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Photoplotter FP-8000/8000 XL

Instruction manual

Note: Any inquiries related to photoplotter hardware or software should be addressed to an authorized distributor. Photoplotter software is subject to copyright. All the information enclosed here is subject to change due to constant innovation of the product.

Date of the last change in this document: **January 27, 2009.**

1. Brief description:

Photoplotter FP-8000/8000 XL is a small, raster, low cost plotter which draws image on film by means of laser diode light. Film itself is fixed to the outer surface of rotating drum by means of masking tape. The source of laser diode light moves step by step along the rotating drum. Photoplotter is controlled by software installed on PC attached via its USB port (PC is not a part of the photoplotter supply). An external, universal power unit is used to supply needed power (100-240V AC / 36V DC – 2.78A).

The photoplotter software allows to read input files, to set output resolution and type of image (negative, mirror, etc.) drawn on the film. When working with Gerber files, it is possible to check and modify used apertures (D-codes) and make simple film panelization for Gerber data and associated drill data. Viewing of Gerber files and conversion of various types of aperture files is possible in freeware program **ViewMate** (made by Pentalogix, formerly Lavenir), which is attached to the photoplotter software for your convenience (otherwise it may be downloaded from Pentalogix web page: <http://www.pentalogix.com/Download/download.html>).

Photoplotter is driven by program **Run_photo_USB**, which reads in hi-resolution bitmap files **FPF**, (photoplotter proprietary file format) and **BMP**. From this reason, if you work with **Gerber** or **Postscript** files, these files must be converted into one of these bitmap files format first. **Gerber files** are converted by program **Gerb2bitmap**, which is a part of the photoplotter software, while **Postscript files** are converted by an **external program**, supplied as an option. Converter of Gerber files has also built-in **converter of aperture files** to convert various aperture format into one standard format (Lavenir format is used as a standard aperture format). **Aperture file conversion is needed only when working with standard Gerber format RS-274-D**. There is no need to convert aperture file when working with extended Gerber format RS-274-X, as this type of file already contains information on used apertures.

Various types of films may be used for this photoplotter, but all of them must be sensitive to light wave length of **670 nm (red light)**. Thin films (0.1 mm) used by image setting machines as well as standard photoplotter films (0.18 mm) can be used, although 0.1mm films are recommended for this model of the photoplotter. Films 0.1mm come either in rolls of various width and length, or in pre-cut sheets of several sizes. Film in roll is easy to tape on a small drum in photoplotter, as film tends to bend automatically. There are several manufacturers of suitable films, like Kodak, Horsell, Fuji, Agfa, Typon Graphic Systems, etc., while films have various names like **EZR4, RD4, TR-LR+**. As film light sensitivity differs with various films, several test plots may be needed to find suitable light intensity. Films have to be wet processed (developed and stabilised) like any other films after lighted in photoplotter. Film manufacturers recommend and usually supply chemicals to be used for their films processing.

The **power switch** is located on the left side of the plotter.

On the back side of the plotter the following items can be found:

- **power supply connector** (label: Input 36V 2A)
- **computer USB cable connector** (label: USB)
- Label with **serial number** of the plotter (SN

On the front or left side of the plotter the following items are located:

- Yellow (or Red) LED indicating plotting operation (label: Laser)
- Green LED indicating power on (label: Power)

2. Technical parameters:

Maximum film size: FP 8000: 360 mm x 360 mm / 14" x 14"

FP 8000 XL: 380 mm x 450 mm / 15" x 17,5"

Maximum photoplotting area: FP 8000: 340 mm x 320 mm

FP 8000 XL: 360 mm x 420 mm

Plot resolution: (508, 1016, 1355, 1625, 2032, 2710, 4064, 8192) x 8600 dpi,

Plotting speed: approximately 13 mm of film width / minute for 1016 dpi

Used light: Laser diode 670 nm (red)

Reads in image formats: Gerber (RS 274D, RS 274X), hi-res BMP, Postscript (option)

Reads in aperture files: directly CAM350, GC-CAM, IsoCAM, Lavenir, other formats like Pads, Eagle, OrCAD, Protel, PCAD reads through built-in converter.

Photoplotter overall size: FP 8000: L x W x H (700x340x210)

FP 8000 XL: L x W x H (700x370x230)

Photoplotter weight: FP 8000: approx. 25 kg (55 lbs)

FP 8000 XL: approx. 26.5 kg (58 lbs)

Power: an external power supply unit 100-240V AC / 36V DC – 2.78A

Reversed (negative) & mirror plotting, film and drill panelization, D-code editing, output preview & print, interactive or coordinates image positioning on film, glue/unglue image location, automatic positioning of associated images on different layers.

Photoplotter software is supplied on CD with installation program. Requires Pentium computer with at least Windows 2000 and USB port, 100 MB HD space minimum for software and output files. The computer speed has influence on plotting time. Plotting files may be quite large, in range of tens of MB, so extra space on hard disk may be required.

Warranty 1 (one) year on parts. There is no expressed warranty on functionality of enclosed software whatsoever except warranty on CD media.

Notes:

1) *Output resolution:*

- *the lowest resolution (508 and 1016 dpi) may not be suitable for fine results*
- *1355 and 1625 dpi resolution is suitable for most plotting application*
- *use 2032 or 2710 dpi for plotting finelines (but it takes longer time to plot)*

2) *Plot size: although plotter allows to plot to maximum specified size, be aware, that films wide across the whole drum may be difficult to fix properly, which may result in higher inaccuracy in the right part of the film. This is due to technics used to fix film to the drum surface by sticky tape. To fix wide film properly requires some experience. If you encounter problem with inaccuracy on wide films, enter deviation values into correction table for the right side of the drum, which will correct it, provided films are always fixed to the drum in the same manner.*



3. How to prepare photoplotter:

3.1 Photoplotter software installation

Connect photoplotter with PC via USB cable supplied with the photoplotter. USB connector is located on the back side of the photoplotter. The photoplotter does not need to be powered at this moment.

Computer will detect new connected USB device (photoplotter) and will run new hardware installation (Windows procedure). Do not use an Automatic installation, but select „ **Install from list or location**“ – point to directory **Install** located on installation CD and confirm. Depending on the Windows version, computer may report that installed USB driver is not Microsoft certified and that may not be compatible with Windows – ignore this message and continue.

After hardware installation you can install photoplotter software – go to directory **Install** on installation CD supplied with the photoplotter and execute **SETUP.exe**. Software starts to install on connected computer.

3.2 Power the photoplotter

*Connect supplied power supply unit with the photoplotter – connector is located on the back side. **Switch power on** (left side of the photoplotter). The **green LED labeled Power will come on**. Red (or yellow) LED labeled Laser will flash four times at this moment.*

When photoplotter is turned on, the laser light head will move back to the left to contact a microswitch and then will move back to the right to its initial position. Attached computer can not initiate communication with photoplotter before light head makes the above described move. This initialization runs automatically, without running photoplotter software.

AUTO/MANUAL switch:

Position of AUTO/MANUAL switch has impact against laser head behavior.

AUTO - laser head moves to its starting position (left side of the drum)

MANUAL - laser head moves 1 cm to the right only

Before first data plotting, check the AUTO/MANUAL switch and set it to AUTO position.

When you start the plotter, laser head will move to its starting position (left side), after that you can start data plotting (laser head will move from left to right side during the plotting).

When the plotting is finished and the switch will be in AUTO position, laser head will move back to its starting position and plotter will be ready again for plotting.

When the plotting is finished and the switch will be in MANUAL position, laser head will move 1 cm to the right only and plotter will be ready again for plotting.

AUTO mode is suitable for single data plotting in the whole film width.

MANUAL mode is suitable when you want to plot 2 (or more) data - side by side (in drum axis direction). After first data plotting laser head moves little to the right only (1 cm) and next plotting starts from this position.

If you turn power on after film is loaded, it may happen that laser light beam flashes shortly on the film at the moment when power is turned on and electronic circuitry is reset. This may result in very small spot on the film.

3.3 Place and tape film

Lift the photoplotter lid, so you have access to the outer surface of the drum. Rotate drum by hand (in any direction) to point white arrow located on the left side of the drum to white arrow located on the left side of drum holder. This is the outgoing position of the drum for photoplotting. The left top corner of photoplotting area is then approximately 20 mm from the left edge of the drum on the horizontal line marked by white arrow. Place film on the drum with its top edge approximately 20 mm behind the white mark on the drum, hold it firm by hand and fix it to the drum by means of a masking tape along the top edge. Rotate drum by one hand to be able to fix film's bottom edge, but make sure film is tight on drum surface. After film is fixed to its position on the drum, rotate drum back to 1st initial position (both white arrows point to each other). Close the lid.

NOTES:

It is a matter of practice to fix film properly on the drum surface.

*Films used in this photoplotter are sensitive to light of 670 nm (red light). When working with film (loading, unloading,...) **use light dark green light**. It is recommended to use dim light in room during photoplotting. Make sure there are no other sources of light that may expose film, for example light coming from monitor screen, when loading and unloading film. The film manufacturer can recommend proper type of dark room safe light if needed.*

Transparent films must be mounted with emulsion side on the drum surface. (film in rolls used for image setting machines has emulsion side on inner side and therefore it is easy to put it on photoplotter drum properly). Emulsion side of the film has light grey color, compare with dark colour of the other side.

However, films made for laser photoplotters, like DuPont films, which have a special anti-reflection coating on the other side of the film, can not be plotted with emulsion side pointed towards drum surface. In this case emulsion side must be on outer surface, while source of laser light may need to be re-focused. From this reason, use transparent films, otherwise laser light focus must be adjusted – contact your photoplotter supplier for details.

3.4 Run photoplotter

Before you start plotting, make sure that drum is in its initial position (white arrow on the left side of the drum should be aligned with white arrow on the top of the left holder of the drum). After you prepared your data for plotting on connected PC using photoplotter software, **start plotting - see further info**. The photoplotter drum starts slowly to rotate. After drum reaches its working speed, it rotates a while before actual plotting starts. At this moment red (or yellow) LED labeled **Laser** starts to light as an indicator that plotting is in progress. When photoplotting is finished or interrupted by STOP command, drum automatically stops, laser head moves back to its outgoing position and LED labeled **Laser** stops light. Time needed for photoplotting of given image is displayed on computer in dialog window of control software.

Do not start plotting again before the laser light head reaches completely its initial position (the left side of the screw)!

***Note:** Because various films used for photoplotting are differently sensitive to light, it is possible to adjust intensity of laser light as needed in photoplotter software, also in respect to selected resolution. This setting may also be needed to adjust time after time to reflect the status of chemicals used for film wet processing.*

Open the lid (dark green light !!!) and remove film. Process film immediately.

***Note:** After removing film from drum surface, it may be necessary to clean the drum surface to remove sticky areas caused by sticky tape. Use soft cloth and common liquid cleaner. Do not spray. Drum surface under film must be kept clean and dry.*

ATTENTION !

During photoplotting is film (drum) lighted by laser light that is harmful to human eye. Do not open photoplotter lid during photoplotting, nor during testing without film.

4. PHOTOPLOTTER SOFTWARE

4.1 Brief Description

Photoplotter software comes on one CD together with **ViewMate** program for viewing Gerber files and with a brief manual in PDF format. It must be installed on PC under with **Windows 98** or higher.

CD contains 5 directories – **Install, Manual, Update, Util, Viewmate**

Install directory contains photoplotter control software. This program can be installed on computer by executing its own installation program **SETUP.EXE**. Installation creates a new directory (default **FP-8000** under **Program Files**) with two programs (**Gerb2bitmap** and **Run_Photo_USB**).

***Gerb2bitmap.exe** reads in Gerber files. It allows to view Gerber data as they appear on the film, edit D-codes, do film panelization, and converts Gerber file into photoplotter bitmap file (.FPF), which can be read into plotter control program (Run_photo_USB) to be used for photoplotting. It can also convert various formats of aperture files into Lavenir's format, which is used by this plotter.*

***Run_photo_USB.exe** controls photoplotting. Reads in bitmap files like photoplotter FPF, regular BMP and controls plotting process. It allows to set output resolution as well as to calibrate photoplotter in X and Y coordinates.*

Latest photoplotter software is located in **Update** directory. Please, copy the files into photoplotter directory (default **FP-8000** under **Program Files**).

Manual directory contains this manual and Adobe Acrobat Reader program.

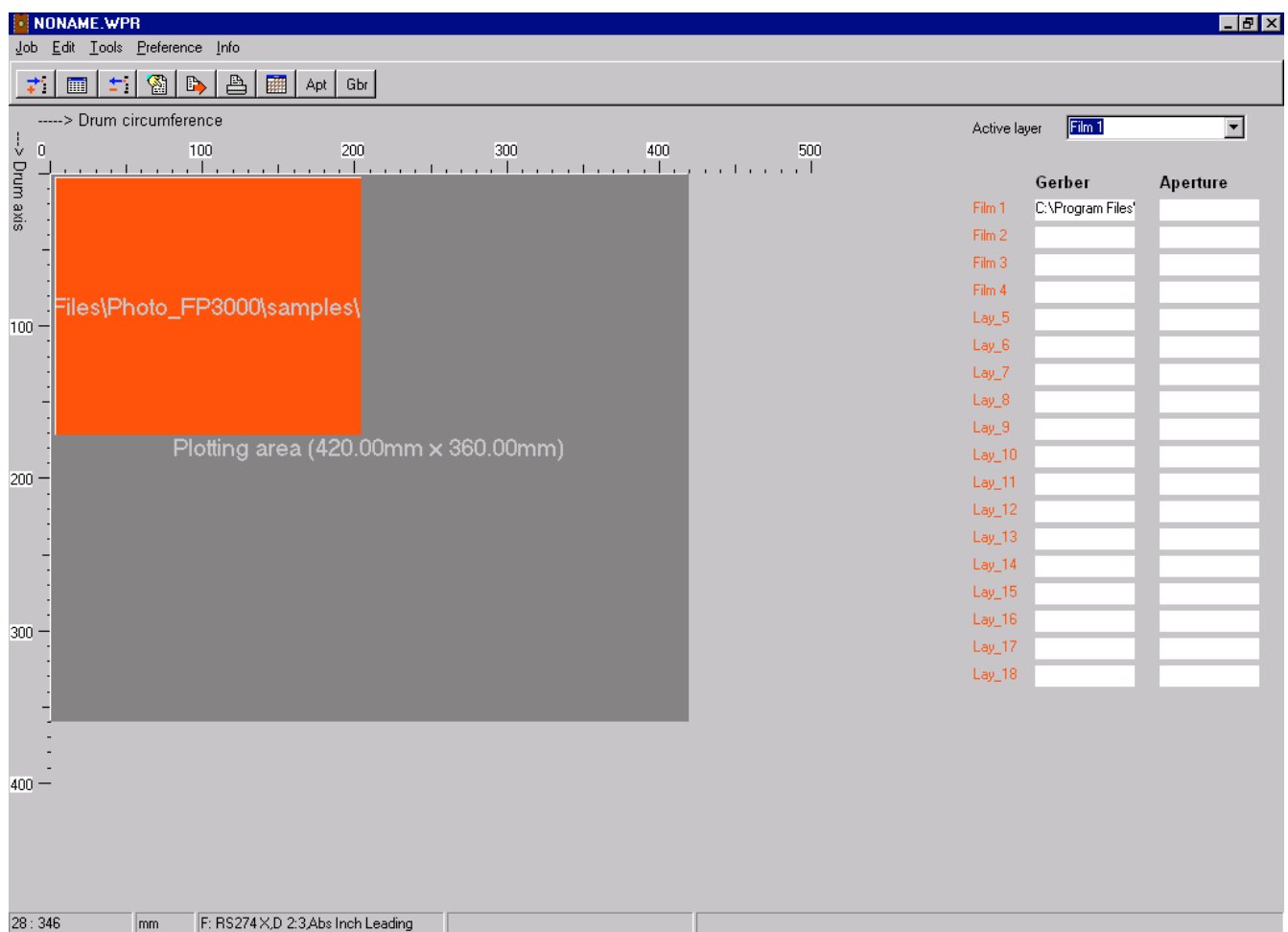
Util directory contains program **MM2INCH.EXE** (mm to mils converter).

Viewmate directory contains program **ViewMate**. This program is made by PentaLogix (Lavenir) and is a free of charge addition to the photoplotter software. It allows to view Gerber files and to convert aperture files made in various PCB layout systems into one common file format (Lavenir's format of aperture file, extension .env). Installation of this program is done by executing ViewMate Setup in directory ViewMate on CD. ViewMate can be expanded to full Gerber editor ViewMaster – contact photoplotter supplier or PentaLogix directly (<http://www.pentalogix.com>).

4.2 Detailed programs description:

Program Gerb2Bitmap

This program reads in Gerber files and converts it into hi-resolution bitmap file in proprietary format (FPF), which can be then read into plotter control program (Run_photo_USB.exe) to be used for photoplotting. It allows to view Gerber image as it appears on the film, edit D-codes, panelize film and associated drill. It also has a built-in converter of aperture files made in various CAD software (Eagle, Pads, OrCad, Protel, P-CAD, etc.)



The large grey area on the screen represents **plotting area of the photoplotter**. The top left corner of grey field area has **0, 0 plotting coordinates** with increasing Y coordinate going vertically down and increasing X coordinate running horizontally to the right. The coordinates of the cursor located in the plotting area are displayed at the left bottom corner in units set in **Preference-Data Format**. The size of the plotting area can be set as user wishes in **Preference-Plotting Area Size**. Although user can set any size of the plotting area, it make sense to set only usable plotting area. The maximum size in drum axis can be 360 mm, in drum circumference axis is the maximum 320 mm for plotters with drum diameter around 110mm or 450 mm for plotters with drum diameter of 150 mm. The reason, why the size of plotting area is not fixed is the fact the user may wish to set size of the area to the size of the film he uses, which may be different from the maximum plotting size.

Please note, that plotted image is in plotting area rotated by 270 degree (or -90 degree) and mirrored from some programming reasons. It means, X axis of the grey plotting area represents Y axis of the film loaded in photoplotter (drum circumference), while Y axis of the grey plotting area represents X axis of the film loaded in photoplotter (drum axis). At the same time the image is mirrored over the Y axis of the plotting area. This has no impact on proper photoplotting, as the overall size of the plotted image is the same.

To avoid confusion with plot rotation on the film, this is the rule: horizontal line of the plotted image will be vertical in plotter.

Command **Job- Import Master Gerber** or the first left icon loads main Gerber file(s), while **Job-Import Associated Gerber** or „Gbr“ icon loads Gerber files associated with the master file. The master Gerber file(s) can be located anywhere inside the plotting area, usually on layer (film) number 1 (default), while associated Gerber files are automatically positioned under Master Gerber on different, specified layers (films). If Master Gerber file is for example top side routing of the PCB, then Associated Gerber files are for example silkscreen, soldermask or bottom side routing of the same board – they will be in same location as the Master image, but on different layers (films), even when panelization is done. Several Master Gerber files (same or different) can be loaded on one, same layer (film). Associated Gerber files are loaded into selected layer, which can be selected in top right window **Active Layer**.

Note: The meaning „Master Gerber“ and „Associated Gerber“ makes sense only in case of several artworks (like Top side routing, Bottom side routing, Silkscreen, Soldermask, etc.) from the same board will be photoplotted, while one of them (Master) will be panelized - the other ones (Associated) must be then be panelized too and be positioned exactly to the same location as the Master image. If films are not panelized, than every Gerber file can be considered as „Master Gerber“, as it can be positioned anywhere in plotting area without considering another Gerber files.

If standard Gerber file is loaded (**RS-274-D**), then data format of Gerber file has to be set in dialog window using command **Preference- Data Format**. This data format does not need to be set for the extended Gerber file (**RS-274-X**), as this information is directly in its Gerber file. After reading Gerber file, a small portion of the image will be displayed in top right corner of plotting field like a red rectangle with its size equal to given image. This rectangle can be moved to any location inside the plotting area by left mouse button (click on red rectangle, hold button down, drag to a new location, release button). As plotter starts to plot at top left corner and continues to the right, it makes sense to place this red rectangle to the top left corner of plotting area.

The screenshot shows the 'Data Format' dialog box with the following settings:

- Type: Absolute, Incremental
- Digits: Integer: 2, Decimal: 3
- Zero suppression: Leading, Trailing, None
- Units: English, Metric

After positioning red rectangle inside plotting area, **corresponding aperture file must be loaded in case of standard Gerber format (RS-274D)**. Extended Gerber format (RS-274X) contains information on used apertures and therefore does not require to load aperture file. If you are not sure which format is loaded, see the aperture table (**Preference – Aperture Table**) an Icon – if table is empty, without information on used D/codes, than aperture file has to be loaded.

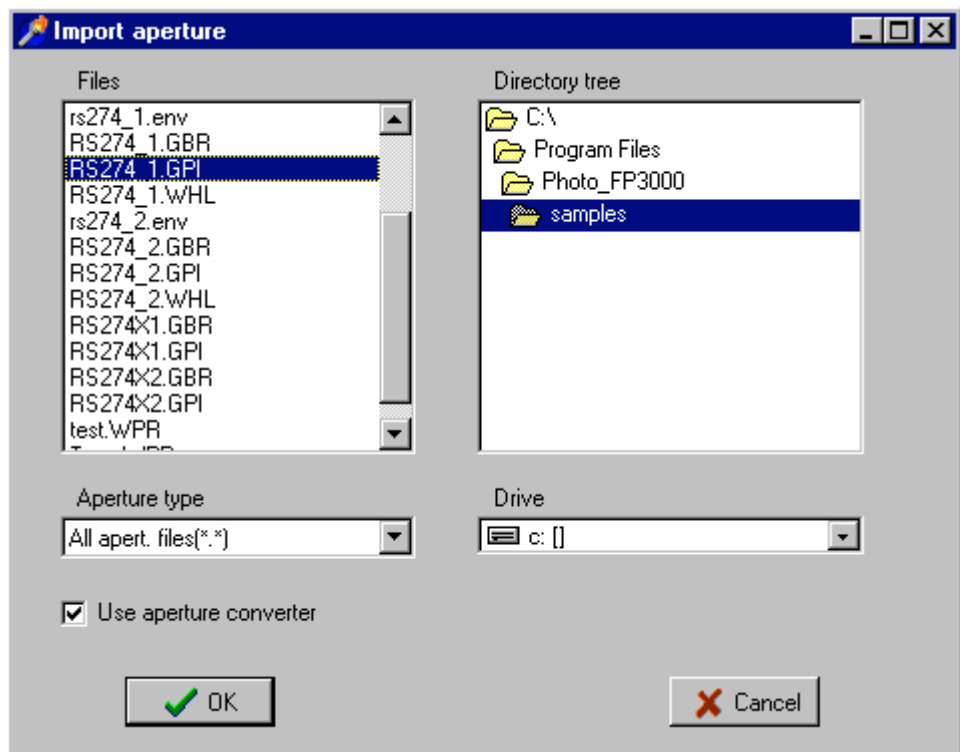
Aperture files can have various formats, depending on software where it was created. This program uses Lavenir's format as a standard. Beside Lavenir's format (.env) can this program read directly several other formats like CAM350, IsoCAM, GC-CAM – other formats must be converted to one of them. The program has built-in DOS aperture converter made by Lavenir, which allows to convert most of the common aperture file formats into Lavenir's format in an easy way.

Before loading aperture file, make sure it will be loaded on the same layer as corresponding Gerber file – use Active Layer to set active layer.

Use **Job – Import Apertures** or „Apt“ icon to activate this apertures converter. A dialog window appears where it is possible to choose **aperture type** of loaded aperture files and to define the loaded aperture **file**. If loaded file has format of **Lavenir, CAM350, GC-CAM** or **IsoCAM** , then it can be loaded directly, just choose this aperture type. If loaded type is not listed under aperture type, use **other apertures** – it will bring up the **aperture converter** automatically.

Note: Similar, new Windows version of this converter is in ViewMate program – that one can be also used to convert aperture files to Lavenir's format.

When DOS aperture converter starts, program will automatically fill all needed information in it. The user can verify the source of aperture file by clicking on „**Guess Format**“ – the converter will report the name of the program where aperture file was created. The



The conversion will start by clicking on „Start“ or F4. Exit converter by using ESC keyboard button. When converter closes, confirm OK on a small dialog window. The name of loaded aperture file will be displayed in the field APERTURE for particular layer, beside name of corresponding Gerber file under GERBER.

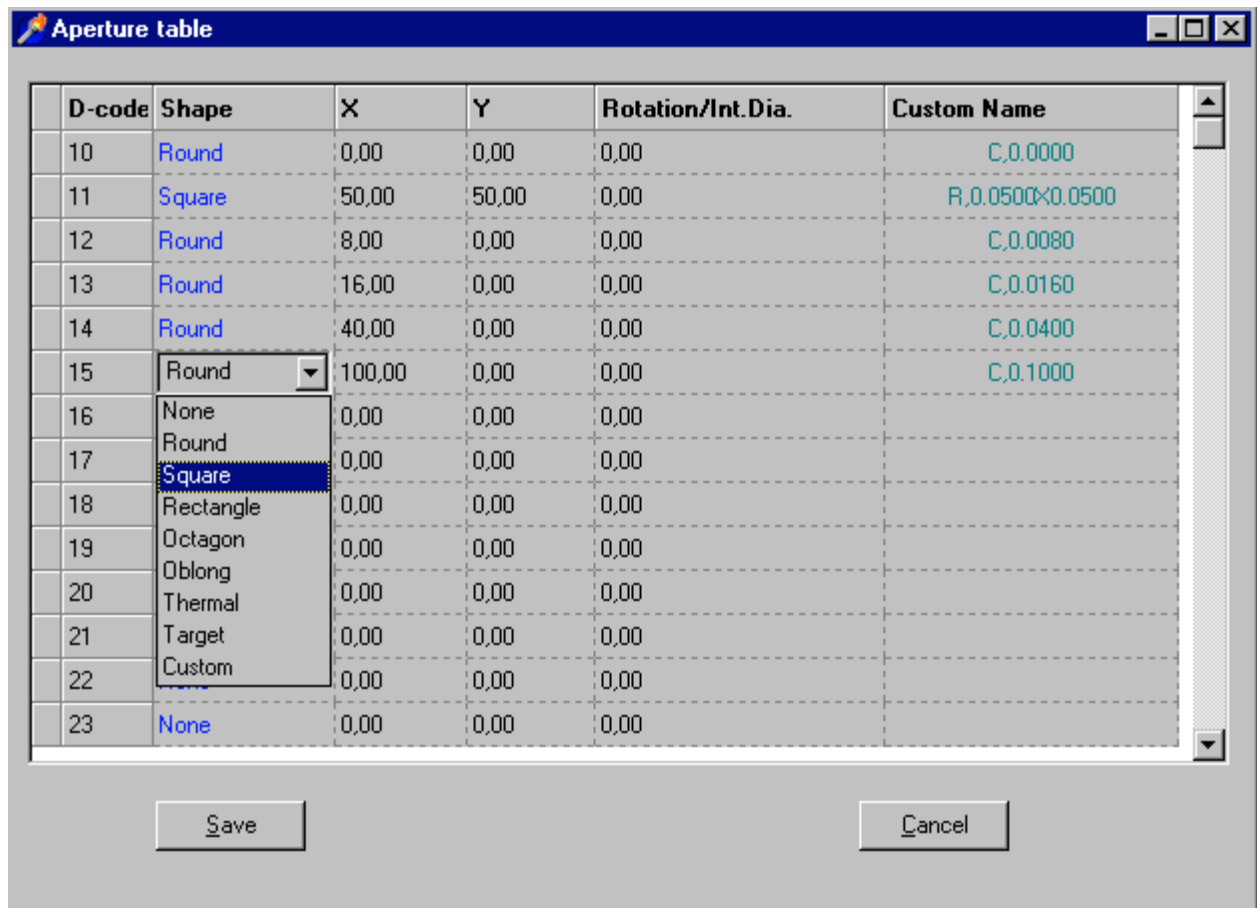
Please note, that selected aperture file will appear in this converter always under name of „APERT.TXT“, while converted file will have assigned name of „APERT.ENV“. This is done on purpose to avoid problems with longer names of aperture files. Program will always rename selected aperture file as APERT.TXT, convert it as APERT.ENV and after this conversion is confirmed by OK in a small dialog window, it rename converted file back to the original one with extension .env.

To check and/or modify loaded aperture table for selected (active) layer use **Preference – Aperture Table** or an icon.

It is possible to define **custom aperture table** directly in Aperture Table (**Preference – Aperture Table**), without any conversion. In aperture table select shapes (Round, ...) and type sizes of selected D-codes, then save under any name. Program will create an aperture file in Lavenir's format (.env), which can be then loaded through **Job-Import Apertures** – as a **Aperture Type select Lavenir**).

This method is used when there is a problem with aperture file conversion, or user does not have any aperture file generated by PCB design software, etc.

Please note, that loaded aperture file is always tied to loaded and active associated Gerber file. If Gerber file is deleted (Edit – Delete Board or icon), the aperture file is also deleted.



A click on red rectangle in working area with right mouse button brings a small menu :

Set Active allows to set this image (board) active – only active board can be moved, deleted,

Move to allows to move this image to desired location by typing in a new absolute coordinates

Lock allows to glue this image to its current location – it can be manipulated any more

Unlock unglues this image – it is free to be manipulated with

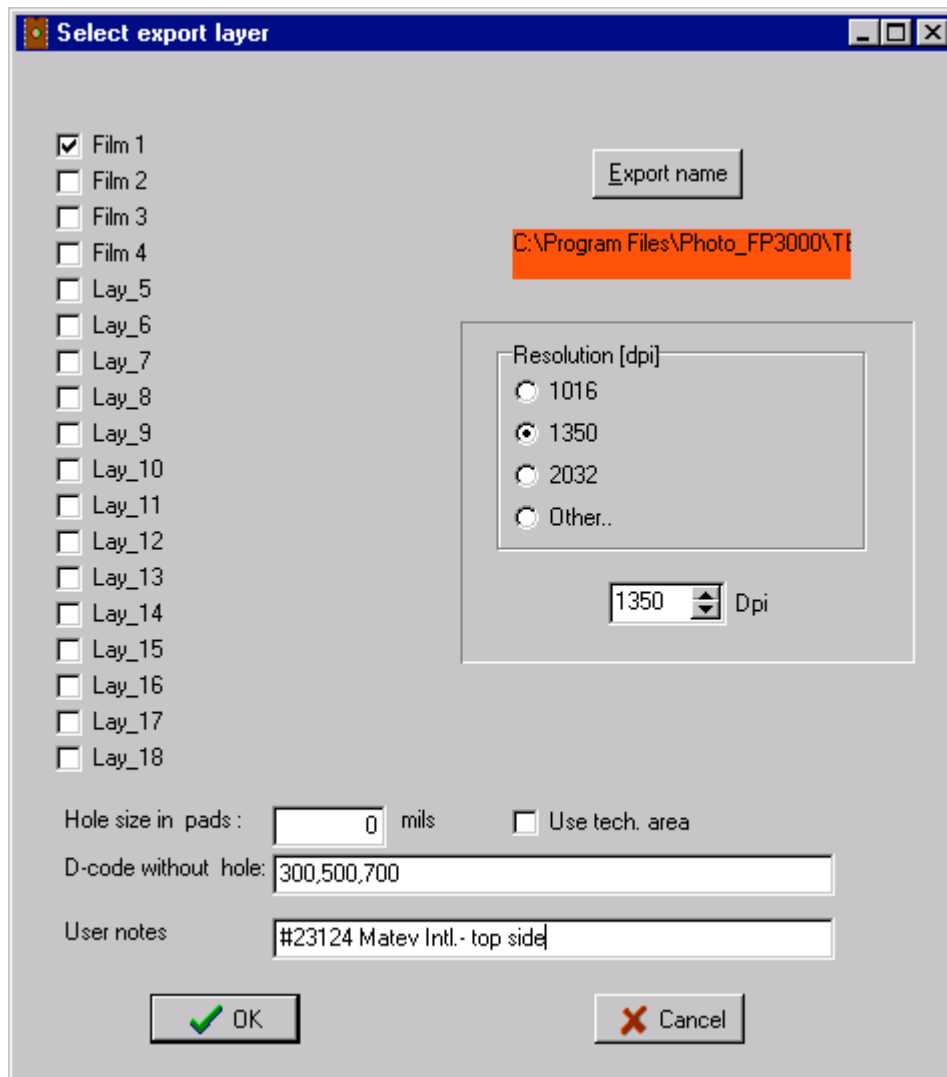
Add Gerber on active layer allows to load Gerber file associated with this one on different layer

Add Aperture on active layer allows to load aperture file for Gerber file associated with this one on selected layer

Use Job-Preview or an icon to preview result of Gerber to bitmap conversion for selected layer. **It is possible to make holes (openings) in otherwise filled pads to make manual drilling easy – specify Hole Size in Pads . As some pads, for example SMD do not have any holes, specify D-codes without holes for these pads. Similarly, to view created technological area defined under Preference-Tech.Area , click on Tech.Area.**

Use Job-Export Photoplotter Bitmap to export converted Gerber image to hi-res bitmap file in photoplotter proprietary format (FPF). As in Preview, it is possible to make holes (openings) in otherwise filled pads to make manual drilling easy – specify **Hole Size in Pads** . As some pads, for example SMD do not have any holes, specify **D-codes without holes** for these pads. Similarly, to

export created technological area (robber bend) defined under **Preference-Tech.Area** , click on **Tech.Area**. It is possible to enter **user notes** that will be attached to the file (for example project identification,...) – this info text will be also displayed in Run_plotter program when searching for particular image file.



Use **Job- 500 dpi Bitmap** to generate BMP file (named Clip.bmp) for checking purpose – you can display it in any bmp viewer (if nothing more, than Paint Brush in Windows will do that).

Gerb2bitmap COMMANDS OVERVIEW:

Icons (from left):



- Import Master Gerber
- Panelize Selected Board
- Delete Selected Board
- Preview
- Export Gerber to Bitmap
- Print Preview
- View & Edit Aperture Table
- Import Apertures
- Import Associated Gerber

JOB:

Job-New starts a new plotting project – default situation when starting this program.

Job-Open opens project file previously saved by command **Job-Save** or **Save as**.

Job- Save /Save as saves the current plotting project as it is in this program under its own file format (.wpr). This allows to exit program and return back without losing any work previously done with loading Gerber and aperture files, panelization, etc.,....

Job- Close clears the plotting area and loaded data to allow to start another project

Job-Print (or an icon) can **print preview** image for checking

Job-Export Photoplotter Bitmap (or an icon) converts loaded Gerber data into hi-resolution bitmap file for selected plotting layer, with specified output resolution and saves it under specified name. User note attached to the file may be here entered. (Export name). After executing OK program calculates new raster data and displays it for checking. Please note that this operation may take some time, be patient.

Job- Preview (or an icon) allows to preview image(s) as it look like on the plot for selected layer.

Job- Import Master Gerber loads main (independent) Gerber file(s)

Job- Import Associated Gerber loads Gerber file(s) associated with the Master file (soldermask, etc...) on selected layer (film)

Job- Import Apertures loads aperture file for selected layer (film)

Job- Exit ends the program

EDIT:

Edit- Insert Mark allows to insert a small Gerber image to the film – see **Preference-Mark**

Edit- Copy to Clipboard

Edit-Delete Board (or an icon) deletes selected board image(s) and associated Gerber and aperture file.

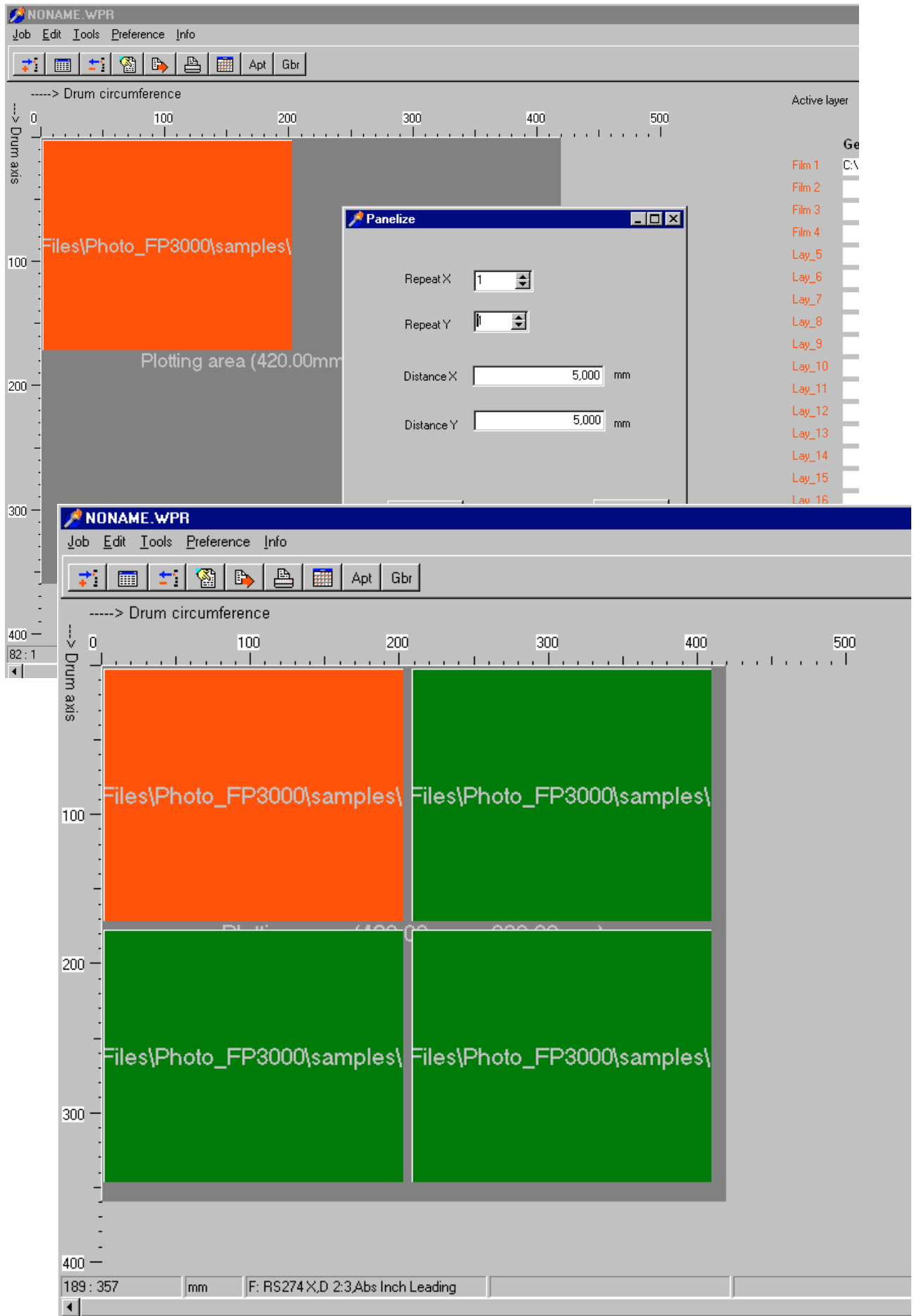
Edit-Lock All Boards glues images to their location in plotting area to prevent any shift or move.

Edit-Unlock All Boards unglues all images, so they may be moved inside plotting area as needed.

Edit-Relative move of Locked Boards allows to move glued images relatively to their current position in X and Y coordinates. Please note, that Y coordinate has reverse polarity (positive value moves image vertically down).

TOOLS:

Tools-Panelize Boards allows to do simple film panelization. The number of copies in X and Y direction and spacing between images (edge to edge) can be set in opened dialog window. New copied images appears as green rectangles. Green colour means that this image is not active (can not be moved, deleted, ...). To set any green rectangles as active, click right mouse button on it and use **Set Active** command. Note, that only one active image (board) at the same time will be inside plotting area.



Tools-Panelize Drill panelizes drill for panelized film (only). The original Excellon drill file (.drl) has to be selected, as well as a new (panelized) drill file name has to be specified. If offset between panelized Gerber data and panelized drill data is required, then this can be also specified. After executing OK, program calculates new drill data for panelized film – it may take some time, please be patient. Once it is done, it displays panelized film including drill marks of new panelized drill data.

Tools- View Text File allows to view a text file (for example aperture or Gerber file)

Tools- Convert Aperture allows to convert selected aperture file

PREFERENCE:

Preference – Memory Setting allows to specify computer memory size used for calculations. Recommended size =RAM memory – 20MB. The more memory available, the faster calculation of bitmap.

Preference - Plotting Area Size allows to set max. size of displayed plotting area

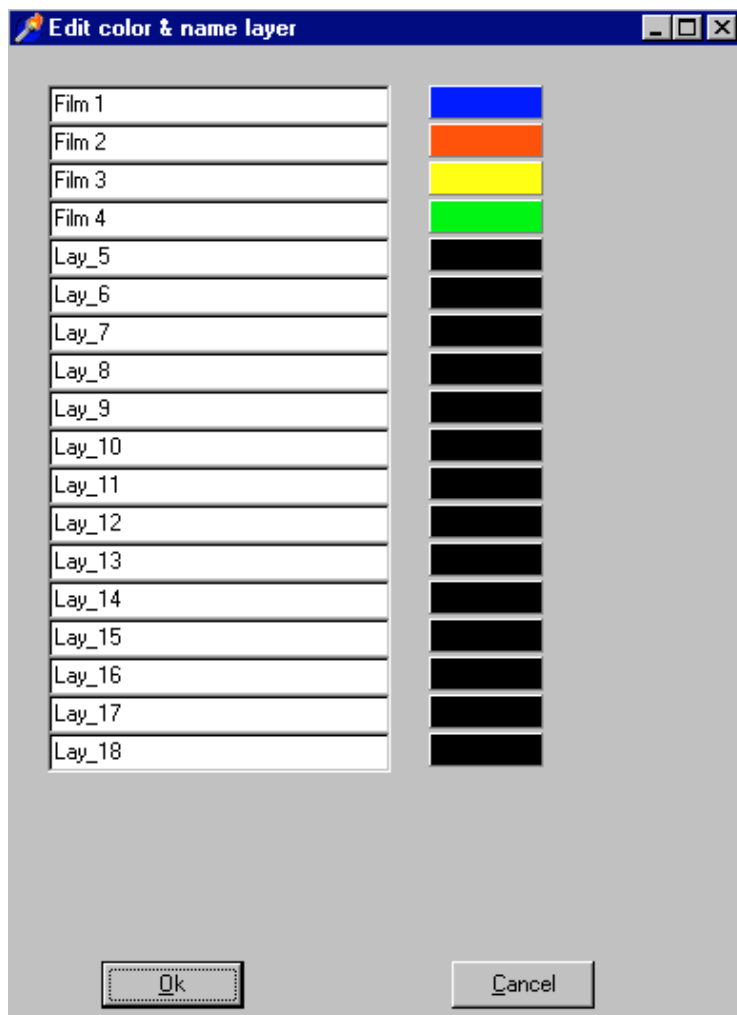
Preference – Data Format allows to set format of loaded Gerber file

Preference – Aperture Table or icon allows to view and edit D/codes of loaded aperture file

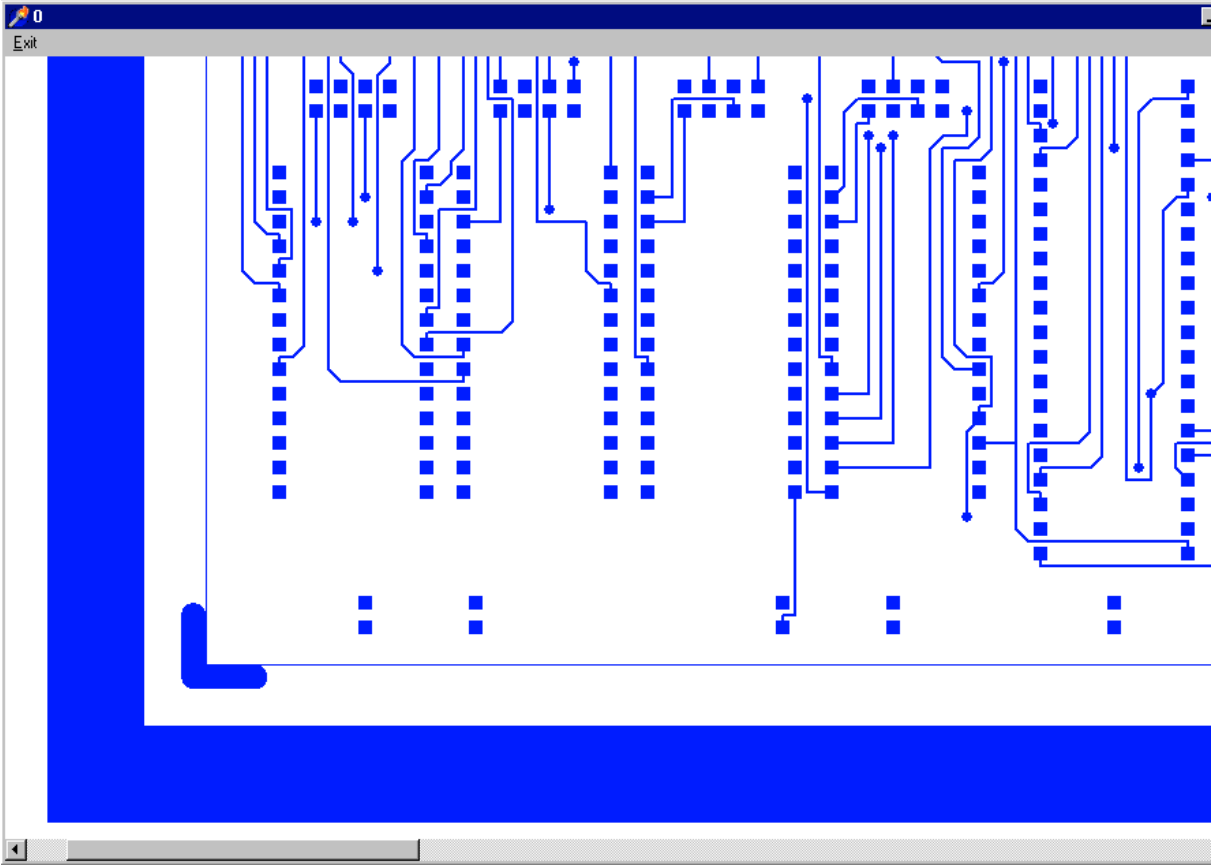
Preference – Units allows to set units of measurement

Preference - Mark allows to specify names and file path for various Mark - small Gerber images used automatically on all plotting layers. They can be inserted to the board image by **Edit-Insert Mark**.

Preference - Colours allows to define plotting **layer names** and their **colors** .



Preference – Tech. Area allows to set parameters for so called robber strip - copper strip around board outline used for board manufacturing purposes



An example of "Tech. Area" – the robber strip

Program Run_Photo_USB

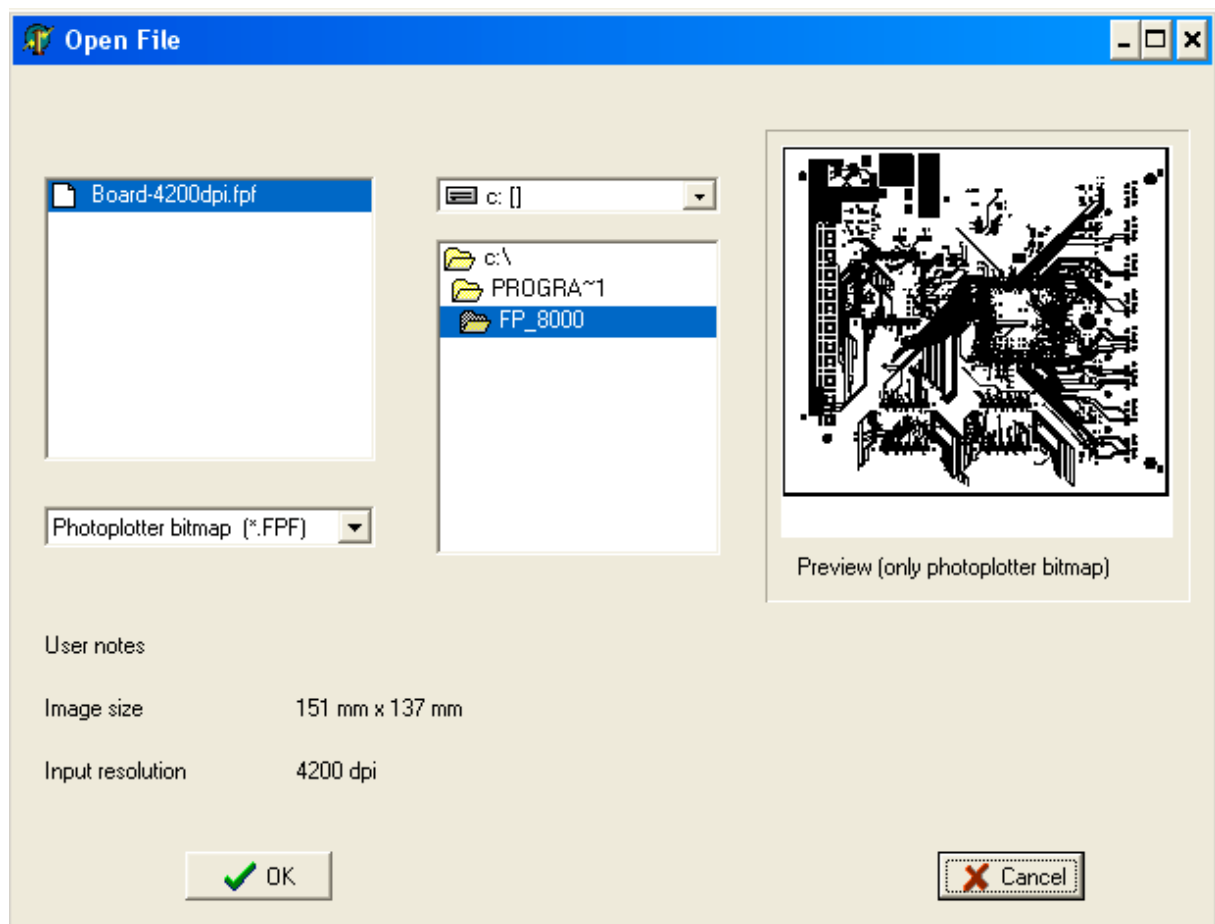
This program controls connected photoplotter. Reads in bitmap files in FPF (proprietary photoplotter format) and standard BMP format, allows to calibrate photoplotter, pre-set values for intensity of laser light and to set output parameters for plotting (plot resolution, negative and/or mirror plotting).

File - Open

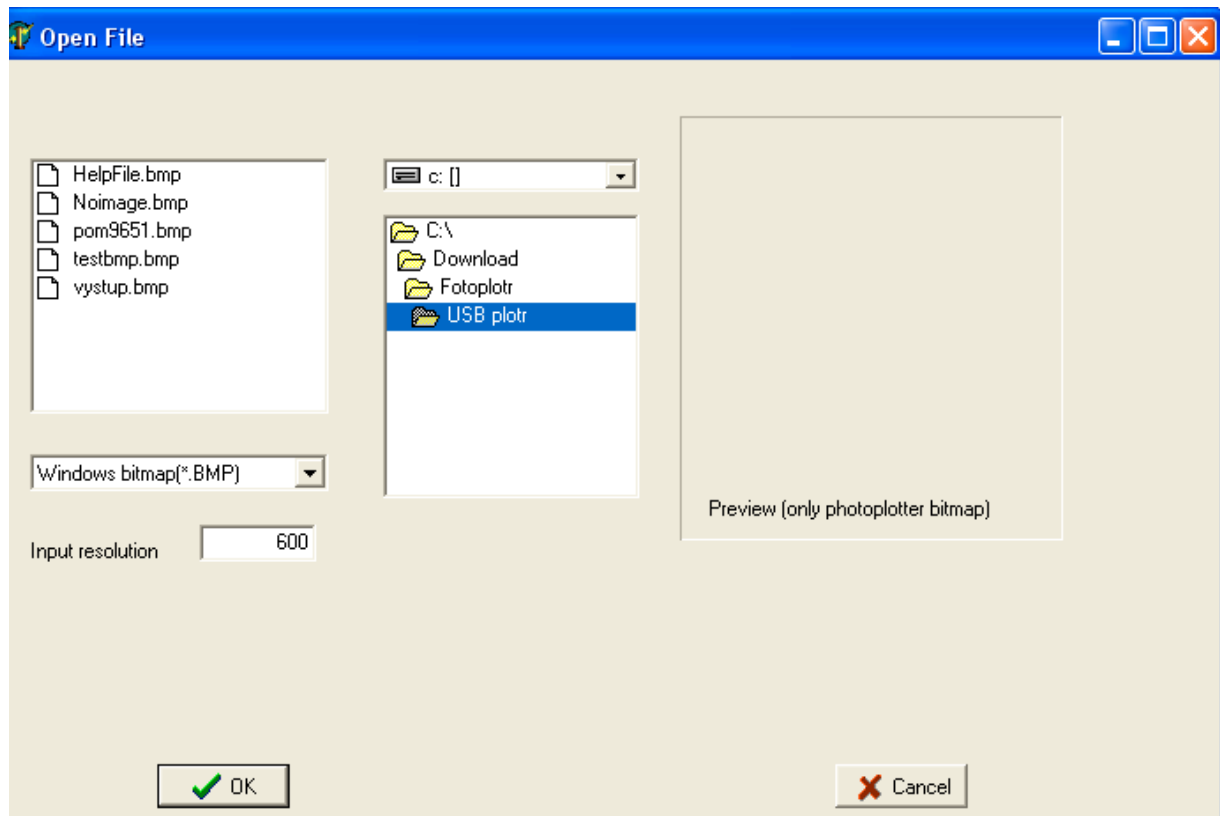
(or **F3**) command allows to read in input file generated previously in **Gerb2bitmap** program (**FPF** format) or Windows **BMP** format (see picture on the next page).

FPF file can be previewed before loading and its image size, resolution and user notes created in Gerb2Bitmap is displayed.

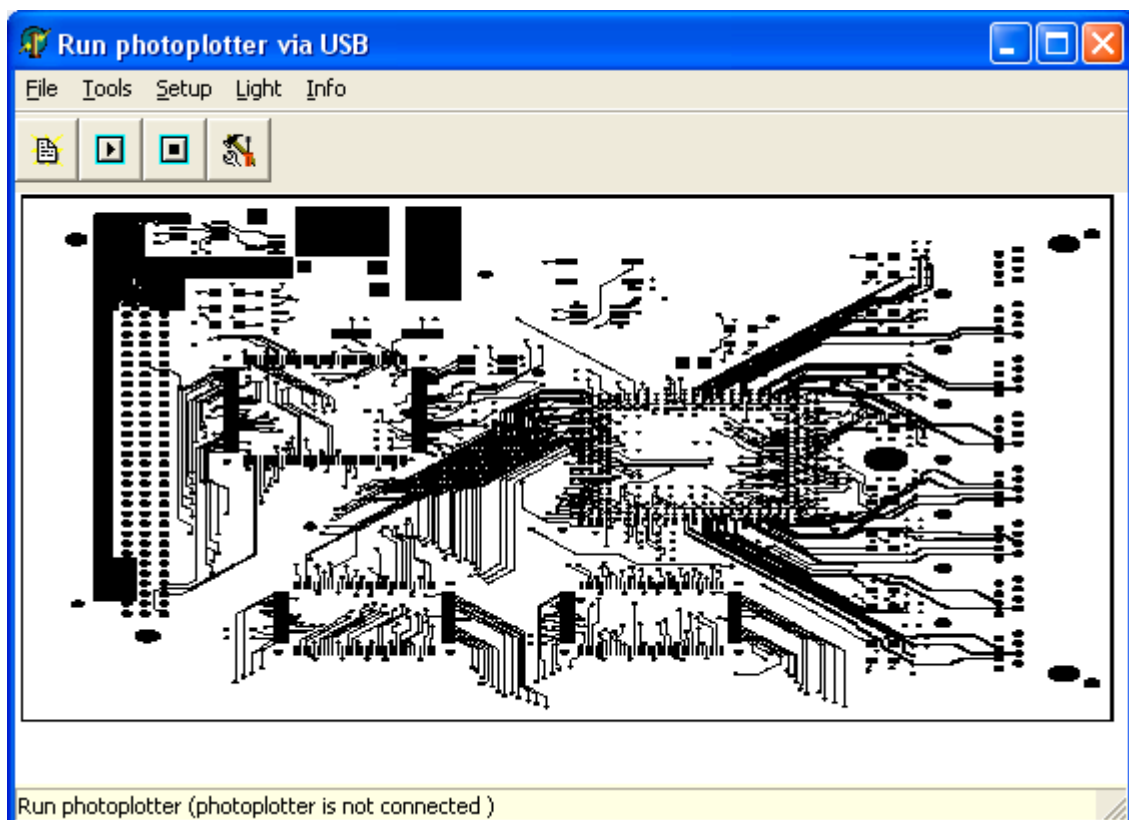
Please note, that image size is extended by 10mm on each side.



In case of BMP file, its image can not be viewed here. Its resolution **MUST** be entered in dialog window (Input Resolution). If input resolution value is entered wrong, the final plot will have wrong dimensions.



Selected file is loaded into program by **OK** button. Loading may take some time, depending on file size. If loaded file size is smaller than 14 MB, than its image is displayed, otherwise a message „File is too big to display, but plotting will be OK“ is displayed.



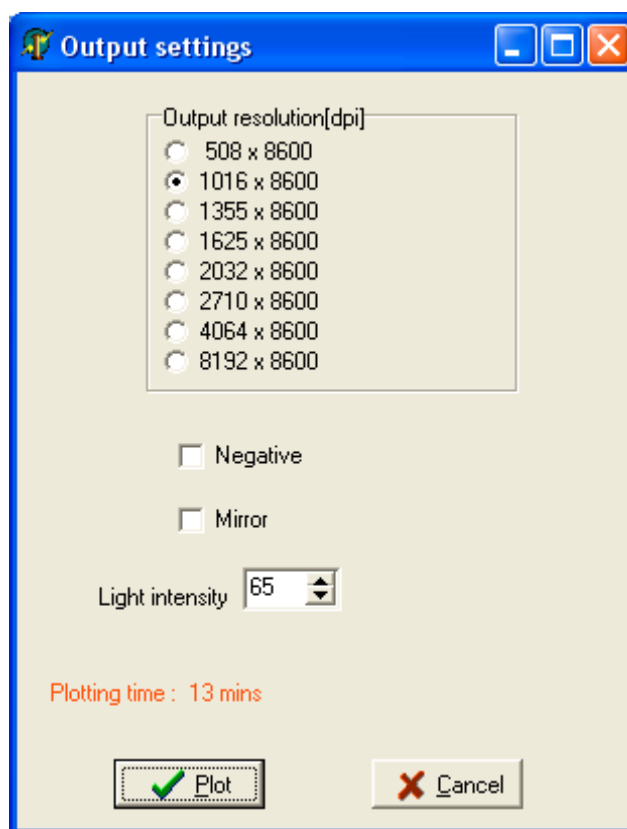
Please note, that loaded image does not need to appear correctly in both axis, usually it is compressed in vertical direction to save space on the screen. You can drag bottom side of the dialog window to make image look right, but keep in mind, that this image is here displayed only for your information.

When image is displayed, use **Tools - Run photoplotter** or button



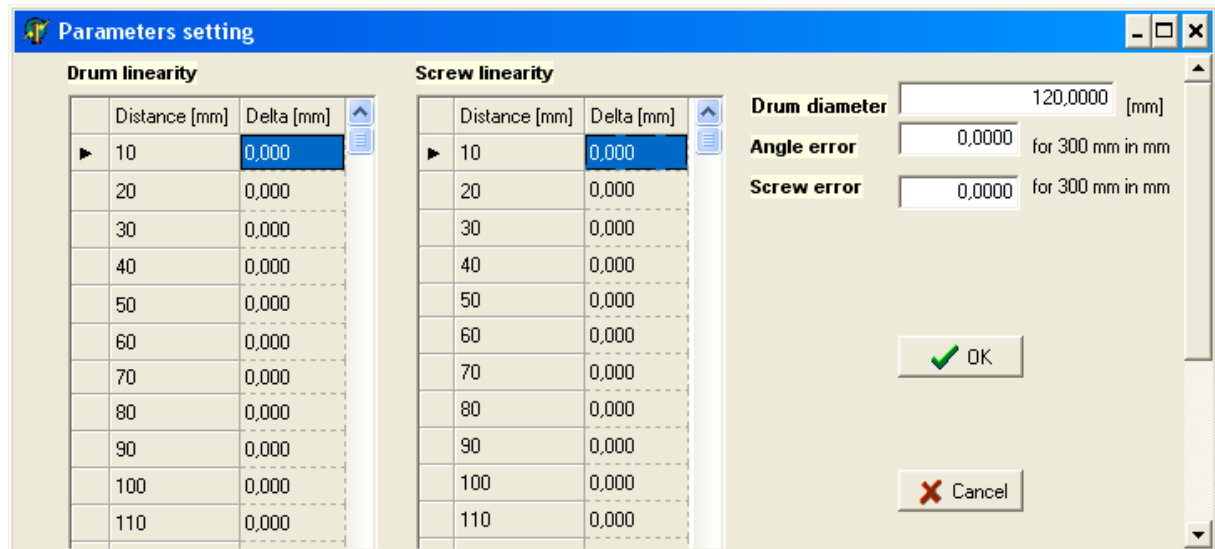
A new dialog box appears, where it is possible to set plot output resolution, reversed (Negative) and mirrored (Mirror) plotting. Time needed for plotting is shown automatically. Click on **Plot** will start the plotter.

The higher output resolution, the longer plotting time.



Setup - Setup Table

opens dialog window for plotter setup – here it is possible to define adjusted drum diameter, measured inaccuracy values in both screw axis and drum rotation (circumference) directions as well as plot angle error used for an automatic correction. This setup is unique for each photoplotter and that is why setup file (.phs) is supplied with each photoplotter. Use **Setup - Import** file (.phs) to load this data into setup table. User may modify this setting in setup table if needed and save it as a new file (.phs) using **Save**, as well as export it by **Setup - Export**.



Drum Diameter is a real drum diameter plus approximately (0.8 x film thickness). As it is an exact drum diameter, it is important to know the proper value – when this value is greater, the plotted line length in drum circumference direction is shorter and vice versa. It may be necessary to modify this value a little bit, to reflect different plotting conditions at the user site (temperature, humidity, film).

Angle Error represents a linear inaccuracy between the right angle plot and the real (non-right angle) plot on a line 360 mm long along drum axis. This is one half of vertical distance between corresponding horizontal lines of the two films, measured 360 mm from the left 0 position, while one of the films is flipped upside down.

Screw Error represents a linear inaccuracy of a screw in its axis direction for 300 mm distance.

Drum Linearity is measured inaccuracy for every 10 mm in drum rotation direction. If measured distance is longer for given distance from the beginning (for example measured distance is 120.09mm from 120 mm distance), then this positive difference is entered (0.09). If measured distance is shorter for given distance (for example measured distance 119.92 for 120 mm distance), then negative difference is entered (-0.08). Software will then automatically compensate for entered differences.

Screw Linearity is measured inaccuracy for every 20 mm in screw axis direction.). Software will then automatically compensate for entered differences.

Tools - Generate Test Grid

generates test plot file in shape of 10 mm line grid of specified dimensions (drum circumference and drum axis direction) and defined line thickness. This plot file will be automatically plotted with resolution 1016 dpi.

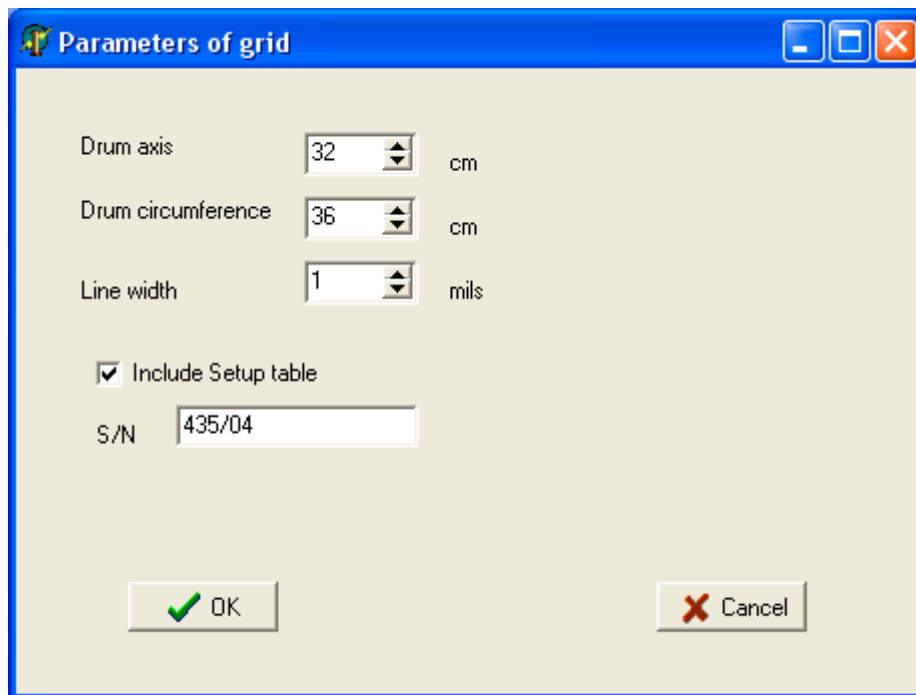
Test plot can be used as a check plot, where plotter accuracy may be measured – any inaccuracies in drum circumference or drum axis direction may be entered into setup table for related distance.

Plot size depends on values written in fields **Drum axis** and **Drum circumference**.

The grid lines are plotted with thickness specified in field **Line width**.

If **Include setup table** is checked, then setup table will be automatically included at the bottom of the plot.

If serial number of the photoplotter is written in field **S/N**, then this info will be also included on the plot.



Parameters of grid

Drum axis 32 cm

Drum circumference 36 cm

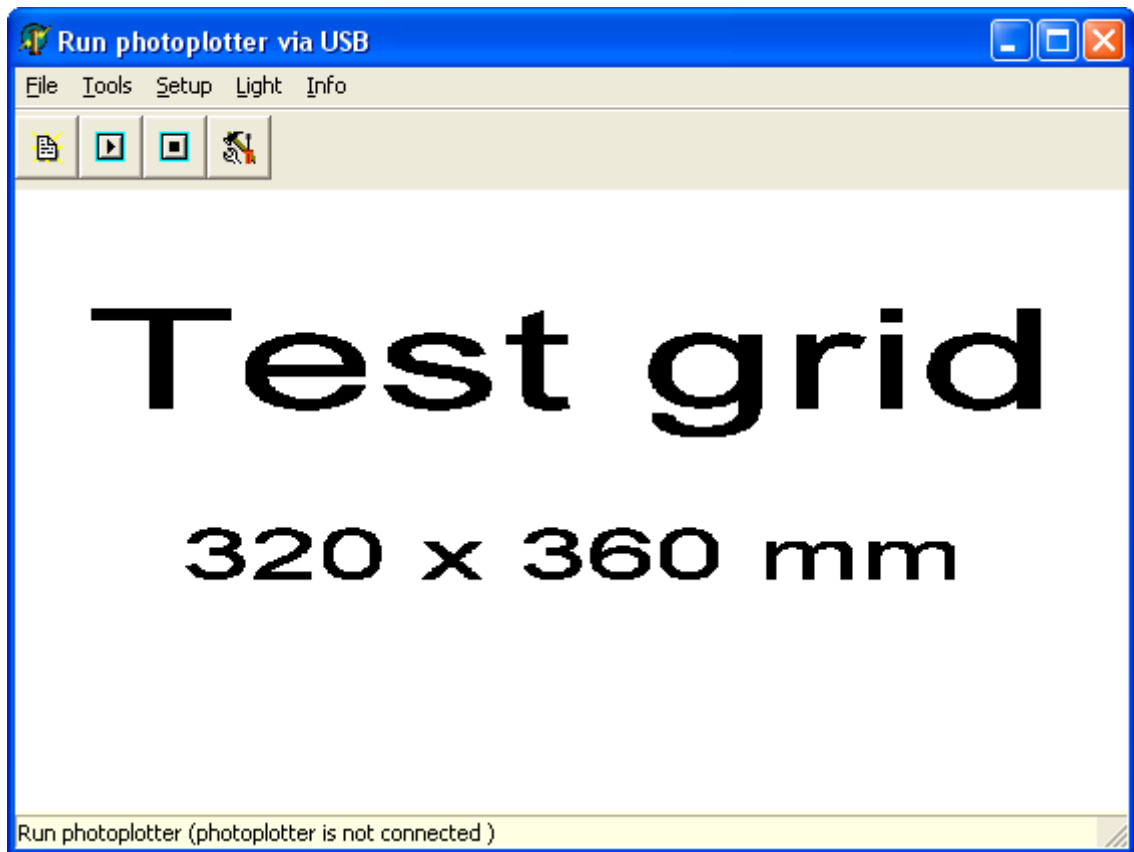
Line width 1 mils

Include Setup table

S/N 435/04

OK Cancel

Click on OK to continue – software will automatically generate test plot file, which can be now plotted as any other plot file.



Continue as with any other plot file – use **Run photoplotter** (Tools–Run Photoplotter or button)



Tools – Plot Light Bar

Will plot several small images in one row, where every image is plotted with different intensity of light according to preset parameters.

Light intensity starts with value entered in field **Initial light** on the first image.

Light intensity automatically increases with every next image by value entered in field **Increment**.

Number of images is set by value in field **Number**.

Click on button **OK** starts plot.

Plot light bar

Output resolution[dpi]

- 508 x 8600
- 1016 x 8600
- 1355 x 8600
- 1625 x 8600
- 2032 x 8600
- 2710 x 8600
- 4064 x 8600
- 8192 x 8600

Initial light: 170

Increment: 10

Number: 6

OK Cancel

Light

allows to pre-set values for **intensity of laser light** related to used film sensitivity and output resolution. For films with higher light sensitivity the values are lower.

Values go also down for higher resolution, regardless of the film, as less light is needed with finer image.

Intensity of laser light

508 dpi	70
1016 dpi	65
1355 dpi	60
1625 dpi	55
2032 dpi	50
2710 dpi	45
4064 dpi	40
8128 dpi	35

Ok Cancel

How to work with program Run_photo_USB:

Use **File - Open** (or use **F3**) to read in an input file, either **FPF** or **BMP**.

If you select FPF bitmap, image will be previewed as you browse across a list of FPF file in given directory. Also information on its resolution is displayed, as well as overall image size (+10mm on each side) and user notes attached to that image.

Information on FPF file resolution, image size and user notes is incorporated into FPF file automatically in Gerb2bitmap program. The input resolution value of selected FPF image will be automatically entered into this program, so there is no need to do that manually (see further).

If you load BMP file, image itself as well as information is not displayed. It is necessary to enter BMP image resolution in field Input resolution.

After you select file for plotting, click **OK**. The file is displayed as it will be plotted on film. Because bitmap files can be quite a large files, it takes some time to read them in to be displayed – be patient. If the input file is bigger than approximately 14 MB, file is not displayed to save time needed for display.

Click on **Run photoplotter** button to get a new dialog window where you set output resolution (**Output Resolution**). Check **Negative** to plot reverse (negative) image and /or **Mirror** to plot mirrored image. You can change intensity of laser light (**Light**) if needed, otherwise this value is pre-set in dialog window under **Light** command. Time needed for given file and set resolution is also indicated (**Plotting time**). Note, that for the higher resolution the longer time is needed.

Click on **Plot** button to start photoplotting. It takes a while for plotter drum to reach needed speed to rotate before it starts to plot. The remaining plotting time is indicated in top left corner of the dialog window.

Program ViewMate

This program can be used to view Gerber files before plotting them. If Gerber file is in extended format (RS-274X), it can be loaded directly by command **FILE- IMPORT- GERBER**. If Gerber file is in standard format (RS-274D), then associated aperture file must be converted into Lavenir's format first. Aperture file conversion is made in the following way:

Use command **FILE- IMPORT- APERTURES** to select given aperture file. To check that ViewMate will automatically recognize format of this aperture file, use button **GUESS TYPE** in the dialog window – a name of the PCB layout system where aperture file was generated will appear. Click on **OPEN** to read in that aperture file. Command **FILE- EXPORT- APERTURES** saves read aperture file under the same (or different) name with Lavenir's extension (**.env**). This new, converted aperture file can also be used in program Gerber2bmp (**File-Import apertures**) – load it after associated Gerber file is loaded into Gerb2bmp. After converting aperture file Gerber file can be loaded to be displayed for checking purposes.

5. Brief, step by step guide for photoplotter software:

5.1 Load Gerber file(s) into Gerb2bitmap program. If you load Gerber file in standard format (RS274-D), it may be necessary to **set parameters** (units, data format, colors,). To load Gerber data use **Job-Import Master Gerber** or an icon. Loaded Gerber data will appear as a red rectangle in right top corner – move it to top left corner of the grey (plotting) area by mouse (left button). At the same moment the name of loaded Gerber file will appear in the table field under GERBER for layer No.1 (plotting layer).

As an example, you can load Gerber file supplied with this software (directory SAMPLES). File Rs274x1.gbr and Rs274x2.gbr are Gerber files in extended format (RS274-X) and therefore there is no need to convert their aperture files. File Rs274_1.gbr and Rs274_2.gbr are Gerber files in standard format (RS274-D) and therefore their corresponding aperture files (Rs274_1.whl and Rs274_2.whl) must be converted into Lavenirs format (.env) before loading them into plotter program. Converted aperture files are also included (rs274_1.env and rs274_2.env) for any case.

5.2 Load corresponding aperture file, but only if the loaded Gerber file was standard Gerber file (**RS-274-D**). Use Job-Import Apertures or an icon APT. Make sure that this is done for the same layer as loaded Gerber data (**select layer under Active Layer**). Loaded aperture file and its D-codes can be viewed and edited in **Preference – Aperture Table**, or use an icon.

5.2b Load associated Gerber file(s) (if any) by **Job-Import Associated Gerber** or use GBR icon on selected layer (film) – **set layer(s) in Active Layer**. Corresponding images will be automatically placed in the same location on the film as the Master Gerber image. When Master image is moved or panelized, all related images are also moved or panelized. If Master image is deleted, all related images (files) are also deleted.

5.2c Load aperture file(s) for associated Gerber images. Make sure that aperture files are loaded on the same layers (active layer)

5.2c If you need to **panelize film** (to place several copies of the same image on one film), use **Tools –Panelize Board**, where you set number of copies and their mutual spacing. Then you need to panelize corresponding drill file by **Tools-Panelize Drill**.

5.2d If you need a robber strip around the image, use Preferences-Tech.Area to create it

5.2e Preview results of placement of loaded Gerber file(s) for selected layer by **Job-Preview** or use an icon.

Note: Command **Delete** deletes loaded image(s), Gerber files and associated aperture files). In case of panelization the image is deleted one by one.

5.3 Export loaded Gerber file(s) to hi-resolution bitmap file by **Job-Export Photoplotter Bitmap**. Specify the export file name (Export Name). Set the export file output resolution. The output resolution can be set in several preset values – 1016, 1350 and 2032, or in any value (Other..). Unless you have a specific reason, we recommend to use preset values. The exported file is displayed for checking purpose.

Selected output resolution has nothing to do with plotting resolution, as program Run_Photo_USB will read in this export file resolution, but plot with output resolution, which will be set in Run_photo_USB program. It may be an advantage to keep both resolutions the same, but in any case, the plotting resolution will always be recalculated from this export file resolution.

5.4 Load bitmap file (.fpf) generated in program Gerb2bmp into program Run_photo_USB by command **File-Open**. Selected file is shown in preview window, displays the overall image dimension (note that displayed image dimension is 10 mm larger on all sides) and any user note created when bitmap file was created in Gerb2Bitmap program. It is also possible to load hi-res **BMP** file by selecting this BMP type of file instead of Photoplotter Bitmap (FPF), but without preview, user notes and overall image dimensions – do not forget to specify BMP resolution in Input resolution field.

Loaded file will be displayed, unless the file is bigger than 14 MB. Note, that image axis X will become axis Y on the film on photoplotter drum, while image axis Y will be the horizontal axis of the film in photoplotter. Click on button **Run photoplotter** and specify desired resolution of the plot. If needed, you can specify **Negative** or/and **Mirrored** image to be plotted. Click on **Plot** button starts plotting.

When photoplotter starts to run, it needs some time to speed up the drum rotation. After drum reaches his working revolution, it rotates 30 times to make sure, the rotation is stabilized. After that plotter starts to plot and indicates time left for plotting. The front panel light labeled **Laser** lights to indicate plotting in progress. When plotting is finished or interrupted (**STOP** button), laser head will return to the initial position and drum will stop. Do not start plotting again, unless laser head has returned to its initial position.

6. How to make test films

Occasionally, it is needed to make test films, just to find out proper working conditions like light intensity or plot accuracy.

- **To make test film to find out proper light intensity**

Use strip of film, approx. 100 mm wide and 300 mm long and tape it to the drum (longer side over drum).

Use command **Tools – Plot Light Bar**, where you set parameters like initial light intensity, automatic light intensity increment and number of test images. Click OK and plot will start. As a result there will be a number of small images automatically generated by software which were plotted with light intensity starting from the initial one and increasing with every image.

Now it is easy to compare images and define the best one, where black area is completely black, but very thin lines are still clean and sharp, without grey surroundings (overexposed).

Make one more test if necessary. Enter value of light intensity of the best image for given output resolution into light label under **Light**.

- **To make test film to check plot accuracy:**

Use **Setup-Generate Test Grid Plot** feature. This will generate raster plot in shape of 10 mm line grid of specified dimensions (drum circumference and axis direction) and defined line thickness. Specify, if you want to include parameters from Setup Table (they will be plotted in small size at the bottom of the film). Plot two test films – they should be same when you mount them together. Rotate one of them 90 degrees, flip one of them horizontally or vertically, they should be same.

What to do if plot is not accurate:

- a) if overall dimension in drum circumference direction is wrong linearly (all or almost all grids in this direction are little bit smaller or bigger), change **Drum Diameter** in Run_photo_USB program under **Setup-Setup Table**. If dimension is smaller, decrease diameter value, if dimension is bigger, increase drum diameter. To estimate correct drum diameter use the following formula: multiply current drum diameter with ratio of measured distance on 300mm and 300 (or any other distance). For example, measured distance in drum circumference on 300 mm grid is 300.1, while current drum diameter is 157.45. New drum diameter will be $300.1/300$ multiplied by $157.45 = 157.50$
Please note that this drum diameter is not real drum diameter, but little bit bigger, depending on film size.
- b) If overall dimension in drum axis direction is wrong linearly, change **Screw Error** value in **Setup Table**. The value represents an error in dimension for 300 mm measured from 0 in drum axis direction. For example value -0.05 means that overall dimension is 0.05mm shorter for 300 mm (measured dimension for 300 mm is 299.95).
- c) If there are errors only in certain areas along the drum circumference direction, enter measured differences in **Drum Linearity** table for every particular grid where error appears.
- d) If there are errors only in certain areas along the drum axis (screw) direction, enter measured differences in **Screw Linearity** table for every particular grid where error appears.
- e) If lines drawn horizontally (in drum axis direction) are not perpendicular to lines in vertical direction (drum circumference direction), measure the difference between ideal horizontal line and drawn horizontal line at 300 mm distance from 0 and enter this value as **Angle Error**.

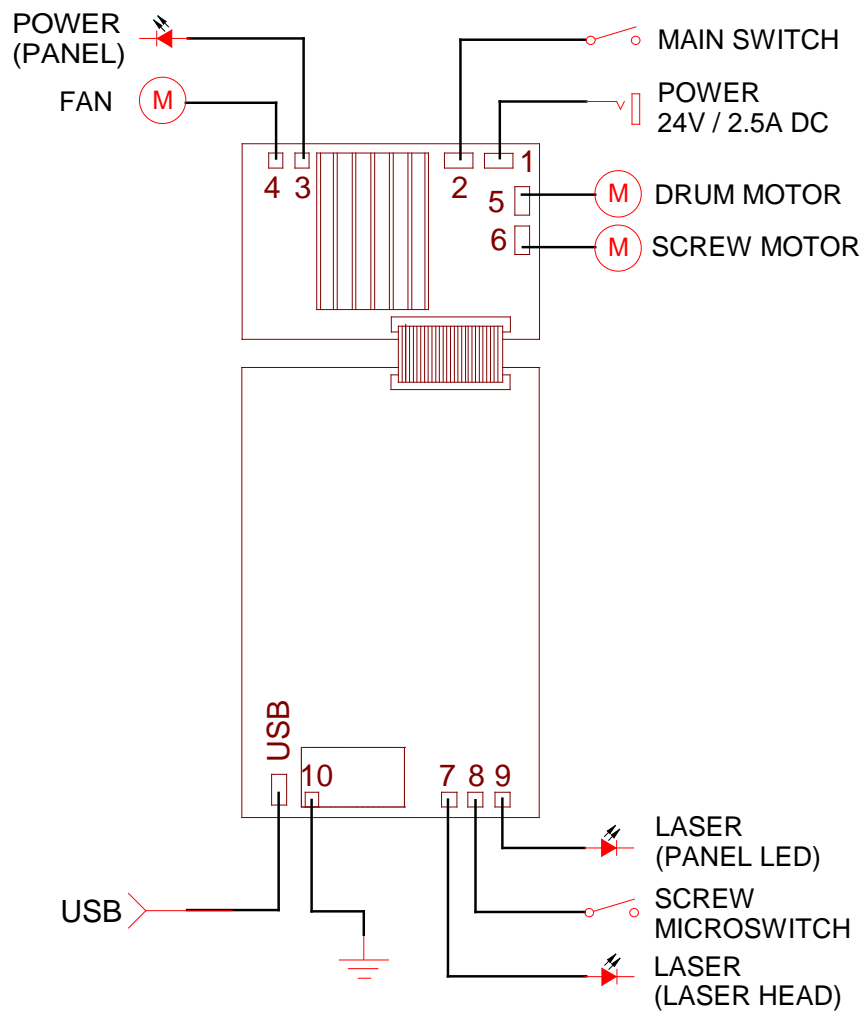
7. Photoplotter Maintenance

There are no serviceable parts inside photoplotter. Keep drum clean and protect inner space of the plotter from falling objects. Keep the lid closed at all times except loading and unloading film. Use basic cleaning chemicals and soft cloth to clean drum surface from sticky areas left behind by masking tape.

Note: If you need to open the plotter, remove all screws and carefully lift the upper part of the case just above the plotter and move it backwards – there are wires between this upper case and the bottom part of the plotter.

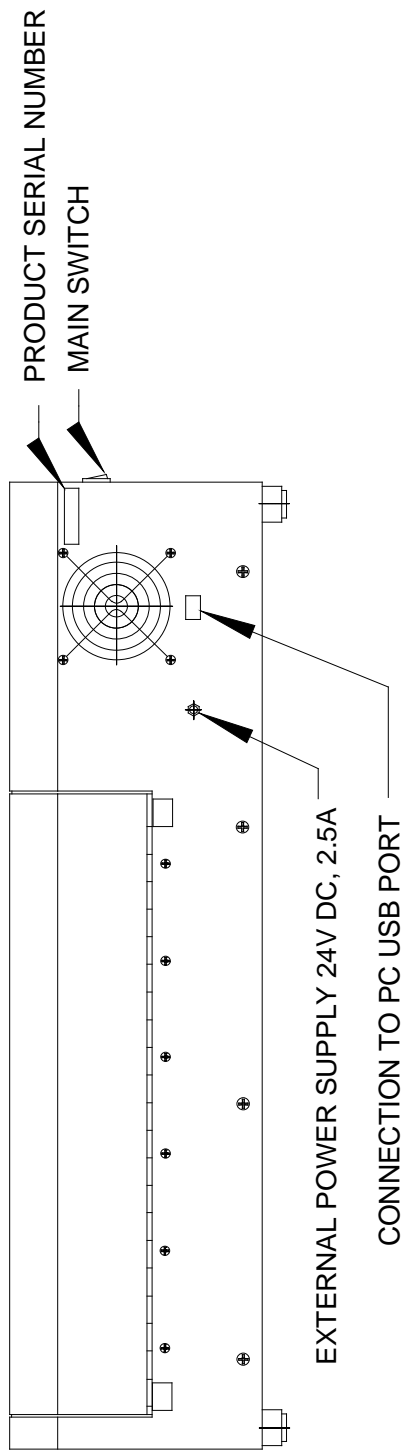
Photoplotter should be kept in dry place at room temperature (around 20 degrees Celsius).

Note: do not rotate drum by hand fast, as attached stepper motor generates then power that can damage photoplotter electronic circuitry.



**PHOTOPLOTTER 8000 DPI
PCB TERMINALS - CABLE BLOCK DIAGRAM**

BACK VIEW



TOP VIEW (WITH LID OPEN)

