

VERS 7

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* M O D 1

IDT 'MOD1'
DEF LABB8,LABB2,LABB3
REF MOD2,MOD3,MOD4
REF TEMDSP,FLDC,FLAGS1,DECOD8,DECOD4,TAPCNT
REF GOTDST,REFCON,ISTRB,REMA,REMB,REMC
REF TAPCTD,FDCON,TPCNCK,FLAGS2,VOLSEL
REF CN5060,LOC1,LOC2,LOC3,TIME,STBY,DISP
REF RECST

THIS IS A TMS9900 PROGRAM WRITTEN TO IMPLIMENT
CONTROL OF A BANG AND OLUFSEN MUSIC CENTRE
INCORPORATING THE FOLLOWING SYSTEM FEATURES :-

1. GRAMOPHONE CONTROL
2. SIX PRE-TUNED FM STATIONS
3. TAPE RECORDER CONTROL
4. REAL TIME CLOCK DISPLAYED
5. TAPE POSITION COUNTER DISPLAYED
6. CURRENT FUNCTION DISPLAYED
7. REMOTE VOLUME CONTROL
8. FLASHING DISPLAY FOR ERROR ON KEYBOARD ENTRY
9. AUTOMATIC SEARCH FOR TAPE POSITION
10. REAL TIME CLOCK SET
11. PROGRAMMED FUNCTION AT SET TIME
12. ONE MINUTE TIME OUT ON PROGRAMMING ENTRY

THE MAIN SYSTEM COMPONENTS ARE :-

1. LOCAL KEYBOARD - 20 KEYS
2. REMOTE KEYBOARD - 14 KEYS
3. 5 X 7 SEGMENT DISPLAY
4. TAPERECORDER
5. GRAMOPHONE
6. RADIO RECEIVER

THE PROGRAM IS DESIGNED TO RUN ON A 990/4 BASED
TMS9940 EMULATOR SYSTEM

0320	DRCRU	EQU	>320	DECREMENTER CRU BASE ADDRESS
0360	FLGCRU	EQU	>360	FLAG REGISTER CRU BASE ADDRESS
03C0	PODATA	EQU	>3C0	P0 - P15 CRU BASE ADDRESS
03E0	P16DTA	EQU	>3E0	P16 - P31 CRU BASE ADDRESS

WORKSPACE / REGISTER ASSIGNMENTS

0057	0001	GENR1	EQU	1	GENERAL REGISTER 1
0058	0002	GENR2	EQU	2	GENERAL REGISTER 2
0059	0003	GENR3	EQU	3	GENERAL REGISTER 3
0060	0004	GENR4	EQU	4	GENERAL REGISTER 4
0061	0005	STROBE	EQU	5	STROBE COUNTER
0062	0006	MILISC	EQU	6	MILISECOND COUNTER
0063	0008	CT5060	EQU	8	50/60 HERTZ COUNTER
0064	0007	MS50	EQU	7	50 MS COUNTER
0065	0009	FLSHCT	EQU	9	FLASH TIME COUNTER
0066	000A	MS3	EQU	10	3 MILESCOND COUNTER
0067	000C	CRUBAD	EQU	12	CRU BASE ADDRESS STORE
0068		*			
0069		*			
0070		*			
0071					WORKSPACE 2 REGISTER ASSIGNMENTS
0072					*R0 USED FOR 60-SECOND DELAY
0072	0001	GENRB1	EQU	1	GENERAL REGISTER 1
0073	0002	GENRB2	EQU	2	GENERAL REGISTER 2
0074	0003	GENRB3	EQU	3	GENERAL REGISTER 3
0075	0004	GENRB4	EQU	4	GENERAL REGISTER 4
0076	0005	MS500	EQU	5	500 MS COUNTER
0077	0006	DELAY	EQU	6	DELAY COUNTER
0078	0007	PRDGPT	EQU	7	PLAY AT SEQUENCE POINTER
0079	0008	GOTOPT	EQU	8	GOTO SEQUENCE POINTER
0080	0009	FTNPT	EQU	9	FUNCTION SEQUENCE POINTER
0081	000A	MEMIPT	EQU	10	MEMORY INPUT SEQUENCE POINTER
0082	000D	TMPIPT	EQU	13	TEMPORARY INPUT STORE
0083		*			
0084		*			
0085		*			
0086		*			
0087					FLAG ASSIGNMENTS IN FLAG REGISTER
0088	0000	ARWFLG	EQU	0	AUTO REWIND FLAG (CHECK TCARW)
0089	0001	RRLFLG	EQU	1	RECORD RELEASE FLAG
0090	0002	RPSFLG	EQU	2	RECORD PAUSE FLAG
0091	0003	RECFLG	EQU	3	RECORD FLAG
0092	0004	MIPFLG	EQU	4	MEMORY INPUT FLAG
0093	0005	TCLFLG	EQU	5	TAPE CALIBRATED FLAG (CHECK TC)
0094	0006	EDTFLG	EQU	6	END OF TAPE FLAG
0095	0007	DLYFLG	EQU	7	DELAY FLAG
0096	0008	PRGFLG	EQU	8	PLAY AT PROGRAM FLAG
0097	0009	FUNFLG	EQU	9	FUNCTION RUNNING FLAG
0098	000A	FFWFLG	EQU	10	FAST FORWARD FLAG
0099	000B	DSPTIM	EQU	11	DISPLAY TIME FLAG
0100	000C	DSPUD	EQU	12	DISPLAY UPDATE FLAG
0101	000D	FLSFLG	EQU	13	FLASH DISPLAY FLAG
0102	000E	DSPDN	EQU	14	DISPLAY ON FLAG
0103	000F	GOTDFG	EQU	15	GOTO FLAG
0104	0000	CKCAL	EQU	0	CLOCK CALIBRATED FLAG
0105	0001	LOCFLG	EQU	1	LOCAL KEYBOARD INPUT FLAG
0106	0002	REMFLG	EQU	2	REMOTE KEYBOARD INPUT FLAG
0107	0003	CKSTAT	EQU	3	CLOCK INPUT STATUS
0108	0004	CKSTFG	EQU	4	CLOCK SET FLAG
0109	0005	TPSTAT	EQU	5	TAPE COUNT INPUT STATUS
0110		*			
0111		*			

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0112      *
0113      *
0114      0027 CON23   EQU   39          DECIMAL POINT - DISC INDICATOR
0115      *
0116      *
0117      *          INPUT-OUTPUT LINE ASSIGNMENTS
0118      *
0119      *
0120      *
0121      0030 CLKIP   EQU   48          REAL TIME CLOCK INPUT
0122      0031 REMIP   EQU   49          REMOTE SIGNAL INPUT
0123      003F TAPIP   EQU   63          TAPE COUNTER SIGNAL INPUT
0124      0040 RECAWD  EQU   64          RECORD ALLOWED INPUT
0125      0041 TAPIND  EQU   65          TAPE CASSETTE INDICATOR
0126      0042 TAPDWR  EQU   66          TAPE POWER SWITCH
0127      0043 FFWD    EQU   67          FAST FORWARD CONTROL SWITCH
0128      0044 REWD    EQU   68          REWIND CONTROL SWITCH
0129      0045 RECDSP  EQU   69          RECORDING DISPLAY LED
0130      0046 GRAMSP  EQU   70          GRAMPHONE STOP CONTROL
0131      0047 DSCPT   EQU   71          DEC POINT- DISC INDICATOR
0132      004F MUTE    EQU   79          MUTING CONTROL
0133      0E20 WKSP1   EQU   >E20 8320   WORKSPACE 1 ADDRESS
0134      0E00 WKSP2   EQU   >E00 8300   WORKSPACE 2 ADDRESS
0135      0E80 DCAPC   EQU   >E80 /      DECIMAL ADD CORRECT ADDRESS
0136      0EA4 DCSPC   EQU   >EA4 /      DECIMAL SUBTRACT ADDRESS
0137      *
0138      *
0139      *
0140      *
0141      *
0142      *          TRAP VECTORS FOR RESET AND DECREMETER INTERRUPTS
0143      *
0144      *
0145      0004      ADRG  >0004  0
0146      0004 0E00  DATA  WKSP2
0147      0006 ----  DATA  RESET          RESET ENTRY POINT
0148      *
0149      000C      ADRG  >C
0150      000C 1000  DATA  >1000
0151      000E 5CEA  DATA  >5CEA
0152      *
0153      0010      ADRG  >0010
0154      0010 0E20  DATA  WKSP1
0155      0012 ----  DATA  DECINT
0156      0014 0E00  DATA  WKSP2
0157      0016 0000  DATA  STBY
0158      *
0159      003C      ADRG  >3C
0160      003C 1000  DATA  >1000
0161      003E 0040  DATA  >40
0162      0040 0380  RTWP
0163      *
0164      *
0165      *
0166      *          POWER ON RESET INTERRUPT TRANSFERS CONTROL TO
  
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1852

Addr 20

← WKSP2
STBY
WKSP1
DECINT
WKSP2
STBY

WORKSPACE 1
DECR INTERRUPT ENTRY POINT

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0167      *      THIS SECTION OF THE PROGRAM. THE RAM IS ZEROED
0168      *      AND INITIALISED TO DRIVE THE DISPLAY AND LOCAL
0169      *      KEYBOARD.
0170      *      THE INPUT-OUTPUT LINES ARE CONFIGURED
0171      *      THE FLAG REGISTERS ARE INITIALISED
0172      *      THE DECREMETER IS LOADED
0173      *      THE TIME AND COUNTER REGISTERS ARE INITIALISED
0174      *
0175      *
0176      *      FIRST ZERO THE RAM
0177 0080      AORG >80 /0
0178 0080 0201 RESET  LI  GENRB1,>E04  PICK UP START ADDRESS OF RAM
      0082 0E04
      0006♦♦0080
0179 0084 0300      LIM1 1
      0086 0001
0180 0088 04F1 INIT1 CLR  *GENRB1+      CLEAR STORE AND INCREMENT MEMOR
0181 008A 0281      CI  GENRB1,>E7E  TEST FOR END OF RAM
      008C 0E7E
0182 008E 16FC      JNE  INIT1      LOOP TIL END OD RAM
0183      *
0184      *      SET UP BIT PATTERN FOR STROBING LOCAL KEYBOARD
0185      *      AND LIGHTING DISPLAY
0186      *
0187 0090 0201      LI  GENRB1,>FFBF  LOAD BIT PATTERN
      0092 FFBF
0188 0094 0202      LI  GENRB2,>E40  POINT TO START OF MEMORY
      0096 0E40
0189 0098 0C81 INIT2 MOV  GENRB1,*GENRB2+      LOAD PATTERN TO MEMOR
0190 009A 0A11      SLA  GENRB1,1      MOVE BIT AROUND
0191 009C 0282      CI  GENRB2,>E4A  TEST IF FINISHED
      009E 0E4A
0192 00A0 16FB      JNE  INIT2      LOOP TIL FINISH
0193      *
0194      *
0195 00A2 05A0      INC  @TIME      * SET TIME TO 0001
      00A4 0000
0196      *
0197      *
0198      *      SET UP THE I/O CONFIGURATION BITS
0199      *
0200 00A6 06A0      BL  @LABX2      GO AND OUTPUT DATA IN TABLE
      00A8 ----
0201      *      ADDRESSES AND DATA FOR I/O CONFIGURATIONS AND COUN
0202 00AA 0380      DATA FLGCRU+32      P0-P15 CONFIGURATION ADDRESS
0203 00AC 7FC0      DATA >7FC0      PIN CONFIGURATION PATTERN
0204 00AE 03A0      DATA FLGCRU+64      P16-P31 CONFIGURATION ADDRESS
0205 00B0 FFFC      DATA >FFFC      PIN CONFIGURATION PATTERN
0206 00B2 03E0      DATA P16DTA      P16-P31 DATA ADDRESS
0207 00B4 47FC      DATA >47FC      DATA CONFIGURATION
0208      *
0209      *
0210      *      SET UP DECREMETER TO COUNT FOR 1 MILLISECOND
0211      *
0212      *

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0213 00B6 033B LABX2 MOV *11+,CRUBAD PICK UP CRU BASE ADDRESS
      00A8♦♦00B6
0214 00B8 303B LDCR *11+,0 OUTPUT DATA
0215 00BA 028C CI CRUBAD,P16DTA
      00BC 03E0
0216 00BE 16FB JNE LABX2 GO ROUND UNTIL DRCRU
0217 * ENABLE DECREMETER INTERRUPT
0218 *
0219 00C0 04C1 CLR GENR1
0220 00C2 020C LI CRUBAD,DRCRU
      00C4 0320
0221 00C6 33C1 LDCR GENR1,15
0222 00C8 0201 LI GENR1,>4092 1 MS FOR DECREMETER
      00CA 4092
0223 00CC 33C1 LDCR GENR1,15
0224 *
0225 * POINT TO FLAG REGISTER
0226 *
0227 00CE 020C LI CRUBAD,FLGCRU
      00D0 0360
0228 00D2 3004 LDCR GENRB4,0 ZERO FLAG REG (TEMP)
0229 00D4 0300 LIM1 5
      00D6 0005
0230 *
0231 *
0232 *
0233 * INITIALISATION COMPLETE SO GO PLACE PROGRAM IN
0234 * STANDBY CONDITION
0235 *
0236 00D8 0460 B @STBY
      00DA 0016
0237 *
0238 *
0239 *
0240 * THE DECREMETER INTERRUPT SUBROUTINE IS RESPONSABLE
0241 * FOR CHECKING AND UPDATING THE FOLLOWING DATA :-
0242 *
0243 * 1. TAPECOUNTER INPUT WITH INC OR DEC ON COUNTER
0244 * 2. CLOCK INPUT WITH INCREMENT ON TIME
0245 * 3. CLOCK CALIBRATION
0246 * 4. CHECK ON GOTO FUNCTION
0247 * 5. DISPLAY UPDATES FOR EITHER TAPECOUNTER OR TIME
0248 * PROVIDING FLASHING IF REQUIRED
0249 * 6. LOCAL KEYBOARD STROBE AND DATA INPUT
0250 * 7. REMOTE KEYBOARD DATA INPUT
0251 *
0252 *
0253 00DC 020C DECINT LI CRUBAD,FLGCRU POINT CRU AT FLAG REGISTER
      00DE 0360
      0012♦♦00DC
0254 00E0 3420 STCR @FLAGS2,0 STORE MAIN BLOCK FLAGS
      00E2 0000
0255 00E4 3260 LDCR @FLAGS1,9 LOAD INTERRUPT FLAGS TO FLAG
      00E6 0000
0256 00E8 0586 INC MILISC INCREMENT MILLISECOND COUNTER

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0257          *
0258          *
0259          *      CHECK PREVIOUS TAPECOUNTER INPUT STATUS AND
0260          *      CHANGE IN NECESSARY
0261          *
0262 00EA 1F05          TB  TPSTAT          TEST TAPE COUNTER STATUS
0263 00EC 13--          JEQ  LABS1          IT IS EQUAL TO ONE
0264 00EE 1F3F          TB  TAPIP          CHECK COUNTER INPUT FOR CHANGE
0265 00F0 16--          JNE  LABA1          NO CHANGE
0266 00F2 1D05          SBO  TPSTAT          CHANGE STATUS TO 1
0267 00F4 10--          JMP  LABS2          GO CHANGE TAPE COUNTER
0268 00F6 1F3F LABS1  TB  TAPIP          CHECK COUNTER INPUT
0268 00EC◆◆1304
0269 00F8 13--          JEQ  LABA1          NO CHANGE
0270 00FA 1E05          SBZ  TPSTAT          CHANGE STATUS TO 0
0271          *
0272          *
0273          *      CHANGE TAPE COUNTER DEPENDING ON MOTION OF TAPE
0274          *
0275 00FC C0E0 LABS2  MOV  @TAPCTD,GENR3          PICK UP DISPLAY COUN
0275 00FE 0000
0275 00F4◆◆1003
0276 0100 1F0A          TB  FFWFLG          CHECK IF FORWARD DIRECTION
0277 0102 13--          JEQ  LABS3          FORWARD
0278 0104 0620          DEC  @TAPCNT          REWINDING SO DECREMENT COUNTER
0278 0106 0000
0279 0108 17--          JNC  ZROTCN          TAPCNT NEGATIV
0280 010A C0A0          MOV  @TAPCNT,GENR2 TEST IF THE TAPE COUNTER
0280 010C 0106
0281 010E 0242          ANDI GENR2,>0003 DISPLAY STORE IS DECREMENTED
0281 0110 0003
0282 0112 16--          JNE  LABA1          NO CHANGE NEEDED
0283          *
0284          *      DECREMENT TAPE COUNTER DISPLAY STORE
0285 0114 06C3 LABA2  SWPB GENR3          TAKE 2 LS DIGITS FIRST
0286 0116 0204          LI  GENR4,>0100
0286 0118 0100
0287 011A 60C4          S   GENR4,GENR3 SUBTRACT 1 FROM 2 LS DIGITS
0288 011C 06A0          BL  @DCSPC
0288 011E 0EA4
0289 0120 06C3          SWPB GENR3          SWITCH BACK DIGITS
0290 0122 18--          JOC  LABS4          NO CARRY SO FINISH
0291 0124 60C4          S   GENR4,GENR3 SUBTRACT 1 FROM 2 MS DIGITS
0292 0126 06A0          BL  @DCSPC
0292 0128 0EA4
0293 012A C803 LABS4  MOV  GENR3,@TAPCTD          STORE UPDATED COUNTER
0293 012C 00FE
0293 0122◆◆1803
0294 012E 10--          JMP  LABA1
0295          *
0296          *      INCREMENT TAPE COUNTER DISPLAY STORE
0297          *
0298 0130 05A0 LABS3  INC  @TAPCNT          INCREMENT TAPE COUNTER
0298 0132 010C
0298 0102◆◆1316

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0299 0134 C0A0      MOV  @TAPCNT,GENR2
      0136 0132
0300 0138 0242      ANDI  GENR2,>0003  TEST FOR NEED TO CHANGE
      013A 0003
0301 013C 16--      JNE  LABA1        DISPLAY COUNTER
0302
      *
0303
      *      INCREMENT TAPE COUNTER DISPLAY STORE
0304 013E 06C3      SWPB  GENR3        TAKE 2 LS DIGITS FIRST
0305 0140 0223      AI    GENR3,>0100  INCREMENT 2 LS DIGITS
      0142 0100
0306 0144 06A0      BL   @DCAPC
      0146 0E80
0307 0148 06C3      SWPB  GENR3        SWAP BACK DIGITS
0308 014A 17EF      JNC  LABS4        NO CARRY SO FINISHED
0309 014C 0223      AI    GENR3,>0100  INCREMENT 2 MS DIGITS
      014E 0100
0310 0150 06A0      BL   @DCAPC
      0152 0E80
0311 0154 10EA      JMP  LABS4
0312
      *
0313      ZROTCN
      0108♦♦1726
0314 0156 04E0      CLR  @TAPCNT
      0158 0136
0315 015A 04E0      CLR  @TAPCTD
      015C 012C
0316 015E C820      MOV  @C2000,@2*MS500+WKSP2  DELAY FOR AUTOSTOP
      0160 ----
      0162 0E0A
0317
0318
      *
0319
      *      CHECK PREVIOUS CLOCK INPUT STATUS AND MODIFY THE
0320
      *      TIME STORE IF CURRENT INPUT HAS CHANGED
0321
      *
0322 0164 1F03 LABA1  TB    CKSTAT        TEST CURRENT CLOCK STATUS
      00F0♦♦1639
      00F8♦♦1335
      0112♦♦1628
      012E♦♦101A
      013C♦♦1613
0323 0166 13--      JEQ  LABS8        IT WAS = 1
0324
      *
0325 0168 1F30      TB    CLKIP        TEST CLOCK INPUT
0326 016A 16--      JNE  LABA4        NO CHANGE ON INPUT
0327 016C 1D03      SBO  CKSTAT        SET STATUS TO CURRENT INPUT
0328 016E 10--      JMP  LABS9
0329
      *
0330 0170 1F30 LABS8  TB    CLKIP        TEST CLOCK INPUT
      0166♦♦1304
0331 0172 13--      JEQ  LABA4        NO CHANGE ON INPUT
0332 0174 1E03      SBZ  CKSTAT        SET STATUS TO CURRENT INPUT
0333
      *
0334 0176 1F00 LABS9  TB    CKCAL        HAS CLOCK BEEN CALIBRATED
      016E♦♦1003
0335 0178 13--      JEQ  LABS10       CLOCK CALIBRATED

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0336          *
0337          *          CALIBRATE THE CLOCK FOR 50 OR 60 HZ INPUT SIGNAL
0338          *
0339 017A 0588      INC  CT5060      INCREMENT CONSTANT STORE
0340 017C 0286      CI   MILISC,>3E8  4AS 1000 MS PASSED YET
      017E 03E8
0341 0180 11--      JLT  LABA4          NO NOT YET
0342 0182 1D00      SBO  CKCAL        SET CLOCK CALIBRATED FLAG
0343 0184 0288      CI   CT5060,110   TEST FOR 50 OR 60 HZ
      0186 006E
0344 0188 15--      JGT  LABS11       60 HZ
0345 018A 0208      LI   CT5060,6000   50 HZ
      018C 1770
0346 018E 10--      JMP  LABS12
0347 0190 0208  LABS11  LI   CT5060,7200   60 HZ
      0192 1C20
      0188♦♦1503
0348 0194 C808  LABS12  MOV  CT5060,@CN5060 STORE CONSTANT
      0196 0000
      018E♦♦1002
0349 0198 10--      JMP  LABA4
0350          *
0351          *
0352 019A 0608  LABS10  DEC  CT5060      DECREMENT COUNTER
      0178♦♦1310
0353 019C 16--      JNE  LABA4          NOT EQUAL TO ZERO
0354 019E C220      MOV  @CN5060,CT5060  LOAD CONSTANT TO CO
      01A0 0196
0355          *
0356          *          INCREMENT TIME AND CORRECT FOR HOURS AND MINUTES
0357          *
0358 01A2 C0E0  LABA5   MOV  @TIME,GENR3   PICK UP TIME
      01A4 00A4
0359 01A6 0583      INC  GENR3          INCREMENT TIME
0360 01A8 06C3      SWPB GENR3         SWAP ROUND DIGITS
0361 01AA 06A0      BL   @DCAPC
      01AC 0E80
0362 01AE 0201      LI   GENR1,>6000
      01B0 6000
0363 01B2 20C1      COC  GENR1,GENR3   CHECK FOR CARRY FROM MINUTES
0364 01B4 16--      JNE  LABS14        NO CARRY
0365 01B6 0243      ANDI GENR3,>00FF  ZERO MINUTES
      01B8 00FF
0366 01BA 0583      INC  GENR3          INCREMENT HOURS
0367 01BC 06C3      SWPB GENR3         SWAP ROUND DIGITS
0368 01BE 06A0      BL   @DCAPC
      01C0 0E80
0369 01C2 10--      JMP  LABS13
0370 01C4 06C3  LABS14  SWPB GENR3         LINE UP HOURS AND MINUTES
      01B4♦♦1607
0371 01C6 0283  LABS13  CI   GENR3,>2401  CHECK FOR MAXIMUM ON HOURS AND
      01C8 2401
      01C2♦♦1001
0372 01CA 16--      JNE  LABS5
0373 01CC 0203      LI   GENR3,>0001  SET TO MINIMUM TIME

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01CE 0001
0374 01D0 C803 LABS5 MOV GENR3,@TIME STORE UPDATED TIME
      01D2 01A4
      01CA♦♦1602
0375
0376
0377
0378
0379
0380 01D4 1F0F LABA4 TB GOTOFG TEST FOR GOTO CONDITION
      016A♦♦1634
      0172♦♦1330
      0180♦♦1129
      0198♦♦101D
      019C♦♦161B
0381 01D6 16-- JNE LABA7
0382 01D8 C0E0 MOV @FLAGS2,GENR3
      01DA 00E2
0383 01DC 24E0 CZC @TCARW,GENR3
      01DE ----
0384 01E0 13-- JEQ LABA7
0385 01E2 8820 C @GOTDST,@TAPCNT CHECK TAPE STORES
      01E4 0000
      01E6 0158
0386 01E8 16-- JNE LABA7
0387 01EA 1D44 SBD REWD AT REQUIRED POSITION SO STOP
0388 01EC 1D43 SBD FFWD FAST FORWARD AND REWIND CONTROL
0389
0390
0391
0392 01EE 1F0D LABA7 TB FLSFLG IS DISPLAY FLASHING
      01D6♦♦160B
      01E0♦♦1306
      01E8♦♦1602
0393 01F0 13-- JEQ LABS15 YES FLASHING DISPLAY
0394 01F2 04C9 CLR FLSHCT
0395 01F4 1F0C LABA31 TB DSPUD IS DISPLAY UPDATED
0396 01F6 16-- JNE LABS16 NOT UPDATED
0397 01F8 1F0B TB DSPTIM DISPLAY TIME OR COUNTER TEST
0398 01FA 13-- JEQ LABS17 DISPLAY TIME
0399 01FC C060 MOV @TAPCTD,GENR1 DISPLAY TAPE COUNTER
      01FE 015C
0400 0200 10-- JMP LABA9
0401 0202 C060 LABS17 MOV @TIME,GENR1 DISPLAY TIME
      0204 01D2
      01FA♦♦1303
0402 0206 10-- JMP LABA9
0403 0208 C060 LABS16 MOV @TEMDSP,GENR1 DISPLAY TEMPORARY STORE
      020A 0000
      01F6♦♦1608
0404 020C 10-- JMP LABA9
0405
0406
0407
0408 020E 0609 LABS15 DEC FLSHCT

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01F0♦♦130E
0409 0210 11--          JLT  LABS18
0410 0212 1F0E          TB   DSPDN      IS DISPLAY ON
0411 0214 16--          JNE  LABA6
0412 0216 8820  LABA30  C    @FD0DN,@C2000
      0218 0000
      021A ----
0413 021C 13EB          JEQ  LABA31      FOR RECORDING
0414 021E 04C1          CLR  GENR1      OTHERWISE FLASH ZEROES
0415 0220 10--          JMP  LABA32
0416                                LABS18
      0210♦♦1108
0417 0222 C260          MOV  @FD0DN,FLSHCT
      0224 0218
0418 0226 0620          DEC  @FLDC
      0228 0000
0419 022A 15--          JGT  DECI18
0420 022C 04E0          CLR  @FLDC
      022E 0228
0421                                DECI18
      022A♦♦1502
0422 0230 1F0E          TB   DSPDN      TEST IF DISPLAY IS ON
0423 0232 13--          JEQ  LABS19
0424 0234 1D0E          SBD  DSPDN      SET DISPLAY ON FLAG
0425 0236 10EF          JMP  LABA30
0426 0238 1E0E  LABS19  SBZ  DSPDN      RESET DISPLAY ON FLAG
      0232♦♦1302
0427 023A 0201  LABA6  LI   GENR1,>FFFF
      023C FFFF
      0214♦♦1612
0428                                *
0429                                *
0430                                *   SET UP THE DISPLAY REGISTER FOR CLOCK OR TAPE COUNT
0431                                *   DISPLAY FORMAT
0432                                *
0433 023E 0281  LABA9  CI   GENR1,>1000
      0240 1000
      0200♦♦101E
      0206♦♦101B
      020C♦♦1018
0434 0242 14--          JHE  LABA32      YES ALL DIGITS
0435 0244 1F0B          TB   DSPTIM     IS TIME DISPLAY
0436 0246 16--          JHE  LABS20      NOT TIME
0437 0248 0202  LABS21  LI   GENR2,>F000     CLIP OFF 4TH DIGIT
      024A F000
0438 024C E042  LABS23  SOC  GENR2,GENR1
0439 024E 10--          JMP  LABA32
0440 0250 0281  LABS20  CI   GENR1,>0100     DISPLAY 3 DIGITS TEST
      0252 0100
      0246♦♦1604
0441 0254 14F9          JHE  LABS21      YES 3 DIGITS
0442 0256 0281          CI   GENR1,>0010     DISPLAY 2 DIGITS TEST
      0258 0010
0443 025A 14--          JHE  LABS22      YES 2 DIGITS
0444 025C 0202          LI   GENR2,>FFF0     CLIP OFF 3 DIGITS

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025E FFF0
0445 0260 10F5      JMP   LABS23
0446 0262 0202      LABS22  LI    GENR2,>FF00    CLIP OFF 2 DIGITS
      0264 FF00
      025A♦♦1403
0447 0266 10F2      JMP   LABS23
0448
0449
0450
0451
0452 0268 0505      LABA32  INCT  STROBE      STROBE + 2
      0220♦♦1023
      0242♦♦1412
      024E♦♦1000
0453 026A 0285      CI     STROBE,10    IS STROBE = 10
      026C 000A
0454 026E 16--      JNE   LABS24
0455 0270 0405      CLR  STROBE      CLEAR STROBE IF = 10
0456 0272 0285      LABS24  CI     STROBE,6    IF GREATER THAT 6
      0274 0006
      026E♦♦1601
0457 0276 15--      JGT  LABA10      DO NOT CHANGE DISP (STROBE)
0458 0278 C005      MOV  STROBE,R0    LOAD R0 WITH STROBE
0459 027A A000      A    R0,R0      DOUBLE R0
0460 027C C0A5      MOV  @DISP(STROBE),GENR2    PICK UP CHANGED DIS
      027E 0000
0461 0280 0B51      SRC  GENR1,5      LINE BITS UP
0462 0282 0B01      SRC  GENR1,0      SHIFT ROUND TO LINE UP DESIRED
0463 0284 0242      ANDI GENR2,>87FF    ZERO DIGIT SPACE
      0286 87FF
0464 0288 0241      ANDI GENR1,>7800    MASK OFF REQUIRED DIGIT
      028A 7800
0465 028C E081      SDC  GENR1,GENR2  INSERT REQUIRED DIGIT
0466 028E C942      MOV  GENR2,@DISP(STROBE)    UPDATE DISPLAY STOR
      0290 027E
0467
0468
0469 0292 020C      LABA10  LI    CRUBAD,PODATA    SET UP CRU ADDRESS
      0294 03C0
      0276♦♦150D
0470 0296 33E5      LDCR @DISP(STROBE),15    OUTPUT STROBE LINE AND D
      0298 0290
0471
0472
0473 029A 020C      LI    CRUBAD,>302
      029C 0302
0474 029E 1D00      SBO  0
0475
0476
0477
0478 02A0 C0A0      MOV  @2*DELAY+WKSP2,GENR2
      02A2 0E0C
0479 02A4 13--      JEQ  DECI02
0480 02A6 0620      DEC  @2*DELAY+WKSP2
      02A8 0E0C

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0481          DECI02
0482 02A4♦♦1302
0482 02AA C0A0      MOV   @REFCON,GENR2
0482 02AC 0000
0483 02AE 13--      JEQ   DECI04
0484 02B0 0620      DEC   @REFCON
0484 02B2 02AC
0485          DECI04
0485 02AE♦♦1302
0486 02B4 C0A0      MOV   @2*MS500+WKSP2,GENR2
0486 02B6 0E0A
0487 02B8 13--      JEQ   DECI06
0488 02BA 0620      DEC   @2*MS500+WKSP2
0488 02BC 0E0A
0489          DECI06
0489 02B8♦♦1302
0490 02BE C0A0      MOV   @WKSP2,GENR2
0490 02C0 0E00
0491 02C2 13--      JEQ   DECI08
0492 02C4 0620      DEC   @WKSP2
0492 02C6 0E00
0493          DECI08
0493 02C2♦♦1302
0494          *
0495 02C8 020C      LI    CRUBAD,P16DTA+16
0495 02CA 03F0
0496 02CC 3620      STCR  @VOLSEL,8
0496 02CE 0000
0497 02D0 020C      LI    CRUBAD,P0DATA+4
0497 02D2 03C4
0498 02D4 3520      STCR  @LDC1,4
0498 02D6 0000
0499 02D8 020C      LI    CRUBAD,FL6CRU POINT TO FLAG REGISTER
0499 02DA 0360
0500          *
0501 02DC 1F02      TB    REMFL6      TEST FOR REMOTE INPUT
0502 02DE 16--      JNE   LABA12     NOT REMOTE
0503 02E0 C060      MOV   @REMA,GENR1 PICK UP REMA
0503 02E2 0000
0504 02E4 0281      CI    GENR1,1    TEST IF = 1
0504 02E6 0001
0505 02E8 16--      JNE   LABS25
0506 02EA 04C1      CLR  GENR1      CLEAR REMA
0507 02EC 1F31      TB    REMIP      IS REMOTE BIT SET
0508 02EE 13--      JEQ   LABS26     YES IT IS SET
0509 02F0 1E02      SBZ  REMFL6     RESET INPUT FLAG
0510 02F2 10--      JMP  RETNA1
0511 02F4 020A LABS26 LI    MS3,2      SET 3 MILLISECOND COUNTER TO 2
0511 02F6 0002
0511 02EE♦♦1302
0512 02F8 058A LABS25 INC  MS3      INCREMENT 3 MILLISEC COUNTER
0512 02E8♦♦1607
0513 02FA 028A      CI    MS3,3     TEST IF = 3
0513 02FC 0003
0514 02FE 16--      JNE   RETNA1

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0515 0300 04CA          CLR  MS3
0516 0302 1F31          TB   REMIP      TEST REMOTE INPUT
0517 0304 16--          JNE  LABA11
0518 0306 0221          AI   GENR1,>0080  ADD A BIT TO REMOTE INPUT
      0308 0080
0519 030A 0A11  LABA11  SLA   GENR1,1    SHIFT REMOTE DATA ROUNT
      0304♦♦1602
0520 030C 19--          JND  RETNA1    AND TEST IF 8 BITS ARE IN
0521 030E 1F09          TB   FUNFLG    TEST FOR CURRENT FUNCTION
0522 0310 13--          JEQ  NOMOV
0523 0312 8060          C    @REMB,GENR1
      0314 0000
0524 0316 16--          JNE  NOMOV
0525 0318 0820          MOV  @REMB,@REMC  THERE ARE 8 BITS SO STORE DATA
      031A 0314
      031C 0000
0526          NOMOV
      0310♦♦1306
      0316♦♦1603
0527 031E 0801          MOV  GENR1,@REMB  STORE REMA
      0320 031A
0528 0322 04C1          CLR  GENR1      CLEAR REMA
0529 0324 1E02          SBZ  REMFLG     RESET REMOTE FLAG
0530 0326 0207          LI   MS50,50
      0328 0032
0531 032A 0801  RETNA1  MOV  GENR1,@REMA  STORE REMA
      032C 02E2
      02F2♦♦101B
      02FE♦♦1615
      030C♦♦190E
0532 032E 10--          JMP  RETNA
0533          *
0534          *  TEST FOR LOCAL KEYBOARD DATA
0535          *
0536 0330 1F01  LABA12  TB   LOCFLG     IS LOCAL DATA COMMING IN
      02DE♦♦1628
0537 0332 16--          JNE  LABA13
0538 0334 8805          C    STROBE,@DSTRB  TEST FOR CORRECT STROBE
      0336 0000
0539 0338 16--          JNE  LABS28     WRONG STROBE
0540 033A 0060          MOV  @LDC1,GENRB1  TEST IF DATA IS ZERO
      033C 02D6
0541 033E 13--          JEQ  LABS27     IS ZERO
0542 0340 8820          C    @LDC1,@LDC2  COMPARE PREVIOUS DATA WITH PR
      0342 033C
      0344 0000
0543 0346 16--          JNE  LABS28
0544 0348 1F09          TB   FUNFLG    TEST FOR CURRENT FUNCTION
0545 034A 13--          JEQ  RETNA
0546 034C 0820          MOV  @LDC2,@LDC3  IT IS EQUAL SO STORE IT
      034E 0344
      0350 0000
0547 0352 10--          JMP  RETNA
0548 0354 0060  LABS27  MOV  @LDC2,GENRB1  IS PREVIOUS DATA ZERO
      0356 034E

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033E♦♦130A
0549 0358 13--          JEQ  LABS29          YES IT WAS ZERO
0550 035A 04E0          CLR  @LDC2          CLEAR STORE
      035C 0356
0551 035E 10--          JMP  RETNA
0552
      *
0553 0360 1E01 LABS29  SBZ  LDCFLG          RESET LOCAL FLAG
      0358♦♦1303
0554 0362 04E0          CLR  @LDC3          CLEAR LDC3
      0364 0350
0555 0366 10--          JMP  RETNA
0556
      *
0557          LABA13
      0332♦♦161A
0558 0368 C1C7          MOV  MS50,MS50      TEST FOR TIME OUT
0559 036A 16--          JNE  LABS33
0560 036C 04E0          CLR  @REMB
      036E 0320
0561 0370 04E0          CLR  @REMC
      0372 031C
0562 0374 10--          JMP  NLAB1
0563          LABS33
      036A♦♦1605
0564 0376 0607          DEC  MS50          DEC 50 MS COUNTER
0565 0378 1F31 NLAB1  TB   REMIP          TEST REMOTE INPUT
      0374♦♦1001
0566 037A 16--          JNE  LABS28          NO DATA
0567 037C 0201          LI   GENR1,1        THERE IS DATA SO STORE
      037E 0001
0568 0380 C801          MOV  GENR1,@REMA    START BIT IN REMA
      0382 032C
0569 0384 1D02          SBO  REMFLG          SET REMOTE INPUT FLAG
0570 0386 10--          JMP  RETNA
0571
      *
0572 0388 C060 LABS28  MOV  @LDC1,GENRB1    CHECK TO SEE IF ANY LOCAL DATA
      038A 0342
      0338♦♦1627
      0346♦♦1620
      037A♦♦1606
0573 038C 13--          JEQ  RETNA
0574
      *
0575 038E C820          MOV  @LDC1,@LDC2    THERE IS DATA SO STORE DATA
      0390 038A
      0392 035C
0576 0394 C805          MOV  STROBE,@DSTRB  AND STORE STROBE DATA ARRIVED
      0396 0336
0577 0398 1D01          SBO  LDCFLG          SET LOCAL FLAG
0578
      *
0579 039A 3660 RETNA  STCR @FLAGS1,9    RETURN SUBROUTINE FLAGS TO FLA
      039C 00E6
      032E♦♦1035
      034A♦♦1327
      0352♦♦1023
      035E♦♦101D
      0366♦♦1019

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0386**1009
038C**1306
0580 039E 32A0          LDRC  @FLAGS2,10      LOAD MAIN BLOCK FLAGS TO FLAG
      03A0  01DA
0581                      *
0582                      *
0583 03A2  0380          RTWP              RETURN FROM SUBROUTINE
0584                      *
0585                      *
0586                      *
0587                      *
0588                      *
0589                      *
0590                      *
0591                      *
0592                      *
0593                      *
0594                      *
0595                      *
0596                      *
0597                      *
0598                      *
0599                      *
0600                      *
0601                      *
0602 03A4  1F09  LABB8    TB      FUNFLG      TEST FOR CURRENT FUNCTION
0603 03A6  13--          JEQ     LABB3        A FUNCTION IS RUNNING
0604 03A8  C820          MOV     @REMC,@REMC    CHECK REMOTE DATA INPUT
      03AA  0372
      03AC  03AA
0605 03AE  13--          JEQ     LABS31      NO DATA
0606 03B0  0460          B       @DECODEA    GO AND DECODE REMOTE DATA
      03B2  0000
0607 03B4  0032  CON50   DATA  50
0608 03B6  02EE  C2000   DATA  750      RECORD PAUSE FLASH
      0160**03B6
      021A**03B6
0609 03B8  0021  TCARW   DATA  >0021
      01DE**03B8
0610                      *
0611                      *
0612                      *
0613                      *
0614                      *
0615 03BA  0460  DECB    B       @DECODEB    GO AND DECODE LOCAL DATA
      03BC  0000
0616                      *
0617 03BE  C820  LABS31  MOV     @LDC3,@LDC3    CHECK FOR LOCAL DATA
      03C0  0364
      03C2  03C0
      03AE**1307
0618 03C4  16FA          JNE     DECB        LOCAL DATA
0619 03C6  1F08          TB      PRGFLG      IS PLAY AT PROGRAM SEQUENCE PR
0620 03C8  16--          JNE     LABB3        NOT PLAY AT SEQUENCE
0621 03CA  0457          B       *PROGPT     GO CONTINUE PLAY AT SEQUENCE

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0622 030C 1F43 LABB3 TB FFWD IS >> ACTIVE
      03A6♦♦1312
      03C8♦♦1601
0623 03CE 16-- JNE LABB4 GO CHECK FOR END OF TAPE
0624 *
0625 03D0 1F44 LABB5 TB REWD IS << ACTIVE
0626 03D2 16-- JNE LABB6 GO CHECK FOR END OF TAPE
0627 *
0628 03D4 1F0F LABB7 TB GOTOP6 IS GOTD FUNCTION RUNNING
0629 03D6 16-- JNE LABB2 NOT RUNNING
0630 03D8 0458 B ♦GOTOPT GO AND CONTINUE GOTD SEQUENCE
0631 *
0632 03DA 1F07 LABB2 TB DLYFLG IS A DELAY CURRENTLY RUNNING
      03D6♦♦1601
0633 03DC 16-- JNE LABB2M NO DELAY
0634 03DE C186 MOV DELAY,DELAY TEST END OF DELAY
0635 03E0 16-- JNE LABB2M
0636 03E2 1E07 SBZ DLYFLG DELAY OVER - RESET DELAY FLAG
0637 03E4 0459 B ♦FTNPT GO CONTINUE CURRENT FUNCTION
0638 03E6 1F04 LABB2M TB MIPFLG
      03DC♦♦1604
      03E0♦♦1602
0639 03E8 16-- JNE LABS34
0640 03EA C000 MOV R0,R0
0641 03EC 16-- JNE LABS34
0642 03EE 1D09 SBO FUNFLG
0643 03F0 045A B ♦MEMIPT
0644 *
0645 03F2 1F0D LABS34 TB FLSFLG IS DISPLAY FLASHING
      03E8♦♦1604
      03EC♦♦1602
0646 03F4 16-- JNE LABS35
0647 03F6 8820 C @FDCON,@C2000 TEST IF RECORD PAUSE AND FLAS
      03F8 0224
      03FA 03B6
0648 03FC 13-- JEQ LABS35
0649 03FE C0A0 MOV @FLIC,GENRB2
      0400 022E
0650 0402 16-- JNE LABS35
0651 0404 1F02 TB RPSFLG TEST FOR RECORD PAUSE MODE
0652 0406 13-- JEQ LABS36
0653 0408 1E0D SBZ FLSFLG RESET FLASHING
0654 040A 10-- JMP LABS35
0655 *
0656 040C C820 LABS36 MOV @C2000,@FDCON RELOAD FLASHING CONSTANT
      040E 03B6
      0410 03F8
      0406♦♦1302
0657 0412 C820 MOV @C2000,@FLSHCT
      0414 03B6
      0416 0009
0658 0418 C820 MOV @C2000,@REFCON
      041A 03B6
      041C 02B2
0659 041E 1D45 SBO RECDSF

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0660 0420 1E0E          SBZ  DSPDN
0661
0662 0422 1F02  LABS35  TB    RPSFLG      TEST FOR RECORD PAUSE MODE
      03F4♦♦1616
      03FC♦♦1312
      0402♦♦160F
      040A♦♦100B
0663 0424 16--          JNE  LABB9          CHECK FOR CASSETTE
0664 0426 C0A0          MOV  @REFCON,GENRB2
      0428 041C
0665 042A 16--          JNE  LABB9
0666 042C C820          MOV  @C2000,@REFCON
      042E 03B6
      0430 0428
0667 0432 1F45          TB    RECDSP      IS RECORD DISPLAY ON
0668 0434 13--          JEQ  LABS37
0669 0436 1D45          SBO  RECDSP      TURN REC DISP OFF
0670 0438 10--          JMP  LABB9
0671 043A 1E45  LABS37  SBZ  RECDSP      TURN REC DISP ON
      0434♦♦1302
0672 043C 10--          JMP  LABB9
0673
0674
0675
0676 043E 1F41  LABB9   TB    TAPIND      CHECK FOR CASSETTE
      0424♦♦160C
      042A♦♦1609
      0438♦♦1002
      043C♦♦1000
0677 0440 13B1          JEQ  LABB8          CASSETTE STICK THERE
0678 0442 1D44          SBO  REWD         TURN OFF REWIND
0679 0444 1D43          SBO  FFW         TURN OFF FAST FORWARD
0680 0446 1E02          SBZ  RPSFLG      RESET RECORD PAUSE FLAG
0681 0448 1E03          SBZ  RECFLG      RESET RECORD FLAG
0682 044A 1E01          SBZ  RRLFLG      RESET RECORD RELEASE FLAG
0683 044C 1E00          SBZ  ARWFLG      RESET AUTO REWIND FLAG
0684 044E 1E06          SBZ  EDTFLG      RESET END OF TAPE FLAG
0685 0450 1E0F          SBZ  GOTOFG      RESET GOTO FLAG
0686 0452 1E05          SBZ  TCLFLG      NOT CALIBRATED
0687 0454 1D45          SBO  RECDSP      STOP RECORDING
0688 0456 04E0          CLR  @TAPCNT
      0458 01E6
0689 045A 04E0          CLR  @TAPCTD
      045C 01FE
0690 045E 04E0          CLR  @RECST
      0460 0000
0691 0462 10A0          JMP  LABB8
0692
0693 0464 8820  LABB4   C    @TPCNCK,@TAPCNT  HAS TAPE MOVED
      0466 0000
      0468 0458
      03CE♦♦164A
0694 046A 13--          JEQ  LABS38          NO MOVEMENT
0695
0696 046C 06A0          BL   @SUB1

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046E ----
0697
0698 0470 10B1      *      JMP      LABB7
0699 0472 C145     LABS38  MOV      MS500,MS500    IS 500 MS UP
      046A♦♦1303
0700 0474 16AF      *      JNE      LABB7          NOT FINISHED
0701 0476 1D43      *      SBO      FFWD          STOP >>
0702 0478 1D44      *      SBO      REWD          STOP REWIND
0703 047A 1D06      *      SBO      EDTFLG       SET END OF TAPE FLAG
0704 047C 1E0F      *      SBZ      GOTDF6       RESET GOTD FLAG
0705 047E 1F03      *      TB       RECFLG       TEST FOR RECORDING
0706 0480 16A9      *      JNE      LABB7
0707 0482 1D45      *      SBO      RECDSP       RECORD DISP GOES HIGH
0708 0484 C820      *      MOV      @C2000,@REFCON
      0486 03B6
      0488 0430
0709 048A 1D02      *      SBO      RPSFLG       SET RECORD PAUSE MODE
0710 048C 1E03      *      SBZ      RECFLG       RESET RECORD FLAG
0711 048E 10A2      *      JMP      LABB7
0712
0713 0490 8820     *      LABB6   C          @TPCNCK,@TAPCNT    HAS TAPE MOVED
      0492 0466
      0494 0468
      03D2♦♦165E
0714 0496 13--     *      JEQ      LABS39
0715
0716 0498 06A0     *      BL       @SUB1
      049A ----
0717
0718 049C 109B     *      JMP      LABB7
0719 049E C145     LABS39  MOV      MS500,MS500    IS 500 MS UP
      0496♦♦1303
0720 04A0 1699     *      JNE      LABB7          NOT UP
0721 04A2 1D44     *      SBO      REWD          STOP REWIND
0722 04A4 1D05     *      SBO      TCLFLG       SET TAPE CALIBRATED
0723 04A6 04E0     *      CLR      @TAPCNT       CLEAR TAPE COUNTER
      04A8 0494
0724 04AA 04E0     *      CLR      @TAPCTD       CLEAR DISPLAY TAPE C
      04AC 045C
0725 04AE 04E0     *      CLR      @RECST
      04B0 0460
0726 04B2 1D45     *      SBO      RECDSP       RECORD DISPLAY GOES HIGH
0727 04B4 1E02     *      SBZ      RPSFLG       RESET RECORD PAUSE FLAG
0728 04B6 1E00     *      SBZ      ARWFLG       RESET AUTO REWIND FLAG
0729 04B8 108D     *      JMP      LABB7
0730
0731
0732 04BA C820     *      SUB1    MOV      @TAPCNT,@TPCNCK    STORE TAPE POSITION
      04BC 04A8
      04BE 0492
      046E♦♦04BA
      049A♦♦04BA
0733 04C0 0205     *      LI       MS500,500
      04C2 01F4
0734 04C4 045B     *      B        *11          RETURN

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