Calibration Settings for Optimal Quality From the Laser Line Probe (LLP)

The Laser Line Probe (LLP) has many settings that affect the quality of the scan data. The defaults are a good place to start, but depending on the material you are scanning and environmental conditions, changing some settings may yield higher-quality scan data. Here is a list of all the settings and what they do.

General Settings

Choose the SCANNER SETTINGS button to show the LASER LINE PROBE CONTROL dialog box. When the Laser Line Probe is within the operating range, a line appears in the Preview Area of the dialog box.

- Disable the RANGE FINDER dialog box by clearing the Range Finder On/Off check box.
- Show visible light in the Preview window by selecting the Show Visible Light check box.
- Activate High Accuracy Mode by select the appropriate check box.

Scan Rate and Scan Density are used for data reduction. Reducing the number of points the laser probe collects can improve system performance, increase scanning speed and potentially reduce unwanted noisy data. For the Scan Rate and Points per Line specifications for your model LLP, refer to the Technical Specification Sheet for the Quantum Series FaroArm and ScanArm.

- **Scan Rate** - choose the number of scan lines per second. 1/1 is the normal rate of scan lines per second, set this to discard scan lines. Always use 1/1 for calibration.
- **Scan Density** - choose the number of points on each scan line. 1/1 is all of the points on the laser line, set this to discard points on each line. Always use 1/1 for calibration.

**NOTE:** Adding visible light to the preview window will decrease the number of frames per second sent to the computer and should only be used when diagnosing problems with the FARO Laser Line Probe.

**NOTE:** High Accuracy mode will improve the quality and 2Sigma value of your data but will reduce your field of view by half and shorten your effective maximum scan line width to 2/3 the normal width.

The Information frame displays the unique information for the current FARO LLP.

- **Serial Number** – Unique identifier for the Laser Line Probe.
- **Firmware Version** – Current firmware version loaded on the LLP.
• **Calibration Date** – Last Factory Calibration Date.

• **Max Pixel** - Indicates the highest return power to the Laser Probe’s CCD for a pixel. Basically this represents the highest intensity of the laser light as seen by a pixel on the CCD. 255 is the maximum and ideal value. Lower values could indicate the lens needs to be cleaned or poor optical quality of the surface, i.e. too much light reflectivity or absorbency.

• **Average Width** – Average width or thickness, in pixels, of the laser stripe as captured by the CCD.

• **COG Count** – The number of CCD columns with a defined COG (Center of Gravity). This represents the number of points the LLP can see in one laser stripe. 640 points per line is the maximum. You can consider the COG to be the centroid or point with highest return power of any given laser line cross section.

• **Dynamic Exposure** – When Automatic Exposure is selected, displays real-time exposure setting up to the maximum set exposure.

• **Saturation** – Average number of pixels per CCD column at maximum return power. Ideally 1 to 2 pixels should be saturated. Lower values could indicate the lens needs to be cleaned or poor optical quality of the surface.

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**Basic Settings for Calibration--V1, V2, and V3**

Below the preview window you find basic LLP settings

• **Material** - Choose any existing material setting from the MATERIAL dropdown window. Use the commands in this drop-down window to save material settings. Choose Save As in the MATERIAL drop-down window to save a material setting.

• **Auto** - Click the AUTO button to allow the LLP to calculate the best Exposure and Noise Threshold levels for the current material. Hold the laser in position, pointing at the surface, until the process completes.

You can also set the values manually:

• **Exposure** - How long the “shutter” is open and the sensor is exposed to light in the camera. Enter a number from 1 to 80; the corresponding value in milliseconds is displayed next to it. Light colors and reflective surfaces are better captured with low exposure levels. Darker colors typically require higher exposure levels.

• **Noise Threshold** – The LLP measures the intensity or return power of all CCD pixels and each pixel of the laser line projected onto a surface using a scale from 0 to 255. All data having intensity below the Noise Threshold value is considered noise or “chatter”; to faint to be usable and is simply ignored. 15 is the recommended average value for most surfaces. Dark colors or surfaces that tend to absorb light may benefit from a lower value. Increasing this value will filter out more data. Do not set this value to 255 as it will consider all data to be noise.

**NOTE:** CCD or Charged-Coupled Device is a sensor normally found in image recording devices like digital cameras. They contain grids of pixels that convert light into electric charges and later become digital images

• **Width Threshold** - When determining the COG for the laser line, groups/columns of pixels are analyzed. Width Threshold sets the minimum number of pixels that must be in a group (or CCD column) to be analyzed for COG calculation. The recommended value is 5 pixels. This means that if the CCD picks up several clusters of light in one column, due to angle of incidence, reflection or any other external interference, only clusters with at least 5 pixels will be considered COG candidates. Pixels must also meet the Noise Threshold criteria. Minimum value is 2.

• **Peak Threshold** - For a group of pixels in a CCD column to be analyzed and the COG calculated, at least one of the pixels must be above this value. The recommended value is 50. Increasing the Peak Threshold is useful with reflective surfaces that may shine or produce flares in the CCD. If a CCD column captures more than one laser light source, only the groups or clusters with at least one pixel at Peak Threshold will be considered. Must meet Noise Threshold and Width Threshold criteria.

• **Algorithm** - Select Fixed or an Automatic exposure setting.
• **Fixed** - The Exposure setting is constant.
• **Automatic** - The Exposure value is set as the maximum value. As you digitize the exposure automatically adjusts to maintain the proper saturation level. There are 3 preset Automatic exposure levels, for Low, Medium and High quality measurements. Low quality should be used on part with poor optical quality (too dark or too shiny) and high quality can be used for part with good optical qualities to get the best possible data. Any Automatic exposure setting adds an exposure indicator to the RANGE FINDER dialog box. A green dot in the upper left-hand corner of the RANGE FINDER will indicate that the exposure has been adjusted and you are ready to scan. The indicator can change to either a red “+” (plus) or “−” (minus) sign indicating that you are either over-exposed or under-exposed and self adjustment is taking place. The LLP will not collect data while it is adjusting. This process is very fast.

**NOTE:** In general, the default values for all settings described here will yield acceptable data on most surfaces. The Exposure parameter would require more frequent adjustments based on the different surface finishes being scanned.

Please keep in mind that there is no exact science as to what settings will work best on a particular surface given the vast range of colors, textures and finishes. Finding the optimum settings may require some trial and error.

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**Basic Settings for Calibration--Edge, ES, HD, FAROBlu, and Prizm**

Ideal settings are as follows:

- Make sure High Accuracy Mode is off
- Set Scan Rates and Scan Density to 1:1
- Set Algorithms to Automatic Normal

**NOTE:** Using Automatic – Normal guarantees that the device will compensate itself to optimum conditions rather than having the user set the exposure him/herself. In other words, let the device figure out what the best settings are.

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**Algorithms Definitions--Edge and ES**

<table>
<thead>
<tr>
<th>Exposure</th>
<th>What does it do?</th>
<th>When to use it</th>
</tr>
</thead>
<tbody>
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<td>Fixed</td>
<td>Keeps Exposure and Laser Intensity constant during use; no adjustment occurs while scanning</td>
<td>Parts with a uniform matte surface</td>
</tr>
<tr>
<td>Normal</td>
<td>Sets Exposure to a low value and automatically adjusts the Laser Intensity to acquire a good return on data</td>
<td>Parts with matte surfaces that are not dark</td>
</tr>
<tr>
<td>Full</td>
<td>Sets Exposure to the highest value and automatically adjusts the Laser Intensity to acquire a good return on data</td>
<td>Matte surfaces that are dark</td>
</tr>
<tr>
<td>Plastic Reflective</td>
<td>Sets Exposure to a high value and automatically adjusts the Laser Intensity. Reflective filter is automatically applied.</td>
<td>Reflective/shiny materials</td>
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</tbody>
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https://knowledge.faro.com/Hardware/FaroArm_and_ScanArm/FaroArm_and_ScanArm/Calibration_Settings_for_Optimal_Quality

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<td>High Contrast (HDR Mode)</td>
<td>Uses a dual exposure where the first exposure is looking for a high return (white-like surfaces) while a second exposure is looking for low return (black-like surfaces)</td>
<td>Parts consisting of dark and light (contrasting) returns within the width of the surface</td>
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Keywords:

LLP scanning best practices, getting the best scan data