

MESURgauge Software



User's Guide

M A R K - 1 0®

Thank you!

Thank you for purchasing MESURgauge software, a data collection and analysis program developed to:

■ **Measure**

Collect data from digital force gauges, torque gauges, test stands, travel displays, and other devices.

■ **Graph**

View a real time graph of load vs. time or travel.

■ **Analyze**

View an analysis graph, calculate statistics, and zoom to selected locations on the graph.

■ **Store**

Save results to a file, or export directly to Microsoft® Excel™. Save and recall previously saved test data, test setups and gauge configurations.

MESURgauge expands the functionality of a Mark-10 testing system, typically comprising a test stand, force gauge, grips, and accessories. For details on communicating with an ESM301 motorized test stand, please refer to page 28.

This User's Guide provides detailed operating instructions. For additional information or answers to your questions, please do not hesitate to contact us. Our technical support and engineering teams are eager to assist you.

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1 STARTUP

1.1 Computer Requirements

A personal computer running Microsoft® Windows 2000 or later operating system, with screen resolution of 1024 x 768 minimum, is required to run MESURgauge software. An RS-232C serial port ("COM" Port) is required to communicate with a gauge. A second COM port is needed to communicate with a digital travel display. A CD-ROM drive is needed for software installation.

1.2 Installation Instructions

Insert the MESURgauge installation CD into the computer's CD-ROM drive. If *AutoRun* is enabled on the computer, the setup program will run automatically. If not, the setup program may be run manually. Click the **START** button on the Windows task bar, select "Run...", type "D:Setup" in the dialog box and press **ENTER**.

Alternately, using *My Computer* or *Windows Explorer*, navigate to the CD-ROM drive and double-click the file "Setup.exe".

Follow the prompts on the screen to install MESURgauge.

1.3 Running MESURgauge Software

When the installation is complete, run MESURgauge by clicking the Windows **START** button, locating "MESURgauge by Mark-10" under "Programs", and then clicking "MESURgauge".

Important Note About Windows Security Settings

Enable full Administrator privileges on your PC to ensure proper functioning of MESURgauge

For full functioning of MESURgauge, the permissions of the default installation folder must be set to *Full Control*. To access these settings, browse to the installation folder in *My Computer* or *Windows Explorer* (default is C:\Program Files\Mark-10 Software\). Right-click the folder, select *Properties*, select the *Security* tab, then enable *Full Control* for the appropriate Group or User Name.

If further instructions are required, consult with your information technology administrator.

1.4 MENU ITEMS (available in all tabs)

File

Factory Defaults – Click to restore the factory default settings.

Close – Click to exit MESURgauge.

Help

Show Tip Strips – Check this box to show “tip strips” (also known as “tool tips”). These are text boxes that appear when the cursor hovers over an object or area of the screen.

MESURgauge User’s Guide – Click to open the user’s guide PDF document. (Note: Adobe Reader is required and is downloadable at www.adobe.com).

Mark-10 Website – Click this to link to the Mark-10 website. (Note: An internet connection and a browser is required).



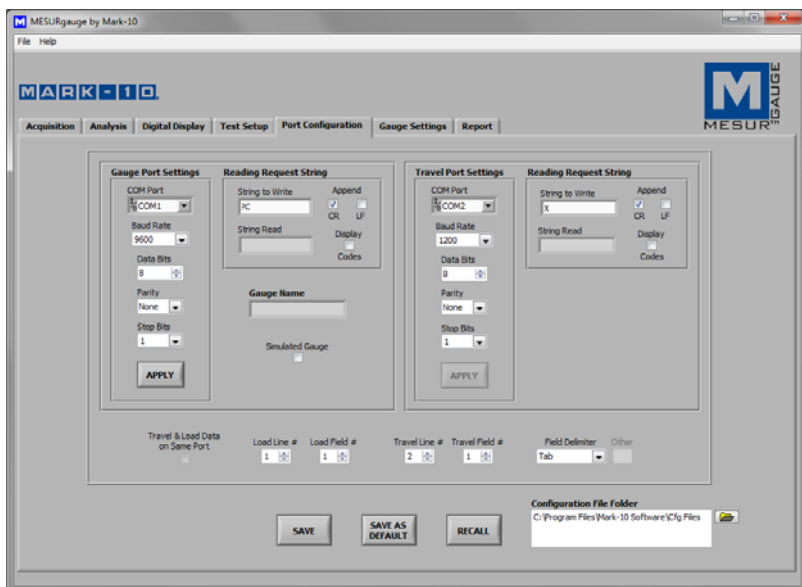
(About)

Click the MESURgauge logo to display general software information.

2 PORT CONFIGURATION TAB

Use this screen to configure the computer’s COM port settings to which the instruments are connected. The default settings are the same as the factory default settings for Mark-10 gauges. MESURgauge can be configured for the following configurations:

1. Single string of data on one COM port - typical for a force or torque gauge.
2. Two strings of data on two separate COM ports - typical for a manual test stand with force gauge and separate travel display option.
3. Two strings of data on the same COM port - typical for an ESM301 test stand with force gauge and integrated travel display option.



2.1 Gauge Port Settings

COM Port

Select the COM port that the instrument is connected to from the drop-down list. Clicking **REFRESH** updates the list with all installed ports. The COM port associated with the instrument can be identified under the *Ports* sub-section of *Device Manager* in *Windows*.

Baud Rate

Select the baud rate of the serial port. The default setting is 9600 baud. Be sure to configure the baud rate to match that of the instrument.

Data Bits

Select the number of data bits for the serial port, then click the **APPLY** button below. The default setting is 8 data bits.

Parity

Select the parity setting of the serial port. The default setting is "None" (no parity).

Stop Bits

Select the number of stop bits for the serial port. The default setting is 1 stop bit.

APPLY

Click this button to apply changes to the above settings.

2.2 Reading Request String

String to Write

Enter the command string to request a reading from the instrument. The default string is "?" (no quotes). Select either or both of the CR and LF check boxes to append the string as required. CR (default) or CR-LF may be used for Mark-10 gauges. The default string can be recalled by right-clicking in the box and selecting "Reinitialize to Default Value".

The ability to specify the request data command adds flexibility in testing. For example, peak or average readings may be read from the gauge. Additionally, it allows for the compatibility of MESURgauge with gauges not manufactured by Mark-10.

A different reading request string and other parameters are required when communicating with the ESM301 test stand and Series DC test stand controllers. Please refer to the section *Communicating With The ESM301 Test Stand*.

String Read

This is the raw character string read from the gauge.

Display Codes

Display control character '\ ' codes (\r = carriage return, \n = line feed, \s = space)

2.3 Gauge Name

Optionally enter a name to be associated with the gauge settings in this text box. This is helpful in identifying the particular gauge being used. This name is automatically entered in the file dialog box which opens when the **SAVE** configuration button is clicked. Any name may be used. For further information on saving, see the **SAVE** button description in Section 2.6.

2.4 Simulated Gauge

Check this box to simulate data being received from an instrument. No serial connection is needed to a gauge. To start collecting data, click the **Acquisition** tab and click the **START** button. Data will populate the graph and table at the specified rate. This is provided for demonstration purposes only.

2.5 Travel Port Settings

These settings apply to the second COM port. This COM port is intended for use with an external digital travel display. The information about the settings in Section 2.1 (Gauge Port Settings) also applies to this section.

2.6 Travel & Load Data on Same Port

Check this box for MESURgauge to accept two strings of data on one COM port, required when sending force and travel data from an ESM301 test stand. Configure the data string as required by selecting the appropriate line numbers, field numbers, and field delimiter. The default settings apply to Mark-10 test stands.

2.7 Configuration File Folder

Enter a full path or browse for a folder to use for Gauge Configuration (*.cfg) files. To browse for a folder, click the folder icon at the right of the text box and navigate to or create the desired folder, then click the "Current Folder" button in the dialog box.

2.8 Shared Buttons

SAVE

Click this button to open a file dialog box prompting to save the current settings to a configuration file (this file has a .cfg extension). Any file name may be entered and any folder may be selected or created.

SAVE AS DEFAULT

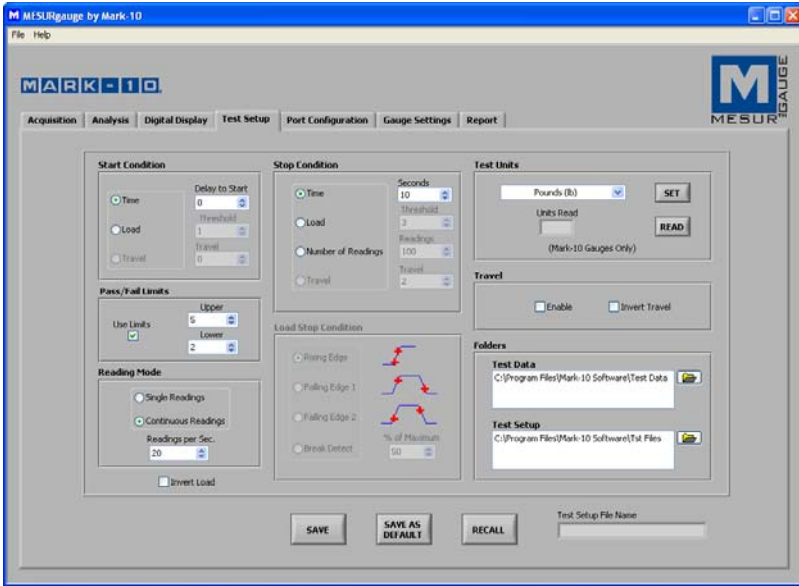
Clicking this button saves the current settings to the default configuration file "Default.cfg". (No file dialog box opens.)

RECALL

Click this button to open a dialog box in which to browse for previously saved configuration files. Parameter fields will be populated based on the information in the configuration file.

3 TEST SETUP TAB

Use this tab to configure various parameters for the test. This includes test start and stop conditions, pass/fail limits, selection of continuous or discrete readings, and data sampling rate.



3.1 Start Condition

Select an option button for time delay, load threshold, or travel to begin the test.

Time

Set time delay, in seconds, to begin the test.

Load

Set a load threshold to begin the test (The load units are as specified in the **Select Units** drop-down list box in the upper right area of this tab).

Travel

Set a travel threshold to begin the test. The second COM port must be enabled for this selection to be made (the travel units are as specified with the **Inches / Millimeter** option buttons in the right-center area of this tab).

3.2 Stop Condition

Select an option button for time, load, the number of readings, or travel to stop the test.

Time – Seconds

Set the duration of the test, in seconds.

Load – Threshold

Set the load threshold at which to terminate the test (the load units are as specified in the **Select Units** drop-down list box in the upper right area of this tab). See **Stop Threshold Options** below for various load stop threshold options.

Number of Readings – Readings

Set the number of readings at which to terminate the test.

Travel

Set the travel threshold to end the test. The second COM port must be enabled for this selection to be made (the travel units are as specified with the **Inches / Millimeter** option buttons in the right-center area of this tab).

3.3 Load Stop Condition

Four test stop options based on load threshold are available:

Rising Edge

Stop threshold is higher than the start threshold (increasing load).

Falling Edge 1

Stop threshold is lower than start threshold (decreasing load).

Falling Edge 2

Stop threshold is higher than Start threshold, but the load is decreasing.

Break Detect

Stop the test when the load decreases to a specified percentage of the maximum (peak) reading during the test.

3.4 Reading Mode

Single Readings

When this option is selected, single readings are taken from the gauge each time **READ** is clicked, or the **DATA** button on the gauge is pressed. This button appears below the graph in the **Acquisition** tab when this option is selected.

Continuous Readings

When selected, readings are taken from the gauge at a rate set in the *Readings per Second* field.

Readings per Second

This numeric box sets the number of readings per second that MESURgauge requests data from the gauge in the “Continuous Readings” mode. Available range is 0.001 to 50 readings per second.

Note: When using a Mitutoyo brand travel display, it is recommended to limit the readings per second at 2, to prevent communication errors.

3.5 Invert Load

Check this box to invert the polarity (sign) of the load reading. This is useful, for example, in tensile strength testing. Tension readings, which have a negative sign, can be reversed so that the graph shows increasing values instead of decreasing values.

Note: There is another instance of this check box in the Acquisition tab. Checking one box automatically checks the other.

3.6 Test Units

Note: Reading and setting units is possible with Mark-10 gauges only.

Select Units

The gauge’s unit of measurement can be set by clicking on the appropriate selection from the drop-down menu.

SET

Sets the gauge to the units of measurement selected.

READ

Reads the unit of measurement to which the gauge is currently set.

Units Read

Displays the unit of measurement to which the gauge is currently set.

3.7 Travel Port

This section refers to the input of travel data in addition to load data. Data may be received from an external travel display or through the integrated encoders from certain Mark-10 test stands. Travel readings are tabulated and plotted vs. load instead of load vs. time.

Enable

Check this box to enable the second COM port for travel data collection. The settings for this port can be configured in the **Port Configuration** tab.

Invert Travel

Check this box to invert the polarity (sign) of the readings from the travel display.

3.8 Pass / Fail Limits

Check this check box to enable high and low indicators for go / no go type testing. When checked, *Pass*, *Fail High*, and *Fail Low* indicators appear in the Acquisition tab, below the **STOP** button.

3.9 Folders

Enter full paths or browse for folders to use for Test Data (*.log) and Test Setup (*.tst) files. To browse for a folder, click the folder icon at the right of the text box and navigate to or create the desired folder, then click the "Current Folder" button in the dialog box.

3.10 Shared Buttons

SAVE

Opens a file dialog box in which to save the current settings to a test setup file (.tst extension). Any file name may be entered and any folder may be selected or created.

SAVE AS DEFAULT

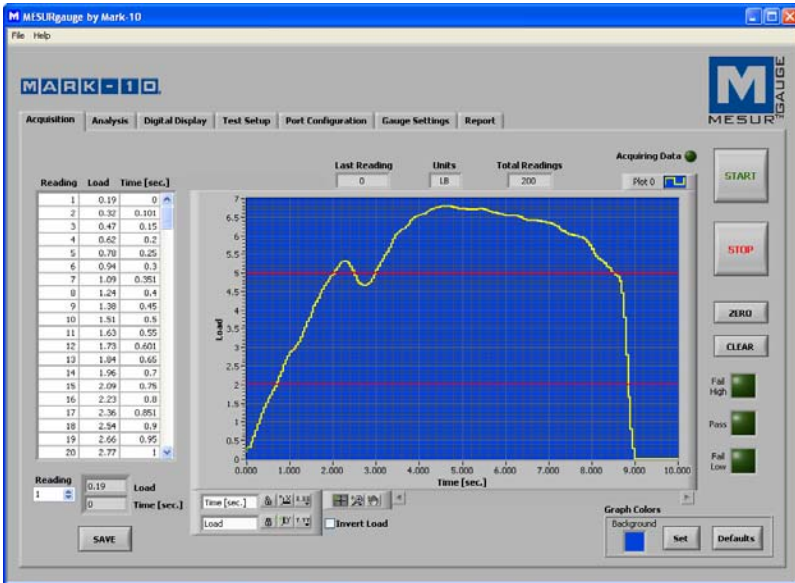
Clicking this button saves the current settings to the default test setup file, "Default.tst".

RECALL

Click this button to open a dialog box in which to browse for previously saved test setup files. Parameter fields will be populated based on the information in the test setup file.

4 ACQUISITION TAB

Use this tab to view tabular and graphical data from a gauge as it is being received. When the **START** button is clicked, data will be graphed and tabulated as they are being received. The test ends automatically when the stop condition in the **Test Setup** tab is met. The test can also be ended at any time by clicking the **STOP** button. Specific load and time (or travel) data points are displayed in the fields below the table.



4.1 START

Starts a test. Readings from the gauge are captured when the start condition in the **Test Setup** tab is met. When data is being captured, the “Acquiring Data” indicator above the **START** button turns on (bright green).

4.2 STOP

Stops a test. The test will stop automatically when the selected stop condition in the **Test Setup** tab has been met. When the test is completed, the “Acquiring Data” indicator will turn off (dark green).

4.3 Table

Contains the reading number, load reading from the gauge, and relative time stamp (or travel datum) for each data point. Scroll to, or manually enter, the desired reading in the *Reading* box to display corresponding load and time (or travel) data in the indicators to the right.

4.4 SAVE

Click this button to open a file dialog box in which to save the data from the table to a tab-delimited text file. Enter a file name and optionally browse to any desired folder location. The default file folder location for the test data files is set in the *Test Data Folder* box in the **Test Setup** tab. After saving, the file can then be opened by common Windows programs such as Notepad and Excel. Note: Saving cannot be performed until the test has been completed.

4.5 Last Reading

The most recent reading received from the gauge.

4.6 Total Readings

The total number of readings taken during the test.

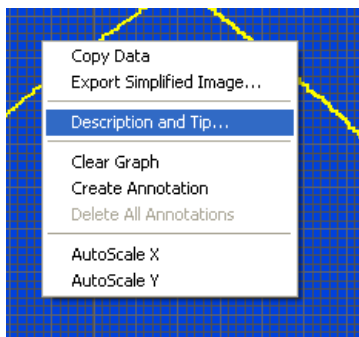
4.7 Units

The unit of measurement received with the data (the gauge[s] must be configured to send units information).

4.8 Graph

The graph plots load versus time or load versus travel (time is default). Scale minimum and maximum values can be set by double-clicking on the numerals long the X and Y axes. Change the numbers to the desired values and press ENTER or click away from the numbers.

Several options are available by right-clicking anywhere within the graph. A pop-up menu appears as follows:



The menu items are provided for quick access and convenience to some common functions. The AutoScale X and Y items are equivalent to the “padlock” icon on the scale palette at the lower right of the graph, described below.

4.9 Tools (under the graph)

View



Clicking on this button brings up the following six viewing options:

	Set a zoom window with adjustable x- and y-dimensions for a specific part of the graph
	Set a zoom window with adjustable x-dimension for a specific part of the graph
	Set a zoom window with adjustable y-dimension for a specific part of the graph
	View entire graph
	Zoom out
	Zoom in

Pan



This allows the user to reposition the graph. Click on the graph, move the mouse to the desired location, and release the mouse button.

4.10 X- & Y-scale Settings

Auto-scale lock



When in the locked position, the scale is in auto-scale mode (default).

Auto-scale



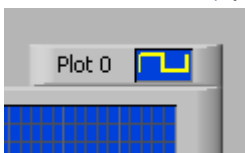
Click to auto-scale the axis.

Scale & grid properties

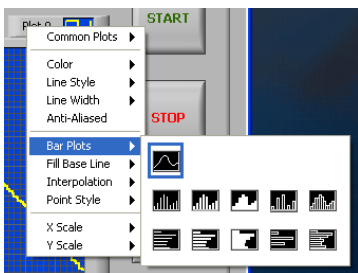


Click to adjust various scale and grid properties. A pop-up context menu provides access to these properties.

4.11 Plot Palette (upper right corner of the graph)

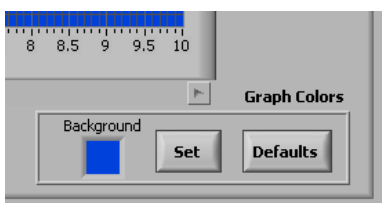


Several plot options are available by clicking on the Plot Palette icon. A menu of options will appear as follows:



Plot settings and graph properties can be configured as desired.

4.12 Graph Colors



Background Color Picker Box
Select the background color of the graph.

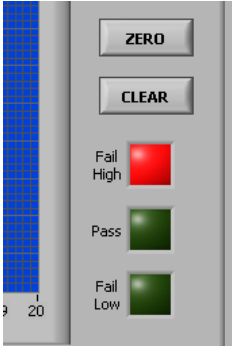
Set
Sets the graph to the selected background color.



Defaults
Restores the background, plot, and grid colors to factory defaults.

4.13 Pass/Fail Indicators

When the *Use Limits* check box in the *Pass/Fail Limits* frame in the **Test Setup** tab is checked, the Pass/Fail indicators, shown below, become visible. While acquiring data, the load values received are compared to the upper and lower limits set in the Test Setup tab, and the appropriate indicator illuminates. A fail condition is represented by a bright red indicator. A pass condition is represented by a bright green indicator.



4.14 Pass/Fail Limit Lines

Horizontal lines corresponding to the pass/fail limits set are displayed on the graph in red.

4.15 Invert Load

See Section 3.5.

4.16 Invert Travel

This checkbox is not visible unless the travel port is enabled in the Test Setup tab. For details see Section 3.7.

4.17 CLEAR

Sends a command to a Mark-10 gauge to clear peaks and start a new average or external trigger test (if so enabled).

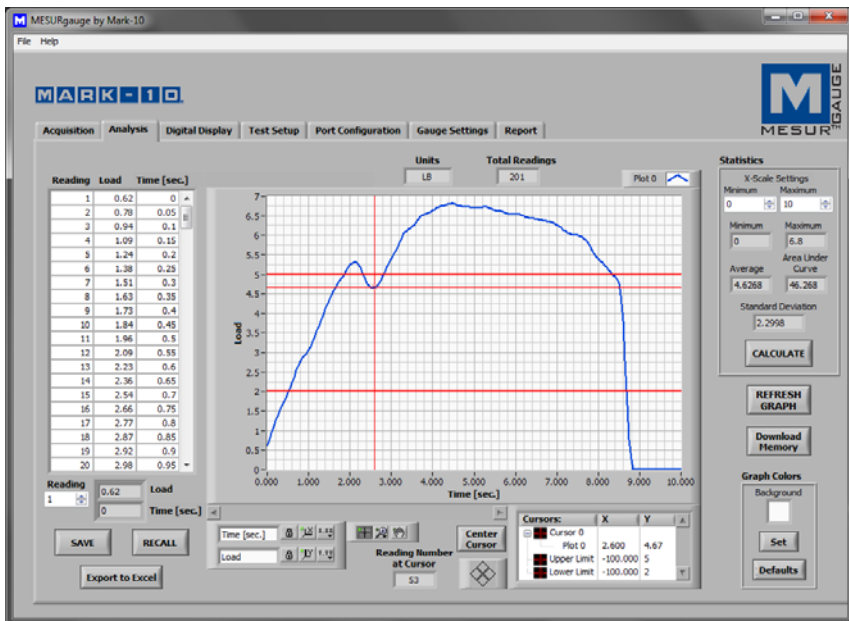
4.18 ZERO

Sends a command to a Mark-10 gauge to zero the display and perform the **CLEAR** function, as described above.

The **ZERO** and **CLEAR** buttons in MESURgauge perform the same functions as the **ZERO** and **CLEAR** buttons on Mark-10 gauges.

5 ANALYSIS TAB

This tab is used to analyze the data obtained during a test. Saved data in a Series 5 or Series 4 may also be downloaded into this tab. Statistics are calculated and displayed automatically upon completion of the test or download of saved data. The graph cursor tools can be used to zoom to a specific area of the graph. Statistics may then be calculated for that region of the graph. Graph and table data from the *Acquisition* tab is automatically transferred to this graph and table when the test has been completed.



5.1 Graph

Graph functionality and tools are the same as in the **Acquisition** tab, with one additional active icon:

Cursor Movement Tool



Clicking this button allows the X-Y cursor to be dragged to the desired position.

Pass/Fail Limit Lines

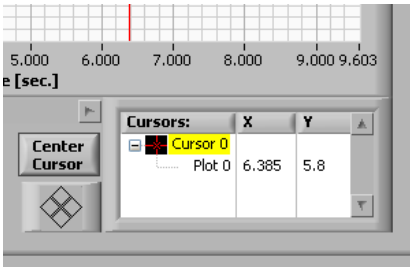
Horizontal lines corresponding to the pass/fail limits set are

displayed on the graph in red.

5.2 REFRESH GRAPH

Redraws the graph based on the data collected during the test.

5.3 Cursor Palette



Center Cursor

Centers the cursor in the graph area.

Cursor Control



Click on the quadrants of this icon to move the cursor in the corresponding direction.

Cursor Table

Displays the cursor position's X and Y values.

Reading Number at Cursor

Reading number corresponding to the current position of the cursor.

5.4 Download Memory

Downloads saved data from a Series 5 or Series 4 gauge. The gauge must be in the main operating mode (i.e. not in a menu or configuration area). A communication error message will appear if an incompatible gauge is used or if a Series 5 or 4 gauge is not in the main operating mode.

5.5 Graph Colors

The graph color selection functionality is the same as described in the Acquisition tab.

5.6 Statistics

This frame displays statistical data for the test.

Maximum

The maximum load reading measured during the test.

Minimum

The minimum load reading measured during the test.

Average

The average (mean) of the readings. Note that in situations where load fluctuates between positive and negative values, this function considers polarity, not the absolute values (for example, the average of +5 and -5 is calculated as 0).

Area Under Curve

The average of the absolute values of the load readings multiplied by the selected time interval.

Standard Deviation

The standard deviation for the acquired data.

The above statistics are based on the data range specified in the X-scale Settings frame. This range defaults to the full range at completion of the test. This range can be modified by entering the desired range in the Minimum and Maximum numeric boxes. Click the **CALCULATE** button to calculate the statistics for the specified range. The graph will automatically adjust to reflect the new range.

5.7 Table

The table functionality is the same as described in the **Acquisition** tab.

5.8 RECALL

Opens a file dialog box prompting to recall a previously saved test data file. The table and graph will be populated with the previously saved data, and the statistics will automatically be calculated.

Note: When recalling a test which used the travel port for travel measurement, or single readings, those options must be selected in the **Test Setup** tab in order for the x-axis label of the graph and the statistics to be displayed correctly.

5.9 SAVE

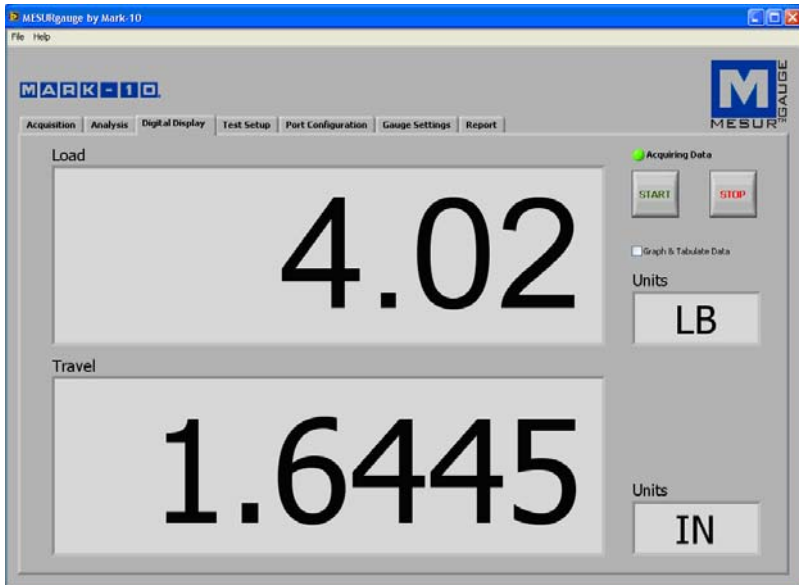
Opens a file dialog box prompting to save the data from the table to a tab-delimited text file. Enter a file name and optionally browse to any desired folder location. The default file folder location for the test data files is set in the **Test Data Folder** box in the **Test Setup** tab. After saving, the file can then be opened by common Windows programs such as Notepad and Excel.

5.10 Export to Excel

Clicking this button launches Microsoft® Excel™ (if installed, sold separately) and populates a worksheet containing reading numbers, load, and time or travel directly into a worksheet.

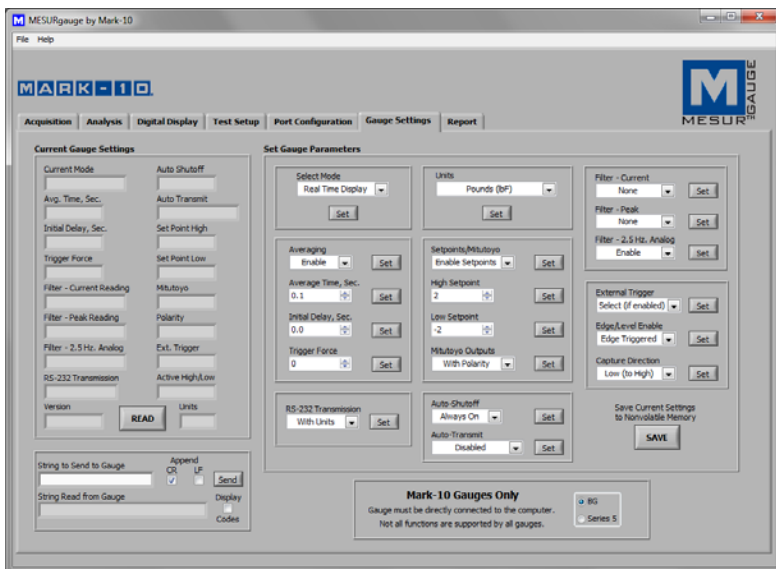
6 DIGITAL DISPLAY TAB

This tab is provided to display real time load readings (and, if the travel port is enabled, travel readings) in large numerals. If the “Graph and Tabulate Data” check box is checked, the graph and table in the Acquisition tab is populated. See image below:



7 GAUGE SETTINGS TAB

This tab provides a convenient utility with which to read and set gauge configuration parameters from a PC. Settings are applicable only for Mark-10 Series BG/CG and Series 5 gauges. Select the appropriate gauge at the bottom right corner of the screen. Changes may only be made if the gauge is **connected directly to the PC** (i.e. not through a test stand such as the ESM301). Refer to your gauge's user's guide for details on the various parameters. In the lower left-hand part of the screen, it is possible to enter commands to send to any gauge via the primary serial port. This facility allows the user to communicate with any gauge.



7.1 READ

Populates the fields above with current settings from a Mark-10 gauge.

7.2 SAVE

Saves the current gauge settings to the gauge's non-volatile memory. These will be the default settings when the gauge powers on.

Note: The desired settings must be individually written to the gauge (by clicking the **Set** button adjacent to the parameter menu) before clicking **SAVE**. It is recommended to click the **READ** button to confirm the current settings before clicking **SAVE**.

7.3 Set Buttons (all)

Click to set the Mark-10 gauge with the parameter selected from the drop-down menu adjacent to the respective **Set** button.

7.4 String to Send to Gauge

Enter a command to send to the gauge via the primary serial port. This facility allows the user to communicate with and send commands to any gauge. Click **Send** to send the command.

7.5 String Read from Gauge

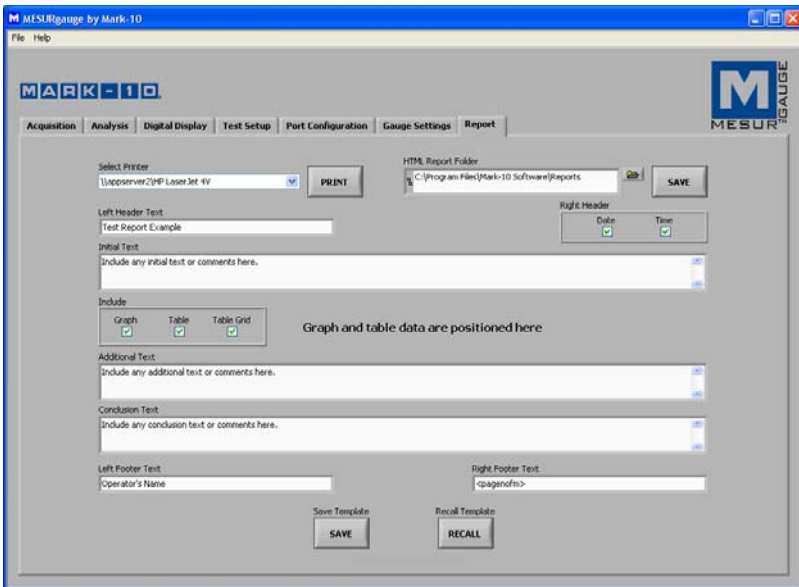
This text box shows the response string, if any, that is received in response to the above command.

7.6 Display Codes

Display control character '\ ' codes (\r = carriage return, \n = line feed, \s = space).

Note: This tab and all gauge-related functions cannot be used while MESURgauge is collecting data from an ESM301 test stand. See Section 9 for details on communicating with the ESM301.

8 REPORT TAB



Use this tab to set up a report for the test. The report may be printed to the selected printer or saved as an HTML file. A report template may be saved and recalled.

8.1 Select Printer

Select the printer to which the report will print. The Windows default printer is selected initially.

8.2 PRINT

Prints the report on the selected printer.

8.3 HTML Report Folder

Enter or browse for a folder in which to save the report files.

8.4 SAVE

Opens a file dialog box prompting to save the report. Enter a file name and optionally browse to any desired folder location. The default file folder location for report files is set in **HTML Report Folder**, as described above.

8.5 Left Header Text

Enter text to appear in the upper left corner of the report. The text will appear as **bold** in the report.

8.6 Right Header Check Boxes

Check the Date and/or Time boxes to include the current date and/or time in the right header of the report. Date and time will appear as **bold** in the report.

8.7 Initial Text

Enter any initial text here.

8.8 Additional Text

Enter any additional text here.

8.9 Conclusion Text

Enter any concluding text here.

8.10 Left Footer Text

Enter text to appear in the lower left corner of the report. The text will appear as **bold** in the report.

8.11 Right Footer Text

Enter text to appear in the lower right corner of the report. The text will appear as **bold** in the report.

Use the above text boxes to enter information and comments pertaining to the test. This information can be saved to a file as a template and can be recalled.

8.12 Include Graph

Check this check box to include an image of the graph in the report.

8.13 Include Table

Check this check box to include the table data in the report.

8.14 Include Table Grid

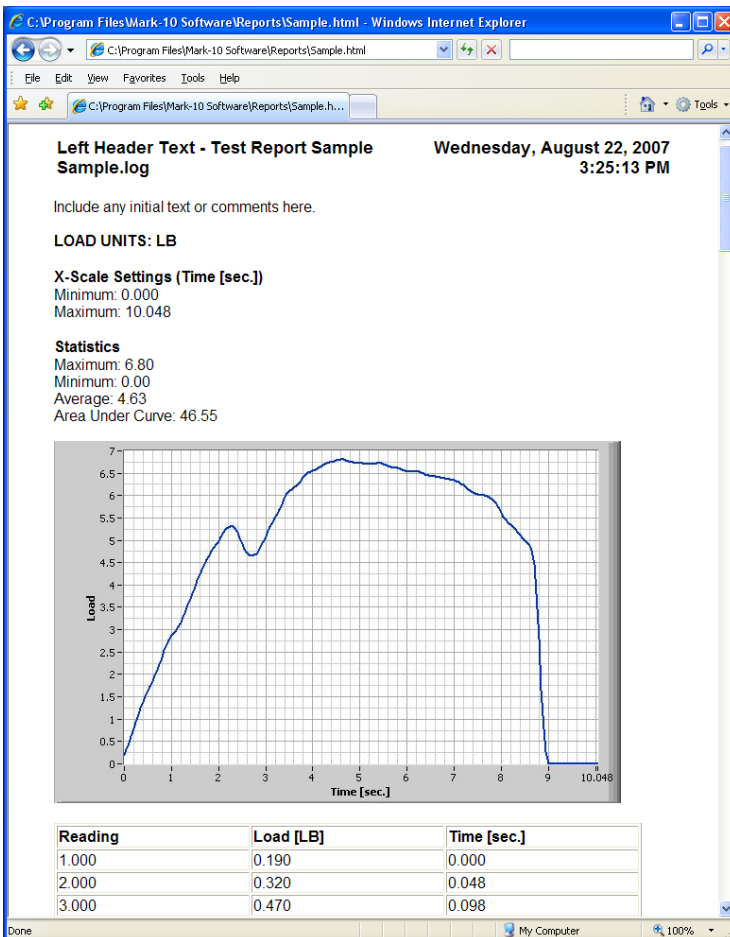
Check this check box to include a grid for the table.

8.15 Save Template

Saves a template of all the information in the text boxes and selected settings to a file for recall.

8.16 Recall Template

Recalls a previously saved template. A sample HTML report is shown below as it would appear in a browser:



9 COMMUNICATING WITH THE ESM301 TEST STAND / DC4040 CONTROLLER

MESURgauge can collect data from an ESM301 test stand or DC4040 controller (used with motorized torque test stands). The test stand controller can output either force data only or force data combined with travel data. To communicate with MESURgauge, certain settings in the test stand, force/torque gauge, and software must be changed as follows:

9.1 Load data only

1. Check cable connections (refer to the stand/controller user's guide).
2. Gauge settings (refer to the gauge's user's guide).
 1. Disable Mitutoyo BCD output (Series BG gauges only).
 2. Set the gauge baud rate to 9,600.
3. Test stand settings
 1. Set the baud rate to 115,200.
 2. Set the Control mode to Console.

9.2 Load and travel data simultaneously

1. Check cable connections (refer to the stand/controller user's guide).
2. MESURgauge settings
 1. Test Setup tab
 1. Under *Travel* check the *Enable* box. Under *Reading Mode*, if *Continuous Readings* is selected, *Readings per Sec.* defaults to 4. This value can be increased.
 2. Port Configuration tab
 1. Identify a working COM port, and select the appropriate port in *Gauge Port Settings*. Refer to *Windows Device Manager* to determine the COM port assigned by *Windows*.
 2. Under *Gauge Port Settings*, change baud rate to 115,200.

3. Under *Reading Request String* change *String to Write* to "n" (lowercase, no quotes). Uncheck the CR box.
 4. Check the box labeled *Travel & Load Data on Same Port*. No changes are needed to the default lines, fields, and delimiter.
 5. Click APPLY after making any changes in the *Gauge Port Settings* area.
3. Gauge settings (refer to the gauge's user's guide)
1. Disable Mitutoyo BCD output (Series BG gauges only).
 2. Set the gauge baud rate to 9,600.
4. Test stand settings
1. Set the baud rate to 115,200.
 2. Set the Control mode to Console.
5. The **Gauge Settings** tab and all other gauge-related functions cannot be used while MESURgauge is connected to the test stand controller. It is intended for use only when connected to a Mark-10 gauge directly.

WARRANTY

Mark-10 Corporation expressly warrants to its buyer for three (3) years from the date of delivery that the goods sold are free from defects in workmanship and materials. Mark-10 Corporation will, at its option, repair or replace or refund the purchase price of goods found to be defective. This remedy shall be the buyer's sole and exclusive remedy. Any modification, abuse, exposure to corrosive environment or use other than intended will void this warranty. This warranty is in lieu of all other warranties, including implied warranties of merchantability and fitness for an intended purpose. In no event shall Mark-10 Corporation be liable for any incidental and consequential damages in connection with goods sold or any part thereof.

NOTES:



Mark-10 Corporation has been an innovator in the Force and Torque measurement fields since 1979. We strive to achieve 100% customer satisfaction through excellence in product design, manufacturing and customer support. In addition to our standard line of products we can provide modifications and custom designs for OEM applications. Our engineering team is eager to satisfy any special requirements. Please contact us for further information or suggestions for improvement.



We make a measurable difference in force and torque measurement

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