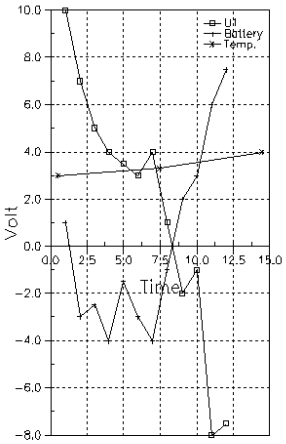
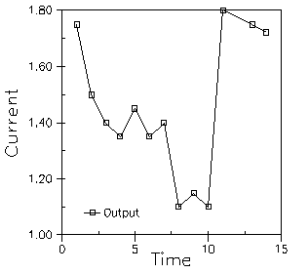
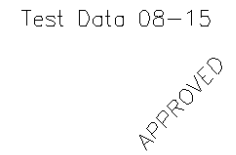
GPLOT X-Y Graphing Program







Martin Hepperle, 2020

So, what can you actually do with the GSX graphics system? As a practical example, I have developed GPLOT. This program is a simple, ready to use plotting program for x-y-graphs.

It uses GSX-80 under CP/M 2.2 and is written in Microsoft Fortran 3.44. It should be easily portable to other Fortran implementations if they support a byte type for character data (often disguised as BYTE, INTEGER*1 or LOGICAL*1 types).

The user (or another program) creates a plain text file with data and some formatting commands which is then processed by GPLOT. Output is directed to a GSX device defined in the ASSIGN.SYS file. Thus, your hobby CP/M system can actually be useful, e.g. for plotting test data.

GPLOT is run from the command line:

```
GPLOT [file.ext [ID=nn]]
```

If no file name is given, GPLOT tries to open a file named GPLOT.PLT.

If no device ID is given on the command line, GPLOT sends output to the device with ID = 01. Note that you must specify a file name if you want to use the ID parameter.

The implementation of autoscaling requires that GPLOT buffers the y and y values in an array. This array is currently sized to hold up to 1000 data pairs per curve. Additional data points will be silently skipped. If you need more data, enlarge the arrays X(1000) and Y(1000) and adapt the comparison of NPTS against 1000.

Structure of the Input File

The input is a simple ASCII file consisting of data and command lines. Each line can be either

- a comment line, which begins with a '#' character in the first column, or
- a command line, which starts with a known keyword.
- All other lines are data lines with a pair of x and y values, each in a 10 character wide field. The data pairs are read with a Fortran F10.5 format – so it is advisable to include a decimal point even if the data is integer.

The following keywords are recognized:

GRID(ON) GRID(OFF)	Toggle the grid line plot flag. When ON, plots dotted grid lines at major ticks. Default: ON
MARKER(ON) MARKER(OFF)	Toggle the marker plot flag. When ON, plots a marker at each data point. Default: ON

XAXIS(ON), XAXIS(OFF) YAXIS(ON), YAXIS(OFF)	Toggle the corresponding axis plot flag. When ON, plots and labels the axis. Default: ON
LEGEND("curve") LEGEND("curve",Xpos,Ypos,Ystep)	Define the name of the curve which appears in the legend block. Default: "", i.e. no legend entry. The optional parameters Xpos, Ypos and Ystep define the starting point of the legend block, and the line spacing, all relative to the viewport. They should only be given for the first curve in a viewport. Default: Xpos=0.7, Ypos=0.93,Ystep=0.03.
VIEWPORT(Xmin,Xmax,Ymin,Ymax)	Define the viewport on the page. X and Y range are specified in a normalized system, referring to the whole page. Default: a viewport covering the full page less a 10% border.
XRANGE(Xmin,Xstep,Xmax) YRANGE(Ymin,Ystep,Ymax)	Define the user system and the minor tick step for the X- resp. Y-axis. Default: autoscaling by the first dataset.
XLABEL("label") XLABEL("label",Yoffset)	Define the title to be written below the X-axis. The optional Yoffset parameter allows shifting the vertical position of the label down from the x-axis line to avoid overlapping the tick labels. The value is in millimeters. Default: Yoffset = 8.0, label = ""
YLABEL("label") YLABEL("label",Xoffset)	Define the title to be written to the left of the Y-axis. The optional Xoffset parameter allows shifting the horizontal position of the label left from the y-axis line to avoid overlapping the tick labels. The value is in millimeters. Default: Xoffset = 12.0. , label = ""
PLOT	Plot the data points collected so far and flush the data point buffer. If this is the first curve to be drawn, frame and axes are plotted too. If no XRANGE or YRANGE commands have been given, the scaling is set up by the extent of the data. If no XLABEL or YLABEL have been given the axes are not titled. Tick marks are drawn at every minor step and every second tick is labeled. If enabled, dotted grid lines are drawn at every second tick. A legend entry is added to the legend block if specified by LEGEND.
XDIGITS(n) YDIGITS(n)	Set the number of digits behind the decimal for the major tick mark labels. Default: 1
XDROP(ON) XDROP(OFF) YDROP(ON) YDROP(OFF)	Toggle a flag to drop a vertical line from each data point to the x-axis, respectively a horizontal line from each data point to the y-axis. Default: OFF
TEXT(Xpos,Ypos,"label",size,angle,system)	Add the text label at the given position. The size is in millimeters and the angle in degrees. For system=0, Xpos and Ypos are given

	in user coordinates, for system=1 relative to the page (like the viewport), system=2 in millimeters relative to the lower left corner.
LINE(X1,Y1,X2,Y2,system)	Draw a line between points 1 and 2. For system=0, the points are given in user coordinates, for system=1 relative to the page (like the viewport), system=2 in millimeters relative to the lower left corner.

Example Input File

```
#
# plot data x,y, 10 columns each
#
# first viewport
VIEWPORT(0.1,0.45,0.1,0.95)
XRANGE (0.0,2.0,16.0)
YRANGE (-10.0,2.0,10.0)
XLABEL ("Time")
YLABEL ("Volt")
LEGEND ("U1")
#   X    ><   Y    >
   1.0      10.0
   2.0       7.0
   3.0       5.0
   4.0       4.0
   5.0      3.5
   6.0       3.0
   7.0        4.0
   8.0       1.0
   9.0      -2.0
  10.0      -1.0
  11.0      -8.0
  12.0      -7.5
# the first curve also plots axes and grids
PLOT
# prepare the next curve
LEGEND ("U Batt")
#   X    ><   Y    >
   1.0        6.0
   2.0        5.8
   3.0        2.5
   4.0        4.0
   5.0        1.5
   6.0        3.0
   7.0        4.0
   8.0        1.0
   9.0        2.0
  10.0        3.0
  11.0        6.0
  12.0        7.5
PLOT
# a straight line
LEGEND ("Temp.")
   1.0        3.0
  14.5        4.0
PLOT
#
# open a second viewport
#
VIEWPORT(0.6,0.95,0.5,0.95)
```

```
XRANGE (0.0,2.5,15.0)
YRANGE (0.0,1.0,10.0)
GRID (OFF)
XLABEL ("Time")
YLABEL ("Current",14.0)
LEGEND ("Output")
#   X    ><   Y    >
   1.0        1.90
   2.0        1.50
   3.0        1.30
   4.0        1.40
   5.0        1.55
   6.0        1.30
   7.0        1.40
   8.0        1.10
   9.0        1.20
  10.0        1.10
  11.0        1.80
  13.0        1.75
YDIGITS (2)
XDIGITS (0)
# the first curve in a viewport also plots axes and grids
PLOT
# add some text labels
TEXT (0.6,0.3,"Test Data 2020",5.0,0.0,0)
TEXT (0.7,0.05,"APPROVED",5.0,45.0,0)
#
# EOF
#
```

Notes on the Parameter Parser

This very simple parser only looks for pairs of delimiters. For example in a TEXT statement like

```
TEXT (0.6,0.3,"Test Data 2020",5.0,0.0,0)
```

it looks for a pair of ‘(‘ and ‘,’ to locate the first parameter, the x-position.

It such a pair is not found, the parser stops and the command is rejected (without error message).

Next it looks for a pair of commas to locate the second parameter, the y-position.

This continues until it finds the last parameter enclosed by a pair of ‘,‘ and ‘)’.

In some cases this leads to the option of omitting parentheses (“syntactical sugar”):

```
XLABEL ("Time")
```

could also be written as

```
XLABEL "Time"
```

because the parser only looks for a pair of ‘"’ double quotes and silently skips the parentheses.

Nevertheless the parentheses should be kept for consistency.

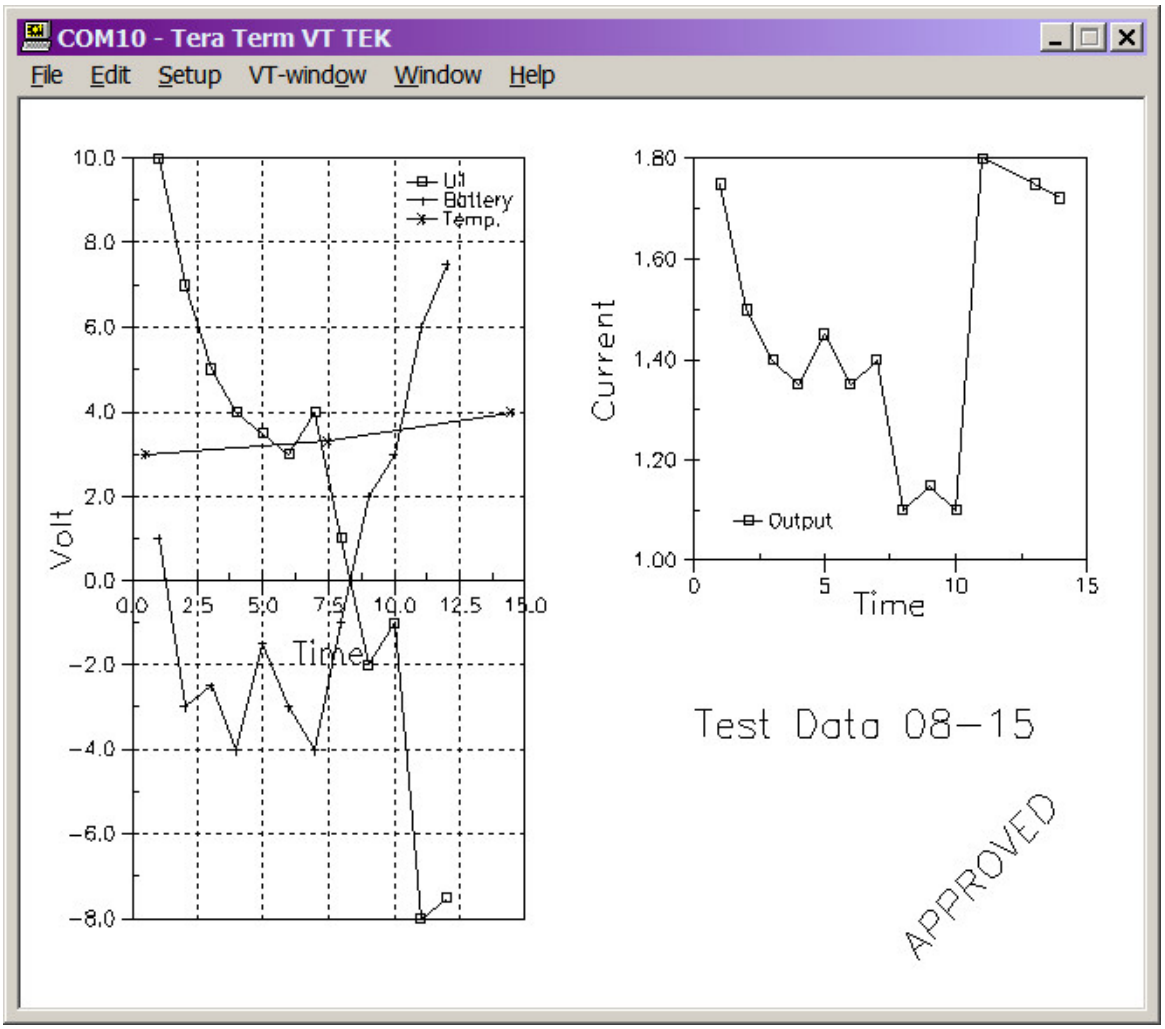


Figure 1: Example output on Teraterm Tektronix screen.

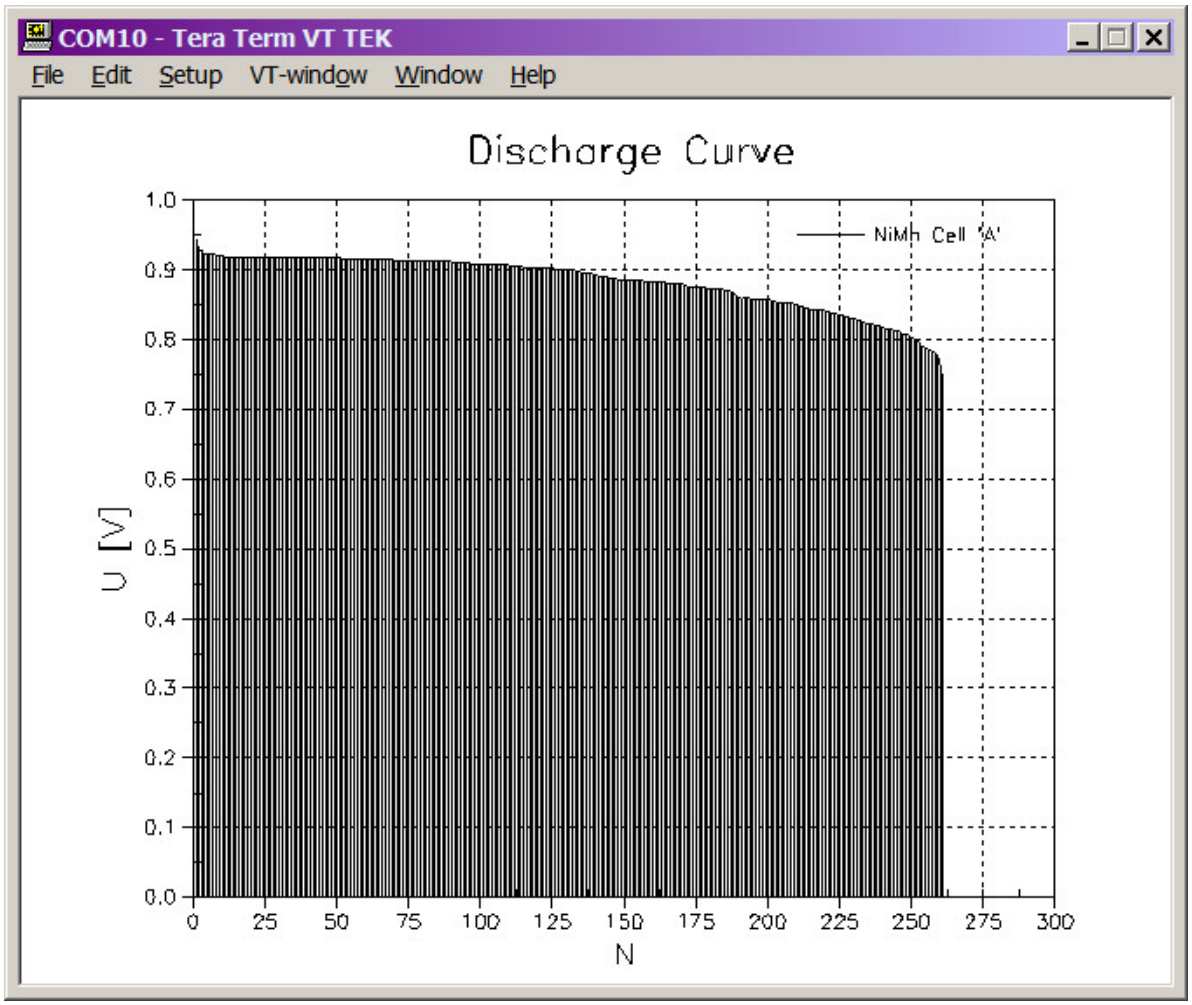


Figure 2: A more practical example: the discharge curve of an almost empty NiMh cell. The voltage has been sampled with a HP 3468A HP-IL multimeter controlled by a HP 71B pocket calculator and sent through a HP 82169A HP-IL to HP-IB converter to a laptop with an NI- PCMCIA HP-IB card and from there via copy and paste in Teraterm to an AVR-CP/M system. Why? Because we can!

Figure 3: Processing chain: HP 3468A, HP 71B, HP-IL–HP-IB converter and Laptop.

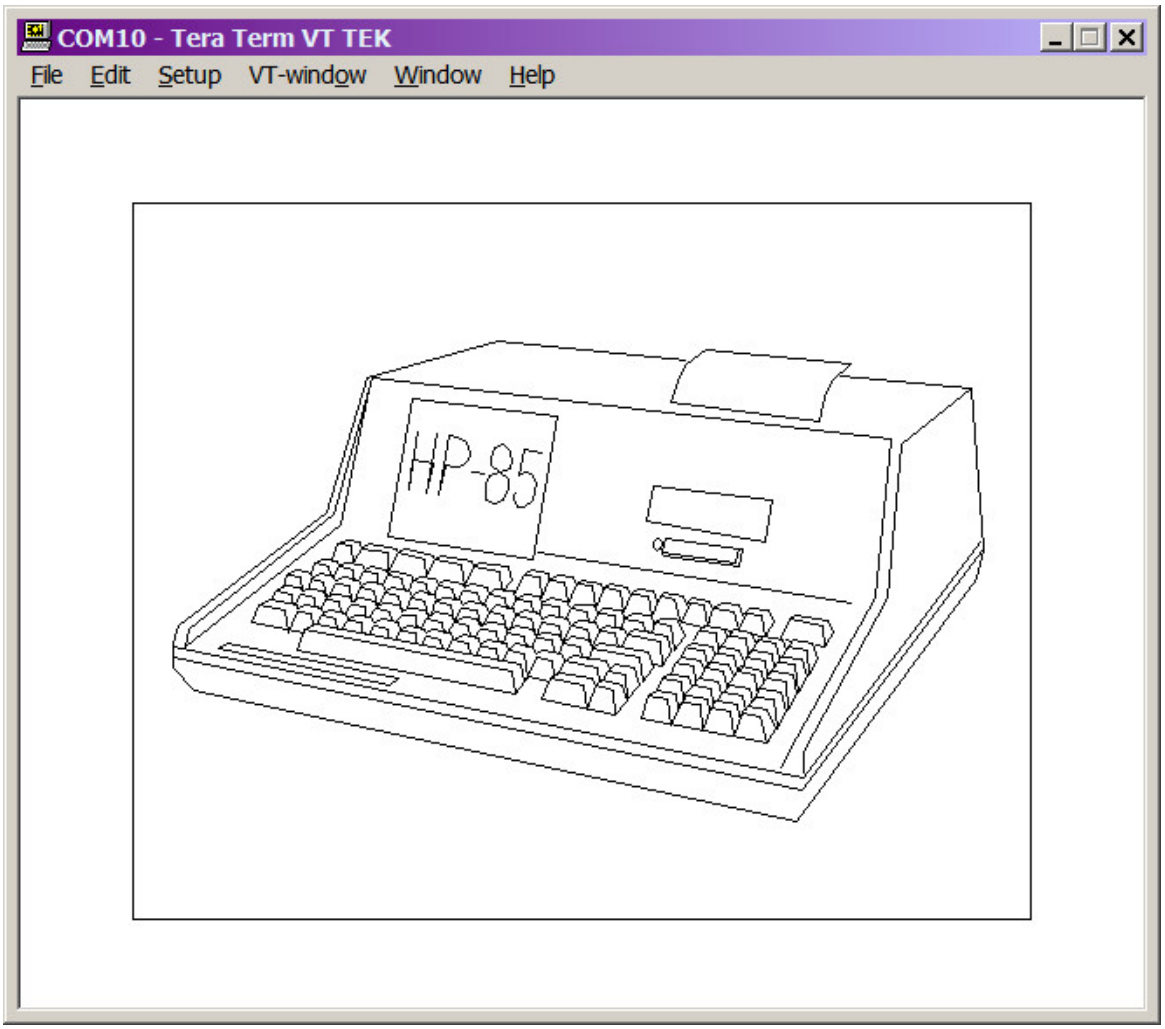


Figure 4: If you switch off axes, grid and legend, you can even plot x-y data like this. The frame is always drawn.