



DECUS

PROGRAM LIBRARY

DECUS NO.	12-75
TITLE	FORTRAN SUBROUTINES FOR THE PDP-12
AUTHOR	<i>Thomas V. McCaffrey</i>
COMPANY	Loyola University Medical Center Maywood, Illinois
DATE	March 20, 1972
SOURCE LANGUAGE	FORTRAN, SABR

FORTRAN SUBROUTINES FOR THE PDP-12

DECUS Program Library Write-up

DECUS NO. 12-75

Abstract: This package of eight subroutines and functions was written for real time control of the PDP-12's clock, display, A to D's, sense switches, external line levels, relays, and left switches. Since these programs are called by FORTRAN, the data acquisition and control functions of the PDP-12 can be manipulated in the conceptually simple atmosphere of a high level language. For this ease of control, however, speed is sacrificed resulting in a minimum sampling interval of approximately 4 msec.

Source Language: FORTRAN, SABR

CLKSET: This subroutine is used to set up the KW12-A clock. It permits direct control of the clock control register, clock enable register, and the clock buffer-preset register. The subroutine is called as follows:

```
CALL CLKSET (IMODE,IRATE,IPRE,I1,I2,I3)
```

All the arguments are inputs to the subroutine.

IMODE: The mode of operation of the clock (0-7); this value is placed into bits 3-5 of the clock control register.

IRATE: The count rate of the clock (0-7); this value is placed into bits 0-2 of the clock control register.

IPRE: The number of counts which are to occur before an interrupt when the clock is running in mode 1 or 5. The octal equivalent of the negative of IPRE is placed in the clock buffer preset register.

I1-I3: The condition of the clock inputs. If 0 the numbered input is not enabled. If 1 the input is enabled but an interrupt is not enabled. If 3 the input is enabled and an interrupt will occur on the input, making the input program detectable. If a fast sample mode is requested (mode 4-7) the fast sample bit of the extended function register is automatically set.

The interrupt facility must not be enabled when this program is operating.

CLKRUN: This subroutine is used to sense clock interrupts. When control enters this subroutine it remains there until an interrupt condition (as specified by CLKSET) occurs. The cause of the interrupt is determined and the parameters of the interrupt are transmitted to the main program. The subroutine is called as follows:

```
CALL CLKRUN (I1,I2,I3, ICOUNT)
```

All arguments are outputs of the subroutine.

I1-I3: In modes 2,3,5, and 6 the input channel producing the interrupt.

∅= The specified channel did not produce the interrupt

1= The specified channel produced the interrupt

3= A pre-event occurred on the channel producing the interrupt

ICOUNT: In modes 2,3,5, and 6 the decimal equivalent of the clock buffer-preset register.

When operating in mode 1 or 5 all arguments are set to zero.

RELAY: This subroutine is used to control the 6 relays. The two states of the relays represented by ∅ and 1 are transmitted to the relay register. The subroutine is called as follows:

```
CALL RELAY (I∅,I1,I2,I3,I4,I5)
```

All arguments are inputs to the subroutine.

I∅-I5: State of relay ∅-5; ∅= state ∅, 1=state 1.

DISP: This subroutine permits point displays on the VR-12 scope. The scope is considered to be an array with the vertical coordinate varying from -256 to 256 and the horizontal coordinate varying from ∅ to 512. The display is an instantaneous display and must be refreshed to maintain an image on the scope.

The subroutine is called as follows:

CALL DISP (IX,IY)

IX= the horizontal coordinate

IY= the vertical coordinate

ISNS: This function subroutine returns the condition of one of the eight sense switches to the main program. The function is called as follows:

K= ISNS (I)

The number of the sense switch (0-7) is indicated by I; its condition (0=down, 1=up) is returned to K.

IEXL: This function subroutine returns the condition of one of the 11 external lines available at the data terminal module. External level 13 can also be used to determine if a key has been struck on the teletype keyboard. The function is called as follows:

K= IEXL (I)

The number of the external line (0-13) is indicated by I; its condition (0=low, 1=high) is returned to K.

IADC: This function subroutine returns the decimal equivalent of the level at the selected A to D channel. Since bit 0 is considered the sign bit high levels can be returned as negative numbers. The function is called as follows:

K= IADC (I)

The channel selected is indicated by I; the A to D conversion is returned to K.

ILSW: This function subroutine reads the octal equivalent of the left switches. The function is called as follows:

K= ILSW(0)

The octal equivalent of the left switches is returned to K.

Listings: Listings of the above subroutines can be found appended to the end

of this write-up. They were assembled on a PDP-12 running under the PS/8 System.

Demonstration Program: An ASCII tape of the program HISTOGRAM is included with write-up. This program demonstrates some of the features of the subroutines. This program generates a time interval histogram of the input on clock channel #3. The program initially requests a clock rate. It then monitors 1000 pulses and returns a print out on the teletype of 100 bins each with a width of 1 clock count at the specified rate. It then displays the histogram on the scope until sense switch 0 is raised, at which time the program restarts.

This program will require modification of its WRITE statement if the FORTRAN compiler does not accept implied do loops.

```

C
C
C
C      HISTOGRAM:  A DEMONSTRATION PROGRAM
C THIS PROGRAM GENERATES A LATENCY HISTOGRAM FROM
C      A WAVEFORM ENTERED AT CLOCK INPUT #3
C
C
C
C ZERO TIME INTERVAL BINS
      DIMENSION IA(100)
1      DO 5 I=1,100,1
5      IA(I)=0
C READ CLOCK RATE (0-7)
      READ (1,101)IRATE
101     FORMAT('CLOCK RATE',I2)
C SET CLOCK TO SELECTED RATE; ENABLE INTERUPT ON CHANNEL #3
      CALL CLKSET(3,IRATE,0,0,0,3)
C COUNT 1000 PULSES
      DO 10 I=1,1000,1
          CALL CLKRUN (I1,I2,I3,ICN)
C INCREMENT BIN EQUAL TO LATENCY
7      IA(ICN)=IA(ICN)+1
10     CONTINUE
C OUTPUT BIN CONTENTS IN A 10X10 TABLE WITH EACH BIN EQUAL TO
C AN INTERVAL OF ONE CLOCK COUNT
      WRITE(1,100) (IA(I),I=1,100)
100    FORMAT (10(1X,I6))
C DISPLAY HISTOGRAM ON SCOPE UNTIL SENSE SWITCH #0 IS RAISED
20     DO 25 I=1,100,1
          CALL DISP (I*5,IA(I)-250)
25     CONTINUE
          IF (ISNS(0)) 20,20,30
30     GOTO 1
      END

```

CLKSE 0202EXT
 CONT 0405
 EXIT 0000EXT
 IN 0423
 LOAD 0436
 OPEN 0000EXT
 SET 0406
 TEMP 0442
 I0 0461
 \IMODE 0445
 \IPRE 0451
 \IRATE 0447
 \I1 0453
 \I2 0455
 \I3 0457

LAP
 DUMMY I0
 CPAGE 6
 EAP
 CALL 0,OPEN
 0200 4033
 0201 0001 06
 PAUSE
 FORTR
 / SUBROUTINE CLKSET(IMODE,IRATE,IPRE,I1,I2,I3)
 ENTRY CLKSE
 CLKSE, BLOCK 2
 0202 0000
 0203 0000
 DUMMY \IMODE
 TAD I CLKSE
 0204 4067
 0205 0202 01
 0206 1407
 0207 6201 05 DCA \IMODE
 0210 3776
 0211 2203 INC CLKSE#
 0212 4067 TAD I CLKSE
 0213 0202 01
 0214 1407
 0215 6201 05 DCA \IMODE#
 0216 3775
 0217 2203 INC CLKSE#
 DUMMY \IRATE
 TAD I CLKSE
 0220 4067
 0221 0202 01
 0222 1407
 0223 6201 05 DCA \IRATE
 0224 3774
 0225 2203 INC CLKSE#
 0226 4067 TAD I CLKSE
 0227 0202 01
 0230 1407
 0231 6201 05 DCA \IRATE#
 0232 3773
 0233 2203 INC CLKSE#
 DUMMY \IPRE

0234	4067	TAD I CLKSE	
0235	0202 01		
0236	1407		
0237	6201 05	DCA \IPRE	
0240	3772		
0241	2203	INC CLKSE#	
0242	4067	TAD I CLKSE	
0243	0202 01		
0244	1407		
0245	6201 05	DCA \IPRE#	
0246	3771		
0247	2203	INC CLKSE#	
		DUMMY \I1	
0250	4067	TAD I CLKSE	
0251	0202 01		
0252	1407		
0253	6201 05	DCA \I1	
0254	3770		
0255	2203	INC CLKSE#	
0256	4067	TAD I CLKSE	
0257	0202 01		
0260	1407		
0261	6201 05	DCA \I1#	
0262	3767		
0263	2203	INC CLKSE#	
		DUMMY \I2	
0264	4067	TAD I CLKSE	
0265	0202 01		
0266	1407		
0267	6201 05	DCA \I2	
0270	3766		
0271	2203	INC CLKSE#	
0272	4067	TAD I CLKSE	
0273	0202 01		
0274	1407		
0275	6201 05	DCA \I2#	
0276	3765		
0277	2203	INC CLKSE#	
		DUMMY \I3	
0300	4067	TAD I CLKSE	
0301	0202 01		
0302	1407		
0303	6201 05	DCA \I3	
0304	3764		
0305	2203	INC CLKSE#	
0306	4067	TAD I CLKSE	
0307	0202 01		
0310	1407		
0311	6201 05	DCA \I3#	
0312	3763		
0313	2203	INC CLKSE#	
0314	7300	CLA CLL	
0315	6133	6133	/AC TO CLOCK BUFFER-PRESET REG
0316	6132	6132	/AC TO CLOCK CONTROL REG
0317	1362	TAD	(K100) /STOP CLOCK
0320	6132	6132	
0321	6135	6135	/CLEAR STATUS
0322	7200	CLA	

0323	4067	TAD I \IPRE	/GET PRESET
0324	0451 01		
0325	1407		
0326	7041	CIA	
0327	6133	6133	/LOAD PRESET REG
0330	7300	CLA CLL	
0331	4067	TAD I \IRATE	/GET RATE
0332	0447 01		
0333	1407		
0334	7012	RTR;RTR	/ROTATE INTO POSITION
0335	7012		
0336	6201 05	DCA TEMP	/SAVE IT
0337	3761		
0340	4067	TAD I \IMODE	/GET MODE
0341	0445 01		
0342	1407		
0343	7006	RTL;RTL;RTL	/ROTATE INTO POSITION
0344	7006		
0345	7006		
0346	6201 05	TAD TEMP	/GET BACK RATE
0347	1761		
0350	6132	6132	/LOAD COMPLETE CONTROL INST.
0351	7200	CLA	
0352	4067	TAD I \IMODE	/GET MODE AGAIN
0353	0445 01		
0354	1407		
0355	1360	TAD (-4	
0356	5377		
0360	7774		
0361	0442 01		
0362	0100		
0363	0460 01		
0364	0457 01		
0365	0456 01		
0366	0455 01		
0367	0454 01		
0370	0453 01		
0371	0452 01		
0372	0451 01		
0373	0450 01		
0374	0447 01		
0375	0446 01		
0376	0445 01		
0377	7000		
0400	7510	SPA	/IS IT MODE 4,5,6,OR 7
0401	5205	JMP CONT	/NO CONTINUE
0402	7200	CLA	/YES SET EXTENDED FUNCTION REG
0403	1377	TAD (K100	/TO FAST SAMPLE
0404	5206	JMP SET	
0405	7200	CONT, CLA	
0406	6141	SET, 6141	/LINC MODE
0407	0004	0004	/LOAD EXTENDED FUNCTION REG
0410	0002	0002	/BACK TO PMODE
0411	7200	CLA	
0412	4067	TAD I \IMODE	/GET MODE AGAIN
0413	0445 01		
0414	1407		

```

0415 1376          TAD (-1
0416 7440          SZA          /MODE #1
0417 5223          JMP IN          /NO CONTINUE
0420 7200          CLA          /YES
0421 1375          TAD (K300    /GET OVERFLOW ENABLE INST
0422 5236          JMP LOAD        /LOAD ENABLE REG
0423 4067          IN, TAD I \I1  /ENABLE #1
0424 0453 01
0425 1407
0426 7006          RTL
0427 4067          TAD I \I2    /ENABLE #2
0430 0455 01
0431 1407
0432 7006          RTL
0433 4067          TAD I \I3    /ENABLE #3
0434 0457 01
0435 1407
0436 6134          LOAD,          6134          /LOAD ENABLE REG
0437 7200          CLA
/          RETURN
0440 4040          RETRN CLKSE
0441 0002 06
0442 0000          TEMP,          0
/          END
0443 4033          CALL 0,EXIT
0444 0003 06
0445 0000          \IMODE, BLOCK 2
0446 0000
0447 0000          \IRATE, BLOCK 2
0450 0000
0451 0000          \IPRE, BLOCK 2
0452 0000
0453 0000          \I1, BLOCK 2
0454 0000
0455 0000          \I2, BLOCK 2
0456 0000
0457 0000          \I3, BLOCK 2
0460 0000
0461 0000          [0, BLOCK 2
0462 0000
0575 0300
0576 7777
0577 0100
END

```

```

BACK      0317
CLKRU     0202EXT
C1        0345
C2        0406
C3        0415
ERROR     0340
EX        0424
EXIT      0000EXT
GO        0303
OPEN      0000EXT
OUT       0431

```

TEMP 0434
 TTEMP 0435
 I0 0450
 \ICOUN 0446
 \I1 0440
 \I2 0442
 \I3 0444

```

LAP
DUMMY I0
CPAGE 6
EAP
0200 4033 CALL 0,OPEN
0201 0001 06

PAUSE
FORTR
/ SUBROUTINE CLKRUN(I1,I2,I3,ICOUNT)
ENTRY CLKRU
CLKRU, BLOCK 2

0202 0000
0203 0000

DUMMY \I1
TAD I CLKRU
0204 4067
0205 0202 01
0206 1407
0207 6201 05 DCA \I1
0210 3776
0211 2203 INC CLKRU#
0212 4067 TAD I CLKRU
0213 0202 01
0214 1407
0215 6201 05 DCA \I1#
0216 3775
0217 2203 INC CLKRU#
DUMMY \I2
TAD I CLKRU
0220 4067
0221 0202 01
0222 1407
0223 6201 05 DCA \I2
0224 3774
0225 2203 INC CLKRU#
0226 4067 TAD I CLKRU
0227 0202 01
0230 1407
0231 6201 05 DCA \I2#
0232 3773
0233 2203 INC CLKRU#
DUMMY \I3
TAD I CLKRU
0234 4067
0235 0202 01
0236 1407
0237 6201 05 DCA \I3
0240 3772
0241 2203 INC CLKRU#
0242 4067 TAD I CLKRU
0243 0202 01
0244 1407
0245 6201 05 DCA \I3#
0246 3771
0247 2203 INC CLKRU#

```

```

DUMMY \ICOUN
0250 4067 TAD I CLKRU
0251 0202 01
0252 1407
0253 6201 05 DCA \ICOUN
0254 3770
0255 2203 INC CLKRU#
0256 4067 TAD I CLKRU
0257 0202 01
0260 1407
0261 6201 05 DCA \ICOUN#
0262 3767
0263 2203 INC CLKRU#
0264 7300 CLA CLL
0265 4067 DCA I \I1
0266 0440 01
0267 3407
0270 4067 DCA I \I2
0271 0442 01
0272 3407
0273 4067 DCA I \I3
0274 0444 01
0275 3407
0276 4067 DCA I \ICOUNT
0277 0446 01
0300 3407
0301 6201 05 DCA TTEMP
0302 3766
0303 6131 GO, 6131 /CLOCK INTERRUPT?
0304 5303 JMP GO /NO WAIT
0305 6135 6135 /YES READ STATUS REG
0306 6201 05 DCA TEMP /SAVE IT
0307 3765
0310 1765 TAD TEMP
0311 0364 AND (K77 /MASK FLAG
0312 7450 SNA /OVERFLOW MODE #1,#5
0313 5763 JMP OUT /YES RETURN
0314 0362 AND (K25 /NO -PREEVENT?
0315 7440 SZA
0316 5340 JMP ERROR /YES SET INDICATOR
0317 7200 BACK, CLA
0320 6201 05 TAD TEMP
0321 1765
0322 0361 AND (K40 /CH #1 INTERRUPT?
0323 7440 SZA
0324 5345 JMP C1 /YES
0325 7200 CLA
0326 1765 TAD TEMP
0327 0360 AND (K10 /CH #2 INTERRUPT?
0330 7440 SZA
0331 5757 JMP C2 /YES
0332 7200 CLA
0333 1765 TAD TEMP
0334 0356 AND (K2 /CH #3 INTERRUPT?
0335 7440 SZA
0336 5755 JMP C3
0337 5763 JMP OUT
0340 7200 ERROR, CLA

```

0341	1354		TAD (K1	/SET ERROR CODE
0342	6201	05	DCA TTEMP	
0343	3766			
0344	5317		JMP BACK	/RETURN
0345	7200	C1,	CLA	
0346	1354		TAD (K1	
0347	6201	05	TAD TTEMP	
0350	1766			
0351	5377			
0354	0001			
0355	0415	01		
0356	0002			
0357	0406	01		
0360	0010			
0361	0040			
0362	0025			
0363	0431	01		
0364	0077			
0365	0434	01		
0366	0435	01		
0367	0447	01		
0370	0446	01		
0371	0445	01		
0372	0444	01		
0373	0443	01		
0374	0442	01		
0375	0441	01		
0376	0440	01		
0377	7000			
0400	7410		DCA I \I1	
0401	5205			
0402	4067			
0403	0440	01		
0404	3407			
0405	5224		JMP EX	
0406	7200	C2,	CLA	
0407	1377		TAD (K1	
0410	1235		TAD TTEMP	
0411	4067		DCA I \I2	
0412	0442	01		
0413	3407			
0414	5224		JMP EX	
0415	7200	C3,	CLA	
0416	1377		TAD (K1	
0417	1235		TAD TTEMP	
0420	4067		DCA I \I3	
0421	0444	01		
0422	3407			
0423	5224		JMP EX	
0424	7200	EX,	CLA	
0425	6136		6136	/GET CLOCK BUFFER
0426	4067		DCA I \ICOUNT	
0427	0446	01		
0430	3407			
0431	7200	OUT,	CLA	
		/	RETURN	

```

0432 4040      RETRN CLKRU
0433 0002 06
0434 0000      TEMP,          0
0435 0000      TTEMP,        0
                /          END
0436 4033      CALL 0,EXIT
0437 0003 06
0440 0000      \I1, BLOCK 2
0441 0000
0442 0000      \I2, BLOCK 2
0443 0000
0444 0000      \I3, BLOCK 2
0445 0000
0446 0000      \ICOUN, BLOCK 2
0447 0000
0450 0000      [0, BLOCK 2
0451 0000
0577 0001
                END

```

```

EXIT      0000EXT
OPEN      0000EXT
RELAY     0202EXT
[0        0354
\I0       0340
\I1       0342
\I2       0344
\I3       0346
\I4       0350
\I5       0352

```

```

                LAP
                DUMMY [0
                CPAGE 6
                EAP
0200 4033      CALL 0,OPEN
0201 0001 06
                PAUSE
                FORTR
                /          SUBROUTINE RELAY (I0,I1,I2,I3,I4,I5)
                ENTRY RELAY
0202 0000      RELAY, BLOCK 2
0203 0000
                DUMMY \I0
0204 4067      TAD I RELAY
0205 0202 01
0206 1407
0207 3340      DCA \I0
0210 2203      INC RELAY#
0211 4067      TAD I RELAY
0212 0202 01
0213 1407
0214 3341      DCA \I0#
0215 2203      INC RELAY#
                DUMMY \I1
0216 4067      TAD I RELAY
0217 0202 01
0220 1407
0221 3342      DCA \I1

```

0222	2203	INC RELAY#	
0223	4067	TAD I RELAY	
0224	0202 01		
0225	1407		
0226	3343	DCA \I1#	
0227	2203	INC RELAY#	
		DUMMY \I2	
0230	4067	TAD I RELAY	
0231	0202 01		
0232	1407		
0233	3344	DCA \I2	
0234	2203	INC RELAY#	
0235	4067	TAD I RELAY	
0236	0202 01		
0237	1407		
0240	3345	DCA \I2#	
0241	2203	INC RELAY#	
		DUMMY \I3	
0242	4067	TAD I RELAY	
0243	0202 01		
0244	1407		
0245	3346	DCA \I3	
0246	2203	INC RELAY#	
0247	4067	TAD I RELAY	
0250	0202 01		
0251	1407		
0252	3347	DCA \I3#	
0253	2203	INC RELAY#	
		DUMMY \I4	
0254	4067	TAD I RELAY	
0255	0202 01		
0256	1407		
0257	3350	DCA \I4	
0260	2203	INC RELAY#	
0261	4067	TAD I RELAY	
0262	0202 01		
0263	1407		
0264	3351	DCA \I4#	
0265	2203	INC RELAY#	
		DUMMY \I5	
0266	4067	TAD I RELAY	
0267	0202 01		
0270	1407		
0271	3352	DCA \I5	
0272	2203	INC RELAY#	
0273	4067	TAD I RELAY	
0274	0202 01		
0275	1407		
0276	3353	DCA \I5#	
0277	2203	INC RELAY#	
0300	7300	CLA CLL	
0301	4067	TAD I \I0	/GET #0
0302	0340 01		
0303	1407		
0304	7004	RAL	
0305	4067	TAD I \I1	/GET #1
0306	0342 01		
0307	1407		


```

0310 7004          RAL
0311 4067          TAD I \I2          /GET #2
0312 0344 01
0313 1407
0314 7004          RAL
0315 4067          TAD I \I3          /GET #3
0316 0346 01
0317 1407
0320 7004          RAL
0321 4067          TAD I \I4          /GET #4
0322 0350 01
0323 1407
0324 7004          RAL
0325 4067          TAD I \I5          /GET #5
0326 0352 01
0327 1407
0330 6141          6141          /LINC MODE
0331 0014          0014          /AC TO RELAYS
0332 0002          0002          /P MODE
0333 7300          CLA CLL
/          RETURN
0334 4040          RETRN RELAY
0335 0002 06
/          END
0336 4033          CALL 0,EXIT
0337 0003 06
0340 0000          \I0, BLOCK 2
0341 0000
0342 0000          \I1, BLOCK 2
0343 0000
0344 0000          \I2, BLOCK 2
0345 0000
0346 0000          \I3, BLOCK 2
0347 0000
0350 0000          \I4, BLOCK 2
0351 0000
0352 0000          \I5, BLOCK 2
0353 0000
0354 0000          I0, BLOCK 2
0355 0000
END

```

```

CONT      0272
DDISP     0264
DIS       0255
DISP      0202EXT
EXIT      0000EXT
FIRST     0270
IN        0241
K1        0265
K6000     0271
LOC       0266
OPEN      0000EXT
SAVE      0267
I0        0303
\IX       0277
\IY       0301

```

```

LAP
DUMMY I0
CPAGE 6
EAP
0200 4033 CALL 0,OPEN
0201 0001 06

PAUSE
FORTR
/ SUBROUTINE DISP(IX,IY)
ENTRY DISP
0202 0000 DISP, BLOCK 2
0203 0000

DUMMY \IX
0204 4067 TAD I DISP
0205 0202 01
0206 1407
0207 3277 DCA \IX
0210 2203 INC DISP#
0211 4067 TAD I DISP
0212 0202 01
0213 1407
0214 3300 DCA \IX#
0215 2203 INC DISP#
DUMMY \IY
0216 4067 TAD I DISP
0217 0202 01
0220 1407
0221 3301 DCA \IY
0222 2203 INC DISP#
0223 4067 TAD I DISP
0224 0202 01
0225 1407
0226 3302 DCA \IY#
0227 2203 INC DISP#
/ SUBROUTINE TO DISPLAY A POINT ON THE CRT X=0>512;Y=-5
0230 7300 CLA CLL
0231 1270 TAD FIRST /PASS 1 MARKER
0232 7450 SNA /FIRST PASS?
0233 5241 JMP IN /NO
0234 1264 TAD DDISP /WHERE ARE WE
0235 0271 AND K6000 /MASK FOR LINC SEGMENT
0236 1265 TAD K1 /LINC LOC #1
0237 3266 DCA LOC /SAVE LOC
0240 3270 DCA FIRST /KILL PASS 1 MARKER
0241 6201 05 IN, TAD I LOC /GET LOC #1
0242 1666
0243 3267 DCA SAVE /SAVE IT
0244 4067 TAD I \IX /GET X COORDINATE
0245 0277 01
0246 1407
0247 6201 05 DCA I LOC /PLACE IN ALPHA REGISTER
0250 3666
0251 4067 TAD I \IY /GET Y COORDINATE
0252 0301 01
0253 1407

```

```

CPAGE 10
0254 6141          6141          /LINC MODE
0255 0141          DIS, 0141      /DISPLAY POINT
0256 0002          0002          /P MODE
0257 7300          CLA CLL
0260 1267          TAD SAVE      /GET BACK LOC #1
0261 6201 05      DCA I LOC      /RETURN IT
0262 3666
0263 5272          JMP CONT      /CONTINUE
0264 0255 01      DDISP,          DIS
0265 0001          KI, 1
0266 0000          LOC, 0
0267 0000          SAVE,          0
0270 0001          FIRST,         1
0271 6000          K6000,         6000
0272 7300          CONT,          CLA CLL
/          RETURN
0273 4040          RETRN DISP
0274 0002 06      /          END
0275 4033          CALL 0,EXIT
0276 0003 06
0277 0000          \IX, BLOCK 2
0300 0000
0301 0000          \IY, BLOCK 2
0302 0000
0303 0000          I0, BLOCK 2
0304 0000          END

```

```

EXIT      0000EXT
ISNS      0202EXT
OPEN      0000EXT
READ      0225
SW        0234
I0        0242
\I        0240
\ISNS     0235

```

```

LAP
DUMMY I0
CPAGE 6
EAP
0200 4033          CALL 0,OPEN
0201 0001 06
PAUSE
FORTR
/          FUNCTION ISNS(I)
ENTRY ISNS
0202 0000          ISNS, BLOCK 2
0203 0000
DUMMY \I
0204 4067          TAD I ISNS
0205 0202 01
0206 1407
0207 3240          DCA \I
0210 2203          INC ISNS#
0211 4067          TAD I ISNS

```

```

0212 0202 01
0213 1407
0214 3241      DCA \I#
0215 2203      INC ISNS#
0216 7320      CLA CLL CML
0217 4067      TAD I \I      /GET SW NO.
0220 0240 01
0221 1407
0222 1234      TAD SW      /GENERATE CODE
0223 3225      DCA READ    /INSERT CODE
0224 6141      6141      /LINC MODE
0225 0000      READ,      0      /SW SET
0226 0261      0261      /YES ROTATE 1 FROM LINK
0227 0002      0002      /NO BACK TO P MODE
0230 3235      DCA \ISNS  /TRANSMIT RESULT
/      RETURN
0231 1235      TAD \ISNS
0232 4040      RETRN ISNS
0233 0002 06
0234 0460      SW, 0460    /SNS CODE
0235 0000      \ISNS,     0      /RESULT
/      END
0236 4033      CALL 0,EXIT
0237 0003 06
0240 0000      \I, BLOCK 2
0241 0000
0242 0000      [0, BLOCK 2
0243 0000
END

```

```

EXIT      0000EXT
IEXL     0202EXT
LE       0234
OPEN     0000EXT
READ     0225
[0       0242
\I       0240
\IEXL    0235

```

```

LAP
DUMMY [0
CPAGE 6
EAP
0200 4033      CALL 0,OPEN
0201 0001 06
PAUSE
FORTR
/      FUNCTION IEXL(I)
ENTRY IEXL
IEXL, BLOCK 2
0202 0000
0203 0000
DUMMY \I
0204 4067      TAD I IEXL
0205 0202 01
0206 1407
0207 3240      DCA \I
0210 2203      INC IEXL#
0211 4067      TAD I IEXL

```

```

0212 0202 01
0213 1407
0214 3241      DCA \I#
0215 2203      INC IEXL#
0216 7320      CLA CLL CML
0217 4067      TAD I \I      /GET EXTERNAL LINE NUMBER
0220 0240 01
0221 1407
0222 1234      TAD LE      /GENERATE CODE
0223 3225      DCA READ    /INSERT CODE
0224 6141      6141      /LINC MODE
0225 0000      READ,      0      / LEVEL +3V
0226 0261      0261      /YES ROTATE 1 FROM LINK
0227 0002      0002      /NO BACK TO P MODE
0230 3235      DCA \IEXL    /TRANSMIT RESULT

/      RETURN
0231 1235      TAD \IEXL
0232 4040      RETRN IEXL
0233 0002 06
0234 0420      LE, 0420      /SXL CODE
0235 0000      \IEXL,      0      /RESULT
/      END
0236 4033      CALL 0,EXIT
0237 0003 06
0240 0000      \I, BLOCK 2
0241 0000
0242 0000      [0, BLOCK 2
0243 0000
END

CONV 0225
EXIT 0000EXT
IADC 0202EXT
OPEN 0000EXT
SAMP 0233
[0 0241
\I 0237
\IADC 0234

LAP
DUMMY [0
CPAGE 5
EAP
0200 4033      CALL 0,OPEN
0201 0001 06
PAUSE
FORTR
/      FUNCTION IADC(I)
ENTRY IADC
IADC, BLOCK 2
0202 0000
0203 0000
DUMMY \I
0204 4067      TAD I IADC
0205 0202 01
0206 1407

```

```

0207 3237      DCA \I
0210 2203      INC IADC#
0211 4067      TAD I IADC
0212 0202 01
0213 1407
0214 3240      DCA \I#
0215 2203      INC IADC#
0216 7300      CLA CLL
0217 4067      TAD I \I      /GET CHANNEL NO.
0220 0237 01
0221 1407
0222 1233      TAD SAMP      /GENERATE ADC INSTRUCTION
0223 3225      DCA CONV      /INSERT INST.
0224 6141      6141      /LINC MODE
0225 0000      CONV,      0      /CONVERT
0226 0002      0002
0227 3234      /      DCA \IADC      /TRANSMIT RESULT
                RETURN
0230 1234      TAD \IADC
0231 4040      RETRN IADC
0232 0002 06
0233 0100      SAMP,      0100      /SAMPLE CODE
0234 0000      \IADC,      0      /RESULT
                /      END
0235 4033      CALL 0,EXIT
0236 0003 06
0237 0000      \I, BLOCK 2
0240 0000
0241 0000      [0, BLOCK 2
0242 0000
                END

```

```

EXIT      0000EXT
ILSW      0202EXT
OPEN      0000EXT
[0        0233
\I        0231
\ILSW     0226

```

```

                LAP
                DUMMY [0
                CPAGE 6
                EAP
0200 4033      CALL 0,OPEN
0201 0001 06
                PAUSE
                FORTR
                /      FUNCTION ILSW(I)
                ENTRY ILSW
0202 0000      ILSW, BLOCK 2
0203 0000
                DUMMY \I
0204 4067      TAD I ILSW

```

```

0205 0202 01
0206 1407
0207 3231 DCA \I
0210 2203 INC ILSW#
0211 4067 TAD I ILSW
0212 0202 01
0213 1407
0214 3232 DCA \I#
0215 2203 INC ILSW#
0216 7300 CLA CLL
0217 6141 6141 /LINC MODE
0220 0517 0517 /READ LEFT SW
0221 0002 0002 /P MODE
0222 3226 DCA \ILSW /TRANSMIT RESULT
/ RETURN
0223 1226 TAD \ILSW
0224 4040 RETRN ILSW
0225 0002 06
0226 0000 \ILSW, 0 /RESULT
/ END
0227 4033 CALL 0,EXIT
0230 0003 06
0231 0000 \I, BLOCK 2
0232 0000
0233 0000 [0, BLOCK 2
0234 0000
END

```

*

