LASERCHECK®

Model 5872
Surface Roughness Measurement Gage

User's Manual - Version 5.1

TABLE OF CONTENTS

Performance Specifications

Measurement / Detection Method	Laser reflectance and scattering
Measurement speed	10 measurements per second
Measurement range	< 0.1 to > 50 µinch / 25 to 12,500 Aº / 0.0025 to 1.25 µm
Accuracy	± 2.0% of measured value
Repeatability	<± 1.0% of measured value
Reflectivity range	< 1.0 % to 100 %
Nominal standoff distance from surface	1.06 inches / 27 mm
Tolerance in standoff distance from surface	± 0.06 inches (± 1.5 mm)
Surface shapes that can be measured	flat, cylindrical
Spot size (area measured)	5 mm X 1 mm
Laser type	visible semiconductor diode
Laser wavelength	650 nm
Average laser power	900 µWatts
Peak laser power	3.0 mWatts
Environmental considerations (temperature / humidity)	
Operating	-10º C to +55º C / 10% to 90% RH
Storage	-40º C to +80º C / 1% to 99% RH
Power requirements	110 VAC, 50 / 60 HZ, 2.0 Amps max.
Size / Weight	
Measurement Head	12 inch X 5.5 inch X 5.375 inch / 9.5 lb.
Power Supply	9.75 inch X 7.125 inch X 5.5 inch / 9.0 lb.

Computer Requirements

Pentium based computer with 16 MB RAM
Windows 95
VGA/SVGA monitor
Available serial ports configured as comm1 and comm2

Other Features

Auto reflectivity correction
Stored and printed items:
- Roughness Plot
- Date and Time
- Average Ra Roughness and Standard Deviation
- ASCII Formatted File
- Individual Measurement Values

SAFETY

Electrical

Lasercheck has been designed as a sealed and enclosed system. Voltages to operate the measurement head are low (0 to ±15 Volts) to minimize shock hazard. A power supply in the control unit converts 110 Volt AC from a wall receptacle to the low regulated DC voltages that power the system. High voltages are present and they are ***dangerous.*** Lasercheck should ***never*** be run with the control unit open as it exposes operators to hazardous voltages.

Laser

At the corner of the control unit is a labeled on/off switch. Turning this to the *on* position provides power to the internal laser. A red LED beside the switch is illuminated when the laser is operating. The laser used in Lasercheck is a class II laser device. Class II lasers are not considered hazardous to the skin but are considered a "chronic viewing hazard". Users should not stare directly into the beam or directly into the beam reflected off a specular surface. The ends of the Lasercheck measurement head have "Caution" and "Avoid Exposure" labels to remind the operator to avoid exposure to the radiation. The Lasercheck control unit also has an "Identification" and "Certification" labels. Reproductions of these labels are shown below. Figure 1 on page 10 of the manual show the placement location of these labels on the Lasercheck measurement head.

Caution – use of controls or adjustments or performance or procedures other than those specified herein may result in hazardous radiation exposure.

The measurement head emits a red visible (650-nm) laser beam pulsing at a 10 Hz. Each "pulse" contains as much as 90 microjoules of energy in as short as a 20 millisecond interval, with 20 microsecond rise and fall times, creating a maximum "peak" power of as much as 4.5 milliwatts. Average maximum power being emitted from the laser, at this repetition rate, is 900 microwatts. Once the beam strikes the measurement surface, the laser energy is reflected back into the Lasercheck detection system. However, multiple reflections and stray light may exit from between the head and measurement surface and care should be taken to avoid direct eye exposure to the radiation.

O P T I C A L D I M E N S I O N S LLC
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Lake Forest, CA 92630

Complies with
21 CFR 1040.10 and 1040.11
U.S. Patent No. 5,608,527

Model 5872
Serial No. _____
Mfg. Lake Forest, CA
200__

WARRANTY

Optical Dimensions, LLC certifies that the Model 5872 Lasercheck surface roughness measurement system meets specifications. The Lasercheck system has a warranty period of 30 days, extended to one (1) year upon receipt of full payment according to the terms specified on the invoice. This warranty is against defects in material and workmanship. During the warranty period, Optical Dimensions will, at its option, either repair or replace products, which prove to be defective.

For warranty service or repair, the Lasercheck system must be returned to Optical Dimensions, Lake Forest, CA after prior authorization has been obtained from Optical Dimensions. Buyer shall prepay shipping charges to Optical Dimensions. Optical Dimensions will pay shipping charges to return the Lasercheck system to the Buyer.

Overseas Buyers are to pay all shipping charges, taxes, and duties to Optical Dimensions. The following statement should be on all documentation for customs: "I, _____, declare that the article(s) herein specified is (are), to the best of my knowledge and belief, the manufactured products(s) of the United States; that it (they) was (were) exported from the United States, from the port of _____ on or about the ___ day of 20___; that it (they) is (are) returned for warranty repair without having been advanced in value or improved in condition by any process of manufacture or other means. (Your signature)".

LIMITATION OF WARRANTY

This warranty will not apply to defects resulting from improper or inadequate maintenance by Buyer (please refer to Maintenance section), unauthorized modification or misuse, operation outside the environmental specifications, improper site preparation or site maintenance, fire, flood earth movement or collapse. Optical Dimensions shall not be liable for any direct, indirect, special, incidental or consequential damages, whether based on contract, tort, or any other legal theory. No other warranty, whether expressed or implied, will be valid.

Assistance

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MAINTENANCE

Lasercheck has been designed and assembled by skilled and experienced engineers and technicians. All components used in the system operate well within their rated specifications to ensure long life and reliability of the Lasercheck system. Electronics, lasers, and detectors are all solid state devices and should not need to be serviced or maintained by the user.

Boards and electronics used in the system are static sensitive and easily damaged by mishandling. The Lasercheck housing and electronics are well grounded and all mounts are made of ¼ inch and ½ inch aluminum for rigidity. The housing is sealed at all seams and holes to protect components from external contaminants. The user for any reason should not open the measurement head. *If opened, the warranty provided by Optical Dimensions will be void.*

Cleaning the Window

The internal optics and electronics are cleaned during assembly and kept within the sealed head. The outside window at the bottom of the Lasercheck head will be exposed to outside contaminants and should be cleaned at least weekly with more frequent cleanings in very dirty environments. Dust and light visible films will not affect Lasercheck performance on rougher surfaces, but on very smooth surfaces (1 to 2 µinches or smoother), even light films and dust can affect performance and should be cleaned off frequently.

The windows are rugged, but care needs to be taken to not scratch them during operation or cleaning. They should only be cleaned with ethanol, methanol, or a quality glass cleaner and a soft, lint-free lens paper or tissue.

INTRODUCTION TO LASERCHECK

Overview

Lasercheck is designed to perform high speed, accurate, non-contact measurements of surface roughness. A built in visible laser diode emits a laser beam from the bottom of the gage illuminating the surface beneath it. After striking the surface, the laser light is reflected and scattered back into the Lasercheck detection system. The overall intensity and distribution of the reflected and scattered light is measured, digitized by Lasercheck electronics, then Ra roughness is calculated for the illuminated area. This Ra value is then sent to a host computer via a RS232 serial communication port on the Lasercheck control unit. The Lasercheck Windows display and control software displays the real time Ra values in graphical and numeric format along with statistical parameters. Display and measurement cycles are provided 10 times per second for an abundance of information about the complete roughness characteristics of the illuminated surface.

Lasercheck sensors and software perform alignment tests during every measurement cycle. Lasercheck has been designed for a nominal height standoff of 1.055 inch ± 0.05 inches from the measurement surface. Motions and vibrations within that tolerance range are monitored continuously and reflectance and scatter distribution are normalized and corrected during every measurement cycle to ensure accurate results. If Lasercheck senses that the standoff height has moved outside of the tolerance range, it will not provide a roughness value to the serial port and Windows software. This feature prevents incorrect data from incorporating into a measurement sequence. If the standoff distance remains out of the tolerance range for an extended period of time (there has been a permanent change in the standoff distance), Lasercheck provides an error message to the Windows software. An alignment dialog box appears prompting the user to correct the problem.

At the end of a measurement sequence, the user is provided several options for saving and/or printing the data. It can be saved in Lasercheck format for subsequent viewing and analysis by Lasercheck Windows display and control software. It can also be saved in ASCII file format for reading into a variety of spreadsheet and analysis software packages. The data can also be printed directly from the Lasercheck software as it appears on the screen, or it can be printed as numeric values only.

Setting up the Instrument

Unpacking Lasercheck

All components of Lasercheck have been inspected and tested individually and as a system prior to shipping. You should find the following items with your system:

1. Lasercheck measurement head.
2. 3.5 inch floppy disks with Lasercheck software (cover of manual).
3. Lasercheck box.
4. AC power cable
5. RS232 serial null modem computer cable.
6. 15 pin cable for Lasercheck head to control box connection.

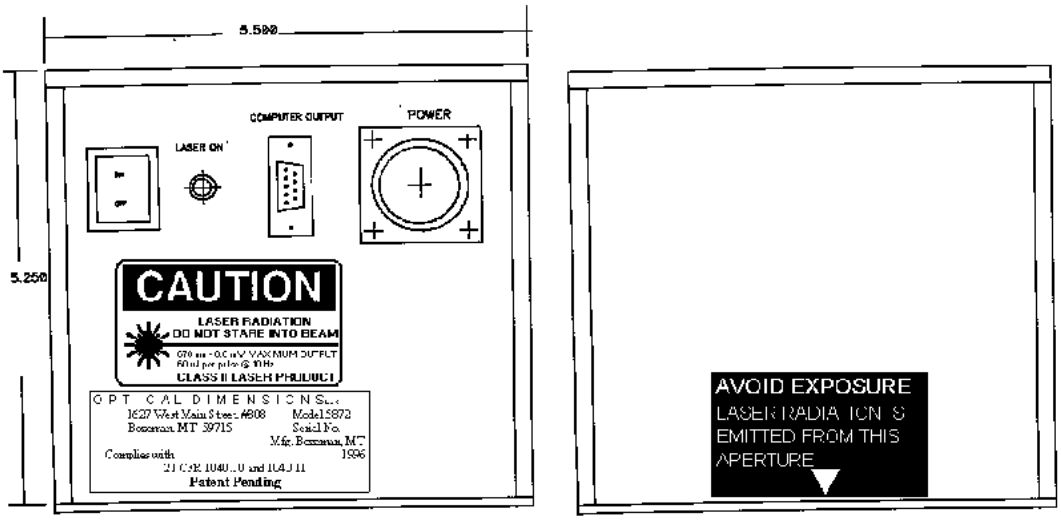
Basic Connections

The computer cable provided is a serial *null modem* variety. Standard serial connector adapters (25 to 9 pins, male to female etc.) can be used with these cables as necessary without affecting the null modem

capability. The Lasercheck control box has a 9-pin RS232 connector port for attaching one end of the cable (Figure 1). The connector should be screwed on to ensure strength and integrity during operation. The other end should be attached to an available serial port on your host computer. Be sure that port has been initialized as either COM1 or COM2 in your computer. These are the only 2 COM selections available to communicate with Lasercheck software.

The 15 pin cable carries voltages to and from the electronics in the Lasercheck head. The connector is a DB15 screw on connector. The cable ends attach to the connectors on the Lasercheck measurement head and control box.

Figure 1



The control box is plugged into a 110 Volt, 60 Hz outlet using the AC power cable. The control box contains a regulated computer supply powering sensitive electronics inside the measurement head. Output from the supply is regulated, but it should be plugged into a surge protector power strip, just as you would with any computer to protect against unforeseen spikes in the 110-Volt line, which could damage the Lasercheck electronics.

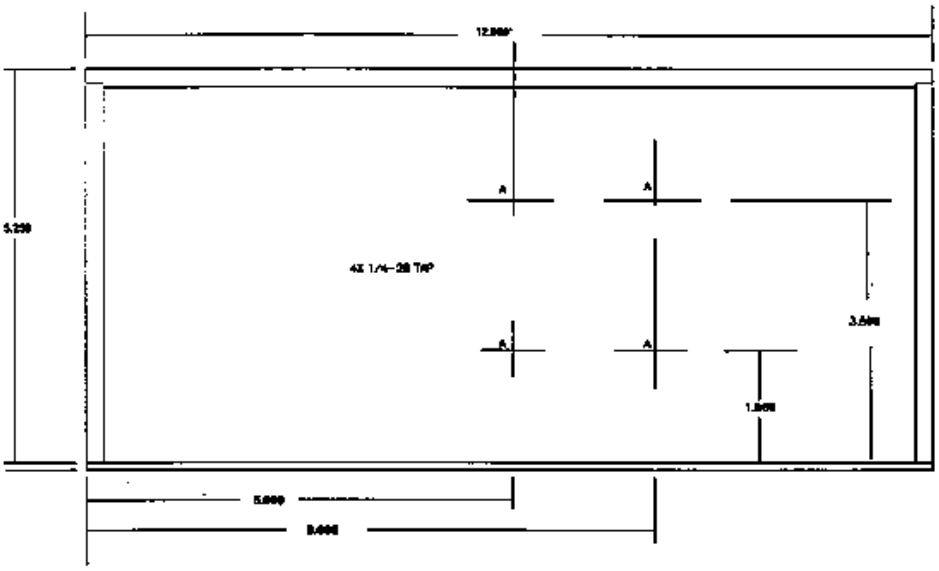
Physical Mounting

The Lasercheck head is designed for two different mounting methods - suspension utilizing mounting holes provided on the side of the box with optional X-Y-Z head mount, and optional mounting “feet” for bench top operation.

Mounting Holes

Lasercheck is provided with four 10-32 mounting holes (A - Figure 2) on both sides of the measurement head. The holes are positioned so that mounting bolts (maximum length ½ inch from outside face of box) can be threaded into them without interfering with any of the electronics inside the head. The holes are provided on both sides so that a suspension mounting can be utilized (overhead gantry, interface bracket) for extra strength and balance. There should be capability for vertical adjustment of the Lasercheck relative to the surface once installed for fine alignment purposes plus horizontal or rotational adjustment. The optional X-Y-Z head mount from Optical Dimensions provides the required adjustment flexibility.

Figure 2



The Lasercheck head has been assembled with sealant around all holes and seams to protect internal components from contaminants. We recommend the use of RTV (Room Temperature Vulcanizing) silicon adhesive sealant around the mounting holes or directly on the threads themselves. This will seal these holes from the outside. This form of seal will be "breakable" or removable should you wish to later remove this mounting and use the Lasercheck in a different process.

Final adjustment of both X, Y and Z positioning as well as rotational alignment are described further in Section *Lasercheck Alignment Principles and Procedures*. For initial visual setup and alignment the following guidelines should be used:

1. Set the height so that the head is approximately one inch from the surface to be measured.
2. Set the rotational orientation so that the long axis of the head is perpendicular to the dominant "lay" of the surface that you wish to measure.

Software Setup

Lasercheck uses two different software packages. The control unit has software that initializes electronics, monitors the laser, reads detector signals, and calculates the alignment and surface parameters. This software comes *pre-installed* inside the control unit. It is designed to auto load and auto execute whenever the "on / off" switch of the AC/DC power is turned on.

A software disk is also provided with a Windows display and control software program. This is used to communicate with the control unit, display data to the user, and for setup and file maintenance. It *must be loaded* onto the host computer.

To Install Lasercheck Windows Software from Windows 95, 98, or NT

1. Insert Lasercheck disk into the appropriate floppy disk drive.

2. Click on the **Start** button. From the **Start** menu, choose **Run**.
3. Click on **Browse** button.
4. Select "**Look In A:**" (or appropriate drive letter)
5. Double click on **Setup.exe**.
6. Finally, click on **Finish** button.

Once this setup is complete you will find that the setup has created a C:\Lasercheck directory on your computer. Inside this directory is a sub-directory named "head". Copy the contents of the second disk into this "head" sub-directory.

Lasercheck Alignment Principles and Procedures

This note contains information on principals and procedures to install and align the Lasercheck heads. The keys to Lasercheck are alignment and cleaning the surface. If both of those are controlled, Lasercheck will give excellent and repeatable data every time.

How Does Lasercheck Work?

The visible (650-nm.) laser illuminates the surface with a shallow incident angle to enhance "wide, high amplitude" surface roughness features. Reflected and scattered light from the surface is detected by a photodiode array with 35 small closely packed detectors; 24 are used each measurement. The array finds the specular beam (when there is one) and uses it to determine height from the surface. The array also measures information about wide, high amplitude surface roughness features. There are also two single element far angle detectors, which measure information about narrow, lower amplitude surface roughness features.

Figure 6

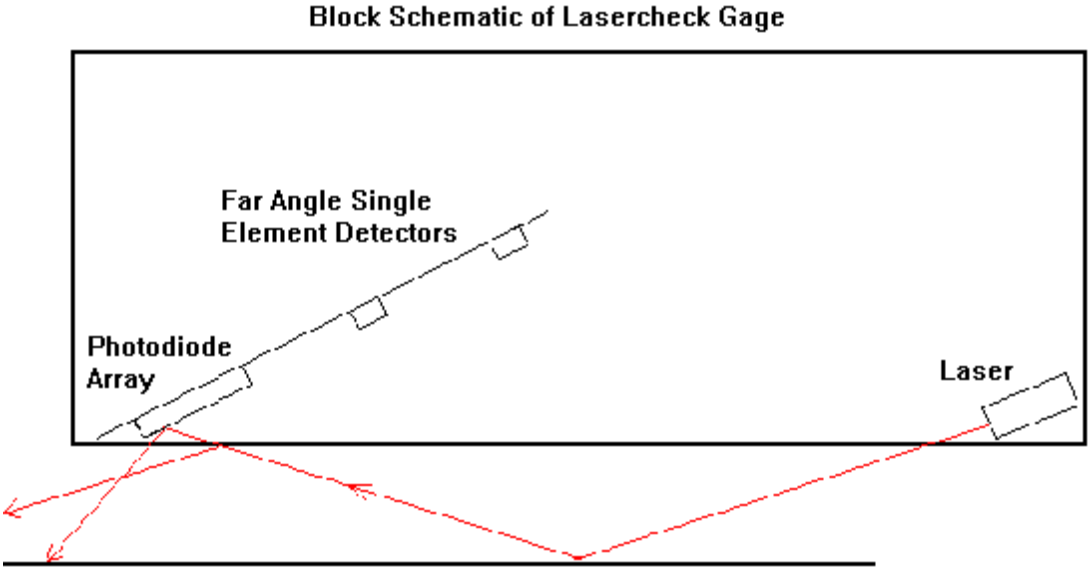


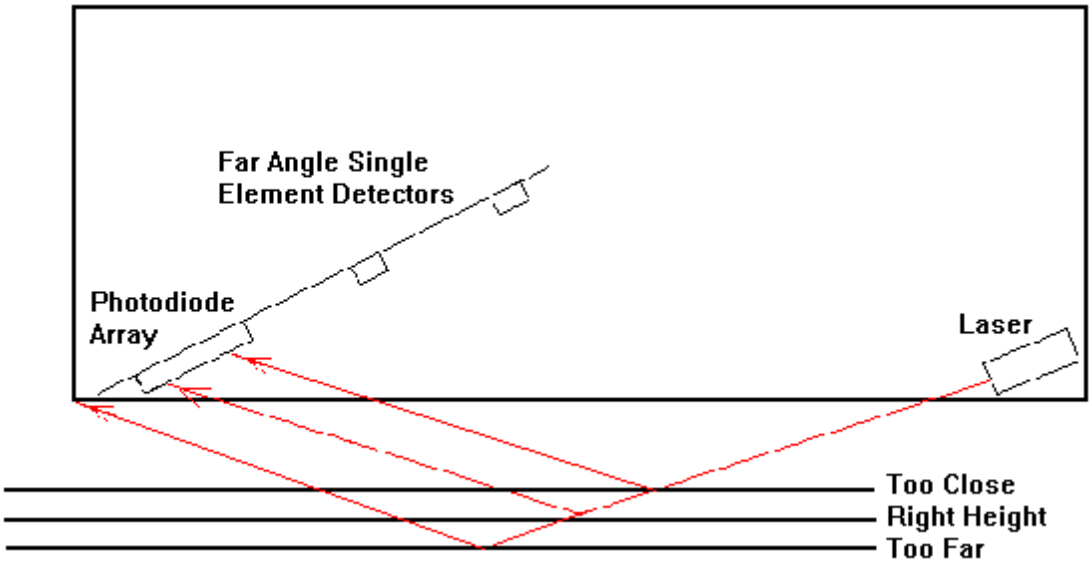
Figure 6 shows a simple schematic of the layout of the laser and detectors in Lasercheck. The "Photodiode Array" has 35 discrete detector elements, then there are 2 "Far Angle Single Element Detectors" for a total of 37 detectors used by Lasercheck. Notice also Figure 6 shows a representation of the beam path of the laser. After bouncing off the surface, some of the light reflects off a window in front of the detectors and some penetrates the window but still bounces off the photodiode array and reflects out of the box. This creates 2 sources of reflected light "leaking" out of the end of the box. These can be used as an alignment aid, which will be discussed later. Of the 35 detectors in the array, Lasercheck uses the specular detector and only 24 array detectors (plus the 2 single element detectors) that are positioned to the "inside" of the specular laser beam. This is also important to understand in the discussion of alignment.

Alignment

Vertical

While the shallow incident angle helps Lasercheck measure similar roughness amplitudes and widths to a stylus profilometer, it does create sensitivity to vertical mis-alignment. This is illustrated in Figure 7.

Figure 7



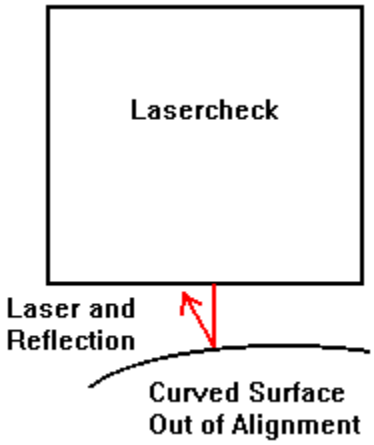
The specular laser beam must fall on one of the first 11 detectors in the 35-element photodiode array; the next 24 are used to calculate surface roughness. If Lasercheck is too close to the surface, specular falls on detector number 12 (or greater), than 12 + 24 = 36 detectors are required - there are only 35 available, result is an invalid measurement and/or an error message. If Lasercheck is too far from a surface, the specular laser beam misses the photodiode array, this also results in an invalid measurement and/or and error message.

If Lasercheck is correctly aligned, the laser beam strikes anywhere in the first 11 detectors in the array. Ideally, it should strike in the middle of those 11 detectors. You can see also, from Figure 7, that if Lasercheck is at approximately the correct height, the laser spot will strike the surface at a position that is close to the middle of the Lasercheck box (viewed from this side). If Lasercheck is too far from the surface the laser beam will strike the surface at a position that is closer to the detector end of the box. If Lasercheck is close to the surface, the laser beam will strike the surface at a position closer to the laser end of the box. This assumes that Lasercheck is mounted parallel to the surface.

Horizontal

Lasercheck also has sensitivity to horizontal mis-alignment on a curved surface. The laser beam and scatter does not reflect back into the center of the box where the sensors are positioned.

Figure 8



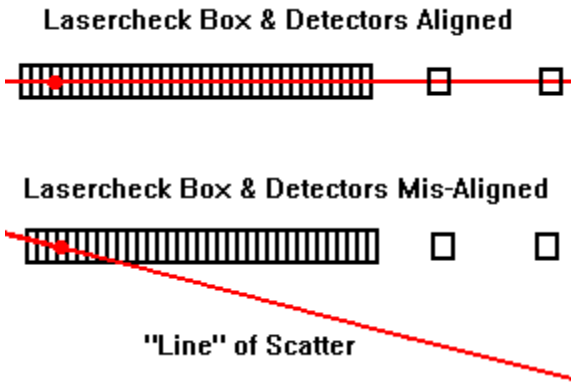
When perfectly aligned, all laser reflection is back into the centerline of the Lasercheck box.

When you look under the Lasercheck from the “connector” or “laser” end of the box you will be able to see where the light is reflected after hitting the surface. If it is correctly aligned, you will see the reflected / scattered light bouncing back into the center of the detector window. If it is mis-aligned, you will see the light bouncing to one side or the other of the center of the detector window (Figure 8).

Directional / Rotational

Many man made surfaces have a dominant direction of roughness. Strong directional roughness produces a strong directional scatter pattern or “line” of scatter across the direction of roughness. The length of the Lasercheck box must be oriented perpendicular to the direction of roughness so that the scatter strikes the detectors (Figure 10) which are oriented in a line down the middle of the box.

Figure 10



If Lasercheck is not aligned at right angles to the grinding groves (or straight along the length of a cylindrical barrel) then the “line” of scattered light will not perfectly fall on the detectors in Lasercheck. Well-designed mounting hardware will eliminate this potential problem.

Headtest Software

Headtest Screen #1 and #2 are printed out from our Headtest software. To run this program, start the "Headtst1.bat or Headtst2.bat" batch file with Lasercheck running depending on whether your Lasercheck is set up on Comm. port 1 or 2 on the host computer. Once Headtest is running, select "1" on the keyboard and this specific screen will be displayed. In this screen, you will see Lasercheck values displayed beside numbers 0 to 38. Nothing is displayed beside number 39. Numbers 0 to 34 are voltage readings from the 35 array detectors. Number 35 and 36 are the single element detector voltages. Number 37 is a sum of voltages from all detectors. Number 38 is a height standoff calculation. Headtest software can be used to assist in alignment of the Lasercheck head. Alignment aids are built into the Lasercheck windows software under "Measure/Align" (shown in the image below), but it is useful to use the Headtest software a few times to better understand the windows alignment aids and what they are reporting and when they can provide erroneous measurements. Also, the surface should be kept stationary while performing both the vertical and horizontal setup alignments.

Headtest Screen #1

```
          Lasercheck Processed Detector Display      SMOOTH
Status: OK                    Aver Counts: 1, # Acquired Ra
Vals: 0
0    0.0823975                          20   0.1753235
1    0.4527283                          21   0.1443481
2    0.9082031                          22   0.1156616
3    1.2463379                          23   0.1521301
4    2.3059082                          24   0.1252747
5    3.8818359                          25   0.1406860
6    1.9598389                          26   0.1245117
7    0.5404663                          27   0.1551819
8    0.2597046                          28   0.1731873
9    0.1611328                          29   0.1124573
10   0.2220154                          30   0.1045227
11   0.1309204                          31   0.1104736
12   0.1437378                          32   0.1423645
13   0.1242065                          33   0.1243591
14   0.1809692                          34   0.1818848
15   0.1153564                          35   0.1354980
16   0.1623535                          36   0.0192261
17   0.1194763                          37  15.5311584
IS   0.1132202                          38   1.0686772
19   0.1832581                          39
0: `Raw' ADC, 1: `Processed' ADC, 2: Scatter,D: Dump, B:
Bandwidth `A': Averaging Counts, `G': Get Ra, 5: Signature,
ESC to Quit. Enter Selection:
```

Headtest Screen #2

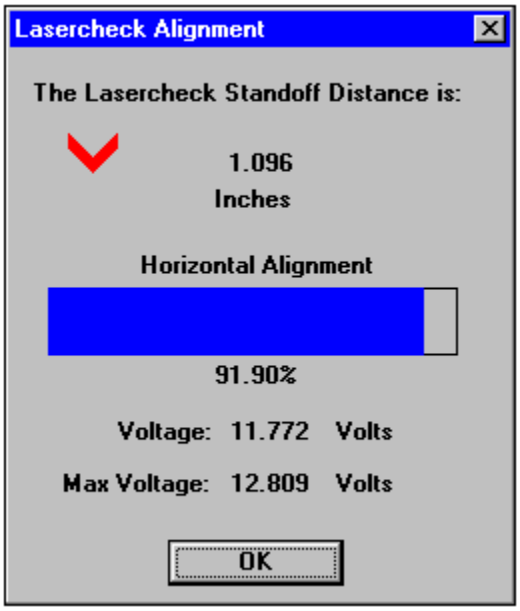
```
            Lasercheck Processed Detector Display     ROUGH
Status: OK                    Aver Counts: 1, # Acquired Ra
Vals: 0
 0   0.0085449                        20   0.0755310
 1   0.0396729                        21   0.0752258
 2   0.0415039                        22   0.0820923
 3   0.0367737                        23   0.0796509
 4   0.0485229                        24   0.0724792
 5   0.0534058                        25   0.0595691
 6   0.0483704                        26   0.0953674
 7   0.0511169                        27   0.1112366
 8   0.0450134                        28   0.0724792
 9   0.0537109                        29   0.1132202
10   0.0720215                        30   0.1174927
11   0.0376892                        31   0.1173401
12   0.0732422                        32   0.1469421
13   0.0794983                        33   0.1567078
14   0.0466919                        34   0.2189636
15   0.0617981                        35   0.7676697
16   0.0640869                        36   0.4104614
17   0.0765991                        37   3.8844299
18   0.0785828                        38   1.0552126
19   0.0651550                        39
0: `Raw' ADC, 1: `Processed' ADC, 2: Scatter,D: Dump, B:
Bandwidth `A': Averaging Counts, `G'; Get Ra, 5: Signature,
ESC to Quit. Enter Selection:
```

Headtest Screen #1 shows a well-aligned smoother surface (about 5 microinches). Lasercheck recognizes this as a smoother surface and indicates this with the word “Smooth” in the upper right corner. Because the surface is relatively smooth, a well-defined specular beam is maintained as it bounces off the surface into Lasercheck. It displays itself as the largest voltage readings in the array centered at detector #5. The Lasercheck standoff height from the surface is indicated on detector number 38 (and in the Windows dialog box shown below). If Lasercheck were moved away from the surface, the specular laser beam would move up to detectors #4, 3, 2, 1 etc. and the standoff reading in the windows dialog box would increase. If Lasercheck were moved closer to the surface, the specular laser beam would move down to detectors #6, 7, 8 etc. and the standoff reading from detector 38 (and in the Windows dialog box) would decrease.

Headtest Screen #2 is a display from a rougher surface (about 30 microinches). Lasercheck recognizes this and indicates this with the word “Rough” in the upper right corner. Because the surface is relatively rough, the specular beam is now lost as it bounces off the surface into Lasercheck. There is no obvious large voltage anywhere in the array. The height value indicated on number 38 and in the windows dialog box is no longer reliable. On these rougher surfaces, we can’t do height alignment with Lasercheck’s help. What we must do, then, is align on a smooth surface or, make a rough surface look smooth to Lasercheck to align it. Once it is aligned, we then teach either the automatic approach to the roll or the operator (on manual machines) what the right position is so that it (they) can go back to it every time.

It is important to perform this alignment on rough surfaces at least once because the signals from a well-aligned rough surface can be identical to signals from a mis-aligned smooth or rough surface. You must be certain Lasercheck and the surface are aligned to rely on “rough” surface measurements.

A reliable way to make a rough surface look smooth to Lasercheck is to wipe a thin film of oil on the surface or apply a piece of shiny tape. This makes the surface look "slick" to the human eye and to Lasercheck. Position the oiled portion of the surface under Lasercheck and proceed with the vertical alignment using the Headtest software to position the specular center on detector number 5 or 6.



Headtest and Lasercheck windows software will help you with horizontal alignment on curved surfaces. Remember, number 37 is a sum of all of the voltages from the detectors. When horizontally aligned, you will obtain the largest possible value on number 37 because more light is reflecting into the center of the detector window and detectors. As you move the box back and forth, you will see this value go up and down. Position Lasercheck for maximum signal on number 37. The lower portion of the alignment dialog box from the Lasercheck windows software under "Measure/Align" provides a display of the reading from number 37 also as well as a continually updating bar graph to help with horizontal alignment. You should also note that number 37 will typically be lower on rough surfaces than on smooth surfaces because less light is reflected and scattered into our detectors on rough surfaces. The Lasercheck Standoff Distance is the value indicated from detector number 38 in the Headtest software.

Step by Step Alignment Procedures

1. Set Head Close Correct Position

Horizontal and vertical alignment should be close before performing any alignment with the Headtest or Lasercheck Windows software. If Lasercheck is badly mis-aligned, than software cannot locate the specular laser beam for vertical alignment and has little or no signal for horizontal alignment.

2. Align Horizontally

Horizontal alignment works best on a clean, rough surface (greater than 10 microinches) with a dominant roughness direction; a ground surface for example. With the alignment aid of the Headtest or Lasercheck Windows software set the horizontal alignment as close to optimal as possible. Visually verify the alignment looks correct with the techniques discussed earlier in this note (observing reflected light "leaking" out the end of the box on a card and looking under the gage from the "connector end of the box to observe reflected/scattered light reflecting back into the windows).

3. Align Vertically

Vertical alignment works best on a smooth surface as discussed earlier. Move the head up or down over a smooth area (or a rough area coated with a film of oil or shiny tape) using the Headtest software to position the specular beam on detector #5 or #6, or using the Lasercheck windows software to set the height reading to "1.055 or 1.069 inches".

4. Verify Alignment

Check visually and with software that horizontal alignment has not changed during the process of performing vertical alignment and verify visually that horizontal and vertical alignment look correct.

Once comfortable that alignment is good, then secure horizontal positioning so it does not change, and set vertical approach so that it always comes back to that height position. You will then be ready to perform positioning of the air knife. If Lasercheck is ever physically removed from the machine, alignment should be checked and reset when Lasercheck is remounted.

As surfaces get rougher (greater than 20 microinches) resolution of Lasercheck decreases and sensitivity to mis-alignment increases. Mounting and alignment stability becomes more important to maintaining high repeatability from Lasercheck. The key issue to appreciate is that on smoother surfaces, Lasercheck has a lot of tolerance to misalignment, shaking, vibrating, etc. On rougher surfaces, Lasercheck does not have as much tolerance for misalignment, shaking, and vibrating.

Air Knife/Squeegee Accessories

Optical Dimensions has designed an Air Knife and Squeegee accessory for cleaning surfaces that are subjected to coolants, lubricants, etc. in the process. For accurate measurements, Lasercheck requires a clean surface. The Air Knife and Squeegee designs have been tested to determine they adequately clean surfaces in the process to allow accurate Lasercheck measurements.

Figure 11

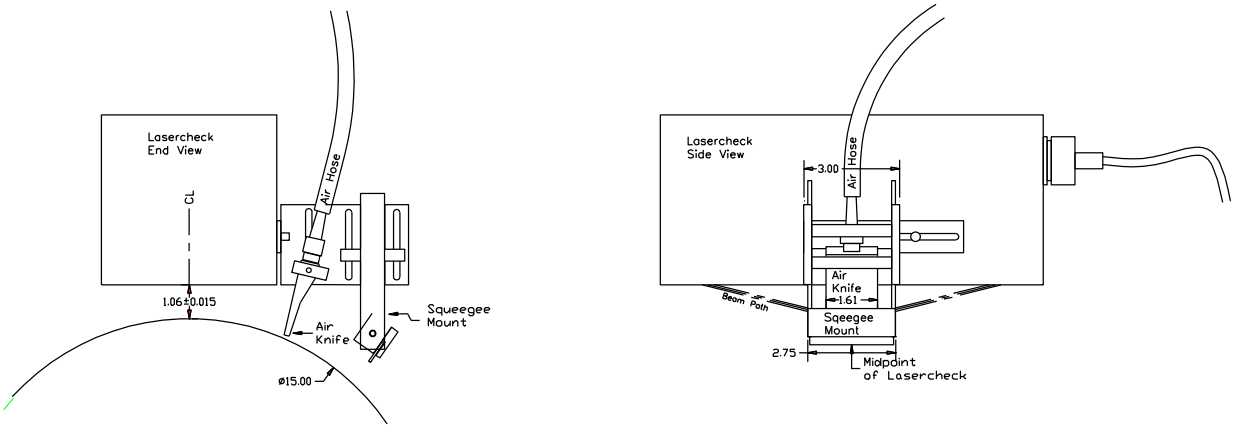


Figure 11 shows a view of Lasercheck from the end and side illustrating air knife positioning for surfaces approaching Lasercheck from the "long" side of the box. The end view at the upper half of the page shows how the air knife should be positioned close to the surface (maximum 1/8" away). It should also be pointing straight at the surface (along a radial to a cylindrical center). This positioning has provided the best performance. Once that is set, start the surface moving, apply water to the roll (do not traverse the surface or Lasercheck) and turn on the air. You will see a dry stripe being created by the air knife. Slide the air knife in its mount until the laser spot on the surface is centered in the dry stripe. This provides optimal positioning of the air knife for operation. A correct automatic or manual approach to the surface will position both the Lasercheck head and the air knife optimally now. The only consideration that would call for resetting of the air knife would be in the event of dramatically different diameter cylinders that could cause the air knife to be positioned too far or too close to the roll surface due to the dramatically different curvature of the surface.

There are two reasons for use of a squeegee in conjunction with the air knife. First, obviously, it reduces the amount of coolant that the air knife has to remove. Second, it will help keep the Lasercheck windows clean. The windows get dirty because the blowing of the air knife on a very wet roll causes coolant to splash on the Lasercheck. If the Lasercheck head gets wet, the coolant drips down and deposits on the windows. By removing the rough amount of coolant from the surface, this splash is virtually eliminated.

Figure 12

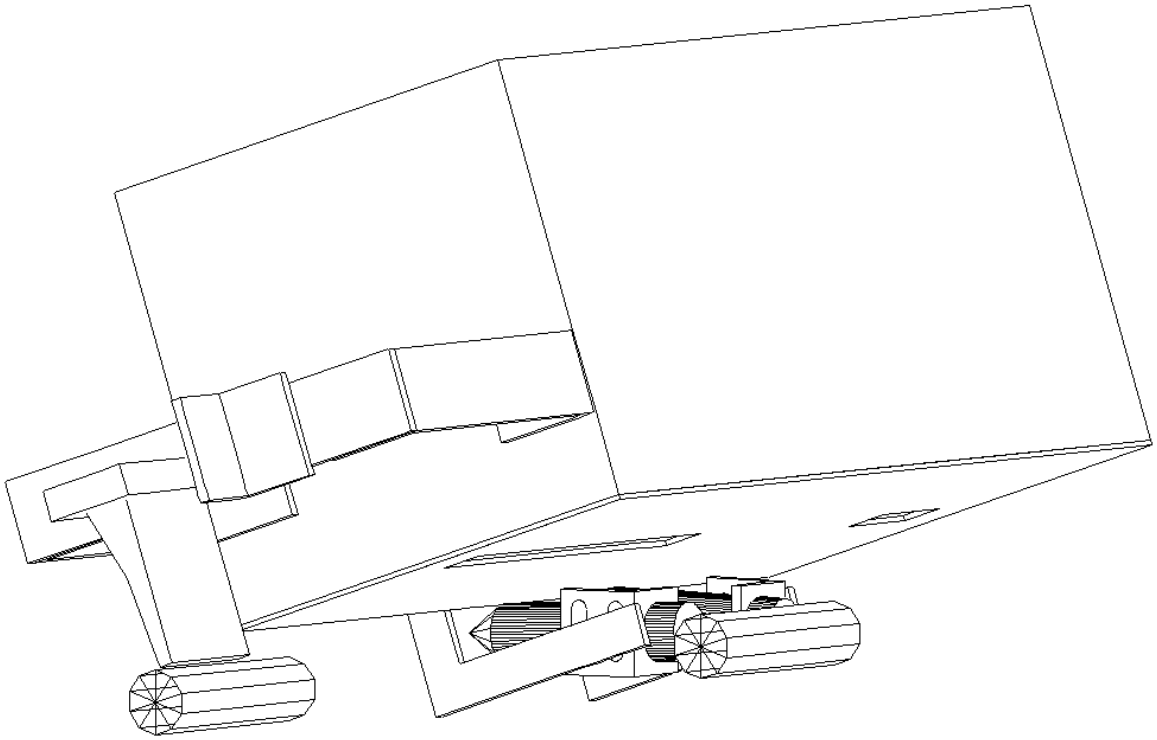


Figure 12 shows a view of Lasercheck illustrating air knife positioning for surfaces approaching Lasercheck from the end of the box (maximum 1/8" away). Proximity sensors are also in the view. The proximity sensors alert the electronics to perform measurements whenever a part is in position.

Performing a Measurement

Once the measurement head is mounted and aligned, the cables attached, and the software is installed in the host computer you are ready to perform a measurement. Lasercheck is set up and run from the Windows software on the host computer. *Detailed* instructions on specific setups and operations can be found in the software users manual. Following is an abbreviated description for setup and performance of a measurement sequence.

Turning the System On

Control Box

The AC/DC power supply has a single red backlit on/off switch, which is illuminated when turned on. This provides regulated DC power to the Lasercheck head. The power supply also powers the internal electronics, automatically loads, and executes software internal to the head.

Lasercheck Head

At the connector end of the head is a labeled on/off switch. Turning this to the on position provides power to the internal laser. A red LED beside the switch is illuminated when measuerments are made and the laser is operating. The system will begin measuring, calculating roughness, and trying to send data to the host Lasercheck Windows software.

Lasercheck Windows Control and Display Software

To Start the Program from Windows 95, 98, or NT

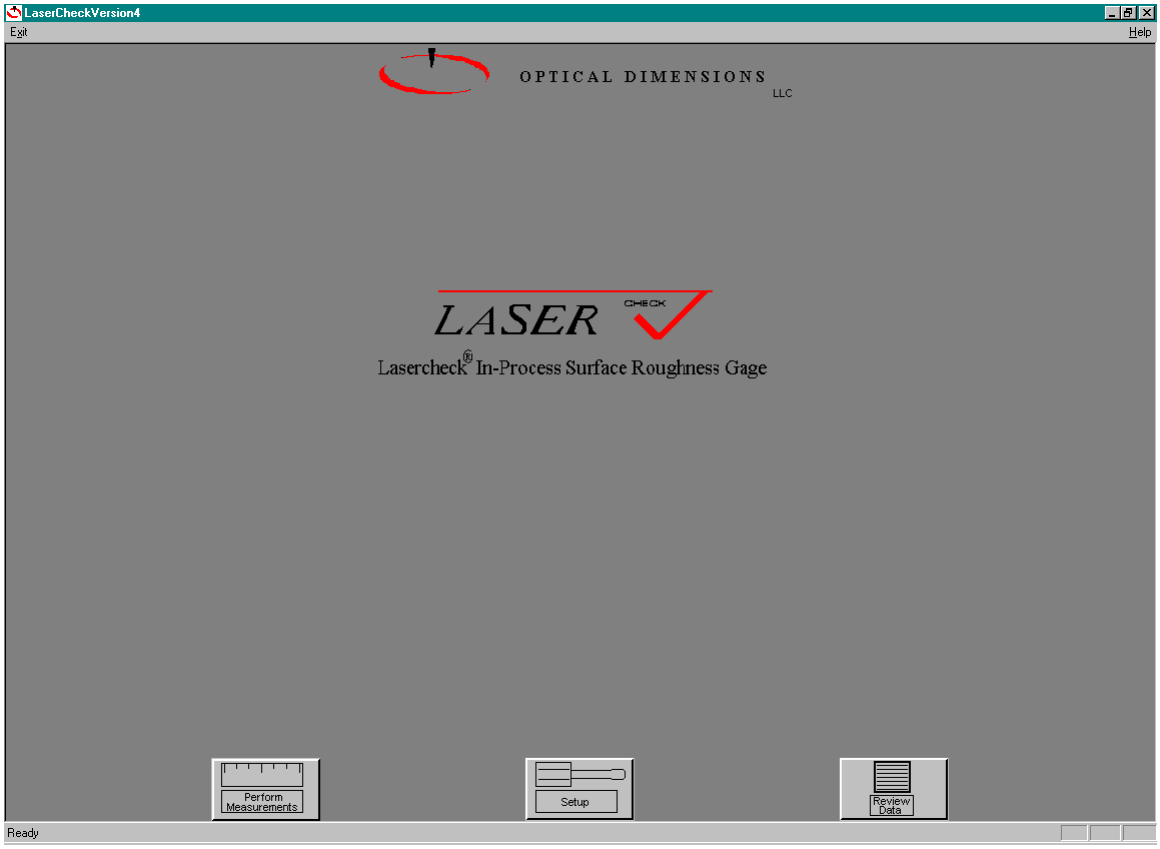
Click on the **Start** button. Choose **Programs**. Next, choose **Lasercheck '98**. Then choose **Lasercheck '98 Comm1 or Lasercheck '98 Comm2** icon depending on which serial port Lasercheck is connected to on your computer.

Initiating a Measurement

The system is now powered and ready to begin providing roughness values. The following section covers the minimum basics required to perform measurements. Additional features built into the Lasercheck Windows software are discussed in detail further in the software section of this manual.

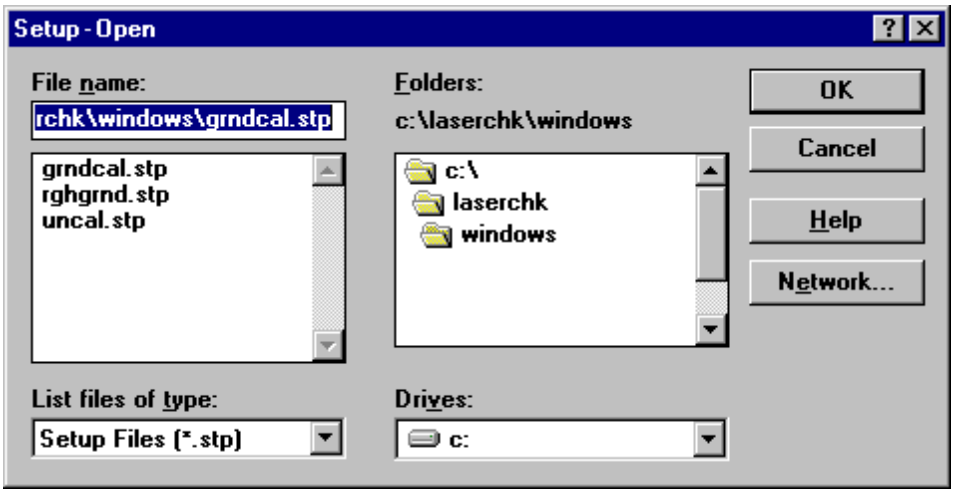
Main window

The main window that is displayed when the Lasercheck host software is started from the program manager is as follows:

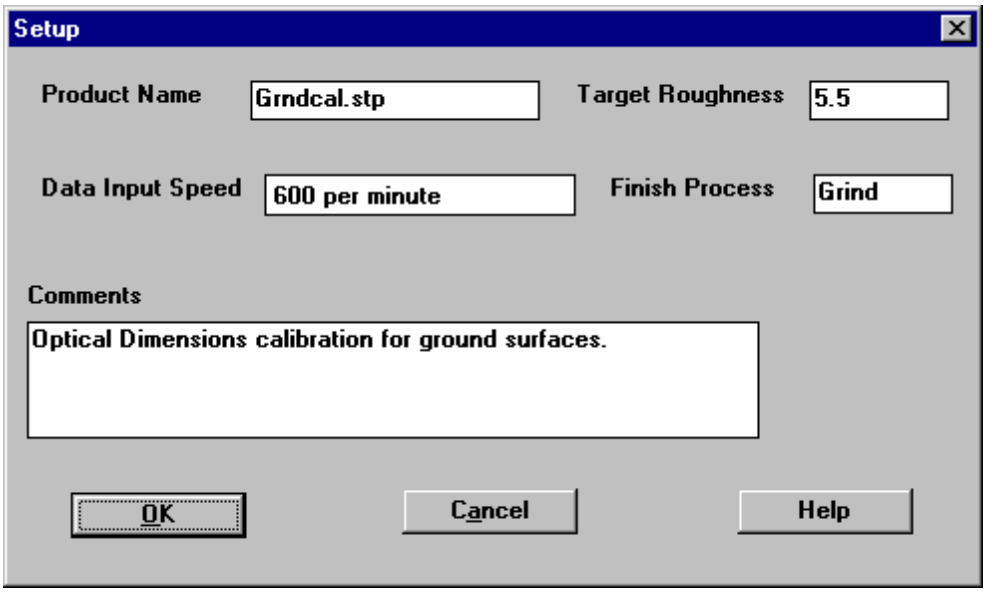


Perform Measurements Module

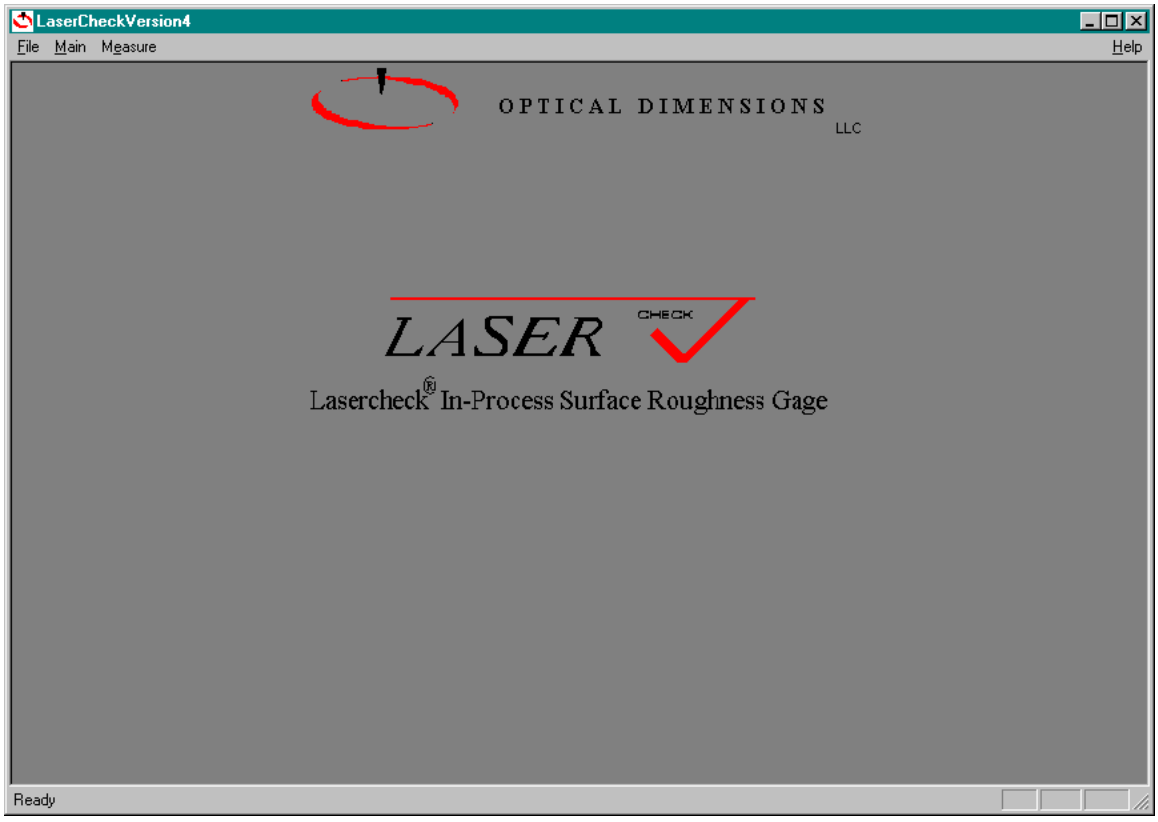
Selecting the "Perform Measurements" push-button from this window invokes the "setup/open" dialog box.



When Lasercheck software is first installed on your computer, sample setup files (*.STP) are loaded on your computer and will appear in this dialog box. No passwords are required to open the setup files that are pre-loaded by Optical Dimensions. Select one of the setup files and the following dialog box will appear.

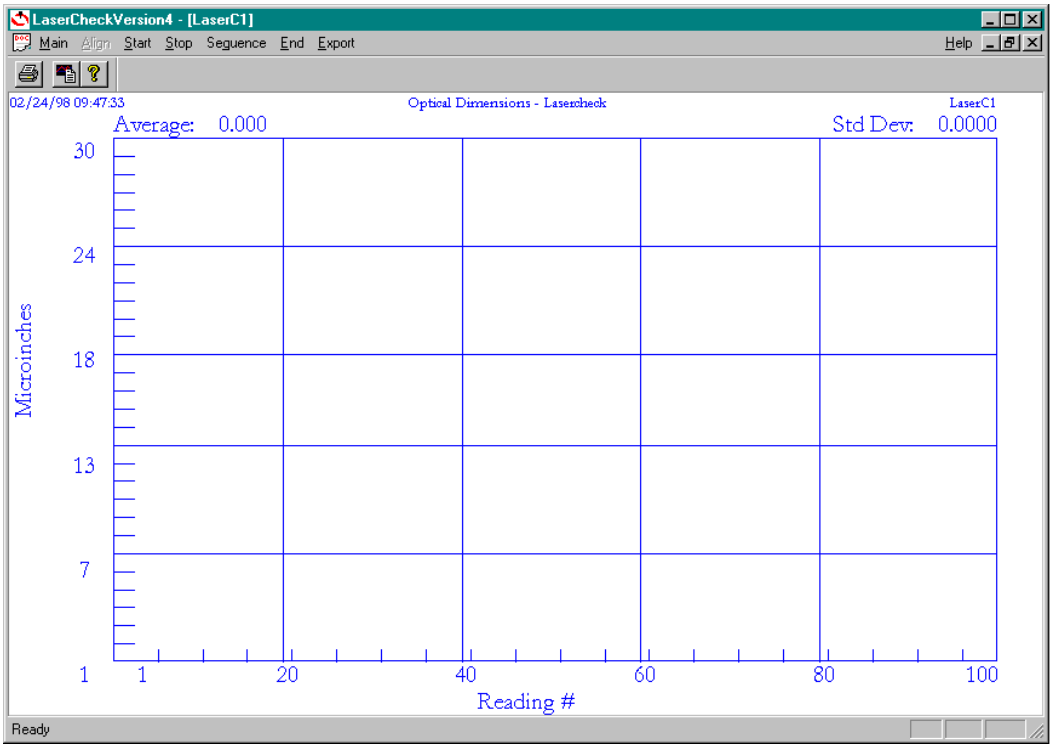


If the correct setup file appears, select the "OK" push-button. The following screen will appear.



Measure Menu

Under the "Measure" menu, select "Measure". This creates an empty graph screen with a run menu.



Start

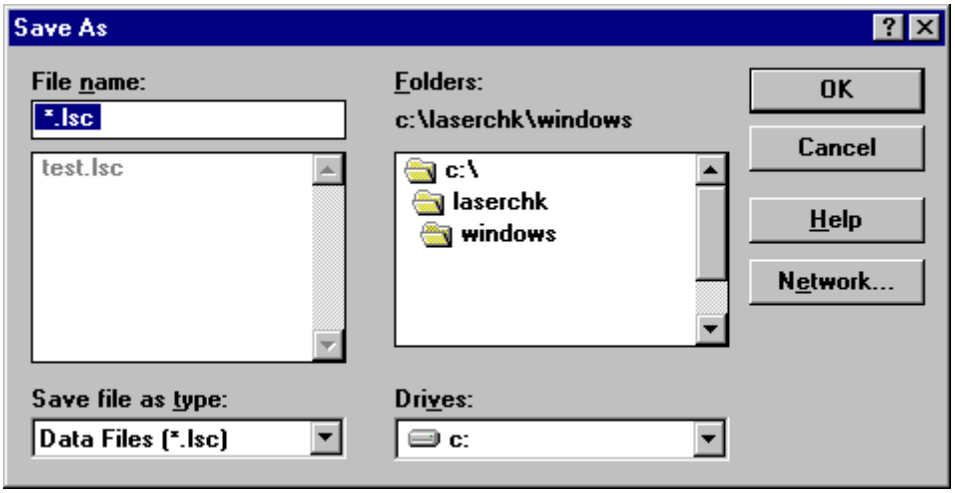
Selection of "Start" from the Run Menu starts the Lasercheck graph to begin displaying roughness information. A graph of roughness vs. reading number will begin appearing in real time on the screen. In addition, statistics of all measurements will be displayed digitally in real time at the top left and right corners of the screen.

Stop

While the roughness display is running, the Stop menu selection can be used to stop the data acquisition. Selecting Start will restart the display. The "Stop / Start" cycle can be repeated as many times as is necessary for the measurement set.

End

End can be used to leave the data acquisition mode. The End menu selection will provide a Windows "Save As" dialog box prompting the user to enter a filename to save the data. Lasercheck software automatically attaches a Lasercheck ".LSC" data file extension to the file name that is typed in.



After saving the measurement, you will be returned to the data graph screen and the new filename you have created will be present in the upper right corner of the graph.

Beyond the Basics

Once the Lasercheck has been mounted and aligned, you should not have to change it unless something in your process changes. Lasercheck smart sensors automatically monitor small changes and corrections for these changes are performed by software. You do not need to worry about re-alignment or setup unless one of the following occurs.

1. The “Alignment” dialog box appears and shows two arrows when you initiate a measurement.
2. During a measurement, data stops appearing and the alignment dialog box appears on the screen. If a sudden motion in a process causes temporary misalignment of the gage outside of its tolerance range, it stops displaying and waits for the sensors to detect it is back in tolerance. If the misalignment is permanent, the software detects this and displays the alignment dialog box.

If you see either of these conditions, the realignment procedure must be repeated.

Features that are more advanced and setups are contained in the software section of this manual.