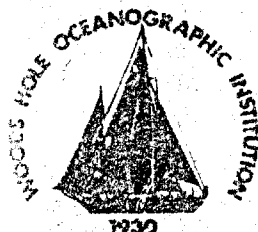


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Woods Hole Oceanographic Institution



Sea Duct: A Deep-Sea Computer-Controlled Recirculating Flume for the Study of Sea Floor Stability

— Appendices —

by

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August 1987

Technical Report

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16. Abstract (Limit: 200 words) ✓ The Sea Duct Ocean-Bottom Laboratory is a computer controlled recirculating inverted flume for the <i>in-situ</i> study of sediment transport. It is designed to measure the sea floor response to controlled currents analogous to those generated by surface waves, tidal, or deep ocean storms. The external support frame is an equilateral triangle with sixteen foot sides. It is 12 feet high, has an air weight of 12,500 lbs., and a 2800 lb. submerged weight. Three lead acid battery packs located at the vertex of the triangle legs provide power for the recirculating water pumps, hydraulic power, and ancillary equipment. The inner rotatable structure consists of a 4 foot long by 2 foot wide open bottom windowed test section that is 9 inches high. It is connected to 30 feet of 8 inch tube configured as an elongated toroid. Above the test section is a traverse carriage with stereo camera, flash, and a laser Doppler velocimeter to measure fluid stresses. Internal flow velocities are controlled and can be ramped up to approximately 2 ft/sec providing shear stress sufficient to scour sand, silts, and fine clays. Water and sediment sampling devices obtain specimens from inside and outside the test section. <i>These appendices include sample programs, flow charts, file formats, electronics drawings, listing of electronics manufacturers, etc. Keywords: Ocean bottom sediment transport, underwater ocean-</i>					
17. Document Analysis a. Descriptors 1. <i>recirculating flumes;</i> 2. <i>sediment transport</i> 3. <i>sediment stress. (etc)</i> <i>Graphic equipment;</i> b. Identifiers/Open-Ended Terms c. COSATI Field/Group					
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Appendix A

Sea Duct Sequencer
Program Generation and Sample Program

Sea Duct sequencer programs are written in a high level language designed specifically for the Sea Duct. An example of a sequencer program is found in this appendix. The specific commands are described in the electrical section of this text. The commands may be put in a text file (source code) using using a word processor in the non-document mode. The file is given a ".MAC" extent and then assembled and linked using Syscon's M13 and L13. An example of typical commands to the assembler and linker are given on the first page of the following sequencer listing. The output listing is given a ".PRN" extent. The output file (object code) may be loaded into RAM or EPROM for use in Sea Duct. Details of the assembly / link procedure may be found in Appendix A and in the Syscon Manual.

When read by the assembler, each high level command is converted into a string of sequencer Pseudo Program Codes (PPCs). Each high level command is called a macro-instruction. During assembly, an "INCLUDE" file labeled ISDEQ.MAC is added to the source file and is used to translate from the macros to the PPCs. See line 45 of this example. Although the actual file listing is inhibited in this example, a copy of the file is present at the end of the listing. It is possible to use higher level macros to call other macros and to create macro subroutines. Several examples of these may be found in the file ISDSUB.MAC which is also included at the end of this appendix.

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; SEA DUCT SEQUENCER PROGRAM
;
; KNORR Cruise # 127      SEPT 86
; SEA DUCT DEPLOYMENT - EXP #
;
; SUBTTL      4KNR127 28 SEP 86
;
; PREV. VERSION 3KNR127 27 SEP 86
; PREV. VERSION 2KNR127 26 SEP 86
; PREV. VERSION 1KNR127 25 SEP 86
; PREV. VERSION 8KNR126 23 SEP 86
; PREV. VERSION 6KNR126 18 SEP 86
; PREV. VERSION 1KNR126 08 SEP 86
;
; W. E. TERRY
;
; INCLUDE FILES REQUIRED:
;   ISDSEQ.MAC      ; Sea Duct PPC Macros
;   ISDDAT7.MAC     ; Sea Duct Data series subroutine
;   ISDSUB.MAC      ; Sea Duct Sequencer Macro subroutines
;
; Note: Radix is set to base 16 in ISDSEQ.MAC - All parameters passed to
;       the macro calls (ie. all parameters) must be HEX (ie. 10D not allowed).
;
;*****
;
; Assemble using M18 SDDEEPn,-SDDEEPn/R/C
;
; Link Using  L18 /P:3000/D:3700,SDDEEPn,SDDEEPn/W/X/E
;             for ".HEX" file. Use MBASIC HIRCA to get ".RCA" file.
;
; Link Using  L18 /P:3000/D:3700,SDDEEPn,SDDEEPn/W/E
;             for ".COM" file. Use BURN to burn a prom.
;
; Form is: M18 Source,-Relocatable/R/C
;          CREP 80 Relocatable=Print file      (then erase .CRF file)
;          L18 /P:Prog start addr/D:Data start addr,Relocatable,Object/Options
;          File extents can be omitted. See Syscon Manual for details.
;
;*****
;
; C INCLUDE ISDSEQ.MAC
; C
; C ; SEA DUCT SEQUENCER PPC MACROS
; C ;
; C ; ISDSEQ.MAC      15 JUL 1986
; C ;
; C ; W. E. TERRY
; C ;
; C ; (Listing Supressed)
; C ; .LIST
; C ;
; C ; .SALL      ; Use for generation of object code only.

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MACRO-18 3.36
4KNR127 28 SEP 86

PAGE 1-1

57
58
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60

.XALL ; Use for generation of object code with source code
; .LALL ; Use for generation of complete macro text.
;
PAGE

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.....  
;  
;                               SEA DUCT FINGER CODES  
;  
; 0 Program Start,              8 Off the bottom  
;   End Transmiss. Test,  
;  
; 1 Start Transmiss. Test,      9 OK to lift and move to  
;   Beginning Rotation,         a new position  
;   On Bottom,  
;  
; 2 End of Rotation             A XYZ Position Error  
;  
; 3 Start of Insertion          B Rotation Error  
;  
; 4 Insertion "OK"              C Tilt "OK"  
;  
; 5 Insertion "Bad"            D Tilt "Bad"  
;  
; 6 Start Core                  E  
;  
; 7 Start of Velocity           F Ready to drop weight  
;   Measuerment Series  
;  
.....  
PAGE
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```

89
90 ;***** SEA DUCT SEQUENCER PSUEDO PROGRAM BEGINS HERE *****
91 ;
92 ;
93 ; While on deck we record individual system batteries. Time is
94 ; included to block the transmissometer beam as a check.
95 ;
96 0000' START: INITC ;INITIALISE, CLEAR COUNTERS
97 0000' 4D + DB 4DH ;Clear stacks, nodes, PPCNT, Counters
98 ;
99 ADON ;A/D, TRANSMISSOMETER, RECORDER ON
100 0001' E031 + DW 0E031H ;A/D ON
101 TRON
102 0003' E041 + DW 0E041H ;Transmissometer ON
103 SDON
104 0005' E051 + DW 0E051H ;Sea Data Recorder ON
105 ;
106 SEND 0 ;SEND PINGER CODE 0
107 0007' 3000 + DW (3000H + 0) ;Push Pinger Code on ASTK
108 0009' E024 + DW 0E024H ;Send Pinger Code (on ASTK)
109 CAMERA ;CHECK THE CAMERA
110 0008' E0C0 + DW 0E0C0H ;Take a Picture
111 ;
112 ;
113 BAT 1 ;RECORD BATTERY #1 VOLTAGE
114 000D' E011 + DW (0E010H + 1) ;Pulse Main Battery Relay #n
115 WAIT20 ; BAT. #1 ON FOR 20 SEC, OFF FOR 20 SEC.
116 000F' 60 + DB 60H ;Go to Sequencer Subroutine
117 0010' 0409' + DW W20
118 BAT 1
119 0012' E011 + DW (0E010H + 1) ;Pulse Main Battery Relay #n
120 WAIT20
121 0014' 60 + DB 60H ;Go to Sequencer Subroutine
122 0015' 0409' + DW W20
123 ;
124 ;
125 BAT 2 ;RECORD BATTERY #2 VOLTAGE
126 0017' E012 + DW (0E010H + 2) ;Pulse Main Battery Relay #n
127 WAIT20 ; BAT. #2 ON FOR 20 SEC, OFF FOR 20 SEC.
128 0019' 60 + DB 60H ;Go to Sequencer Subroutine
129 001A' 0409' + DW W20
130 BAT 2
131 001C' E012 + DW (0E010H + 2) ;Pulse Main Battery Relay #n
132 WAIT20
133 001E' 60 + DB 60H ;Go to Sequencer Subroutine
134 001F' 0409' + DW W20
135 ;
136 ;
137 BAT 3 ;RECORD BATTERY #3 VOLTAGE
138 0021' E013 + DW (0E010H + 3) ;Pulse Main Battery Relay #n
139 WAIT20 ; BAT. #3 ON FOR 20 SEC, OFF FOR 20 SEC.
140 0023' 60 + DB 60H ;Go to Sequencer Subroutine
141 0024' 0409' + DW W20
142 BAT 3
143 0026' E013 + DW (0E010H + 3) ;Pulse Main Battery Relay #n

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144                                     WAIT20
145      0028'  60      +      DB 60H      ;Go to Sequencer Subroutine
146      0029'  0409'  +      DW W20
147                                     ;
148                                     ;
149      BAT 1      ;TURN ON ALL SYSTEM BATTERIES
150      002B'  E011  +      DW (0E010H + 1) ;Pulse Main Battery Relay #n
151      BAT 2
152      002D'  E012  +      DW (0E010H + 2) ;Pulse Main Battery Relay #n
153      BAT 3
154      002F'  E013  +      DW (0E010H + 3) ;Pulse Main Battery Relay #n
155                                     ;
156                                     ;
157      CAMERA
158      0031'  E0C0  +      DW 0E0C0H      ;Take a Picture
159                                     ;
160      SEND 1      ;SEND CODE "1" TO SIGNAL TRANSMISSOMETER TEST;
161      0033'  E001  +      DW (3000H + 1) ;Push Pinger Code on ASTK
162      0035'  E024  +      DW 0E024H      ;Send Pinger Code (on ASTK)
163                                     ;
164                                     ;
165      WAIT2M      ;WAIT FOR 2 MINUTES TO ALLOW FOR
166      0037'  50      +      ; TRANSMISSOMETER CHECK
167      0038'  043F'  +      DB 60H      ;Go to Sequencer Subroutine
168                                     ;
169      SEND 0      ;SEND PINGER CODE 0
170      003A'  3000  +      DW (3000H + 0) ;Push Pinger Code on ASTK
171      003C'  E024  +      DW 0E024H      ;Send Pinger Code (on ASTK)
172                                     ;
173                                     ;
174      ;*****
175      ;
176      ; At this point we launch the instrument. The bottom sense switch
177      ; is NOT enabled for 20 Min. in order not to false trigger during launch.
178      ; The transmissometer is tested after the 20 min. wait to get a clear water
179      ; transmission sample.
180      ;
181      ;
182      DIVE: PUSH 1,0AH      ;REST FOR 08 Min. DURING LAUNCH
183      003E'  30      +      DB (2FH + 1) ;Push Data on ASTK
184      003F'  0A      +      DB 0AH
185      WAITF MIN
186      0040'  82      +      DB 82H      ;Wait for interval of Min on ASTK
187      ;
188      TCHK1: SDON
189      0041'  E051  +      DW 0E051H      ;Sea Data Recorder ON
190      ADON
191      0043'  E031  +      DW 0E031H      ;A/D ON
192      TRON
193      0045'  E041  +      DW 0E041H      ;Transmissometer ON
194      ;
195      ;
196      ONBOT?: NOOP      ;WAIT TILL WE ARE ON THE BOTTOM
197      0047'  C4      +      DB 0C4H      ;No Operation
198      BRBOT ONBOT
199      0048'  E0F0  +      DW 0E0F0H      ;Branch if Bottom Sw to

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```

200 004A' 004F' + DW ONBOT ;Address
201 JUMP ONBOT?
202 004C' 28 + DB 28H ;Jump To PPC at
203 004D' 0047' + DW ONBOT? ;Address
204 ;
205 ;
206 ;*****
207 ;
208 ; We are on the bottom. We send signal 1 and then see if we are level.
209 ;
210 ;
211 004F' ONBOT: SEND 1 ;SEND PINGER CODE 1
212 004F' 3001 + DW (3000H + 1) ;Push Pinger Code on ASTK
213 0051' E024 + DW 0E024H ;Send Pinger Code (on ASTK)
214 ;
215 ADON ;TURN ON A/D AND RECORD
216 0053' E031 + DW 0E031H ;A/D ON
217 SDON
218 0055' E051 + DW 0E051H ;Sea Data Recorder ON
219 TRON
220 0057' E041 + DW 0E041H ;Transmissometer ON
221 ;
222 CAMERA ;TAKE A PICTURE
223 0059' E0C0 + DW 0E0C0H ;Take a Picture
224 WAIT20 ;WAIT 20 SEC TO GET TILTS RECORDED
225 005B' 60 + DB 60H ;Go to Sequencer Subroutine
226 005C' 0409' + DW #20
227 ;
228 005E' TLTIN: CHKTILT ;CHECK TILTS. SEND SIGNAL TO SURFACE (C=OK, D=BAD)
229 005E' E070 + DW 0E070H ;Check Roll, Pitch; Send Signal
230 ;
231 ;
232 ; ;SET COUNTER "A" FOR DEFAULT CONTINUATION AT ROTATE
233 ; ;IF SURFACE COMMAND IN NOT RECEIVED IN 2 MIN.
234 SETCTA 078H, INSERT
235 0060' A1 + DB 0A1H
236 0061' 0078 + DW 078H ;Set Counter A (Hex Seconds)
237 0063' 0084' + DW INSERT ; Counter A Vector (When count = 2600)
238 ;
239 ;
240 ; ;WAIT FOR SURFACE SIGNAL
241 0065' RPLY1?: BRCMD1 INSERT ; CMD "1" = GO TO INSERT
242 0065' E0F8 + DW 0E0F8H ;Branch if XPONDR CMD. 1 Received to
243 0067' 0084' + DW INSERT ;Address
244 BRCMD2 LIFT1 ; CMD "2" = GO TO B
245 0069' E0F9 + DW 0E0F9H ;Branch if XPONDR CMD. 2 Received to
246 006B' 0070' + DW LIFT1 ;Address
247 JUMP RPLY1?
248 006D' 28 + DB 28H ;Jump To PPC at
249 006E' 0065' + DW RPLY1? ;Address
250 ;
251 ;
252 0070' LIFT1: INITC
253 0070' 4D + DB 4DH ;Clear stacks. modes, PPCNT, Counters
254 SEND 9 ;HERE WE LIFT THE SEA DUCT AND MOVE TO A NEW POSITION
255 0071' 3009 + DW (3000H + 9) ;Push Pinger Code on ASTK

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256 0073' E024      +          DW 0E024H      ;Send Pinger Code (on ASTK)
257 0075'          + OFFBOT: NOOP
258 0075' C1        +          DB 0C4H        ;No Operation
259          BRBOT OFFBOT
260 0076' E0F0      +          DW 0E0F0H      ;Branch if Bottom Sw to
261 0078' 0075'     +          DW OFFBOT      ;Address
262          SEND 8      ;SEND OFF BOTTOM SIGNAL
263 007A' 3008      +          DW (3000H + 8) ;Push Pinger Code on ASTK
264 007C' E024      +          DW 0E024H      ;Send Pinger Code (on ASTK)
265          WAIT60
266 007E' 60        +          DB 60H        ;Go to Sequencer Subroutine
267 007F' 042D'     +          DW W60
268          JUMP ONBOT? ;GO TO ONBOT?
269 0081' 28        +          DB 28H        ;Jump To PPC at
270 0082' 0047'     +          DW 0047H      ;Address
271          ;
272          ;
273          ;
274          ;
275          ;
276          ; We are ready to insert the flume. Signal "3" is sent to the
277          ; surface. Then the insertion attempt is made. When the four insertion
278          ; sense switches are closed, Signal "3" is sent and insertion is stopped.
279          ; If insertion is not achieved within 5 Min., the "insertion bad
280          ; (Sig. "5")" is sent. We then wait for a surface reply. Surface
281          ; command "1" will continue the program and go to the "RUN1" routine.
282          ; Surface command "2" will continue insertion.
283          ;
284          ;
285          ;
286 0084'          + INSERT: INITC      ;INITIALIZE - JUST IN CASE
287 0084' 4D        +          DB 4DH        ;Clear stacks, nodes, PPCONT, Counters
288          ;
289          LDVRS
290 0085' E0D0      +          DW 0E0D0H      ;Reset the LDV
291          ;
292          CAMERA
293 0087' E0C0      +          DW 0E0C0H      ;Take a Picture
294          SEND 3      ;SEND SIGNAL "3" - START OF INSERTION
295 0089' 3003      +          DW (3000H + 3) ;Push Pinger Code on ASTK
296 008B' E024      +          DW 0E024H      ;Send Pinger Code (on ASTK)
297          ;
298          HYDRA      ;START THE HYDRAULIC PUMP
299 008D' E0A8      +          DW 0E0A8H      ;Pulse Hydraulic Pump Relay
300          FLUMIN     ;START THE FLUME INSERTION
301 008F' E0AC      +          DW 0E0ACH      ;Insert Flume
302          ;
303          SETCTA 01A4H, INBAD ;SET TIME OUT COUNTER FOR 7 MIN.
304 0091' A1        +          DB 0A1H
305 0092' 01A4      +          DW 01A4H      ;Set Counter A (Hex Seconds)
306 0094' 00A9'     +          DW INBAD      ; Counter A Vector (When count = 0000)
307          ;
308 0096'          + IN?: BRINS INOK   ;WAIT FOR INSERTION SWITCHES TO CLOSE
309 0096' E0F1      +          DW 0E0F1H      ;Branch if Flume Inserted to
310 0098' 009D'     +          DW INOK        ;Address
311          JUMP IN?

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312 000' 28 + DB 28H ;Jump To PPC at
313 009B' 0096' + DW IN? ;Address
314 ;
315 009D' INOK: CLRCTA ;CLEAR COUNTER A
316 009D' A0 + DB 0A0H ;Clear Counter A
317 FLUMIN ;STOP THE INSERTION
318 009E' E0AC + DW 0E0ACH ;Insert Flume
319 HYDRA ;HYDRAULIC PUMP OFF
320 00A0' E0A8 - DW 0E0A8H ;Pulse Hydraulic Pump Relay
321 SEND 4 ;SEND SIGNAL "4" (INSERTION OK)
322 00A2' 3004 + DW (3000H + 4) ;Push Pinger Code on ASTK
323 00A4' E024 - DW 0E024H ;Send Pinger Code (on ASTK)
324 JUMP RUN1 ;GO TO "RUN1"
325 00A6' 28 - DB 28H ;Jump To PPC at
326 00A7' 00C5' + DW RUN1 ;Address
327 ;
328 ;
329 ;
330 00A9' INBAD: FLUMIN ;STOP THE INSERTION
331 00A9' E0AC + DW 0E0ACH ;Insert Flume
332 BRINS INOK+3 ;JUST IN CASE
333 00AB' E0F1 - DW 0E0F1H ;Branch if Flume Inserted to
334 00AD' 00A0' - DW INOK+3 ;Address
335 ;
336 HYDRA ;STOP THE HYDRAULIC PUMP
337 00AF' E0A8 - DW 0E0A8H ;Pulse Hydraulic Pump Relay
338 SEND 5 ;SEND SIGNAL "5" (INSERTION BAD)
339 00B1' 3005 - DW (3000H + 5) ;Push Pinger Code on ASTK
340 00B3' E024 - DW 0E024H ;Send Pinger Code (on ASTK)
341 ;
342 ;
343 ; ;SET COUNTER 'A' FOR DEFAULT CONTINUATION IF
344 ; ;SURFACE COMMAND IS NOT RECEIVED WITHIN 5 MIN.
345 SETCTA 012CH, RUN1
346 00B5' A1 - DB 0A1H
347 00B6' 012C - DW 012CH ;Set Counter A (Hex Seconds)
348 00B8' 00C5' + DW RUN1 ; Counter A Vector (When count = 0000)
349 ;
350 ; ;WAIT FOR SURFACE SIGNAL
351 00BA' RPLY3?: BRCOND1 RUN1 ; CMD "1" = GO TO RUN1
352 00BA' E0F8 - DW 0E0F8H ;Branch if XPONDR CMD. 1 Received to
353 00BC' 00C5' + DW RUN1 ;Address
354 BRCOND2 INSERT ; CMD "2" = GO TO INSERT TO TRY AGAIN
355 00BE' E0F9 - DW 0E0F9H ;Branch if XPONDR CMD. 2 Received to
356 00C0' 0084' + DW INSERT ;Address
357 JUMP RPLY3?
358 00C2' 28 + DB 28H ;Jump To PPC at
359 00C3' 00BA' + DW RPLY3? ;Address
360 ;
361 ;
362 ;
363 ;
364 ; .....
365 ; We are now ready to start the experiment.
366 ;
367 00C5' RUN1: INITC ;INITIALIZE

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```

368 00C5' 4D      +          DB 4DH      ;Clear stacks, modes, PPCNT, Counters
369              ADON      ;A/D, TRANS, RECORDER ON
370 00C6' E031    +          DW 0E031H   ;A/D ON
371              TRON
372 00C8' E041    +          DW 0E041H   ;Transmissometer ON
373              SDON
374 00CA' E051    +          DW 0E051H   ;Sea Data Recorder ON
375              ;
376              ;
377              WAIT5M    ;MEASURE ZERO VELOCITY FOR 5 MORE MIN.
378 00CC' 60      +          DB 60H      ;Go to Sequencer Subroutine
379 00CD' 0448'   +          DW W5M
380              ;
381              CAMERA
382 00CF' E0C0    +          DW 0E0C0H  ;Take a Picture
383              ;
384              PMPRLY    ;TURN ON FLUME PUMP POWER
385 00D1' E0AE    +          DW 0E0AEH  ;Pulse Water Pump Power Relay
386              ;
387              PMP1 040H ;SET PUMP1 = 40H (35%)
388 00D3' 02      +          DB 0D2H   ;Send Data On SAIL Loop 2
389 00D4' 00D9'   +          DW ..0000  ;Data List Address
390 00D6' 28      +          DB 28H   ;Jump To PPC at
391 00D7' 00E5'   +          DW ..0001  ;Address
392 00D9' 23 50 43 21 +          ..0000:  DB "#PC!P1"
393 00DD' 50 31   +
394 00DF' 30 34 30 48 +          DB '040H'
395 00E3' 20      +          DB ' '
396 00E4' FF      +          DB DONE
397 00E5'         +          ..0001:  LROFF
398 00E5' 00      +          DB 0D0H   ;SAIL Loop 2 Power Off
399 00E6' E061    +          DW 0E061H  ;Set PUMP1 on SPAGE = N1
400 00E8' 40      +          DB 040H
401              ;
402              GOSUB DATRUN ;DO A DATA SERIES
403 00E9' 60      +          DB 60H      ;Go to Sequencer Subroutine
404 00EA' 0300'   +          DW DATRUN
405              ;DATRUN SUB. RETURNS WITH NO CHANGE IN X,Y,Z POSITION
406              ;
407              ;
408              ;*****
409              ;
410              ; This marks the end of the first velocity measurement series.
411              ; The second run is started.
412              ;
413              ;*****
414              ;
415 00EC'         RUN2:  INITC  ;INITIALIZE
416 00EC' 4D      +          DB 4DH      ;Clear stacks, modes, PPCNT, Counters
417              ;
418              PMP1 073H ;SET PUMP1 = 73H (45%)
419 00ED' 02      +          DB 0D2H   ;Send Data On SAIL Loop 2
420 00EE' 00F3'   +          DW ..0002  ;Data List Address
421 00F0' 28      +          DB 28H   ;Jump To PPC at
422 00F1' 00FF'   +          DW ..0003  ;Address
423 00F3' 23 50 43 21 +          ..0002:  DB "#PC!P1"

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424 00F7' 50 31 +
425 00F9' 30 37 33 48 + DB '073E'
426 00FD' 20 + DB ' '
427 00FE' FF + DB DONE
428 00FF' + ..0003: L2OFF
429 00FF' D0 + DB 0D0H ;SAIL Loop 2 Power Off
430 0100' E061 + DW 0E061H ;Set PUMPI on GPAGE = N1
431 0102' 73 + DB 073H
432 ;
433 ; GOSUB DATRUN ;DO A DATA SERIES
434 0103' 60 + DB 60H ;Go to Sequencer Subroutine
435 0104' 0300' + DW DATRUN
436 ; ;DATRUN SUB. RETURNS WITH NO CHANGE IN X,Y,Z POSITION
437 ;
438 ;
439 ;*****
440 ;
441 ; This marks the end of the second velocity measurement series.
442 ; The third run is started.
443 ;
444 ;*****
445 ;
446 0106' RUN3: INITC ;INITIALIZE
447 0106' 4D + DB 4DH ;Clear stacks, modes, PPCNT, Counters
448 ;
449 ; PMP1 08DH ;SET PUMPI = 8DH (55%)
450 0107' D2 + DB 0D2H ;Send Data On SAIL Loop 2
451 0108' 010D' + DW ..0004 ;Data List Address
452 010A' 28 + DB 28H ;Jump To PPC at
453 010B' 0119' + DW ..0005 ;Address
454 010D' 23 50 43 21 + ..0004: DB "$PC:P1"
455 0111' 50 31 +
456 0113' 30 38 44 48 + DB '08DH'
457 0117' 20 + DB ' '
458 0118' FF + DB DONE
459 0119' + ..0005: L2OFF
460 0119' D0 + DB 0D0H ;SAIL Loop 2 Power Off
461 011A' E061 + DW 0E061H ;Set PUMPI on GPAGE = N1
462 011C' 8D + DB 08DH
463 ;
464 ; GOSUB DATRUN ;DO A DATA SERIES
465 011D' 60 + DB 60H ;Go to Sequencer Subroutine
466 011E' 0300' + DW DATRUN
467 ; ;DATRUN SUB. RETURNS WITH NO CHANGE IN X,Y,Z POSITION
468 ;
469 ;
470 ;*****
471 ;
472 ; This marks the end of the third velocity measurement series.
473 ; The fourth run is started.
474 ;
475 ;*****
476 ;
477 0120' RUN4: INITC ;INITIALIZE
478 0120' 4D + DB 4DH ;Clear stacks, modes, PPCNT, Counters
479 ;
```

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480                                PMP1 040H      ;SET PUMP2 = 40H (25%)
481      0121'  D2                +                DB 0D2H      ;Send Data On SAIL Loop 2
482      0122'  0127'            +                DW ..0006    ;Data List Address
483      0124'  28                +                DB 28H      ;Jump To PPC at
484      0125'  0133'            +                DW ..0007    ;Address
485      0127'  23 50 43 21      +                ..0006:  DB "#PC!P1"
486      012B'  50 31            +
487      012D'  30 34 30 48      +                DB '040H'
488      0131'  20                +                DB ' '
489      0132'  FF                +                DB DONE
490      0133'                    +                ..0007:  L2OFF
491      0133'  D0                +                DB 0D0H      ;SAIL Loop 2 Power Off
492      0134'  E061            +                DW 0E061H    ;Set PUMP1 on GPAGE = N1
493      0136'  40                +                DB 040H
494                                GOSUB DRUNY     ;DO A DATA SERIES
495      0137'  60                +                DB 60H      ;Go to Sequencer Subroutine
496      0138'  0368'            +                DW DRUNY
497                                ;                ;DATRUN SUB. RETURNS WITH CHANGE IN Y POSITION
498                                ;
499                                ;
500                                ;*****
501                                ;
502                                ; This marks the end of the last velocity measurement series.
503                                ;
504                                ;*****
505                                ;
506                                INITC          ;INITIALIZE
507      013A'  4D                +                DB 4DH      ;Clear stacks, modes, PPCNT, Counters
508                                PMPOFF        ;TURN OFF BOTH PUMPS
509      013B'  D2                +                DB 0D2H      ;Send Data On SAIL Loop 2
510      013C'  0141'            +                DW ..0008    ;Data List Address
511      013E'  28                +                DB 28H      ;Jump To PPC at
512      013F'  0146'            +                DW ..0009    ;Address
513      0141'  23 50 43 58      +                ..0008:  DB "#PCX"
514      0145'  FF                +                DB DONE
515      0146'                    +                ..0009:  L2OFF
516      0146'  D0                +                DB 0D0H      ;SAIL Loop 2 Power Off
517      0147'  E060            +                DW 0E060H    ;Set PUMP1,2 on GPAGE = 00
518                                PMPRLY        ;TURN OFF PUMP POWER RELAY
519      0149'  E0AE            +                DW 0E0AEH    ;Pulse Water Pump Power Relay
520                                ;
521                                ;
522                                ;*****
523                                ;
524                                ;
525                                PUSH 1, 01EH    ;WAIT 30 MIN
526      014B'  30                +                DB (2FH + 1) ;Push Data on ASTK
527      014C'  1E                +                DB 01EH
528                                WAITF MIN
529      014D'  82                +                DB 82H      ;Wait for interval of Min on ASTK
530                                ;
531                                CAMERA
532      014E'  20C0            +                DW 0E0C0H    ;Take a Picture
533                                ;
534                                ; Velocity data series is now done. We are ready to take both cores.
535                                ;

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536      ;
537      SEND 6      ;SIGNAL START OF CORE
538      0150' 3006      +      DW (3000H + 6) ;Push Pinger Code on ASTK
539      0152' E024      +      DW 0E024H      ;Send Pinger Code (on ASTK)
540      ;
541      HYDRA      ;START THE HYDRAULIC PUMP
542      0154' E0A8      +      DW 0E0A8H      ;Pulse Hydraulic Pump Relay
543      ;
544      SEDINS 1      ;START SEDIMENT 1 INSERT
545      0156' E0A1      +      DW 0E0A1H      ;Insert Sediment Sampler #1
546      WAIT20
547      0158' 60      +      DB 60H      ;Go to Sequencer Subroutine
548      0159' 0409'      +      DW W20
549      WAIT30      ;WAIT 30 SEC
550      015B' 60      +      DB 60H      ;Go to Sequencer Subroutine
551      015C' 041B'      +      DW W30
552      SEDINS 1      ;STOP SEDIMENT 1 INSERT
553      015E' E0A1      +      DW 0E0A1H      ;Insert Sediment Sampler #1
554      ;
555      SEDUNL 1      ;UNLATCH CLOSSES THE CORE BOX AND TAKES A WATER SAMPLE
556      0160' E0A3      +      DW 0E0A3H      ;Unlatch Sed. Sampler #1, Sample H20-1
557      WAIT30      ;WAIT 30 TO LET HYDRAULIC PRES. BUILD
558      0162' 60      +      DB 60H      ;Go to Sequencer Subroutine
559      0163' 041B'      +      DW W30
560      SEDUNL 1      ;2nd UNLATCH TURNS OFF THE UNLATCH POWER
561      0165' E0A3      +      DW 0E0A3H      ;Unlatch Sed. Sampler #1, Sample H20-1
562      ;
563      SEDRET 1      ;START SEDIMENT 1 RETRACT
564      0167' E0A2      +      DW 0E0A2H      ;Retract Sediment Sampler #1
565      WAIT20
566      0169' 60      +      DB 60H      ;Go to Sequencer Subroutine
567      016A' 0409'      +      DW W20
568      WAIT30      ;WAIT 30 SEC
569      016C' 60      +      DB 60H      ;Go to Sequencer Subroutine
570      016D' 041B'      +      DW W30
571      SEDRET 1      ;STOP SEDIMENT 1 RETRACT
572      016F' E0A2      +      DW 0E0A2H      ;Retract Sediment Sampler #1
573      ;
574      ;
575      ;
576      SEDINS 2      ;START SEDIMENT 2 INSERT
577      0171' E0A5      +      DW 0E0A5H      ;Insert Sediment Sampler #2
578      WAIT20
579      0173' 60      +      DB 60H      ;Go to Sequencer Subroutine
580      0174' 0409'      +      DW W20
581      WAIT30      ;WAIT 30 SEC
582      0176' 60      +      DB 60H      ;Go to Sequencer Subroutine
583      0177' 041B'      +      DW W30
584      SEDINS 2      ;STOP SEDIMENT 2 INSERT
585      0179' E0A5      +      DW 0E0A5H      ;Insert Sediment Sampler #2
586      ;
587      SEDUNL 2      ;UNLATCH CLOSSES THE CORE BOX AND TAKES A WATER SAMPLE
588      017B' E0A7      +      DW 0E0A7H      ;Unlatch Sed. Sampler #2, Sample H20-2
589      WAIT30      ;WAIT 30 TO LET HYDRAULIC PRES. BUILD
590      017D' 60      +      DB 60H      ;Go to Sequencer Subroutine
591      017E' 041B'      +      DW W30

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592          SEDUNL 2      ;2nd UNLATCH TURNS OFF THE UNLATCH POWER
593    0180'   E0A7      +      DW 0E0A7H      ;Unlatch Sed. Sampler #2, Sample H20-2
594          ;
595          SEDRET 2      ;START SEDIMENT 2 RETRACT
596    0182'   E0A6      +      DW 0E0A6H      ;Retract Sediment Sampler #2
597          WAIT20
598    0184'   60        +      DB 60H          ;Go to Sequencer Subroutine
599    0185'   0409'     +      DW W20
600          WAIT30      ;WAIT 30 SEC
601    0187'   60        +      DB 60H          ;Go to Sequencer Subroutine
602    0188'   041B'     +      DW W30
603          SEDRET 2      ;STOP SEDIMENT 2 RETRACT
604    018A'   E0A6      +      DW 0E0A6H      ;Retract Sediment Sampler #2
605          ;
606          HYDRA        ;STOP THE HYDRAULIC PUMP
607    018C'   E0A8      +      DW 0E0A8H      ;Pulse Hydraulic Pump Relay
608          ;
609          ;
610          ;*****
611          ;
612          ;      Move X near to Xo.
613          ;
614          HYDRA        ;START THE HYDRAULIC PUMP
615    018E'   E0A8      +      DW 0E0A8H      ;Pulse Hydraulic Pump Relay
616    0190'   E091      +      DW 0E091H      ;MOVE X-
617          WAIT30
618    0192'   60        +      DB 60H          ;Go to Sequencer Subroutine
619    0193'   041B'     +      DW W30
620          WAIT10
621    0195'   60        +      DB 60H          ;Go to Sequencer Subroutine
622    0196'   0400'     +      DW W10
623    0198'   E091      +      DW 0E091H      ;MOVE X-
624          HYDRA        ;STOP THE HYDRAULIC PUMP
625    019A'   E0A8      +      DW 0E0A8H      ;Pulse Hydraulic Pump Relay
626          ;
627          CAMERA
628    019C'   E0C0      +      DW 0E0C0H      ;Take a Picture
629          ;
630          ;
631          ;      We are ready to retract the flume.  Signal "3" is sent to the
632          ;      surface.  Then the retraction attempt is made.  When the flume retracted
633          ;      sense switch is closed, Signal "3" is sent and retraction is stopped.
634          ;      If retraction is not achieved within 6 Min., the "retraction bad
635          ;      (Sig. "5")" is sent.  We then wait for a surface reply.  CMD "1" will
636          ;      direct the program to the "FINI" routine;  CMD"2" will continue retraction.
637          ;
638          ;
639          ;
640          RETRCT: INITC
641    019E'   4D        +      DB 4DH          ;Clear stacks, modes, PPCNT, Counters
642          SEND 3      ;SEND SIGNAL "3" - START OF RETRACTION
643    019F'   3003      +      DW (3000H + 3) ;Push Pinger Code on ASTK
644    01A1'   E024      +      DW 0E024H      ;Send Pinger Code (on ASTK)
645          HYDRA        ;START THE HYDRAULIC PUMP
646    01A3'   E0A8      +      DW 0E0A8H      ;Pulse Hydraulic Pump Relay
647          PLUMOUT     ;RETRACT THE FLUME

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648 01A5' EOAD + DW OE0ADH ;Retract Flume
649 ;
650 SETCTA 01E0H, RETBAD ;SET TIME OUT COUNTER FOR 8 MIN.
651 01A7' A1 + DB 0A1H
652 01A8' 01E0 + DW 01E0H ;Set Counter A (Hex Seconds)
653 01AA' 01BF' + DW RETBAD ; Counter A Vector (When count = 0000)
654 ;
655 01AC' RET?: BRRET RETOK
656 01AC' EOP2 + DW OEOP2H ;Branch if Flume Retracted to
657 01AE' 01B3' + DW RETOK ;Address
658 JUMP RET?
659 01B0' 28 + DB 28H ;Jump To PPC at
660 01B1' 01AC' + DW RET? ;Address
661 ;
662 01B3' RETOK: CLRCTA ;CLEAR THE TIME OUT COUNTER
663 01B3' A0 + DB 0A0H ;Clear Counter A
664 FLUMOUT ;STOP THE RETRACTION
665 01B4' EOAD + DW OE0ADH ;Retract Flume
666 HYDRA ;STOP THE HYDRAULIC PUMP
667 01B6' EOA8 + DW OE0A8H ;Pulse Hydraulic Pump Relay
668 SEND 4 ;SEND SIGNAL "4" - RETRACTION OK
669 01B8' 3004 + DW (3000H + 4) ;Push Pinger Code on ASTK
670 01BA' E024 + DW OE024H ;Send Pinger Code (on ASTK)
671 JUMP SETTLE
672 01BC' 28 + DB 28H ;Jump To PPC at
673 01BD' 01DB' + DW SETTLE ;Address
674 ;
675 ;
676 01BF' RETBAD: FLUMOUT ;STOP THE RETRACTION
677 01BF' EOAD + DW OE0ADH ;Retract Flume
678 BRRET RETOK+3 ;JUST IN CASE
679 01C1' EOP2 + DW OEOP2H ;Branch if Flume Retracted to
680 01C3' 01B6' + DW RETOK+3 ;Address
681 ;
682 HYDRA ;STOP THE HYDRAULIC PUMP
683 01C5' EOA8 + DW OE0A8H ;Pulse Hydraulic Pump Relay
684 SEND 5 ;SEND SIGNAL "5" (RETRACTION BAD)
685 01C7' 3005 + DW (3000H + 5) ;Push Pinger Code on ASTK
686 01C9' E024 + DW OE024H ;Send Pinger Code (on ASTK)
687 ;
688 ; ;SET COUNTER 'A' FOR DEFAULT CONTINUATION IF
689 ; ;SURFACE COMMAND IS NOT RECEIVED WITHIN 6 MIN.
690 SETCTA 0168H, SETTLE
691 01CB' A1 + DB 0A1H
692 01CC' 0168 + DW 0168H ;Set Counter A (Hex Seconds)
693 01CE' 01DB' + DW SETTLE ; Counter A Vector (When count = 0000)
694 ;
695 ;
696 ; ;WAIT FOR SURFACE SIGNAL
697 01D0' RPLY4?: BRCMD1 SETTLE ; CMD "1" = GO SETTLE
698 01D0' EOP8 + DW OEOP8H ;Branch if XPONDR CMD. 1 Received to
699 01D2' 01DB' + DW SETTLE ;Address
700 BRCMD2 RETRCT ; CMD "2" = GO TO RETRACT AGAIN
701 01D4' EOP9 + DW OEOP9H ;Branch if XPONDR CMD. 2 Received to
702 01D6' 019E' + DW RETRCT ;Address
703 JUMP RPLY4?

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704 01D8' 28      +      DB 28H      ;Jump To PPC at
705 01D9' 01D0'  +      DW RPLY4?      ;Address
706      ;
707      ;
708      ;
709      ;*****
710      ;
711      ;      At this point the flume is retracted. Now we will wait 3 min. for
712      ;the water to clear.
713      ;
714 01DB'          SETTLE: INITC
715 01DB' 4D      +      DB 4DH      ;Clear stacks, modes, PPCNT, Counters
716      CAMERA      ;TAKE A PICTURE
717 01DC' E0C0    +      DW 0E0C0H    ;Take a Picture
718      ;
719      WAIT59      ;WAIT FOR 1 MIN.
720 01DE' 60      +      DB 60H      ;Go to Sequencer Subroutine
721 01DF' 0424'   +      DW W59      ;
722      CAMERA      ;TAKE A PICTURE
723 01E1' E0C0    +      DW 0E0C0H    ;Take a Picture
724      ;
725      WAIT59      ;WAIT FOR 1 MIN.
726 01E3' 60      +      DB 60H      ;Go to Sequencer Subroutine
727 01E4' 0424'   +      DW W59      ;
728      CAMERA      ;TAKE A PICTURE
729 01E6' E0C0    +      DW 0E0C0H    ;Take a Picture
730      ;
731      WAIT59      ;WAIT FOR 1 MIN.
732 01E8' 60      +      DB 60H      ;Go to Sequencer Subroutine
733 01E9' 0424'   +      DW W59      ;
734      CAMERA      ;TAKE A PICTURE
735 01EB' E0C0    +      DW 0E0C0H    ;Take a Picture
736      ;
737      ;
738      ;
739      ;*****
740      ;
741      ;      Here we return to the surface. Haul it up.
742      ;
743      ;
744 01ED'          FINI: INITC      ;INITIALIZE JUST IN CASE
745 01ED' 4D      +      DB 4DH      ;Clear stacks, modes, PPCNT, Counters
746      SEND F      ;SEND SIGNAL "F" - HAUL IT UP
747 01EE' 300F    +      DW (3000H + F) ;Push Pinger Code on ASTK
748 01FO' E024    +      DW 0E024H    ;Send Pinger Code (on ASTK)
749      ;
750      ;
751 01F2'          GOHOME: NOOP
752 01F2' C4      +      DB 0C4H      ;No Operation
753      BRBOT GOHOME
754 01F3' E0F0    +      DW 0E0F0H    ;Branch if Bottom Sw to
755 01F5' 01F2'   +      DW GOHOME     ;Address
756      ;
757      ;
758 01F7'          MOVING: SEND 8      ;On the way up!
759 01F7' 3008    +      DW (3000H + 8) ;Push Pinger Code on ASTK

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760 01F9' E024 + DW 0E024H ;Send Pinger Code (on ASTK)
761 ;
762 ;*****
763 ;
764 ;
765 ;
766 ;
767 01FB' STOP: NOOP ;END OF DIVE IDLE LOOP
768 01FB' C4 + DB 0C4H ;No Operation
769 JUMP STOP
770 01FC' 28 + DB 28H ;Jump To PPC at
771 01FD' 01FB' + DW STOP ;Address
772 ;
773 ;
774 ;
775 ;
776 ;***** END OF SEQUENCER MAIN PROGRAM *****
777 ;
778 PAGE
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779
780 ;***** Sequencer Subroutines *****
781 ;
782 01FF' CSEG
783     ORG (START + 0300H)
784 ;
785 ;*****
786 ;
787     C     INCLUDE ISDDAT7.MAC     ;Include Sea Duct Data series subroutine
788     C     ;
789     C     ;***** DATA SERIES SUBROUTINE *****
790     C     ;
791     C     ;ISDDAT7.MAC  19 SEP 86
792     C     ;
793     C     ;
794     C     ;
795     C     DATRUN: WAIT60         ;TAKE DATA WITH FLUME PUMP ON FOR 25 MIN.
796     C+    0300' 60              DB 60H         ;Go to Sequencer Subroutine
797     C+    0301' 042D'          DW W60
798     C     WAIT59                ;2
799     C+    0303' 60              DB 60H         ;Go to Sequencer Subroutine
800     C+    0304' 0424'          DW W59
801     C     CAMERA
802     C+    0306' E0C0           DW 0E0C0H      ;Take a Picture
803     C     ;
804     C     WAIT60
805     C+    0308' 60              DB 60H         ;Go to Sequencer Subroutine
806     C+    0309' 042D'          DW W60
807     C     WAIT59                ;4
808     C+    030B' 60              DB 60H         ;Go to Sequencer Subroutine
809     C+    030C' 0424'          DW W59
810     C     CAMERA
811     C+    030E' E0C0           DW 0E0C0H      ;Take a Picture
812     C     ;
813     C     WAIT60
814     C+    0310' 60              DB 60H         ;Go to Sequencer Subroutine
815     C+    0311' 042D'          DW W60
816     C     WAIT59                ;6
817     C+    0313' 60              DB 60H         ;Go to Sequencer Subroutine
818     C+    0314' 0424'          DW W59
819     C     CAMERA
820     C+    0316' E0C0           DW 0E0C0H      ;Take a Picture
821     C     ;
822     C     WAIT60
823     C+    0318' 60              DB 60H         ;Go to Sequencer Subroutine
824     C+    0319' 042D'          DW W60
825     C     WAIT59                ;8
826     C+    031B' 60              DB 60H         ;Go to Sequencer Subroutine
827     C+    031C' 0424'          DW W59
828     C     CAMERA
829     C+    031E' E0C0           DW 0E0C0H      ;Take a Picture
830     C     ;
831     C     WAIT60
832     C+    0320' 60              DB 60H         ;Go to Sequencer Subroutine
833     C+    0321' 042D'          DW W60
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834			C	WAIT59	:10	
835	0323'	60	C+		DB 60H	;Go to Sequencer Subroutine
836	0324'	0424'	C+		DW W59	
837			C	CAMERA		
838	0326'	E0C0	C+		DW 0E0C0H	;Take a Picture
839			C			
840			C	WAIT60		
841	0328'	60	C+		DB 60H	;Go to Sequencer Subroutine
842	0329'	042D'	C+		DW W60	
843			C	WAIT59	:12	
844	032B'	60	C+		DB 60H	;Go to Sequencer Subroutine
845	032C'	0424'	C+		DW W59	
846			C	CAMERA		
847	032E'	E0C0	C+		DW 0E0C0H	;Take a Picture
848			C			
849			C	WAIT60		
850	0330'	60	C+		DB 60H	;Go to Sequencer Subroutine
851	0331'	042D'	C+		DW W60	
852			C	WAIT59	:14	
853	0333'	60	C+		DB 60H	;Go to Sequencer Subroutine
854	0334'	0424'	C+		DW W59	
855			C	CAMERA		
856	0336'	E0C0	C+		DW 0E0C0H	;Take a Picture
857			C			
858			C	WAIT60		
859	0338'	60	C+		DB 60H	;Go to Sequencer Subroutine
860	0339'	042D'	C+		DW W60	
861			C	WAIT59	:16	
862	033B'	60	C+		DB 60H	;Go to Sequencer Subroutine
863	033C'	0424'	C+		DW W59	
864			C	CAMERA		
865	033E'	E0C0	C+		DW 0E0C0H	;Take a Picture
866			C			
867			C	WAIT60		
868	0340'	60	C+		DB 60H	;Go to Sequencer Subroutine
869	0341'	042D'	C+		DW W60	
870			C	WAIT59	:18	
871	0343'	60	C+		DB 60H	;Go to Sequencer Subroutine
872	0344'	0424'	C+		DW W59	
873			C	CAMERA		
874	0346'	E0C0	C+		DW 0E0C0H	;Take a Picture
875			C			
876			C	WAIT60		
877	0348'	60	C+		DB 60H	;Go to Sequencer Subroutine
878	0349'	042D'	C+		DW W60	
879			C	WAIT59	:20d	
880	034B'	60	C+		DB 60H	;Go to Sequencer Subroutine
881	034C'	0424'	C+		DW W59	
882			C	CAMERA		
883	034E'	E0C0	C+		DW 0E0C0H	;Take a Picture
884			C			
885			C	WAIT60		
886	0350'	60	C+		DB 60H	;Go to Sequencer Subroutine
887	0351'	042D'	C+		DW W60	
888			C	WAIT59	:22	
889	0353'	60	C+		DB 60H	;Go to Sequencer Subroutine

890	0354'	0424'	C+		DW W59	
891			C		CAMERA	
892	0356'	30C0	C+		DW 0E0C0H	;Take a Picture
893			C	;		
894			C		WAIT60	
895	0358'	60	C+		DB 60H	;Go to Sequencer Subroutine
896	0359'	042D'	C+		DW W60	
897			C		WAIT59	;24d Min.
898	035B'	60	C+		DB 60H	;Go to Sequencer Subroutine
899	035C'	0424'	C+		DW W59	
900			C		CAMERA	
901	035E'	E0C0	C+		DW 0E0C0H	;Take a Picture
902			C	;		
903			C		WAIT30	;25 Min.
904	0360'	60	C+		DB 60H	;Go to Sequencer Subroutine
905	0361'	041B'	C+		DW W30	
906			C	;		
907			C		SEND 7	;SEND SIG. 7 END OF VELOCITY RUN
908	0363'	3007	C+		DW (3000H + 7)	;Push Pinger Code on ASTK
909	0365'	E024	C+		DW 0E024H	;Send Pinger Code (on ASTK)
910			C	;		
911			C		RETURN	
912	0367'	58	C+		DB 58H	;Return from Sequencer Subroutine
913			C	;		
914				;		
915				;		*****
916				;		
917				;		
918	0368'				DRUNY: WAIT60	
919	0368'	60	+		DB 60H	;Go to Sequencer Subroutine
920	0369'	042D'	+		DW W60	
921					WAIT59	
922	036B'	60	+		DB 60H	;Go to Sequencer Subroutine
923	036C'	0424'	+		DW W59	
924					CAMERA	
925	036E'	E0C0	+		DW 0E0C0H	;Take a Picture
926				;2		
927					WAIT60	
928	0370'	60	+		DB 60H	;Go to Sequencer Subroutine
929	0371'	042D'	+		DW W60	
930					WAIT59	
931	0373'	60	+		DB 60H	;Go to Sequencer Subroutine
932	0374'	0424'	+		DW W59	
933					CAMERA	
934	0376'	E0C0	+		DW 0E0C0H	;Take a Picture
935				;4		
936					WAIT60	
937	0378'	60	+		DB 60H	;Go to Sequencer Subroutine
938	0379'	042D'	+		DW W60	
939					WAIT59	
940	037B'	60	+		DB 60H	;Go to Sequencer Subroutine
941	037C'	0424'	+		DW W59	
942					CAMERA	
943	037E'	E0C0	+		DW 0E0C0H	;Take a Picture
944				;6		
945					WAIT60	

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946	0380'	60	+		DB 60H	;Go to Sequencer Subroutine
947	0381'	042D'	+		DW W60	
948				WAIT59		
949	0383'	60	+		DB 60H	;Go to Sequencer Subroutine
950	0384'	0424'	+		DW W59	
951				CAMERA		
952	0386'	E0C0	+		DW OE0C0H	;Take a Picture
953						
954				HYDRA	;MOVE TO Y ZERO	
955	0388'	E0A8	+		DW OE0A8H	;Pulse Hydraulic Pump Relay
956	038A'	E093		DW OE093H		
957				WAIT20		
958	038C'	60	+		DB 60H	;Go to Sequencer Subroutine
959	038D'	0409'	+		DW W20	
960	038F'	E093		DW OE093H		
961				HYDRA		
962	0391'	E0A8	+		DW OE0A8H	;Pulse Hydraulic Pump Relay
963						
964				WAIT60		
965	0393'	60	+		DB 60H	;Go to Sequencer Subroutine
966	0394'	042D'	+		DW W60	
967				WAIT59		
968	0396'	60	+		DB 60H	;Go to Sequencer Subroutine
969	0397'	0424'	+		DW W59	
970				CAMERA		
971	0399'	E0C0	+		DW OE0C0H	;Take a Picture
972						
973				WAIT60		
974	039B'	60	+		DB 60H	;Go to Sequencer Subroutine
975	039C'	042D'	+		DW W60	
976				WAIT59		
977	039E'	60	+		DB 60H	;Go to Sequencer Subroutine
978	039F'	0424'	+		DW W59	
979				CAMERA		
980	03A1'	E0C0	+		DW OE0C0H	;Take a Picture
981						
982				WAIT60		
983	03A3'	60	+		DB 60H	;Go to Sequencer Subroutine
984	03A4'	042D'	+		DW W60	
985				WAIT59		
986	03A6'	60	+		DB 60H	;Go to Sequencer Subroutine
987	03A7'	0424'	+		DW W59	
988				CAMERA		
989	03A9'	E0C0	+		DW OE0C0H	;Take a Picture
990						
991				WAIT60		
992	03AB'	60	+		DB 60H	;Go to Sequencer Subroutine
993	03AC'	042D'	+		DW W60	
994				WAIT59		
995	03AE'	60	+		DB 60H	;Go to Sequencer Subroutine
996	03AF'	0424'	+		DW W59	
997				CAMERA		
998	03B1'	E0C0	+		DW OE0C0H	;Take a Picture
999						
1000				HYDRA	;MOVE TO Y3	
1001	03B3'	E0A8	+		DW OE0A8H	;Pulse Hydraulic Pump Relay

1002	03B5'	E092		DW 0E092H		
1003				WAIT20		
1004	03B7'	60	+		DB 60H	;Go to Sequencer Subroutine
1005	03B8'	0409'	+		DW W20	
1006	03BA'	E092		DW 0E092H		
1007				HYDRA		
1008	03BC'	E0A8	+		DW 0E0A8H	;Pulse Hydraulic Pump Relay
1009						
1010				WAIT60		
1011	03BE'	60	+		DB 60H	;Go to Sequencer Subroutine
1012	03BF'	042D'	+		DW W60	
1013				WAIT59		
1014	03C1'	60	+		DB 60H	;Go to Sequencer Subroutine
1015	03C2'	0424'	+		DW W59	
1016				CAMERA		
1017	03C4'	E0C0	+		DW 0E0C0H	;Take a Picture
1018						;2
1019				WAIT60		
1020	03C6'	60	+		DB 60H	;Go to Sequencer Subroutine
1021	03C7'	042D'	+		DW W60	
1022				WAIT59		
1023	03C9'	60	+		DB 60H	;Go to Sequencer Subroutine
1024	03CA'	0424'	+		DW W59	
1025				CAMERA		
1026	03CC'	E0C0	+		DW 0E0C0H	;Take a Picture
1027						;4
1028				WAIT60		
1029	03CE'	60	+		DB 60H	;Go to Sequencer Subroutine
1030	03CF'	042D'	+		DW W60	
1031				WAIT59		
1032	03D1'	60	+		DB 60H	;Go to Sequencer Subroutine
1033	03D2'	0424'	+		DW W59	
1034				CAMERA		
1035	03D4'	E0C0	+		DW 0E0C0H	;Take a Picture
1036						;6
1037				WAIT60		
1038	03D6'	60	+		DB 60H	;Go to Sequencer Subroutine
1039	03D7'	042D'	+		DW W60	
1040				WAIT59		
1041	03D9'	60	+		DB 60H	;Go to Sequencer Subroutine
1042	03DA'	0424'	+		DW W59	
1043				CAMERA		
1044	03DC'	E0C0	+		DW 0E0C0H	;Take a Picture
1045						;8
1046						;
1047				RETURN		
1048	03DE'	58	+		DB 58H	;Return from Sequencer Subroutine
1049						;
1050						;
1051						;
1052				PAGE		

```

1053
1054 ;
1055 ;***** SEQUENCER MACRO SUBROUTINES *****
1056 ;
1057 03DF' CSEG
1058     ORG (START + 0400H)
1059 ;
1060     C      INCLUDE ISDSUB.MAC      ;Include Sea Duct Macro Subroutines
1061     C
1062     C ;*****
1063     C ;
1064     C ; SEQUENCER MACRO SUBROUTINES
1065     C ;
1066     C ; SUBTTL ISDSUB 15 JUL 86
1067     C ;
1068     C ; This file must be included at the end of a Sequencer Macro Program
1069     C ; Use "INCLUDE ISDSUB.MAC"
1070     C ;
1071     C ;*****
1072     C ;
1073 0400' C      CSEG      ; Change to Code Segment
1074     C ;
1075     C ; Note: W10 - W60 allow for the call and return times.
1076     C ; ie. W10 is set for 8 sec.
1077     C ;
1078 0400' C      W10: SETCTC 0008, $+5      ;Wait for 10 Sec.
1079 0400' C1      C+      DB 0C1H
1080 0401' 0008      C+      DW 0008      ;Set Counter C (Hex Seconds)
1081 0403' 0408'      C+      DW $+5      ; Counter C Vector (When count = 0000)
1082     C      JUMP $-1
1083 0405' 28      C+      DB 28H      ;Jump To PPC at
1084 0406' 0405'      C-      DW $-1      ;Address
1085     C      RETURN
1086 0408' 58      C+      DB 58H      ;Return from Sequencer Subroutine
1087     C ;
1088     C ;
1089 0409' C      W20: SETCTC 0012, $+5      ;Wait for 20 Sec.
1090 0409' C1      C+      DB 0C1H
1091 040A' 0012      C+      DW 0012      ;Set Counter C (Hex Seconds)
1092 040C' 0411'      C+      DW $+5      ; Counter C Vector (When count = 0000)
1093     C      JUMP $-1
1094 040E' 28      C+      DB 28H      ;Jump To PPC at
1095 040F' 040E'      C+      DW $-1      ;Address
1096     C      RETURN
1097 0411' 58      C+      DB 58H      ;Return from Sequencer Subroutine
1098     C ;
1099     C ;
1100 0412' C      W29: SETCTC 001B, $+5      ;Wait for 29 Sec.
1101 0412' C1      C+      DB 0C1H
1102 0413' 001B      C+      DW 001B      ;Set Counter C (Hex Seconds)
1103 0415' 041A'      C+      DW $+5      ; Counter C Vector (When count = 0000)
1104     C      JUMP $-1
1105 0417' 28      C+      DB 28H      ;Jump To PPC at
1106 0418' 0417'      C+      DW $-1      ;Address
1107     C      RETURN

```

```

1108 041A' 58 C+ DB 58H ;Return from Sequencer Subroutine
1109 C ;
1110 C ;
1111 041B' C1 C+ W30: SETCTC 001C, $+5 ;Wait for 30 Sec.
1112 041B' C1 C+ DB 0C1H
1113 041C' 001C C+ DW 001C ;Set Counter C (Hex Seconds)
1114 041B' 0423' C+ DW $+5 ; Counter C Vector (When count = 0000)
1115 C JUMP $-1
1116 0420' 28 C+ DB 28H ;Jump To PPC at
1117 0421' 0420' C+ DW $-1 ;Address
1118 C RETURN
1119 0423' 58 C+ DB 58H ;Return from Sequencer Subroutine
1120 C ;
1121 C ;
1122 0424' C1 C+ W59: SETCTC 0039, $+5 ;Wait for 59 Sec.
1123 0424' C1 C+ DB 0C1H
1124 0425' 0039 C+ DW 0039 ;Set Counter C (Hex Seconds)
1125 0427' 042C' C+ DW $+5 ; Counter C Vector (When count = 0000)
1126 C JUMP $-1
1127 0429' 28 C+ DB 28H ;Jump To PPC at
1128 042A' 0429' C+ DW $-1 ;Address
1129 C RETURN
1130 042C' 58 C+ DB 58H ;Return from Sequencer Subroutine
1131 C ;
1132 C ;
1133 042D' C1 C+ W60: SETCTC 003A, $+5 ;Wait for 60 Sec.
1134 042D' C1 C+ DB 0C1H
1135 042E' 003A C+ DW 003A ;Set Counter C (Hex Seconds)
1136 0430' 0435' C+ DW $+5 ; Counter C Vector (When count = 0000)
1137 C JUMP $-1
1138 0432' 28 C+ DB 28H ;Jump To PPC at
1139 0433' 0432' C+ DW $-1 ;Address
1140 C RETURN
1141 0435' 58 C+ DB 58H ;Return from Sequencer Subroutine
1142 C ;
1143 C ;
1144 C ;
1145 0436' C1 C+ W1M: SETCTC 003A, $+5 ;Wait for 1 MIN.
1146 0436' C1 C+ DB 0C1H
1147 0437' 003A C+ DW 003A ;Set Counter C (Hex Seconds)
1148 0439' 043E' C+ DW $+5 ; Counter C Vector (When count = 0000)
1149 C JUMP $-1
1150 043B' 28 C+ DB 28H ;Jump To PPC at
1151 043C' 043B' C+ DW $-1 ;Address
1152 C RETURN
1153 043E' 58 C+ DB 58H ;Return from Sequencer Subroutine
1154 C ;
1155 C ;
1156 043F' C1 C+ W2M: SETCTC 0076, $+5 ;Wait for 2 MIN.
1157 043F' C1 C+ DB 0C1H
1158 0440' 0076 C+ DW 0076 ;Set Counter C (Hex Seconds)
1159 0442' 0447' C+ DW $+5 ; Counter C Vector (When count = 0000)
1160 C JUMP $-1
1161 0444' 28 C+ DB 28H ;Jump To PPC at
1162 0445' 0444' C+ DW $-1 ;Address
1163 C RETURN

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```
1164 0447' 58 C+ DB 58H ;Return from Sequencer Subroutine
1165 C ;
1166 C ;
1167 0448' C W5N: SETCTC 012A, $+5 ;Wait for 5 MIN.
1168 0448' C1 C+ DB 0C1H
1169 0449' 012A C+ DW 012A ;Set Counter C (Hex Seconds)
1170 044B' 0450' C+ DW $+5 ; Counter C Vector (When count = 0000)
1171 C JUMP $-1
1172 044D' 28 C+ DB 28H ;Jump To PPC at
1173 044E' 044D' C+ DW $-1 ;Address
1174 C RETURN
1175 0450' 58 C+ DB 58H ;Return from Sequencer Subroutine
1176 C ;
1177 C ;
1178 0451' C W7M: SETCTC 01A2, $+5 ;Wait for 7 MIN.
1179 0451' C1 C+ DB 0C1H
1180 0452' 01A2 C+ DW 01A2 ;Set Counter C (Hex Seconds)
1181 0454' 0459' C+ DW $+5 ; Counter C Vector (When count = 0000)
1182 C JUMP $-1
1183 0456' 28 C+ DB 28H ;Jump To PPC at
1184 0457' 0456' C+ DW $-1 ;Address
1185 C RETURN
1186 0459' 58 C+ DB 58H ;Return from Sequencer Subroutine
1187 C ;
1188 C ;
1189 C ;
1190 C ;***** END OF SUBROUTINE INCLUDE FILE - ISDSUB *****
1191 C ;
1192 C ;*****
1193 C ;
1194 C ;
1195 C ;
1196 C ;*****
1197 C ;
1198 C ;***** END OF SEQUENCER PSEUDO PROGRAM *****
1199 C ;
1200 END
```

MACROS:

ADOFF	ADOM	3AT	BRBOT	BRCMD1	BRCMD2	BRCMD3	BRINS
BRRET	CAMERA	CHRTLT	CLRABC	CLRCTA	CLRCTB	CLRCTC	FLUMIN
FLUMOU	GOSUB	HYDRA	INCX	INCY	INCZ	INITC	INIT5
JUMP	L2OFF	L2ON	L2SEND	LDVRS	NOOP	PING	TMP1
PMP2	PMPOFF	PMPLY	POP	PUSH	RETURN	ROTCCW	ROTCW
ROTHDG	ROTRTN	SDOFF	SDON	SEDINS	SEDRET	SEDUNL	SEND
SETCTA	SETCTB	SETCTC	SPMPO	SPMP1	SPMP2	TROFF	TRON
WAIT10	WAIT1M	WAIT20	WAIT29	WAIT2M	WAIT30	WAIT59	WAIT5M
WAIT60	WAIT7M	WAITF	WAITT	XYZO	ZEROX	ZEROY	ZEROZ

SYMBOLS:

..0000	00D9'	..0001	00E5'	..0002	00F3'	..0003	00FF'
..0004	010D'	..0005	0119'	..0006	0127'	..0007	0133'
..0008	0141'	..0009	0146'	A	000A	B	000B
C	000C	D	000D	DATRUN	0300'	DAYS	0001
DIVE	003E'	DONE	00FF	DRUNY	0368'	E	000E
F	000F	FINI	01ED'	GOHOME	01F2'	HOURS	0002
HRS	0002	IN?	0096'	INBAD	00A9'	INOK	009D'
INSERT	0084'	LIFT1	0070'	MIN	0003	MOVING	01F7'
OFFBOT	0075'	ONBOT	004F'	ONBOT?	0047'	RET?	01AC'
RETBAD	01BF'	RETOK	01B3'	RETRCT	019E'	RPLY1?	0065'
RPLY3?	00BA'	RPLY4?	01D0'	RUN1	00C5'	RUN2	00EC'
RUN3	0106'	RUN4	0120'	SEC	0004	SETTLE	01DB'
START	0000'	STOP	01FB'	TCHK1	0041'	TLTIN	005E'
W10	0400'	W1M	0436'	W20	0409'	W29	0412'
W2M	043F'	W30	041B'	W59	0424'	W5M	0448'
W60	042D'	W7M	0451'				

NO FATAL ERROR(S)

..0000	389	392#										
..0001	391	397#										
..0002	420	423#										
..0003	422	428#										
..0004	451	454#										
..0005	453	459#										
..0006	482	485#										
..0007	484	490#										
..0008	510	513#										
..0009	512	515#										
A	54#											
ADOFF	54#											
ADON	54#	99	190	215	369							
B	54#											
BAT	54#	113	118	125	130	137	142	149	151	153		
BRBOT	54#	198	259	753								
BRCMD1	54#	241	350	697								
BRCMD2	54#	244	353	700								
BRCMD3	54#											
BRINS	54#	308	332									
BRRBT	54#	655	678									
C	54#											
CAMERA	54#	109	157	222	292	381	531	627	716	722	728	734
	801	810	819	828	837	846	855	864	873	882	891	900
	924	933	942	951	970	979	988	997	1016	1025	1034	1043
CHKTLT	54#	228										
CLRABC	54#											
CLRCTA	54#	315	662									
CLRCTB	54#											
CLRCTC	54#											
D	54#											
DATRUN	404	435	466	795#								
DAYS	54#	186	529									
DIVE	182#											
JONE	54#	396	427	458	489	514						
DRUNY	496	918#										
E	54#											
F	54#	747	747	747								
FINI	744#											
FLUMIN	54#	300	317	330								
FLUNOU	54#	647	664	676								
GOHOME	751#	755										
GOSUB	54#	116	121	128	133	140	145	166	225	266	378	402
	433	464	494	547	550	558	566	569	579	582	590	598
	601	618	621	720	726	732	796	799	805	808	814	817
	823	826	832	835	841	844	850	853	859	862	868	871
	877	880	886	889	895	898	904	919	922	928	931	937
	940	946	949	958	965	968	974	977	983	986	992	995

RUN1	326	347	352	367*								
RUN2	415*											
RUN3	446*											
RUN4	477*											
SDOFF	54*											
SDON	54*	103	188	217	373							
SEC	54*											
SEDINS	54*	544	552	576	584							
SEDRET	54*	563	571	595	603							
SEDUNL	54*	555	560	587	592							
SEND	54*	106	160	169	211	254	262	294	321	338	537	642
	668	684	746	758	907							
SETCTA	54*	234	303	344	650	690						
SETCTB	54*											
SETCTC	54*	1078	1089	1100	1111	1122	1133	1145	1156	1167	1178	
SETTLE	673	693	699	714*								
SPMPO	54*	517										
SPMP1	54*	399	430	461	492							
SPMP2	54*											
START	96*	783	1058									
STOP	767*	771										
TCHK1	188*											
TLTIN	228*											
TROFF	54*											
TRON	54*	101	192	219	371							
W10	622	1078*										
W1M	1145*											
W20	117	122	129	134	141	146	226	548	567	580	599	959
	1005	1089*										
W29	1100*											
W2M	167	1156*										
W30	551	559	570	583	591	602	619	905	1111*			
W59	721	727	733	800	809	818	827	836	845	854	863	872
	881	890	899	923	932	941	950	969	978	987	996	1015
	1024	1033	1042	1122*								
W5M	379	1167*										
W60	267	797	806	815	824	833	842	851	860	869	878	887
	896	920	929	938	947	966	975	984	993	1012	1021	1030
	1039	1133*										
W7M	1178*											
WAIT10	54*	620										
WAIT1M	54*											
WAIT20	54*	115	120	127	132	139	144	224	546	565	578	597
	957	1003										
WAIT29	54*											
WAIT2M	54*	165										
WAIT30	54*	549	557	568	581	589	600	617	903			
WAIT59	54*	719	725	731	798	807	816	825	834	843	852	861
	870	879	888	897	921	930	939	948	967	976	985	994


```

: SEA DUCT SEQUENCER PPC MACROS
:
: ISDSEQ.MAC      15 JUL 1986
:
: W. E. TERRY
:
: (Listing Supressed)
: .XLIST
:
: PREVIOUS VERS.  16 JUN 1986
: PREVIOUS VERS.  26 MAR 1986
: PREVIOUS VERS.  25 MAR 1986
: PREVIOUS VERS.  11 DEC 1985
: PREVIOUS VERS.  21 NOV 1985
:
: Earlier versions exist.
:
: ***** USED ONLY FOR ASSEMBLY OF SEQUENCER PSUEDO PROGRAM CODES *****
:
: USE "INCLUDE ISDSEQ.MAC" IN SEQUENCER SOURCE
:
: *****
: ***** BASIC FUNCTIONS *****
:
: JUMP  MACRO P1
:           DB 28H      ;Jump To PPC at
:           DW P1       ;Address
:
: ENDM
:
:
: PUSH  MACRO P0,P1,P2,P3,P4
:           DB (27H + P0) ;Push Data on ASTK
:           IF P0 EQ 1
:               DB P1
:           ELSE
:               IF P0 EQ 2
:                   DB P1
:                   DB P2
:               ELSE
:                   IF P0 EQ 3
:                       DB P1
:                       DB P2
:                       DB P3
:                   ELSE
:                       IF P0 EQ 4
:                           DB P1
:                           DB P2
:                           DB P3
:                       ELSE
:                           DB P4
:                   ELSE
:                       DB P0 ;***** PUSH PARAMETER ERROR *****!!!!!!!!!!!!!!!!!!!!!!
:

```

```

        ENDIF
        ENDIF
        ENDIF
        ENDIF
    ENDM
;
;
POP    MACRO P0
        DB (3FH + P0)    ;Pop data from ASTK
    IF (P0 GT 4) OR (P0 LT 1)
        DB FQ    ;***** POP PARAMETER ERROR *****!!!!!!!!!!!!!!!!!!!!!!
    ENDIF
    ENDM
;
;
INITS  MACRO
        DB 4CH          ;Clear stacks, nodes, PPCNT
    ENDM
;
;
INITC  MACRO
        DB 4DH          ;Clear stacks, nodes, PPCNT, Counters
    ENDM
;
;
CLRABC MACRO
        DB 4EH          ;Clear Counters A, B, C
    ENDM
;
;
RETURN MACRO
        DB 58H          ;Return from Sequencer Subroutine
    ENDM
;
;
GOSUB  MACRO P1
        DB 60H          ;Go to Sequencer Subroutine
        DW P1
    ENDM
;
;
NOOP   MACRO
        DB 0C4H         ;No Operation
    ENDM
;
;
;***** RTC Macros *****
;
DAYS   EQU 01
HRS    EQU 02
HOURS  EQU HRS
MIN    EQU 03
SEC    EQU 04
;
WAITT  MACRO P1

```

```

IF P1 EQ DAYS          DB 70H          ;Wait Till Days = ASTK
ELSE
IF P1 EQ HOURS        DB 71H          ;Wait Till Hours = ASTK
ELSE
IF P1 EQ MIN          DB 72H          ;Wait Till Min = ASTK
ELSE
IF P1 EQ SEC          DB 73H          ;Wait Till Sec = ASTK
ELSE
DB 0FQ ;**** WAIT TILL ERROR ****!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!
ENDIF
ENDIF
ENDIF
ENDIF
ENDM
;
;
WAITF MACRO P1
IF P1 EQ DAYS          DB 80H          ;Wait for interval of Days on ASTK
ELSE
IF P1 EQ HOURS        DB 81H          ;Wait for interval of Hours on ASTK
ELSE
IF P1 EQ MIN          DB 82H          ;Wait for interval of Min on ASTK
ELSE
DB 0FQ ;**** WAIT TILL ERROR ****!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!
ENDIF
ENDIF
ENDIF
ENDM
;
;
***** Sequencer Counter Macros *****
;
*** Note: see INITC (PPC = 4D)
;          CLRABC (PPC = 4E) above for other clear counter instructions.
;
;
CLRCTA MACRO
DB 0A0H          ;Clear Counter A
ENDM
;
;
CLRCTB MACRO
DB 0B0H          ;Clear Counter B
ENDM
;
;
CLRCTC MACRO
DB 0C0H          ;Clear Counter C

```

```

ENDM
;
;
SETCTA MACRO P0, P1
    DB 0A1H
    DW P0          ;Set Counter A (Hex Seconds)
    DW P1          ; Counter A Vector (When count = 0000)
ENDM
;
;
SETCTB MACRO P0, P1
    DB 0B1H
    DW P0          ;Set Counter B (Hex Seconds)
    DW P1          ; Counter B Vector (When count = 0000)
ENDM
;
;
SETCTC MACRO P0, P1
    DB 0C1H
    DW P0          ;Set Counter C (Hex Seconds)
    DW P1          ; Counter C Vector (When count = 0000)
ENDM
;
;
;
;***** SAIL Loop # 2 Macros *****
;
L2OFF MACRO
    DB 0D0H        ;SAIL Loop 2 Power Off
ENDM
;
;
L2ON  MACRO
    DB 0D1H        ;SAIL Loop 2 Power On
ENDM
;
;
L2SEND MACRO P0
    DB 0D2H        ;Send Data On SAIL Loop 2
    DW P0          ;Data List Address
ENDM
;
;
;
;***** EXTENDED SEQUENCER FUNCTIONS ( EO PREFIX ) *****
;
;
BAT  MACRO P0
    IF (P0 EQ 1) OR (P0 EQ 2) OR (P0 EQ 3)
        DW (0E010H + P0)      ;Pulse Main Battery Relay #n
    ELSE
        DW 0FFFFH ; *** Battery Relay Error ***!!!!!!!!!!!!!!!!!!!!!!
    ENDIF

```



```

;
;
; ***** Rotation Macros *****
;
ROTCW  MACRO
        DW 0E080H    ;Pulse Rotate CW Relay
        ENDM
;
;
ROTCW  MACRO
        DW 0E081    ;Pulse Rotate CCW Relay
        ENDM
;
;
ROTRTN MACRO
        DW 0E082H    ;Rotate Flume to Transport Position
        ; Send Signal "B" if error
        ENDM
;
;
ROTHDG MACRO
        DW 0E083H    ;Rotate Flume to Experiment Position
        ; Send Signal "B" if error
        ENDM
;
;
; ***** X Y Z Traverse Macros *****
;
ZEROX  MACRO
        DW 0E09AH    ;Zero X Position
        ; Send Signal "A" if error
        ENDM
;
;
INCX   MACRO
        DW 0E09BH    ;Increment X Position
        ; Send Signal "A" if error
        ENDM
;
;
ZER0Y  MACRO
        DW 0E09CH    ;Zero Y Position
        ; Send Signal "A" if error
        ENDM
;
;
INCY   MACRO
        DW 0E09DH    ;Increment Y Position
        ; Send Signal "A" if error
        ENDM
;
;
ZEROZ  MACRO
        DW 0E09EH    ;Zero Z Position
        ; Send Signal "A" if error

```



```

        ENDIF
    ENDIF
ENDM
;
;
;*****
;
HYDRA  MACRO
        DW 0E0A8E      ;Pulse Hydraulic Pump Relay
    ENDM
;
;
FLUMIN MACRO
        DW 0E0A8E      ;Insert Flume
    ENDM
;
;
FLUMOUT MACRO
        DW 0E0ADH      ;Retract Flume
    ENDM
;
;
PNPRLY MACRO
        DW 0E0A8E      ;Pulse Water Pump Power Relay
    ENDM
;
;
:PUMPI MACRO
        DW 0E0A8E      ;Pulse Water Pump #1 Relay
    ENDM
;
;
:PUMP2 MACRO
        DW 0E0AFH      ;Pulse Water Pump #2 Relay
    ENDM
;
;
LDVRST MACRO
        DW 0E0D0H      ;Reset the LDV
    ENDM
;
;
CAMERA MACRO
        DW 0E0C0H      ;Take a Picture
    ENDM
;
;
;***** Pump Control Macros *****
;
DONE EQU OFFH
;
;
PNPOFF MACRO
    LOCAL D,J
    L2SEND D

```

```

        JUMP J
        D:  DB "#PCX"
           DB DONE
J:  L2OFF
    SPMP0
    ENDM
;
;
PMP1  MACRO A
        LOCAL D,J
        L2SEND D
        JUMP J
        D:  DB "#PC:P1"
           DB '&A'
           DB ' '
           DB DONE
J:  L2OFF
    SPMP1 A
    ENDM
;
;
PMP2  MACRO A
        LOCAL D,J
        L2SEND D
        JUMP J
        D:  DB "#PC:P2"
           DB '&A'
           DB ' '
           DB DONE
J:  L2OFF
    SPMP2 A
    ENDM
;
;
;
;
;***** "Branch" Macros *****
;
BRBOT  MACRO P0
           DW 0E0F0H      ;Branch if Bottom Sw to
           DW P0         ;Address
        ENDM
;
;
BRINS  MACRO P0
           DW 0E0F1H      ;Branch if Flume Inserted to
           DW P0         ;Address
        ENDM
;
;
BRRET  MACRO P0
           DW 0E0F2H      ;Branch if Flume Retracted to
           DW P0         ;Address
        ENDM
;

```

```
BRCMD1 MACRO PO
        DW 0E0F8H ;Branch if XPONDR CMD. 1 Received to
        DW PO ;Address
        ENDM
```

```
BRCMD2 MACRO PO
        DW 0E0F9H ;Branch if XPONDR CMD. 2 Received to
        DW PO ;Address
        ENDM
```

```
BRCMD3 MACRO PO
        DW 0E0FAH ;Branch if XPONDR CMD. 3 Received to
        DW PO ;Address
        ENDM
```

```
*****
***** COMBINED FUNCTION MACROS *****
```

```
***** SEND ACOUSTIC CODE - MACRO *****
```

```
A EQU 0AH
B EQU 0BH
C EQU 0CH
D EQU 0DH
E EQU 0EH
F EQU 0FH
```

```
PING MACRO
        DW 0E024H ;Send Pinger Code (on ASTK)
        ENDM
```

```
SEND MACRO PO
        IF (PO GT 0FH) OR (PO LT 0)
            DB PQ ;***** PINGER CODE ERROR *****!!!!!!!!!!!!!!
        ELSE
            DW (3000H + PO) ;Push Pinger Code on ASTK
        ENDIF
        PING
        ENDM
```

```
***** SPECIFIC "WAIT FOR" MACROS *****
```

```
***** Wait for 10 Sec. *****
```

```
WAIT10 MACRO
```

```
                                GOSUB W10      ; Wait for 10 Sec.
      ENDM
; ***** Wait for 20 Sec. *****
WAIT20 MACRO
                                GOSUB W20      ; Wait for 20 Sec.
      ENDM
; ***** Wait for 29 Sec. *****
WAIT29 MACRO
                                GOSUB W29      ; Wait for 29 Sec.
      ENDM
; ***** Wait for 30 Sec. *****
WAIT30 MACRO
                                GOSUB W30      ; Wait for 30 Sec.
      ENDM
; ***** Wait for 59 Sec. *****
WAIT59 MACRO
                                GOSUB W59      ; Wait for 59 Sec.
      ENDM
; ***** Wait for 60 Sec. *****
WAIT60 MACRO
                                GOSUB W60      ; Wait for 60 Sec.
      ENDM
; ***** Wait for 1 Min. *****
WAIT1M MACRO
                                GOSUB W1M     ; Wait for 1 Min.
      ENDM
; ***** Wait for 2 Min. *****
WAIT2M MACRO
                                GOSUB W2M     ; Wait for 2 Min.
      ENDM
; ***** Wait for 5 Min. *****
```

```
;
WAIT5M MACRO          GOSUB W5M      ; Wait for 5 Min.
```

```
ENDM
```

```
;
; ***** Wait for 7 Min. *****
```

```
; WAIT7M MACRO          GOSUB W7M      ; Wait for 7 Min.
```

```
ENDM
```

```
;
;
; .LIST
```


***** DATA SERIES SUBROUTINE *****

:ISDDAT7.MAC 19 SEP 86

```
DATRUN: WAIT60      ;TAKE DATA WITH FLUME PUMP ON FOR 25 MIN.
        WAIT59      ;2
        CAMERA

        WAIT60
        WAIT59      ;4
        CAMERA

        WAIT60
        WAIT59      ;6
        CAMERA

        WAIT60
        WAIT59      ;8
        CAMERA

        WAIT60
        WAIT59      ;10
        CAMERA

        WAIT60
        WAIT59      ;12
        CAMERA

        WAIT60
        WAIT59      ;14
        CAMERA

        WAIT60
        WAIT59      ;16
        CAMERA

        WAIT60
        WAIT59      ;18
        CAMERA

        WAIT60
        WAIT59      ;20d
        CAMERA

        WAIT60
        WAIT59      ;21
        CAMERA

        WAIT60
        WAIT59      ;24d Min.
        CAMERA
```

WAIT30 :25 Min.

:

SEND 7 :SEND SIG. 7 END OF VELOCITY RUN

:

RETURN

:

: SEQUENCER MACRO SUBROUTINES

: SUBTTL ISDSUB 15 JUL 36

: This file must be included at the end of a Sequencer Macro Program
: Use "INCLUDE ISDSUB.MAC"

: CSEG ; Change to Code Segment

: Note! W10 - W60 allow for the call and return times.
: ie. W10 is set for 8 sec.

: W10: SETCTC 0008, \$+5 ;Wait for 10 Sec.
: JUMP \$-1
: RETURN

: W20: SETCTC 0012, \$+5 ;Wait for 20 Sec.
: JUMP \$-1
: RETURN

: W29: SETCTC 0013, \$+5 ;Wait for 29 Sec.
: JUMP \$-1
: RETURN

: W30: SETCTC 001C, \$+5 ;Wait for 30 Sec.
: JUMP \$-1
: RETURN

: W59: SETCTC 0039, \$+5 ;Wait for 59 Sec.
: JUMP \$-1
: RETURN

: W60: SETCTC 003A, \$+5 ;Wait for 60 Sec.
: JUMP \$-1
: RETURN

: W1M: SETCTC 003A, \$+5 ;Wait for 1 MIN.
: JUMP \$-1
: RETURN

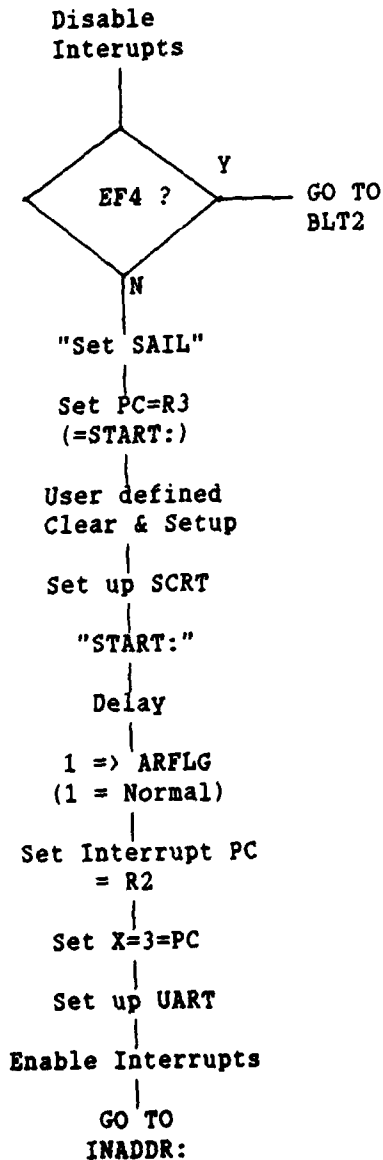
: W2M: SETCTC 0076, \$+5 ;Wait for 2 MIN.
: JUMP \$-1
: RETURN

```
;
;
W5M: SETCTC 012A, $+5      ;Wait for 5 MIN.
      JUMP $-1
      RETURN
;
;
W7M: SETCTC 01A2, $+5      ;Wait for 7 MIN.
      JUMP $-1
      RETURN
;
;
;***** END OF SUBROUTINE INCLUDE FILE - ISDSUB *****
;*****
;
;
```

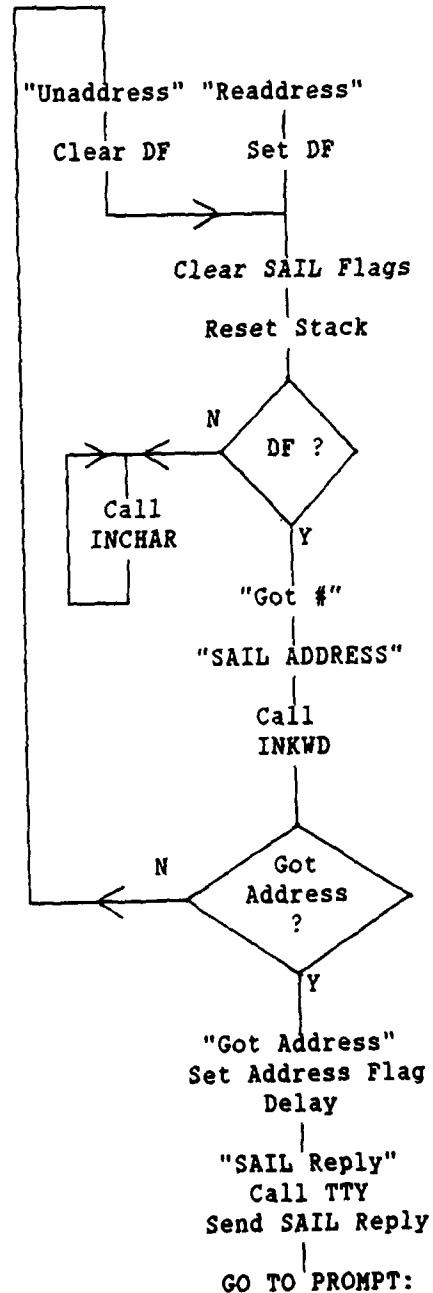
Appendix B

Sea Duct Monitor Program
Block Diagrams

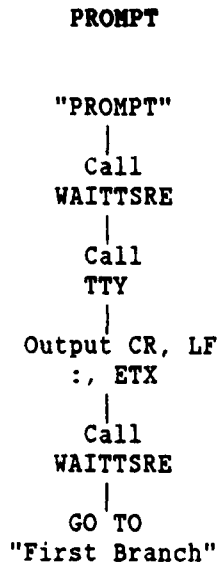
HARDSTART



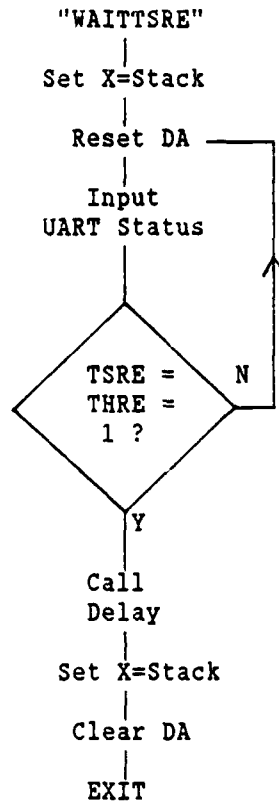
UNADDRESS and READDRESS



(Appendix B contd.)



WAITTSRE
(Wait for Trans. Ser.
Shift Reg. Ready)

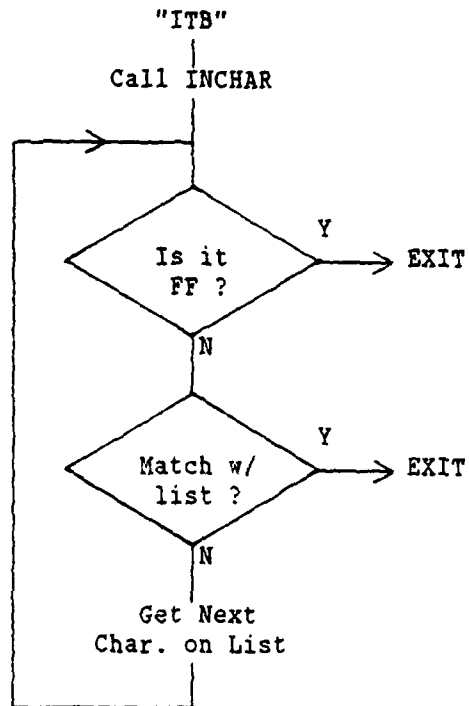


(Appendix B contd.)

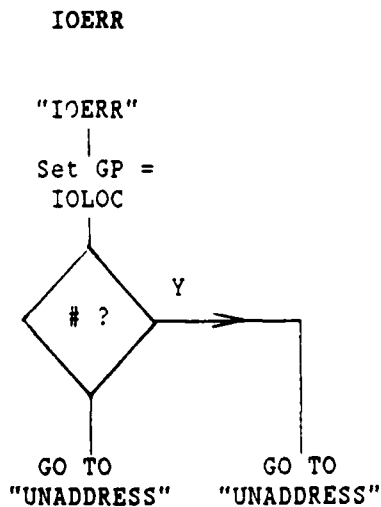
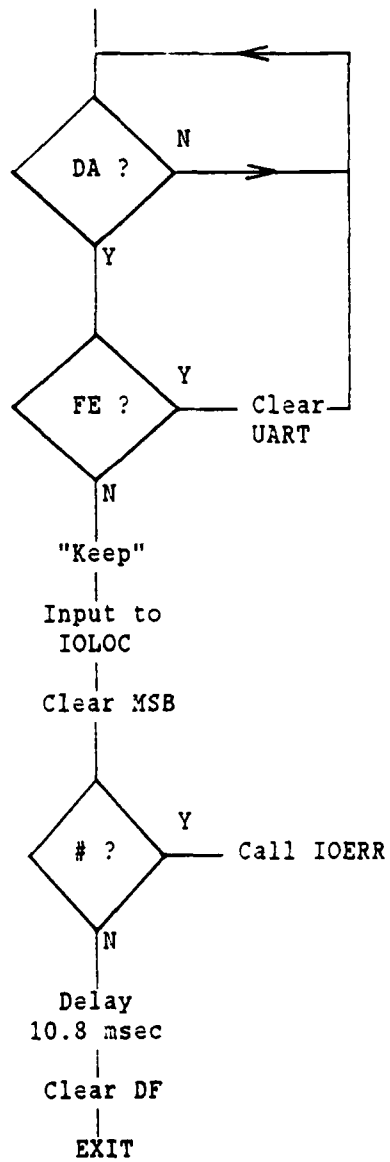
First Branch

"First Branch"
|
Call ITB
|
? Group
|
! Group
|
S Group
|
H Group
|
M Group
|
(Add others here)
|
End of List
|
GO TO PROMPT:

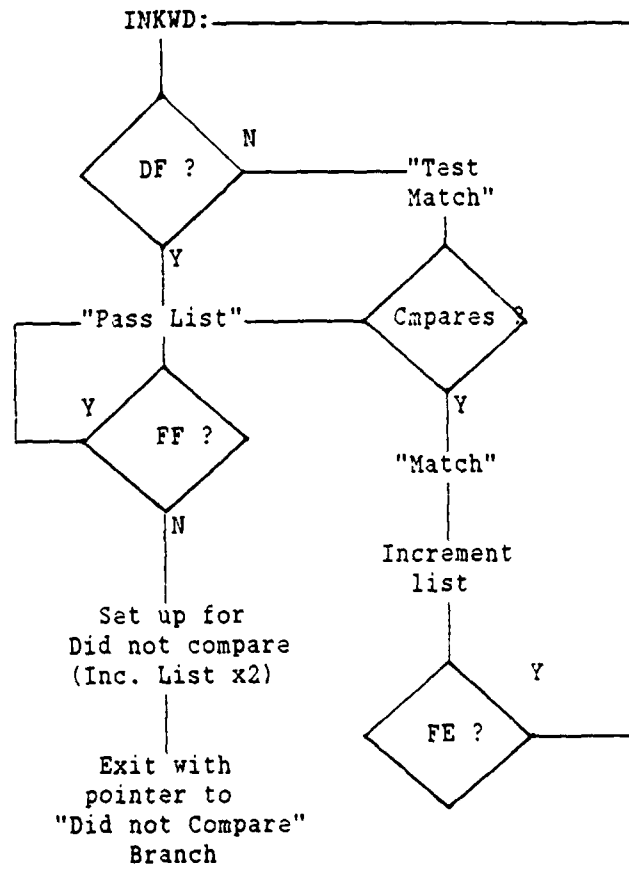
ITB
(Input Test and Branch)



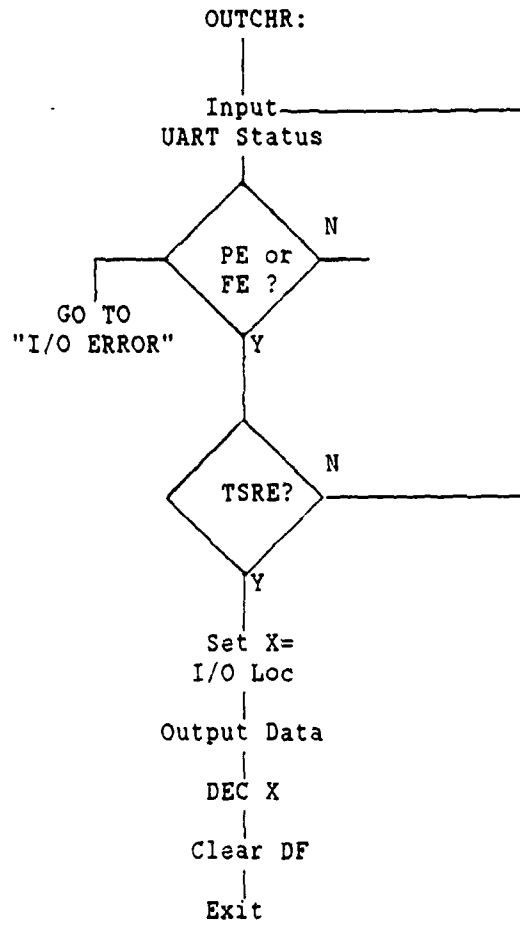
"INCHAR"
Input UART Status

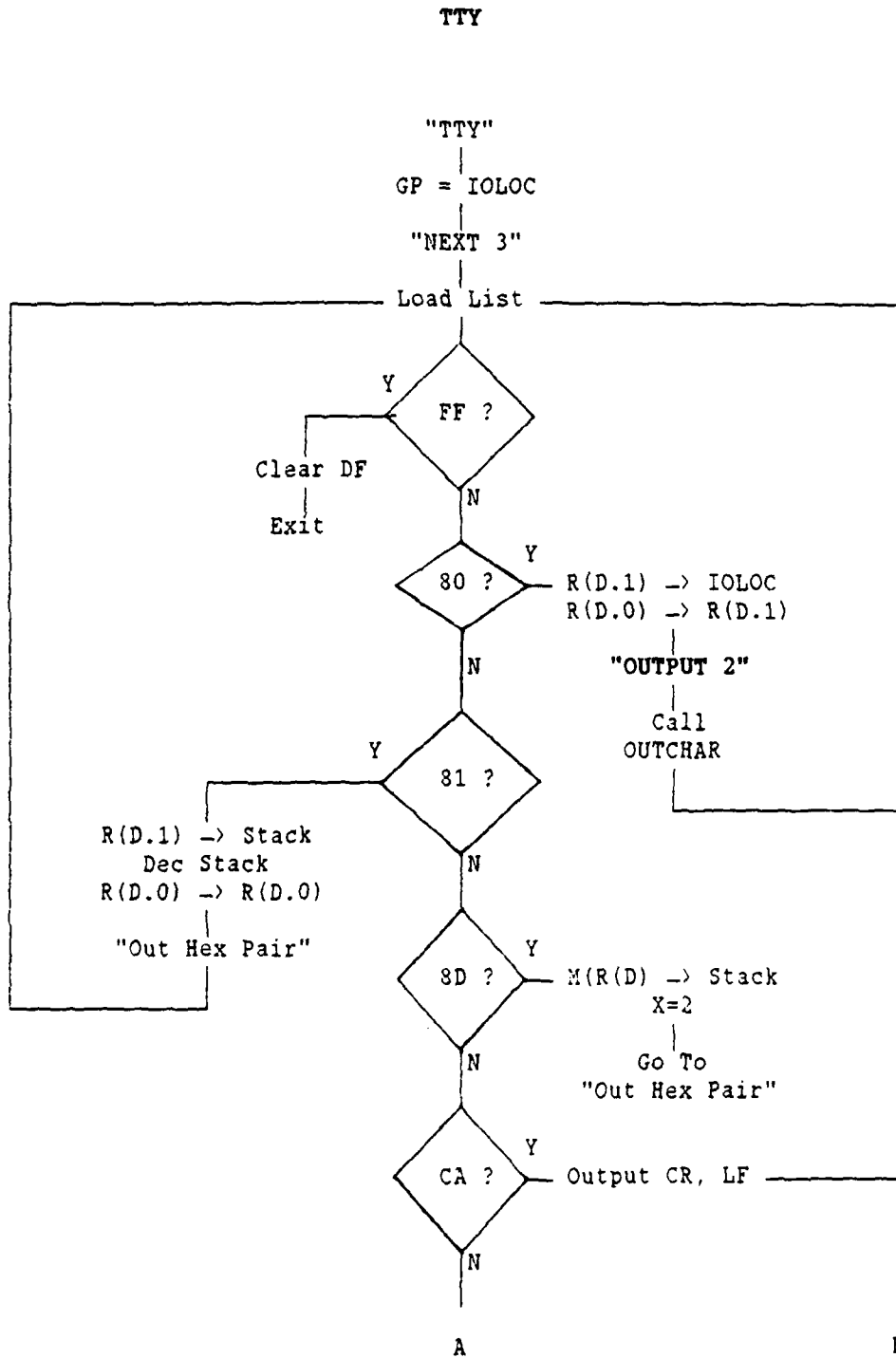


IN KEY WORD



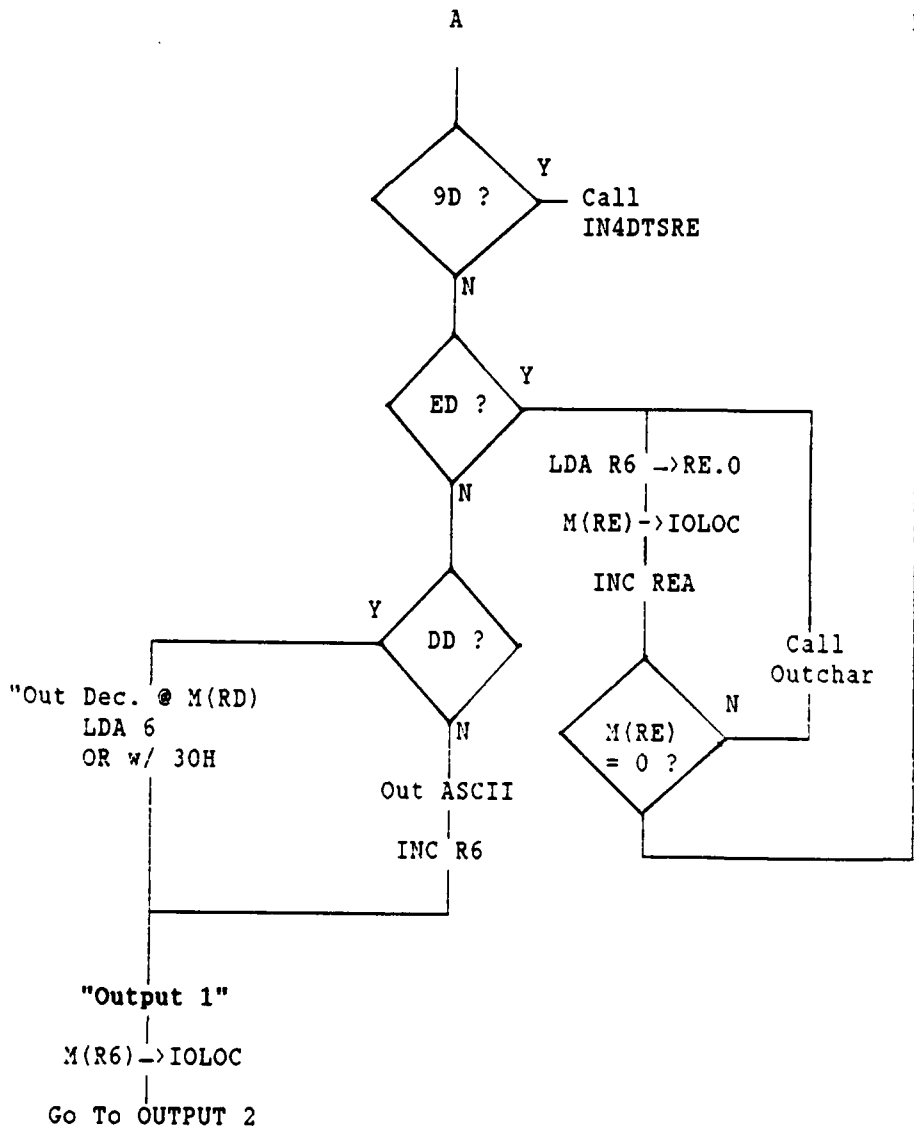
OUT CHARACTER



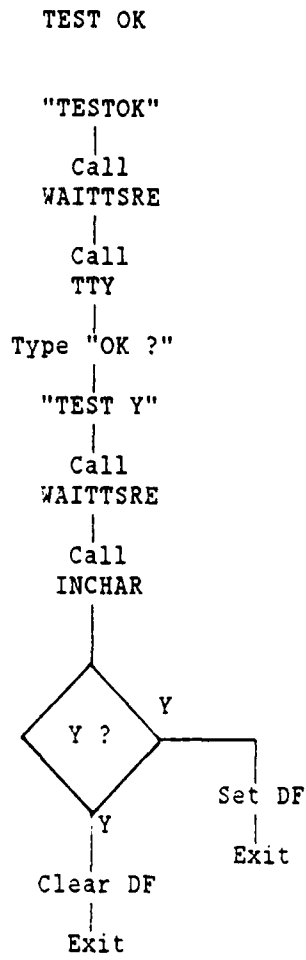


Continued next page

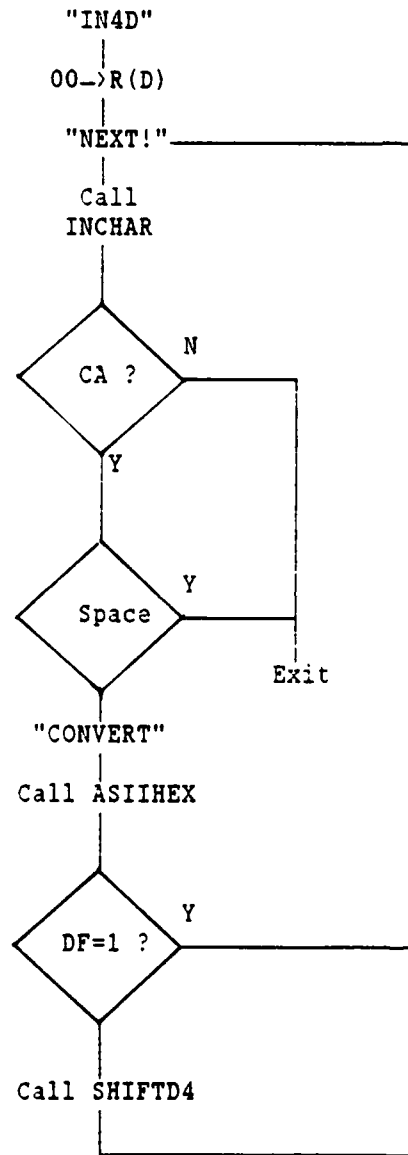
TTY contd.



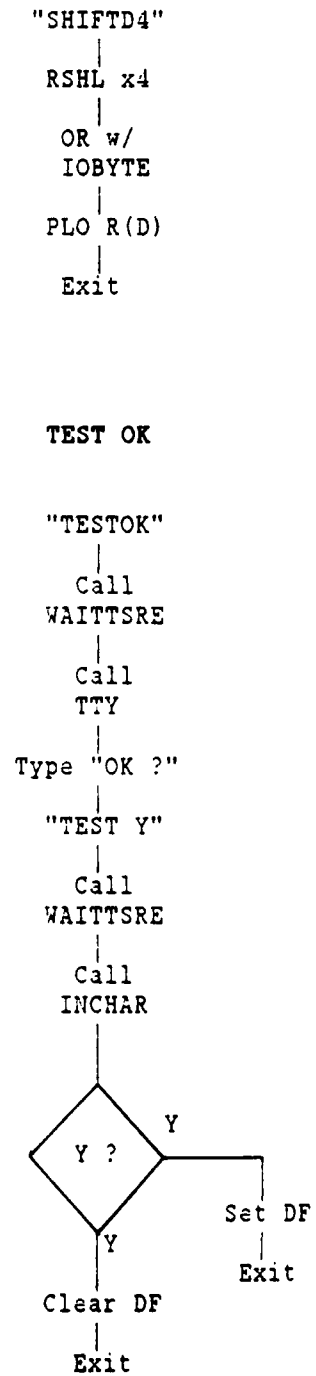
(Appendix B contd.)



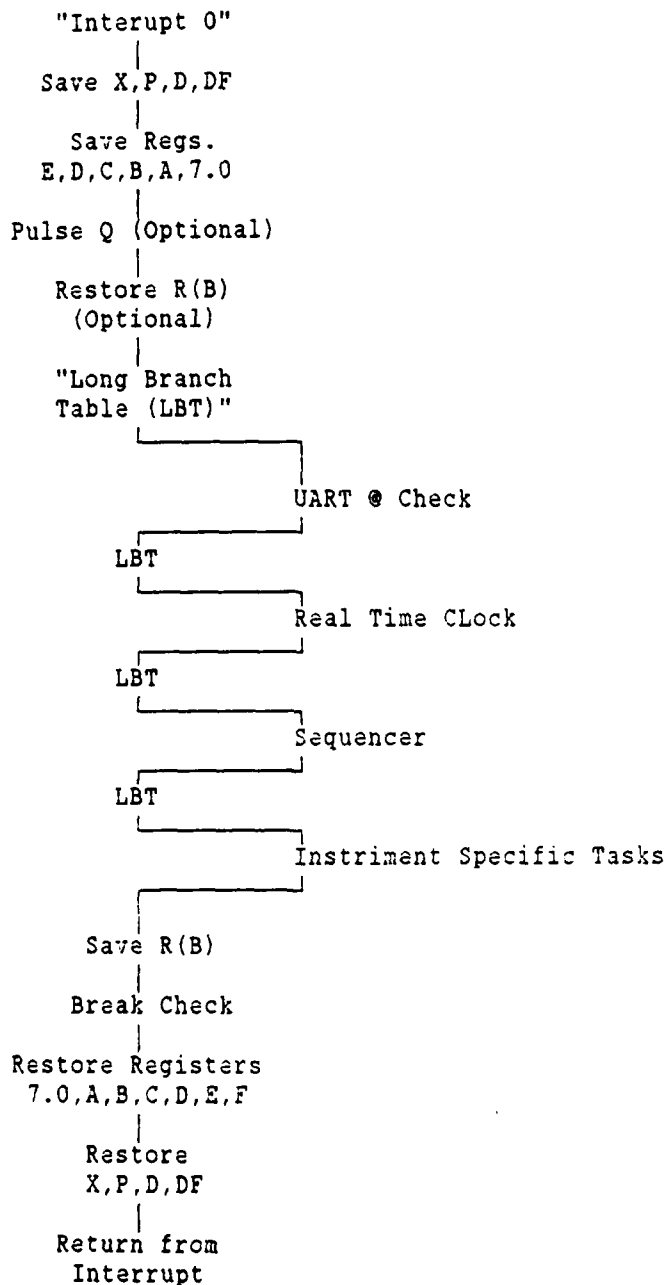
IN4D - Input 4
Digits to R(D)



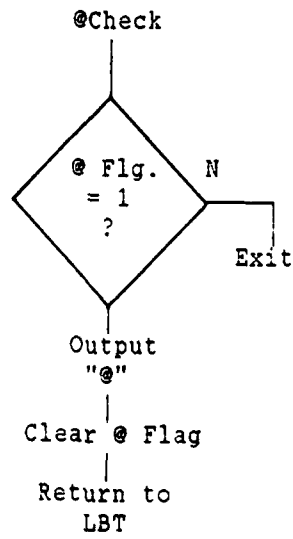
IN4D



Interrupt Service Routine



"UART @ Check"



Appendix C

Sea Duct Main Program Program Generation and Listing

SEA DUCT PROGRAM GENERATION

Software used in the Sea Duct System was developed on a CompuPro 816A Computer. The CompuPro 816A uses a modified version of CP/M and CP/M-86 to run 8 and 16 bit programs. All software purchased for the system was designed for eight bit CP/M systems.

The current version of the Sea Duct Main Program, SDSYS5n, is made from two files: SD05Rn and SDE5Rn. These are assembled using the Syscon M18 assembler (for RCA 1802 series) and are linked using L18.

SD05Rn is linked using the command /P:800/D:5000, and SDE5Rn is linked using /P:2000/D:5000; the combined version is called SDSYS5n.HEX. This can be converted to RCA format (file type ".RCA") using the command MBASIC_HXRCA. Appendix D contains a listing of the Hex to RCA format conversion program. The resulting .RCA file can be loaded into Sea Duct system RAM using a version of MCALL named SAIL via the BTU Monitor which resides in PROM at 0000 in the SEA DUCT System. RAM versions are usually used for testing only. At the present time the program is burned into EPROMs which are then installed in the system. Four proms (2716) are needed. They are inserted into prom locations 0800, 1000, 1800, and 2000. For the prom version, a ".COM" version of the program is made using the L18 linker. CP/M Submit files L18COM and L18HEX exist for linking the main program. See the Syscon manual as well as information at the top of each source file for further information. These files exist on disks labeled "Sea Duct Main Prog. - Working Copy" and "1802 Development System". This text and other text files are on the "Sea Duct Text Files". The "1802 Development System" disk is the disk used for assembly, etc. Backup copies of these disks exist.

The proms for the system are programmed using "BURN" and the system object file SDSYSn.COM. "Burn" is a renamed version of PROMPROG, the Optimal Technology prom programming package.

The Sea Duct Sequencer Macro Programs are the ones used to control the Sea Duct does during an actual deployment. These macro programs are on a disk labeled "Sea Duct Sequencer Progs." These are also assembled using Syscon's M18 and are linked using L18. These programs are also made into ".RCA" files using the MBASIC program HXRCA. The sequencer programs are loaded into battery backed ram memory at location 2000 hx. using the a version of MCALL renamed SAIL.COM. SAIL.COM resides on the "1802 Development System" disk. The command "SAIL -Z:SAIL." is used. This connects the Sea Duct computer to the CompuPro computer via the lab SAIL system.

```

1          :PAGE 60
2          SUBTTL SEA DUCT: SD05R9.MAC  15 SEP 86
3          ;
4          0035     VERS  EQU "5"          ;VERSION 5.9
5          0039     REV   EQU "9"
6          ;
7          ;
8          : PREVIOUS VERS.: SD05R8.MAC  06 SEP 86
9          : PREVIOUS VERS.: SD05R7.MAC  26 AUG 86
10         : PREVIOUS VERS.: SD05R6.MAC  08 AUG 86
11         : PREVIOUS VERS.: SD05R5.MAC  21 JUN 86
12         ;
13         : Other older versions exist - no longer used.
14         ;
15         ;
16         :SAIL SEA DUCT PROGRAM
17         ;
18         :FOR RCA 1806 WITH:
19         ;
20         :      1877 VECTORED INTERRUPT
21         :      MEMORY PROTECT.
22         :      REAL TIME CLOCK.
23         :      BASIC SEQUENCER
24         :      PASS THRU MODE W/ LOOP2 PWR CONTROL
25         :      FAST SEQUENCER W/ LOOP2
26         :      SEQUENCER TIMEOUT COUNTER
27         :      EXTENDED SEQUENCER POINTER (EO)
28         :      A/D. MUX CONTROL
29         ;
30         ;
31         C  INCLUDE I1806A.MAC
32         C  ;      I1806A.MAC - Macro Definitions for RCA 1805A/6A Opcodes
33         C  ;
34         C  ;
35         C  ;      20 FEB 1986
36         C  ;      W. E. TERRY
37         C  ;
38         C  ;      (LISTING SUPPRESSED)
39         C  ;
40         C  ;      With some Level II codes
41         C  ;
42         C  .LIST
43         ;      Macro Definitions for RCA 1805A/1806A Opcodes
44         ;
45         C  INCLUDE ISDRQU.MAC
46         C  ;      SEA DUCT EQUATE TABLE - ISDRQU.MAC

```

```

47      C      ;
48      C      ;      26 AUG 86 - SD05R7
49      C      ;
50      C      ;      W. E. PERRY
51      C      ;
52      C      ;      INCLUDING:
53      C      ;          REGISTER ALLOCATION
54      C      ;          GLOBAL PAGE REFERENCES
55      C      ;          I/O EQUATES
56      C      ;          DEFAULT VALUES
57      C      ;
58      C      ;      (LISTING SUPPRESSED)
59      C      ;      .LIST
60      C      ;
61      C      ;      Sea Duct Equate Table
62      C      ;
63      C      ;      *****
64      C      ;
65      C      ;      *** NOTE : EXTENDED SEQUENCER FUNCTIONS ARE NOT ON THIS FILE
66      C      ;      SEE FILE TYPES SDEvRr.MAC
67      C      ;      PUBLIC REFERENCES ARE MADE TO THE EXTENDED FILES
68      C      ;
69      C      ;      Assemble using: M18 SD0vRn.=SD0vRr/R/C then use
70      C      ;
71      C      ;      CREP80 SD0vRr=SD0vRr to get a .PRN file.
72      C      ;
73      C      ;      Link using:
74      C      ;      M18 /P:800/D:5000.SD0vRr./P:2000/D:5000.SDEvRr.SDSYSvr/W/X/E
75      C      ;      where v = Vers. . r = Rev.
76      C      ;      to link both this file and the extended sequencer file.
77      C      ;
78      C      ;      *****
79      C      ;
80      C      ;      ***** PROGRAM BEGINS HERE *****
81      C      ;
82      C      ;
83      0000' 71      HDSTRY: DIS
84      0001' 00      DB 00          ;DISABLE INTERRUPTS
85      C      ;
86      0002' 30 19'   BR SETSL      ;CAN BE BNA TO SETSL
87      0004' FFFF     DW OFFPPH     ;3 BYTE SPACE FOR LBR TO BLT
88      0006' FF       DB OFFH
89      C      ;
90      0007' 53 45 41 20  DB "SEA DUCT VERS."
91      0008' 44 55 43 54
92      000F' 20 56 45 52
  
```

```

93 0013' 53 2E
94 0015' 35          DB VERS
95 0016' 2E          DB '.'
96 0017' 39          DB REV
97 0018' 20          DB ' '
98
99 0019' 90          SETSL: CHI R0
100 001A' B3          PHI PC          ;SET PC TO STARTING ADDRESS
101 001B' F8 25'     LDI LOW(START1)
102 001D' A3          PLO PC
103
104 001E' F8 53          SETSYK: LDI STEPG
105 0020' B2          PHI STACK          ;PUT STACK LOCATION IN R2
106 0021' F8 DF          LDI LOW STKEND
107 0023' A2          PLO STACK
108 0024' D3          SRP PC          ;PROGRAM BEGINS TO RUN w/ PC = R3
109
110
111 0025' E2          START1: SEX STACK
112                    SCAL R6. MEMSUB ;CALL MEMORY ENABLE SUBROUTINE
113 0025' 68 35          +
114 0028' 07B2'          +
115 002A' 01          DB 01          ; ENABLE
116 002B' 00          DB 00          ; START PAGE = 00
117 002C' FF          DB 0FFH          ; # OF PAGES = FF
118
119                    ;
120                    SCAL R6. SETUP ;CALL FOR USER DEFINED CLEAR &
121 002D' 68 86          +
122 002F' 005A'          +
123
124                    ;
125                    ; INITIALIZE ROUTINE
126
127 0031' F8 20          DLY20: LDI 20H
128 0033' BE          PHI RE          ;20 = ARBITRARY DELAY WHICH
129 0034' 2E          WAIT: DEC RE          ; INSURES UART WILL RESET
130 0035' 9E          CHI RE
131 0036' 3A 34'          BHZ WAIT
132 0038' C4          NOP
133 0039' F8 1D          LDI ARPLG          ;SET RTC A/R FLAG
134 003B' A7          PLO GPAGE
135 003C' F8 01          LDI 01
136 003E' 57          STR GPAGE          ;1 -> A/R FLAG => NORMAL
137
138
139 003F' F8 F8          RESTR1: LDI HIGH(INTVEC)
140 0041' B1          PHI INTPC          ;SET R1 = INTERRUPT VECTOR PAGE
141 0042' F8 80          LDI LOW(INTVEC)

```

```

139 0044' A1          PLO INTPC
140 0045' F8 50      LDI GLOPG          ;SET GPAGE.1
141 0047' B7          PHI GPAGE
142
143 0048' F8 0A      SETURT: LDI GRPSAV          ;SELECT UART I/O GROUP
144 004A' A7          PLO GPAGE          ; AND STORE ON GLOBAL PAGE
145 004B' F8 06      LDI UARTS
146 004D' 57          STR GPAGE
147 004E' E7          SEX GPAGE
148 004F' 61          OUT GROUP
149 0050' B3          SEX PC
150 0051' 63          OUT CNTRL1        ;SET UART1 AS SHOWN IN THE I/O GROUP
151 0052' 12          DB FORMT1        ; ALLOCATION SETUP
152
153 0053' 65          OUT CNTRL2        ;THIS BLOCK:
154 0054' 12          DB FORMT1        ;
155
156
157
158
159 0055' B3          SEX PC
160 0056' 70          RET
161 0057' 33          DB 33H          ;ENABLE INTERRUPTS
162 0058' 30 94'      BR UNADDR        ;GO TO UNADDRESS
163
164
165
166
167
168
169
170
171 005A' F8 50      SETUP: LDI GLOPG          ;GLOBAL PAGE SETUP
172 005C' B7          PHI GPAGE          ;SETS R7.1 TO GLOPG
173
174 005D' F8 FF      LDI OFFH          ;CLEAR 5000 TO 5BFF WITH 00'S
175 005F' AA          PLO RA          ;CONFIGURE THIS SECTION TO
176 0060' F8 5B      LDI BUTPG          ;SUIT THE NEEDS OF YOUR SYSTEM
177 0062' BA          PHI RA
178 0063' F8 00      AGAIN: LDI 00H
179 0065' 5A          STR RA
180 0066' 2A          DEC RA
181 0067' 8A          GLO RA
182 0068' 32 6C'     BZ CLRPG
183 006A' 30 63'     BR AGAIN
184 006C' 9A          CLRPG: GHI RA

```

```

185 006D' F8 50          XRI GLOPG
186 006F' 12 73'       BZ SEQRST
187 0071' 30 63'       BR AGAIN
188
189
190 0073' F8 50          SEQRST: LDI PPCHI      ;INITIALIZE SEQUENCER
191 0075' A7            PLO GPAGE
192 0076' F8 07'       LDI HIGH(IDLLOC)
193 0078' 57            STR GPAGE
194 0079' 17            INC GPAGE
195 007A' F8 00'       LDI LOW(IDLLOC)
196 007C' 57            STR GPAGE
197 007D' 17            INC GPAGE
198 007E' F8 52          LDI HIGH(RSTKTP)
199 0080' 57            STR GPAGE
200 0081' 17            INC GPAGE      ;GPAGE AT RSTK POINTER
201 0082' F8 3F          LDI LOW(RSTKTP)
202 0084' 57            STR GPAGE
203 0085' 17            INC GPAGE
204 0086' F8 52          LDI HIGH(ASSTKTP)
205 0088' 57            STR GPAGE
206 0089' 17            INC GPAGE
207 008A' F8 7F          LDI LOW(ASSTKTP)
208 008C' 57            STR GPAGE
209
210
211 008D' F8 F8          LDI INTPG
212 008F' 9A            PHI RA      ;SET UP PROG. INTERRUPT CONTROLLER
213 0090' F8 00          LDI LOW(INTMSK)
214 0092' AA            PLO RA      ;SET INTERRUPT MASK FOR ONLY INT. 0
215 0093' F8 FE          LDI OPER
216 0095' 5A            STR RA
217 0095' F8 40          LDI LOW(INTCRL)
218 0098' AA            PLO RA      ;SET PIC CONTROL REG.
219 0099' F8 05          LDI 05
220 009B' 5A            STR RA
221 009C' F8 80          LDI LOW(INTVEC)
222 009E' AA            PLO RA      ;SET PIC VECTOR PAGE REG
223 009F' F8 08'       LDI HIGH(INTPGH)
224 00A1' 5A            STR RA
225
226 00A2' F8 3F          LDI HDGEXP      ;SET DEFAULT VALUE FOR THE PLUME HEADING
227 00A4' A7            PLO GPAGE      ; FOR THE EXPERIMENT
228 00A5' F8 20          LDI HDGVAL
229 00A7' 57            STR GPAGE
230

```

```

231 ;
232 ;*** THIS SPACE MAY BE USED FOR FURTHER SETUP ROUTINES ***
233 ;
234 ;
235 00A8' E2 SEX STACK
236 SEX R6
237 00A9' 68 95 +
238 ;
239 ;
240 ;*****
241 ;
242 ;***** I / O ERROR RECOVER *****
243 ;
244 00AB' E2 IOERR: SEX STACK
245 ;
246 ; SCAL R6. INTBR2 ; REMOVED VERS. 5.8 - 5.9
247 ;
248 00AC' F8 FE LDI IOLOC
249 00AE' A7 PLO GPAGE ;SAIL ENTERS HERE IF
250 00AF' 07 LDW GPAGE ; 1. UART GOT #
251 00B0' FB 23 XRI 023H ; 2. XMIT ECHOED ERROR
252 00B2' 32 37' BZ READDR ;IS INPUT CHARACTER '#' ?
253 ;
254 ;
255 00B4' FC 00 UNADDR: ADI 00H ;CLEAR DF
256 00B6' C8 LSKP
257 00B7' FF 00 READDR: SMI 00H ;SET DF
258 00B9' F8 03 LDI SYSPLG
259 00BB' A7 PLO GPAGE ;DF = 1 MEANS IT GOT '#'
260 00BC' E7 SEX GPAGE
261 00BD' F8 00 LDI 00H
262 00BF' 73 STXD
263 00C0' 73 STXD
264 00C1' 73 STXD ;CLEAR SAIL FLAGS AT
265 00C2' 57 STR GPAGE ;GLOBAL PAGE 00 THRU 03
266 ;
267 ;
268 ;*****
269 ; LDI SYSPLG ;REMOVE THE BEGINNING ';' FOR
270 ; PLO GPAGE ; PERMANENT OPEN SYSTEM
271 ; LDI 50H ;MAKE THESE STATEMENTS COMMENTS FOR
272 ; STR GPAGE ; NORMAL SYSTEM OPERATION
273 ;*****
274 ;
275 ;
276 00C3' F8 DF LDI LOW STREND

```

```

277 00C5' A2          PLO STACK      :RESET STACK
278 00C6' 33 CF'     BDF GOTNUM
279 00C8' E2         POWND?: SEX STACK
280                          SCAL R6. INCHAR
281 00C9' 68 86      +
282 00CB' 0181'      +
283 00CD' 30 C8'     BR POWND?
284 00CF' 30 D1'     GOTNUM: BR ADDR?
285                          ;
286                          ;
287                          ;***** SAIL ADDRESS *****
288                          ;
289                          ;
290 00D1' E2         ADDR?: SEX STACK
291                          SCAL R6. INKWD ;LOOK FOR NOTE: SAIL ADDRESS
292 00D2' 68 86      +
293 00D4' 0208'      +
294 00D6' 53 44      DB 'SD'          ; IS INSTRUMENT SPECIFIC
295 00D8' FF         DB DONE          ; DONE
296 00D9' 00DE'     DW ADDR
297 00DB' C0 00B4'   LBR UNADDR
298                          ;
299                          ;
300                          ;***** GOT SAIL ADDRESS *****
301                          ;
302                          ;
303 00DE' F8 03      ADDR: LDI SYSPLG
304 00E0' A7         PLO GPAGE      :ENTERS FROM SAIL ADDRESS
305 00E1' 07         LDW GPAGE
306 00E2' F9 80     ORI 080E
307 00E4' 57         STR GPAGE
308 00E5' E2         SEX STACK
309                          SCAL R6. DELAY2 ;2 BIT DELAY
310 00E5' 58 86      +
311 00E8' 019B'      +
312 00EA' 30 EC'     BR RPLY
313                          ;
314                          ;
315                          ;***** INSTRUMENT SAIL REPLY *****
316                          ;
317                          ;
318 00EC'          RPLY: SCAL R6. TTY ;TYPE:
319 00EC' 58 86      +
320 00EE' 024E'      +
321 00F0' CA         DB OCAN
322 00F1' 53 55 61 20 DB 'Sea Duct' ; REPLY
  
```



```

323 00F5' 44 75 63 74
324 00F9' 20 20 56 65          DB ' Vers. '
325 00FD' 72 73 2E 20
326 0101' 35                  DB VERS
327 0102' 2E                  DB '.'
328 0103' 39                  DB REV
329 0104' FF                  DB DONE      : DONE
330 0105' 30 07'             BR PROMPT
331 :
332 :
333 :***** PROMPT *****
334 :
335 :
336 0107' E2                   PROMPT: SEX STACK
337                               SCAL R6. TSRE?      ;WAIT FOR TRANS. SER. REG. EMPTY
338 0108' 68 86               +
339 010A' 02F0'               +
340                               SCAL R6. TTY        ;TYPE:
341 010C' 68 86               +
342 010E' 024E'               +
343 0110' CA                   DB OCAR          : CR. LF
344 0111' 3A                   DB PNTCHR       : PROMPT CHAR
345 0112' 03                   DB ETX          : ETX
346 0113' FF                   DB DONE          : DONE
347                               SCAL R6. TSRE?      ;WAIT FOR TRANS. SER. REG. EMPTY
348 0114' 68 86               +
349 0116' 02F0'               +
350 0118' 30 1A'              BR BRIST        ;GO TO FIRST BRANCH
351 :
352 :
353 :***** FIRST BRANCH *****
354 :
355 :
356 011A'                       BRIST: SCAL R6. ITB ;TEST FOR: ;ADD OR DELETE
357 011A' 68 86               +
358 011C' 022E'               +
359 011E' 3F                   DB '?'        ;? GROUP      : AS NECESSARY
360 011F' 0133'               DW QUESGR     : FOR YOUR SYSTEM
361 0121' 21                   DB '!'        ;! GROUP
362 0122' 014F'               DW BANGGR
363 0124' 24                   DB 'S'        ;S GROUP
364 0125' 0472'               DW TESTS
365 0127' 48                   DB 'R'        ;HELP FILE
366 0128' 1000'               DW HELP
367 012A' 4D                   DB 'M'        ;MEMORY PROTECT
368 012B' 0734'               DW HENSAV

```

```

369 012D' 25 DB '4' :PASS THRU GROUP
370 012E' 0171' DW PASSGR
371 0130' FF DB DONE :DONE :EXPANSION CAN BE
372 0131' 30 07' BR PROMPT :ADDED HERE
373 ;
374 ;
375 ;***** ? GROUP *****
376 ;
377 ;
378 0133' QUESGR: SCAL R6. ITB :LOOK FOR: :ADD OR DELETE
379 0133' 58 86 +
380 0135' 022E' +
381 0137' 4D DB 'M' : AS NECESSARY
382 0138' 0395' DW QUESTM :? M
383 013A' 43 DB 'C'
384 013B' 04A2' DW CRC :? CRC
385 013D' 54 DB 'T'
386 013E' 05C2' DW QUESTT :? TIME
387 0140' 53 DB 'S'
388 0141' 068A' DW SEQ? :? SEQUENCER
389 0143' 42 DB 'B'
390 0144' 1178' DW QUEBUF :? Buffer
391 0146' 48 DB 'H'
392 0147' 129D' DW HDG? :? Heading
393 0149' 45 DB 'E'
394 014A' 12DC' DW EXP? :? Experiment #
395 014C' FF DB DONE :DONE :EXPANSION CAN BE
396 014D' 30 07' BR PROMPT : ADDED HERE
397 ;
398 ;
399 ;***** ! GROUP *****
400 ;
401 ;
402 014F' BANGGR: SCAL R6. ITB :LOOK FOR: :ADD OR DELETE
403 014F' 68 86 +
404 0151' 022E' +
405 0153' 4C DB 'L' : AS NECESSARY
406 0154' 0331' DW LOCK :! LOCK
407 0156' 55 DB 'U'
408 0157' 0315' DW UNLOCK :! UNLOCK
409 0159' 4F DB 'O'
410 015A' 0348' DW OPEN? :! OPEN SYS
411 015C' 4D DB 'K'
412 015D' 03P5' DW WRITEN :! MEMORY
413 015F' 54 DB 'T'
414 0160' 0535' DW TIMEST :! TIME

```

```

415 0162' 53          DB 'S'
415 0163' 0602'      DW SEQSET      :! SEQUENCER
417 0165' 46         DB 'Y'
418 0166' 0704'      DW PPCSHO      :! FOLLOW PPC
419 0168' 48         DB 'H'
420 0159' 1273'      DW HDGSET      :! SET HEADING
421 016B' 45         DB 'E'
422 015C' 12B9'      DW EXPSET      :! SET EXPERIMENT #
423 016E' FF         DB DONE        :DONE          ;EXPANSION CAN BE
424 016F' 30 07'     BR PROMPT      ; ADDED HERE
425
426
427 ;***** PASS THRU GROUP *****
428
429
430 0171'          PASSGR: SCAL R6. ITB
431 0171' 58 86      +
432 0173' 022E'      +
433 0175' 50         DB 'P'          :START PASS THRU MODE
434 0176' 1540'      DW PTHRU        ;
435 0178' 42         DB 'B'          :SEND BREAK          ***
436 0179' 163E'      DW PASSBR      ;                   * BOTH SEND A
437 017B' 58         DB 'X'          :ESCAPE ( DROP ONE LEVEL ) * BREAK UNLESS
438 017C' 163E'      DW PASSBR      ;                   * *P MODE HAS
439 017E' FF         DB DONE        :DONE   EXPANSION CAN BE *** BEEN ENTERED
440 017F' 30 07'     BR PROMPT      ;   ADDED HERE
441
442
443 ;***** SAIL IN CHARACTER *****
444
445 0181' 5B          INCHAR: INP STAT1
446 0182' F6         SHR             :CHECK FOR DA (DATA AVAILABLE)
447 0183' 3B 81'     BWP INCHAR      :IF NOT TRY AGAIN
448 0185' FA 06      ANI 06H         :MASK FOR:
449 0187' 32 8C'     SZ KEEP2        ;   FRAME AND PARITY ERROR
450 0189' 5A         INP DATA1      :CLEAR BAD DATA
451 018A' 30 81'     BR INCHAR
452 018C' F8 FE      KEEP2: LDI IOLOC  :PUT GOOD DATA AT GP = I/O LOCATION
453 018E' A7         PLO GPAGE
454 018F' E7         SEX GPAGE
455 0190' 5A         INP DATA1
456 0191' FA 7F     ANI 07FH        :CLEAR MSB
457 0193' 57         STR GPAGE       :STORE AT GP I/O LOCATION
458 0194' FD 23     XRI '4'         :IS IT '4' ?
459 0196' C2 00AB'  LBZ IOERR
460 0199' 30 9B'     BR DELAY2       :2 BIT DELAY

```

```

461 ;
462 ;
463 ;***** 2 BIT DELAY *****
464 ;
465 ;
466 019B' F8 80 DELAY2: LDI 80H ; INSTRUMENT SPECIFIC:
467 019D' FF 01 WAIT3: SHI 01H ; 80H = 10.8 mSec FOR
468 019F' C4 NOP ; 1.2288 MHz SYSTEM CPU CLOCK
469 01A0' C4 NOP
470 01A1' C4 NOP
471 01A2' 3A 9D' BNZ WAIT3
472 01A4' FC 00 ADI 00H ;CLEAR DF
473 01A6' E2 SEX STACK
474 SRET R6
475 01A7' 68 96 +
476 ;
477 ;
478 ;***** INPUT 4 DIGITS TO R(D) - (IN4D) *****
479 ;
480 ;
481 01A9' F8 00 IN4D: LDI 00
482 01AB' BD PHI RD ;SET R(D) = 0000
483 01AC' AD PLO RD
484 01AD' NEXT1: SCAL R6. INCHAR
485 01AD' 68 86 +
486 01AF' 0181' +
487 01B1' 07 LDW GPAGE
488 01B2' FB 0D XRI 0DH ;INCHAR XOR CR IS IT 'CR' ?
489 01B4' 32 BA' BZ IN4DXT ;GP -> I/O LOC.
490 01B6' FB 2D XRI 2DH ;"SPACE" XOR CR IS IT ' ' ?
491 01B8' 3A BC' BNZ CVVRT
492 01BA' IN4DXT: SRET R6
493 01BA' 68 95 +
494 ;
495 ;
496 01BC' CVVRT: SCAL R6. ASCHEX
497 01BC' 68 86 +
498 01BE' 01C8' +
499 01C0' 33 AD' BDF NEXT1
500 SCAL R6. SHPTD4
501 01C2' 68 86 +
502 01C4' 01EF' +
503 01C6' 30 AD' BR NEXT1
504 ;
505 ; ;ASCII TO HEX CONVERSION
506 01C8' 07 ASCHEX: LDW GPAGE

```

507	01C9'	FC D0	ADI 0D0H	:CALLED BY CNVRT AND ! MEMORY
508	01CB'	CD 01EB'	LBNF NOTHEX	
509	01CE'	07	LDN GPAGE	
510	01CF'	FD 39	SDI 039H	
511	01D1'	C3 01E3'	LBNF NUMBER	
512	01D4'	07	LDN GPAGE	
513	01D5'	FC BF	ADI 0BPH	
514	01D7'	CD 01EB'	LBNF NOTHEX	
515	01DA'	07	LDN GPAGE	
516	01DB'	FD 46	SDI 046H	
517	01DD'	3B EB'	BWF NOTHEX	
518	01DF'	07	LDN GPAGE	
519	01E0'	FC C9	ADI 0C9H	
520	01E2'	38	SKP	
521	01E3'	07	NUMBER: LDN GPAGE	
522	01E4'	FA 0F	ANI 00FH	
523	01E6'	57	STR GPAGE	
524	01E7'	FC 00	ADI 00H	:CLEAR DF
525			SRET R6	
526	01E9'	58 96		
527	01EB'	FF 00	NOTHEX: SHI 00H	:SET DF
528			SRET R6	
529	01ED'	58 96		
530			:	
531			:	
532	01EF'	8C	SHFTD4: GLO RC	
533	01F0'	52	STR STACK	
534	01F1'	F8 04	LDI 04H	
535	01F3'	AC	PLO RC	
536	01F4'	8D	SHIFT: GLO RD	
537	01F5'	FE	SHL	
538	01F6'	AD	PLO RD	
539	01F7'	9D	GHI RD	
540	01F8'	7E	SHLC	
541	01F9'	BD	PBI RD	
542	01FA'	2C	DEC RC	
543	01FB'	8C	GLO RC	
544	01FC'	CA 01P4'	LBNZ SHIFT	
545	01FF'	02	LDN STACK	
546	0200'	AC	PLO RC	
547	0201'	E7	SEX GPAGE	
548	0202'	8D	GLO RD	
549	0203'	F1	OR	
550	0204'	AD	PLO RD	
551	0205'	E2	SEX STACK	
552			SRET R6	

```

553 0206' 68 96 +
554 ;
555 ;
556 ;***** IN KEY WORD *****
557 ;
558 0208' E2 INKWD: SEX STACK
559 SCAL R6. INCHAR
560 0209' 68 96 +
561 020B' 0181' +
562 020D' 3B 19' BWF MATCH?
563 020F' 46 PLIST: LDA LIST
564 0210' FB FF ;IS IT FF ? FF = LIST END
565 0212' 3A 0F' BMZ PLIST
566 0214' 16 INC LIST
567 0215' 16 INC LIST
568 0216' E2 SEX STACK
569 SRET R6 ;GOES TO LBR AT END OF LIST
570 0217' 68 96 +
571 ;
572 0219' 07 MATCH?: LDW GPAGE ;GPAGE = I/O LOC.
573 021A' E6 SEX RTNPTR
574 021B' F3 XOR ;DOES I/O LOC = LIST ?
575 021C' 3A 0F' BMZ PLIST
576 021E' 16 MATCH: INC LIST
577 021F' 06 LDW LIST
578 0220' FB FF XRI OPFH
579 0222' 3A 08' BMZ INKWD
580 0224' 16 INC LIST
581 0225' 46 LDA RTNPTR
582 0226' 52 STR STACK
583 0227' 46 LDA RTNPTR
584 0228' A6 PLO RTNPTR
585 0229' 02 LDW STACK
586 022A' B6 PHI RTNPTR
587 022B' E2 SEX STACK
588 SRET R6 ;GOES RETURN INDICATED AT LIST END
589 022C' 68 96 +
590 ;
591 ;
592 ;***** INPUT TEST AND BRANCH *****
593 ;
594 ;
595 022E' E2 ITD: SEX STACK
596 SCAL R6. INCHAR
597 022F' 68 86 +
598 0231' 0181' +
  
```

```

599 0233' E7          SEX GPAGE
600 0234' 46          NEXT2: LDA LIST
601 0235' FB FF       XRI OFFH      ;IS LIST FF ?
602 0237' 3A 3C'     BNZ TEST
603 0239' E2          SEX STACK
604                   SRET R6
605 023A' 68 96      +
606 023C' FB FF       TEST:  XRI OFFH
607 023E' F3          XOR
608 023F' 32 45'     BZ MATCH2     ;DOES CHAR = LIST ?
609 0241' 16          INC LIST
610 0242' 16          INC LIST
611 0243' 30 34'     BR NEXT2
612 0245' 46          MATCH2: LDA R6
613 0246' 52          STR STACK
614 0247' 46          LDA R6
615 0248' 16          PLO R6
616 0249' 02          LDW STACK
617 024A' B6          PHI R6
618 024B' E2          SEX STACK
619                   SRET R6
620 024C' 68 96      +
621                   ;
622                   ;
623                   ;***** TTY *****
624                   ;
625                   ;
626 024E' F8 FE       TTY:  LDI IOLOC
627 0250' A7          PLO GPAGE      ;TTY CHECKS FOR THE FOLLOWING PSEUDO OPS IN LIST:
628 0251' 46          NEXT3: LDA R6      ;*****
629 0252' FB FF       XRI OFFH      ;IS IT FF?      ; ASCII CHAR -> TYPES IT
630 0254' 3A 5A'     BNZ TEST80     ; 80 = TYPES ASCII @ RD.1
631 0256' FC 00       ADI 00H      ;CLEAR DF      ; 31 = HEX PAIR @ RD.1
632                   SRET R6      ;      2nd CALL SENDS HEX PR @ RD.0
633 0258' 68 96      +
634                   ;
635 025A' FB 7F       TEST80: XRI (80H XOR OFFH) ; 8D = HEX PAIR @ M(RD), INC RD
636 025C' 3A 58'     BNZ TEST81     ; CA = TYPES CR, LF
637 025E' 9D          ASCRD1: GHI RD ; 9D = CALLS IN4D
638 025F' 57          STR GPAGE     ; DD = DECIMAL @ M(RD) (00-99), INC RD
639 0260' 8D          GLO RD        ; A1 = SEND HI HEX NIBBLE @ M(RD)
640 0261' BD          PHI RD        ; A2 = SEND LO HEX NIBBLE @ M(RD), INC RD
641 0262'             OUTPT2: SCAL R6, OUTCHR ; FF = DONE (END OF LIST)
642 0262' 68 86      +
643 0264' 0300'      +
644 0266' 30 51'     BR NEXT3

```

545					
546	0268'	PB 01		TEST81: XRI (81H XOR 80H)	:81 XOR 80
547	026A'	3A 88'		BWZ TEST8D	:IS IT 81?
548	026C'	9D		HEXRD1: GHI RD	
549	026D'	E2		SEX STACK	
550	026E'	73		STXD	
551	026F'	8D		GLO RD	
552	0270'	8B		PHI RD	
553	0271'	12		OUTHEX: INC STACK	
554	0272'	02		LDW STACK	
555	0273'	22		DEC STACK	
556	0274'	F6		SHR	
557	0275'	F6		SHR	
558	0276'	F6		SHR	
559	0277'	F6		SHR	
560	0278'	57		STR GPAGE	
561				SCAL R6. HICONV	
562	0279'	58 86	+		
563	027B'	02D4'	+		
564	027D'	12		INC STACK	
565	027E'	02		LDW STACK	
566	027F'	FA 0F		ANI OFH	
567	0281'	57		STR GPAGE	
568				SCAL R6. HICONV	
569	0282'	58 86	+		
570	0284'	02D4'	+		
571	0286'	30 51'		BR NEXT3	
572					
573					
574	0288'	PB 0C		TEST8D: XRI (8DH XOR 81H)	
575	028A'	3A 91'		BWZ TESTCA	:IS IT 8D ?
576	028C'	4D		LDA RD	
577	028D'	E2		SEX STACK	
578	028E'	73		STXD	
579	028F'	30 71'		BR OUTHEX	
580					
581	0291'	PB 47		TESTCA: XRI (0CAH XOR 8DH)	
582	0293'	3A 9E'		BWZ TEST9D	:IS IT CA ?
583	0295'			OUTCA: SCAL R6. TTY	:OUTPUT CR. LF
584	0295'	68 86	+		
585	0297'	024E'	+		
586	0299'	0D0A		DW 0D0AH	
587	029B'	FF		DB DOWE	:DOWE
588	029C'	30 51'		BR NEXT3	
589					
590	029E'	PB 57		TEST9D: XRI (9DH XOR 0CAH)	


```

691 02A0' 3A A8'          BNZ TESTDD          ;IS IT 9D ?
692                          SCAL R6, IN4DT?        ;ONLY CALL OF IN4DT?
693 02A2' 58 86          +
694 02A4' 02E9'          +
695 02A6' 30 51'          BR NEXT3
696                          ;
697 02A8' FB 40          TESTDD: XRI (ODDH XOR 09DH) ;IS TI DD ?
698 02AA' 3A B1'          BNZ TESTA1          ;EXTEND TTY W/ BRANCH FROM HERE
699 02AC' 4D              LDA RD
700 02AD' P9 30          ORI 030H
701 02AF' 30 D1'          BR OUTPT1
702                          ;
703 02B1' FB 7C          TESTA1: XRI (0A1H XOR 0DDH) ;IS IT A1 ?
704 02B3' 3A C1'          BNZ TESTA2
705 02B5' 0D              LDW RD
706 02B6' P5              SHR
707 02B7' P6              SHR
708 02B8' P6              SHR
709 02B9' P6              SHR
710 02BA' 57              STR GPAGE
711                          SCAL R6, HXCONV
712 02BB' 58 86          +
713 02BD' 02D4'          +
714 02BF' 30 51'          BR NEXT3
715                          ;
716 02C1' FB 03          TESTA2: XRI (0A2H XOR 0A1H) ;IS TI A2 ?
717 02C3' 3A CF'          BNZ OUTASC
718 02C5' 4D              LDA RD          ;R(D)=R(D)+1
719 02C5' PA 0F          ANI 0FH
720 02C8' 57              STR GPAGE
721                          SCAL R6, HXCONV
722 02C9' 58 86          +
723 02CB' 02D4'          +
724 02CD' 30 51'          BR NEXT3
725                          ;
726 02CF' 25              OUTASC: DEC R6
727 02D0' 46              LDA R6
728 02D1' 57              OUTPT1: STR GPAGE
729 02D2' 30 52'          BR OUTPT2
730                          ;
731 02D4' 07              HXCONV: LDW GPAGE          ;ONLY USED BY TTY
732 02D5' PC P6          ADI 0F5H
733 02D7' C3 02E4'      LBDP GTR9
734 02DA' 07              LDW GPAGE
735 02DB' P9 30          ORI 030H
736 02DD' 57              STORE: STR GPAGE
  
```

```

737                                     SCAL R6. OUTCHR
738 02DE' 68 86      +
739 02EO' 0300'     +
740                                     SRET R6
741 02E2' 58 96      +
742                                     ;
743 02E4' FC 41      GTR9: ADI 041H
744 02E6' CO 02DD'   LBR STORE
745                                     ;
746                                     ;
747 ;***** IN4D TSRE *****
748                                     ;
749                                     ;
750 02E9'            IN4DT?: SCAL R6. TSRE?
751 02E9' 68 86      +
752 02EB' 02FO'     +
753 02ED' CO 01A9'   LBR IN4D
754                                     ;
755                                     ;
756 ;***** WAIT FOR TRANS. SER. REG. EMPTY *****
757                                     ( LOOP 1 )
758                                     ;
759                                     ;
760 02FO' E2          TSRE?: SEX STACK      ; CALLED BY PROMPT. TEST OK.
761 02F1' 5A          ;                   ; AND IN4DTSRE. AND PASSTHRU
762 02F2' 5B          WAIT4: INP DATA1    ; CLEAR DA (DATA AVAILABLE)
763 02F3' FA CO      ANI OCOH             ; MASK FOR TSRE & THRE
764 02F5' FB CO      XRI OCOH             ; TSRE = THRE = 1 ?
765 02F7' 3A F1'     BNZ WAIT4
766                                     SCAL R6. DELAY2 ;2 BIT DELAY
767 02F9' 68 86      +
768 02FB' 019B'     +
769 02FD' 5A          INP DATA1          ; CLEAR ECHO DA
770                                     SRET R6
771 02FE' 58 96      +
772                                     ;
773                                     ;
774 ;***** SAIL OUT CHARACTER *****
775                                     ( LOOP 1 )
776                                     ;
777 0300' 5B          OUTCHR: INP STAT1
778 0301' FA OC      ANI OCH              ; CHECK PREVIOUS I/O ERROR
779 0303' CA 00AB'   LBZ IOERR
780 0306' 02          THRE?: LDW STACK
781 0307' FE          SHL                  ; CHECK THRE
782 0308' 3B 00'     BNZ OUTCHR          ; WAIT FOR UART READY
  
```

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783 030A' E7          SEX GPAGE
784 030B' F8 FE      LDI IOLOC
785 030D' A7          PLO GPAGE
786 030E' 52          OUT DATAI      :LOAD UART FROM I/O LOCATION
787 030F' 27          DEC GPAGE
788 0310' FC 00      ADI 00H          :CLEAR DF
789 0312' E2          SEX STACK
790                               SRET R6
791 0313' 58 96      +
792                               ;
793                               ;
794                               :***** UNLOCK *****
795                               ;
796                               ;
797 0315'          UNLOCK: SCAL R6. INKWD :LOOK FOR:
798 0315' 68 86      +
799 0317' 0208'     +
800 0319' 4E 4C 4F 43 DB 'NLOCK'      :      NLOCK
801 031D' 4B
802 031E' FF          DB DONE          :      DONE
803 031F' 0324'     DW NOLOCK         :BR TO NOLOCK
804 0321' C0 035D'   LBR SAYNO
805 0324' F8 40      NOLOCK: LDI 40H
806 0326' 52          STR STACK
807 0327' E2          SETPLG: SEX STACK
808 0328' F8 03      LDI SYSPLG
809 032A' A7          PLO GPAGE
810 032B' 07          LDW GPAGE
811 032C' F1          OR              :STORE WRITE FLAG
812 032D' 57          MODPLG: STR GPAGE
813 032E' C0 0107'   LBR PROMPT
814                               ;
815                               ;
816                               :***** LOCK *****
817                               ;
818                               ;
819                               ;
820 0331'          LOCK: SCAL R6. INKWD
821 0331' 58 86      +
822 0333' 0208'     +
823 0335' 4F 43 4B DB 'OCK'
824 0338' FF          DB DONE
825 0339' 033D'     DW LOCKUP
826 033B' 30 5D'     BR SAYNO
827 033D' F8 9F      LOCKUP: LDI 9FH
828 033F' 52          STR STACK
  
```

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829 0340' E2 CLRPLG: SEX STACK
830 0341' F8 03 LDI SYSPLG
831 0343' A7 PLO GPAGE
832 0344' 07 LDH GPAGE
833 0345' F2 AND ;CLEAR WRITE AND SYS FLAGS
834 0346' 30 2D' BR MODPLG
835 ;
836 ;
837 ;***** :OPEN SYS *****
838 ;
839 ;
840 0348' OPEN?: SCAL R6. INKWD
841 0348' 68 86 +
842 034A' 0208' +
843 034C' 50 45 4E DB 'PEN' ;LOOK FOR:
844 034F' 20 53 59 53 DB ' SYS' ; PEN SYS
845 0353' FF DB DONE ; DONE
846 0354' 0358' DW OPEN
847 0356' 30 5D' BR SAYNO
848 0358' F8 20 OPEN: LDI 20H
849 035A' 52 STR STACK
850 035B' 30 27' BR SETPLG ;SET SYS FLAG
851 ;
852 ;
853 ;***** SAY NO ! *****
854 ;
855 035D' E2 SAYNO: SEX STACK
856 SCAL R6. DELAY2
857 035E' 68 86 +
858 0360' 019B' +
859 SCAL R6. TTY
860 0362' 68 86 +
861 0364' 024E' +
862 0366' 204E DW 204EH ;TYPE: SPACE No !
863 0368' 6F20 DW 6F20H ; DONE
864 036A' 21FF DW 21FFH
865 036C' C0 0107' LBR PROMPT
866 ;
867 ;
868 ;***** TEST OK ? *****
869 ;
870 036F' E2 TESTOK: SEX STACK
871 SCAL R6. TSRE?
872 0370' 68 86 +
873 0372' 02F0' +
874 SCAL R6. TTY ;TYPE: OK ?

```

875	0374'	68 86	+	
876	0376'	024E'	+	
877	0378'	20 4F 5B 20		DB ' OK ? '
878	037C'	3F 20		
879	037R'	03		DB ETX ; ETX
880	037P'	FF		DB DONE ; DONE
881	0380'	E2		TESTY: SEX STACK
882				SCAL R6. TSRE?
883	0381'	68 86	+	
884	0383'	02F0'	+	
885				SCAL R6. INCHAR
886	0385'	68 86	+	
887	0387'	0181'	+	
888	0389'	07		LDW GPAGE
889	038A'	FB 59		XRI 059H ;XOR 'Y' IS IT YES ?
890	038C'	3A 92'		BWZ NOVRTM
891	038E'	FF 00		SKRTM: SMI 00H ;SET DF
892				SRET R6
893	0390'	68 96	+	
894	0392'	FC 00		NOVRTM: ADI 00H ;CLEAR DF
895				SRET R6
896	0394'	68 96	+	
897				:
898				:
899				;***** ? Memory routine *****
900				:
901	0396'			QUESTM: SCAL R6. IN4D
902	0396'	68 86	+	
903	0398'	01A9'	+	
904	039A'	8D		GLO RD
905	039B'	73		STXD
906	039C'	9D		GHI RD
907	039D'	73		STXD
908				SCAL R6. IN4D
909	039E'	68 86	+	
910	03A0'	01A9'	+	
911	03A2'	9D		GHI RD
912	03A3'	BE		PHI RE
913	03A4'	8D		GLO RD
914	03A5'	AE		PLO RE
915	03A6'	12		INC STACK
916	03A7'	42		LDA STACK
917	03A8'	BD		PHI RD
918	03A9'	02		LDW STACK
919	03AA'	AD		PLO RD
920				SCAL R6. DELAY?

```

921 03AB' 58 86 +
922 03AD' 019B' +
923 03AE' E2 OUTADR: SEX STACK
924 03B0' 8D GLO RD
925 03B1' 73 STXD
926 03B2' 9D GHI RD
927 03B3' 73 STXD
928 SCAL R6, TTY
929 03B4' 58 86 +
930 03B6' 024E' +
931 03B8' CA DB OCAH
932 03B9' 81 DB 081H ;TYPE: CR.LF
933 03BA' 81 DB 081H
934 03BB' 20 DB 020H ; OUT HEX PR 12. SPACE
935 03BC' FF DB DONE ; DONE
936 03BD' 12 INC STACK
937 03BE' 42 LDA STACK
938 03BF' 9D PHI RD
939 03C0' 02 LDN STACK
940 03C1' AD PLO RD
941 03C2' 8E HEXBYT: GLO RE
942 03C3' 3A C9' BNZ DECCNT
943 03C5' 9E GHI RE
944 03C6' C2 0107' LBZ PROMPT
945 03C9' 2E DECCNT: DEC RE
946 SCAL R6, TTY
947 03CA' 58 86 +
948 03CC' 024E' +
949 03CE' 8DFF DW 8DFF ;TYPE: OUT HEX RD. DONE
950 03D0' 8D GLO RD
951 03D1' FA 0F ANI 00FH ;MASK FOR LINE LENGTH
952 03D3' C2 03E3' LBZ LNTST ; 07 = 08H / LINE
953 03D6' FA 01 ANI 01H ; 0F = 10H / LINE
954 03D8' 3A C2' BNZ HEXBYT
955 SCAL R6, TTY
956 03DA' 58 86 +
957 03DC' 024E' +
958 03DE' 20FF DW 20FF ;TYPE: SPACE, DONE
959 03E0' C0 03C2' LBR HEXBYT
960 ;
961 03E3' 8E LNTST: GLO RE ;TEST FOR END OF LINE
962 03E4' 3A EC' BNZ LEND
963 03E6' 9E GHI RE
964 03E7' 3A EC' BNZ LEND
965 03E9' C0 0107' LBR PROMPT
966 ;

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967 038C'          MNEND: SCAL R6. TTY ;TYPE: ';'. DONE
968 038C' 68 86   +
969 038E' 024E'   +
970 03F0' 3BFF          DW 3BFFH
971 03F2' C0 03AF'     LBR 00TADR
972
973
974 ;***** ! Memory routine *****
975 ;
976 03F5' F8 03   WRITEN: LDI SYSPLG
977 03F7' A7          PLO GPAGE
978 03F8' 07          LDM GPAGE
979 03F9' FA 40          ANI 40H ;CHECK FOR UNLOCK FLAG
980 03FB' C2 035D'     LBR SAYNO
981 03FE'          INADDR: SCAL R5. IN4D
982 03FE' 68 86   +
983 0400' 01A9'   +
984 0402' 9D          SHI RD
985 0403' BE          PHI RE
986 0404' 3D          SLO RD
987 0405' AE          PLO RE
988 0405'          INIST: SCAL R6. INCHAR
989 0405' 68 86   +
990 0408' 0181'   +
991 040A' 07          LDM GPAGE
992 040B' 32 06'     BZ INIST ;IGNORE NULLS
993          SCAL R5. ASCHEX
994 040D' 68 86   +
995 040F' 01C8'   -
996 0411' 03 0437'   LDDF *TESTSP ;DF = NOT HEX
997 0414' 07          LDM GPAGE
998 0415' AD          PLO RD ;SAVE LO DIGIT
999 0415'          INEND: SCAL R6. INCHAR
1000 0415' 68 86   -
1001 0418' 0181'   -
1002          SCAL R6. ASCHEX
1003 041A' 68 86   +
1004 041C' 01C8'   -
1005 041E' 33 09'   BDF ERROR!
1006          SCAL R5. SBPTDA
1007 0420' 68 86   +
1008 0422' 01EF'   +
1009 0424' 8D          SLO RD
1010 0425' 5E          STR R5 ;WRITE INTO RAM
1011 0425' 1E          INC R5
1012 0427' 30 06'     BR INIST

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1013 0429' ERROR1: SCAL R6. DELAY2
1014 0429' 58 86 +
1015 042B' 019B' +
1016 SCAL R6. TTY ;TYPE:
1017 042D' 58 86 +
1018 042E' 024E' +
1019 0431' 3F3F DW 3F3F ; ? ?
1020 0433' FF DB DOWE ; DOWE
1021 0434' C0 0107' LBR PROMPT
1022 0437' 07 TESTSP: LDW GPAGE
1023 0438' FB 20 XRI 20H ; ' ' XOR 'SPACE' IS IT 'SPACE' ?
1024 043A' C2 0406' LBZ INIST
1025 043D' FB 0C XRI 0CH ; ' ' XOR SPACE IS IT ' ' ?
1026 043E' CA 0449' LBWZ SEMI?
1027 SCAL R6. PASSCA
1028 0442' 58 86 +
1029 0444' 045E' +
1030 0446' C0 0406' LBR INIST
1031 0449' FB 17 SEMI?: XRI 017H ; ' ' XOR ' ' IS IT ' ' ?
1032 044B' 3A 54' BNZ TESTCR
1033 SCAL R6. PASSCA
1034 044D' 58 86 +
1035 044E' 045E' +
1036 0451' C0 03FE' LBR INADDR
1037 ;
1038 0454' FB 36 TESTCR: XRI 036H ; 'CR' XOR ' ' IS IT 'CR' ?
1039 0455' CA 0429' LBWZ ERROR1
1040 0459' FC 30 ADI 30H ;CLEAR DF
1041 045B' C0 0107' LBR PROMPT
1042 ;
1043 045E' PASSCA: SCAL R6. INCHAR ;ONLY USED BY .M
1044 045E' 58 86 +
1045 0460' 0181' +
1046 0462' 07 LDW GPAGE
1047 0463' FB 0D XRI 0DH ;IS IT 'CR' ?
1048 0465' 3A 5E' BNZ PASSCA
1049 0467' INLP: SCAL R6. INCHAR
1050 0467' 58 86 +
1051 0469' 0181' +
1052 046B' 07 LDW GPAGE
1053 046C' FB 0A XRI 0AH ;IS IT 'LF' ?
1054 046E' 3A 57' BNZ INLP
1055 SRET R6
1056 0470' 58 86 +
1057 ;
1058 ;

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1059 ;***** S P (RUNS PROGRAM AT AAAA *****
1060 ; WITH PC = R3. Y = R2)
1061 ;
1062 0472' P8 03 TESTS: LDI SYSPLG
1063 0474' A7 PLO GPAGE
1064 0475' 07 LDN GPAGE
1065 0476' FA E0 ANI OROH ;MASK FOR ADDR, WRITE, SYS FLAGS
1066 0478' FB E0 XRI OROH ;ADDR = WRITE = SYS = 1 ?
1067 047A' CA 035D' LBNZ SAYNO
1068 047D' JOLIN: SCAL R6. IN4D
1069 047D' 58 86 +
1070 047F' 01A9' +
1071 0481' 9D GHI RD
1072 0482' BE PHI RE
1073 0483' 3D GLO RD
1074 0484' AE PLO RE
1075 SCAL R6. TTY
1076 0485' 58 86 +
1077 0487' 024E' +
1078 0489' CA81 DW 0CA81H ;TYPE: SPACE.
1079 048B' 812C DW 812CH ; OUT HEX PR ' '
1080 048D' FF DB DONE ; DONE
1081 SCAL R6. TESTOK
1082 048E' 58 86 +
1083 0490' 036F' +
1084 0492' CB 0107' LBNF PROMPT
1085 0495' 52 SEX STACK ;I = R2
1086 0496' 36 GLO R6
1087 0497' 73 STXD
1088 0498' 96 GHI R5
1089 0499' 73 STXD
1090 049A' 9E GHI RE
1091 049B' 86 PHI R6
1092 049C' 8E GLO RE
1093 049D' A6 PLO R6
1094 049E' FC 00 ADI 00 ;CLEAR DF
1095 SRET R6
1096 04A0' 58 86 +
1097 ;
1098 ;
1099 ;***** CRC CALCULATION *****
1100 ;
1101 04A2' CRC: SCAL R6. TTY ;TYPE:
1102 04A2' 58 86 +
1103 04A4' 024E' +
1104 04A6' 52 43 20 DB 'RC' ; RC from.

```

1105	04A9'	66 72 6F 6D	DB 'from '	:	ETX.
1106	04AD'	20			
1107	04AE'	03	DB ETX	:	IN4D.
1108	04AF'	9DFF	DW 9DFFH	:	DONE
1109	04B1'	9D	GHI RD		
1110	04B2'	BE	PHI RE		
1111	04B3'	8D	GLO RD		
1112	04B4'	AE	PLO RE		
1113			SCAL R6. TTY	:	TYPE:
1114	04B5'	58 86			
1115	04B7'	024E'			
1116	04B9'	6F 76 65 72	DB 'over '	:	over.
1117	04BD'	20			
1118	04BE'	03	DB ETX	:	ZTX.
1119	04BF'	9D	DB 09DH	:	IN4D.
1120	04C0'	FF	DB DONE	:	DONE
1121	04C1'	F8 07	LDI CRCLO		
1122	04C3'	A7	PLO GPAGE		
1123	04C4'	F8 00	LDI 00H		
1124	04C6'	BC	PHI RC	:	CLEAR "ALL FF'S" FLAG
1125	04C7'	57	STR GPAGE		
1126	04C8'	27	DEC GPAGE	:	SET CRC HI & LO = 0000
1127	04C9'	57	STR GPAGE		
1128	04CA'	0E	CLOOP1: LDW RE		
1129	04CB'	FB FF	XRI 0FFH		
1130	04CD'	CE	LSZ		
1131	04CE'	BC	PHI RC		
1132	04CF'	E2	SEX STACK	:	A NOP
1133			SCAL R6. CRCSUB		
1134	04D0'	58 86			
1135	04D2'	050E'			
1136	04D4'	2D	DEC RD		
1137	04D5'	8D	GLO RD		
1138	04D6'	3A CA'	BWZ CLOOP1		
1139	04D8'	9D	GHI RD		
1140	04D9'	CA 04CA'	LBWZ CLOOP1		
1141	04DC'	9C	GHI RC		
1142	04DD'	C2 04F5'	LBZ SAYCLR	:	IS MEMORY SPACE EMPTY :
1143	04E0'	97	GHI GPAGE		
1144	04E1'	BD	PHI RD		
1145	04E2'	87	GLO GPAGE		
1146	04E3'	AD	PLO RD	:	
1147			SCAL R6. TTY	:	IF NOT. TYPE:
1148	04E4'	58 86			
1149	04E6'	024E'			
1150	04E8'	CA	DB 0CAN	:	CR. LF

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1151 04R9' 43 52 43 20      DB 'CRC = ' ; CRC =
1152 04RD' 3D 20
1153 04RP' 8D8D      DW 8D8D ; OUT VID RD X2
1154 04R1' FF      DB DONE ; DONE
1155 04R2' CO 0107'      LBR PROMPT
1156 04R5'          SAYCLR: SCAL 25, TTY ;IF CLEAR, TYPE: CR, LF, NULL X6
1157 04R5' 58 86      +
1158 04R7' 024R'      +
1159 04R9' CA      DB OCAR ; Memory is clear
1160 04PA' 4D 55 5D 5F      DB 'Memory '
1161 04PE' 72 79 20
1162 0501' 59 73 20 53      DB 'is clear.'
1163 0505' 6C 55 61 72
1164 0509' 2E
1165 050A' FF      DB DONE ; DONE
1166 050B' CO 0107'      LBR PROMPT ;GO TO PROMPT
1167
1168
1169 050E' E7      CRCSUB: SEX GPAGE ;CRC CALCULATION SUBROUTINE
1170 050F' 4E      LDA RE ;SEE BRADLEY CRC WRITEUP
1171 0510' F3      IOR
1172 0511' 27      DEC GPAGE
1173 0512' 57      STR GPAGE
1174 0513' F6      SHR
1175 0514' F6      SHR
1176 0515' F6      SHR
1177 0516' F6      SHR
1178 0517' F3      IOR
1179 0518' 57      STR GPAGE
1180 0519' FE      SHL
1181 051A' FE      SHL
1182 051B' FE      SHL
1183 051C' FE      SHL
1184 051D' 5D      IRI
1185 051E' 5D      IRI
1186 051F' F3      IOR
1187 0520' 27      DEC GPAGE
1188 0521' 73      STXD
1189 0522' 72      LDIA
1190 0523' F6      SHR
1191 0524' F6      SHR
1192 0525' F6      SHR
1193 0526' F3      IOR
1194 0527' 73      STXD
1195 0528' F0      LDI
1196 0529' FE      SHL
  
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1197 052A' FE          SHL
1198 052B' FE          SHL
1199 052C' FE          SHL
1200 052D' FE          SHL
1201 052E' F3          XOR
1202 052F' 60          IRX
1203 0530' 60          IRX
1204 0531' 73          STXD
1205 0532' R2          SEX STACK
1206                                SRET R6
1207 0533' 68 96      +
1208                                ;
1209                                ;
1210                                ;***** TIME *****
1211                                ;
1212                                ;
1213 0535'          TIMEST: SCAL R6, INKWD :LOOK FOR:
1214 0535' 68 86      +
1215 0537' 0208'     +
1216 0539' 49 4D 45      DB 'IME'      ;      IME
1217 053C' FF          DB DONE      ;      DONE
1218 053D' 0542'     DW CLRBUF
1219 053F' C0 0107'    LBR PROMPT
1220 0542' 97          CLRBUF: GHI GPAGE
1221 0543' 8E          PHI RE
1222 0544' F8 20      LDI BUF9      :GPAGE = 9 DIGIT INPUT BUFFER
1223 0546' 52          STR STACK
1224 0547' AE          PLO RE
1225 0548' F8 00      CLR: LDI 00R      :CLEAR 9 DIGIT BUFFER
1226 054A' 5E          STR RE
1227 054B' 1E          INC RE
1228 054C' 8E          GLO RE
1229 054D' FF 09      SHI 09R
1230 054F' E2          SEX STACK
1231 0550' F3          XOR          :9 PAST END ?
1232 0551' CA 0548'    LBWZ CLR
1233 0554' 02          SETTOP: LDW STACK
1234 0555' AE          PLO RE
1235 0556' 22          INPUT: DEC STACK
1236                                SCAL R6, INTIME
1237 0557' 68 86      +
1238 0559' 05AC'     +
1239 055B' 12          INC STACK
1240 055C' 07          LDW GPAGE
1241 055D' FB 40      XRI 40R      :XOR '0'      IS IT AN 0 ?
1242 055F' 32 7B'     BZ TIMEJH

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1243	0561'	07	LDN GPAGE	
1244	0562'	FF 30	SNI 030H	:IGNORE NON-DECIMAL
1245	0564'	CB 0556'	LBWF INPUT	
1246	0567'	FF 0A	SNI 0AH	
1247	0569'	C3 0556'	LBDF INPUT	
1248	056C'	FC 0A	KEEP1: ADI 0AH	
1249	056E'	5E	STR RE	
1250	056F'	1E	INC RE	
1251	0570'	8E	GLO RE	
1252	0571'	FF 09	SNI 09H	
1253	0573'	E2	SEX STACK	
1254	0574'	F3	IOR	
1255	0575'	C2 0554'	LBZ SETTOP	
1256	0578'	CO 0556'	LBR INPUT	
1257				
1258				
1259	057B'	E3	TINRM: SEX PC	:DISABLE INTERRUPTS
1260	057C'	71	OIS	
1261	057D'	33	DB 33H	
1262	057E'	02	LDN STACK	
1263	057F'	FF 10	SNI 10H	
1264	0581'	A7	PLO GPAGE	:NOW AT DAYS 1100
1265	0582'	8E	TINRM: GLO RE	: PREVIOUSLY CALLED COPYLOOP
1266	0583'	FF 09	SNI 09H	
1267	0585'	E2	SEX STACK	
1268	0586'	F3	IOR	
1269	0587'	3A 83'	BWZ COPY	
1270	0589'	02	LDN STACK	
1271	058A'	AE	PLO RE	
1272	058B'	4E	COPY: LDA RE	
1273	058C'	57	STR GPAGE	
1274	058D'	17	INC GPAGE	
1275	058E'	87	GLO GPAGE	
1276	058F'	FC 37	ADI 07H	
1277	0591'	F3	IOR	
1278	0592'	3A 82'	BWZ TINRM	
1279	0594'	F8 01	LDI 01	:TIME CORRECTION FOR LOADING
1280	0596'	57	STR GPAGE	
1281	0597'	02	LDN STACK	
1282	0598'	FC 02	ADI 02	
1283	059A'	A7	PLO GPAGE	
1284	059B'	F8 00	LDI 00	
1285	059D'	F7	SEX GPAGE	
1286	059E'	73	STED	
1287	059F'	73	STED	
1288	05A0'	F8 01	LDI 01	

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1289 05A2' 57          STR GPAGE
1290 05A3' C8          LSEF          ;LBR TO FINETRIM CAN BE /INSERTED HERE
1291 05A4' FFFF        DW OFFFPH
1292 05A6' E3          START2: SEX PC          ;IS NOT INCLUDED IN THIS SYSTEM
1293 05A7' 70          RET
1294 05A8' 33          DB 33H          ;ENABLE INTERRUPT
1295 05A9' C0 00B4'    LBR UNADDR
1296
1297
1298 ;***** INPUT TIME *****
1299
1300 05AC' 6B          INTIME: INP STAT1          ;CHECK FOR DA
1301 05AD' F6          SHR
1302 05AE' 3B AC'      BNF INTIME          ;WAIT FOR DA
1303 05B0' FA 06      ANI 06H          ;CHECK FOR FE AND PE
1304 05B2' 32 B7'     BZ KEEPT
1305 05B4' 6A          INP DATA1          ;CLEAR BAD DATA
1306 05B5' 30 AC'     BR INTIME
1307 05B7' F8 FE      KEEPT: LDI IOLOC
1308 05B9' A7          PLO GPAGE
1309 05BA' E7          SEX GPAGE
1310 05BB' 6A          INP DATA1
1311 05BC' FA 7F      ANI 07FH          ;MASK MSB
1312 05BE' 57          STR GPAGE
1313 05BF' C0 019B'    LBR DELAY2
1314
1315
1316 ;***** ? TIME *****
1317
1318
1319 05C2'          QUESTY: SCAL R6, TTY          ;TYPE:
1320 05C2' 68 86      +
1321 05C4' 024E'      +
1322 05C6' 2E 2E 2E 20      DB '...'          ; ... DONE
1323 05CA' FF          DB DONE
1324 05CB' F8 18      LDI SECI
1325 05CD' A7          PLO GPAGE
1326 05CE' 07          WAIT1: LDH GPAGE          ;WAIT FOR SEC = 00
1327 05CF' 3A CE'     BNZ WAIT1
1328 05D1' 87          GLO GPAGE
1329 05D2' FF 08      SMI 08H          ;MOVE GPAGE TO D X 100
1330 05D4' AD          PLO RD
1331 05D5' 97          GHI GPAGE
1332 05D6' BD          PHI RD          ;SET R(D) = GPAGE DX100
1333
1334 05D7' 68 86      +
  
```

```

1335 05D9' 024E' +
1336 05DB' 20DD DW 020DDH ; DDD HH MM SS Z
1337 05DD' DDDD DW 0BDDDH ; ...
1338 05DE' 20DD DW 020DDH
1339 05E1' DD DB 0DDH
1340 05E2' 3ADD DW 03ADDH
1341 05E4' DD20 DW 0DD20H
1342 05E6' DD DB 0DDH
1343 05E7' 35 20 5A 2E DB '5 Z...'
1344 05EB' 2E 2E 20
1345 05EE' FF DB DONE
1346 05EF' 8D GLO RD
1347 05F0' FC 06 ADI 06H
1348 05F2' AD PLO RD
1349 05F3' 5D STR RD
1350 05F4' FF 06 SHI 06H
1351 05F6' A7 PLO GPAGE
1352 05F7' 07 WAIT2: LDH GPAGE
1353 05F8' FB 06 XRI 06H
1354 05FA' CA 05F7' JBNZ WAIT2
1355 05FD' FC 00 ADI 00H ;CLEAR 0F
1356 05FF' CO 0107' LBR PROMPT
1357 ;
1358 ;
1359 ;***** : SEQUENCER *****
1360 ;
1361 ;
1362 3602' SEQSET: SCAL R6. TTY ;TYPE:
1363 0502' 68 86 +
1364 0604' 024E' +
1365 0606' 65 71 75 55 DB 'equencer' ; equencer On ?
1366 060A' 6E 63 65 72
1367 060E' 20 4F 6E 20 DB 'On ?' ; ETX
1368 0612' 3F 20
1369 0614' 03FF DW 03FFH ; DONE
1370 0616' 68 86 +
1371 0618' 0380' +
1372 061A' 33 32' BDF SETPC ;IS IT Yes ?
1373 061C' F8 07' LDI HIGH(IDLLOC) ;IF NOT GO TO IDLE LOOP
1374 061E' 8D PHI RD
1375 061F' F8 00' LDI LOW(IDLLOC)
1376 0621' AD PLO RD
1377 0622' F8 60 SETPPC: LDI PPCHI ;START PSUEDO PROGRAM
1378 0624' A7 PLO GPAGE
1379 0625' E3 SEX PC
1380 0626' 71 DIS
  
```

```

1381 0627' 33 DB 33H ;DISABLE INTERRUPT
1382 0628' 9D GHI RD
1383 0629' 57 STR GPAGE
1384 062A' 17 INC GPAGE
1385 062B' 3D GLO RD
1386 062C' 57 STR GPAGE
1387 062D' 70 RET
1388 062E' 33 DB 33H ;ENABLE INTERRUPT
1389 062F' C0 0107' LBR PROMPT
1390
1391 ;
1392 ;
1392 0632' SETPC: SCAL R6. TTY ;TYPE:
1393 0632' 58 86 +
1394 0634' 024E' +
1395 0635' 20 51 74 20 DB ' at PPC = ' ; at PPC =
1396 0638' 50 50 43 20
1397 063E' 3D 20
1398 0640' 03 DB ETX ; ETX
1399 0641' 9DFF DW 9DFF ; IN4D, DONE
1400 0643' 8D GLO RD
1401 0644' AE PLO RE
1402 0645' 9D GHI RD
1403 0646' BE PHI RE
1404 ;
1405 0647' 32 50' BZ PCSAME ;If the entered PPC = SPACE or 30xx.
1406 ; ; the current PPC will continue.
1407 ;
1408 SCAL R6. TTY
1409 0649' 58 86 +
1410 064B' 024E' +
1411 064D' CA81 DW 0CA81H ;TYPE: SPACE.
1412 064F' 812C DW 812CH ; OUT HEX PR ','
1413 0651' FF DB DONE ; DONE
1414 SCAL R6. TESTOK
1415 0652' 58 86 +
1416 0654' 036F' +
1417 0656' 3B 7B' BNF SET2ND
1418 0658' 9E GHI RE
1419 0659' 3D PHI RD
1420 065A' 8E GLO RE
1421 065B' AD PLO RD
1422 065C' FC 00 ADI 00 ;CLEAR DF
1423 065E' 30 22' BE SETPPC
1424 ;
1425 0660' PCSAME: SCAL R6. TTY ;TYPE:
1426 0660' 58 86 +

```



```

1427 0662' 024E' +
1428 0664' CA DB OCAH ; CR.LF
1429 0665' 43 6F 6E 74 DB 'Continue ? ': Continue
1430 0669' 69 6E 75 65
1431 066D' 20 3F 20
1432 0670' 03 DB ETX
1433 0671' FF DB DONE
1434 SCAL R6. TESTY ;IS THE RESPONSE 'Y'?
1435 0672' 68 86 +
1436 0674' 0380' +
1437 0676' 3B 7B' BWP SET2ND ;If not 'Y', try again
1438 0678' C0 0107' LBR PROMPT ;IF 'Y' (Continue w/ same PPC): go to Prompt
1439 ;
1440 067B' SET2ND: SCAL R6. TTY
1441 067B' 68 86 +
1442 067D' 024E' +
1443 067E' CA53 DW OCA53H ;TYPE: CR.LF.'S'
1444 0681' FF DB DONE ; DONE
1445 0682' 30 02' BR SEQSET
1446 ;
1447 ;
1448 ;..... ? SEQUENCER .....
1449 ;
1450 0684' 97 SEQ?: GHI SPAGE
1451 0685' BD PHI RD
1452 0686' P8 60 LDI PPCHI
1453 0688' 2D PLO RD
1454 SCAL R5. TTY ;TYPE:
1455 0689' 68 86 -
1456 068B' 024E' +
1457 068D' 65 71 75 65 DB 'equencer ' ; equencer
1458 0691' 6E 63 65 72
1459 0695' 20
1460 0695' 50 50 43 20 DB 'PPC = ' ; PPC =
1461 069A' 3D 20
1462 069C' 8D8D DW 8D8DH ; OUT HK PR M(RD) I2
1463 069E' 20 20 52 73 DB ' Rstk = ' ; Rstk =
1464 06A2' 74 6B 20 3D
1465 06A6' 20
1466 06A7' 8D8D DW 8D8DH ; OUT HK PR M(RD) I2
1467 06A9' 20 20 41 73 DB ' Astk = ' ; Astk =
1468 06AD' 74 6B 20 3D
1469 06B1' 20
1470 06B2' 8D8D DW 8D8DH ; OUT HK PR M(RD) I2
1471 06B4' 20 20 DB ' '
1472 06B6' FF DB DONE ;DONE
  
```

```

1473 06B7' F8 54          LDI ASTXHI
1474 06B9' A7            PLO GPAGE
1475 06BA' 47           LDA GPAGE
1476 06BB' BD           PHI RD
1477 06BC' 07           LDN GPAGE
1478 06BD' AD           PLO RD
1479 06BE' 8D           SEQ?EX: GLO RD
1480 06BF' FA 0F        ANI OFR
1481 06C1' FB 0F        XRI OFR
1482 06C3' C2 0107'     LBZ PROMPT
1483                          SCAL R5, TTY ;TYPE:
1484 06C5' 58 86          +
1485 06C8' 024E'         +
1486 06CA' 8D20          DW 8D20H ; OUT EX PR M(RD)
1487 06CC' FF           DB DONE ;DONE
1488 06CD' 30 BE'       BR SEQ?EX
1489                          ;
1490                          ;*****
1491                          ;
1492                          ;***** SEQUENCER IDLE LOOP *****
1493                          ;
1494                          ;
1495                          ; ORG (HDSTRT + 700H) ; DO NOT MOVE !
1496                          ;
1497                          ;***** SEQUENCER IDLE LOOP (PSUEDO OP CODES - NOT 1806 CODE ..
1498                          ;
1499 0700' 4D28          IDLLOC: DW 4D28H ;INITIALIZE SEQUENCER 4D = ENIT STK & CTES
1500 0702' 0700'       DW IDLLOC ;GO TO IDLLOC 08 = GOTO
1501                          ;
1502                          ;
1503                          ;*****
1504                          ;
1505                          ;
1506                          ;***** ! FOLLOW PPC (PPCSHO) *****
1507                          ;
1508                          ; :FOLLOW PPC CAN ONLY BE STOPPED
1509                          ; :BY BREAKING THE LOOP AND READDRESSING
1510                          ;
1511 0704'             PPCSHO: SCAL R5, TTY ;TYPE:
1512 070A' 58 86          +
1513 0706' 024E'         +
1514 0708' 5F 6C 5C 5F   DB 'allow' ; allow PPC
1515 070C' 77
1516 070D' 20 50 50 43   DB ' PPC' ;
1517 0711' CAPP          DW OCAFFH ; CR. LP. DONE
1518 0713' F8 50        REPORT: LDI PPCHI
  
```

```

1519 0715' AD PLO RD
1520 0716' 97 GHI GPAGE
1521 0717' 9D PHI RD
1522 0718' E2 SEX STACK
1523 SCAL R6. TTY ;TYPE:
1524 0719' 68 86 +
1525 0718' 024E' +
1526 071D' 8D8D DW 3D8DR ; OUT VIA M(R(D)) I 2
1527 071F' 20 DB ' '
1528 0720' FF DB DONE ; . . . DONE
1529 0721' 2D DEC RD
1530 0722' 2D DEC RD ;POINT TO PPCHI
1531 0723' 4D LDA RD
1532 0724' 3C PHI RC
1533 0725' 0D LDM RD
1534 0726' AC PLO RC
1535 0727' ED PPCCMP: SEX RD ;COMPARE WITH OLD PPC
1536 0728' 2D DEC RD ;TYPE NEW PPC WHEN IT APPEARS
1537 0729' 9C GHI RC
1538 072A' F3 IOR
1539 072B' 3A 13' BNZ REPORT
1540 072D' 1D INC RD
1541 072E' 8C GLO RC
1542 072F' F3 IOR
1543 0730' 3A 13' BNZ REPORT
1544 0732' 30 27' BR PPCCMP
1545 :
1546 :
1547 :
1548 :
1549 :***** MEMORY PROTECT AND ENABLE *****
1550 :
1551 0734' HENSAY: SCAL R6. TTY ;TYPE: (text)
1552 0734' 68 86 +
1553 0736' 024E' +
1554 0738' 65 6D 6F 72 DB 'emory - '
1555 073C' 79 20 2D 30
1556 0740' 50 72 6F 74 DB 'Protect or Enable'
1557 0744' 65 63 74 20
1558 0748' 6F 72 20 45
1559 074C' 6E 61 62 6C
1560 0750' 65
1561 0751' 20 28 50 20 DB ' (P or E) ? '
1562 0755' 6F 72 20 45
1563 0759' 29 20 3F 20
1564 075D' 03 DB ETX
  
```

```

1565 075E' FF          DB DONE
1566
1567                SCAL R6. TSRE?
1568 075F' 68 86      +
1569 0761' 02F0'      +
1570                SCAL R6. ITB          :CALL INPUT TEST AND BRANCH
1571 0763' 68 86      +
1572 0765' 022E'      +
1573 0767' 50          DB 'P'          : IF P. GO TO PTECT
1574 0768' 0779'      DW PTECT
1575 076A' 45          DB 'E'          : IF E. GO TO ENABLE
1576 076B' 0771'      DW ENABLE
1577 076D' FF          DB DONE
1578 076E' C0 0107'   LBR PROMPT      :GO TO PROMPT IF NOT P OR E
1579
1580                ;
1580 0771' F8 00        ENABLE: LDI 00
1581 0773' BB          PHI RB
1582 0774' F8 01      LDI 01
1583 0776' AB          PLO RB          :SET PROTECT FLAG
1584 0777' 30 7D'     BR SETPG
1585 0779' F8 00      PTECT: LDI 00
1586 077B' AB          PLO RB
1587 077C' BB          PHI RB          :SET ENABLE
1588 077D'            SETPG: SCAL R6. TTY      :TYPE: CR. LF. text
1589 077D' 68 86      +
1590 077F' 024E'      +
1591 0781' CA          DB 0CAH
1592 0782' 46 72 5F 5D DB 'From page '
1593 0786' 20 70 51 57
1594 078A' 65 20
1595 078C' 03          DB ETX          : ETX
1596 078D' 9DFF       DW 9DFF         : INAD. DONE
1597 078F' 8D          GLO RD
1598 0790' BE          PHI RE          :SET CURRENT PAGE
1599                SCAL R6. TTY
1600 0791' 68 86      +
1601 0793' 024E'      +
1602 0795' 5F 76 55 72 DB 'over '          :TYPE: (text)
1603 0799' 20
1604 079A' 03          DB ETX          : ETX
1605 079B' 9D          DB 09DE         : INAD.
1606 079C' 20 70 51 57 DB ' pages..'          : pages..
1607 07A0' 65 73 2E
1608 07A3' 00FF       DW DONE          : DONE
1609 07A5' 8D          GLO RD
1610 07A6' AC          PLO RC

```

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1611 07A7' C5          LSNZ
1612 07A8' PC 01      ADI 01
1613 07AA' AC          PLO RC
1614                          SCAL R6. HENCNG
1615 07AB' 68 86      +
1616 07AD' 0788'      +
1617 07AF' CO 0107'   LBR PROMPT
1618 ;
1619 ;
1620 ;***** MEMORY PROTECT OR ENABLE SUBROUTINE *****
1621 ;
1622 ;
1623 07B2' 46           HENSUB: LDA LIST      :PASS ENABLE BIT
1624 07B3' AB          PLO RB
1625 07B4' 46           LDA LIST      :PASS START PAGE
1626 07B5' BE          PHI RE
1627 07B6' 46           LDA LIST      :PASS # OF PAGES
1628 07B7' AC          PLO RC
1629 ;
1630 07B8' F8 0A       HENCNG: LDI GRPSAV    :SELECT SYSTEM I/O GROUP
1631 07BA' A7          PLO GPAGE      ; AND STORE ON GLOBAL PAGE
1632 07BB' F8 07       LDI SYSTEM
1633 07BD' 57          STR GPAGE
1634 07BE' E7          SEX GPAGE
1635 07BF' 61          OUT GROUP
1636 ;
1637 07C0' EE          SEX RE
1638 07C1' 8C          NEXTPG: GLO RC
1639 07C2' 32 E2'     BZ NDONE
1640 ;
1641 07C4' 9E          GHI RE          :ALWAYS ENABLE:
1642 07C5' FB 50       XRI GLOPG      ; GLOBAL PAGE
1643 07C7' 32 E2'     BZ SETQ
1644 ;
1645 07C9' 9E          GHI RE
1646 07CA' FB 52       XRI SSKPG      ; SEQUENCER STACK PAGE
1647 07CC' 32 E2'     BZ SETQ
1648 ;
1649 07CE' 9E          GHI RE
1650 07CF' FB 53       XRI STXPG      ; STACK PAGE
1651 07D1' 32 E2'     BZ SETQ
1652 ;
1653 07D3' 9E          GHI RE
1654 07D4' FB 5B       XRI BUTPG      ; BUFFER PAGE
1655 07D6' 32 E2'     BZ SETQ
1656 ;

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1657 07D8' 9E          GHI RE
1658 07D9' FB F8      XRI INTPG      ; INTERRUPT CONTROLLER PAGE
1659 07DB' 32 E2'     BZ SETQ
1660 07DD' 8B          GLO RB
1661 07DE' 3A E2'     BHZ SETQ      ;PROTECT OR ENABLE ?
1662 07E0' 7A          REQ          ; PROTECT -> Q = 0
1663 07E1' 38          SKP
1664 07E2' 7B          SETQ: SEQ          ; ENABLE -> Q = 1
1665 07E3' 67          OUT MEMORY ;I/O = MEM. PROTECT
1666 07E4' 7A          REQ
1667 07E5' 9E          GHI RE
1668 07E6' FC 01      ADI 01
1669 07E8' BE          PHI RE
1670 07E9' 8C          GLO RC
1671 07EA' FF 01      SMI 01
1672 07EC' AC          PLO RC
1673 07ED' 30 C1'     BR NEXTPG
1674
;
1675 07EF' F8 0A      NDONE: LDI GRPSAV ;SELECT UART I/O GROUP
1676 07F1' A7          PLO GPAGE      ; AND STORE ON GLOBAL PAGE
1677 07F2' F8 06      LDI UARTS
1678 07F4' 57          STR GPAGE
1679 07F5' E7          SEX GPAGE
1680 07F6' 61          OUT GROUP
1681 07F7' E2          SEX STACK
1682 SRET R6
1683 07F8' 68 95      +
1684
;
1685
;
1686
;
1687 .....
1688 .....
1689
;
1690 ORG HDSTRY + 800H
1691
;
1692 ..... 2ND. PROM STARTS HERE .....
1693
;
1694 ;THIS SECTION INCLUDES:
1695
;
1696 ; INTERRUPT HANDLING
1697 ; REAL TIME CLOCK
1698 ; BASIC SEQUENCER
1699 ; LONG BRANCH TABLE
1700 ; PASS THRU MODE
1701 ; SEA DUCT SPECIFIC CODE
1702
;

```

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1703 :
1704 :***** INTERRUPT VECTORS *****
1705 :
1706 :
1707 0800' C0 083F' INTPGM: LBR INTPO ;INTERRUPT 0 VECTOR
1708 0803' C8 LSKP ;***
1709 0804' FFFF DW OFFFPH ; *
1710 0806' C8 LSKP ; *
1711 0807' FFFF DW OFFFPH ; *
1712 0809' C8 LSKP ; *
1713 080A' FFFF DW OFFFPH ; *
1714 080C' C8 LSKP ; * FOR FUTURE VECTORS
1715 080D' FFFF DW OFFFPH ; *
1716 080F' C8 LSKP ; *
1717 0810' FFFF DW OFFFPH ; *
1718 0812' C8 LSKP ; *
1719 0813' FFFF DW OFFFPH ; *
1720 0815' C8 LSKP ; *
1721 0816' FFFF DW OFFFPH ;***
1722 :
1723 :
1724 :
1725 :***** RESTORE FROM INTERRUPT 0 *****
1726 :
1727 :***** NOTE! - MUST DIRECTLY PRECEED INTERRUPT 0 *****
1728 :
1729 0818' F8 50 RESTRO: LDI GLOPG ;RESET GPAGE(HI) JUST IN CASE
1730 081A' B7 PRI GPAGE
1731 081B' F8 0A LDI GRPSAV ;RESTORE I/O GROUP
1732 081D' A7 PLO GPAGE
1733 081E' E7 SEX GPAGE
1734 081F' 61 OUT GROUP
1735 0820' E2 SEX STACK ;SET X TO STACK = R2
1736 0821' 12 INC STACK
1737 0822' 72 LDXA
1738 0823' A7 PLO GPAGE ;RESTORE GLOBAL PAGE R7.0
1739 0824' 72 LDXA
1740 0825' BA PRI RA ;RESTORE RA
1741 0826' 72 LDXA
1742 0827' AA PLO RA
1743 0828' 72 LDXA
1744 0829' BB PRI RB ;RESTORE RB
1745 082A' 72 LDXA
1746 082B' AB PLO RB
1747 082C' 72 LDXA
1748 082D' BC PRI RC ;RESTORE RC

```

1749	082E'	72	LDXA	
1750	082F'	AC	PLO RC	
1751	0830'	72	LDXA	
1752	0831'	BD	PHI RD	:RESTORE RD
1753	0832'	72	LDXA	
1754	0833'	AD	PLO RD	
1755	0834'	72	LDXA	
1756	0835'	BE	PHI RE	:RESTORE RE
1757	0836'	72	LDXA	
1758	0837'	AE	PLO RE	
1759	0838'	72	LDXA	
1760	0839'	FE	SXL	:RESTORE DF
1761	083A'	72	LDXA	:RESTORE D
1762	083B'	70	RET	:RETURN
1763	083C'	CO P880	LBR INTVEC	
1764			:	
1765			:***** INTERRUPT 0 *****	
1766			:	
1767	083F'	22	INTRPO: DEC STACK	
1768	0840'	78	SAV	:SAVE X.P
1769	0841'	22	DEC STACK	
1770	0842'	73	STXD	:SAVE D
1771	0843'	76	SHRC	
1772	0844'	73	STXD	:SAVE DF
1773	0845'	8E	GLO RE	
1774	0846'	73	STXD	:SAVE RE
1775	0847'	9E	GHI RE	
1776	0848'	73	STXD	
1777	0849'	8D	GLO RD	
1778	084A'	73	STXD	:SAVE RD
1779	084B'	9D	GHI RD	
1780	084C'	73	STXD	
1781	084D'	8C	GLO RC	
1782	084E'	73	STXD	:SAVE RC
1783	084F'	9C	GHI RC	
1784	0850'	73	STXD	
1785	0851'	8B	GLO RB	
1786	0852'	73	STXD	:SAVE RB
1787	0853'	9B	GHI RB	
1788	0854'	73	STXD	
1789	0855'	8A	GLO RA	
1790	0856'	73	STXD	:SAVE RA
1791	0857'	9A	GHI RA	
1792	0858'	73	STXD	
1793	0859'	87	GLO GPAGE	
1794	085A'	73	STXD	:SAVE GPAGE LOC. (R7.0)


```

1795 085B' 7B          SEQ
1796 085C' 7A          REQ          ;PLUSE Q
1797                      ;
1798                      ;
1799 085D' F8 08      RBRET: LDI RBHI          ;RESTORES RB USED IN THE LAST INTERRUPT
1800 085F' A7          PLO GPAGE
1801 0860' 47          LDA GPAGE
1802 0861' BB          PHI RB
1803 0862' 07          LDN GPAGE
1804 0863' AB          PLO RB
1805                      ;
1806                      ;
1807                      ;***** LONG BRANCH TABLE *****
1808                      ;
1809 0864' C0 08B1'     LBT:  LBR ATCHK          ;@ CHECK
1810 0867' C0 0900'     ATRTN: LBR RTC          ;RUN REAL TIME CLOCK
1811 086A' C0 09CA'     RTCRTN: LBR SEQCYC       ;RUN SEQUENCER THIS CYCLE ?   CYCLE > 0
1812                      ;
1813 086D' C0 0A32'     SEQRTN: LBR TTY2          ;SEND DATA ON LOOP 2 IF REQUIRED
1814 0870' C0 0A7D'     TY2RTN: LBR BR2          ;BREAK LOOP 2 IF REQUIRED
1815 0873' C0 0A97'     BR2RTN: LBR CTRCHK       ;SEQUENCER CNTR(n) TIMEOUT?   CYCLE = 26H
1816                      ;
1817 0876' C0 12F0'     CTRRTN: LBR CNPSRD       ;READ COMPASS          SEC. = X1; CYC = 0A,0B
1818 0879' C0 131A'     CMPRTN: LBR SWRD          ;READ SWITCHES        SEC. =ALL; CYC = 24,25
1819 087C' C0 133F'     SWRTN:  LBR AD           ;A/D, MUX CONTROL
1820 087F' C0 13BA'     ADRTN:  LBR TR           ;TRANSMISSOMETER A/D CONTROL
1821                      ;
1822 0882' C0 143B'     TRRTN:  LBR PDCHK          ;RELAY PODS / ACOUSTIC LINK SEC = ALL, CYC = 27H
1823 0885' C0 1478'     PDRTN:  LBR HDGCHK       ;HEADING INDICATOR          CYC = 0B,0C
1824 0888' C0 14CA'     HDGRTN: LBR PULCHK       ;PULSE RELAY DRIVER?
1825                      ;
1826 088B' C0 1500'     PULRTN: LBR XYZCHK          ;XYZ OPTC INTERRUPTERS  FLG: 00=CYC 24,25
1827                      ;                               AC=OPTO PWR. ON
1828 088E' C0 0DAD'     XYZRTN: LBR SD           ;SEA DATA BUFFER SETUP AND RECORD SEC. = 0; CYC = 1A
1829 0891' C8          SDRET:  LSKP
1830 0892' PFFF        DW 0FFFFH
1831                      ;
1832                      ;
1833 0894' E2          RBSAVE: SEX STACK
1834 0895' F8 08          LDI RBHI          ;SAVE RC FOR NEXT INTERRUPT
1835 0897' A7          PLO GPAGE
1836 0898' 9B          PHI RB
1837 0899' 57          STR GPAGE
1838 089A' 17          INC GPAGE
1839 089B' 8B          GLO RB
1840 089C' 57          STR GPAGE
  
```

```

1841
1842
1843 089D' E1
1844 089E' 61
1845 089F' 06
1846 08A0' E2
1847 08A1' 6B
1848 08A2' FA 10
1849 08A4' 3A A8'
1850 08A6' 30 18'
1851
1852 08A8' F8 3F'
1853 08AA' A3
1854 08AB' F8 00'
1855 08AD' B3
1856 08AE' C0 001E'
1857
1858
1859
1860
1861 08B1' F8 03
1862 08B3' A7
1863 08B4' 07
1864 08B5' F6
1865 08B6' 3B 67'
1866 08B8' E1
1867 08B9' 51
1868 08BA' 06
1869 08BB' 62
1870 08BC' 40
1871 08BD' 07
1872 08BE' FA FE
1873 08C0' 57
1874 08C1' 30 67'
1875
1876
1877
1878
1879
1880
1881
1882 0900' F8 1D
1883 0902' 52
1884 0903' A7
1885 0904' 07
1886 0905' 3A 2D'
  
```

```

;
;
BRCHK: SEX INTPC ;CHECK FOR SAIL BREAKS
        OUT GROUP
        DB UARTS ;UART GROUP X = INTERRUPT PC
        SEX STACK ;CHECK FOR SAIL BREAK LOOP 2
        INP STAT1 ;UART EXT STATUS LOOP 1 ?
        ANI 10H
        BNZ BROKE
        BR RESTRO
  
```

```

;
;
BROKE: LDI LOW(RESTRT) ;SET PC = RESTRT
        PLO PC
        LDI HIGH(RESTRT)
        PHI PC
        LBR SETSTK ;RESET STACK
  
```

```

;
;
;***** UART # CHECK *****
;
;
  
```

```

;
;
ATCHK: LDI SYSFLG ;CHECKS TO TYPE # FOR ?TIME
        PLO GPAGE
        LDN GPAGE
        SHR
        BNF ATRTN ;# FLAG SET ?
        SEX INTPC
        OUT GROUP
        DB UARTS ;UART GROUP
        OUT DATA1
        DB '#';TYPE '#'
        LDN GPAGE
        ANI OFEH
        STR GPAGE ;CLEAR # FLAG
        BR ATRTN ;RETURN TO LBT
  
```

```

;
;
ORG (INTPGM + 100H)
  
```

```

;
;
;***** REAL TIME CLOCK *****
;
;
  
```

```

;
;
RTC: LDI ARELG
      STR STACK
      PLO GPAGE
      LDN GPAGE
      BNZ INCRTC
  
```

1887	0907'	F8 03	DECAR:	LDI 03H	;03 = 3 DIGIT LOOP COUNT
1888	0909'	A8		PLO CYCCNT	
1889	090A'	FC 00		ADI 00	;SET DF TO BORROW
1890	090C'	27	DECNEX:	DEC GPAGE	
1891	090D'	07		LDN GPAGE	
1892	090E'	7F 00		SMBI 00	
1893	0910'	33 14'		BDF NOBRRW	
1894	0912'	F8 09	BORROW:	LDI 09	
1895	0914'	57	NOBRRW:	STR GPAGE	
1896	0915'	28		DEC CYCCNT	
1897	0916'	88		GLO CYCCNT	
1898	0917'	3A 0C'		BNZ DECNEX	
1899	0919'	F8 03	TEST0:	LDI 03	;03 = 3 DIGIT LOOP COUNT
1900	091B'	A8		PLO CYCCNT	
1901	091C'	47	TSTNEX:	LDA GPAGE	
1902	091D'	CA 086A'		LBZ RTCRTN	
1903	0920'	28		DEC CYCCNT	
1904	0921'	88		GLO CYCCNT	
1905	0922'	3A 1C'		BNZ TSTNEX	
1906	0924'	F8 1D	CLRAR:	LDI ARFLG	;SET A-R FLG. = NORM.
1907	0926'	A7		PLO GPAGE	
1908	0927'	F8 01		LDI 01	
1909	0929'	57		STR GPAGE	
1910	092A'	C0 086A'		LBZ RTCRTN	
1911	092D'	F8 19	INCRTC:	LDI CYCLES	;INCREMENT CYCLE COUNT
1912	092F'	A7		PLO GPAGE	
1913	0930'	07		LDN GPAGE	
1914	0931'	FC 01		ADI 01	
1915	0933'	57		STR GPAGE	
1916	0934'	FF 28		SNI HZ	;HZ = INTERRUPT RATE
1917	0936'	3B B4'		BNZ TSTADV	
1918	0938'	F8 00		LDI 00	;CARRY CYCLES
1919	093A'	E7		SEX GPAGE	
1920	093B'	73		STXD	
1921	093C'	07		LDN GPAGE	
1922	093D'	FC 01		ADI 01	;INCREMENT SECCNDS
1923	093F'	57		STR GPAGE	
1924	0940'	FF 0A		SNI 0AH	
1925	0942'	33 5B'		BDF INC10	
1926	0944'	07	TEST5:	LDN GPAGE	
1927	0945'	FB 05		XRI 05	;SECONDS = 5 ?
1928	0947'	3A B4'		BNZ TSTADV	
1929	0949'	F8 1E		LDI ATFLG	
1930	094B'	A7		PLO GPAGE	
1931	094C'	07		LDN GPAGE	
1932	094D'	32 B4'		BZ TSTADV	;RTC @ FLAG = 0 ?

1933	094F'	F8 00	SETAT: LDI 00	
1934	0951'	57	STR GPAGE	;CLEAR RTC @ FLAG
1935	0952'	F8 03	LDI SYSFLG	
1936	0954'	A7	PLO GPAGE	;SET SAIL @ FLAG
1937	0955'	07	LDN GPAGE	
1938	0956'	F9 01	ORI 01	
1939	0958'	57	STR GPAGE	
1940	0959'	30 B4'	BR TSTADV	
1941				
1942	095B'	F8 00	INC10: LDI 00	;SET SEC X1 = 0
1943	095D'	73	STXD	;X = GPAGE HERE
1944	095E'	07	LDN GPAGE	;INC. SEC X 10
1945	095F'	FC 01	ADI 01	
1946	0961'	57	STR GPAGE	
1947	0962'	FF 06	SNI 06	;SEC X 10 = 6 ?
1948	0964'	3B B4'	BNF TSTADV	
1949	0966'	F8 00	INCMIN: LDI 00	
1950	0968'	E7	SEX GPAGE	
1951	0969'	73	STXD	;CLEAR SEC X 10
1952	096A'	07	LDN GPAGE	
1953	096B'	FC 01	ADI 01	;INCREMENT MIN. X 1
1954	096D'	57	STR GPAGE	
1955	096E'	FF 0A	SNI 0AH	
1956	0970'	3B B4'	BNF TSTADV	
1957	0972'	F8 00	LDI 00	
1958	0974'	73	STXD	
1959	0975'	07	LDN GPAGE	;MIN X 1 = 0, INC MIN X 10
1960	0976'	FC 01	ADI 01	
1961	0978'	57	STR GPAGE	
1962	0979'	FF 06	SNI 06	;HOUR UP ?
1963	097B'	3B B4'	BNF TSTADV	
1964	097D'	F8 00	HOURLUP: LDI 00	;CLEAR MIN X 10
1965	097F'	73	STXD	
1966	0980'	07	LDN GPAGE	
1967	0981'	FC 01	ADI 01	;INCREMENT HOURS
1968	0983'	73	STXD	
1969	0984'	FF 04	SNI 04	;HOURS X1 = 4 ?
1970	0986'	3B B4'	BNF TSTADV	
1971	0988'	07	LDN GPAGE	
1972	0989'	FF 02	SNI 02	;DAY UP ?
1973	098B'	33 9C'	BDP DAYUP	
1974	098D'	17	CHK10: INC GPAGE	
1975	098E'	07	LDN GPAGE	
1976	098F'	FF 0A	SNI 0AH	
1977	0991'	3B B4'	BNF TSTADV	
1978	0993'	F8 00	LDI 00	

1979	0995'	73	STXD	
1980	0996'	07	LDN GPAGE	
1981	0997'	FC 01	ADI 01	;INC HOURS X 10
1982	0999'	57	STR GPAGE	
1983	099A'	30 34'	BR TSTADV	
1984				
1985	099C'	F8 00	DAYUP: LDI 00	
1986	099E'	57	STR GPAGE	
1987	099F'	17	INC GPAGE	;CLEAR HOURS
1988	09A0'	73	STXD	
1989	09A1'	27	DEC GPAGE	
1990	09A2'	F8 03	LDI 03	
1991	09A4'	A8	PLO R8	
1992	09A5'	07	DAYCAR: LDN GPAGE	;CARRY DAYS AS REQUIRED
1993	09A6'	FC 01	ADI 01	
1994	09A8'	57	STR GPAGE	
1995	09A9'	FF 0A	SMI 0AH	
1996	09AB'	3B 34'	BNF TSTADV	
1997	09AD'	F8 00	LDI 00	
1998	09AF'	73	STXD	
1999	09B0'	28	DEC R8	
2000	09B1'	38	GLO R8	
2001	09B2'	3A A5'	BNZ DAYCAR	
2002				
2003	09B4'	F8 1D	TSTADV: LDI ARFLG	
2004	09B6'	A7	PLO GPAGE	
2005	09B7'	07	LDN GPAGE	
2006	09B8'	F8 02	XRI 02	
2007	09BA'	3A C1'	BNZ TST2ND	
2008	09BC'	F8 03	LDI 03	
2009	09BE'	57	STR GPAGE	
2010	09BF'	30 2D'	BR INCRTC	
2011	09C1'	F8 01	TST2ND: XRI 01	;01 = 02 OR 03
2012	09C3'	3A 24'	BNZ CLRAR	
2013	09C5'	F8 02	LDI 02	
2014	09C7'	57	STR GPAGE	
2015	09C8'	30 07'	BR DECAR	
2016				
2017				
2018				
2019				
2020	09CA'	F8 67	SEQCYC: LDI SEQRAT	;SPECIAL SEQUENCER RATE NEEDED? (SEQRAT .NE. 00 ?)
2021	09CC'	A7	PLO GPAGE	
2022	09CD'	07	LDN GPAGE	
2023	09CE'	32 3E'	BZ SEQ01	; IF NOT RUN ONLY ON CYCLE #1
2024				

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2025 09D0' FA 80 ANI 80H ;SEQRAT MSB = 1? (1XXX XXXX)
2026 09D2' C2 0A22' LBZ CYXXNN ; IF NOT, WAIT FOR CYCLE #NN OR #01 (GO TO CYXXNN)
2027 ;
2028 09D5' 07 ; LDN GPAGE ;IF MSB = 1 (8X), CHECK LOW NIBBLE
2029 09D6' FB 80 XRI 80H ; (1000 0000) = EVERY CYCLE
2030 09D8' C2 0B00' LBZ SEQNCR ; (1000 0001) = EVERY OTHER CYCLE
2031 09DB' FB 01 XRI 01 ; (1000 0010) = EVERY FOURTH CYCLE
2032 09DD' 12 FA' BZ CYXXX1 ; (1000 0100) = EVERY EIGHT CYCLE
2033 09DF' FB 03 XRI 03 ;
2034 09E1' C2 0A06' LBZ CYXX01 ; (1000 1111) = EVERY FOURTH CYCLE
2035 09E4' FB 06 XRI 06 ; (PINGER CONTROL ONLY)
2036 09E6' C2 0A14' LBZ CYX001 ;
2037 09E9' FB 0B XRI 0BH ;IF NONE OF THE ABOVE,
2038 09EB' C2 0A06' LBZ CYXX01 ; RUN ONLY ON CYCLE #01
2039 ;
2040 09EE' F8 19 SEQ01: LDI CYCLES ;CHECK CYCLE #
2041 09F0' A7 PLO GPAGE
2042 09F1' 07 LDN GPAGE
2043 09F2' FB 01 XRI 01 ;RUN SEQUENCER ONLY ON CYCLE 01
2044 09F4' C2 0B00' LBZ SEQNCR
2045 09F7' C0 086D' LBR SEQRTN
2046 ;
2047 09FA' F8 19 CYXXX1: LDI CYCLES ;RUN EVERY OTHER CYCLE
2048 09FC' A7 PLO GPAGE
2049 09FD' 07 LDN GPAGE
2050 09FE' FA 01 ANI 01
2051 0A00' CA 0B00' LBZ SEQNCR
2052 0A03' C0 086D' LBR SEQRTN
2053 ;
2054 0A06' F8 19 CYXX01: LDI CYCLES ;RUN EVERY FOURTH CYCLE
2055 0A08' A7 PLO GPAGE
2056 0A09' 07 LDN GPAGE
2057 0A0A' FA 03 ANI 03
2058 0A0C' FB 01 XRI 01
2059 0A0E' C2 0B00' LBZ SEQNCR
2060 0A11' C0 086D' LBR SEQRTN
2061 ;
2062 0A14' F8 19 CYX001: LDI CYCLES ;RUN EVERY EIGHT CYCLE
2063 0A16' A7 PLO GPAGE
2064 0A17' 07 LDN GPAGE
2065 0A18' FA 07 ANI 07
2066 0A1A' FB 01 XRI 01
2067 0A1C' C2 0B00' LBZ SEQNCR
2068 0A1F' C0 086D' LBR SEQRTN
2069 ;
2070 0A22' 07 CYXXNN: LDN GPAGE ;RUN ON ONLY CYCLES = NN OR 01

```

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2071 0A23' FA 7F ANI 7FH
2072 0A25' AD PLO RD
2073 0A26' F8 19 LDI CYCLES
2074 0A28' A7 PLO GPAGE
2075 0A29' E7 SEX GPAGE
2076 0A2A' 8D GLO RD
2077 0A2B' F3 XOR
2078 0A2C' C2 0B00' LBZ SEQNCR ;ON CYCLES = NN, RUN SEQUENCER
2079 0A2F' C0 09F1' LBR (SEQ01 + 3) ;CHECK FOR CYCLES = 01
2080 ;
2081 ;
2082 ;***** TTY2 *****
2083 ;
2084 0A32' F8 7E TTY2: LDI TTY2HI ;CHECK LOOP 2 OUTPUT LIST PNTR
2085 0A34' A7 PLO GPAGE
2086 0A35' 07 LDN GPAGE
2087 0A36' C2 0870' LBZ TY2RTN ;IF CLEAR (=00), RETURN TO LBT
2088 0A39' E7 SEX GPAGE
2089 RLXA RTTY2 ;LOAD TTY2 POINTER (REG RTTY2)
2090 0A3A' 68 6F
2091 0A3C' 27 DEC GPAGE
2092 0A3D' 0F LDN RTTY2 ;GET N(RTTY2)
2093 0A3E' F9 FF XRI 0FFH ;IS IT FF ?
2094 0A40' C2 0870' LBZ TY2RTN ; IF SO RETURN TO LBT
2095 0A43' F9 6F XRI (0FFH XOR 090H) ;IS IT 90 ?
2096 0A45' 02 5C' BZ TY2ETX ; IF SO GO TO TTY2-ETX
2097 ;
2098 0A47' E1 TTY2OUT: SEX INTPC ;TYPE ON LOOP2
2099 0A48' 61 OUT GROUP
2100 0A49' 06 DB UARTS ; SET UART GROUP
2101 0A4A' E2 SEX STACK
2102 0A4B' 6D INP STAT2 ; CHECK STATUS
2103 0A4C' FB C0 XRI 0C0H ; INVERT
2104 0A4E' FA C0 ANI 0C0H ; MASK FOR THRE AND TSRE
2105 0A50' CA 0870' LBZ TY2RTN
2106 0A53' 6C INP DATA2 ; CLEAR ECHO DA
2107 0A54' EF SEX RTTY2
2108 0A55' 64 OUT DATA2 ; SEND DATA ON LOOP 2
2109 0A56' E7 SEX GPAGE
2110 RSDX RTTY2 ; SET DATA POINTER ON GLOBAL PAGE
2111 0A57' 68 AF
2112 0A59' C0 0870' LBR TY2RTN
2113 ;
2114 0A5C' E1 TY2ETX: SEX INTPC ;WAIT FOR ETX
2115 0A5D' 61 OUT GROUP ; SET UART GROUP
2116 0A5E' 06 DB UARTS

```

```

2117 0A5F' E2 SEX STACK
2118 0A60' 6D INP STAT2 ; CHECK STATUS
2119 0A61' FB C0 XRI 0C0H ; INVERT
2120 0A63' FA C0 ANI 0C0H ; MASK FOR THREE AND TSRE
2121 0A65' CA 0870' LBNZ TY2RTN ; RETURN TO LBT IF REGS. NOT EMPTY
2122 0A68' E2 SEX STACK
2123 0A69' 6D INP STAT2 ; DA?
2124 0A6A' F6 SHR
2125 0A6B' CB 0870' LBNF TY2RTN ; IF NOT RETURN TO LBT
2126 0A6E' 5C INP DATA2 ; IF DA2
2127 0A6F' FA 7F ANI 07FH ; MASK MSB
2128 0A71' FB 03 XRI 03 ; IS IT ETX ?
2129 0A73' CA 0870' LBNZ TY2RTN ; IF NOT ETX, RETURN TO LBT
2130 0A76' 1F INC RTTY2 ; IF ETX, INC. TTY2 LIST POINTER
2131 0A77' E7 SEX GPAGE
2132 RSXD RTTY2 ; AND RESTORE
2133 0A78' 68 AF +
2134 0A7A' C0 0870' LBR TY2RTN ;RTN TO LBT
2135 ;
2136 ;
2137 ;***** BREAK LOOP 2 ? *****
2138 ;
2139 ;
2140 0A7D' F8 7D BR2: LDI BR2CNT ;GET BREAK COUNT FROM GPAGE
2141 0A7F' A7 PLO GPAGE
2142 0A80' 07 LDN GPAGE
2143 0A81' FB 00 XRI 00
2144 0A83' C2 0873' LBZ BR2RTN ;IF 0, RETURN TO LBT
2145 0A86' 07 LDN GPAGE ;IF NOT, DECREMENT COUNT
2146 0A87' FF 01 SMI 01
2147 0A89' 57 STR GPAGE
2148 0A8A' CA 0873' LBNZ BR2RTN ;IF NOT 0, RETURN TO LBT
2149 0A8D' E1 BR2CLR: SEX INTPC ;IF NOW 0, RESET UART 2
2150 0A8E' 61 OUT GROUP
2151 0A8F' 06 DB UARTS
2152 0A90' 65 OUT CNTRL2
2153 0A91' 12 DB FORNT1
2154 0A92' 64 OUT DATA2 ;SEND NULL TO RESET UART 2
2155 0A93' 00 DB 00
2156 0A94' C0 0873' LBR BR2RTN ;RETUTN TO LBT
2157 ;
2158 ;
2159 ;
2160 ;***** TIME OUT COUNTER FUNCTIONS *****
2161 ; *** RUNS ON CYCLES = 26H ONLY ***
2162 ;

```


2163	0A97'	F8 19		CTRCHK: LDI CYCLES	;RUN ONLY ON CYCLE 26H (NEXT TO LAST CYCLE)
2164	0A99'	A7		PLO GPAGE	
2165	0A9A'	07		LDN GPAGE	
2166	0A9B'	F8 26		XRI 26H	
2167	0A9D'	CA 0876'		LBZ CTRRTN	;RETURN TO LBT IF CYCLE NOT = 26H
2168				:	
2169	0AA0'	E2		CTCHK: SEX STACK	
2170				SCAL R6, CTNCHK	
2171	0AA1'	58 36	+		
2172	0AA3'	0AB6'	+		
2173	0AA5'	5C		DB CTBHI	
2174	0AA6'	6E		DB CTAVHI	
2175				:	
2176				SCAL R6, CTNCHK	
2177	0AA7'	58 36	+		
2178	0AA9'	0AB6'	+		
2179	0AAB'	70		DB CTBHI	
2180	0AAC'	72		DB CTBVHI	
2181				:	
2182				SCAL R6, CTNCHK	
2183	0AAD'	58 36	+		
2184	0AAF'	0AB6'	+		
2185	0AB1'	74		DB CTCHI	
2186	0AB2'	76		DB CTCVHI	
2187				:	
2188	0AB3'	50 0876'		LBR CTRRTN	;RETURN TO LBT
2189				:	
2190				:	
2191	0AB6'	46		CTNCHK: LDA LIST	
2192	0AB7'	A7		PLO GPAGE	;EXIT IF CNTR A = 0
2193	0AB8'	E7		SEX GPAGE	
2194				RLXA RA	;PUT CNT(n) IN RA
2195	0AB9'	58 6A	+		
2196	0ABB'	9A		GHI RA	; Is it =0 ?
2197	0ABC'	3A C1'		BNZ CTNDEC	
2198	0ABE'	8A		GLO RA	
2199	0ABF'	32 E1'		BZ (CTNRTN-1)	;SKIP VECTOR POINTER IN PASSLIST AND RETURN
2200				:	
2201	0AC1'	2A		CTNDEC: DEC RA	;DECREMENT CNTR N AND
2202	0AC2'	9A		GHI RA	;BRANCH TO CTNSTR IF NOT =0
2203	0AC3'	3A DE'		BNZ CTNSTR	
2204	0AC5'	8A		GLO RA	
2205	0AC6'	3A DE'		BNZ CTNSTR	;IF CNTR N = 0, STORE 0 COUNT
2206	0AC8'	27		DEC GPAGE	
2207				RSXD RA	
2208	0AC9'	58 AA	+		

```

2209  OACB' 46          LDA LIST      ;GET CT(n)VHI FROM PASSLIST
2210  OACC' A7          PLO GPAGE      ; and put it in RA
2211                                     RLXA RA
2212  OACD' 68 6A      +
2213  OACF' F8 61          LDI PPCLO      ;Put the new PPC in the
2214  OAD1' A7          PLO GPAGE      ; PPC pointer
2215  OAD2' E7          SEX GPAGE
2216                                     RSXD RA
2217  OAD3' 68 AA      +
2218  OAD5' F8 68          LDI PPCNT      ;SET =00:
2219  OAD7' A7          PLO GPAGE
2220  OAD8' F8 00          LDI 00          ; PPCNT
2221  OADA' 73          STXD          ; SEQRAT
2222  OADB' 73          STXD
2223  OADC' 30 E2'      BR CTNRTN      ;GO TO CNTRTN
2224                                     ;
2225  OADE' 27          CTNSTR: DEC GPAGE ;STORE COUNTER N
2226                                     RSXD RA
2227  OADF' 68 AA      +
2228  OAE1' 16          INC LIST      ;SKIP VECTOR POINTER IN PASSLIST
2229                                     ;
2230  OAE2' E2          CTNRTN: SEX STACK ;RETURN
2231                                     SRET R6
2232  OAE3' 68 96      +
2233                                     ;
2234                                     ;
2235                                     ;
2236                                     ;***** SEQUENCER *****
2237                                     ;
2238                                     ORG (INTPGM + 300H)
2239                                     ;
2240                                     ;*** LOCATION OF VARIOUS ELEMENTS IN THIS SECTION ARE ***
2241                                     ;*** EXTREMELY CRITICAL !      MUST START AT A PAGE START ***
2242                                     ;
2243                                     ;
2244  OB00' F8 60      SEQNCR: LDI PPCHI
2245  OB02' A7          PLO GPAGE
2246  OB03' 47          LDA GPAGE
2247  OB04' 3C          PHI PPC          ;SET UP PPC
2248  OB05' 47          LDA GPAGE
2249  OB06' AC          PLO PPC
2250  OB07' 47          LDA GPAGE
2251  OB08' BD          PHI RSTK      ;SET UP R STACK
2252  OB09' 47          LDA GPAGE
2253  OB0A' AD          PLO RSTK
2254  OB0B' 47          LDA GPAGE
  
```

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2255 0B0C' BE          PHI ASTK      ;SET UP A STACK
2256 0B0D' 47          LDA GPAGE
2257 0B0E' AE          PLO ASTK
2258 0B0F' 0C          LDN PPC       ;GET NEXT PPC
2259 0B10' FA FC       ANI OFCH     ;MASK TO DECODE PPC
2260 0B12' A1          PLO INTPC     ;REDIRECT INTERRUPT PC TO PPC
2261 ;
2262 ;
2263 0B13' 1C          INCPPC::INC PPC      ;SET UP FOR NEXT PPC
2264 0B14' CO 3C00'   SAVE:: LBR SAVPPC
2265 ;
2266 0B17' 2C          DECPPC::DEC PPC      ;SET UP FOR PREVIOUS PPC
2267 0B18' 30 14'     BR SAVE          ; USED BY EXT. SEQUENCER FUNCTIONS
2268 ;
2269 ;
2270 ;
2271 ;***** PPC's START HERE *****
2272 ;
2273 ;
2274 ;          ORG (SEQNCR + 28H)
2275 0B28' 1C          JUMP:: INC PPC      ;JUMP TO PPC AT AAAA
2276 0B29' 30 66'     BR JMPEXC
2277 ;
2278 ;
2279 ;          ORG (SEQNCR + 30H)
2280 0B30' 4C          PUSH: LDA PPC      ;PUSH N BYTES TO A STACK
2281 0B31' FA 03       ANI 03
2282 0B33' A9          PLO R9
2283 0B34' 2E          PUSH1: DEC ASTK
2284 0B35' 4C          LDA PPC          ;LOAD IMMEDIATE PPC BYTE
2285 0B36' 5E          STR ASTK
2286 0B37' 89          GLO R9
2287 0B38' 32 14'     BZ SAVE          ;ANOTHER BYTE ?
2288 0B3A' 29          DEC R9
2289 0B3B' 30 34'     BR PUSH1
2290 ;
2291 ;
2292 ;          ORG (SEQNCR + 40H)
2293 0B40' 4C          POP: LDA PPC       ;POP N BYTES FROM A STACK
2294 0B41' FA 03       ANI 03
2295 0B43' A9          PLO R9
2296 0B44' 1E          POP1: INC ASTK
2297 0B45' 89          GLO R9
2298 0B46' 32 14'     BZ SAVE
2299 0B48' 29          DEC R9
2300 0B49' 30 44'     BR POP1

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2301      ;
2302      ;
2303      ;          ORG (SEQNCR + 4CH)
2304      0B4C'  C0 0C22'  INIT:  LBR INITX
2305      ;
2306      ;
2307      ;          ORG (SEQNCR + 58H)
2308      0B58'  1D      RETURN:  INC RSTR
2309      0B59'  4D      LDA RSTR      ;RETURN FROM PPC SUBROUTINE
2310      0B5A'  BC      PHI PPC
2311      0B5B'  0D      LDN RSTR
2312      0B5C'  AC      PLO PPC
2313      0B5D'  1C      INC PPC
2314      0B5E'  30 13'  BR  INCPPC
2315      ;
2316      ;
2317      ;          ORG (SEQNCR + 60H)
2318      0B60'  1C      GOSUB:  INC PPC      ;GOTO PPC SUBROUTINE
2319      0B61'  ED      SEX RSTR
2320      0B62'  8C      GLO PPC
2321      0B63'  73      STXD
2322      0B64'  9C      GHI PPC
2323      0B65'  73      STXD
2324      0B66'  4C      JMPEXC:  LDA PPC
2325      0B67'  A9      PLO R9
2326      0B68'  0C      LDN PPC
2327      0B69'  AC      PLO PPC
2328      0B6A'  89      GLO R9
2329      0B6B'  BC      PHI PPC
2330      0B6C'  30 14'  BR  SAVE
2331      ;
2332      ;
2333      ;          ORG (SEQNCR + 70H)
2334      0B70'  0C      WTTILL:  LDN PPC      ;WAIT TILL DAYS, HOURS,
2335      0B71'  FA 03      ANI 03      ;MIN, SEC ON RTC
2336      0B73'  FE      SHL
2337      0B74'  FC 11      ADI D10
2338      0B76'  A7      PLO GPAGE
2339      0B77'  E2      SEX STACK
2340      ;          SCAL R6, CMPARE
2341      0B78'  68 86      +
2342      0B7A'  0C9C'      +
2343      0B7C'  33 13'      BDF  INCPPC
2344      0B7E'  30 14'      BR  SAVE
2345      ;
2346      ;

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2347                                ORG (SEQNCR + 80H)
2348    0B80'  CO 0C6F'  WTYOR:  LBR WTYORK
2349                                ;
2350                                ;
2351                                ORG (SEQNCR + 0A0H)
2352    0BA0'  CO 0D3A'  CTA:    LBR CTAX
2353                                ;
2354                                ;
2355                                ORG (SEQNCR + 0B0H)
2356    0BB0'  CO 0D57'  CTB:    LBR CTBX
2357                                ;
2358                                ;
2359                                ORG (SEQNCR + 0C0H)
2360    0BC0'  CO 0D74'  CTC:    LBR CTCX
2361                                ;
2362                                ;
2363                                ORG (SEQNCR + 0C4H)
2364    0BC4'  30 13'  NOOP:    BR INCRPPC      ;PPC NO OP
2365                                ;
2366                                ;
2367                                ORG (SEQNCR + 0C8H)
2368                                ;*** ADDITIONAL PSEUDO CODES CAN BE INSERTED HERE ***
2369                                ;
2370                                ;
2371                                ORG (SEQNCR + 0D0H)
2372    0BD0'  CO 0CB9'  LOOP2:  LBR LOOP2X      ;START OUTPUT LIST ON LOOP 2
2373                                ;                               ; AND PWR ON/OFF LOOP 2
2374                                ;
2375                                ;
2376                                ORG (SEQNCR + 0E0H)
2377    0BE0'  CO 1800'  SEQXT1: LBR HELP + 800H      ;SEA DUCT EXTENDED SEQUENCER
2378                                ;                               ; FUNCTION PREFIX
2379                                ;
2380                                ;*** MORE PSEUDO CODES CAN BE INSERTED HERE ***
2381                                ;
2382                                ;
2383                                ;
2384                                ORG (SEQNCR + 100H)
2385                                ;
2386                                ;***** BASIC SEQUENCER IN THIS SECTION ARE CALLED BY THE
2387                                ; PREVIOUS PROGRAM PAGE *****
2388                                ;
2389                                ;
2390    0C00'  F8 65  SAVPPC::LDI ASTKLO      ;SAVE PPC AND STACKS ON GPAGE
2391    0C02'  A7      PLO GPAGE
2392    0C03'  E7      SEX GPAGE
  
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2393 0C04' 8E          GLO ASTK
2394 0C05' 73          STXD
2395 0C06' 9E          GHI ASTK
2396 0C07' 73          STXD
2397 0C08' 8D          GLO RSTK
2398 0C09' 73          STXD
2399 0C0A' 9D          GHI RSTK
2400 0C0B' 73          STXD
2401 0C0C' 8C          GLO PPC
2402 0C0D' 73          STXD
2403 0C0E' 9C          GHI PPC
2404 0C0F' 57          STR GPAGE          ;GPAGE -> PPCHI
2405
2406
2407 0C10' 81          FLAGCK: SEX INTPC          ;THIS SECTION COULD CHECK INSTRUMENT
2408          ;*** DO FLAG CKECKS          ; SPECIFIC FLAGS ( ON / OFF )
2409          ; AS NECESSARY          ; AND PERFORM THE INDICATED
2410          ; THEN ...          ***          ; OPERATION WHEN SEQUENCER
2411          ;          ; EXITS TO LBT
2412
2413 0C11' CO 086D'          LBR SEQRTN          ;RETURN TO LBT
2414
2415
2416
2417
2418
2419 0C14' A7          SETCLR::PLO GPAGE          ;SET OR CLR FLAG ON GPAGE
2420 0C15' 4C          LDA PPC
2421 0C16' F6          SHR
2422 0C17' 33 1C'          BDF SETAC
2423 0C19' F8 00          LDI 00
2424 0C1B' C8          LSKP
2425 0C1C' F8 AC          SETAC: LDI 0ACH
2426 0C1E' 57          STR GPAGE
2427 0C1F' CO 0B14'          LBR SAVE
2428
2429
2430          ;***** INITIALIZE STACKS AND COUNTERS - 4C, 4D, 4E *****
2431
2432 0C22' 0C          INITX: LDN PPC
2433 0C23' FA 03          ANI 03
2434 0C25' 32 37'          BZ INITS          ;4C = INITIALIZE ONLY SEQ. STACKS, PCCNT,
2435 0C27' FB 01          XRI 01          ; FASTMODE, ETC.
2436 0C29' 32 32'          BZ INITB          ;4D = INITIALIZE BOTH
2437 0C2B' FB 03          XRI (01 XOR 02)
2438 0C2D' 32 3F'          BZ INITC          ;4E = INITIALIZE ONLY SEQ. COUNTERS

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2439   OC2F'  CO 0B13'          LBR INCPPC
2440
2441   OC32'  E2                ;
                                INITB: SEX STACK
2442                                     SCAL R6, CNTCLR
2443   OC33'  68 86            +
2444   OC35'  OC47'          +
2445
2446   OC37'  E2                ;
                                INITS: SEX STACK
2447                                     SCAL R6, STKCLR
2448   OC38'  68 86            +
2449   OC3A'  OC59'          +
2450   OC3C'  CO 0B13'          LBR INCPPC
2451
2452   OC3F'  E2                ;
                                INITC: SEX STACK
2453                                     SCAL R6, CNTCLR
2454   OC40'  68 86            +
2455   OC42'  OC47'          +
2456   OC44'  CO 0B13'          LBR INCPPC
2457
2458
2459
2460
2461   OC47'  E2                ;
                                ;*** SUBROUTINES FOR INITIALIZE ***
2462                                     ;
                                CNTCLR: SEX STACK           ;CLEAR COUNTERS A, B, C
2463                                     SCAL R6, CTNCLR
2464   OC48'  68 86            +
2465   OC4A'  ODA3'          +
2466   OC4C'  6D                DB CTALO
2467                                     SCAL R6, CTNCLR
2468   OC4D'  68 86            +
2469   OC4F'  ODA3'          +
2470   OC51'  71                DB CTBLO
2471                                     SCAL R6, CTNCLR
2472   OC52'  68 86            +
2473   OC54'  ODA3'          +
2474   OC56'  75                DB CTCLO
2475                                     SRET R6           ;RETURN
2476
2477
2478   OC59'  F8 52            ;
                                ;
                                STKCLR: LDI SSTRPG       ;INITIALISE STACKS
2479                                     PHI RSTK
2480                                     PHI ASTK
2481   OC5D'  F8 3F            LDI LOW(RSTKTP)
2482   OC5F'  AD                PLO RSTK           ; R STACK
2483   OC60'  F8 7F            LDI LOW(ASTKTP)
2484   OC62'  AE                PLO ASTK           ; A STACK

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2485   OC63'   F8 68           LDI PPCNT
2486   OC65'   A7             PLO GPAGE
2487   OC66'   E7             SEX GPAGE
2488   OC67'   F8 00         LDI 00
2489   OC69'   73             STXD           ;CLEAR PPC COUNT
2490   OC6A'   73             STXD           ;SET SEQUENCER RATE TO CYCLZ 1 ONLY
2491   OC6B'   73             STXD           ;CLEAR FAST SEQUENCER MODE
2492   OC6C'   E2             SEX STACK
2493                                     SRET R6           ;RETURN
2494   OC6D'   68 96         +
2495                                     ;
2496                                     ;
2497                                     ;***** 'Wait For' Sequencer Code *****
2498                                     ;
2499   OC6F'   0C             WTFORX: LDN PPC           ;WAIT FOR DAYS, HOURS, MIN
2500   OC70'   FA 03         ANI 03           ;GET LOW NIBBLE
2501   OC72'   FE             SHL
2502   OC73'   FC 13         ADI H10
2503   OC75'   A7             PLO GPAGE
2504   OC76'   C4             NOP
2505   OC77'   2E             PUSH00: DEC ASTK
2506   OC78'   F8 00         LDI 00
2507   OC7A'   5E             STR ASTK
2508   OC7B'   E2             SEX STACK
2509                                     SCAL R6, CMPARE
2510   OC7C'   68 86         +
2511   OC7E'   0C9C'         +
2512   OC80'   33 88'           BDF MATCH3
2513   OC82'   1E             INC ASTK
2514   OC83'   C0 0B14'       LBR SAVE
2515   OC86'   C4             YOP
2516   OC87'   C4             NOP
2517                                     ;
2518   OC88'   87             MATCH3: GLO GPAGE
2519   OC89'   F3 19         XRI CYCLES
2520   OC8B'   3A 77'         BNZ PUSH00
2521   OC8D'   C4             NOP
2522   OC8E'   C4             NOP
2523   OC8F'   0E             LDN ASTK
2524   OC90'   32 98'         BZ STKERR
2525   OC92'   FF 01         SMI 01           ;DEC. COUNT
2526   OC94'   5E             STR ASTK
2527   OC95'   CA 0B14'       LBNZ SAVE
2528   OC98'   1E             STKERR: INC ASTK
2529   OC99'   C0 0B13'       LBR INCPPC
2530                                     ;

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2531 ;
2532 ;***** COMPARE TIME SUBROUTINE *****
2533 ;***** Used by Wait Till and Wait For *****
2534 ;
2535 0C9C' 47 CMPARE: LDA GPAGE ;GET X 10 DIGIT
2536 0C9D' FE SHL
2537 0C9E' FE SHL
2538 0C9F' FE SHL
2539 0CA0' FE SHL
2540 0CA1' EE SEX ASTK
2541 0CA2' F3 XOR
2542 0CA3' FA F0 ANI OFOH ;CONSIDER HI DIGIT
2543 0CA5' 32 AD' BZ CHK1
2544 0CA7' FC 00 NONTCH: ADI 00 ;CLEAR DF
2545 0CA9' 27 DEC GPAGE
2546 0CAA' E2 SEX STACK
2547 SRET R6
2548 0CAB' 68 96 +
2549 0CAD' 47 CHK1: LDA GPAGE
2550 0CAE' F3 XOR
2551 0CAF' FA 0F ANI OFH ;CONSIDER LO DIGIT
2552 0CB1' 3A A7' BNZ NONTCH
2553 0CB3' FF 00 SMI 00 ;SET DF
2554 0CB5' 1E INC ASTK
2555 0CB6' E2 SEX STACK
2556 SRET R6
2557 0CB7' 68 96 +
2558 ;
2559 ;
2560 ;*** LOOP 2 -- PWR ON; OFF; ON AND SEND DATA ON LOOP 2 *****
2561 ;***** D0= PWR OFF, D1= PWR ON, D2nnnn = PWR ON AND SEND DATA LOOP 2 *****
2562 ;
2563 ;
2564 0CB9' 0C LOOP2X: LDN PPC ;IS PPC D0, D1, OR D2?
2565 0CBA' FA 03 ANI 03 ; MASR FOR 2 LSB's
2566 0CBC' 32 C9' BZ LP2OFF ; IF D0, LOOP 2 PWR OFF
2567 0CBE' FB 01 XRI 01
2568 0CC0' 32 D1' BZ LP2ON ; IF D1, LOOP 2 PWR ON
2569 0CC2' FB 03 XRI 01 XOR 02
2570 0CC4' 32 D9' BZ LP2XMT ; IF D2, LOOP 2 PWR ON AND SEND DATA
2571 0CC6' C0 0D2D' LBR LP2XIT ;IF NOT 1, 2, OR 3, GO TO NEXT PPC
2572 ;
2573 0CC9' E1 LP2OFF: SEX INTPC ;D0 = LOOP2 PWR OFF
2574 0CCA' 61 OUT GROUP
2575 0CCB' 02 DB 02
2576 0CCC' 67 OUT RELAYS

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2577   OCCD'  00           DB 08
2578   OCCF'  C0 0B13'    LBR INCPPC
2579   ;
2580   OCD1'  E1           LP20N: SEX INTPC      ;D1 = LOOP 2 PWR ON
2581   OCD2'  61           OUT GROUP
2582   OCD3'  02           DB 02
2583   OCD4'  67           OUT RELAYS
2584   OCD5'  40           DB 100Q
2585   OCD6'  C0 0B13'    LBR INCPPC
2586   ;
2587   OCD9'  F8 68       LP2XMT: LDI PPCCNT      ;D2 = LOOP2 PWR ON, SEND LIST ON LOOP2 VIA TTY2
2588   OCDB'  A7           PLO GPAGE      ; CHECK IF 1st TIME THRU THIS PPC
2589   OCDC'  07           LDM GPAGE      ; *** NOTE: 60 SEC. TIMEOUT
2590   OCDD'  32 FF'      BZ LP20TH      ;         ON THIS PART OF PPC! ***
2591   OCDF'  FB 01       XRI 01
2592   OCE1'  C2 0D11'   LBZ LP21ST
2593   ;
2594   OCE4'  F8 7E       LP2NTH: LDI TTY2HI     ;NEXT TIME THRU:
2595   OCE6'  A7           PLO GPAGE      ; LOOK AT TTY2 CHARACTER
2596   OCE7'  E7           SEX GPAGE
2597   ;
2598   OCE8'  68 69       RLXA R9      ;LOAD TTY2 POINTER INTO R9
2599   OCEA'  09           LDM R9          ;LOOK AT TTY2 DATA
2600   OCEB'  FB FF       XRI 0FFH     ; IS IT FF ?
2601   OCED'  C6           LSNZ          ;         IF SO, GO TO LP2XIT
2602   OCSE'  C0 0D2D'    LBR LP2XIT      ;         IF NOT, CONTINUE
2603   OCF1'  EE           SEX ASTK
2604   OCF2'  0E           LDM ASTK
2605   OCF3'  FB 3C       XRI 03CH     ; 60 SEC. UP ?
2606   OCF5'  C1 0D26'   LBZ LP2ERR     ;         IF SO, GO TO LP2ERR ROUTINE
2607   OCF8'  FB 01       LDI 01          ;         IF NOT, CONTINUE THIS PPC
2608   OCPA'  F4           ADD            ;ADD 01 TO ASTK
2609   OCFB'  5E           STR ASTK
2610   OCFC'  C0 0C00'    LBR SAVPPC
2611   ;
2612   ;
2613   OCFF'  F8 01       LP20TH: LDI 01      ;FIRST TIME THRU:
2614   OD01'  57           STR GPAGE      ; SET PPC COUNT = 01
2615   ;
2616   OD02'  E1           SEX INTPC      ;SELECT I/O GROUP 02
2617   OD03'  61           OUT GROUP
2618   OD04'  02           DB 02
2619   OD05'  67           OUT RELAYS     ;LOOP 2 PWR ON
2620   OD06'  40           DB 100Q
2621   ;
2622   OD07'  F8 80       LDI ERROR     ;CLEAR LOOP 2 ERROR BITS (0,1) IF PRESENT
  
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2623 0D09' A7 PLO GPAGE
2624 0D0A' 07 LDN GPAGE
2625 0D0B' FA FC ANI QPCH
2626 0D0D' 57 STR GPAGE
2627 0D0E' C0 0C00' LBR SAVPPC
2628 ;
2629 ;
2630 0D11' F8 02 LP21ST: LDI 02 ;2nd TIME THRU:
2631 0D13' 57 STR GPAGE ; SET PPC COUNT = 02
2632 ;
2633 0D14' 1C INC PPC ;SEND DATA ON LOOP 2
2634 0D15' F8 7E LDI TTY2HI ; UNDER SEQUENCER CONTROL
2635 0D17' A7 PLO GPAGE ; BY PUTTING SEND-LIST POINTER
2636 0D18' 4C LDA PPC ; IN TTYHI AND TTYLO FOR TTY2
2637 0D19' 57 STR GPAGE
2638 0D1A' 17 INC GPAGE
2639 0D1B' 0C LDN PPC
2640 0D1C' 57 STR GPAGE
2641 0D1D' 2E DEC ASTK
2642 0D1E' F8 00 LDI 00 ;SET ASTK TO 00 TO START
2643 0D20' 5E STR ASTK ; TIME OUT LOOP
2644 0D21' 2C DEC PPC ;DECREMENT PPC TWICE TO RUN
2645 0D22' 2C DEC PPC ; AGAIN ON NEXT PASS
2646 0D23' C0 0C00' LBR SAVPPC
2647 ;
2648 ;
2649 0D26' F8 80 LP2ERR: LDI ERROR ;SET LOOP 2 ERROR BIT (01)
2650 0D28' A7 PLO GPAGE ;ERROR SET BY TIME OUT
2651 0D29' 07 LDN GPAGE
2652 0D2A' F9 02 ORI 02
2653 0D2C' 57 STR GPAGE
2654 ;
2655 ;
2656 0D2D' 1C LP2XIT: INC PPC ;MOVE TO NEXT PPC
2657 0D2E' 1C INC PPC
2658 0D2F' 1C INC PPC
2659 0D30' 1E INC ASTK
2660 0D31' F8 68 LDI PPCCNT ;CLEAR PPC COUNT
2661 0D33' A7 PLO GPAGE
2662 0D34' F8 00 LDI 00
2663 0D36' 57 STR GPAGE
2664 0D37' C0 0C00' LBR SAVPPC
2665 ;
2666 ;
2667 ;
2668 ***** SEQUENCER COUNTER A CONTROL *****

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2669 ;
2670 OD3A' 0C ;CTAX: LDN PPC ;SET OR CLEAR CNTR A
2671 OD3B' FA 03 ;ANI 03 ;AD = CLEAR
2672 0D3D' 32 45' ;BZ CTACL R ;A1 = SET (B1 CCCC AAAA)
2673 OD3F' F6 ;SHR ;A2 = A3 = IGNORED
2674 OD40' 33 4E' ;BDF CTASET ; WHERE CCCC = COUNT IN SECONDS
2675 OD42' C0 0B13' ;LBR INCPPC ; AND AAAA = VECTOR ADDR AT CNT = 0000
2676 ;
2677 0D45' E2 ;CTACL R: SEX STACK
2678 ;SCAL R6, CTNCLR ;CLEAR COUNTER A
2679 OD46' 68 86 +
2680 OD48' 0DA3' +
2681 OD4A' 60 ;DB CTALO
2682 OD4B' C0 0B13' ;LBR INCPPC
2683 ;
2684 OD4E' E2 ;CTASET: SEX STACK ;SET COUNTER B
2685 ;SCAL R6, CTNSET
2686 OD4F' 68 86 +
2687 OD51' 0D91' +
2688 OD53' 6C ;DB CTBHI
2689 OD54' C0 0C00' ;LBR SAVPPC ;GO TO SAVE PPC
2690 ;
2691 ;
2692 ;***** SEQUENCER COUNTER B CONTROL *****
2693 ;
2694 OD57' 0C ;CTBX: LDN PPC ;SET OR CLEAR CNTR B
2695 OD58' FA 03 ;ANI 03 ;B0 = CLEAR
2696 OD5A' 32 62' ;BZ CTBCLR ;B1 = SET (B1 CCCC AAAA)
2697 OD5C' F6 ;SHR ;B2 = B3 = IGNORED
2698 OD5D' 33 6B' ;BDF CTBSET ; WHERE CCCC = COUNT IN SECONDS
2699 OD5F' C0 0B13' ;LBR INCPPC ; AND AAAA = VECTOR ADDR AT CNT = 0000
2700 ;
2701 OD62' E2 ;CTBCLR: SEX STACK
2702 ;SCAL R6, CTNCLR ;CLEAR COUNTER B
2703 OD63' 68 86 +
2704 OD65' 0DA3' +
2705 OD67' 71 ;DB CTBLO
2706 OD68' C0 0B13' ;LBR INCPPC
2707 ;
2708 OD6B' E2 ;CTBSET: SEX STACK ;SET COUNTER B
2709 ;SCAL R6, CTNSET
2710 OD6C' 68 86 +
2711 OD6E' 0D91' +
2712 OD70' 70 ;DB CTBHI
2713 OD71' C0 0C00' ;LBR SAVPPC ;GO TO SAVE PPC
2714 ;
  
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2715 ;
2716 ;***** SEQUENCER COUNTER C CONTROL *****
2717 ;
2718 0D74' 0C          CTCX: LDN PPC          ;SET OR CLEAR CNTR C
2719 0D75' FA 03      ANI 03          ; C0 = CLEAR
2720 0D77' 32 7F'     BZ CTCCLR      ; C1 = SET (C1 CCCC AAAA)
2721 0D79' F6         SHR           ; C2 = C3 = IGNORED
2722 0D7A' 33 88'     BDF CTCSET      ; WHERE CCCC = COUNT IN SECONDS
2723 0D7C' C0 0B13'  LBR INCPPC      ; AND AAAA = VECTOR ADDR AT CNT = 0000
2724 ;
2725 0D7F' E2         CTCCLR: SEX STACK
2726                      SCAL R6, CTNCLR ;CLEAR COUNTER C
2727 0D80' 58 86      +
2728 0D82' 0DA3'     +
2729 0D84' 75         DB CTCLO
2730 0D85' C0 0B13'  LBR INCPPC
2731 ;
2732 0D88' E2         CTCSET: SEX STACK      ;SET COUNTER C
2733                      SCAL R6, CTNSET
2734 0D89' 68 86      +
2735 0D8B' 0D91'     -
2736 0D8D' 74         DB CTCCHI
2737 0D8E' C0 0C00'  LBR SAVPPC          ;GO TO SAVE PPC
2738 ;
2739 ;
2740 ;***** SET COUNTER (N) SUBROUTINE *****
2741 ;
2742 0D91' 1C          CTNSET: INC PPC        ;INCREMENT PPC
2743 0D92' 46          LDA LIST            ;GET CTA(N) HI
2744 0D93' A7          PLO GPAGE
2745 0D94' EC          SEX PPC
2746 0D95' 72          LDXA              ;STORE CT(N) HI
2747 0D96' 57          STR GPAGE
2748 0D97' 17          INC GPAGE
2749 0D98' 72          LDXA              ;STORE CT(N) LO
2750 0D99' 57          STR GPAGE
2751 0D9A' 17          INC GPAGE
2752 0D9B' 72          LDXA              ;STORE CT(N) VECT HI
2753 0D9C' 57          STR GPAGE
2754 0D9D' 17          INC GPAGE
2755 0D9E' 72          LDXA              ;STORE CT(N) VECT LO
2756 0D9F' 57          STR GPAGE
2757 0DA0' E2          SEX STACK
2758                      SRET R6          ;RETURN
2759 0DA1' 68 86      +
2760 ;

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2761 ;
2762 ;***** CLEAR COUNTER #N (SUBROUTINE) *****
2763 ;***** Called by CTAX, CTBX, CTCX *****
2764 ;
2765 ODA3' 46 CTNCLR: LDA LIST ;GET CT(N) LO ADDRESS
2766 ODA4' A7 PLO GPAGE ;CLEAR COUNT OF CNT(N)
2767 ODA5' E7 SEX GPAGE
2768 ODA6' F8 00 LDI 00
2769 ODA8' 73 STXD
2770 ODA9' 73 STXD
2771 ODAA' E2 SEX STACK
2772 SRET R6 ;RETURN FROM SUB
2773 ODAB' 68 96 +
2774 ;
2775 ;
2776 ;
2777 ;*****
2778 ;
2779 ;***** SET UP SEA DATA BUFFER AND RECORD *****
2780 ;
2781 ODAD' F8 18 SD: LDI SECI ;SEC. = X0?
2782 ODAF' A7 PLO GPAGE
2783 ODB0' 07 LDN GPAGE ; IF NOT, RETURN TO LBT
2784 ODB1' CA 0891' LBNZ SDRET
2785 ODB4' 17 INC GPAGE ;CYCLES = 1A?
2786 ODB5' 07 LDN GPAGE
2787 ODB6' FB 1A XRI 1AH ; IF NOT, RETURN TO LBT
2788 ODB8' CA 0891' LBNZ SDRET
2789 ;
2790 RLDI DMA, BUFFER ;SET UP BUFFER RO = DMA = 5800
2791 ODBB' 68 C0 +
2792 ODBD' 5800 +
2793 ;
2794 ;
2795 ; TRANSFER DATA FROM GLOBAL PAGE TO DMA BUFFER
2796 ; DATA IS PACKED DURING TRANSFER
2797 ;
2798 ; DO EXP. # AND TIME WORDS FIRST
2799 ;
2800 ;
2801 ODBF' F8 0F LDI EXPNUM ;GP TO EXPNUM (GP = 0F)
2802 ODC1' A7 PLO GPAGE
2803 ODC2' E7 SEX GPAGE
2804 ODC3' 72 LDXA ;LD EXPNUM; GP TO D100 (GP=10)
2805 ODC4' FE SHL
2806 ODC5' FE SHL
  
```

2807	ODC6'	FE	SHL	
2808	ODC7'	FE	SHL	
2809	ODC8'	F1	OR	
2810	ODC9'	50	STR DMA	; EXPNUM/D100 TO DMA BUFFER 00
2811	ODCA'	10	INC DMA	; DMA BUFFER TO 01
2812	ODCB'	17	INC GPAGE	; GP -> D11
2813	ODCC'	72	LDXA	;LD D10; GP TO D1 (GP=12)
2814	ODCD'	FE	SHL	
2815	ODCE'	FE	SHL	
2816	ODCF'	FE	SHL	
2817	ODD0'	FE	SHL	
2818	ODD1'	F1	OR	
2819	ODD2'	50	STR DMA	; D10/D1 TO DMA BUFFER 01
2820	ODD3'	10	INC DMA	; DMA BUFFER TO 02
2821	ODD4'	17	INC GPAGE	; GP -> D13
2822				
2823	ODD5'	72	LDXA	;LD H10;GP TO H1 (GP=14)
2824	ODD6'	FE	SHL	
2825	ODD7'	FE	SHL	
2826	ODD8'	FE	SHL	
2827	ODD9'	FE	SHL	
2828	ODDA'	F1	OR	
2829	ODDB'	50	STR DMA	; HE TO DMA BUFFER 02
2830	ODDC'	10	INC DMA	; DMA BUFFER TO 03
2831	ODDD'	17	INC GPAGE	; GP->M10
2832	ODDE'	72	LDXA	;LD M10;GP TO M1 (GP=16)
2833	ODDF'	FE	SHL	
2834	ODE0'	FE	SHL	
2835	ODE1'	FE	SHL	
2836	ODE2'	FE	SHL	
2837	ODE3'	F1	OR	
2838	ODE4'	50	STR DMA	; NM TO BUFFER 03
2839	ODE5'	10	INC DMA	; DMA BUFFER TO 04
2840	ODE6'	17	INC GPAGE	; GP -> S10
2841	ODE7'	72	LDXA	;LD S10;GP TO S1 (GP=18)
2842	ODE8'	FE	SHL	
2843	ODE9'	FE	SHL	
2844	ODEA'	FE	SHL	
2845	ODEB'	FE	SHL	
2846	ODEC'	F1	OR	
2847	ODED'	50	STR DMA	;SS TO DMA BUFFER 04
2848				
2849				
2850	ODEE'	10	INC DMA	; DMA BUFFER TO 05
2851	ODEF'	F8 60	LDI PPCHI	
2852	ODPI'	A7	PLO GPAGE	

2853	ODF2'	72	LDXA	; LOAD PPCHI (GP=60); GP TO PPCLO (GP=61)
2854	ODF3'	50	STR DMA	; PPCHI TO DMA BUFFER 05
2855	ODF4'	10	INC DMA	; DMA BUFFER TO 06
2856	ODF5'	F0	LDX	; LOAD PPCLO (GP=61); GP STAYS AT GP=61
2857	ODF6'	50	STR DMA	; PPCLO TO DMA BUFFER 06
2858	ODF7'	10	INC DMA	; DMA BUFFER TO 07
2859				
2860				
2861				; PUT STATUS BYTES IN BUFFER
2862				
2863	ODF8'	F8 80	LDI ERROR	; SET GLOBAL PAGE TO ERROR (GP=80)
2864	ODFA'	A7	PLO GPAGE	
2865	ODFB'	72	LDXA	; LOAD ERROR (GP=80); GP -> 81
2866	ODFC'	50	STR DMA	; ERROR WORD TO DMA BUFFER 07
2867	ODFD'	10	INC DMA	; DMA BUFFER TO 08
2868				
2869	ODFE'	72	LDXA	;LOAD ACSTAT (GP=81); GP -> 82
2870	ODFF'	50	STR DMA	; ACOUSTIC STATUS TO DMA BUFFER 08
2871	OE00'	10	INC DMA	; DMA BUFFER TO 09
2872				
2873	OE01'	72	LDXA	;LOAD SWSTAT (GP=82); GP -> 83
2874	OE02'	50	STR DMA	; SWSTAT TO DMA BUFFER 09
2875	OE03'	10	INC DMA	; DMA BUFFER TO 0A
2876				
2877	OE04'	72	LDXA	;LOAD PODSTAT (GP=83); GP -> 84
2878	OE05'	50	STR DMA	; PODSTAT TO DMA BUFFER 0A
2879	OE06'	10	INC DMA	; DMA BUFFER TO 0B
2880				
2881	OE07'	72	LDXA	;LOAD CMPSS (GP=84); GP -> 85
2882	OE08'	50	STR DMA	; COMPASS TO DMA BUFFER 0B
2883	OE09'	10	INC DMA	; DMA BUFFER TO 0C
2884				
2885	OE0A'	72	LDXA	;LOAD HDG (GP=85); GP -> 86
2886	OE0B'	50	STR DMA	; HEADING TO DMA BUFFER 0C
2887	OE0C'	10	INC DMA	; DMA BUFFER TO 0D
2888				
2889	OE0D'	72	LDXA	;LOAD PUMP1 (GP=86); GP -> 87
2890	OE0E'	50	STR DMA	; PUMP 1 SPEED TO DMA BUFFER 0D
2891	OE0F'	10	INC DMA	; DMA BUFFER TO 0E
2892				
2893	OE10'	72	LDXA	;LOAD PUMP2 (GP=87); GP -> 88
2894	OE11'	50	STR DMA	; PUMP 2 SPEED TO DMA BUFFER 0E
2895	OE12'	10	INC DMA	; DMA BUFFER TO 0F
2896				
2897	OE13'	72	LDXA	;LOAD CANCNT (GP=88); GP -> 98
2898	OE14'	50	STR DMA	; CAMERA FRAME COUNT TO DMA BUFFER 0F

2899	0E15'	10	INC DMA	:	DMA BUFFER TO 10
2900				:	
2901	0E16'	72	LDXA	:	LOAD PITCH (GP=89); GP -> 8A
2902	0E17'	50	STR DMA	:	PITCH TO DMA BUFFER 10
2903	0E18'	10	INC DMA	:	DMA BUFFER TO 11
2904				:	
2905	0E19'	72	LDXA	:	LOAD ROLL (GP=8A); GP -> 8B
2906	0E1A'	50	STR DMA	:	ROLL TO DMA BUFFER 11
2907	0E1B'	10	INC DMA	:	DMA BUFFER TO 12
2908				:	
2909	0E1C'	72	LDXA	:	LOAD BATTUP (GP=8B); GP -> 8C
2910	0E1D'	50	STR DMA	:	UP BATTERY TO DMA BUFFER 12
2911	0E1E'	10	INC DMA	:	DMA BUFFER TO 13
2912				:	
2913	0E1F'	72	LDXA	:	LOAD BATTSY (GP=8C); GP -> 8D
2914	0E20'	50	STR DMA	:	SYSTEM BATTERY TO DMA BUFFER 13
2915	0E21'	10	INC DMA	:	DMA BUFFER TO 14
2916				:	
2917				:	
2918	0E22'	20	SEX DMA	:	START STORING A/D STRING
2919				:	
2920				:	
2921	0E23'	47	LDA GPAGE	:	LOAD ADGH8 (GP=8D); GP -> 8E
2922	0E24'	50	STR DMA	:	ADGH8 TO DMA BUFFER 14
2923	0E25'	10	INC DMA	:	DMA BUFFER TO 15
2924	0E26'	47	LDA GPAGE	:	LOAD ADGL4 (GP=8E); GP -> 8F
2925	0E27'	FE	SHL		
2926	0E28'	FE	SHL		
2927	0E29'	FE	SHL		
2928	0E2A'	FE	SHL		
2929	0E2B'	50	STR DMA	:	ADGL4/XXXX TO DMA BUFFER 15
2930	0E2C'	07	LDM GPAGE	:	LOAD ADRH8 (GP=8F)
2931	0E2D'	F6	SHR		
2932	0E2E'	F6	SHR		
2933	0E2F'	F6	SHR		
2934	0E30'	F6	SHR		
2935	0E31'	F1	OR		
2936	0E32'	50	STR DMA	:	ADGL4/ADRH4 TO DMA BUFFER 15
2937	0E33'	10	INC DMA	:	DMA BUFFER TO 16
2938	0E34'	47	LDA GPAGE	:	LOAD ADRH8 (GP=8F); GP -> ADRL4 (GP=90)
2939	0E35'	FE	SHL		
2940	0E36'	FE	SHL		
2941	0E37'	FE	SHL		
2942	0E38'	FE	SHL		
2943	0E39'	50	STR DMA	:	ADRN4 TO DMA BUFFER 16
2944				:	

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2945 0E3A' 47 LDA GPAGE ;LOAD ADRL4 (GP=90); GP -> AD5H8 (GP=91)
2946 0E3B' FA OF ANI OFH
2947 0E3D' F1 OR
2948 0E3E' 50 STR DMA ; ADRL8 TO DMA BUFFER 16
2949 0E3F' 10 INC DMA ; DMA BUFFER TO 17
2950 ;
2951 ;DMA = 17 (AD5H8) ;GP = 91 (AD5H8)
2952 ;
2953 0E40' 47 LDA GPAGE ;LOAD AD5H8 (GP=91); GP -> AD5L4 (GP=92)
2954 0E41' 50 STR DMA ;AD5H8 TO DMA BUFFER 17
2955 0E42' 10 INC DMA ; DMA BUFFER TO 18
2956 0E43' 47 LDA GPAGE ;LOAD AD5L4 (GP=92); GP -> XPOS (GP=93)
2957 0E44' FE SHL
2958 0E45' FE SHL
2959 0E46' FE SHL
2960 0E47' FE SHL
2961 0E48' 50 STR DMA ;AD5L4/XXXX TO DMA BUFFER 18
2962 0E49' 47 LDA GPAGE ;LOAD XPOS (GP=93); GP -> YZPOS (GP=94)
2963 0E4A' FA OF ANI OFH
2964 0E4C' F1 OR
2965 0E4D' 50 STR DMA ;AD5L4/XPOS TO DMA BUFFER 18
2966 0E4E' 10 INC DMA ; DMA BUFFER TO 19
2967 0E4F' 47 LDA GPAGE ;LOAD YZPOS (GP=94); GP TO ADT1H8 (GP=95)
2968 0E50' 50 STR DMA ;YZPOS TO DMA BUFFER 19
2969 0E51' 10 INC DMA ; DMA BUFFER TO 1A
2970 ;
2971 ;DO TRANSMISSOMETER STRING: DMA = BUF + 1AH ;GP = 95H
2972 ;
2973 0E52' 47 LDA GPAGE ;LOAD ADT1H8 (GP=95); GP -> ADT1L4 (GP=96)
2974 0E53' 50 STR DMA ;ADT1H8 TO DMA BUFFER 1A
2975 0E54' 10 INC DMA ; DMA BUFFER TO 1B
2976 0E55' 47 LDA GPAGE ;LOAD ADT1L4 GP=96); GP -> ADT2H8 (GP=97)
2977 0E56' FE SHL
2978 0E57' FE SHL
2979 0E58' FE SHL
2980 0E59' FE SHL
2981 0E5A' 50 STR DMA ;ADT1L4/XXXX TO DMA BUFFER 1B
2982 0E5B' 07 LDN GPAGE ;LOAD ADT2H8 (GP=97)
2983 0E5C' F6 SHR
2984 0E5D' F6 SHR
2985 0E5E' F6 SHR
2986 0E5F' F6 SHR
2987 0E60' F1 OR
2988 0E61' 50 STR DMA ;ADT1L4/ADT2H4 TO DMA BUFFER 1B
2989 0E62' 10 INC DMA ; DMA BUFFER TO 1C
2990 0E63' 47 LDA GPAGE ;LOAD ADT2H8 (GP=97); GP -> ADT2L4 (GP=98)
  
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2991 0E64' FE          SHL
2992 0E65' FE          SHL
2993 0E66' FE          SHL
2994 0E67' FE          SHL
2995 0E68' 50          STR DMA ;ADT2M4 TO DMA BUFFER 1C
2996 0E69' 47          LDA GPAGE ;LOAD ADT2L4 (GP=98); GP TO ADT3H8 (GP=99)
2997 0E6A' FA OF      ANI OFH
2998 0E6C' F1          OR
2999 0E6D' 50          STR DMA ;ADT2L8 TO DMA BUFFER 1C
3000 0E6E' 10          INC DMA ; DMA BUFFER TO 1D
3001
3002 0E6F' 47          LDA GPAGE ;LOAD ADT3H8 (GP=99); GP TO ADT3L4 (GP=9A)
3003 0E70' 50          STR DMA ;ADT3H8 TO DMA BUFFER 1D
3004 0E71' 10          INC DMA ; DMA BUFFER TO 1E
3005 0E72' 47          LDA GPAGE ;LOAD ADT3L4 (GP=9A); GP TO ADT4H8 (GP=9B)
3006 0E73' FE          SHL
3007 0E74' FE          SHL
3008 0E75' FE          SHL
3009 0E76' FE          SHL
3010 0E77' 50          STR DMA ;ADT3L4/XXXX TO DMA BUFFER 1E
3011 0E78' 07          LDN GPAGE ;LOAD ADT4H8 GP=9B
3012 0E79' F6          SHR
3013 0E7A' F6          SHR
3014 0E7B' F6          SHR
3015 0E7C' F6          SHR
3016 0E7D' F1          OR
3017 0E7E' 50          STR DMA ;ADT3L4/ADT4H4 TO DMA BUFFER 1E
3018 0E7F' 10          INC DMA ; DMA BUFFER TO 1F
3019 0E80' 47          LDA GPAGE ;LOAD ADT4H8 (GP=9B); GP TO ADT4L8 (GP=9C)
3020 0E81' FE          SHL
3021 0E82' FE          SHL
3022 0E83' FE          SHL
3023 0E84' FE          SHL
3024 0E85' 50          STR DMA ;ADT4M4/XXXX TO DMA BUFFER 1F
3025 0E86' 47          LDA GPAGE ;LOAD ADT4L8 (GP=9C); GP TO ADT5H8 (GP=9D)
3026 0E87' FA OF      ANI OFH
3027 0E89' F1          OR
3028 0E8A' 50          STR DMA ;ADT4L8 TO DMA BUFFER 1F
3029 0E8B' 10          INC DMA ; DMA BUFFER TO 20
3030
3031 0E8C' 47          LDA GPAGE ;LOAD ADT5H8 (GP=9D); GP TO ADT5L4 (GP=9E)
3032 0E8D' 50          STR DMA ;ADT5H8 TO DMA BUFFER 20
3033 0E8E' 10          INC DMA ; DMA BUFFER TO 21
3034 0E8F' 47          LDA GPAGE ;LOAD ADT5L4 (GP=9E); GP TO ADT6H8 (GP=9F)
3035 0E90' FE          SHL
3036 0E91' FE          SHL
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3037 0E92' FE          SHL
3038 0E93' FE          SHL
3039 0E94' 50          STR DMA      ;ADT5L4/XXXX TO DMA BUFFER 21
3040 0E95' 07          LDN GPAGE     ;LOAD ADT6H8 (GP=9F)
3041 0E96' F6          SHR
3042 0E97' F6          SHR
3043 0E98' F6          SHR
3044 0E99' F6          SHR
3045 0E9A' F1          OR
3046 0E9B' 50          STR DMA      ;ADT5L4/ADT6H4 TO DMA BUFFER 21
3047 0E9C' 10          INC DMA      ;      DMA BUFFER TO 22
3048 0E9D' 47          LDA GPAGE     ;LOAD ADT6H8 (GP=9F); GP TO ADT6L4 (GP=A0)
3049 0E9E' FE          SHL
3050 0E9F' FE          SHL
3051 0EA0' 7E          SHL
3052 0EA1' FE          SHL
3053 0EA2' 50          STR DMA      ;ADT6M4/XXXX TO DMA BUFFER 22
3054 0EA3' 47          LDA GPAGE     ;LOAD ADT6L4 (GP=A0); GP TO ADT7H8 (GP=A1)
3055 0EA4' FA OF      ANI OFH
3056 0EA6' F1          OR
3057 0EA7' 50          STR DMA      ;ADT6L8 TO DMA BUFFER 22
3058 0EA8' 10          INC DMA      ;      DMA BUFFER TO 23
3059
3060 ;GP = A1 (ADT7H8); DMA = BUF + 23 (ADT7H8)
3061 ;
3062 0EA9' 47          LDA GPAGE     ;LOAD ADT7H8 (GP=A1); GP TO ADT7L4 (GP=A3)
3063 0EAA' 50          STR DMA      ;ADT7H8 TO DMA BUFFER 23
3064 0EAB' 10          INC DMA      ;      DMA BUFFER TO 24
3065 0EAC' 47          LDA GPAGE     ;LOAD ADT7L4 (GP=A2); GP TO ADT8H8 (GP=A3)
3066 0EAD' FE          SHL
3067 0EAE' FE          SHL
3068 0EAF' FE          SHL
3069 0EB0' FE          SHL
3070 0EB1' 50          STR DMA      ;ADT7L4/XXXX TO DMA BUFFER 24
3071 0EB2' 07          LDN GPAGE     ;LOAD ADT8H8 (GP=A3)
3072 0EB3' F6          SHR
3073 0EB4' F6          SHR
3074 0EB5' F6          SHR
3075 0EB6' F6          SHR
3076 0EB7' F1          OR
3077 0EB8' 50          STR DMA      ;ADT7L4/ADT8H4 TO DMA BUFFER 24
3078 0EB9' 10          INC DMA      ;      DMA BUFFER TO 25
3079 0EBA' 47          LDA GPAGE     ;LOAD ADT8H8 (GP=A3); GP TO ADT8L4 (GP=A4)
3080 0EBB' FE          SHL
3081 0EBC' FE          SHL
3082 0EBD' FE          SHL
  
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3083 0EBE' FE          SHL
3084 0EBF' 50          STR DMA          ;ADT8M4/XXXX TO DMA BUFFER 25
3085 0EC0' 47          LDA GPAGE          ;LOAD ADT8L4 (GP=A4); GP TO ADT9H8 (GP=A5)
3086 0EC1' FA 0F       ANI 0FH
3087 0EC3' F1          OR
3088 0EC4' 50          STR DMA          ;ADT8L8 TO DMA BUFFER 25
3089 0EC5' 10          INC DMA          ;          DMA BUFFER TO 26
3090
3091 0EC6' 47          LDA GPAGE          ;LOAD ADT9H8 (GP=A5); GP TO ADT9L4 (GP=A6)
3092 0EC7' 50          STR DMA          ;ADT9H8 TO DMA BUFFER 26
3093 0EC8' 10          INC DMA          ;          DMA BUFFER TO 27
3094 0EC9' 47          LDA GPAGE          ;LOAD ADT9L4 (GP=A6); GP TO ADT0H8 (GP=A7)
3095 0ECA' FE          SHL
3096 0ECB' FE          SHL
3097 0ECC' FE          SHL
3098 0ECD' FE          SHL
3099 0ECE' 50          STR DMA          ;ADT9L4/XXXX TO DMA BUFFER 27
3100 0ECF' 07          LDM GPAGE          ;LOAD ADT0H8 (GP=A7)
3101 0ED0' F6          SHR
3102 0ED1' F6          SHR
3103 0ED2' F6          SHR
3104 0ED3' F6          SHR
3105 0ED4' F1          OR
3106 0ED5' 50          STR DMA          ;ADT9L4/ADT0H4 TO DMA BUFFER 27
3107 0ED6' 10          INC DMA          ;          DMA BUFFER TO 28
3108 0ED7' 47          LDA GPAGE          ;LOAD ADT0H8 (GP=A7); GP TO ADT0L4 (GP=A8)
3109 0ED8' FE          SHL
3110 0ED9' FE          SHL
3111 0EDA' FE          SHL
3112 0EDB' FE          SHL
3113 0EDC' 50          STR DMA          ;ADT0M4/XXXX TO DMA BUFFER 28
3114 0EDD' 07          LDM GPAGE          ;LD ADT0L4 (GP=A8)
3115 0EDE' FA 0F       ANI 0FH
3116 0EE0' F1          OR
3117 0EE1' 50          STR DMA          ;ADT0L8 TO DMA BUFFER 28
3118
3119
3120 ;DATA IS NOW LOADED INTO DMA BUFFER
3121 ;START RECORDER IF REC. FLG. = AC
3122
3123 0EE2' F8 00         LDI 00          ;SET DMA TO START OF BUFFER
3124 0EE4' A0           PLO DMA
3125 0EE5' F8 B2         LDI RECPLG      ;RECORD IF RECPLG = AC
3126 0EE7' A7           PLO GPAGE
3127 0EE8' 07          LDM GPAGE
3128 0EE9' FB AC        XRI 0ACH
  
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3129 0EEB' 32 F3'          BZ SDREC
3130 0EED' F8 00          LDI 00          ;IF NOT = AC, SET TO 00
3131 0EEF' 57             STR GPAGE
3132 0EFO' CO 0891'      LBR SDRET          ;      AND RETURN TO LBT
3133                      ;
3134 0EF3' E1             SDREC: SEX INTPC        ;START RECORDING AFTER
3135 0EF4' 61             OUT GROUP
3136 0EF5' 02             DB 02
3137 0EF6' 63             OUT SDREQ          ;      SENDING RECORD LENGTH
3138 0EF7' 29             DB SDLNGT
3139 0EF8' CO 0891'      LBR SDRET          ;RETURN TO LBT
3140                      ;
3141                      ;
3142                      ;*****
3143                      ;
3144                      ;***** PROM 3 *****
3145                      ;
3146                      ;
3147                      ;      ORG (HDSTRT + 1000H)
3148                      ;
3149                      ;
3150                      ;***** HELP FILE *****
3151                      ;
3152 1000'                HELP:  SCAL R6, TTY
3153 1000' 68 86          +
3154 1002' 024E'         +
3155 1004' 65 6C 70 3A   DB 'elp:'
3156 1008' CA            DB OCAH
3157 1009' 53 65 61 20   DB 'Sea Duct '
3158 100D' 44 75 63 74
3159 1011' 20
3160 1012' 56 65 72 73   DB 'Vers. '
3161 1016' 2E 20
3162 1018' 35            DB VERS
3163 1019' 2E            DB '.'
3164 101A' 39            DB REV
3165 101B' 00CA         DW OCAH
3166                      ;
3167 101D' 53 79 73 74   DB 'System Cnds:'
3168 1021' 65 6D 20 43
3169 1025' 6D 64 73 3A
3170 1029' 20 21 55 4E   DB ' !UNLOCK; !LOCK'
3171 102D' 4C 4F 43 4B
3172 1031' 3B 20 21 4C
3173 1035' 4F 43 4B
3174 1038' CA            DB OCAH
  
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3175	1039'	4D 65 6D 6F	DB 'Memory Commands:'
3176	103D'	72 79 20 43	
3177	1041'	6F 6D 6D 61	
3178	1045'	6E 64 73 3A	
3179	1049'	CA	DB OCAH
3180	104A'	20 20 21 4D	DB ' !Naaaa dd...;'
3181	104E'	61 61 61 61	
3182	1052'	20 64 64 2E	
3183	1056'	2E 2E 3B	
3184	1059'	20 3F 4D 61	DB ' ?Naaaa nnnn;'
3185	105D'	61 61 61 20	
3186	1061'	6E 6E 6E 6E	
3187	1065'	3B	
3188	1066'	20 3F 43 20	DB ' ?C (CRC)'
3189	106A'	28 43 52 43	
3190	106E'	29	
3191	106F'	CA	DB OCAH
3192	1070'	20 20 4D 20	DB ' N (Memory protect)'
3193	1074'	28 4D 65 6D	
3194	1078'	6F 72 79 20	
3195	107C'	70 72 6F 74	
3196	1080'	65 63 74 29	
3197	1084'	CA	DB OCAH
3198			
3199	1085'	43 6C 6F 63	DB 'Clock Commands:'
3200	1089'	6B 20 43 6F	
3201	108D'	6D 6D 61 6E	
3202	1091'	64 73 3A	
3203	1094'	20 3F 54 3B	DB ' ?T; '
3204	1098'	20	
3205	1099'	21 54 49 4D	DB ' !TIME DDDHHMSS @'
3206	109D'	45 20 44 44	
3207	10A1'	44 48 48 4D	
3208	10A5'	4D 53 53 20	
3209	10A9'	40	
3210	10AA'	CA	DB OCAH
3211			
3212	10AB'	50 61 73 73	DB 'Pass Thru Mode:'
3213	10AF'	20 54 68 72	
3214	10B3'	75 20 4D 6F	
3215	10B7'	64 65 3A	
3216	10BA'	20 25 50 3B	DB ' %P; %R; %X; %B'
3217	10BE'	20 25 52 3B	
3218	10C2'	20 25 58 3B	
3219	10C6'	20 25 42	
3220	10C9'	CA	DB OCAH

3221				:	
3222	10CA'	53 65 71 75			DB 'Sequencer Cnds:'
3223	10CE'	65 6E 63 65			
3224	10D2'	72 20 43 6D			
3225	10D6'	64 73 3A			
3226	10D9'	CA			DB 00CAH
3227	10DA'	20 20 3F 53			DB ' ?S; !S; !F (Follow PPC)'
3228	10DE'	3B 20 21 53			
3229	10E2'	3B 20 21 46			
3230	10E6'	20 28 46 6F			
3231	10EA'	6C 6C 6F 77			
3232	10EE'	20 50 50 43			
3233	10F2'	29			
3234	10F3'	CA			DB 0CAH
3235				:	
3236	10F4'	20 20 4D 61			DB ' Main Sequencer PPC Starts at 3000'
3237	10F8'	69 6E 20 53			
3238	10FC'	65 71 75 65			
3239	1100'	6E 63 65 72			
3240	1104'	20 50 50 43			
3241	1108'	20 53 74 61			
3242	110C'	72 74 73 20			
3243	1110'	61 74 20 33			
3244	1114'	30 30 30			
3245	1117'	CA			DB 0CAH
3246				:	
3247	1118'	53 65 61 20			DB 'Sea Duct Cnds:'
3248	111C'	44 75 63 74			
3249	1120'	20 43 6D 64			
3250	1124'	73 3A			
3251	1126'	CA			DB 0CAH
3252	1127'	20 20 3F 48			DB ' ?H; !H (Read or Set Exp. Hdg.)'
3253	112B'	3B 20 21 48			
3254	112F'	20 28 52 65			
3255	1133'	61 64 20 6F			
3256	1137'	72 20 53 65			
3257	113B'	74 20 45 78			
3258	113F'	70 2E 20 48			
3259	1143'	64 67 2E 29			
3260	1147'	CA			DB 0CAH
3261	1148'	20 20 3F 45			DB ' ?E; !E (Read or Set Exp. #)'
3262	114C'	3B 20 21 45			
3263	1150'	20 28 52 65			
3264	1154'	61 64 20 6F			
3265	1158'	72 20 53 65			
3266	115C'	74 20 45 78			


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3267 1160' 70 2E 20 23
3268 1164' 29
3269 1165' CA DB OCAH
3270 1166' 20 20 3F 42 DB ' ?B (?Buffer) '
3271 116A' 20 28 3F 42
3272 116E' 75 66 66 65
3273 1172' 72 29
3274
3275 1174' FF DB DONE
3276 1175' C0 0107' LBR PROMPT
3277
3278
3279 ;***** ? BUFFER (INSTRUMENT SPECIFIC) *****
3280
3281 1178' QUEBUF: SCAL R6, TTY ;TYPE "uffer CR,LF
3282 1178' 68 86 +
3283 117A' 024E' +
3284 117C' 20 20 57 41 DB ' WAIT...'
3285 1180' 49 54 2E 2E
3286 1184' 2E
3287 1185' CAFF DW OCAFFH
3288
3289 1187' F8 18 LDI SEC1 ; WAIT FOR SEC = 0
3290 1189' A7 PLO GPAGE
3291
3292 118A' 07 LDN GPAGE
3293 118B' FA 0F ANI 0FH
3294 118D' 3A 8A' BNZ $-03
3295
3296 118F' 17 INC GPAGE ;SET GP = CYCLES
3297 1190' 07 LDN GPAGE ; WAIT FOR CYCLES = 18
3298 1191' FB 1B XRI 1BH
3299 1193' 3A 90' BNZ $-03
3300 RLDI RD, BUFFER ;SET UP RD TO START OF
3301 1195' 68 CD +
3302 1197' 5B00 +
3303
3304
3305 ; ; SEA DATA BUFFER
3306 1199' 68 86 +
3307 119B' 024E' +
3308 119D' CA DB OCAH
3309 119E' 42 75 66 66 DB 'Buffer:'
3310 11A2' 65 72 3A
3311 11A5' CA DB OCAH
3312 11A6' 45 58 50 23 DB 'EXP# ' ;FIRST LINE:
```

3313	11AA'	20		
3314	11AB'	A1	DB 0A1H	; OUTPUT 4 BIT EXPERIMENT #
3315	11AC'	20 20	DB ' '	
3316	11AE'	A2	DB 0A2H	; OUTPUT 3 DIGIT DAYS
3317	11AF'	8D	DB 08DH	
3318	11B0'	2F	DB '/'	
3319				
3320	11B1'	8D	DB 08DH	;OUTPUT TIME
3321	11B2'	3A	DB ':'	
3322	11B3'	8D	DB 08DH	
3323	11B4'	3A	DB ':'	
3324	11B5'	8D	DB 08DH	
3325				
3326	11B6'	20 20 20 50	DB ' PPC='	;OUTPUT SEQUENCER PPC
3327	11BA'	50 43 3D		
3328	11BD'	8D	DB 08DH	
3329	11BE'	8D	DB 08DH	
3330				
3331	11BF'	CA	DB 0CAH	
3332				
3333				;SECOND LINE:
3334	11C0'	45 52 52 3D	DB 'ERR='	; ERROR WORD
3335	11C4'	8D	DB 08DH	
3336	11C5'	20 20 41 43	DB ' ACU='	; ACOUSTIC STATUS
3337	11C9'	55 3D		
3338	11CB'	8D	DB 08DH	
3339	11CC'	20 20 53 57	DB ' SW='	; SWITCH STATUS
3340	11D0'	3D		
3341	11D1'	8D	DB 08DH	
3342	11D2'	20 20 50 4F	DB ' POD='	
3343	11D6'	44 3D		
3344	11D8'	8D	DB 08DH	; RELAY POD STATUS
3345	11D9'	20 20 43 4D	DB ' CMPS='	
3346	11DD'	50 53 3D		
3347	11E0'	8DCA	DB 08DCAH	; COMPASS, CR, LF
3348				
3349				;THIRD LINE:
3350	11E2'	48 44 47 3D	DB 'HDG='	
3351	11E6'	8D	DB 08DH	; HEADING
3352	11E7'	20 20 20 50	DB ' P1='	
3353	11EB'	31 3D		
3354	11ED'	8D	DB 08DH	; PUMP 1 SPEED
3355	11EE'	20 20 50 32	DB ' P2='	
3356	11F2'	3D		
3357	11F3'	8D	DB 08DH	; PUMP 2 SPEED
3358	11F4'	20 20 43 41	DB ' CAN='	

3359	11F8'	4D 3D		
3360	11FA'	8DCA	DW 08DCAH	; CAMERA FRAME COUNT, CR, LF
3361			;	
3362			;	;FOURTH LINE:
3363	11FC'	50 49 54 43	DB 'PITCH='	
3364	1200'	48 3D		
3365	1202'	8D	DW 08DH	; PITCH
3366	1203'	20 20 52 4F	DB 'ROLL='	
3367	1207'	4C 4C 3D		
3368	120A'	008D	DW 08DH	; ROLL
3369	120C'	20 20 75 50	DB 'uP Bat='	
3370	1210'	20 42 61 74		
3371	1214'	3D		
3372	1215'	8D	DB 08DH	; COMPUTER BATTERY
3373	1216'	20 20 53 79	DB 'SysBat='	
3374	121A'	73 42 61 74		
3375	121E'	3D		
3376	121F'	8DCA	DW 08DCAH	; SYSTEM BATTERY, CR, LF
3377			;	
3378			;	;FIFTH LINE:
3379	1221'	47 4E 44 3D	DB 'GND='	
3380	1225'	8DA1	DW 08DA1H	; A/D GND REF (12BIT)
3381	1227'	20 20 52 45	DB 'REF='	
3382	122B'	46 3D		
3383	122D'	A28D	DW 0A28DH	; A/D REF (12 BIT)
3384	122F'	20 20 2B 35	DB '+5V='	
3385	1233'	56 3D		
3386	1235'	8DA1	DW 08DA1H	; A/D +5V (12 BIT)
3387	1237'	CA	DB 0CAH	; CR, LF
3388			;	
3389			;	;SIXTH LINE:
3390	1238'	58 50 4F 53	DB 'XPOS='	
3391	123C'	3D		
3392	123D'	A2	DB 0A2H	; XPOS (4 BIT)
3393	123E'	20 20 20 59	DB 'YPOS='	
3394	1242'	50 4F 53 3D		
3395	1246'	A1	DB 0A1H	; YPOS (4 BIT)
3396	1247'	20 20 20 5A	DB 'ZPOS='	
3397	124B'	50 4F 53 3D		
3398	124F'	A2CA	DW 0A2CAH	; ZPOS (4 BIT), CR, LF
3399			;	
3400			;	;SEVENTH LINE:
3401	1251'	8DA1	DW 08DA1H	; T1
3402	1253'	20	DB ' '	
3403	1254'	A28D	DW 0A28DH	; T2
3404	1256'	20	DB ' '	

3405	1257'	8DA1	DW 08DA1H	:	T3
3406	1259'	20	DB ' '		
3407	125A'	A28D	DW 0A28DH	:	T4
3408	125C'	20	DB ' '		
3409	125D'	8DA1	DW 08DA1H	:	T5
3410					
3411	125F'	2F	DB '/'	:	/
3412					
3413	1260'	A28D	DW 0A28DH	:	T6
3414	1262'	20	DB ' '		
3415	1263'	8DA1	DW 08DA1H	:	T7
3416	1265'	20	DB ' '		
3417	1266'	A28D	DW 0A28DH	:	T8
3418	1268'	20	DB ' '		
3419	1269'	8DA1	DW 08DA1H	:	T9
3420	126B'	20	DB ' '		
3421	126C'	A28D	DW 0A28DH	:	T10
3422					
3423	126E'	00FF	DW DONE	:	DONE
3424					
3425	1270'	CO 0107'	LBR PROMPT		
3426					
3427					
3428			;***** SET EXPERIMENT HEADING VALUE *****		
3429					
3430	1273'		HDGSET: SCAL R6, TTY		
3431	1273'	68 86			
3432	1275'	024E'			
3433	1277'	65 61 64 69	DB 'eading (HX) Flow from = ?'		
3434	127B'	6E 67 20 28			
3435	127F'	48 58 29 20			
3436	1283'	20 46 6C 6F			
3437	1287'	77 20 66 72			
3438	128B'	6F 6D 20 3D			
3439	128Z'	20 3F 20			
3440	1292'	03	DB 03H	:	ETX
3441	1293'	9D	DB 9DH	:	IN4D
3442	1294'	FF	DB DONE	:	DONE
3443					
3444	1295'	F8 3F	LDI HDGEXP	:	SET GPAGE TO HEADING LOCATION
3445	1297'	A7	PLO GPAGE		
3446	1298'	8D	GLO RD		
3447	1299'	57	STR GPAGE		
3448	129A'	CO 0107'	LBR PROMPT	:	RETURN TO PROMPT
3449					
3450					

```

3451 ;***** READ EXPERIMENT HEADING VALUE *****
3452 ;
3453 129D' F8 BF HDG?: LDI HDGEXP ;SET RD = HDGEXP LOCATION
3454 129F' AD PLO RD
3455 12A0' 97 GHI GPAGE
3456 12A1' BD PHI RD
3457 ;
3458 SCAL R6, TTY
3459 12A2' 68 36 +
3460 12A4' 024E' +
3461 12A6' 65 61 64 69 DB 'eading = '
3462 12AA' 6E 67 20 3D
3463 12AE' 20
3464 12AF' 8D DB SDH ;OUT HX PR
3465 12B0' 20 28 48 58 DB ' (HX)'
3466 12B4' 29
3467 12B5' FF DB DONE ;DONE
3468 12B6' C0 0107' LBR PROMPT
3469 ;
3470 ;
3471 ;***** SET EXPERIMENT NUMBER *****
3472 ;
3473 12B9' EXPSET: SCAL R6, TTY
3474 12B9' 68 36 +
3475 12BB' 024E' +
3476 12BD' 78 70 2E 20 DB 'xp. # (1 Char.) = ? '
3477 12C1' 23 20 28 31
3478 12C5' 20 43 68 61
3479 12C9' 72 2E 29 20
3480 12CD' 3D 20 3F 20
3481 12D1' 33 DB 03H ;ETX
3482 12D2' 9D DB 9DH ;IN4D
3483 12D3' 7F DB DONE ;DONE
3484 ;
3485 12D4' F8 0F LDI EXPNUM ;SET GPAGE TO EXPERIMENT NUMBER LOCATION
3486 12D6' A7 PLO GPAGE
3487 12D7' 8D GLO RD
3488 12D8' 57 STR GPAGE
3489 12D9' C0 0107' LBR PROMPT ;RETURN TO PROMPT
3490 ;
3491 ;
3492 ;***** READ EXPERIMENT NUMBER (4 BIT) *****
3493 ;
3494 12DC' F8 0F EXP?: LDI EXPNUM ;SET RD = EXPNUM LOCATION
3495 12DE' AD PLO RD
3496 12DF' 97 GHI GPAGE
  
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3497 12E0' 8D          PHI RD
3498                               ;
3499                               SCAL R6, TTY
3500 12E1' 68 86      +
3501 12E3' 024E'      +
3502 12E5' 78 70 2E 20 DB 'xp. #'
3503 12E9' 23 20
3504 12EB' A2          DB 0A2H      ;OUT LOW NIBBLE OF EXPNUM
3505 12EC' FF          DB DONE      ;DONE
3506 12ED' CO 0107'   LBR PROMPT
3507                               ;
3508                               ;
3509                               ;***** COMPASS ROUTINE *****
3510                               ;          ENTERS FROM LONG BRANCH TABLE
3511                               ;
3512 12F0' F8 18      CNPSRD: LDI SEC1      ;RUN ONLY ON SEC = X1
3513 12F2' A7          PLO GPAGE
3514 12F3' 07          LDN GPAGE
3515 12F4' FA 0F      ANI 0FH
3516 12F6' FB 01      XRI 01
3517 12F8' CA 0879'   LBNZ CMPRTN
3518 12FB' 17          INC GPAGE      ;SET GPAGE = CYCLES
3519 12FC' 07          LDN GPAGE      ;START ONLY IF CYCLES = 0A
3520 12FD' F3 0A      XRI 0AH
3521 12FF' C2 1312'   LBZ CNPPWR
3522 1302' FB 01      XRI (0BH XOR 0AH) ;READ IF CYCLES = 0B
3523 1304' CA 0879'   LBNZ CMPRTN
3524                               ;
3525 1307' E1          SEX INTPC      ;READ THE COMPASS
3526 1308' 61          OUT GROUP
3527 1309' 01          DB 01
3528 130A' F8 84      LDI CNPSS
3529 130C' A7          PLO GPAGE
3530 130D' E7          SEX GPAGE
3531 130E' 6A          INP CNPASS
3532 130F' CO 0879'   LBR CNPRTN      ;RETURN TO LBT
3533                               ;
3534 1312' E1          CNPPWR: SEX INTPC ;FIRE UP THE COMPASS
3535 1313' 61          OUT GROUP
3536 1314' 01          DB 01
3537 1315' 62          OUT CNPASS
3538 1316' 00          DB 00
3539 1317' CO 0879'   LBR CNPRTN      ;RETURN TO LBT
3540                               ;
3541                               ;
3542                               ;

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```

3543 ;***** READ SWITCH ROUTINE *****
3544 ; ENTERS FROM LONG BRANCH TABLE
3545 ;
3546 ;
3547 131A' F8 19 SWRD: LDI CYCLES ;RUNS EVERY SEC.
3548 131C' A7 PLO GPAGE
3549 131D' 07 LDN GPAGE ;START ONLY IF CYCLES = 24H
3550 131E' F8 24 XRI 024H
3551 1320' 32 37' BZ SWPWR
3552 1322' F8 01 XRI (024H XOR 025H) ;READ ONLY IF CYCLES = 24H
3553 1324' CA 087C' LBNZ SWRTN
3554 ;
3555 1327' E1 SEX INTPC
3556 1328' 61 OUT GROUP
3557 1329' 00 DB 00
3558 132A' F8 82 LDI SWSTAT ;INPUT SWITCH STATUS TO
3559 132C' A7 PLO GPAGE ; GLOBAL PAGE AT SWSTAT
3560 132D' E7 SEX GPAGE
3561 132E' 6A INP SWITCH ; Bot | | |Ins0 | | Ins4 | Ins3 | Ins2 | Ins1
3562 ;
3563 132F' E1 SEX INTPC
3564 1330' 61 OUT GROUP
3565 1331' 02 DB 02 ;TURN OFF BOTTOM SW. DRIVE PWR.
3566 1332' 67 OUT RELAYS
3567 1333' 0B DB 015Q
3568 1334' C0 087C' LBR SWRTN ;RETURN TO LBT
3569 ;
3570 1337' E1 SWPWR: SEX INTPC
3571 1338' 61 OUT GROUP ;TURN ON BOTTOM SW. DRIVE PWR.
3572 1339' 02 DB 02
3573 133A' 67 OUT RELAYS
3574 133B' 4D DB 115Q
3575 133C' C0 087C' LBR SWRTN ;RETURN TO LBT
3576 ;
3577 ;
3578 ;
3579 ;***** A/D CONTROL *****
3580 ; ENTERS FROM LONG BRANCH TABLE
3581 ;
3582 ;
3583 133F' F8 18 AD: LDI SEC1 ;RUNS ONLY ON SEC = 0
3584 1341' A7 PLO GPAGE
3585 1342' 07 LDN GPAGE
3586 1343' FA 0F ANI 0FH ;MASK FOR LO BYTE
3587 1345' CA 087F' LBNZ ADRTN ; IF NOT = 0, RETURN TO LBT
3588 1348' F8 80 LDI ADFLG ;A/D FLAG = AC?

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3589 134A' A7 PLO GPAGE
3590 134B' 07 LDN GPAGE
3591 134C' FB AC XRI OACH
3592 134E' C2 1367' LBZ ADGO
3593
3594 1351' F8 00 LDI 00 ; IF NOT AC, SET FLAG = 00
3595 1353' 57 STR GPAGE
3596 1354' F8 92 LDI AD5L4 ; AND CLEAR A/D STORAGE
3597 1356' A7 PLO GPAGE ; LOCATIONS ON GPAGE
3598 1357' E7 SEX GPAGE
3599 1358' F8 00 LDI 00
3600 135A' 73 STXD
3601 135B' 73 STXD
3602 135C' 73 STXD
3603 135D' 73 STXD
3604 135E' 73 STXD
3605 135F' 73 STXD
3606 1360' 73 STXD
3607 1361' 73 STXD
3608 1362' 73 STXD
3609 1363' 57 STR GPAGE
3610 1364' CO 087F' LBR ADRTN ; RETURN TO LBT
3611
3612 1367' F8 19 ADGO: LDI CYCLES ; IF AC, CONTINUE
3613 1369' A7 PLO GPAGE ; IF CYCLES NOT = 0,
3614 136A' 07 LDN GPAGE ; DO NOT RESET POINTERS
3615 136B' 3A 7B' BNF S+10H ; IF = 0:
3616 136D' F8 AD LDI MUXPTR ; RESET MUX LIST POINTER
3617 136F' A7 PLO GPAGE
3618 1370' F8 00' LDI LOW(MUXLST)
3619 1372' 57 STR GPAGE
3620 1373' 17 INC GPAGE ; RESET MEM LIST POINTER
3621 1374' F8 80' LDI LOW(MEMLST)
3622 1376' 57 STR GPAGE
3623 1377' F8 19 LDI CYCLES
3624 1379' A7 PLO GPAGE
3625 137A' 07 LDN GPAGE
3626
3627 137B' FP 16 SMI 16H ; IF CYCLES > 15H,
3628 137D' 3B 84' BNF S+07H ; / BORROW => DF = 0)
3629 137F' FC 00 ADI 00 ; CLR DF
3630 1381' CO 087F' LBR ADRTN ; RETURN TO LBT
3631
3632 1384' E1 SEX INTPC ; IF CYCLES < 16 ;
3633 1385' 61 OUT GROUP ; SELECT MUX GROUP
3634 1386' 02 DB 02 ; CONTROL MUX

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3635 1387' F8 AD          LDI MUXPTR      ; WITH MUX LIST
3636 1389' A7            PLO GPAGE
3637 138A' 07            LDN GPAGE
3638 138B' AA            PLO RA
3639 138C' F8 17'       LDI HIGH(MUXLST)
3640 138E' BA            PHI RA
3641 138F' EA            SEX RA
3642 1390' 62            OUT MUX          ; (OUT MUX INCREMENTS RA)
3643 1391' 62            OUT MUX
3644 1392' 8A            GLO RA          ; STORE MUX LIST ADDR
3645 1393' 57            STR GPAGE       ; AT GP = MUXPTR
3646
3647 1394' F8 19          LDI CYCLES      ;IF CYCLES < 9 :
3648 1396' A7            PLO GPAGE       ; RETURN TO LBT
3649 1397' 07            LDN GPAGE
3650 1398' FF 08          SMI 08H
3651 139A' CB 087F'      LBNF ADRTN
3652
3653 139D' 07            LDN GPAGE       ;IF CYCLES > 8 :
3654 139E' F6            SHR
3655 139F' 33 A4'        BDF $+5
3656 13A1' CO 087F'      LBR ADRTN      ; RETURN TO LBT ON EVEN CYCLES
3657
3658 13A4' F8 AE          LDI MEMPTR      ; ON ODD CYCLES :
3659 13A6' A7            PLO GPAGE       ; READ A/D AND STORE AT
3660 13A7' 07            LDN GPAGE       ; GPAGE LOCATION REFERENCED
3661 13A8' AA            PLO RA          ; BY MEMLST
3662 13A9' 0A            LDN RA
3663 13AA' A7            PLO GPAGE
3664 13AB' E7            SEX GPAGE
3665 13AC' 6B            INP ADH18      ; X=GPAGE; HI 8 BITS TO
3666 13AD' 1A            INC RA          ; GPAGE STORAGE
3667 13AE' 0A            LDN RA
3668 13AF' A7            PLO GPAGE
3669 13B0' 6A            INP ADL04      ; LO 8 BITS TO NULL LOCATION
3670 13B1' 1A            INC RA
3671 13B2' F8 AE          LDI MEMPTR      ;STORE MEM LIST POINTER
3672 13B4' A7            PLO GPAGE       ; ON GPAGE AT MEMPTR
3673 13B5' 8A            GLO RA
3674 13B6' 57            STR GPAGE
3675 13B7' CO 087F'      LBR ADRTN      ;RETURN TO LBT
3676
3677
3678 ;***** TRANSMISSOMETER CONTROL *****
3679 ; ENTERS FROM LONG BRANCH TABLE
3680 ;
  
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3681 13BA' E1          TR:  SEX INTPC      ;TR FLAG = AC?
3682 13BB' F8 B1      LDI TRFLG
3683 13BD' A7         PLO GPAGE
3684 13BE' 07         LDN GPAGE
3685 13BF' FB AC      XRI OACH      ;IF = AC, GO TO TRCY02
3686 13C1' C2 13EF'   LBZ TRCY02
3687                   ;
3688 13C4' F8 18      LDI SEC1
3689 13C6' A7         PLO GPAGE      ; SEC =1 ?
3690 13C7' 07         LDN GPAGE
3691 13C8' FA 0F      ANI OFH
3692 13CA' FB 01      XRI 01          ; IF SEC NOT = X1
3693 13CC' CA 0882'   LBZ TRRTN      ; RETURN TO LBT
3694                   ;
3695 13CF' 17         INC GPAGE      ; CYCLES = 03 ?
3696 13D0' 07         LDN GPAGE
3697 13D1' FB 03      XRI 03H        ; IF CYCLES NOT = 03
3698 13D3' CA 0882'   LBZ TRRTN      ; RETURN TO LBT
3699                   ;
3700 13D6' 61         OUT GROUP      ; SELECT RELAYS GROUP
3701 13D7' 02         DB 02
3702 13D8' 67         OUT RELAYS
3703 13D9' 04         DB 04H        ; TRANSMISSOMTER PWR OFF
3704 13DA' F8 B1      LDI TRFLG
3705 13DC' A7         PLO GPAGE      ; SET TRFLG = 30
3706 13DD' F8 00      LDI 00
3707 13DF' 57         STR GPAGE
3708                   ;
3709 13E0' F8 A8      LDI ADTOLA    ; CLEAR TRANSMISSOMETER
3710 13E2' A7         PLO GPAGE      ; A/D LOCATIONS ON GPAGE
3711 13E3' E7         SEX GPAGE
3712 13E4' F8 00      LDI 00
3713 13E6' 73         STXD
3714 13E7' 87         GLO GPAGE
3715 13E8' FF 95      SMI ADT1H8
3716 13EA' 33 E4'    BDF $-06H
3717 13EC' C0 0882'   LBR TRRTN      ; RETURN TO LBT
3718                   ;
3719 13EF' F8 19      TRCY02: LDI CYCLES ;CYCLES = 2?
3720 13F1' A7         PLO GPAGE
3721 13F2' 07         LDN GPAGE
3722 13F3' FB 02      XRI 02H
3723 13F5' CA 13FF'   LBZ TRCY17    ; IF NOT = 2, GO TO TRCY17
3724 13F8' 61         OUT GROUP      ; IF = 2:
3725 13F9' 02         DB 02          ; SELECT RELAYS GROUP
3726 13FA' 67         OUT RELAYS
  
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3727 13FB' 44 DB 104Q ; TRANSMISSOMETER PWR ON
3728 13FC' C0 0882' LBR TRRTN ; RETURN TO LBT
3729 ;
3730 13FF' FB 15 TRCY17: XRI (02H XOR 17H) ;CYCLES = 17?;IF NO GO TO TRCY18
3731 1401' 3A 0A' BNZ TRCY18 ; IF = 17:
3732 1403' 61 OUT GROUP ; SELECT MUX GROUP
3733 1404' 02 DB 02H ; ( R(X)= INTPC )
3734 1405' 62 OUT MUX ; A/D = PWR ON
3735 1406' 72 DB 72H ; MUX = TRANSMISSOMETER
3736 1407' C0 0882' LBR TRRTN ; RETURN TO LBT
3737 ;
3738 140A' FB 0F TRCY18: XRI (17H XOR 18H) ;CYCLES = 19?
3739 140C' CA 1418' LBNZ TRCY19 ; IF NOT, GO TO TRCY19
3740 140F' 61 OUT GROUP ; IF CYCLES = 18
3741 1410' 02 DB 02H ; SELECT MUX GROUP
3742 1411' 62 OUT MUX ; A/D = START CNVRT
3743 1412' 73 DB 73H ; MUX = TRANSMISSOMETER
3744 1413' 62 OUT MUX
3745 1414' 72 DB 72H ; A/D = PWR ON
3746 1415' C0 0882' LBR TRRTN ; GO TO LBT
3747 ;
3748 1418' FB 01 TRCY19: XRI (18H XOR 19H) ;CYCLES = 19H?
3749 141A' CA 0882' LBNZ TRRTN ; IF NOT RETURN TO LBT
3750 141D' 27 DEC GPAGE ; IF = 19: SET GP-> SEC1
3751 141E' 07 LDM GPAGE ; LOOK AT SEC1
3752 141F' FA 0F ANI 0FH ; IF 0, STORE A/D AT GP = ADT0H8, ADT0L4
3753 1421' 3A 27' BNZ $+06
3754 1423' F8 A7 LDI ADT0H8
3755 1425' 30 2B' BR $+06H
3756 1427' 07 LDM GPAGE ;IF SEC1 NOT = 0; LOAD SEC.
3757 1428' FE SHL ; SEC. * 2
3758 1429' FC 93 ADI (ADT1H8)-02H ; STORE A/D HI 8 BITS AT
3759 142B' A7 PLO GPAGE ; GP= 2(SEC1) + ADT1H8 - 02H
3760 142C' 21 SEX INTPC
3761 142D' 61 OUT GROUP
3762 142E' 02 DB 02
3763 142F' E7 SEX GPAGE
3764 1430' 6B INP ADH18
3765 1431' 60 IRX ; STORE A/D LO 4 BITS AT
3766 1432' 6A INP ADL04 ; GP= 2(SEC1) + ADT1H8 - 01H
3767 1433' E1 SEX INTPC
3768 1434' 61 OUT GROUP ;SELECT MUX GROUP
3769 1435' 02 DB 02 ; A/D = ON
3770 1436' 62 OUT MUX ; MUX = PENDULUM 1
3771 1437' 00 DB 00
3772 1438' C0 0882' LBR TRRTN ;RETURN TO LBT

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3773 ;
3774 ;
3775 ; ***** RELAY POD AND ACOUSTIC LINK CHECK *****
3776 ; ***** RUNS EACH SEC. ON CYCLE = 27H *****
3777 ;
3778 143B' F8 19 PDCHK: LDI CYCLES ;RUN ONLY ON CYCLE 27H 39 dec. (Last cycle)
3779 143D' A7 PLO GPAGE
3780 143E' 07 LDN GPAGE
3781 143F' F8 27 XRI 27H
3782 1441' CA 0885' LBNZ PDRTN ;RETURN TO LBT IF CYCLE NOT = 27H
3783 ;
3784 1444' F8 18 LDI SEC1 ;IF Sec = n0, reset PDSTAT, ACSTAT
3785 1446' A7 PLO GPAGE
3786 1447' 07 LDN GPAGE
3787 1448' FA 0F ANI 0FH
3788 144A' CA 145F' LBNZ PDSTR ; If SEC. not = n0, GO TO PDSTR
3789 ;
3790 144D' E1 PDCLR: SEX INTPC
3791 144E' 61 OUT GROUP ; SET RELAY GROUP
3792 144F' 02 DB 02 ; GROUP 2
3793 1450' F8 83 LDI PDSTAT ;CLEAR POD STATUS (Sec.=n9)
3794 1452' A7 PLO GPAGE
3795 1453' F8 00 LDI 00
3796 1455' 57 STR GPAGE
3797 ;
3798 1456' E1 ACUCLR: SEX INTPC
3799 1457' 61 OUT GROUP ; SET GROUP 0
3800 1458' 00 DB 00
3801 1459' F8 81 LDI ACSTAT ;CLEAR ACOUSTIC STATUS (Sec.=n9)
3802 145B' A7 PLO GPAGE
3803 145C' F8 00 LDI 00
3804 145E' 57 STR GPAGE
3805 ;
3806 145F' E1 PDSTR: SEX INTPC ;CHECK RELAY PODS FOR ACTIVE RELAYS
3807 1460' 61 OUT GROUP ; SET RELAY GROUP
3808 1461' 02 DB 02 ; GROUP 2
3809 ;
3810 1462' F8 83 LDI PDSTAT
3811 1464' A7 PLO GPAGE
3812 1465' E2 SEX STACK ;Input POD STATUS
3813 1466' 6F INP RELAYS
3814 1467' E7 SEX GPAGE
3815 1468' F1 OR ;OR with existing data
3816 1469' 57 STR GPAGE ;store in PDSTAT on GPAGE
3817 ;
3818 ;
  
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3819 146A' E1 ACSTR: SEX INTPC ;CHECK ACOUSTIC LINK FOR ACTIVE INPUT
3820 146B' 61 OUT GROUP ; SET GROUP 0
3821 146C' 00 DB 00
3822 ;
3823 146D' F8 81 LDI ACSTAT
3824 146F' A7 PLO GPAGE
3825 1470' E2 SEX STACK ;INPUT ACOUSTIC LINK
3826 1471' 6F INP PING
3827 1472' E7 SEX GPAGE
3828 1473' F1 OR ;OR W/ EXISTING DATA
3829 1474' 57 STR GPAGE ;STORE IN ACSTAT ON GPAGE
3830 ;
3831 ;
3832 1475' C0 0885' LBR PDRTN ;RETURN TO LBT
3833 ;
3834 ;
3835 ;***** READ HEADING *****
3836 ; ENTERS FROM LONG BRANCH TABLE
3837 ;
3838 1478' F8 B3 HDGCHK: LDI HDGFLG ;CHECK HDG FLAG STATUS:
3839 147A' A7 PLO GPAGE ; AC = TURN ON HEADING INDICATOR PWR
3840 147B' 07 LDN GPAGE ; ( USED BY SEQUENCER FOR FAST READ
3841 147C' FB AC XRI OACH ; DURING ROTATION )
3842 147E' C2 149C' LBZ HDG1B
3843 ; ELSE = TURN ON PWR AT CYC=1B (SEC = x9)
3844 ; READ XYZ AT CYC=1C AND TURN OFF PWR
3845 ; SET XYZ FLG = 00
3846 ;
3847 1481' F8 00 LDI 00 ;Force HDG Flag = 00
3848 1483' 57 STR GPAGE
3849 1484' F8 18 LDI SEC1 ;Run Slow only on Sec =9
3850 1486' A7 PLO GPAGE
3851 1487' 07 LDN GPAGE
3852 1488' FB 09 XRI 09H
3853 148A' CA 14A1' LBWZ HDGXT
3854 ;
3855 148D' F8 19 HDGSLO: LDI CYCLES ;Check cycle
3856 148F' A7 PLO GPAGE
3857 1490' 07 LDN GPAGE
3858 1491' FB 1B XRI 1BH
3859 1493' C2 149C' LBZ HDG1B ; If CYC = 1B go to HDG1B
3860 1496' FB 07 XRI (1BH XOR 1CH)
3861 1498' 32 A4' BZ HDG1C ; If CYC = 1C go to HDG1C
3862 149A' 30 A1' BR HDGXT ; If not 1B or 1C return to LBT
3863 ;
3864 ;

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3865 149C' E1 HDG1B: SEX INTPC ;SET GROUP 02
3866 149D' 61 OUT GROUP
3867 149E' 02 DB 02
3868 149F' 67 OUT RELAYS ;TURN ON HEADING INDICATOR PWR
3869 14A0' 41 DB 101Q
3870 14A1' CO 0888' HDGXT: LBR HDGRTN
3871 ;
3872 ;
3873 14A4' E2 HDG1C: SEX STACK
3874 SCAL R6, HDGIN ;READ IN THE HEADING
3875 14A5' 68 86 +
3876 14A7' 14B1' +
3877 ;
3878 14A9' E1 SEX INTPC ;SET GROUP 02
3879 14AA' 61 OUT GROUP
3880 14AB' 02 DB 02
3881 14AC' 67 OUT RELAYS ;TURN OFF HEADING INDICATOR PWR
3882 14AD' 01 DB 01Q
3883 14AE' CO 14A1' LBR HDGXT
3884 ;
3885 ;
3886 ;*** SUBROUTINE - INPUT HEADING ***
3887 ;
3888 ; ** CALLED BY THIS ROUTINE AND EXT. SEQUENCER ROTATION ROUTINE **
3889 ;
3890 14B1' E1 HDGIN:: SEX INTPC
3891 14B2' 61 OUT GROUP
3892 14B3' 01 DB 01
3893 14B4' 63 OUT HLATCH ;LATCH DATA IN ENCODER
3894 14B5' 00 DB 00 ;NULL DATA
3895 RLDI RA ,0008H ;SHIFT IN DATA TO I/O BOARD
3896 14B6' 68 CA +
3897 14B8' 0008 +
3898 ;
3899 14BA' 64 HDGAGN: OUT HSHIFT ;SEND SHIFT PULSE
3900 14BB' 00 DB 00
3901 14BC' C4 NOP ;SMALL DELAY
3902 14BD' C4 NOP
3903 14BE' 2A DEC RA
3904 14BF' 8A GLO RA
3905 14C0' 3A BA' BNZ HDGAGN ;ANOTHER SHIFT PULSE?
3906 ;
3907 14C2' F8 85 LDI HDG ;INPUT HEADING
3908 14C4' A7 PLO GPAGE
3909 14C5' E7 SEX GPAGE
3910 14C6' 6C INP HEADNG

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3911 ;
3912 14C7' E2 SEX STACK
3913 SRET R6
3914 14C8' 68 96 +
3915 ;
3916 ;
3917 ;
3918 ;***** RELAY DRIVER PULSE ROUTINE *****
3919 ;
3920 14CA' F8 40 PULCHK: LDI PULFLG
3921 14CC' A7 PLO GPAGE
3922 14CD' 07 LDN GPAGE ;Pulse flag = AC
3923 14CE' FB AC XRI OACH
3924 14D0' 3A E8' BNZ PSET00 ;If not, set to 00
3925 14D2' 17 INC GPAGE ; SET GPAGE = PULCNT
3926 14D3' 07 LDN GPAGE
3927 14D4' 32 E8' BZ PSET00
3928 14D6' FF 01 SMI 01 ;DECREMENT THE PULSE COUNTER
3929 14D8' 57 STR GPAGE ; AND STORE IT
3930 14D9' E1 SEX INTPC
3931 14DA' 61 OUT GROUP ;SET RELAYS GROUP
3932 14DB' 02 DB 02
3933 14DC' 17 INC GPAGE
3934 14DD' E7 SEX GPAGE
3935 14DE' 07 LDN GPAGE
3936 14DF' FA 3F ANI 077Q ;Mask Relay #
3937 14E1' F9 40 ORI 100Q ; Set Relay Data Bit = ON
3938 14E3' 57 STR GPAGE
3939 14E4' 67 OUT RELAYS ; Turn on the Relay driver
3940 14E5' C0 14FD' LBR PULXT ;EXIT THE ROUTINE
3941 ;
3942 14E8' E1 PSET00: SEX INTPC
3943 14E9' 61 OUT GROUP ;SET RELAYS GROUP
3944 14EA' 02 DB 02
3945 14EB' F8 42 LDI PULNUM
3946 14ED' A7 PLO GPAGE
3947 14EE' E7 SEX GPAGE
3948 14EF' 07 LDN GPAGE
3949 14F0' FA 3F ANI 077Q ;Set Relay Data Bit = OFF
3950 14F2' 57 STR GPAGE
3951 14F3' 67 OUT RELAYS ;Turn Off the Relay Driver
3952 ;
3953 14F4' 27 DEC GPAGE ;SET GPAGE = PULNUM
3954 14F5' F8 FF LDI OFFH
3955 14F7' E7 SEX GPAGE
3956 14F8' 73 STXD ;Set PULNUM = FF (FF IS NOT USED)
  
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3957 14F9' F8 00          LDI 00
3958 14FB' 73            STXD          ;Set PULCNT = 00
3959 14FC' 57            STR GPAGE     ;Set PULFLG = 00
3960 14FD' C0 088B'     PULXT: LBR PULRTM ;EXIT THE ROUTINE
3961 ;
3962 ;
3963 ;***** READ XYZ POSITION *****
3964 ; ENTERS FROM LONG BRANCH TABLE
3965 ;
3966 1500' F8 B4          XYZCHK: LDI XYZFLG ;CHECK XYZ FLAG STATUS
3967 1502' A7            PLO GPAGE ; AC = TURN ON OPTO INTERRUPTER PWR
3968 1503' 07            LDN GPAGE ; ( USED BY SEQUENCER FOR FAST READ
3969 1504' FB AC          XRI OACH ; DURING XYZ POSITIONING)
3970 1506' C2 1525'     LBZ XYZON ; ELSE = TURN ON PWR AT CYC=24 (SEC = x9)
3971 ; ; READ XYZ AT CYC=25 AND TURN OFF PWR
3972 ; ; SET XYZ FLG = 00
3973 ; ; ****!! NOTE:
3974 ; ; **** CYCLE 25 CURRENTLY MUST LEAVE PWR ON
3975 ; ; DUE TO HDWR. BUG *****
3976 ;
3977 1509' F8 00          LDI 00          ;FORCE XYZFLG = 00
3978 150B' 57            STR GPAGE
3979 150C' F8 18          LDI SEC1        ;CHECK FOR SEC = x9
3980 150E' A7            PLO GPAGE
3981 150F' 07            LDN GPAGE
3982 1510' FB 09          XRI 09H
3983 1512' CA 1522'     LBNZ XYZXT        ;IF NOT = x9, EXIT
3984 1515' F8 19          LDI CYCLES
3985 1517' A7            PLO GPAGE
3986 1518' 07            LDN GPAGE
3987 1519' FB 24          XRI 24H
3988 151B' C2 1525'     LBZ XYZON
3989 151E' FB 01          XRI (24H XOR 25H)
3990 1520' 32 2C'       BZ XYZIN
3991 1522' C0 088E'     XYZXT: LBR XYZRTM
3992 ;
3993 1525' E1            XYZON: SEX INTPC
3994 1526' 61            OUT GROUP
3995 1527' 02            DB 32
3996 1528' 67            OUT RELAYS
3997 1529' 4C            DB 114Q        ;TURN ON OPTO INTERRUPTER PWR
3998 152A' 30 22'       BR XYZXT
3999 ;
4000 152C' E1            XYZIN: SEX INTPC
4001 152D' 61            OUT GROUP
4002 152E' 00            DB 00
  
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4003 152F' E7 SEX GPAGE
4004 1530' F8 93 LDI XPOS
4005 1532' A7 PLO GPAGE
4006 1533' 6B INP X ;INPUT X POSITION
4007 1534' FA 0F ANI 0FH ;MASK UNUSED BITS
4008 1536' 57 STR GPAGE
4009 1537' 17 INC GPAGE ;GPAGE => YX POSITION
4010 1538' 6C INP YZ
4011 ;
4012 1539' E1 SEX INTPC
4013 153A' 61 OUT GROUP
4014 153B' 02 DB 02
4015 153C' 67 OUT RELAYS
4016 153D' 4C DB 114Q ;TURN OFF OPTO INTERRUPTER PWR
4017 ; ;*** NOTE !!! PWR IS KEPT ON -- DUE TO HDWR. BUG ***
4018 153E' 30 22' BR XYZXT
4019 ;
4020 ;
4021 ;
4022 ;***** PASS THRU MODE *****
4023 ;
4024 ;
4025 1540' F8 0A PTHRU: LDI GRPSAV ;PWR UP LOOP 2
4026 1542' A7 PLO GPAGE
4027 1543' F8 02 LDI 02 ; STORE NEW I/O GROUP
4028 1545' 57 STR GPAGE
4029 1546' E7 SEX GPAGE
4030 1547' 61 OUT GROUP
4031 1548' E3 SEX PC
4032 1549' 67 OUT RELAYS ;POWER UP LOOP2
4033 154A' 40 DB 100Q
4034 154B' 27 DEC GPAGE
4035 154C' F8 06 LDI UARTS
4036 154E' 57 STR GPAGE
4037 154F' E7 SEX GPAGE
4038 1550' 61 OUT GROUP ;RESET UART I/O GROUP
4039 ;
4040 1551' F8 02 LDI PLEVEL ;SET PASS LEVEL = 01
4041 1553' A7 PLO GPAGE
4042 1554' F8 01 LDI 01
4043 1556' 57 STR GPAGE
4044 ;
4045 1557' E2 SEX STACK
4046 SCAL R6, DELAY2 ;WAIT FOR LOOP 2 POWER TO SETTLE
4047 1558' 68 86 +
4048 155A' 019B' +
  
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4049                                     SCAL R6, DELAY2 ; AND UARTS TO CLEAR BREAK
4050 155C' 68 86 +
4051 155E' 019B' +
4052                                     SCAL R6, DELAY2
4053 1560' 68 86 +
4054 1562' 019B' +
4055 ;
4056 1564' E2 RADDR2: SEX STACK ;CLEAR ANY DATA FROM LOOP 2
4057 1565' 6C INP DATA2
4058 1566' F8 FE LDI IOLOC ;XMIT '#' ON LOOP 2
4059 1568' A7 PLO GPAGE
4060 1569' F8 23 LDI '#'
4061 156B' 57 STR GPAGE
4062 SCAL R6, XMTLP2
4063 156C' 68 86 +
4064 156E' 167D' +
4065 1570' E2 DA1: SEX STACK
4066 1571' 6B INP STAT1 ;CHECK FOR DA1
4067 1572' F6 SHR ;DA1?
4068 1573' 3B 93' BNF DA2 ;IF NOT GO TO DA2
4069 1575' FA 06 ANI 06H ;IF DA1, MASK AND CHECK PE,OE
4070 1577' 32 7C' BZ KEEP3
4071 1579' 6A INP DATA1 ;CLEAR BAD DATA
4072 157A' 30 93' BR DA2
4073 ;
4074 157C' F8 FE KEEP3: LDI IOLOC
4075 157E' A7 PLO GPAGE
4076 157F' E7 SEX GPAGE
4077 1580' 6A INP DATA1
4078 1581' FA 7F ANI 7FH ;MASK MSB
4079 1583' 57 STR GPAGE
4080 1584' FB 23 XRI '#' ;IS IT # ?
4081 1586' C2 00AB' LBZ IOERR
4082 1589' FB 06 XRI ('#' XOR '#') ;IS IT # ?
4083 158B' C2 160A' LBZ PNODE
4084 158E' E2 PNODEX: SEX STACK
4085 SCAL R6, XMTLP2
4086 158F' 68 86 +
4087 1591' 167D' +
4088 ;
4089 ;
4090 1593' 6D DA2: INP STAT2
4091 1594' F6 SHR ;DA2 ?
4092 1595' C3 15B8' LBDF DA2YES ;IF NOT, CHECK ES LOOP 2
4093 1598' FB 08 XRI 08H ;IF ES LOOP 2,
4094 159A' C2 163E' LBZ PASSBR ; GO TO PASS BREAK

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4095 159D' 30 70'          BR DAI          ;IF NOT GO TO DAI
4096                               ;
4097 159F' 6D              DA2MOR: INP STAT2
4098 15A0' F6              SHR              ;DA2?
4099 15A1' C3 1598'        LBDP DA2YES  ;IF NOT, CHECK ES LOOP 2
4100 15A4' FB 08          XRI 08H      ;IF ES LOOP 2,
4101 15A6' C2 163E'        LBZ PASSBR    ;          GO TO PASS BREAK
4102 15A9' 1C              INC RC        ;IF NOT, INC TIME OUT LOOP
4103 15AA' 9C              GHI RC
4104 15AB' FB 02          XRI 02        ;IF NOT 512 LOOPS (2 CHAR),
4105 15AD' CA 159F'        LBNZ DA2MOR  ;LOOK FOR MORE DATA ON 2
4106 15B0' E2              SEX STACK
4107                               SCAL R6, TSRE? ;IF 512, WAIT FOR TSRE AND
4108 15B1' 68 86          +
4109 15B3' 02F0'          +
4110 15B5' C0 1570'        LBR DAI          ;          GO TO DAI
4111                               ;
4112 15B8' FA 06          DA2YES: ANI 06H  ;MASK FOR FE, PE
4113 15BA' CA 163E'        LBNZ PASSBR  ;IF FE OR PE, GO TO PASS BREAK
4114 15BD' F8 00          LDI 00
4115 15BF' 3C              PHI RC
4116 15C0' AC              PLO RC
4117 15C1' F8 FE          LDI IOLOC   ;IF DATA IS OK, INPUT DATA
4118 15C3' A7              PLO GPAGE    ;          ON LOOP 2          TO I/O LOCATION
4119 15C4' E7              SEX GPAGE
4120 15C5' 6C              INP DATA2
4121 15C6' FA 7F          ANI 7FH      ;MASK MSB
4122 15C8' 57              STR GPAGE
4123 15C9' FB 03          XRI 03      ;IS IT ETX ?
4124 15CB' C2 15E2'        LBZ PMT2     ;IF ETX, ADD A PROMPT
4125                               ;
4126 15CE' E2              NOTETX: SEX STACK  ;IF DATA LOOP 2 IS NOT ETX:
4127 15CF' 6B              INP STAT1   ;CHECK FE, PE ON LOOP 1
4128 15D0' FA 9C          ANI 0CH
4129 15D2' CA 00AB'        LBNZ ICERR  ;BRANCH IF ERROR
4130 15D5' 02              LDN STACK
4131 15D6' FE              SHL          ;WAIT FOR THRE LOOP 1
4132 15D7' CB 15CE'        LBNF NOTETX
4133 15DA' E7              SEX GPAGE
4134 15DB' 62              OUT DATA1  ;IN LOOP 2 -> OUT LOOP 1
4135 15DC' 27              DEC GPAGE
4136 15DD' FC 00          ADI 00      ;CLEAR DF
4137 15DF' C0 159F'        LBR DA2MOR  ;GO TO DA2MOR
4138                               ;
4139 15E2' E2              PMT2:  SEX STACK  ;IF DATA LOOP 2 = ETX:
4140 15E3' 6B              INP STAT1   ;CHECK FE, PE ON LOOP 1

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4141 15E4' FA OC ANI OCH
4142 15E6' CA 00AB' LBNZ IOERR ;BRANCH IF ERROR
4143 15E9' 02 LDN STACK
4144 15EA' FE SHL ;WAIT FOR THREE LOOP 1
4145 15EB' 3B E2' BNF PMT2
4146 15ED' E3 SEX PC
4147 15EE' 62 OUT DATA1 ;OUTPUT PROMPT CHAR. ON LOOP 1
4148 15EF' 3A DB PMTCHR
4149 15FO' FC 00 ADI 00H ;CLEAR DF
4150 15F2' E2 SEX STACK
4151 15F3' 6B XMTETX: INP STAT1 ;CHECK FE, PE ON LOOP 1
4152 15F4' FA OC ANI OCH
4153 15F6' CA 00AB' LBNZ IOERR ;BRANCH IF ERROR
4154 15F9' 02 LDN STACK
4155 15FA' FE SHL ;WAIT FOR THREE LOOP 1
4156 15FB' 3B F3' BNF XMTETX
4157 15FD' E7 SEX GPAGE
4158 15FE' 62 OUT DATA1 ;IN LOOP 2 -> OUT LOOP 1
4159 15FF' 27 DEC GPAGE
4160 1600' FC 00 ADI 00 ;CLEAR DF
4161 1602' E2 SEX STACK
4162 SCAL R6, TSRE? ;WAIT TSRE1 AND CLEAR ECHO 1
4163 1603' 68 86 -
4164 1605' 02F0' +
4165 1607' C0 1570' LBR DA1 ;GO TO DA1
4166 ;
4167 ;
4168 ;
4169 160A' E2 PMODE: SEX STACK
4170 SCAL R6, ITB ;PMODE ENTERED WHEN LOOP 1 = 'A'
4171 160B' 68 86 +
4172 160D' 022E' +
4173 160F' 50 DB 'P'
4174 1610' 161P' DW PINC ;OPEN THE NEXT LOWER LEVEL
4175 1612' 52 DB 'R'
4176 1613' 1564' DW RADDR2 ;READDRESS THE CURRENT LEVEL
4177 1615' 42 DB 'B'
4178 1616' 163E' DW PASSBR ;SEND BREAK ON LOOP 2
4179 1618' 58 DB 'X'
4180 1619' 1658' DW PDEC ;DROP THE LOWEST LEVEL
4181 161B' FF DB DONE
4182 161C' C0 158E' LBR PMODEX
4183 ;
4184 ;
4185 161F' F8 02 PINC: LDI PLEVEL ;INCREMENT PASS LEVEL
4186 1621' A7 PLO GPAGE
  
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4187	1622'	07		LDN GPAGE	
4188	1623'	FC 01		ADI 01H	
4189	1625'	57		STR GPAGE	
4190	1626'	F8 FE		LDI IOLOC	
4191	1628'	A7		PLO GPAGE	
4192	1629'	F8 25		LDI 'N'	
4193	162B'	57		STR GPAGE	
4194	162C'	E2		SEX STACK	
4195				SCAL R6, XMTLP2	
4196	162D'	68 86	+		
4197	162F'	167D'	+		
4198	1631'	F8 FE		LDI IOLOC	
4199	1633'	A7		PLO GPAGE	
4200	1634'	F8 50		LDI 'P'	
4201	1636'	57		STR GPAGE	
4202				SCAL R6, XMTLP2	
4203	1637'	68 86	+		
4204	1639'	167D'	+		
4205	163B'	CO 1593'		LBR DA2	
4206					
4207					
4208	163E'	F8 02		PASSBR: LDI PLEVEL	;CLEAR PASS LEVEL
4209	1640'	A7		PLO GPAGE	
4210	1641'	F8 00		LDI 00	
4211	1643'	57		STR GPAGE	
4212				SEX STACK	
4213				SCAL R6, XMTBR2	;BREAK LOOP 2 (NOT USED WITH LOOP2
4214					; PWR CONTROL SYSTEM)
4215	1644'	F8 0A		LDI GRPSAV	
4216	1646'	A7		PLO GPAGE	
4217	1647'	F8 02		LDI 02	
4218	1649'	57		STR GPAGE	
4219	164A'	E7		SEX GPAGE	
4220	164B'	61		OUT GROUP	
4221	164C'	E3		SEX PC	
4222	164D'	67		OUT RELAYS	;LOOP2 POWER OFF
4223	164E'	00		DB 00	
4224	164F'	27		DEC GPAGE	;RESET UART GROUP
4225	1650'	57		SEX GPAGE	
4226	1651'	F8 06		LDI UARTS	
4227	1653'	57		STR GPAGE	
4228	1654'	61		OUT GROUP	
4229	1655'	CO 0107'		LBR PROMPT	;EXIT PASS THRU MODE TO PROMPT
4230					
4231					
4232	1658'	F8 02		PDEC: LDI PLEVEL	

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4233 165A' A7 PLO GPAGE
4234 165B' 07 LDN GPAGE
4235 165C' FB 01 XRI 01 ;IS P LEVEL 01 ?
4236 165E' C0 163E' LBR PASSBR ; IF SO, BREAK LOOP 2
4237 1661' 07 LDN GPAGE
4238 1662' FF 01 SMI 01 ; IF NOT, DECREMENT PASS LEVEL
4239 1664' 57 STR GPAGE
4240 1665' F8 FE LDI IOLOC
4241 1667' A7 PLO GPAGE
4242 1668' F8 25 LDI 'X' ;OUTPUT X ON LOOP 2
4243 166A' 57 STR GPAGE
4244 166B' E2 SEX STACK
4245 SCAL R6, XMTLP2
4246 166C' 68 86 +
4247 166E' 167D' +
4248 1670' F8 FE LDI IOLOC
4249 1672' A7 PLO GPAGE ;OUTPUT X ON LOOP 2
4250 1673' F8 58 - LDI 'X'
4251 1675' 57 STR GPAGE
4252 SCAL R6, XMTLP2
4253 1676' 68 86 +
4254 1678' 167D' +
4255 167A' C0 1593' LBR DA2 ;GO TO DA2
4256 ;
4257 ;
4258 ;***** XMIT LOOP 2 *****
4259 ;
4260 167D' F8 FE XMTLP2: LDI IOLOC
4261 167F' A7 PLO GPAGE
4262 1680' E7 SEX GPAGE
4263 1681' F0 LDX
4264 1682' AA PLO RA ;ALSO PUT IT IN RA
4265 1683' 64 OUT DATA2 ;OUTPUT CHARACTER LOOP 2
4266 1684' 27 DEC GPAGE
4267 1685' E2 SEX STACK
4268 1686' 5C INP DATA2 ;CLEAR DA
4269 1687' 6D WAIT6: INP STAT2
4270 1688' FA C0 ANI 0COH ;MASK FOR THRE & TSRE
4271 168A' FB C0 XRI 0COH
4272 168C' 3A 87' BRZ WAIT6
4273 SCAL R6, DELAY2 ;2 BIT DELAY
4274 168E' 68 86 +
4275 1690' 019B' +
4276 1692' E7 SEX GPAGE
4277 1693' 6C INP DATA2 ;INPUT ECHOED CHAR
4278 1694' FA 7F ANI 07FH ;MASK MSB

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4279 1696' 57 STR GPAGE
4280 1697' 8A GLO RA ;COMPARE WITH XMIT CHAR
4281 1698' F3 XOR
4282 1699' CA 163E' LBNZ PASSBR ;BREAK IF ECHO WAS BAD
4283 169C' E2 SEX STACK
4284 SRET R6
4285 169D' 68 96 +
4286 ;
4287 ;
4288 ;
4289 ;***** XMITBR2 *****
4290 ; ( BREAK LOOP 2)
4291 ;
4292 169F' F8 0A XMTBR2: LDI GRPSAV ;SELECT UART I/O GROUP
4293 16A1' A7 PLO GPAGE ; AND STORE ON GLOBAL PAGE
4294 16A2' F8 06 LDI UARTS
4295 16A4' 57 STR GPAGE
4296 16A5' E7 SEX GPAGE
4297 16A6' 61 OUT GROUP
4298 16A7' E3 SEX PC
4299 16A8' 65 OUT CNTRL2 ;BREAK LOOP 2
4300 16A9' 52 DB (40H OR FORNT1)
4301 16AA' F8 7D LDI BR2CNT
4302 16AC' A7 PLO GPAGE
4303 16AD' F8 0A LDI OAH ;OA = 250 mSEC. (10 INTERRUPT CYCLES)
4304 16AF' 57 STR GPAGE
4305 16B0' E2 SEX STACK
4306 SRET R6
4307 16B1' 68 96 +
4308 ;
4309 ;
4310 ;
4311 ;*****
4312 ORG (HELP + 700H)
4313 ; ; MUX AND A/D CONTROL
4314 ;
4315 1700' 0000 MUXLST: DW 0000H ;CYCLE 00 A/D OFF MUX PITCH
4316 1702' 0000 DW 0000H ;CYCLE 01
4317 1704' 0000 DW 0000H ;CYCLE 02
4318 1706' 0000 DW 0000H ;CYCLE 03
4319 1708' 0000 DW 0000H ;CYCLE 04
4320 170A' 0000 DW 0000H ;CYCLE 05
4321 170C' 0000 DW 0000H ;CYCLE 06
4322 170E' 0202 DW 0202H ;CYCLE 07 A/D ON MUX PITCH
4323 1710' 0302 DW 0302H ;CYCLE 08 A/D START PULSE,MUX PITCH
4324 1712' 1212 DW 1212H ;CYCLE 09 A/D ON MUX ROLL

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4325	1714'	1312	DW 1312H	;CYCLE 0A	A/D START PULSE,MUX ROLL
4326	1716'	2222	DW 2222H	;CYCLE 0B	A/D ON MUX UP BAT
4327	1718'	2322	DW 2322H	;CYCLE 0C	A/D START PULSE MUX UP BAT
4328	171A'	3232	DW 3232H	;CYCLE 0D	A/D ON MUX SYSBAT
4329	171C'	3332	DW 3332H	;CYCLE 0E	A/D START PULSE MUX SYSBAT
4330	171E'	4242	DW 4242H	;CYCLE 0F	A/D ON MUX A/D GND
4331	1720'	4342	DW 4342H	;CYCLE 10	A/D START PLUSE MUX A/D GND
4332	1722'	5252	DW 5252H	;CYCLE 11	A/D ON MUX A/D REF
4333	1724'	5352	DW 5352H	;CYCLE 12	A/D START PULSE MUX A/D REF
4334	1726'	6262	DW 6262H	;CYCLE 13	A/D ON MUX A/D +5V
4335	1728'	6362	DW 6362H	;CYCLE 14	A/D START PULSE MUX A/D +5V
4336	172A'	7070	DW 7070H	;CYCLE 15	A/D OFF MUX TRANSMISSOMETER
4337					
4338					
4339				ORG (HELP + 780H)	
4340					; A/D STORAGE LOCATIONS
4341					
4342	1780'	89	MEMLST: DB PITCH	;PITCH (PENDULUM 1)	
4343	1781'	AF	DB (NULL)		
4344	1782'	8A	DB ROLL	;ROLL (PENDULUM 2)	
4345	1783'	AF	DB (NULL)		
4346	1784'	8B	DB BATTUP	;UP BATTERY	
4347	1785'	AF	DB (NULL)		
4348	1786'	8C	DB BATTSY	;SYS BATTERY	
4349	1787'	AF	DB (NULL)		
4350	1788'	8D	DB ADGH8	;GND HI 8 BITS	
4351	1789'	3E	DB ADGL4	;GND LOW 4 BITS	
4352	178A'	8F	DB ADRH8	;REF HI 8 BITS	
4353	178B'	90	DB ADRL4	;REF LOW 4 BITS	
4354	178C'	91	DB AD5H8	;+5V HI 8 BITS	
4355	178D'	92	DB AD5L4	;+5V LOW 4 BITS	
4356					
4357					
4358					*****
4359					
4360					
4361					
4362					
4363					
4364				END	

MACROS:

BCI	BKI	CALL	CID	CIE	DACI	DADC	DADD
DADI	DBNZ	DSAV	DSBI	DSM	DSMB	DSMI	DTC
ETQ	EXIT	GEC	IDLE	LDC	POP	PPAGE	PUSH
RLDI	RLXA	RNX	RSXD	SCAL	SCM1	SCM2	SPM1
SPM2	SRET	STM	STPC	TCAL	TRET	XID	XIE

SYMBOLS:

ACSTAY	0081	ACSTR	146A'	ACUCLR	1456'	AD	133F'
AD5H8	0091	AD5L4	0092	ADDR	00DE'	ADDR?	00D1'
ADFLG	00B0	ADGH8	008D	ADGL4	008E	ADGO	1367'
ADH18	0003	ADLQ4	0002	ADRH8	008F	ADRL4	0090
ADRTN	087F'	ADTGH8	00A7	ADTOL4	00A8	ADT1H8	0095
ADT1L4	0096	ADT2H8	0097	ADT2L4	0098	ADT3H8	0099
ADT3L4	009A	ADT4H8	009B	ADT4L4	009C	ADT5H8	009D
ADT5L4	009E	ADT6H8	009F	ADT6L4	00A0	ADT7H8	00A1
ADT7L4	00A2	ADT8H8	00A3	ADT8L4	00A4	ADT9H8	00A5
ADT9L4	00A6	AGAIN	0063'	ARI	001C	AR10	001B
AR100	001A	ARFLG	001D	ASCHEX	01C8'	ASCRD1	025E'
ASTK	000E	ASTKHI	0064	ASTKLO	0065	ASTKTP	527F'
ATCHK	0881'	ATFLG	001E	ATMFLG	001F	ATRTN	0867'
BANGGR	014F'	BAT1	0002	BAT2	0003	BAT3	0004
BATTSY	008C	BATTUP	008B	BLT	0000	BORROW	0912'
BRIST	011A'	BR2	0A7D'	BR2CLR	0A8D'	BR2CNT	007D
BR2RTN	0873'	BRCHK	089D'	BROKE	08A8'	BUF9	0020
BUFFER	5B00	BUFPG	005B	CANCNT	0088	CAMERA	0006
CHK1	0CAD'	CHK10	098D'	CLOOP1	04CA'	CLR	0548'
CLRAR	0924'	CLRBUF	0542'	CLRFLG	0340'	CLRPC	006C'
CMPARE	0C9C'	CMPASS	0002	CMPWR	1312'	CMPTN	0879'
CMPSRD	12F0'	CMPSS	0084	CNTCLR	0C47'	CNTRL1	0003
CNTRL2	0005	CNTRL3	0007	CNVRT	01BC'	COPY	058B'
CRC	04A2'	CRCHI	0006	CRCLO	0007	CRCRAM	0005
CRCSUB	050E'	CTA	0BA0'	CTACLR	0D45'	CTAHI	006C
CTALO	006D	CTASET	0D4E'	CTAVHI	006E	CTAVLO	006F
CTAX	0D3A'	CTS	0B80'	CTBCLR	0D62'	CTBHI	0070
CTBLO	0071	CTBSET	0D6B'	CTBVHI	0072	CTBVLO	0073
CTEX	0D57'	CTC	0BC0'	CTCCLR	0D77'	CTCHI	0074
CTCHK	0AA0'	CTCLO	0075	CTCSET	0D88'	CTCVHI	0076
CTCVLO	0077	CTCX	0D74'	CTNCHK	0AB6'	CTNCLR	0DA3'
CTNDEC	0AC1'	CTNRTN	0AE2'	CTNSET	0D91'	CTNSTR	0ADE'
CTRCHK	0A97'	CTRRTN	0876'	CYCCNT	0008	CYCLES	0019
CYX001	0A14'	CYXX01	0A06'	CYXXNN	0A22'	CYXXI	09PA'
D1	0012	D10	0011	D100	0010	DA1	1570'
DA2	1593'	DA2MOR	159F'	DA2YES	15B8'	DATA1	0002
DATA2	0004	DATA3	0006	DAYCAR	09A5'	DAYUP	099C'
DECAR	0907'	DECCNT	03C9'	DECNEX	090C'	DECPPC	0B17I'
DELAY2	019B'	DLY20	0031'	DNA	0000	DOLIN	047D'
DONE	00FF	ENABLE	0771'	ERROR	0080	ERROR1	0429'
BTX	0003	EXP?	12DC'	EXPNUM	000F	EXPSET	12B9'

FLAGA	0069	FLAGB	006A	FLAGC	006B	FLAGCK	0C10'
FORMT1	0012	GLOPG	0050	GOSUB	0B60'	GOTNUM	00CF'
GP	5000	GPAGE	0007	GROUP	0001	GRPSAV	000A
GTR9	02E4'	H1	0014	H10	0013	HALT	0006
HDG	0085	HDG1B	149C'	HDG1C	14A4'	HDG?	129D'
HDGAGN	14BA'	HDGCHK	1478'	HDGEXP	00BF	HDGFLG	00B3
HDGIN	14B11'	HDGPR	0005	HGRTN	0888'	HGSET	1273'
HDSLO	148D'	HGVAL	0020	HGXT	14A1'	HDSTR	0000'
HEADNG	0004	HELP	1000'	HEXRD1	026C'	HLATCH	0003
HOURLP	097D'	HSHIFT	0004	HXCONV	02D4'	HZ	0028
IDLOC	0700'	IN1ST	0406'	IN2ND	0416'	IN4D	01A9'
IN4DT?	02E9'	IN4DXT	013A'	INADDR	03FE'	INC10	095B'
INCHAR	0181'	INCMIN	0966'	INCPPC	0B13I'	INCRIC	092D'
INIT	0B4C'	INITB	0C32'	INITC	0C3F'	INITS	0C37'
INITX	0C22'	INKWD	0208'	INLF	0467'	INPUT	0556'
INTCRL	F840	INTIME	05AC'	INTMSK	F800	INTPC	0001
INTPG	00F8	INTPGM	0800'	INTPOL	F840	INTRPO	083F'
INTSTA	F800	INTVEC	F880	IOA	0006	IOCLR	0004
IOCTEL	0005	IOERR	00AB'	IOLOC	00FE	IOSTAT	0005
ITB	022E'	JMPEXC	0B66'	JUMP	0B28I'	KEEP1	056C'
KEEP2	018C'	KEEP3	157C'	KEEPT	05B7'	L2BUF	00C0
LBT	0864'	LDVRST	0005	LIST	0006	LNEND	03EC'
LNTST	03E3'	LOCK	0331'	LOCKUP	033D'	LOOP2	0BDO'
LOOP2X	0CB9'	LP20TH	0CFF'	LP21ST	0D11'	LP2ERR	0D26'
LP2NTH	0CE4'	LP2OFF	0CC9'	LP2ON	0CD1'	LP2XIT	0D2D'
LP2XMT	0CD9'	M1	0016	M10	0015	MATCH	021E'
MATCH2	0245'	MATCH3	0C88'	MATCH?	0219'	MDONE	07EF'
MEMCEG	07B8'	MEMLST	1780'	MEMORY	0007	MEMPTR	00AE
MEMSAV	0734'	MEMSUB	07B2'	MODFLG	032D'	MUX	0C02
MUXLST	1700'	MUXPTR	00AD	NEXBYT	03C2'	NEXT1	01AD'
NEXT2	0234'	NEXT3	0251'	NEXTPG	07C1'	NOBRW	0914'
NOLOCK	0324'	NOPTCH	0CA7'	NOOP	0BC4'	NOTETX	15CE'
NOTHEX	01EB'	NOYRTN	0392'	NULL	00AF	NUMBER	01E3'
OKRTN	038E'	OPEN	0358'	OPEN?	0348'	OUTADR	03AF'
OUTASC	02CF'	OUTCA	0295'	OUTCHR	0300'	OUTHEX	0271'
OUTPT1	02D1'	OUTPT2	0262'	PASSBR	163E'	PASSCA	045E'
PASSGR	0171'	PC	0003	PCSANE	0660'	PDCR	143B'
PDCLR	144D'	PDEC	1658'	PDRTN	0885'	PDSTAT	0083
PDSTR	145F'	PINC	161F'	PING	0007	PITCH	0089
PLEVEL	0002	PLIST	020F'	PMODE	160A'	PMODEX	158E'
PMPSPD	0006	PMT2	15E2'	PMTCHR	003A	POP	0B40'
POP1	0B44'	PORTB	0007	POUND?	00C8'	PPC	000C
PPCCNP	0727'	PPCCNT	0068	PPCHI	0060	PPCLO	0061
PPCSHO	0704'	PROMPT	0107'	PSET00	14E8'	PTECT	0779'
PTRU	1540'	PULCHK	14CA'	PULCNT	0041	PULFLG	0040
PULNUM	0042	PULRTN	088B'	PULXT	14FD'	PUMP1	0086

MACRO-18 3.36 PAGE 5-2
SEA DUCT: SD05R9.MAC 16 SEP 86

PUMP2	0087	PUSH	0830'	PUSH00	0C77'	PUSH1	0B34'
QUEBUF	1178'	QUESGR	0133'	QUESTM	0396'	QUESTT	05C2'
RADDR2	1564'	RBHI	0008	RBLO	0009	RBRET	085D'
RBSAVE	0894'	READDR	00B7'	RECPLG	00B2	RELAYS	0007
REPORT	0713'	RESTRO	0818'	RESTRT	003F'	RETURN	0B58'
REV	0039	ROLL	008A	RPLY	008C'	RSTK	000D
RSTKHI	0062	RSTKLO	0063	RSTKTP	533F	RTC	0900'
RTRCRN	086A'	RTNPTR	0006	RTTY2	000F	SAVE	0B14I'
SAVPPC	0C00I'	SAYCLR	04F5'	SAYNO	035D'	SD	0DAD'
SDLNGT	0029	SDREC	0EF3'	SDREQ	0003	SDRET	0891'
SEC1	0018	SEC10	0017	SEMI?	0449'	SEQ01	09EE'
SEQ?	0684'	SEQ?EX	06BE'	SEQCYC	09CA'	SEQFAS	0066
SEQNCR	0B00'	SEQRAT	0067	SEQRST	0073'	SEQRTN	086D'
SEQSET	0602'	SEQXT1	0BE0'	SET2ND	067B'	SETAC	0C1C'
SETAT	094F'	SETCLR	0C14I'	SETPLG	0327'	SETPC	0632'
SETPG	077D'	SETPPC	0622'	SETQ	07E2'	SETSL	0019'
SETSTK	001E'	SETTOP	0554'	SETUP	005A'	SETURT	0048'
SHPTD4	018F'	SHIFT	01F4'	SSTRPG	0052	STACK	0002
START1	0025'	START2	05A6'	STAT1	0003	STAT2	0005
STAT3	0007	STZCLR	0C59'	STRZND	53DF	STKERR	0C98'
STKPG	0053	STORE	02DD'	SWITCH	0002	SWPWR	1337'
SWRD	131A'	SWRTN	087C'	SWSTAT	0082	SYSPLG	0003
SYSTEM	0007	TEST	023C'	TEST5	0472'	TEST0	0919'
TEST5	0944'	TEST80	025A'	TEST81	0268'	TEST8D	0288'
TEST9D	029E'	TESTA1	02B1'	TESTA2	02C1'	TESTCA	0291'
TESTCR	0454'	TESTDD	02A8'	TESTOR	036F'	TESTSP	0437'
TESTY	0380'	THRE?	0306'	TIME01	003C	TIMB02	00F0
TIMEIN	0582'	TIMEJM	057B'	TIMEST	0535'	TLEVEL	005A
TLIMIT	0006	TR	13BA'	TRCY02	13EF'	TRCY17	13FF'
TRCY18	140A'	TRCY19	1413'	TRPLG	00B1	TRRTN	0882'
TSRE?	02F0'	TST2ND	09C1'	TSTADV	09B4'	TSTNEX	091C'
TTY	024E'	TTY2	0A32'	TTY2HI	007E	TTY2LO	007F
TY2BTX	0A5C'	TY2OUT	0A47'	TY2RTN	0870'	UARTS	0006
UNADDR	00B4'	UNLOCK	0315'	VERS	0035	WAIT	0034'
WAIT1	05CE'	WAIT2	05F7'	WAIT3	019D'	WAIT4	02F1'
WAIT6	1687'	WRITEM	03F5'	WTFOR	0880'	WTFORX	0C6F'
WTTILL	0B70'	X	0003	XMTBR2	169F'	XMTETX	15F3'
XMTLP2	167D'	XPOS	0093	XYZCHK	1500'	XYZPLG	00B4
XYZIN	152C'	XYZON	1525'	XYZRTN	088E'	XYZXT	1522'
YZ	0004	YZPOS	0094				

NO FATAL ERROR(S)

ASTKTP	59#	204	207	2483
ATCHK	1809	1861#		
ATFLG	59#	1929		
ATMFLG	59#			
ATRTN	1810#	1865	1874	
BANGGR	362	402#		
BAT1	59#			
BAT2	59#			
BAT3	59#			
BATTSY	59#	4348		
BATTUP	59#	4346		
BCI	42#			
BLT	59#			
BORROW	1894#			
BR1ST	350	356#		
BR2	1814	2140#		
BR2CLR	2149#			
BR2CNT	59#	2140	4301	
BR2RTN	1815#	2144	2148	2156
BRCHK	1843#			
BROKE	1849	1852#		
BUFF9	59#	1222		
BUFFER	59#	2792	3302	
BUFFG	59#	59	176	1654
BXI	42#			
CALL	42#			
CAMCNT	59#			
CAMERA	59#			
CHK1	2543	2549#		
CHK10	1974#			
CID	42#			
CIE	42#			
CLOOPI	1128#	1138	1140	
CLR	1225#	1232		
CLRAR	1906#	2012		
CLRBUP	1218	1220#		
CLRELG	829#			
CLRPG	182	184#		
CMPARE	2342	2511	2535#	
CMPASS	59#	3531	3537	
CMPWR	3521	3534#		
CNPRTN	1818#	3517	3523	3532
CNPSRD	1817	3512#		3539
CNPSS	59#	3528		
CNTCLR	2444	2455	2461#	
CNTRL1	59#	150		
CNTRL2	59#	153	2152	4299
CNTRL3	59#			
CNVRT	491	496#		

EXPSET	422	3473#										
FLAGA	59#											
FLAGB	59#											
FLAGC	59#											
FLAGCK	2407#											
FORMT1	59#	151	154	2153	4300							
GEC	42#											
GLOPG	59#	59	140	171	135	1642	1729					
GOSUB	2318#											
GOTNUM	278	284#										
GP	59#											
GPAGE	59#	131	133	141	144	146	147	172	191	193	194	196
	197	199	200	202	203	205	206	208	227	229	249	250
	259	260	265	304	305	307	453	454	457	487	506	509
	512	515	518	521	523	547	572	599	627	638	660	667
	710	720	728	731	734	736	783	785	787	809	310	312
	831	832	888	977	978	991	997	1022	1046	1052	1063	1064
	1122	1125	1126	1127	1143	1145	1169	1172	1173	1179	1187	1220
	1240	1243	1264	1273	1274	1275	1280	1283	1285	1289	1308	1309
	1312	1325	1326	1328	1331	1351	1352	1378	1383	1384	1386	1450
	1474	1475	1477	1520	1631	1633	1634	1676	1678	1679	1730	1732
	1733	1738	1793	1800	1801	1803	1835	1837	1838	1840	1862	1863
	1871	1873	1884	1885	1890	1891	1895	1901	1907	1909	1912	1913
	1915	1919	1921	1923	1926	1930	1931	1934	1936	1937	1939	1944
	1946	1950	1952	1954	1959	1961	1966	1971	1974	1975	1980	1982
	1986	1987	1989	1992	1994	2004	2005	2009	2014	2021	2022	2023
	2041	2042	2048	2049	2055	2056	2063	2064	2070	2074	2075	2085
	2086	2088	2091	2109	2131	2141	2142	2145	2147	2164	2165	2192
	2193	2206	2210	2214	2215	2219	2225	2245	2246	2248	2250	2252
	2254	2256	2338	2391	2392	2404	2419	2426	2496	2487	2503	2518
	2535	2545	2549	2588	2589	2595	2596	2614	2623	2624	2626	2631
	2635	2637	2638	2640	2650	2651	2653	2661	2663	2744	2747	2748
	2750	2751	2753	2754	2756	2766	2767	2782	2783	2785	2786	2802
	2803	2812	2821	2831	2840	2852	2864	2921	2924	2930	2938	2945
	2953	2956	2962	2967	2973	2976	2982	2990	2996	3002	3005	3011
	3019	3025	3031	3034	3040	3048	3054	3062	3065	3071	3079	3085
	3091	3094	3100	3108	3114	3126	3127	3131	3290	3292	3296	3297
	3445	3447	3455	3486	3488	3496	3513	3514	3518	3519	3529	3530
	3548	3549	3559	3560	3584	3585	3589	3590	3595	3597	3598	3609
	3613	3614	3617	3619	3620	3622	3624	3625	3636	3637	3645	3648
	3649	3653	3659	3660	3663	3664	3668	3672	3674	3683	3684	3689
	3690	3695	3696	3705	3707	3710	3711	3714	3720	3721	3750	3751
	3756	3759	3763	3779	3780	3785	3786	3794	3796	3802	3804	3811
	3814	3816	3824	3827	3829	3839	3840	3848	3850	3851	3856	3857
	3908	3909	3921	3922	3925	3926	3929	3933	3934	3935	3938	3946
	3947	3948	3950	3953	3955	3959	3967	3968	3978	3980	3981	3985
	3986	4003	4005	4008	4009	4026	4028	4029	4034	4036	4037	4041
	4043	4059	4061	4075	4076	4079	4118	4119	4122	4133	4135	4157
	4159	4186	4187	4189	4191	4193	4199	4201	4209	4211	4216	4218

LP2NTH	2594#								
LP2OFF	2566	2573#							
LP2ON	2568	2580#							
LP2XIT	2571	2602	2656#						
LP2XNT	2570	2587#							
M1	59#								
M10	59#								
MATCH	576#								
MATCH2	608	612#							
MATCH3	2512	2518#							
MATCH?	562	572#							
MDONE	1639	1675#							
MENCHG	1616	1630#							
MEMLST	3621	4342#							
MEMORY	59#	1665							
MEMPTR	59#	3658	3671						
MEMSAV	368	1551#							
MEMSUB	114	1623#							
MODFLG	812#	834							
MUX	59#	3642	3643	3734	3742	3744	3770		
MUXLST	3618	3639	4315#						
MUXPTR	59#	3616	3635						
NEXBYT	941#	954	959						
NEXT1	484#	499	503						
NEXT2	600#	511							
NEXT3	628#	644	671	588	695	714	724		
NEXTPG	1638#	1673							
NOBRW	1893	1895#							
NOLOCK	803	805#							
NOMTCH	2544#	2552							
NOOP	2364#								
NOTETX	4126#	4132							
NOTHEX	508	514	517	527#					
NOYRTN	890	894#							
NULL	59#	4343	4345	4347	4349				
NUMBER	511	521#							
OKRTN	891#								
OPEN	846	848#							
OPEN?	410	840#							
OUTADR	923#	971							
OUTASC	717	726#							
OUTCA	583#								
OUTCHR	643	739	777#	782					
OUTHEX	653#	679							
OU'PT1	701	728#							
OU'PT2	641#	729							
PASSBR	436	438	4094	4101	4113	4178	4208#	4236	4282
PASSCA	1029	1035	1043#	1048					
PASSGR	370	430#							

SCM2	42#												
SD	1828	2781#											
SDLNGT	59#	3138											
SDREC	3129	3134#											
SDREQ	59#	3137											
SDRET	1829#	2784	2788	3132	3139								
SEC1	59#	1324	2781	3289	3512	3583	3688	3784	3849	3979			
SEC10	59#												
SEMI?	1026	1031#											
SEQ01	2023	2040#	2079										
SEQ?	388	1450#											
SEQ?EX	1479#	1488											
SEQCYC	1811	2020#											
SEQFAS	59#												
SEQNCR	2030	2044	2051	2059	2067	2078	2244#	2274	2279	2292	2303	2307	
	2317	2333	2347	2351	2355	2359	2363	2367	2371	2376	2384		
SEQRAT	59#	2020											
SEQRST	186	190#											
SEQRTH	1813#	2045	2052	2060	2068	2413							
SEQSET	416	1361#	1445										
SEQXT1	2377#												
SET2ND	1417	1437	1440#										
SETAC	2422	2425#											
SETAT	1933#												
SETCLR	2419#												
SETFLG	307#	850											
SETPC	1372	1392#											
SETPG	1584	1588#											
SETPPC	1377#	1423											
SETQ	1643	1647	1651	1655	1659	1661	1664#						
SETSL	86	99#											
SETSTK	104#	1856											
SETTOP	1233#	1255											
SETUP	121	171#											
SETURT	143#												
SHPTD4	502	532#	1008										
SHIFT	536#	544											
SPM1	42#												
SPM2	42#												
SRET	42#	236	474	492	525	528	552	569	588	604	619	632	
	740	770	790	892	895	1055	1095	1206	1682	2231	2474	2493	
	2547	2556	2758	2772	3913	4284	4306						
SSTXPG	59#	59	59	1646	2478								
STACK	59#	105	107	111	235	244	277	279	290	308	336	473	
	533	545	551	558	568	582	585	587	595	603	613	616	
	618	649	653	654	655	664	665	677	760	780	789	306	
	807	828	829	849	855	870	881	915	916	918	923	936	
	937	939	1085	1132	1205	1223	1230	1233	1235	1239	1253	1262	
	1267	1270	1281	1522	1681	1735	1736	1767	1769	1833	1846	1883	

YZPOS

53#

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; I1806A.MAC - Macro Definitions for RCA 1805A/6A Opcodes

; 20 FEB 1986
; W. E. TERRY

; (LISTING SUPRESSED)

; With some Level II codes

.XLIST ;TURN OFF LISTING
.SALL ;INHIBIT SOURCE LISTING

; For use with Syscon M18 assembler -- adds:
; 1805A/6A capability
; some RCA LEVEL II CODES
; some WET MACROS

; Include this file into source program using
; INCLUDE I1806A.MAC

----- COUNTER CONTROL -----

; STPC MACRO ;STOP COUNTER
DB 68H,00H
ENDM

; DTC MACRO ;DECREMENT COUNTER
DB 68H,01H
ENDM

; SPM2 MACRO ;SET PULSE MODE 2
DB 68H,02H
ENDM

; SPM1 MACRO ;SET PULSE MODE 1
DB 68H,04H
ENDM

```
47 ;
48 ; SCM2 MACRO ;SET COUNTER MODE 2
49 DB 68H,03H
50 ENDM
51 ;
52 ; SCM1 MACRO ;SET COUNTER MODE 1
53 DB 68H,05H
54 ENDM
55 ;
56 ; LDC MACRO ;LOAD COUNTER
57 DB 68H,06H
58 ENDM
59 ;
60 ; STM MACRO ;SET TIMER MODE
61 DB 68H,07H
62 ENDM
63 ;
64 ; GEC MACRO ;GET COUNTER
65 DB 68H,08H
66 ENDM
67 ;
68 ; ETQ MACRO ;ENABLE TOGGLE Q
69 DB 68H,09H
70 ENDM
71 ;
72 ;
73 ;----- REGISTER OPS -----
74 ;
75 ;
76 ; RNX MACRO P1 ;RN TO RX COPY
77 DB 68H,(0B0H + P1)
78 ENDM
79 ;
80 ; RLDI MACRO P1,P2 ;REGISTER LOAD IMMEDIATE
81 DB 68H,(0C0H + P1)
82 DW P2
83 ENDM
84 ;
85 ;
86 ;----- MEMORY OPS -----
87 ;
88 ;
89 ; RLXA MACRO P1 ;REGISTER LOAD VIA X AND ADVANCE
90 DB 68H,(060H + P1)
91 ENDM
92 ;
```

```
93          RSXD MACRO P1          ;REGISTER STORE VIA X AND DECREMENT
94          DB 68H,(0A0H + P1)
95          ENDM
96          ;
97          ;
98          ;----- BRANCHES -----
99          ;
100         ;
101         BCI MACRO P1          ;BRANCH ON COUNTER INTERRUPT
102         DB 68H,35H
103         DB LOW (P1)
104         ENDM
105         ;
106         BXI MACRO P1          ;BRANCH ON EXTERNAL INTERRUPT
107         DB 68H,3FH
108         DB P1
109         ENDM
110         ;
111         DBNZ MACRO P1,P2      ;DECREMENT AND BRANCH IF NOT ZERO
112         DB 68H,(020H + P1)
113         DW P2
114         ENDM
115         ;
116         ;
117         ;----- INTERRUPT CONTROL -----
118         ;
119         ;
120         XIE MACRO          ;EXTERNAL INTERRUPT ENABLE
121         DB 68H,0AH
122         ENDM
123         ;
124         XID MACRO          ;EXTERNAL INTERRUPT DISABLE
125         DB 68H,0BH
126         ENDM
127         ;
128         CIE MACRO          ;COUNTER INTERRUPT ENABLE
129         DB 68H,0CH
130         ENDM
131         ;
132         CID MACRO          ;COUNTER INTERRUPT DISABLE
133         DB 68H,0DH
134         ENDM
135         ;
136         DSAV MACRO          ;SAVE D
137         DB 68H,76H
138         ENDM
```

```
139 ;
140 ;
141 ;
142 ----- BCD ARITHMETIC -----
143 ;
144 ;
145 ;
146 DADC MACRO ;ADD WITH CARRY
147 DB 68H,74H
148 ENDM
149 ;
150 DSMB MACRO ;SUBTRACT MEMORY WITH BORROW
151 DB 68H,77H
152 ENDM
153 ;
154 DACI MACRO P1 ;ADD WITH CARRY, IMMEDIATE
155 DB 68H,7CH
156 DB P1
157 ENDM
158 ;
159 DSBI MACRO P1 ;SUBTRACT MEMORY WITH BORROW, IMMEDIATE
160 DB 68H,7FH
161 DB P1
162 ENDM
163 ;
164 DADD MACRO ;ADDITION
165 DB 68H,0F4H
166 ENDM
167 ;
168 DSM MACRO ;SUBTRACT MEMORY
169 DB 68H,0F7H
170 ENDM
171 ;
172 DADI MACRO P1 ;ADD IMMEDIATE
173 DB 68H,0FCH
174 DB P1
175 ENDM
176 ;
177 DSNI MACRO P1
178 DB 68H,0FFH
179 DB P1
180 ENDM
181 ;
182 ----- SUBROUTINE CONTROL -----
183 ;
184 ;
```

```

185 ;
186 SCAL MACRO P1,P2 ;RCA SCAL
187 DB 68H,(80H + P1)
188 DW P2
189 ENDM
190 ;
191 SRET MACRO P1 ;RCA SRET
192 DB 68H,(90H + P1)
193 ENDM
194 ;
195 TCAL MACRO P1 ;TERRY SCAL USING
196 SEX STACK ;X=R2=STACK
197 DB 68H,86H ;RN=R6=RTNPTR
198 DW P1
199 ENDM
200 ;
201 TRET MACRO ;TERRY SRET USING:
202 SEX STACK
203 DB 68H,96H ;X=R2=STACK
204 ENDM ;RN=R6=RTNPTR
205 ;
206 ----- RCA LEVEL II MACROS -----
207 ;
208 CALL MACRO P1
209 SEP R4
210 DW P1
211 ENDM
212 ;
213 EXIT MACRO
214 SEP R5
215 ENDM
216 ;
217 PUSH MACRO
218 STXD
219 ENDM
220 ;
221 POP MACRO
222 LDXA
223 ENDM
224 ;
225 IDLE MACRO
226 IDL
227 ENDM
228 ;
229 PPAGE MACRO
230 ORG HDSTR+($-LOW($))+100H

```

MACRO-18 1.36

PAGE

1-5

231
232
233
234

ENDM

.LIST

MACRO-18 3.36

PAGE

5

MACROS:

BCI	BXI	CALL	CID	CIE	DACI	DADC	DADD
DADI	DBNZ	DSAV	DSBI	DSN	DSMB	DSMI	DTC
ETQ	EXIT	GEC	IDLE	LDC	POP	PPAGE	PUSH
RLDI	RLXA	RNX	RSXD	SCAL	SCM1	SCM2	SPM1
SPM2	SRET	STM	STPC	TCAL	TRET	XID	XIE

SYMBOLS:

NO FATAL ERROR(S)

BCI	101#
BXI	106#
CALL	208#
CID	132#
CIE	128#
DACI	154#
DADC	146#
DADD	164#
DADI	172#
DBNZ	111#
DSAV	136#
DSBI	159#
DSM	168#
DSMB	150#
DSMI	177#
DTC	36#
BTQ	68#
EXIT	213#
GEC	64#
IDLE	225#
LDC	56#
POP	221#
PPAGE	229#
PUSH	217#
RLDI	80#
RLXA	89#
RNX	76#
RSXD	93#
SCAL	186#
SCM1	52#
SCM2	48#
SPM1	44#
SPM2	40#
SRET	191#
STM	60#
STPC	32#
TCAL	195#
TRET	201#
XID	124#
XIE	120#

```

1      : SEA DUCT EQUATE TABLE - ISDEQU.MAC
2      :
3      : 26 AUG 86 - SD05R9
4      :
5      : W. E. TERRY
6      :
7      : INCLUDING:
8      :     REGISTER ALLOCATION
9      :     GLOBAL PAGE REFERENCES
10     :     I/O EQUATES
11     :     DEFAULT VALUES
12     :
13     : (LISTING SUPRESSED)
14     : .XLIST
15     :
16     : PREVIOUS VERSION: 08 AUG 86 - SD05R6
17     : PREVIOUS VERSION: 20 JUN 86 - SD05R5
18     : PREVIOUS VERSION: 21 MAR 86 - SD05R2 thru 5R4
19     :
20     :
21     : .....
22     :
23     : ***** THIS FILE MUST BE INCLUDED IN ALL
24     : SEA DUCT PROGRAM SOURCE (".MAC") FILES
25     :
26     : USE "INCLUDE ISDEQU.MAC"
27     :
28     : ***** THIS FILE MUST NOT BE INCLUDED IN SEA DUCT SEQUENCER
29     : MACRO PROGRAM SOURCE (".MAC") FILES
30     :
31     :
32     : ..... REGISTER ALLOCATION .....
33     :
34     : ***** SAIL REGISTERS *****
35     :
36     0000 DMA EQU R0 :DMA IN/OUT - ALSO START
37     0001 INTPC EQU R1 :INTERRUPT PROGRAM COUNTER
38     0002 STACK EQU R2 :UTILITY STACK
39     0003 PC EQU R3 :MAIN PROGRAM COUNTER
40     : R4 :SCRT CALL * SCRT NOT USED BY *
41     : R5 :SCRT RETURN * THIS PROGRAM *
42     0006 RTNPTR EQU R6 :POINTER FOR RETURN & IMMEDIATE BYTES
43     0006 LIST EQU R6 : " " " " " "
44     0007 GPAGE EQU R7 :GLOBAL PAGE S & R R7.0 (R7.1 REMAINS CONSTANT)
45     0008 CYCCNT EQU R8 :REAL TIME CLOCK CYCLE COUNT, OTHER MISC.
46     :

```

```

47      :**** NOTE:  S & R => SAVED AND RESTORED BY INTERRUPT  ****
48      :
49      :
50      :   REGISTERS A - F, 7.0 ARE S & R
51      :
52      :
53      :***** INTERRUPT REGISTERS *****
54      :
55      :   INTERRUPT PC = R1
56      :
57      000C      PPC      EQU RC  :SEQUENCER PSEUDO PROGRAM COUNTER
58      000D      RSTK     EQU RD  :SEQUENCER RETURN STACK
59      000E      ASTK     EQU RE  :SEQUENCER STACK
60      :
61      000F      RTTY2    EQU RF  :TTY2 OUTPUT POINTER
62      :
63      :**** REGISTER B IS ALSO SAVED AND RESTORED
64      :   FROM INSIDE INTERRUPT TO INTERRUPT
65      :
66      :
67      :***** MISC. ALLOCATION *****
68      :
69      :Q      UT4 (BLT.2):INTERRUPT PULSE:NEM. PROTECT
70      :SF1    INTERRUPT      ( FUTURE OPTION )
71      :SF2
72      :SF3    SEA DATA RECORDER
73      :SF4    UT4 (BLT.2)
74      :
75      :
76      :***** I/O SELECT *****
77      :
78      0001      GROUP    EQU 01  :SELECT = OUT 01; READ = INP 01 - GROUP SELECT
79      :
80      :
81      :***** GROUP 0 *****
82      :
83      :< INPUT >
84      :
85      0002      SWITCH   EQU 02  :BOTTOM AND INSERTION SWITCHES
86      0003      X        EQU 03  :X POSITION
87      0004      YZ       EQU 04  :YX POSITIONS
88      :PING      EQU 07  :ACOUSTIC TRANSPONDER
89      :
90      :< OUTPUT >
91      :
92      0002      BAT1     EQU 02  :BATTERY 1 RELAY

```

```

93      0003      BAT2 EQU 03 :BATTERY 2 RELAY
94      0004      BAT3 EQU 04 :BATTERY 3 RELAY
95      0005      LDVRST EQU 05 :RESET THE LDV
96      0006      CAMERA EQU 06 :TAKE A PICTURE
97      0007      PING EQU 07 :PINGER
98      :
99      :
100     :***** GROUP 1 *****
101     :
102     :< INPUT >
103     :
104     0002      COMPASS EQU 02 :INPUT COMPASS
105     0004      HEADNG EQU 04 :INPUT HEADING
106     :
107     :< OUTPUT >
108     :
109     :COMPASS EQU 02 :COMPASS PWR. AND LATCH
110     0003      HLATCH EQU 03 :LATCH HEADING
111     0004      HSHIFT EQU 04 :HEADING SER. SHIFT IN
112     0005      HDGPWR EQU 05 :HEADING POWER
113     :
114     :
115     :***** GROUP 2 *****
116     :
117     :< INPUT >
118     :
119     0002      ADLO4 EQU 02 :A/D FOUR LSB's
120     0003      ADHI8 EQU 03 :A/D EIGHT MSB's
121     0007      RELAYS EQU 07 :RELAY CONTROLS
122     :
123     :< OUTPUT >
124     :
125     0002      MUX EQU 02 :MUX AND A/D CONTROL
126     0003      SDREQ EQU 03 :SEA DATA RECORD REQUEST
127     0006      PMPSPD EQU 06 :CIRCULATION PUMP SPEED
128     :RELAYS EQU 07 :RELAY SENSE LINES
129     :
130     :
131     :***** GROUP 3 *****
132     :
133     :
134     :***** GROUP 4 *****
135     :
136     :*** GROUP 5 - 1851 BIT I/O ***
137     :
138     :< INPUT >

```

```
139      :
140      0005      IOSTAT EQU 05 :1851 PORT STATUS
141      :ICA = 06 :READ PORT A
142      :IOB = 07 :READ PORT B
143      :
144      :< OUTPUT >
145      :
146      0004      IOCLR EQU 04 :CLEAR 1851
147      0005      IOCTEL EQU 05 :1851 PORT CONTROL
148      0006      IOA EQU 06 :LOAD PORT A
149      0007      PORTB EQU 07 :LOAD PORT B
150      :
151      :
152      :***** GROUP 6 - UARTS *****
153      :
154      0006      UARTS EQU 06 :UART GROUP
155      0012      FORMT1 EQU 12H :7 DATA BITS, 1 STOP BIT, EVEN PARITY
156      :
157      :<INPUT>
158      :
159      0002      DATA1 EQU 02 :LEVEL 1 SAIL UART
160      0003      STAT1 EQU 03 :LEVEL 1 SAIL UART
161      0004      DATA2 EQU 04 :LEVEL 2 SAIL UART
162      0005      STAT2 EQU 05 :LEVEL 2 SAIL UART
163      0006      DATA3 EQU 06 :NOT USED
164      0007      STAT3 EQU 07 :NOT USED
165      :
166      :< OUTPUT >
167      :
168      0003      CNTRL1 EQU 03 :LEVEL 01 SAIL UART CONTROL
169      0005      CNTRL2 EQU 05 :LEVEL 02 SAIL UART CONTROL
170      0007      CNTRL3 EQU 07 :NOT USED
171      :
172      :
173      :***** GROUP 7 *****
174      :
175      0007      SYSTEM EQU 07
176      :
177      :< INPUT >
178      :
179      :< OUTPUT >
180      :
181      0006      HALT EQU 06 :SUICIDE FUNCTION
182      0007      MEMORY EQU 07 :MEMORY PAGE PROTECT OR ENABLE
183      :
184      :
```

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185      :***** DEFINITIONS AND REFERENCES *****
186      :
187      :
188      :*** SAIL FROM LOCATIONS (2716'S) AND PAGE REFERENCES ***
189      :
190      0000      BLT      EQU 00H      :*** BLT MONITOR PROM BASE PAGE ***
191      0050      GLOPG     EQU 050H     :*** GLOBAL PAGE
192      0052      SSTKPG    EQU 052H     :*** SEQUENCER STACK PAGE ***
193      0053      STKPG     EQU 053H     :*** MAIN STACK BASE PAGE ***
194      0058      BUFPG     EQU 05BH     :*** SEA DATA OUTPUT BUFFER PAGE ***
195      00F8      INTPG     EQU 0F8H     :*** INTERRUPT CONTROLLER BASE PAGE
196      :          :          : ( CDP1877 ) ***
197      :
198      :          BLT.2 MONITOR RAM PAGE = 5700:STACK END = 57DF
199      :
200      :
201      :*** OTHER REFERENCES ***
202      :
203      :
204      53DF      STKEND    EQU (STKPG * 100H) + 0DFH      :*** MAIN STACK END = STKPG+DF
205      :
206      523F      RSTKTP    EQU (SSTKPG * 100H) + 3FH      :SEQ R STACK TOP - RSTK = 5200 - 523F
207      527F      ASTKTP    EQU (SSTKPG * 100H) + 7FH      :SEQ A STACK TOP - ASTK = 5240 - 527F
208      :
209      F800      INTMSK    EQU (INTPG * 100H) + 00H      :INTERRUPT MASK - WRITE ONLY
210      F840      INTCTRL   EQU (INTPG * 100H) + 40H      :INTERRUPT CONTROL - WRITE ONLY
211      F880      INTVEC    EQU (INTPG * 100H) + 80H      :INTERRUPT PAGE REGISTER - WRITE ONLY
212      F800      INTSTA    EQU (INTPG * 100H) + 00H      :INTERRUPT STATUS REG. - READ ONLY
213      F840      INTPOL    EQU (INTPG * 100H) + 40H      :INTERRUPT POLLING REG. - READ ONLY
214      :
215      5800      BUFFER    EQU (BUFPG * 100H)              :SEADATA BUFFER 0 LOCATION
216      :
217      :
218      :
219      :***** GLOBAL PAGE REFERENCES *****
220      :
221      5000      GP        EQU (GLOPG * 100H)
222      :
223      0002      PLEVEL    EQU 02H      :PASS THRU LEVEL
224      0003      SYSFLG    EQU 03H      :SYSTEM FLAG (ADDR;WRITE;SYS;  ; ; ; ; 0
225      0005      CRCRAM    EQU 05H      :CRC CALC. SCRATCH
226      0006      CRCHI     EQU 06H      :CRC HI BYTE RESULT
227      0007      CRCLO     EQU 07H      :CRC LO BYTE RESULT
228      0008      RBHI      EQU 08H      :RB.1 SAVE FROM LAST INTERRUPT
229      0009      RBLO      EQU 09H      :RB.0 SAVE FROM LAST INTERRUPT
230      000A      GRPSAV    EQU 0AH      :CURRENT I/O GROUP (OUTSIDE INTERRUPT)

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231      :
232      000F      EXPNUM EQU 0FH      :EXPERIMENT NUMBER (LOW NIBBLE ONLY)
233      :
234      00FE      IOLOC EQU 0FEH      :I/O BYTE
235      :
236      :
237      :***** REAL TIME CLOCK LOCATIONS *****
238      :
239      0028      HZ EQU 40      :40 Hz INTERRUPT RATE
240      :
241      0010      D100 EQU 10H      :DAYS X 100
242      0011      D10 EQU 11H      :DAYS X 10
243      0012      D1 EQU 12H      :DAYS X 1
244      0013      H10 EQU 13H      :HOURS X 10
245      0014      H1 EQU 14H      :HOURS X 1
246      0015      M10 EQU 15H      :MIN. X 10
247      0016      M1 EQU 16H      :MIN. X 1
248      0017      SEC10 EQU 17H      :SEC. X 10
249      0018      SEC1 EQU 18H      :SEC. X 1
250      0019      CYCLES EQU 19H      :RTC CYCLE COUNT
251      001A      AR100 EQU 1AH      :ADV.-RET. CNT X 100
252      001B      AR10 EQU 1BH      :ADV.-RET. CNT X 10
253      001C      AR1 EQU 1CH      :ADV.-RET. CNT X 1
254      001D      ARPLG EQU 1DH      :00= RETARD, 01= NORM., 02= ADVANCE: RTC REF. LOC.
255      001E      ATPLG EQU 1EH      :0 FLAG
256      001F      ATMFLG EQU 1FH      :0 MINUTE FLAG
257      0020      BUF9 EQU 20H      :START OF 9 DIGIT INPUT BUFFER
258      :
259      :
260      :***** INSTRUMENT SPECIFIC FLAGS *****
261      :
262      0040      PULPLG EQU 40H      :RELAY DRIVER PULSE FLAG (AC = ON)
263      0041      PULCNT EQU 41H      :RELAY DRIVER PULSE COUNTER (00=DONE)
264      0042      PULNUM EQU 42H      :RELAY DRIVER NUMBER (= PF when inactive)
265      :
266      :
267      :***** SEQUENCER *****
268      :
269      0060      PPCHI EQU 60H      :SEQ PSUEDO PC HI BYTE POINTER
270      0061      PPCLO EQU 61H      : " " PC LO BYTE POINTER
271      0062      RSTKHI EQU 62H      :SEQ R STACK LO BYTE POINTER
272      0063      RSTKLO EQU 63H      :SEQ R STACK HI BYTE POINTER
273      0064      ASTKHI EQU 64H      :SEQ A STACK LO BYTE POINTER
274      0065      ASTKLO EQU 65H      :SEQ A STACK HI BYTE POINTER
275      :
276      :

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277 0066 SEQFAS EQU 66H :SEQ CTR FOR FAST CYCLE MODE
278 0067 SEQRAT EQU 67H :SEQ CYCLE RATE FOR INDIV. SEQ. INST.
279 : : if SEQRAT MSB=1 (ie. 8x), check lo nibble:
280 : : (1000 0000) EVERY CYCLE
281 : : (1000 0001) EVERY OTHER CYCLE
282 : : (1000 0010) EVERY FOURTH CYCLE
283 : : (1000 0100) EVERY EIGHT CYCLE
284 : : if MSB = 0 (ie. 0x) run on cycle #NN and #01
285 : : if SEQRAT = 00, run only on cycle #01
286 :
287 :
288 0068 PPCCNT EQU 68H :# TIMES THRU CURRENT PPC
289 :
290 0069 FLAGA EQU 69H :FLAG A LOCATION
291 006A FLAGB EQU 6AH :FLAG B LOC.
292 006B FLAGC EQU 6BH :FLAG C LOC.
293 :
294 :
295 006C CTAHI EQU 6CH :COUNTER A, HI CNT.
296 006D CTALO EQU 6DH :COUNTER A, LO CNT.
297 006E CTAVHI EQU 6EH :COUNTER A, HI VECTOR
298 006F CTAVLO EQU 6FH :COUNTER A, LO VECTOR
299 :
300 0070 CTBHI EQU 70H :COUNTER B, HI CNT.
301 0071 CTBLO EQU 71H :COUNTER B, LO CNT.
302 0072 CTBVHI EQU 72H :COUNTER B, HI VECTOR
303 0073 CTBVLO EQU 73H :COUNTER B, LO VECTOR
304 :
305 0074 CTCHI EQU 74H :COUNTER C, HI CNT.
306 0075 CTCLO EQU 75H :COUNTER C, LO CNT.
307 0076 CTCVHI EQU 76H :COUNTER C, HI VECTOR
308 0077 CTCVLO EQU 77H :COUNTER C, LO VECTOR
309 :
310 :
311 :***** PASS THRU LOOP FLAGS *****
312 :
313 007D BR2CNT EQU 7DH :COUNTER FOR BREAK LOOP 2
314 007E TTY2HI EQU 7EH :TTY2 OUTPUT LIST POINTER
315 007F TTY2LO EQU 7FH : " " " "
316 :
317 :
318 :***** INSTRUMENT SPECIFIC *****
319 :
320 0080 ERROR EQU 80H :ERROR WORD :XYZ:ROT:TGT: -- : -- : -- :L2T1:L2UR1
321 0081 ACSTAT EQU 81H :XPNDER STATUS :Signl.to Surface: -- :Cnd3:Cnd2:Cnd1
322 0082 SWSTAT EQU 82H :SWITCH STATUS :Bot: - : - :Ins0:Ins4:Ins3:Ins2:Ins1

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323	0083	PDSTAT EQU 83H	:RELAY POD STATUS
324		:	
325	0084	CMPSS EQU 84H	:COMPASS VALUE
326	0085	HDC EQU 85H	:HEADING VALUE
327	0086	PUMP1 EQU 86H	:FLUME PUMP 1 SPEED
328	0087	PUMP2 EQU 87H	:FLUME PUMP 2 SPEED
329		:	
330	0088	CAMCNT EQU 88H	:CAMERA FRAME COUNTER
331	0089	PITCH EQU 89H	:PITCH - PENDULUM 1 (OLD TILT1)
332	008A	ROLL EQU 8AH	:ROLL - PENDULUM 2 (OLD TILT2)
333	008B	BATTUP EQU 8BH	:UP BATTERY VOLTAGE * (1/6)
334		:	
335	008C	BATTSY EQU 8CH	:SYS BATTERY VOLTAGE * (1/6)
336	008D	ADGH8 EQU 8DH	:A/D GROUND VALUE HI 8 BITS
337	008E	ADGL4 EQU 8EH	:A/D GROUND VALUE LO 4 BITS
338	008F	ADRH8 EQU 8FH	:A/D REFERENCE VALUE HI 8 BITS
339		:	
340	0090	ADRL4 EQU 90H	:A/D REFERENCE VALUE LO 4 BITS
341	0091	AD5H8 EQU 91H	:A/D +5V VALUE HI 8 BITS
342	0092	AD5L4 EQU 92H	:A/D +5 VALUE LO 4 BITS
343	0093	XPOS EQU 93H	:CARRAGE X POSITON
344		:	
345	0094	YZPOS EQU 94H	:CARRAGE Y,Z POSITION
346	0095	ADT1H8 EQU 95H	:1st SEC. TRANSMISSOMETER HI 8 BITS (BA98:7654)
347	0096	ADT1L4 EQU 96H	:1st SEC. TRANSMISSOMETER LO 4 BITS (FFFF:3210)
348	0097	ADT2H8 EQU 97H	:2nd SEC. TRANS HI 8 BITS (BA98:7654)
349		:	
350	0098	ADT2L4 EQU 98H	:2nd SEC. TRANS LO 4 BITS (FFFF:3210)
351	0099	ADT3H8 EQU 99H	:3rd SEC. TRANS HI 8 BITS
352	009A	ADT3L4 EQU 9AH	:3rd SEC. TRANS LO 4 BITS
353	009B	ADT4H8 EQU 9BH	:4th SEC. TRANS HI 8 BITS
354		:	
355	009C	ADT4L4 EQU 9CH	:4th SEC. TRANS LO 4 BITS
356	009D	ADT5H8 EQU 9DH	:5th SEC. TRANS HI 8 BITS
357	009E	ADT5L4 EQU 9EH	:5th SEC. TRANS LO 4 BITS
358	009F	ADT6H8 EQU 9FH	:6th SEC. TRANS HI 8 BITS
359		:	
360	00A0	ADT6L4 EQU 0A0H	:6th SEC. TRANS LO 4 BITS
361	00A1	ADT7H8 EQU 0A1H	:7th SEC. TRANS HI 8 BITS
362	00A2	ADT7L4 EQU 0A2H	:7th SEC. TRANS LO 4 BITS
363	00A3	ADT8H8 EQU 0A3H	:8th SEC. TRANS HI 8 BITS
364		:	
365	00A4	ADT8L4 EQU 0A4H	:8th SEC. TRANS LO 4 BITS
366	00A5	ADT9H8 EQU 0A5H	:9th SEC. TRANS HI 8 BITS
367	00A6	ADT9L4 EQU 0A6H	:9th SEC. TRANS LO 4 BITS
368	00A7	ADT0H8 EQU 0A7H	:10thSEC. TRANS HI 8 BITS (BA98:7654)

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369 00A8          ADTOLA EQU 0A8H      :10CHSEC. TRANS LO 4 BITS (FFFF13210)
370              :
371              :
372 00AD          MUXPTR EQU 0ADH      :MUX LIST POINTER FOR A/D
373 00AE          MEMPTR EQU 0AEH      :MEM LIST POINTER FOR A/D
374 00AF          NULL   EQU 0AFH      :NULL STROAGE LOC. FOR UNUSED
375              :
376              :
377              :
378 00B0          ADPLG  EQU 0B0H      :A/D 'ON' FLAG. AC = ON
379 00B1          TRPLG  EQU 0B1H      :TRANSMISSOMETER A/D 'ON' FLAG. AC = ON
380 00B2          RECPLG EQU 0B2H      :SEA DATA RECORDER 'ON' FLAG. AC = ON
381              :
382 00B3          HDGFLG EQU 0B3H      :HEADING (ROTATION) FLAG:
383              :
384              :
385              :
386              :
387              :
388              :
389              :
390 00B4          XYZFLG EQU 0B4H      :XYZ POSITIONS FLAG:
391              :
392              :
393              :
394              :
395              :
396              :
397              :
398 00BF          HDGEXP EQU 0BFH      :PLUME HEADING VALUE FOR THE EXPERIMENT
399              :
400 00C0          L2BUF  EQU 0C0H      :LOOP 2 RECEIVE BUFFER (USED BY TTY2)
401              :
402              :
403              :***** INSTRUMENT SPECIFIC EQUATES *****
404              :
405 003A          PMTCHR EQU ':'        :PROMPT CHARACTER = :
406              :
407 0003          ETX    EQU 03H      :ASCII ETX = 03
408 00FF          DONE   EQU 0FFH     :USED BY TTY CALLS
409              :
410 0029          SDLNGT EQU 41D      :SEA DATA RECORD LENGTH (BYTES)
411              :
412 0020          HDGVAL EQU 020H     :PLUME HEADING DEFAULT VALUE
413              :
414              :
414              :

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```
415 003C          TIME01 EQU 60D          :TIME OUT CONST. FOR XYZ POSITION MOVEMENT
416              :
417 00F0          TIME02 EQU 0F0H         :TIME OUT CONST. FOR ROTATION MOVEMENT
418              :           TIME02 X 2 = TIME OUT VALUE FOR ROTATION MOVEMENT
419              :           ie. F0 = 480 Sec.
420              :
421 005A          TLEVEL EQU 05AH         :PENDULUM TILT ZERO VALUE
422 0006          TLIMIT EQU 06D         :EXPERIMENT TILT LIMITS (IN DEGREES)
423              :
424              :
425              :2 BIT DELAY ROUTINE
426              :SAIL ADDRESS AND REPLY
427              :DELAY 250      ( 250 mSEC DELAY)
428              :DELAY 20       ( INITIAL SETUP DELAY)
429              :
430              :
431              .LIST
432              :
433
```

```

1          :PAGE 60
2          :
3          :       SUBTTL SEADUCT EXT SEQUENCER: SDE5R9.MAC  22 SEP 36
4          :
5          :
6          :       PREVIOUS VERSION: SDE5R7.MAC  20 AUG 36
7          :       PREVIOUS VERSION: SDE5R6.MAC  14 AUG 36
8          :       PREVIOUS VERSION: SDE5R5.MAC  21 JUN 36
9          :
10         :       PREVIOUS VERSIONS EXIST
11         :
12         :       W. E. TERRY
13         :
14         :       SEA DUCT EXTENDED SEQUENCER FUNCTIONS
15         :       (SEQUENCER PREFIX EC)
16         :
17         C INCLUDE I1806A.MAC
18         C :       I1806A.MAC - Macro Definitions for RCA 1805A, 6A OpCodes
19         C :
20         C :
21         C :       20 FEB 1986
22         C :       W. E. TERRY
23         C :
24         C :       LISTING SUPPRESSED.
25         C :
26         C :       With some Level II codes
27         C :
28         C :       LIST
29         C :
30         C INCLUDE ISDEQU.MAC
31         C :       SEA DUCT EQUATE TABLE - ISDEQU.MAC
32         C :
33         C :       26 AUG 36 - SDO5R7
34         C :
35         C :       W. E. TERRY
36         C :
37         C :       INCLUDING:
38         C :           REGISTER ALLOCATION
39         C :           GLOBAL PAGE REFERENCES
40         C :           I/O EQUATES
41         C :           DEFAULT VALUES
42         C :
43         C :       LISTING SUPPRESSED.
44         C :       LIST
45         C :
46         C :

```

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47 ;**** NOTE: *****
48 ;
49 ; ASSEMBLY OF THIS EXTENDED PROGRAM REQUIRES LINKING
50 ; THIS PROGRAM SEGMENT WITH THE MAIN SEA DUCT SEGMENT VIA L13.
51 ;
52 ; USE: L18 /P:300/D:5000,SDOnRn,/P:2000/D:5000,SDEnRn,SDSYSn/N/A/E
53 ; for generation of ".HEX" file. Use MBASIC HXRCA to get ".RCA" file.
54 ;
55 ; USE: L18 /P:300/D:5000,SDOnRn,/P:2000/D:5000,SDEnRn,SDSYSn/N/E
56 ; for generation of ".COM" file. Use BURN to burn the PROMS.
57 ;
58 ;*****
59 ;
60 EXTRN DECPPC, INCPPC, JUMP, SAVPPC, SETCLR
61 EXTRN HDGIN
62 ;
63 ;
64 ; THIS PAGE (100H LOCATIONS) ACTS AS A POINTER TO THE ACTUAL
65 ; EXTENDED SEQUENCER FUNCTIONS (PREFIX "EO") ON THE NEXT PAGE.
66 ;
67 ;
68 0000' 1C EXTEN: INC PPC ; DECODE EXTENDED FUNCTION
69 0001' 3C LDN PPC
70 0002' FA FC ANI OFCH
71 0004' A1 PLO INTPC
72 ;
73 ;
74 ; ORG (EXTEN + 10H)
75 0010' C0 0100' BATTERY: LBR BATT ; PULSE MAIN BATTERY RELAYS (EO 1n)
76 ; ; 10 = Do Nothing
77 ; ; 11 = Relay 1
78 ; ; 12 = Relay 2
79 ; ; 13 = Relay 3
80 ;
81 ;
82 ; ORG (EXTEN + 24H)
83 0024' C0 0123' PINGR: LBR PINGR ; KEY TELEMETRY PINGER (EO 0n)
84 ; ; n = Telemetry Code ,where
85 ; ; n = 0-F
86 ;
87 ;
88 ; ORG (EXTEN + 30H)
89 0030' F8 80 ADON: LDI ADFLG ; A/D ON/OFF (EO 3n)
90 0032' C0 0000* LBR SETCLR ; 30=A/D OFF -- 31=A/D ON
91 ;
92 ;

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93          ORG (EXTE0 + 40H)
94 0040' F8 B1      TRON: LDI TRFLG      ; TRANSMISSOMETER ON/OFF (EO 4n)
95 0042' CO 0000*   LBR SETCLR      ; 40=TRANS OFF -- 41=TRANS ON
96          ;
97          ;
98          ORG (EXTE0 + 50H)
99 0050' F8 B2      SDON: LDI RECFLG     ; RECORDER ON/OFF (EO 5n)
100 0052' CO 0000*  LBR SETCLR     ; 50=REC OFF -- 51=REC ON
101         ;
102         ;
103         ORG (EXTE0 + 60H)
104 0060' CO 019B'   PMPS: LBR PMPSX     ; STORE PUMP SPEED VALUES ON GPAGE
105         ;
106         ;
107         ORG (EXTE0 + 70H)
108 0070' CO 013D'   TILT: LBR TILT*     ; PITCH - ROLL CHECK (EO 70)
109         ;
110         ;
111         ORG (EXTE0 + 80H)      ; EO 80-83
112 0080' CO 01FD'   ROT:  LBR ROTX      ; PLUME ROTATION CONTROLS
113         ;
114         ;
115         ORG (EXTE0 + 84H)      ; EO 84-87
116 0084' CO 01FD'   LBR ROTX      ; PLUME ROTATION CONTROLS
117         ;
118         ;
119         ORG (EXTE0 + 90H)      ; EO 90-93
120 0090' CO 0342'   XY:  LBR POSX     ; PULSE X+, X-, Y-, Y- TRAVERSE PWR
121         ;
122         ;
123         ORG (EXTE0 + 94H)      ; EO 94-97
124 0094' CO 0342'   Z:  LBR POSX     ; PULSE Z+, Z- TRAVERSE PWR
125         ;
126         ;
127         ORG (EXTE0 + 98H)      ; EO 98-99
128 0098' CO 0342'   POSXY: LBR POSX   ; POSITION X OR Y TRAVERSE
129         ;
130         ;
131         ORG (EXTE0 + 9CH)      ; EO 9C-9F
132 009C' CO 0342'   POSZ: LBR POSX   ; POSITION Z TRAVERSE
133         ;
134         ;
135         ORG (EXTE0 + 0A0H)     ; EO A0-A3
136 00A0' CO 0660'   SAM1: LBR SAM1X   ; WATER AND SEDIMENT SAMPLER #1
137         ;
138         ;

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139          ORG (EXTEO + 0A4H) ; E0 A4-A7
140 00A4' CO 0691' SAM2: LBR SAM2X ; WATER AND SEDIMENT SAMPLER #2
141          ;
142          ;
143          ORG (EXTEO + 0A8H) ; E0 A8-AB
144 00A8' CO 06C4' PUMP: LBR PUMPX ; HYDRAULIC AND SUCTION PUMPS
145          ; ; VIEW PORT CLEAN
146          ;
147          ORG (EXTEO + 0ACH) ; E0 AC-AF
148 00AC' CO 0701' FLUM: LBR FLUMX ; FLUME INSERT AND WITHDRAW
149          ; ; RECIRCULATE PUMPS
150          ;
151          ORG (EXTEO + 0C0H) ; E0 C0
152 00C0' CO 0730' FLASH: LBR FLASHX ; TAKE A PICTURE
153          ;
154          ;
155          ORG (EXTEO + 0D0H) ; E0 D0
156 00D0' CO 0745' RLDV: LBR RLDVX ; RESET LDV
157          ;
158          ;
159          ORG (EXTEO + 0F0H)
160 00F0' CO 0753' IFSW: LBR IFSWX ; BRANCH IF SWITCH (E0 F0 aaaa)
161          ; ; n=switch F0=Bottom contact switch
162          ; ; F1=Flume insertion switches
163          ; ; F2=Flume retracted switch
164          ; ; aaaa = Branch address
165          ;
166          ;
167          ORG (EXTEO + 0F8H)
168 00F8' CO 0738' IFACU: LBR IFACUX ; BRANCH IF ACOUSTIC SIGNAL
169          ;
170          ;
171          ;
172          ; *****
173          ;
174          ORG EXTEO - 100H
175          ;
176          ; THIS PAGE CONTAINS THE EXTENDED SEQUENCER FUNCTIONS PREPARED
177          ; WITH "E0".
178          ;
179          ;
180          ; ***** E0 In - PULSE BATTERY RELAYS *****
181          ;
182          ;
183 0100' E1 BATT: SEX INTPC
184 0101' E1 OUT GROUP ; SET I/O GROUP = 0

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185 0102' 00 DB 00
186 0103' 0C LDN PPC
187 0104' FA 03 ANI 03 ; DECIDE IF BATTERY 1,2,OR 3
188 0106' FB 01 XRI 01 ; EO 10 = Do Nothing
189 0108' 32 14' BZ BATT1 ; EO 11 = BATTERY 1
190 010A' FB 03 XRI (01 XOR 02)
191 010C' 32 13' BZ BATT2 ; EO 12 = BATTERY 2
192 010E' FB 01 XRI (02 XOR 03)
193 0110' 32 1C' BZ BATT3 ; EO 13 = BATTERY 3
194 0112' 30 20' BR BATTXT ; EXIT IF NOT 1,2, OR 3
195 ;
196 0114' 62 BATT1: OUT BAT1 ; BATTERY RELAY 1
197 0115' 30 DB 00 ; Conn. M - Pin 3
198 0116' 30 20' BR BATTXT ; Relay Pod 1
199 ;
200 0118' 63 BATT2: OUT BAT2 ; BATTERY RELAY 2
201 0119' 00 DB 00 ; Conn. M - Pin 4
202 011A' 30 20' BR BATTXT ; Relay Pod 1
203 ;
204 011C' 64 BATT3: OUT BAT3 ; BATTERY RELAY 3
205 011D' 00 DB 00 ; Conn. M - Pin 5
206 011E' 30 20' BR BATTXT ; Relay Pod 1
207 ;
208 0120' 00 0000* BATTXT: LBR INCPPC
209 ;
210 ;
211 ;
212 ; ***** EO 24 - TELEMETRY PINGER CONTROL *****
213 ;
214 ;
215 0123' F8 68 PINGRX: LDI PPCNT ; PING CODE nn (nn = 00-0F) MUST BE ON ASTR
216 0125' A7 PLO GPAGE ; CYCLES FOR 30 SEC. (Conn. M - Pin 3)
217 0126' 07 LDN GPAGE
218 0127' 3A 37' BNZ PNGAGN ; IF FIRST TIME, SET CNTR
219 0129' F8 1E LDI 30 ; FOR 30 PING CYCLES
220 012B' 57 STR GPAGE
221 ;
222 012C' F8 31 LDI ACSTAT ;STORE PING CODE IN HI NIBBLE ACSTAT
223 012E' A7 PLO GPAGE
224 012F' E7 SEX GPAGE
225 0130' 0E LDN ASTK
226 0131' FE SHL
227 0132' FE SHL
228 0133' FE SHL
229 0134' FE SHL
230 0135' F1 OR

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231 0136' 57 STR GPAGE
232 ;
233 0137' 51 PNGAGN: SEX INTPC ; SET GROUP 00
234 0138' 51 OUT GROUP
235 0139' 00 DB 00
236 013A' F8 19 LDI CYCLES
237 013C' A7 PLO GPAGE
238 013D' 07 LBN GPAGE
239 013E' FB 01 XRI 01 ; CYCLES = 1 ?
240 0140' 32 64' BZ PNGCY1
241 0142' FB 04 XRI (01 XOR 05) ; = 5 ?
242 0144' 32 30' BZ PNGCY2
243 0146' FB 0C XRI (05 XOR 09) ; = 9 ?
244 0148' 32 89' BZ PNGCY3
245 014A' FB 04 XRI (09 XOR 0DH) ; = D ?
246 014C' 32 92' BZ PNGCY4
247 014E' FB 1C XRI (0DH XOR 11H) ; = 11?
248 0150' 3A 5C' BZ PNGXT1 ; IF NOT GO TO PINGER EXIT 1
249 ;
250 0152' 0E PNGCY5: LBN ASTR ; LAST PING IN GROUP
251 0153' FA 01 ANI 01
252 0155' 32 59' BZ S+4 ; 'TO PING OR NOT TO PING?'
253 0157' 67 OUT PING
254 0158' 00 DB 00
255 ;
256 0159' F8 68 LDI PPCCNT
257 015B' A7 PLO GPAGE
258 015C' 07 LBN GPAGE
259 015D' FF 01 SMI 01 ; DECREMENT PING CYCLE COUNT
260 015F' 57 STR GPAGE ; GO TO NEXT PPC IF DONE
261 0160' 32 6F' BZ PNGXT2 ; IF NOT, DO ANOTHER PING CYCLE
262 0162' 30 6C' BR PNGXT1
263 ;
264 0164' 67 PNGCY1: OUT PING ; 1st. PING CYCLE ALWAYS PINGS
265 0165' 00 DB 00
266 0166' F8 57 LDI SEQRATE ; SET SEQ RATE TO EVERY 4 CYC
267 0168' A7 PLO GPAGE
268 0169' F8 3F LDI 3FH ; (3FH = EVERY 4th CYC)
269 016B' 57 STR GPAGE
270 ;
271 ;
272 016C' C0 0000* PNGXT1: LBR DECPPC ; POINT PPC TO RUN AGAIN
273 ; AND EXIT SEQUENCER
274 ;
275 ;
276 016F' F8 57 PNGXT2: LDI SEQRATE ; SET SEQ. RATE TO ONLY CYCLE #1

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277 0171' A7 PLO GPAGE
278 0172' F8 00 LDI 00
279 0174' 57 STR GPAGE
280 ;
281 0175' F8 31 LDI ACSTAT ; CLEAR HI NIBBLE OF ACSTAT
282 0177' A7 PLO GPAGE
283 0178' 07 LDN GPAGE
284 0179' FA 0F ANI 0FH
285 017B' 57 STR GPAGE
286 ;
287 017C' 1E INC ASTK ; CLEAR PING CODE FROM SEQUENCER ASTK
288 017D' C0 0000* LBR INCPPC ; AND EXIT SEQUENCER
289 ;
290 ;
291 0180' 0E PNGCY2: LDN ASTK ; PING?
292 0181' FA 08 ANI 08
293 0183' 32 37' BZ S+4
294 0185' 67 OUT PING
295 0186' 00 DB 00
296 0187' 30 6C' BR PNGXT1 ; EXIT SEQ. FOR 100mSEC.
297 ;
298 0189' 0E PNGCY3: LDN ASTK ; PING?
299 018A' FA 04 ANI 04
300 018C' 32 90' BZ S+4
301 018E' 67 OUT PING
302 018F' 00 DB 00
303 0190' 30 6C' BR PNGXT1 ; EXIT FOR 100mSEC.
304 ;
305 0192' 0E PNGCY4: LDN ASTK ; PING?
306 0193' FA 02 ANI 02
307 0195' 32 99' BZ S+4
308 0197' 67 OUT PING
309 0198' 00 DB 00
310 0199' 30 6C' BR PNGXT1 ; EXIT FOR 100mSEC.
311 ;
312 ;
313 ;***** B0 60 - STORE PUMP VALUES ON GLOBAL PAGE *****
314 ;
315 019B' F8 36 PMPX: LDI PUMP1 ;SET GPAGE TO PUMP1
316 019D' A7 PLO GPAGE
317 019E' 0C LDN PPC
318 019F' FA 03 ANI 03
319 01A1' 32 B5' BZ PMP30
320 01A3' FB 01 XRI 01
321 01A5' 32 AF' BZ PMP51
322 01A7' FB 03 XRI (01 XOR 02)

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```

323 01A9' 32 AE'          GZ PMPS2
324 01AB' C0 0000*      LBR INCPPC
325                      ;
326 01AE' 17            PMPS2: INC GPAGE      ;SET GPAGE TO PUMP2
327                      ;
328 01AF' 1C            PMPS1: INC PPC        ;STORE PUMP SPEED VALUE
329 01B0' 0C            LDN PPC
330 01B1' 57            STR GPAGE
331 01B2' C0 0000*      LBR INCPPC
332                      ;
333 01B5' F8 00         PMPS0: LDI 00          ;SET PUMPI,2 = 00
334 01B7' 57            STR GPAGE
335 01B8' 17            INC GPAGE
336 01B9' 57            STR GPAGE
337 01BA' C0 0000*      LBR INCPPC
338                      ;
339                      ;
340                      ;***** EQ 70 - PITCH AND ROLL CHECK *****
341                      ;
342 01B3' 0C            TILTX: LDN PPC          ;READ PPC
343 01B4' FA 03         ANI 03              ;MASK FOR 10 3 BITS
344 01C0' CA 0000*     LBNZ INCPPC         ;RETURN IF NOT = 70
345                      ;
346 01C3' F9 67         LDI SEQRAT        ;CHECK TO SEE IF WE ARE SENDING THE
347 01C5' A7           PLO GPAGE          ; ACOUSTIC ERROR MESSAGE GENERATED
348 01C6' 07           LDN GPAGE          ; BY THIS PPC (SEQRAT = 3FH)
349 01C7' F9 8F         XRI 08FH
350 01C9' C2 0123'     LBZ PINGRX        ; IF SO, GO TO THE PINGER ROUTINE
351                      ;
352 01CC' 3E           DEC ASTX           ;DEC ASTX (USED TO SEND PINGER CODE)
353                      ;
354 01CD' F8 89         LDI PITCH          ;CHECK PITCH (1BIT = .50 DEG)
355 01CF' A7           PLO GPAGE          ;TLEVEL = VERTICAL = 8A
356 01D0' 07           LDN GPAGE          ;TLIMIT = TIDE LIMIT IN DEG.
357 01D1' FF 4E         SMI (TLEVEL-(TLIMIT * 2)) ;CHECK FOR UNDER LIMIT
358 01D3' 3B F0'       BNF TILERR
359 01D5' FF 18         SMI (TLIMIT * 4)      ;CHECK FOR OVER LIMIT
360 01D7' 33 F0'       BDF TILERR
361                      ;
362 01D9' 17           INC GPAGE          ;SET GPAGE = ROLL
363 01DA' 07           LDN GPAGE          ;CHECK ROLL
364 01DB' FF 4E         SMI (TLEVEL-(TLIMIT * 2)) ;CHECK FOR UNDER LIMIT
365 01DD' 3B F0'       BNF TILERR
366 01DF' FF 18         SMI (TLIMIT * 4)      ;CHECK FOR OVER LIMIT
367 01E1' 33 F0'       BDF TILERR
368                      ;

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369 01E3' F8 80      TILTOK: LDI ERROR      ;SET TILT BIT OF ERROR WORD = 0
370 01E5' A7          PLO GPAGE
371 01E6' 07          LDN GPAGE
372 01E7' FA 0F      ANI 0DFH              ;TILT BIT = BIT 5
373 01E9' 57          STR GPAGE
374                  ;
375 01EA' F8 0C      LDI 0CH              ;LOAD ASTK WITH "TILT OK" CODE
376 01EC' 5E          STR ASTK
377 01ED' C0 0123'   LBR PINGRX          ;SEND "TILT OK" ("C")
378                  ;
379 01F0' F8 80      TILERR: LDI ERROR      ;SET TILT BIT OF ERROR WORD = 1
380 01F2' A7          PLO GPAGE
381 01F3' 07          LDN GPAGE
382 01F4' F9 20      ORI 20H              ;TILT BIT = BIT 5
383 01F6' 57          STR GPAGE
384                  ;
385 01F7' F8 0D      LDI 0DH              ;LOAD ASTK WITH "TILT BAD" CODE
386 01F9' 5E          STR ASTK
387 01FA' C0 0123'   LBR PINGRX          ;SEND "TILT BAD" ("D")
388                  ;
389                  ;
390                  ;
391                  ;
392                  ;***** 50 8n - PLUME ROTATION CONTROL *****
393                  ;
394 01FD' F8 67      ROTX:  LDI SEQRAT     ;CHECK TO SEE IF WE ARE SENDING THE
395 01FF' A7          PLO GPAGE      ; ACOUSTIC ERROR MESSAGE GENERATED
396 0200' 07          LDN GPAGE      ; BY THIS PPC (SEQRAT = 8FH)
397 0201' FB 8F      XRI 08FH
398 0203' C2 0123'   LBZ PINGRX     ; IF SO, GO TO THE PINGER ROUTINE
399                  ;
400 0206' 0C          LDN PPC
401 0207' FA 03      ANI 03
402 0209' C2 0223'   LBZ RCW        ;E0 30 ROTATE CW
403 020C' FB 01      XRI 01
404 020E' C2 0223'   LBZ RCCW      ;E0 31 ROTATE CCW
405 0211' FB 03      XRI (01 XOR 02)
406 0213' C2 0233'   LBZ ROTRTN    ;E0 32 ROTATE TO TRANSPORT POSITION
407 0216' FB 01      XRI (02 XOR 03)
408 0218' C2 027D'   LBZ ROTHDG    ;E0 33 ROTATE TO EXPERIMENT POSITION
409 021B' FB 07      XRI (03 XOR 04)
410 021D' C2 02D1'   LBZ ROTCOR    ;E0 34 ROTATE TO CORE POSITION
411 0220' C0 0000*   ROTXT:  LBR INCPPC
412                  ;
413                  ;
414 0223'            RCW:  SCAL R6, PULSE ;PULSE ROTATE CW RELAY

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```

415 0223' 68 36 +
416 0225' 0736' +
417 0227' 14 DB 24Q
418 0228' 08 DB 08H ;3 CYCLES = 200 mSec. Pulse
419 0229' 30 20' BR ROTXT
420 ;
421 ;
422 022B' RCCW: SCAL R6. PULSE ;PULSE ROTATE CCW RELAY
423 022B' 68 36 -
424 022D' 0736' -
425 022F' 15 DB 25Q
426 0230' 08 DB 08H ;3 CYCLES = 200 mSec. Pulse
427 0231' 30 20' BR ROTXT
428 ;
429 ;
430 ;***** ROTATE TO "TRANSPORT" POSITION - E0 82 *****
431 ;
432 0233' F8 68 ROTRTN: LDI PPCCNT ;1st TIME THRU THE PPC ?
433 0235' A7 PLO GPAGE
434 0236' 07 LCN GPAGE
435 0237' CA 0254' LBNZ ROTON ; IF NOT: GO TO XON
436 ;
437 ;
438 023A' F8 35 ROT00: LDI HDG ; SET CURRENT HEADING
439 023C' A7 PLO GPAGE
440 023D' 07 LCN GPAGE
441 ;
442 023E' 2E DEC ASTK ;STORE CURRENT HEADING ON ASTK
443 023F' 5E STR ASTK ; (NOT USED BUT THE ASTK GETS INCREMENTED
444 ; ; LATER AND MUST BE DECREMENTED HERE)
445 0240' FF FD SMI OFDH ;TRANSPORT POS. = FD, FE, FF SMI=> D-MIR(P11)-DEF.D
446 0242' C3 02E4' LBDP ROTXT2
447 ;
448 0245' E2 SEX STACK ; SET UP INITIAL PARAMETERS
449 SCAL R6. ROTO
450 0246' 68 36 -
451 0248' 02FD' -
452 ;
453 024A' E2 SEX STACK
454 SCAL R6, PULSE ; PULSE ROTATION-CW RELAY TO START ROTATION
455 024B' 68 36 -
456 024D' 0736' +
457 024F' 14 DB 24Q ; 24Q = ROT-CW Relay
458 0250' 04 DB 04H ; 100 mSec. Pulse
459 ;
460 0251' C3 02E8' LBR ROTXT1 ; EXIT THE ROUTINE

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461 ;
462 ;
463 0254' E2 ROTON: SEX STACK
464 SCAL R6, HDGIN ; READ THE CURRENT HEADING ,STORE AT GP = HDG
465 0255' 68 36 +
466 0257' 0000* -
467 ;
468 0259' F8 35 LDI HDG
469 025B' A7 PLO GPAGE
470 025C' 07 LDN GPAGE ;TRANSPORT POS. = FD, FE, FF
471 025D' FF FD SMI 0FDH ; SMI=> D-M(RP):->DF,D
472 025F' 33 73' BDF ROTOOK ;IF AT TRANSPORT POSITION, GO TO ROTOOK
473 ;
474 ;
475 0261' E2 SEX STACK ; GO TO ROTATION TIMEOUT SUBROUTINE
476 SCAL R6, RCNT
477 0262' 68 36 -
478 0264' 0326' -
479 ;
480 0266' 00 0235' LBR ROTXTI ;TIMEOUT ROUTINE USUALLY RETURNS HERE
481 ;
482 ; ;TIMEOUT ROUTINE RETURNS HERE IF TIME OUT IS REACHED
483 0269' E2 ROTDER: SEX STACK ;PULSE ROT-CW RELAY TO STOP ROTATION
484 SCAL R6, PULSE
485 026A' 68 36 -
486 026C' 0736' -
487 026E' 14 DB 24Q
488 026F' 08 DB 08H
489 0270' 00 0233' LBR ROTERR ;GO TO ROTATION ERROR ROUTINE
490 ;
491 ;
492 0273' E2 ROTOOK: SEX STACK ;PULSE ROT-CW RELAY TO STOP ROTATION
493 SCAL R6, PULSE
494 0274' 68 36 +
495 0276' 0736' -
496 0278' 14 DB 24Q
497 0279' 08 DB 08H
498 027A' 00 02DF' LBR ROTOK ;GO TO ROTATION OK ROUTINE
499 ;
500 ;
501 ;
502 ;***** ROTATE TO POSITION FOR EXPERIMENT - E0 33 *****
503 ;
504 027D' F8 68 ROTHDG: LDI PPCNT ;1st TIME THRU THE PPC ?
505 027F' A7 PLO GPAGE
506 0280' 07 LDN GPAGE

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507 0281' JA A7'          BNZ ROTHX          ; IF NOT; GO TO ROTHX
508                          ;
509                          ;
510 0283' F8 34          ROTH0: LDI CMPSS          ; GET CURRENT COMPASS READING
511 0285' A7            PLO GPAGE
512 0286' J7            LDN GPAGE
513 0287' AA            PLO RA          ; STORE CMPSS READING IN R(A,0)
514 0288' E7            SEX GPAGE
515 0289' F8 3F          LDI HDGEXP          ; GET THE HEADING FOR THE EXPERIMENT
516 028B' A7            PLO GPAGE          ; HEADING = DIRECTION FLOW COMES FROM
517 028C' 8A            GLO RA
518 028D' F5            SD              ; SD=> M(R(X)) - D -> DF,D
519                          ;          ; HDGEXP - CMPS = -> HDGFINAL
520                          ;
521 028E' 2E            ROTH1: DEC ASTK
522 028F' 5E            STR ASTK          ; STORE FINAL HEADING (H final) ON SEQUENCER ASTK
523                          ;
524 0290' FF 33          SMI J3H          ;          SMI=> D-M R.P. ->DF,D
525 0292' 3B 34'        BNF ROTXT2          ; EXIT IF NEW HEADING < CH 4.2 DEG
526                          ;
527 0294' FF 3A          SMI 3FAH          ;          SMI=> D-M R.P. ->DF,D
528 0296' 3D 32B4'     LBDF ROTXT2          ; EXIT IF NEW HEADING > FCH
529                          ;
530                          ;
531 0299' E2            SEX STACK          ; SET UP INITIAL PARAMETERS
532 SCAL R6, ROTO
533 029A' 68 36          -
534 029C' 3E7D'         -
535                          ;
536 029E' E2            SEX STACK
537 SCAL R6, PULSE          ; PULSE ROT-CCW RELAY TO START ROTATION
538 029F' 68 36          -
539 02A1' 37B6'         -
540 02A3' 15            DB 25Q          ; 25Q = CCW Rotation Relay
541 02A4' 04            DB 14H          ; 100 mSec. Pulse
542 02A5' 30 38'        BR ROTXT1          ; EXIT THE ROUTINE
543                          ;
544                          ;
545 02A7' E2            ROTHX: SEX STACK
546 SCAL R6, HDGIN          ; READ CURRENT HEADING H now . STORE AT 3F = HDG
547 02A8' 68 36          -
548 02AA' 303C'         -
549                          ;
550 02AC' F8 35          LDI HDG
551 02AE' A7            PLO GPAGE
552 02AF' J7            LDN GPAGE          ; H now -> D

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```

553 ;
554 02B0' B8 SEX ASTK ; H final -> ASTK
555 ;
556 ; ;COMPARE H final WITH H now
557 02B1' F5 SD ; (H final - (H now) -> D
558 ;
559 02B2' C3 02C7' LBRF ROTBOK ;IF AT PROPER POSITION, GO TO ROTBOK
560 ;
561 ; ;IF NOT:
562 02B5' B2 SEX STACK ; GO TO ROTATION TIMEOUT SUBROUTINE
563 SCAL R6, RCNT
564 02B6' 68 36 -
565 02B8' 0326' -
566 ; ;TIMEOUT ROUTINE USUALLY RETURNS HERE
567 02BA' C0 02E8' LBR ROTXT1 ;TIMEOUT ROUTINE RETURNS HERE IF TIME OUT IS REACHED
568 ;
569 ;
570 02BD' B2 ROTHR: SEX STACK ;PULSE ROT-CCW RELAY TO STOP ROTATION
571 SCAL R6, PULSE
572 02BE' 68 36 -
573 02C0' 07B6' -
574 02C2' 15 DB 25Q
575 02C3' 08 DB 08H
576 02C4' C0 02EB' LBR ROTERR
577 ;
578 02C7' B2 ROTBOK: SEX STACK ;PULSE ROT-CCW RELAY TO STOP ROTATION
579 SCAL R6, PULSE
580 02C8' 68 36 -
581 02CA' 07B6' -
582 02CC' 15 DB 25Q
583 02CD' 08 DB 08H
584 02CE' C0 02DF' LBR ROTOK ;GO TO ROTATION OK ROUTINE
585 ;
586 ;
587 ;***** ROTATE TO "CORE" POSITION - EQ 40 *****
588 ;
589 02D1' F8 68 ROTCOR: LDI PPOCNT ;1st TIME THRU THE PPO ?
590 02D3' A7 PLO GPAGE
591 02D4' 07 LDN GPAGE
592 02D5' 3A A7' BNZ ROTHN ; IF NOT: GO TO ROTHN
593 ;
594 ; ;ELSE:
595 02D7' F8 65 ROTCO: LDI HDG ; GET CURRENT HEADING
596 02D9' A7 PLO GPAGE
597 02DA' 07 LDN GPAGE
598 02DB' FF 20 SMI 20H ; FIND CORE HEADING

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600 ; ; HDGNOW - 20E = -> HDGCCRE
601 02DD' 30 3E' ; BR ROTH? ; GO TO ROTH?
602 ;
603 ;
604 ;
605 ;***** ROTATION - COMMON EXIT POINTS *****
606 ;
607 02DF' 52 ROTOK: SEX STACK
608 ; SCAL R6, ROT1 ;CLEAR PARAMETERS
609 02E0' 68 36 +
610 02E2' 0316' +
611 ;
612 02E4' 1E ROTXT2: INC ASTK
613 02E5' C0 0000* ; LBR INCPPC
614 ;
615 ;
616 02E8' C0 0000* ROTXT1: LBR DECPPC
617 ;
618 02EB' F8 30 ROTERR: LDI ERROR ;SET ROTATION ERROR CODE IN ERROR WORD
619 02ED' A7 ; PLO GPAGE
620 02EE' 07 ; LDN GPAGE
621 02EF' F9 40 ; ORI 40H ;ROTATION ERROR CODE = BIT 6
622 02F1' 57 ; STR GPAGE
623 ;
624 02F2' 52 ; SEX STACK ;CLEAR PARAMETERS
625 ; SCAL R6, ROT1
626 02F3' 58 36 +
627 02F5' 0316' -
628 ;
629 02F7' F8 0B ; LDI 0BH ;LOAD ASTK WITH ERROR CODE (stk position is
630 02F9' 5E ; STR ASTK ; not changed; pinger will clear and increment)
631 02FA' C0 0123' ; LBR PINGRX ;SEND PINGER ROTATION ERROR CODE (*3*)
632 ;
633 ;
634 ;
635 ;***** ROTATION SUBROUTINES *****
636 ;
637 02FD' F8 33 ROT0: LDI HDGFLG ; SET HDG FLAG = AC FOR THIS SEQUENCE
638 02FF' A7 ; PLO GPAGE ; RETURNS ON ROTATION ENCODER PWR)
639 0300' F8 AC ; LDI 0ACH
640 0302' 57 ; STR GPAGE
641 ;
642 0303' F8 80 ; LDI ERROR ; SET ERROR WORD BIT 6 = 0
643 0305' A7 ; PLO GPAGE
644 0306' 07 ; LDN GPAGE

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```

645 0307' FA 3F ANI 0BFH
646 0309' 57 STR GPAGE
647 ;
648 030A' F8 68 LDI PPCCNT ; SET PPCCNT TO 01
649 030C' A7 PLO GPAGE
650 030D' F8 01 LDI 01
651 030F' 57 STR GPAGE
652 ;
653 0310' 27 DEC GPAGE ; SET SEQRAT TO RUN EVERY FORTH CYCLE
654 0311' F8 82 LDI 82H ; (EVERY 100 MSEC.)
655 0313' 57 STR GPAGE
656 ;
657 SRET R6 ;RETURN FROM SUBROUTINE
658 0314' 68 96 +
659 ;
660 ;
661 0316' F8 68 ROT1: LDI PPCCNT ;CLEAR PPC COUNT
662 0318' A7 PLO GPAGE
663 0319' F8 00 LDI 00
664 ;
665 031B' 57 STR GPAGE
666 ;
667 031C' 27 DEC GPAGE ;CLEAR SEQUENCER RATE
668 031D' 57 STR GPAGE
669 ;
670 031E' F8 33 LDI HDGFLG ;RESET HDG FLAG = 00
671 0320' A7 PLO GPAGE
672 0321' F8 00 LDI 00
673 0323' 57 STR GPAGE
674 ;
675 SRET R6 ;RETURN FROM SUBROUTINE
676 0324' 68 96 +
677 ;
678 ;
679 ;
680 ;***** ROTATION - TIMEOUT CHECK SUBRCUTINE *****
681 ;
682 0326' F8 19 RCNT: LDI CYCLES ;INCREMENT PPC COUNT ONCE PER SEC.
683 0328' A7 PLO GPAGE ; AT CYCLES = 01
684 0329' 07 LDN GPAGE
685 032A' F8 01 XRI 01
686 032C' 1A 3B' BNZ RCNTX1 ; EXIT IF CYCLES NOT 01
687 ; ; IF CYCLES = 01
688 ;
689 032E' 27 DEC GPAGE ; LOOK AT SEC1
690 032F' F6 SHR
  
```

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691 0330' 33 33'          BDF RCNTX1      ; EXIT IF SEC = ODD
692                               ;
693 0332' F8 68          LDI PPCCNT      ; INC PPCCNT IF SEC = EVEN
694 0334' A7             FLO GPAGE
695 0335' 07            LDN GPAGE
696 0336' 57            STR GPAGE
697 0337' FF F0          SMI TIME02      ; EXIT IF PPC COUNT IS LESS THAN TIME02 LIMIT
698 0339' 33 3D'        BDF RCNTX2      ; GO TO RCNTX2 IF PPC COUNT = OR GREATER THAN TIME02
699                               ;
700 033B'                RCNTX1: SRET R6      ;RETURN FROM SUBROUTINE
701 033B' 68 96          ;
702                               ;
703 033D' 16            RCNTX2: INC R6      ;IF PPC COUNT = TIME LIMIT,
704 033E' 16            INC R6
705 033F' 16            INC R6
706                               SRET R6      ;RETURN TO ROTATION ERROR SETUP
707 0340' 68 96          ;
708                               ;
709                               ;
710                               ;***** EO 9h - X, Y, Z, TRAVERSE CONTROL *****
711                               ;
712 0342' E2            POSX:  SEX STACK      ;EO 90-9F
713 0343' 0C            LDN PPC
714 0344' FA 0F          ANI 0FH
715 0346' C2 0383'      LBZ PULXP      ;EO 90 Pulse X+ Relay
716 0349' FB 01          XRI 01
717 034B' C2 038C'      LBZ PULXN      ;EO 91 Pulse X- Relay
718 034E' FB 03          XRI (01 KOR 02)
719 0350' C2 0395'      LBZ PULYP      ;EO 92 Pulse Y+ Relay
720 0353' FB 01          XRI (02 KOR 03)
721 0355' C2 039E'      LBZ PULYN      ;EO 93 Pulse Y- Relay
722 0358' FB 07          XRI (03 KOR 04)
723 035A' C2 03A7'      LBZ PULZP      ;EO 94 Pulse Z+ Relay
724 035D' FB 01          XRI (04 KOR 05)
725 035F' C2 03B0'      LBZ PULZN      ;EO 95 Pulse Z- Relay
726 0362' FB 0F          XRI (05 KOR 0AH)
727 0364' C2 03B9'      LBZ X0          ;EO 9A = Zero X Position
728 0367' FB 01          XRI (0AH KOR 0BH)
729 0369' C2 041A'      LBZ XINC      ;EO 9B = Increment X Position
730 036C' FB 07          XRI (0BH KOR 0CH)
731 036E' C2 0482'      LBZ Y0          ;EO 9C = Zero Y Position
732 0371' FB 01          XRI (0CH KOR 0DH)
733 0373' C2 04E2'      LBZ YINC      ;EO 9D = Increment Y Position
734 0376' FB 03          XRI (0DH KOR 0EH)
735 0378' C2 0552'      LBZ Z0          ;EO 9E = Zero Z Position
736 037B' FB 01          XRI (0EH KOR 0FH)

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737 037D' C2 05B4'          LBZ ZINC          ;EO 9F = Increment Y Position
738 0380' C0 0000*          LBR INCPPC
739                                     ;
740 0383'                   PULXP: SCAL R6, PULSE
741 0383' 68 86             +
742 0385' 07B6'             +
743 0387' 18                 DB 30Q          ; Relay Driver 30Q = 16H = 24D
744 0388' 08                 DB 08H          ; 8 CYCLES = 200mSec.
745 0389' C0 0000*          LBR INCPPC
746                                     ;
747 038C'                   PULXN: SCAL R6, PULSE
748 038C' 68 86             +
749 038E' 07B6'             +
750 0390' 19                 DB 31Q
751 0391' 08                 DB 08H
752 0392' C0 0000*          LBR INCPPC
753                                     ;
754 0395'                   PULYP: SCAL R6, PULSE
755 0395' 68 86             +
756 0397' 07B6'             +
757 0399' 1A                 DB 32Q
758 039A' 08                 DB 08H
759 039B' C0 0000*          LBR INCPPC
760                                     ;
761 039E'                   PULYN: SCAL R6, PULSE
762 039E' 68 86             +
763 03A0' 07B6'             -
764 03A2' 1B                 DB 33Q
765 03A3' 08                 DB 08H
766 03A4' C0 0000*          LBR INCPPC
767                                     ;
768 03A7'                   PULZP: SCAL R6, PULSE
769 03A7' 68 86             +
770 03A9' 07B6'             -
771 03AB' 1C                 DB 34Q
772 03AC' 08                 DB 08H
773 03AD' C0 0000*          LBR INCPPC
774                                     ;
775 03B0'                   PULZN: SCAL R6, PULSE
776 03B0' 68 86             +
777 03B2' 07B6'             +
778 03B4' 1D                 DB 35Q
779 03B5' 08                 DB 08H
780 03B6' C0 0000*          LBR INCPPC
781                                     ;
782                                     ;

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783 ;
784 ;***** ZERO THE X POSITION: SEQUENCER CODE = E0 9A *****
785 ;
786 03B9' F8 57 X0: LDI SEQRAT ;CHECK TO SEE IF WE ARE SENDING THE
787 03BB' A7 PLO GPAGE ; ACOUSTIC ERROR MESSAGE GENERATED
788 03BC' 07 LDN GPAGE ; BY THIS PPC (SEQRAT = 8FH)
789 03BD' FB 8F XRI 08FH
790 03BF' C2 0123' LBZ PINGRX ; IF SO, GO TO THE PINGER ROUTINE
791 ;
792 03C2' F8 68 LDI PPCCNT ;1st TIME THRU THE PPC ?
793 03C4' A7 PLO GPAGE
794 03C5' 07 LDN GPAGE
795 03C6' 3A E4' BNZ XON ; IF NOT; GO TO XON
796 ;
797 ;
798 03C8' F8 93 X00: LDI XPOS ; CHECK CURRENT X POSITION
799 03CA' A7 PLO GPAGE
800 03CB' 07 LDN GPAGE
801 03CC' 2E DEC ASTK ; STORE CURRENT VALUE OF X POS. ON ASTK
802 03CD' FA 0F ANI 0FH ; (NOT USED BUT THE ASTK GETS INCREMENTED
803 03CF' 5E STR ASTK ; LATER AND MUST BE DECREMENTED HERE)
804 03D0' FA 08 ANI 08H ;CHECK ZERO POSITION BIT (MSB OF LO NIBBLE)
805 03D2' CA 061E' LBZ POSXT2 ; IGNORE AND EXIT IF ZERO POSITION BIT= 0
806 ;
807 03D5' E2 SEX STACK ; SET UP INITIAL PARAMETERS
808 SCAL R6, POS0
809 03D6' 68 36 +
810 03D8' 0637' +
811 ;
812 03DA' E2 SEX STACK ; PULSE X- RELAY to start
813 SCAL R6, PULSE ; the traverse
814 03DB' 68 86 +
815 03DD' 07B6' +
816 03DF' 19 DB 31Q ; 31Q = X- Relay
817 03E0' 34 DB 04H ; 100 mSec. Pulse
818 ;
819 03E1' C0 0622' LBR POSXT1 ; EXIT THE ROUTINE
820 ;
821 ;
822 03E4' 21 XON: SEX INTPC ;READ X POSITION OPTO INTERRUPTERS
823 03E5' 61 OUT GROUP ;GROUP 00
824 03E6' 00 DB 00
825 03E7' F8 93 LDI XPOS
826 03E9' A7 PLO GPAGE
827 03EA' 27 SEX GPAGE
828 03EB' 6B INP X ;INPUT X POSITION

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829 03EC' FA 08 ANI 08H ;CHECK X ZERO POSITION BIT
830 03EE' CA 0410' LBNZ XOOK ;IF AT ZERO POSITION, GO TO XOOK
831 ; ;IF NOT:
832 03F1' F8 19 LDI CYCLES ; INCREMENT PPC COUNT ONCE PER SEC.
833 03F3' A7 PLO GPAGE ; AT CYCLES= 01
834 03F4' 07 LDN GPAGE
835 03F5' FB 01 XRI 01
836 03F7' CA 0622' LBNZ POSXT1 ; EXIT IF CYCLES NOT 01
837 03FA' F8 68 LDI PPCCNT ; INC PPCCNT
838 03FC' A7 PLO GPAGE
839 03FD' 07 LDN GPAGE
840 03FE' FC 01 ADI 01
841 0400' 57 STR GPAGE
842 0402' FB 78 XRI (TIME01 * 2); IF PPC COUNT NOT = (TIME01 * 2) LIMIT
843 0403' CA 0622' LBNZ POSXT1 ; THEN EXIT
844 ;
845 ;
846 0406' E2 XOERR: SEX STACK ;PULSE X- RELAY TO STOP TRAVERSE
847 SCAL R6, PULSE
848 0407' 68 86 +
849 0409' 07B6' +
850 040B' 19 DB 31Q
851 040C' 08 DB 08H
852 040D' C0 0625' LBR POSERR ;GO TO POSITION ERROR ROUTINE
853 ;
854 ;
855 0410' E2 XOOK: SEX STACK ;PULSE X- RELAY TO STOP TRAVERSE
856 SCAL R6, PULSE
857 0411' 68 86 +
858 0413' 07B6' +
859 0415' 19 DB 31Q
860 0416' 08 DB 08H
861 ;
862 0417' C0 0619' LBR POSOK
863 ;
864 ;
865 ;
866 ;***** INCREMENT X POSITION: SEQUENCER CODE = 20 9B *****
867 ;
868 041A' F8 67 XINC: LDI SEQRAT ;CHECK TO SEE IF WE ARE SENDING THE
869 041C' A7 PLO GPAGE ; ACOUSTIC ERROR MESSAGE GENERATED
870 041D' 07 LDN GPAGE ; BY THIS PPC (SEQRAT = 8FH)
871 041E' FB 8F XRI 08FH
872 0420' C2 0123' LBR PINGRX ; IF SO, GO TO THE PINGER ROUTINE
873 ;
874 0423' F8 68 LDI PPCCNT ;1st TIME THRU THE PPC ?

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875 0425' A7 PLO GPAGE
876 0426' 07 LDN GPAGE
877 0427' CA 0446' LBNZ XINCN ; IF NOT: GO TO XINCN
878 ;
879 ; ;ELSE:
880 042A' F8 93 XINC0: LDI XPOS ; CHECK CURRENT POSITION
881 042C' A7 PLO GPAGE
882 042D' 07 LDN GPAGE
883 042E' 2E DEC ASTK
884 042F' FA 07 ANI 07 ; MASK OUT UNUSED HI NIBBLE AND ZERO (RESET) BIT
885 0431' 5E STR ASTK ; STORE ON SEQUENCER ASTK
886 0432' FF 07 SMI 07
887 0434' C3 061E' LBDF POSXT2 ; IGNORE AND EXIT IF POSITION >= 7
888 ;
889 0437' E2 SEX STACK ; SET UP INITIAL PARAMETERS
890 SCAL R6, POS0
891 0438' 68 86 +
892 043A' 0637' +
893 ;
894 043C' E2 SEX STACK ; PULSE X+ RELAY to start
895 SCAL R6, PULSE ; the traverse
896 043D' 68 86 +
897 043F' 0736' +
898 0441' 13 DB 30Q ; 30Q = X+ Relay
899 0442' 04 DB 04H ; 100 mSec. Pulse
900 ;
901 0443' C0 0622' LBR POSXT1 ; EXIT THE ROUTINE
902 ;
903 ;
904 0446' E1 XINCN: SEX INTPC ;READ X POSITION OPTO INTERRUPTERS
905 0447' 61 OUT GROUP ;GROUP 00
906 0448' 00 DB 00
907 0449' F8 93 LDI XPOS
908 044B' A7 PLO GPAGE
909 044C' E7 SEX GPAGE
910 044D' 6B INP X ;INPUT X POSITION
911 044E' FA 07 ANI 07H ;Mask null bits "0" position bit
912 0450' E2 SEX STACK
913 0451' 52 STR STACK
914 0452' 0E LDN ASTK ;GET THE ORIGINAL X VALUE FOR THE ASTK
915 0453' FC 01 ADI 01
916 0455' F3 XOR ;(X POS) XOR (OLD POS - 1)
917 0456' C2 0478' LBZ XINCOK ;IF AT NEXT POSITION, GO TO XINCOK
918 ; ;IF NOT:
919 0459' F8 19 LDI CYCLES ; INCREMENT PPC COUNT ONCE PER SEC.
920 045B' A7 PLO GPAGE ; AT CYCLES= 01
  
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921 045C' 07 LDN GPAGE
922 045D' F8 01 XRI 01
923 045F' CA 0622' LBNZ POSXT1 ; EXIT IF CYCLES NOT 01
924 0462' F8 58 LDI PPCCNT ; INC PPCCNT
925 0464' A7 PLO GPAGE
926 0465' 07 LDN GPAGE
927 0466' FC 01 ADI 01
928 0468' 57 STR GPAGE
929 0469' FB 3C XRI TIME01 ; IF PPC COUNT NOT = TIME01 LIMIT
930 046B' CA 0622' LBNZ POSXT1 ; THEN EXIT
931 ;
932 ;
933 046E' E2 XINCER: SEX STACK ;PULSE X+ RELAY TO STOP TRAVERSE
934 SCAL R6, PULSE
935 046F' 68 86 +
936 0471' 07B6' +
937 0473' 18 DB 30Q
938 0474' 08 DB 08H
939 0475' C0 0625' LBR POSERR
940 ;
941 0478' E2 XINCOK: SEX STACK ;PULSE X+ RELAY TO STOP TRAVERSE
942 SCAL R6, PULSE
943 0479' 68 86 +
944 047B' 07B6' +
945 047D' 18 DB 30Q
946 047E' 08 DB 08H
947 047F' C0 0619' LBR POSOK
948 ;
949 ;
950 ;
951 ;***** ZERO THE Y POSITION: SEQUENCER CODE = E0 9C *****
952 ;
953 0482' F8 67 Y0: LDI SEQRAT ;CHECK TO SEE IF WE ARE SENDING THE
954 0484' A7 PLO GPAGE ; ACOUSTIC ERROR MESSAGE GENERATED
955 0485' 07 LDN GPAGE ; BY THIS PPC (SEQRAT = 3FH)
956 0486' FB 3F XRI 08FH
957 0488' C2 0123' LBR PINGRX ; IF SO, GO TO THE PINGER ROUTINE
958 ;
959 048B' F8 68 LDI PPCCNT ;1st TIME THRU THE PPC ?
960 048D' A7 PLO GPAGE
961 048E' 07 LDN GPAGE
962 048F' CA 04AD' LBNZ YON ; IF NOT; GO TO YINCX
963 ;
964 ; ;ELSE:
965 0492' F8 94 Y00: LDI YZPOS ; CHECK CURRENT POSITION
966 0494' A7 PLO GPAGE

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967 0495' 07          LDN GPAGE
968 0496' 2E          DEC ASTK      ; STORE CURRENT VALUE OF Y POS. ON ASTK
969 0497' FA F0       ANI OFOH      ; (NOT USED BUT THE ASTK GETS INCREMENTED
970 0499' 5E          STR ASTK      ; (LATER AND MUST BE DECREMENTED HERE)
971 049A' FE          SHL           ;CHECK ZERO POSITION BIT (MSB OF HI NIBBLE)
972 049B' C3 061E'   LBDF POSXT2  ; IGNORE AND EXIT IF ZERO POSITION BIT= 0
973
974 049E' E2          SEX STACK    ; SET UP INITIAL PARAMETERS
975 SCAL R6, POS0
976 049F' 68 36       -
977 04A1' 0637'       +
978
979 04A3' E2          SEX STACK    ; PULSE Y- RELAY to start
980 SCAL R6, PULSE   ; the traverse
981 04A4' 68 86       +
982 04A6' 07B6'       +
983 04A8' 1B          DB 33Q      ; 33Q = Y- Relay
984 04A9' 04          DB 04H      ; 100 mSec. Pulse
985
986 04AA' C3 0622'    LBR POSXT1  ; EXIT THE ROUTINE
987
988
989 04AD' E1          YCN: SEX INTPC  ;READ YZ POSITION OPTO INTERRUPTERS
990 04AE' 61          OUT GROUP    ;GROUP 00
991 04AF' 00          DB 00
992 04B0' F8 94       LDI YZPOS
993 04B2' A7          PLO GPAGE
994 04B3' E7          SEX GPAGE
995 04B4' 5C          INP YZ      ;INPUT YZ POSITION
996 04B5' FE          SHL           ;MOVE Y ZERO POSITION BIT TO LOW NIBBLE
997 04B6' C3 04D8'   LBDF YOOK   ;IF AT ZERO POSITION, GO TO YOOK
998
999 04B9' F8 19       LDI CYCLES  ; INCREMENT PPC COUNT ONCE PER SEC.
1000 04BB' A7          PLO GPAGE   ; AT CYCLES= 01
1001 04BC' C7          LDN GPAGE
1002 04BD' FB 01       XRI 01
1003 04BF' CA 0622'   LBZ POSXT1  ; EXIT IF CYCLES NOT 01
1004 04C2' F8 68       LDI PPCCNT  ; INC PPCCNT
1005 04C4' A7          PLO GPAGE
1006 04C5' 07          LDN GPAGE
1007 04C6' FC 01       ADI 01
1008 04C8' 57          STR GPAGE
1009 04C9' FB 3C       XRI TIME01  ; IF PPC COUNT NOT = TIME01 LIMIT
1010 04CB' CA 0622'   LBZ POSXT1  ; THEN EXIT
1011
1012

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1013 04CE' E2          YOER: SEX STACK      ;PULSE Y- RELAY TO STOP TRAVERSE
1014                                SCAL R6, PULSE
1015 04CF' 68 86      +
1016 04D1' 0736'     +
1017 04D3' 1B          DB 33Q
1018 04D4' 08          DB 08H
1019 04D5' C0 0625'   LBR POSERR      ;GO TO POSITION ERROR ROUTINE
1020                                ;
1021                                ;
1022 04D8' E2          YOOR: SEX STACK      ;PULSE Y- RELAY TO STOP TRAVERSE
1023                                SCAL R6, PULSE
1024 04D9' 68 86      +
1025 04DB' 0736'     +
1026 04DD' 1B          DB 33Q
1027 04DE' 08          DB 08H
1028                                ;
1029 04DF' C0 0619'   LBR POSOK
1030                                ;
1031                                ;
1032                                ;
1033                                ;***** INCREMENT Y POSITION: SEQUENCER CODE = 50 8D *****
1034                                ;
1035 04E2' F8 67      YINC: LDI SEQRAT   ;CHECK TO SEE IF WE ARE SENDING THE
1036 04E4' A7          PLO GPAGE    ; ACOUSTIC ERROR MESSAGE GENERATED
1037 04E5' 07          LDN GPAGE    ; BY THIS PPC (SEQRAT = 3FH)
1038 04E6' F8 8F      XRI 08FH
1039 04E8' C2 0123'   LBR PINGRX   ; IF SO, GO TO THE PINGER ROUTINE
1040                                ;
1041 04EB' F8 68          LDI PPCCNT   ;1st TIME THRU THE PPC ?
1042 04ED' A7          PLO GPAGE
1043 04EE' 07          LDN GPAGE
1044 04EF' CA 0512'   LBRZ YINCN   ; IF NOT; GO TO YINCN
1045                                ;
1046                                ;
1047 04F2' F8 94      YINC0: LDI YZPOS    ; CHECK CURRENT POSITION
1048 04F4' A7          PLO GPAGE
1049 04F5' 07          LDN GPAGE
1050 04F6' 2E          DEC ASTK
1051 04F7' F6          SHR          ;MOVE Y POSITION TO LOW NIBBLE
1052 04F8' F6          SHR
1053 04F9' F6          SHR
1054 04FA' F6          SHR
1055 04FB' FA 07      ANI 07      ; MASK OUT UNUSED HI NIBBLE AND ZERO (RESET) BIT
1056 04FD' 5E          STR ASTK     ; STORE ON SEQUENCER ASTK
1057 04FE' F7 07      SMI 07
1058 0500' C3 061E'   LBRDF POSXT2 ; IGNORE AND EXIT IF POSITION >= 7

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1059          ;
1060    0503'  E2          SEX STACK      ; SET UP INITIAL PARAMETERS
1061          ;          SCAL R6, POS0
1062    0504'  68 86      +
1063    0506'  0637'     +
1064          ;
1065    0508'  E2          SEX STACK      ; PULSE Y+ RELAY to start
1066          ;          SCAL R6, PULSE ; the traverse
1067    0509'  68 86      +
1068    050B'  0736'     +
1069    050D'  1A          DB 32Q         ; 32Q = Y+ Relay
1070    050E'  04          DB 04H         ; 100 mSec. Pulse
1071          ;
1072    050F'  C0 0622'   LBR POSXT1    ; EXIT THE ROUTINE
1073          ;
1074          ;
1075    0512'  E1          YINCN: SEX INTPC ;READ YZ POSITION OPTO INTERRUPTERS
1076    0513'  61          OUT GROUP      ;GROUP 00
1077    0514'  00          DB 00
1078    0515'  F8 94      LDI YZPOS
1079    0517'  A7          PLO GPAGE
1080    0518'  E7          SEX GPAGE
1081    0519'  6C          INP YZ        ;INPUT YZ POSITION
1082    051A'  F6          SHR           ;MOVE Y POSITION TO LOW NIBBLE
1083    051B'  F6          SHR
1084    051C'  F6          SHR
1085    051D'  F6          SHR
1086    051E'  FA 07      ANI 07H        ;Mask null bits "0" position bit
1087    0520'  52          STR STACK
1088    0521'  E2          SEX STACK
1089    0522'  0E          LDN ASTK      ;GET THE ORIGINAL Y VALUE FOR THE ASTK
1090    0523'  FC 01      ADI 01
1091    0525'  F3          XOR           ;(Y POS) XOR (OLD POS + 1)
1092    0526'  C2 0543'   LBZ YINCOK    ;IF AT NEXT POSITION, GO TO YINCOK
1093          ;          ;IF NOT:
1094    0529'  F8 19      LDI CYCLES    ; INCREMENT PPC COUNT ONCE PER SEC.
1095    052B'  A7          PLO GPAGE      ; AT CYCLES= 01
1096    052C'  07          LDN GPAGE
1097    052D'  FB 01      XRI 01
1098    052F'  CA 0622'   LBNZ POSXT1    ; EXIT IF CYCLES NOT 01
1099    0532'  F8 68      LDI PPCCNT    ; INC PPCCNT
1100    0534'  A7          PLO GPAGE
1101    0535'  07          LDN GPAGE
1102    0536'  FC 01      ADI 01
1103    0538'  57          STR GPAGE
1104    0539'  FB 3C      XRI TIME01    ; IF PPC COUNT NOT = TIME01 LIMIT
  
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1105 053B' CA 0622'          LBNZ POSXT1 ; THEN EXIT
1106
1107
1108 053E' E2                YINCER: SEX STACK ;PULSE Y+ RELAY TO STOP TRAVERSE
1109                          SCAL R6, PULSE
1110 053F' 68 86              -
1111 0541' 07B6'              +
1112 0543' 1A                DB 32Q
1113 0544' 08                DB 08H
1114 0545' C0 0625'        LBR POSERR
1115
1116 0548' E2                YINCOR: SEX STACK ;PULSE Y+ RELAY TO STOP TRAVERSE
1117                          SCAL R6, PULSE
1118 0549' 68 36              +
1119 054B' 0736'              +
1120 054D' 1A                DB 32Q
1121 054E' 08                DB 08H
1122 054F' C0 0619'        LBR POSOK
1123
1124
1125
1126 ;***** ZERO THE Z POSITION: SEQUENCER CODE = E0 9E *****
1127
1128 0552' F8 67              Z0:  LDI SEQRAT ;CHECK TO SEE IF WE ARE SENDING THE
1129 0554' A7                PLO GPAGE ; ACOUSTIC ERROR MESSAGE GENERATED
1130 0555' 07                LDN GPAGE ; BY THIS PPC (SEQRAT = 8FH)
1131 0556' F8 3F              XRI 08FH
1132 0558' C2 0123'        LBR PINGRX ; IF SO, GO TO THE PINGER ROUTINE
1133
1134 055B' F8 68              LDI PPCCNT ;1st TIME THRU THE PPC ?
1135 055D' A7                PLO GPAGE
1136 055E' 07                LDN GPAGE
1137 055F' CA 057E'        LBNZ ZON ; IF NOT, GO TO ZINCN
1138
1139 ;
1140 ;
1141 ;
1142 ;
1143 ;
1144 ;
1145 ;
1146 ;
1147 ;
1148 ;
1149 0567' E2                Z00:  LDI YZPOS ; CHECK CURRENT POSITION
1150                          PLO GPAGE
1151                          LDN GPAGE
1152                          DEC ASTR ; STORE CURRENT VALUE OF Z POS. ON ASTR
1153                          ANI 0FH ; (NOT USED BUT THE ASTR GETS INCREMENTED
1154                          STR ASTR ; LATER AND MUST BE DECREMENTED HERE)
1155                          ANI 08H ;CHECK ZERO POSITION BIT (MSB OF LO NIBBLE)
1156                          LBNZ POSXT2 ; IGNORE AND EXIT IF ZERO POSITION BIT= 0
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1151 0570' 68 86 +
1152 0572' 0637' +
1153 ;
1154 0574' E2 SEX STACK ; PULSE Z- RELAY to start
1155 SCAL R6, PULSE ; the traverse
1156 0575' 68 86 -
1157 0577' 0786' +
1158 0579' 1D DB 35Q ; 35Q = Z- Relay
1159 057A' 04 DB 34H ; 100 mSec. Pulse
1160 ;
1161 057B' C0 3622' LBR POSXT1 ; EXIT THE ROUTINE
1162 ;
1163 ;
1164 057E' E1 ZON: SEX INTPC ;READ YZ POSITION OPTO INTERRUPTERS
1165 057F' 61 OUT GROUP ;GROUP 00
1166 0580' 00 DB 00
1167 0581' F8 94 LDI YZPOS
1168 0583' A7 PLO GPAGE
1169 0584' E7 SEX GPAGE
1170 0585' 6C INP YZ ;INPUT YZ POSITION
1171 0586' FA 08 ANI 08H ;CHECK Z ZERO POSITION BIT
1172 0588' CA 05AA' LBNZ Z00K ;IF AT ZERO POSITION, GO TO Z00K
1173 ; ;IF NOT:
1174 058B' F8 19 LDI CYCLES ; INCREMENT PPC COUNT ONCE PER SEC.
1175 058D' A7 PLO GPAGE ; AT CYCLES= 01
1176 058E' 07 LDN GPAGE
1177 058F' F9 01 XRI 01
1178 0591' CA 0622' LBNZ POSXT1 ; EXIT IF CYCLES NOT 01
1179 0594' F8 68 LDI PPCONT ; INC PPCONT
1180 0596' A7 PLO GPAGE
1181 0597' 07 LDN GPAGE
1182 0598' FC 01 ADI 01
1183 059A' 57 STR GPAGE
1184 059B' FB 3C XRI TIME01 ; IF PPC COUNT NOT = TIME01 LIMIT
1185 059D' CA 0622' LBNZ POSXT1 ; THEN EXIT
1186 ;
1187 ;
1188 ;
1189 05A0' E2 ZOSERR: SEX STACK ;PULSE Z- RELAY TO STOP TRAVERSE
1190 SCAL R6, PULSE
1191 05A1' 68 86 -
1192 05A3' 0786' +
1193 05A5' 1D DB 35Q
1194 05A6' 08 DB 08H
1195 05A7' C0 0625' LBR POSERR ;GO TO POSITION ERROR ROUTINE
1196 ;
  
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1197 ;
1198 05AA' E2 ZOOK: SEX STACK ;PULSE Z- RELAY TO STOP TRAVERSE
1199 SCAL R6, PULSE
1200 05AB' 68 86 +
1201 05AD' 07B6' +
1202 05AF' 1D DB 35Q
1203 05B0' 08 DB 08H
1204 ;
1205 05B1' C0 0619' LBR POSOX
1206 ;
1207 ;
1208 ;
1209 ;***** INCREMENT Z POSITION: SEQUENCER CODE = E0 9F *****
1210 ;
1211 05B4' F8 67 ZINC: LDI SEQRAT ;CHECK TO SEE IF WE ARE SENDING THE
1212 05B6' A7 PLO GPAGE ; ACOUSTIC ERROR MESSAGE GENERATED
1213 05B7' 07 LDN GPAGE ; BY THIS PPC (SEQRAT = 8FH)
1214 05B8' FB 8F XRI 08FH
1215 05BA' C2 0133' LBR PINGRX ; IF SO, GO TO THE PINGER ROUTINE
1216 ;
1217 05BD' F8 68 LDI PPCCNT ;1st TIME THRU THE PPC ?
1218 05BF' A7 PLO GPAGE
1219 05C0' 07 LDN GPAGE
1220 05C1' CA 05E0' LBRZ ZINCN ; IF NOT, GO TO ZINCN
1221 ;
1222 ;
1223 05C4' F8 94 ZINC0: LDI YZPOS ;ELSE:
1224 05C6' A7 PLO GPAGE ; CHECK CURRENT POSITION
1225 05C7' 07 LDN GPAGE
1226 05C8' 2E DEC ASTK
1227 05C9' FA 07 ANI 07 ; MASK OUT UNUSED HI NIBBLE AND ZERO RESET BIT
1228 05CB' 5E STR ASTK ; STORE ON SEQUENCER ASTK
1229 05CC' FF 07 SMI 07
1230 05CE' C3 061E' LBRDF POSXT2 ; IGNORE AND EXIT IF POSITION >= "
1231 ;
1232 05D1' E2 SEX STACK ; SET UP INITIAL PARAMETERS
1233 SCAL R6, POS0
1234 05D2' 68 86 -
1235 05D4' 0637' -
1236 ;
1237 05D6' E2 SEX STACK ; PULSE Z+ RELAY to start
1238 SCAL R6, PULSE ; the traverse
1239 05D7' 68 86 +
1240 05D9' 07B6' +
1241 05DB' 1C DB 34Q ; 32Q = Z+ Relay
1242 05DC' 04 DB 04H ; 100 mSec. Pulse

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1243 ;
1244 05DD' CO 0622' LBR POSXT1 ; EXIT THE ROUTINE
1245 ;
1246 ;
1247 05E0' E1 ZINCX: SEX INTPC ;READ YZ POSITION OPTO INTERRUPTERS
1248 05E1' 61 OUT GROUP ;GROUP 00
1249 05E2' 00 DB 00
1250 05E3' F8 94 LDI YZPOS
1251 05E5' A7 PLO GPAGE
1252 05E6' E7 SEX GPAGE
1253 05E7' 6C INP YZ ;INPUT Z POSITION
1254 05E8' FA 07 ANI 07H ;Mask null bits "0" position bit
1255 05EA' E2 SEX STACK
1256 05EB' 52 STR STACK
1257 05EC' 0E LDN ASTK ;GET THE ORIGINAL Z VALUE FOR THE ASTK
1258 05ED' FC 01 ADI 01
1259 05EF' F3 XOR ;(Z POS) XOR (OLD POS + 1)
1260 05F0' C2 0612' LBZ ZINCOK ;IF AT NEXT POSITION, GO TO ZINCOK
1261 ; ;IF NOT:
1262 05F3' F8 19 LDI CYCLES ; INCREMENT PPC COUNT ONCE PER SEC.
1263 05F5' A7 PLO GPAGE ; AT CYCLES= 01
1264 05F6' 07 LDN GPAGE
1265 05F7' F3 01 XRI 01
1266 05F9' CA 0622' LBZ POSXT1 ; EXIT IF CYCLES NOT 01
1267 05FC' F8 68 LDI PPCCNT ; INC PPCCNT
1268 05FE' A7 PLO GPAGE
1269 05FF' 07 LDN GPAGE
1270 0600' FC 01 ADI 01
1271 0602' 57 STR GPAGE
1272 0603' F3 3C XRI TIME01 ; IF PPC COUNT NOT = TIME01 LIMIT
1273 0605' CA 0622' LBZ POSXT1 ; THEN EXIT
1274 ;
1275 ;
1276 0608' E2 ZINCER: SEX STACK ;PULSE Z+ RELAY TO STOP TRAVERSE
1277 SCAL R6, PULSE
1278 0609' 68 36 +
1279 060B' 07B6' +
1280 060D' 1C DB 34Q
1281 060E' 08 DB 08H
1282 060F' CO 0625' LBR POSERR
1283 ;
1284 0612' E2 ZINCOK: SEX STACK ;PULSE Z+ RELAY TO STOP TRAVERSE
1285 SCAL R6, PULSE
1286 0613' 68 36 +
1287 0615' 07B6' +
1288 0617' 1C DB 34Q

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1289 0618' 08          DB 08H
1290
1291 0619' 02          POSOK: SEX STACK
1292                      SCAL R6, POS1 ;CLEAR PARAMETERS
1293 061A' 68 36      -
1294 061C' 0650'      +
1295
1296 061E' 1E          POSXT2: INC ASTK      ;CLEAR OLD ZPOS FROM ASTK
1297 061F' 00 0000*   LBR INCPPC      ;GO TO SET UP FOR NEXT PPC
1298
1299
1300 0622' 00 0000*   POSXT1: LBR DECPPC      ;GO TO DECREMENT PPC
1301
1302
1303 0625' F8 80          POSERR: LDI ERROR      ;SET POSITION ERROR CODE IN ERROR WORD
1304 0627' A7          PLO GPAGE
1305 0628' 07          LDN GPAGE
1306 0629' F9 80          ORI 80H      ;POSITION ERROR = BIT 7
1307 062B' 57          STR GPAGE
1308
1309 062C' 02          SEX STACK      ;CLEAR PARAMETERS
1310                      SCAL R6, POS1
1311 062D' 68 36      +
1312 062F' 0650'      +
1313
1314 0631' F8 0A          LDI 0AH      ;LOAD ASTK WITH ERROR CODE (Stk position is
1315 0633' 0E          STR ASTK      ; not changed; pinger will clear and increment)
1316 0634' 00 0123'   LBR PINGRX      ;SEND PINGER XYZ ERROR CODE "A"
1317
1318
1319
1320 ;*** SUBROUTINES ***
1321
1322 0637' F8 34          POS0:  LDI XYZFLG      ; SET XYZ FLAG = AC FOR THIS SEQUENCE
1323 0639' A7          PLO GPAGE      ; (TURNS ON OPTO INTERRUPTER PWR)
1324 063A' F8 AC          LDI 0ACH
1325 063C' 57          STR GPAGE
1326
1327 063D' F8 80          LDI ERROR      ; SET ERROR WORD MSB = 0
1328 063F' A7          PLO GPAGE
1329 0640' 07          LDN GPAGE
1330 0641' FA 7F          ANI 7FH
1331 0643' 57          STR GPAGE
1332
1333 0644' F8 68          LDI PPCCNT      ; SET PPCCNT TO 01
1334 0646' A7          PLO GPAGE

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1335 0647' F8 01          LDI 01
1336 0649' 57          STR GPAGE
1337                      ;
1338 064A' 27          DEC GPAGE          ; SET SEQRAT TO RUN EVERY CYCLE
1339 064B' F8 10          LDI 10H          ; (EVERY 25 mSEC.)
1340 064D' 57          STR GPAGE
1341                      ;
1342                      SRET R6          ;RETURN FROM SUBROUTINE
1343 064E' 68 96          ;
1344                      ;
1345                      ;
1346 0650' F8 68          POS1: LDI PPCCNT          ;CLEAR PPC COUNT
1347 0652' A7          PLO GPAGE
1348 0653' F8 00          LDI 00
1349 0655' 57          STR GPAGE
1350                      ;
1351 0656' 27          DEC GPAGE          ;CLEAR SEQUENCER RATE
1352 0657' 57          STR GPAGE
1353                      ;
1354 0658' F8 34          LDI XYZFLG          ;RESET XYZ FLAG = 00
1355 065A' A7          PLO GPAGE
1356 065B' F8 00          LDI 00
1357 065D' 57          STR GPAGE
1358                      ;
1359                      SRET R6          ;RETURN FROM SUBROUTINE
1360 065E' 68 96          +
1361                      ;
1362                      ;
1363                      ;
1364                      ;
1365                      ;***** EO An - SEDIMENT AND WATER SAMPLE FUNCTIONS *****
1366                      ;          where n = 0-7
1367                      ;
1368 0660' E2          SAMIX: SEX STACK          ;EO A0-A3
1369 0662' 0C          LDN PPC
1370 0662' FA 03          ANI 03          ;MASK FOR LAST 2 BITS
1371 0664' C2 0000*          LBR INCPPC          ; EO A1 = DOES NOTHING
1372 0667' FB 01          XRI 01
1373 0669' 32 76'          BZ SED1I          ; EO A1 = SED. 1 INSERT
1374 066B' FB 03          XRI (01 XOR 02)
1375 066D' 32 7F'          BZ SED1R          ; EO A2 = SED. 1 RETRACT
1376 066F' FB 01          XRI (02 XOR 03)
1377 0671' 32 38'          BZ SED1U          ; EO A3 = SED. 1 UNLATCH & H2O SAMPLE 1
1378 0673' C0 0000*          LBR INCPPC
1379                      ;
1380                      ;

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1381	0676'		SED1I: SCAL R6, PULSE	;PULSE SED.1 INSERT RELAY
1382	0676'	68 86		
1383	0678'	07B6'		
1384	067A'	06	DB 06Q	; Conn. 2 - Pin 3
1385	067B'	08	DB 08H	; Relay Pod 2
1386	067C'	CO 0000*	LBR INCPPC	
1387				
1388	067F'		SED1R: SCAL R6, PULSE	;PULSE SED.1 RETRACT RELAY
1389	067F'	68 86		
1390	0681'	07B6'		
1391	0683'	07	DB 07Q	; Conn. 2 - Pin 7
1392	0684'	08	DB 08H	; Relay Pod 2
1393	0685'	CO 0000*	LBR INCPPC	
1394				
1395	0688'		SED1U: SCAL R6, PULSE	;PULSE SED.1 UNLATCH. H20 SAMPLE 1 RELAY
1396	0688'	68 86		
1397	068A'	07B6'		
1398	068C'	08	DB 10Q	; Conn. 2 - Pin 6
1399	068D'	08	DB 08H	; Relay Pod 2
1400	068E'	CO 0000*	LBR INCPPC	
1401				
1402				
1403				
1404	0691'	E2	SAM2X: SEX STACK	;EO A4-A7
1405	0692'	0C	LDN PPC	
1406	0693'	FA 03	ANI 03	;MASK FOR LAST 2 BITS
1407	0695'	C2 0000*	LBZ INCPPC	; EO A4 = DOES NOTHING
1408	0698'	FB 01	XRI 01	
1409	069A'	32 A9'	BZ SED2I	; EO A5 = SED. 2 INSERT
1410	069C'	FB 03	XRI (01 XOR 02)	
1411	069E'	C2 06B2'	LBZ SED2R	; EO A6 = SED. 2 RETRACT
1412	06A1'	FB 01	XRI (02 XOR 03)	
1413	06A3'	C2 06BB'	LBZ SED2U	; EO A7 = SED. 2 UNLATCH
1414	06A6'	CO 0000*	LBR INCPPC	
1415				
1416				
1417	06A9'		SED2I: SCAL R6, PULSE	;PULSE SED.2 INSERT RELAY
1418	06A9'	68 86		
1419	06AB'	07B6'		
1420	06AD'	09	DB 11Q	; Conn. 2 - Pin 5
1421	06AE'	08	DB 08H	; Relay Pod 2
1422	06AF'	CO 0000*	LBR INCPPC	
1423				
1424	06B2'		SED2R: SCAL R6, PULSE	;PULSE SED.2 RETRACT RELAY
1425	06B2'	68 86		
1426	06B4'	07B6'		

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1427 06B6' 0A          DB 12Q          ; Conn. 2 - Pin 4
1428 06B7' 08          DB 08H          ; Relay Pod 2
1429 06B8' C0 0000*   LBR INCPPC
1430
1431 06BB'          SED2U: SCAL R6, PULSE      ;PULSE SED.2 UNLATCH, H2O SAMPLE 2 RELAY
1432 06BB' 68 86      +
1433 06BD' 07B6'      +
1434 06BF' 0B          DB 13Q          ; Conn. 2 - Pin 3
1435 06C0' 08          DB 08H          ; Relay Pod 2
1436 06C1' C0 0000*   LBR INCPPC
1437
1438
1439
1440 ;***** EO A8-AB - HYDRAULIC, SUCTION PUMPS AND VIEW PORT CLEAN *****
1441
1442
1443 06C4' E2          PUMPX: SEX STACK
1444 06C5' 0C          LBN PPC
1445 06C6' FA 03      ANI 03          ;MASK FOR LOW 2 BITS
1446 06C8' C2 06DD'   LBZ HYDRU      ; EO A8 = HYDRAULIC PUMP
1447 06CB' FB 01      XRI 01
1448 06CD' C2 06E6'   LBZ SPARE1     ; EO A9 = SPARE #1
1449 06D0' FB 03      XRI (01 XOR 02)
1450 06D2' C2 06EF'   LBZ SUCT       ; EO AA = SUCTION PUMP
1451 06D5' FB 01      XRI (02 XOR 03)
1452 06D7' C2 06F8'   LBZ CLEAN     ; EO AB = CLEAN VIEW PORT
1453 06DA' C0 0000*   LBR INCPPC
1454
1455 06DD'          HYDRU: SCAL R6, PULSE      ;HYDRAULIC PUMP
1456 06DD' 68 86      +
1457 06DF' 07B6'      +
1458 06E1' 13          DB 36Q          ; Conn. 6 - Pin 3
1459 06E2' 08          DB 08H          ; Relay Pod 6
1460 06E3' C0 0000*   LBR INCPPC
1461
1462 06E6'          SPARE1: SCAL R6, PULSE      ;SPARE #1
1463 06E6' 68 86      +
1464 06E8' 07B6'      +
1465 06EA' 21          DB 41Q          ; Conn. 6 - Pin 5
1466 06EB' 08          DB 08H          ; Relay Pod 6
1467 06EC' C0 0000*   LBR INCPPC
1468
1469 06EF'          SUCT: SCAL R6, PULSE      ;SUCTION PUMP
1470 06EF' 68 86      +
1471 06F1' 07B6'      +
1472 06F3' 16          DB 26Q          ; Conn. 4 - Pin 4

```

```

1473 06F4' 08 DB 08H ; Relay Pod 4
1474 06F5' C0 0000* LBR INCPPC
1475 ;
1476 06F8' CLEAN: SCAL R6, PULSE ;CLEAN VIEW PORT
1477 06F8' 68 86 +
1478 06FA' 07B6' +
1479 06FC' 17 DB 27Q ; Conn. 4 - Pin 3
1480 06FD' 08 DB 08H ; Relay Pod 4
1481 06FE' C0 0000* LBR INCPPC
1482 ;
1483 ;
1484 ;***** EO AC-AF - Flume Insert and Withdraw; Recirculate Pumps *****
1485 ;
1486 0701' E2 FLUMX: SEX STACK
1487 0702' 0C LDM PPC
1488 0703' FA 03 ANI 03 ;MASK FOR LOW 2 BITS
1489 0705' C2 0715 LBZ INSRT ; EO AC = Insert Flume
1490 0708' FB 01 XRI 01
1491 070A' C2 071E' LBZ RETRAC ; EO AD = Retract Flume
1492 070D' FB 03 XRI (01 XOR 02)
1493 070F' C2 0727' LBZ PUMPR1 ; EO AE = Recirculate Pump #1
1494 ; XRI (02 XOR 03) ;***** EO AF DISABLED *****
1495 ; BZ PUMPR2 ; EO AF = Recirculate Pump #2
1496 0712' C0 0000* LBR INCPPC
1497 ;
1498 0715' INSRT: SCAL R6, PULSE ;Insert Flume
1499 0715' 68 86 +
1500 0717' 07B6' -
1501 0719' 12 DB 22Q ; Conn. 4 - Pin 3
1502 071A' 08 DB 08H ; Relay Pod 4
1503 071B' C0 0000* LBR INCPPC
1504 ;
1505 071Z' RETRAC: SCAL R6, PULSE ;Retract Flume
1506 071E' 68 86 +
1507 0720' 07B6' +
1508 0722' 13 DB 23Q ; Conn. 4 - Pin 7
1509 0723' 08 DB 08H ; Relay Pod 4
1510 0724' C0 0000* LBR INCPPC
1511 ;
1512 0727' PUMPR1: SCAL R6, PULSE ;RECURCULATE PUMP #1
1513 0727' 68 86 +
1514 0729' 07B6' +
1515 072B' 1F DB 37Q ; Conn. 6 - Pin 7
1516 072C' 08 DB 08H ; Relay Pod 6
1517 072D' C0 0000* LBR INCPPC
1518 ;

```

```

1519 ;PUMPR2: SCAL R6, PULSE ;RECIRCULATE PUMP #2
1520 ; DB 40Q ; Conn. 6 - Pin 6
1521 ; DB 08R ; Relay Pod 5
1522 ; LBR INCPPC
1523 ;
1524 ;
1525 ;
1526 ;***** EO C0 - TAKE A PICTURE *****
1527 ;
1528 0730' 0C FLASHX: LDN PPC ;DECODE PPC
1529 0731' FA 03 ANI 03
1530 0733' CA 0000* LBNZ INCPPC ;RETURN IF NOT C0
1531 ;
1532 0736' E1 SEX INTPC
1533 0737' 61 OUT GROUP ; SELECT I/O GROUP 0
1534 0738' 00 DB 00
1535 ;
1536 0739' 66 OUT CAMERA ; I/O 6
1537 073A' 00 DB 00 ; NULL DATA
1538 ;
1539 073B' F8 88 LDI CANCNT ;INCREMENT CAMERA FRAME COUNTER
1540 073D' A7 PLO GPAGE
1541 073E' 07 LDN GPAGE
1542 073F' FC 01 ADI 01H
1543 0741' 57 STR GPAGE
1544 ;
1545 0742' C0 0000* LBR INCPPC
1546 ;
1547 ;
1548 ;
1549 ;***** EO D0 - RESET THE LDV *****
1550 ;
1551 0745' 0C RLDVX: LDN PPC ;DECODE PPC
1552 0746' FA 03 ANI 03
1553 0748' CA 0000* LBNZ INCPPC ;RETURN IF NOT D0
1554 ;
1555 074B' E1 SEX INTPC ;SELECT I/O GROUP 0
1556 074C' 61 OUT GROUP
1557 074D' 00 DB 00
1558 ;
1559 074E' 65 OUT LDVRST ;RESET LDV (I/O 5)
1560 074F' 00 DB 00 ; NULL DATA
1561 ;
1562 ;
1563 0750' C0 0000* LBR INCPPC
1564 ;
  
```

```

1565 ;
1566 ;
1567 ;***** EO Fn aaaa - SEQUENCER BRANCH ON SWITCH *****
1568 ;***** n = 0-3, aaaa = Branch address
1569 ;***** F0 = Bottom Switch, F1 = Flume Insertion Switches,
1570 ;***** F2 = Flume Retracted Switch, F3 = IGNORED (Spare)
1571 ;
1572 ;***** SWSTAT = ! Bot | ___ | ___ | Ins0 || Ins4 | Ins3 | Ins2 | Ins1 | *****
1573 ;
1574 ;
1575 0753' F8 82 IFSWX: LDI SWSTAT ; IF SWITCH nn FUNCTIONS
1576 0755' A7 PLO GPAGE ; LOAD SWITCH STATUS
1577 0756' 0C LDN PPC
1578 0757' FA 03 ANI 03 ; DO: IF PPC =
1579 0759' C2 076C' LBZ IFBOT ; EO F0, GO TO BOTTOM SW. ROUTINE
1580 075C' FB 01 XRI 01 ;
1581 075E' C2 0774' LBZ IFINS ; EO F1, GO TO FLUME INSERTION SW ROUTINE
1582 0761' FB 03 XRI (01 XOR 02) ;
1583 0763' C2 077F' LBZ IFRTR ; EO F2, GO TO FLUME RETRACTED SW ROUTINE (Ins0)
1584 ;
1585 0766' 1C IFSWX: INC PPC ; OTHERWISE, EXIT
1586 0767' 1C INC PPC
1587 0768' 1C INC PPC
1588 0769' C0 0000* LBR SAVPPC
1589 ;
1590 076C' 07 IFBOT: LDN GPAGE ; IF BOTTOM SW, JUMP TO AAAA
1591 076D' FE SHL ; ELSE, EXIT
1592 076E' C3 0766' LBNF IFSWX
1593 0771' C0 0000* LBR JUMP
1594 ;
1595 0774' 07 IFINS: LDN GPAGE ; IF ALL 4 INSERTION SWITCHES, JUMP TO AAAA
1596 0775' FA 0F ANI 0FH ; ELSE, EXIT
1597 0777' FB 0F XRI 0FH
1598 0779' C2 0000* LBZ JUMP
1599 077C' C0 0766' LBR IFSWX
1600 ;
1601 077F' 07 IFRTR: LDN GPAGE ; IF FLUME IS RETRACTED, JUMP TO AAAA
1602 0780' FA 10 ANI 10H
1603 0782' C2 0766' LBZ IFSWX
1604 0785' C0 0000* LBR JUMP
1605 ;
1606 ;
1607 ;
1608 ;***** EO Fn aaaa - SEQUENCER BRANCH ON ACOUSTIC SIGNAL *****
1609 ;***** n = 8-B, aaaa = Branch address
1610 ;***** F8 = Sig. A, F9 = Sig. B, FA = Sig. C, FB = IGNORED *****

```



```
1657 07C0' 57 STR GPAGE ;Set Pulse Flag = AC (active)
1658 07C1' E2 SEX STACK
1659 SRET R6 ;Return from this routine
1660 07C2' 68 96 +
1661 ;
1662 ;
1663 ;
1664 ; ***** END OF EXTENDED SEQUENCER FUNCTIONS *****
1665 ;
1666 ; *****
1667 ;
1668 END
```


MACROS:

BCT	BXI	CALL	CID	CIE	JACI	DADC	DADD
DADI	DBNZ	DSAV	DSBI	DSM	DSMB	DSMI	DTC
ETQ	EXIT	GEC	IDLE	LDC	POP	PPAGE	PUSH
RLDI	RLXA	RNX	RSXD	SCAL	SCM1	SCM2	SPM1
SPM2	SRET	STM	STPC	TCAL	TRET	XID	XIE

SYMBOLS:

ACSTAT	0081	AD5H8	0091	AD5L4	0092	ADFLG	0080
ADGH8	008D	ADGL4	008E	ADH18	0003	ADL04	0002
ADON	0030'	ADRH8	008F	ADRL4	0090	ADT0H8	00A7
ADT0L4	00A8	ADT1H8	0095	ADT1L4	0096	ADT2H8	0097
ADT2L4	0098	ADT3H8	0099	ADT3L4	009A	ADT4H8	009B
ADT4L4	009C	ADT5H8	009D	ADT5L4	009E	ADT6H8	009F
ADT6L4	00A0	ADT7H8	00A1	ADT7L4	00A2	ADT8H8	00A3
ADT8L4	00A4	ADT9H8	00A5	ADT9L4	00A6	ARI	001C
AR10	001B	AR100	001A	ARFLG	001D	ASTK	000E
ASTKHI	0064	ASTKLO	0065	ASTKTP	527F	ATFLG	001E
ATMFLG	001F	BAT1	0002	BAT2	0003	BAT3	0004
BATT	0100'	BATT1	0114'	BATT2	0118'	BATT3	011C'
BATTERY	0010'	BATTSY	008C	BATTUP	008B	BATTXT	0120'
BLT	0000	BR2CNT	007D	BUF9	0020	BUFFER	5B00
BUTPG	005B	CANCNT	0088	CAMERA	0006	CLEAN	06F8'
CMPASS	0002	CMPSS	0064	CNTRL1	0003	CNTRL2	0005
CNTRL3	0007	CRCHI	0006	CRCL0	0007	CRCRAM	0005
CTAHI	006C	CTALO	006D	CTAVHI	006E	CTAVLO	006F
CTBHI	0070	CTBLO	0071	CTBVHI	0072	CTBVLO	0073
CTCHI	0074	CTCLO	0075	CTCVHI	0076	CTCVLO	0077
CYCCNT	0008	CYCLES	0019	D1	0012	D10	0011
D100	0010	DATA1	0002	DATA2	0004	DATA3	0006
DECPFC	0623*	DMA	0000	DONE	00FF	ERROR	0080
ETX	0003	EXPNUM	000F	EXT00	0000'	FLAGA	0069
FLAGB	006A	FLAGC	006B	FLASH	00C0'	FLASHX	0730'
FLUM	00AC'	FLUMX	0701'	FORMT1	0012	GLOPG	0050
GP	0000	GPAGE	0007	GROUP	0001	GRPSAV	000A
H1	0014	H10	0013	HALT	0006	H0G	0085
H0GEXP	00BF	H0GFLG	0083	H0GIN	02AA*	H0GPWR	0005
H0GVAL	0020	HEADNG	0004	HLATCH	0003	HSHIFT	0004
HYDRU	06DD'	HZ	0028	IFAC?	0730'	IFACA	07A1'
IFACB	07A6'	IFACC	07AB'	IFACU	00F8'	IFACUX	0788'
IFACXT	079B'	IFBOT	076C'	IFINS	0774'	IFRETR	077F'
IFSW	00FD'	IFSWX	0753'	IFSWXT	0766'	INCPFC	0751*
INSRT	0715'	INTCRL	F840	INTMSK	F800	INTPC	0001
INTPG	00F8	INTPOL	F840	INTSTA	F800	INTVEC	F880
IOA	0006	IOCLR	0004	IOCTEL	0005	IOLOC	00FE
IOSTAT	0005	JUMP	07B1*	L2BUF	00C0	L0VRST	0005
LIST	0006	M1	0016	M10	0015	MEMORY	0007
MEMPTR	00AE	MUX	0002	MUXPTR	00AD	NULL	00AF
PC	0003	PDSTAT	0083	PING	0007	PINGR	0024'

PINGRX	0123'	PITCH	0089	PLEVEL	0002	PMPS	0060'
PMPS0	0135'	PMPS1	01AF'	PMPS2	01AE'	PMPSPD	0006
PMPSX	019B'	PMTCHR	003A	PNGAGN	0137'	PNGCY1	0164'
PNGCY2	0130'	PNGCY3	0189'	PNGCY4	0192'	PNGCY5	0152'
PNGXT1	016C'	PNGXT2	016F'	PORTB	0007	POSO	0637'
POS1	0650'	POSERR	0625'	POSOK	0619'	POSX	0342'
POSXT1	0622'	POSXT2	061E'	POSXY	0098'	POSZ	009C'
PPC	000C	PPCCNT	0068	PPCHI	0060	PPCLO	0061
PULCNT	0041	PULFLG	0040	PULNUM	0042	PULSE	0786'
PULXN	038C'	PULXP	0383'	PULYN	039E'	PULYP	0395'
PULZN	0380'	PULZP	03A7'	PUMP	00A8'	PUMP1	0086
PUMP2	0087	PUMPR1	0727'	PUMPX	06C4'	RBHI	0008
RBLO	0009	RCCW	022B'	RCNT	0326'	RCNTX1	033B'
RCNTX2	033D'	RCW	0223'	RECFLG	00B2	RELAYS	0007
RETRAC	071E'	RLDV	00D0'	RLDVX	0745'	ROLL	008A
ROT	0080'	ROTO	02FD'	ROTOO	023A'	ROTOER	0269'
ROTON	0254'	ROTOOK	0273'	ROT1	0316'	ROTCO	02D7'
ROTCOR	02D1'	ROTERR	02EB'	ROTHO	0283'	ROTH?	028E'
ROTHDG	027D'	ROTHER	02BD'	ROTHN	02A7'	ROTHOK	02C7'
ROTK	02DF'	ROTRTN	0233'	ROTX	01FD'	ROTXT	0220'
ROTXT1	02E8'	ROTXT2	02E4'	RSTK	000D	RSTKHI	0062
RSTXLO	0063	RSTXTP	523F	RTNPTR	0006	RTTY2	000F
SAM1	00A0'	SAM1X	0660'	SAN2	00A4'	SAM2X	0691'
SAVPPC	079F*	SDLNGT	0029	SDCN	0050'	SDREQ	0003
SEC1	0018	SEC10	0017	SED11	0676'	SED1R	067F'
SED1U	0688'	SED21	06A9'	SED2R	06B2'	SED2U	06BB'
SEQPAS	0066	SEQRAT	0067	SETCLR	0053*	SPARE1	06E6'
SSTRPG	0052	STACK	0002	STAT1	0003	STAT2	0005
STAT3	0007	STKEND	53DF	STRPG	0053	SUCT	06EF'
SWITCH	0002	SWSTAT	0082	SYSFLG	0003	SYSTEM	0007
TILERR	01F0'	TILT	0070'	TILTOK	0123'	TILT1	01BD'
TIME01	003C	TIME02	00F0	TLEVEL	005A	TLIMIT	0006
TRFLG	00B1	TRON	0040'	TTY2HI	007E	TTY2LO	007F
UARTS	0006	X	0003	X0	03B9'	X00	03C8'
XOERR	0406'	XON	03E4'	XOOK	0410'	XINC	041A'
XINCO	042A'	XINCER	0465'	XINCN	0446'	XINCOX	0473'
XPOS	0093	XY	0090'	XYZFLG	00B4	YO	0482'
Y00	0492'	YCER	04C2'	YCN	04AD'	YOOK	04D8'
YINC	04E2'	YINCO	04F2'	YINCER	053E'	YINCN	0512'
YINCOX	0548'	YZ	0004	YZPOS	0094	Z	0094'
Z0	0552'	Z00	0562'	ZOERR	05A0'	ZON	057E'
ZOOK	05AA'	ZINC	05B4'	ZINCO	05C4'	ZINCER	0608'
ZINCN	05E0'	ZINCOR	0612'				

NO FATAL ERROR(S)

YCN	962	989#							
YOCK	997	1022#							
YINC	733	1035#							
YINCO	1047#								
YINCER	1108#								
YINCN	1044	1075#							
YINCOK	1092	1116#							
YZ	44#	995	1081	1170	1253				
YZPOS	44#	965	992	1047	1078	1140	1167	1223	1250
Z	124#								
ZO	735	1128#							
ZOO	1140#								
ZOERR	1189#								
ZCN	1137	1164#							
ZOOK	1172	1198#							
ZINC	737	1211#							
ZINCO	1223#								
ZINCER	1276#								
ZINCX	1220	1247#							
ZINCOK	1260	1284#							

APPENDIX D

HXRCA - Intel .HEX file format to .RCA file format conversion.

The following BASIC program converts Intel HEX format object code files created by the Syscon assembler - linker to RCA file format. In this version, the HEX file resides on a ram disk called drive M. This must be changed for use in other systems. The M drive is specified on lines 40 and 80 of the program.

```
10 'Program to read .HEX file from the M: drive and write a .RCA file.
20 'W. Terry, A. Bradley - 1986
30 'This section selects input file
40 GS="M:*.*)"
50 FILES GS
60 PRINT"FILE TO READ? (must be M:nnnnnn.HEX, just input without extension)"
70 INPUT FS
80 FS="M:"+FS
90 PRINT FS+".HEX";" OK?";:INPUT Y$
100 IF Y$(">")"Y" GOTO 60
110 '
120 'Now open the .HEX and .RCA files
130 OPEN "I",#1,FS+".HEX"
140 OPEN "O",#2,FS+".RCA"
150 RS="!M "
160 '
170 'Read a line at a time and translate
180 INPUT#1, L$ 'get Intel line
190 L=LEN(L$)
200 N$=MID$(L$,2,2) 'get length in hex
210 H$=N$:GOSUB 500 'convert HEX byte to DEC
220 IF H=0 GOTO 280
230 PRINT#2, RS+";"
240 A$=MID$(L$,4,4)
250 D$=MID$(L$,10,2*H)
260 RS=A$+" "+D$
270 GOTO 170
280 ' Print final line
290 PRINT#2, RS
300 RESET 'close disk files
310 SYSTEM
320 STOP
330 '
500 ' Convert H$ in hex to H in dec.
510 ' Convert H$ in hex to H in dec
520 H=ASC(RIGHT$(H$,1))-48
530 IF H>9 THEN H=H-7
540 H1=ASC(LEFT$(H$,1))-48
550 IF H1>9 THEN H1=H1-7
560 H=H+16*H1
570 RETURN
```

Appendix E

Sea Duct Monitor Cyclic Redundancy Check (CRC)

Calculation of a CRC checksum over a block of memory is reputed to be the remainder from a division. The entire data block is divided by a special 16 bit constant and the CRC is the remainder. The constant is chosen such that the probability of a random change in the data block giving the same CRC value is minimal.

The procedure is as follows:

1. Set the 16 bit CRC variable to zero.
2. Call the CRC subroutine and give it the first byte of the data block. The subroutine will modify the CRC.
3. Call the CRC subroutine again, this time passing it the next data byte. Repeat this until you have given it all the bytes in the block.
4. The final CRC is now valid for the data block.

The CRC subroutine

Variable use:

B = data byte passed in the call
CH = high byte of the 16 bit CRC
CL = low byte of the 16 bit CRC
S = a scratch byte

1. $S = B \text{ XOR } CH$:Constants shown base 16
2. $S = (S/16) \text{ XOR } S$:Integer arithmetic
3. $CH = CL \text{ XOR } ((S*16) \text{ mod } 256)$:mod 256 arithmetic
4. $CH = CH \text{ XOR } (S/8)$
5. $CL = S \text{ XOR } ((S*32) \text{ mod } 256)$
- R. Return from subroutine

Notice that this can be done easily in 8 bit machine code using logical shifts and XOR.

Debug Test: The CRC over a string of 0 bytes stays 0. The CRC over the four bytes 11 22 33 44 is DD33. The CRC over the string 00 01 02 03 04 05 06 07 08 09 0A 0B 0C 0D 0E 0F is 513D.

Appendix F

Radio Shack TRS-80 Model 100 Communication with SAIL and MCALL

To use the Radio Shack Mod.100 with MCall:

Set MCALL to:
Echoplex, 2400 Baud, X-ON/X-OFF,
7 Data, Even Parity, 1 Stop bit

For two way communication:
Get the M-100 running in TELCOM,
M-100 status = 67E1D, Half Duplex

To send a file to the M-100:
Set the M-100 to half duplex (see above)
Enter the text mode for a new file and name the new file.
To replace an existing file, enter the text mode by
running the file name, then clear the file.

MCALL - Use (esc.)F to name the file to send.
M100 - Use "LOAD" - Load from COM:67E1D
MCALL - Use (esc.)T to send

To send a file to MCALL:
Set the M-100 to half duplex (see above)
Enter the text mode by running the file name.
MCALL - Use (esc.)F name the file to receive.
MCALL - Use (esc.)R to receive the file.
M100 - Use "SAVE" - Save to COM:67E1D

To use the Radio Shack M-100 with SAIL:

(Assumes 300 Baud, 7 data, Even Par., 1 Stop, RCA format):

For two way communication:
Get the M-100 running in TELCOM,
M-100 status = 37E1D, Full Duplex

To send a file to a SAIL instrument:
Set the M-100 to full duplex (see above)
Enter the text mode by running the file name.
M100 - Use "SAVE" - Save to COM:67E1D
(Assumes a !M; at the start of the file.)

Appendix G

Electrochem Lithium Battery Warning

The page copied below is included with the Lithium batteries supplied by Electrochem Industries, Inc. These batteries are used in the microprocessor and emergency hydrostatic release systems.

Electrochem Industries, Inc.
9990 Wehrle Drive
Clarence, New York 14031
716-759-2626

TLX 91-386



LITHIUM BATTERY

WARNING: FIRE, EXPLOSION AND SEVERE BURN HAZARD.
DO NOT SHORT CIRCUIT, CHARGE, FORCE OVER-DISCHARGE,
DISASSEMBLE, CRUSH, PENETRATE, INCINERATE, HEAT
ABOVE 72° C (162° F), OR BATTERY MAY LEAK OR EXPLODE

CELLS MAY BECOME SHORT CIRCUITED BY ALLOWING A CONDUCTIVE
(METALLIC, ETC.) MATERIAL TO COME IN CONTACT WITH THE LEADS.

CELLS MAY SWELL AND LEAK WHEN OPERATED AT BOTH MAXIMUM
RATED CURRENT AND MAXIMUM RATED TEMPERATURE.

FORM NO. 3-3000/0683
REV. B

Appendix H

Sea Duct Pump Controller Program Listing

INPUT FILENAME : SDPUMP1.ASM
 OUTPUT FILENAME : SDPUMP1.OBJ

```

1          TITLE SDPUMP1.ASM - SEA DUCT - 6301 SAIL PUMP CONTROLLER
2          SUBTITLE
3          :
4          : A. Bradley, W. Terry
5          :
6          : Rev. 24 MAR 86 X COMMAND CLEARS REGISTERS.
7          : 06 MAR 86 First version.
8          :
9          : SAIL portion interrupt driven by SCI
10         : PARITY SEEMS TO WORK, BUT THE PMF000 1000 SEEMS TO
11         : HANG WITH THE MAC AT 9600, GET BETTER TERMINAL?
12         :
13         :
14         RADIX H      :SET HEX DEFAULT
15         CODE
16         ABSOLUTE
17         :
18         -----
19         :
20         00 00      DDR1:      EQU    0
21         00 01      DDR2:      EQU    1
22         00 02      PORT1:     EQU    2      : (brk.x.x.x!x.x.P2 . P1)
23         :          : (flg. .ebl.ebl)
24         :
25         00 03      PORT2:     EQU    3      : (X.X.X!SDC.SDI.SCK!TOUT.TIN)
26         :          : (mode ! serial ! timer )
27         00 04      DDR3:      EQU    4
28         00 05      DDR4:      EQU    5
29         00 06      PORT3:     EQU    6      : pump 1 power control
30         00 07      PORT4:     EQU    7      : pump 2 power control
31         00 08      TCSR:      EQU    S8      : (ICP.OCP.TOP!EICI.EOCI.ETC!IEDG.CIVL)
32         :          : ( int flags ! int masks . in . out)
33         00 09      COUNTHI:    EQU    S9      : Counter HI (1st)
34         00 0A      COUNTLO:    EQU    SA      : LO (2nd)
35         00 0B      COMPARHI:   EQU    SB      : Out compare HI
36         00 0C      COMPARLO:   EQU    SC      : LO
37         00 0D      CAPTURHI:   EQU    SD      : Input Capture HI
38         00 0E      CAPTURLO:   EQU    SE      : LO
39         00 0F      P1CSR:      EQU    SF      : PORT3 C/S REG
40         00 10      TRMCR:      EQU    S10     : XPR RATE & MODE CONTROL
41         :          : (x.x.x.x!CCI.CCO.SS1.SS0)
42         00 11      TRCSR:      EQU    S11     : T/R CONTROL & STATUS REG
43         :          : (RDRP.CRPE.TDRE.RIE.RE.TIE.TE.WU)
44         00 12      RECD:      EQU    S12     : REC'D DATA
45         00 13      XDATA:     EQU    S13     : XMIT DATA
46         00 14      RANCON:     EQU    S14     : (STDBY PWR.RANE.x.x.x.x!)
47         :
48         : SAIL inteface RAM workspace
    
```

SDPUMP1.ASM - SEA DUCT - 6301 SAIL PUMP CONTROLLER

```

49      00 80      RJUMP:      EQU      $80      :JUMP INST GOES HERE..
50      00 81      RVECT:      EQU      $81      :      HI
51      :          :          $82      :      LO
52      00 83      XJUMP:      EQU      $83      :XMIT JUMP INST
53      00 84      XVECT:      EQU      $84      :      HI
54      :          :          $85      :      LO
55      00 86      JUMP2:      EQU      $86      :2ND JUMP INST
56      00 87      VECT2:      EQU      $87      :      HI
57      :          :          $88      :      LO
58      00 89      SCRATCH1: EQU      $89      :SCRATCH LOC 1
59      00 8A      SCRATCH2: EQU      $8A      :SCRATCH LOC 2
60      00 8B      SCRATCH3: EQU      $8B      :SCRATCH LOC 3
61      00 8C      SCRATCH4: EQU      $8C      :SCRATCH LOC 4
62      00 8D      SCRATCH5: EQU      $8D      :SCRATCH LOC 5
63      :
64      00 8E      BMODE:      EQU      $8E      :SAIL BREAK MODE
65      :          :          :|brk.x.x|x|x.x.x|x|
66      :          :          :|flg.
67      00 8F      STATUS:     EQU      $8F      :REPLY STATUS
68      -----
69      : general workspace
70      :
71      00 90      PUMP:      EQU      $90      :PUMP ADDRESS
72      :          :          $91      :
73      :
74      :*****
75      :
76      F000      :          ORG      $F000 :ASSUME 32K EPROM
77      : SAIL Address stored here..
78      F000 23 50 43 ADDR:      DB      '#PC' :SAIL ADDRESS
79      F003 00      :          DB      $00      :TERMINATOR
80      F004 00 00 00 00 :          DB      $00,$00,$00,$00 :SPACE FOR LONG ADDRESS..
81      :
82      -----
83      F008 8E 00 FF START:      LDS      $S00FF :SET STACK POINTER
84      F00B 86 7F      LDAA     $S7F :PREPARE PORT 1
85      F00D 97 00      STAA     DDR1 :AS OUTPUT WITH MSB AS BREAK DETECT
86      F00F 86 00      LDAA     $S00 : AND DISABLE PUMPS
87      F011 86 12      LDAA     $S12 :PREPARE PORT 2
88      F013 97 01      STAA     DDR2 :FOR FUTURE TIMER USE
89      F015 86 FF      LDAA     $SFF :PREPARE PORT 3
90      F017 97 04      STAA     DDR3 :AS PUMP 1 CONTROL
91      F019 7F 00 06      CLR      PORT3 : AND CLEAR
92      F01C 86 FF      LDAA     $SFF :PREP PORT 4
93      F01E 97 05      STAA     DDR4 :AS PUMP 2 CONTROL
94      F020 7F 00 07      CLR      PORT4 : AND CLEAR
95      :
96      F023 7F 00 89      CLR      SCRATCH1 :USE AS SAIL MODE FLAG & ADDR POINTER
97      F026 86 7E      LDAA     $S7E :MUST WRITE JMP INSTS.
98      F028 97 80      STAA     RJUMP :FOR SAIL DRIVER
99      F02A 97 83      STAA     XJUMP
100     F02C 97 86      STAA     JUMP2
101     F02E CC F9 78      LDD      $SETUNAD :SET VECTORS TO INITIAL VALUES
102     F031 DD 81      STD      RVECT
103     F033 DD 84      STD      XVECT
104     :
105     F035 86 04      LDAA     $S04 :ENABLE ETOI (TIMER OVERFLOW INTERRUPT)

```

SDPUMP1.ASM - SEA DUCT - 6301 SAIL PUMP CONTROLLER

```

106 F037 97 08          STAA  TCSR
107 F039 86 0C          LDAA  #$SOC      :EXTERNAL CLOCK
108 F03B 97 10          STAA  TRMCR
109 F03D 86 1A          LDAA  #$S1A     : SET RE TE RIE TO INIT SERIAL &
110 F03F 97 11          STAA  TRCSR     :ALLOW SERIAL INTERRUPTS FOR REC NOW
111
112 F041 86 2A          LDAA  #'*'
113 F043 97 8F          STAA  STATUS   :INITIALIZE STATUS
114 F045 7F 00 8E       CLR   BMODE    :AND MODE FLAG
115
116 F048 0E             CLI           :AND ALLOW INTERRUPTS
117 F049 1A             DOZE: SLP           :SLEEP BETWEEN INTERRUPTS
118 F04A 20 FD          BRA   DOZE     :TO MINIMIZE POWER DRAIN
119
120 :*****
121 : HELP FILE
122 : LIST ON
123 F800                ORG   $F800
124 F800 6C 70 0D 0A    HELPFIL:DB   'lp',S0D,S0A
125 F804 4D 6F 6E 69    DB     'Monitor Commands (enter via _ or ? or !)',S0D,S0A
      F808 74 6F 72 20
      F80C 43 6F 6D 6D
      F810 61 6E 64 73
      F814 20 28 65 6E
      F818 74 65 72 20
      F81C 76 69 61 20
      F820 5F 20 6F 72
      F824 20 3F 20 6F
      F828 72 20 21 29
      F82C 0D 0A
126 F82E 20 5F 20 28    DB     '_ (space) enter monitor*',S0D,S0A
      F832 73 70 61 63
      F836 65 29 20 65
      F83A 6E 74 65 72
      F83E 20 6D 6F 6E
      F842 69 74 6F 72
      F846 2A 0D 0A
127 F849 20 3F 4D 61    DB     '?Maaaa_llllcr *',S0D,S0A
      F84D 61 61 61 5F
      F851 6C 6C 6C 6C
      F855 63 72 20 2A
      F859 0D 0A
128 F85B 20 21 4D 61    DB     '!Maaaa_dd...cr *',S0D,S0A
      F85F 61 61 61 5F
      F863 64 64 2E 2E
      F867 2E 63 72 20
      F86B 2A 0D 0A
129 F86E 20 20 77 69    DB     ' with all RCA UT4 conventions',S0D,S0A
      F872 74 68 20 61
      F876 6C 6C 20 52
      F87A 43 41 20 55
      F87E 54 34 20 63
      F882 6F 6E 76 65
      F886 6E 74 69 6F
      F88A 6E 73 0D 0A
130 F88E 43 6F 6E 74    DB     'Control Commands',S0D,S0A
      F892 72 6F 6C 20

```

SDPUMP1.ASM - SEA DUCT - 6301 SAIL PUMP CONTROLLER

```

F896 43 6F 6D 6D
F89A 61 6E 64 73
F89E 0D 0A
131 F8A0 20 21 50 31 DB ' !P1hh_ ,!P2hh_ set pump power to hh *',SOD,SOA
F8AA 68 68 5F 20
F8A8 2C 21 50 32
F8AC 68 68 5F 20
F8B0 73 65 74 20
F8B4 70 75 6D 70
F8B8 20 70 6F 77
F8BC 65 72 20 74
F8C0 6F 20 68 68
F8C4 20 2A 0D 0A
132 F8C8 20 3F 50 31 DB ' ?P1 , ?P2 shows current pump setting *',SOD,SOA
F8CC 20 2C 20 3F
F8D0 50 32 20 73
F8D4 68 6F 77 73
F8D8 20 63 75 72
F8DC 72 65 6E 74
F8E0 20 70 75 6D
F8E4 70 20 73 65
F8E8 74 74 69 6E
F8EC 67 20 2A 0D
F8F0 0A
133 F8F1 20 58 20 28 DB ' X (may be PCX only) Immeadiate Shutdown',SOD,SOA
F8F5 6D 61 79 20
F8F9 62 65 20 7E
F8FD 50 43 58 20
F901 6F 6E 6C 79
F905 29 20 49 6D
F909 6D 65 61 64
F90D 69 61 74 65
F911 20 53 68 75
F915 74 64 6F 77
F919 6E 0D 0A
134 F91C 0D 0A DB SOD,SOA
135 F91E 20 2A 20 72 DB ' * returns prompt '
F922 65 74 75 72
F926 6E 73 20 70
F92A 72 6F 6D 70
F92E 74 20
136 F930 00 00 DB $00,$00 :TERMINATOR
137
138 :*****
139 F932 7B 40 11 SCISTR:TIM $S40,TRCSR :TEST ORFE
140 F935 27 03 BEQ CXCHAR
141 LIST OFF
142 F937 96 12 LDAA RECD :READ BAD CHAR TO CLEAR?
143 F939 3B SCIXIT: RTI : & EXIT
144 :
145 F93A 7B 80 11 CXCHAR: TIM $S80,TRCSR :TEST DA
146 F93D 26 03 BNE READD :IF NOT, XMIT
147 F93F 7E FC 10 JNP CHECKX
148 :
149 F942 96 12 READD: LDAA RECD :READ DATA TO A..
150 F944 16 TAB :AND COPY TO B
151 F945 CE FD 66 LDX $PARITY :POINT PARITY TABLE

```

SDPUMP1.ASM - SEA DUCT - 6301 SAIL PUMP CONTROLLER

```

152 F948 3A          ABX          :POINT INTO PARITY TABLE
153 F949 E6 00      LDAB         0,X          :GET PARITY WORD
154 F94B 26 EC      BNE         SCIXIT      :REJECT IF NOT EVEN PARITY
155 F94D 84 7F      ANDA        $S7F       :ELSE REMOVE PARITY FOR SUBSEQUENT TESTS
156 F94F 16         TAB          : (ALSO COPY TO B)
157 F950 C8 23      EORB        #'#'       :IS IT '#'?
158 F952 27 03      BEQ         GOTNUM
159 F954 7E 00 80   JMP         RJUMP      :ELSE GO THRU VECTOR
160
161                :
161                : SAIL ADDRESS RECOGNIZE SECTION
162 F957 C6 01      GOTNUM: LDAB  $01        : GOT # CODE
163 F959 D7 89      STAB        SCRTCH1     :SET SAIL FLAG TO 01
164 F95B 71 FB 11   AIN         $SPB,TRCSR  :OFF XMIT IF REQ'D?
165 F95E CC F9 66   LDD         $READAD     :POINT READ ADDRESS
166 F961 DD 81      STD         RVECT
167 F963 7E F9 39   JMP         SCIXIT      :AND EXIT
168
169                :
169 F966 D6 89      READAD: LDAB  SCRTCH1     :GET SNODE COUNT
170 F968 C1 01      CNPB        $S01        :IS THIS THE FIRST CHAR?
171 F96A 26 04      BNE         TRYADD
172 F96C 81 30      CNPA        #'0'       :IF FIRST, IS IT '0'?
173 F96E 27 2E      BEQ         TSTBAUD     :IF SO, MAY BE BAUD SWITCH
174
175                :
175 F970 CE F0 00   TRYADD: LDX   $ADDR      :ELSE POINT X TO ADDR
176 F973 3A         ABX          :ADD TO X
177 F974 A1 00      CNPA        0,X         :COMPARE NEW CHAR TO A
178 F976 27 13      BEQ         NEXTAD      :IF MATCH, LOOK FOR NEXT CHAR
179
180                :
180 F978 CC F9 7D   SETUNAD:LDD  $UNADDR     :ELSE SET UNADDRESS STATE
181 F97B DD 81      STD         RVECT
182
183                :
183 F97D 7F 00 89   UNADDR: CLR   SCRTCH1     :CLEAR SAIL NODE TO 00
184 F980 71 FB 11   AIN         $SPB,TRCSR  :STOP XMIT INTRPTS
185 F983 CC FC 19   LDD         $XPASS      :SET XMIT VECTOR TO PASS
186 F986 DD 84      STD         XVECT
187 F988 7E F9 39   JMP         SCIXIT
188
189                :
189                NEXTAD: INX          :POINT NEXT ADD CHAR
190 F98C 7C 00 89   INC         SCRTCH1     :(& INC COUNTER)
191 F98F 6D 00      TST         0,X         :TEST IT.
192 F991 27 03      BEQ         GOTADDR     : TERMINATOR?
193 F993 7E F9 39   JMP         SCIXIT      :ELSE SAME VECTOR
194
195                :
195 F996 CC FA 1B   GOTADDR:LDD  $CONCHAR    :REC CONTROL CHAR NEXT..
196 F999 DD 81      STD         RVECT
197 F99B 7E F9 39   JMP         SCIXIT
198
199                :
199                : TEST FOR BAUD CHANGE COMMAND
200 F99E CC F9 A6   TSTBAUD:LDD  $BAUD2     :
201 F9A1 DD 81      STD         RVECT
202 F9A3 7E F9 39   JMP         SCIXIT
203
204                :
204 F9A6 81 30      BAUD2: CNPA  #'0'       :GOT SECOND 0?
205 F9A8 27 03      BEQ         BAUD3
206 F9AA 7E F9 78   JMP         SETUNAD
207
208                :
208 F9AD CC F9 BA   BAUD3: LDD  $BAUD4     :HERE IF GOT #00 (BAUD CHANGE)

```

SDPUMP1.ASM - SEA DUCT - 6301 SAIL PUMP CONTROLLER

```

209 F9B0 DD 31          STD   RVECT
210 F9B2 CE 00 89      LDX   #SCRTCH1      :POINT TO 5 CHAR BUFFER
211 F9B5 DF 37          STX   VECT2          :SAVE AT VECT2
212 F9B7 7E F9 39      JMP   SCIXIT
213
214 F9BA DE 37          BAUD4: LDX   VECT2      :GET POINTER
215 F9BC 81 20          CMPA  #' '          :IS IT SPACE?
216 F9BE 26 02          BNE   ,BAUD5
217 F9C0 86 30          LDAA  #'0'          :...CHAO 0'S
218 F9C2 A7 00          BAUD5: STAA  0,X      :STORE CHAR
219 F9C4 08             INX
220 F9C5 8C 00 8E      CPX   #SCRTCH1+5    :PAST END OF 5 CHAR BUFFER?
221 F9C8 27 05          BEQ   BAUD6
222 F9CA DF 37          STX   VECT2          :IF NOT DONE, SAVE POINTER
223 F9CC 7E F9 39      JMP   SCIXIT          :AND GET MORE
224
225 F9CF DE 3C          BAUD6: LDX   SCRTCH1+3 :GET LAST TWO CHARS
226 F9D1 8C 30 30      CPX   #S3030        :ARE LAST TWO CHARS BOTH 0?
227 F9D4 26 31          BNE   WAITBRK        :IF NOT VALID, SET UP TO WAIT FOR BREAK
228
229
230 F9D6 CC FA 0E      LDD   #BAUDTBL      :SET UP TABLE POINTER
231 F9D9 DD 37          STD   VECT2          :AND STORE IN JUMP2 VECTOR
232
233
234 F9DB DE 87          BTRY: LDX   VECT2      :GET TABLE POINTER
235 F9DD A6 00          LDAA  0,X            : AND TABLE ELEMENT
236 F9DF 27 26          BEQ   WAITBRK        : IF=00, WAS NO MATCH, WAIT FOR BREAK
237
238
239 F9E1 CE 00 89      LDX   #SCRTCH1      :INIT BUFFER POINTER TO TOP
240 F9E4 DF 34          STX   XVECT          : & SAVE IN XMIT JUMP VECTOR
241
242 F9E6 DE 34          COMPARE:LDX  XVECT      :GET BUFFER POINTER
243 F9E8 A6 00          LDAA  0,X            : TO GET BUFFER CHAR TO A
244 F9EA 08             INX
245 F9EB DF 34          STX   XVECT          : & SAVE..
246 F9ED DE 87          LDX   VECT2          :NOW GET TABLE POINTER
247 F9EF A1 00          CNPA  0,X            : & USE TO COMPARE CHARS
248 F9F1 26 09          BNE   NOMATCH
249 F9F3 08             CNATCH: INX           :IF MATCH, MOVE AHEAD TABLE POINTER
250 F9F4 A6 00          LDAA  0,X            :LOOK AT NEXT TABLE ELEMENT
251 F9F6 27 1C          BEQ   MATCH          : IF IT'S 00, FULL MATCH!
252 F9F8 DF 37          STX   VECT2          : ELSE SAVE TABLE POINTER
253 F9FA 20 EA          BRA   COMPARE        : AND TRY NEXT CHAR
254
255 F9FC 08             NOMATCH:INX          :INC TABLE POINTER
256 F9FD A6 00          LDAA  0,X            :AND LOOK FOR 00
257 F9FF 26 FB          BNE   NOMATCH        :LOOP TILL IT'S FOUND
258 FA01 08             INX
259 FA02 08             INX
260 FA03 DF 87          STX   VECT2          :AND REPLACE TO HOLDING LOCATION
261 FA05 20 D4          BRA   BTRY           :GO BACK TO CHECK NEXT TABLE
262
263 FA07 86 0A          WAITBRK:LDAA #S0A      :TURN OFF SCI INTERRUPTS
264 FA09 97 11          STAA  TRCSR         : (REQUIRES TOP INTERRUPT TO RESTART)
265 FA0B 7E F9 78      JMP   SETUNAD        :AND SET VECTORS FOR NEW ADDRESS..

```

SDPUMP1.ASM - SEA DUCT - 6301 SAIL PUMP CONTROLLER

```

266      ;
267      : MATCH TABLE FOR BAUD RATE SWITCH
268  FA0E 30 30 33 00  BAUDTBL:DB '003',S00,S01 : 300 baud is only rate allowed
      FA12 01
269  FA13 00          DB S00 :DONE
270      ;
271  FA14 08  MATCH: INX          :PASS 00 TERMINATOR
272  FA15 A6 00      LDAA 0,X      :GET BAUD BYTE
273  FA17 16          TAB          :SAVE IN B
274      : This unit has no baud change hardware, these lines are kept here
275      : to allow it to be added later.
276      : ORAA PORT1          :SET BITS ON BAUD CONTROL PORT
277      : STAA PORT1
278      : ORAB #SP8          :CLEAN UP MASK SO OTHERS DON'T CHANGE
279      : ANDB PORT1          : WHEN CLEAR BITS..
280      : STAB PORT1          : IN PORT1 (BAUD SET PORT)
281  FA18 7E F9 78  JMP SETUNAD  :AND PREPARE FOR NEW ADDRESSING
282      ;
283      : AFTER VALID ADDRESS, RECEIVE CONTROL CHAR..
284  FA1B 01  CONCHAR:NOP
285  FA1C 81 21      CMPA #'!'      :IS IT '!'
286  FA1E 27 13      BEQ BANG
287  FA20 81 3F      CMPA #'?'      :OR IS IT '?'
288  FA22 27 22      BEQ QUERY
289  FA24 81 20      CMPA #' '      : SPACE TO ENTER MONITOR?
290  FA26 27 3D      BEQ GOMON
291  FA28 81 48      CMPA #'H'      :HELP?
292  FA2A 27 48      BEQ SAYHELP
293  FA2C 81 58      CMPA #'X'      : IMMEDIATE STOP?
294  FA2E 27 38      BEQ XSTOP
295  FA30 7E F9 78  JMP SETUNAD  :UNADDRESS IF NOT VALID..
296      ;
297      ;
298  FA33 CC FA 3B  BANG: LDD #GOTBANG :GOT ! PREFIX
299  FA36 DD 81      STD RVECT
300  FA38 7E F9 39  JMP SCIXIT
301      ;
302  FA3B 81 4D  GOTBANG:CMPA #'M'      :!M COMMAND?
303  FA3D 27 20      BEQ BANGML
304  FA3F 81 50      CMPA #'P'      :!P COMMAND?
305  FA41 27 1F      BEQ BANGPL
306  FA43 7E F9 78  JMP SETUNAD
307      ;
308  FA46 CC FA 4E  QUERY: LDD #GOTQURY
309  FA49 DD 81      STD RVECT
310  FA4B 7E F9 39  JMP SCIXIT
311      ;
312  FA4E 81 4D  GOTQURY:CMPA #'M'      :?M COMMAND?
313  FA50 27 07      BEQ QUERYML
314  FA52 81 50      CMPA #'P'      :?P COMMAND
315  FA54 27 06      BEQ QUERYPL
316  FA56 7E F9 78  JMP SETUNAD
317      ;
318  FA59 7E FA 92  QUERYML:JMP QUERYM      :LINK TO ?M
319  FA5C 7E FB 32  QUERYPL:JMP QUERYPL      :LINK TO ?P
320  FA5F 7E FA 84  BANGML: JMP BANGM      :LINK TO !M
321  FA62 7E FB 6F  BANGPL: JMP BANGP      :LINK TO !P

```

SDPUMP1.ASM - SEA DUCT - 6301 SAIL PUMP CONTROLLER

```

322 FA65 7E FC BA      GOMON: JMP      PROMPT      :LINK INTO MONITOR
323
324                  : IMMEDIATE STOP
325 FA68 71 FC 02      XSTOP: AIM      $SFC,PORT1    :DROP BOTH ENABLE BITS
326 FA6B 86 00          LDAA            $S00          :AND SET PORTS TO 00
327 FA6D 97 06          STAA            PORT3
328 FA6F 97 07          STAA            PORT4
329 FA71 7E F9 78      JMP            SETUNAD
330
331                  : HELP FILE DUMP
332 FA74 CC FA 83      SAYHELP:LDD     $OUTHLP
333 FA77 DD 84          STD            XVECT
334 FA79 CC F8 00      LDD            $HELPPIL      :SET POINTER
335 FA7C DD 89          STD            SCRTCH1
336 FA7E 86 65          LDAA            #'e'         :SEND FIRST LETTER OF REPLY
337 FA80 7E FC C1      JMP            SETOUT
338
339 FA83 DE 89          OUTHLP:LDX     SCRTCH1      :GET POINTER
340 FA85 A6 00          LDAA            0,X          :GET CHAR ->A
341 FA87 27 06          BEQ            HELPDUN      :NUL IS TERMINATOR
342 FA89 08             INX
343 FA8A DF 89          STX            SCRTCH1      :AND SAVE
344 FA8C 7E FC C1      JMP            SETOUT      :FINALLY SEND THE CHAR IN A..
345
346 FA8F 7E FC BA      HELPDUN:JMP     PROMPT
347
348
349                  : ?M COMMAND - DATA INPUT SECTION
350 FA92 CC FA 98      QUERYM: LDD     $SAVEADD     :NOW INPUT ADDRESS
351 FA95 7E FB BB      JMP            IN4
352
353 FA98 DC 89          SAVEADD:LDD     SCRTCH1      :GET ADDRESS,
354 FA9A DD 8B          STD            SCRTCH3      ADDRESS POINTER
355 FA9C CC FA A2      LDD            $STARTL
356 FA9F 7E FB BB      JMP            IN4          :THEN GET LENGTH
357
358 FAA2 DC 89          STARTL: LDD     SCRTCH1      :IF LENGTH NE 0000
359 FAA4 26 03          BNE            STARTL2      : CARRY ON..
360 FAA6 7E FC BA      JMP            PROMPT      :ELSE QUIT
361
362 FAA9 CC FB B5      STARTL2:LDD     $ECHO        :PREPARE TO IGNORE ECHO CHARS
363 FAAC DD 81          STD            RVECT
364 FAAE 72 04 11      OIM            $S04,TRCSR    :START XMIT INTERRUPTS
365 FAB1 7E FC 1F      JMP            OUTLINE     :& SEND A LINE..
366
367                  : ..THE ?M DUMP IS STORED IN THE XMIT SERVICE SECTION BELOW
368
369
370                  : !M SECTION
371 FAB4 CC FA BA      BANGM: LDD     $KEEPADD     :INPUT STARTING ADDRESS
372 FAB7 7E FB BB      JMP            IN4
373
374 FABA CC FA C2      KEEPADD:LDD     $HIHEX      :WAIT FOR HIGH HEX CHAR
375 FABD DD 81          STD            RVECT
376 FABF 7E F9 19      JMP            SCIXIT
377
378 FAC2 BD FD 16      HIHEX: JSR     ASCHEX      :ATTEMPT CONVERT TO HEX

```


SDPUMP1.ASM - SEA DUCT - 6301 SAIL PUMP CONTROLLER

```

379 FAC5 25 27          BCS  TERMIN          :CHECK TERMINATOR IF NOT..
380 FAC7 48            ASLA
381 FAC8 48            ASLA          :MOVE OVER NIBBLE
382 FAC9 48            FACA 48        ASLA
384 FACB 97 8D         STAA  SCRTCH5
385 FACD CC FA D5      LDD  #LOWHEX
386 FADO DD 81         STD  RVECT
387 FAD2 7E F9 39     JMP  SCIXIT
388
389 FAD5 BD FD 16      LOWHEX: JSR  ASCHEX          :CONVERT LOW
390 FAD8 24 03         BCC  STASH
391 FADA 7E FC BA     JMP  PROMPT          :PROMPT IF BAD SECOND CHAR
392 FADD DE 89        STASH: LDX  SCRTCH1        :GET POINTER
393 FADF 9A 8D         ORAA SCRTCH5          :COMBINE NIBBLES
394 FAE1 A7 00         STAA 0,X            :STORE IT..
395 FAE3 08           INX
396 FAE4 DF 89         STX  SCRTCH1        :RESTORE POINTER
397 FAE6 CC FA C2     LDD  #HIHEX
398 FAE9 DD 81         STD  RVECT          :&PREP FOR MORE
399 FAEB 7E F9 39     JMP  SCIXIT
400
401 FAE8 84 7F        TERMIN: ANDA #S7F        :MASK OFF FLAG BIT
402 FAF0 81 0D        CMPA #S0D            :IS IT CR?
403 FAF2 26 03         BNE  TERMIN2
404 FAF4 7E FC BA     JMP  PROMPT
405
406 FAF7 81 20        TERMIN2: CMPA #' '        :IS IT SPACE?
407 FAF9 26 08         BNE  TERMIN3
408 FAFB CC FA C2     LDD  #HIHEX
409 FAFE DD 81         STD  RVECT
410 FB00 7E F9 39     JMP  SCIXIT
411
412 FB03 81 38        TERMIN3: CMPA #' : '      :OR ' : ' ?
413 FB05 26 05         BNE  TERMIN4
414 FB07 CC FA B4     LDD  #BANGM
415 FB0A 20 07         BRA  PASSLF
416
417 FB0C 81 2C        TERMIN4: CMPA #' , '      :OR ' , ' ?
418 FB0E 26 1F         BNE  TERMIN5
419 FB10 CC FB 27     LDD  #SETHIX
420 FB13 DD 87        PASSLF: STD  VECT2
421 FB15 CC FB 1D     LDD  #PASSLF2
422 FB18 DD 81         STD  RVECT
423 FB1A 7E F9 39     JMP  SCIXIT
424
425 FB1D 81 0A        PASSLF2: CMPA #S0A        :GOT LF YET?
426 FB1F 26 03         BNE  PXIT
427 FB21 7E 00 86     JMP  JUMP2          :IF YES, EXIT THRU JMP2
428 FB24 7E F9 39     PXIT: JMP  SCIXIT    :ELSE WAIT FOR MORE CHARS..
429
430 FB27 CC FA C2     SETHIX: LDD  #HIHEX        :IF ' , ' THEN PREP FOR MORE HEX
431 FB2A DD 81         STD  RVECT
432 FB2C 7E F9 39     JMP  SCIXIT
433
434 FB2F 7E FC BA     TERMIN5: JMP  PROMPT      :TO PROMPT IF NOT VALID CHAR
435
-----

```

SDPUMP1.ASM - SEA DUCT - 6301 SAIL PUMP CONTROLLER

```

436          : QUERY PUMP COMMAND (?Pn, N=1,2)
437 FB32 CC FB 3A   QUERYP: LDD   #QP2
438 FB35 DD 81     STD   RVECT
439 FB37 7E F9 39  JMP   SCIXIT
440
441 FB3A 81 31     QP2:  CMPA   #'1'           :PUMP 1?
442 FB3C 26 04     BNE   QP3
443 FB3E C6 06     LDAB  #PORT3           :PORT 3 ADDRESS TO B
444 FB40 20 09     BRA   QP5              :AND GO FIND VALUE
445
446 FB42 81 32     QP3:  CMPA   #'2'           :PUMP 2?
447 FB44 27 03     BEQ   QP4
448 FB46 7E F9 78  JMP   SETUNAD
449
450 FB49 C6 07     QP4:  LDAB  #PORT4           :IF 2, POINT PORT 4
451 FB4B CE 00 00  QP5:  LDX   #0000          :CLEAR INDEX REGISTER
452 FB4E 3A        ABX                :AND PUT B IN IT
453 FB4F A6 00     LDAA  0,X              :FETCH VALUE FROM PORT
454 FB51 97 89     STAA  SCRATCH1        :AND SAVE
455 FB53 CC FB 5D  LDD   #QP6
456 FB56 DD 84     STD   XVECT           :PREP FOR NEXT
457 FB58 86 3D     LDAA  #'='            :SEND =
458 FB5A 7E FC C1  JMP   SETOUT
459
460 FB5D CC FB 67  QP6:  LDD   #QP7           :PREP FOR PROMPT
461 FB60 DD 87     STD   VECT2
462 FB62 96 89     LDAA  SCRATCH1        :GET PUMP CONTROL VALUE.
463 FB64 7E FC 9D  JMP   OUTBYTE
464
465 FB67 CC FC BA  QP7:  LDD   #PROMPT
466 FB6A DD 84     STD   XVECT
467 FB6C 7E F9 39  JMP   SCIXIT
468
469 -----
470          : SET PUMP SPEED COMMAND (!Pnhh n=1,2 hh=value)
471
472 FB6F CC FB 77  BANGP: LDD   #BP1           :IMMEDIATELY AFTER !P.
473 FB72 DD 81     STD   RVECT           :PREPARE FOR N
474 FB74 7E F9 39  JMP   SCIXIT
475
476 FB77 CE 00 06  BP1:  LDX   #PORT3           :SET ADDRESS OF PUMP1
477 FB7A 81 31     CMPA  #'1' PUMP 1 ?
478 FB7C 27 0A     BEQ   BP2
479 FB7E CE 00 07  LDX   #PORT4           :NEXT SET ADDRESS OF PUMP2
480 FB81 81 32     CMPA  #'2'           :PUMP 2 ?
481 FB83 27 03     BEQ   BP2
482 FB85 7E FC BA  JMP   PROMPT          :PROMPT IF NOT 1 OR 2
483
484 FB88 DF 90     BP2:  STX   PUMP           :SAVE PUMP ADDRESS
485 FB8A CC FB 90  LDD   #BP3           :SET EXIT VECTOR
486 FB8D 7E FB BB  JMP   IN4             :AND GO READ NEW PUMP VALUE
487
488 FB90 DE 90     BP3:  LDX   PUMP           :RETRIEVE PUMP ADDRESS
489 FB92 C6 01     LDAB  #01            :SET PUMP1 FLAG
490 FB94 8C 00 06  CPX   #PORT3
491 FB97 27 0A     BEQ   BP4
492 FB99 C6 02     LDAB  #02            :ELSE SET PUMP2 FLAG

```

SDPUMP1.ASM - SEA DUCT - 6301 SAIL PUMP CONTROLLER

```

493 FB9B 8C 00 07          CPX    #PORT4
494 FB9E 27 03          BEQ    BP4
495 FBA0 7E F9 78          JMP    SETUNAD          :ERROR IF NOT VALID ADDRESS!
496                          :
497 FBA3 96 8A          BP4:  LDAA  SCRTCH2          :RETRIEVE NEW VALUE
498 FBA5 A7 00          STAA  0,X                :AND STORE IN PUMP PORT
499 FBA7 26 08          BNE   BP6                :IS IT NOT 00?
500 FBA9 53             COMB                    :INVERT B TO CLEAR ENABLE BIT
501 FBAA D4 02          ANDB  PORT1              :AND WITH ENABLE PORT
502 FBAC D7 02          BP5:  STAB  PORT1          :AND MODIFY THE BIT.
503 FBAE 7E FC BA          JMP    PROMPT
504                          :
505 FBB1 DA 02          BP6:  ORAB  PORT1          :ELSE ENABLE THE CORRECT BIT
506 FBB3 20 F7          BRA   BP5                :AND CARRY ON...
507                          :
508                          :-----
509                          : RECEIVE AN ECHO CHARACTER (& IGNORE!)
510 FBB5 01          ECHO:  NOP                :ROOM FOR JUMP...
511 FBB6 01          NOP
512 FBB7 01          NOP
513 FBB8 7E F9 39          JMP    SCIXIT
514                          :
515                          :-----
516                          : IN4 HEX DIGITS
517                          : INPUTS HEX DIGITS TILL TERMINATED BY A SPACE OR
518                          : BY A CR. (OR BY UNADDRESS). RESULT LEFT AT SCRTCH1,2
519                          : EXITS THRU JUMP2 WHEN DONE (TARGET IN D ON ENTRY)
520                          :
521 FBBB DD 87          IN4:  STD   VECT2          :STORE EXIT VECTOR
522 FBBD 7F 00 89          CLR   SCRTCH1            :CLEAR INPUT BUFFER
523 FBC0 7F 00 8A          CLR   SCRTCH2
524 FBC3 CC FB CB          LDD   #IN4HEX            :POINT CHAR RECEIVER
525 FBC6 DD 81          STD   RVECT
526 FBC8 7E F9 39          JMP   SCIXIT
527                          :
528 FBC9 BD FD 16          IN4HEX: JSR  ASCHEX        :CONVERT TO HEX
529 FBCE 25 15          BCS   CKEND              :IF NOT HEX, CHECK FOR END
530 FBD0 36             PSHA                    :SAVE..
531 FBD1 96 89          LDAA  SCRTCH1            :HI TO A
532 FBD3 D6 8A          LDAB  SCRTCH2
533 FBD5 05             ASLD
534 FBD6 05             ASLD
535 FBD7 05             ASLD
536 FBD8 05             ASLD
537 FBD9 97 89          STAA  SCRTCH1            :RETURN HIGH
538 FBDB D7 8A          STAB  SCRTCH2            :AND B
539 FBDD 32             PULA                    :RETRIEVE NEW NIBBLE
540 FBDE 9A 8A          ORAA  SCRTCH2            :ADD NEW NIBBLE
541 FBEO 97 8A          STAA  SCRTCH2            : & UPDATE
542 FBE2 7E F9 39          JMP   SCIXIT
543                          :
544 FBE5 84 7F          CKEND: ANDA  #S7F         :CLEAN OFF MS FLAG BIT
545 FBE7 81 20          CMPA  #' '              :IS IT SPACE?
546 FBE9 27 07          BEQ   INEXIT
547 FBEB 81 0D          CMPA  #S0D              :IS IT CR?
548 FBED 27 03          BEQ   INEXIT
549 FBEP 7E F9 39          JMP   SCIXIT          :ELSE, GET ANOTHER CHAR

```

SDPUMP1.ASM - SEA DUCT - 6301 SAIL PUMP CONTROLLER

```

550      :
551  FBF2  7E 00 86  INEXIT: JMP      JUMP2          :IF DONE, CARRY ON THRU VECTOR..
552      :
553      :
554      :-----
555      : INPUT ONE HEX BYTE AND CONTINUE THRU JUMP2
556  FBF5  48      INBYTE: ASLA          :MOVE OVER
557  FBF6  48      ASLA
558  FBF7  48      ASLA
559  FBF8  48      ASLA
560  FBF9  97 8D   STAA  SCRTCH5      :SAVE
561  FBFB  CC FC 03 LDD   #INBYTE2      :POINT TO NEXT SEGMENT
562  FBFE  DD 81   STD   RVECT
563  FC00  7E F9 39 JMP   SCIXIT
564      :
565  FC03  BD FD 16 INBYTE2:JSR  ASCHEX      :CONVERT LOW NIBBLE
566  FC06  24 03   BCC   SAVEDAT
567  FC08  7E F9 78 JMP   SETUNAD      :UNADDRESS IF ERROR
568      :
569  FC0B  9A 8D   SAVEDAT:ORAA  SCRTCH5      :COMBINE
570  FC0D  7E 00 86 JMP   JUMP2        :AND CARRY ON THRU VECTOR2
571      :
572      :-----
573      : NOW CHECK THE TRANSMIT SITUATION
574  FC10  7B 20 11 CHECKX: TIM  #S20,TRCSR  :TEST TDRE
575  FC13  27 03   BEQ   XERROR
576  FC15  7E 00 83 JMP   XJUMP        :GO THRU XMIT VECTOR
577      :
578      : THESE SEGMENTS ARE ENTERED THRU XJUMP AND XVECTOR..
579  FC18  01      XERROR: NOP          :TRIG LOC FOR DIAGNOSTICS
580      :
581      : XJUMP TARGETS..
582  FC19  71 FB 11 XPASS: AIM  #SPB,TRCSR  :TURN OFF XMIT INTERRUPTS
583  FC1C  7E F9 39 JMP   SCIXIT
584      :
585      : OUTPUT A LINE OF DATA (FROM 2M DUMP)
586  FC1F  CC FC 29 OUTLINE:LDD  #OUTLF      :& SET UP TO XMIT
587  FC22  DD 84   STD   XVECT
588  FC24  86 9D   LDAA  #SOD            :SEND CR
589  FC26  7E FC C1 JMP   SETOUT
590      :
591  FC29  CC FC 33 OUTLF: LDD  #OUTADDR
592  FC2C  DD 84   STD   XVECT
593  FC2E  86 0A   LDAA  #SOA            :SEND LF
594  FC30  7E FC C1 JMP   SETOUT
595      :
596  FC33  CC FC 3D OUTADDR:LDD  #LOWADDR    :PREP OUTBYTE XIT
597  FC36  DD 87   STD   VECT2
598  FC38  96 8B   LDAA  SCRTCH3        :GET HIGH ADDRESS
599  FC3A  7E FC 9D JMP   CUTBYTE
600      :
601  FC3D  CC FC 45 LOWADDR:LDD  #LOWADD2    :EXIT FROM 2ND OUTBYTE..
602  FC40  DD 84   STD   XVECT
603  FC42  7E F9 39 JMP   SCIXIT
604      :
605  FC45  CC FC 4F LOWADD2:LDD  #ADDRSP
606  FC48  DD 87   STD   VECT2

```

SJPUMPI.ASM - SEA DUCT - 6301 SAIL PUMP CONTROLLER

```

607 FC4A 96 8C          LDAA  SCRTCH4      :NOW LOW ADDRESS
608 FC4C 7E FC 9D      JMP   OUTBYTE
609                      :
610 FC4F CC FC 57      ADDRSP: LDD  #SENDSP  :EXIT FROM 2ND OUTBYTE...
611 FC52 DD 84          STD   XVECT
612 FC54 7E F9 39      JMP   SCIXIT
613                      :
614 FC57 CC FC 61      SENDSP: LDD  #OUTDATA
615 FC5A DD 84          STD   XVECT
616 FC5C 86 20          LDAA  #$20          :SEND SPACE
617 FC5E 7E FC C1      JMP   SETOUT
618                      :
619 FC61 DE 8B          OUTDATA:LDX  SCRTCH3  :GET ADDR POINTER
620 FC63 A6 00          LDAA  0,X          :TO GET DATA BYTE
621 FC65 36             PSHA                    :SAVE
622 FC66 CC FC 6F      LDD  #DECLEN
623 FC69 DD 87          STD   VECT2        :PREP XIT VECTOR
624 FC6B 32             PULA          :RETRIEVE DATA BYTE
625 FC6C 7E FC 9D      JMP   OUTBYTE      :& SEND IT
626                      :
627 FC6F CC FC 77      DECLEN: LDD  #DECLEN2  :EXIT FROM OUTBYTE2..
628 FC72 DD 84          STD   XVECT
629 FC74 7E F9 39      JMP   SCIXIT
630                      :
631 FC77 DE 89          DECLEN2:LDX  SCRTCH1   :GET LENGTH
632 FC79 09             DEX                    :DECREMENT
633 FC7A DF 89          STX   SCRTCH1     :& RETURN
634 FC7C 26 03          BNE  SAYMORE      : MORE DATA?
635 FC7E 7E FC BA      JMP   PROMPT      :PROMPT IF DONE
636                      :
637 FC81 DE 8B          SAYMORE:LDX  SCRTCH3   :GET ADDR
638 FC83 08             INX                    :INCREMENT
639 FC84 DF 8B          STX   SCRTCH3     :REPLACE
640 FC86 18             XGDX                   :X REG TO ACCD
641 FC87 04             LSRD                   :LSB TO C
642 FC88 25 D7          BCS  OUTDATA      :NEXT BYTE NOW IF ODD
643 FC8A C4 07          ANDB  #$07         :CHECK FOR XXX0 (LINE END)
644 FC8C 26 C9          BNE  SENDSP       :IF ONLY EVEN, SEND SP
645                      :
646 FC8E 86 3B          LDAA  #' '         :IF NEW LINE, SEND CONTINUATION
647 FC90 BD FD 33      JSR  GENPAR
648 FC93 97 13          STAA  XDATA
649 FC95 CC FC 1F      LDD  #OUTLINE     :& PREP FOR NEW LINE..
650 FC98 DD 84          STD   XVECT
651 FC9A 7E F9 39      JMP   SCIXIT
652                      :
653                      :-----
654          : OUTPUTS A BYTE IN A AS TWO HEX CHARS, EXITS VIA VECT2..
655 FC9D 97 8D          OUTBYTE:STAA  SCRTCH5  :STASH FOR LATER
656 FC9F 44             LSRA
657 FCA0 44             LSRA          :MOVE OVER
658 FCA1 44             LSRA
659 FCA2 44             LSRA
660 FCA3 BD FD 0B      JSR  HEXASC        :CONVERT
661 FCA6 36             PSHA          :AND SAVE..
662 FCA7 CC FC B0      LDD  #OUTBYT2
663 FCAA DD 84          STD   XVECT

```

SDPUMP1.ASM - SEA DUCT - 6301 SAIL PUMP CONTROLLER

```

664 FCAC 32          PULA          :RECOVER CHARACTER
665 FCAD 7E FC C1   JMP          SETOUT
666
667 FCBO 96 8D      OUTBYT2:LDAA   SCRTCH5
668 FCB2 84 3F      ANDA          $SOF          :CLEAN UP
669 FCB4 BD FD 0B   JSR          HEXASC
670 FCB7 7E FD 03   JMP          OUTJMP       :CONVERT, SEND & JUMP THRU VECT2
671
672
673
674 FCBA CC FC D1   PROMPT: LDD   $PROMPT1
675 FCBD DD 84      STD          XVECT
676 FCBF 86 0D      LDAA        $SOD          :SEND CR FIRST
677
678
679 FCC1 BD FD 33   SETOUT: JSR   GENPAR
680 FCC4 97 13      STAA        XDATA          :SEND FIRST CHAR
681 FCC6 72 04 11   OIM        $S04,TRCSR     :TURN ON INTERRUPTS IF REQ'D
682 FCC9 CC FB B5   LDD        $ECHO
683 FCCC DD 81      STD          RVECT        :& PREPARE TO ECHO
684 FCCF 7E F9 39   JMP        SCIXIT
685
686 FCD1 CC FC DA   PROMPT1:LDD   $PROMPT2
687 FCD4 DD 84      STD          XVECT
688 FCD6 86 3A      LDAA        $S0A          :SEND LF
689 FCD8 20 E7      BRA          SETOUT
690
691 FCDA CC FC E3   PROMPT2:LDD   $PROMPT3
692 FCDD DD 84      STD          XVECT
693 FCDF 86 3A      LDAA        $:' '
694 FCS1 20 DE      BRA          SETOUT
695
696 FCE3 36 03      PROMPT3:LDAA  $S03          :FINALLY ETX
697 FCE5 BD FD 33   JSR        GENPAR
698 FCE8 97 13      STAA        XDATA          :DRAGON HERE?
699 FCEA 71 FB 11   AIM        $SFB,TRCSR     :NOW TURN OFF XMIT INTERRUPTS
700 FCED CC FC F5   LDD        $WAITPR1
701 FCF0 DD 81      STD          RVECT        :WAIT FOR ETX ECHO
702 FCF2 7E F9 39   JMP        SCIXIT
703
704
705 FCF5 81 03      WAITPR1:CMPL  $S03          :IS IT THE ETX YET?
706 FCF7 26 35      BNE        WXIT           :IF NOT, WAIT FOR NEXT CHAR
707 FCF9 CC FA 1B   LDD        $CONCHAR
708 FCFC DD 81      STD          RVECT        :IF SO, CONTROL CHAR WILL BE NEXT
709 PCFE 7E F9 39   WXIT:  JMP   SCIXIT
710
711
712
713 PD01 86 03      XETX:  LDAA  $S03          :SEND ETX
714 PD03 BD FD 33   OUTJMP: JSR  GENPAR       :MAY ENTER HERE...
715 PD06 97 13      STAA    XDATA           :DRAGON AGAIN?
716 PD08 7E 00 86   JMP    JUMP2            :NOW THRU JUMP2
717
718
719
720

```

: SUBROUTINES.....

SDPUMP1.ASM - SEA DUCT - 6301 SAIL PUMP CONTROLLER

```

721 ;-----
722 : Converts low nibble in A to ASCII char in A
723 FD0B 34 0F HEXASC: ANDA #S0F :CLEAN IT UP
724 FD0D 3B F6 ADDA #SF6
725 FD0F 24 02 BCC HNUMBER
726 FD11 3B 07 ADDA #S07 :CONVERT
727 FD13 8B 3A HNUMBER:ADDA #S3A ; TO ASCII
728 FD15 39 RTS
729 ;
730 ;-----
731 : Converts ASCII char in A to nibble in A if it is HEX &sets C bit.
732 : Otherwise, returns original char with C bit set.
733 FD16 36 ASCHEX: PSRA :SAVE CHAR
734 FD17 80 30 SUBA #S30
735 FD19 25 15 BCS NOTHEX
736 FD1B 80 0A SUBA #S0A
737 FD1D 2C 04 BGE TSTALPH
738 FD1F 8B 0A ADDA #S0A :REPAIR NUMB
739 FD21 20 0A BRA AXIT
740 FD23 80 07 TSTALPH:SUBA #S07 :41->00 ?
741 FD25 2D 09 BLT NOTHEX
742 FD27 80 06 SUBA #S06
743 FD29 2C 05 BGE NOTHEX
744 FD2B 8B 10 ADDA #S10 :REPAIR ALPH
745 FD2D 31 AXIT: INS :POP OFF SAVED CHAR
746 FD2E 0C CLC :AND CLEAR CARRY BIT
747 FD2F 39 RTS
748 ;
749 FD30 32 NOTHEX: PULA :GET CHAR
750 FD31 0D SEC :SET CARRY
751 FD32 39 RTS
752 ;-----
753 : GENERATE PARITY- Char is passed in and out thru A
754 FD33 37 GENPAR: PSHB :SAVE SOME STUFF..
755 FD34 3C PSHX
756 FD35 16 TAB :COPY CHAR TO B
757 FD36 CE FD 66 LDX #PARITY :POINT TO PARITY TABLE TOP
758 FD39 3A ABX :ADD OFFSET TO POINT X TO CHAR
759 FD3A AA 00 ORAA 0,X :ADD PARITY BIT
760 FD3C 38 PULX :..RESTORE
761 FD3D 33 PULB
762 FD3E 39 RTS
763 ;
764 ;-----
765 : TIMER INTERRUPT PROCESSING SECTIONS
766 ;-----
767 : TIMER OVERFLOW INTERRUPT, WATCHES FOR SAIL BREAK EXIT
768 ;
769 FD3F 96 08 TOP: LDAA TCSR :READ COUNTER STATUS REG
770 FD41 96 09 LDAA COUNTHI ; AND COUNTER TO CLEAR INTERRUPT
771 FD43 7B 80 02 TIM #S80,PORT1 :TEST BREAK SENSE BIT
772 FD46 27 11 EQ SETBRK :IF LOW, SET BREAK FLAG
773 : IF NOT LOW, JUST RISEN?
774 FD48 96 8E LDAA BNODE
775 FD4A 2A 13 BPL TOPXIT :IF WAS NO BREAK, CARRY ON..
776 : IF JUST CAME OUT OF BREAK...
777 FD4C 71 7F 8E AIN #S7F,BNODE :CLEAR BREAK FLAG

```

SDPUM1.ASM - SEA DUCT - 6301 SAIL PUMP CONTROLLER

```

778 FD4F 72 10 11      OIM  $S10,TRCSR  :ENABLE SCI INTERRUPTS
779 FD52 CC F9 7D      LDD  #UNADDR
780 FD55 DD 81        STD  RVECT      :AND PRESET JUMP VECTOR..
781 FD57 20 06        BRA  TOFKIT
782
783 FD59 72 80 9E      SETBRK: OIM  $S80,BMODE  :SET BREAK FLAG
784 FD5C 71 EB 11      AIM  $SEB,TRCSR  :TURN OFF BOTH SCI INTERRUPTS
785 FD5F 3B          TOFKIT: RTI
786
787
788 :-----
789 : OUTPUT COMPARE INTERRUPT
790
791 FD60 7B 40 08      OCI:  TIM  $40,TCSR
792 FD63 27 00          SEQ  OXIT  :EXIT IF NOT OCFlag
793          : DUMMY FOR INSTRUCTIONAL PURPOSES ONLY
794          OXIT: RTI  :AND EXIT..
795          :*****
796          : PARITY TABLE
797          PARITY: DB 00,80,80,00,80,00,00,80      :A
798          FD66 00 80 80 00
799          FD6A 80 00 00 80
800          FD6E 80 00 00 80      DB 80,00,00,80,00,80,80,00      :B
801          FD72 00 80 80 00
802          FD76 80 00 00 80      DB 80,00,00,80,00,80,80,00      :B
803          FD7A 00 80 80 00
804          FD7E 00 80 80 00      DB 00,80,80,00,80,00,00,80      :A
805          FD82 80 00 00 80
806          : XX20
807          FD86 80 00 00 80      DB 80,00,00,80,00,80,80,00      :B
808          FD8A 00 80 80 00
809          FD8E 00 80 80 00      DB 00,80,80,00,80,00,00,80      :A
810          FD92 80 00 00 80
811          FD96 00 80 80 00      DB 00,80,80,00,80,00,00,80      :A
812          FD9A 80 00 00 80
813          FD9E 80 00 00 80      DB 80,00,00,80,00,80,80,00      :B
814          FDA2 00 80 80 00
815          : XX40
816          FDA6 80 00 00 80      DB 80,00,00,80,00,80,80,00      :B
817          FDAA 00 80 80 00
818          FDAE 00 80 80 00      DB 00,80,80,00,80,00,00,80      :A
819          FDB2 80 00 00 80
820          FDB6 00 80 80 00      DB 00,80,80,00,80,00,00,80      :A
821          FDBA 80 00 00 80
822          FDBE 80 00 00 80      DB 80,00,00,80,00,80,80,00      :B
823          FDC2 00 80 80 00
824          : XX60
825          FDC6 00 80 80 00      DB 00,80,80,00,80,00,00,80      :A
826          FDCA 80 00 00 80
827          FDCE 80 00 00 80      DB 80,00,00,80,00,80,80,00      :B
828          FDD2 00 80 80 00
829          FDD6 80 00 00 80      DB 00,00,00,80,00,80,80,00      :B
830          FDDA 00 80 80 00
831          FDDE 00 80 80 00      DB 00,80,80,00,80,00,00,80      :A
832          FDE2 80 00 00 80
833          : XX80
834          FDE6 80 00 00 80      DB 80,00,00,80,00,80,80,00      :B
835          FDEA 00 80 80 00
836          FDEE 00 80 80 00      DB 00,80,80,00,80,00,00,80      :A

```


SDPUMP1.ASM - SEA DUCT - 6301 SAIL PUMP CONTROLLER

***** CROSS REFERENCE TABLE *****

-----	FC10	:				
ADDR	F000	:	175			
ADDRSP	FC4F	:	605			
ASCHEX	FD16	:	378	389	528	565
AXIT	PD2D	:	739			
BANG	FA33	:	286			
BANGM	FAB4	:	320	414		
BANGML	FA5F	:	303			
BANGP	FB6F	:	321			
BANGPL	FA62	:	305			
BAUD2	F9A6	:	200			
BAUD3	F9AD	:	205			
BAUD4	F9BA	:	208			
BAUD5	F9C2	:	216			
BAUD6	F9CF	:	221			
BAUDTBL	FA0E	:	230			
BMODE	= 008E	:	114	774	777	783
BP1	FB77	:	472			
BP2	FB88	:	478	481		
BP3	FB90	:	485			
BP4	FBA3	:	491	494		
BP5	FBAC	:	506			
BP6	FBB1	:	499			
BTRY	F9DB	:	261			
CAPTURHI	= 000D	:				
CAPTURLO	= 000E	:				
CHECKX	FC10	:	147			
CKCHAR	F93A	:	140			
CKEND	FBE5	:	529			
CMATCH	F9F3	:				
COMPARE	F9E6	:	253			
COMPARHI	= 000B	:				
COMPARLO	= 000C	:				
CONCHAR	FA1B	:	195	707		
COUNTHI	= 0009	:	770			
COUNTLO	= 000A	:				
DDR1	= 0000	:	85			
DDR2	= 0001	:	88			
DDR3	= 0004	:	90			
DDR4	= 0005	:	93			
DECLEN	FC6F	:	622			
DECLEN2	FC77	:	627			
DOZE	F049	:	118			
ECHO	FBB5	:	362	682		
GENPAR	FD33	:	647	679	697	714
GONON	FA65	:	290			
GOTADDR	F996	:	192			
GOTBANG	FA3B	:	298			
GOTNUM	F957	:	158			
GOTQURY	FA4E	:	308			
HELPDUN	FA8F	:	341			
HELPPIL	F800	:	334			
HEXASC	FDOB	:	660	669		
HIHEX	FAC2	:	374	397	408	430

Appendix I
SEA DUCT - ELECTRONIC DRAWINGS

Dwg. #	Size	Title	Rev. Date.
SD-B001	B	Computer System Connection List	20 Nov. 84
SD-B002	B	Computer System Connections	20 Nov. 84
SD-B003	B	U/W Connectors (CPU System)	24 Nov. 86
SD-B004	B	I/O Decode	24 Nov. 86
SD-B005	B	Output Driver Decoding	24 Nov. 86
SD-B006	B	Pulse Driver Decoding, A/D, Mux. Decoding	23 Apr. 86
SD-B007	B	Software Timing	24 Nov. 86
SD-B008	B	Computer Ribbon Conn. Pin / Funct. Cross Ref.	04 Nov. 83
SD-B009	B	uP, System Battery	24 Mar. 87
SD-B010	B	SAIL, Camera, Transmissometer - External Conn.	02 Dec. 86
SD-0011	B	Bottom Sw., Opto. Int., Xponder - Ext. Conn.	23 Apr. 86
SD-B012	B	Buffer Board - Main Section	23 Apr. 86
SD-0013	B	Buffer Board - SAIL and Reset	12 Jun. 86
SD-B014	B	Buffer Board - Circulation Pump Control	24 Nov. 86
SD-0015	B	Buffer Board - Parts Layout	24 Nov. 86
SD-B016	B	Output Driver Board	24 Nov. 86
SD-0017	B	Output Driver Board - Parts Layout	24 Nov. 86
SD-B018	B	Interface Board - A/D, Voltage Convertor	24 Nov. 86
SD-0019	B	Interface Board - Compass Interface	15 Oct. 84
SD-B020	B	Interface Board - Rotation Encoder Interface	24 Nov. 86
SD-0021	B	Interface Board - Parts Layout	28 Sep. 83
SD-B022	B	Rotation Encoder Interface (Encoder Housing)	20 Nov. 84
SD-B023	B	LITTON Rotation Encoder	20 Nov. 84
SD-B024	B	Rotation Encoder Interface - Parts Layout	20 Nov. 84
SD-B025	B	Auxillary Board	24 Nov. 86
SD-B026	B	Auxillary Board - Parts Layout	05 Dec. 85
SD-B027	B	Manual Control Box (Connections)	24 Nov. 86
SD-B028	B	HP 1630D Analyzer Interface Box	02 Feb. 84
SD-B029	B	HP 1630D Analyzer Interface Box - Layout	18 Oct. 83
SD-B030	B	HP 1630D/HP 1610 Analyzer Interface Box	12 Jul. 84
SD-B031	B	Main Wiring Harness	28 Mar. 87
SD-B032	B	CPU Endcap - Electrical Connections	13 Dec. 85
SD-B033	B	Pump Controller - Control Circuit	26 Nov. 86
SD-B034	B	Pump Controller - Power Circuit	26 Nov. 86
SD-B035	B	Pump Controller - Board Layout	26 Nov. 86
SD-B036	B	Pump Controller - Block Diagram	26 Nov. 86
SD-B037	B	CMOS - RS232 Interface	24 Nov. 86
SD-B038	B	OIS Acoustic Command Xcvr. - Modifications	30 Dec. 86
SD-B039	B	OIS Acoustic Command Rcvr. - Modifications	30 Dec. 86
SD-B040	B	Photosea Camera Cable	28 Mar. 87
SD-C001	C	CPU BOARD (2 Sheets)	19 Dec. 85
SD-C002	C	Main Junction Box Wiring	18 Dec. 85
SD-D001	D	Electrical Master	31 Jul. 85

CONN	WIRE	WIRE	WIRE	WIRE	WIRE	WIRE	WIRE
A	INTERFERENCE	34	AMP LATCH	N	BUFFERED I/O BUS		
B	"	8	"	BB	Pendulums		
C	"	8	"	AND INTRMS			
D	"	8	"	I/O E	Position Encoder (Rotation)		
E	"	14	AMP LATCH	CC	Compass		
F	"	6	AMP DRIVER	L	SYS. PWR		
G	OUTPUT DRV.	34	AMP LATCH	I/O A	BUFFERED I/O BUS		
H	"	8	AMP DRIVER	K, U	Sail Pwr, Rot Pos Pwr, Trans Pwr		
I	"	8	AMP DRIVER	F, G	Relay Cam 2 Sed. Sample Pwr. for Oct. SW, Opto Interruptors		
J	"	8	"	I/O 2	Relay Cam 4 Insert Rotate, Suct., Clean		
K	"	8	"	I/O 4	Relay Cam 5 XYZ Position		
L	"	8	"	I/O 5	Relay Cam 6 Pumps & H ₂ O Samples		
M	"	8	"	NC.	} Not Currently in Use		
N	"	8	"	NC.			
O	BUFFER	26	AMP LATCH	SEN DATA	BUFFERED I/O BUS Sea Data Recorder		
P	CPU	50	AMP LATCH	Q	CPU BUS		
Q	"	26	AMP DRIVER	U	CHARTS (LDV SAIL)		
R	"	26	"	EXTERNAL	BOTTOM SWITCHES		
S	"	8	"	S	SAIL/RESET		
T	BUFFER	34	AMP LATCH	H, W	BUFFERED I/O BUS		
U	"	6	AMP POWER	F	POWER		
V	"	8	"	H0(A, I, D, L)	BATT RELAYS, ACOUSTIC LINK, CAMERA, LDV RST		
W	"	34	AMP LATCH	A	BUFFERED I/O BUS		
X	NONE						
Y	BUFFER	50	AMP LATCH	EXT	BUFFERED CPU BUS FOR LOGIC ANALYZER		
Z	AUX	50	AMP LATCH	J1	CPU BUS		
AA	"	8	AMP POWER	G	LDV Sail Pwr, Misc.		
AB	"	8	AMP HEADER	J4, T	UNW SAIL #1 (Control) Sail		
	"	8	"	I/O C, S	CONTROL WART For Sail Loop 1		
	"	8	"	J2	UNW SAIL #2, LDV		
	"	8	"	I/O D	UNW SAIL #2 (LDV) + LDV RESET (M)		
	"	34	AMP LATCH	K, H	BUFFERED I/O BUS		
	"	8	AMP DRIVER	I/O J	OPTO-INTERCHANGERS		
	"	3	"		POWER FOR GOT.SW. & OPTO.INT.		
	"	10	"	I/O K	BOTTOM SENSE SWITCHES		
	"	4	"	I/O B	AUX SUPPLY IN		
	"	6	"	I/O I	Acoustic Signals (from XPONDA)		
	"	9	Caution D	B, Pendulum	Pendulums		

20 Nov 84 WE
 29 Oct 84 W.
 REV 24 Oct 84 RA

POWER FOR BOT. SW. & OMO INT.

BOTTOM SENSE SWITCHES

AUXILIARY IN
Acoustic Signals (from XPONDR)
Pendulum
Compass

Sys. Batt. + Relays
PP Batt.
Control Sail
LDV Sp. 1
Rotation Position
Transmissometer

Relay Can 2 Sediment Sampler
Relay Can 4 Insert, Rotate, Suct, Clean
Relay Can 5 XYZ Position
Relay Can 6 Hydraulic Pump, Flow Pump
Acoustic Link
Opto Encoders (XYZ)
Bottom Switches
Camera

Sys. Batt. + Bat Relays
PP Batt
Control SAIL
LDV
Rotation Position
Transmissometer

Relay Can 2
" 4
" 5
" 6

Acoustic Link
Opto Encoders
Bottom Switches
Camera

I/O

I/O K
I/O B
I/O I
B, Pendulum

UWA, G
UWB, PWR
UWC, T
UWD, V
UWE, D
UWF, C, 1
UWR, 2
UW4, 4
UW5, 5
UW6, L
UWI, AA
UWJ, X
UWK, Z
UWL, M

I/O A
I/O B
I/O C
I/O D
I/O E
I/O F

I/O 2
I/O 4
I/O 5
I/O 6

I/O I
I/O J
I/O K
I/O L

Color

Caron D
Augat Dip
Red Molex
Red Sq Molex
Grn Sq Molex
Grn Molex
Grn Molex
Blu Sq Molex
Blu Molex
Blu Molex
Blu Molex
Blu Molex
Wht Molex
Yel Molex
Wht Molex
Wht Molex

XSK-5-BCL
XSG-4-BCL
" "
XSK-8-BCL
XSG-4-BCL
XSK-5-FCL
" "
" "
XSK-3-BCL
" "
XSG-4-BCL

3

10
4
6
9
14

9
4
4
4
9
4
9
9
9
9
6
7
9
2

8
4
4
4
8
4

8
3
8

8
8
4

Y

RAW
AA
BB
CC

I/O A
I/O B
I/O C
I/O D
I/O E
I/O F
I/O 2
I/O 4
I/O 5
I/O 6
I/O I
I/O J
I/O K
I/O L

UWA
UWB
UWC
UWD
UWE
UWF

UW 2
UW 4
UW 5
UW 6

UW I
UW J
UW K
UW L

WOODS HOLE OCEANOGRAPHIC INSTITUTION
WOODS HOLE, MASS. 02543

PROJ. 10/82.69 BY ARD
SHEET 1 OF 1 DATE 7 NOV 83

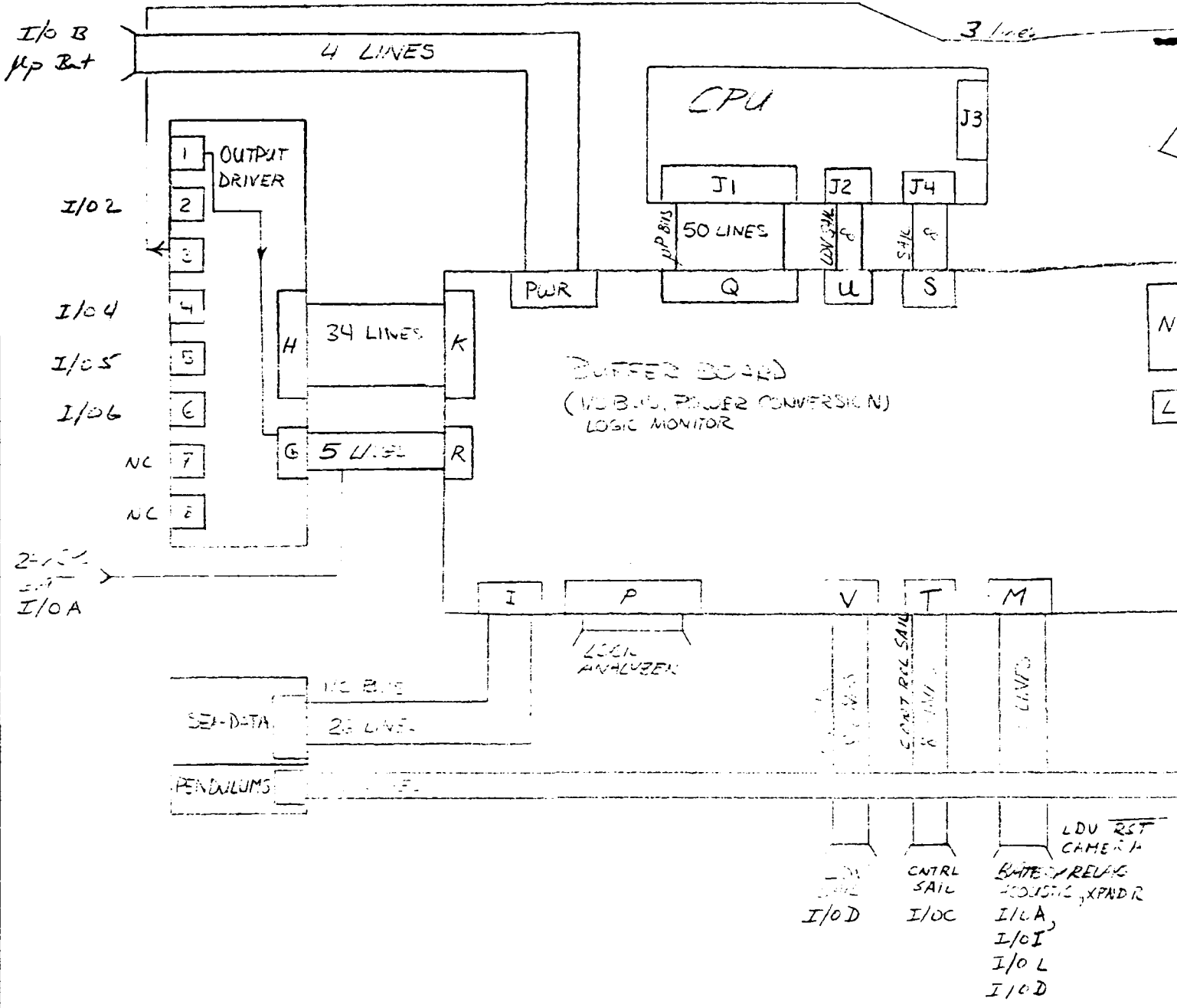
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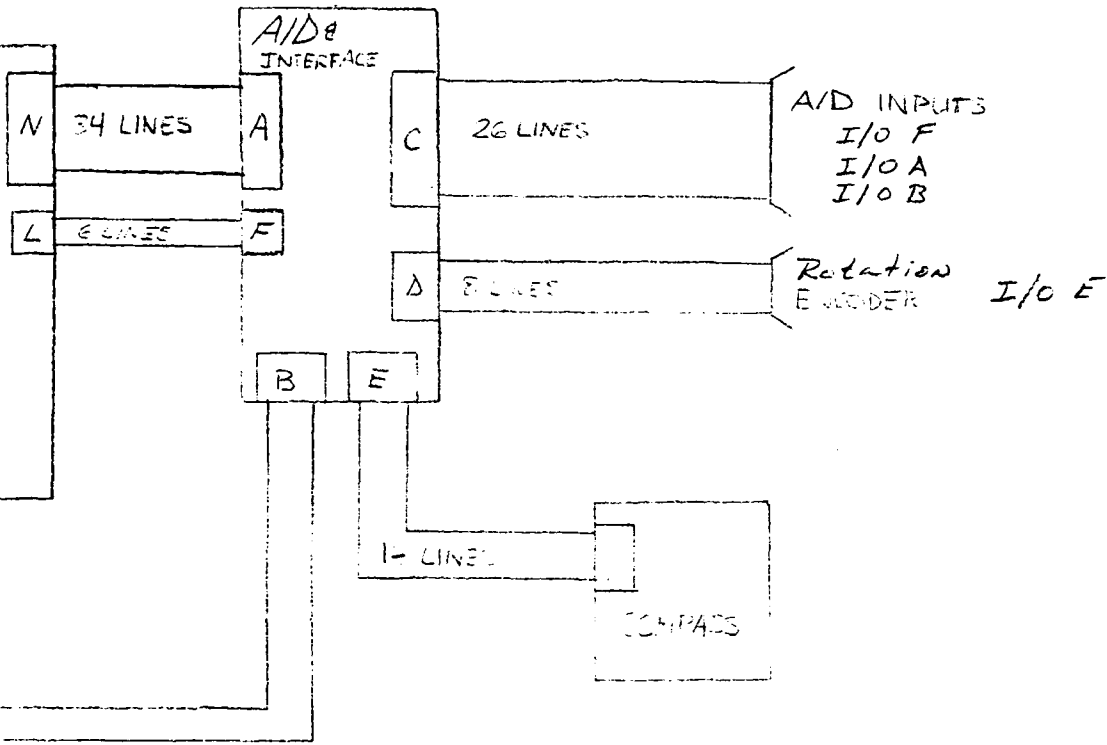
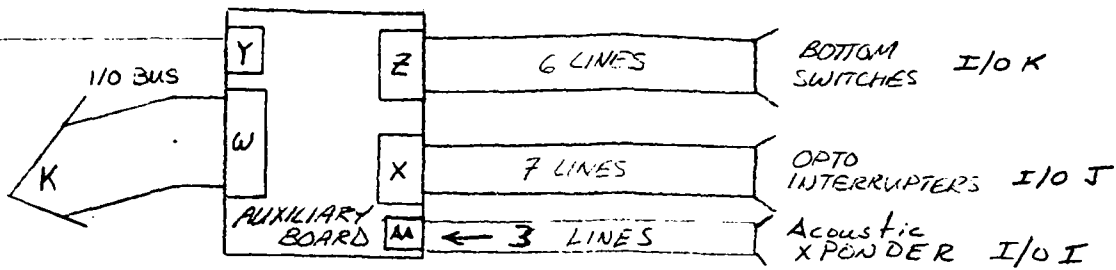
Computer System - Connector List

SD-B-001

SEA DUCT

NOV 84 WET
OCT 84 WET
OCT 84 RAW





LDU RST
CAMERA
MTE PRELAC
ACOUSTIC XPOWDER
I/O A
I/O I
I/O L
I/O D

REV. 20 Nov 84 WET

WOODS HOLE OCEANOGRAPHIC INSTITUTION
WOODS HOLE, MASS. 02543
PROJ. 12/82.69 BY ARD
SHEET 2 OF 2 DATE 4 NOV 83

TITLE
Computer System Connectors
SD-B-002 SEA DUCT

SD-B-002

CPU Pressure Housing Connectors

Function	Conn.	Mates With	Wire	Other End	Connector
I/O A Main Battery (Relay Pod #1)	XSK-8-BCL 3 Spins	RMK-8-FS W/K-FLS-P	30' 18/8 SO	Danco	
I/O E Position Encoder	XSK-8-BCL	RMK-8-FS W/K-FLS-P	18/8 SD	RMK-8-FS W/K-FLS-P	XSK-8-BCL
Sail to Control I/O to LDV	XSG-4-BCL 4 Pins each	RMG-4-FS RMG-4-FS	Two shielded Pair in oil tube	BARE for SAIL CONTROL RMG-4-FS	RMG-4-FSD XSG-4-BCL
Acoustic Link I/O-I (XPONDER)	XSK-8-BCL 6 Pins	RMK-8-FS W/K-FLS-P	30' 18/8 SO to 6 INDIV.	Mecca Female (6)	Mecca (6)
I/O-F Transmissometer	XSG-4-BCL 4 PIN	RMG-4-FS W/G-FLS-P	2 shielded Pair in oil tube	VMG-4-FS W/G-FLS-P	VSG-4-BCL
XYZ Opto Encoder I/O-J	XSK-8-BCL	RMK-8-FS W/K-FLS-P	18/8 SO to 30'	DANCO	
Bottom + Sense I/O-K Switches	XSK-8-BCL	RMK-8-FS W/K-FLS-P	18/8 SO to 30'	DANCO	
I/O-L Camera	XSG-4-BCL	RMG-4-FS W/G-FLS-P	18/4 SO	SIFZF (Electro)	SIFZH (Electro) See Note 3
I/O-2 Relay Pod # 2	XSK-8-BCL	RMK-8-FS K-FLS-P	18/8 SO	DANCO	
I/O-4 Relay Pod # 4	XSK-8-BCL	RMK-8-FS K-FLS-P	18/8 SO	DANCO	
I/O-5 Relay Pod # 5	XSK-8-BCL	RMK-8-FS K-FLS-P	18/8 SO	DANCO	
I/O-6 Relay Pod # 6	XSK-8-BCL	RMK-8-FS K-FLS-P	18/8 SO	DANCO	
I/O-B UP Battery	XSG-4-BCL	RMG-4-FS G-FLS-P	30' 18/4 SO to MECCA	Mecca Female Mecca Male (4) or (2)	
Pump Controller (Recirculate Pumps)	XSK-8-BCL XSG-4-BCL SEE SAIL LDV	RMK-8-FS RMG-4-FS G-FLS-P K-FLS-P	10/2 SO	Danco on Pumps + B or B	See Note 2
Emergency Battery to Emergency Acoustic Link	Mecca Male (2)	Mecca	?	Mecca Female (6)	Mecca Male * Not connected to

also G-FLS-P
also (2) G-FLS-P
also to pump con

See Note 3

See Note 2

* Not connected to

WC
CONTRA
BY W

9223L-078

2

1

REVISIONS				
ZONE	LTR	DESCRIPTION	DATE	APPROVED

G-FLS-P
 (2x G-FLS-P)
 to pump control)

Note:

1. 9 ea XSK-8-BCL } ON CPU
 5 ea XSG-4-BCL } Pressure Case
2. Current Configuration uses separate SAIL Controller in separate U/W Housing See Dwgs. SD-8010, 8036
3. ref. PhotoSea Systems - Dwg 100667 (2/82) "Cable Diagram - 15000 Ft. - Woods Hole Home System", or SD-B037

ite 3

ite 2

connected to CPU housing

D

C

B

A

REV. 24 Nov 86

WOODS HOLE OCEANOGRAPHIC INSTITUTION ENGINEERING DEPT. WOODS HOLE, MA. 02543		TITLE U/W Connectors (μ P System)		
CONTRACT NO. 10/82.69		CODE NO.		
BY W.E.T.		DATE 11 July 84	SIZE B	DWG. NO. SD-B-003
		OF		REV. 31 Jul 85

2

1

4

Input

Output

Group 0

1	Read Grp. Sel.	Set Grp. Sel.
2	Contact Switches	Bat. 1 Relay
3	X Position	Bat. 2 Relay
4	Y Z Position	Bat. 3 Relay
5	—	LDV Reset
6	—	Camera
7	Acoustic Xpond	Acoustic Xpond

Group 1

1	Read G. S.	Set G. S.
2	Compass	Compass
3	—	—
4	Heading	Heading Latch
5	—	Heading Shift Clk.
6	—	Heading PWR.
7	—	—

Group 2

1	Read G. S.	Set G. S.
2	A/D Low 4 bits	Mux + A/D Control
3	A/D High 8 bits	Sea Data Request
4	—	—
5	—	—
6	—	Circ. Pump Control (PWR)
7	Relay Sense	Relay Control

Group 3

1	Read Grp. Sel.	Set Grp. Sel.
2	—	—
3	—	—
4	—	—
5	—	—
6	—	—
7	—	—

Input

Output

3

Input

Output

Group 4

1	Read Grp. Sel.	Set Grp. Sel.
2	—	—
3	—	—
4	—	—
5	—	—
6	—	—
7	—	—

Group 5 (1851)

1	Read G. S.	Set G. S.
2	—	—
3	—	—
4	CLR	CLR
5	Port Status	Port Control
6	Port A	Port A
7	Port B	Port B

] Not Us

Group 6 (Harts)

1	Read G. S.	Set G. S.
2	Data 1 in	Data 1 out
3	Status 1	Control 1
4	Data 2 in	Data 2 out
5	Status 2	Control 2
6	Data 3 in	Data 3 out
7	Status 3	Control 3

Group 7

1	Read Grp. Sel.	Set Grp. Sel.
2	—	—
3	—	—
4	—	—
5	—	—
6	—	Halt (Suicide)
7	—	Memory Protect.

WOODS

CONTRACT NO

BY W. E.

4

3

2

1

t put

t Grp. Sal.

t G.S.

Control
A } Not
B } Used

s)
t G.S
ta 1 out } Control
trol 1 } SAIL
ta 2 out } LDV, PUMP
trol 2 } SAIL
ta 3 out } UNUSED
trol 3 }

Grp. Sal.

(Suicide) Not Used
ry Protect

REVISIONS				
ZONE	LTR	DESCRIPTION	DATE	APPROVED

Other 1806 'I/O'

EF1 —

EF2 Compass + A/D

EF3 Sea Data Recorder

EF4 UTH

Q UTH, Mem. Protect, Interrupt Pulse

D

C

B

A

24 Nov 86 WET
16 Oct 84 WET
27 July 84 WET
REV 7 Nov 83 ARD

WOODS HOLE OCEANOGRAPHIC INSTITUTION ENGINEERING DEPT. WOODS HOLE, MA. 02543		TITLE 1806A CPU I/O DECODING SEA DUCT		
CONTRACT NO. 10/82.69	CODE NO.	DWG. NO. SD-B004	OF	REV.
BY W. E. TERRY	DATE	SIZE B		

2

1

GS2-I/O 7

M R D G G G A A A

MASTER
RESET
DATA
CHIP
Sel.
ADDR

USE OCTAL
 { 2 XX = RESET
 1 NN = Set Function
 0 NN = CLR Function

I.C. Pin	Logical Device		Function	CONN. # Pin		I.C. Pin #	DEC	H
	#	HEX		Octal #	#			
4	0	0	LDV sail Loop	*	1 8	4	32	
5	1	1	HEADING INDICATOR	*	1 7	5	33	
6	2	2	—	*	1 6	6	34	
7	3	3	—	*	1 5	7	35	
9	4	4	TRANSMISSOMETER PWR	*	1 4	9	36	
10	5	5	—	*	1 3	10	37	
11	6	6	Sed 1 insert		2 8	11	38	
12	7	7	Sed 1 retract		2 7	12	39	
4	8	8	Sed 1 unlatch - H ₂ O Sample 1		2 6	4	40	
5	9	9	Sed 2 insert		2 5	5	41	
6	10	A	Sed 2 retract		2 4	6	42	
7	11	B	Sed 2 unlatch - H ₂ O Sample 2		2 3	7	43	
9	12	C	Opto Interrupter Drive		3 8	9	44	
10	13	D	Bottom Switch Drive		3 7	10	45	
11	14	E	—		3 6	11	46	
12	15	F	—		3 5	12	47	
4	6	10	—		3 4			
5	7	11	—		3 3			
6	8	12	Flume insert		4 8			
7	19	13	Flume withdraw		4 7			
9	14	14	Rotate CW		4 6			
10	21	15	Rotate CCW		4 5			
11	22	16	Suctions Pump (Spare)		4 4			
12	23	17	View Port Clean (Spare)		4 3			
4	24	18	X+		5 8			
5	25	19	X-		5 7			
6	26	1A	Y+		5 6			
7	27	1B	Y-		5 5			
9	28	1C	Z+		5 4			
10	29	1D	Z-		5 3			
11	30	1E	Hydraulic Pump		6 8			
12	31	1F	Recirculate Pump Pwr		6 7			

Not Inst. Used

* Supplied by μ P Battery -
 All others are System Battery

WOOL
 PROJ...
 SHEET.

I.C. Pin #	DEC	HEX	OCTAL	Function	Conn. #	# Pin
4	32	20	40	Spare (was Recirculate Pump #2)	6	6
5	33	21	41	Spare	6	5
6	34	22	42	Spare (was H ₂ O sample 1)	6	4
7	35	23	43	Spare (was H ₂ O sample 2)	6	3
8	36	24	44		7	8
9	37	25	45		7	7
10	38	26	46		7	6
11	39	27	47		7	5
12	40	28	50		7	4
13	41	29	51		7	3
14	42	2A	52		8	8
15	43	2B	53		8	7
16	44	2C	54		8	6
17	45	2D	55		8	5
18	46	2E	56		8	4
19	47	2F	57		8	3

Relay Car. #6 con't

Not Ins't. Used

24 Nov 86 WET
 16 Oct 84 WET
 27 July 84 WET
 17 July 84 RAW

WOODS HOLE OCEANOGRAPHIC INSTITUTION WOODS HOLE, MASS. 02543	TITLE
PROJ. <u>10/82.69</u> BY <u>W.E.T.</u>	<u>Output Driver Decoding</u>
SHEET <u>3</u> OF <u>3</u> DATE <u>4 NOV 83</u>	<u>SEA DUCT</u>

SD-8-005

4

3

SEA DUCT-BUFFER BOARD

PULSE DRIVERS

						Cann/Pin
1	Compass	GS 1	I/O 2	10. mSec	24V	L1
2	Spare	-		-	24V	L2
3	Bat.1 RELAY	GS ϕ	I/O 2	160 mSec	24V	M3
4	Bat 2 RELAY	GS ϕ	I/O 3	160 mSec	24V	M4
5	Bat.3 Relay	GS ϕ	I/O 4	160 mSec	24V	M5
6	LDV RESET	GS ϕ	I/O 5	200 mSec.	O.C	M6
7	Camera	GS ϕ	I/O 6	150 mSec	O.C	M7
8	Acoustic XPONDER (SEND)	GS ϕ	I/O 7	35 mSec	O.C	M8

SEA D

Hi Byte
(N Z)

0	x	Pe
1	x	Pe
2	x	u
3	x	Sy
4	x	A/
5	x	A/
6	x	A/
7	x	T
8	x	
9	x	
A	x	
B	x	
C	x	
D	x	
E	x	
F	x	

WOODS HOLE

W

CONTRACT NO. 10/

BY W. E. T.

4

3

2

1

REVISIONS

ZONE	LTR	DESCRIPTION	DATE	APPROVED

SEA DUCT - A/D + MUX DECODING

Hi Byte (N X)		Lo Byte X N
0 x	Pendulum 1-Pitch (8 bit)	x 0 A/D OFF
1 x	Pendulum 2-Roll (8 bit)	x
2 x	μ P 24V Bat (8 bit)	x 2 A/D Pwr On
3 x	Sys 24V Bat (8 bit)	x 3 A/D Start Convert
4 x	A/D GND (12 bit)	x
5 x	A/D REF (12 bit)	
6 x	A/D +5V (12 bit)	
7 x	Transmissometer (12 bit)	
8 x		
9 x		
A x		
B x		
C x		
D x		
E x		
F x		

GS = 2 I/O = 2
(Use GP = X Reg)

Rev 23 Apr 86

WOODS HOLE OCEANOGRAPHIC INSTITUTION
ENGINEERING DEPT.
WOODS HOLE, MA. 02543

TITLE

Pulse Driver Decoding
A/D, Mux Decoding SEA DUCT

CONTRACT NO. 10/82.69

CODE NO.

BY W. E. T.

DATE 20 Nov 84

SIZE B

DWG. NO. SD-B-006

OF

REV.

2

1

D

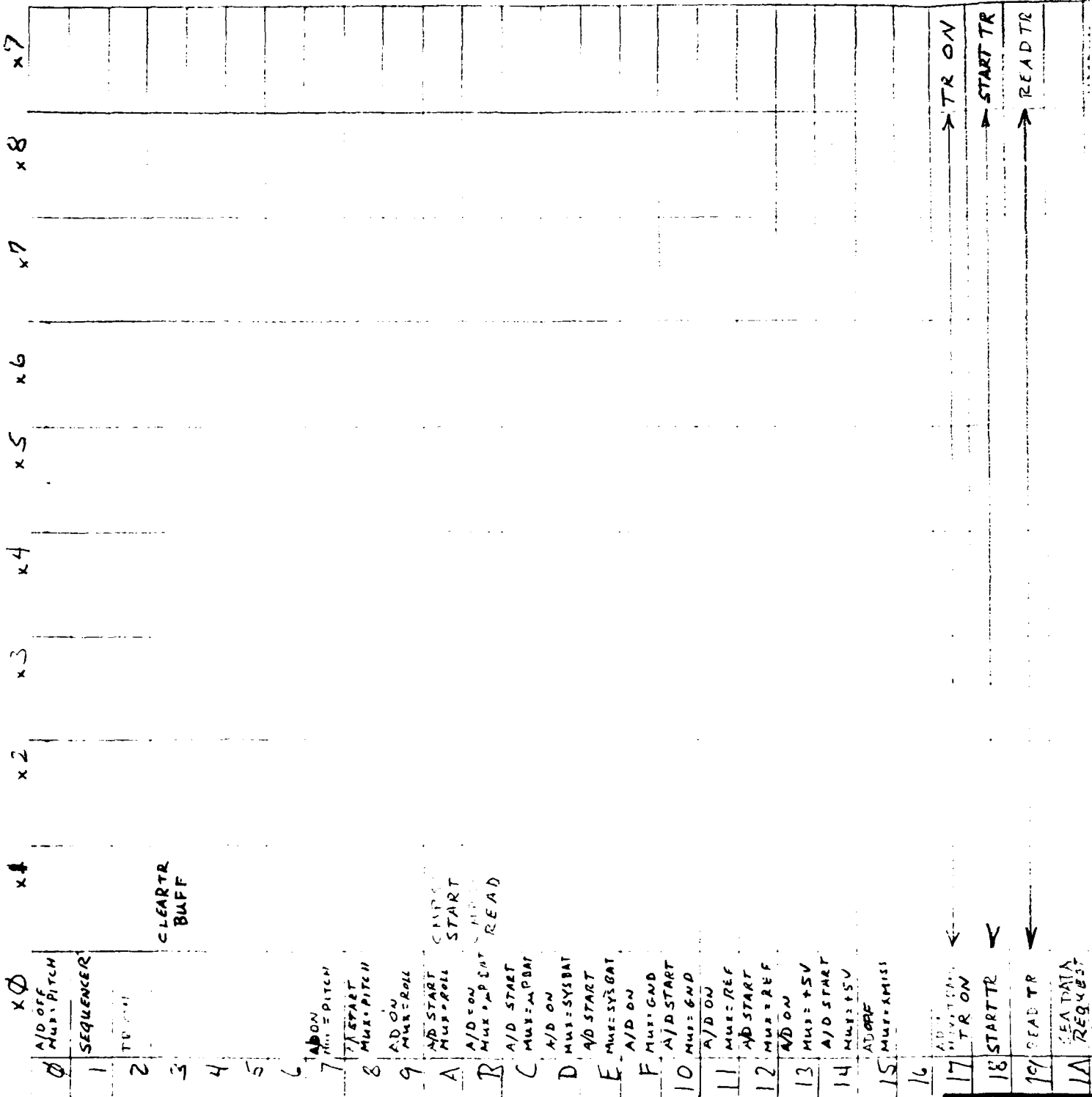
C

B

A

Second

Clock Cycle (40 Hz)



WOODS HO

CONTRACT NO.

BY WET

2

1

REVISIONS

ZONE	LTR	DESCRIPTION	DATE	APPROVED
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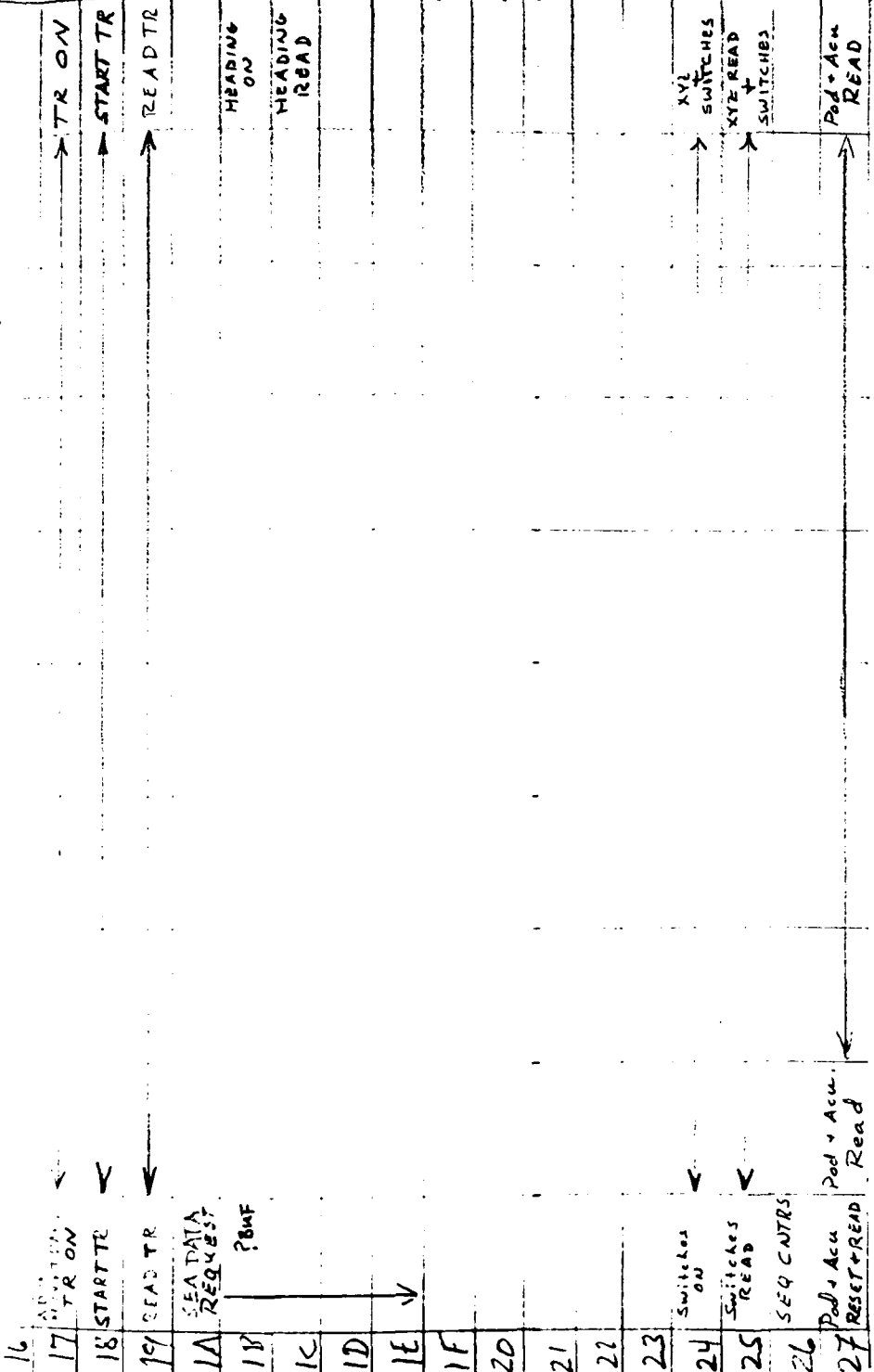
Note
 This chart is a general reference. It does not represent everything done by the CPU.

D

C

B

A



REV 24 Nov. 86

WOODS HOLE OCEANOGRAPHIC INSTITUTION
 ENGINEERING DEPT.
 WOODS HOLE, MA. 02543

CONTRACT NO. 10/82.69 CODE NO.

BY WET DATE 9/9/84 SIZE B

TITLE
Software Timing

SEA DUCT

DWG. NO. SD-B-007 OF REV.

2

1

FUNCTION CNV →

→ PIN # CNV

PIN #	FUNCTION CNV →				→ PIN # CNV			
	50 PIN CPU	34 PIN I/O BUS	26 PIN SERIAL		50 PIN CPU	34 PIN I/O BUS	26 PIN SERIAL	
1	110 4	110 4°	EF 2		45	33	8	BP (L)
2	110 7	110 7°	EF 3		43	31	10	1 "
3	110 3	110 3°	EF 1		41	29	12	2 "
4	110 6	110 6°	EF 4		39	27	14	3 "
5	110 2	110 2°	GND		37	25	16	4 "
6	110 5	110 5°	NC		35	23	18	5 "
7	GND	GND	GS2°		33	21	20	6 "
8	GND	GND	BP L		31	19	22	BP (L)
9	5V	5V	110 3°		24	NC	NC	NØ
10	5V	5V	B1 L		22	NC	NC	N1
11	EF 4	EF 4	NC		20	NC	NC	N2
12	NC KEY	GS 3°	B2 L		18	18	3	EF 1
13	MWR	GS 2°	SC Ø		16	16	1	EF 2
14	EF 3	EF 3	B3 L		14	14	2	EF 3
15	A7	GS 1°	TPB°		11	11	4	EF 4
16	EF 2	EF 2	B4 L		40	NC	NC	0
17	A6	GS Ø°	DMA OUT		49	34	NC	TPA
18	EF 1	EF 1	B5 L		47	32	15	TPB (O)
19	A5	B7°	MRS°		38	NC	13	SC Ø
20	N2	NC KEY	B6 L		36	NC	21	SC 1
21	A4	B6°	SC 1		48	NC	17	DMA OUT
22	N1	CLP	B7 L		50	NC	NC	DMA IN
23	A3	B5°	GND		42	30	19	MRS (O)
24	NØ	NC KEY	V ₁ MWR		13	NC	NC	MWR
25	A2	B4°	5V		44	NC	NC	TNT
26	GS 2	NC	V ₁ 10 NC		NC	NC	NC	CLK
27	A1	B3°			29	NC	NC	AØ
28	GS 1	NC			27	NC	NC	A1
29	AØ	B2°			25	NC	NC	A2
30	GS Ø	MRS°			23	NC	NC	A3
31	B7	B1°			21	NC	NC	A4
32	WAIT	TPB°			19	NC	NC	A5

27	NC	NC	NC	NC
25	NC	NC	NC	NC
23	NC	NC	NC	NC
21	NC	NC	NC	NC
19	NC	NC	NC	NC
17	NC	NC	NC	NC
15	NC	NC	NC	NC
7, 10	7, 10	7, 10	7, 10	25
7, 8	7, 8	7, 8	7, 8	23
NC	NC	NC	NC	26
7, 8	NC	NC	NC	24
34	22	NC	NC	NC
32	NC	NC	NC	NC
30	17	NC	NC	NC
28	15	NC	NC	NC
26	13	7	NC	7
46	12	NC	NC	NC
5	5	NC	NC	NC
3	3	9	NC	9
1	1	NC	NC	NC
6	6	NC	NC	NC
11	4	NC	NC	NC
2	2	NC	NC	NC
NONE	26, 28	6, 11	NC	6, 11
12	20, 24	NONE	NC	NONE
41	NC	KEY	NC	NC
A2	NC		NC	NC
A3	NC		NC	NC
A4	NC		NC	NC
A5	NC		NC	NC
A6	NC		NC	NC
A7	NC		NC	NC
K50 (5v)	7, 10		NC	25
K55 (GMS)	7, 8		NC	23
K17	NC		NC	26
K11 -	7, 8		NC	24
CLR	34		NC	NC
WAIT	32		NC	NC
G50	30		NC	NC
G51	28		NC	NC
G52	26		7	7
G53	46		NC	NC
110 2	5		NC	NC
110 3	3		9	9
110 4	1		NC	NC
110 5	6		NC	NC
110 6	11		NC	NC
110 7	2		NC	NC
NC	NONE		NC	6, 11
NC	12		NC	NONE

26	G51	NC	NC	NC
24	40	B2°	NC	NC
30	G50	AIRS°	NC	NC
31	B7	B1°	NC	NC
32	WAIT	TPB°	NC	NC
33	B6	B0°	NC	NC
34	CLR	TRM	NC	NC
35	B5		NC	NC
36	SC		NC	NC
37	B4		NC	NC
38	SC		NC	NC
39	B3		NC	NC
40	Q		NC	NC
41	B2		NC	NC
42	MRD		NC	NC
43	B1		7	7
44	TNT		NC	NC
45	B0		NC	NC
46	G53		9	9
47	TPB		NC	NC
48	DMA OUT		NC	NC
49	TPA		NC	NC
50	DMA IN		NC	NC

WOODS HOLE OCEANOGRAPHIC INSTITUTION
WOODS HOLE, MASS. 02543

PROJ. 10/82.69 BY ARD

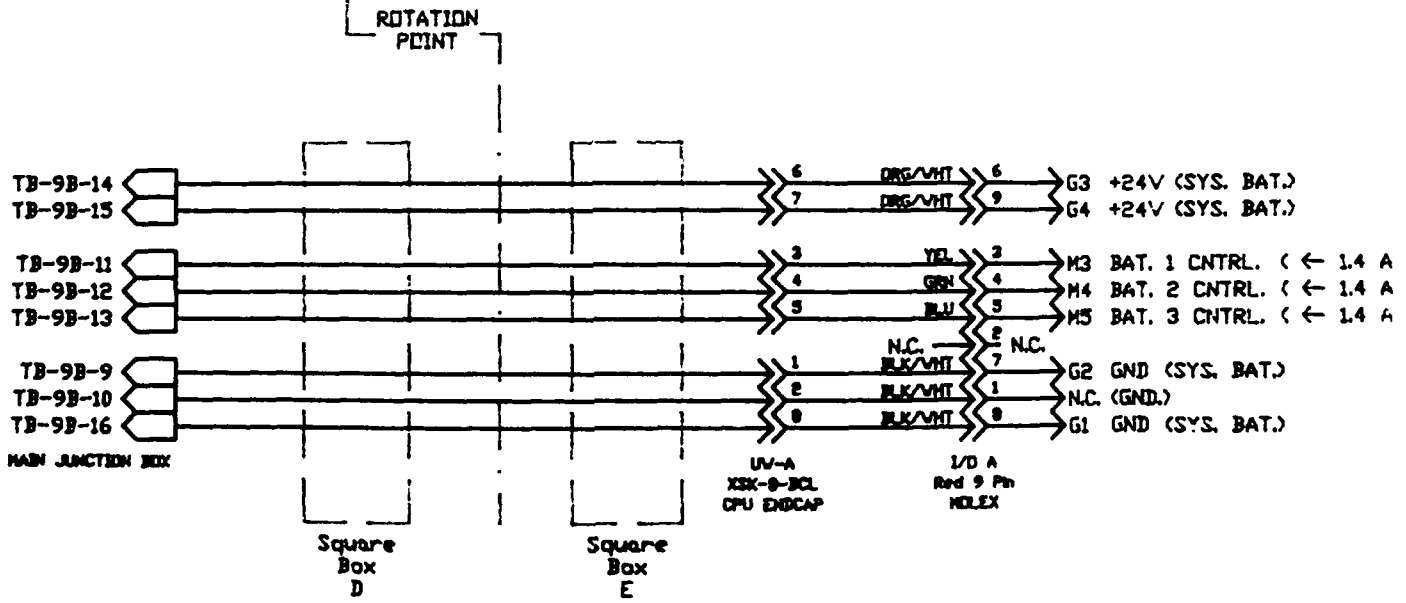
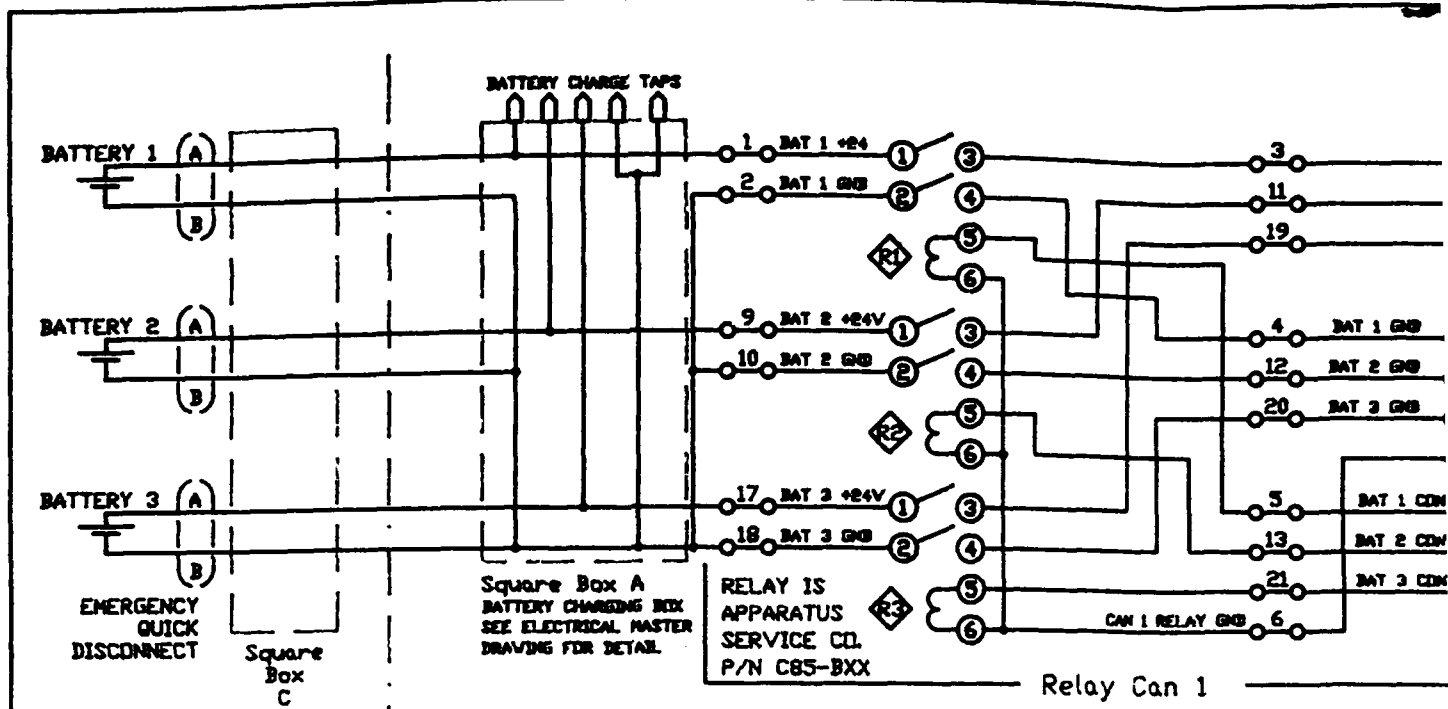
SHEET 1 OF 1 DATE 4 NOV 83

TITLE

Computer Ribbon Conn.

Pin/Funct. Cross Ref. SEA DUCT

SD-P-002

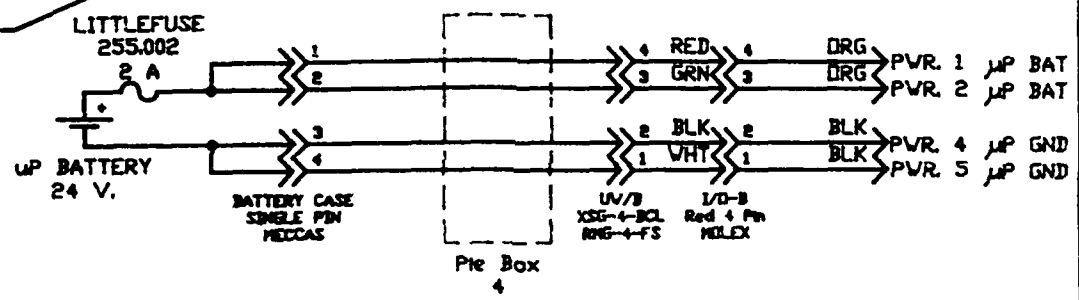
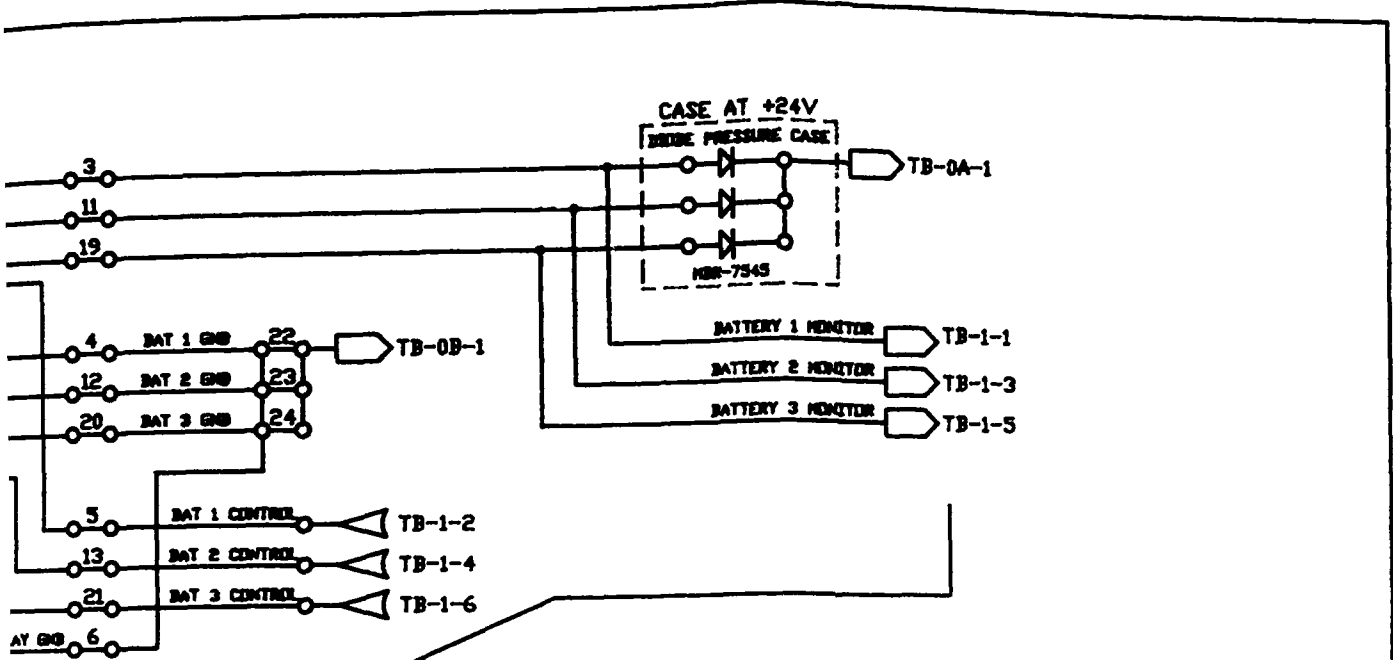


- 18-4, 18-8
Color Code
- VHT = 1
 - BLK = 2
 - GRN = 3
 - RED = 4
 - DRG = 5
 - BLU = 6
 - VHT/BLK = 7
 - RED/BLK = 8

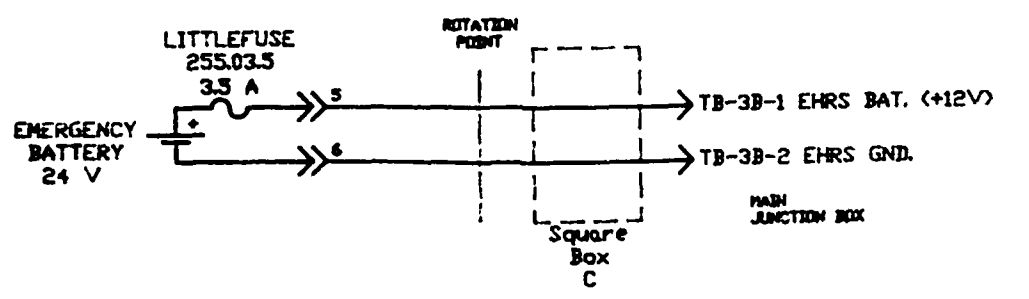
WOODS HOLE DC
APPLIED ENG
WOODS

CONTRACT NO. 10/82.69

BY V.E. TERRY

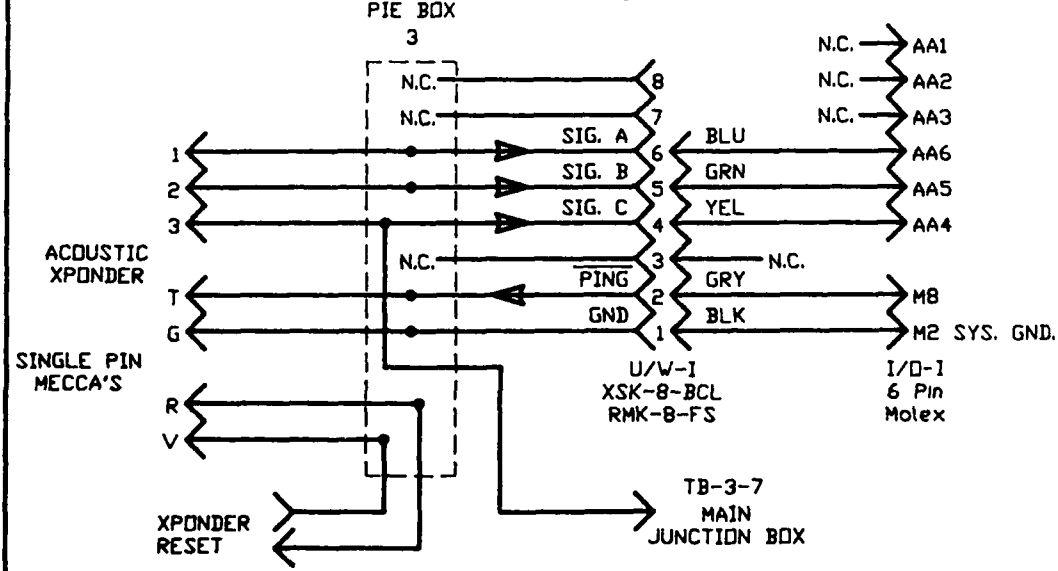
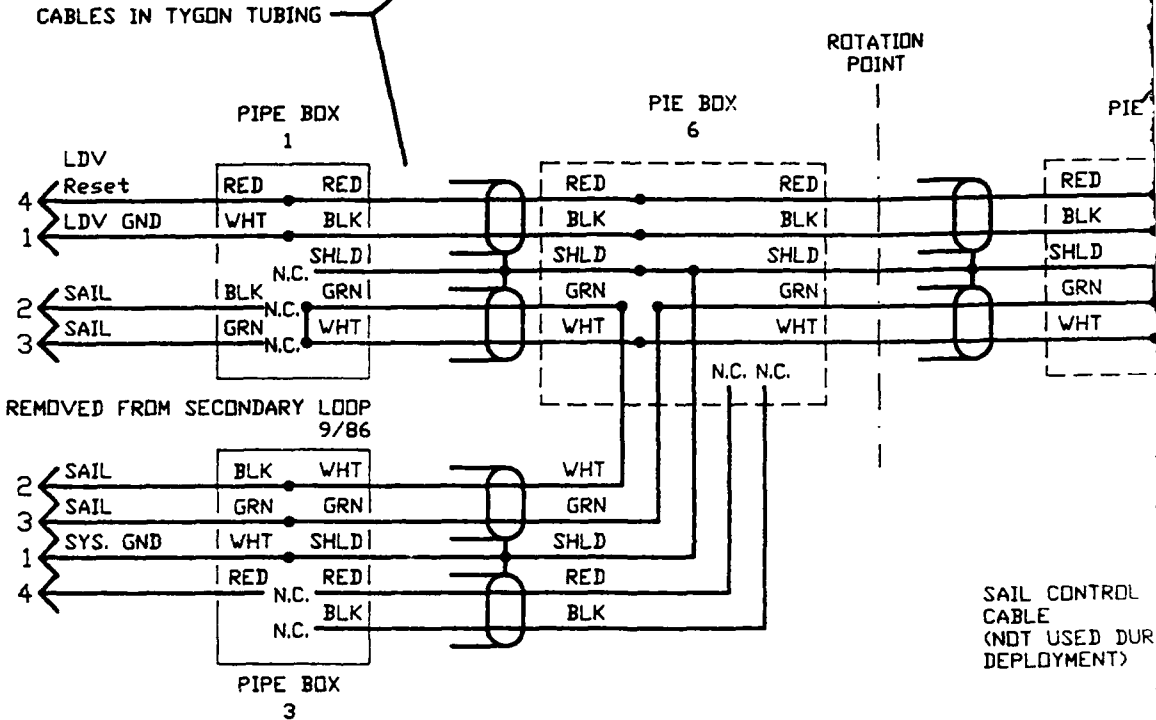
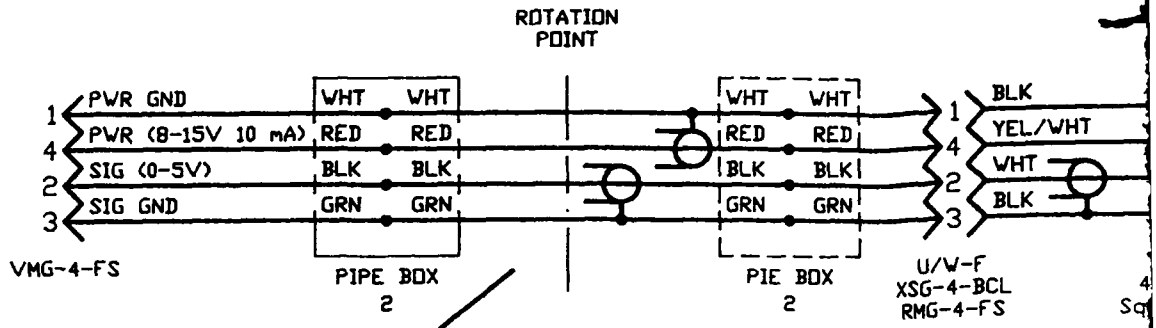
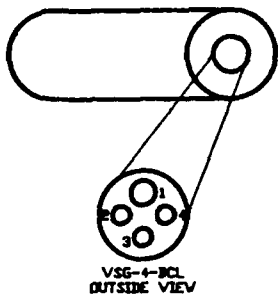


V (SYS. BAT.)
V (SYS. BAT.)
. 1 CNTRL. (← 1.4 A)
. 2 CNTRL. (← 1.4 A)
. 3 CNTRL. (← 1.4 A)
(SYS. BAT.)
D.)
(SYS. BAT.)



WOODS HOLE OCEANOGRAPHIC INSTITUTION APPLIED ENGINEERING LABORATORY WOODS HOLE, MA. 02543			TITLE UP BATTERY, SYSTEM BATTERY AND, EMERGENCY BATTERY SYSTEMS			SEA DUCT
INTRACT NO. 10/82.69	CODE NO.		DATE 1 AUG. 84	SIZE B	DVG. NO. SD-009	DF
V.E. TERRY						REV. 24 MAR 87

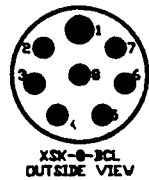
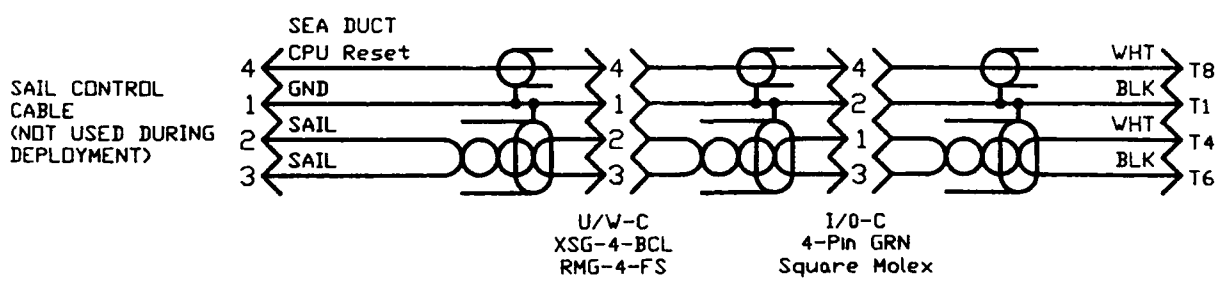
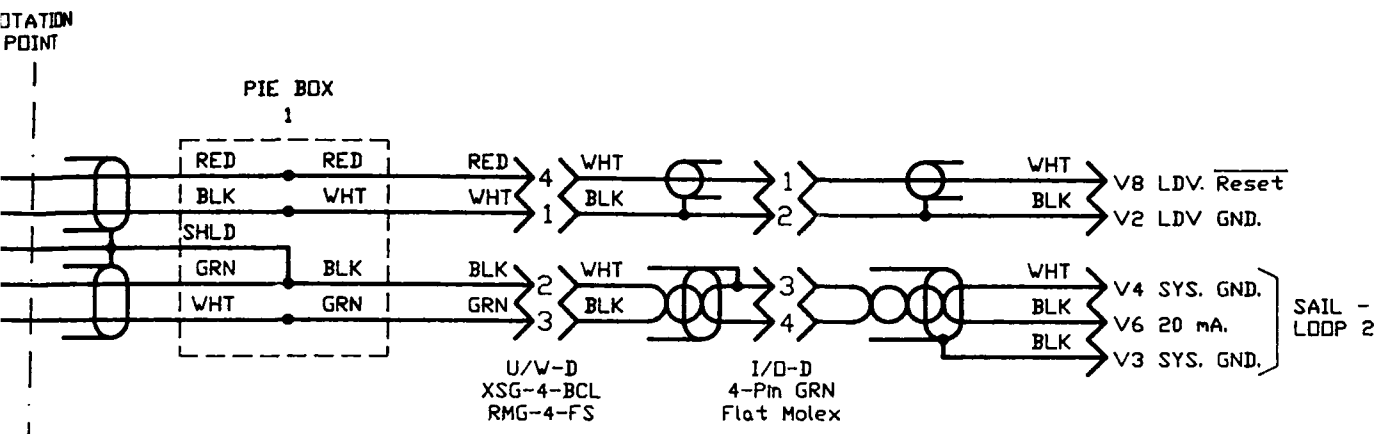
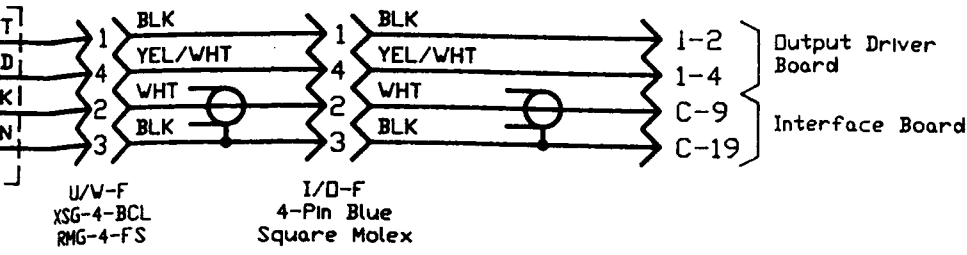
Sea Tech Transmissometer



WOODS HOLE OCEAN APPLIED ENGINEERING
WOODS HOLE OCEAN CENTER

CONTRACT NO. 10/85.69

BY W. E. TERRY



- 18-4, 18-8
Color Code
- WHT = 1
 - BLK = 2
 - GRN = 3
 - RED = 4
 - DRG = 5
 - BLU = 6
 - WHT/BLK = 7
 - RED/BLK = 8

WOODS HOLE OCEANOGRAPHIC INSTITUTION
APPLIED ENGINEERING LABORATORY
WOODS HOLE, MA. 02543

CONTRACT NO. 10/85.69

V. E. TERRY

TITLE

SAIL, TRANSPONDER,
AND TRANSMISSOMETER

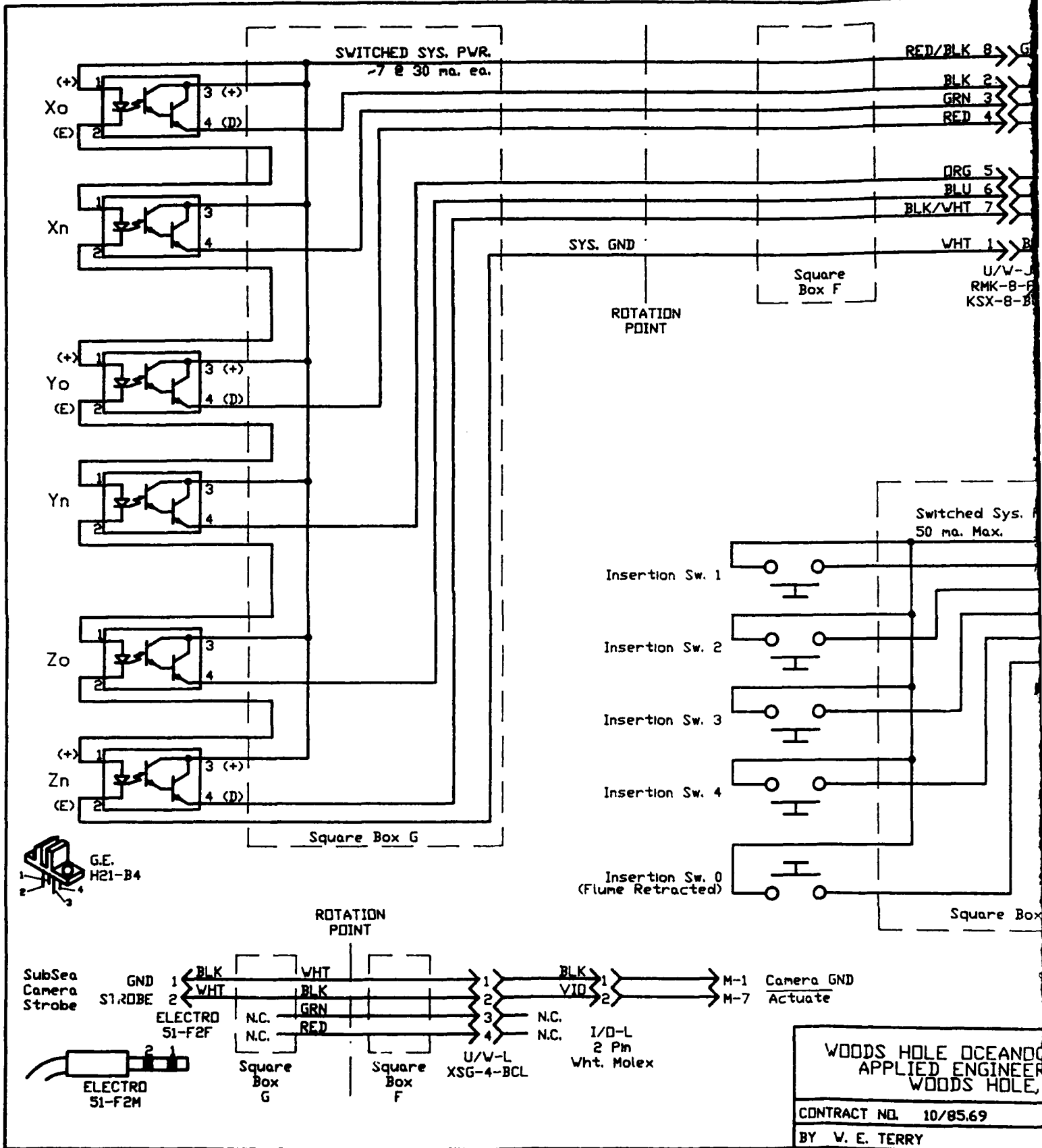
EXTERNAL CONNECTIONS SEA DUCT

DATE 26 JUL 85

SIZE B

DWG. NO. SD-B-010

REV. 02 DEC 86



RED/BLK 8 → G
 BLK 2 →
 GRN 3 →
 RED 4 →
 ORG 5 →
 BLU 6 →
 BLK/WHT 7 →
 WHT 1 → B
 U/V-L
 RMK-8-B
 KSX-8-B

SYS. GND

ROTATION POINT

Switched Sys. 50 ma. Max.

Square Box



G.E. H21-B4

ROTATION POINT

SubSea Camera Strobe

GND 1
 ST.ROBE 2
 ELECTRO 51-F2F

BLK
 WHT
 N.C.
 N.C.
 Square Box G

WHT
 BLK
 GRN
 RED
 Square Box F

1
 2
 3
 4
 U/V-L XSG-4-BCL

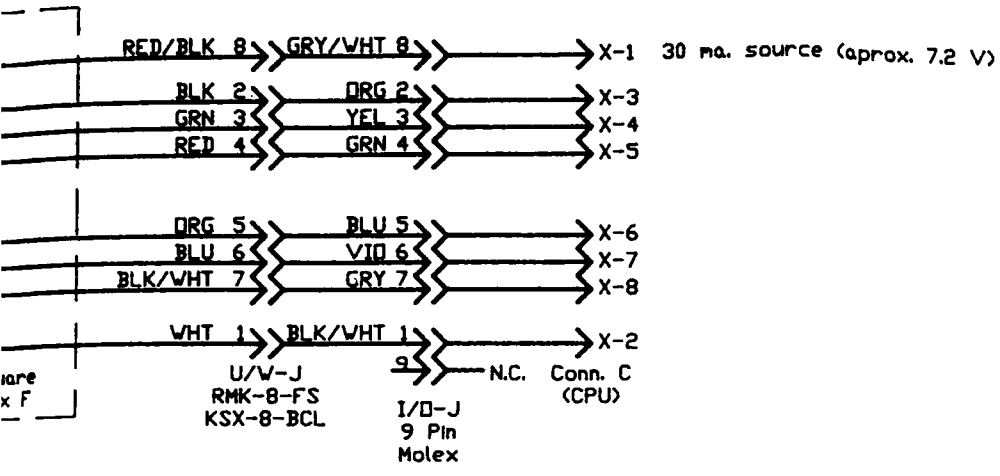
BLK
 VID
 N.C.
 N.C.
 I/O-L
 2 Pm
 Wht. Molex

M-1 Camera GND
 M-7 Actuate

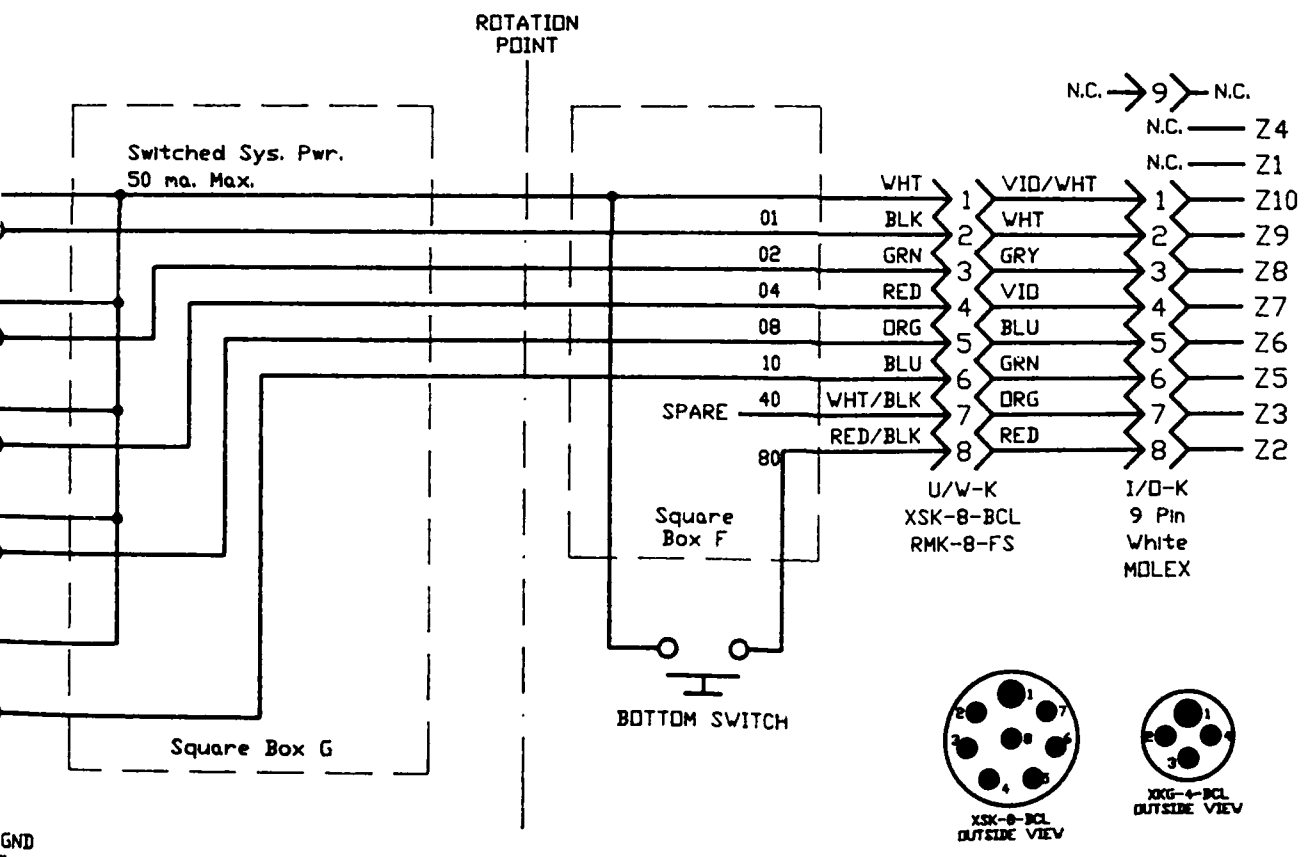
WOODS HOLE OCEANOGRAPHIC APPLIED ENGINEER WOODS HOLE, MA

CONTRACT NO. 10/85.69

BY W. E. TERRY



- 18-4, 18-8
Color Code
- WHT = 1
 - BLK = 2
 - GRN = 3
 - RED = 4
 - DRG = 5
 - BLU = 6
 - WHT/BLK = 7
 - RED/BLK = 8



WOODS HOLE OCEANOGRAPHIC INSTITUTION
 APPLIED ENGINEERING LABORATORY
 WOODS HOLE, MA. 02543

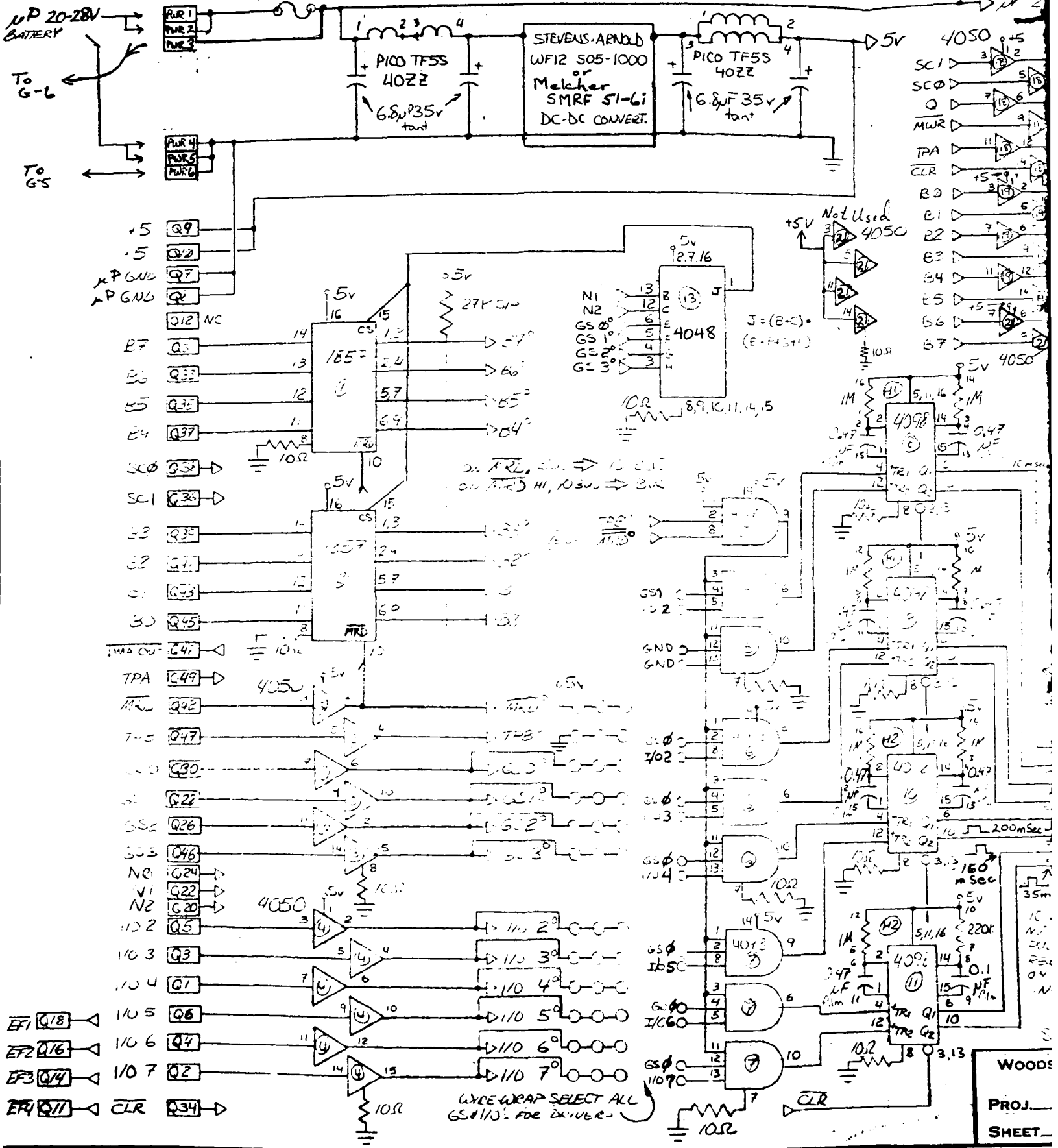
TITLE OPTO INTERRUPTERS, CAMERA
 SENSE SWITCHES

 EXTERNAL WIRING SEA DUCT

TRACT NO. 10/85.69	CODE NO.	DATE 1 NOV. 83	SIZE B	DWG. NO. SD-B011	DF	REV. 23 APR 86
V. E. TERRY						

3AG or equiv.
1 A. Fast blow

6.8V ZENER 1W 5%
10%



10P 20-28V
BATTERY

To G-L

To G-S

+5 Q9

.5 Q10

AP GND Q11

AP GND Q12

Q12 NC

B7 Q13

B6 Q14

B5 Q15

B4 Q16

SC0 Q17

SC1 Q18

B3 Q19

B2 Q20

B1 Q21

B0 Q22

TPA Q23

CLR Q24

TPA Q25

CLR Q26

TPA Q27

CLR Q28

TPA Q29

CLR Q30

TPA Q31

CLR Q32

TPA Q33

CLR Q34

TPA Q35

CLR Q36

TPA Q37

CLR Q38

TPA Q39

CLR Q40

TPA Q41

CLR Q42

TPA Q43

CLR Q44

TPA Q45

CLR Q46

TPA Q47

CLR Q48

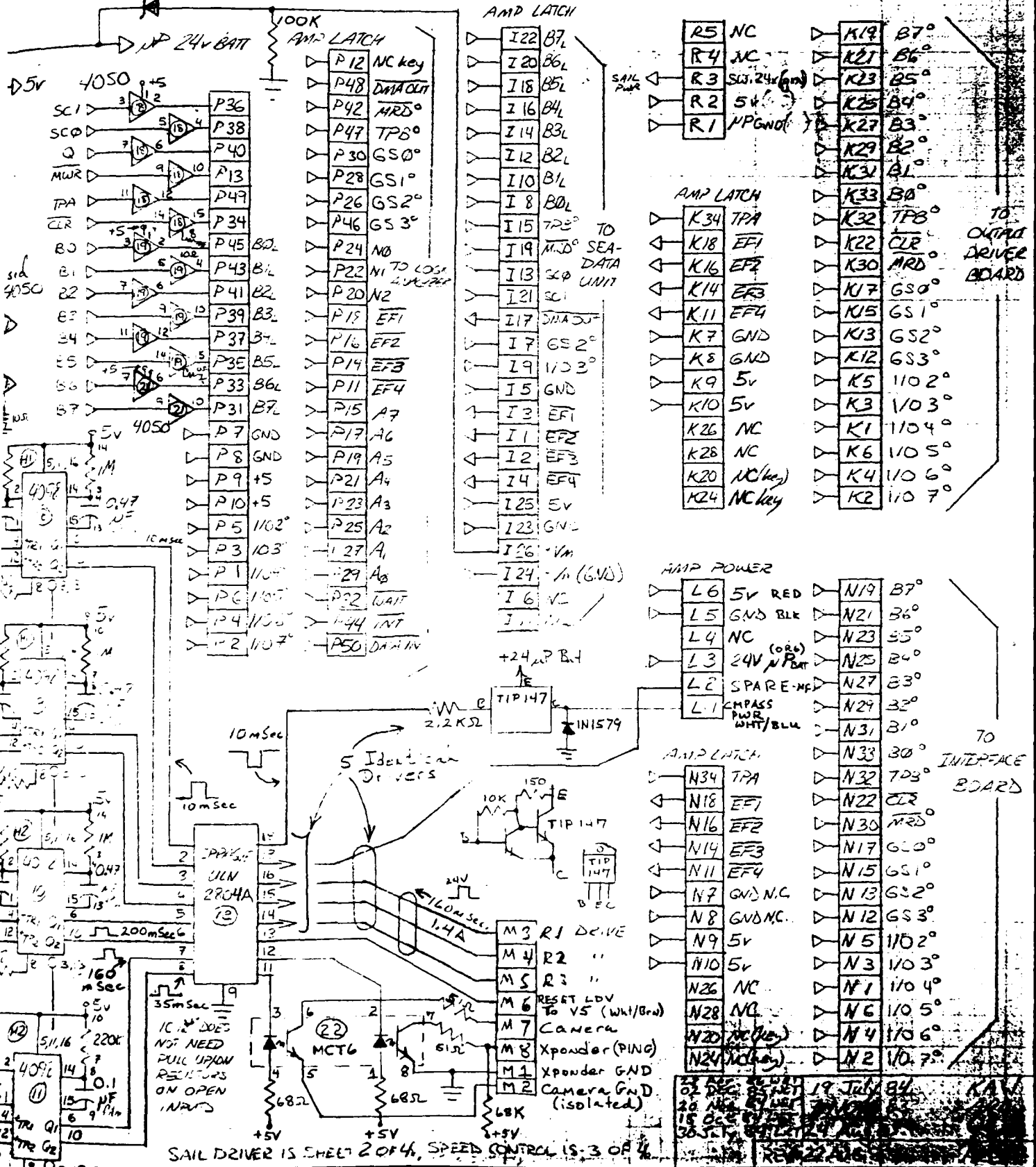
TPA Q49

CLR Q50

WIRE WRAP SELECT ALL
GS#10'S FOR DRIVER

WOODS
PROJ.
SHEET

6.8V ZENER IN 3999A 10 Watt
10%

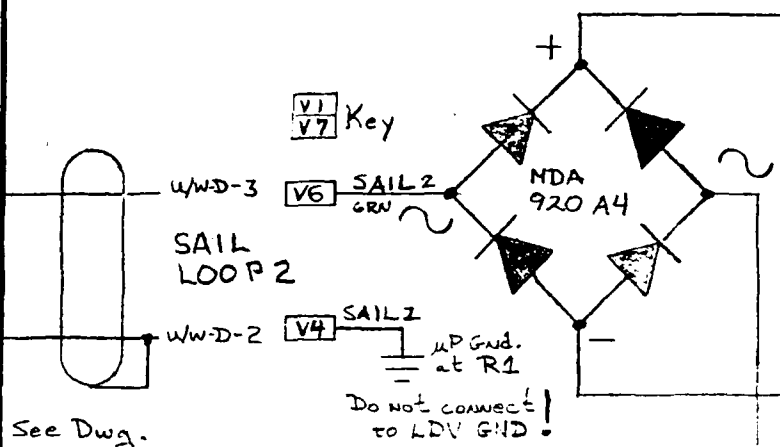


WOODS HOLE OCEANOGRAPHIC INSTITUTION
WOODS HOLE, MASS. 02543
PROJ. 10L82369. BY ARD
SHEET 1 OF 4 DATE 2/1/85

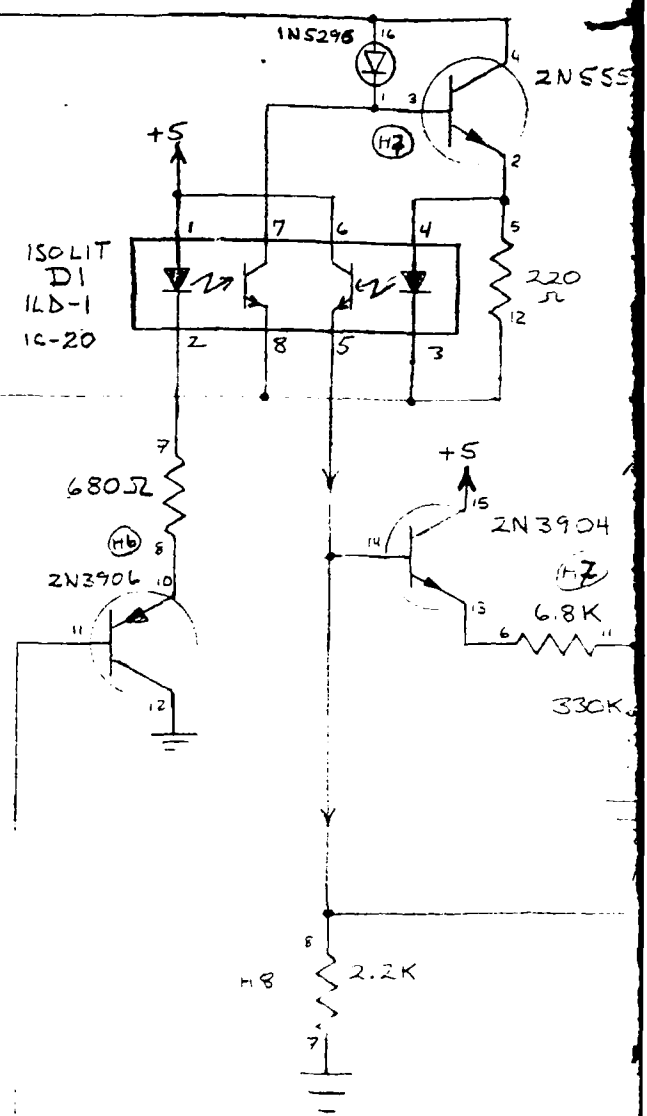
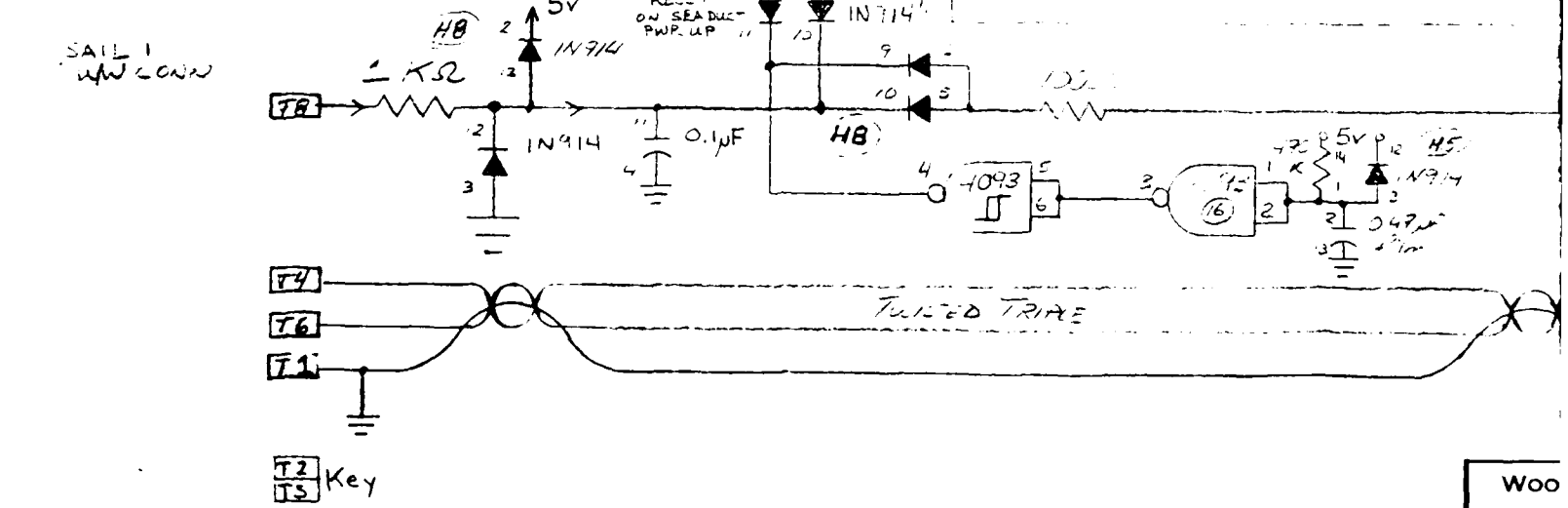
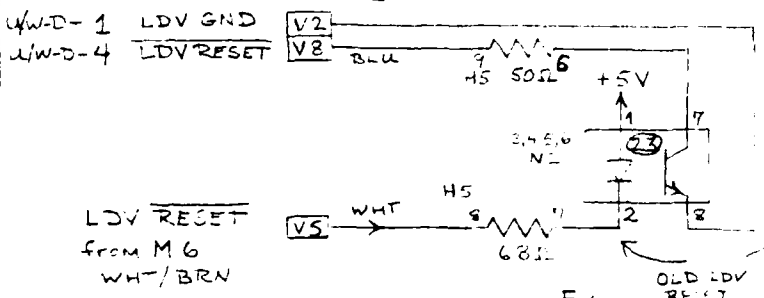
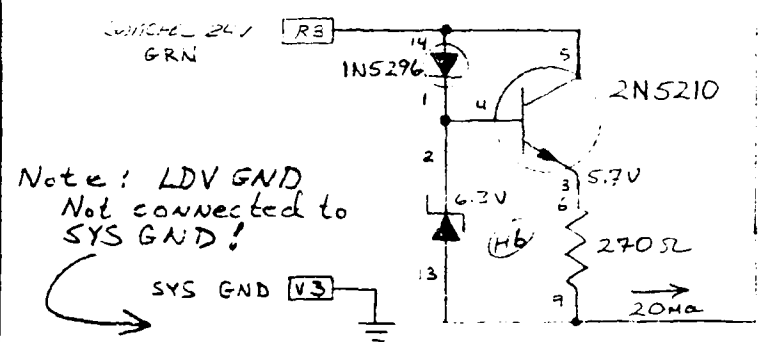
TITLE: Buffer Board
REV 22/85

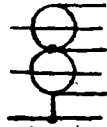
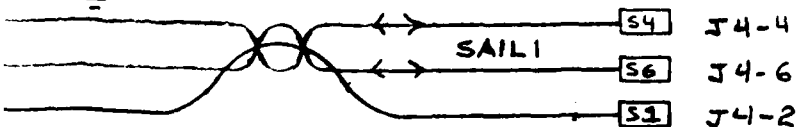
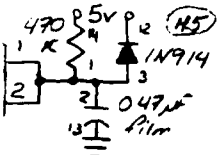
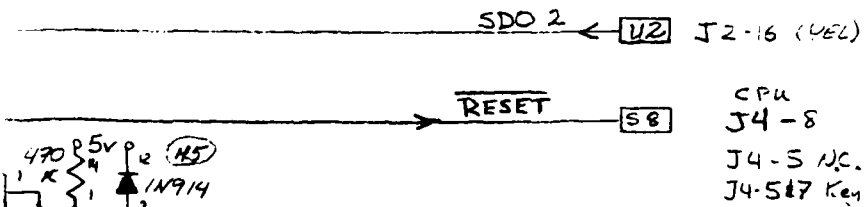
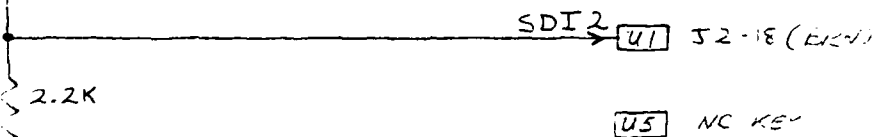
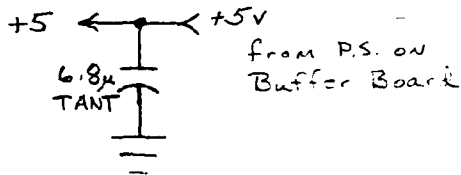
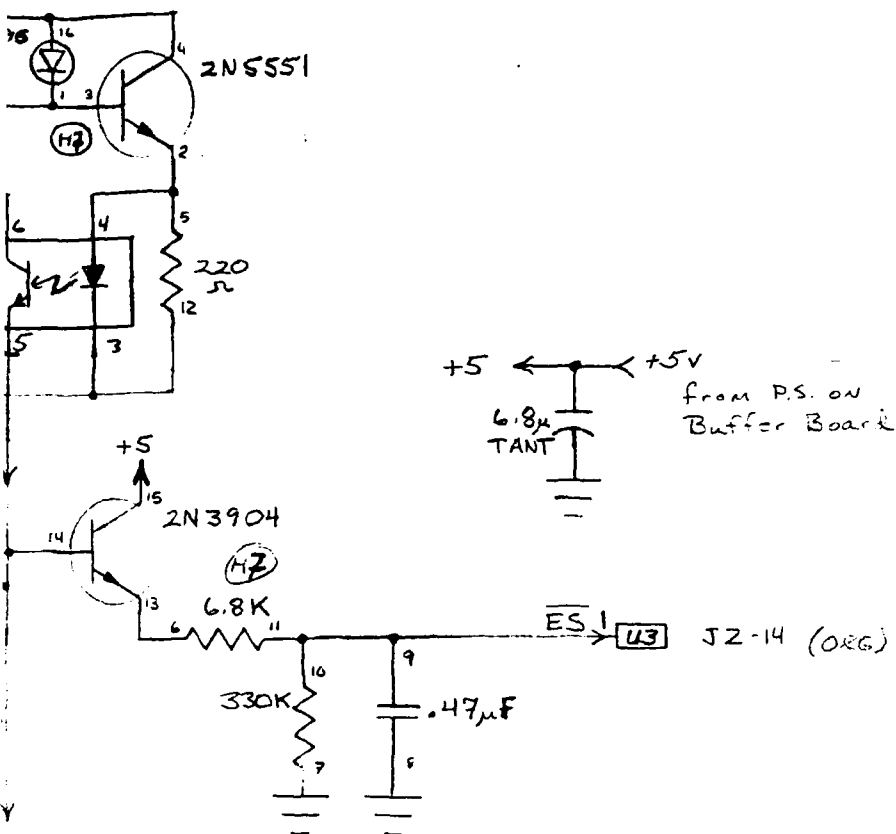
53 Sec
20 M
18 Dec
30 JET

19 July 84
KAV



See Dwg. SD-B010





20 Nov 84	WET	
15 Oct 84	WET	
31 Jul 84	RAW	
30 Sept 83	WAT	

WOODS HOLE OCEANOGRAPHIC INSTITUTION
WOODS HOLE, MASS. 02543

PROJ. 10/82.69 BY WEF

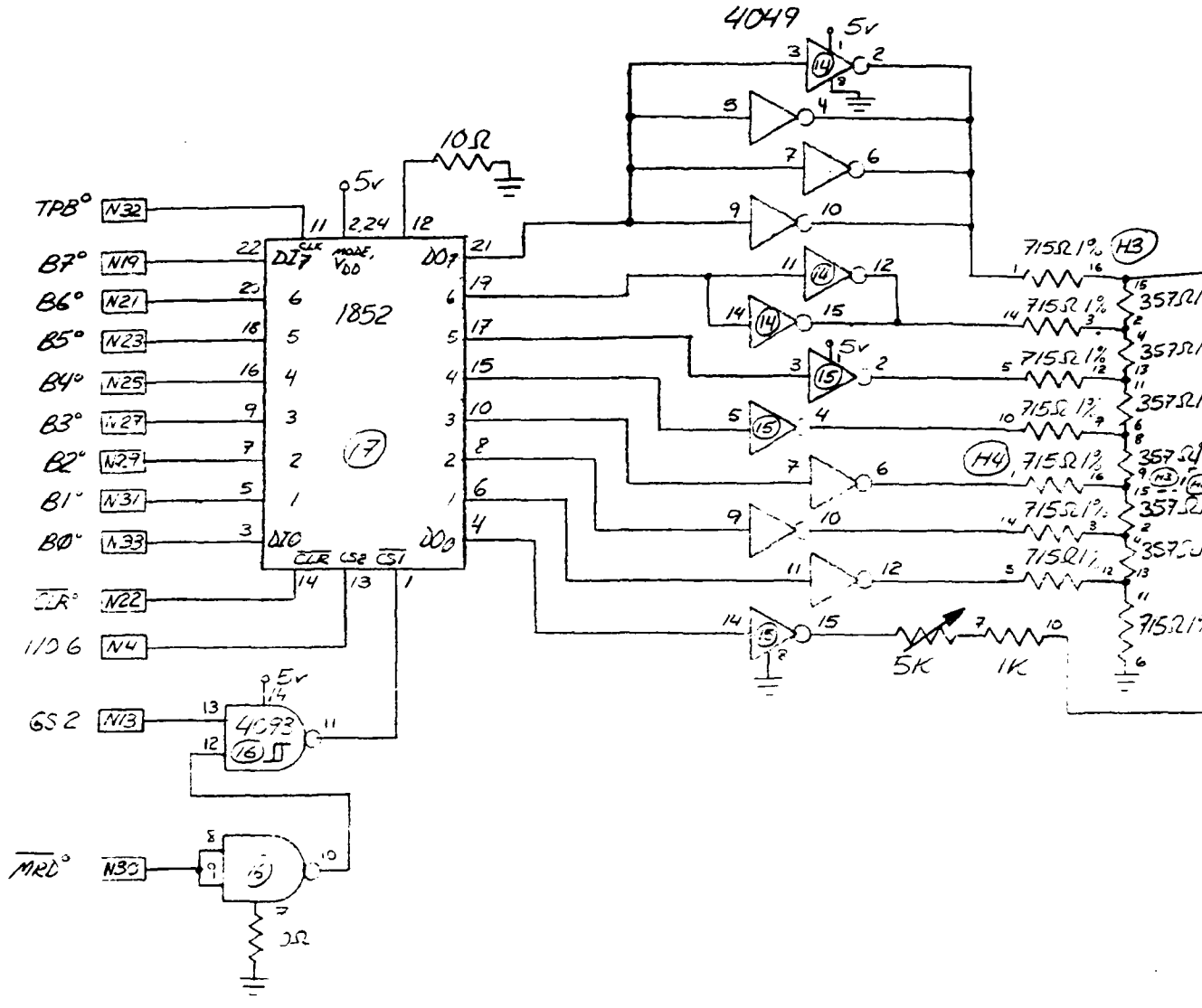
SHEET 2 OF 4 DATE 11 Apr 83

TITLE Buffer Board - SAIL

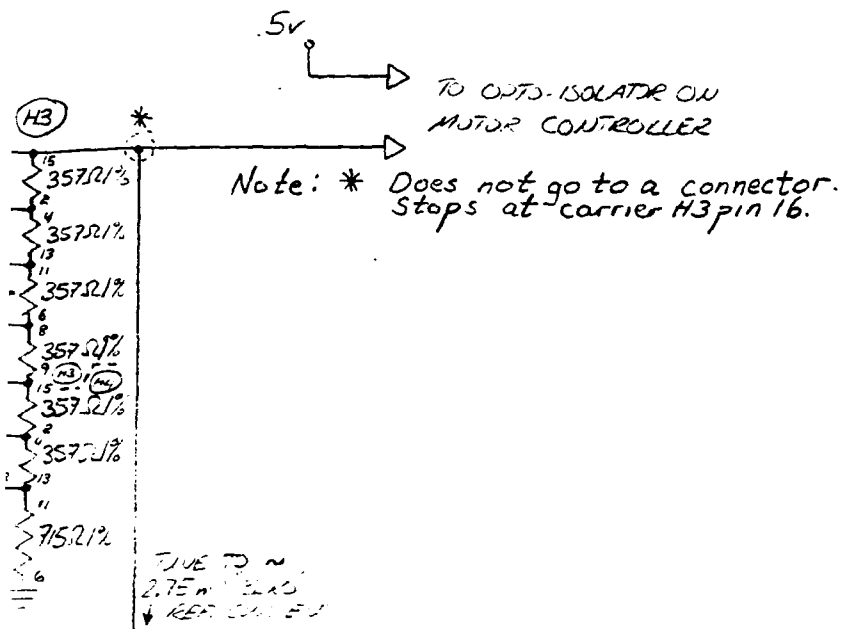
REV. 12 JUN 80 WET

REV. 12 DEC 81 WET

SD-B013



2.75 ma = ϕ Motor Speed
 ? Ma = F.S. Motor Speed (trim on motor control)

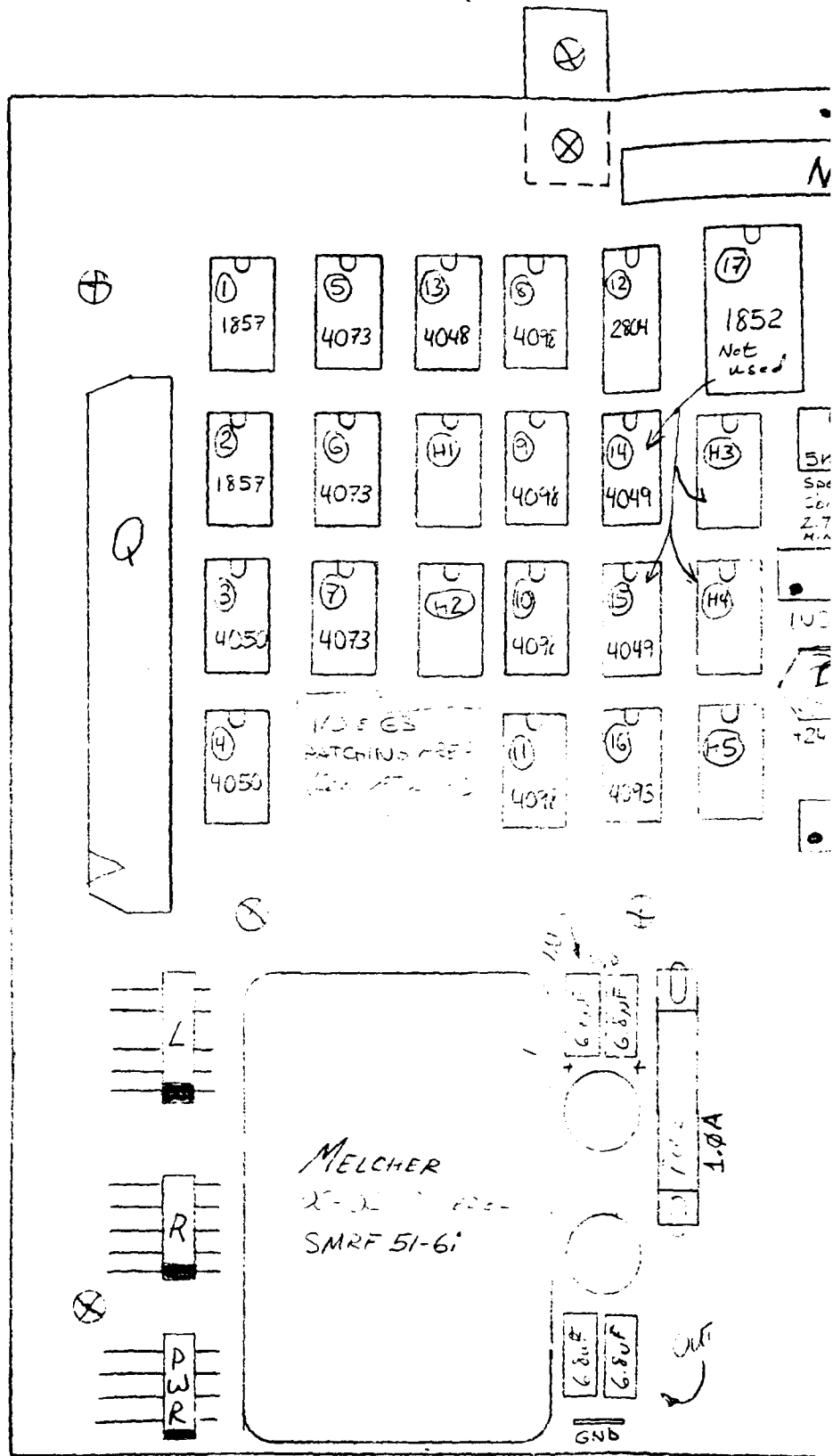


Note: Circuit no longer used, but wiring still in place!
 IC's 14, 15, 17 and parts carriers H3, H4 have been removed.
 Speed control PWR via Output Driver Board
 Speed control in separate SAIL controlled housing.

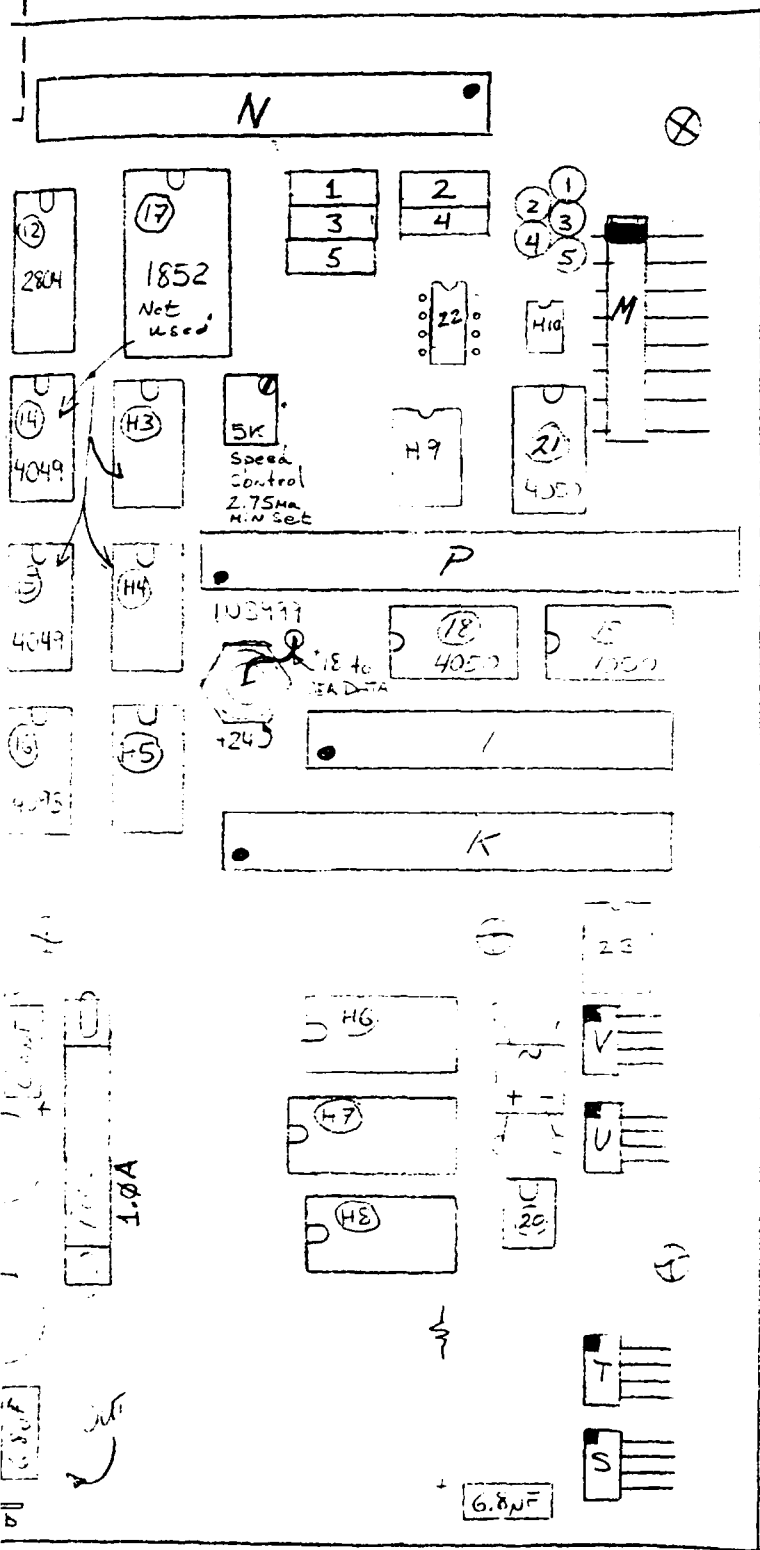
24 Nov 86 NET
 REV 1 Mar 85 GAT
 REV 12 Jul 84 KAV
 REV 23 Aug 83

WOODS HOLE OCEANOGRAPHIC INSTITUTION WOODS HOLE, MASS. 02543		TITLE
PROJ. 10187.67	BY APD	Buffer Board -
SHEET 3 OF 4	DATE 4 Aug 83	Circ. Pump Control

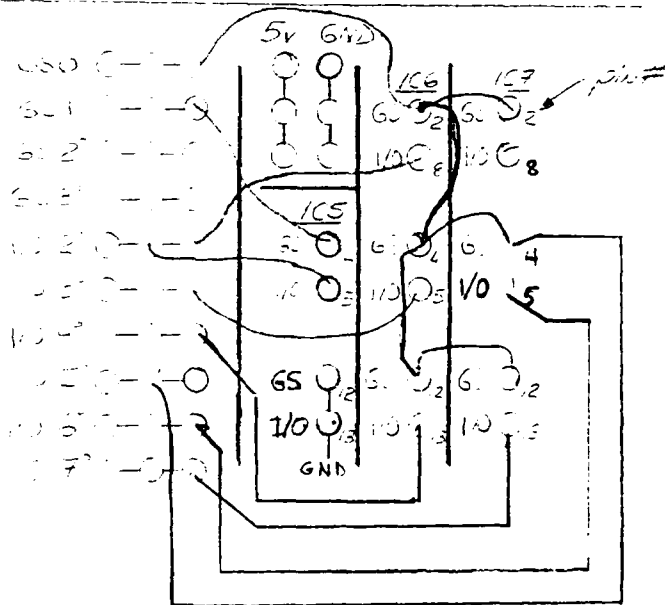
SEA DUCT



W
PR
SH



1/28 52 PARTS AREA



24 Nov 86 WET
 02 DEC 85 WET
 15 Oct 84 WET
 30 July WET
 Rev 19 July WET

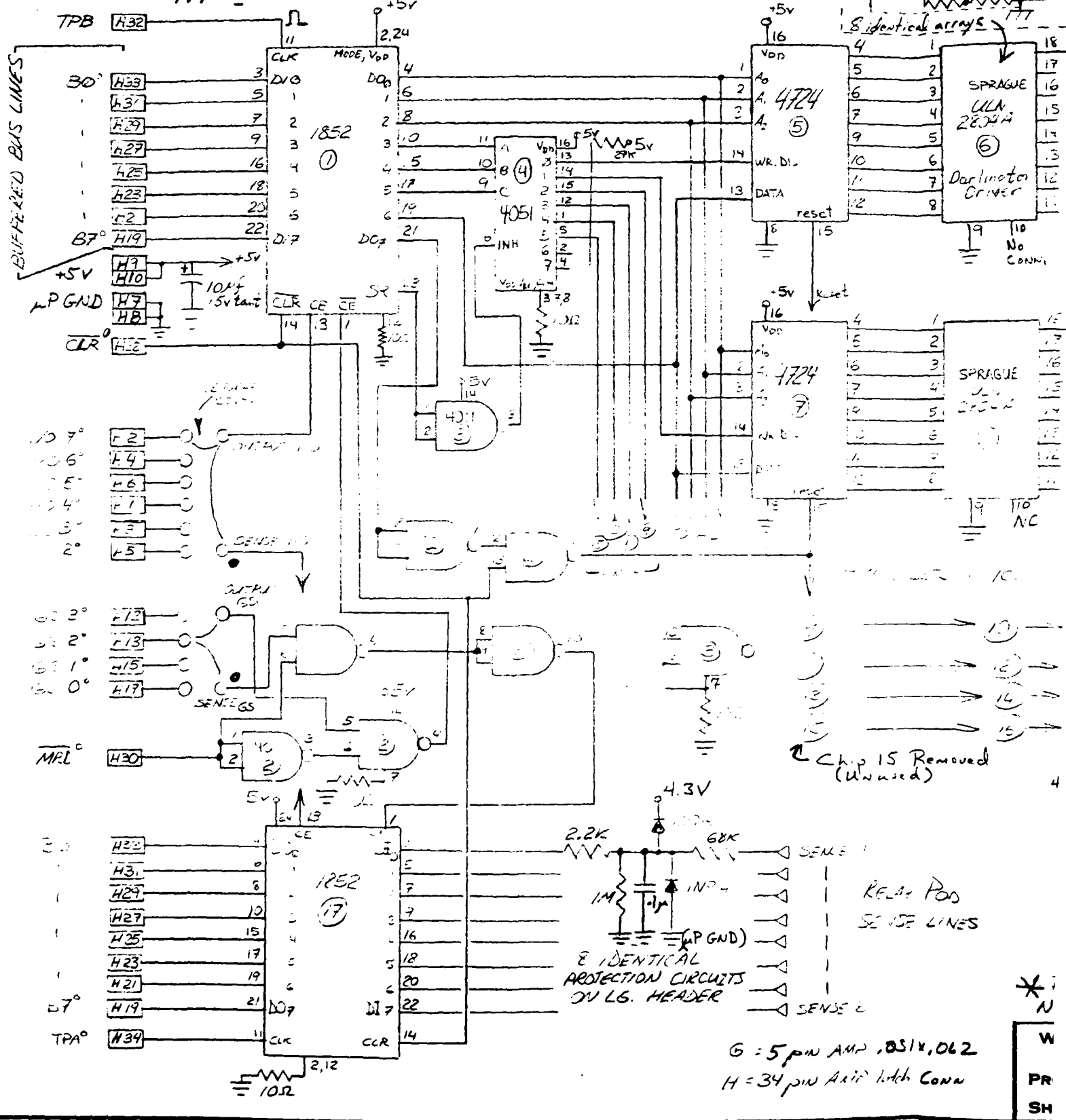
WOODS HOLE OCEANOGRAPHIC INSTITUTION
 WOODS HOLE, MASS. 02543
 PROJ. 10/82.69 BY ARD
 SHEET 4 OF 4 DATE 26 Sep 83

TITLE
Buffer Board - Parts Layout
SEA DUCT
 SD-B015

Sys Bat (24V Nom)
 μP Bat
 μP GND
 SYS GND
 SYS GND

Emitters of TIP147s #0-5
 Only Connection of Sys + μP GND

22nF 35V
 5V

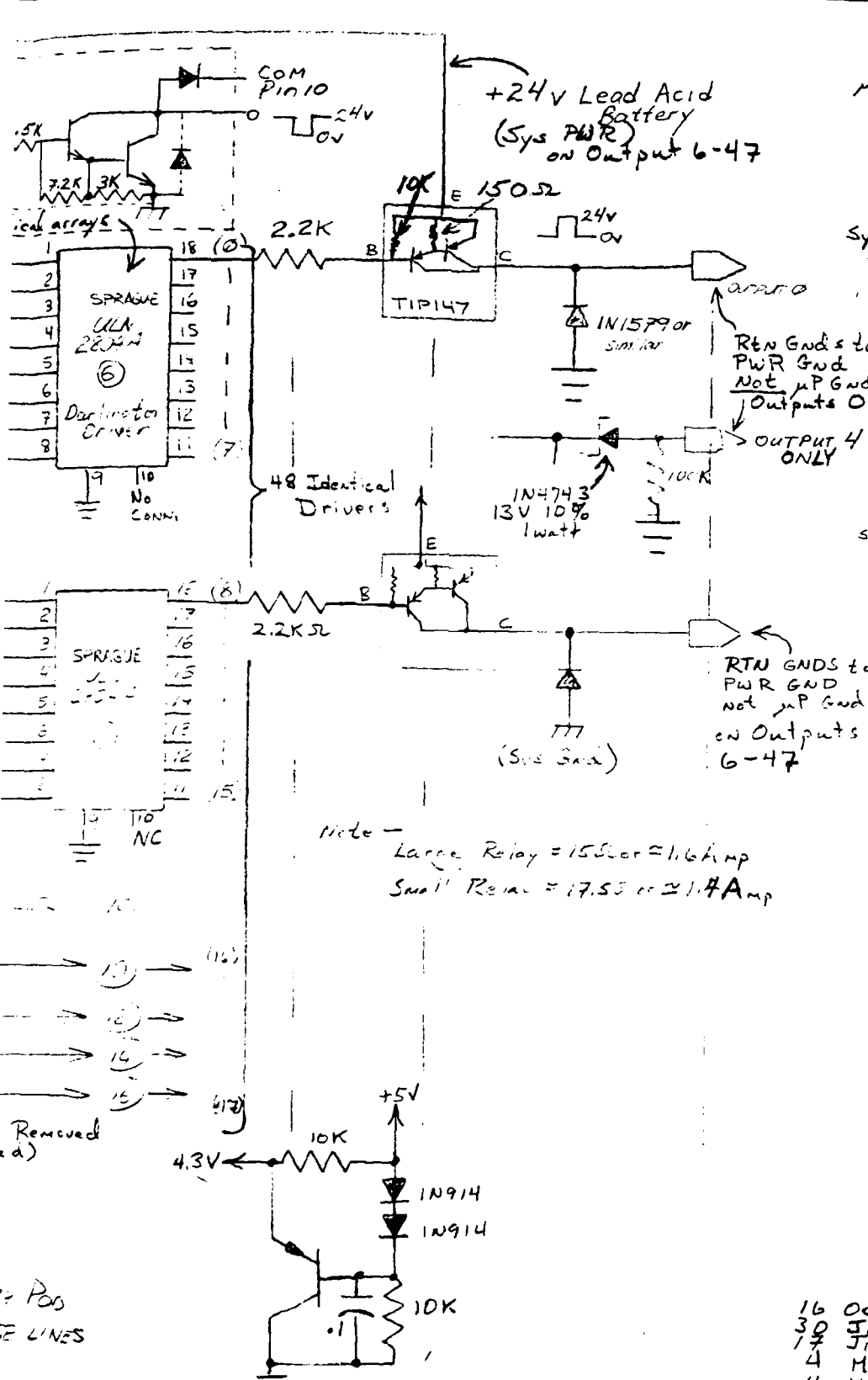


Chip 15 Removed (Unused)

4.3V
 2.2K 68K
 100μF
 8 IDENTICAL PROTECTION CIRCUITS ON LG. HEADER
 SENSE 1
 RELAY POS
 SENSE LINES
 SENSE 2

G = 5pin AMP .0514.062
 H = 34pin Axis Latch Conn

*
 N
 W
 PR
 SH



OUTPUT #	PIN #	CONNECTOR #
μP Bat 0	ADV SAIL / HDG	8 7
" 1	2	6 6
" 2	3	5 5
" 3	4 Trans	4 4
" 4	5	3 3
" 5	SUB	2 2
" 6	SENSE 1	1 1
Sys Bat 6		8 8
" 7		7 7
" 8		6 6
" 9		5 5
" 10		4 4
" 11		3 3
" 12	GND	2 2
" 13	SENSE 2	1 1
" 14	Opto	8 7
" 15	Bit	6 6
" 16		5 5
" 17		4 4
" 18	SUB	3 3
" 19	SENSE 3	2 2
Sys Bat 18 SENS		8 8
" 19 WITHDRAW		7 7
" 20 CW		6 6
" 21 CCW		5 5
" 22 Spare		4 4
" 23 Spare		3 3
" 24	SUB	2 2
" 25	SENSE 4	1 1
" 26	X+	8 7
" 27	X-	6 6
" 28	Y+	5 5
" 29	Y-	4 4
" 30	Z+	3 3
" 31	Z-	2 2
" 32	SUB	1 1
" 33	SENSE 5	
" 34	Hydr Pump 1	6 7
" 35	Pump 2	6 6
" 36		5 5
" 37		4 4
" 38		3 3
" 39		2 2
" 40		1 1
" 41	SUB	8 7
" 42	SENSE 7	6 6
" 43		5 5
" 44		4 4
" 45		3 3
" 46		2 2
" 47		1 1
" 48	SENSE 8	

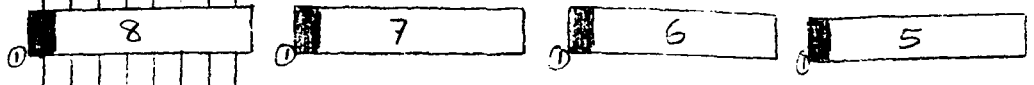
16 Oct 84 WET
 30 July 84 WET
 17 July 84 KAW
 4 May 84 WET
 4 NOV 83 ARD
 4 AUG 83 WET
 REV 24 NOV 86 WET
 REV 3 AUG 83 ARD

WOODS HOLE OCEANOGRAPHIC INSTITUTION
 WOODS HOLE, MASS. 02543
 PROJ. 10/82.67 BY ARD
 SHEET 1 OF 3 DATE 17 Feb 83

TITLE
OUTPUT DRIVER BOARD
SEA DUCT

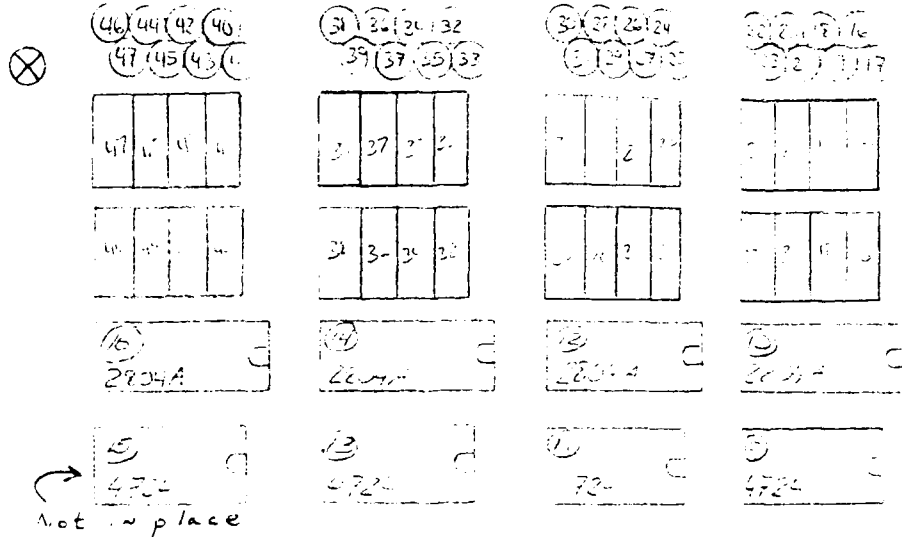
SD-8016

PIN 1 2 3 4 5 6 7 8 12, ...
 → etc

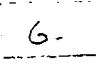
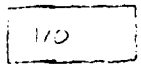
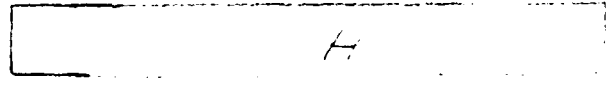
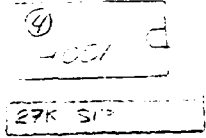
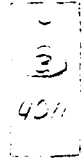
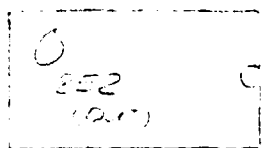


FREE-WHEELING
DOSES →

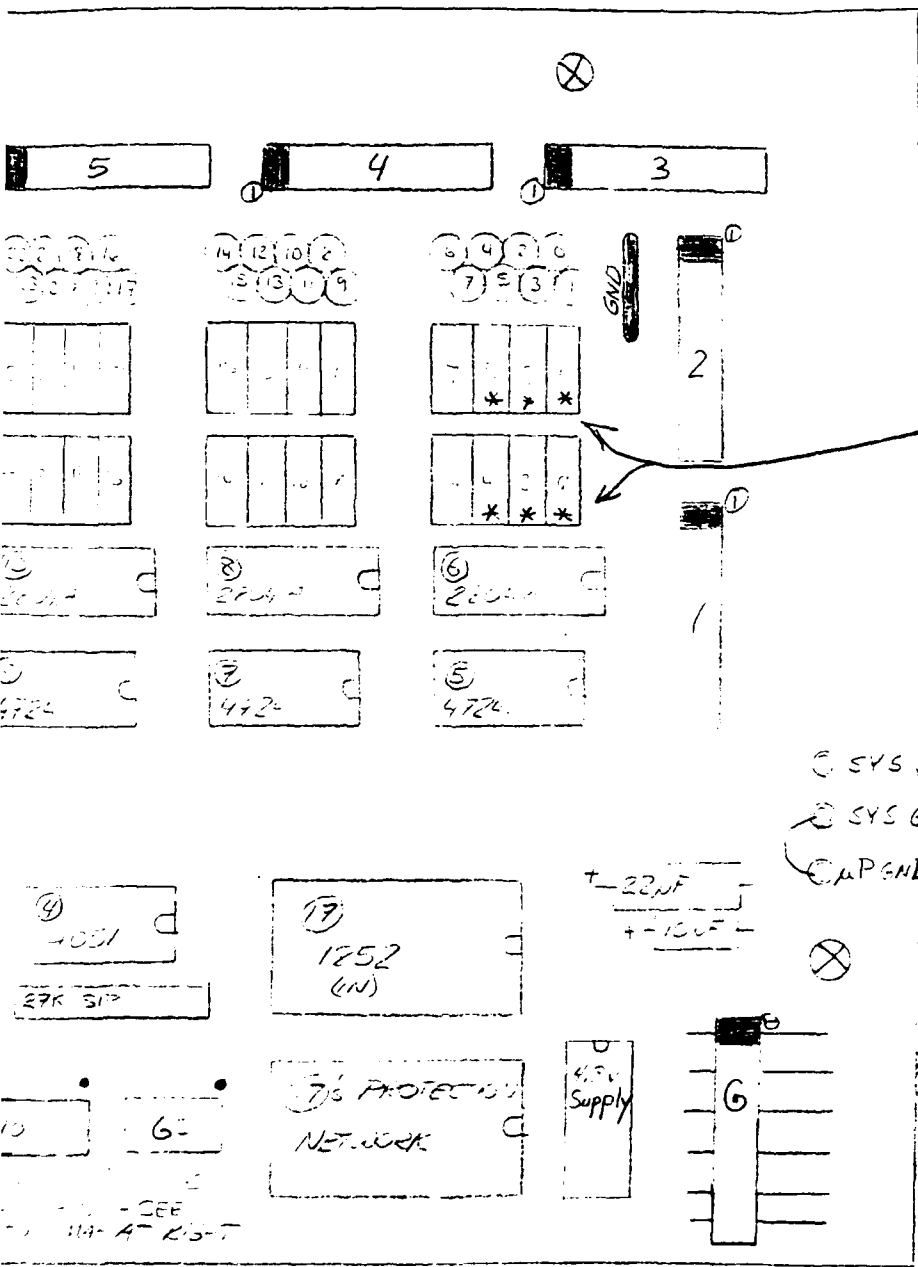
TIP 147: →



Not in place



... - CEP
 22-0... 11A-A-25



Note:
 0-6 Connected to
 μ P Bat. Source
 All others to Sys Bat.

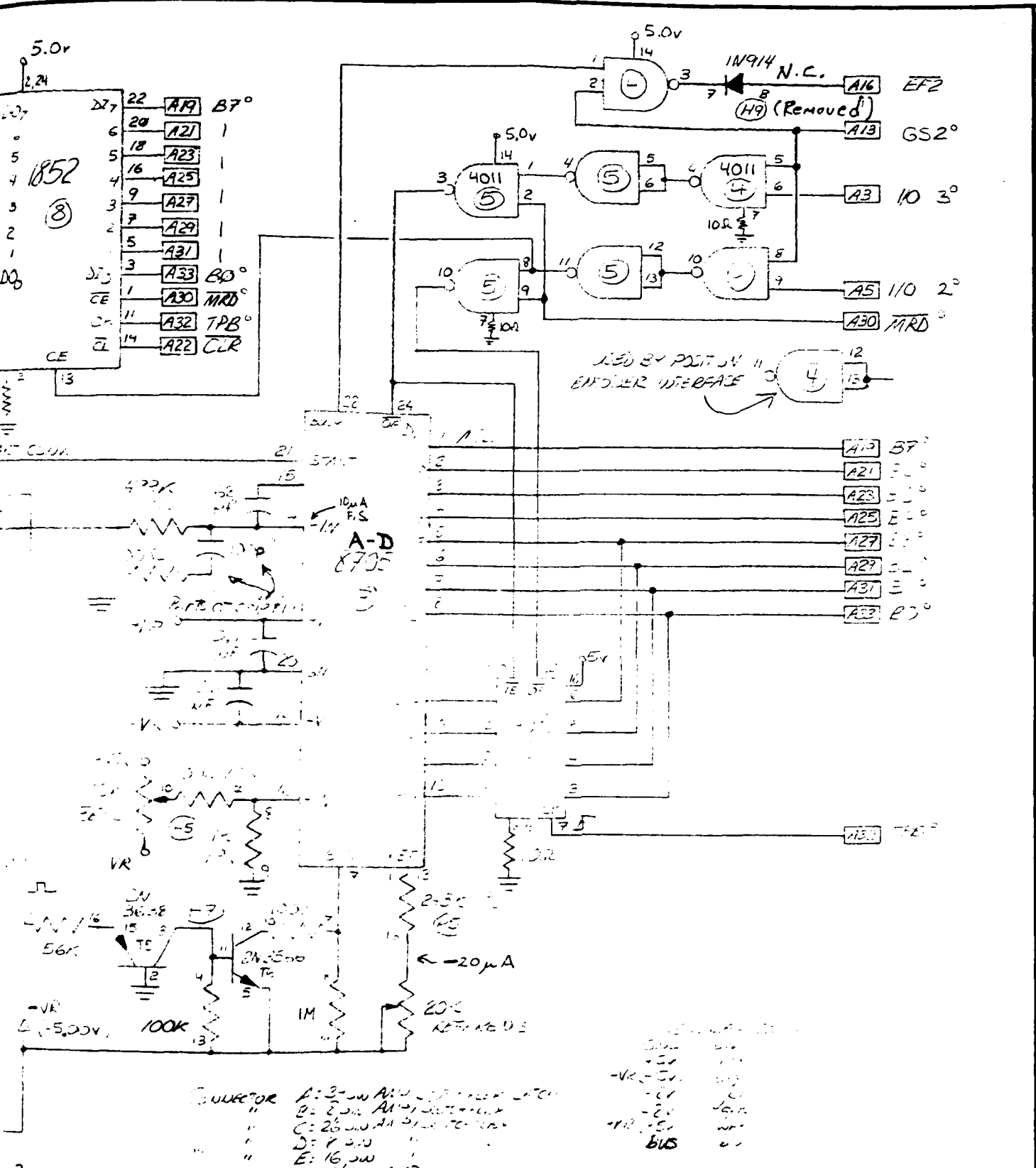
- ① SYS BAT (+24)
- ② SYS GND
- ③ μ P GND

- WDS SELECTOR SWITCH
- 1107° C
 - 1108° C
 - 1109° C
 - 1110° C
 - 1111° C
 - 1112° C
 - 1113° C
 - 1114° C
 - 1115° C
 - 1116° C
 - 1117° C
 - 1118° C
 - 1119° C
 - 1120° C
 - 1121° C
 - 1122° C
 - 1123° C
 - 1124° C
 - 1125° C
 - 1126° C
 - 1127° C
 - 1128° C
 - 1129° C
 - 1130° C
 - 1131° C
 - 1132° C
 - 1133° C
 - 1134° C
 - 1135° C
 - 1136° C
 - 1137° C
 - 1138° C
 - 1139° C
 - 1140° C
 - 1141° C
 - 1142° C
 - 1143° C
 - 1144° C
 - 1145° C
 - 1146° C
 - 1147° C
 - 1148° C
 - 1149° C
 - 1150° C
 - 1151° C
 - 1152° C
 - 1153° C
 - 1154° C
 - 1155° C
 - 1156° C
 - 1157° C
 - 1158° C
 - 1159° C
 - 1160° C
 - 1161° C
 - 1162° C
 - 1163° C
 - 1164° C
 - 1165° C
 - 1166° C
 - 1167° C
 - 1168° C
 - 1169° C
 - 1170° C
 - 1171° C
 - 1172° C
 - 1173° C
 - 1174° C
 - 1175° C
 - 1176° C
 - 1177° C
 - 1178° C
 - 1179° C
 - 1180° C
 - 1181° C
 - 1182° C
 - 1183° C
 - 1184° C
 - 1185° C
 - 1186° C
 - 1187° C
 - 1188° C
 - 1189° C
 - 1190° C
 - 1191° C
 - 1192° C
 - 1193° C
 - 1194° C
 - 1195° C
 - 1196° C
 - 1197° C
 - 1198° C
 - 1199° C
 - 1200° C

24 Nov 86 WJET
 19 July 84 WJET
 REV 12 July 84 KAW
 REV 21 OCT 83 ARD

WOODS HOLE OCEANOGRAPHIC INSTITUTION
 WOODS HOLE, MASS. 02543
 PROJ. W22 69 BY ARD
 SHEET 2 OF 3 DATE 26 SEP 83

TITLE
Output Drivers Board-Parts Layout
SEA DUCT
SD-B-017



Bottom View

- COMPONENTS
- A: 2-watt AMP POWER
 - B: 2-watt AMP POWER
 - C: 20-watt AMP POWER
 - D: 2-watt AMP POWER
 - E: 16-watt AMP POWER
 - F: 6-watt AMP POWER

+5V
 -5V
 -VR
 -5V
 -5V
 -5V
 BUS

24 Nov 86 WET
 15 Oct 84 WET
 REV. 1 NOV 83 ARD

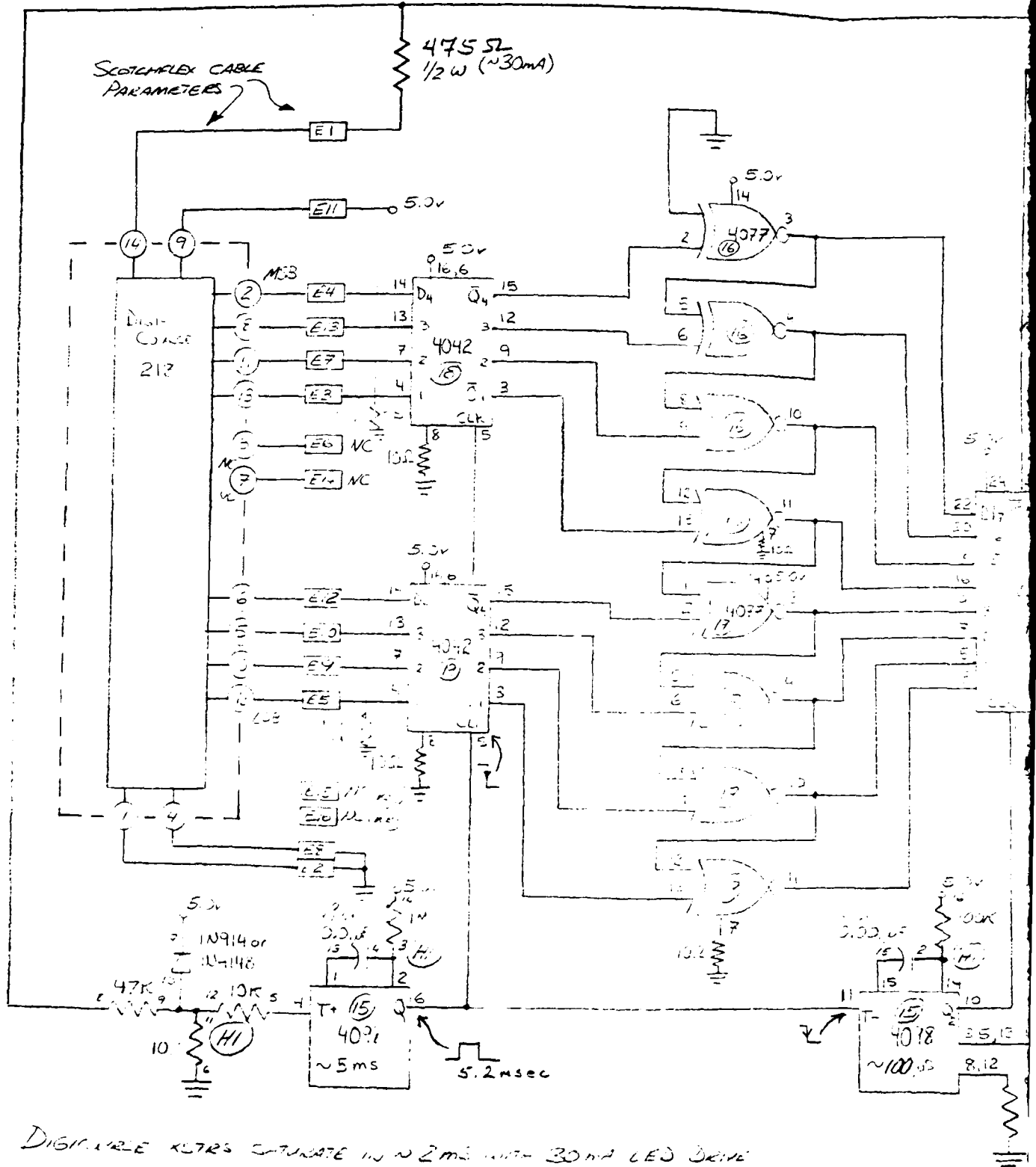
WOODS HOLE OCEANOGRAPHIC INSTITUTION
 WOODS HOLE, MASS. 02543

PROJ. 10/82.69 BY ARD

SHEET 1 OF 4 DATE 24 Feb 83

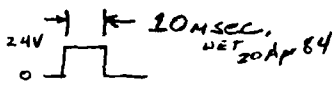
TITLE Interface Board
 A/D, Voltage Converter
 SEA DUCT

SD-B-018

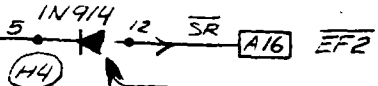


Note:

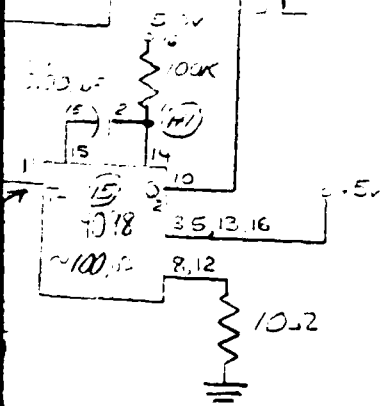
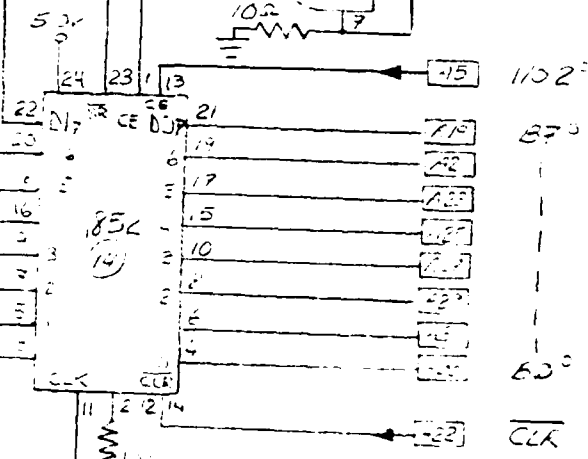
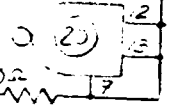
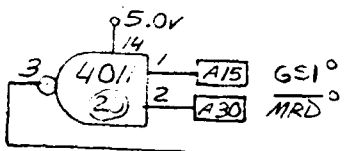
WOC
PROJ:
SHEE



F1 SWITCHED 24V .. GRI; 10 OUT 2



NOTE: DIODE IS NOT INSTALLED CURRENTLY. LINE SHOULD BE LEFT OPEN. IF RECONNECTED, DIODE MUST BE INSTALLED



REV 15 Oct 84 WET

NOTE: ALTERNATE WIRING (instead of \bar{Q} on 4011 output) WILL ALLOW USE OF 4070 XOR IN PLACE OF 4071 XOR
REV. 1 NOV 83 ARD

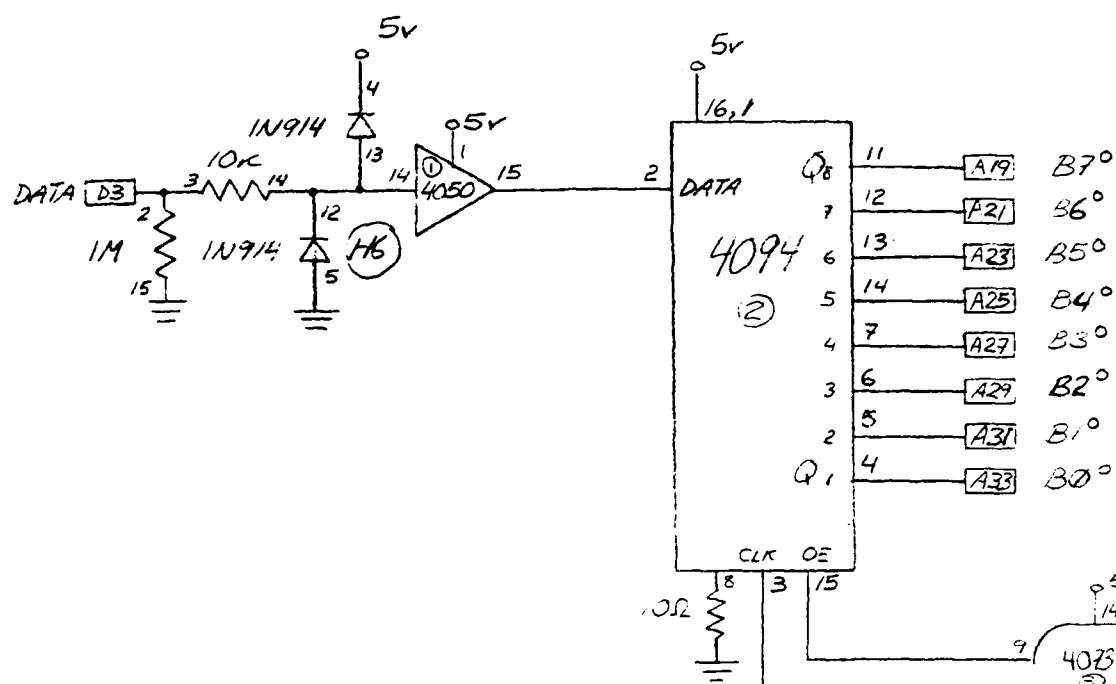
WOODS HOLE OCEANOGRAPHIC INSTITUTION
WOODS HOLE, MASS. 02543
PROJ. 10182.69 BY ARD
SHEET 2 OF 4 DATE 22 Feb 83

TITLE INTERFACE BOARD
COMPASS INTERFACE
SEA DUCT
SD-8019 ?

9 pin GRN
Molex

24 V_s Switched
To Pos. ENC

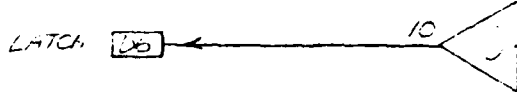
5
8



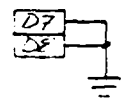
4



2

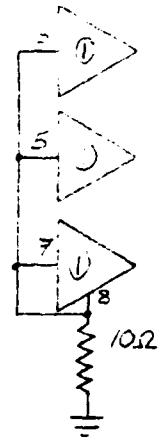


1
7



3-9 NC

[D4] N.C.



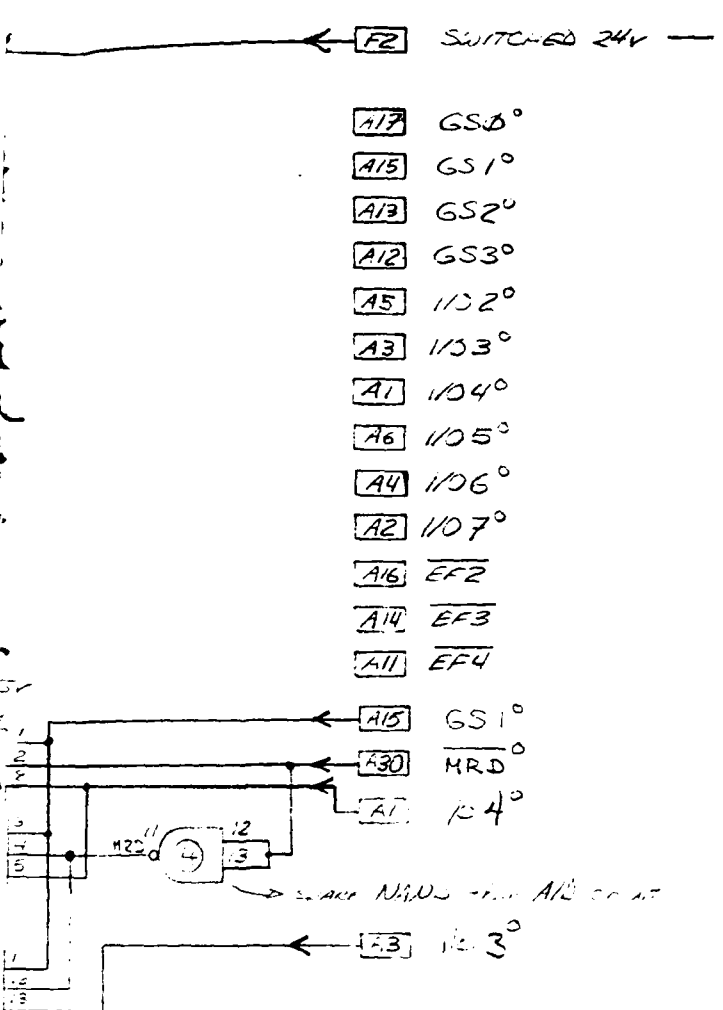
$$OE = GS \cdot \overline{MRD} \cdot I/O$$

$$CLK = GS \cdot I/O$$

$$LATCH = GS \cdot I/O$$

Relay Driver # $\phi 1 Q$
 Conn. 1 pin 7
 (WHT/GRN)

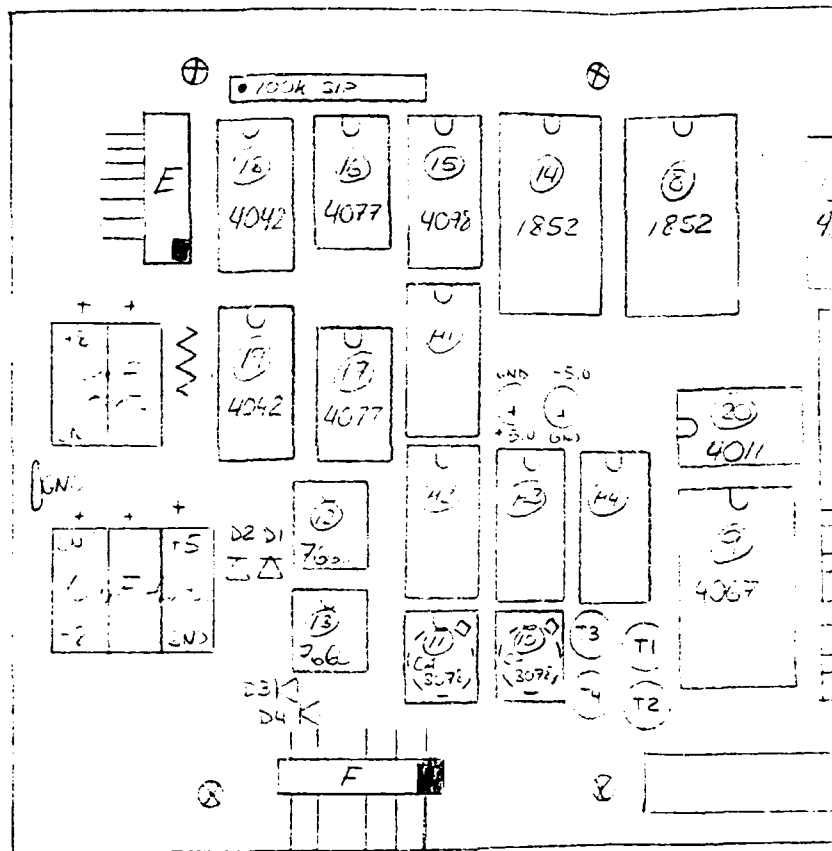
- A17 GS0°
- A15 GS1°
- A13 GS2°
- A12 GS3°
- A5 1102°
- A3 1103°
- A1 1104°
- A6 1105°
- A4 1106°
- A2 1107°
- A16 EF2
- A14 EF3
- A11 EF4

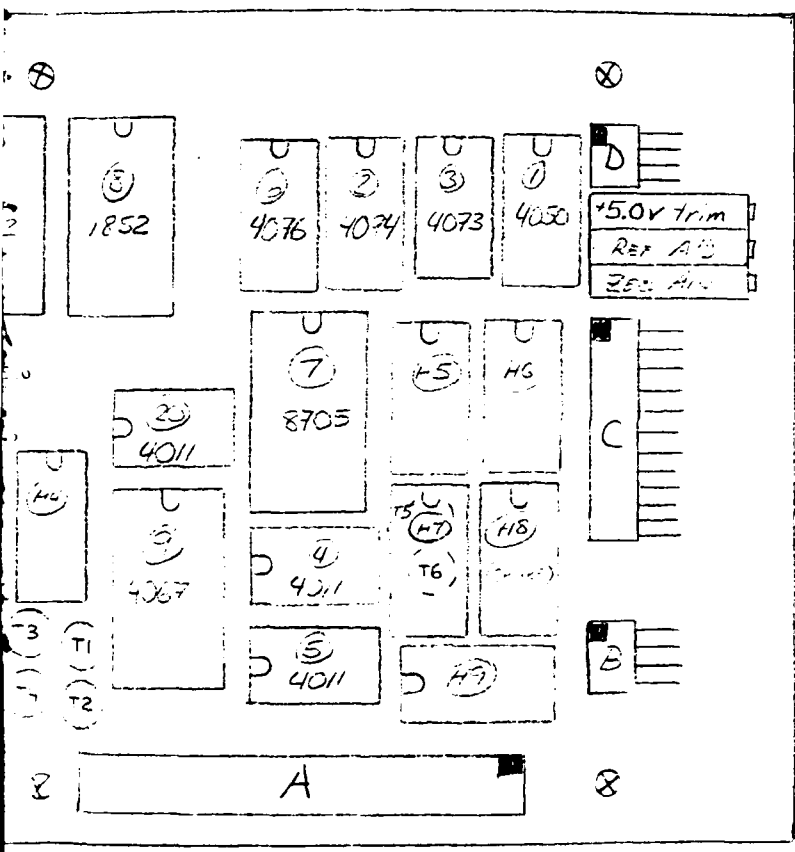


$F = GS \cdot \overline{MRD} \cdot I/O = GS 1 \cdot INP 4$
 $R = GS \cdot I/O = GS 1 \cdot OUT 4$
 $TCH = GS \cdot I/O = GS 1 \cdot OUT 3$

REV 24 Nov 86 WET
 16 Oct 84 WET
 REV 27 July 83 ARD

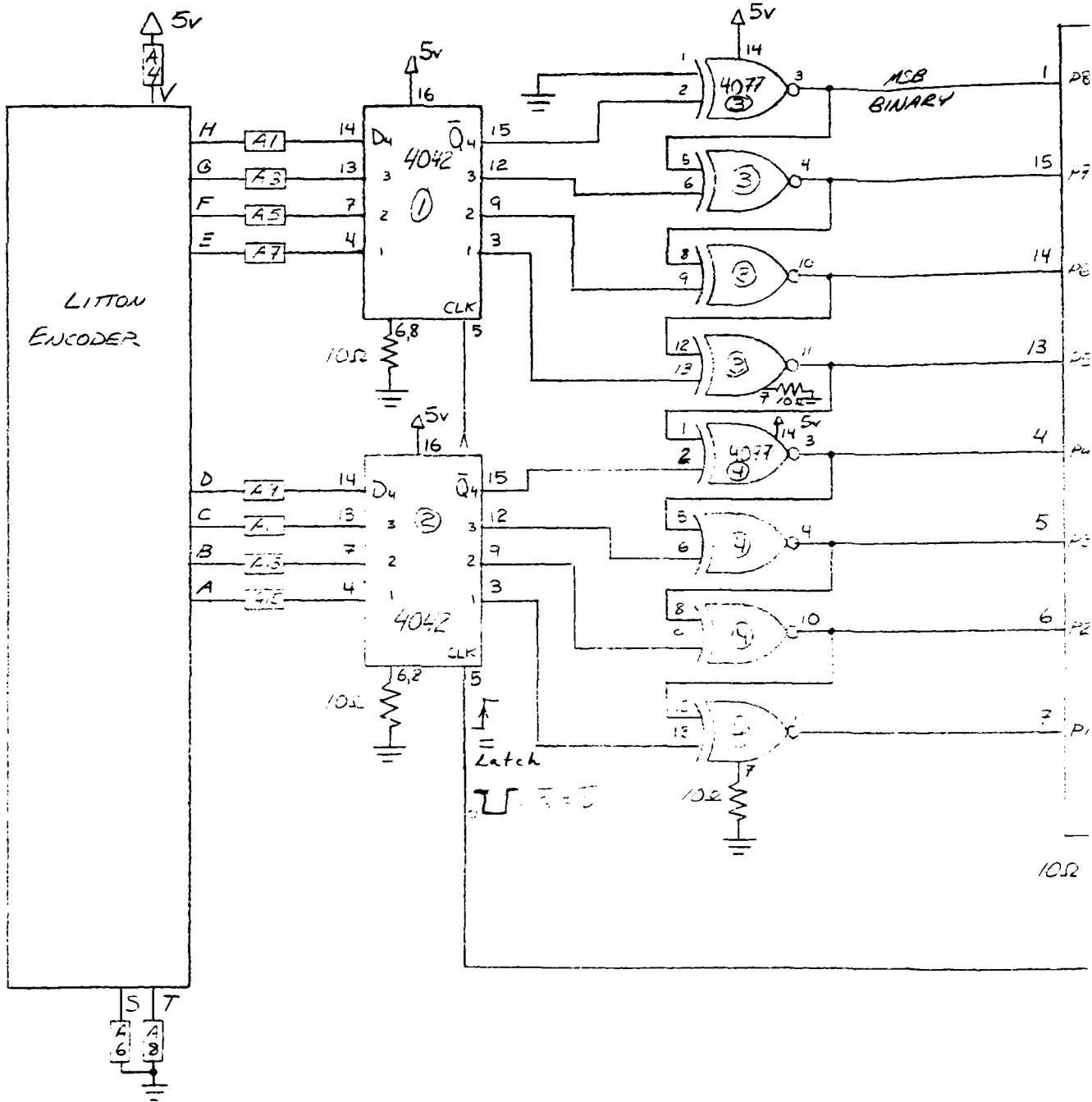
WOODS HOLE OCEANOGRAPHIC INSTITUTION WOODS HOLE, MASS. 02543 PROJ. <u>10/82.69</u> BY <u>ARD</u> SHEET <u>3</u> OF <u>4</u> DATE <u>14 MAR 83</u>	TITLE <u>Interface Board</u> <u>Rotation Encoder Interface</u> SEA DUCT SD-B-010
--	---





WOODS HOLE OCEANOGRAPHIC INSTITUTION
 WOODS HOLE, MASS. 02543
 PROJ. 10/82.69 BY ARD
 SHEET 4 OF 4 DATE 28 Sep 83

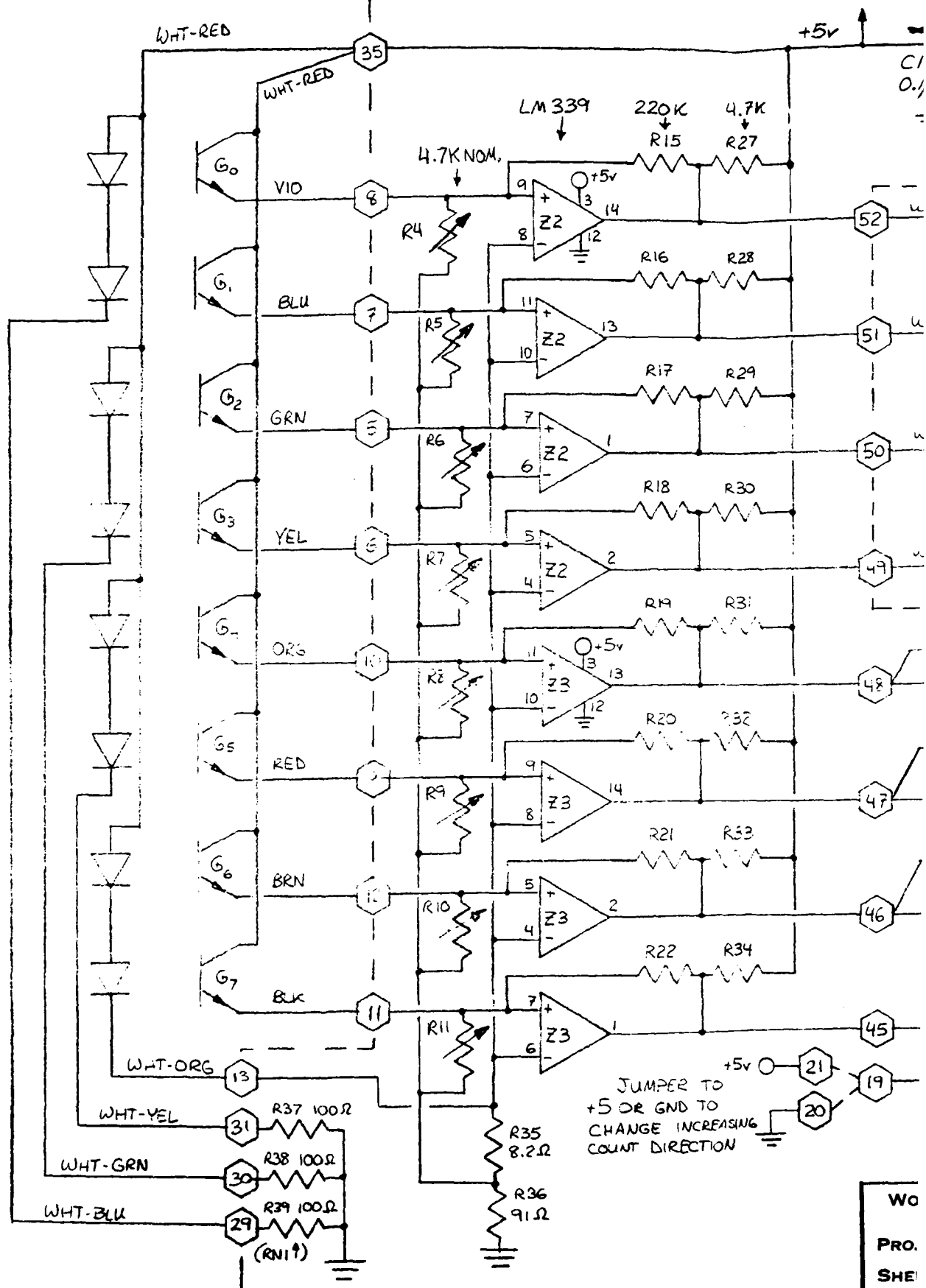
TITLE Interface Board
Parts Layout
 SEADUCT
 SD-B-021



Wc
PRO
SHE

SP 11203A

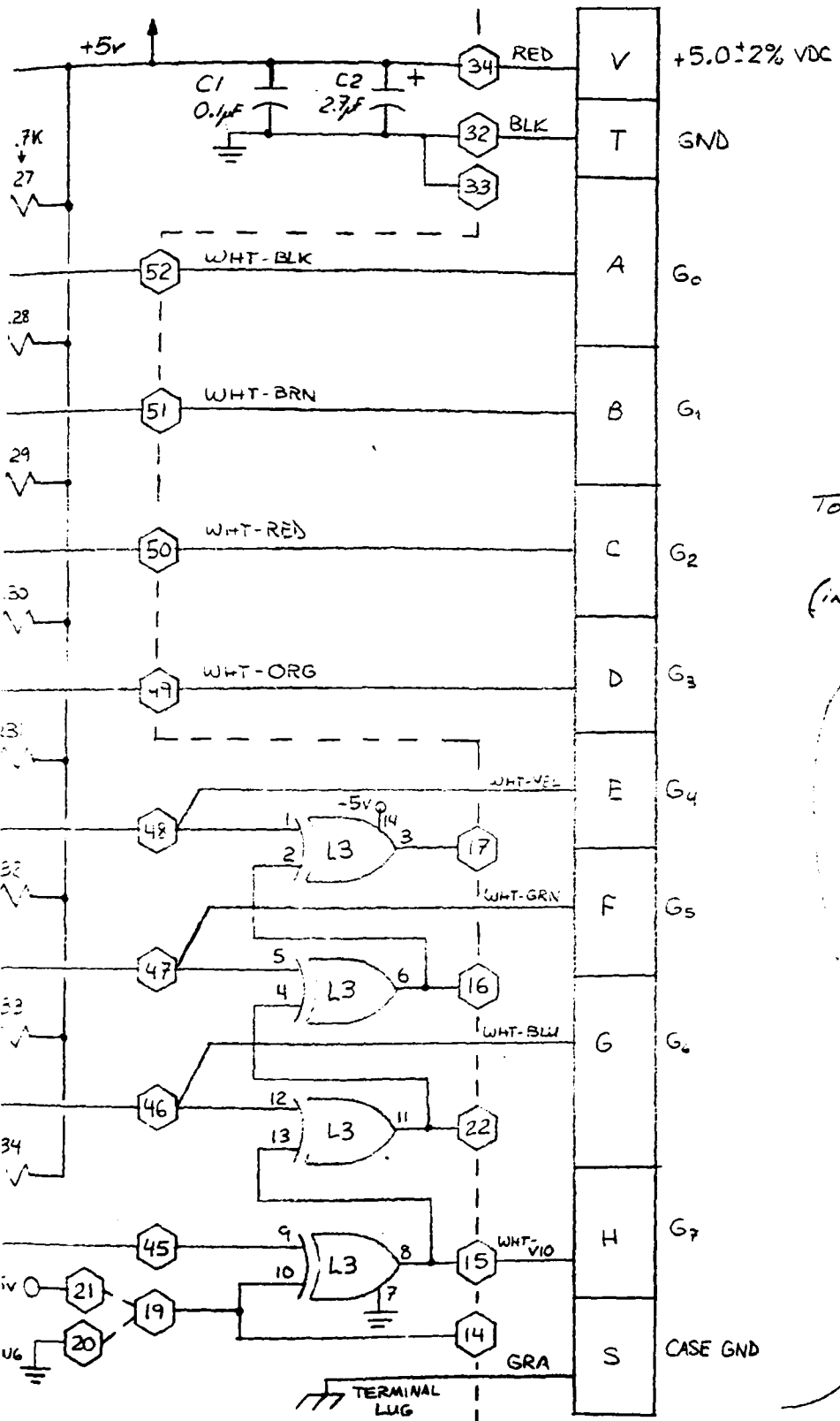
AMPLIFIER BOARD ASSY PIN 29215 -3 & -16



WO
PRO.
SHE

29215 -3 & -16

PT 07C-14-19P

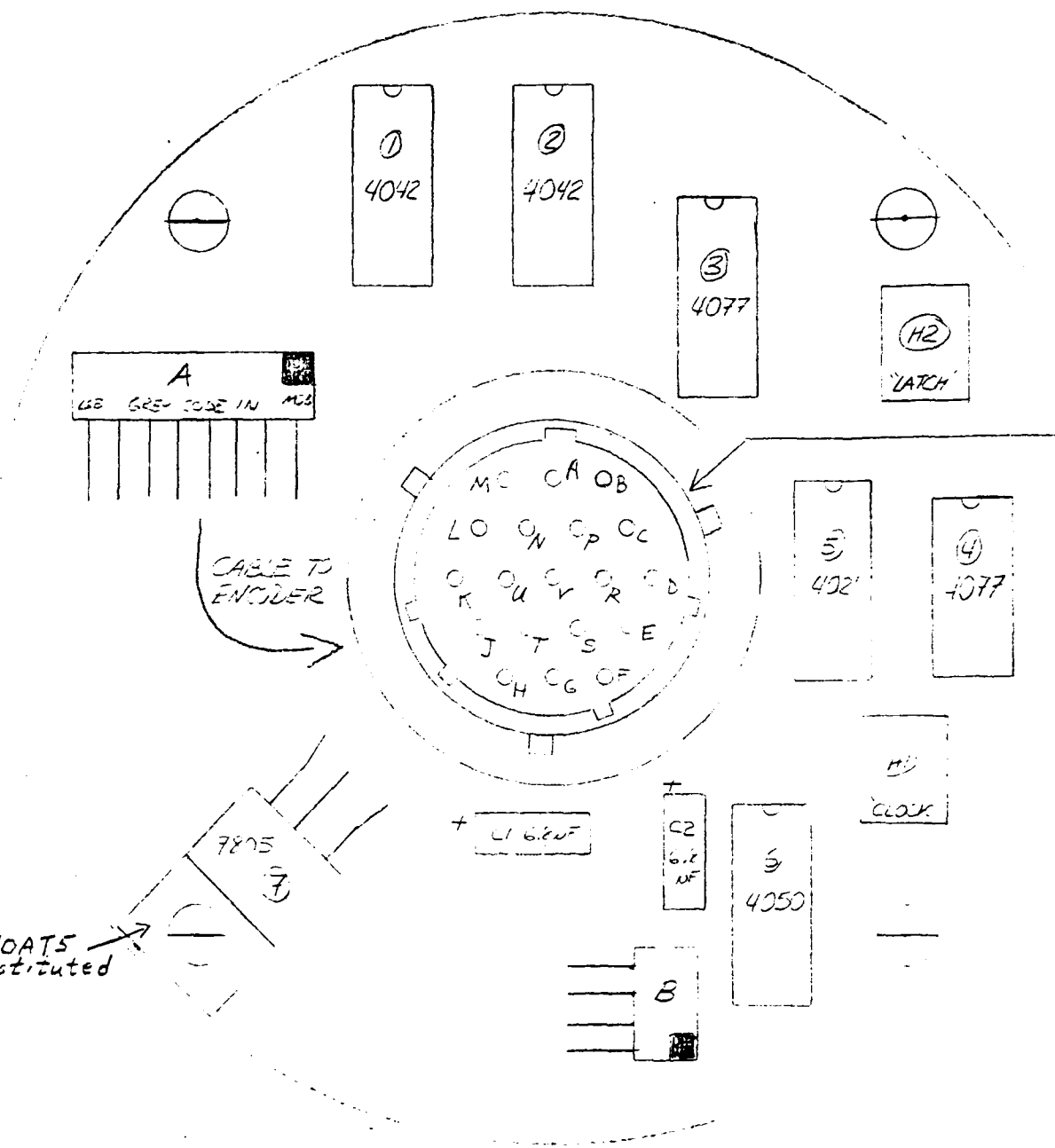


To:
 POSITION ENCODER Interface
 (in Encoder Press. Housing)

REV 20 Nov 84 W.E.T.

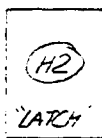
<p>WOODS HOLE OCEANOGRAPHIC INSTITUTION WOODS HOLE, MASS. 02543 PROJ. 10/82.69 BY ARD SHEET 2 OF 3 DATE 15 FEB 83</p>	<p>TITLE LITTON Rotation Encoder SEA DUCT</p>
--	---

SD-B-023

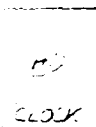
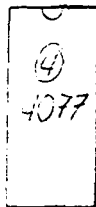
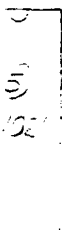


Note: ~~LM340ATS~~
 LM340ATS
 substituted

WC
 PRO
 SHE



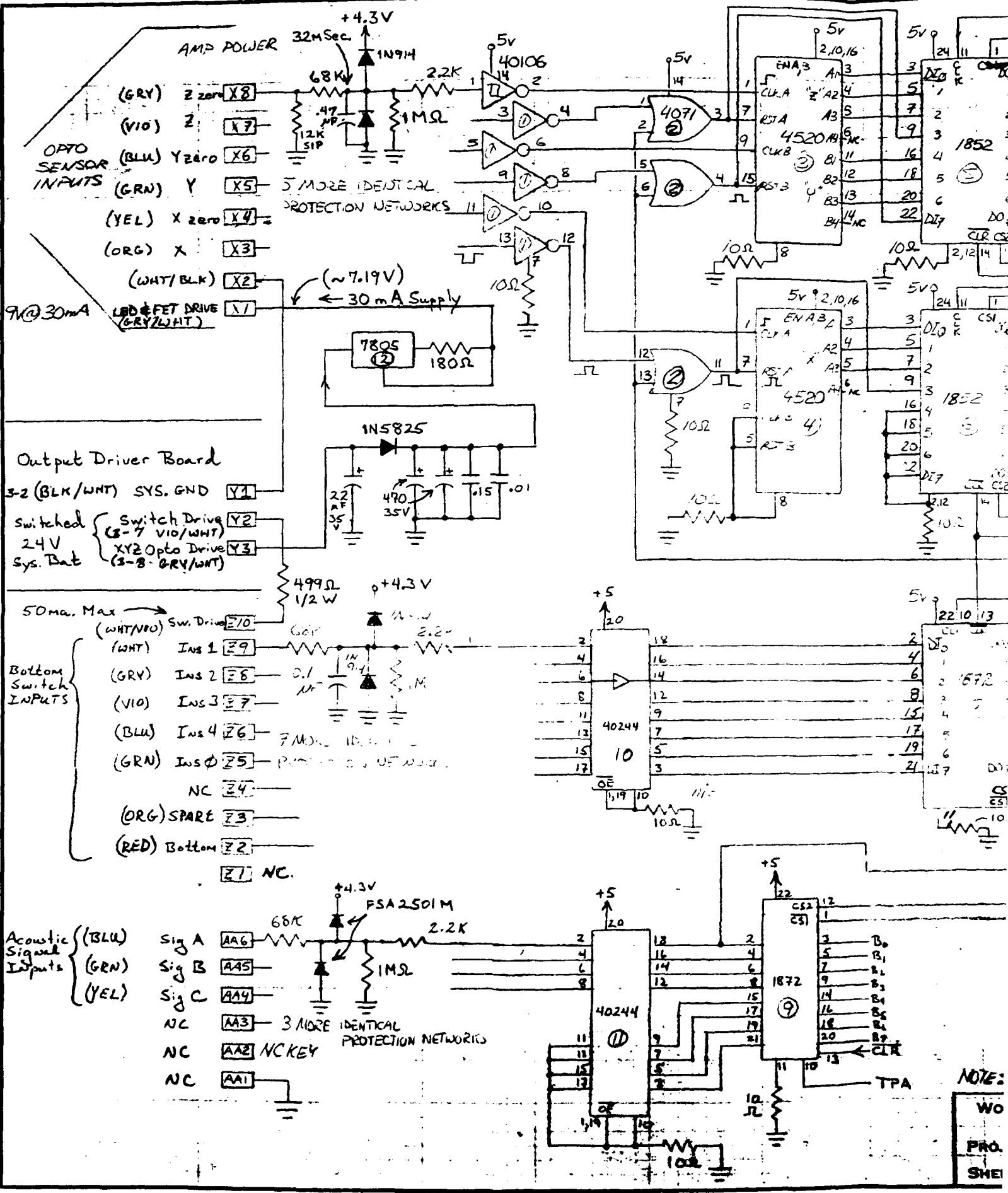
CONNECTOR ON
LITTON ENCODER



20 Nov 84 WET
REV 12 July 84 KAW

WOODS HOLE OCEANOGRAPHIC INSTITUTION WOODS HOLE, MASS. 02543	TITLE
PROJ. <u>10182.69</u> BY <u>ARD</u>	<u>Rotation Encoder Interface</u>
SHEET <u>3</u> OF <u>3</u> DATE <u>19 Oct 83</u>	<u>Parts Layout</u>
	<u>(Encoder Housing)</u>

SEA DUCT
SD-B-024



AMP POWER

OPTO SENSOR INPUTS

- (GRY) Z zero X8
- (VIO) Z X7
- (BLU) Y zero X6
- (GRN) Y X5
- (YEL) X zero X4
- (ORG) X X3
- (WHT/BLK) X2
- LED/FET DRIVE (GRY/WHT) X1

5 MORE IDENTICAL PROTECTION NETWORKS

9V @ 30mA

Output Driver Board

- 3-2 (BLK/WHT) SYS. GND Y1
- Switched 24V Sys. Bat
 - Switch Drive (3-7 VIO/WHT) Y2
 - XYZ Opto Drive (3-8 GRN/WHT) Y3

Bottom Switch INPUTS

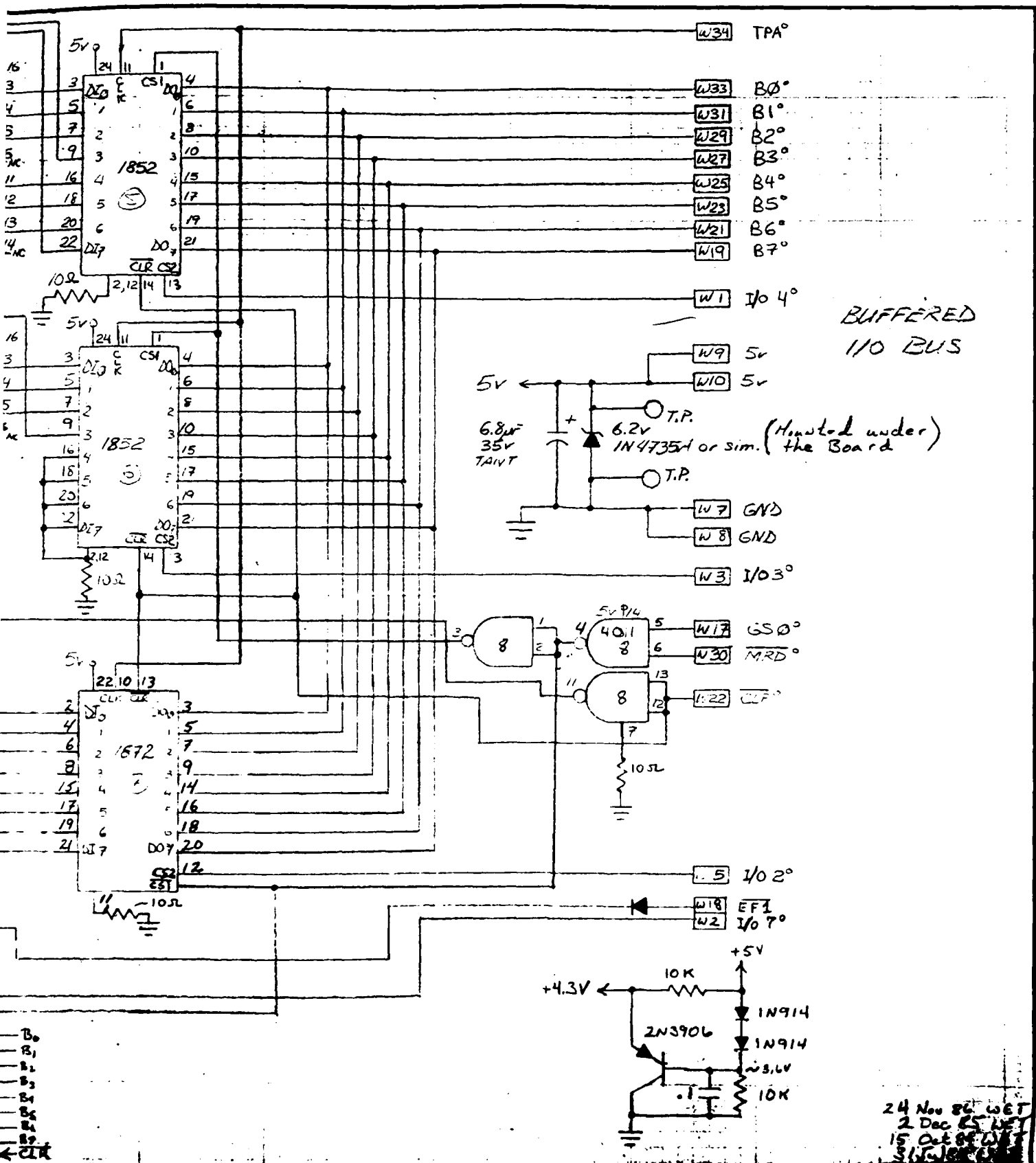
- (WHT/VIO) Sw. Drive Z10
- (WHT) Ins 1 Z9
- (GRY) Ins 2 Z8
- (VIO) Ins 3 Z7
- (BLU) Ins 4 Z6
- (GRN) Ins 0 Z5
- NC Z4
- (ORG) SPARE Z3
- (RED) Bottom Z2
- Z1 NC.

Acoustic Signal Inputs

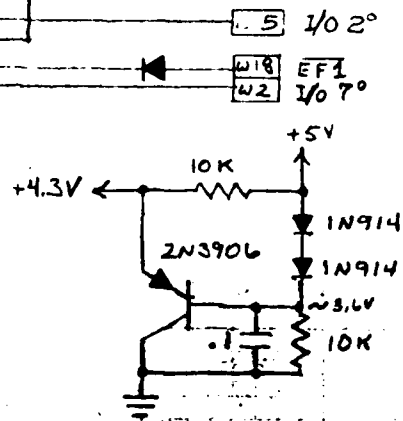
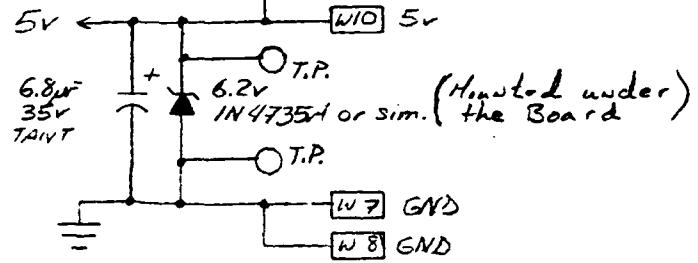
- (BLU) Sig A AA6
- (GRN) Sig B AA5
- (YEL) Sig C AA4
- NC AA3
- NC AA2
- NC AA1

3 MORE IDENTICAL PROTECTION NETWORKS

NOTE:
 WO
 PRO.
 SHEI



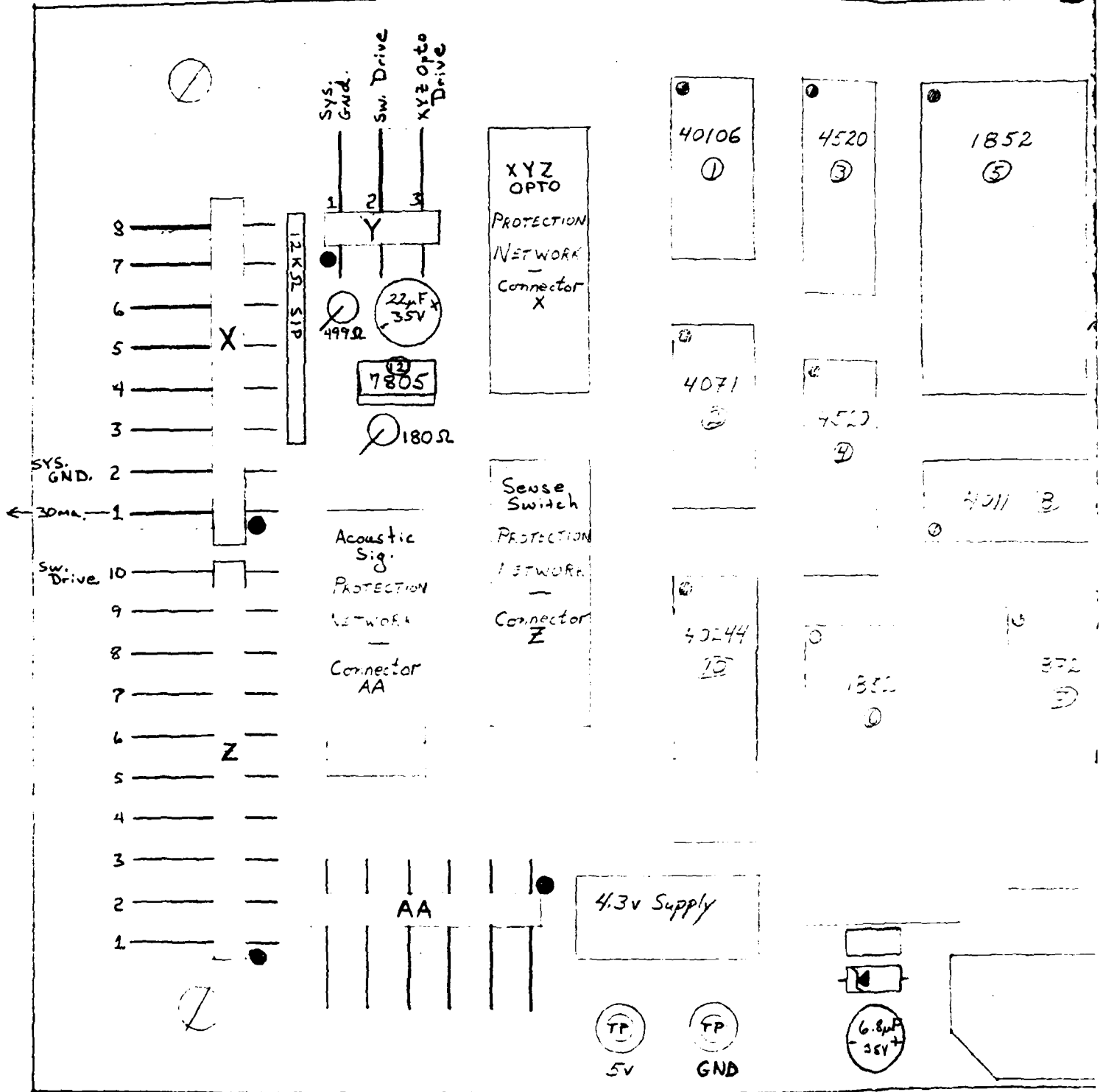
BUFFERED
I/O BUS



24 Nov 86 WET
2 Dec 85 WET
15 Oct 84 WET
REV 3
REV 2

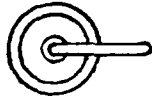
NOTE: COUNTERS INCREMENT ON LEADING EDGE OF OPTICAL INTERRUPTION.

WOODS HOLE OCEANOGRAPHIC INSTITUTION WOODS HOLE, MASS. 02543		TITLE Auxiliary Board	
PROJ 10182-69	BY ARD		
SHEET 1 OF 2	DATE 27 Oct 83	SEALED	



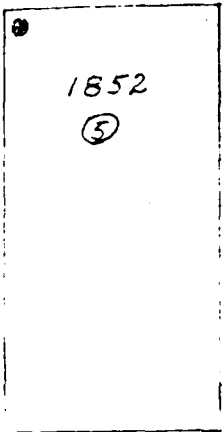
WOOD
 PROJ. /
 SHEET. /

1N5825



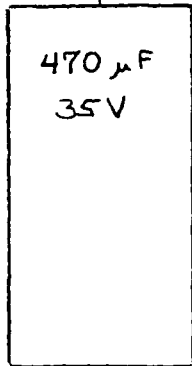
.01

.15

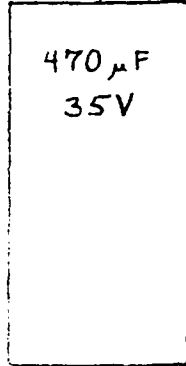


1852

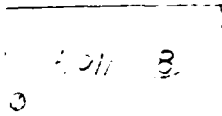
5



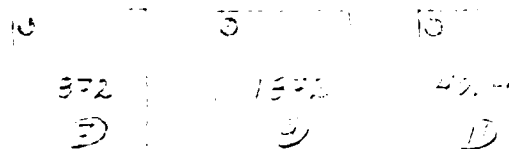
470 μF
35V



470 μF
35V



4011 B



372

3

1852

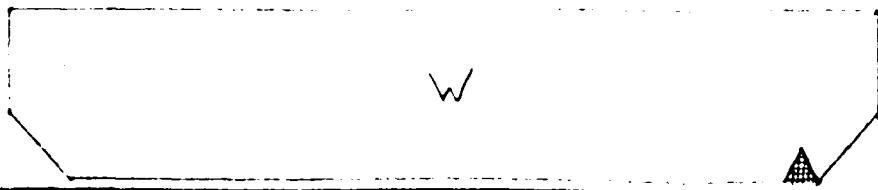
5

4011 B

D

.01

.15



W

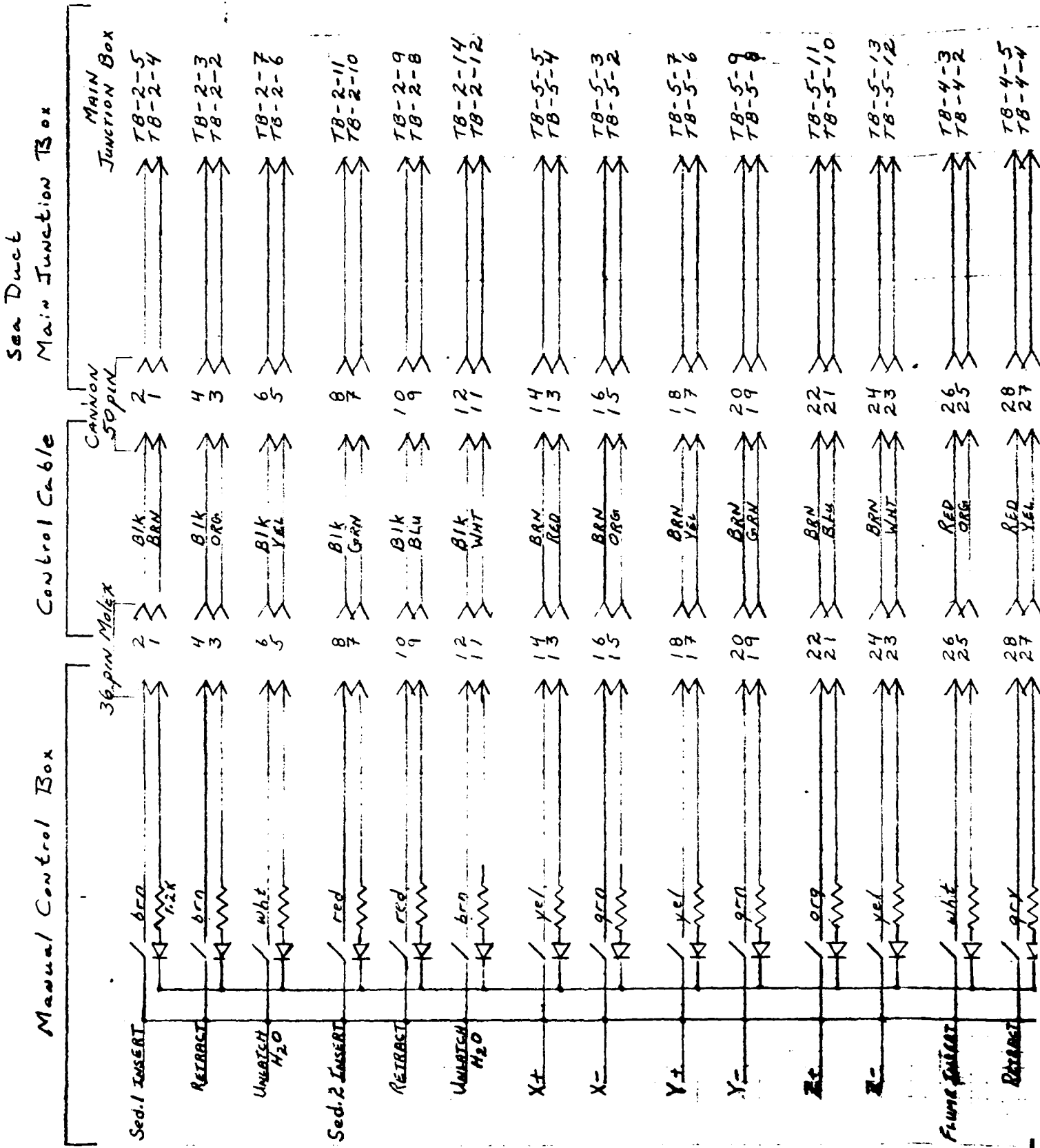


0.8 μF
35V

05 Dec 85 WET
20 Nov 84 WET
REV 12 July 84 KAW

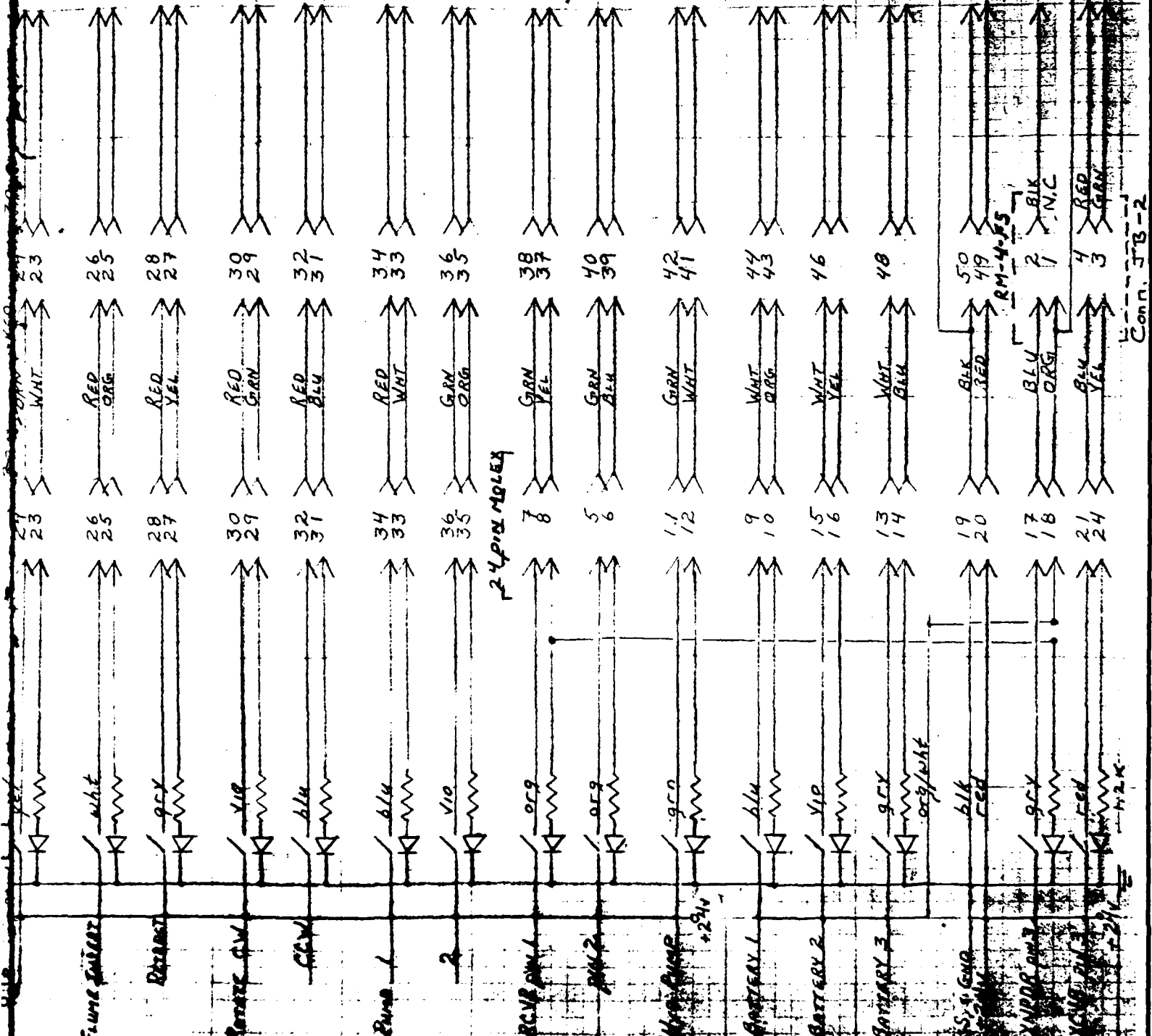
<p>WOODS HOLE OCEANOGRAPHIC INSTITUTION WOODS HOLE, MASS. 02543 PROJ. <u>10/82.69</u> BY <u>KAW</u> SHEET <u>2</u> OF <u>2</u> DATE <u>26 June 84</u></p>	<p>TITLE <u>Auxillary Board - Parts Layout</u> <u>SEA DUCT</u></p>
---	--

50-8-8212



Rev 24 Nov 88 WBT
 Rev 24 July 86 KAW

78-5-12



2.4 PIN MOLEX

2 PIN MOLEX
Temp (12V)
Battery

Conn. TB-2

WOODS HOLE OCEANOGRAPHIC INSTITUTION
 WOODS HOLE, MASS. 02543
 PROJ. 10/06 69 BY [Signature]
 SHEET 1 OF 1 DATE 5/10/83

TITLE
 SEA DUCT
 SD-5-0027

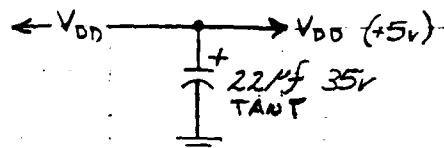
Nov 86 WBT
 July 86 KAW

J4
50 pin Amp

1	1/0 4°	TP 3	37	B4°
2	1/0 7°	TP 6	38	SCΦ
3	1/0 3°	TP 2	39	B3°
4	1/0 6°	TP 5	40	Q° TP 18
5	1/0 2°	TP 1	41	B2°
6	1/0 5°	TP 4	42	MRD TP 14
7	GND	TP 0	43	B1°
8	GND	TP 27	44	TNT TP 25
9	+V _{DD}	TP 26	45	BΦ°
10	+V _{DD}		46	GS3° TP 10
11	EF4	TP 24	47	TPB° TP 29
12	NC. (KEY)		48	DMA OUT-TP 16
13	HWR°	TP 15	49	TPA° TP 28
14	EF3	TP 23	50	DMA IN-TP 17
15	A7'			
16	EF2	TP 22		
17	A6'			
18	EFT	TP 21		
19	A5'			
20	N2	TP 13		
21	A4'			
22	N1	TP 12		
23	A3'			
24	NΦ	TP 11		
25	A2'			
26	GS2°	TP 9		
27	A1'			
28	GS1°	TP 8		
29	AΦ			
30	GSΦ°	TP 7		
31	B7°			
32	WAIT	TP 19		
33	B6°			
34	CLR	TP 20		
35	B5°			
36	SC1			

To Connector 'P'
Ser Duct Buffer Board

TO CONNECT
P' ON SER DUCT
BUFFER BOARD



← AΦ'
← A1'
← A2'
← A3'

← A4
← A5
← A6
← A7

← TPA° -

→ V_{DD} (+5V)
2Mf 35V
ANT

J2
26 Pin AMP
POD 3

J1
26 Pin AMP
POD 1

A9' J2-1 — 0
A10' J2-2 — 1
A11' J2-3 — 2
A12' J2-4 — 3
A13' J2-5 — 4
A14' J2-6 — 5
A15' J2-7 — 6
N.C. J2-8 — 7
J2-9 — 8
⊥ J2-10 GND
J3-8 J2-11 K CLK

B0° J1-1 — 0
B1° J1-2 — 1
B2° J1-3 — 2
B3° J1-4 — 3
B4° J1-5 — 4
B5° J1-6 — 5
B6° J1-7 — 6
B7° J1-8 — 7
⊥ J1-10 GND
J1-9 = KEY

POD 2

A0' J1-13 — 0
A1' J1-14 — 1
A2' J1-15 — 2
A3' J1-16 — 3
A4' J1-17 — 4
A5' J1-18 — 5
A6' J1-19 — 6
A7' J1-20 — 7
A8' J1-21 — 8
⊥ J1-22 GND
J3-9 J1-23 L CLK
J1-24 Key

J2-12 = KEY

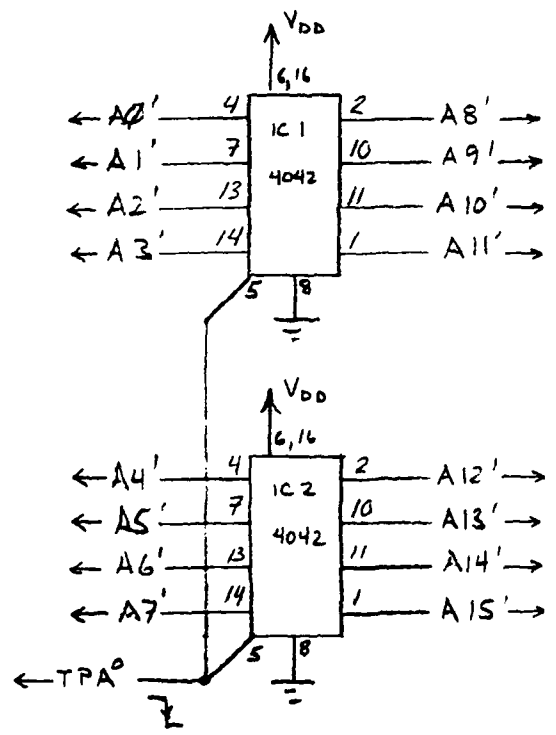
POD 4

MWR J2-13 — 0 ✓
MRD J2-14 — 1 ✓
SCφ J2-15 — 2 ✓
SC1 J2-16 — 3
J3-2 J2-17 — 4
J3-3 J2-18 — 5
J3-4 J2-19 — 6
J3-5 J2-20 — 7
J3-6 J2-21 — 8
⊥ J2-22 GND
TPB J2-23 J CLK
J2-24 KEY

Ranges

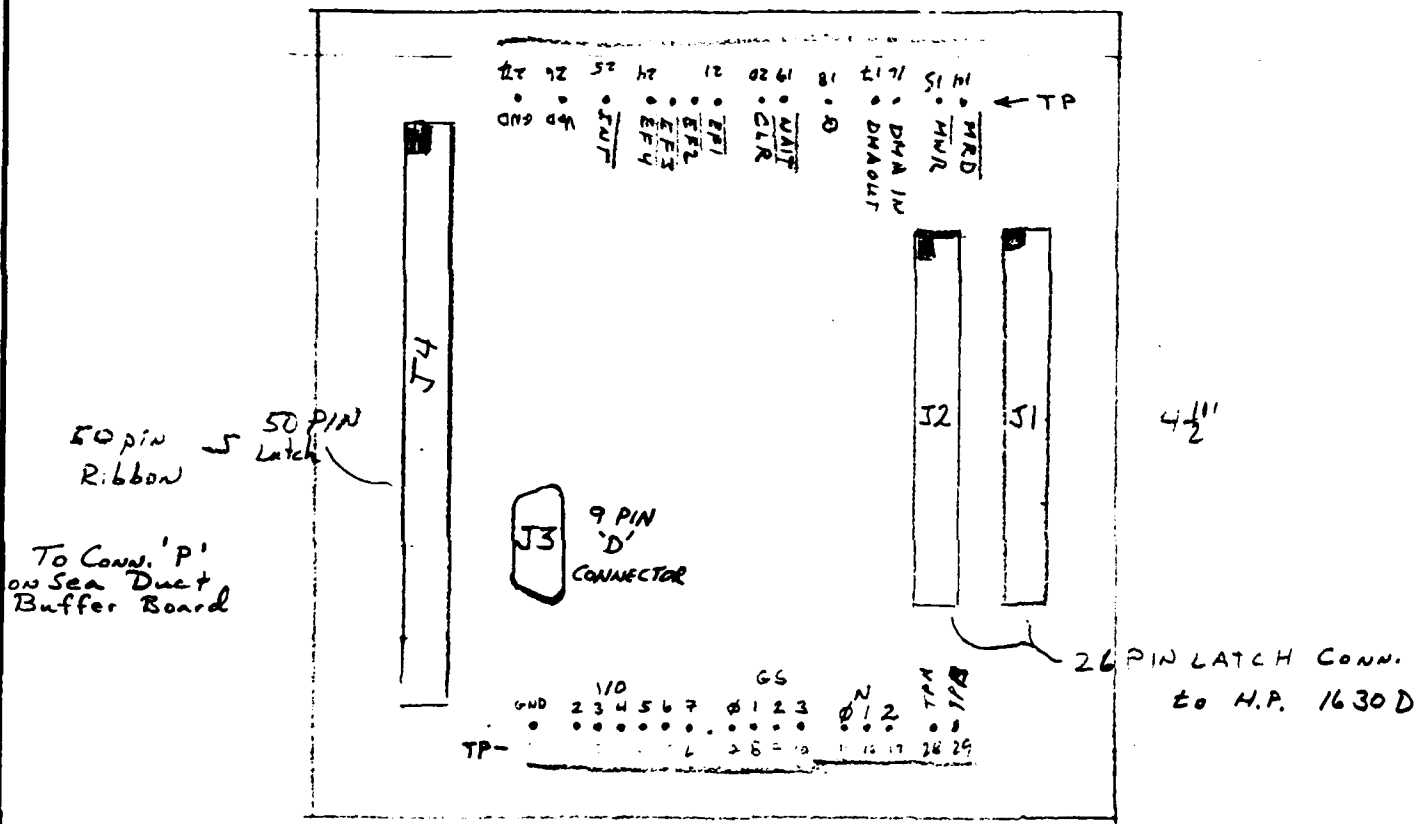
J3 - 9 Pin 'D'

1	GND	BIK
2	POD 4-4	BRN
3	POD 4-5	RED
4	POD 4-6	ORG
5	POD 4-7	YEL
6	POD 4-8	GRN
7		
8	K CLK	
9	L CLK	



REV 2 Feb 84 WET
REV 31 OCT 85 ARD

WOODS HOLE OCEANOGRAPHIC INSTITUTION WOODS HOLE, MASS. 02543	TITLE SEA DUCT - HP1630 D Analyser Interface Box
PROJ. 10/82.69 BY WET	SEA DUCT
SHEET 1 OF 2 DATE 18 Oct 83	SD-B-028



50 pin Ribbon
 50 PIN Latch
 To Conn. 'P'
 on Sea Duct
 Buffer Board

26 PIN LATCH CONN.
 to H.P. 1630D

J3

1	BLK	Bongo	w/GRY
2	BRN	Bongo	w/GRY WIRE
3	RED	"	"
4	ORG	"	"
5	YEL	"	"
6	GRN	"	"
7	BLU	"	"
8	NC		
9	NC		

CONN.
1630 D

WOODS HOLE OCEANOGRAPHIC INSTITUTION WOODS HOLE, MASS. 02543		TITLE
PROJ. 10/82.69	BY WET	SEA DUCT - HP 1630 D Logic Analyser Interface Box - Legend
SHEET 2 OF 2	DATE 18 Oct 83	SEA DUCT

SD-R-0029

JA-Pins:

- 1 — B₀
- 2 — B₁
- 3 — B₂
- 4 — B₃
- 5 — B₄
- 6 — B₅
- 7 — B₆
- 8 — B₇
- 9 — N.C. (KEY)
- 10 — GND
- 11 — N.C.
- 12 — N.C.
- 13 — A₁
- 14 — A₂
- 15 — A₃
- 16 — A₄
- 17 — A₅
- 18 — A₆
- 19 — A₇
- 20 — A₈
- 21 — A₉
- 22 — GND
- 23 —
- 24 — N.C. (KEY)
- 25 — N.C.
- 26 — N.C.

JB-Pins:

- 1 — A₉
- 2 — A₁₀
- 3 — A₁₁
- 4 — A₁₂
- 5 — A₁₃
- 6 — A₁₄
- 7 — A₁₅
- 8 — N.C.
- 9 —
- 10 — GND
- 11 —
- 12 — N.C. (KEY)
- 13 — MRD
- 14 — MRD
- 15 — SCO
- 16 — SCL
- 17 — GND (N.C.)
- 18 — MRD
- 19 —
- 20 —
- 21 —
- 22 —
- 23 —
- 24 —
- 25 —
- 26 —

TO 52 OR
 CELE DUCT - HP 1630 D
 MIC W/ALVEER
 INTERFACE

TO 52 OR
 CELE DUCT - HP 1630 D
 MIC W/ALVEER
 INTERFACE

WOODS HO
CONTRACT NO. /
BY WET

2

1

REVISIONS

ZONE	LTR	DESCRIPTION	DATE	APPROVED

J2-PIN:

- B₀ — 1
- B₁ — 3
- B₂ — 5
- B₃ — 7
- B₄ — 9
- B₅ — 11
- B₆ — 13
- B₇ — 15

Pod
1

J3-PIN:

- A₀ — 1
- A₁ — 3
- A₂ — 5
- A₃ — 7
- A₄ — 9
- A₅ — 11
- A₆ — 13
- A₇ — 15

Pod
3

- A₀ — 2
- A₁ — 4
- A₂ — 6
- A₃ — 8
- A₄ — 10
- A₅ — 12
- A₆ — 14
- A₇ — 16

Pod
2

- SC4 — 1
- SC1 — 4
- NRD — 6
- KWR — 8
- RECEIVER — 10
- TX — 12
- REL. CONTROL — 14
- ... — 16

Pod
7

- GN2 — 10
- GN2 — 20

- GN2 — 10
- GN2 — 20

To: HP 1610 Logic Analyzer

Note: HP 1610 Clock Pod GN2 = GN2
K CLK = TPE

WOODS HOLE OCEANOGRAPHIC INSTITUTION
ENGINEERING DEPT.
WOODS HOLE, MA. 02543

TITLE

HP 16302 / HP 1610 Analyzer
Interface Box

SEA DUCT

CONTRACT NO. 10/82 69

CODE NO.

BY W ET

DATE 12 July 84 SIZE B

DWG. NO. SD-B-030

OF

REV.

2

1

SD-B-030

D

C

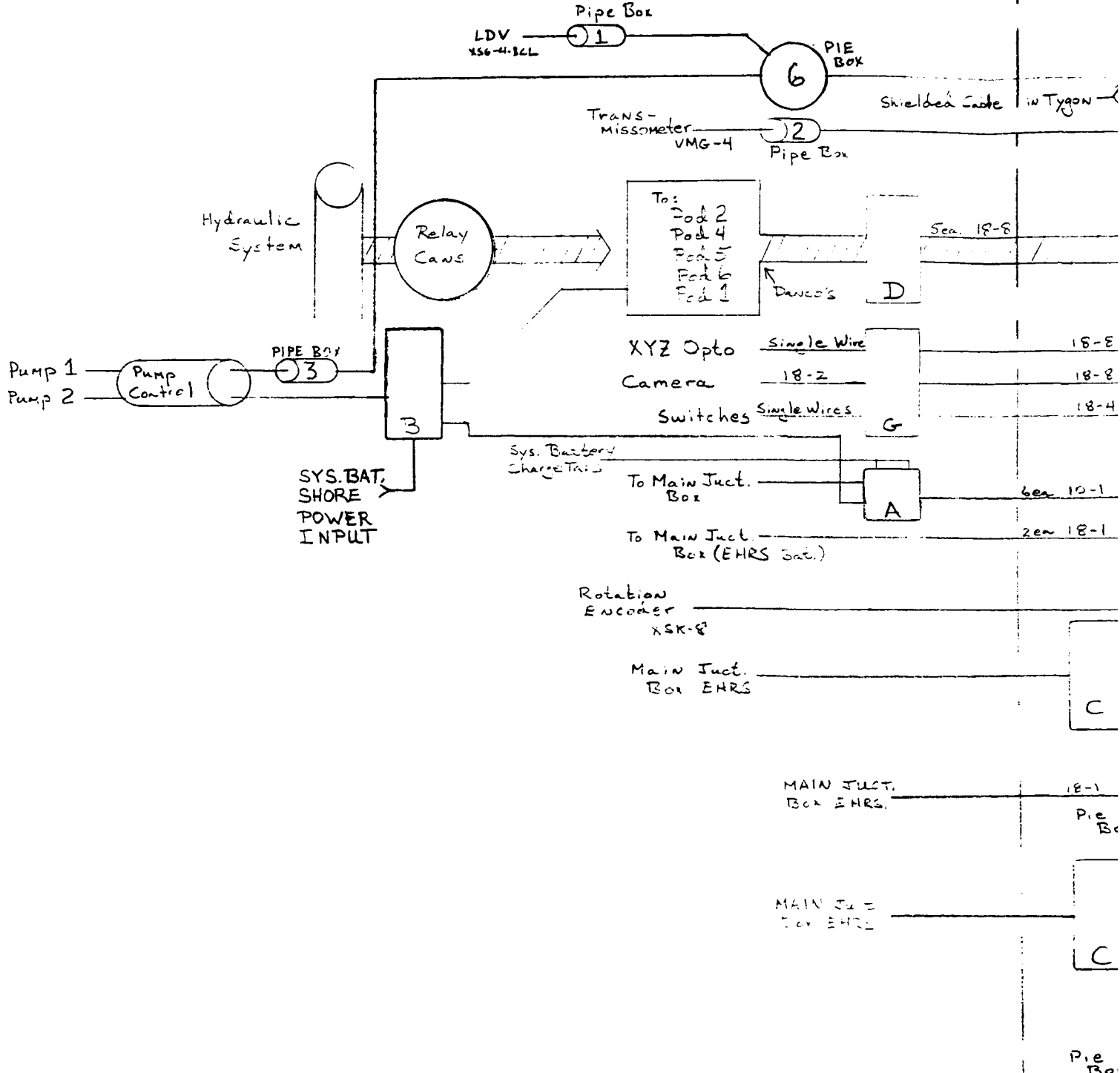
B

A

4

3

Rotatic
Point



EHRS = Emergency Hydrostatic Release System

Rotation Side

WOO

CONTRACT

BY W. J.

9223L-078

4

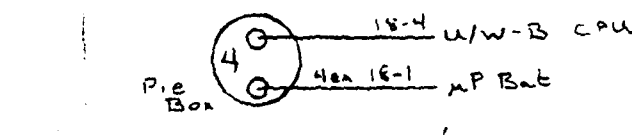
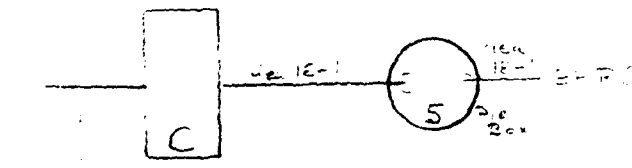
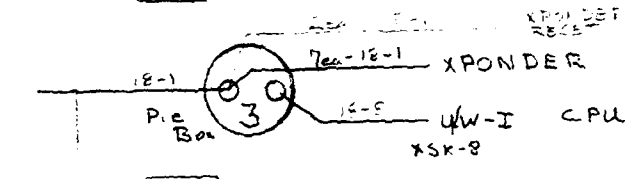
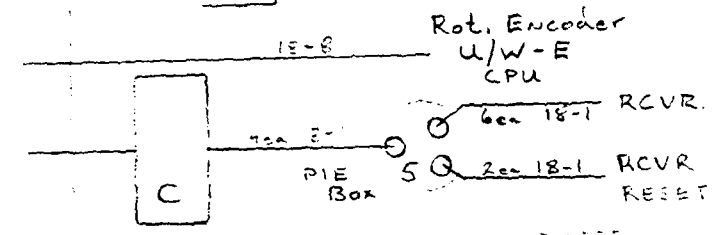
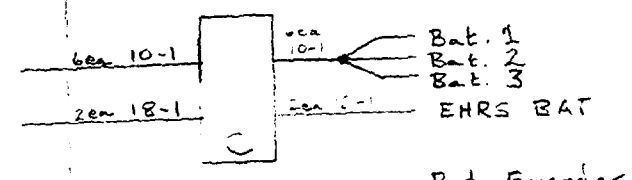
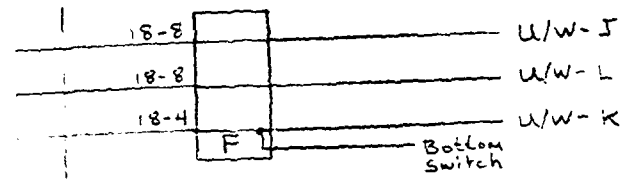
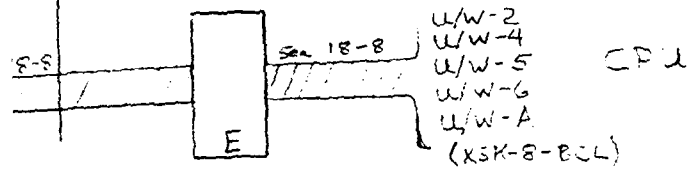
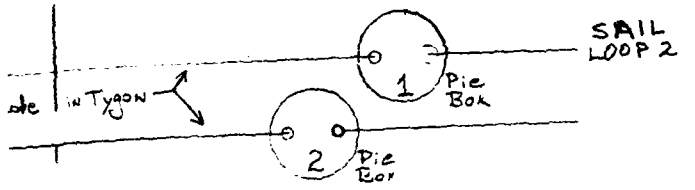
3

2

1

Rotation Point

REVISIONS				
ZONE	LTR	DESCRIPTION	DATE	APPROVED



Leg Side

28 Mar 87 WET
 12 Jun 86 WET
 Rev. 23 Apr 86 WET

D

C

B

A

WOODS HOLE OCEANOGRAPHIC INSTITUTION
 ENGINEERING DEPT.
 WOODS HOLE, MA. 02543

TITLE Main Wiring Harness

SEA DUCT

CONTRACT NO. 10/85.69 CODE NO.
 BY W. E. Terry DATE 3 Dec 85 SIZE B

DWG. NO. SD-B031 OF REV.

2

1

4

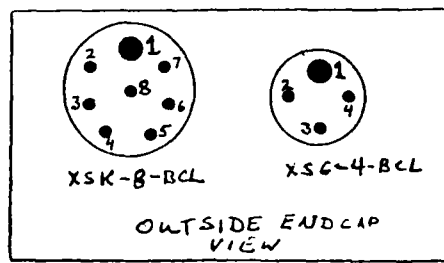
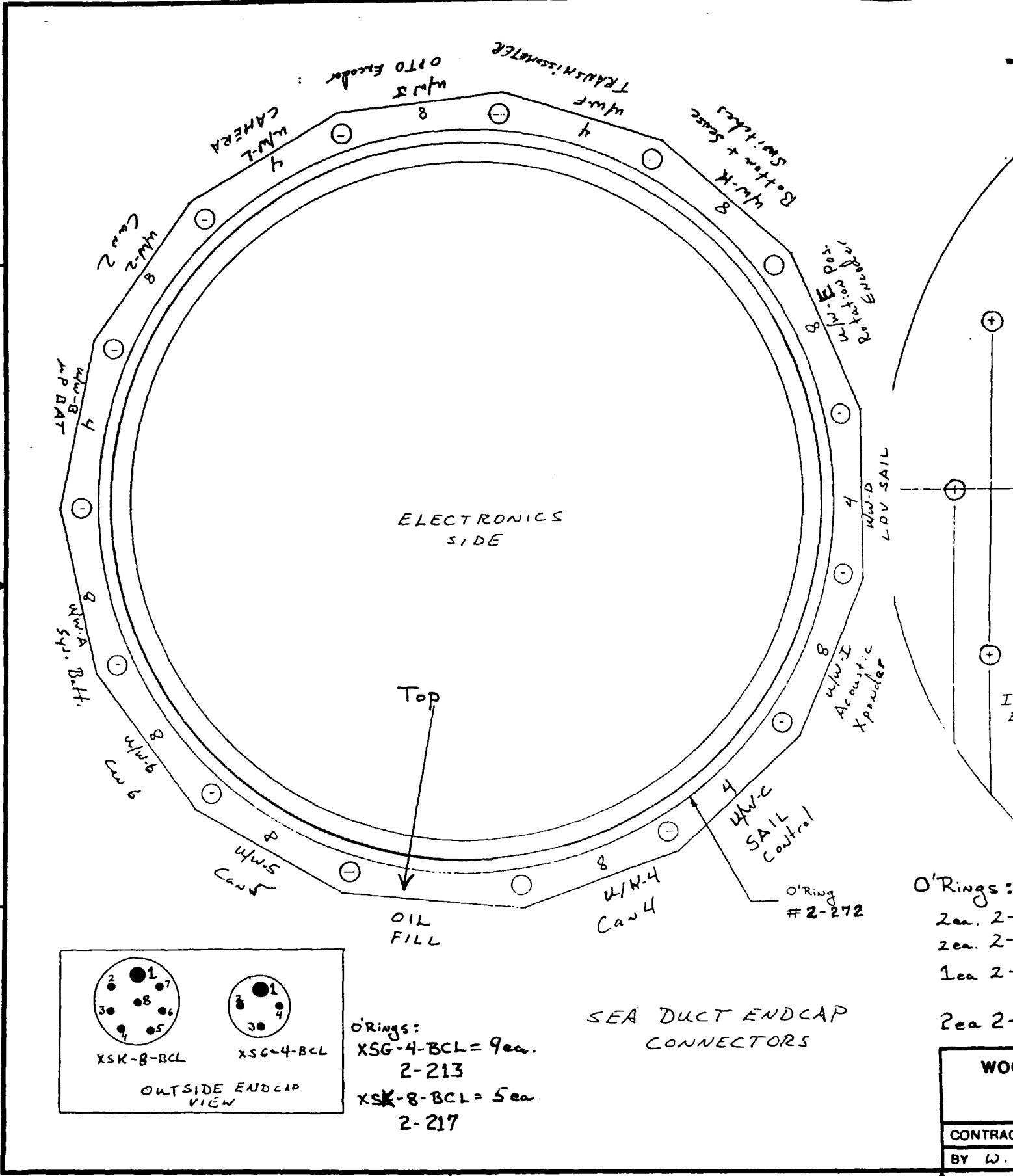
3

D

C

B

A



O'Rings:
 XSG-4-BCL = 9ea. 2-213
 XSK-8-BCL = 5ea. 2-217

O'Rings:
 2ea. 2-
 2ea. 2-
 1ea. 2-
 2ea. 2-

WOI
CONTRACT
BY W.

9225L-078

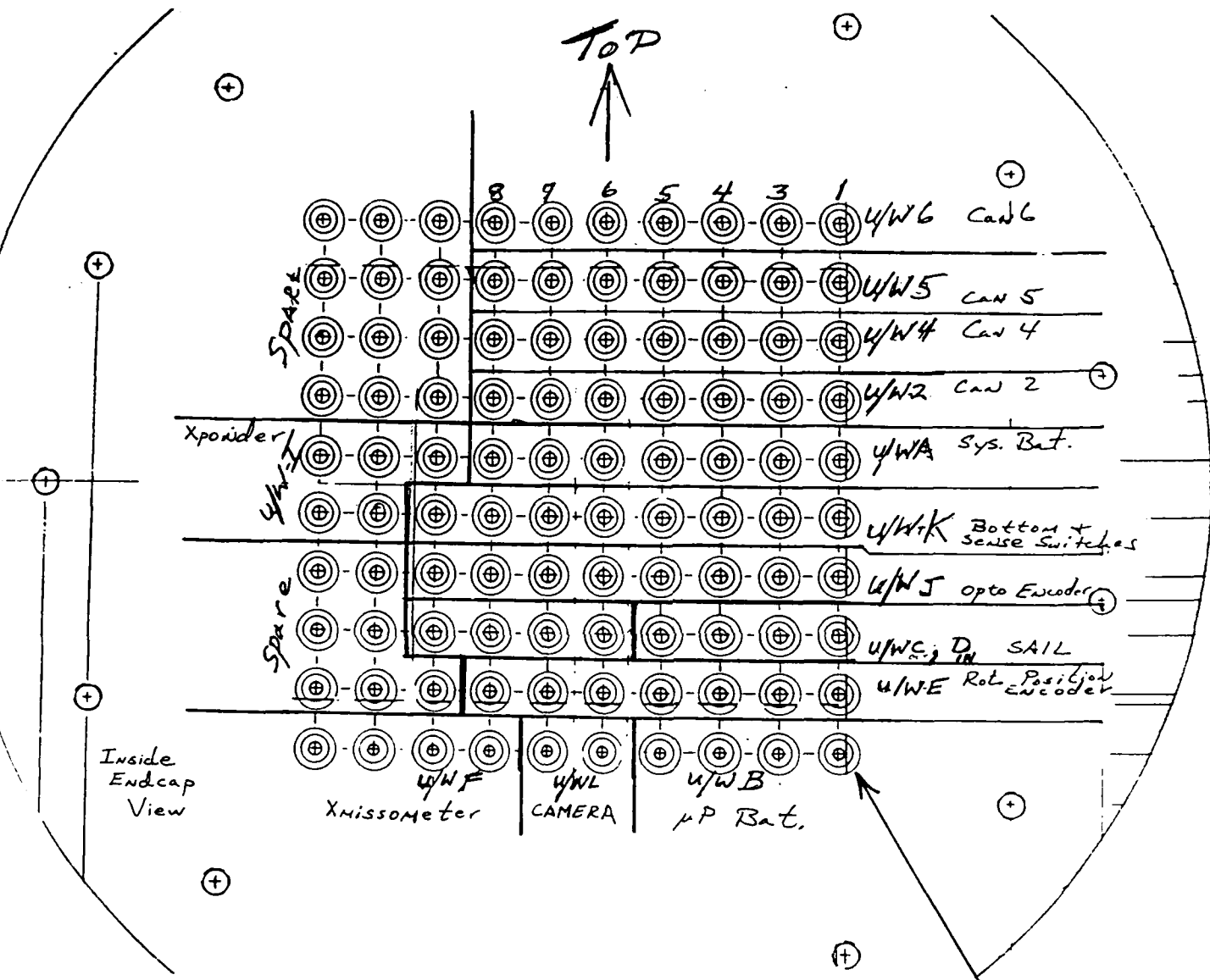
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3

2

1

REVISIONS				
ZONE	LTR	DESCRIPTION	DATE	APPROVED



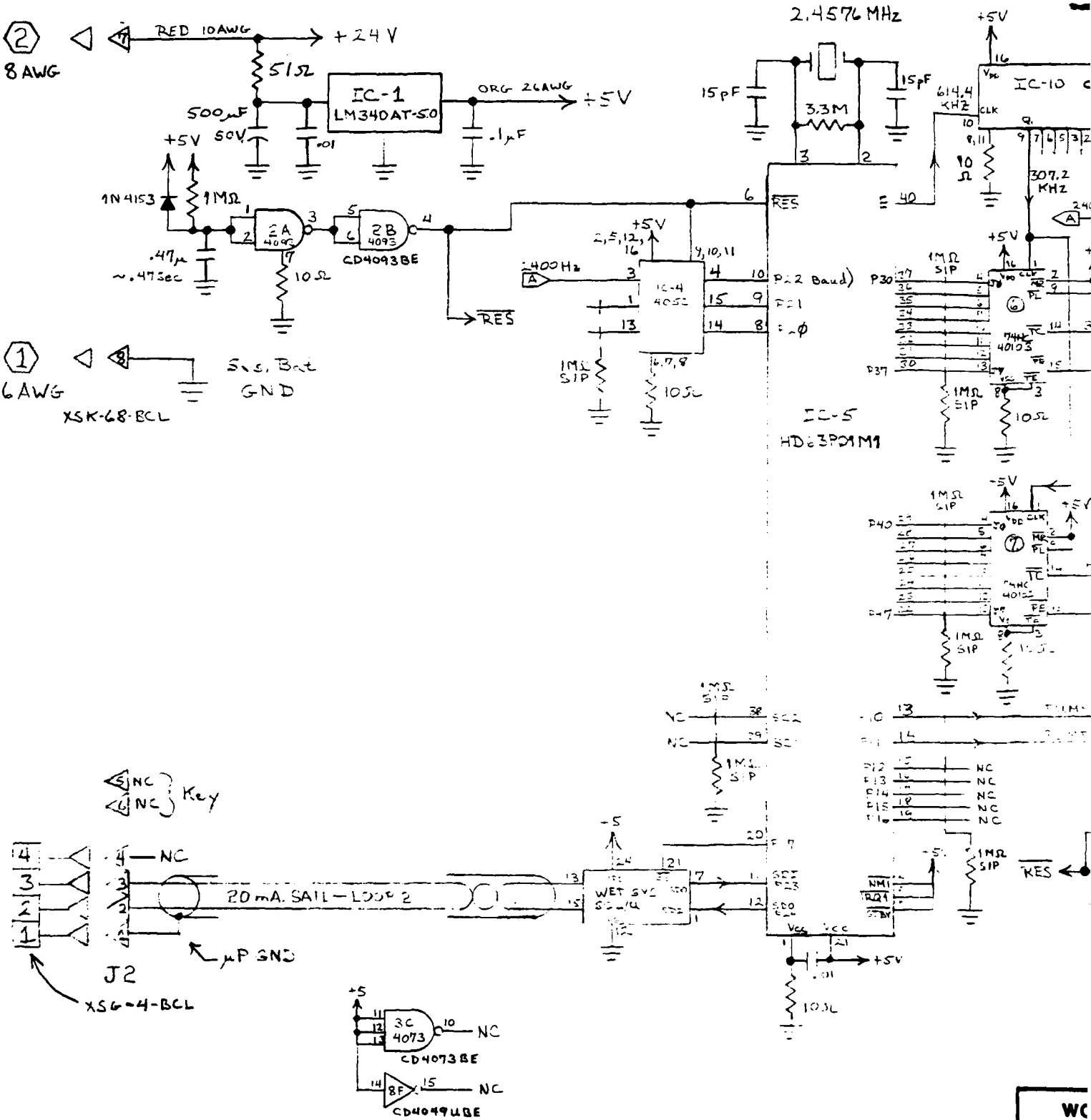
- O'Rings:
- 2 ea. 2-273 } Endcap to
 - 2 ea. 2-276 } Pressure Housing
 - 1 ea 2-272 - Endcap to Oil filled Connector Housing
 - 2 ea 2-112 - Endcap purge plugs

100 ea.
Sinclair Mfg. Co.
TBTHSW605SS
Glass to metal feed-thru.

WOODS HOLE OCEANOGRAPHIC INSTITUTION ENGINEERING DEPT. WOODS HOLE, MA. 02543		TITLE CPU Endcap - Electrical Connections Sea Duct	
CONTRACT NO. 10 / 85.69	CODE NO.	DWG. NO. SD-B-032	OF
BY W. Terry	DATE 13 Dec 85	SIZE B	REV.

2

1



① 6 AWG XSK-68-BCL S.S. Bat GND

② 8 AWG RED 10AWG +24V

IC-1 LM340AT-50 ORG 26AWG +5V

1N4153 50V 500µF 1MΩ 10Ω

IC-2 2A 4093

IC-3 2B 4093

IC-4 4093 400Hz

2.4576 MHz

IC-5 HD6301M1

IC-6 4093

NC Key

J2 XSG-4-BCL 20 mA SAIL-100P2

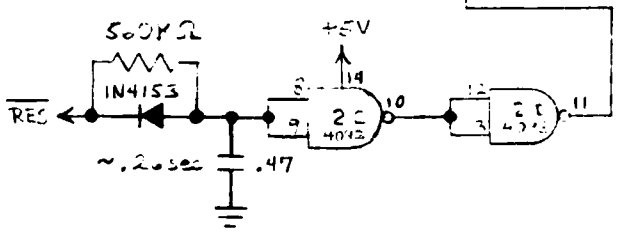
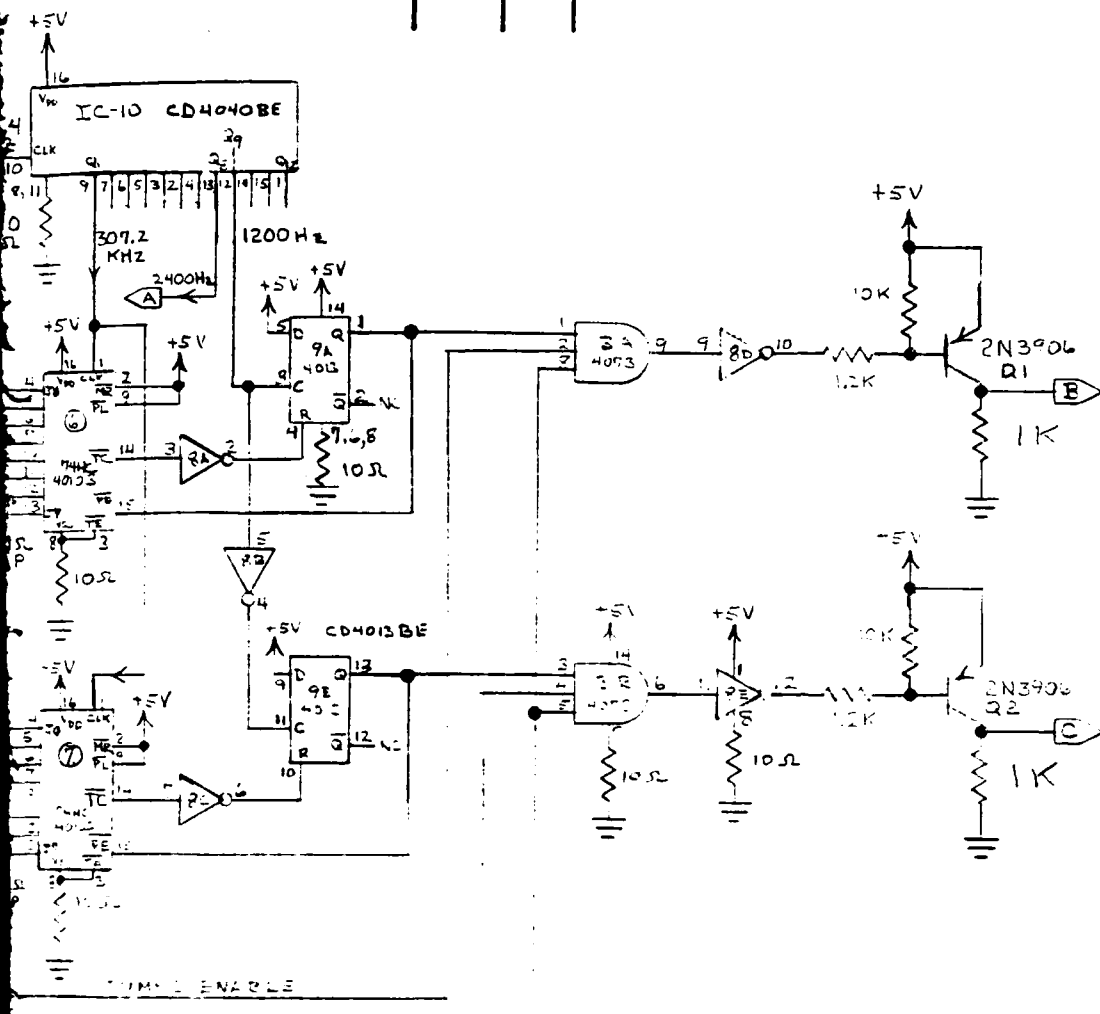
IC-4 3C 4073

Continued on DWG SD-B034
Layout on DWG SD-B035

WC
CONTR
BY

92231-078

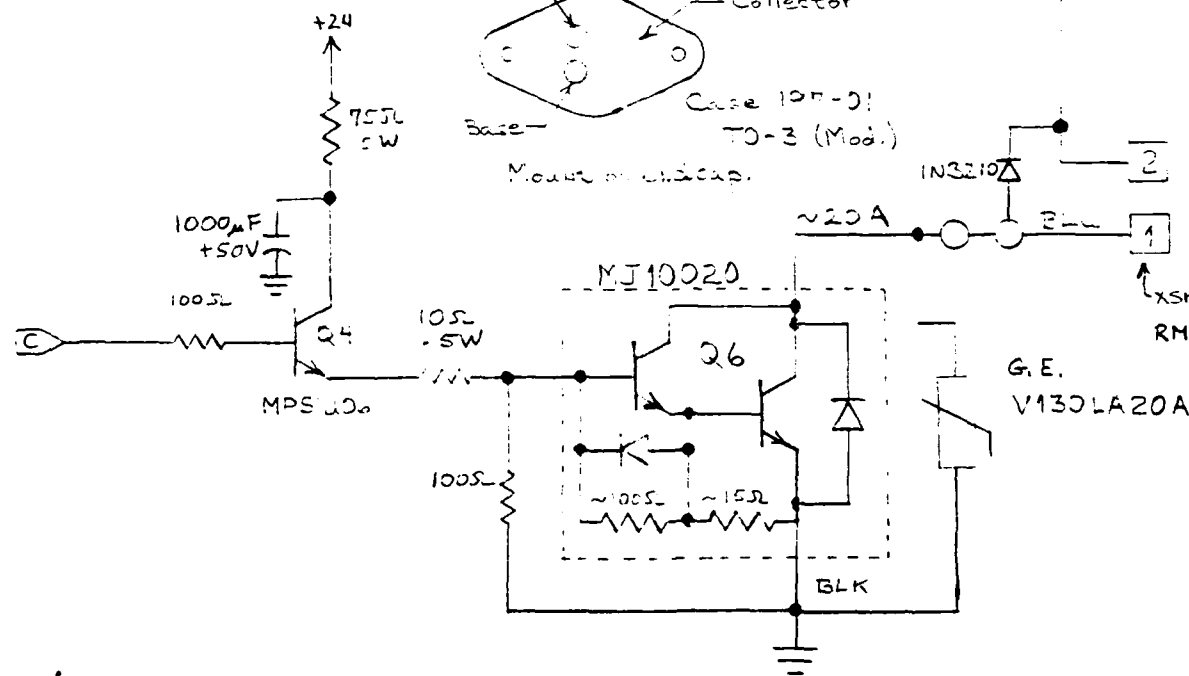
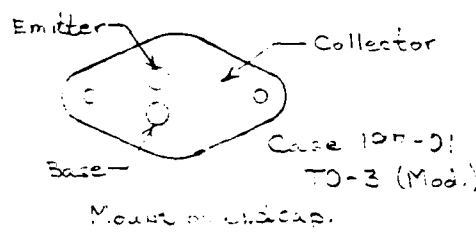
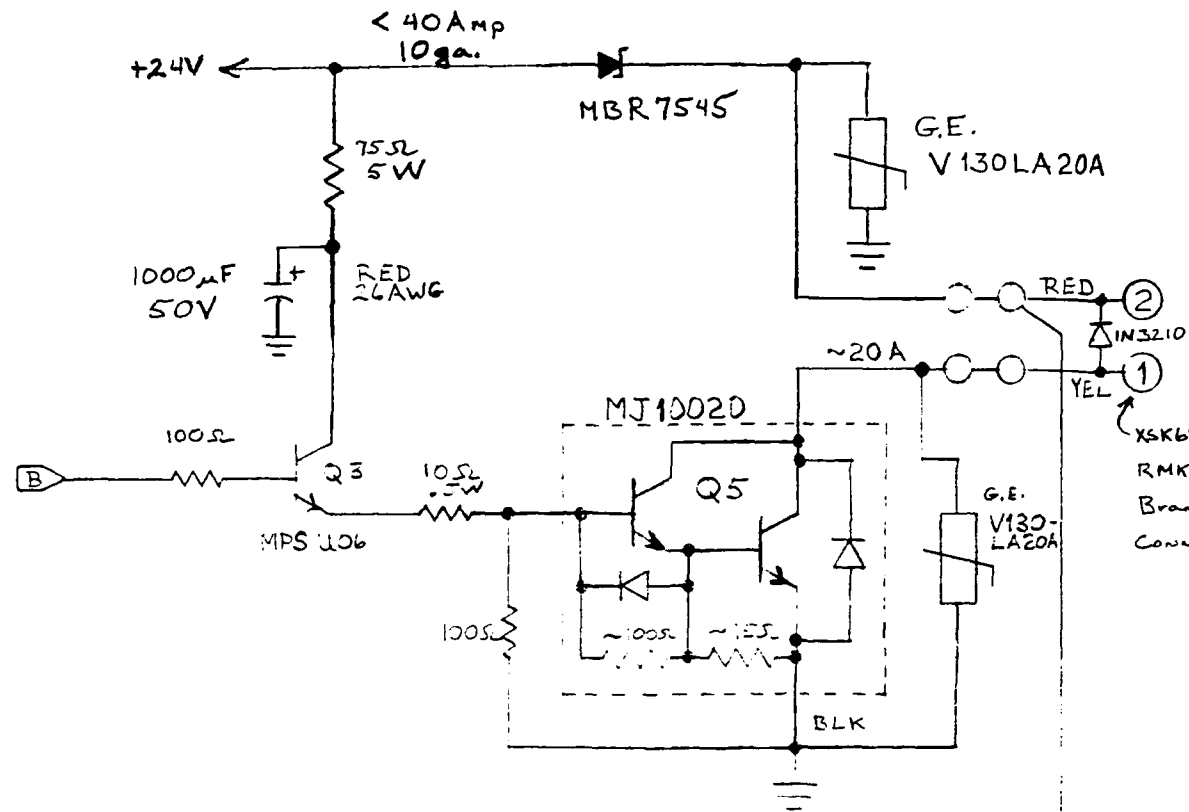
REVISIONS				
ZONE	LTR	DESCRIPTION	DATE	APPROVED



CA 1	CA 2	CA 3	CA 4
1 1N4153	1 15pf	1 1.2K	1 51Ω
2 1M	2 XT61	2 10K	2 .01μF
3 .47μF	3 15pf	3 2N3906	3 .1μF
4 1N4153	4 3.3M	4 1.0K	4
5 560K	5	5 1.2K	5
6 .47μF	6	6 10K	6
		7	7
		8 C	
		9 2N3906	
		10 1.0K	

REV 26 Nov. 86 W.E.T.
REV. 23 Apr 86 W.E.T.

WOODS HOLE OCEANOGRAPHIC INSTITUTION ENGINEERING DEPT. WOODS HOLE, MA. 02543		TITLE Pump Controller (Control Circuit)		Sea Duct	
CONTRACT NO. 10/85.69		CODE NO.		DWG. NO. SD-B-033	
BY W. TERRY		DATE 27 Feb 86		SIZE B	
1 OF 3		REV.		1	



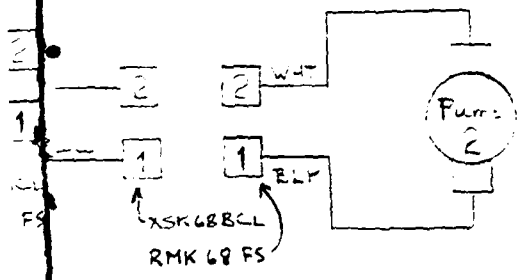
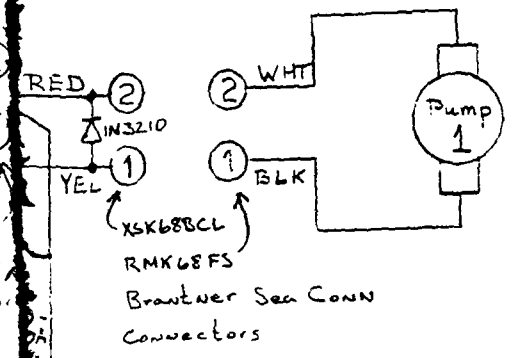
Continued From Dwg. SD-B033

9223L-078

CON BY

REVISIONS				
ZONE	LTR	DESCRIPTION	DATE	APPROVED

A 20A



OLA 20A

REV 26 Nov 86 W.E.T.
REV 23 Apr 86 W.E.T.

WOODS HOLE OCEANOGRAPHIC INSTITUTION ENGINEERING DEPT. WOODS HOLE, MA. 02543		TITLE Pump Controller (Power Circuitry) Sea Duct		
CONTRACT NO. 10/85.69	CODE NO.	DWG. NO. SD-B-034	2 OF 3	REV.
BY W. Terry	DATE 27 Feb 86	SIZE B	1	

D

C

B

A

2

1

LM
340
ATE

CA4

CA 2

10 4040

IN=OUT

SOC M F
SCY
on Back

J2

4053

5
HD63FG1
M1

40103

401

2 4093

1052

1052

105

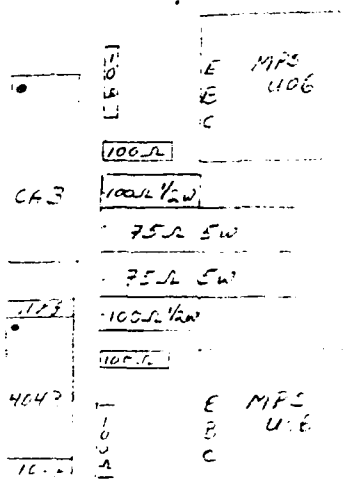
SC L U

CA 1

M
S
F

40103
1052

401
105



2 ea:
1000V
SW
in Rack

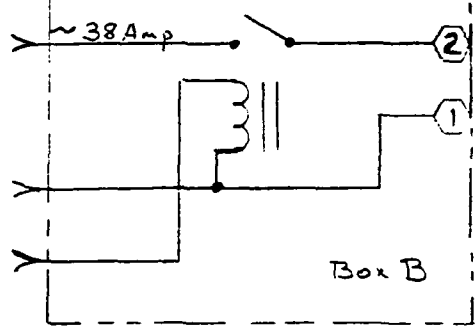
REV 26 Nov 86 W.E.T.
REV 20 Apr 86 W.E.T.

WOODS HOLE OCEANOGRAPHIC INSTITUTION WOODS HOLE, MASS. 02543		TITLE	Pump Controller (Layout)
PROJ.	10/RS.69	BY	KAWannop
SHEET	3 OF 3	DATE	6 March 86
		SD-B-035	Sea Duct

SAIL LOOP 2
"LDV RESET"
GND

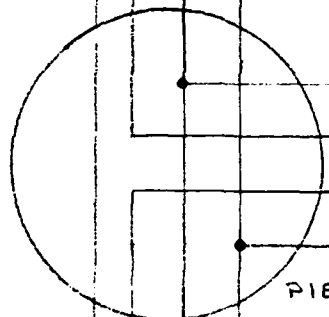
PIE BOX 1

SYS. BAT. +24V

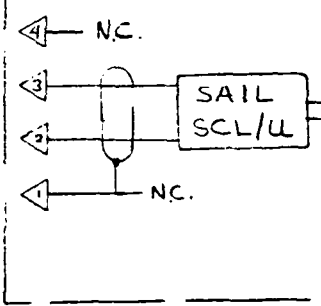


Box B

PIPE BOX 3



PIE BOX 6



Pump

Belden 8723
2 pr., Each Shielded
in oil filled tubing

SHORTED LOOP 9/86
LDV NOT SAIL COMPATABLE

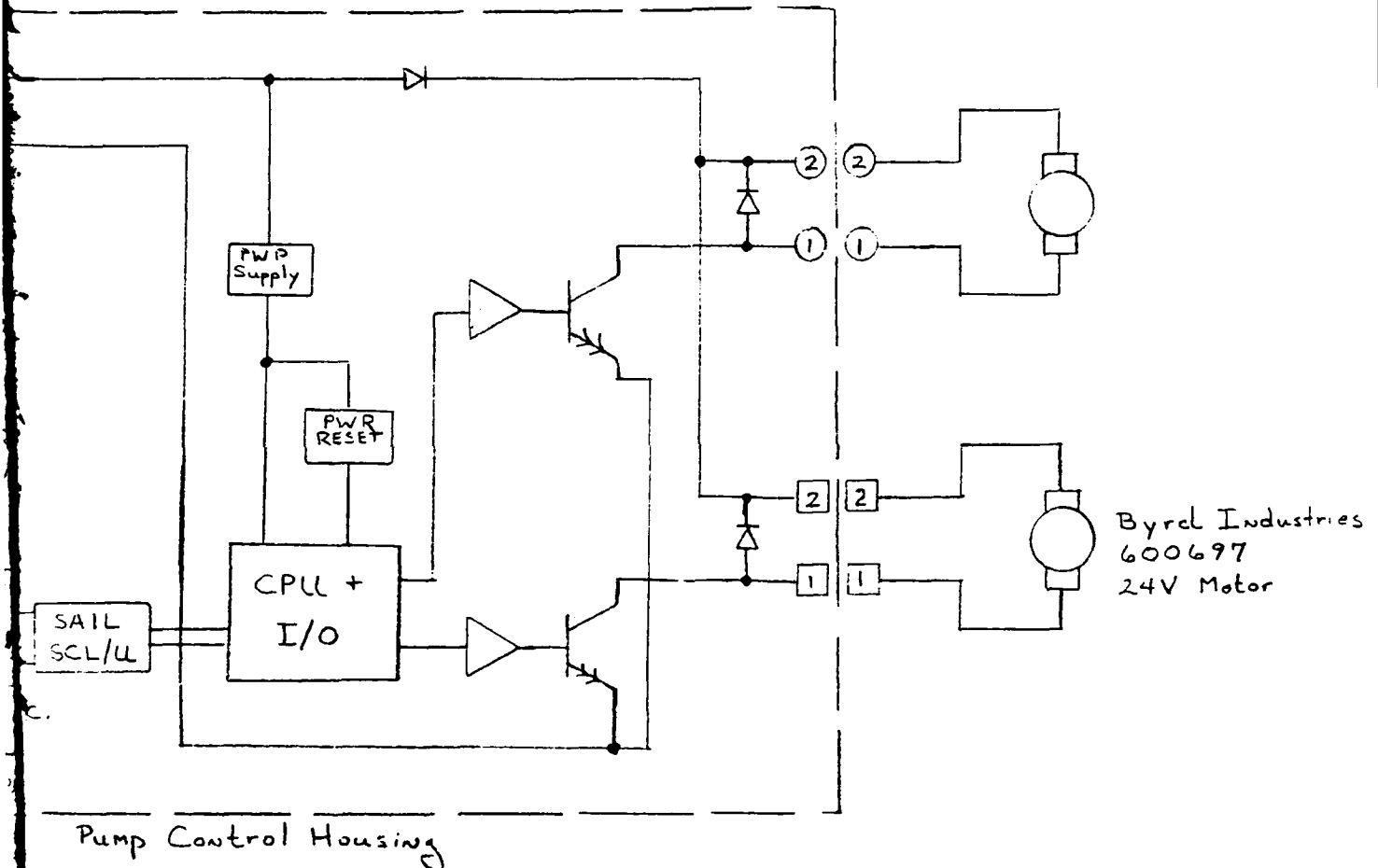
PIPE BOX 1

See Dwg SD-BØ1Ø for cable electrical detail.

LDV

WC
CONTRA
BY W.

REVISIONS				
ZONE	LTR	DESCRIPTION	DATE	APPROVED

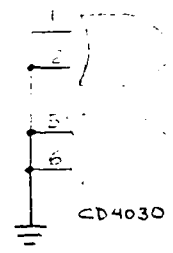
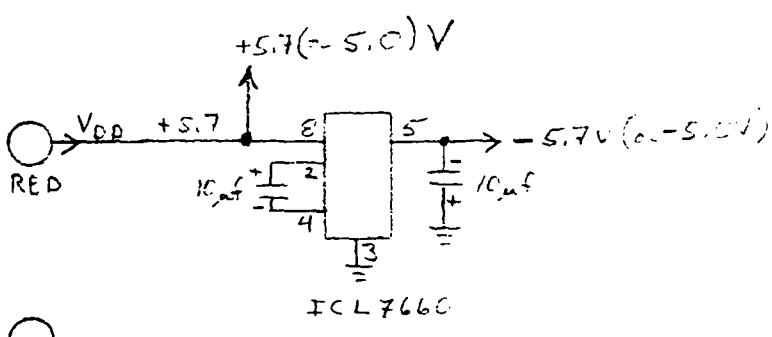
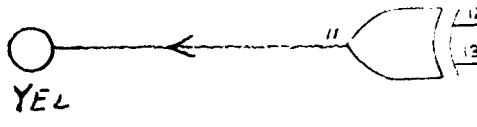
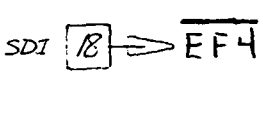
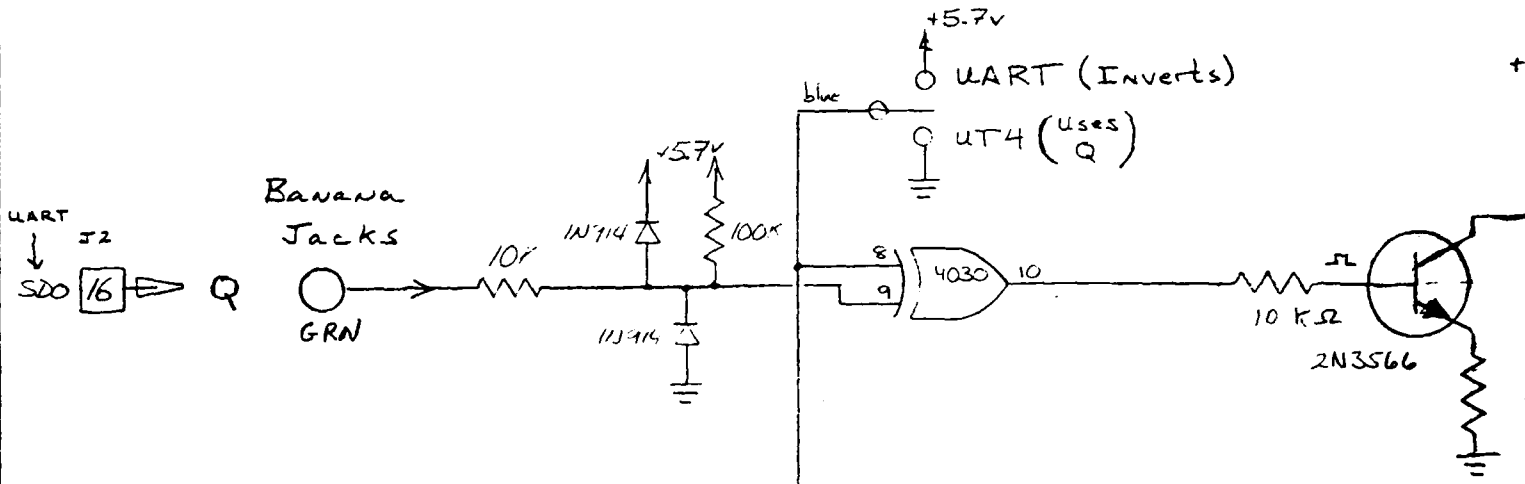
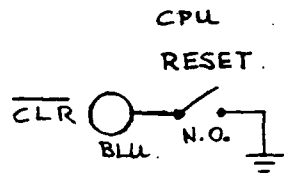


Pump Control Housing

detail.

Rev 26 Nov 86 WET
REV 12 Jun 86 WET

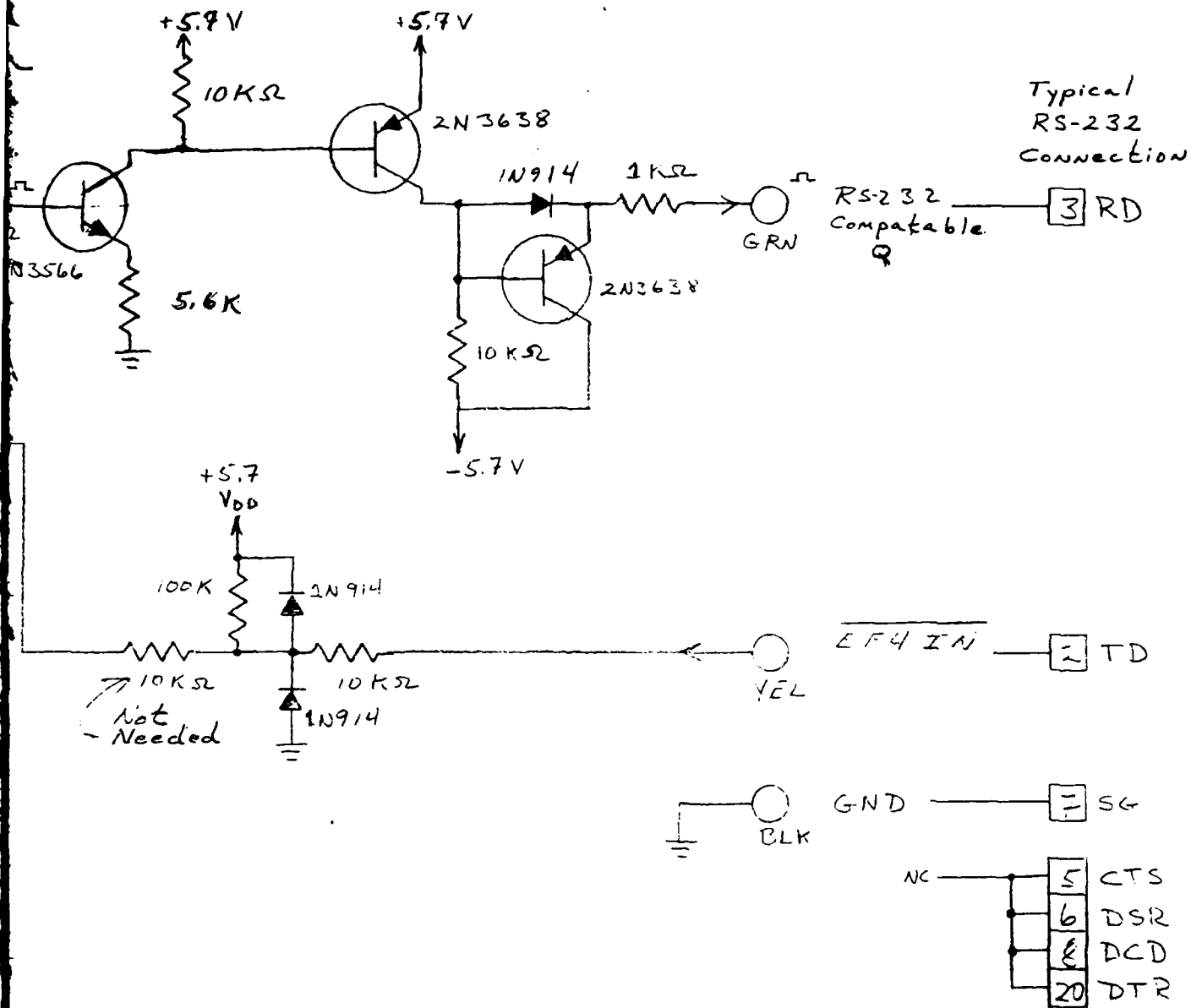
WOODS HOLE OCEANOGRAPHIC INSTITUTION ENGINEERING DEPT. WOODS HOLE, MA. 02543			TITLE Pump Control Block Diagram		Sea Duct
CONTRACT NO. 10/85.69	CODE NO.	DATE 4 Mar 86	SIZE B	DWG. NO. SD-BØ36	
BY W. TERRY				OF	REV. 26 Nov 86



10
Not
Nee

Connections
for Sea Data
Cable to J2

NOTE:
GND not connected to Chassis



Rev 24 Nov 86 WET
 Rev 28 June 88 ACU

WOODS HOLE OCEANOGRAPHIC INSTITUTION
 WOODS HOLE, MASS. 02543
 PROJ. 10/82.69 BY W. TERRY
 SHEET 1 OF 1 DATE

TITLE CMOS - RS-232
 Interface
 Sea Duct
 SD-BØ37

Note - Pressure Housing is isolated from ground.

Case Gnd. (N.C.)

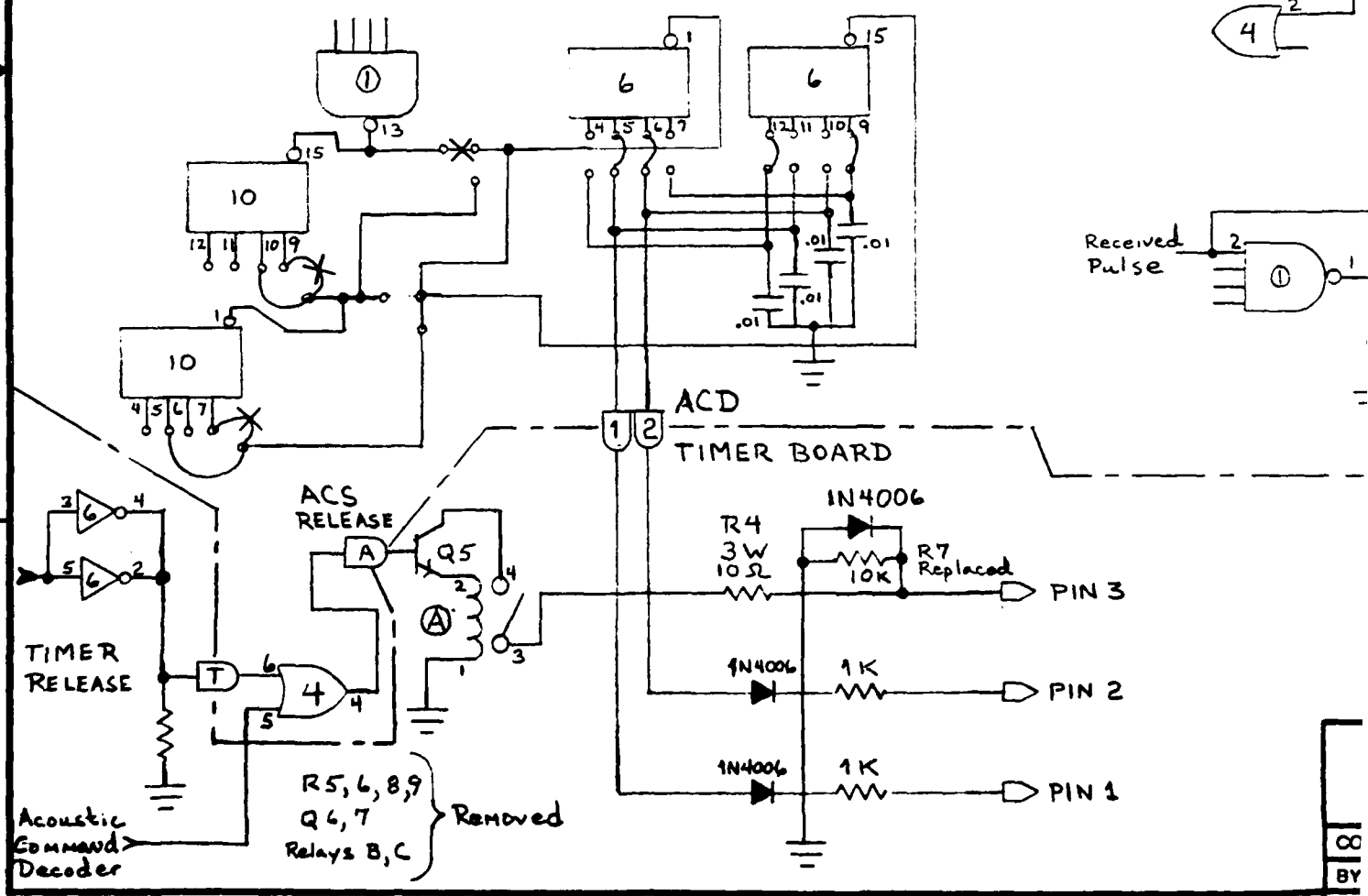
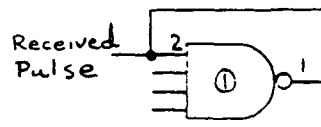
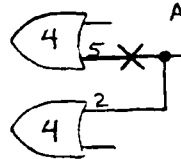
V+

PIN R "Reset"

GND (Isolated from Case)

PIN T "PING"

Acoustic Command Decoder Board (ACD)



9228L-078

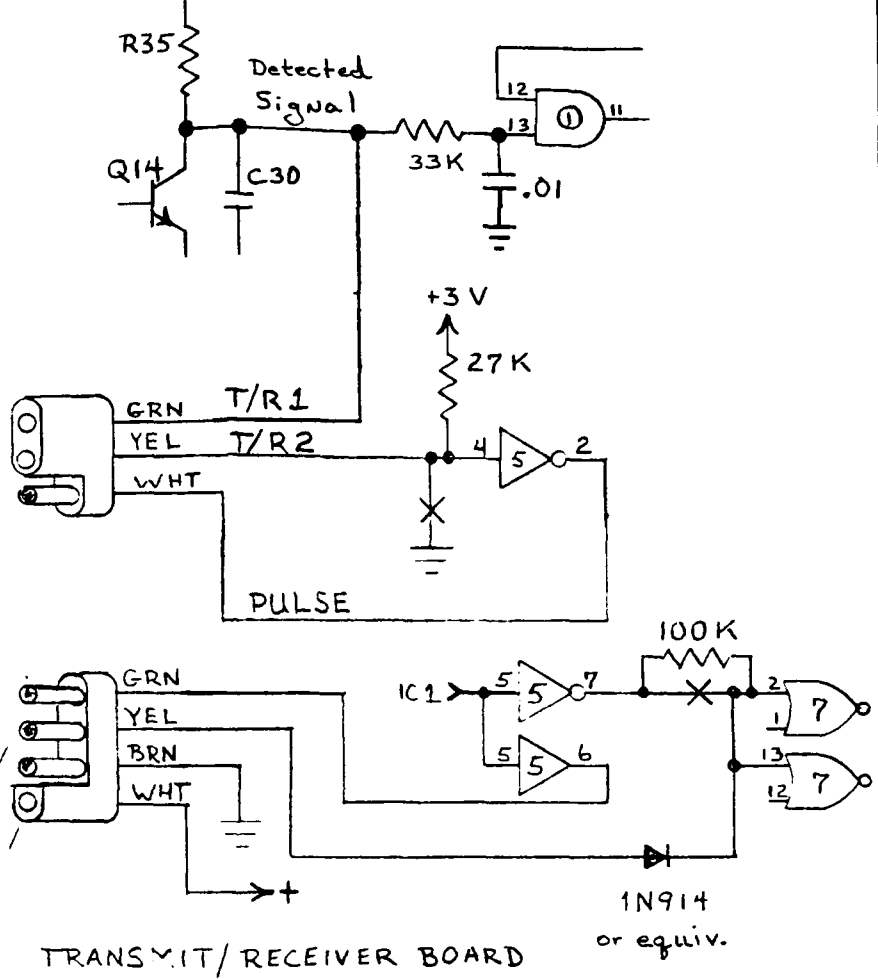
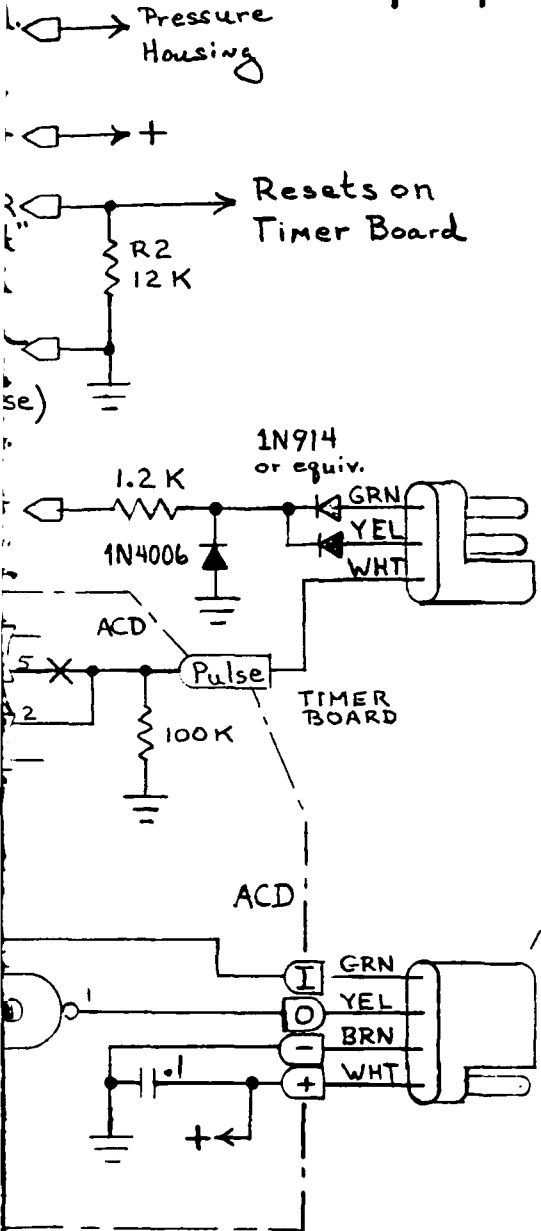
BY

2

1

REVISIONS

ZONE	LTR	DESCRIPTION	DATE	APPROVED



X = Cut Trace
 ▷ = End Cap Mecca Conn.
 ◻ = Transition between boards (Solder Connection)

ACD = Acoustic Command Decoder (Board)

WOODS HOLE OCEANOGRAPHIC INSTITUTION
ENGINEERING DEPT.
WOODS HOLE, MA. 02543

CONTRACT NO. _____ CODE NO. _____

BY W. Terry DATE 30 Dec. 84 SIZE B

TITLE Q15. Acoustic Command Xcvr.
Modifications Sea Duct

DWG. NO. SD-B038 OF _____ REV. _____

2

1

D

C

B

A

P

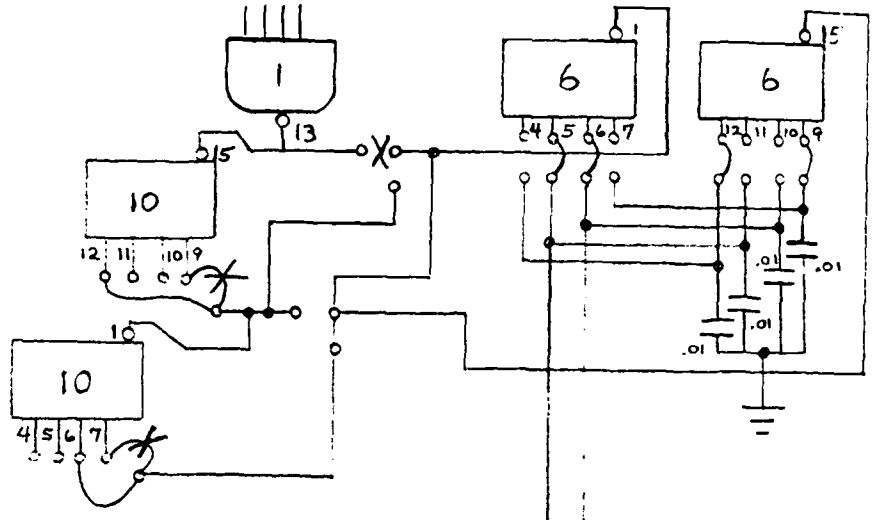
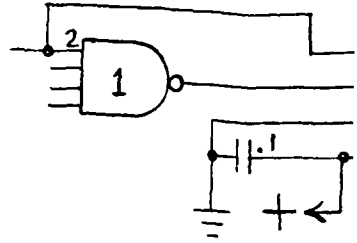
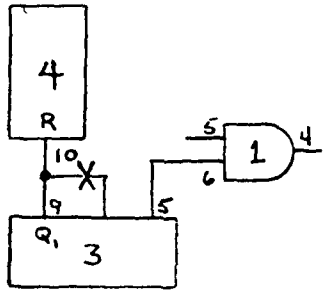
C

B

A

9223L-076

TRANSMIT /
RECEIVE
BOARD



ADDRESS 0010

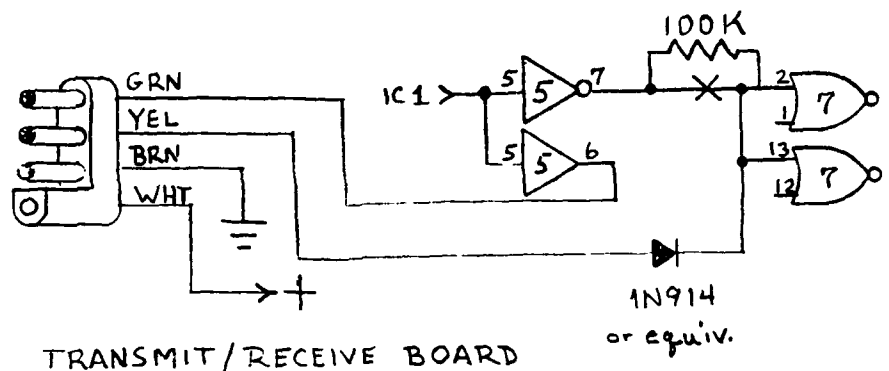
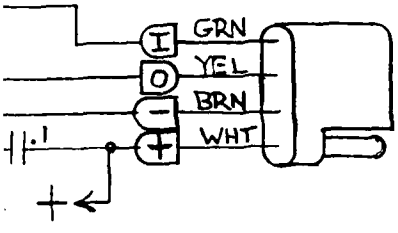
- X = Cut Trace
- ▷ = End Cap Mecca Conn.
- ◻ = Transition between boards
(Solder Connection)

2

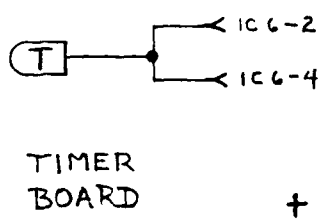
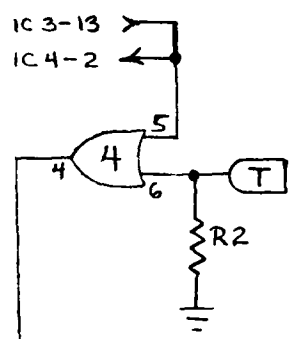
1

REVISIONS

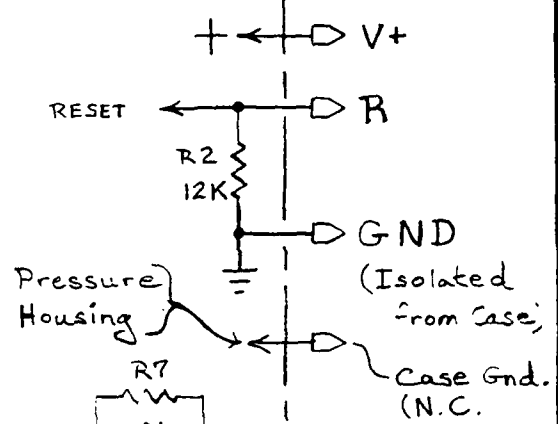
ZONE	LTR	DESCRIPTION	DATE	APPROVED



TRANSMIT/RECEIVE BOARD



TIMER BOARD



ENDCAP

ACOUSTIC CMD. DECODER BOARD

Set for 1/10 day

WOODS HOLE OCEANOGRAPHIC INSTITUTION
 ENGINEERING DEPT.
 WOODS HOLE, MA. 02543

TITLE
 O.I.S. Acoustic Command Rcvr.
 Modifications Sea Duct

CONTRACT NO. _____ CODE NO. _____
 BY W. Terry DATE 30 Dec 84 SIZE B

DWG. NO. SD-B039 OF _____ REV. _____

2

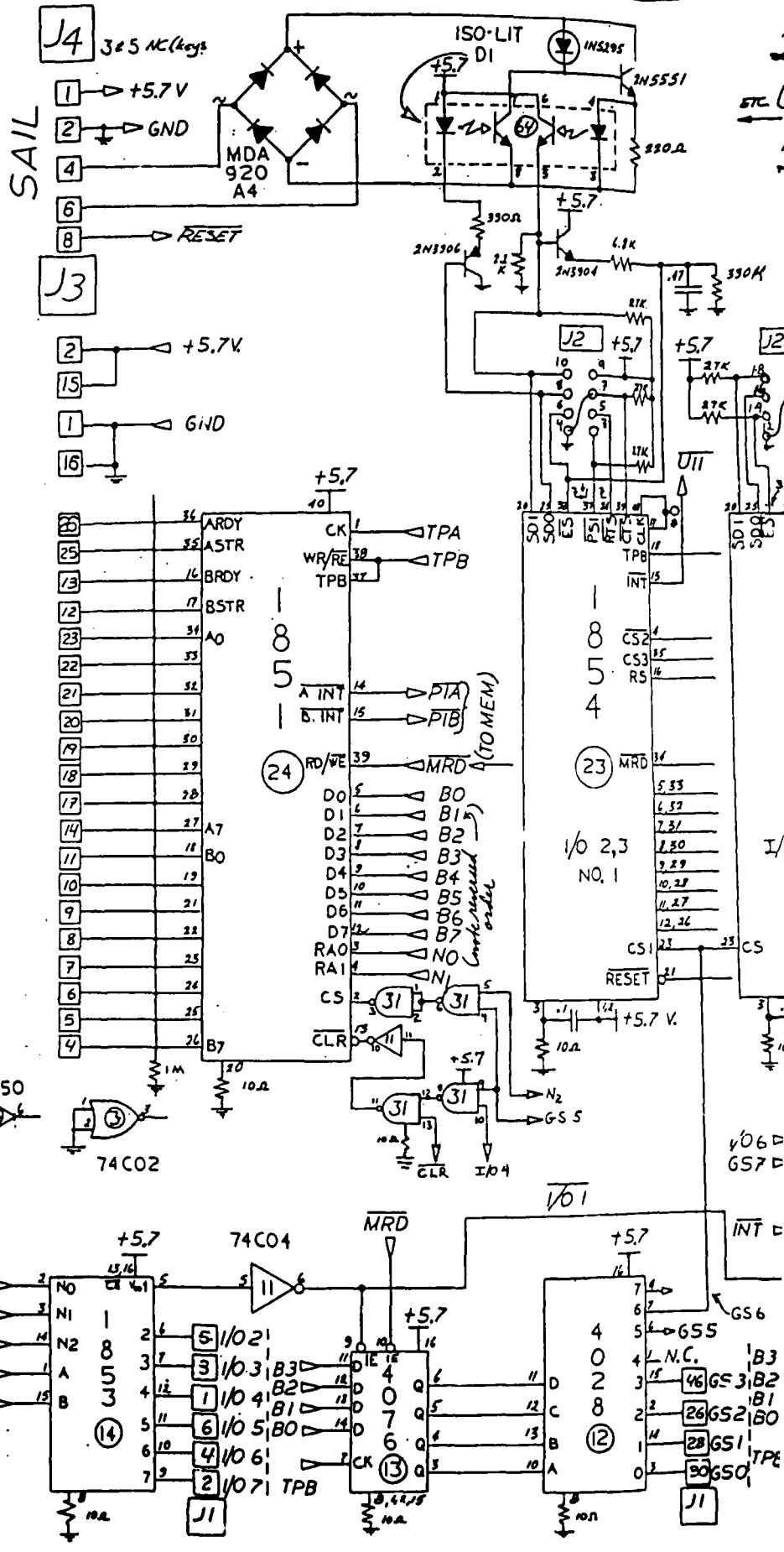
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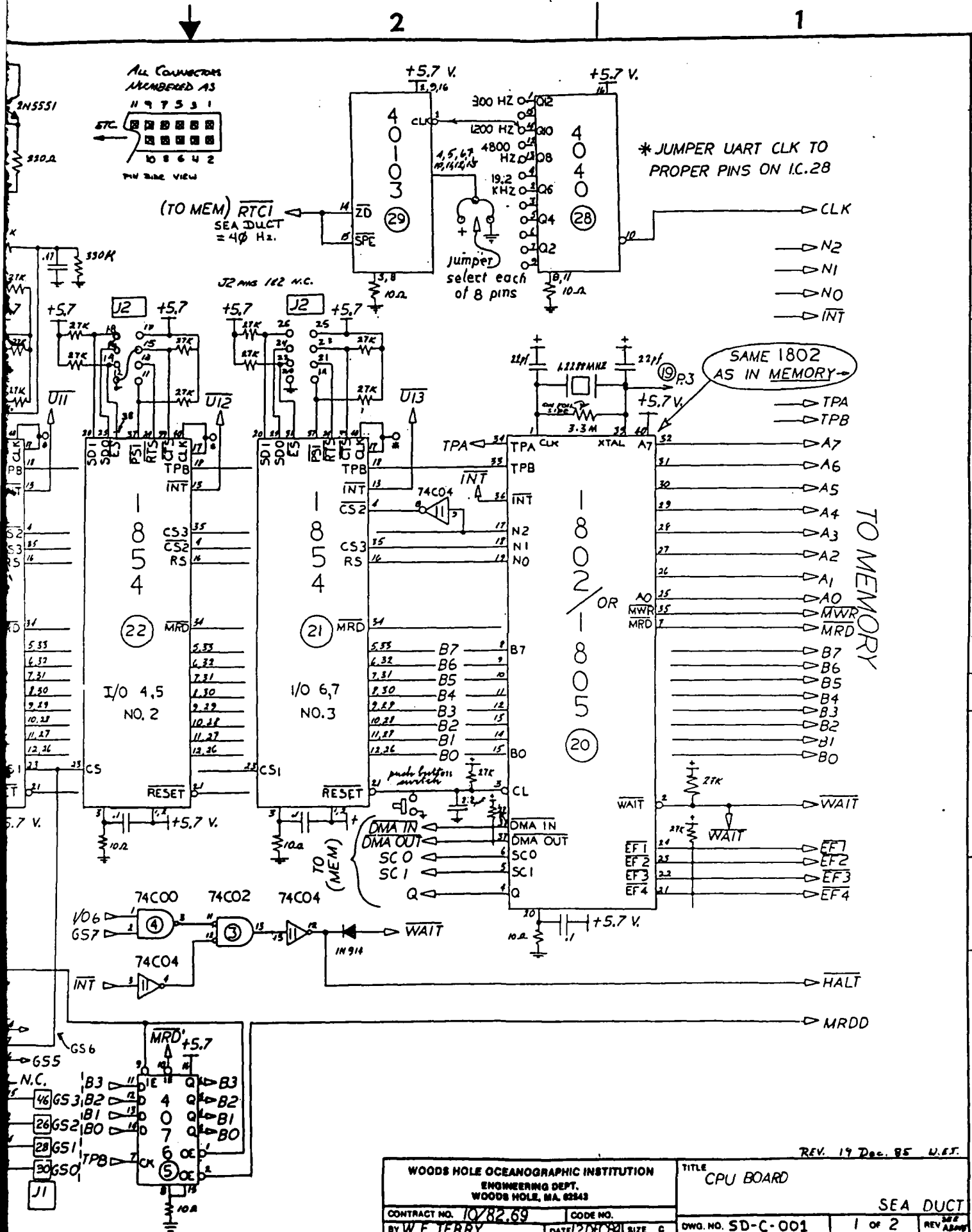
D

C

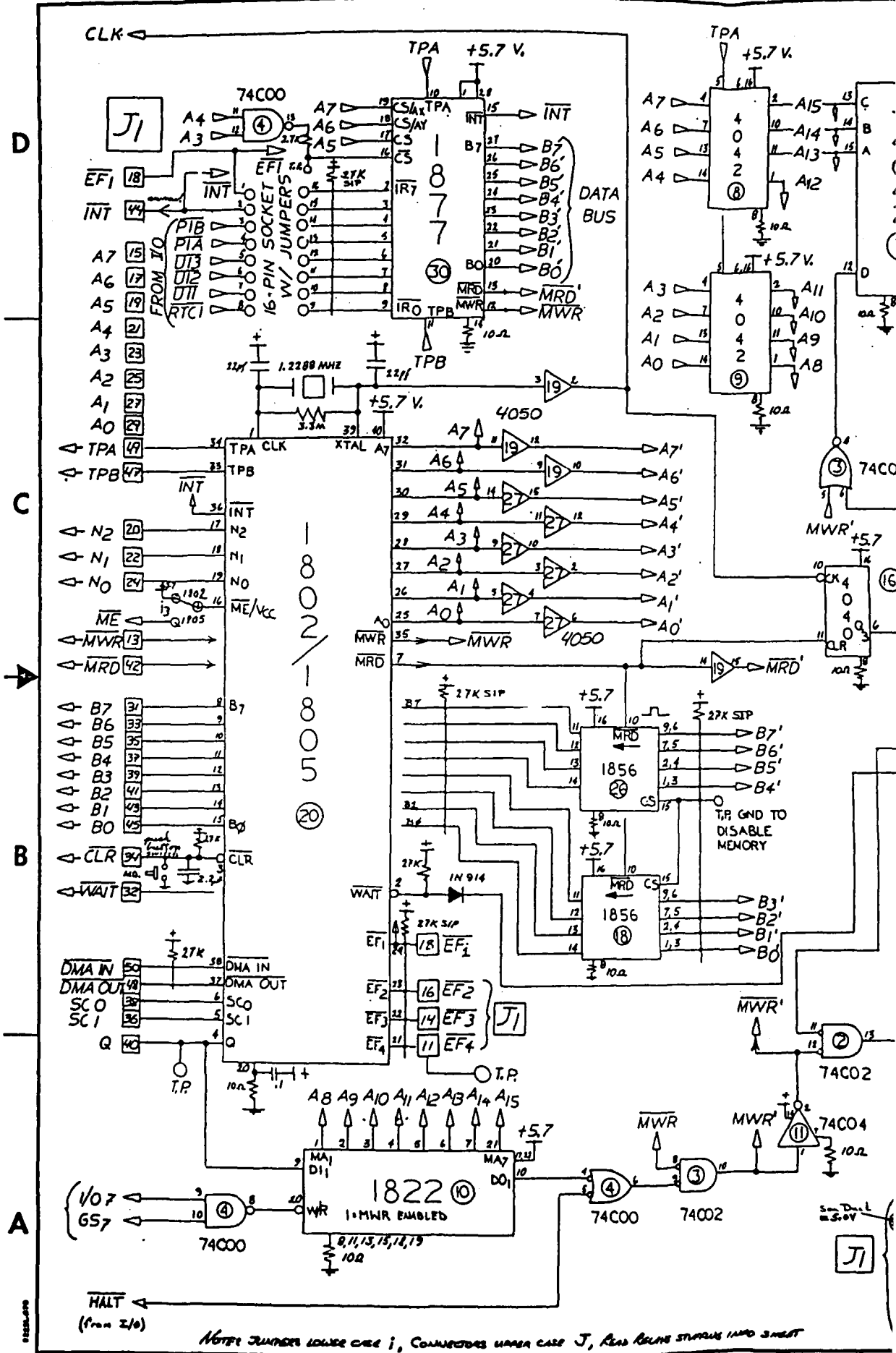
B

A





WOODS HOLE OCEANOGRAPHIC INSTITUTION ENGINEERING DEPT. WOODS HOLE, MA. 02543		TITLE CPU BOARD	
CONTRACT NO. 10782.69	CODE NO.	DWG. NO. SD-C-001	1 OF 2
BY W.E. TERRY	DATE 2/1/81	SIZE G	REV. 5/82



D

C

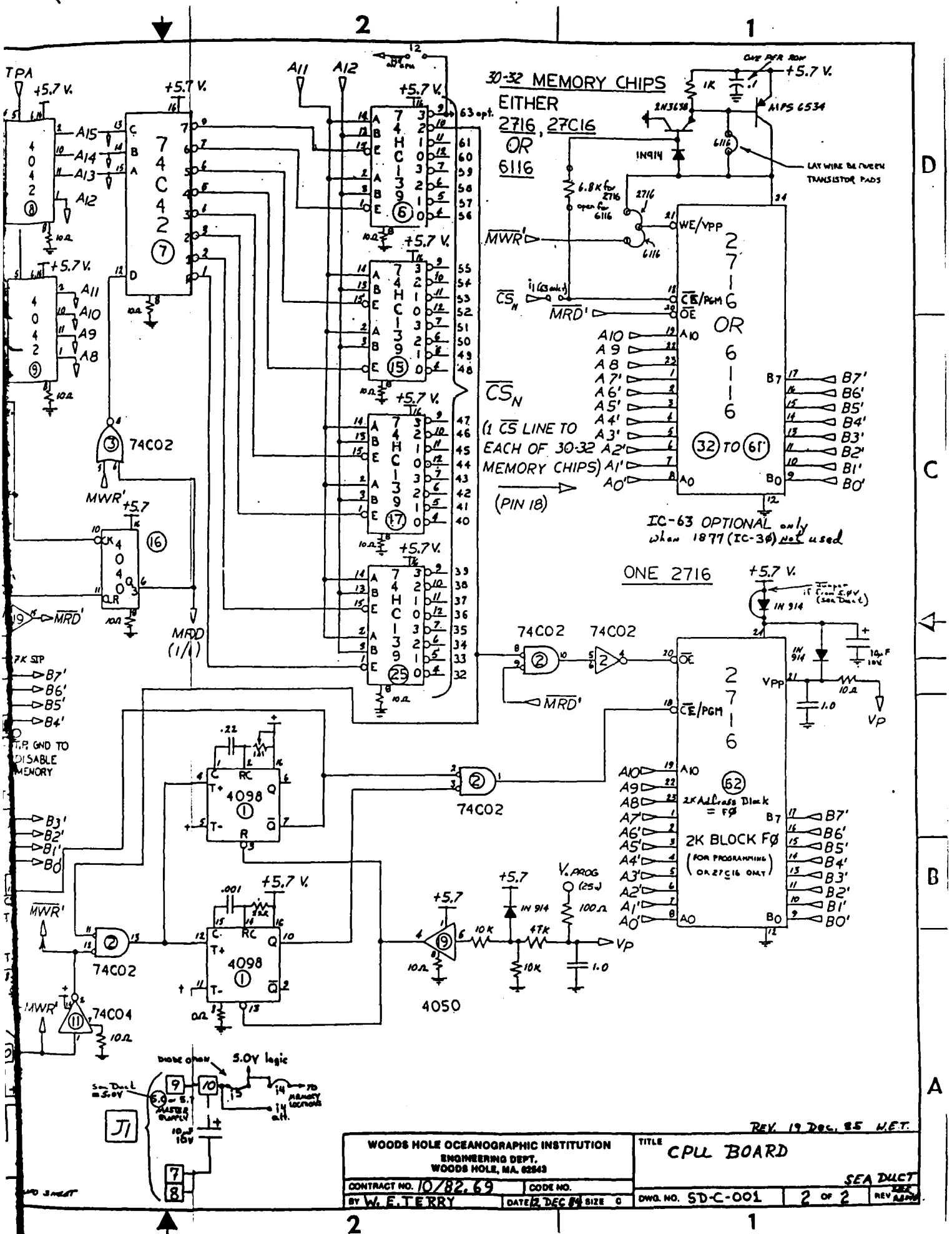
B

A

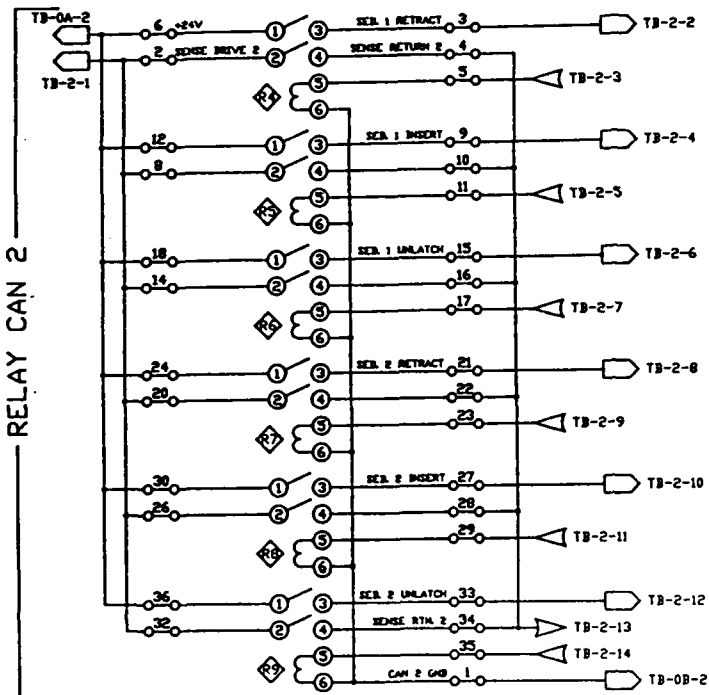
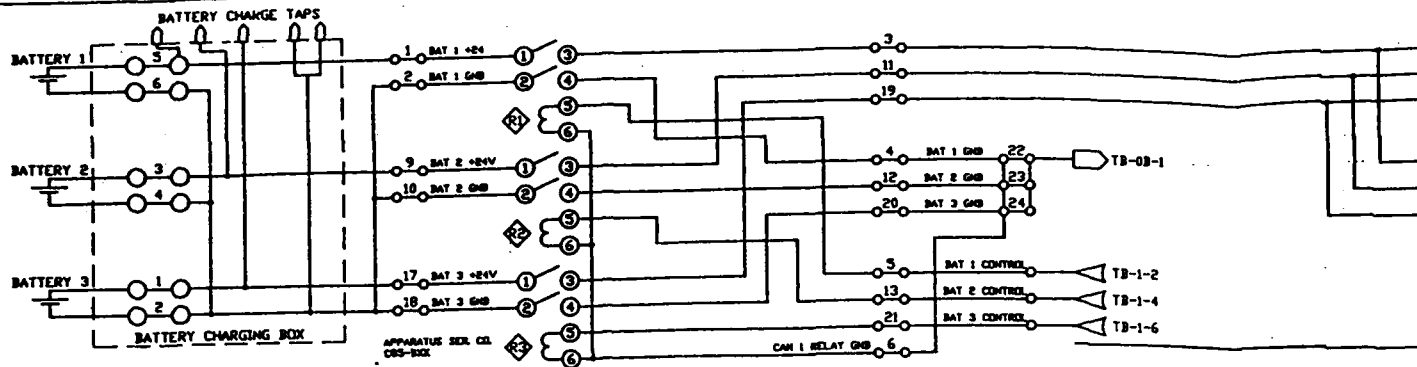
RES-600

HALT (from I/O)

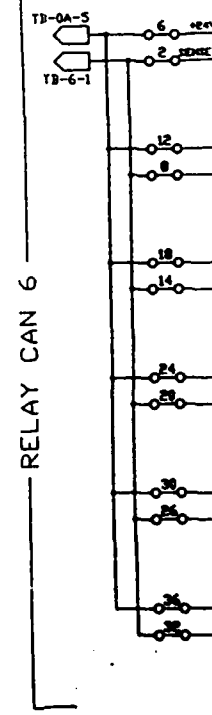
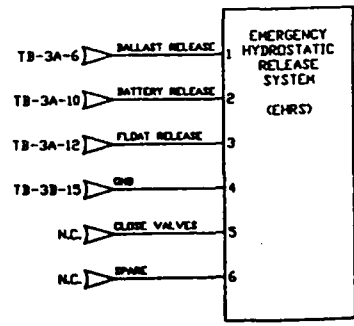
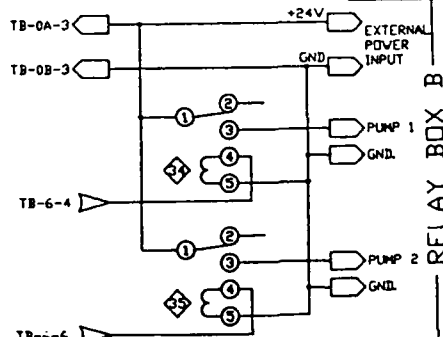
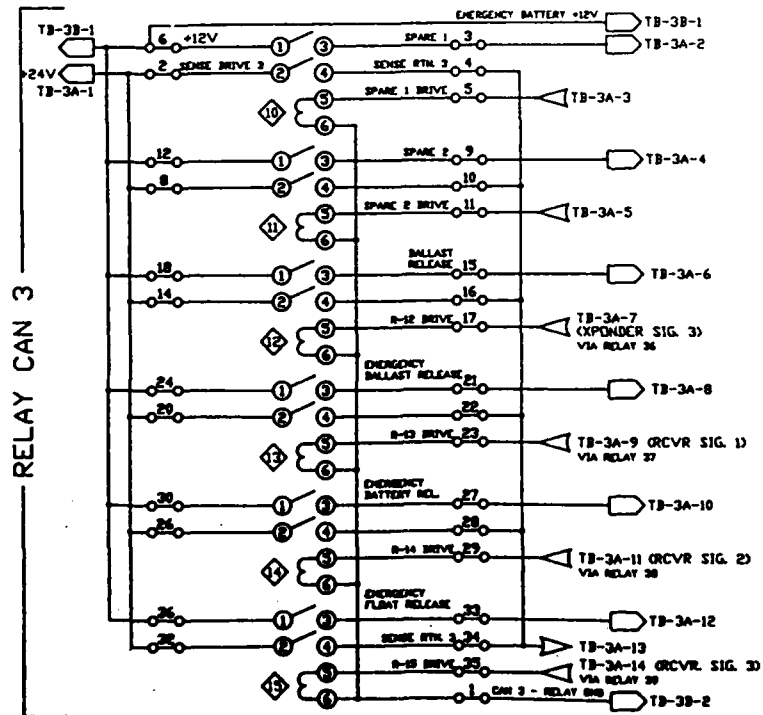
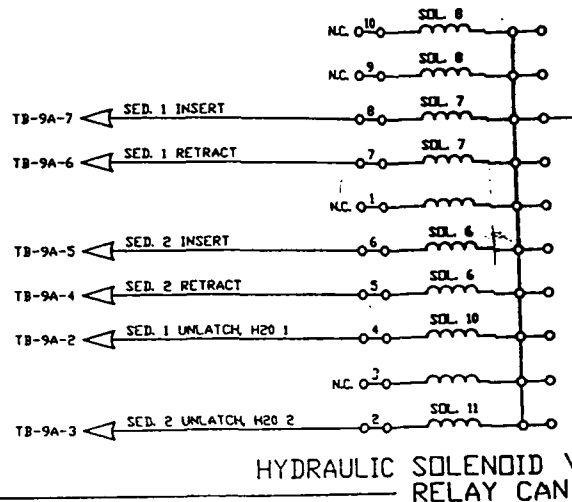
NOTE: JUMPERS LOWER CASE j, CONNECTORS UPPER CASE J, READ RELAY STATUS AND SHEET

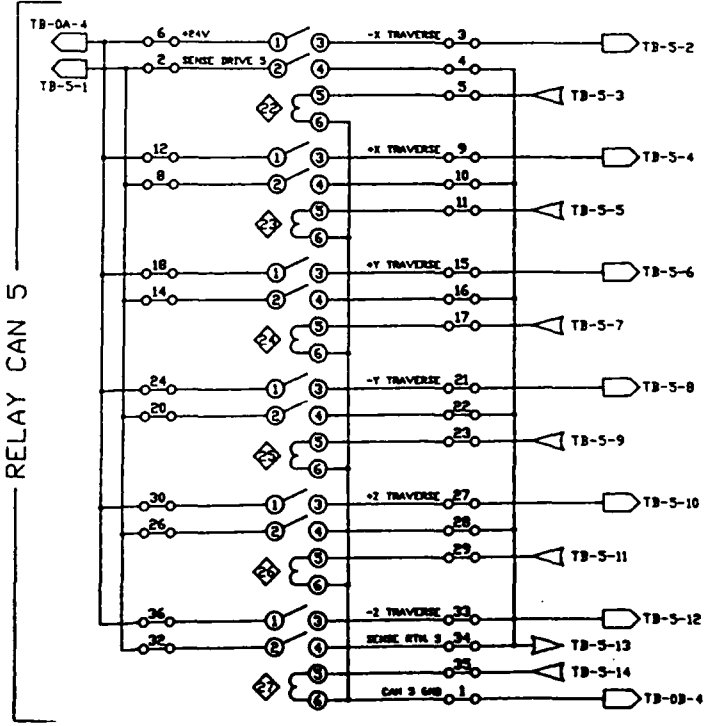
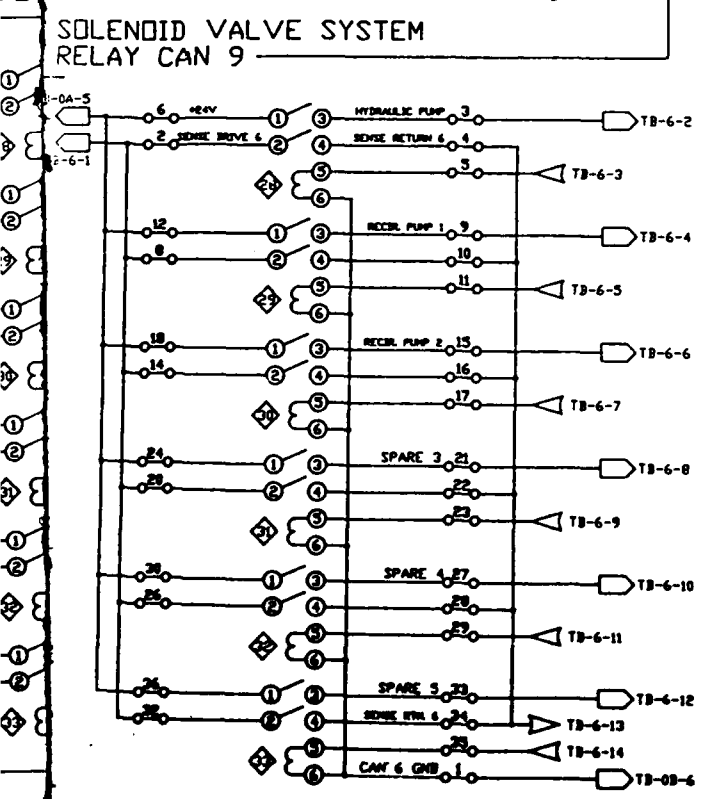
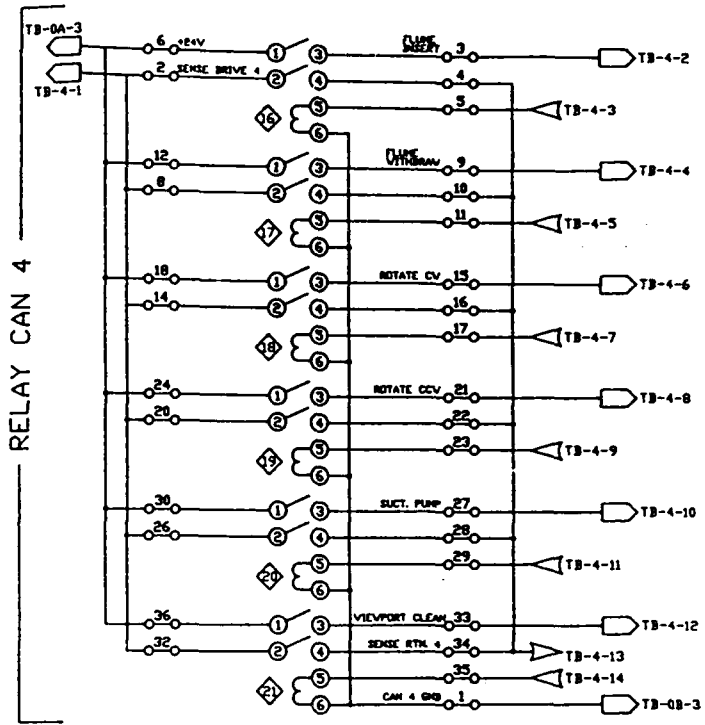
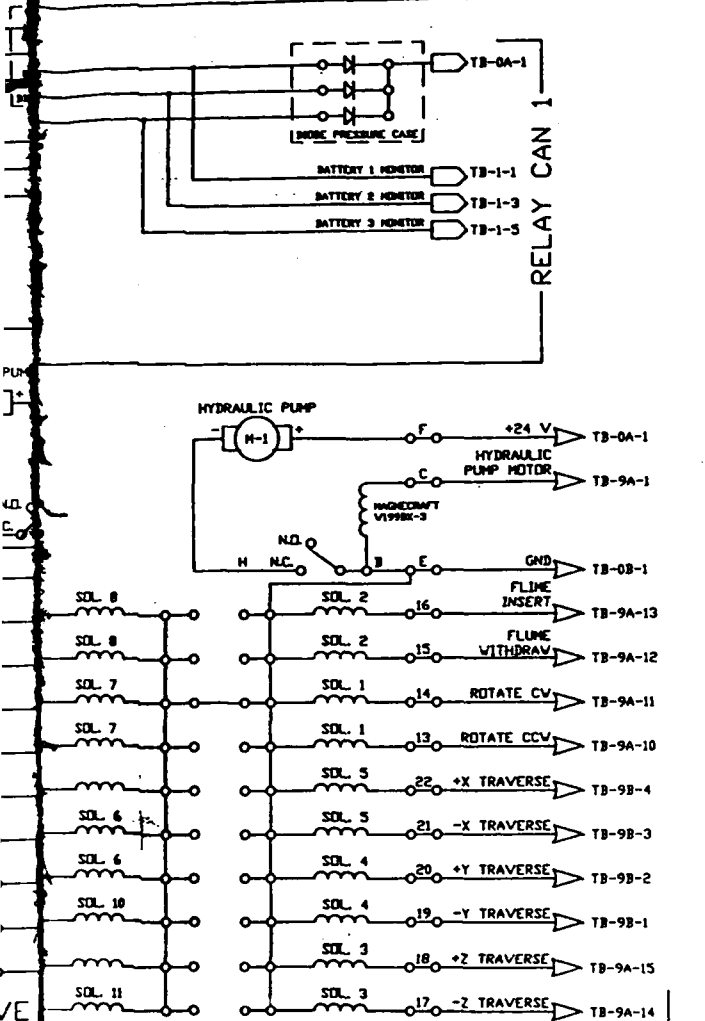


WOODS HOLE OCEANOGRAPHIC INSTITUTION ENGINEERING DEPT. WOODS HOLE, MA. 02543		TITLE CPU BOARD	
CONTRACT NO. 10/82.69	CODE NO.	SEA DUCT	
BY W. E. TERRY	DATE 12 DEC 84	SIZE 0	REV 19 DEC 85
DWG. NO. SD-C-001		2 OF 2	REV 19 DEC 85



RELAYS 4 - 35 ARE
RELAY SERVICE CD.
P/N X01-SF181D





WOODS HOLE OCEANOGRAPHIC INSTITUTION APPLIED ENGINEERING LABORATORY WOODS HOLE, MASS. 02543		TITLE ELECTRICAL MASTER	
CONTRACT NO. 00/0249	CODE NO.	DATE OF REV. 05	REV. 04 MAR 67
BY V. E. Terry	DATE OF PROJ. 05	DATE OF Dwg. 05	CD-000

SEA DUCT

APPENDIX J

Electronics Manufacturers

Apparatus Service Co.
5 Henshaw St.
Woburn, MA 01801
617-933-5999

Belden - Electronic Wire
and Cable Division
P.O. Box 1980
Richmond IN, 47375
317-983-5200

Brantner & Associates
1240 Vernon Way
El Cajon, CA 92020
619-562-7070
800-854-2552

Byrd Industries
P.O. Box 278
Industrial Park
Shelbyville, KY 40065
502-633-1338

Carrol Cable Company, Inc.
Pawtucket, RI 02862
401-728-7000

CompuPro
3506 Breakwater Court
Hayward, CA 94545
415-786-0909

Digicourse, Inc.
P.O. Box 50699
New Orleans, LA 70150
504-733-6061

Electrochem Industries
10,000 Wehrle Dr.
Clarence, NY 14031
716-759-6901

Humphrey, Inc.
9212 Balboa Ave.
San Diego, CA 92123
714-656-6631

Littlefuse, Inc.
800 E. Northwest Hwy.
Des Plains, IL 60016
312-433-2050

Litton Systems, Inc.
Encoder Divison
20745 Nordhoff St.
Chattsworth, CA 91311
213-341-6161

Magnacraft Electric Co.
1910 Techny Road
Northbrook IL 60062-5376
312-282-5500

Melcher elektronische Gerate AG
Ackerstrasse 56
Postfach
CH-8610 Uster
Switzerland
Telex 57154 MEUS CH
Telephone 01 941 37 37

Molex, Inc.
2222 Wellington Court
Lisle, Illinois 60532
312-969-4550

Micro Power Systems
3100 Alfred St.
Santa Clara, CA 95054
408-727-5350

Oceanographic Instrument Systems
Box 766
N. Falmouth, MA 02556

Optimal Technology, Inc.
Blue Wood 127
Earlsville, VA 22936

Photosea Systems, Inc.
11120 Roselle St.
San Diego, CA 92121
619-452-8903

Potter & Brumfield
P.O. Box 322
Princeton, Indiana 47671-0001
812-386-1000

Relay Service Co.
1310 North Pulaski Rd.
Chicago, Ill. 60651
312-252-2700

Sea Data Corporation
One Bridge St.
Newton, MA 02158
716-244-3203

Sea Tech, Inc.
P.O. Box 779
Corvallis, OR 97330
503-757-9716

Stevens Arnold
7 Elkins St.
South Boston, MA 02127
617-268-1170

Sinclair Manufacturing Co.
Chartley, MA. 02712
617-222-7440

Sprague Electric Co.
87 Marshall St.
North Adams, MA 02147-2484
413-664-4411

Syscon Corp.
5015 Hancock St.
San Diego, CA 92110

Teledyne - Mecca
P.O. Box 36393
Houston, Texas 77236
(713) 772-2811

WET Instrument Systems
P.O. Box 517
Woods Hole, MA 02543

Appendix K

BLT.2 Mini-Monitor Program

BLT, (Bradley-Liberatore-Terry) is an extension and modification of RCA's UT4 monitor. The only I/O used are Q and EF4*. The baud rate is fixed, and an entry at location 0000 (cold start) will give a prompt without typing CR. Some of the extended functions require a modest amount of RAM but BLT checks before using it and will refuse these functions if it can't write in the assigned area.

To install BLT:

1. Find the timing constant and write it into the PROM at M(0108).

300 Baud 1.0000 Mhz. = 14	300 Baud 1.6000 Mhz. = 18
300 Baud 1.2288 Mhz. = 1E	300 Baud 2.0000 Mhz. = 26
2. Select one page of RAM for BLT's use if you need either the subroutine call or CRC functions. BLT will use EO-FF on this page with a stack extending back from DF. The page selected is specified at M(001F).
3. BLT.2 is page relocatable and may be moved if required. Two long branches must be changed in the UT4 part. The bytes to be changed are 01 at M(00D0) and 00 at M(01FD). These are the values for the version that starts at 0000. Add to these values to move to a higher location in memory. If you need to use the \$P entry method with RAMTEST (see section on modification of BLT), you may wish to change the LBR at M(0010) as well.
4. Select the user branch at bytes 0005 and 0006. If EF4* is not held low (true) on entry by an RS232 device, the monitor will jump to the user program via a LBR at 0004. This is usually set to 0800 but can be any value.
5. If the terminal you are using has a narrow screen (H.P. 85) you can shorten the memory dump line length (set to 16 bytes normally) by changing the 0F at M(009D) to 07, giving a format of 8 bytes per line.
6. If you can't use EF4*, the monitor can be switched to any other flag by changing the 37's (BF4) at M(0002), M(0153), and M(0161) and the 3F (BN4) at M(0173) and M(014D).

Features of the BLT.2 Mini-Monitor

BLT contains the !M, ?M and \$P commands of UT4. Read the RCA documentation for details. Notice that, although RCA doesn't list it in the register use table, the TYPE routines use an additional scratch location. RCA selected RD.0 but this interferes with alternating calls to TYPE and READH which is occasionally useful. BLT.2 therefore substitutes R8.0 which is "scratched" by all calls to TYPE.

All the BLT added commands are accessed by typing "." (the monitor echos "...") then typing a single letter to select the command. The commands prompt the user for the necessary arguments which are usually addresses or byte counts. The argument rules are similar to those for UT4. When the monitor expects a constant, all non-hex entries are ignored except space and CR, either of which terminate the entry. (Don't use CR since the subsequent reply will overwrite the beginning of the line.) Leading zeros are provided and excess hex digits may be added to correct an entry error since only the last valid hex digits are used. Examples of valid entries are 0001, 20, 3WE5 (=35), ABC34EF2 (=4EF2).

1. .M, block move. Format, "...Move from AAAA to BBBB length CCCC ok?Y" where AAAA, BBBB, CCCC are source start address, sink start address and length to copy. If the reply to "ok?" is not "Y", no move will occur. "Move" copies from low to high address and can get into trouble if the source and sink overlap.

2. .V, Verify. Format, "...Verify AAAA with BBBB length CCCC". This command compares two blocks of memory and list the differences. The format of non equal data is AAAA BB CC DDDD where BB is the byte at AAAA and CC is the byte at DDDD and BB<>CC.

3. .C CRC calculation. Format "...CRC from AAAA over BBBB =CCCC". This calculates a 16 bit CRC check character over the block of memory starting at AAAA of length BBBB. It takes about 15 seconds to do all 65K. It is based on some European standard polynomial for generating CRC's. This command will refuse if there is no RAM in the system.

4. .S Subroutine. Format "...Subroutine AAAA DD DD X". This command invokes a SCRT call to a routine at AAAA, passes it in-line data, DDDD, and expects the subroutine to return via a D5 instruction (standard RCA call and return using R3=pc, R4=call, R5=return, R6=immediate bytes pointer and R2-stack pointer). The in-line-data is optional but will run out of buffer if longer than 28 bytes. For this one command, spaces are allowed between bytes hence the terminator "X" must be used to invoke the command. Any other non-hex entry will abort the command and return to the prompt. After the return from the user subroutine, the monitor re-initializes all it's registers so there are no restrictions on register use (other than those used by SCRT itself.) The stack is set up on the ram page starting at location DF. This command will abort if no RAM is present in the system.

5. .R Ramtest. Format "...Ram test start at AAAA over BBBB". Ramtest tests an area of RAM starting at AAAA by writing a pseudo-random sequence BBBB bytes long, then checking the entire area on a second pass. It is very good at finding obscure "connected cell" errors. Every good pass causes an "*" on the terminal. Each subsequent pass uses the sequence shifted over one bit so several are required to catch all bit locations. When RAMTEST finds an error, it lists the XDR of the data it wrote and read along with the address where the error occurred.

Modifications to BLT.2

There are several attractive alternative configurations of BLT. First, if memory is at a premium, the first two pages alone can be used to give a self-starting version of UT4 which can be re-entered at 0000 with X=P=0 or 0007 with only P=0 to elicit an immediate prompt. Similarly, RAMTEST is totally contained on the third page and will work with UT4 as a 3 page package. To enter RAMTEST without the rest of the monitor, use \$P10. If you use either of these truncated versions, you should delete the extended command test branch added to UT4. The easiest way to do this is to change the 3A (BNZ) at M(001C) to 30 (BR).

It's easy to add more functions to BLT.2 as well. Study the code at 0592-059A then add more tests by changing the jump at 059A. Notice that the letter entered as a response to the "... " extended prompt is stored at RF.1 and that the "no match" return is through 0522. Notice also that P=R4 at this time. If your routine is used, return through the "warm start" location, 0007, with P=0 to re-initialize the registers required for the monitor's use. There is a small text handling subroutine included with BLT (called QTTY) that runs in R5 and starts at 04A1 which may be handy if you need some prompting for your extension. Read the source file for details. Remember the bit about all TYPE calls (QTTY calls TYPE) scratching R8.0.

RCA Format listing for BLT2

!M ;

```


0000 7100 3707 C008 00F8 02BE 2E9E 3A0A 3029;
0010 C002 F6FF FFFF FFFF FFFF FB11 3A42 F857;
0020 B295 FC03 B4F8 06A4 D490 B5B3 F830 A5D5;
0030 E571 55C4 C4F8 FEA3 D3F8 9CA3 D30D D30A;
0040 D32B F800 ADBD F83B A3D3 FB24 32D6 FB05;
0050 A1CE FB1E 3A1A D3FB 4D3A CAD3 3B5B D333;
0060 5EFB 203A CA9D B08D A081 32B4 F800 ADBD;
0070 D333 70FB 0D3A CAF8 9CA3 8DA1 9DB1 D30A;
0080 90BF F8AE A3D3 80BF F8AE A3D3 D320 40BF;
0090 F8AE A3D3 2181 3A9B 9132 3980 FA0F 3AA6;
00A0 D33B D30D 307E F633 8E30 8CD3 3BAB D33B;
00B0 CA8D 5010 D333 AEFB 0D32 39FB 2132 ABFB;
00C0 173A B4D3 FB0D 3AC3 305B F89C A3D3 0DC0;
00D0 01F8 0000 0000 D3FB 503A CAD3 33DB FB0D;
00E0 3ACA 9DB0 8DA0 F89C A3D3 0AE5 7100 D39E;
00F0 F6AE 2E43 FF01 3AF4 8E32 EE23 30F2 93BC;
0100 F800 AEAFF F8EF ACF8 18BE F839 A530 2EFF;
0110 FFFF FFFF FFFF FFFF FFFF FFFF FFFF FFFF;
0120 FFFF FFFF FFFF FFFF FFFF FFFF FFFF D5FC;
0130 0733 37FC 0A33 87FC 009F D5F8 0038 83C8;
0140 F801 AFF8 80BF E38F F63B 4D38 803F 4D37;
0150 4FDC 0237 4F8F F63B 5B38 40E2 C49E F633;
0160 6837 667B 3068 7AC4 DC07 C4C4 9FF6 BF33;
0170 78F9 803F 5BBF 305D 7A32 438F 3A39 9FFF;
0180 413B 2FFF 0633 37FE FEFE FEFC 08FE AE8D;
0190 7EAD 9D7E BD8E FE3A 8E30 3900 DC17 38D5;
01A0 4538 4638 9FAE FBOA 3ABF F88B 30C1 9FF6;
01B0 F6F6 F6FC F63B B9FC 07FF C6AE F81B C8F8;
01C0 0BAF 7B8E A8DC 072F F588 76A8 33D1 7B30;
01D0 D37A C48F FA0F C4C4 3AC5 8FFC FBAF 3B9F;
01E0 FF1B 329F 3BEA F800 30F5 9FFA 0FFC F63B;
01F0 F3FC 07FF C6AE 30C2 D30A D33F C000 3947;
0200 90B5 F8BB A5D5 0000 0000 0000 0000 0061;
0210 6D20 7465 7374 2073 7461 7274 2061 7420;
0220 9DFF 9DBB 8DAB D56F 7665 7220 9DFF C4C4;
0230 07B8 9BB9 8BA9 9DBA 8DAA F898 A5D5 98C4;
0240 5919 2A8A 3A3D 9A3A 3DC4 97B8 9BB9 8BA9;
0250 9DBA 8DAA D5E9 98F3 3A70 192A 8A3A 549A;
0260 3A54 97B8 D598 B7F8 BBA5 D52A FF30 30FF;
0270 A8F8 BBA5 D50D 0A00 0000 0000 FF88 BFD5;
0280 8120 6174 20FF 99BF D581 FF89 BFD5 81FF;
0290 F898 A530 5AFF FFDO F800 A898 3AA1 F8FF;
02A0 B8F6 3BA5 18F6 F63B AA18 F63B AE18 F63B;
02B0 B218 88F6 9876 B830 97FF D040 A7FA 803A;
02C0 C9F8 A4A3 87BF D330 BB87 FBFF 32BA 87FB;
02D0 813A D8F8 AEA3 30C6 87FB 9D3A C130 EDFF;
02E0 D39F FB20 3AEO F89C A3D3 2030 BBF8 00AD;
02F0 BDF8 3BA3 30EO F810 BA2A 9A3A F930 002F;
    
```

User Branch
 LBR for Ram Test
 Ram page select
 Sea Duct = 57

?M line length
 0F=16 Bytes
 07=08 Bytes

Page dependent
 \$P exit

Baud Rate Select

BF4, BN4 

R8.0 scratched by 'type'

Page Dependent
 Ram Test Routine
 * Page independent
 * Enter \$P 2F6 from UT4
 * Enter ...R from BLT2

Ram Test entry point
 BLT additions to UT4

0300 B4FF FFFF FFFF 94FC 01B5 F8A1 A5C4 D5DD;
 0310 2E2E 9ADD 00C4 9FFB 4D32 30FB 0E32 70C4;
 0320 FB15 32C2 30FE 94FF 03B0 F807 A0E0 DOFF;
 0330 D5DD 6F76 6520 6672 6F6D 209D 00C8 FFFF;
 0340 9DBA 8DAA D574 6F20 9D00 9DBB 8DAB D56C;
 0350 656E 6774 6820 9D6F 6B3F 9A00 9FFB 59C4;
 0360 3A26 4A5B 1B2D 9D3A 628D 3A62 30EA FFFF;
 0370 D5DD 7263 2066 726F 6D20 9D00 9DBA 8DAA;
 0380 FFFF D56F 7665 7220 9D00 F8E2 A2F8 6DA5;
 0390 D533 26F8 00BB 7352 FFFF 0AFB FFCE BBC4;
 03A0 D52D 9D3A 9A8D 3A9A F8A1 A59B 32B9 92BD;
 03B0 82AD D53D 8D8D 0030 26D5 436C 6561 7200;
 03C0 3026 D5DD 6572 6966 7920 9D00 9DBA 8DAA;
 03D0 D5DD 7769 7468 209D 009D BB8D ABD5 DD6C;
 03E0 656E 6774 6820 9D00 30FF D5DD 0700 3026;
 03F0 FFFF FFFF FFFF FFFF FFFF FFFF FFFF 38C8;
 0400 30FE 9D3A 148D 3A14 D5DD 2064 6F6E 6500;
 0410 3022 FFFF EBOA F33A 261A 1B2D 3002 FFFF;
 0420 FFFF 94FF 01B4 D50D 0A00 F84B A5FC 009A;
 0430 D58A D5F6 D50A D5F6 D50B D5F6 D59B D58B;
 0440 D5F8 A1A5 3019 FFF8 02F6 D433 54BF F8AE;
 0450 A3D3 3047 F820 BFF8 A430 50FF FFFF FFFF;
 0460 FFFF FFFF FFFF FFFF FFFF FFFF FFF8 7352;
 0470 E2F3 3277 FF00 C8FC 00D4 E24A F322 52F6;
 0480 F6F6 F6F3 52FE FEFE FE60 60F3 2273 72F6;
 0490 F6F6 F373 F0FE FEFE FEFE F360 6073 3079;
 04A0 D404 3AA7 1430 A0FB 8A3A B4F8 A4A3 D314;
 04B0 30A1 FFFF FB07 3AC0 4DBF F8AE A330 AEFB;
 04C0 FB02 3AD0 30BA FB40 32EC FBDD BF30 ABFF;
 04D0 FB15 3ADA F83E A330 AEFB FB07 3AC6 F800;
 04E0 BDAD F83B A3D3 9FFB 203A E5C4 9EFE FEAE;
 04F0 8E32 AF2E C430 F0FF FFFF FFFF FFFF 38C8;
 0500 3092 FFFF FFFF D5DD 7562 726F 7574 696E;
 0510 6520 00C4 F86D A5D5 3322 94B5 F87C A5C4;
 0520 3028 94FF 02B4 FFFF F8E0 A2F8 D452 12D5;
 0530 9FFB 583A 22F8 D552 C4C4 F8DF A294 B6C4;
 0540 F870 A692 B3F8 E0A3 94B5 F861 A5C8 FFFF;
 0550 D3E2 8673 9673 93B6 83A6 46B3 46A3 3050;
 0560 D396 B386 A3E2 1272 B6F0 A630 60FF FFFF;
 0570 93FF 05B0 F807 A0E3 7100 FFD4 F83B A3D3;
 0580 3B8A D33B 8A8D 5212 307F 9FFB 2032 7C30;
 0590 7BFF 9FFB 5332 06FB 013A 2294 FF03 B0C4;
 05A0 F8F6 A0E0 DOFF FFFF FFFF FFFF FFFF FFFF;
 05B0 FFFF FFFF FFFF FFFF FFFF FFFF FFFF FFFF;
 05C0 FFFF FFFF FFFF FFFF FFFF FFFF FFFF FFFF;
 05D0 FFFF FFFF FFFF FFFF FFFF FFFF FFFF FFFF;
 05E0 FFFF FFFF FFFF FFFF FFFF FFFF FFFF FFFF;
 05F0 FFFF FFFF FFFF FFFF FFFF FFFF FFFF FFFF

Locations 0600 - 07FF are also empty.

Appendix L

BTU Monitor Program Listing

The BTU Monitor program runs automatically when the CPU is reset. A description of this monitor may be found in the software section.

```

2
3
4 ;SAIL BASIC MONITOR PROGRAM
5 ;
6 ;
7         SUBTTL BTU SAIL MONITOR          20 FEB 1986      BTU2.MAC
8 ;
9         PREVIOUS VERSION:      13 FEB 1985      BTU2.MAC
10 ;
11 ;*****
12 ;
13 ;SEA DUCT VERSION - Easily adaptable for other 1805A/6A SAIL systems
14 ;
15 ;*** UNLOCKED SYSTEM VERSION !!! ***
16 ;
17 ;*** DOES NOT USE INTERRUPTS !!! ***
18 ;
19 C         INCLUDE I1806A ;include file for 1806A opcodes
20 C         I1806A.MAC - Macro Definitions for RCA 1805A/6A Opcodes
21 C ;
22 C ;
23 C         20 FEB 1986
24 C         W. E. TERRY
25 C ;
26 C         (LISTING SUPRESSED)
27 C ;
28 C         With some Level II codes
29 C ;
30 C         .LIST
31 ;
32 ;         FOR RCA 1805A/6A
33 ;
34 ;         W. E. TERRY
35 ;
36 ;
37 ;***** REGISTER ALLOCATION *****
38 ;
39 ;         ***** SAIL *****
40 ;
41 0000      DMA EQU 0 ;DMA IN/OUT - ALSO START
42 0001      ENTPC EQU 1 ;INTERRUPT PROGRAM COUNTER
43 0002      STACK EQU 2 ;UTILITY STACK
44 0003      PC EQU 3 ;MAIN PROGRAM COUNTER
45 ;         4 ;SCRT CALL
46 ;         5 ;SCRT RETURN
47 0006      RTNPTR EQU 6 ;POINTER FOR RETURN & IMMEDIATE BYTES
48 0006      LIST EQU 6 ;
49 0007      GPAGE EQU 7 ;GLOBAL PAGE S.O & R.O
50 0008      CYCCNT EQU 8 ;REAL TIME CLOCK CYCLE COUNT
51 ;
52 ;
53 ;***** I/O SELECT *****
54 ;
55 0001      GROUP EQU 01 ; SELECT = OUT 01
56 ;         ; READ = INP 01

```



```
57 ;
58 ;
59 ; ***** GROUP 6 - UARTS *****
60 ;
61 0006 UARTS EQU 06 ; UART GROUP
62 0012 FORNT1 EQU 12H ; 7 DATA BITS, 1 STOP BIT, EVEN PARITY
63 ;
64 ;
65 ; <INPUT>
66 ;
67 0002 DATA1 EQU 02 ; LEVEL 1 SAIL UART
68 0003 STAT1 EQU 03 ; LEVEL 1 SAIL UART
69 0004 DATA2 EQU 04 ; LEVEL 2 SAIL UART
70 0005 STAT2 EQU 05 ; LEVEL 2 SAIL UART
71 0006 DATA3 EQU 06 ; NOT USED
72 0007 STAT3 EQU 07 ; NOT USED
73 ;
74 ; < OUTPUT >
75 0003 CTRL1 EQU 03 ; LEVEL 01 SAIL UART CONTROL
76 0005 CTRL2 EQU 05 ; LEVEL 02 SAIL UART CONTROL
77 0007 CTRL3 EQU 07 ; NOT USED
78 ;
79 ;
80 ; ***** GROUP 7 *****
81 ;
82 0007 SYSTEM EQU 07
83 ;
84 ; < INPUT >
85 ;
86 ; < OUTPUT >
87 ;
88 0006 HALT EQU 06 ; SUICIDE FUNCTION
89 0007 MEMORY EQU 07 ; MEMORY PAGE PROTECT OR ENABLE
90 ;
91 ; *****
92 ;
93 ; Q = UT4 (BLT.2)
94 ; INTERRUPT PULSE
95 ; MEM. PROTECT
96 ;
97 ; EF1 =
98 ; EF2 =
99 ; EF3 =
100 ; EF4 =
101 ;
102 ;***** DEFINITIONS *****
103 ;
104 ;*** SAIL PROM LOCATIONS - 2716'S ***
105 ;
106 0000 BTU EQU 00H ;*** BTU MONITOR PROM BASE PAGE ***
107 0008 PROM1 EQU 08H ;*** TARGET PROGRAM BASE PAGE ***
108 ;
109 ;***** PAGE REFERENCES *****
110 ;
111 0056 GLOPG EQU 056H ;*** BTU2 GLOBAL PAGE ***
112 0057 STRPG EQU 057H ;*** BTU STACK BASE PAGE ***
```

```

113 ;
114 ;
115 ; SEA DUCT GLOBAL PAGE = 5000
116 ; SEA DUCT STACK PAGE = 5300
117 ; SEA DUCT SEQUENCER STACK PAGE = 5200
118 ;
119 ; BLT.2 MONITOR STACK PAGE = 5700
120 ; STACK END = 57FF
121 ;
122 ;
123 ;*** OTHER REFERENCES ***
124 ;
125 57DF STKEND EQU (STKPG * 100H) + 0DFH ;*** STACK END = STKPG+DF
126 ;
127 ;
128 ;*** SAIL FLAGS, ETC. ***
129 ;
130 5600 GP EQU (GLOPG * 100H)
131 ;
132 5602 PLEVEL EQU (GP + 02H) ; PASS THRU LEVEL
133 5603 SYSFLG EQU (GP + 03H) ; <ADDR:WRITE:SYS: : : : :>
134 5605 CRCRAM EQU (GP + 05H) ; CRC CALC. SCRATCH
135 5606 CRCHI EQU (GP + 06H) ; CRC HI BYTE RESULT
136 5607 CRCLO EQU (GP + 07H) ; CRC LO BYTE RESULT
137 5608 RBHI EQU (GP + 08H) ; RB.1 SAVE FROM LAST INTERRUPT
138 5609 RBLO EQU (GP + 09H) ; RB.0 SAVE FROM LAST INTERRUPT
139 560A GRPSAV EQU (GP + 0AH) ; CURRENT I/O GROUP (OUTSIDE INTERRUPT)
140 ;
141 56FE IOLOC EQU (GP + 0FEH) ; I/O BYTE
142 ;
143 0003 ETX EQU 03H ;ASCII ETX = 03
144 00FF DONE EQU 0FFH ;USED BY TTY CALLS
145 ;
146 081F TARADR EQU 081FH ;TARGET SYSTEM ADDRESS - USED BY .R
147 ;
148 003B PMTCHR EQU ',' ; PROMPT CHARACTER = :
149 ; 2 BIT DLY ROUTINE
150 ; SAIL ADDRESS AND REPLY
151 ; DLY 250 ( 250 μSEC DLY)
152 ; DLY 20 ( INITIAL SETUP DLY)
153 ;
154 ;*****
155 ;
156 ;***** PROGRAM BEGINS HERE *****
157 ;
158 ;
159 0000' HDSTRT: ORG (BTU * 100H)
160 0000' 71 DIS
161 0001' 00 DB 00 ; DISABLE INTERRUPTS
162 0002' 30 07' BR SETSL
163 0004' FFFF DW 0FFFFH
164 0006' FF DB 0FFH
165 0007' 90 SETSL: GHI R0
166 0008' B3 PHI PC ; SET PC TO STARTING ADDRESS
167 0009' F8 0E' LDI LOW(START1)
168 000B' A3 PLO PC

```

```

169 000C' 30 56' BR SCRTST ; BRANCH TO SCRT SET UP
170 ;
171 000E' F8 01 START1: LDI 01
172 0010' AB PLO RB
173 0011' F8 00 LDI 00
174 0013' AE PLO RE
175 0014' F8 FF LDI OFFH
176 0016' AC PLO RC
177 ;
178 0017' E3 MENAB: SEX PC ;SELECT SYSTEM I/O GROUP
179 0018' 61 OUT GROUP
180 0019' 07 DB SYSTEM
181 ;
182 001A' EE SEX RE
183 001B' 8C NEWPG: GLO RC
184 001C' 32 3A' BZ FINIS
185 001E' 9E GHI RE ;ALWAYS ENABLE:
186 001F' FB 57 XRI STKPG ; STACKPAGE
187 0021' 32 2D' BZ SETQ1
188 0023' 9E GHI RE
189 0024' FB 56 XRI GLOPG ; GLOBAL PAGE
190 0026' 32 2D' BZ SETQ1
191 0028' 8B GLO RB
192 0029' 3A 2D' BNZ SETQ1 ;PROTECT OR ENABLE ?
193 002B' 7A REQ ; PROTECT -> Q = 0
194 002C' 38 SKP
195 002D' 7B SETQ1: SEQ ; ENABLE -> Q = 1
196 002E' 67 OUT MEMORY ;I/O = MEM. PROTECT
197 002F' 7A REQ
198 0030' 9E GHI RE
199 0031' FC 01 ADI 01
200 0033' BE PHI RE
201 0034' 8C GLO RC
202 0035' FF 31 SMI 01
203 0037' AC PLO RC
204 0038' 30 1B' BR NEWPG
205 ;
206 003A' E3 FINIS: SEX PC
207 003B' 61 OUT GROUP
208 003C' 06 DB JARTS
209 ;
210 ;
211 003D' F8 56 SETUP: LDI GLOPG ; GLOBAL PAGE SETUP
212 003F' B7 PHI GPAGE ; SETS R7.1 TO GLOPG
213 ;
214 ;
215 ; NO MEMORY IS CLEARED IN CASE WE WOULD LIKE TO SEE WHAT FORCED
216 ; US TO RESET THE SYSTEM
217 ;
218 ;
219 ;
220 ; *** THIS SPACE MAY BE USED FOR FURTHER SETUP ROUTINES ***
221 ;
222 ;
223 ;
224 0040' F8 20 DLY00: LDI 20H
  
```

```

225 0042' 3E          PHI RE          ; 20 = ARBITRARY DELAY WHICH
226 0043' 2E          WAIT: DEC RE          ; INSURES UART WILL RESET
227 0044' 9E          GHI RE
228 0045' 3A 43'     BNZ WAIT
229
230
231 0047' F8 0A       SETURT: LDI LOW GRPSAV ; SELECT UART I/O GROUP
232 0049' A7          PLO GPAGE          ; AND STORE ON GLOBAL PAGE
233 004A' F8 06       LDI LOW UARTS
234 004C' 57          STR GPAGE
235 004D' E7          SEX GPAGE
236 004E' 61          OUT GROUP
237 004F' E3          SEX PC
238 0050' 63          OUT CTRL1      ; SET UART1 AS SHOWN IN THE I/O GROUP
239 0051' 12          DB FORMT1      ; ALLOCATION SETUP
240
241 0052' E3          SEX PC
242 0053' C0 0084'    LBR UNADDR          ; GO TO UNADDRESS
243
244
245
246
247 ***** STANDARD CALL AND RETURN *****
248
249 0056' 90          SCRTST: GHI R0          ; GET PROM #1 BASE PAGE
250 0057' B4          SCRT: PHI R4
251 0058' B5          PHI R5          ; AND PUT IN R4.1 & R5.1
252 0059' F8 57       LDI LOW STKPG
253 005B' B2          PHI STACK          ; PUT STACK LOCATION IN R2
254 005C' F8 DF       LDI LOW STKEND
255 005E' A2          PLO STACK
256 005F' F8 66'     LDI LOW CALL
257 0061' A4          PLO R4          ; SET UP SCAL RTNPTR
258 0062' F8 76'     LDI LOW(RTN)
259 0064' A5          PLO R5          ; AND RETURN
260
261 ; *** STANANDARD CALL ***
262
263 0065' D3          CTOP: SEP PC
264 0066' E2          CALL: SEX STACK
265 0067' 36          GLO RTNPTR
266 0068' 73          STXD
267 0069' 96          GHI RTNPTR
268 006A' 73          STXD
269 006B' 93          GHI PC
270 006C' B6          PHI RTNPTR
271 006D' 83          GLO PC
272 006E' A6          PLO RTNPTR
273 006F' 46          LDA RTNPTR
274 0070' B3          PHI PC
275 0071' 46          LDA RTNPTR
276 0072' A3          PLO PC
277 0073' 30 65'     BR CTOP
278
279 ; *** STANDARD RETURN ***
280

```

```

281 0075' 03      RTOP:  SEP PC      ; SET P = PROGRAM COUNTER
282 0076' 96      RTN:   GHI RTNPTR
283 0077' 33      PHI PC      ; RETURN ROUTINE
284 0078' 86      GLO RTNPTR
285 0079' A3      PLO PC
286 007A' 52      SEX STACK
287 007B' 12      INC STACK
288 007C' 72      LDXA
289 007D' 86      PHI RTNPTR
290 007E' F0      LDX
291 007F' A6      PLO RTNPTR
292 0080' 30 75'  BR RTOP
293                ;
294                ;*****
295                ;
296                ;***** I / O ERROR RECOVER *****
297                ;
298 0082' 32 35'  IOERR:  BZ READDR
299                ;
300                ;
301 0084' C4      UNADDR:  NOP
302 0085' F8 03  READDR:  LDI LOW SYSFLG ; FORCE OPEN SYSTEM
303 0087' A7      PLO GPAGE
304 0088' F8 30  LDI OROH
305 008A' 57      STR GPAGE
306                ;
307 008B' F8 DF  LDI LOW STKEND
308 008D' A2      PLC STACK ; RESET STACK
309                ;
310                ;***** PROMPT *****
311                ;
312                ;
313 008E'          PROMPT:  CALL TSRE? ;(TRANS. SER. REG. EMPTY)
314 008E' 04      +
315 008F' 023A'  -
316                CALL TTY ;TYPE:
317 0091' 04      +
318 0092' 019D'  +
319 0094' CA      DB 0CAH
320 0095' 3B      DB PMTCHR
321 0096' 03      DB 003H
322 0097' FF      DB 0FFH ; CR, LF, NULL X6,
323                CALL TSRE? ; PROMPT CHAR., ETX
324 0098' 04      +
325 0099' 023A'  +
326 009B' C0 009E' LBR BR1ST ; GO TO FIRST BRANCH
327                ;
328                ;
329                ;***** FIRST BRANCH *****
330                ;
331                ;
332 009E'          BR1ST:  CALL ITB ; TEST FOR: ; ADD OR DELETE
333 009E' 04      -
334 009F' 0180'  +
335 00A1' 3F      DB '?' ; ? GROUP ; AS NECESSARY
336 00A2' 00C7'  DW QUESGR ; FOR YOUR SYSTEM

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```
337 00A4' 21 DB 'I' ; I GROUP
338 00A5' 00D4' DW BANGGR
339 00A7' 24 DB 'S' ; S GROUP
340 00A8' 0427' DW TESTS
341 00AA' 48 DB 'H' ; HELP FILE
342 00AB' 04E0' DW HELP
343 00AD' 4D DB 'M' ; MEMORY PROTECT
344 00AE' 0598' DW MEMSAV
345 00B0' 2E DB '.' ; DOT COMMAND EXTENSION
346 00B1' 00B7' DW DOTGR
347 00B3' FF DB OFFH ; DONE ; EXPANSION CAN BE
348 00B4' CO 008E' LBR PROMPT ; ADDED HERE
349 ;
350 ;
351 ;***** DOT GROUP *****
352 ;
353 00B7' DOTGR: CALL ITB
354 00B7' D4 +
355 00B8' 0180' +
356 00BA' 4D DB 'M' ; .MOVE
357 00BB' 0336' DW MOVE
358 00BD' 56 DB 'V' ; .VERIFY
359 00BE' 037B' DW VERFY
360 00C0' 52 DB 'R' ; .RAMTEST
361 00C1' 0642' DW RAMTST
362 00C3' FF DB OFFH
363 00C4' CO 008E' LBR PROMPT
364 ;
365 ;
366 ;***** ? GROUP *****
367 ;
368 ;
369 00C7' QUESGR: CALL ITB ; LOOK FOR:
370 00C7' D4 -
371 00C8' 0180' +
372 ;
373 00CA' 4D DB 'M' ; ADD OR DELETE
374 00CB' 025D' DW QUESTM ; ? M ; AS NECESSARY
375 00CD' 43 DB 'C'
376 00CE' 0453' DW CRC ; ? CRC
377 00D0' FF DB OFFH ; DONE ; EXPANSION CAN BE
378 00D1' CO 008E' LBR PROMPT ; ADDED HERE
379 ;
380 ;
381 ;***** : GROUP *****
382 ;
383 ;
384 00D4' BANGGR: CALL ITB ; LOOK FOR:
385 00D4' D4 +
386 00D5' 0180' +
387 00D7' 4D DB 'M'
388 00D8' 02B7' DW WRITEM ; : MEMORY
389 00DA' 52 DB 'R'
390 00DB' 03P5' DW RUN ; : Run target system
391 00DD' FF DB OFFH ; DONE ; EXPANSION CAN BE
392 00DE' CO 008E' LBR PROMPT ; ADDED HERE
```

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393 ;
394 ;
395 ;***** SAIL IN CHARACTER *****
396 ;
397 00E1' 6B INCHAR: INP STAT1
398 00E2' F6 SHR ; CHECK FOR DA (DATA AVAILABLE)
399 00E3' 3B E1' BNF INCHAR ; IF NOT TRY CLRBIT
400 00E5' FA 06 ANI 06H ; MASK FOR:
401 00E7' 32 ED' BZ KEEP2 ; FRAME AND PARITY ERROR
402 00E9' 6A INP DATA1 ; CLEAR BAD DATA
403 ;
404 ;*****
405 00EA' C0 0082' LBR IOERR ;***** USUALLY "BR INCHAR"
406 ; BR INCHAR ;IS USED HERE *****
407 ;*****
408 ;
409 00ED' F8 FE KEEP2: LDI LOW IOLOC ; PUT GOOD DATA AT GP = I/O LOCATION
410 00EF' A7 PLO GPAGE
411 00F0' E7 SEX GPAGE
412 00F1' 6A INP DATA1
413 00F2' FA 7F ANI 07FH ; CLEAR NSB
414 00F4' 57 STR GPAGE ; STORE AT GP I/O LOCATION
415 00F5' FB 23 XRI '#' ; IS IT '#' ?
416 00F7' C2 0082' LBZ IOERR
417 00FA' C0 0150' LBR DELAY2 ; 2 BIT DELAY
418 ;
419 ;
420 ;***** INPUT 4 DIGITS TO R(D) (IN4D) *****
421 ;
422 00FD' F8 00 IN4D: LDI LOW 00
423 00FF' 3D PHI RD ; SET R(D) = 0000
424 0100' AD PLO RD
425 0101' IN4D2: CALL INCHAR
426 0101' D4 -
427 0102' 00E1' -
428 0104' 07 LDN GPAGE
429 0105' FB 0D XRI 0DH ;INCHAR XOR CR IS IT 'CR' ?
430 0107' 32 0D' BZ IN4RET ; GP -> I/O LOC.
431 0109' FB 2D XRI 2DH ;"SPACE" XOR CR IS IT ' ' ?
432 010B' 3A 0E' BNZ CNVRT
433 010D' IN4RET: EXIT
434 010D' D5 +
435 ;
436 ;
437 010E' CNVRT: CALL ASCHEX
438 010E' D4 -
439 010F' 0118' +
440 0111' 33 01' BDF IN4D2
441 0111' 33 01' CALL SHFTD4
442 0113' D4 +
443 0114' 013A' +
444 0116' 30 01' BR IN4D2
445 ;
446 ;
447 0118' 07 ASCHEX: LDN GPAGE
448 0119' 5C 00 ADI 000H ; CALLED BY CNVRT AND ! MEMORY

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449 011B' 3B 37'      BNF NOTHEX
450 011D' 07          LDN GPAGE
451 011E' FD 39      SDI 039H
452 0120' 33 30'     BDF NUMBER
453 0122' 07          LDN GPAGE
454 0123' FC BF      ADI 0BFH
455 0125' 3B 37'     BNF NOTHEX
456 0127' 07          LDN GPAGE
457 0128' FD 46      SDI 046H
458 012A' 3B 37'     BNF NOTHEX
459 012C' 07          LDN GPAGE
460 012D' FC C9      ADI 0C9H
461 012F' 38          SKP
462 0130' 07          NUMBER: LDN GPAGE
463 0131' FA 3F      ANI 00FH
464 0133' 57          STR GPAGE
465 0134' FC 00      ADI 000H      ; CLEAR DF
466                                EXIT
467 0136' D5          +
468 0137' FF 00      NOTHEX: SMI 000H      ; SET DF
469                                EXIT
470 0139' D5          +
471                                ;
472                                ;
473 013A' 8C          SHFTD4: GLO RC
474 013B' 52          STR STACK
475 013C' F8 04      LDI LOW 04H
476 013E' AC          PLO RC
477 013F' 8D          SHIFT: GLO RD
478 0140' FE          SHL
479 0141' AD          PLO RD
480 0142' 9D          GHI RD
481 0143' 7E          SHLC
482 0144' 8D          PHI RD
483 0145' 2C          DEC RC
484 0146' 8C          GLO RC
485 0147' 3A 3F'     BNZ SHIFT
486 0149' 02          LDN R2
487 014A' AC          PLO RC
488 014B' E7          SEX GPAGE
489 014C' 8D          GLO RD
490 014D' F1          OR
491 014E' AD          PLO RD
492                                EXIT
493 014F' D5          +
494                                ;
495                                ;
496                                ;***** 2 BIT DELAY *****
497                                ;
498                                ;
499 0150' F8 80      DELAY2: LDI LOW 80H      ; INSTRUMENT SPECIFIC:
500 0152' FF 01      WAIT3: SMI 01H      ;      80H = 10.8 mSec FOR
501 0154' C4          NOP      ;      1.2288 MHz SYSTEM CPU CLOCK
502 0155' C4          NOP
503 0156' C4          NOP
504 0157' 3A 52'     BNZ WAIT3

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```
505 0159' FC 00          ADI 00H          ; CLEAR DF
506                               EXIT
507 015B' D5              +
508                               ;
509                               ;
510                               ; ***** IN KEY WORD *****
511                               ;
512 015C'                 INKWD: CALL INCHAR
513 015C' D4              +
514 015D' 00E1'          +
515 015F' CB 016B'
516 0162' 46             PLIST: LBNF TMATCH
517 0163' FB FF          XRI OFFH          ; IS IT FF ?
518 0165' CA 0162'      LBNZ PLIST
519 0168' 16             INC LIST
520 0169' 16             INC LIST
521                               EXIT          ; GOES TO LBR AT END OF LIST
522 016A' D5              +
523                               ;
524 016B' 07             TMATCH: LDN GPAGE          ; GPAGE = I/O LOC.
525 016C' E6             SEX RTNPTR
526 016D' P3             XOR          ; I/OLOC = LIST ?
527 016E' CA 0162'      LBNZ PLIST
528 0171' 16             MATCH: INC LIST
529 0172' 06             LDN LIST
530 0173' FB FF          XRI OFFH
531 0175' CA 015C'      LBNZ INKWD
532 0178' 16             INC LIST
533 0179' 46             LDA RTNPTR
534 017A' 52             STR STACK
535 017B' 46             LDA RTNPTR
536 017C' A6             PLO RTNPTR
537 017D' 02             LDN STACK
538 017E' B6             PHI RTNPTR
539                               EXIT          ; GOES RETURN INDICATED AT LIST END
540 017F' D5              -
541                               ;
542                               ;
543                               ; ***** INPUT TEST AND BRANCH *****
544                               ;
545                               ;
546 0180'                 ITB: CALL INCHAR
547 0180' D4              -
548 0181' 00E1'          +
549 0183' E7             SEX GPAGE
550 0184' 46             NEXT2: LDA LIST
551 0185' FB FF          XRI OFFH          ; IS LIST FF ?
552 0187' CA 018B'      LBNZ TEST
553                               EXIT
554 018A' D5              +
555                               ;
556 018B' FB FF          TEST: XRI OFFH
557 018D' P3             XOR
558 018E' C2 0196'      LBZ MATCH2          ; DOES CHAR = LIST ?
559 0191' 16             INC LIST
560 0192' 16             INC LIST
```

561 0193' C0 0124'
562 0196' 46
563 0197' 52
564 0198' 46
565 0199' A6
566 019A' 02
567 019B' B6
568
569 019C' D5 +
570
571
572
573
574
575 019D' F8 FE
576 019F' A7
577 01A0' 46
578 01A1' FB FF
579 01A3' 3A A8'
580 01A5' FC 00
581
582 01A7' D5 +
583 01A8' FB 7F
584 01AA' 3A B5'
585 01AC' 9D
586 01AD' 57
587 01AE' 8D
588 01AF' 3D
589 01B0'
590 01B0' D4 +
591 01B1' 0249' +
592 01B3' 30 A0'
593
594 01B5' FB 01
595 01B7' CA 01D4'
596 01BA' 9D
597 01BB' E2
598 01BC' 73
599 01BD' 8D
600 01BE' 3D
601 01BF' 12
602 01C0' 02
603 01C1' 22
604 01C2' F6
605 01C3' F6
606 01C4' F6
607 01C5' F6
608 01C6' 57
609
610 01C7' D4 +
611 01C8' 0222' +
612 01CA' 12
613 01CB' 02
614 01CC' FA 0F
615 01CE' 57
616

LBR NEXT2
MATCH2: LDA RTNPTR
STR STACK
LDA RTNPTR
PLO RTNPTR
LDN STACK
PHI RTNPTR
EXIT
;
;
;***** TTY *****
;
;
TTY: LDI LOW IOLOC
PLO GPAGE ;TTY CHECKS FOR THE FOLLOWING PSEUDO OPS IN LIST:
NEXT3: LDA RTNPTR ;*****
XRI OFFH ;IS IT FF? ; ASCII CHAR -> TYPES IT
BNZ TEST80 ; 30 = ASCII @ RD.1
ADI 00H ;CLEAR DF ; 31 = HEX PAIR @ RD.1
EXIT ; 2nd CALL SENDS HXPR @ RD.0
TEST80: XRI 07FH ;80 XOR FF ; 3D = HEX PAIR @ M(RD), INC RD
BNZ TEST81 ;IS IT 80? ; CA = TYPES CR, LF
ASCRD1: GHI RD ; 9D = CALLS IN4D
STR GPAGE ; DD = DECIMAL @ M(RD) (00-99)
GLO RD ; A1 = SEND HI HX NIBBLE @ M(RD)
PHI RD ; A2 = SEND LO HX NIBBLE @ M(RD), INC RD
OUTPT2: CALL OUTCHR ; FF = DONE (END OF LIST)
;
BR NEXT3 ;*****
TEST81: XRI (31H XOR 30H) ;31 XOR 30
LBNZ TEST8D ;IS IT 31?
HEXRD1: GHI RD
SEX STACK
STXD
GLO RD
PHI RD
OUTHEX: INC STACK
LDN STACK
DEC STACK
SHR
SHR
SHR
SHR
STR GPAGE
CALL HXCONV
INC STACK
LDN STACK
ANI 0FH
STR GPAGE
CALL HXCONV

```

617 01CF' D4 +
618 01D0' 0222' -
619 01D2' 30 A0' BR NEXT3
620 ;
621 01D4' FB 0C TEST8D: XRI (8DH XOR 81H) ;8D XOR 81
622 01D6' 3A DD' BNZ TESTCA ;IS IT 8D ?
623 01D8' 4D LDA RD
624 01D9' 52 SEX STACK
625 01DA' 73 STXD
626 01DB' 30 BF' BR OUTHEX
627 ;
628 01DD' FB 47 TESTCA: XRI (0CAH XOR 8DH) ;CA XOR 8D
629 01DF' 3A E9' BNZ TEST9D ;IS IT CA ?
630 01E1' OUTCA: CALL TTY
631 01E1' D4 +
632 01E2' 019D' +
633 01E4' 0D0A DW 0D0AH ;CR,LF
634 01E6' FF DB DONE ;DONE
635 01E7' 30 A0' BR NEXT3
636 ;
637 01E9' FB 57 TEST9D: XRI (9DH XOR 0CAH) ;9D XOR CA
638 01EB' 3A F2' BNZ TESTDD ;IS IT 9D ?
639 CALL IN4DT? ; ONLY CALL OF IN4DT?
640 01ED' D4 +
641 01EE' 0234' +
642 01F0' 30 A0' BR NEXT3
643 ;
644 01F2' FB 40 TESTDD: XRI (0DDH XOR 9DH) ;DD XOR ED IS IT DD ?
645 01F4' CA 01FD' LBNZ TESTA1
646 01F7' 4D LDA RD
647 01F8' F9 30 ORI 030H
648 01FA' C0 021E' LBR OUTPT1
649 ;
650 01FD' FB 3C TESTA1: XRI (0A1H XOR 09DH) ;IS IT A1?
651 01FF' CA 020E' LBNZ TESTA2
652 0202' 0D LDN RD
653 0203' F6 SHR
654 0204' F6 SHR
655 0205' F6 SHR
656 0206' F6 SHR
657 0207' 57 STR GPAGE
658 CALL HXCONV
659 0208' D4 +
660 0209' 0222' +
661 020B' C0 01A0' LBR NEXT3
662 ;
663 020E' FB 03 TESTA2: XRI (0A2H XOR 0A1H) ;IS IT A2?
664 0210' 3A 1C' BNZ OUTASC ;EXTEND TTY W/ BRANCH FROM HERE
665 0212' 4D LDA RD
666 0213' FA 0F ANI 0FH
667 0215' 57 STR GPAGE
668 CALL HXCONV
669 0216' D4 +
670 0217' 0222' +
671 0219' C0 01A0' LBR NEXT3
672 ;

```

```
673 021C' 26          OUTASC: DEC RINPTR
674 021D' 46          LDA RINPTR
675 021E' 57          OUTPT1: STR GPAGE
676 021F' C0 0130'   LBR OUTPT2
677 ;
678 ;
679 0222' 07          HXCONV: LDN GPAGE      ;ONLY USED BY TTY
680 0223' FC F6          ADI OF6H
681 0225' C3 0230'   LBDF GTR9
682 0228' 07          LDN GPAGE
683 0229' F9 30          ORI 030H
684 022B' 57          STORE: STR GPAGE
685                   CALL OUTCHR
686 022C' D4          +
687 022D' 0249'      +
688                   EXIT
689 022F' D5          +
690 ;
691 0230' FC 41          GTR9: ADI 041H
692 0232' 30 2B'      BR STORE
693 ;
694 ;
695 ;***** IN4D TSRE *****
696 ;
697 ;
698 0234'              IN4DT?: CALL TSRE?
699 0234' D4          +
700 0235' 023A'      +
701 0237' C0 00FD'   LBR IN4D
702 ;
703 ;***** WAIT FOR TRANS. SER. REG. EMPTY *****
704 ;          ( LOOP 1 )
705 ;
706 ;
707 023A' E2          TSRE?: SEX STACK      ; CALLED BY PROMPT, TEST OK,
708 023B' 6A          ;          AND IN4DTSRE, AND PASSTHRU
709 023C' 6B          WAIT4: INP DATA1 ; CLEAR DA (DATA AVAILABLE)
710 023D' FA C0          ANI 0COH      ; MASK FOR TSRE & THRE
711 023F' FB C0          XRI 0COH      ; TSRE = THRE = 1 ?
712 0241' 3A 3B'      BNZ WAIT4
713                   CALL DELAY2    ; 2 BIT DLY
714 0243' D4          +
715 0244' 0150'      +
716 0246' E2          SEX STACK
717 0247' 6A          INP DATA1      ; CLEAR ECHO DA
718                   EXIT
719 0248' D5          +
720 ;
721 ;
722 ;***** SAIL OUT CHARACTER *****
723 ;          ( LOOP 1 )
724 ;
725 0249' 6B          OUTCHR: INP STAT1
726 024A' FA C0          ANI OCH      ; CHECK PREVIOUS I/O ERROR
727 024C' CA 0082'   LBNZ IOERR
728 024F' 02          THRE?: LDN STACK
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729 0250' FE           SHL           ; CHECK THREE
730 0251' CB 0249'    LBNF OUTCHR  ; WAIT FOR UART READY
731 0254' E7          SEX GPAGE
732 0255' F8 FE      LDI LOW IOLOC
733 0257' A7          PLO GPAGE
734 0258' 62          OUT DATA1  ; LOAD UART FROM I/O LOCATION
735 0259' 27          DEC GPAGE
736 025A' FC 00      ADI 00H       ; CLEAR DF
737                   EXIT
738 025C' D5          +
739                   ;
740                   ;
741                   ;***** ? Memory routine *****
742                   ;
743                   ;
744 025D'             QUESTM: CALL IN4D
745 025D' D4          +
746 025E' 00FD'      +
747 0260' E2          SEX STACK
748 0261' 8D          GLO RD
749 0262' 73          STXD
750 0263' 9D          GHI RD
751 0264' 73          STXD
752                   CALL IN4D
753 0265' D4          +
754 0266' 00FD'      -
755 0268' 9D          GHI RD
756 0269' 3E          PHI RE
757 026A' 3D          GLO RD
758 026B' AE          PLO RE
759 026C' 12          INC STACK
760 026D' 42          LDA STACK
761 026E' 3D          PHI RD
762 026F' 02          LDN STACK
763 0270' AD          PLO RD
764                   CALL DELAY2
765 0271' D4          +
766 0272' 0150'      +
767 0274' E2          OUTADR: SEX STACK
768 0275' 8D          GLO RD
769 0276' 73          STXD
770 0277' 9D          GHI RD
771 0278' 73          STXD
772                   CALL TTY
773 0279' D4          +
774 027A' 019D'      +
775 027C' CA          DB 0CAH
776 027D' 81          DB 081H  ; TYPE: CR, LF, NULL X 6, R
777 027E' 81          DB 081H
778 027F' 20          DB 020H  ; OUT HEX PR X2, SPACE
779 0280' FF          DB 0FFH  ; DONE
780 0281' 12          INC STACK
781 0282' 42          LDA STACK
782 0283' BD          PHI RD
783 0284' 02          LDN STACK
784 0285' AD          PLO RD

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785 0286' 8E          NEXBYT: GLO RE
786 0287' 3A 8D'     BNZ DECCNT
787 0289' 9E          GHI RE
788 028A' C2 008E'   LBZ PROMPT
789 028D' 2E          DECCNT: DEC RE
790                   CALL TTY
791 028E' D4          +
792 028F' 019D'     +
793 0291' 8DFF       DW 8DFFH      ; TYPE: OUT HEX RD, DONE
794 0293' 8D         GLO RD
795 0294' FA 0F      ANI 00FH      ; MASK FOR LINE LENGTH
796 0296' C2 02A6'   LBZ LNTEST    ;      07 = 08H / LINE
797 0299' FA 01      ANI 01H       ;      0F = 10H / LINE
798 029B' CA 0286'   LBNZ NEXBYT
799                   CALL TTY
800 029E' D4          +
801 029F' 019D'     +
802 02A1' 20FF       DW 20FFH      ; TYPE: SPACE, DONE
803 02A3' C0 0286'   LBR NEXBYT
804 02A6' 8E          LNTEST: GLO RE    ; TEST FOR END OF LINE
805 02A7' 3A AF'     BNZ LNEND
806 02A9' 9E          GHI RE
807 02AA' 3A AF'     BNZ LNEND
808 02AC' C0 008E'   LBR PROMPT
809 02AF'            LNEND: CALL TTY    ; TYPE: ' ', DONE
810 02AF' D4          +
811 02B0' 019D'     +
812 02B2' 3BFF       DW 3BFFH
813 02B4' C0 0274'   LBR OUTADR
814                   ;
815                   ;
816                   ; ***** ! Memory Routine *****
817                   ;
818                   ;
819 02B7' F8 33       WRITEM: LDI LOW SYSFLG
820 02B9' A7          PLO GPAGE
821 02BA' 07          LDN GPAGE    ; CHECK FOR UNLOCK FLAG
822 02BB' FA 40      ANI 40H      ;      GO TO SAY NO IF LOCKED
823 02BD' C2 03F8'   LBZ SAYNO
824 02C0'            INADDR: RLDI RD, 0000 ; WAIT FOR NUMERIC INPUT
825 02C0' 68 CD      +
826 02C2' 0000      +
827                   CALL INCHAR
828 02C4' D4          +
829 02C5' 00E1'     +
830                   CALL ASCHEX
831 02C7' D4          +
832 02C8' 0118'     +
833 02CA' 33 C0'     BDF INADDR
834                   CALL SHFTD4    ; PUT ADDRESS POINTER IN R(6)
835 02CC' D4          +
836 02CD' 013A'     +
837                   CALL IN4D2
838 02CF' D4          +
839 02D0' 0101'     +
840 02D2' 9D         GHI RD

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```

341 02D3' BE PHI RE
342 02D4' 3D GLO RD
343 02D5' AE PLO RE
344 02D6' INIST: CALL INCHAR
345 02D6' D4
346 02D7' 00E1'
347 02D9' 07 LBN GPAGE
348 02DA' 32 D6' BZ INIST ; IGNORE NULLS (NULL =00)
349 CALL ASCHEX
350 02DC' D4
351 02DD' 0118'
352 02DF' 33 FF' BDF TESTSP ; DF = NOT HEX
353 02E1' 07 LBN GPAGE
354 02E2' AD PLO RD ; SAVE 10 DIGIT
355 02E3' INEND: CALL INCHAR
356 02E3' D4
357 02E4' 00E1'
358 CALL ASCHEX
359 02E6' D4
360 02E7' 0118'
361 02E9' 33 FF' BDF ERROR
362 CALL SHFTD4
363 02EB' D4
364 02EC' 013A'
365 02EE' 3D GLO RD
366 02EF' 5E STR RE ; WRITE INTO RAM
367 02F0' 1E INC RE
368 02F1' 30 D6' BR INIST
369 ;
370 02F3' ERROR: CALL DELAY2
371 02F3' D4
372 02F4' 0150'
373 CALL DTY ; TYPE:
374 02F5' D4
375 02F7' 019D'
376 02F9' 3F3F DW 3F3FH ;
377 02FB' FF DB DONE ; DONE
378 02FC' 3C 003E' LBR PROMPT
379 ;
380 02FF' 07 TESTSP: LBN GPAGE ; TEST FOR DELIMITORS
381 0300' FB 0C XRI 0CH ; KOR 'SPACE' IS IT 'SPACE' ?
382 0302' 3C 02D6' LBE INIST
383 0305' FB 0C XRI 0CH ; KOR 'SPACE' IS IT 'SPACE' ?
384 0307' 3A 0310' LBNZ SEMI?
385 CALL PASSCA
386 030A' D4
387 030B' 0324'
388 030D' 30 02D6' LBR INIST
389 0310' FB 07 SEMI?: XRI 07H ; KOR 'SPACE' IS IT 'SPACE' ?
390 0312' 3A 1A' BNZ TESTCR
391 CALL PASSCA
392 0314' D4
393 0315' 0324'
394 0317' 30 02C0' LBR INADDR
395 031A' FB 36 TESTCR: XRI 036H ; KOR 'SPACE' IS IT 'SPACE' ?
396 031C' 3A 02F3' LBNZ ERROR

```

```

897 031F' FC 00 ADI 00H ; IF NO ERROR, CLEAR DF
898 0321' CO 008E' LBR PROMPT ; GO TO PROMPT
899 ;
900 0324' PASSCA: CALL INCHAR ; ONLY USED BY M
901 0324' D4 +
902 0325' 00E1' +
903 0327' 07 LDN GPAGE
904 0328' FB 0D XRI 0DH ; IS IT 'CR' ?
905 032A' CA 0324' LBNZ PASSCA
906 032D' INLF: CALL INCHAR
907 032D' D4 +
908 032E' 00E1' +
909 0330' 07 LDN GPAGE
910 0331' FB 0A XRI 0AH ; IS IT 'LF' ?
911 0333' 3A 2D' BNZ INLF
912 EXIT
913 0335' D5 +
914 ;
915 ;
916 ;***** MOVE *****
917 ;
918 0336' MOVE: CALL TTY
919 0336' D4 +
920 0337' 019D' +
921 0339' 6F 76 65 20 DB 'ove from '
922 033D' 66 72 6F 6D
923 0341' 20
924 0342' 03 DB ETX
925 0343' 9DFF DW 09DFFH
926 0345' 9D GHI RD
927 0346' 3A PHI RA
928 0347' 3D GLO RD
929 0348' AA PLO RA
930 CALL TTY
931 0349' D4 +
932 034A' 019D' +
933 034C' 74 6F 20 DB ' '
934 034F' 03 DB ETX
935 0350' 9DFF DW 09DFFH
936 0352' 9D GHI RD
937 0353' 3B PHI RB
938 0354' 2D GLO RD
939 0355' AB PLO RB
940 CALL TTY
941 0356' D4 +
942 0357' 019D' +
943 0359' 6C 65 6E 67 DB 'length '
944 035D' 74 68 20
945 0360' 03 DB ETX
946 0361' 9DFF DW 09DFFH
947 CALL OK?
948 0363' D4 +
949 0364' 0407' +
950 0366' CB 008E' LBNF PRONPT ;return to prompt if no flag
951 ;
952 0369' 4A NOV: LDA RA

```



```

953 036A' 5B STR RB
954 036B' 1B INC RB
955 036C' 2D DEC RD
956 036D' 9D GHI RD
957 036E' 3A 69' BNZ MOV
958 0370' 3D GLO RD
959 0371' 3A 69' BNZ MOV
960 CALL TTY
961 0373' D4 +
962 0374' 019D' +
963 0376' 07FF DW 07FFH
964 0378' C0 008E' MOVRTN: LBR PROMPT
965 ;
966 ;
967 ;***** VERIFY *****
968 ;
969 ;
970 037B' VERFY: CALL TTY
971 037B' D4 +
972 037C' 019D' +
973 037E' 65 72 69 66 DB 'erify '
974 0382' 79 20
975 0384' 03 DB ETX
976 0385' 9DFF DW 09DFFH
977 0387' 9D GHI RD ;STORE 'VERIFY' GROUP ADDR IN RA
978 0388' BA PHI RA
979 0389' 3D GLO RD
980 038A' AA PLO RA
981 CALL TTY
982 038B' D4 -
983 038C' 019D' -
984 038E' 77 69 74 63 DB 'with '
985 0392' 20
986 0393' 03 DB ETX
987 0394' 9DFF DW 09DFFH
988 0396' 9D GHI RD ;STORE 'WITH' group in RB
989 0397' 3B PHI RB
990 0398' 3D GLO RD
991 0399' AB PLO RB
992 CALL TTY
993 039A' D4 -
994 039B' 019D' -
995 039D' 6C 65 6E 67 DB 'length '
996 03A1' 74 68 20
997 03A4' 03 DB ETX
998 03A5' 9DFF DW 09DFFH
999 03A7' 9D GHI RD ;STORE LENGTH IN RC
1000 03A8' 3C PHI RC
1001 03A9' 3D GLO RD
1002 03AA' AC PLO RC
1003 ;
1004 03AB' 9C WNEXT: GHI RC
1005 03AC' 3A 3D' BNZ VMORE
1006 03AE' 3C GLO RC
1007 03AF' 3A 3D' BNZ VMORE
1008 CALL TTY

```

1009	03B1'	D4	+		
1010	03B2'	019D'	+		
1011	03B4'	20 44 4F 4E			DB ' DONE'
1012	03B8'	45			
1013	03B9'	FF			DB DONE
1014	03BA'	CO 008E'			LBR PROMPT
1015					
1016	03BD'	EB		VMORE:	SEX RB
1017	03BE'	0A			LDN RA
1018	03BF'	F3			XOR
1019	03C0'	3A C7'			BNZ VBAD
1020	03C2'	1A		VCONT:	INC RA
1021	03C3'	1B			INC RB
1022	03C4'	2C			DEC RC
1023	03C5'	30 AB'			BR VNEXT
1024					
1025	03C7'	E2		VBAD:	SEX STACK ; OUTPUT BAD LOCATIONS AND CONTENTS
1026	03C8'	9A			GHI RA
1027	03C9'	3D			PHI RD
1028	03CA'	9A			GLO RA
1029	03CB'	AD			PLO RD
1030					CALL TTY
1031	03CC'	D4	+		
1032	03CD'	019D'	+		
1033	03CF'	CA81			DW 0CAB1H ; REG A ADDRESS
1034	03D1'	3120			DW 08120H
1035	03D3'	FF			DB 0FFH
1036	03D4'	9A			GHI RA
1037	03D5'	3D			PHI RD
1038	03D6'	8A			GLO RA
1039	03D7'	AD			PLO RD
1040					CALL TTY
1041	03D8'	D4	+		
1042	03D9'	019D'	+		
1043	03DB'	3D20			DW 08D20H ; REG A CONTENTS
1044	03DD'	20FF			DW 020FFH
1045	03DF'	9B			GHI RB
1046	03E0'	3D			PHI RD
1047	03E1'	3B			GLO RB
1048	03E2'	AD			PLO RD
1049					CALL TTY
1050	03E3'	D4	+		
1051	03E4'	019D'	+		
1052	03E6'	3D20			DW 08D20H ; REG B CONTENTS
1053	03E8'	FF			DB 0FFH
1054	03E9'	9B			GHI RB
1055	03EA'	3D			PHI RD
1056	03EB'	3B			GLO RB
1057	03EC'	AD			PLO RD
1058					CALL TTY
1059	03ED'	D4	+		
1060	03EE'	019D'	+		
1061	03F0'	9181			DW 08181H ; REG B ADDRESS
1062	03F2'	FF			DB 0FFH
1063	03F3'	30 C2'			BR VCONT
1064					

```

1065 ;
1066 ;***** RUN TARGET SYSTEM *****
1067 ;
1068 03F5' 00 081F RUN: LBR TARADR
1069 ;
1070 ;
1071 ;
1072 ;***** SAY NO : *****
1073 ;
1074 03F8' SAYNO: CALL DELAY2
1075 03F8' D4 +
1076 03F9' 0150' +
1077 CALL TTY
1078 03FB' D4 +
1079 03FC' 019D' +
1080 03FE' 204E DW 204EH ; TYPE: SPACE No :
1081 0400' 6F20 DW 6F20H ; DONE
1082 0402' 21FF DW 21FFH
1083 0404' 00 008E' LBR PROMPT
1084 ;
1085 ;
1086 ;
1087 ;***** TEST OK ? *****
1088 ;
1089 0407' OK?: CALL TSRE?
1090 0407' D4 -
1091 0408' 023A' -
1092 CALL TTY ;TYPE: Ok ? ,
1093 040A' D4 +
1094 040B' 019D' +
1095 040D' 20 4F 6B 20 DB ' Ok ? '
1096 0411' 3F 20
1097 0413' 03 DB ETX
1098 0414' FF DB DONE : DONE
1099 ;
1100 0415' YES?: CALL TSRE?
1101 0415' D4 +
1102 0416' 023A' +
1103 CALL INCHAR
1104 0418' D4 -
1105 0419' 00E1' -
1106 041B' 07 LDN SPAGE
1107 041C' FB 59 XRI 059H ; XOR 'Y' IS IT YES ?
1108 041E' CA 0424' LBNZ NO
1109 ;
1110 0421' FF 00 OKRTN: SMI 00H ; SET DF
1111 EXIT
1112 0423' D5 +
1113 0424' FC 00 NO: ADI 00H ; CLEAR DF
1114 EXIT
1115 0426' D5 +
1116 ;
1117 ;
1118 ;
1119 ;***** $ P (RUNS PROGRAM AT AAAA *****
1120 ; WITH PC = R3, X = R2)

```

```

1121 ;
1122 0427' F8 03 TESTS: LDI LOW SYSFLG
1123 0429' A7 PLO GPAGE
1124 042A' 07 LDN GPAGE
1125 042B' FA E0 ; MASK FOR ADDR, WRITE, SYS FLAGS
1126 042D' FB E0 ; ADDR = WRITE = SYS = 1 ?
1127 042F' CA 03F8' LBNZ SAYNO
1128 0432' INS: CALL IN4D
1129 0432' D4 +
1130 0433' 00FD' +
1131 0435' 9D GHI RD
1132 0436' BE PHI RE
1133 0437' 8D GLO RD
1134 0438' AE PLO RE
1135 CALL TTY
1136 0439' D4 +
1137 043A' 019D' +
1138 043C' 2081 DW 2081H ; TYPE: SPACE,
1139 043E' 812C DW 812CH ; OUT HEX PR ', '
1140 0440' FF DB 0FFH ; DONE
1141 CALL OK?
1142 0441' D4 +
1143 0442' 0407' +
1144 0444' CB 008E' LBNF PROMPT
1145 0447' 32 SEX STACK ; X => R2
1146 0448' 36 GLO RTNPTR
1147 0449' 73 STXD
1148 044A' 96 GHI RTNPTR
1149 044B' 73 STXD
1150 044C' 9E GHI RE
1151 044D' 36 PHI RTNPTR
1152 044E' 3E GLO RE
1153 044F' A6 PLO RTNPTR
1154 0450' FC 00 ADI 00 ; CLEAR DF
1155 EXIT
1156 0452' D5 +
1157 ;
1158 ;
1159 ;
1160 ;***** CRC CALCULATION *****
1161 ;
1162 ;
1163 CRC: CALL TTY ;TYPE:
1164 0453' D4 +
1165 0454' 019D' +
1166 0456' 52 43 20 DB 'RC ' ; RC from.
1167 0459' 66 72 6F 6D DB 'from ' ; ETX,
1168 045D' 20
1169 045E' 03 DB 03H ; IN4D,
1170 045F' 9DFF DW 9DFFH ; DONE
1171 0461' 9D GHI RD
1172 0462' BE PHI RE
1173 0463' 8D GLO RD
1174 0464' AE PLO RE
1175 CALL TTY ;TYPE:
1176 0465' D4 +

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1177 0466' 019D' +
1178 0468' 6F 76 65 72 DB 'over ' ; over,
1179 046C' 20
1180 046D' 03 DB 03H ; ETX,
1181 046E' 9D DB 09DH ; IN4D,
1182 046F' FF DB 0FFH ; DONE
1183 0470' F8 07 LDI LOW CRCLO
1184 0472' A7 PLO GPAGE
1185 0473' F8 00 LDI LOW 00H
1186 0475' 3C PHI RC ; CLEAR "ALL FF'S" FLAG
1187 0476' 57 STR GPAGE
1188 0477' 27 DEC GPAGE ; SET CRC HI & LO = 0000
1189 0478' 57 STR GPAGE
1190 0479' 0E CLOOP1: LDN RE
1191 047A' FB FF XRI 0FFH
1192 047C' CE LSZ
1193 047D' BC PHI RC
1194 047E' E2 SEX STACK ; A NOP
1195 CALL CRCSUB
1196 047F' 04 +
1197 0480' 04BB' +
1198 0482' 2D DEC RD
1199 0483' 8D GLO RD
1200 0484' CA 0479' LBNZ CLOOP1
1201 0487' 9D GHI RD
1202 0488' CA 0479' LBNZ CLOOP1
1203 048B' 9C GHI RC
1204 048C' C2 04A3' LSZ SAYCLR ; IS MEMORY SPACE EMPTY ?
1205 048F' 97 GHI GPAGE
1206 0490' 3D PHI RD
1207 0491' 37 GLO GPAGE
1208 0492' AD PLO RD
1209 CALL TTY ; IF NOT, TYPE:
1210 0493' 04 +
1211 0494' 019D' +
1212 0496' CA DB 0CAH ; CR, LF
1213 0497' 43 52 43 20 DB 'CRC = ' ; CRC =
1214 0498' 3D 20
1215 049D' 3D8D DW 3D3DH ; OUT VID RD X2
1216 049F' FF DB 0FFH ; DONE
1217 04A0' C0 008E' LBR PROMPT
1218 04A3' SAYCLR: CALL TTY ; IF CLEAR, TYPE: CR, LF, NULL X6
1219 04A3' 04 +
1220 04A4' 019D' +
1221 04A6' CA DB 0CAH ; Memory is clear
1222 04A7' 4D 65 6D 6F DB 'Memory '
1223 04AB' 72 79 20
1224 04AE' 69 73 23 63 DB 'is clear.'
1225 04B2' 6C 65 61 72
1226 04B6' 2E
1227 04B7' FF DB 0FFH ; DONE
1228 04B8' C0 008E' LBR PROMPT ; GO TO PROMPT
1229 ;
1230 ;
1231 04BB' E7 CRCSUB: SEX GPAGE ; CRC CALCULATION SUBROUTINE
1232 04BC' 4E LDA RE

```

1233	04BD'	F3	XOR
1234	04BE'	27	DEC GPAGE
1235	04BF'	57	STR GPAGE
1236	04C0'	F6	SHR
1237	04C1'	F6	SHR
1238	04C2'	F6	SHR
1239	04C3'	F6	SHR
1240	04C4'	F3	XOR
1241	04C5'	57	STR GPAGE
1242	04C6'	FE	SHL
1243	04C7'	FE	SHL
1244	04C8'	FE	SHL
1245	04C9'	FE	SHL
1246	04CA'	60	IRX
1247	04CB'	60	IRX
1248	04CC'	F3	XOR
1249	04CD'	27	DEC GPAGE
1250	04CE'	73	STXD
1251	04CF'	72	LDXA
1252	04D0'	F6	SHR
1253	04D1'	F6	SHR
1254	04D2'	F6	SHR
1255	04D3'	F3	XOR
1256	04D4'	73	STXD
1257	04D5'	F0	LDX
1258	04D6'	FE	SHL
1259	04D7'	FE	SHL
1260	04D8'	FE	SHL
1261	04D9'	FE	SHL
1262	04DA'	FE	SHL
1263	04DB'	F3	XOR
1264	04DC'	60	IRX
1265	04DD'	60	IRX
1266	04DE'	73	STXD
1267			EXIT
1268	04DF'	D5	
1269			:
1270			:
1271			:***** HELP FILE *****
1272			:
1273			:
1274	04E0'		HELP: CALL TTY
1275	04E0'	D4	
1276	04E1'	019D'	
1277	04E3'	65 6C 70	DB 'elp'
1278	04E6'	CA	DB OCAH
1279	04E7'	42 54 55 20	DB 'BTU MONITOR'
1280	04EB'	4D 4F 4E 49	
1281	04EF'	54 4F 52	
1282	04F2'	CACA	DW OCACAH
1283	04F4'	53 79 73 74	DB 'System Commands:'
1284	04F8'	65 6D 20 43	
1285	04FC'	6F 6D 6D 61	
1286	0500'	6E 64 73 3A	
1287	0504'	CA	DB OCAH
1288	0505'	20 24 61 61	DB ' \$aaaa (Run @ aaaa)'

1289	0509'	61 61 20 28	
1290	050D'	52 75 6E 20	
1291	0511'	40 20 61 61	
1292	0515'	61 61 29	
1293	0518'	CA	DB 0CAH
1294	0519'	20 21 52 75	DB ' !Run target system ('
1295	051D'	6E 20 74 61	
1296	0521'	72 67 65 74	
1297	0525'	20 73 79 73	
1298	0529'	74 65 6D 20	
1299	052D'	29	
1300	052E'	081F	DW TARADR
1301	0530'	29	DB ')'
1302	0531'	CACA	DW 0CACAH
1303	0533'	4D 65 6D 6F	DB 'Memory Commands:'
1304	0537'	72 79 20 43	
1305	053B'	6F 6D 6D 61	
1306	053F'	6E 54 73 3A	
1307	0543'	CA	DB 0CAH
1308	0544'	20 2E 4D 6F	DB ' .Move; .Verify; .Ram Test'
1309	0548'	76 65 3B 20	
1310	054C'	2E 56 65 72	
1311	0550'	69 56 79 3B	
1312	0554'	20 2E 52 61	
1313	0558'	6D 20 54 65	
1314	055C'	73 74	
1315	055E'	CA	DB 0CAH
1316	055F'	20 21 4D 61	DB ' !Maaaa dd; '
1317	0563'	61 61 61 20	
1318	0567'	64 64 3B 20	
1319	056B'	20	
1320	056C'	20 3F 4D 61	DB ' ?Maaaa unuu'
1321	0570'	61 61 61 20	
1322	0574'	6E 6E 6E 6E	
1323	0578'	CA	DB 0CAH
1324	0579'	20 4D 65 6D	DB ' Memory protect'
1325	057D'	6F 72 79 20	
1326	0581'	7D 72 6F 74	
1327	0585'	65 63 74	
1328	0588'	CA	DB 0CAH
1329	0589'	20 3F 43 72	DB ' ?Crc calc'
1330	058D'	63 20 63 61	
1331	0591'	6C 63	
1332	0593'	CAFF	DW 0CAFFH
1333	0595'	C0 008E'	LBR PROMPT
1334			;
1335			;
1336			*****
1337			;
1338			***** MEMORY PROTECT AND ENABLE *****
1339			;
1340	0598'		MENSAV: CALL TTY ;TYPE: (text)
1341	059B'	D4	+
1342	0599'	019D'	+
1343	059B'	65 6D 6F 72	DB 'emory - '
1344	059F'	79 20 2D 20	

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1345 05A3' 50 72 6F 74          DB 'Protect or Enable'
1346 05A7' 65 63 74 20
1347 05AB' 6F 72 20 45
1348 05AF' 6E 61 62 6C
1349 05B3' 65
1350 05B4' 20 28 50 20          DB ' (P or E) ? '
1351 05B8' 6F 72 20 45
1352 05BC' 29 20 3F 20
1353 05C0' 03FF                DW 03FFH          ;      STX, DONE
1354                                CALL TSRE?
1355 05C2' D4                    +
1356 05C3' 023A'                +
1357                                CALL ITB          ;CALL INPUT TEST AND BRANCH
1358 05C5' D4                    +
1359 05C6' 0180'                +
1360 05C8' 50                    DB 'P'           ;      IF P, GO TO PTECT
1361 05C9' 05DA'                DW PTECT
1362 05CB' 45                    DB 'E'           ;      IF E, GO TO ENABLE
1363 05CC' 05D2'                DW ENABLE
1364 05CE' FF                    DB OFFH
1365 05CF' C0 008E'            LBR PROMPT      ;GO TO PROMPT IF NOT P OR E
1366                                ;
1367 05D2' F8 00                ENABLE: LDI 00
1368 05D4' BB                    PHI RB
1369 05D5' F8 01                LDI 01
1370 05D7' AB                    PLO RB          ;SET PROTECT FLAG
1371 05D8' 30 DE'                BR SETPG
1372 05DA' F8 00                PTECT: LDI 00
1373 05DC' AB                    PLO RB
1374 05DD' 3B                    PHI RB          ;SET ENABLE
1375 05DE'                        SETPG: CALL TTY  ;TYPE: CR, LF, (text)
1376 05DS' D4                    +
1377 05DF' 019D'                +
1378 05E1' CA                    DB 0CAH
1379 05E2' 46 72 6F 6D          DB 'From page '
1380 05E6' 20 70 61 67
1381 05EA' 65 20
1382 05EC' 03                    DB ETX
1383 05ED' 9DFF                DW 9DFFH          ;      IN4D, DONE
1384 05EF' 8D                    GLO RD
1385 05F0' BE                    PHI RE          ;SET CURRENT PAGE
1386                                CALL TTY
1387 05F1' D4                    +
1388 05F2' 019D'                +
1389 05F4' 6F 76 65 72          DB 'over '      ;TYPE: (text)
1390 05F8' 20
1391 05F9' 03                    DB ETX          ;      ETX
1392 05FA' 9D                    DB 09DH          ;      IN4D,
1393 05FB' 20 70 61 67          DB ' pages..'   ;      pages..
1394 05FF' 65 73 2E
1395 0602' 03FF                DW 03FFH          ;      ETX, DONE
1396 0604' 8D                    GLO RD
1397 0605' AC                    PLO RC
1398 0606' C6                    LSNZ
1399 0607' FC 01                ADI 01
1400 0609' AC                    PLO RC

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```

1401                                CALL MEMCHG
1402      060A'  D4                    +
1403      060B'  0616'                +
1404      060D'  CD 008E'            LBR PROMPT
1405                                ;
1406                                ;
1407                                ;***** MEMORY PROTECT OR ENABLE SUBROUTINE *****
1408                                ;
1409                                ;
1410      0610'  46                    MEMSUB: LDA LIST      ;PASS ENABLE BIT
1411      0611'  AB                    PLO RB
1412      0612'  46                    LDA LIST      ;PASS START PAGE
1413      0613'  5E                    PHI RE
1414      0614'  46                    LDA LIST      ;PASS # OF PAGES
1415      0615'  AC                    PLO RC
1416                                ;
1417      0616'  E3                    MEMCHG: SEX PC      ;SELECT SYSTEM I/O GROUP
1418      0617'  61                    OUT GROUP
1419      0618'  97                    DB SYSTEM
1420                                ;
1421      0619'  EE                    SEX RE
1422      061A'  8C                    NEXPG: GLO RC
1423      061B'  32 39'                BZ MDONE
1424      061D'  9E                    GHI RE          ;ALWAYS ENABLE:
1425      061E'  FB 57                XRI STKPG      ;          STACKPAGE
1426      0620'  32 2C'                BZ SETQ
1427      0622'  9E                    GHI RE
1428      0623'  FB 56                XRI GLOPG      ;          GLOBAL PAGE
1429      0625'  32 2C'                BZ SETQ
1430      0627'  8B                    GLO RB
1431      0628'  3A 2C'                BNZ SETQ      ;PROTECT OR ENABLE ?
1432      062A'  7A                    REQ          ;          PROTECT -> Q = 0
1433      062B'  38                    SKP
1434      062C'  7B                    SETQ: SEQ          ;          ENABLE -> Q = 1
1435      062D'  67                    OUT MEMORY    ;I/O = MEM. PROTECT
1436      062E'  7A                    REQ
1437      062F'  9E                    GHI RE
1438      0630'  FC 01                ADI 01
1439      0632'  BE                    PHI RE
1440      0633'  8C                    GLO RC
1441      0634'  FF 01                SMI 01
1442      0636'  AC                    PLO RC
1443      0637'  30 1A'                BR NEXPG
1444                                ;
1445      0639'  F8 0A                MDONE: LDI LOW GRPSAV ;SELECT UART I/O GROUP
1446      063B'  A7                    PLO GPAGE      ;          AND STORE ON GLOBAL PAGE
1447      063C'  F8 06                LDI UARTS
1448      063E'  57                    STR GPAGE
1449      063F'  E7                    SEX GPAGE
1450      0640'  61                    OUT GROUP
1451                                EXIT
1452      0641'  D5                    +
1453                                ;
1454                                ;
1455                                ;***** RAM TEST ROUTINE *****
1456                                ;

```

```

1457 0642'          RANTST: CALL TTY
1458 0642'  D4      +
1459 0643'  019D'   +
1460 0645'  CA      DB 0CAH
1461 0646'  52 51 6D 20  DB 'Ram test - start at '
1462 064A'  74 65 73 74
1463 064B'  20 2D 20 73
1464 0652'  74 61 72 74
1465 0656'  20 61 74 20
1466 065A'  03      DB ETX
1467 065B'  9DFF    DW 9DFFH
1468 065D'  9D      GHI R0      ;Start address to R8
1469 065E'  8B      PHI R8
1470 065F'  8D      GLO R0
1471 0660'  AB      PLO R8
1472
1473          ;
1474          CALL TTY
1475 0661'  D4      +
1476 0662'  019D'   +
1477 0664'  20 4F 56 45  DB ' OVER '
1478 0668'  52 20
1479 066A'  03      DB ETX
1480 066B'  9DFF    DW 9DFFH
1481
1481 066D'  9F      LDSET: GHI R0      ;Get rand key from R0
1482 066E'  8B      PHI R8
1483
1484 066F'  9B      GHI R8      ;Start address to R8
1485 0670'  89      PHI R9
1486 0671'  8B      GLO R8
1487 0672'  A9      PLO R9
1488
1489 0673'  9D      GHI R0      ;Length to RA
1490 0674'  8A      PHI RA
1491 0675'  8D      GLO R0
1492 0676'  AA      PLO RA
1493
1494          ;
1494 0677'          LDLOOP: CALL RAND
1495 0677'  D4      +
1496 0678'  06CA'   +
1497
1498 067A'  98      GHI R8
1499 067B'  59      STR R9
1500 067C'  19      INC R9
1501 067D'  2A      DSC RA
1502 067E'  8A      GLO RA
1503 067F'  3A 77'  BNZ LDLOOP
1504 0681'  9A      GHI RA
1505 0682'  3A 77'  BNZ LDLOOP
1506
1507          ;
1508 0684'  9F      CHRSET: GHI R0
1509 0685'  8B      PHI R8
1510 0686'  9B      GHI R8
1511 0687'  89      PHI R9
1512 0688'  8B      GLO R8

```

1513	0689'	A9		PLO R9
1514	068A'	9D		GHI RD
1515	068B'	3A		PHI RA
1516	068C'	8D		GLO RD
1517	068D'	AA		PLO RA
1518	068E'		CHK:	CALL RAND
1519	068E'	D4	-	
1520	068F'	06CA'	+	
1521	0691'	E9		SEX R9
1522	0692'	98		GHI R8
1523	0693'	F3		XOR
1524	0694'	3A AD'		BNZ ERRST
1525	0696'	19	CCNT1:	INC R9
1526	0697'	2A		DEC RA
1527	0698'	3A		GLO RA
1528	0699'	3A 3E'		BNZ CHK
1529	069B'	3A		GHI RA
1530	069C'	3A 3E'		BNZ CHK
1531			;	
1532	069E'	9F	PASSDN:	GHI RF
1533	069F'	38		PHI R8
1534				CALL RAND
1535	06A0'	D4	-	
1536	06A1'	06CA'	-	
1537	06A3'	98		GHI R8
1538	06A4'	3F		PHI RF
1539				CALL TTY
1540	06A5'	D4	-	
1541	06A6'	019D'	-	
1542	06A8'	2A		DB '*'
1543	06A9'	00FF		DW DONE
1544	06AB'	30 5D'		BR LDSET
1545			;	
1546	06AD'	A8	ERRST:	PLO R8
1547				CALL TTY
1548	06AE'	D4	-	
1549	06AF'	019D'	-	
1550	06B1'	CAFF		DW 0CAFFH
1551	06B3'	38		GLO R8
1552	06B4'	3D		PHI RD
1553				CALL TTY
1554	06B5'	D4	-	
1555	06B6'	019D'	-	
1556	06B8'	31		DB 081H
1557	06B9'	20 61 74 20		DB ' at '
1558	06BD'	FF		DB OFFH
1559	06BE'	99		GHI R9
1560	06BF'	3D		PHI RD
1561	06C0'	39		GLO R9
1562	06C1'	AD		PLO RD
1563				CALL TTY
1564	06C2'	D4	+	
1565	06C3'	019D'	+	
1566	06C5'	8181		DW 8181H
1567	06C7'	FF		DB OFFH
1568	06C8'	30 96'		BR CONT1

```
1569  
1570  
1571 06CA' F8 00  
1572 06CC' A8  
1573 06CD' 98  
1574 06CE' 3A D3'  
1575 06D0' F8 FF  
1576 06D2' B8  
1577 06D3' F6  
1578 06D4' 3B D7'  
1579 06D6' 18  
1580 06D7' F6  
1581 06D8' F6  
1582 06D9' 3B DC'  
1583 06DB' 18  
1584 06DC' F6  
1585 06DD' 3B E0'  
1586 06DF' 18  
1587 06E0' F6  
1588 06E1' 3B E4'  
1589 06E3' 18  
1590 06E4' 88  
1591 06E5' F6  
1592 06E6' 98  
1593 06E7' 76  
1594 06E8' 88  
1595  
1596 06E9' 06  
1597  
1598  
1599  
1600  
1601
```

RAND: LDI 00
PLO R8
GHI R8
BNZ ON0
LDI 0FFH
PHI R8
ON0: SHR
BNF ON1
INC R8
ON1: SHR
SHR
BNF ON2
INC R8
ON2: SHR
BNF ON3
INC R8
ON3: SHR
BNF ON4
INC R8
ON4: GLO R8
SHR
GHI R8
RSHR
PHI R8
EXIT

LIST
END

MACROS:

BCI	3XI	CALL	CID	CIE	DACI	DADC	DADD
DADI	DBNZ	DSAV	DSBI	DSM	DSNB	DSMI	DTC
ETQ	EXIT	GEC	IDLE	LDC	POP	PPAGE	PUSH
RLDI	RLXA	RNX	RSXD	SCAL	SCM1	SCM2	SPM1
SPM2	SRET	STM	STPC	TCAL	TRET	XID	XIE

SYMBOLS:

ASCHX	0118'	ASCRD1	01AC'	BANGGR	00D4'	BR1ST	009E'
BTU	0000	CALL	0066'	CHK	068E'	CHKSET	0684'
CLOOP1	0479'	CNVRT	010E'	CONT1	0696'	CRC	0453'
CRCHI	5606	CRCLO	5607	CRCRAM	5605	CRCSUB	04BB'
CTOP	0065'	CTRL1	0003	CTRL2	0005	CTRL3	0007
CYCCNT	0008	DATA1	0002	DATA2	0004	DATA3	0006
DECCNT	028D'	DELAY2	0150'	DLY00	0040'	DMA	0000
DONE	00FF	DOTGR	00B7'	ENABLE	05D2'	ERRLST	06AD'
ERROR	02F3'	ETX	0003	FINIS	003A'	FORMT1	0012
GLOPG	0056	GP	5600	GPAGE	0007	GROUP	0001
GRPSAV	560A	GTR9	0230'	HALT	0006	HDSTRT	0000'
HELP	04E0'	HEXRD1	01BA'	HXCONV	0222'	INS	0432'
IN1ST	02D6'	IN2ND	02E3'	IN4D	00FD'	IN4D2	0101'
IN4DT?	0234'	IN4RET	010D'	INADDR	02C0'	INCHAR	00E1'
INKWD	015C'	INLF	032D'	INTPC	0001	IOERR	0082'
IOLOC	56FE	ITS	0180'	KEEP2	00ED'	LDLOOP	0677'
LDSET	066D'	LIST	0006	LNEND	02AF'	LNTST	02A6'
MATCH	0171'	MATCH2	0196'	MDONE	0639'	MEMCHG	0616'
MEMORY	0007	MEMSAV	0598'	MENSUB	0610'	MENAB	0017'
MCV	0369'	MOVE	0336'	MOVRTN	0378'	NEWPG	001B'
NEXBYT	0286'	NEXPG	061A'	NEXT2	0184'	NEXT3	01A0'
NO	0424'	NOTHEX	0137'	NUMBER	0130'	OK?	0407'
OKRTN	0421'	ONO	06D3'	ON1	06D7'	ON2	06DC'
ON3	06E0'	ON4	06E4'	OUTADR	0274'	OUTASC	021C'
OUTCA	01E1'	OUTCHR	0249'	OUTHEX	01BF'	OUTPT1	021E'
OUTPT2	01B0'	PASSCA	0324'	PASSDN	069E'	PC	0003
PLEVEL	5602	PLIST	0162'	PMTCHR	003B	PROM1	0008
PROMPT	008E'	PTECT	05DA'	QUESGR	00C7'	QUESTM	025D'
RANTST	0642'	RAND	06CA'	RBHI	5608	RBLO	5609
READDR	0085'	RTN	0076'	RTPTR	0006	RTOP	0075'
RUN	03F5'	SAYCLR	04A3'	SAYNO	03F8'	SCRT	0057'
SCRTST	0056'	SEMI?	0310'	SETPG	05DE'	SETQ	062C'
SETQ1	002D'	SETSL	0007'	SETUP	003D'	SETURT	0047'
SHPTD4	013A'	SHIFT	013F'	STACK	0002	START1	000E'
STAT1	0003	STAT2	0005	STAT3	0007	STKEND	57DF
STKPG	0057	STORE	022B'	SYSFLG	5603	SYSTEM	0007
TARADR	081F	TEST	018B'	TESTS	0427'	TEST90	01A8'
TEST81	01B5'	TEST8D	01D4'	TEST9D	01E9'	TESTA1	01FD'
TESTA2	020E'	TESTCA	01DD'	TESTCR	031A'	TESTDD	01F2'
TESTSP	02FF'	THRE?	024F'	TMATCH	016B'	TSRE?	023A'
TTY	019D'	UARTS	0006	UNADDR	0084'	VBAD	03C7'
VCONT	03C2'	VERFY	037B'	VMORE	03BD'	VNEXT	03AB'
WAIT	0043'	WAIT3	0152'	WAIT4	023B'	WRITEM	0287'
YES?	0415'						

NO FATAL ERROR(S)

LIST	48#	516	519	520	528	529	532	550	559	560	1410	
	1412	1414										
LHEND	305	307	809#									
LHTEST	796	804#										
MATCH	528#											
MATCH2	558	562#										
MDONE	1423	1445#										
MENCHG	1403	1417#										
MEMORY	89#	196	1435									
MENSAV	344	1340#										
MENSUB	1410#											
MENAB	178#											
MOV	952#	957	959									
NOVE	357	918#										
NOVRTN	964#											
NEWPG	183#	204										
NEXBYT	785#	798	803									
NEXPG	1422#	1443										
NEXT2	550#	561										
NEXT3	577#	592	619	635	642	661	671					
NO	1108	1113#										
NOTHEX	449	455	458	468#								
NUMBER	452	462#										
OK?	949	1089#	1143									
OKRTN	1110#											
ON0	1574	1577#										
ON1	1578	1580#										
ON2	1582	1584#										
ON3	1585	1587#										
ON4	1588	1590#										
OUTADR	767#	813										
OUTASC	664	673#										
OUTCA	630#											
OUTCHR	591	687	725#	730								
OUTHEX	601#	626										
OUTPT1	648	675#										
OUTPT2	589#	676										
PASSCA	887	893	900#	905								
PASSDN	1532#											
PC	44#	166	168	178	206	237	241	263	269	271	274	276
	281	283	285	1417								
PLEVEL	132#											
PLIST	516#	518	527									
PMTCHR	148#	320										
POP	30#											
PPAGE	30#											
PROM1	107#											
PROMPT	313#	348	363	378	392	788	808	878	898	950	964	1014
	1083	1144	1217	1228	1333	1365	1404					

Appendix M

The following program was written for a Hewlett - Packard HP-16C calculator. It is used to convert data in the Sea Duct buffer to engineering units. Before running the program, Calculator Register .0 must contain the A/D GND value and Register F must contain the A/D +5V value. The calculator must be placed in the HEX mode before each conversion.

Calculator subroutines A, B, C and D are run to give the following conversions:

A = A/D conversion (12 bit) C = Compass conversion
B = Battery conversion (8 bit) D = Pendulum conversion

For example to convert an A/D value of 3F8 to engineering units, (assume A/D GND = 009 [R.0] and A/D +5V = FE1 [R F.])

1. Press HEX
2. Enter 3F8 - There is no need to hit ENTER
3. Press GSB A
4. Read the answer in the appropriate units (1.24063 Volts for this example).

To convert a compass value of 2C to degrees,

1. Press HEX
2. Enter 2C - There is no need to hit ENTER
3. Press GSB C
4. Read the answer in the appropriate units (61.88 degrees for this example).

HP 16C - Sea Duct Programs

A = A/D conversion (12 Bit) HEX to Volts
B = Battery conversion (8 bit) HEX to Volts
C = Compass HEX to Degrees
D = Pendulum HEX to Degrees

Note: First store A/d GND in R0, A/D +5V in RF in HEX mode

001	43,22, A	LBL-A	A/D Program
002	21, 8	GSB 8	
003	4	4	
004	48	.	
005	9	9	
006	9	9	
007	7	7	
008	20	X	
009	43,21	g RTN	

Appendix M (contd.)

010	43,22, B	LBL-B	Battery Program
011	21, 9	GBS 9	
012	21, 8	GBS 8	
013	3	3	
014	0	0	
015	20	X	
016	43,21	g RTN	
017	43,22, C	LBL-C	Compass Program
018	42, 3	f UNSGN	
019	36	Enter	
020	0	0	
021	42,45, 2	f float 2	
022	3	3	
023	6	6	
024	0	0	
025	20	X	
026	2	2	
027	5	5	
028	6	6	
029	10	:	
030	43,21	g RTN	
031	43,22, D	LBL-D	Pendulum Program
032	36	Enter	
033	0	0	
034	42,45, 2	f float 2	
035	2	2	
036	20	X	
037	4	4	
038	5	5	
039	30	-	
040	43, 21	g RTN	
041	43,22, 8	LBL-8	Scale 12 bit #(HEX) to Decimal Routine
042	42, 3	f UNSGN	
043	36	Enter	
044	45,.0	Rcl.0 (Recall A/D Gnd)	
045	30	-	
046	36	Enter	
047	0	0	
048	42,45, 2	f float 2	
049	44,.1	Store .1	
050	23	HEX	
051	45, F	Rcl F. (Recall A/D +5V)	
052	36	Enter	

Appendix M (contd.)

053	45,.0	Rcl.0	
054	30	-	
055	0	0	
056	42,45, 2	f float 2	
057	45,.1	Recall .1	
058	34	XY	
059	10	‡	
060	42,45, 5	f float 5	
061	43,21	g RTN	
062	43,22, 9	LBL-9	8 bit to 12 bit conversion routine
063	42, A	f SL	
064	42, A	f SL	
065	42, A	f SL	
066	42, A	F SL	
067	43,21	g RTN	

APPENDIX N

SEA DUCT PRE-LAUNCH CHECK LIST

Deployment Date _____

Location _____

Depth _____

1. MAIN BATTERY PACKS

<u>Pack #1</u>	<u>Initial</u>
A. Safety Chain On _____ Off _____	_____
B. Top of Compensation Oil (Marcol)	_____
C. Check water sump drain plugs for security	_____
D. Tie wrap any loose hoses or electrical cables	_____
E. Check microprocessor for security in cradle	_____
F. Check microprocessor compensation diaphragm for top off (Marcol)	_____
G. Check microprocessor electrical plugs for full seating, milk air from connector if necessary	_____
H. Check microprocessor electrical cables; tie wrap if necessary	_____
I. Check all tea cup diaphragms for leakage at wires and seals. Top off as required (5 places)	_____
White (Marcol)	_____
Red (Mil H5606 Hyd. fluid)	_____

J. Back fill battery disconnect with (Marcol) Use disconnect at base of battery to force all air thru plastic check valve. Reconnect to drain fitting	_____
K. Remove battery gas vent line	_____
L. Install disconnect plug in battery gas vent fitting	_____
M. Remove overflow can	_____
N. Check pinger battery voltage	_____
O. Reset pinger and reinstall dummy plugs	_____

Pack #2

Initial

- A. Safety Chain On _____ Off _____
- B. Top of Compensation Oil (Marcol) _____
- C. Check water sump drain plugs for security _____
- D. Tie wrap any loose hoses or electrical cables _____
- E. Check emergency battery pack for security in cradle _____
- F. Check EHRS battery voltage _____
Check MP battery voltage _____
- G. Check emergency battery wiring and plugs for proper
seating, milk air if necessary, cap unused plugs
and wires _____
- H. Check all tea cup diaphragms for leakage at wires
and seals, top off as required (3 places)
 white (Marcol) _____
 red (Mil H5606 Hyd. fluid) _____
- I. Back fill battery disconnect with (Marcol)
Use disconnect at base of battery to force all air
thru plastic check valve. Reconnect at
drain fitting _____
- J. Remove battery gas vent line _____
- K. Install disconnect plug in battery gas vent fitting _____
- L. Remove overflow can _____

Pack #3

Initial

- A. Safety Chain On _____ Off _____
- B. Top of Compensation Oil (Marcol) _____
- C. Check water sump drain plugs for security _____
- D. Tie wrap any loose hoses or electrical cables _____
- E. Check emergency release control canister for security in cradle _____
- F. Check emergency release wiring and plugs for proper seating, milk air if necessary, cap unused plugs and wires _____
- G. Check cylindrical vertical reservoir for security in cradle _____
- H. Check all 1/8 inch st/sl tube and gland nuts for tightness _____
- I. Back fill relief valve vent tube loop with oil (Marcol) _____
- J. Check all electrical cables for security, tie wrap if necessary _____
- K. Check all tea cup diaphragms for leakage at wires and seals. Top off as required (4 places)
 - white (Marcol) _____
 - red (Mil H5606 Hyd fluid) _____
- L. Back fill battery disconnect with (Marcol)
Use disconnect at base of battery to force all air thru plastic check valve. Reconnect at drain fitting _____
- M. Remove battery gas vent line _____
- N. Install disconnect plug in battery gas vent fitting _____
- O. Remove overflow can _____
- P. Check pinger battery voltage _____
- Q. Reset pinger and reinstall dummy plugs _____

Hydraulic Canister

Initial

- A. Top off canister with (Marcol) _____
- B. Check all seals and fittings for leakage _____
- C. Check all electrical cables for leakage at Dancos _____
- D. Check all electrical cable for security; tie wrap as necessary _____
- E. Back fill relief valve hose loop with (Marcol) _____
- F. Remove top vent line from over flow can; plug male disconnect into female disconnect on PVC relief valve mounting block _____
- G. Disconnect compensation regulator sense line at canister base, plug in free flow male disconnect fitting to assure regulator feels ambient sea water pressure _____
- H. Install dead ended female disconnect into sump sense line male fitting _____
- I. Open valve at N₂ compensation accumulator. 1/2 to 3/4 turn is sufficient. Do not open further; a stem leak could occur. _____

Relay Canisters

- A. Check all seals and fittings for leakage _____
- B. Check all electrical cables for leakage at Dancos _____
- C. Check all electrical cables for security; tie wrap as required _____
- D. Top off all canisters as necessary (use Marcol) _____

Main Junction Box

Initial

- A. Check all seals and fittings for leakage _____
- B. Check all electrical cables for leakage at Dancos _____
- C. Check all electrical cables for security; tie wrap as required _____
- D. Top off all canisters as necessary (use Marcol) _____
- E. Insure all functions are "off" on external manual control. Remove external test box plug. Clean 'O' ring and install test plug cap. Be sure 'T' handle plug is centered; a leak will occur if the plug is not centered in the step machined in the cap ring. Install dummy plug on 4-bin Brantner connector. _____

N₂ Compensation Systems

- A. Pressurize recirculating pump motor accumulators with 3,000+ psi N₂ _____
- B. Pressurize hydraulic pump motor with 3,000+ PSI N₂ _____
- C. Check all lines and valves for leakage _____
- D. Back fill accumulator diaphragms with water base hydraulic fluid as required _____

Insert/Retract System

- A. Check hydraulic cylinders and hoses for leaks _____
- B. Check cable and turnbuckler for security and freedom of motion _____
- C. Check cable to assure they do not hang slack; adjust if necessary _____
- D. Remove 3 lock clamps _____

Interface Junction Boxes (5" x 9")

- A. Check for fluid leakage at seals, wires and dancos _____
- B. Back fill with (Marcol)
Four located on rotary frame A _____ B _____ D _____ G _____
Three located on main structure C _____ E _____ F _____

Bottom Contact Switches

Initial

- A. Check for freedom of motion and smooth operation
 - 1. One bottom contact switch with contact weight
 - 2. One rotary frame retract switch
 - 3. Four test section insert switches

Hydraulic System Accumulators

- A. Check accumulators for leakage at fittings and diaphragms
- B. Cylindrical accumulator has piston with (Red Mil H5606) on system side, (water base hydraulic fluid in flexible diaphragm)
- C. Flexible accordion diaphragm assembly has (red Mil H5606 hydraulic fluid only). Replacable filters are located in the upper PVC cap.

Water Vent Flapper Tees

- A. Check flapper valve freedom of motion (8 flappers)

Window and Lens Cleaning

- A. Clean camera lens
- B. Clean transmissometer glass
- C. Remove plywood safety covers from test section top
- D. Clean upper test section glass
- E. Clean side ports in test section
- F. Clean photo flash port

Rotary Mechanism

- A. Check hydraulic cylinders and hoses for leakage
- B. Check drive chains for lubricant
- C. Check F/G cover cap for security

Camera System

Initial

- A. Charge camera battery pack _____
- B. Install film, set data chamber _____
- C. Charge photo flash battery pack _____
- D. Install assemblies on x-y-z traverse mechanism _____
- E. Install control cables; tie wrap as required _____
- F. Turn on switch _____

Water Samplers

- A. Hydro products butter-fly
 - 1. Install bag _____
 - 2. Cock mechanism _____
 - 3. Hook up sample tube at test section port _____
 - 4. Remove safety clamp _____
- B. Hydro products chop-stik baggie
 - 1. Install bag _____
 - 2. Wind up spring mechanism _____
 - 3. Cock latch mechanism _____

Sediment Samples (two)

- 1. Retract hydraulic cylinder until it bottoms out _____
- 2. Retract closure doors; install safety lock link (two)
CAUTION—Do not put hands or fingers into
opening at base of sampler. _____
- 3. Install release cable loop eyes on release pins _____
- 4. Rotate release pin mechanism until cable eyes
are secure _____
- 5. Carefully remove safety lock link _____

Battery Charge Junction Box (A)

Initial

1. Check penetrator caps (4) for full seating; milk air from connector cap if necessary (4 places)

Shore Power Junction Box (B)

1. Check penetrator cap (1) for full seating; milk air if necessary; check Danco connectors

Recirculating Pump Motors (two)

1. Check Danco electrical plugs for security
2. Check plastic N₂ compensation line for collapse water tie wraps; correct if required
3. Check plastic N₂ compensation line for cracks at inlet fitting to motor
4. Open valve at N₂ compensation accumulator, 1/2 to 3/4 turn is sufficient. Do not open further; a stem leak could occur.

Hydraulic Flow Dividers (two at center line of structure)

1. Visually inspect cylindrical PVC housings and large top hat bladder for leakage
2. Check tube fittings at top of both assemblies for leakage
3. Top off compensation fluid in both assemblies; use Mil-H-5606 (Red)

Recirculating Pump Motor Controller

1. Check electrical plugs for proper seating; milk air from caps if necessary
2. Check mechanical security of pressure housing
