

GSI Lumonics

POSTGRID User Manual

**Post-Objective
Grid-Correction Software**

**60 Fordham Road
Wilmington, MA 01887**

**GMAX™ SYSTEMS
MULTI-AXIS BEAM HANDLING**

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POSTGRID

1. INTRODUCTION

PostGrid is GSI Lumonics software for the generation of theoretical Grid-Correction files for Post-Objective Scan Systems.

PostGrid can only be used to generate Grid-Correction files for 2- or 3-axis Post-Objective scan systems. In Post-Objective scan systems the scanners are located after (post) the objective-lens. **PostGrid** can also be used to generate Grid-Correction files for scan-heads used without a lens.



NOTE

Grid-Correction files generated by PostGrid MUST NOT be used with any Pre-Objective scan systems. In Pre-Objective scan systems the scanners are located before (pre) an F-Theta lens, a flat-field lens or some other kind of lens.

1.1 Warranty

GSI LUMONICS (GSLI) warrants this product to be free from defects in materials and workmanship for 12 months from the date of shipment. GSLI will, at its option, repair or replace the product if it is defective within the warranty period and returned, freight pre-paid, to a service center designated by GSLI.

General Scanning requests that customers obtain a Return Authorization Number prior to returning units, and that they carefully pack units in their original packing or equivalent.

Under warranty, GSLI is not obligated to repair damage to any units resulting from the following conditions (customers are responsible for defining which conditions are applicable to their product):

- a) Personnel other than GSLI representatives attempting to repair or service the product.
- b) Improper use of the equipment.
- c) Connecting the product to incompatible equipment.
- d) Personnel other than GSLI representatives modifying the product.
- e) Scratches and chips on any optical surface after three weeks from the date of receipt.
- f) Damage to any optical surface from improper handling or cleaning procedures. This applies specifically to those items subjected to excess laser radiation, contaminated environments, extreme temperature or abrasive cleaning.

Customers assume all responsibility for maintaining a laser-safe working environment. OEM customers must assume all responsibility for **CDRH** (Center for Devices and Radiological Health) certification.



NOTE

There is no implied warranty of fitness for a particular purpose, and GSLI is not responsible for consequential damages. Individual components manufactured by GSLI or others may be covered by their own warranties. Refer to the appropriate manuals for this information.

1.2 Customer Support

GSI LUMONICS has support services available to you concerning problems with either the product or manual you are using.

Before calling for assistance, please make sure you refer to any appropriate sections in the manual that may answer your questions.

If you need further assistance:

The customer service personnel will be able to give you direct assistance and answers to your questions.



CALL

In the U. S.: (978) 661-4300

Outside the U. S.: +01-978-661-4300

... ask for the GMAX Customer Service Department

2. Installation

2.1 Installing with PC-MARK

Install **PC-MARK** first. Then install **PostGrid** in a sub-directory of your MARK directory. Just run the installation batch file by typing:

“a: install a: c:”

from your root directory. **PostGrid** will automatically be installed in the directory `\mark\postgrid`. The installation program places the file “*postgrid.bat*” in your `\mark\tools` directory so that you can start **PostGrid** anytime just by typing “postgrid” (assuming `\mark\tools` is included in your path).

2.2 Installing in a custom directory

Copy all files from the installation disk to your harddisk. **PostGrid** will run from any directory and does not require PC-MARK. However, the `postgrid.ini` file has to be in the same directory that you start the program from. Therefore it is advisable to place the file “*postgrid.bat*” in your root directory or another directory which is included in your path. You have to modify “*postgrid.bat*” to reflect the drive and path where you installed the **PostGrid** files.

2.3 Configuring PostGrid for Windows

A sample pif file, *postgrid.pif*, is supplied with **PostGrid**. Copy this file to your Windows directory (e.g. `c:\windows`). Use the pif-editor and change the startup-directory to the directory where you installed **PostGrid**.

You can create an icon for **PostGrid** by choosing “File-New-Program Item” from the Program Manager Menu. For the Command line type “*postgrid.pif*”. Select an icon from the `postgrid` directory. You can also associate all files with the extension “*inf*” with **PostGrid**. You can then start **PostGrid** with the parameters of an existing Grid-Correction file by just double clicking on the file with the extension “*inf*” from the file-manager. To associate *.*inf* files with **PostGrid** open the file manager, select your **PostGrid** directory, highlight the file “*sample.inf*”. From the File Manager menu select “Associate”. Type “*postgrid.pif*” in the “Associate with” box.

3. Theory of Operation

3.1 Grid Distortion and Correction

Due to the separation of the x- and y-mirror in 2-axis scan systems, a grid scanned with such a systems will show pincushion distortion. **PC-MARK**, GSI LUMONICS PC based Driver Software for Multi-Axis Scanning Systems (HPM and HPLK), uses Look-Up-Tables (LUT) and sophisticated interpolation algorithms to correct for such distortions. The Look-Up-Tables are stored in Grid Correction files (sometimes also referred to as Calibration Files). The Grid Correction data is actually stored in two files: one with the extension ".asc" (e.g. oc100a1.asc) contains the actual data in ASCII format, the other one with the extension ".inf" (e.g. oc100a1.inf) contains calibration parameters and information about the system the file was created for, and about the file itself.

It is possible to further manipulate the Grid-Correction files in order to compensate for any non-linearity in the system. Such a *Calibration* can increase the linearity of the system by a factor of 10. Special Calibration Software is available from GSI LUMONICS (9-point Grid Corrector).

3.2 Three Axis Systems

Three axis systems are systems containing a dynamic focusing module (also called a z-axis or Linear Translator or LT). The Grid-Correction files for these systems also store the information **PC-MARK** requires to keep the laser beam focused over the entire field. For the High-Performance version of the Laser Kits (HPLK) the data for the z-axis already contains the required amplitude and offset information so that further electronic adjustments are obsolete. This requires that the driver electronic (e.g. EDD card) is in the original factory calibrated condition and the Amplitude and Offset settings have not been changed.

3.3 Configuration Files

In order to generate the right Grid-Correction file for your system, **PostGrid** needs to have the appropriate information about your system. This information includes the maximum possible Scan Angle, the mirror separation, the distance from the y-mirror to the frame of the head as well as information about the optical system and the z-axis, where applicable.

All required information is compiled into a CONFIGURATION file which is available from GSI LUMONICS for all High Performance Laser Kits (HPLK), Laser Kits (LK), and XY Scan Heads. **PostGrid** comes with Configuration files for the most common systems. If you have a different or custom configuration, please contact GSI LUMONICS.

With the right Configuration file for your system, **PostGrid** will display important information about the system as well as the mechanical settings which are required for a specific Field Size or Working Distance.

4. Generating Grid-Correction (INF) Files



NOTE

For the sake of convenience we'll refer to Grid-Correction files as "*inf-files*" from here on.

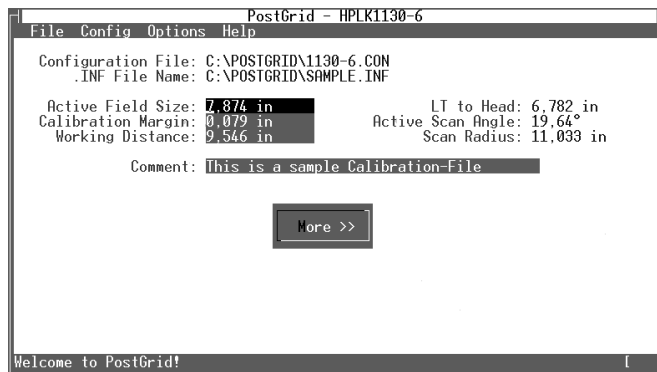
4.1 Getting help

After you started **PostGrid** you can use the tab keys or your mouse to place the cursor on a field. Press F1 for help on that field. Press **◆+** or open "Help-Instructions" for brief instructions. See "Help-About" for information about the program.

4.2 Starting the Program

Start **PostGrid** by typing "*postgrid*" at the DOS prompt or by clicking on the icon. The first time you start **PostGrid** it will use the parameters from the file "*sample.inf*" as start-up values.

Start Screen



The next time, it will start-up with the parameters from the Grid-Correction file you used last at your last session. If **PostGrid** cannot find this file (because you moved, deleted or renamed it in the meantime) it will give you a warning and use default parameters instead. **PostGrid** will also try to load the configuration file which is associated with that *inf*-file. If it can not find the Configuration file in its memorized path, it will insist that you try to find it somewhere else. You can just type "**.con*" in the File Name box and it will let you load any other Configuration file instead.

PostGrid can also be started with the parameters of an existing *inf*-file. For example, to start with the parameters of a file called "*myoldinf.inf*" you would type "*postgrid myoldinf*". In Windows you would just double-click on the existing *inf*-file.

You may load the parameters from an existing *inf*-file any time after you started **PostGrid** by selecting "File - Open .INF File" from the main menu. This is in particular helpful to generate new files for an existing system and can also be used to look at existing *inf*-files.

4.3 Choosing the right Configuration File

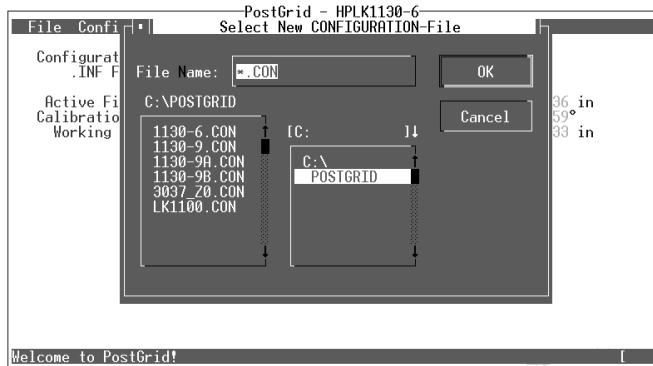
The first line of the **PostGrid** screen will tell you the name of the Configuration file the program is currently using. By clicking on “Config - System-Info” you can get more detailed information about the system configuration.

Screen:
 "System Information"



By clicking on “Config - Load Config File” you can browse through and load other Configuration files.

Screen:
 "Load Config File"



4.4 Entering Parameters

To enter parameters just type over the existing parameters in the field. Then press the ↔ or ♥ key to update all fields.

PostGrid allows you to enter three different parameters and a Comment line:

- a) The Active Field Size. This is the size of the field you want to scan.
- b) The Working Distance. This is the distance measured perpendicular from the target field to the frame of the Scan Head. This value has to match the distance in your system exactly in order to achieve undistorted scanning!

You can either enter the measured Working Distance and the program will display the resulting Active Field Size or enter the desired Field Size and the program will display the required Working Distance.

- c) The Calibration Margin: this is an area around the Active Field which is within the mechanical limits of the system but will be excluded from scanning through the software. A Calibration Margin can be used for several purposes:
 - to limit the Active Scan Angle of the system to a certain value
 - to achieve a specific Active Field Size for a given Working Distance
 - to provide a buffer region for additional calibration of the system

The recommended value for the Calibration Value is at least 1% of the Active Field Size.

- d) Comment: this is just one line of text which is saved with the INF file to help you remember what the file was generated for.

4.4.1 Field Size

Just enter the size of the field you want to scan. We recommend that you set the Margin to roughly 1 % of the Field Size. **PostGrid** will tell you the required Working Distance.

4.4.2 Working Distance

Enter the Working Distance you measured for your setup. **PostGrid** will tell you the resulting Field Size. To then adjust the Margin or the Field Size see below.

4.4.3 Specific Field Size for a specific Working Distance

To achieve a specific Field Size at a specific Working Distance proceed as follows:

- Set the Margin to zero.
- Enter the Working Distance. Hit enter.
- **PostGrid** will display the resulting Field Size.
- You can now reduce this Field Size by reserving part of it as a Margin. If you just enter a Margin the Working Distance will change. But if you then enter the right reduced Field Size the Working Distance will change back to what it was again.
- The Working Distance remains constant if
$$2 * \text{Margin} + \text{Field Size} = \text{old Field Size (with Margin} = 0).$$

4.4.4 Specific Active Scan Angle

Enter Working Distance or Field Size. Then adjust the Margin until the Active Scan Angle field shows the desired value.

4.4.5 Comment

Enter a one line comment in the Comment field to help you remember what the file was generated for. Your comment can be 255 characters long, but **PC-MARK** will only return the first 40 characters (using the *get_config* command).

4.5 Output Fields

4.5.1 LT to Head

3-axis systems only. This is the distance from the Linear Translator module (LT) to the Scan Head. Usually this distance is measured from the frame of the LT to the end of the objective lens closest to the head.

You can use this distance for the initial setup of you system for a specific Field Size. Due to the divergence of your laser beam you might have to move the LT to a slightly different position in order to achieve the best focusing. For some (older) systems this is only a relative value without a certain mechanical reference.

In either case you can define your own reference point and empirically find the offset you need to add to the number returned by **PostGrid**. The difference of the "LT to Head" value for two different Field Sizes will tell you how far you have to move the LT when changing from one Field Size to the other.

4.5.2 Scan Radius

This is the distance from the center of the Y-mirror to the target. The Scan Radius is different from the Working Distance only by a fixed mechanical offset.

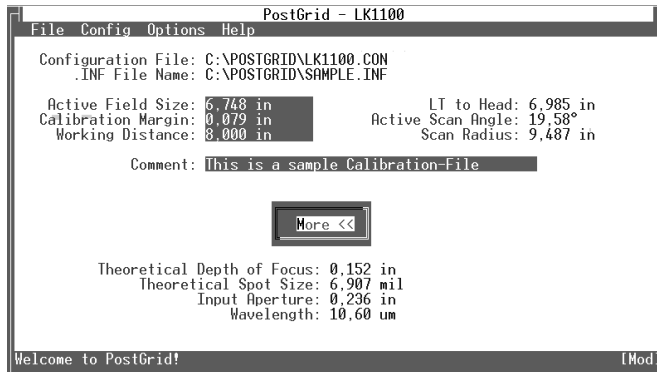
4.5.3 Active Scan Angle

The Active Scan Angle is the maximum deflection of the X- or Y-galvo when scanning the perimeter of the Active Field. Most scan-systems are capable of scanning 20 deg. However, the active angle can be restricted in software by specifying a "Calibration Margin" (see there).

The angle of incidence in the target will be the compound angle of X and Y.

4.5.4 The “More” fields

Screen:
"More" Field

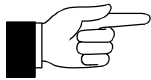


When available the “More” fields display the Depth of Focus and the Spot Size. These are theoretical values based on a laser beam with an M^2 of 1.3 and an e^2 diameter equal to the size of the “Input Aperture” of the Scan System.

These values should be used for relative comparison only and state by no means the values GSLI specifies for such a configuration.

5. The “Run Batch File” Option

PostGrid can start a batch file upon exit. It will pass the path and name of the last used *inf*-file to that batch file. This allows you to write your own batch files. The default name for the batch file is “*PGCOPDEF.bat*”. This name can be changed in the “POSTGRID.INI” file. You can find the PGCOPDEF batch file in your **PostGrid** directory. This file will copy the last used *inf*-file to your */mark/cal* directory into the file “*default.asc*”. This makes it easier to start **PC-MARK** and immediately use the newly generated file. Remember that the file will NOT automatically be active if **PC-MARK** is already loaded. You will still have to load the new *inf*-file using the *.set_config_file* command (see **PC-MARK** manual).



NOTE

**Make changes to PGCOPDEF to meet your needs and your configuration!
Be aware that PostGrid will remain in memory until the batch file terminates.**

6. Other Uses of PostGrid

6.1 Using PostGrid without a Configuration file

PostGrid will use built-in default values if you start it with a *inf*-file which does not reference any Configuration file. This makes **PostGrid** compatible with all existing systems and Grid Correction files because it lets you manipulate these “*configuration-free*” files and generate new ones.

If an *inf*-file references a Configuration file then you cannot open the *inf*-file unless **PostGrid** finds the referenced Configuration file or you specify a new Configuration file. To load a different Configuration file then the one which is referenced type “*.con” over the suggested file name in the “File-open” dialog. Then browse for the new file.

6.2 PostGrid as an INF-File Viewer

Use **PostGrid** to look at existing *inf*-files. It is more convenient and will give you more information than using a text editor to look at the contents of the file.

7. GLOSSARY

- Field Flattening Lens:* Designed for specific wavelengths, the lens focuses the laser to a small spot and maintains this spot size over the entire target field.
- Galvanometer:* A limited rotation magnetic torque motor with position feedback. The galvanometer (galvo) rotates a mirror to direct the laser beam.
- HelperCard:* A board that installs in your PC and provides a hardware link between the PC and the **XY10A** scanning module. It also provides I/O for laser control and parts handling.
- HPGL:* Hewlett Packard Graphics Language, a graphics format which the **PC-MARK** software can translate into usable laser graphics applications.
- HPM10A:* High performance module, the complete beam position package consisting of the **XY10A** Scan Head, PC **HelperCard**, **PC-MARK** software and interconnects.
- I/O-2:* An add-on board available as an option to the **HelperCard**. Features include opto-isolation and first pulse suppression option.
- JOB EDITOR:* A menu-driven applications program of **PC-MARK** that provides an extensive graphics user interface and file management. It allows the user to manipulate HPGL-based graphics and gives a real time preview of your mark.
- MCL.EXE:* A set of routines that optimizes and outputs vector lists. **MCL** is a low level program that serves two purposes:
- 1) Optimizing vector lists according to a set of control parameters when scanner is initiated.
 - 2) Controlling the scanner and laser system in real time.
- PC-MARK:* A command language that works closely with **MCL**. **PC-MARK** accepts application commands to place text and graphics in the marking field and translate them into the appropriate list of vectors. Users may also write their own **PC-MARK** application programs in one of the many popular software languages such as Pascal.
- Vector Scanning:* A process used primarily for line drawings. The laser spot is directed to follow the actual lines in an image. Vector scanning is analogous to the way a pen plotter draws an image. For example, a pen down command translates to "laser on".
- XY10A Scan Head:* The basic scanning configuration. The **XY10A** Scan Head consists of two galvanometers, mirrors, drive electronics, a serial interface, and an appropriate field flattening lens.

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