

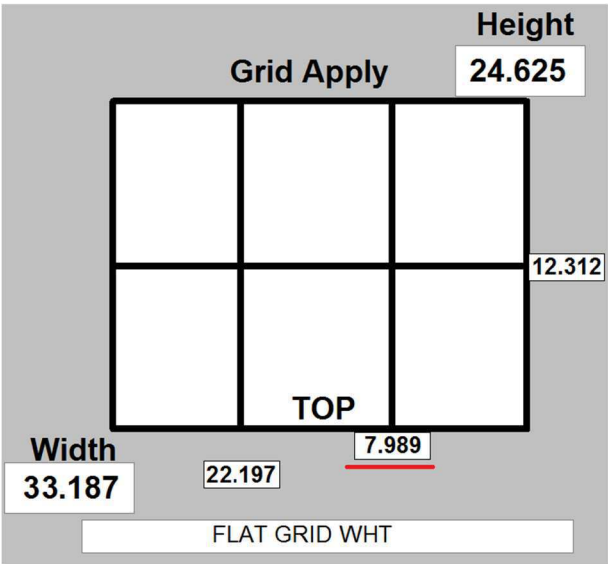
Investigating Grid Pattern Misplacement.

Section 1

When the laser projected grid pattern appears off, it may be for several reasons. It is critical for debug purposes to know exactly how and why these marks may appear off.

- 1) The glass must convey fully up to glass stop on the Grid Apply station.
- 2) There must be no slop or play of the Glass Stop side to side.
- 3) The spacer should be appropriately inset from the edge of the glass.
Spacer inset that is too deep or too shallow will misplace the grid but this is not a fault of the laser projector.
- 4) Measure to the center of the marks and compare this to the grid location values displayed on the grid apply screen (see below). Laser marks are measured as they touch the spacer, not from the glass surface or easel surface. If the grid clip is present but not pressed down, it may provide an erroneous target for the laser projection.

All measurements are from the edge of the glass to the center of the laser projected box.



- 5) If the measured values **do match** the displayed values, one or more of several problems is present:
 - a. The spacer is offset, offsetting the grids relative to the projected locations. Check and adjust;
 - b. The grids were made incorrectly.
 - c. The information sent from the server for the running list at the front of the line is incorrect;

Record batch, bin, slot, sequence or sync numbers (as applicable).
Record (if possible) the file from which the problem IG was loaded.
Please coordinate with IT and assembly to determine the culprit(s).

	SO	Svnc	Slot	I.G.	
Cap. Tube	2351774	187	373	0.563	GRID
Grid Apply	2351774	186	371	0.563	GRID

The laser projector is not currently at fault.

- 6) If the bottom (vertical) or right (horizontal) marks **do not** match the displayed value, laser offset adjustment may be required. (see below)
- 7) If the top and bottom **or** left and right marks do not match each other, laser software calibration is required.

Measuring Technique:

The projector displays relative to the edge of the glass, not the spacer. It is an easy mistake to look at the grids as they sit in the spacer and say that the grids are off.

Any measurement must be based from the edge of the glass:

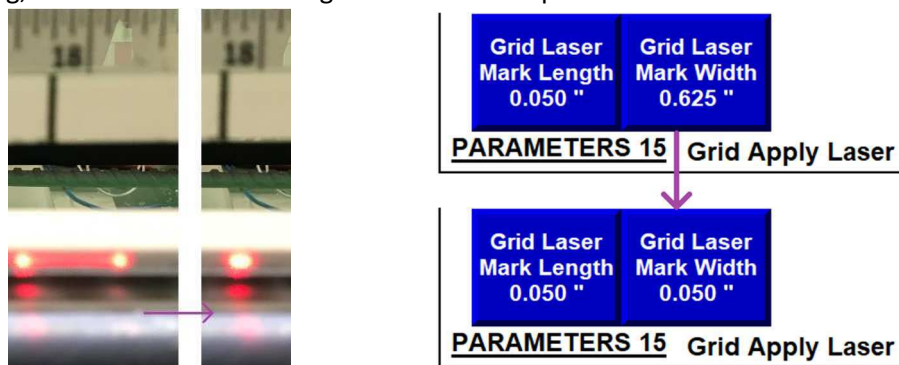
- **measured from the surface of the conveyor vertically,**
- **from the glass stop horizontally.**

It's tricky but necessary to measure from the edge of the glass. It is recommended that spacer or some other reference be used to measure off of the edge of the glass:



If the spacer or shim doesn't match the inset of the spacer from the edge of the glass, don't use it; use something else.

When measuring, it is often useful to change the size of the spacer box:



This may be done from the SAM operator interface in the parameter screens. Reduce the **Grid Laser Mark Height** or **Width** parameter.

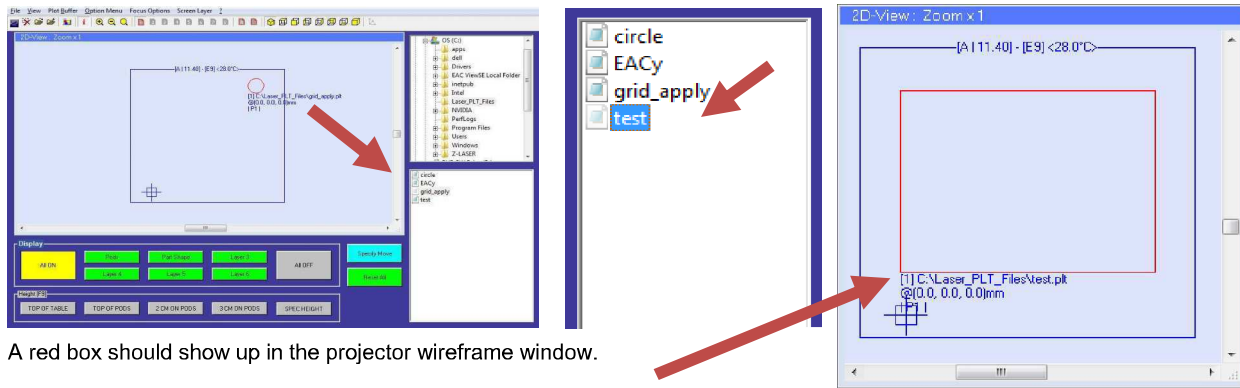
Note: position is measured from the center of the grid mark to the edge of the glass, not the edge of the spacer.

Z Laser Projector Calibration - LPM Software

Section 2

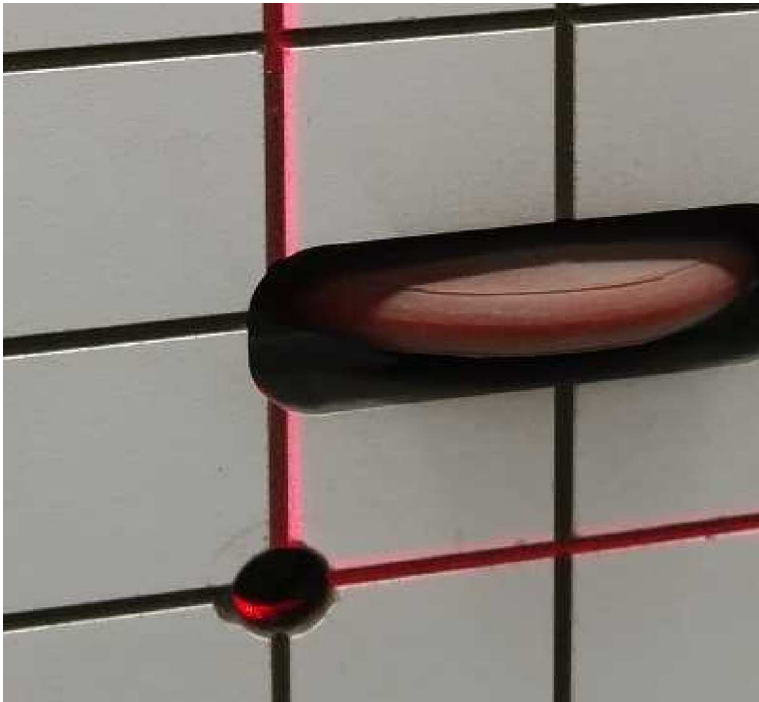
Run the Test Program

Make sure that the laser projector is on and has been running for 5 minutes.
Run the LPM (Laser Projector Manager) software (see troubleshooting below).
Expand the software window if necessary.
Double click the "test" file in the file chooser window in the lower right.



A red box should show up in the projector wireframe window.

Go over to the Grid Apply Station and examine the location of the projected laser box.
Each corner of the projected laser box should be centered in on of the 4 calibration holes.
Each side of the box should be nestled within a grid line connecting each calibration hole.
Each line must be straight and true to the grid line in which it is located.



In the above image, the left vertical side is inset toward the right slightly and is not "nestled" in the grid line. Calibration should be done to shift the left side by moving the bottom left corner out slightly

Note: due to slight variation in easel table height, the projected line may very slightly or seem to curve or bow slightly. While this is not ideal, it may be a necessary concession to assembly practices.

If all of these cases are true, **LPM software calibration is not required**. Please skip to the following section.
This test may be performed daily or as needed.

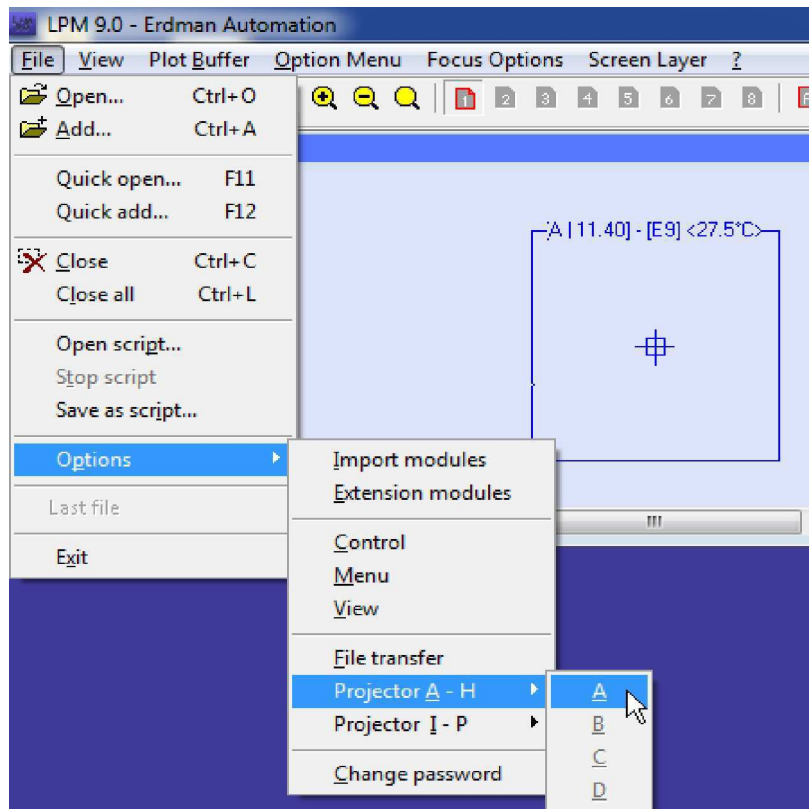
Z Laser Projector Calibration - LPM Software

Section 2

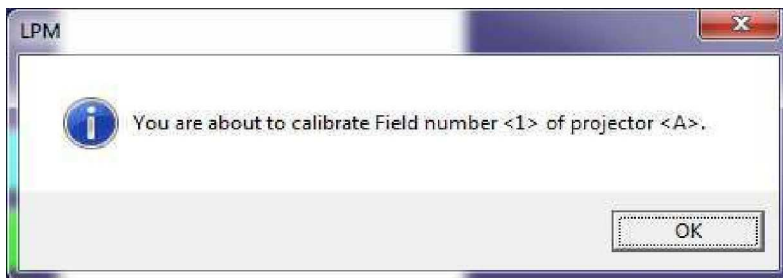
Calibrating the projector software.

Assuming that the wireframe is displayed, the software calibration routine may be run. MAKE SURE to that they key-switch on the laser projector is set to on.

From the "File" menu, select "Options," then "Projector A-H" and then "A" projector.



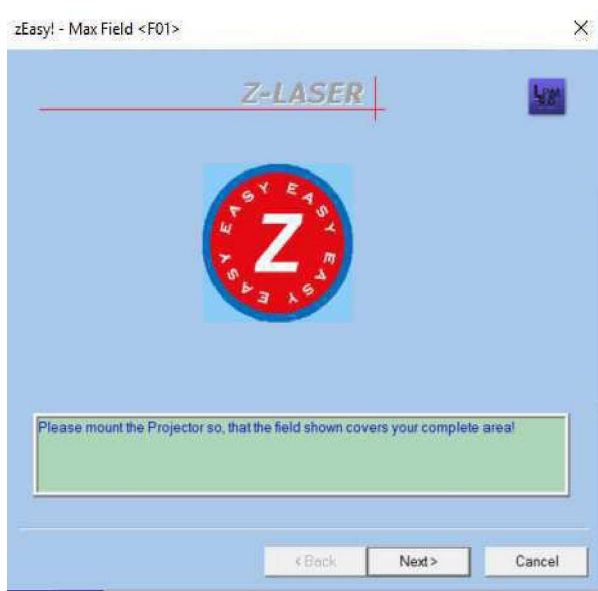
You are about to calibrate the laser projector for it's angle to the projection surface and topography. Enter the password as necessary: "cps".



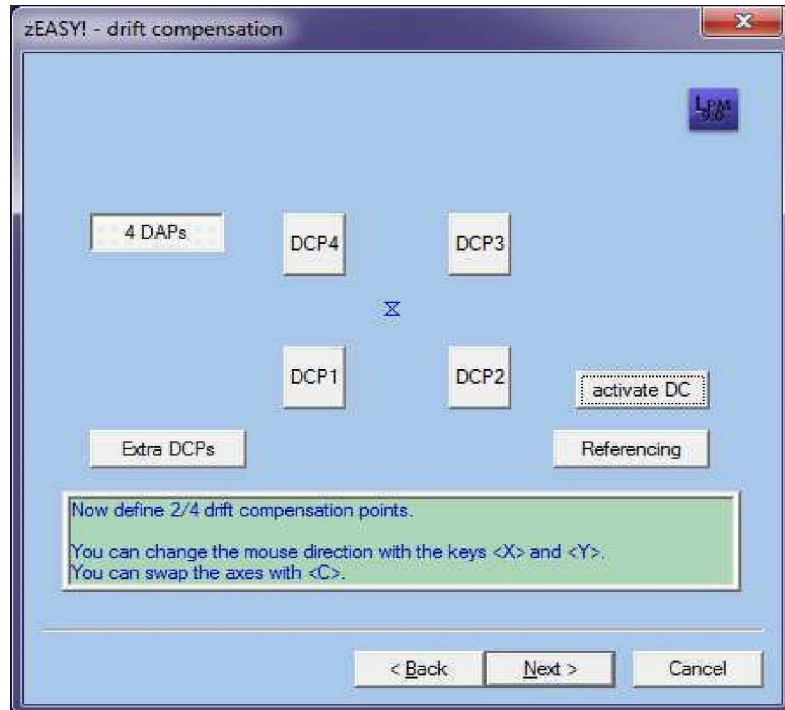
Click ok and begin the calibration.

Z Laser Projector Calibration - LPM Software

Section 2



This Max Field screen pops up next. The projector should display a large rectangle. This is the largest possible display area for the projector where it is physically mounted. If the rectangle at this stage does not exceed the glass positions by at least 2 feet in all directions. Its physical position must be adjusted.



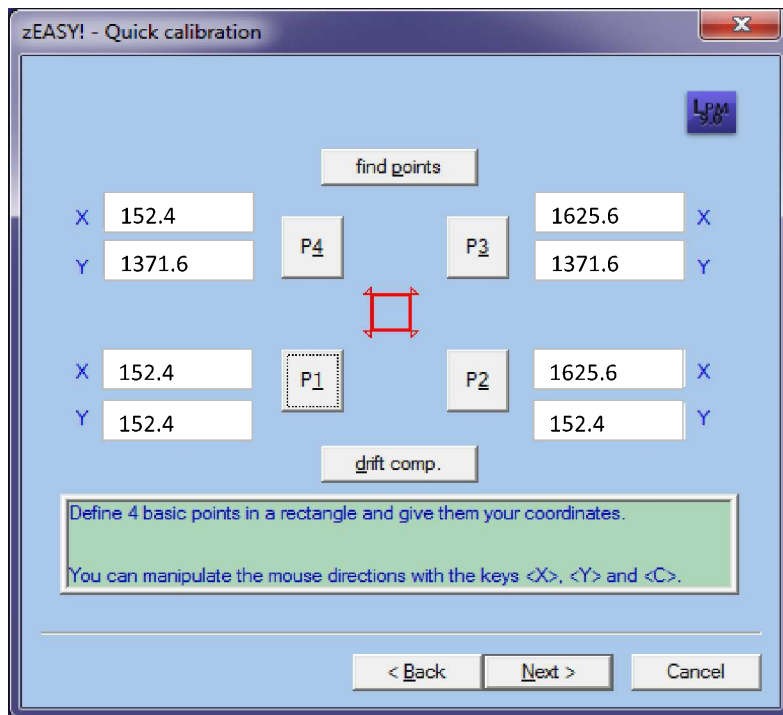
One of the first tabs is the drift compensation which allows the laser to automatically adjust for slight changes to the mounting or surface.

This feature uses reflectors and sensors to monitor for changes of the projection field relative to the camera (or the camera relative to the projection field).

This is not used. Disable drift compensation (DC) and then select Next.

Z Laser Projector Calibration - LPM Software

Section 2

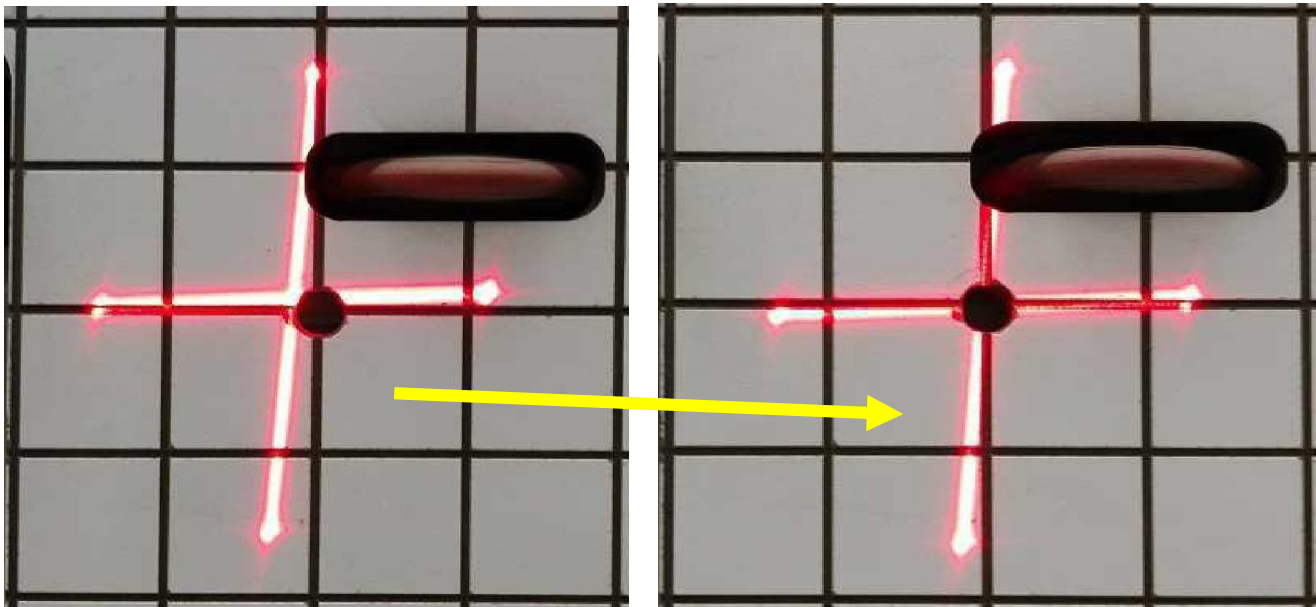


The next calibration screen comes up. The position of the 4 targets (referenced from the machine zero) in millimeters is already entered and should **not be changed**.

Note: Most production lines run infeed to the left, outfeed to the right; for these, P1, P2, P3, P4 are flipped horizontally when projected. P1 is in the lower right of the projected field while P3 is the upper left.

Press one of the P# buttons. The mouse will now change over to directly control the laser rather than the cursor. Move the laser target over each reference point. Please note: up and down or left and right may be reversed.

The arrow keys on the keyboard may also be used to make very fine changes to position.



Please note: As of this version of adjustment, the **reflectors are not required**; adjusting to the hole is sufficient. If used, the center of the reflector at the surface of the easel bed is the desired target. Do not use any spacers to hold the reflector away from the table.

Z Laser Projector Calibration - LPM Software

Section 2

Center the cross-hairs around the marker hole.

If the cross-hairs are not straight, vertically or horizontally, try to split the difference between up/down and left right.

In this case, make sure to double check the resulting test images closely.

You can also use the arrow keys to move the crosshairs very slowly.

Right click or press **ENTER** to accept or press **ESC** to cancel.

Repeat this process for all 4 points.

While no point is selected for adjustment, the laser displays a test pattern connecting each of the 4 points of the calibration rectangle.

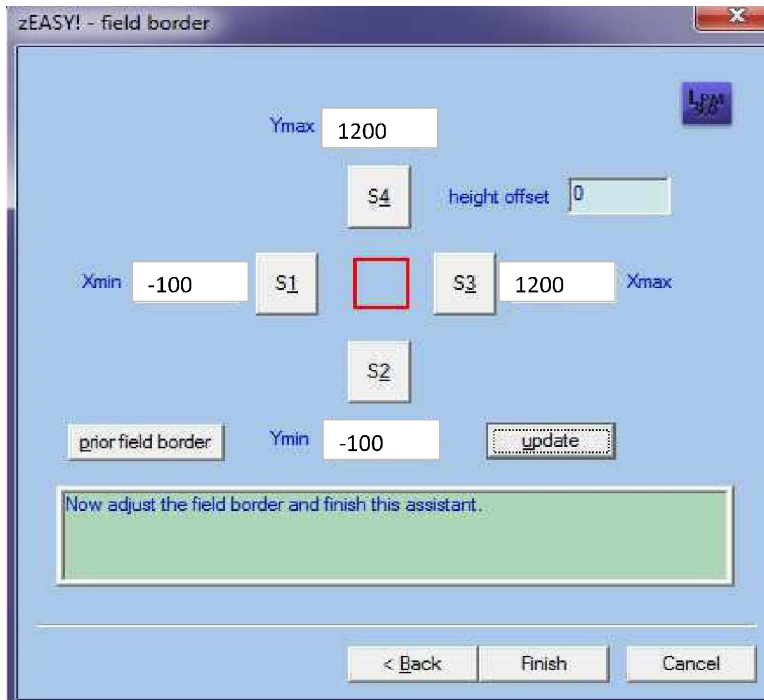
This is somewhat similar to the test pattern manually selected above and the same rules apply. Make sure that each line is fully nestled snugly into a etched-out gridline on the grid apply easel table surface.

If this is not the case, re-calibrate points on the offending line. Repeat as necessary.

Select Next

Z Laser Projector Calibration - LPM Software

Section 2



While initially setting the field boarder, the laser displays a test pattern connecting each of the 4 points of the calibration rectangle. This is somewhat similar to the test pattern manually selected above and the same rules apply. Make sure that each side is fully nestled snugly into a etched-out gridline on the grid apply easel table surface.

If this is not the case, go back and re-calibrate the P1-P4 points on the offending line. Repeat as necessary.

Next, set the borders (max / min) of the field projection. These correspond to the blue wireframe shown on the main LPM screen.

For the Ymax and Xmax, type in numbers that are larger than the largest glass converted to millimeters.

For the Ymin and Xmin, type -100.

Alternately, select S1-S4 and use the mouse to move the lines that appear off the easel bed.

Click the update button.

Click on Finish on the bottom.

Note, the calibration results are stored in the laser projector, not the local software so different computers may be used with the same results.

The **Grid Laser Calibration X and Y Offsets** must now be set from the operator interface. Please see the next section.

Grid Laser Calibration Operator Interface Offsets

Section 3

After the laser software projector is calibrated, it still needs to be offset slightly in the X and Y directions (left/right and up/down on the easel).

The software calibration teaches the projector to show lines that are straight and true and have the proper scaling.

Shifting the whole pattern is done with the Grid Laser Calibration Offsets.

Offset calibration must be done after software calibration.

It may be checked at any time and adjusted if necessary.

Adjusting Offsets from SAM HMI

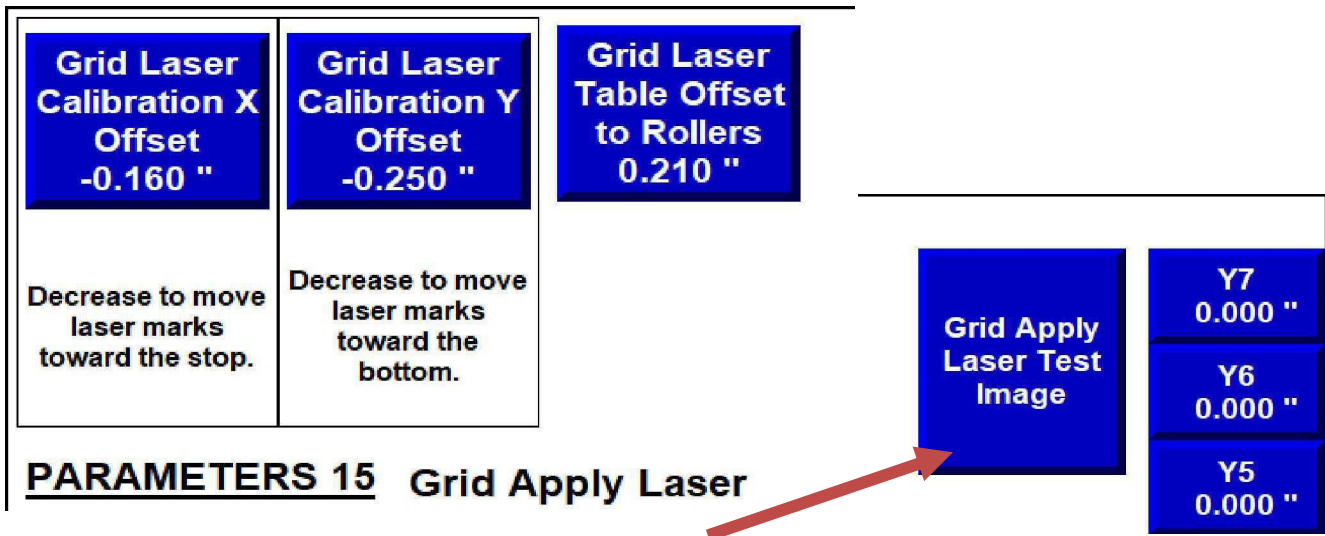
Make sure that the laser projector is on and has been running for 5 minutes.

Run the LPM (Laser Projector Manager) software.

Make sure the PC at the front of the line is running the "running list" software and each monitor on the line is showing the correct display. Take the line out of Auto Mode by stopping the Spacer Applicator Machine (SAM), finishing and outfeeding any product on the Grid Apply Station.

From the SAM HMI, go into the parameter screens and select "Grid Apply Laser" button in the middle right of the parameter index screen.

Unlike earlier renditions of calibration, there are only 3 parameter available from the SAM HMI to adjust the laser settings. Those three are "Grid Laser Calibration X Offset", "Grid Laser Calibration Y Offset" and "Grid Laser Table Offset to Rollers."



When the line is not running, select the "Grid Apply Laser Test Image" button from the Grid Laser Calibration Parameter screen (#15). The stop on the Grid Apply station will extend.

Make a unit with single strength glass (0.086") with 5/8 spacer (0.625"). **It is very important to use the correct height spacer and glass.**

Place the test unit on the grid apply station, **up tight to the glass stop**, flat on the belt and back against all the rollers it can contact on the roller bed. **There must be no slop or play in the glass stop.**

The grid laser projector should display a test image based on a pre-defined glass size (36"x24"). Grid marks will be displayed at 6" inches from the glass edge (check grid location values on the Grid Apply Parameter Screen (#15)).

**** For an alternate method run during production, see below.**

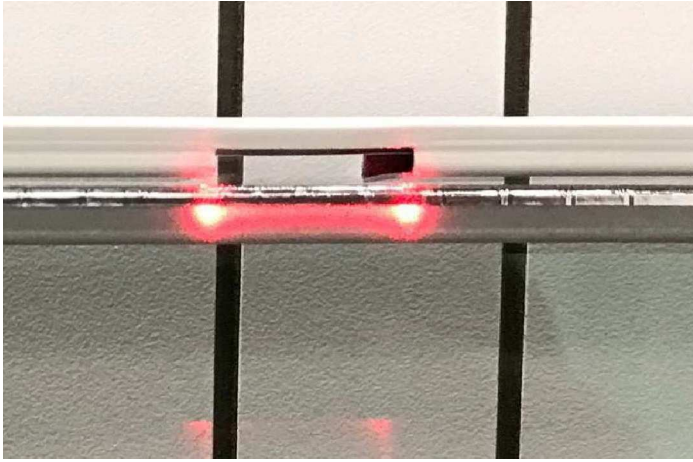
Grid Laser Calibration Operator Interface Offsets

Section 3

The best way to measure and adjust these offsets is with a calibrated reference.

Below, a 36" grid bar is used with 5/8" notches centered on 6.000", 18.000" and 30.000".

Place the reference against the spacer the spacer. Make sure the reference is up against the glass edge.



Adjust the Laser X and Y Calibration Offsets so that the laser projection lines up with the reference marks. Increase the value to raise the images up or left. Decrease to lower or move right.

Note: Compare the laser projection on the **spacer** to the marks on the reference. Do not be concerned about where the laser projection falls on the reference. Since the reference may have a different thickness than the spacer, the laser display will fall on it differently. Only the display shown on the spacer is relevant.



Grid Laser Calibration X Offset -0.220 "	Grid Laser Calibration Y Offset -0.250 "	Grid Laser Table Offset to Rollers 0.210 "
Decrease to move laser marks toward the stop.	Decrease to move laser marks toward the bottom.	
Grid Laser Calibration X Offset -0.270 "	Grid Laser Calibration Y Offset -0.250 "	Grid Laser Table Offset to Rollers 0.210 "
Decrease to move laser marks toward the stop.	Decrease to move laser marks toward the bottom.	

PARAMETERS 15 Grid Apply Laser

When done, disable the **GRID APPLY TEST IMAGE** key on the operator interface. The glass stop should retract and the laser software should revert to the default image (a circle in the upper left).

Offset Calibration is complete.

Grid Laser Calibration Operator Interface Offsets

Section 3

Alternate Method for Checking / Adjusting Offsets during Production:

The **Grid Laser Calibration X & Y Offsets** may be checked during production if there is any question of accuracy.

When glass is leaving or entering the Grid Apply Station press the GRID ACKNOWLEDGE push button. It should begin to flash.

The next unit that comes in will be staged to the glass stop (whether it has grid data or not).

Make sure the glass is **up tight to the glass stop**, flat on the belt and back against all the rollers it would contact on the roller bed.

There must be no slop or play in the glass stop.

On the Spacer Applicator (SAM) operator interface screen, go to the Grid Apply Laser parameter screen (often parameter screen #15)

Grid Laser Calibration X Offset -0.160 "	Grid Laser Calibration Y Offset -0.250 "	Grid Laser Table Offset to Rollers 0.210 "					Grid Apply Laser Test Image	Y7 0.000 "	
Decrease to move laser marks toward the stop.	Decrease to move laser marks toward the bottom.							Y6 0.000 "	
								Y5 0.000 "	
								Y4 0.000 "	
								Y3 0.000 "	
								Y2 0.000 "	
								Y1 12.312 "	
				Glass X Size 31.187 "	Glass Y Size 24.625 "				
Grid Description FLAT GRID WHT				Grid Apply Grid Locations					
X7 0.000 "		X6 0.000 "		X5 0.000 "		X4 0.000 "		X3 0.000 "	
X2 21.197 "		X1 9.989 "							
Grid Laser Mark Length 0.050 "		Grid Laser Mark Width 0.625 "							
				Previous Screen		Next Screen		Return to Index	

PARAMETERS 15 Grid Apply Laser

Select **Grid Description** and enter any text; "test" is a good choice but it does not matter.

Under **Grid Laser Mark Width** select 0.625" or the value required of your reference. For simple tape measuring (not recommended), select a smaller number such as 0.050".

Parameters **X1-X7** and **Y1-Y7** represent different grid locations. We will be using **X6 & X7** and **Y6 & Y7** because they are not likely to be used. Other parameters may be used but this may overwrite existing grid information.

Select X6 & X7 and Y6 & Y7. Set:

X6 = 6.00

X7 = 30.00

Y6 = 6.00

Y7 = 18.00

Using a calibrated reference, place the it against the spacer the spacer. **Make sure the reference is up against the glass edge** on the glass stop side or against the conveyor when measuring vertically.

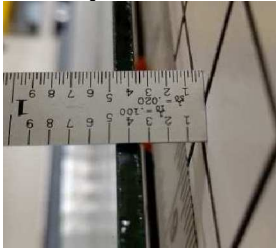
Proceed as above in the earlier method.

The glass may be sent on its way down the line when finished.

Grid Laser Calibration Operator Interface Offsets

Section 3

The **Grid Laser Table Offset to Rollers** is the distance from the surface of the roller bed to the physical surface of the easel - the white board with the black grid lines etched into it. This may be measured by placing a piece of glass at the station against the rollers and then measuring from the bed to the back edge of the glass.



This value may vary slightly over the table as the surface of the easel bed and should be measured multiple times for best results..

The surface of the spacer onto which the laser is projected is the sum of the **Grid Laser Table Offset to Rollers**, the **Glass Thickness**, and the **Spacer Thickness**.

These values are added together and sent to the laser projector by the PC at the front of the line.

This can be seen on the LPM software in the wireframe where the laser display is shown. (The LPM window may need to be maximized to show the whole window.) The value is displayed in the following example (in millimeters).

Grid Laser Table Offset to Rollers = 0.210"

Glass Thickness = 0.086 (single strength)

Spacer Thickness = 0.5625 (9/16)

$0.210" + 0.086" + 0.563" = 0.859"$

$0.859" * 25.400\text{mm}/" = 21.819\text{mm} \sim 21.8\text{mm}$

[1] C:\Laser_PLT_Files\grid_apply.plt
@ (0.0, 0.0, -21.8mm)

Note: if the z offset is 0.0 when displaying a grid pattern, the Running List display program is not correct. (However, the circle and test programs are both shown at the 0.0 level.)

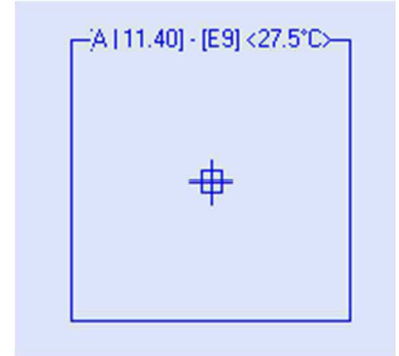
Running the Laser Projector Software

Section 4



Double-click the LPM software icon on the desktop or the Windows Start menu. The LPM software should start. If everything is working properly, the software should display a blue wire frame in the main display.

Software version may be 8.0 or higher.



If, alternately, a sweeping flashlight is displayed, that indicates that the software is NOT connected to the laser projector.

Note: contrary to the displayed message, the delay is not registration but the software attempting to connect communications to the laser projector. It is a lie.



Shut down the LPM software.

Make sure the Grid Apply station power is on. If not, pull out the E-Stop on the Grid Apply and Cap Tube stations; press the POWER-ON button. Wait for 5 minutes to allow the projector to boot up.

Retry opening the LPM software.

Restart LPM software.

If wireframe does not appear, cycle power to laser projector.

Shut down local computer.

Wait 30 seconds for laser to power up. Restart computer.

Restart LPM software.

Using a web-browser or terminal utility, confirm projector IP address settings and ping IP address.

If communications are not restored, the software may need to be re-installed.