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TITLE	XYPLOT - A VERSATILE PLOT ROUTINE FOR THE D/A CONVERTER
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XYPLOT - A VERSATILE PLOT ROUTINE FOR THE D/A CONVERTER

DECUS Program Library Write-up

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ABSTRACT

XYPLOT is a one page subroutine which scales, offsets, and simultaneously plots two integer arrays from any two data fields, using the D/A converter and a conventional x-y recorder. Incorporation of a programmed pen lift makes available to those users having the necessary additional hardware a point plot capability, selectable by properly setting bit zero of the variable PENFLG in the calling sequence. Loading of the additional 41 (octal) memory location program GENX, and setting of bit one of PENFLG allows a y-data array to be plotted versus locally generated, equispaced x-data, with the spacing interval user specified.

The program was primarily designed to conveniently handle the output of real experimental data with the minimum of prior manipulation consistent with generality. Scaling of the data, for example, from internal code integers to meaningful units is accomplished by XYPLOT just prior to the actual plot step, a procedure which obviates an intermediate, storage consuming, array scaling step. Flexibility of plot size, on the other hand, is provided by passing offset and axis scale values via the subroutine argument list. Thus, these values may be user supplied, or may be computed by the calling program just prior to the call of XYPLOT.

Minimum Hardware Required: PDP-8 with AA-01A D/A Converter (Mod AH03)

Other Programs or Subroutines Needed: Floating Point Package III (DEC-08-YQ3A-PB), Subroutines FETCH, FIX, and FLOAT (supplied).

Storage Requirement: 1 page, plus 41 (octal) locations if x-axis data is to be generated locally by the subroutine at plot time.

Execution Time: Limited by the number of wait loops used. Adequate delay is provided for the x-y recorder to settle between points.

```
*XYPLOT
/SUBROUTINE XYPLOT
/
/CALLING SEQUENCE:
/       100     EFFECTIVE JMS XYPLOT
/       101     "ADDRESS OF X OFFSET (XOFF)
/       102     "ADDRESS OF Y OFFSET (YOFF)
/       103     "ADDRESS OF XAXIS UNITS/IN (XPLTSC)
/       104     "ADDRESS OF YAXIS UNITS/IN (YPLTSC)
/       105     "ADDRESS OF INTEGER>UNITS FACTOR (XFACTR)
/       106     "ADDRESS OF INTEGER>UNITS FACTOR (YFACTR)
/       107     "FLAG: BIT ZERO SET=PLOT POINTS
/                      BIT ONE SET=GENERATE X-DATA
/       110     "ADDRESS OF NO DATA POINTS
/       111     "ADDRESS OF DATA FIELD FOR XDATA
/       112     "BASE ADDRESS OF XDATA, OR POINT SPACING
/       113     "ADDRESS OF DATA FIELD FOR YDATA
/       114     "BASE ADDRESS OF YDATA
/
/THE SUBROUTINE SCALES DATA TO ANY DESIRED SIZE AND
/PLOTS EITHER POINT BY POINT OR WITH THE PEN
/CONTINUOUSLY DOWN. THE PEN LIFTS AFTER THE PLOT
/IS COMPLETE AND RETURNS TO ITS ZERO POINT.
/
/REQUIRED ANCILLARY PROGRAMS:
/       FLOATING POINT PACKAGE
/       FIX
/       FLOAT
/       FETCH
/
/PAGE ZERO LOCATIONS:
/       AUTOINDEX 12,13
/
/THE SCALING ALGORITHM:
/
/       INTEGER TO DAC= (XDATA*XFACTR+XOFF)/XPLTSC*DACSCL
/
/       DACSCL = VOLTS OUT/(INTEGER IN * RECORDER SCL (V/IN
/
/THE DATA IS ASSUMED TO BE INTEGER, THE SCALING
/CONSTANTS FLOATING. IF LOCAL GENERATION OF X DATA
/IS DESIRED, LOAD GENX, SET BIT ONE OF PENFLG, AND
/NOTE THAT XDTABS (IN THE ARGUMENT LIST) NOW
/MUST CONTAIN THE ADDRESS (IN THE SAME DF AS THE
/IF) OF THE FLOATING MODE POINT SPACING.
/
/PNLIFT IS A CONSTANT WHICH MAY BE PREADJUSTED TO
/PROVIDE PROPER VOLTAGE FOR DRIVING A PEN LIFT
/RELAY.
/
```

```
0200  0000  XYPLOT, 0
0201  4465          JMS I FETCHP
0202  0014          14
0203  0000  XOFF,   0
0204  0000  YOFF,   0
0205  0000  XPLTSC, 0
0206  0000  YPLTSC, 0
0207  0000  XFACTR, 0
0210  0000  YFACTR, 0
0211  0000  PENFLG, 0
0212  0000  POINTS, 0
0213  0000  DFXDTA, 0
0214  0000  XDTABS, 0
0215  0000  DFYDTA, 0
0216  0000  YDTABS, 0
0217  1211          TAD PENFLG
0220  0377          AND (2000
0221  7640          SZA CLA          /GEN XDATA?
0222  5226          JMP OMIT         /YES.
0223  1613          TAD I DFXDTA     /NO. SET UP X POINTER
0224  1360          TAD K6201
0225  3253          DCA DFX
0226  1615  OMIT,   TAD I DFYDTA
0227  1360          TAD K6201
0230  3267          DCA GETY
0231  6214          RDF
0232  1360          TAD K6201
0233  3255          DCA RSTRE
0234  1255          TAD RSTRE
0235  3271          DCA REST
0236  1612          TAD I POINTS
0237  7041          CIA
0240  3354          DCA CNTR
0241  7240          CLA CMA
0242  1614          TAD   XDTABS
0243  3012          DCA 12
0244  7240          CLA CMA
0245  1616          TAD I YDTABS
0246  3013          DCA 13
0247  1211  RPEAT,  TAD PENFLG
0250  0377          AND (2000
0251  7640          SZA CLA          /GENERATE XDATA?
0252  5765          JMP I GENXP
0253  7402  DFX,    7402
0254  1412          TAD I 12         /NO. FETCH XPOINT
0255  7402  RSTRE,  7402
0256  4463          FLOAT
0257  4407          JMS I 7          /ENTER FLOATING INT
0260  3607          FMPY I XFACTR
0261  1603          FADD I XOFF
0262  4605          FDIV I XPLTSC
```

```
0263  4355          FDIV DACSCL
0264  0000          FEXT
0265  4464          FIXPT
0266  3361          DCA XTEMP
0267  7402  GETY,   7402
0270  1413          TAD I 13          /FETCH Y POINT
0271  7402  REST,   7402
0272  4463          FLOAT
0273  4407          JMS I 7
0274  3610          FMPY I YFACTR
0275  1604          FADD I YOFF
0276  4606          FDIV I YPLTSC
0277  4355          FDIV DACSCL
0300  0000          FEXT
0301  4464          FIXPT
0302  3362          DCA YTEMP
0303  4342          JMS PLOT          /POSITION PEN
0304  4336          JMS WAIT
0305  7000          NOP
0306  1363          TAD PNLIFT
0307  6554          DAL3              /PEN DOWN.
0310  7300          CLA CLL
0311  4336          JMS WAIT          /TO BE SURE PEN IS DOWN
0312  7000          NOP
0313  1211          TAD PENFLG
0314  7710          SPA CLA           /POINT PLOT?
0315  6554          DAL3              /YES. PEN UP
0316  2354          ISZ CNTR          /NO. LAST POINT?
0317  5247          JMP RPEAT         /NO.
0320  6554          DAL3              /YES. PEN UP
0321  4336          JMS WAIT
0322  1361  RTNZRO, TAD XTEMP         /RETURN PEN TO ZERO.
0323  7110          CLL RAR           /DIVIDE BY TWO
0324  3361          DCA XTEMP
0325  1362          TAD YTEMP
0326  7110          CLL RAR           /DIVIDE BY TWO
0327  3362          DCA YTEMP
0330  4342          JMS PLOT
0331  1361          TAD XTEMP
0332  1362          TAD YTEMP
0333  7640          SZA CLA           /BOTH AXES ZERO?
0334  5322          JMP RTNZRO        /NO. DO AGAIN
0335  5600          JMP I XYPLOT      /YES. RETURN
0336  0000  WAIT,   0
0337  2364          ISZ WAIT1
0340  5337          JMP .-1
0341  5736          JMP I WAIT
0342  0000  PLOT,   0
0343  4336          JMS WAIT
0344  1361          TAD XTEMP
0345  6551          DAL1              /LOAD DAC CH(1) WITH X
```

```
0346  7200          CLA
0347  1362          TAD YTEMP
0350  6552          DAL2              /LOAD DAC CH(2) WITH Y
0351  7200          CLA
0352  4336          JMS WAIT          /SETTLE TIME
0353  5742          JMP I PLOT
0354  0000  CNTR,    0
0355  7771  DACSCL,  7771;
0356  2400   2400;
0357  5002   5002    /10.0V/2047*1V/IN (DECIMAL)
0360  6201  K6201,   6201
0361  0000  XTEMP,   0
0362  0000  YTEMP,   0
0363  0000  PNLIFT,  0                 /ADJUST TO OPERATE PEN RELAY
0364  0000  WAIT1,   0
0365  0400  GENXP,   GENX
0377  2000
                    *PAGE               /TRICKS ASSEMBLER TO PRINT LITERALS AND LIN&
                    /
                    /NEED BE LOADED ONLY TO GENERATE LOCAL XDATA
                    /
                    *GENX
0400  1632  GENX,     TAD I FLGP        /USE AS FLAG: NON-ZRO FIRST PASS
0401  7650            SNA CLA           /FIRST PASS?
0402  5216            JMP INCR          /NO. INCREMENT
0403  3633            DCA I XTEMPP      /YES.   INITIALIZE
0404  3632            DCA I FLGP        /CLEAR FLAG
0405  3237            DCA XVAR
0406  3240            DCA XVAR+1
0407  3241            DCA XVAR+2
0410  7001            IAC
0411  1012            TAD 12            /POINT SPACING ADDRESS
0412  3230            DCA PSPACE
0413  1634            TAD I XPLTSP
0414  3231            DCA XSCALE
0415  5636            JMP I GETYP
0416  4407  INCR,     JMS I 7
0417  5237            FGET XVAR
0420  1630            FADD I PSPACE
0421  6237            FPUT  XVAR
0422  4631            FDIV I XSCALE     /FETCHES XPLTSC
0423  4635            FDIV I DACSCP
0424  0000            FEXT
0425  4464            FIXPT
0426  3633            DCA I XTEMPP
0427  5636            JMP I GETYP
0430  0000  PSPACE,   0
0431  0000  XSCALE,   0
0432  0215  FLGP,     DFYDTA
0433  0361  XTEMPP,   XTEMP             /POINTER TO XTEMP
0434  0205  XPLTSP,   XPLTSC            /POINTER TO XPLTSC
0435  0355  DACSCP,   DACSCL            /POINTER TO DACSCL
0436  0267  GETYP,    GETY              /POINTER TO RETURN
0437  0000  XVAR,     0;
0440  0000   0;
0441  0000   0
```

```
CNTR    0354
DACSCL  0355
DACSCP  0435
DFX     0253
DFXDTA  0213
DFYDTA  0215
FETCHP  0065
FIX     4464
FLGP    0432
GENX    0400
GENXP   0365
GETY    0267
GETYP   0436
INCR    0416
K6201   0360
OMIT    0226
PENFLG  0211
PLOT    0342
PNLIFT  0363
POINTS  0212
PSPACE  0430
REST    0271
RPEAT   0247
RSTRE   0255
RTNZRO  0322
WAIT    0336
WAIT1   0364
XDTABS  0214
XFACTR  0207
XOFF    0203
XPLTSC  0205
XPLTSP  0434
XSCALE  0431
XTEMP   0361
XTEMPP  0433
XVAR    0437
XYPLOT  0200
YDTABS  0216
YFACTR  0210
YOFF    0204
YPLTSC  0206
YTEMP   0362
```

```
/DEFINITIONS FOR ASSEMBLY OF XYPLOT.
/
XYPLOT=200
GENX=400
FIX=JMS I 64
FLOAT=JMS I 63
DAL1=6551
DAL2=6552
DAL3=6554
FETCHP=65
/
PAUSE
```

```
*FETCH
/SUBROUTINE FETCH
/
/FETCHES ARGUMENTS FOR SUBROUTINES
/
/CALLING SEQUENCE:
/       200     SUBR,   0
/       201             EFFECTIVE JMS FETCH
/       202             NUMBER OF ARGUMENTS (OCTAL)
/       203     ARG1,   0
/       204     ARG2,   0
/         .       .     .
/         .       ETC., ONE FOR EACH ARGUMENT
/       20-             NEXT EXECUTABLE STATEMENT
/
/FETCH UPDATES THE EXIT OF THE CALLING SUBROUTINE
/PAGE ZERO LOCATIONS REQD:
/       AUTOINDEX 16, 17
/       65
/
/
/
FETCH,  0
        CLA CMA
        TAD FETCH           /POINTER TO STORE ARGUMENTS
        DCA 16
        CLA CLL CMA RAL     /SET ACC TO MINUS TWO
        TAD FETCH           /POINTER TO SOURCE ARG LI IST
        DCA FETCH
        CMA
        TAD I FETCH         /GET ARG SOURCE LIST ADDRESS
        DCA 17
        TAD I 16            /FETCH NO OF ARGUMENTS
        CIA
        DCA CNTR
NEXT,   TAD I 17            /FETCH THE ARGUMENT
        DCA I 16            /STORE IT
        ISZ CNTR
        JMP NEXT
        CLA IAC
        TAD 17
        DCA I FETCH         /UPDATE SUBROUTINE EXIT
        JMP I 16            /RETURN TO SUBROUTINE
CNTR,   0
*65
        FETCH
$
```

```
*FIX
/SUBROUTINES TO TRANSMIT DATA FROM FAC TO ACC AND BACK
/FIX OR FLOAT THE RESULTING DATA.
/
/FOR USE WITH FLOATING POINT PACKAGE III
/
FIX,     0
         JMS I FIXPTR
         TAD 45
         JMP I FIX
FIXPTR,  4757
FLOA,    0
         DCA 45
         JMS I FLOPTR
         JMP I FLOA
FLOPTR,  5563
*63
         FLOA
         FIX
PAUSE
```