Instron Training Notebook

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University of California, Riverside

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Before you begin…

- ❑ Complete the required safety training modules on UC Learning
  - ❑ Laboratory Safety Orientation (Fundamentals) 2013
  - ❑ Hazardous Waste Management
  - ❑ Compressed Gas Safety
- ❑ Submit a copy of your Training Transcript to Lab Manager
- ❑ Review the MSE 150 250 309 Policies and Regulations
- ❑ Fill out the MSE 150 250 309 Authorization Form with PI signature
- ❑ Provide your ENGR user name to Lab Manager to set up Faces account
- ❑ Arrange a time for training with Lab Manager
- ❑ Schedule your reservation on Faces for your training

Instron Operation

A. GUI

B. Control Panel

C. Console Control

D. Preparation

E. Removing Load Cells

I. Installing Load Cells

- A. 50 kN
- B. 500 N
- C. 10 N (Huinan Lui Group)

II. Tension Tests

- A. Jaw Faces
- B. Wedge Grips
- C. Preloading
- D. Specimen Loading
- E. Extensometer (optional)

III. Compression Tests

- A. Top Platen
- B. Bottom Platen

IV. Flexure Tests

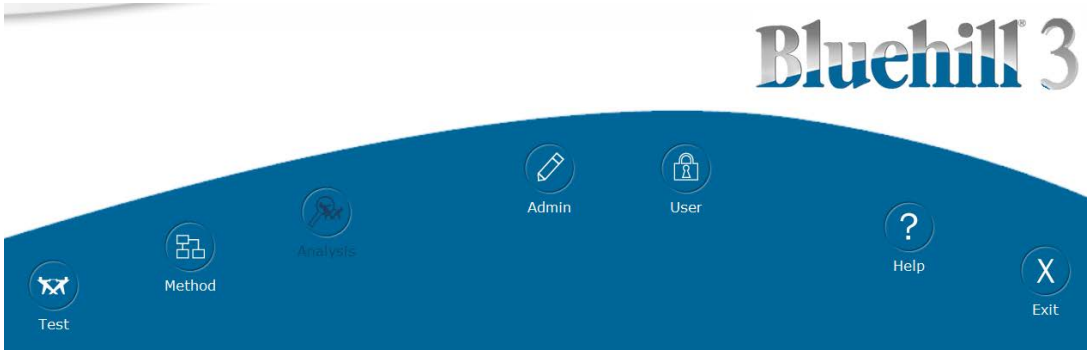
- A. Lower Anvils
- B. Upper Anvils
- C. Alignment
- D. Specimen Loading
- E. Deflectometer (optional)

V. Configuring Test

VI. Running Test

VII. Cleanup

A. GUI – 1/2



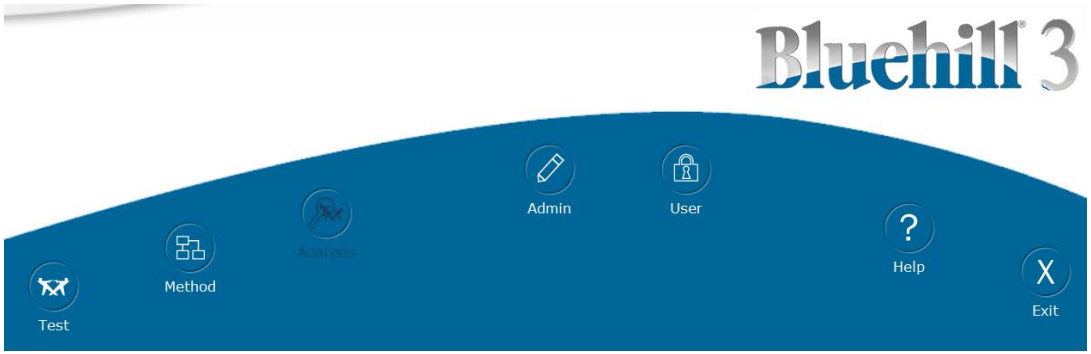
1. *Test Button*

- ***Start a New Sample***
  a) Starting a New Sample enables you to either select an existing test method or create a method "on the fly"
  b) Specify the name of the file the test data will be stored within and begin running tests
- ***Continue a Sample***
  a) Continuing a Sample allows you to open a sample file that had been previously created and test additional samples
  b) This option will allow you to review the data from a previously created Sample

2. *Method Button*

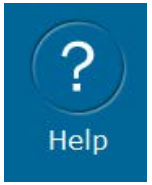
- ***Create a Method***
- ***Choose a Method***
  a) Make changes to the test parameters and either save those changes back to the original test method file (***Save***) or to a new test file (***Save As***)

A. GUI – 2/2



3. Analysis Button 

- Choose a sample to open
- Choose a test method from which to load calculation and result parameters
- Analyze and recalculate test data in a sample

4. Help Button 

- Click to open the Help system

5. Exit Button 

- Click to exit the software

B. Control Panel – 1/4

1. ***Power*** Indicator lights
   - ***Frame Standby*** – Frame is not set to move
   - ***Frame Ready*** – Test system is ready for operation

2. ***Start Test*** button
   - Press this button AFTER setting test parameters to begin test
   - Test in Progress indicator will be illuminated showing direction of ***Crosshead*** movement

3. ***Stop Test*** button
   - Press this button to stop ***Crosshead*** during or end of test
   - Test Stopped indicator will be illuminated showing test has stopped but ***Crosshead*** has not returned to the gauge length position

B. Control Panel – 2/4

4. ***Specimen Protect*** button

- ***On*** – Protects specimen from overloads set by software
- ***Off*** – No protection on specimen from any possible overloads

5. ***Reset GL*** button

- Press this button to set the current position of the ***Crosshead*** as the gauge length or zero extension position
- Pressing ***Return*** button afterwards will return ***Crosshead*** to this gauge length position

6. ***Return*** button

- Press this button to move ***Crosshead*** back to gauge length position
- ***Return in Progress*** indicator will be illuminated to show ***Crosshead*** is returning to gauge length position

WARNING: DO NOT PRESS THIS BUTTON UNLESS YOU ARE READY FOR THE CROSSHEAD TO RETURN TO GAUGE LENGTH POSITION OF 0.000 INCHES!

B. Control Panel – 3/4

7. Δ ***Jog Up*** button

- Press this button to move the ***Crosshead*** upward (in tension)
- Holding the button increases the speed linearly, up to a maximum speed, until you release the button

8. ∇ ***Jog Down*** button

- Press this button to move the ***Crosshead*** downward (in compression)
- Holding the button increases the speed linearly, up to a maximum speed, until you release the button

9. ***Fine Jog*** wheel

- Turn thumbwheel to slowly position ***Crosshead***
- Use to set an accurate zero extension point
- Use to set a precise grip position for loading specimens

B. Control Panel – 4/4

10. ***Toggle*** button

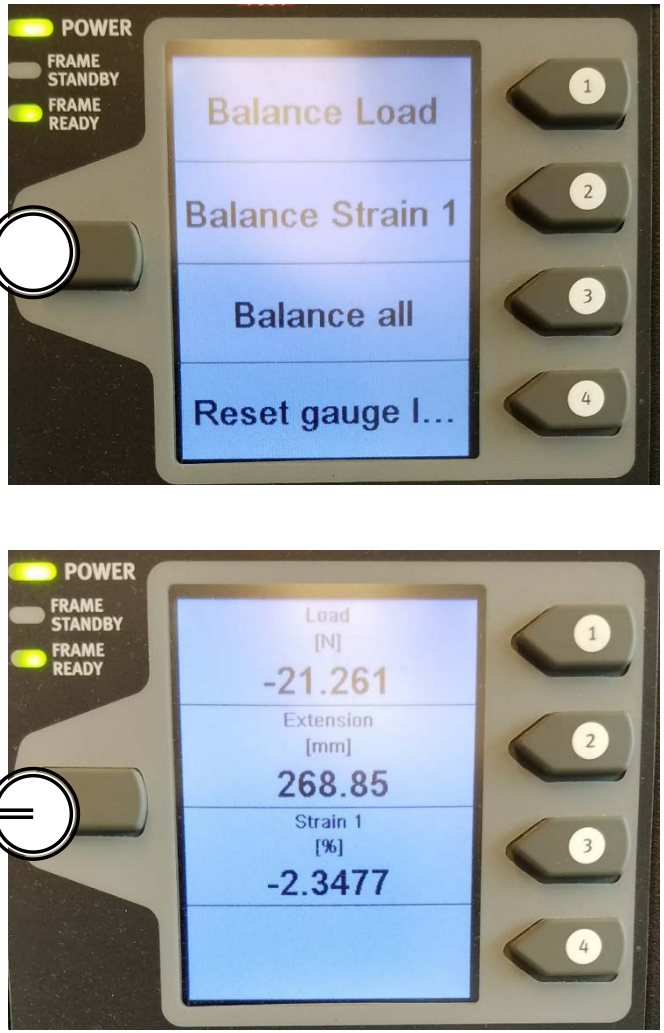
- Use to toggle between the ***Soft Keys*** and the ***Live Displays***

11. “***1***” – ***Balance Load***
    - Balances load to ~ 0.0 N

12. “***2***” – ***Balance Strain 1***
    - Balances strain to ~ 0.0 %
    - Meaningful only when using ***Extensometer***

13. “***3***” – ***Balance All***
    - Balances loads, strain, and resets gauge length

14. “***4***” – ***Zero Extension (or Reset Gauge Length)***
    - Resets extension (or gauge length) back to 0.0 mm



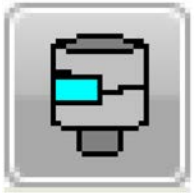
C. Console Control – 1/1

1. *Console Settings*

- Click this icon to access the control panel settings and configure the general ***Live displays***, ***Soft Keys***, frame settings and grips

2. *Calibration of Transducers*

- Calibration of transducers (i.e. load cell) is automatic and its settings should **NOT** be changed

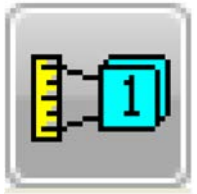


3. *Software Limits*

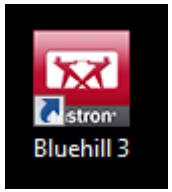
- Software limits are assigned to each transducer and need to be **CONFIRMED**
- These limits are separate from methods and are independently set

4. *Transducer Setup for Extensometer*

- Extensometer settings should **NOT** be changed and values are automatically assigned

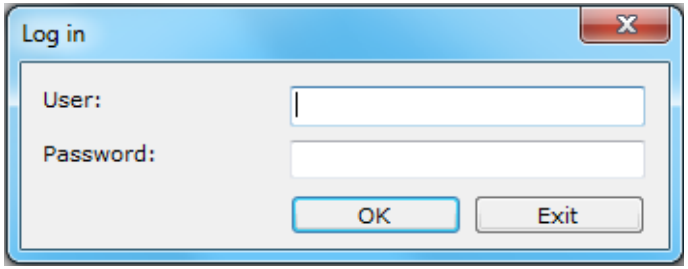


D. Preparation – 1/4

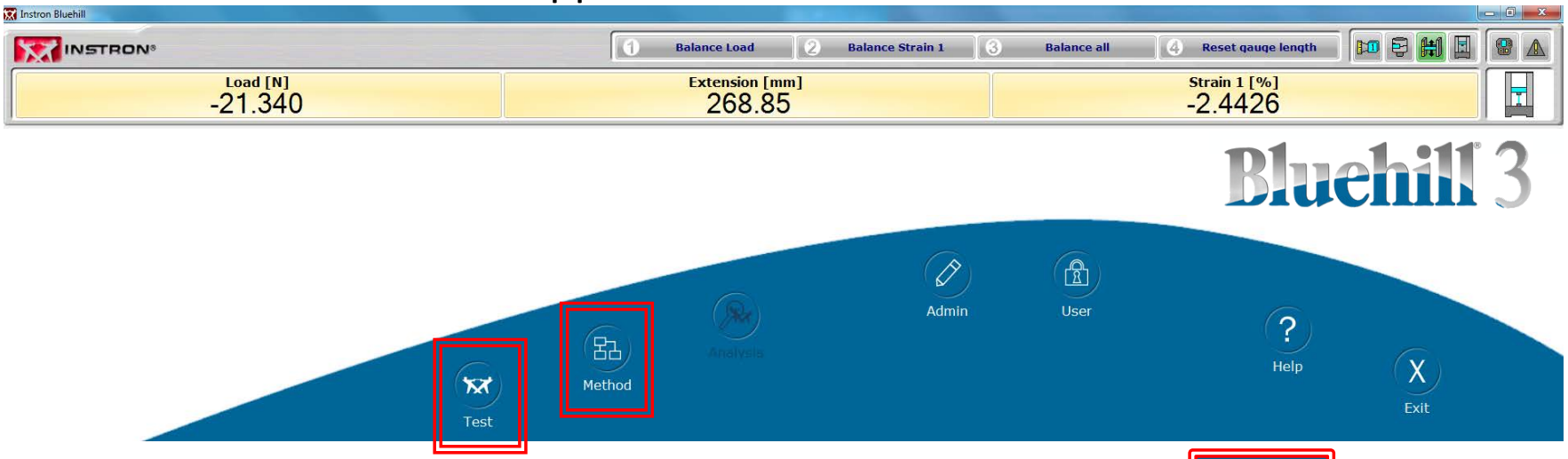


1. Double-click on the ***Instron Bluehill 3*** icon

2. Log in with User: ***mseinstron*** and Password: ***mseffs***



3. The ***Home Screen*** will appear

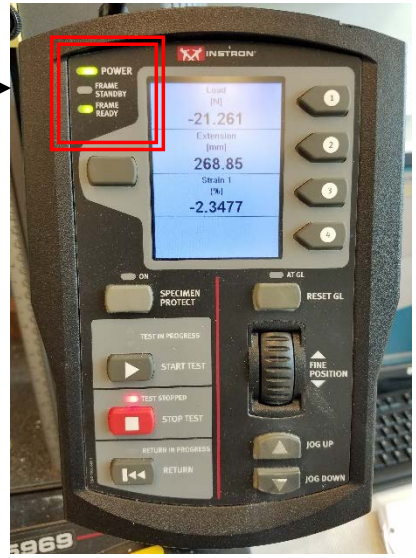


4. Click on ***Method*** to configure a new or existing method

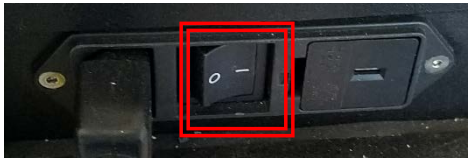
5. Click on ***Test*** if you have a method prepared

D. Preparation – 2/4

6. Check if the Instron is powered ***ON*** via the control panel



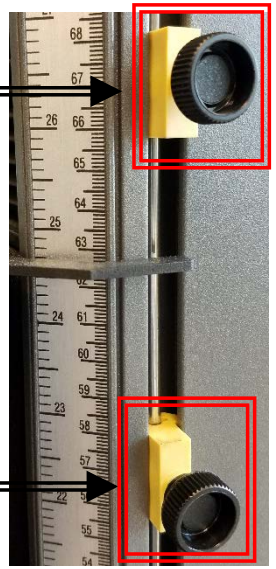
7. If not, turn to ***ON*** at the back of the Instron



8. Check if the ***Crosshead*** is sufficiently high enough to install the desired load cell, grips, or fixtures on measurement scale

9. Always set limits before operating the Instron and ensure appropriate limits are enabled before moving the ***Crosshead***

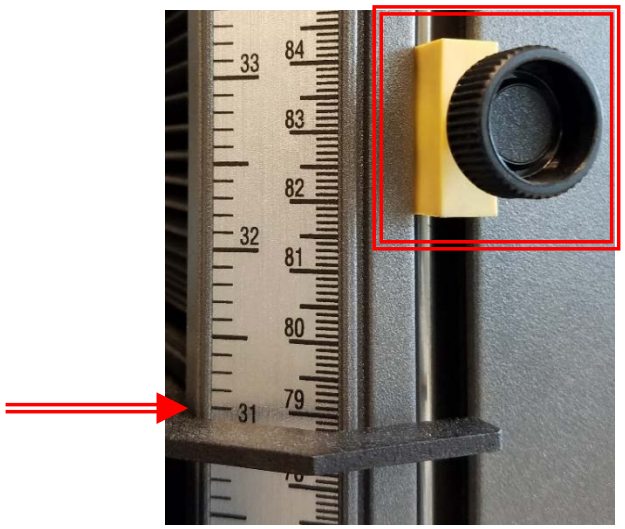
10. Loosen and move the slides to the desired positions and tighten the thumb screws



D. Preparation – 3/4

11. Raise the ***Upper Limit Stop*** on the measurement scale first for desired installation for:

a)	Load Cell	> 16”
b)	Tension Tests	> 31”
c)	Compression Tests	> 22”
d)	Flexure Tests	> 25”



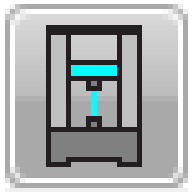
12. Press the ***Jog Up*** Δ on the control panel to raise the ***Crosshead*** to the appropriate height on the measurement scale for desired installation:

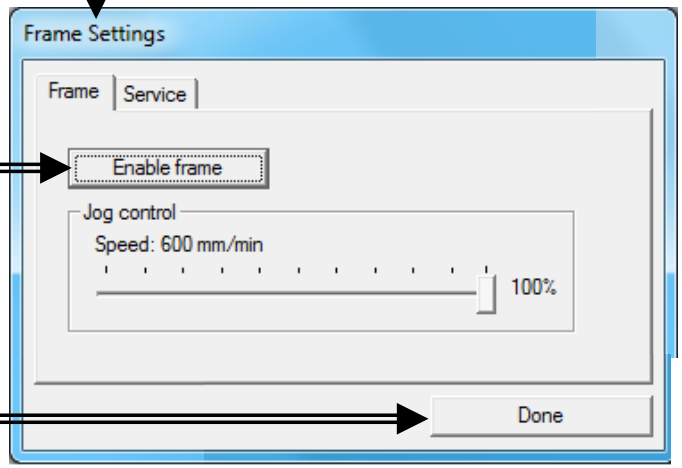
a)	Load Cell	> 16”
b)	Tension Tests	> 31”
c)	Compression Tests	> 22”
d)	Flexure Tests	> 25”

D. Preparation – 4/4

13. Press the ***Emergency Stop*** button to stop the test immediately when a condition develops that:
    - Could affect the safety of persons operating system
    - Could damage the load frame or test fixtures

14. To reset the ***Emergency Stop*** button and re-enable load frame:
    a) Rotate ***Emergency Stop*** button ***clockwise*** until it resets
    b) Click on ***Frame*** button to open the ***Load Frame Settings*** dialog
    c) Click the ***Frame*** tab and ***Enable Frame***
    d) Click ***Done*** and the ***Frame Ready*** light on the control panel should be illuminated





E. Removing Load Cell – 1/2

1. Remove the installed ***Load Cell*** using the ***Breaker Bar***

Breaker Bar

2. Install the appropriate ***Hex Adapter*** to ***Breaker Bar*** for installed ***Mounting Screw***

3. Push ***counter-clockwise*** against the ***Breaker Bar*** until ***Mounting Screw*** “breaks” and becomes loose

4. If necessary, spray a little of ***WD-40*** at top of ***Mounting Screw*** to provide lubrication

50 kN

500 N
and 10 N

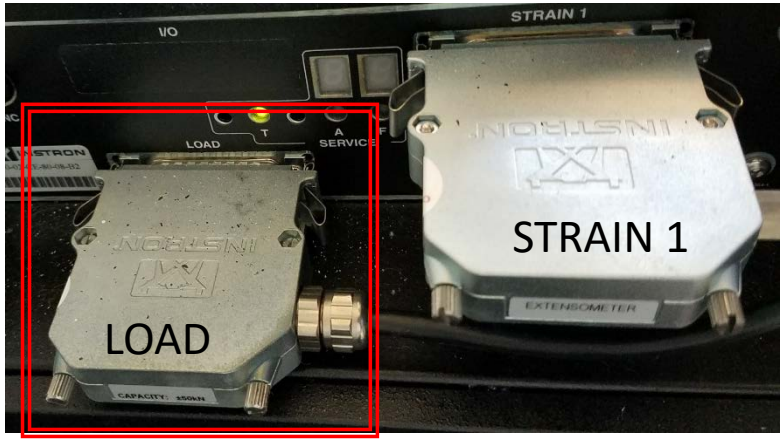
5. Remove the ***Hex Adapter*** from ***Breaker Bar***

6. Support the ***Load Cell*** with one hand while unscrewing the ***Mounting Screw*** with your other hand

NOTE: DO NOT LET THE LOAD CELL DROP AS YOU UNSCREW IT!

E. Removing Load Cell – 2/2

7. Carefully detach the ***Load Cell Cable*** from ***LOAD*** connector on controller



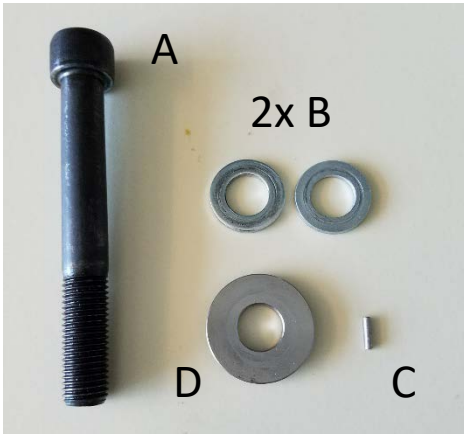
8. Remove the cable from the ***Hook*** on the back of frame

Hook

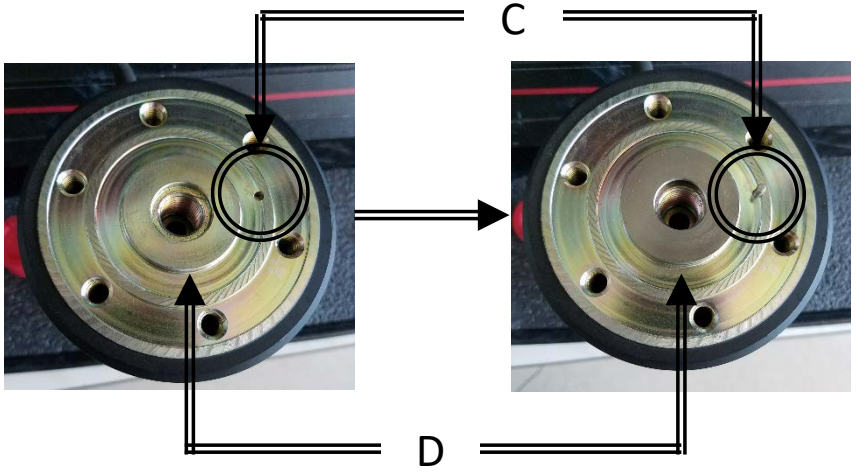
9. Carefully place the uninstalled ***Load Cell*** back in its appropriate ***Storage Box***

I.A. 50 kN Load Cell – 1/4

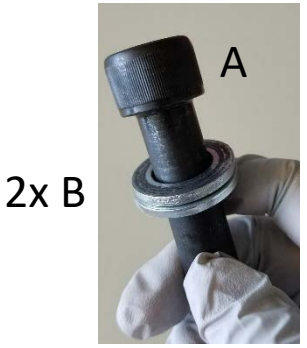
1. Locate the necessary components
   - A. Mounting Screw
   - B. 2 Large Washers
   - C. Anti-rotation Pin
   - D. Locating Ring



2. Insert the ***Anti-rotation Pin (C)*** and ***Locating Ring (D)*** into top of ***Load Cell***



3. Assemble the ***Mounting Screw (A)*** and ***2x Washers (B)***



I.A. 50 kN Load Cell – 2/4

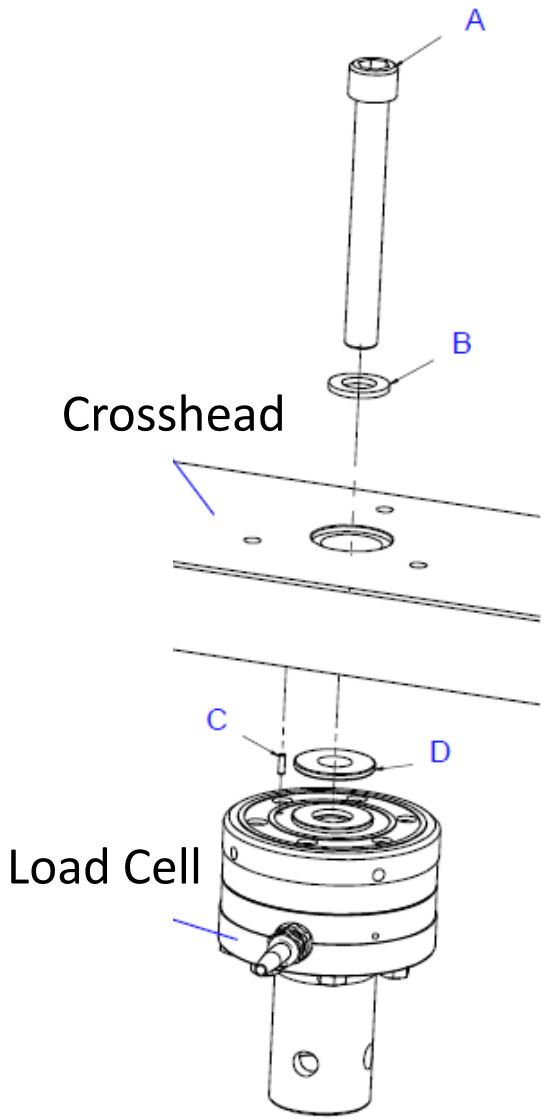
4. Lubricate the ***Mounting Screw*** threads with ***WD-40*** and wipe off any excess with a towel

5. Place the ***Load Cell*** against bottom of ***Crosshead***

6. Align the ***Load Cell*** so ***Anti-rotation Pin*** will fit into slot underneath ***Crosshead*** and cable is toward the back

7. Ensure that ***Anti-rotation Pin*** and ***Locating Ring*** fit securely in place against ***Crosshead*** and ***Load Cell***

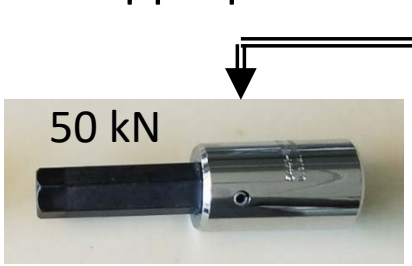
8. Insert the ***Mounting Screw*** on to top of ***Crosshead***

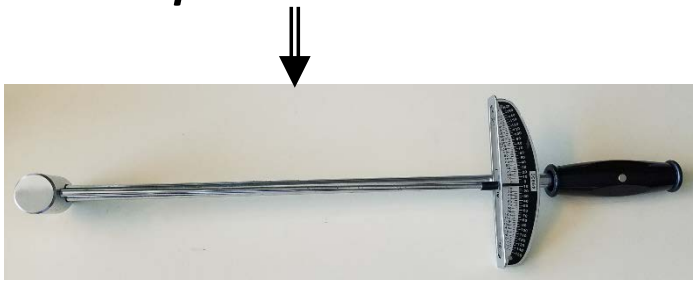


I.A. 50 kN Load Cell – 3/4

9. Tighten the ***Mounting Screw*** by hand so that it is secure against the ***Load Cell***

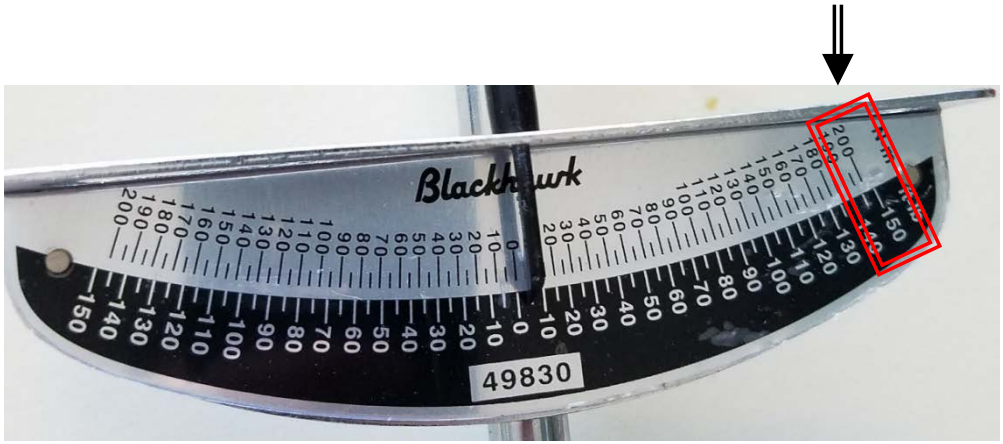
10. Install the appropriate ***Hex Adapter*** to ***Torque Wrench***





9. Further tighten the ***Mounting Screw*** with the ***Torque Wrench***

10. Torque down to 148 ft-lb (***200 N-m***) or as high as possible using the ***Torque Wrench***

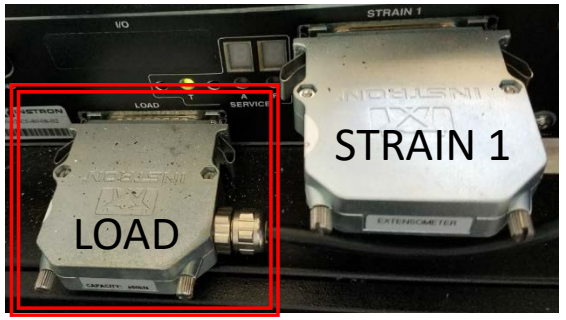


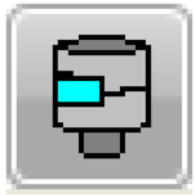
I.A. 50 kN Load Cell – 4/4

11. Carefully attach the ***Load Cell Cable*** into ***LOAD*** connector on controller

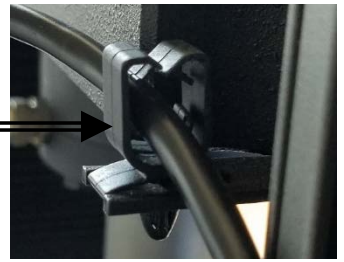
12. Insert the cable on to the ***Hook*** on the back of frame

13. Click on ***Transducers*** icon



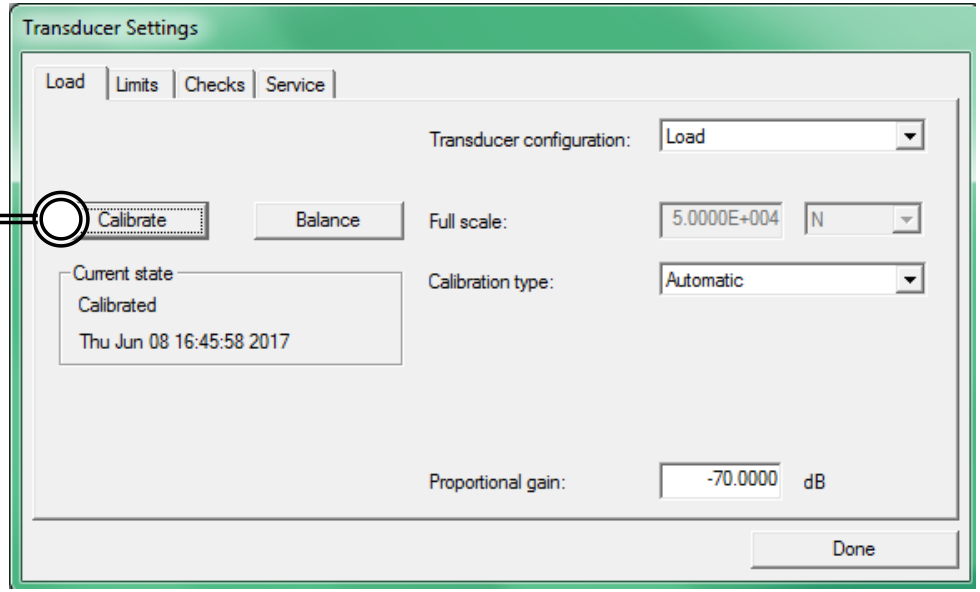


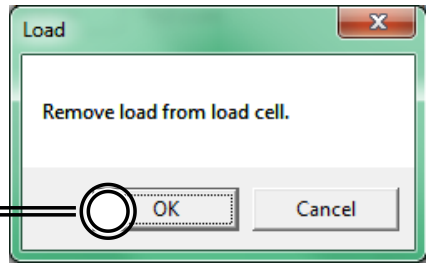
Hook



14. Click "***Calibrate***", and click "***OK***"

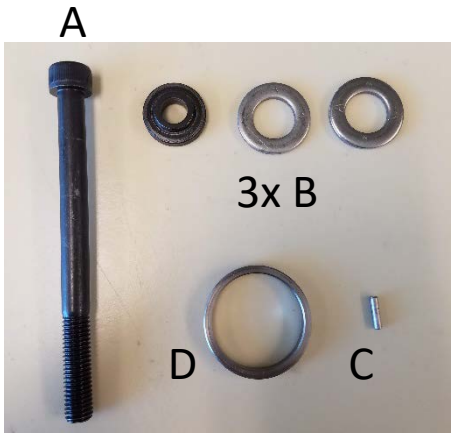
15. Wait for at least ***15 MINUTES*** to allow ***Load Cell*** to warm-up, then click "***Calibrate***", and "***OK***" again



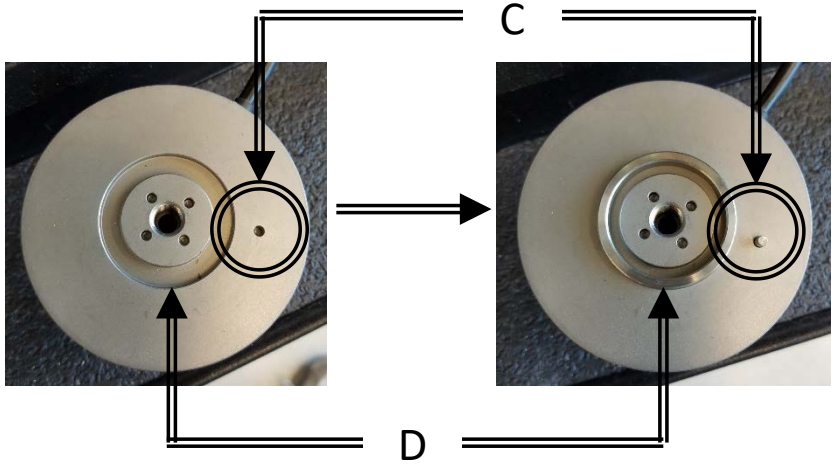


I.B. 500 N Load Cell – 1/4

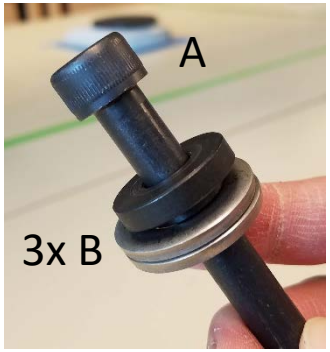
1. Locate the necessary components
   - A. Mounting Screw
   - B. Small + 2 Large Washers
   - C. Anti-rotation Pin
   - D. Locating Ring



2. Insert the ***Anti-rotation Pin (C)*** and ***Locating Ring (D)*** into top of ***Load Cell***



3. Assemble the ***Mounting Screw (A)*** and ***2x Washers (B)***



I.B. 500 N Load Cell – 2/4

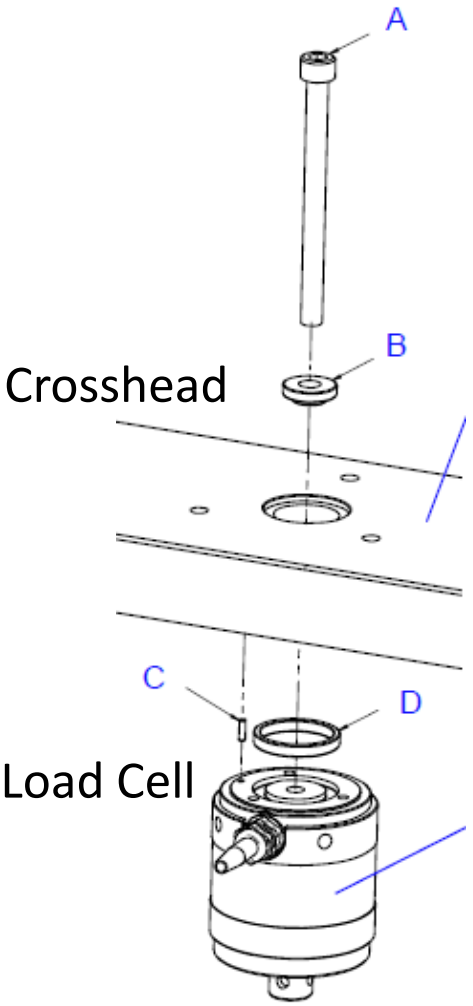
4. Lubricate the ***Mounting Screw*** threads with ***WD-40*** and wipe off any excess with a towel

5. Place the ***Load Cell*** against bottom of ***Crosshead***

6. Align the ***Load Cell*** so ***Anti-rotation Pin*** will fit into slot underneath ***Crosshead*** and cable is toward the back

7. Ensure that ***Anti-rotation Pin*** and ***Locating Ring*** fit securely in place against ***Crosshead*** and ***Load Cell***

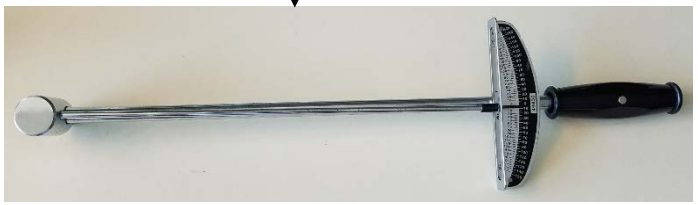
8. Insert the ***Mounting Screw*** on to top of ***Crosshead***



I.B. 500 N Load Cell – 3/4

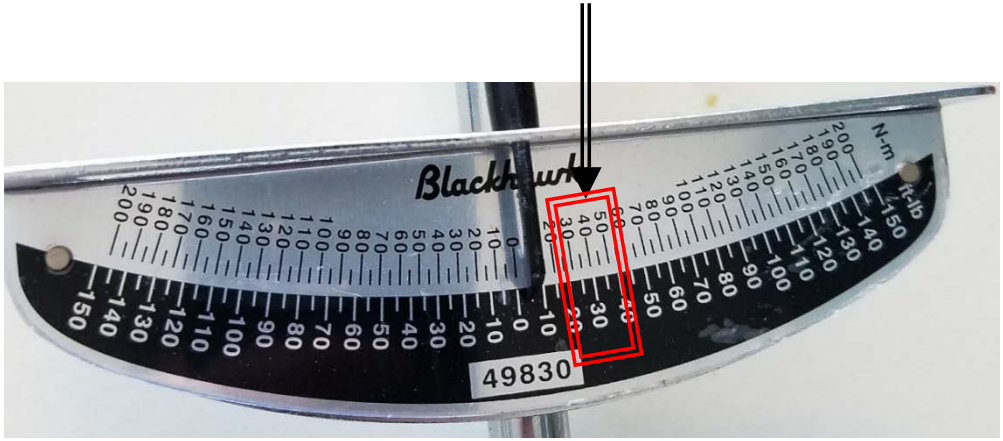
9. Tighten the ***Mounting Screw*** by hand so that it is secure against the ***Load Cell***

10. Install the appropriate ***Hex Adapter*** to ***Torque Wrench***



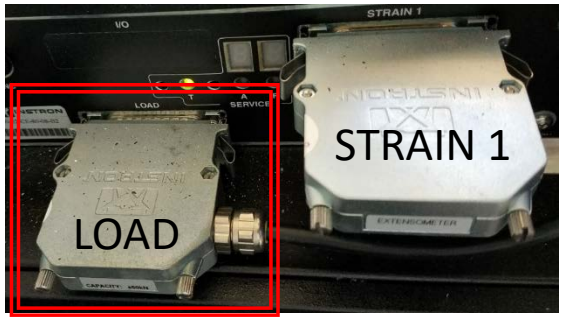
9. Further tighten the ***Mounting Screw*** with the ***Torque Wrench***

10. Torque down to 30 ft-lb (***40 N-m***) using the ***Torque Wrench***



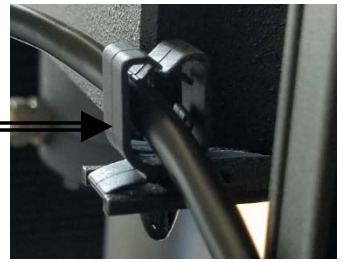
I.B. 500 N Load Cell – 4/4

12. Carefully attach the ***Load Cell Cable*** into ***LOAD*** connector on controller

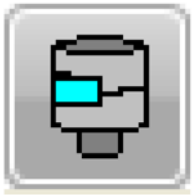


13. Insert the cable on to the ***Hook*** on the back of frame

Hook

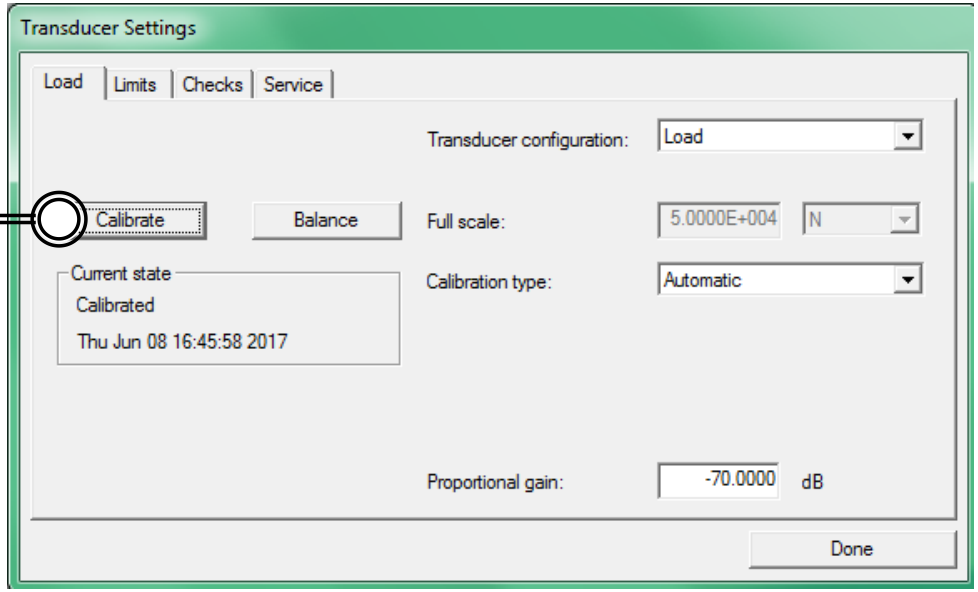


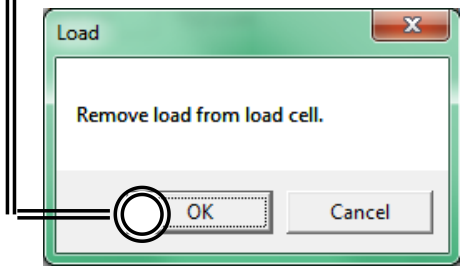
14. Click on ***Transducers*** icon



15. Click "***Calibrate***", and click "***OK***"

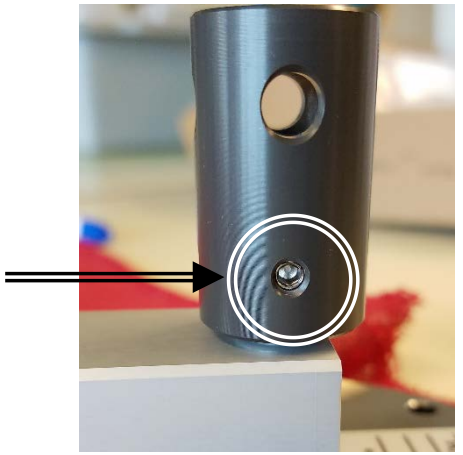
16. Wait for at least ***15 MINUTES*** to allow ***Load Cell*** to warm-up, then click "***Calibrate***", and "***OK***" again





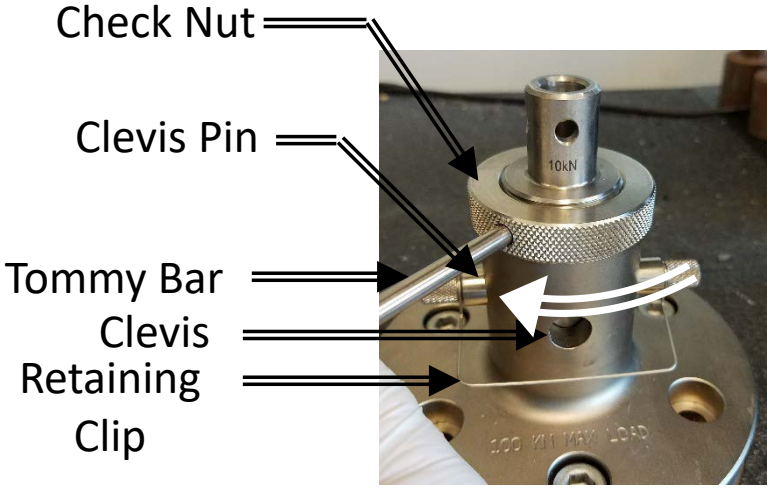
I.C. 10 N Load Cell – 1/5

1. Before installing the ***Load Cell***, ensure that the ***4 Set Screws*** holding the ***Adapter*** are securely tightened
2. Check that the ***Compression Spring*** is placed inside the bottom ***Base Adapter***
3. Position ***O Adapter Check Nut*** until it is close to the top
4. Install the ***O Adapter*** in to ***Base Adapter***
5. Align the ***O Adapter Clevis*** to the ***Clevis*** in the ***Base Adapter***
6. Insert the ***½" Clevis Pin*** through the ***Clevis*** and into the ***Base Adapter***
7. Attach the ***Retaining Clip***
8. Hand tighten the ***Check Nut*** turning ***clockwise*** towards the ***Base Adapter***
9. Use the provided ***Tommy Bar*** to further tighten, but DO NOT OVERTIGHTEN!



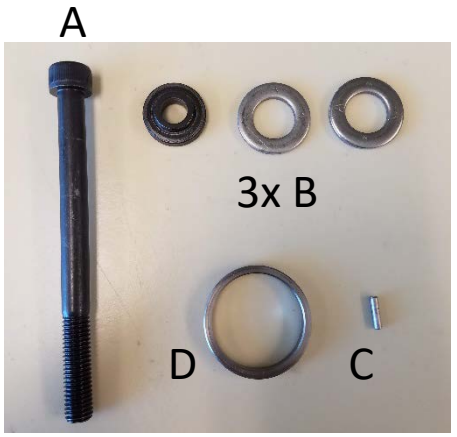
Compression Spring

Bottom Base Adapter

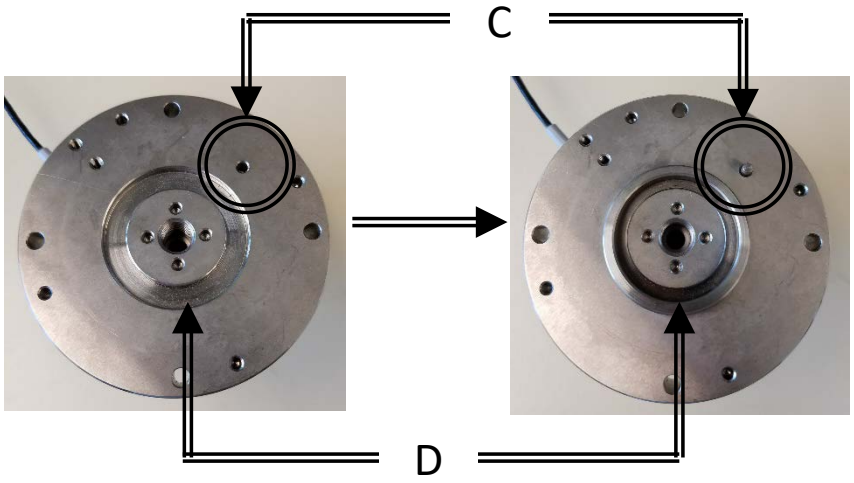


I.C. 10 N Load Cell – 2/5

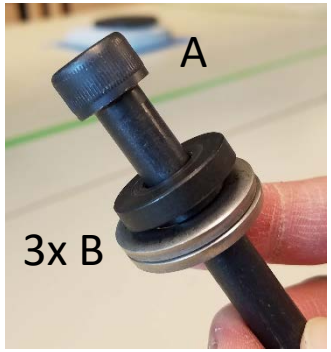
10. Locate the necessary components
    - A. Mounting Screw
    - B. Large + Small Washers
    - C. Anti-rotation Pin
    - D. Locating Ring



11. Insert the ***Anti-rotation Pin (C)*** and ***Locating Ring (D)*** into top of ***Load Cell***



12. Assemble the ***Mounting Screw (A)*** and ***2x Washers (B)***



I.C. 10 N Load Cell – 3/5

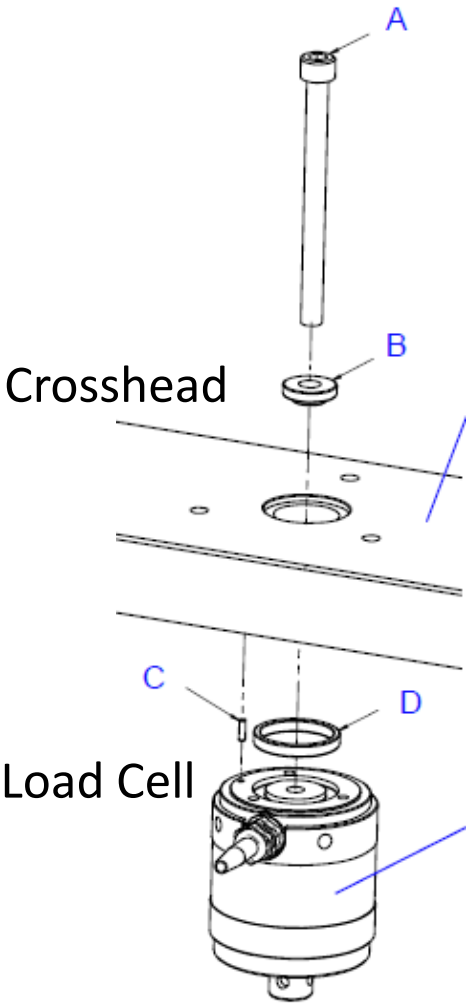
13. Lubricate the ***Mounting Screw*** threads with ***WD-40*** and wipe off any excess with a towel

14. Place the ***Load Cell*** against bottom of ***Crosshead***

15. Align the ***Load Cell*** so ***Anti-rotation Pin*** will fit into slot underneath ***Crosshead*** and cable is toward the back

16. Ensure that ***Anti-rotation Pin*** and ***Locating Ring*** fit securely in place against ***Crosshead*** and ***Load Cell***

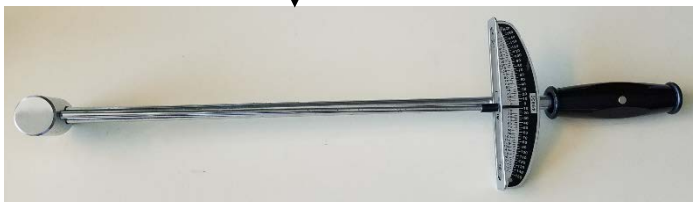
17. Insert the ***Mounting Screw*** on to top of ***Crosshead***



I.C. 10 N Load Cell – 4/5

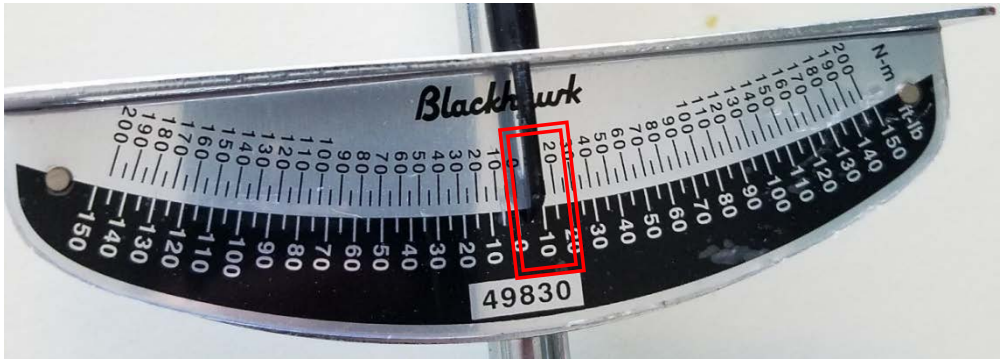
18. Tighten the ***Mounting Screw*** by hand so that it is secure against the ***Load Cell***

19. Install the appropriate ***Hex Adapter*** to ***Torque Wrench***



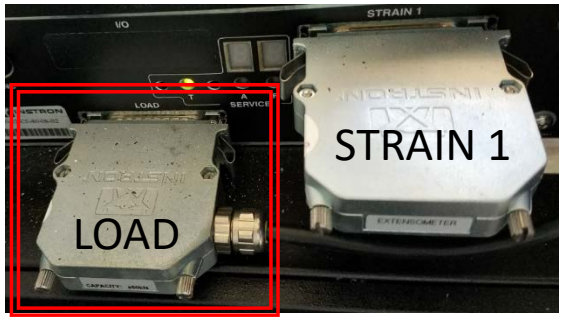
19. Further tighten the ***Mounting Screw*** with the ***Torque Wrench***

20. Torque down to 9 ft-lb (***12 N-m***) using the ***Torque Wrench***



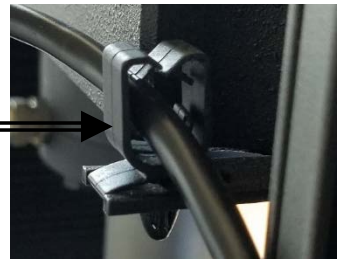
I.C. 10 N Load Cell – 5/5

22. Carefully attach the ***Load Cell Cable*** into ***LOAD*** connector on controller

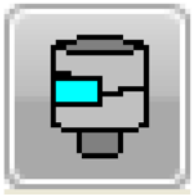


23. Insert the cable on to the ***Hook*** on the back of frame

Hook

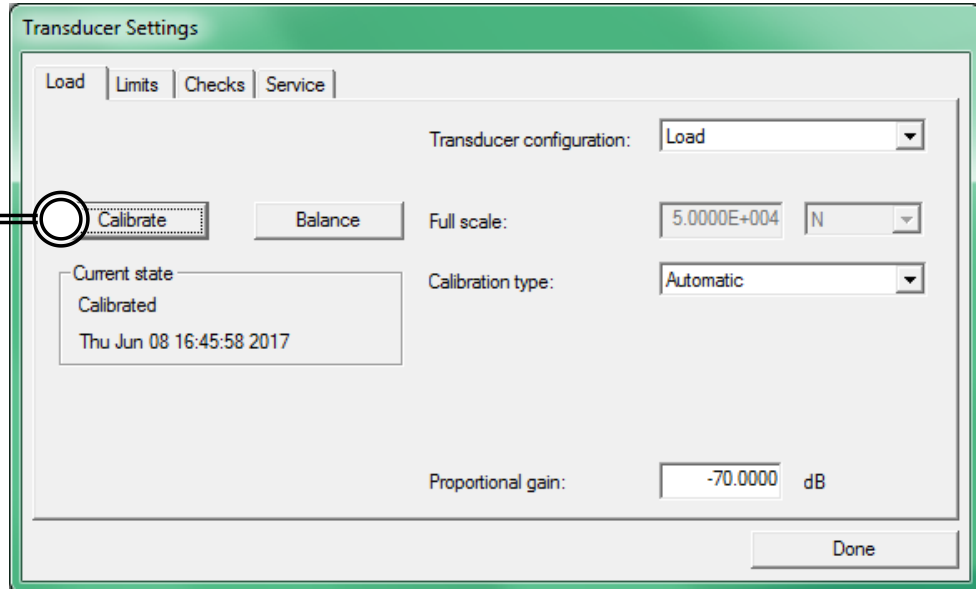


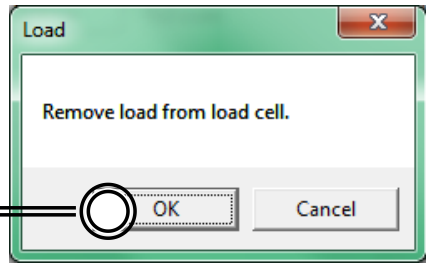
24. Click on ***Transducers*** icon



25. Click "***Calibrate***", and click "***OK***"

26. Wait for at least ***15 MINUTES*** to allow ***Load Cell*** to warm-up, then click "***Calibrate***", and "***OK***" again

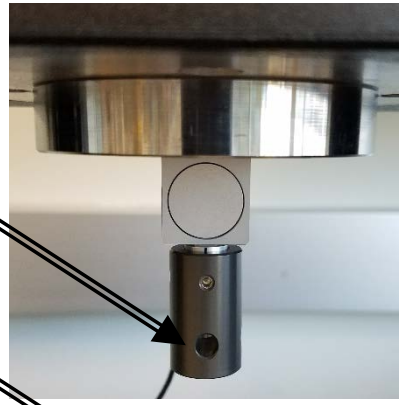


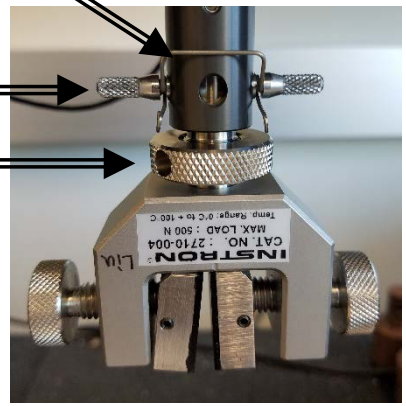


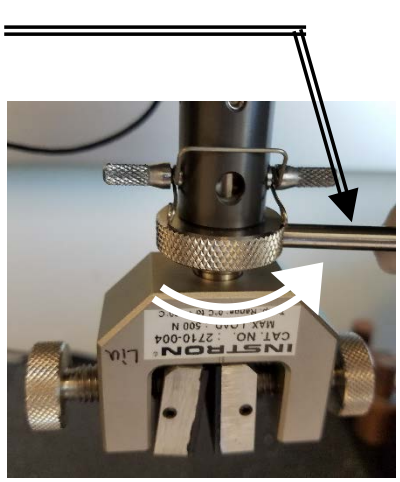
I.C. Top Screw Grip – 1/1

NOTE: ALWAYS SUPPORT FIXTURE WITH HAND
DURING INSTALLATION AS IMPOSED LOAD BY USER
MAY BE ENOUGH TO PERMANENTLY DAMAGE LOAD CELL

1. Position ***Check Nut*** until it is loose against ***Grip***
2. Align the ***Grip Clevis*** to the ***Clevis*** in the ***Load Cell***
3. Insert the ***6 mm Clevis Pin*** through the ***Clevis*** and into the ***Load Cell***
4. Attach the ***Retaining Clip***, making sure the fixture is supported at the bottom
5. Hand tighten the ***Check Nut*** turning ***counter-clockwise*** toward ***Load Cell***
6. Further tighten the ***Check Nut*** with ***Tommy Bar***, but DO NOT OVERTIGHTEN!







I.C. Bottom Screw Grip – 1/1

1. Position the ***Check Nut*** until it is loose against ***Grip***

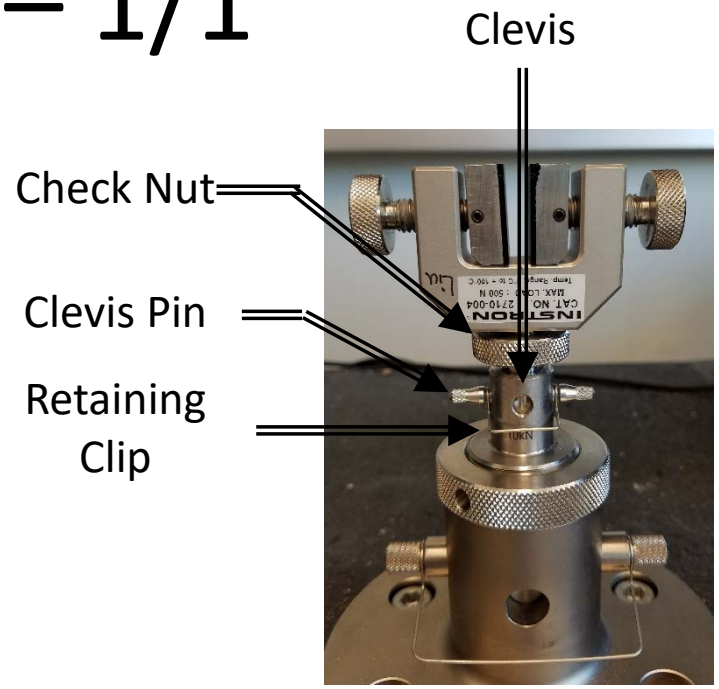
2. Align the ***Grip Clevis*** to the ***Clevis*** in the ***O Adapter***

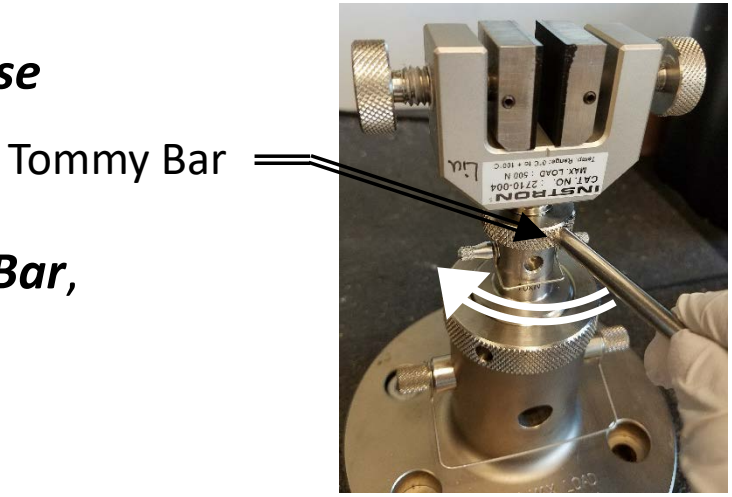
3. Insert the ***6 mm Clevis Pin*** through the ***Clevis*** and into the ***Load Cell***

4. Attach the ***Retaining Clip***

5. Hand tighten the ***Check Nut*** turning ***clockwise*** toward ***O Adapter***

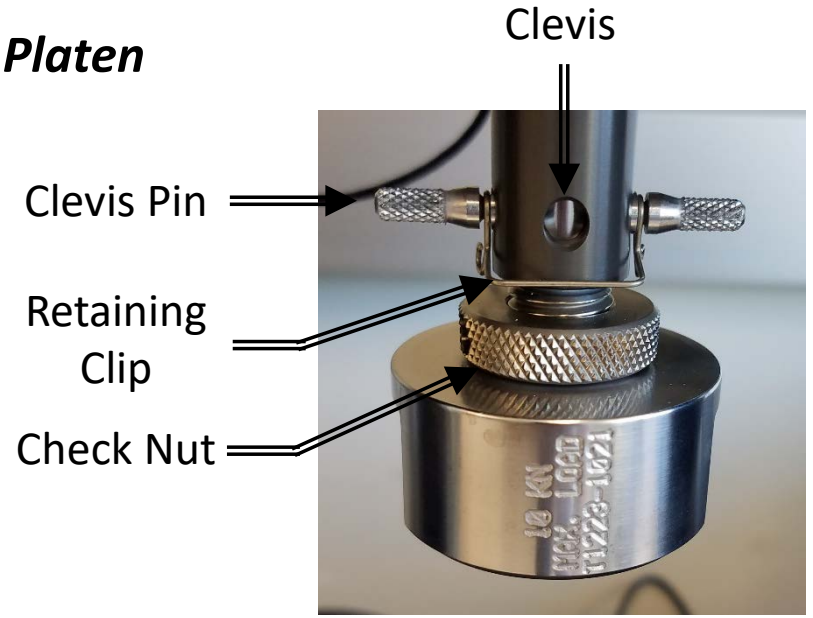
6. Further tighten the ***Check Nut*** with ***Tommy Bar***, but DO NOT OVERTIGHTEN!

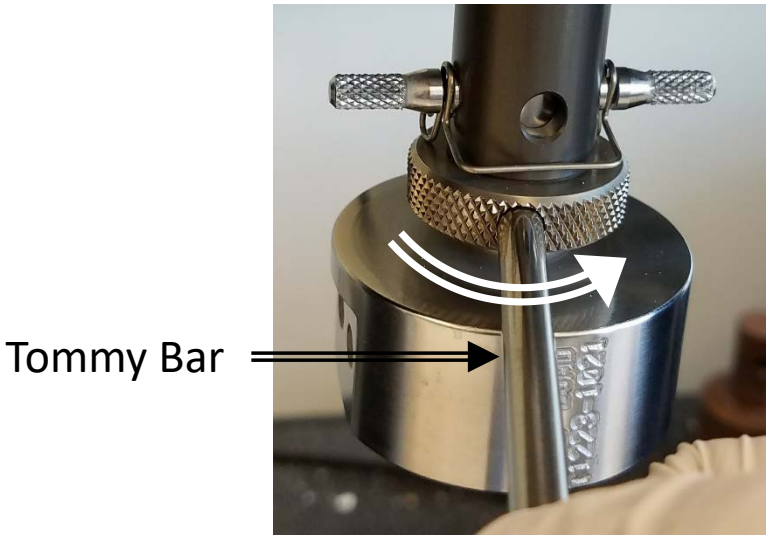




I.C. Top 2” Platen – 1/1

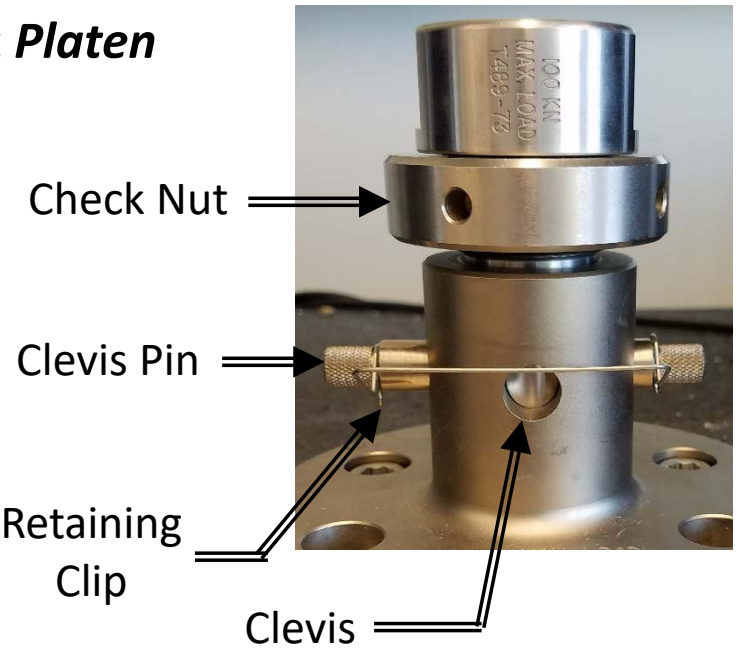
1. Position ***Check Nut*** until it is loose against ***Platen***
2. Align the ***Platen Clevis*** to the ***Clevis*** in the ***Load Cell***
3. Insert the ***6 mm Clevis Pin*** through the ***Clevis***
4. Attach the ***Retaining Clip***
5. Hand tighten ***Check Nut*** turning ***counter-clockwise*** until it is against the ***Load Cell***
6. Use the provided ***Tommy Bar*** to help, but DO NOT OVERTIGHTEN!

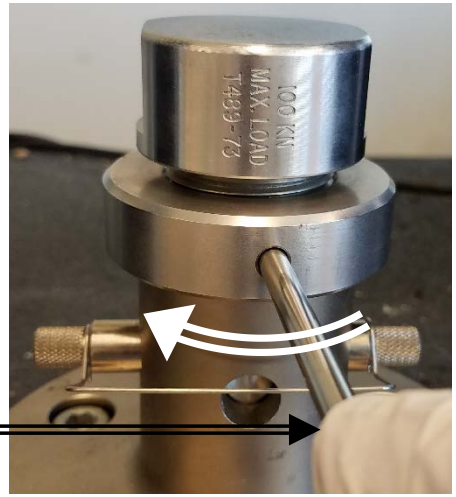




I.C. Bottom 2” Platen – 1/1

1. Position the ***Check Nut*** until it is loose against ***Platen***
2. Align the ***Platen Clevis*** to the ***Clevis*** in the ***Base Adapter***
3. Insert the ***½” Clevis Pin*** through the ***Clevis***
4. Attach the ***Retaining Clip***
5. Hand tighten the ***Check Nut*** turning ***clockwise*** until it is against the ***Base Adapter***
6. Use the provided ***Tommy Bar*** to help, but DO NOT OVERTIGHTEN!





II.A. Jaw Faces – 1/2

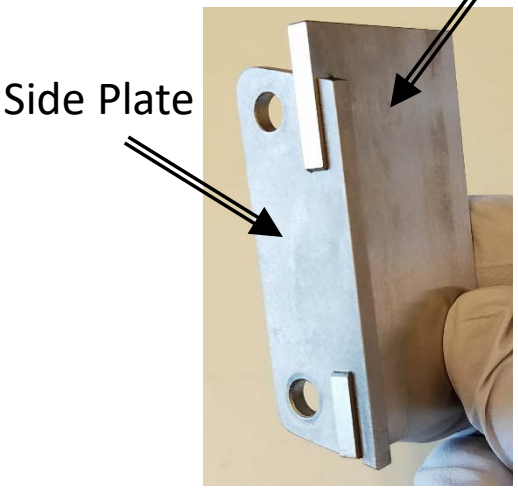
1. Identify the appropriate ***Jaw Faces*** for your test specimen size
   a) 0 – 0.25” Jaws – requires side plate only
   b) 0.25 – 0.5” Jaws – requires spacer + side plate

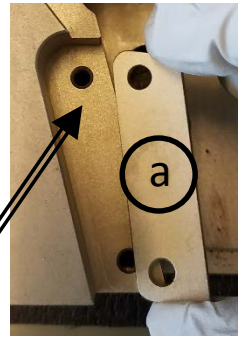
2. If desired ***Jaw Face*** is already installed, skip to ***II.B. Wedge Grips***

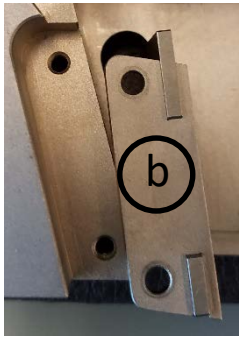
3. Remove installed spacers or side plates using a ***3 mm hex wrench***

4. Align the ***Side Plate*** so it is aligned with the two screw holes on top of the flat section

5. Rotate the handle until the ***Wedge Grips*** are in the fully ***Open*** position







II.A. Jaw Faces – 2/2

6. Coat the back and base of the ***Jaw Face*** with ***Molykote g-N paste*** using the applicator provided

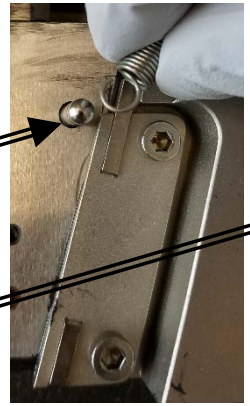
Note: Wipe down applicator + Wash hands thoroughly after using Molykote g-N paste!

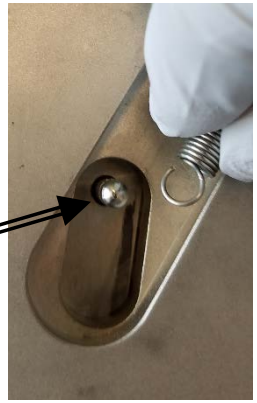
6. Insert the ***Jaw Face*** and slide it towards the base of the ***Wedge Grip***

7. Firmly secure the ***Side Plates*** using the ***3 mm hex wrench*** so the ***Jaw*** has no sideways movement

8. Attach the ***Springs*** from the spring retainer post to the post for each ***Jaw Face***

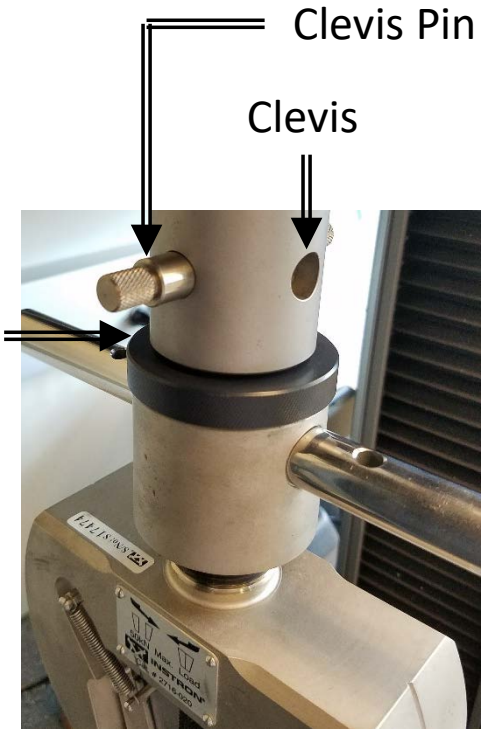
9. Repeat for the back side

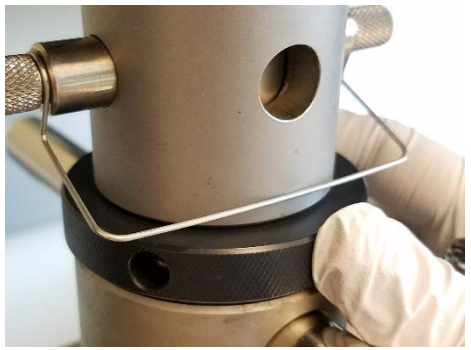




II.B. Top Wedge Grips – 1/2

1. Identify the ***Top Wedge Grip*** from drawer first
2. Position ***Check Nut*** until it is loose against ***Grip***
3. Orient the ***Wedge Grip*** to be perpendicular to the ***Crosshead***
4. Align the ***Wedge Grip Clevis*** to the ***Clevis*** in the ***Load Cell***
5. Insert the ***½" Clevis Pin*** through the ***Clevis*** and into the ***Load Cell***
6. Attach the ***Retaining Clip***
7. Confirm that the ***Check Nut*** is still loose between the ***Load Cell*** and ***Wedge Grip***





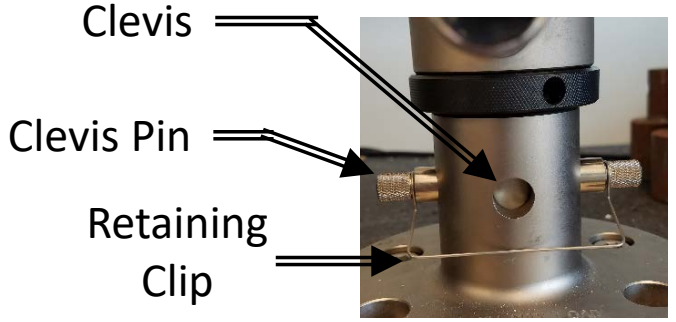
II.B. Bottom Wedge Grips – 2/2

8. Identify the ***Bottom Wedge Grip*** from drawer first
9. Check that the ***Compression Spring*** is placed inside the bottom ***Base Adapter***
10. Position ***Check Nut*** until it is loose against ***Grip***
11. Orient the ***Wedge Grip*** to be perpendicular to the ***Crosshead***

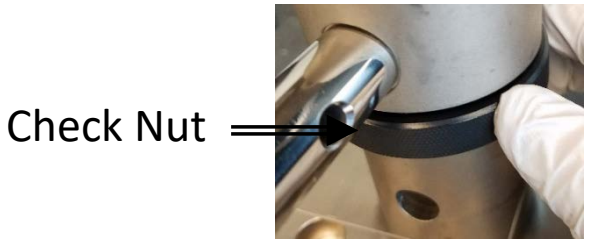
Compression Spring

Bottom Base Adapter

12. Align the ***Wedge Grip Clevis*** to the ***Clevis*** in the ***Base Adapter***
13. Insert the ***½" Clevis Pin*** through the ***Clevis*** and into the ***Base Adapter***
14. Attach the ***Retaining Clip***



15. Confirm that the ***Check Nut*** is still loose between the ***Base Adapter*** and ***Wedge Grip***

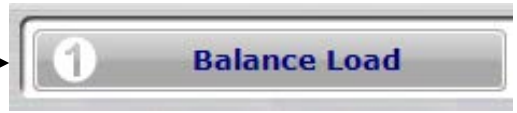


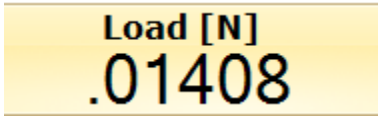
II.C. Preloading – 1/5

Note: Preloading the load string prevents backlash and deflections which can degrade integrity of results at high load tension tests

1. Identify which ***Preloading specimen*** is appropriate for your Jaw Faces
   a) 20 kN Maximum Load: 0 – 0.25” Jaws
   b) 50 kN Maximum Load: 0.25 – 0.5” Jaws

2. Before inserting ***Preloading specimen***, check the following:
   a) Both ***Check Nuts*** are loose
   b) Click ***Balance Load*** and check live load is near zero

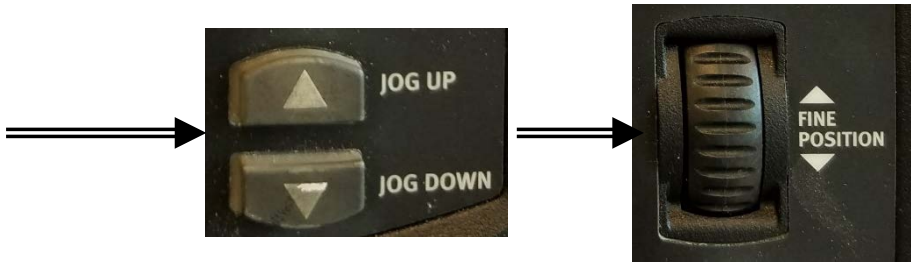




   c) Identify the ***Maximum Load*** you plan on applying for your tests and **NEVER** exceed the ***Maximum Load*** for **ANY** component in the load string

II.C. Preloading – 2/5

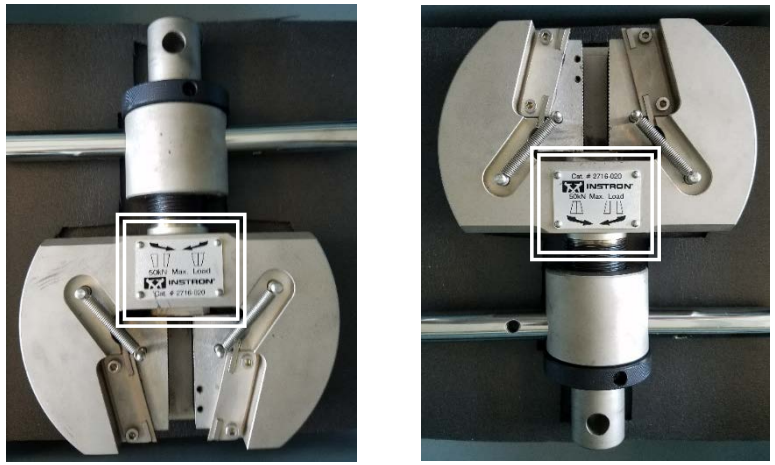
3. Press the ***Jog Up/Down*** $\Delta\nabla$ buttons and ***Fine Jog*** on the control panel to adjust the ***Wedge Grip*** positions to an appropriate height



4. Adjust ***Wedge Grip*** positions until majority of Jaw Faces are engaged with the ***Preloading specimen***

5. Align and center the specimen visually into the ***Jaw Faces***

6. Turn handles to tighten the lower and upper grips until the ***Jaw Faces*** engage the specimen



II.C. Preloading – 3/5

7. Identify a ***Load Limit*** that is ***10-15%*** greater than the highest load you will be applying for your tests

8. If unknown, check the provided table to estimate the anticipated load applied to your specimen

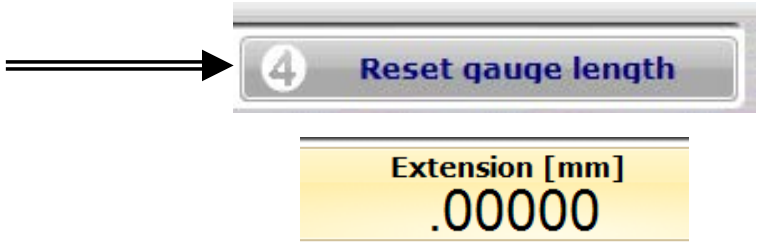
   Load (N) = Yield Strength or Ultimate Strength (MPa) x Area (mm^2)

   e.g. Mild Steel 1090: Yield Strength = 248 Mpa
   Ultimate Strength = **841 MPa** (largest)

   Ultimate Load = 841 MPa x 25 mm^2 ≈ 21,000 N or 21 kN

   To be safe, assume **Max Load ≈ 25,000 N** or 25 kN (15% greater)

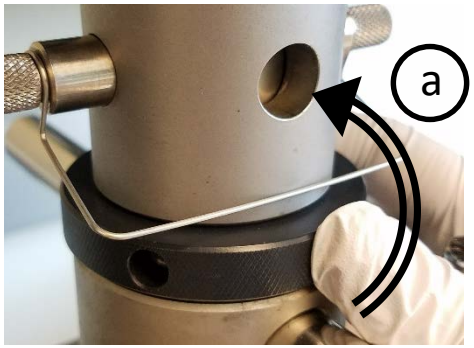
9. Click on ***Reset Gauge Length*** to set the ***Crosshead*** position to zero

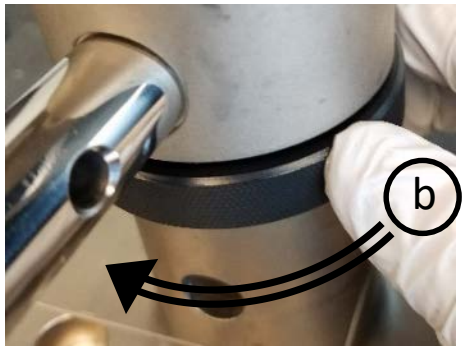


II.C. Preloading – 4/5

10. Slowly ***Fine Jog*** up until the desired load is achieved

11. Hand tighten the ***Check Nuts*** against the ***Load Cell*** and ***Base Adapter***; respectively
    a) Top: ***Counter-clockwise***
    b) Bottom: ***Clockwise***





12. Use provided ***Spanner Wrench*** to provide additional help if necessary, but DO NOT OVERTIGHTEN!

13. Slowly ***Fine Jog*** back down until the load is near zero again

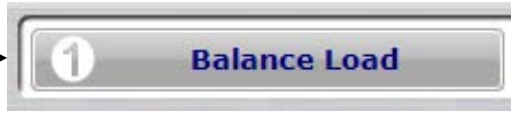
14. Unload the ***Preloading specimen*** by turning the handles on the upper and lower grips

15. You may now execute tests on your desired samples, but remember to **UNLOAD PRELOAD** before leaving!

II.C. Preloading – 5/5

NOTE: Check nuts will now be TOO TIGHT and will require you to unload preload to remove wedge grips!

16. To unload the Preload, click ***Balance Load*** with nothing installed



17. Re-install the ***Preloading specimen***

18. Slowly ***Fine Jog*** up until the previously used load is achieved again (approximately)

19. Loosen the ***Check Nuts*** again if possible, else slowly ***Fine Jog*** to increase the load until ***Check Nuts*** are loose again

20. If necessary, use the provided ***Spanner Wrench*** to help you loosen

21. Slowly ***Fine Jog*** back to near ***Zero Load*** to uninstall the ***Preloading specimen***

II.D. Specimen Loading – 1/1

NOTE: NEVER exceed the Maximum Load for ANY component in the load string such as Load Cell, Grips, or Fixtures!

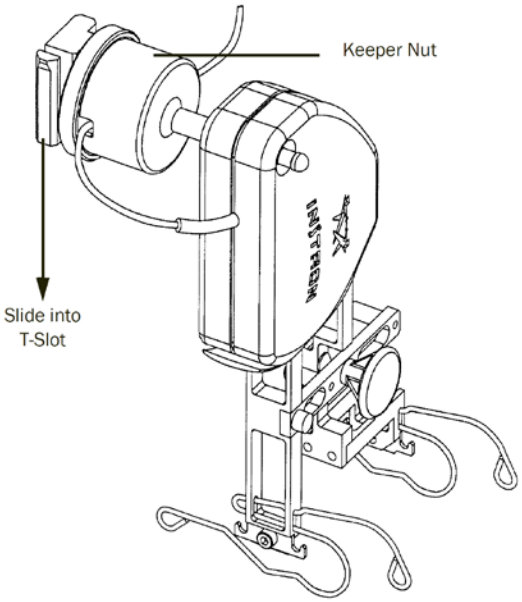
1. Adjust ***Wedge Grip*** height and install specimen so majority of ***Jaw Faces*** are engaged

2. Align and center the specimen visually into the ***Jaw Faces***

3. Turn handles to tighten the lower and upper grips until the ***Jaw Faces*** engage the specimen

4. Continue to ***II.E. Extensometer*** if you require accurate Stress-Strain values prior to yielding (e.g. Young's Modulus), else skip directly to ***VI. Running Test***

II.E. Extensometer – 1/5



Extensometer provides a more accurate measure of ***Strain*** during your test compared to using the ***Extension*** alone from ***Crosshead*** position

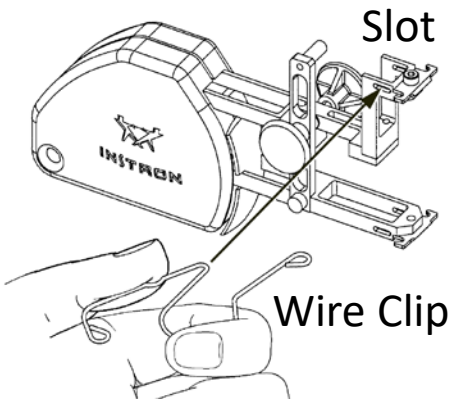
NOTE: ***Extensometer*** is only rated to travel -0.1” to +1.0” for a set gauge length of 1.0” or -10% to 100% ***Strain*** and is only appropriate for low ductility samples like metals and NOT polymers!

1. Identify appropriate ***Wire Clip*** based on specimen shape and size

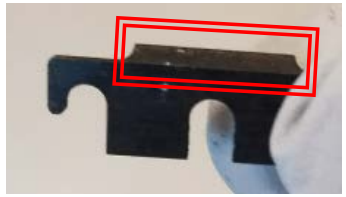
Specimen Shape	**A**	**B**	**C**	**D**	**E**	**F**
Round (RO)	0 – 3 mm 0 – 0.12”	3 – 6 mm 0.12 – 0.24”	6 – 9 mm 0.24 – 0.35”	9 – 12 mm 0.35 – 0.47”	12 – 15 mm 0.47 – 0.59”	20 mm 0.79”
Rectangle (RE)	0 – 3 mm 0 – 0.12”	3 – 6 mm 0.12 – 0.24”	6 – 9 mm 0.24 – 0.35”	9 – 12 mm 0.35 – 0.47”	12 – 15 mm 0.47 – 0.59”	N/A

II.E. Extensometer – 2/5

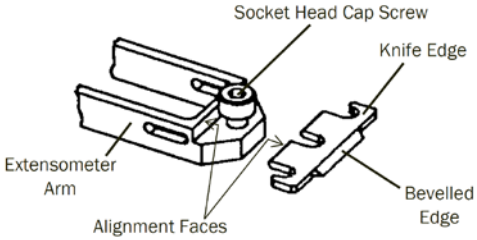
2. Insert the ***Wire Clip*** by squeezing and inserting into ***Slot*** as shown

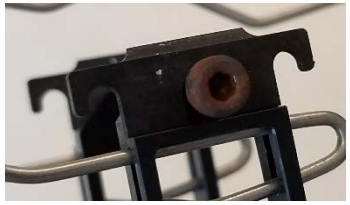


3. Visually inspect the ***Bevelled Edge*** on the ***Knife Edge*** and contact Lab Manager if chipped or severely worn

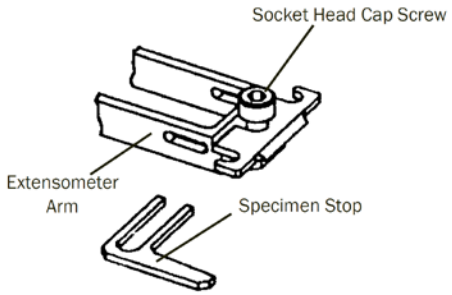


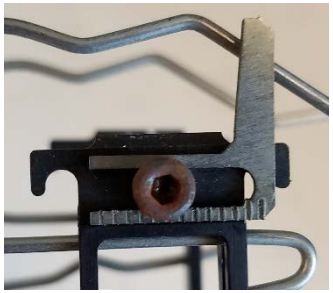
4. Check that the ***Knife Edge*** is installed correctly and flush against the ***Alignment Faces*** using provided ***2 mm Hex Key***





5. If desired, install and visually align the ***Specimen Stop*** to help with specimen alignment





II.E. Extensometer – 3/5

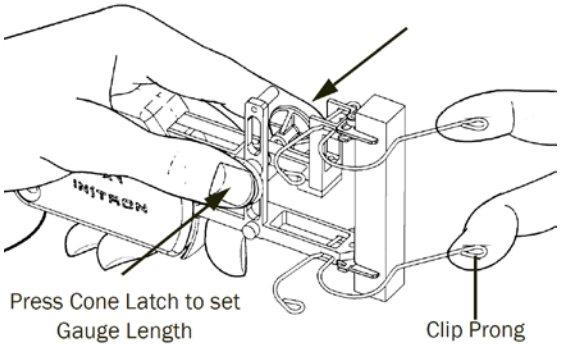
6. Push the ***Cone-Latch*** together with your index finger and thumb to set ***Gauge Length***

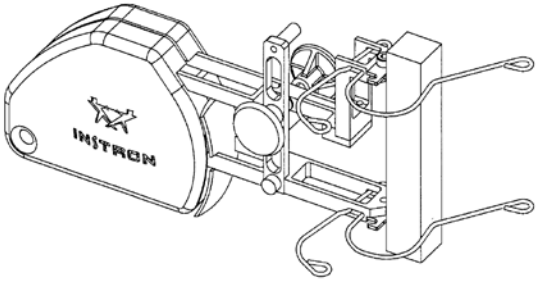
7. Use other hand to hold the ***Clip Prongs*** open and slip onto specimen as shown

8. Gradually release the clip prongs first and allow ***Bevelled Edge*** to gently touch specimen

9. Release the ***Cone-Latch*** to set the 1” gauge length

10. If the ***Extensometer*** slips, you may need to use a smaller sized ***Wire Clip***



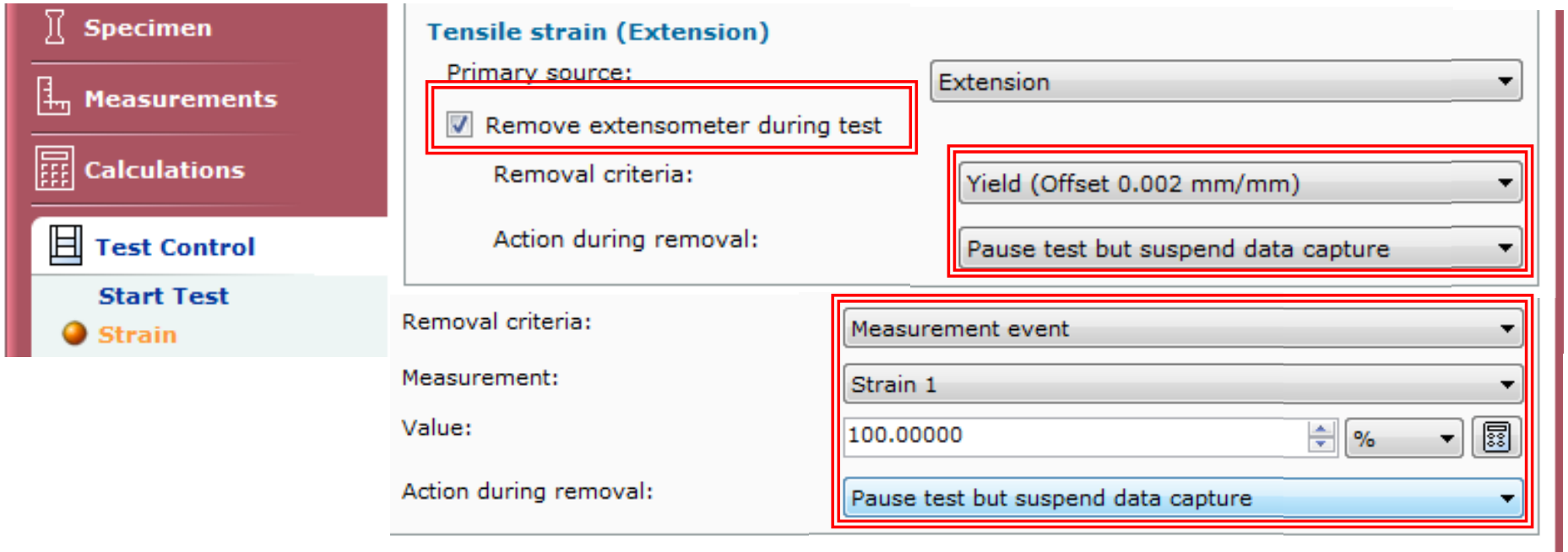


NOTE: Do not slide ***Bevelled Edge*** against the specimen as you attach to specimen as it will blunt the ***Bevelled Edge*** and scratch your specimen

II.E. Extensometer – 4/5

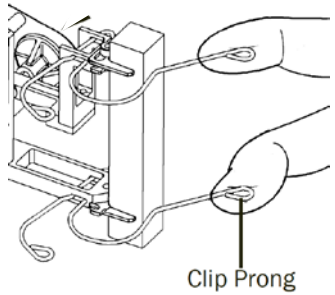
NOTE: ***Extensometer*** can only be used in the elastic region of the stress-strain curve and **MUST** be removed at the **Yield Strength** or before reaching **+100% strain**

11. Protect the ***Extensometer*** by removing it before it gets broken!
12. Ensure that "***Remove extensometer during test***" is checked under the ***Methods > Test Control > Strain*** section
13. Select "***Yield (Offset 0.002 mm/mm)***" or "***Measurement event*** - (***Strain 1 = 100%)"*** as the Removal criteria
14. Select "***Pause test but suspend data capture***" as the Action during removal

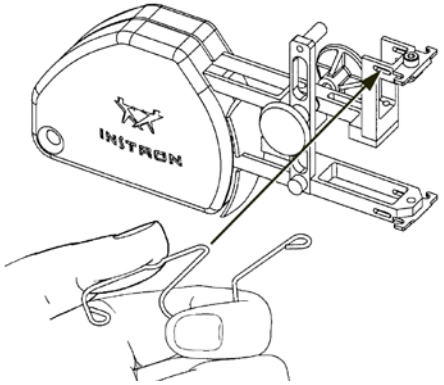


II.E. Extensometer – 5/5

14. To remove, hold ***Extensometer*** with one hand and carefully pry the clip prongs open with other hand



NOTE: DO NOT PUSH THE CONE-LATCH BUTTONS TOGETHER AS THIS WILL SCRAPE THE BEVELLED EDGE AGAINST YOUR SPECIMEN BACK TO GAUGE LENGTH!



15. Remove the ***Extensometer*** from the ***Specimen***

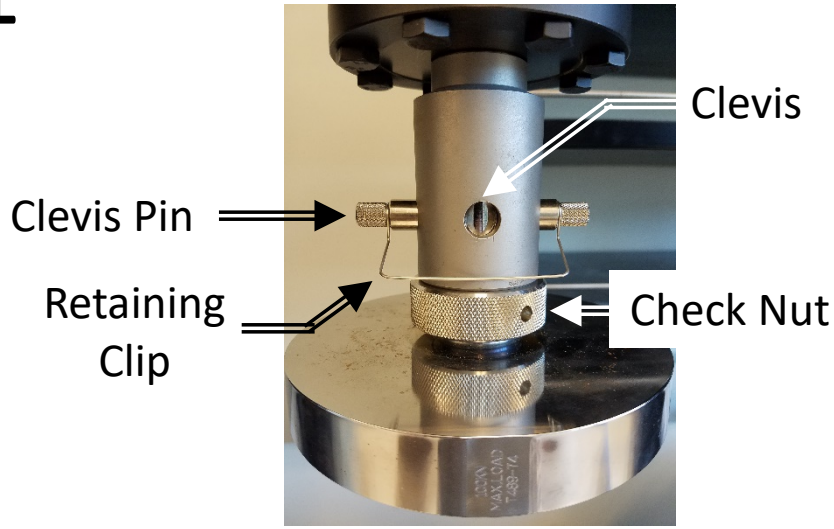
16. Avoid sliding the knife edge against the specimen as you remove the ***Extensometer*** again to prevent damage

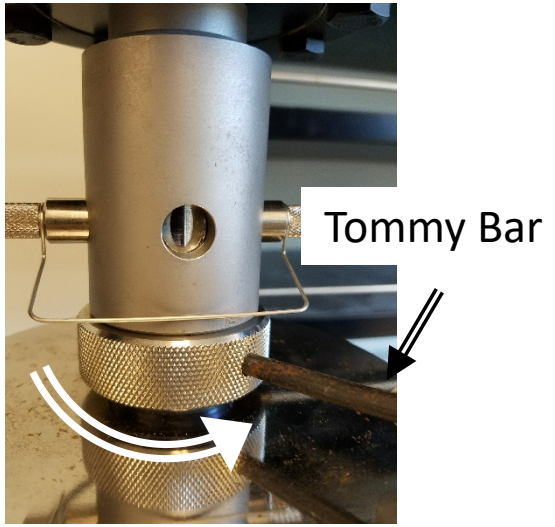
17. Remove the ***Wire Clip*** and place back into storage box

18. Place the ***Extensometer*** back onto its holder next to the frame

III.A. Top Platen – 1/1

1. Position the ***Check Nut*** until it is loose against the ***Platen***
2. Align the ***Platen Clevis*** to the ***Clevis*** in the ***Load Cell***
3. Insert the ***½" Clevis Pin*** through the ***Clevis***
4. Attach the ***Retaining Clip***
5. Hand tighten ***Check Nut*** turning ***counter-clockwise*** until it is against the ***Load Cell***
6. Use the provided ***Tommy Bar*** to help, but DO NOT OVERTIGHTEN!





III.B. Bottom Platen – 2/1

1. Check that the ***Compression Spring*** is placed inside the bottom ***Base Adapter***

2. Position the ***Check Nut*** until it is loose against the ***Platen***

3. Align the ***Platen Clevis*** to the ***Clevis*** in the ***Base Adapter***

4. Insert the ***½" Clevis Pin*** through the ***Clevis***

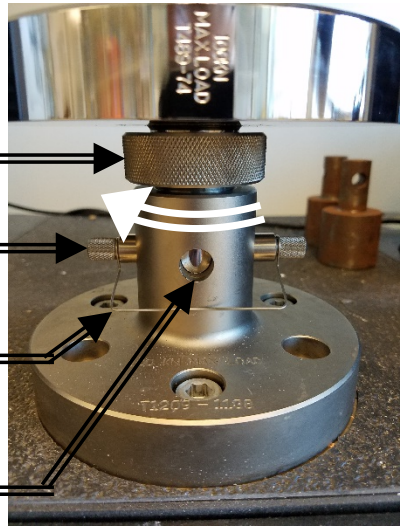
5. Attach the ***Retaining Clip***

6. Hand tighten the ***Check Nut*** turning ***clockwise*** until it is against the ***Base Adapter***

7. Use the provided ***Tommy Bar*** to help, but DO NOT OVERTIGHTEN!

Compression Spring

Bottom Base Adapter



IV.A. Lower Anvils – 1/1

1. Check that the ***Compression Spring*** is placed inside the bottom ***Baseplate Adapter***

2. Position ***Check Nut*** until it is loose against ***Anvil***

3. Place the ***Lower Anvil*** assembly into the ***Baseplate Adapter***

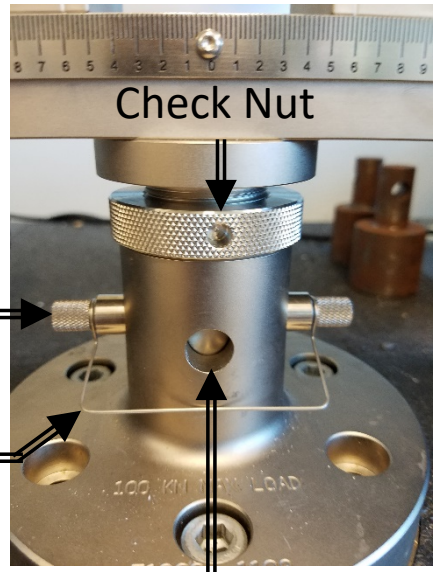
4. Rotate the ***Lower Anvil*** until the scale faces the front and the ***Anvil Clevis*** are aligned with ***Baseplate Adapter Clevis***

5. Insert the ***½" Clevis Pin*** into the ***Baseplate Adapter***

6. Attach the ***Retaining Clip***

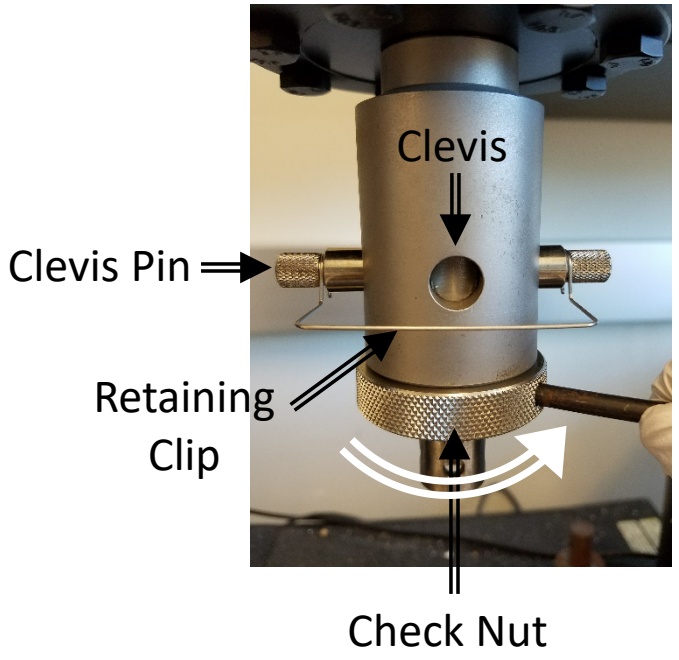
Compression Spring

Bottom Base Adapter

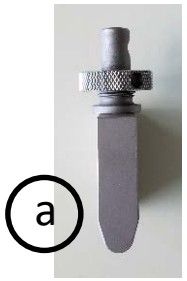


IV.B. Upper Anvils – 1/2

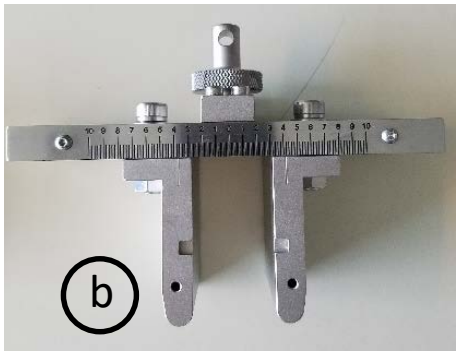
1. Position ***O Adapter Check Nut*** until it is loose
2. Insert the ***O Adapter*** into the ***Load Cell***
3. Align the ***O Adapter Clevis*** to the ***Clevis*** in the ***Load Cell***
4. Insert the ***½" Clevis Pin*** through the ***Load Cell***
5. Attach the ***Retaining Clip***
6. Hand tighten the ***Check Nut*** turning ***counter-clockwise*** until it is against the body of the ***Load Cell***
7. Use the provided ***Tommy Bar*** to help, but DO NOT OVERTIGHTEN!
8. Select desired ***Upper Anvils*** to install
   a) 3-point Flexural tests
   b) 4-point Flexural tests



3-point



4-point



IV.B. Upper Anvils – 2/2

9. Position ***Check Nut*** until it is loose against ***Anvil***

10. Insert the ***Upper Anvil*** into the ***O Adapter***

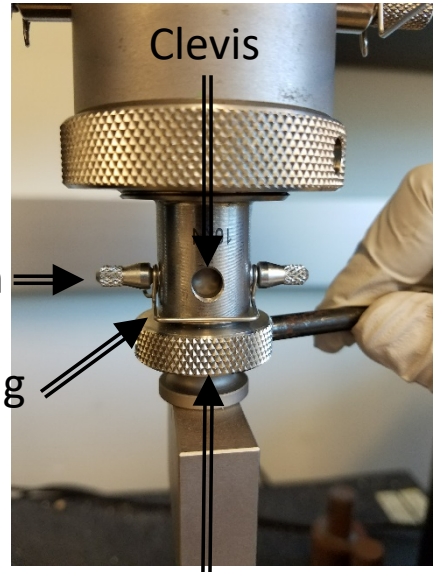
11. (3-point) Rotate the ***Upper Anvil*** until it is parallel with the ***Lower Anvils***

12. (4-point) Rotate the ***Upper Anvils*** until it is parallel with the ***Lower Anvils*** and the scale faces the front

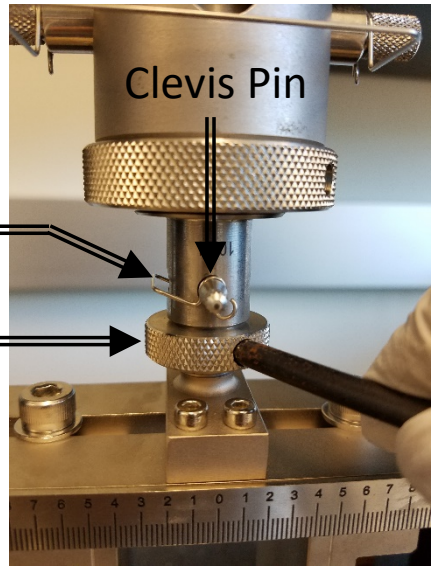
13. Align and insert the ***6 mm Clevis Pin*** into ***O Adapter*** clevis

14. Attach the ***Retaining Clip***

3-point



4-point



IV.C. Alignment – 1/2

1. Loosen the cap screws with ***6 mm Hex*** holding the ***Lower and Upper Anvils*** and allow them to slide freely

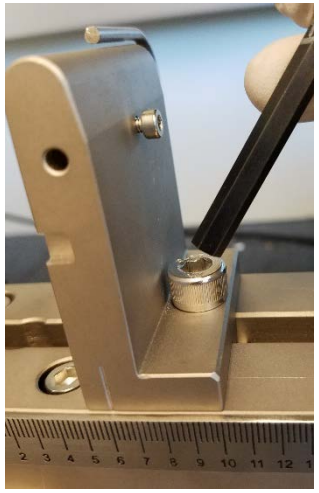
2. Place the ***Alignment Plate*** onto the ***Lower Anvils***

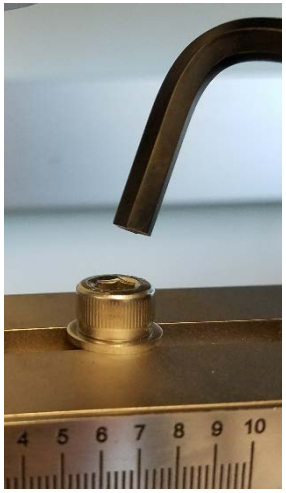
3. Adjust the ***Lower Anvil*** positions until they are both at about ***6.2*** on the lower front scale

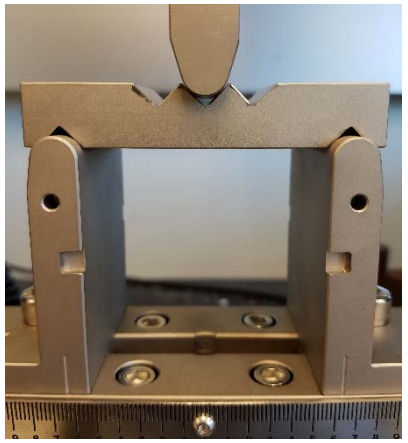
4. For 3-point fixture, there is no need for adjustment of the single ***Upper Anvil***

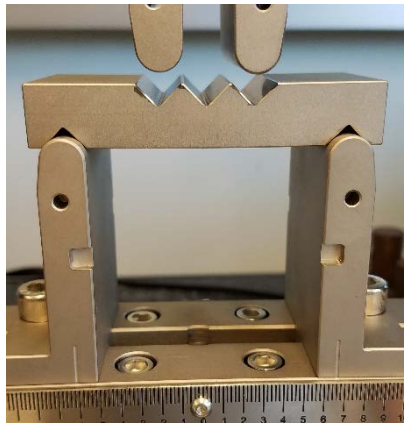
5. For 4-point fixture, adjust the ***Upper Anvils*** until they are both at about ***2*** on the upper front scale

6. Carefully lower the ***Crosshead*** using ***Jog*** and ***Fine Jog*** until the ***Upper Anvil(s)*** are just above the ***Alignment Plate***









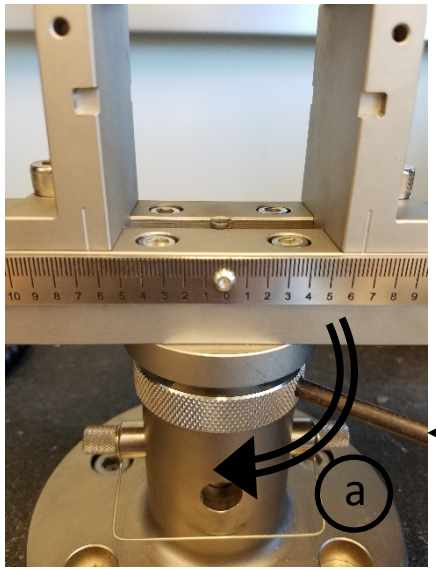
IV.C. Alignment – 2/2

7. Adjust and align both the ***Upper and Lower Anvils*** until they BARELY touch

8. Hand tighten the ***Check Nuts*** on the ***Upper and Lower Anvils***
   a) Lower Anvil: ***Clockwise***
   b) Upper Anvils: ***Counter-clockwise***

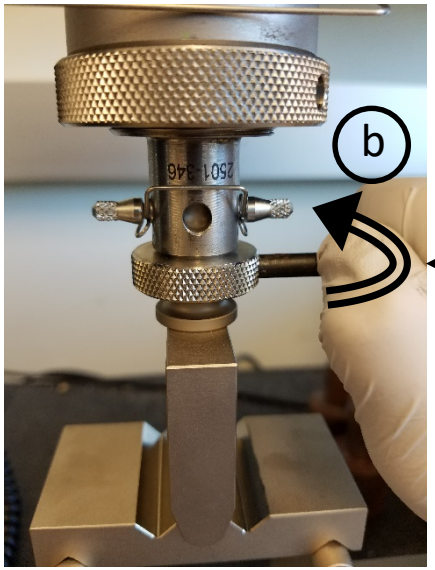
9. Use the provided ***Tommy Bar*** to help, but DO NOT OVERTIGHTEN!

Lower Anvil



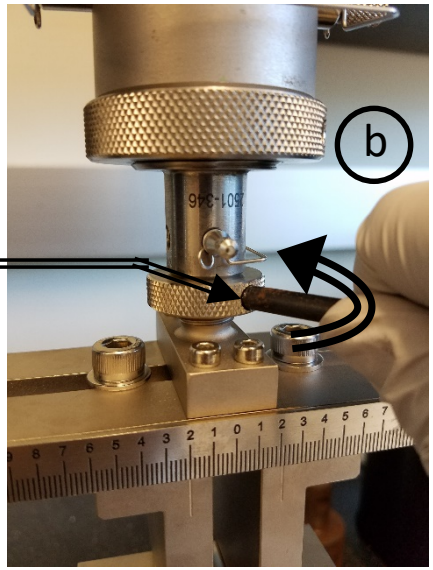
Tommy Bar

Upper Anvil



Tommy Bar

Upper Anvil



IV.D. Specimen Loading – 1/1

1. For 3-point fixture, set the span of the ***Lower Anvils*** to an appropriate spacing for your specimen

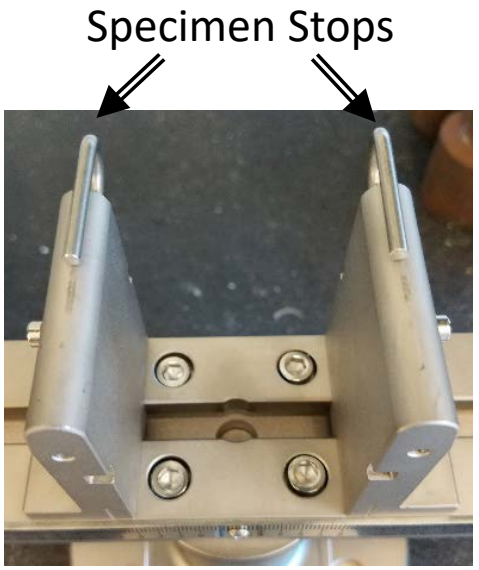
2. For 4-point fixture, set the span of both the ***Upper and Lower Anvils*** to an appropriate spacing for your specimen

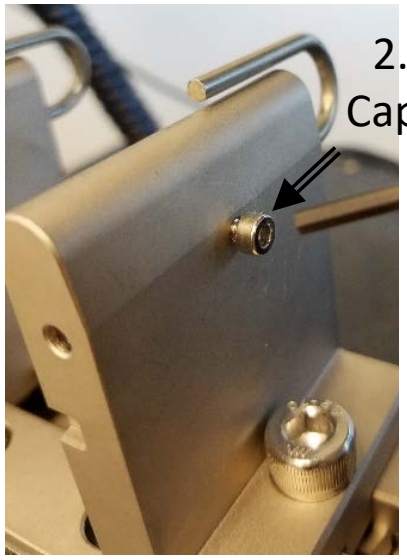
3. Slightly raise the ***Crosshead*** to allow room for your specimen

4. Install ***Specimen Stops*** to ensure that each specimen is consistently in the same position on the fixture

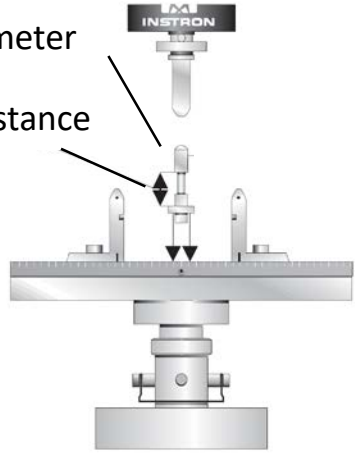
5. Slide each specimen stop through the hole on the back (or front) of each ***Lower Anvil***

6. Secure ***Specimen Stops*** in the desired position with the ***2.5 mm Cap Screws*** located on the side of each ***Lower Anvil***



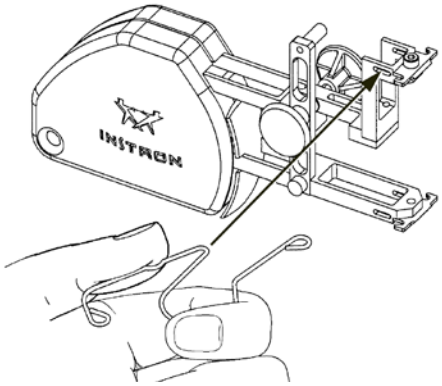


IV.E. Deflectometer – 1/4



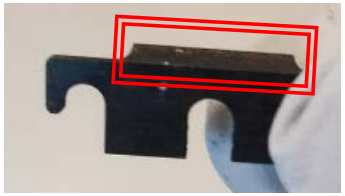
1. Install ***Deflectometer*** and ***Extensometer*** to accurately measure deflection of the specimen during a flexure test

2. Place ***Deflectometer*** in the center hole, located in the T-slot of ***Anvil***

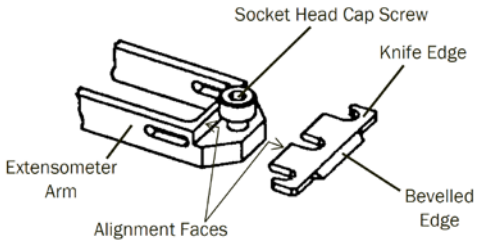


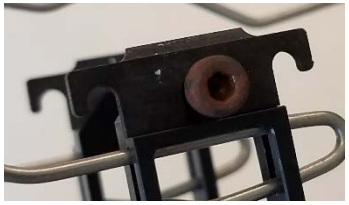
3. Choose ***Wire Clip RO D 9 - 12 mm*** and insert the ***Wire Clip*** by squeezing and inserting into slot as shown

4. Visually inspect the ***Bevelled Edge*** on the ***Knife Edge*** and contact Lab Manager if chipped or severely worn



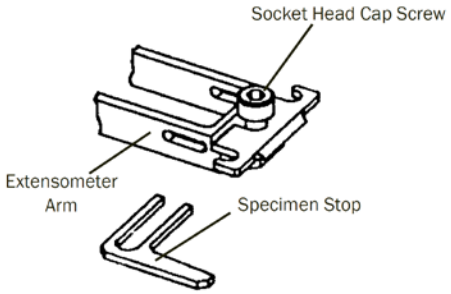
5. Check that the ***Knife Edge*** is installed correctly and flush against the ***Alignment Faces*** using provided ***2 mm Hex Key***

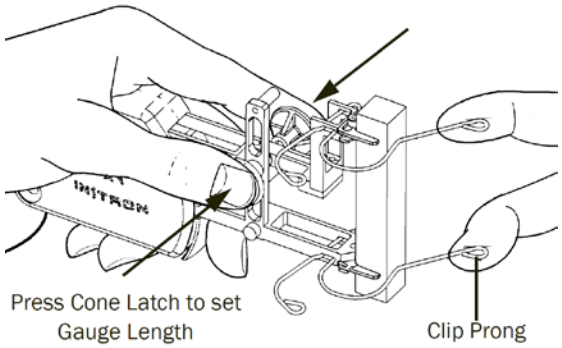


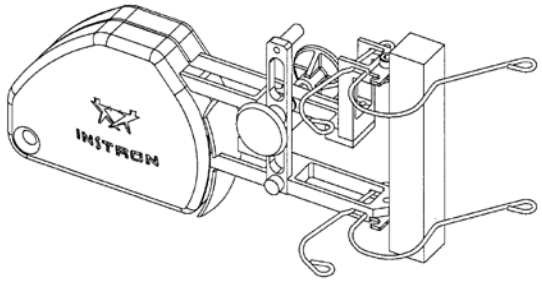


IV.E. Deflectometer – 2/4

6. If desired, install and visually align the ***Specimen Stop*** to help with specimen alignment
7. Push the ***Cone-Latch*** together with your index finger and thumb to set gauge length
8. Use other hand to hold the ***Clip Prongs*** open and slip onto ***Deflectometer***
9. Gradually release the clip prongs first and allow ***Bevelled Edge*** to gently touch ***Deflectometer***
10. Release the ***Cone-Latch*** to set the 1” gauge length
11. If the ***Extensometer*** slips, you may need to use a smaller sized ***Wire Clip***





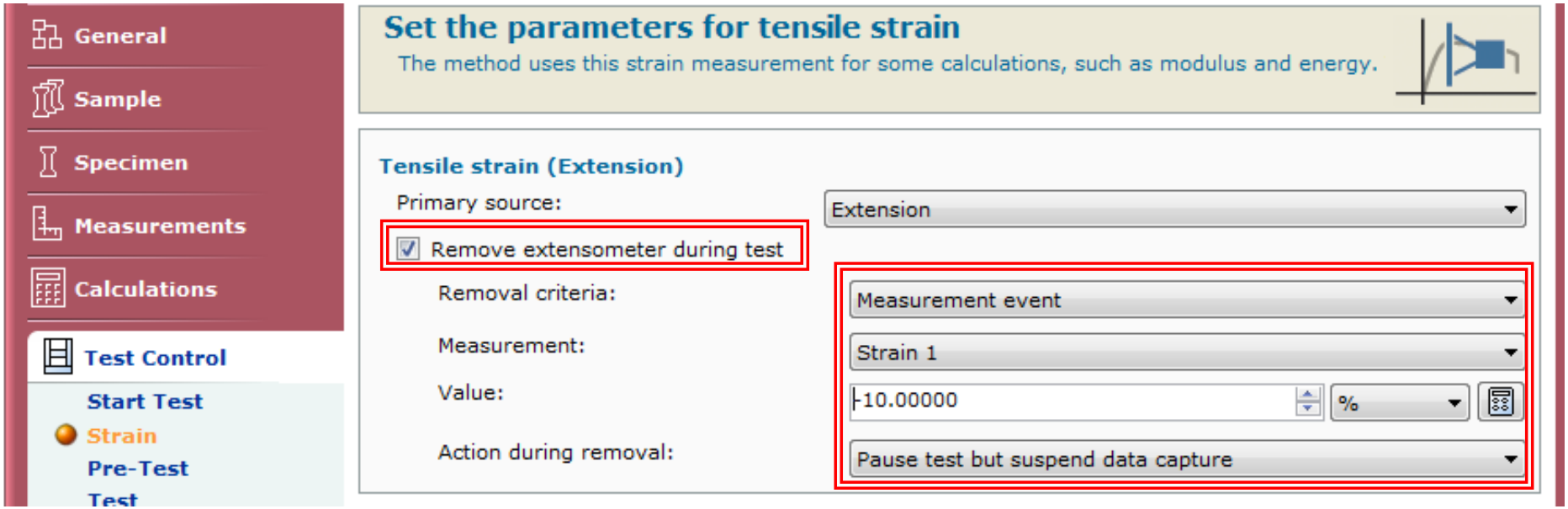


NOTE: Do not slide ***Bevelled Edge*** against the ***Deflectometer*** as it will blunt the ***Bevelled Edge*** and scratch ***Deflectometer*** surface

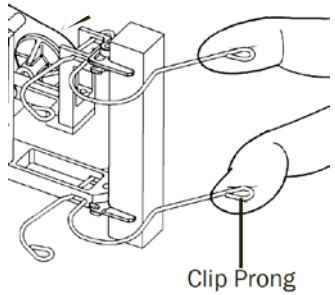
IV.E. Deflectometer – 3/4

NOTE: EXTENSOMETER **MUST** BE REMOVED BEFORE REACHING -10% STRAIN

12. Protect the ***Extensometer*** by removing it before it gets broken!
13. Ensure that "***Remove extensometer during test***" is checked under the ***Methods > Test Control > Strain*** section
14. Select "***Measurement event***" as the Removal criteria
15. Select "***Strain 1***" as Measurement and "***-10%***" as Value
16. Select "***Pause test but suspend data capture***" as the Action during removal

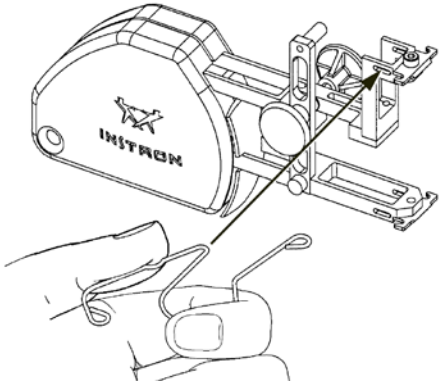


IV.E. Deflectometer – 4/4



17. Hold the ***Extensometer*** with one hand and carefully pry the ***Clip Prongs*** open with your other hand

NOTE: DO NOT PUSH THE CONE-LATCH BUTTONS TOGETHER AS THIS WILL SCRAPE THE BEVELLED EDGE AGAINST DEFLECTOMETER BACK TO GAUGE LENGTH!



18. Remove the ***Extensometer*** from the ***Deflectometer***

19. Avoid sliding the knife edge against the ***Deflectometer*** as you remove the ***Extensometer*** again to prevent damage

20. Remove the ***Wire Clip*** and place back into storage box

21. Place the ***Extensometer*** back onto its holder next to the frame

V. Configuring Test – 1/22

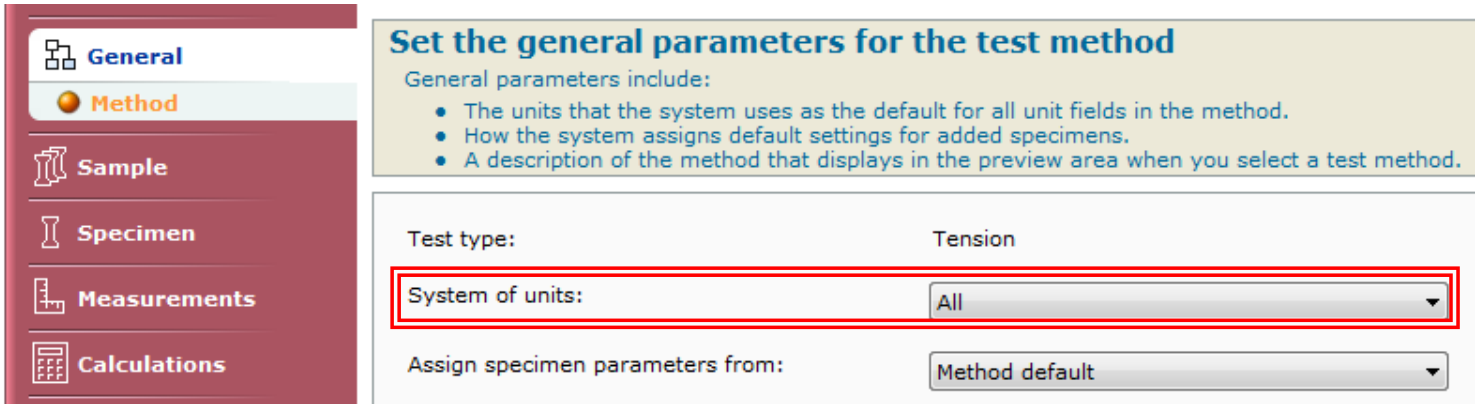
1. The following questions should be answered prior to creating or executing a test procedure:
   a) What is the test going to do?
   b) What starts and stops the test?
   c) What speed or speeds should the test run?
   d) What is the shape and dimensions of the test specimen?
   e) What data is collected and at what rate?
   f) What output (graphs, reports) are required?
   g) What answers from the test do you require?
   h) What information is going to be supplied by the operator?

2. Click ***Method > Open Method > Create Method***

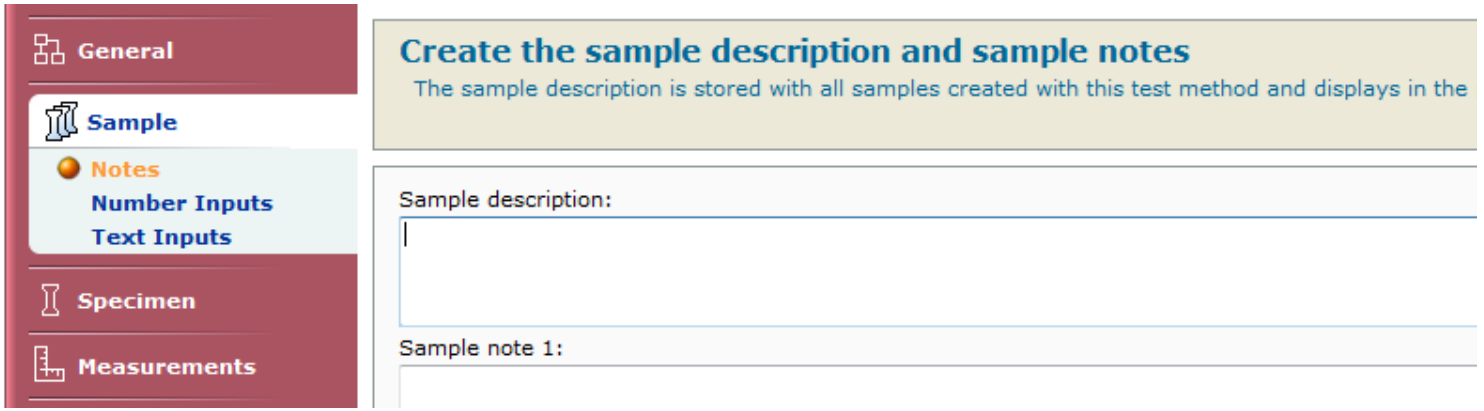
3. Choose the appropriate ***Test Type*** and click ***Next***
   - ***Tension method***
   - ***Compression method***
   - ***Flexure method***

V. Configuring Test – 2/22

4. Select ***General*** parameters for your test such as:
   - System of units: (SI, Metric, US, or All) – Recommend "***All***"

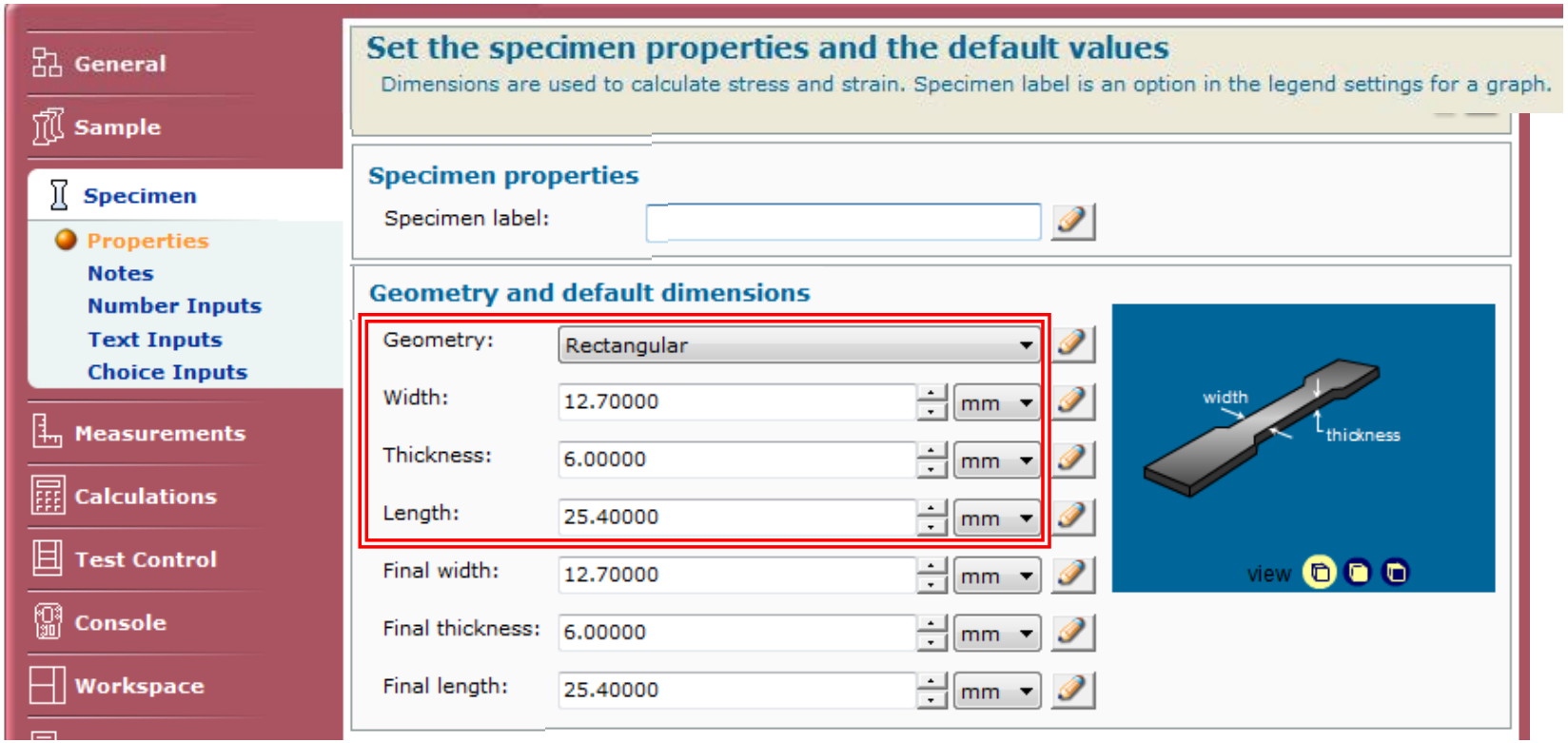


5. Select ***Sample > Notes*** to create any sample description or notes
   - Sample description is stored with all samples created with this test method
   - Sample notes are available for display when notes are included with sample



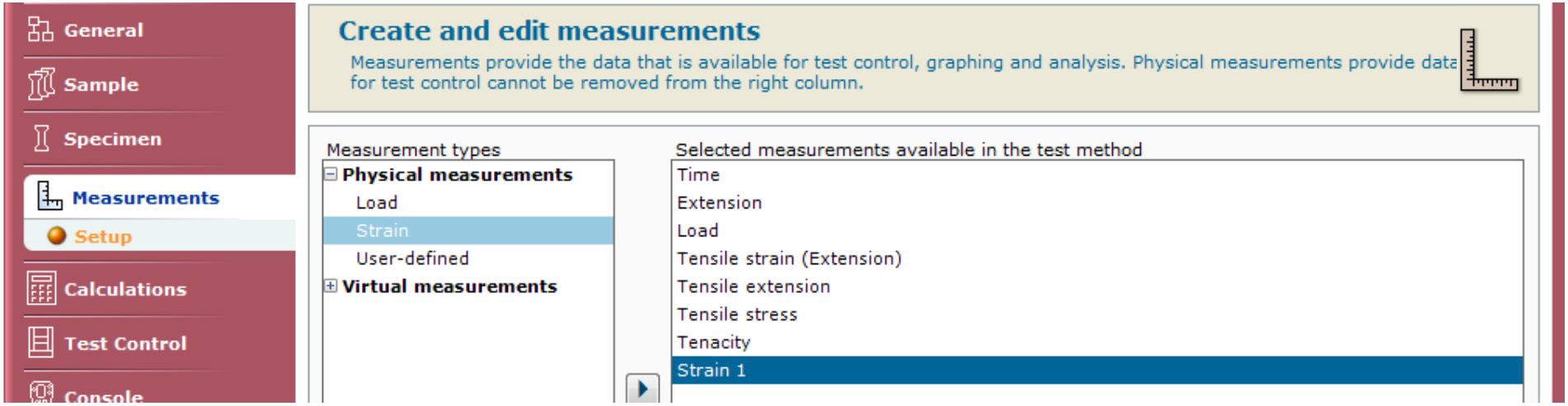
V. Configuring Test – 3/22

6. Click ***Specimen > Properties*** to specify the specimen default properties for each specimen
   - Geometry and default dimensions are important for the software calculations



V. Configuring Test – 4/22

7. Click ***Measurements > Setup*** to specify the data that is available for the test control, data analysis and live display



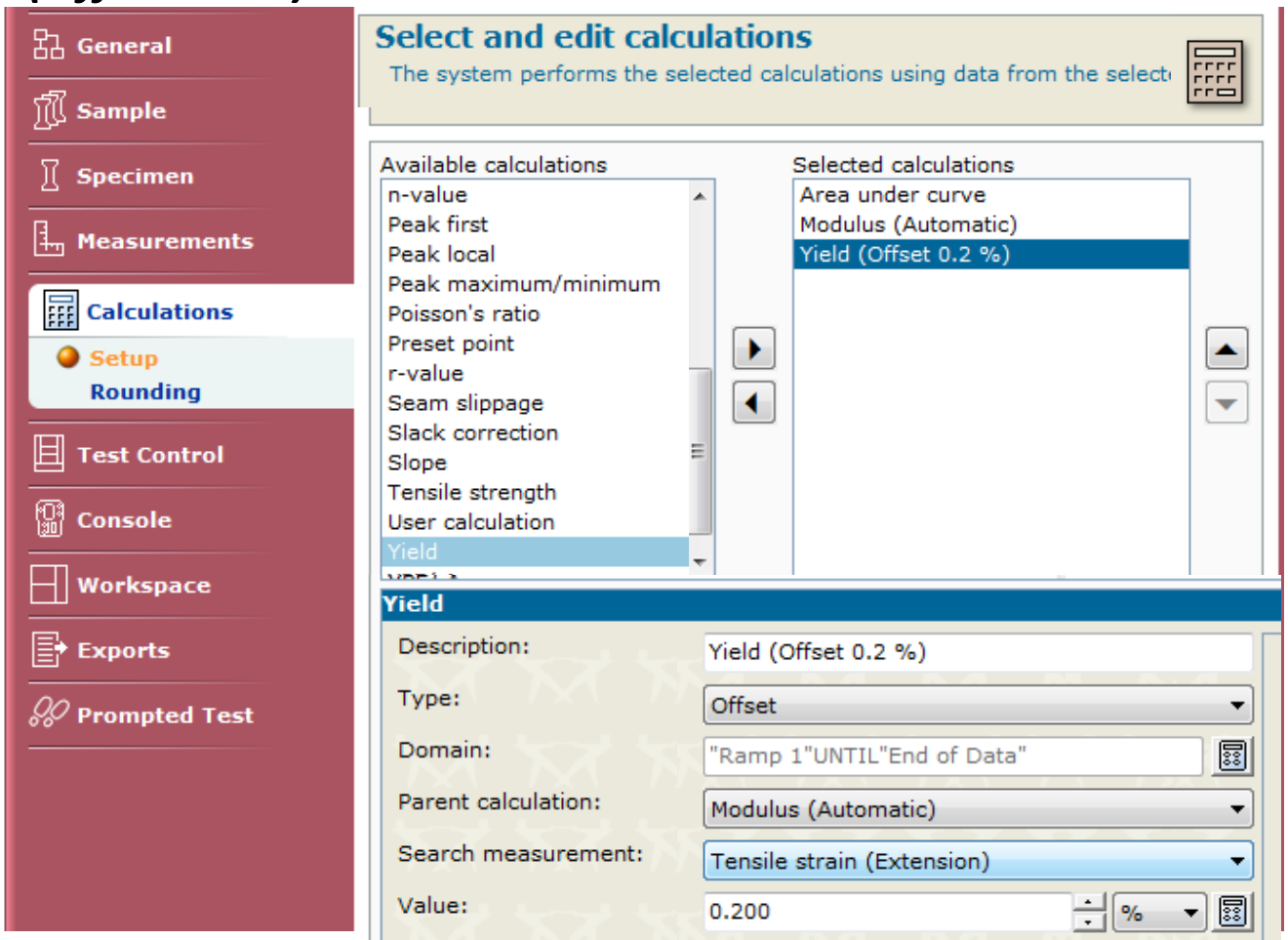
8. Physical Measurements directly measured from physical transducer include:
   - Time
   - Load
   - Extension (determined based on ***Crosshead*** location)
   - Strain 1 (only when using the ***Extensometer***)

9. Virtual Measurements are calculated from one or more physical measurements include:
   - Strain (compressive, tensile, or flexure)
   - Stress (compressive, tensile, or flexure)

V. Configuring Test – 5/22

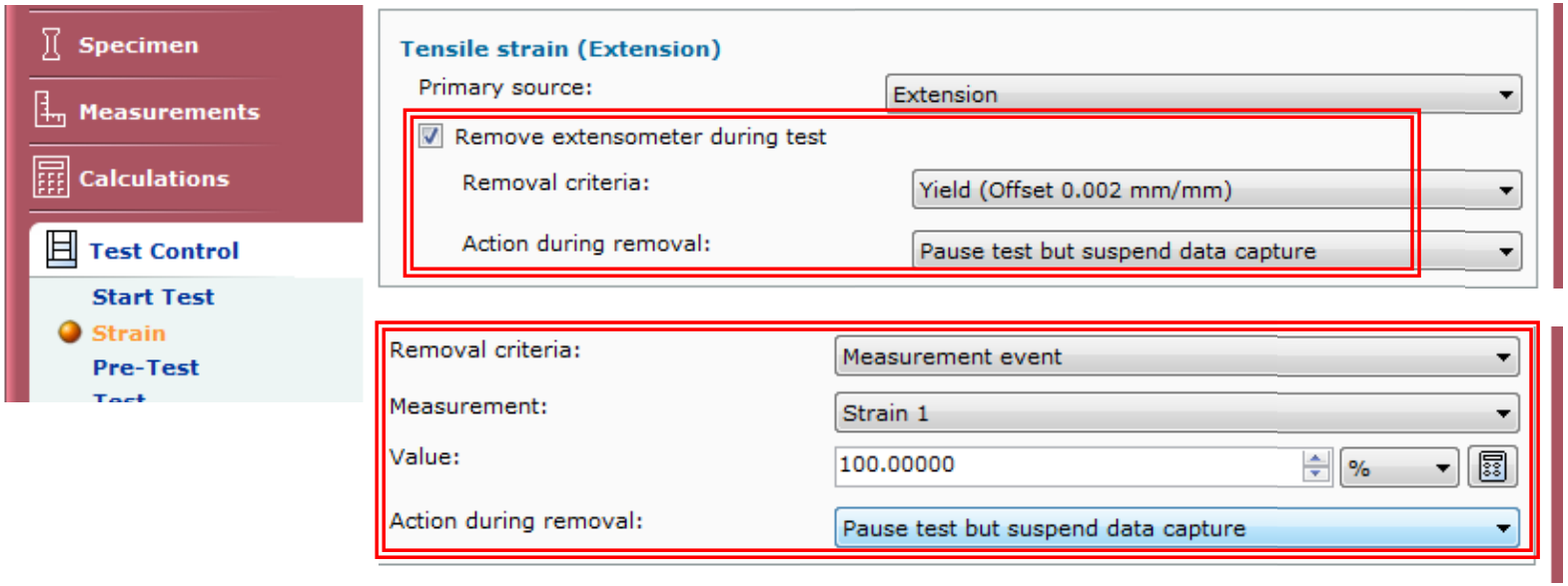
10. Click ***Calculations > Setup*** to identify desired calculations that will be performed during or after the test is run

11. Use of ***Extensometer*** with Tension tests, will require calculation of the ***Yield (Offset 0.2%)***



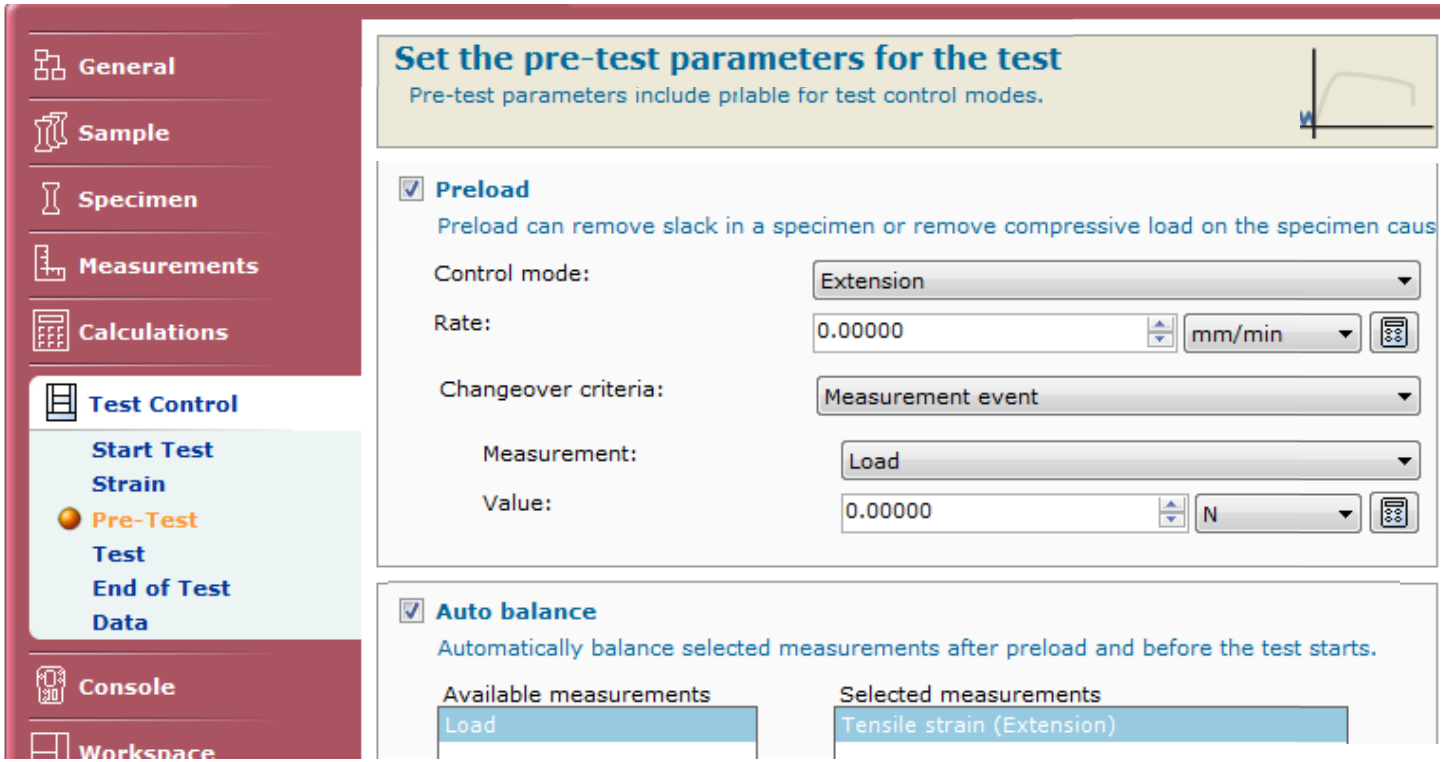
V. Configuring Test – 6/22

12. Click ***Test Control > Start Test*** and choose ***Start button*** (default)
13. Click ***Test Control > Strain*** to specify primary source of data for strain measurements
    - Choose "***Extension***" as the Primary source using the ***Crosshead*** location
14. If using ***Extensometer***, you **MUST** check "***Remove extensometer during test***"
    - Choose "***Yield (Offset 0.002 mm/mm)*** or "***Measurement event*** - (***Strain 1 = 100%)***" as the Removal criteria
    - Choose "***Pause test but suspend data capture***" as the Action during removal



V. Configuring Test – 7/22

15. Click ***Test Control > Pre-Test*** to assign a preload, auto balance, or precycling
    - ***Preload*** – used to remove slack from test fixtures that requires specifying the control measurement, preload rate, target measurement, and target value
    - ***Auto balance*** – used to automatically balance transducers associated with selected measurements after preload or precycling
    - ***Precycling*** – may be required for some tests and not available in every testing type



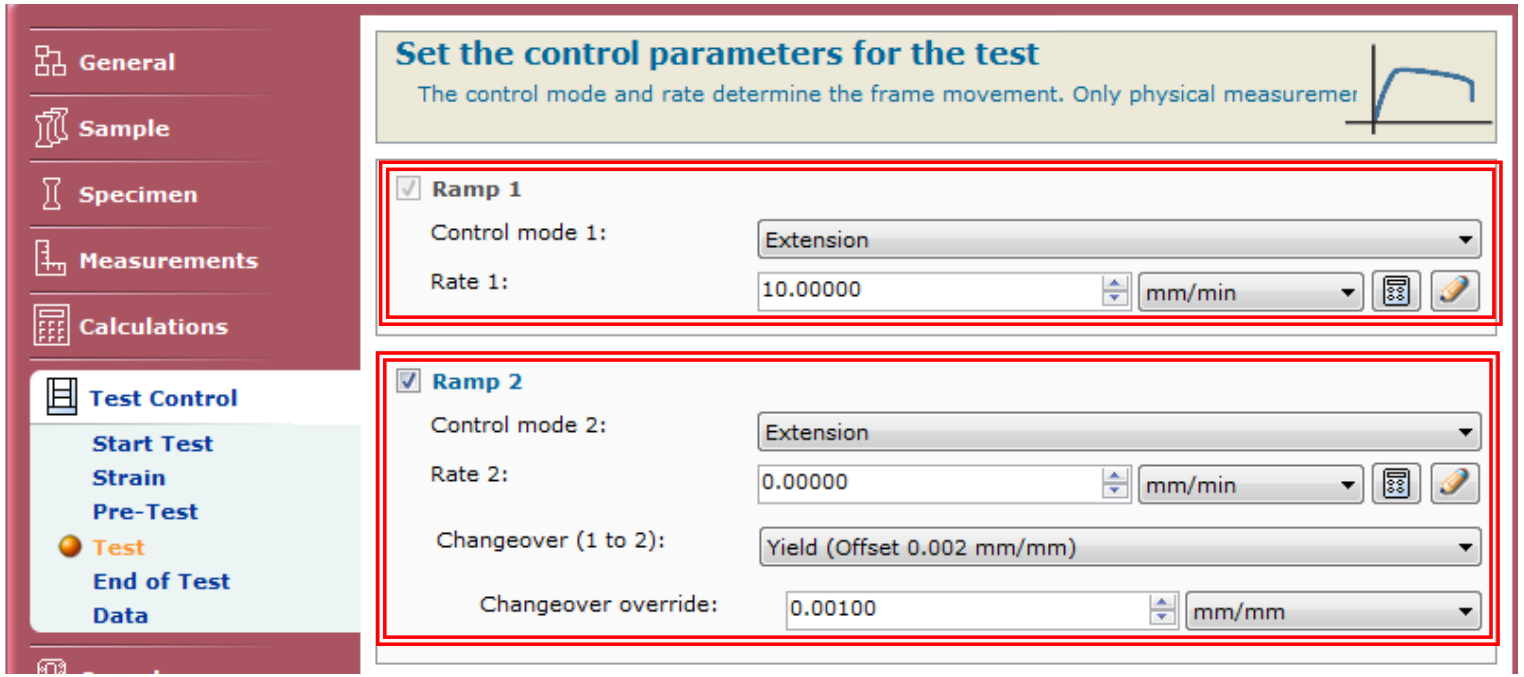
V. Configuring Test – 8/22

16. Click ***Test Control > Test*** to identify parameters specific to the test type such as the speed of the test and the number of speeds

- Specify a default or initial speed with ***Ramp 1*** control

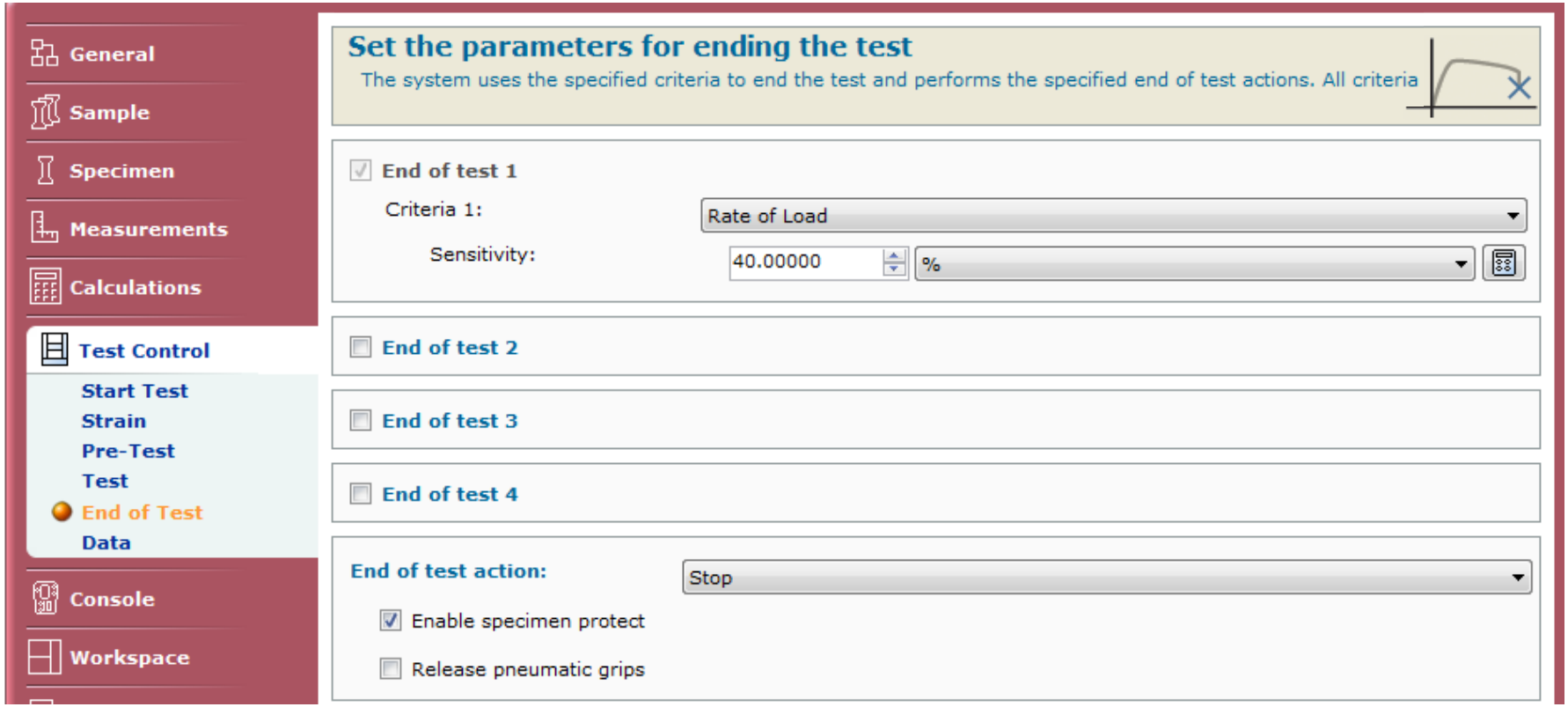
- Choose a ***Ramp 2*** control to separate a slow speed in elastic region (***Ramp 1***) and a faster speed in the plastic region (***Ramp 2***)

- Choose a ***Changeover (1 to 2)*** criteria such as ***Yield (Offset 0.002 mm/mm)***



V. Configuring Test – 9/22

17. Click ***Test Control > End of Test*** to set up to 4 criteria for ending the test and the actions that the system performs when one of the end of test criteria is satisfied



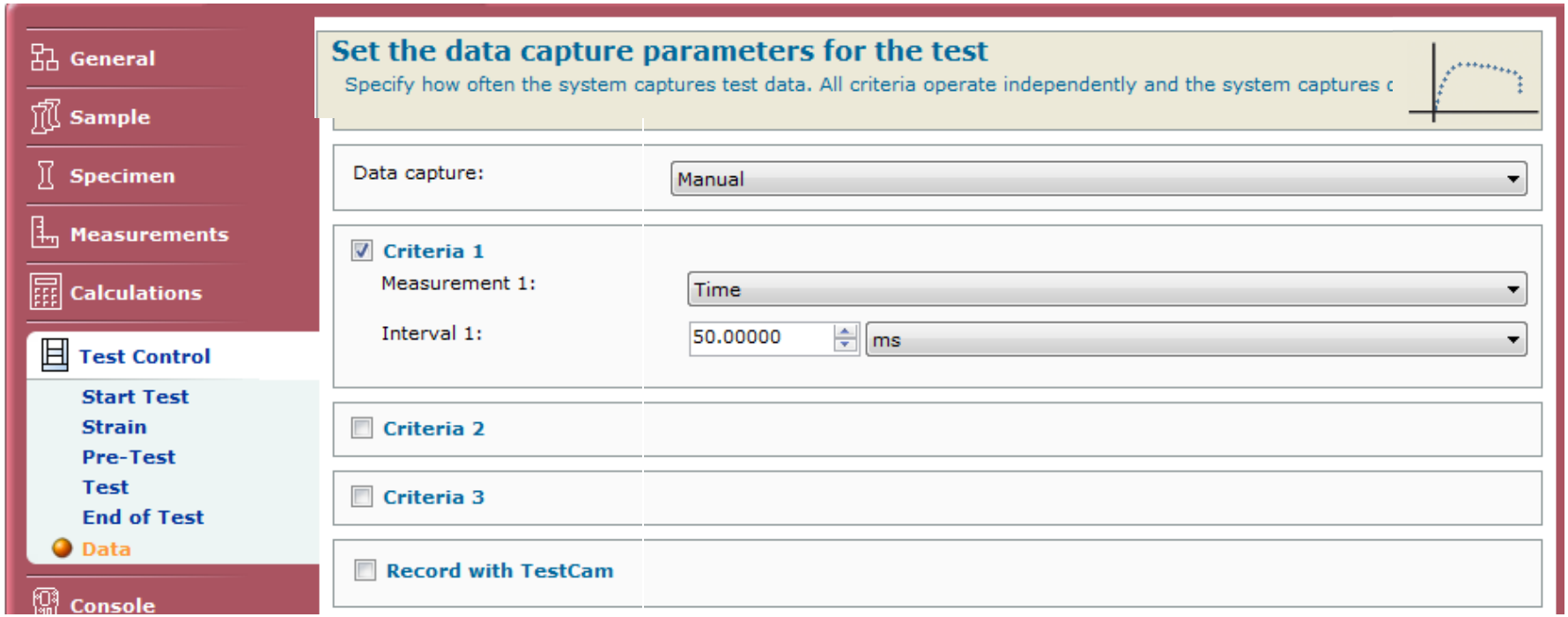
V. Configuring Test – 10/22

18. Select the appropriate ***End of Test Criteria***:
    - ***Rate of load*** – test ends when load drops by Sensitivity value within 100 ms time period
    - ***Load threshold*** – test ends when load falls to ***Load drops to value***, but is only active when load attains a value of 1.5 x ***Load drops to value*** first
    - ***Load with delay*** – detector is inactive for the ***Delay period*** specified and ends when load falls to the ***Load drops to value***
    - ***% Peak Load*** – detector is inactive until ***Load threshold*** field is exceeded and ends test when load drops by specified ***% Peak Load***
    - ***Measurement Event*** – transition occurs when system detects a specified measurement criteria being satisfied such as ***Extension*** value or ***Load*** value

19. Select the appropriate ***End of Test action***:
    - ***Stop*** – the ***Crosshead*** stops (**good default**)
    - ***Return*** – the ***Crosshead*** stops and returns to gauge length (**NEVER SELECT!**)
    - ***Stop, then Return*** – ***Crosshead*** stops, prompt to remove specimen first then return to gauge length (good for multiple specimens)

V. Configuring Test – 11/22

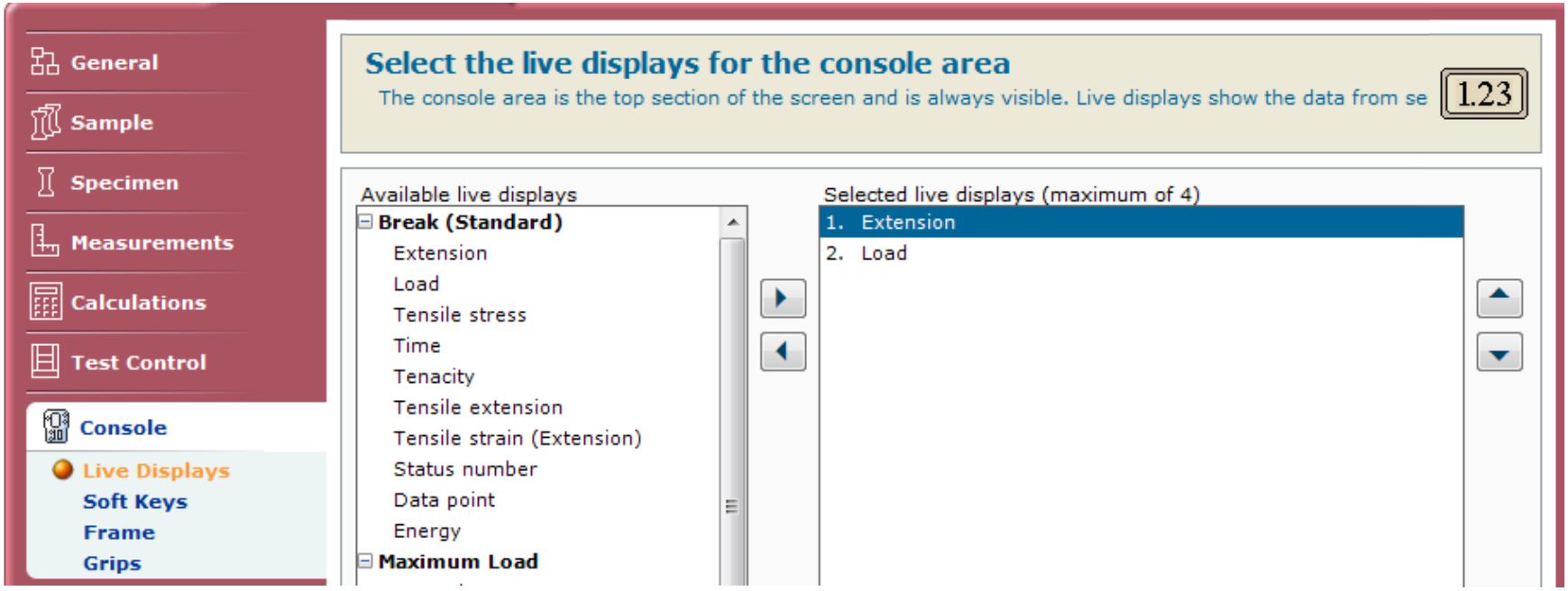
20. Click ***Test Control > Data*** to determine the number of data sets stored in the test data file
    - ***Automatic (default)*** – default data capture criteria captures 10 points/sec and whenever load changes 0.25% of load capacity
    - ***Manual*** – set up to three separate data logging criteria to tailor data logging to application needs



V. Configuring Test – 12/22

21. Click ***Console > Live Displays*** to customize up to 4 live displays on the console (if desired)

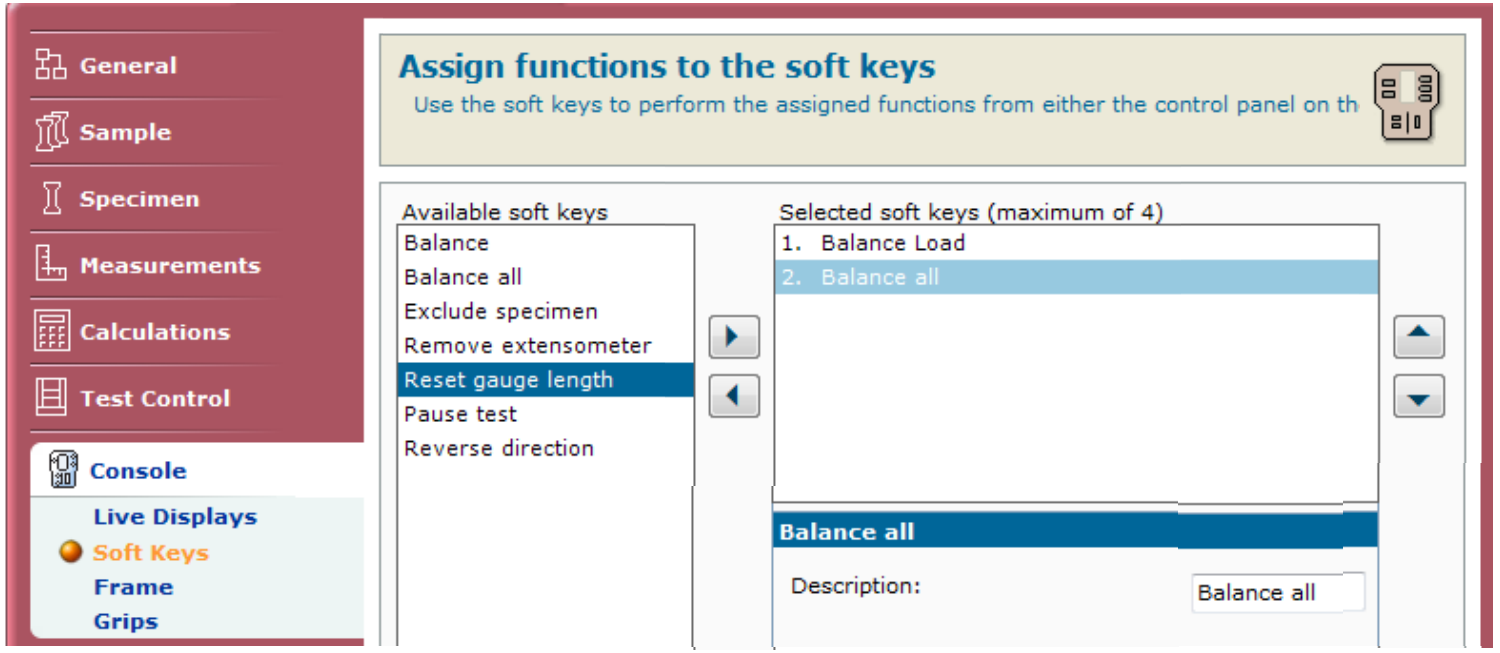
22. Recommended ***Live Displays*** are:
    - ***Load*** (N)
    - ***Extension*** (mm)
    - ***Strain 1*** (%) – if using ***Extensometer***



V. Configuring Test – 13/22

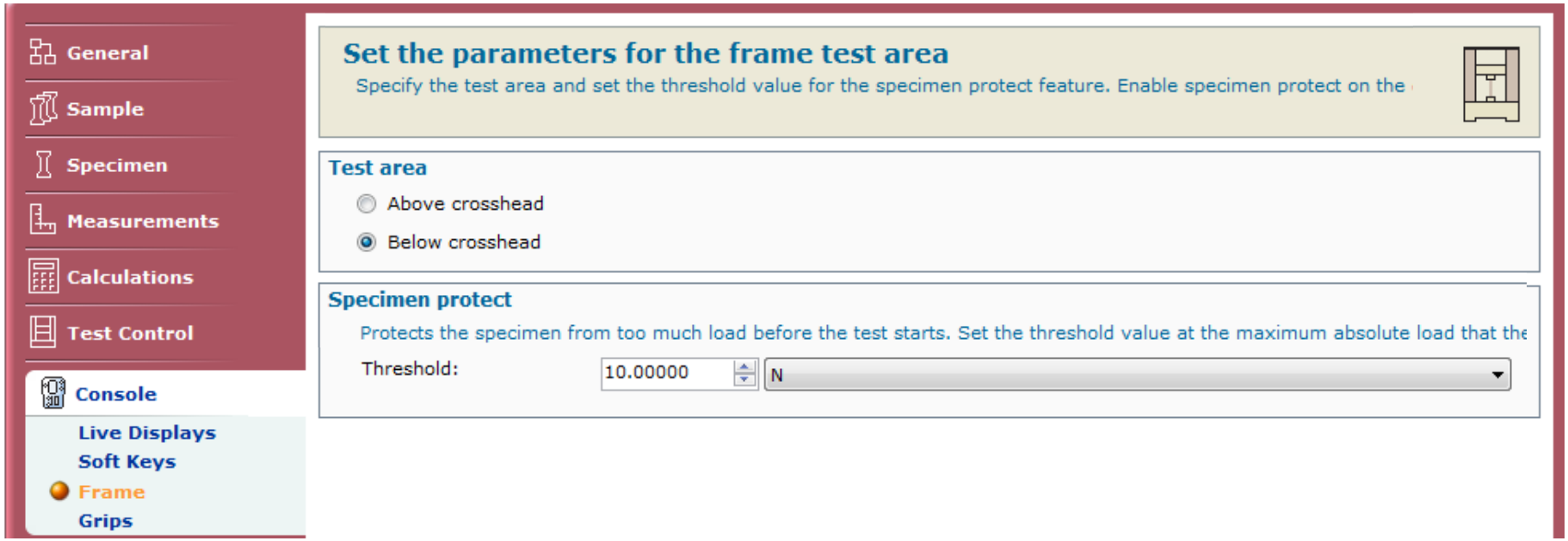
23. Click ***Console > Soft Keys*** to selectively program up to 4 functions on the control panel

24. Recommended ***Soft Keys*** are:
    - ***Balance Load***
    - ***Balance Strain 1*** – if using ***Extensometer***
    - ***Balance all***
    - ***Reset gauge length***



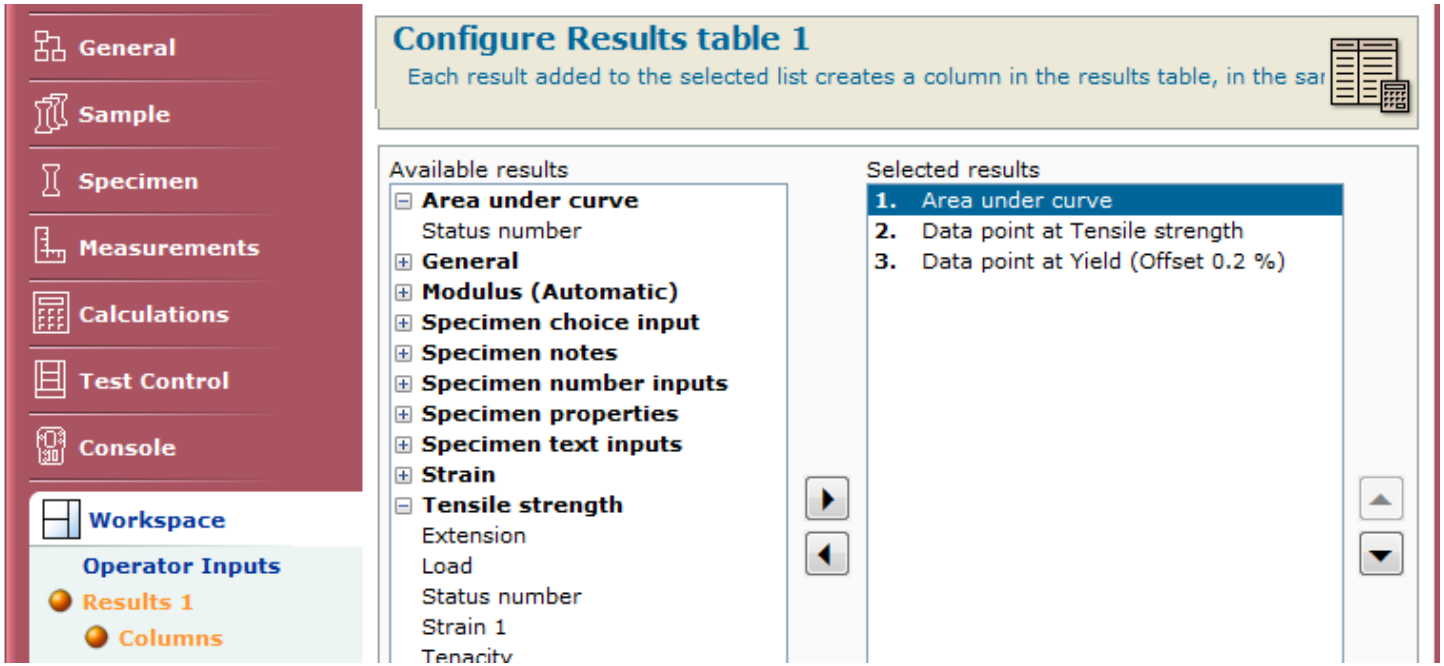
V. Configuring Test – 14/22

25. Click ***Console > Frame*** to specify the test area to be ***Below crosshead***
26. Specify the maximum absolute load that the specimen can experience without damage under the ***Threshold*** value for ***Specimen protect***



V. Configuring Test – 15/22

27. Click ***Workspace > Results 1 & 2 > Column*** to add specified calculation to be added into results table in the report



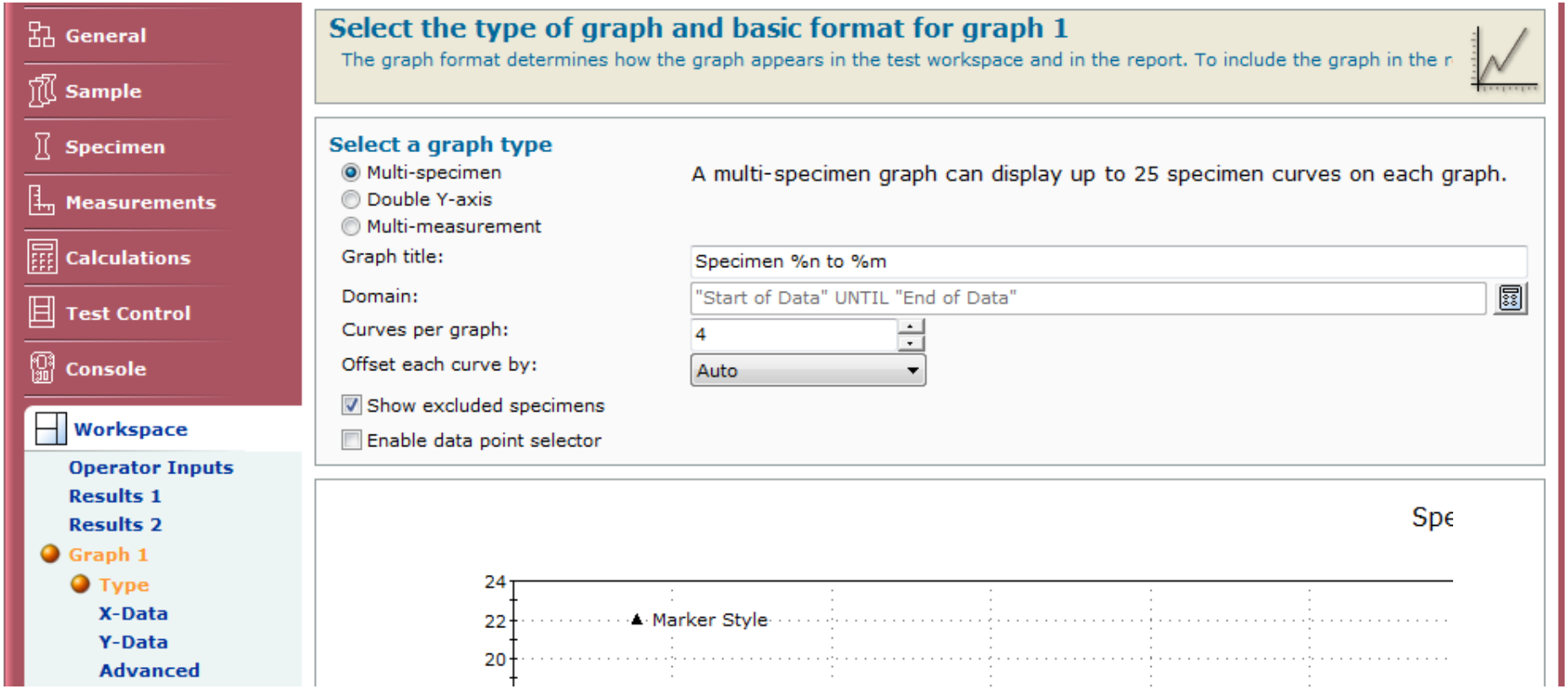
28. Click ***Workspace > Results 1 & 2> Statistics*** to add specified statistics to a row in results table

29. Click ***Workspace > Results 1 & 2> Format*** to select how the results table appears in the test workspace and in the report

V. Configuring Test – 16/22

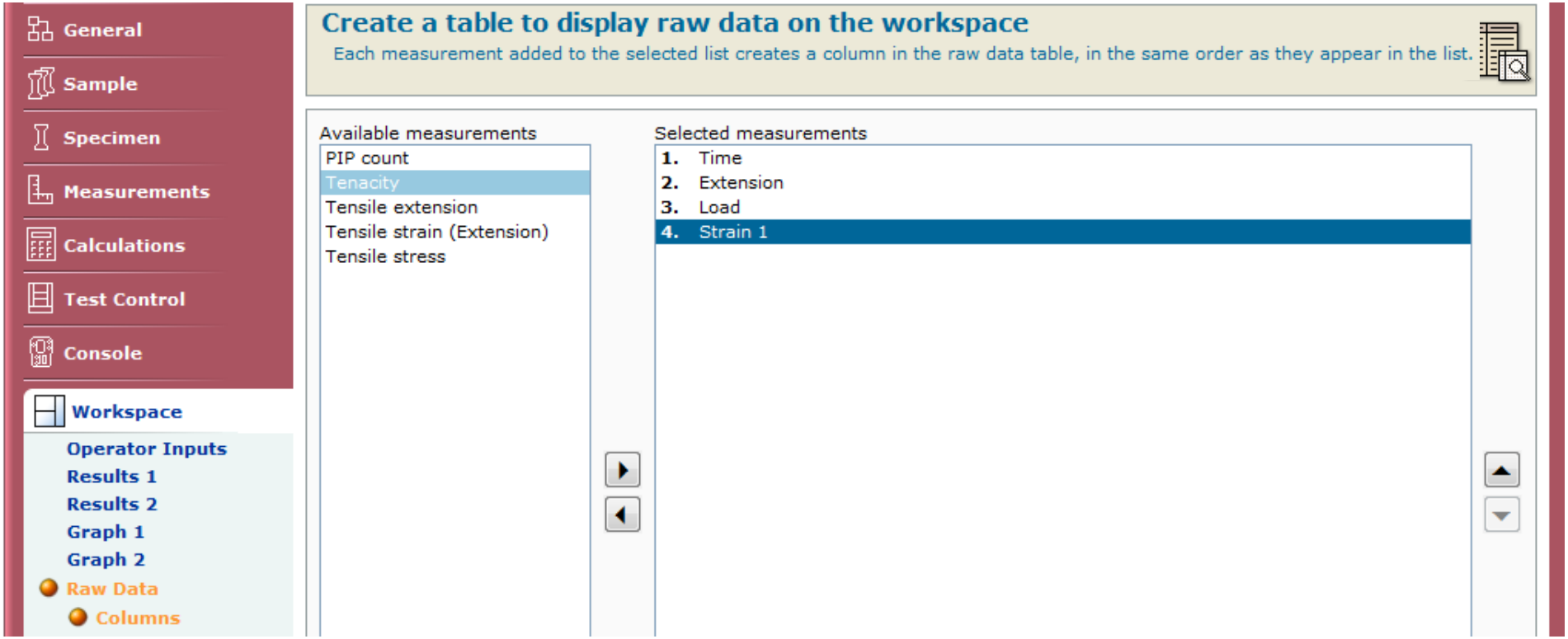
30. Click ***Workspace > Graph 1 & 2*** to select the graphics for this method in the test workspace and in a report

31. Click ***Workspace > Graph 1 & 2 > X & Y-Data*** to choose axes variables



V. Configuring Test – 17/22

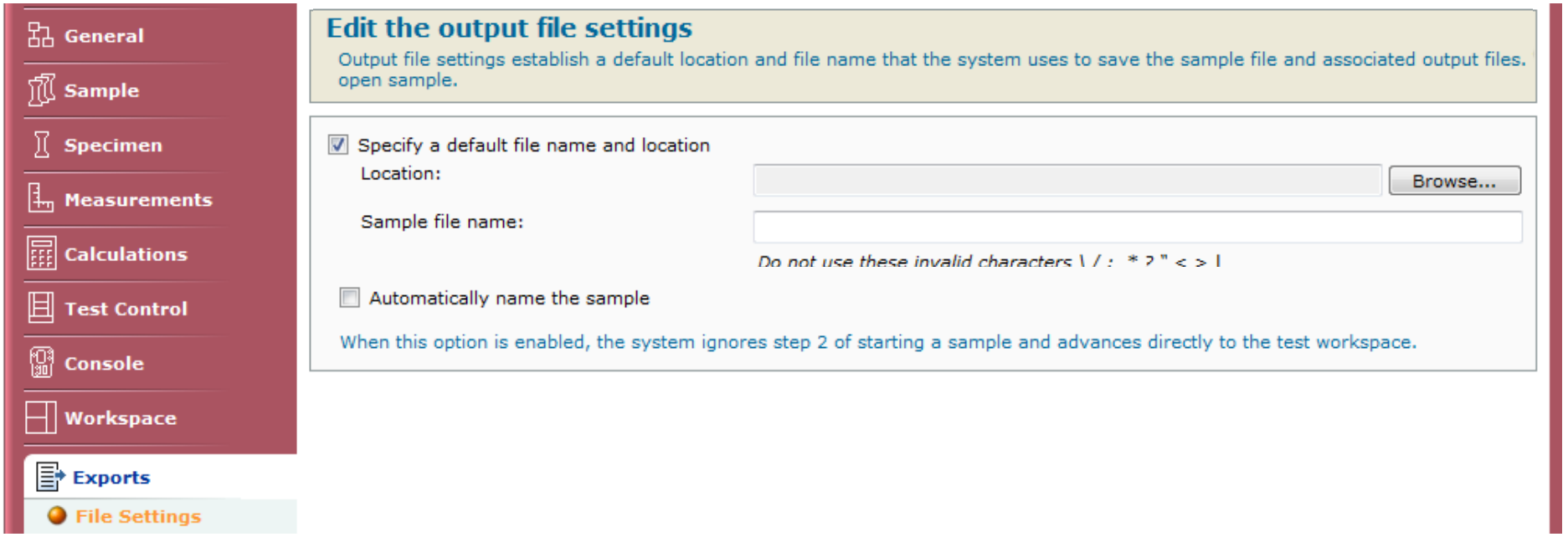
32. Click ***Workspace > Raw Data*** to set up the content for the raw data table
33. Click ***Workspace > Raw Data > Columns*** to arrange the order
34. Click ***Workspace > Layout*** to set up what is displayed on the test workspace



V. Configuring Test – 18/22

35. Click ***Exports > File Settings*** to set a default file name and location for all your output files such as Reports, Results, and Raw Data

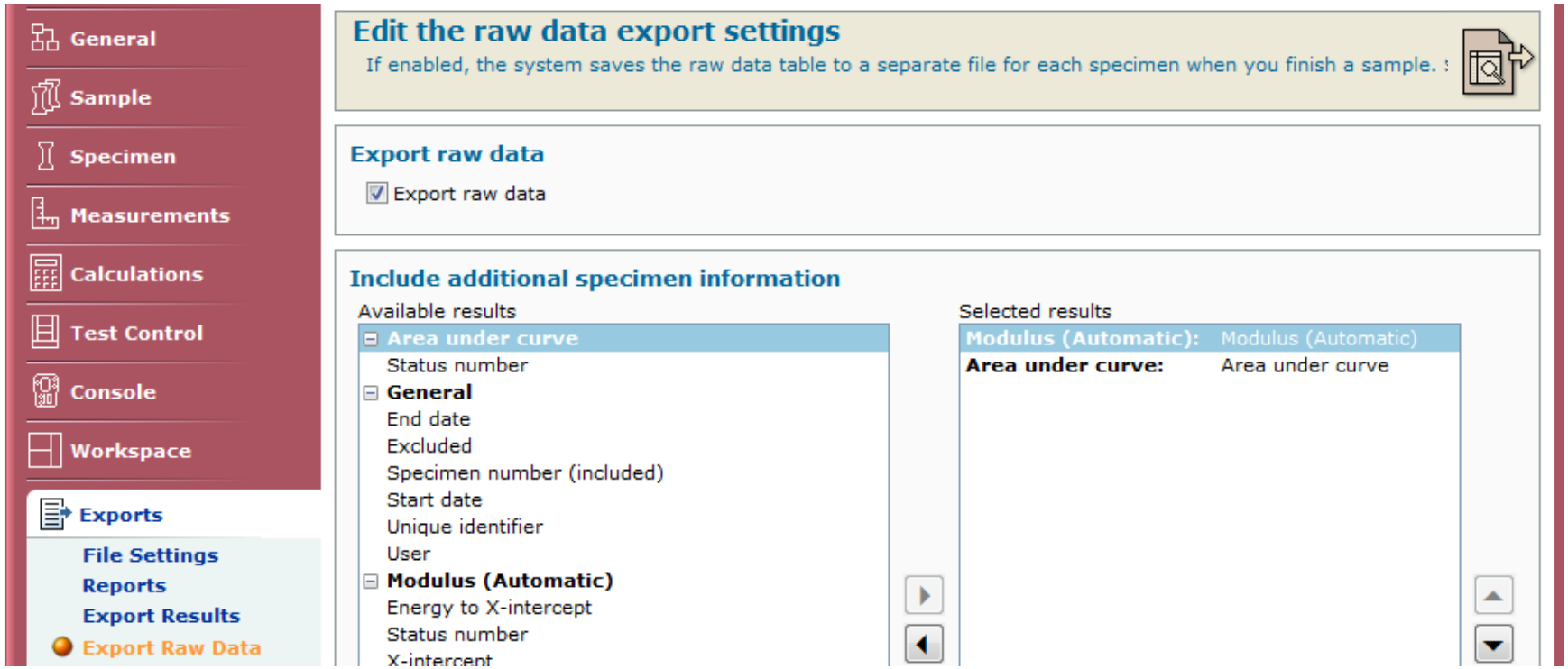
36. Click ***Exports > Reports*** to determine how the system produces the report when it generates output for a sample



V. Configuring Test – 19/22

37. Click ***Exports > Export Results*** to export results tables to .CSV file that the system generates

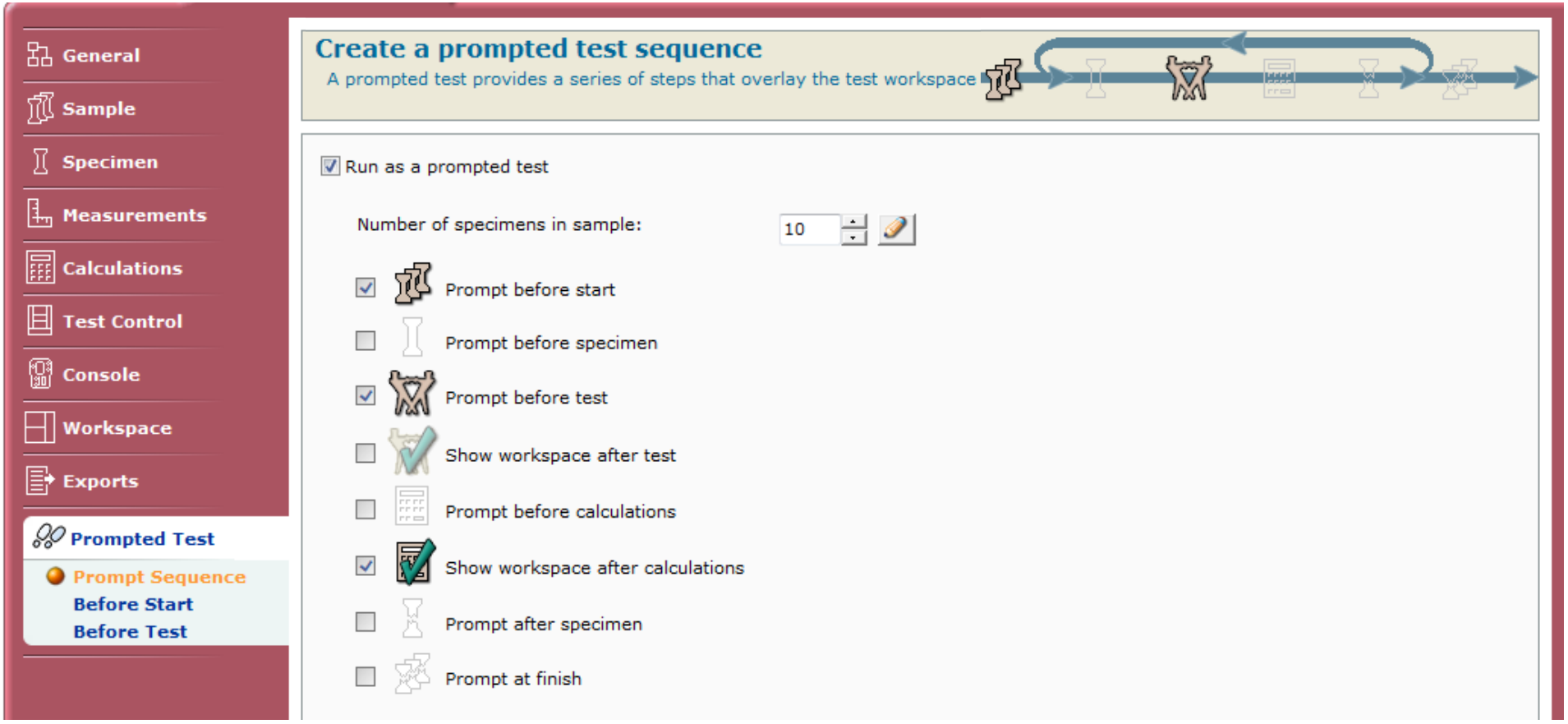
38. Click ***Exports > Export Raw Data*** to export raw data and determine the additional content in the raw data output file that the system generates



V. Configuring Test – 20/22

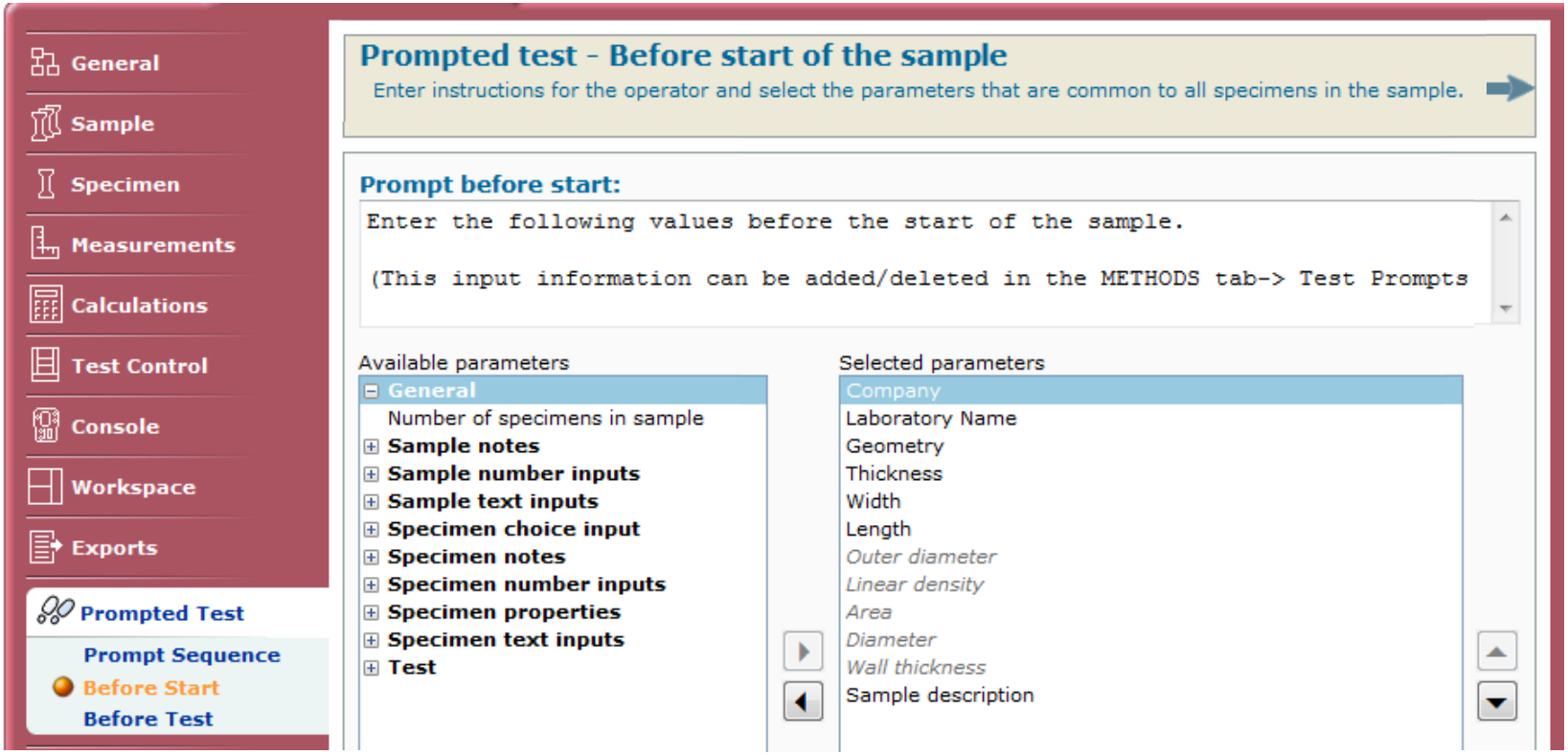
39. Click ***Prompted Test > Prompt Sequence*** to specify if the test would proceed with or without a sequence of prompts

40. Select which ***Prompts*** to be included in the test



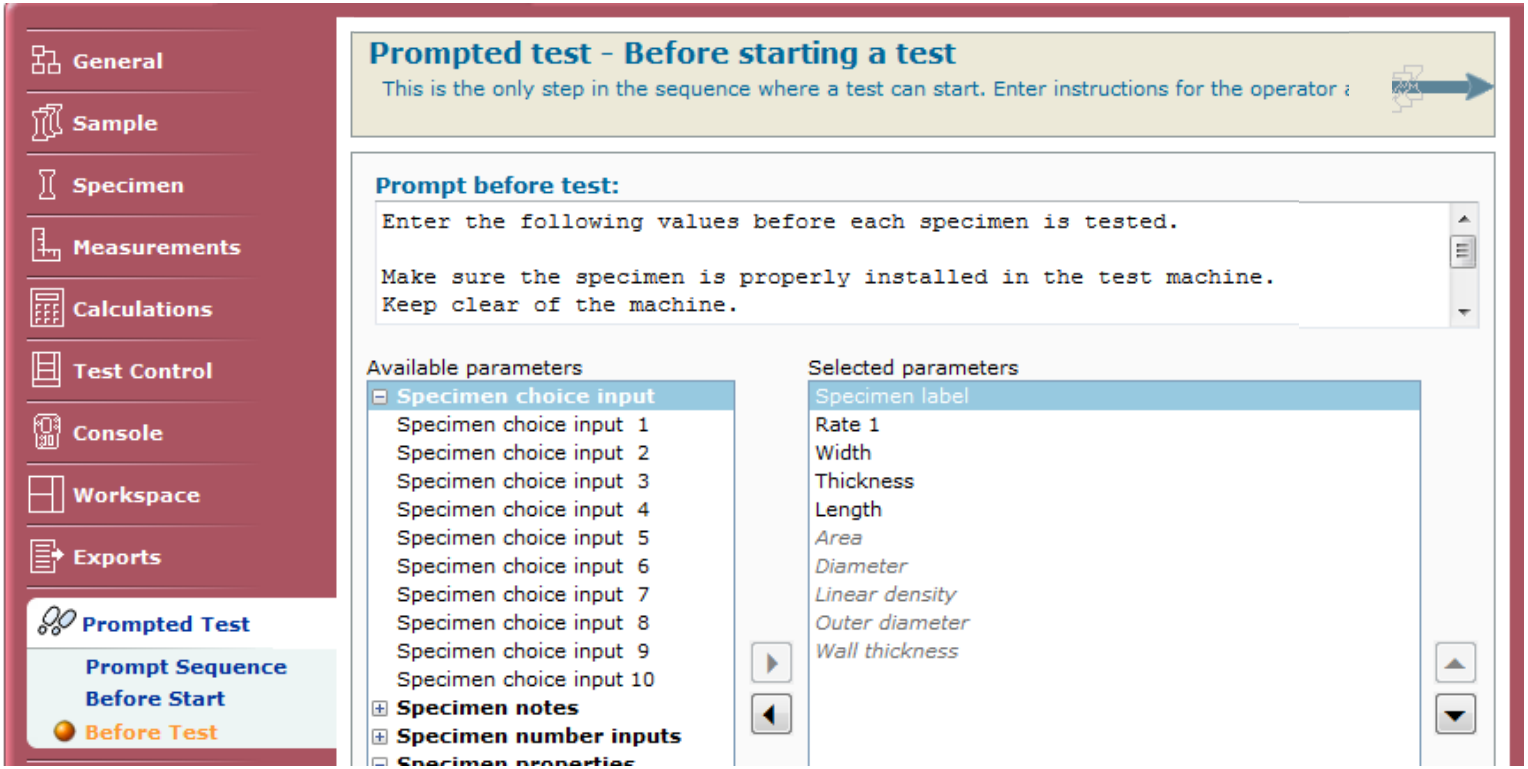
V. Configuring Test – 21/22

41. Click ***Prompted Test > Before start of the sample*** to enter instructions for the operator and select the parameters that are common to all specimens



V. Configuring Test – 22/22

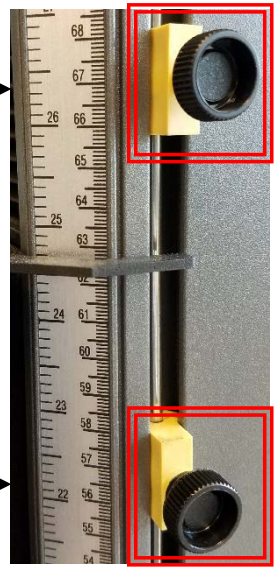
42. Click ***Prompted Test > Before test*** to enter instructions for the operator and select the parameters that required before each specimen is tested



VI. Running Test – 1/3

1. Always set ***Upper and Lower Limits*** before operating the Instron and ensure appropriate limits are enabled before moving the ***Crosshead***

2. Loosen and move the slides to the desired positions and tighten the thumb screws



3. Position the ***Crosshead*** to its starting position for the test using ***Jog*** $\Delta\nabla$ and ***Fine Jog*** controls

NOTE: ALWAYS RESET EXTENSION GAUGE LENGTH AFTER JOGGING OR MANUALLY CHANGING POSITION OF CROSSHEAD BEFORE STARTING TEST

4. Determine how you would like to measure strain (if applicable)
   a) "Extension" is determined by the location of the ***Cross Head*** (default)
   b) "Strain 1" is determined by ***Extensometer*** via the knife edge distance

VI. Running Test – 2/3

5. Collect all ***Specimens*** together that will make up your sample and identify each ***Specimen*** (e.g. with markings) by 1, 2, 3….

6. Load your ***Specimen*** appropriately into installed fixture or grip and close door

7. Click "***Balance All***" or if desired, click on individual measurements to be balanced (e.g. ***Load***, ***Strain***, ***Gauge Length***)

8. Click ***Test*** on the ***Home screen***

10. Click ***New Sample > Select Method*** in the navigation bar

11. Click ***Browse…*** to find desired test method file, click ***Open***

12. Input desired ***Sample Name*** and determine the location to save the file in ***Location*** field, click ***Next***

VI. Running Test – 3/3

13. Click on ***Start*** button to start your test

14. Your test will begin and will end automatically based on your chosen "***End Test***" criteria

15. If your test does not trigger the "***End Test***" criteria,
you can stop the test yourself by clicking on the ***Stop*** button

16. Safely remove your sample

17. If you press the Return button, it will return your crosshead back to the Zero extension value

18. Clicking on ***Save*** or ***Save As*** to continue your test later

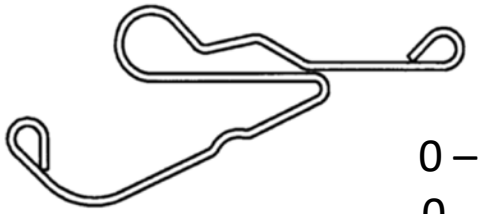
19. Load your next sample (if any) or click on ***Finish*** will end all your tests and generate your report and raw files

VII. Cleanup – 1/1

1. Remove ***Specimen*** from the installed grip or fixtures
2. Remove the ***Preload*** if performing Tension tests, see ***II.C. Preloading***
3. Remove any installed grip or fixtures
4. Return all components back to their respective storage drawers and boxes
5. Clean up any broken or specimen debris around the Instron
6. Turn off the software by clicking on the ***Exit*** button

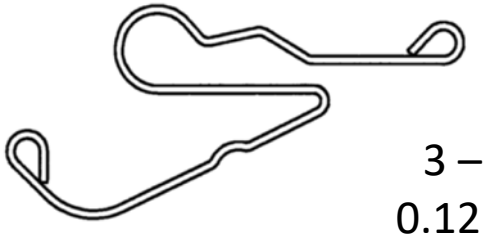
7. Sign-out of your ***ENGR account***

Round A



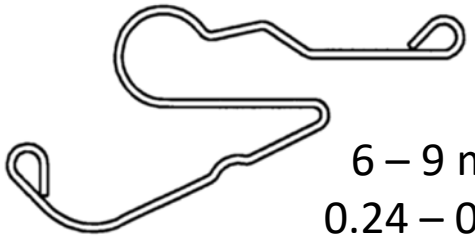
0 – 3 mm
0 – 0.12”

Round B



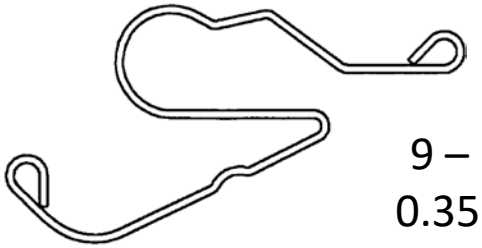
3 – 6 mm
0.12 – 0.24”

Round C



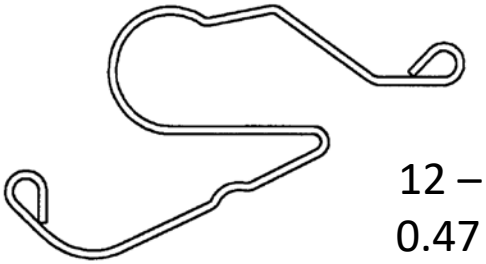
6 – 9 mm
0.24 – 0.35”

Round D



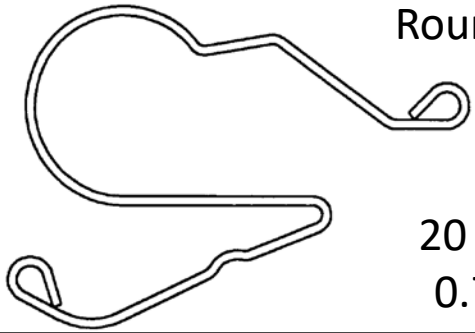
9 – 12 mm
0.35 – 0.47”

Round E

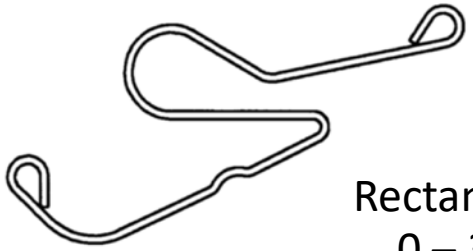


12 – 15 mm
0.47 – 0.59”

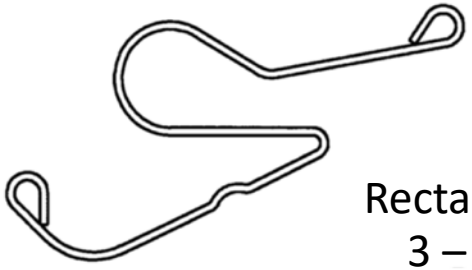
Round F



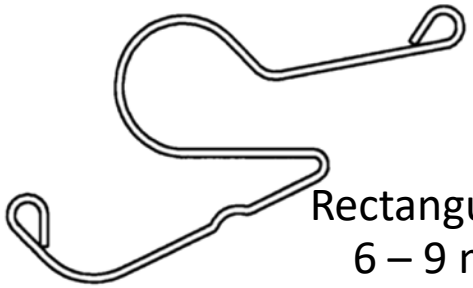
20 mm
0.79”



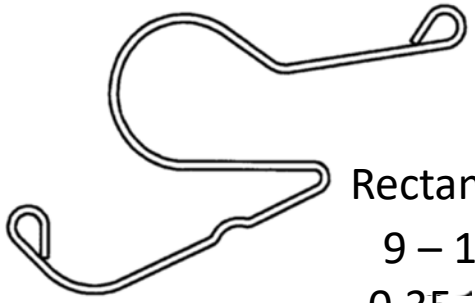
Rectangular A
0 – 3 mm
0 – 0.12”



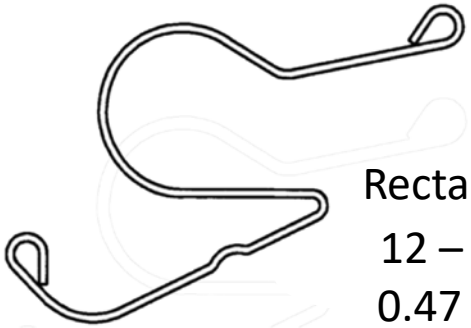
Rectangular B
3 – 6 mm
0.12 – 0.24”



Rectangular C
6 – 9 mm
0.24 – 0.35”

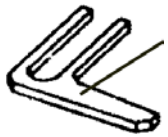


Rectangular D
9 – 12 mm
0.35 – 0.47”



Rectangular E
12 – 15 mm
0.47 – 0.59”

2 mm Hex Key



Specimen Stop