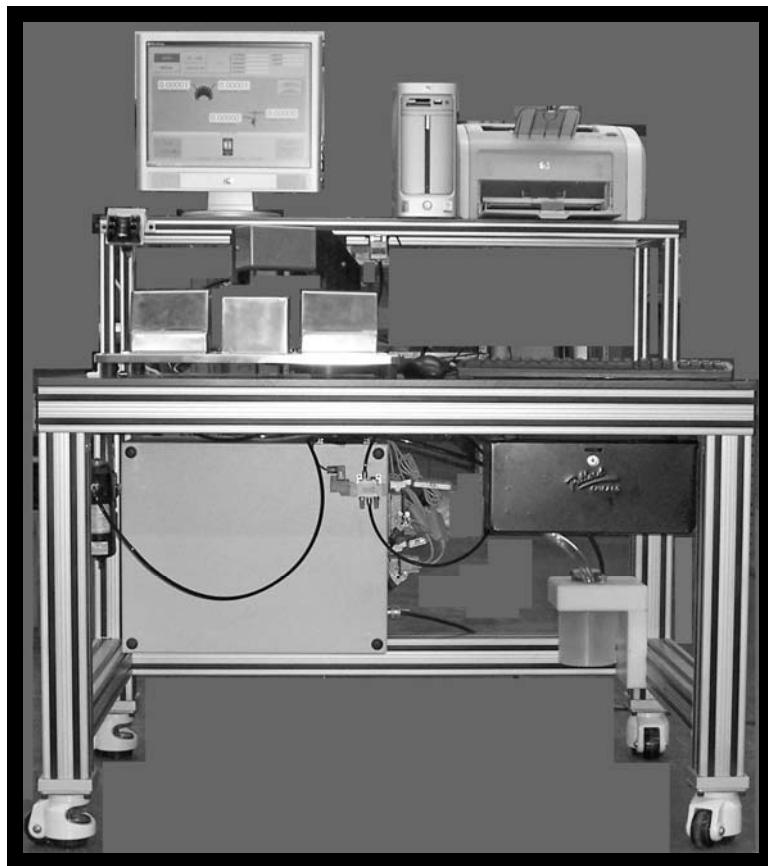




Instruction Manual

PacMan Measurement Gauge



Safety Precautions

The PacMan Measurement Gauge uses Keyence laser gauges with a Semiconductor laser as the light source. Before using the product, see “Laser Safety Precautions” on page 1 to learn the safe and correct method of using the LS-5000 series.

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Chapter 1

Laser Safety Precautions

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1.1 Classification (Keyence Laser Gauges)

	LS-5041	LK-G87
FDA	Class II	
IEC 825-1 11.1993	Class 2	
DIN EN 60825-1 07.1994	Klasse 2	

* refer to Keyence manual for complete classification and safety precautions

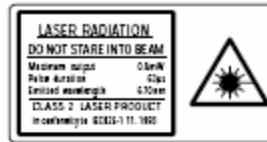
1.2 Warning Labels

■ LS-5041

- 1) Warning label/Aperture label
FDA Class II



IEC Class 2



IEC (French) Classe 2

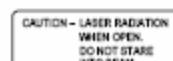


DIN Klasse 2

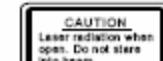


- 2) Label for non-interlocked protective housing

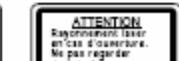
FDA
Class II



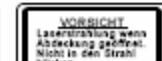
IEC
Class 2



IEC (French)
Classe 2



DIN
Klasse 2



1.2 Safety Considerations

Read Keyence manuals provided with gauge thoroughly before using gauge.

1.3 Preparation for Operation

Operating Environments

- Use the controller at an ambient temperature of 0°C to 45°C (32 to 113°F), No freezing.
- Fluctuations in the ambient temperature cause measurement errors; therefore, the ambient temperature should be kept constant. If the temperature changes by 10°C (18°F), the LS-5000 series will take approximately 60 minutes until the temperature distribution in the unit becomes even.

- Do not allow any substance which may refract the laser beam, such as water and oil, to adhere to the scanning head.
- Blow dust off the protective glass using clean air. Wipe off any remaining dust using a soft cloth moistened with alcohol.

Note 1: Measurement Conditions

When the target oscillates, the measured value may fluctuate. The measurement accuracy can be improved when the number of averaging measurements (in Keyence LS software) is set higher.

Notes 2: Target

When the target shape or luster varies, a measurement error may occur. In this case, place a standard target in the measuring area and perform the calibration using the [CALIB] key in the Keyence LS software.

Chapter 2

Before Using the PacMan Gauge

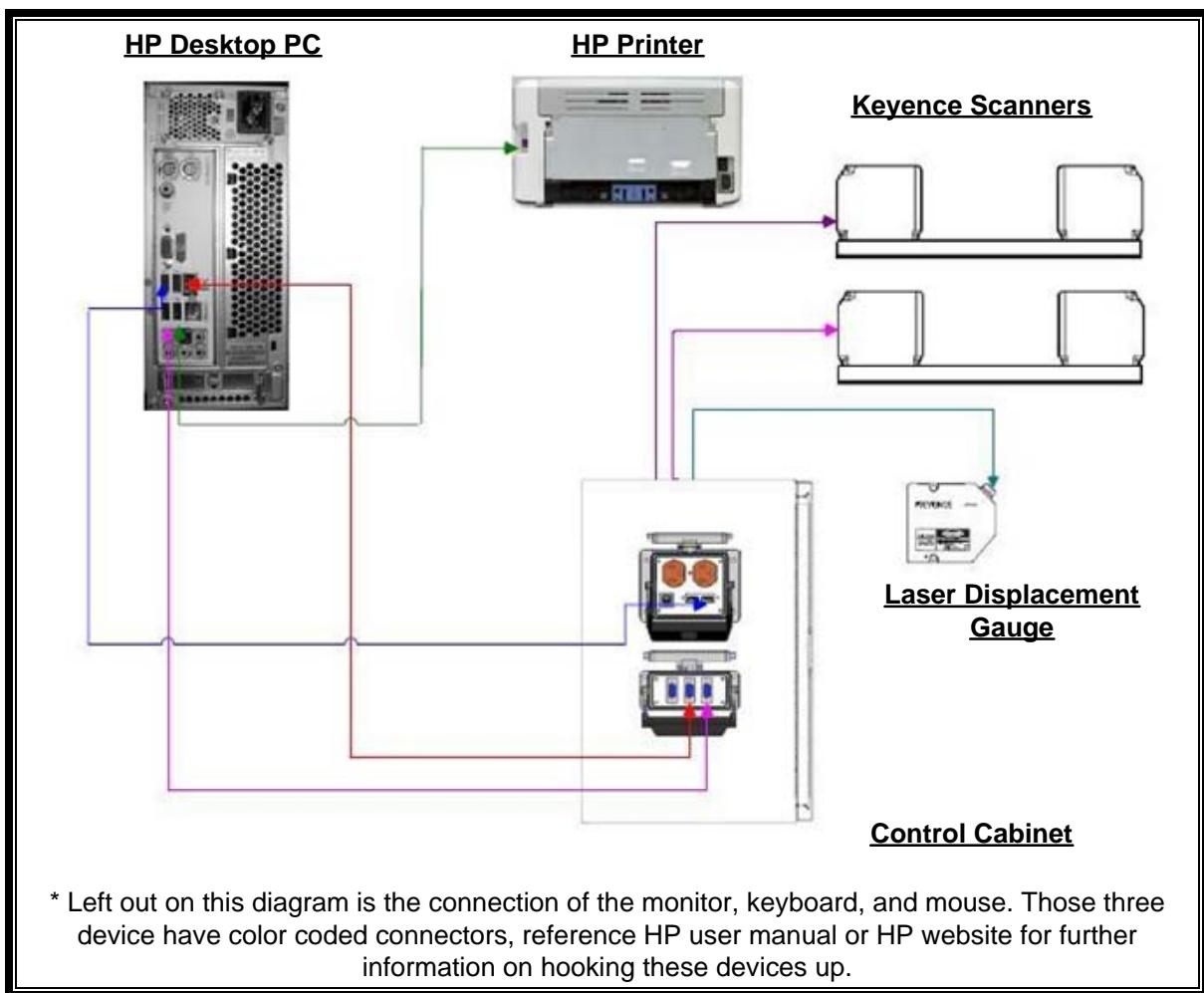
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2.1 System Configuration and Connection

The PacMan Gauge consists of two scanning heads, a displacement gauge, printer, monitor, control cabinet, and pc.

System Configuration

The PacMan Gauge consists of two scanning heads, a laser displacement gauge, printer, monitor, control cabinet, and pc. Inside the control cabinet are a PLC, USB I/O, controller for the laser displacement gauge, and controller for the two laser scanners.



NOTE: Each Keyence scanner plugs into a ROM board that in turn plugs into the Keyence LS-5001 controller. The ROM cards are not interchangeable, each gauge and ROM card calibrated together at the factory. Refer to the Keyence manual for more information.

2.2 Names and Functions of Indicators and Switches

This section describes the names and functions of the indicators and switches.

■ Names and Functions of Indicators and Switches

Display	Name	Description
	Auto Mode button	Used to switch from manual to auto mode.
	Manual Mode button	Used to switch from auto to manual mode.
	Edit Part Info button	Used to bring up the part information edit screen. This button is disabled in manual mode.
	Data Collection button	Used to bring up the data collection screen. From there you can change from production to validation mode data collection. You can also reset and print production reports from this screen. This button is disabled in manual mode.
	Zero button	Used to zero all gauges. This button is disabled in auto mode.

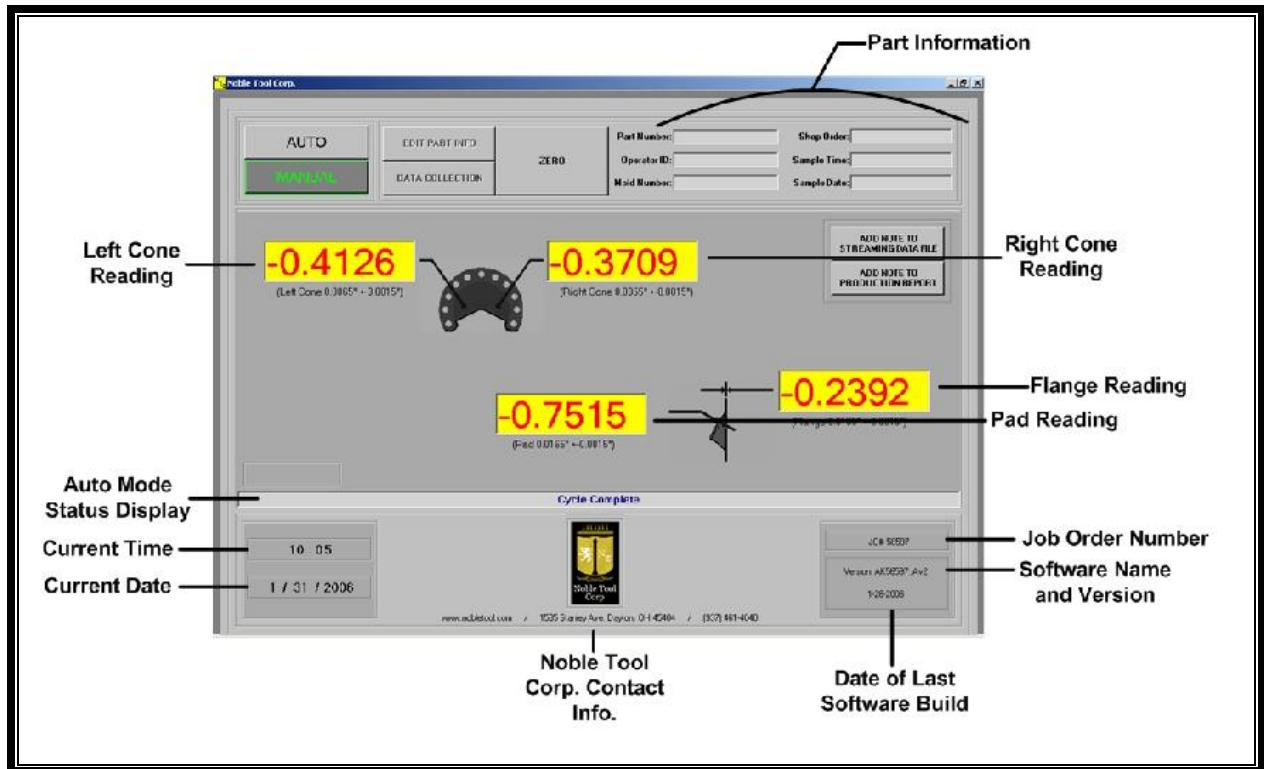
Display	Name	Description
	Streaming Data File Note button	Used to add a note to the streaming data collection file. If you're in production mode data collection, the note will be added to the production streaming data file. If you're in validation mode data collection the note is added to the validation streaming data file.
	Production Report Note button	Used to add a note to the production report. This button is disabled when validation mode data collection is selected.
	Opto-touch Start button	Used to start the measurement sequence in auto mode. In manual mode this button turns the vacuum on.

- **Vacuum Indicator:**



The vacuum indicator measures vacuum in *inHg* at the base of the nest.

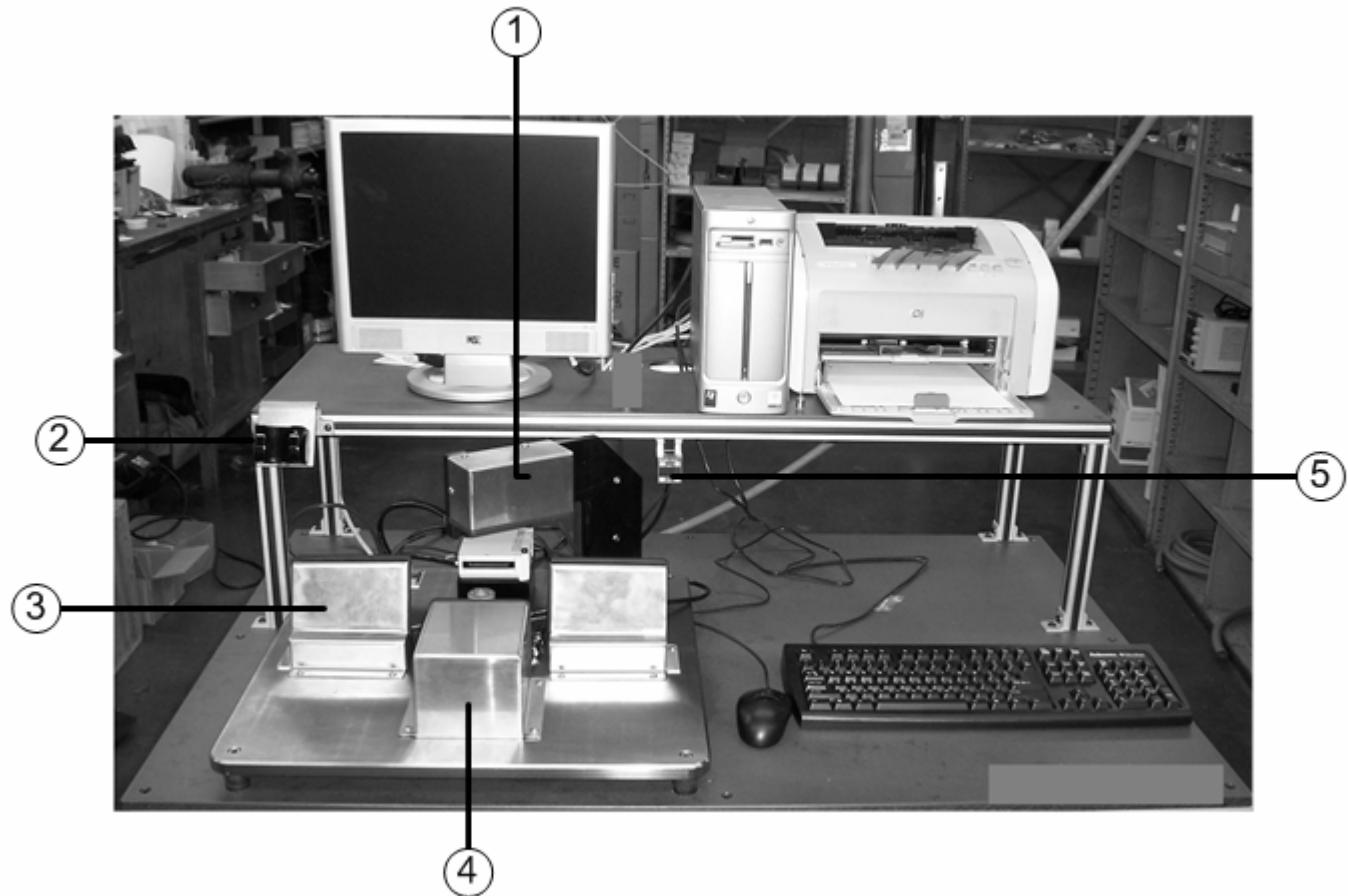
- **Measurement Software Display:**



2.3 Part Names

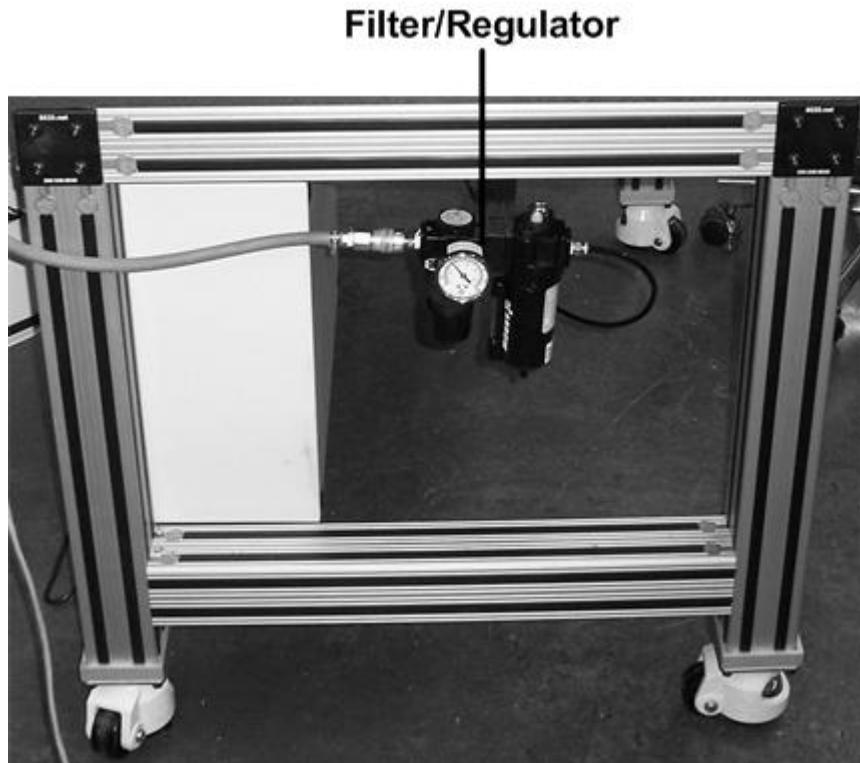
This section describes the part names used for the various components.

Front of Gauge:

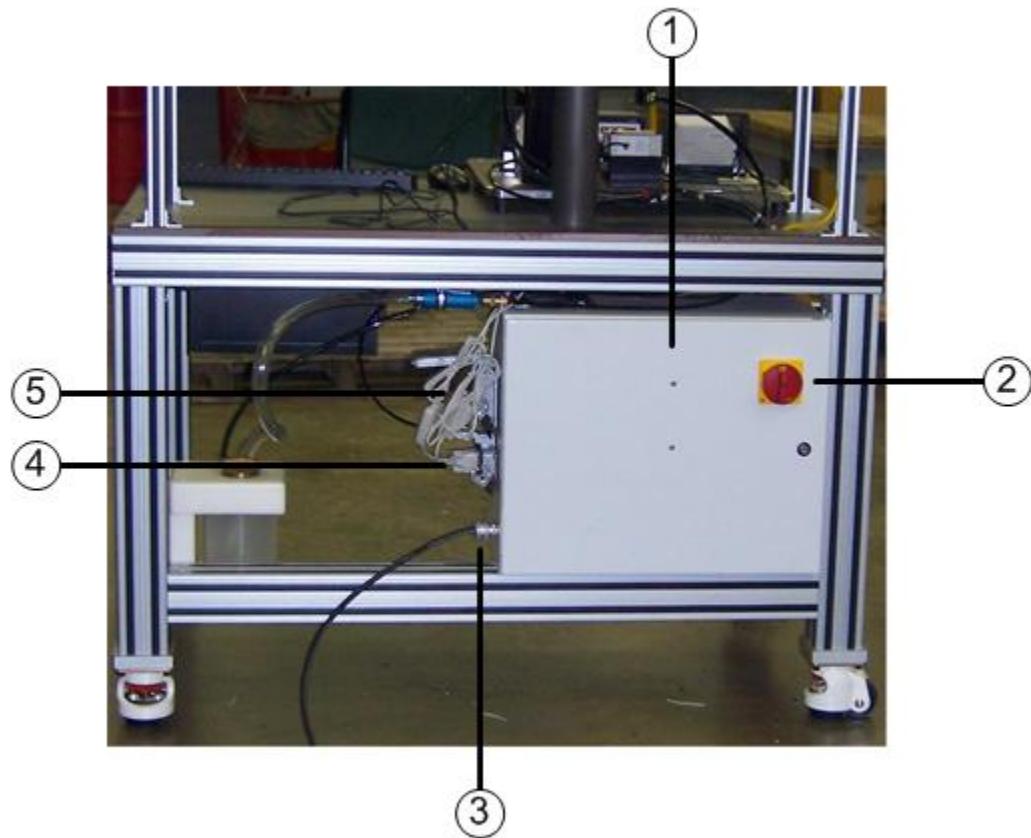


- (1) Laser Displacement Gauge
- (2) Opto-touch Button
- (3) Pad Scanner
- (4) Left/Right Cone Scanner
- (5) Vacuum Gauge

Left Side of Gauge:



Rear of Gauge:



- ① Controls Cabinet
- ② Main Power Disconnect
- ③ Power Connection (110V 15A)
- ④ Gauge Com Ports
- ⑤ USB Computer Connection and Auxiliary Power Outlets (110V 3A MAX)

Chapter 3

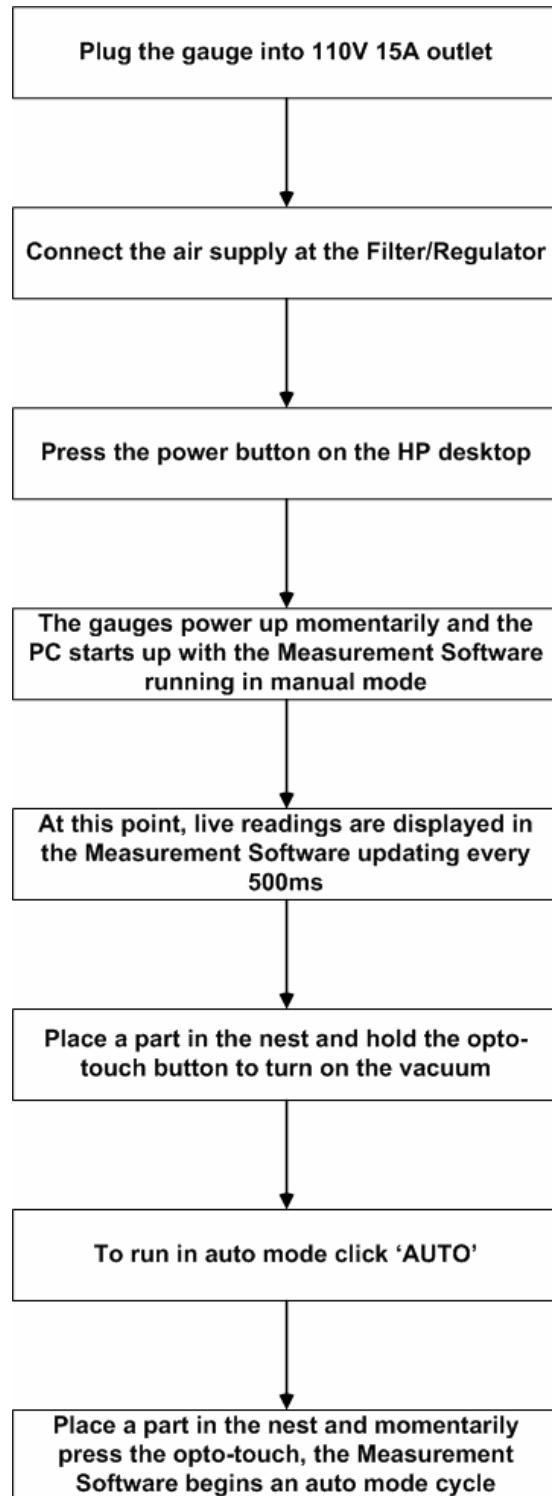
Quick Start Reference

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3.1 Quick Start Reference

This section describes from power-up how to take measurements from the gauge.

3.1.1 Procedure for Starting Measurement



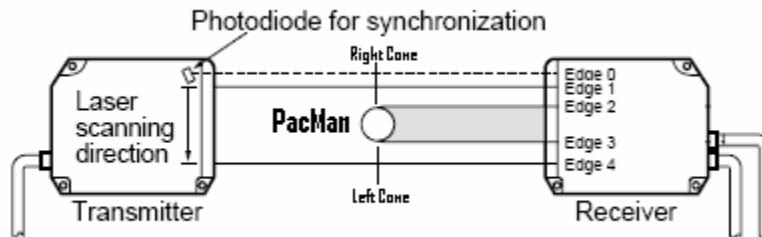
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Outline of Measurements

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4.2 Left and Right Cone Measurements

The Left Cone and Right Cone are measured using a single Keyence LS-5041 scanner. The Left Cone uses the bottom edge reading, which is the distance from the bottom edge (Edge 4) of the beam to the edge (Edge 3) created by the beam intersecting left cone of the PacMan part. The Right Cone uses the top edge reading, which is the distance from the top edge (Edge 1) of the beam to the edge (Edge 2) created by the right cone of the PacMan part.



Calculating Left Cone:

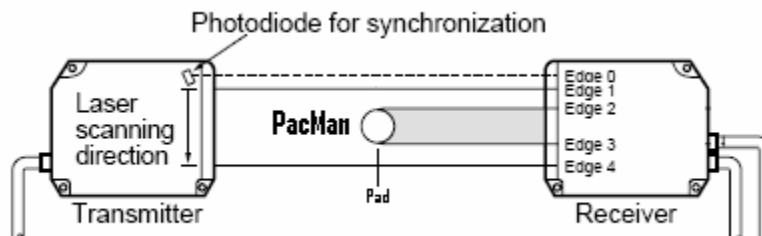
$$\text{Left Cone (in.)} = (\text{Bottom Edge (part in nest)} - \text{Bottom Edge (no part in nest)}) * \sin 30$$

Calculating Right Cone:

$$\text{Right Cone (in.)} = (\text{Top Edge (part in nest)} - \text{Top Edge (no part in nest)}) * \sin 30$$

4.3 Pad Measurement

The Pad is measured using a single Keyence LS-5041 scanner. The pad measurement uses the bottom edge reading, which is the distance from the bottom edge (Edge 4) of the beam to the edge (Edge 3) created by the beam intersecting the pad of the PacMan part



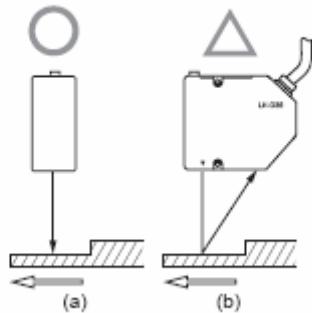
Calculating the Pad:

$$\text{Pad (in.)} = (\text{Bottom Edge (part in nest)} - \text{Bottom Edge (no part in nest)})$$

4.3 Flange Measurement

The Flange is measured using a single Keyence LK-G3001 laser displacement gauge. The function of the gauge used is the 'Height-difference measurement.'

Height-difference measurement



Calculating the Flange:

$$\text{Flange (in.)} = (\text{gauge reading (no part)} - \text{gauge reading (part)}) / 1000$$

* Divide by 1000 to convert from mils to inches

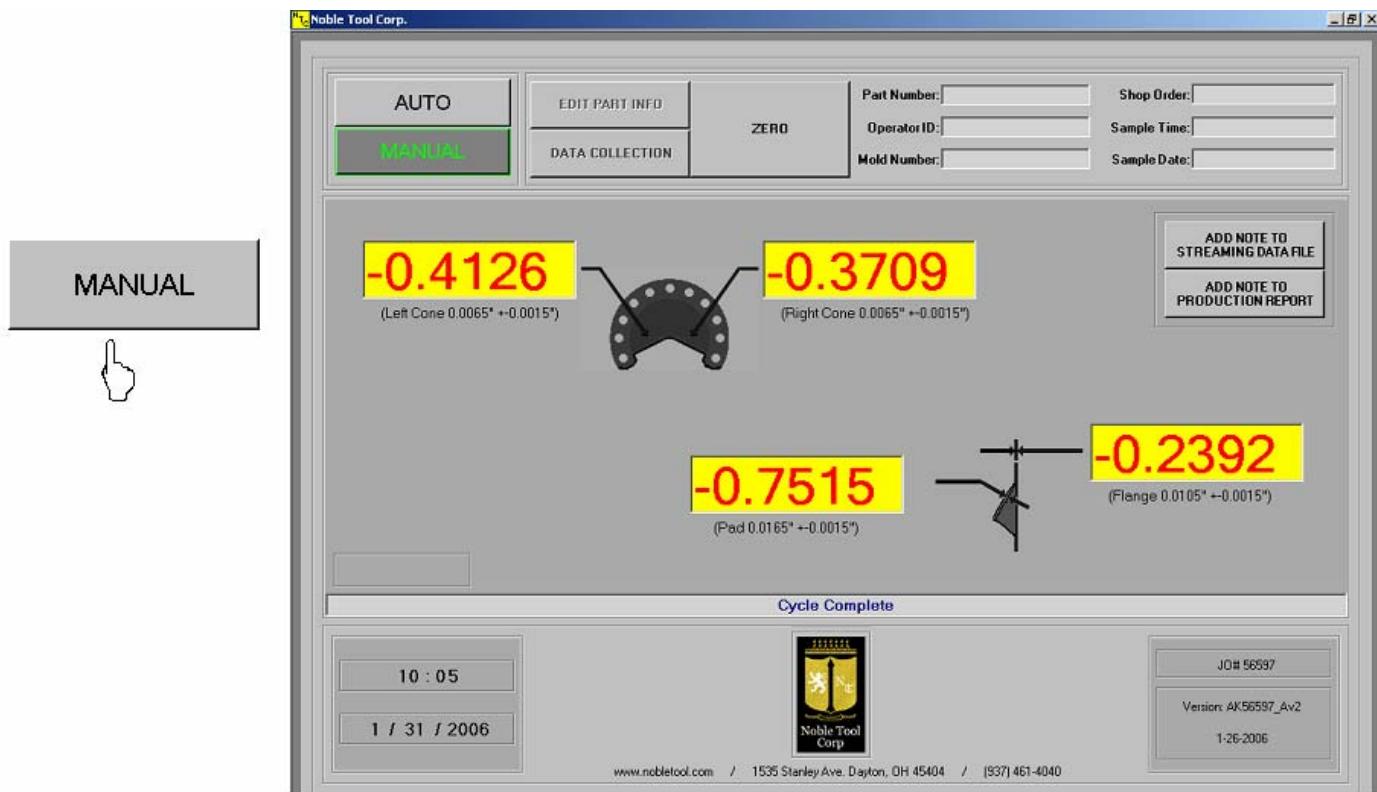
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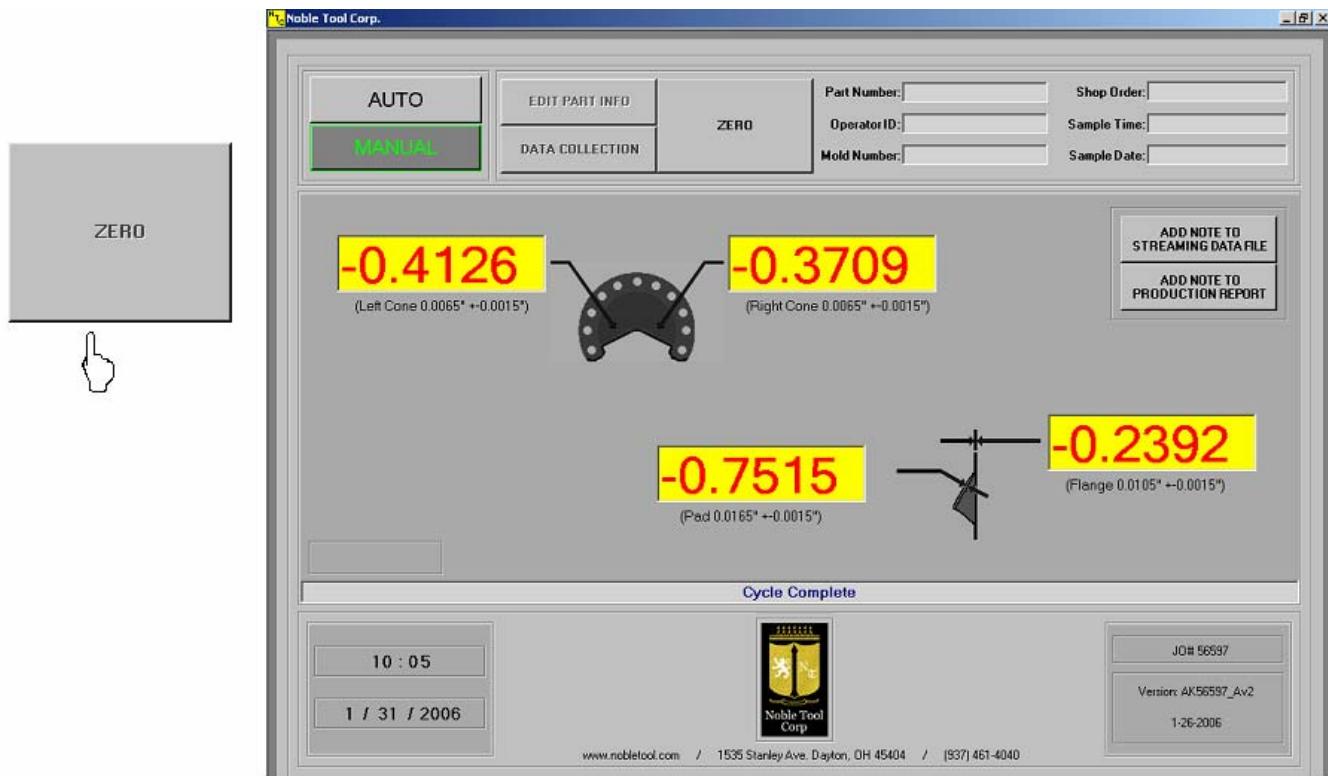
5.1 Main Screen

Click the 'MANUAL' button to switch to manual mode. The Left Cone, Right Cone, Pad, and Flange data fields update every 500ms. The buttons 'EDITPART INFO', 'DATA COLLECTION', 'ADD NOTE TO STREAMING DATAFILE', and 'ADD NOTE TO PRODUCTION REPORT' are all disabled.



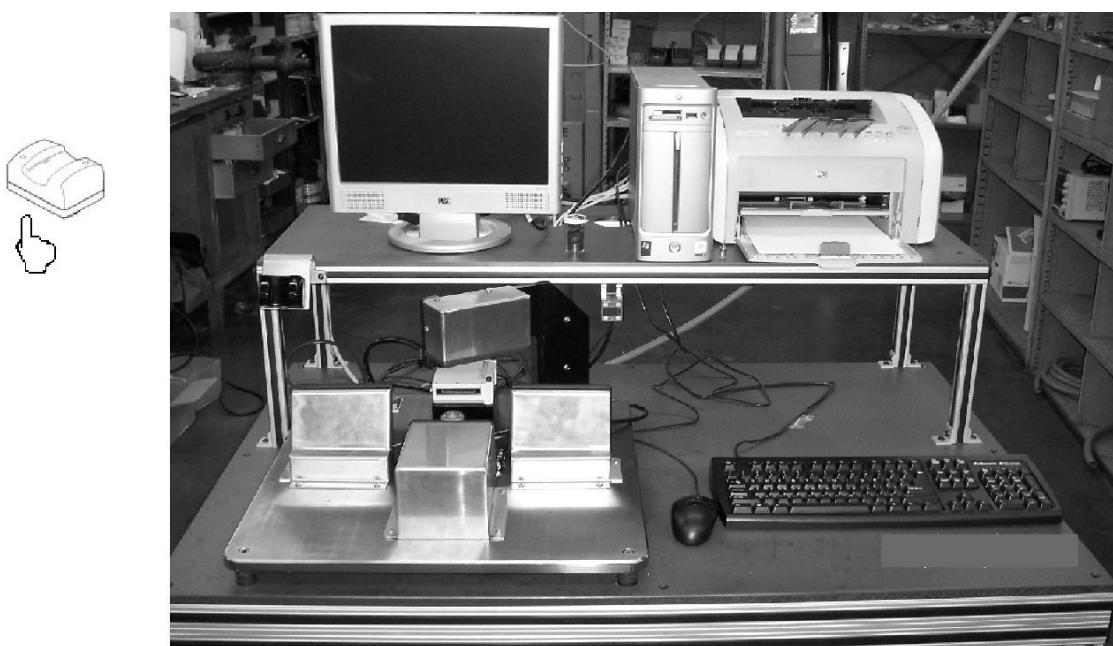
5.2 Zero Function

The zero function triggered by the 'ZERO' button sets all the measurements to Zero.



5.3 Opto-Touch Operation

In manual mode the opto-touch button is used to turn on the vacuum. The air is on when your finger is actuating the button, the moment your finger is removed the air shuts off. Measurements continue to update every 500ms.

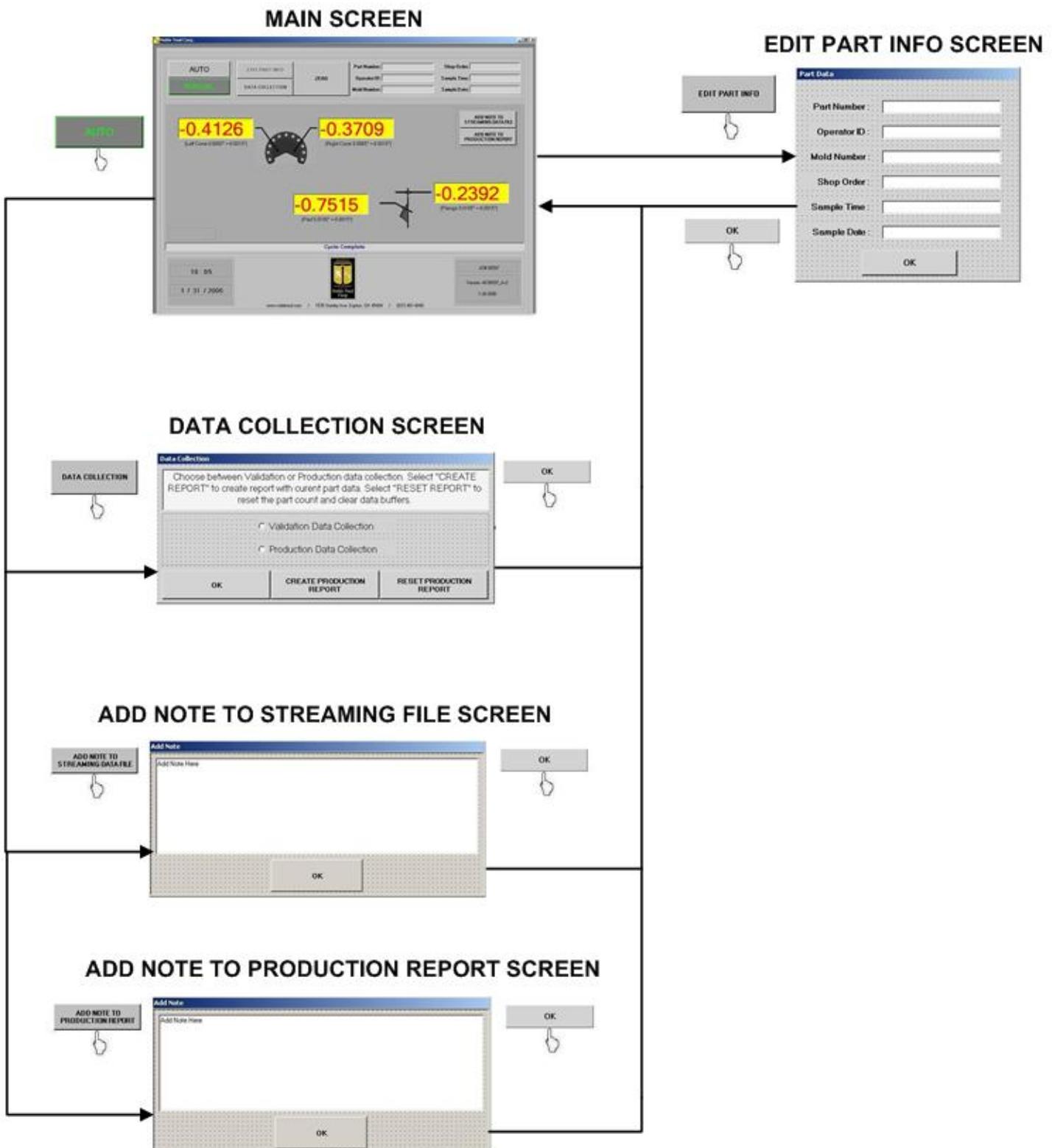


Chapter 6

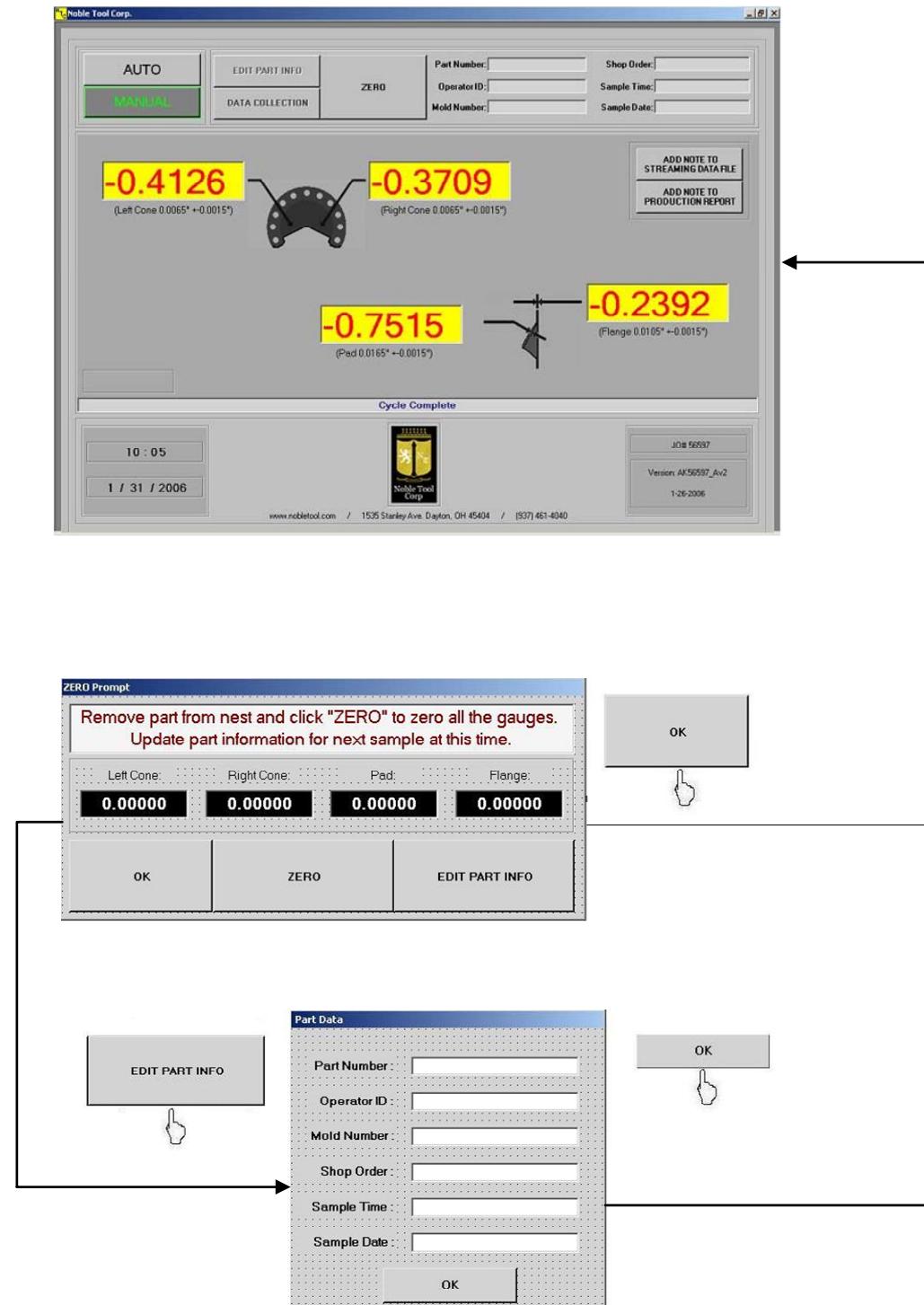
Auto Mode Operation

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6.1 Auto Mode Screens

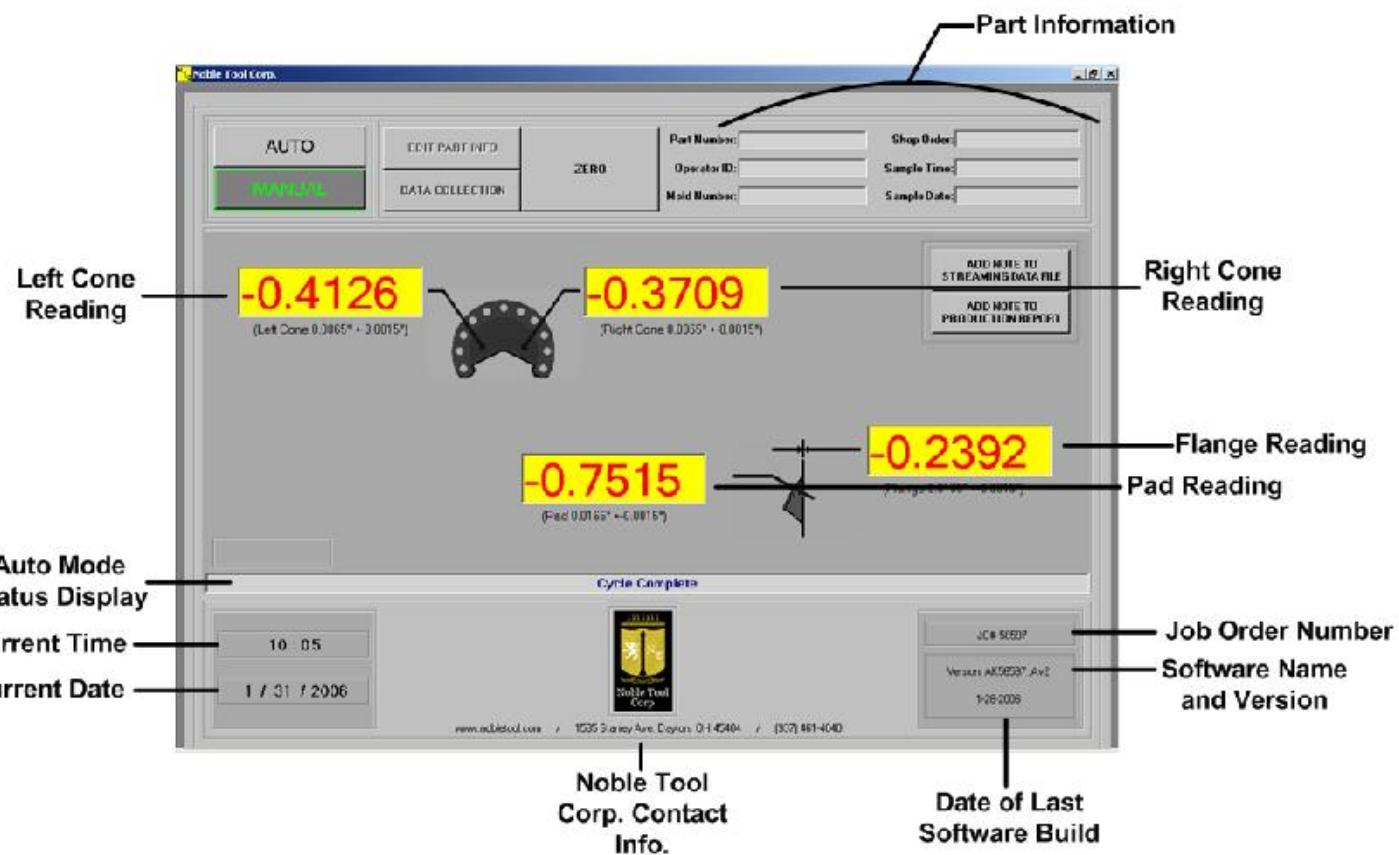


After the fifth part is ran in auto (in production collection or validation collection) the 'Zero Prompt' screen pops up.



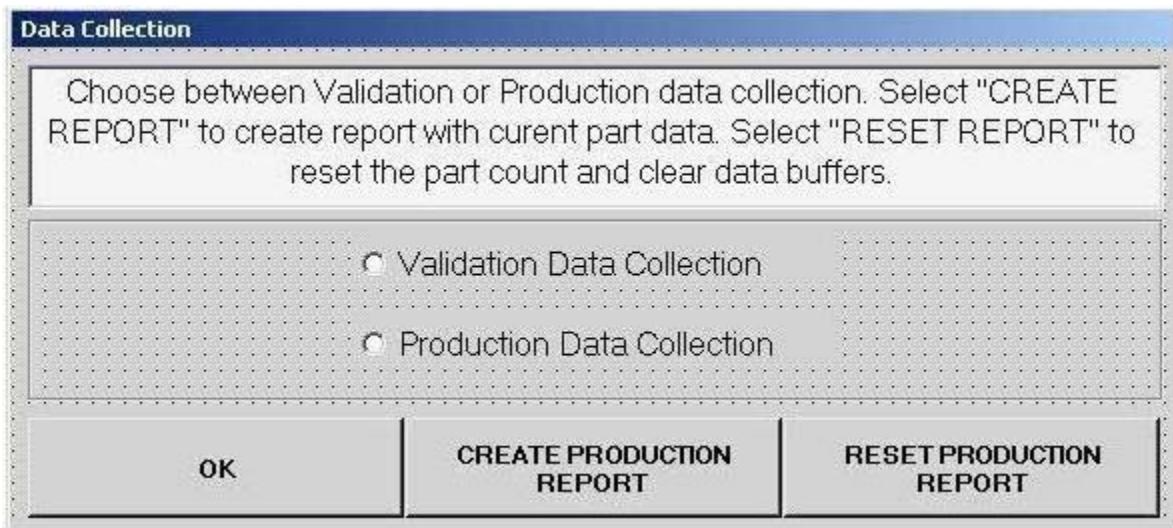
6.2 Main Screen

In Auto Mode the Zero function is disabled on the main screen. You can edit part information, change data collection, and notes to the data files all from the main screen.



6.3 Data Collection Screen

Production Data Collection vs. Validation Data Collection



1. Production Data Collection:

The user runs the five part sample. After each part cycle is complete a data packet is written to a streaming file consisting of a data/time stamp, left cone measurement, right cone measurement, pad measurement, flange measurement, and all the part information entered by using 'EDIT PART INFO'. The location of the production streaming file is:

C:\Streaming Production Data\d13137_Production_Stream.csv

Upon completion of the fifth part a production report is created And appears after the 'Zero Prompt' screen is closed. The Production report consists of data for all five parts, part information, and statistical analysis. See *example on next page*. In addition to the copy that is displayed after completion of the fifth part a copy is saved to the following directory:

C:\Production Reports\d13137_date_stamp_time_stamp.xls

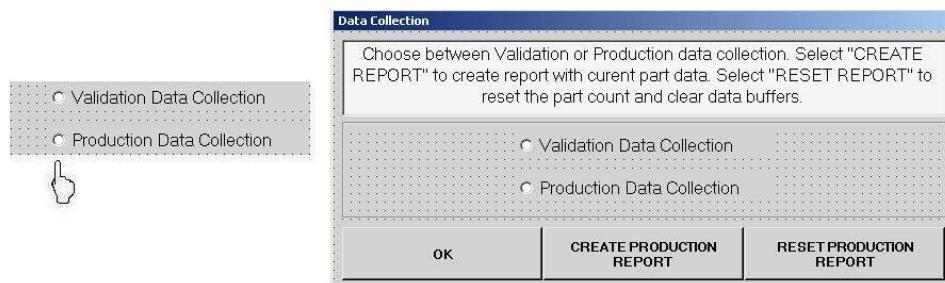
D13137 Production Report				February 3, 2006 9:27:04 AM
Part Number:		Stop Order:		
Operator Id:		Sample Time:		
Mold Number:		Sample Date:		
	Pad	Range	Left Cone	Right Cone
Nominal	0.01650	0.01050	0.00650	0.00650
USL	0.01800	0.01200	0.00800	0.00800
LSL	0.01500	0.00900	0.00500	0.00500
1	0.00025	0.00000	-0.00010	0.00000
2	-0.00005	0.00000	-0.00003	0.00003
3	0.00000	0.00000	-0.00005	0.00003
4	-0.00010	0.00000	0.00005	0.00010
5	-0.00005	0.00000	-0.00003	0.00008
Mean	0.00001	0.00000	-0.00003	0.00006
Sigma	0.00014	0.00000	0.00005	0.00004
Max	0.00025	0.00000	0.00006	0.00010
Min	-0.00010	0.00000	-0.00010	0.00000
Range	0.00035	0.00000	0.00015	0.00010

2. Validation Data Collection:

In validation data collection, data is written to a streaming file after each part is measured. There is no production report created after the fifth part has been measured. The streaming data file for validation is located in the following directory:

C:\Streaming Validation Data\13137_Validation_Stream.csv

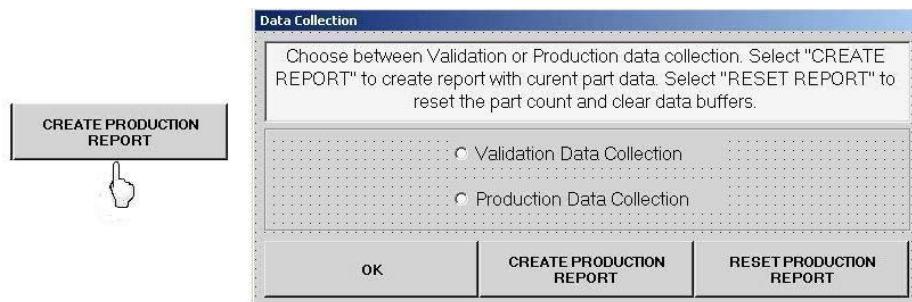
Changing between Production Data Collection and Validation Data Collection:



'CREATE PRODUCTION REPORT' function

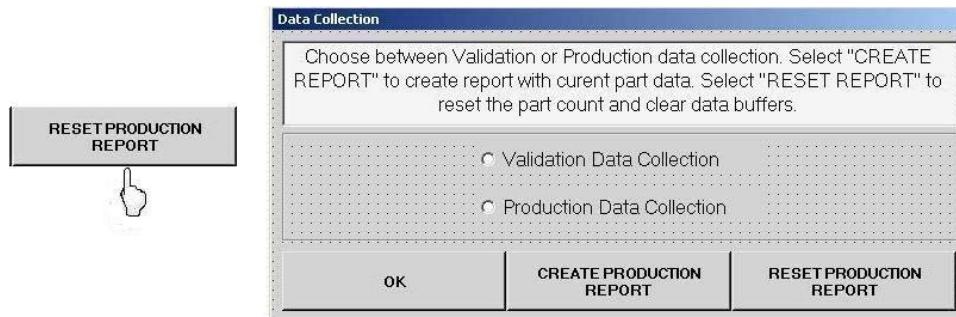
The 'CREATE PRODUCTION REPORT' button is used to create a report with whatever part data is currently in the data buffers. If three parts have been run in a five part sample then a report will be created with the data for those three parts.

NOTE: The data buffers are erased after a report is created.



'RESET PRODUCTION REPORT' function

The 'RESET PRODUCTION REPORT' button resets the current production part sample count back to zero. If three part have been run in a five part sample and the 'RESET PRODUCTION REPORT' button is selected; the sample part count is reset to zero.



6.4 Edit Part Information Screen

Part Number :	<input type="text"/>
Operator ID :	<input type="text"/>
Mold Number :	<input type="text"/>
Shop Order :	<input type="text"/>
Sample Time :	<input type="text"/>
Sample Date :	<input type="text"/>
OK	

Select the data field you wish to change, add information and click 'OK' when finished Editing.

NOTE: The part information available changes when using production data collection or validation data collection.

Production Part Information

The part information used in production data collection is:

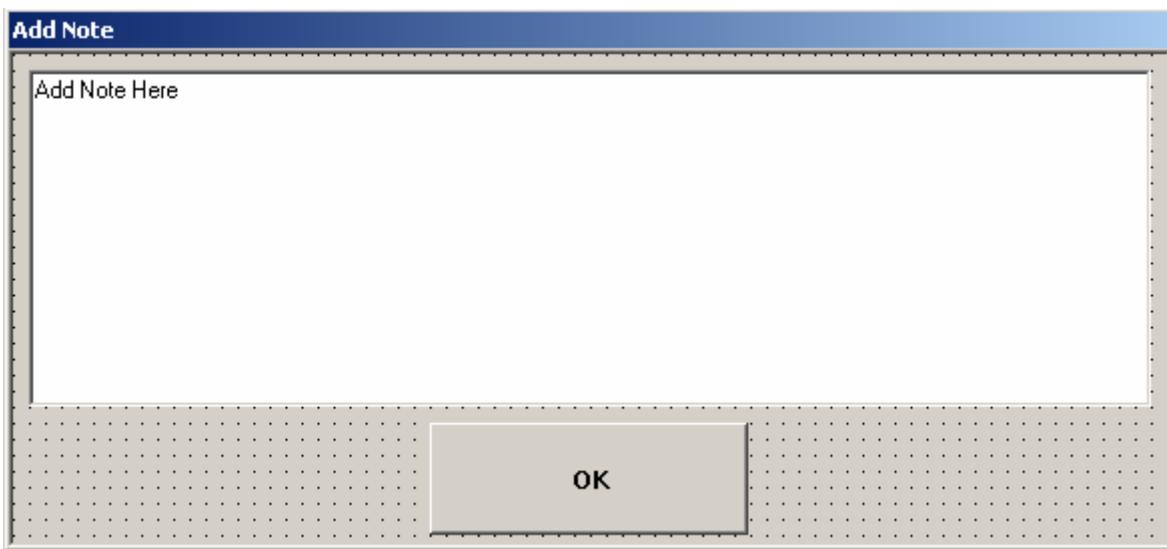
Part Number
Operator ID
Mold Number
Shop Order
Sample Time
Sample Date

Validation Part Information

The part information used in validation data collection is:

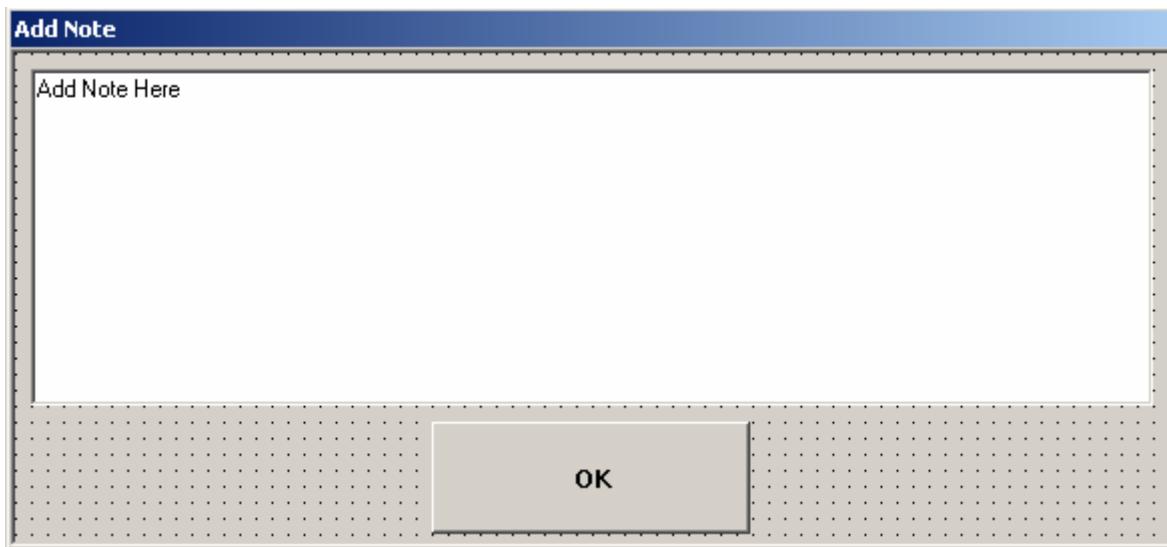
Part Number
Operator ID
Mold Number
Cavity Number
Heat Number
Run Number

6.5 Add Note to Data Stream Screen



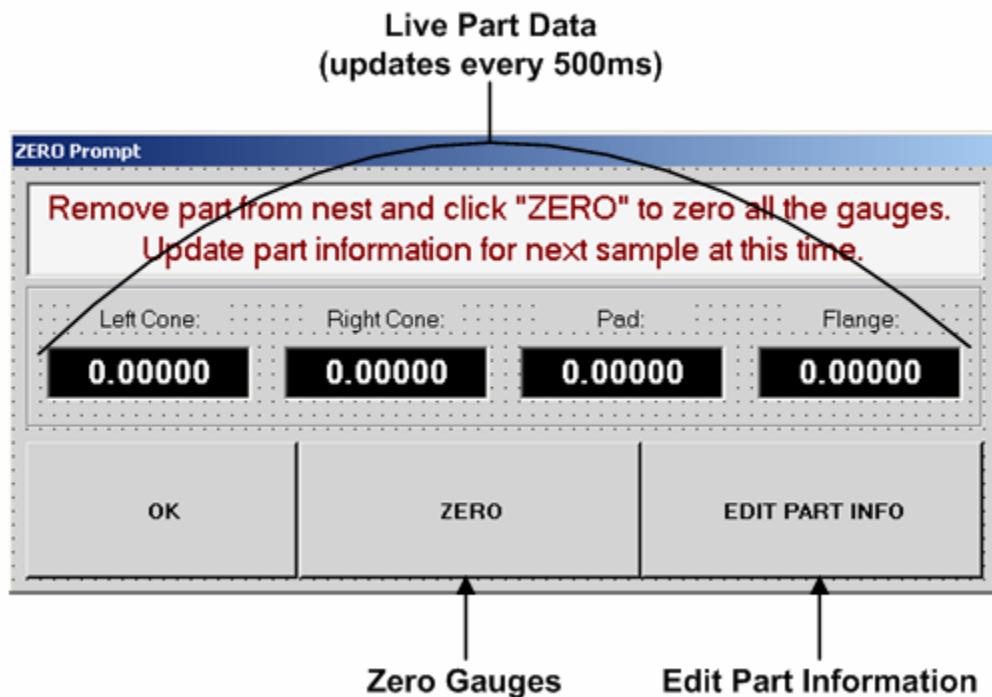
Add text for note in the text box and click okay. The note will be written to either the production streaming data file or the validation streaming data file.

6.6 Add note to the Production Report



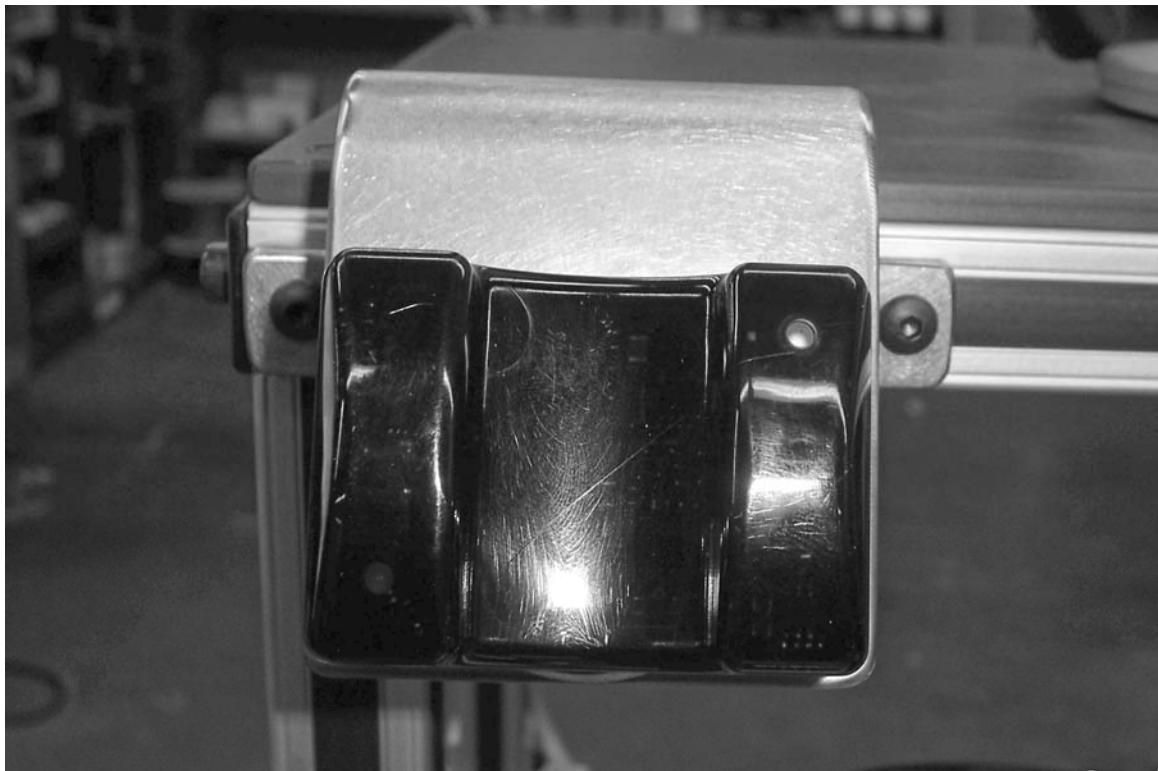
Adding a note to the report works the same way as adding a note to the streaming data file. Type the note in to the text box and select 'OK', the note will appear at the bottom of the production report once it is created.

6.7 Zero Prompt Screen



After five parts are measured in either production data collection or validation data Collection the Zero Prompt screen pops up to prompt the user to re-zero if need be. The 'ZERO' and 'EDIT PART INFO' button work the same as on the main screen.

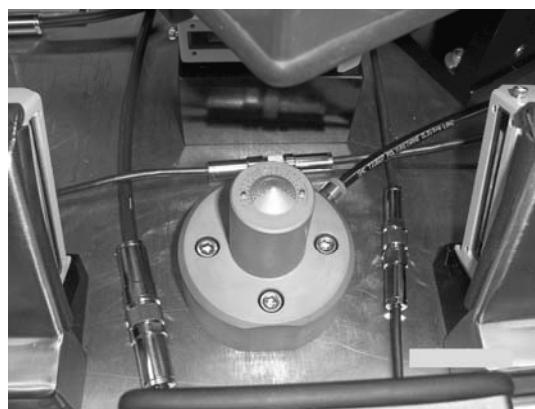
6.8 Opto-touch Operation



The opto-touch button triggers the measurement cycle.

6.9 Description of a Measurement Cycle

1. Place a part onto the nest:



2. Touch the opto-touch button.
 - ◆ Vacuum turns on.
 - ◆ Four-and-a-half seconds later gauges are queried for data.
 - ◆ Data fields are updated and data is written to streaming file
 - ◆ Two seconds later the air shuts off
3. Upon completion of the fifth part the Zero Prompt screen will be visible on the screen.
 - ◆ Remove part from the nest.
 - ◆ The data field update every 500ms, if the values are close to (i.e. +- .00002), there is no need to re-zero.
 - ◆ If you need to re-zero select 'ZERO'
 - ◆ At this time update part information for next 5 part sample by Selecting 'EDIT PART INFO'.
 - ◆ Close the Zero Prompt screen by selecting 'OK'
 - ◆ The production report is created and opened in Excel.
 - ◆ Print the report by clicking the print icon or File-Print
 - ◆ Close the spreadsheet.

NOTE: There is no need to save a copy of the production report a copy is already saved in the C:\Production Reports directory. Close the report without saving when prompted.

4. System is now ready to run the next five part sample

Chapter 7

RS-232 Communication

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7.2 RS-232 communication components

The controller for the two scanners and the controller for the laser displacement gauge communicate with the pc via RS-232. More specifically through a USB-to-Serial converter purchased through Radio Shack. Provided with the documentation is a CD that has the drivers necessary for the converters.



7.2 RS-232 communication settings

Communication setting for Left Cone, Right Cone, and Pad measurement

Com Port #: 2
Baud Rate: 9600
Data Bits: 8
Parity: None
Stop Bits: 1
Flow Control: None

Communication setting for Flange

Com Port #: 5
Baud Rate: 9600
Data Bits: 8
Parity: None
Stop Bits: 1
Flow Control: None

Chapter 8

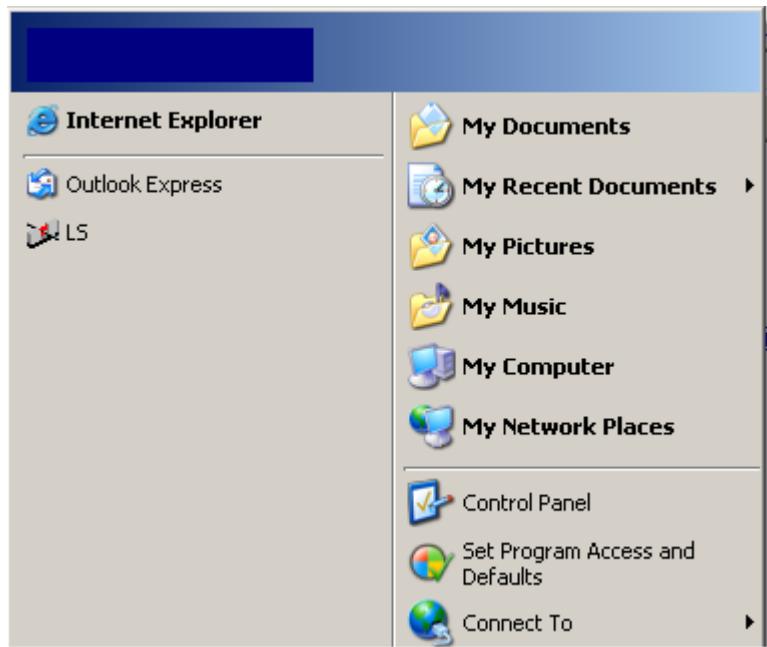
Keyence Software

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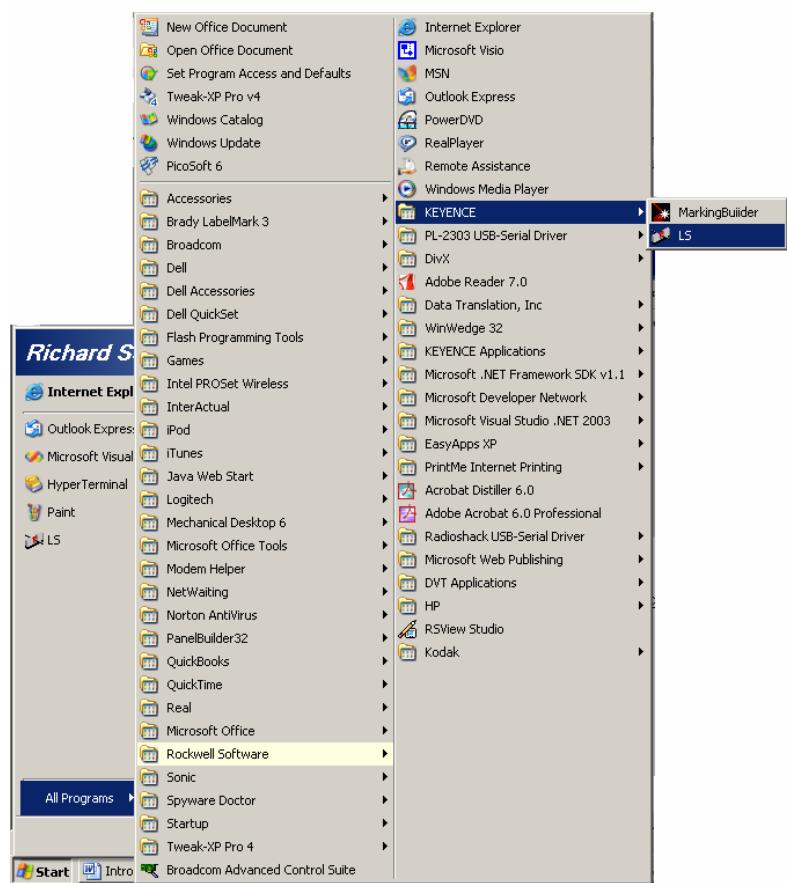
8.1 LS Navigation Software

To calibrate and make changes to the Keyence scanners for the Left Cone, Right Cone, and Pad measurements, the user must use the LS Navigation Software. This software is accessible through the start menu:

- 1) on the start menu



2) Start-All Programs-KEYENCE-LS



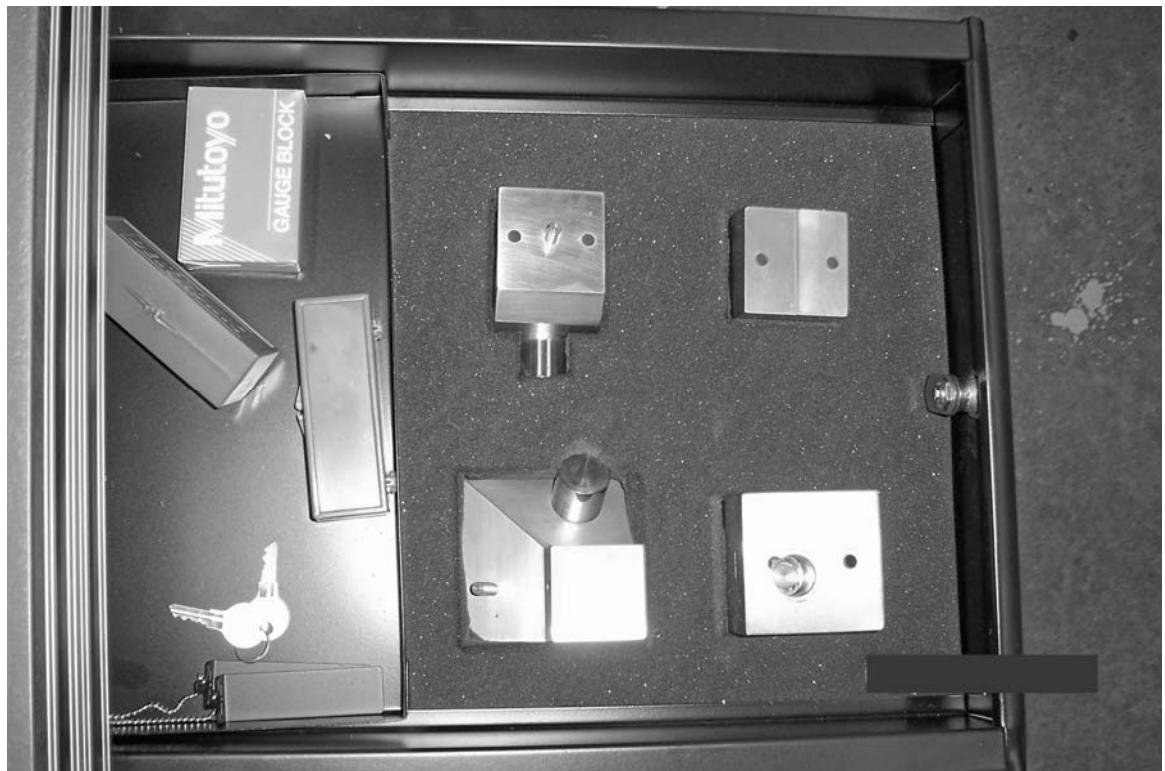
Chapter 9

Gauge and Alignment Blocks

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9.1 OverView

To ensure proper and accurate measurements are being made by the Pac Man gauge It is necessary to routinely check alignment of the scanners and laser displacement Gauge and also re-calibrate the laser scanners. This section describes the gauge and Check blocks used in those procedures. Gauge blocks are located in the drawer.



9.2 Left/Right Cone Gauge Block

This block utilizes purchased .2500" and 1.000" gauge pins.



9.3 Pad Gauge Block

This block utilizes purchased .2500" and 1.000" gauge pins.



9.4 Flange Gauge Block



9.5 Alignment Block



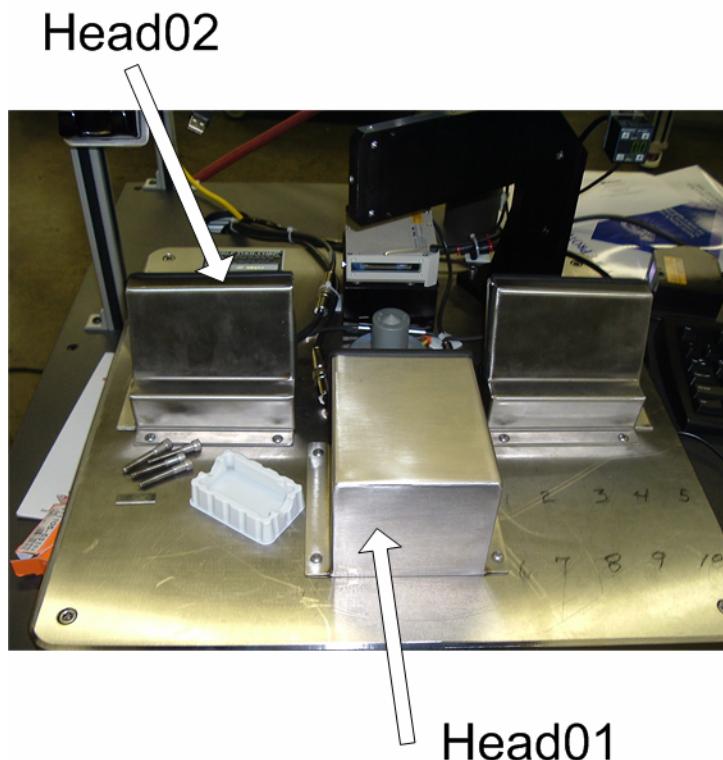
Chapter 10

Calibration

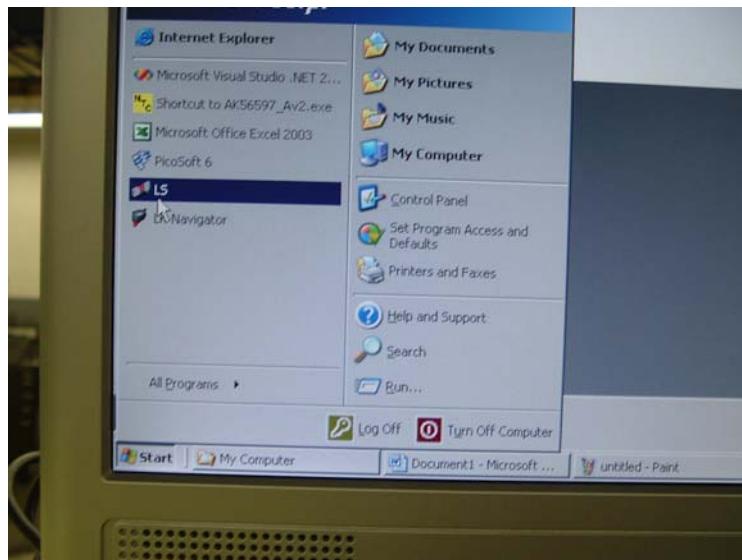
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10.1 Procedure

1. Remove Nest:



2. Press windows button and then double-click 'LS' program.



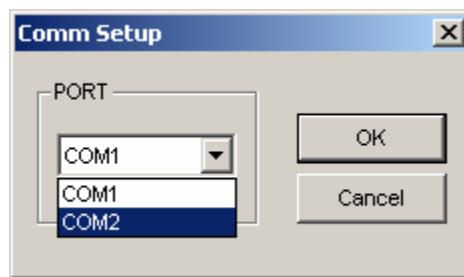
3. When this window pops up click 'OK':



4. When this window pops up click 'Comm Setup':



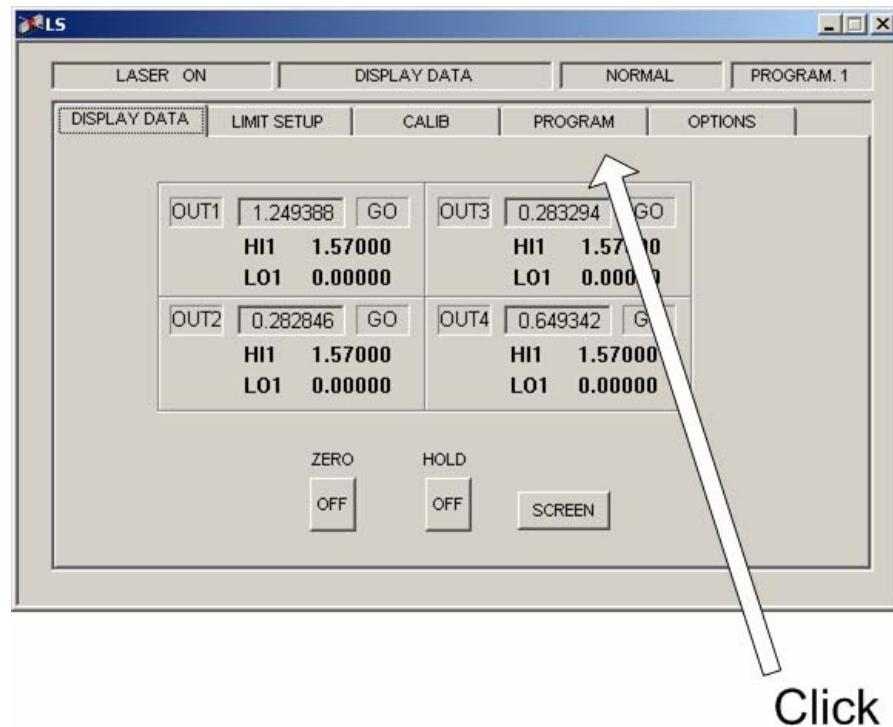
5. When this window pops up select COM2 from the drop-down window and click 'OK':



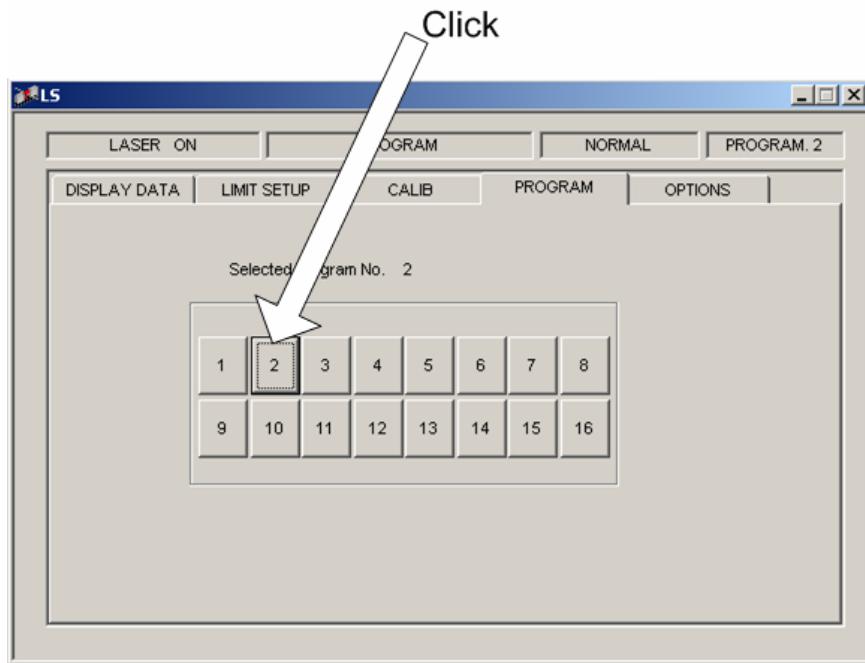
6. When this window pops up click 'OK':



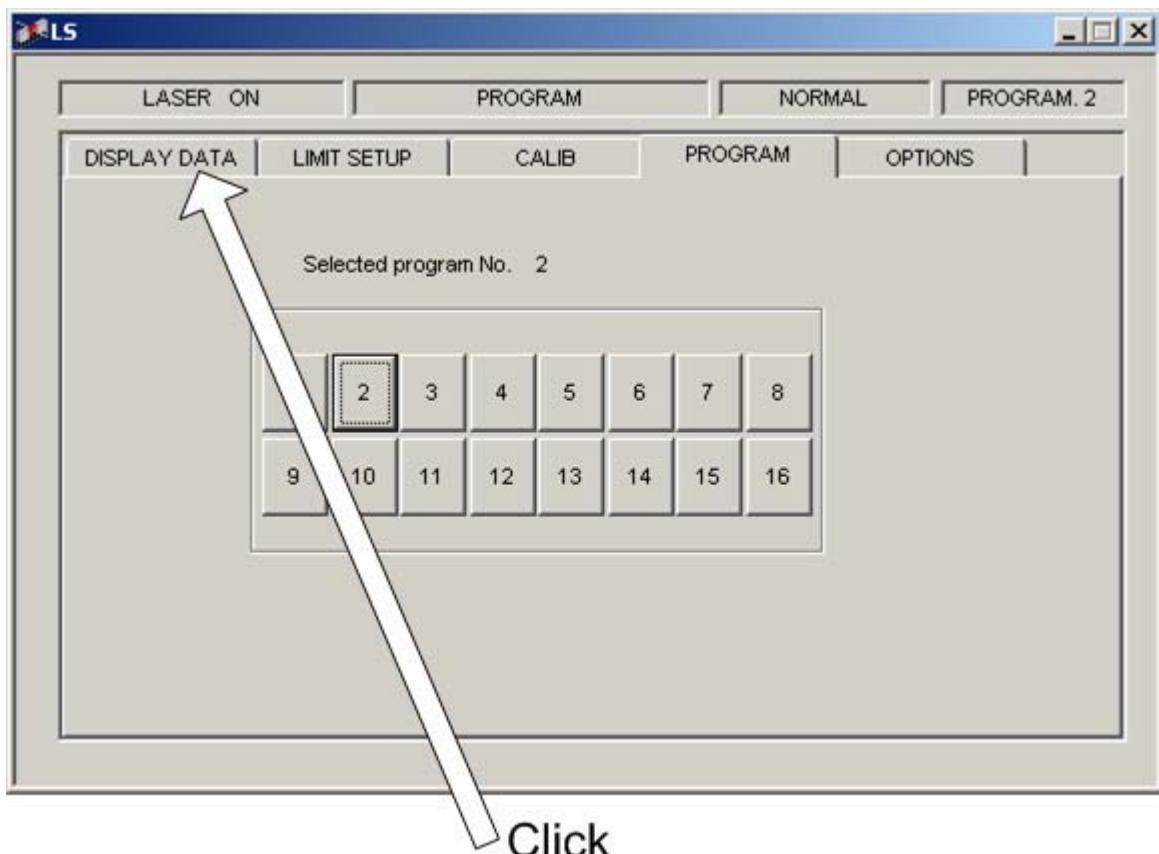
7. When this screen pops –up click on the ‘PROGRAM’ tab:



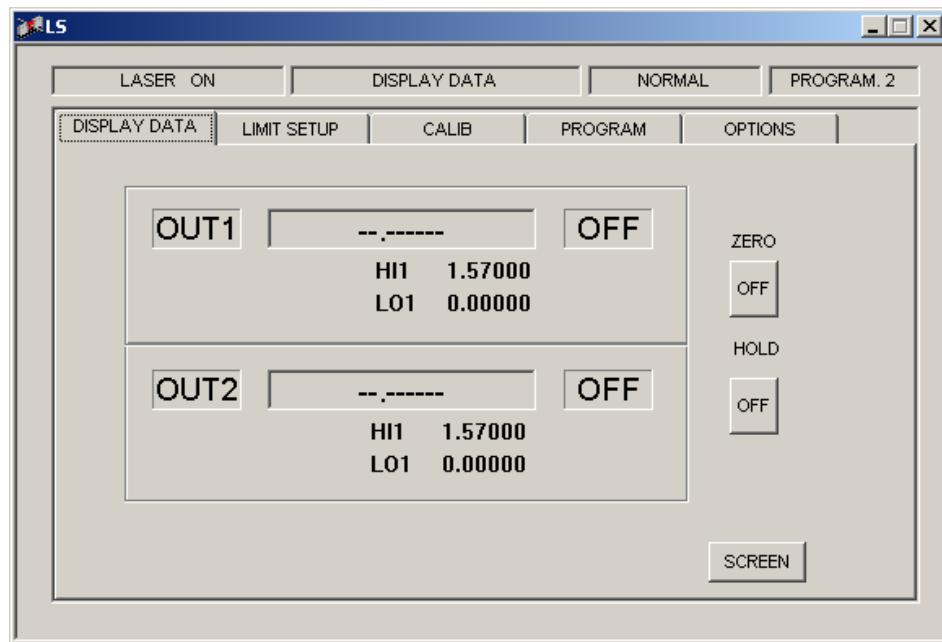
8. In the program tab click '2':



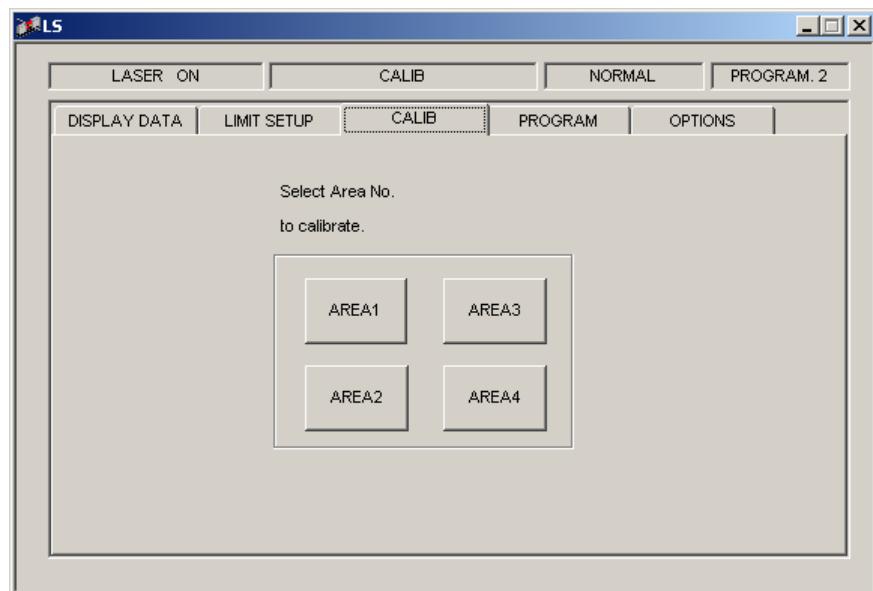
9. Now click on the 'DISPLAY DATA' tab:



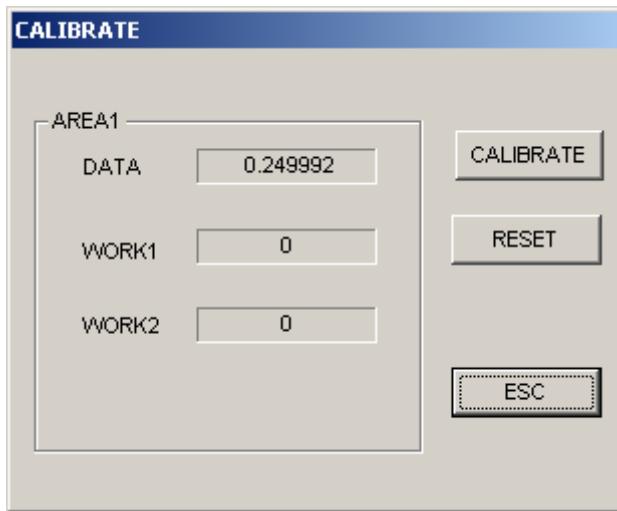
- a. 'OUT1' / 'AREA1' is the Left/Right Cone reading.
- b. 'OUT2' / 'AREA2' is the Pad reading.



10. Insert the Left/Right Cone gauge block into the measurement area with the .250" gauge pin up:
11. "Out1" should be reading $0.25" + 0.000040" / -000000$ If it is not you will need to re-calibrate
12. If you need to re-calibrate select the 'CALIB' tab:



13. In the CALIB tab click 'AREA1'



14. When this window pops up click 'RESET' and then 'CALIBRATE':

15. With 'WORK1' selected type in: **.2500** and then click 'SET':



16. Rotate gauge block such that the 1.0000" gauge block is in the up position:

17. Now Click "WORK2" and type in: **1.000** and click 'SET'

18. Now click 'OK'

19. Now click 'ESC'

20. Repeat above steps for Area2 (Pad measurement). If the readings are out of tolerance you will need to re-calibrate.

21. After Calibration or validation is complete click 'PROGRAM' tab and click '1'.

22. You can now close the 'LS' navigation software.

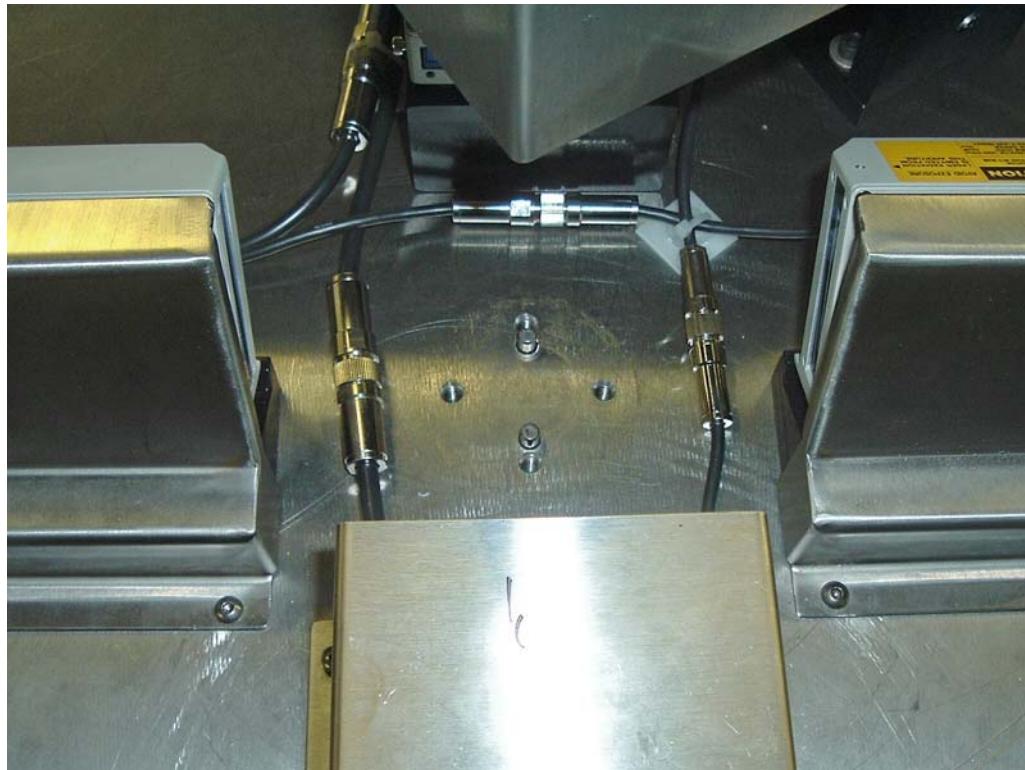
Chapter 11

Alignment

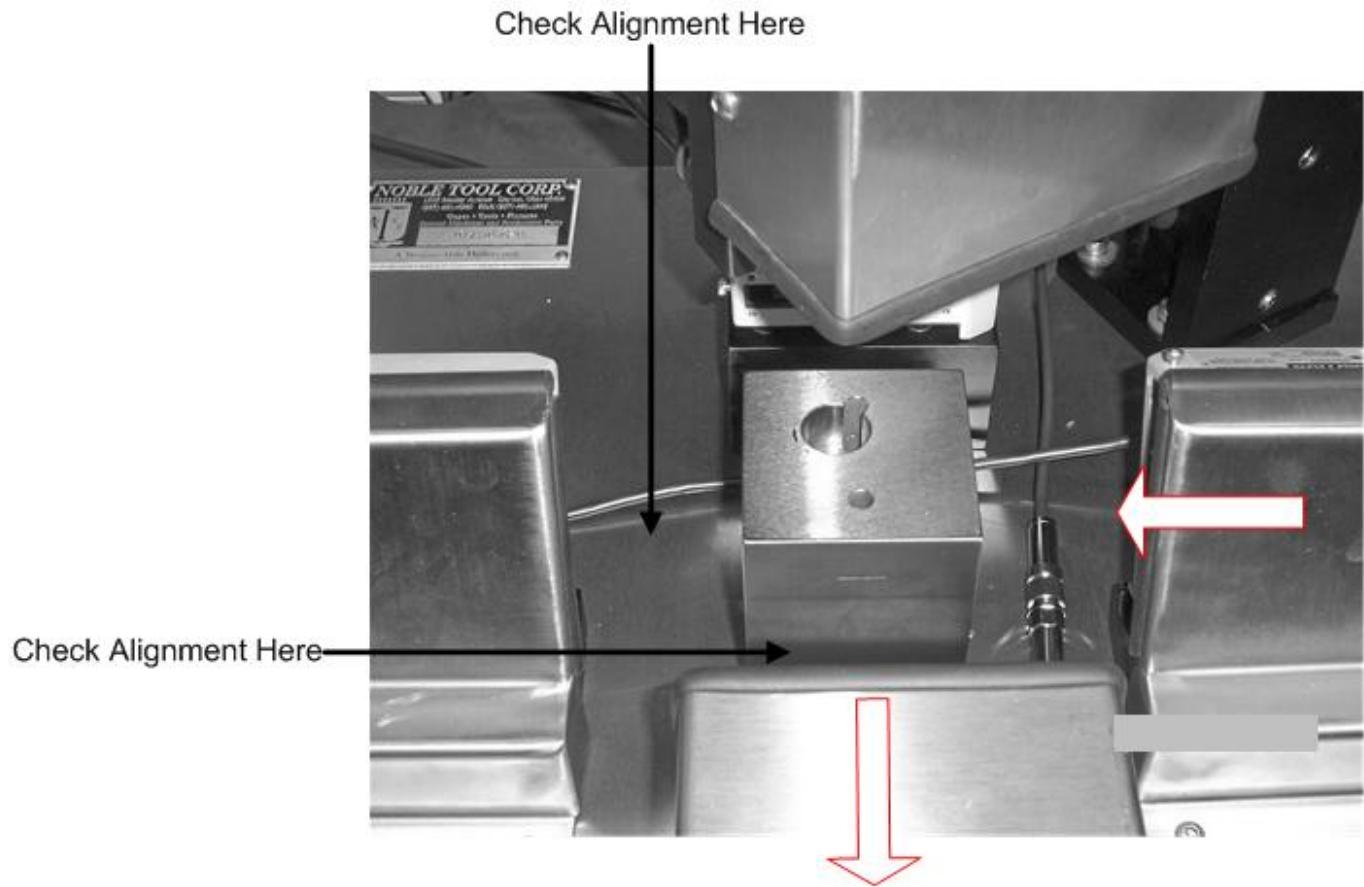
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11.1 Laser Scanner Alignment

- 1.1 Remove nest from measurement area.



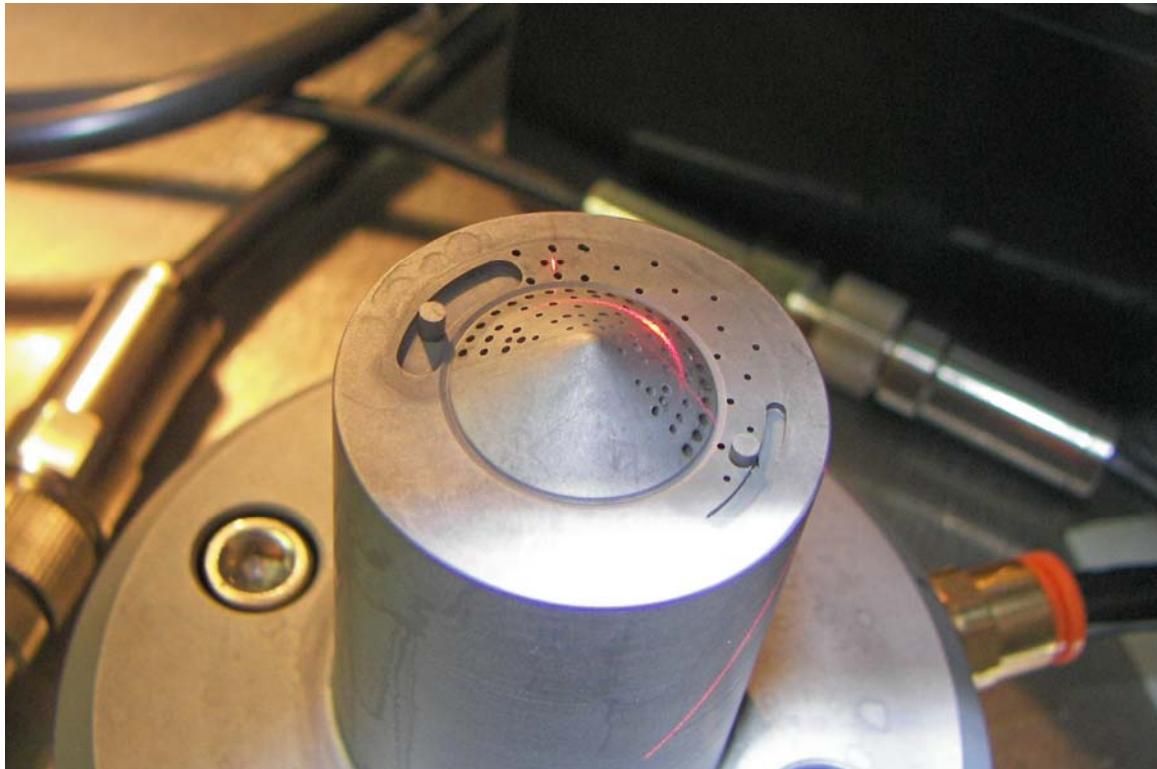
- 1.2 Place Alignment block into measurement are onto dowel pins.



- 1.3 Place a blank piece of paper in area depicted by "Check Alignment Here" arrows. If the laser light is not visible on the blank paper you will need to loosen mounting screws of corresponding gauge and align gauge until the laser on the paper is at it's brightest.

11.2 Laser Displacement Gauge Alignment

With nest mounted on dowel pins in measurement area check the position of the laser beam. The beam should be between vacuum holes. If not, the arm the gauge is mounted to will need to be loosened and adjusted until laser beam is in between vacuum holes.



NOTE: It is very important that the laser beam is adjusted such that it does not touch any vacuum holes. Allowing the laser beam to intersect a vacuum hole will result in a false zero reading.