BARCO

SilverWriter 800 Multi Format Family Laser plotters

Product and Pre-Installation Manual

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Introduction

The SILVERWRITER produces high quality photo tools for high density PCB, BGA, lead frame, stencil, Flat Panel Displays and Chemical Milling.

The SILVERWRITER is an external drum laser photo plotter. It has an automatic film loader and on-line connection to the film processor. The film handling system is very simple, to maximize accuracy and reliability.

Barco offers several models, with different speeds and resolutions.

- SILVERWRITER 815
- SILVERWRITER 830
- SILVERWRITER 860

The light source is a red Helium-Neon laser, 632.8 nm.

To date, about 180 SILVERWRITERS have been sold around the world. The SilverWriter enjoys an enviable reputation for speed, accuracy, film quality and reliability. The average number of interventions is now one per 14 months.

Resolutions

Model	Resolutions in pixel per inch (PPI)							
Imperial Metric	2,000 2,032	4,000 4,064	5,000 5,080	8,000 8,128	10,000 10,160	16,000 16,256	20,000 20,320	25,000 25,400
Standard	D	✔		✔				
Option A	D	✔	✔	✔	✔			
Option B	D	✔	✔	✔	✔	✔	✔	
Option C	D	✔	✔	✔	✔	✔	✔	✔

'D' stands for draft mode. The user can to plot at these lower resolutions, with the corresponding high speed, but Barco ETS can not warrant the film quality. Some customers expose less critical films like check plots, silk screen films, etc. at these resolutions.

The time to produce a film is the sum of two times.

- The expose time.
- The film switch time

The expose time depends on

- The model
- The film format across the drum
- The resolution

Expose Speed (inch per minute)								
Model	Resolutions in pixel per inch (PPI)							
Imperial	2.000	4.000	5.000	8.000	10.000	16.000	20.000	25.000
815	4,68	2,34	1,87	1,17	0,94	0,59	0,47	0,37
830	9,36	4,68	3,74	2,34	1,87	1,17	0,90	0,58
860	18,72	9,36	7,49	4,68	3,74	2,34	1,80	1,15
Metric	2.032	4.064	5.080	8.128	10.160	16.256	20.320	25.400
815	4,68	2,30	1,84	1,15	0,92	0,58	0,46	0,37
830	9,21	4,61	3,69	2,30	1,84	1,15	0,90	0,58
860	18,43	9,21	7,37	4,61	3,69	2,30	1,80	1,15

Expose Time for a 18"x24" Film (minutes)								
Model	Resolutions in pixel per inch (PPI)							
Imperial	2.000	4.000	5.000	8.000	10.000	16.000	20.000	25.000
815	3,8	7,7	9,6	15,4	19,2	30,8	38,5	48,1
830	1,9	3,8	4,8	7,7	9,6	15,4	20,0	31,3
860	1,0	1,9	2,4	3,8	4,8	7,7	10,0	15,6
Metric	2.032	4.064	5.080	8.128	10.160	16.256	20.320	25.400
815	3,8	7,8	9,8	15,6	19,5	31,3	39,1	48,8
830	2,0	3,9	4,9	7,8	9,8	15,6	20,0	31,3
860	1,0	2,0	2,4	3,9	4,9	7,8	10,0	15,6

Notes.

- If 20.000 ppi is installed expose times at all resolutions below 20.000 ppi increase by 4% (times 1.04).
- If 25.000 ppi is installed expose times at all resolutions below 20.000 ppi increase by 23% (times 1.23) and for 20.000ppi by 20% (times 1.20).

Film switch time

The film switch time consists of the time to load and unload the film, to speed up and stop the drum, and the "optics tuning" time. These steps partially overlap. Before each exposure, each beam is measured and tuned automatically to maintain constant image quality and maximize reliability. This "optics tuning" time is short for successive films of the same resolution, longer when switching resolutions and the longest when the plotter is warming up.

Practically, the film switch time is

<120s when queuing jobs of the same resolution.

<160s when heavy tuning is required, e.g. when warming up.

The following table gives the productivity when queuing jobs at the same resolution.

Productivity (32"x28" films per hour)								
Model	Resolutions in pixel per inch (PPI)							
Imperial	2.000	4.000	5.000	8.000	10.000	16.000	20.000	25.000
815	6,8	3,8	3,1	2,0	1,7	1,1	0,9	0,7
830	11,1	6,8	5,7	3,8	3,1	2,0	1,6	1,0
860	16,2	11,1	9,6	6,8	5,7	3,8	3,0	2,0
Metric	2.032	4.064	5.080	8.128	10.160	16.256	20.320	25.400
815	6,8	3,8	3,1	2,0	1,6	1,0	0,8	0,7
830	11,0	6,7	5,6	3,8	3,1	2,0	1,6	1,0
860	16,1	11,0	9,5	6,7	5,6	3,8	3,0	2,0

Film Formats

General

Minimum and maximum film formats supported are:

	Minimum	Maximum
Along the drum	18"	32"
Around the drum	24"	28"

- Expose time is minimized if the smallest side is across the drum.
- Maximum image format

Along drum	Film format along drum less 0.2"
Around drum	Film format around drum less 0.9"

- The whole film format can be imaged. However, outside the supported image format area, the image quality may be of lesser quality.

  Example: on a film of 24" x 28", 28" side is put around drum. The customer can image a panel up to 23.8" x 27.1"

- Sheet tolerance: Nominal format - 0.5 mm (0.02") ± 0.5 mm (0.02")

Multi Film Format

The operator can set the film format of the input magazine to any of the supported film formats, by simply changing the position of studs (see picture).

The supported film formats are shown in the table below.

		Film format along the drum (inches)														
film format around drum (inches)		18 18.5	19 19.5	20 20.5	21 21.5	22 22.5	23 23.5	24 24.5	25 25.5	26 26.5	27 27.5	28 28.5	29 29.5	30 30.5	31 31.5	32
	24	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	-	-	-	-
	25	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	-	-	-
	26	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	-	-
	27	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	-
	28	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔

Geometric Accuracy

Geometric accuracy of the plotter	<0.16 mil (4 µm)
Geometric repeatability of the plotter	<0.08 mil (2 µm)
Geometric accuracy on film	<0.5 mil (12.5 µm)
Geometric repeatability on film	<0.5 mil (12.5 µm)

To achieve this accuracy and repeatability requires air conditioning within 1°C (2°F) and 2% relative humidity.

Scaling

Scaling can be set:

- in steps of 1 PPM (parts per million)
- between –5 % and +5 %
- in horizontal and vertical direction independently

It is performed by scaling the distance of the pixels in steps of 0.5µm. This is equivalent to true photographic scaling.

In most systems, scaling is performed at plot resolution, by adding and removing pixels. This introduces artifacts the image of the size of one pixel in, especially errors in line-width and spacing. Scaling in 0.5µm steps avoids these problems.

Electronic Geometric Correction

Residual film distortion can be corrected electronically. This correction can be set to different values at different locations of the film, independently in X and Y, in steps of 1/32 mil.

Field engineers can use this capability to tune the plotter to the customer process and measuring table and when installing the plotter. It effectively removes all repetitive geometric error of the overall system.

Line Widths

Accuracy

The line-width can be set in multiples of the pixel size (which is the inverse to the resolution).

Variation

The film type used, the film processor chemistry used and the developer chemistry stability (temperature, replenishment and anti-oxidation settings) determine the line width variation over time.

A long-term variation of less then 3 µm has been achieved with good control of these parameters.

Minimum Line Widths

Minimum Line Width (mil)								
Model	Resolutions in pixel per inch (PPI)							
Imperial Metric	2,000 2,032	4,000 4,064	5,000 5,080	8,000 8,128	10,000 10,160	16,000 16,256	20,000 20,320	25,000 25,400
815/830/860		0.8	0.8	0.6	0.6	0.5	0.5	0.4

Operation

- Job submission either interactive with Uplot or in batch with AutoPlot Manager. Both submit the jobs in a plot queue on the RIP that is managed from the Uplot GUI.
- Daylight exposure, film loading and unloading in safe light for the panchromatic films. For the dry film the loading and unloading can also be done in daylight.
- Film handling: fully automatic with plot queuing system, semi-automatic as system mounts the film on request or manual.
- Plot switches: positive or negative, right or wrong reading.
- Film load magazine capacity: 150 sheets of film.
- The workstations in the CAM area are to be connected to the SILVERWRITER by means of an Ethernet network connection to enable data transfer between the SILVERWRITER and the workstation(s).

- The advanced POWERRIP (Power Raster Image Processor) performs Rasterization on the fly. In the unlikely event that the PowerRIP cannot keep up with the plotter, the plotter will slow down to the speed of the PowerRIP.
- The POWERRIP runs on an Intel Pentium III processor running at minimum 733MHz and with minimum 128Mb RAM, under Windows NT or Windows 2000.
- It has a built in LAN 10/100Mb Ethernet interface with UTP (twisted pair) connection to connect it to the customer's network and CAM workstations.
- It has a hard disk of minimum 9Gbyte.
- The POWERRIP is connected to the SILVERWRITER by means of a dedicated high-speed data connection with a speed of 330 Mb/s.
- Initializing the plotter as well as running the diagnostics software on the plotter is done from the POWERRIP by means of the serial connection.
- The POWERRIP is equipped with a modem for diagnostic purposes.
  - The customer has the choice between an analog or ISDN (digital) modem and has to make this choice when ordering.
  - The purpose is to give better and faster service via remote access. This also implies that either an analog or a digital (ISDN) modem line should be available in the plotter room.
- It's strongly recommended to connect the POWERRIP to a true UPS (power always goes through a power conditioner inside the UPS):
  - Voltage: 100-127 VAC or 200-240 VAC 50/60 Hz
  - Power: 500 W

Opto-Electronical Architecture.

The light source is a red Helium-Neon laser, 632.8 nm with a power of 2 mW.

The optical system is mounted on a carriage supported on air bearings and driven by a linear DC motor. The whole system hovers on a massive granite block, which is isolated from the ground by air cushions to eliminate vibrations during exposure. The optical system itself has no moving parts.

Beam Auto-Tuning.

The SILVERWRITER uses multiple beams to achieve the speeds. The beams are measured and tuned automatically before each plot to maximize image quality and reliability. This system is so powerful that in the (unlikely) event that one beam totally fails, the plotter will readjust the optics with one less beam, issue a warning, and continue to plot without loss of quality.

Internal Resolution of 50,000 PPI (1/50 mil of 0.5µm)

The *internal resolution* specifies the *number of positions* a pixel can take per inch. (The *standard* or *RIP resolution* specifies the *number of pixels* per inch). The SILVERWRITER itself has an internal resolution of minimum 50,000 PPI.

This high internal resolution is used to perform scaling and electronic geometric correction without artifacts in the image.

In most systems, the internal resolution is limited to the standard or RIP resolution. Scaling and corrections are then performed in steps that relatively coarse resolution, say ¼ mil for 4000 PPI. In the SILVERWRITER it is performed in steps of minimum 1/50 mil, whatever the RIP resolution. Always plotting at the highest possible RIP resolution would obviously reduce productivity.