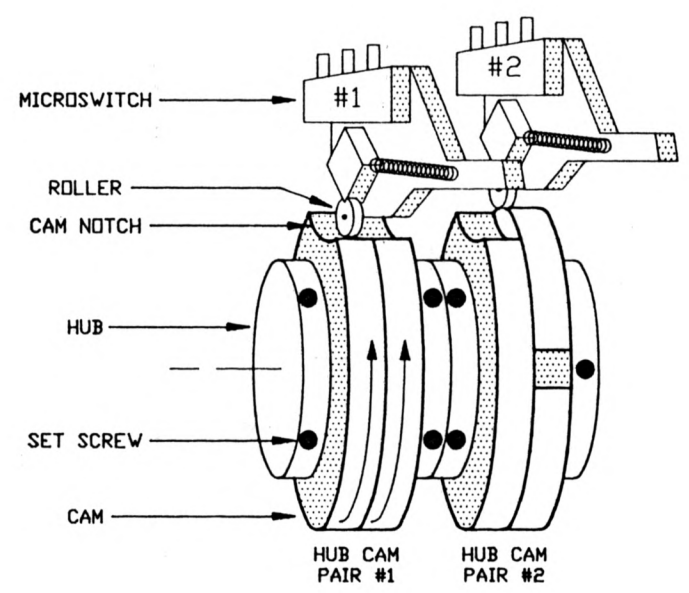
PIN	FUNCTION	TYPE	FROM	TO
A	RESOLVER EXCITATION +	TP/E #26 RED	A-8J1-X	
B	CABLE INTERLOCK IN	26WU	I/O-J3-HH	
C	RESOLVER SHIELD	SHIELD	A-8J1-A_	
D	ROTATION COARSE S1	TP/J #26 RED		A-1J1-M
E	RESOLVER EXCITATION -	TP/A #26 BLK	A-8J1-Z	
F	SHIELD FOR D/J	SHIELD		
H	ROTATION COARSE S2	TP/M #26 RED		A-1J1-N
J	ROTATION COARSE S3	TP/D #26 BLK		A-1J1-P
K	SHIELD FOR H/M	SHIELD		
L	ROTATION FINE S1	TP/R #26 RED		A-1J1-V
M	ROTATION COARSE S4	TP/M #26 BLK		A-1J1-R
N	SHIELD FOR L/R	SHIELD		
P	ROTATION FINE S2	TP/U #26 RED		A-1J1-W
R	ROTATION FINE S3	TP/L #26 BLK		A-1J1-X
S	SHIELD FOR P/U	SHIELD		
T	ROTATION CW1 LIMIT	26WU		A-1J2-Z
U	ROTATION FINE S4	TP/P #26 BLK		A-1J1-Y
V	SHIELD FOR T/X			CHASSIS GND
W	ROTATION CW2 LIMIT	26WU		A-1J2-AA
X	ROTATION CCW1 LIMIT	26WU		A-1J2-BB
Y	SHIELD FOR W/A_			CHASSIS GND
Z				
A_	ROTATION CCW2 LIMIT	26WU		A-1J2-CC
B_	SHIELD FOR Z/D_			CHASSIS GND
C_				
D_				
E_	SHIELD FOR C_/H_			CHASSIS GND
F_	AD590 TEMP1+	26WU		A-1J1-W_
H_				
J_	SHIELD FOR F_/M_			CHASSIS GND
K_				
M_	AD590 TEMP1-	26WU		A-1J1-X_
N_	SHIELD FOR K_/R_			
P_	SECOND SCREW SENSOR	TP/U_ 26WU WHT		A-1J2-P_
R_				
S_	SHIELD FOR P_/U_			CHASSIS GND
T_				
U_	SECOND SCREW SENSOR RET	TP/P_ 26WU BLK		A-1J2-U_
V_	SHIELD FOR T_/X_			CHASSIS GND
W_				
X_				
Y_	SHIELD FOR W_/AA			CHASSIS GND
BIN I/O			CONN I/O-J4 AMP 50	
F-R BIN WIRE LIST			SHEET 33 OF 39	



ROTATION LIMIT SWITCH PACKAGE (2 SWITCHES)
NOT TO SCALE



TYPICAL TWO SWITCH TRANSDUCER WITH RESOLVERS
NOT TO SCALE



LIMIT SWITCH ASSEMBLY
NOT TO SCALE

NOTES :

1. MICRO SWITCH #1 IS CLOSEST TO INPUT SHAFT.
2. TO SET LIMITS :
 - A. LOOSEN ALL SET SCREWS ON CAMS
 - B. MOVE RESOLVER UNTIL THE DESIRED POSITION IS ON THE S102 (SEE TABLE A)
 - C. ALIGN THE CAM NOTCHES BENEATH THE CORRECT MICRO SWITCH AND ACTIVATE THE LIMIT
 - D. TIGHTEN SET SCREWS FOR THAT CAM AND TEST THE LIMIT
 - E. REPEAT STEPS A THRU D UNTIL ALL LIMITS HAVE BEEN SET

MOTOR	WEST (1st LIMITS)		EAST (2nd LIMITS)	
	CLOCKWISE LIMIT	COUNTER CLOCKWISE LIMIT	CLOCKWISE LIMIT	COUNTER CLOCKWISE LIMIT
SWITCH NUMBER	MICRO SWITCH #1	MICRO SWITCH #2	MICRO SWITCH #1	MICRO SWITCH #2
S102 DISPLAY (IN HEX)	F500	700	F600	600

ACAD : ROTSW1

NEXT ASSY	USED ON

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES
 TOLERANCES: ANGLES ± —
 3 PLACE DECIMALS (.XXX): ± —
 2 PLACE DECIMALS (.XX): ± —
 1 PLACE DECIMALS (.X): ± —

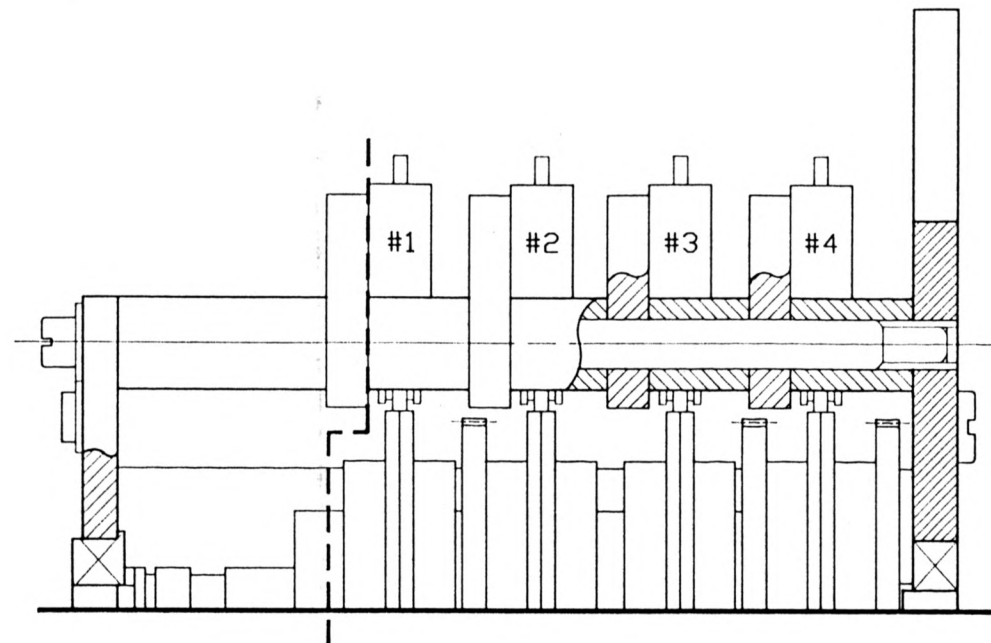
MATERIAL: _____
 FINISH: _____

V
L
B
A
PROJECT
 ROTATION MICRON
 RESOLVER/
 LIMIT SWITCH
 ASSEMBLY

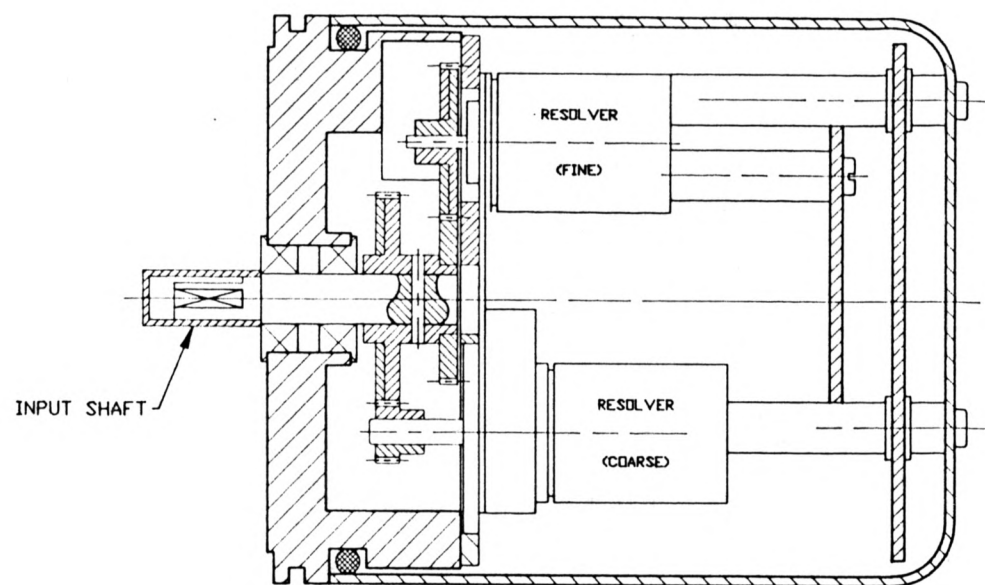
NATIONAL RADIO ASTRONOMY OBSERVATORY
 SOCORRO, NEW MEXICO 87801

DRAWN BY ANDREATTA	DATE 8-89
DESIGNED BY KOSK1	DATE 7-89
APPROVED BY	DATE

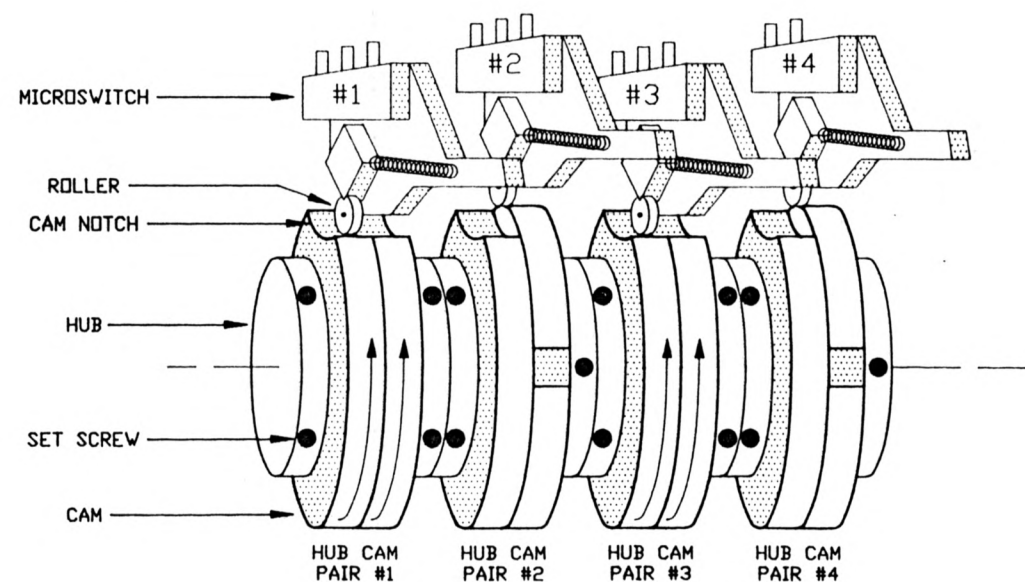
BRUNING 44-231-444272



FOCUS LIMIT SWITCH PACKAGE (4 SWITCHES)
NOT TO SCALE



TYPICAL FOUR SWITCH TRANSDUCER WITH RESOLVERS
NOT TO SCALE



LIMIT SWITCH ASSEMBLY
NOT TO SCALE

NOTES :

1. MICRO SWITCH #1 IS CLOSEST TO INPUT SHAFT.
2. TO SET LIMITS :
 - A. LOOSEN ALL SET SCREWS ON CAMS
 - B. MOVE RESOLVER UNTIL THE DESIRED POSITION IS ON THE S102 (SEE TABLE A)
 - C. ALIGN THE CAM NOTCHES BENEATH THE CORRECT MICRO SWITCH AND ACTIVATE THE LIMIT
 - D. TIGHTEN SET SCREWS FOR THAT CAM AND TEST THE LIMIT.
 - E. REPEAT STEPS A THRU D UNTIL ALL LIMITS HAVE BEEN SET

LIMIT	1st LOWER LIMIT	2nd LOWER LIMIT	1ST UPPER LIMIT	2nd UPPER LIMIT
SWITCH NUMBER	MICRO SWITCH #1	MICRO SWITCH #3	MICRO SWITCH #2	MICRO SWITCH #4
S102 DISPLAY (IN HEX)	0700	0600	F500	F600

ACAD : FOC SW1

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES
 TOLERANCES: ANGLES ± —
 3 PLACE DECIMALS (.XXX): ± —
 2 PLACE DECIMALS (.XX): ± —
 1 PLACE DECIMALS (.X): ± —

MATERIAL: _____
 FINISH: _____

NEXT ASSY	USED ON

PROJECT
 FOCUS/ROTATION
TITLE
 FOCUS MICRON RESOLVER/LIMIT SWITCH ASSEMBLY

NATIONAL RADIO ASTRONOMY OBSERVATORY
 SOCORRO, NEW MEXICO 87801
 DRAWN BY ANDREATTA DATE 8-89
 DESIGNED BY ROSKI DATE 7-89
 APPROVED BY _____ DATE _____