LBP Series

LBP HR

Laser Beam Profiler for Windows

User's Manual

Newport

EU Declaration of Conformity

This is to certify that the accompanying product, identified with the CE mark, complies with requirements of the Electromagnetic Compatibility Directives.

Model name: LBP HR

Year CE mark affixed: 2007

Type of equipment: An optical beam intensity CCD profiler intended to be installed in a Host Computer. The device is constructed from a sensor head with an attached cable to the computer via USB 2.0 and control software.

Has been tested and was found to comply with the requirements of:

- EN 55022 Class B: “Information technology equipment – Radio disturbance characteristics – Limits and methods of measurement” (1998 + A1:2000 + A2:2003).
- EN 50024: “Information technology equipment – Immunity characteristics – Limits and methods of measurement” (1998 + A1:2001 + A2:2003).
- IEC 61000: “Electromagnetic Compatibility (EMC)”,

  Part 3. “Limits”;

  Section 3. “”Limitation of voltage changes, voltage fluctuations and flicker in public low-voltage supply systems, for equipment with rated current < 16A per phase and not subjected to conditional connection” (1995 + A1:2001).

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First printing 2007

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Newport Corporation

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This section contains information regarding factory service for the source. The user should not attempt any maintenance or service of the system or optional equipment beyond the procedures outlined in this manual. Any problem that cannot be resolved should be referred to Newport Corporation.

Technical Support Contacts

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Newport Corporation Calling Procedure

If there are any defects in material or workmanship or a failure to meet specifications, promptly notify Newport's Returns Department by calling 1-800-222-6440 or by visiting our website at www.newport.com/returns within the warranty period to obtain a **Return Material Authorization Number (RMA#)**. Return the product to Newport Corporation, freight prepaid, clearly marked with the RMA# and we will repair or replace it at our discretion. Newport is not responsible for damage occurring in transit and is not obligated to accept products returned without an RMA#.

E-mail: rma.service@newport.com

When calling Newport Corporation, please provide the customer care representative with the following information:

- Your Contact Information
- Serial number or original order number
- Description of problem (i.e., hardware or software)

To help our Technical Support Representative diagnose your problem, please note the following conditions:

- Is the system used for manufacturing or research and development?
- What was the state of the system right before the problem?
- Have you seen this problem before? If so, how often?
- Can the system continue to operate with this problem? Or is the system non-operational?
- Can you identify anything that was different before this problem occurred?

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1.0 Introduction

This manual describes briefly the main capabilities of the LBP HR – high resolution Laser Beam Profiler System with 12 bit resolution.

The LBP HR system is a beam diagnostics measurement system for real-time measurement of CW or Pulsed laser beams. It provides an extensive range of graphical presentations and analysis capabilities of laser beam parameters, such as: beam width, shape, position, power, and intensity profiles.

The LBP HR is based on a USB 2.0 CCD Camera, software driven device, which can be connected to a Notebook (or Desktop) computer via the High Speed USB 2.0 port.

Software version is user-friendly systems that present graphical and numerical information for intuitive interpretation of data in real-time.

Some applications for the LBP HR system, include:

- Laser beam optimization
- Quality control
- Gaussian fit analysis
- Beam alignment

Main Software Features

The LBP HR system software features include:

- Customer set pass/fail criteria
- Zooming
- Average
- User set threshold levels
- Data logging to a text file (up to 99 hours)
- Shutter and gain software controllable

- Trigger level software controllable for pulsed lasers
- Video with playback for future analysis
- Tile images in matrix format
- Printing of text and pictures
- Full on line Help routine

2.0 Overview

A basic LBP HR system includes the following items:

A CCD detector head:

LBP HR - a camera head for the 350-1310 nm wavelength range. The system comes with a camera, a standard USB 2.0 cable, a post, a set of 3xND-FILT in housing and 1xNG10 filter in housing, power supply 6V DC, software on CD disk, carrying case.

Accessories:

SAM1 - Beam sampler (ration $3x10^{(-3)}$)

SAM2 - Beam sampler (ration $1x10^{(-6)}$)

RDC - Beam Reducer (ration 2.5x1)

MountB - Mounting base

ND-FILT - 1/8ND filter, M37x0.75

NG-Filters - 1.6mm thick Schott colored filter in mount with adaptor, type: NG10 (optional)

Acc-Set – Full set of accessories

Windows Software
The installation and application software comes on a CD disk. OS supported are Windows XP/Vista.

User Manual
The user manual contains the same information as the On-line Help in the software. A README.TXT in the installation disk may have corrections to the manual and the on-line help. The user manual is saved as a PDF file on the software CD.

Mounting Post
The post is 105 mm long with 8-32 thread and is used for mounting the detector head.

QC test and calibration certificate.

2.1 Revision History

Any new editions of this manual will incorporate all material updated since the previous edition. Update packages issued between editions contain replacement and/or additional pages to be appended to the current edition. A “ReadMe.TXT” file is provided during the installation and may contain additions or corrections to the manual or the help file.

The manual printing date indicates its current edition. Updates and corrections to the current edition will be indicated.

- July 2007 – Revision 1.0

2.2 Precautions

The LBP HR system is a precision instrument and in normal usage will provide years of trouble free operation. However, several precautions must be taken to ensure proper function of the devices.

- The instrument must not be subjected to physical abuse. If the detector head is dropped it might be damaged.
- Temperature and moisture extremes can also damage the instruments. Make sure there is adequate ventilation for the host computer.
- Make sure you have a backup copy for the system CD disk, and that the software CD is protected from long term, direct exposure to sunlight and heat.
- When not in use, keep the Detector head and filter wheel inside the carrying case to prevent dust from accumulating on the sensor and the filters.
- Filters are provided with each LBP HR head. Dust, scratches and other types of contamination will degrade the accuracy of the system. Please keep unused filters in a storage case. Please be gentle when handling these fragile items.

- Laser Safety Rules: Please comply with all relevant laser safety procedures and precautions when using this device. The instrument will reflect a portion of the laser light. The resulting diffuse and specular reflections may be dangerous.

Contact Newport Corporation if you have any additional questions.

3.0 Theory of Operation

The main technologies available for laser beam diagnostics are:

- Using spatial cameras as the beam characterization system.
- Using moving mechanical slit, or knife-edges to scan across the incoming beam.

The main advantage of the mechanical scanning devices over a camera type laser beam profiler is the large dynamic range that allows accurate measurements of beams with both high and low intensities. On the other hand, camera type laser beam profilers are excellent for fast and detailed analysis of laser beam intensity profiles, but are limited in their accuracy due to a relatively low dynamic range.

The LBP HR Solution

The LBP HR overcomes the limited dynamic range of a camera type beam profiler and accurately measures faint laser beam structures by sampling the beam several times. Each measurement is performed at a different attenuation or electronic shutter speed.

The LBP HR analyzes both continuous wave (CW) and pulsed lasers, and accepts a wide range of input powers.

The video beam images are digitized with a 12 or 8-bit resolution (1024 or 256 digital levels) video capture. The digitized beam images are then stored in memory where a variety of analysis can be performed on the stored images. The images are then displayed on the VGA monitor according to the user-selected format.

Additional functions provide the ability to print information, transmit data via an RS-232 link to another computer, and control numerous video and calibration functions including shutter speed and camera gain.

Technology

The LBP HR uses a USB 2.0 video camera to image, capture, store, and perform two-dimensional intensity distribution analysis on laser beams.

CCD camera laser beam profilers are based on a mosaic of two-dimensional detectors called pixels. The two-dimensional mosaic-like detector instantly records the amount of energy impending on its surface, thus recording the optical pattern of the laser beam. The intensity distribution of the laser beam is recorded pixel-by-pixel and displayed as a two-dimensional topographic map or a three-dimensional isometric view.

The advantages of a CCD based laser beam profiler is fully utilized by powerful software that displays any structure larger than one pixel in vivid colors, calculates the beam distribution and profile as well as total beam intensity distribution, in order to allow full analysis of the laser beam's characteristics.

4.0 Specifications

This section describes the technical and system performance specifications.

Item	Specification
Camera type	Monochrome interline transfer 1.4 Mega-Pixel CCD ½" format
Sensor active area:	7.6mm wide x 6.2mm high.
Pixel size	4.65 µm (H) X 4.65 µm (V)
Spectral Response:	350 - 1310nm
Weight:	165 gr.
Power consumption:	6V, 4 Watts
Accessories included:	3X ND 1/8 filter in housing and 1xNG10 in housing, adaptor ring for filters.
	One X 8/32 threaded mounting hole
Trigger in:	Female RCA connector jack 4.5V square wave TTL output
PC interface:	High Speed USB 2.0 (480Mbits/sec)
RS232:	Data out
Operating temperature:	0ºc to 50ºc
Minimum host system requirements	Pentium IV, 2.4GHz 512MB RAM
	100MB HDD free
	64MB 24bit color VGA card, resolution 1024X768
	One free High Speed USB 2.0 port
	One CD ROM any type
	Windows XP/Vista
CE compliance	

System Performance with Software:	
Dynamic Range:	Up to 60dB not including filters.
Shutter speeds:	1µs to 0.6 sec
Software controlled gain	1dB to 23dB
Maximum frame rate	25Hz
Sensitivity:	~5nW/cm² at 633nm
	~60µW/mm² at 1310nm
Saturation intensity:	~2mW/cm²
Damage threshold	50W/cm² with all filters installed.
Operation with pulsed laser	Ability to capture and replay pictures and statistics from a slowly pulsing laser (1-100Hz) while filtering out frames with no laser pulse.
Hardware Triggering	In pulsed mode, sliding bar control allows setting of threshold so as to display only frames with captured pulses.

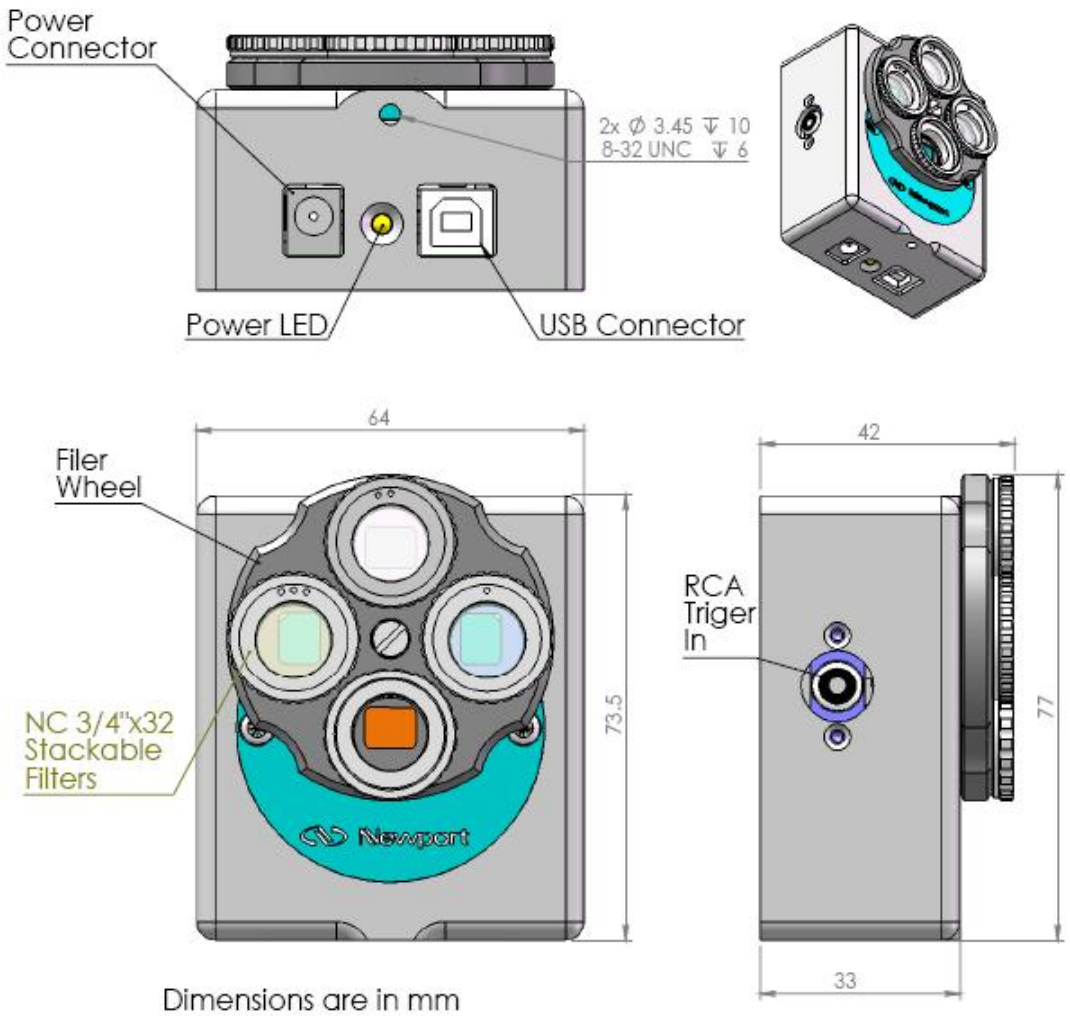


Figure 1 Camera Dimensions

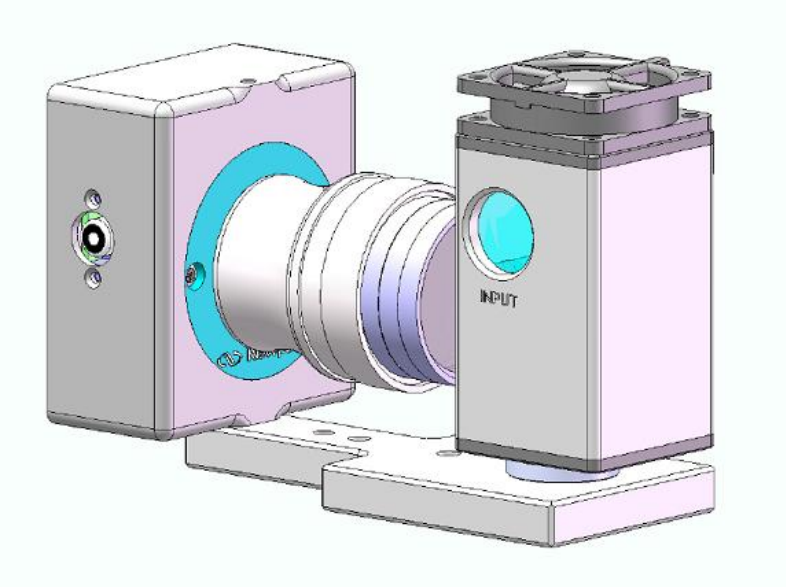


Figure 2 Accessories combination

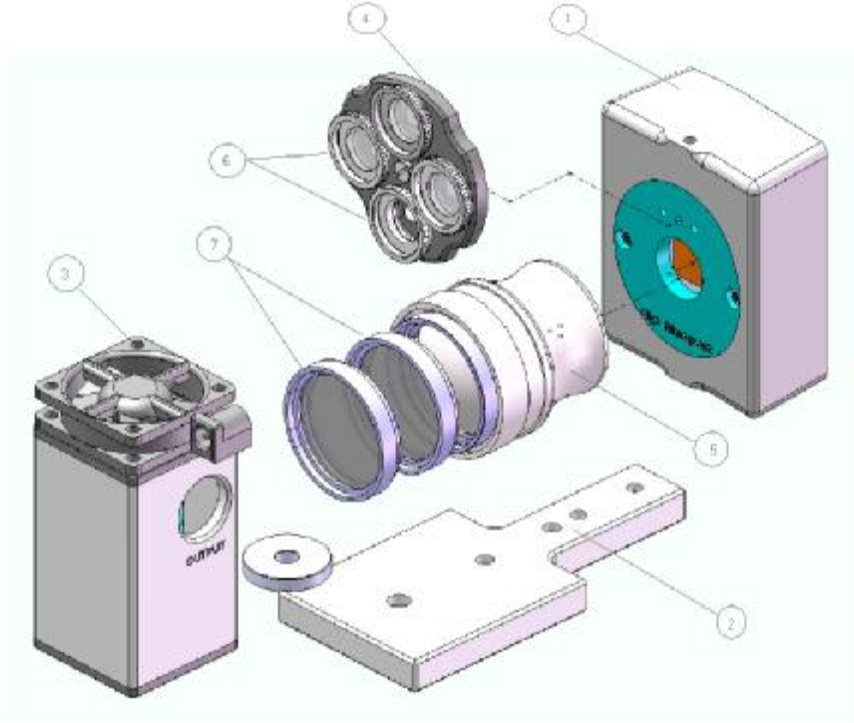


Figure 3 Full accessories set

1-LBP HR, 2-MountB, 3-SAM2, 4-Filter Wheel, 5-RDC,
6–NG filters and adapter, 7-ND-FILT

5.0 Quick Reference

This chapter provides brief instructions for operating your LBP HR. Full explanations of these various operations can be found throughout this manual.

To install the LBP HR USB 2.0 version:

1. Check **Hardware Requirements**
2. Follow **Software installation**
3. Connect the LBP HR CCD camera into a Hi-Speed USB 2.0 -compliant port..
4. Connect the power supply cable to the LBP HR USB 2.0 camera via the 6V jack and plug the power supply into the surge-protector outlet.
6. Follow **Hardware installation – USB 2.0 Camera**

To configure the LBP HR hardware and software:

1. Open the Settings menu and select **Hardware Setup**.
2. Click each tab and enter your hardware information in each window.
3. Repeat steps 1 and 2 for **Software Setup**.

To set up the laser beam mode:

1. From Hardware Setup, select either CW or Pulsed.
2. If Pulsed is selected, then the  icon is displayed at the **Control Toolbar**. Select a shutter speed that enables an acceptable saturation level.
3. If the image is still saturated at the fastest shutter speed, attach ND filters to the CCD camera until an acceptable saturation level is reached.
4. Further adjust the intensity level using the gain control
5. Adjust the trigger level using the  icon until you get a steady reading. It is best to move to the right until triggering stops, and then move back a little.

To measure the beam width:

1. Open the Settings menu and select **System Setup**.
2. Select the **Profiles** tab.
3. Set the three clip levels values.
4. Read the beam width values from the **Measurement Data box** or from **Statistics** window.
5. To view more detailed statistics, click  to open the statistics window.

To select the profile type:

On the **Control** Toolbar, click  for Sum Profiles or  for Line Profiles.

To view the centroid and/or beam peak:

1. Click  on the **Control Toolbar** for a 2D display.
2. Click  on the **Control Toolbar** to view the centroid.

To freeze the screen graphics:

Click  on the **Control Toolbar**.

To return to real-time measurement mode, click  on the **Control Toolbar**.

To print various screens:

1. To print the entire screen, open the File menu and select **Print Screen.**
2. To print the view area only, open the File menu and select **Print Frame**.

To save screen graphics:

1. Open the Options menu and select **Save image File**. A sub-menu displays.
2. Select the screen section to be saved: **Frame**, **Statistics** or **Full Screen**. The **Save image File** window displays. Select either a BMP or JPG file type.
3. Enter a filename for the saved screen graphic and click **OK**.

To save X-Y profiles:

1. Open the Options menu and select **Save data in text file**. A sub-menu displays.
2. Select **profiles.**
3. Enter a filename for the saved file and click **Save**.

To view and print a file:

1. Click  on the **Control Toolbar**. The **View File** window displays.
2. In the **Files of Type** field, select the file type for the file you want to view.
3. Select the file and click **OK**.
4. Click on print if you want to print the file.

To test a laser beam:

1. Click  on the **Control Toolbar**. The **Analysis Toolbar** displays.
2. To run the test, click  on the **Analysis Toolbar**. The **Test** window displays the test results.
3. To save the current test result in a bitmap or test file, click **Save** in the Test window.

To calculate a beam elliptical footprint:

1. From the **Control Toolbar**, click  to freeze the screen.
2. From the **Control Toolbar**, click  . The **Analysis Toolbar** displays.
3. From the **Analysis Toolbar**, click  . The LBP HR calculates the best-fit ellipse and displays it as a dotted white ellipse just around the edges of the measured ellipse. The best-fit ellipse parameters are displayed below the Analysis Toolbar.

To measure the distance between two points on the beam image:

1. From the **Control Toolbar**, click  to freeze the screen.
2. From the **Control Toolbar**, click  . The **Analysis Toolbar** displays.
3. From the **Analysis Toolbar**, click  .
4. Select the first point by placing the cursor on the beam image and click the left mouse button. Drag the mouse to the second point on the beam image and click the left mouse button. A straight line is drawn between these two points and the line distance calculation is displayed below the Analysis toolbar.

To create a data log:

1. From the **Control Toolbar**, click  to setup the data log. The **Log Setup** window displays.
2. Enter the information in the Log Setup window and click **OK**.
3. From the **Control Toolbar**, click  to start the data log function.
4. To view the data log file, open the File menu and select **View File**. Select the data log file you want to view and click **Open**.

To create a video:

1. Open the Settings menu and select **Video Properties…**. The **Video Properties** window displays.
2. Enter your information and click **OK**.

3. Click  on the **Control Toolbar**.

To play a video file:

1. Click  on the **Control Toolbar**. The **Playback Toolbar** displays.
2. Click  on the **Playback Toolbar**. The **Open Video File** dialog displays.
3. From the Open Video File dialog, select the video file you want to view and click **Open**. The video file displays.
4. Use the **Playback Toolbar** buttons to play the video.
5. Click  to close the video file.

To work with still images:

1. To capture a still image, click  on the **Control Toolbar**.
2. To view a single still image, position the cursor on the still image icon at the **Status Bar** and click the left mouse button.
3. To close an opened still image click the close button in the upper right corner of the image window. If you want to save the still image, click **Yes** in the Still Image window.

To measure two beam's centroids simultaneously:

1. From the **Control Toolbar**, click  to select the first Region of Interest.
2. Move the small rectangle marking  to the first beam presentation on the screen, magnify or shrink it to the proper size by graphical means (using the mouse).
3. From the **Control Toolbar**, click  to select the second Region of Interest.
4. Move the small rectangle marking  to the second beam presentation on the screen, magnify or shrink it to the proper size by graphical means (using the mouse).

To work with snapshot files:

1. To create a snapshot file, open the **Options menu** and select **Save Snapshot**. The **Save Snapshot File** window displays. Enter a filename for the snapshot file and click **OK**.
2. To view a snapshot file, open the View menu and select **Snapshot**. The **Load Snapshot File** window displays. Select a snapshot file and click **OK**. The snapshot file displays. Analyze the measured results by activating the system tools.
3. To close a Snapshot file, open the View menu and select **Snapshot**. The LBP HR restores real-time measurement displays.

To transmit serial data over an RS-232 link:

1. Open the File menu and select **Link Setup**.
2. Click the **General** tab and enter your information.
3. Select the **Port Settings** tab, enter your information and click **OK**.
4. Connect the LBP HR computer to another computer using a null-modem cable.
5. Enable the receiving program to receive the file/data.
6. Open the File menu and select **Start Link**. If you are transmitting data, the LBP HR automatically starts sending the data. A link-in-progress message displays in the menu bar.
7. If you are transmitting a file, the **Link File** window displays. Select the file you want to send and click **OK**. A link-in-progress message displays in the menu bar.

5.1 Software General Layout

This section covers the basic layout of the LBP HR software.

The LBP HR window display consists of display and control elements similar to most Windows applications along with elements specific to LBP HR interface.

5.1.1 Title Bar

The title bar displays the name “LBP HR USB 2.0”, and followed by the CCD detector SN.

5.1.2 Menu Bar

The Menu Bar lists menus available for LBP HR system. The menus contain commands and other sub-menus or dialog boxes to be displayed which provide controls of various functions: graphics, analysis, setup configurations. All functions can be activated via the menus, some functions can also be activated via the Tool Bar.

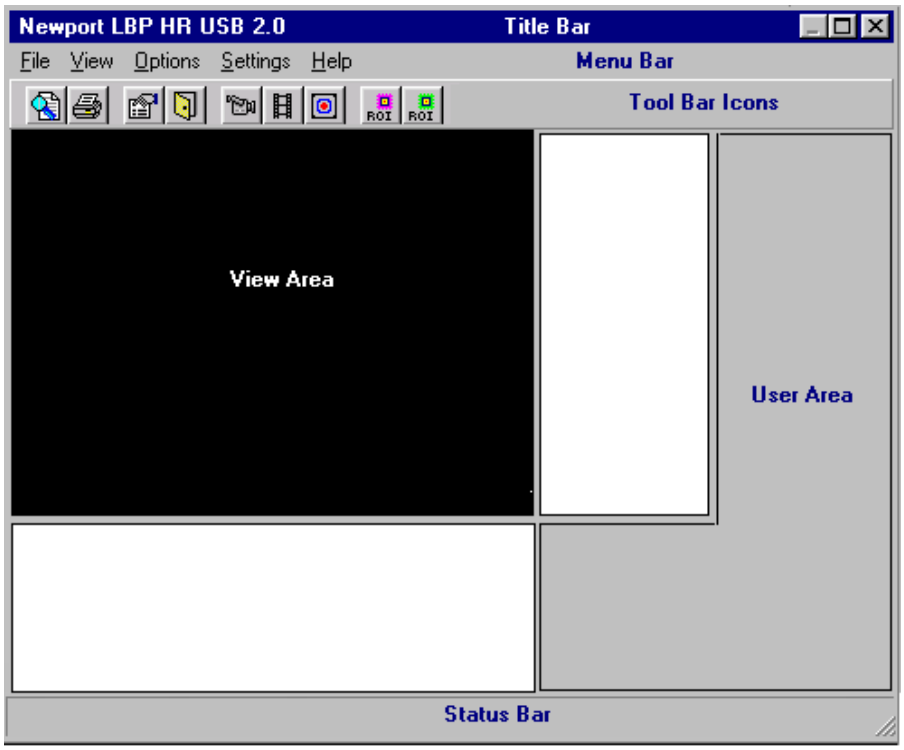


Figure 4 General software layout

5.1.3 Control Toolbar

The Tool Bar consists of various icon buttons, which are small symbols that provide quick access alternatives to using menus or keyboard equivalent keys to perform various functions. To activate a tool button, place the mouse over the button and click the Left

mouse button. The button will change both color and shadow to designate the fact that this function is activated. This is an example of ToolBar (buttons activated):

To view the function of each icon button, place the mouse cursor on the icon and wait momentarily, a brief function description will appear near the icon.

5.1.4 View Area

The View Area is used to view all the LBP HR graphical presentations, such as: beam image, intensity profiles, 2D/3D or Position presentation, as well as summary table of measurement results and statistics table.

5.1.5 Status Bar

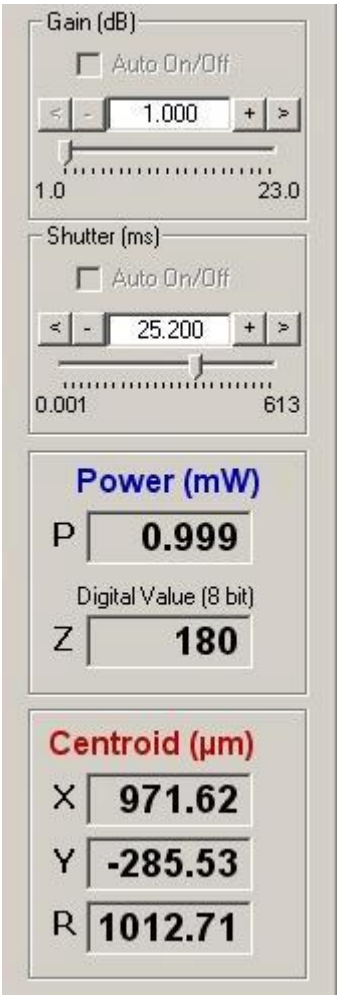
The status bar is located at the bottom of the LBP HR window. It indicates the current status of some operational parameters, such as presentation of date and time, average level, zooming level, Null status, Power reading, and up to 12 Still images taken. The Status Bar enables a fast access to system's setup screens for setting up the average level, the zoom,

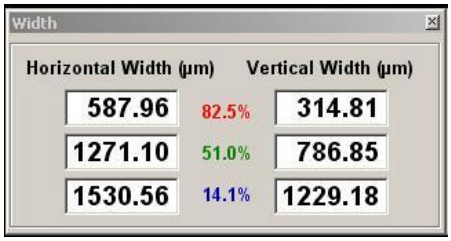
the null parameter as well as the power calibration: if the mouse cursor is placed at one of these parameters and then double-clicked the appropriate setup screen appears.

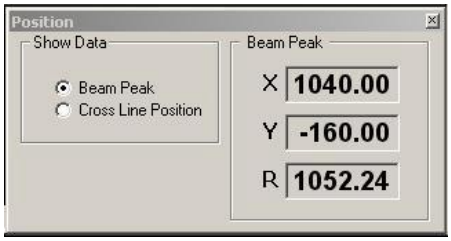
Also. If the mouse cursor is placed at any one of the Still Image icons and double-clicked the image is then magnified.

5.1.6 User Area

The User Area is used to view beam centroid's presentation, as well as a summary table of measurement data, including the beam width reading at 3 different clip levels and the Gaussian fit profile at these levels as well as the correlation factor.







6.0 Installation

This chapter provides instructions for installing the hardware and software for the LBP HR system.

6.1 Hardware Requirements

To run the LBP HR USB 2.0 system, the computer system must meet the following minimum requirements:

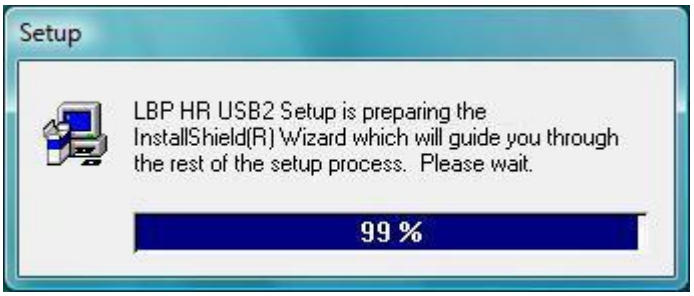
Item	Minimum Requirements	Recommended Requirements
CPU	Pentium 4, 2.4 GHz	Pentium 4, GHz
System RAM	128MB RAM	512 MB RAM
Hard disk	100MB HD free	
CD ROM drive	Any type	
Operating system	Windows XP/Vista	
Mouse	Microsoft mouse or equivalent	
VGA display	1024 x 768 resolution	1600 x 1200 resolution
VGA card	16MB 16 bit color	64MB 16 bit color
USB Port	One free High Speed USB 2.0	

6.2 Software Installation

Important Note: ***Please install the USB 2.0 camera driver before connecting the LBP HR USB 2.0 camera to your computer!***

Perform **Software Installation**. Only after you click “Finish” to complete the software installation procedure, continue with the **Hardware Installation**.

1.Insert the LBP HR CD disk in the CD drive.



- A Welcome screen appears when beginning the software installation routine. Click *Next*.
- Insert your User Name, Company Name and System S/N (appearing on the system CD).
- The following screen is a Registration Confirmation. Click *Yes* in order to confirm. If you click No, the software will return back to a previous prompt.
  Now provide the full path for installation of the LBP HR USB 2.0 system software:
  More information about the exact folder for the software and branching in existing folder for LBP HR USB 2.0 system software can be done in the Select Program Folder prompt.
  Click the *Next* button to proceed.
- Copying files routine. Click Next button. At this stage the system copies all files from the CD-ROM to the selected directory in your computer. There is a graphical presentation showing the amount of data copied to the system disk. If the Cancel button is pressed the installation is aborted.

- For Windows Vista:

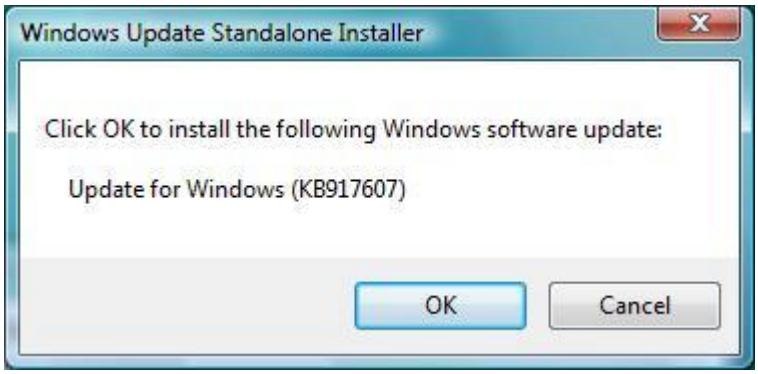


Figure 5 Windows Update

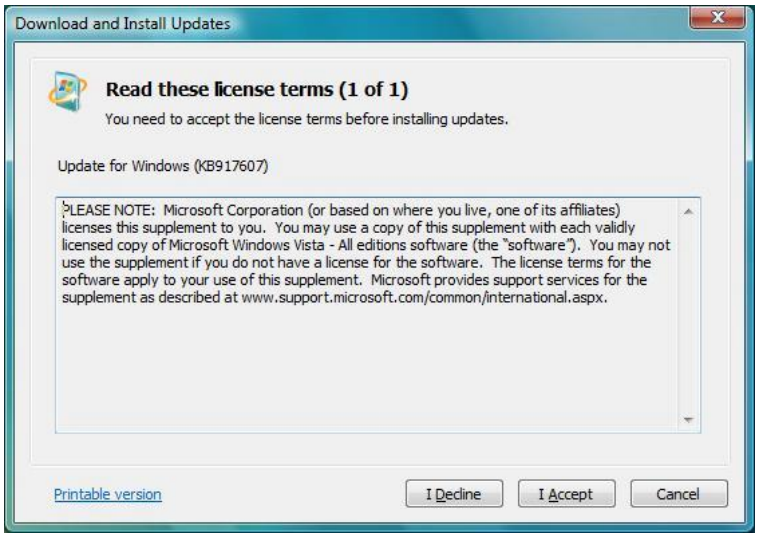


Figure 6 Download and Install Updates

Press “I Accept” button for install update.

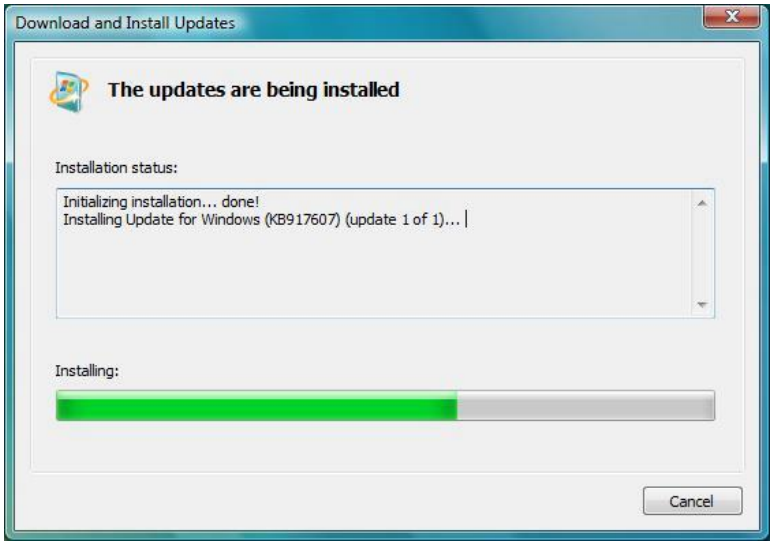


Figure 7 Update installation status

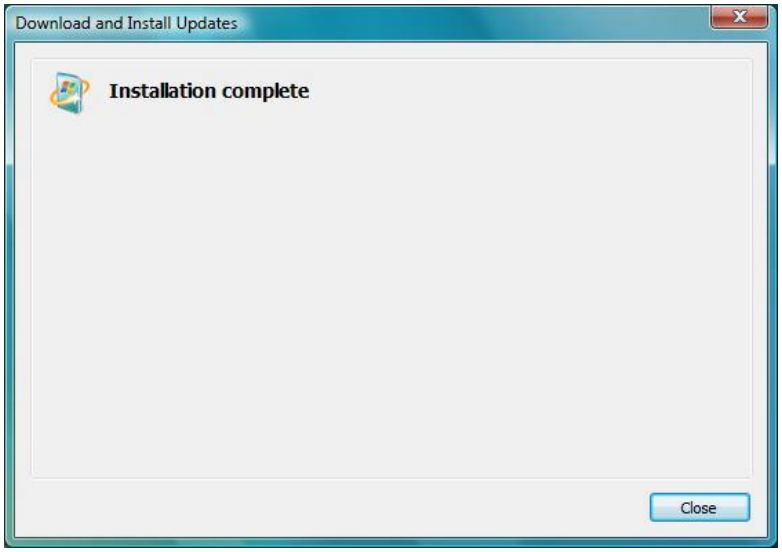


Figure 8 Installation complete

- Setup Complete.

6.3 Hardware Installation LBP HR USB 2.0 Camera

Plug the LBP HR USB 2.0 camera into a Hi-Speed USB 2.0 port.

The USB 2.0 device will be detected and the New Hardware Wizard will launch.

6.3.1 Windows XP

1. The following message is displayed

Figure 9 Found new hardware wizard

Figure 10 Welcome screen. Press *Next* to continue.

Figure 11 Alert, press *Continue* Anyway.

Figure 12 Installing…

Figure 13 Complete installation screen

Figure 14 Press *Next* to continue.

Figure 15 Press *Continue* Anyway.

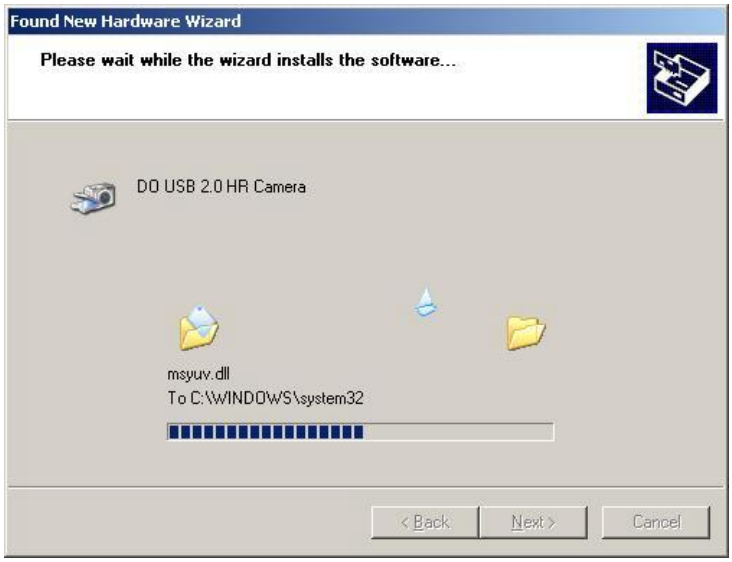


Figure 16 Installing…

Figure 17 Complete installation screen

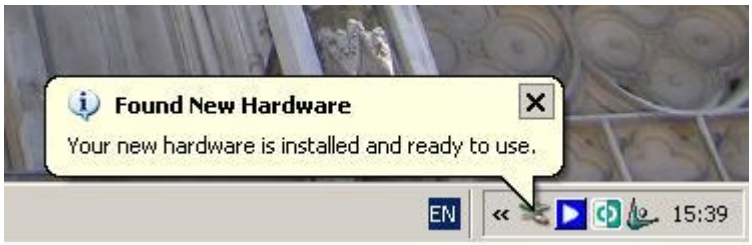


Figure 18 New Hardware ready to use

After completion of USB device installation, when the device is configured successfully one can check under System Properties, Device Manager Tab and see that under imaging devices the “DO USB 2.0 HR Camera” is listed.

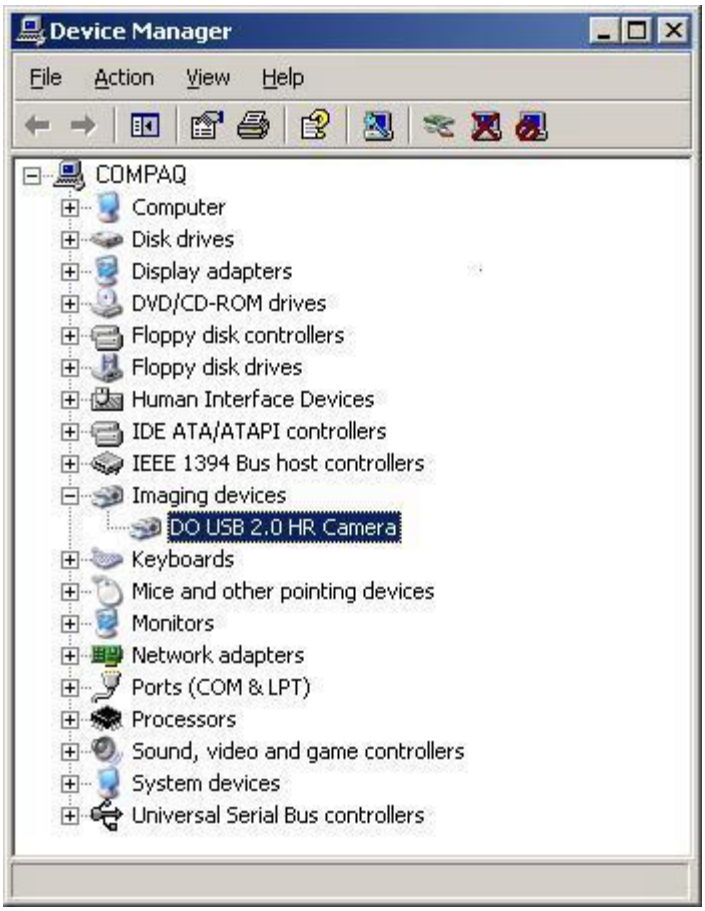


Figure 19 Drivers installed list (DO USB 2.0 HR Camera)

6.3.2 Windows Vista

The following message is displayed

Figure 20 Installing device driver software

Figure 21 Windows Vista Security

Figure 22 Windows Vista Security

Figure 23 Devices are ready to use

After completion of USB device installation, when the device is configured successfully one can check under System Properties, Device Manager Tab and see that under imaging devices the “DO USB 2.0 HR Camera” is listed.

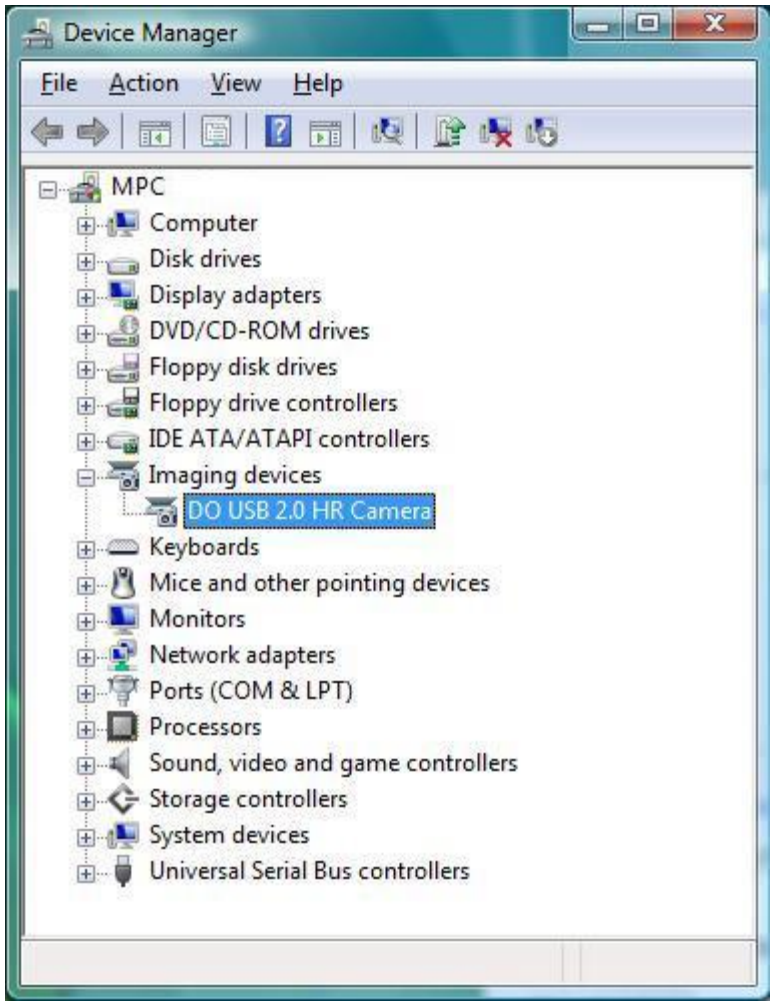


Figure 24 Drivers installed list (DO USB 2.0 HR Camera)

6.4 Running the Software

Make sure hardware is installed properly. (See **Hardware Installation**).

Boot the computer.

From the **Start** Menu, select **Programs**, then choose **LBP HR USB 2.0** folder, and then click on the **LBP HR USB 2.0** program. Alternatively, you can activate the software by placing the mouse cursor at the **LBP HR USB 2.0 Icon**  and click the mouse button twice.

To end a LBP HR session, open the **File** menu and select **Exit.**

The LBP HR saves all current setup parameters when you exit a session.

Possible Errors that indicate an interface conflict:

There are a few common symptoms, which point to an interface conflict:

* System Lock-up during software startup.

* There is no picture displayed on the screen

* Displayed measurements are sporadic and erroneous.

If your symptoms match one of those presented above, or if the LBP HR System was working at one time and has now stopped working, check for conflicts with other devices in the same computer.

If it has no affect and no new software of any kind has been installed since the LBP HR System last worked and the computer has not been moved, contact Newport Inc. for immediate support.

More information about Installation problems in the **Troubleshooting** section.

7.0 Setting Up the LBP HR

This chapter provides instructions for setting up the LBP HR system. Before you can accurately use the LBP HR you must do the following:

- Configure the hardware
- Configure the software
- Configure your continuous or pulsed laser beam

The LBP HR installs a configuration file called: “LBP HR USB 2.0.ini “ in the LBP HR USB 2.0 working directory. All system setup parameters are saved in this file, including all setup modifications introduced during the last session. When you start the system software, the setup parameters in the INI file are automatically loaded.

7.1 Configuring the Hardware

To configure the hardware, open the Settings menu and select **Hardware Setup**. The Hardware Setup window displays.

7.1.1 Hardware Setup - Settings

From the Settings tab, you can configure the following information:

- Type of connected camera equipment
- Input connector
- Image display
- Shutter control
- Gain control

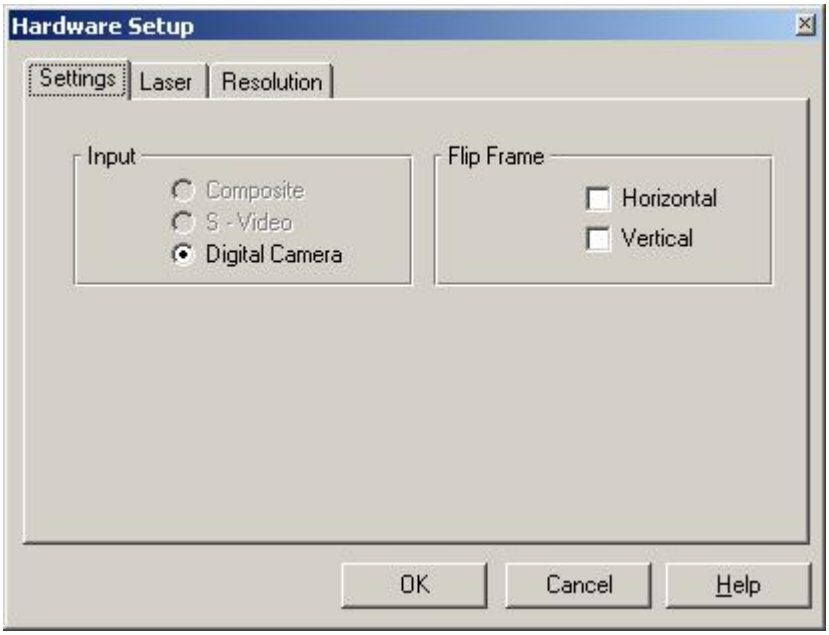


Figure 25 Hardware Setup - Settings Tab Selected

To configure the hardware settings:

1. Click the **Settings** tab.

2. Enter your information according to the descriptions below.
3. Click **OK**.

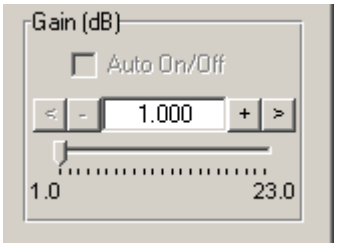
Input Type of video connection:

- **Composite** - RCA-style video connector.
- **S-Video** - S-Video input connector.
- **Digital Camera** - This is the default setting for the LBP HR camera..

Flip Frame Flips the image presentation by 180 degrees.

To flip the image presentation, select Horizontal or Vertical.

Gain Sets the Gain level manually, values range is 1-23dB.



Auto Gain function offers an automatic gain setting, best fitted to the work condition.

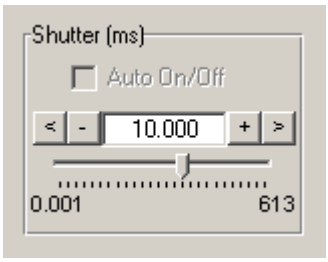
Shutter The built-in electronic shutter controls the integration time of each frame. By activating the shutter you control the amount of collected light similar to the way a mechanical shutter controls the exposure time in a regular photographic camera. You select the required shutter speed to prevent saturation and distortion of the measured beam profile. This option is significant for continuous laser beams only.

The shutter speed is set manually and is only selectable if you are using the LBP HR USB2 camera. Automatic value setting is a future option.

The possible shutter speeds range from 0.001 to 613 millisecond.

To configure the shutter speed:

1. Unselect **Auto**.
2. Drag the slide bar along the “shutter scale” to select a shutter speed.



Auto Shutter function offers an automatic shutter setting, best fitted to the work condition

7.1.2 Hardware Setup - Laser

Laser configuration allows you to specify the type of laser used and define the synchronization.

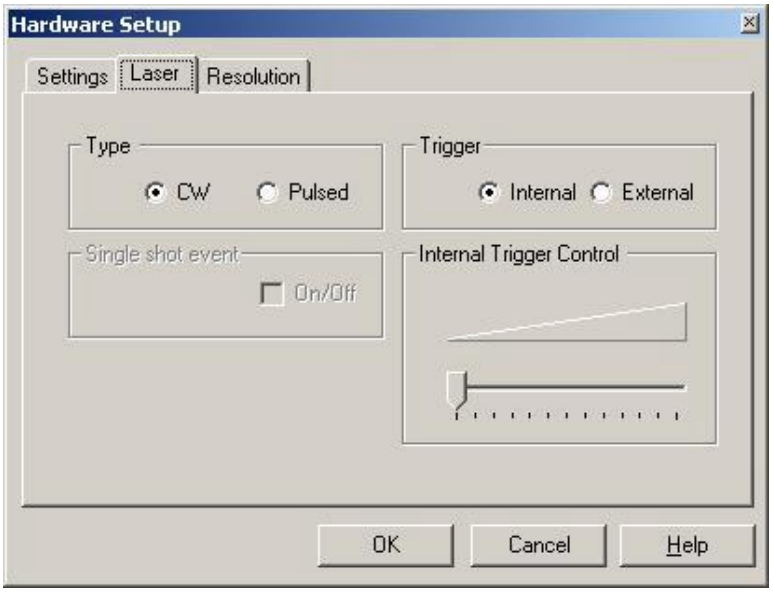


Figure 26 Hardware Setup - Laser Tab Selected

To configure the laser information:

- **Type** - select one of the laser types.
    1. Click the **Laser** tab in Settings, then click **CW** or **Pulsed** and then **OK**. When Pulsed mode is selected, the icon is displayed at the **Control Toolbar** and next to it the Trigger Control Bar for setting up the Trigger level.
- **Single shot event** - Capture and look at a single shot event. When single shot is activated, the freeze button acts as a run/stop button and can be toggled between Run where the system is ready to capture and freeze the next active frame and Stop where system is frozen with the single shot frame, which has been captured.
- **Trigger** - Select the graphical presentation's background color. You can choose either internal or ex and white (mono).
- **Internal Trigger Control -** This function sets the minimum signal level at which images will be displayed on the screen. It ensures that with pulsed lasers, only frames with images will be displayed.
  Hardware Input.
  RCA connector (see Fig.1. page 10)
  Delay: image latency 148 µsec.
  Shutter exposure: >= (Delay + Pulse width)

Upon selecting the required parameter value, press OK to confirm the selection, press Cancel to abort.

7.1.3 Hardware Setup - Optical Scaling and Resolution

If you are using external optics to reduce or expand the beam size, then set the scaling factor accordingly. After this is done, all values measured by the CCD will be multiplied or divided by the value chosen.

For example, if you are using an optical attachment which reduces the beam size by a factor of 2, choose 2 as the scaling factor and all values read by the camera will be multiplied by 2 to give the true size instead of the size as it is projected on the camera.

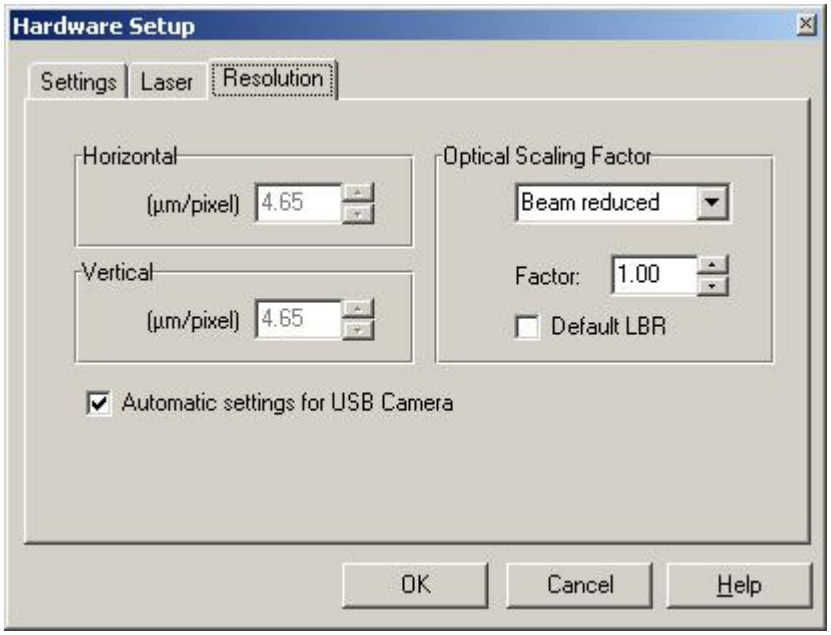


Figure 27 Hardware Setup - Resolution Tab

To set optical scaling:

1. Set the scaling to multiply or divide as needed

2. If using an external optics, one needs to select the appropriate option in **Optical Scaling Factor** (toggle between Multiply option and Divide option). Then select the appropriate Factor parameter accordingly.

Resolution

The resolution setting is only necessary if you are not using the LBP HR camera. These values are the resolution parameters (in microns per pixel) of your non-LBP HR camera.

The LBP HR camera uses the default values shown in the Horizontal and Vertical fields. Please note that the **Automatic settings for USB Camera** field is checked.

To configure the resolution:

1. Click the **Resolution** tab.
2. If you are using the LBP HR camera, select **Automatic settings for USB camera**.
3. If you are not using the LBP HR camera, enter your camera's resolution parameters.
4. Click **OK.**

7.1.4 Power Calibration

The power calibration function allows you to enter a power value as a "base" power level. The power calculation sets the total summed intensity of all the pixels in the subsequent captured samples to be proportional to this value.

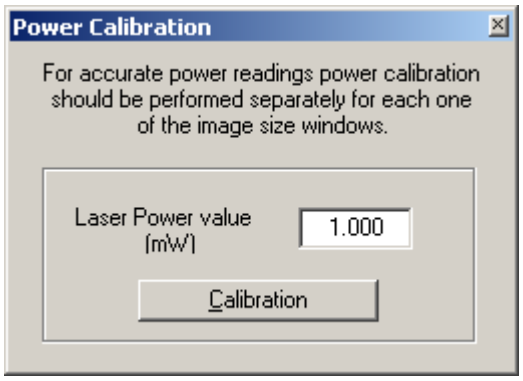


Figure 28 Power Calibration window

To configure the power settings:

1. Open the **Options menu** and select Calibrations u **Power**.
2. Follow the on-screen instructions.
3. Enter the power value of your laser beam as measured by a reference power meter.
4. Click **Calibration**.
5. Click **OK**.

The power reading itself is viewed at the Status Bar.

Note: If you place the mouse cursor at the Power field located at the Status Bar and double click the mouse right button you get the Power Calibration Screen.

7.2 Configuring the Software

To configure the software, open the Settings menu and select **System Setup**. The System Setup window displays.

7.2.1 System Setup - Settings

From the Settings tab, you can configure the following information:

- Averaged consecutive measurements.
- Zoom On/Off and setting up the zooming level.
- Set display presentation
- Set color or monochrome display for the View Area.
- Number of still image bitmap files taken during the Still Image function. This is useful only for cases of Pulsed Lasers. This parameter will determine the # of images that will be captured once the Still Image function is activated.

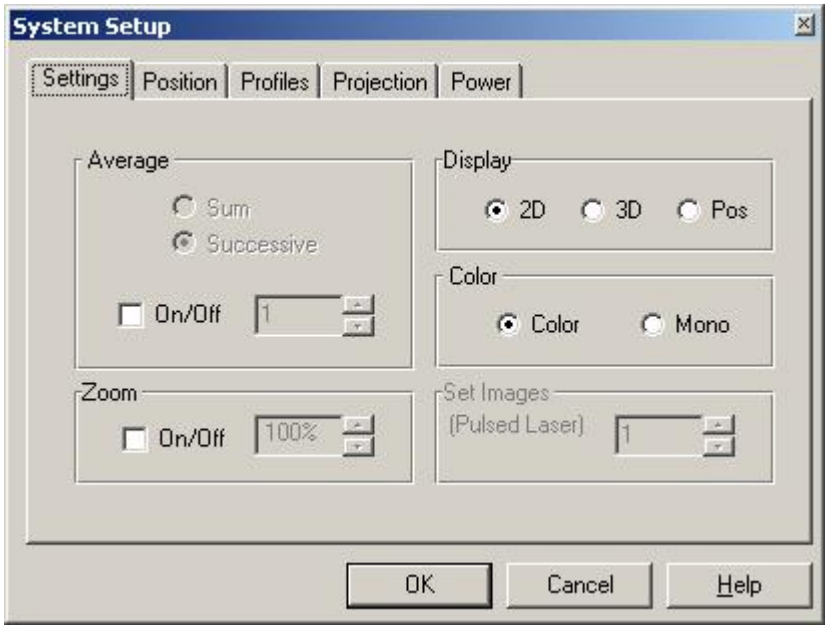


Figure 29 System Setup - Settings Tab Selected

To configure the system settings:

1. Click the **Settings** tab.
2. Enter your information according to the descriptions below.
3. Click **OK**.

Average Used to smooth the data display of quickly varying sources.

When using a beam with a significant amount of jitters, set this feature on. The LBP HR takes a user defined number of successive measurements. These measurements are averaged and displayed.

For example, you choose a value of 10, ten consecutive measurements are averaged and the result is displayed. When an eleventh measurement is taken, the first measurement value is dropped and the second through the eleventh are averaged, etc.

Because a successive averaging technique is employed, the window display update rate is only slightly affected, if at all.

***NOTE**: The Average function only affects the numerical data and not the picture. The picture is not averaged.*

To smooth the data display:

1. Select **On/Off** to activate. Or,

   From the **Status Bar**, click 

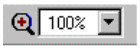
. The System Setup window displays.

2. Enter a successive measurement value. Possible values are 1-20 where 1 means no averaging and each measured value is displayed.

Zoom Enables magnification of the image displayed in the view area.

When zooming in or out, the system centers the plot as close as possible over the current crosshair cursor position.

To magnify the image*:*

1. Select **On/Off** from the **Control Toolbar**, click 

. Or,

   From the **Status Bar**, click 

. The System Setup window displays.

2. If Zoom is On set the Zoom level required by pressing on the Up/Down arrow buttons (select the magnification you desire, 100% is normal size).

Set Images Sets the number of still image bitmap files that the system takes during pulsed laser operations.

If, for example, you input 4 and select the still image function, the system captures and saves the next 4 still images.

The set images function is disabled for continuous lasers.

To set the number of still image bitmap files, enter a set image value. Possible values are 1 - 12.

Display Toggles between a 2D, 3D or Position graphical presentation in the view area.

To select the graphical presentation*:*

1. Select **2D, 3D or Pos** Or,
   From the **Control Toolbar**, click  for a 2D display,  for a 3D display or for  Position display. Or,

Open the View menu and select Display u **2D, 3D** or **Position**

Color Select the graphical presentation's background color. You can choose either colored or black and white (mono).

To select the background, select **Color** or **Mono***.*

7.2.2 System Setup - Profiles

Profiles setup allows you to control the display in the profiles area.

You can control the following displays:

- Profile type display
- Gaussian / Top Hat profile
- Clip levels
- Angle of rotation at which the X-Y cross-section profiles are cut.

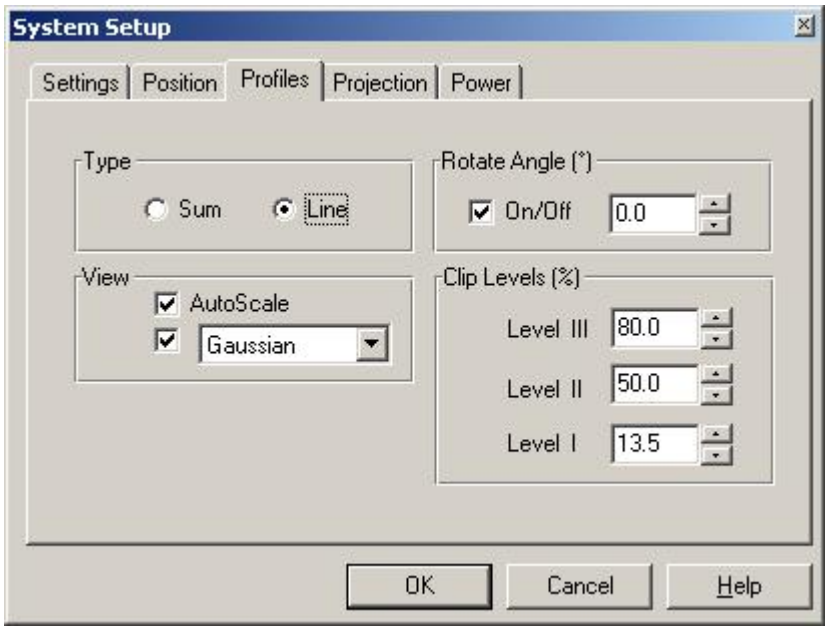


Figure 30 System Setup - Profiles Tab Selected

To configure the profiles:

1. Click the **Profiles** tab.
2. Enter your information according to the descriptions below.
3. Click **OK**.

Profile Type The following methods for profiles calculations are available:

- **Sum Profiles -** Displays the two orthogonal profiles, one along the vertical axis and one along the horizontal axis. Each profile is composed of a summation of rows and columns at a beam cross-section.
- **Line Profiles -** Displays the contour of the beam along a line parallel to the vertical axis and a line parallel to the horizontal axis. The two lines, along which these contours are displayed, are designated as a cross hair cursor. The cross hair cursor can be moved along the image screen, so that the displayed profile is the cross section line profile located by the cursor.

To select the profile calculation method:

1. Select Sum or Line. Or,

   From the **Control** Toolbar, click  for Sum Profiles or  for Line Profiles. Or,

   Open the View menu and select Profiles u **Sum** or **Line**.

To select the angle at which you want to cut the X, Y profiles:

Click on the On/Off of **Rotate Angle** and select the angle desired from –45 to +45 degrees. The allowed increments are 0.1 degree.

View

Controls the following profile displays:

- **AutoScale On/Off** – Displays the profiles using the full height of the profile window.

  When Auto Scale is not selected, the beam peak can be observed as it changes which can be advantageous during a focusing process. The peak intensity changes may be observed as a function of the focus, showing the variations in beam's peak with respect to the changes in beam size.

- The **Gaussian** fit profile shows how closely the measured beam profile matches a Gaussian profile. The Gaussian fit profile is displayed on top of both the vertical and horizontal profiles in red.

  The Gaussian Fit is a least-squares fit of a Gaussian equation to the cross section beam profiles. The correlation coefficient is the normalized sum of the fit residuals. The following equation is used for the Gaussian Fit calculation:

  $$I = Ve \wedge [-(x-c)/s\ ]^2$$

  Where
  I = the intensity of a pixel at location x
  V = the maximum intensity of the fitted Gaussian curve (Peak Intensity)
  C = the center of the Gaussian fit peak (Centroid)
  σ = the radius of the Gaussian fit curve at the $1/e^2$ intensity level (diameter)

- **Gaussian/Top Hat** selects between Gaussian or Top Hat calculation and display. The display of the best fit Gaussian or Top Hat profile is overlaid in red on top of the profiles in real time

To configure the profile view, select the desired options.

Clip Levels

Sets the levels at which the width of the vertical profile and horizontal profile are measured by the system.

A clip level defines the percentage of the peak intensity profile at which the beam is measured. For example, a clip level of 50% indicates that the beam is to be measured at its full width at half maximum (FWHM), whereas a clip level of 13.5% measures the beam at a point, which is 13.5% of the profile peak. The 13.5% level corresponds to the $1/e^2$ point of a Gaussian profile.

Both the horizontal and vertical profile windows display the width of the beam at three clip levels simultaneously.

There are three clip levels represented by solid horizontal lines superimposed on the profiles. The default clip levels are 80%, 50% and 13.5%.

The three clip levels are labeled I, II and III.

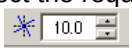
To change the clip levels:

1. Enter a value in the **Clip Level** field. The clip levels values are in 0.1% increments. Or,

1. In the profiles area, position the cursor just above (or below) the width level bar you want to change.
2. Press the left mouse button and drag the line up or down, while watching the change in the clip level setting on the profile presentation. The new clip levels can be seen in the Measurement Data window. When performing this operation it is helpful to size the profiles area as large as possible.

Rotate Angle

This option is available only when **Line Profile** option is enabled.

Click on the On/Off of **Rotate Angle** and select the angle desired from –45 to +45 degrees. The allowed increments are 0.1 degree. Alternatively, select the required value for angle rotation via the **Control ToolBar**, using the 

icon.

7.2.3 System Setup - Projection

Projection setup allows you to control the display of the image area.

Displays you control include:

- Wire density
- Rotation function

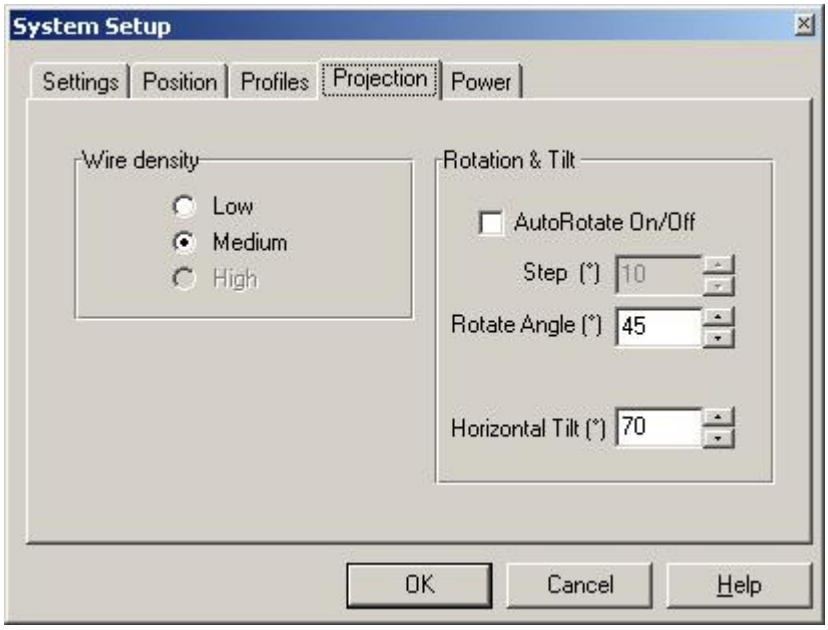


Figure 31 System Setup - Projection Tab Selected

To configure the projection:

1. Click the **Projection** tab.
2. Enter your information according to the descriptions below.
3. Click **OK**.

Wire Density

Controls the graphical presentation of the 3D plot by means of line density. There are three wire densities to choose from: **Low**, **Medium** and **High**. High density displays the best graphics for the 3D image, as the color lines are condensed, but as the graphics become more complex, it takes more time to draw the image on the screen.

To set the Wire density, select the desired wire density.

Rotation& Tilt

This function is used to change the viewing angle of a 3D graphics presentation. This enables you to view the angles around the beam's main axis as well as to flip the displayed image.

- **Auto Rotate On/Off** - When Auto Rotate is On, the image is rotated about the optical axis or azimuth of the 3D display. The amount of rotation (viewing angle) is defined by the Step parameter (in degrees). Possible values for Step are 1 through 30 degrees. When Auto Rotate is on, Rotate Angle is disabled.
- **Rotate Angle (°)** - Sets the viewing angle of the 3D projection display. Possible values are 1 through 360 degrees in 1 degrees increments.
- **Horizontal Tilt (°)** - Sets the tilt viewing angle of the 3D projection (from a top view to a side view). The values range from 0 to 90 degrees in 1 degree increments.

To set automatic rotation:

1. Select **AutoRotate On/Off**.
2. In the Step field, enter the viewing angle.

To set manual rotation:

1. Deselect **AutoRotate On/Off**.
2. In the Rotate Angle (°) field, enter the viewing angle.

To set manual tilt:

1. In the Horizontal Tilt (°) field, enter the tilt angle. Or,
2. Place the cursor over the image and press the left mouse button. The cursor changes shape.

   Drag the cursor along the view area. The 3D plot rotates around the image main axis and flips from top view to a side view of the image.

7.2.4 System Setup - Position

The Position setup defines the attributes for the beam centroid calculation & disply.

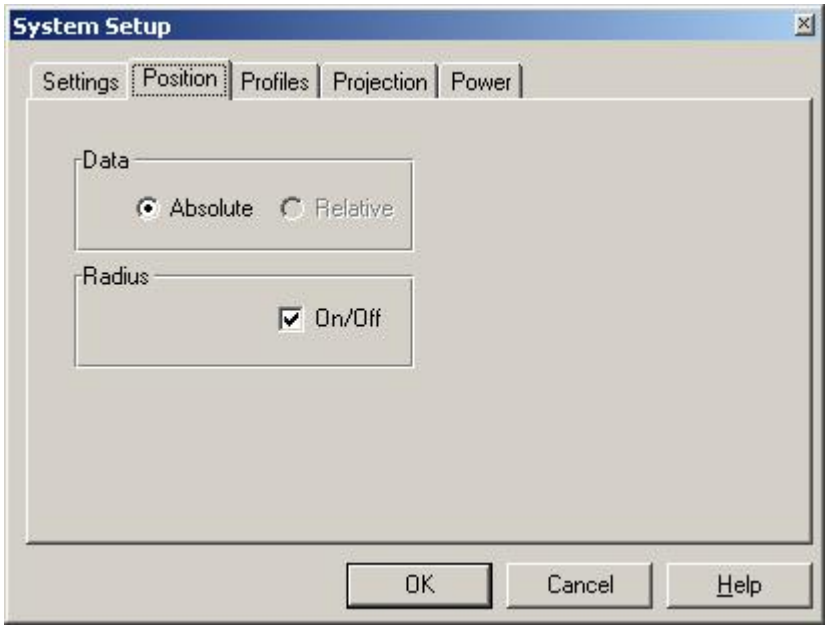


Figure 32 System Setup - Position Tab Selected

To configure the Position features:

1. Click the **Position** tab.
2. Enter your information according to the descriptions below.
3. Click **OK**.

Data Data is used to toggle between Absolute and Relative modes of position, where the default is Absolute.

When Relative is selected then all the position centroid data will be calculated versus the Cross Line center.

The Relative point coordinates can be set by graphical means, by dragging the Cross Line center to any requested location over the View Area.

Radius Controls the numerical calculation of the position function. Some applications require a calculation of the radius of beam centroid deviations. In this case the R parameter is calculated as follows:

$\sqrt{(X^2 + Y^2)}$

Mark the Radius parameter as On in order to enable the Radius function.

7.2.5 System Setup - Power

The Power setup allows the user to configure the power measurement capability to suit a particular set of needs.

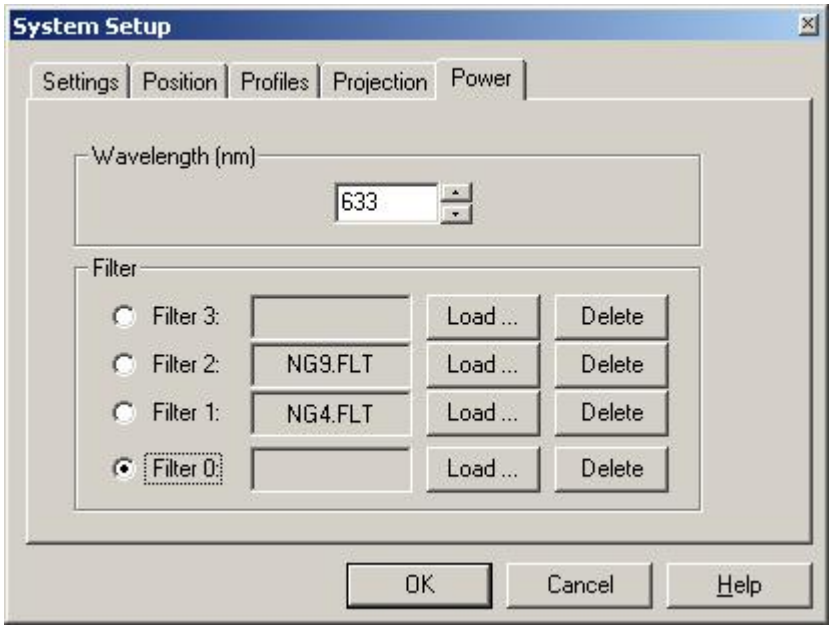


Figure 33 System Setup - Power Tab Selected

To configure the Power features:

4. Click the **Power** tab.
5. Enter your information according to the descriptions below.
6. Click **OK**.

Wavelength The wavelength value is used by the Power function to correct the sensor reading for the selected wavelength response.

This option should be used to input the wavelength (in nanometers) of the laser source used in the current measurement session.

The system will recalculate the beam power value and correct the display accordingly. The wavelength can be entered in 1-nanometer increments from the data entry box. Possible values for wavelength are: 350 - 1100 nm.

Filter Filter option is used in order to inform the system which filter file to use in the current session

Pre-Load a Filter file to the system via **Load …** button, after physically installing the filter in front of the detector. A file list is displayed, presenting all the available Filter files to choose from (all files having extension name *.FLT).

7.2.6 Configuring a Continuous Laser Beam

When using a continuous laser beam, attenuate powerful laser beams by selecting a combination of shorter shutter speeds and attaching the ND filters to the LBP HR camera until the saturation level is acceptable. Refer to **Hardware Setup - Shutter** and **Using Filters** topics for more information.

To configure a continuous laser beam:

1. Open the Settings menu and select **Hardware Setup**.
2. Click the **Laser** tab and select the **CW** radio button in the **Type** field.
3. From the **Control Panel**, select a shutter speed in the shutter field that enables an acceptable saturation level.
4. From the **Control Panel**, select a gain level in the gain field that enables an acceptable saturation level.
5. If the image is still saturated at the fastest shutter speed or gain selected, attach ND filters to the LBP HR camera until an acceptable saturation level is reached.

7.2.7 Setting the Ambient Light Suppression (CW lasers)

The **Null** function allows you to subtract off background and display the correct power value.

When null calibration is off, the power value displayed in the measurement data or statistics window is the total power incident on the detector surface. When null calibration is on, the power value displayed does not contain the ambient light.

You should perform the null calibration function during your set up routine. During the null calibration routine, a message is displayed at the top right side of the screen, which reads: **Null Calibration**.

To calibrate the ambient light suppression:

1. Open the **Options** menu and select Calibration u **Null.** Or,

   From the **Status Bar**, click Null: Off.

   A message displays instructing you to turn off your laser beam.
2. Turn off or block your laser and click **OK**. The system now measures the ambient light level. Note that the power reading in the Measurement Data area is now zero.
3. Turn on or unblock your laser. The Null button on the **Status Bar** changes to Null: Off.

7.2.8 Configuring a Pulsed Laser Beam

When using a pulsed laser beam:

- Attenuate powerful laser beams by attaching the ND filters to the LBP HR camera until an acceptable saturation level is reached. Refer to **Using Filters** topic for more information.

- Set the gain setting to the optimum for displaying a full dynamic range without saturation (white on the image).

- Set the trigger level. This allows you to measure slowly pulsing lasers without displaying blank frames.

To configure a pulsed laser beam:

1. Select Pulse option via Hardware Setup Settings. The  icon will further be displayed at the **Control ToolBar** and just next to it the Trigger control panel  **.**
2. Select the slowest shutter speed (1/50s).
3. Attach ND filters to the CCD camera until an acceptable saturation level is reached.
4. Further adjust the intensity level using the gain control
5. Adjust the trigger level using the  icon until you get a steady reading. It is best to move to the right until triggering stops, then move back a little.

7.2.9 Using Filters

When setting up your system, use the three calibrated optical filters (ND filters) supplied with the LBP HR system to attenuate powerful beams. By doing so the amount of energy, which the LBP HR camera is sensing, is significantly smaller. The use of filters is especially significant when operating a pulsed laser beam.

To attenuate powerful-pulsed laser beams, attach filters to the LBP HR camera until the saturation level is acceptable. The LBP HR camera is supplied with the following filters: 3xND filters in housing (1/8 ND filter, M37x0.75), and 1xNG10 1.6mm thick Schott colored filter NG10. Optional filters include NG4 or NG9 Schott colored filters 1.6mm thick.

See curves of optical filters in Appendix section. You can order more filters if desired.

The filter type is marked on the filter housing according to the following schematics:

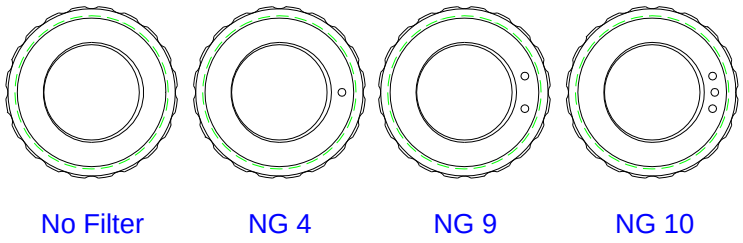


Figure 34 Filter type marking

To attenuate powerful continuous laser beams, select a combination of shorter shutter speeds and attaching filters to the LBP HR camera until the saturation level is acceptable.

Refer to **Configuring a continuous Laser Beam** for more information.

7.2.10 Using the Filter Wheel

Figure 35 Filter Wheel

Rotate the Filter wheel manually and make sure the required filter is placed at the bottom position.

Place the mouse cursor over the required filter to be used, and click left mouse button.

The filter wheel will rotate accordingly and place the selected filter at the bottom position (in front of the CCD sensor).

The name of the selected filter is displayed at the status bar.

From now on the software will include the filter transmission curve in the power calculation.

8.0 General description of Software

This chapter discusses the following LBP HR operations:

- Viewing Beam Profiles and Width
- Viewing the Centroid
- Viewing the 2D / 3D / Pos presentations
- Viewing Power
- Viewing the Beam Peak
- Viewing Measurement Data
- Viewing the Statistics
- Freezing Screen Graphics
- Printing Screen Displays
- Saving Screen Graphics
- Working with Stored Files

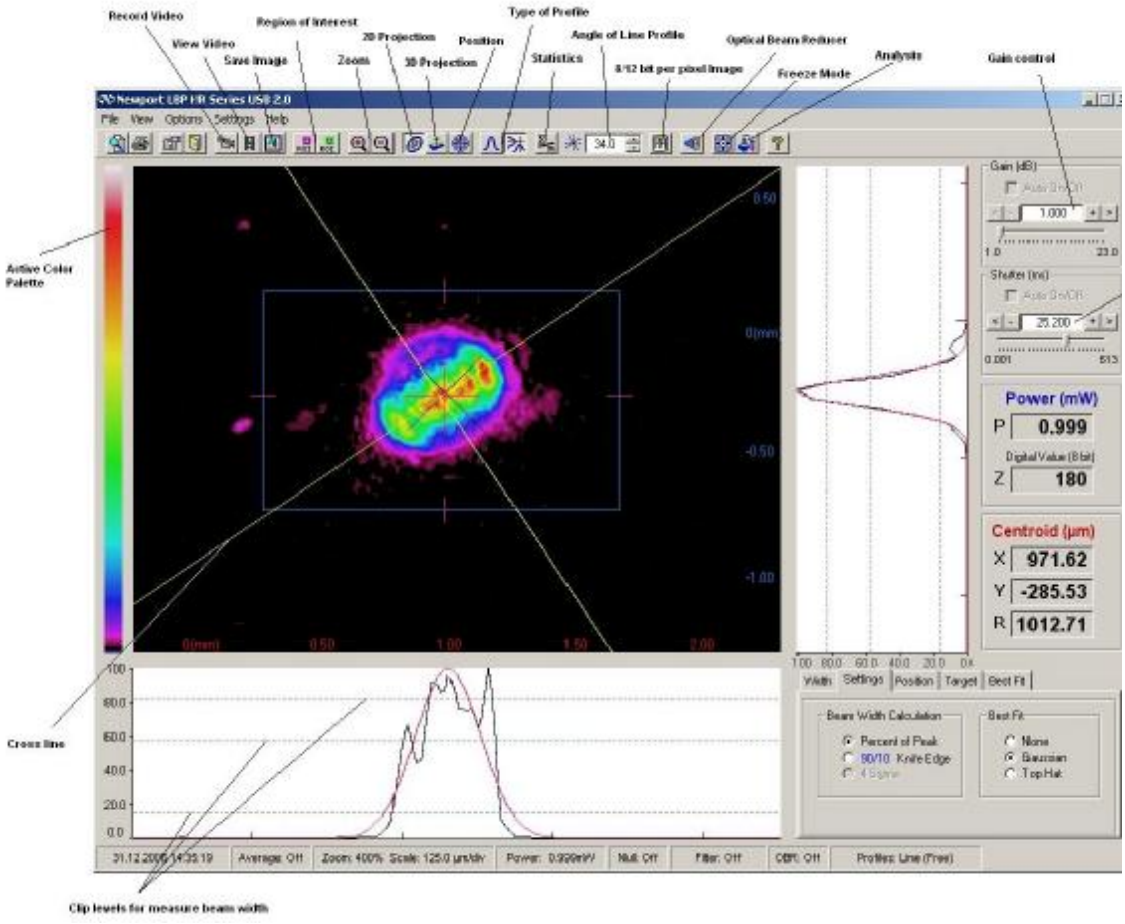


Figure 36 LBP HR Application window

8.1 Viewing Beam Profiles and Width

Two types of profiles are being displayed by LBP HR:

Sum Profiles- Displays the two orthogonal, one along the vertical axis and one along the horizontal axis. Each profile is composed of a summation of rows and columns at a beam cross-section.

Line Profiles- Displays the beam contour along a line parallel to the vertical and horizontal axes. These two orthogonal lines are designated as a cross hair cursor on the image plane and can be moved along the working area.

1. To select the profile calculation method:

From the **Control** Toolbar, click  for Sum Profiles or  for Line Profiles. Or,

Open the View menu and select Profiles u **Sum** or **Line**.

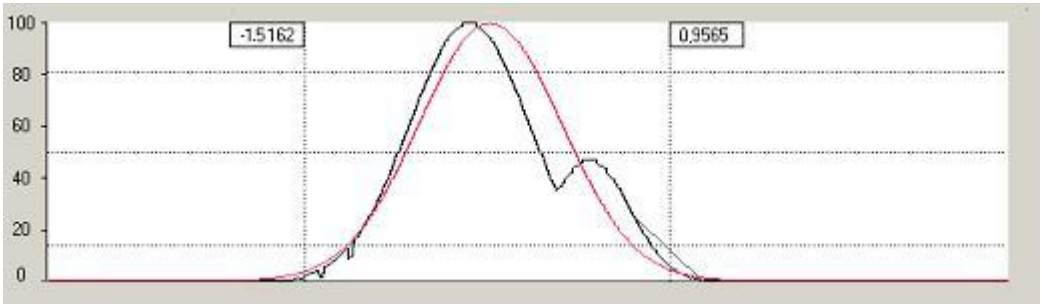


Figure 37 Horizontal Profile

Beam widths are digitally displayed for any three user selected clip levels.

A Gaussian fit profile can be overlaid on profiles in real time, while the correlation and fit values are displayed digitally. This function determines how closely the measured beam profile matches a theoretical Gaussian profile. The Gaussian fit profile is in red. The percent correlation and width comparisons utilize the currently selected clip levels.

Two vertical bars can be moved along the horizontal axis, designating the distance (in microns) along this axis. This is a useful feature for tracing and measuring of beam phenomena at certain locations.

The comparison data is displayed in the Measurement Data Box. A top hat profile presentation and fit is also available.

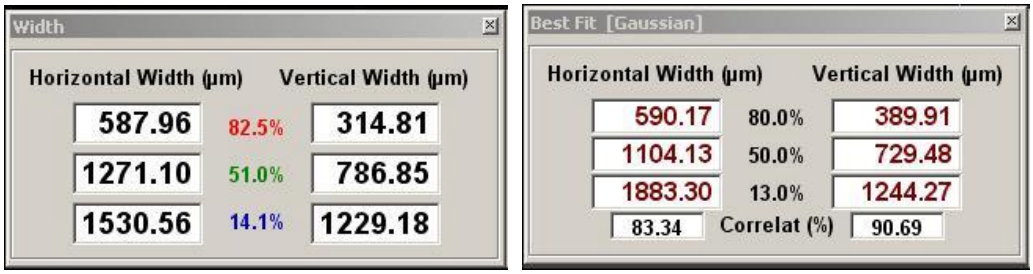


Figure 38 Measurement Data.

8.2 Viewing the Centroid

The Centroid is the beam intensity center of gravity.

The LBP HR determines the location of the beam centroid by summing the intensities of all image pixels in both horizontal and vertical axes, and computing the center of gravity of the beam intensity. The pixel coordinates at this location define the centroid. The horizontal (H) and vertical (V) coordinates of the Centroid are computed using the following formula:

$$H = \mathring{a}\{h * i(h,v)\} / I$$

$$V = \mathring{a}\{v * i(h,v)\} / I$$

Where i(h,v) = the intensity at location (h,v) and I = the total intensity taken over the total area. The centroid calculation is displayed in the User Area window and also in the Statistics window.

The LBP HR enables you to display the centroid in the view area when a 2D image is displayed. The centroid is located where the horizontal and vertical profiles cross in the view area. Two additional regions of interest (ROI) can be defined by the user and displayed at the Statistics table, thus enabling the user to monitor up to 3 beams' centorids simultaneously.

To display the centroid in the view area:

1. From the **Control Toolbar**, click  for a 2D display.
2. From the **Control Toolbar**, click  for a sum profiles display
3. Open the View menu and select **CrossLine -Centroid**.

.**The ROI function selects a region of interest within the total CCD detector area.** To activate the ROI press the appropriate ROI button on the **Control ToolBar**. The ROI region is defined by a square, the color of which is identical to the numerical presentation at the **User Area,** as well as to the ROI tool button color. The user can control the size of the ROI and its location by graphical means using the mouse.

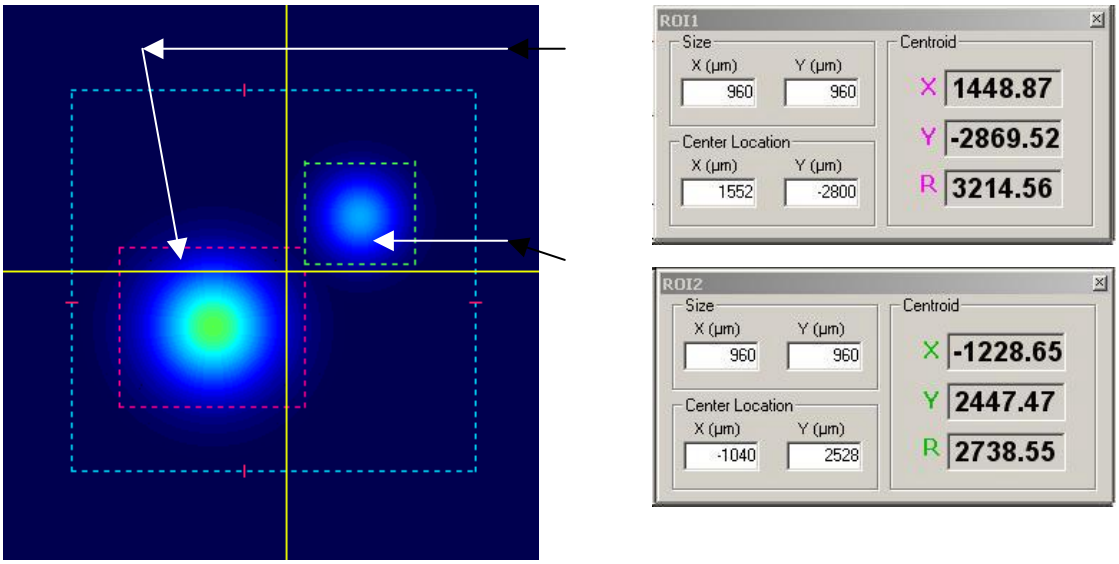


Figure 39: ROI's representation

The software calculates the centroid of the beam, which resides inside the ROI area only, disregarding the energy outside of this region. Thus, the result of the beam centroid

calculation will be displayed in the appropriate ROI area at the User Area. In case the Radius parameter is set On at the Position Setup – Position tab, then there is an additional calculation and display of the R value, which is the radius of beam centroid with regards to the cross line.

Note: *The default ROI is the total centroid of the energy impending on the entire CCD area.*

The user can change this default by graphical means, by dragging the ROI frame to the location and size at the screen, which is of interest.

The default setting of the system when it boots up is the entire CCD area is being considered the area main region of interest and the beam centroid calculation is performed over the entire CCD area. This default can also be changed by graphical means, the same way both other ROI's borders and location can be set.

In order to resume the default setting, double click on the mouse Left button.

Position Data in User Area

The User Area displays four numerical results. There are two types of presentations, according to the system setup setting:

Beam centroid (X, Y), which is the beam centroid location calculated over the entire CCD area.

Cross Line coordinates (X, Y) displaying either the CCD center of origin (CCD Center option), or the cross line coordinates at any point over the CCD View Area (Free option), or the beam centroid coordinates or any offset value with respect to the centroid (Centroid option)

ROI 1: the beam centroid (X, Y) in the defined Region of Interest 1.

ROI 2: the beam centroid (X, Y) in the defined Region of Interest 2.

In each one of the above listed presentations (Centroid, ROI1 and ROI2) a third line can appear, marked as "R" and stands for the Radius calculation (squared-root of X^2+Y^2). This calculation and presentation appear when the Radius parameter is set on in the System Setup – Position tab.

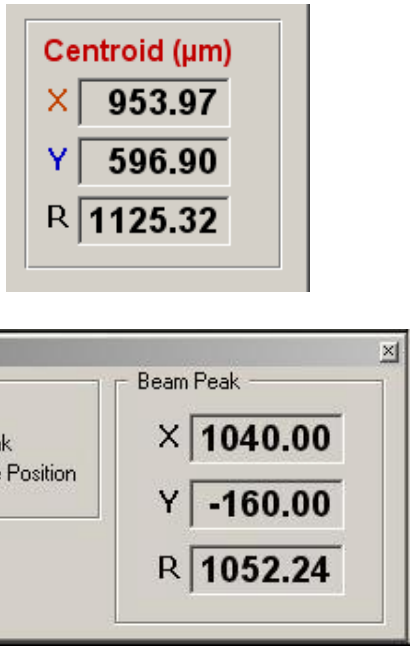


Figure 40: Position Data Calculation

8.3 Beam Finding Module – Target

A special feature, which facilitates finding your area of interest within the total CCD area. It is derived from the high-resolution CCD feature, where the resolution is much higher, than the screen display capabilities. Your area of interest is clearly displayed as a small rectangular frame within a picture representing the CCD module. Move the small rectangle frame to explore other portions of the CCD.

8.4 Viewing the 2D / 3D Presentations

The projection function provides either a 2D or a 3D plot of the beam intensity profile. A zooming feature enables magnification of the displayed image. It is possible to control the 3D plot wire density.

To display the 2D presentation in the view area:

From the **Control Toolbar**, click  for a 2D display.

To display the 3D presentation in the view area:

From the **Control Toolbar**, click  for a 3D display.

The 3D image can be rotated along the vertical and horizontal axes, as well as be flipped, using the following routine. This feature enables the user to view the beam image from various angles around the beam:

- Place the mouse cursor over the 3D image
- Hold the left mouse button down
- Drag the mouse while pressing the left mouse button. You can move the cursor up/down or left/right. The image will rotate accordingly.

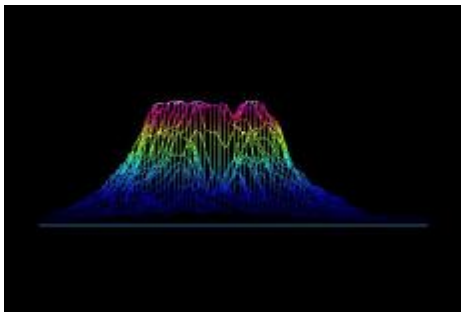


Figure 41 3D Plot – Side View

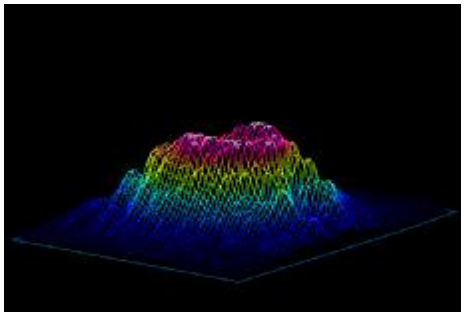


Figure 42 3D Plot – Top View

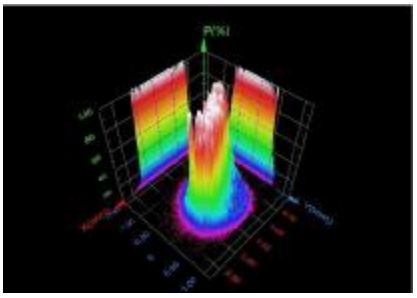


Figure 43 3D Plot with projected images

If beam is weak even when shutter is wide-open then increase the gain. If beam is very weak and color is dark even at the maximum shutter opening and gain, then optimize the color with the side panel. To optimize beam image place mouse cursor at the color bar and click the right mouse button. Return to default color bar press left mouse button once. (See illustrations below).

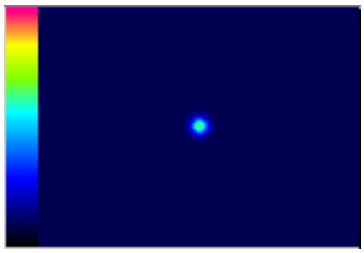


Figure 44 Weak beam

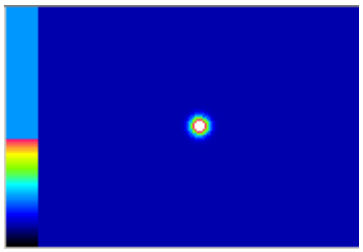


Figure 45 Weak beam with optimized color

8.5 Viewing Power

The Beam Power is displayed as a digital readout at the status bar, as well as at the right-hand screen panel, where there is also a display of the "Z" digital value in a specific cursor location (in 8 bits or 12 bits)

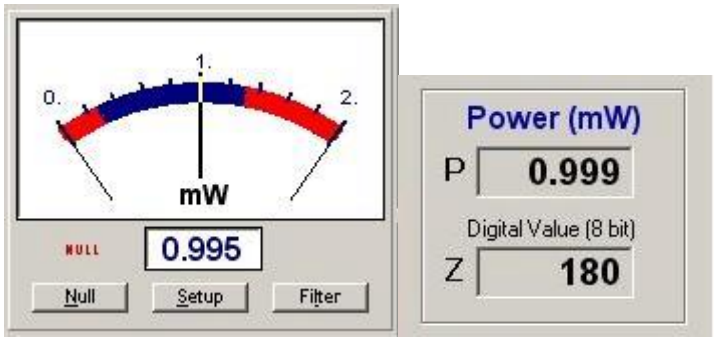


Figure 46 Power Windows

Alternatively, a needle-type display is available with additional features like: changing power measuring units, averaging, loading a predefined filter file, ambient light suppression.

A power calibration function allows the user enter a "base" power value. In subsequent captured images the summer intensity of all pixels will be proportional to this value.

Power Setup allows the user to configure the power measurement capability to suit a particular set of needs required for the operation of the Power meter function

Power Setup is selected from the Setup button at the Power window panel. Power Setup includes the following options: Settings and Zoom & Limits Tabs.

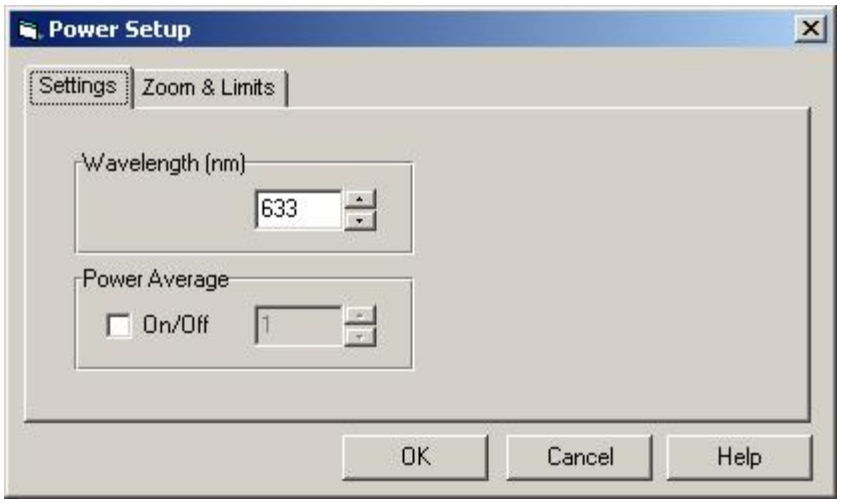


Figure 47 Power Setup - Settings

Settings Tab options are:

Wavelength: For setting the wavelength of the laser in use.

Power Average: For averaging the power reading, by smoothing the display.

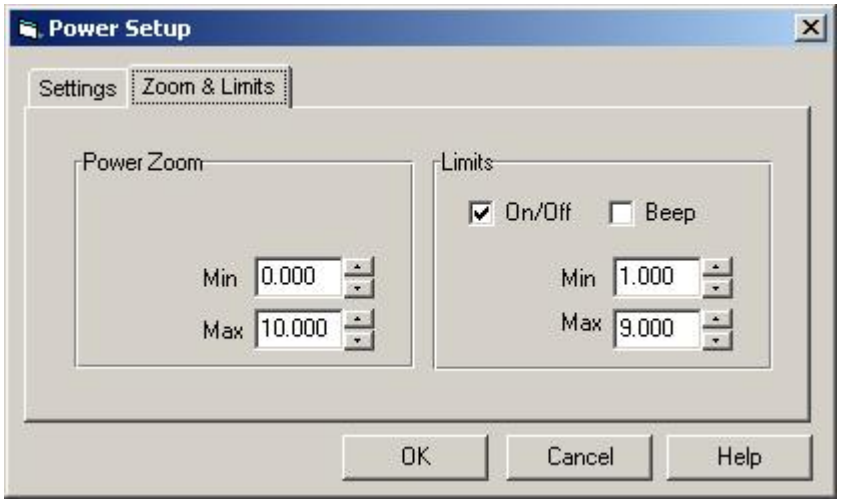


Figure 48 Power Setup – Zoom & Limits

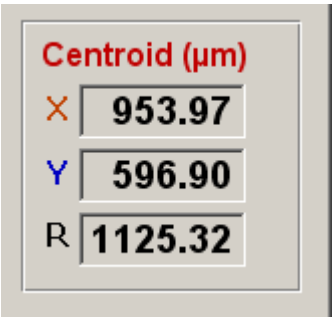
Zoom & Limits Tab options are:

Power Zoom: For magnifying the measurement area , in order to are easily detect small variations in beam power.

Limits: For setting an area within the needle graph display, to warn the user if power drifts outside the zone.

8.6 Viewing Position

The beam centroid is continuously monitored relative to the center of CCD head. Three Region of Interest (ROI) can be defined by the user, thus enabling monitor of up to 3 beams centroids simultaneously. The display includes the values X and Y (in µm) as well as R, which is the distance from the CCD center.



Trace On/Off feature enables beam centroid tracking. Reticule type targets can be laid out on the position screen, for ease of positioning analysis. The following targets can be selected from Control panel, including: Cross, Circle, Square, multiple circles and multiple squares.

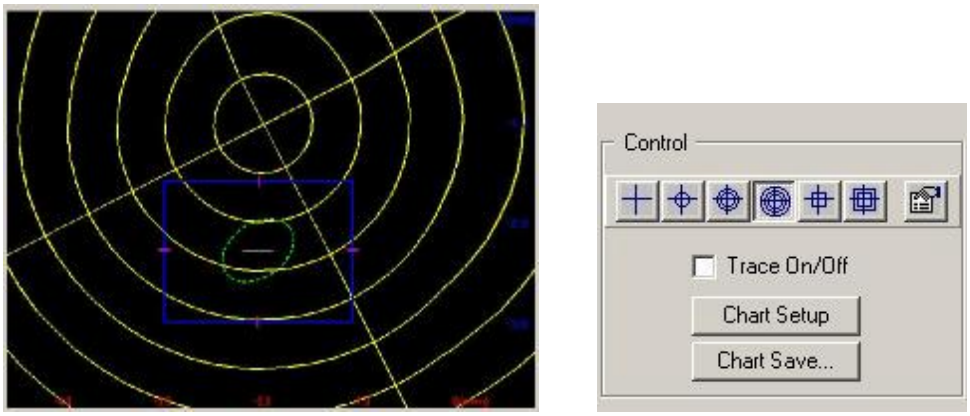


Figure 49 Target Control

Chart position function is used to display changes in in the position (X and Y) with time with auto scaling and saving capabilities.

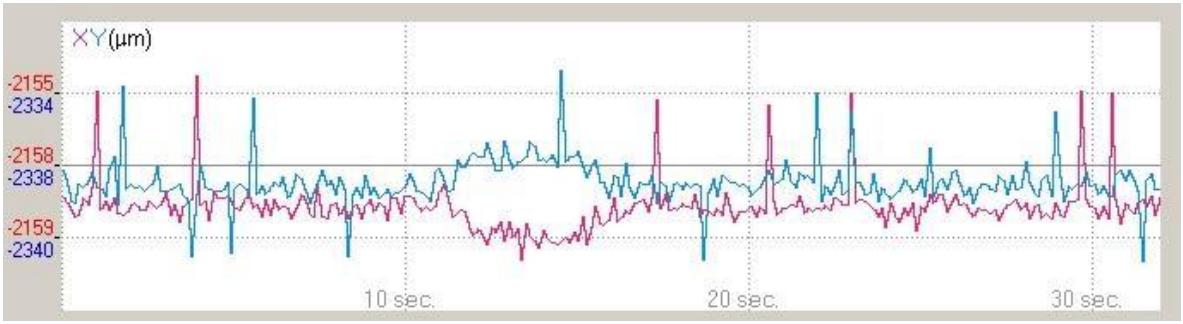


Figure 50 Chart position

8.7 Viewing the Beam Peak

The beam peak calculation provides the position of the peak intensity in the captured beam image.

The beam peak intensity location is found by searching all the pixels in a scanned sample for the maximum digital intensity level. The location of the pixel with maximum intensity is the peak location. It is possible that more than one pixel is found at the maximum intensity signal. In this case, the peak location will be the peak intensity pixel which is found first. The search is conducted by scanning the image from left to right, top to bottom.

The beam peak calculation is displayed in the **Statistics** window. Refer to **Viewing the Statistics** topics for more information.

The LBP HR enables you to display the beam peak in the view area when a 2D image is displayed. The beam peak is located where the two diagonal black lines cross in the view area. Two additional regions of interest (ROI) can be defined by the user and displayed at the Statistics table, thus enabling the user to monitor up to 3 beams' beam peaks simultaneously.

To display the beam peak in the view area:

1. From the **Control Toolbar**, click  for a 2D display.
2. From the **Control Toolbar**, click  for a sum profiles display.

   Open the View menu and select **Beam Peak**.

8.8 Viewing Measurement Data

The LBP HR enables you to view real-time measurement data. The measurement data includes:

- The beam width measurements at 3 selected clip levels for measured beam and Gaussian profile
- The correlation factor to the ideal Gaussian beam

The Measurement Data window is located by default in the User area, but you can move it anywhere on the screen.

The Measurement Data window contains the following information:

Width — The width comparisons of measured beam and Gaussian beam are located at the current selected clip levels (μm).

Correlation — The deformation calculation from the ideal Gaussian beam (%).

Given a theoretical curve (G) and a set of data points from a beam profile (P), where each data set is composed of points for j=0, 1, 2, … N. The correlation coefficient is derived from the following steps:

1. $S = \text{Integral } [(P-G)^2]$
   where S = the integration of the squared differences between the two curves.
2. $So = \text{Integral } [(G)^2]$
   where So = the deformation at each point from the average, Dj.
3. $C = 100 * \{ 1 – [\text{SQRT } (3/S-So)]\}$
   where C = the fit coefficient percentage.

The beam column displays the laser beam's readings. The Gaussian column displays the data of the ideal Gaussian profile.

These measurement results are calculated and displayed for both the Horizontal and the Vertical profile.

The Measurement Data window can be viewed off-line in stored snapshot images for further analysis. Refer to **Creating / Viewing Snapshot Files**.

To view the Measurement Data window:

1. If the **Statistics** window is displayed, open the View menu and select **Statistics**. Or,

   From the **Control Toolbar**, click  .
   The **Statistics** window is not displayed.

NOTE: *When the Statistics window displays, the Measurement Data window is hidden.*

To move the Measurement Data window:

1. Position the cursor on the blank area on the top corner of the Measurement Data window.
2. Press the left mouse button and drag the Measurement Data window to the desired location.

8.9 Saving and Viewing the numerical data of the profiles

The LBP HR allows you to save, view and print the numerical values of the X and Y profiles for later analysis.

To View the numerical data of the X and Y profiles:

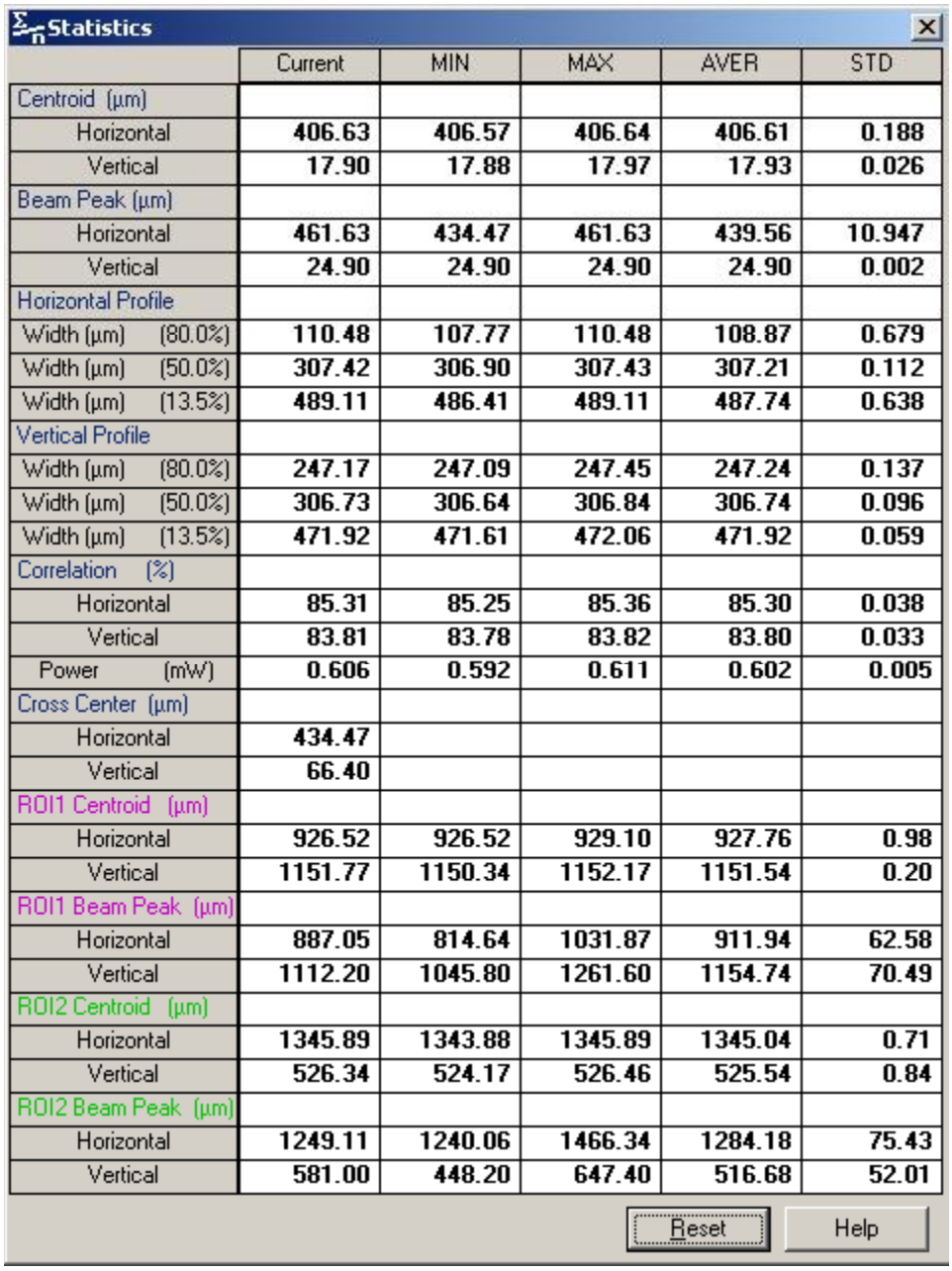
3. Place the X and Y crosshairs at the angle and position you desire.
4. Press **Options** menu, **Save data in text file**, **Profiles** option.
5. Name the text file and save with the TXT extension. The data will be saved as a text file with the relative X and Y intensity vs. pixel number. The setup data will be saved at the same time.
6. To view the data, press **File** menu, **View file** option and the view file window will open. Under Files of type select snapshot files and double click on the desired TXT file. If you want to print the file when open, press **Print**.

8.10 Viewing the Statistics

The information in the Statistics window is useful for analyzing beam stability related characteristics. The statistics can help you monitor fluctuations and beam stability of the images captured and stored in the data buffer or analyze the warm-up characteristics when measuring beam-pointing stability.

- Current - the actual measurement values
- MIN - the minimum measured value

- MAX - the maximum measured value
- AVER - the average value
- STD - the standard deviation



	Current	MIN	MAX	AVER	STD
Centroid (µm)					
Horizontal	406.63	406.57	406.64	406.61	0.188
Vertical	17.90	17.88	17.97	17.93	0.026
Beam Peak (µm)					
Horizontal	461.63	434.47	461.63	439.56	10.947
Vertical	24.90	24.90	24.90	24.90	0.002
Horizontal Profile					
Width (µm) (80.0%)	110.48	107.77	110.48	108.87	0.679
Width (µm) (50.0%)	307.42	306.90	307.43	307.21	0.112
Width (µm) (13.5%)	489.11	486.41	489.11	487.74	0.638
Vertical Profile					
Width (µm) (80.0%)	247.17	247.09	247.45	247.24	0.137
Width (µm) (50.0%)	306.73	306.64	306.84	306.74	0.096
Width (µm) (13.5%)	471.92	471.61	472.06	471.92	0.059
Correlation (%)					
Horizontal	85.31	85.25	85.36	85.30	0.038
Vertical	83.81	83.78	83.82	83.80	0.033
Power (mW)	0.606	0.592	0.611	0.602	0.005
Cross Center (µm)					
Horizontal	434.47				
Vertical	66.40				
ROI1 Centroid (µm)					
Horizontal	926.52	926.52	929.10	927.76	0.98
Vertical	1151.77	1150.34	1152.17	1151.54	0.20
ROI1 Beam Peak (µm)					
Horizontal	887.05	814.64	1031.87	911.94	62.58
Vertical	1112.20	1045.80	1261.60	1154.74	70.49
ROI2 Centroid (µm)					
Horizontal	1345.89	1343.88	1345.89	1345.04	0.71
Vertical	526.34	524.17	526.46	525.54	0.84
ROI2 Beam Peak (µm)					
Horizontal	1249.11	1240.06	1466.34	1284.18	75.43
Vertical	581.00	448.20	647.40	516.68	52.01

Figure 51 Statistics Window

To view the Statistics window:

1. Open the View menu and select **Statistics.** Or,

   From the **Control Toolbar**, click .

You can reset the parameters in the statistics window to initiate a new statistics calculation session. To reset the parameters in the Statistics window, press the **Reset** button.

NOTE: *When the Statistics window displays, the Measurement Data window is hidden.*

8.11 Freezing Screen Graphics

It is possible to freeze the last image display and its measured data for further analysis using the Analysis function. You can perform the following functions on the frozen data:

- Calculating a beam footprint (refer to page 64)
- Measuring distances between two points (refer to page 65)
- Viewing the measurement data (refer to page 57)
- Viewing the Statistics (refer to page 59)

When the LBP HR is in freeze mode, a message displays on the top left-hand side of the screen, which reads: **Freeze Mode**.

To freeze the screen graphics:

1. Open the Options menu and select **Freeze Mode**. Or,

   Click  on the **Control Toolbar**. A Freeze Mode message appears on the menu bar.

To return to real-time measurement mode:

1. Open the Options menu and select **Freeze Mode**. Or,

   Click  on the **Control Toolbar**. The Freeze Mode message disappears from the menu bar.

8.12 Printing Screen Displays

This section describes how to print:

- The LBP HR window
- The view area (2D/3D image only)

To print the LBP HR window, open the File menu and select **Print Screen**.

To print the view area, open the File menu and select **Print Frame**.

8.13 Saving Screen Graphics

The LBP HR's screen graphics are saved as image files, which you can view, edit or print at a later time.

To save screen graphics:

1. Open the Options menu and select **Save Image File**. A sub-menu displays**.**
2. Select the screen section to be saved: Frame (view area), Profiles, Statistics or Full Screen. The **Save Image File** window displays.
3. Enter a filename and file extension (BMP or JPG) for the saved screen graphic.
4. Click **OK**.

☞ ***NOTE****: You can only save graphics, which appear in the LBP HR window. For example, if the Statistics window is not displayed, the Statistics option is disabled.*

8.14 Working with saved Files

You can view or print stored LBP HR files.

Viewing Files

To view a file:

1. Open the File menu and select **View File**, Or

   Click  , from the **Control Toolbar**.

   The **View File** window displays.
2. In the **Files of Type** field, select the file type.
3. Select the file. Click **OK**.

Printing Files

LBP HR provides you with the ability to print a saved text or image file.

To print a text or bitmap file:

1. Open the File menu and select **Print**, Or

   From the **Control Toolbar**, click  .
2. Select the file type for the file you want to print **Text** or **Image**. If you select Text, the **Print Text File** window displays. If you select Image, a menu appears for selecting **Print Image File** window (select BMP or JPG file).
3. Select the file you want to print. Click **OK**.

9.0 Analysis Functions

This chapter includes the following:

- Testing the beam
- Calculating a beam elliptical footprint
- Measuring distances

9.1 Test

LBP HR provides a test routine, which allows you to test a laser beam based on user defined pass/fail criteria. The test results are calculated for any one of the following user-selected parameters:

- Centroid Horizontal (µm)
- Centroid Vertical (µm)
- Width Horizontal (µm) at the lowest clip level
- Width Vertical (µm) at the lowest clip level
- Gaussian Width Horizontal (µm) at the lowest clip level
- Gaussian Width Vertical (µm) at the lowest clip level
- Correlation Horizontal (%)
- Correlation Vertical (%)
- Power (mW)

To test a laser beam:

1. Open the **View** menu and select Toolbars u **Analysis**. Or,

   From the **Control Toolbar**, click  .

   The **Analysis Toolbar** displays.

2. To run the test, click  on the **Analysis Toolbar**.
3. Select the parameters to include in the test and set the minimum and maximum values for these parameters.
4. Enter your test related information.
5. Click **Test** button to perform a test routine.

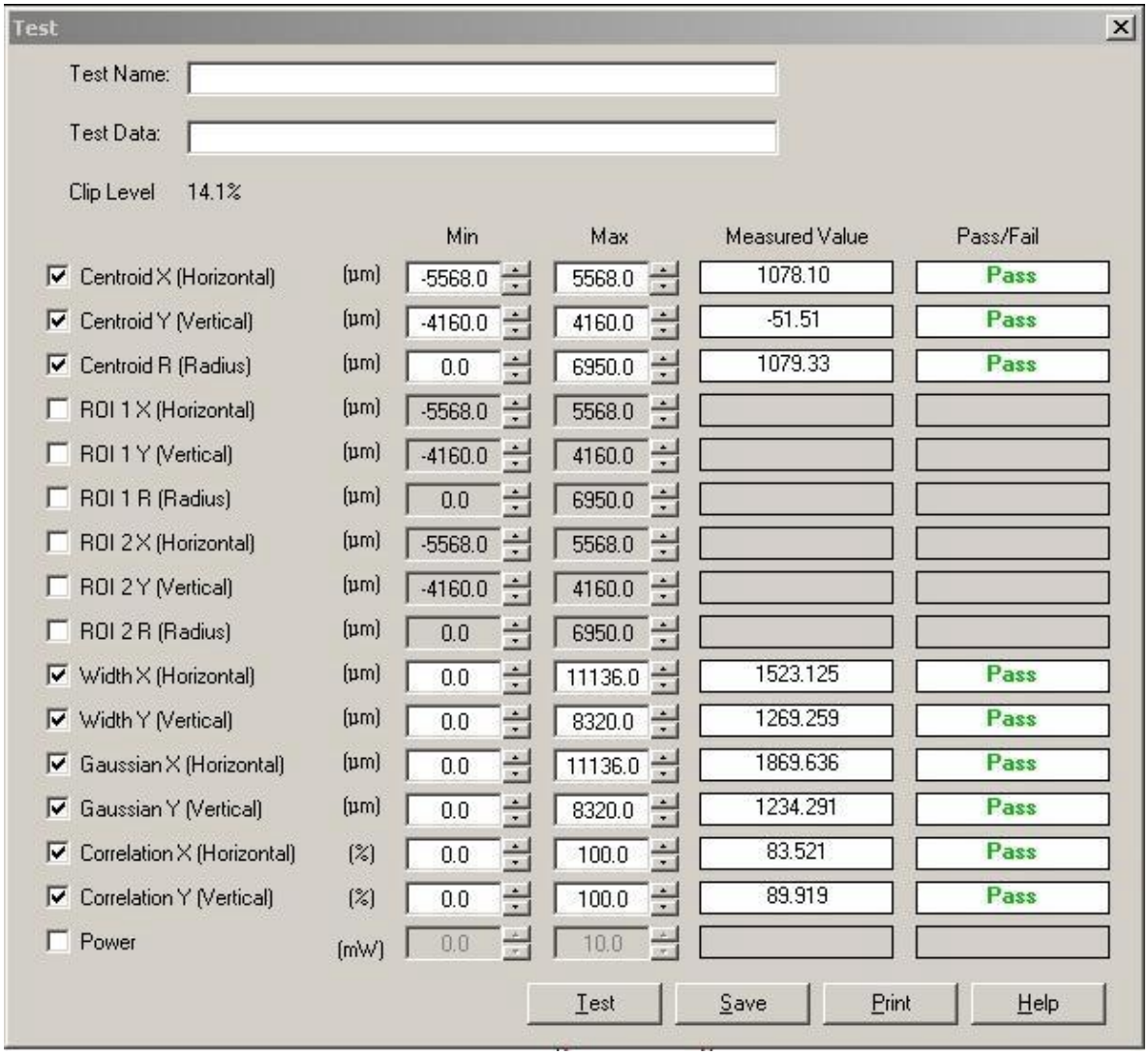


Figure 52 Test window

The test window displays the beam's test results based on the parameters entered in the Test window.

To save the current test results in a bitmap or test file, click **Save** in the Test window.

To print the current test results, click **Print** in the Test window.

To close Test window click PF on the **Analysis Toolbar**.

9.2 Calculating a Beam Footprint

Analyzing a laser beam frequently requires a definition of beam elliptical footprint in the profile cross-section plane, and beam angular orientation with respect to the camera axis. The ellipse function calculates the best-fit ellipsoid for the examined beam. The major and

minor axes of the fit ellipse are calculated by determining the distance from the centroid (center of the beam) to the ellipse. Also, the orientation (Theta θ) is a measure of the orientation of the major axes of the fit. Theta is measured from the positive X-axis and varies between +90° and –90°.

To use the ellipse function the image must be frozen. The LBP HR can now calculate the best-fit ellipse and display it as a dotted white ellipse just around the edges of the measured ellipse. The best-fit ellipse parameters are also calculated and displayed.

To calculate a beam elliptical footprint:

1. Open the Options menu and select **Freeze Mode**. Or,

   From the **Control Toolbar**, click  .

2. Open the View menu and select Toolbars u **Analysis**. Or,

   Click  from the **Control Toolbar**.

   The **Analysis Toolbar** displays.

3. From the **Analysis Toolbar**, click  . The LBP HR calculates the best-fit ellipse and displays it as a dotted white ellipse just around the edges of the measured ellipse. The best-fit ellipse parameters are displayed below the Analysis Toolbar (see below).

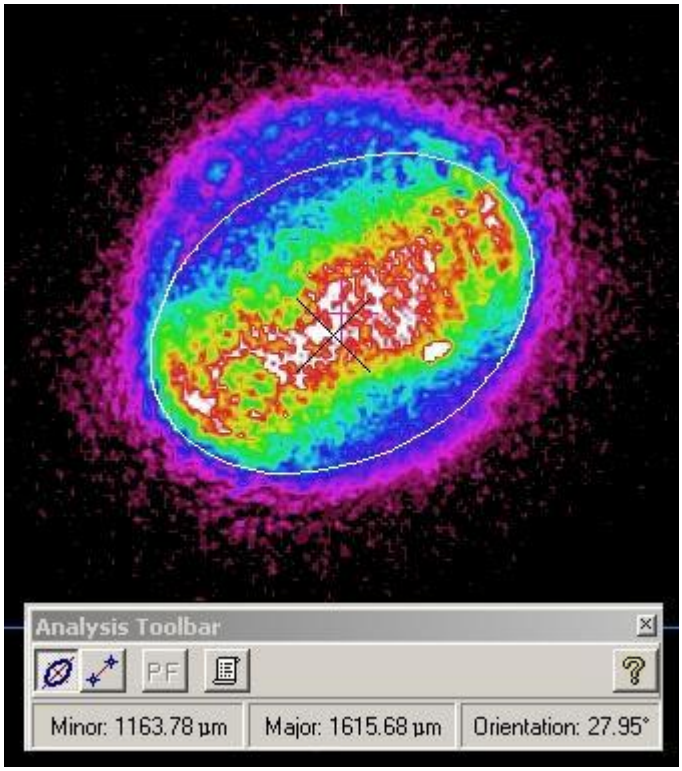


Figure 53 Best fit Ellipse

9.3 Measuring Distances

The LBP HR can accurately measure distances between any two points on the beam image. You select the end points and the LBP HR calculates and displays the results.

To measure the distance between two points on the beam image:

1. Open the Options menu and select **Freeze Mode**. Or,

   From the **Control Toolbar**, click  .

2. Open the View menu and select Toolbars u **Analysis**. Or,

   From the **Control** Toolbar, click  .

   The **Analysis Toolbar** displays.

3. From the **Analysis Toolbar**, click  .

4. Select the first point by placing the cursor on the beam image and click the left mouse button.

5. Drag the mouse to the second point on the beam image and click the left mouse button. A straight line is drawn between these two points and the line distance calculation is displayed below the Analysis toolbar.

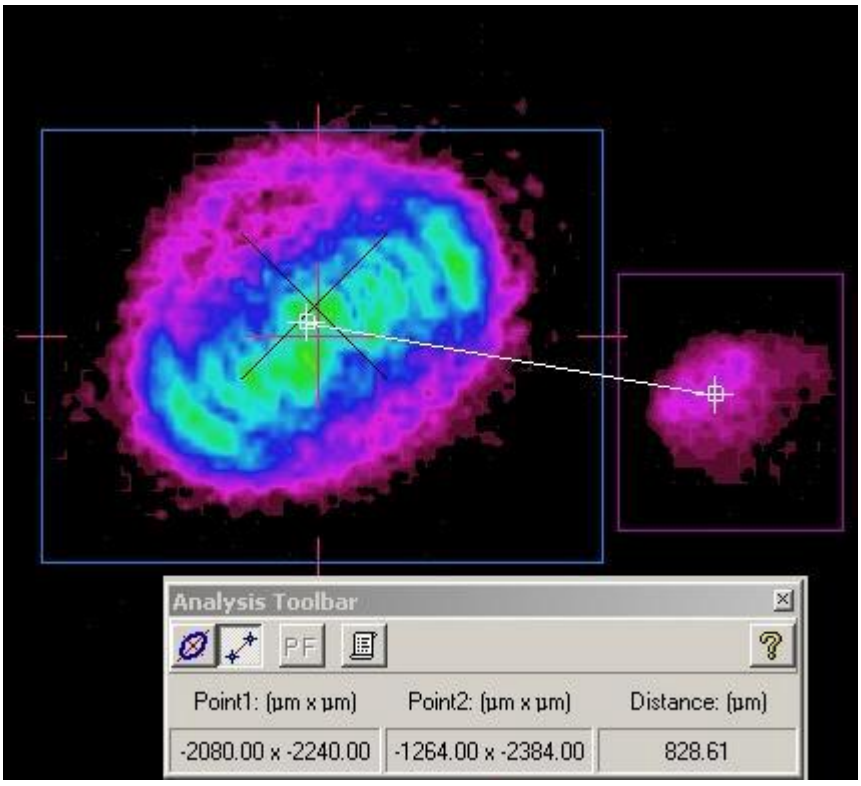


Figure 54 Measuring Distances Between two Points

10.0 Saving Data Log files

This chapter describes how to create a data log.

All the data collected by the LBP HR can be saved in a file with a .LOG extension. The data log files are stored in ASCII format so they can be easily printed, viewed, and analyzed by other programs. Refer to an example of the contents of a data log file (below).

The data log file contains general information including system parameters at the time of the log operation, such as the amount of averaging used, shutter level, Null (Offset) indication, zooming parameter and the size of the picture frame.

Additionally, at the lowest selected clip level beam width measurements for the horizontal and vertical profiles, centroid indication, as well as the power level value are displayed.

The end of the data log file contains a statistics summary of all the measured parameters, including the minimum measured value, maximum measured value, average measured value, as well as the standard deviation for each parameter.

10.1 Setting Up the Data Log Function

This setup screen allows the user to customize the Log operation to suit a particular need: the duration of an experiment, the rate of data saving into file, and the Log filename can be input by this setup screen. Also, data can be saved either to a Log file or to Excel file for further analysis at a later stage**.**

To setup the data log function:

1. Open the File menu and select **Log Setup**. Or,

   From the **Control Toolbar**, click  . The **Log Setup** window displays

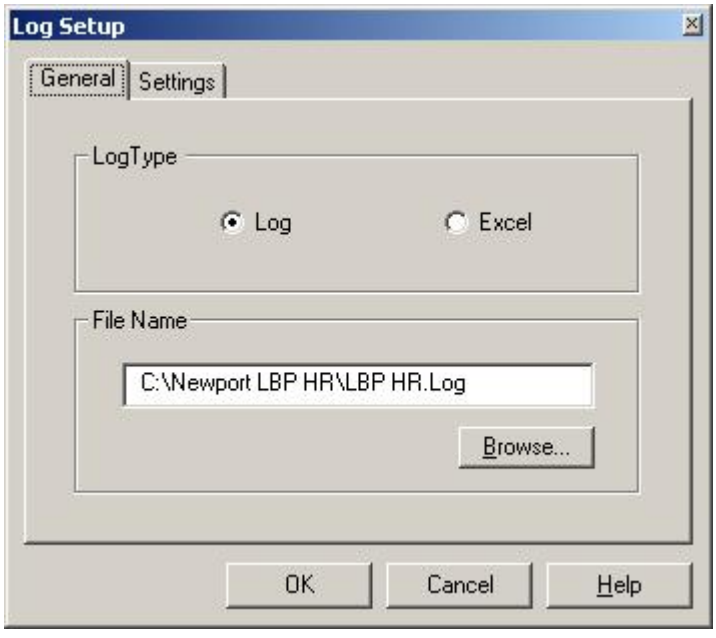


Figure 55 Log Setup

1. **Logtype:** LOG file or Excel file

2. **File Name:** Providing the system with a filename where Log data will be saved. Activate Button Browse... in order to provide the system with a filename via the standard Windows File Input interface box.

Note: When LOG file type was selected, all data collected will be saved in a file name ***.LOG**, which is a text file and can be imported into other programs. When Excel file type was selected, all data collected will be saved in a file name ***.XLS**.

3.Click **OK**.

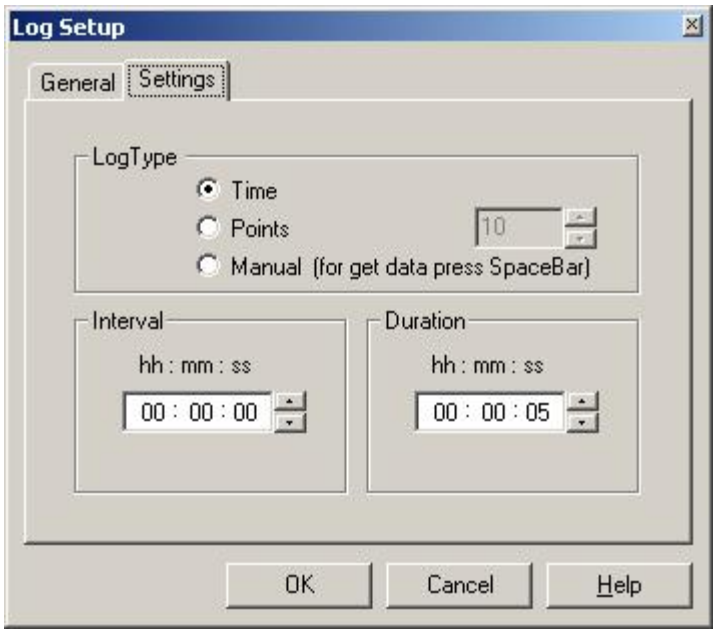


Figure 56 Log Setup – Settings Tab

Interval Configures the time interval between consecutive measurements.

To configure the time interval between consecutive measurements, enter the time. The number of hours, minutes and seconds must each be entered separately.

Duration Defines the duration of the data log function. The data log function ends automatically at the end of the duration; however, you can stop the data log function prematurely (refer to **Stop Data Logging**).

To configure the duration of the data log function, enter the amount of time. The number of hours, minutes and seconds must each be entered separately.

Log Type Provide the system with a method to control the data logging operation:

Time: Save measurements for a pre-defined duration, the interval between the saved measurements is also defined prior to saving.

Points: Save a certain amount of measurements taken at the system's data capturing rate, the exact figure is entered at the points field to the right of this option.

Manual: Save a certain measurement to the file by pressing the SpaceBar. This method is called "Event oriented", meaning once the user observes a certain measurement on the screen he can control the system to save this exact measurement data to the file, rather than other methods of stream data saving.

10.2 Start Data Logging

The LBP HR collects the laser beam's data in the configured data log. While the data log function is in progress, a message displays on the top left side of the screen, which reads: **Log in Progress.**

To start the data log function:

1. Open the File menu and select **Start Log**. Or,

   From the **Control Toolbar**, click  .

10.3 Stop Data Logging

The data log function automatically terminates after the user-preset time is reached. However, you can stop the function at any time.

To stop the data log function:

1. Open the File menu and select **Stop Log**. Or,

   From the **Control Toolbar**, click  .

10.4 Viewing Data Log Files

To view the data log file:

1. Open the File menu and select **View File**.
2. Select the data log file you want to view.
3. Click **Open**. The **Data Log** displays.

*** Newport LBP Measurement system, Version 1.0 ***

UserData:

Date: 11 Dec 2003
Time: 13:27:38

Serial number: 0013

Size:	640x480
Average:	5
Zoom:	Off
Null:	Off
Gain:	10 dB
Shutter:	1/4000 sec
Level:	13.5%

Time (sec)	Centroid_H (µm)	Centroid_V (µm)	Beam Peak_H (µm)	Beam Peak_V (µm)	Width_H (µm)	Width_V (µm)	Power (mw)
0	5636.697	5116.958	5666.368	5087.760	1028.711	1051.327	0.610
1	5636.798	5117.217	5646.416	5087.760	1029.077	1052.208	0.605
2	5636.711	5117.316	5646.416	5087.760	1026.432	1051.198	0.598
3	5636.753	5117.277	5646.416	5087.760	1029.360	1051.124	0.615
4	5636.633	5117.107	5646.416	5087.760	1031.083	1051.243	0.610
5	5636.536	5117.277	5646.416	5087.760	1029.482	1052.578	0.615
**********	Statistics	**********					
Min	5636.536	5116.958	5646.416	5087.760	1026.432	1051.124	0.598
Max	5636.798	5117.316	5666.368	5087.760	1031.083	1052.578	0.615
Aver	5636.688	5117.192	5649.741	5087.760	1029.024	1051.613	0.609
STD	2.092	1.503	8.216	0.959	1.519	0.474	0.007

Figure 57 Data Log File example

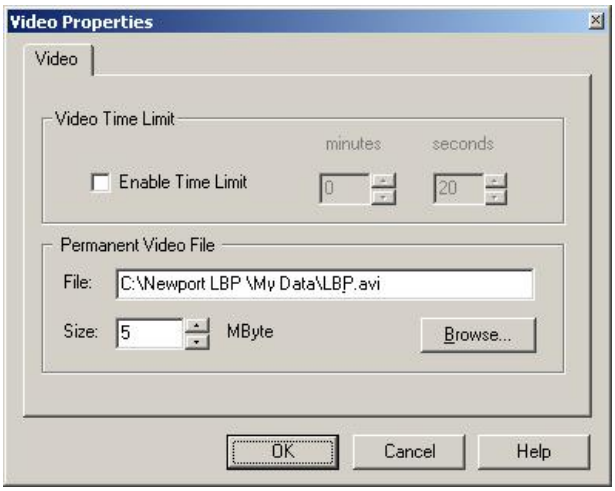
11.0 Creating / Viewing a Video

This chapter describes how to create and view a video file. The recording program enables recording and saving a continuous set of images from a single LBP HR camera source. The video is saved in a file with the extension .AVI.

11.1 Initializing the Video Parameters

To initialize the video parameters:

1. Open the Settings menu and select **Video Properties…**. The Video Properties window displays.



2. Enter your information according to the descriptions below.
3. Click **OK**.

Figure 58 Video Properties

Video Time Limit	Sets a time limit for the video recording. To set the video time limit: 1. Select **Enable Time Limit.** 2. Enter the time limit in minutes and seconds.
Permanent Video File	This setting allows you to specify the filename and path, where the recorded video is saved. For best results, if you have multiple hard drives, this file should be located on the fastest hard disk drive or the disk drive with the most available free space. You can also use this setting to limit the video to a selected amount of memory. To specify a location for the video file, enter the file name and path. To limit the video to a selected amount of memory: 1. Deselect **Enable Time Limit** check box in the **Video Time Limit** field. 2. Enter memory size (in Mbytes) in the **Size** field.

11.2 Record a Video file

When you record a video, the video is saved in the file you specified in the Video Properties window. If you don't want to overwrite this file, you must change the file name before recording a new video.

During video recording, a message at the top of the screen indicates the recording operation. When the LBP HR is recording a video, a message displays on the top left side of the screen, which reads: 

, and during recording the **Status Bar** presents the following pattern: 

You can change the setup parameters while recording your video (refer to **Initializing the Video Parameters**).

To record a video:

1. Open the Options menu and select **Record Video**. A checkmark is placed beside this option. Or,

   Click  from the **Control Toolbar**.

11.3 Stop the Video Recording

The video recording automatically terminates after the user-preset time is reached. However, you can stop recording at any time. When recording terminates, it is automatically saved in the file you specified during video setup.

To stop the video recording:

1. Open the Options menu and select **Record Video**. The checkmark is removed from this option. Or,

   Click  from the **Control Toolbar**.

When video recording is terminated the following message is displayed:

Figure 59 Stop video recording

11.4 Play a Video File

During a video playback routine, the LBP HR displays a digital presentation of the time elapsed since the video began, as well as the number of the frame being displayed.

To play a video, open the video file you want to see and use the following buttons on the Playback Toolbar to play your video:

	Play	Plays the recorded video file.
	Stop	Stops the playback of the video file once it is started.
	Rewind	Rewinds the current video one frame backwards.
	Forward	Fast-forwards the current video one frame.
	Open	Opens a video file.
	Close	Closes an open video file.

There is a slide bar in the middle of the Playback Toolbar, which moves in accordance with the video's progress. It is also possible to use this slide bar to rewind the video to its starting point, or to bring it to the end of the video.

To play a video file:

1. Open the View menu and select Toolbars u **Playback**. Or,

   Click  from the **Control Toolbar**.

   The **Playback Toolbar** displays.
2. Click  on the **Playback Toolbar**. The **Open Video File** dialog displays.
3. From the Open Video File dialog, select the video file you want to view.
4. Click **Open**. The video file displays.
5. Use the **Playback Toolbar** buttons as defined above to play the video.
6. Click  to close the video file.

12.0 Saving / Viewing Still Images

This chapter describes how to capture and view high quality digital images with LBP HR system. A still image is captured by digitizing a single video frame. The still images can be saved as bitmaps.

The captured image is displayed as an icon on the Status Bar with a number assigned to it. If you are using a pulsed laser, you can set the number of bitmap files that the system captures when performing a still image operation. The LBP HR can capture up to 12 still images during one session.

12.1 Capturing a Still Image

To capture a still image:

1. Open the Options menu and select **Still Images**. Or,

   Click  on the **Control Toolbar**.

   The image is captured and an icon is placed on the Status Bar.

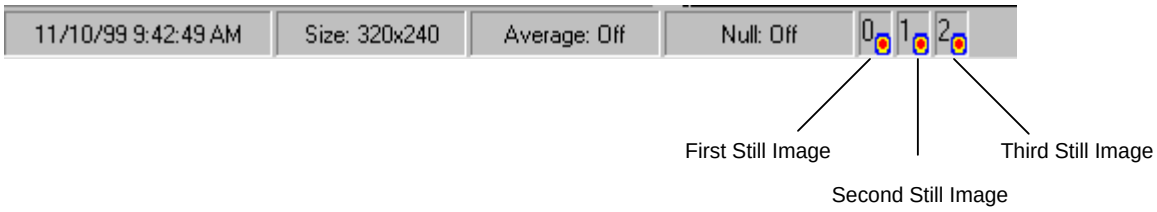


Figure 60 Status Bar with Still Image Icons

12.2 Viewing a Still Image

To view a single still image, click the still image icon on the **Status Bar**.

To close the magnified still image, click  in the upper right corner of the image window.

12.3 Tile Images

You can view a single still image or all your still images in a matrix (refer to the following figure). When viewing the still images in a matrix, you can select a single still image to magnify for details.

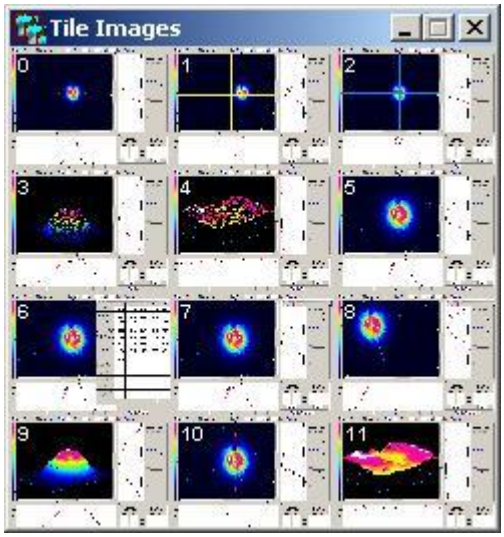


Fig. 61: Tile Images window

To view a single still image, click the still image icon on the Status Bar, as explained in previous section.

To view the still images in a matrix, open the **Options** menu and select **Tile Images**.

To magnify a still image in a matrix, click one of the tile images. To close the magnified still image, click in the upper right corner of the image window. The still image remains in the matrix.

12.4 Saving / Closing Still Images

When you close a still image you must either save it or discard it. If you close a still image matrix and choose to save it, each of the images in the matrix are saved as separate bitmap files. The bitmap filenames are created by the LBP HR and consist of the image number, day, hour, minutes and seconds (n_ddhhmmss.bmp).

To close an opened still image or still image matrix:

1. Click in the upper right corner of the image window. The **Still Image** window displays.
2. If you want to save the still image, click **Yes** in the Still Image window.

To close all captured images at once, open the Options menu and select **Close All Images**.

13.0 Creating / Viewing Snapshot Files

Snapshot files enable you to create and view a pre-saved snapshot image for analysis and in-depth study of a beam measurement frame stored in the system's memory.

When you view a saved snapshot file you can analyze the measured results by activating system tools, such as:

- Viewing measurement data
- Change profiles clip levels
- Explore 2D contour or 3D isometric plots
- Perform Beam Analysis.

When the LBP HR displays the snapshot file, a message displays on the top left side of the screen, which reads: **Snapshot in progress**. The LBP HR does not display real-time measurements and the screen is frozen.

13.1 Creating a Snapshot File

The snapshot image is captured as soon as you select the Save Snapshot option. You then save the snapshot image as an .SNP file. The snapshot file is saved in binary format and can only be processed by this application.

To create a snapshot file:

1. Open the Options menu and select **Save Snapshot**. The Save Snapshot File window displays.
2. Enter a filename for the snapshot file.
3. Click **OK**.

13.2 Viewing a Snapshot File

To view a snapshot file:

1. Open the View menu and select **Snapshot**. The Load Snapshot File window displays.
2. Select a snapshot file.
3. Click **Open**. The snapshot file displays.

13.3 Closing a Snapshot File

To close a Snapshot file, open the View menu and select **Snapshot**. The LBP HR restores real-time measurement displays, or click  in the upper right corner of the image window.

14.0 RS232 Communication

The LBP HR enables you to operate an RS-232 communication link for serial data transmission.

Any displayed data or pre-saved log file can be transmitted via the RS-232 communication link. Another computer can receive the data using a program that can communicate over a COM Port like Windows Hyper Terminal program.

While the link function is in progress, a Link in progress message displays on the top right corner of the Menu Bar.

Transmitting serial data requires the following steps:

- Setting up the parameters needed for the link transmission.
- Making a null modem cable for connecting the two computers.
- Starting the link transmission.
- Terminating the link transmission.

14.1 Setting Up for RS232

The LBP HR allows you to configure a particular set of parameters needed for the RS-232 transmission.

To configure the RS-232 link:

1. Open the File menu and select **Link Setup**. The Link Setup window displays.
2. Click the **General** tab.

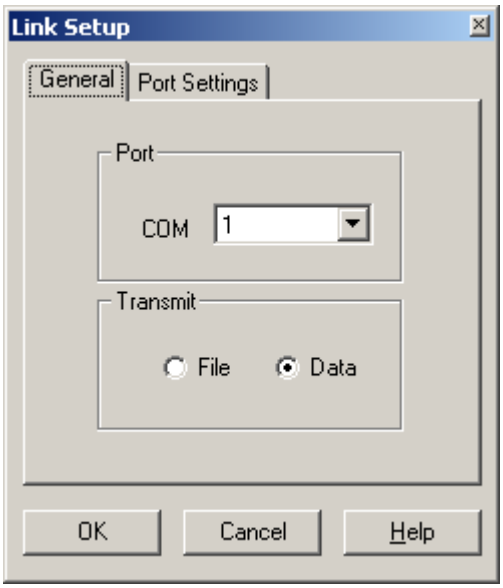


Figure 62 Link Setup - General Tab Selected

3. Complete the information as described below.

Port Sets the computer communication port through which the data is transmitted over the RS-232 link. The possible values for Port are 1 through 4, for COM1 through COM4 respectively.

Transmit Select one of the radio buttons:

- **File** - transmits a pre-saved text file.
- **Data** - transmits real-time measurements. The data is sent in the sequence and format of the saved data in the text (ASCII) file.

4. Click the **Port Settings** tab.

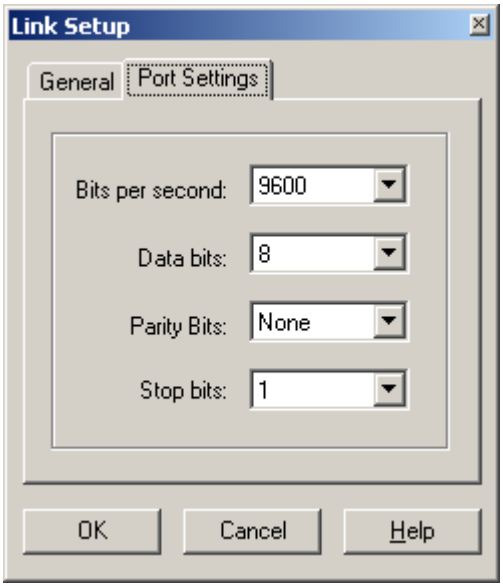


Figure 63 Link Setup - Port Settings Tab Selected

5. Complete the information as described below. These settings must match the settings on the receiving computer.

Frequency Sets the transmission rate for the RS-232 link. The possible values for Frequency are: 110, 300, 600, 1200, 2400, 9600, 14400, 19200, 38400, 57600, 115200.

Data Bit Determines the number of bits used for the RS-232 transmission. The possible values are: 4, 5, 6, 7, and 8.

Parity Bit Determines whether or not a parity bit is transmitted. The possible values are: None, Odd, Even, Space, Mark.

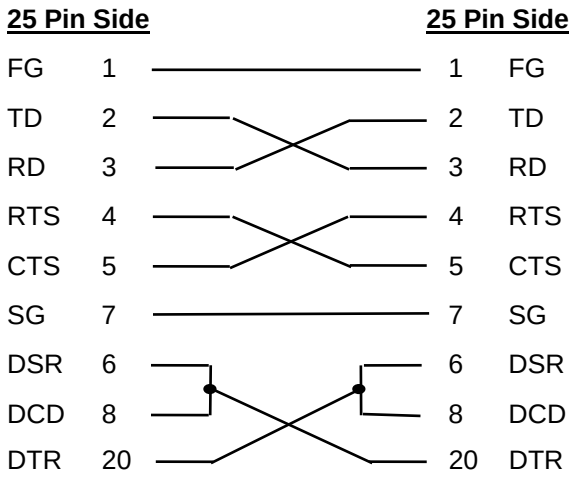
Stop Bit Determines the number of stop bits transmitted. The possible values are: 1 or 2.

6. Click **OK**.

14.2 Making a Null Modem Cable

A null modem cable can be made from a standard RS-232 cable by connecting the pins on one end of the cable to the pins on the other end as shown below.

Null modem cable with 25 pins on both sides:



Null modem cable with 9 pins on both sides:

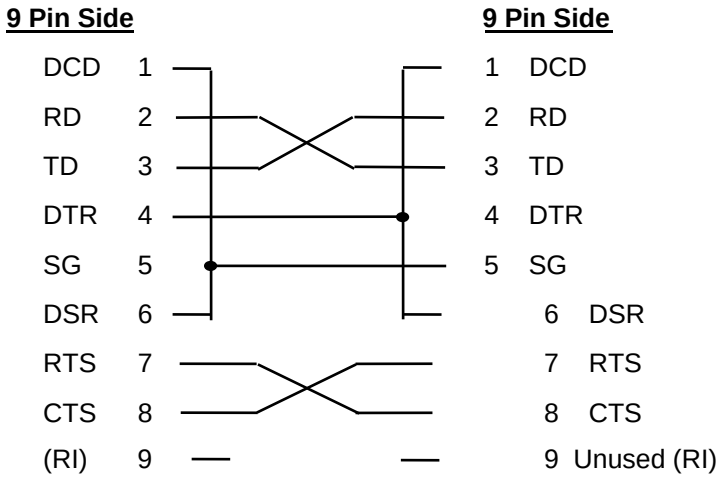


Figure 64 Null Modem cable

14.3 Starting an RS-232 Link Transmission

The file (or measured data) is transmitted in the background while the system continues to capture data. When the LBP HR is transmitting data, a message displays on the top left side of the screen, which reads: **Link in progress**.

If you transmit a file, the contents of the file are sent.

If you transmit real time data, the following information is sent:

- Time of measurement
- Beam Centroid (H)
- Beam Centroid (V)
- Beam Peak (H)
- Beam Peak (V)
- Width (H)
- Width (V)
- Power

To transmit files over an RS-232 link:

1. Connect the LBP HR computer to another computer using a null modem cable.
2. Enable the receiving program to receive the file/data.
3. Open the File menu and select **Start Link**.
4. If you are transmitting data the LBP HR immediately starts sending measured data via the RS-232 link. A “link in progress” message displays on the Menu Bar. Proceed to **Terminating an RS232 link.**
5. If you are transmitting a file, the **Link File** window displays. Select the file you want to send. A 

message displays on the Menu Bar.
6. Click **OK**.

14.4 Terminating an RS-232 Link Transmission

When transmitting a file, the RS-232 link transmission is automatically terminated upon completion of the transmission. However, if you are transmitting data, or you want to terminate your file transmission, you can manually terminate a transmission in progress.

To stop a transmission in progress, open the **File** menu and select **Stop Link**.

15.0 Troubleshooting

If, after reading this chapter and reviewing relevant portions of the user manual or on-line help, you still have a question, refer to **Customer Support** on page 85.

15.1 Common Operating Problems

The following are some common problems and possible solutions:

Problem	Possible Solution
Display Problems:	
• No picture appears on the screen	• If you are using a camera other than the one provided by the LBP HR System, make sure it is turned on. • Check the Settings parameters (refer to **Setting Up the LBP HR**). If this does not correct the problem: • If using Windows XP/Vista, refer to **Windows XP/Vista Installation**.
Other Windows applications run slowly, or appear to be interrupted	Because the LBP HR System must constantly collect and analyze data, it might not work well with all Windows applications. If you want to use another application while the LBP HR System is running, select **About** from the Help menu. This will cause the LBP HR to pause the data collection. Now run your other application.
System Locks-up During Software Startup	• If using Windows XP/Vista, refer to **Windows XP/Vista Installation**.
The following error message displays: "Hardware error #1: Cannot find the USB Camera"	Possible problems include: • Check proper connection of USB camera • Unsuccessful installation of the USB camera – check installation via Windows Device Manager. See more details at the **Software Installation – LBP HR USB 2.0** camera. • Problem with video card hardware – contact your provider
The following error message displays: "Video Device Error"	• Contact factory for Service

Problem	Possible Solution
Display does not update fast enough	The display update rate of a particular computer is influenced by a variety of factors: • CPU Speed • Computer RAM • Video Card • Video RAM • Screen resolution • Screen color depth • Other applications open at the same time Refer to **Hardware Requirements** to see if your computer meets minimum requirements. Upgrade your computer hardware or close other opened applications.
The power value in the Measurement Data window is not correct	Verify that: • The Power Calibration is set (refer to **Configuring Hardware** topic). • The Null Calibration is performed (refer to **Setting the Ambient Light Suppression (CW lasers)**. • The LBP HR camera is not saturated (refer to **Using Filters**).
Image is seen, but appears faint (weak intensity)	• Try setting a smaller shutter speed or Gain value in order to improve the image presentation (refer to **Configuring the Hardware**, Shutter option or Gain. • Use the Zoom option to magnify the image display (refer to **Configuring the Software**, option Zoom).
Screen image is frozen, no real-time measurements	• Verify that the Freeze option is not activated, by checking the menu bar for a “freeze” message (refer to **Freezing Screen Graphics**). • Verify that the Snapshot option is not activated, by checking the menu bar for a “snapshot” message (refer to **Creating / Viewing Snapshot files**.
The image in the view area does not fully display	If the Zoom option is greater than 100%: • Use the scroll bars to reach the main image presentation display. • Reduce the Zoom value to 100%.
The Control Toolbar is not complete	You must use a 1024 x 768 resolution screen in order to fully view all the graphics. You can still operate the system using the menu commands for activating the hidden **Control Toolbar** icons.

16.0 A P P E N D I X

1. NG4 filter transmittance & curve
2. NG9 filter transmittance & curve
3. NG10 filter transmittance & curve
4. ActiveX Software

NG 4

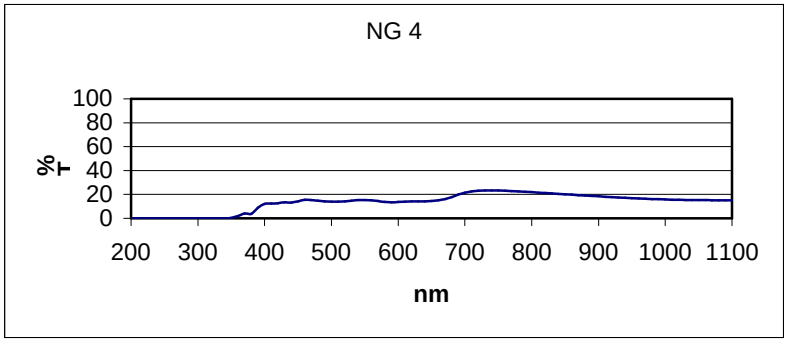
Diameter 12,7 mm

Thickness 1,6 mm

Wavelength-nm	Transmission-%
350	0.353
360	1.767
370	3.89
380	3.866
390	8.864
400	12.014
410	12.274
420	12.659
430	13.459
440	13.25
450	14.276
460	15.416
470	15.369
480	14.809
490	14.304
500	14.039
510	13.985
520	14.23
530	14.68
540	15.153
550	15.267
560	14.955
570	14.377
580	13.772
590	13.439

Wavelength-nm	Transmission-%
600	13.574
610	13.898
620	14.223
630	14.342
640	14.282
650	14.388
660	14.885
670	16.003
680	17.803
690	19.871
700	21.517
710	22.503
720	23.025
730	23.256
740	23.304
750	23.211
760	23.032
770	22.776
780	22.51
790	22.197
800	21.865
810	21.507
820	21.171
830	20.809
840	20.45
850	20.092
860	19.754
870	19.401
880	19.088
890	18.738

Wavelength-nm	Transmission-%
900	18.385
910	18.078
920	17.766
930	17.459
940	17.179
950	16.905
960	16.637
970	16.404
980	16.19
990	15.984
1000	15.807
1010	15.644
1020	15.493
1030	15.364
1040	15.271
1050	15.191
1060	15.169
1070	15.121
1080	15.072
1090	15.129
1100	15.125



NG 9

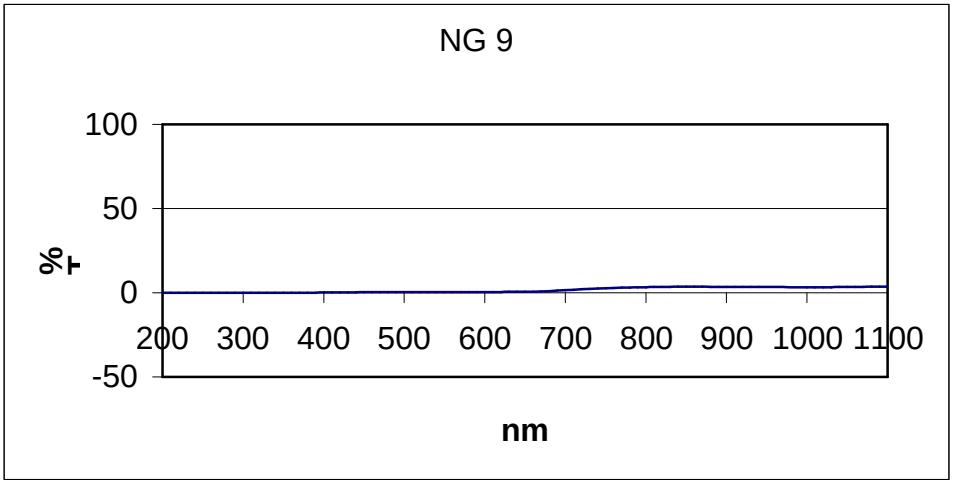
Thickness 1,6 mm +/- 0,1 mm

Diameter 12.7mm

Wavelength-nm	Transmission-%
350	0.002
360	0.001
370	0
380	0.008
390	0.049
400	0.117
410	0.159
420	0.196
430	0.241
440	0.244
450	0.294
460	0.366
470	0.378
480	0.362
490	0.342
500	0.335
510	0.327
520	0.332
530	0.345
540	0.362
550	0.365
560	0.361
570	0.35
580	0.34
590	0.344

Wavelength-nm	Transmission-%
600	0.367
610	0.402
620	0.446
630	0.485
640	0.523
650	0.575
660	0.654
670	0.781
680	0.978
690	1.236
700	1.517
710	1.787
720	2.033
730	2.252
740	2.454
750	2.633
760	2.802
770	2.962
780	3.086
790	3.204
800	3.31
810	3.395
820	3.456
830	3.502
840	3.53
850	3.542
860	3.548
870	3.53
880	3.515
890	3.489

Wavelength-nm	Transmission-%
900	3.453
910	3.421
920	3.396
930	3.364
940	3.333
1000	3.268
1010	3.278
1020	3.298
1030	3.317
1040	3.347
1050	3.374
1060	3.423
1070	3.486
1080	3.522
1090	3.602
1100	3.675

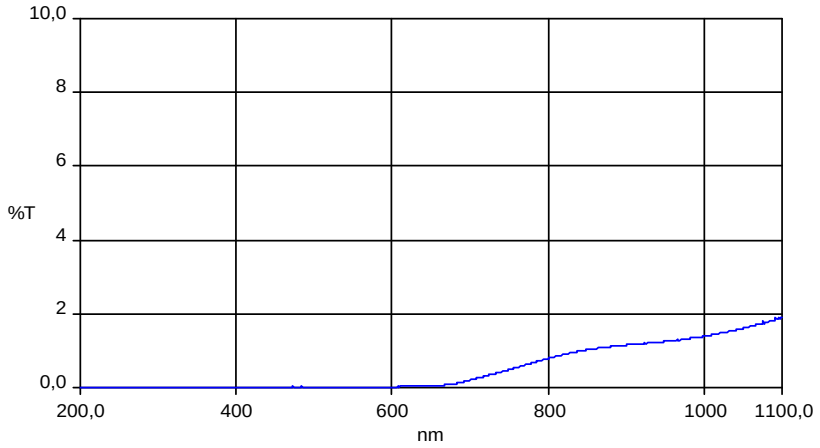


Type :	**NG10**
Thickness	**1,6 mm**
Diameter	**12,7 mm**

Wavelength-nm	Transmission-%
350	0.000
360	0.000
370	0.000
380	0.008
390	0.000
400	0.000
410	0.003
420	0.000
430	0.001
440	0.007
450	0.011
460	0.017
470	0.020
480	0.016
490	0.016
500	0.022
510	0.016
520	0.015
530	0.017
540	0.021
550	0.020
560	0.019
570	0.018
580	0.019
590	0.018
600	0.021
610	0.024

Wavelength-nm	Transmission-%
620	0.030
630	0.031
640	0.037
650	0.043
660	0.054
670	0.073
680	0.107
690	0.152
700	0.206
710	0.259
720	0.313
730	0.369
740	0.429
750	0.485
760	0.545
770	0.608
780	0.671
790	0.726
800	0.788
810	0.845
820	0.904
830	0.942
840	0.984
850	1.023
860	1.062
870	1.084
880	1.112
890	1.135
900	1.153
910	1.169
920	1.189

Wavelength-nm	Transmission-%
930	1.209
940	1.225
950	1.249
960	1.273
970	1.297
980	1.333
990	1.360
1000	1.393
1010	1.431
1020	1.471
1030	1.510
1040	1.558
1050	1.603
1060	1.653
1070	1.717
1080	1.776
1090	1.801
1100	1.904



Active X Software (for Windows XP)

Introduction

As mentioned in previous chapters, the Newport LBP HR is a full capture and analysis application with sophisticated capabilities. However, many customers have special analysis demands and tools, yet are lacking data collection capabilities. In order to meet this demand, the LBP HR can act as an ActiveX server. This allows system integrators to integrate the LBP HR's data capture capabilities with legacy analysis packages.

This has been tested in LabVIEW 7.0 (National Instruments) as well as Visual Basic 6.0 (Microsoft). In practice, these controls can be used in any environment that allows interaction with ActiveX servers (although it hasn't been tested with tools other than those mentioned).

Registration

The ActiveX controls will be registered the first time that the LBP HR software application is run.

Examples

Examples of a LabVIEW and a Visual Basic application are provided with the installation CD disk. All examples assume a rudimentary knowledge of the respective development platforms.

Active X Details

Types

1) **ccdUpdated**
   a. Flag used to inform calling application if camera has made a new measurement (used with the DataUpdated property). Also used on startup to inform calling application that the camera has been initialized (used with the SettingsUpdated property)
   b. Values
      i. ccdNotUpdated = 0 (Settings/Data not yet updated)
      ii. ccdUpdatedSusccessful = 1 (Settings/Data have been updated)
      iii. ccdFailed = -1 (Failed to set up initial settings)

Events (in Visual Basic only)

Note: Events can only be used in Visual Basic applications. In order to use events, the EventsEnabled property (described below) must be set to TRUE.

1) DataUpdated: LBP HR has made a new measurement
2) ShutterChanged: Shutter setting has been updated
3) GainChanged: Gain setting used by hardware has been updated
4) ErrorMessage: LBP HR is reporting an operational error (as a code and as a text message).

Properties

1) **ShutterTable**
   a. Used to get the shutter table used by the camera hardware
2) **Shutter**
   a. Used to get or set the shutter time of the camera
   b. Used Shutter value from array values of the Shutter Table
3) **GainTable**
   a. Used to get the gain table used by the camera hardware
4) **Gain**
   a. Used to get or set the gain used by the camera hardware
   b. Used Gain value from array values of the Gain Table
5) **SizeCapture**
   a. Used to get or set the size of the capture screen
   b. Used with the ccdSize type described above
6) **ClipLevel**
   a. Used to get or set the Clip Levels of the profiles
7) **EnableEvents**
   a. Used to enable Visual Basic events. This is compatible with Visual Basic applications that used simple broadcast events.
   b. Default is set to FALSE (no Visual Basic events)
8) **SettingsUpdated**
   a. Used on startup to inform the calling application that the LBP HR has finished its initialization
   b. Used with the ccdUpdated type described above
9) **DataUpdated**
   a. Used by non-Visual Basic applications.

b. Set to 0 by calling application to request new measurement from the LBP HR
c. Set to 1 by LBP HR to inform calling application that a new measurement has been made and processed

Methods

1) **HideForm**
    a. When launched, the LBP HR window is displayed. This property allows the window to be hidden without affecting measurements, thereby freeing the screen for the calling application.
2) **ShowForm**
    a. Allows LBP HR window to be displayed
3) **GetCentroid**
    a. Returns horizontal and vertical centroid in a 2 elements array
    b. Values are in microns
4) **GetPeak**
    a. Returns horizontal and vertical Beam peak in a 2 elements array
    b. Values are in microns
5) **GetBeamWidths**
    a. Returns array of horizontal and vertical beamwidths at all 3 clip levels
    b. First 3 elements are horizontal beamwidths at clip levels 1,2, and 3
    c. Second 3 elements are vertical beamwidths at clip levels 1,2, and 3
    d. Values are in microns
6) **GetGaussWidths**
    a. Returns array of horizontal and vertical gaussian widths at all 3 clip levels
    b. First 3 elements are horizontal gaussian widths at clip levels 1,2, and 3
    c. Second 3 elements are vertical gaussian widths at clip levels 1,2, and 3
    d. Values are in microns
7) **GetGaussCorrelation**
    a. Returns horizontal and vertical correlation in a 2 elements array
    b. Values are in percent
8) **GetColorMaxAmplitude**
    a. Return highest pixel intensity measured
    b. Value is between 0.0 and 100.0
9) **GetAmplitudeVectorX**
    a. Returns horizontal profile as array with values from 0.0 to 100.0
    b. Array length is a function of capture size
10) **GetAmplitudeVectorY**
    a. Returns vertical profile as array with values from 0.0 to 100.0
    b. Array length is a function of capture size
11) **GetMatrix**
    a. Returns input matrix array from CCD detector with values from 0 to 255
    b. Array length is a function of capture size
12) **GetPower**
    a. Returns power measured in milliwatts
    b. If LBP HR wasn't calibrated for power, returns 0.

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