

## 5940 Series Single Column Table Frames



## **Electromagnetic Compatibility**

Where applicable, this equipment is designed to comply with International Electromagnetic Compatibility (EMC) standards.

To ensure reproduction of this EMC performance, connect this equipment to a low impedance ground connection. Typical suitable connections are a ground spike or the steel frame of a building.

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## **Original Instructions**

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## General Safety Precautions



Materials testing systems are potentially hazardous.



Materials testing involves inherent hazards from high forces, rapid motions, and stored energy. You must be aware of all moving and operating components in the testing system that are potentially hazardous, particularly force actuators or a moving crosshead.

Carefully read all relevant manuals and observe all Warnings and Cautions. The term Warning is used where a hazard may lead to injury or death. The term Caution is used where a hazard may lead to damage to equipment or to loss of data.

Instron products, to the best of its knowledge, comply with various national and international safety standards, in as much as they apply to materials and structural testing. We certify that our products comply with all relevant EU directives (CE mark).

Because of the wide range of applications with which our instruments are used, and over which we have no control, additional protection devices and operating procedures may be necessary due to specific accident prevention regulations, safety regulations, further EEA directives or locally valid regulations. The extent of our delivery regarding protective devices is defined in your initial sales quotation. We are thus free of liability in this respect.

At your request, we will gladly provide advice and quotations for additional safety devices such as protective shielding, warning signs or methods of restricting access to the equipment.

The following pages detail various general warnings that you must heed at all times while using materials testing equipment. You will find more specific Warnings and Cautions in the text whenever a potential hazard exists.

Your best safety precautions are to gain a thorough understanding of the equipment by reading your instruction manuals and to always use good judgement.

It is our strong recommendation that you should carry out your own safety risk assessment on the use of the test system, test methods employed, specimen loading and specimen behavior at failure.

## Warnings

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**Crush Hazard - Allow only one person to handle or operate the system at all times.**

Operator injury may result if more than one person operates the system. Before working inside the hazard area between the grips or fixtures, ensure that no other personnel can operate the computer or any of the system controls.



**Crush Hazard - Take care when installing or removing a specimen, assembly, structure, or load string component.**

Installation or removal of a specimen, assembly, structure, or load string component involves working inside the hazard area between the grips or fixtures. Keep clear of the jaws of a grip or fixture at all times. Keep clear of the hazard area between the grips or fixtures during actuator or crosshead movement. Ensure that all actuator or crosshead movements necessary for installation or removal are slow and, where possible, at a low force setting.



**Hazard - Press the Emergency Stop button whenever you consider that an unsafe condition exists.**

The Emergency Stop button removes hydraulic power or electrical drive from the testing system and brings the hazardous elements of the system to a stop as quickly as possible. It does not isolate the system from electrical power, other means are provided to disconnect the electrical supply. Whenever you consider that safety may be compromised, stop the test using the Emergency Stop button. Investigate and resolve the situation that caused the use of the Emergency Stop button before you reset it.



**Flying Debris Hazard - Make sure that test specimens are installed correctly in grips or fixtures in order to eliminate stresses that can cause breakage of grip jaws or fixture components.**



Incorrect installation of test specimens creates stresses in grip jaws or fixture components that can result in breakage of these components. The high energies involved can cause the broken parts to be projected forcefully some distance from the test area. Install specimens in the center of the grip jaws in line with the load path. Insert specimens into the jaws by at least the amount recommended in your grip documentation. This amount can vary between 66% to 100% insertion depth; refer to supplied instructions for your specific grips. Use any centering and alignment devices provided.



**Hazard - Protect electrical cables from damage and inadvertent disconnection.**

The loss of controlling and feedback signals that can result from a disconnected or damaged cable causes an open loop condition that may drive the actuator or crosshead rapidly to its extremes of motion. Protect all electrical cables, particularly transducer cables, from damage. Never route cables across the floor without protection, nor suspend cables overhead under excessive strain. Use padding to avoid chafing where cables are routed around corners or through wall openings.

## Warnings

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### **High/Low Temperature Hazard - Wear protective clothing when handling equipment at extremes of temperature.**



Materials testing is often carried out at non-ambient temperatures using ovens, furnaces or cryogenic chambers. Extreme temperature means an operating temperature exceeding 60 °C (140 °F) or below 0 °C (32 °F). You must use protective clothing, such as gloves, when handling equipment at these temperatures. Display a warning notice concerning low or high temperature operation whenever temperature control equipment is in use. You should note that the hazard from extreme temperature can extend beyond the immediate area of the test.



### **Hazard - Do not place a testing system off-line from computer control without first ensuring that no actuator or crosshead movement will occur upon transfer to manual control.**

The actuator or crosshead will immediately respond to manual control settings when the system is placed off-line from computer control. Before transferring to manual control, make sure that the control settings are such that unexpected actuator or crosshead movement cannot occur.



### **Robotic Motion Hazard - Keep clear of the operating envelope of a robotic device unless the device is de-activated.**

The robot in an automated testing system presents a hazard because its movements are hard to predict. The robot can go instantly from a waiting state to high speed operation in several axes of motion. During system operation, keep away from the operating envelope of the robot. De-activate the robot before entering the envelope for any purpose, such as reloading the specimen magazine.



### **Hazard - Set the appropriate limits before performing loop tuning or running waveforms or tests.**

Operational limits are included within your testing system to suspend motion or shut off the system when upper and/or lower bounds of actuator or crosshead travel, or force or strain, are reached during testing. Correct setting of operational limits by the operator, prior to testing, will reduce the risk of damage to test article and system and associated hazard to the operator.



### **Electrical Hazard - Disconnect the electrical power supply before removing the covers to electrical equipment.**

Disconnect equipment from the electrical power supply before removing any electrical safety covers or replacing fuses. Do not reconnect the power source while the covers are removed. Refit covers as soon as possible.

## Warnings

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**Rotating Machinery Hazard - Disconnect power supplies before removing the covers to rotating machinery.**

Disconnect equipment from all power supplies before removing any cover which gives access to rotating machinery. Do not reconnect any power supply while the covers are removed unless you are specifically instructed to do so in the manual. If the equipment needs to be operated to perform maintenance tasks with the covers removed, ensure that all loose clothing, long hair, etc. is tied back. Refit covers as soon as possible.



**Hazard - Shut down the hydraulic power supply and discharge hydraulic pressure before disconnection of any hydraulic fluid coupling.**

Do not disconnect any hydraulic coupling without first shutting down the hydraulic power supply and discharging stored pressure to zero. Tie down or otherwise secure all pressurized hoses to prevent movement during system operation and to prevent the hose from whipping about in the event of a rupture.



**Hazard - Shut off the supply of compressed gas and discharge residual gas pressure before you disconnect any compressed gas coupling.**

Do not release gas connections without first disconnecting the gas supply and discharging any residual pressure to zero.



**Explosion Hazard - Wear eye protection and use protective shields or screens whenever any possibility exists of a hazard from the failure of a specimen, assembly or structure under test.**



Wear eye protection and use protective shields or screens whenever a risk of injury to operators and observers exists from the failure of a test specimen, assembly or structure, particularly where explosive disintegration may occur. Due to the wide range of specimen materials, assemblies or structures that may be tested, any hazard resulting from the failure of a test specimen, assembly or structure is entirely the responsibility of the owner and the user of the equipment.



**Hazard - Ensure components of the load string are correctly pre-loaded to minimize the risk of fatigue failure.**

Dynamic systems, especially where load reversals through zero are occurring, are at risk of fatigue cracks developing if components of the load string are not correctly pre-loaded to one another. Apply the specified torque to all load string fasteners and the correct setting to wedge washers or spiral washers. Visually inspect highly stressed components such as grips and threaded adapters prior to every fatigue test for signs of wear or fatigue damage.

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# Chapter 1

## Introduction

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These instructions describe the following table model single column load frames, Model 5942 500 N capacity, Model 5943 1 kN capacity, Model 5944 2kN capacity. They are intended to get you started working with your testing system.

These instructions assume the following:

- You are an operator familiar with the operation of materials testing systems in general.
- Your system consists of a load frame with integral controller and a control panel fitted to the column, a load cell, a set of manually-operated grips and Instron Bluehill<sup>®</sup> test control software.
- The system has been installed in its final location by an Instron service engineer.
- Bluehill software test methods that are appropriate for your testing requirements are available.

Using these instructions you will be able to:

- Check the interconnections between all the individual elements of the basic system.
- Select and install a load cell, if the one that you want to use is not already installed.
- Install the grips and preload the loadstring.
- Prepare a set of specimens (sample) for testing.
- Test the sample.
- View the test results and print a test report.

These instructions do not include the development of Bluehill test methods. This is covered in more advanced training that can be provided by Instron Service and Training departments.

# System Description and Terminology

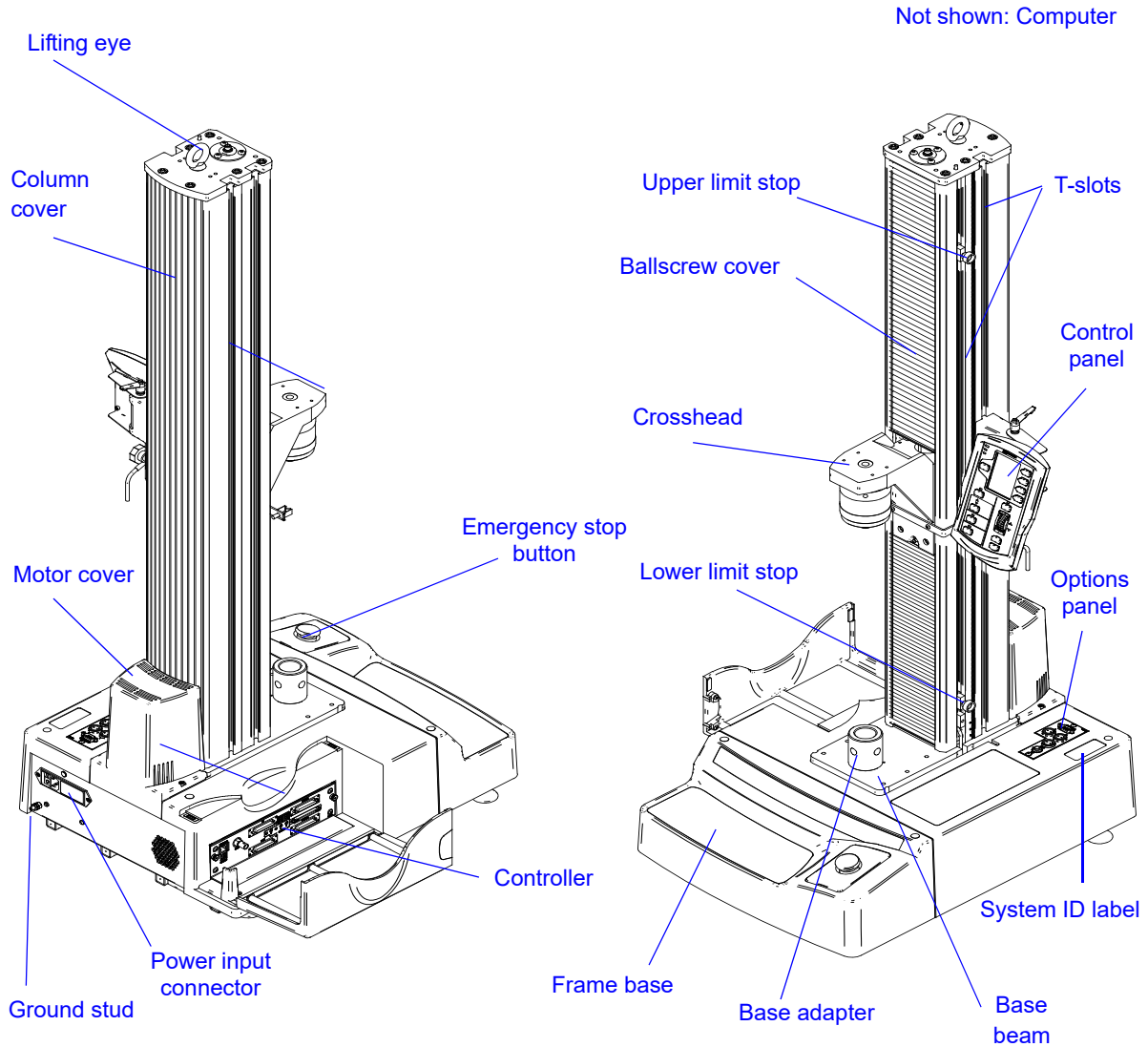


Figure 1-1. 5940 Single Column Table Frame

## Components

The major components of an Instron electromechanical testing system include:

- Load frame with integral controller
- Load cell mounted to the crosshead

- Grips for tension testing or table-mounted anvils on a platen for compression testing.
- Instron approved computer system with Instron Bluehill® software.

Special fixtures are available for applications such as flexure and peel testing. For strain measurement, an optional strain gauge extensometer attaches to the specimen. You can use non-contacting extensometers with specimens that are unable to support a contacting extensometer. Contact your regional Instron office or check our web site at [www.instron.com](http://www.instron.com) for assistance with Instron’s grips and fixtures.

The following table defines the components of the testing system:

*Table 1-1. Testing System Components*

| Component         | Description   |
|-------------------|---|
| Load Frame        | <p>The load frame comprises a base, one or two columns, a moving crosshead, and a top plate. It is a high stiffness support structure against which the test forces react.</p> <p>Each column comprises a guide column and a ballscrew. The crosshead is mounted on both the guide column and the ballscrew. Rotation of the ballscrew drives the crosshead up or down while the guide column provides stability.</p>   |
| Controller        | The hardware that controls the frame and any ancillary equipment connected to the testing system. The controller panel contains all the connectors for load cells, extensometers and any other sensors that are required for testing.   |
| Control Panel     | The hardware panel, mounted on the side of the load frame, that lets you perform some of the software functions directly at the frame.  |
| Load String       | <p>Comprises all of the components that you install between the moving crosshead and the load frame base (or fixed crosshead). Typically this involves a load cell, a set of grips, any adapters that are required to connect the components, and the specimen to be tested.</p> <p>Typically, you mount a load cell on the crosshead, then a pair of grips or fixtures on the load cell and frame base. The grips or fixtures secure the specimen and when you start a test the crosshead moves up or down applying a tensile or compressive load to the specimen. The load cell converts this load into an electrical signal that the software measures and displays.</p> |
| Bluehill Software | Instron testing software that controls the testing system, running tests and analyzing test data to produce test results.   |
| Specimen          | A single piece of material to be tested.  |

## Principle of Operation

The system communicates primarily through the controller. The controller contains sensor conditioning cards for the system transducers and transfers data between the transducers and the computer. The controller also communicates with the load frame via a frame interface board (FIB) inside the load frame. The FIB links all the electrical components of the frame together.

## Hardware Controls

The hardware controls consist of:

- Emergency stop button - to be used whenever you need to stop the crosshead immediately because an unsafe condition exists.
- Limit stops - these must be set before each test session to protect the operator against unexpected crosshead movement.
- Control panel - lets you perform certain functions at the frame instead of at the computer. These include starting and stopping a test and using the jog controls to position the crosshead prior to installing a specimen.

## Software

Control of the testing system is carried out via Instron Bluehill software. Setting test parameters, operating the system, and collecting test data is done through the software program.

*Table 1-2. Software Terminology*

| <b>Term</b> | <b>Description</b>  |
|-------------|---|
| Test Method | In Bluehill software, a test method is a file that contains a set of defined parameters that the system uses to run tests, analyze the test data, and produce calculated results.   |
| Sample      | A group of material specimens, whose properties are studied and compared to gain statistical or quality assurance information. For example, you could take a specimen from different parts of a single manufacturing run of a material to form a sample of the material. The sample is then representative of the complete run and you can test it to ensure that the material quality has remained stable over the complete run. You perform the same test on each specimen in a sample. |

# System Components and Interconnections

Figure 1-2 on page 1-5 shows you how each hardware component is connected to make up the complete testing system.

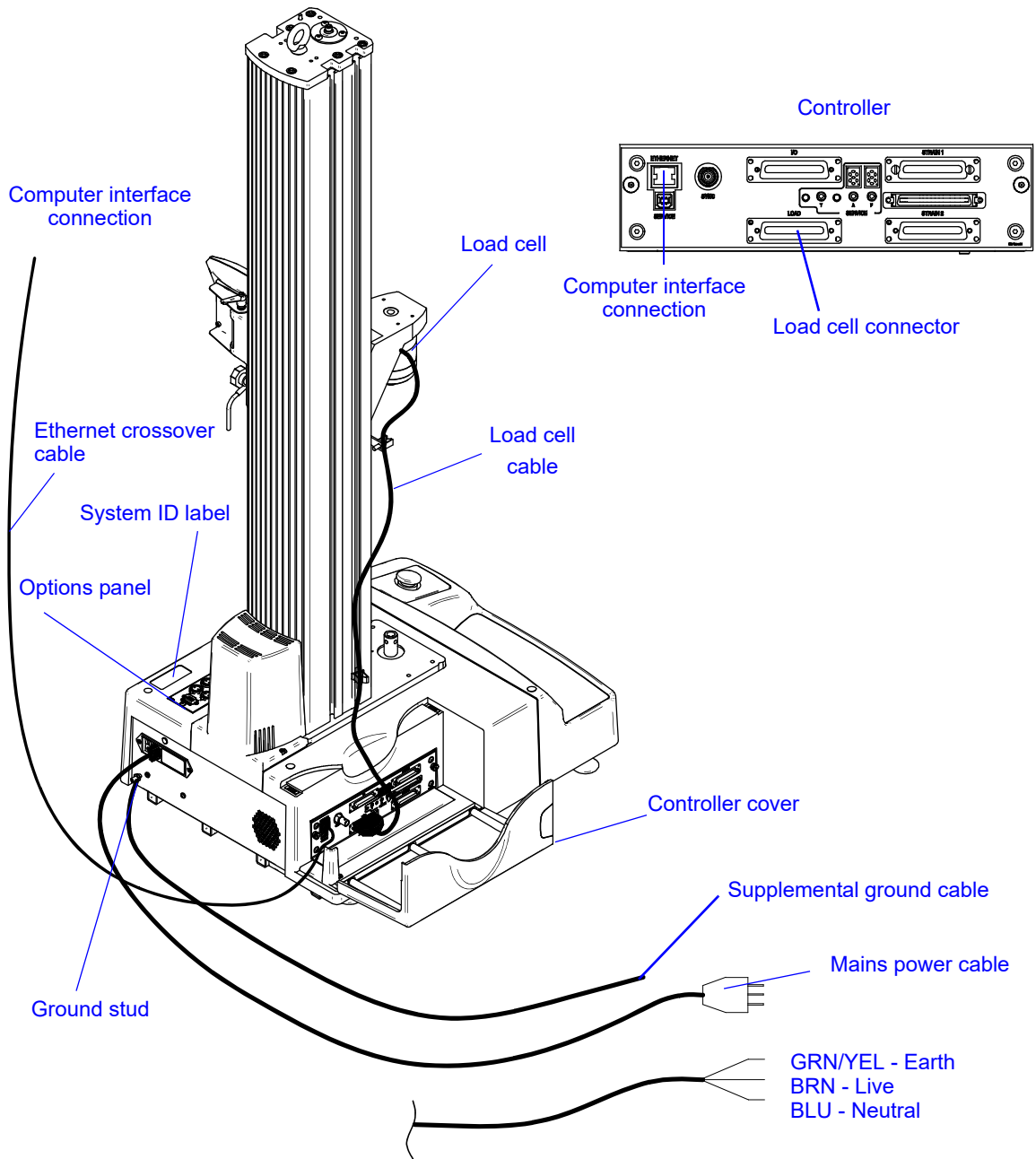


Figure 1-2. 5940 System Connections

## System Safety and Information Labeling

Table 1-3 on page 1-6 explains the meanings of any safety and information labels that may be attached to any part of the testing system.

*Table 1-3. Safety and Information Labeling Descriptions*



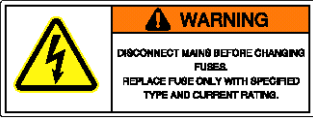








| Label   | Meaning                   | Purpose  |
|---|---------------------------|--|
|    | Electrical hazard         | Indicates that an electrical hazard exists from high voltage or electrical current.  |
|    | Disconnect power supply   | Disconnect the power supply before servicing machine.  |
|  | Electrical - fuse warning | Indicates an electrical hazard exists. Advises about disconnecting power mains before changing fuses and using only specified fuses. |
|  | Belt entanglement hazard  | Indicates that a hazard exists from the drive belt and pulley system.  |
|  | High temperature hazard   | Indicates that a heat hazard exists. Stay clear of area when operating the machine.  |
|  | Rotating machinery hazard | Indicates that a rotating hazard exists. Keep clear of these areas (and tie back long hair).   |

Table 1-3. Safety and Information Labeling Descriptions (Continued)

| Label   | Meaning  | Purpose  |
|---|--|--|
|    | Ground stud                                      | Indicates a ground stud.   |
|    | Read the manual                                  | Read and understand the operator's manual before using the machine.  |
|    | Crosshead direction                              | Indicates the direction to turn the pulley to manually move the crosshead upward. Pulleys can be turned by hand when power is disabled.  |
|  | Crush hazard                                     | Indicates the crush hazard of the moving crosshead and instructs the user to read and understand the operator's manual before using the machine.   |
|  | Waste Electrical and Electronic Equipment (WEEE) | In accordance with the European Union's WEEE directive, the crossed out wheeled bin symbol indicates that the equipment must be disposed of separately from other waste at the end of its usable life. For advice on the disposal of electrical and electronic equipment in your country, contact your local Instron representative. |

## Product Support

Instron provides documentation, including manuals and online help, that can answer many of the questions you may have. It is recommended that you review the documentation sent with the system you purchased for possible solutions to your questions.

If you cannot find answers in these sources, contact Instron's Service department directly. A list of Instron offices is available on our website at [www.instron.com](http://www.instron.com). In the US and Canada, you can call directly at 1-800-473-7838.

## Product Documentation

Instron offers a comprehensive range of documentation to help you get the most out of your Instron products. Depending on what you have purchased, your documentation may include some or all of the following:

|                               |  |
|-------------------------------|--|
| Operator's Guide              | How to use your system components and controls, procedures for setting limits, calibration and other frequently performed operating tasks.     |
| System Support                | Information about system installation, set up and configuration, transducer connection and calibration.  |
| Online Help                   | Software products come complete with context sensitive help, which provides detailed information on how to use all software features.          |
| Accessory Equipment Reference | How to set up and use any accessories you have purchased, for example grips, fixtures, extensometers, transducers, and environmental chambers. |

We welcome your feedback on any aspect of the product documentation. Please email [info\\_dev@instron.com](mailto:info_dev@instron.com) with your comments.



# Chapter 2

## Preparing the System

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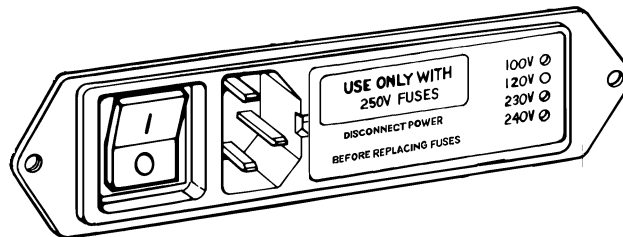
### Before you Begin

Before you start the system, make sure you familiarize yourself with the following controls:

#### Power Input Connector

The power input connector, shown in [Figure 2-1](#), performs the following functions:

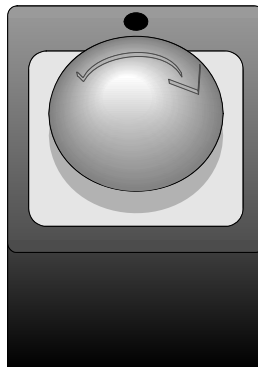
- Connects the load frame to the electrical power supply.
- Contains the power **ON/OFF** switch.
- Holds the power fuse.
- Controls the voltage setting. The voltage setting can be changed if necessary, refer to the System Support manual for details.



*Figure 2-1. Power Input Connector*

Refer to [Figure 1-1](#) on page 1-2 to see the location of the power input connector on the load frame.

## Emergency Stop Button



*Figure 2-2. Emergency Stop Button*

The Emergency Stop button is a large, round, red button on the testing system. Press this button to stop the test as soon as possible when a condition develops that:

- Could affect the safety of persons operating the system.
- Could damage the specimen, load frame, or test fixtures.

## Start the System

Before operating the system each day, ensure:

- All cables are properly installed and securely connected.
- All cables are free of wear and chafing. Re-route the cables if necessary, and replace any damaged cables.
- Signal and power cables have adequate slack to prevent excessive strain on connectors.
- All grips, fixtures and accessories are free of dirt, damage and deformation.
- The load frame is level. If an adjustment is necessary, refer to the System Support manual.

Correct any problems before you operate the testing system. If you require assistance, contact your local Instron Service department.

1. Turn the power switch for the frame to the On (I) position. Ensure that the **POWER** indicator light illuminates.
2. Power on all other system components (e.g. computer and any other accessories).
3. Observe the display on the control panel; an hourglass displays while the system performs its self-test procedure. The procedure is complete when the hourglass disappears and only the Instron logo displays.

If the hourglass persists or if it is replaced with a warning icon, then the self-test has not been successful. Contact Instron Service.

4. When the system self-test has completed successfully, start the Instron Bluehill software.
5. Wait for the software to fully initialize the machine before using the jog controls on the machine. The machine relay makes a clicking sound before the machine is ready.
6. Ensure that the **FRAME READY** indicator on the control panel illuminates.

Refer to “Control Panel” on page 2-3 and “Bluehill Software” on page 2-6. for details of the controls available in each.

## Control Panel

The control panel attaches to one of the column covers on the load frame and works in conjunction with the software to operate the frame. The control panel lets you perform many of the software functions directly at the frame, so you can perform these functions either at the computer or at the load frame.

### Warning



**Crush Hazard - Do not place your hands between the moving grips or fixtures while operating any controls on the control panel.**

The display and its associated numbered buttons operate together with Bluehill software. Any soft key functions that you have assigned in Bluehill are shown in the display next to the appropriate button. Pressing a button performs the action displayed next to it.

Use the toggle button on the left of the display key to toggle the display between soft key functions and up to 4 live displays. The live displays are copies of any live displays that you

If the display is showing live displays you must toggle back to show the softkey functions if you want to use a soft key button on the control panel.



Figure 2-3. Control Panel

Table 2-1. Control Panel Functions

| Control                 | Function  |
|-------------------------|---|
| <b>JOG UP</b>           | Press the ▲ <b>JOG UP</b> arrow button to move the crosshead in tension (away from the base beam). Pressing the button increases the speed linearly, up to a maximum speed, until you release the button.   |
| <b>JOG DOWN</b>         | Press the ▼ <b>JOG DOWN</b> arrow button to move the crosshead in compression (toward the base beam). Pressing the button increases the speed linearly, up to a maximum speed, until you release the button.  |
| <b>FINE JOG</b>         | Turn this thumbwheel to slowly position the crosshead. This control lets you set an accurate zero extension point, or set a precise grip position for loading specimens.<br>Note: on some control panels, this control is labeled <b>FINE POSITION</b> .  |
| <b>ZERO EXTENSION</b>   | Press this button to set the current position of the crosshead as the zero extension point (or gauge length) position. After setting the zero extension point, the crosshead returns to this position when: <ul style="list-style-type: none"> <li>You press the <b>RETURN</b> button</li> <li>The crosshead encounters a pre-set limit or event that instructs the crosshead to return to the zero extension point</li> </ul> Note: on some control panels, this button is labeled <b>RESET GL</b> (reset gauge length). |
| <b>AT ZERO</b>          | This indicator illuminates when the crosshead is at the zero extension point.<br>Note: on some control panels, this indicator is labeled <b>AT GL</b> (at gauge length).  |
| <b>POWER</b>            | This indicator illuminates when the system power is in either <b>STANDBY</b> or <b>FRAME READY</b> mode. In <b>STANDBY</b> mode, the system supplies power to the load cell and its conditioner board but not to the frame. In <b>FRAME READY</b> mode, the system supplies power to all load frame and transducer components. This indicates that the test system is ready for operation.  |
| <b>SPECIMEN PROTECT</b> | Press this button to toggle on or off the <b>SPECIMEN PROTECT</b> function. This function protects the test specimen and load string components from overloads.<br>The <b>ON</b> indicator flashes when <b>SPECIMEN PROTECT</b> is functioning.   |
| <b>START TEST</b>       | After you set the test parameters, press this button to begin the test. When the crosshead starts to move, the appropriate <b>TEST IN PROGRESS</b> indicator illuminates showing the direction of crosshead movement.   |
| <b>STOP TEST</b>        | Press this button to stop crosshead motion during or at the end of a test. The <b>TEST STOPPED</b> indicator illuminates to show that the test has stopped, but that the crosshead has not returned to the gauge length position.   |
| <b>RETURN</b>           | Press this button to move the crosshead back to the gauge length position after a test. The <b>RETURN IN PROGRESS</b> indicator illuminates to show that the crosshead is returning to the gauge length position.   |

Figure 2-3 on page 2-4 illustrates the control panel. Table 2-1 on page 2-5 describes the control panel's functions.

## Bluehill Software

Setting test parameters, operating the system, and collecting test data is done through the software program.

### Home Screen

Bluehill software opens at the **Home** screen. The console section of the software is at the top of the screen and provides important information about the system. The console is always visible and always available from any screen within the software.

Buttons on the **Home** screen take you to other parts of the software, as follows:

*Table 2-2. Buttons on the Home screen*

| Button          | Function  |
|-----------------|---|
| <b>Test</b>     | Click this button to perform tests on specimens. The software displays a sequence of screens where you:<br><ol style="list-style-type: none"><li>1. choose a test method from which to load test parameters.</li><li>2. name the sample and select a location to store the test data.</li><li>3. perform tests.</li></ol> |
| <b>Method</b>   | Click this button to edit and save test method files.<br>Refer to the software online help.   |
| <b>Analysis</b> | Click this button to either modify an existing sample or replay a sample with parameters from a different test method.<br>Refer to the software online help.  |
| <b>Admin</b>    | Click this button to change the configuration of the testing system.<br>Refer to the software online help.  |
| <b>User</b>     | This button is grayed if Security is not enabled.<br>Click this button to log out the current user and let a new user log in to the software. When you log out you do not exit the program.   |
| <b>Help</b>     | Click this button to open the online help.  |
| <b>Exit</b>     | Click this button to exit the program.  |

### Console

The console area of the software provides important information during testing and is also where you can edit system wide settings.

Table 2-3. Console Controls

| Control                | Function   |
|------------------------|--|
| Frame status indicator | <p data-bbox="540 380 1369 436">During test setup, the image of the frame changes according to the status of the testing system.</p> <ul data-bbox="540 447 1369 541" style="list-style-type: none"> <li data-bbox="540 447 987 474">• image grayed when frame is disabled</li> <li data-bbox="540 480 1369 541">• green arrow superimposed on image indicates direction that crosshead will move when test starts</li> </ul>  |
| System settings        | <p data-bbox="540 684 1369 741">This area contains a number of buttons, one for each component that makes up the testing system, as follows:</p> <ul data-bbox="540 751 1369 909" style="list-style-type: none"> <li data-bbox="540 751 1247 779">• Frame - enables and disables the frame and set the jog speed</li> <li data-bbox="540 785 1333 812">• Extension - lets you set limits for extension and reset the gauge length</li> <li data-bbox="540 819 1305 846">• Load - lets you set limits for load, calibrate and balance the load cell</li> <li data-bbox="540 852 1235 909">• Strain - lets you set limits for strain, calibrate and balance the extensometer connected to this channel</li> </ul> <p data-bbox="540 919 1369 976">Other buttons will display for other more specialized equipment, for example a video extensometer or automatic extensometer.</p> |
| Soft keys              | <p data-bbox="540 1003 1369 1117">You can assign up to four functions that you use frequently to these keys. Each key can display on the control panel so that you can perform that function from the software console or from the control panel. Examples of common functions assigned to soft keys are Balance Load and Reset Gauge Length.</p>  |
| Live display           | <p data-bbox="540 1146 1369 1203">You can set up a number of live displays that display values of parameters that you choose throughout the test.</p>  |
| System event log       | <p data-bbox="540 1234 1369 1348">The event log provides information and warnings regarding various aspects of the system. These include frame status messages, indications that certain test method parameters are preventing the start of a test, or indications that the system cannot open a sample file or method file.</p>   |

## Status Bar

The status bar appears at the bottom of every screen and provides status information for:

- Security - is security enabled and, if it is, the name of the current user.
- Machine - is the software connected to a testing machine or running in demo mode.
- Sample - the name of the current sample.
- Method - the name of the current method file that is open, if any.
- Report - the name of the current report template that is open.

- Progress messages - various messages indicating progress, for example “Opening”, “Closing” and “Generating”.

## Assemble the Load String

The load string consists of all the hardware components between the crosshead and the base of the testing machine. It includes the load cell, the grips, the specimen and any adapters that allow you to connect all of these components together.

The service engineer will set up the testing machine during the installation, but you may need to change one or more of these components for different types of testing.



*When creating a load string, keep in mind the maximum capacity for all the components making up the load string. The expected test load should not exceed the maximum capacity of any load string component including, but not limited to:*

- *load frame*
- *load cell*
- *adapters*
- *grips or fixtures*

## Select a Load Cell

If you know the approximate tensile or compressive strength of the material that you are testing, use these guidelines to choose a load cell:

- The minimum test load must be greater than the smallest load cell capacity range shown in the specifications for your machine.
- If there is a choice between two different load cells because of overlapping ranges:
  - select a higher capacity load cell when you require minimum deflection
  - select a lower capacity load cell when you require maximum long term balance or stability

If you don't know the tensile strength of the material, refer to a Properties of Materials handbook to obtain an approximate strength. To calculate the tensile strength in force units for a specimen, use the following equation:

tensile strength x cross-sectional area



For example, for a standard ASTM tensile specimen (0.502 in wide, 0.125 in thick) made with a material of tensile strength 5200 psi (from Materials Handbook) perform the following calculation:

$$5200 \times 0.502 \times 0.125 = 328 \text{ lbf}$$

This produces a recommendation of the 5 kN (1000 lb, 500kg) capacity load cell.

If you cannot determine an approximate value of tensile strength, use the highest capacity load cell rated for the frame. Perform a preliminary test at a very slow speed to obtain the load range required. You can then determine if a lower capacity load cell can provide improved resolution.

Table 2-4 on page 2-9 lists the load cells that are recommended for use with 5940 Series frames. If you have a load cell that is not listed, contact Instron for advice on compatibility and adapters that may be available for your load cell.

**Table 2-4. Compatible Load Cells for 5940 Frames**

| Load Cell                                  | Capacity  |          |          |
|--|---|----------|----------|
|  | 500 N   | 1 kN     | 2 kN     |
| Catalog no.                                | 2580-105  | 2580-106 | 2580-107 |
| Weight - kg (lb)                           | 0.6 (1.3)   |          |          |
| Effective Length - mm (in)                 | 100 (3.9)   |          |          |
| Machine Interface                          | M10 x 40 long x 1.5 pitch<br>RH central thread                |          |          |
| Torque - load cell to machine - Nm (ft-lb) | 19 (14)   |          |          |
| Accessory Interface                        | Integral type O (female)<br>12 mm clevis with 6 mm clevis pin |          |          |

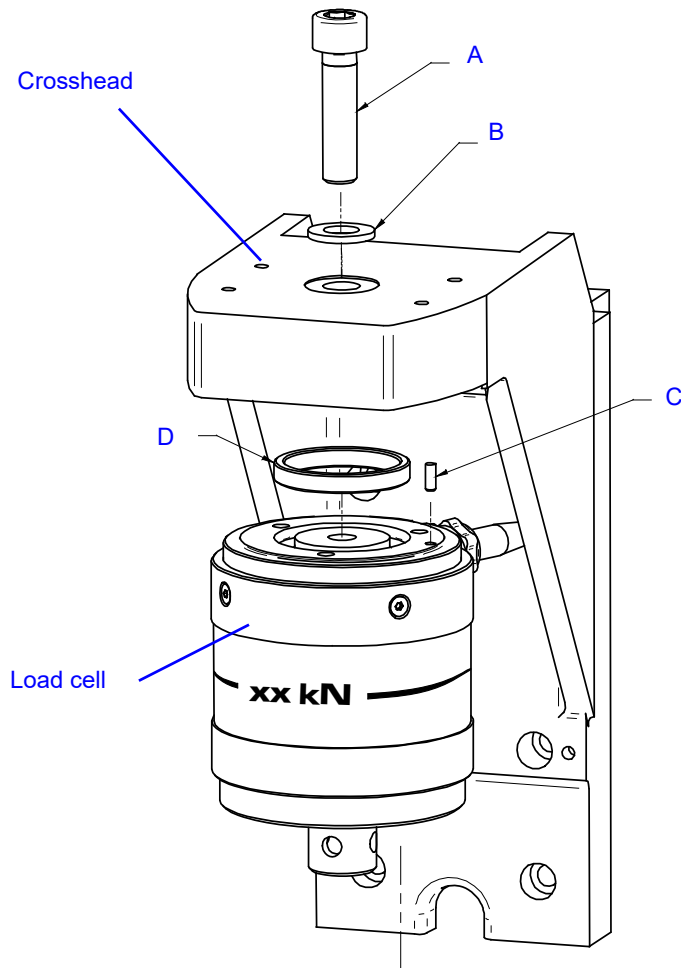
### Install the Load Cell

Check the following before installing a load cell:

- The load cell installation drawings are available and you have all the parts that are required for the installation.
- Mounting screws are lubricated.
- A torque wrench is available.
- All threads, bores and mating surfaces are clean and free of damage.

- ❑ The crosshead is positioned below its travel midpoint so that you can easily and safely access the crosshead.
- ❑ The crosshead is stationary and the **TEST IN PROGRESS** indicator light is not illuminated.

Refer to [Figure 2-4](#) on page 2-10 and perform the following procedure.



*Figure 2-4. Installing the Load Cell*

**Load cell installation procedure:**

1. Refer to the load cell installation drawing and collect together the correct mounting screw, washer, anti-rotation pin and locating ring for your combination of load frame and load cell.

2. Assemble the mounting screw (A) and washer (B), as shown in the figure.
3. Place the mounting screw and washer assembly into the top of the central bore of the crosshead.
4. Insert the anti-rotation pin (C) into one of the holes on the bottom of the crosshead.



*There are four pin holes on the bottom of the crosshead that let you position the load cell either straight on or at a 45° angle.*

5. Place the locating ring (D) into the top of the load cell that connects to the crosshead.
6. Place the load cell against the bottom of the crosshead, ensuring that the anti-rotation pin and locating ring fit securely in place against both the crosshead and load cell. Place the cable to the left side of the column.
7. Tighten the mounting screw by hand so that it secures to the load cell underneath the crosshead.

## Caution

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**When applying torque to the mounting screw, prevent the load frame from sliding by holding the crosshead with one hand while applying torque with the other.**

8. Set the torque wrench to the value specified in the load cell installation drawing (and in “Compatible Load Cells for 5940 Frames” on page 2-9) and tighten the mounting screw.
9. Connect the load cell cable to the **LOAD** connector on the controller. Ensure that the connector is fully engaged in the socket.
10. Press the load cell cable into the clips on the rear of the column cover to prevent it from interfering with your test.
11. Calibrate the load cell (refer to “Calibrate a transducer” on page 3-6).
12. Leave the system on for at least 15 minutes to allow the load cell circuitry to stabilize. After this warm-up period, calibrate the load cell again.

## Adapters

Adapters let you connect grips or fixtures to the frame when the interfaces have different connection sizes. There are two types of adapters: base adapters and coupling adapters.

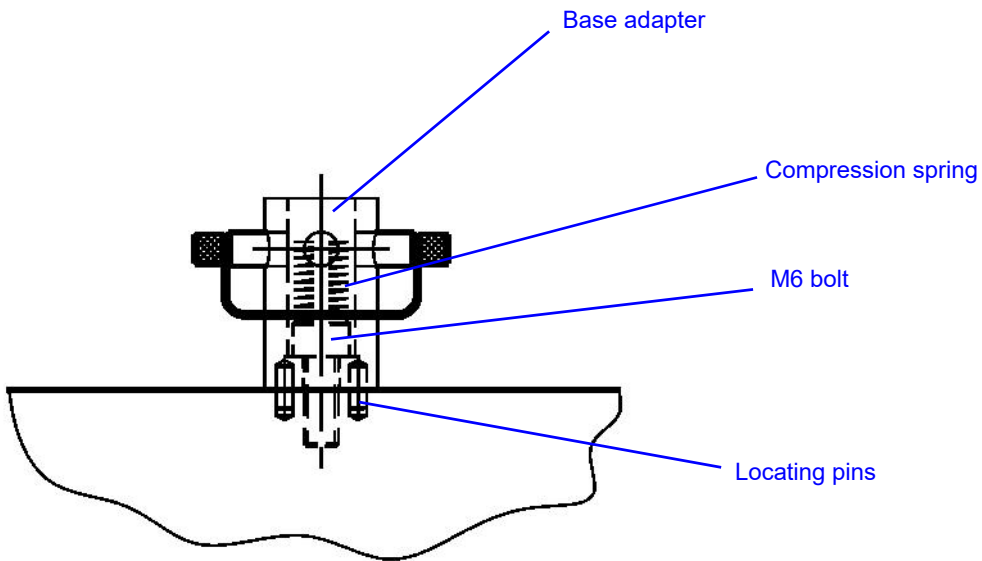
### Base Adapters

Base adapters let you connect grips and fixtures to the base of the load frame. All 5940 Series load frames are supplied with a Type O base adapter installed. A Type D base adapter

is also supplied in the ancillary parts kit. If you need to remove and re-install the base adapter, for example to change the orientation, use one of the following procedures.

**To remove the base adapter:**

1. Remove the compression spring located inside the adapter.
2. Insert a 5mm hex key into the base adapter, ensuring that it fits into the screw at the base of the adapter.
3. Using a torque wrench, loosen and remove the screw inside the adapter.
4. Lift the base adapter away from the base beam.



*Figure 2-5. Type O Base Adapter*

**To re-install the base adapter:**

1. Insert the adapter into the base beam, noting the orientation of the locating pin on the bottom of the adapter. The locating pin fits into any of the three locating pin holes on the base beam.
2. Insert a 5mm hex key into the base adapter, ensuring that it fits into the screw at the base of the adapter.
3. Using a torque wrench, tighten the screw to 7 Nm (5.2 ftlb)
4. Remove the hex key and insert the compression spring.

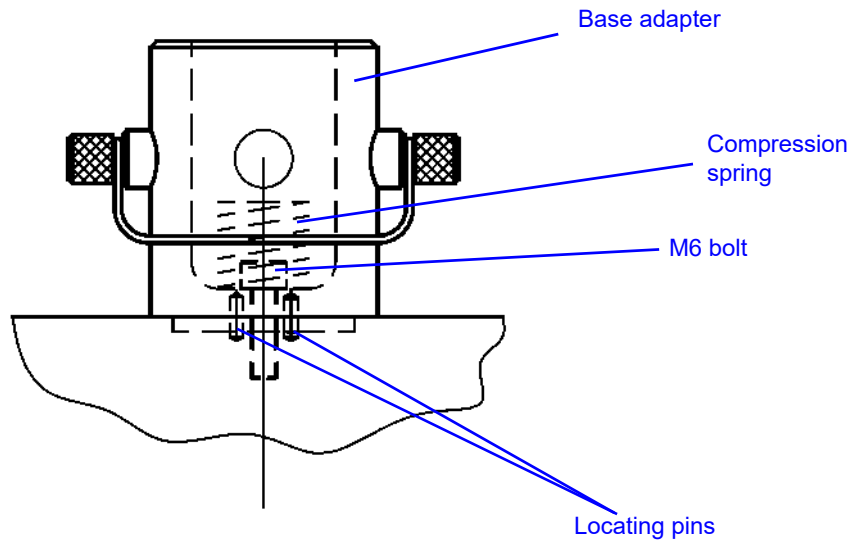


Figure 2-6. Type D Base Adapter

## Coupling Adapters

Coupling adapters let you attach grips and fixtures of different sizes to the load cell and base adapter, providing more options for testing. There are two primary types:

- **For tension testing only:**  
Tension coupling adapters, also known as self-aligning coupling adapters, which provide a swivel connection and connect between clevis pin type interfaces. The swivel action allows the grip or fixture to self-align in the direction of the test load, thus minimizing any bending load on the specimen.
- **For tension or compression testing:**  
Rigid coupling adapters which also connect between clevis pin type interfaces but use checknuts to provide fixed connections. This type can also have a threaded interface. These couplings are not self-aligning and the load string alignment is dependent on the accuracy of load cell alignment during installation.

When assembling the load string, you may need to use adapters if the load cell interface, or base adapter interface, differs from your grip interface. A coupling adapter creates a secure connection between these two different interfaces.

If your grip or fixture interface is the same size as your load cell interface, then you can connect these directly and you do not need an adapter. If, however, you need the self-aligning feature that the adapter offers, you should use the appropriate self-aligning coupling adapter.

Coupling types are listed from the load cell towards the accessory or from the frame base towards the accessory. For example, if you need to connect a load cell with a Type D (female) connector to a grip with a Type O (male) connector you require a Type Dm to Of adapter.

## Select Grips and Fixtures

A set of grips are installed on the system during installation by a service engineer. If your testing requires it, you may need to install a different set to obtain optimum test results.

The selection of grips depends on the material, geometry and strength of the test specimen.

In compression testing, the diameter or area of the anvil is important, in addition to the maximum loading capacity.

For tensile testing:

- ❑ Make sure the tensile strength of the specimen does not exceed the maximum loading capacity of the grips.
- ❑ Minimize the risk of slippage by:

- selecting jaw faces with a surface area large enough to cover the tab (for dumbbell-shaped specimens) or as much surface area as possible for parallel-sided specimens.
  - ensuring that the specimen is gripped by at least 75% of the available jaw face length.
  - using serrated jaw faces
- ❑ Breaks at the jaw face may be caused by:
- Screw action grips - you may be using too much force when tightening the grips. Use a torque wrench or switch to pneumatic grips for a consistent force.
  - Pneumatic grips - the pressure may be too high. Drop the pressure, but not to the point where you get slippage.
  - Serrated faces - the serrations are damaging the specimen. Change to faces that have more serrations per inch (less bite) or cover with masking tape or similar material to soften the bite and prevent damage to the specimen.

## Insert Jaw Faces into Grips

Different grips use different mechanisms for attaching jaw faces. Refer to the documentation supplied with the grips for more information.

## Install Grips

Figure 2-7 on page 2-16 shows a typical grip with clevis pin coupling.

Before you begin, check the following:

- ❑ There is sufficient space between the load cell and the load frame base to install the grips.
- ❑ The crosshead is stationary and the **TEST IN PROGRESS** indicator light is not illuminated.
- ❑ The crosshead limit stops on the load frame are set to prevent the upper and lower grips from colliding with each other (refer to “Set the crosshead limit stops” on page 3-10).
- ❑ The mating surfaces of the grips, load cell and the base adapter are free of dirt or debris.

### To install the grips:

1. For the lower grip, insert the adapter on the grip into the female clevis socket on the load frame base adapter, as shown in Figure 2-7 on page 2-16.
2. Align the clevis holes and insert the clevis pin through the holes.

3. Secure the clevis pin in position with the clevis pin clip.
4. Repeat steps 1 through 3 to install the upper grip onto the load cell.
5. When both grips are installed, follow the procedure to preload the load string (refer to “Preload the Load String” on page 2-17).

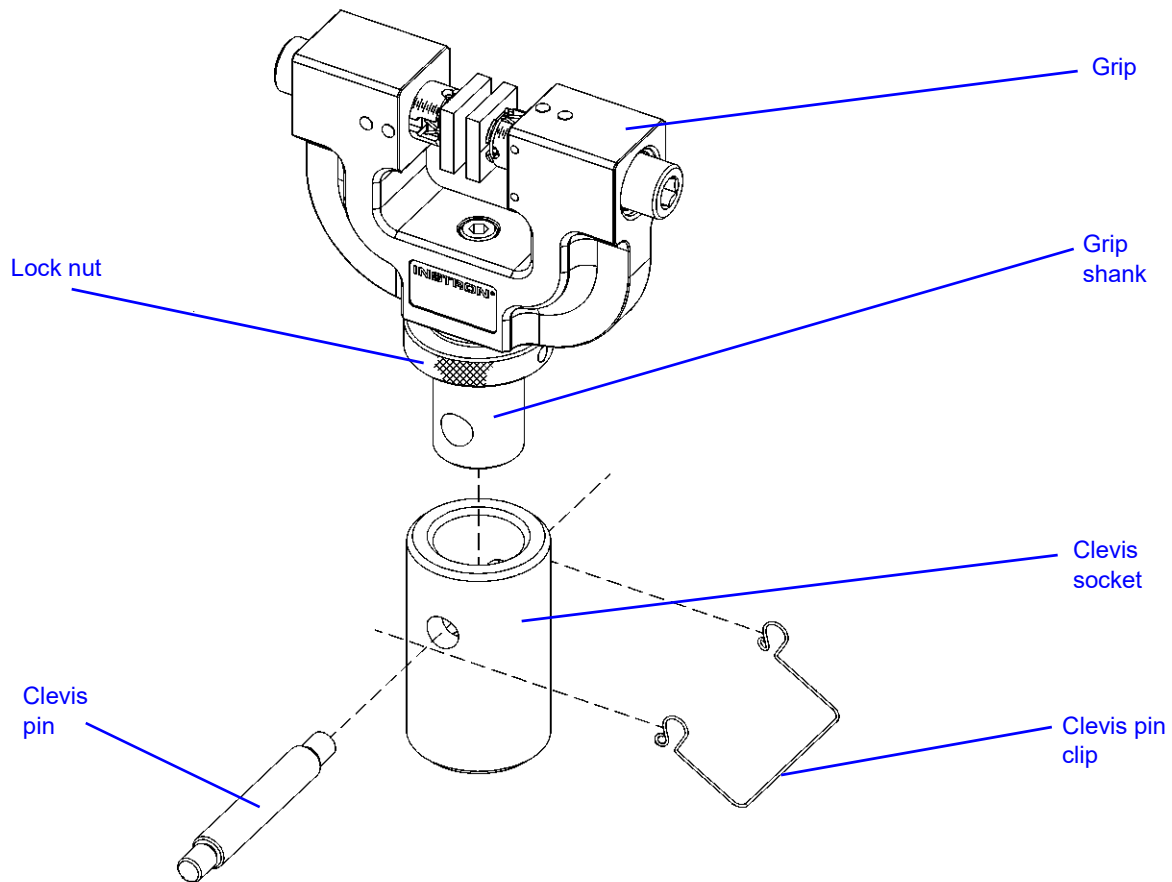


Figure 2-7. Grip with Clevis Pin Coupling



## Preload the Load String

This procedure eliminates backlash and deflections within the load string which can degrade the integrity of test results, especially when testing at high loads. The procedure involves preloading the entire load string and then hand-tightening all the locknuts on all the grips and couplings. Even when using self-aligning couplings on the upper grip, it is good practice to preload the lower grip.

You will need a rigid specimen that is strong enough to sustain the preload value without breaking. This means a specimen that can sustain a load that is:

- 10% above the expected test load, or
- the maximum load rating of the weakest component of the load string (grips or load cell)

whichever is less. For example, if your grips are rated at 1kN, the load cell at 2kN and your expected test load is 500N then you should preload to at least 550N but not more than 1kN.

Before inserting the specimen ensure that:

- The grips and couplings are installed but the locknuts are not tightened.
- Crosshead travel limits are set (refer to “[Set the crosshead limit stops](#)” on page 3-10).
- The value of load in the live display is near zero. If it is not, balance the load (refer to “[Balance a transducer](#)” on page 3-12).
- The load limits are set in the software to a value that matches the maximum load capacity of the weakest component in the load string.

### To preload the load string:

1. Install the strong specimen.
2. Increase the load on the load string to the chosen preload value.
3. Hand tighten all the locknuts on the grips and any intermediate couplings.
4. Reduce the load to zero.
5. Remove the specimen.

The load string is now preloaded and all the locknuts are tight and should not move during subsequent testing. The system is now ready to test.



*When you next need to change grips or any other part of the load string, the locknuts will be too tight to loosen by hand. Follow the unload procedure (“[To unload the load string:](#)” on page 2-18).*

**To unload the load string:**

1. Install the strong specimen.
2. Increase the load on the load string to the chosen preload value.
3. Loosen all the locknuts on the grips and any intermediate couplings.
4. Reduce the load to zero.
5. Remove the specimen.

The load string is now unloaded and all the locknuts are loose so that you can change any component.

# Chapter 3

## Testing Specimens

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- Testing a Sample. . . . . 3-2
  - Create a sample in Bluehill. . . . . 3-4
  - Calibrate a transducer. . . . . 3-6
  - Set the zero extension point . . . . . 3-9
  - Set the crosshead limit stops. . . . . 3-10
  - Set the limits for a transducer. . . . . 3-12
  - Balance a transducer. . . . . 3-12
  - Stop a test . . . . . 3-13
  - Shut down the system. . . . . 3-14
  - Troubleshooting . . . . . 3-15
- 

Materials testing systems are inherently hazardous. The following two statements warn of behavior that offers the highest probability of personal injury from using the system.

### Warnings

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**Hazard - do not allow more than one person to operate a testing machine.**

Operator injury may result if more than one person operates the testing machine. For example, injury can occur if one person moves the crosshead or actuator while the other is working inside the hazard area between the grips or fixtures.



**Crush hazard - take care when installing or removing a specimen, assembly, structure or load string component.**

Installation or removal of a specimen, assembly, structure or load string component involves working inside the hazard area between the grips or fixtures. When working in this area, ensure that other personnel cannot operate any of the system controls. Keep clear of the jaws of a grip or fixture at all times. Keep clear of the hazard area between the grips or fixtures during actuator or crosshead movement. Ensure that all actuator or crosshead movements necessary for installation or removal are slow and, where possible, at a low force setting.

## Testing a Sample

The following are guidelines for the steps that you would typically go through when testing a group of specimens on a 5900 system. Some steps include references to more detail in separate sections.

These guidelines assume that a test method has already been created that satisfies your testing requirements and provides the required test parameters (e.g. specimen dimensions, testing notes) on the test workspace.

1. Collect all specimens together that will make up your testing sample.
2. Identify each specimen, e.g. by marking. You need to identify each specimen so that you can match it to the appropriate specimen number in the completed sample test report.
3. In Bluehill, create a new sample, refer to [“Create a sample in Bluehill”](#) on page 3-4.
4. Verify the test area and test direction is correct on the **Frame Status indicator** in the console area.
5. Verify these settings on the control panel:
  - **FRAME READY** indicator illuminates
  - **TEST STOPPED** indicator illuminates
  - **START TEST** arrow indicator illuminates the correct direction of the test
  - **AT ZERO** (or **AT GL**) indicator illuminates green if you are starting the test from zero extension
6. If necessary, calibrate the transducer configurations required by the test method, refer to [“Calibrate a transducer”](#) on page 3-6.

If the load frame was previously switched off, allow the load cell to warm up for at least 20 minutes after calibration to ensure stable readings.
7. If the test method includes a specimen protect threshold value, enable specimen protect by pressing the **SPECIMEN PROTECT** button on the control panel.
8. Take measurements of the required specimen dimensions for each specimen and enter the values into the appropriate fields in the operator’s input component of the test workspace.
9. Complete any additional fields that the test method requires, e.g. specimen notes, sample notes.
10. Use the jog controls to move the crosshead to its starting position for the test and set the zero extension point (refer to [“Set the zero extension point”](#) on page 3-9).
11. Ensure that the crosshead travel limits are set (refer to [“Set the crosshead limit stops”](#) on page 3-10).

12. Ensure that limits are set for each transducer (extension, load, strain and user-defined) required by the test method. Refer to “[Set the limits for a transducer](#)” on page 3-12).
13. Balance each transducer configuration required by the test method. Refer to “[Balance a transducer](#)” on page 3-12. If the method has this function assigned to a soft key, click the **Balance** soft key or the **Balance all** soft key.

## Warnings

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### **Hazard - do not allow more than one person to operate a testing machine.**

Operator injury may result if more than one person operates the testing machine. For example, injury can occur if one person moves the crosshead or actuator while the other is working inside the hazard area between the grips or fixtures.



### **Crush hazard - take care when installing or removing a specimen, assembly, structure or load string component.**

Installation or removal of a specimen, assembly, structure or load string component involves working inside the hazard area between the grips or fixtures. When working in this area, ensure that other personnel cannot operate any of the system controls. Keep clear of the jaws of a grip or fixture at all times. Keep clear of the hazard area between the grips or fixtures during actuator or crosshead movement. Ensure that all actuator or crosshead movements necessary for installation or removal are slow and, where possible, at a low force setting.



### **Flying Debris Hazard - Make sure that test specimens are installed correctly in grips or fixtures in order to eliminate stresses that can cause breakage of grip jaws or fixture components.**

Incorrect installation of test specimens creates stresses in grip jaws or fixture components that can result in breakage of these components. The high energies involved can cause the broken parts to be projected forcefully some distance from the test area. Install specimens in the center of the grip jaws in line with the load path. Insert specimens into the jaws by at least the amount recommended in your grip documentation. This amount can vary between 66% to 100% insertion depth; refer to supplied instructions for your specific grips. Use any centering and alignment devices provided.

14. Install the specimen into the grips. Refer to the documentation provided with the grips for details.
15. Check that the specimen is aligned properly in the grips.
16. Start the test by pressing the **START** button on the control panel or by clicking the **Start** button in the Bluehill test workspace.

The test method may also include a start test parameter that may automatically start a test when specified criteria are satisfied. Review the **Test Control > Start Test** screen to verify how the test should start.

A test method includes the layout of the test workspace, which typically includes a graph, a results table, and an area where you can enter parameter values before or after the test. As the test proceeds you can view the graph and when the test is complete, results for that specimen display in the results table.

17. If you need to stop the test before it completes, press the **STOP** button on the control panel or click the **Stop** button in the Bluehill test workspace (refer to “[Stop a test](#)” on page 3-13).

If during the test a condition develops that could affect the safety of an operator or could damage the specimen or test equipment, press the Emergency Stop button on the front of the frame.

18. When the test is complete, remove the specimen by first releasing the upper grip followed by the lower grip.
19. Bring the crosshead back to gauge length by pressing the **RETURN** button on the control panel or by clicking the **Return** button in the Bluehill test workspace. The system is ready for the next specimen.
20. After all specimens are tested, click the **Finish** button in the Bluehill test workspace.

## Create a sample in Bluehill

### Create a new sample

The first step to create a sample is to select an existing test method that contains the settings and parameters for the test.

1. Click **Test** on the **Home** screen.
2. Click **New Sample > Select Method** in the navigation bar.
3. Select a test method. You can either:
  - browse to select an existing method. Refer to “[Select a test method file](#)” on page 3-5.
  - select a method shown on the Most Recently Used list. Refer to “[Select from the Most Recently Used list](#)” on page 3-5



*If the test method has the **Automatically name the sample** feature enabled, the system automatically names the sample according to the default name and the default location identified in the test method. The system appends a number to the sample name every time this method is used for a new sample. The system skips the second step and advances directly to the test workspace on the **Test** tab.*

### Select a test method file

1. Click **Browse...** to open a standard **Open File** dialog box.
2. Find the method file and click **Open**.

When you open the selected method file, the software advances to the next step in which you name the new sample.



*If the file does not open, the system displays an open file error message. Refer to the online help for further assistance.*

### Select from the Most Recently Used list

1. Click on the name in the **Most recently used** list. The file name and its location appear in the associated fields and a preview of the file displays in the **Preview** window.
2. Click **Next** to open the file.

The software advances to the next step in which you name the new sample.



*Double-click a file name in the list to open it.*

### Name the new sample

The second step in creating a new sample is to name the sample and identify where to save the sample file.



*If the test method has the **Automatically name the sample** feature enabled, the system automatically names the sample according to the default name and the default location identified in the test method. The system appends a number to the sample name every time this method is used for a new sample. The system skips the second step and advances directly to the test workspace on the **Test** tab.*

#### To name a sample file:

1. In the **Sample name** field, enter a name for the sample file or accept the name generated by the system.

The system produces a suggested name for the sample file, based on the most recently used sample file name. If there are no sample files created, the system uses “TestSample” as the default name. The system appends a number to the file name to ensure a unique name.

2. In the **Location** field, verify the location to save the sample file. To change the location, refer to “[Change the location for the sample files](#)” below.
3. Click **Next** to advance to the **Test** tab.

To return to the previous screen, click **Back**.

### Change the location for the sample files

1. Click **Browse...** on the right side of the screen.  
The **Save Sample File As** dialog displays.
2. Browse to find the directory to save the output files and, if desired, enter a different file name.
3. Click **Save**.  
The system creates the sample file and advances to the **Test** tab.

## Calibrate a transducer

### Automatic calibration

1. Click on the icon for the transducer in the system settings area of the console.
2. In the first tab, select the transducer configuration in the **Transducer configuration** field.
3. Ensure that **Calibration type** is set to **Automatic**.

Automatic calibration uses the following basis for the calibration point value:

|        |  |
|--------|--|
| Load   | 50% of the full-scale load transducer    |
| Strain | 100% of the full-scale strain transducer |

4. Set the transducer to its zero point. For load, zero point means no load on the system. For strain, zero point means returning to the gauge length position.
5. Click **Calibrate**.  
The system performs the calibration and displays a dialog with the calibration status.
6. Click **Done** to complete the calibration.



## Manual calibration

During a manual calibration, you apply a measured physical force to the transducer and the system calibrates on the signal that is output as a result of that force. For strain calibration, you can install the extensometer on a specially designed calibration jig to apply a precise deflection to the extensometer. For load calibration, you can hang a measured weight from the load cell.

The system only saves the values entered for a manual calibration after there is a successful calibration. If you select a different transducer configuration or close the dialog before calibrating a transducer configuration, the calibration fields revert to the default values for that configuration.

## Rationalized transducers

1. Click on the icon for the transducer in the system settings area of the console.
2. In the first tab, select the transducer configuration in the **Transducer configuration** field.
3. Set **Calibration type** to **Manual**.
4. Enter a value for the calibration point. This value is the load (for a load cell) or deflection (for an extensometer) that you apply to the transducer during calibration.

For example, to calibrate a 100 kN load cell using a 50 kN weight, the full scale value is 100 kN and the calibration point is 50 kN.

The range for a valid calibration point value is between:

|         | Load<br>(% full scale) | Strain<br>(% full scale) |
|---------|------------------------|--------------------------|
| Minimum | 2                      | 2                        |
| Maximum | 105                    | 110                      |



*If you change the units for a field, the software converts the corresponding value to its equivalent value in the new units. Verify that the value is correct for the specified units.*

5. Click **Calibrate**. Follow the directions in the message window sequence, as follows:
  - a. Set the transducer to its zero or gauge length point.
  - b. Click **OK**.
  - c. Deflect the transducer to its calibration point using a weight (load cell) or a calibration jig (extensometer). For load, if you have a load cell with an associated

electrical calibration circuit, you can use this to apply an electrical signal instead of applying a physical force to the load cell.

- d. Click **OK**.
- e. Reset the transducer to its zero or gauge length point.
- f. Click **OK**.

### Non- rationalized transducers

- 1. Click on the icon for the transducer in the system settings area of the console.
- 2. In the first tab, select the transducer configuration in the **Transducer configuration** field.
- 3. Set **Calibration type** to **Manual**.
- 4. Enter the full scale value of the transducer.
- 5. For strain transducers, enter the gauge length of the extensometer.

The system must know the gauge length of the installed extensometer in order to calculate strain values for display and for further calculations.

- 6. Enter a value for the calibration point. This value is the load (for a load cell) or deflection (for an extensometer) that you apply to the transducer during calibration.

For example, to calibrate a 100 kN load cell using a 50 kN weight, enter 100 kN as the full scale value and 50 kN as the calibration point.

The range for a valid calibration point value is between:

|         | <b>Load<br/>(% full scale)</b> | <b>Strain<br/>(% full scale)</b> |
|---------|--------------------------------|----------------------------------|
| Minimum | 2                              | 2                                |
| Maximum | 105                            | 110                              |



*If you change the units for a field, the software converts the corresponding value to its equivalent value in the new units. Verify that the value is correct for the specified units.*

- 7. Click **Calibrate**. Follow the directions in the message window sequence, as follows:
  - a. Set the transducer to its zero or gauge length point.
  - b. Click **OK**.

- c. Deflect the transducer to its calibration point using a weight (load cell) or a calibration jig (extensometer). For load, if you have a load cell with an associated electrical calibration circuit, you can use this to apply an electrical signal instead of applying a physical force to the load cell.
- d. Click **OK**.
- e. Reset the transducer to its zero or gauge length point.
- f. Click **OK**.

## Set the zero extension point

### From Bluehill software

1. Use the jog controls to move the crosshead to its starting position for the test.
2. Click in the console area to open the Transducer Settings dialog for Extension.
3. Click the **Extension** tab.
4. Click **Zero**.

### From the Control Panel

1. Use the jog controls to move the crosshead to its starting position for the test.
2. Press the **ZERO EXTENSION** button on the control panel.



*On some control panels, the **ZERO EXTENSION** button is labeled **RESET GL** (reset gauge length).*

## Set the crosshead limit stops

### Warning

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**Crush hazard - you must set the crosshead travel limits as protection against unexpected crosshead movement.**

Although Bluehill lets you set limits of travel in the software, you must set the crosshead travel limits as well. These hardware limits provide an absolute limit of travel that operates independently of the software.

Set the crosshead limits stops after you have established the crosshead starting position, but before you start a test.

The crosshead limit stops are two adjustable blocks mounted on the limit switch rod, which is located inside the column of the machine, as shown in [Figure 3-1](#) on page 3-11. Limit stops have thumbscrews that you tighten and release by hand, and you can move them to any position on the limit rod. Position these stops just beyond the test parameters to prevent crosshead over-travel. When the crosshead reaches the maximum pre-set travel, the limit switch actuator contacts one of these stops. Contact between the limit actuator and the limit stop moves the limit switch rod and activates the limit switches. This stops crosshead motion.

There is an additional, second level of crosshead limit stop that is activated if the first level switch malfunctions. Activating a second-level limit switch disables the drive system so you cannot move the crosshead. The second level limits are internal to the machine and cannot be manually adjusted.

### Set the crosshead limit stops:

1. Ensure that the crosshead is stationary and that the test parameters are set. The **TEST IN PROGRESS** indicator light on the control panel should not illuminate.



*When setting limit stops, allow for an additional 3 mm of crosshead travel after the actuator activates a limit stop. There is a small delay time from the point when the actuator hits the limit stop and when the message relays to the limit switches located in the frame base.*

2. Set the upper limit stop at a position just above the expected maximum crosshead travel in the upward direction when tension testing, or just above the test starting point when compression testing. Tighten the stop securely on the limit rod.
3. Set the lower limit stop at a position just below the starting position when tension testing or just below the expected maximum crosshead travel in the down direction when compression testing. Tighten the stop securely on the limit rod.

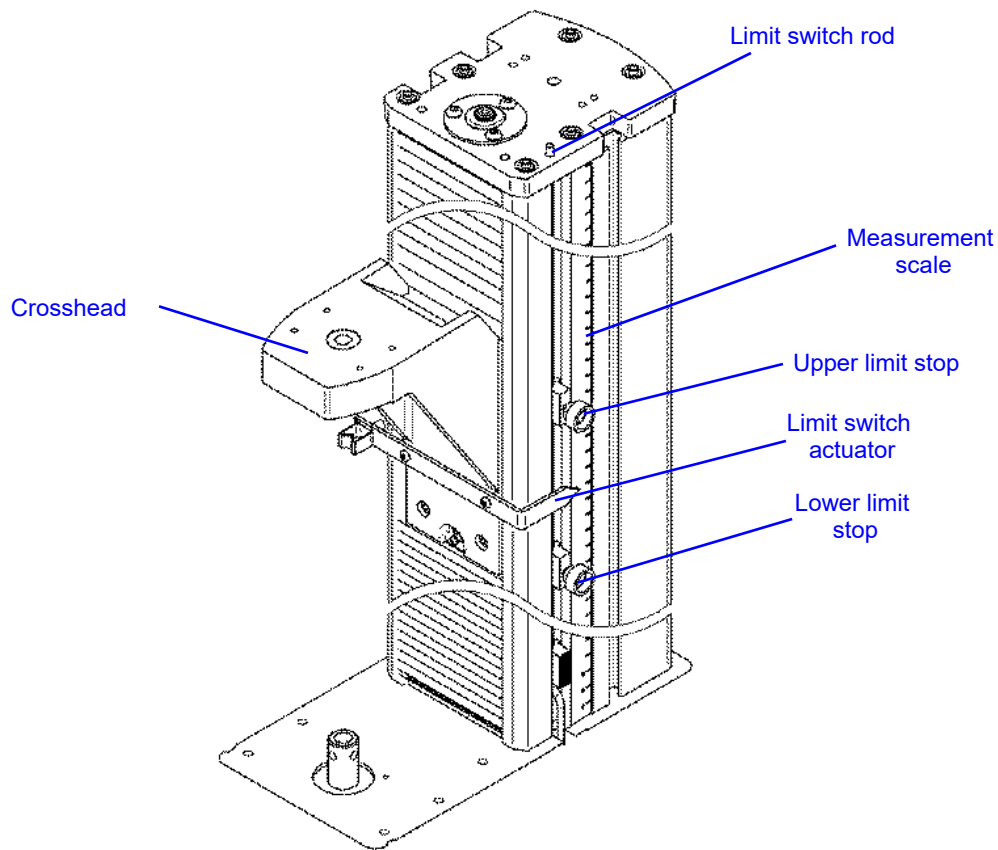


Figure 3-1. Setting Limit Stops

## Caution

**Do not use limit stops to end a test.**

The limit stops are not intended to be an end of test condition to end every test. Repeated use of the limit stops in this way may cause excessive wear, which can result in the limit stop failing to stop the crosshead. Proper end of test conditions can be set from the software. Refer to the online help system for further assistance.

## Move Off a Crosshead Limit Stop

When the crosshead contacts either the upper or lower limit stop, the test stops. If this happens, use the jog buttons to move the crosshead off the limit stop. Press the ▼ button to move the crosshead off the upper limit stop. Press the ▲ button to move the crosshead off the lower limit stop. The **TEST IN PROGRESS** indicator light illuminates when you move the crosshead.

## Set the limits for a transducer

### Warning

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**Set the load frame limit stops to limit crosshead travel, and set adequate transducer limits to ensure the safe operation of the testing system.**

Set all available limits before using the system to avoid crosshead overtravel, contact between grips and fixtures, overloading any component of the load string, or overtravel of a contacting extensometer.



*Although you can set limits for a transducer in the software, always ensure that the physical limit stops on the load frame are also set.*

*Always calibrate the transducer before you enable the limits.*

1. Click on the icon for the transducer in the system settings area of the console.
2. In the first tab, select the transducer configuration in the **Transducer** field.
3. Click the **Limits** tab.
4. Enter a value for the Minimum limit and set an action that the system performs if it reaches the minimum limit.

If you change the units for a field, the software converts the corresponding value to its equivalent value in the new units. Therefore, you must re-enter the correct value based on the new units.

5. Enter a value for the Maximum limit and set an action that the system performs if it reaches the maximum limit.
6. Click **Enable** to activate these limits.

The system activates the limits and disables the fields in this dialog. To make further changes to these limits, you must first uncheck **Enable** to activate these fields again. If **Enable** is unchecked, the system stops monitoring the transducer limits.

## Balance a transducer



*Calibrate the transducer before you balance it.*

1. Make sure that no specimen is installed.
2. Click on the icon for the transducer in the system settings area of the console.
3. In the first tab, select the transducer configuration in the **Transducer** field.
4. Click the Balance button.



You can also set a soft key to **Balance** a specific source transducer or **Balance all**.

## Stop a test

You can stop a test by using hardware controls on the machine or settings in the software. The following sections describe the different ways to stop a test.

### Control Panel Buttons

Press the **STOP** button on the control panel to stop the crosshead during or after a test. The crosshead remains in its current position.

Press the **RETURN** button on the control panel to stop a test and return the crosshead to the gauge length position specified during test setup.

### Emergency Stop Button



*Figure 3-2. Emergency Stop Button*

The Emergency Stop button is a large, round, red button on the testing system. Press this button to stop the test as soon as possible when a condition develops that:

- Could affect the safety of persons operating the system.
- Could damage the specimen, load frame, or test fixtures.

Investigate and resolve the situation that caused the use of the Emergency Stop button before you reset the system.

When operated, the Emergency Stop button locks into the closed position and the system is disabled until you reset the button and re-enable the load frame.

To reset the Emergency stop button and re-enable the load frame:

1. Rotate the Emergency Stop button a quarter-turn clockwise until it resets.
2. In Bluehill software, click on the Frame button in the console area to open the Load Frame Settings dialog.
3. Click the **Frame** tab.
4. Click **Enable frame**.
5. Click **Done** to close the dialog box. The **FRAME READY** light on the control panel illuminates when the frame is enabled.

## Crosshead Limit Switches

The test stops if the crosshead contacts the upper or lower limit stops. If this happens, move the crosshead away from the limit by pressing the ▲ or ▼ jog buttons.

## Software Controls

When the system encounters a pre-set limit or event set from the software, the test stops. The crosshead may stop or return to the gauge length position, depending on the test stop action setting in the software.

## Shut down the system

Wait until the system completes all active tasks before shutting it off or disconnecting the electrical power. The system may be engaged in recalculations or printing tasks after the test has run.

Shut off the power to the system before you:

- Perform any maintenance procedure on the load frame.



- Disconnect the main power cable.
- Move the load frame.
- Connect or install optional components or accessories.

**To turn the system off:**

1. Complete the test and ensure that the **TEST IN PROGRESS** indicator light no longer illuminates.
2. Remove the specimen.
3. Exit the software and turn off the computer and printer using the normal shutdown procedure.
4. Shut off all the other components or accessories to the test system.
5. Switch the power for the load frame to the Off (**O**) position. The **POWER** indicator light no longer illuminates.

## Troubleshooting

The following sections list some of the things that might happen to interrupt your testing and what you need to do to resume testing.

### A Software Transducer Limit Trips

When the system encounters a pre-set limit or event set from the software, the test stops.

If the system trips a transducer limit, you must remove the condition that caused it to trip before you can reset the limit. To remove the condition, use the jog controls on the frame to drive the crosshead in the opposite direction and remove the force being applied to the transducer. For example, if you set a load of 10 kN and the crosshead moves to or beyond a point that imposes a load of 10 kN on the specimen, you cannot reset the limit until you remove the limit condition.

1. Use the jog buttons to drive the crosshead in the direction necessary to remove the limit condition.
2. Click on the icon for the transducer that you want to work on.
3. Click the **Limits** tab.

The label for the **Enabled** check box for the tripped limit changes to **Tripped**.

4. Click to uncheck the box. The label reverts back to **Enabled**.

5. Check the box again to re-enable the limit.

## A Crosshead Travel Limit Trips

When the crosshead contacts either the upper or lower limit stop, the test stops. If this happens, use the jog buttons to move the crosshead off the limit stop. Press the ▼ button to move the crosshead off the upper limit stop. Press the ▲ button to move the crosshead off the lower limit stop. The **TEST IN PROGRESS** indicator light illuminates when you move the crosshead.

## Second Level Limit Stops

The second level limit switch acts as a backup if the first level switch (the limit stops) malfunctions. Activating a second-level limit switch disables the drive system so you cannot move the crosshead. The second level limits are internal to the machine and cannot be manually adjusted.

## Warning

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**Hazard - Identify and resolve the condition that caused the operation of the secondary overtravel limit before you use the testing system.**

Operation of a secondary overtravel limit indicates a serious problem with your testing system, not least that the primary overtravel limit may have failed. Identify and resolve the condition that caused the secondary overtravel limit to trip before you use the testing system again. Contact the Instron service department for assistance.

## You press the Emergency Stop button

Refer to “Emergency Stop Button” on page 3-13.

## The System Shuts down Unexpectedly

1. To verify that power has been disabled, ensure that the **POWER** indicator is not illuminated.
2. Save your existing data.
3. Exit the software program.
4. Before you resume testing, determine why the system shut down and take the necessary steps to avoid repeating the action. Check the following:
  - Are all cables connected?

Check that all the cables in the testing system are connected securely.

- Did someone inadvertently press the Emergency Stop button?

Refer to “[Emergency Stop Button](#)” on page 3-13.

- Did the fuse on the power supply blow?

Refer to the System Support manual for instructions on replacing a fuse.

5. When you have resolved the problem, switch on the frame and start the software program. The system should reset itself. Verify that the **POWER** indicator light illuminates.



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Product Support: [www.instron.com](http://www.instron.com)