

Using HPGL as a drawing interchange media

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Introduction

HPGL is the HP graphics language designed for specifying 2D graphical information for the HP range of plotters. It was not intended as an interchange format but some software suppliers use it as such. At least it is efficient and easy to write and read. This short note describes those aspects of the format which may be used to describe geometry. The language itself has a large number of instructions, most of the ones not touched on here relate directly to plotter devices, for a full description of the language the HPGL description is normally provided with an HPGL compatible plotter.

Basics

HPGL commands are basically two uppercase character instructions followed by any arguments, and finally ending in the separator character which is a semicolon by default. The arguments are normally separated by commas. String arguments are normally terminated by carriage return.

In what follows, all the standard HPGL commands are listed, those which are likely to be useful for data interchange will be discussed at the end of this document. Optional arguments for any command are shown in brackets.

Commands

	<i>Instruction</i>	<i>Arguments</i>
AA	Arc Absolute	<i>x,y,angle(,tolerance)</i>
AF	Advance page	
AH	Advance page	
AP	Automatic Pen Operations	<i>n</i>
AR	Arc Relative	<i>x,y,angle(,tolerance)</i>
AS	Acceleration Select	<i>acceleration(,pennumber)</i>
BF	Buffer Plot	
BL	Buffer label	<i>string</i>
CA	Select Alternative Charset	<i>set</i>
CC	Character chord angle	<i>angle</i>
CI	Circle	<i>radius(,tolerance)</i>
CM	Character Selection Mode	<i>switchmode(,fallbackmode)</i>
CP	Character Plot	<i>spaces,lines</i>
CS	Select Standard Charset	<i>set</i>
CT	Chord Tolerance	<i>n</i>
CV	Curved line generator	<i>n(,inputdelay)</i>
CD	Digitize Clear	
DF	Default	
DI	Absolute Direction	<i>run,rise</i>
DL	Define Download character	<i>charnumber(,pencontrol),x,y(...)</i>
DP	Digitize Point	
DR	Relative Direction	<i>run.rise</i>

DS	Designate Charset	<i>slot, set</i>
DT	Define Label Terminator	<i>terminator</i>
EA	Edge Rectangle Absolute	<i>x, y</i>
EP	Edge Polygon	
ER	Edge Rectangle Relative	<i>x, y</i>
ES	Extra Space	<i>spaces(, lines)</i>
EW	Edge Wedge	<i>radius, startangle, sweepangle(, tolerance)</i>
FP	Fill Polygon	
FS	Force Select	<i>force(.pennumber)</i>
FT	Fill Type	<i>type(, spacing(, angle))</i>
GC	Group Count	<i>countnumber</i>
GM	Graphics Memory	<i>(polygonbuff)(, downloadbuff)(, replotbuff)(, vectorbuff)</i>
GP	Group Pen	<i>(groupnumber(, pennumber(, numberofpens(, length))))</i>
IM	Input Mask	<i>emaskvalue(, smaskvalue(, pmaskvalue))</i>
IN	Initialize	
IP	Input p1 and p2	<i>x, y(, x, y)</i>
IV	Invoke Character Slot	<i>slot(, left)</i>
IW	Input Window	<i>x, y, x, y</i>
KY	Define Key	<i>key(, function)</i>
LB	Label	<i>string</i>
LO	Label Origin	<i>positionnumber</i>
LT	Line Type	<i>patternnumber(, patternlength)</i>
NR	Not Ready	
PA	Plot Absolute	<i>x, y(, ...)</i>
PB	Print Buffered Label	
PD	Pen Down	<i>x, y(, ...)</i>
PG	Page Feed	<i>n</i>
PM	Polygon Mode	<i>n</i>
PR	Plot Relative	<i>x, y(, ...)</i>
PT	Pen Thickness	<i>thickness</i>
PU	Pen Up	<i>x, y(, ...)</i>
RA	Fill Rectangle Absolute	<i>x, y</i>
RO	Rotate Coordinate System	<i>n</i>
RP	Replot	<i>n</i>
RR	Fill Rectangle Relative	<i>x, y</i>
SA	Select Alternative Charset	
SC	Scale	<i>x, y, x, y(, type(, left, bottom))</i>
SG	Select Pen Group	<i>groupnumber</i>
SI	Absolute Character Size	<i>width, height</i>
SL	Character Slant	<i>tantheta</i>
SM	Symbol Mode	<i>character</i>
SP	Select Pen	<i>pennumber</i>
SR	Relative Character Size	<i>width, height</i>
SS	Select Standard Charset	
TL	Tick Length	<i>tp(, tn)</i>
UC	User Defined Character	<i>(pencontrol,) x, y</i>
UF	User Defined Fill	<i>gap1(, gap2, ... gap20)</i>
VS	Velocity Select	<i>speed(, pennumber)</i>
WD	Write to Display	<i>string</i>
WG	Fill Wedge	<i>radius, startangle, sweepangle(, tolerance)</i>
XT	X Tick	
YT	Y Tick	

Output Instructions

The following instructions don't have any arguments but rather generate output from the plotting device. They are of no use for interchanging geometric data and therefore the form of the output is not discussed. See an HPGL reference book.

- OA** Output Actual Position
- OC** Output Position
- OD** Output Digitised Point
- OE** Output Error
- OF** Output Factors
- OG** Output Group Count
- OH** Output HardClip Limits
- OI** Output Identification
- OK** Output Key
- OL** Output Label Length
- OO** Output Options
- OP** Output p1 and p2
- OS** Output Status
- OT** Output Carousel Type
- OW** Output Window

Escape sequences

The following escape sequences are generally only applicable when connected through a serial interface to a physical plotter, they have nothing to do with data interchange and so their arguments will not be listed nor will the form of the output most of them create.

- esc@** Set Plotter Configuration
- escA** Output Identification
- escB** Output Buffer Space
- escE** Output Extended error
- escH** Set Handshake Mode 1
- escI** Set Handshake Mode 2
- escJ** Abort Device Control
- escK** Abort Graphics
- escL** Output Buffer Size When Empty
- escM** Set Output Mode
- escN** Set Extended Output and Handshake Mode
- escO** Output Extended Status
- escP** Set Handshake Mode
- escQ** Set Monitor Mode
- escR** Reset
- escS** Output Configurable Memory
- escT** Allocate Configurable Memory
- escU** End Flush Mode
- escY** Plotter On
- esc(** Plotter On
- escZ** Plotter Off
- esc)** Plotter Off

Useful Commands with examples

Since plotters are very basic line drawing hardware devices it is not surprising that the most commonly used commands are those that draw lines from one point to another.

This operation is controlled by 4 commands,

PA - plot absolute

PR - plot relative

PU - pen up

PD - pen down

Pen up and down dictate when a line is actually being created, the plot commands do the movement between points.

For example to draw a line from (1,0) to (2,0) might be specified as follows

```
PU;PA1,0;PD;Pr1,0;PU;
```

There are two basic attributes that can be assigned to a line, as expected they are actually applied to the pens of the plotting device. They are:

SP - pen number

PT - pen thickness

The pen number normally acts as an indexed colour system, most commonly there are only 8 pens (colour) available.

The other geometry that can be specified is

AR - arc relative

CI - circle

EA - edge rectangle absolute

ER - edge rectangle relative

EP - edge polygon

EW - edge wedge

LB - label

There are a large number of settings for controlling text, these and further details of the above instructions will be left to the reader to experiment with or read in the full HPGL manuals.