LMI Corporation

LMI Ripple Gauge

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LMI Corporation
101 N. Alloy Dr
Fenton, Michigan 48430

Warranty

LMI *hardware* is warranted by LMI against defects in materials and workmanship for 12 months from date of original purchase. If you transfer ownership, the warranty is automatically transferred to the new owner and remains in effect for the original 12-month period. During the warranty period we will repair or, at our option, replace at no charge product that proves to be defective, provided it is returned, shipping prepaid, to LMI.

LMI *software and firmware* are warranted by LMI against defects in materials and workmanship for 60 days from date of original purchase, when the software and firmware is used in accordance with published or other written specifications prepared, approved, and issued by LMI and when used with specifically identified hardware. In any event, LMI makes no representation or warranty, express or implied, that the operation of the software or firmware will be uninterrupted or error free, or that the functions contained in the software or firmware will meet or satisfy the Distributor's intended use or license agreement or LMI extended support agreement. Software and firmware corrections are warranted for a period of thirty (30) days from the date shipped by LMI, or the remainder of the original warranty term, whichever is longer.
If you transfer ownership, the warranty is automatically transferred to the new owner and remains in effect for the original 60-day period.

LMI *interface accessories*, such as cords and connectors are warranted by LMI against defects in materials and workmanship for 30 days from date of original purchase. Repaired or replacement cords or connectors are warranted for a period of 30 days from the date of shipment by LMI.

This warranty does not apply if the product has been damaged by accident or misuse or as a result of service or modification by other than LMI, or by hardware, software, interfacing or peripherals not provided by LMI.

This is your warranty.

Please retain this document for your records.

No other express warranty is given. The repair or replacement of a product is your exclusive remedy. Any implied warranty of merchantability or fitness is limited to the duration of this written warranty. Some States do not allow the exclusion or limitations of incidental or consequential damages, so the above exclusion or limitations may not apply to you.

Support

LMI Customer Service and Technical Support can be reached at **810-714-5811** Monday through Friday between 8:00 a.m. and 5:00 p.m. Eastern Standard Time or fax anytime at **810-714-5711.** They can also be reached by sending an email to customersupport@lmicorporation.com **or** techsupport@lmicorporation.com

Customer Service

Call LMI Customer Service to:
- Request quotations
- Inquire about the status of an order or repair
- Return LMI equipment for service
- Upgrade LMI equipment

LMI On-Site Training & Phone Support

LMI Technical Support can provide on-site training or phone support for LMI equipment and support software. Contact LMI Customer Service for pricing and scheduling information.

Call LMI Technical Support to:
- Assist in installing and configuring LMI equipment
- Help setup and configure gages, multiplexers and accessories
- Troubleshoot LMI equipment or LMI support software

Returns for Service

To expedite your service order:

- Contact Customer Service to obtain a Return Materials Authorization (RMA) number.
- Complete the RMA form provided and return the form, along with the unit, to LMI's repair department at the following address:
  LMI

  Attn: Repair Department
  101 N. Alloy Dr.
  Fenton, MI 48430

- Pack the equipment properly, using the original shipping container if possible. LMI cannot assume responsibility for damage caused by improper packaging.
- LMI will evaluate the unit and supply an evaluation and quotation for the necessary repairs.
- Upon receipt of a purchase order, LMI will repair and return the unit.

Recommended User Requirements

Below are **minimum** and **recommended** specifications in order to run Ripple Gauge Software effectively on any local computer:

<u>**Minimum Computer Specifications**</u>:
Screen Resolution: 800x600
Memory needed: 256 MB
Processor Speed needed: Pentium 3
Serial COM Port: 1 (1 COM Port/ LMI System)

<u>**Recommended Computer Specifications**</u>:
Screen Resolution: 1024x768
Memory needed: 512 MB
Processor Speed needed: Pentium 4
Serial COM Port: 1 COM Port & 1 USB Port

<u>**Recommended User Requirements:**</u>
Administrative Rights are necessary for installation purposes
Basic User Rights are necessary for application use

<u>**Minimum Software Requirements**</u>
.NET Framework 2.0 must be installed on the PC in order to use this software

System Overview

This chapter will help organize the user to get started.

The LMI Ripple Gauge collects data along the X and Z axis. The data pairs are transmitted per increment distance of x to a data collection device such as a "DataMyte 4000" or a PC/Laptop. This data can be then graphed and saved to a Microsoft Excel file and saved as an image type (i.e. jpg, gif, bmp).

The axis of the Ripple Gauge can also be set to zero at any point along the travel of the Ripple Gauge.
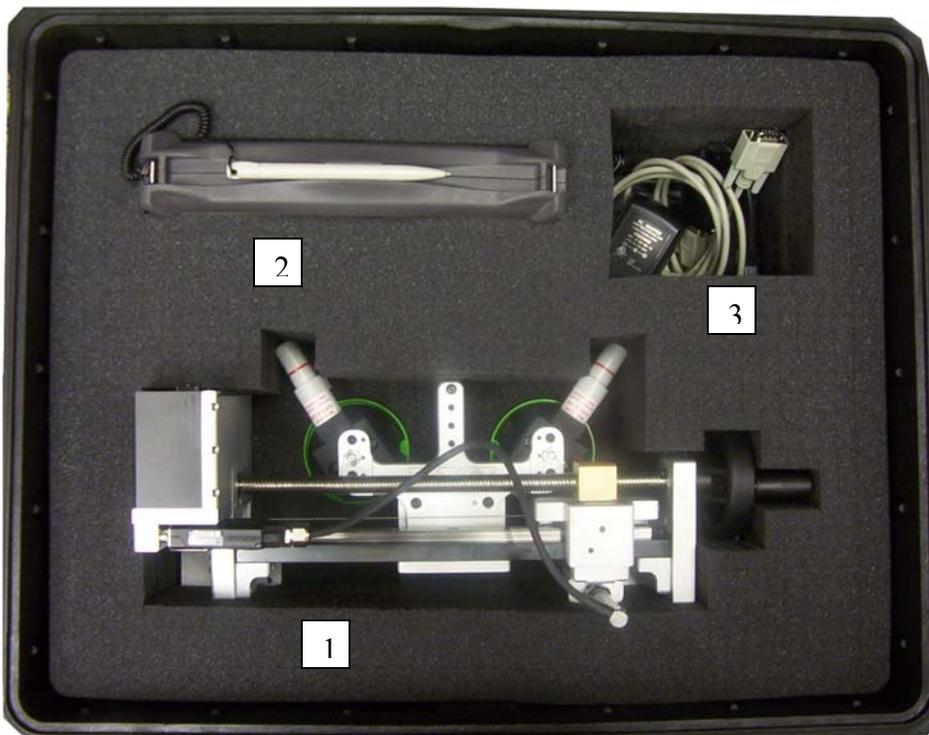
Ripple Gauge System Includes:

1. ☐ Ripple Gauge Controller
2. ☐ ASI DataMyte 4000 Collector
3. ☐ USB Firmware Cable
   ☐ USB to Serial Adapter Cable
   ☐ Serial Cable
   ☐ Power Cable

Hardware Components

This chapter will focus on the components of the Ripple Gauge.

Ripple Gauge Specifications

Specifications:
▪ Z-Axis Probe: Travel (0.4724")- Accuracy (3.937008 $*10^{-05}$)[1]

▪ X-Axis Probe: Travel (8.0") – Accuracy (4.00 $*10^{-04}$)

Ripple Gauge Components
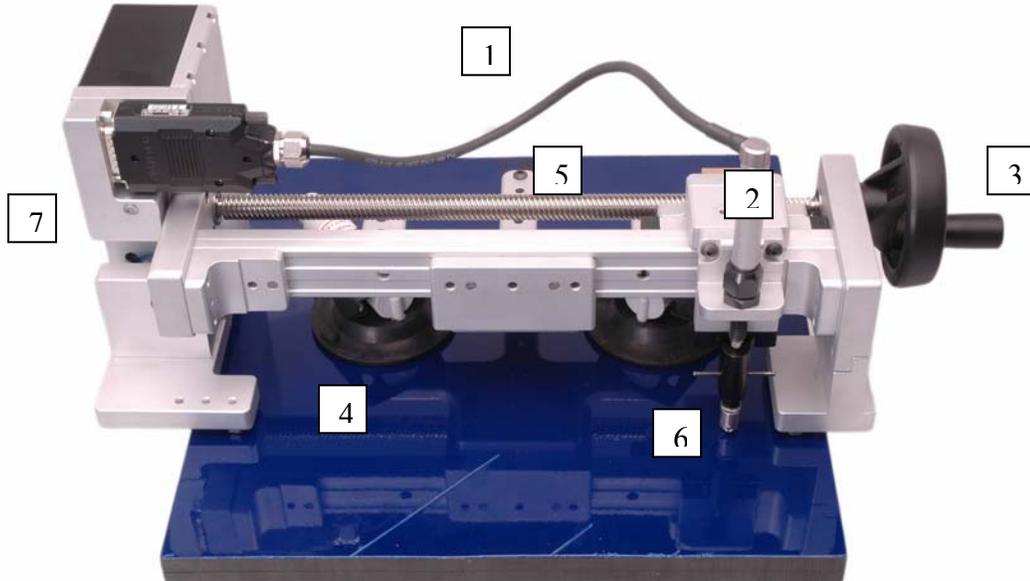
FIGURE 1.1 A **Ripple Gauge.**

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[1] Specifications are in English Units.

1. **Ripple Gauge**
   The Ripple Gauge is the central hardware controller that will transfer data to the DataMyte 4000 or software.

2. **Z-Axis Probe**
   The Z-Axis Probe will transfer the height (profile) of the measured surface.

3. **Hand Wheel**
   The hand wheel drives the X-axis and Z-axis probes across the measured surface in either direction.

4. **Vacuum Cups**
   The Vacuum Cups act to stabilize the Ripple Gauge by securing to the measured surface.

5. **Stainless Steel Feet**
   A 3 point stance on a curved surface is use to stabilize the gauge on the measured surface. The positions of these feet are adjustable with additional threaded holes.

6. **Roller Contact Tip**
   The roller contact Tip is located on the X-axis and can be raised and lower at time of measurement. In the measuring position it should be down so that it makes contact with the surface. (Tread type 4-48th)

7. **LED Status Light**
   A dual function indication LED, which notifies the user on the Ripple Gauge states: A solid GREEN LED represents the power is <ON> and the gauge is in "Standby Mode". A blinking GREEN LED represents communication mode and the gauge is in "Test mode".

Hardware Configuration

This chapter will focus on how to connect the Ripple Gauge to a PC/Laptop or DataMyte 4000.

Ripple Gauge Communication

The communication Port is used to connect the Ripple Gauge to a PC/Laptop COM port or DataMyte 400 using a RS 232 serial cable.
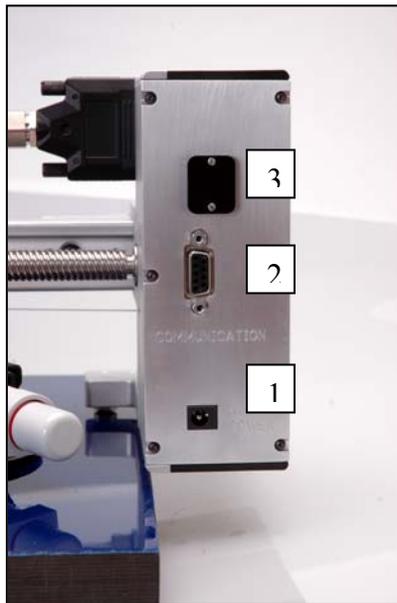
FIGURE 1.1 B **– COM Port for the Serial Cable.**

1. **A/C Wall Adapter (Optional set with PC/Laptop)**
   Used to power the Ripple Gauge if connecting with a serial cable to a PC/Laptop terminal.

2. **Communication Port for Serial Cable.**
   Communication interface with the Ripple Gauge to read in the measured data into the DataMyte 4000.

3. **USB Port**
   The USB interface port on the Ripple Gauge is only used for Firmware updates (see the Firmware Update section).

Ripple Gauge Power Supply

The Ripple Gauge can be powered using 3 different ways:

1. The Ripple Gauge can be powered with 5 volts over pin 9 with the Bridge Cable LMI 5996 Serial to USB adapter.

2. If a PC/Laptop is chosen to interface with the Ripple Gauge, the power will be an auxiliary power source cube (optional). Plug the provided power cube into the jack labeled AUX PWR.

3. If the "DataMyte 4000" is selected the Ripple Gauge will be powered with 5 volts over pin 9 of the DataMyte communication cable.

Proper Lifting Instruction of the Ripple Gauge
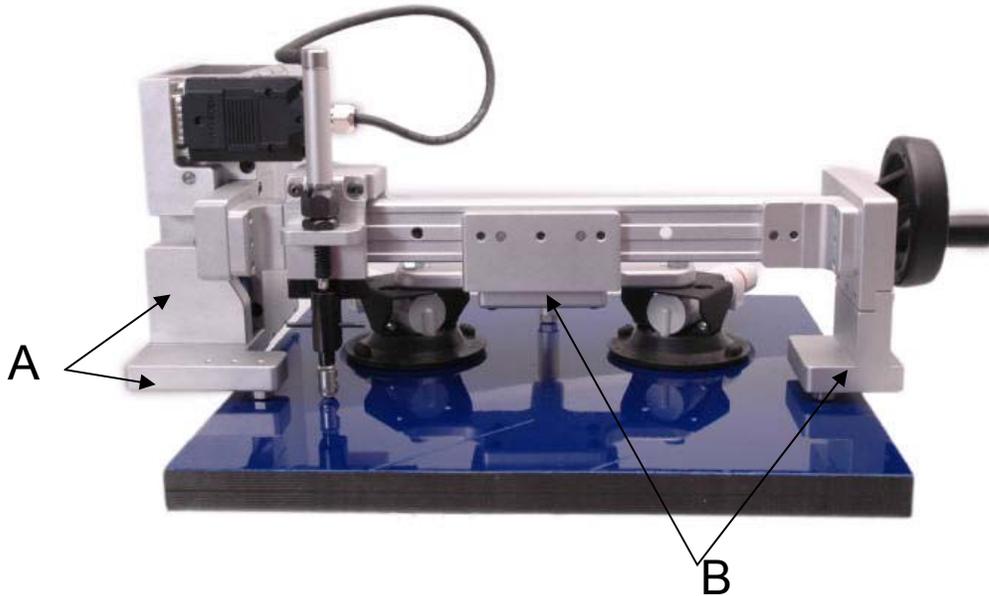
FIGURE 2.1 A – **Lifting the Ripple Gauge.**

1.   Make sure the Z Axis sensor is moved to the home position at either end of the travel.

2.   Always use two hands to lift into position.

3.   Never lift on the Z Axis sensor or the X-Axis Drive Screw.

4.   Lift using the three solid aluminum reference supports:

- Position one hand on the end with electronics connection (position A)
- Position your second hand on the center bracket or the crank end support (position B)

Hardware Configuration

This chapter will focus on how to setup the Ripple Gauge for use with a PC/Laptop or DataMyte 4000.

Setup Instructions for PC/Laptop

1. Attach the "Ripple Gauge" to a surface by activating suction cups to achieve 3-point foot contact. Pump the vacuum cup plungers until redline is no longer visible.[2]
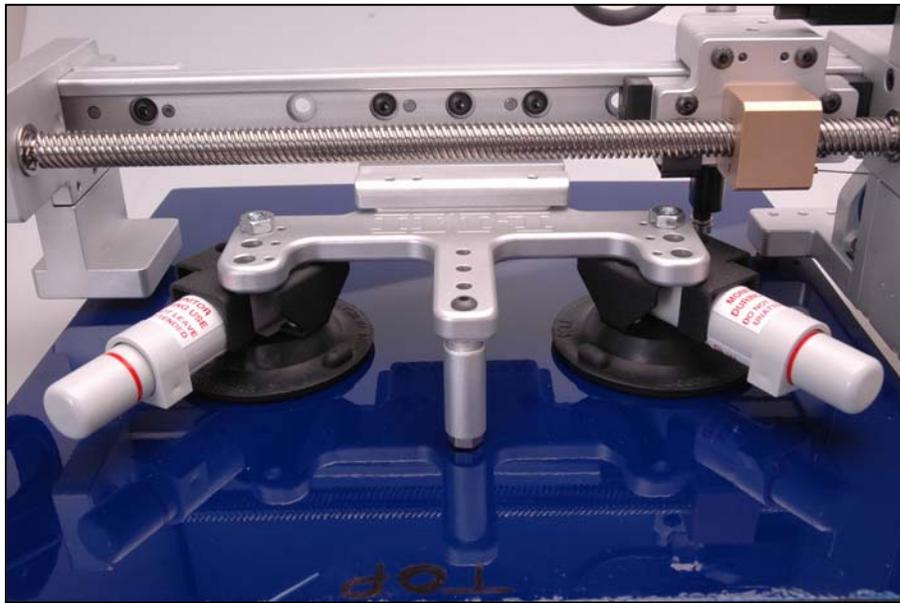
FIGURE 2.1 A – **Vacuum Cups.**

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[2] The Gauge is NOT secure if the Red Line is visible. Note the "Warning Label" on vacuum cup plunger housing.

2. It is suggested to start an operation with X-probe at home position & Z-probe retracted to the up position. Once the Ripple Gauge is set on the desired surface, set the Z-probe in the down position, so that it makes contact with the measured surface.
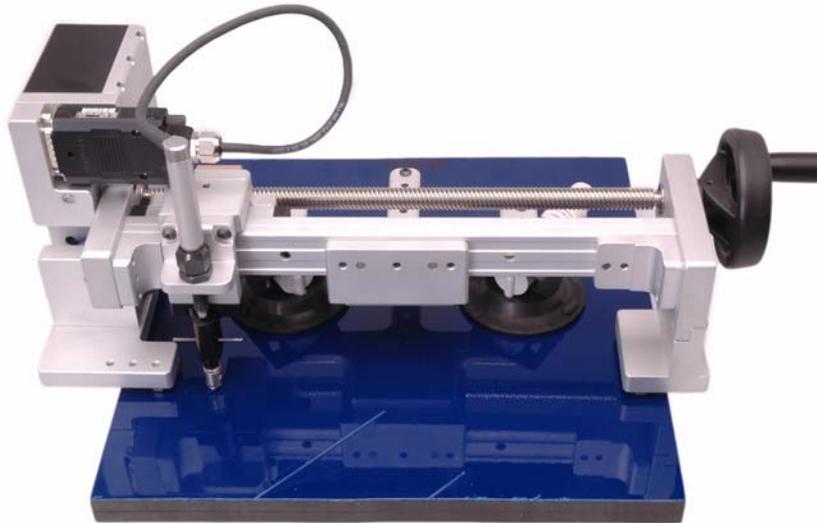
FIGURE 2.1 B **– Ripple Gauge Probe Start Position.**
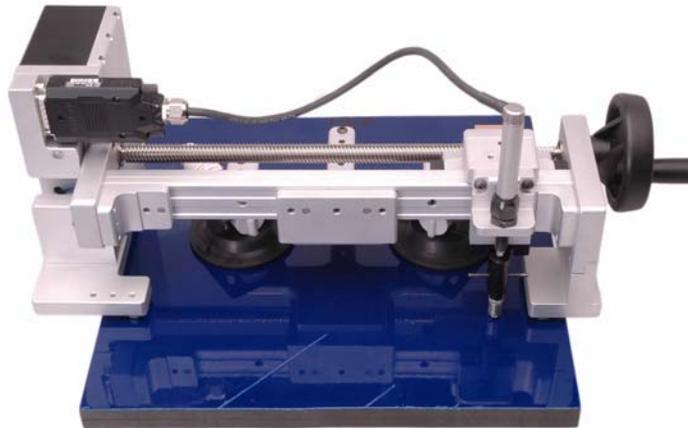
FIGURE 2.1.C   – **Ripple Gauge Probe End Position.**

3. Next, communication will need to be setup. Using the provided Serial RS232 cable, connect one end to the Ripple Gauge Serial Port and the other end using a Bridge Cable (LMI 5996) Serial to USB adapter. Plug the serial end into the RS232 cable and the other end into a free USB port on the PC/Laptop[3].

FIGURE 2.1 D – **Ripple Gauge to PC/Laptop Communication.**

The second option to communicate would be to directly connected from the LMI Ripple Gauge to the PC/Laptop with the RS232 cable. The difference in this

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[3] Drivers for the LMI 5996 Bridge cable Serial to USB adapter can be found on the CD. These drivers need to be installed for initial use.

connection would be that an auxiliary power source (A/C wall Adapter) would need to plug into the LMI Ripple Gauge to supply power.

4. Once powered and connected to the PC/Laptop, check that the LED communication light on the Ripple Gauge is solid for "Standby Mode". Open the Ripple Gauge software application on the PC/Laptop. When in measuring mode the Ripple Gauge LED will blink to signify measuring mode (See Steps to use the Ripple Gauge under the Software Section).
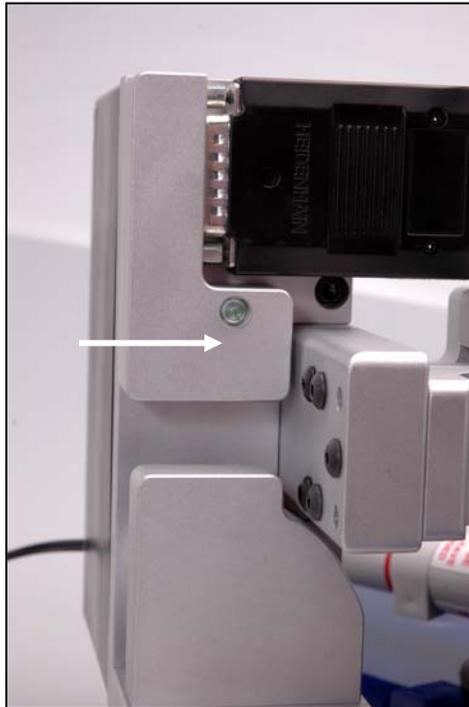
FIGURE 2.1 E – **Ripple Gauge LED Communication.**

5. Sweep over the desired run, up to 8 inches, at an even feed rate. Do not traverse faster than 1 revolution per ½ second. Any faster may cause data error. An eight inch run should take 8 seconds minimum. Recommended speed to traverse surface is 8 seconds [4]

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[4] This is a hand operated gauge that is very accurate so any fast/hard movements will effect the result of the test .

Setup Instructions for ASI DataMyte 4000

1. Attach the "Ripple Gauge" to a surface by activating suction cups to achieve 3-point foot contact. Pump the vacuum cup plungers until redline is no longer visible.[5]
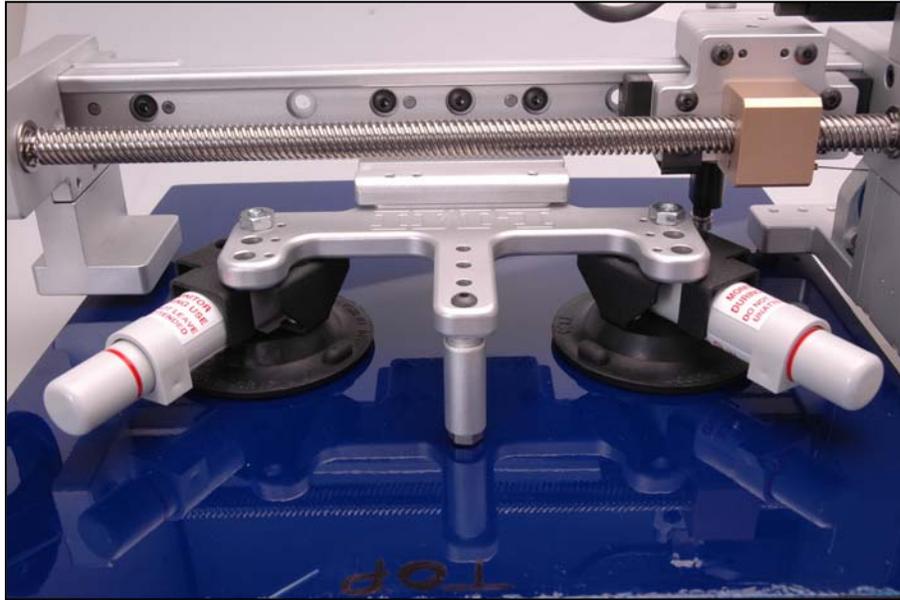
FIGURE 2.2 A – **Vacuum Cups.**

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[5] The Gauge is NOT secure if the Red Line is visible. Note the "Warning Label" on vacuum cup plunger housing.

2. It is suggested to start an operation with X-probe at home position & Z-probe retracted to the up position. Once the Ripple Gauge is set on the desired surface, set the Z-probe in the down position, so that it makes contact with the measured surface.
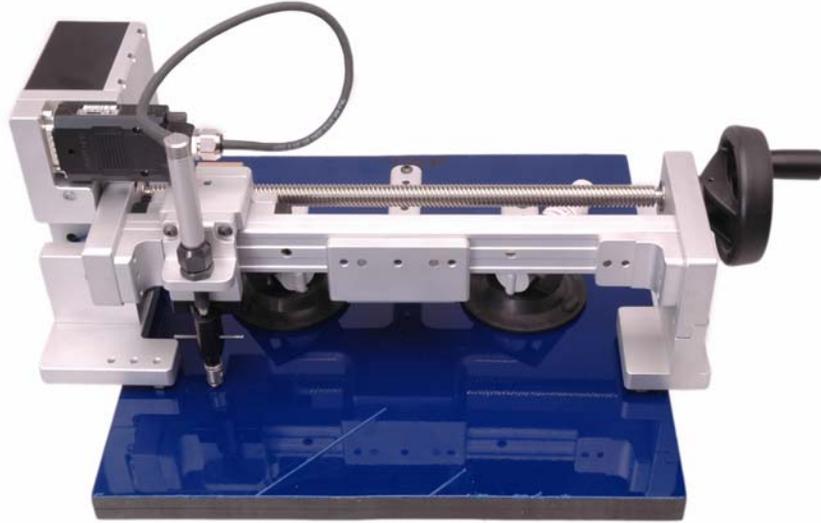
FIGURE 2.2 B – **Ripple Gauge Probe Start Position.**
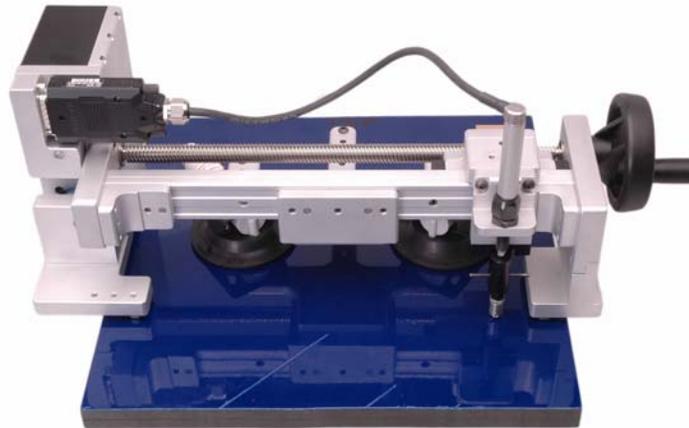
FIGURE 2.2.C – **Ripple Gauge Probe End Position.**

3. Next, the communication and power interface to the ASI DataMyte 4000 will need to be setup. Using the provided power cable and provided DB9 Serial to Circular Din attach both end to the bottom of the ASI DataMyte 4000. Attach the other end of the ASI DataMyte 4000 COM cable into the PC Serial Port of an available COM Port.

ASI DataMyte 4000 Power Cable

ASI DataMyte 4000 COM Circular Din Cable

FIGURE 2.1 D – **Bottom View of ASI DataMyte 4000 (Power / Serial Communication to PC).**

Connect the Circular Din Serial Cable (LMI SK 4825) to the Top Bar Code Port of the 4000. Then connect the Serial end to the LMI Ripple Gauge. This Cable will provide the data communication to and from the Ripple Gauge and power the unit.

Serial COM –Ripple Gauge
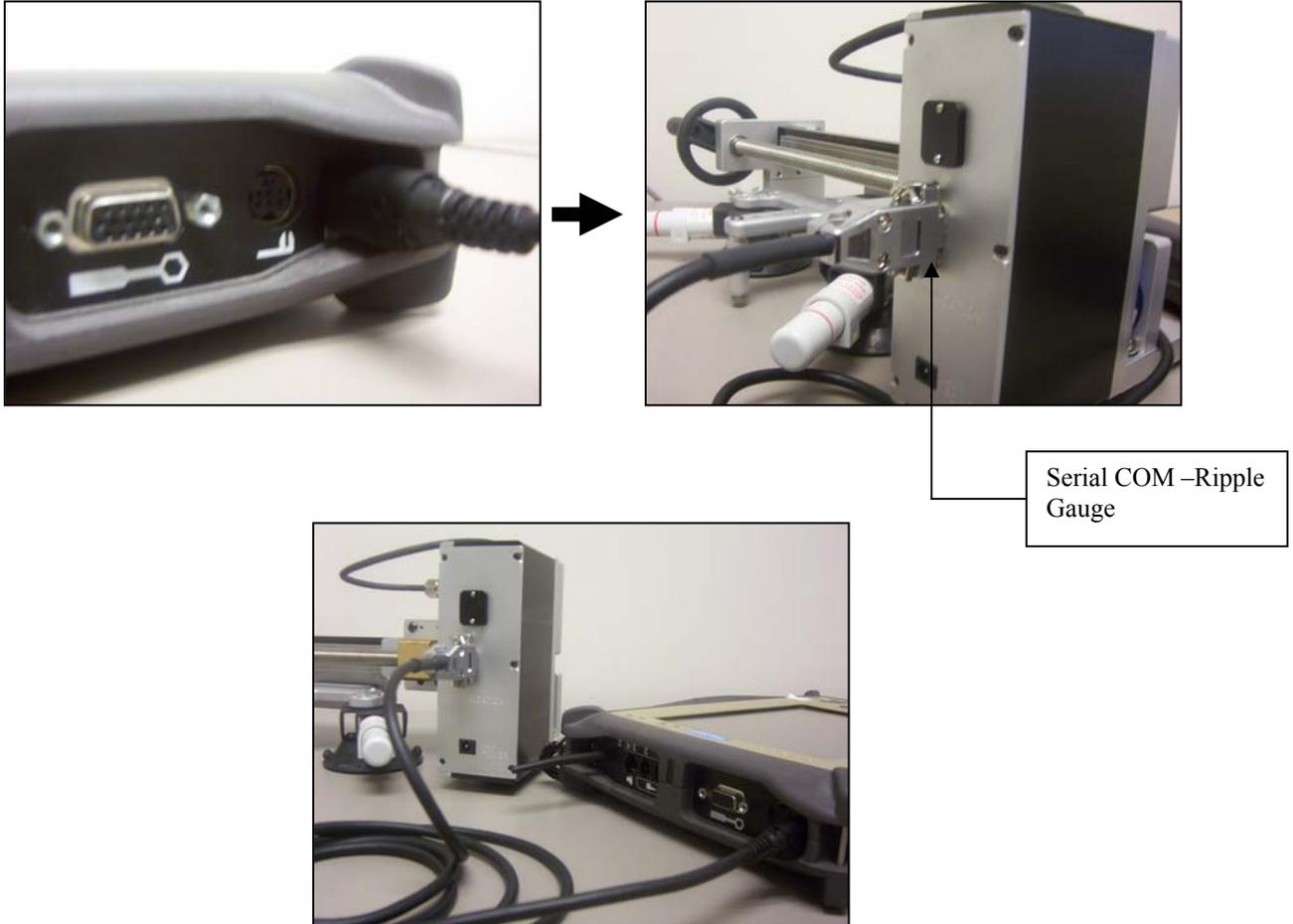
FIGURE 2.1 E **– Ripple Gauge to ASI DataMyte 4000 Communication Configuration.**

6. Once powered and connected to the ASI DataMyte 4000, check that the LED communication light on the Ripple Gauge is solid for "Standby Mode". Open the Ripple Gauge software application on the PC/Laptop. When in measuring mode the Ripple Gauge LED will blink to signify measuring mode.
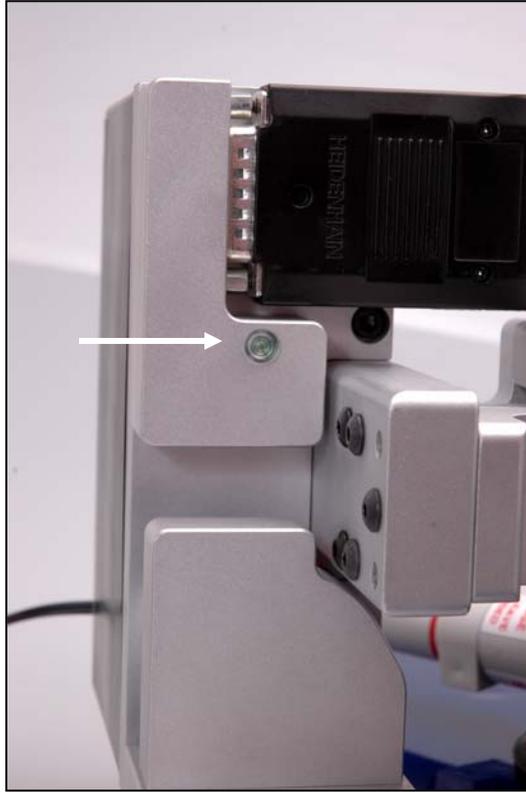
FIGURE 2.2 F **– Ripple Gauge LED Communication.**

7. Sweep over the desired run, up to 8 inches, at an even feed rate. Do not traverse faster than 1 revolution per ½ second. Any faster may cause data error. An eight inch run should take 8 seconds minimum. Recommended speed to traverse surface is 8 seconds [6]

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[6] This is a hand operated gauge that is very accurate so any fast/hard movements will effect the result of the test .

Software Installation

This chapter will step through the installation process of the software

ASI DataMyte Software Installation

For more information on how load and configure the ASI DataMyte Transend Software see http://www.asidatamyte.com/

User Interface

Operating System—Either Microsoft® Windows 98 SE, Windows 2000 (with SP4 installed), Windows XP (with SP2 installed),

Analysis Software—Microsoft Excel version 8.0 (for Microsoft Office™ 97), version 9.0 (for Microsoft Office 2000/3/7), or Office XP needs to be installed and operational.

Ripple Gauge Software Installation

1. Make sure proper administrative or user rights are available in order to install software on the computer (see Recommended User Requirements).

2. Place the Ripple Gauge installation CD in the CD ROM Drive.
   (Drive D:\ will be used for this example)

   The CD should automatically enter the setup. In the case that this does not occur, follow the next two steps.

3. Click the **Start** button and select the **Run** Option.

4. Type D:\Setup and click Enter.

5. The Install Wizard for Ripple Gauge will initiate.

6. Click **Next** as shown in Figure 3.1 A.
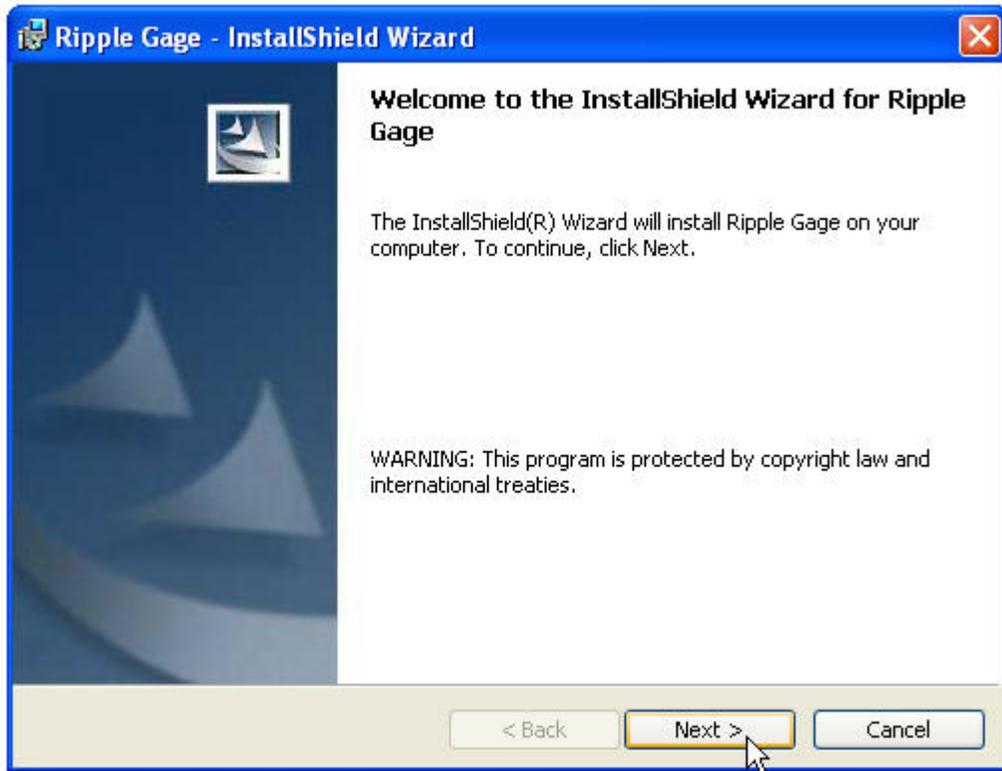
FIGURE 3.1 A – **Install Wizard**
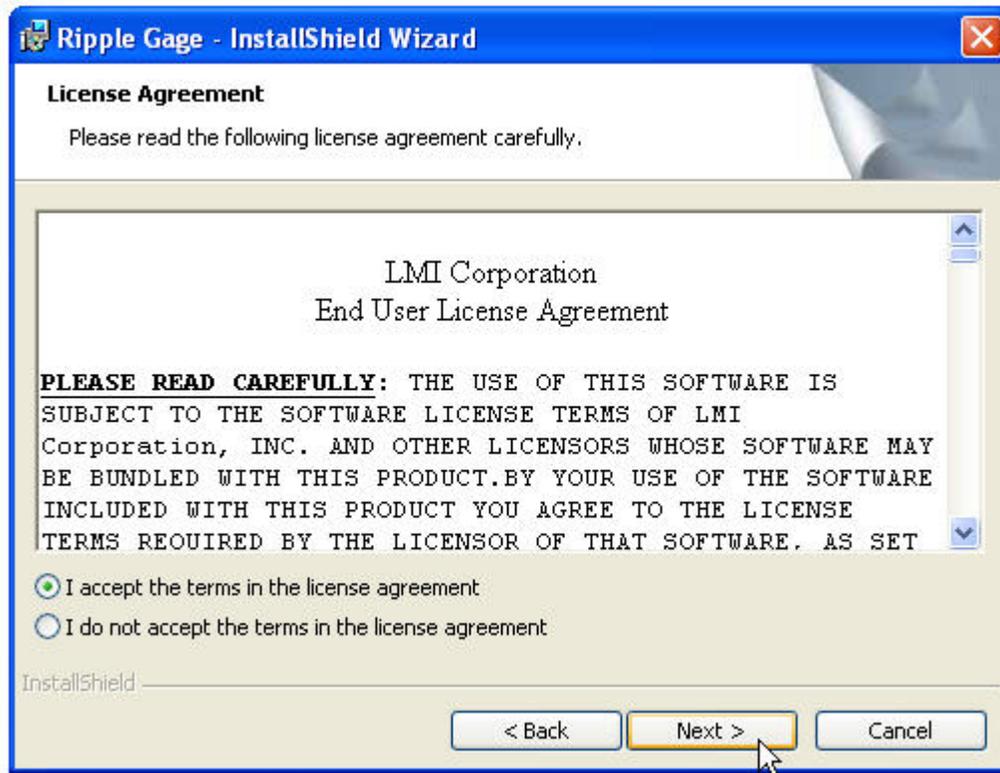
FIGURE 3.1 B – Customer Information

7. Click the **Next** button to start the installation
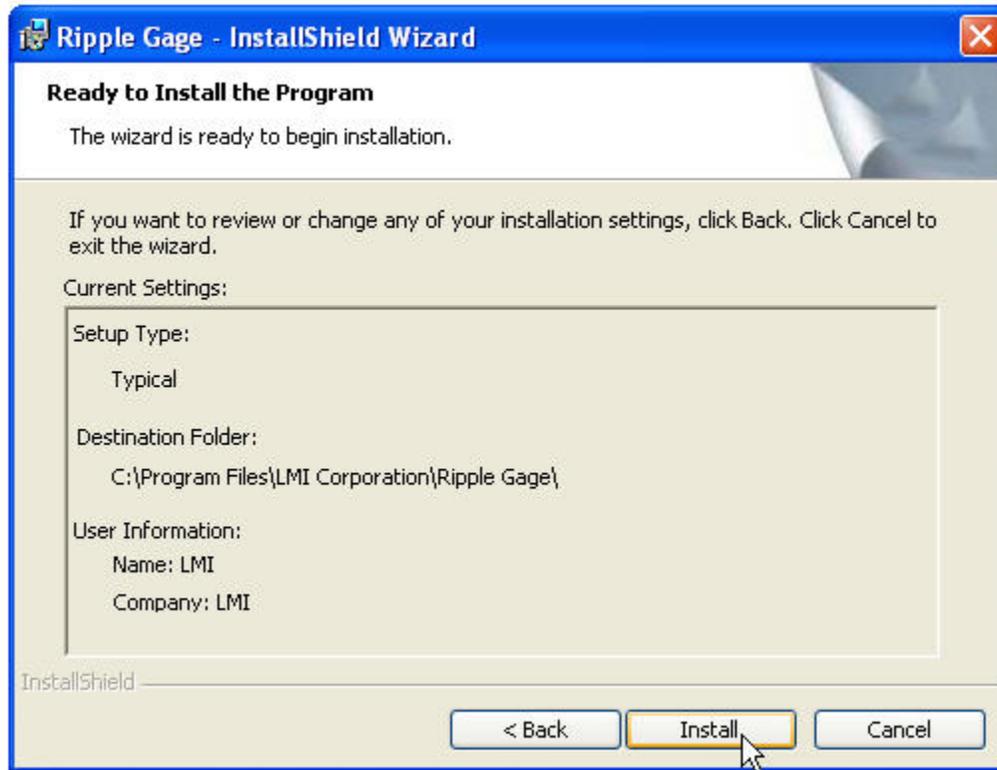
FIGURE 3.1 C **– Installation status.**

7. Select the Install button to launch the Ripple Gauge Software Installation.
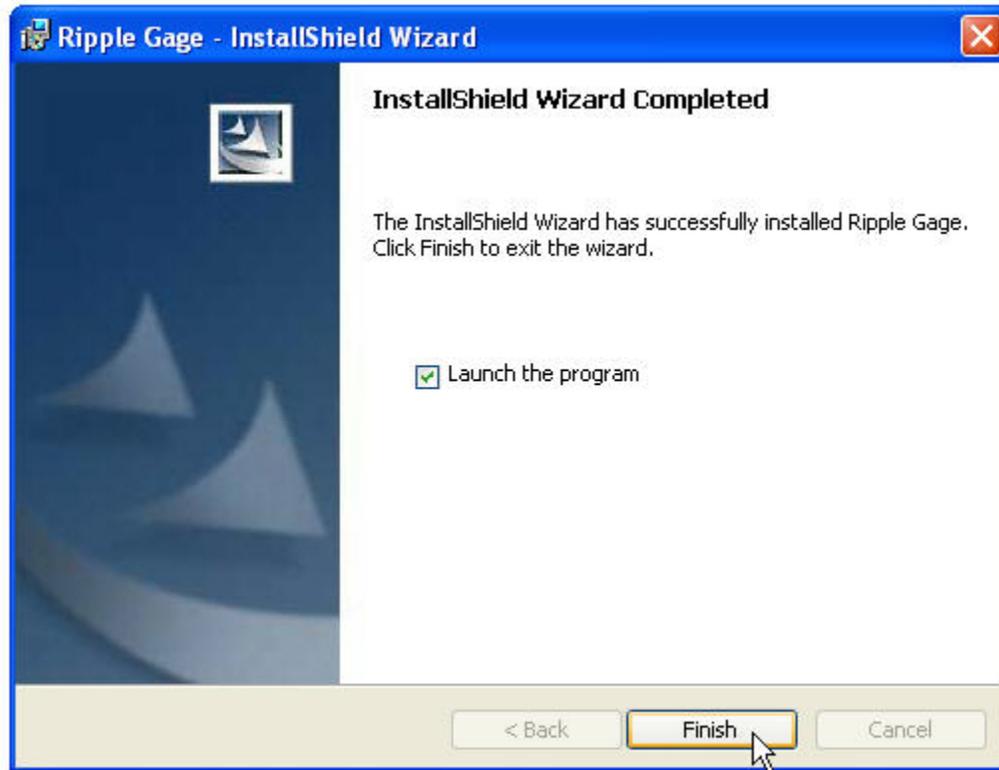
FIGURE 3.1 D **– Install Complete**

8. Click **Finish** when the installation is complete.

Ripple Gauge User Interface

The Ripple Gauge software consists of only one screen. This is the complete interface for the user.
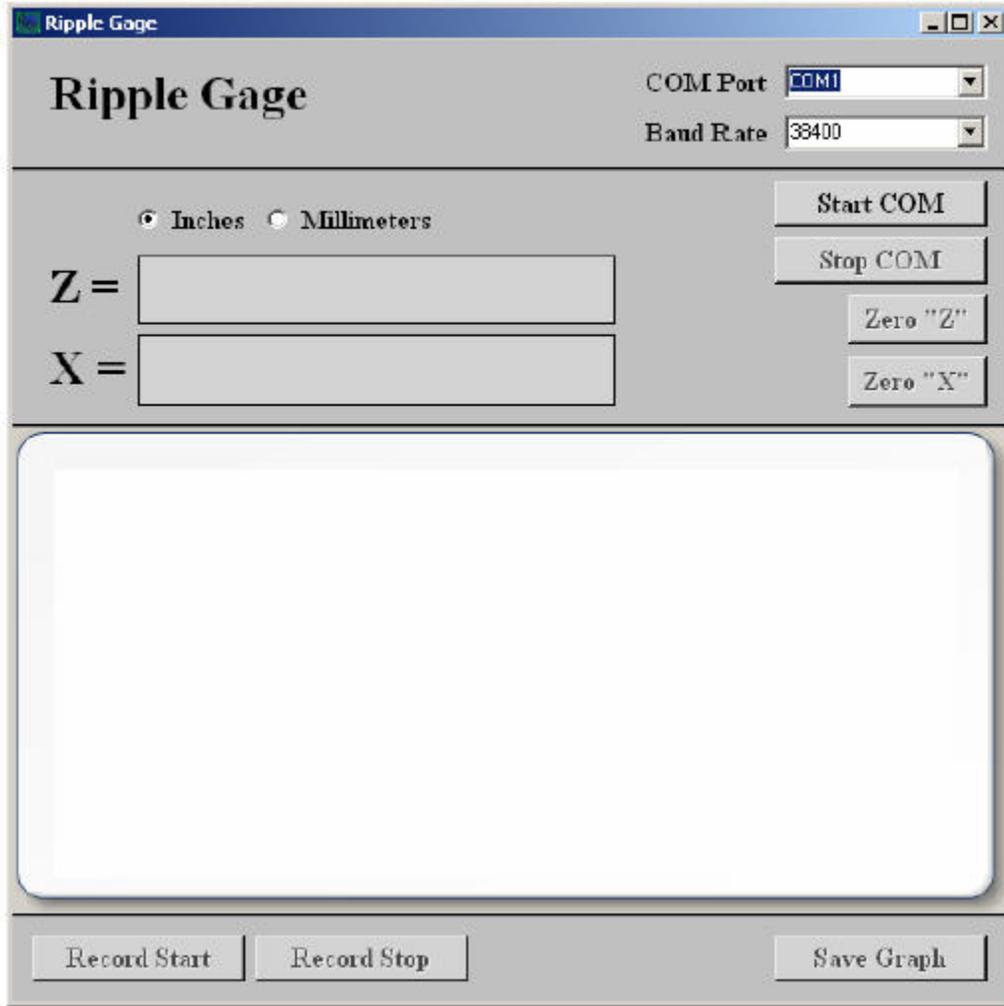
FIGURE 3.2 A **– User Interface**

User Interface

COM Port - This is the COM Port that is connected to the Ripple Gauge

Baud Rate - This is the baud rate of the Ripple Gauge. (Ripple Gage Baud Rate =38400)

Inches/Millimeters - This is the unit of measure that will be used when collecting and viewing the data. When the Record Start button is pressed, these radio buttons will no longer be enabled:

Z = - This is the value of the Z-Axis

X = - This is the value of the X-Axis

Start COM - This will open communications with the Ripple Gauge. It will also enable the Record Start button, the Stop COM button, and the Zero X and Zero Z buttons. Once this button has been pressed, if the user does not send data from the Ripple Gauge within 2 minutes, it will automatically stop communications with the Ripple Gauge (See System Timeout Section).

Stop COM - This will close communications with the Ripple Gauge as well as disable all of the other buttons on the screen except for the Start COM button.

Zero "Z" - This will 0 out the Z-Axis at the current point on the Ripple Gauge

Zero "X" - This will 0 out the X-Axis at the current point on the Ripple Gauge

Record Start - When this button is pressed, all of the data received from the Ripple Gauge will be stored until the data is saved or this button is pressed again.

Record Stop - When this button is pressed, no more data received from the Ripple Gauge will be stored. It will then compare all of the data that was stored and verify that there were no missing packets from the Ripple Gauge. If this check passes, the graph will then be populated with the associated data. The user will now be able to save this information.

Save Graph - This button serves two purposes. It will give the user the ability to save only the data in a Microsoft Excel file, and it will give the user the ability to save the graph in a various number of graphics and image files.

Example Graph

The following is an example of what the user will see once they have collected data from the Ripple Gauge.
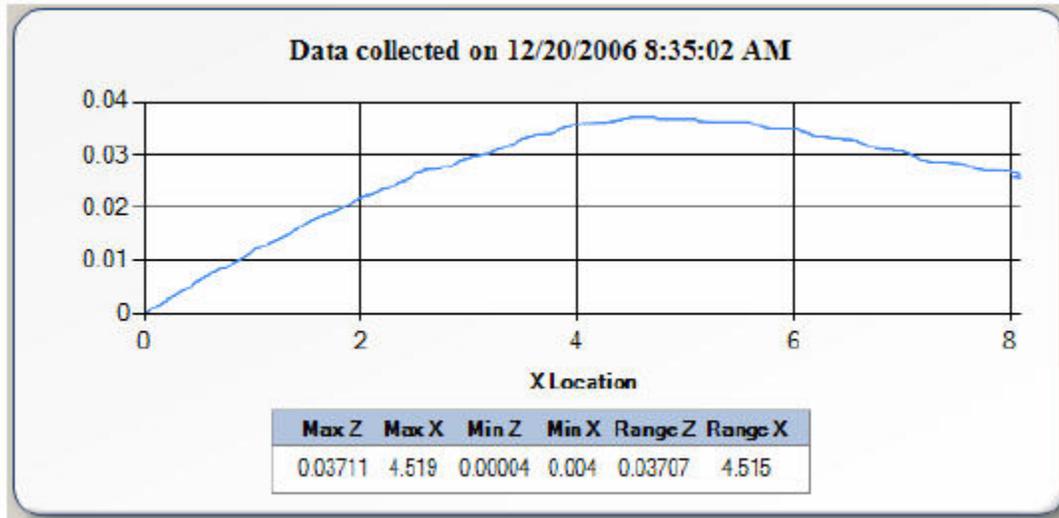
FIGURE 3.2 B **– Completed Graph**

Max Z – This is the maximum value that is found on the Z axis

Max X – This is the value of the X Location at the point that the Max Z was found

Min Z – This is the minimum value that is found on the Z axis

Min X – This is the value of the X Location at the point that the Min Z was found

Range Z – This is the range between the Max Z and the Min Z

Range X – This is the range between the Max X and the Min X.

Steps To Use The Ripple Gauge

1. Set the COM Port that will be connected to the Ripple Gauge.
2. Set the Baud Rate of the data transfer. The Com Port must be set to 38400 and, unless stated in the hardware manual, will not work with any other settings.
3. Select the units of measurement that will be used.
4. Make all necessary hardware connections (i.e. Serial Port, Power).
5. Press the Start COM button to initiate communications with the Ripple Gauge.[7]

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[7] **NOTE:** value should be populated in the corresponding x and z axis boxes.

Steps To Record Data

1. With the Ripple Gauge started, press the Record Start button. This will record all values received from the gage until the Record Stop button is pressed.

2. Press the Record Stop button when you are finished collecting data. At this point, the graph will be populated with the recorded data.

Steps To Save The Data

1. Once data has been collected, the Save Graph button will be enabled. Pressing this button will initially display a Save File Dialog box for the **data**. Enter the name of the file to save and hit the Okay button.

2. After the data has been saved, another dialog box will be displayed in order to save the **graph**. By default, it will have the same name as the data file. Select the file type to save the graph as below the file name (i.e. jpg, bmp, gif, etc.). The **data file** will be saved in an Excel (.XLS) spreadsheet format.

System Timeout

After 2 minutes, if the system has not received any data from the Ripple Gauge, it will automatically stop communications. It will also display a message box on the screen letting the user know what has occurred. If this occurs, the user just needs to press the Start COM button again to start receiving data from the Ripple Gauge.
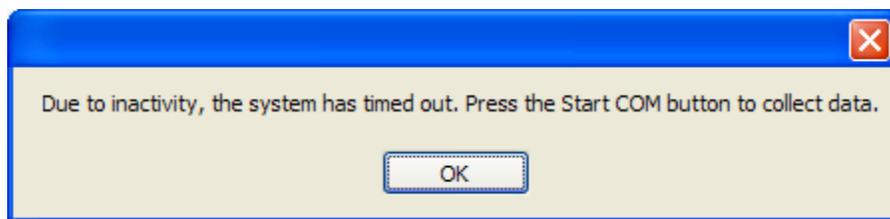
FIGURE 3.2 C **– Time-out message**

Firmware

This chapter will step through Firmware update instruction for the Ripple Gauge.

Firmware Instructions

- On a PC, double click the self extracting zip to place the new firmware hex file in the C:\Program Files\LMI Corporation\Ripple Gauge Hex folder.
- Make sure the "FLIP" software is installed from the provided LMI CD and open the utility. It can be found "start > All Programs > ATMEL > FLIP 3.0.4 > FLIP. If you need to install the utility look for a folder called "FLIP" under the Hardware Flash Installation directory on the CD.
- Remove "USB Hatch Panel" on the Ripple Gauge and plug in the supplied USB cord and connect it to the PC (The serial cable can be attached.
- Open device manager.
- You will need two unfolded paper clips. Insert a paper clip into the hole marked "HWB" and hold while inserting the second clip into the "RST" hole. Remove the "RST" paper clip followed by the "HWB". This will put the device into "Firmware Update Mode".

FIGURE 4.1 A **– Inside Panel**

- Check that the dual function LED (Power Indication/Test in Progress) on the Ripple Gauge is now off for "Firmware Update Mode".
- Check device manager to see if the "Jungo" driver showed up. This means that the microcontroller is now running out of the "Bootloader" code instead of the Ripple Gauge application code. If it is not present, repeat previous step.
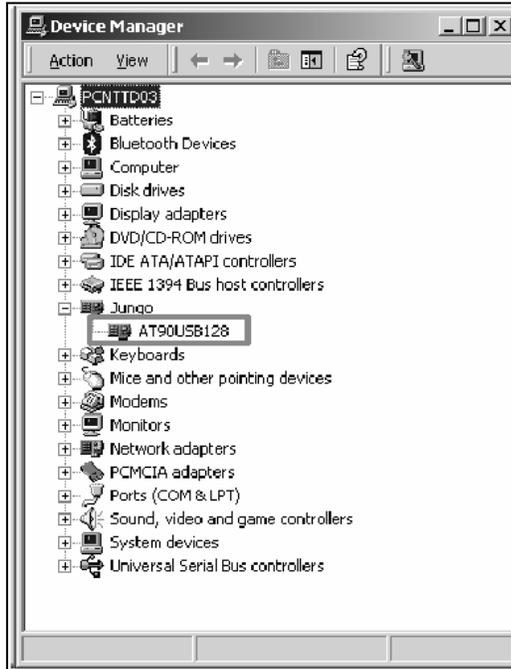
FIGURE 4.1 B **– Device Manager**

- In the "Atmel Flip" application window select the USB icon to connect.
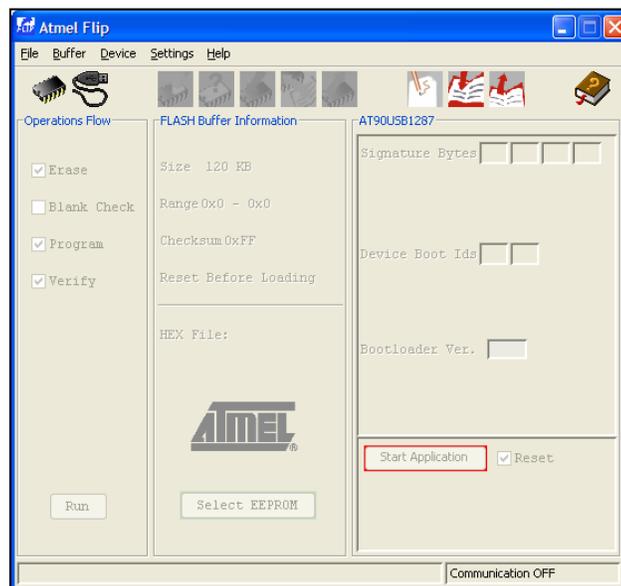
FIGURE 4.1 C **– Firmware Update**

- Load up the hex new hex file by selecting "File > Load HEX File" then browse for the hex file that you unzipped.
- Once auto parsed select the "Run" button. You will be notified of your success.
- Select the "Start Application" and close the utility.
- Check device manager to see if the "Jungo" icon disappeared meaning the MCU is no longer running the "Bootloader".
- Run application and test device. If it works remove USB cable and replace hatch cover.

Troubleshooting

This chapter will step through the Ripple Gauge troubleshooting steps.

Troubleshooting

- If you have a problem receiving data on the Data Terminal Equipment Example: (Computer or Printer) end:
  - o Check to see if the dual function LED (Power Indication/Test in Progress) on the "Ripple Gauge" is illuminated solid for "Standby Mode" or blinking for "Test Mode".
  - o Make sure the RS232 cable is firmly attached at both ends. If the DTE is a PC make sure that the provided power cube is plugged into the "AUX PWR" port on the "Ripple Gauge".
- Periodically clean and inspect vacuum cups if the units do not attach to surface properly.

Maintenance

This chapter will step through the Ripple Gauge maintenance

Wood's Powr-Grip CO., INC.

VACUUM CUP INSTRUCTIONS

- for all cup sizes listed hereafter -

Rev. 1.1 / 09-05 Instruction Sheet 32630 **SC**
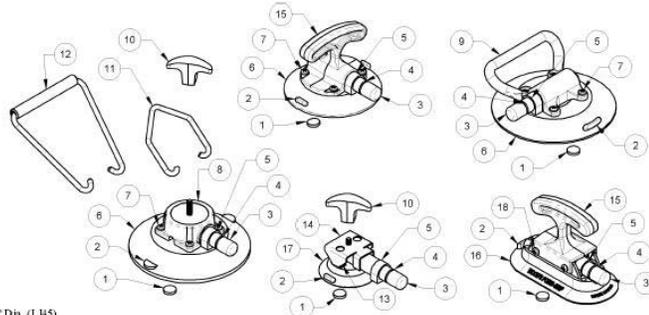
1.	60024	Air Filter
2.		Release Tab
3.		Plunger
4.		Red Line
5.	90111	Pump
6.	49345T	Vacuum Pad, 4 1/2" Dia. (LJ45)
	49386T	Vacuum Pad, 6" Dia. (TL6)
	49396T	Vacuum Pad, 6" Dia. (TL6T / for Rigid Handle)
	49426T	Vacuum Pad, 6" Dia. (LP6)
7.	10014	Screw, 10-32 x 7/16"
	10024	Screw, 10-32 x 5/8" (for 4 1/2" pad only)
8.	50220	Accessory Mount, Aluminum (for Tie-Down or Flip Handle)
	50210	Accessory Mount, Aluminum, 1/4-20 Stud
	60181	Accessory Mount, Polycarbonate, 1/4-20 Insert
	60180	Accessory Mount, Polycarbonate, 1/4-20 Stud
9.	50230	Rigid Handle
10.	15790	T-Handle (fits on 1/4-20 stud)
11.	50100	Tie-Down
12.	50102	Flip Handle

13.	10156	Screw, 10-32 x 1/4"
14.	60118	Accessory Mount, 1/4-20 Stud
15.	60116	Handi-Grip Handle (for 3" x 6" pad)
	50205	Handi-Grip Handle (for 4 1/2" and 6" pads)
16.	49365T	Vacuum Pad, 3" x 6" (RF36)
17.	49326T	Vacuum Pad, 3" Dia. (TL3)
18.	10008	Screw, 10-32 x 3/8"

Not Shown
29306MM	Pad Cover, 3"
29308	Pad Cover, 4 1/2"
29312	Pad Cover, 6"

SPECIFICATIONS

Product Description

Vacuum cups use vacuum to secure or to lift and carry small loads, as follows: A manual pump removes air from between the rubber pad and the contact surface; a red line on the pump's plunger serves as a vacuum indicator; a check valve allows the user to repump the cup without removing it from the contact surface; and a release mechanism allows the cup to disengage completely.

Nominal Size	Load Capacity*
3" [77 mm] diameter	15 lbs [7 kg]
3" x 6" [77 mm x 153 mm]	40 lbs [18 kg]
4½" [115 mm] diameter	40 lbs [18 kg]
6" [153 mm] diameter	70 lbs [32 kg]

*This rating includes a 3:1 safety factor and assumes the following: attachment on clean, smooth, nonporous flat surfaces; a minimum vacuum level of 17½" Hg [-59 kPa]; and a friction coefficient of 1. See WARNINGS for more information.

Contact Surface and Environmental Conditions

Use the cup on clean, relatively smooth, nonporous surfaces, at temperatures from 0° to 120° Fahrenheit [-18° to 49° Celsius]. Moisture or contaminants can reduce the slip resistance of the cup. The red-line indicator may not perform reliably at elevations above 5000 feet [1524 meters]; see Service.

Cleaning

1) Remove the air filter from the cup face.
2) Scrub the cup face, using soapy water, glass cleaner, or alcohol. CAUTION: To prevent liquid from contaminating the pump, hold the cup face-down or cover the suction hole in the filter recess.
3) Rinse all residue from the cup face.
4) Allow the cup to dry and reinstall the air filter.

Storage

Store in a clean, dry location out of direct sunlight. Protect the cup face from damage using the pad cover (when supplied) or another appropriate means.

WARNINGS

Failure to observe WARNINGS could damage the vacuum cup or the load, or cause injury to the user.

- Load Capacity is calculated for cups attached to the upper side of horizontally oriented, static objects. Any leverage generated by lifting vertically oriented loads or by attaching equipment on cups may reduce the effective capacity. See www.powrgrip.com for more information.
- Do not use the cup to support loads that exceed the load capacity.
- Do not use the cup to support a person.

OPERATION
To Attach
1) Clean the contact surface and, if needed, the face of the vacuum cup (see Cleaning). CAUTION: Test the cup for staining or deformation of surfaces with light colors or soft coatings.
2) Position the cup so the red line will be visible if it should appear while the cup is attached.
3) Pump the plunger until the cup attaches completely. When the red line is hidden, the cup is ready for use.
4) Check the plunger frequently to make sure the cup remains securely attached. If the red line appears, pump the plunger until the red line is hidden again (see WARN-INGS).

To Release
1) Secure the load.
2) Pull a release tab until the cup disengages completely. CAUTION: Remove the cup when not in use.

MAINTENANCE
Service
Regularly make sure the vacuum cup's air filter is in place. If not, discontinue use until the filter is replaced.

If the cup does not function normally, the cup face may be dirty or damaged, or the pump may require service. First clean the cup face according to the directions to follow. If the problem persists, contact our Customer Service department or an authorized dealer for assistance.

- Do not use the cup to support loads which could injure people if the cup disengages unexpectedly.
- Do not place the cup face against surfaces which could damage the sealing edge of the rubber pad.
- Avoid conditions that could cause the cup to slip or to disengage prematurely, such as: contaminants, cuts or scratches in the cup face or contact surface; applying the cup to porous materials; or applying pressure against the cup edge.
- Do not use the cup when the red line is visible. If the red line reappears frequently, discontinue use and see Service.
- Do not allow anything to interfere with free movement of the plunger while the cup is attached.
- Do not touch any release tab while using the cup.
- Do not leave the cup in use and unattended.
- Do not use solvents, gasoline or other harsh chemicals to clean the cup.