Universal Laser Systems, Inc.
Laser Engraver Control Language and Escape Sequences
For
ULS M-360, V-460, X-660, X2-660 and X2-660SS
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(ROLAND SUBSET – Vector commands)

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The ULS M-360, V-460, X-660, X2-660 and X2-660SS Laser Engravers are compatible with a minimal SUBSET of the Roland RD-GL I plotter commands (similar to HP-GL). Popular DOS software packages are able to use the laser systems directly, by choosing a Roland plotter as the printing device. Additionally, a propietary set of escape sequences are supported to control ULS laser-specific features.

Note: in RD-GL I machines, location (0,0) is in the upper-left corner of the machine.
In Microsoft Windows programs, location (0,0) is usually the bottom-left corner of the screen.

Coordinates used for positioning the carriage are ALWAYS in 1/1000 of an inch.

When writing coordinates, if a coordinate is a "0", it may be left out if you want to make the print files slightly smaller:
Example   PR10,10,0,5; is the same as PR10,10,,5;

Roland commands should be ended with a semicolon.

SUPPORTED ROLAND RD-GL I COMMANDS		
COMMAND	NAME	FUNCTION
DF;	Default	This is primarily provided for Roland compatibility. Resets terminator character to the default ETX, which is CHR$(3). The separator character ";" is required.
IN;	Initialize	This is primarily provided for Roland compatibility. Same as DF command above. The separator character ";" is required.
PAx,y; or PAx1,y1,x2,y2...;	Plot Absolute	Function takes absolute X and Y coordinates. Plotter coordinates are always in 1/1000 of an inch. More than one set of x,y coordinates may be given. Maximum limits depends on machine's table size.X series: xmax=32000, ymax=18000.M25 series: xmax=24000, ymax=12000.Example: PA1000,1000,0,0,0,5000; moves to location 10", 10", then to location 0,0, then to location 0",5" from upper left corner of machine (0,0).

PRx,y; or PRx1,y1,x2,y2...;	Plot Relative	Function takes relative X and Y coordinates. Plotter coordinates are always in 1/1000 of an inch. More than one set of x,y coordinates may be given. Moves which would place the postion beyond the table boundaries will be ignored. X and Y ranges are from -32768 to +32767.Example: PR-5000,3000; moves 5" to the left and down 3" from the last carriage position.
PD; or PDx1,y1,x2,y2...;	Pen Down	Vector cutting/engraving will be done when the next PA or PR command is given. The machine will use the last selected pen power and speed.
PU or PDx1,y1,x2,y2...;	Pen Up	Turn off vector cutting. Since the machine is not cutting, any following PA, PU, PU, or PD move commands will instead be treated as high-speed moves.
VS; or VSx;	Velocity Select	This Roland command is consumed, but it is ignored.
DTx;	Define Terminator	"x" is any number except NULL, CHR$(0). Problems could arise if you choose an ASCII value used in other commands.
SPx;	Select Pen	The range of the number "x" is from 0 to 8. So there are 9 pens. Pens are used for both Vector cutting, and Raster engraving (bitmaps, etc.)Numbers 1-8 correspond to the "DOS PEN SETTINGS" which may only be changed by the user on the machine's LCD control panel. These pens are used so standard plotter software (DOS Autocad for example) can use the machine as a plotter.Pen 0 is called the "Windows Pen." It is a SINGLE software-downloadable pen. This pen's power, speed, and PPI may be downloaded using ULS escape codes below.(On an actual roland plotter, pen #0 would tell the plotter to return the active pen to the carousel pen holder.)

The following RD-GL commands are not supported and may cause subsequent commands to malfunction. This is not a problem because all of the commercial DOS software tested uses only the minimal command set above.
UNSUPPORTED COMMANDS: DP, IP, IW, OA, OC, OD, OE, OF, OH, OI, OO, OP, OS, OW, RO, SC.

No internal system vector fonts are provided. DOS Autocad & other programs use their own proprietary fonts so they may calculate line spacing. These fonts are converted to lines directly by the program, and then output to the plotter as lines. Internal fonts are **NOT** supported.

DRAWING VECTORS:
To draw vectors (vector cutting lines), make sure the machine is in vector mode (<esc>U) and use the appropriate RDGL-I commands. Enable laser to fire with the "PD" (pen down) command and turn it off with the "PU" (pen up) command.

PEN 0: SOFTWARE CHANGEABLE SPEED & POWER LEVEL.

The "ESC p" power and "ESC v" pen speed commands differ on our older line of machines (the 25E and the 25PS, 50PS, and YAG).   Specifically, these commands are now followed by a 16-bit number in highbyte/lowbyte format, whereas the 25E and PS took a single byte number ranging from 0-250 for speed, and 0-255 for %power.

ULS additional escape codes			
Function	Escape Code	Parameters	Parameter meaning
Set Pen 0 Laser Power	<esc>p	<PowerHB><PowerLB>	Parameters are highbyte/lowbyte. This sets the laser power for PEN 0, the "windows pen".Please note the power must be scaled by 320.Range is from 0 = 0% 320 decimal = 1% 6400 decimal = 20%to 32000 decimal = 100 %
Set Pen 0 PPI	<esc>s	<PPIBYTE>	Sets the Pulses Per Inch to use for Pen 0. Please note that the PPI is sent as PPI/10. PPIBYTE value 0 = 0 PPI 10 decimal = 100 PPI 50 decimal = 500 PPI 100 decimal = 1000 PPI
Send Title	<esc>t	<TITLESTRING>~	This must be near the beginning of the file, if present. Please see the recommended initialization sequence. This can only appear once in the file. This is the filename that will be displayed on the LCD. It must be 15 characters or less, and terminated with a "~" character.

Set Pen 0 Speed	<esc>v	<SpeedHB><SpeedLB>	Parameters are highbyte/lowbyte. Speed parametmer is calculated as follows: $P=S*648$ Where P us the parameter and S is the percent of full scale speed desired as an integer. Examples: 648 = 1% full scale speed 64800 = 100% full scale speed
Initialize	<esc>Z	(no parameters)	This should be the FIRST thing in the print file.
Set Vector Mode	<esc>U	(no parameters)	Turns rastering OFF & does a PEN UP. Use when you want to switch to vector cutting.
End of File	<esc>e	(no parameters)	REQUIRED. This must be the last thing sent in a print file. If this is not present, you will not see the file appear in the LCD display.

INITIALIZATION:

The recommended Initialization sequence for the ULS M-360, V-460, X-660, X2-660 and X2-660SS machines is:

<esc>Z<esc>x<IDBYTE><esc>t<TITLE>~;IN;DF;PS0;DT~
followed by pen 0 PPI & speed settings that you wish to use.

Remember to end your file with <esc>e