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SUBJECT: AUTOMATIC SCOPE OUTPUT DISPLAY ROUTINES

To: Scientific and Engineering Computations Group

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Abstract: Ten routines (5 interpreted and 5 non-interpreted) have been written
for use in automatic curve plotting on the oscilloscope. Two different formats
are availagle; one for use when the variables involved are symmetric about the
origin and another for use when the variables involved are asymmetric about the
origin. Along with these formats routines for displaying calibrated and un-
calibrated axes and point by point curve plotting were written.

Routines are now available for use in automatic curve plotting.*

There are two different formats available; one for use when the range
of variables involved is symmetric and one to be used for a range which is asym-
metric. The instructions to be used to set up the first format specification are
i FOC 1 and FOC 1. They are to be followed by two program parameters as illustrat-
ed.

i FOC 1   FOC 1

x_m ⎫ G. D. x_m ⎫ Single length
y_m ⎭ (30 - j, j) #s y_m ⎭ WWI #s

where x_m represents the limit of variation of the x variables; and y_m that of
the y variables; i.e. the points to be plotted are in the range

$$-x_m \leq x \leq + x_m$$

$$-y_m \leq y \leq + y_m$$

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* There are two sets of routines: one for use in programs which are to be
interpreted (these instructions are preceded by the letter "i"): and one for
use in non-interpreted programs.

The second format available is for use when the range of variables involved is asymmetric about the origin. The instructions used to set up these formats are i FOC 2 and FOC 2 (interpreted and non-interpreted respectively). They are used as follows:

i FOC 2   FOC 2

$$\left.\begin{array}{c} x_{min} \\ x_{max} \\ y_{min} \\ y_{max} \end{array}\right\} \quad \begin{array}{l} \text{G. D.} \\ (30 - j, j) \; \#s \end{array} \qquad\qquad \left.\begin{array}{c} x_{min} \\ x_{max} \\ y_{min} \\ y_{max} \end{array}\right\} \text{single length } \#s$$

where the range of variables involved is $x_{min} \leq x \leq x_{max}$ and $y_{min} \leq y \leq y_{max}$

There are also routines available for placing sets of axes on the scope face. The instructions used are i SCX and SCX for calibrated axes (interpreted and non-interpreted routines respectively) and i SUX and SUX for uncalibrated axes. The method of their use is as follows:

i SCX   SCX

$$\left.\begin{array}{c} x_o \\ y_o \end{array}\right\} \begin{array}{l} \text{Double length, G. D.} \\ (30 - j, j) \; \#s \end{array} \qquad\qquad \left.\begin{array}{c} x_o \\ y_o \\ \alpha \\ \beta \end{array}\right\} \begin{array}{l} \text{single length} \\ \#s \end{array}$$
$$\left.\begin{array}{c} \alpha \\ \beta \end{array}\right\} \begin{array}{l} \text{single length} \\ \#s \end{array}$$

where x_o and y_o are the x and y coordinates respectively of the origin. In the interpreted routine they are specified by G. D. #s and α and β are the numbers of increments on the x and y axes respectively. Any number of increments can be specified so long as $\alpha \leq 3$ and $\beta \leq 3$ as single length Whirlwind integers.

To draw uncalibrated axes, on the other hand, one uses

i SUX   SUX

$$\left.\begin{array}{c} x_o \\ y_o \end{array}\right\} \text{G. D. } \#s \qquad\qquad \left.\begin{array}{c} x_o \\ y_o \end{array}\right\} \text{WWI } \#s$$

where x_o and y_o as before specify the x and y coordinates of the origin.

The routines available for plotting curves point by point are called in by using the instruction i SOC and SOC. They are used as follows

i SOC   SOC
$$\left.\begin{array}{c} a \; 1 \end{array}\right\} \begin{array}{l} \text{single register} \\ \text{address specification} \end{array} \qquad\qquad a \; 1$$

The instructions are given with the y coordinate of the point one wishes to plot in the MRA or the WW AC (depending on whether on uses i SOC or SOC respectively) and with the x coordinate in the register specified by a 1 (all represents any permissible absolute or floating address).

To summarize, the ten new instructions and the program parameters required by each are listed below.

Formats

i FOC 1

Upper limits of variables $\left\{ \begin{array}{l} x_m \\ y_m \end{array} \right.$ double length numbers

FOC 1

$\left. \begin{array}{l} x_m \\ y_m \end{array} \right\}$ single length numbers

i FOC 2

Range of variables $\left\{ \begin{array}{l} x_{min} \\ x_{max} \\ y_{min} \\ y_{max} \end{array} \right.$ double length numbers

FOC 2

$\left. \begin{array}{l} x_{min} \\ x_{max} \\ y_{min} \\ y_{max} \end{array} \right\}$ single length numbers

Scope Calibrated Axes

i SCX

Coordinates of origin $\left\{ \begin{array}{l} x_o \\ y_o \end{array} \right.$ double length #s

no. of increments on x and y axes $\left\{ \begin{array}{l} \alpha \\ \beta \end{array} \right.$ single length integers ≥ 3

SCX

$\left. \begin{array}{l} x_o \\ y_o \end{array} \right\}$ single length numbers

$\left. \begin{array}{l} \alpha \\ \beta \end{array} \right\}$ single length integers

Scope Uncalibrated Axes

i SUX

Coordinates of origin $\left\{ \begin{array}{l} x_o \\ y_o \end{array} \right.$ double length numbers

SUX

$\left. \begin{array}{l} x_o \\ y_o \end{array} \right\}$ single length numbers

Scope Point Display

i SOC

a 1

SOC

a 1

The SOC and i SOC routines are entered with the ordinate of the point in the AC or MRA and the abcissa in register a 1.*

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* Special note should be made here of the fact that the SOC and i SOC instructions can exist independently of the formats. If no specific format is set up the range $- 1 < x < + 1$, $- 1 \leq y \leq + 1$ is used. If a format is to be used it must precede the curve plotting instructions to which it pertains.

A specified format will hold until another format specification is made.

An example of a typical program using some of these instructions would be:

```
ml,         i FOC 1
            +50,000
            +100,000
            iscx
            +0.00
            +0.00
            +10
            +10
              ⌐
              ¦
              ¦
              ¦
            ica [+10.00]
            i SOC
            [+10.00]
              ¦
              ¦
            i FOC 2
            -.0.00
            +20.00
            -30.00
            +40.00
            iSUX
            +0.00
            +0.00
```

[+10.00] ——→ signifies register containing +10.00

Some cautions:

1. Each instruction must be followed by the exact number of parameters specified and in the order specified.

2. Each instruction and each parameter must be followed by a tab or a carriage return.

3. In using the formats no tab or carriage return should appear between the FOC instruction and the numbers 1 or 2. Spaces are permissible (i.e. FOC ("space") 1 ("tab")).

4. If no format is specified, the range $-1 < x < +1$ $-1 < y < +1$ is used.

5. All the routines will leave the MRA or the AC undisturbed.

6. If there is an attempt to plot points outside the range specified by the format a check alarm will result.

7. You have to be "IN" to use the interpreted routines and "OUT" to use non-interpreted routines.

8. Programmers should also remember that the resolution of the scope is about 1/256 maximum deflection. By this is meant that any two points which are closer together than 1/256 of the maximum deflection allowable will appear to overlap.

9. In the case of SCX it must be remembered that α and β are single length WWI integers (i.e.   + 3, +10, etc.)