OPTICAL DIMENSIONS™
2973 Harbor Blvd, #665, Costa Mesa, CA 92626
Phone: (831) 287-0495
info@optica-ldimensions.com
www.optical-dimensions.com

LASER CHECK®

Surface Roughness Measurement Gages

5872D Manual Version 14.54

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Operations and Specification Manual for the

Lasercheck 5872D System

Manual Revision 14.54

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Performance Specifications

Measurement / Detection Method	Angle resolved laser scattering
Measurement speed	Single measurement in < 0.5 seconds
Measurement range	1.00 µinch to 80 µinch / 0.012 µm to 2.0 µm
Repeatability	± 3.0% of measured value
Spot size (area-measured)	5 mm X 1 mm
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.

Storage Computer Requirements

Windows 98, 2000, NT, or ME
Available serial port

Other Features

Works on any material/color (rubber, glass, steel, etc.)
RS232 Interface to upload and store data
Input Triggering: Start, Stop, and Save Measurements
User Configurable Failed Part Trigger Output
User Configurable Analog (0-10 Volt or 4-20 mA Current Loop) Output
Stored and printed items:
Roughness Plot
Date and Time
Average Ra Roughness and Standard Deviation
Minimum / Maximum Ra Roughness
ASCII Formatted File
Individual Measurement Values

SAFETY

Electrical

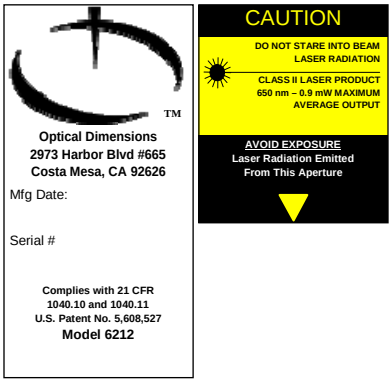
Lasercheck has been designed as a sealed and enclosed system. Voltages to operate the measurement sensor are low (0 to +5 Volts) to minimize shock hazard.

Laser

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 smooth specular surface. The ends of the Lasercheck measurement sensor have “Caution” and “Avoid Exposure” labels to remind the operator to avoid exposure to the radiation. The sensor also has “Identification” and “Certification” labels. The Lasercheck control unit also has "Identification” and “Certification” labels. Reproductions of these labels are shown below.

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

The measurement sensor emits a red visible (650-nm) laser beam pulsing at a 10 to 50 Hz. Each “pulse” contains as much as 90 microjoules of energy. Pulses can be as short as a 5 millisecond interval, with 20 microsecond rise and fall times. Maximum “peak” power can be as high as 2.0 milliwatts. Average maximum power being emitted from the laser can be as high as 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 sensor and measurement surface and care should be taken to avoid direct eye exposure to the radiation.



Typical Laser Identification and Warning Labels

WARRANTY OVERVIEW

Optical Dimensions certifies that the Lasercheck surface roughness measurement system meets specifications. The Lasercheck system has a warranty period of one (1) year from date of first usage. 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 detailed warranty information, refer to second page of this manual.

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.

For warranty service or repair, the Lasercheck system must be returned to Optical Dimensions, after prior Return Material Authorization Number (RMA #) has been obtained. Buyer shall prepay shipping charges to Optical Dimensions. The return shipment should be labeled with the RMA #.

Contact Optical Dimensions customer service for shipping instructions:

OPTICAL DIMENSIONS
2973 Harbor Blvd, #665
Costa Mesa, CA 92626

Phone: 831-287-0495
Email: info@optical-dimensions.com

Customs Statement for Returning Lasercheck Equipment to Optical Dimensions

Overseas Buyers are to pay all shipping charges, taxes, and duties to Optical Dimensions. Optical Dimensions will not pay customs and duties charges on returns. Returns must include required paperwork. Incorrectly labeled and incorrectly prepared shipping and customs documents will result in delays to equipment being returned to customer.

The following indications should be on all customs invoices and documents:

The articles are manufactured in the United States.
They are being returned for (use the most appropriate statement below):

a) No charge warranty repair.
c) Repair/service by manufacturer.

Also on the Air Waybill label there is usually a box for "Declared Value for Customs". If it is being returned for a “no charge warranty”, list $O as value, AGR (American Goods Returned) in the box. Or to be more clear "$0 - Warranty" if there is space in the box.

If it is being returned for an out of warranty repair, also put $0 in that box. When we return it, $xx (the cost of the repair) will be on the paperwork. At that time, any required duties on repair costs will be applied. On the International Waybill, mark under type of export "RETURN" and "TEMPORARY". With that being done, it shouldn’t incur and DUTY charges but it still may incur customs clearance fees

DO NOT put the original price of the instrument on any packing lists or shipping labels or customs paperwork that accompanies the shipment. This can result in excessive duty charges being applied. Any customs / duty charges will be charged to the customer.

Applying these statements, following these procedures and always using “no charge”, $0, or only the dollar amount of the repair will help to avoid customs and duties fees being applied to the unit being returned for repair or at least restrict customs and duties being applied to the value of the repair work or service only.

Send the equipment to the following address:

Optical Dimensions
2973 Harbor Blvd, #665
Costa Mesa, CA 92626
USA

Phone: 831-287-0495

Email: info@optical-dimensions.com

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.

The laser head is made of machined aluminum and plastic and all electronics and optics are secured and sealed within the head. The head is rugged enough to withstand handling that might be normally encountered in manufacturing shop floor gage operation. The head is also water resistant and can be subjected to moderate rain or splash without harm.

Boards and electronics used in the system are static sensitive and easily damaged by mishandling. The Lasercheck housing and electronics are well grounded. The head is sealed at all seams and holes to protect components from external contaminants. The user should not open the measurement head. *If opened by non-authorized personnel, the warranty provided by Optical Dimensions will be void.*

Cleaning the Windows

The internal optics and electronics are cleaned during assembly and kept within the sealed sensor. The internal windows at the bottom of the Lasercheck sensor cover and protect the internal sensors and laser source. They will be exposed to outside contaminants and in very dirty environments should be cleaned at least weekly.

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 glass cleaner and a soft, clean paper towel, tissue, or Q-tip.

Assistance

Contact your nearest Optical Dimensions office.

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, and then Ra roughness is calculated for the illuminated area. The Lasercheck Windows display and control software can be used to display the real time Ra values in graphical and numeric format along with statistical parameters.

Lasercheck has been designed for a nominal height standoff of 1.055 inch $\pm$ 0.01 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. Surfaces are positioned 1.055 inches below the gage allowing non-contact measurements of the surface to be made.

Measurements can be performed by continuous high-speed measurements controlled by Windows software, or fully automated high speed on-line measurements triggered by external signals and the Windows software. At the end of a measurement sequence, the user is provided options for performing additional measurements, saving the current measurements or exiting the measurement sequence. When measurements are saved an ASCII file format can be created for reading into a variety of spreadsheet and analysis software packages.

Setting up the Instrument

Unpacking Lasercheck

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

1) Lasercheck measurement head.
2) Lasercheck Power Supply
3) 110 Volt Power Device Cable
4) DB15 extension cable
5) RS232 serial null modem computer cable.
6) CD or 3.5 inch floppy disk with Lasercheck Calibration & Setup Files, Plus Manual

Measurement Head

Power Supply

Basic Connections

Attach circular DIN connector from power supply to power supply on measurement head. Attach the power device cable to the "power supply.

The measurement head has a DB15 connector. A DB15 extension cable is provided that can be used to extend connection distance to the head. A pinout map is provided in the appendix at the back of the manual that is used to attach input / output connections from the users process to control and monitor the instrument.

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. Three of the pins from the DB15connector are dedicated to serial connection.

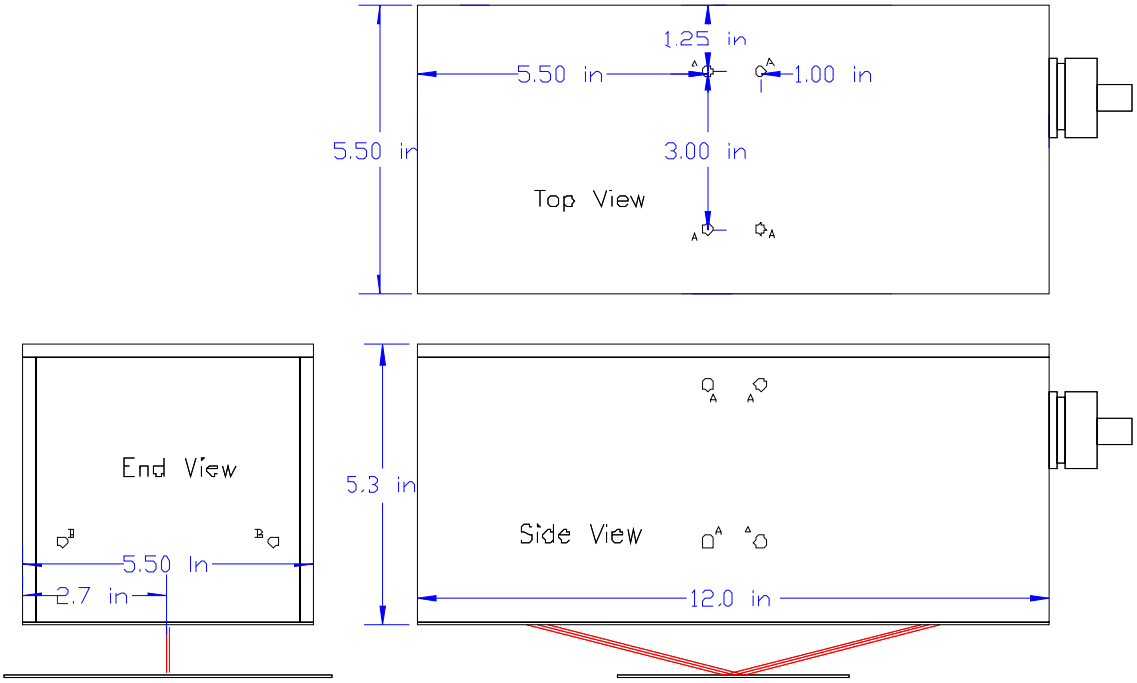
The start and stop inputs also utilized the DB15 connector. Analog (0-10 Volt or 4-20 mA Current Loop) or indicators for "out of spec" surfaces also are present on the DB15 connector.

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 ¼-20 mounting holes (Labeled “A” in the following image) on both sides and top of the measurement head. The holes are positioned so that mounting bolts can be threaded 3/8” 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 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.



Side View of Lasercheck Head Showing Four Mounting Hole Locations

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.

An understanding of alignment principals of Lasercheck is required for development of fixturing. Please read the section “LASERCHECK ALIGNMENT PRINCIPALS AND PRECEDURES” later in this manual to understand principals of alignment.

When performing measurements, 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. The long axis of the head determines the direction of measurement in the same way that the direction of motion of a stylus on a stylus gage determines the direction of measurement.

Software Setup

Lasercheck uses two different software packages. The measurement head has software that initializes electronics, monitors the laser, reads detector signals, and calculates the alignment and surface roughness. This software comes *pre-installed*. It is designed to auto load and auto execute whenever power is applied.

A CD or floppy disk with the Windows display and control software program, calibration & setup files, plus the manual is provided. This software is installed on a separate computer. The Windows software uses the included serial null modem cable to communicate with the measurement head. It displays real time data to the user, and transfers files to and from the measurement head

To Install Lasercheck Software from Windows 98 or Newer

1) Insert Lasercheck CD or disk into the appropriate drive.
2) Click on the Start button. From the Start menu, choose Run.
3) Click on Browse button.
4) Select drive containing CD
5) Double click on Lasercheck Model 5872D setup.exe.
6) Click on Finish button.

Basic Operation

Turning the System On

The measurement head has a power supply which provides regulated DC power to the Lasercheck head. The measurement head also powers the internal electronics, and automatically loads and executes software.

Performing Measurements

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 user's manual. Following is an abbreviated description for setup and measurement.

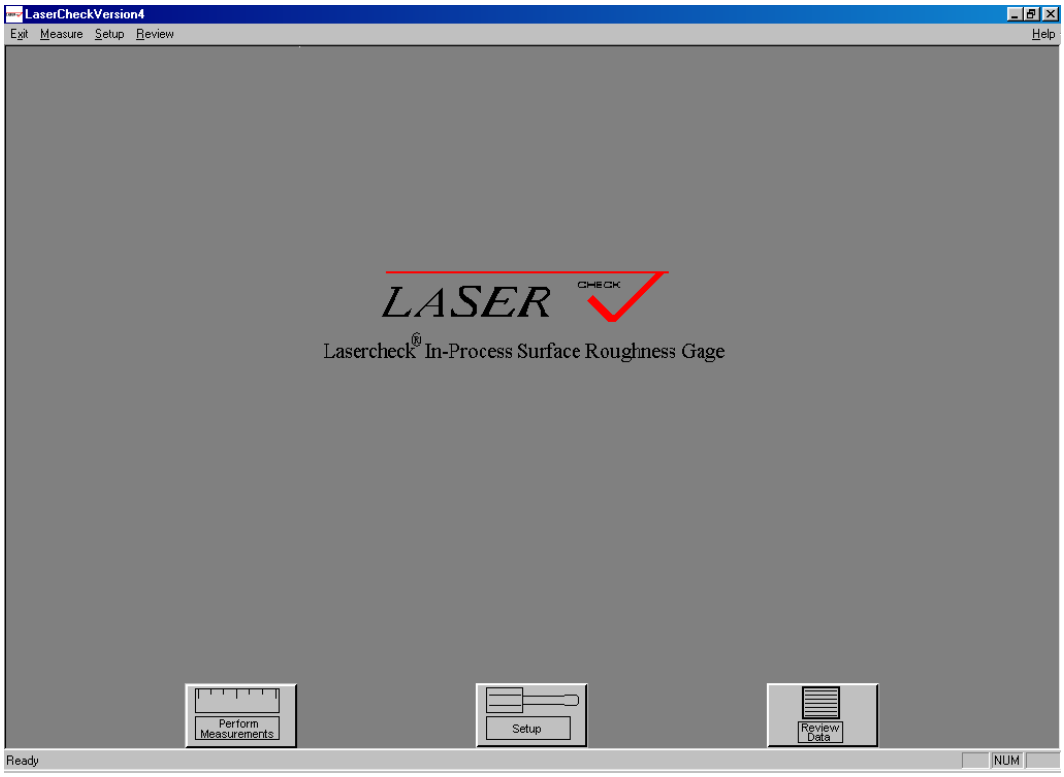
Operation Using Windows Software

The Lasercheck can also be used and controlled through the Lasercheck windows software. For a detailed explanation of using the Lasercheck windows software see the included software manual. A PDF version of the software manual can be found under the C:\Program Files\Lasercheck directory created by the installation program. The following is just a simple example of using the basic features of the windows software.

Initiating a Measurement

Starting Software

Make sure the Lasercheck system is connected correctly and powered on. For more detail on doing this refer to the "Setting Up the Instrument" section in the beginning of the manual. Next start the Lasercheck Windows Software Program. Click on the **Start** button; choose **Programs**, and then **Lasercheck**. Then choose **Lasercheck Windows Program**.

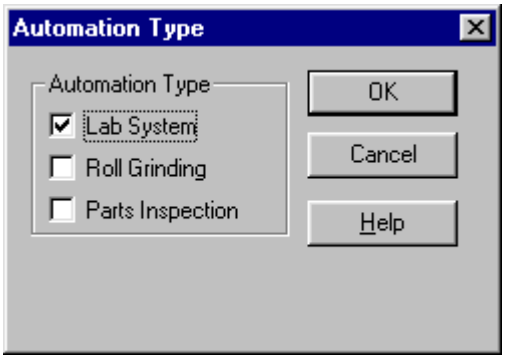


Entering the Setup Module

From the main window of the Lasercheck software select the “Setup” push-button. This invokes the “Password Entry” dialog box. Enter the password “4956”, and click OK.

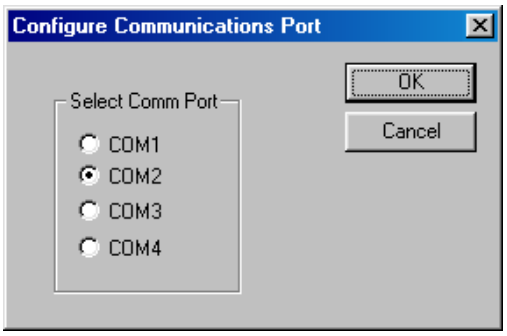
Setup for Lab System

Under the Setup menu, select “Setup” and “Automation Type”. Choices are Lab System, Roll Grinding, and Parts Inspections. “Lab System” will return single measurements. “Roll Grinding” will provide continuous stream of measurements. These are the 2 most common selections for automated use of the 5872 Lasercheck.



Select the Communications Port

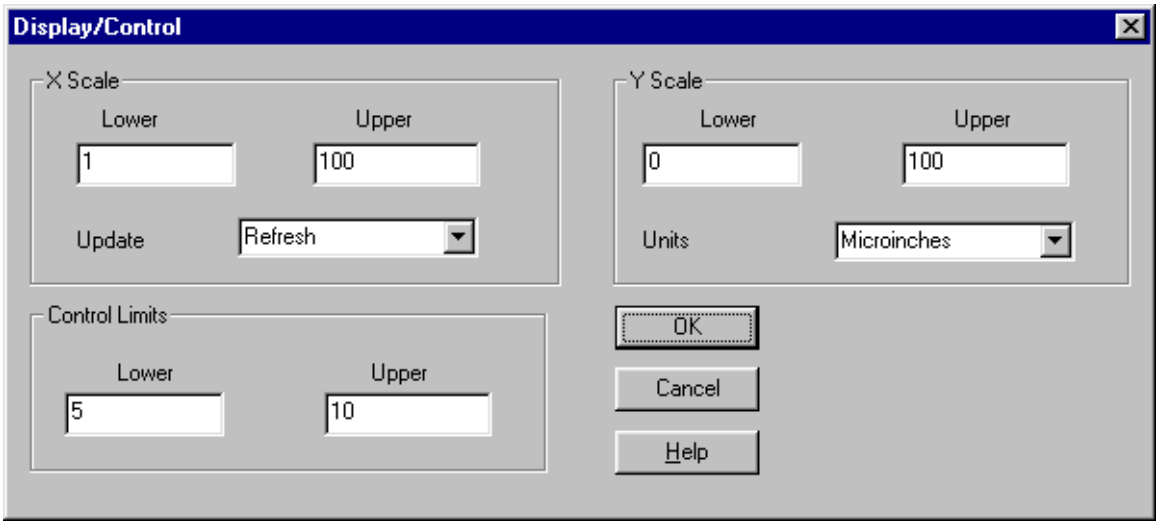
Under the Setup menu, select “Setup” and “COM Port”. Select the COM port that the RS232 null modem cable is connected to on your computer. Then select “OK”



Selecting “Main: from the top menu selection of the Setup Module will return you to Lasercheck software main menu.

Changing the Display Control of the Setup File

Under the Setup menu, select Open, and pick a setup file to modify. Use “Uncal.stp” to start with. Select the “Display/Control” button and configure the X Scale to be from 1 to 100 and the Y Scale to be from 0 to 100 to assure that measurements will display within the graph window properly. This can be edited later to values that best display the typical operation range. Set the Control Limits to the specification range you would like the graph to display in green; outside these specification limits the graph will display in red. Use the “Units” drop down box to select roughness displayed in Microns, Microinches, Nanometers, or Angstroms of roughness. Other display options are described in the software manual.

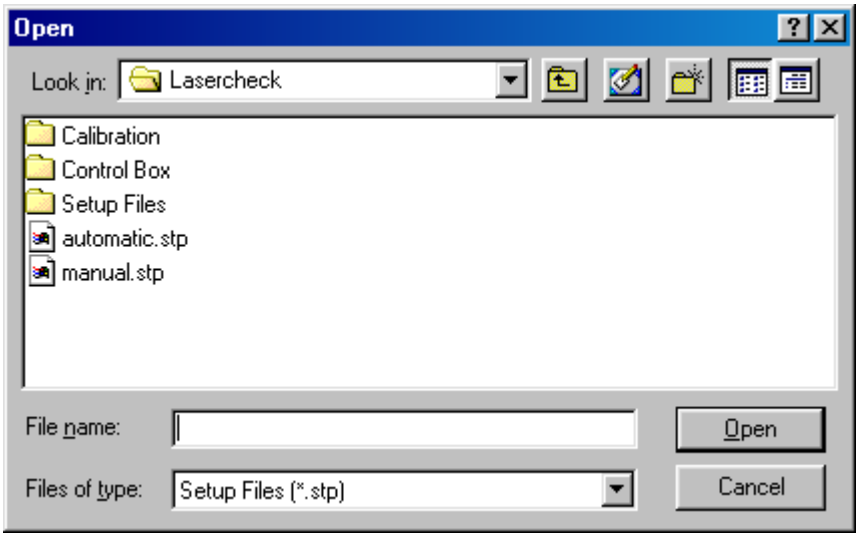


Select “OK”. Now save the modified setup file by clicking “Save Setup” and renaming it to “filename.stp”.

Manual Operation

Perform Measurements Module

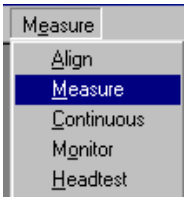
From the main window of the Lasercheck software select the “Perform Measurements” push-button. This invokes the “setup/open” dialog box.

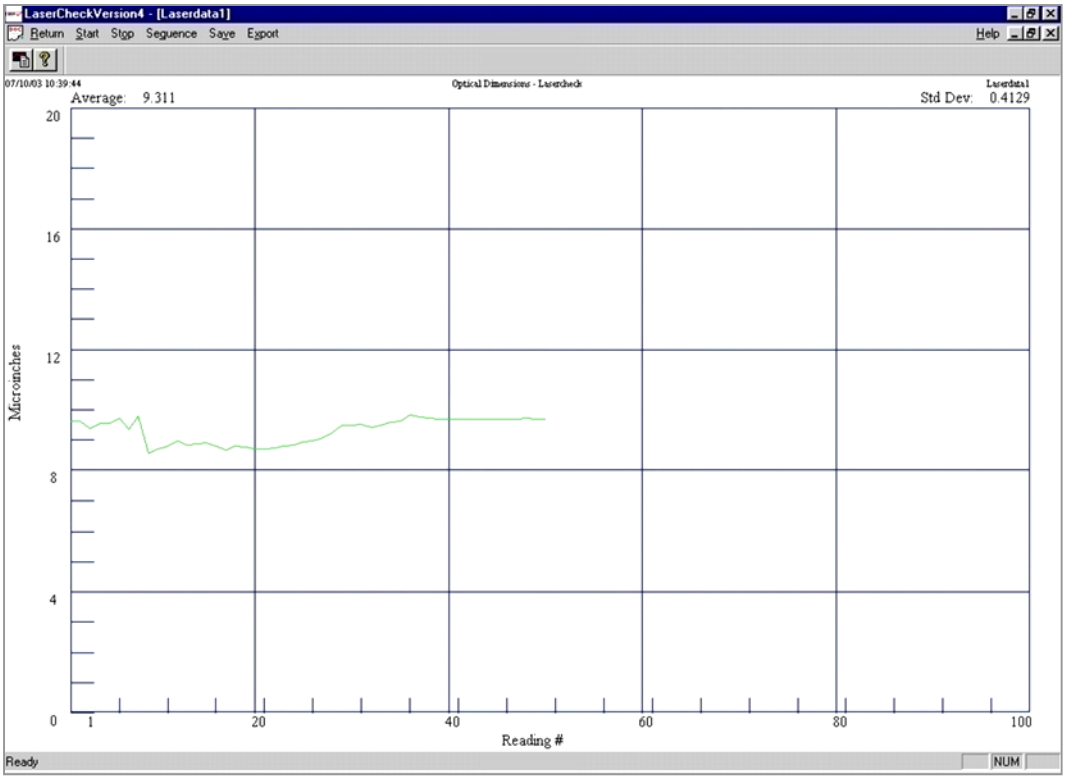


When Lasercheck software is first installed on your computer, sample setup files (*.STP) are loaded on your computer in the C:\Program Files\Lasercheck directory. Select one of the pre-loaded setup files or any new setup files that you have created or saved. A “Setup Information” dialog box will appear verifying your setup file selection. If correct, select “OK”.

Measure Menu

Under the menu item “Measure”, select the option “Measure”. This creates an empty graph screen with a run menu.





Return

Selecting “Return” from the Run Menu at any time closes the current graph and returns you to the “Measure Menu”.

Start

Selecting “Start” from the Run Menu starts the Lasercheck and the graph begins 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 graph, and the current measurement in the top center of the graph.

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.

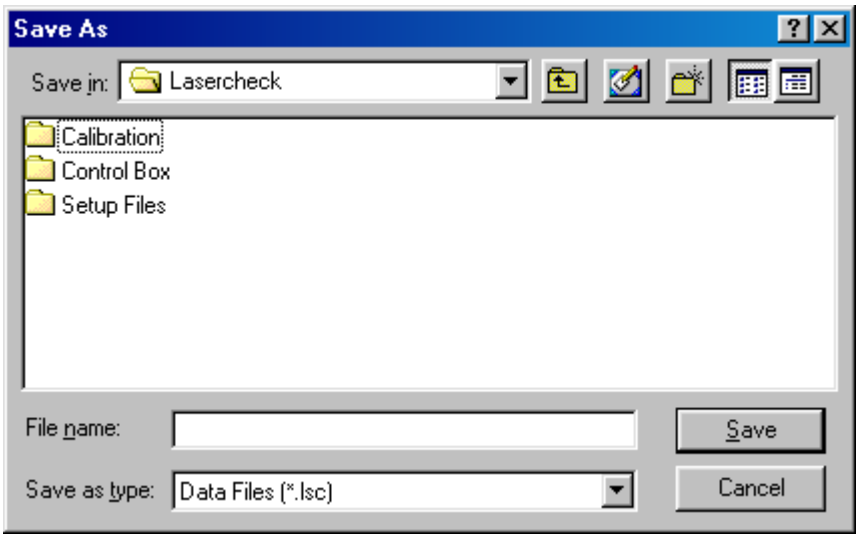
Sequence

While the roughness display is running, the Sequence menu selection can be used to restart a fresh data acquisition cycle.

Save

The Save 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. This data file can be opened for review in the Review Data module from the main screen of the software.



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.

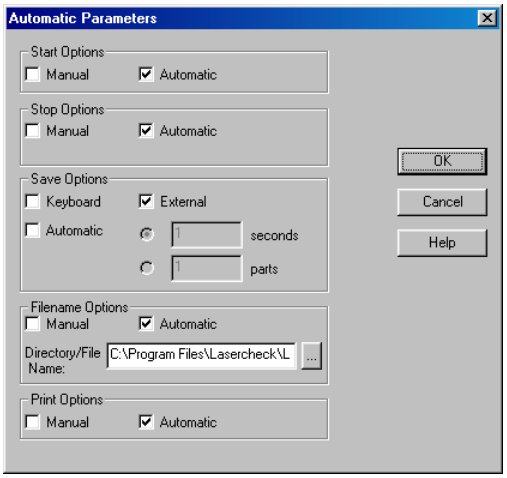
Export

Export can be used to export a text format file of the data named “Lasrdata.txt” to the active directory on your computer.

Automated Operation

The Lasercheck can be used with external inputs to start and stop the measurements in an automated installation. The inputs on the back of the Lasercheck Measurement Head are read by the Lasercheck Windows software, so the Lasercheck must be connected to a host computer for this option to work.

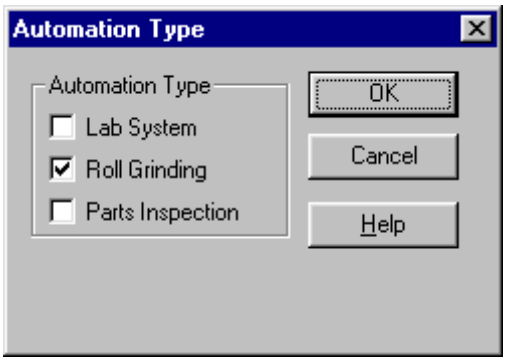
The windows software is designed to work with external inputs in two modes for automated applications. One is for continuous surface applications in which numerous measurements are taken between one start input and one stop input. This mode of operation is typically used to rapidly provide numerous roughness measurements on large surfaces such as mill rolls or sheet surfaces. All data points are displayed on the graph as they are being taken at a rate of approximately 10 readings per second. The second mode of operation is for measuring individual parts being presented to the gage, such as parts on a conveyor. In this mode the few measurements made between a start input and a stop are averaged and only the single average of that part is plotted on the graph; one average point for each start and stop input received.



Numerous Continuous Measurements / Roll Grinding

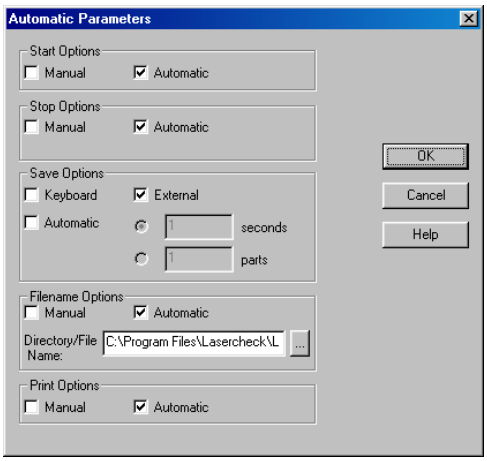
Setting up Windows Software for External Inputs

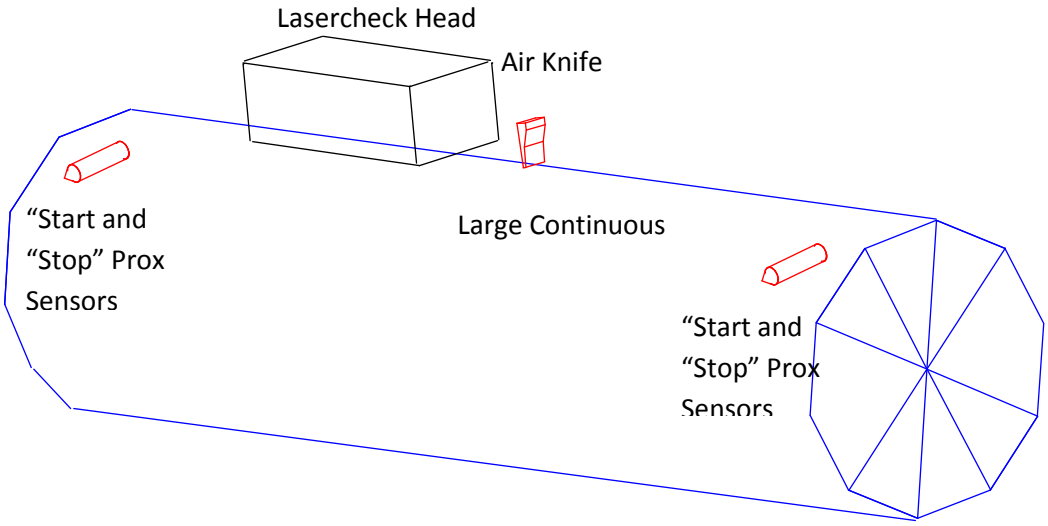
Under the Setup menu, select “Setup” and “Automation Type”. Select “Roll Grinding”. This is the best configuration for software to be used to perform automated measurements on large continuous surfaces.


Automation Type
Automation Type
Lab System
Roll Grinding
Parts Inspection
OK
Cancel
Help

Automatic Parameters for Automatic Start, Stop and Save Options

Under the Setup Module, select Open, and open the setup file named “automatic.stp” to modify and use. Next select the “Automatic” button and select “Automatic” for the Start and Stop options. Select “External” for Save Options. The name of the data file can also be generated and printed automatically or manually each time a new data file is saved. For details of doing this refer to the Lasercheck Windows Software Manual.





Lasercheck Head Mounted over Large Surface for Continuous Automated Inspection

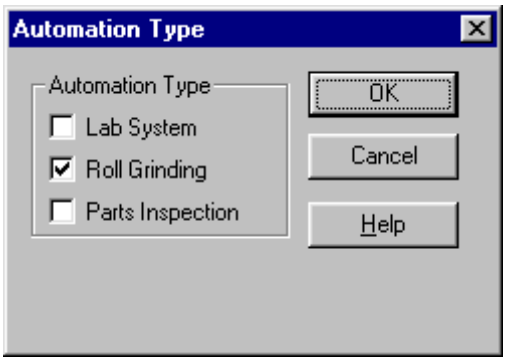
There are drilled and tapped holes on the Lasercheck sensor head that can be used for mounting and installing the Lasercheck in a continuous automated inspection application. The head should be positioned at a location where surface will be at the correct vertical and horizontal position relative to the gage head (see appendix section on Lasercheck Alignment Principles and Procedures). Either the surface will move under the gage or the gage will be moved over the surface. In either case, alignment must be maintained during relative motion. An air knife can be used prior to the gage to clean coolant etc. from surfaces to be inspected if necessary. “Start” and “Stop” sensors or inputs should be positioned to be activated when the gage is positioned to measure at the start of the process and at the stop of the process. Both of these sensors should be wired to the “Input”

connector on the back of the Measurement Head as described in the Appendix – Input and Output Pinouts section. Measurements will proceed at a rate of approximately 10 per second between the “Start” and “Stop” activation.

Individual Measurement Inspection

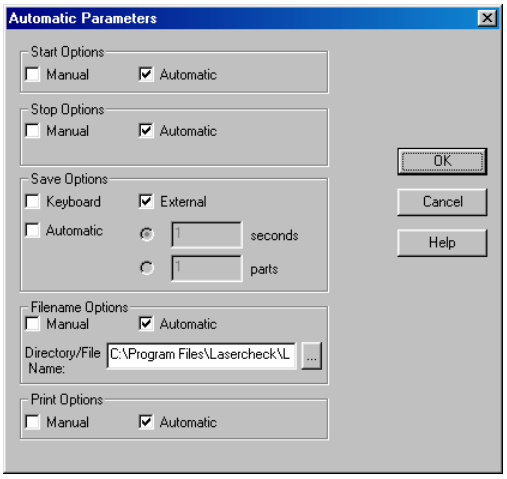
Setting up Windows Software for External Inputs

Under the Setup menu, select “Setup” and “Automation Type”. Select “Roll Grinding”. This is the best configuration for software to be used to perform automated measurements on individual parts.

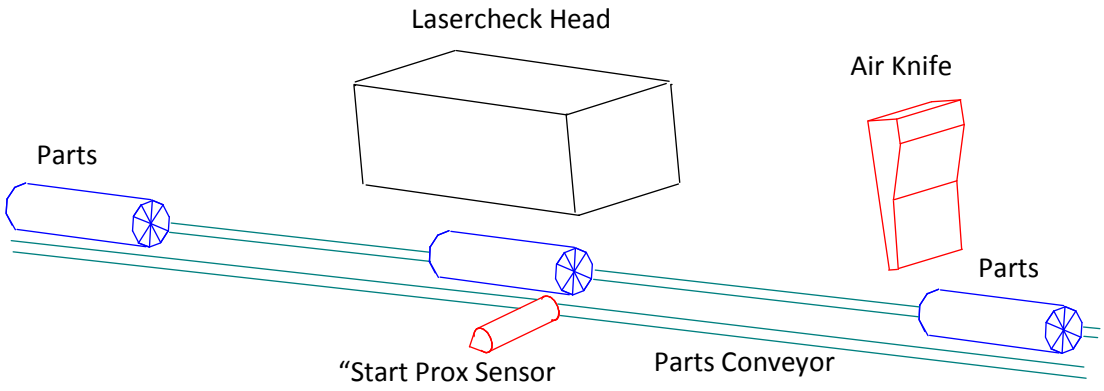


Automatic Parameters for Automatic Start, Stop and Save Options

Under the Setup Module, select Open, and open the setup file named “automatic.stp” to modify and use. Next select the “Automatic” button and select “Automatic” for the Start and Stop options. Select “External” for Save Options. The name of the data file can also be generated and printed automatically or manually each time a new data file is saved. For details of doing this refer to the Lasercheck Windows Software Manual.

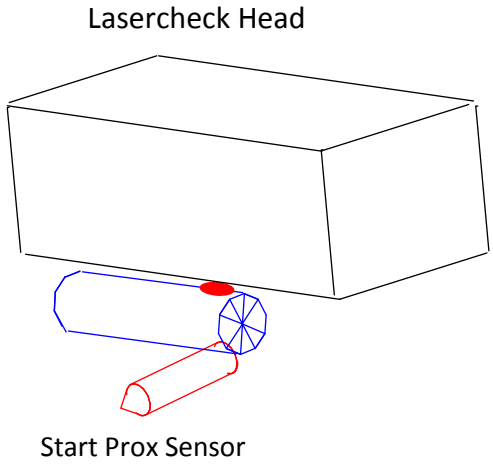


Optionally data files can be saved automatically at time intervals or after a set number of parts. The name of the data file can also be generated automatically and printed automatically each time a new data file is saved. For details of doing this refer to the Lasercheck Windows Software Manual.



Lasercheck Head Mounted on Conveyor for Automated Inspection

There are drilled and tapped holes on the Lasercheck sensor head that can be used for mounting and installing the Lasercheck in an automated inspection application. The head should be positioned at a location where parts will pass beneath the gage at the correct vertical and horizontal position relative to the gage head (see appendix section on Lasercheck Alignment Principles and Procedures). If parts are not clean, an air knife should be installed and mounted prior to the laser head to blow-dry excess coolant off of the surface to be measured. Ideally the parts would pass a few millimeters under the air knife, which would operate with a pressure of approximately 20 psi blowing on the surface.



Positioning Prox Sensors on Conveyor for Automated Inspection

A "start" sensor should be mounted in a location that activates as soon as the surface to be measured is entering a position for the Lasercheck head to measure (indicated by laser beam being fully positioned at the front edge of the measurement area of the part). The sensors should be wired to the "Input" connector on the back of the Measurement Head as described in the Appendix – Input and Output Pinouts section.

"Start" and "Stop" Sensor Wiring Inputs

External inputs to trigger the starting and stopping of measurements can be push buttons, proximity sensors, or any type of input that momentarily closes contacts.

For individual parts in Parts Inspection mode use input 1 for start and input 2 for stop. For a continuous surface in Roll Grinding mode use input 1 to initialize the system, input 3 for start, and input 2 for end/save.

See the Appendix – Input and Output Pinouts for the details of wiring the inputs.

External Trigger or Pushbutton Operation

An external push button or foot pedal can be hooked to the 5872D to control the measurement.

Measurement Head Input

Wire up the push button or foot pedal to external input 1 as indicated in the Lasercheck Manual Appendix for inputs and outputs.

Setup File

Use the Setup File and Calibration Template.xls to create a setup file with the line in the file:

"START_INPUT= SERIAL" – use this for "continuous Ra values for each "start" trigger
"START_INPUT= EXTERNAL1" – use this for single Ra values for each "start" trigger"

For instructions about how to create or edit a setup file see the section in this manual under "Appendix - Calibration Procedures". For instructions about how to load a setup file into the Measurement Head see the section in this manual under "File Management / Receive Command".

This will allow first external input on the 9-pin connector to trigger a measurement (the measure button on the LCD display is also still active).

An example setup file for "continuous" stream of Ra values for each start input would look like:

```
RECEIVE_NAME=          default.set
FILENAME=       default
START_INPUT=    SERIAL
RA_UNITS=       MICROINCHES
RA_LIMITS=      10.00    20.00
LOW_ANALOG=10.00
HIGH_ANALOG=           20.00
RA_THRESHOLD=          -1.00
CAL_TYPE=       EXPONENTIAL
CAL1=   -11.90  14.81    0.00     0.46
CAL2=   0.00    3.90     2.50     4.70
CAL3=   1.10    -6.44    26.80    MAX
CAL4=
CAL5=
PCAL1= 12.791  0.6404  MAX
EOF
```

An example setup file for "single" Ra value for each start input would look like:

```
RECEIVE_NAME=          default.set
FILENAME=       default
START_INPUT=    EXTERNAL1
RA_UNITS=       MICROINCHES
RA_LIMITS=      10.00    20.00
LOW_ANALOG=10.00
HIGH_ANALOG=           20.00
RA_THRESHOLD=          -1.00
```

```
CAL_TYPE=       EXPONENTIAL
CAL1=  -11.90   14.81   0.00    0.46
CAL2=  0.00     3.90    2.50    4.70
CAL3=  1.10     -6.44   26.80   MAX
CAL4=
CAL5=
PCAL1= 12.791   0.6404  MAX
EOF
```

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 manual.

Lasercheck Alignment Principles and Procedures

This section contains information on principals and procedures to install and align Lasercheck heads. The keys to getting accurate and repeatable data are controlling alignment and cleaning the surface.

How Does Lasercheck Work?

The visible (650-nm.) laser illuminates the surface with a shallow incident angle to measure surface roughness features. The distribution of reflected and scattered light from the surface is detected by a photodiode array with 35 small closely packed detectors. This relative distribution of reflected and scattered light is used to calculate the surface roughness of the area illuminated by the laser beam. The array is also scanned by software to find the specular beam (when there is one) and its position is used to determine height of the measurement head from the surface.

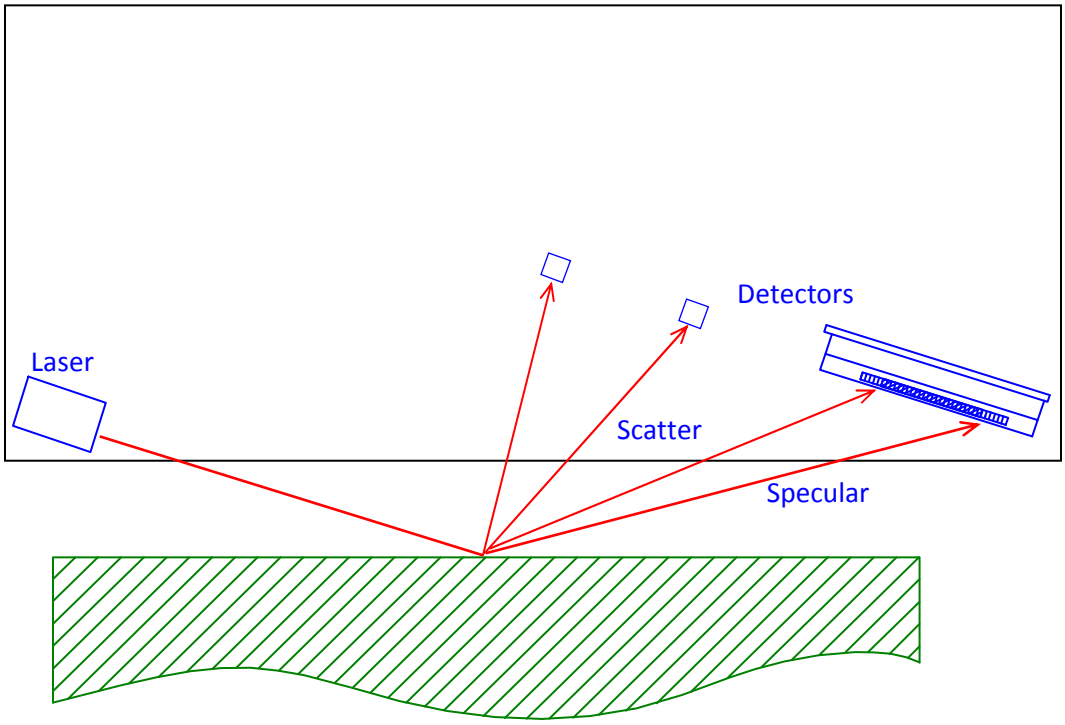


Figure 6 - Schematic Diagram of Lasercheck Instrument

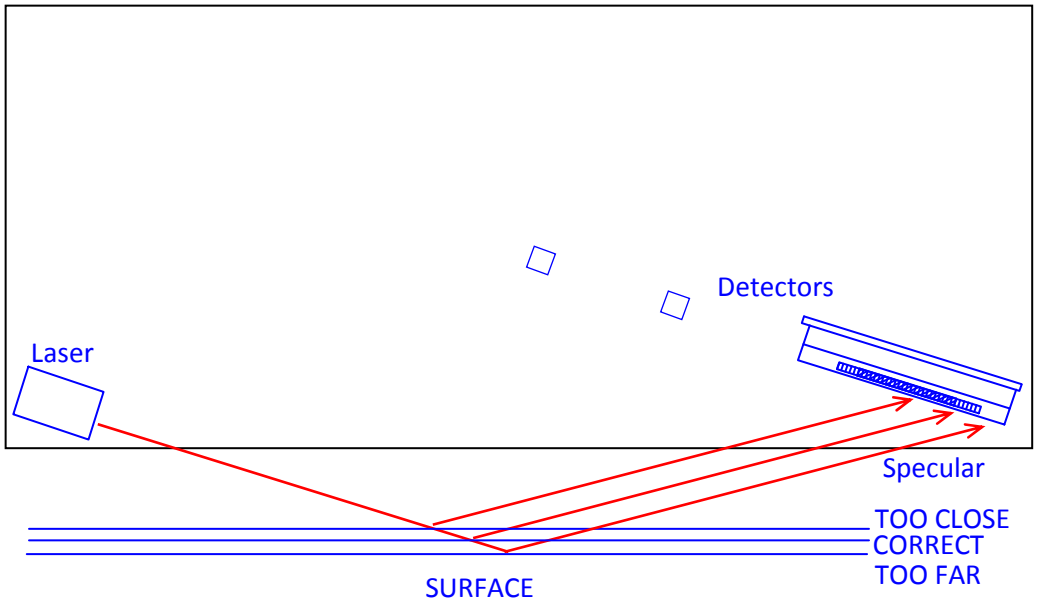
This shows a schematic of the layout of the laser, the beam path and the detectors in Lasercheck. The "Photodiode Array" has 35 discrete detector elements. Of the 35 detectors in the array, the 24 detectors that are positioned to the "inside" of the specular laser beam (toward the direction of the incoming laser beam) are used. This is important to understand in the discussion of alignment.

Alignment

Vertical

The shallow incident angle allows Lasercheck to measure similar roughness features to a stylus gage. It also creates sensitivity to vertical misalignment.

The specular laser beam must fall on one of the first 3 to 9 detectors in the 35-element photodiode array; the next 26 (closest to the incoming laser beam) are used to calculate surface roughness. If Lasercheck is too close to the surface, the specular reflection falls on detector number 10 or greater. Since 10 + 26 = 36 and there are only 35 detectors available, there are no longer enough "scatter" detectors available to calculate roughness. 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.



Positions of the specular reflected laser beam for three different positions of the surface relative to the Lasercheck instrument

This depicts the laser path and specular reflection from surfaces at three different distances from the head. The bottom surface, the farthest from the head, shows the specular reflection missing the detector array. This is misaligned – the head is too far from the surface. The specular reflection from the middle surface strikes the array in the first 11 detectors; this is the proper alignment. Ideally, it should strike in the middle of those 11 detectors. The top surface is also misaligned because the specular hitting too high on the detector array – the head is too close to the surface. The highlighted 24 detectors are the ones that would determine the roughness on the properly aligned middle surface.

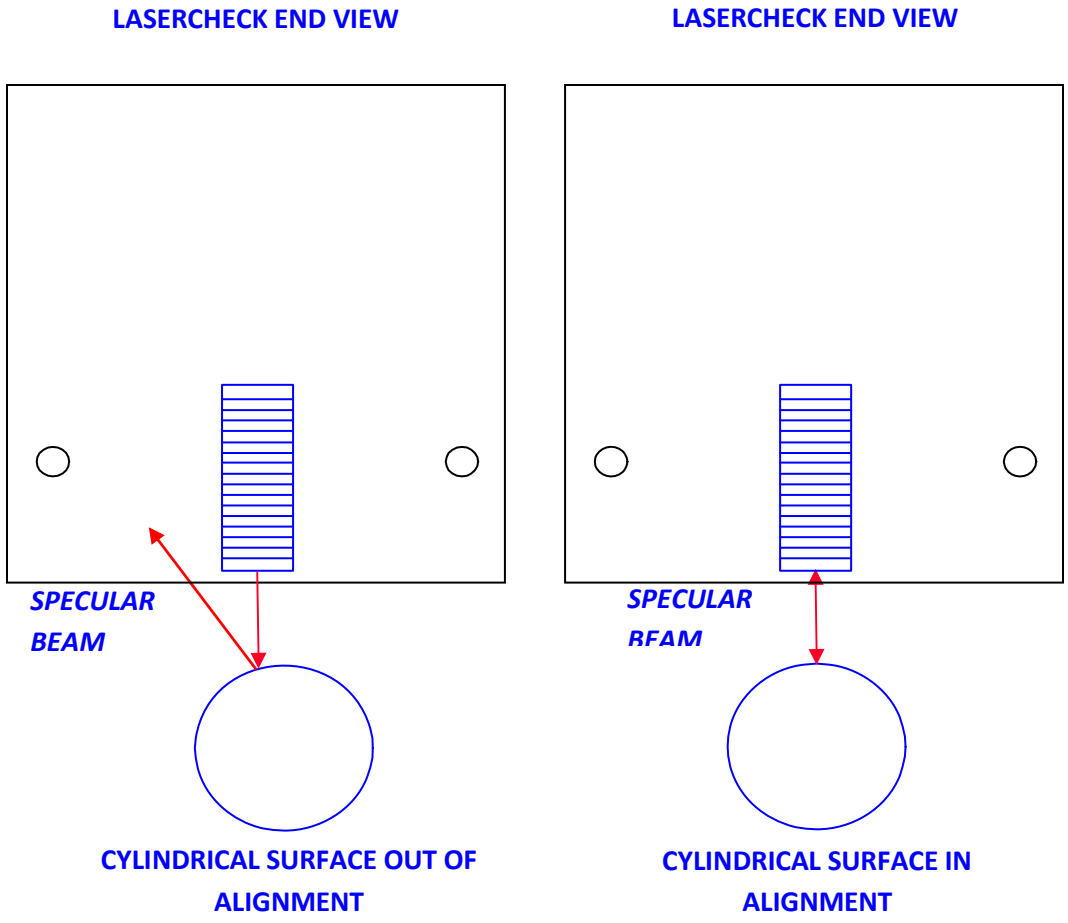
Ideally, Lasercheck is positioned so that the specular laser beam falls on one of the central detectors in the first 11. A good guideline is to try to maintain alignment so that specular falls on detector 6 with a tolerance of no

more than +/- 2 detector elements. As a reference, the head movement is approximately 0.010 inches for every shift of the specular beam of one detector element.

Horizontal

The Lasercheck is also sensitive to horizontal misalignment on curved surfaces.

When you look under the Lasercheck from the “laser” end of the head, 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 and scattered light bouncing back into the center of the detector window. If it is misaligned, you will see the light bouncing to one side or the other of the center of the detector window.



Lateral offset of the specular reflected laser beam on a misaligned curved surface

This demonstrates horizontal misalignment because the laser beam and scatter does not reflect back into the center of the head where the sensors are positioned. When a cylindrical surface is perfectly horizontally aligned, all laser reflection is back into the centerline of the Lasercheck head.

Directional / Rotational

Many manmade 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

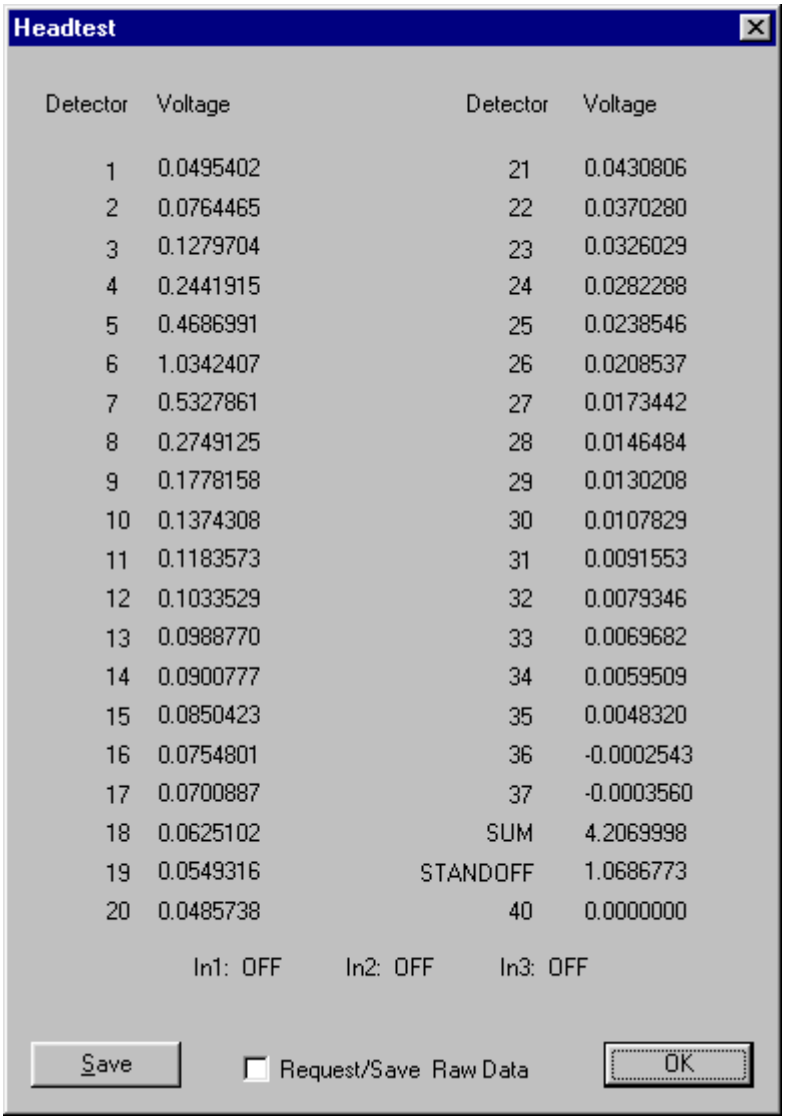
Lasercheck head must be oriented perpendicular to the direction of roughness so that the scatter strikes the detectors, which are oriented in a line down the middle of the head.

If Lasercheck is not aligned at right angles to grinding groves on a ground surface for example (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.

Measure/Headtest Dialog Box

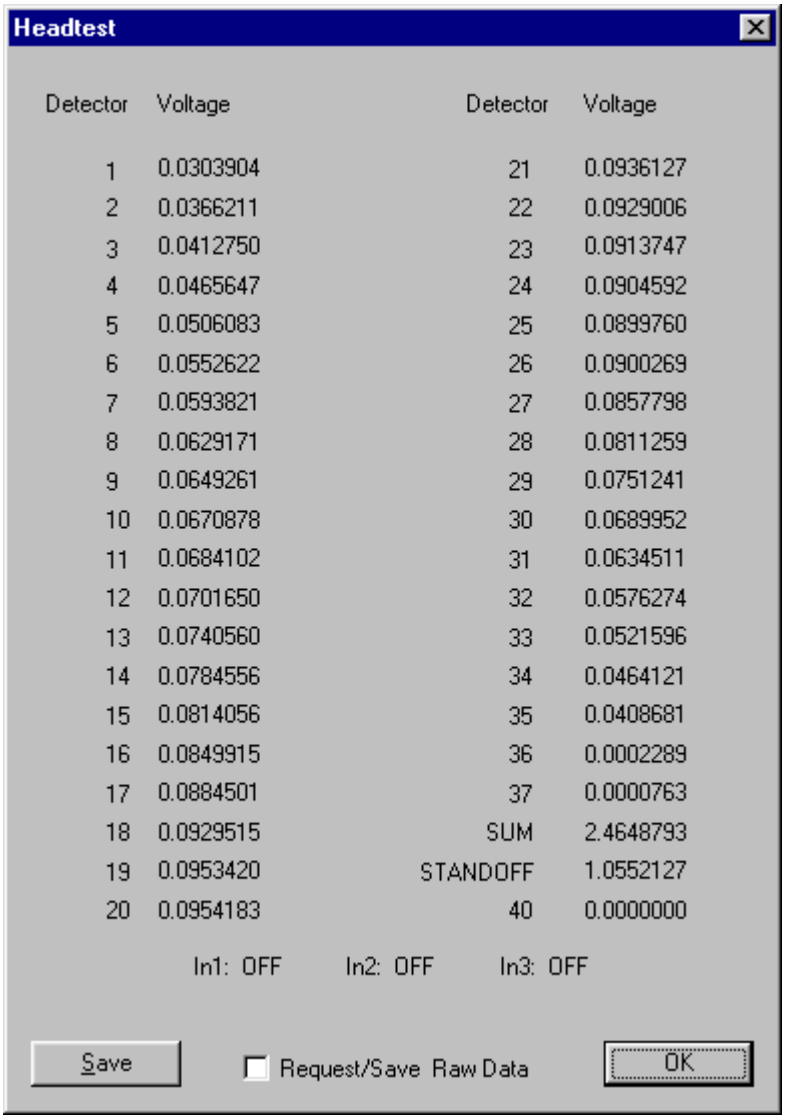
Measure/Headtest Screen A and B are printed out from our Measure/Headtest selection in our windows software. In this screen, you will see Lasercheck values displayed beside numbers 1 to 37. Numbers 1 to 35 are voltage readings from the 35 array detectors. Also displayed is a sum of voltages from all detectors and a “relative” height standoff calculation. Nothing is displayed beside number 40. Measure/Headtest can be used to assist in alignment of the Lasercheck head.

Measure/Headtest Screen A



Measure/Headtest Screen A shows a well-aligned smoother surface, Ra of about 5 microinches. 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 at # 6. A relative indication of the Lasercheck standoff height from the surface is also indicated. *Note: this Standoff Distance calculation is a relative reading only; the absolute values are not correct.* If Lasercheck were moved away from the surface, the specular laser beam would move up to detectors # 5, 4, 3, 2, 1 etc. and the standoff reading indication would increase. If Lasercheck were moved closer to the surface, the specular laser beam would move down to detectors # 7, 8, 9 etc. and the standoff reading indication would decrease.

Measure/Headtest Screen B



Measure/Headtest Screen B is a display from a rougher surface, Ra of about 30 microinches. 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 standoff reading indication is no longer reliable. On these rougher surfaces, we cannot do height alignment with Laserchecks help. What must be done is to either align on a smooth surface in the exact position the rough surface is at or make the rough surface look smooth to Lasercheck for just the alignment. A reliable way to make a rough surface look smooth to Lasercheck is to wipe a thin film of oil on the surface. 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 Measure/Headtest to position the specular center on detector # 6.

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

Measure/Align Dialog Box

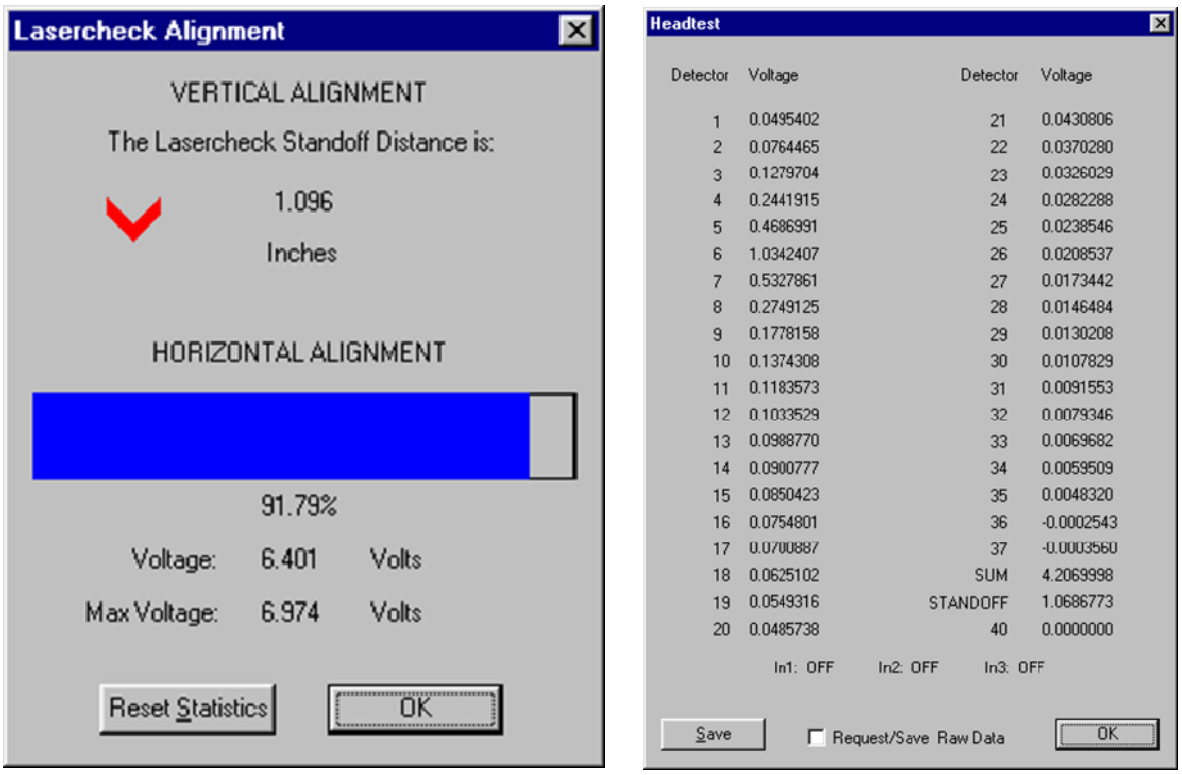
Horizontal Alignment with Measure/Headtest or Measure/Align

Measure/Headtest and Measure/Align in the windows software will help you with horizontal alignment on cylindrical surfaces. Remember SUM is a sum of all of the voltages from the detectors. When horizontally aligned, you will obtain the largest possible value on SUM because more light is reflecting into the center of the detector window and detectors. As you move the head back and forth over a cylindrical surface, you will see this value go up and down. Position Lasercheck for a maximum signal on SUM. The lower portion of the “Measure/Align” dialog box provides a display of the reading from SUM, a continuously updating maximum value from SUM, as well as a continually updating bar graph to help with horizontal alignment.

You must be sure to pass the head back and forth over the surface one or two times so that the maximum possible value for SUM can be found. Once it is found, then the head must be positioned to achieve a value as close to that maximum as possible.

NOTE: *Do not assume that a 100% reading in the Measure/Align dialog box is correct. Always move the head back and forth to find and update a true maximum 100% value.*

You should also note that the maximum reading observed on SUM will typically be lower on rough or non-metallic surfaces than on smooth and metallic surfaces because less light is reflected and scattered into our detectors on rough or non-metallic surfaces.



Measure/Align and Measure/Headtest Screens for Horizontal Alignment

Verifying Alignment Procedures

Set Head Close Correct Position

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

Align Horizontally

Horizontal alignment works best on a clean, rough surface (greater than 10 microinches) with a dominant roughness direction, for example a ground surface. With an alignment aid, Measure/Headtest or Measure/Align; set the horizontal alignment as close to optimal as possible. This is done by maximizing the value of SUM displayed on Measure/Headtest software or by maximizing the horizontal alignment percent within Measure/Align.

Align Vertically

Vertical alignment works best on a smooth surface. Move the head up or down over a smooth area (or a rough area coated with a film of oil). Use Measure/Headtest to position the specular beam on # 6.

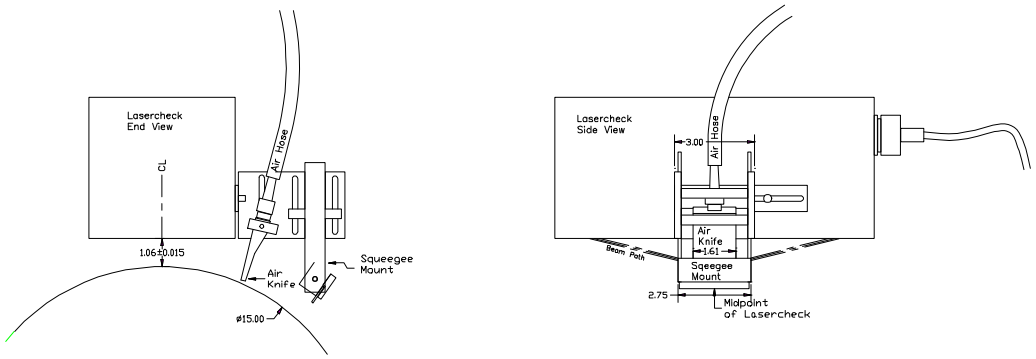
Verify Alignment

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

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

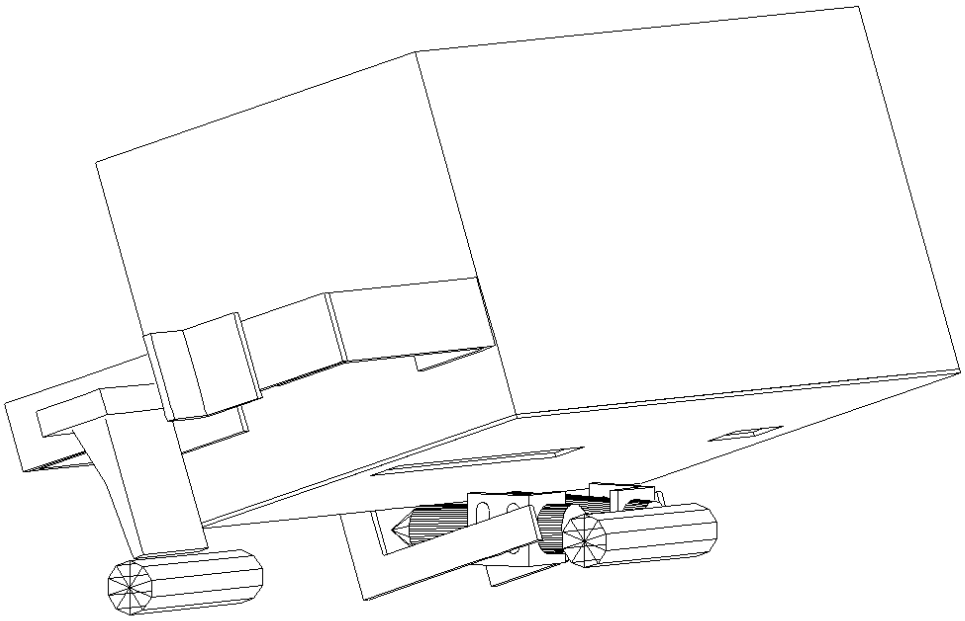
Air Knife/Squeegee Accessories

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.



The above figure 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.



The above figure 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.

Appendix - Setup Files

Triggering measurements

An external trigger (foot pedal, pushbutton, proximity sensor, trigger from the manufacturing or automated inspection process, or any type of input that momentarily closes contacts) can be hooked to the 8826A controller to control the measurement. Use input 1 for starting a measurement, input 2 for stopping a measurement, and input 3 for saving a measurement.

See the Appendix – Input and Output Pinouts for the details of wiring the inputs.

Specific instructions must be loaded into the control box in a Lasercheck setup file ("filename.set"), which is a text file containing calibration, display and operation configuration for the Lasercheck instrument.

For instructions about how to create or edit a setup file see the section in this manual under "Appendix - Calibration Procedures". For instructions about how to load a setup file into the control box see the section in this manual under "File Management / Receive Command".

Setup file format

```
RECEIVE_NAME=          example.set
FILENAME=       example
START_INPUT=  MEAS / SERIAL / EXTERNAL1
RA_UNITS=       MICROINCHES / MICRONS
RA_LIMITS=      15.00    20.00
LOW_ANALOG=15.00
HIGH_ANALOG=           20.00
RA_THRESHOLD=          12.00
CAL_TYPE=       POWER / EXPONENTIAL
CAL1=   -11.90  14.81   0.00    0.46
CAL2=   0.00    3.90    2.50    4.70
CAL3=   1.10    -6.44   26.80   MAX
CAL4=
CAL5=
PCAL1= 12.791  0.6404  MAX
EOF
```

RECEIVE_NAME

This is the name that will be saved in the control box and displayed on the control box LCD screen. The name must be any number of characters up to eight in length.

FILENAME

This is the prefix of the filename to which the data is saved. The prefix must be five characters that are used to create an incremental data file; abcde will create files named abcde001.txt, abcde002.txt, etc. If “DATE” is used, then the system date will be used to start the file name (i.e. 0428_001.txt).

START_INPUT

MEAS

Default. Responds only to front panel pushbutton. Single value response only sent to front panel LCD and to serial port.

SERIAL

Responds to command from serial port to front panel LCD and to serial port.

EXTERNAL1

Starts as soon as receives command from EXTERNAL1, respond as fast as can to front panel LCD and to serial port.

RA_UNITS

This sets which units the Ra is displayed on the LCD screen.
The RA_UNITS options are microinches, microns, or nanometers.

RA_LIMITS

This option accepts two numbers; the first is the minimum and the second is the maximum Ra value of the surface specification. This sets the specification range for Ra values. If a measured Ra is outside (lower than the minimum or higher than the maximum) these values pins on the control box output port (Ra_Limit) momentarily close. An “out of spec” indicator, or automated part rejecter can be connected to these pins to alert operators and / or reject parts when they are outside of specification.

ANALOG_OUTPUT

LOW_ANALOG

This option is used to configure the low current or voltage setting of the Analog_Out pin of the output connector. This number shall determine the Ra value that will generate 0 Volts or 4 milliamps output at the pins.

HIGH_ANALOG

This option is used to configure the high current or voltage setting of the Analog_Out pin of the output connector. This number shall determine the Ra value that will generate 10 Volts or 20 milliamps output at the pins.

Jumper Settings for Setting Analog Output to 4-20 mA or 0-10 V

Jumpers JP2 and JP3 on top board inside of control box must be set to configure 0-10V voltage or 4-20 mA current output. Set JP2 and JP3 to “C” for 4-10 mA current output or to “V” for 0-10V voltage output.

RA_THRESHOLD

The Ra threshold is the value in microinches the control box Ra calculation program switches between rough and smooth algorithms. For most surfaces and processes 12 microinches is recommended.

CAL_TYPE

Lasercheck software calculates a raw, uncalibrated relative roughness value. To display “calibrated” values calibration equation values must be mathematically applied to the uncalibrated Lasercheck value. For information on calibration, see the section in this manual under “Appendix - Calibration Procedures”.

POWER

Applies “power based” calibration to Lasercheck raw roughness values. Reads and applies calibrations from values in setup file line named “PCAL1”.

EXPONENTIAL

Default. Applies “linear and exponential based” calibration to Lasercheck raw roughness values. Reads and applies calibrations from values in setup file lines named “CAL1, CAL2, CAL3, CAL4, and CAL5”.

CALIBRATION

The calibration conversion equations, CAL1 through CAL5, are in the form Ax^2 + Bx + C followed by a break point which transitions to the next calibration equation or region. There are up to 5 “calibration” regions. Setting the break point value to “MAX” indicates that data set is the last “calibration” region.

PCAL1 are calibration conversion values used in “power based” calibration equations.

Default.set setup files

Many different setup files can reside on the controller so users can scroll to, and use these different setups for different applications. The first setup file to “load” when the controller is started is typically the most recent setup file that was loaded onto the controller. If desired, one setup file can be configured to always be the one that first loads whenever the system is turned on. Naming the setup file “Default.set” will cause that file to always be loaded when the controller is first started. The first two lines of the setup file should read:

RECEIVE_NAME= default.set
FILENAME= default

Appendix - Calibration Procedures

Overview

Calibration of the Lasercheck gage involves testing known surfaces with the Lasercheck and developing a correlation between the Lasercheck readings and the actual Ra roughness values on several surfaces with different roughness values. This correlation is stored in a setup file that is used when the Lasercheck performs a measurement.

Lasercheck requires calibrations for different processes. Lasercheck will read a turned surface different than it reads a lapped and polished surface so an independent calibration is required for each of these processes. Once a calibration is performed, Lasercheck never requires re-calibration for a given process.

Lasercheck Calibration Measurements

Please refer to the subsection of the manual named “New Cal Command” in the “File Management” section.

Statistics and Accuracy

It is important to remember that more calibration measurements provide better statistics and better calibration, especially if a wide range of roughness is used in the calibration. It is also important to remember that stylus gages measurements often lack repeatability depending on surface uniformity, the environment the measurement is taken in, condition of the instrument and condition of the actual stylus tip. It is a good idea, therefore, to take a few stylus gages measurements for each sample and enter the average of those values into the spreadsheet.

Calibration Spreadsheet

The spreadsheet is designed to step you through the calibration process from "Step 1" through "Step 6". Follow the detailed instructions on each page of the spreadsheet. The overall process involves:

1) Perform and save measurements on calibration test surfaces with the Lasercheck using uncal.set file.
2) Measure calibration test surfaces with a calibrated stylus gage (if the actual surface roughness is not known.
3) After measurements are performed, follow the specific numbered instructions on each sequential page in the spreadsheet (Step 1 Enter Ra Values, Step 2 Mid Range, Step 3 High Range, Step 4 Low Range, Step 5 Review, and Step 6 Export Setup File).

Instructions for using the Setup File and Calibration Template.xls

The spreadsheet is designed to step you through the calibration process from "Step 1" through "Step 6". Lasercheck calibrations often show three regions of correlation. There is an exponential correlation on smooth surfaces (a few microinches of roughness), followed by a linear correlation region (from a few microinches to 10’s of microinches of roughness), followed by a final exponential correlation region (10’s of microinches to approximately 100 microinches of roughness). The spreadsheet instructions will allow adjustment of calibration correlation curves in each of these regions to provide the best fit to the calibration data.

Step 1 Enter Ra Values

Below is an image of the Step 1 tab of the spreadsheet including instructions.

1. Export measurement files containing Lasercheck calibration measurement values from the Lasercheck controller. Then "Left-Click" on the Push-Button below labeled "Insert Lasercheck Values" to import the values into this spreadsheet program. Select the appropriate directory and file containing the data when prompted. *Note:* Lasercheck values can also be entered manually in the Green Highlighted Column labeled **Lasercheck Ra Value** below.

2. Enter values measured with Stylus Gage corresponding to Lasercheck values in Yellow Highlighted Column labeled **Stylus Ra Value** below.

3. Enter new name for the Setup File or finishing process that is being created by this spreadsheet beside **Filename =** in Yellow Highlighted Space below. Name must Be 5 letters or less.

Filename = ProcessA

4. Use Drop Down Box to select "Meas" if measurements to be taken by operator in a manual / pushbutton mode, "Serial" if measurements to be performed by operator control or fully automated external input control of Lasercheck Windows Software, or "External_1" if measurements to be performed by external input control in a manual single measurement mode.

Control = MEAS

5. Use Drop Down Box to select "Microinches" or "Microns" for the roughness units you wished displayed by the Lasercheck display.

Units = MICROINCHES

6. Use Drop Down Box to select "EXPONENTIAL" or "POWER" depending on curve fitting routine selected that is best fit to correlation between stylus and Lasercheck values

Cal Type = EXPONENTIAL

Measure #	Stylus Ra Value	Lasercheck Ra Value
1	2.770	0.450
2	4.803	0.900
3	10.367	1.980
4	17.200	3.200
5	31.500	6.000
6	67.767	9.100
7	1.340	0.200
8	2.210	0.350
9	4.150	0.750
10	8.730	1.610
11	18.100	3.500
12	38.200	7.000
13	64.600	9.000
14	125.000	12.300
15	2.150	0.350
16	4.310	0.790
17	9.480	1.900
18	15.490	3.300
19	31.710	6.000
20	55.450	8.000
21	0.995	0.200
22	1.870	0.300
23	4.505	0.820
24	8.140	1.580
25	16.345	3.620
26	30.610	6.230
27	56.475	9.000
28	114.155	12.200
29		

Stylus and Lasercheck Ra Values

All Lasercheck values are imported or manually entered into this spreadsheet. The known (or stylus gages measured) values taken on the same area of the same surface are manually entered into the spreadsheet beside the corresponding Lasercheck value.

*<u>Note</u>: This spreadsheet is designed for inputting stylus values in **microinches**. The final setup file can be configured to provide results in microinches or microns, but it is important to input stylus or actual surface values in microinches only in this spreadsheet.*

Filename =

Manually enter a filename here. This will be carried through the spreadsheet and used in naming the setup file when transferred into the 5872D. Try to use a name that is descriptive of either the process or the job and parts that it is to be used on.

Control =

Use the drop down dialog box to select how measurements will be performed. Options are:

- MEAS Controlled by front panel pushbutton (Only option available with this system)
- SERIAL Controlled by external software (Not available with this instrument)
- EXTERNAL1 Controlled by external trigger (Not available with this instrument)

Units =

Use the drop down dialog box to select measurement units to be displayed. Options are:

- MICROINCHES
- MICRONS
- NANOMETERS

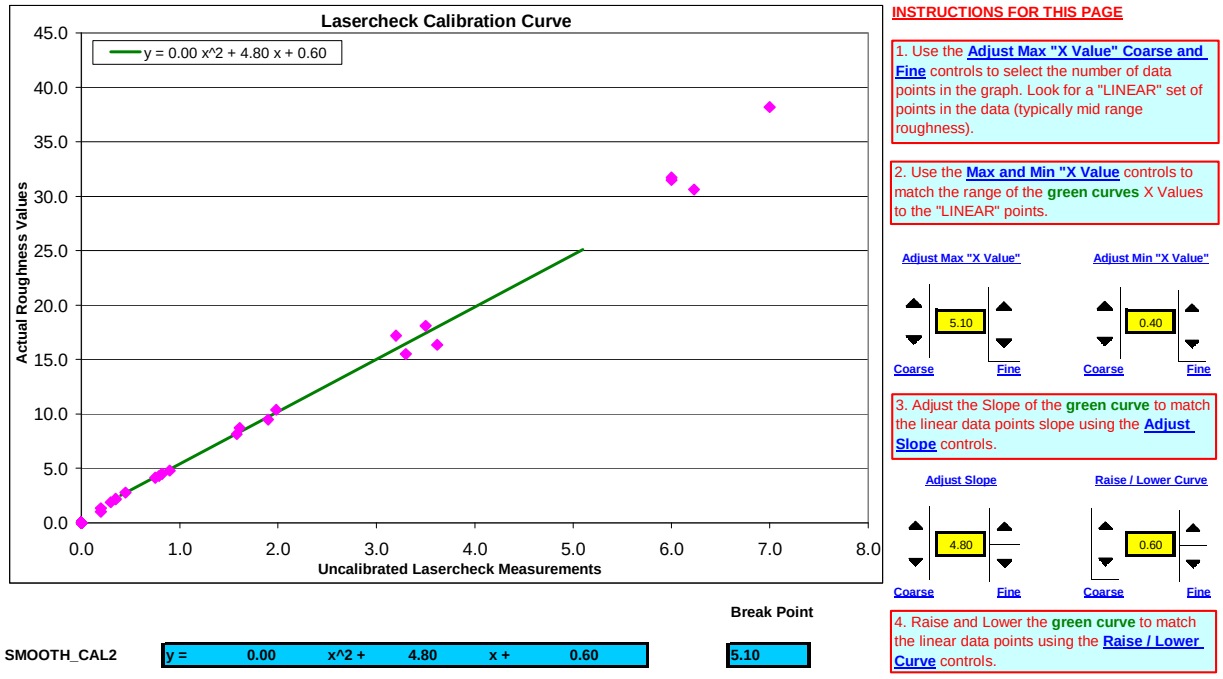
Cal Type =

Use the drop down dialog box to select “curve fitting mathematics” to be used for creating calibration values. Options are:

- EXPONENTIAL Linear and exponential equations (Only option available with this system)
- POWER Power based equations (Not available with this instrument)

Step 2 Mid Range

Below is an image of the Step 2 tab of the spreadsheet including instructions.



Adjust Max "X Value" / Adjust Min "X Value"

Use the scroll buttons to extend or contract the linear green curve and the associated data points that the linear curve will be best fit to. Linear fits will be found on most sets of Lasercheck and stylus values and this may include some or all of the values. Try to find the linear data set than isolate those values with these scroll buttons.

Adjust Slope

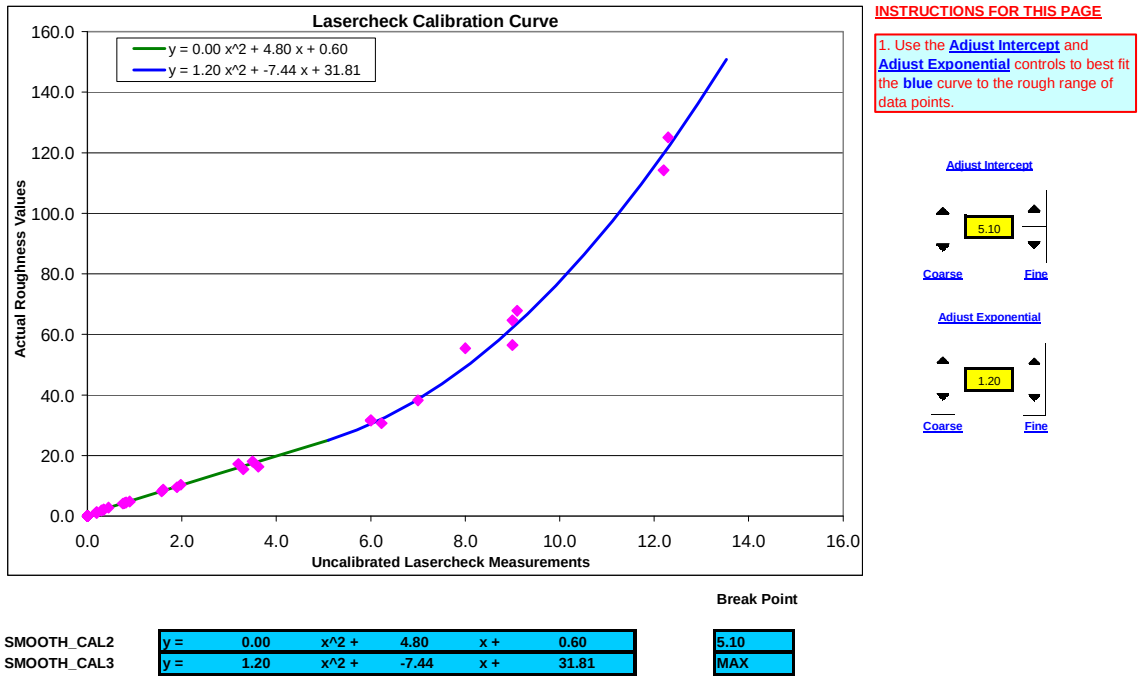
Use the Coarse and Fine scroll buttons to match the slope of the linear green curve and the associated data points.

Raise / Lower Curve

Use the Coarse and Fine scroll buttons to raise and lower the linear green curve until it best fits the associated data points.

Step 3 High Range

Below is an image of the Step 3 tab of the spreadsheet including instructions.



Adjust Intercept

Use the Coarse and Fine scroll buttons to select where the values in the graph appear to transition from a "linear" best fit – linear green curve – a - to an "exponential" best fit – exponential blue curve. In most processes, Lasercheck measurements and actual surface roughness eventually exhibit an exponential relationship as the surface values get rougher.

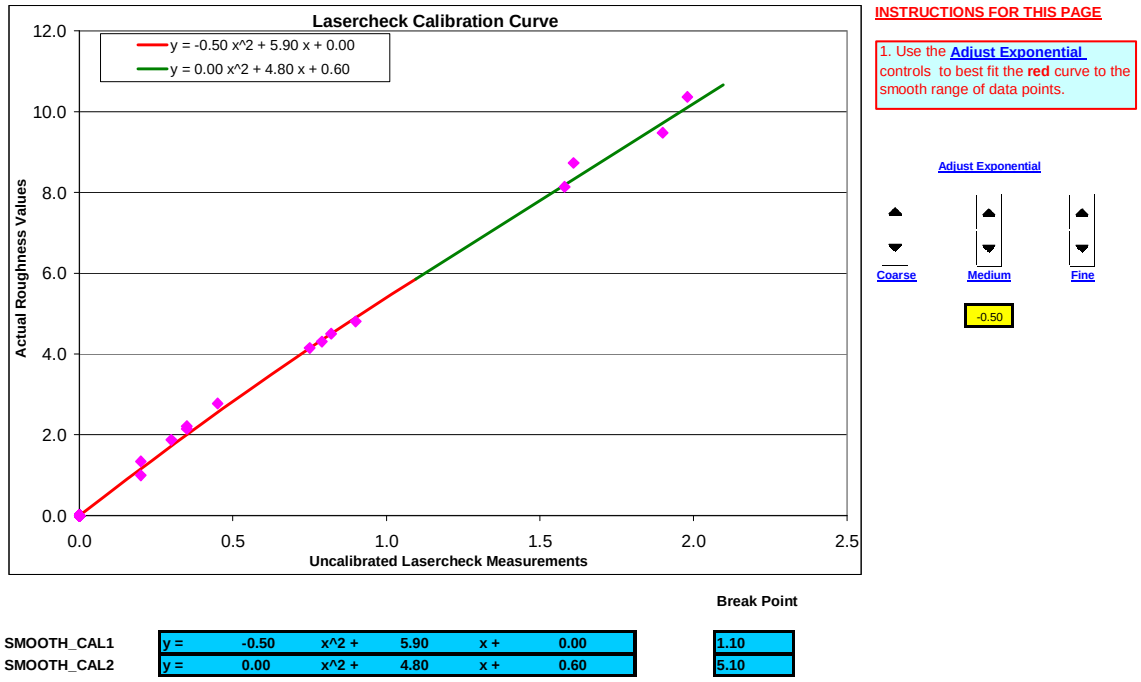
Adjust Exponential

Use the Coarse and Fine scroll buttons to match the exponential blue curve and the associated data points at the rougher range of surface values.

Note: The "Adjust Intercept" and "Adjust Exponential" operations usually are iterative operations.

Step 4 Low Range

Below is an image of the Step 4 tab of the spreadsheet including instructions.

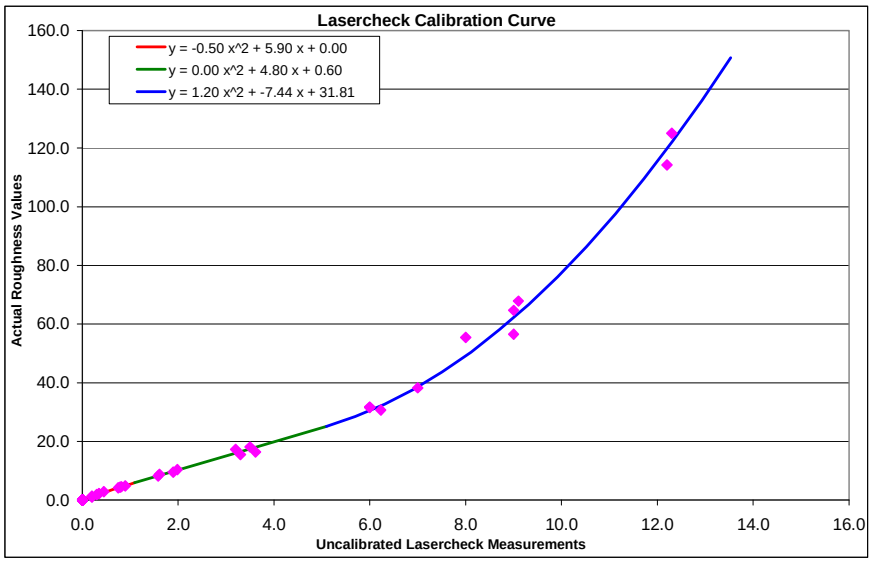


Adjust Exponential

Use the Coarse, Medium, and Fine scroll buttons to match the slope of the exponential red curve and the associated data points at the smoothest range of surface values. Lasercheck measurements and actual surface roughness eventually exhibit an exponential relationship as the surface values get very smooth (a few microinches and below).

Step 5 Review

Below is an image of the Step 5 tab of the spreadsheet including instructions. This final graph allows you to review the curve fitting of all regions of roughness - exponential red curve, linear green curve, exponential blue curve – that have been performed in Step 2 through Step 4. If any regions of the best fit curves do not appear to "best-fit" the data, then go back to the relevant tabs and step back through the process until "best possible fit" is obtained for all ranges of roughness.



INSTRUCTIONS FOR THIS PAGE

1. Review the overall calibration curve fits for all roughness regions. If any part of the calibration does not visually appear correct, go back to the tab corresponding to that region and make adjustments. You may have to edit other tabs after that to correct the overall calibration.

							Break Point
SMOOTH_CAL1	y =	-0.50	x^2 +	5.90	x +	0.00	1.10
SMOOTH_CAL2	y =	0.00	x^2 +	4.80	x +	0.60	5.10
SMOOTH_CAL3	y =	1.20	x^2 +	-7.44	x +	31.81	MAX

Step 6 Export Setup File

Below is an image of the Step 6 tab of the spreadsheet including instructions.

File Transfer Setup File

RECEIVE_NAME=	ProcessA.set			
FILENAME=	ProcessA			
START_INPUT=	MEAS			
RA_UNITS=	MICROINCHES			
RA_LIMITS=	15.00	20.00		
LOW_ANALOG=	15.00			
HIGH_ANALOG=	20.00			
RA_THRESHOLD=	12.00			
CAL_TYPE=	EXPONENTIAL			
CAL1=	-0.50	5.90	0.00	1.10
CAL2=	0.00	4.80	0.60	5.10
CAL3=	1.20	-7.44	31.81	MAX
CAL4=				
CAL5=				
EOF				

Manual Input Setup File

FILENAME=	ProcessA
Cal_A1:	-0.50
Cal_B1:	5.90
Cal_C1:	0.00
Cal_A2:	0.00
Cal_B2:	4.80
Cal_C2:	0.60
Cal_A3:	1.20
Cal_B3:	-7.44
Cal_C3:	31.81
Break_1:	1.10
Break_2:	5.10
Threshold:	20.00
RA_UNITS=	MICROINCHES

INSTRUCTIONS FOR THIS PAGE

1. Click on Push-Buttons Below Labeled "Export Standard Setup File", or "Export Manual Input Setup File" depending on whether new setup file created will be input into the Lasercheck electronics by computer file transfer or by manually inputting values. You may rename any of these files, but they **MUST** end in ".set". Close the new setup file that is created in Excel. When the dialog box appears asking you about saving the changes to the file, select "No".

Export "File Transfer" Setup File

Export "Manual Input"Setup File

Export "File Transfer" or "Manual Input" Setup File

Pushing either of these buttons will create a setup file with a default name of "std.set" or "manual.set". When this is done, you should rename this file to a descriptive name for the finishing process or job it is to be sued on and later loaded onto the 5872D. The "File Transfer" button will create a properly formatted file for downloading using the optional Computer File Storage Interface upgrade. The "Manual Input" button will create a properly formatted file that allows easy entry into the 5872D using the keypads.

Typical "File Download" Calibration Setup File

```
RECEIVE_NAME=       ProcessA.set
FILENAME=     ProcessA
START_INPUT=  MEAS
RA_UNITS=     MICROINCHES
RA_LIMITS=    15.00   20.00
LOW_ANALOG=15.00
HIGH_ANALOG=        20.00
RA_THRESHOLD=       12.00
CAL_TYPE=     EXPONENTIAL
```

```
CAL1=  -0.50    5.90    0.00    1.10
CAL2=  0.00     4.80    0.60    5.10
CAL3=  1.20     -7.44   31.81   MAX
CAL4=
CAL5=
EOF
```

Appendix – Input, Output, Serial Pinouts

15-Pin Female D-sub Connector

15 Pin I/O#	Signal Name	Function Inspect Continuous Surface	Function Inspect Individual Parts
	INPUT FUNCTIONS		
3	+12 VDC (power supply)	Power for external trigger device and Internal Opto relay	
1	GND (power supply ground)	Ground for Inputs 1, 2, 3	
9	Input 1	Initialize System to Begin	Start
2	Input 2	Stop and Save	Stop
10	Input 3	Start	Initialize System to Begin; Save
	OUTPUT FUNCTIONS		
4	Analog_Out + (0-10V / 4-20mA)		
12	Analog_Out GND (0-10V / 4-20mA)		
7	GND (system ground)		
11	No Connection; NC; No Function		
13	Not Used		
8	Ra_Limit (Closed if Out of Spec)		
15	Ra_Limit (Closed if Out of Spec)		
	SERIAL COMMUNICATION		
14	Serial Ground		
6	Serial RXD		
5	Serial TXD		

Input

Internal Opto relay:

Optically Isolated. **Internally connected to power.**

Pulls low to activate.

Voltage Range: 3VDC to 50VDC, ideal 5VDC

Max Ratings: 60 mA

Internal part: QT Optoelectronics MCT9001

Trigger pins:

Pin 9, 2, 10 = Trigger inputs 1, 2, 3

Normally open, “switch” low (close) to ground to activate

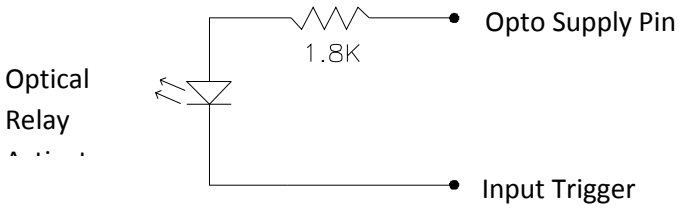
Pin 1 = Ground of internal power supply (Connect to input triggers)

Power pins (Use for powering external triggering devices such as inductive proximity sensors):

Pin 3 = 12 to 13 VDC from internal power supply

Pin 7 = Ground of internal power supply

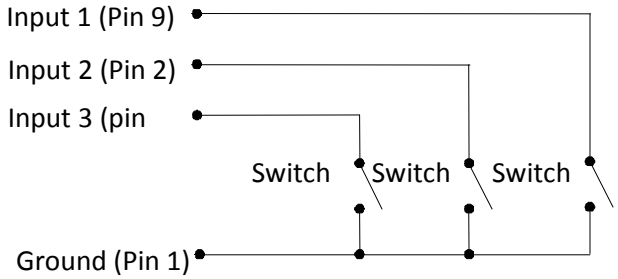
Internal Opto relay Schematic:



Typical Input Wiring Example:

Using Unpowered Switches for inputs:

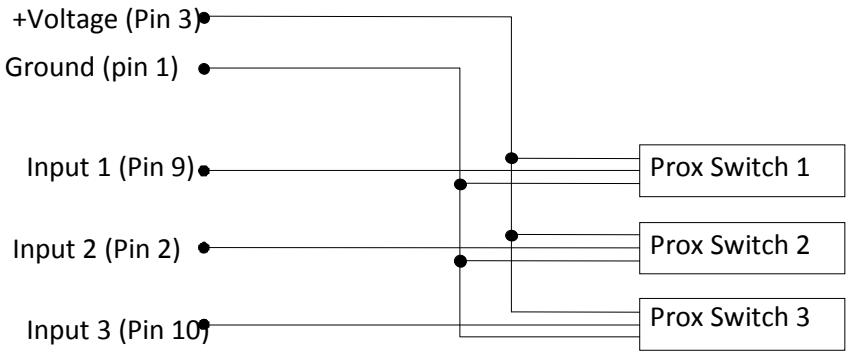
a) Connect Switches between Ground (Pin 7) and Input Pin



Using Powered Triggering Device (e.g. Proximity Sensors) for Inputs:

a) Connect Power for Triggering Devices using Control Box Voltage (Pin 9)

b) Connect Triggering Devices between Ground (Pin 7) and Input Pin



Recommended Proximity Sensor Specifications:

- DC, NPN (short to ground to activate), shielded (for most applications), normally open output

Output

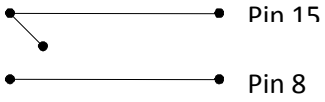
Failed part output. Closes when measurement is out of software specified range.

SPDT Relay, Resistive load Max: 200mA
Max Ratings: 30VDC @ 1A, 125VAC @ 0.1A
Internal parts: Omron G6E, connected internally with 28AWG ribbon cable

*** NOTE:** Jumpers JP2 and JP3 on top board inside of measurement head must be set to configure 0-10V voltage or 4-20 mA current output. Set JP2 and JP3 to "C" for 4-20 mA current output or to "V" for 0-10V voltage output.

Output Schematic Ra_Limit

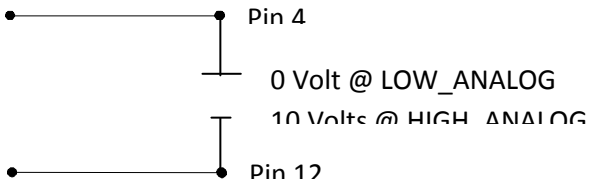
Normal State – Surface Within Ra_Limit – in Spec



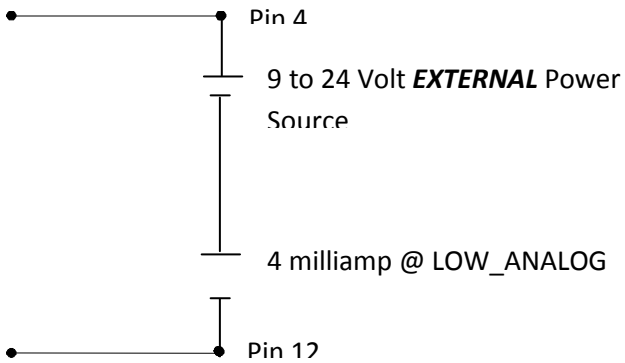
Surface Outside Ra_Limit – out of Spec

Output Schematic Analog_Out

0-10V



4-20mA



NOTE: 9 to 24 Volts power must be connected in series with Current Monitor (*Must be **External** power source*):

Appendix - File Management

Upgrading 5872D Software and Files

Prepare 5872D

- Remove top lid (8 screws around outside)
- Carefully lift lid (one 4-40 threaded hole on outer end of lid can be used to “loosen” lid by slowly threading 4-440 screw in until it pushes lid up to break any seal
- Set lid in position so as to not strain any internal wires.
- Connect a computer keyboard to the connector on the Lasercheck measurement head computer board Keyboard connector
- Connect a computer monitor to the Lasercheck measurement head computer board monitor connector.
- Turn on the measurement head main power switch. When fully executed, the attached monitor will display something like:

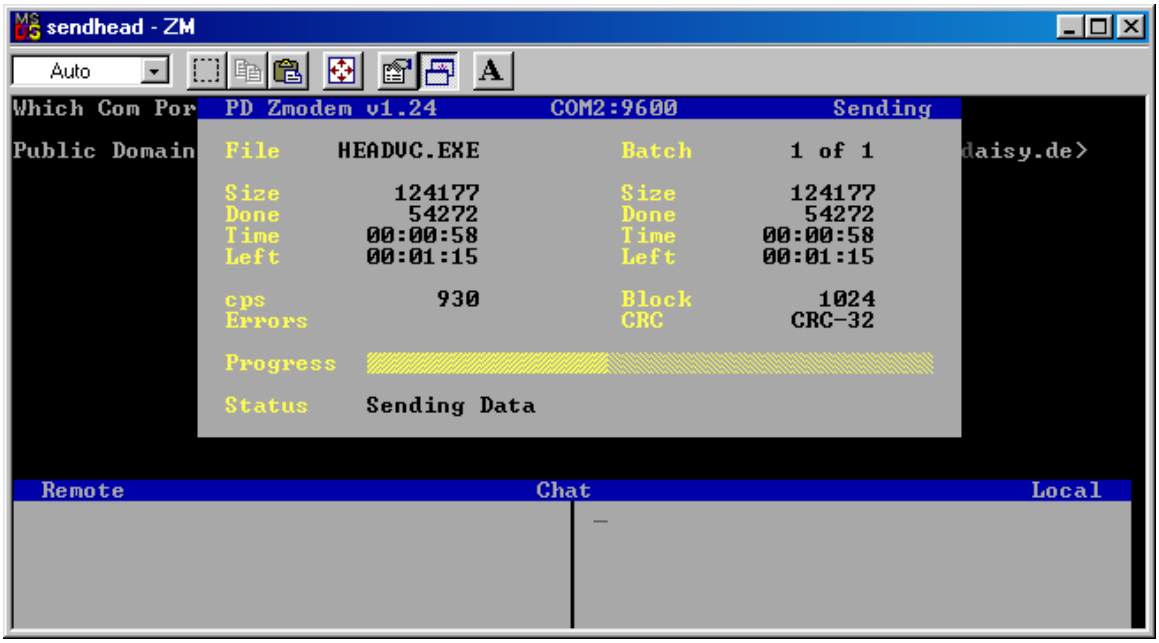
    Current setup file is ……

Prepare Computer

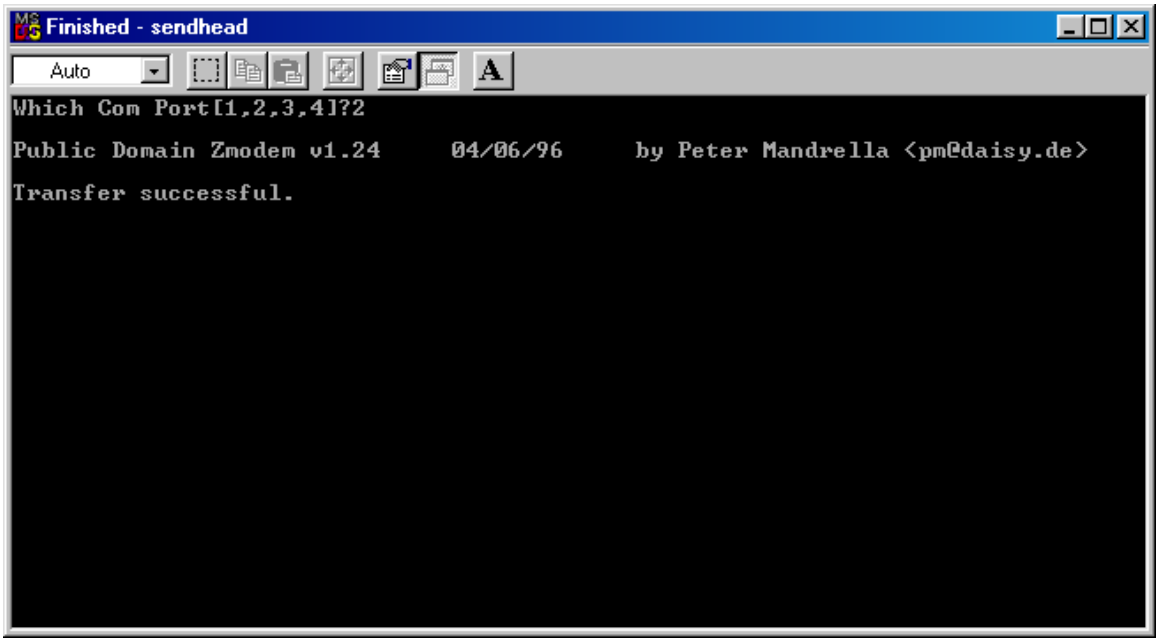
- The files named Sndcfg.bat, Sndset.bat Sndhead.bat, and Zm.exe should be found in the “C:\Program Files\Lasercheck\5872D 5872D Software” directory on your computer.
- Copy the new files that you wish to transfer to that same directory.

Perform Transfer

- Push the “Esc” key on the keyboard attached to the measurement head. This will initiate the file transfer process.
- Double click on the Snd.bat file (depends on set, exe, or cfg file you will send. A DOS prompt will appear asking “Which Com Port?” Type in the COM port on your computer that is connected to the serial null modem cable through to the measurement head.
- Transfer will begin. The PC will display a screen similar to the following DOS window with a bar graph indicating progress of the file transfer.



When the file has been transferred, the measurement head will return to the File System Window and the DOS window on the PC will indicate that the file(s) have been successfully transferred.



Finish

- Exit the DOS program.
- Power Cycle the measurement head (turn the main power on and off again).
- Watch for correct booting of software to be displayed as measurement head executes.