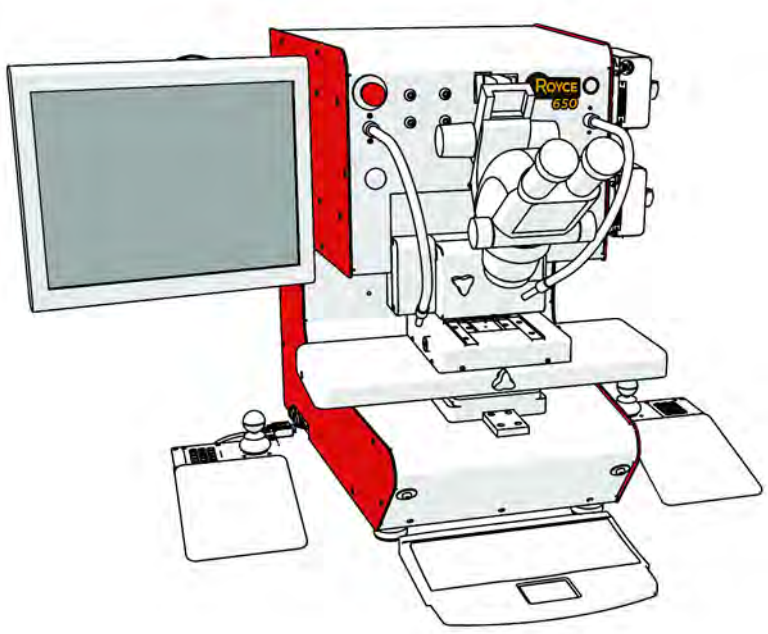
ROYCE INSTRUMENTS



650 & 620

User Guide

User's Guide #23943, R10

Royce Instruments
480 Technology Way
Napa, CA 94558
PH (707) 255-9078
www.royceinstruments.com

V-TEK INC.

V-TEK, Inc.
751 Summit Avenue
Mankato, MN 56001
PH (507) 387-2039
www.vtekusa.com

EU Declaration of Conformity

Manufacturer's Name: **V-TEK, Inc.**

Manufacturer's Address: **751 Summit Avenue**
Mankato, MN 56001 USA

V-TEK, Inc. declares that the equipment described below complies with all applicable health and safety requirements of the Machinery Directive 2006/42/EC, LVD Directive 2014/35/EU, EMC Directive 2014/30/EU.

This declaration has been issued under the sole responsibility of the manufacturer. The object of the declaration is in conformity with relevant Union harmonization legislation.

Confidential technical documentation has been compiled in accordance with LVD Directive 2014/35/EU and is available to European national authorities on written request only. If a request is received documentation will be delivered on a CD or by post.

Machinery Description: **Royce Universal Bond Tester**
Model Number: **Model 650**
Specification: **Bond Test System**
Serial Number: **202X000xxx**

The following standards have either been referred to or been complied with in part or in full as relevant:

EN ISO 12100: 2010	Machinery Safety	Safety of Machinery - General Principles for Design - Risk Assessment & Reduction, includes EN 14121:2007
EN 61010-1: 2010	Machinery Safety	Safety Requirements for Electrical Equip- Measurement/ Laboratory Use
EN 13854:1996	Machinery Safety	Minimum Gaps to Avoid Crushing of Human Body Parts
EN 13857:2008	Machinery Safety	Safe Distances to prevent Danger Zones being reached by upper limbs
EN 614-2:2008	Machine Safety	Ergonomic Design Principals
EN ISO 14118:2018	Machine Safety	Prevention of Unexpected Start-Up
EN 61326-1:2006	EMC	EMC Standard for Electrical Equipment used in Laboratory & Mfg.
CISPR 11:2009/A1:2010	EMC	Industrial, Scientific Equipment – Radio Frequency Characteristics
EN 61000-6-2:2005	EMC	Electromagnetic Compatibility - Immunity for Industrial Environments
EN 61000-6-4	EMC	EMC Standard – Emission Standard for Industrial Environments
IEC 61000-3-2:2006/A2:2009	EMC	Electromagnetic Compatibility (EMC) –Limits for Harmonic Emissions
IEC 61000-3-3:2008	EMC	Electromagnetic Compatibility (EMC) Limitation of Voltage Changes Voltage Fluctuation in Public Low Voltage Supply Systems
2011/65/EU	RoHS 2	Restriction of Hazardous Substances

Full name, position of responsible person and place of signing

Mitchell Jacobs

Place V-TEK, Inc. **Title** President/CEO

Signature **Date** 02/11/2021

EC REP
QNET BV
Hommerterweg 286
6436 AM Amstenrade
The Netherlands

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Machinery Description: **Royce Multitest Bond Tester**
Model Number: **Model 620**
Specification: **Bond Test System**
Serial Number: **202X000xxx**

The following standards have either been referred to or been complied with in part or in full as relevant:

EN ISO 12100: 2010	Machinery Safety	Safety of Machinery - General Principles for Design - Risk Assessment & Reduction, includes EN 14121:2007
EN 61010-1: 2010	Machinery Safety	Safety Requirements for Electrical Equip- Measurement/ Laboratory Use
EN 13854:1996	Machinery Safety	Minimum Gaps to Avoid Crushing of Human Body Parts
EN 13857:2008	Machinery Safety	Safe Distances to prevent Danger Zones being reached by upper limbs
EN 614-2:2008	Machine Safety	Ergonomic Design Principals
EN ISO 14118:2018	Machine Safety	Prevention of Unexpected Start-Up
EN 61326-1:2006	EMC	EMC Standard for Electrical Equipment used in Laboratory & Mfg.
CISPR 11:2009/A1:2010	EMC	Industrial, Scientific Equipment – Radio Frequency Characteristics
EN 61000-6-2:2005	EMC	Electromagnetic Compatibility - Immunity for Industrial Environments
EN 61000-6-4	EMC	EMC Standard – Emission Standard for Industrial Environments
IEC 61000-3-2:2006/A2:2009	EMC	Electromagnetic Compatibility (EMC) –Limits for Harmonic Emissions
IEC 61000-3-3:2008	EMC	Electromagnetic Compatibility (EMC) Limitation of Voltage Changes Voltage Fluctuation in Public Low Voltage Supply Systems
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Full name, position of responsible person and place of signing

Mitchell Jacobs

Place V-TEK, Inc. **Title** President/CEO

Signature **Date** 02/11/2021

EC REP
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Hommerterweg 286
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Safety Precautions

- Read and follow the instructions! All the safety and operating instructions must be read before the machine is operated.
- Use only the correct power source as marked on the machine - if you are not sure of the power supply consult you local power company. If the machine uses a wall plug-in transformer, use only the transformer supplied.
- Your wall outlet must accept a polarized, three-prong grounded plug. These plugs are designed for your safety, so do not attempt to defeat them. If you cannot insert the plug easily, an electrician should replace the outlet.
- Pressing the emergency off switch (EMO) will stop all mechanical motions instantly.
  The Windows operating system is unaffected.
- Do not operate the Royce 650 or 620 without the debris shield. Operators must be trained on the proper use of the machine and on handling shear tools and pull hooks before performing any tests.
- Do not place hands or fingers at pinch points.
- Do not use liquids where they can be spilled into the enclosure through openings.
- Do not use machine if you suspect a gas leak. Report the leak immediately.
- Do not use the machine near water, or when you are wet. If the machine comes in contact with any liquids, unplug the power and line cords immediately.
  Do not plug the machine back in until it has been dried thoroughly.
- The machine must be serviced by qualified service personnel when:
  - The power supply cord or the plug has been damaged
  - Objects have fallen or liquid has been spilled into the machine
  - The machine has been exposed to rain
  - The machine does not appear to operate normally or exhibits a marked change in the performance
  - The machine has been dropped, or the enclosure is damaged
- Do not attempt to service the machine beyond the operating instructions.
  All other servicing should be referred to qualified service personnel.
  Opening the machine or reassembling it incorrectly may expose you to dangerous voltages or other risks.
- The Royce 650 system mainframe weighs 55 kg (120 lb.). Royce 620 system weighs 50 kg (110.5 lb) with typical module and tooling installed.
  Two people are needed to move or lift the system mainframe safely.

Get Help from Royce Instruments

Before you contact us, please record the following information.

System serial number : *(located on the back of the machine)*

_____

Installed software revision number : *(under **Help>About**)*

_____

Module serial numbers : *(located on the right side of the test module)*

_____

_____

Support Options

Internet – www.royceinstruments.com

Check us out online for answers to frequently asked questions and product information.

Email – customerservice@royceinstruments.com

For individual attention on a special issue, contact our knowledgeable technical support representatives.

Process Consumables

Many consumable items are can be purchased directly from our website.

http://www.royceinstruments.com/consumables

Extended Warranty

Royce Instruments Extended Warranty is a cost-effective service and support program. For more information, visit the Royce Instruments website.

Decommissioning the 650/620

The 650/620 contains many different components which are primarily composed of steel, aluminum, plastic and other metals, many which can be recycled. Always recycle and dispose of equipment per applicable regulations.

Contents

Chapter 5

Chapter 1

Hardware Overview

The Royce Instruments **620** and **650** are multi-functional bond testers for accurate and repeatable mechanical testing of micro-electronic products.

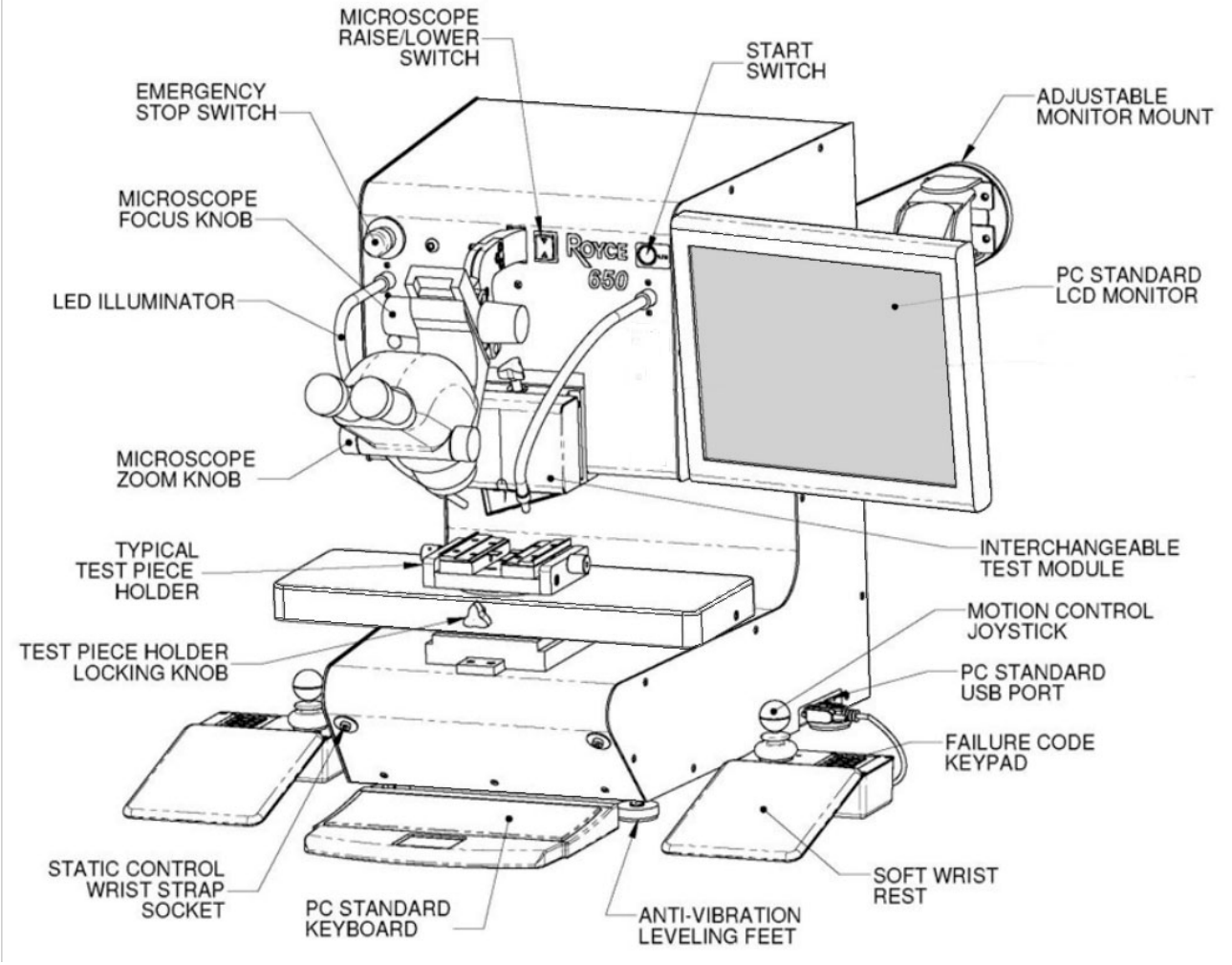
To minimize the use of bench space, each system incorporates an industry standard PC motherboard, a 128 Gb solid state drive and an integrated keyboard / touchpad.

This gives the Royce 620 and 650 all the functionality of a compact desktop PC, along with the familiarity and inter-connectivity of the Windows 10 operating system, without the clutter and cables of a separate PC.

The rigid backbone and robust X-Y stage of the Royce 650 allows shear testing up to 200 kgf, with Z position accuracy better than 1 micron.

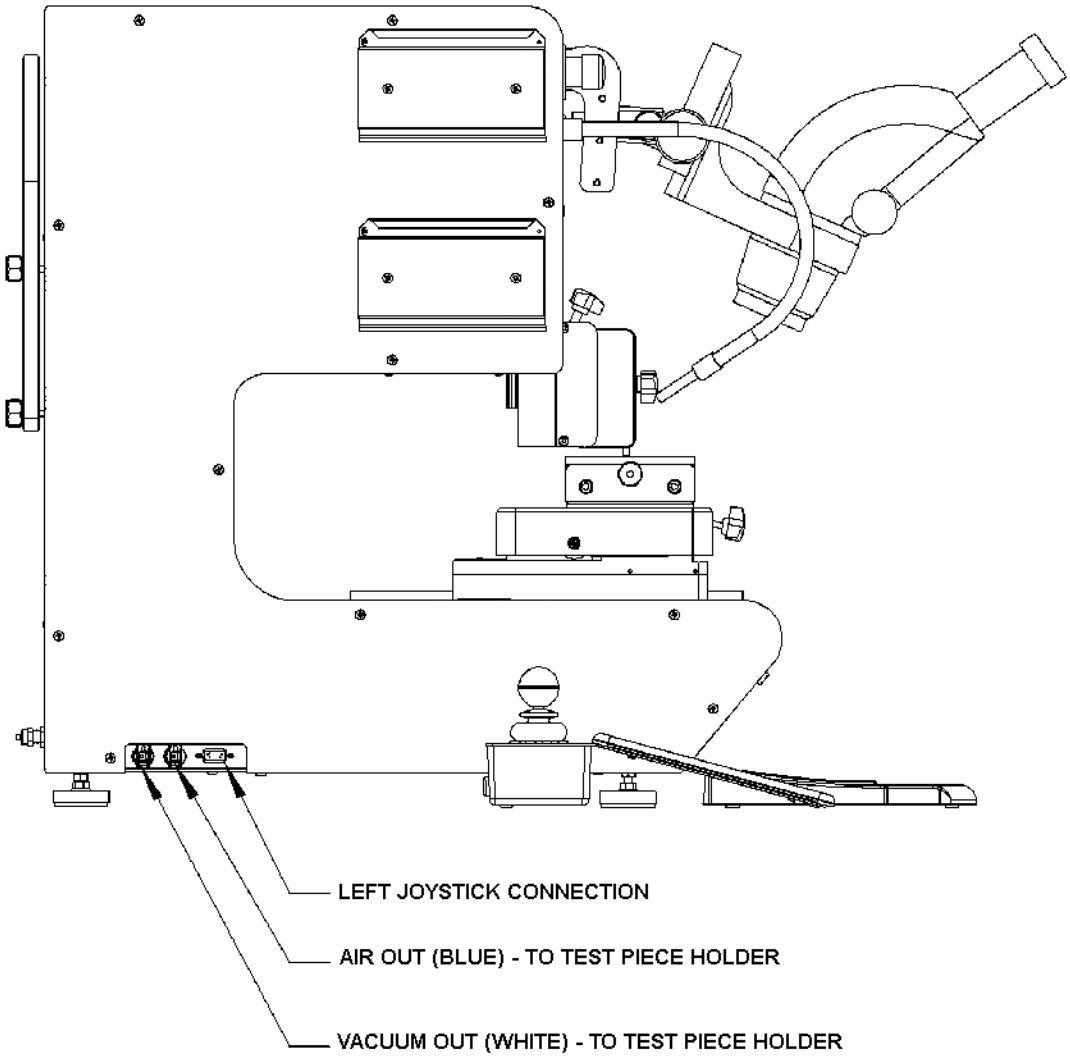
The versatile Royce 620 allows for interchangeable tooling with older System 552's and uses modules interchangeable with the Royce 650. Direct hand control of part samples is available with selected manipulators.

Royce 650 Components



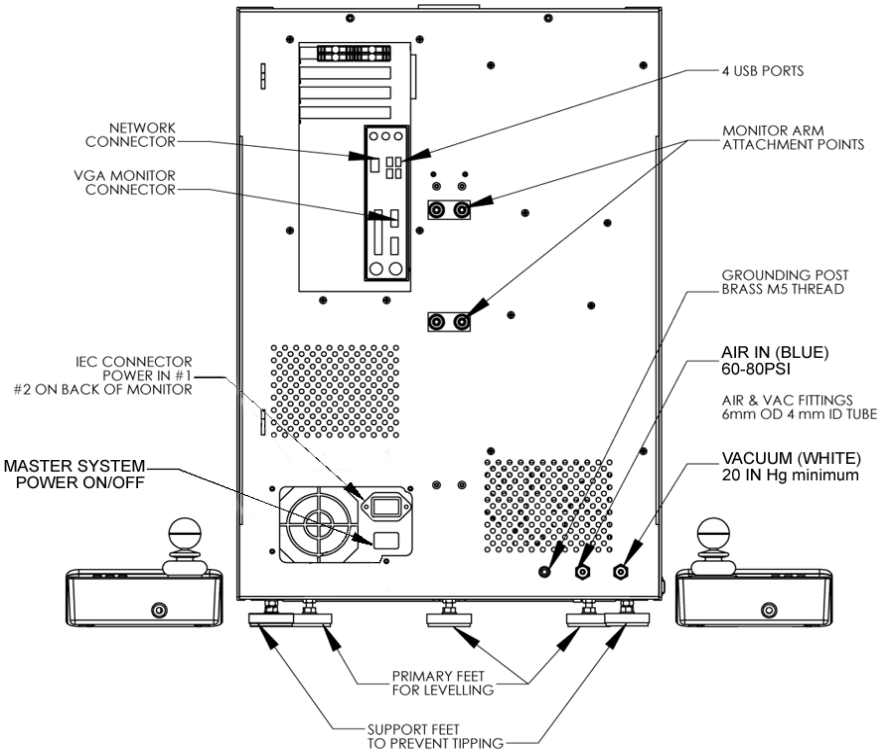
Component Name	Component Description
Microscope Raise/Lower Switch	Controls the microscope eyepiece height by electric actuator, allowing users to smoothly and quickly position the eyepiece height to their personal preference. The eyepiece height range accommodates a wide range of user statures, exceeding most ergonomic standards.
System Start Switch (button)	Turns the Royce 650 system on and off. Note, this button operates in the same way as the “power” button on the front panel of a PC and safely shuts down Windows.
Monitor Mount	Adjustable mount allows users to position the monitor on the left side, the right side, or on top of the machine.
LCD Video Monitor	PC-standard high-quality LCD monitor fits in space-limited areas. The monitor tilts to reduce glare and optimize comfort.
Test Module	Interchangeable modular subsystem, see pages 13 and 14 for more information.

Component Name	Component Description
Motion Control Joysticks	One joystick moves the test tool in the Z (up/down) plane and rotates the pull hook. The other joystick moves the test piece holder in the X and Y planes. Both joystick controllers permit test start and test result classification and are interchangeable to accommodate user preference.
Integrated Windows 10 Computer (not shown)	PC-standard Windows 10 computer minimizes the overall footprint and simplifies installation, setup, and operation. Pre-installed software is based on the familiar Microsoft Windows user interface.
USB Ports	4 PC-standard USB ports are accessible from the rear panel. A fifth USB port is readily accessible on the right hand panel for connecting to flash memory drives, printers, and other optional devices.
Failure Code Keypad	Each joystick controller has a keypad that allow users to enter test commands or failure codes without having to remove their eyes from the microscope. The number and symbol keys are laid out like a familiar telephone keypad.
Soft Wrist Rest	Ergonomically designed wrist rest reduces finger, wrist, and arm fatigue.
Anti-Vibration Leveling Feet	Adjustable feet support a solid, steady work platform to maintain accuracy and optical performance.
Keyboard	PC-standard USB keyboard is used to enter text-based data and can be positioned for user preference. It incorporates a touch pad to control the screen position arrow. It is preferable to connect keyboard/touch pad USB to a rear USB port, leaving the side USB port available for USB Flash drives etc.
Static Control Wrist Strap Socket	The sockets secure the static control wrist straps which dissipate static electricity charges
Test Piece Holder Locking Knob	Securely fastens the test piece holder to the X-Y stage.
Module Receiver	Sturdy horizontal mount allows users to easily slide test modules on and off the machine.
Microscope Zoom Knob	Smoothly adjusts the microscope magnification throughout the zoom range.
LED Illuminators	Flexible arms and bright LED lighting increase visibility and facilitate load tool alignment and test failure mode grading.
Microscope Focus Knob	Focuses the microscope on the test piece.
Emergency Off (EMO) or Stop Switch	Highly visible and accessible switch immediately disconnects the motor power but maintains the Windows 7 user interface for corrective action.
Stereo Zoom Microscope	Objective lens and eyepiece choices permit a configurable magnification range of 4.7x to 120x.
Motorized X-Y Stage	Precision servo motors in the X-Y stage position the part for testing with sub-micron resolution. The Royce 650 stage design significantly increases stage travel to improve test position flexibility. X axis stroke: 305mm Y axis stroke: 155mm



Joystick Connection Air Out Vacuum Out

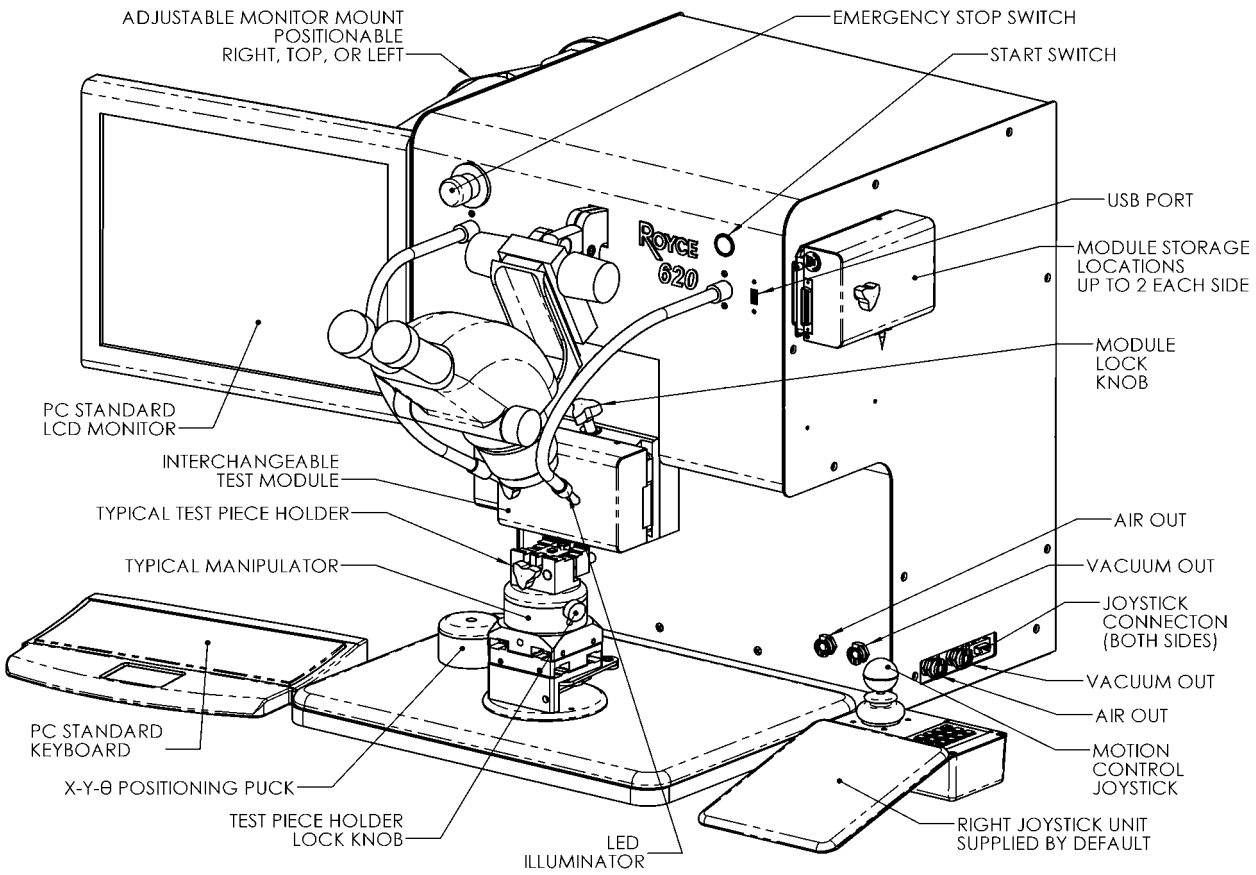
Component Name	Component Description
Left Joystick Connection	The cable connector for the left joystick controller.
Air Out Connection (Blue Key)	Certain test piece holders need compressed air to operate. The Blue keyed “snap-in” connector quickly connects the test piece holder to the compressed air supply tubing
Vacuum Out Connection (White Key)	Certain test piece holders need vacuum to operate. The White keyed “snap-in” connector quickly connects the test piece holder to the vacuum supply tubing.



Royce 650 Back Panel

Component Name	Component Description
USB Connections	Four USB ports are provided for computer accessories.
Monitor Arm Attachment Points	The video monitor can be mounted in 3 positions, on either side, or over the top of the mainframe using these attachments points.
Grounding Post	Supplementary connection to earth ground.
Air input connection (Blue)	Connects the system to the facility 3 to 4 bar (60-80 psi) clean, dry air or nitrogen supply. The connector accommodates customer-supplied 6 mm OD, 4 mm ID tubing.
Vacuum input connection (White)	Connects the system to the facility 500mm (20 in) Hg vacuum supply. The connector accommodates customer-supplied 6 mm OD, 4 mm ID tubing.
Primary and Support Feet	Three primary feet level the machine. Two support feet prevent tipping.
Master System Power On/Off Switch	Powers the Royce 650 system on and off.
IEC Power Connection	Connects the machine to external power. Note that the Royce 650 accommodates any international power source, 90-264 VAC, 50-60 Hz
VGA Monitor Connection	Connects the video cable from the LCD monitor to the internal PC.
Network Connection	Connects the Royce 650 computer to the (optional) facility network using a standard RJ45, Category 5 Ethernet cable.

Royce 620 Components



Component Name	Component Description
Microscope Raise/Lower lever	Controls microscope position, simply pull or push the scope in or out to move it to the desired position. The eyepiece height range accommodates a wide range of user statures, exceeding most ergonomic standards.
System Start Switch (button)	Turns the Royce 620 on and off. Note, this button operates in the same way as the “power” button on the front panel of a PC and safely shuts down Windows.
Monitor Mount	Adjustable mount allows users to position the monitor on the left side, the right side, or on top of the machine.
LCD Video Monitor	PC-standard high-quality LCD monitor fits in space-limited areas. The monitor tilts to reduce glare and optimize comfort.
Test Module	Interchangeable modular subsystem, see pages 13 and 14 for more information.

Component Name	Component Description
Motion Control Joystick	The Royce 620 uses one joystick to move the test tool in Z (up/down) and rotate the pull hook.
Integrated Windows 10 Computer (not shown)	PC-standard Windows 10 computer minimizes the overall footprint and simplifies installation, setup, and operation. Pre-installed software is based on the familiar Microsoft Windows user interface.
USB Ports	4 PC-standard USB ports are accessible from the rear panel. A further USB port is readily accessible on the front panel for connecting to flash memory drives, printers, and other optional devices.
Failure Code Keypad	The joystick controller has a keypad that allow users to enter test commands or failure codes without having to remove their eyes from the microscope. The number and symbol keys are laid out like a familiar telephone keypad.
Soft Wrist Rest	Ergonomically designed wrist rest reduces finger, wrist, and arm fatigue.
Keyboard	PC-standard USB keyboard is used to enter text-based data and can be positioned for user preference. It incorporates a touch pad to control the screen position arrow. It is preferable to connect keyboard/touch pad USB to a rear USB port, leaving the side USB port available for USB Flash drives etc.
Static Control Wrist Strap Socket	Located on the left side of the system, this socket secures the static control wrist strap which dissipate static electricity charges
Test Piece Holder Locking Knob	Securely fastens the test piece holder to the manipulator (MPS)
Module Receiver	Sturdy horizontal mount allows users to easily slide test modules on and off the machine.
Microscope Zoom Knob	Smoothly adjusts the microscope magnification throughout the zoom range.
LED Illuminators	Flexible arms and bright LED lighting increase visibility and facilitate load tool alignment and test failure mode grading.
Microscope Focus Knob	Focuses the microscope on the test piece.
Emergency Off (EMO) or Stop Switch	Highly visible and accessible switch immediately disconnects the motor power but maintains the Windows 7 user interface for corrective action.
Stereo Zoom Microscope	Objective lens and eyepiece choices permit a configurable magnification range of 4.7x to 120x.
Motorized Y Stage	Precision servo motors in the base of the system control drive the base plate for shear testing with high resolution.
Typical Manipulator	A type MPS-3 manipulator is shown. The Royce 620 can use the same manipulators as the earlier 550 and 552 models

Components on 620 side & front panel:

Component Name	Component Description
Right Joystick Connection	The cable connector for the right joystick controller.
Air Out Connection (Blue Key)	Certain test piece holders need compressed air to operate. The Blue keyed “snap-in” connector quickly connects the test piece holder to the compressed air supply tubing
Vacuum Out Connection (White Key)	Certain test piece holders need vacuum to operate. The White keyed “snap-in” connector quickly connects the test piece holder to the vacuum supply tubing.

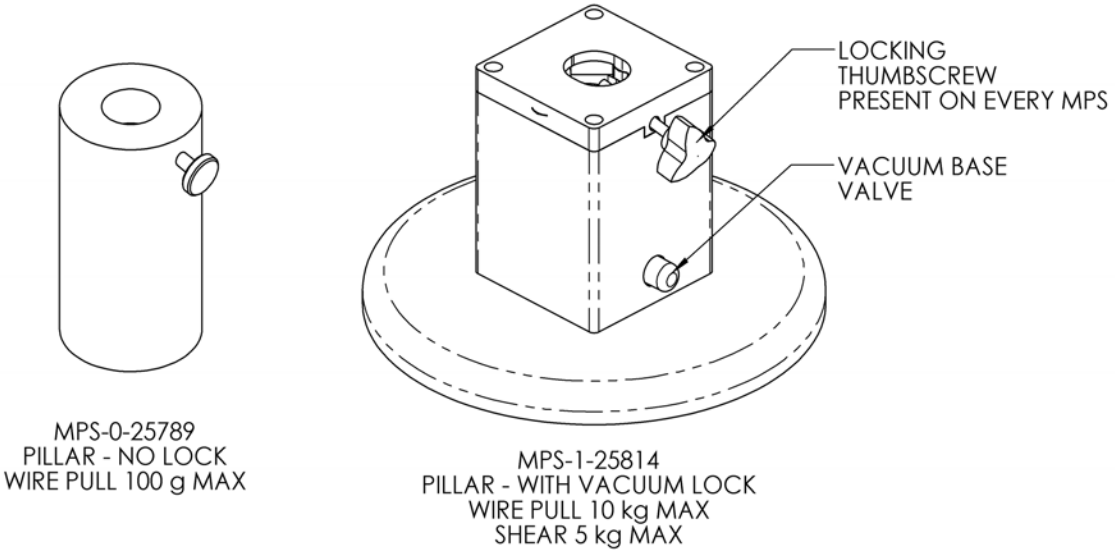
Components on 620 Back panel:

Component Name	Component Description
Monitor Arm Attachment Points	The video monitor can be mounted in three positions, on either side, or over the top of the mainframe using these attachments points.
Grounding Post	Supplementary connection to earth ground.
Air input connection (Blue)	Connects the Royce 620 system to the facility 3 to 4 bar (60-80 psi) clean, dry air or nitrogen supply. The connector accommodates customer-supplied 6 mm OD, 4 mm ID tubing.
Vacuum input connection (White)	Connects the Royce 620 system to the facility 500mm (20 in) Hg vacuum supply. The connector accommodates customer-supplied 6 mm OD, 4 mm ID tubing.
Master System Power On/Off Switch	Powers the Royce 620 system on and off.
IEC Power Connection	Connects the machine to external power. Note that the Royce 620 automatically accommodates any international power source, 90-264 VAC, 50-60 Hz without switch selection.
VGA Monitor Connection	Connects the video cable from the LCD monitor to the Royce 620 internal PC computer.
Network Connection	Connects the Royce 620 computer to the (optional) facility network using a standard RJ45, Category 5 Ethernet cable.

MPS Manipulators

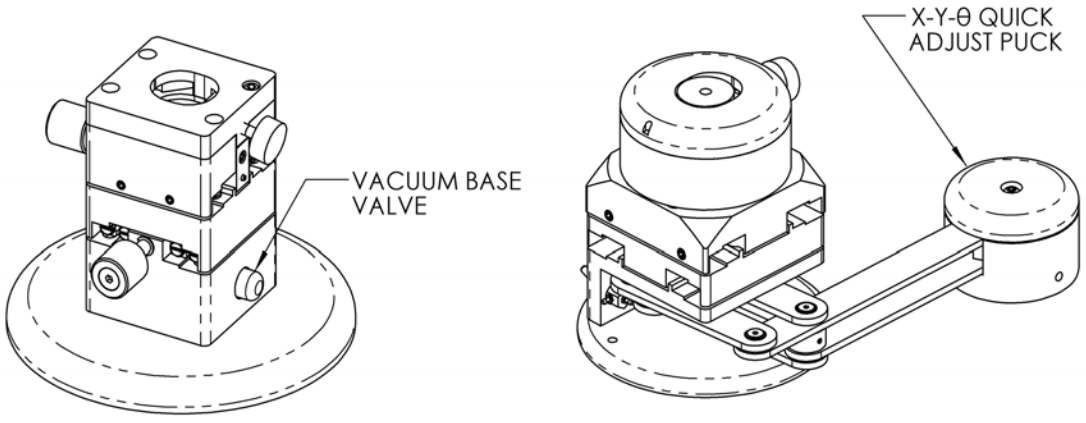
(for use with Royce 620 only)

Note manipulators and test piece holders from earlier 550 and 552 systems can be used with Royce 620



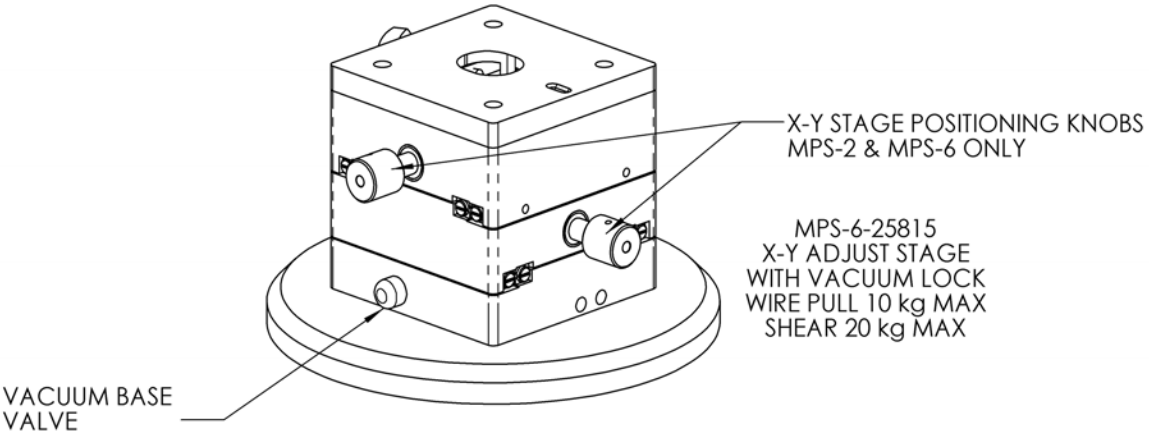
MPS-0-25789
PILLAR - NO LOCK
WIRE PULL 100 g MAX

MPS-1-25814
PILLAR - WITH VACUUM LOCK
WIRE PULL 10 kg MAX
SHEAR 5 kg MAX



MPS-2-25816
X-Y ADJUST STAGE
WITH VACUUM LOCK
WIRE PULL 10 kg MAX
SHEAR 5 kg MAX

MPS-3-25794
X-Y-θ QUICK ADJUST STAGE
WITH VACUUM LOCK
WIRE PULL 1 kg MAX
SHEAR 250g MAX



MPS-6-25815
X-Y ADJUST STAGE
WITH VACUUM LOCK
WIRE PULL 10 kg MAX
SHEAR 20 kg MAX

MPS-2 Setup

Place the MPS2 manipulator on the base of the machine so that the vacuum tube comes out of the right hand side of the manipulator base and the vacuum release knob is facing the front of the unit. This will result in the left/right adjustment knob being on the left-hand side of the unit and the front/back adjustment knob being on the back of the unit. This makes it natural for the left hand to make position adjustments in both left/right and front/back directions. The right hand is normally used to operate the Z -theta controller joystick located on the right hand side of the machine.

When shear loads are in excess of about 150 gm, it will be necessary to hold down the positioning stage with vacuum during the test. For shearing bonds made with 1 mil wire, loads greater than 150 gm are unlikely. Connect the positioning stage to one of the vacuum ports on the front or side of the machine and connect the vacuum port on the rear of the machine to the vacuum supply. Vacuum to the manipulator base is released by pressing the plunger at the back of the positioning stage.

MPS-3 Setup

If the MPS-3, chessman style manipulator stage has been specified, place it on the base of the machine so that the chessman is located to the left of the main stage and can readily be positioned by your left hand. When the vacuum valve is moved to the right, vacuum is supplied to the vacuum base and the unit is clamped firmly in position. When the vacuum release lever points sideways, vacuum is switched off and air is released into the vacuum space, allowing the position of the manipulator base to be freely adjusted.

When shear loads are in excess of about 150 gm, it will be necessary to hold the chessman in position during the test or select a different manipulator.

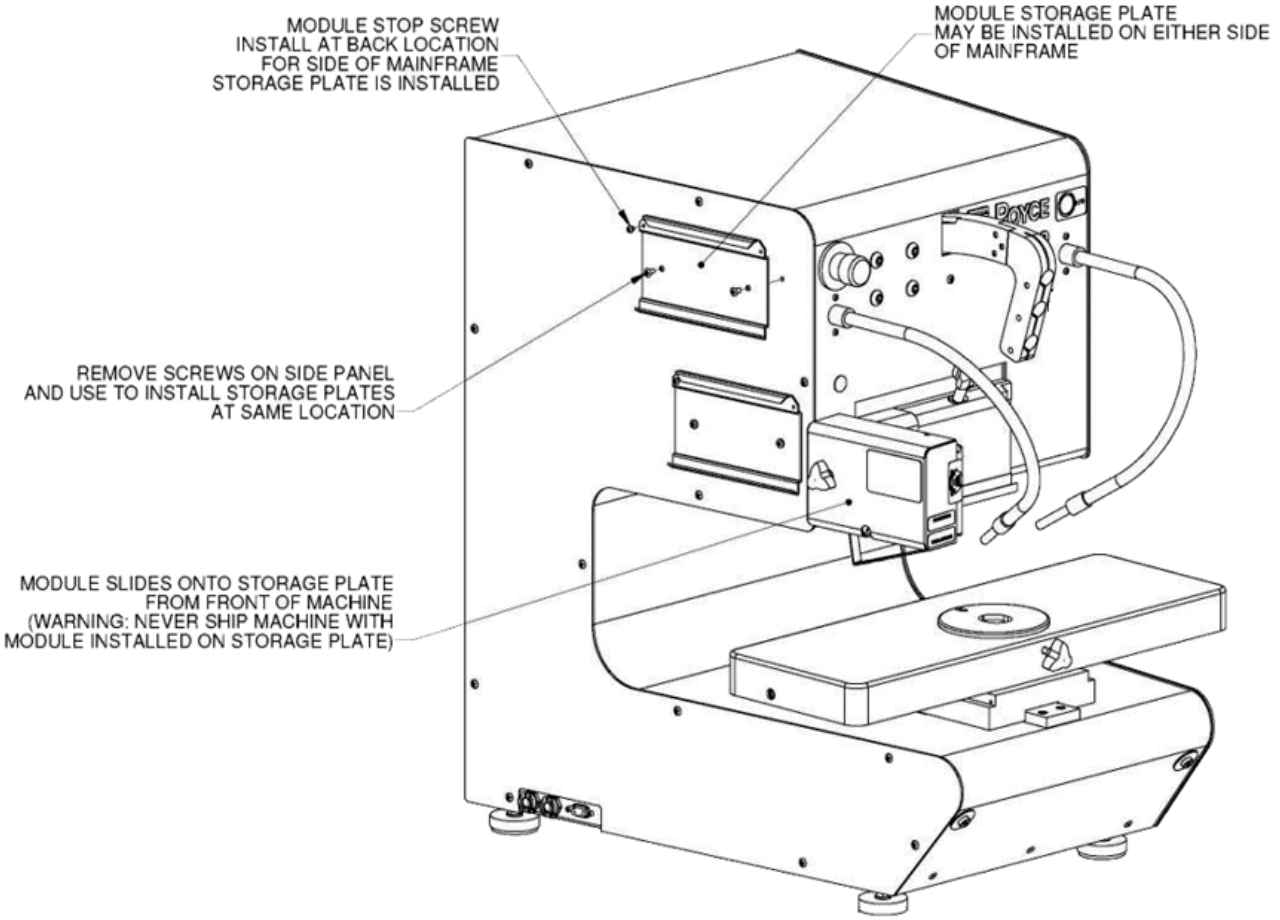
Test Modules

Test Module Storage Racks

There are two storage racks to house test modules for easy retrieval when needed. The storage racks are installed on the right side of the machine when shipped, an LCD monitor is normally mounted on the left hand side.

If it is preferred to mount the LCD monitor on the right hand side, then it will be necessary to transfer the storage racks to the tapped holes on the left hand side of the machine.

Note that the module stop screw must be placed in the back position.



Test Modules

Test modules are interchangeable modular subsystems which can be quickly removed from the machine for rapid test changeover. Modules contain high precision mechanical and electronic components to deliver excellent accuracy and stability.

All test modules with a force range of 10 kgf or under can be used interchangeably on either the Royce 650 or the Royce 620.

The 20kgf and 200 kgf shear modules can only be used on the Royce 650

Test module calibration should be checked and if necessary re-calibrated every 6 months. Test modules may be returned to Royce Instruments for a quick turnaround calibration. Alternatively, calibration equipment can be purchased from Royce Instruments for on-site calibration.

Each test module undergoes rigorous qualification procedures to meet Royce Instruments' high standards. The module is then carefully calibrated to assure accuracy and repeatability. Calibration and qualification data are stored in the on-board memory contained inside each test module.

Re-calibration is recommended at 6 month intervals. Royce 650 and 620 test modules are independently calibrated to a total accuracy of better than ±0.1%.

All test modules can be operated at user-selected force sub-ranges of down to one tenth (1/10) of the nominal test module capacity. This ensures that an appropriate force range can be selected without having to change to another module.

Note that *Gripper, Tweezer Pull* test modules can be fitted with load tools to perform both ribbon and wire tweezer pull testing.

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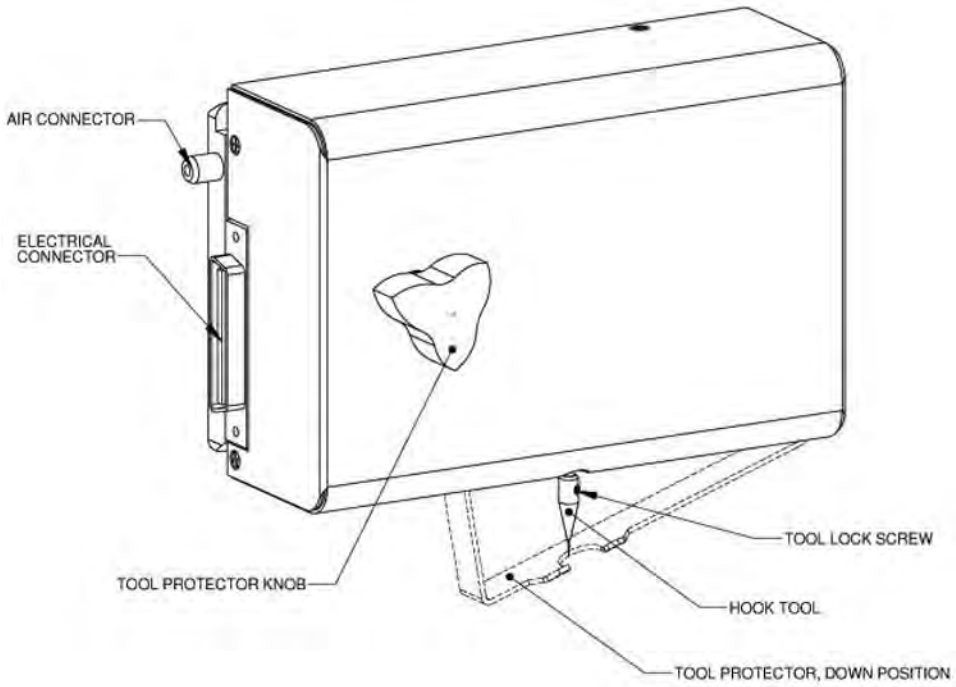
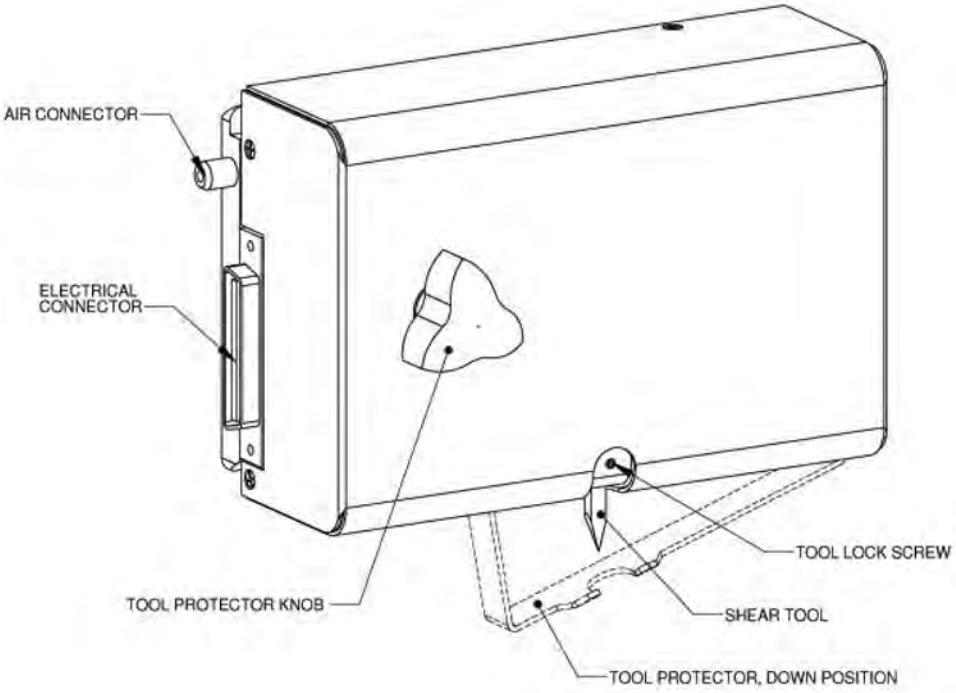
Tool Protector

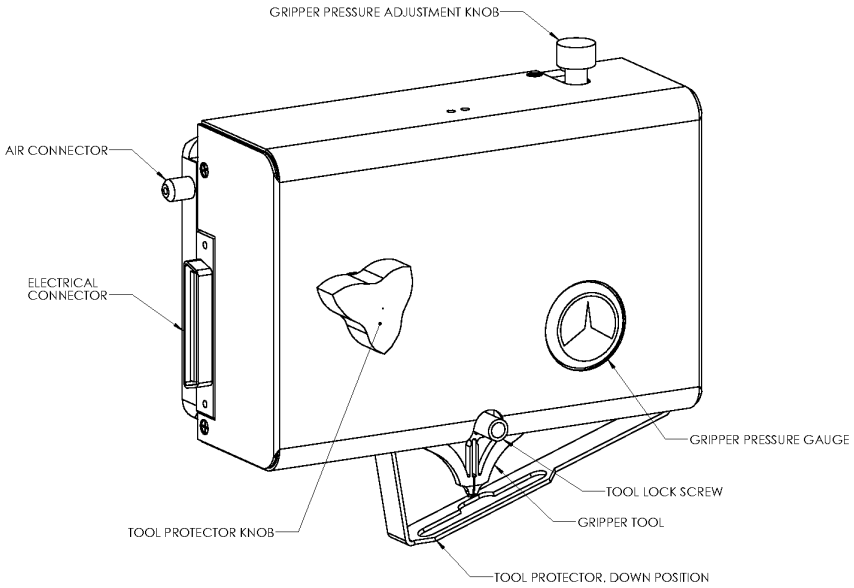


Typical SMW Wire Pull Test Module

The tool protector reduces the likelihood of injury from accidental contact with the sharp wire pull hooks or shear tools. The tool protector can be manually raised and lowered to allow easy access for tool changing. When the tool protector is in the down position, a sensor prevents downward travel of the test module.



Typical SMS Shear Test Module



Typical SMG (Tweezer) Test Module

Test Module	Nominal Range	Selectable Sub-ranges	Part Number
Wire Pull Accuracy: +/- 0.1 %	100g	10g, 20g, 50g, 100g	SMW-100g-21845
	1kg	100g, 200g, 500g, 1kg	SMW-1kg-21846
	10kg	1kg, 2kg, 5kg, 10kg	SMW-10kg-21847
Die Shear (Royce 650 only) Accuracy: +/- 0.1 %	20kg	2kg, 5kg, 10kg, 20kg	SMS-20kg-24020
	200kg	20kg, 50kg, 100kg, 200kg	SMS-200kg-24200
Ball Shear Accuracy: +/- 0.1 %	250g	25g, 50g, 100g, 250g	SMS-250g-21857
	1kg	100g, 200g, 500g, 1kg	SMS-1kg-21858
	5kg	500g, 1kg, 2kg, 5kg	SMS-5kg-21859
Gripper, Tweezer Pull Accuracy: +/- 0.1 %	100g	10g, 20g, 50, 100g	SMG-100G-21853
	1kg	100g, 200g, 500g, 1kg	SMG-1k-21854
	10kg	1kg, 2 kg, 5kg, 10kg	SMG-10k-21855
3 Point Bend Test (Push Test Module) Accuracy: +/- 0.1 %	10kg	1kg, 2 kg, 5kg, 10kg	SMP-10K-24145

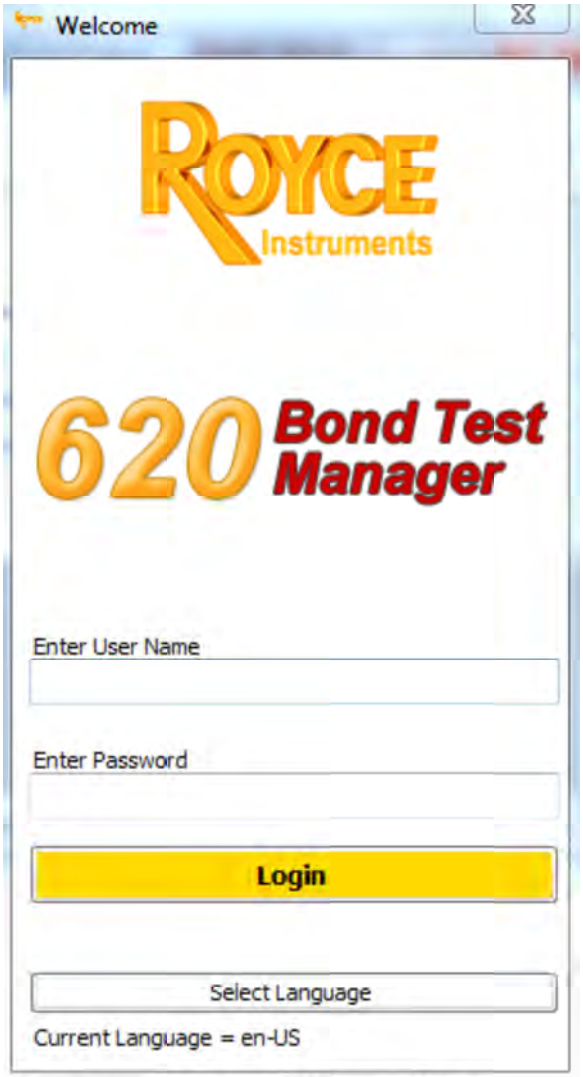
Chapter 2

Software Overview

System Welcome Window

Login

To protect your system against unauthorized modifications to test parameters, the **Royce 650** and Royce 620 requires users to enter a user name and password to access the operating software.



Royce 620 Login Welcome Window

When shipped from Royce Instruments, Windows is set up to accept the following default user name and password. It is strongly recommended that your network administrator change this after installation.

For older systems running Windows XP:

Windows Administrator Login:

User-name: **Administrator**
Password: **ROYCE**

Windows User Login

User-name: **System650**
Password: **Royce650**

For newer systems running Windows 10

Windows Administrator Login:

User-name: **ROYCE**
Password: **ROYCE**

Windows User Login

User-name: **User**
Password: **User**

A further login is required to use the Bond Test Manager program. The factory set default login will give the maximum level of access to all user parameters.

Bond Test Manager Login

User-name: **Administrator**
Password: **admin**

NOTE: Passwords **are case sensitive**, but user names are **not** case sensitive.

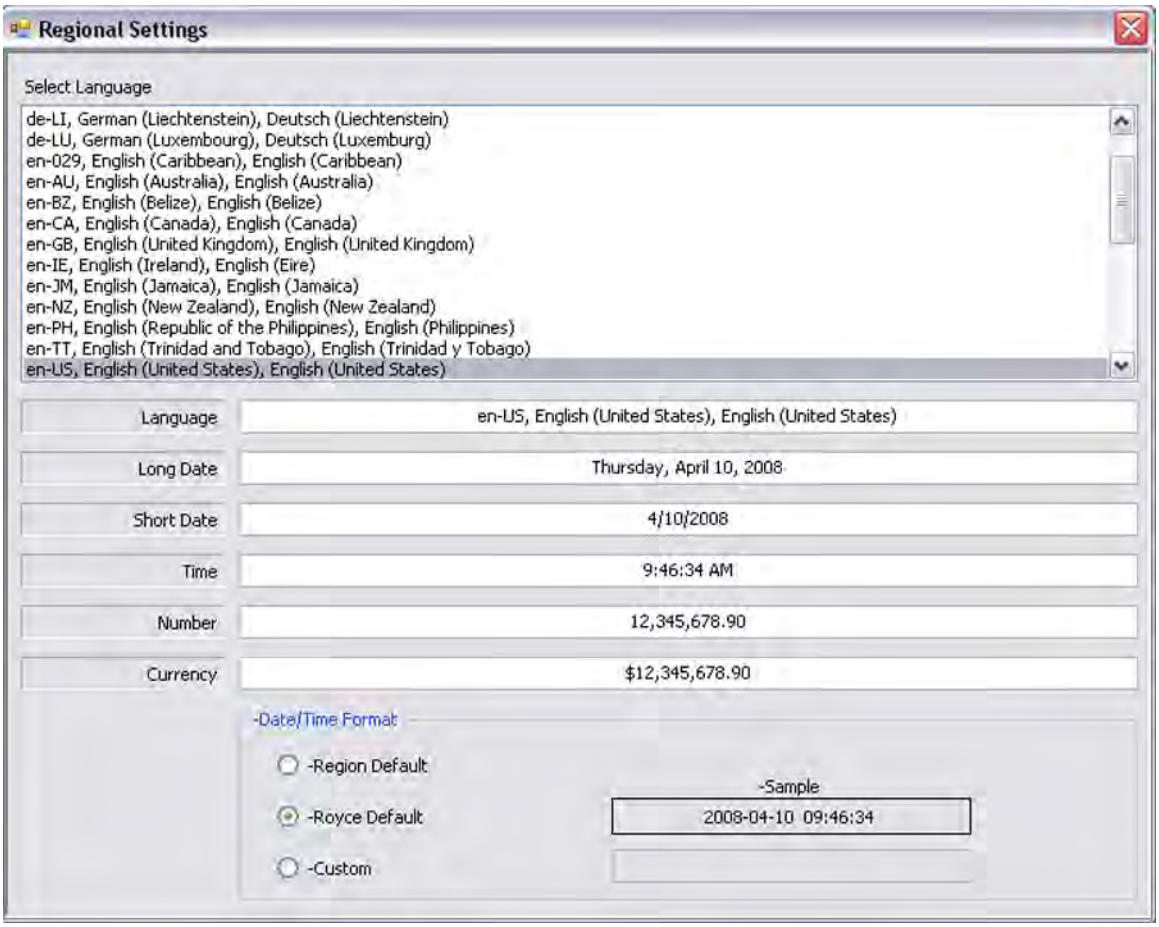
Passwords and user names can be changed, see Page 43 for details.

Select Language

The Royce 620 and 650 systems support multiple languages: Mandarin, French, English, Spanish, German, Japanese and Korean. The default setting is English.

To change the language or date and time formats, choose **Select Language** from:

1. Several cultural choices are available for many languages. Whichever culture of a particular language you choose, the “mother” language will be selected.

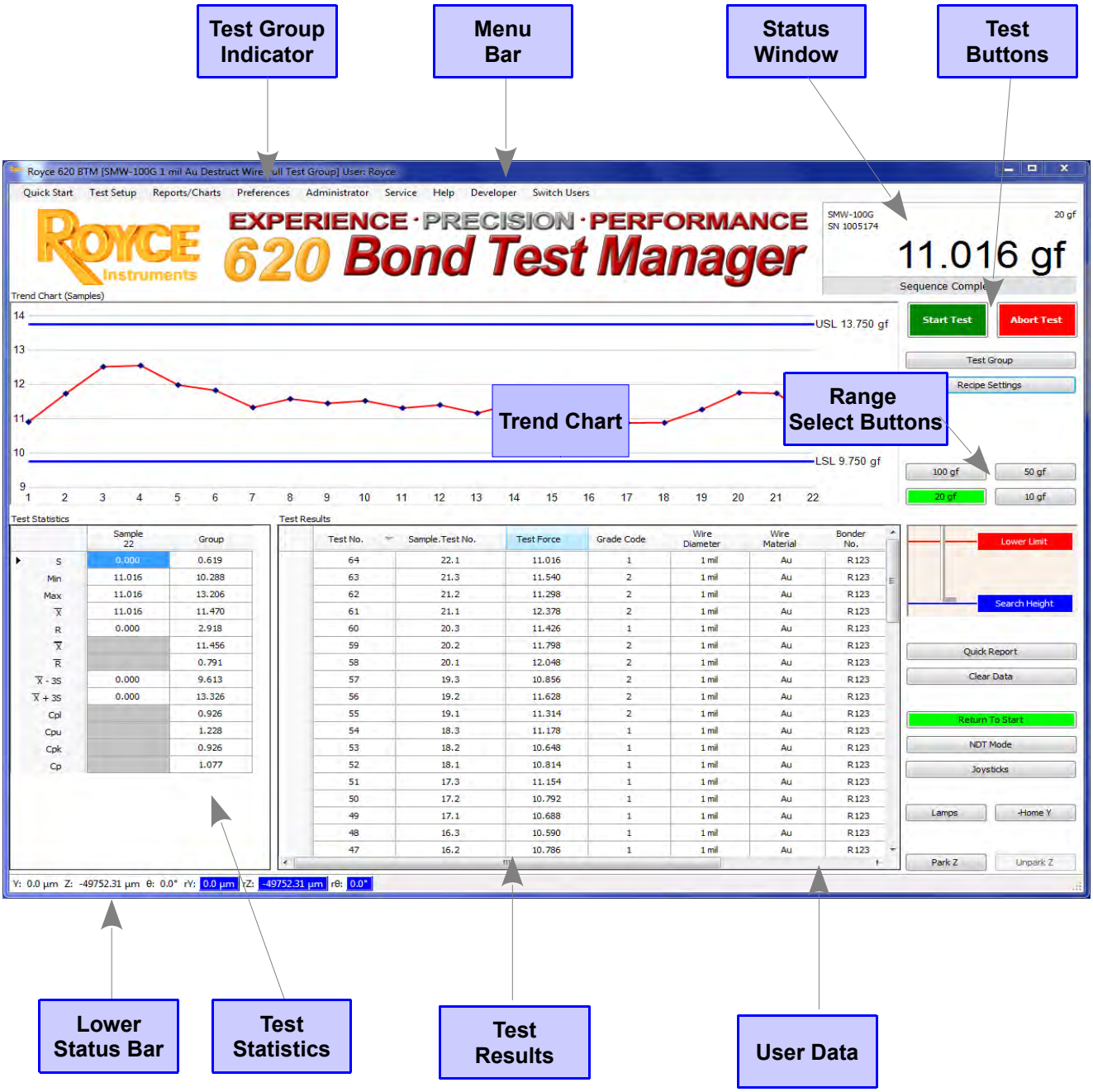


Select language, *Regional Settings*

Set PC System Time

To set PC system time, log into Windows as administrator then double click on the time in the bottom right corner.

Royce 620 & 650 Main Screen



The Royce 650 *Main Screen* is shown above. For most of this manual 650 screens will be shown. The 620 *Main Screen* and other screens are identical except for some features as noted.

	Description	
Test Group Indicator	Name of of currently selected test group	
Menu Bar	Quick Start	Starts a step-by-step Program Wizard for the operator.
	Test Setup	Includes screens, parameters and commands for creating test groups and recipes.
	Image Capture	This displays only if Image Capture is installed
	Reports /Charts	User selectable chart and print options for current test results and data export.
	Preferences	Includes user-definable screen display and operation options.
	Administrator	Includes windows for changing user roles, passwords, and access rights.
	Service	Diagnostic feature for Engineers and Service Personnel.
	Help	Displays software version and user guide.
	Switch User	Enables changing users without closing the program.
Status Window	Displays peak test force, in gram force units or Newtons (see **Preferences: Units of Measure)**	
	Displays test module serial number, this is read automatically when module in installed.	
	Displays test module selected load range, selected from Test Setup menu.	
	During testing, the current motion step in the motion sequence is displayed.	
Test Buttons	Start Test	Starts the test operation.
	Abort Test	Stops the test and returns the test module to the start position.
	Clear Data	Provides options to delete data.
	Recipe Settings	Displays a list of test recipe and test group parameters that support the test module installed. See “Recipe Settings ” on page 49 for more detail.
	Quick Report	Opens the Quick Report window. Quick Report can be printed or exported in Excel or Adobe Acrobat format.
	Return to Start / Search	Moves the test module back to the initial start or search position after a test is completed.

	Description		
	NDT Mode	Used for non-destructive testing (NDT). In this mode, the force applied to the wire or shear bond stops before the bond breaks. NDT Mode is active when the button is shown in yellow.	
	Lamps	Set Illuminator Intensity and Camera Intensity.	
	X-Y Unload	Moves the X -Y stage to a user defined position so that the sample can be safely accessed.	Load and park options available for 650 only
	X-Y Load	Moves the X-Y Stage to a user defined start position.	
	Park	Moves the test module to the user set park position.	
	Unpark	Moves the test module to the the pre park height.	
Trend Chart	Displays test results summarized in a graph. Users can toggle between the average peak force for each sample (represents multiple tests per point) or the peak force for each test.		
Tool Position Window	Displays the height of the test module and tool relative to the test sample. The positions will vary with each sample.		
Search Height	Controls the upper limit of the test position range.		
Lower Limit	Controls the tool's lowest limit of travel. The machine arm will automatically stop if a user attempts to lower the tool module beyond this limit.		
Zero Datum	User definable loop height reference.		
Test Results	Displays the test results. Default information parameters include test number, sample number, and test force.		
Test Statistics	Displays the statistics for samples and group test results.		
User Data	Displays the last value entered for optional user defined fields.		
Lower Status Bar	Displays X, Y and Z Position absolute and relative (in blue) coordinates, alarms and button for controlling Joystick Velocities above and below search height.		
Sub-Range Selection	Selects the primary and sub-ranges of the test module installed on the machine. The sub-range choices will vary depending on the type of module installed.		

Royce 620 & 650 Menus

Quick Start Menu

The *Quick Start Wizard* leads users through a step by step test procedure.

Depending on the assigned permission level, users can choose an existing test group or create a new group from a previously saved Template Group.

Recently Used List Option

The recently used list shows all test groups, in order of last used date/time.

Click on a row to select a group.

Click **NEXT** to continue.

All Groups Option

Either choice brings up a listing of existing test groups in order of date /time created

Click on a row to select a group.

Click **NEXT** to continue.

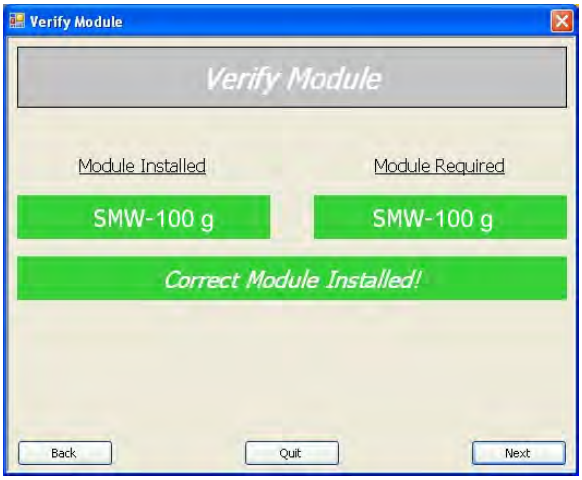
Create New Group from Template Option

1. Click on *Quick Start* from the menu bar.
2. Click the button next to *Create New Group From Template*
3. Click on the line of the desired Template Group and click **Next**.
4. Enter a Group Description for the new group to be created and click **Next**.
5. (Optional) Enter data into the User Fields and click **Next**. **Note:** If *Require with New Group* was selected for any of the data fields on the *Edit Group* window, then the **User Data Incomplete** message will appear until something is entered into the required User Data fields.
6. The *Quick Start Wizard* now verifies that the correct module is installed.
7. If the module is correct, then click **Next**.
8. If the module is incorrect, then install the correct module and click **Next**.
9. Complete the items on the Quick Start Check list, check the check boxes, and click **Next**.
10. Begin testing.

Verify Module

Screen will appear and automatically verify the correct module is installed for the group previously selected.

Click **NEXT** to continue.

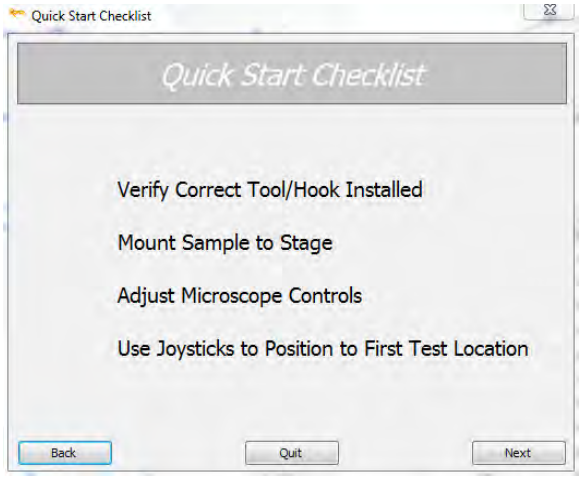


Quick Start Checklist

This window displays a list of actions the operator should complete before beginning the bond test.

The user must check all boxes before continuing to the next screen.

Click **NEXT** to continue.



Creating, configuring, and converting Template Test Groups

To Create a Template Test Group

1. Click on *Test Groups* on the *Test Setup* menu.
2. Click on the **Add New Group** button.
3. Edit the Test Group
   a) Do not check the Template box yet.
   b) Change the Description.
   c) Module will be automatically set to match the module currently plugged into the System. You can override that setting using the pull down list.
   d) Choose a Grading Scheme.
   e) (Optional) Enter Captions for the User Fields.
   f) (Optional) Change the settings for if or when the User Fields are cleared and if or when they are required.
   g) (Optional) Enter a Memo for the Test Group.
4. Click the **Accept** button.

To Configure the Test Group

1. Click the *Recent Groups* tab.
2. Click on the line of the group you just created.
3. Click the **Select Group** button.
4. Change the Recipe Settings, Lower Limit, and Search Height to suit your sample.
   Note: You can perform tests to help you determine the best settings for the sample. However, you must delete the test results before the Test Group can be converted to a Template.

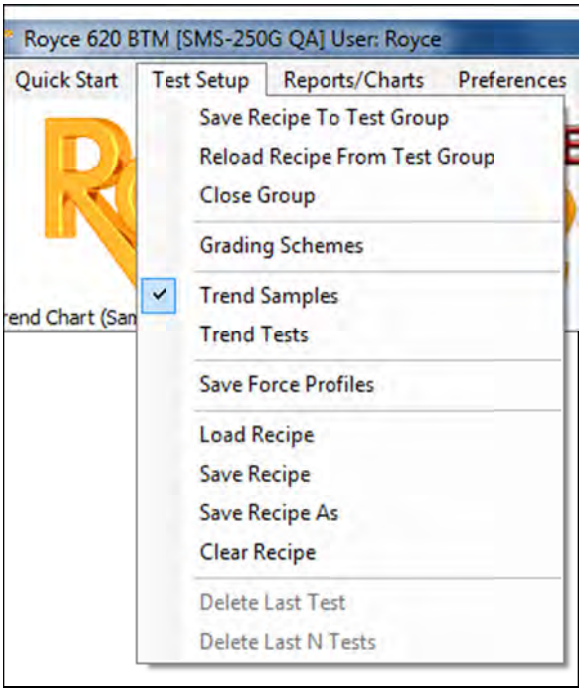
To Convert the Test Group into a Template Test Group

1. If there are any Test Results in the Test Group, then delete them by clicking on the **Clear Data** button.
2. Click on *Test Groups* on the *Test Setup* menu.
3. Click the *Recent Groups* tab.
4. Click on the line of the group you just configured.
5. Click the **Edit Group** button.
6. Check the *Template* check box.
7. Click the **Accept** button.
8. Click the *Template Group* tab and confirm the group appears in the template group list.
9. Click the red **X** to close the *Test Groups* window.

Test Setup Menu

The *Test Setup* menu commands allow users to define the test recipe and test group parameters.

Access to some of the Test Setup commands may be limited by permissions assigned to the the login role of the user.
(See **Administrator Menu:Permissions**, Page 46)



Quick Start Wizard

This menu opens the *Quick Start Wizard* menu. See Quick Start Menu, Page 21
Note that although the *Quick Start Wizard* is accessible from both menus, operator role permissions can be disabled for this menu.

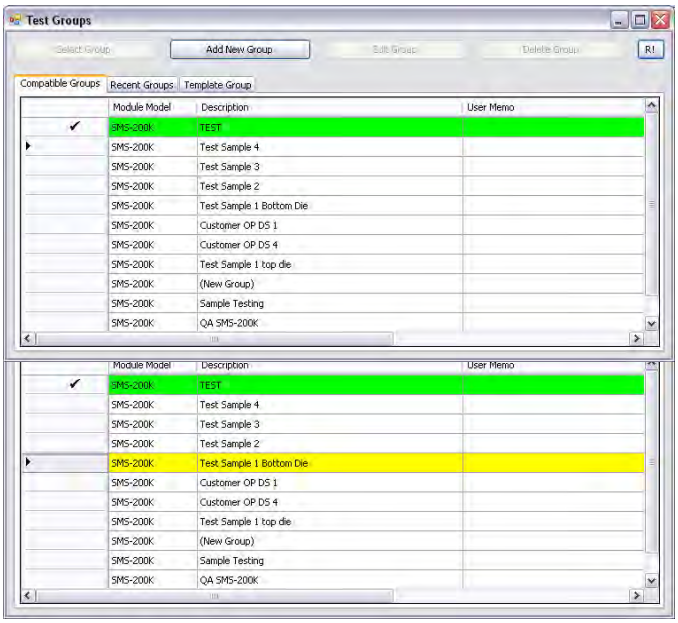
Test Groups

A test group is a collection of data with all the associated test settings saved together.

This series of windows is used to select, edit, create or delete a test group.

The currently selected Test Group is displayed with a checkmark and is colored green.

Note that once a test group has been used and contains test data, it can no longer be edited or deleted.



A different test group must be selected before the **Select**, **Edit** or **Delete** buttons are

enabled.

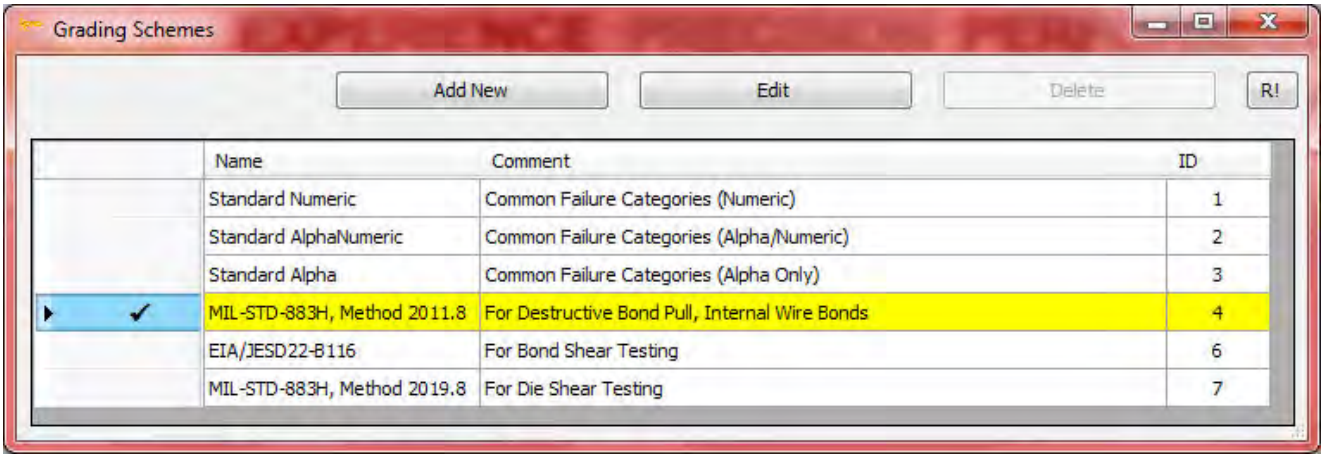
Edit Group

From this window a user can define the test recipe, grading scheme and user fields. A user can also create a new test group or edit an existing test group. The System keeps a record of changes to the test group definition and displays the most recent access date.

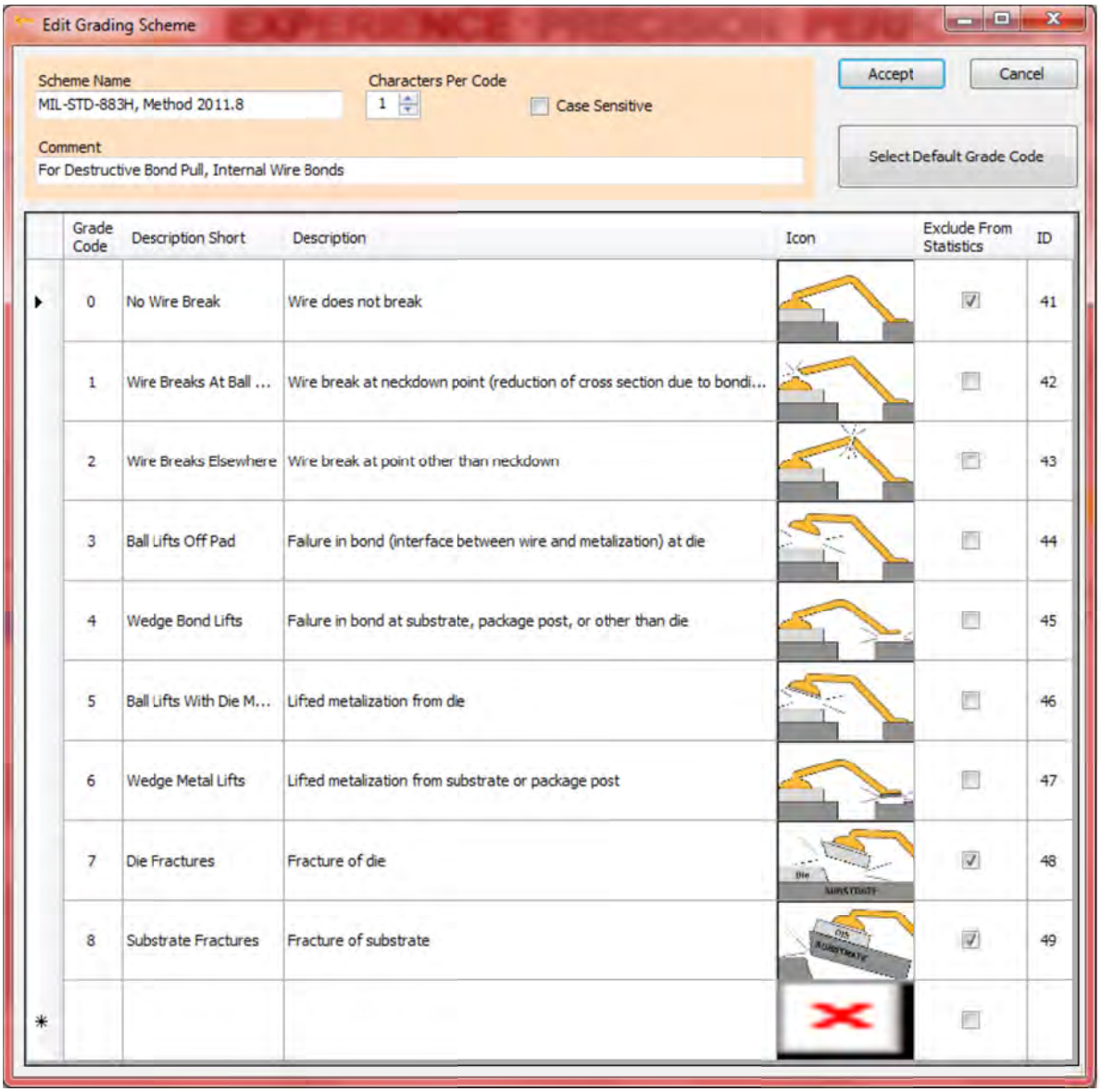
Grading Schemes

This window defines the bond failure grading scheme for a particular test recipe. The grading scheme typically describes the location of the bond failure and the way it failed. Royce provides sets of default grade codes for common bond test failures.

Grading schemes can be edited from the *Test Setup > Grading Schemes* menu.



Click to select the grading scheme, then click E**dit**.



Trend Samples, Trend Tests

When *Trend Samples* is checked, each point on the graph represents the average of all test values in each sample.

When *Trend Tests* is checked, each point on the graph represents the test value for a single test.

Save Force Profiles

Saves profiles from every test in the sample.
This option can be turned off to save storage space.

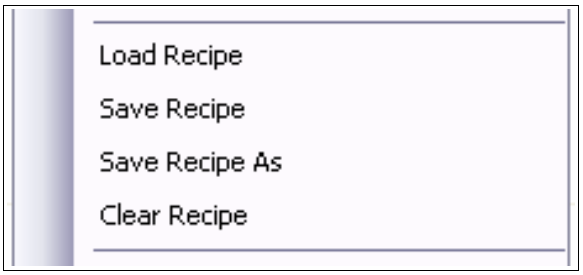
Save Force profiles

Load Recipe

Embed an existing recipe file into the currently selected group.

Save Recipe

Ensure that current recipe parameters are embedded in the group. These will then be saved in the database.



Recipe Commands

Save Recipe As

Extract the recipe information embedded in the currently selected group and save it as an external recipe file.

Clear Recipe

Clear Recipe deletes any changes and returns to the factory default recipe file.

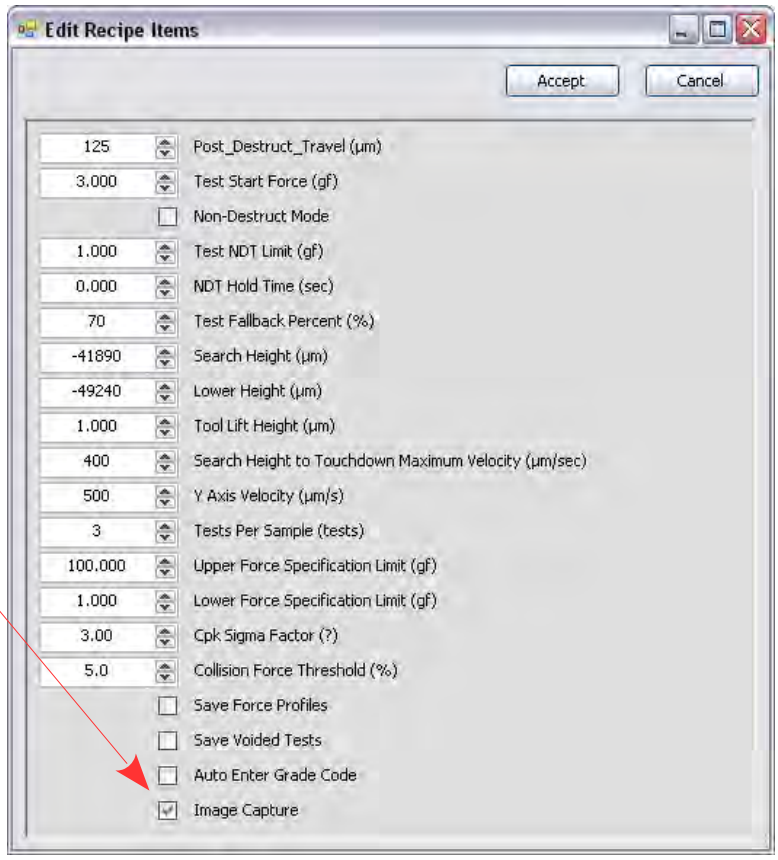
Image Capture Menu

The Image Capture option for the Royce 650 allows the system to capture, annotate, measure, and save an image of a tested bond site. Image capture is not compatible with 620 systems.

This is a field retro-fittable option; contact Royce Instruments for pricing and installation information.

Image Capture Setup

1. Open or create a new test group.
2. Select 



Edit Recipe Items, Set Image Capture ON

3. Set any other recipe parameters as appropriate for your sample.
4. Check the Image Capture option in the Recipe.
5. Perform a test.
6. When the test ends, you will receive the following prompt:

Confirm Tool Height

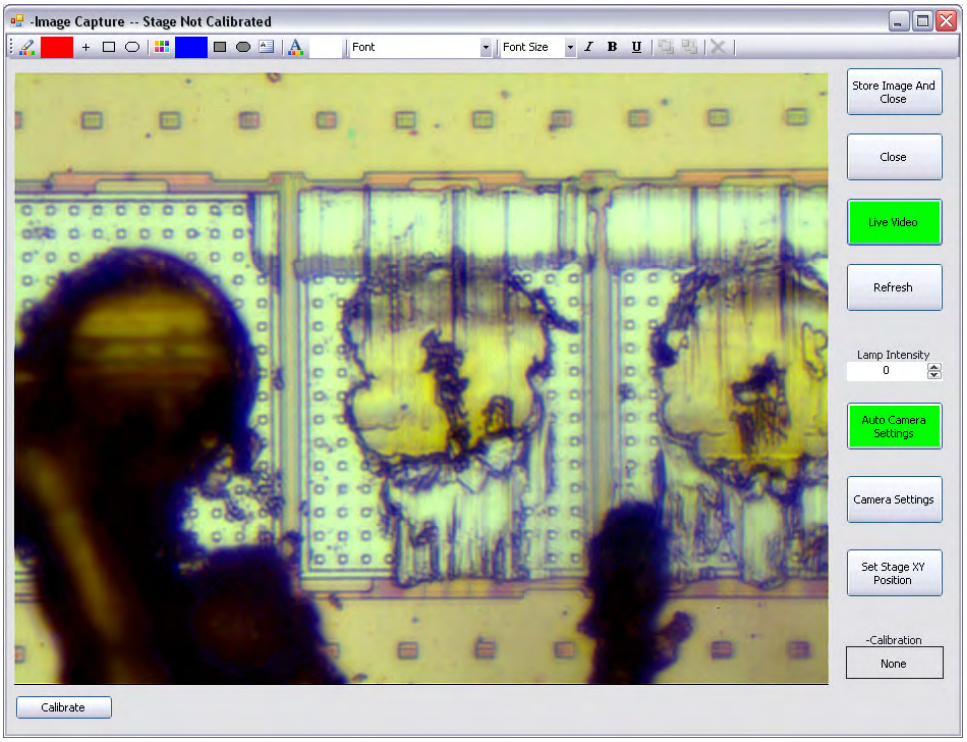
7. Move the tool up to clear obstructions, if necessary, and click **OK**. This will set the Traverse Height. After each test the tool will move to this height before moving the stage to the inspection position.

8. You will then receive this prompt:

9. If you click **NO,** you will not receive either of the above prompts after the next test and the stage will move to the Traverse Height and then the inspection position automatically after each test.

   Note: If you need to adjust the Traverse Height, close and re-open the test group. The first test performed after a group is opened will prompt you to set the Traverse Height.

10. You will then see the *Image Capture Screen*:

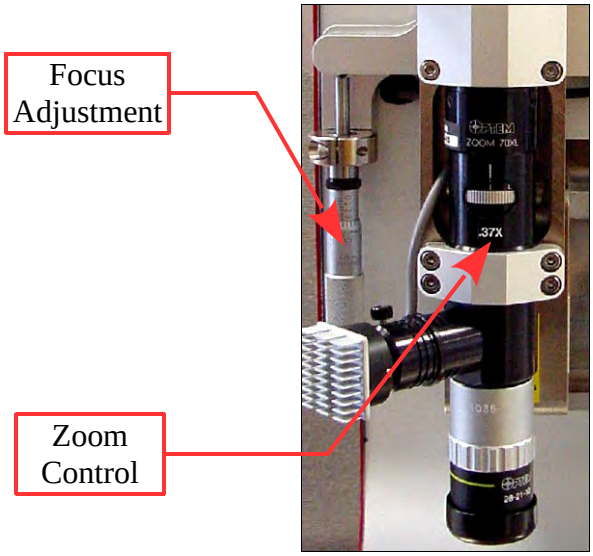


11. Use the Joysticks to move the stage so that the bond you just tested appears in the center of the image capture screen.

12. Click the **Set Stage XY Position** button 

to lock this position for subsequent tests.

13. Set the Lamp Intensity, Zoom and Focus so that you can see the sample clearly.



Zoom Lens Controls

Bond Site Image Annotation

You can add annotations to the image by clicking on one of the buttons shown below.

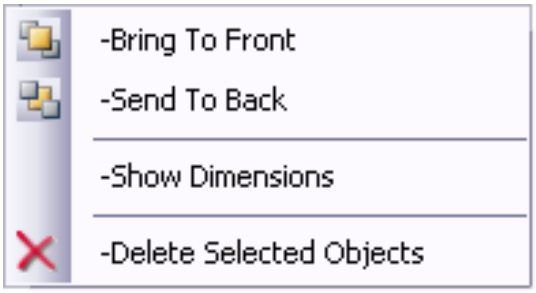
Annotations Menu

You can use the annotations to measure distances and areas within the image, however the image capture system must be calibrated first. It will only need to be re-calibrated if the zoom ratio is changed.

1. Click on the **Calibrate** button in the bottom left corner of the image capture screen and follow the onscreen directions to set the microns per pixel scaling factor.

   Note: If you change the zoom level, you must recalibrate the microns per pixel factor.

2. To display the dimensions of an annotation right click on the annotation to display the context menu and click on **Show Dimensions**.



Annotation Menu

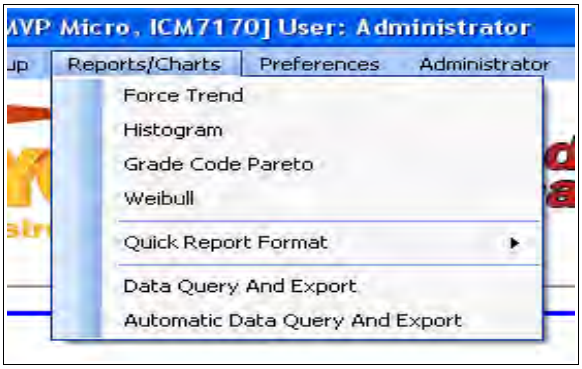
3. If you click on the button, the button 

the *Image Capture* screen will close and two images will be stored to ***C:\Program Files (x86)\Royce Instruments\650\Images*** directory. One image will contain just the raw image and the other will include the image and annotations. If you do not want to save the image, click the **Close** button.

4. Grade or void the test and the stage will return to the testing position.

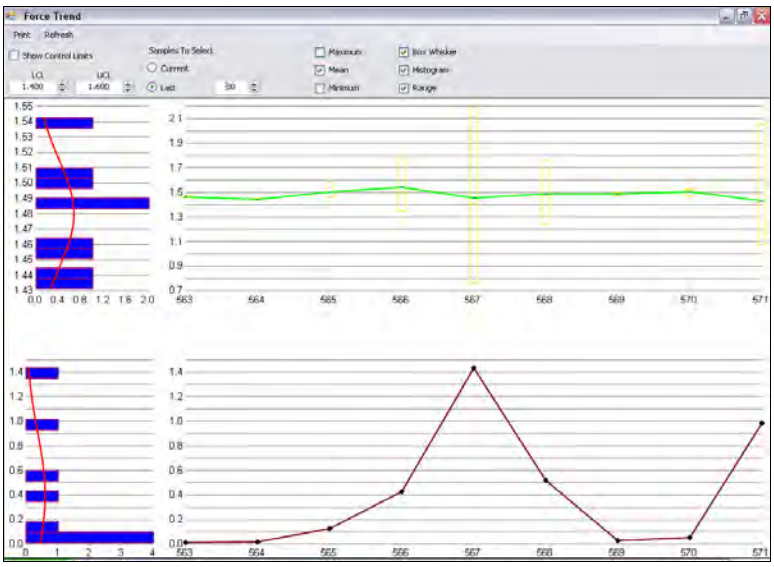
   To recall an image following a test, right click on the test under test results section and then click **Recall Test and Regrade**.

Reports/Charts Menu



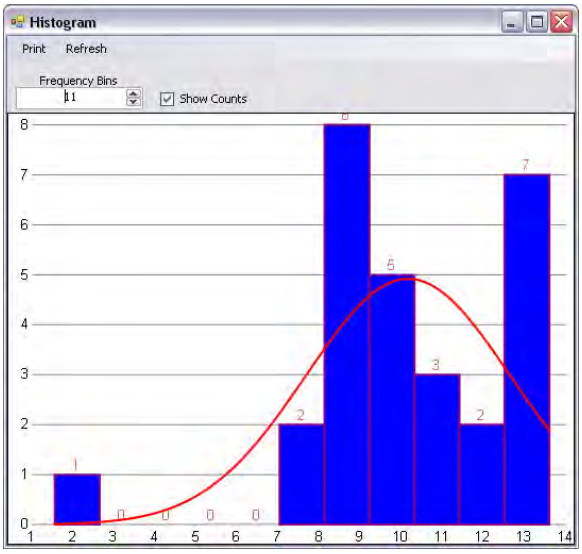
Reports/Charts Menu

Force Trend Chart



Force Trend

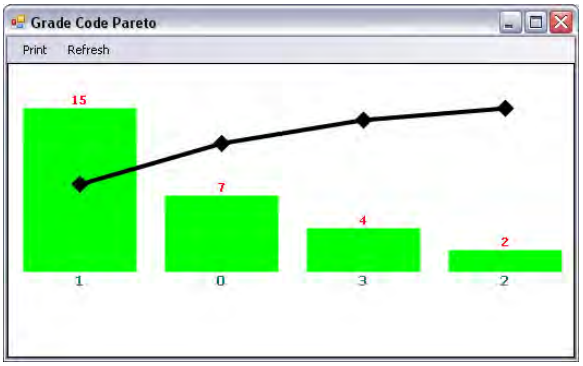
Histogram Chart



Histogram

Grade Code Pareto Chart

The *Grade Code Pareto Chart* plots the frequency of grade codes and the cumulative total of all failure codes in the selected test group.

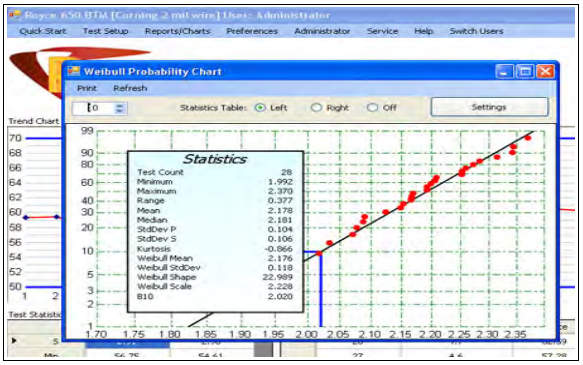


Grade Code Pareto Diagram

Weibull Chart

The *Weibull Chart* is used in reliability analysis.

For further information on Weibull analysis, please refer to:

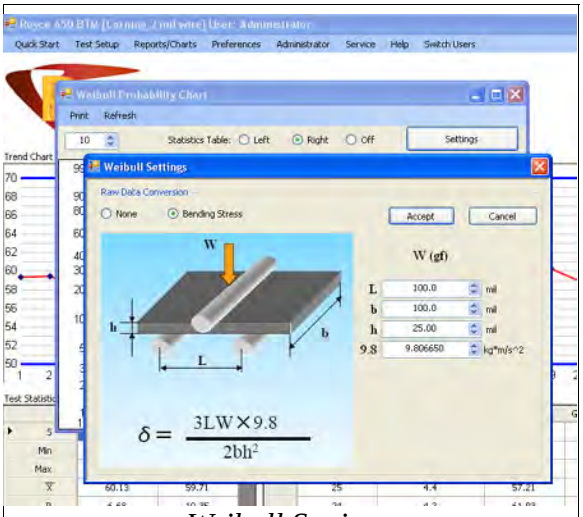


Weibull Probability Chart

http://www.weibull.com/basics/lifedata.htm

The *Statistics Table* can be turned off or it can positioned to the left or to the right of the probability chart .

Selecting Settings will reveal the settings window where die dimensions and stress values can be adjusted to obtain the optimal straight line representation on the *Weibull* chart.



Weibull Settings

Data Query and Export

The Data Query And Export feature of Bond Test Manager provides a means to extract any or all test results from the Royce 650 database based on user-defined criteria, then format and output these data in a user configured report format.

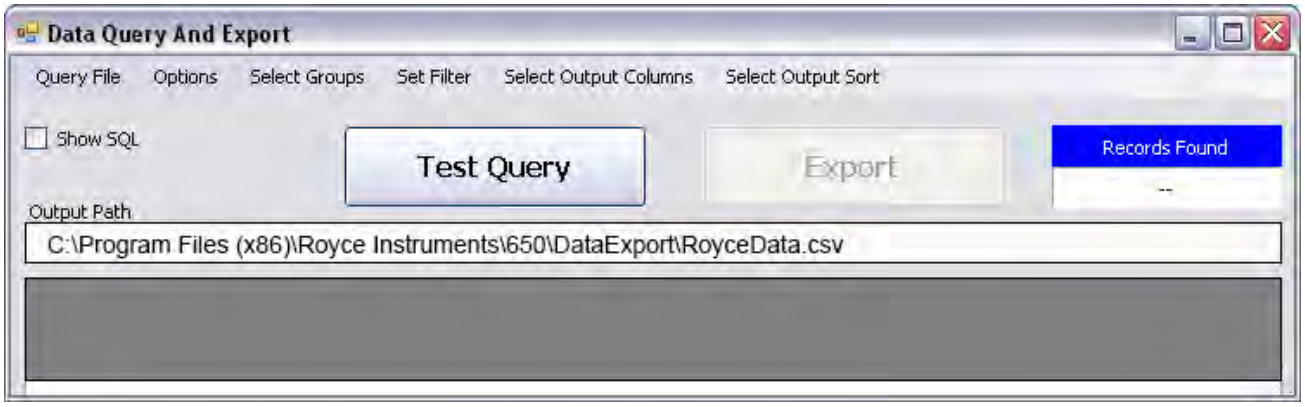
The *Data Query And Export* feature can be used two ways:

1. On-demand.
   Data is exported when needed, according to the user designed report

OR

2. After every test. Data is exported automatically to the report following every test or every test recall and re-grade.

Selecting either option will bring up the *Data Query and Export Screen* in which you can design the report format.



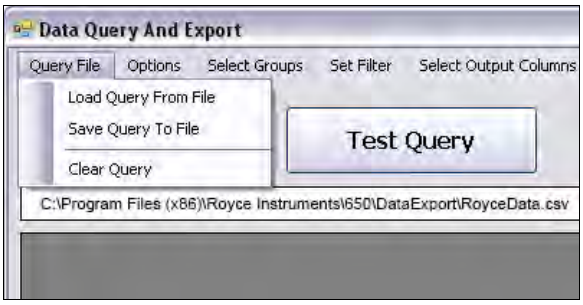
Data Query and Export Screen

Query File Menu

Load Query from File

Loads a previously created SQL query file.

NOTE: A query file is automatically saved to test group.



Data Query and Export
Query File Menu

Save Query to file

Saves a user created SQL query file.

Clear Query

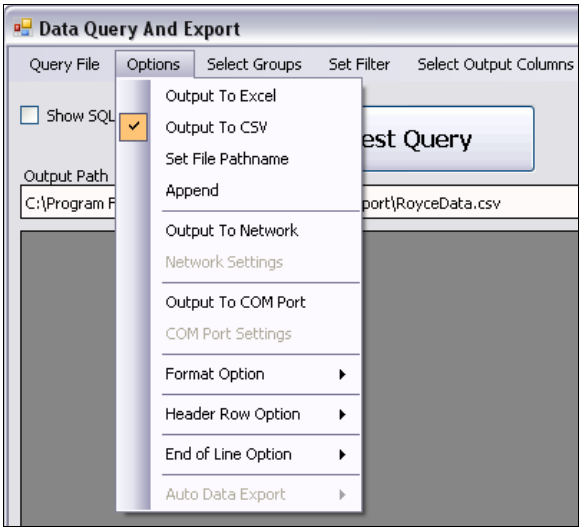
Clears a user created SQL query.

Options Menu

Output to Excel

Output to Excel will save the data to a Microsoft Excel formatted spreadsheet.

Use *Set File Pathname* to change the location of the Excel file.



Data Query and Export
Options Menu

Output to CSV

Sets output to be in CSV (Comma Separated Values) format. *Output to CSV* will output the data to a CSV file

Use *Set File Pathname* to change the location of the CSV file.

Select the *Append* option to add data to the end of an existing CSV file every time an export is performed.

Set File Pathname

This allows the user to set the destination folder for the report.

Append

This appends data to existing CSV output file.

Output to Network

This permits data to be output to a network file system.

Network Settings

This sets the network IP address and port.

Output to COM port

Selecting output to COM Port will send the data through the selected serial port.

COM port Settings

Selects the COM Port Settings for the serial communications.

Format Option

This sets the output format to be either the Default format or the same format as is used in Royce System 552.

Header Row Option

This sets when to output a header line in the report.

End of Line Option

This sets the end of line character permutations of:

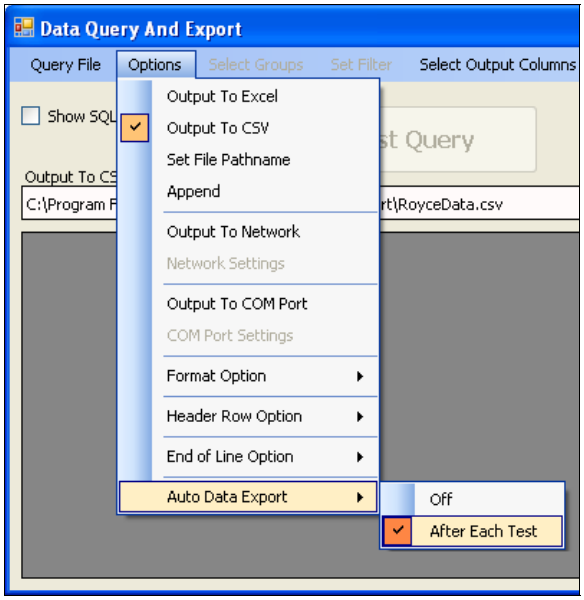
CR (Carriage return character)

LF (Line feed character).

Auto Data Export

This sets the *Data Query Report* to be sent after each test.

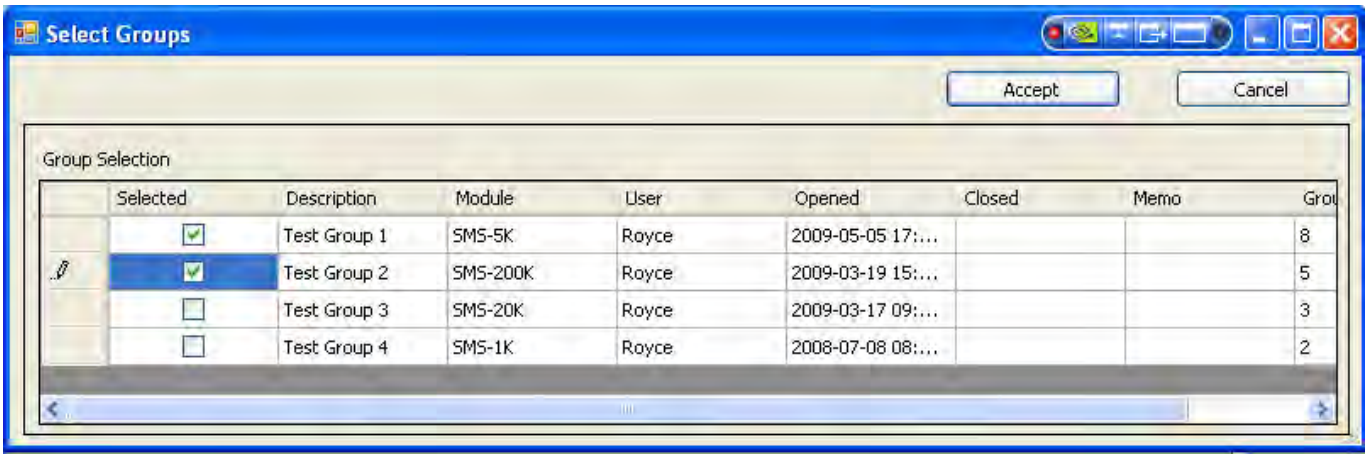
Note that the report configuration must be appropriate for sending after each test.



Set Auto Data Export

Select Groups

Selecting this will immediately present a list of groups to choose from.

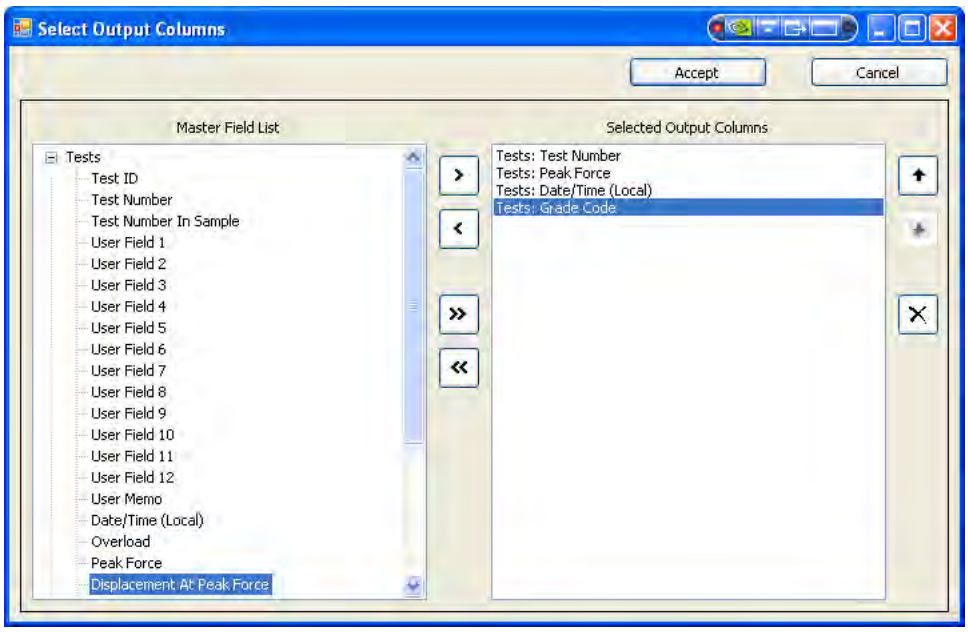


Select Group for reporting

Check the boxes next to the groups you wish to include in your query.
If none of the boxes are checked, then all of the groups will be included in your query.

Groups can also be selected or restricted using Filtering Data Query and Export:

Select Output Columns



Data Query and Export: Select Output Columns

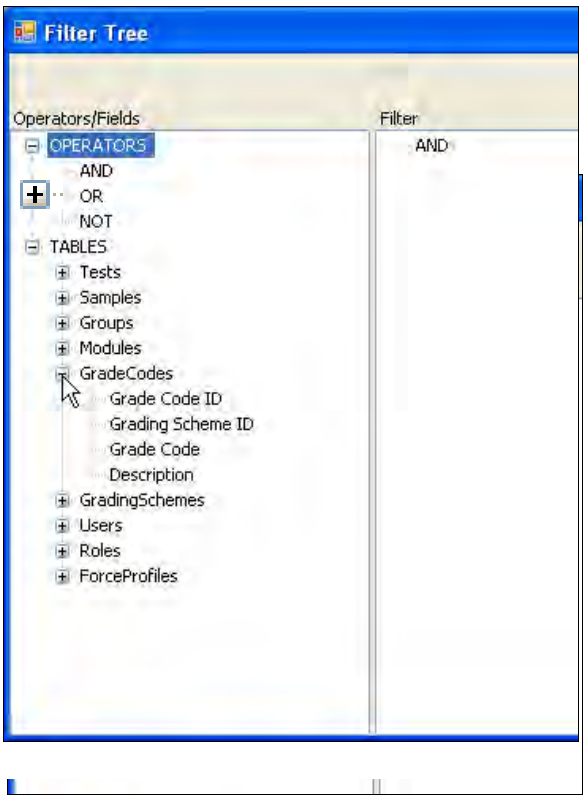
This menu launches a dialog box enabling you to define which data fields are returned by the query, and in which order they should appear.

1. In the **Master Field List** click the ⊞ to expand the categories of fields.
2. Select a field you wish to include in your export
3. Click the › button to add the selected field to the Selected Output Columns List.
4. Use the ↑ and ↓ buttons to change the order of the output columns.
5. Use the ✕ button or the ‹ button to remove a field from the Output Columns List.
6. Click the Accept button.
7. Use Test Query button to see the results of your selections.

Set Filter

This menu launches a dialog box which allows you to construct a filter which restricts the data selected by the query.

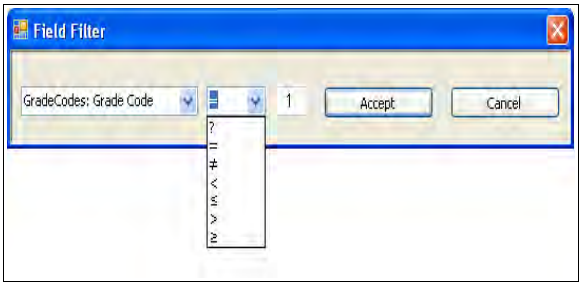
1. To choose a field to filter on, click on the box next to the field name to expand that section.
2. Select a field and drag it over to the base operator (AND).
   NOTE: you must drop the field exactly on the **AND**



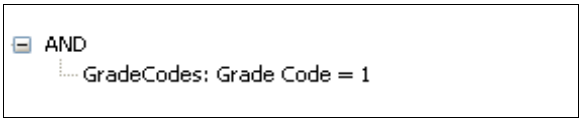
Drag the field to the logic operation

3. Select the filter type (=, <, >, etc.), enter the filter parameter, and click Accept

   This example will limit the results to only those whose grade code is equal to 1.

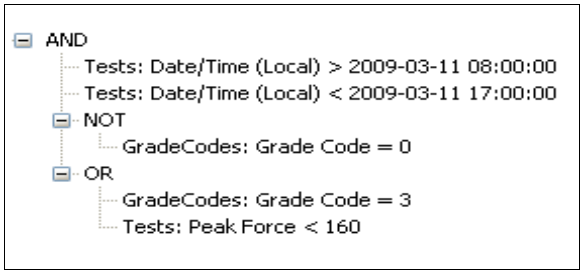


Field Filter



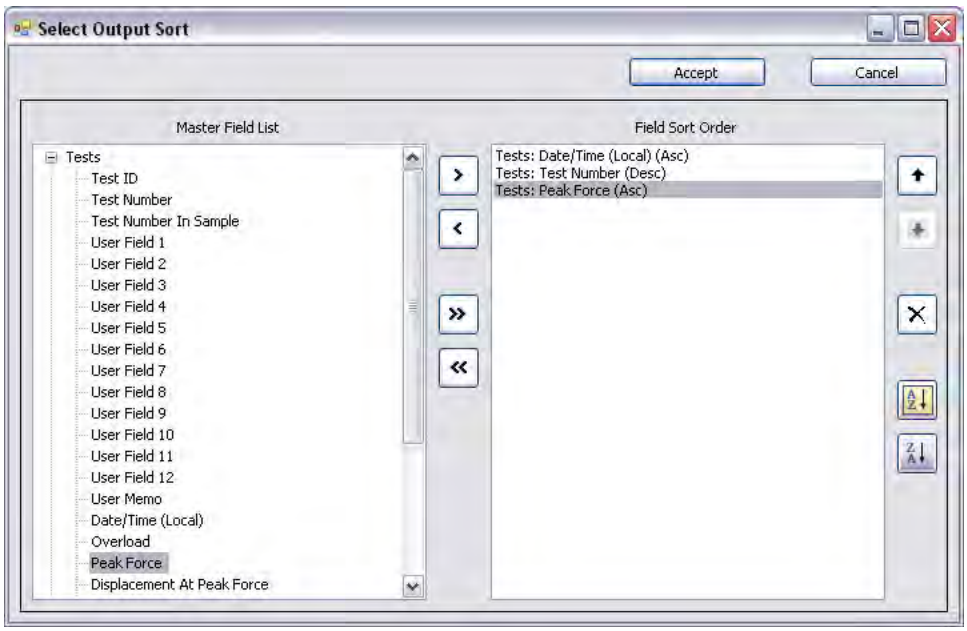
4. You can now click Accept to save your filter or you can continue to add more parameters to the current filter tree.

   This example will include all tests from the selected test groups that occurred between 8am and 5pm on March 3, 2009, whose grade code is equal to 3 or whose peak force was less than 160, and will exclude all tests whose grade code is equal to 0.



Select Output Sort

This menu launches a dialog box offering sorting options. In general, output data can be sorted by one or more data fields and in ascending or descending order.

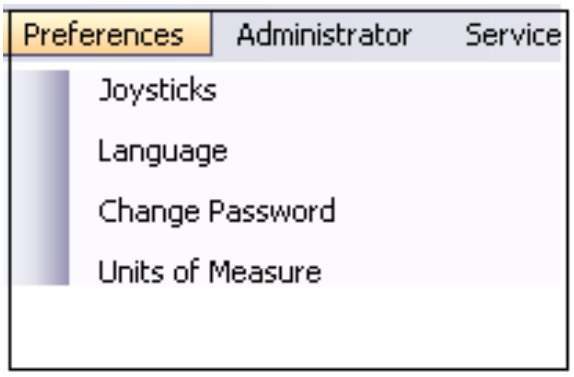


Select Output Sort Order

1. In the Master Field List click the ⊞ to expand the categories of fields.
2. Select a field you wish to specify sort order.
3. Click the › button to add the selected field to the Field Sort Order List.
4. Use the ↑ and ↓ buttons to change the sort priority of the field.
5. The fields toward the top of the list will have the highest sort priority.
6. Use the ✕ button or the ‹ button to remove a field from the Field Sort Order List.
7. The button A↓Z selects ascending order for a field (asc) , the button Z↓A selects descending order for the field (desc)
8. Click the Accept button.
9. Use Test Query button to see the results of your selections.

Preferences Menu

This pull-down menu includes user-definable display screen and operation options. Note that you may not be able to access this menu or sub-menus if the administrator has not granted access rights to your user role.

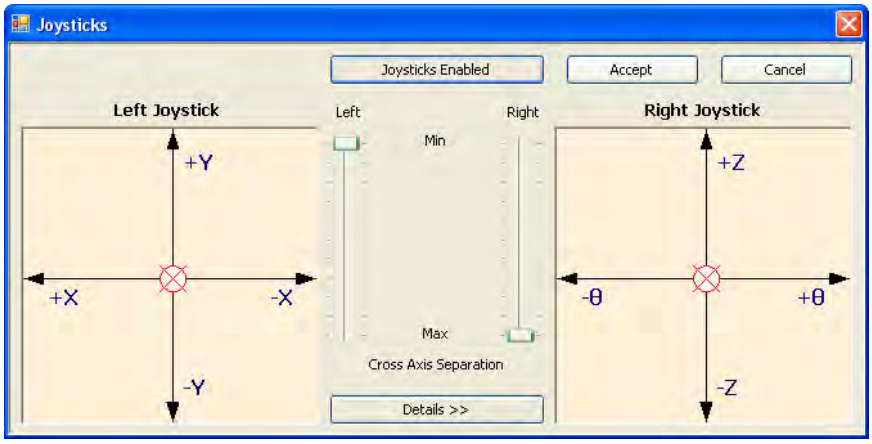


Preferences Menu

Joysticks

The Joysticks windows allow users to change joystick assignments and axis separation.

For 620 systems, only one joystick is supplied by default.



Joystick Preferences Window

Axis Assignment

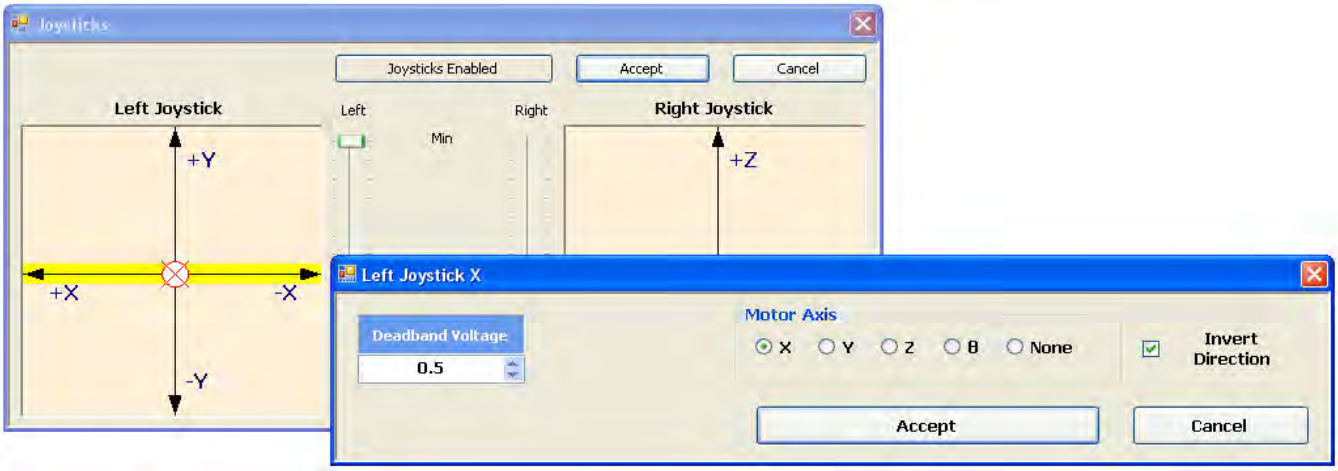
The joysticks have been designed for right-handed or left-handed use.

The axis lines are highlighted in green when the mouse arrow moves over them.

Clicking on a highlighted axis brings up the selected left or right joystick preferences window that allows users to change default dead-band voltage and direction.

620 Systems: Z, Θ

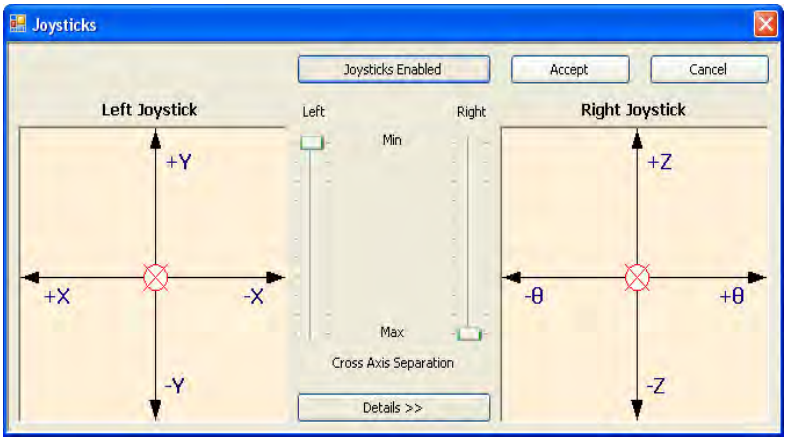
650 Systems: X, Y, Z, Θ



By default, the right joystick controls the Z (up/down) or vertical travel of the test module and the hook rotation. The left joystick controls the left-right (X) and front-to-back (Y) stage movement. To change the assignment of joystick to axis, in the graphic above, click on the axis you want to change.

Select the motor axis you want to correspond to the selected axis. You may also select “Invert Direction “ if you would prefer the motion to move in the opposite direction. Note that Each direction must have it's own unique motor axis.

Cross Axis Separation



It can be difficult to control a joystick so that there is motion in only the Front/Back or Left/Right direction without disturbing the other axis. The *Cross Axis Separation* adjusts the size of a “dead band” which prevents a small joystick movement in one axis from disturbing the other axis.

When the slider is set to **Min**, both X and Y axes can move at the same time, for example in a diagonal direction. When the slider is set to **Max**, you can move only one axis at a time.

Note: The factory defaults for the XY axes separation is **Min**. The factory defaults for the Z-Theta axes are **Max.**

Language/Culture

At this time, the System supports 7 languages: Mandarin, French, English, Spanish, German, Japanese, and Korean. The default setting is English. This menu allows users to select another language. (See Page 17 for the Regional Settings window.)

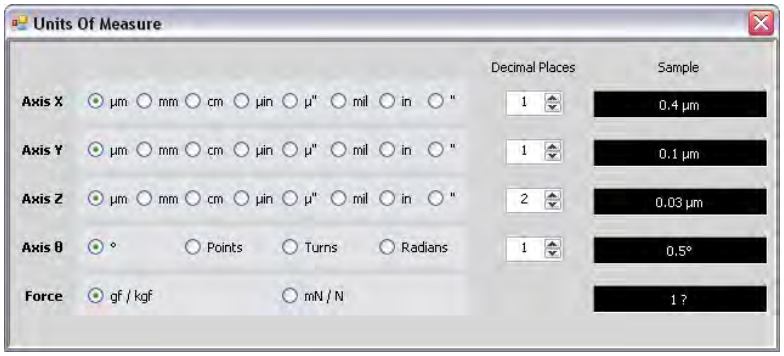
Change Password

This window allows users to change their assigned passwords.

Change Password Window

Units of Measure

This window allows users to change the units of measure for distance, angle and force.

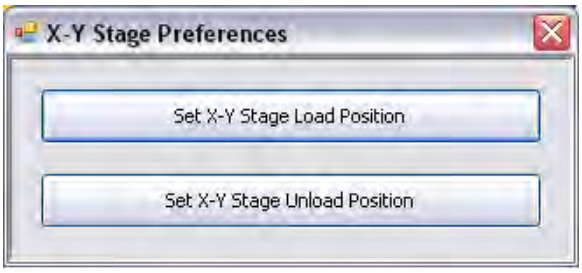


Units of Measure Window

X-Y Stage Load and Unload Positions

For 650 Systems only.

This window allows users to set the load and unload positions for the X-Y stage. The buttons define stop positions within the X-Y stage area.



X-Y Stage Preferences Window

Setting the Load position moves the X-Y stage to the programmed Load (or test) position.

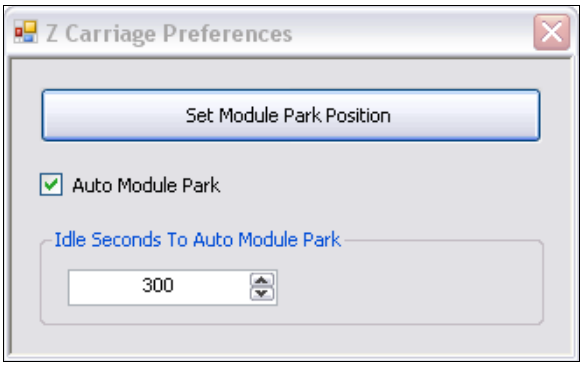
Setting the Unload position moves the X-Y stage to the programmed unload position. This is usually toward the right hand side and towards the front of the machine to permit easy access to the test sample.

To set a position, move the stage with the joystick to the desired location and click the button.

Set Module Park Position

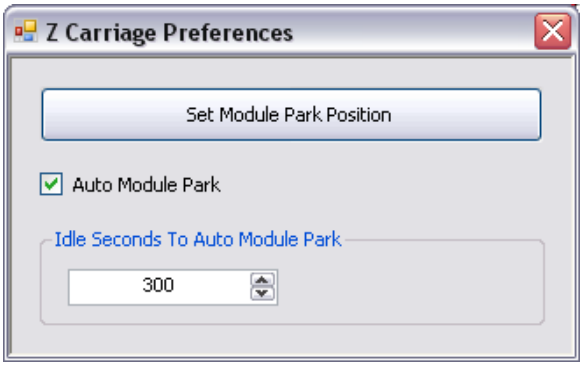
For 650 Systems only.

This parameter allows the user to set the module's Park height. The park position can be used to move the module upward to a preferred height allowing for safe loading and unloading of samples.



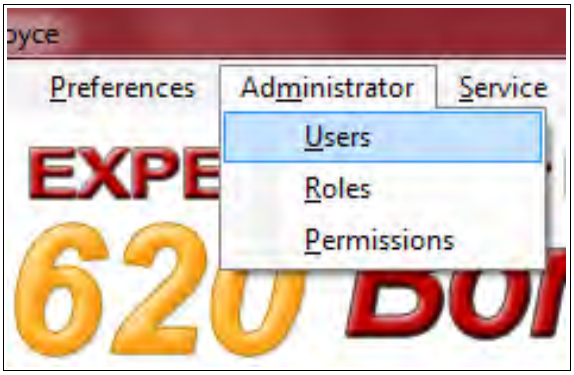
Caution:
Set Module Park Position high enough to avoid collisions when changing test tools, test samples or test piece holders.

If *Auto Module Park* is selected, the module will automatically return to the user set park position after the system has been idling for a specified time. The time delay is adjustable from a minimum of 60 seconds.



Administrator Menu

The windows in this menu allow a user to add and delete users, and assign and change user roles, passwords, and permissions.



Administrator Menu

Users

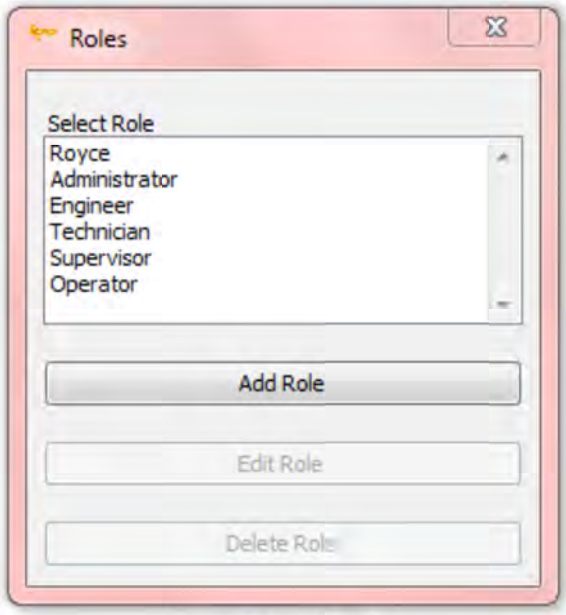
This window allows a user to add and delete users, and edit user information.

The users role is shown in parenthesis, see next paragraph.

Administrator Users Window

Roles

This windows allow an administrator to assign default roles to people who will be working on the system. Royce provides a set of predefined roles with default permissions. A user can also modify or define new roles and assign permissions to them.



User Roles Window

Permissions

Role permissions Window

This window allows an administrator to modify the default role permissions or assign a set of permissions to a newly created role.

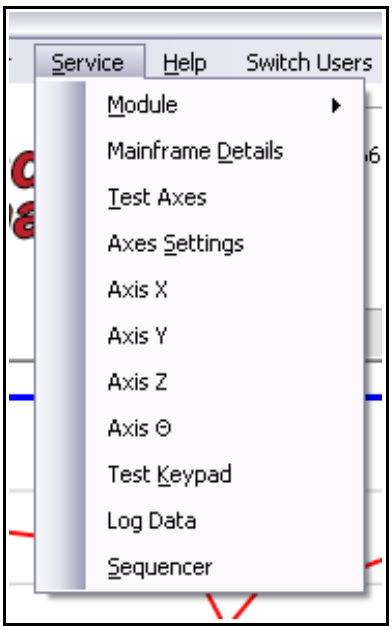
Click **Accept** to save changes.

Service Menu

This menu offers many tools for interacting with the details of mainframe setup.

Access to this menu and its items is controlled through **Administrator Menu: Permissions**, see Page 46.

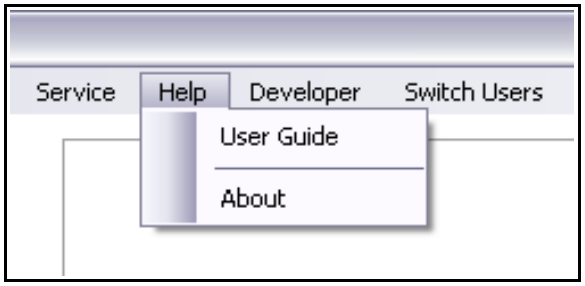
Some functions may be enabled only under direction from Royce Instruments technical personnel.



Service Menu

Help Menu

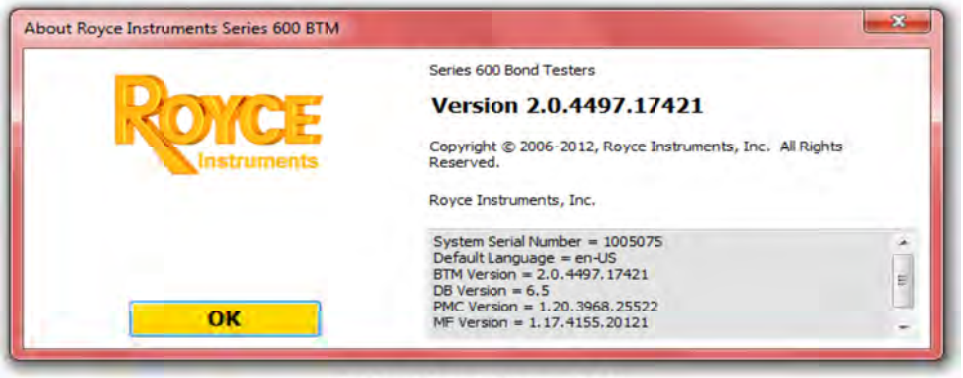
The *Help* menu displays software versions and system serial number information.



User Guide

Selecting *User Guide* will open the electronic version of this document.

About



Help About Royce 650

In the event of a support issue, Royce Instruments customer support will ask you to report these software versions and serial numbers.

Operation Buttons

Start Test

Click to Start a test using the mouse.
Note that generally it is more convenient to start a test by pressing the "*****" key on either joystick keypad.

Abort Test

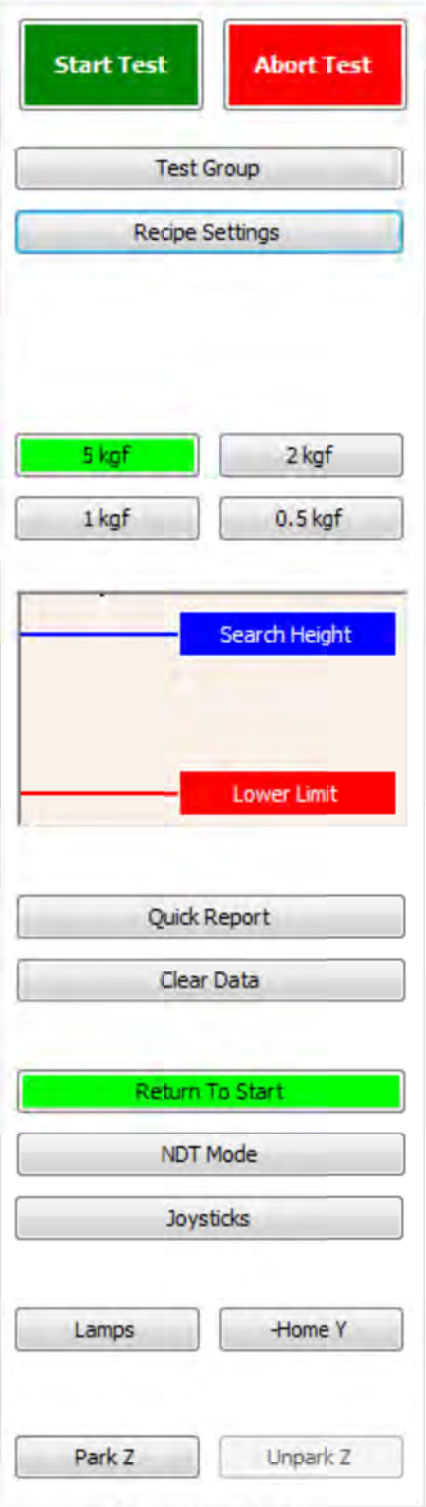
Click to Abort a test using the mouse.
Note that generally it is more convenient to start a test by pressing the "**#**" key on either joystick keypad.

Recipe Settings

Selecting the **Recipe Settings** button brings up the *Edit Recipe Items* menu, which lists all the test recipe parameters.

The recipe settings are assigned default values when a new test group is opened. Users with the appropriate permission can change these values as needed. Any changed values are automatically embedded with the test group data.

Note that the units shown in this window are those selected under: **Preferences > Units of measure.**



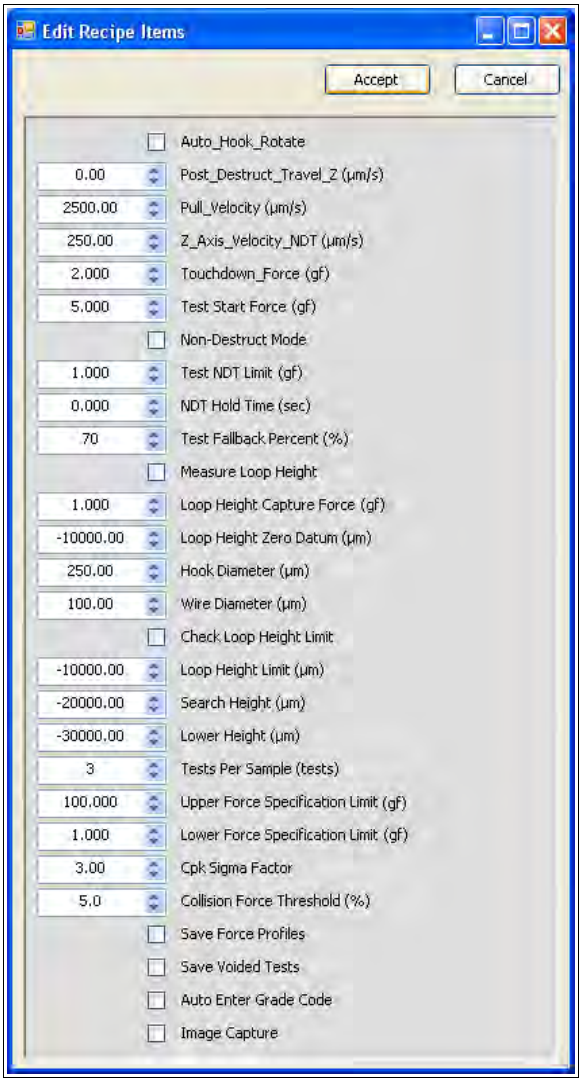
Operation Buttons

Recipe Settings (Wire Pull)

Auto Hook Rotate

When wire pull testing, it is often convenient to let the system automate the hook rotate process. The hook is positioned with the foot parallel to the wire loop and located adjacent to the wire to be tested. The hook can be located at any height. After testing the hook will return to the height specified with the "Return to start Height/Return to Search Height" buttons.

On pressing the **Start Test** button, the hook will descend to Lower Height then rotate 90° clockwise. This will position the hook foot under the wire of interest. The pull test now starts.



Destruct testing:

The hook will now move upwards until the wire breaks. The hook now returns to start height or search height, as preferred, then rotates back to its' original orientation.

Non Destruct testing:

The hook will now move upwards until the non destruct test force limit is reached.

The hook now returns to the lower limit height, rotates back to its' original orientation and then returns to the test start height or search height, as preferred

Post Destruct Travel Z

This is the distance the hook tool will travel after the test is complete. Sometimes it is convenient to continue pulling after the test has terminated. For example when testing thick aluminum wire, the hook can push the broken wire out of the way, making it easier to judge failure mode.

Note that no test readings are taken during the Post Destruct portion of the test.

Pull Velocity

This is the test speed for destructive wire pull tests and the 3 point push test.

Z Axis Velocity NDT

This is the test speed used for Non Destruct Testing.

Touchdown Force

During the pull test sequence, it is necessary to touch down onto the die surface before clamping the wire, ribbon, etc. This setting determines the touchdown force.

Test Start Force

The system will ignore any test forces below this threshold. During wire pull testing for example, no force data will be captured before the hook contacts the wire with Test Start Force. Once this force is reached, force profile data is collected and the automatic process of deciding when to terminate the test is started. If the Test Start Force setting is too low, workplace vibration may trigger premature start of test. This would cause the automatic end of test process to terminate the test too early.

Non-Destruct Mode

When selected, increasing force will be applied until a set “Test NDT Limit” force is reached. Once this force is reached, the test will terminate and the hook will return. If the wire breaks during Non Destruct testing, the test will be treated as a normal destructive test.

Test NDT Limit

This is the force setting for Non Destructive testing.

NDT Hold Time

Once the Non Destruct Test force limit is reached, the force is held in place for “NDT Hold Time”.

Test Fallback Percent

During a test, the force increases gradually. The software watches as the force increases and identifies when the force peak value has been reached. The test will continue and data will continue to be gathered until the force has dropped back below the “Test Fallback Percent” of the force peak value.

Measure Loop Height

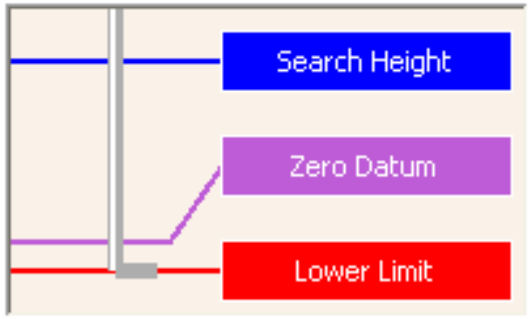
The system can be set to measure wire loop height.
When this check box is selected, the tool position graphic on the right of the display will change to display a purple box “Zero Datum”.

Loop Height Capture Force

During a test, loop height is measured when the pull force equals the “Loop Height Capture Force”. In order to minimize the effects of distorting the wire loop, this is usually set to a small value, for example 1 gf.

Loop Height Zero Datum

In order to measure loop height, it is necessary to specify the measurement datum surface.
The numeric value can be adjusted in this box.
It is usually easier to adjust this value by clicking on the purple “Zero Datum” box in the tool position graphic.



Tool Position Graphic, Zero Datum

Hook Diameter

Since the bottom of a wire pull hook will be used to set the datum surface, but the top side of the hook will make contact with the underside of the wire loop, the hook diameter must be entered in order to calculate the height of the top surface of the wire loop.

Wire Diameter

Since the height of the top of the wire must be measured, but hook contact takes place underneath the wire loop, the wire diameter must be entered in order to calculate the height of the top surface of the wire loop.

Check Loop Height Limit

This setting will ensure that the loop height is checked during every test. If the loop is too high, a warning will appear.

Loop Height Limit

This is the loop height above which a loop height failure will be recorded.

Search Height

Search height is a convenient height at which the hook can be moved around the test sample without damage. Also, when the tool is below search height, XYZ speeds are usually set to slow down (*See Set Joystick Velocities, Page 66*). In this way, small position adjustments can be made when the tool is close to the test sample, but once the tool is above search height, high speed moves can be made without damage to the tool, sample or tooling.
It is easier to adjust this value by using clicking on the search height box in the graphical tool height display window.

Lower Height Limit

When wire pull testing, it is convenient to stop the hook tool before it contacts the substrate. Setting the lower height to just above the substrate will stop the hook before it makes contact.

Note that hook Z motion will also stop when collision force is exceeded, however if the collision speed is very high, the drive system may not be able to stop in time before hook damage occurs.

Tests per Sample

This sets how many tests comprise a statistical sample for SPC purposes.

Upper Force Specification Limit (USL)

This setting adjusts the height of the upper Specification Limit line in the graphical display.

Lower Force Specification Limit (LSL)

This setting adjusts the height of the lower Specification Limit line in the graphical display.

Cpk Sigma Factor

Generally, this is set to 3.

Collision Force Threshold

During hook positioning, the hook can be accidentally bumped into the sample or the tooling. The vertical force on the hook is monitored continuously and XYZ motion will be stopped when this force setting is exceeded. Only the vertical force can be monitored, so if the hook bumps horizontally into an object, there is usually a vertical component of the collision force which can be detected. When this occurs, the joysticks must be returned to the neutral “hands off” position in order to restart XYZ motion.

If collision is detected, a red *Collision alarm* message will appear on the lower status bar.

Save Force Profiles

If this is set, a separate force profile data file will be saved to disk for each test, using the test number as identifier. Force profile data is a table of force versus displacement.

Save Voided tests

If this is set, then any test voided by the user will be saved in the database. Even though the voided tests are recorded, they are not included in any statistical calculations.

Auto Enter Grade Code

Sometimes it is not necessary to capture failure modes for every test, but only the force data. If the grade code data is not needed, the system can be set to enter a default grade code.

The G*rade Code* screen will be presented as usual, but the user is not forced to enter a grade code, but may do so optionally. The default grade code can be set in **Test setup>Grading schemes**.

Image Capture

If this is set, the Royce 650 will operate in “Image Capture” mode.

(See Image Capture Menu, Page 28)

When finished changing recipe settings, click the **Accept** button so that settings are saved in the test group database.

Recipe Settings (Bond Shear Testing)

Automatic Testing

This box is checked to enable automatic shear testing mode.

Post Destruct Travel Y

This is the distance the shear tool will travel after the test is complete. Sometimes it is convenient to continue shearing after the test has terminated. For example when shear testing thick aluminum wire bonds, the shear tool can push the broken bond out of the way, making it easier to judge failure mode.

Test Start Force

The system will ignore any test forces below this threshold. During shear testing for example, no force data will be captured before the shear tool makes contact with the bond at Test Start Force. Once this force is reached, force profile data is collected and the automatic process of deciding when to terminate the test is started.

Non-Destruct Mode

When selected, increasing force will be applied until a set “Test NDT Limit” force is reached. Once this force is reached, the test will terminate and the shear tool will return. It is not recommended to perform Non Destructive shear testing since it is difficult to avoid sample damage.

Test NDT Limit

This is the force setting for Non Destructive testing.

NDT Hold Time

Once the Non Destruct Test force limit is reached, the force is held in place for “NDT Hold Time”.

Test Fallback Percent

During a test, the force increases gradually. The software watches as the force increases and identifies when the force peak value has been reached. The test will continue and data will continue to be gathered until the force has dropped below the “Test Fallback Percent” of the force peak value.

Search height

Search height is a convenient height at which the shear tool can be moved around the test sample without damage. Also, when the tool is below search height, XYZ speeds are usually set to slow down (*See Set Joystick Velocities, Page 66*). In this way, small position adjustments can be made when the tool is close to the test sample, but once the tool is above search height, high speed moves can be made without damage to the tool, sample or tooling.

Lower Height

When shear testing, the shear tool moves down until it makes light contact with the substrate. This is the surface datum from which tool flying height is based. The tool then lifts to the Tool Lift Height and moves to shear the test sample.
It is important to set the Lower Height BELOW the anticipated substrate surface height. If the shear tool reaches the Lower Limit Height before it touches the substrate surface, an erroneous surface datum height will be acquired.

Tool Lift Height

This is the distance that the shear tool is lifted from the substrate surface before shearing the bond. During shearing, it is important that the tool does not scrape on the substrate surface or a there may be measurement error and often the test will end prematurely. If the Tool Lift Height is too high, the shear tool may merely skim across the top surface of the bond, or even miss it completely. Common height settings are 2 to 4 microns.

Search Height to Touchdown Maximum Velocity

On certain fragile or soft materials, it is useful to reduce the speed at which the tool makes touchdown with the surface.

Y Axis Velocity

This is the test speed in the shearing direction.

Tests per Sample

This sets how many tests comprise a statistical sample for SPC purposes.

Upper Force Specification Limit

This setting adjusts the height of the upper Specification Limit line in the graphical display.

Lower Force Specification Limit

This setting adjusts the height of the lower Specification Limit line in the graphical display.

Cpk Sigma Factor

Generally, this is set to 3.

Collision Force Threshold

During shear tool positioning, the shear tool can be accidentally bumped into the sample or the tooling. The force on the shear tool is monitored continuously and XYZ motion will be stopped when this force setting is exceeded. When this occurs, the joysticks must be returned to the neutral “hands off” position to restart XYZ motion.

Save Force Profiles

If this is set, a separate force profile data file will be saved to disk for each test, using the test number as identifier.

Save Voided Tests

If this is set, then any test voided by the user will be saved in the database. Even though the voided tests are recorded, they are not included in any statistical calculation.

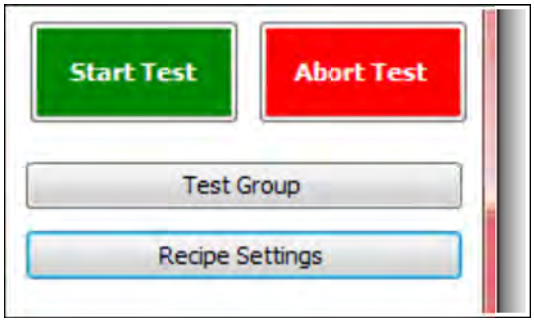
Auto Enter Grade Code

Sometimes it is not necessary to capture failure modes for every test, but only the force data. If the grade code data is not needed, the system can be set to enter a default grade code. The grade code screen will be presented as usual, but the user is not forced to enter a grade code, but may do so optionally. The default grade code can be set in **Test setup>Grading schemes**.

Image Capture

If this is set, the Royce 650 will operate in "Image Capture" mode. 650 Systems only. (See Image Capture Menu, Page 28)

When finished changing recipe settings, click the **Accept** button so that settings are saved in the test group database.

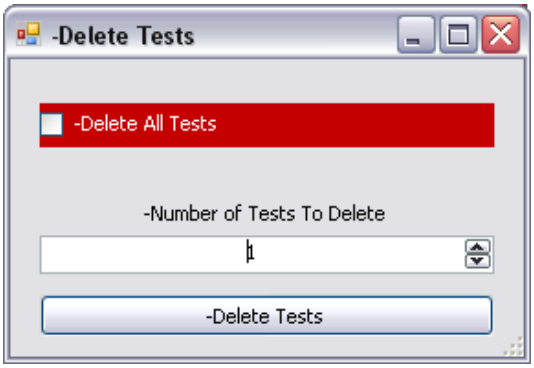


Clear Data

If the user has the appropriate permission, this button opens a window in which deletion options can be chosen.

Selecting *Delete All Tests* will remove all test data from the current test group.

Recent tests can be deleted by selecting the number of tests to delete.



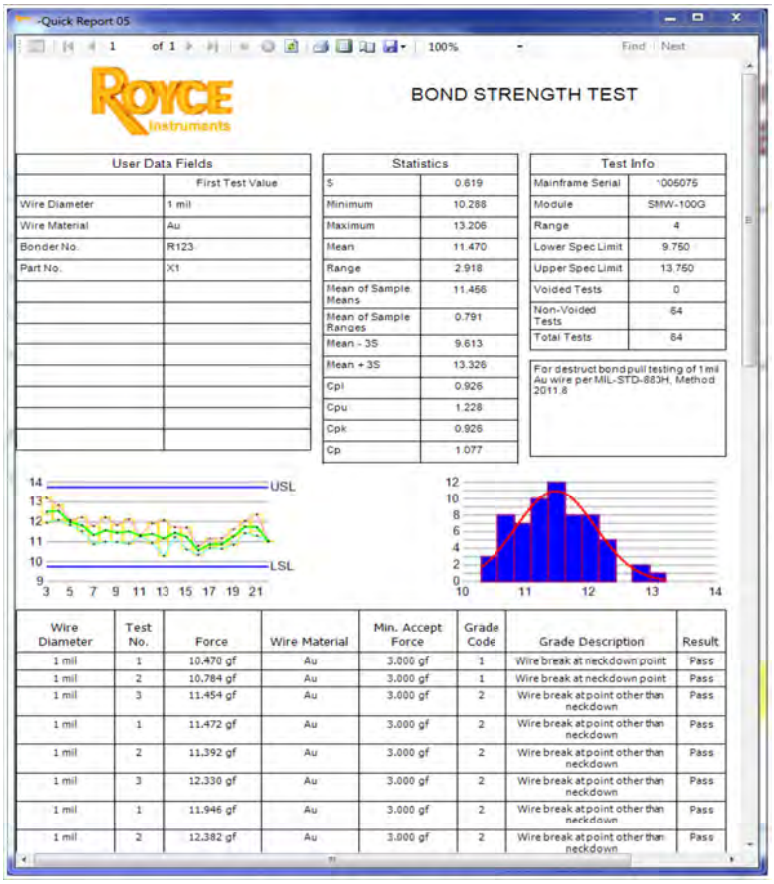
Quick Report

Selecting **Quick Report** will generate a report which can be printed or saved in Excel or PDF formats.

The report format can not be changed, however the company logo image shown in the reports can be changed to a user supplied image.

The user image should be a 3:1 aspect ratio and should be stored as file-name:

650 system for example:
C:\Program Files (x86)\Royce Instruments\650\ CustomLogo.jpg

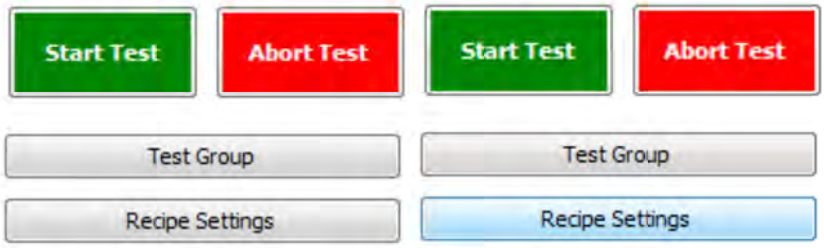


Return To Start/Search

Once a test is complete, the test tool will return automatically.

You can select whether you want the tool to return to the height it was at before the test started or to return to the search height. Selecting this button will toggle the return height between Start and Search.

Return to Start or Search Height

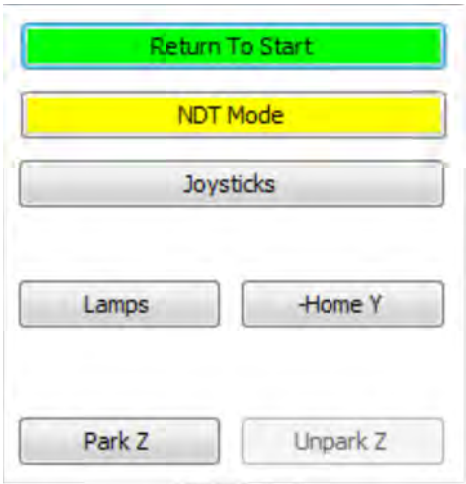


In destructive testing, it is usually better to select “Return to Search”.

If the hook returns to the start position, it will usually land on top of the broken wire loop, this makes it more difficult to determine the failure mode.

NDT Mode

Non Destruct Test mode (NDT) of operation is selected with this button. The button will be highlighted **yellow** when NDT is selected.



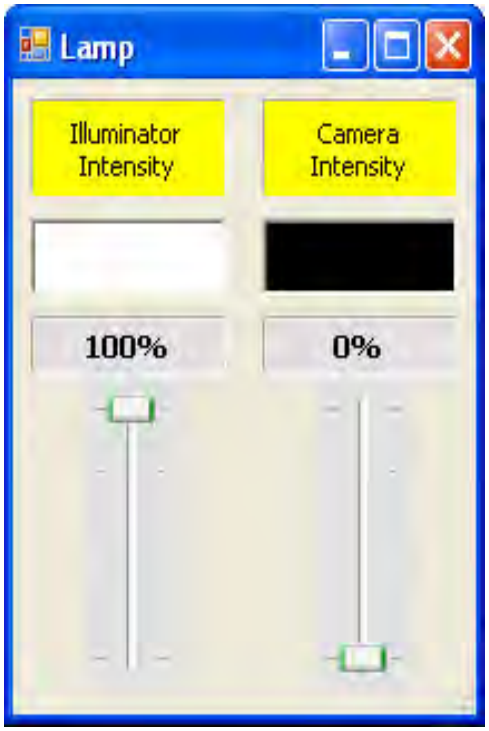
NDT Mode

In a Non Destruct test, the hook will pull on the wire loop until the specified Non Destruct test force is reached. The load will be maintained for the specified “NDT Hold Time”. In a satisfactory Non Destruct test, the specified load will be reached without breaking the wire. The hook will then retract and return to the test start height.

If the wire breaks before the NDT limit is reached, the hook will return to either the test start height or the search height, as selected, although “Return to Start” is recommended for NDT testing.

Illuminator Lamps

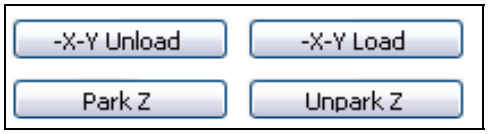
The Lamps slider bar allows the user to change the intensity of the LED area illuminators and the camera illuminator fitted to the lens system when using the IC option.



Lamp Intensity Adjustment

X-Y Unload

Selecting this button moves the X-Y stage to the Unload Position. 650 Systems only.



X-Y Unload, Load & Park Buttons

X-Y Load

Selecting this button moves the X-Y stage to the Load Position. 650 Systems only.

Park Z

Selecting this button moves the Z stage to the Park height.

UnPark Z

Selecting this button moves the Z stage to the the former height.

Search Height

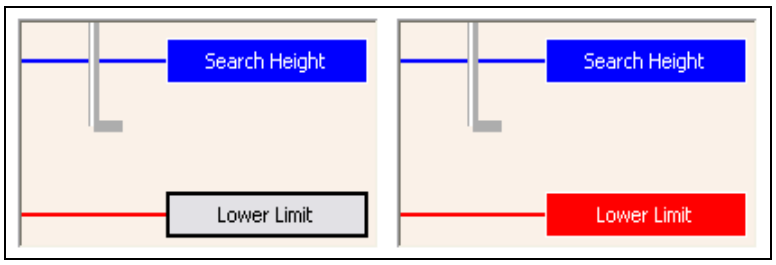
Selecting this button will prompt the user to set the Search Height. Make any adjustments and click YES to continue or NO to cancel.

The search height is usually set to be high enough above the test piece so that the test tool can navigate over the test piece area without collision with the part.

Confirm change to search height

Lower Limit

Selecting the button will allow the user to set the lower limit for the position of the test tool. Once selected, the lower limit button will flash.



Setting the Lower Limit

Using the Z control joystick, the tool height can now be adjusted to preference.
When wire pull testing, the lower height is usually set to be slightly above the substrate height to prevent the hook from hitting the substrate surface. In die and ball shear testing, the tool is driven onto the surface to acquire a datum, so the lower height should be adjusted to be below the substrate surface.

Once the tool height is satisfactory, selecting the flashing Lower Limit box will set the current value.

Note that the graphic will show either a pull hook tool or a shear tool, depending on the type of module installed.

Display Fields

Current Test Group

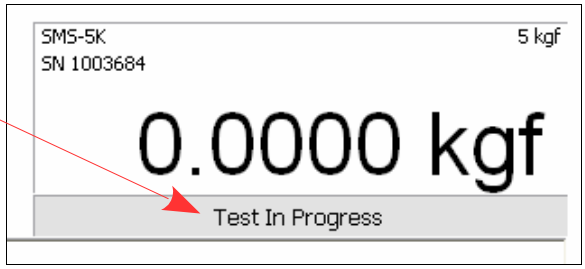
The currently open test group is displayed on the top status bar.

Test Group Indicator

NOTE: Clicking anywhere on the Royce logo will toggle language display between the chosen language and English.

Status Window

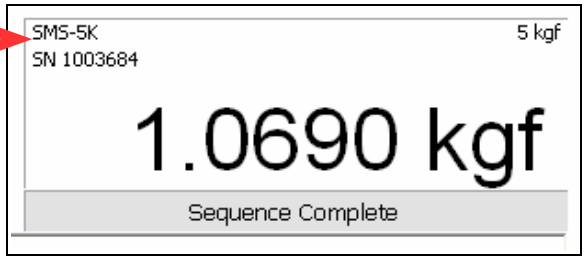
During the machine operation , system status is shown in this window.



Status Window
Showing Test in progress

Installed Test Module

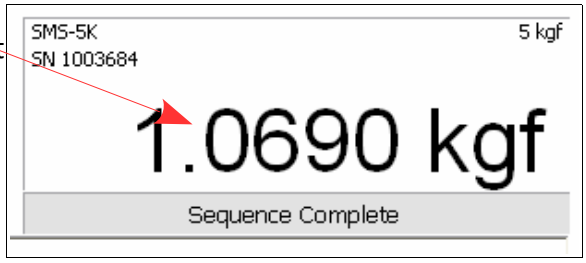
The currently installed test module type, serial number and selected range are shown in this part of the display.



Installed test Module Display

Force Display

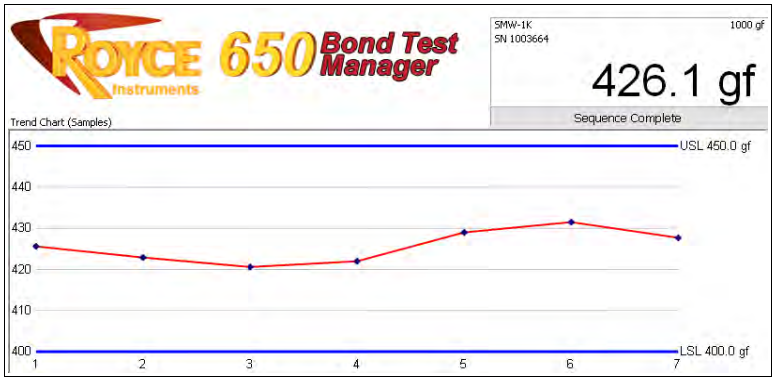
This window displays the test force during the test and the peak test force after a test is completed. The force will be shown in the units selected in Preferences settings. (**Preferences: Units of Measure**).



Test Force Display

Trend Chart

The Trend Chart graphically displays test results. The chart can be set to plot individual test data points or to plot completed test samples. See (Page 26 **Test Setup: Trend Samples and Trend Tests**)



Trend Chart

When in Trend Samples mode, selecting a data point in the plot will illuminate the constituent test results in the Test Results table (see **Test Results** below). When in Trend Results mode, selecting a data point in the plot will illuminate the individual test result in the Test Results table (see below).
The X axis represents the test or sample number, the Y axis represents peak force.

The position of the blue chart lines for Upper Specification Limit (USL) and Lower specification Limit (LSL) are manually set by the user from Test Recipe menu. (see Page 49)

Test Statistics, Test Results, User Data

The Test Statistics table fields display the statistics for test samples and group test results.
The Test Results fields show the Test No., Sample Test No., Test Force and Grade Code for each test.
The User Data table shows the user data which may be required to be entered for each test and will display the last entered value for each user field.
User fields can be set up under Edit test Group, see Page 25

Test Statistics

	Sample	Group
S	9.7	11.5
Min	417.2	409.8
Max	436.4	462.5
$\bar{X}$	427.6	426.3
R	19.3	52.7
$\bar{\bar{X}}$		426.3
$\bar{R}$		21.1
$\bar{X}$ - 3S	0.000	391.9
$\bar{X}$ + 3S	0.000	460.6
Cpl		0.765

Test Results

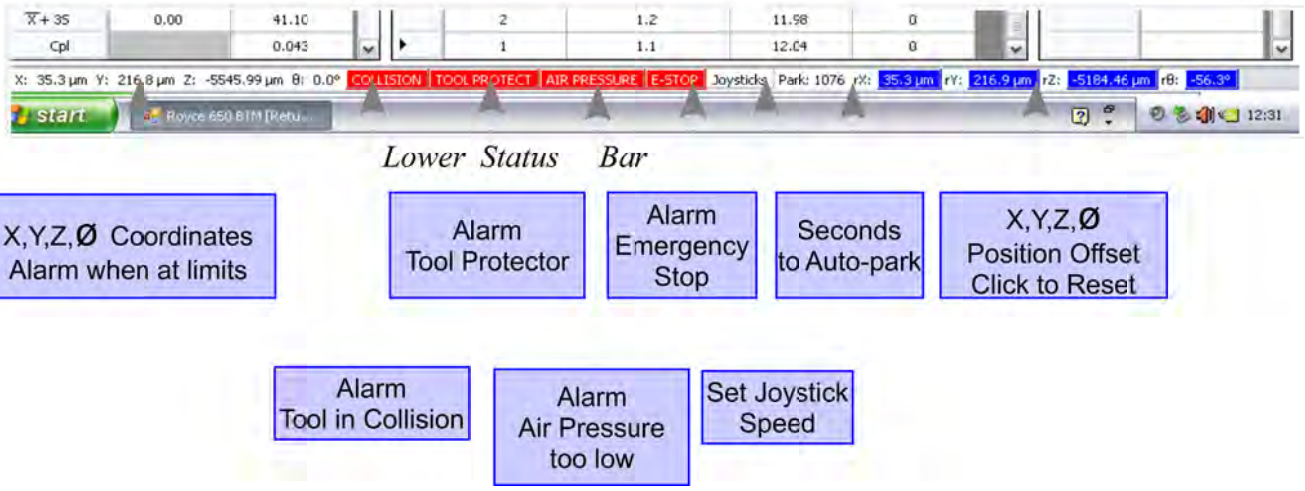
Test No.	Sample.Test No.	Test Force	Grade Code
27	9.3	429.1	4
26	9.2	436.4	2
25	9.1	417.2	1
24	8.3	462.5	2
23	8.2	416.9	1
22	8.1	409.8	1
21	7.3	426.1	5
20	7.2	423.8	6
19	7.1	433.3	1
18	6.3	436.1	0

User Data

	Value
Die No.	
Bond No.	

Test Statistics, Test Results and User Data

Lower Status Bar

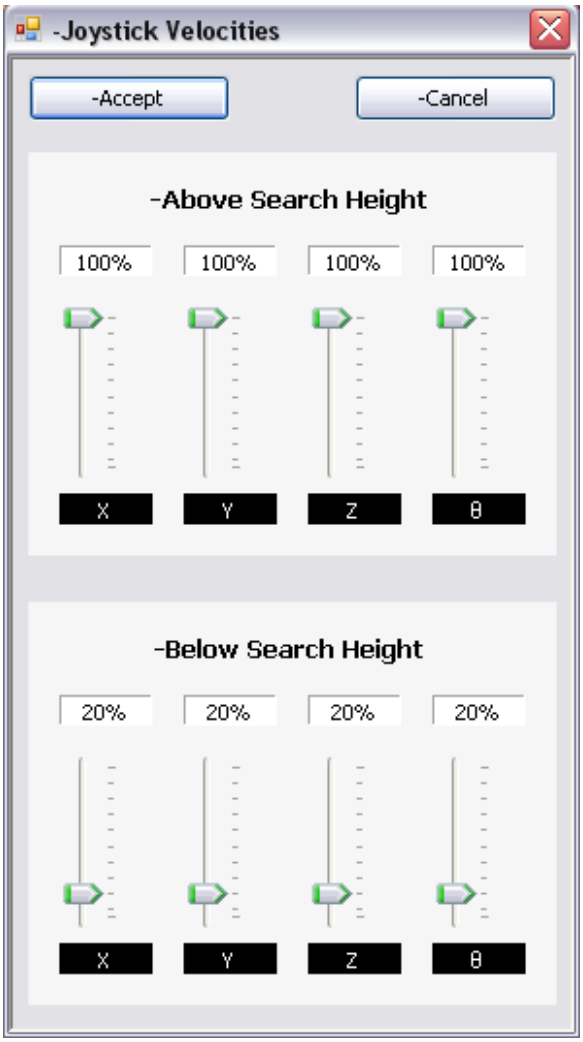


Lower Status Bar

Set Joystick Velocities

It is useful to be able to move X, Y and Z axes rapidly if there is no danger of collision with test sample or tooling. When the tool height is below the search height setting, it would be dangerous to move at high speed, so the X, Y, Z speeds can be set to a more comfortable speed for viewing through the microscope.

Royce 620: Y, Z, Θ
Royce 650: X, Y, Z, Θ



Set Joystick Velocities above and below Search Height

Chapter 3

Bond Testing with Quick Start Wizard

The bond testing overview information in this chapter was developed from Royce Instruments technical expertise and from online material on **www.royceintruments.com** and **www.SiliconFarEast.com**, a comprehensive Web reference for the semiconductor manufacturing industry.

Bond Testing Overview

Bond testing evaluates the integrity of the wire loops or solder balls that form connections between the silicon chip and the external leads of the semiconductor device to the substrate. The force required to break the bond is measured and recorded. The type of bond failure is also recorded. The grade code grading scheme changes depending on the type of bond test.

Wire Pull Testing Overview

Wire pull testing assesses wire bond strength and quality. In this test, an upward force is applied by a pull hook under the wire, effectively pulling the wire away from the die. The pull hook is normally positioned at the highest point along the loop of the wire, and the pulling force is applied perpendicular to the die surface.
The wire pull test is described by Mil Spec 883, method 2011 and others.

Common wire pull failures

- First bond lift
- Neck break
- Span (wire) break
- Heel break
- Second bond lift

Ball Shear Testing Overview

Ball shear testing is a complementary test for assessing the strength of a bond. In this test, a chisel-shaped shear tool is placed against the edge of the ball bond and a horizontal force is applied. The force required to shear the ball from the pad is measured and recorded.
The ball bond shear is described by ASTM Spec 1269 and others.

Common ball shear failures:

- First bond lift
- Ball shear
- Pad lift
- Cratering

Die Shear Testing Overview

Die shear testing assesses the overall quality of the die attach process, including the integrity of the materials and the capabilities of the processes used in mounting the die to the package substrate. In this test, a shear tool makes contact with the full length of the die edge to apply a force uniformly from one end of the edge to the other. The force must be applied perpendicular to the die edge and parallel to the die attach or substrate plane. The force required to shear the die from the substrate is then measured and recorded.
The die test is described by Mil Spec 883, method 2019 and others.

Common die shear failures:

- Die interface break
- Die fracture
- Substrate interface break

Gripper Pull or Tweezer Pull Testing Overview

Ribbon or tweezer pull testing assesses the strength of the solder bump connection between the flip chip die and the substrate. In this test, a tweezer tool grips the solder bump and attempts to pull it away from the substrate. The force required to pull the bump from the substrate is then measured and recorded.

The cold pull test is described in JESD22-B115 and others.

Common pull failures:

- First bond lift
- Pad lift
- Cratering

3 Point Die Bend Testing Overview

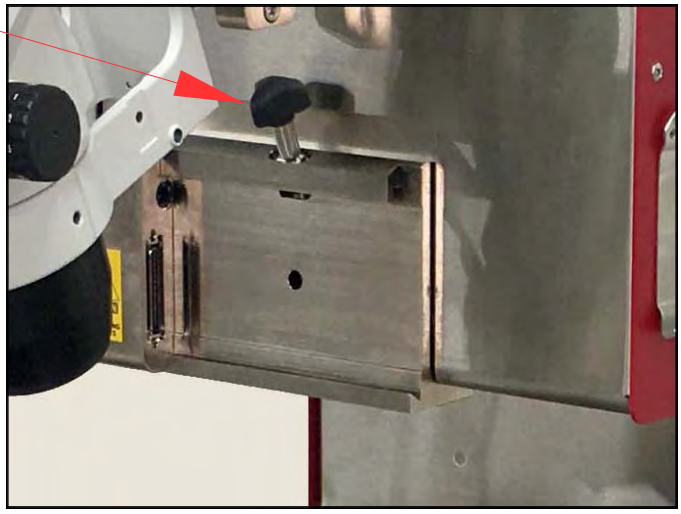
Die push testing assesses the strength of a semiconductor die by pressing a carefully profiled push tool into the center of a die supported on 2 smooth radiused edges.
The 3 point die strength test is described in SEMI G86-0303.

Preparations for Testing

Installing a Test Module

Regardless of the type of bond test you are using, you will follow the same steps to install a test module. Choose a test module according to the directions from your process engineer.

1. Loosen the test module holder lock screw on the front of the machine.
2. Slide the test module into the module receiver until it is seated all the way to the left.
3. Tighten the test module holder lock screw finger-tight.



Installing a test module

4. Once the module is seated, an *Initializing Module – Please Wait!* window appears as the machine software initializes the module.

Initializing Module

5. The system then automatically checks module transducer sub-ranges and collects the no load readings for each sub-range.

Installing a Test Tool

Regardless of the type of bond test you are running, you will follow the same steps to install a test tool. When not in use, turn the tool protector knob to lower the tool protector down over the tool. This is especially important to protect the hook tools.

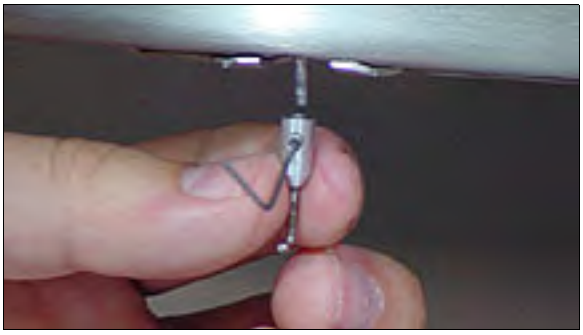
WARNING: Carefully remove tools by sliding them gently from their plastic holders. Small hooks and shear tools are sharp and can be easily damaged.

1. Move the module to the park position by pressing the Park button.
2. Raise the tool protector by rotating the black knob on the test module.
   This will allow easy installation of the tool.
3. Using the joystick, rotate the test module pull rod so that the cut-out flat faces toward the front of the machine.
4. Remove the tool from its plastic holder by twisting the red cap while pulling it gently.
5. Use the Allen wrench/hex key that was attached to the plastic tool holder tube to loosen the set screw that holds it onto the cap.

Wire Pull Hook Installation

DO NOT TOUCH THE HOOK TIP.

The hook tip is sharp and easily damaged.



Installing wire pull hook

1. Insert the tool body onto the shaft until it is fully seated.
2. Align the set screw with the rod cutout and gently turn the set screw using the SHORT end of the Hex key until it is comfortably tight.

WARNING:
Do not screw the tool in too tightly. You may damage the tool pull rod if you over-tighten the screw.

Shear Tool Installation

1. Insert the hex key into the tool shaft set screw and hold it with an index finger.
2. Position the tool so that the flat surface faces the operator.
3. Tighten the tool in position using the short end of the hex key to minimize excessive leverage.

Installing shear tool

Installing a Test Piece Holder and Sample

Position the table for easy access to the test piece holder. This can be done by using the joysticks or by selecting X-Y Unload button (which automatically send the test module to the park height) on the Bond Test Manager main screen.

1. Install the test piece holder into the socket in the X-Y stage.
2. Once the test piece holder collar is seated into the X Y table, lock it in place with the locking knob.

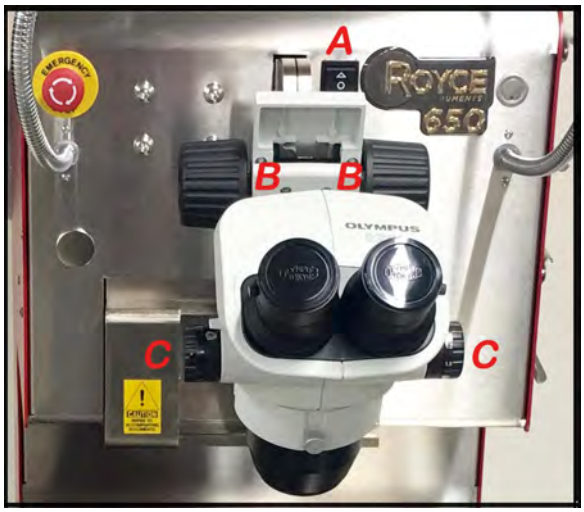
Inserting sample in test piece holder

Note that by slightly slackening the locking knob, you can make small corrections to the rotation of the test piece holder.

Depending on the test piece holder supplied with the machine, place your test sample into the test piece holder and clamp it with the tightening screws to finger-tight.

Adjusting the Microscope, Royce 650

1. Position the tool tip on or close to the test piece surface.
2. Adjust the focus knobs so the microscope focuses on the tool tip. **(B)**
3. Press the up/down Height Adjustment switch **(A)** on the front of the Royce 650 system to position the microscope eyepieces to a comfortable working height.
4. Use the Zoom Adjustment knobs **(C)** to adjust the microscope lens magnification throughout the viewing range.



Adjusting the microscope

NOTE: If you are having difficulty focusing the microscope, the arm may have been installed "upside down" or the scope arm may be inserted in the wrong hole in the mounting arm.

Once adjusted correctly, the microscope will remain in focus throughout the height adjustment range.

Adjusting the Microscope, Royce 620

1. Position the tool tip on or close to the test piece surface.
2. Adjust the focus knobs so the microscope focuses on the tool tip. **(B)**
3. The Royce 620 does not have a Height Adjustment switch, so it must be manually adjusted. Grip the focusing rack and or base of the microscope and gently press in or pull out to position the microscope eyepieces at a comfortable working height.
4. Use the Zoom Adjustment knobs **(C)** to adjust the microscope lens magnification throughout the viewing range.

Wire Pull Testing

1. Select *Quick Start* from the top menu bar.

2. Select *Recently Used* or *All Groups* to bring up an existing test group.
   Depending on your permission level, you can choose an existing test group or create a new group.

Choosing Groups

3. Choose an existing group from the list.
   A check mark will appear next to your selection.

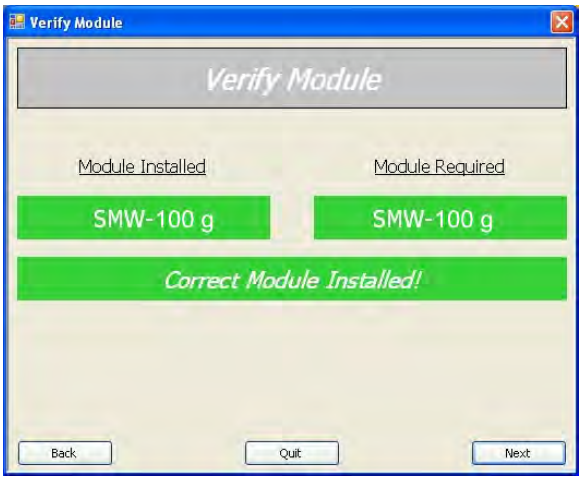
Open Recently Used Wire Pull Test Group

4. Select **Next** to continue.

The Royce 650 automatically checks the installed module type against the test settings for the selected recipe associated with the test group.

NOTE: If you do not have the correct test module installed, the bars turn red and you will not be able to continue the test.

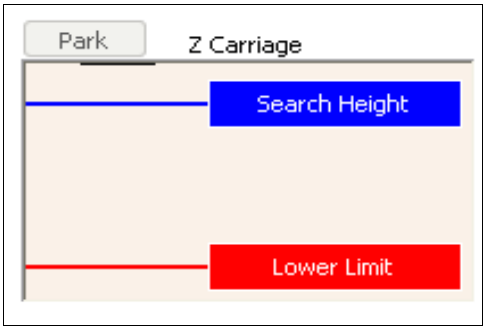
Once the module is verified, select **Next**.



Verify Wire Pull Module

Set Lower Limit

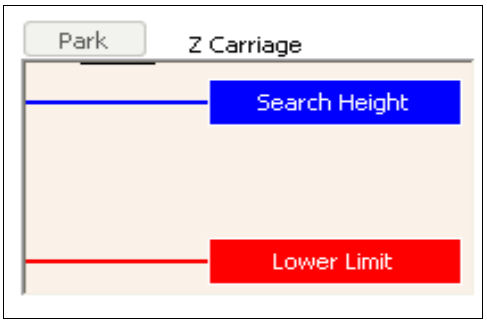
1. Select *Lower Limit* in the Z Carriage display to start the positioning sequence. The button will begin flashing **red**.
2. Position the hook tool so that it stops just above the test substrate, but below the wire loop.
3. Select *Lower Limit* again to save the position setting.



Set Lower Limit

Set Search Height

1. Using the Joystick, raise or lower the hook so that the hook can safely move around the test sample without bumping into tooling or the test sample, but low enough so that the tool can quickly reach the test surface when you start a test.
2. Once the hook is in the proper position, select the blue Search Height Icon.



Set Search Height

3. Select **Yes** to confirm Search Height position.
4. Looking through the microscope and using the joystick controls, position the hook underneath the wire loop to be tested.

Confirm Search Height

Start a Wire Pull Test

Start a test by pressing the asterisk key (*) on the keypad or select Start Test button in the *Bond Test Manager* window.

The hook will move upwards at the speed set by the recipe settings (See Page 49, **Recipe Settings: Z Axis Velocity**). The force on the hook is monitored thousands of times a second and the maximum value is continuously displayed. Once a minimum force has been reached , (See Page 49, **Recipe Settings: Test Start Force**) the force profile data will be logged and the automatic test stop value will be calculated.

Once the test force starts to fall to a percentage of the maximum force reached in the current test, (See Page 49, **Recipe Settings: Test Fallback Percent**) the test will stop automatically and the maximum value will be displayed in the force window. The test result is then added to the test results database and to the Test Results display.

NOTE: To eliminate a test from the statistics database, select the Void button. The test result will not be saved and will not be included in the statistics reporting.
If you need to stop a test while in progress, press the pound or hash (#) key on the keypad.

The test module automatically goes back to the selected return height (See Page 61 **Return To Start/Search**) after the test.

Test results window

The *Test Results* window displays the force profile. The recipe instructions that the process engineer created may direct you to determine the type of bond failure and enter an appropriate *Grade Code*, or you may be directed to grade every test. If required, enter the Grade Code by pressing a numbered button on the keypad or by selecting the *Grade Code* on the Test Results screen. Click on the graph to bring up a larger view of the force profile.

When all the test samples are complete, choose Quick Report to print the results or to export the data to an Excel or PDF file.

When testing is complete, select Park X-Y Unload to move the test module out of the way and remove the test sample from the test piece holder.

Ball Shear Testing

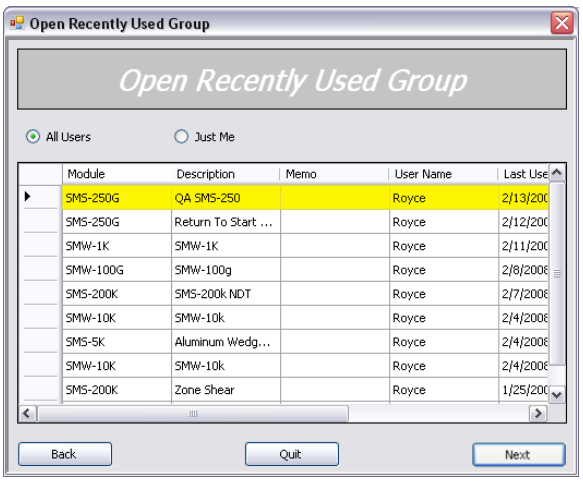
1. Select *Quick Start* from the top menu bar.

Select Quick Start from menu title bar

2. Select *Recently Used* or *All Groups* to bring up an existing test group.
   Depending on your permission level, you can choose an existing test group or create a new group.

Choosing Groups

3. Choose an existing group from the list.
   A check mark will appear next to your selection.



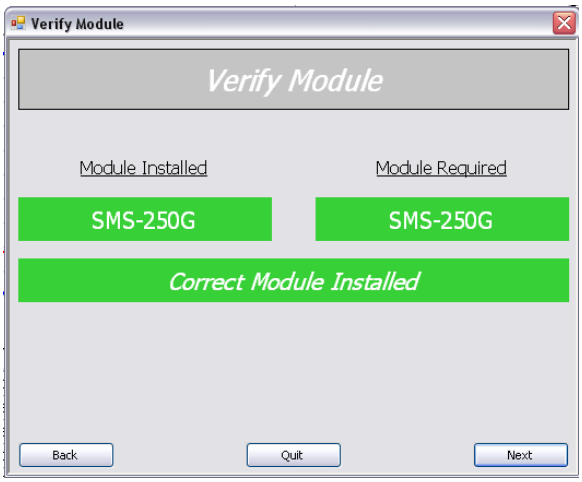
Open Recently Used Ball Shear Test Group

4. Select **Next** to continue.

The system automatically checks the installed module type against the test settings for the selected recipe associated with the test group.

NOTE: If you do not have the correct test module installed, the bars turn red and you will not be able to continue the test.

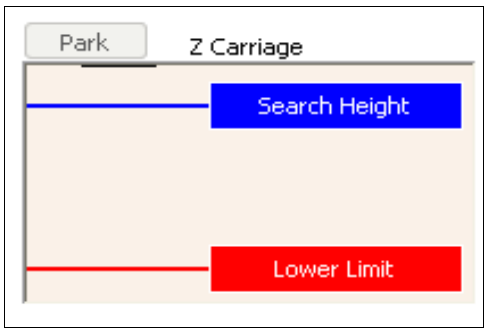
Once the module is verified, select **Next**.



Verify Ball Shear Module

Set Lower Limit

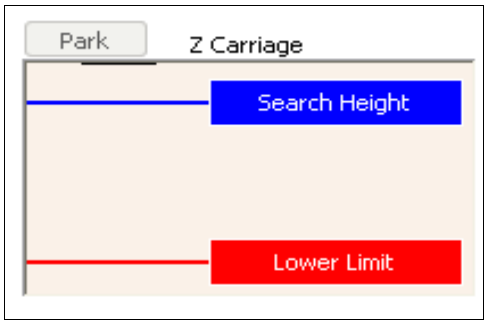
1. Select *Lower Limit* in the Z Carriage display to start the positioning sequence. The button will begin flashing **red**.
2. Position the shear tool so that it is lower than the test surface.
3. Select *Lower Limit* again to save the position setting.



Set Lower Limit

Set Search Height

1. Using the Joystick, raise or lower the shear tool so that it can safely move around the test sample without bumping into tooling or the test sample, but low enough so that the tool can quickly reach the test surface when you start a test.
2. Once the shear tool is in the proper position, select the blue *Search Height* Icon.



Set Search Height

3. Select **Yes** to confirm Search Height position.
4. Looking through the microscope and using the joystick controls, position the shear tool just behind the ball, about ½ ball height above the die surface.

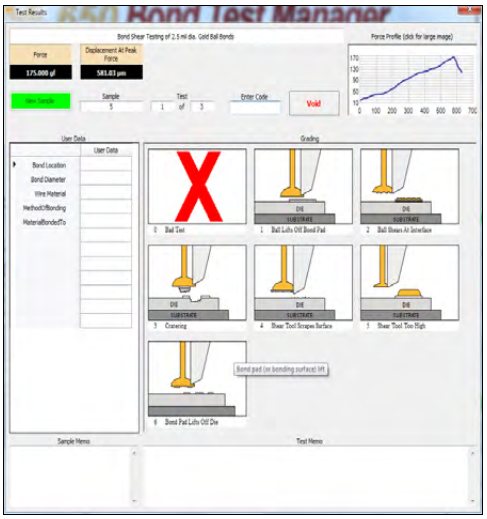
Confirm Search Height

Start a Ball Shear Test

1. Start a test by pressing the asterisk key (*) on the keypad or select Start Test button in the *Bond Test Manager* window.
2. The shear tool will move downwards at the speed set by the recipe settings (See Page 49, **Recipe Settings: Search Height to Touchdown Maximum Velocity**). Once the shear tool has made contact with the die surface, it will jump upwards a tiny distance as it is clamped firmly. The height is then corrected automatically so that the shear tool tip is positioned precisely at the height above the touch down surface specified in recipe settings (See Page 49, **Recipe Settings: Tool Lift Height**).
3. The XY table will then move to the rear of the machine at a speed specified in the recipe settings (See Page 49, **Recipe Settings: Y Axis Velocity)**. The force on the shear tool is monitored thousands of times a second and the maximum value is continuously displayed. Once a minimum force has been reached, (See Page 49, **Recipe Settings: Test Start Force**), force profile data will be logged and the automatic test stop value will be calculated.
4. Once the test force starts to fall to a percentage of the maximum force reached in the current test, (See Page 49, **Recipe Settings: Test Fallback Percent**) the test will stop automatically and the maximum value will be displayed in the force window. The test result is then added to the test results database and to the Test Results display.

NOTE: To eliminate a test from the statistics database, select the Void button. The test result will not be saved and will not be included in the statistics reporting.
If you need to stop a test while in progress, press the pound or hash (#) key on the keypad.

5. The test module automatically goes back to the selected return height (See Page 61 **Return To Start/Search**) after the test.
6. The *Test Results* window displays the force profile. You can click on the graph to bring up a larger view of the force profile.
7. The recipe instructions that the process engineer created may direct you to determine the type of bond failure and enter an appropriate *Grade Code*, or you may be directed to grade every test.
8. If required, enter the *Grade Code* by pressing a numbered button on the keypad or by selecting the *Grade Code* on the *Test Results* screen.
9. When you have completed all the test samples, choose Quick Report to print the results or to export the data to an Excel or PDF file.



Test Results Window

10. When testing is complete, select X-Y Unload or Park to move the test module out of the way and remove the test sample from the test piece holder.

For 650 systems only

Introduction

The Automation feature (also known as “step and repeat”) of the Royce 650 BTM software provides a means to automatically index the XY table to each bond test site of a particular sample and perform shear testing using any SMS module. In addition, the software can be configured to automatically enter the grade code and optional user-defined field data for each test, allowing the system to run unattended.

The first part of this document shall focus on the setup and configuration of this feature, while the second part focuses on how to perform testing using this feature.

PART 1 – SETUP & CONFIGURATION

1. Perform Conventional Bond Test Setup
2. Mount sample in appropriate test piece holder and mount test piece holder on system.
3. Install appropriate SMS test module and shear tool in system.
4. Create a new test group or open an existing test group. Adjust relevant recipe settings to achieve good bond testing performance for the installed sample. Test several bonds to verify performance. It is suggested that bonds located near the center of the bond array or matrix be used for this testing.

Automation Window

The Automation function is available by choosing *Automation* from the *Test Setup* menu on the *Main Screen*. A new “Automation” window opens with an additional tab on the Windows task bar thereby enabling easy screen switching. This screen provides all the controls necessary to create and edit the automation patterns which define all the bond site locations. This window can be re-sized or maximized, as desired.

Automation Patterns

Every group stored in the database includes one automation pattern, which is completely empty by default. The current automation pattern is automatically saved when changing groups and loaded when the group is opened.

Main Menu

The Automation screen offers four main-menu functions:

- File
- User Field Setup
- Segments
- STOP

The *File* menu offers means to import or export automation patterns from/to the Windows file system. These functions may be used to copy an automation pattern from one group to another.

One or more of the twelve user fields available in every test result may be automatically pre-loaded from the automation pattern definition. For example, each bond site could be given a unique location identifier, such as ***A01, A02, … A14, B01, B02, … B14, K01, K02, … K14***, etc., and this location identifier could be automatically loaded into any desired user field whenever that particular bond is tested. Additional user fields can be established for similar purposes. The *User Field Setup* menu will open an additional window to configure which user fields will be used by the pattern together with an optional validator.

In situations where a sample part has multiple bond areas requiring segregated testing due to clearance or alignment issues, a Segment is established for each area. A Segment maps all the bond sites; the Automation Pattern contains at least one, and possibly more than one Segment. The Segments menu provides functions for adding, deleting, renaming, and clearing a Segment.

The red **STOP** menu item provides a convenient means to stop the automation function and any pending motion.

Creating an Automation Pattern

1. Check the checkbox **Allow Edits**.
2. From the **Segments** menu, click **Add**.
3. In the textbox enter a name for the segment and click **Accept**.

A data grid will now appear in the lower part of the screen. The *X* and *Y* columns of this table define the locations of all the bond sites to be tested within the segment, one row per bond site. The *Datum* column defines reference bond sites used for alignment. The *Force* and *Grade Code* columns show the result of testing. The larger box on the screen labeled **Points:** shows all the bond sites in the data grid graphically.

The red **crosshair** in the graphics area always indicates the current X/Y stage position relative to the bond site pattern.

The user has the following options for establishing the bond site pattern in the data grid:

- Enter X/Y coordinate data manually (the X coordinate increases towards the right, the Y coordinate increases towards the front). This option is particularly useful when the full bond site geometry of the sample is known.
- Navigate to each bond site using the joysticks and use the **Capture** button (lower-right) to automatically enter the current stage coordinates into the data grid.

- Using the **Insert** button (lower-right) provides three sub-options:
- Insert a single bond site between two rows in the table.
- Insert an entire row or column of bond sites. (A series of dialogs guide you through this process.)
- Insert a matrix of bond sites. (A series of dialogs guide you through this process.)

As bond sites are entered into the data grid, they will appear graphically as circles in the box above. A filled circle (or other filled shape) indicates the currently selected bond site in the data grid.

In order to use the automation feature, one bond must be designated *Datum 1* and another bond must be designated *Datum 2*. These two bonds are defined to facilitate alignment of subsequent samples. Graphically, *Datum 1* appears as a triangle and *Datum 2* appears as a square. Typically, *Datum 1* should be the first bond tested, and *Datum 2* should be the bond site furthest from *Datum 1*, which may or may not be the last bond to be tested.

- Left-clicking anywhere on the graphic and dragging will move the graphic;
- The mouse wheel (if available) will zoom;
- Right-clicking on or near a bond site will select that bond site and highlight the corresponding row in the data grid.
- The **Recenter** button can be used at any time to bring the pattern and the X*/Y Stage Crosshair* into view.

Right-click on the bond site in the graphic to be designated *Datum 1*. Then in the data grid, enter a **1** in the *Datum* column on the currently highlighted row. The selected bond site will now appear graphically as a triangle.

Likewise, right-click on the bond site in the graphic to be designated **Datum 2**. Now, in the data grid enter a **2** in the *Datum* column for the currently highlighted row. The selected bond site will now appear graphically as a square.

Go back to step 2 to create additional segments.

Click on the row corresponding to the desired segment in the Segment list box to switch between segments.

Editing a Segment

When the *Allow Edits* checkbox is checked, changes may be made to the segment pattern using the following controls and features:

The currently selected bond site may be moved up or down in the data grid using the up and down arrow buttons on the lower-right of the screen. This will change the sequence in which bonds are tested.

The currently selected bond site may be removed from the data grid using the X delete button on the lower-right of the screen.

The X/Y coordinates of the currently selected bond site can be replaced with the current stage position coordinates simply by clicking on the Replace button on the lower-right of the screen.

The X/Y coordinates on any bond site can be directly edited by going to the appropriate cell of the data grid and making the desired changes.

Saving the Automation Pattern

As with all recipe settings, the automation pattern is saved when any of the following events occur:

- the current group is explicitly closed using menu **Test Setup -> Close Group** option, or
- the current group is implicitly closed as occurs when another group is opened, or
- BTM is exited to the Login prompt, or
- the current group is explicitly saved using the menu **Test Setup -> Save Recipe** to Test Group option.

PART 2 – OPERATION

Perform Conventional Bond Test Setup

1. Mount sample in appropriate test piece holder and mount test piece holder on system.
2. Install appropriate SMS test module and tool in system.
3. Open an existing test group (or template using the Quick Start Wizard) which has been configured for Automation per part 1.

Automation Window

The Automation function is available by choosing Automation from the *Test Setup* menu on the main screen. A new *Automation* window opens with an additional tab on the Windows task bar thereby enabling easy screen switching. This screen provides all the controls necessary to create and edit the automation patterns which define all the bond site locations, however, in this document we will focus on those controls used for running a pattern. This window can be re-sized or maximized, as desired.

It may be necessary for automated testing of a particular part type to be divided into two or more “Segments”. This may be necessary in certain situations to prevent collisions on complex part geometries, or when some manual manipulation of the part is required in order to continue testing a particular sample. When the *Automation* window opens, the first segment is selected by default.

The upper part of the *Automation* window graphically displays the pattern, or map, of all bond sites in the currently selected segment. If more than one segment is defined, those other segments may be viewed simply by clicking on the desired segment in the list box under the word “Segments”.

Automatic Segment Testing

1. Begin by navigating the X/Y stage to Datum 1 on the physical sample. Position the tool just behind the bond site just as if you were going to perform a test manually at this site. The tool’s current Z-height becomes the start height for all bonds in the Segment.
2. Click the **Lock Datums** button. You will be prompted to perform the preceding step.
3. Click **Next**.
4. You will be prompted to joystick the Z axis to an appropriate clearance height.
5. Move the Z axis up or down ensuring that the tool is high enough to prevent collision with any sample structures, but not excessively high, adding unnecessary motion and delay when the system moves automatically from bond to bond. Click **Next**.

6. The system will automatically move the stage to Datum 2. However, due to normal variation in sample placement in the test piece holder and variation in the orientation of the test piece holder when clamped to the system, the tool may not arrive exactly at the desired Datum 2 start position. Simply use the joysticks to adjust the stage to the ideal start position for Datum 2.

7. Click the **Lock Datums** button.

8. At this point additional controls on the *Automation* screen are enabled:

   - The **left-arrow, square**, and **right-arrow** buttons. These buttons allow you to move the stage to the bond site backwards one row in the data grid, to the current row, or forward one row to the next bond site in the data grid, respectively. It is sometimes necessary to use the square button to return to the current bond site if one were to joystick away from it for any reason.
   - The **triangle** button is a shortcut button that will drive the stage to the Datum 1 bond site. Likewise, the square button will drive the stage to the Datum 2 bond site. In both cases, the corresponding row in the data grid is selected, becoming the "current" bond site.

9. Use the **triangle** button to quickly go back to Datum 1, which is also the starting position – unless specified otherwise during set-up.

10. If desired, you can test the accuracy of the pattern and the datum lock by right-clicking on various bond sites in the graphic, then clicking on the square **Go To Current Bond** button. Return to the start position using the triangle button.

11. Check the checkboxes *Auto Advance* and *Auto Start Next Test*.

12. Use the **Test Start** button to test the first bond site. After grading the test, the system will automatically advance to the next bond site and begin the next test.

13. As tests are graded, the results are recorded to the data grid Force and Grade Code columns as a convenient reference.

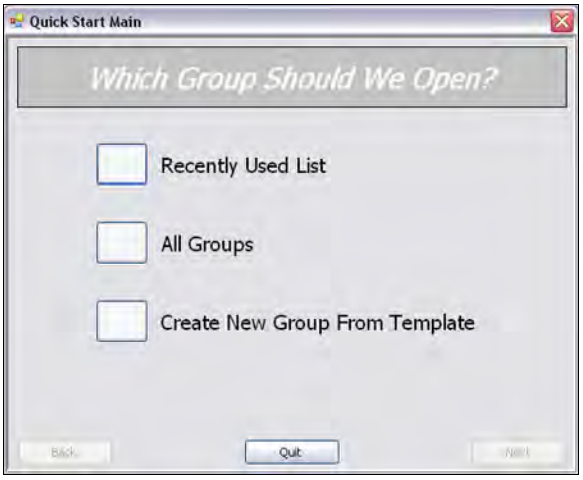
14. The system will continue testing in this manner until the last bond in the Segment has been tested, at which point the Datums are unlocked and a message box appears alerting you to this fact.

Die Shear Testing

1. Select Quick Start from the top menu bar.

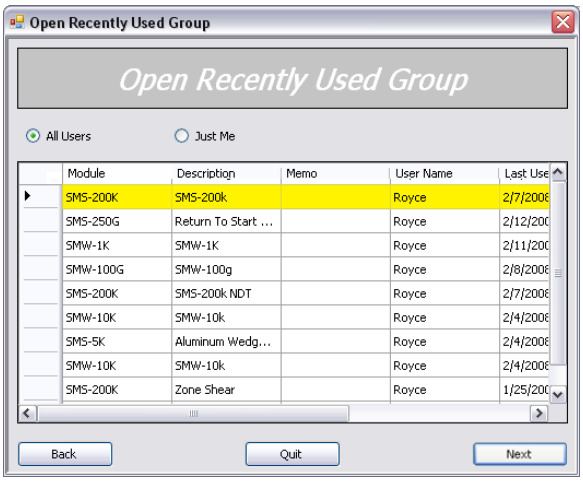
Select Quick Start from Menu Title Bar

2. Select *Recently Used* or *All Groups* to bring up an existing test group. Depending on your permission level, you can choose an existing test group or create a new group.



Choosing Groups

3. Choose an existing group from the list. A check mark will appear next to your selection.



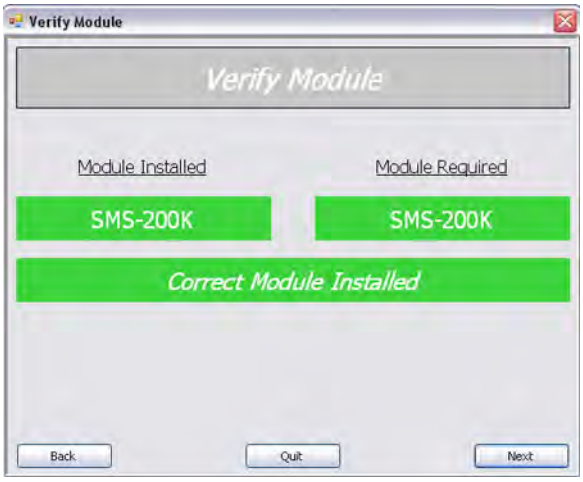
Open Recently Used Die Shear Test Group

4. Select **Next** to continue.

The system automatically checks the installed module type against the test settings for the selected recipe associated with the test group.

NOTE: If you do not have the correct test module installed, the bars turn red and you will not be able to continue the test.

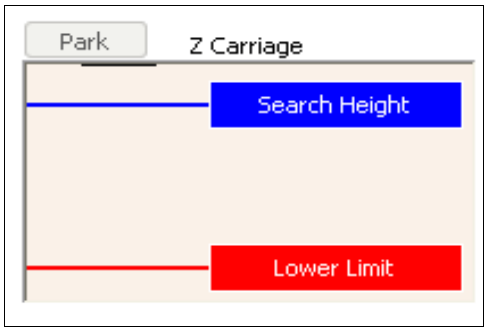
Once the module is verified, select **Next**.



Verify Die Shear Module

Set Lower Limit

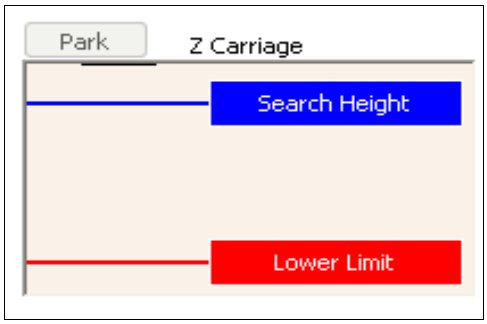
1. Select *Lower Limit* in the Z Carriage display to start the positioning sequence. The button will begin flashing red.
2. Position the shear tool so that it is lower than the touchdown surface.
3. Select *Lower Limit* again to save the position setting.



Set Lower Limit

Set Search Height

1. Using the Joystick, raise or lower the shear tool so that it can safely move around the test sample without bumping into tooling or the test sample, but low enough so that the tool can quickly reach the test surface when you start a test.
2. Once the shear tool is in the proper position, select the blue *Search Height Icon*.



Set Search Height

3. Select **Yes** to confirm Search Height position.
4. Looking through the microscope and using the joystick controls, position the shear tool just behind the die, just above the die surface.

Confirm Search Height

Start a Die Shear Test

Start a test by pressing the asterisk key (*) on the keypad or select Start Test button in the Bond Test Manager window.

The shear tool will move downwards at the speed set by the recipe settings (See Page 49, **Recipe Settings: Search Height to Touchdown Maximum Velocity**). Once the shear tool has made contact with the die surface, it will jump upwards a tiny distance as it is clamped firmly. The height is then corrected automatically so that the shear tool tip is positioned precisely at the height above the touch down surface specified in recipe settings (See Page 49, **Recipe Settings: Tool Lift Height**).

The XY table will then move to the rear of the machine at a speed specified in the recipe settings (See Page 49, **Recipe Settings: Y Axis Velocity)**. The force on the shear tool is monitored thousands of times a second and the maximum value is continuously displayed. Once a minimum force has been reached, (See Page 49, **Recipe Settings: Test Start Force**), force profile data will be logged and the automatic test stop value will be calculated.

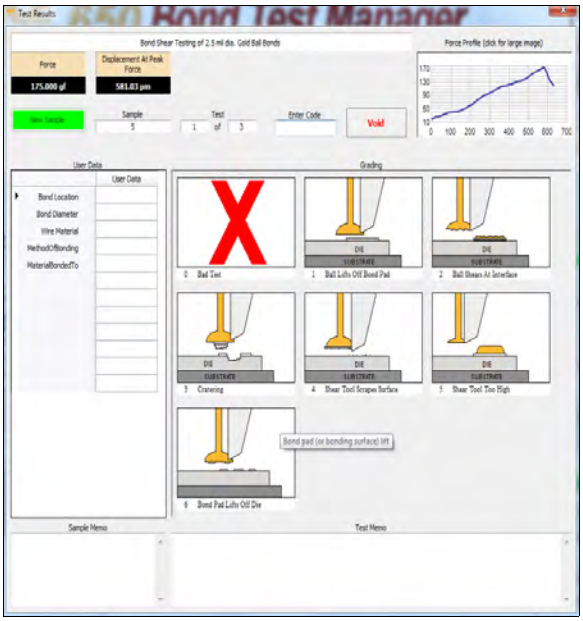
Once the test force starts to fall to a percentage of the maximum force reached in the current test, (See Page 49, **Recipe Settings: Test Fallback Percent**) the test will stop automatically and the maximum value will be displayed in the force window. The test result is then added to the test results database and to the Test Results display.

> **NOTE:** To eliminate a test from the statistics database, select the Void button. The test result will not be saved and will not be included in the statistics reporting. If you need to stop a test while in progress, press the pound or hash (#) key on the keypad.

The test module automatically goes back to the selected return height (See Page 61 **Return To Start/Search**) after the test. The *Test Results* window displays the force profile.

The recipe instructions that the process engineer created may direct you to determine the type of bond failure and enter an appropriate *Grade Code*, or you may be directed to grade every test. If required, enter the Grade Code by pressing a numbered button on the keypad or by selecting the *Grade Code* on the *Test Results* screen.

You can click on the graph to bring up a larger view of the force profile.



Test Results Window

When you have completed all the test samples, choose Quick Report to print the results or to export the data to an Excel or PDF file.

When testing is complete, select Park or X-Y Unload to move the test module out of the way and remove the test sample from the test piece holder.

Gripper/Tweezer Pull Testing

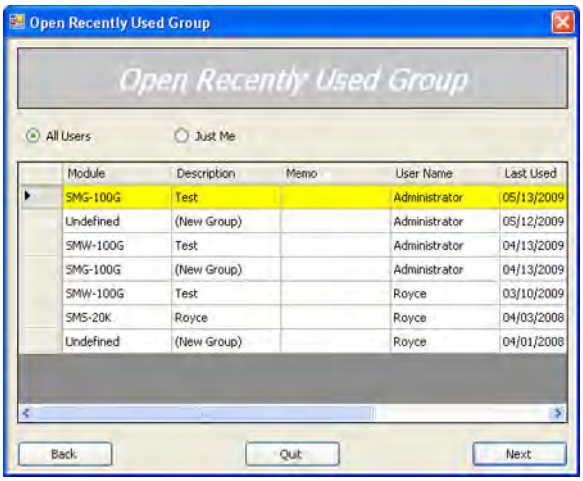
1. Select *Quick Start* from the top menu bar.

Select Quick Start from Menu Title Bar

2. Select *Recently Used* or *All Groups* to bring up an existing test group.
   Depending on your permission level, you can choose an existing test group or create a new group.

Choosing Groups

3. Choose an existing group from the list.
   A check mark will appear next to your selection.



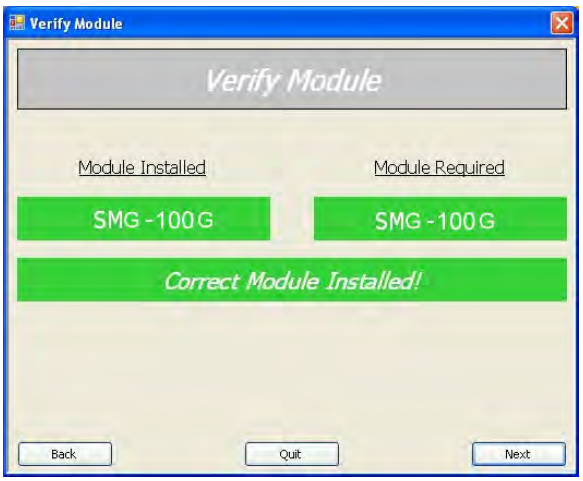
Open Recently Used Gripper Test Group

4. Select **Next** to continue.

The system automatically checks the installed module type against the test settings for the selected recipe associated with the test group.

NOTE: If you do not have the correct test module installed, the bars turn red and you will not be able to continue the test.

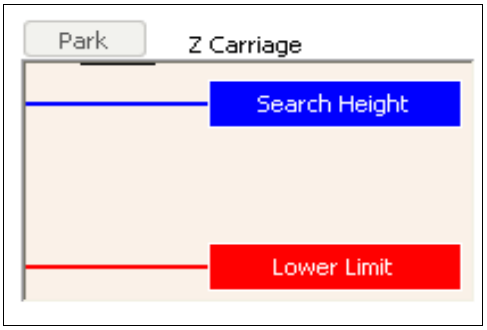
Once the module is verified, select **Next**.



Verify Gripper Pull Module

Set Lower Limit

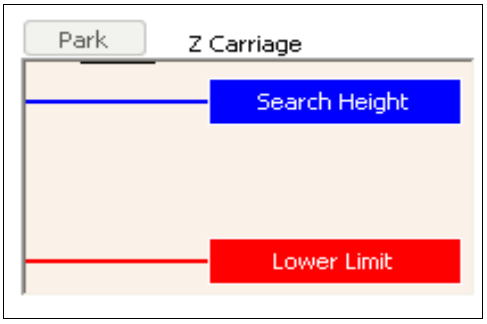
1. Select *Lower Limit* in the Z Carriage display to start the positioning sequence. The button will begin flashing red.
2. Position the gripper pull tool tool so that it is below the touchdown surface.
3. Select *Lower Limit* again to save the position setting.



Set Lower Limit

Set Search Height

1. Using the Joystick, raise or lower the shear tool so that it can safely move around the test sample without bumping into tooling or the test sample, but low enough so that the tool can quickly reach the test surface when you start a test.
2. Once the shear tool is in the proper position, select the blue *Search Height Icon*.



Set Search Height

3. Select **Yes** to confirm Search Height position.

Confirm Search Height

4. Looking through the microscope and using the joystick controls, position the gripper tool just centered on the feature and just above the feature.

Start a Gripper Pull Test

Start a test by pressing the asterisk key (*) on the keypad or select Start Test button in the Bond test Manager window.

If Auto Tool Lift has been enabled (See Page 49, **Recipe Settings: Auto Tool Lift** check box**), t**he Gripper tool will move downwards at the speed set by the recipe settings (See Page 49, **Recipe Settings: Search Height to Touchdown Maximum Velocity**). Once the Gripper tool has made contact with the die surface, it will make a small move upwards to position it precisely at the height above the touch down surface specified in recipe settings (See Page 49, **Recipe Settings: Tool Lift Height**).

The Gripper tool then closes on the feature and moves upwards at the speed set by the recipe settings (See Page 49, **Recipe Settings: Z Axis Velocity**). The force on the gripper is monitored thousands of times a second and the peak force is continuously calculated and displayed. Once the peak force exceeds the Test Start Force (See Page 49, **Recipe Settings: Test Start Force**), the automatic test stop value is calculated from the setting for Test Fallback Percent (See Page 61, **Recipe Settings: Test Fallback Percent**) and the peak force is logged into the force profile database. The test result is then added to the test results database and to the Test Results display.

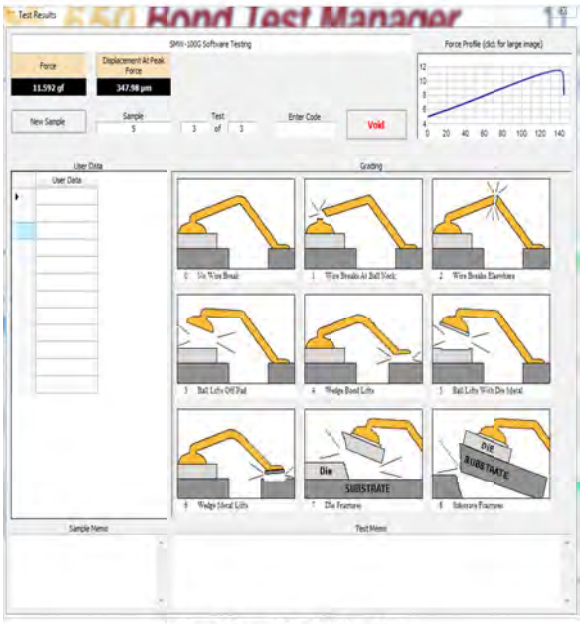
NOTE: To eliminate a test from the test results, select the Void button.
If you need to stop a test while in progress, press the pound or hash (#) key on the keypad.

The test module automatically goes back to the selected return height (See Page 61, **Return To Start/Search**) after the test.

The *Test Results* window displays the force profile. The recipe instructions that the process engineer created may direct you to determine the type of bond failure and enter an appropriate *Grade Code*, or you may be directed to grade every test.

If required, enter the Grade Code by pressing a numbered button on the keypad or by selecting the *Grade Code* on the *Test Results* screen.

You can click on the graph to bring up a larger view of the force profile.



Test Results Window

When you have completed all the test samples, choose Quick Report to print the results or to export the data to an Excel or PDF file.

When testing is complete, select Park or X-Y Unload to move the test module out of the way and remove the test sample from the test piece holder.

Chapter 4

Module Calibration

In order to calibrate a test module, a certified load must be measured. The calibration data are then saved inside the test module, a technique pioneered by Royce Instruments since the early 1990's.

Whenever a test module is loaded on a Royce 620 or 650, the machine then knows the characteristics of the load transducer in the test module.

As with all measuring instruments, **Royce 620 and 650 test modules must be calibrated regularly**. We recommend that each test module be calibrated every 6 months, though the customer can choose a calibration interval corresponding to their own internal procedures.

The most common calibration source for a force measuring instrument is a certified mass. The mass in turn is calibrated from another certified mass. The chain of certification is traceable to a mass standard carefully stored and maintained by the US National Institute of Standards and Technology (NIST) in Washington DC. Since these are mass standards, the actual force they will deliver due to gravity (IE their weight) will vary by a small amount depending on what part of the world they are used. In general the weight variation is small enough to be negligible for our purposes.

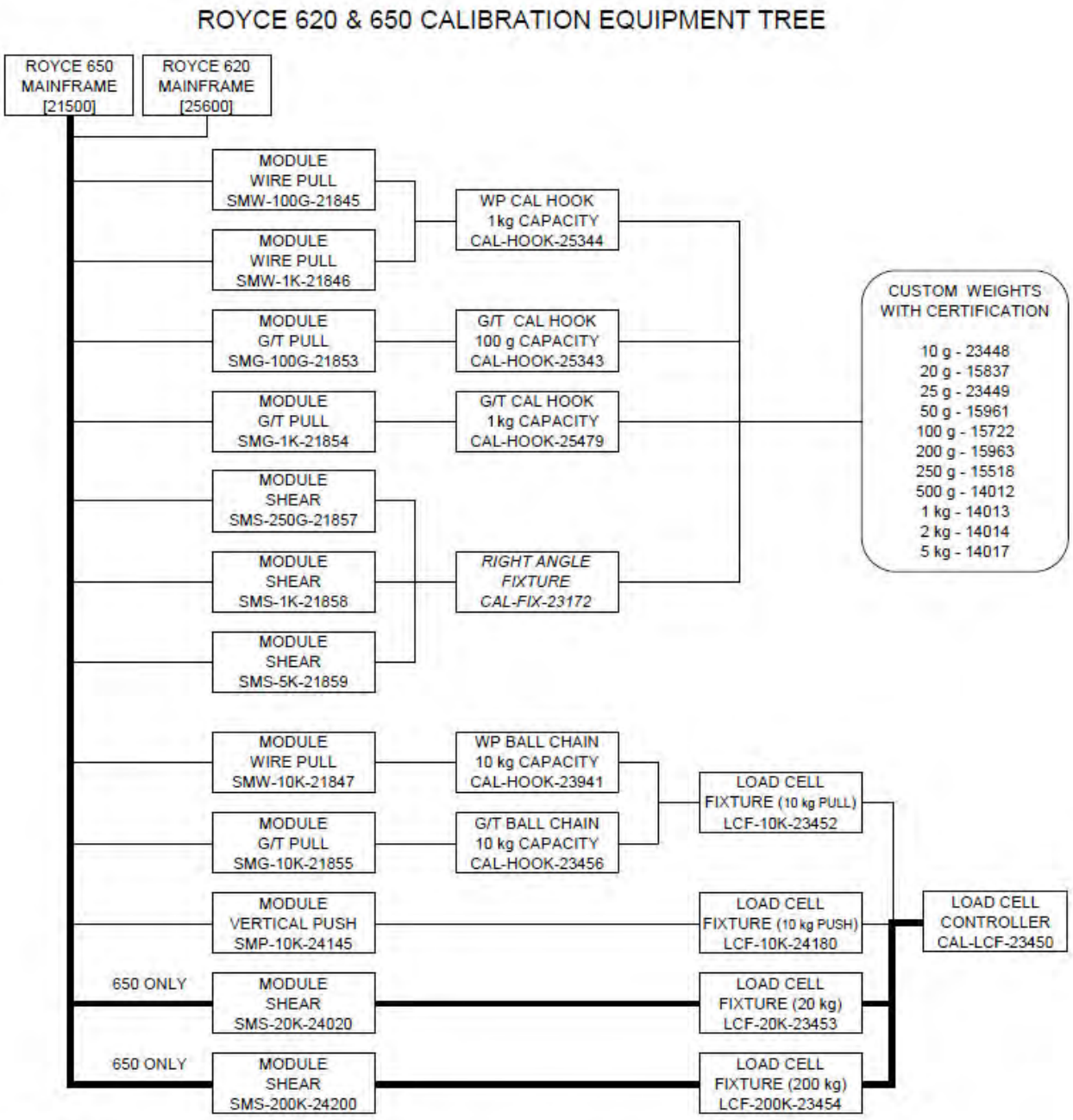
Certified weights are used to calibrate all low force range 600 series test modules.
Due to the great precision of the 620 and 650 systems, we have developed certified weights whose center of gravity is precisely controlled to minimize weight swinging during calibration. In our experience, unless these weights are used, it is unlikely that the user will be able to demonstrate the high precision of the 620 and 650 systems.

For forces higher than 5 kg, we consider weights to be impractical since they are awkward to handle and can cause injuries if handled carelessly.

For the high range forces, we chose not to use the weight and lever system favored by our competitors since the lever system also has to be re-certified on a regular basis, a task for which which local calibration labs are not qualified.

In order to calibrate test modules in higher ranges, Royce Instruments has chosen to use a high precision certified load cell. These are very accurate, easy to handle and can be re-calibrated by your local calibration lab. Contact Royce Customer Support for instruction.

Calibration Equipment



NOTES: 1. ALL MODULES AND CALIBRATION EQUIPMENT ARE INTERCHANGEABLE WITH 620 AND 650 SYSTEMS EXCEPT:
2. SMS-20K-24020 AND SMS-200K-24200 MODULES ARE COMPATABLE WITH 650 SYSTEMS ONLY.
3. FOR 620 SYSTEMS, THE SELECTED MANIPULATOR (MPS) MUST BE RATED FOR THE MAXIMUM CALIBRATION FORCE.

Selecting tooling

Using the calibration equipment tree, determine what tooling is needed. For example, for the SMS-250G-21857 Module the following equipment is needed:

Royce 620 or 650, SMS-250g-21857 Module, CAL-FIX-23172, 250g-15518 full scale weight, Any other desired weights for any given sub-range, Compatible manipulator, needed only if using 620.

Manufacturer's calibration requirements

It is recommended that all Royce Instruments test systems and modules be calibrated **at a minimum of every six months**.

All calibration certificates being issued by Royce Instruments will have an expiration date of six months from the date of issue. Royce Instruments will not issue certificates that exceed the six month interval for calibration.

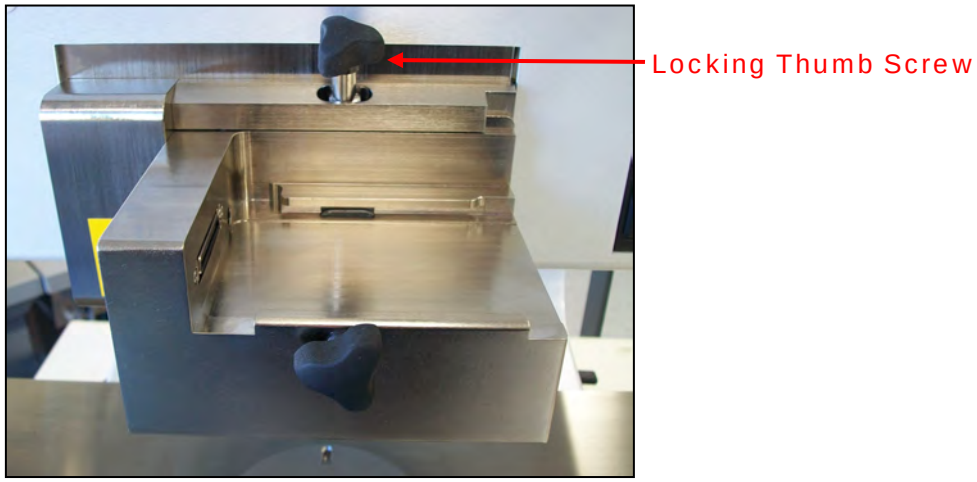
Customers who wish to have calibration intervals longer than the recommended 6 months, are required to provide their own calibration and certification services. These calibration services should meet manufacturer's specifications and procedures.

Required Equipment

- System 650/620
- Calibration Fixture (P/N 23172)
- Calibration Weights for module rating

Section I: Performing New Calibration

1. Power on the 650.
2. Login to BTM Software.
3. Select **Home.**
4. Using the Stage Controller, move the X-Stage to the far left position, and the Y-Stage all the way towards the front of the system.
5. Install Calibration Fixture P/N 23172. **Ensure the locking thumb screw is secure.**

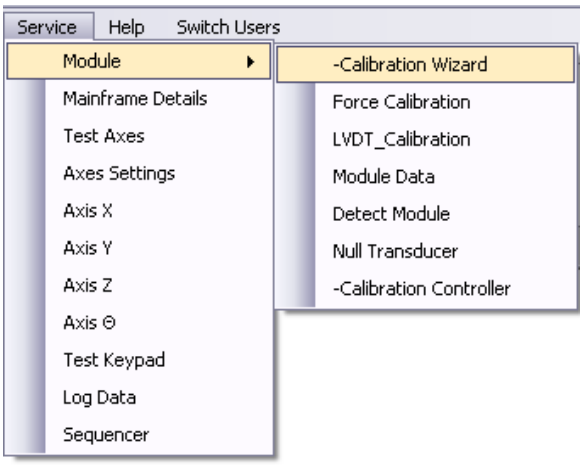


6. Place a Mouse Pad flat on the X-Stage.

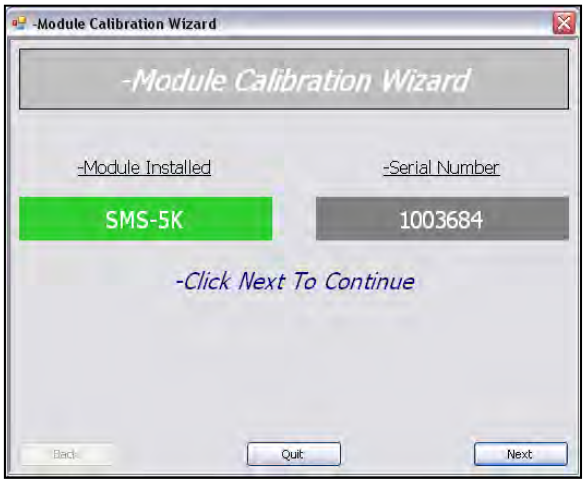
7. Install Shear Module into Calibration Fixture and tighten Lock Screw.

8. Insert Calibration Tool into Shear Module. Secure with Set Screw.

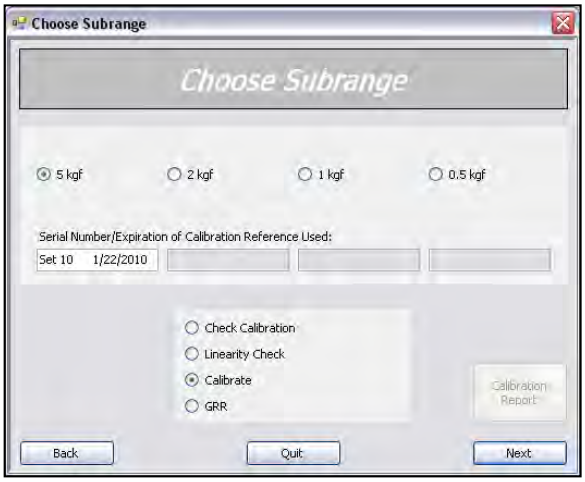
9. Select **Service > Module > Calibration Wizard** from the top Tool Bar



10. The *Module Calibration* window will appear. Select **Next** to continue.

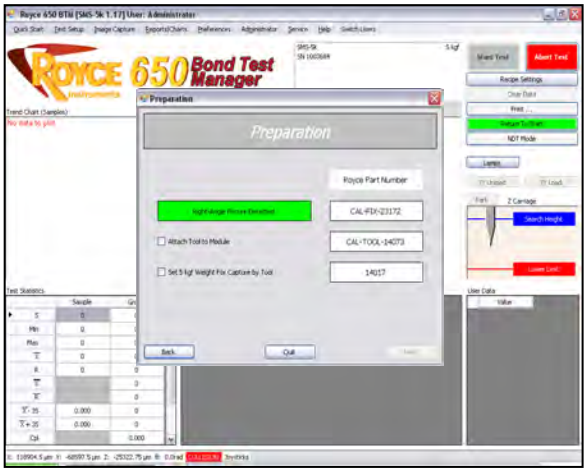


11. Select the **Sub Range** of the module and enter weight information. In the example at right, the 5 kg range selected. Then select the **Calibrate** option. Click **Next**.



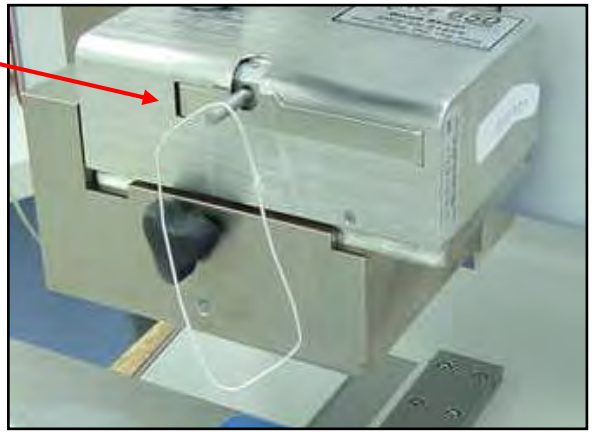
12. The *Preparation Screen* will appear. At this point Tool Touch Detection is disabled and the Z-Axis can be moved if necessary to prepare for the calibration.

    See Steps 14 & 15 prior to selecting **Next**.



Note: The *Shear Module Collision Indicator* (in red at the bottom of the screen) will indicate collision. This is normal. It is due to the module being mounted on its back. The system will allow the XY stage and the Z axis to be moved in order to properly position the weight.

13. Place the Cal Loop on the Calibration Tool.

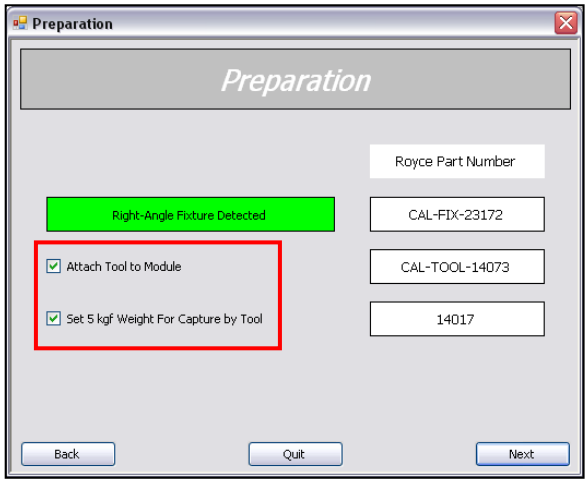


14. Using the Z-Axis Joystick, lower the module so that the cal loop is at the same or similar height as the weight. Attach the weight to the Cal Loop. Adjust the module position until there is some slack in the cal loop.

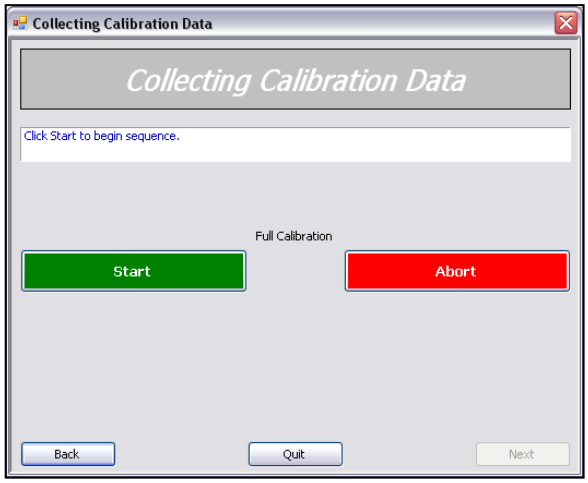
15. Check the **Attach Tool to Module** box.

    Note: Check boxes may not be present in later software versions.

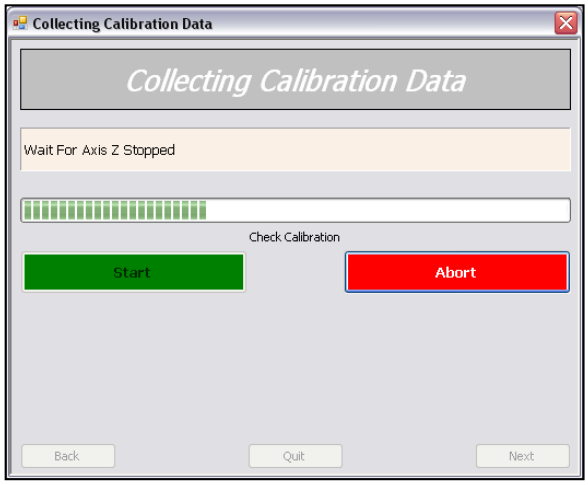
16. Check the **Set Weight For Capture by Tool** box. Select Next.

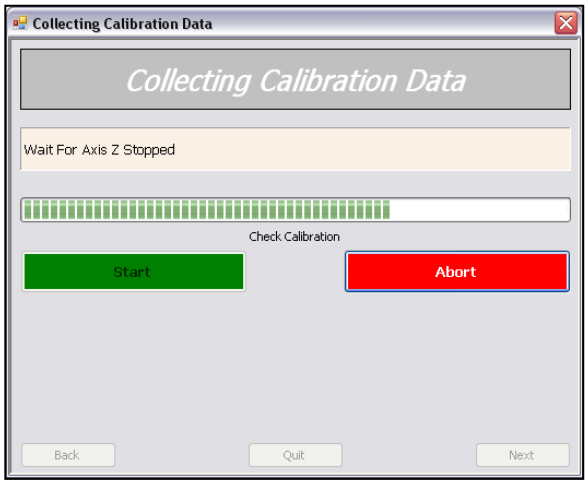


17. Select the green **Start** button to initiate the Calibration routine.



18. The system will perform a series of lifts as illustrated below. Verify the weight is being lifted completely off the stage.

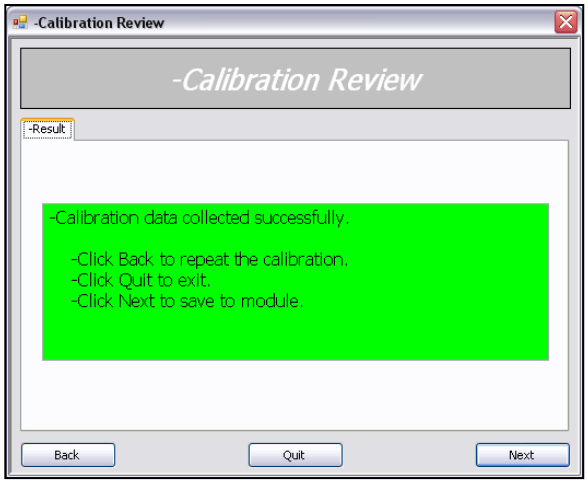




19. The *Calibration Review* window will open with one of the following results:

Calibration data collected successfully

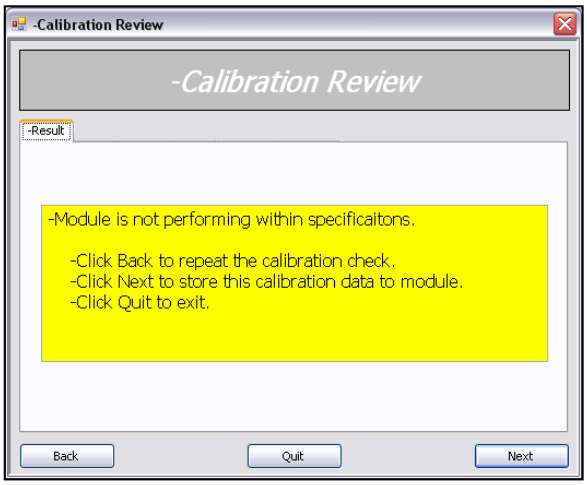
- Calibration completed
- Select **Next** to save the calibration data to the module



Module not within specification

Typical Cause:

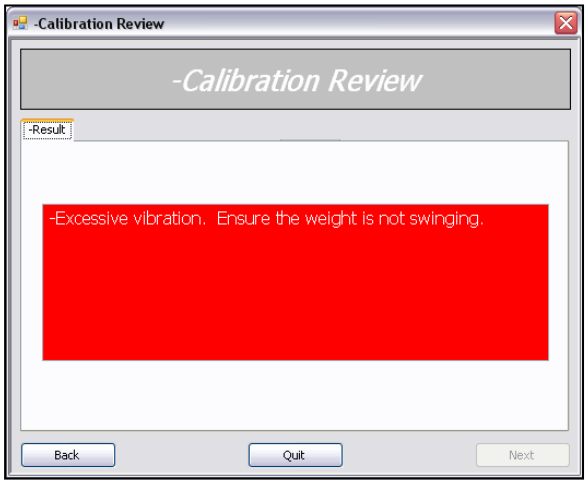
- Excessive slack in the cal loop prior to calibration (weight may not have been completely lifted from mouse pad)
- Select **Back** until Preparation Screen appears. Move Z-Stage up until slack is removed from the Cal Loop.
- Select **Next** to continue



Excess vibration. Ensure the weight is not swinging.

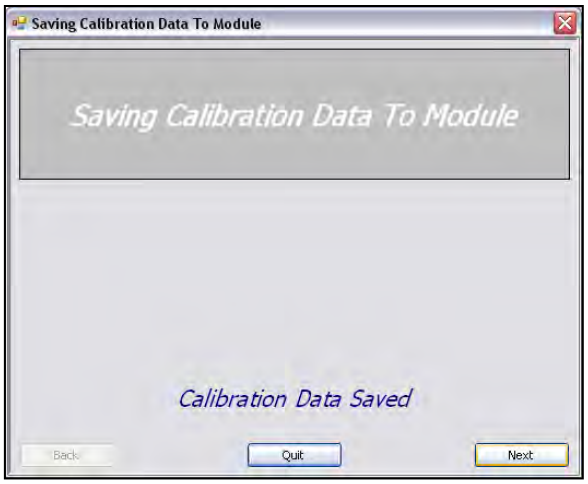
Typical Causes:

- Excess swinging of the weight during the calibration
- The Calibration Loop is under tension prior to beginning the calibration
- Select **Back** until Preparation Screen appears. Move Z-Stage down until Cal loop is no longer in tension.
- Select **Next** to continue

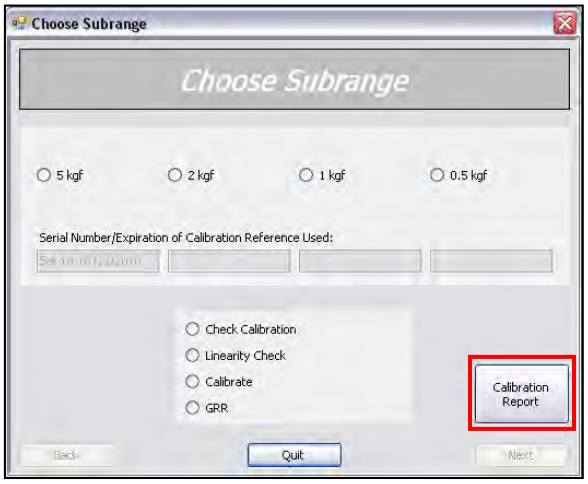


If Calibration Check continues to fail after calibration, contact customerservice@royceinstruments.com for further instructions.

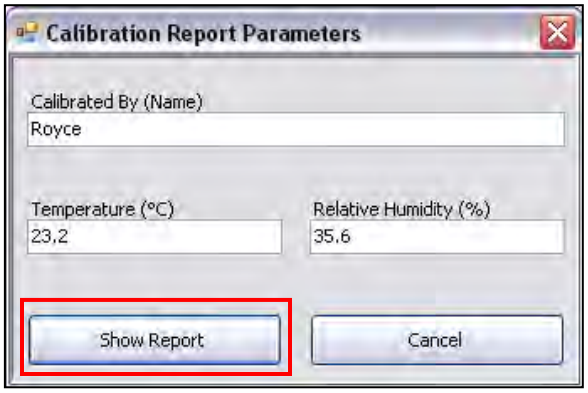
20. The *Saving Calibration Data to Module* screen will appear. Select **Next** to complete the calibration and to generate a calibration report.



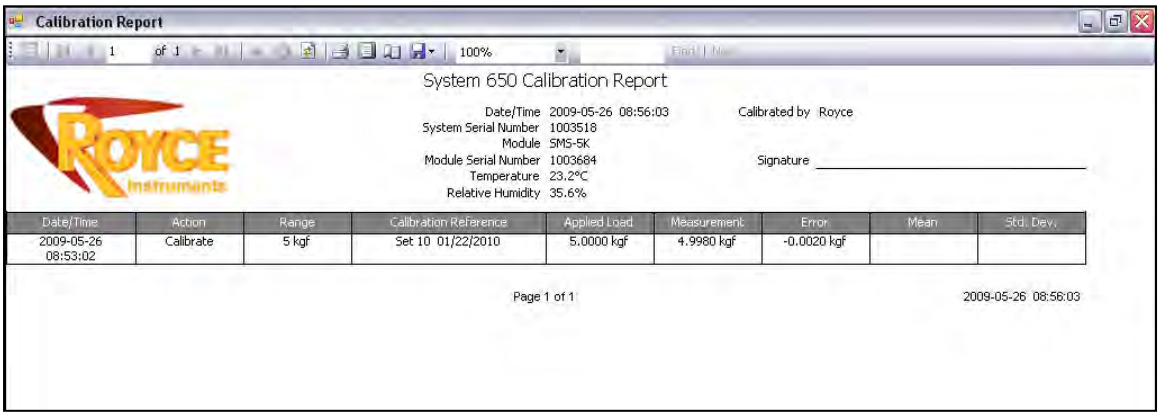
21. Click on the **Calibration Report** button.



22. Enter report parameters and click **Show Report**.



Note: The Modules are highly linear; however for the utmost accuracy each sub range will require calibration with the appropriate calibration weight for that sub range. Repeat Steps 11-18 for each sub range.

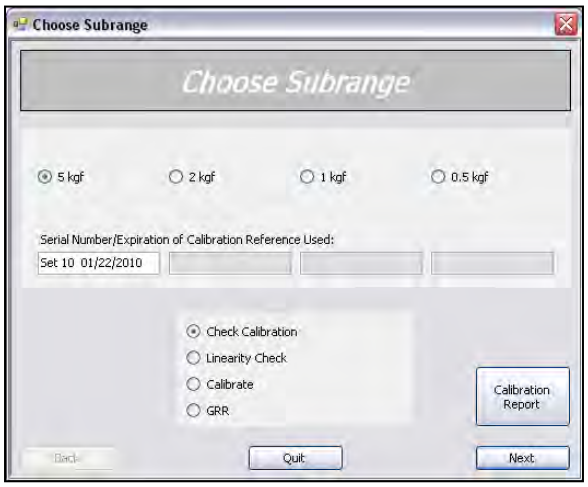


Section II: Check Calibration

Note: If the Calibration fixture is not installed complete Steps 1 - 10 listed in Section I prior to proceeding.

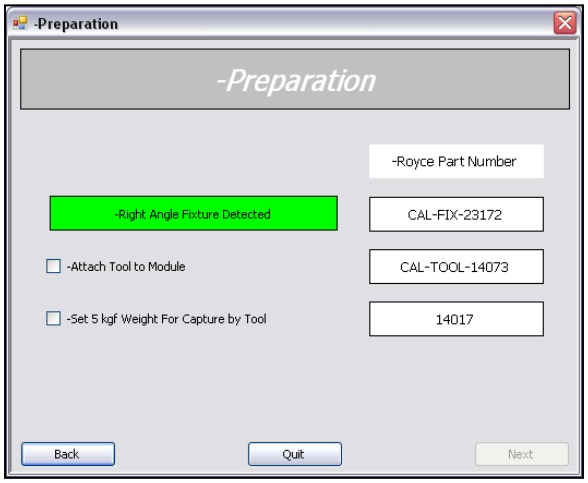
1. Select the Sub Range of the Module and enter weight information. In the example at right, the 5 kg range is selected.

2. Select **Check Calibration**, then select Next.



3. The *Preparation Screen* will appear. At this point Tool Detection is disabled and the Z-Axis can be moved if necessary to prepare for the calibration.

   Steps 4 & 5 are required prior to selecting **Next.**



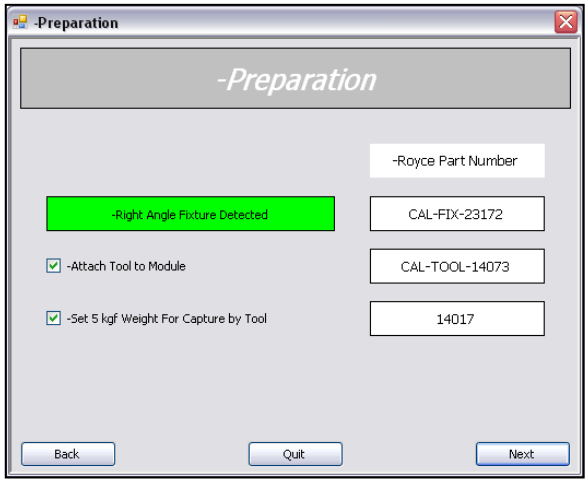
4. Place the Cal Loop on the Calibration Tool.

5. Using the Z-Axis Joystick, lower the module so that the Cal Loop is at the same or similar height as the weight. Attach the weight to the Cal Loop. Adjust the module position until there is some slack in the Cal Loop.

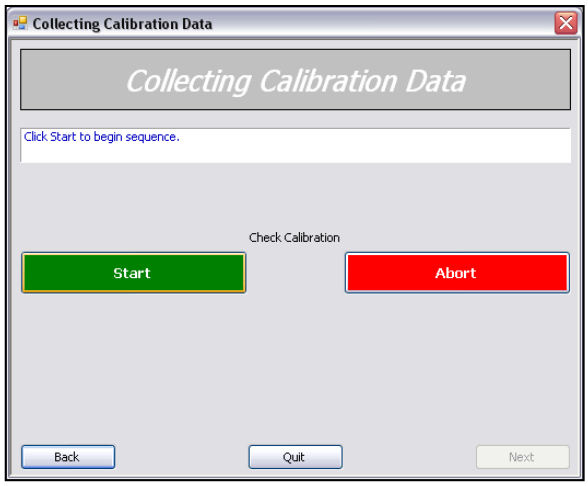
6. Check **Attach Tool to Module**.

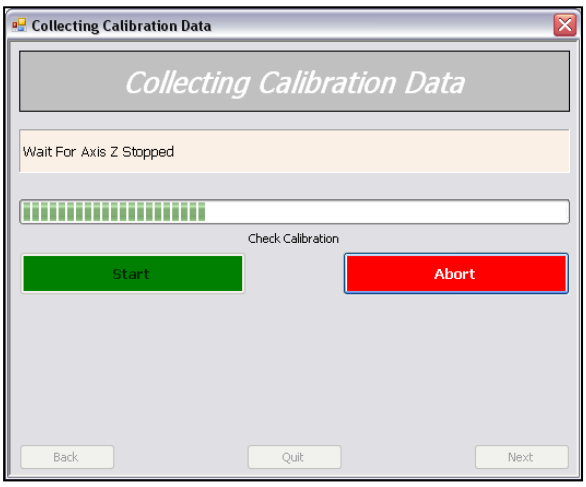
   Note: Check boxes may not be present in later software versions.

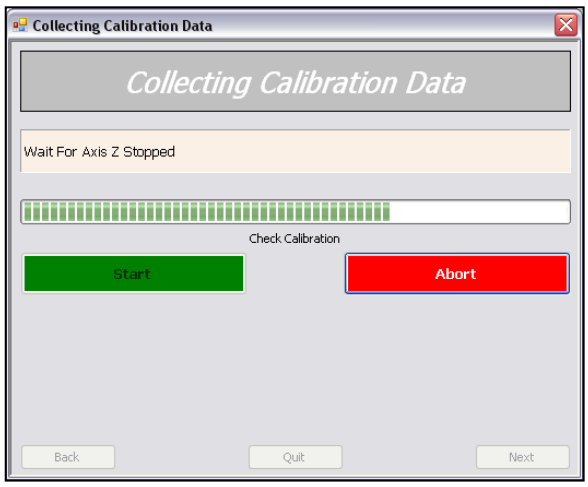
   Check **Set Weight For Capture by Tool**. Select **Next**.



7. From the Collecting Calibration Data screen. Select **Start.** The system will perform a series of lifts as illustrated below. Verify the weight is being lifted completely off the stage.



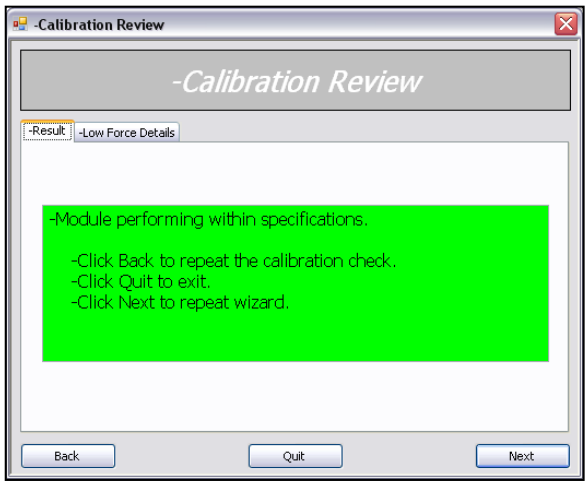




8. Once the Calibration Check has completed there are three possible results.

Calibration Review

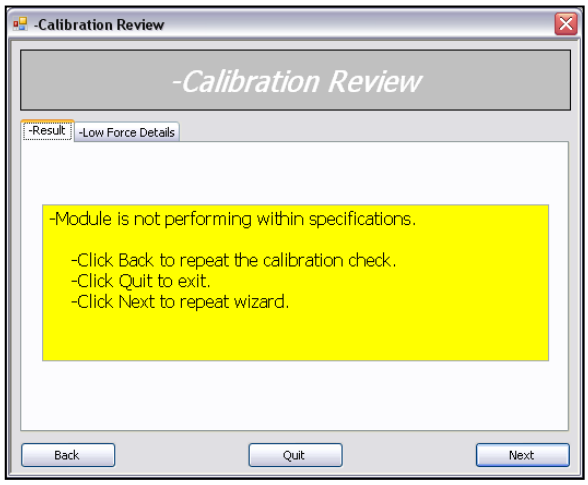
- Select the *Low Force Details* tab to view calibration check data
- Select **Next** to return to the Select Sub Range Menu or select **Quit** to end the Calibration Check



Module not performing within specification

Typical Causes:

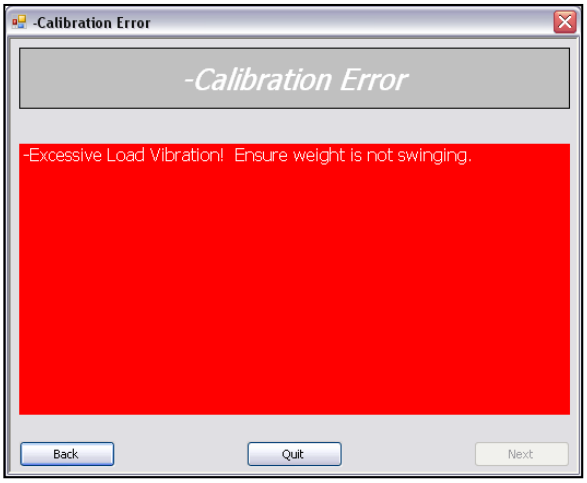
- Module Requires Calibration
- Excessive slack in the cal loop prior to calibration (Weight may not have been completely lifted from mouse pad)
  - Select **Back** until the Preparation Screen appears and move Z-Stage up until slack is removed from the cal loop.
  - Select **Next** to continue



Excess vibration. Ensure the weight is not swinging.

Typical causes:

- Excess swinging of the weight during the calibration
- The Calibration Loop is under tension prior to beginning the calibration
  - Select **Back** until Preparation screen appears. Move Z-Stage down until Cal Loop is no longer in tension.
  - Select **Next** to continue



Note: If Calibration Check continues to fail after calibration, contact **customerservice@royceinstruments.com** for further instructions.

9. The data captured during the calibration check can be view by selecting the *Low Force Details* tab.

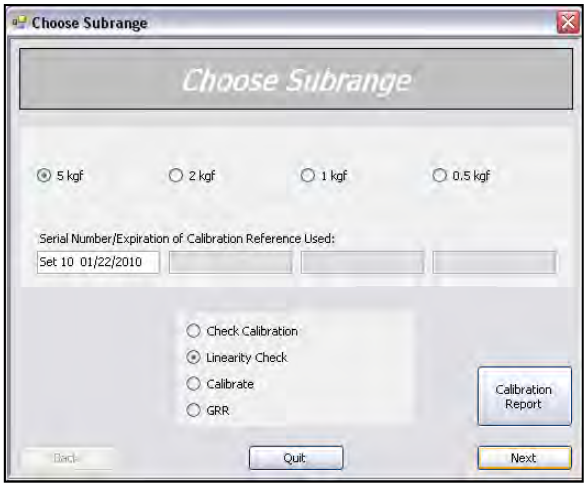
   Select **Next** to return to the *Select Sub Range Menu* and generate a calibration report OR select **Quit** to exit the Calibration Wizard.

Section III: Linearity Check:

Note: If the Calibration fixture is not installed complete Steps 1-10 listed in Section I prior to proceeding.

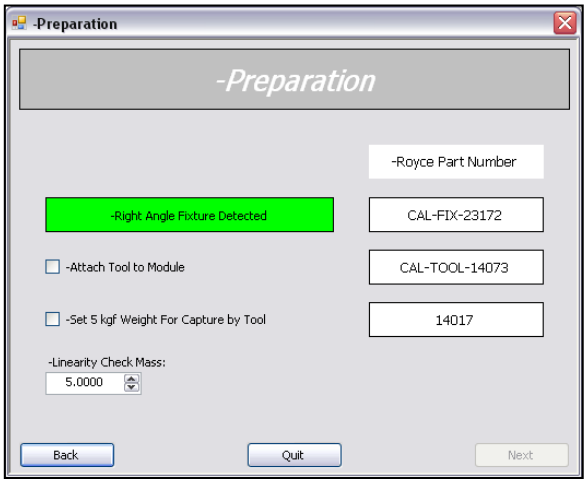
1. Select the Sub Range of the Module and enter weight information. In the example on the right, the 5 kg range is selected.

   Select **Linearity Check** option, then select **Next.**



2. The *Preparation Screen* will appear. At this point Tool Detection is disabled and the Z-Axis can be moved if necessary to prepare for the calibration.

   See Steps 4 & 5 prior to selecting **Next**.



3. Place the Cal Loop on the Calibration Tool.

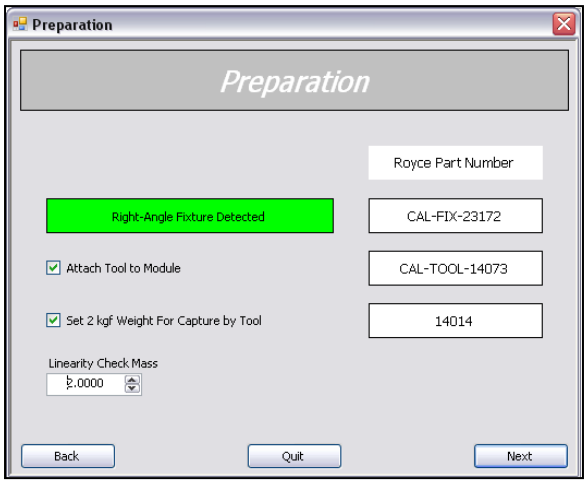
4. Using the Z-Axis Joystick, lower the module so that the cal loop is at the same or similar height as the weight. Attach the weight to the Cal Loop. Adjust the module position until there is some slack in the Cal Loop.

5. Check the **Attach Tool to Module** box

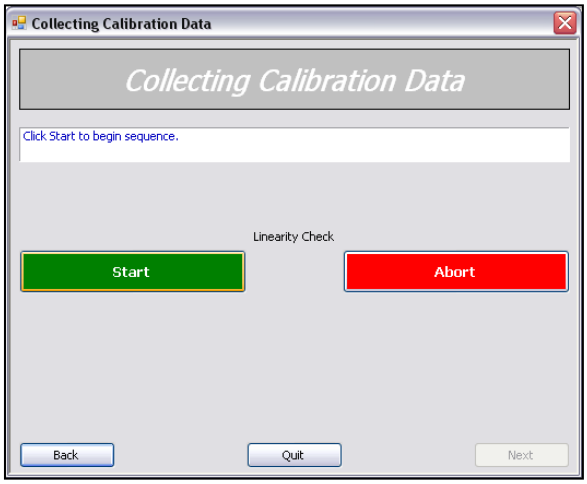
   Note: Check boxes may not be present in later software versions

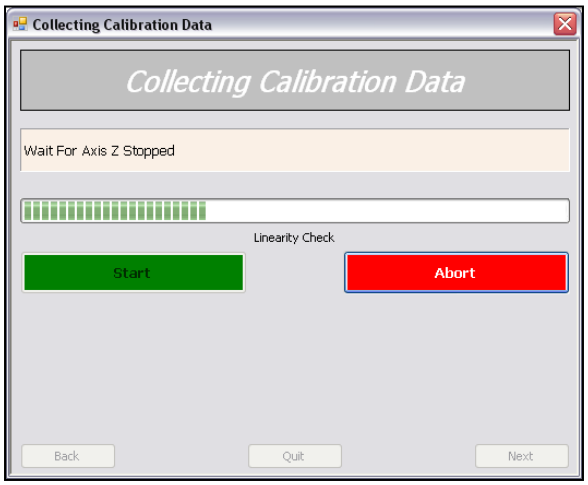
   Check **Set Weight For Capture by Tool** box

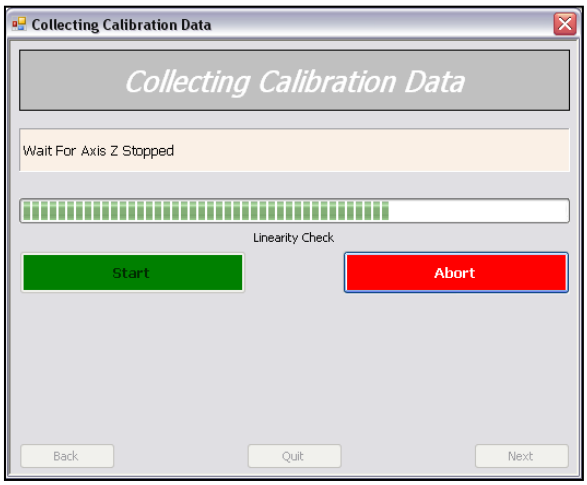
   Enter the **Linearity Check Mass,** then select **Next**. (2 kg is selected in this example.)



6. Select **Start** from the *Calibration Screen*. The System will perform a series of lifts as illustrated below.



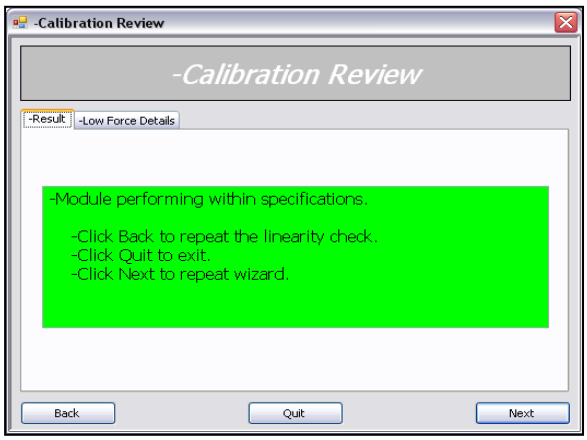




7. Once the Calibration has completed there are two possible pop ups.

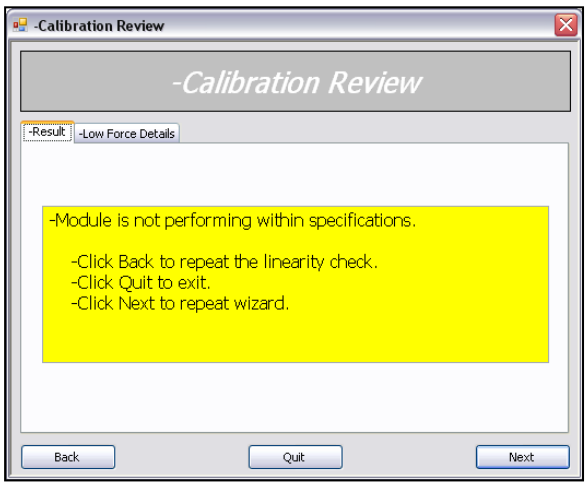
Linearity Check within specification

- The data captured during the linearity check can be viewed by selecting the 'Low Force Details' tab



Module is not in spec

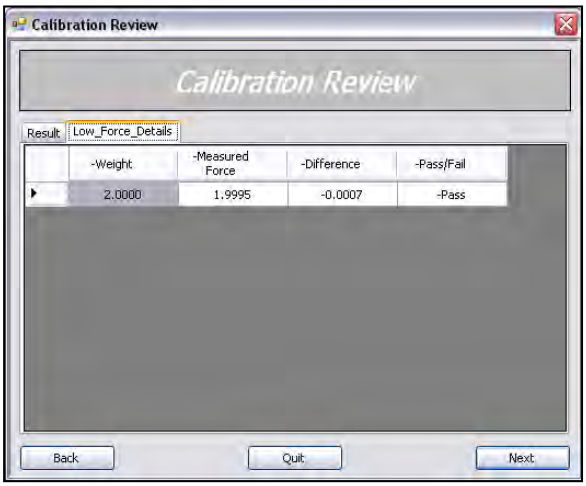
- Select **Next** to return to the select Sub Range to re-calibrate module.



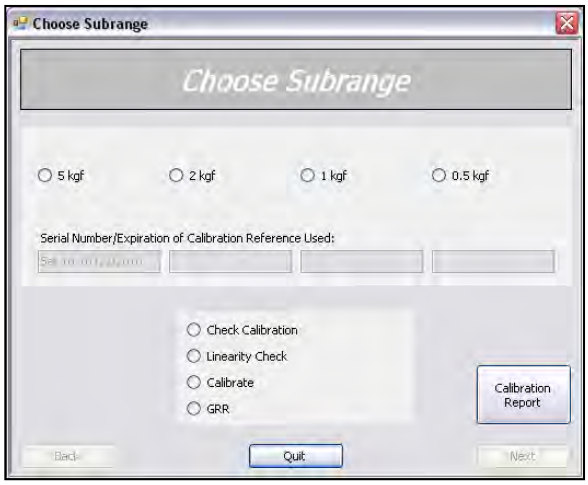
Note: If Linearity Check continues to fail after calibration, contact **customerservice@royceinstruments.com** for further instructions.

8. The data captured during the Linearity Check can be viewed by selecting the Low Force Details tab.

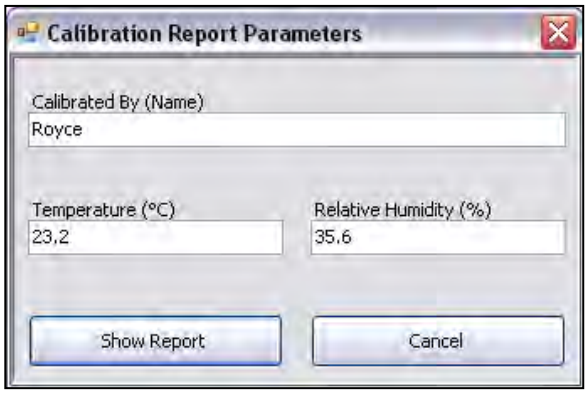
   Select **Next** to return to the *Select Sub Range Menu* and generate a calibration report OR select **Quit** to exit the Calibration Wizard.

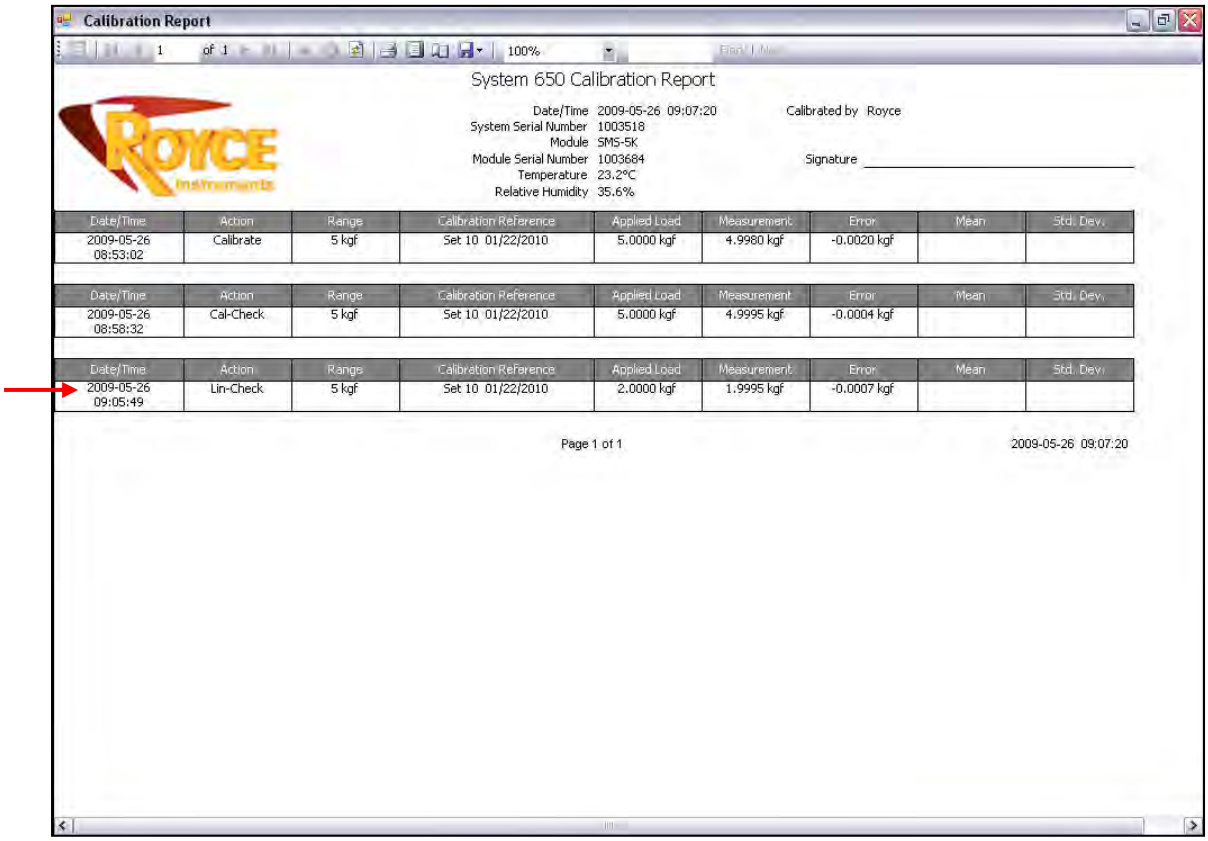


9. Click on the **Calibration Report** button.



10. Enter report parameters and click **Show Report**.



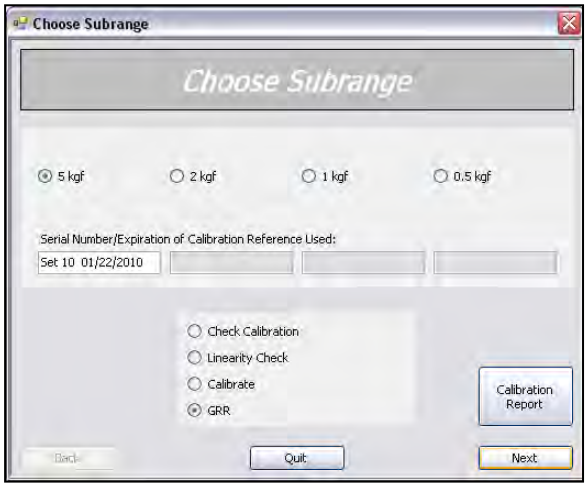

Calibration Report
1 of 1
100%
System 650 Calibration Report
Date/Time 2009-05-26 09:07:20
System Serial Number 1003518
Module SMS-5K
Module Serial Number 1003684
Temperature 23.2°C
Relative Humidity 35.6%
Calibrated by Royce
Signature
Date/Time | Action | Range | Calibration Reference | Applied Load | Measurement | Error | Mean | Std. Dev.
2009-05-26 08:53:02 | Calibrate | 5 kgf | Set 10 01/22/2010 | 5.0000 kgf | 4.9980 kgf | -0.0020 kgf
Date/Time | Action | Range | Calibration Reference | Applied Load | Measurement | Error | Mean | Std. Dev.
2009-05-26 08:58:32 | Cal-Check | 5 kgf | Set 10 01/22/2010 | 5.0000 kgf | 4.9995 kgf | -0.0004 kgf
Date/Time | Action | Range | Calibration Reference | Applied Load | Measurement | Error | Mean | Std. Dev.
2009-05-26 09:05:49 | Lin-Check | 5 kgf | Set 10 01/22/2010 | 2.0000 kgf | 1.9995 kgf | -0.0007 kgf
Page 1 of 1
2009-05-26 09:07:20

Section IV: GR&R

Note: If the Calibration fixture is not installed, complete Steps 1 - 10 listed in Section I prior to proceeding.

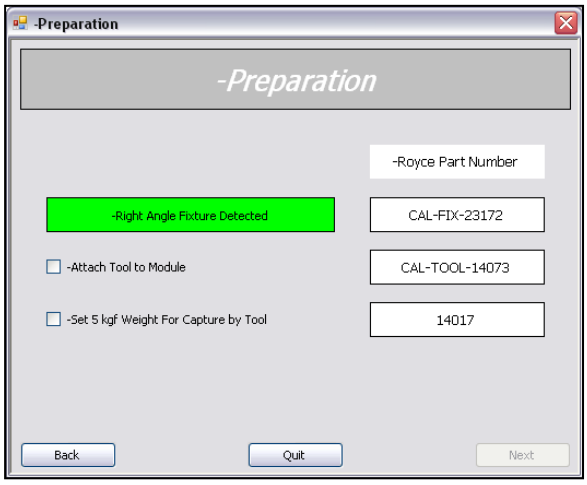
1. Select the Sub Range of the Module and enter weight information. (5 kgf in this example.)

   Select **GRR** option then select **Next.**



2. The *Preparation Screen* will appear. At this point the Collision is disabled and the Z-Axis can be moved if necessary to prepare for the calibration.

   See Steps 4 & 5 prior to selecting **Next**.



3. Place the Cal Loop on the Calibration Tool.

4. Using the Z-Axis Joystick, lower the module so that the Cal Loop is at the same or similar height as the weight.

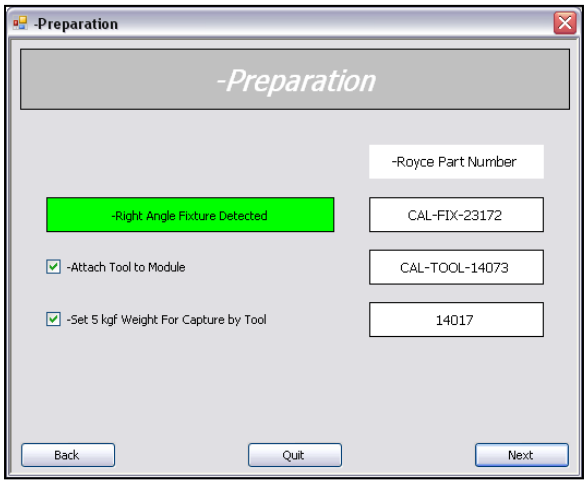
   Attach the weight to the Cal Loop. Adjust the module position until there is some slack in the Cal Loop.

5. Check the **Attach Tool to Module** box.

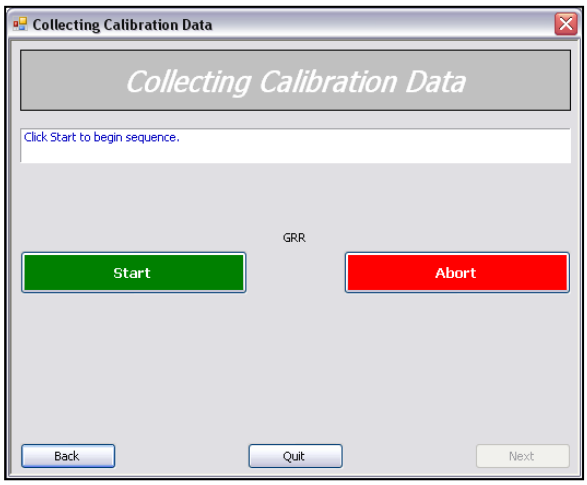
   Note: Check boxes may not be present in later software versions.

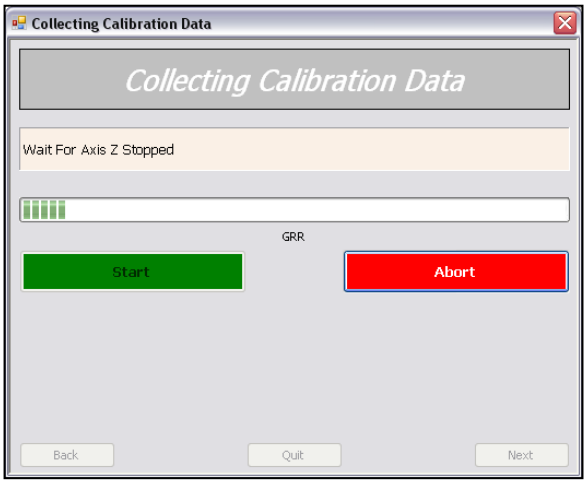
   Check the **Set Weight For Capture by Tool** box.

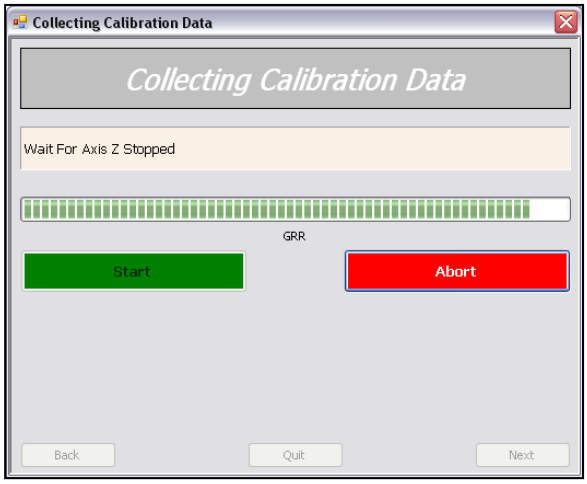
   Select **Next**.



6. Select **Start** from the Collecting Calibration Data Screen. The system will perform a series of lifts as illustrated below.



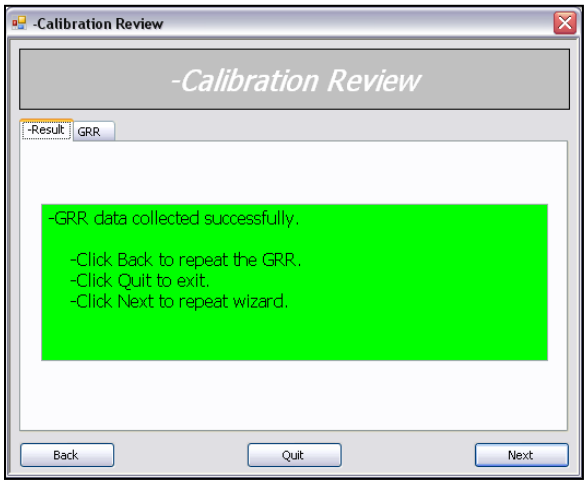




7. Once the GRR has completed there are two possible pop ups.

GRR data collected successfully

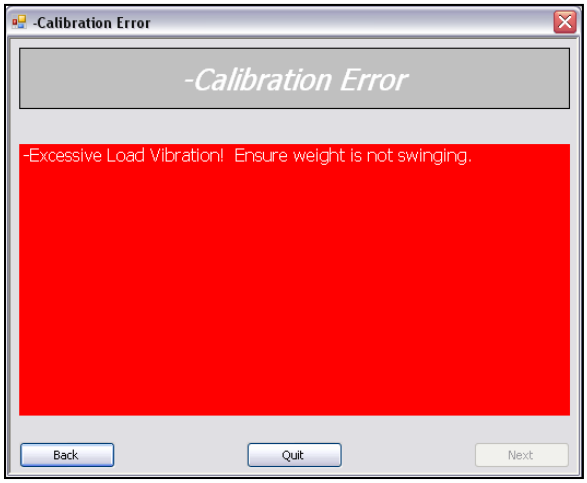
- The data captured during the GR&R check can be viewed by selecting the GRR tab



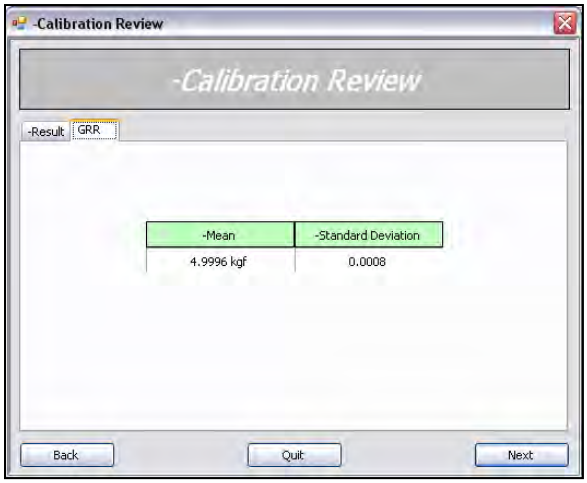
Module is not in spec

- Select **Back** to return to the select Sub Range to re-calibrate module

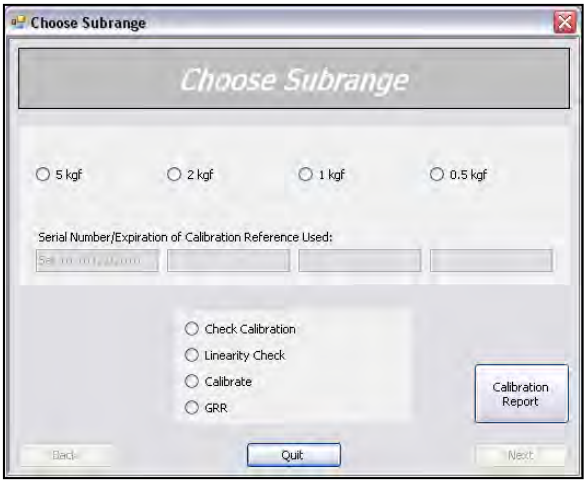
Note: If GR&R continues to fail after calibration, contact **customerservice@royceinstruments.com** for further instructions.



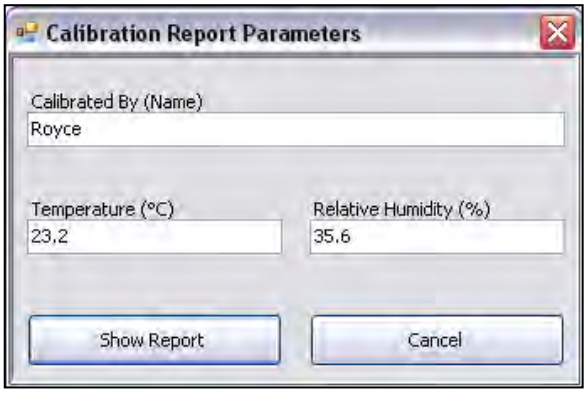
- Select **Next** to return to the *Select Sub Range Menu* and generate a calibration report OR select **Quit** to exit Calibration Wizard

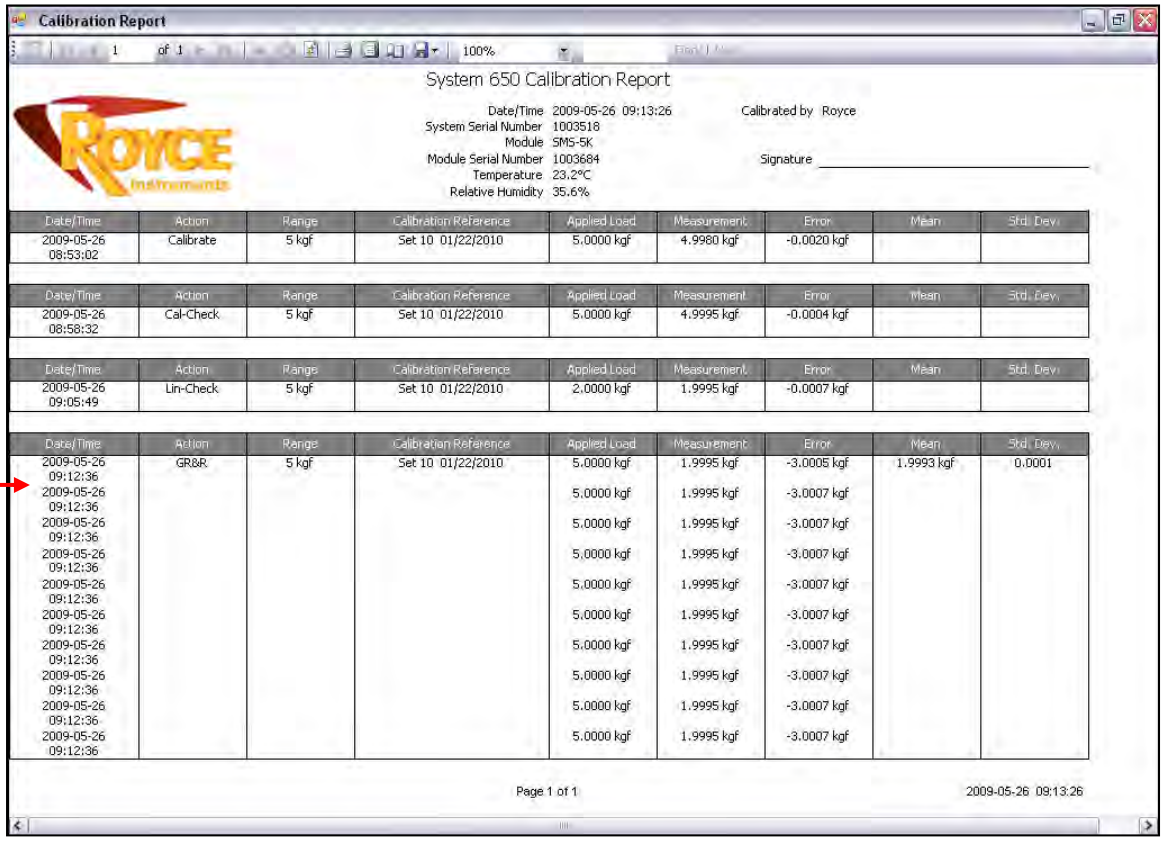


8. Click on the **Calibration Report** button.



9. Enter report parameters, then click **Show Report**.





Calibration Report

System 650 Calibration Report

Date/Time 2009-05-26 09:13:26
System Serial Number 1003518
Module SMS-5K
Module Serial Number 1003684
Temperature 23.2°C
Relative Humidity 35.6%

Calibrated by Royce

Signature _____

Date/Time	Action	Range	Calibration Reference	Applied Load	Measurement	Error	Mean	Std. Dev.
2009-05-26 08:53:02	Calibrate	5 kgf	Set 10 01/22/2010	5.0000 kgf	4.9980 kgf	-0.0020 kgf		

Date/Time	Action	Range	Calibration Reference	Applied Load	Measurement	Error	Mean	Std. Dev.
2009-05-26 08:58:32	Cal-Check	5 kgf	Set 10 01/22/2010	5.0000 kgf	4.9995 kgf	-0.0004 kgf		

Date/Time	Action	Range	Calibration Reference	Applied Load	Measurement	Error	Mean	Std. Dev.
2009-05-26 09:05:49	Lin-Check	5 kgf	Set 10 01/22/2010	2.0000 kgf	1.9995 kgf	-0.0007 kgf		

Date/Time	Action	Range	Calibration Reference	Applied Load	Measurement	Error	Mean	Std. Dev.
2009-05-26 09:12:36	GR&R	5 kgf	Set 10 01/22/2010	5.0000 kgf	1.9995 kgf	-3.0005 kgf	1.9993 kgf	0.0001
2009-05-26 09:12:36				5.0000 kgf	1.9995 kgf	-3.0007 kgf		
2009-05-26 09:12:36				5.0000 kgf	1.9995 kgf	-3.0007 kgf		
2009-05-26 09:12:36				5.0000 kgf	1.9995 kgf	-3.0007 kgf		
2009-05-26 09:12:36				5.0000 kgf	1.9995 kgf	-3.0007 kgf		
2009-05-26 09:12:36				5.0000 kgf	1.9995 kgf	-3.0007 kgf		
2009-05-26 09:12:36				5.0000 kgf	1.9995 kgf	-3.0007 kgf		
2009-05-26 09:12:36				5.0000 kgf	1.9995 kgf	-3.0007 kgf		
2009-05-26 09:12:36				5.0000 kgf	1.9995 kgf	-3.0007 kgf		

Page 1 of 1 2009-05-26 09:13:26

Required Equipment & Tools

- System 650
- Load Cell Controller [CAL-LCF-23450]
- Load Cell Fixture
  - LCF-20K-23453 (For SMS-20k Module)
  - LCF-200K-23454 (For SMS-200k Module)
- Push Tool [CAL-TOOL-23746]
- Rotary Torque Wrench (in/lbs)
- 2.5 mm Hex Bit

Section 1: Preparation

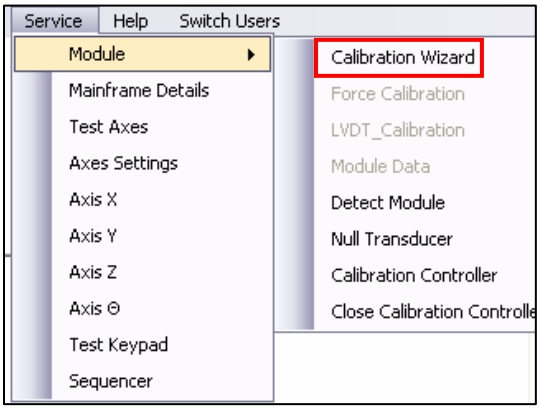
1. Power on the 650

2. Login to *Bond Test Manager Software*

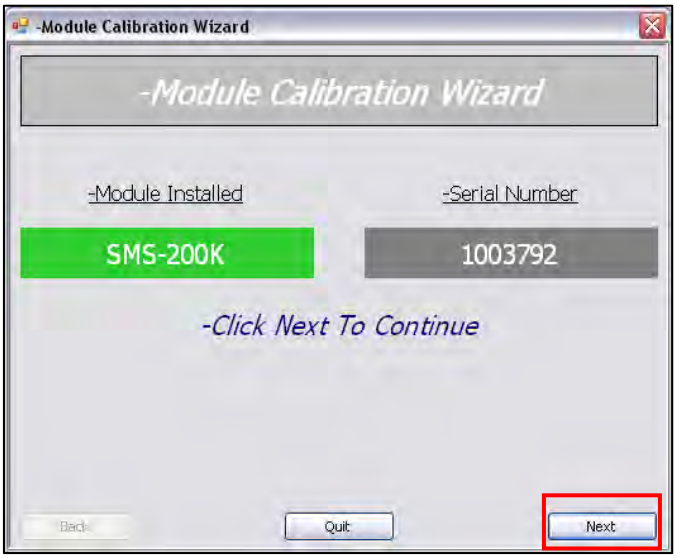
3. Select **Home**

4. Install the Shear Module on the mainframe and secure with the Lock Screw. Allow the module to initialize.

5. From the top Menu Bar, select **Service > Module > Calibration Wizard**.



6. The *Module Calibration Wizard* window will appear. Select **Next** to continue.



Section 2: Calibration Procedure

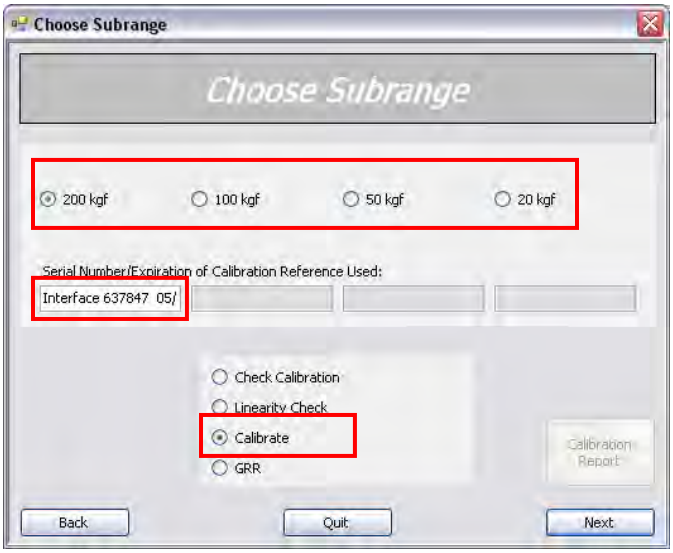
Performing a New Calibration

1. Select the sub range of the module to be calibrated. The 200kgf range is selected in this example.

   Enter Load-cell serial number/Expiration information.

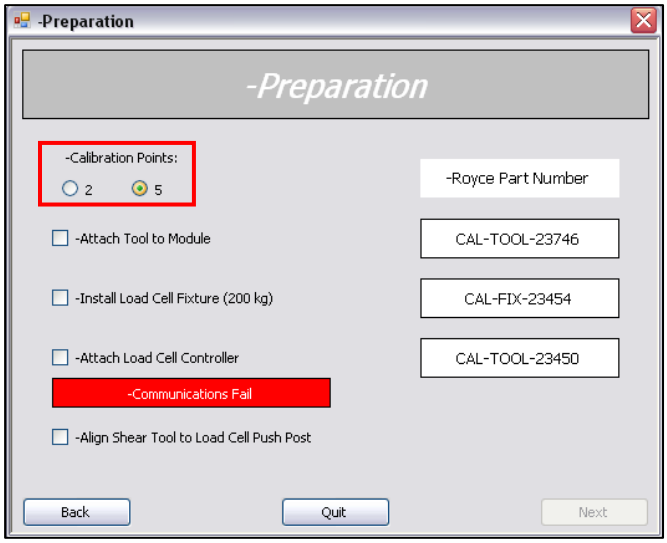
   Select the **Calibrate** option.

   Click **Next** to continue.



2. In the *Preparation Screen* there is the option to perform a 2-point or 5-point calibration. (A 5-point calibration can provide improved linearity results.)

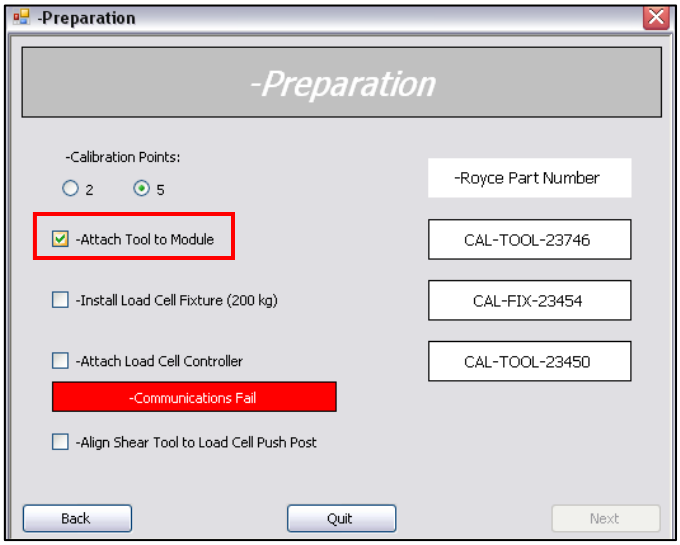
   Note: Depending on software version, Check boxes may not be present.



3. Insert the push tool [23746] into shear module until it stops. Secure the tool to 25 in/lbs with torque wrench.

   CAUTION: The push tool [CAL-TOOL-23746] is designed specifically for high force application. Failure to use this push tool [CAL-TOOL-23746] could result in damage to tooling and equipment.

4. Check the *Attach Tool to Module* box.

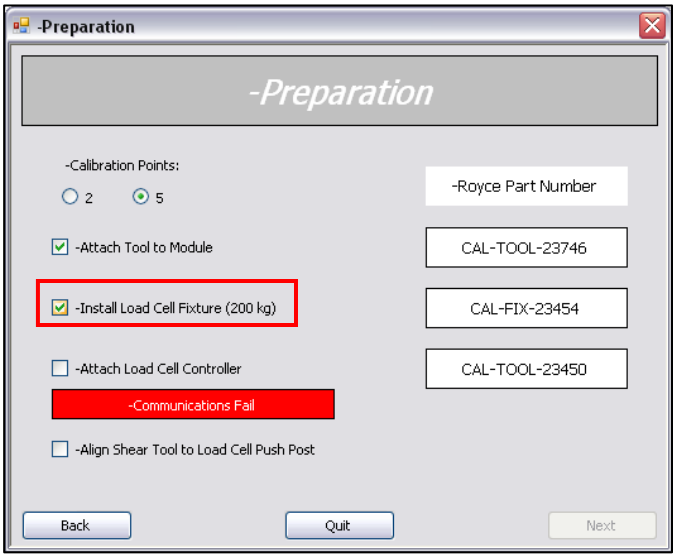


5. Install the Load Cell fixture (LCF) on the X-Y stage.

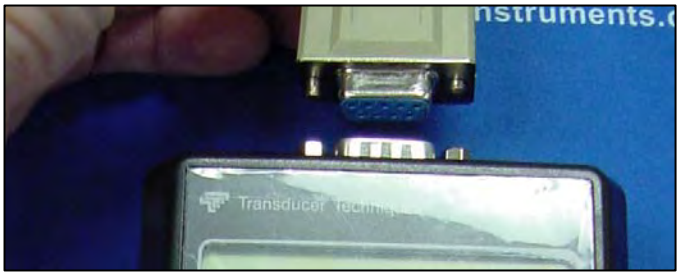
Secure the load cell fixture in place by tightening the TPS locking knob. **Failure to do so can result in injury and damage to the equipment.**

6. Note the Load Cell Range and confirm the correct Load Cell Fixture is installed. The fixture has an ID label.

   Check the **Install Load Cell Fixture (Range)** box.



7. Connect the load cell (9-pin connector) to the load cell SSI controller.



Connect the **phone cable** to the Controller and to the external Mainframe COM 1 port (COM 2 on newer systems) on rear panel using the **adapter** provided.

If **USB cable** is provided, connect it to a USB port on rear panel.

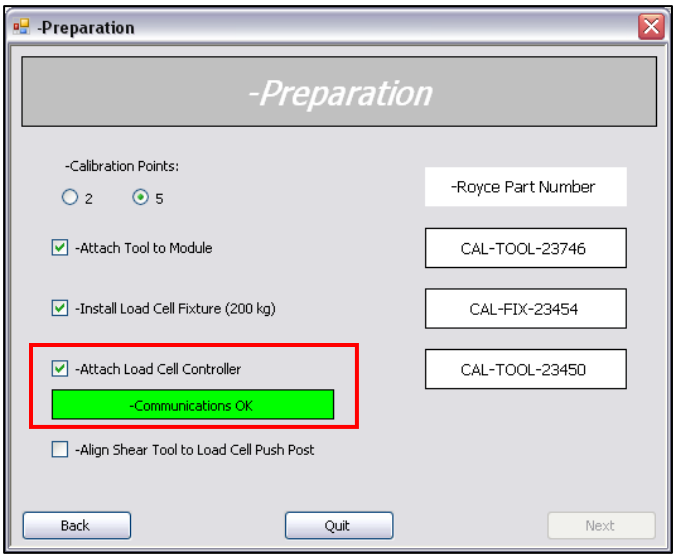
Press the **Power** button on the Load Cell Controller. The display units will be in Newtons (N).

Note: The Controller has been configured and tested at the factory and is ready for use with the Load Cell Fixture.

8. Check the **Attach Load Cell Controller** box.

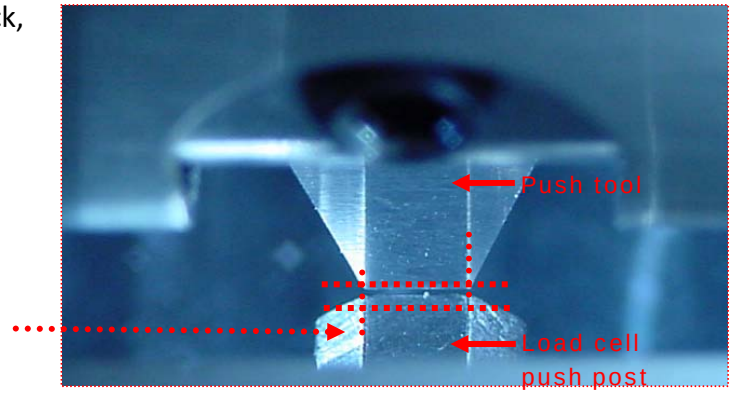
Note: The green **Communication OK** box indicates the Load Cell Controller is communicating with the System 650.

If a red **Communication Fail** message is present, ensure the Controller is powered on and all connections are secure.



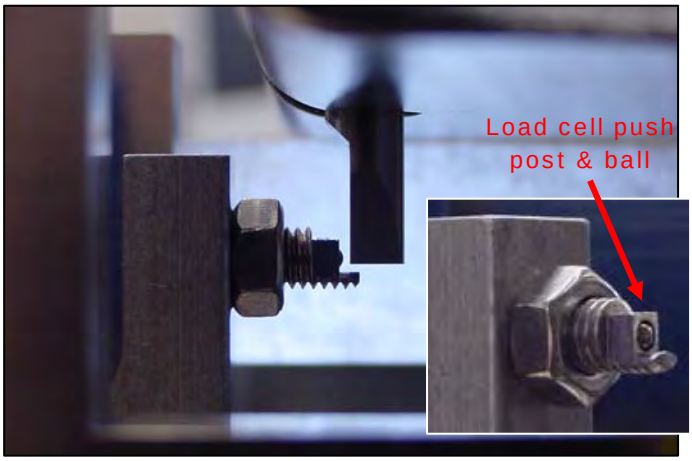
9. Using the X-Y Stage Controller Joystick, align the Load Cell Push Post to the Module Push Tool in the X-direction (left & right) as shown at right.

The edges of the push tool should be even with the edges of the load cells push post.

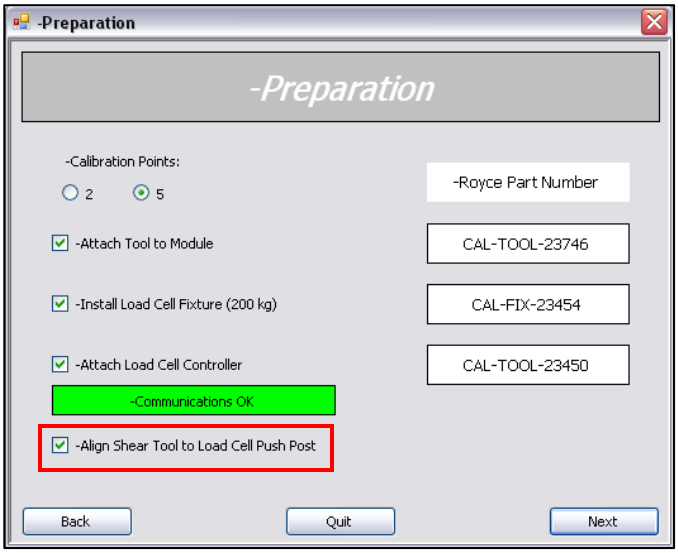


Realign the fixture if tool is not parallel. Using the X-Y Stage Controller, move the stage in the Y-direction (backward) to position the tool while maintaining the prior alignment.

During the Calibration & Check Calibration Process, the Module Push Tool will touch down on the Push Post, lift then push against the ball on the Push Post.

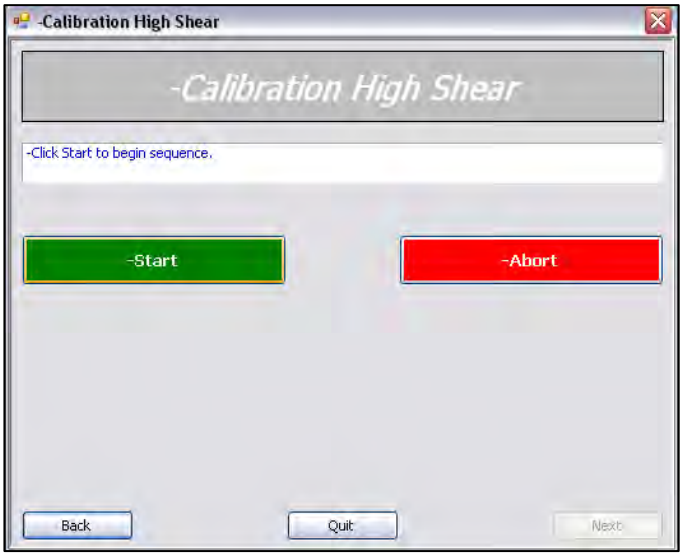


10. Check **Align Shear Tool to Load Cell Push Post** box.



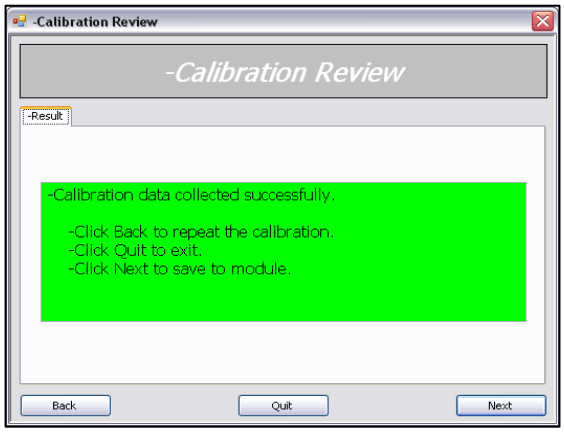
11. Select the green **Start** button to begin the calibration routine.

Note: The Calibrate sequence can be aborted at any time by pressing the red **Abort** button.

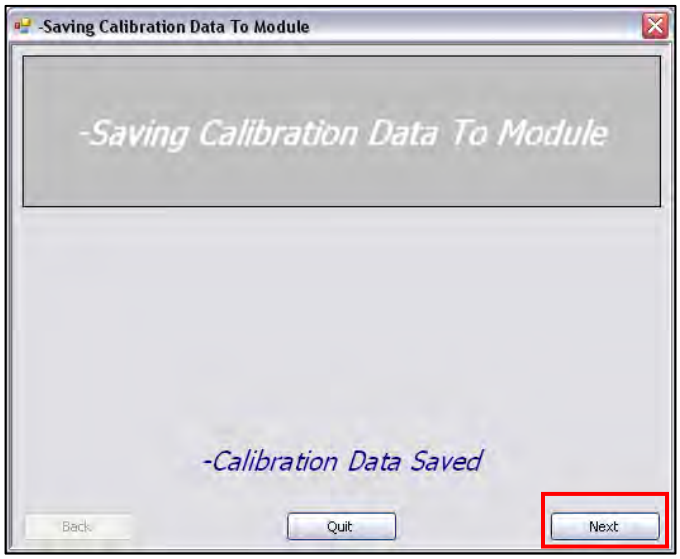


12. Once the Calibration has completed the following pop up will occur.

    Calibration data collected successfully
    - Calibration completed
    - Select **Next** to save the calibration data to the module.



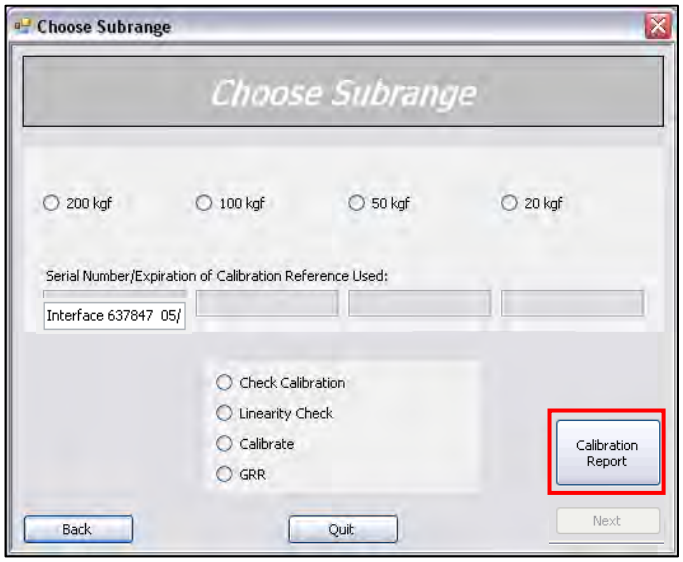
13. The *Saving Calibration Data to Module* screen will appear. Select **Next** to complete the calibration and to generate a calibration report.

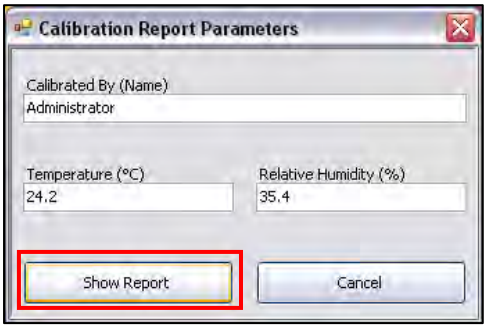


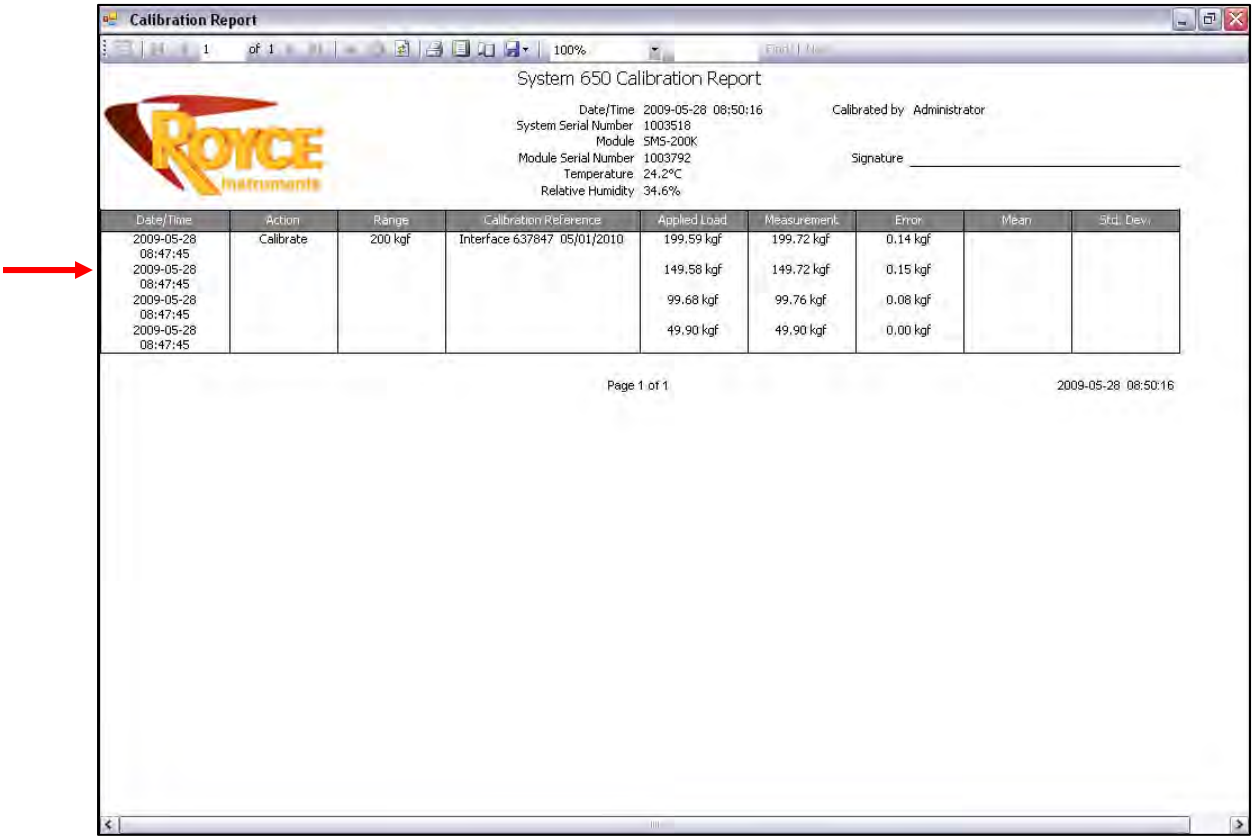
Note: The Modules are highly linear; however for the utmost accuracy, each sub range will require calibration. Repeat steps 1-13 for each sub range.

IF calibration continues to fail, contact customerservice@royceinstruments.com for further instructions.

14. Click on the **Calibration Report** button, enter report parameters and click **Show Report**.





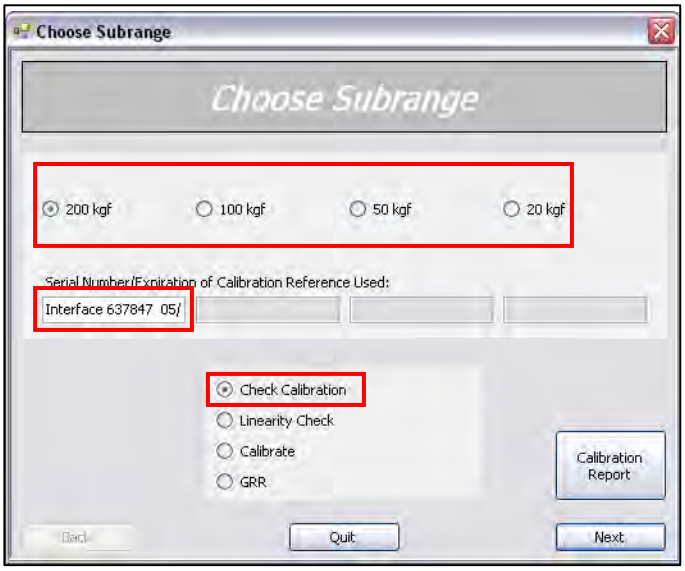


Section 3: Check Calibration:

Note: If Load Cell Fixture has not been installed, refer to Sections 1 and 2 before proceeding.

1. Select the sub range of the Module to perform a Check Calibration. For example the 200kg sub range is illustrated here.

   Enter Load-cell information.



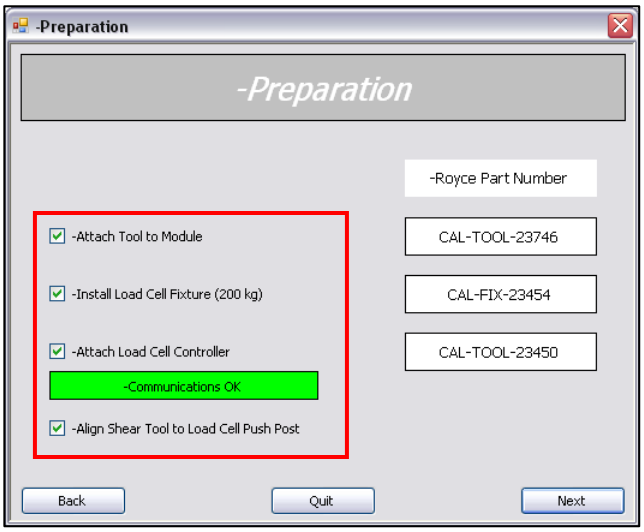
2. Select **Check Calibration** option then select **Next**.

3. The *Preparation Screen* will appear.

   Note: If the calibration equipment has not been installed, refer to Section 2: Steps 3 - 10.

   Check the **Attach Tool to Module** box, the **Install Load Cell Fixture (200 kg)** box, the **Attach Load Cell Controller** box and the **Align Shear Tool to Load Cell Push Post** box.

   Select the **Next** button to continue.



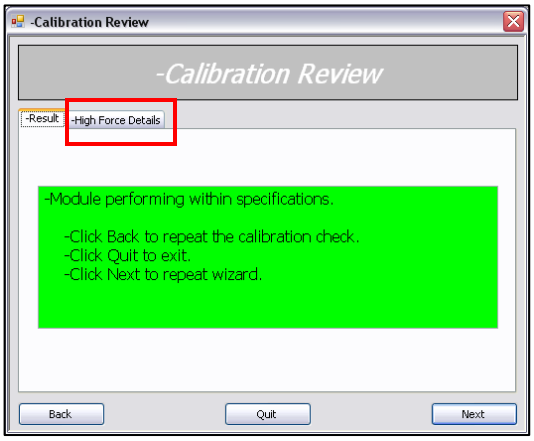
4. Select **Start** from the *Calibration High Shear* screen.

Note: The Check Calibration sequence can be aborted at any time by clicking the red **Abort** button.

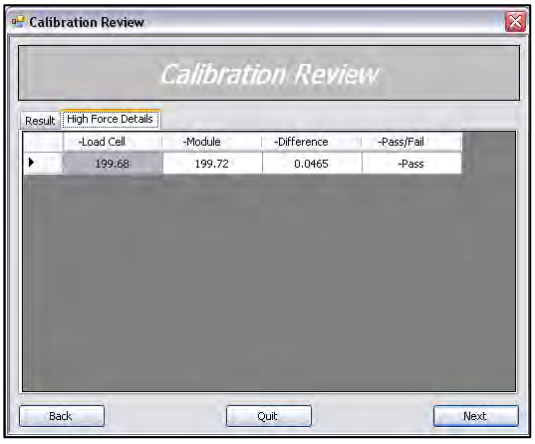
5. Once the Calibration Check has completed there are two possible pop ups.

Module performing with specifications

- Select *High Force Details* tab to view Calibration Check data

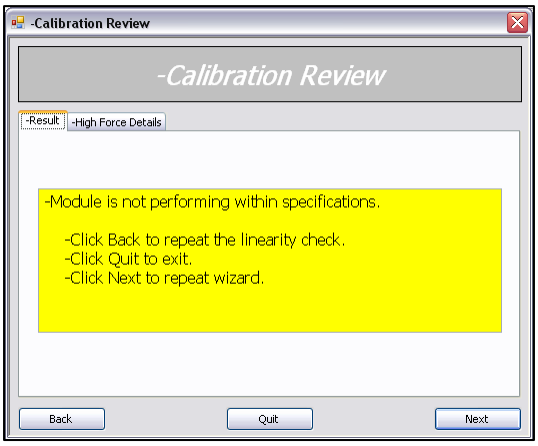


Select **Next** to return to the *Select Sub Range Menu* and generate a calibration report or select **Quit** to end the Calibration Check.



Module is not performing within specifications
Typical Causes:

- Module Requires Calibration
- Load Cell fixture not secured in stage properly.
- Tooling Misaligned.

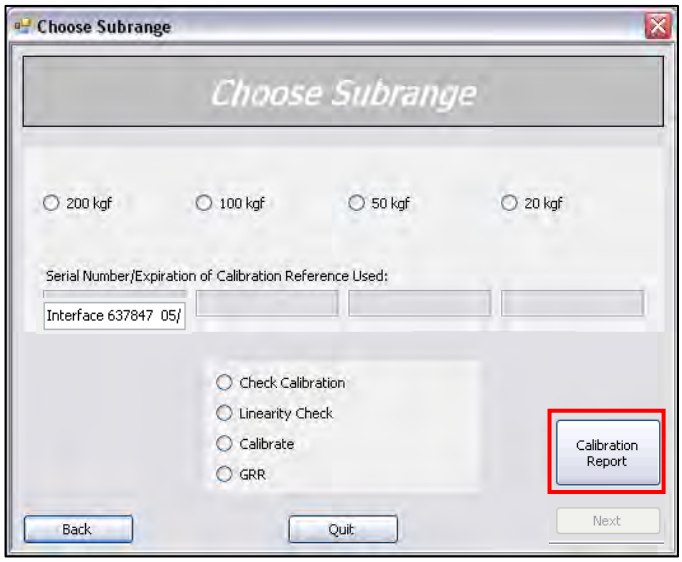


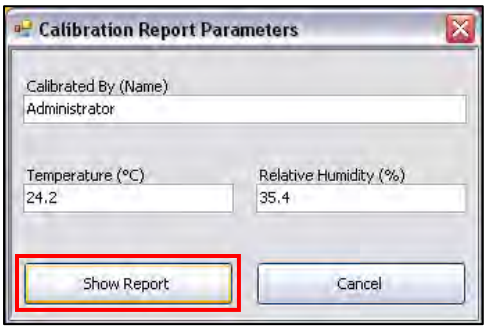
Action:

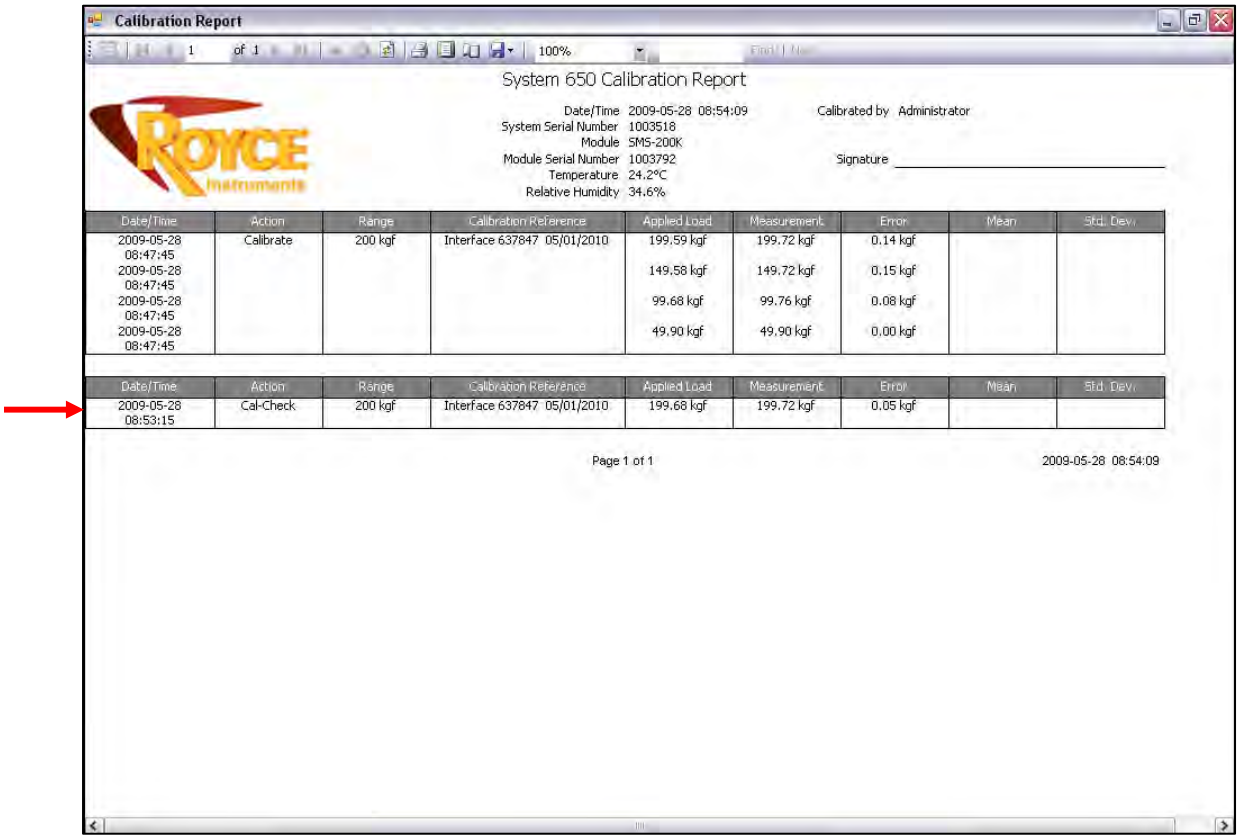
- Click the Back button to the 'Choose Subrange' menu.
- Secure the Load Cell Fixture.
- Realign the tooling.
- Perform a New Calibration (see Section 2)

NOTE: IF Calibration Check continues to fail after calibration, contact customerservice@royceinstruments.com for further instructions.

6. Click the **Calibration Report** button, enter report parameters then click **Show Report**.





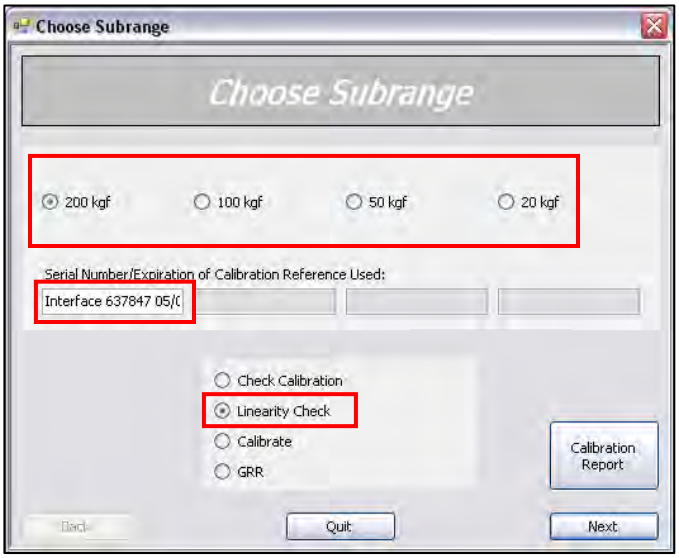

Calibration Report
System 650 Calibration Report
Date/Time 2009-05-28 08:54:09
System Serial Number 1003518
Module SMS-200K
Module Serial Number 1003792
Temperature 24.2°C
Relative Humidity 34.6%
Calibrated by Administrator
Signature
Date/Time | Action | Range | Calibration Reference | Applied Load | Measurement | Error | Mean | Std. Dev.
2009-05-28 08:47:45 | Calibrate | 200 kgf | Interface 637847 05/01/2010 | 199.59 kgf | 199.72 kgf | 0.14 kgf
2009-05-28 08:47:45 | 149.58 kgf | 149.72 kgf | 0.15 kgf
2009-05-28 08:47:45 | 99.68 kgf | 99.76 kgf | 0.08 kgf
2009-05-28 08:47:45 | 49.90 kgf | 49.90 kgf | 0.00 kgf
Date/Time | Action | Range | Calibration Reference | Applied Load | Measurement | Error | Mean | Std. Dev.
2009-05-28 08:53:15 | Cal-Check | 200 kgf | Interface 637847 05/01/2010 | 199.68 kgf | 199.72 kgf | 0.05 kgf
Page 1 of 1
2009-05-28 08:54:09

Section 4: Linearity Check

Note: If Load Cell Fixture has not been installed, refer to Sections 1 and 2 before proceeding.

1. Select the sub range of the Module to perform a Linearity Check. For example, the 200kg sub range is illustrated here.

   Enter Load-cell information



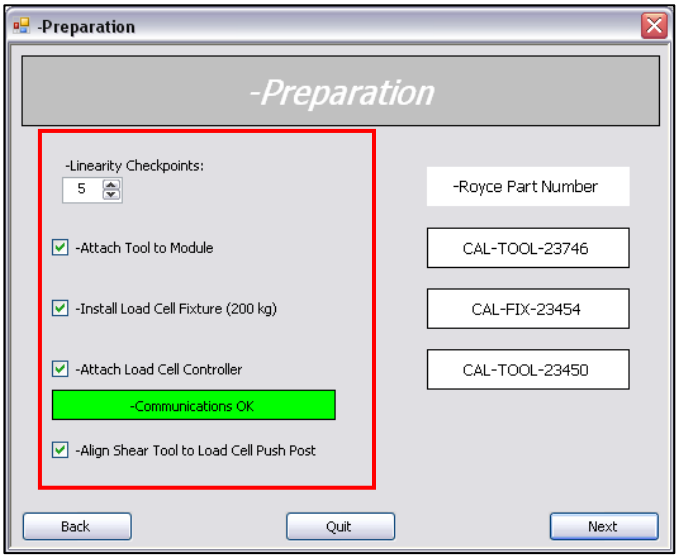
2. Select **Linearity Check** option then select **Next**.

3. In the *Preparation Screen*, select the number of linearity points. 5-point is selected in this example.

   Note: If the calibration equipment has not been installed, refer to Section 2: Steps 3 though 10.

   Check the **Attach Tool to Module** box, the **Install Load Cell Fixture (200 kg)** box, the **Attach Load Cell Controller** box and the **Align Shear Tool to Load Cell Push Post** box.

   Select the **Next** button to continue.



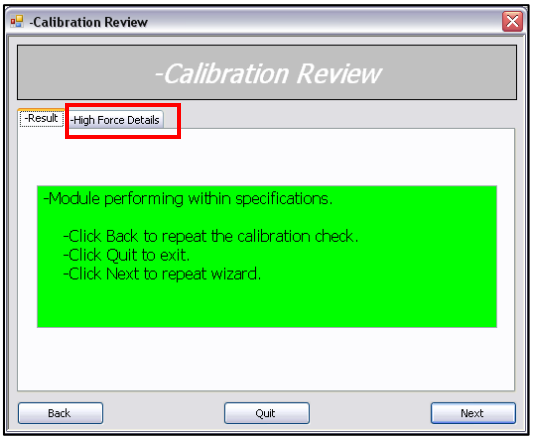
4. Select the green **Start** button to begin the Linearity Check routine.

Note: The Linearity Check sequence can be aborted at any time by clicking the red **Abort** button.

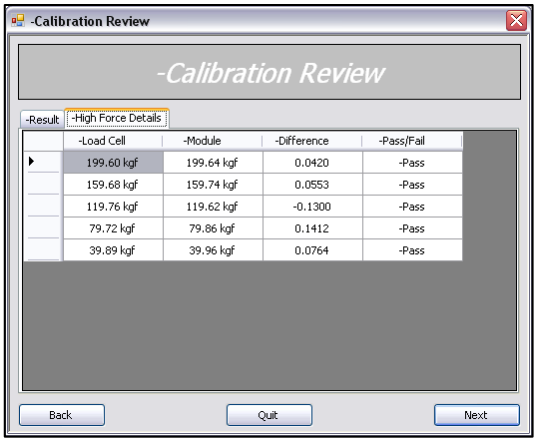
5. Once the Calibration Check has completed there are 2 possible pop ups.

Module performing within specifications

- The data captured during the linearity check can be viewed by selecting the *High Force Details* tab

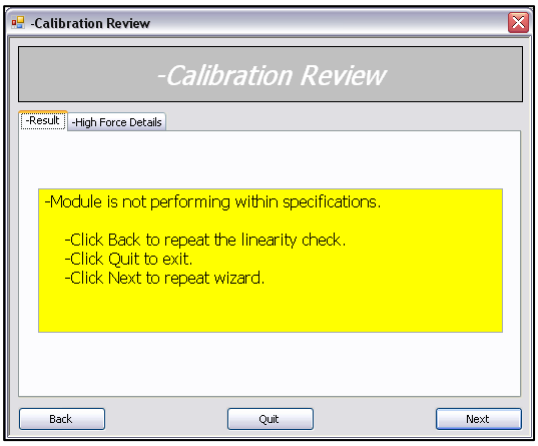


- Select **Next** to return to the *Choose Subrange Menu* and generate a calibration report or select **Quit** to end the Linearity Check.



Module is not performing within specifications
Typical Causes:

- Module Requires Calibration.
- Load Cell fixture not secured in stage properly.
- Tooling Misaligned.

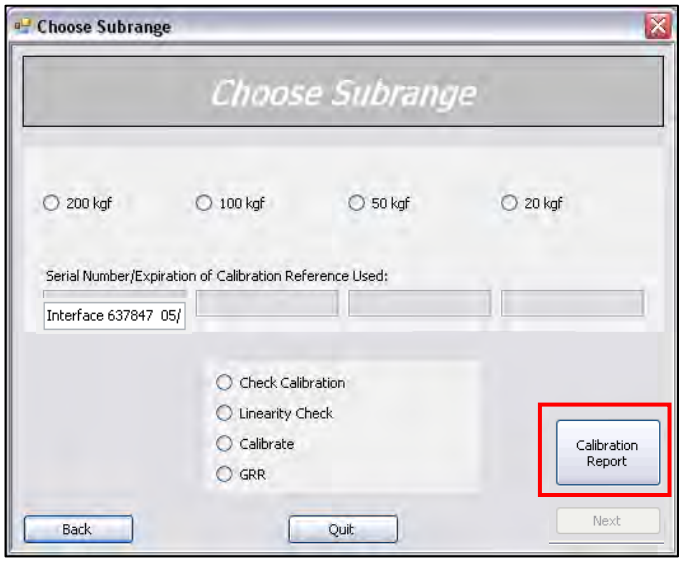


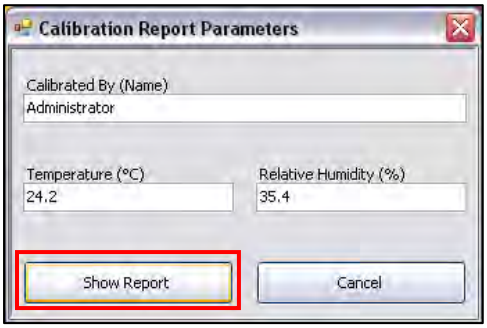
Action:

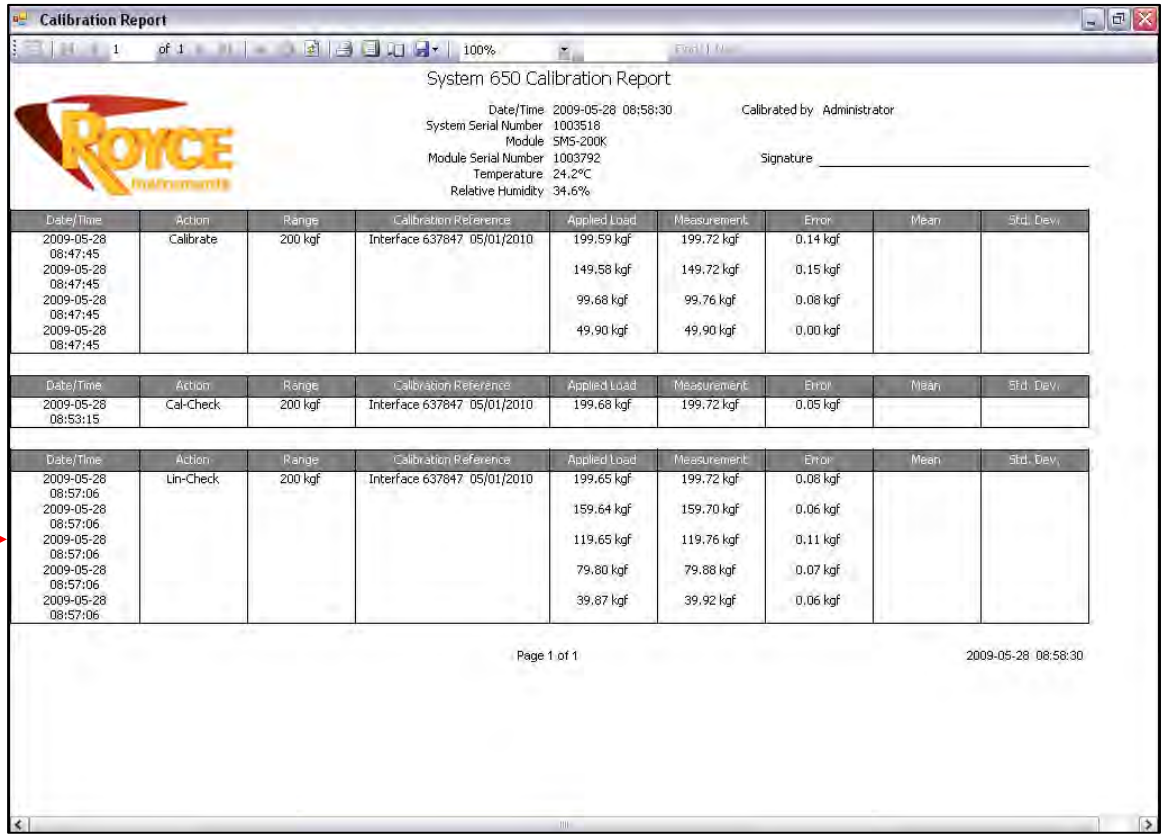
- Click the **Back** button to the *Choose Subrange* menu.
- Secure the Load Cell Fixture.
- Realign tooling.
- Perform a New Calibration (see Section 2, step 3).

Note: IF Linearity Check continues to fail after calibration, contact customerservice@royceinstruments.com for further instructions.

6. Click the **Calibration Report** button, enter report parameters, then click **Show Report**.







Calibration Report

1 of 1 100%

System 650 Calibration Report

Date/Time 2009-05-28 08:58:30
System Serial Number 1003518
Module SMS-200K
Module Serial Number 1003792
Temperature 24.2°C
Relative Humidity 34.6%

Calibrated by Administrator

Signature _____

Date/Time	Action	Range	Calibration Reference	Applied Load	Measurement	Error	Mean	Std. Dev.
2009-05-28 08:47:45	Calibrate	200 kgf	Interface 637847 05/01/2010	199.59 kgf	199.72 kgf	0.14 kgf		
2009-05-28 08:47:45				149.58 kgf	149.72 kgf	0.15 kgf		
2009-05-28 08:47:45				99.68 kgf	99.76 kgf	0.08 kgf		
2009-05-28 08:47:45				49.90 kgf	49.90 kgf	0.00 kgf		

Date/Time	Action	Range	Calibration Reference	Applied Load	Measurement	Error	Mean	Std. Dev.
2009-05-28 08:53:15	Cal-Check	200 kgf	Interface 637847 05/01/2010	199.68 kgf	199.72 kgf	0.05 kgf		

Date/Time	Action	Range	Calibration Reference	Applied Load	Measurement	Error	Mean	Std. Dev.
2009-05-28 08:57:06	Lin-Check	200 kgf	Interface 637847 05/01/2010	199.65 kgf	199.72 kgf	0.08 kgf		
2009-05-28 08:57:06				159.64 kgf	159.70 kgf	0.06 kgf		
2009-05-28 08:57:06				119.65 kgf	119.76 kgf	0.11 kgf		
2009-05-28 08:57:06				79.80 kgf	79.88 kgf	0.07 kgf		
2009-05-28 08:57:06				39.87 kgf	39.92 kgf	0.06 kgf		

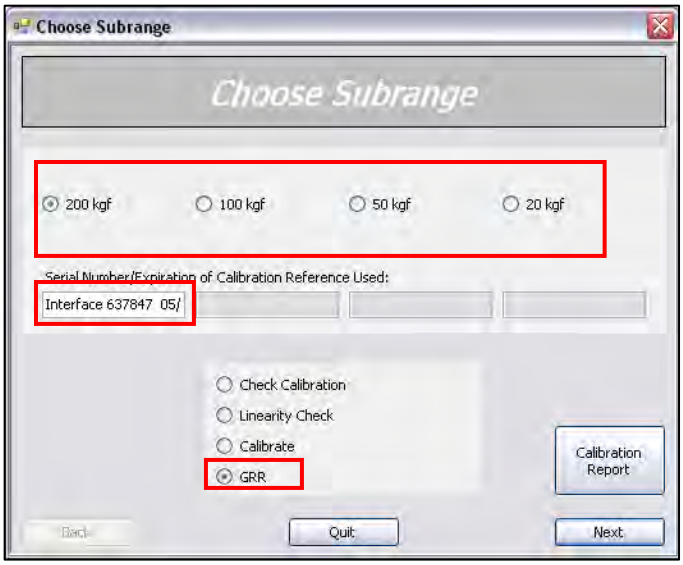
Page 1 of 1 2009-05-28 08:58:30

Section 5: GR&R

Note: If Load Cell Fixture has not been installed, refer to Sections 1 and 2 before proceeding.

1. Select the sub range of the Module to perform GR&R. For example, the 200kg sub range is illustrated here.

   Enter Load-cell information.



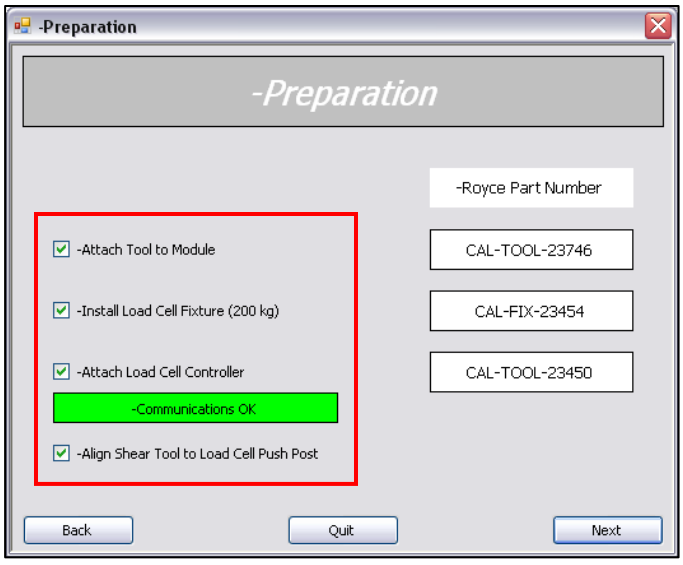
2. Select GRR option then select **Next**.

3. The *Preparation Screen* will appear.

   Note: If the calibration equipment has not been installed, refer to Section 2: Steps 3-10.

   Check the **Attach Tool to Module** box, the **Install Load Cell Fixture (200 kg)** box, the **Attach Load Cell Controller** box and the **Align Shear Tool to Load Cell Push Post** box.

   Select the **Next** button to continue.



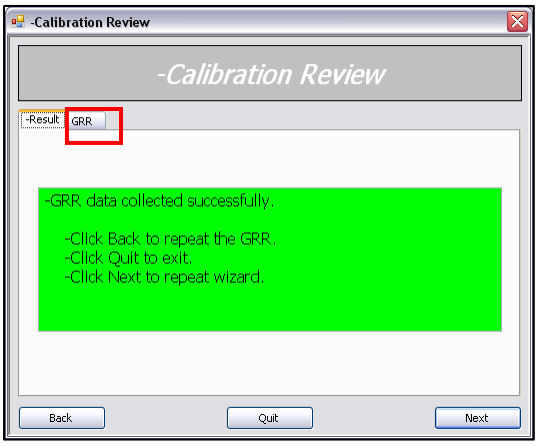
4. Select the green **Start** button to begin the GRR routine.

Note: The GRR sequence can be aborted at any time by clicking the red **Abort** button.

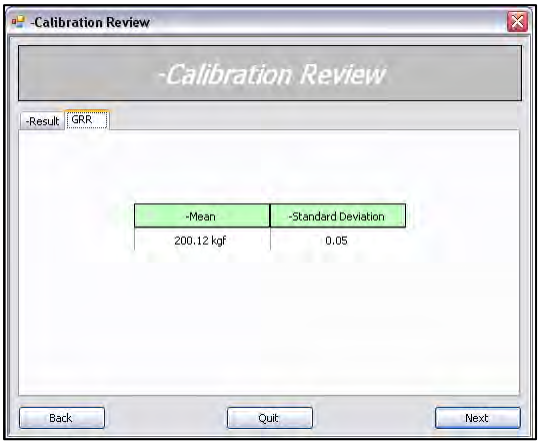
5. Once the Calibration has completed there are 2 possible pop ups.

   GRR data collected successfully

   - The data captured during the GR&R check can be viewed by selecting the *GRR Tab*

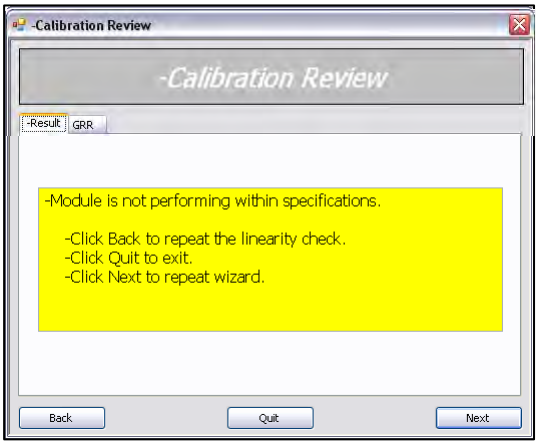


   - Select **Next** to return to the *Choose Subrange Menu* and generate a report or select **Quit** to exit Calibration Wizard



Module is not performing within specifications
Typical Causes:

- Module Requires Calibration.
- Load Cell fixture not secured in stage properly.
- Tooling Misaligned.

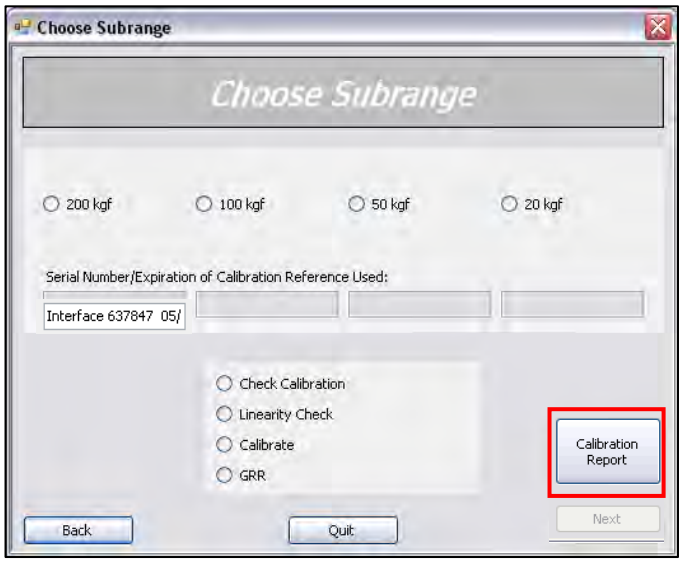


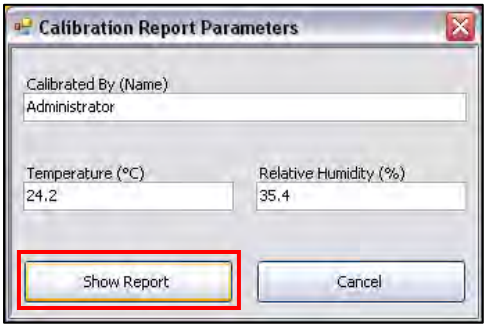
Action:

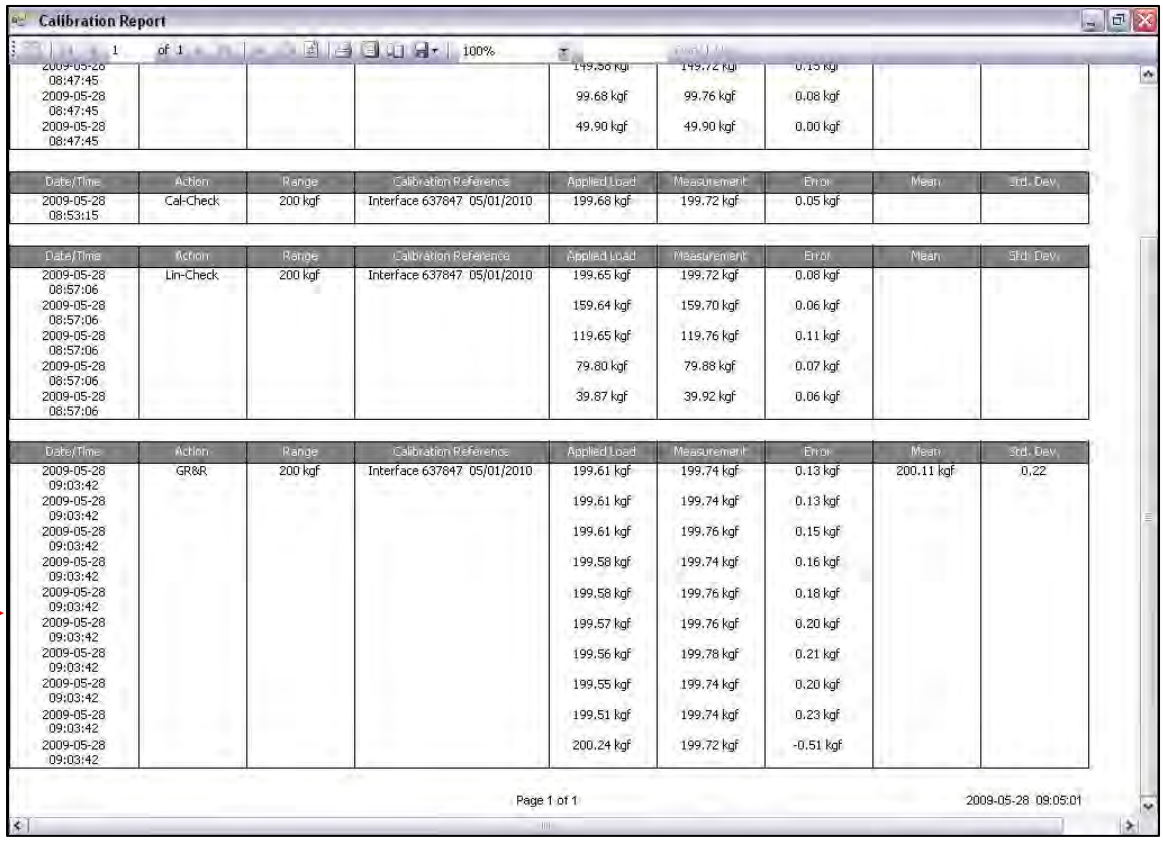
- Click the **Back** button to return to the *Choose Subrange Menu*.
- Secure the Load Cell Fixture.
- Realign tooling.
- Perform a New GRR (see step 1).
- Perform a New Calibration (see Section 2, step 3).

Note: IF GR&R continues to fail after calibration, contact customerservice@royceinstruments.com for further instructions.

6. Click the **Calibration Report** button, enter report parameters, and then click **Show Report**.






Calibration Report
1 of 1
100%
2009-05-28 08:47:45
99.68 kgf
99.76 kgf
0.08 kgf
2009-05-28 08:47:45
49.90 kgf
49.90 kgf
0.00 kgf
Date/Time
Action
Range
Calibration Reference
Applied Load
Measurement
Error
Mean
Std. Dev.
2009-05-28 08:53:15
Cal-Check
200 kgf
Interface 637847 05/01/2010
199.68 kgf
199.72 kgf
0.05 kgf
2009-05-28 08:57:06
Lin-Check
200 kgf
Interface 637847 05/01/2010
199.65 kgf
199.72 kgf
0.08 kgf
159.64 kgf
159.70 kgf
0.06 kgf
119.65 kgf
119.76 kgf
0.11 kgf
79.80 kgf
79.88 kgf
0.07 kgf
39.87 kgf
39.92 kgf
0.06 kgf
2009-05-28 09:03:42
GR&R
200 kgf
Interface 637847 05/01/2010
199.61 kgf
199.74 kgf
0.13 kgf
200.11 kgf
0.22
199.61 kgf
199.74 kgf
0.13 kgf
199.61 kgf
199.76 kgf
0.15 kgf
199.58 kgf
199.74 kgf
0.16 kgf
199.58 kgf
199.76 kgf
0.18 kgf
199.57 kgf
199.76 kgf
0.20 kgf
199.56 kgf
199.78 kgf
0.21 kgf
199.55 kgf
199.74 kgf
0.20 kgf
199.51 kgf
199.74 kgf
0.23 kgf
200.24 kgf
199.72 kgf
-0.51 kgf
Page 1 of 1
2009-05-28 09:05:01

Required Equipment & Tools

- System 650
- Calibration Weights for module rating
- Cal-Hook 15738 or 25344 (SMW-100G and SMW-1K modules)
- Cal-Hook 25479 (SMG-1K module)
- Cal-Hook 23455 or 25343 (SMG-100G module)
- Mouse Pad
- 5/64” Hex Key

Section 1: Performing New Calibration

1. Power on the 650

2. Login to Bond Test Manager (BTM) Software

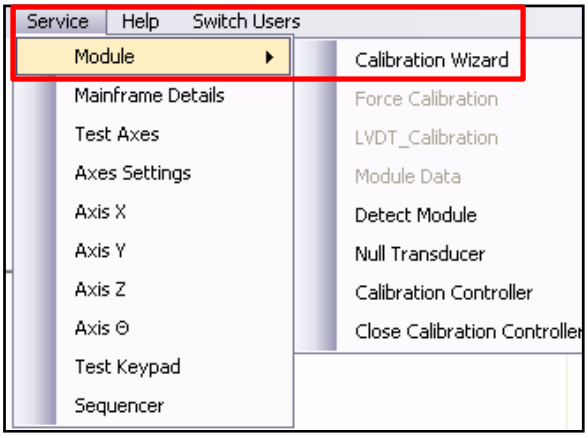
3. Select **Home**

4. Using the Stage Controller, move the X-Stage to the far left position and the Y-Stage all the way towards the front of the system.

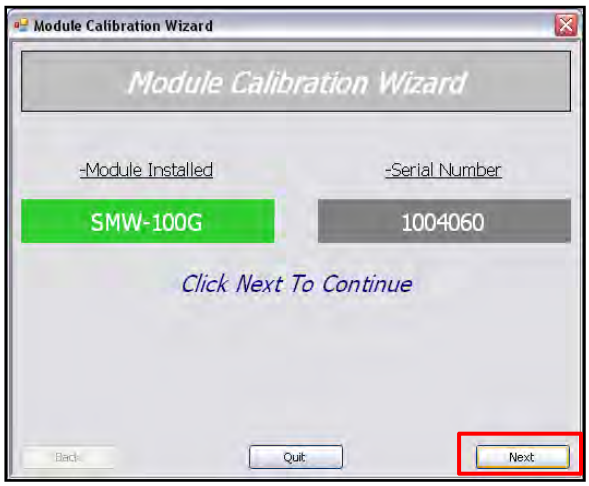
5. Place Mouse Pad flat on X-Stage.

6. Install the Test Module onto module mount and secure with thumb screw.

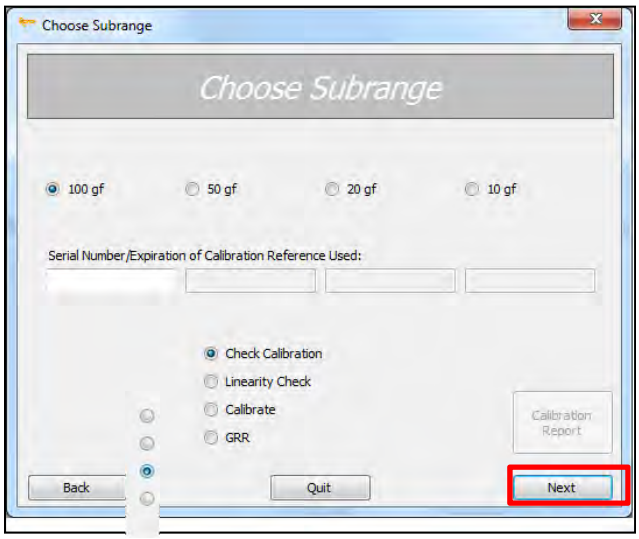
7. Select Service > Module > Calibration Wizard from the top Tool Bar



8. The *Module Calibration* window will appear. Select **Next** to continue.

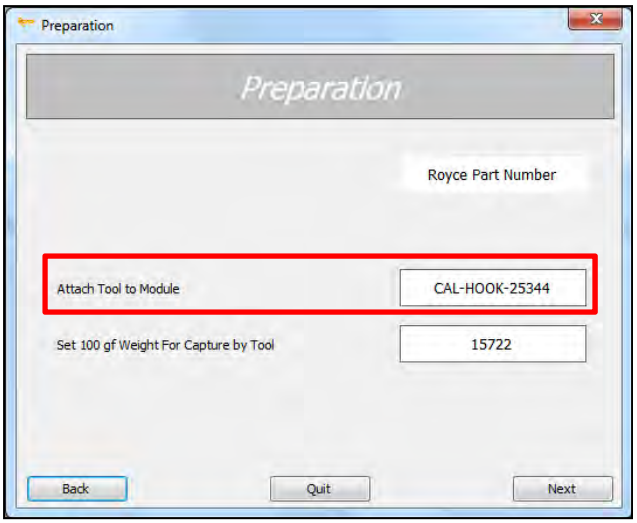


9. Select the **Sub Range** of the Module and enter weight information. For example, if the module is a 100g module select the 100g option.

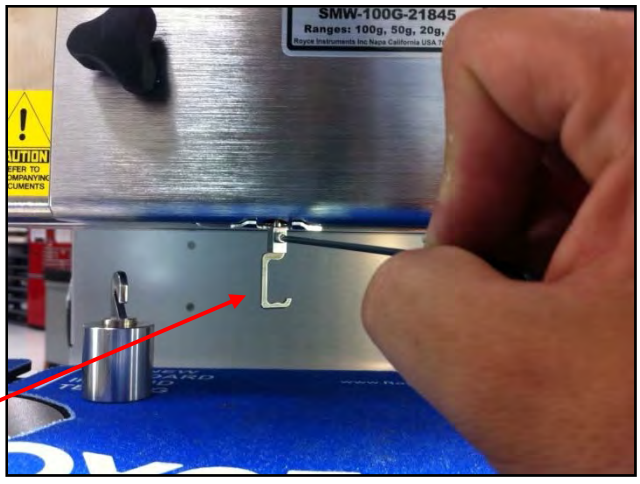


10. Select the **Calibrate** option, then select **Next**.

11. The *Preparation Screen* will appear. At this point the Lower Limit is disabled and the Z-Axis can be moved if necessary to prepare for the calibration. See Steps 12-13 prior to selecting **Next**.

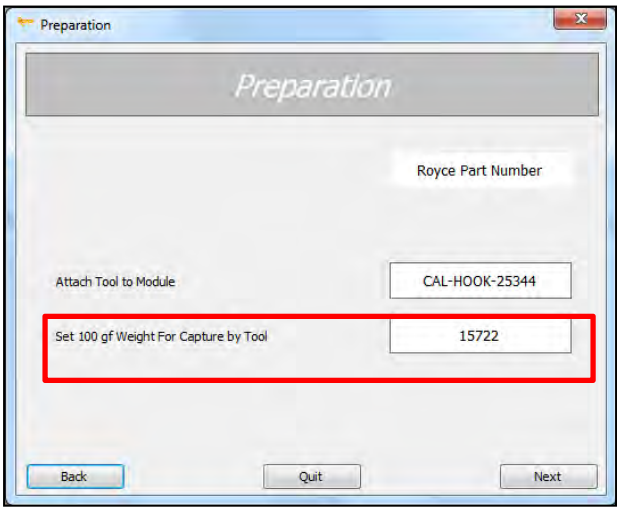


12. **Attach Tool to Module**. Install the Cal Hook to the Test Module. Setscrew tightens on pull rod flat.
    - Use Cal Hook 15738 or 25344 for SMW-100G and SMW-1K Wire Pull Modules
    - Use Cal Hook 23942 for SMG-1K Gripper Pull Module
    - Use Cal Hook 23455 or 25343 for SMG-100G Gripper Pull Module

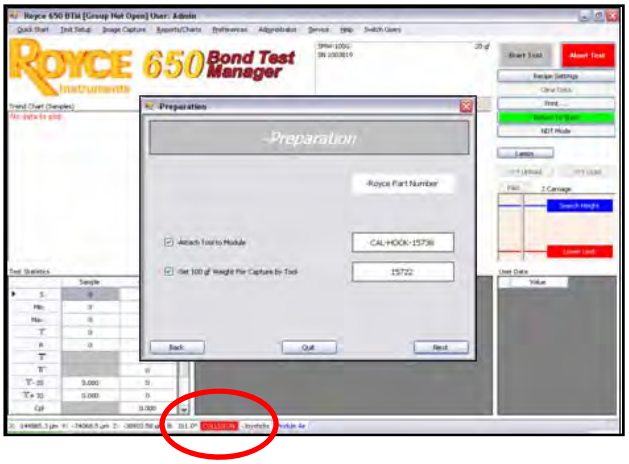


Set 100 gf Weight For Capture by Tool

Using the Z-Axis joystick, lower the module so that the cal hook is at the same or similar height as the weight. Attach the weight to the cal hook. *It is important to ensure that there is no tension on the cal hook prior to moving to the next step.*

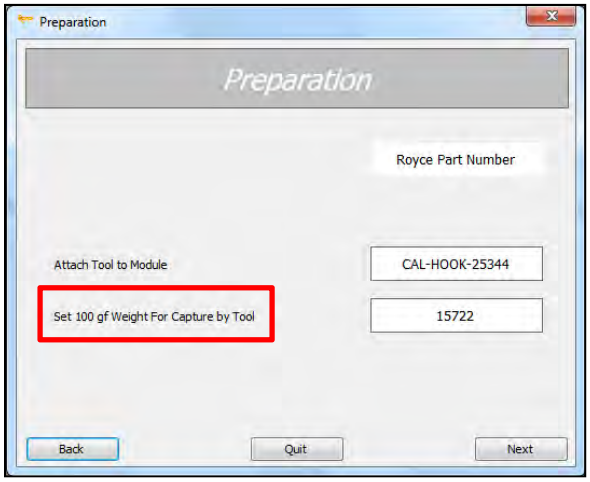


Position the hook so that it does not contact the top or bottom of weight hook surfaces.

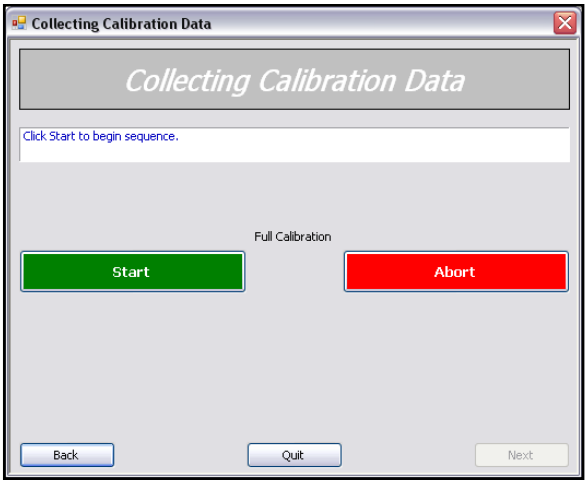


Note: The collision indicator will be red if there is tension on the module prior to calibration. If this occurs, slightly lower the Z-Axis until the red indicator turns off.

Note: Confirm the correct weight is loaded prior to proceeding.

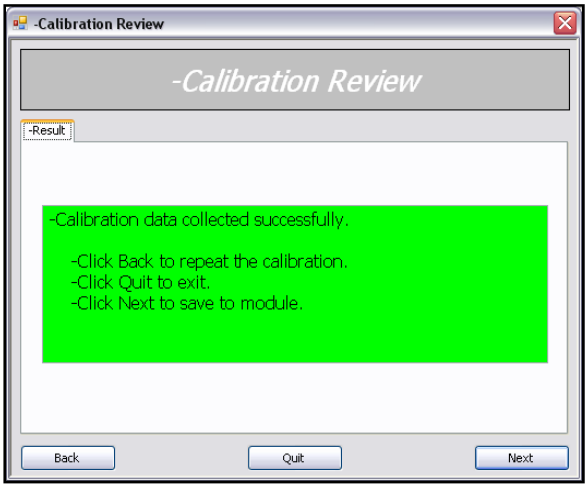


13. Select the green **Start** button to initiate the Calibration routine.



14. Once the Calibration is complete, one of the following messages will appear.

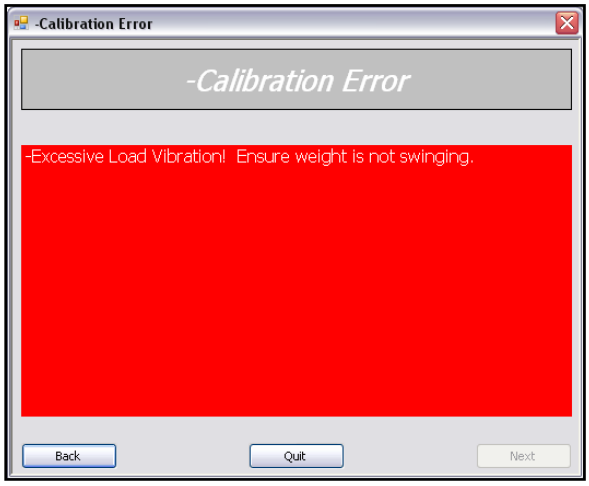
"Calibration data collected successfully" Calibration completed. Select **Next** to save calibration data to the module



"Excess load vibration." Ensure weight is not swinging.

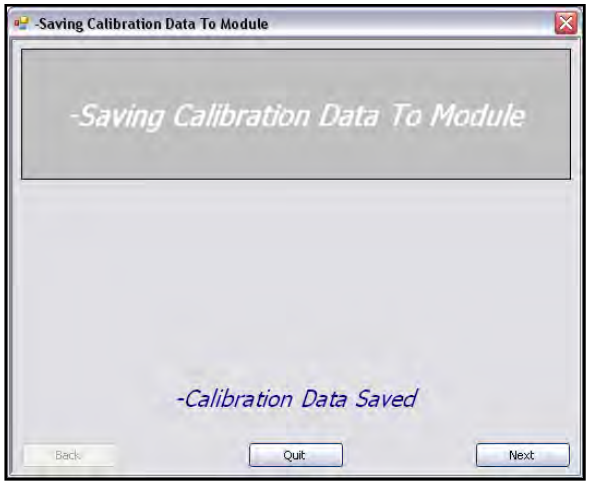
Typical Cause:

- Excessive slack in the cal hook prior to calibration. Click **Back** button until *Preparation Screen* appears. Move Z-Stage up until slack is removed from the cal hook.
- Incorrect weight



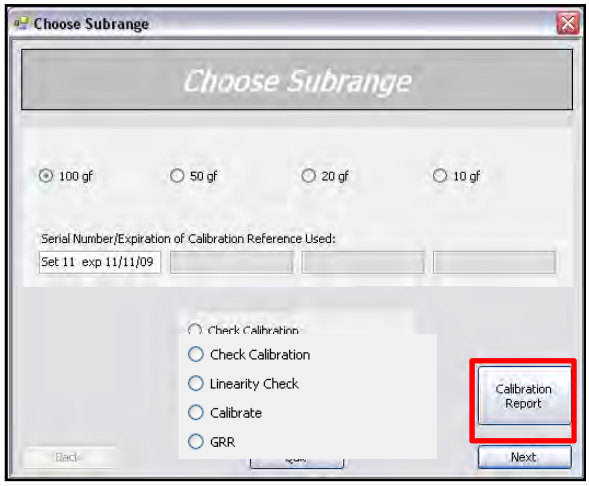
Note: If calibration check continues to fail after calibration, contact customerservice@royceinstruments.com for further instructions.

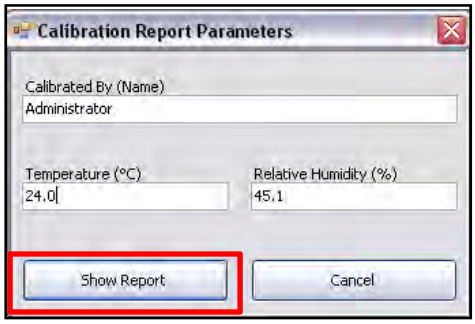
15. The *Saving Calibration Data to Module Screen* will appear. Select **Next** to complete the calibration and generate a calibration report.

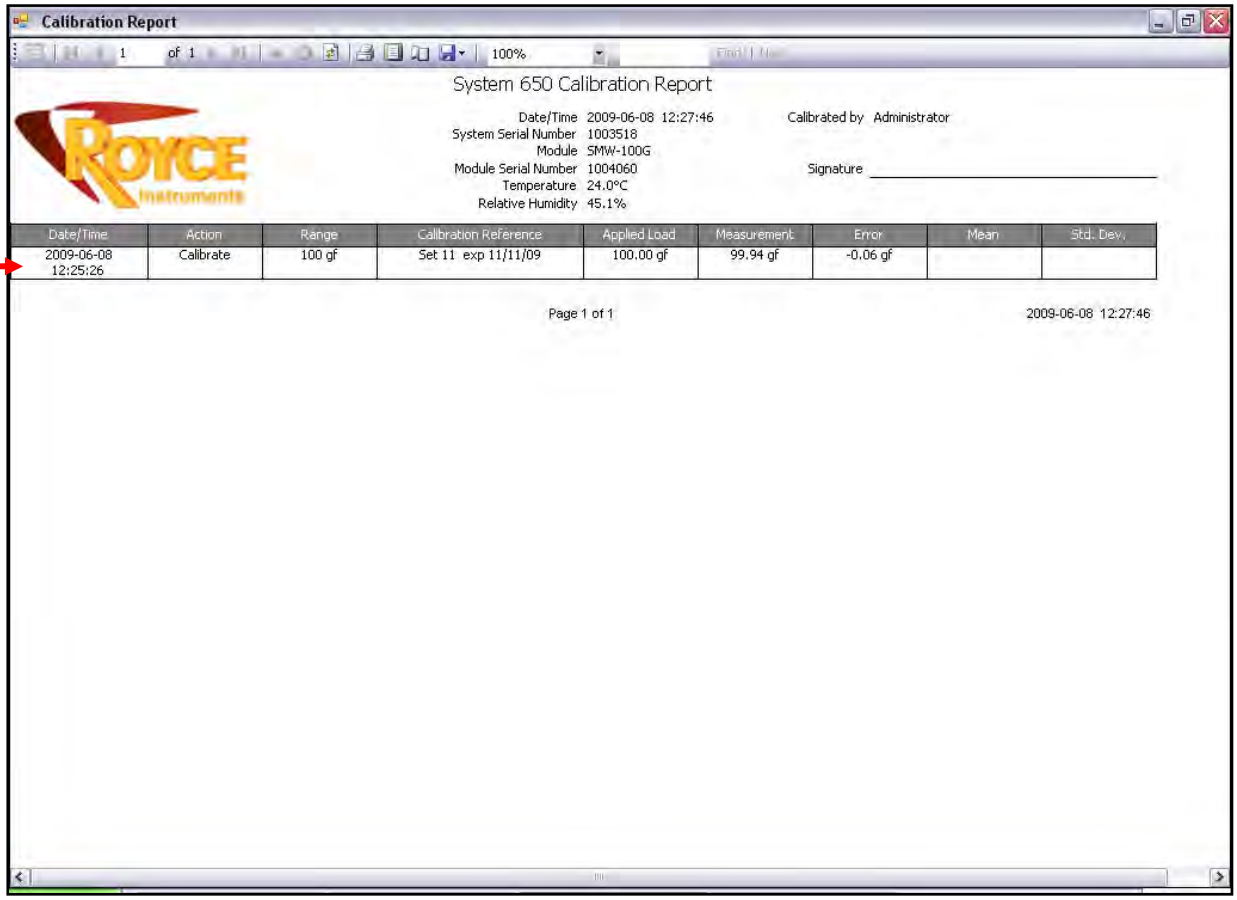


Note: The Modules are highly linear; however for the utmost accuracy each sub range will require calibration with the appropriate calibration weight for that sub range. **Repeat Steps 10 - 17 for each sub range.**

16. Click on the **Calibration Report** button. Enter report parameters then select **Show Repor**t.





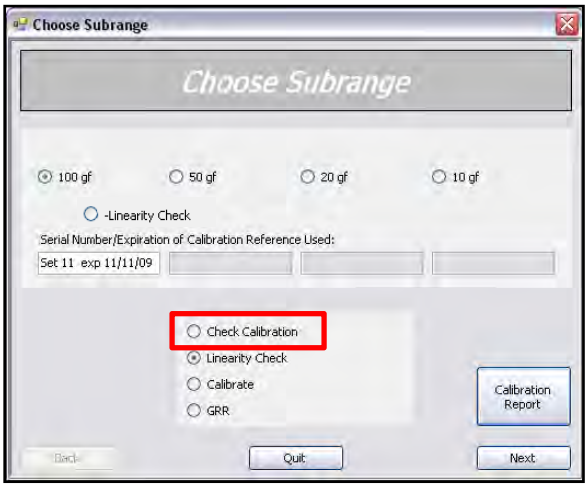


Section 2: Check Calibration

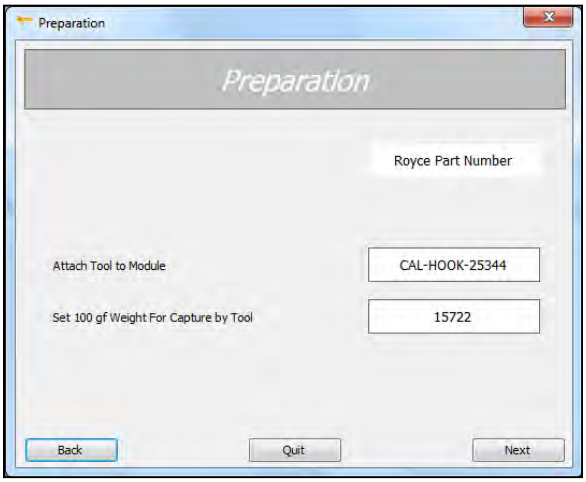
Note: If the Calibration Hook is not installed, complete Section 1, Steps 1-9 prior to proceeding.

1. Select the Sub Range of the Module and weight information. For example, if the module is a 100g module select the 100g option.

2. Select **Check Calibration** option then select **Next.**



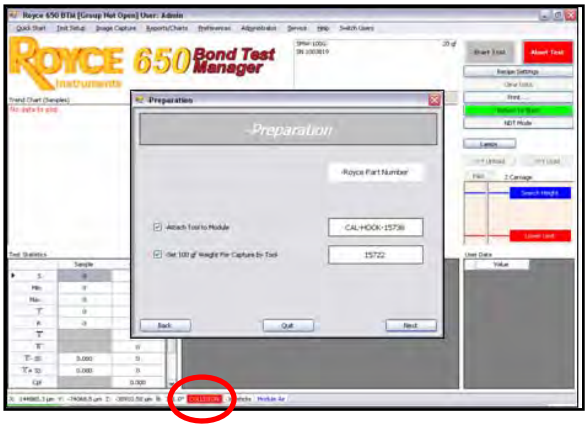
3. Attach Tool to Module. Install the Cal Hook to the Test Module. Setscrew tightens on pull rod flat.
   - Cal Hook 15738 or 25344 for SMW-100G and SMW-1K Wire Pull Modules
   - Cal Hook 23942 for SMG-1K Gripper Pull Module
   - Cal Hook 23455 or 25343 for SMG-100G Gripper Pull Module



4. Using the Z-Axis joystick, lower the module so that the cal hook is at the same or similar height as the weight and attach the weight to the cal hook. Ensure that there is no tension on the cal hook prior to moving to the next step.

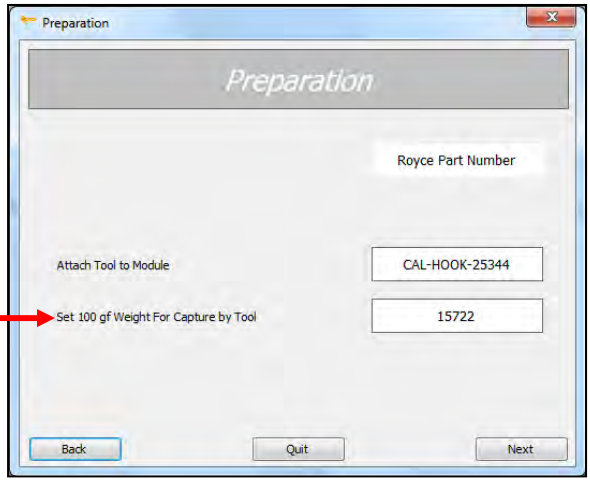
Position the hook so that it does not contact the top or bottom of weight hook surfaces.

Note: The collision indicator will be red if there is tension on the module prior to calibration. If this occurs, lower the Z-Axis slightly until the red indicator turns off.

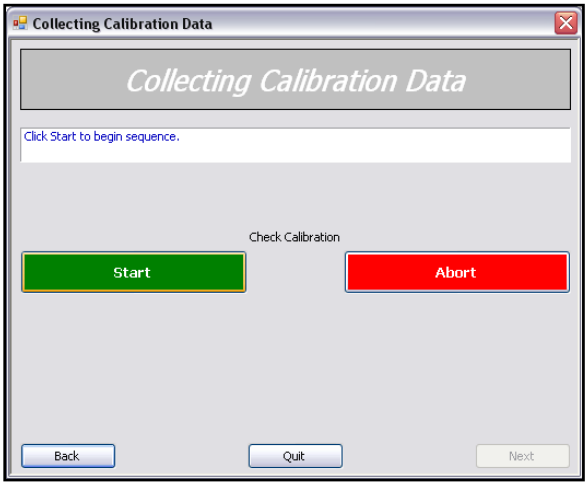


5. 'Set Weight For Capture by Tool'

Note: Confirm the correct weight is loaded prior to proceeding.



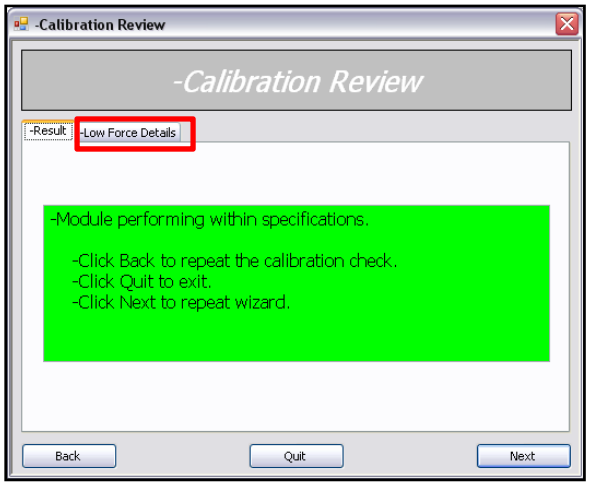
6. Select the green **Start** button to initiate the Calibration routine.



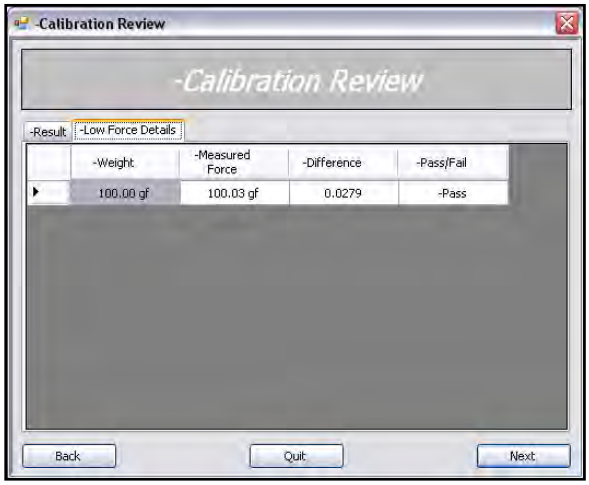
7. Once the calibration check has completed, one of the following three messages will appear:

   A. Module performing within specifications.

      i. Select *Low Force Details Tab* to view calibration check data.



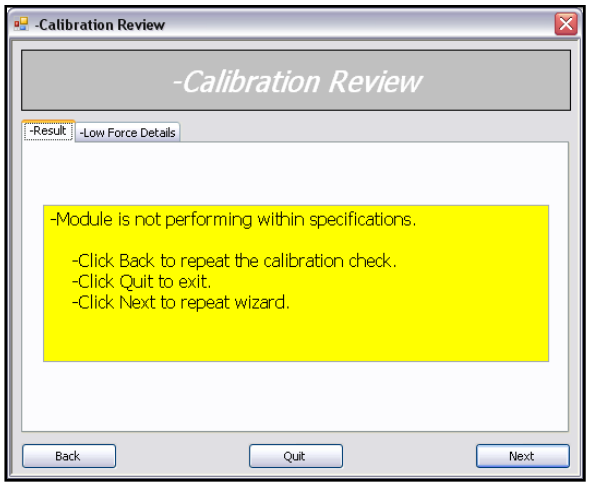
      ii. Select **Next** to return to the **Select Sub Range** menu and generate a calibration report or select **Quit** to end the calibration check.



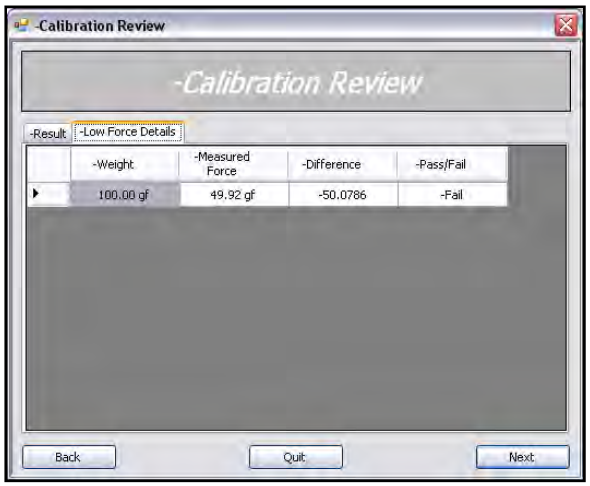
B. Module not performing within specifications.

Typical Causes:

i. Module Requires Calibration
ii. Excessive slack in the cal hook prior to calibration
iii. Incorrect weight used to verify calibration



Select **Back** until *Calibration Review Screen* appears, then move Z-Stage up until slack is removed from the cal hook.

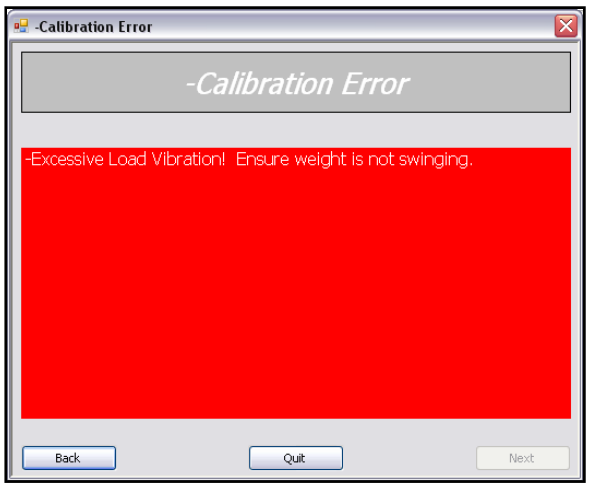


C. Excess Load Vibration. Ensure weight is not swinging:

Typical causes**:**

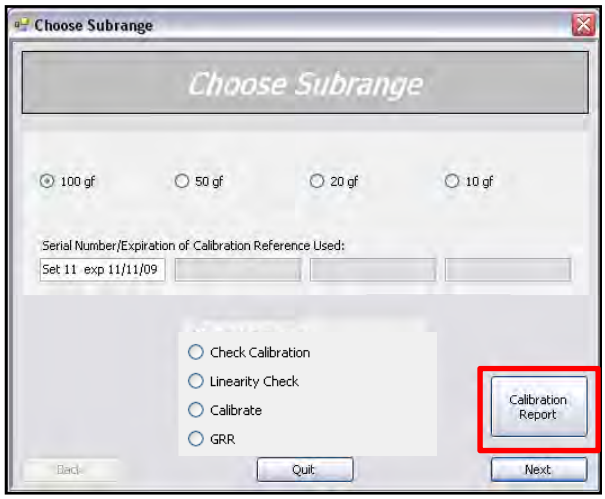
i. Excess swinging of the weight during the calibration
ii. Incorrect Weight
iii. Module under tension prior to Calibration Check

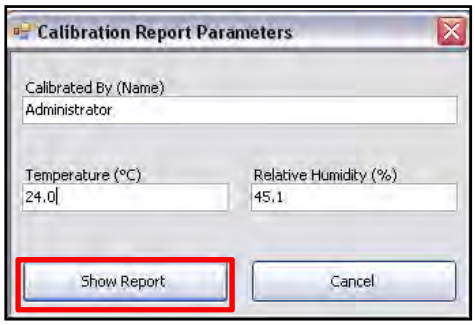
Select **Back** until *Calibration Review Screen* appears, then move Z-Stage down until Cal loop is no longer in tension.

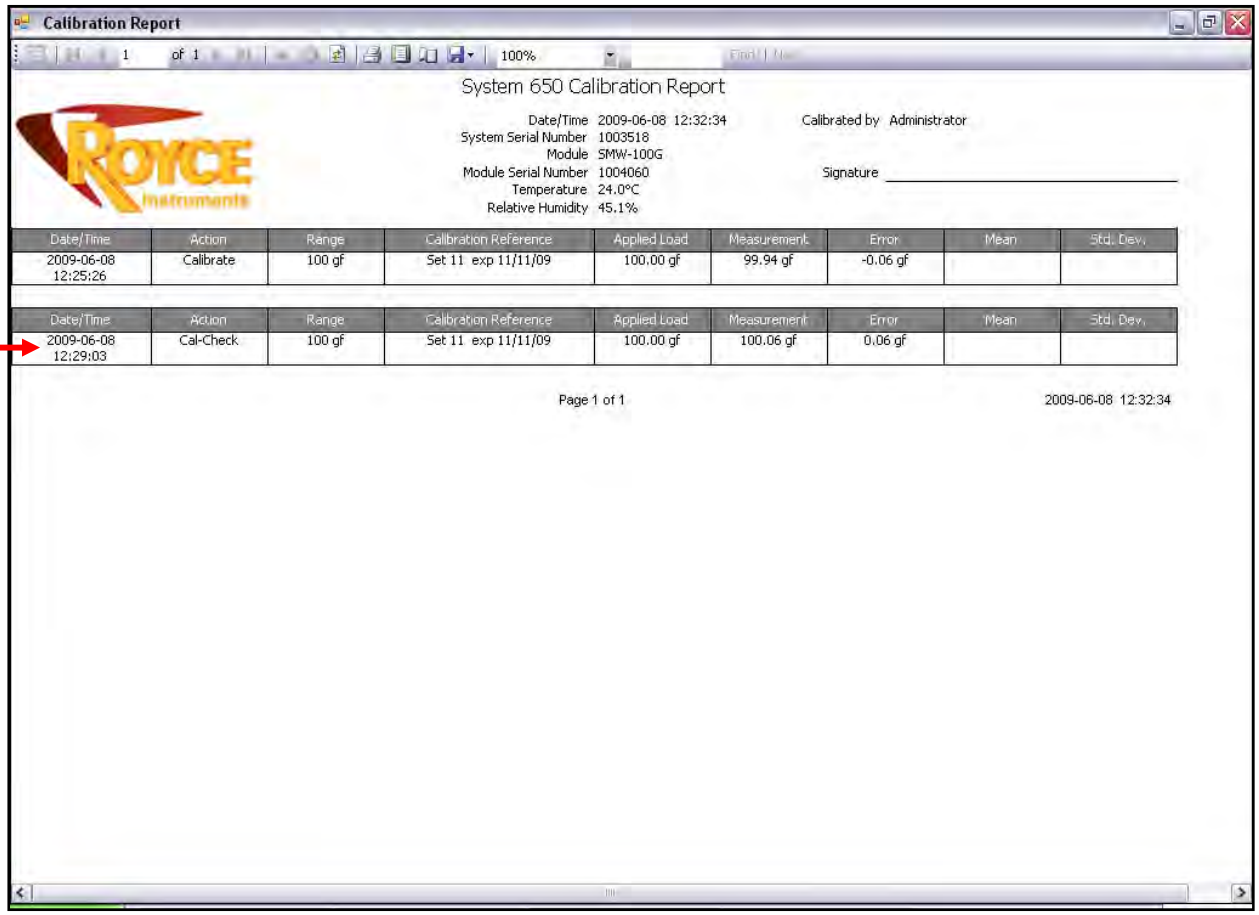


Note: If calibration check continues to fail after calibration, contact customerservice@royceinstruments.com for further instructions.

8. Click on the **Calibration Report** button, enter report parameters, then select **Show Report**.





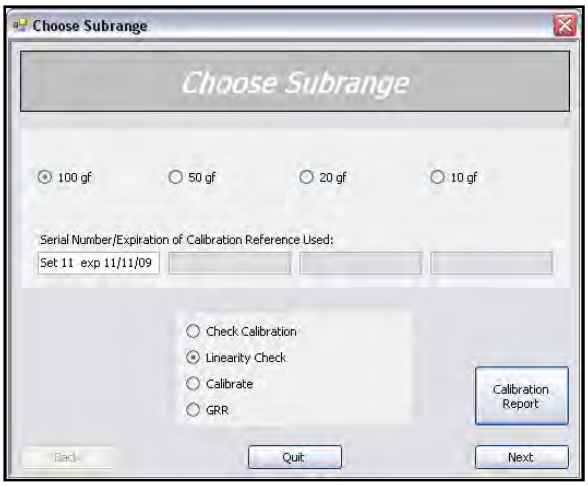


Section 3: Linearity Check :

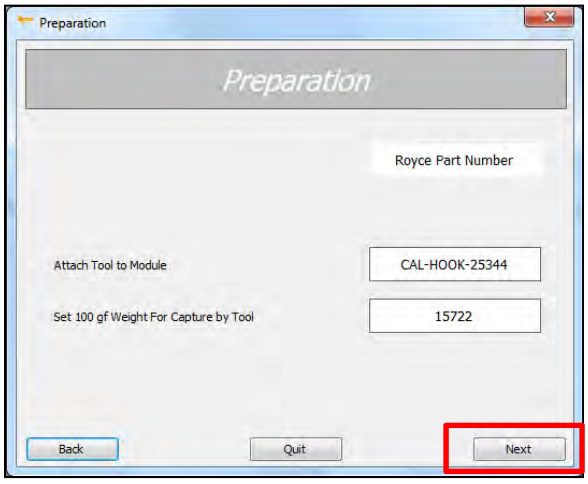
Note: If the Calibration Hook is not installed, complete Section 1, Steps 1-9 prior to proceeding.

1. Select the Sub Range of the Module and weight information. For example, if the module is a 100g module, select the 100g option.

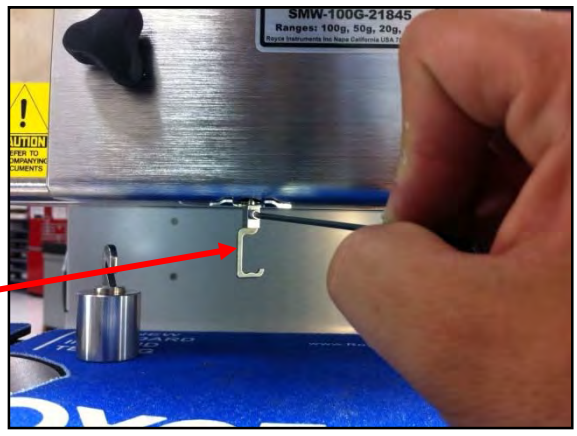
2. Select **Linearity Check** option then select **Next.**



3. The *Preparation Screen* will appear. At this point the Lower Limit is disabled and the Z-Axis can be moved if necessary to prepare for the calibration. See Steps 4-5 prior to selecting **Next**.



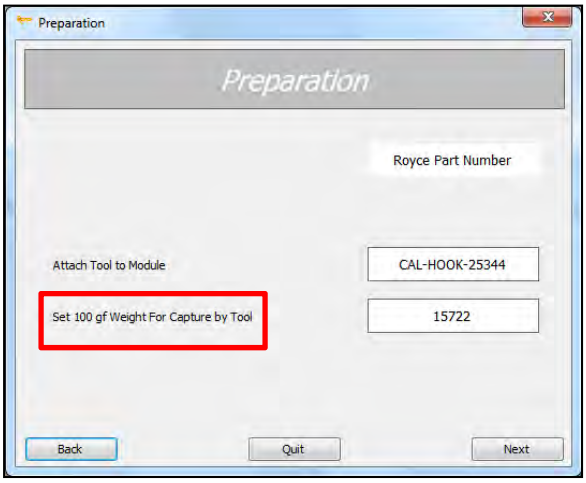
4. Attach Tool to Module.Install the Cal Hook to the Test Module. Setscrew tightens on pull rod flat.
   - Cal Hook 15738 or 25344 for SMW-100G and SMW-1K Wire Pull Modules
   - Cal Hook 23942 for SMG-1K Gripper Pull Module
   - Cal Hook 23455 or 25343 for SMG-100G Gripper Pull Module



Calibration Hook (25344)

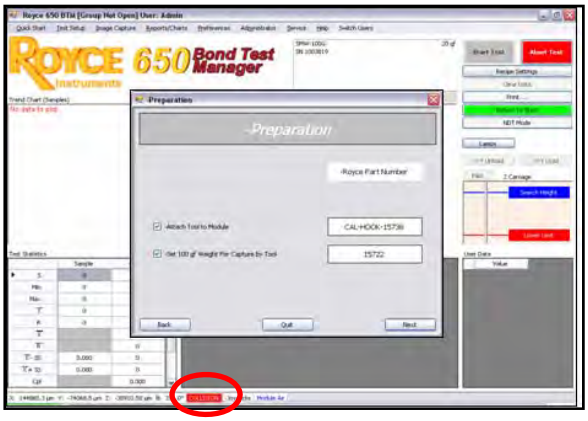
5. ‘Set 100 gf Weight For Capture by Tool’

Using the Z-Axis joystick, lower the module so that the cal hook is at the same or similar height as the weight. Attach the weight to the cal hook**.** *It is important to ensure that there is no tension on the cal hook prior to moving to the next step.*

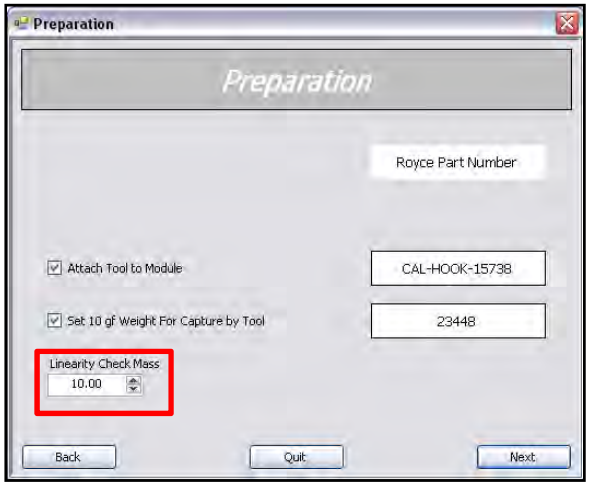


Position the hook so that it does not contact the top or bottom of weight hook surfaces.

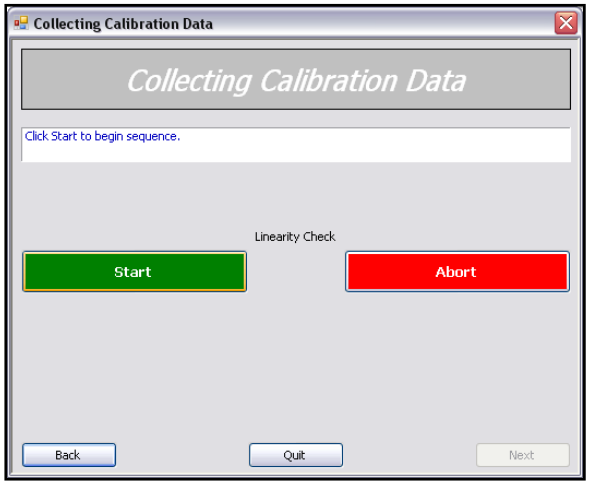
Note: The collision indicator will be red if there is tension on the module prior to calibration. If this occurs, slightly lower the Z-Axis until the red indicator turns off.



9. Enter the **Linearity Check Mass** value, then select **Next**.

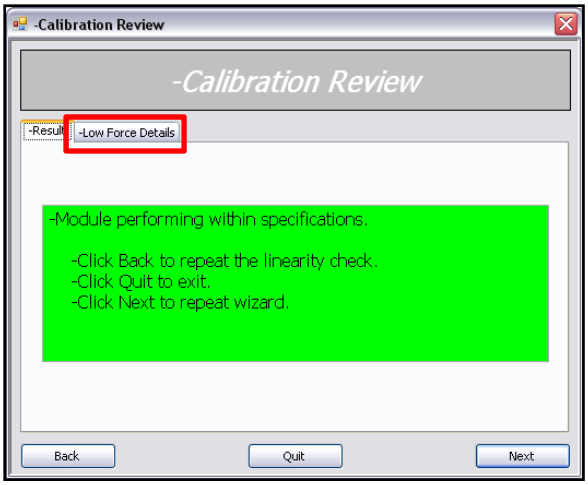


10. Select the green **Start** button to initiate the calibration routine.

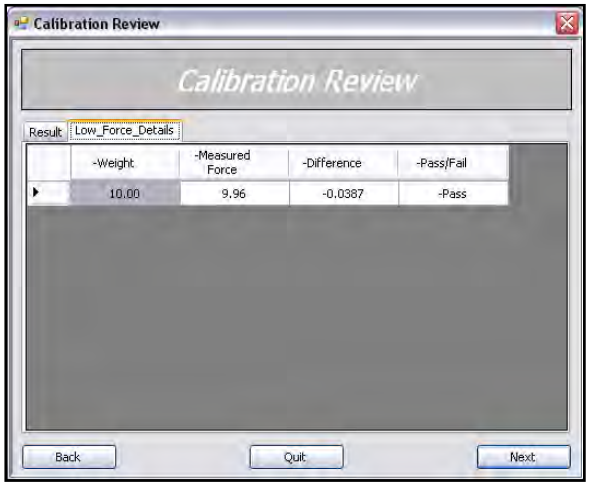


11. Once the Linearity Check has completed, one of the following three messages will appear:

    A. Module performing within specifications. The data captured during the linearity check can be viewed by selecting the 'low force details' tab



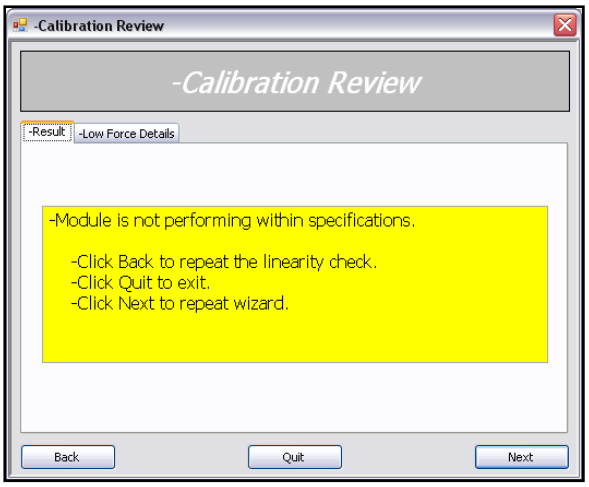
Select **Next** to return to the *Select Sub Range Menu* or select *Quit* to exit Calibration Wizard.



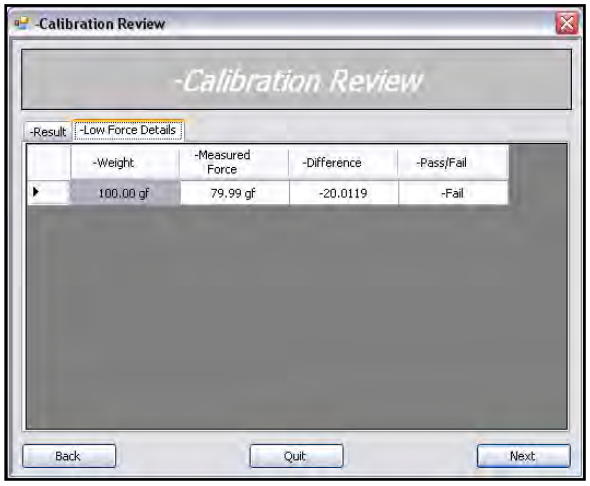
B. **Module is not performing within specifications**:

Typical Causes:

- Module Requires Calibration
- Incorrect weight used
- The data captured during the linearity check can be viewed by selecting the 'low force details' tab



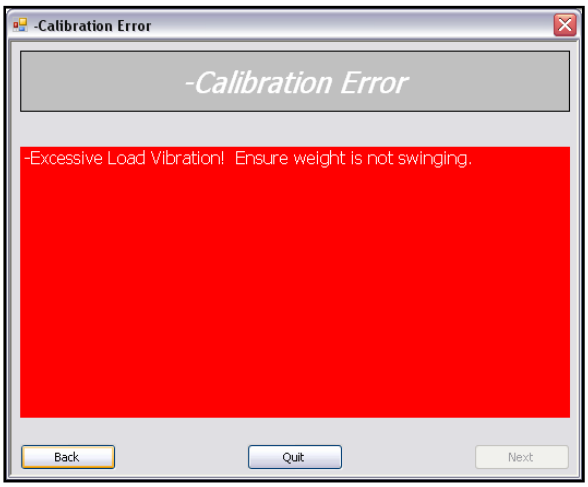
Select **Next** to return to the *Select Sub Range Menu* and generate a calibration report or re-calibrate. Select **Quit** to exit Calibration Wizard.



C. **Excess Load Vibration. Ensure the weight is not swinging**.

Typical causes:

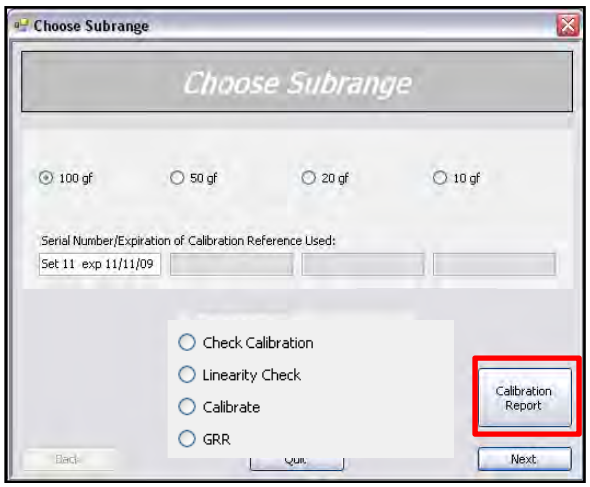
- Excess swinging of the weight during the calibration
- The Calibration Loop is under tension prior to beginning the calibration

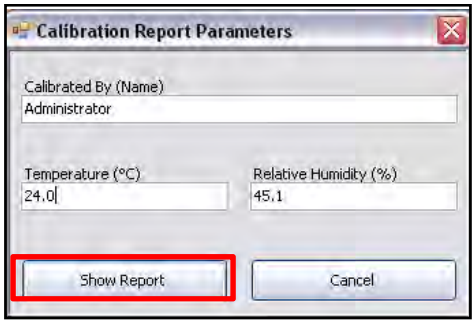


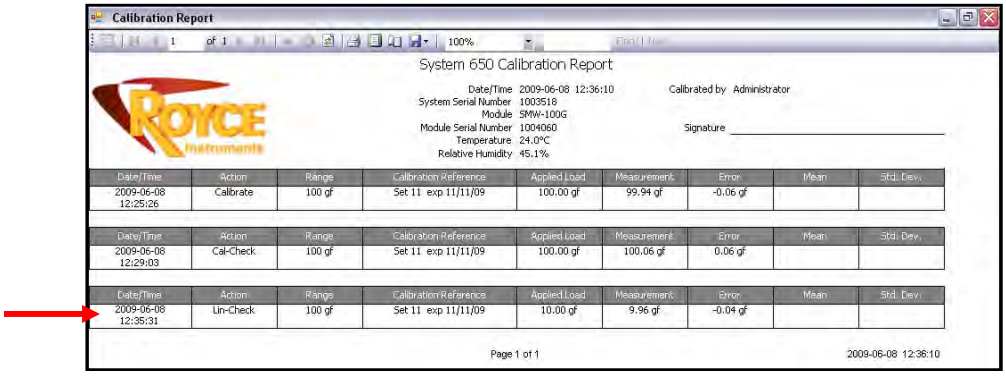
Select **Back** until *Calibration Review* screen appears. Move Z-Stage down until Cal hook is no longer in tension.

Note: If Linearity Check continues to fail after calibration, contact customerservice@royceinstruments.com for further instructions.

12. Click on the **Calibration Report** button, enter report parameters then select **Show Report**.





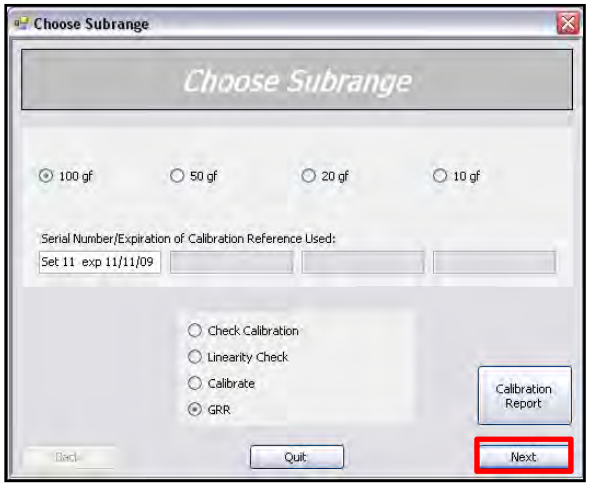


Section 4: GR&R

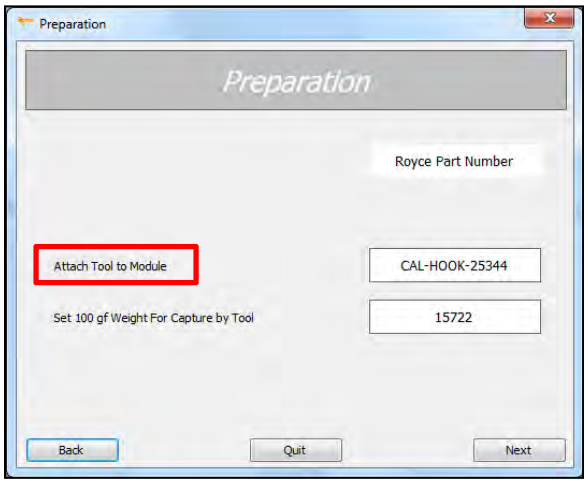
Note: If the Calibration Hook is not installed complete Section 1, Steps 1-9 prior to proceeding.

1. Select the Sub Range of the Module and enter weight information. For example if the module is a 100g module select the 100g option.

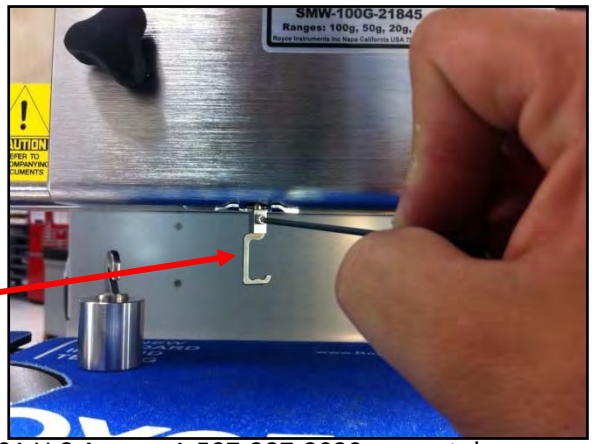
2. Select GRR option then select **Next**.



3. The *Preparation Screen* will appear. At this point the Lower Limit is disabled and the Z-Axis can be moved if necessary to prepare for the calibration. See Steps 4-5 below prior to selecting **Next**.

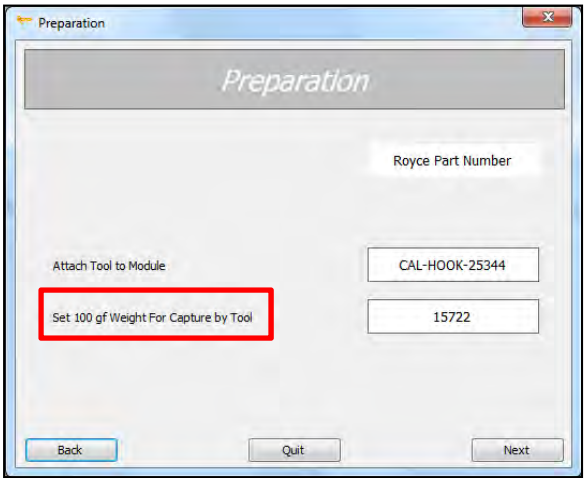


4. **Attach Tool to Module**. Install the Cal Hook to the Test Module. Setscrew tightens on pull rod flat.
   - Cal Hook 15738 or 25344 for SMW-100G and SMW-1K Wire Pull Modules
   - Cal Hook 23942 for SMG-1K Gripper Pull Module
   - Cal Hook 23455 or 25343 for SMG-100G Gripper Pull Module



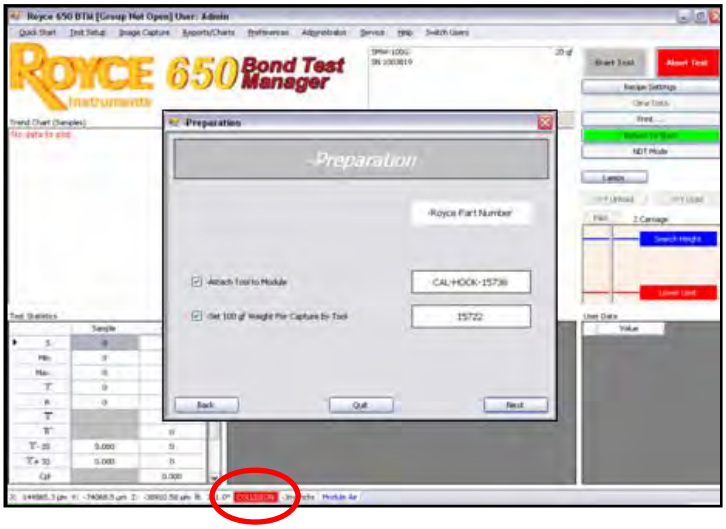
5. **'Set 100 gf Weight For Capture by Tool'**

Using the Z-Axis joystick, lower the module so that the cal hook is at the same or similar height as the weight. Attach the weight to the cal hook**.** *It is important to ensure that there is no tension on the cal hook prior to moving to the next step.*



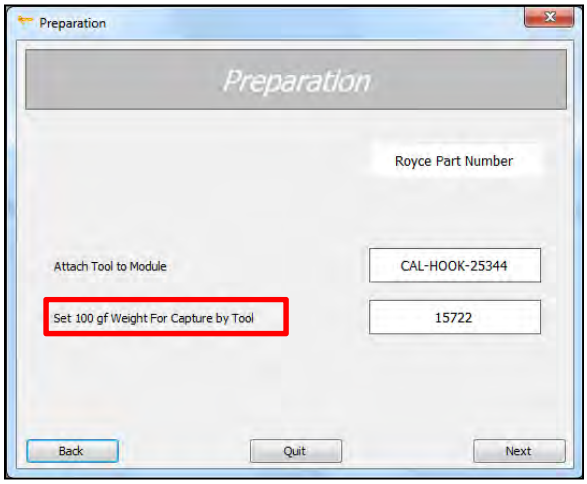
Position the hook so that it does not contact the top or bottom of weight hook surfaces.

Note: The collision indicator will be red if there is tension on the module prior to calibration. If this occurs, slightly lower the Z-Axis until the red indicator turns off.

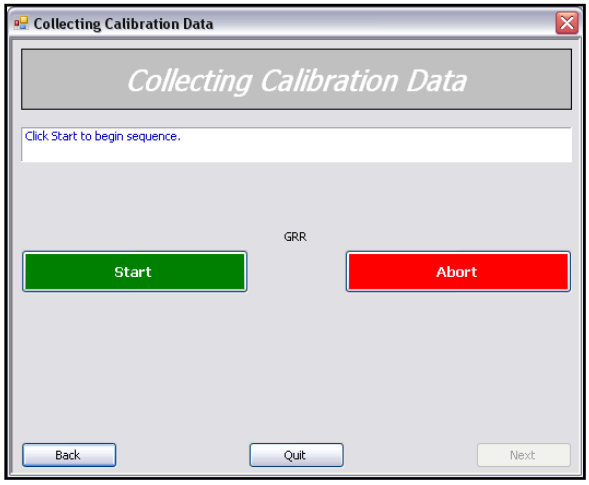


6. **'Set Weight For Capture by Tool'**

Note: Confirm the correct weight is loaded prior to proceeding.



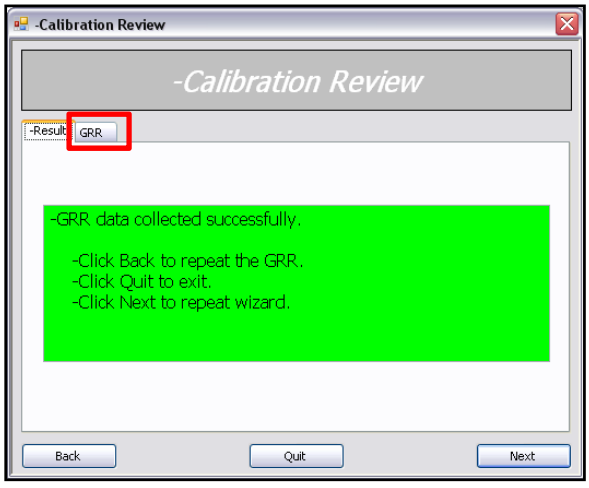
7. Select the green **Start** button to initiate the GR&R routine.



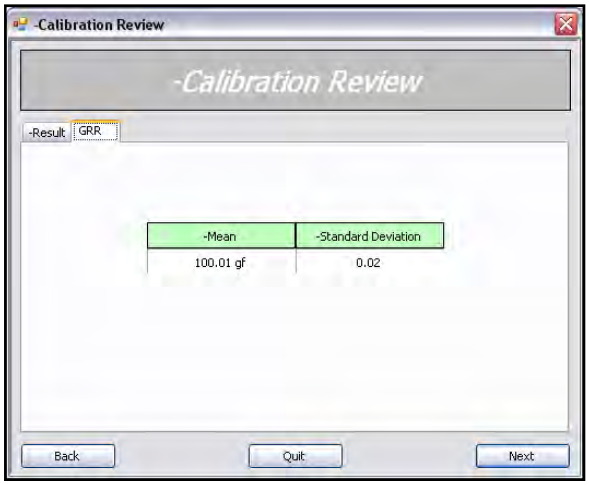
8. Once the GR&R has completed there, one of the following three messages will appear:

   A. GRR data collected successfully:

   The data captured during the GR&R check can be viewed by selecting the 'GRR' tab



Select **Next** to return to the *Select Sub Range Menu* and generate a calibration report or select **Quit** to exit Calibration Wizard.

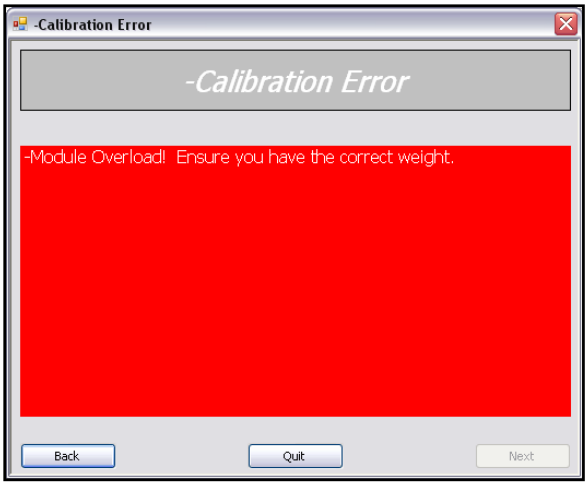


B. **Module Overload. Ensure you have the correct weight**:

Typical Causes:

- Module requires Calibration
- Incorrect weight loaded per sub-range selected
- Module under tension prior to GR&R test

Select **Back** until *Calibration Review* screen appears, verify correct weight and that the module is not under tension.

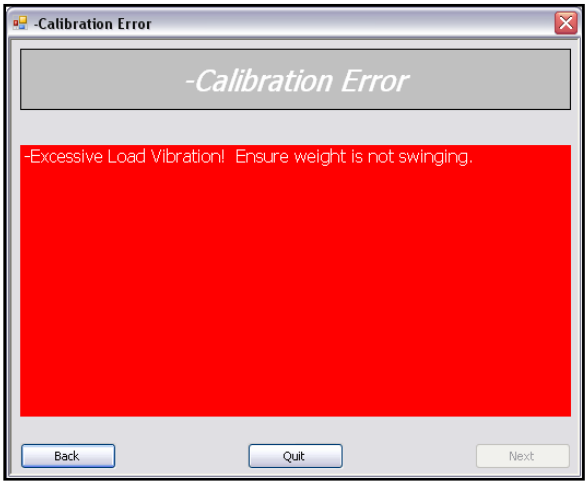


C. Excess Load Vibration. Ensure the weight is not swinging

Typically causes:

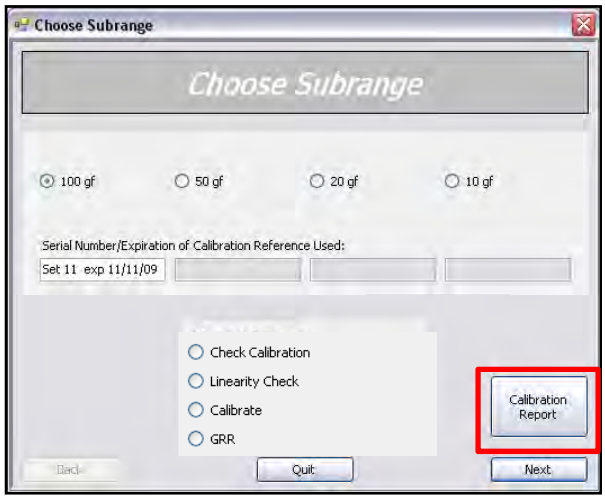
- Excess swinging of the weight during the calibration
- The Calibration Loop is under tension prior to beginning the calibration

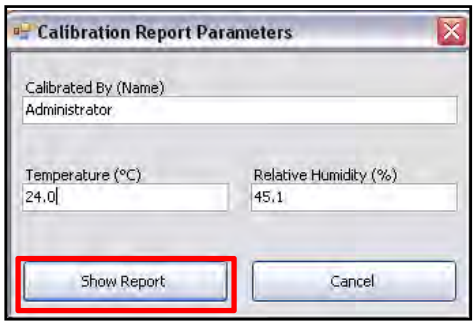
Select **Back** until *Calibration Review screen* appears, move Z-Stage down until Cal loop is no longer in tension. Select **Next** to continue

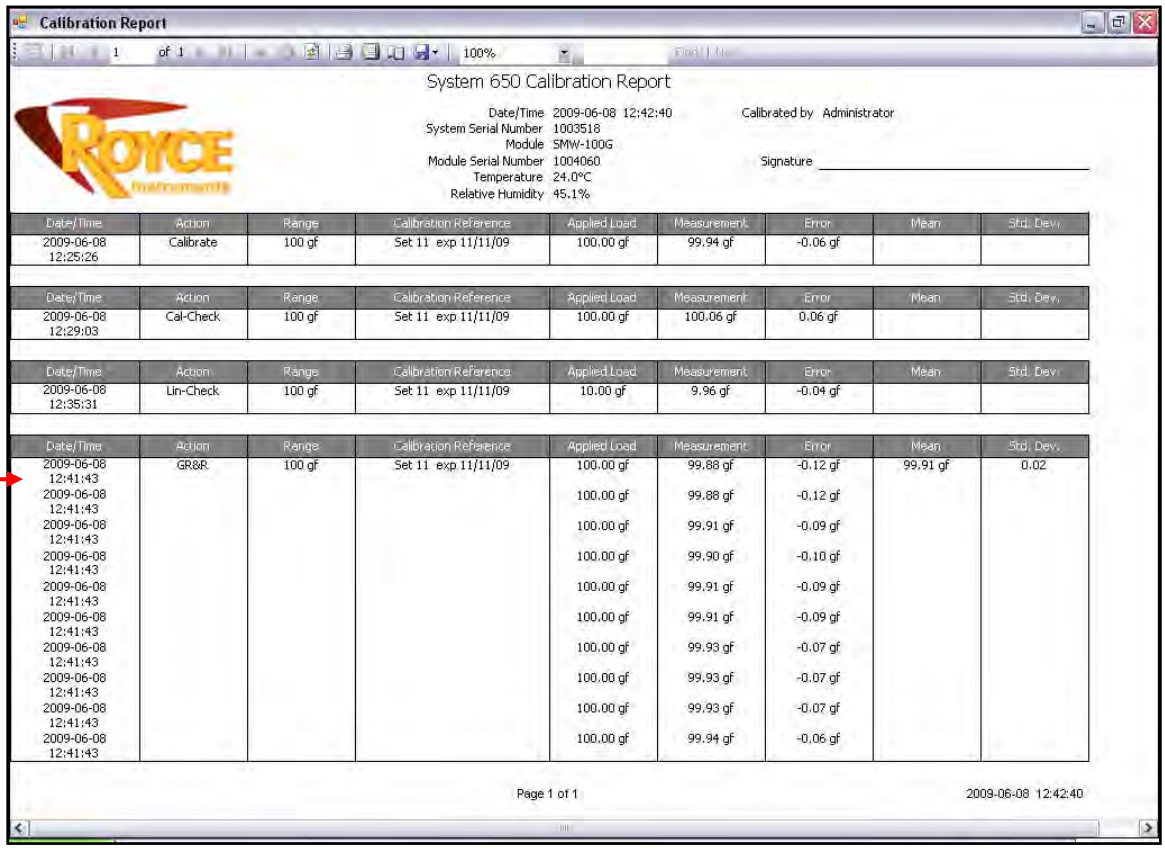


Note: If GR&R continues to fail after re-calibration, contact **customerservice@royceinstruments.com** for further instructions.

9. Click on the **Calibration Report** button, enter report parameters then select **Show Report**.







Calibration Report

System 650 Calibration Report

Date/Time 2009-06-08 12:42:40
System Serial Number 1003518
Module SMW-100G
Module Serial Number 1004060
Temperature 24.0°C
Relative Humidity 45.1%

Calibrated by Administrator

Signature _____

Date/Time	Action	Range	Calibration Reference	Applied Load	Measurement	Error	Mean	Std. Dev.
2009-06-08 12:25:26	Calibrate	100 gf	Set 11 exp 11/11/09	100.00 gf	99.94 gf	-0.06 gf		

Date/Time	Action	Range	Calibration Reference	Applied Load	Measurement	Error	Mean	Std. Dev.
2009-06-08 12:29:03	Cal-Check	100 gf	Set 11 exp 11/11/09	100.00 gf	100.06 gf	0.06 gf		

Date/Time	Action	Range	Calibration Reference	Applied Load	Measurement	Error	Mean	Std. Dev.
2009-06-08 12:35:31	Lin-Check	100 gf	Set 11 exp 11/11/09	10.00 gf	9.96 gf	-0.04 gf		

Date/Time	Action	Range	Calibration Reference	Applied Load	Measurement	Error	Mean	Std. Dev.
2009-06-08 12:41:43	GR&R	100 gf	Set 11 exp 11/11/09	100.00 gf	99.88 gf	-0.12 gf	99.91 gf	0.02
2009-06-08 12:41:43				100.00 gf	99.88 gf	-0.12 gf		
2009-06-08 12:41:43				100.00 gf	99.91 gf	-0.09 gf		
2009-06-08 12:41:43				100.00 gf	99.90 gf	-0.10 gf		
2009-06-08 12:41:43				100.00 gf	99.91 gf	-0.09 gf		
2009-06-08 12:41:43				100.00 gf	99.91 gf	-0.09 gf		
2009-06-08 12:41:43				100.00 gf	99.93 gf	-0.07 gf		
2009-06-08 12:41:43				100.00 gf	99.93 gf	-0.07 gf		
2009-06-08 12:41:43				100.00 gf	99.93 gf	-0.07 gf		
2009-06-08 12:41:43				100.00 gf	99.94 gf	-0.06 gf		

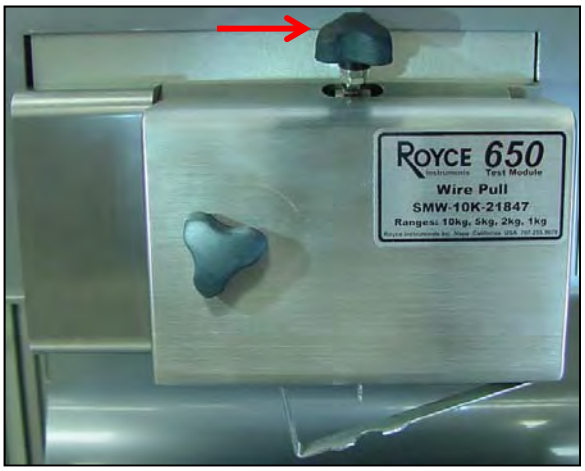
Page 1 of 1 2009-06-08 12:42:40

Required Equipment

- System 650
- Load Cell Controller [CAL-LCF-23450]
- Load Cell Fixture [LCF-10K-23452]
- Calibration Tool [CAL-TOOL-23941]

Section 1: Preparation

1. Power on the 650
2. Login to the *Bond Test Manager (BTM) Software*
3. Select **HOME**
4. Install the 10kg Pull Module on the mainframe and secure with the Lock Screw.
5. Allow the module to initialize.



6. From the top Menu Bar, select **Service > Module > Calibration Wizard**.

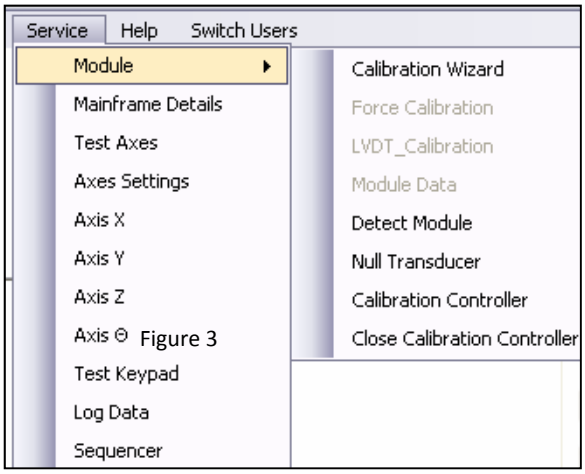
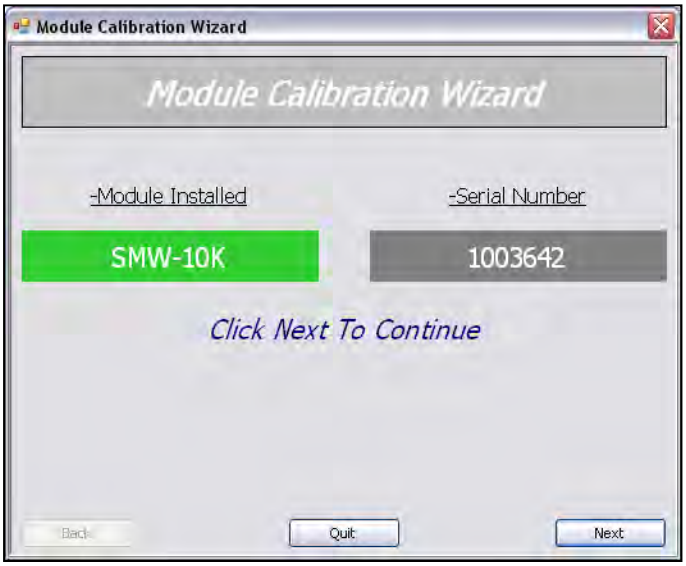


Figure 3

7. The *Module Calibration Wizard* window will appear. Select '**Next**' to continue.



Section 2: Performing a New Calibration

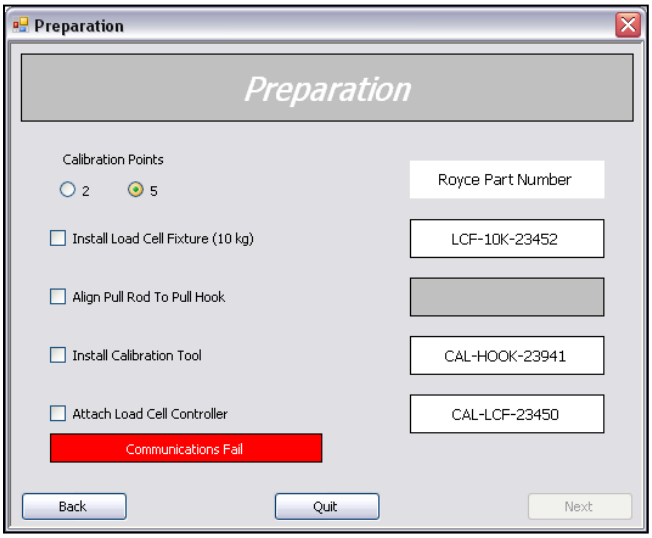
1. Select the subrange of the Module to be calibrated. For example, the 10k range is selected in this example.

   Select the '**Calibrate**' option.

   Click the '**Next**' button to continue.

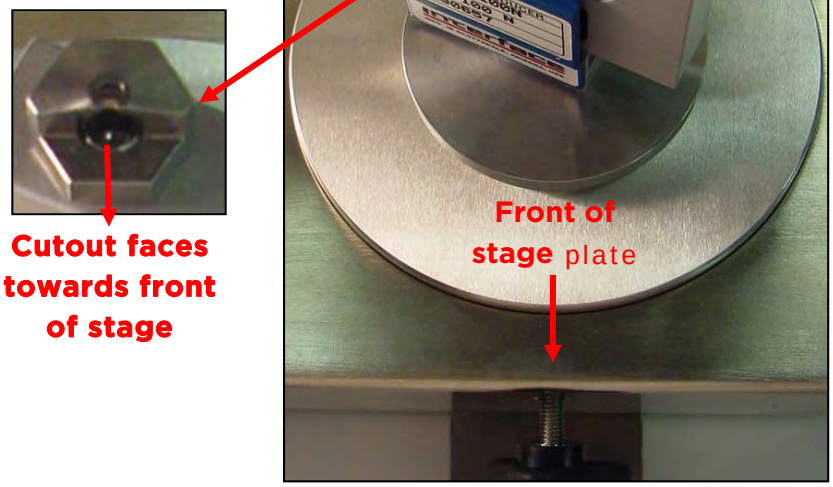
2. In the *Preparation Screen* is the option to perform a **2 point** or **5 point** calibration.

   Note: Performing a 5-point calibration can provide improved linearity results.



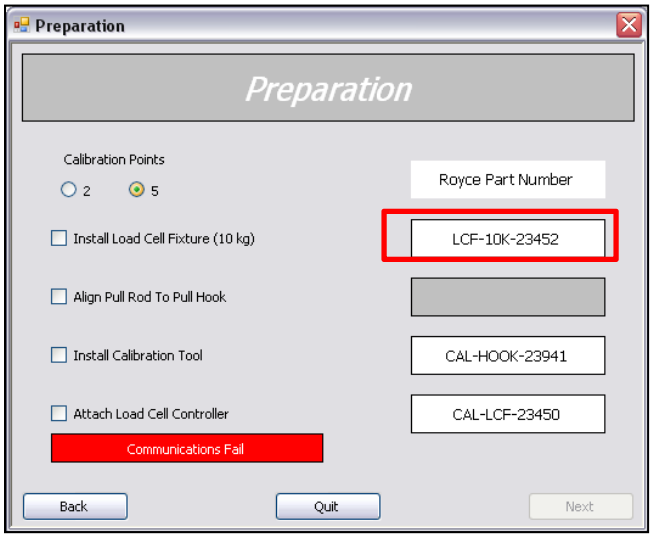
3. Install the Load Cell Fixture (LCF) on the X-Y stage.

4. Position the LCF such that the cutout in the Pull Cap is facing towards the front of the stage plate as shown below.

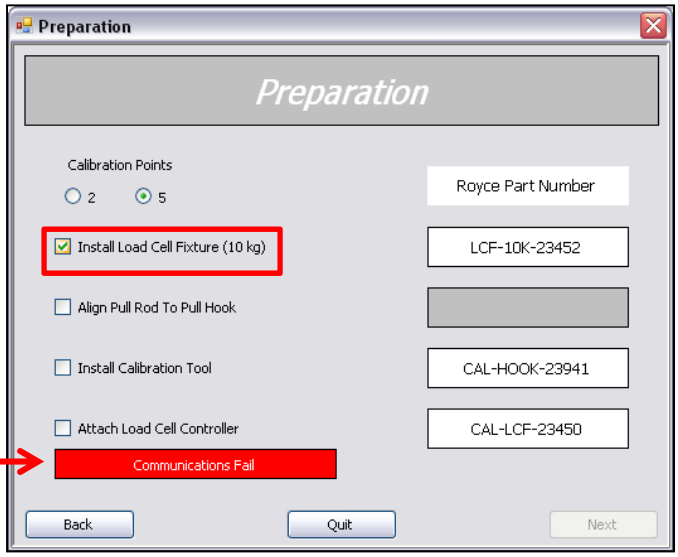


5. Secure the Load Cell Fixture in place by tightening the TPS locking knob. **Caution! Failure to do so can result in injury and damage to the equipment.**

   Note the Load Cell Range. Confirm the correct Load Cell Fixture is installed. The fixture has an ID label.



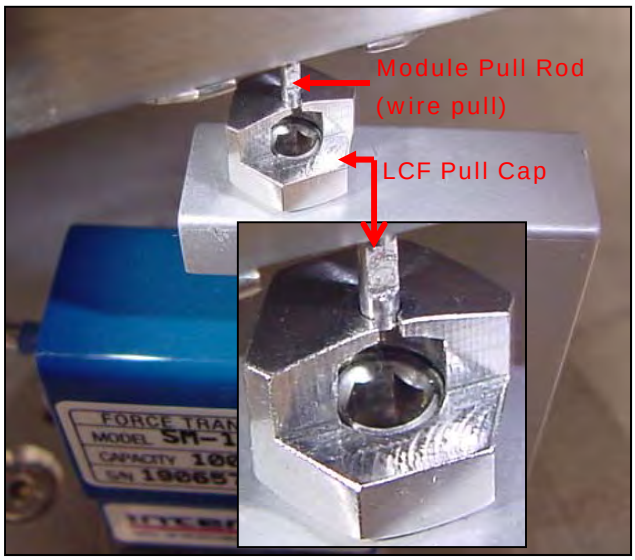
6. Check the **Install Load Cell Fixture (Range)** box.



Note: The red **Communications Fail** message will remain in this state until the Load Cell Controller is connected and powered on.

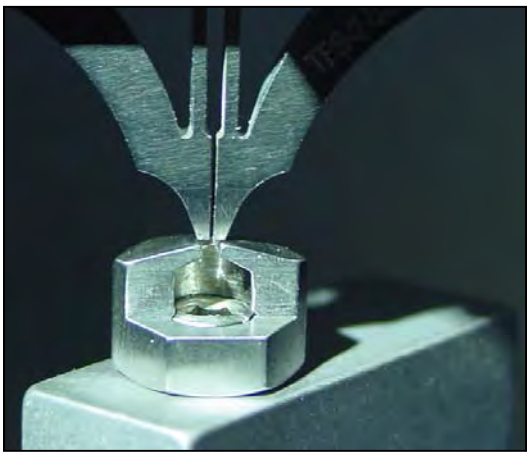
7. The alignment of the module pull rod/gripper to the Load Cell Fixture Pull Cap is critical for proper calibration.

   Use caution when moving the stages.



   a. Using the joystick controllers, move the X-Y stage to align the module pull rod to the hole in the top of the Load Fixture Pull Cap.

   b. Use gripper or tweezer fingers to align module to Load Cell Fixture Pull Cap. Align both side-to-side and front-to-back.

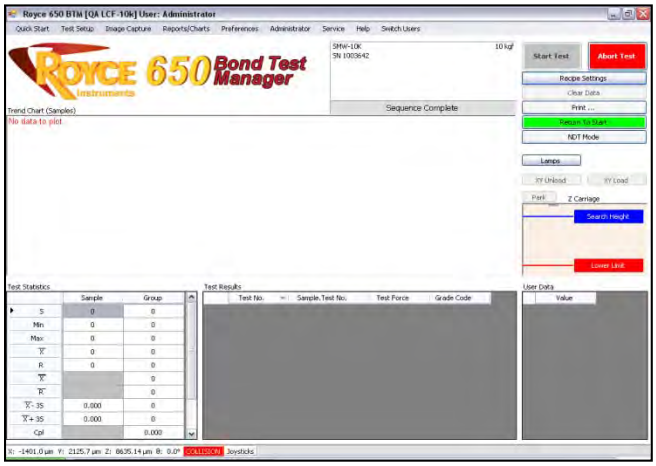


c. Lower the module down to verify the alignment. The module's pull rod should insert freely into the hole at the top of the load fixture. It may be helpful to use the microscope for this alignment.

i. Position the scope and view the alignment.

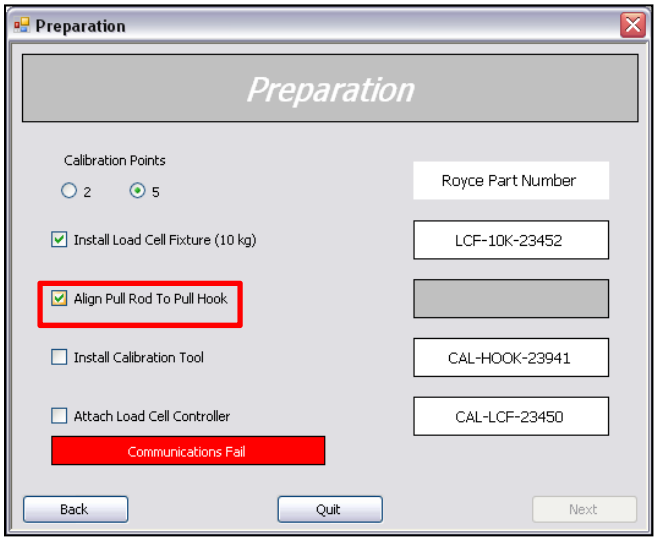
ii. Pull one of the eyepieces out until the image comes in focus. If the pull rod is in contact with the perimeter of the hole, the **Collision Indicator** will appear on the bottom of the screen.

iii. Press the eyepiece back in place and move the microscope up out of the way before continuing.



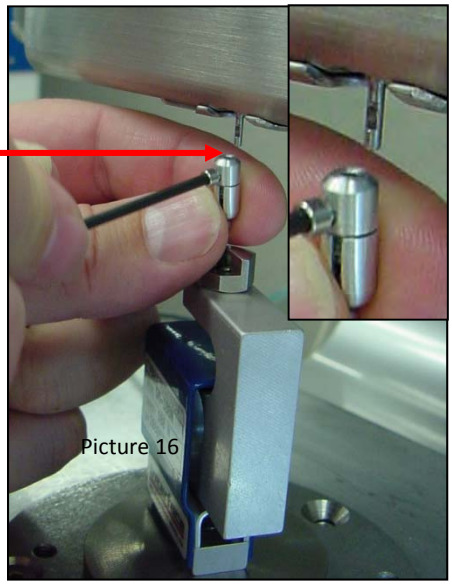
d. Move the module up out of the way and realign the X-Y stage until satisfied with the alignment (no **Collision Indicator** and the pull rod inserts freely into the pull gap cutout). Raise the module up enough to attach the calibration tool.

8. Check the **Align Pull Rod to Pull Hook** box.



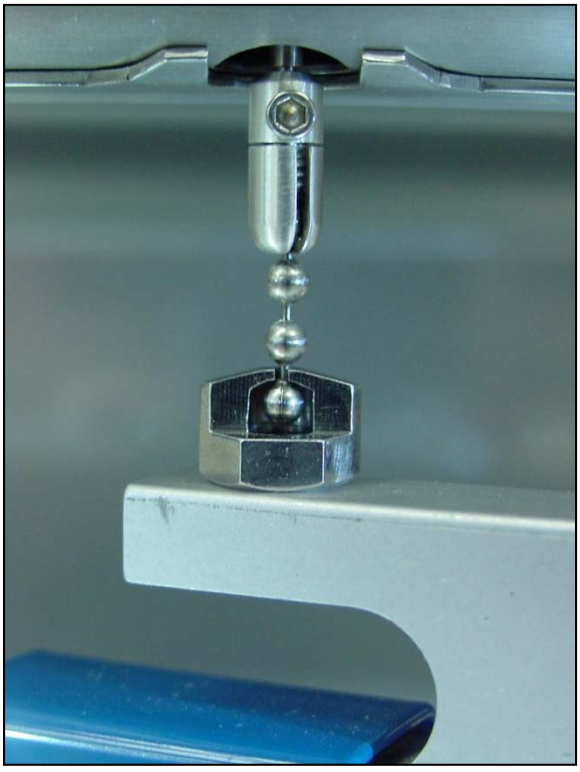
9. Install the calibration tool on the module pull rod. Ensure the socket cap screw on the calibration tool faces the 'flat' surface on the pull rod. Secure in place.

Attach the calibration tool and secure to 'flat' surface on pull rod.

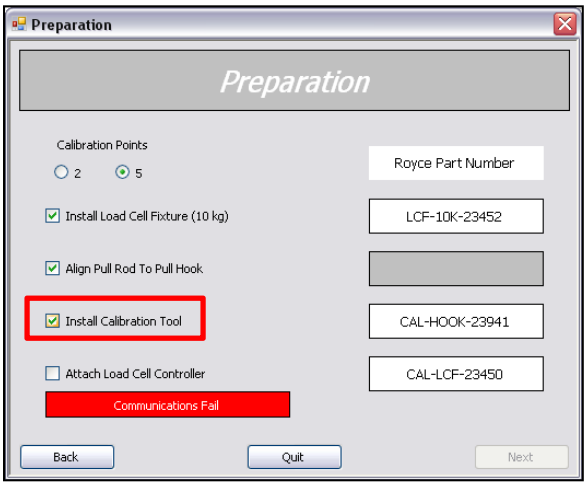


Picture 16

10. Lower the test module until the lowest ball on the chain slips freely into the cutout of the LCF Pull Cap. Make final alignments if necessary.

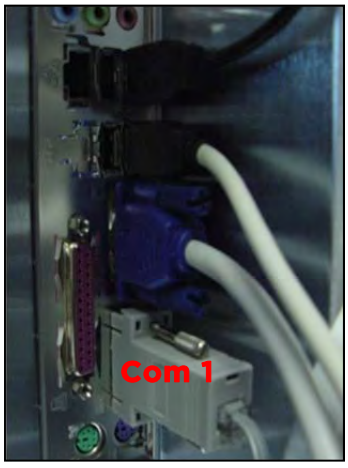


11. Check the **Install Calibration Tool** box.



12. Connect the Load Cell (9-pin connector) to the Load Cell Controller.

13. Connect the phone cable to the Controller and then to the external Mainframe Com 1 port on the rear 650 panel using the adapter provided.

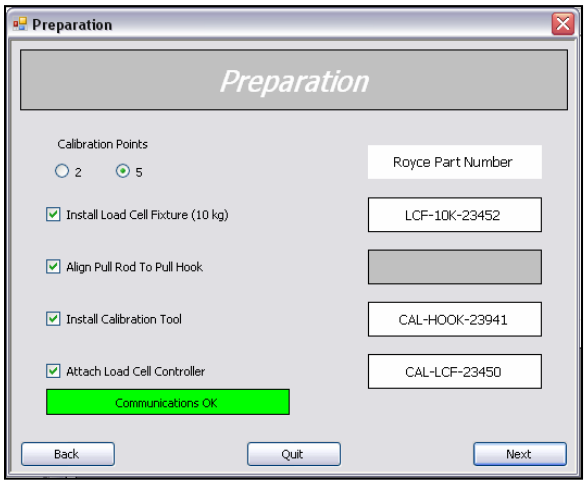


14. Press the **Power** button on the Load Cell Controller.

    Note: The Controller has been configured and tested at the factory and is ready for use with the Load Cell Fixture. The units will be N (Newtons**), DO NOT CHANGE THE UNITS.**

15. Check the **Attach Load Cell Controller** box.

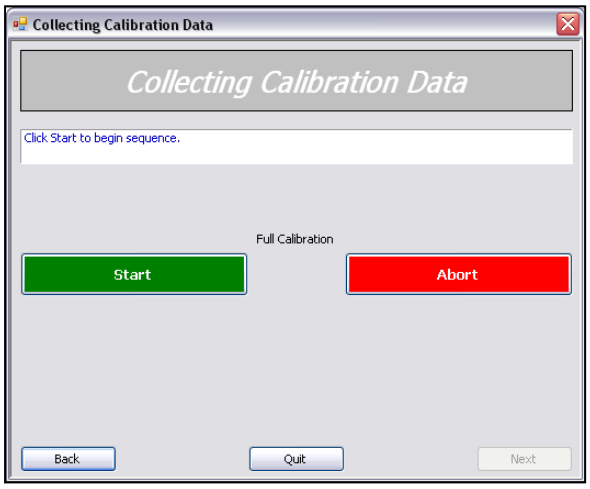
    Note: The green **Communication OK** box indicates the Load Cell Controller is communicating with the System 650. If a red **Communication Fail** message is present, ensure the Controller is powered on and all connections are secure.



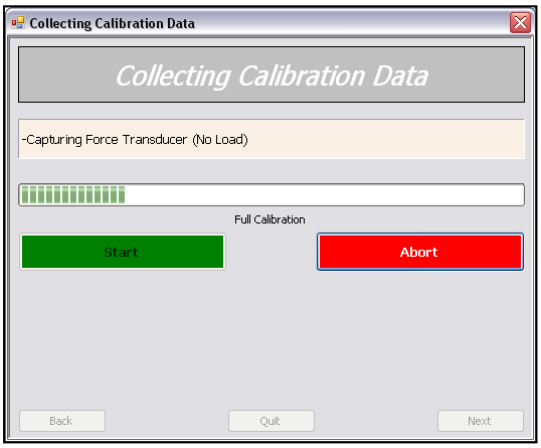
16. Click **Next** to continue.

17. Select the green **Start** button to begin Calibration routine.

    Note: The calibrate sequence can be aborted at any time by pressing the red **Abort** button.



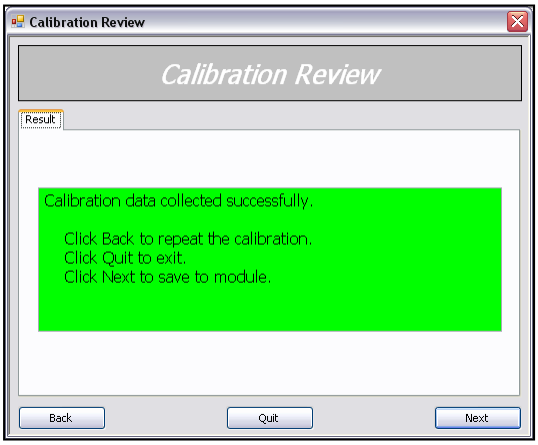
The system will perform a series of lifts.



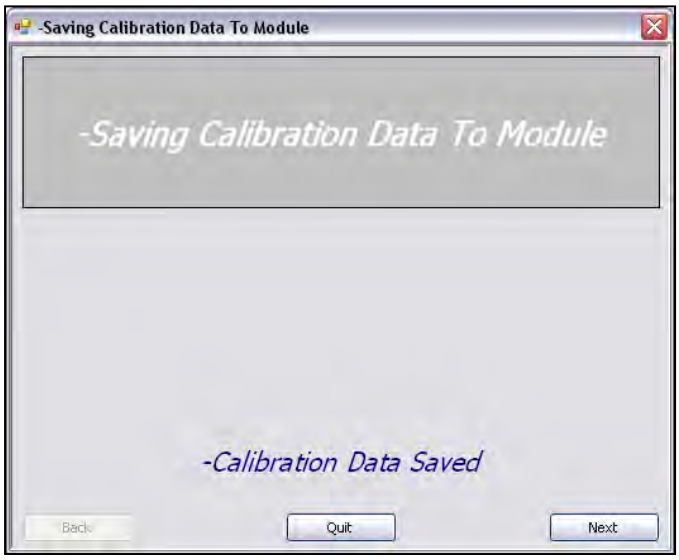
18. Once the Calibration has completed the following pop up will occur.

    Calibration data collected successfully

    Select **Next** to save the calibration data to the module.



19. The *Saving Calibration Data to Module* screen will appear. Select **Next** to complete the Calibration.



Note: The Modules are highly linear; however for the utmost accuracy, each sub range will require calibration.

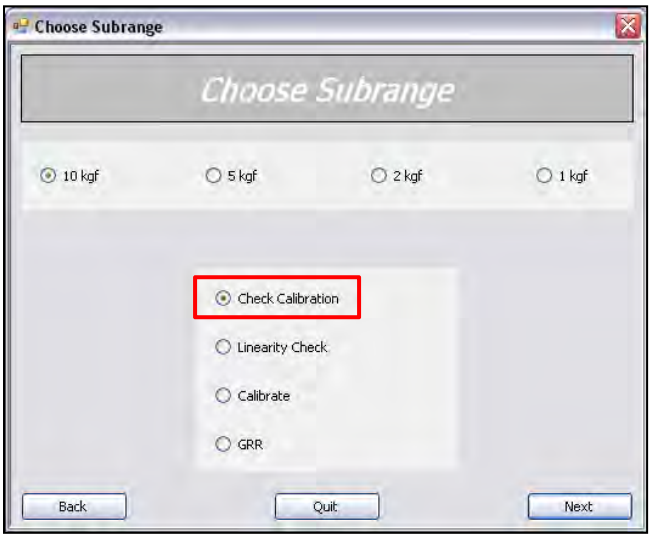
Repeat Steps 1-13 for each sub range.

IF Calibration continues to fail, contact customerservice@royceinstruments.com for further instructions.

Section 3: Check Calibration:

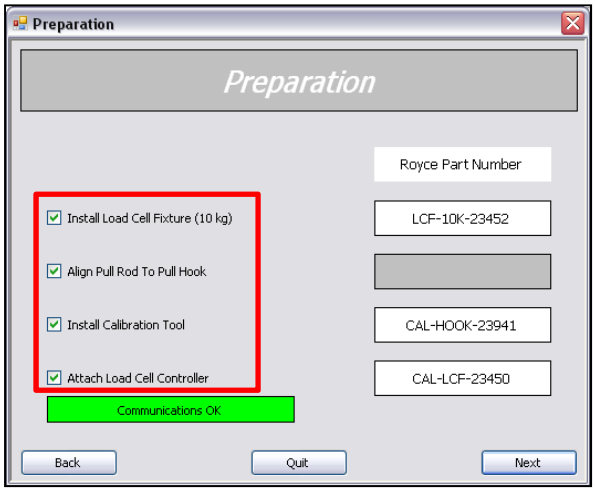
Note: If the Load Cell Fixture has not been installed, refer to Sections 1 and 2 before proceeding.

1. Select the **Subrange** of the Module to perform a Check Calibration. The 10kg sub range is illustrated here.



2. Select **Check Calibration** then select **Next.**

3. The *Preparation Screen* will appear.



Note: If the calibration equipment has not been installed, refer to Section 2: Steps 3 - 19.

Check the following boxes:

✓ Install Load Cell Fixture (10 kg)

✓ Align Pull Rod To Pull Hook

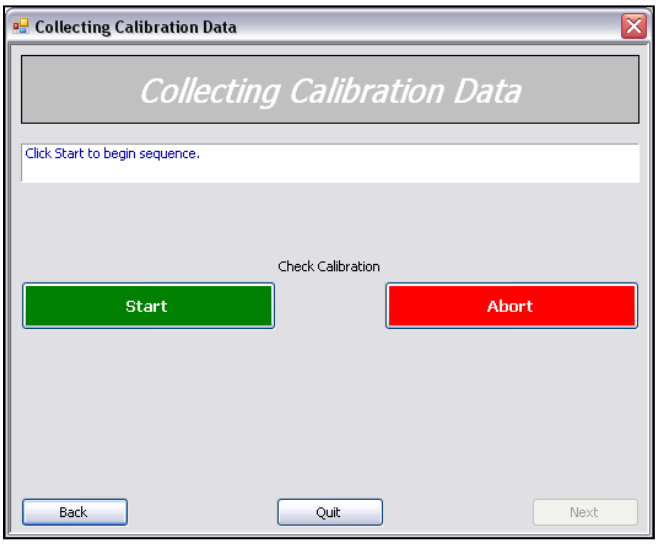
✓ Install Calibration Tool

✓ Attach Load Cell Controller

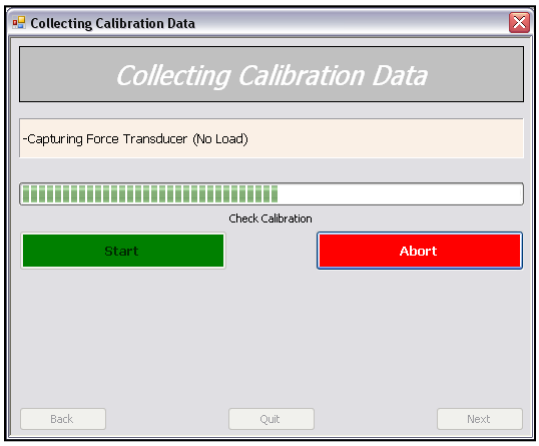
Select the **Next** button to continue.

4. Select **Start** from the *Collecting Calibration Data Screen*.

   Note: The Check Calibration sequence can be aborted at any time by clicking the red **Abort** button.



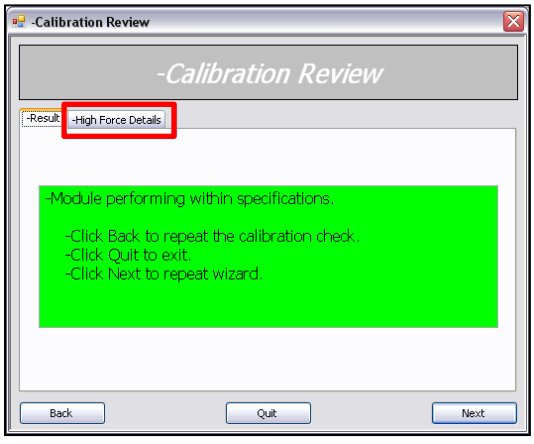
5. The system will perform a series of lifts as illustrated at right.



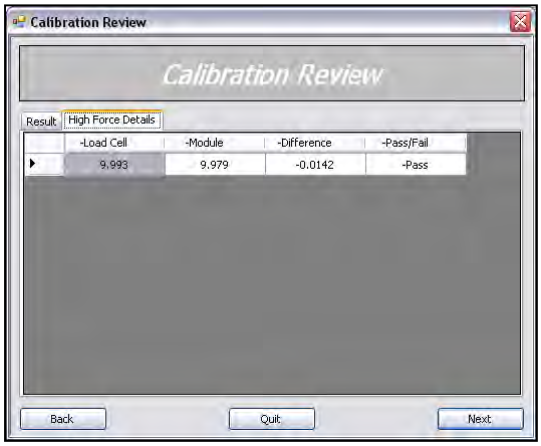
6. Once the Calibration Check has completed there are two possible pop ups.

   Module performing within specifications

   - The data captured during the calibration check can be viewed by selecting the ***High Force Details*** *tab*.



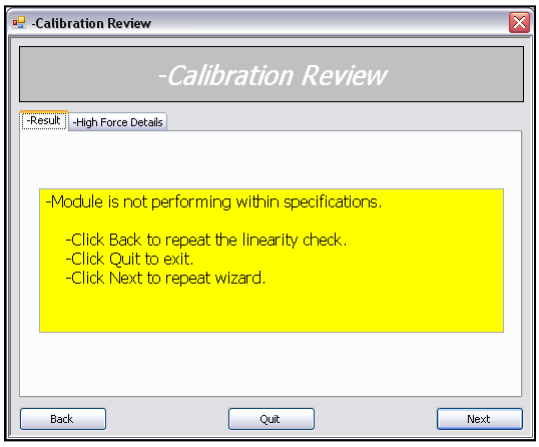
Select **Next** to return to the *Select Sub Range Menu* or select **Quit** to end the Calibration Check.



Module is not performing within specifications

Typical Causes:

- Module Requires Calibration
- Load Cell fixture not secured in stage properly.
- Tooling Misaligned.



Action:

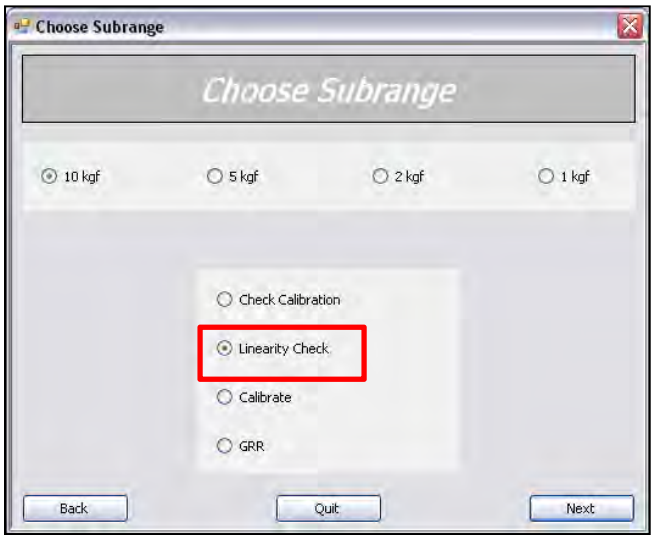
- Click the **Back** button to the *Choose Subrange menu*.
- Secure the Load Cell Fixture.
- Realign the tooling.
- Perform a New Calibration (see Section 2)

NOTE: IF Calibration Check continues to fail after calibration, contact customerservice@royceinstruments.com for further instructions.

Section 4: Linearity Check:

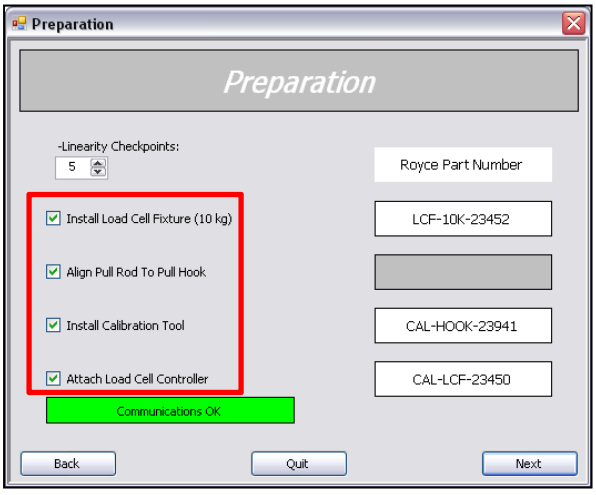
Note: If Load Cell Fixture has not been installed, refer to Sections 1 and 2 before proceeding.

1. Select the Subrange of the Module to perform a Linearity Check. The 10kg subrange is illustrated here.



2. Select **Linearity Check** then select **Next**.

3. In the *Preparation Screen*, select the number of linearity points. 5-point is selected in this example.



Note: If the calibration equipment has not been installed, refer to Section 2: Steps 3 though 19.

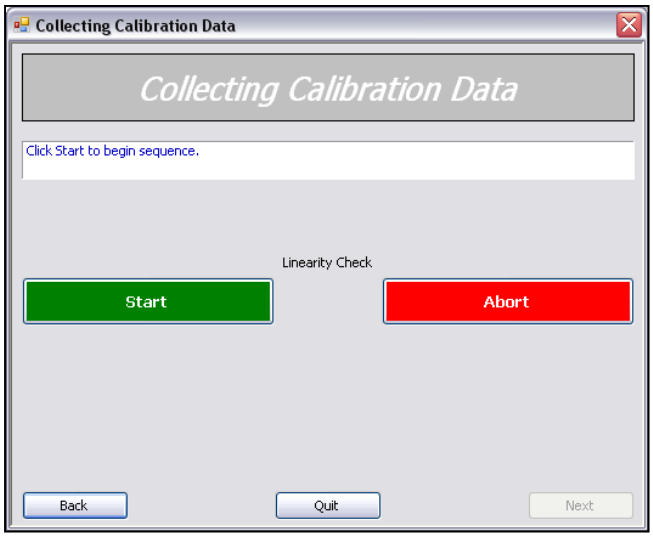
Check the following boxes:

- ✓ Install Load Cell Fixture
- ✓ Align Pull Rod To Pull Hook
- ✓ Install Calibration Tool
- ✓ Attach Load Cell Controller

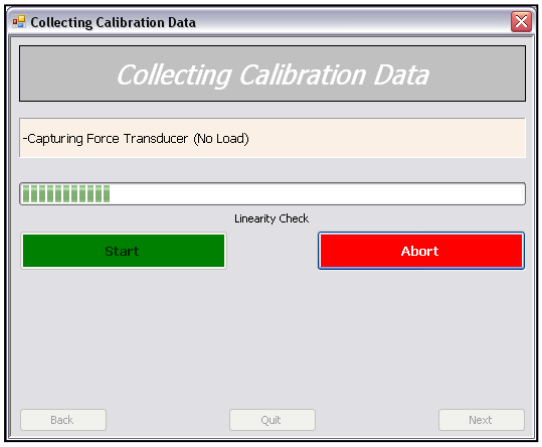
Select the **Next** button to continue.

4. Select the green **Start** button to begin the Linearity Check routine.

   Note: The Linearity Check sequence can be aborted at any time by clicking the red **Abort** button.



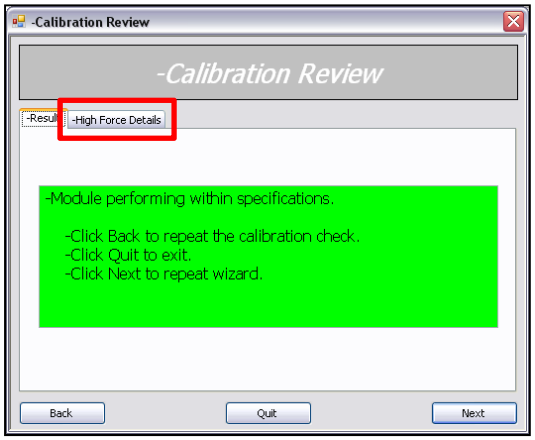
5. The system will perform a series of lifts as illustrated at right.



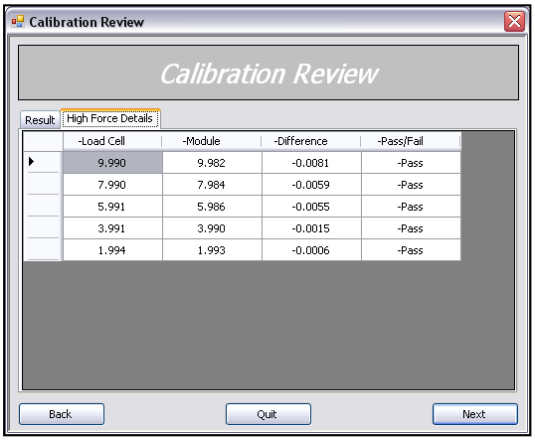
6. Once the Linearity Check has completed there are two possible pop ups.

   Module performing within specifications

   - The data captured during the linearity check can be viewed by selecting the *High Force Details tab.*



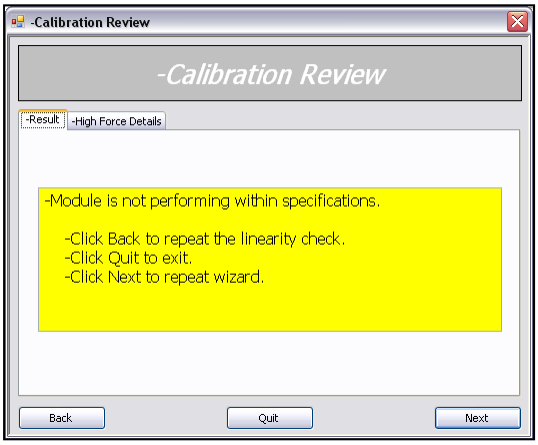
Select **Next** to return to the *Choose Subrange Menu* or select **Quit** to end the Linearity Check.



Module is not performing within specifications

Typical Causes:

- Module Requires Calibration.
- Load Cell fixture not secured in stage properly.
- Tooling Misaligned.



Action:

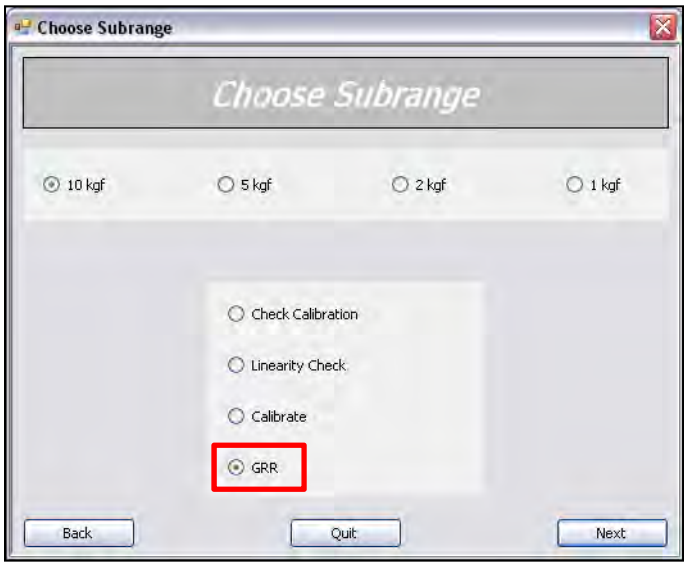
- Click the **Back** button to the *Choose Subrange Menu*.
- Secure the Load Cell Fixture.
- Realign tooling.
- Perform a New Calibration (see Section 2, Step 3).

Note: IF Linearity Check continues to fail after calibration, contact **customerservice@royceinstruments.com** for further instructions.

Section 5: GR&R:

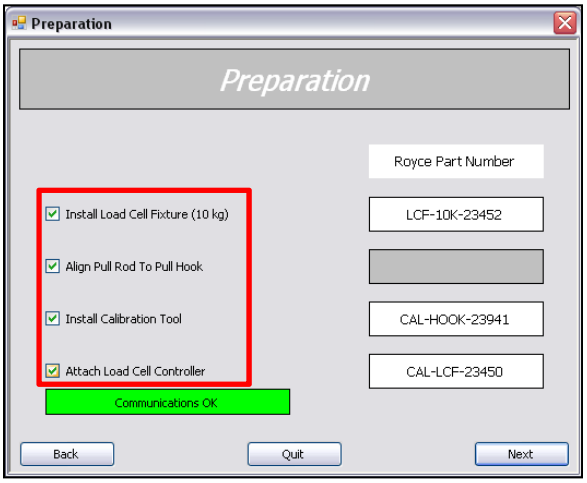
Note: If Load Cell Fixture has not been installed, refer to Sections 1 and 2 before proceeding.

1. Select the subrange of the Module to perform GR&R. The 10kg subrange is illustrated here.



2. Select **GRR** option, then select **Next**.

3. The *Preparation Screen* will appear.



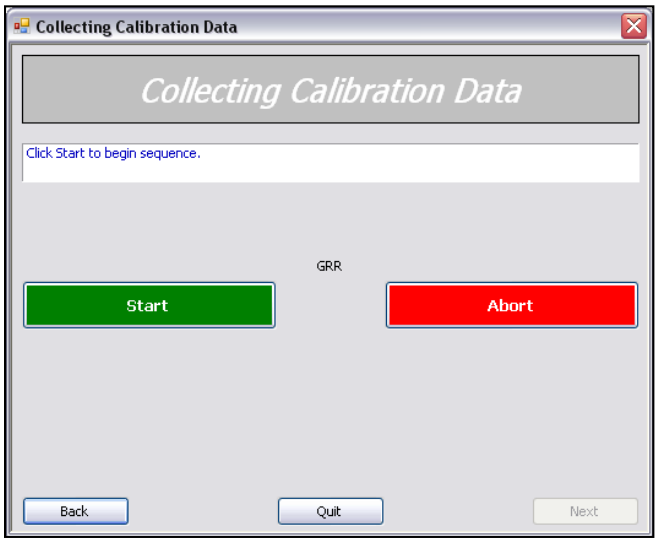
Note: If the calibration equipment has not been installed, refer to Section 2: Steps 3 - 19.

Check the following boxes:

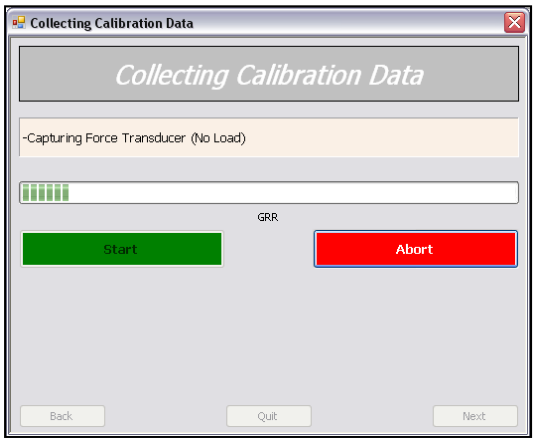
- ✓ Install Load Cell Fixture
- ✓ Align Pull Rod To Pull Hook
- ✓ Install Calibration Tool
- ✓ Attach Load Cell Controller

4. Select the green **Start** button to begin the GRR routine.

Note: The GRR sequence can be aborted at any time by clicking the red **Abort** button.



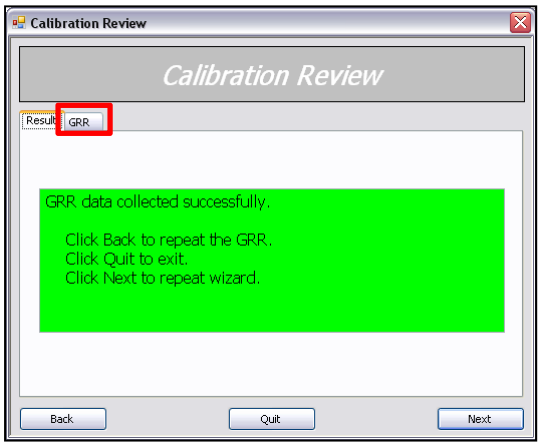
5. The system will perform a series of lifts as illustrated at right.



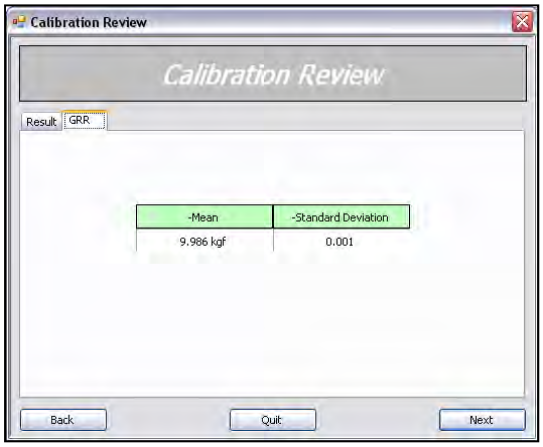
6. Once the GRR has completed there are 2 possible pop ups.

GRR data collected successfully

- The data captured during the GR&R check can be viewed by selecting the *GRR Tab*



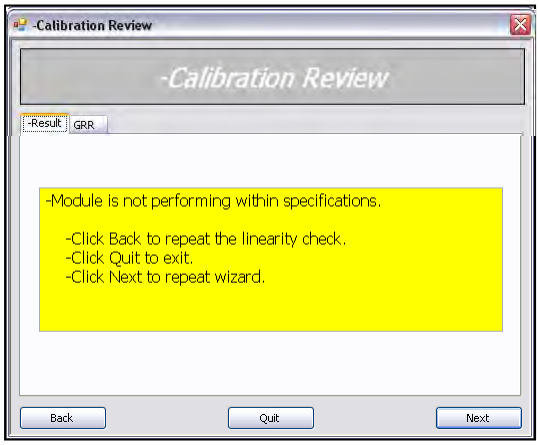
- Select **Next** to return to the *Choose Subrange Menu* or select **Quit** to exit Calibration Wizard



Module is not performing within specifications

Typical Causes:

- Module Requires Calibration.
- Load Cell fixture not secured in stage properly.
- Tooling Misaligned.



Action:

- Click the **Back** button to the *Choose Subrange Menu*.
- Secure the Load Cell Fixture.
- Realign tooling.
- Perform a New GRR (see Step 1).
- Perform a New Calibration (see Section 2, Step 3).

Note: IF GR&R continues to fail after calibration, contact **customerservice@royceinstruments.com** for further instructions.

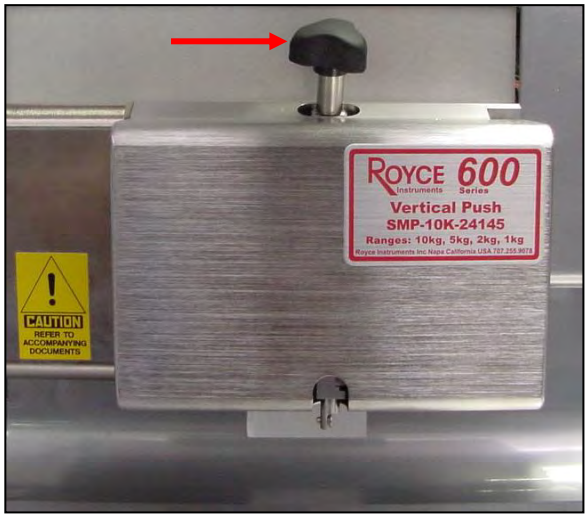
650 Calibration and Linearity Check
SMP-10kg Module

Required Items:

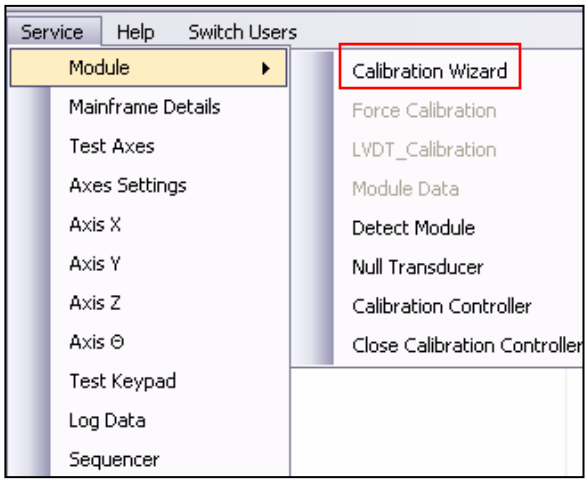
- System 650
- Load Cell Controller [CAL-LCF-23450]
- Load Cell Fixture [LCF-10K-24180]
- Calibration Tool [CAL-TOOL-24173]

Section 1: Preparation

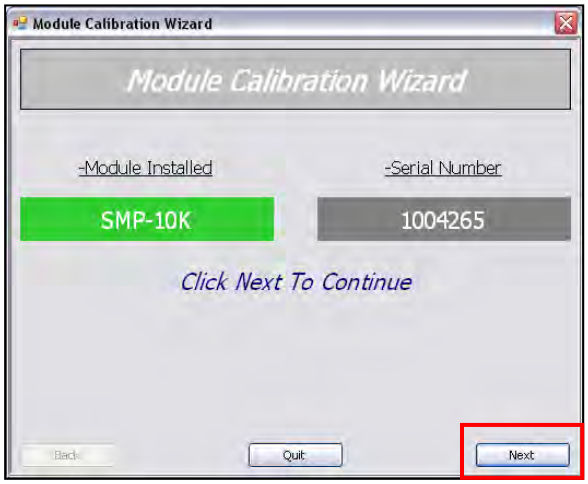
1. Power on the 650
2. Login to the BTM Software
3. Select HOME
4. Install the 10kg Push Module on the mainframe and secure with the Lock Screw.
5. Allow the module to initialize.



From the top Menu Bar, select **Service > Module > Calibration Wizard**.



6. The *Module Calibration Wizard Window* will appear. Select **Next** to continue.



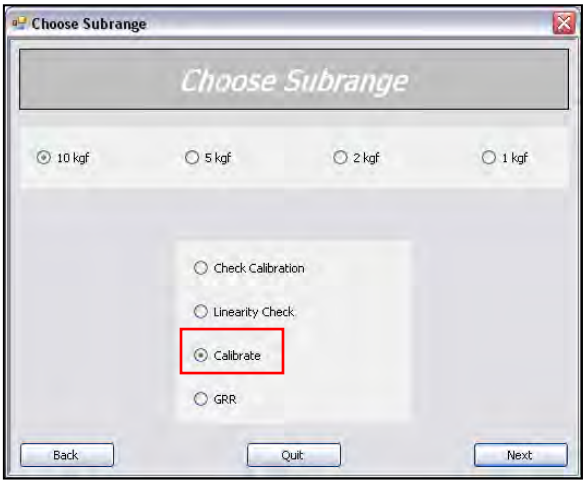
Section 2: Calibration Procedure

Performing a New Calibration

1. In the *Choose Subrange Screen*, select the subrange to be calibrated. Example: The 10k range is selected in this example.

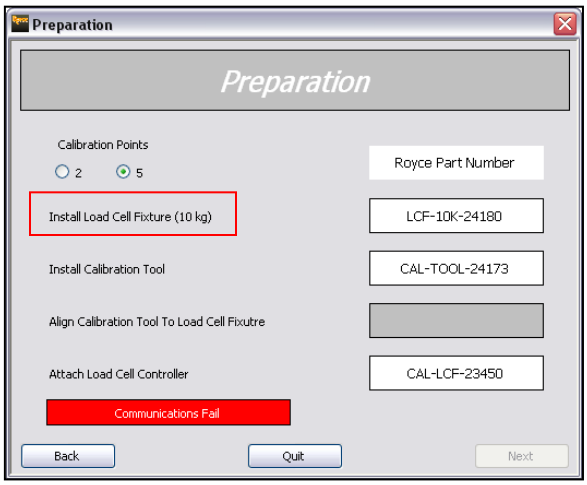
   Select the **Calibrate** option.

   Click the **Next** button to continue.



2. In the *Preparation Screen* is the option to perform a 2 or 5-Calibration Points.

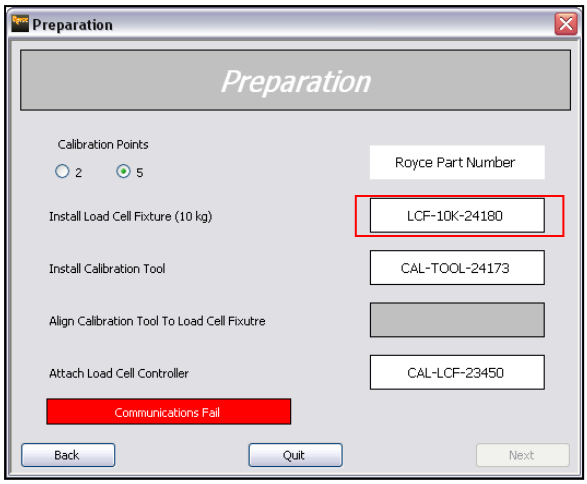
   Note: Performing a 5-point calibration can provide improved linearity results.



3. Select *Install the Load Cell Fixture* (LCF) on the X-Y stage. Secure the Load Cell Fixture in place by tightening the TPS locking knob.

   Caution: Failure to secure the Load Cell can result in injury and damage to the equipment.

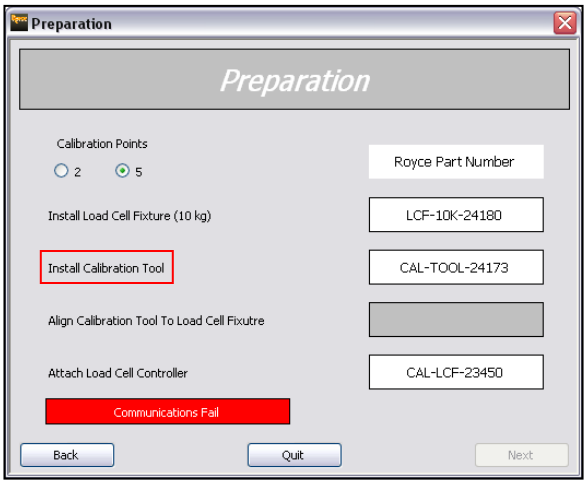
Note the Load Cell Range. Confirm the correct Load Cell Fixture is installed. The fixture has an ID label.



✓

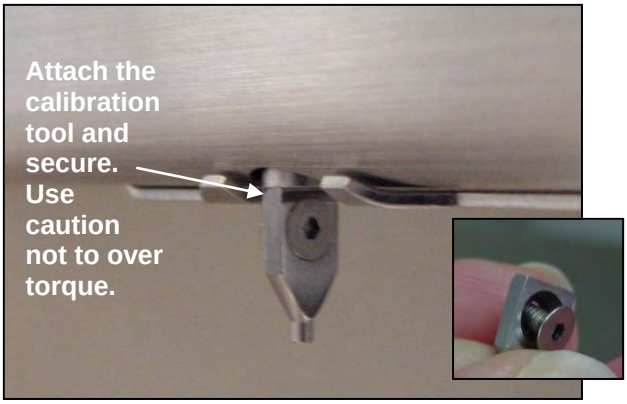
Note: The Red message will remain in this state until the Load Cell Controller is connected and powered on.

4. Select *Install Calibration Tool.*

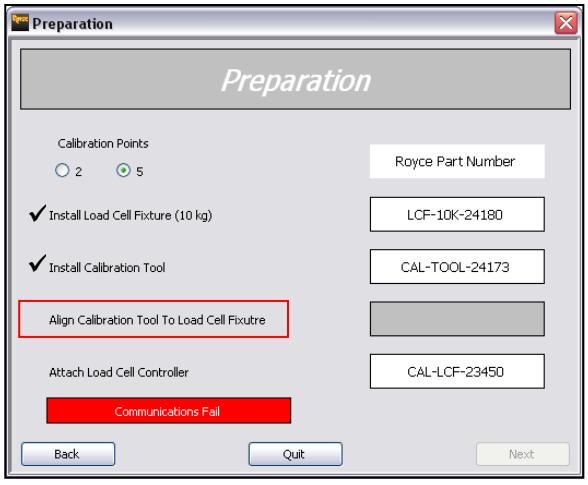


✓

5. Install the calibration tool on the module. Ensure the socket flat mount screw for the calibration tool is in the countersink of the tool. Secure in place.

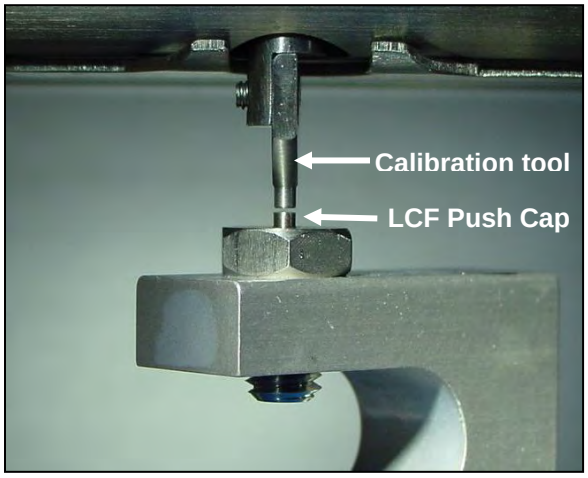


6. Select *Align Calibration Tool to Load Cell Fixture*



The alignment of the calibration tool to the Load Cell Fixture Push Cap is critical for proper calibration.

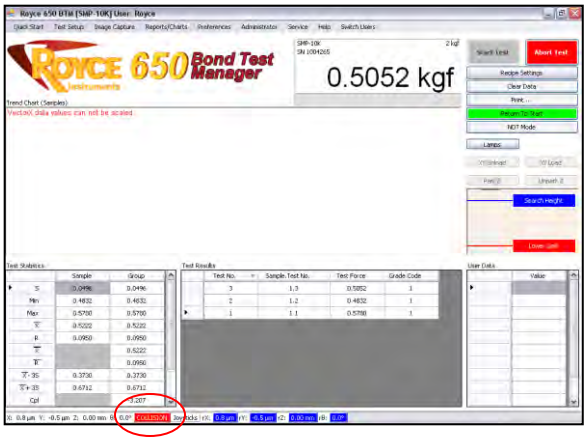
Caution: Use caution when moving the stages.



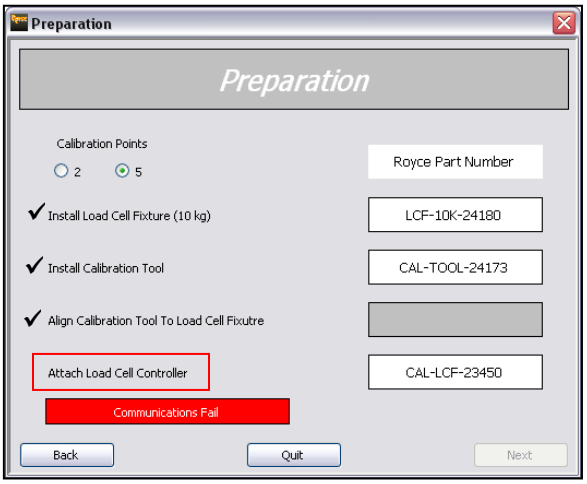
Using the joystick controllers, move the X-Y stage to align the tip of the calibration tool to the tip of the Load Fixture Push Cap.

Lower the module down to verify the alignment. It may be helpful to use the microscope. Verify alignment in the x (left to right) and y (front to back) axis'.

Note: If red COLLISON indicator is present, the cal tool is in contact the load-cell and the x-y stage will not move. Raise the module up out of the way and realign the X-Y stage until satisfied with the alignment. Finish by raising the module up enough to leave a gap. Continue to next step.



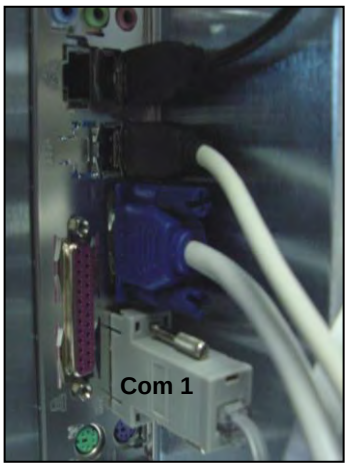
7. Select *Attach Load Cell Controller*



Connect the Load Cell (9-pin connector) to the Load Cell Controller.

Connect the phone cable to the Controller.

Connect the other end of the phone cable to the Mainframe external Com 1 port or on newer systems, Com 2. Both are located on the rear 650 panel using the adapter provided.

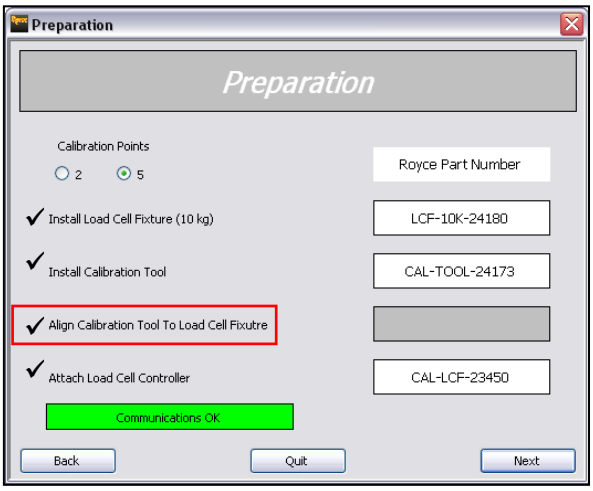


8. Press the **Power** button on the Load Cell Controller.

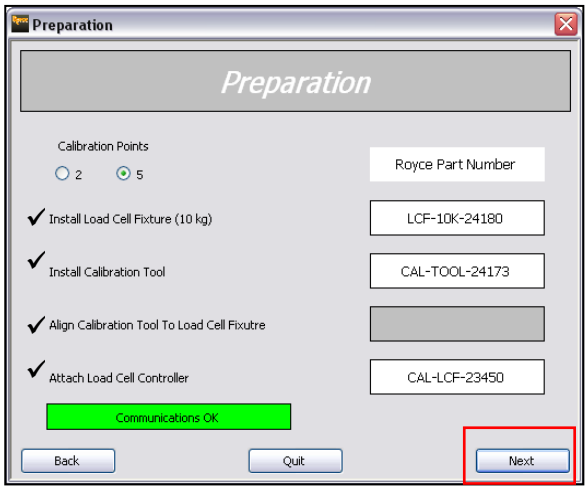
   Note: The Controller has been configured and tested at the factory and is ready for use with the Load Cell Fixture.

   The units will be N (Newtons), **DO NOT CHANGE THE UNITS.**

Note: The green **Communication OK** box indicates the Load Cell Controller is communicating with the System 650. If a red **Communication Fail** message is present, ensure the Controller is powered on and all connections are secure.

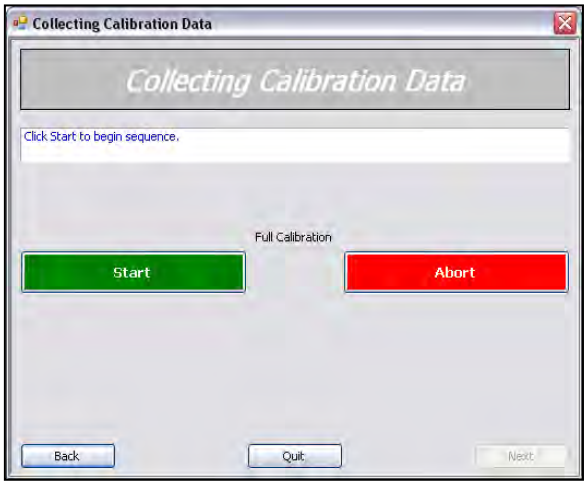


9. Click **Next** to continue.

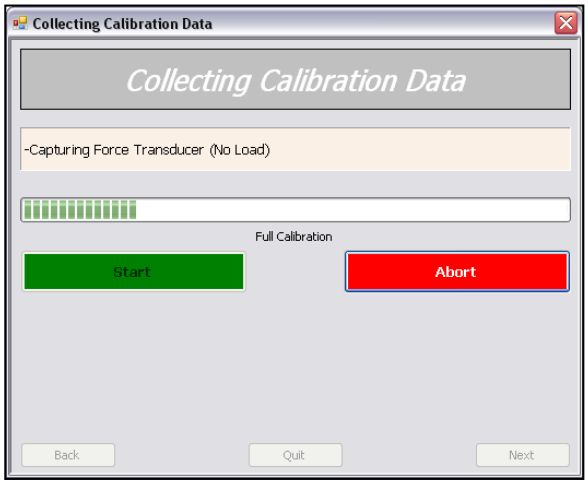


10. Select the green **Start** button to begin the calibration routine.

Note: The Calibrate sequence can be aborted at any time by pressing the red **Abort** button.



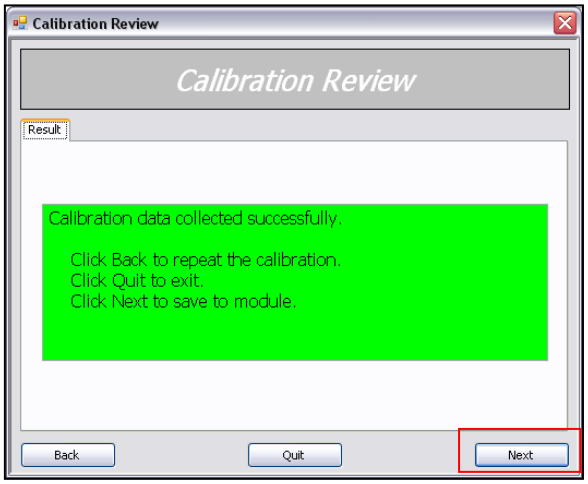
11. The system will perform a series of pushes as illustrated at right



12. Once the Calibration has completed the following pop up will occur.

    Calibration data collected successfully

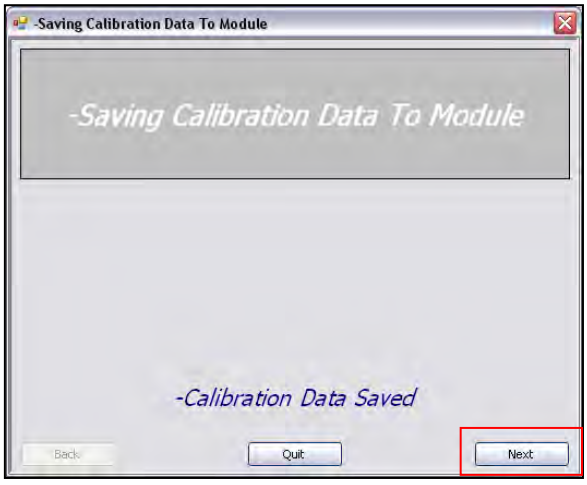
    - Calibration completed.
    - Select **Next** to save the calibration data to the module.



13. The *Saving Calibration Data To Module Screen* will appear. Select **Next** to complete the calibration.

    Note: the Modules are highly linear; however for the utmost accuracy, each sub range will require calibration. Repeat steps 1 through 13 for each sub range.

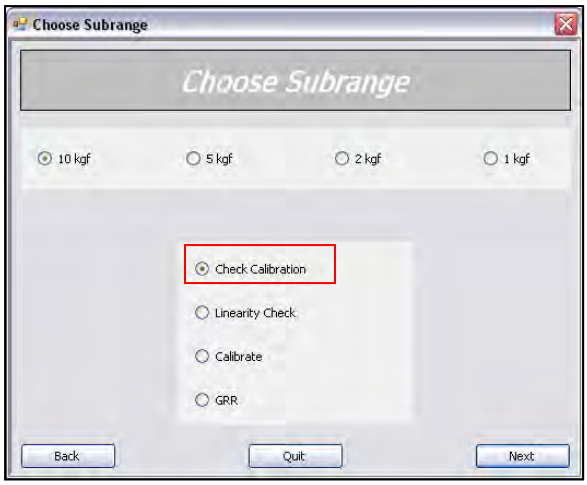
    IF Calibration continues to fail, contact customerservice@royceinstruments.com for further instructions.



Section 3: Check Calibration

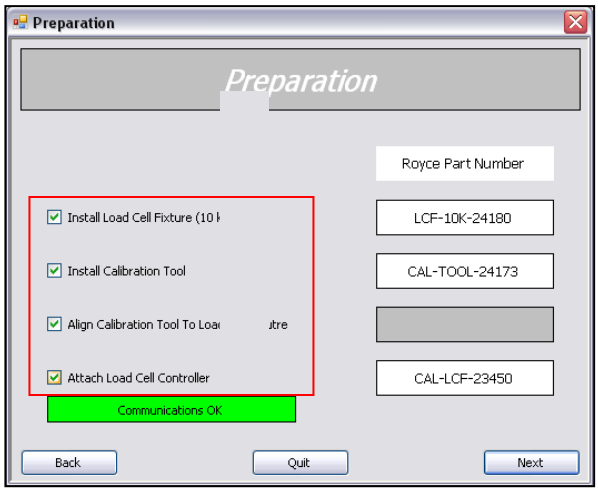
Note: If the Load Cell Fixture has not been installed, refer to Sections 1 and 2 before proceeding.

1. Select the Subrange of the module to perform a Check Calibration. Example: 10kg sub range is illustrated here.



2. Select **Check Calibration** option then select **Next.**

3. The *Preparation Screen* will appear.



Note: If the calibration equipment has not been installed, refer to Section 2: Steps 3 - 18.

Perform the following:

✓ Install Load Cell Fixture

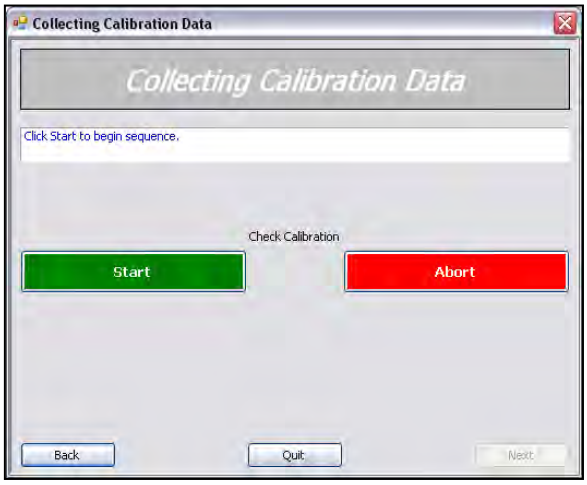
✓ Install Calibration Tool

✓ Align Calibration Tool to Load Cell Fixture

✓ Attach Load Cell Controller

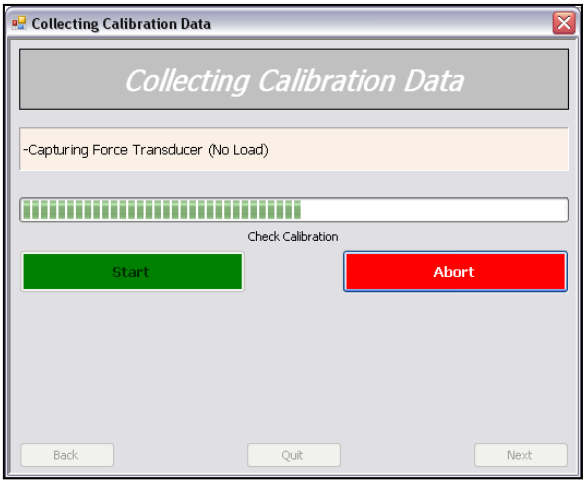
Select the **Next** button to continue.

4. Select **Start** from the *Collecting Calibration Data Screen*.



Note: The *Check Calibration* sequence can be aborted at any time by clicking the red **Abort** button.

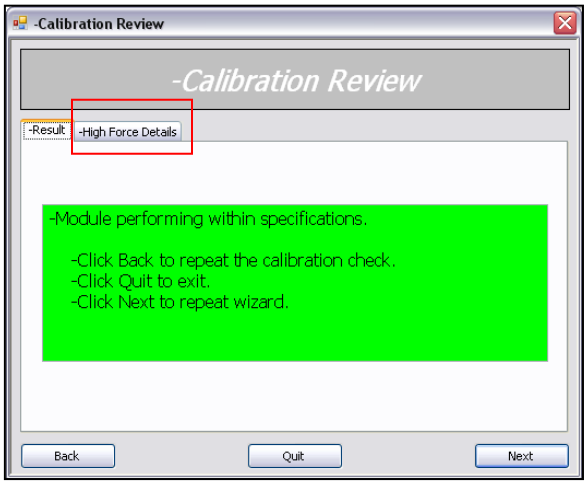
5. The system will perform a series of pushes as illustrated at right.



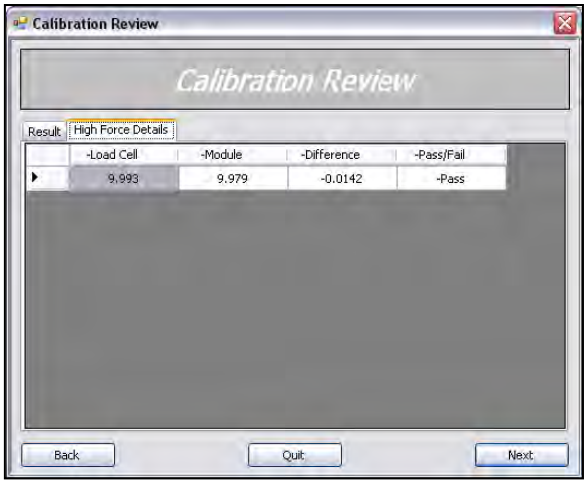
6. Once the Calibration Check has completed there are two possible pop ups.

Module performing with specifications

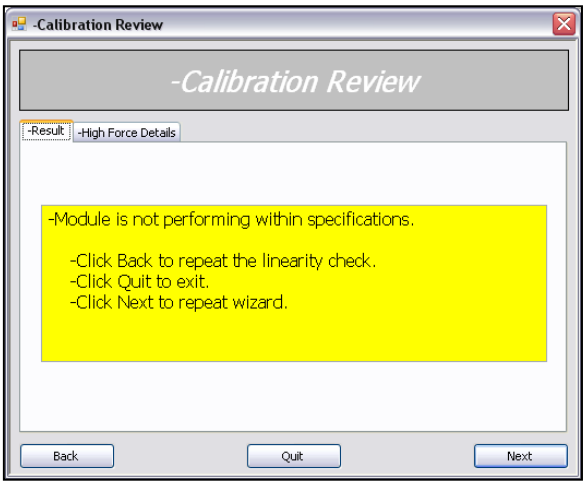
- The data captured during the calibration check can be viewed by selecting the *High Force Details Tab*.



Select **Next** to return to the *Select Sub Range Menu* or select **Quit** to end the Calibration Check.



Module is not performing within specifications



Typical Causes:

- Module Requires Calibration
- Load Cell fixture not secured in stage properly.
- Tooling Misaligned.

Action:

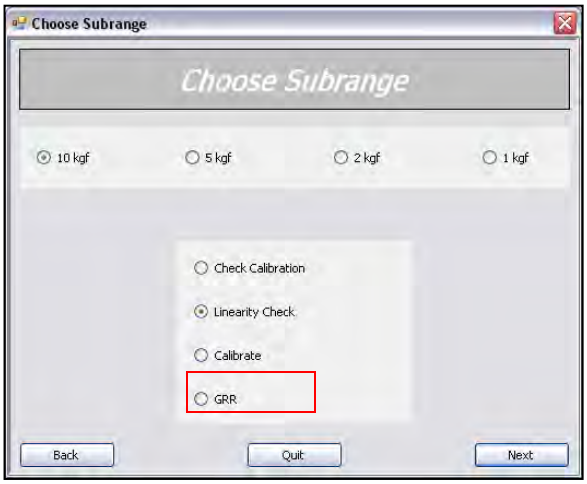
- Click the **Back** button to the *Choose Subrange Menu*.
- Secure the Load Cell Fixture.
- Realign the tooling.
- Perform a new Calibration (see Section 2)

NOTE: IF Calibration Check continues to fail after calibration, contact customerservice@royceinstruments.com for further instructions.

Section 4: Linearity Check:

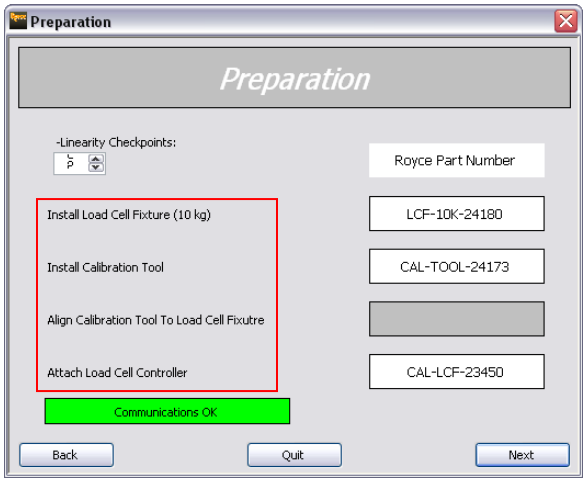
Note: If Load Cell Fixture has not been installed, refer to Sections 1 and 2 before proceeding.

1. Select the Subrange of the module to perform a Linearity Check. Example: 10kg subrange is illustrated here.



2. Select **Linearity Check** option then select **Next**.

3. In the *Preparation Screen*, select the number of linearity points. 5-point is selected in this example.



Note: If the calibration equipment has not been installed, refer to Section 2: Steps 3 though 18.

Perform the following:

✓ Install Load Cell Fixture

✓ Install Calibration Tool

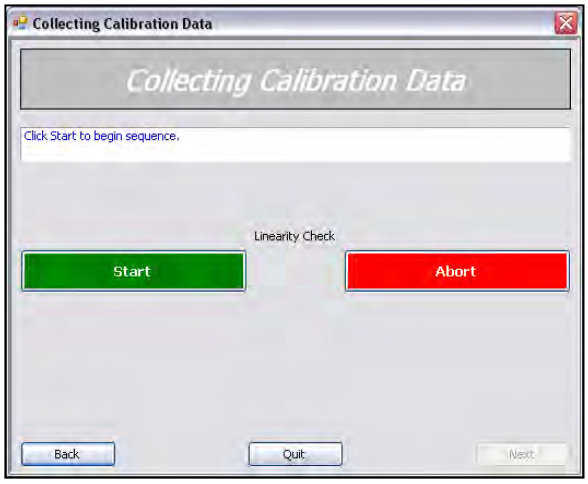
✓ Align Calibration Tool to Load Cell Fixture

✓ Attach Load Cell Controller

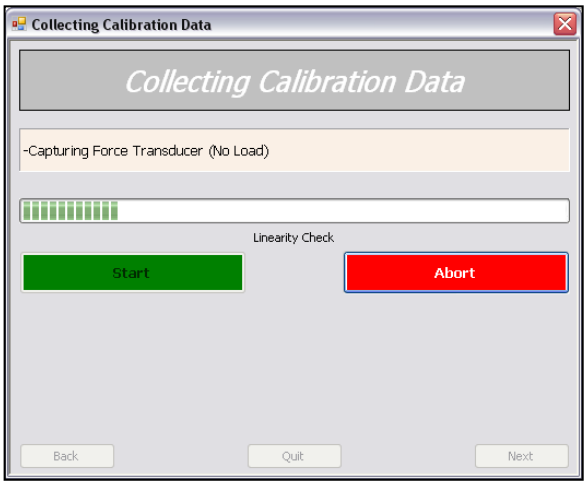
Select the **Next** button to continue.

4. Select the green **Start** button to begin the *Linearity Check Routine*.

   Note: The *Linearity Check* sequence can be aborted at any time by clicking the red **Abort** button.



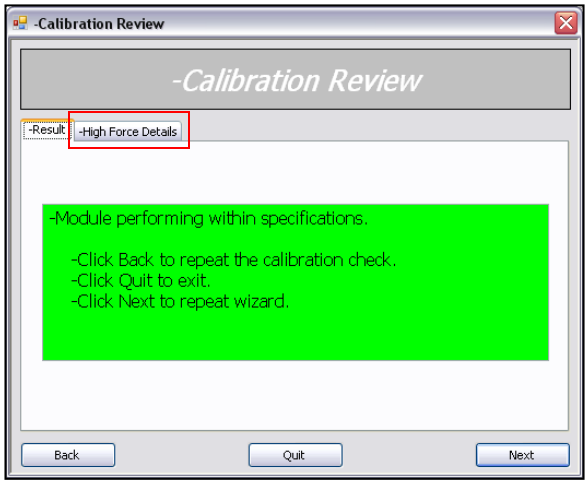
5. The system will perform a series of pushes as illustrated at right.



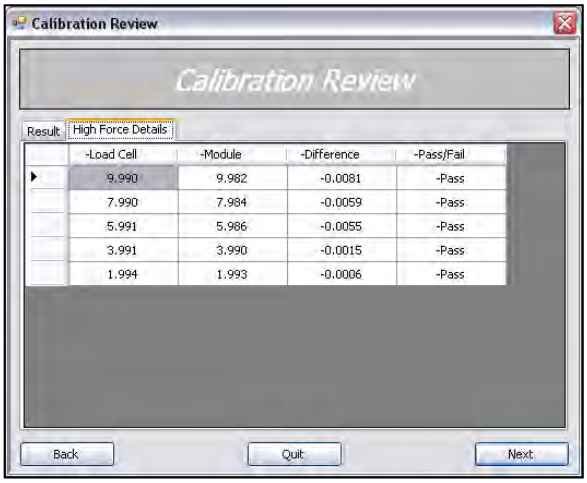
6. Once the Linearity Check has completed there are 2 possible pop ups.

Module performing within specifications

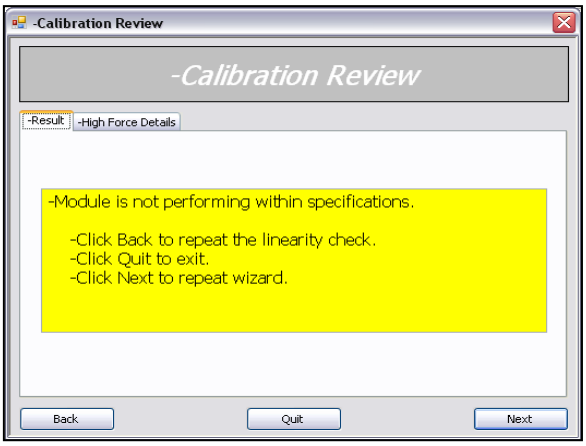
- The data captured during the linearity check can be viewed by selecting the *High Force Details Tab*.



- Select **Next** to return to the *Choose Subrange Menu* or select **Quit** to end the Linearity Check.



Module is not performing within specifications.



Typical Causes:

- Module Requires Calibration.
- Load Cell fixture not secured in stage properly.
- Tooling Misaligned.

Action:

- Click the **Back** button to the *Choose Subrange Menu*.
- Secure the Load Cell Fixture.
- Realign tooling.
- Perform a new Calibration (see Section 2, step 3).

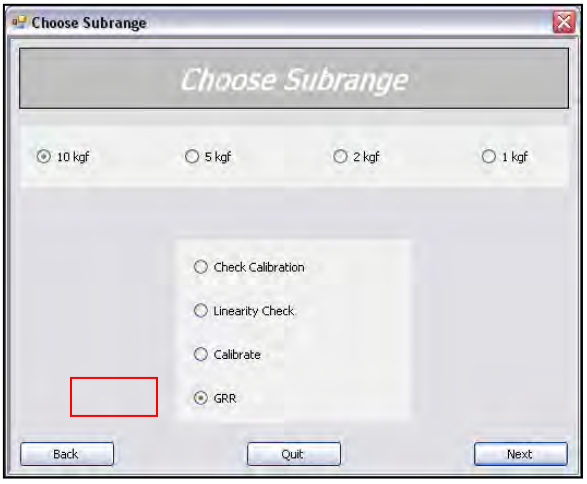
NOTE: IF Linearity Check continues to fail after calibration, contact customerservice@royceinstruments.com for further instructions.

Section 5: GR&R

Note: If Load Cell Fixture has not been installed, refer to Sections 1 and 2 before proceeding.

1. Select the subrange of the Module to perform GR&R.

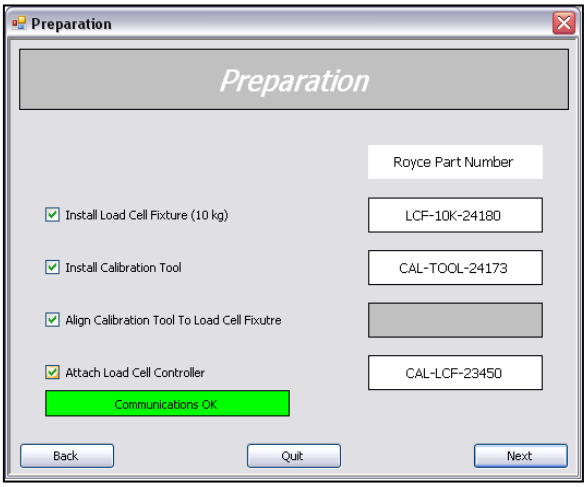
   Example: 10kg subrange is illustrated here.



2. Select **GRR** option then select **Next**

3. The *Preparation Screen* will appear.

   Note: If the calibration equipment has not been installed, refer to Section 2: Steps 3 though 19.



   Check the following boxes:

   ✓ Install Load Cell Fixture

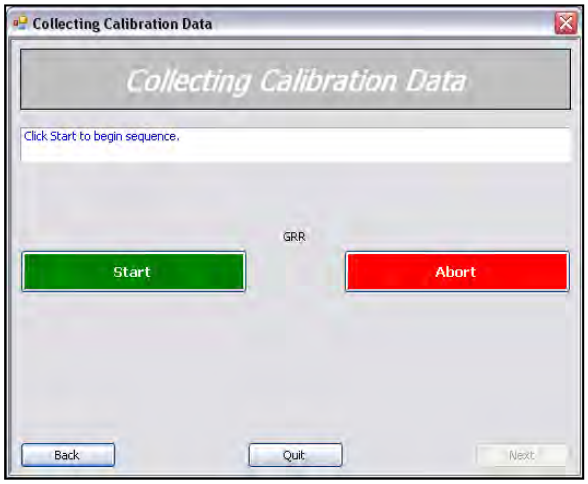
   ✓ Install Calibration Tool

   ✓ Align Calibration Tool to Load Cell Fixture

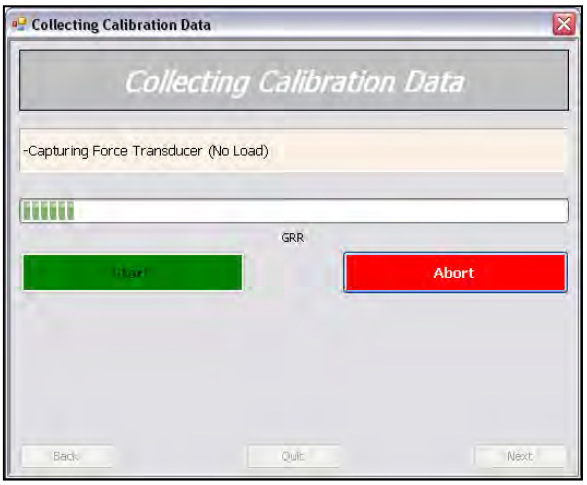
   ✓ Attach Load Cell Controller

4. Select the green **Start** Button to begin the GRR routine.

   Note: The GRR sequence can be aborted at any time by clicking the red **Abort** button.



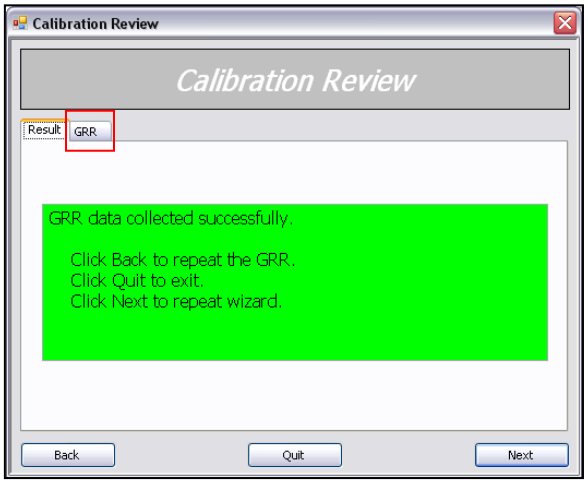
5. The system will perform a series of pushes as illustrated at right.



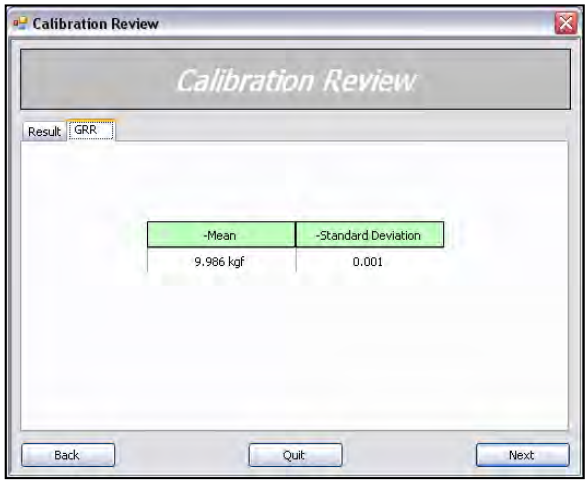
6. Once the GRR has completed there are two possible pop ups.

   GRR data collected successfully

   - The data captured during the GR&R check can be viewed by selecting the *GRR Tab*



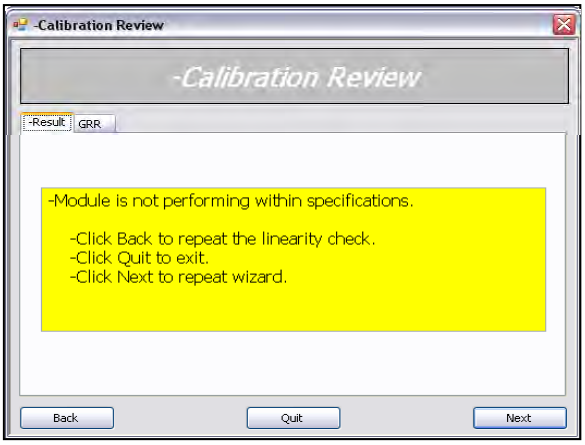
- Select **Next** to return to the *Choose Subrange Menu* or select **Quit** to exit Calibration Wizard.



Module is not performing within specifications

Typical Causes:

- Module Requires Calibration.
- Load Cell fixture not secured in stage properly.
- Tooling Misaligned.



Action:

- Click the **Back** button to the *Choose Subrange Menu*.
- Secure the Load Cell Fixture.
- Realign tooling.
- Perform a New GRR (see step 1).
- Perform a New Calibration (see Section 2, step 3).

NOTE: IF GR&R continues to fail after calibration, contact customerservice@royceinstruments.com for further instructions.

Chapter 5

Reference Material

This section contains application specific information, consumable products, glossary and index.

Glossary

Absolute value	For bond test systems, the force applied by weights certified as traceable to NIST and used as standards for calibration.
Accuracy	Deviation from the true or accepted value, or the distance from point to the center of the target.
Gripper pull test	Evaluates the strength of a bond. A gripper tool is positioned around a wire bond, ribbon bond, or given feature, and a pulling force is applied. The peak force required to break the bond is measured and recorded.
Ball shear test	Evaluates the strength of a bond. A shear tool is placed against the edge of the ball bond and a horizontal force is applied. The peak force required to shear the ball from the pad is measured and recorded.
Destructive test	A bond test that destroys the bond.
Die shear test	Evaluates the overall quality of the die attach process. A shear tool makes contact with the full length of the die edge. The force is applied perpendicular and parallel to the die attach or substrate plane. The force required to shear the die from the substrate is measured and recorded.
Error	The difference between the measured force and the absolute value, for example, the difference between a perfect measurement and one actually made. Factors that can affect the degree of error include temperature, non-compliance, creep and vibration, electrical noise, and operator inconsistencies.
Failure code	An engineer-defined description of a type of bond failure. The code typically describes the location of the bond failure and the way it failed.
Force profile	A graphical representation of the force applied to the bond and the force at which the bond breaks.
NDT	Non-destructive test. A test that does not destroy the bond.
Precision	The degree of freedom from random error, or the degree of cluster in the data points. Also, the smallest increment of force that an instrument can detect and respond to.
Recipe	A set of test parameters defined by the process engineer, includes specifications such as maximum and minimum force applied, force profile, number of test samples, etc.
Repeatability	The degree to which the accuracy of a measurement can be duplicated from test to test.
Resolution	The smallest increment an instrument can display,
Sample	A number of individual bond tests, defined by the process engineer.
Test module	Interchangeable modular subsystems that contain high precision mechanical and electronic components for applying and calculating the force applied to a test bond.
Test piece holder	Interchangeable modular tooling which secures samples for all types of bond testing.

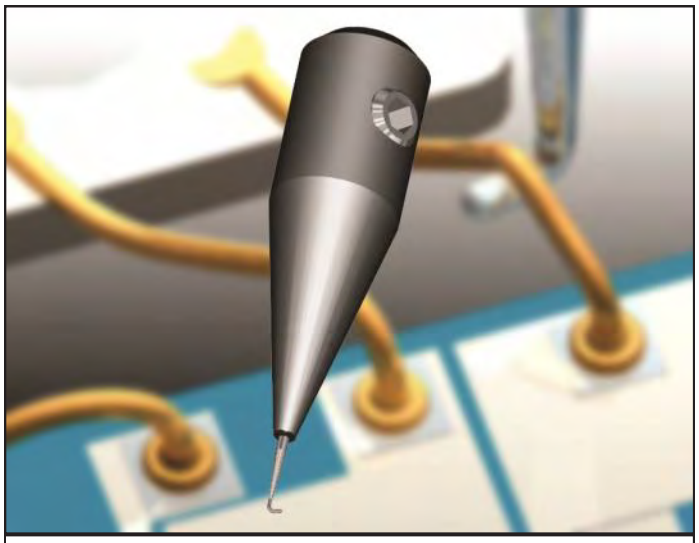
Test statistics	A series of mathematical formulas applied to the test results to analyze the behavior of the data.
Trend chart	A graphical representation of the test results spread; it can depict the average peak force for each sample (multiple tests) or the peak force for each test
Wire pull test	Evaluates wire bond strength and quality. An upward force is applied by a pull hook under the wire, pulling the wire away from the die. The pulling force is applied perpendicular to the die surface. The peak force required to break the wire bond is then measured and recorded.

Index

Wire and Ribbon Pull Test Hooks

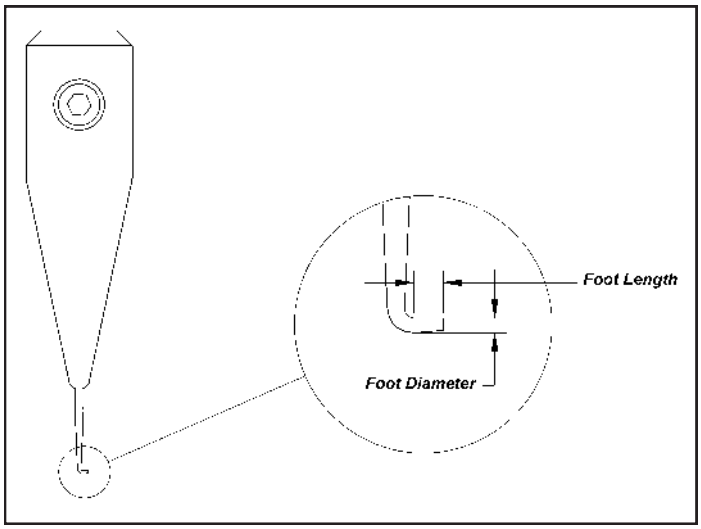
Product Datasheet

Royce Instruments pull test hooks are compatible with Royce Instruments System 550, 552, 580, 610, 620 and 650. The hook dimensions meet the requirements of MIL 883 Method 2011 and 2023. To permit ease of rotation, each hook is carefully adjusted so that it will rotate concentrically. Below are listed the standard hook dimensions. We can usually ship custom hooks to user specified dimensions within a few days.



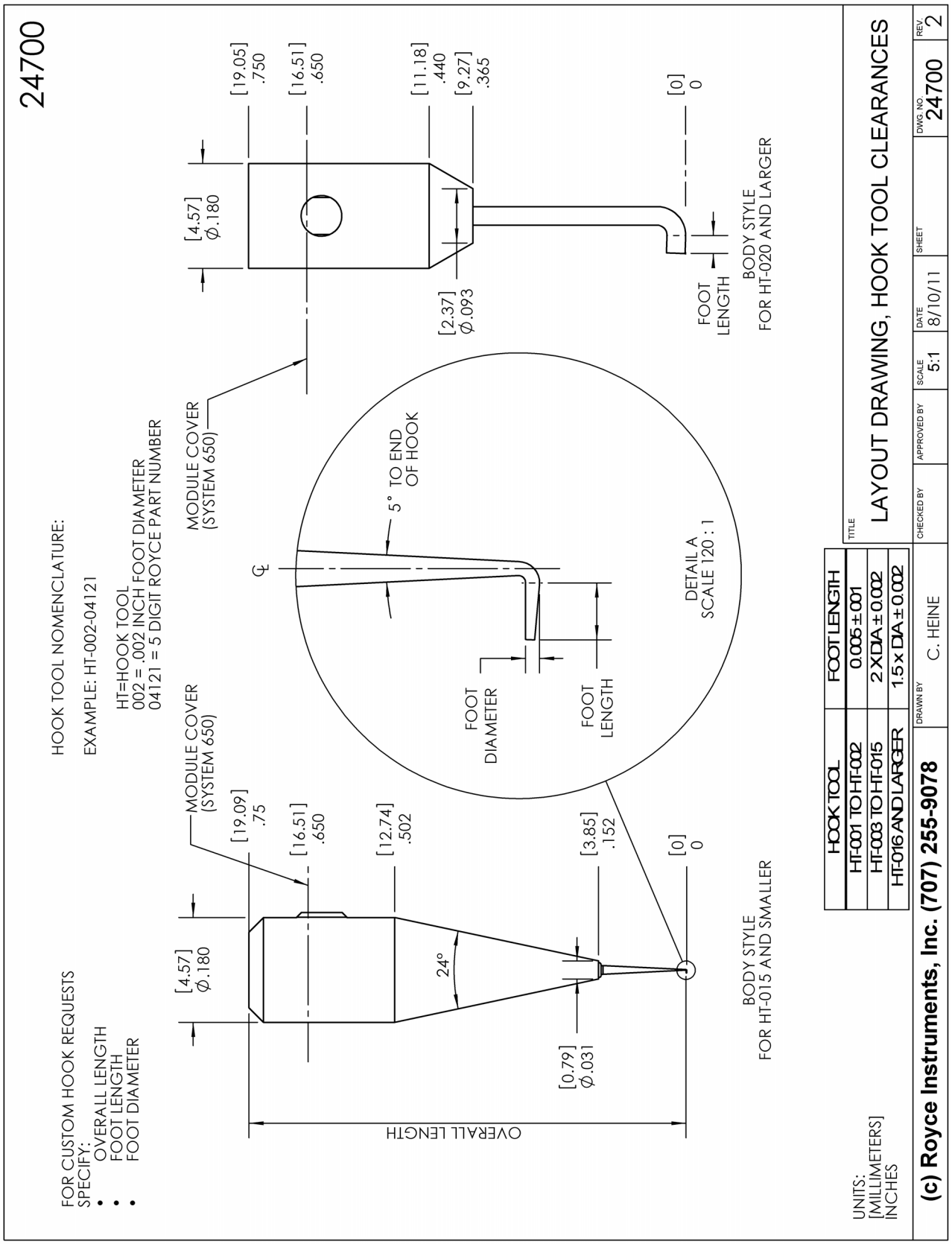
High Precision wire pull test hooks are available in a wide range of standard and custom sizes.

Ribbon pull hook for testing high power ribbon bonds



Choose a foot diameter of at least twice the diameter of the wire to be tested

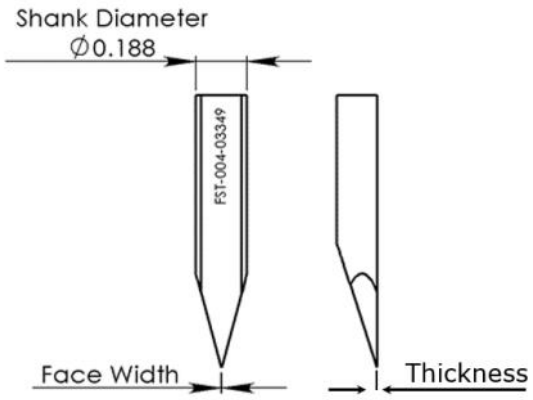
Part Number	Foot Diameter	Foot Length	Max force (g)
HT-001-04120	0.001 in, 25 µm	0.005 in, 125 µm	4
HT-002-04121	0.002 in, 50 µm	0.005 in, 125 µm	13
HT-003-04122	0.003 in, 75 µm	0.006 in, 150 µm	50
HT-004-04123	0.004 in, 100 µm	0.008 in, 200 µm	50
HT-005-04124	0.005 in, 125 µm	0.010 in, 250 µm	113
HT-006-04125	0.006 in, 150 µm	0.012 in, 300 µm	113
HT-010-04129	0.010 in, 255 µm	0.020 in, 500 µm	314
HT-015-04134	0.015 in, 380 µm	0.030 in, 750 µm	804
HT-020-04135	0.020 in, 505 µm	0.030 in, 750 µm	1257
HT-025-04136	0.025 in, 635 µm	0.037 in, 940 µm	2124
HT-032-04137	0.032 in, 810 µm	0.048 in, 1200 µm	3217
HT-nnn-nnnn	Customer Choice	Customer Choice	TBD


24700
HOOK TOOL NOMENCLATURE:
EXAMPLE: HT-002-04121
HT=HOOK TOOL
002 = .002 INCH FOOT DIAMETER
04121 = 5 DIGIT ROYCE PART NUMBER
FOR CUSTOM HOOK REQUESTS
SPECIFY:
OVERALL LENGTH
FOOT LENGTH
FOOT DIAMETER
MODULE COVER
(SYSTEM 650)
[19.09]
.75
[16.51]
.650
[12.74]
.502
[4.57]
Ø.180
24°
[3.85]
.152
[0]
0
[0.79]
Ø.031
OVERALL LENGTH
BODY STYLE
FOR HT-015 AND SMALLER
5° TO END
OF HOOK
FOOT
DIAMETER
FOOT
LENGTH
DETAIL A
SCALE 120 : 1
[19.05]
.750
[16.51]
.650
[11.18]
.440
[9.27]
.365
[4.57]
Ø.180
[2.37]
Ø.093
FOOT
LENGTH
BODY STYLE
FOR HT-020 AND LARGER
HOOK TOOL
FOOT LENGTH
HT-001 TO HT-002
0.005 ± .001
HT-003 TO HT-015
2 X DIA ± 0.002
HT-016 AND LARGER
1.5 x DIA ± 0.002
UNITS:
[MILLIMETERS]
INCHES
(c) Royce Instruments, Inc. (707) 255-9078
DRAWN BY
C. HEINE
CHECKED BY
APPROVED BY
SCALE
5:1
DATE
8/10/11
SHEET
TITLE
LAYOUT DRAWING, HOOK TOOL CLEARANCES
DWG. NO.
24700
REV.
2

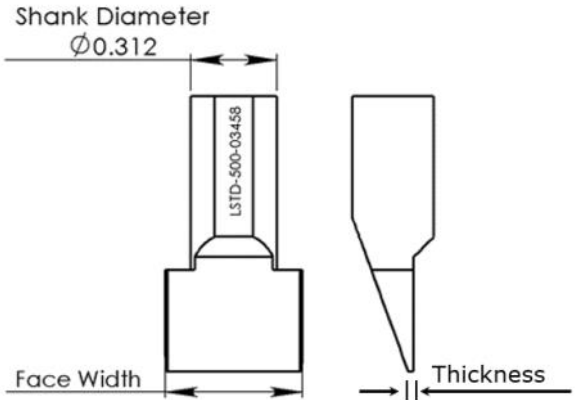
Shear Tools for Bond Testers

Product Datasheet

Royce Instruments shear tools are compatible with test modules used on System 550, 552, 580, 620 and 650. Bond shear tools and die shear tools are similar in overall geometry, however die shear tools have thicker tool tip to handle high die shear loads. Bond shear tools have a thinner tip for access between closely spaced bond pads. All shear tools are made from Tungsten Carbide for its high stiffness and resistance to wear. Below are listed the standard shear tool dimensions. Shear tools are also available to customer specified dimensions. Shear tool should be wider than part to be sheared.



FST Shear Tools



LSTD Shear Tools

Wire Bond Shear Tools For System 620, 650 & 580 SMS &TMS modules up to 5kg forces (0.1875 in, 4.75 mm shank diameter)			
Part Number	Face Width	Tool Thickness	Max Test Force
FST-002-03347	0.002 in, 50 µm	0.002 in	0.11 kg
FST-003-03348	0.003 in, 75 µm	0.002 in	0.16 kg
FST-004-03349	0.004 in, 100 µm	0.002 in	0.19 kg
FST-005-03350	0.005 in, 125 µm	0.002 in	0.22 kg
FST-006-03351	0.006 in, 150 µm	0.002 in	0.27 kg
FST-010-03352	0.010 in, 250 µm	0.003 in	0.69 kg
FST-015-03354	0.015 in, 380 µm	0.003 in	0.96 kg
FST-020-03355	0.020 in, 500 µm	0.003 in	1.22 kg
FST-030-03356	0.030 in, 760 µm	0.003 in	1.75 kg
FST-035-11858	0.035 in, 890 µm	0.003 in	2.01 kg
FST-050-03358	0.050 in, 1.27 mm	0.020 in	5.00 kg
FST-nnn-nnnnn	Customer Choice	TBD	TBD

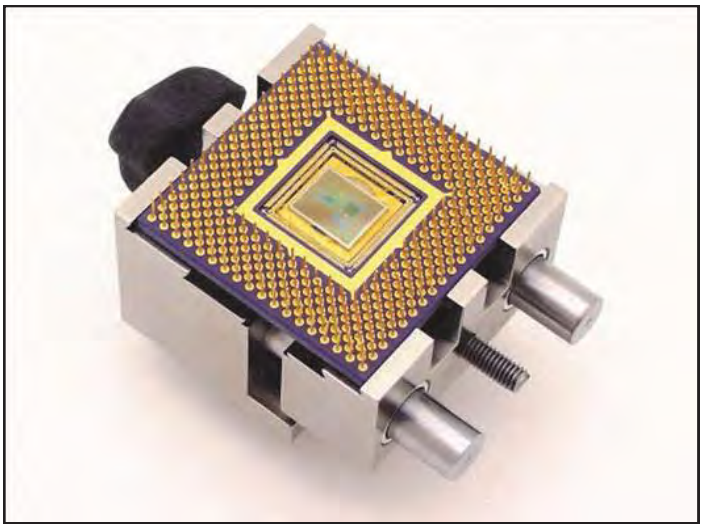
Die Bond Shear Tools For System 650, 580, 552, 550 SMS, TMS & STM modules up to 200kg (0.3125 in, 7.94 mm shank diameter)			
Part Number	Face Width	Tool Thickness	Max Test Force
LSTD-010-05008	0.010 in, 250 µm	0.005 in	1.3 kg
LSTD-020-05202	0.020 in, 500 µm	0.015 in	8.7 kg
LSTD-050-05094	0.050 in, 1.25 mm	0.015 in	19.7 kg
LSTD-100-04095	0.100 in, 2.5 mm	0.020 in	52.7 kg
LSTD-150-04094	0.150 in, 3.8 mm	0.020 in	79.1 kg
LSTD-200-04093	0.200 in, 5.1 mm	0.020 in	105 kg
LSTD-300-04092	0.300 in, 7.6 mm	0.020 in	163 kg
LSTD-350-04091	0.350 in, 8.9 mm	0.020 in	184 kg
LSTD-400-04090	0.400 in, 10.2 mm	0.020 in	200 kg
LSTD-500-03458	0.500 in, 12.7 mm	0.020 in	200 kg
LSTD-nnn-nnnnn	Customer Choice	TBD	TBD

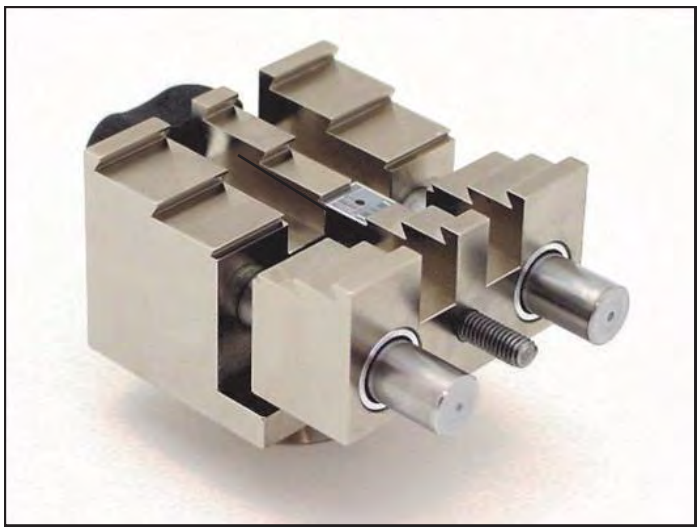
Product Datasheet

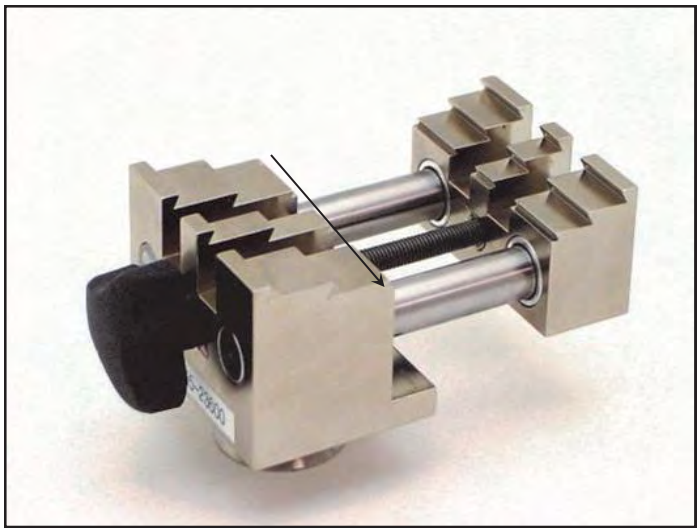
Test Piece Holder TPS-55

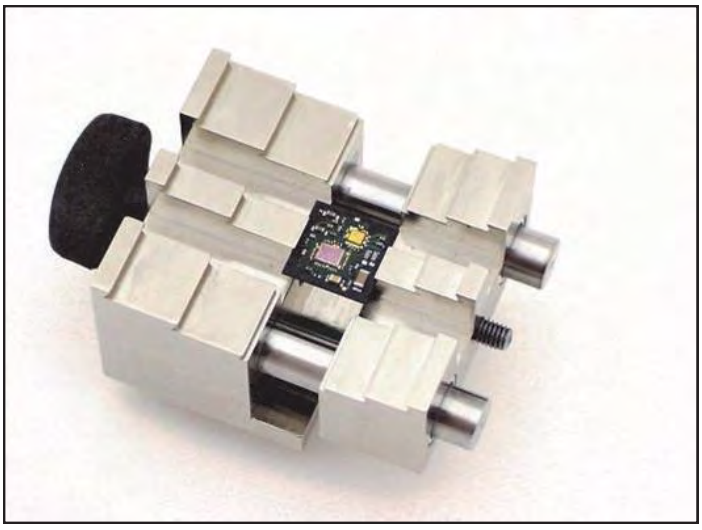
TPS-55 is a low cost, universal “vice” style test piece holder for use up to 20 kgf on the System 650 bond tester.

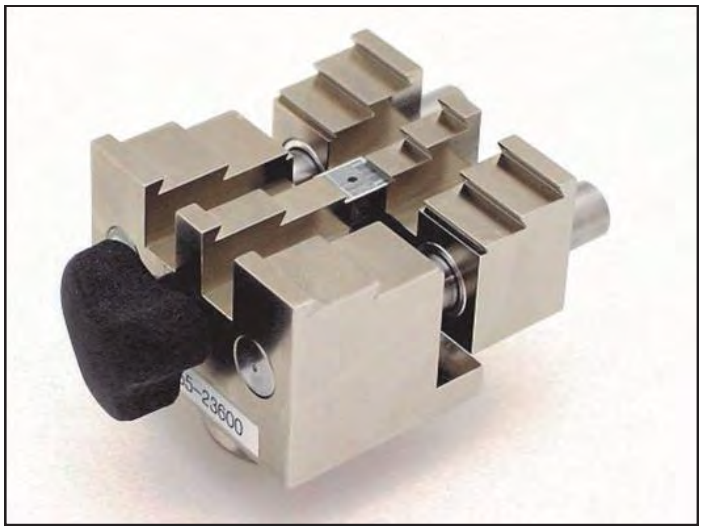
The jaw sets have been designed for maximum flexibility, allowing substrates up to 50 mm square or smaller components as small as 2 mm to be captured securely. Dual Inline IC packages can also be retained due to the relieved geometry of the jaw faces.









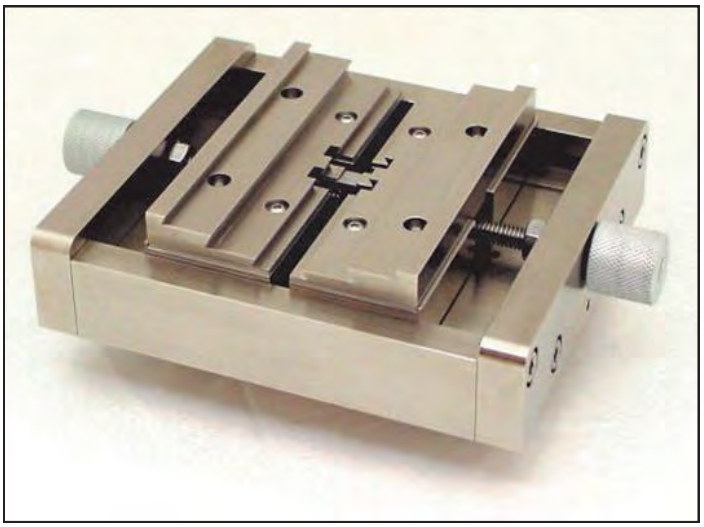


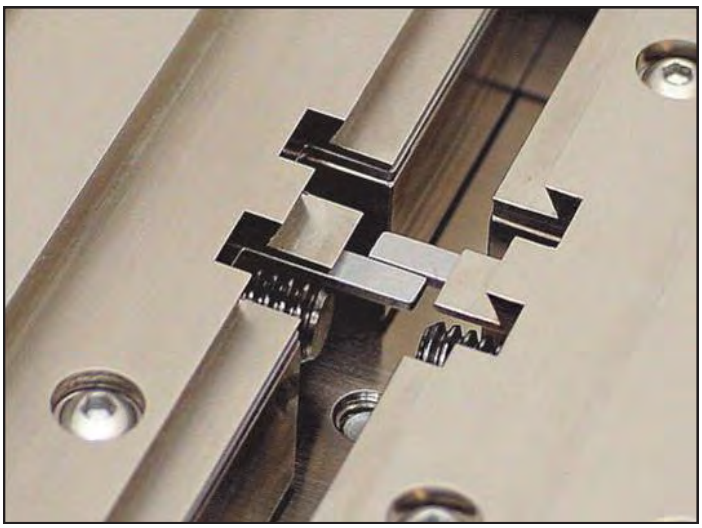
Product Datasheet
Test Piece Holder TPS-200

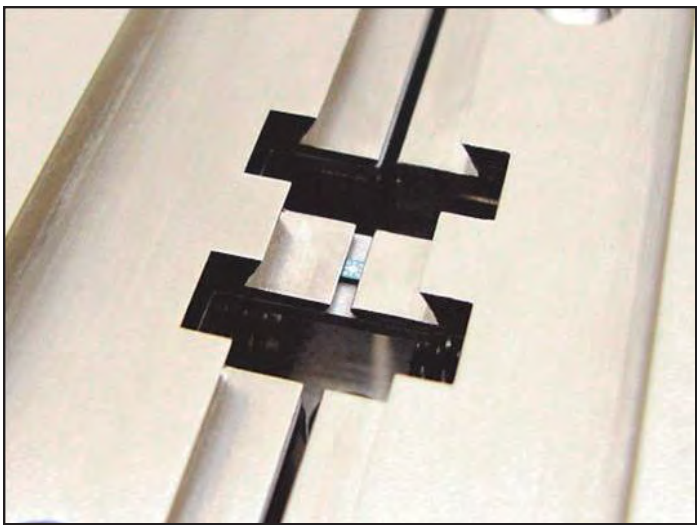
TPS-200 is a universal “vice” style test piece holder for use up to 200kgf on the Royce 650 bond tester.

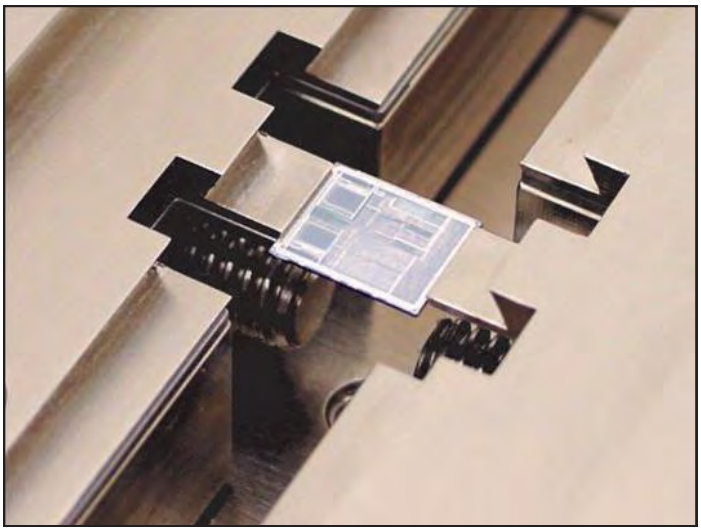
The jaw sets have been designed for the utmost flexibility, allowing substrates up to 100 mm square or individual components such as semiconductor die as small as 0.75mm to be captured securely.

Dual Inline IC packages can also be retained due to the relieved geometry of the jaw faces. The jaw faces are readily removable and may be modified for special applications.









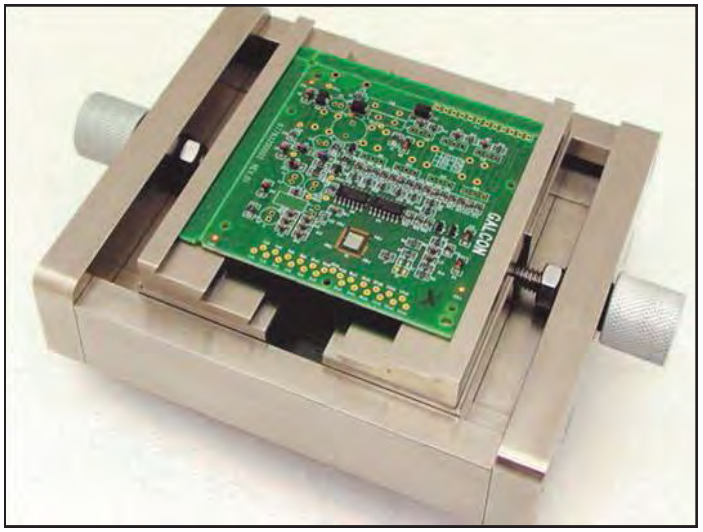
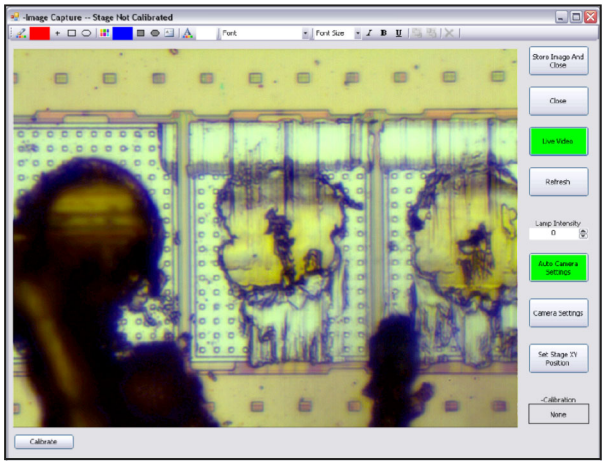


Image Capture

Image Capture

The Royce 650 Image Capture Option offers the ability to digitally store images of bond test failure sites. This option incorporates a high-resolution camera and high-magnification optics that are mounted on the front of the Royce 650. After a test, the motorized stage automatically repositions the bond site underneath the optics for review and image capture. The saved images can be used to create application-specific grading schemes. The standard image capture option (IC-22222) is recommended for viewing individual bond sites at high magnification. A wide zoom range option (IC-23500) is also available for viewing an individual bond site or an entire package.



Technical Details for IC-22222 Image Capture Option

Property / Component	Specification / Description
Compatible Systems	Royce 650 Universal Bond Tester
Approximate Field of View Range	0.005 in x 0.004 in — 0.036 in x 0.027 in. (0.140 um x 0.100 um — 0.920 um x 0.690 um)
Camera	USB CCD color camera, 1600 x 1200 pixels
Integrated Software	• Images can be inspected and saved post test, and are linked to the corresponding test result. • Once the stage is calibrated via an intuitive 3-step procedure, measurements can be displayed in the X and Y directions. • A variety of shapes can be drawn on the video image, and line styles, sizes, and colors can be changed. • Text can be added to the image. • With the Centralized Database option, saved videos and images can be viewed remotely using Desktop BTM.

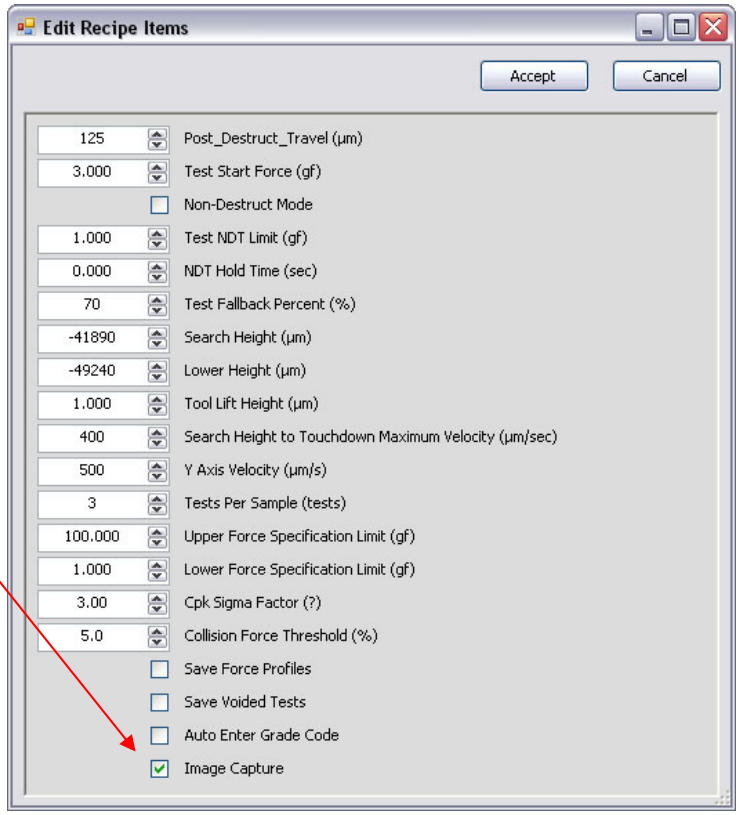
IC-23500 Wide Zoom Range Image Capture Option includes the same specifications seen above, except it includes two different objectives to allow for a field of view range of approximately 0 0.014 inch by 0.010 inch up to 0.719 inch by 0.540 inch. (352 µm by 264 µm up to 18.2 mm by 13.7 mm)

The Image Capture option for the System 650 allows the system to capture, annotate, measure, and save an image of a tested bond site.

Setup

1. Open or create a new test group.

2. Check the **Image Capture** option in the Recipe. Set any other recipe parameters as appropriate for your sample.



3. Test a bond.

4. When the test ends, you will receive the following prompt:

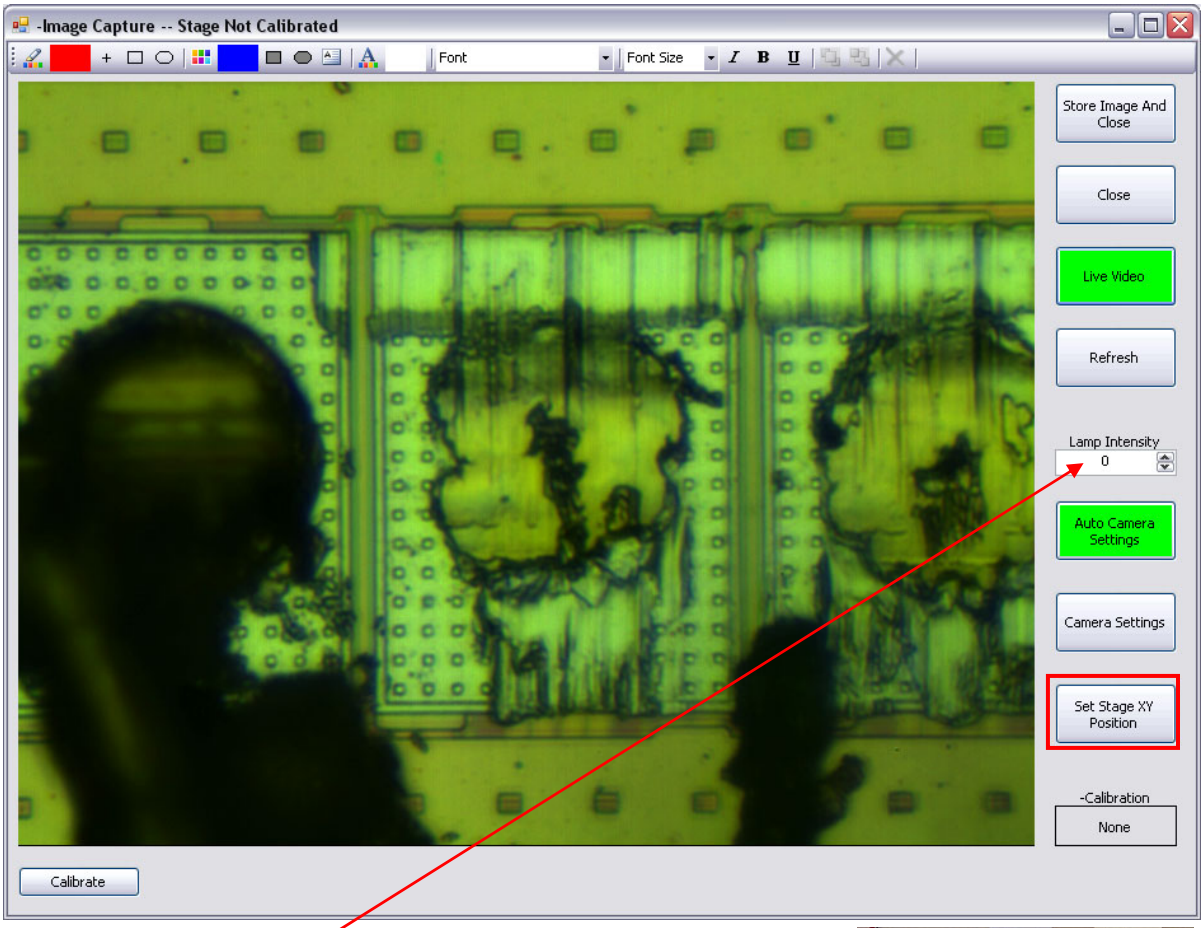
5. Move the tool up to clear obstructions, if necessary, and click OK. This will set the Traverse Height. After each test the tool will move to this height before moving the stage to the inspection position.

6. You will then receive the following prompt:

7. If you click "NO" you will not receive either of the above prompts after the next test and the stage will move to the Traverse Height and then the inspection position automatically after each test.

   Note: If need to adjust the **Traverse Height,** close the test group and then re-open the group. The first test performed after a group is opened will prompt to set the Traverse Height.

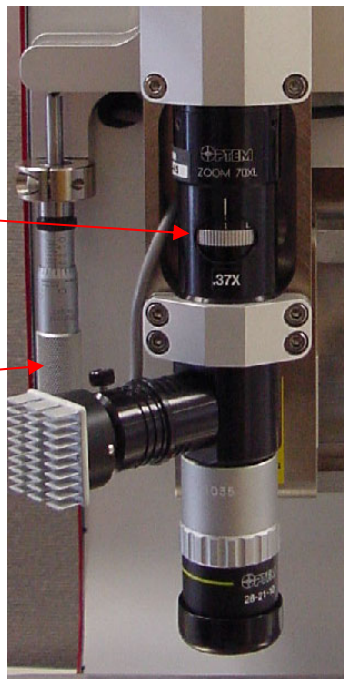
8. You will then see the Image Capture Screen:



9. Set the **Lamp Intensity**, **Zoom** and **Focus** so that you can see the sample clearly.

10. Use the Joysticks to move the stage so that the bond you just tested appears in the center of the image capture screen.

11. Click the **Set Stage XY Position** button to set the position that the stage will automatically travel to for the next and all subsequent tests.



Annotations

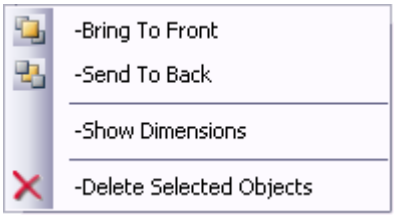
You can add annotations to the image by clicking on one of the buttons shown below.

You can use the annotations to measure distances and areas within the image, however, the image capture system must be calibrated first.

12. Click on the **Calibrate** button and follow the onscreen directions to set the microns per pixel factor.

    Note: If you change the zoom level, you must recalibrate the microns per pixel factor.

13. To display the dimensions of an annotation right click on the annotation to display the context menu and click on **Show Dimensions.**



14. If you click on the **Store Image and Close** button, the Image Capture screen will close and 2 images will be stored to C:\Program Files (x86)\Royce Instruments\650\Images directory. One image will contain just the raw image and the other will include the image and annotations. If you do not want to save the image, click the **Close** button.

15. Grade or void the test and the stage will return to the testing position.

Trinocular Microscope

Trinocular Microscope

The Royce Instruments 600 Series Trinocular Microscope option offers the ability to view and capture live videos of bond tests in the Bond Test Manager software. A high-resolution digital camera is incorporated into a third port on the microscope, which allows the operator to seamlessly transition between the eyepieces and the live video displayed on screen. The trinocular microscope is available on new bond test systems (MS4-TC-26437), or as a field upgrade to existing systems (MS4-TC-26537).

Technical Details for MS4-TC-26437 & MS4-TC-26537 Trinocular Microscopes

Property / Component	Specification / Description
Compatible Systems	Royce 650 Universal Bond Tester; Royce 620 Multitest Bond Tester
Total Magnification Range*	12X - 75X
Field of View*	Eyepieces: 2.5 - 15.6 mm (without 0.75x objective)
Camera	USB CCD color camera, 1600 x 1200 pixels
Integrated Software	• Live video can be viewed before, during, and after testing. • Videos can be automatically recorded and saved during tests, and are linked to the corresponding test results. • Videos can be manually recorded. • Still image snapshots from the camera can be saved. • Videos and images can be reviewed and deleted. • With the Centralized Database option, saved videos and images can be viewed remotely using Desktop BTM.

*A 0.75X objective lens can be removed for higher zoom applications.

Trinocular Microscope User Instructions

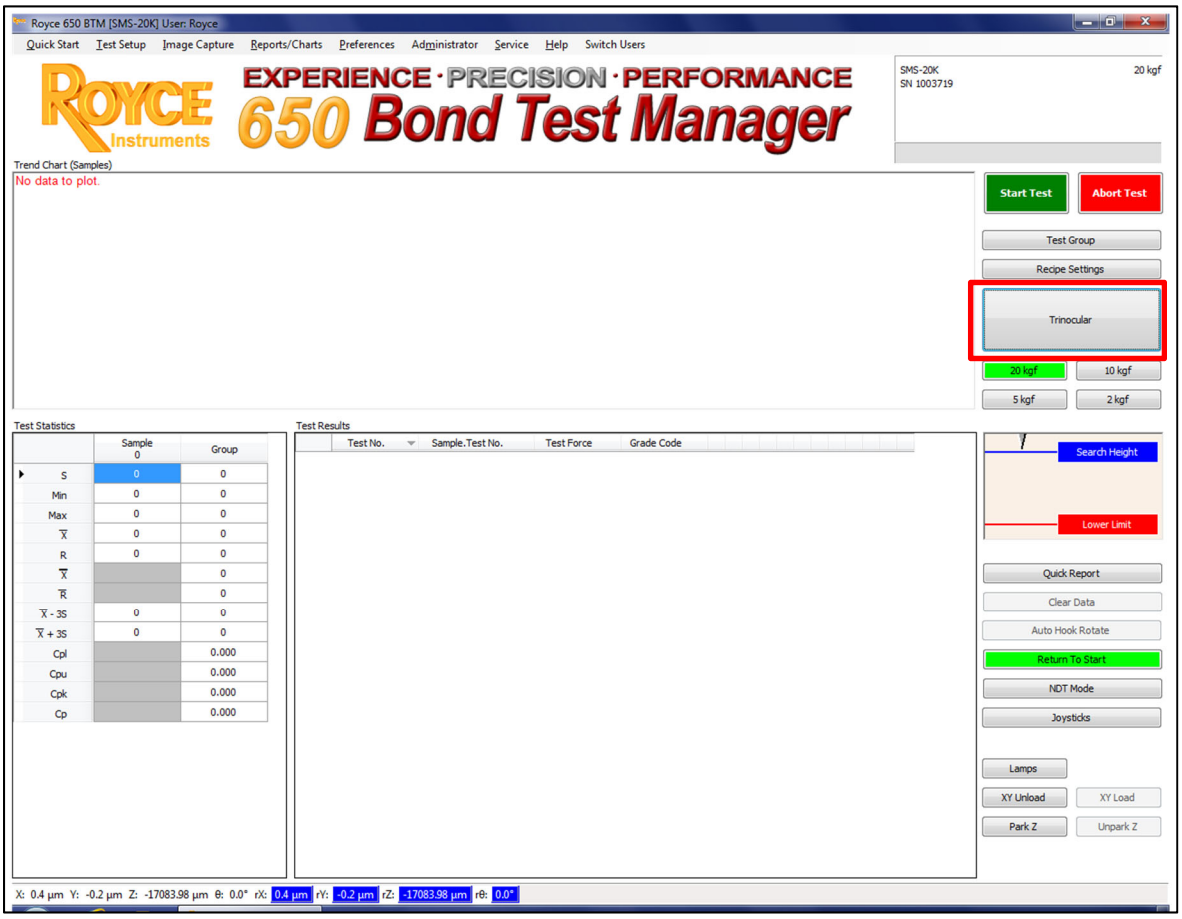
MS4-TC-26437

The Trinocular option for the Royce 650/620 offers the ability to view and capture live images and videos of bond tests in the Bond Test Manager software.

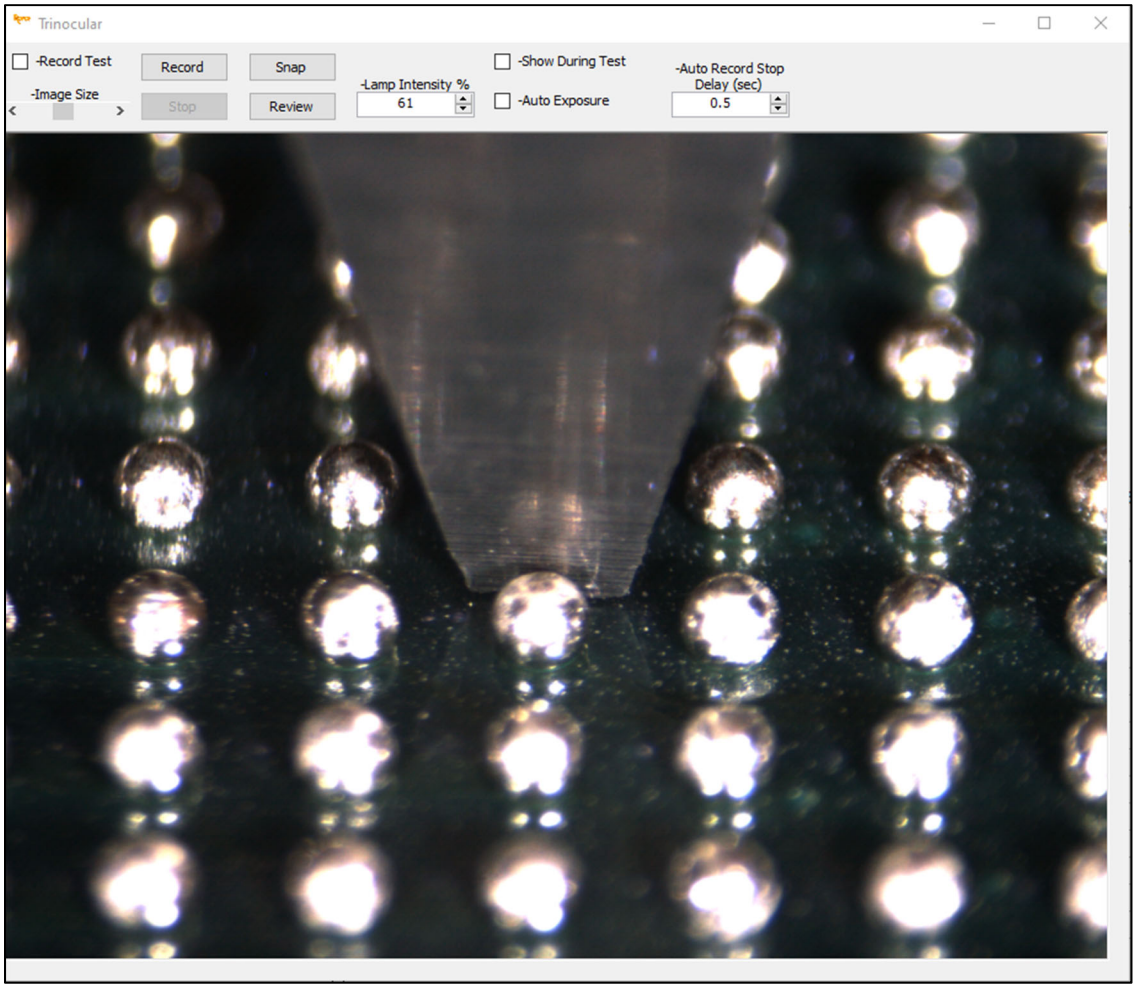
Setup

1. Install appropriate module with shear/hook tool on the system.
2. Open or create a new test group and adjust the recipe settings needed for bond test. Deselect **Auto Enter Grade Code** checkbox to save videos with test data.

3. Mount the sample in the appropriate test piece holder, mount and secure the holder on the stage.
4. Viewing through the microscope, align the shear/hook tool to the bond to be tested, set zoom and focus.
5. Click the **Trinocular** button on the *Main Screen* to launch the *Trinocular Screen*.



6. The *Trinocular Screen* will open. It includes a live video display and control buttons at the top which allow the capture and replay of images and video.

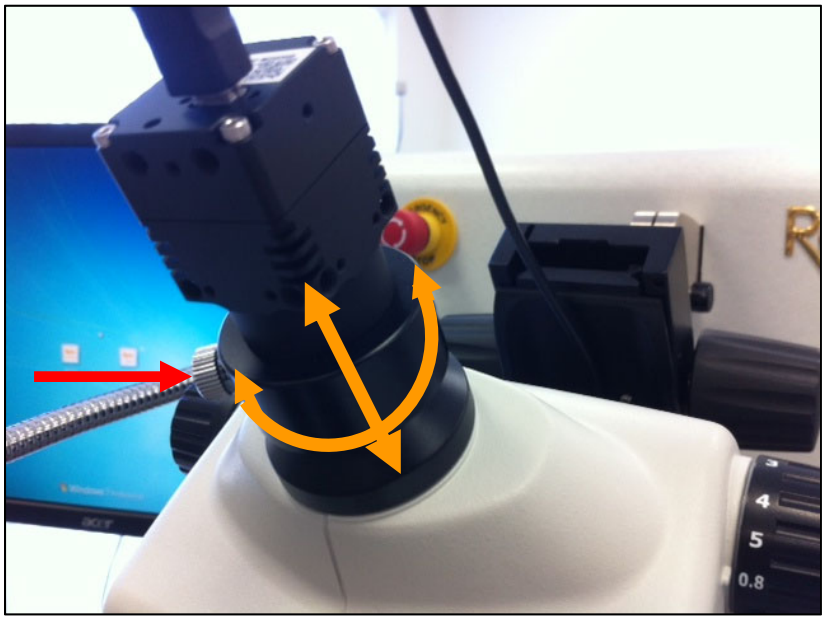


A thumbnail of the live camera image appears on the BTM *Main Screen* to show it's active

Adjust Camera Focus

1. Adjust the Microscope Mount Focus Arm to focus sharply on the sample at max zoom.
2. Each eyepiece has a focus adjustment. Rotating the Bezel moves the eyepiece in/out. Adjust each eyepiece until both views are in sharp focus.

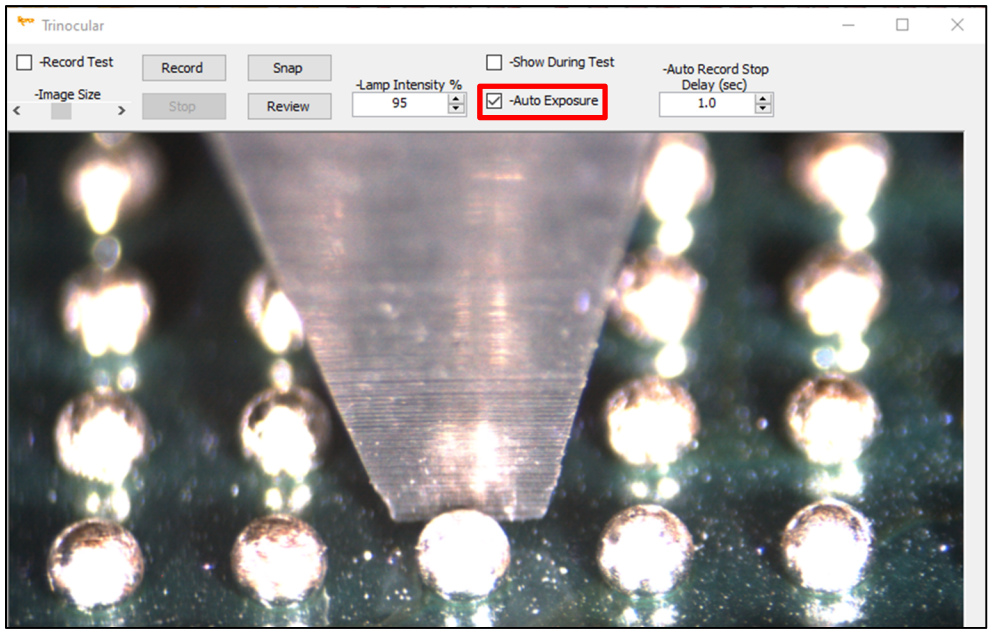
3. Loosen the thumbscrew on the side of the Camera Mount Ring. Move the Camera in/out until it is in sharp focus. Rotate to align image rotation, then tighten thumbscrew to lock in position.



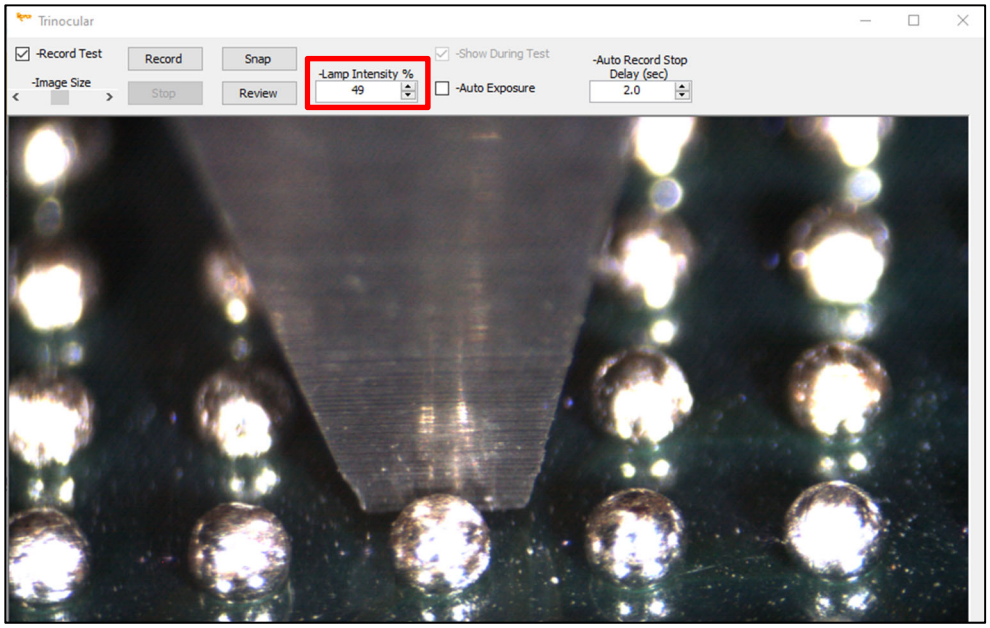
Microscope and camera should now be adjusted and both in focus at the same time.

Setting Lamp Intensity

1. Select the **Auto Exposure** checkbox to automatically adjust the lamp intensity.

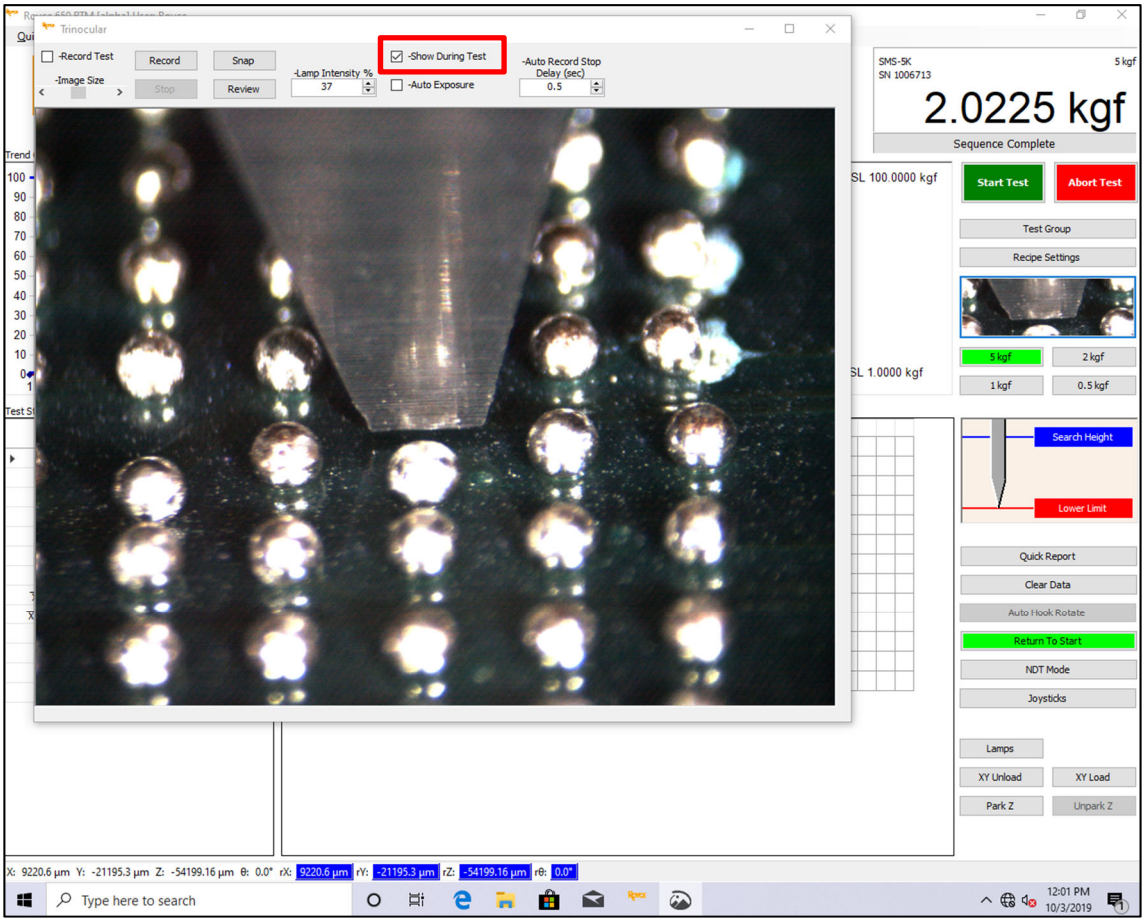


2. Deselect the Auto Exposure checkbox to manually adjust the **Lamp Intensity %** using the up/down arrows.



Test Capture Options

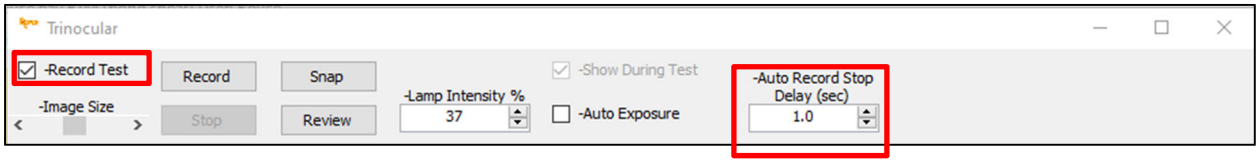
1. Select the **Show During Test** checkbox to show the Trinocular Screen during the bond test. Deselect this checkbox to disable this feature.



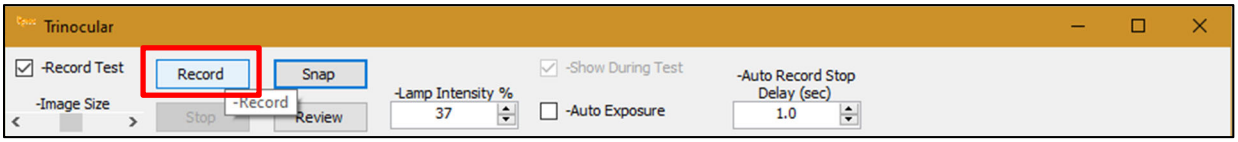
2. Select the **Record Test** checkbox to save the live video of the test to the Images folder. The video is saved with the test data and can be recalled.

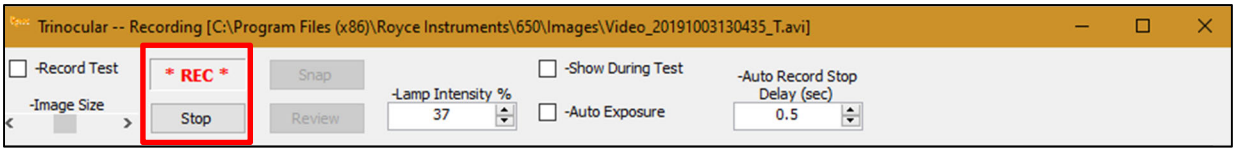
   Note: Record Test requires the Auto Enter Grade Code to be deselected in the test recipe.

3. The **Auto Record Stop Delay (sec)** field allows the user to set an extra time delay after the test is completed. No delay will stop the video recording at the moment the test is completed.

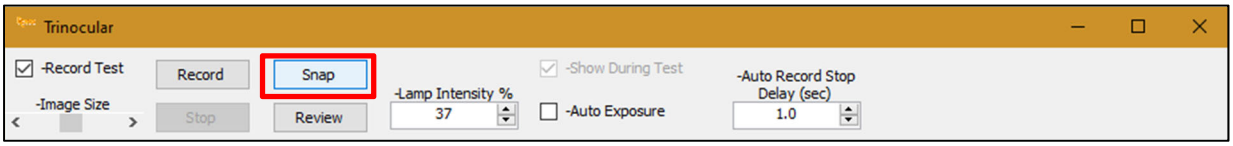


4. **Record – Start / Stop Video**. This button is used for manual recording. The Video is saved to **Images** folder. Video can be reviewed but video cannot be recalled with the test result.



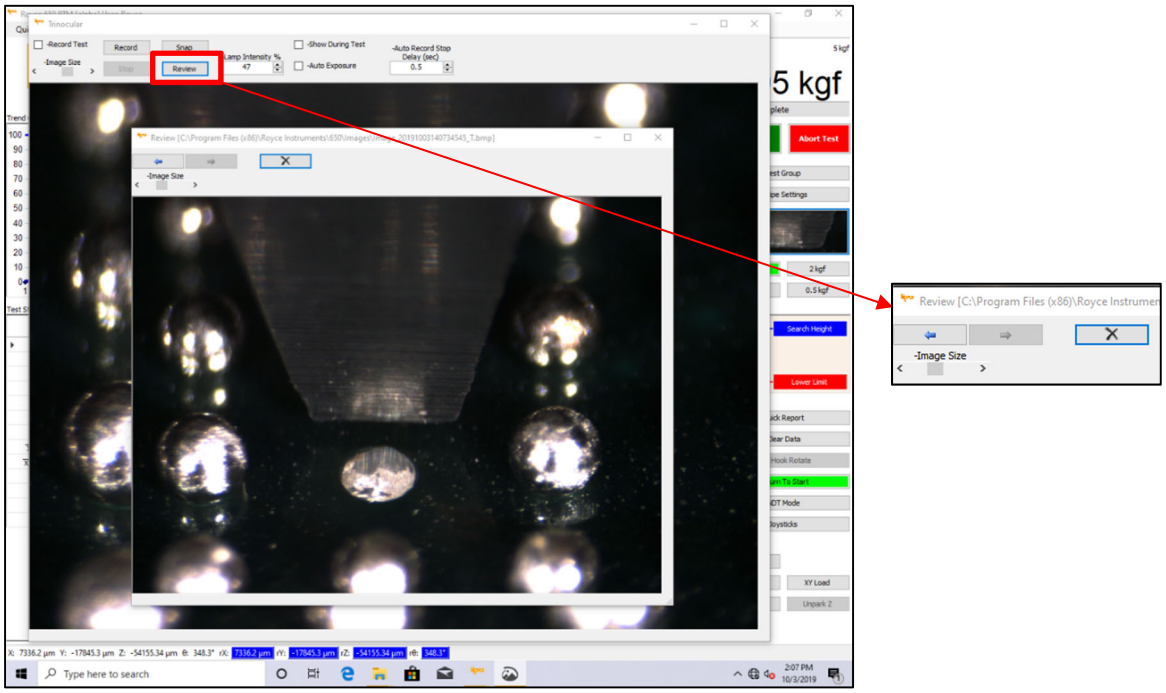


5. **Snap** takes a live still image and saves it to the **Images** folder. Image can be reviewed but is not saved with the test data.

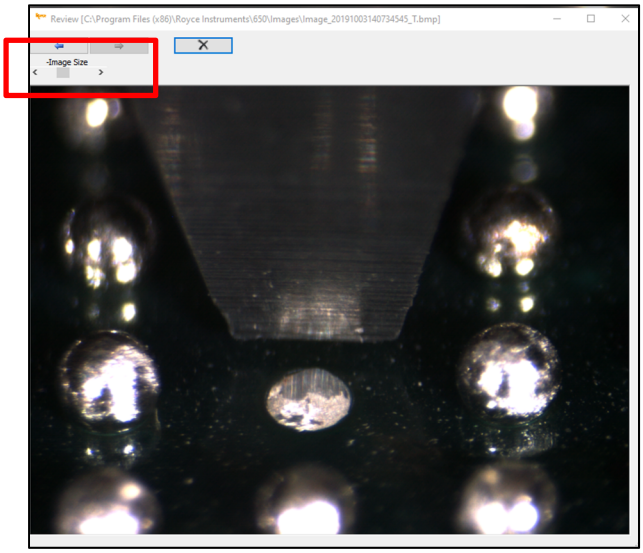


Reviewing Videos and Camera Stills

1. The **Review** button launches the last test video or image with ability to index to previous images or videos, or delete.

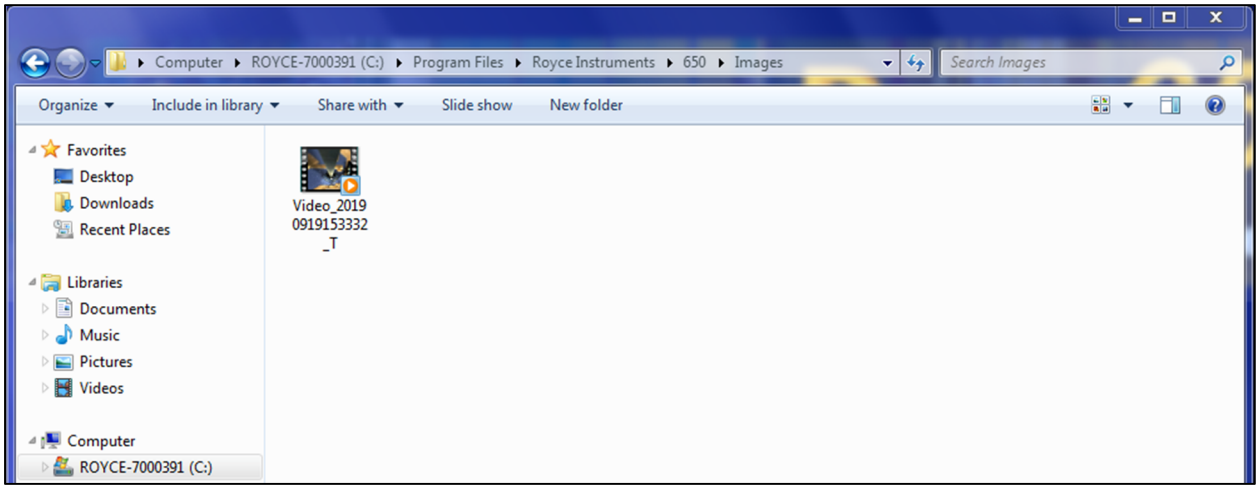


2. Use the **Image Size Slider** to adjust image size.

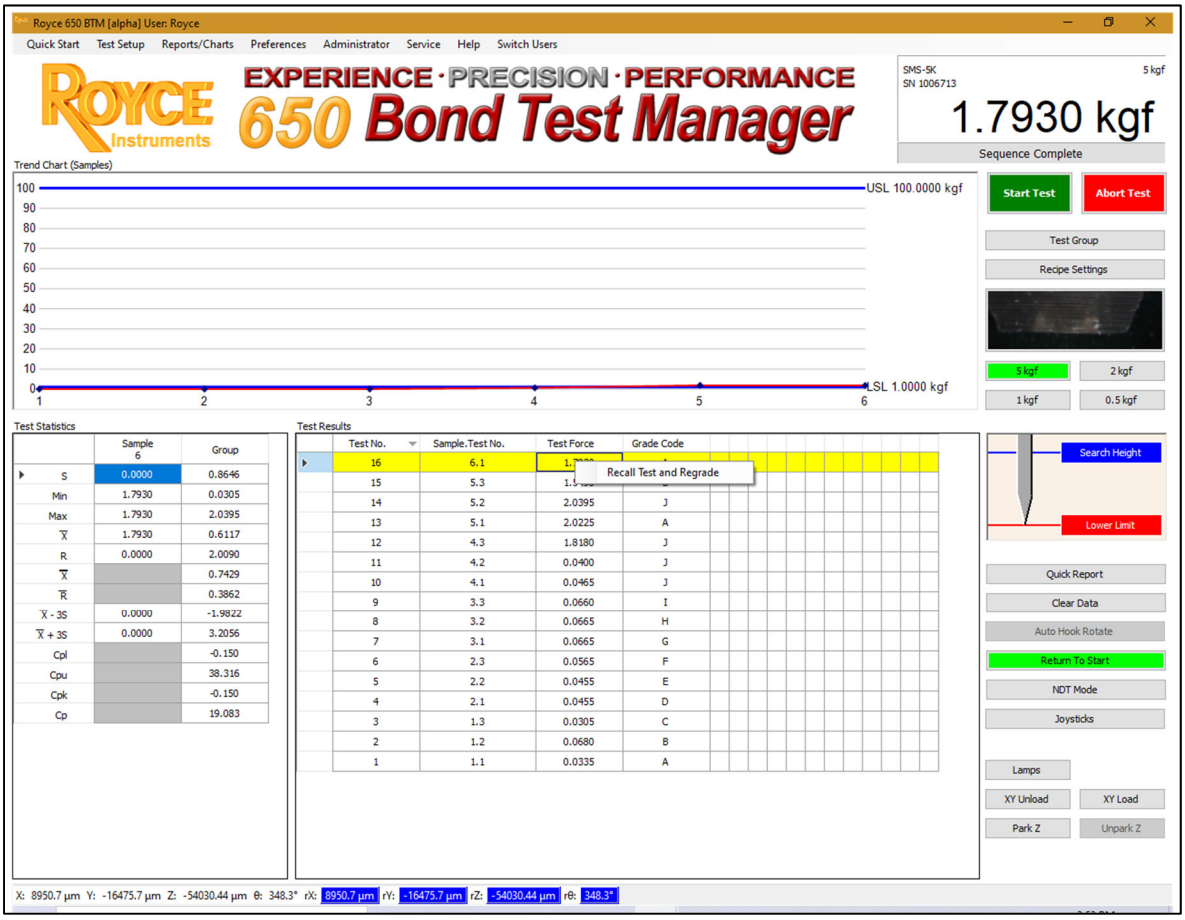


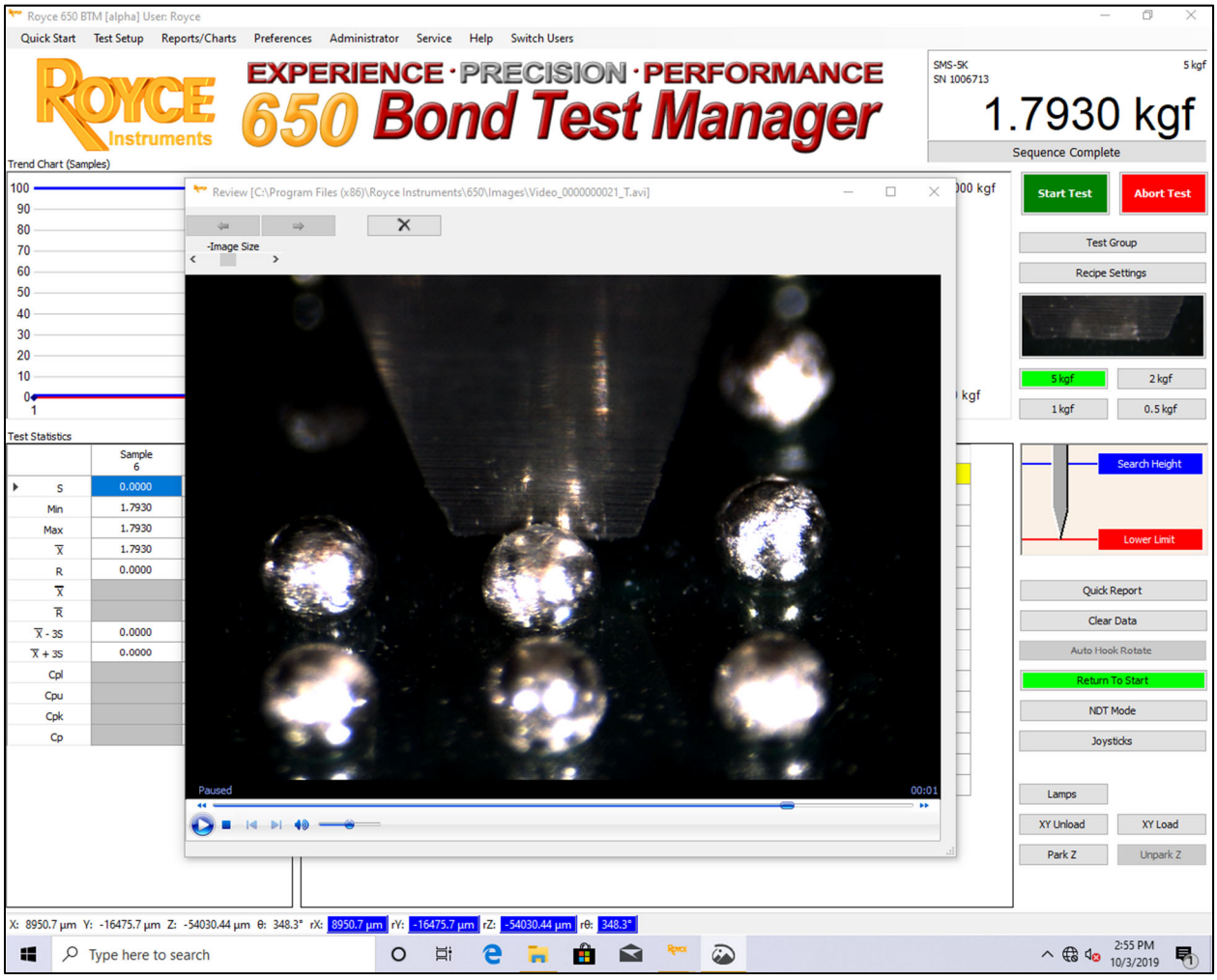
3. The *Images Folder* file path (Windows 10) is shown below.

The *Images Folder* file path (Windows XP & Windows 7) is shown below.



4. **Recall Test and Regrade** (with Recipe Setting **Auto Enter Grade Code** deselected)




Royce 650 BTM [alpha] User: Royce
Quick Start
Test Setup
Reports/Charts
Preferences
Administrator
Service
Help
Switch Users
EXPERIENCE · PRECISION · PERFORMANCE
650 Bond Test Manager
SMS-5K
SN 1006713
5 kgf
1.7930 kgf
Sequence Complete
Trend Chart (Samples)
Review [C:\Program Files (x86)\Royce Instruments\650\Images\Video_0000000021_T.avi]
-Image Size
Paused
00:01
Start Test
Abort Test
Test Group
Recipe Settings
5 kgf
2 kgf
1 kgf
0.5 kgf
Test Statistics
Sample 6
S 0.0000
Min 1.7930
Max 1.7930
X̄ 1.7930
R 0.0000
X̄ - 3S 0.0000
X̄ + 3S 0.0000
Cpl
Cpu
Cpk
Cp
Search Height
Lower Limit
Quick Report
Clear Data
Auto Hook Rotate
Return To Start
NDT Mode
Joysticks
Lamps
XY Unload
XY Load
Park Z
Unpark Z
X: 8950.7 µm Y: -16475.7 µm Z: -54030.44 µm θ: 348.3° rX: 8950.7 µm rY: -16475.7 µm rZ: -54030.44 µm rθ: 348.3°
Type here to search
2:55 PM
10/3/2019

Suggested Spare Parts List

650 Spare Parts

Caution!
Only genuine spares should be used on the Royce 650/620. Failure to use genuine spare parts could render the machine unsafe and void the factory warranty.

Immediate Spare Parts List

Part Number	Description	Qty
12036	O-Ring, X Axis Leadscrew	1
19739	O-Ring, Module Mount Air Seal	1
22354	Y Axis Pre-Load Spring	1
23163	Grease, Y Axis Ball Screw, Mobilith SHC 460	1

Medium Term Spare Parts List

Part Number	Description	Qty
18620	650/620 Keyboard	1
20793	Timing Belt, Y & Z Axis	1
20794	Belt, Y Axis	1
21667	Belt, X Axis	1
23596	650/620 Replacement Right Joystick	1
23598	650 Replacement Left Joystick	1
24287	Replacement Joystick Keypad	1
24289	Replacement 2 Axis Joystick	1

Suggested Spare Parts List

650 Spare Parts (continued)

Long Term Spare Parts List

Part Number	Description	Qty
23858	Replacement X-Axis Leadscrew Assembly 650	1
24248	Replacement Module Interface PCB 650/620	1
24275	Replacement Z-Axis Motor and Cable 650	1
24277	Replacement X-Axis Motor and Cable 650	1
24279	Replacement Controller PCB 650	1
24281	Replacement Joystick PCB 650/620	1
24283	Replacement Main Power Supply 650/620	1
24285	Replacement PMC PCB 650/620	1
24649	Replacement Module Lock 650/620	1
24764	Replacement TPDS Lock Knob 650/620	1
25173	Z-Axis Glass Encoder Retrofit Upgrade	1
26434	Replacement Glass - Z-Axis Encoder (with Retrofit Kit 25173 already installed	1
26667	Replacement Glass - Z-Axis Encoder 650/620	1
26681	Replacement Y-Axis Motor and Cable 650	1
27249	Replacement Z-Axis Encoder and Home Cable 650	1
27721	Replacement Gooseneck LED	2
28285	Windows 10 Upgrade Kit from Windows XP (includes: Motherboard, SSD preloaded with current version BTM & DVD Drive); Requires MONITOR 1280 X 1024 Resolution [18394]	1
28287	Windows 10 Upgrade Kit from Windows 7 (includes: Motherboard, SSD preloaded with current version BTM & DVD Drive); Requires MONITOR 1280 X 1024 Resolution [18394]	1
SPHD-28278	Replacement SSD 650/620 (preloaded with current version of BTM and Windows 10)	1

Suggested Spare Parts List

620 Spare Parts

Caution!
Only genuine spares should be used on the Royce 650/620. Failure to use genuine spare parts could render the machine unsafe and void the factory warranty.

Immediate Spare Parts List

Part Number	Description	Qty
2091	620 MPS Air/Vacuum Quick Disconnect O-Ring	1
5932	620 MPS Vacuum Quick Disconnect	1
6092	620 MPS Air Quick Disconnect	1
19739	650/620 O-Ring, Module Mount Air Seal	1

Medium Term Spare Parts List

Part Number	Description	Qty
18620	650/620 Keyboard	1
20793	Timing Belt, Z Axis	1
23596	650/620 Replacement Right Joystick	1
24287	Replacement Joystick Keypad	1
24289	Replacement 2 Axis Joystick	1

Suggested Spare Parts List

620 Spare Parts (continued)

Long Term Spare Parts List

Part Number	Description	Qty
24248	Replacement Module Interface PCB 650/620	1
24281	Replacement Joystick PCB 650/620	1
24283	Replacement Main Power Supply 650/620	1
24285	Replacement PMC PCB 650/620	1
24649	Replacement Module Lock 650/620	1
24764	Replacement TPDS Lock Knob 650/620	1
25173	Z-Axis Glass Encoder Retrofit Upgrade	1
26667	Replacement Glass - Z-Axis Encoder 650/620	1
26681	Replacement Y-Axis Motor and Cable 650/620	1
27242	Replacement Z-Axis Motor and Cable 620	1
27244	Replacement Z-Axis Encoder and Home Cable 620	1
27247	Replacement Controller 620	1
27721	Replacement Gooseneck LED 650/620	2
28285	Windows 10 Upgrade Kit from Windows XP 650/620 (includes: Motherboard, SSD preloaded with current version BTM & DVD Drive); Requires MONITOR 1280 X 1024 Resolution [18394]	1
28287	Windows 10 Upgrade Kit from Windows 7 650/620 (includes: Motherboard, SSD preloaded with current version BTM & DVD Drive); Requires MONITOR 1280 X 1024 Resolution [18394]	1
SPHD-28278	Replacement SSD 650/620 (preloaded with current version of BTM and Windows 10)	1

EXPRESS WARRANTY, EXCLUSION AND DISCLAIMER OF UNSTATED WARRANTIES AND LIMITATION OF LIABILITY

V-TEK Inc (V-TEK) manufactures equipment for the Royce Instruments and V-TEK International brands. The following warranty applies to both product lines.

1. V-TEK warrants for one year from date of receipt by end user that equipment manufactured by V-TEK will be free of defects in workmanship and materials.
2. All integrated products purchased by V-TEK and integrated on to V-TEK equipment shall be covered in accordance with the manufacturer's pass through warranty and limited in costs equal to the amount of the manufacturer's pass through warranty.
3. V-TEK's obligation under this warranty applies only to the original Customer and commences when V-TEK is notified of name, address of Customer, and date of receipt of equipment.
4. During the warranty period, V-TEK will replace any defective non-consumable parts returned for that purpose to the designated V-TEK Replacement Parts Center or at V-TEK's option, refund original cost of equipment.
5. Authorization to return Articles purchased from V-TEK must be obtained by Customer before return shipping commences.
6. Credit may be granted, less an appropriate restocking charge of 15 to 20% of invoice amount, depending on the reason for the return and condition of the Articles.
7. Returns should always be carefully packed in original shipping carton and sent via ground service. V-TEK does not assume any liability for damage incurred during shipment.
8. For the first 30 days that you own your V-TEK product, V-TEK will be responsible for ground shipments to and from V-TEK's facility in Mankato, MN, U.S.A. or its designate. For the remainder of your warranty V-TEK will pay freight for returning your product to you after its repair.
9. Customer shall bear all charges for customs duty fees or freight above the ground rate or for articles returned which are not defective.
10. Collect shipments will not be accepted.
11. Insurance coverage during shipping is the responsibility of the Customer. V-TEK does not assume any liability for damage incurred during shipment.
12. The warranty applies only to normal use of the equipment and shall be void if V-TEK determines that defects in or failures of the equipment were caused by the Customer's negligence including the lack of proper preventative maintenance, misuse or accident or by unauthorized repair, alteration or installation.
13. This Warranty does not extend to consumable items or mechanical parts subject to normal wear.
14. Customer's exclusive remedy for claims against V-TEK shall be the repair or replacement of defective equipment and parts.
15. Any modification to the standard configuration of this equipment as delivered will void the warranty, unless V-TEK personnel make the modification.

THIS WARRANTY IS EXPRESSLY MADE IN LIEU OF ANY AND ALL OTHER WARRANTIES, EXPRESSED OR IMPLIED, INCLUDING THE WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE. IN NO EVENT WILL V-TEK BE LIABLE FOR INCIDENTAL, SPECIAL OR CONSEQUENTIAL PENALTIES OR DAMAGES, INCLUDING LOST PROFITS OR PENALTIES AND/OR DAMAGES FOR DELAY IN DELIVERY OR FAILURE TO GIVE NOTICE OF DELAY EVEN IF V-TEK HAS BEEN ADVISED OF THE POSSIBILITY OF SUCH DAMAGES.

PASS THROUGH WARRANTIES ARE AVAILABLE FROM THE RESPECTIVE MANUFACTURERS**.**

SERIAL NUMBER:

MODEL:

DATE OF MANUFACTURE: