# DECUS
## PROGRAM LIBRARY

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| DECUS NO. | 8-264 |
| TITLE | CLOK - AXØ8 RC CLOCK OR EXTERNAL CLOCK FREQUENCY OR PERIOD MEASUREMENT |
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| SOURCE LANGUAGE | PAL |

# CLOK - AXØ8 RC CLOCK OR EXTERNAL CLOCK FREQUENCY OR PERIOD MEASUREMENT

DECUS Program Library Write-up

DECUS No. 8-264

## PROGRAM UTILIZATION

Load Floating point package 2

Load program CLOK

Set 200 on Switch Register. Load address. Depress start.

Select SR (0) = 0 if Frequency measurement
= 1 if Period measurement

SR (1) = 0 if normal RC clock rate
= 1 if RC clock slowed by 8

SR (2) = 0 if RC clock
= 1 if External clock

## PROGRAM DESCRIPTION.

The first operation is loading the enable register of AXØ8 by :

ØØ4Ø2 if RC clock flag

ØØ42Ø if RC clock slowed by 8

ØØ4Ø4 if external clock is to be measured.

Then the program wait for the first clock pulse.
Interrupt is enabled and the program counts simultaneously the number of RC or External clock pulses and the number of crystal clock pulses (10 KHz) by program interrupt.
The respective floating counters are NBRRC and NBCRY.
When more than M2 x 4Ø96 (in this case 8192) crystal clock pulses and more than one RC or External clock pulse occur, the calcul of the Frequency or of the period is done and the result typed out on ASR 33.

Frequency is calculated in the folowing way :

$$\frac{\text{NBRRC}}{\text{NBCRY}} \times 10\ 000 \text{ Herz}$$

and the period :

$$\frac{1000}{\text{Frequency}} \text{ milliseconds}$$

LIMITATIONS.

The maximum Frequency measurable is given by the time for executing one loop of the program (about 90 microseconds). The maximum Frequency is then more than 10 KHz.
Minimum Frequency is function of the capacity of NBCRY which is $2048 \times 4096 \quad 8 \times 10^6$. This minimum is $10^4 / 8 \times 10^6 = 0{,}00125$ Hz ($10^4$ is the Frequency of the crystal clock).

OUTPUT FORMAT.

The total number of digit outputted may be changed by setting the new number in address 62.
In the same way, number of digit of the decimal part must be put in P4 (address 341)

PRECISION.

Precision of the measure may be augmented by changing the contain of M2 (address 342).
The precision is given by $\frac{1}{M2 \times 4096}$.
The measure time is then as much augmented as the precision increase.

RESTRICTIONS.

When this program is used for measuring external clock and no signal is applied, the program is always waiting.
It may be restarted at address 200.

EXAMPLE OF RC CLOCK MEASUREMENT AND ADJUSTEMENT.

```
+      .6944 HZ
+      .6944 HZ
+      .6944 HZ
+ 1439.9000 MS
+ 1440.0010 MS
+ 1440.0010 MS
+    9.7680 MS
+  265.7250 MS
+  265.7250 MS
+  265.7250 MS
+    3.7632 HZ
+    3.7632 HZ
+    3.7629 HZ
+    3.7632 HZ
+  143.0302 HZ
+   14.2874 HZ
+   14.2874 HZ
+   14.2874 HZ
+  264.4668 HZ
+  100.6548 HZ
+  100.6548 HZ
+  100.6792 HZ
+  100.6670 HZ
+  100.6304 HZ
+  105.2631 HZ
+  105.2504 HZ
+  222.2222 HZ
+  222.2222 HZ
+  219.8736 HZ
+  290.7542 HZ
+  521.9510 HZ
+  894.3386 HZ
+  894.3386 HZ
+  943.0278 HZ
+  984.6267 HZ
+ 1008.7820 HZ
+ 1027.7060 HZ
+ 1024.7650 HZ
+ 1023.1700 HZ
+ 1019.5120 HZ
+ 1017.9410 HZ
+ 1015.8530 HZ
+ 1014.6340 HZ
+ 1013.0590 HZ
+ 1009.0280 HZ
+ 1005.1230 HZ
+ 1004.2700 HZ
+ 1002.1970 HZ
+ 1001.2190 HZ
+ 1000.6090 HZ
+ 1000.3650 HZ
+ 1000.2430 HZ
```

```
+      .9997 MS
+      .9997 MS
+      .9998 MS
+ 1000.1210 HZ
+ 1000.1210 HZ
+ 1000.1210 HZ
+  999.2679 HZ
+  999.5119 HZ
+ 1000.0000 HZ
+ 1000.1210 HZ
+    1.0000 MS
+    1.0000 MS
+ 1000.0000 HZ
+ 1000.0000 HZ
+    1.0001 MS
+    1.0000 MS
+    1.0000 MS
+ 1000.0000 HZ
+ 1000.0000 HZ
+ 8000.4880 HZ
+ 7999.2670 HZ
+ 8000.4880 HZ
+      .1249 MS
+      .1249 MS
+      .1249 MS
+      .1250 MS
+      .1249 MS
+      .1250 MS
+      .1148 MS
+      .1102 MS
+ 9090.5760 HZ
+ 9538.5740 HZ
+ 9763.1830 HZ
+ 9920.6540 HZ
+10074.4600 HZ
+10093.9900 HZ
+10069.5800 HZ
+10062.2500 HZ
+10051.2600 HZ
+10035.3900 HZ
+10032.9500 HZ
+10019.5300 HZ
+10018.3100 HZ
+10012.2000 HZ
+10003.6600 HZ
+10004.8800 HZ
+      .0999 MS
+      .0999 MS
+      .0999 MS
+      .0999 MS
+      .1000 MS
+      .1000 MS
+ 9996.3370 HZ
+ 9995.1170 HZ
+      .1000 MS
+      .1000 MS
+ 9995.1170 HZ
+ 9996.3370 HZ
```

```
ADCRYH 0021
ADCRYL 0022
BLAN   0356
CR     0351
DEBUT  0200
H      0362
LF     0352
M      0357
M2     0342
NBCRY  0346
NBCRYH 0347
NBCRYL 0350
NBRRC  0343
NBRRCH 0344
NBRRCL 0345
P1000  0353
P10000 0336
P4     0341
P402   0335
P404   0334
S      0360
START  0333
SWITCH 0363
TYPE   0364
WAIT   0227
ZED    0361
```

```
          XLIST
          PAUSE
          /AX08 RC OR EXTERNAL CLOCK FREQUENCY OR PERIOD MEASUREMENT
          /AL:5/10/70
          /OPTION ON SWITCH REGISTER
          /SR(0)  0 FREQUENCY MEASUREMENT
          /       1       PERIOD  "
          /SR(1)  0 RC CLOCK FLAG EVERY 4 CLOCK PULSES OR EVERY EXT CLOCK
          /       1 RC CLOCK SLOWED BY 8(RC CLOCK FLAG EVERY 32 RC PULSE
          /SR(2)  0 RC CLOCK
          /       1 EXTERNAL CLOCK
          /THIS PROGRAM MUST BE LOADED WITH FLOATING 2
          *0
0000 0000 0
0001 6352 CLXK
0002 2022 ISZ ADCRYL
0003 7410 SKP
0004 2021 ISZ ADCRYH
0005 6001 ION
0006 5400 JMP I 0
0007 5600 5600
          *20
0020 7200 7200
0021 0000 ADCRYH,0          /NUMBER OF CRYSTAL CLOCK BETWEEN 2 RC CLOCKS
0022 0000 ADCRYL,0
          *62
0062 0011 11 /NBER OF DIGIT TO BE OUTPUTTED
          *200
0200 7604 DEBUT,CLA OSR
```

```
0201  7004  RAL
0202  7710  SPA CLA
0203  7330  CLA CLL CML RAR
0204  3333  DCA START
0205  7604  CLA OSR
0206  7006  RTL
0207  7710  SPA CLA
0210  5213  JMP .+3
0211  1335  TAD P402
0212  7410  SKP
0213  1334  TAD P404
0214  1333  TAD START
0215  6346  ZTEN OTEN
0216  3346  DCA NBCRY
0217  3344  DCA NBRRCH
0220  3345  DCA NBRRCL
0221  3350  DCA NBCRYL
0222  3347  DCA NBCRYH
0223  6354  CLRK
0224  6341  SKRK     /WAIT FOR FIRST RC CLOCK PULSE
0225  5224  JMP .-1
0226  6354  CLRK
0227  3021  WAIT, DCA ADCRYH
0230  3022  DCA ADCRYL
0231  6001  ION
0232  6341  SKRK
0233  5232  JMP .-1 /WAIT CLOCK PULSE
0234  6002  IOF
0235  6354  CLRK
0236  2345  ISZ NBRRCL
0237  7410  SKP
0240  2344  ISZ NBRRCH
0241  7300  CLA CLL
0242  1350  TAD NBCRYL
0243  1022  TAD ADCRYL
0244  3350  DCA NBCRYL
0245  7004  RAL
0246  1347  TAD NBCRYH
0247  1021  TAD ADCRYH
0250  3347  DCA NBCRYH
0251  1347  TAD NBCRYH
0252  1342  TAD M2
0253  7710  SPA CLA
0254  5227  JMP WAIT
0255  4407  JMS I 7
0256  5346  FGET NBCRY
0257  7000  FNOR
0260  6346  FPUT NBCRY
0261  5343  FGET NBRRC
0262  7000  FNOR
0263  4346  FDIV NBCRY
0264  3336  FMPY P10000
0265  0000  FEXT
0266  7604  CLA OSR
0267  3363  DCA SWITCH
0270  1363  TAD SWITCH
0271  7700  SMA CLA
0272  5300  JMP .+6
```

```
0273  4407  JMS I 7
0274  6346  FPUT NBCRY
0275  5353  FGET P1000
0276  4346  FDIV NBCRY
0277  0000  FEX
0300  7200  CLA
0301  6046  TLS
0302  1341  TAD P4
0303  4420  JMS I 20/OUTPUT ROUTINE.FLOATING 2
0304  7200  CLA
0305  1356  TAD BLAN
0306  4364  JMS TYPE
0307  1363  TAD SWITCH
0310  7700  SMA CLA
0311  5317  JMP .+6
0312  1357  TAD M
0313  4364  JMS TYPE
0314  1360  TAD S
0315  4364  JMS TYPE
0316  5323  JMP .+5
0317  1362  TAD H
0320  4364  JMS TYPE
0321  1361  TAD ZED
0322  4364  JMS TYPE
0323  1351  TAD CR
0324  4364  JMS TYPE
0325  1352  TAD LF
0326  4364  JMS TYPE
0327  6041  TSF
0330  5327  JMP .-1
0331  6042  TCF
0332  5200  JMP DEBUT
0333  0000  START,0
0334  0404  P404,404
0335  0402  P402,402
0336  0016  P10000,16
0337  2342  2342
0340  0000  0
0341  0004  P4,4 /NUMBER OF DIGIT OF THE DECIMAL PART
0342  7776  M2,-2
0343  0000  NBRRC,0 /EXPONENT
0344  0000  NBRRCH,0 /NRRE DE RC CLOCK
0345  0000  NBRRCL,0
0346  0000  NBCRY,0 /EXPONENT
0347  0000  NBCRYH,0 /NUMBER OF CRYSTAL CLOCK
0350  0000  NBCRYL,0
0351  0215  CR,215
0352  0212  LF,212
0353  0012  P1000,12
0354  3720  3720
0355  0000  0
0356  0240  BLAN,240
0357  0315  M,315
0360  0323  S,323
0361  0332  ZED,332
0362  0310  H,310
0363  0000  SWITCH,0
0364  0000  TYPE,0
```

```
0365   6041   TSF
0366   5365   JMP .-1
0367   6046   TLS
0370   7200   CLA
0371   5764   JMP I TYPE
```

```
*OPT-←
*OUT-T:
*
*IN-S:SYMB,S:  CLOK
*
*
*OPT-T
```

Temps max d'une boucle 90µs

```
B@3*<Ø,.@:@2B>8?;>8?*<3&&$%('3,3!*3,Ø3!*Ø3,%<$;((8''"?*$+&83&+#8#&>33?■
Ø!+5Ø&:/43
```