# SpecMetrix® Dark Software Manual
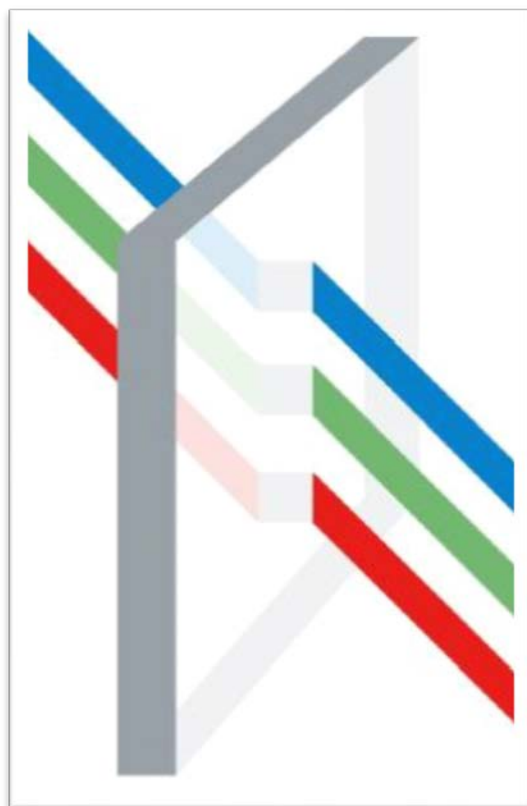
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# Table of Contents

## Software Description

SpecMetrix® Dark is software for measuring low observable coating thickness and many other coatings with a conducting substrate.

## Description

SpecMetrix® Dark software is a unique process information technology platform. Coating thickness is calculated based on electrical properties of known coating thickness compared to the measured thickness. The software must be calibrated with a set of standards of known thickness of a specific substrate/coating combination.

SpecMetrix® Dark also includes quality reporting software. The results of each measurement will include: operator information, part information, and thickness measurements for each measurement run. This information will be compiled and stored into a report file format saved on the SpecMetrix® system.

## Installation

The SpecMetrix® system has been preloaded with a latest version of SpecMetrix® Dark. Please contact technical support if the software needs to be re-installed for any reason.

## Setting up part parameters

The following series of steps must be followed to set up new part information. A part number must be assigned to a coating/substrate combination.

a) Select the "**Parts**" tab on the software interface screen.
b) Select a recipe from the **Part # drop-down menu** for an existing recipe, or
c) Enter Part name in the "**Part #**" field
d) Enter the **# of measurements** that need to be taken on the part per measurement run.
e) Enter the **lower limit** (This is a quality control limit, any value below this will be displayed as red as it is out of range).
f) Enter the **upper limit** (This is a quality control limit, any value above this will be displayed as red as it is out of range).
g) Enter **Unit of measurement** (mils, microns, mm etc.).
h) Select the **# of Reference Values**, using the Up/Down arrow control.  Recommended range is between 6 and 10. Each value corresponds to a thickness standard of known thickness which will be used for reference calibration.  Enter the Reference values (The six reference values are shown as an example below. The six values represent the thicknesses of known standards starting from 10 mils to 60 mils. It is recommended to have 6 to 10 samples of known thickness to calibrate the instrument. The "# of Reference Values" can be changed using the Up/Down arrows. The more number of thickness standards used to calibrate the instrument, the more accurate the reported measurements will be.  The thickness values of the standards should be entered in an ascending order and it is *highly desirable* if there is reasonably uniform spacing in coating thickness between successive standards.)
Acceptable ranges for reference values can be displayed when entering a part.  To do this, enter data in the Part Information panel for the first and last reference values.  Then click Display Range.
i) Enter the **# to Average** to determine how many times the trigger or mouse button will be pressed per sample to generate an average thickness.

The acceptable range of values is displayed to the right of each text box. Values in red indicate unacceptable values entered in each field. In the example below, no values have been entered for reference values 2 – 5, so each range displays red. The user then must enter a reference value for each field in the specified range.



When saving a new part, the following screen is presented if one or more reference values is unacceptable. After dismissing the message box (by clicking on "OK"), the user may again click the **Display Range** button to display acceptable ranges.

Click on "Save" button to save the part information that has been entered.

**Taking a Measurement**

      a) Execute the *SpecMetrix® Dark* software by clicking on the shortcut for "*SpecMetrix® Dark*" file on the desktop. You should now see the following screen.

      b) The user must select an operator name and enter an appropriate password as shown below.

When an incorrect password is entered, the user will witness the following screen:
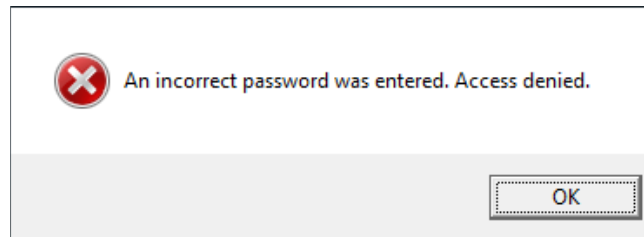
*SpecMetrix® Dark* users are created with an authority level. Depending on the authority level, the screen presented varies. For a **Basic User**, the following screen is displayed:
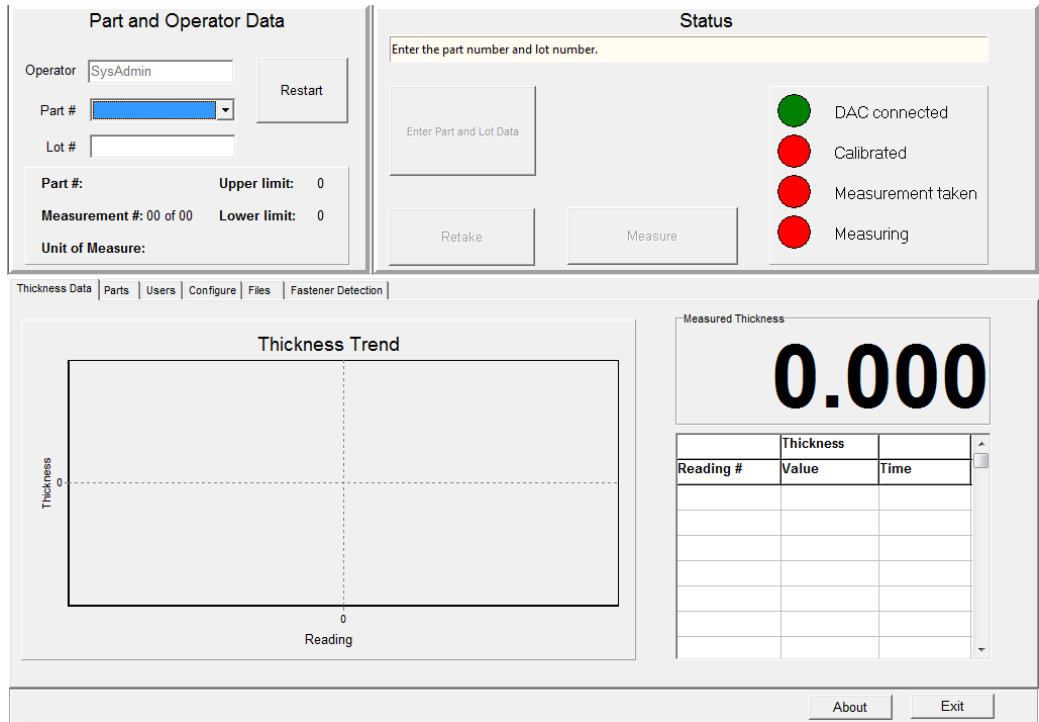
For an **Administrator**, the following screen is displayed: Notice that the Administrator has control over two additional tabs: "Users" and "Configure'
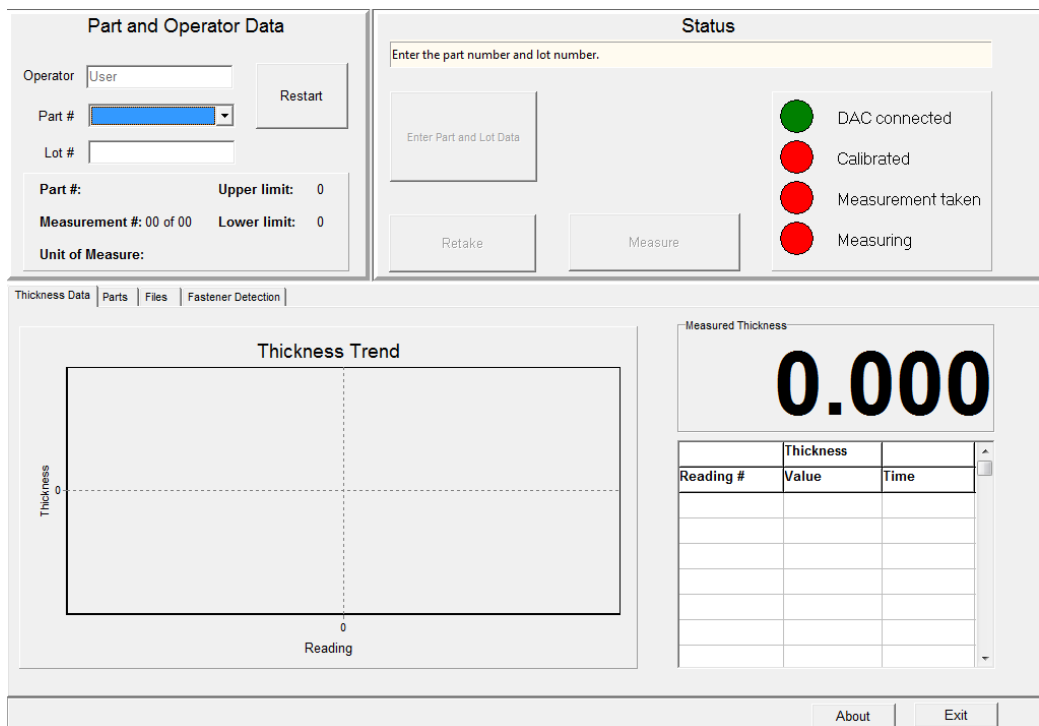
c) Select the name of the operator taking measurements.



The operator name will be part of the file name used to store the report file.

f) Select the part number to be measured.

g) Enter **Lot #.** If the selected part has not been calibrated with reference thickness standards before, the screen will change as in the example below: the **Go** button is enabled and the next step is to calibrate the software for that part.



h) If the selected part has already been calibrated with reference points before, the screen below (see next page) is presented. The selected part has voltage values stored for each reference point (A reference point corresponds to voltage value of the sensor on a known thickness standard). In addition to the **Go** button, a **Recalibrate** button is enabled. You may click the **Go** button and begin measuring using the previously recorded reference values or you may click **Recalibrate** and take the reference voltage values again. If you click **Go,** you can directly start taking measurements on coated samples.

Part and Operator Data

Operator  SysAdmin

Part #  cards

Lot #  123-A

Restart

Part #: cards          Upper limit:  11

Measurement #: 0 of 0   Lower limit:  1

Unit of Measure:   cds

Status

To begin measuring click Go.  To re-calibrate, click Recalibrate.

Go

Recalibrate      Measure

● DAC connected
● Calibrated
● Measurement taken
● Measuring

Thickness Data | Parts | Users | Configure | Files | Fastener Detection

Calibration Settings

DAQ Device   0:USB-1608FS

DAQ Voltage  -10 to +10 Volts

Reference #1  0        0.645  Volts

Reference #2  0       -0.004  Volts

Base measurement      1.777  Volts

Gain     1.902    Offset    0.399

Calibrate

Reference Gap Tolerance %    20

Algorithm
○ Cubic   ● Polynomial      Scroll Graph  □

DAQ Onboard Average  50

Network

This PC's network address:
192.168.10.102

Allow Connections  □

TCP Port  27410

Connections

Sensor Voltage

Number mask  ##0.000

Apply Mask

Start Probe Trigger Test

Continuous Voltage Display

About      Exit

i) If the selected part has not been calibrated before then the series of steps shown below demonstrates the calibration procedure.

j) Place the sensor over an uncoated sample (bare substrate) and click on the "Measure Base" button.

Status

Move sensor to base reference position.  When ready, click Measure.

Stop        Base

Retake      Measure Base

● DAC connected
● Calibrated
● Measurement taken
● Measuring
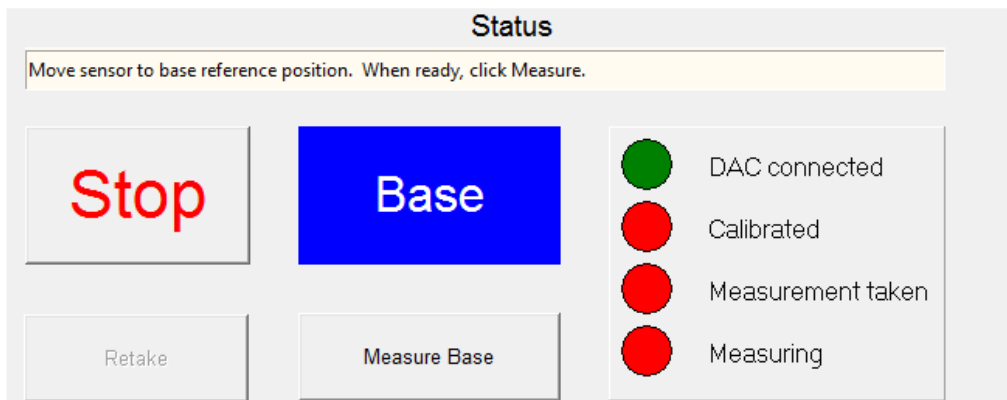
k) Place the sensor on reference thickness standard 1 and click on "Measure Reference #1" button. The value in blue shows the thickness of the reference standard.
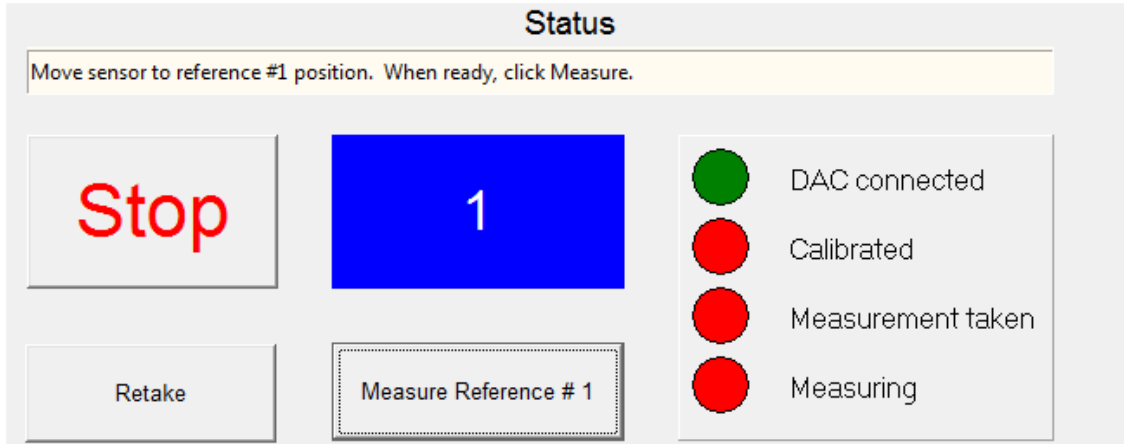
Continue taking the rest of the reference measurements. Note that the **Voltage Values** panel is updated with the measured voltage values. After the first reference is taken, the **Retake** button is enabled and allows the user to re-take the previously taken value. *It is highly imperative that all the reference voltage values are in an increasing order and the software will not allow the operator to progress further if the values are not in an ascending order*. (The voltage values might not be in an increasing order for increasing thickness if the probe is not positioned properly or if there is a deviation in the actual thickness of the standard from the thickness value used for reference value).
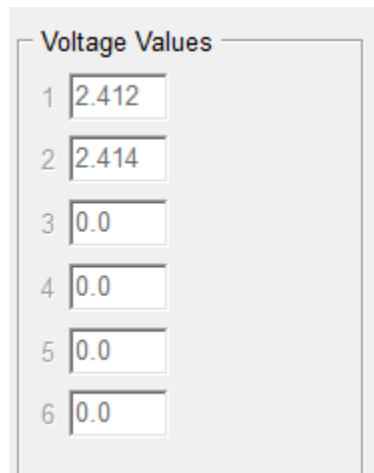


l) Once the reference values are taken, the calibration for that part is complete. Now same calibration can be used to measure coating thickness on a sample of unknown thickness. There is usually no need to recalibrate the part for a whole work shift. Now, place the coated sample to be measured under the sensor and click on "Measurement #1" button.
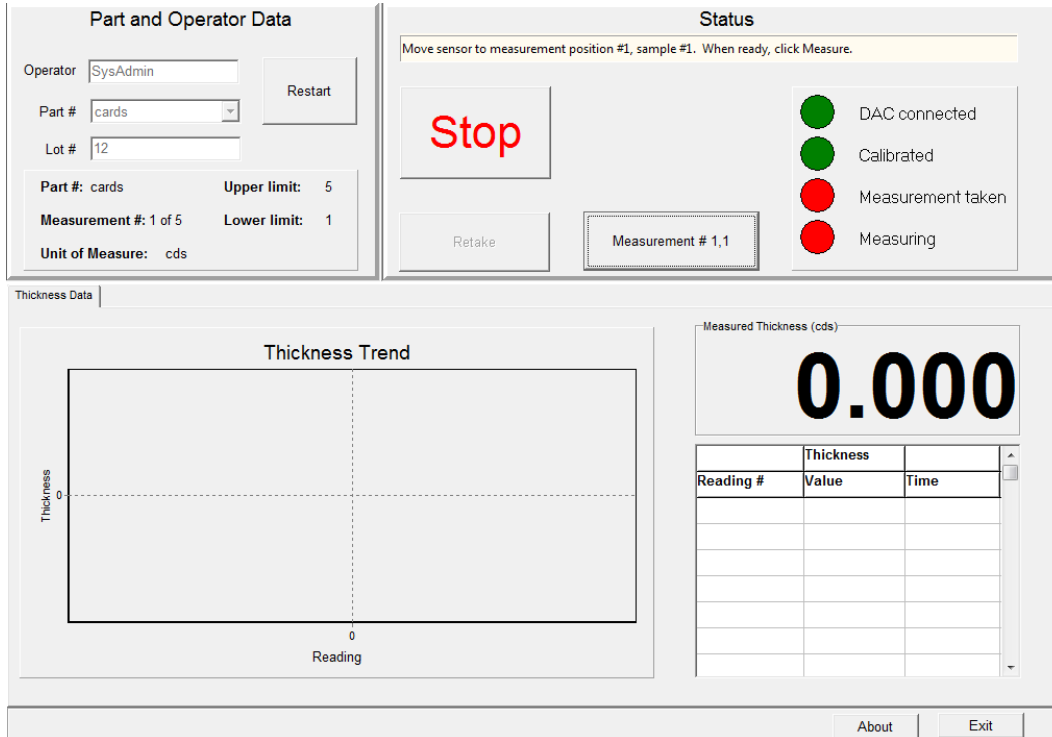
When the **Measurement #** button or the probe trigger is clicked, each measurement taken is displayed in the **Measured Thickness** panel, added to the **Thickness** string grid, and plotted on the **Thickness Trend** graph. The screen will look like the example below.
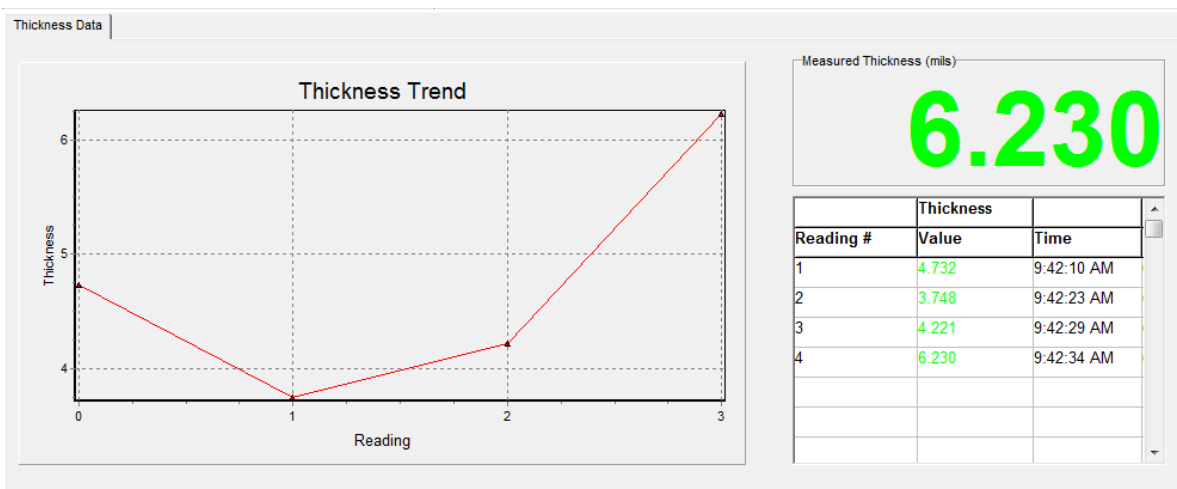


m) If the calculated thickness is greater than the **Upper limit** value, the screen displays the result as in the example below:
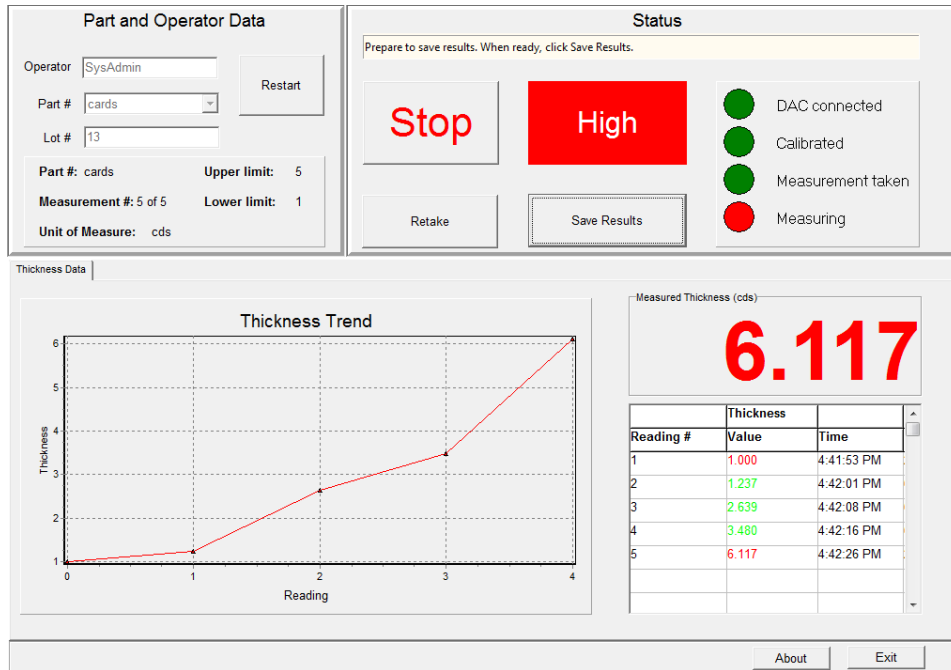
n) If the calculated thickness is lesser than the **Low limit** value, the screen displays the result as in the example below:
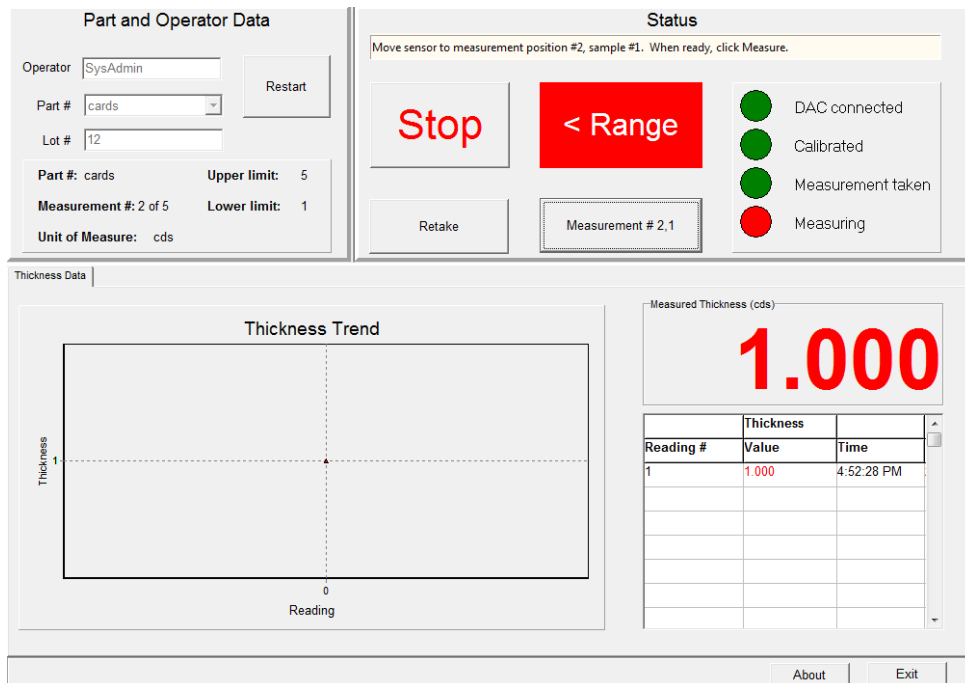


o) After the measurement set has been completed, select the "Save Results" button to save the measurements.

The results will be saved to an Excel spreadsheet.  The file name for above example would be:
**07241654**-**cards-12**-**SysAdmin**.**xls**.  This is:  month, day of month, hour of day, minute of hour – Part number-Lot number- Operator Name. The file will be saved in the directory C:\*DarkMetrix\Reports.*

## Adding New Users

An Administrator has the rights to add and delete users as well as the authority to set user privileges. A new User can be given *Administrator* rights or new user 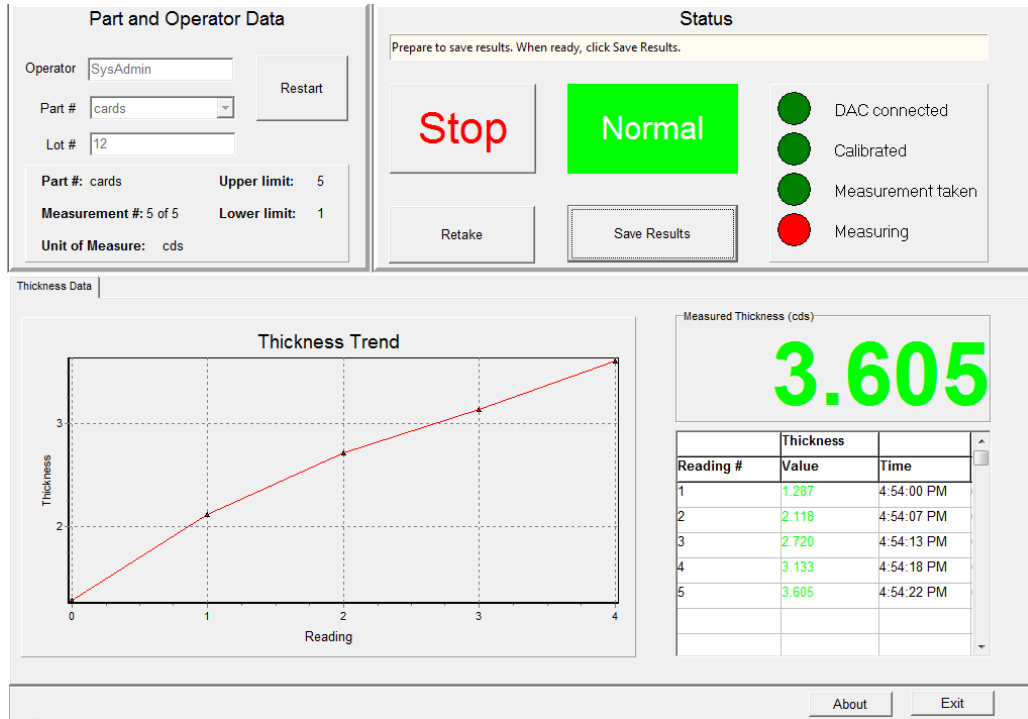can be designated as *Basic User.* An Administrator will also need to set up user name and passwords for the new user. A new user can be added under "*Users*" tab after the *Administrator* logs in. The following series of steps need to be followed for creating a new user:

- Enter new Username
- Enter Full Name of the user
- Enter Password
- Assign Security level using the drop-down menu
- Click on "Save" button and the software will automatically populate the "*Created*" field.

**Note:** *Any existing user accounts, created with previous versions of SpecMetrix® Dark software, can be edited to include password and authority level. Since existing accounts will have no password and authority level, they will not be able to access the system until a password and authority levels are assigned.*

**Excel report**

The Excel spreadsheet created includes the thickness values of the measurements along with Time, Date, Operator, Part# and Lot # information. An example of the report is shown below:

| | |
|---:|:---|
| **Date:** | 7/24/2017 04:54:22 PM |
| **Operator:** | SysAdmin |
| **Part #:** | cards |
| **Lot #:** | 12 |

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| Reading | mils | Time |
|---------|--------|-------------|
| 1 | 3.08 | 4:36:48 PM |
| 2 | 4.987 | 4:36:55 PM |
| 3 | 5.947 | 4:37:08 PM |
| 4 | 8.125 | 4:37:49 PM |
| 5 | 14.144 | 4:38:04 PM |
| 6 | 0 | 4:38:28 PM |
| 7 | 8.061 | 4:38:50 PM |
| 8 | 6.762 | 4:39:09 PM |
| 9 | 5.805 | 4:39:40 PM |
| 10 | 6.034 | 4:39:58 PM |

The Measurement table has three columns, the first column corresponds to the reading #, second column gives the units of measurement used and the third column reports the actual time the measurement was taken.

**Delete a part**
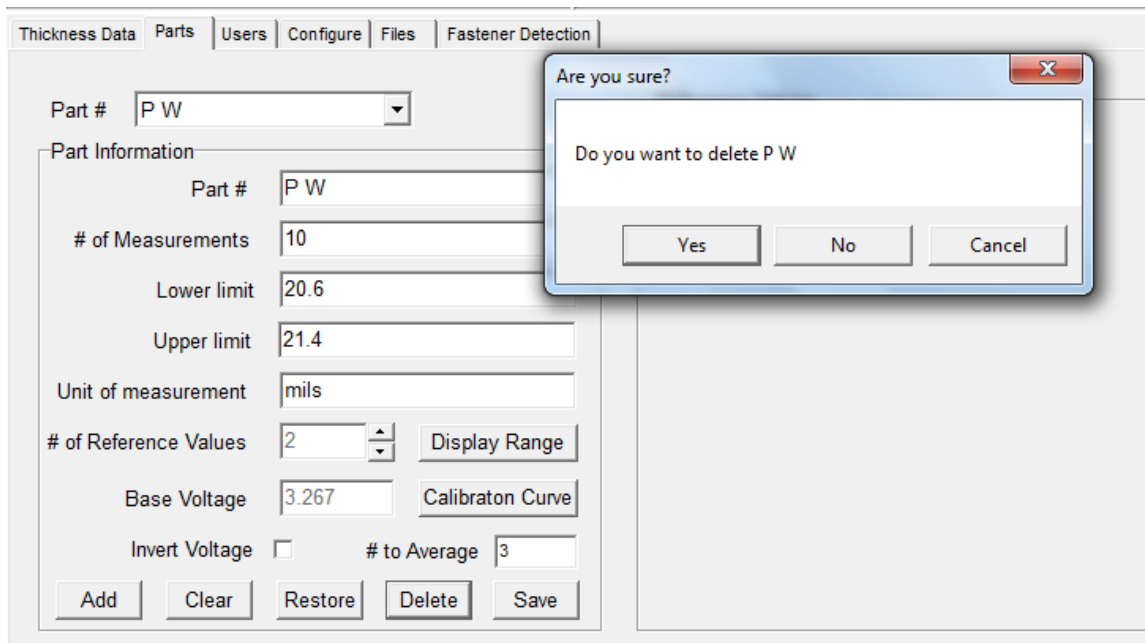


## To Delete a Part:

- Select the **Parts** tab
- Select a **Part #** that needs to be deleted, using the drop-down box.
- Select **Yes, No** or **Cancel** to confirm or reject your selection.

- Click **Save**.
- Clicking **Yes** deletes the selected part.  Clicking **No** or **Cancel** cancels the delete function
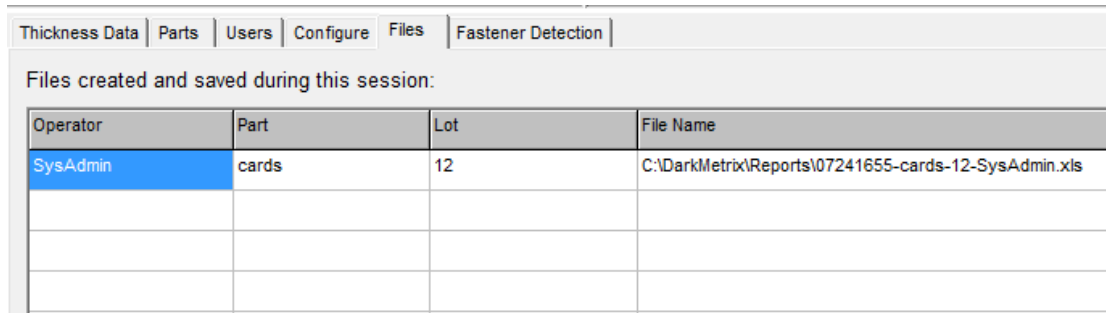
**Editing part Information**



To edit part information:

- Select the **Parts** tab
- Select a **Part #** that needs to be edited, using the drop-down box.
- Edit the information as needed
- Click **Save**.
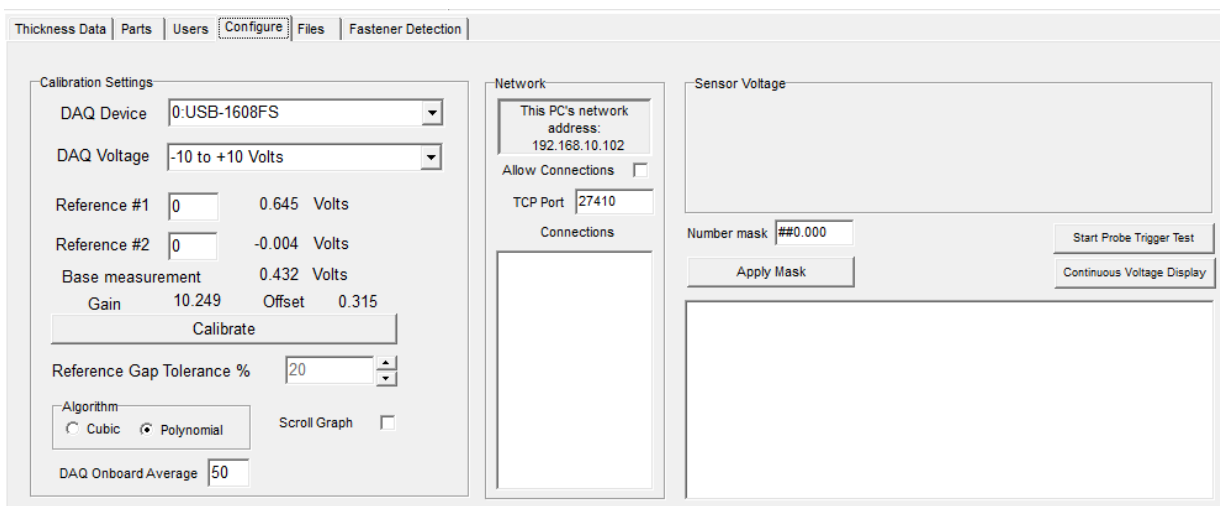
**Tabs**

## Files tab

The **Files** tab contains a list of files created during the current session. When the software is exited, this list is not preserved. See the example below:



## Configure tab

The **Configure** tab contains configuration options. Most are inappropriate for the user and are not enabled. See the example below. Only the account with administrative rights will be able to modify the information under this tab.



To change the format numbers are displayed throughout the application, modify the contents of the **Numeric mask** and then click **Apply** to save the changes. Mask characters include:

- **0 -** Digit place holder. If the value being formatted has a digit in the position where the '0' appears in the format string, then that digit is copied to the output string. Otherwise, a '0' is displayed in that position.
- **#** - Digit placeholder. If the value being formatted has a digit in the position where the '#' appears in the format string, then that digit is displayed. Otherwise, nothing is stored in that position.
- **.** - Decimal point. The first '.' character determines the location of the decimal separator in the formatted value; any additional '.' characters are ignored.

The probe trigger may be tested by clicking the **Start Probe Trigger Test** button. After clicking this button and engaging the probe trigger, the raw voltage returned from the probe is displayed in the **Sensor Voltage** panel. See the example below.
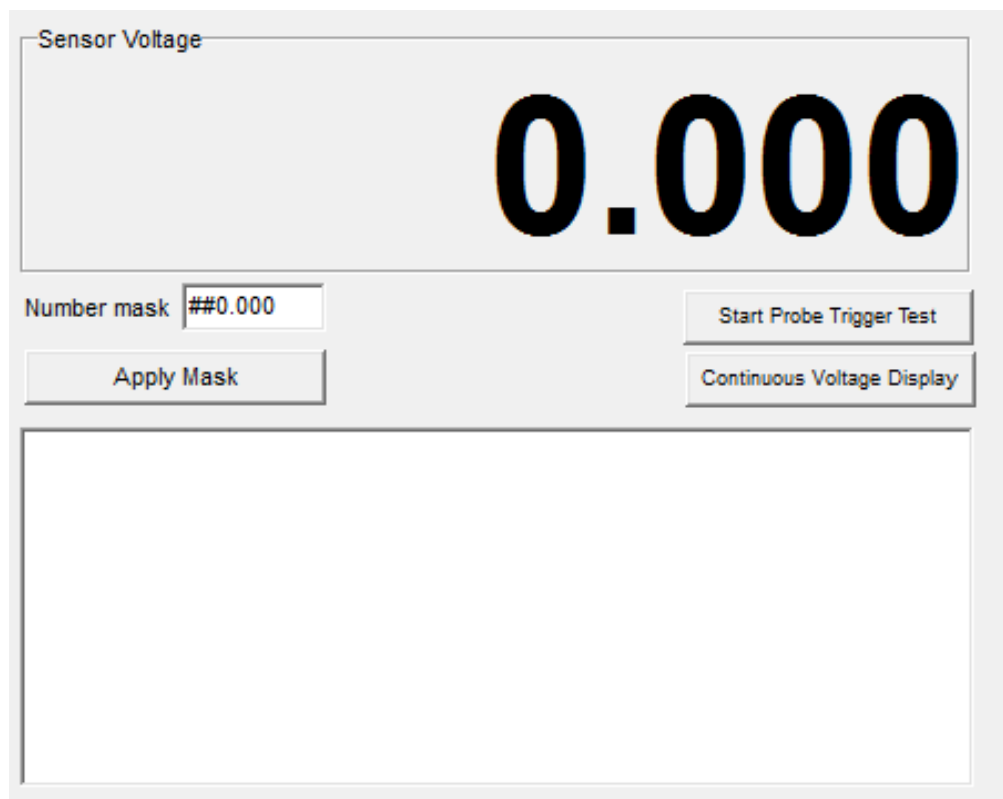
## Application buttons

The **Exit** button, in the lower right of the screen, exits the application.
The **About** button displays information about *SpecMetrix® Dark*.  See the example below.
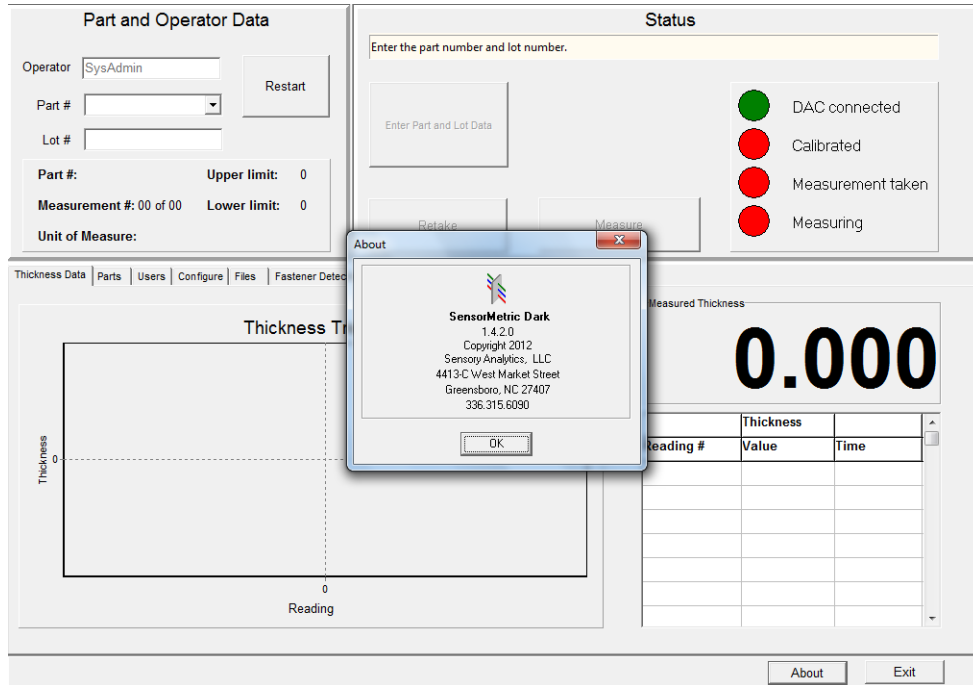


## Connecting the Sensor

Below is a picture showing how the sensor is connected to the side of the *SpecMetrix®* box.

**Network output functionality**

        *SpecMetrix® Dark* has support for transmitting data to a network listener application.  (A network listener application is an application, separate from *SpecMetrix® Dark*, which can receive output from the *SpecMetrix® Dark* application). To do this, *SpecMetrix® Dark* must be configured to listen for network connections on a user-definable TCP port.

        Likewise, the listener application must be configured to access *SpecMetrix® Dark*. To do this, you must know which port *SpecMetrix® Dark* is configured to accept connections on and the IP address of *SpecMetrix® Dark*.



        To configure *SpecMetrix® Dark* for a network listener application, access the application **Configure** tab.  The center panel, labeled **Network**, displays the *SpecMetrix® Dark* **IP address**. You will need this information when configuring the listener application.  IP Address and Port are displayed in the top portion of the **Network** panel, on the **Configure** tab:
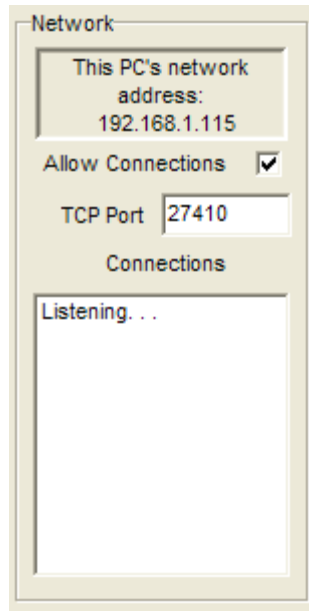
The box marked **Allow Connections** enables or disables network connections. The default TCP port that *SpecMetrix*® *Dark* will listen on is **27410**. This is an unassigned port on most networks. If this port conflicts with traffic or services available on your network, you can change the port by changing the value in the box labeled **TCP Port.**

When you have enabled connections, the center **Network** panel should look like the example above. The **Allow Connections** checkbox indicates that *SpecMetrix*® *Dark* is listening for a client application on port 27410. However, there are no connections listed in the box labeled **Connections.**

For this example, we will use the default Windows Telnet client to attach to *SpecMetrix*® *Dark*. We will also use the network address and port as in the examples above. Here, an assumption is made that both PCs (*SpecMetrix*® *Dark* and the listener) are connected to the same network. On the *SpecMetrix*® unit, *SpecMetrix*® *Dark* can be configured as described above.

On a PC other than the *SpecMetrix*® unit, execute the command:

**telnet -f telnet_record.txt 192.168.1.115 27410**

This will:
- Start the Windows telnet client.
- Record all I/O to a file in the local directory named **telnet_record.txt**.
- Attempt to establish a network connection to port 27410 at IP address 192.168.1.115. If this is successfully done, the client computer will display something like:

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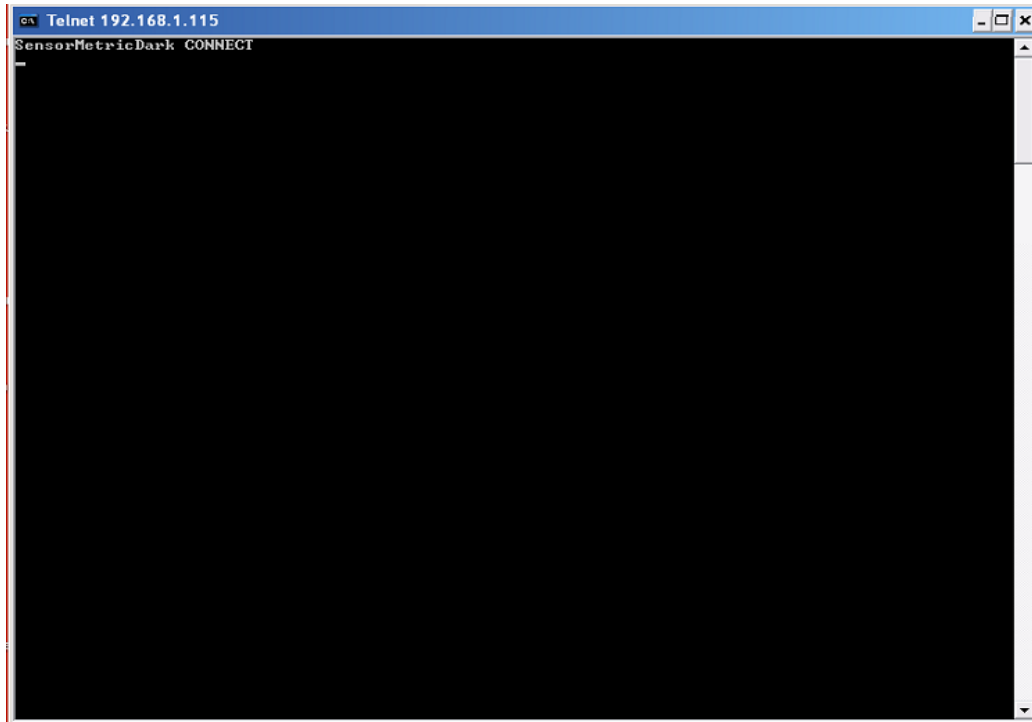
On the *SpecMetrix*® unit, the display will change to something like this:
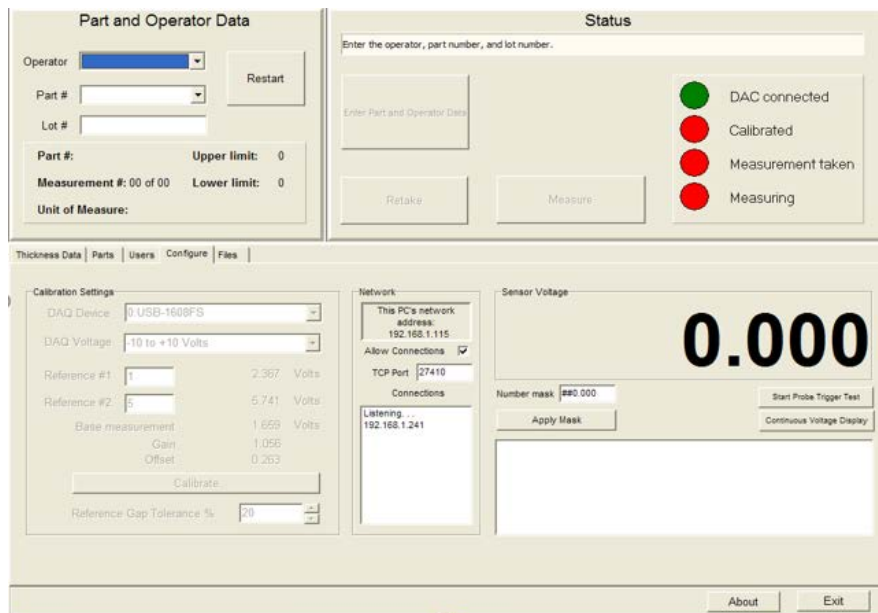


After the user selects an operator, part #, and lot #, the following screen is displayed on the *SpecMetrix*® Unit:
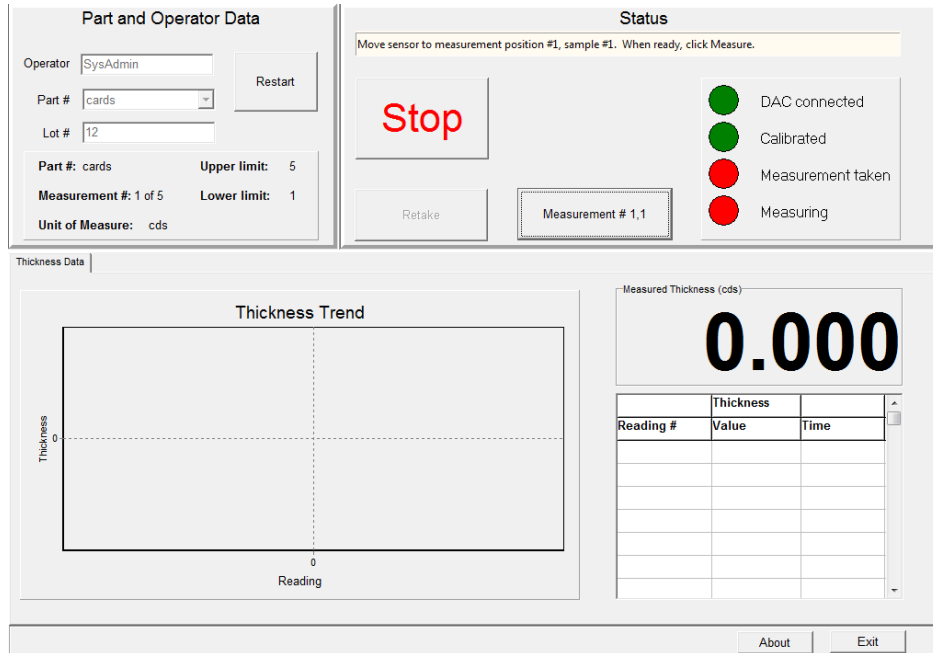
The listener application screen will display:



As the *SpecMetrix® Dark* user takes measurements, they are transmitted through the network connection to the listener application:

In this example, the traffic between Telnet and Sensor Metric Dark has been saved in a text file named **telnet_record.txt.** The contents of the **telnet_record.txt** file are**:**

```
           Date: 12/3/2017 8:27:07 AM
        Operator: Augie
          Part #: A New Part 113007
          Lot #: 1234
```

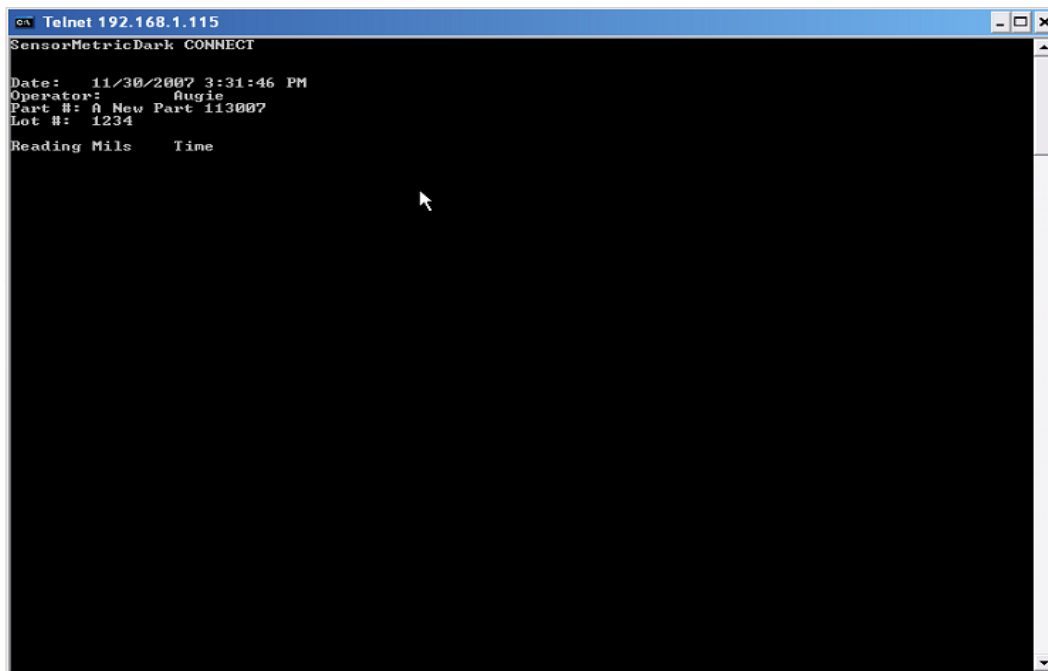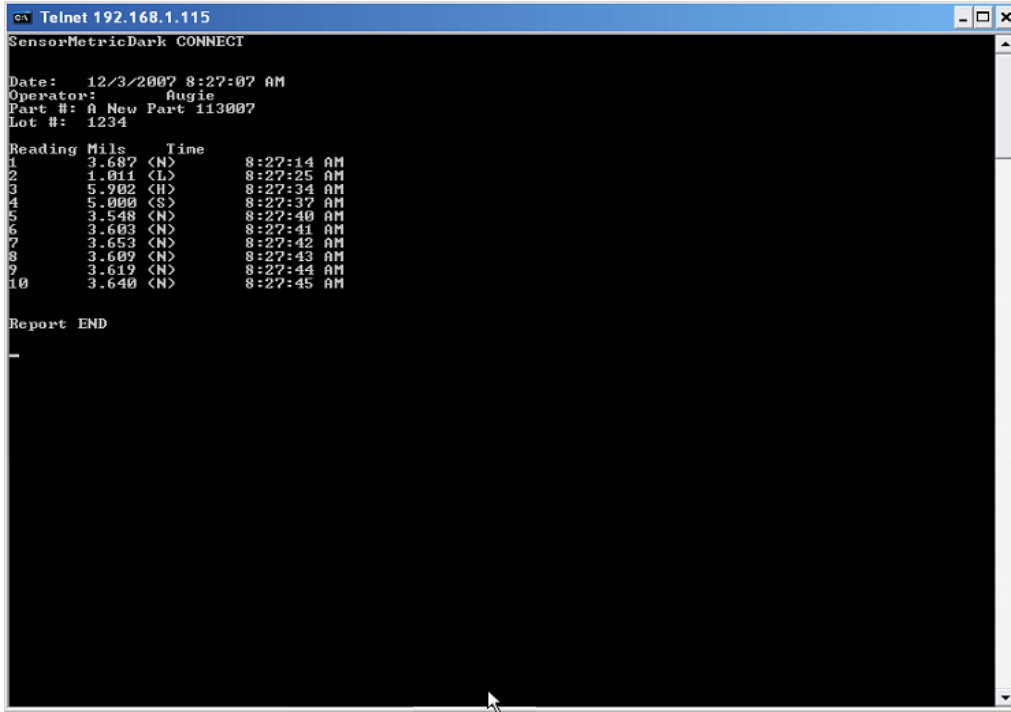|    | Reading | Mils | Time |
|----|---------|------|------------|
| 1  | 3.687   | N    | 8:27:14 AM |
| 2  | 1.011   | L    | 8:27:25AM  |
| 3  | 5.902   | H    | 8:27:34 AM |
| 4  | 5.000   | S    | 8:27:37AM  |
| 5  | 3.548   | N    | 8:27:40 AM |
| 6  | 3.603   | N    | 8:27:41 AM |
| 7  | 6.653   | N    | 8:27:42AM  |
| 8  | 6.609   | N    | 8:27:43 AM |
| 9  | 6.619   | N    | 8:27:44 AM |
| 10 | 3.640   | N    | 8:27:45 AM |

```
              Report  END
```

The data contained in the file is like the Excel report produced by *SpecMetrix® Dark.*  This includes a non-repeating header consisting of the *SpecMetrix® Dark* system date and the operator, part #, and lot # as selected by the operator.

Each data line includes the reading number, the calculated thickness, and the timestamp.

The column that records the thickness also includes the status of the calculated thickness, as it was displayed on the *SpecMetrix® Dark* screen. The system may display:

> **N** – *Normal*: the measurement is within the defined upper and lower limits
> **L** – *Low*: the measured thickness is less than the lower limit
> **H** – *High*: the measured thickness is above the upper limit
> **S** – *Saturated*: the sensor is saturated

## Calibration Curve

The calibration curve generated based on the reference voltages and reference thickness standards can be seen by clicking on *Calibration Curve* button under Parts tab.
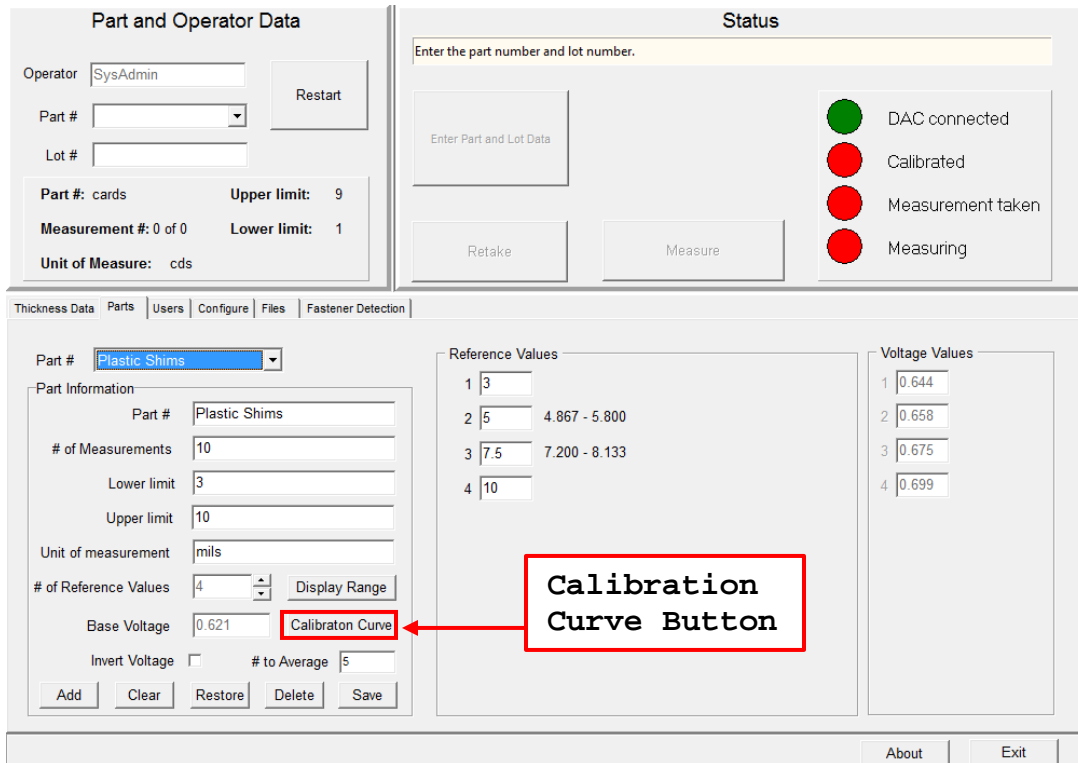


Depending on the magnitude of the voltage detected by a sensor on a sample of unknown coating thickness, the thickness of the sample will overlap with one of the points on the calibration curve. If an unusual shape is witnessed for a calibration curve, then it is most likely because of improper selection of reference thickness standards.

For the example curve shown below, two reference points are chosen at the *low limit* and two reference points at *high limit*, this will usually lead to an erroneous curve and hence the measurements will be erroneous. So, proper care should be taken to choose reference thickness standards which are reasonably uniformly spaced between *low limit* and *high limit*.
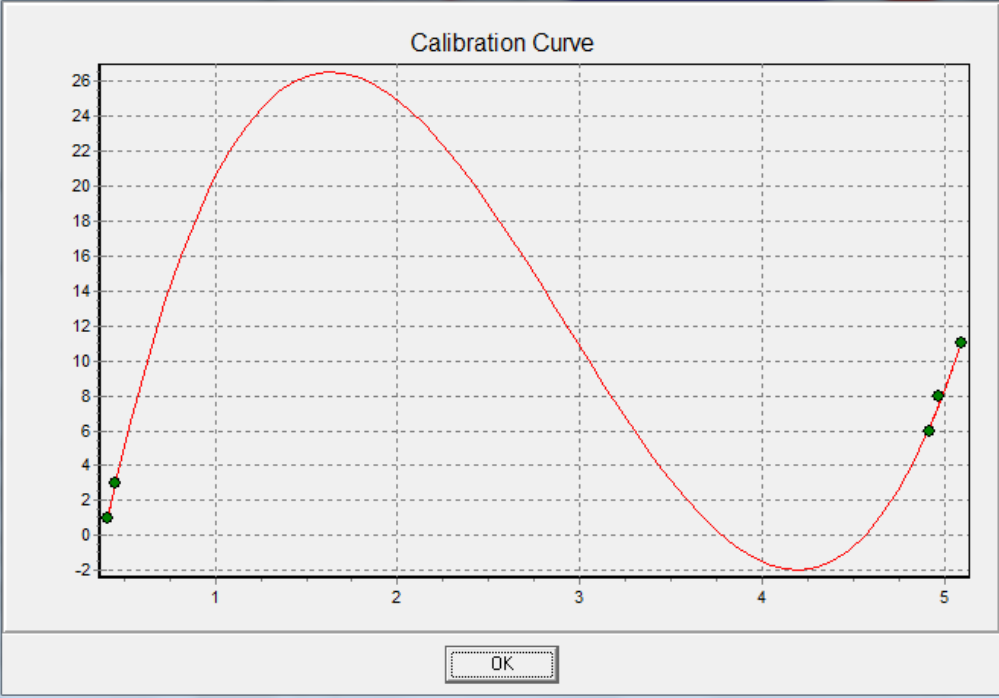
# *SpecMetrix Online Support*

To facilitate with any technical support needs that may arise, the *SpecMetrix®* unit includes provisions to connect remotely with support personnel at Sensory Analytics via the "TeamViewer" program. If the unit has an internet connection, establishing a remote connection with Sensory Analytics can be achieved by double clicking on the Team Viewer Support icon located on the desktop as shown below:



Clicking this icon will result in a pop-up window opening as shown below:
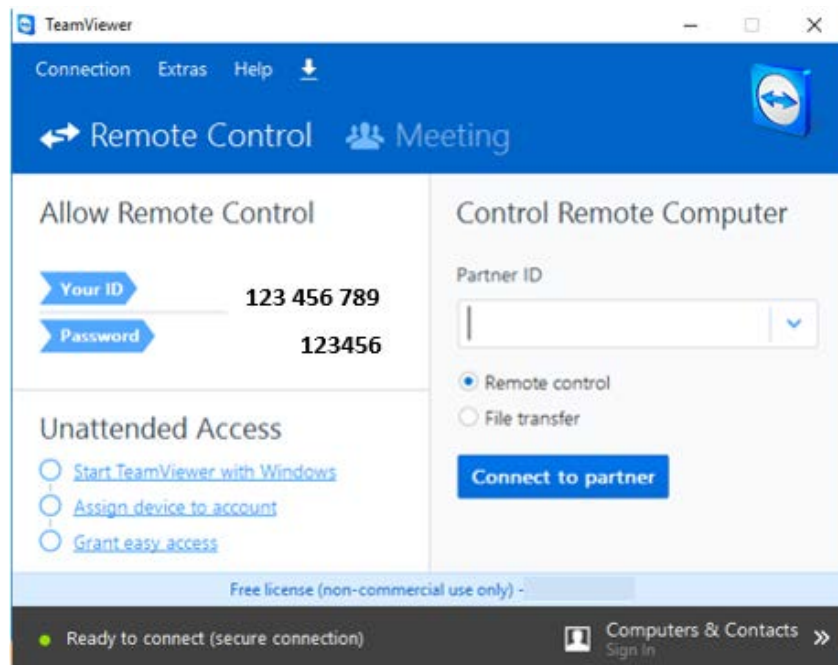


It is then necessary to contact Sensory Analytics with the 9-digit ID # as it appears in the Team Viewer Support window. This will allow the technical staff to remotely access the unit to assist with any operational needs.

*We trust that the above information will be sufficient to meet your training, operating and troubleshooting needs. However, in the unlikely case of any difficulties encountered in the operation of the SpecMetrix® Dark measurement system, please contact your area representative for immediate service, or contact SpecMetrix® Technical Support at:*

*(336) 315-6090 or support@specmetrix.com*