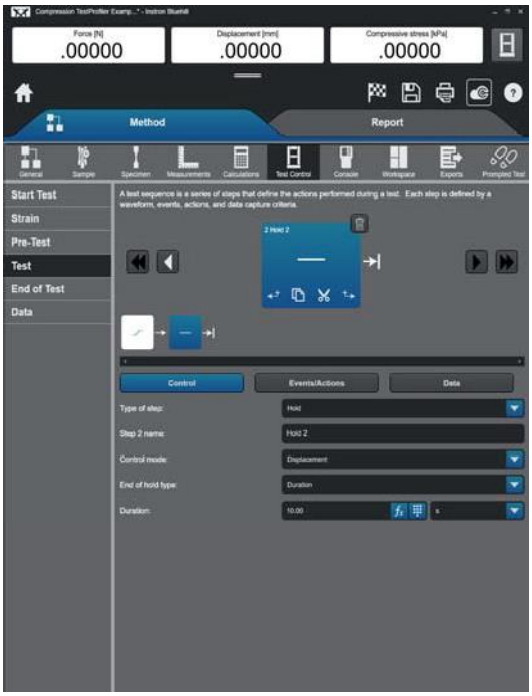
INSTRON®

Bluehill Universal Advanced Features Training Manual



Reference Manual M18-17147-EN Revision C

The difference is measurable®

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 Language:

World Wide Headquarters

Instron
825 University Avenue
Norwood
MA 02062-2643
United States of America

European Headquarters

Instron
Coronation Road
High Wycombe, Bucks
HP12 3SY
United Kingdom

General 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 that are potentially hazardous, particularly the actuator in a servohydraulic testing system or the moving crosshead in an electromechanical testing system.

Whenever you consider that safety is compromised, press the Emergency Stop button to stop the test and isolate the testing system from hydraulic or electrical power.

Carefully read all relevant manuals and observe all warnings and cautions. The term Warning is used when a hazard may lead to injury or death. The term Caution is used when a hazard may lead to damaged equipment or loss of data.

Ensure that the test setup, test execution, materials, assemblies, and structures constitute no hazard to yourself or others. Make full use of all mechanical and software limits. These enable you to prevent movement of the actuator or moving crosshead beyond desired regions of operation.

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.

Contents

Chapter 1
Introduction

Important Information about This Manual

This manual is relevant to Bluehill Universal® running on the following testing systems:

- 6800 Systems
- 3400 Systems
- 5900 Systems
- 5500A Systems
- 5500 Systems
- 3300 Systems
- DX Systems
- KN Systems
- LX Systems
- RD Testing Systems
- SF Systems
- Torsion Systems
- 8800 Systems
- 88MT Systems
- ElectroPuls Systems

It is important to understand that the above testing frames all provide a standard controllerand conditioner card configuration that enables the connection of transducers in a more simplified process than earlier testing systems.

Overview

Instron's Bluehill Universal® software was developed to run on an array of Instron testing instruments. This manual was developed to provide a more detailed explanation of advanced features of the software. Each chapter within the manual addresses a separate topic and can be reviewed individually or grouped to cover the necessary topics. Topics covered in this manual include:

- Connecting and Configuring Transducers
- Measurements
- Expression Builder
- TestProfiler
- Traceability (local)
- Bluehill Central

As it is not possible to discuss each users need the manual will provide a detailed overview of the capabilities of the testing system using general examples of how each section can be applied to the users need.

Connecting and Configuring Transducers

Standard testing systems provide the user with transducers that measure displacement, force and as an option strain. Many users have the need to connect additional transducers. The 5900 testing system and Bluehill software streamline this process. Your software allows you to configure most any transducer by selecting units, defining limits and calibrating the device. This chapter will demonstrate how to connect and configure these devices as well as the options that a user must consider when determining how to connect a transducer.

Measurements

Within the Bluehill Universal application measurements provide data that is available for test control, graphing and analysis. A Physical Measurement is data from a transducer that is connected to the testing system and a Virtual Measurement provides data that is calculated using a mathematical expression. This manual will explain these measurements and show how to create them.

Expression Builder

The Expression Builder is a tool that enables, in various forms, the user to create custom calculations, virtual measurements and logical expressions that can evaluate specific values. It is integrated into the software to calculate the value of any expression, provided the formula is comprised of predefined values and follows standard algebraic rules. The user can then utilize this function to calculate results, define test rates or identify a domain in which a calculation is to be performed.

Test Profiler

TestProfiler is an optional feature in the software that requires a unique key code.

In the Test Control > Test section of a TestProfiler method, you can create a customized test sequence that defines the behavior and actions of the testing system during a test. The test sequence is comprised of a series of steps. Each step specifies the control parameters, data acquisition criteria, and a combination of events and actions. Every step includes a step completion event where you can specify the next step in the test sequence. The system performs the test sequence in the order specified in the Step completion event for each step.

Traceability (local)

Traceability is an optional feature in the software that is only available if purchased.

Traceability creates an audit trail that provides a chronological record of activity made to your test methods and sample files. Most activities completed in the software are saved to an audit trail database with a date and time stamp. Documenting the sequence of activities ensures that your testing processes remain consistent and reliable over time, thus maintaining a high level of data integrity.

The Traceability feature has two components:

- An audit trail database that maintains a history documenting the changes, actions, and reviews done on a Bluehill system.

- Signature requirements to document who has performed an action or changed a file. Signature requirements can also be used as a review process to ensure any changes to a file are reviewed and validated.

Bluehill Central

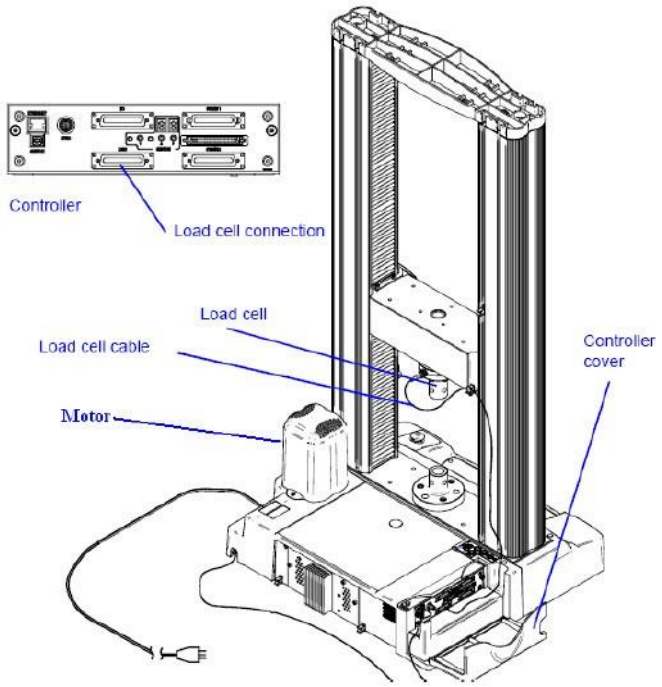
Bluehill Central is an application that provides access to the Bluehill Server from testing systems and other workstations on your company network. It is a laboratory management application that creates a network of testing systems to share information from a central server. Bluehill Central streamlines laboratory management in that changes are implemented centrally and made available to all connected testing systems and Bluehill Central workstations.

Bluehill Server is an external server that manages the various databases where the system files (method and sample files), testing data and audit trail history are stored. Information is organized by teams. You must be a member of the team to access the information saved for that team. Your security permissions for a team may further limit the level of access to the team's information. The team settings are managed from the Bluehill Central application.

Chapter 2
Connecting and Configuring Transducers

Introduction

Transducers are sensors that generate an electrical signal that can be input into your mechanicaltesting system. A basic electromechanical testing system has two transducers, one that measures movement within the test space and one that measures force exerted. The movement of the crosshead is measured by either an optical encoder or a Linear Voltage Displacement Transducer. These directly measure the movement of either the crosshead or actuator within the test space. Force is measured by a load cell, typically a strain gauge device, connected to the crosshead. The testing system uses these transducers to characterize materials. Values for stress and strain can be derived from these physical measurements by the force and displacement transducers respectively.



When the need to connect additional transducers arises the user can add up to three additionalSCM's to the controller, each transducer requires a dedicated SCM. The SCM provides an interface to the transducer through a 25 pin "D" connector that extends through the face of the controller. These boards are optional and are not provided unless specified by the customer. If the user has a need to connect more than four transducers to the testing system the Channel Expansion Module (CEM) option on the 5900 product line gives the user the ability to connect four or eight additional transducers.

Transducer Types

When connecting transducers to the testing system they are classified in one of three categories;Force, Strain or User-Defined. If your transducer was purchased as part of the testing system most time it is self-identifying. When connected, the controller reads the transducer type and capacity. These transducers have also been rationalized to enable to user to perform an automatic electrical calibration. User Transducers are initially non-self-identifying; they are not automatically recognized by the controller. During the setup of the User Transducer the operator "teaches" the testing system to recognize the device if identification is available.

Self-Identifying Transducers

The standard Instron transducers have a connector that contains a "Cal and ID" board. This board provides the resources to identify the transducer as to its type, whether it's a load cell or extensometer, its capacity and provides the necessary electronic components to enable the userto calibrate the transducer automatically.

User Transducers

The user transducer must be connected to the system and configured in order for the testing system to recognize, calibrate and use the device for testing. As part of the process of configuringthe transducer connector the user must identify the transducer category. Additional considerations that the user must take into consideration are:

- Does the transducer require excitation? - Some devices require an external voltage applied to the transducer for it to operate.

- Do the transducer outputs require conditioning? - Devices such as strain gauges require conditioning electronics in order to create a signal that is linear and of sufficient amplitude.

- How will the device be calibrated? - During the configuration of the transducer the user must perform a calibration to enable the SCM to quantify its output. Typically this requires the transducer to output a "zero signal" and a "full scale" signal. The operator must have some means to vary the output voltage of the transducer to perform this function.

High Level DC Devices

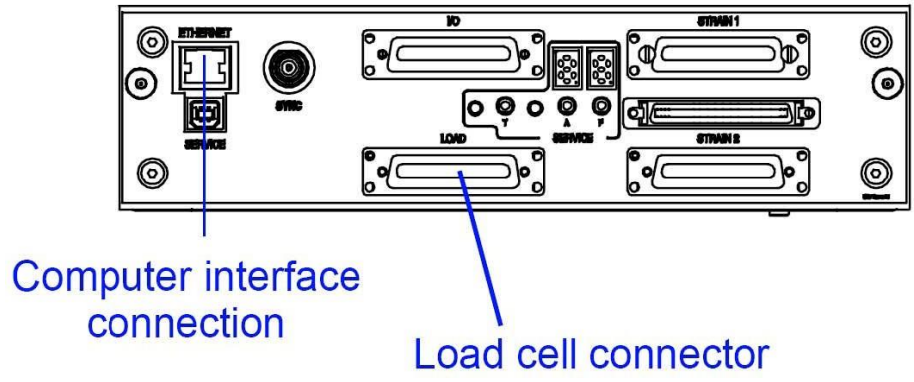
High level DC devices will output a signal between 0.06 VDC and 10 VDC proportional to the magnitude of the measurement being monitored. Maximum voltage is 12 VDC; voltages abovethat level may cause damage to the SCM. Maximum input impedance is 10K Ohms.

Low Level AC Devices

Typically these types of transducers are a full Wheatstone bridge. They require an excitation to operated and have a low level of sensitivity, typically a few millivolts per Volt. They also provide noability to perform a calibration. Because of this it becomes a very difficult transducer to work with. Users that need to have the output of a bridge or single strain gauge will usually use some form of bridge completion circuit and condition box that provides a high level DC output to the 5900 test system.

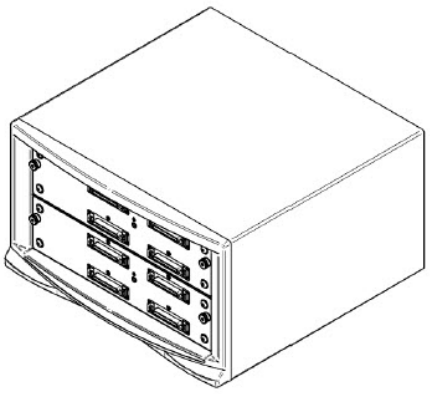
Connecting User Transducers

On the 5900 testing system all transducers plug into the controller located on the left side of thetest frame. An option, this requires the installation of an additional SCM into the controller. The controller can have up to 12 SCM's connected, 4 in the controller itself and up to 8 additional SCM's in the CEM. Refer to the diagrams below for slot designations and compatibility.



Connector Label	Transducer Configuration	Software Label
Load	Load Cells Only	1 Labeled as Load
Strain 2	Strain 2 Load 2	2 Labeled as Strain 2
Strain 1	Strain 1 Load 3	3 Labeled as Strain 1
I/O	If I/O card is fitted, no transducer can be connected	4 Labeled as I/O
5*		5
6*		6
7*		7
8*		8
9*		9
10*		10
11*		11
12*		12

* These are only available if CEM, shown below, is fitted to the Expansion slot between the Strain1 and Strain 2 connectors. Also note, only load cells can be connected to the load SCM.



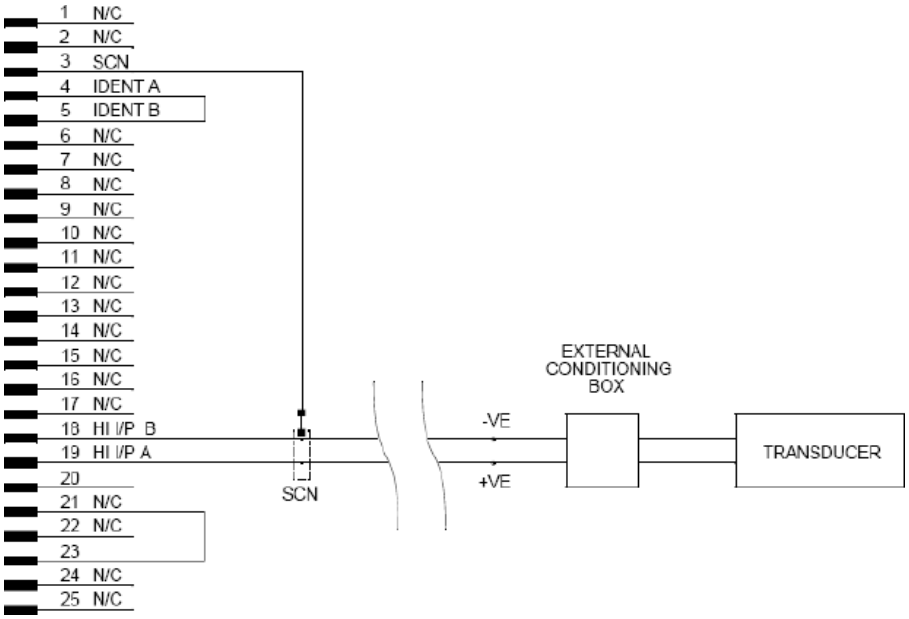
Simple Connection of a High Level DC Device

This is the most straight forward way of connecting transducers; it requires a 25 Way D-type plugand two wire links. The wire links are used to identify

Transducer is a high level DC device (pin 21 to pin 23)

The device is a User Transducer with a Rcode of “0,0” (pin 4 to pin 5)

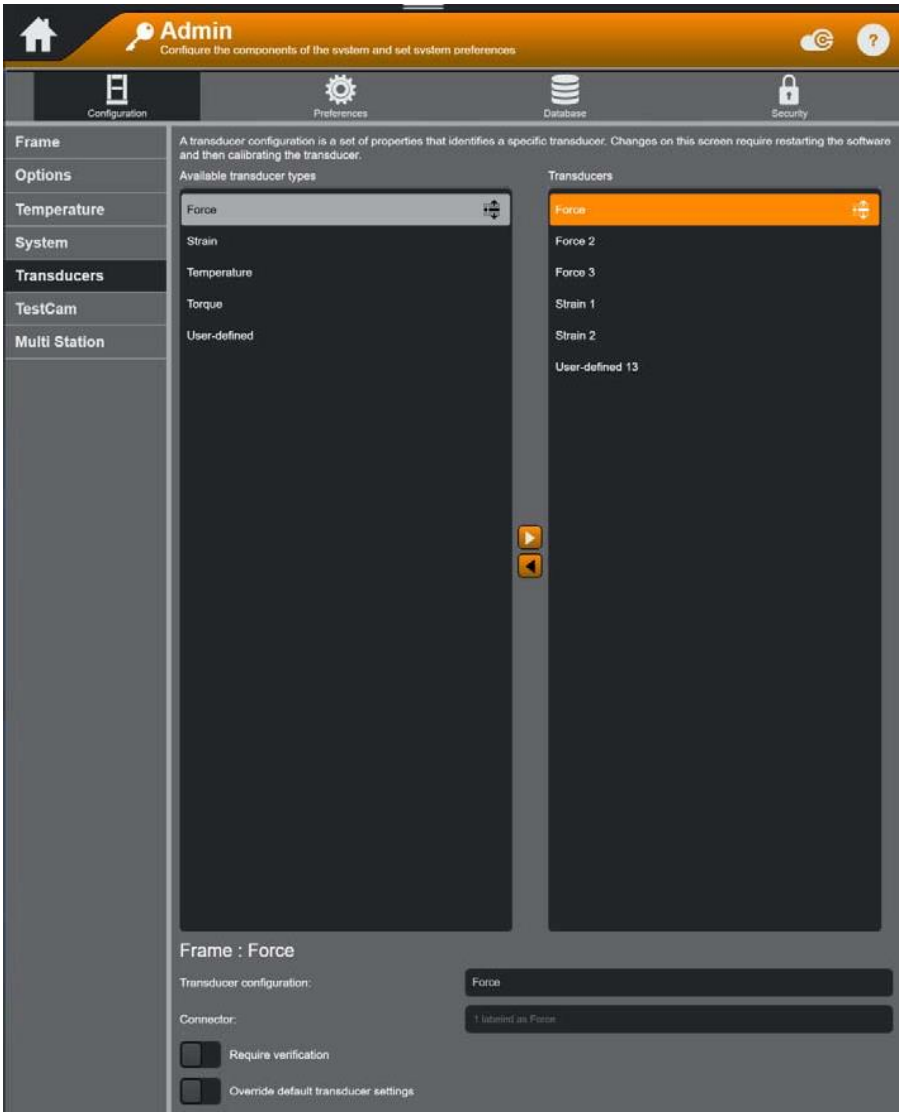
The user then connects the transducer “+” and “-” leads to the connector as shown below (“+” topin 19 “-” to pin 18).



The transducer may need an external conditioning box to enable the device to be calibrated. During the calibration of the transducer the user must be able to generate specific output signalsin order for the SCM to condition the electronics to recognize these signals as a specific value.
With these connections made the transducer can now be connected to the SCM in the controller.

Additional Considerations

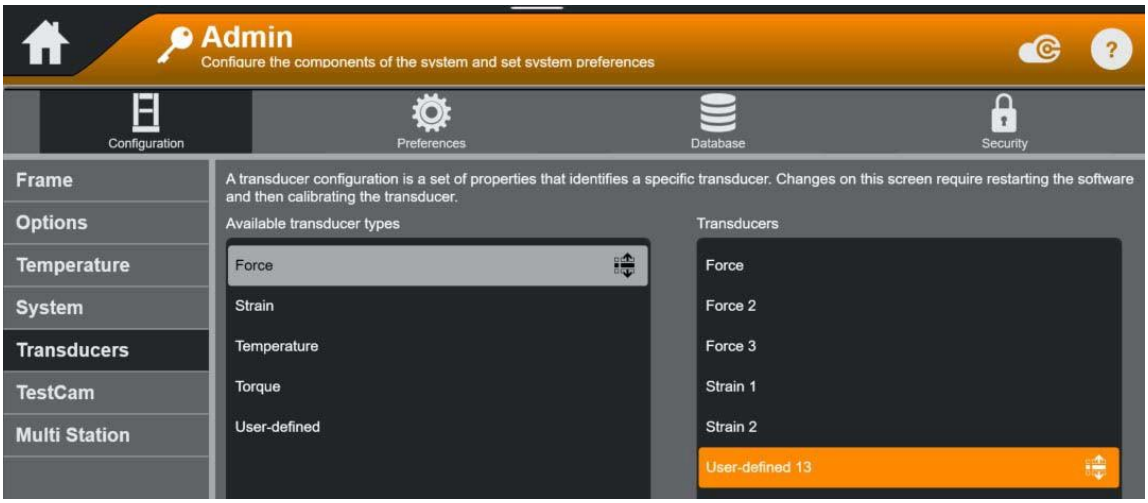
In the above example an Rcode of 0,0 was used. If more than one User Transducer will be connected to the testing system the user must assign a unique Rcode to each transducer. This isrequired even if the two transducers are not being used at the same time. During the calibration process the testing system will store the calibration coefficients associated with the transducer; this information is stored based upon the identification of the transducer.



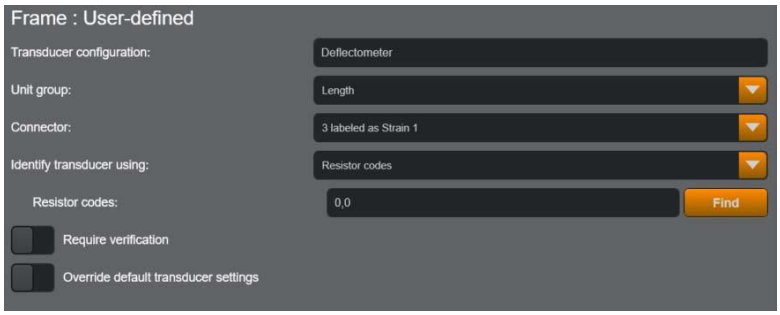
Configuring the Software

New transducers must be configured in the Admin section of the Bluehill Universal software; this will enable the transducer to be used within a test method. Transducers are added to the system in the Admin area of the software. Once in the Admin area, select Configuration > Transducers.

The operator can select a named transducer type or User-defined in the available transducer type listing and touch on the right triangle to add a new transducer to the Transducer listing. Once added the transducer will become available to configure as shown below.



The user can now uniquely identify the transducer, operating units, its physical connection and how it is to be identified. In this example we will be configuring a deflectometer device. We will Change the name of the transducer from User-defined 12 to “Deflectometer”



- Set the units to “Length”
- Indicate the device will be connected to “3 labelled as Strain 1”
- Identify the device using “Resistor Codes”
- Once the user selects the “Resistor Codes” option an additional field will be displayed with a pre-filled value of “0,0”. The user can read the correct resistor code from the connector by touching on the “Find” button to the right of the field.

Additional options available to the user to further define the transducer are:

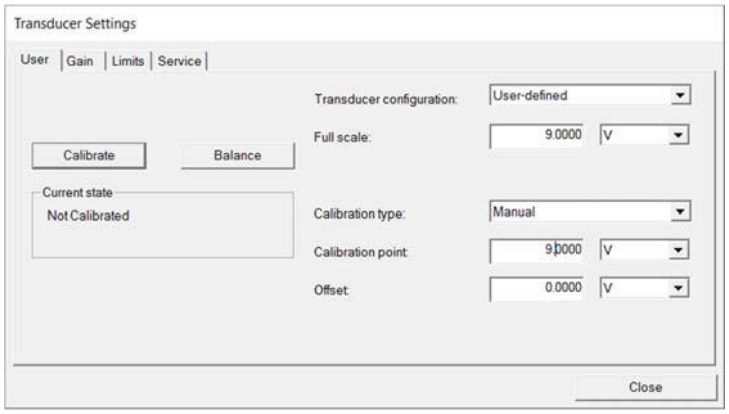
Require Verification - Verification is the comparison of the transducer to a national or international standard. To ensure that the verification for the selected transducer is valid, select Require Verification and enter the date that the current verification expires. When the transducer is selected for a measurement in a test method, the system verifies that the date is valid. If the date has expired, the system does not start the test. The system will display a warning in the system event log in the console area 30 days prior to this expiration date so that you can schedule a service appointment before the verification expires. Once the verification date passes,the system cannot start tests that use this transducer until the verification date is updated. This is not linked to Instron Connect which is updated from the Instron Connect page inside the Admin section

Override Default Transducer Settings - If your testing system has both upper and lower test spaces it may require customizing a transducer's settings so the device functions properly in a given test space. These settings are available for both the upper and lower test space for each transducer. This setting reverses the polarity of a transducer's measurement in the Bluehill® software. This affects the polarity of any softwareinputs such as test rates and end levels and also the polarity of the live display for the measurement. Refer to the Bluehill Help system for additional details.

Once configuration of the transducer is complete the software must be restarted. Upon restarting the software a new transducer icon, User Transducer 1, will be displayed in the console section of the software. The transducer can now be calibrated for usage.

Calibrating User Transducers

Calibration ensures that the output voltage from a transducer is directly proportional to the forceexerted on the transducer. In other words, it ensures that the transducer measures correctly.
There are two types of calibration: manual and automatic. The default calibration for user transducers is manual. Calibration is required when a transducer is first installed, and recommended at regular intervals after installation. Pressing the user transducer icon within thesystem details page will open the calibration dialog box as shown below.



The first step is to select the transducer from Transducer configuration. Touching on the dropdown list for the transducer will display the available user-defined transducers. Selecting the desired user transducer will change the system of units for all of the calibration fields to the defined unit group. The user needs to define the calibration settings as follows:

Full Scale - Enter the full scale value of the transducer. In this example the full scale value is 9V.

Calibration Type - Only manual calibration is valid for user transducers.

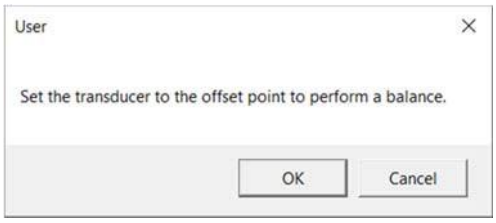
Calibration Point - The user must identify a value for the calibration point. This value must be at least 10% of the full scale value. During the calibration process the transducer will have to be setto this value to successfully calibrate. If the device does not give the user the ability to output a preselected value the use must incorporate an external conditioning box that will provide this capability.

Offset - This is the lowest value in the scale of the transducer. It is the point at which the transducer outputs 0 VDC. In this example we will use 0V.

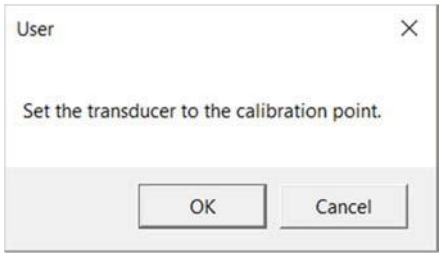
Gain - Do not change this value. During the calibration process the SCM firmware will determinethe gain value based upon the input signals it receives.

Once these values have been entered in the dialog box, the user can calibrate the transducer asfollows:

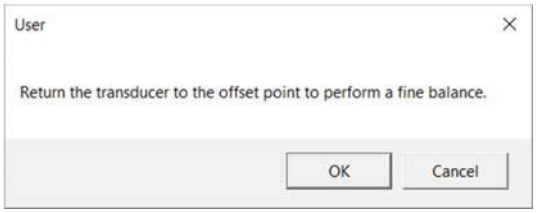
1. Touch on the Calibrate button in the dialog box. An additional dialog box will open directing the operator to set the transducer to the offset point to perform a balance.



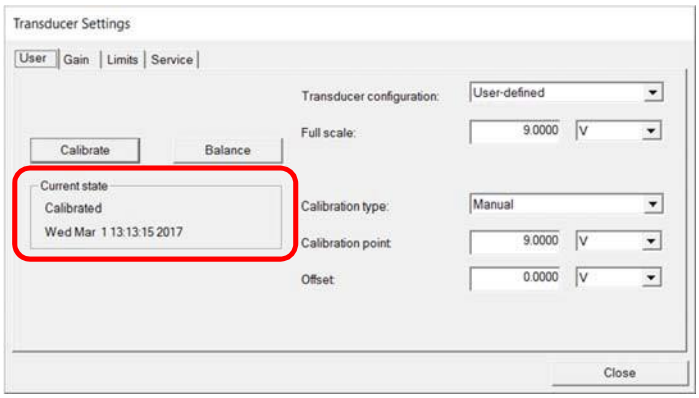
2. The user must set the transducer to the point at which it output is 0 VDC, then touch OK. The controller will now balance the output of the transducer with the SCM electronics.
3. Once complete the software will direct the user to set the transducer to the Calibration Point:



4. The user must now set the transducer to the calibration point value entered in the dialog box. Once the transducer is stable at the calibration point, touch OK. The system will now conduct a span adjustment where it correlates the output voltage of the transducer to the calibration point value. From this adjustment the system can create a relationship between the transducer output voltage and the values it is meant to represent. Upon completion of the span adjustment the user will be directed to return the transducer to the offset point. Return the transducer to the offset point and touch OK.

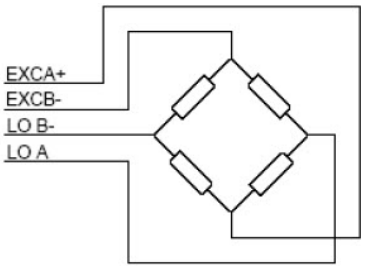


5. Upon completion of the fine balance operation, the transducer is calibrated.



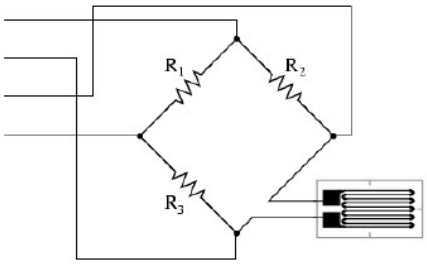
With the calibration process complete, the dialog box will indicate a status of calibrated and the date and time the device was calibrated. The User transducer Icon in the console will now displaythe icon in color indicating that it is calibrated. This completes the process of adding a user transducer. This device can now be added as a measurement within any test method. If you disconnect the transducer you must remember that it is designated for use in which it was calibrated. If you plug this device in any other slot the system will not recognize the device or collect any data from it.

Connecting a Low Level AC Device

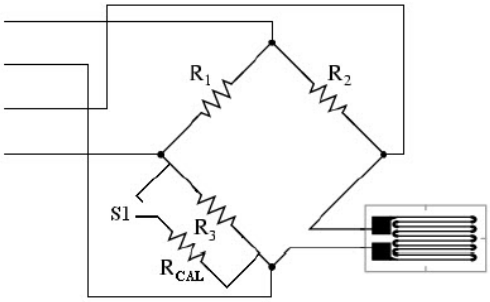


Low level AC devices are typically strain gauges, used in a Wheatstone bridge that provides a highly accurate means of measuring strain on a specimen. The complete Wheatstone bridge contains four active gauges, as shown below:

The bridge requires an excitation voltage to operate and in an unstressed state the output of thebridge would be equal to zero. If any of the active gauges change their values the resulting measured output will change, that change represents the strain on the specimen. More commonly users will be connecting a single active gauge to measure strain referred to as a quarter- bridge.



Using a single gauge required the use of a bridge completion circuit as the 5900 will only accept the connection of a full bridge. As shown in the previous diagram R1, R2 and R3 would form this bridge completion circuit and when connected to the strain gauge would provide a complete bridge to the SCM. One additional consideration the user must include is the ability to perform an electrical calibration. The 5900 and Bluehill Universal must be able to recognize the output of thecircuit as a specific value of micro-strain. The calibration process goes through a sequence of steps the “teach” the SCM how to recognize these inputs and relate them to specific values of micro-strain. To do this the user must provide some means to force the bridge to output a change in the balance of the bridge.



As shown in the previous diagram a calibration resistor (R_{cal}) and a switch (S_1) are added to the circuit to provide for this calibration. The calibration resistor pro-vides a means to create an imbalance in the bridge when the switch is closed. The value of the resistor can be calculated butrequire that the user have a complete understanding of the components that make up the bridge circuit. Strain gauges used in materials testing are usually 120 or 350 Ohm gauges, for simplification of this explanation the following criteria will be used:

1. A 350 Ohm strain gauge will be used (Rgauge)
2. The gauge factor (F) is 2.105
3. Full scale of the gauge is 2000 micro-strain (ε)
4. The calibration point is 2000 micro-strain
5. To calculate the value of the calibration resistor you must first calculate how much of a change in resistance must be generated in the bridge to simulate the calibration point. This is done as follows:

    a. $R\Delta = \varepsilon * (F * R_{gauge})$

    b. $R\Delta = .002 * (2.105 * 350)$

    c. $R\Delta = 1.4735$ Ohms

6. With the necessary change in resistance now known calculate the Value of the calibration resistor as follows:

    a. Rcal = [Rgauge * (Rgauge - RΔ)] / [(Rgauge - (Rgauge - RΔ)]

    OR

    b. Rcal = [350 * (350 - 1.4735)] / [350 - (350 - 1.4735)]

    c. Rcal = (350 * 348.5265) / (350 - 348.5265)

    d. Rcal = 121984.27 / 1.4735

    e. Rcal = 82785.388 Ohms (82.785K Ohms)

7. Finding a precision resistor with the value calculated is not always possible. Once you know the value of resistance needed use a resister as close as possible to the calculated value. In this example we will use a resistor of 90.9K Ohms. You cannot use a resistor that has a lower value of resistance than calculated; this would create a value higher than the full scale value.

8. Using a 90.9K Ohm resistor we need to now calculate the resistance in parallel (Rt) when we close S1 to unbalance the bridge.

    a. Rt = (Rgauge * Rcal) / (Rgauge + Rcal)

    b. Rt = (350 * 90.9K) / (350 + 90.9K)

    OR

    c. Rt = 31815000 / 91250

    d. Rt = 348.65753

9. Using a 90.9K Ohm calibration resistor we can now calculate the exact micro-strain value for the calibration point as follows:

    a. ε = (Rgauge - Rt) / (F * Rgauge)

    OR

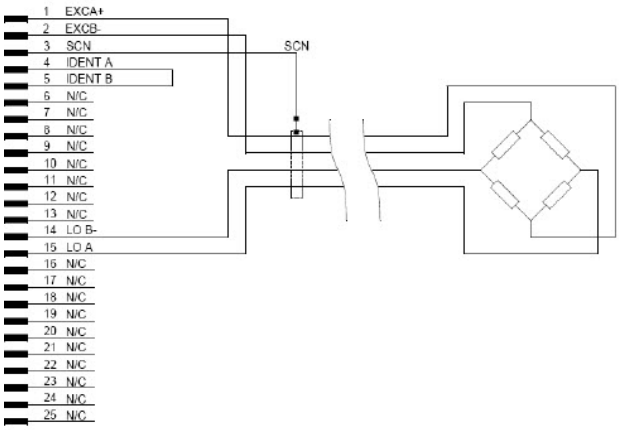
    b. ε = (350 - 348.65753) / (2.105 * 350)

    c. ε = (1.34247) / (736.75)

    d. ε = 0.0018221 = 1822.1με

Connecting a Wheatstone Bridge to the Controller

As with the High DC device explained earlier this connection requires a 25 Way D-type plug and one wire link. The wire link is used to identify:



The device is a User Transducer with a Rcode of “0,0” (pin 4 to pin 5)

The user then connects the bridge leads to the connector on pins 14 and 15 and the excitation to pins 1 and 2 as shown.

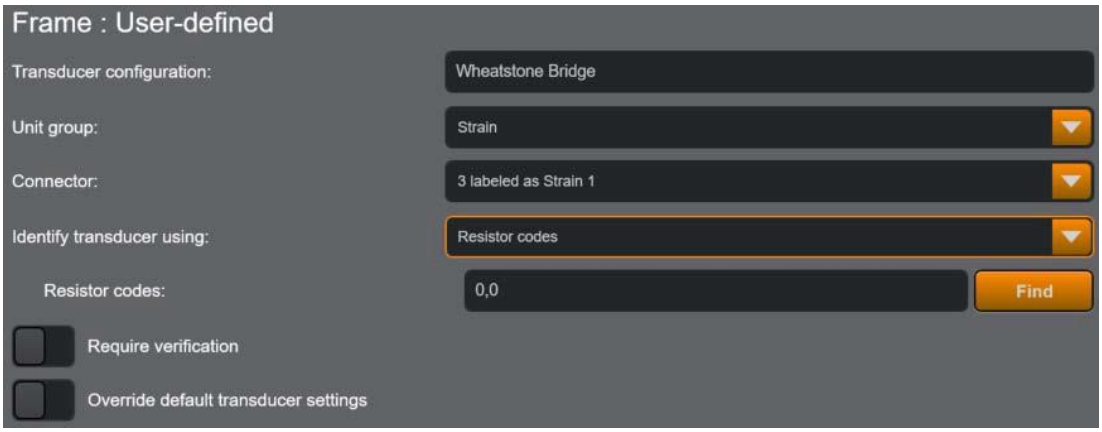
Configuring the Software

New transducers must be configured in the Admin section of the Bluehill Universal software; this will enable the transducer to be used within a test method. Transducers are added to the system in the Admin area of the software. Once in the Admin area, select Configuration > Transducers. The operator can select User-defined in the available transducer type listing and touch on the right triangle to add a new transducer to the Transducer listing.

Once added the transducer will become available to configure as shown below.

The user can now uniquely identify the transducer, operating units, its physical connection and how it is to be identified. In this example we will be configuring the Wheatstone bridge with the

testing system enabling the user to record the strain measured by the strain gauge during a test. We will Change the name of the transducer from User-defined 12 to “Wheatstone Bridge”.



- Set the units to “Strain”
- Indicate the bridge will be connected to “3 labeled as Strain 1”
- Identify the chamber using “Resistor Codes”

Once the user selects the “Resistor Codes” option an additional field will be displayed with a pre-filled value of “0,0”. The user can read the correct resistor code from the connector by touching on the “Find” button to the right of the field.

Additional options available to the user to further define the transducer are:

Require Verification - Verification is the comparison of the transducer to a national or international standard. To ensure that the verification for the selected transducer is valid, select “Require verification” and enter the date that the current verification expires. When the transducer is selected for a measurement in a test method, the system verifies that the date is valid. If the date has expired, the system does not start the test. The system will display a warning in the system event log in the console area 30 days prior to this expiration date so that you can schedule a service appointment before the verification expires. Once the verification date passes, the system cannot start tests that use this transducer until the verification date is updated.

Override Default Transducer Settings - If your testing system has both upper and lower test spaces it may require customizing a transducer's settings so the device functions properly in a given test space. These settings are available for both the upper and lower test space for each transducer. This setting reverses the polarity of a transducer's measurement in the Bluehill® software. This affects the polarity of any software inputs such as test rates and end levels and also the polarity of the live display for the measurement. Refer to the Bluehill Help system for additional details.

Once configuration of the transducer is complete the software must be re-started. Upon re-starting the software a new transducer icon, User Transducer 1, will be displayed in the console section of the software. The transducer can now be calibrates for usage.

Chapter 3
Measurements

What is a Measurement?

A measurement is a value which represents a magnitude. For example, in material testing the amount a specimen is stretched during a tension test is a measurement referred to as elongation. This elongation value can then be put into a mathematical formula (Δ gauge length / original gauge length) to calculate the strain of the material at any given point during a test. In the previous example we have defined the two types of measurements that exist within the Bluehill Universal® software. The measurement shows how much the specimen has been elongated and is taken from the movement of the crosshead in the testing system. This is considered a Physical Measurement. The measurement of the strain is calculated based upon the original length of the specimen and its change in length. This type of measurement is referred to as a Virtual measurement.

Physical Measurements

Physical measurements provide data directly from transducers connected to the testing system. When a new method is created the software automatically provides the following physical transducers within the method:

- Time
- Displacement (Electromechanical systems)
- Force
- Strain 1 (if connected)
- Strain 2 (if connected)

Physical measurements are defined within the test method, this enables each test method to have a separate configuration of physical measurements. To accommodate this each physical measurement must have a unique designator or name to specifically identify the transducer.

Virtual Measurements

Virtual measurements provide data related to the specimen that has been calculated. For example, stress is derived from the force applied to the specimen divided by the cross sectional area of the specimen. When a new method is created the software provides several predefined virtual measurements:

- Tensile Displacement (Compressive, Flexure, Peel)
- Compressive Force (Flexure)
- Tensile Strain (Compressive, Flexure)
- Tensile Stress (Compressive, Flexure)
- Force / Width
- Tenacity

As with physical measurements these measurements are uniquely defined within each test method. You can create additional virtual measurements within a test method by providing a unique name, a valid expression, and the units of measurement.

Corrected Displacement

The corrected displacement measurement provides data on the compliance, “elastic give”, of the testing system. It is important to understand that this measurement is a property of the entire load string not just the test frame. The load string consists of the frame, load cell, adapters and grips or fixtures. In order to correct for this compliance the user must first create a compliance data file, a file needs to be created for each different configuration of the load string and applied appropriately.

Availability of Measurements

Measurements created within a test method are available in several areas of the method including calculations, test control, live displays, graphs, raw data viewer, and results. When you create a measurement, the system updates all these sections to make the new measurement available. If you have a sample open, the new measurement is available for all untested specimens. If you remove a measurement from a test method, the system again updates all the above sections to remove the measurement as an option. If the measurement is in use, the system changes the display to show No selection made. For example, if you created a measurement called Force 2 and selected Force 2 to display in the live display section of console, then remove it from the method the live display changes to show No selection made. If a measurement is modified, the system updates all the above sections to reflect the changes to the measurement. The factors that affect the measurements available in the software are:

- The transducers connected to the system - the system detects the type of transducer and the connector it is plugged into to create a measurement for that transducer. For example, if a load transducer is connected to the Strain 1 connector on the frame, the system creates a new physical measurement named Force 2. If an extensometer is

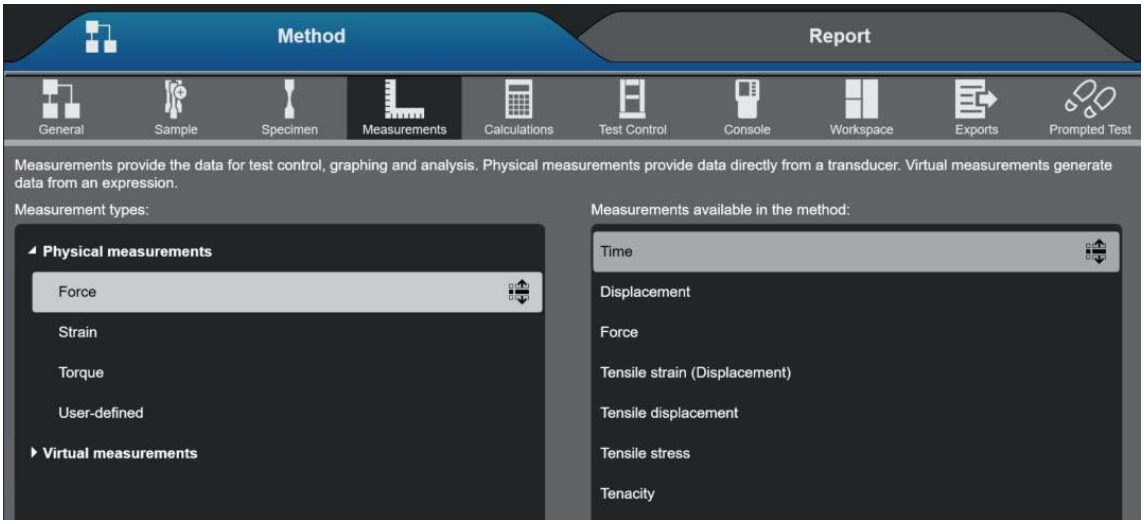
connected to the Strain 1 connector, the system creates a new physical measurement named Strain 1.

- The selected test type - some measurements are specific to a test type. For example, compressive strain only appears in a compressive test method, peel displacement is only available in a peel tear friction test method.

Creating Physical Measurements

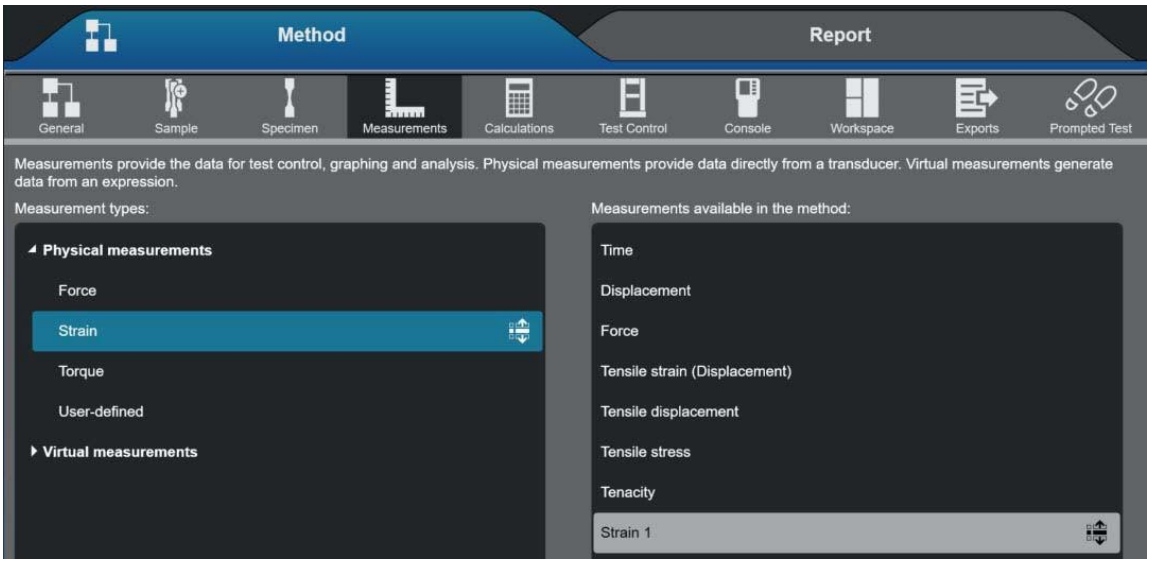
Measurements are created within the test method. As previously indicated, physical measurements are created from transducers. This is not to be confused with connecting and configuring a transducer, in order to create a measurement the transducer must already exist within the software. In this section of the manual we will create a measurement of strain from an extensometer connected to the testing system.

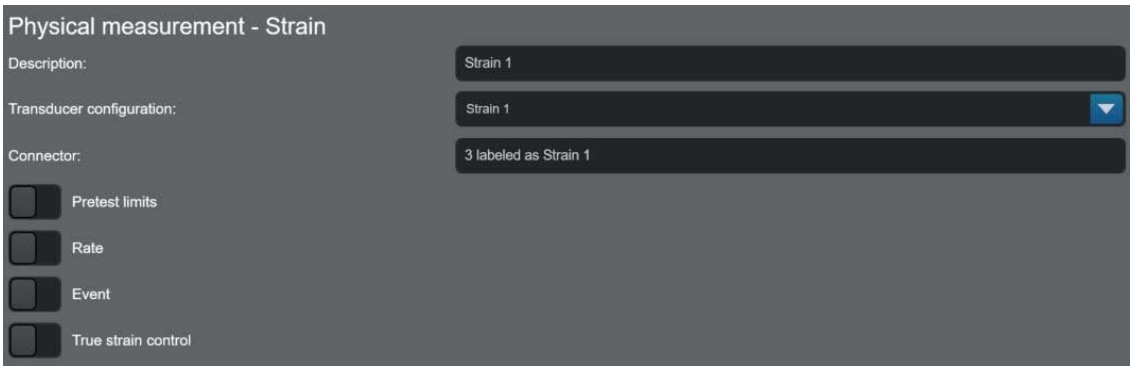
1. Open or create the test method for the measurement to be added to and select the Measurements item in the Navigation Bar.



2. The extensometer does not need to be connected to the system to create the measurement but needs to be connected and calibrated in order to run a test using this test method.

3. Select “Strain” in the Physical Measurements list, by either double-touching the term Strain or touching the right pointing triangle. This will add the Measurement “Strain 1” to the selected measurements list as shown below.



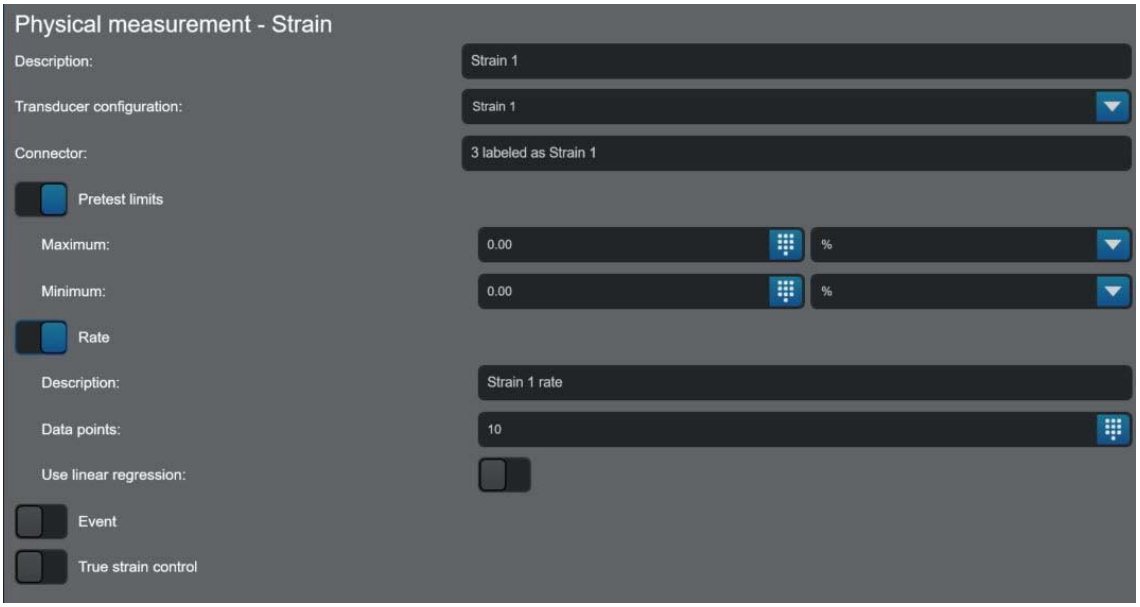


4. Once the measurement is added it can be used within the test method.

Associated Parameters of a Physical Measurement

In addition to creating the physical measurement the user can identify the following additionalparameters:

- **Pretest limits**
- **Rate**
- **Event**
- **True strain control (strain measurements only)**



Pretest Limits

The pretest limits define an acceptable range of transducer readings under which the test may be started. As shown above, when the pretest limits are enabled the operator can enter the maximum and minimum values to establish an acceptable range. These values can be either positive or negative, and it does not matter if the maximum value is greater than or less than the minimum value. If the value at the start of the test is not within the specified range the system will prevent the start of the test and display a message to the operator. The operator can then:

- Re-install the specimen
- Make other adjustments to the position of the crosshead.

Rate Measurement

If the user enables the Rate option the system will create two separate data streams, one that measures strain and one that calculates the strain rate based upon the additional required parameters. The default setting is 10 data points and the system calculates the rate using the difference between the current data point and the previous 10 points. As an example, the user adds a calculation for a Preset Point of 16% Strain and ask for the strain rate.

The system would calculate the rate as follows (for the purposes of this example 16% strain was data point 114): Changing the number of data points to 20 would change the calculation as follows:

Strain Rate =

(Strain @ point 114 - Strain @ point 94) / (Time @ point 114 - Time @ point 94)

The calculation of rate is a function of time. The user can identify that the rate recalculates using linear regression. If this option is enabled the software will perform a linear regression over the number of data points identified.

Events

Events enable the user to specify an action to occur at a specific point during the test related to the measurement. Two separate functions can be triggered by the events item:

- Playing of a wave (*.wav) file
- Setting a digital output line

The user can have the testing system play a wave file at a specific point in the test associated with the measurement by entering a “Value” and a “Criteria”. An example is:

Criteria: “Equals or passes through”

Value: 15 % (The value and units available are based on the measurement selected)

Once the Strain value reaches 15% the system will play the selected wave file. The second option in events requires the installation of the Analog Output and Digital Input /Output option. The Digital Input/Output provides 4 logic line inputs and 4 logic line outputs to trigger internal and external events. When the event value and criteria have been met, you can configure the outputs, up to four, to:

- Set
- Clear
- Retain

True Strain Control (Strain Devices only)

This gives the user the ability to identify the specific device to be used for true strain control during the test. True Strain differs from normal strain (also termed Engineering Strain) by calculating the instantaneous strain based on the equation True Strain = ln(Strain +1). This is used in certain applications most notably in the Medical Device Industry. Generally if True Strain is used the sister unit True Stress will also be selected.

Creating Virtual Measurements

As explained previously virtual measurements are calculated from a mathematical expression. This expression can use data from one or more physical measurements, variables the user inputs via the Numbered Inputs, or general numbers written directly into the equation. Virtual measurements provide the user with great flexibility when defining the measurement. As with physical measurements, the measurement is created within the test method in which it will be used. In this section of the manual we will create a virtual measurement to calculate stress in an o-ring as required in ASTM D1414.

1. Open or create the test method for the measurement to be added to and select the Measurements item in the Navigation Bar.

2. Expand the Virtual Measurements to display the two measurements that can be added.

Expression: This option enables the user to use the Expression Builder to create custom equations.

Corrected Displacement: This measurement corrects values of displacement to allow for the compliance, or elastic "give", of the testing system.

Creating an Expression

Selecting the expression option gives the user the ability to access the expression builder. The expression builder provides the user with the ability to create a custom equation. A detailed explanation in the use of the expression builder, including examples is covered later.

Creating Corrected Measurements

In an effort to have measurements that are as accurate as possible the user must sometimes take into account the entire load string and the gripping of the specimen. Knowing how much compliance there is in the testing system will enable the user to correct the values of displacement. This is done by conducting a test using a rigid specimen that deforms very little at the maximum test force. As force is applied to the specimen, the system collects force and displacement data. The displacement data represents the amount the load string displaces with respect to the corresponding force readings when there is no specimen deflection. The collected data is written to a file, which is then used for correction while testing specimens. It is important to understand that the machine compliance is a property of the entire testing system, not only the load frame. When you perform the test to create the compliance file you must use the exact same components in the load string as you will when running the tests, including the load cell, grips and couplings.

Creating a Compliance Data File

Compliance data files are created by running a test, in this example we will utilize a tension typetest.

1. Create a new tension test method and set the end of test criteria to a force value that is higher than the maximum force expected during the test or to the maximum capacity of the system. You must use the same load string components that will be used when testing specimens.

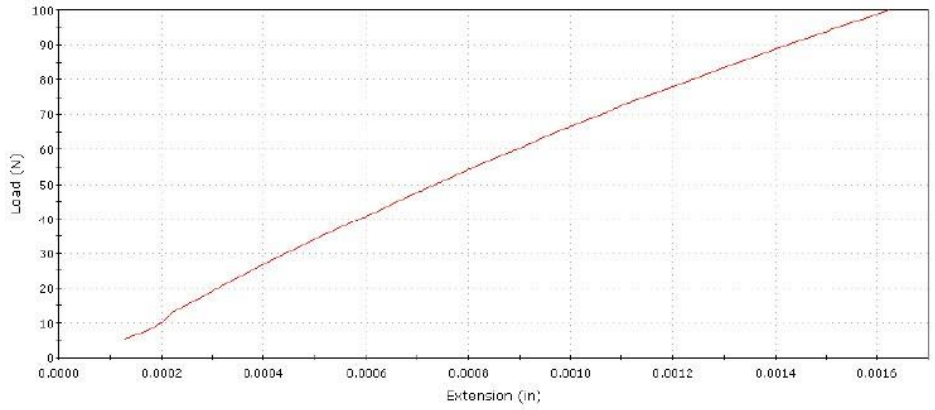
2. Set up the test to apply a small preload to ensure that there is no slack in the specimen.

3. Use stop as the end of test action.

4. Set up the data logging so that a data point is collected for every 1% change in force only.

5. Save the test method and return to the home screen.

6. Perform a test on the rigid specimen. The following diagram reflects the data collected during the test. As you can see in the diagram, the total amount of compliance in the frame at 100N is slightly over 0.0016 inches. Viewing the raw data from the test shows that 39 data points were collected and the displacement at 100 Newtons to be 0.00162 inches.



Creating a Corrected Displacement Measurement

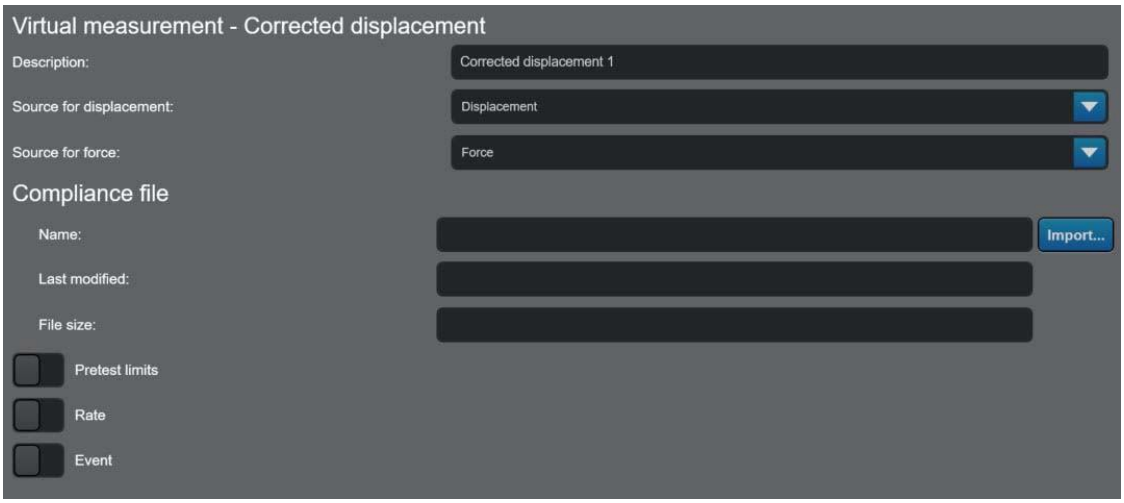
Once the compliance file has been generated the user can now create a corrected displacement measurement.

1. From the measurements page expand the Virtual Measurements and add a corrected displacement measurement.

2. The user must select the compliance file (the data from the tested sample) for the test method to use in calculating the corrected displacement.

3. Utilizing the Import button, select the compliance file to be applied when conducting tests with this test method.

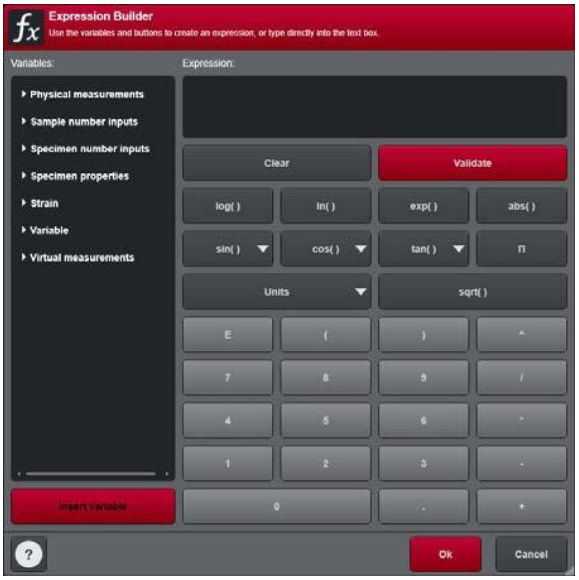
4. Now, anytime testing is conducted with this test method, a corrected displacement measurement will be made.



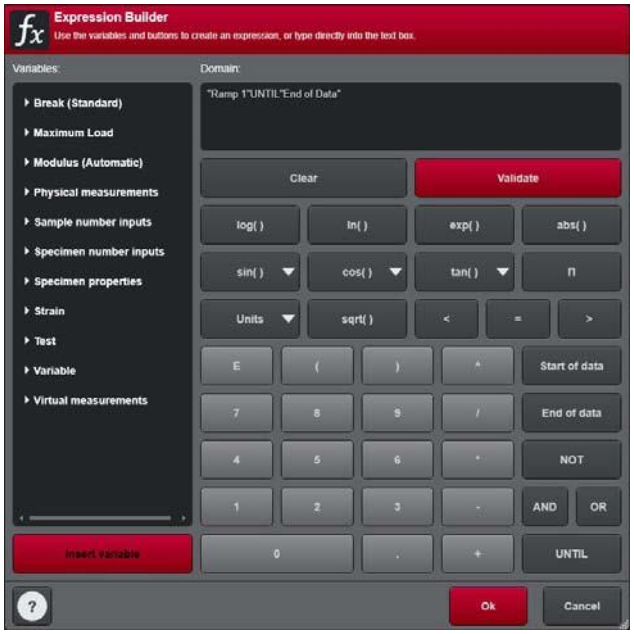
Chapter 4
Expression Builder

What is Expression Builder

The Expression Builder is an integral part of the Bluehill Universal software that provides the user with the interface to create virtual measurements, custom calculations, or logical expressions. These expressions can be used to create a calculated data stream, test speeds or identify test end criteria without requiring custom software. The expression builder can be displayed to the user in two different ways. When used to create a virtual measurement or to calculate a test rate the expression builder will be displayed as follows:



When used to specify a domain for graphing or calculations the expression builder will be displayed as shown below:



You should notice that when used to define domains Boolean logic is added. The domain provides the user the ability to define a specific region within the test curve. Identifying a domain enables the user to specify the test data that is available for a calculation or graph. Throughout the software, when available, the Expression Builder can be accessed by selecting its icon shown below.

When viewed, the Expression Builder window can be divided into five sections. They are:

The Expression window - This window will display your expression / equation as you add values or terms to it.

The Variables window - This window will display the variables that can be used to create an expression / equation. Variables can be added to this listing by adding information to the test method such as:

- Physical Measurements
- Virtual Measurements
- Sample / Specimen Numbered Inputs

The Unary Keys - These keys permit the user to select a single mathematical function to be performed, i.e. sin() will provide the sine of the value between the parentheses.

The Standard Calculator keys - These keys enable the user to enter numbers and basic mathematical functions into an equation. The ^ key represents exponential form, as in 4^2=16 and the E displays scientific notation as in 1E2 = 100.

The Boolean Operators - Only displayed for the domain calculation, this section enables the user to identify the domain in which a calculation is to be performed.

Creating Virtual Measurements with the Expression Builder

We are going to create a measurement that calculates True Strain. True strain is defined by the American Society for Testing and Materials (ASTM) as the natural logarithm of the ratio of instantaneous gauge length to the original gage length and is expressed as follows:

$E = ln\ (1+e)$

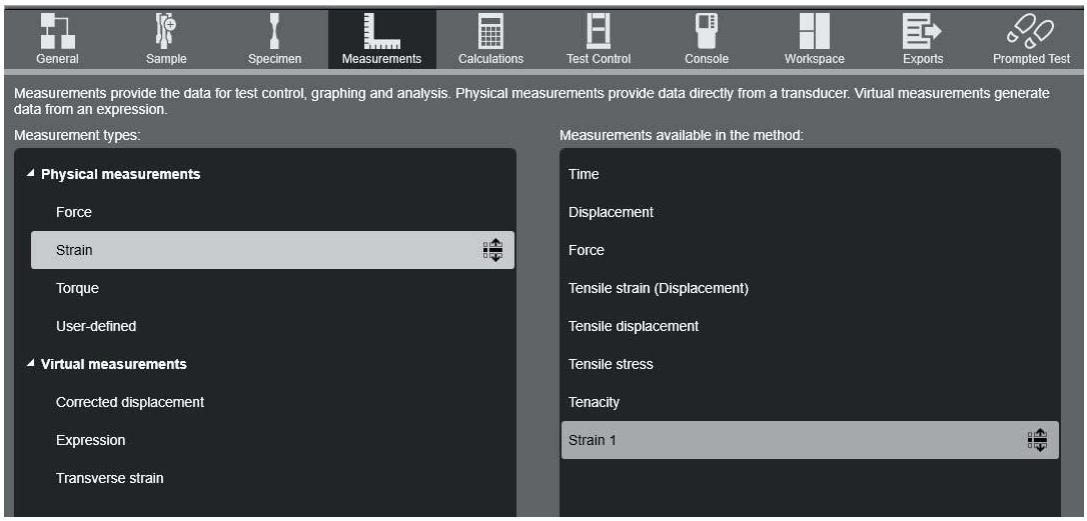
Where:

E = True Strain

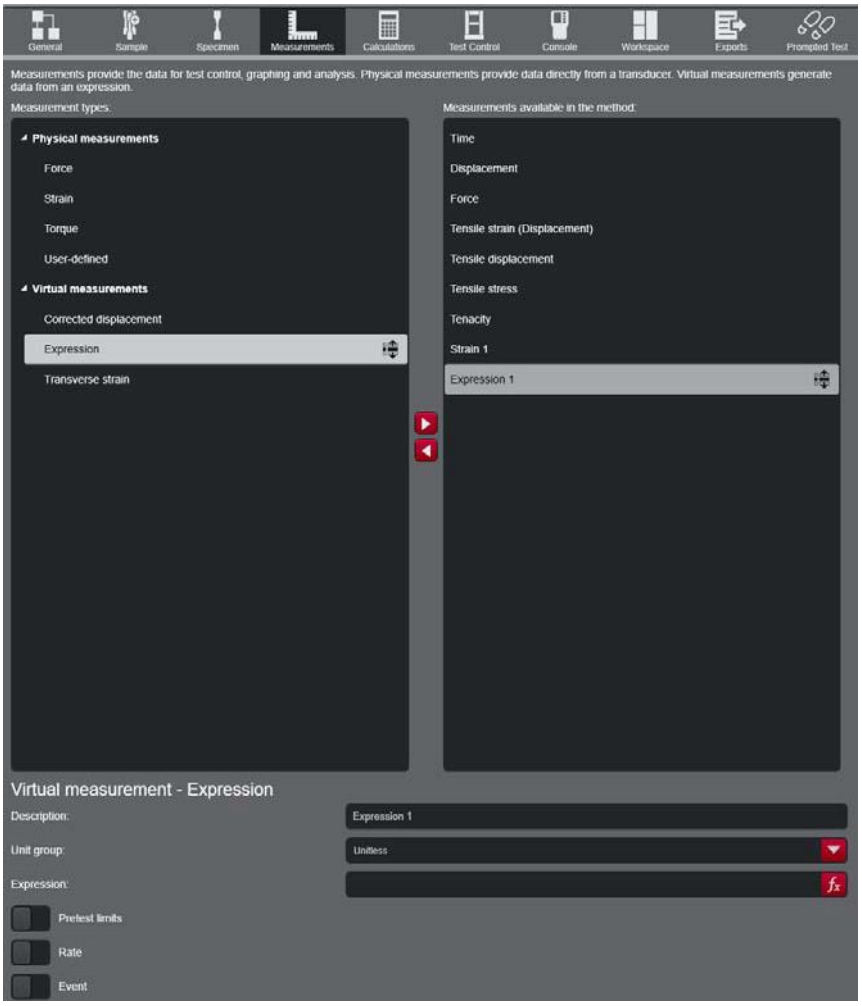
ln = Natural Logarithm

e = Strain measurement

Before creating this measurement the user must first add the physical measurement for the extensometer (Strain 1) to be used. Once the physical measurement has been created you can now create the virtual measurement for True Strain. Selecting Measurements in the navigation bar will display the following screen.



From this screen the user expands the Virtual Measurements item in the measurement type window, selects the Expression item and touch the right facing arrow to add Expression 1 to the selected measurements listing as shown below.



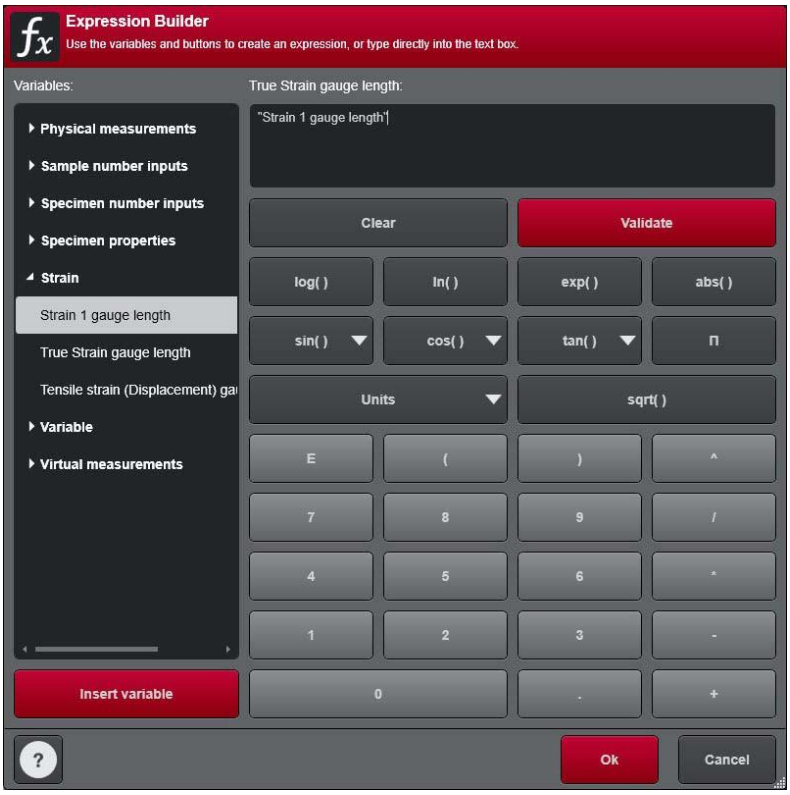
The user can now create and name the expression to calculate true strain.

1. Change the Description field to title the expression “True Strain”

2. Select the appropriate Unit Group for the measurement; in this case we will define this measurement within the Strain unit group. Once the Strain unit group is identified the software adds an additional field, “True Strain gauge length”

3. Due to the fact that this is a virtual measurement, the software does not know the value to use for gauge length. We want the system to use the gauge length of the extensometer and can indicate this using the Expression Builder. Select the Expression Builder icon to the right of the field.

By expanding Strain in the Variables window you will see “Strain 1 gauge length”, double click on the term and it will be automatically entered into the expression window as shown below.

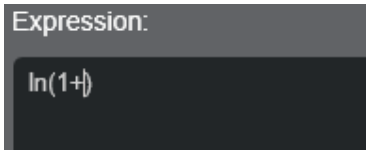


4. Touch OK and the expression will be added to the virtual measurement field.

5. The user can now enter the equation for True Strain into the Expression field by selecting the equation builder icon to the right of the Expression field. This will open the expression builder in a new window.

6. Select the natural log key; this will add the function to the expression field as shown below with the words “Enter here” highlighted.

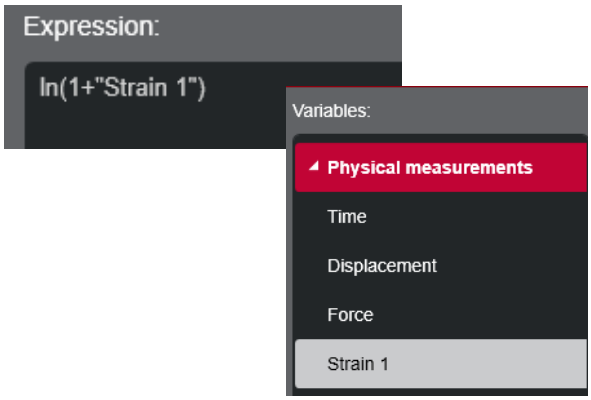
7. Using the calculator keys select the number one and the minus sign, these will be added in order as shown below.



8. The last element of the equation is the value of strain measured by the extensometer. This can be found in the list of variables.

   Expand the variable for physical measurements.

   Double click on the term Strain 1, this completes the equation and should be as displayed below.



9. You can validate the mathematical expression by selecting the “Validate” key. The software performs a validation of the syntax and mathematical rules.

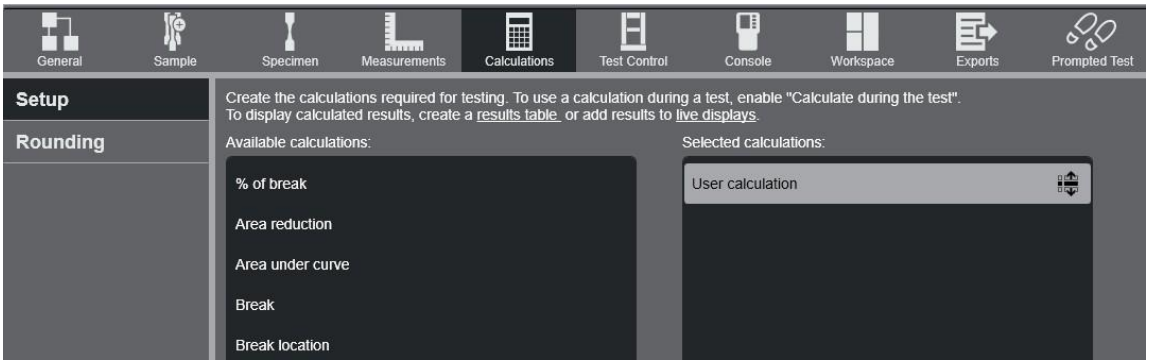
   If the expression is valid the software will display a small window stating “The expression is valid”.

   If the expression is invalid the software will display a window giving the operator an indication of the error.

   Once the expression is validated the user can touch OK to return to the virtual measurement screen. You cannot exit the window with an invalid expression.

Creating a User Calculation with the Expression Builder

User calculations are also built utilizing the expression builder. Once added to the Selected calculations list the user can access the expression builder by selecting the icon to the right ofthe user expression field.



In this example, toughness will be calculated. Toughness is defined as the amount of energy pervolume that a specimen can absorb before rupturing and is expressed as follows:

$$J_b/V$$

Where:

Jb = Energy in joules (at

rupture/break)V = Volume (Length *

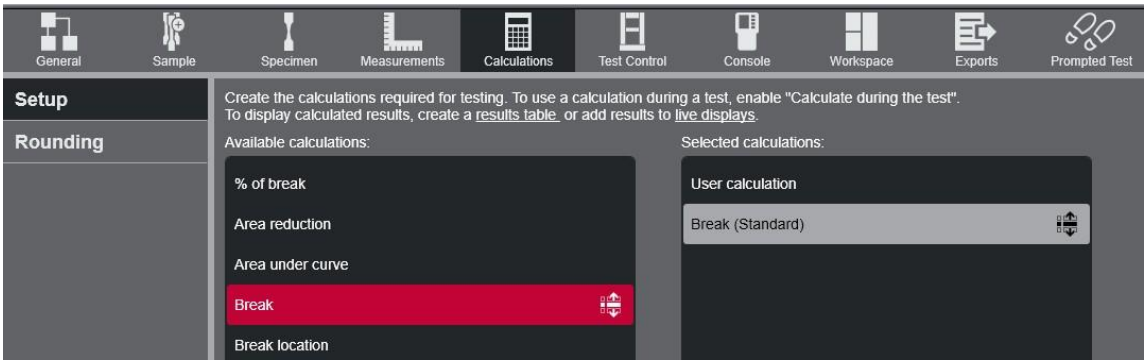
Width * Height)

We have identified that there are four variables within this calculation:

- Energy @ Break
- Specimen Length
- Specimen Width
- Specimen Thickness

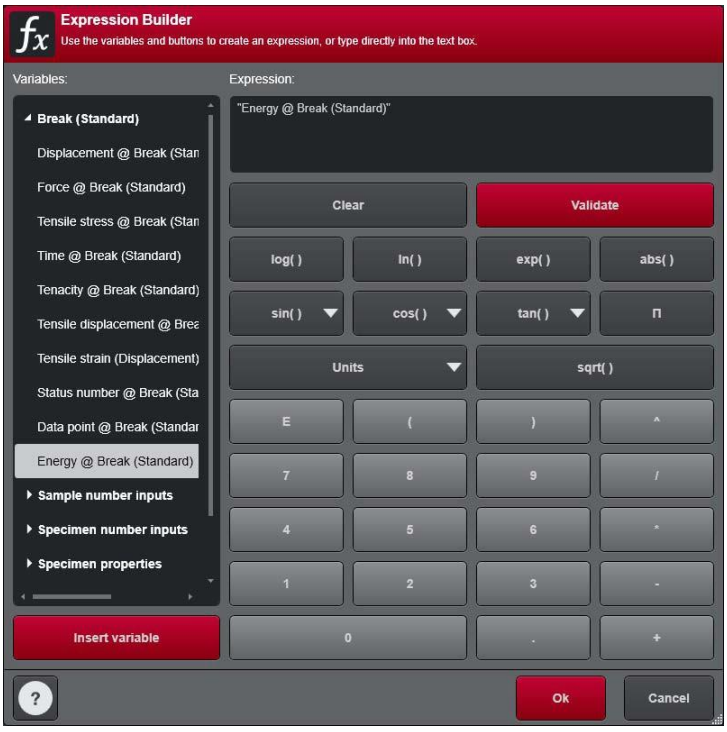
With this information we can build our user calculation as follows:

1. Add a calculation for Break, in this example we will use the “Break (Standard)” option.
2. Add a user calculation, these two calculations are shown below.



3. With the User calculation selected, select the expression builder icon to create the expression. With the expression builder open you can see that the Break calculation has been added to the list of variables. As long as a calculation has been added to the selected calculations list it will be available as a variable within the expression builder.

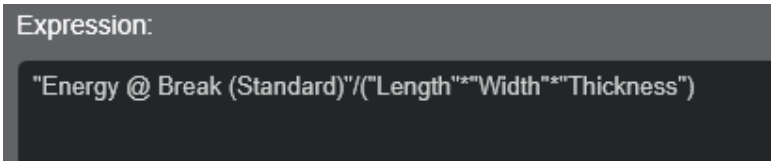
4. Expanding the Break calculation will display the available values that will be calculated at the break point. Select the value Energy; this will calculate the energy to the break point, selecting the term energy will add the value to the user expression window as shown below.



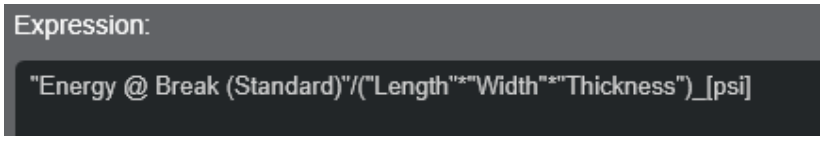
5. Continue to add the remaining portion of the mathematical expression as follows:

    - Add the "/" using the calculator keys
    - Add a left parentheses "("
    - Expand the Specimen properties in the variables listing and add the term Length
    - Add the "*" using the calculator keys
    - Expand the Specimen properties in the variables listing and add the term Width
    - Add the "*" using the calculator keys
    - Expand the Specimen properties in the variables listing and add the term Thickness
    - Add a right parentheses ")"

    The user expression will display the following:



6. The last step is to identify the units used to represent the result. In this case the units will be selected as Stress. The unit should follow the term or expression that it applies to, in this case at the end of the expression. Selecting the Units Unary key will display all of the systems of units available within the software. It is very important the unit selected follows the values in the expression, in this case the expression results are in joules per volume. This can also be represented in lbs.-in per in3, or lbs. per in2. So we will select the unit pounds per square inch (PSI). This will result in the expression to be displayed as shown below.

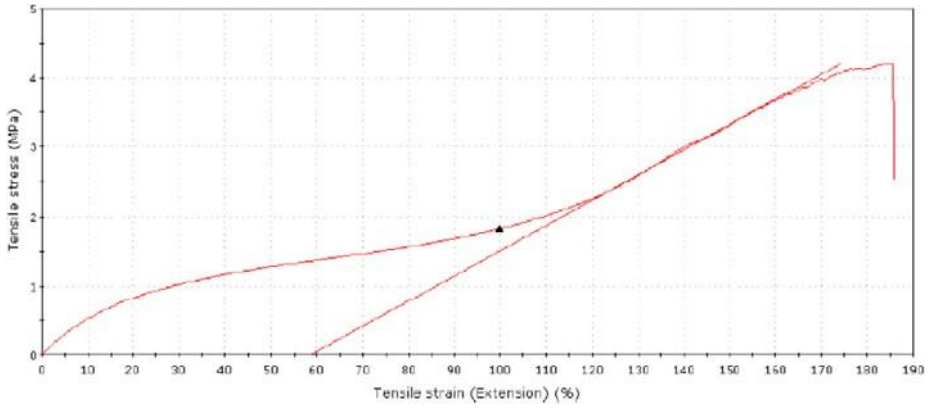


7. You can now either touch on the "Validate" unary key to perform the validation of the equation or Touch OK. By touching OK the software will perform a validation prior to closing the expression builder window.

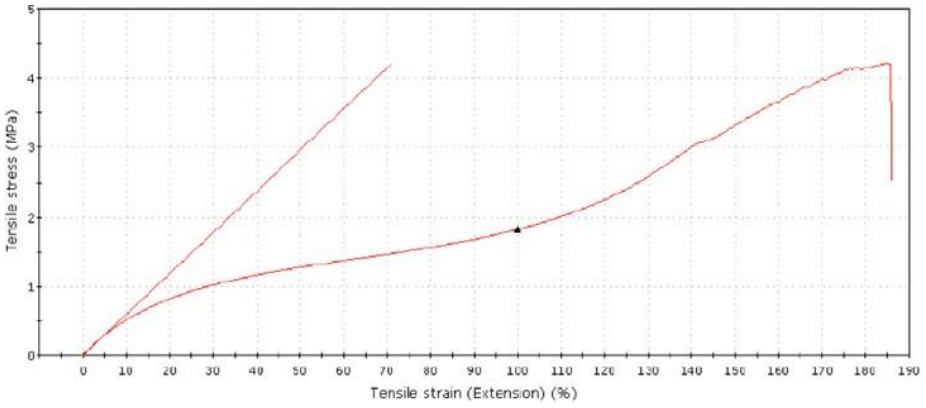
    The user calculation will now be displayed in the "user expression" field on the calculation setup screen. This enables the result of the calculation to be added to a Results table.

Identifying a Domain – What is a Domain?

A domain is a region within the test curve. A feature within Bluehill Universal enables the user to select the data that is analyzed for a calculation by identifying a domain. Users can utilize this function to ensure that calculations are performed within specific areas of a test curve. As an example observe the test curve below.

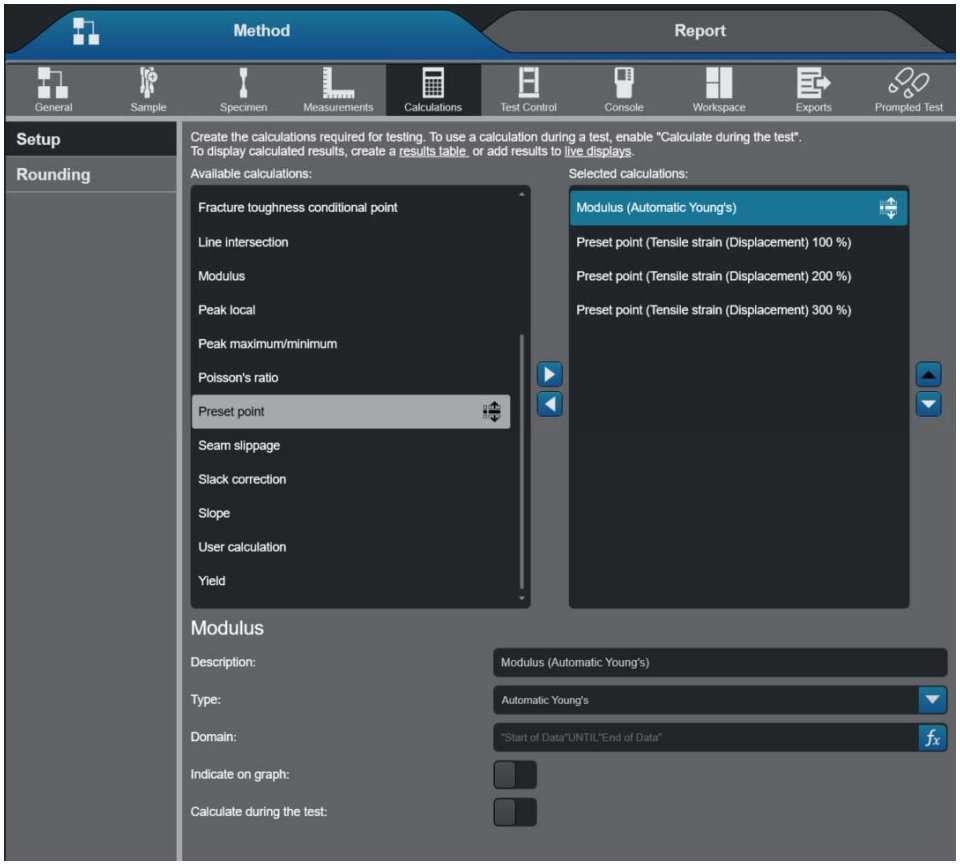


In this test curve the operator needed to calculate the modulus of the material and selected the "Automatic Young's Modulus" calculation. Modulus is a value that is calculated within the initial linear region of the curve. As shown above we can see that the calculation is not being performed within the initial linear region. This is because of the characteristics of the curve, there is no zero slope and the peak force is at the end of the curve, which satisfies the parameters of the automatic young's modulus calculation. Having the ability to identify the domain in which the calculation is to be performed enables the user to restrict the analysis of data to a specific region of the curve. In this case the user can restrict the calculation domain so that only data from the start of the test until the specimen reaches 30% strain is analyzed. This will ensure that the calculation is performed on the initial linear region of the curve, as indicated by the construction line, and would produce a curve as shown below.



Adding a Domain to a Calculation

Using the previous explanation as an example the user can identify a domain for the calculation to ensure that the calculation is performed within a specific region of the test curve. To do this the user must have the test method open to the calculations – setup screen and have the "Automatic Young's Modulus" calculation selected as shown below.

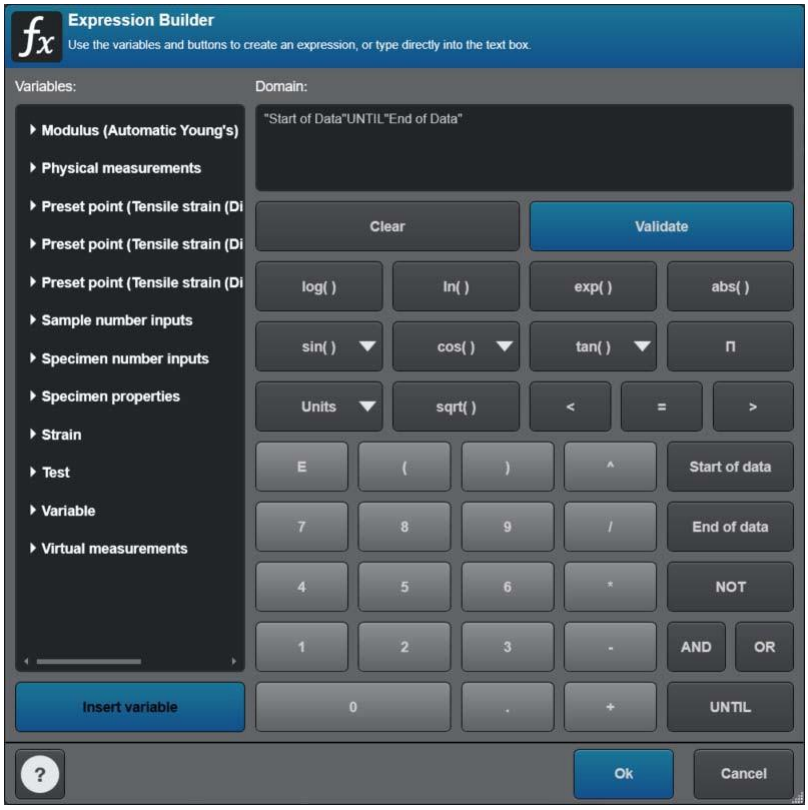


You should notice that the Domain field is automatically selected to analyze "Ramp 1" UNTIL "End of Data" which means that the software default is to analyze from the start of the test until the end of the test. When entering domain parameters this is the format that must be followed:

"Ramp 1"UNTIL"End of Data"

To change the Domain:

1. Select the expression builder icon to the right of the Domain field which will launch the expression builder in a new window. You will notice that the Domain function keys are available within the window as shown below.



2. Highlight and delete the current entry in the Domain field at the top of the window. The user can now identify a new domain, in this example we will choose to start analyzing data at the first data point by clicking on the “Start of Data” key in the Domain Operator section of the window.

3. You must now insert the term “UNTIL” into the expression.

4. The ending point in the example is a value of 30% strain. This is entered in the following format:

   “Measurement” = “Value of the Measurement”

   “Tensile Strain” = 30 _%

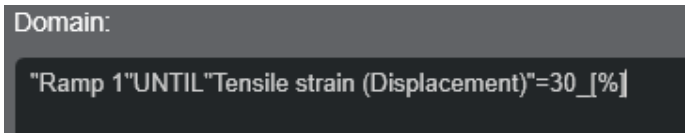
   As tensile strain is a virtual measurement, expand the virtual measurements in the Variables window and double click on the term “Tensile strain”, this will add tensile strain to the expression following “UNTIL”

   Click on the “=” key

   Enter the value 30 using the calculation keys

   Add the units in percentage by clicking on the Units key and selecting Percentage in “%”

5. The Domain window should now look as indicated below.



6. You can now either click on the “Validate” unary key to perform the validation of the domain or Click OK. By clicking OK the software will perform a validation prior to closing the expression builder window.

Chapter 5
Test Profiler

Test Profiler Overview

TestProfiler is an optional feature in the software that requires a unique key code.

In the Test Control > Test section of a TestProfiler method, you can create a customized test sequence that defines the behavior and actions of the testing system during a test. The test sequence is comprised of a series of steps. Each step specifies the control parameters, data acquisition criteria, and a combination of events and actions. The system performs the test sequence in the order specified in the Step completion event for each step.

When running a test, the system collects measurement data during the entire test sequence, excluding the steps for auto balance. The criteria for data acquisition is defined in each step. Therefore you can customize the data acquisition criteria throughout the test sequence to meet your testing requirements.

A test sequence requires:

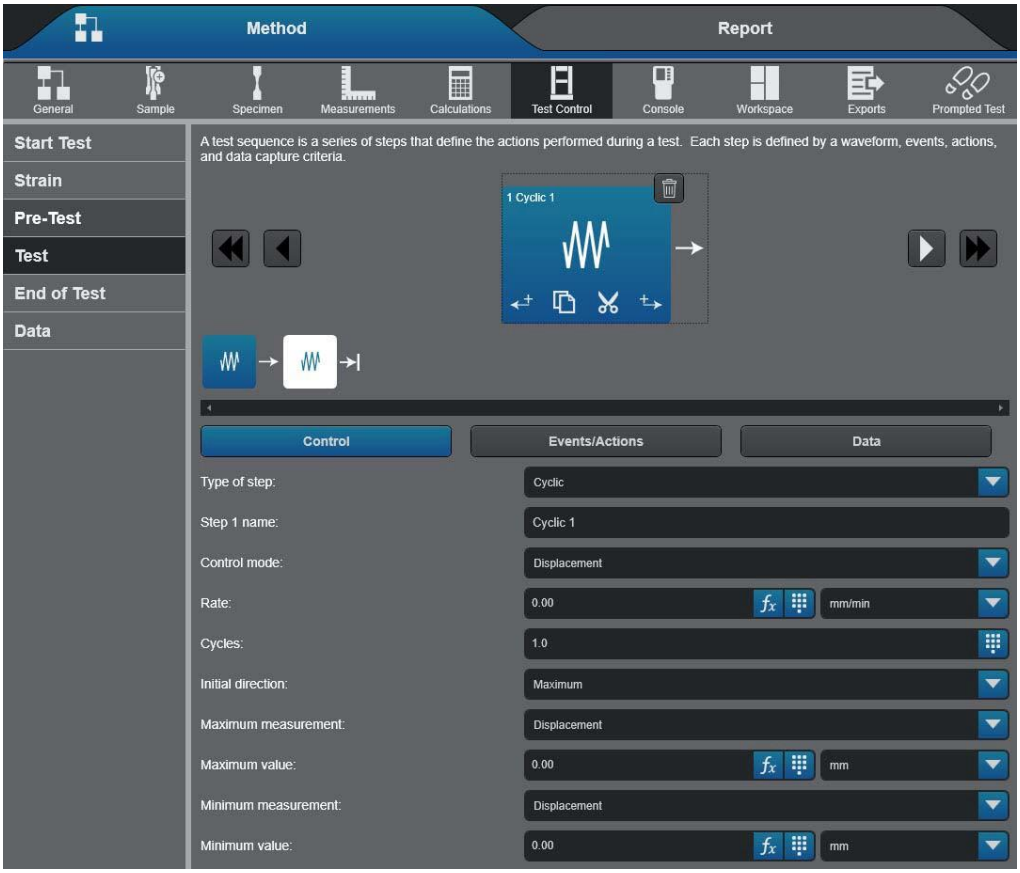
- A step for each change the system requires for the test. For example, any one of the following changes would require a new step in a test sequence: a change in control mode, a change in rate or change in crosshead direction.
- The command parameters for each step in the test sequence. Use the tabs in the Properties section of the screen to customize each step, including:
    - The type of waveform and the control parameters that specify how the system controls the frame during the step.
    - Events that occur during the step and the actions that the system performs when the event occurs.

- The data capture parameters during the step. You can customize the data capture parameters for specific steps in the sequence if desired or use the method data capture scheme set on the Test Control > Data screen.

- A unique name for the step. The system default name is Step 1, Step 2 etc. You can rename the step if desired.

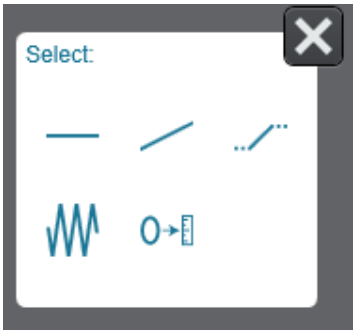
Test Profiler Layout

The top section of the Test Control > Test screen provides a view of the test sequence and each step within the sequence. The bottom section of the screen shows the properties of the highlighted step.



Step Types

In a TestProfiler method, a test sequence can be created with a combination of steps.



The types of step controls include:

Hold waveform - Indicated by . A hold waveform maintains the crosshead/actuator at ameasured value, achieved at the completion of the previous step in the test sequence, for a specified period of time or when a specified event occurs.

Absolute Ramp - Indicated by . An absolute ramp moves the crosshead/actuator to anabsolute endpoint over a specified period of time.

Relative Ramp - Indicated by . A relative ramp moves the crosshead/actuator from itsstarting point, achieved at the completion of the previous step in the test sequence, by a specified value.

Cyclic waveform - Indicated by . A cyclic waveform moves the crosshead/actuator between amaximum value and minimum value for a specified number of cycles.

Test Profiler auto balance - Indicated by . The system automatically balances the selectedmeasurements.

Each step in the test sequence can be used as a variable in a domain expression. The domainexpression defines the region of data available for calculating results and graphing.

The parameters that define each step are available for the method parameters list and exportresults files.

You must set the control parameters for each step to define the behavior and actions of thetesting system during a test.

Graphical View Section

The graphical view section provides the following information:

- The type of step
- The step number and step name of each step
- The next step in the test sequence. The blue arrows in the test sequence indicate the Go to action associated with the step completion event for the step that immediately precedes the arrow:

	The Go to Step action under the Step completion event has the Go to action defined as Next step. The step immediately to the right of the arrow is the next step in the test sequence.
	The Go to Step action under the Step completion event has the Go to action defined as a specific step number. To determine the specific step number, select the step that precedes the arrow. Go to the Events/Actions tab in the step properties section, select the Step completion event and then select its Go to step action. The specific step number displays in the Go to field on the right.
	The Go to Step action under the Step completion event has the Go to action defined as End the test. or The Go to action is defined as Next step but the step that precedes the arrow is the last step in the test sequence.

	The Go to Step action under the Step completion event has Loop enabled and the Go to action defined as Next step. For information on the loop parameters, select the step that precedes the arrow. Go to the Events/Actions tab in the step properties section, select the Step completion event and then select its Go to step action. The loop parameters display on the right.
	The Go to Step action under the Step completion event has Loop enabled and the Go to action defined as a specific step number.
	The Go to Step action under the Step completion event has Loop enabled and the Go to action defined as either: End the test. Next step but the step that precedes the arrow is the last step in the test sequence.

Navigation Assistance Includes

	The system moves to the previous step in the test sequence and displays its step parameters.
	The system moves to the previous group of steps that can display in the viewing space.
	The system moves to the next step in the test sequence and displays its step parameters.
	The system moves to the next group of steps that can display in the viewing space.

Step Properties Sections

The bottom section is where you edit the properties to define each step. It includes separatetabs for each component of the step, including:

Control	Select the type of waveform that the system will perform in thehighlighted step and set the parameters for the waveform. Identify the highlighted step with a unique name. You cannotedit the number.
Events/Actions	Add events that the system looks for during the step and theactions that the system performs when the event occurs.
Data	Select the criteria for data acquisition during the step. You cankeep the method settings from the Test Control > Data screen, opt for no data acquisition, or customize the data criteria for the step.

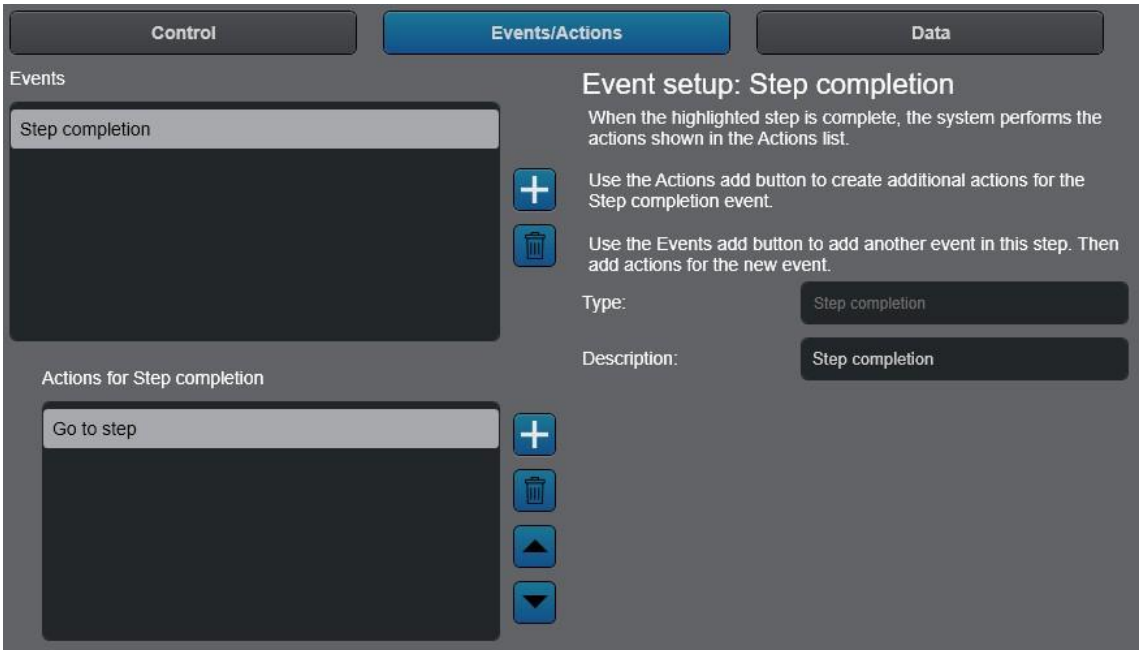
Events and Actions for a Step

In a TestProfiler method, the Events/Actions tab is where you add events that the system looks for during the step and add the associated actions. When the event occurs, the system performsthe associated actions.

Every step includes a Step completion event with the Go to step action set to Next step. This event and associated action defines the next step in the test sequence when the system completes the current step, as per the selected parameters under the Control tab. You can editthe Go to action to select another step in the test sequence, end the test or create a loop that repeats a group of steps. Note that the Step completion event and associated action cannot beremoved from the step.

You can add additional events to a step that also have a Go to step action. When there are multiple events with a Go to action, the system will perform the action associated with the firstevent that occurs.

If auto balance is the selected step type, then the default Step completion event is the only validevent. You cannot add additional events to an auto balance step.



Events

The types of events that the system can look for during a test sequence are:

- Step completion
- Break detector event
- Calculation event
- Digital input event
- Measurement event
- Step entry event
- Variable event

You can change the name of the event in the Description field. The new name will appear in theEvents list and in the heading of the Actions list.

Actions

The actions created for an event will be performed in the order that they are listed in the Actionslist, except the Go to action. The Go to action is always the last action performed by the system. Use the arrow keys next to the list to edit the order.

The types of actions that the system can perform are:

Type of Action	Description
Go to Step	When the associated event occurs, the system will proceed to the step specified in the Go to field. The default setting is Next step sothe system will perform the next step in the test sequence. Other options include: All other steps in the test sequence. End the test. When the associated event occurs, the system ends thetest. An event can only have one Go to action. Note: The Loop option is only available for theStep completion event.
Pause the Test	The system temporarily suspends the test when the associated eventoccurs. A message displays to confirm that the test is paused. Use the Message field to edit the message that displays when the pause action occurs. When you are ready to resume the test, use the Resume button. To close the message while the test remains in the paused state, usethe Dismiss button. If the message is dismissed, you will need a soft key configured for the pause/resume feature to continue the test. Use the Console settings button in the console area to configure asoft key with the pause/resume action.
Play a wav file	The system plays the specified wave file when the associated eventoccurs. The wave file makes an audible sound to indicate the event has occurred. Use the Browse button to find one of the wave files provided with the software or your own wave file.
Show a message	The system displays the message created in the Message field when the associated event occurs. The test continues without interruption. Use the OK button to dismiss the message during a test.

Set a digital output	When the associated event occurs, the system sends a signal through the digital output line to an external device. There are twostates available for digital output lines: On Of f Note: The digital line names and these two states are the same as the labels specified in the Digital Outputs tab in the Frame Settingsarea of the console. Use Single pulse to change the action for a specified period of time.When enabled, the system changes the action for the specified period of time and then reverts the output line back to the initial setting.
Set a temperature	Select the temperature measurement that is associated with the temperature device and set the temperature set point. The system sends the temperature set point to the device and the device adjusts its temperature to reach the set point. The temperature set point maybe an absolute or relative temperature value. If the temperature device is a furnace with three controllers, you mustadd a separate action for each temperature set point that is required.This provides a way to set individual temperature set points for each controller inside the device. Note that the system only sends the command to the device. It does not wait until the temperature set point is satisfied before proceedingto the next step in the test sequence.
Set a variable	Select a specimen number input (or sample number input) and specify the desired value. When the associated event occurs, thesystem changes the original value for the variable to the value specified for this action. The original value is specified on Specimen > Number Inputsscreen (or Sample> Number Inputs) or entered as an operatorinput at the start of the test.

You can change the name of the action in the Description field. The new name will appear in theActions list.

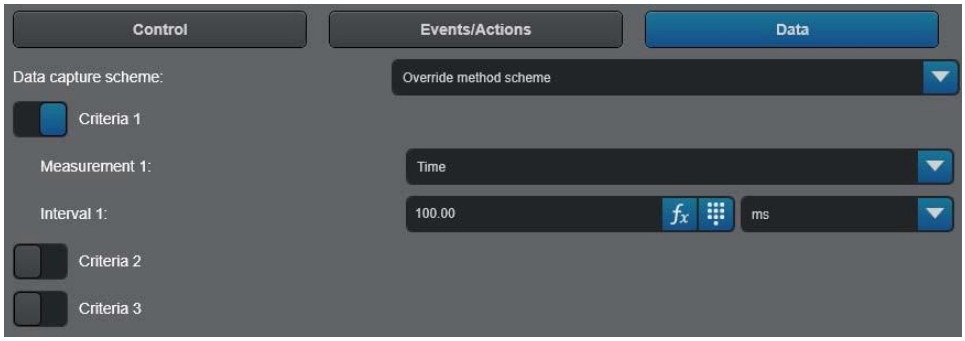
Data Capture Criteria

In a TestProfiler method, the default data capture setting for a step in a test sequence is the method scheme specified on the Test Control > Data screen in the Method menu.

However, a TestProfiler method provides additional options that let you customize the data capture settings for selected steps in the test sequence. The TestProfiler data capture options include:

Method Scheme	The highlighted step uses the data capture scheme specified on the Test Control > Data screen in the Method menu. This is the default setting for all steps except auto balance. When this option is selected, you can view the data capture parameters in the method scheme, but you cannot edit these parameters from the Data tab. You must navigate to Test Control > Data to edit these parameters.
Override Method Scheme	Enables the data capture parameters shown on the Data tab so you can edit the parameters for the highlighted step. Any changes made under this option will only apply to the currently highlighted step. Within the limits of the controller for the system, you can establish up to three measurements to control how frequently data is captured. All three criteria operate independently and the system captures the data from all available measurements when any of the specified intervals occur.
No Data	The system collects no data from any measurements during the currently selected step.

At a minimum, the system will capture the first data point and the last data point in a step. For a cyclic waveform step, the system will capture at least the first and last data point for every loading and unloading zone completed during the step. The only time no data is captured during a step is when No data is specified.



End of Test Sequence

In a TestProfiler method, there are several ways to end a test:

- When one of the End of test criteria is satisfied. The End of test criteria are set on the Test Control > End of Test screen. These criteria operate independently and the first one that is satisfied stops the test.
- When the system completes a step and the Step completion event is set to End the test.
- When an event triggers a Go to action that is set to End the test.
- When the system completes the last step in the test sequence, even if the Step completion event is set to Next step.

You can also select an End of test action on the Test Control > End of Test screen that defines the behavior of the crosshead/actuator when the test is ended. The system will perform the End of test action when the test ends by any one of the above options.

Test Profiler Zones

A test sequence is broken up into a number of test zones.

The following steps or actions in TestProfiler use one or more zones in a test sequence:

Steps/Actions	Zones Used
Temperature soak	1 zone
Preload	1 zone
Auto balance	1 zone
Precycling	2 zones
Relative ramp	1 zone
Absolute ramp	1 zone
Hold waveform	1 zone
Cyclic waveform	2 zones
TestProfiler auto balance	1 zone
Pause the test action	1 zone

The pre-cycling and cyclic waveform require two zones (loading and unloading) because the crosshead cycles in both directions between two points.

The following items do not require additional zones, and thus are not limited by the number of available zones:

- The number of cycles in a cyclic waveform.
- The number of loops repeated in a looping action.
- The number of pauses in the test sequence.

Cycle Counting

In a cyclic waveform step, the system counts the number of times the crosshead/actuator moves between the maximum value and minimum value. When the specified number of cycles is complete, the system proceeds to the next step specified in the test sequence. The system counts the cycles in increments of half cycles.

Example 1 - Initial direction is Maximum

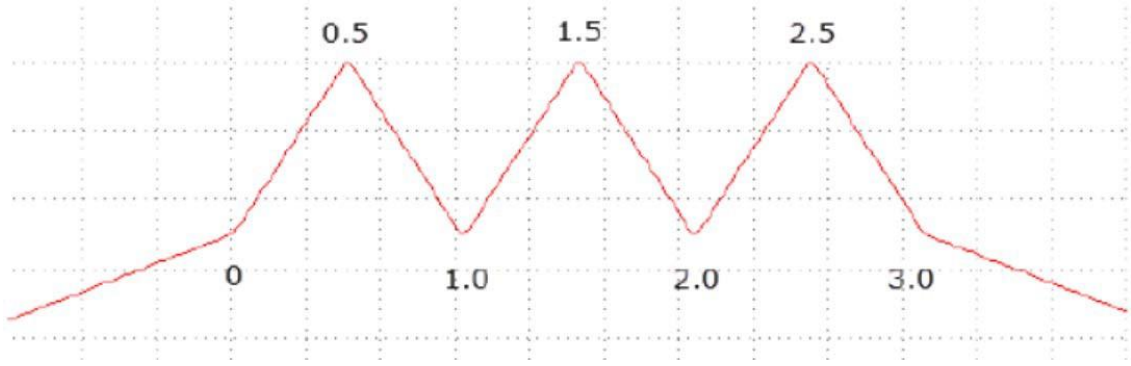
When the initial direction is Maximum:

- The first half cycle is counted when the system reaches the maximum value.
- A complete cycle is counted when the system reaches the minimum value.

Example:

A test sequence includes an absolute ramp, cyclic waveform and another absolute ramp.

The graph for this test sequence displays as follows:



The start of the cyclic waveform step is 0 in the graph. The systems cyclic counter increments to 0.5 when the crosshead/actuator initially reaches the maximum value. The region from 0 to 0.5 is defined as the “loading” zone. The “unloading” zone is defined as when the crosshead/actuator is moving to the minimum value for the cycle (from 0.5 to 1.0 in the graph). A complete cycle includes both the loading and unloading zones.

Example 2 - Initial direction is Minimum

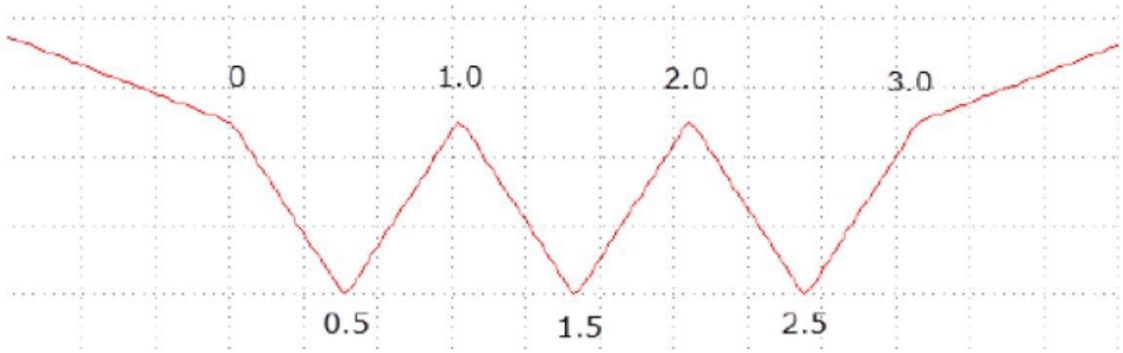
When the initial direction is Minimum:

- The first half cycle is counted when the system reaches the minimum value.
- A complete cycle is counted when the system reaches the maximum value.

Example:

A test sequence includes an absolute ramp, cyclic waveform and another absolute ramp.

The graph for this test sequence displays as follows:



The start of the cyclic waveform step is 0 in the graph. The systems cyclic counter increments to 0.5 when the crosshead/actuator initially reaches the minimum value. The region from 0 to 0.5 is defined as the “unloading” zone. The “loading” zone is defined as when the crosshead/actuator is moving to the maximum value for the cycle (from 0.5 to 1.0 in the graph). A complete cycle includes both the unloading and loading zones.

Loop Counting

A Step completion event in a TestProfiler method can include a loop that repeats specified steps in the test sequence. When Loop is enabled, the system goes to the step identified in the Loop to field and repeats the test sequence from the Loop to step until the system returns to the step that initiated the loop. The system repeats the loop for the specified Number of loops.

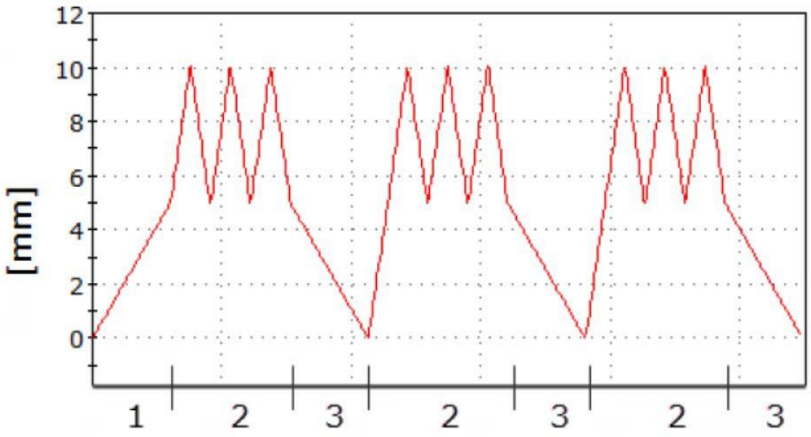
The system counts a complete loop every time the system completes the step that initiated the loop. Note that the system counts the initial run through the test sequence as the first complete loop.

Looping example:

The test sequence in this example includes 3 steps:

1. An absolute ramp with an end of ramp value of 5mm.
2. A cyclic waveform step that cycles the specimen three times between 5mm and 10mm.
3. An absolute ramp with an end of ramp value of 0mm. The third step includes a loop with the following settings:
    a. Loop to: Step 2
    b. Number of loops: 3

The graph below shows the test sequence:



The system performs steps 1 through 3 in the test sequence and the systems loop counter counts one complete iteration of the test sequence. The step completion event for Step 3 has Loop enabled so the system returns to step 2. The system repeats step 2 and 3 again and the system's loop counter counts two complete iterations of the loop.

The loop is then repeated again for a total number of three iterations. The system counts a complete loop every time the system completes the step that initiated the loop (Step 3 in the above example).

System Restrictions

Consider the following restrictions on the testing system when you create, edit, or perform aTestProfiler file:

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

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

- Although the system warns that a test may exceed the performance envelope of the system, it does not restrict a TestProfiler method from performing the test unless a transducer defined for control is not connected or calibrated.
- The ball screws of frames built prior to 1994 were not designed for through-zero force cyclic testing. These systems may display a nonlinear bump at the zero force point.
- Check that the testing system is capable of achieving the parameters that you set in a TestProfiler method. TestProfiler methods does not limit the parameter values.

TestProfiler Examples

The following examples will help with setting up common tests along with illustrating how to setup a practical application.

Foam Compression Test

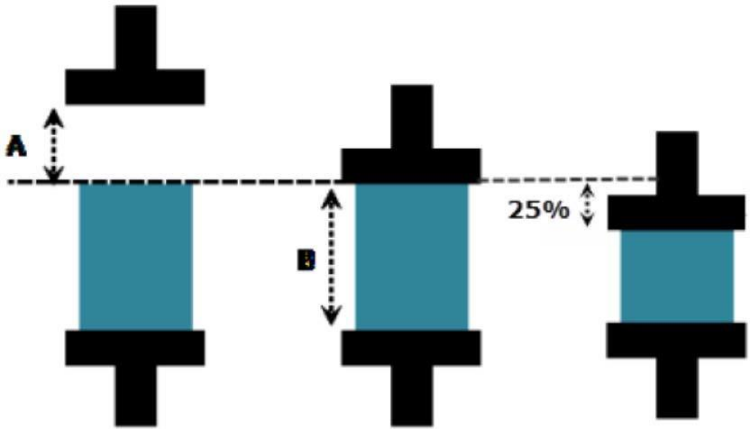
This example focuses on setting up the TestProfiler method to compress a foam specimen. It does not provide specific test requirements such as rates, values and other parameters that aredependent on the type of foam under test.

This example shows how to set up a test that compresses a foam specimen by a specified percentage of the specimen height. In this example, the specimen will be compressed 25% of itsheight.

Test requirements:

- Preload the specimen to a specified force value.
- Determine the distance that the anvil travels to reach the point at preload (“A” in the graphic). This is the Distance at preload variable in the TestProfiler method.

- Determine the distance between the anvils while at the preload value (“B” in the graphic).
- Compress the specimen 25% of the distance between the anvils while at the preload value.



The TestProfiler test sequence is:

Create a specimen number input

1. Create a compression TestProfiler method.
2. Select Specimen > Number Inputs in the Method menu.
3. Edit Specimen number input 1 to:
    a. Prompt: Distance at preload
    b. Unit group: Length

Create the test sequence

1. Select Test Control > Test in the Method menu.
2. Select absolute ramp to create the first step in the test sequence.
3. Use  and select relative ramp to insert the next step.

Set the parameters for

1. Select Step 1 in the test sequence.
2. In the Properties area select the Control tab.
3. Set the following parameters:
    a. Control mode: Displacement
    b. End of ramp type: Measurement value
    c. End of ramp measurement: Force
4. Select the Events/Actions tab.
5. Use next to the Actions for Step completion list to add an action for the Step 1 completion event.
6. In the Type field, select Set a variable.
7. In the Variable field, select Distance at preload.
8. In the Value field, select to open Expression Builder.
9. In Expression Builder, expand Physical measurements in the Variables list and select Displacement.
10. Select OK to close Expression Builder.

Based on the above parameters, step 1 commands the system to do the following:

- The system is controlled by displacement.
- The system compresses until the force measurement attains the specified End of ramp value. The specimen is now preloaded to the required value. This completes step 1.
- Upon completing step 1, the system performs the two actions specified under the Events/Actions tab for step 1:
    - Sets the value for the Distance at preload variable to the current displacement value.
    - Proceeds to the next step as defined by the Go to step action.

Set the parameters for Step 2

1. Select Step 2 in the test sequence.
2. In the Properties area select the Control tab.
3. Set the following parameters:
    a. Control mode: Displacement
    b. Delta measurement: Displacement
    c. Delta: ("Anvil height" - "Distance at preload")*.25
4. Select to open Expression Builder and create the delta expression:
    a. Anvil height is found under Specimen properties in the Variables list.
    b. Distance at preload is found under Specimen number inputs in the Variables list.

Based on the above parameters, step 2 commands the system to do the following:

- The system is controlled by displacement.
- Determines the distance between the anvils while at the preload value by subtracting the Distance at preload from the Anvil height.
- Compresses the specimen 25% of the distance between the anvils while at the preload value. This completes step 2.
- Upon completing step 2, the system ends the test because it is the last step in the test sequence. The system performs the end of test actions specified on the Test Control > End of Test screen.

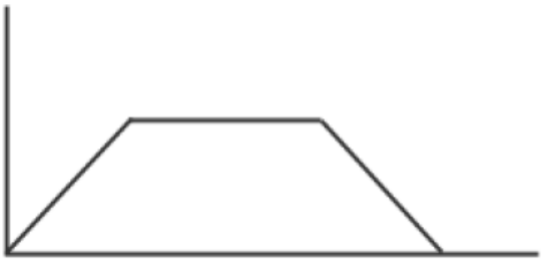
Trapezoidal Waveform

This example focuses on setting up a tension TestProfiler method to create a trapezoidalwaveform. It does not provide specific test requirements such as rates, values or other parameters that are dependent on the type of specimen under test.

Test requirements:

- Absolute ramp that ends when displacement reaches 50mm.
- Hold the specimen at 50mm for 30 seconds.
- Absolute ramp that returns to zero displacement.

The graph of a test would appear similar to:



The TestProfiler test sequence is:

Create the test sequence

1. Create a TestProfiler method.
2. Select Test Control > Test in the Method menu.
3. Select absolute ramp to create the first step in the test sequence.
4. Use and select hold waveform to insert the next step.
5. Use and select absolute ramp to insert the next step.

Set the parameters for

1. Select Step 1 in the test sequence.
2. In the Properties area select the Control tab.
3. Set the following parameters:
    a. End of ramp type: Measurement value
    b. End of ramp measurement: Displacement
    c. End of ramp value: 50mm

Set the parameters for Step 2

1. Select Step 2 in the test sequence.
2. In the Properties area select the Control tab.
3. Set the following parameters:
    a. Control mode: Displacement
    b. End of hold type: Duration
    c. Duration: 30s

Set the parameters for Step 3

1. Select Step 3 in the test sequence.
2. In the Properties area select the Control tab.
3. Set the following parameters:
    a. End of ramp type: Measurement value
    b. End of ramp measurement: Displacement
    c. End of ramp value: 0mm

To repeat the trapezoid multiple times, you can create a loop to repeat steps 1 through 3 for aspecific number of loops.

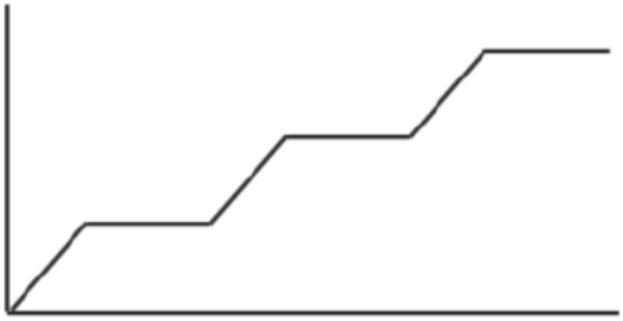
Test Sequence with Multiple Plateaus

This example focuses on setting up a tension TestProfiler method to create a test sequence with multiple plateaus at different forces. It does not provide specific test requirements such as rates,values or other parameters that are dependent on the type of specimen under test.

Test requirements:

- Apply a specified force to the specimen. For this example, 100N.
- Hold the specimen at the specified value for a specific period of time. 30s.
- Increase the force again by the same specified value.
- Hold the specimen again for the same period of time.
- Increase the force again by the same specified value.
- Hold the specimen again for the same period of time.

The graph of a test would appear similar to:



This test sequence can be created in a TestProfiler method as follows:

- Scenario 1 - Basic test sequence
- Scenario 2 - Using a loop

Scenario 1 - Basic test sequence

The TestProfiler test sequence is:

Create the test sequence

1. Create a TestProfiler method.
2. Select Test Control > Test in the Method menu to create a test sequence.
3. Select relative ramp to create the first step in the test sequence.
4. Use and select hold to insert the next step.
5. Use and select relative ramp to insert the next step.
6. Use and select hold to insert the next step.
7. Use and select relative ramp to insert the next step.
8. Use and select hold to insert the next step.

Set the parameters for Step 1

1. Select Step 1 in the test sequence.
2. In the Properties area select the Control tab.
3. Set the following parameters:
    a. Delta measurement: Force
    b. Delta: 100N

Set the parameters for Step 2

1. Select Step 2 in the test sequence.
2. In the Properties area select the Control tab.
3. Set the following parameters:
    a. Control mode: Displacement
    b. End of hold type: Duration
    c. Duration: 30s

Set the parameters for Step 3

1. Select Step 3 in the test sequence.
2. In the Properties area select the Control tab.
3. Set the following parameters:
    a. Delta measurement: Force
    b. Delta: 100N

Set the parameters for Step 4

1. Select Step 4 in the test sequence.
2. In the Properties area select the Control tab.
3. Set the following parameters:
    a. Control mode: Displacement
    b. End of hold type: Duration

c. Duration: 30s

Set the parameters for Step 5

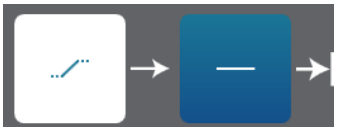
1. Select Step 5 in the test sequence.
2. In the Properties area select the Control tab.
3. Set the following parameters:
    a. Delta measurement: Force
    b. Delta: 100N

Set the parameters for Step 6

1. Select Step 6 in the test sequence.
2. In the Properties area select the Control tab.
3. Set the following parameters:
    a. Control mode: Displacement
    b. End of hold type: Duration
    c. Duration: 30s

Scenario 2 - Using a loop

The TestProfiler test sequence is:



Create the test sequence

1. Create a TestProfiler method.
2. Select Test Control > Test in the Method menu to create a test sequence.
3. Select relative ramp to create the first step in the test sequence.
4. Use and select hold to insert the next step.

Set the parameters for Step 1

1. Select Step 1 in the test sequence.
2. In the Properties area select the Control tab.
3. Set the following parameters:
    a. Delta measurement: Force
    b. Delta: 100N

Set the parameters for Step 2

1. Select Step 2 in the test sequence.
2. In the Properties area select the Control tab.
3. Set the following parameters:
    a. Control mode: Displacement
    b. End of hold type: Duration
    c. Duration: 30s
4. Select the Events/Actions tab.

5. Select Go to step listed under Actions for Step completion.
6. In the Go to field, select End the test.
7. Enable Loop and set the following parameters:
    a. Loop to: Step 1
    b. Number of loops: 3

Action Set a Temperature

This example focuses on setting up a TestProfiler method to include an action that sets the temperature inside a temperature device. It does not provide specific test requirements such as rates, values or other parameters that are dependent on the type of specimen under test.

A TestProfiler method can be customized to heat or cool a specimen to a specified temperature during a test.

Test requirements:

- System must be configured with a temperature device.
- At the start of a hold step, set the temperature as required for the test. In this example, the temperature must be 25° C.

The TestProfiler method can be set up to include a temperature set point command in a variety of ways. Refer to the following scenarios:

- Scenario 1 - "Set the temperature" action
- Scenario 2 - Step ends when the device reaches the temperature set point
- Scenario 3 - Device has three temperature controllers

Scenario 1 – "Set the temperature" action

1. Select Measurements > Setup to create a measurement for the temperature controller.
2. Select Test Control > Test in the Method menu and select the hold step.
3. In the Properties area select the Control tab.
4. Set the control parameters as required for the test.
5. Select the Events/Actions tab.
6. Use next to the Events list to add a new event.
7. In the Type field, select Step entry event.
8. Use next to the Actions for Step entry event list to add an action for the system to perform at the start of the hold step.
9. In the Type field, select Set a temperature and set the following parameters:
    a. Measurement: Temperature
    b. Temperature set point: 25° C.

In this scenario, the system sends the set point command to the temperature device at the start of the hold step. The hold step ends when the End of hold parameters set on the Control tab are satisfied. The system does not wait until the set point is reached before proceeding with the test sequence.

Scenario 2 – Step ends when the device reaches the temperature set point

If the test requires that the system maintain the hold waveform until the temperature device reaches the set point, you can add a measurement event to the hold step:

1. Select Measurements > Setup to create a measurement for the temperature controller.
2. Select Test Control > Test in the Method menu and select the hold step.
3. In the Events/Actions tab for the hold step, use next to the Events list to add a new event.
4. In the Type field, select Measurement event and set the following parameters:
    a. Measurement: Temperature
    b. Value criteria: Equals or passes through
    c. Value: 25° C
5. Use next to the Actions for Measurement event list to add an action for the system to perform when the measurement reaches 25° C.
6. In the Type field, select Go to step and set the Go to field to Next step.

When the temperature measurement reaches 25° C, the system proceeds to the next step in the test sequence.

The measurement event must occur before the "End of hold" control parameters to ensure that the hold step ends when the temperature device reaches the set point. You may need to edit the "End of hold" parameters on the Control tab to ensure that the measurement event occurs first.

Scenario 3 – Device has three temperature controllers

The temperature device has three controllers and the test requires the system to maintain the hold waveform until all three temperature controllers reach the set point. The hold step can be configured to continue until all three controllers have reached the set point. The test method requires:

- A number input "Controller count" that tracks the number of controllers that have reached the set point.
- Three temperature measurements: one for each temperature controller.
- A variable action at the start of the hold step that sets Controller count to 0.
- Variable actions that increment Controller count when each of the temperature measurements reaches the set point.
- A variable event that defines the end of the hold when Controller count equals 3.

To create this scenario:

1. Select Specimen > Number Inputs in the Method menu.
2. Edit Specimen number input 1 to:
    a. Prompt: Controller count
    b. Unit group: Unitless
3. Select Measurements > Setup to create a measurement for each temperature controller.
4. Select Test Control > Test in the Method menu and select the hold step.
5. Use next to the Events list to add a new event.
6. In the Type field, select Step entry event.
7. Use next to the Actions for Step entry event list to add the following actions for the start of the hold step:
    a. Set a temperature. Select temperature measurement #1 and set the Temperature set point to 25° C.
    b. Set a temperature. Select temperature measurement #2 and set the Temperature set point to 25° C.
    c. Set a temperature. Select temperature measurement #3 and set the Temperature set point to 25° C.

    d. Set a variable. Select Controller count as the variable and set the value to 0.
8. Use next to the Events list to add the following events:
    a. Measurement event. Select temperature measurement #1 with value criteria Equals or passes through and value 25° C.
    b. Measurement event. Select temperature measurement #2 with value criteria Equals or passes through and value 25° C.
    c. Measurement event. Select temperature measurement #3 with value criteria Equals or passes through and value 25° C.
9. For each measurement event, use next to the Actions for Measurement event list to add a Set a variable action.
10. Select Controller count as the variable and use Expression Builder to set the value to:
    a. "Controller count"+1
11. Use next to the Events list to add a Variable event with the following event parameters:
    a. Variable: Controller count
    b. Value criteria: =
    c. Value: 3
12. Use next to the Actions for Variable event list to add a Go to step action with Go to set to Next step.

When the system starts this hold step during a test, the system does the following:

- Sets the Controller count variable to 0.
- Sends the command to each temperature controller to adjust the temperature to 25° C.
- When each temperature measurement reads 25° C, the system increments the current value for the Controller count variable by 1.
- When the Controller count variable event reaches 3, the system performs the “Go to step” action, which is defined as the next step.

The Controller count variable event must occur before the “End of hold” control parameters to ensure that the hold step ends when the Controller count variable input reaches 3. You may need to edit the “End of hold” parameters on the Control tab to ensure that the measurement event occurs first.

Chapter 6
Traceability (local)

Traceability Overview

Traceability is an optional feature in the software that is only available if purchased.

Traceability creates an audit trail that provides a chronological record of activity made to your test methods and sample files. Most activities completed in the software are saved to an audit trail database with a date and time stamp. Documenting the sequence of activities ensures that your testing processes remain consistent and reliable over time, thus maintaining a high level of data integrity.

The Traceability feature has two components:

- An audit trail database that maintains a history documenting the changes, actions, and reviews done on a Bluehill system.
- Signature requirements to document who has performed an action or changed a file. Signature requirements can also be used as a review process to ensure any changes to a file are reviewed and validated.

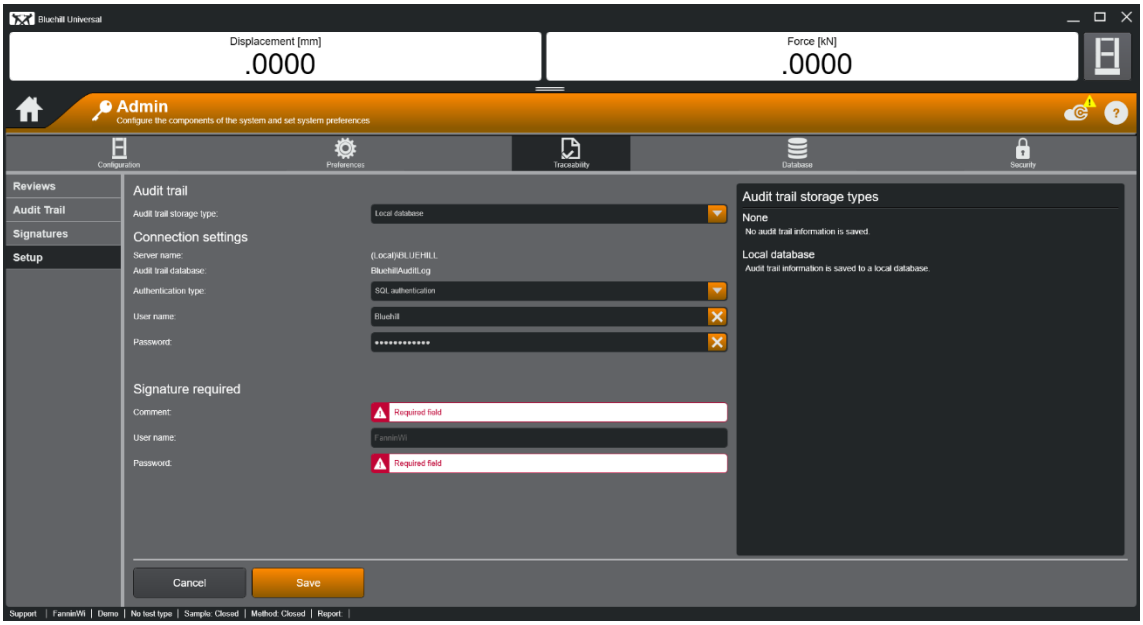
Traceability works in conjunction with the system security to provide the following advantages:

- User access is limited by security permissions.
- Track changes made to test methods and sample files by requiring the individual to acknowledge the changes with an electronic signature.
- Prevent the use of revised methods or samples until the changes have been reviewed by a secondary reviewer, and tertiary reviewer if required. Reviews are accepted or rejected with secondary and tertiary signatures.
- Maintain a history of changes, actions, and reviews done in the system, which is saved to a local database. This audit trail is fully searchable directly from the Bluehill software.

Note: If the system security is disabled, the Traceability feature is also disabled. When the security is re-enabled, Traceability will also need to be reconfigured.

Traceability Setup

The Traceability > Setup screen is where you enable the audit trail tracking by creating a connection to a database. The database is where the Bluehill system saves information on most activity performed in the software and provides an audit trail that is a chronological record of activity made to your test methods and sample files. You must have Configure Traceability permission under Security on the Admin tab to access this screen. If the system security is disabled, the Traceability feature is also disabled. When the security is re-enabled, Traceability will also need to be reconfigured.



Audit Trail Storage Type
- Local database: Audit trail information is saved to a local database.
- None: No audit trail information is saved

Server name: (local)BLUEHILL
- This is the SQL Server instance hosting the Traceability database; it is created during Traceability SQL Server setup

Audit trail database: BluehillAuditLog
- This is the Traceability database name; it is created during Traceability SQL Server setup

Authentication Type
- SQL authentication: SQL Server authenticates database user access
- Windows authentication: Windows authenticates database user access

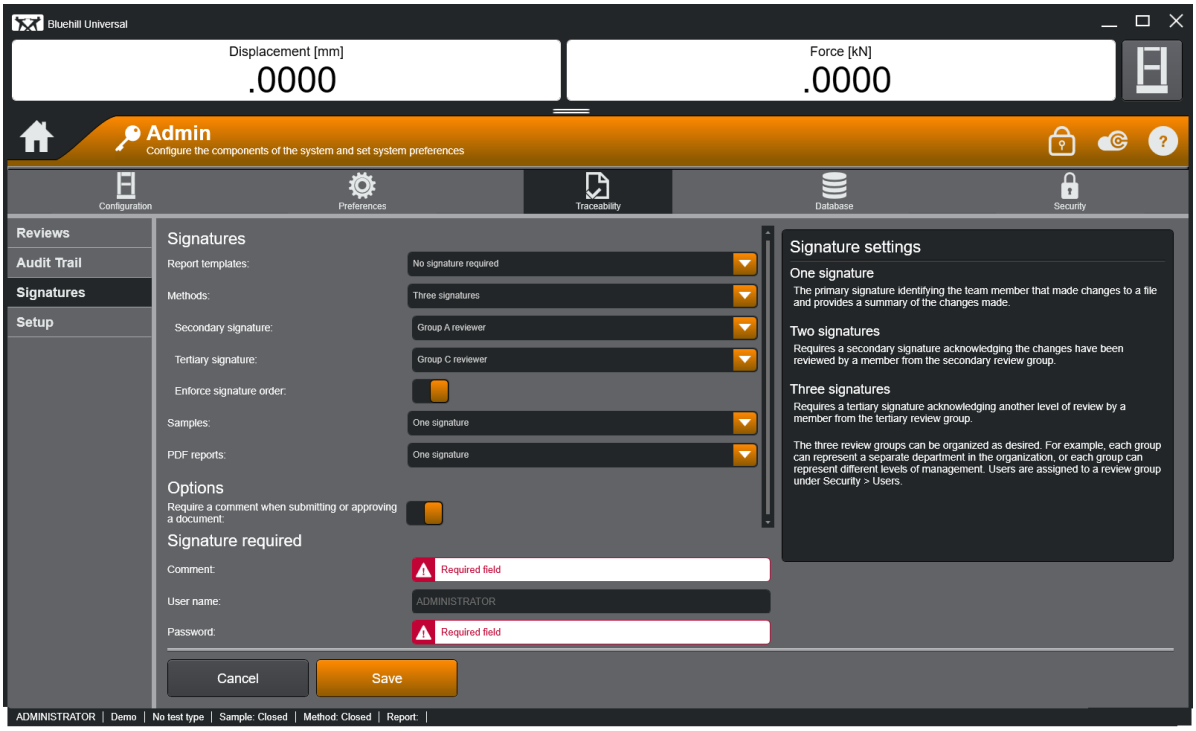
User name
- SQL user created during Traceability SQL Server installation

Password
- SQL user password created during Traceability SQL Server installation

Signature Configuration

The Admin > Traceability > Signatures screen is where you set the signature requirements for tracking changes to the various components of a sample file. You must have Configure Traceability permission under Security on the Admin tab to access this screen.

Note: Users cannot approve their own changes. Also, the same user cannot sign both secondary and tertiary reviews for the same pending changes.



Tracking Activity with Signatures

Traceability can include a review process to ensure changes are approved before the revised files are implemented. Review signatures are also recorded and saved to the database.

When signatures are required, the system requests the user name and password when any changes are saved. This information is recorded and saved to the audit trail database to maintain a history of changes, actions, and reviews done in the system.

Signature levels can be assigned as follows:

Signature option	Description
No signature required	The system does not require a signature when a file is changed and no further review is required.
One signature	Requires the signature of the person that changed the file. This is the primary signature and acknowledges that the person editing the file has completed their work. The signature is required upon saving the file. Primary signatures provide a summary of the changes made, the date and time the changes are saved, and identifies the person that saved the file. For the PDF report, the signature identifies the individual that finished the sample and generated the PDF report.
Two signatures	Requires a secondary signature that acknowledges the changes have been reviewed by an individual from the review group assigned to Secondary signature. Secondary signatures provide a date and time when the changes are approved and identifies the reviewer.
Three signatures	Requires a tertiary signature that acknowledges another level of review by an individual from the review group assigned to Tertiary signature. Tertiary signatures provide a date and time when the changes are approved and identifies the reviewer. Enable **Enforce signature order** to require the secondary signature must occur before the tertiary signature.

Go to the Security screen on the Admin tab to determine if you are included in a review group.

If “require a comment” when submitting or approving a document is enabled, the person signing a file must enter a comment with their user name and password. The comment is also saved in the audit trail database.

An individual can only sign a file once. If you are the primary signature, you cannot also sign as the secondary or tertiary reviewer. If you are in the secondary or tertiary review group, you will not see any pending reviews for which you previously signed as the primary signature.

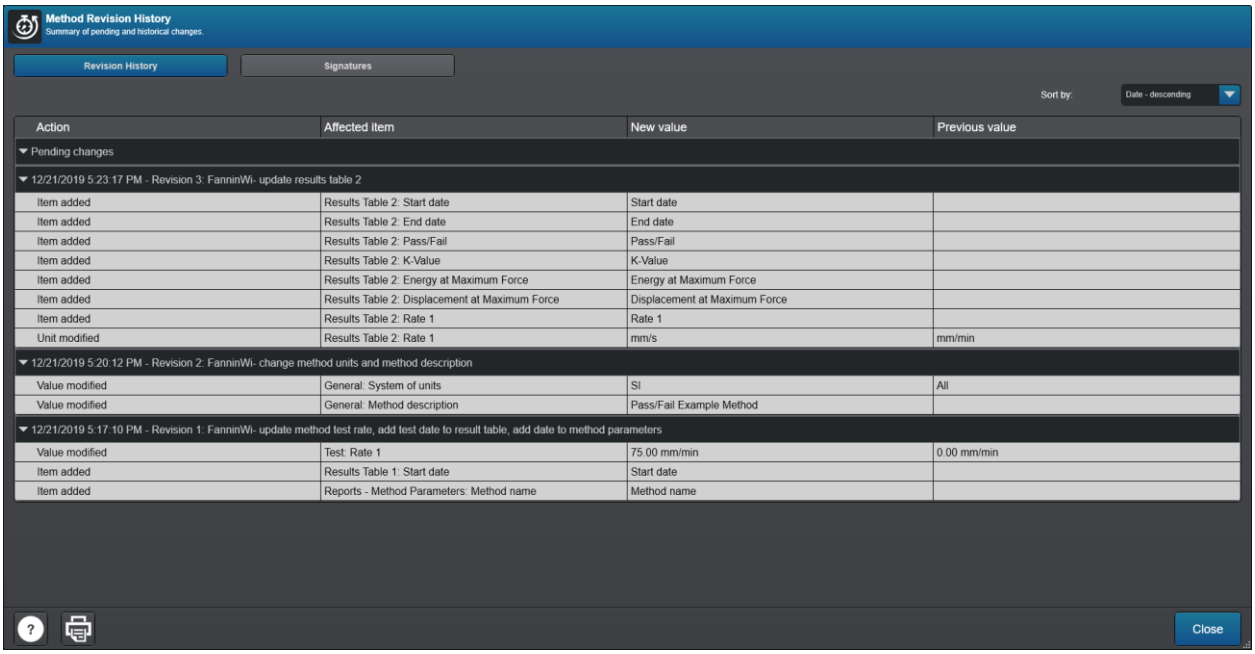
Traceability Files

The files that may require a signature approval include:

Report template	The report template defines the information included in the sample report and the layout of the report. The system tracks the changes made to the report template on the Report tab. A method file includes a link to the report template that is specified in the method. If changes to the report template are pending a secondary or tertiary review, neither the method or the report template can be used for testing until the report review is complete.
Method file	A method is a set of defined parameters that the system uses to perform a test, analyze the test data and produce calculated results. The system tracks the changes made to the method parameters on the Method tab. If changes to a method are pending a secondary or tertiary review, then the method cannot be used for testing until the review is complete.
Sample	A sample file includes the test parameters that were used to test the specimens in a sample and contains all of the test data for each tested specimen. The system requires a primary signature every time the sample is saved and when it is finished. This signature tracks: • the tested specimens • changes made to the tested specimens on the Test tab • changes to the method parameters • changes to the report parameters
PDF report	Upon finishing a sample, the system automatically generates a PDF of the report, as defined by the report template. The individual that finishes the sample is also documented as the author of the PDF report.

After a primary signature is completed, the system sends the revision information to the database. If a review is required, the system issues a review task on the **Traceability > Reviews** screen on the Admin tab. The reviewer can go to the **Reviews** screen in the software to review the changes and either approve or reject them.

Revision History with Traceability



When the Audit trail component of the Traceability feature is activated on the Admin tab, the **Save revision history** option is automatically enabled and it cannot be disabled.

When Save revision history is enabled on the Method tab (or Report tab), the system saves the changes to a revision number every time the file is saved. The Revision History dialog includes a summary of the changes made, the date, and time of each revision.

With the Traceability feature activated, the system includes the user name of the person that saved each revision in the Revision History dialog. The system also sends the revision information to the audit trail database that is specified on the **Traceability > Setup** screen on the Admin tab.

The audit trail database is fully searchable directly from the Bluehill software.

When Save revision history is initially activated, the system displays the revision history link as **Revision 0** on the **General** screen. In Revision 0, the system only displays the currently pending changes. Once the file is saved, the link displays as Revision 1. The Revision History dialog for this version includes the changes saved in Revision 1 along with any pending changes made since the file was last saved. Every time the file is saved, the system saves the changes to the Revision History dialog and increases the revision number. You can use the dialog to view the entire history of changes to the file.

When editing a file, the system tracks the pending changes. To view these changes, open the Revision History dialog using any one of the following options:

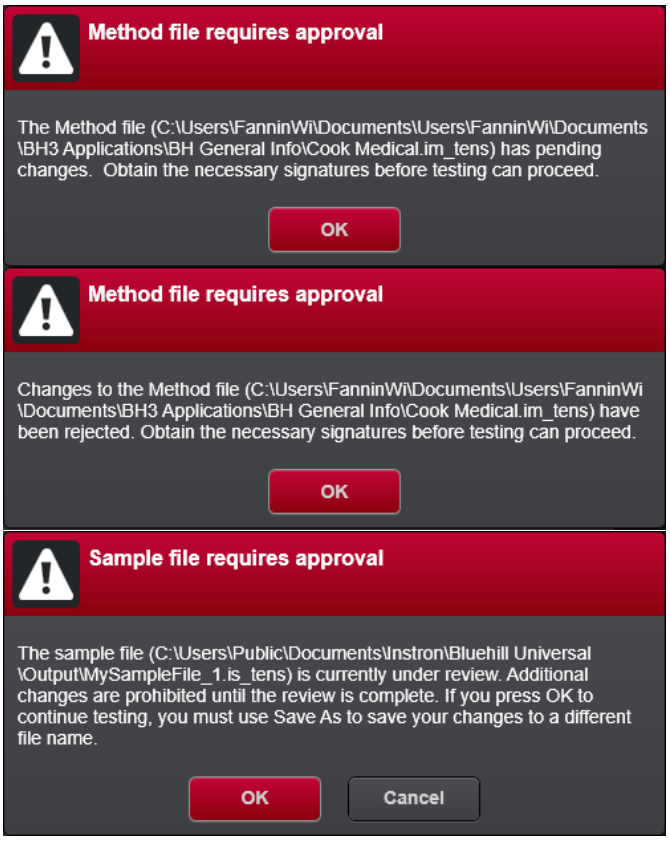
- Select  from any screen on the Test tab or Method tab (or Report tab if editing the report template).

- Go to the General screen under the Method tab (or Report tab if editing a report template) and select the Show pending revisions link.

Save the file. The Save As dialog includes a summary of the pending revisions.

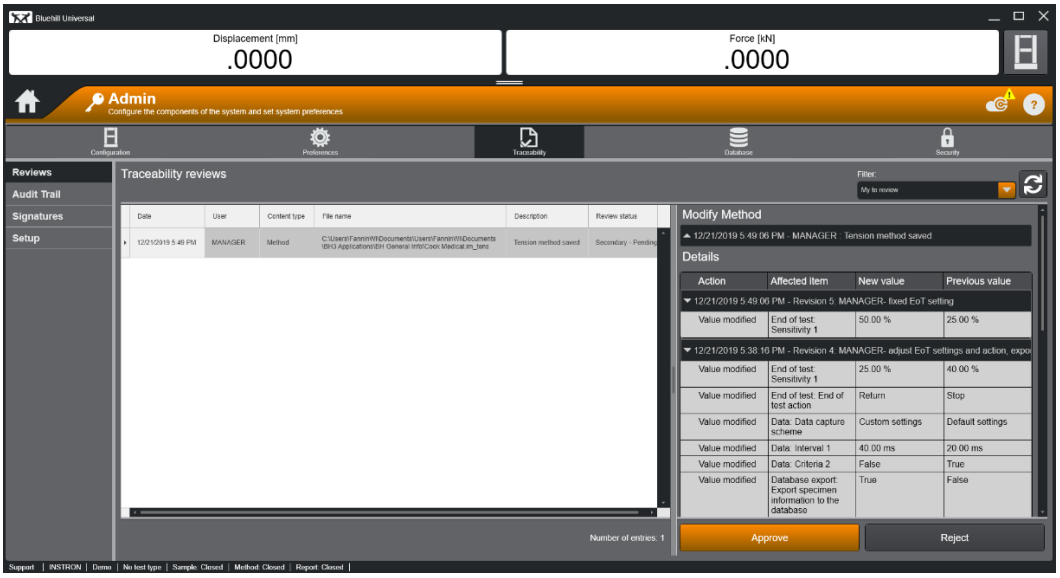
The system displays all the pending revisions since the file was last saved. The information includes the parameter that was changed along with the previous value and the new value. When the file is saved, the system clears this dialog.

Pending changes that were rejected or yet to be approved will prevent further changes:



Traceability Reviews

The Traceability > Reviews screen is where pending reviews are maintained. Any revisions that require a review, as determined by the settings on the Traceability > Signatures screen, are managed here. The table on the left is a summary of all the pending revisions awaiting review. The information on the right provides the details regarding the highlighted row in the table.



The table can be filtered using the following options:

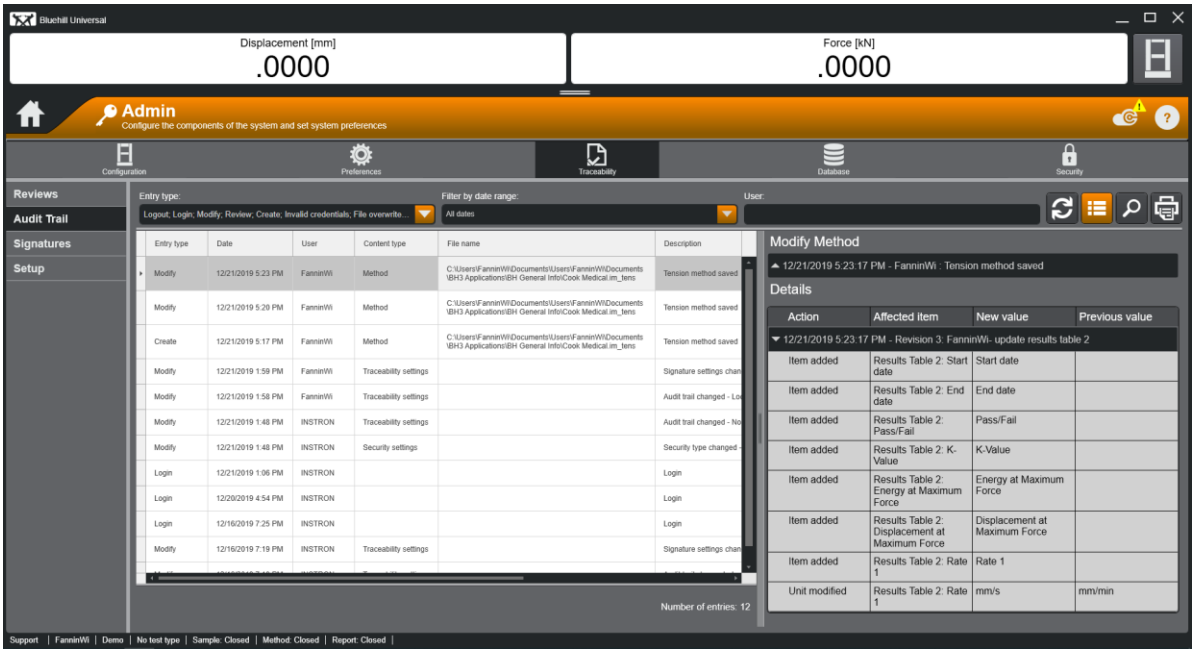
- **My to review**: the table shows only the pending reviews based on the reviewer level assigned to you. For example, if you have Secondary reviewer permission enabled under Security on the Admin tab, you can only see revisions that are pending a secondary signature.
- **My reviewed**: the table shows only the reviews that you have reviewed and either accepted or rejected.
- **All to review**: the table shows all revisions that are pending either a secondary review or a tertiary review.
- **My changes pending review**: the table shows only the revisions that you have submitted for review and are still pending.

All users have access to the Traceability feature to view the status of pending revisions. However, you must have the appropriate permissions enabled under Security on the Admin tab to approve or reject pending revisions.

When a revision is either approved or rejected, the system sends this information to the audit trail database.

Traceability Audit Trail

The Traceability > Audit trail screen provides access to the audit trail database. All users have access to this screen and can search the database using filters.



Filters include:

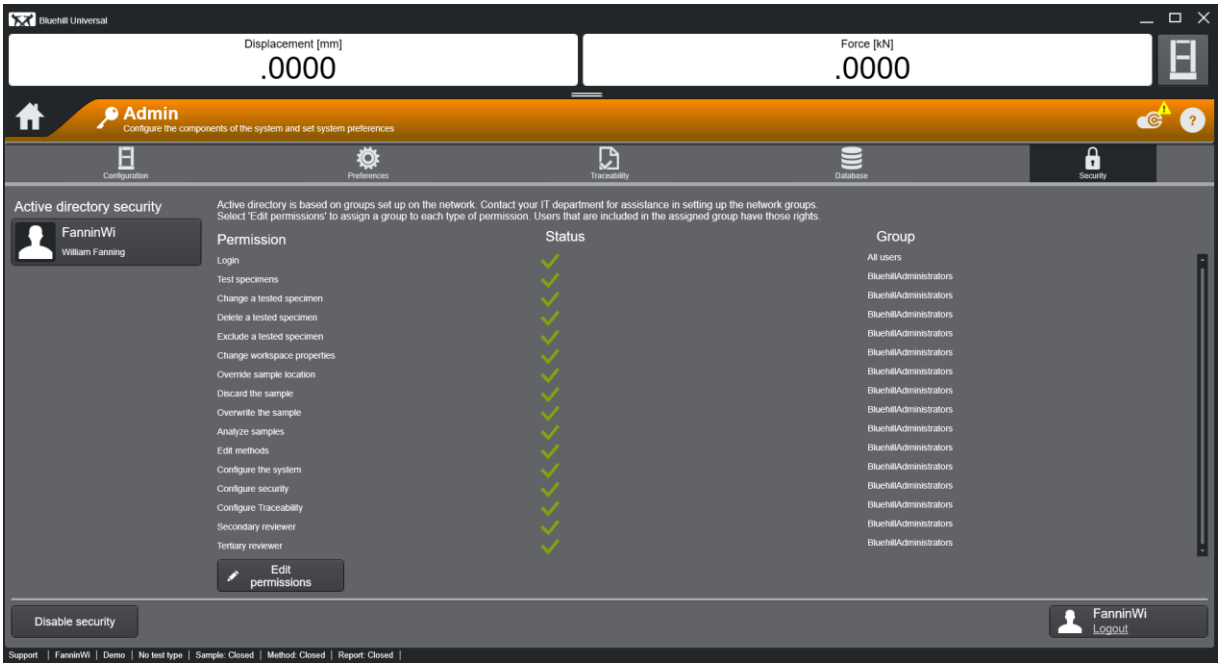
- **Entry type**: select the type of action performed on this system. The table displays all database entries classified as the selected entry type.
- **Filter by date range**: the system further filters the table to show only the entries that were completed within the specified date range.
- **User**: enter a user name to further filter the table to show only the entries that were completed by that user.

Use the following Audit Trail controls to further customize the table of entries:

	Button Name	Function
	Refresh	Refresh the table of entries
	Details	Show or hide the section that displays the details of the entry highlighted in the table
	Search	Search the database for a specific word or phrase. A Search field displays above the table of database entries
	Print	Print the current table of entries

Security Configuration

The Security screen on the Admin tab provide the security parameters that limit access to the software in order to protect your system, methods and sample files.



When security is enabled the software can:

- Requires a person to log in to the software.
- Limits access to the software based on the permissions authorized for the user.
- Limits ability to edit existing specimens or samples based on the permissions authorized for the user.
- Limits ability to change the configuration of the system, including Operator Protection, based on the permissions authorized for the user.
- Identifies the currently logged-in user in the status bar and the home screen.
- Saves the user name of the person who ran the test. The user name can be added to the results table.
- Saves the user name of the person who last saved a method. The user name displays as the **Method author** in the preview section of either a method or a sample. The **Method author** can be added to the method parameters for a report or to exported content.
- Saves the user name of the person who last saved a sample. The user name displays as the **Sample author** in the preview section of the sample. The **Sample author** can be added to the report content under the Report tab.
- The current user can be added to the header or footer of a report.

Security can be configured to allow specific permissions for each user or for groups of users. Each type of security assigns these permissions in a different way.

The types of security are:

- Active Directory
- Bluehill Security
- Windows Security

Active Directory

The active directory security links to a network domain that is managed by your network administrator. In the software, the security permissions are assigned to a group and any user that is included in that group has those rights. The user groups are created and managed by the network administrator.

This type of security requires very little maintenance from within the software. After a group is assigned to each permission, any changes to the users included in a group is done by the network administrator. You will need to work with your IT department to request changes to these groups.

Before enabling the active directory security, it is important to establish the groups that are required and the users that are included in each group. Provide this information to your network administrator to implement on the network domain. Then the security can be activated and a group assigned to each permission.

The software includes two common groups: All users and No users. These groups are not managed by the network administrator. These groups provide a simple way of either allowing or prohibiting all users from a specific task.

After the security is activated, all users must log in to the software. Users log in to the software with the same login credentials they use to access the network.

All users have access to the Security screen on the Admin tab. The user that is currently logged in displays and the Status column displays the permissions for this user. If you need additional permissions, contact your manager to request being added to the assigned group.

Users with Configure security permission can modify the group assignments using the Edit button.

Bluehill Security

Bluehill security is internal to the software and is based on creating a user profile for each person that requires access to the system. After the security is activated, all users must log in to the software. Permissions are organized into three user types that provide different levels of access to the software. There must be at least one user designated as an administrator in order to manage the security feature and user profiles.

User Information

User information displays on the Security > Users screen on the Admin tab tab and provides basic identification information. Every user has access to this section in order to edit their own information as necessary. Each user can also change their own password, if desired.

When the administrator creates a new user profile, a password must be set. The new user should change the password upon logging in for the first time. The setting Change password on next login allows the administrator to require the new user to reset the password.

When the user logs in the next time and changes the password, this setting is disabled automatically.

Only the administrator can set this parameter.

Permissions

The Permissions section determines what each user can do within the software. An administrator creates a user profile for each person and assigns a user classification of Administrator, Manager or Operator. The type of classification that is assigned determines the level of access within the software.

Each user profile, regardless of the user type, can be further customized with the listed permissions. Disabling these permissions prevent a user from performing that task.

Permissions display on the Security > Users screen on the Admin tab tab. Users can see only their permissions. Administrators can see every user profile on the system.

Permissions can only be changed by an Administrator.

Windows Security

The Windows security uses the local user accounts and groups provided by the Windows operating system. In the software, the security permissions are assigned to a group and any user that is included in that group has those rights. The user groups are created and managed via the Windows user accounts.

This type of security requires very little maintenance from within the software. After groups are assigned to the various permissions, any changes to the users included in a group is done via the Windows control panel, by any user included in the Administrators group.

The software includes several common groups:

All users - By default includes all users. There is no specific group to maintain.

No users - By default excludes all users. There is no specific group to maintain.

Administrators - Includes any user that is included in the Windows Administrators group.

Users - Includes any user that is included in the Windows Users group.

The security feature can be enabled using just the common groups listed above. Additional groups can be created to further customize the security feature, if necessary. For example, a group can be created for each permission and then add only the users that should perform each task. It is recommended that you work with your IT department to create the user accounts and the groups that will be assigned in the software.

After the security is activated, all users must log in to the software. Users log in to the software with the login credentials assigned to their user account. All users have access to the Security screen on the Admin tab. The user that is currently logged in displays and the Status column displays the permissions for this user.

The permissions in the software are managed by the users included in the group assigned to Configure security. For these users, an Edit button is available to edit the assigned groups as necessary.

Comparison of Security Types

Bluehill Security	Active Directory	Windows® Security
Application based	Network based	Computer based
Login credentials are managed in the software.	Login credentials use the individual's network credentials.	Login credentials are based on Windows user accounts.
Users are assigned to one of three user types with defined permissions: Administrator, Manager, Operator. Additional permissions are assigned to each user.	Permissions are assigned to a group. The groups are created on the network domain. Users that are included in the assigned group have those rights.	Permissions are assigned to a group. The groups are based on Windows user groups. Users that are included in the assigned group have those rights.
User profiles are managed by any user that is an Administrator user type.	The Permissions section of security is managed by any user included in the network group assigned to Configure security.	The Permissions section of security is managed by any user included in the Windows group assigned to Configure security.
N/A	Groups are managed by the network domain administrator.	Groups are managed by any user included in the Windows Administrators group.
Multiple testing systems: Security is managed separately on each system. Each user requires a user profile on each system.	Multiple testing systems: Security is managed separately on each system. Network groups are shared among all systems.	Multiple testing systems: Security is managed separately on each system. Windows user groups are managed separately on each system.

Security Permissions

The permissions provided within the software security feature determines what each user can do within the software.

In Bluehill Universal security, each permission is either enabled or disabled. When a permission is enabled, the user is allowed to perform that task. When disabled, the software prohibits the user from performing the task.

In Active Directory or Windows security, each permission is assigned to a group. A user must be included in the group to have access to that area of the software or be authorized to perform that task.

Permission	Description
User type	In Bluehill security, the type of user determines the level of access to the software.
Login	Allows access to the software by logging in with proper login credentials. In Bluehill security, all users have login permissions.
Test specimens	Allows access to the Test tab to set up and test specimens. In Bluehill security, all users can access the Test tab.
Change a tested specimen	Allows a user to change values for tested specimens. For example, when enabled, the user can change the dimensions shown in the Operator Inputs area after a specimen is tested and recalculate the results. Alternatively, to protect the system from obvious bad entries, such as entering 250mm instead of 25mm, you can assign bounds to these parameters that prevent operators from entering values outside the specified range.
Delete a tested specimen	Allows a user to delete specimens from a sample. Deleting specimens is not the same as excluding specimens. Excluding a specimen only removes the specimen from the statistics and the specimen can be included again if necessary. If a specimen is deleted, its data is erased from the test data file and it cannot be recovered. Specimens in the sample are renumbered. This may not be desirable if you need to comply with certain standards.
Exclude a tested specimen	Allows a user to exclude a specimen from the statistics for the sample and include a specimen that has been previously excluded.

Permission	Description
Change workspace properties	Enables the properties icon,  , on the Test tab components to edit the settings for the test workspace. Note that this button provides limited access to the method tab settings (e.g. graph, result columns, and web camera settings).
Override sample location	Allows a user to browse to a different folder when using “save as” to save the sample in a different folder. A user not authorized for this task can save the sample under a different name using “save as” but the user cannot browse to a different folder. If users will be prevented from changing the sample location, it is important that the method specifies a default folder. Go to Exports > File Settings on the Method tab tab to specify a default folder. This ensures that all samples using this method are saved to the same folder. If no default folder is specified, the sample will be saved to the folder used for the previous sample. If it is not the correct folder for the current sample, an unauthorized user cannot change the folder.
Discard the sample	Allows a user to close the Test tab without saving a sample that was not previously finished or saved. The user can either close the software or return to the home screen without saving the sample. Discarding a sample permanently deletes all changes made since the sample was last saved. These changes cannot be recovered. A user not authorized for this task must save the sample to close the Test tab.
Overwrite an existing sample via Save As	Allows a user to save the currently open sample with the Save as option and enter a previously used sample name. This option overwrites the previously saved sample. The contents from previous sample cannot be recovered. A user that does not have this permission must use the Save option to save an existing sample with the original file name. When this user selects the Save as option, the user must create a unique file name that has not been previously used, thus protecting all previously saved samples.

Analyze samples	The Analysis tab is an optional feature in the software that is only available if purchased. Allows access to the Analysis tab in the software. This tab lets a user replay an existing sample with limited parameters from a different method. When a user has access to the Analysis tab, carefully consider authorizing permission to overwrite samples. If both permissions are authorized, the user can save a replayed sample and thus overwrite the original sample. If Overwrite samples is not allowed, the software prompts the user for a new sample name.
Edit methods	Allows access to the Method tab to edit parameters in a method file. In Bluehill security, you must be either an Administrator or Manager to access the Method tab.
Configure the system	Allows access to the following sections on the Admin tab: • Configuration • Preferences > Email • Preferences > Connect • Database An authorized user can: • change the configuration of the frame, including Operator Protection settings • edit transducer configurations • configure the TrendTracker database, if purchased • configure email and Instron Connect In Bluehill security, you must be an Administrator to access these sections of the Admin tab.
Configure security	Allows access to the Security section of the Admin tab. An authorized user can enable or disable security and edit the permissions. In Bluehill security, you must be an Administrator to enable or disable security and edit the permissions.

Security Permissions for Traceability

Permission	Description
Configure Traceability	Allows access to the Traceability > Setup screen to configure the Traceability feature and signature requirements. In Bluehill security, only an Administrator has this permission.
Group A reviewer Group B reviewer Group C reviewer	Assign an individual to a review group, or multiple review groups, for Traceability reviews. When one of these groups is assigned to review a file, anyone included in the assigned group may complete the review. Go to Traceability > Signatures on the Admin tab to specify the signature requirements for each type of file and assign a review group for each signature option.
View audit trail	Provides access to the Audit Trail section under Traceability. This permission is intended for individuals that are classified as Manager or Operator, but also need access to the team's audit trail.

Traceability Workflow

The following process reflects the basic workflow for implementing and using the Traceability feature.

For this workflow, secondary and tertiary reviews are required.

1) Create a local database on the same computer where the system software is installed. Your IT department or Instron support can provide assistance.

2) Configure the system security using any of the three types: Bluehill, Active directory or Windows security. The only requirement is to have one or more users with the Configure Traceability permission. This permission is required to edit the Traceability settings.

3) Go to **Traceability > Setup** on the Admin tab to enable the audit tracking feature by establishing a connection to the local database. The software can now track the activity performed in the software. Changes made to samples, methods and report templates will be saved in the audit trail database.

4) If reviews will be required, go to **Traceability > Signatures** on the Admin tab to configure the signature level requirements.

5) Proceed with testing specimens, and editing report templates and methods as necessary. As files are created or edited, the user that changes a file (sample, method or report template) signs the revision by entering a user name and password. The system creates a new revision to the file, which can be viewed in the Revision History log. The system also sends the revision information to the audit trail database and adds a task to the **Traceability > Reviews** screen on the Admin tab.

6) A user with **Secondary reviewer** permission under Security must go to the **Traceability > Reviews** screen on the Admin tab to review the changes made in the revision. When the review is accepted, the system sends the approval information to the audit trail database. After the secondary review is complete, the system adds a new task to the Traceability reviews table for a tertiary review and approval.

7) A user with **Tertiary reviewer** permission under Security must go to the **Traceability > Reviews** screen on the Admin tab to review the changes made in the revision. When the review is accepted, the system sends the approval information to the audit trail database. After the tertiary review is complete, the file is now available for testing.

8) To search the audit trail database, go to the **Traceability > Audit trail** screen on the Admin tab.

Pre-Installation

Prior to going onsite contact the customer and make them aware of the following Traceability requirements:

- Traceability supports **Windows 10 (64 bit)** systems only.
- **Windows Administrator access** is required during Traceability SQL Server installation. Customers IT group needs to provide administrator login access to the workstation.
- Find out which BHU Security mode the customer plans on using. BHU Security must be enabled in order to use the Traceability feature.

  If they plan on using Active Directory security customers IT group will need to create the Active Directory groups and assign network users to each group prior to your arrival. You'll also need some of these users available to login during Traceability configuration and IQ/OQ.

  There's a whitepaper on Instron.com that will help customer decide how they want to configure their AD groups. Link to whitepaper on instron.com

  Available BHU security modes are:

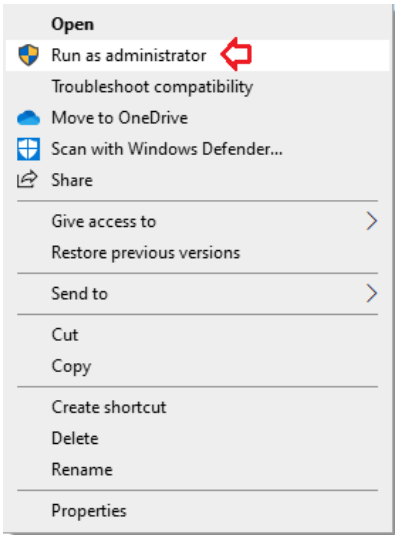
  - Active Directory
  - Bluehill Security
  - Windows Security

- During Traceability SQL Server installation you'll create a password for the system administrator account on the SQL Server. ***Ask the customer if they have any password requirements and if so, what they are so you create a password that meets their password complexity requirements.*** Things like minimum number of characters, upper and lower case, include symbols and numbers…

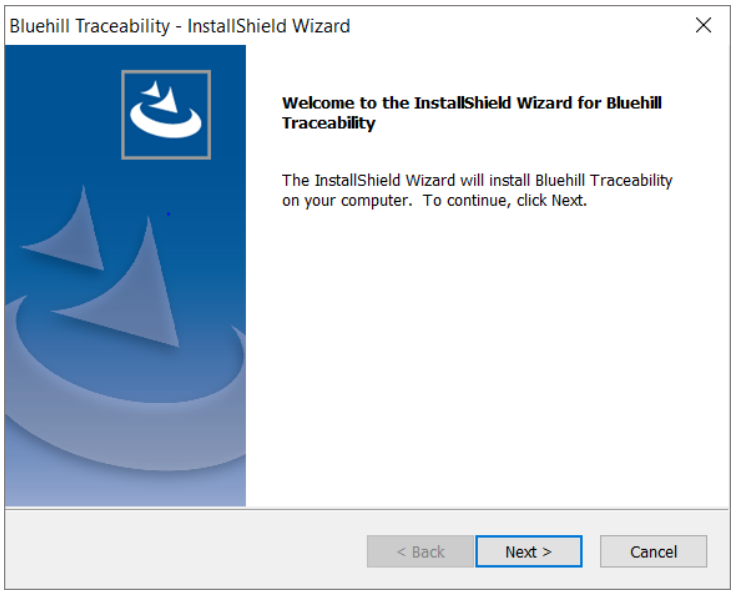
Installation

SQL Server 2019 Express Install

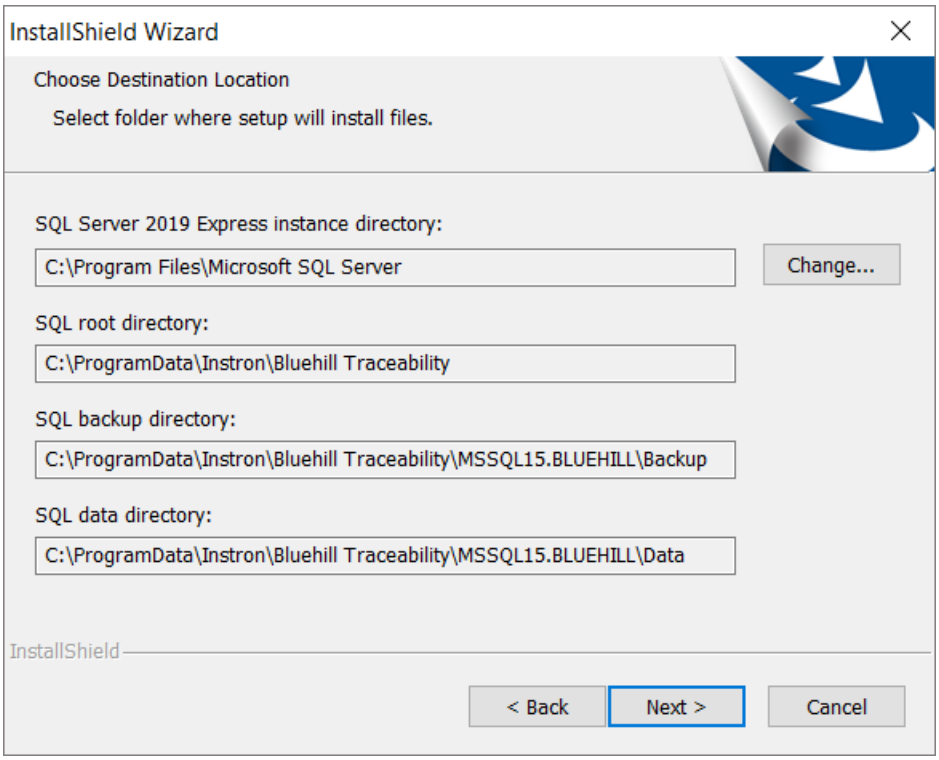
1) Login to workstation with administrator access then from the Traceability Server folder right-click Setup.exe then select "**Run as administrator**".



2) Click Next >



3) **Click Next >**


InstallShield Wizard
Choose Destination Location
Select folder where setup will install files.
SQL Server 2019 Express instance directory:
C:\Program Files\Microsoft SQL Server
Change...
SQL root directory:
C:\ProgramData\Instron\Bluehill Traceability
SQL backup directory:
C:\ProgramData\Instron\Bluehill Traceability\MSSQL15.BLUEHILL\Backup
SQL data directory:
C:\ProgramData\Instron\Bluehill Traceability\MSSQL15.BLUEHILL\Data
InstallShield
< Back
Next >
Cancel

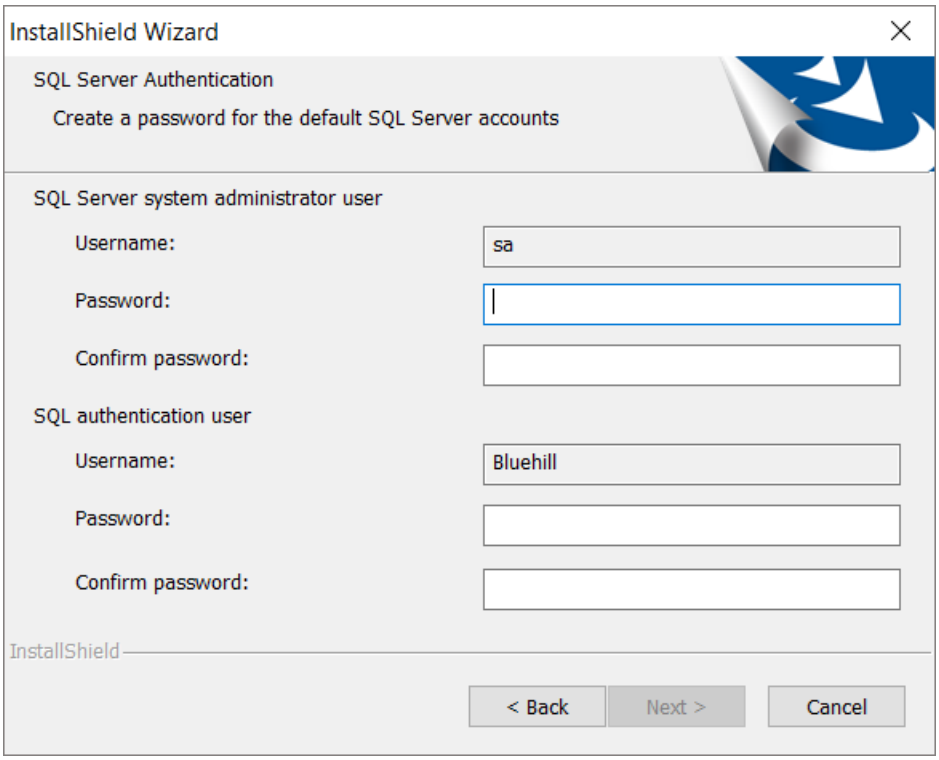
4) Enter passwords for sa administrator and Bluehill user accounts.

Write these down you'll need them later.

Give these to customer as well, they'll need them if they want to backup the database.

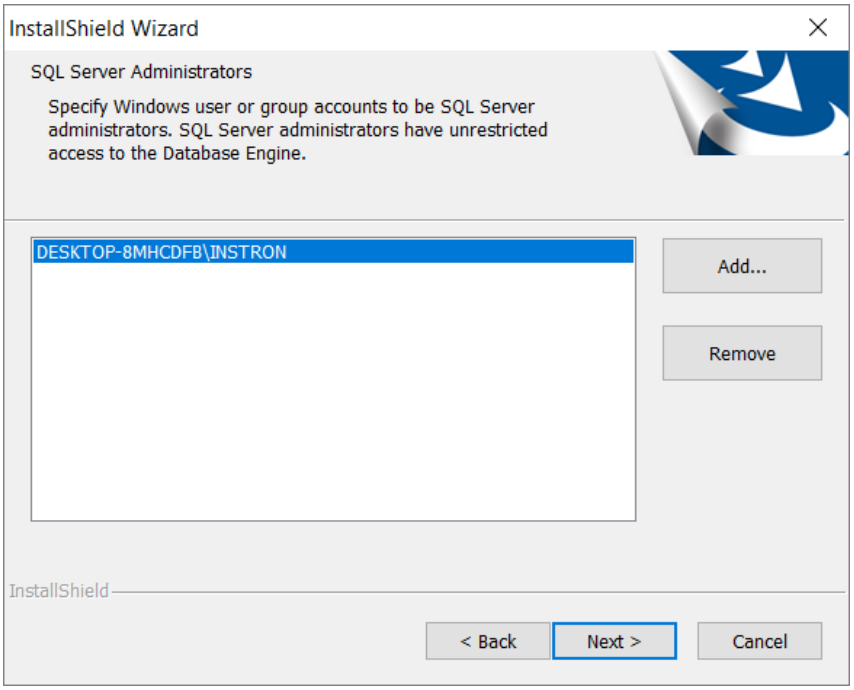
NOTE: Prior to creating the "sa" administrator password check with customers IT group as they may have password complexity requirements for the server administrator account.

Once complete Click Next >

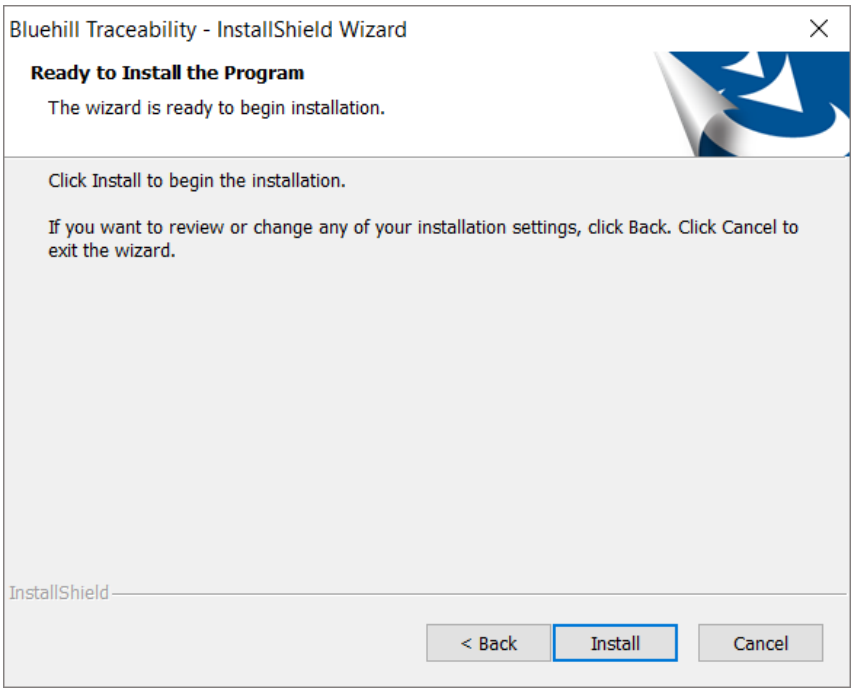


5) This defines which Windows user or group accounts are SQL Server administrators. It defaults to current logged user. Check with customers IT group and change as needed.

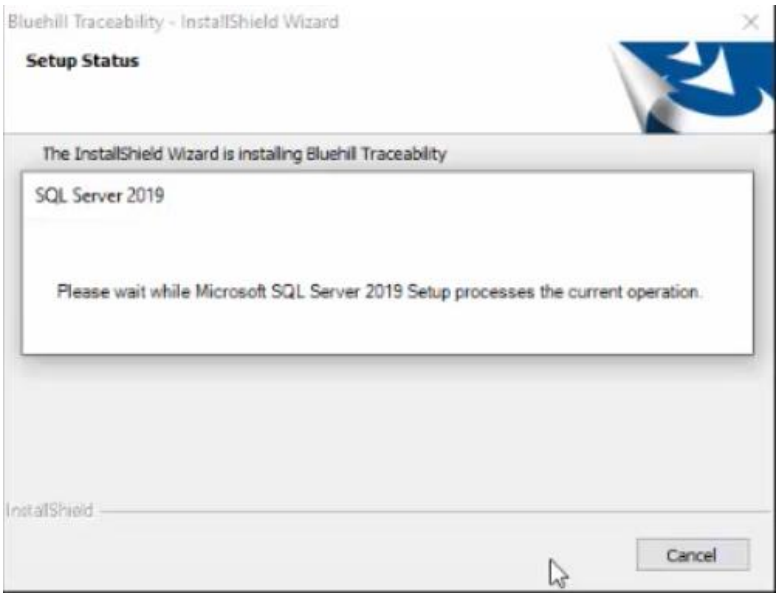
Once complete Click Next >



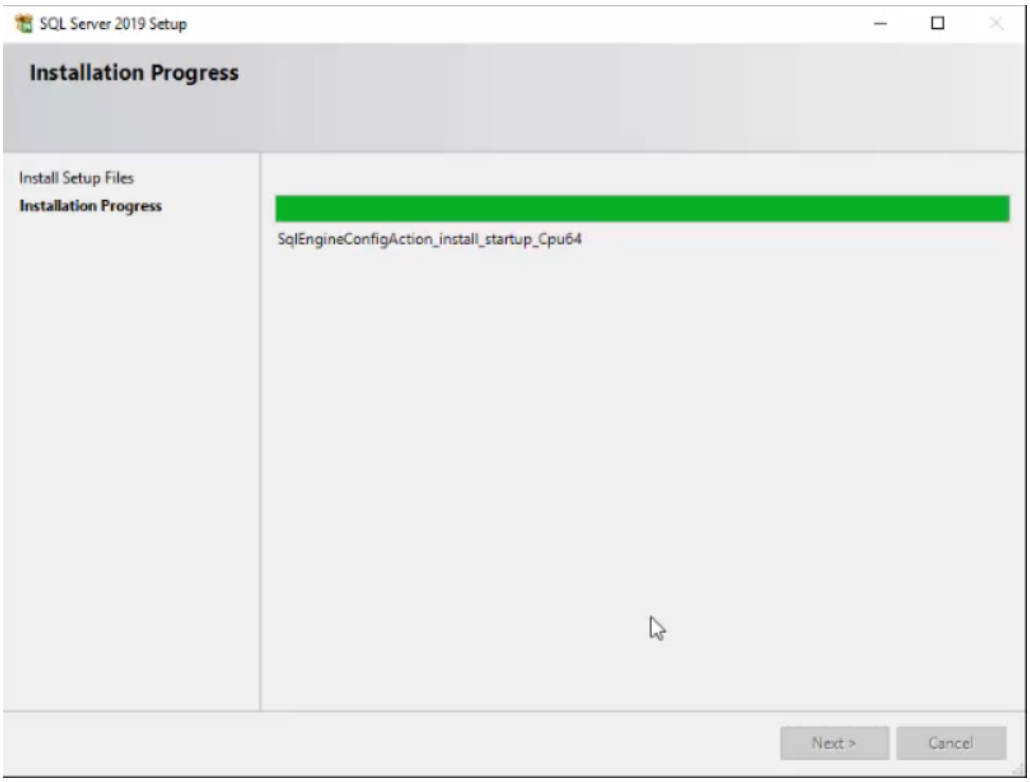
6) Click Install



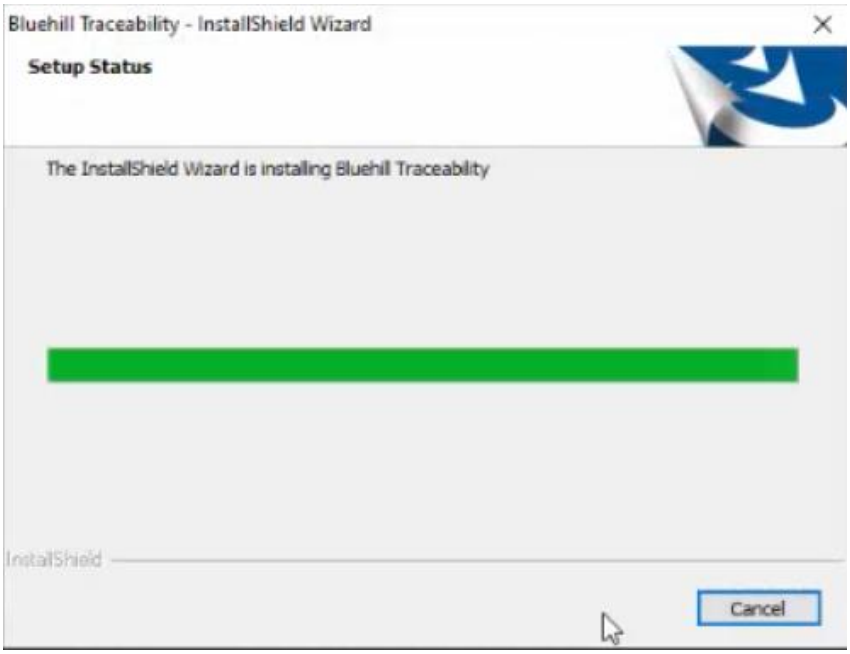
7) SQL Server 2019 Express installation begins



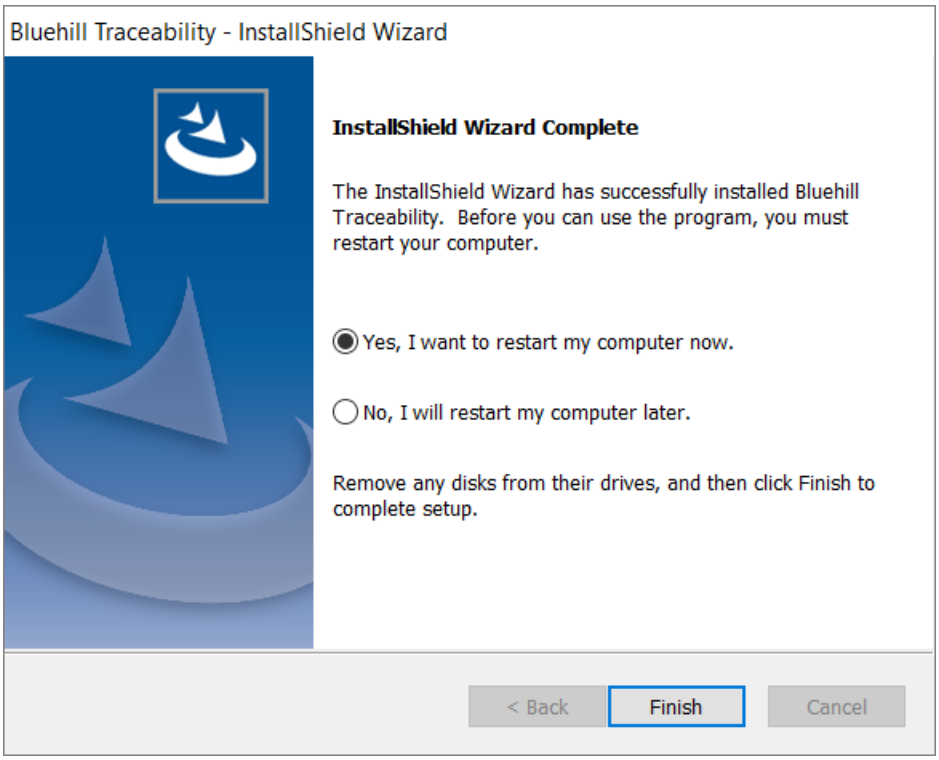
If there's a problem with the SQL Server install you'll get an error pointing to an **"InstallSQLLog.txt"** file. Locate the log file and review for indications why the server installation failed. Resolve issue then run install again if needed.



Once the SQL Server install wraps up the Traceability instance install will begin automatically.



8) Click Finish to reboot computer



Create Traceability Database

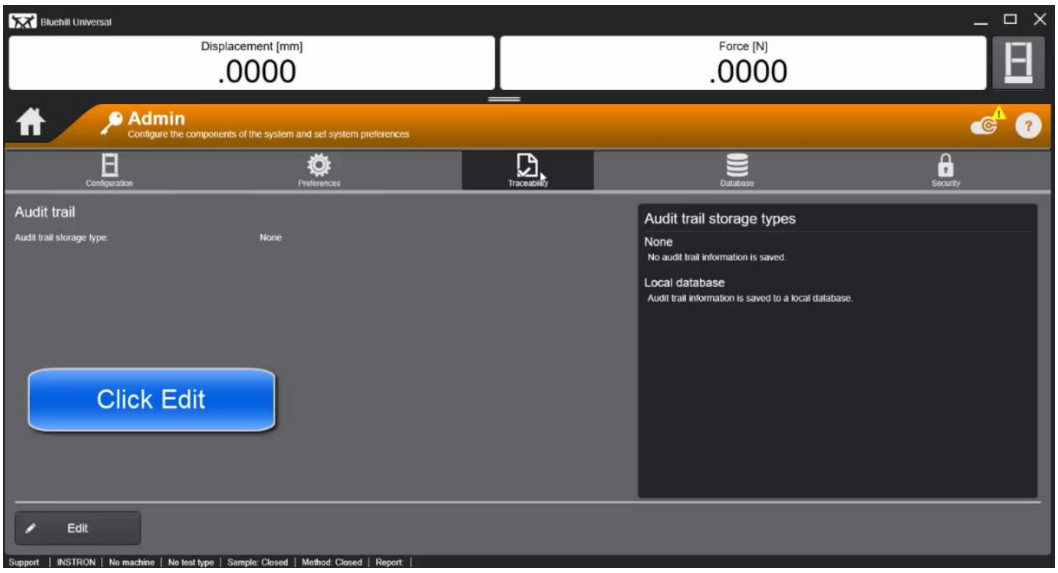
1) Install BHU (v4.15+) if not already installed then start Bluehill Universal.

2) Enable Security from Admin > Security

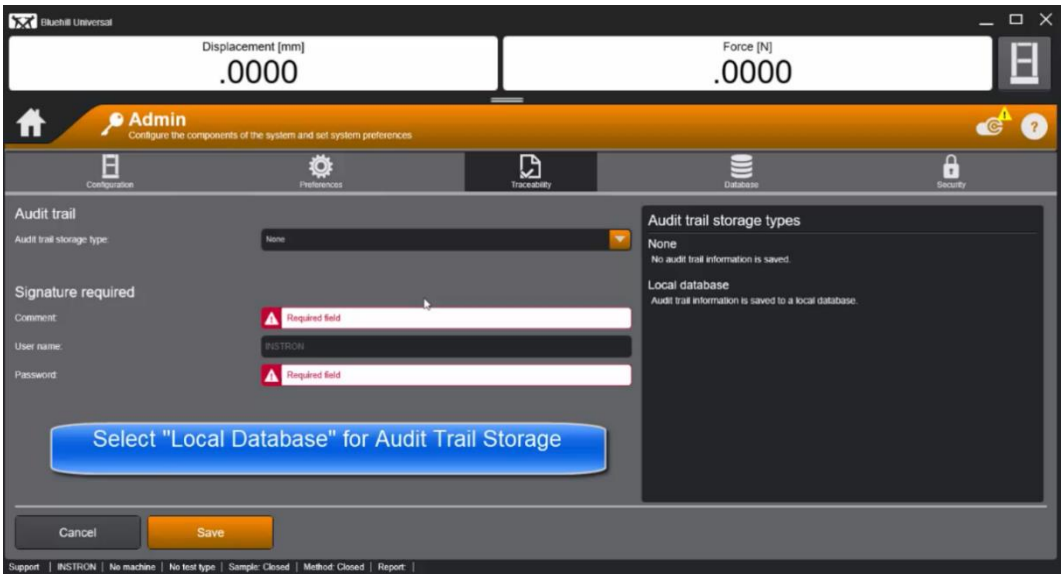
   Discuss with customer which Security type they prefer; Active Directory, Bluehill Security or Windows Security. You'll need a user with "Configure Traceability" and "Configure Security" permissions.

3) Login to Bluehill with an account that has “Configure Traceability” permission.

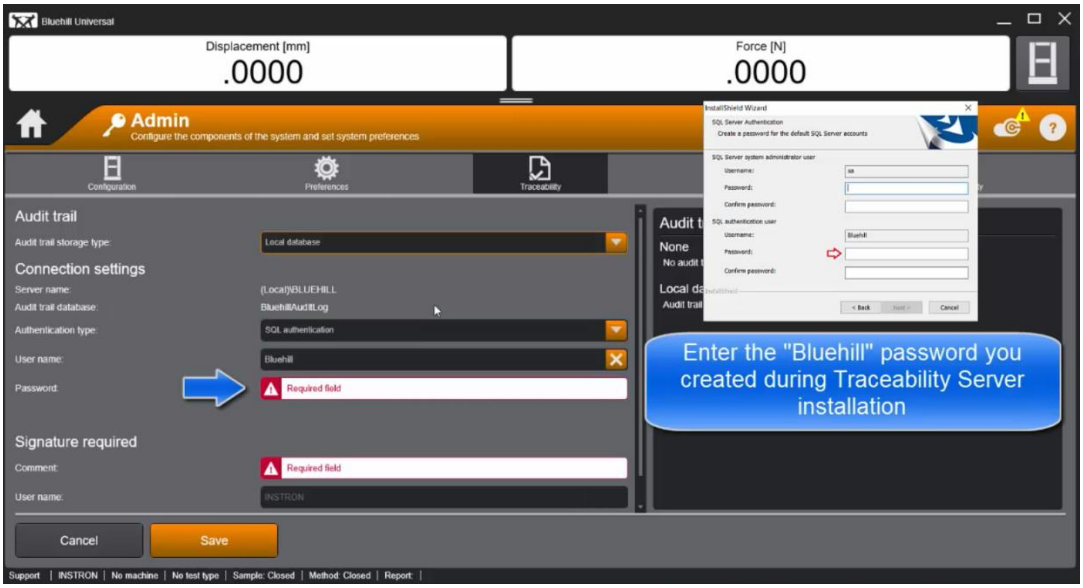
4) Click Admin > Traceability then click Edit



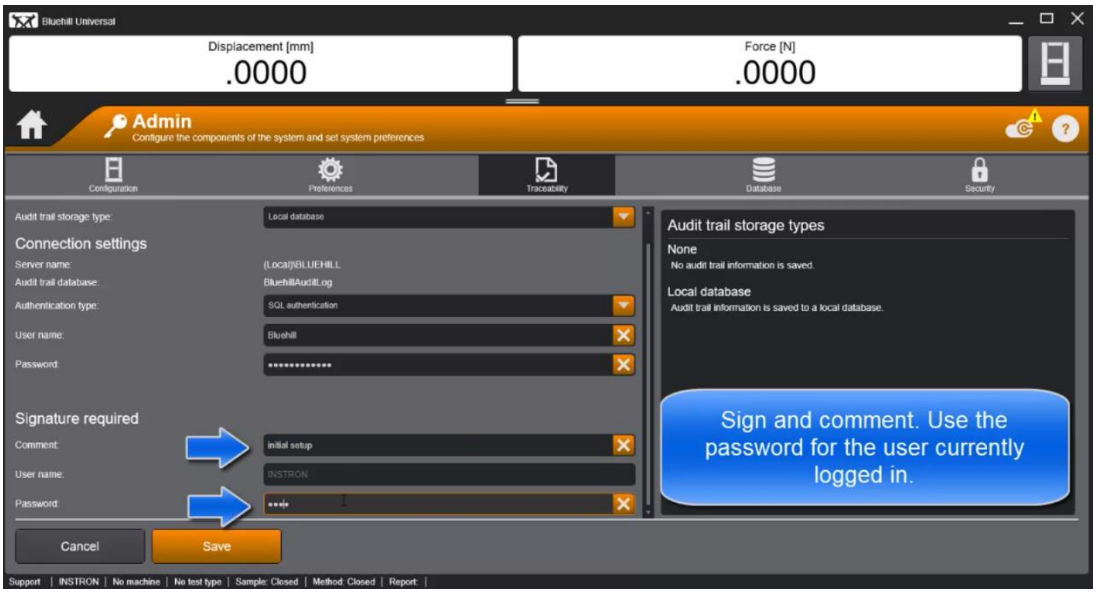
5) Select “Local database” for Audit trail storage type



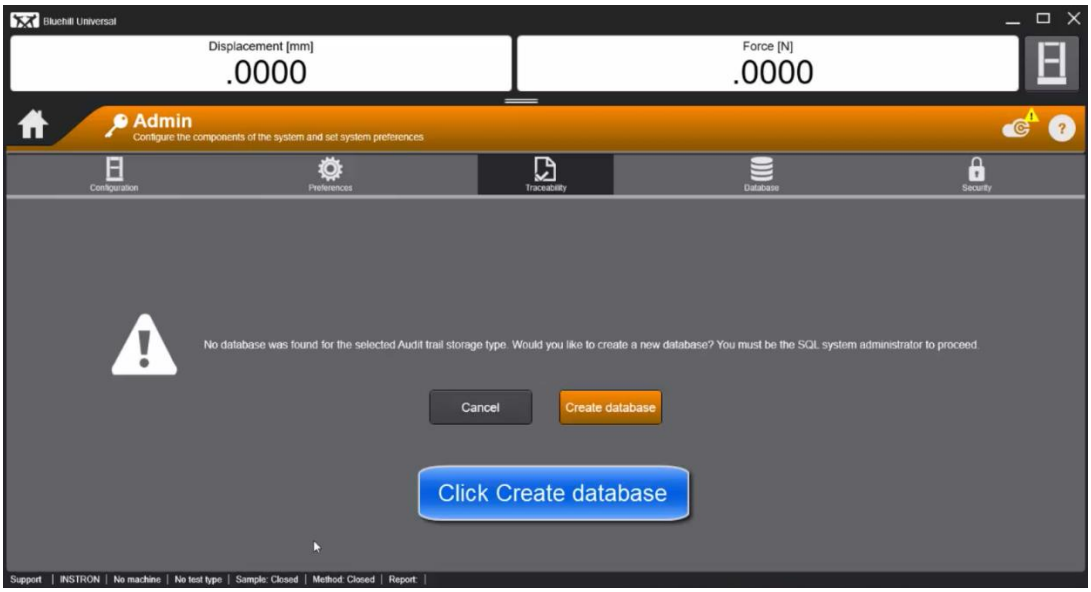
6) Enter the “Bluehill” password you created during Traceability server installation



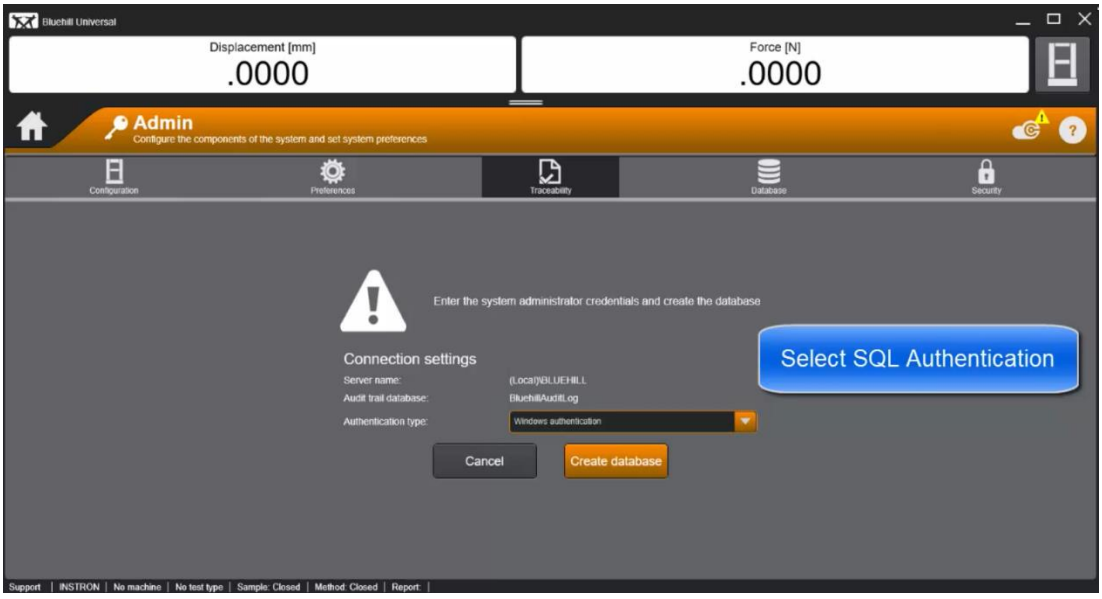
7) Sign and comment then Save. Use the password for user currently logged in.



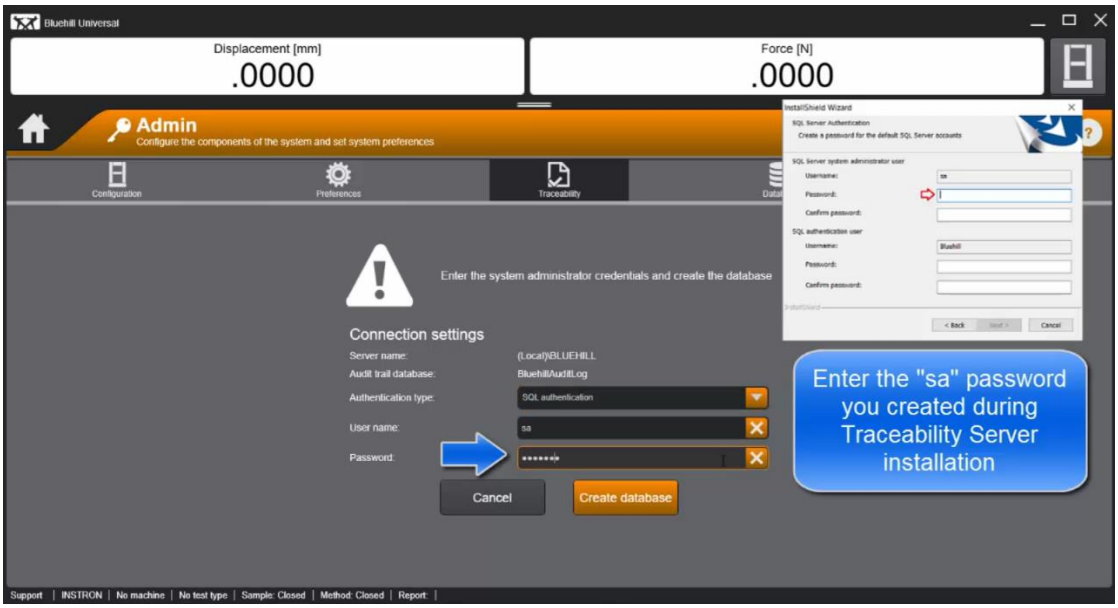
8) Click Create Database



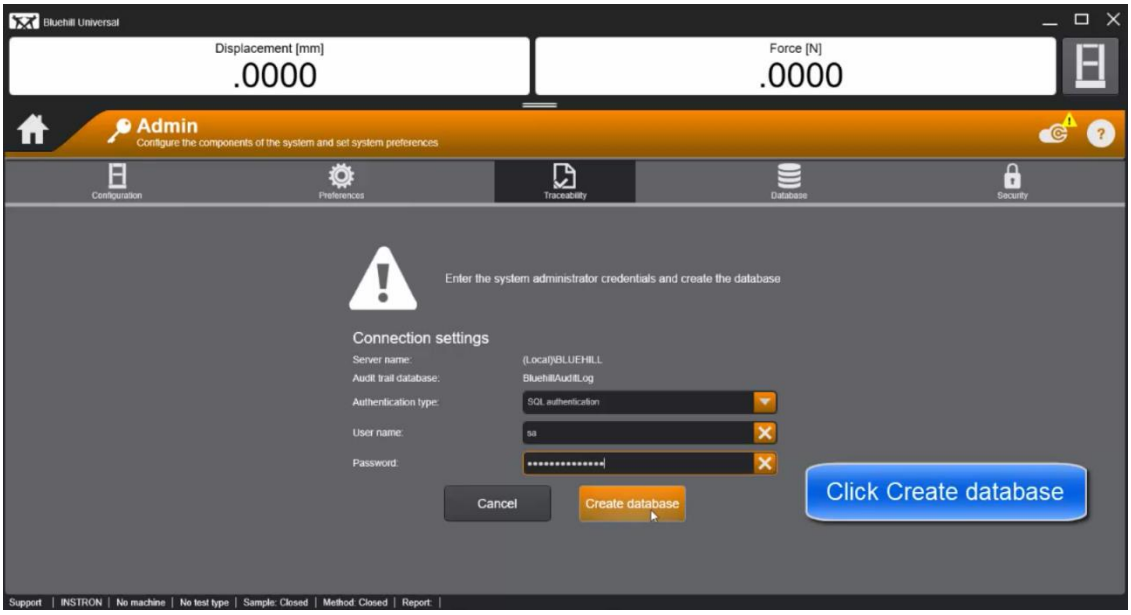
9) Select SQL Authentication



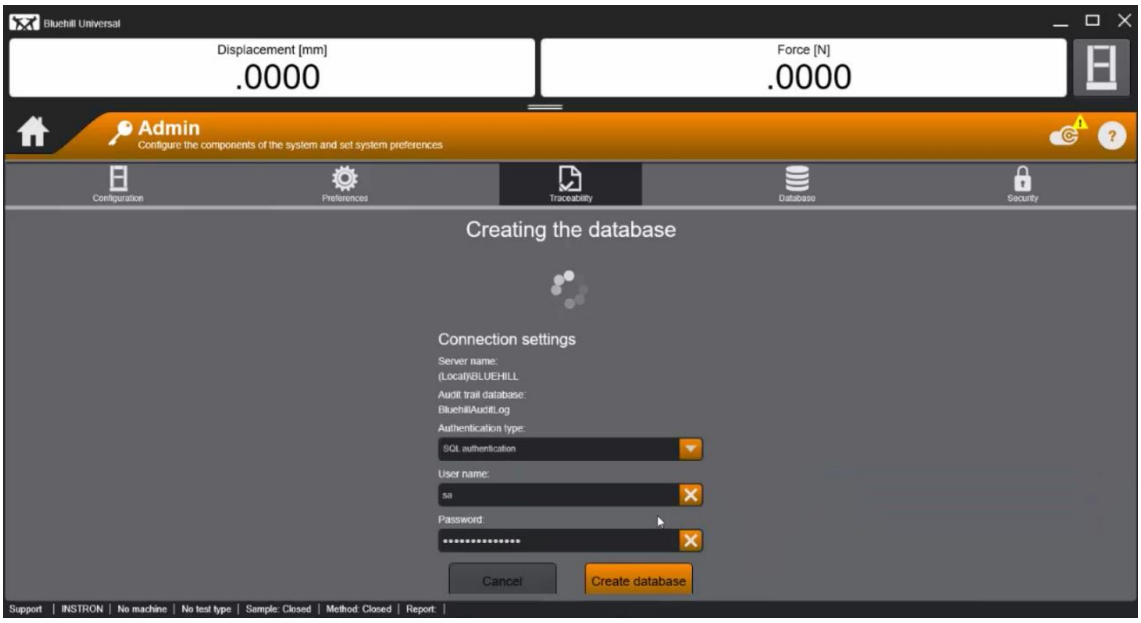
10) Enter the “sa” password you created during Traceability Server installation



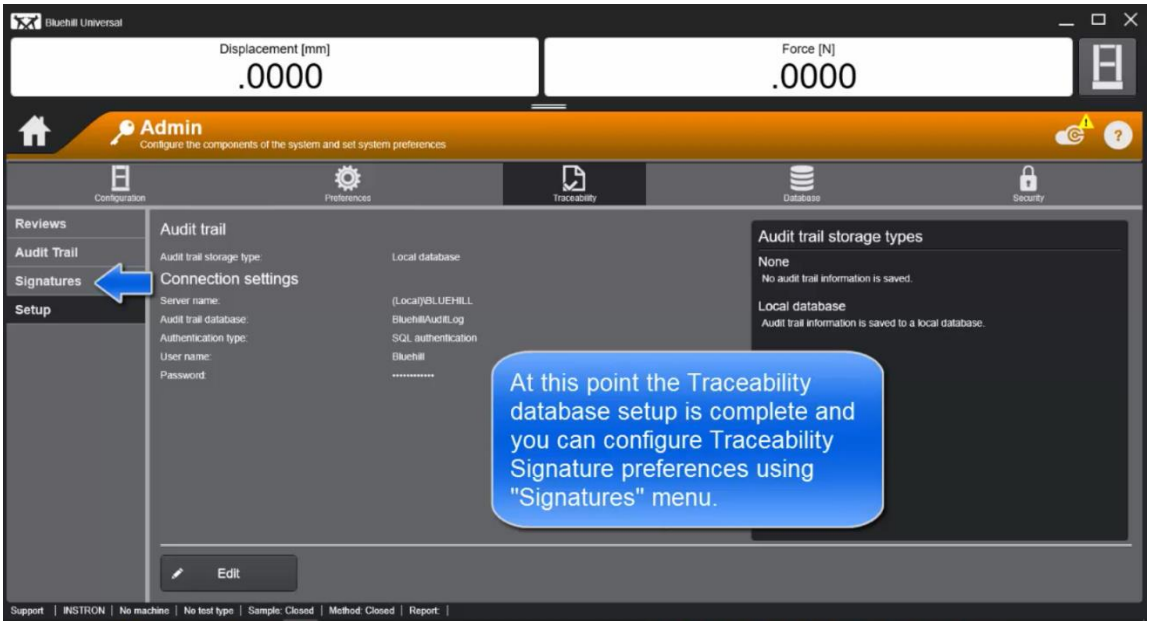
11) Click Create Database



12) Wait while database gets created

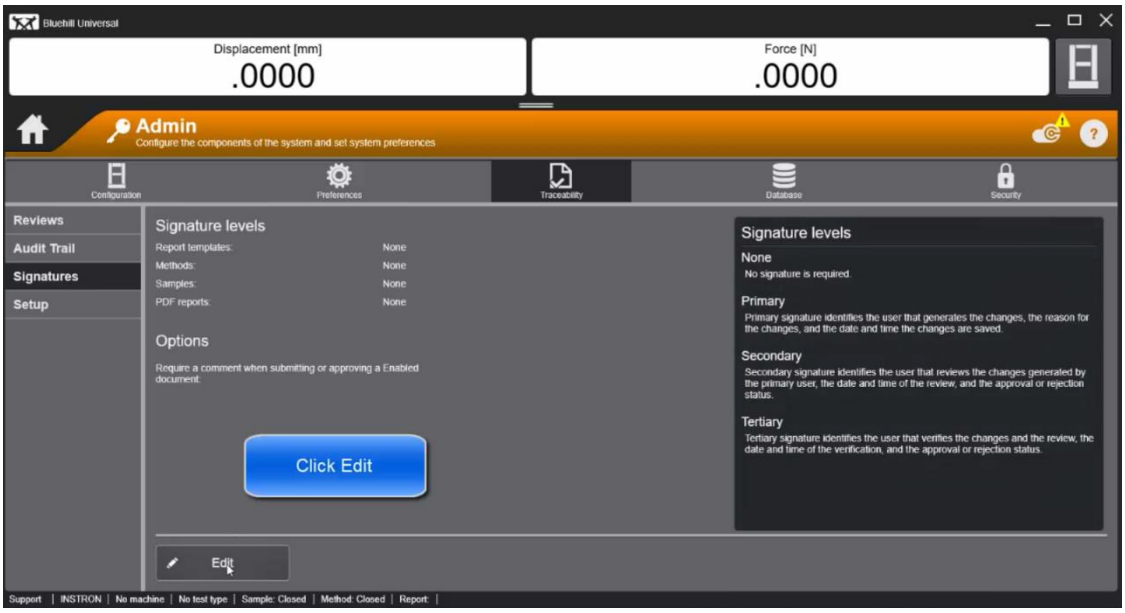


13) Traceability database is complete

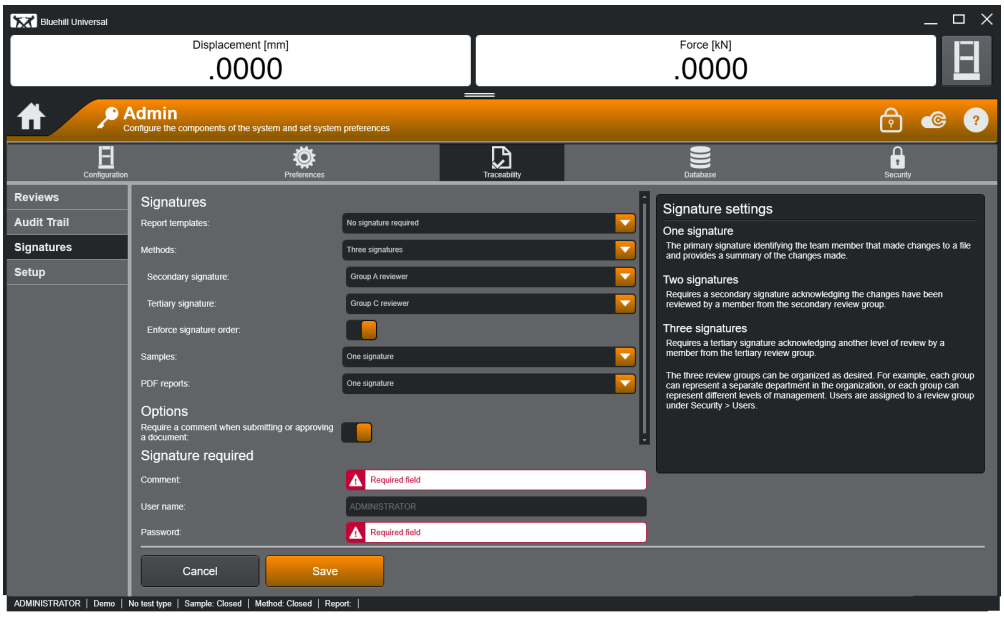


Configure Traceability Signatures

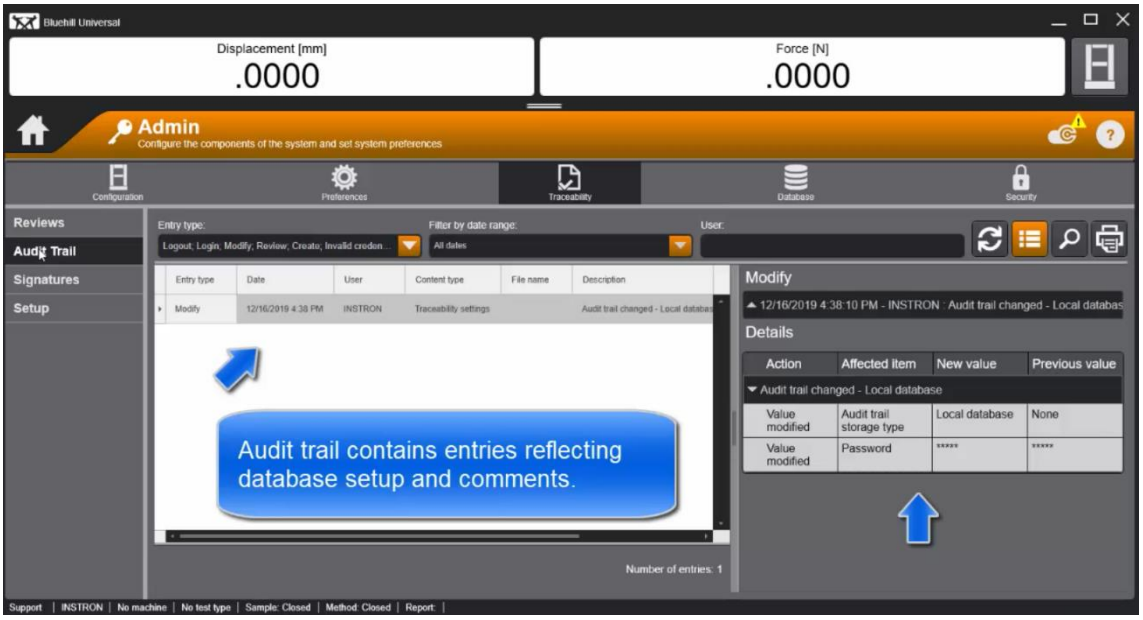
1) Click Signatures then Edit

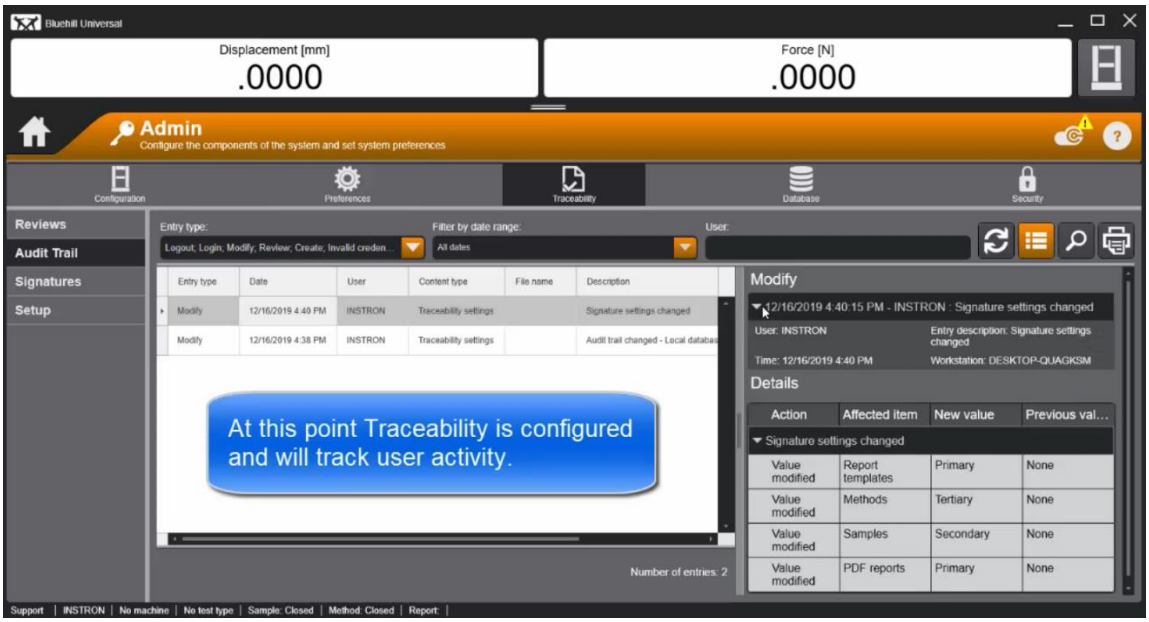


2) Discuss Electronic Signature options with customer and configure based on their preferences, then sign comment and Save.



3) At this point Traceability is configured and will track user activity.





Installation Complete

(BHU v4.28 or higher) Backup/Restore Audit Trail

The audit trail is a database located on the computer where the testing software is installed. Each testing system will have its own audit trail. This task will create a backup copy of the current audit trail. The backup copy is also saved to the local computer.

If the local audit trail database is damaged or the existing computer is replaced, the system can restore a backup version so that the audit trail history is not lost. The only information that will be lost is the information created after the last backup date.

It is recommended that a backup is created on a regular basis to minimize the history that may be lost.

Backup Database

1. Select **Admin** on the Home screen.
2. Go to **Traceability > Setup** on the Admin tab.

You must have **Configure Traceability** permission under **Security** on the Admin tab to access this screen.

3. Select the **Backup** button under **Database administration**.

The screen updates to show the backup location and the connection settings for the local database.

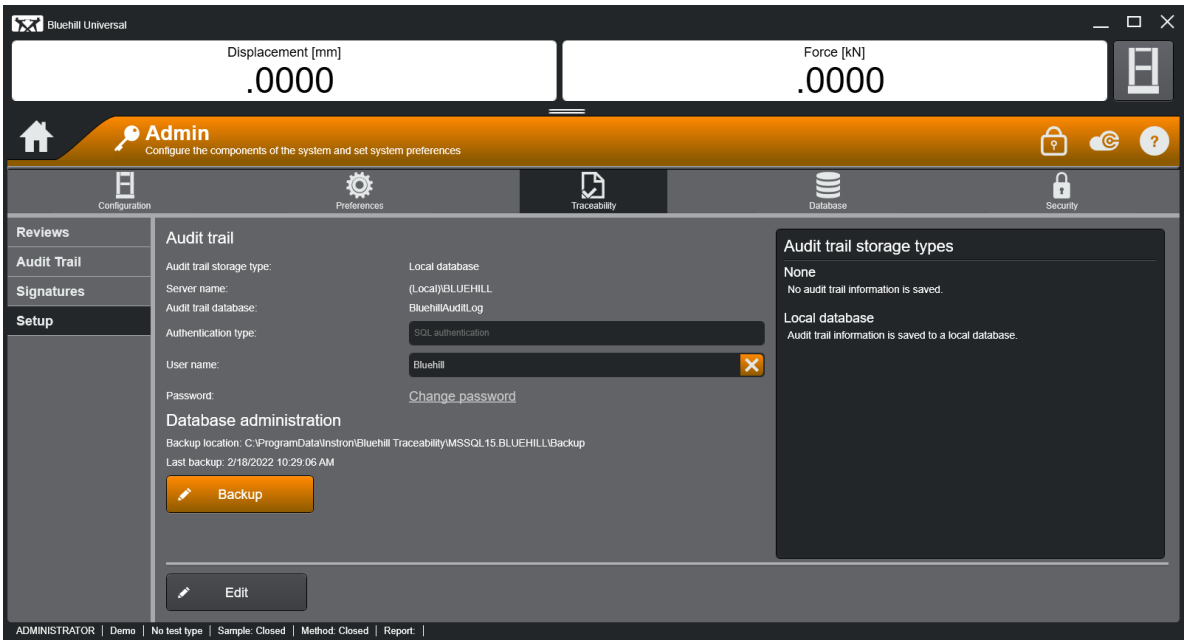
The backup location is preset by the system and cannot be changed.

4. If the **Authentication type** is **SQL authentication**, enter the SQL server system administrator credentials under **Connection settings**.

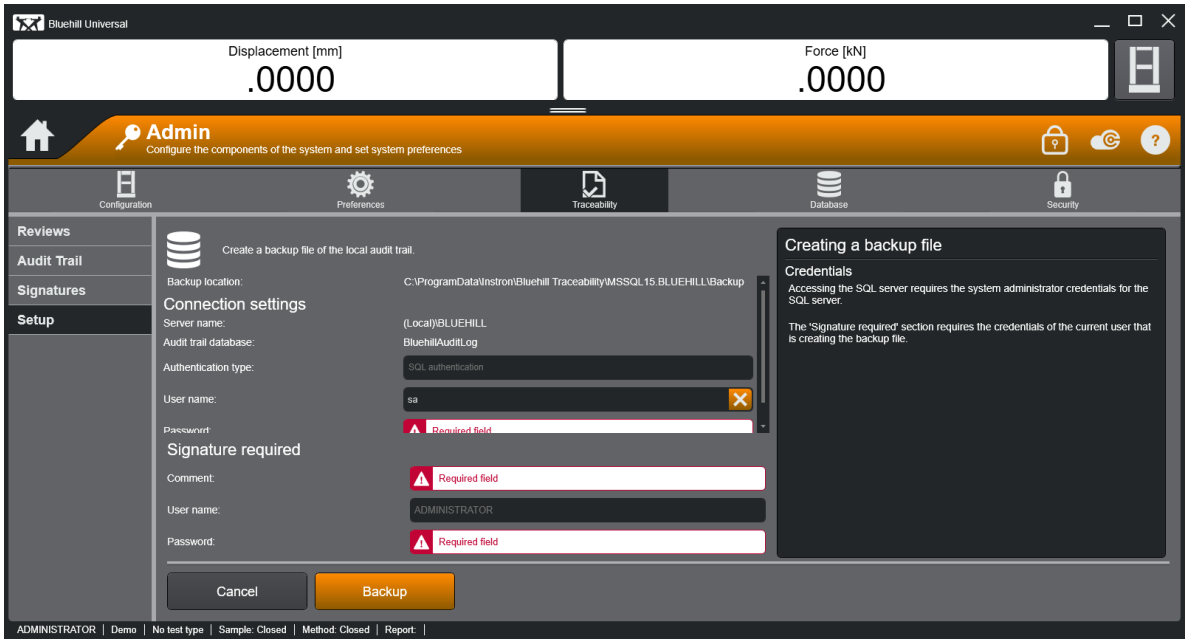
The user name is most likely **sa**. If you do not know the password, you must reset the password using Microsoft SQL Server Management Studio (SSMS).

5. Enter a comment describing the changes.
6. Enter your password for the system.
7. Select the **Backup** button.

The software returns to the **Traceability > Setup** screen and the backup information under **Database administration** is updated to reflect the most current backup.



Traceability Setup page (step 2)



Page that appears when initiating a Backup (steps 3-7)

Restore Database

The audit trail is a database located on the computer where the testing software is installed. Each testing system will have its own audit trail.

You must create a backup copy of the local audit trail. The system does not back up the system automatically. If the local audit trail database is damaged or the existing computer is replaced, the system can restore a backup version so that the audit trail history is not lost. The only information that will be lost is the information created after the last backup date.

It is recommended that a backup is created on a regular basis to minimize the history that may be lost.

1. Select **Admin** on the Home screen.

2. Go to **Traceability > Setup** on the Admin tab.

You must have **Configure Traceability** permission under **Security** on the Admin tab to access this screen.

To restore a backup version, the **Audit trail storage type** must be set to **None**. This is to protect the existing database from being overwritten. When configuring a new computer on a testing system, the new computer defaults to **None**. However, if the database is damaged, you may need to manually reset the **Audit trail storage type** in order to restore a backup version:

   a. Select the **Edit** button at the bottom of the screen.
   b. For the **Audit trail storage type**, select **None**.
   c. Save the changes and return to the **Traceability > Setup** screen.

3. Select the **Restore** button under **Database administration**.

The screen updates to show the backup location and the connection settings for the local database.

The backup location is preset by the system and cannot be changed.

4. Select  to open a file dialog.

A backup folder name is formatted as:

Bluehill_yyyymmdd_hhmmss

The file name uses the 24 hour time format.

5. Select a backup copy folder and press **Select**.
6. If the **Authentication type** is **SQL authentication**, enter the SQL server system administrator credentials under **Connection settings**.

The user name is most likely **sa**. If you do not know the password, you must reset the password using Microsoft SQL Server Management Studio (SSMS).

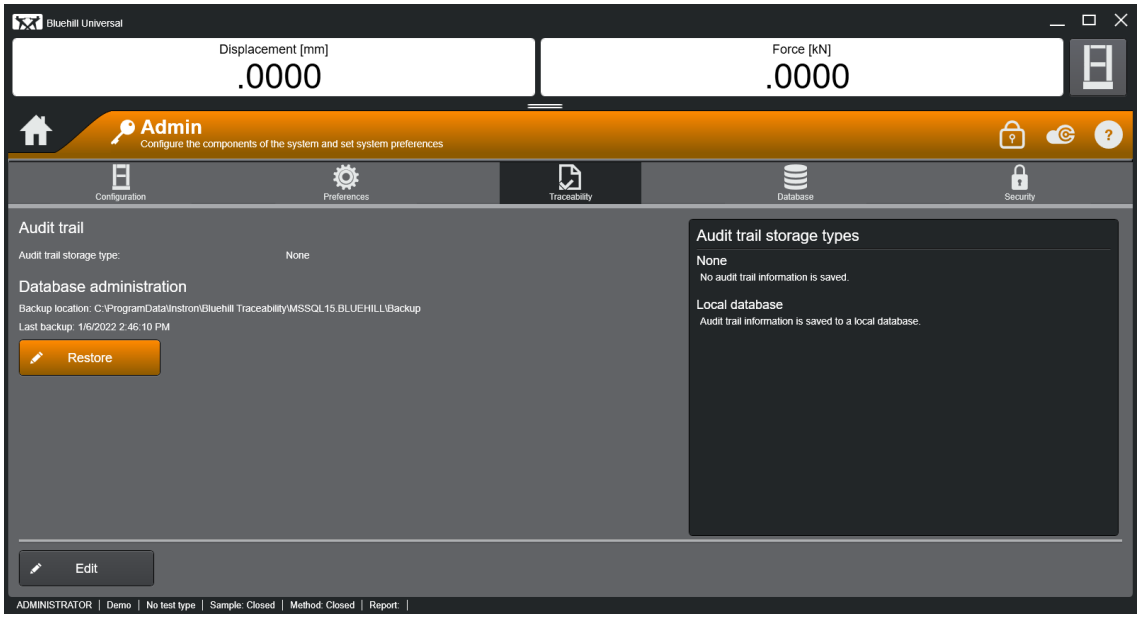
7. Enter a comment describing the changes.

8. Enter your password for the system.

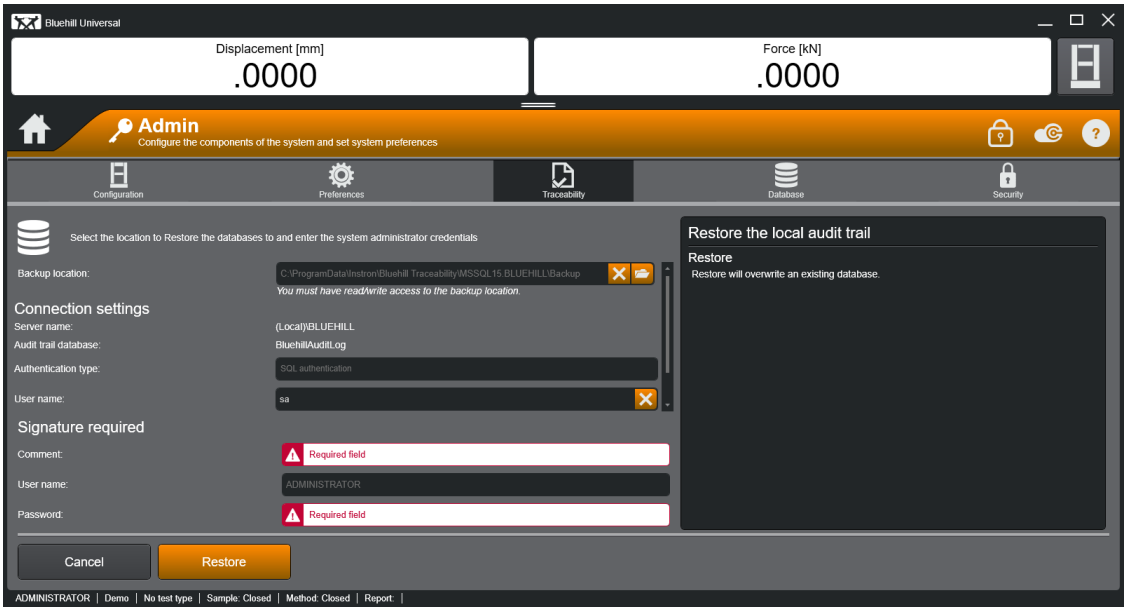
9. Select the **Restore** button.

10. If necessary, confirm that the system should overwrite the audit trail database.

The software returns to the **Traceability > Setup** screen and the backup information under **Database administration** is updated to reflect the restored backup copy.



Page that appears after completing (step 2.c)



Restore page (step 3)

(BHU v4.27 or lower) Backup/Restore Audit Trail

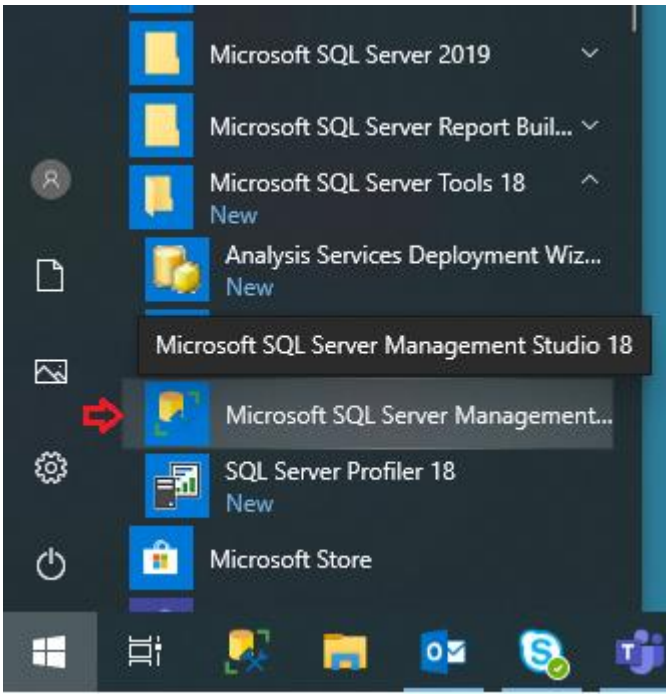
This section is only applicable for Bluehill Universal versions v4.27 and lower. If using Bluehill Universal v4.28 or higher refer to section (BHU v4.28 or higher) for Backup/Restore procedure.

The steps that follow are optional and not required for Traceability normal operation. Prior to backup/restore consult customers IT department as they may have other backup processes already in place within the customers organization.

These steps include the Traceability Audit Trail database only they do not include the customers Bluehill Method/Sample/Template files. The customer would be responsible to put in place processes that safeguard their Bluehill Method/Sample/Template files.

1) **Backup Process**

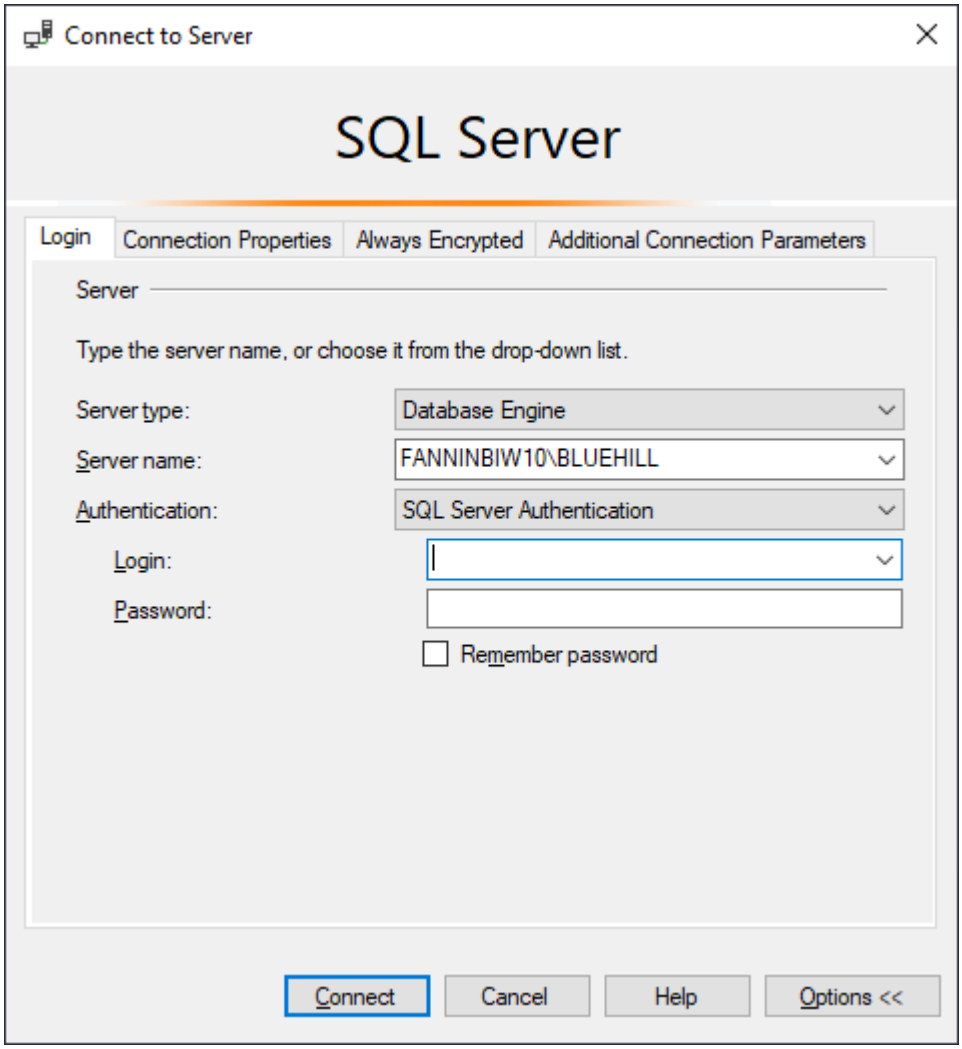
Launch SQL Server Management Studio (SSMS v18)



2) Login with the sa user account

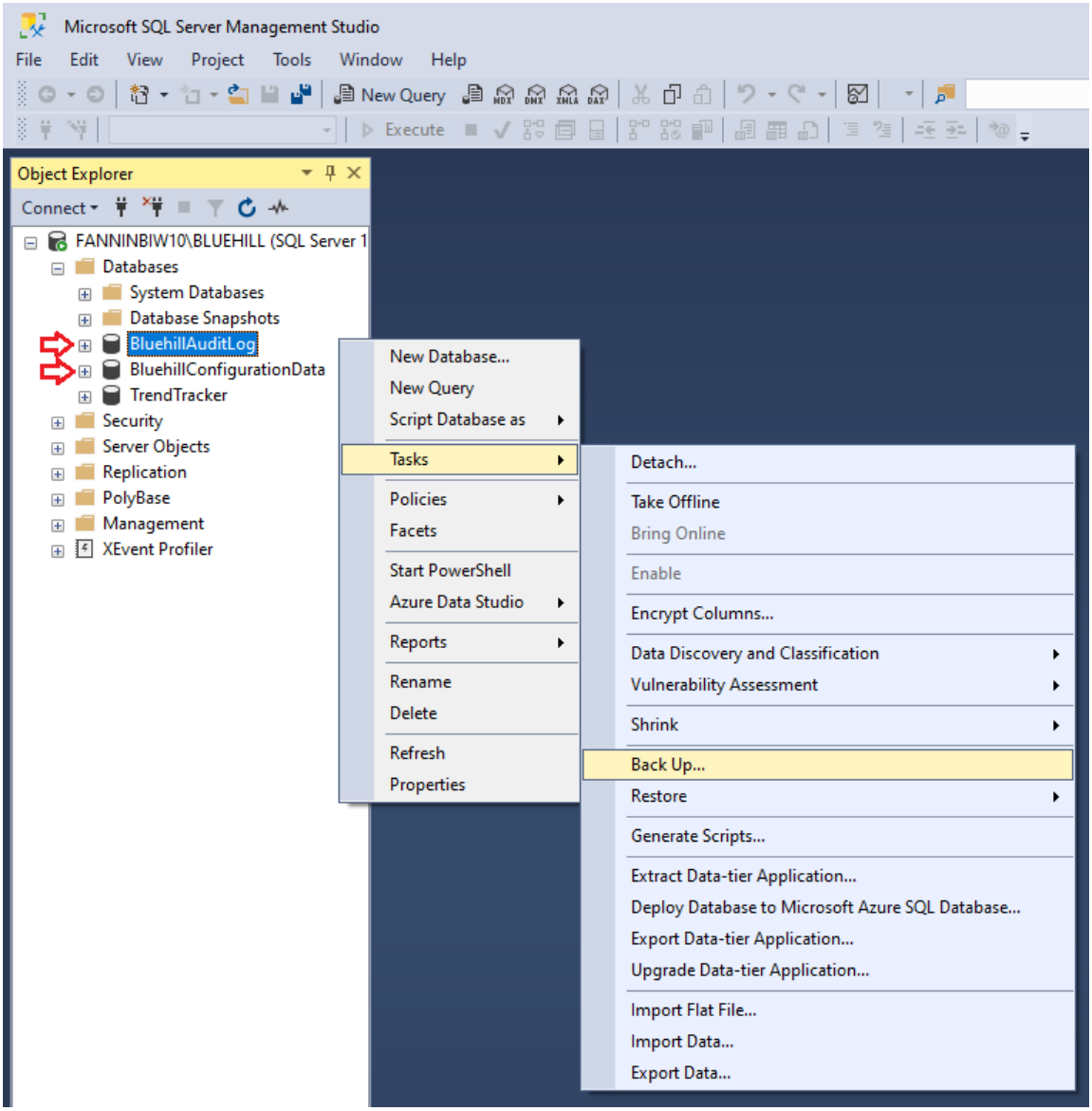
Note: If the Server Name is not automatically entered, select from list or type it in. The server name will be: <Workstation Name>\BLUEHILL

Use the same sa password that was created during the Traceability server installation.



3. Once connected, expand the Databases folder. Find your database, Right click on the database and Choose Tasks > Back Up...

   Traceability databases are “BluehillAuditLog” and “BluehillConfigurationData”.



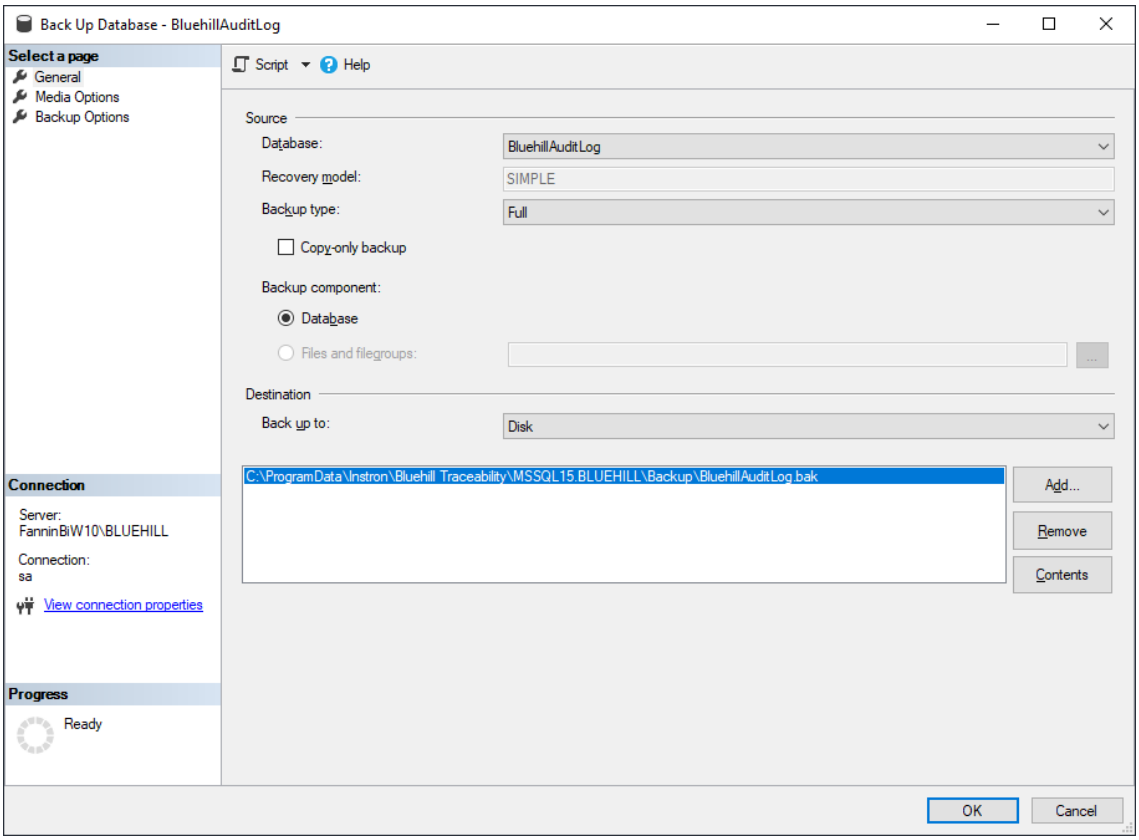
4 On the Back Up Database screen, most fields can be left at their defaults.

Verify Backup type is Full.

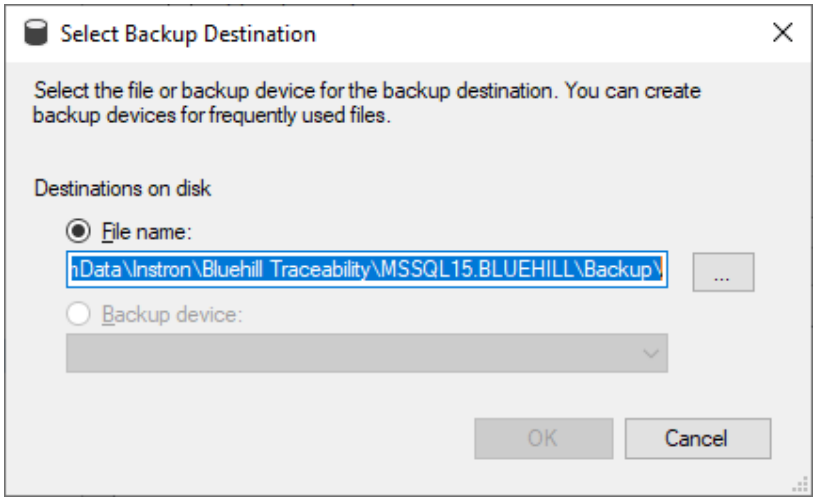
Verify Backup Component is Database.

Verify the Destination is saving the backup to disk.

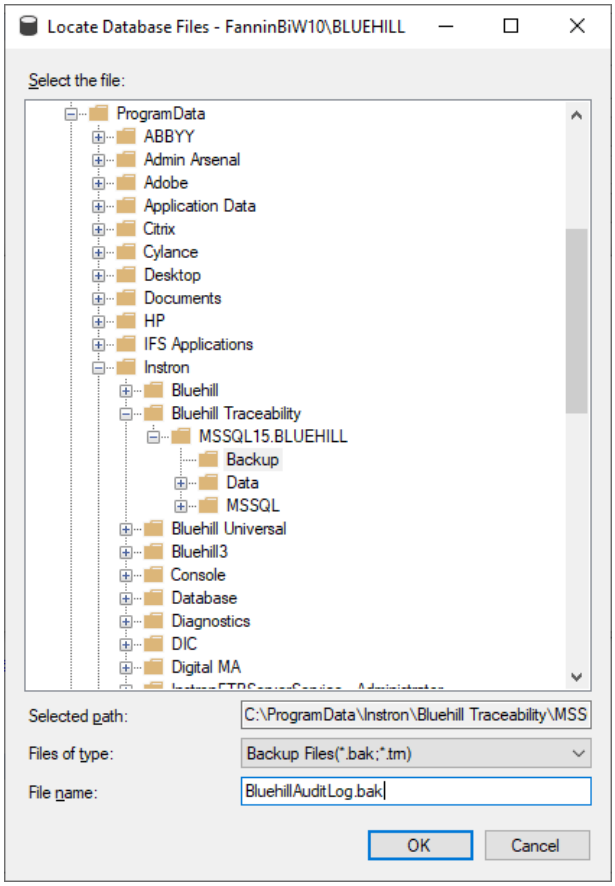
If you want to save the backup to a folder other than the default location you can remove the default
destination and add a destination to a different path.



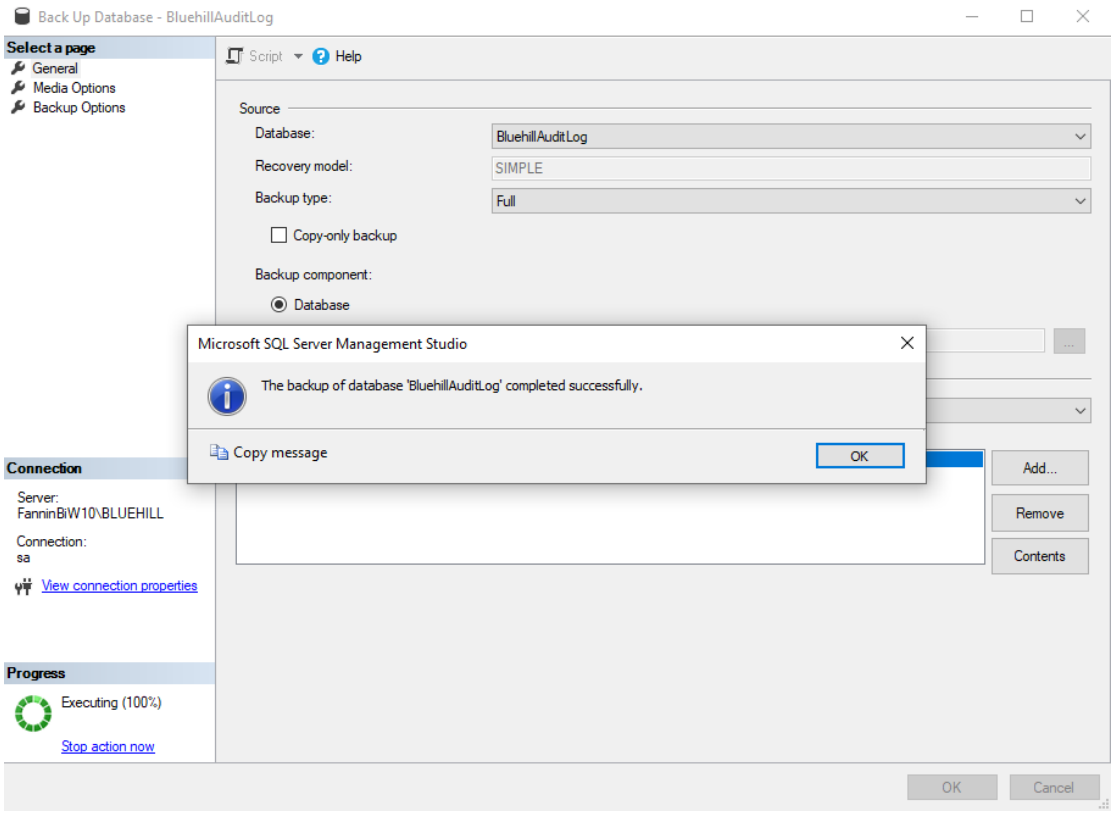
4a) (optional) To choose another destination, select the default under Destination and click the Remove button. Then click Add. With File Name selected, click the '...' button.



4b) (optional) Choose another directory as the destination and give the backup a name ending with .bak.

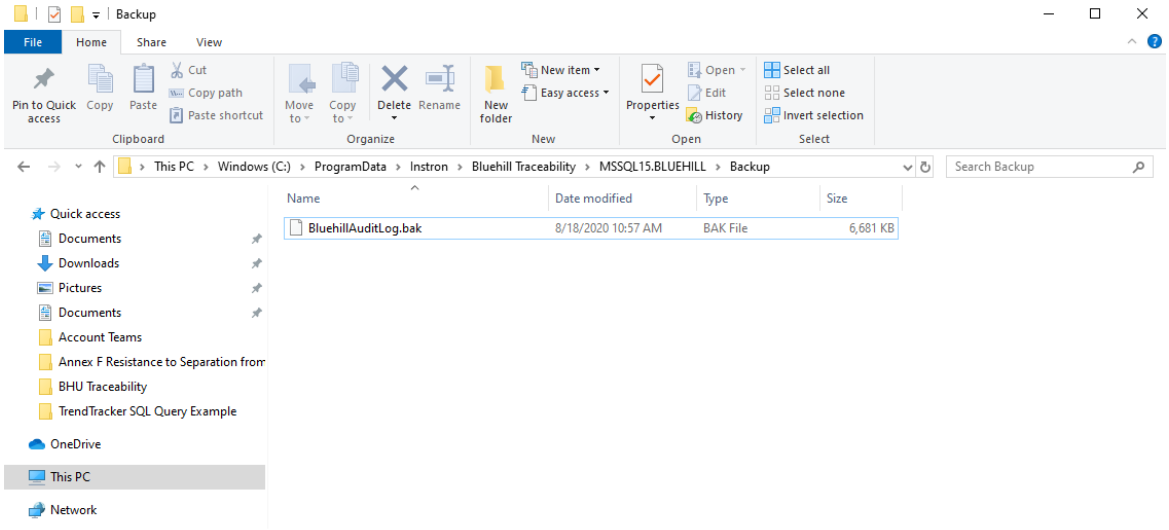


5 Once everything is set and the options have been verified, hit OK to start the backup. In the lower left corner you will see the status of the backup.



6 Once it is done, locate your backup file and store it in a secure location. This file will be required during the Restore operation so don't lose it!

Repeat these steps for each Traceability database "BluehillAuditLog" and "BluehillConfigurationData".

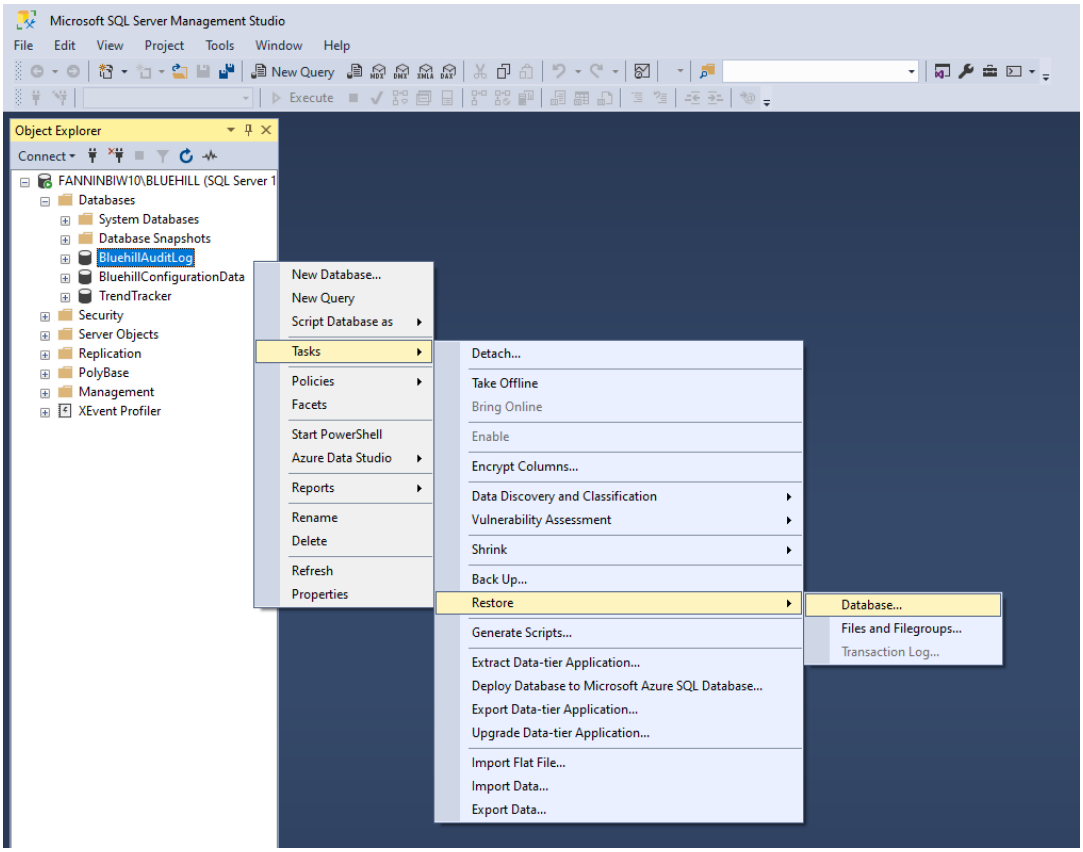


This ends the Backup process

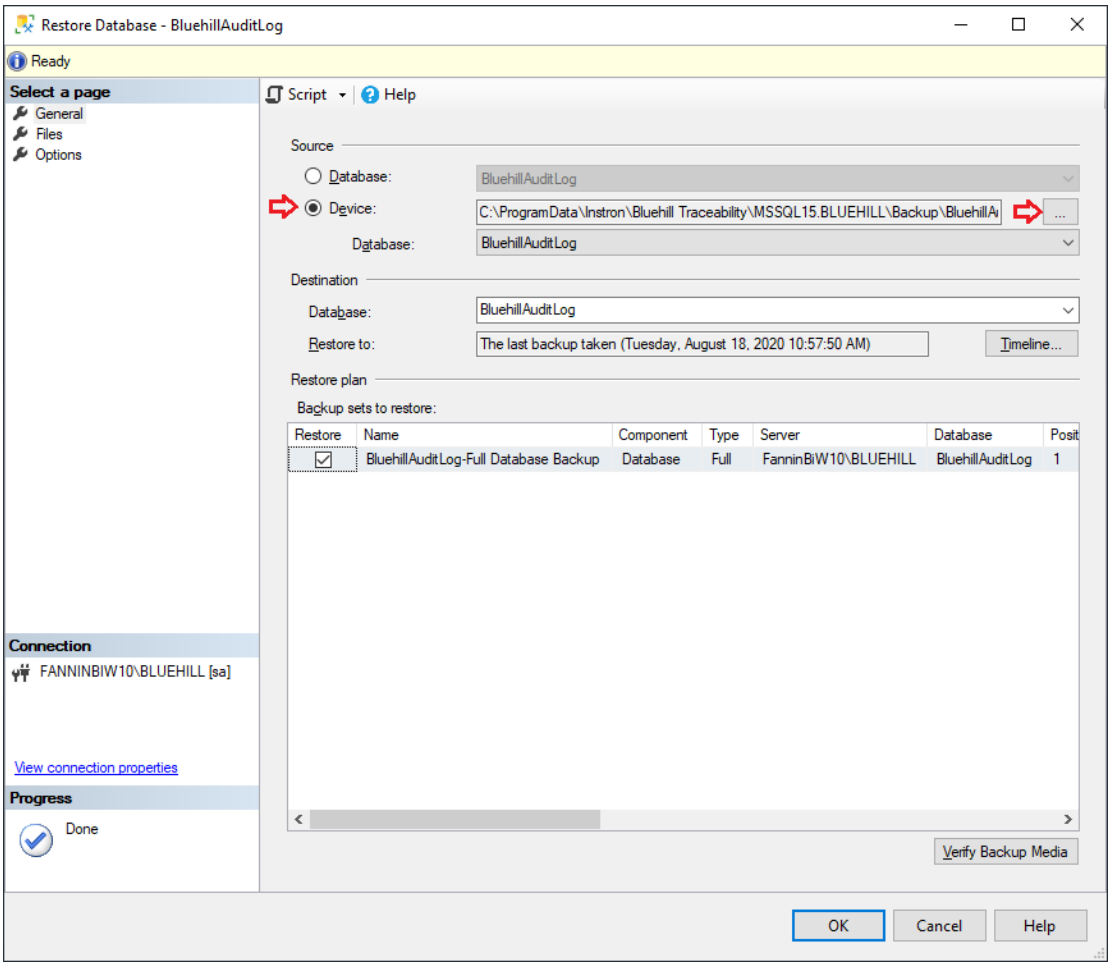
1) **Restore Process**

To begin the restoration process, launch SQL Server Management Studio and login with the 'sa' account. See steps 1 and 2 from Backup process.

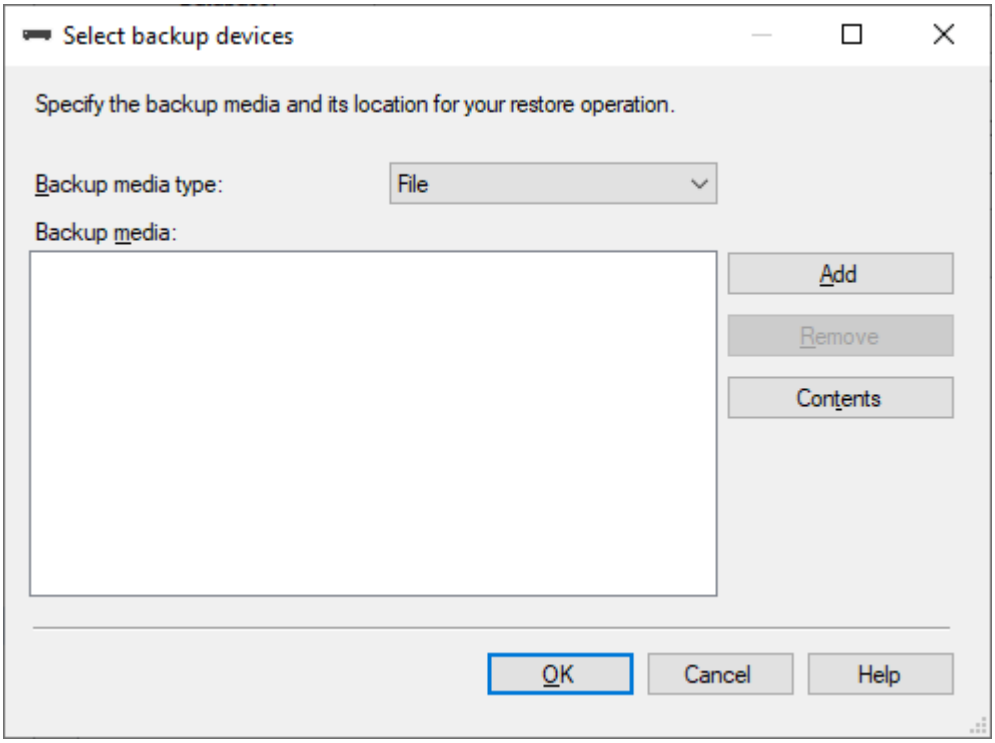
2) Locate the database to be restored, right click on it, choose Tasks > Restore > Database.



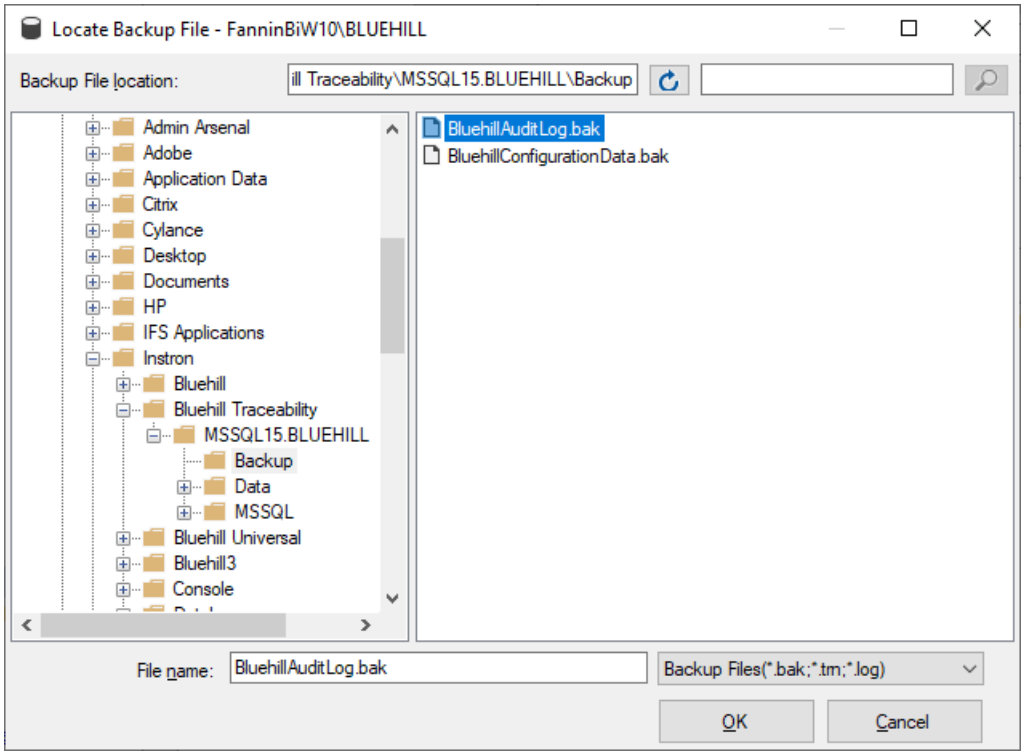
3) The Restore Database window will display. Under Source for restore, select From device and then click the '...' button to the right.

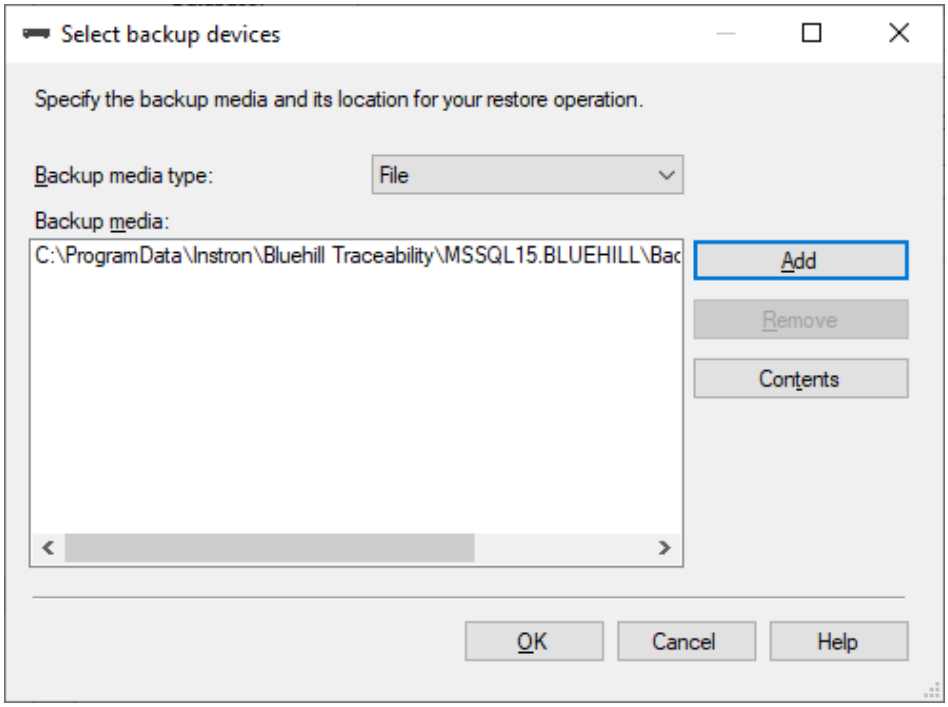


4) Select File as the Backup Media and then click the Add button

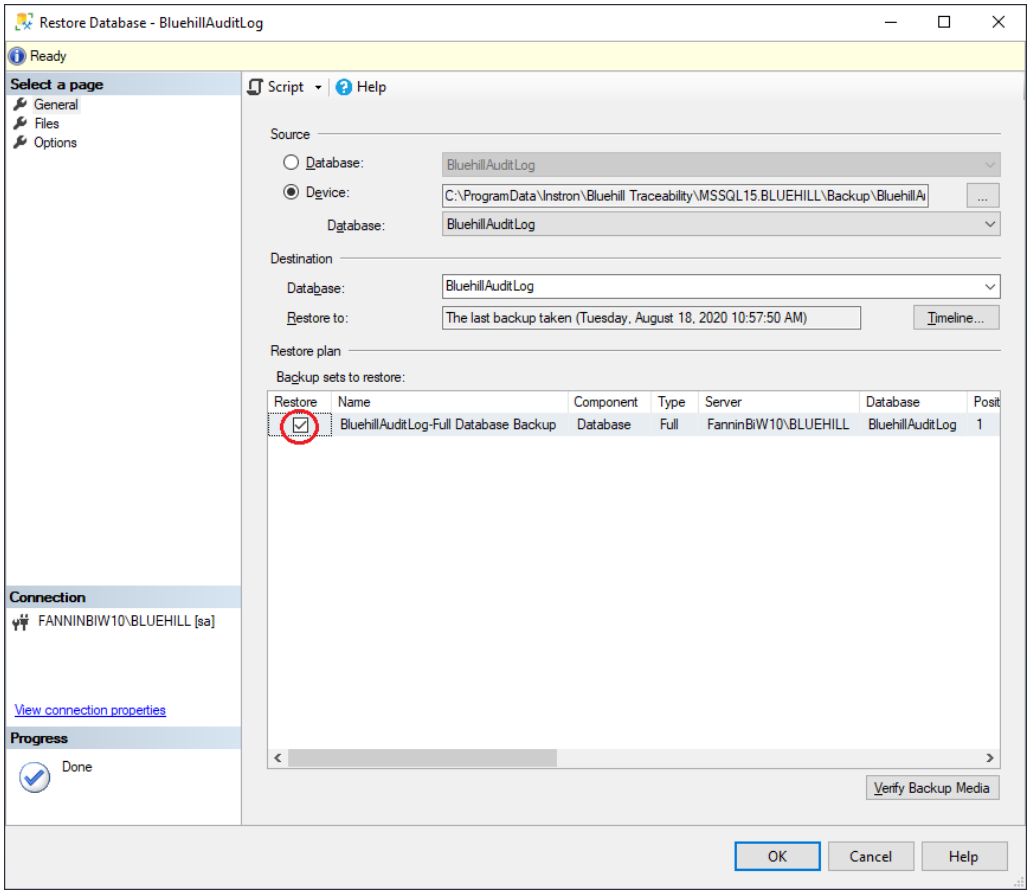


5) **Locate your backup file and select it. Click OK until you're back to the Restore Database screen.**

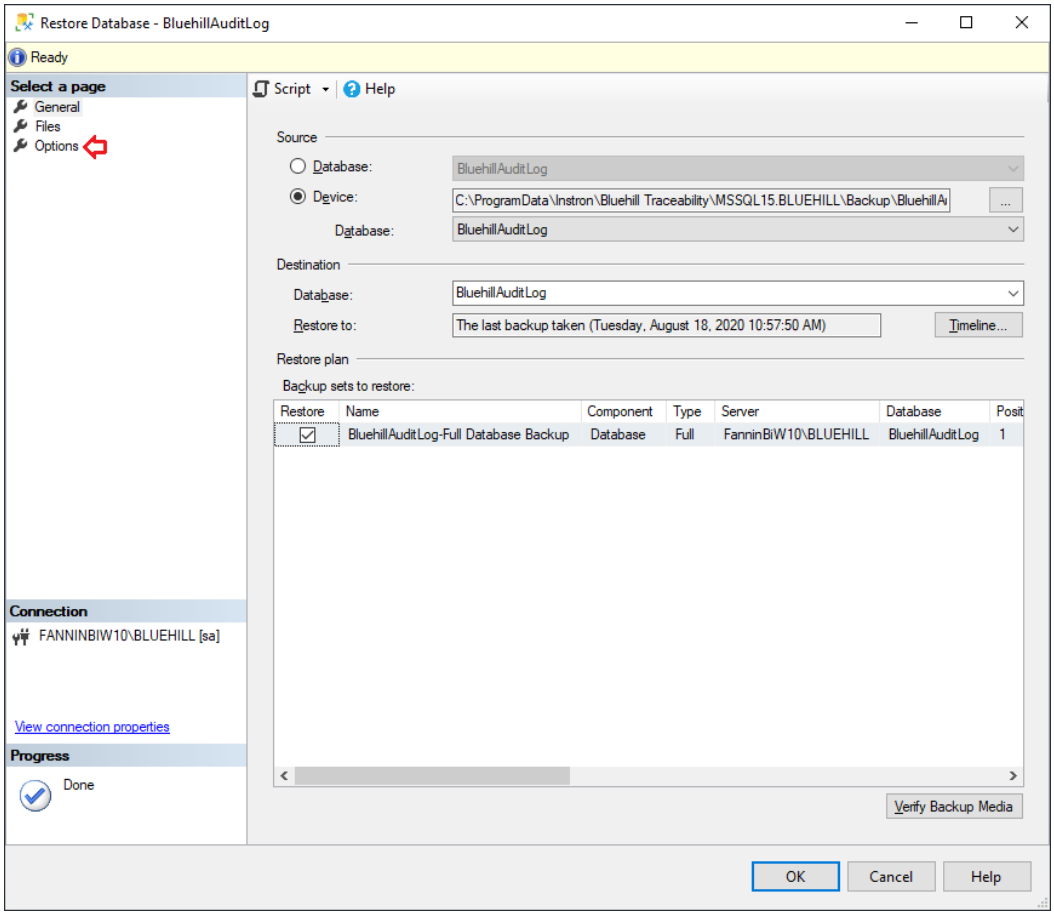




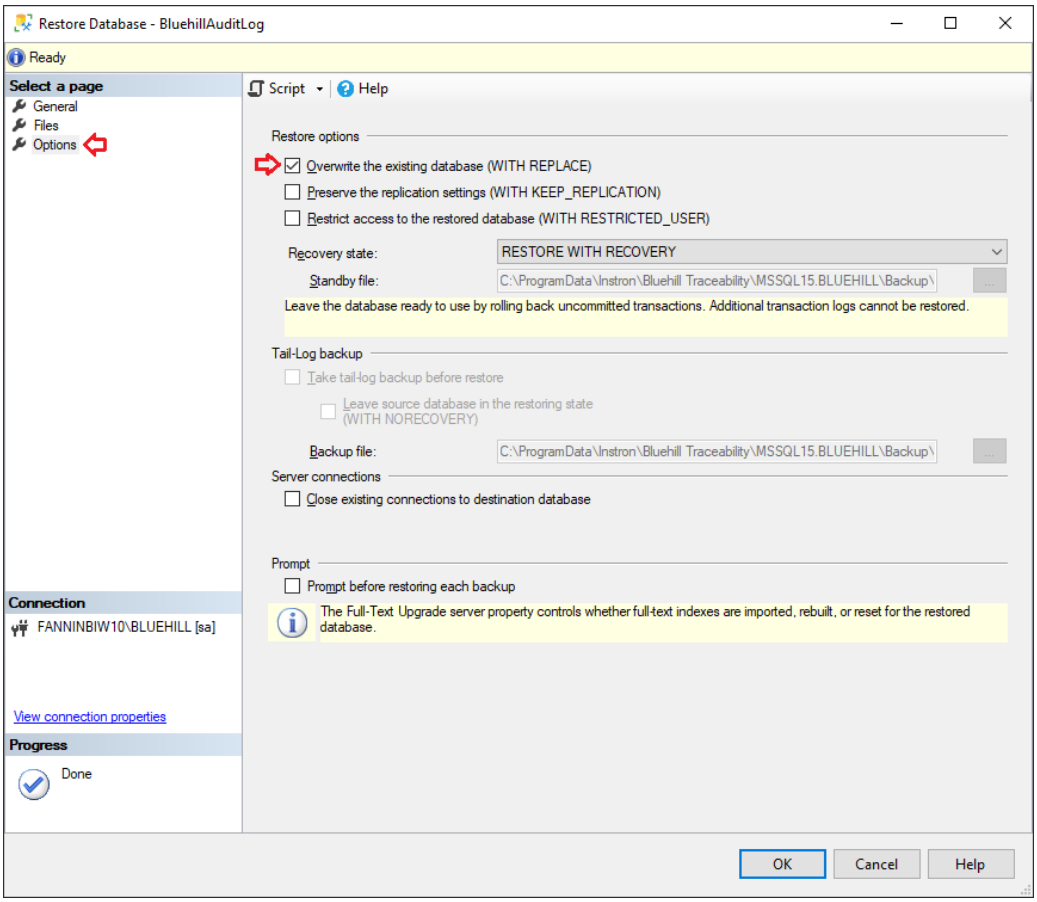
6) Under Backup sets to restore, make sure the checkbox under Restore is checked.



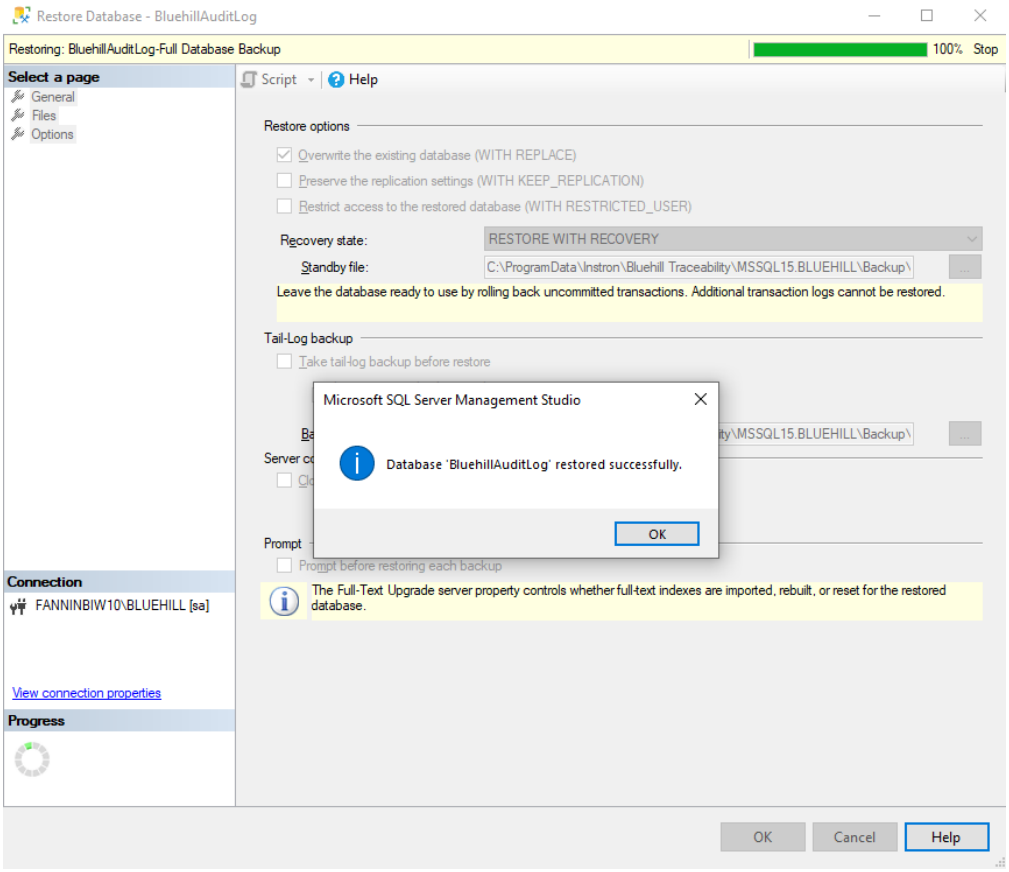
7) **Next click on the Options link on the left-hand side.**



8) Check the option that states ‘Overwrite the existing database (WITH REPLACE)’ All other options should be left at their defaults.



9) Click OK and the Restore process will execute, Progress can be seen in the lower left corner.



The Restore process is now complete

Chapter 7
Bluehill Central

Bluehill Central Overview

Bluehill Central has two components:

- Bluehill Central is an application that provides access to the Bluehill Server from testing systems and other workstations on your company network. It is a laboratory management application that creates a network of testing systems to share information from a central server. Bluehill Central streamlines laboratory management in that changes are implemented centrally and made available to all connected testing systems and Bluehill Central workstations.

- Bluehill Server is an external server that manages the various databases where the system files (method and sample files), testing data and audit trail history are stored. Information is organized by teams. You must be a member of the team to access the information saved for that team. Your security permissions for a team may further limit the level of access to the team's information. The team settings are managed from the Bluehill Central application.

Teams

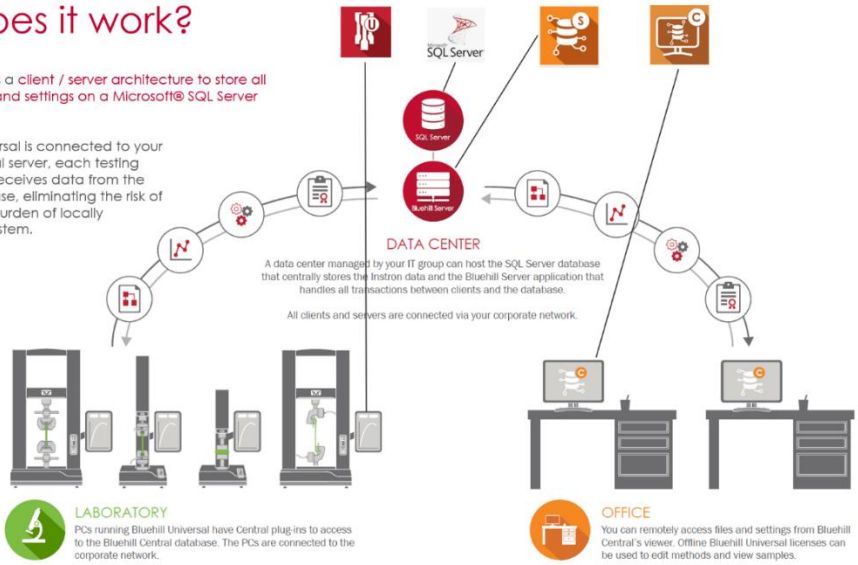
A team is a group of users that share access to specific software modules and common files, such as method and sample files. Data from testing systems is saved to a database on a central server and is available to team members, as defined by the team's security permissions.

For the initial startup of the Bluehill Central application, you must create a team to initiate the Bluehill Server and begin saving content to the server.

How does it work?

Bluehill Central uses a client / server architecture to store all shared data, files, and settings on a Microsoft® SQL Server database.

When Bluehill Universal is connected to your lab's Bluehill Central server, each testing system sends and receives data from the centralized database, eliminating the risk of variation and the burden of locally managing each system.



DATA CENTER

A data center managed by your IT group can host the SQL Server database that centrally stores the Instron data and the Bluehill Server application that handles all transactions between clients and the database.

All clients and servers are connected via your corporate network.

LABORATORY

PCs running Bluehill Universal have Central plug-ins to access to the Bluehill Central database. The PCs are connected to the corporate network.

OFFICE

You can remotely access files and settings from Bluehill Central's viewer. Offline Bluehill Universal licenses can be used to edit methods and view samples.

INSTRON

What is a Team?

Bluehill Central allows groups of users to be organized into teams who share common files and settings.

MEMBERS
Individual users with personalized permissions.

TESTING SYSTEMS
Instron frames in your lab connected to Bluehill Central.

FILES
Bluehill methods, report templates, PDF reports, or other Instron related files.

AUDIT TRAIL
Record of actions performed by team members.

SETTINGS
Security type, file approvals, and other team-level settings.

INSTRON

Value-add

PROCESS FLEXIBILTY
Each team can be configured with their own team members, permissions, file systems, and signature requirements to allow multiple processes to be effortlessly supported.

EASE OF COMPLIANCE
Teams can specify the number of signatures required and which review groups are responsible for performing a review for each type of Bluehill file. The audit trail displays entries from the active team (i.e. the team of the current user) to present relevant data only.

REDUCE COST
Integrated support of multiple workflows makes managing Instron systems easier, quicker, and reduces risk of error – all ways to lower the overall cost of your lab.

Bluehill Central Home Screen

The Home screen provides access to the following modules of the Bluehill Central application:

- **Lab Management**
    - The Lab management screen provides access to the database on the Bluehill® Server where files are saved. Files are organized by team. You can only view files that are saved to the team you used to access Bluehill Central. The folder structure for the team displays on the left. Select a folder to display its contents in the center component. Select a sub-folder or file in the center component to preview its details in the right component.
- **Traceability**
    - Traceability is an optional feature that is only available if the Traceability module is enabled for the team. Traceability tracks activity on all systems connected to the Bluehill® Server. The Traceability feature has two components:
        - an audit trail database that maintains a history documenting the changes, actions, and reviews done by the team.
        - signature requirements to document who has performed an action or changed a file. Signature requirements can also be used as a review process to ensure any changes to a file are reviewed and validated.
- **TrendTracker**
    - TrendTracker is an optional feature that is only available if the TrendTracker module is enabled. TrendTracker provides the ability to store specimen information from multiple Bluehill samples in a database, thus allowing you to perform statistical analysis across specimens from multiple samples with one search.
- **Settings**
    - Use the Settings module to manage the following:
        - Team information
        - Bluehill Central
        - Edit team settings
- **System Administration**
    - System administration provides access to the Bluehill® Server to view all teams currently on the server. A member of a team must have “Configure the team” permission to view this section of the application. In Bluehill security, the Team administrator has the Configure the team permission.

Access to these modules is dependent on which modules are configured for your team and your permissions provided within the team. To view a summary of your permissions, sign into Bluehill Central with your team credentials. On the Home screen, select your user name in the lower left corner.

The software can be locked at anytime using the button.

While the screen lock is active, a dialog displays advising that the software is locked. You can customize the message in this dialog to provide more detailed information by using the Edit message button. Select Unlock to enter your credentials and open the software.

Bluehill Central home screen

Connection to Bluehill Server

The Bluehill Central application must connect to the Bluehill Server in order to communicate with the server and transfer information.

Connecting to the server requires identifying the server name and its port number. Obtain this information from your IT department.

Server name identifies the computer or IP address that hosts the Bluehill Server.

Port is an integer value representing an endpoint for the communication protocol between this software and the Bluehill Server. The default port is 50051. But your network administrator may reassign this number.

Press Next to connect to the server and then create a team to initialize Bluehill Central.

How to Create First Team Using Bluehill® Security

The person that will be the initial team administrator must create the team.

1. Enter the key code for Bluehill Central.
2. Enter the Server name and Port for Bluehill Server.
3. Select Next.
4. Enter the name of the team.
5. Select Bluehill security as the type of security.
   The team will use Bluehill security to manage access to the team's information that is stored on the server.
6. Enable the modules for the team.
7. Select Next.
8. Select a time interval for password expiration.
   All members of the team must change their password when the time interval has expired.
9. In the Bluehill Central locks when inactivity exceeds field, specify the time of inactivity that must elapse before the system locks the application.
10. Select Next.
11. Create a user profile for the Team administrator.
    The Team administrator must use this user name and password to access this team.
12. Select Next.
13. Select the security permissions granted to the Team administrator within each module.
    If the Traceability module is enabled, it is recommended that the Team administrator also have the Configure Traceability permission.
14. Select a User type for Bluehill Universal and associated permissions.
15. Select Next.
16. Build the team by adding existing users or creating new user profiles.
    For each member added to this team, select a User type for Bluehill Central and Bluehill Universal. Enable the security permissions granted to each team member in each module.
17. Select Next.
18. Under Traceability, select the signature requirements for each type of file.
19. As an option, enable Require a comment when submitting or approving a document.
    This option requires each user to enter a comment when a signature is required. The comment is saved to the audit trail along with details regarding the action performed by the user.
20. Select Next.
21. Review the selections made to configure the team.
22. Select Save to save the team to Bluehill Server.

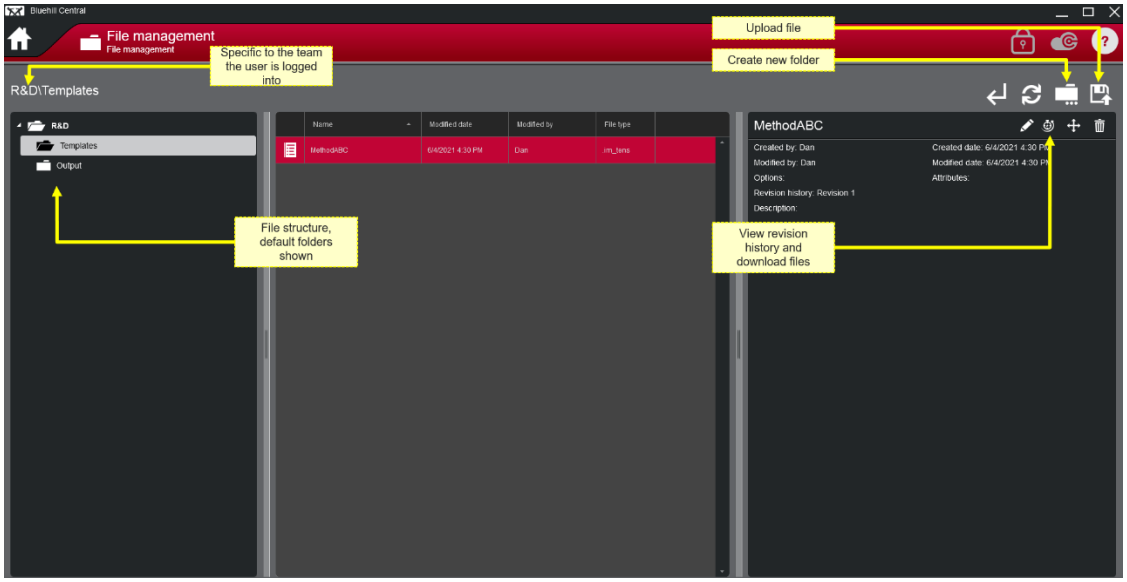
How to Create First Team Using Active Directory

1. Enter the key code for Bluehill Central.
2. Enter the Server name and Port for Bluehill Server.
3. Select Next.
4. Enter the name of the team.
5. Select Active Directory as the type of security.
   The team will use Active Directory to manage access to the team's information that is stored on the server.
6. Enable the modules for the team.
7. Select Next.
8. Enter your network credentials.
9. Select Next.
10. In the Bluehill Central locks when inactivity exceeds field, specify the time of inactivity that must elapse before the system locks the application.
11. Select Next.
12. For each module, select an Active Directory group for each permission.
    All team members that are in an assigned group will have access to that permission.
13. Select Next.
14. Select Add to find an existing user profile and add the user to the team.
15. Select Next.
16. Under Traceability, select the signature requirements for each type of file.
17. As an option, enable Require a comment when submitting or approving a document.
    This option requires each user to enter a comment when a signature is required. The comment is saved to the audit trail along with details regarding the action performed by the user.
18. Select Next.
19. Review the selections made to configure the team.
20. Select Save to save the team to Bluehill Server.

Lab Management Module

The Lab management screen provides access to the database on the Bluehill® Server where files are saved. Files are organized by team. You can only view files that are saved to the team you used to access Bluehill Central.

The folder structure for the team displays on the left. Select a folder to display its contents in the center component. Select a sub-folder or file in the center component to preview its details in the right component. You must have the appropriate permissions to manage the folders or files. The icons that display are based on the permissions granted to you for this team.



Lab Management

From this screen you can manage the files for the team as follows:

- Create a new folder
- Upload files to the team database
- Download a file to a local computer
- Edit the attributes for a file
- View the revision history of a file
- Move a file within the team database
- Remove a file from the team database

Traceability Module

Traceability is an optional feature that is only available if the Traceability module is enabled for the team.

Traceability tracks activity on all systems connected to the Bluehill® Server.

The Traceability feature has two components:

- An audit trail database that maintains a history documenting the changes, actions, and reviews done by the team.
- Signature requirements to document who has performed an action or changed a file. Signature requirements can also be used as a review process to ensure any changes to a file are reviewed and validated.

Traceability works in conjunction with the system security to provide the following advantages:

- User access is limited by security permissions.
- Track changes made to the method, sample, report template and PDF files by requiring the individual to acknowledge the changes with an electronic signature.
- Prevent the use of method, sample, and report templates until the changes have been reviewed and accepted by a secondary reviewer, and tertiary reviewer if required. Reviewers can accept or reject the changes.
- Maintain a history of changes, actions, and reviews done in the system, which is saved to a database.

Traceability Reviews

The **Traceability > Reviews** screen is where pending reviews for the team are maintained. Any revisions that require a review are managed here.

The review requirements are defined by the signature settings specified on the Team > Traceability screen in the Settings module of Bluehill® Central.

The table on the left is a summary of all the pending revisions awaiting review. The information on the right provides the details regarding the highlighted row in the table.

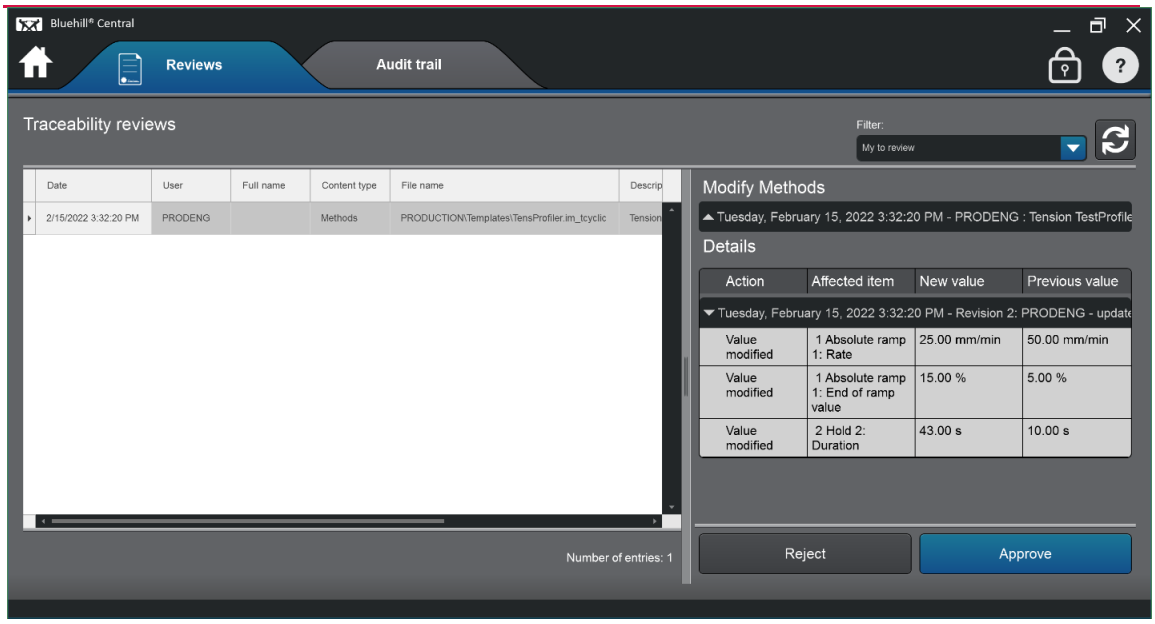
The table can be filtered using the following options:

Filter	Description
My to review	The table shows only the pending reviews that are assigned to your review group. For example, if you are included in the review group assigned to Secondary signature under methods, you will only see method revisions that are pending a secondary signature. An individual can only sign a file once. If you are the primary signature, you cannot also sign as the secondary or tertiary reviewer. If you are in the secondary or tertiary review group, you will not see any pending reviews for which you previously signed as the primary signature.
My reviewed	The table shows only the reviews that you have completed and either accepted or rejected.
All to review	The table shows all revisions that are pending either a secondary review or a tertiary review.
My changes: pending review	The table shows only the revisions that you have submitted for review and are still pending.

All team members have access to the Traceability module to view the status of pending revisions. However, a member must be included in the appropriate review group to approve or reject pending revisions. To view a summary of your permissions, including your Traceability review group assignment, return to the Home screen and select your user name in the lower left corner.

When the review is accepted or rejected, the system sends the review information to the audit trail database. If the Traceability notifications feature is enabled for your team, the system will also send an email to the appropriate team members advising of the change in status.

After all reviews are approved, the file is available for testing.



Traceability Reviews

Audit Trail

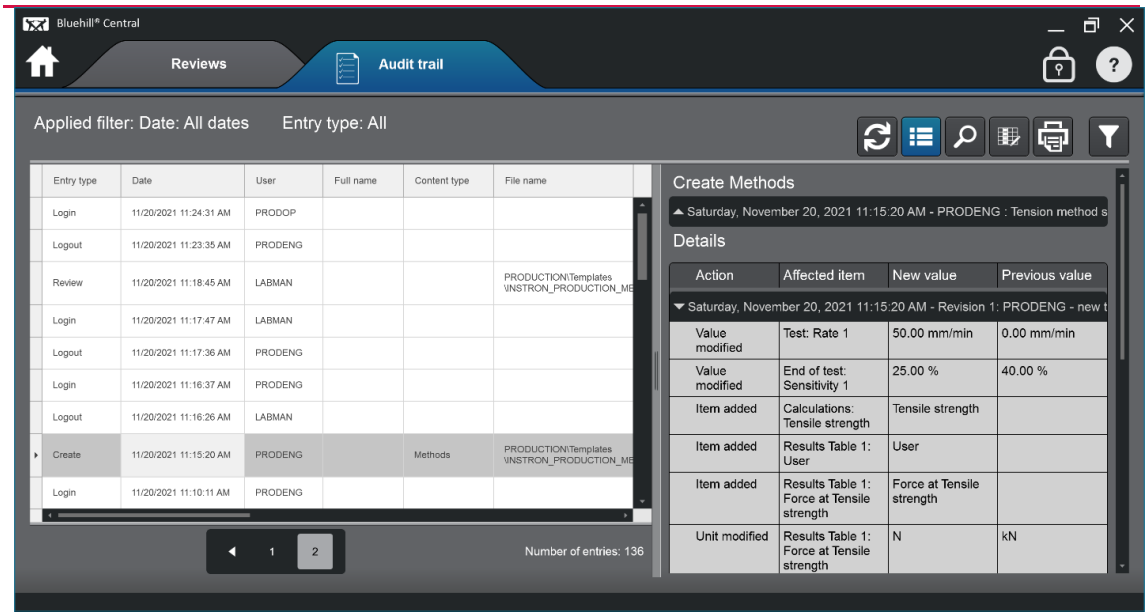
The **Traceability > Audit Trail** screen provides access to the audit trail database. All team members have access to this screen and can search the database using filters.

Traceability creates an audit trail that provides a chronological record of activity made to your test methods and sample files. Most activities completed in the software are saved to an audit trail database with a date and time stamp. Documenting the sequence of activities ensures that your testing processes remain consistent and reliable over time, thus maintaining a high level of data integrity.

Use the following controls to customize the table of entries:

	Button name	Function
	Refresh	Refresh the table of entries.
	Show entry	Show or hide the section that displays the details of the entry highlighted in the table.
	Find	Searches the audit trail database to find a specific word or phrase. A Find field displays above the table of database entries. The software highlights the word or phrase everywhere it is found in the table.
	Show/hide columns	Customizes the table to show or hide columns as desired. Your selections will be saved for this team. When you visit the audit trail for this team, the table will display the same way you last customized it.
	Print	Prints the current page of entries. One page can have up to 100 entries. If there are multiple pages in the table, you must print each page to print all the entries.

	Button name	Function
	Filter	Filter the audit trail database to show only the entries that satisfy the filter selections. Filters include: **Date**: shows only the database entries that were completed within the specified date range. **Entry type**: select any combination of actions. The table displays all database entries classified as the selected entry type. **User**: enter a name (user name, first name or last name) to show only the database entries that were completed by that user. Entering a name in the User field will filter the database based on either the User column or Full name column. **Application**: shows only the database entries that include the specified application used when the activity occurred (e.g. Bluehill Universal or Bluehill Central). **File name**: shows only the database entries that include the specified text in the File name column. **System ID**: shows only the database entries that include the specified text in the System ID column. The system ID identifies the serial number of the testing frame used when the activity occurred. **Device name**: shows only the database entries that include the specified text identifying the computer, or other device, used when the activity occurred (e.g. an individual's computer or a computer connected to a testing system in the lab). **Comment**: shows only the database entries that include the specified text in the Comment column.



Traceability Audit Trail

Displaying Dates and Times

Dates and times are used in several different ways. The following table describes the various types of date/time values and how the software displays these values with respect to world time zones.

The format for most date/time values is based on the Microsoft Windows regional settings.

Type of date/time value	Display	Examples
Saved	The software saves the date/time values and then converts the values to the time zone of the software responsible for restoring and displaying the values.	Revision history, audit log entries. An operator saves a sample in New York on 15 May at 1 pm. From London, the sample displays the saved date information as 15 May at 6 pm. From Beijing, the sample displays the saved date information as 16 May at 1 am.
Fixed	The software saves the date/time value in the time zone of the software responsible for the action. Once the values are saved, they are never changed to another time zone.	Traceability signatures. The manager reviews and approves a sample on 15 May at 1 pm in New York. From London, the audit trail displays the approval as 15 May at 1 pm.

Traceability Signature Requirements

The Traceability screen is located on the Team tab in the Settings module. It displays the signature requirements for the currently active team. A member of the team with Configure Traceability permission can edit these settings.

When signatures are required, the system requests the user name and password when any changes are saved. This information is recorded and saved to the audit trail database to maintain a history of changes, actions, and reviews done in the system.

Signature options include:

Signature option	Description
No signature required	The system does not require a signature when a file is changed and no further review is required.
One signature	Requires the signature of the person that changed the file. This is the primary signature and acknowledges that the person editing the file has completed their work. The signature is required upon saving the file. Primary signatures provide a summary of the changes made, the date and time the changes are saved, and identifies the person that saved the file. For the PDF report, the signature identifies the individual that finished the sample and generated the PDF report.
Two signatures	Requires a secondary signature that acknowledges the changes have been reviewed by an individual from the review group assigned to Secondary signature. Secondary signatures provide a date and time when the changes are approved and identifies the reviewer.
Three signatures	Requires a tertiary signature that acknowledges another level of review by an individual from the review group assigned to Tertiary signature. Tertiary signatures provide a date and time when the changes are approved and identifies the reviewer. Enable Enforce signature order to require the secondary signature must occur before the tertiary signature.

The files that may require a signature approval include:

File Type	Description
Report template	The report template defines the information included in the sample report and the layout of the report. The system tracks the changes made to the report template on the Report tab. A method file includes a link to the report template that is specified in the method. If changes to the report template are pending a secondary or tertiary review, neither the method or the report template can be used for testing until the report review is complete.
Method file	A method is a set of defined parameters that the system uses to perform a test, analyze the test data and produce calculated results. The system tracks the changes made to the method parameters on the Method tab. If changes to a method are pending a secondary or tertiary review, then the method cannot be used for testing until the review is complete.
Sample file	A sample file includes the test parameters that were used to test the specimens in a sample and contains all of the test data for each tested specimen. The system requires a primary signature every time the sample is saved and also when it is finished. This signature tracks: • the tested specimens. • changes made to the tested specimens on the Test tab. • changes to the method parameters • changes to the report parameters
PDF report	Upon finishing a sample, the system automatically generates a PDF of the report, as defined by the report template. The individual that finishes the sample is also documented as the author of the PDF report.

After a primary signature is completed, the system sends the revision information to the audit trail database. If a review is required, the system issues a review task accordingly and a team member included in the appropriate review group must review the changes to the file. The file cannot be used by other team members until the review is complete.

Traceability Signatures

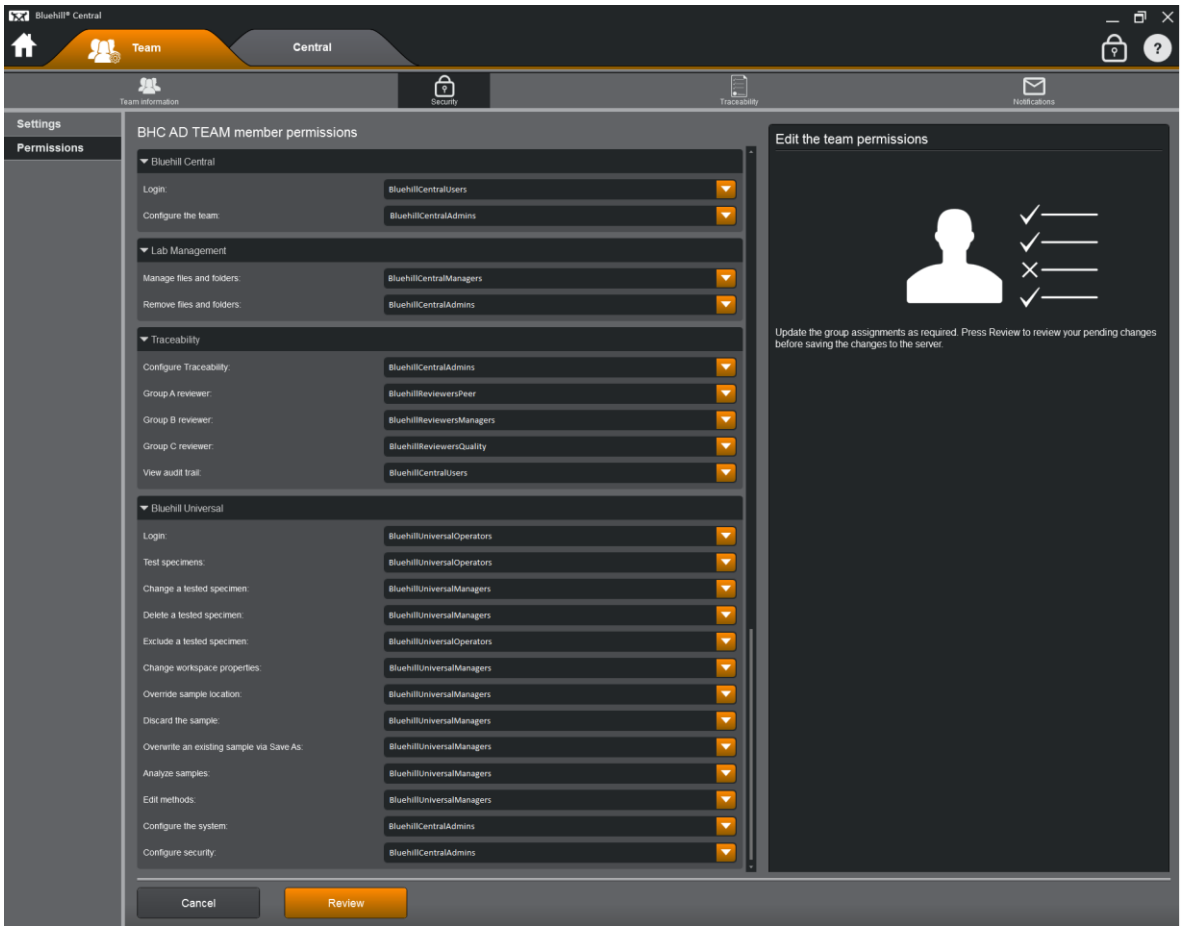
Security Permissions

The **Security > Permissions** screen is located on the Team tab in the Settings module. It displays the security permissions for the currently active team.

A member of the team with “Configure the team” permission can edit these settings. In Bluehill security, the Team administrator has the Configure the team permission to edit the team settings.

In Bluehill® security, each permission is available to an individual and is either enabled or disabled. When a permission is enabled, the individual has access to that area of the application and is able to edit those settings. When disabled, the application disables the edit button on that screen.

In Active Directory, each permission is assigned to a group. An individual must be included in the group to be authorized to edit that area of the application.



Security Permissions (Active Directory Security)

Permissions for Bluehill Central

Bluehill Central includes the following permissions:

Permission	Description
User type	Applies to Bluehill security only. The type of user determines the level of access to the Bluehill Central application.
Login	Allows access to the Bluehill Central application by logging in with proper login credentials.

Configure the team	This individual is responsible for creating user profiles and adding/removing team members as necessary.
	
	Allows access to the Bluehill Central application as follows:
	
	• **Settings** module to edit:
	  ○ the team name and the modules for the team.
	  ○ the security settings, including member permissions.
	  ○ email notifications for the team.
	
	• **System administration** to add additional teams, remove teams from the server, edit the identification information in a user profile and remove a user profile from the server.
	
	Note: If the Traceability module is enabled, it is recommended that the Team administrator also have the Configure Traceability permission.

Permissions for Lab Management

The Lab Management module includes the following permissions:

Permission	Description
Manage files and folders	Allows a team member to manage files on the team database in the following ways: • upload files to the team database in Bluehill Central. • download files to a local device. • edit the attributes for a file. • move a file within the team database. If a team member does not have this permission, the associated icons for the above actions do not display in the Lab Management module.
Remove files and folders	Allows a team member to remove files and folders from the team database. If a team member does not have this permission, the  icon does not display in the Lab Management module.

Permissions for Traceability

Traceability includes the following permissions and review groups:

Permission	Description
View audit trail	Provides access to the Audit Trail section under Traceability. If a team member does not have this permission, the Audit trail tab does not display in the Traceability module.
Configure Traceability	This permission allows an individual to edit the signature requirements for Traceability reviews. A team member with this permission can edit the signature requirements in the Settings module of the Bluehill Central application. The signature requirements define the review process for Bluehill Universal files.
Group A reviewer Group B reviewer Group C reviewer	Assign an individual to a review group, or multiple review groups, for Traceability reviews. When one of these groups is assigned to review a file, anyone included in the assigned group may complete the review.

Permissions for Bluehill Universal

Bluehill Universal includes the following permissions:

Permission	Description
User type	Applies to Bluehill security only. The type of user determines the level of access to the Bluehill Universal software.
Login	Allows access to the Bluehill Universal software by logging in with proper login credentials.
Test specimens	Allows access to the Test tab to set up and test specimens. In Bluehill security, all users have access to the Test tab.
Change a tested specimen	Allows a user to change values for tested specimens. For example, when enabled, the user can change the dimensions shown in the Operator Inputs area after a specimen is tested and recalculate the results. Alternatively, to protect the system from obvious bad entries, such as entering 250mm instead of 25mm, you can assign bounds to these parameters that prevent operators from entering values outside the specified range.
Delete a tested specimen	Allows a user to delete specimens from a sample. When a specimen is deleted, its data is erased from the test data file and it cannot be recovered. Specimens in the sample are renumbered. This may not be desirable if you need to comply with certain standards.
Exclude a tested specimen	Allows a user to exclude a specimen from the statistics for the sample. Excluding a specimen only removes the specimen from the statistics. The specimen can be included again if necessary.
Change workspace properties	Enables the properties icon,  , on the Test tab components to edit the settings for the test workspace. Note that this button provides limited access to the method tab settings (e.g. graph, result columns, and web camera settings).

Permission	Description
Override sample location	Allows a user to browse to a different folder when using “save as” to save the sample in a different folder. A user not authorized for this task can save the sample under a different name using “save as” but the user cannot browse to a different folder. If users will be prevented from changing the sample location, it is important that the method specifies a default folder. Go to **Exports > File Settings** on the Method tab to specify a default folder. This ensures that all samples using this method are saved to the same folder. If no default folder is specified, the sample will be saved to the folder used for the previous sample. If it is not the correct folder for the current sample, an unauthorized user cannot change the folder.
Discard the sample	Allows a user to close the Test tab without saving a sample that was not previously finished or saved. The user can either close the software or return to the home screen without saving the sample. Discarding a sample permanently deletes all changes made since the sample was last saved. These changes cannot be recovered. A user not authorized for this task must save the sample to close the Test tab.
Overwrite an existing sample via Save As	Allows a user to save the currently open sample with the **Save As** option and enter a previously used sample name. This option overwrites the previously saved sample. The contents from previous sample cannot be recovered. A user that does not have this permission must use the **Save** option to save an existing sample with the original file name. When this user selects the **Save As** option, the user must create a unique file name that has not been previously used, thus protecting all previously saved samples.
Analyze samples	The Analysis tab is an optional feature in the software that is only available if purchased. Allows access to the Analysis tab in the software. This tab lets a user replay an existing sample with limited parameters from a different method. When a user has access to the Analysis tab, carefully consider authorizing permission to overwrite an existing sample. If both permissions are authorized, the user can save a replayed sample and thus overwrite the original sample. If **Overwrite an existing sample via Save As** is not allowed, the software prompts the user for a new sample name.

Permission	Description
Edit methods	Allows access to the Method tab to edit parameters in a method file. In Bluehill security, only an Administrator or Manager can access the Method tab.
Configure the system	Allows access to the following sections on the Admin tab: • **Configuration** • **Preferences** • **Bluehill Central** • **TrendTracker Database** An authorized user can: • change the configuration of the frame, including Operator Protection settings • edit transducer configurations • configure the TrendTracker database, if purchased • configure email and Instron® Connect • customize the default units the system uses for new methods. • connect and disconnect the testing system from Bluehill Central. In Bluehill security, only an Administrator can access these sections of the Admin tab.
Configure security	Allows access to the **Security** section of the Admin tab. An authorized user can enable or disable security, add or remove users, and change permissions. In Bluehill security, only an Administrator can access the **Security** section.

Types of Users for Bluehill® Security

In the Bluehill Central and Bluehill Universal modules, permissions are organized into general user types. Each type of user presets the permissions to provide varying levels of access to the associated software. The permissions in each module can be further customized if necessary. However, some permissions are locked and can only be changed by changing the User type. These permissions are grayed.

Bluehill Central

Bluehill Central has the following user types:

User type	Description

Team administrator	The Team administrator in Bluehill Central manages the security feature and user profiles for the team.
	
	This user type enables the Configure the team permission providing access to the Bluehill Central application as follows:
	
	• Settings module to edit:
	  ○ the team name and the modules for the team.
	  ○ the security settings, including member permissions.
	  ○ email notifications for the team.
	
	This individual is responsible for creating user profiles and adding/removing team members as necessary.
	
	If the Traceability module is enabled, it is recommended that the Team administrator also have the Configure Traceability permission.
	
	• System administration to add additional teams, remove teams from the server, edit the identification information in a user profile and remove a user profile from the server.

Restricted user	Disables the Configure the team permission. A team member with this classification: • can view the Settings section of Bluehill Central, but cannot edit any settings. • cannot view the System administration section of Bluehill Central.
Not allowed	Disables the Login permission. A team member with this classification cannot access the Bluehill Central application.

Bluehill Universal

The testing software has three types of users and each type has varying levels of access to the software:

	Administrator	Manager	Operator
Test tab	Full access	Full access	Full access
Analysis tab	Full access	Full access	Full access
Method tab	Full access	Full access	No access
Report tab	Full access	Full access	No access
Admin tab	Full access	Limited access to: • Security - User information • Traceability	Limited access to: • Security - User information • Traceability

Edit Permissions for a Bluehill® Security Team Member

This task requires the “Configure the team” permission.

In Bluehill® security, the Team administrator has the Configure the team permission to edit the team settings.

1. The team administrator must log into the Bluehill Central viewer application using the credentials for the team that requires the changes.
2. Select **Settings** on the Home screen.
3. Select the **Team** tab.
4. Select **Security > Permissions**.
5. Press the **Edit** button.
6. Select the team member.
7. Edit the **User type** (if needed) for Bluehill Central and Bluehill Universal, and then customize the security permissions as required for this team member.
8. If required, edit the Traceability reviewer group, or groups, for this team member.
9. Select **Review**.
10. Review the changes made under **Pending changes**.
11. Enter a comment, if required, and enter your team credentials.
12. Press **Save** to save the changes.

The changes are saved to the team database. The changes, and the team member making the changes, are documented on the team’s audit trail.

Edit Permissions for Active Directory Team Members

To edit the settings in an Active Directory team, you must be a team member and included in the group assigned to Configure the team under the Bluehill Central module.

1. Log into the Bluehill Central viewer application using the credentials for the team that requires the changes.
2. Select **Settings** on the Home screen.
3. Select the **Team** tab.
4. Select **Security > Permissions**.
5. Press the **Edit** button.
6. Edit the Active Directory groups assigned to the permissions in each module.
7. Select **Review**.
8. Review the changes made under **Pending changes**.
9. Enter a comment, if required, and enter your team credentials.
10. Press **Save** to save the changes.

The changes are saved to the team database. The changes, and the team member making the changes, are documented on the team's audit trail.

TrendTracker Module

TrendTracker is an optional feature that is only available if the TrendTracker module is enabled.

TrendTracker provides the ability to store specimen information from multiple Bluehill samples in a database, thus allowing you to perform statistical analysis across specimens from multiple samples with one search.

A connection establishes a link to a TrendTracker database that allows the software to communicate with the database. The Bluehill software requires a connection in order to export sample information to the database. The TrendTracker software, requires a connection in order to search the database and analyze the records that meet the specified search criteria.

The TrendTracker module is where you search a TrendTracker database and then analyze the specimen records by grouping, sorting and performing statistical analysis.

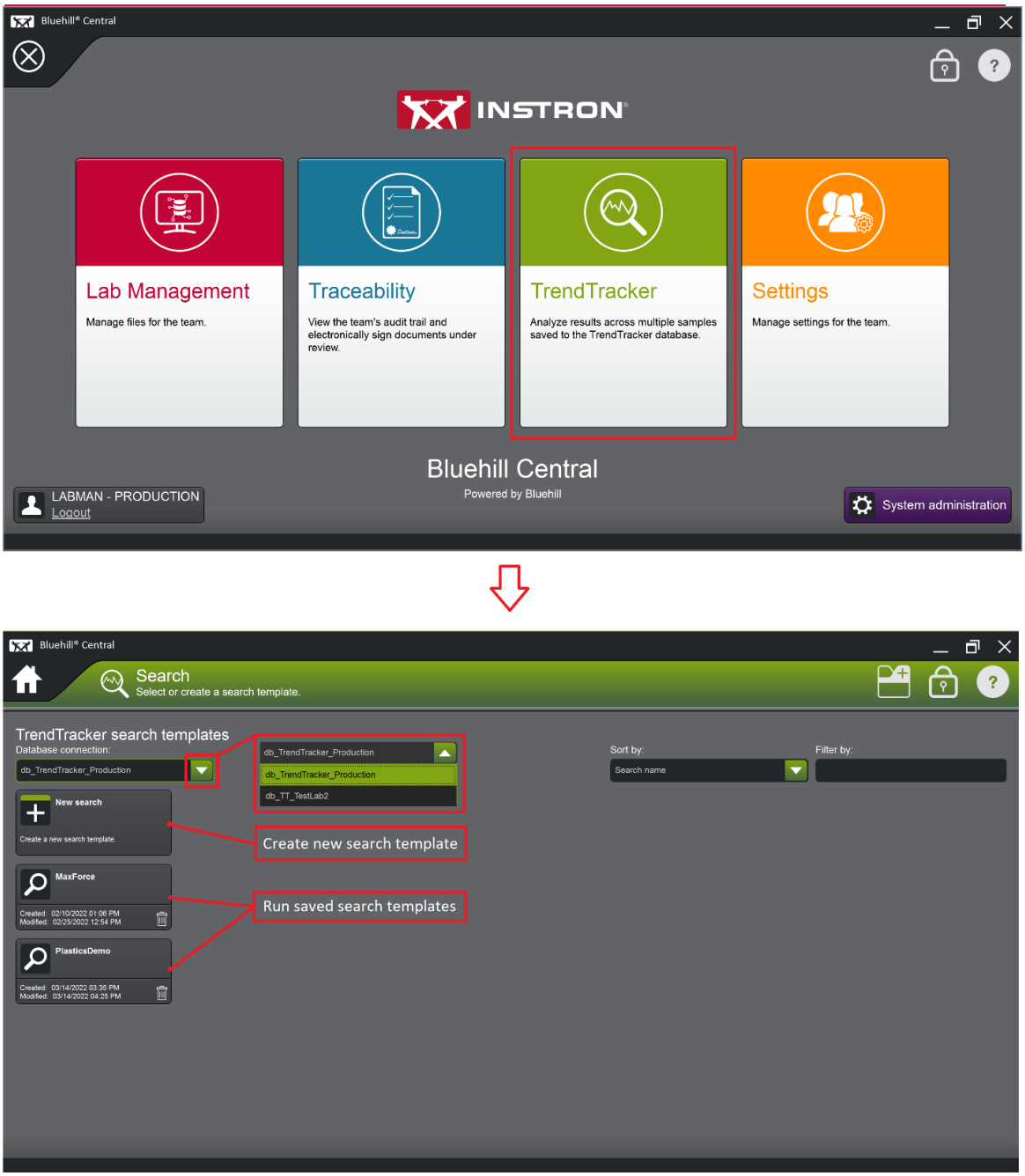
The **Database connection** field contains every database connection created for the team from the Settings module. Select one of these connections to specify the database you want to search. The screen then updates to show all TrendTracker searches previously saved to the selected database.

A TrendTracker search includes all the search criteria required to find specimen records in the database, along with the settings for a customized table to display the specimen records. TrendTracker searches are available to all members of the team.

To find a specific TrendTracker search, you can:

- Select **Search name** in the **Sort by** field to list the searches in alphabetical order.
- Select **Modified date** in the **Sort by** field to list the searches by the last modified date. The searches are listed by the most recent modified date in descending order.
- Enter text in the **Filter by** field to display only the TrendTracker searches that contain the filter text.

You can select a previously saved TrendTracker search or select **New search** to advance to the next screen where you set the search criteria and view the search results.



Bluehill Central TrendTracker home page

TrendTracker Database Connections

The TrendTracker screen is located on the Team tab in the Settings module and displays the TrendTracker database connections for the currently active team.

TrendTracker is an optional feature that is only available if the TrendTracker module is enabled for the team.

A member must have **Configure the team** permission to edit the team settings.

Overview

TrendTracker provides the ability to store specimen information from multiple Bluehill samples in a database, thus allowing you to perform statistical analysis across specimens from multiple samples with one search.

The TrendTracker database can be located on a network SQL server, managed by your IT department, or it can be located on an individual computer that is connected to the company network.

The TrendTracker module in Bluehill Central includes features that enable you to further analyze the data or export the data to a spreadsheet.

Connections

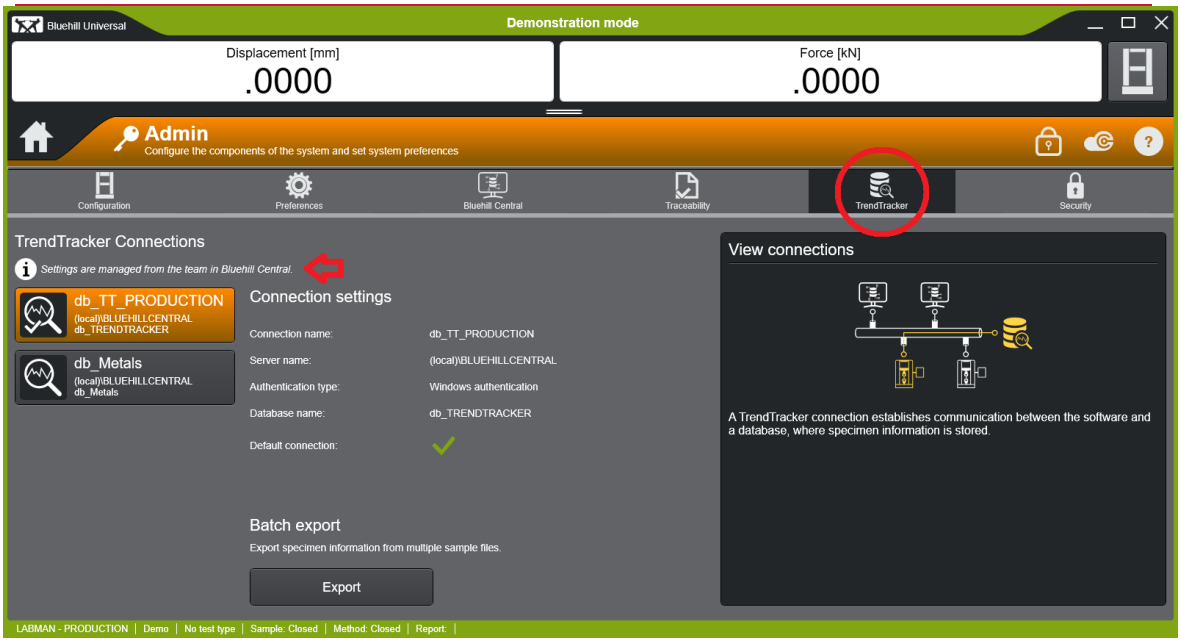
A connection establishes a link to a TrendTracker database that allows Bluehill Universal and Bluehill Central software to communicate with the database.

[**Note:**] Bluehill 3 connections are also supported.

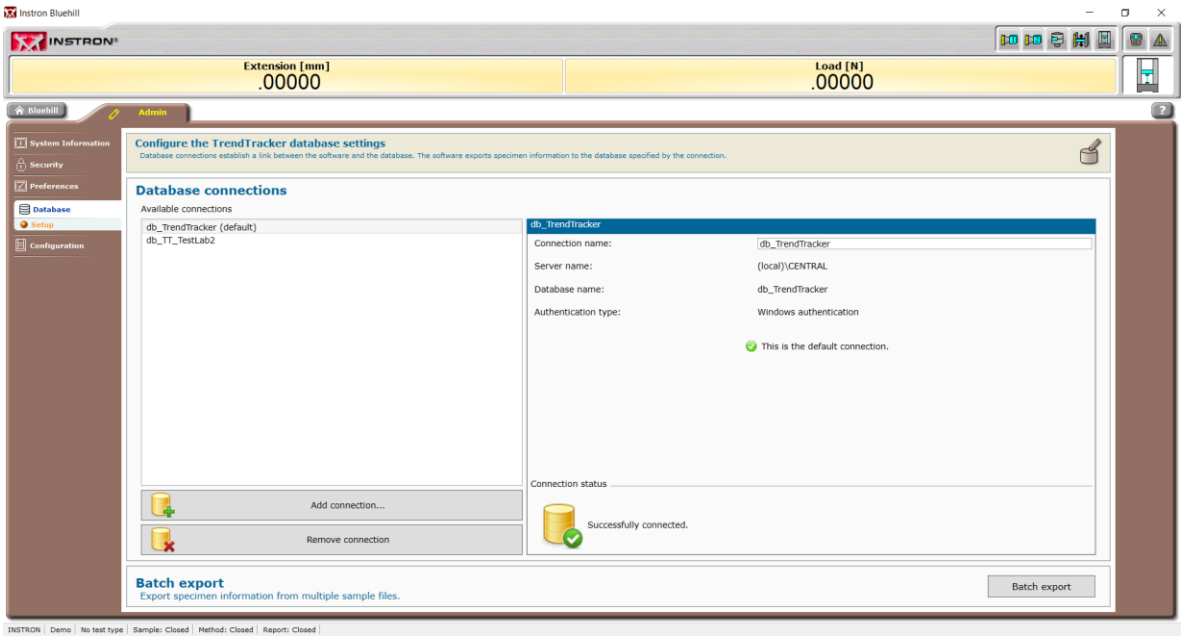
The Bluehill software requires a connection in order to export sample information to the database. The Bluehill Central TrendTracker module requires a connection in order to search the database and analyze the records that meet the specified search criteria.

TrendTracker connections are created and managed in Bluehill Central but are also available from the Bluehill Universal software. These connections are available to all team members.

TrendTracker Connections page in Bluehill Central



TrendTracker Connections page in Bluehill Universal



TrendTracker Connections page in Bluehill 3

A connection between the software and database requires the following information:

- **Connection name**: A unique name that identifies the TrendTracker database.

  When interacting with TrendTracker, you must select a connection to a specific database. It is helpful to include the name of the SQL server and the database in the connection name to ensure that all users connect to the correct database.

- **Server name**: The SQL server that hosts the TrendTracker database.

  When adding a connection, this drop-down list will include:
  - all SQL server instances connected to the network.
  - all local SQL instances displayed as: (local)\<instance name>.

- **Authentication type**: Identifies the type of authentication the SQL server requires for access to the database.

  [note]: SQL authentication requires an SQL login and password. The person that created the database will have this information.

- **Database name**: The database for this connection.

  When adding a connection, the list includes all databases located on the SQL server selected in the Server name field.

  If the team will use multiple databases to store sample information, it will be helpful to use names that differentiate each database and identify the information that should be saved to each database. Then using the database name in the connection name will facilitate team members to select the appropriate connection for the type of testing or analysis they will be doing.

  For example, if your testing involves different test types, such as tension testing and metals testing, you can create separate databases for each test type. Each tension method can be set to export sample information to the tension database, while metals methods can be set to export sample information to the metals database.

- **Default connection**: The default database connection is identified by a green check mark.

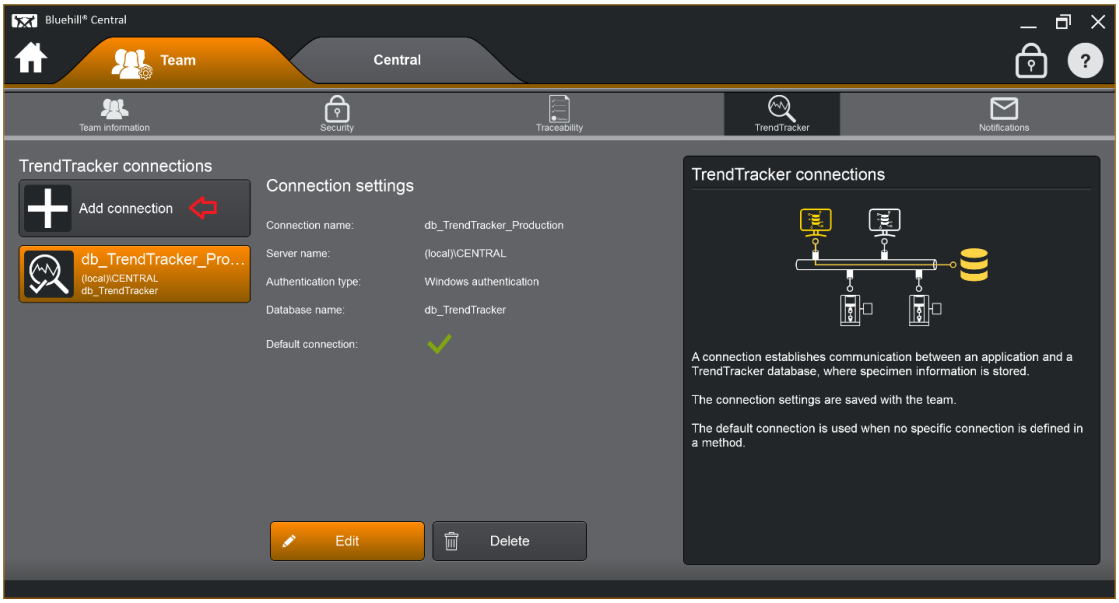
  The default connection is the primary connection. The software uses the default connection when no specific connection is defined. In the Bluehill software, if no specific connection is defined in a method, the software automatically sends the specimen information to the database identified as the default connection on the Database screen on the Admin tab.

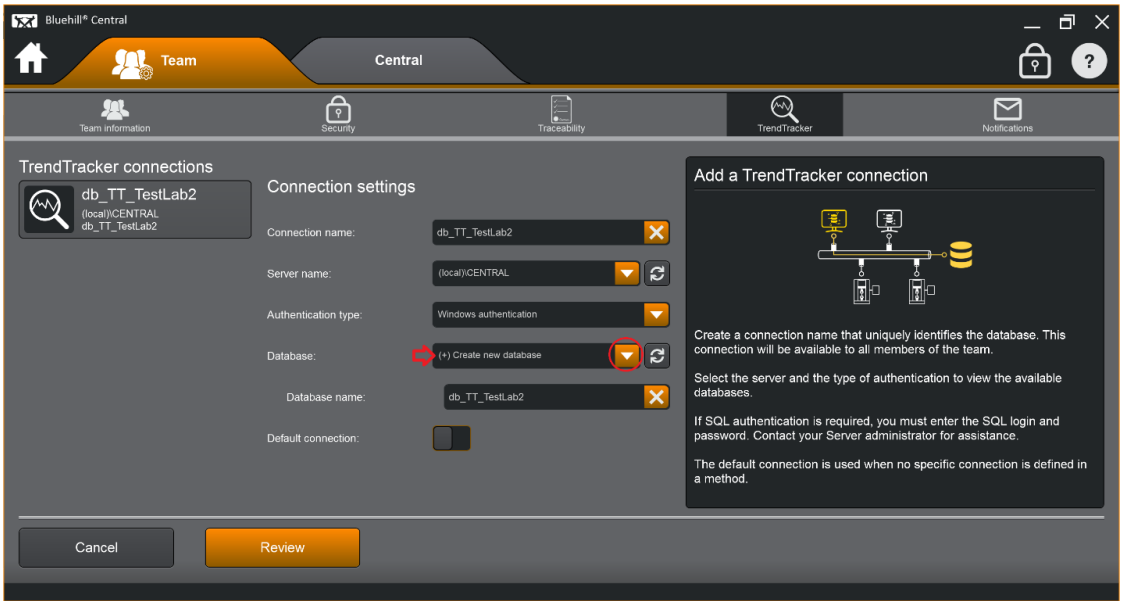
  In the TrendTracker module, the default connection is the primary connection for the team. The default connection always displays in the Database name field unless it is manually changed when editing a connection.

Creating Additional Databases

To add additional databases to an existing SQL Server launch **Bluehill Central** then navigate to **Settings > Team tab > TrendTracker**.

Select Add Connection button then complete required fields.
Set Database field to “(+) Create new database” then enter name for the new database.

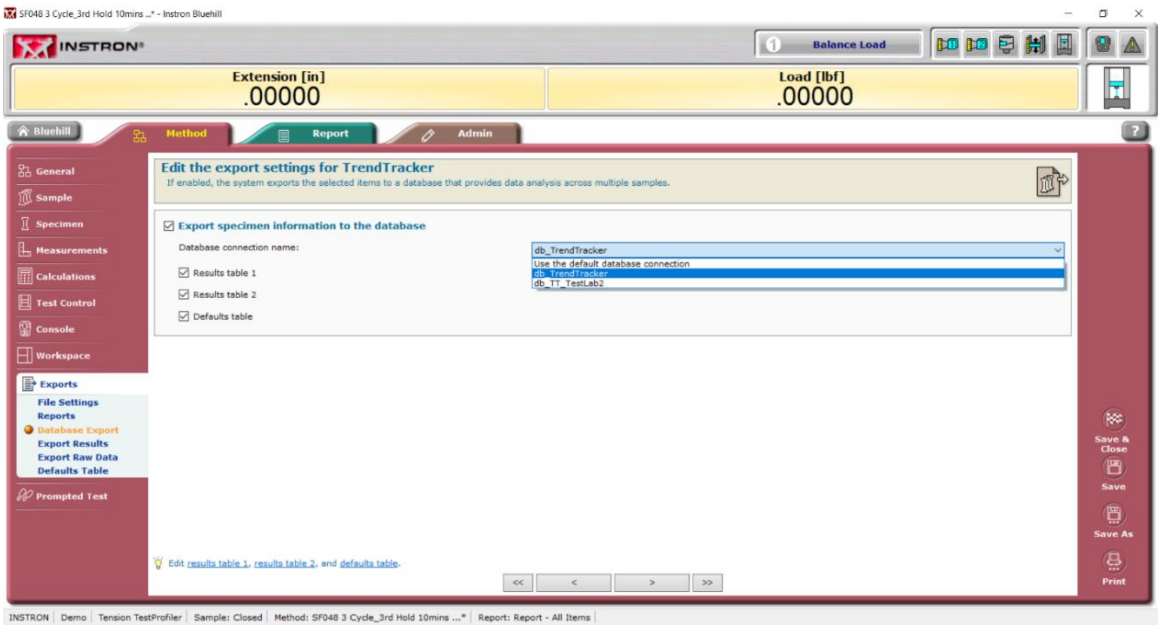




Enable Database Export in Test Method

To enable database export, open the test method then navigate to **Exports > TrendTracker**. Select the database connection and enable elements you want exported.

Database Export page in Bluehill Universal

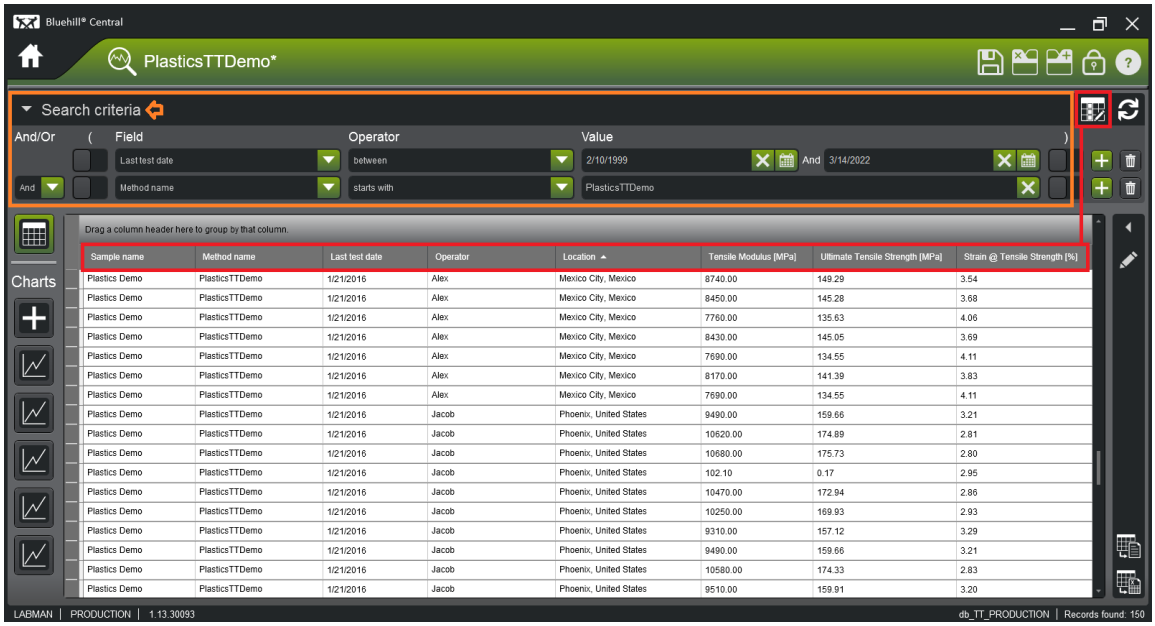


Database Export page in Bluehill 3

Search Criteria Screen

Upon creating a new TrendTracker search, or selecting an existing search, the TrendTracker module displays the **Search criteria** screen. For a new search, this is where you specify the criteria for searching the database selected in the Database connection field on the previous screen.

When you select an existing TrendTracker search, the software searches the database selected in the Database connection field and then displays the search results, based on the saved settings. The search criteria and display settings can be changed as necessary.



Search Criteria

Search Criteria

Each option in the **Field** represents a result or specimen parameter from a Bluehill sample file that was exported to the database.

Each field is classified into a data category, which determines the type of operators and valid values that are available.

Search Records Table

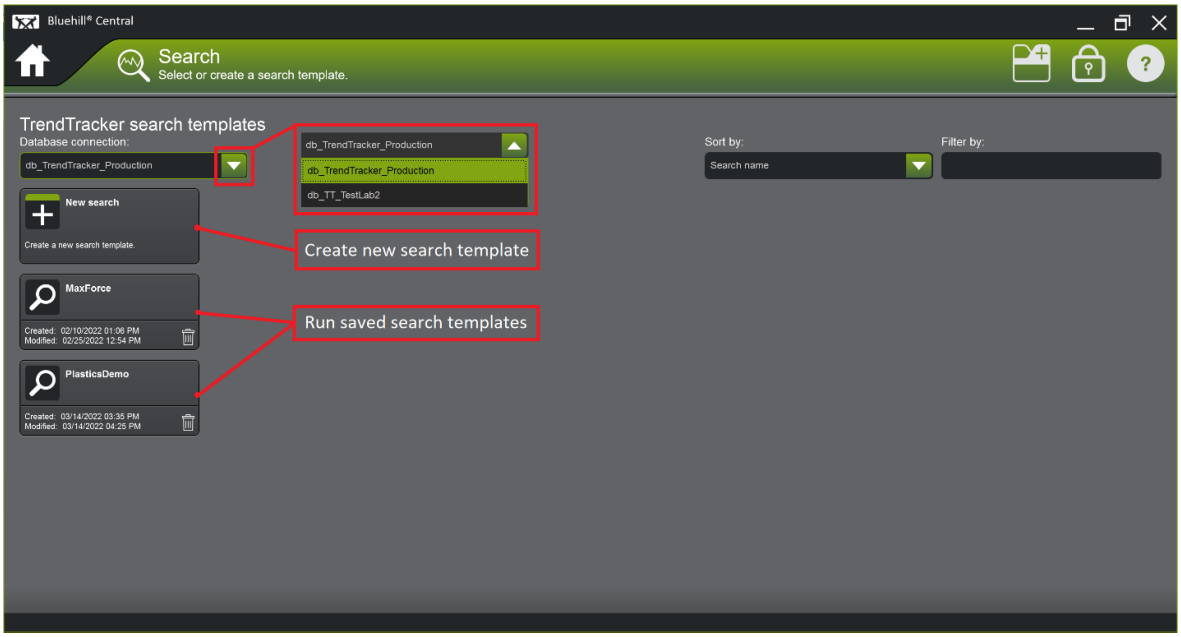
When you run a query, TrendTracker searches the database and displays the specimen records that satisfied the search criteria in a table format. Each row represents a specimen record and each column represents a result or specimen parameter from a Bluehill sample file that was exported to the database.

The data categories are summarized as follows:

Data category	Available operators	Valid values
Boolean	equals not equal to	True False
Date/Time	on after before on or after on or before between *	Any valid date in the format of the local regional settings.
Integer Number Dimension	equals does not equal greater than less than greater than or equal to less than or equal to between *	1e-20 to 1e20 Dimension values are in SI units.
Text	equals contains does not contain starts with end with	Text is limited to a single line with up to 100 characters.
	* The between operator requires upper and lower boundary values. The search includes both of the specified values.	

Search Templates

When saving a search template all charts and search criteria get saved as part of the search template. The search template is saved to the database and can be run anytime from the TrendTracker home page.



Statistical Charts

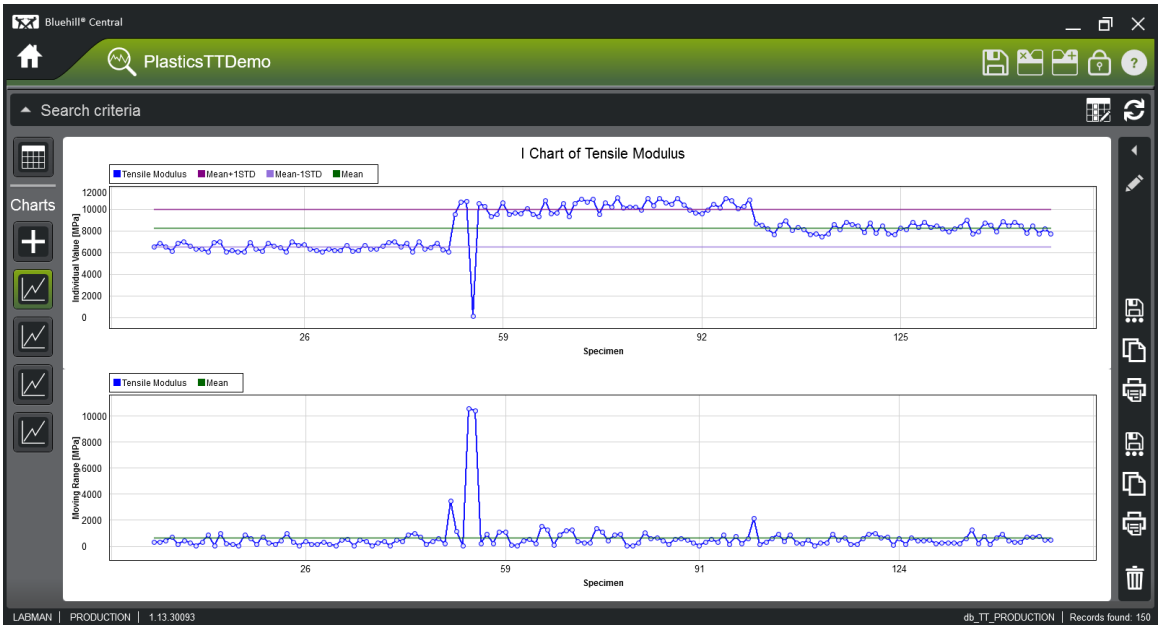
TrendTracker can generate several charts from the search records. When saving a search template all charts and search criteria get saved as part of the search template. The search template is saved to the database and can be run anytime from the TrendTracker home page.

Available charts include:

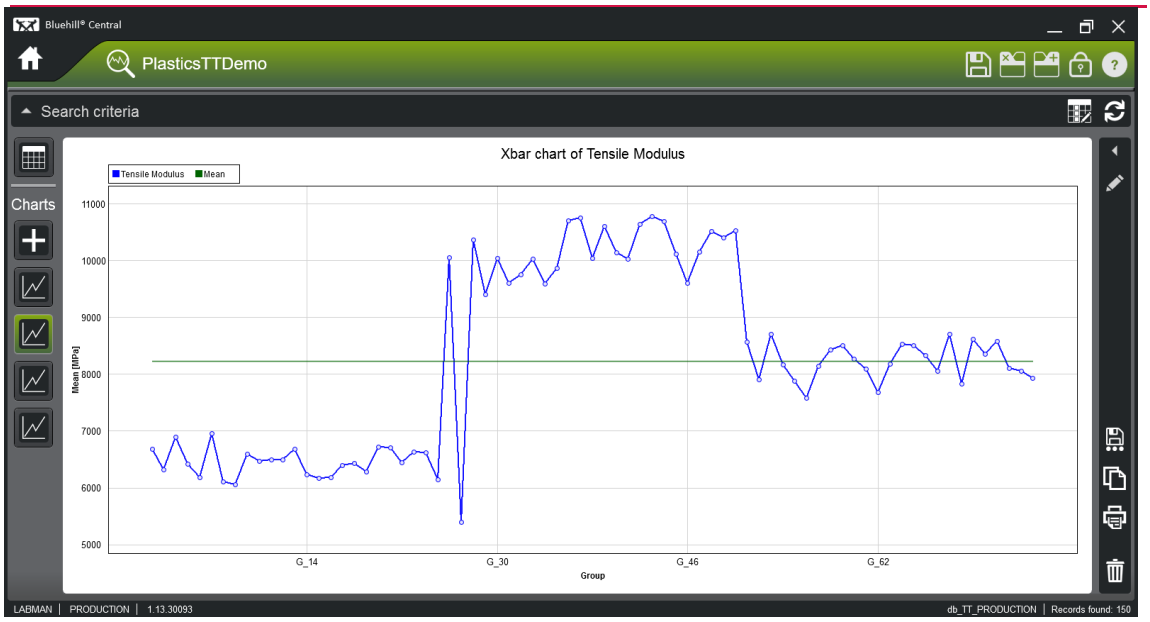
- Individual
- Group
- Xbar
- R chart
- S chart
- Xbar-R
- Xbar-S
- Box Plot
- Histogram

Refer to the NIST/SEMATECH e-Handbook of Statistical Methods at NIST/SEMATECH e-Handbook of Statistical Methods for detailed information and definitions for the various statistical charts available.

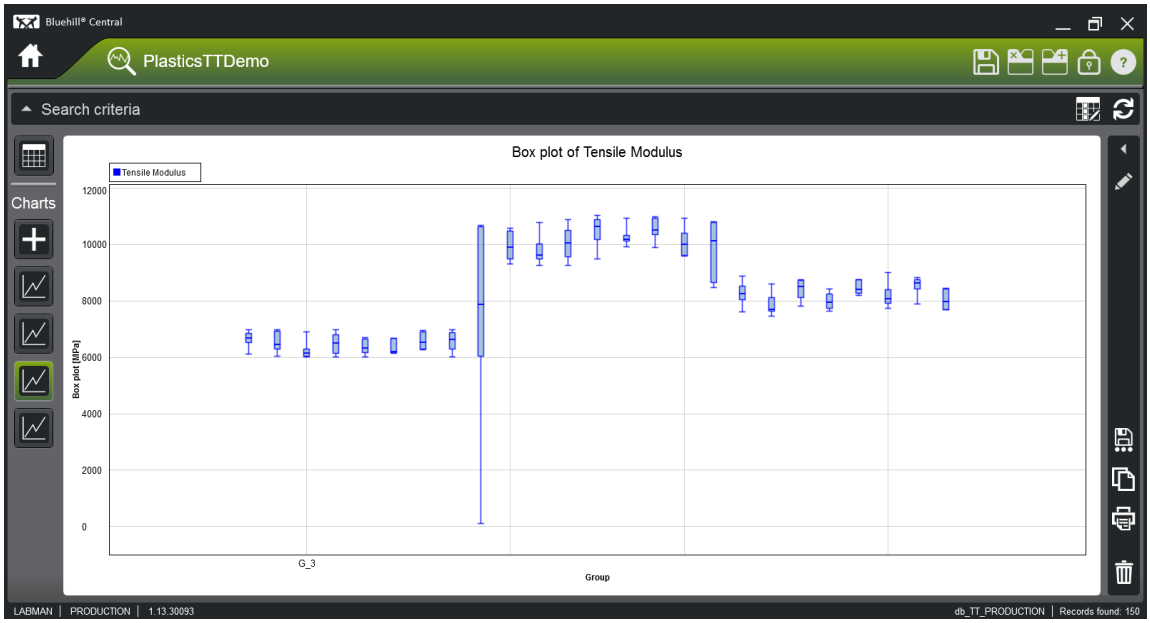
Use sidebar to select chart type and settings



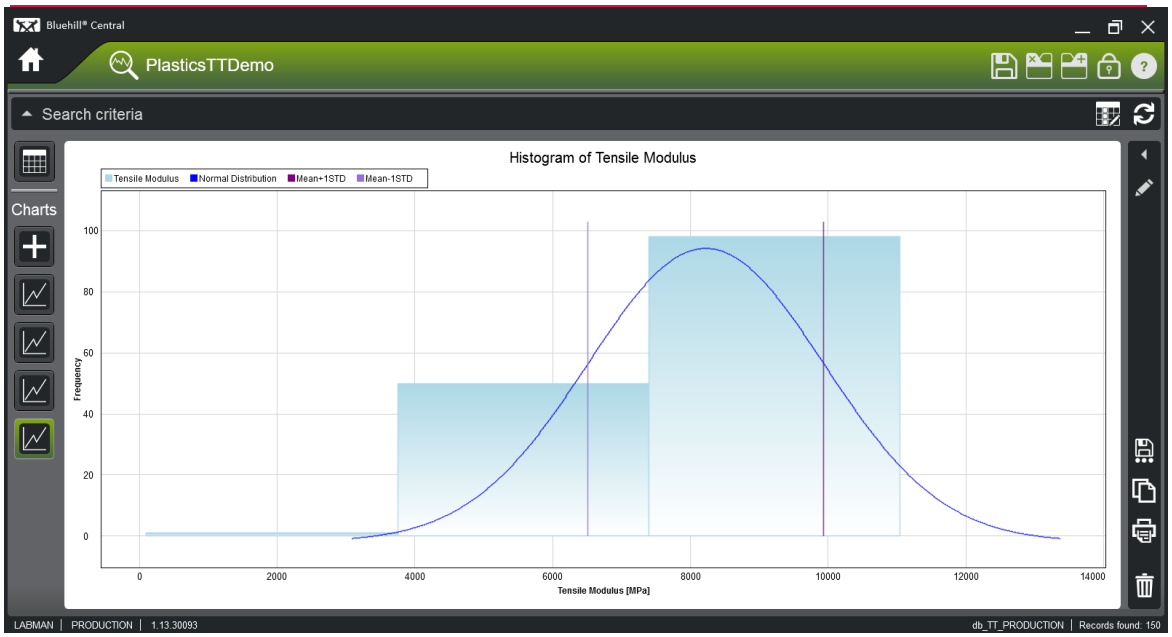
Individual Chart



Xbar Chart



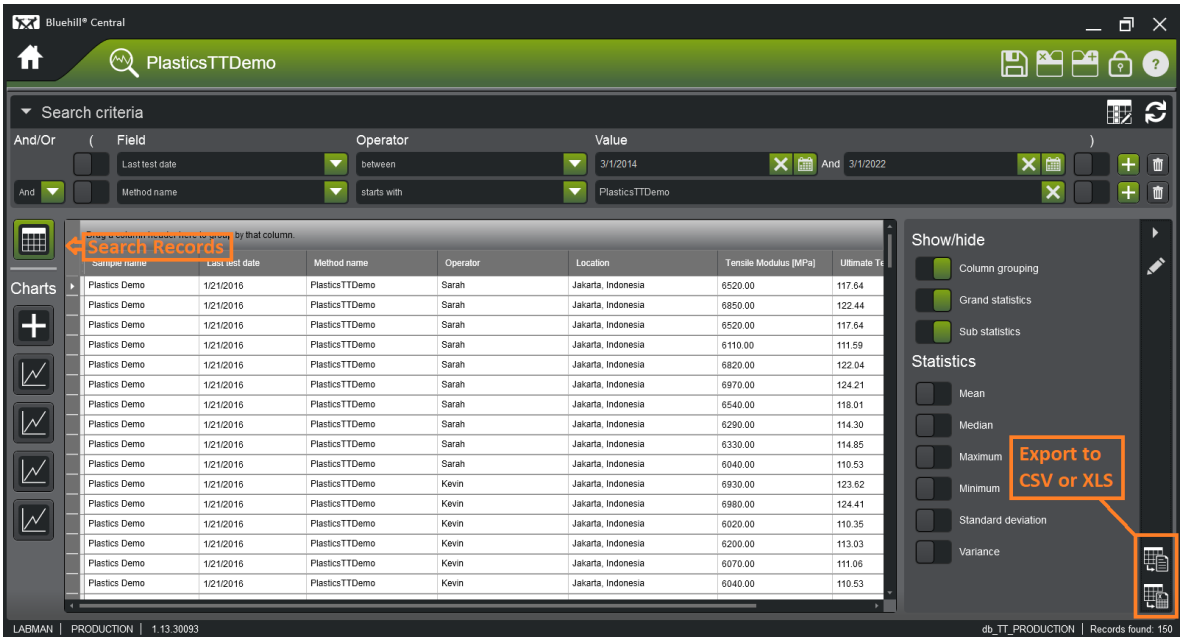
Box Plot Chart



Histogram Chart

Export Results to Excel or CSV

Search results can be exported to Excel or CSV file. Use sidebar to export.



System Administration Module

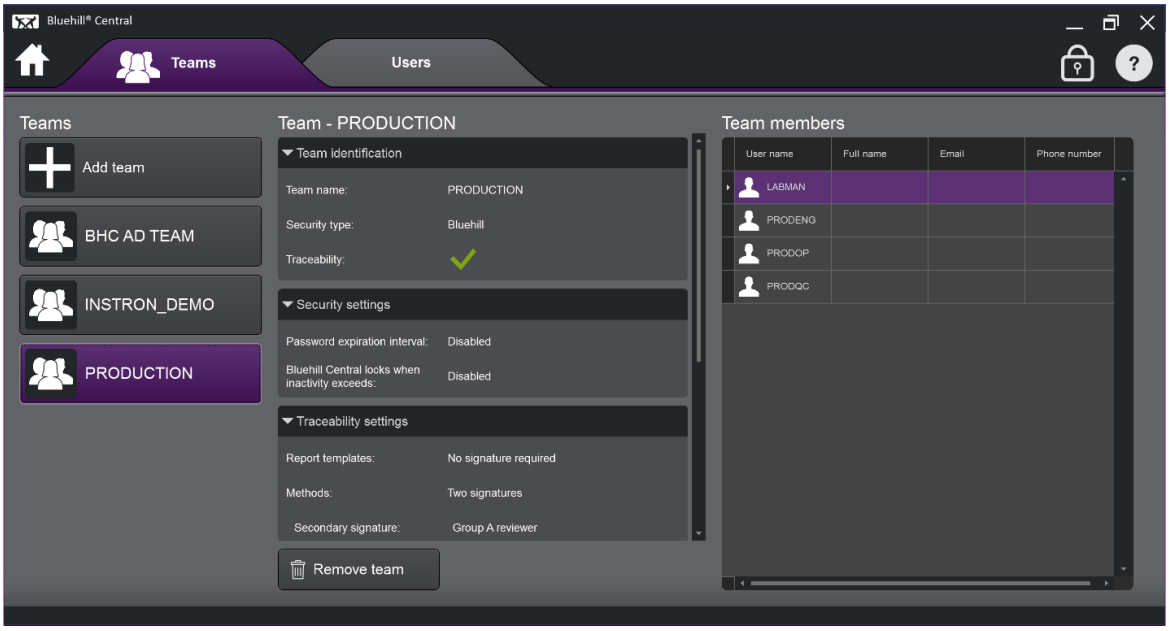
System administration provides an overview of all the teams on the server. To edit the settings for a specific team, you must have the appropriate permissions for that team. Log into Bluehill Central for a specific team and edit the team settings in the Settings module on the Home screen.

A member of a team must have “Configure the team” permission to view this section of the application.

In Bluehill security, the Team administrator has the “Configure the team” permission.

The **Teams** tab in the **System administration** module provides access to the server to do any of the following:

- View the configuration of each team on the server, including the members of each team.
- Add a new team to the server.
- Delete a team from the server.



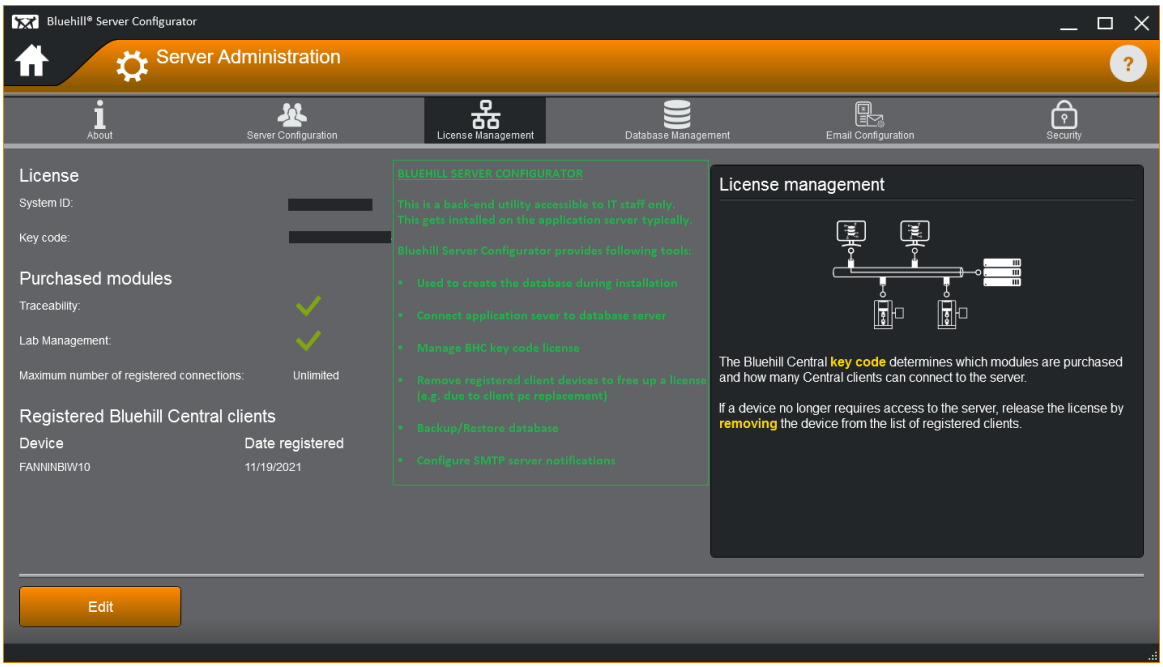
System Administration

Bluehill Server Configurator Application

Your server administrator uses the Bluehill Server Configurator application to manage and maintain the server and associated databases for Bluehill Central.

The server administrator uses the server configurator application to manage:

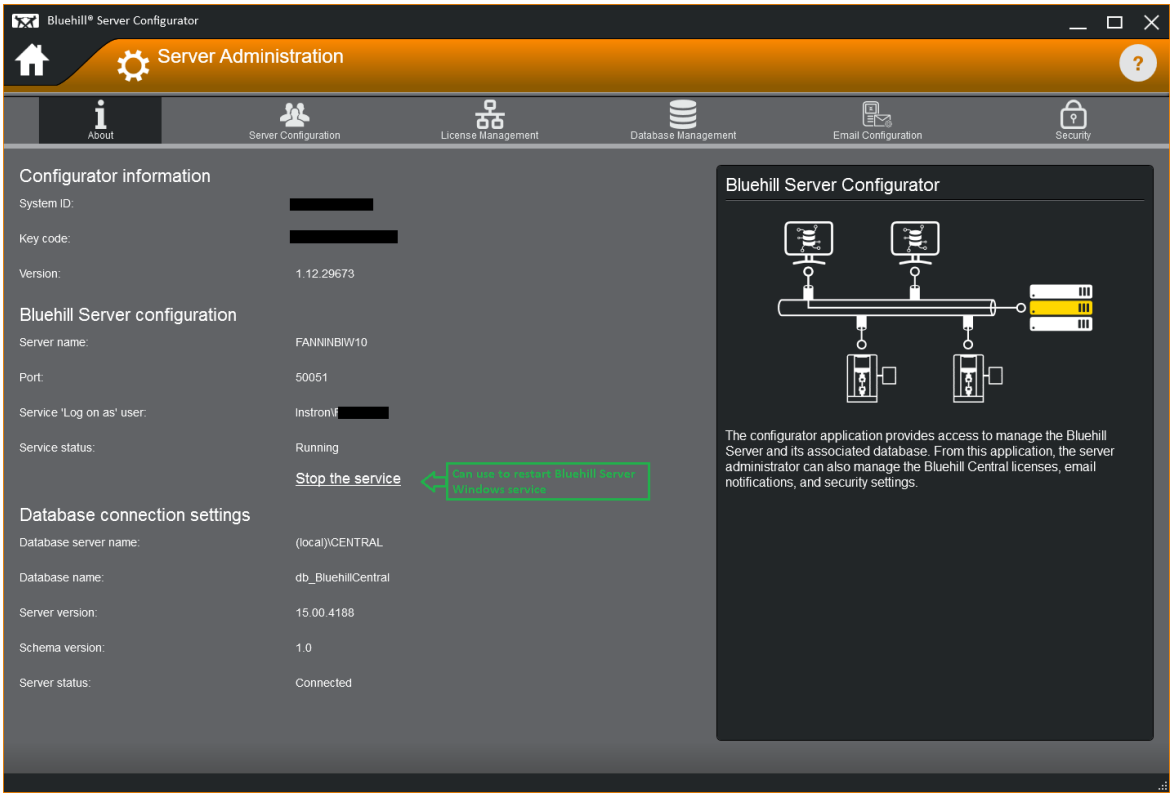
- **the Bluehill Server**
- **the database associated with the server**
- **the licenses purchased for Bluehill Central**
- **email notifications from the Bluehill Central application**
- **security for the server configurator application**



Bluehill Server Configurator

About the Bluehill Server Configurator

The About screen in the Server Administration module provides important information for the Bluehill Server Configurator application, the Bluehill Server, and the connection to the associated database.



About menu

Server Configuration

If security is enabled, only a user that is included in the group assigned to “Configure the system” can edit the settings for this screen. For these users, an **Edit** button is available to edit the settings as necessary.

Bluehill Server configuration

This section provides the identification information for the server including:

- Server name and port for the currently connected server.

  Server name identifies the computer or IP address that hosts the Bluehill Server.

  Port is an integer value representing an endpoint for the communication protocol between this software and the Bluehill Server. The default port is 50051. But your network administrator may reassign this number.

- **Service ‘Log on as’ user**: The Bluehill Server runs as a Windows® Service. This user information is for the service that runs the Bluehill Server.

  This user must have permission to read and write to the database and file system. These permissions are managed by your server administrator in the IT department.

  If a team is configured with Active Directory security, this user must be a member of the same Active Directory domain and have read permissions on the domain.

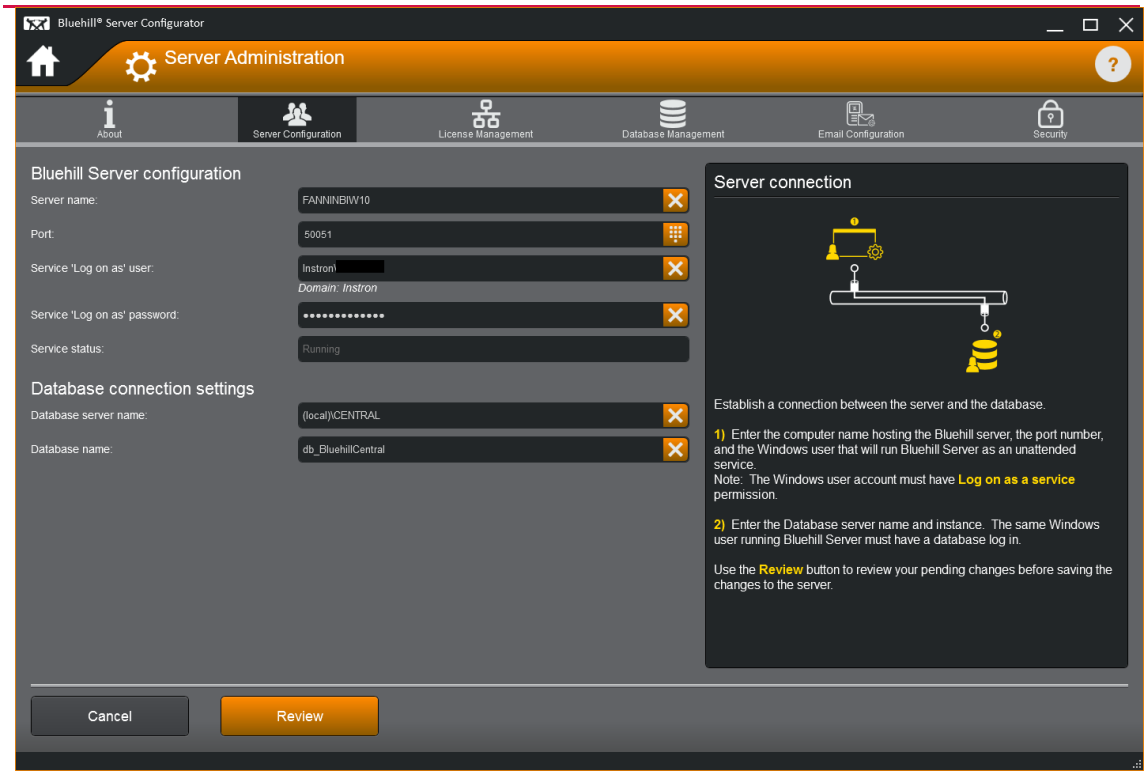
- Service status: Identifies the status of the server.

Database connection settings

This section provides the connection information that allows the Bluehill Server to communicate with the server and database for Bluehill Central:

- **Database server name**: Identifies the server that hosts the database.

- **Database name**: Identifies the database that stores information for Bluehill Central.



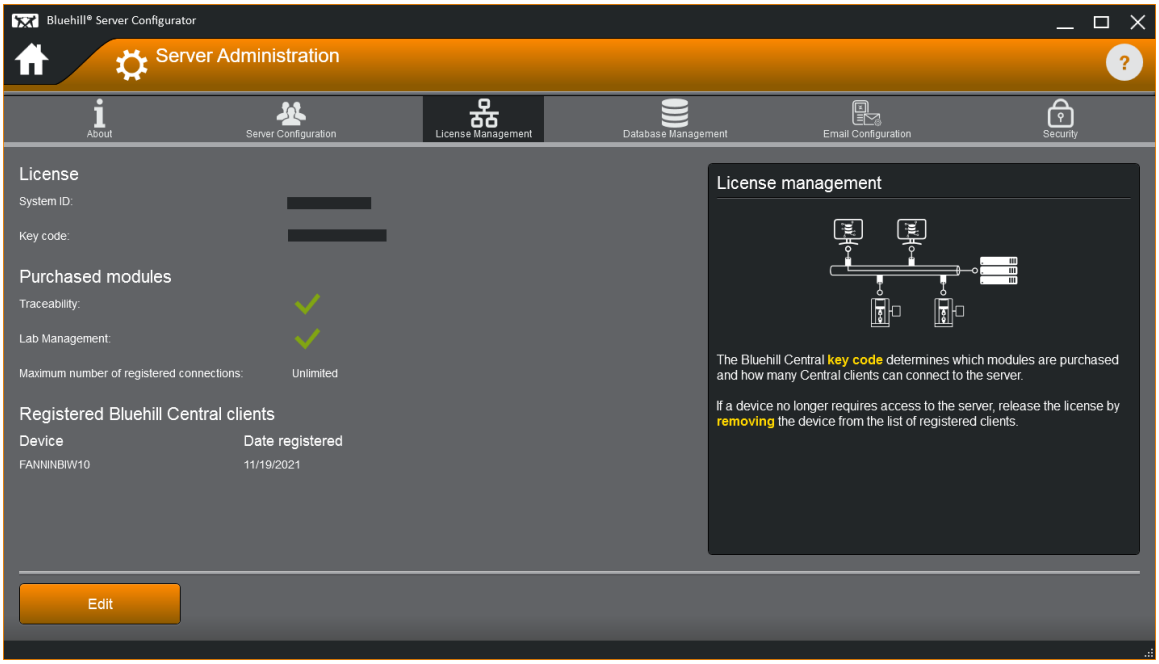
Server Configuration menu

License Management

If security is enabled, only a user that is included in the group assigned to “Configure the system” can edit the settings for this screen. For these users, an **Edit** button is available to edit the settings as necessary.

The system ID and key code identify the license that was purchased and also identifies:

- the modules included in the license.
- the maximum number of server connections available under the license.



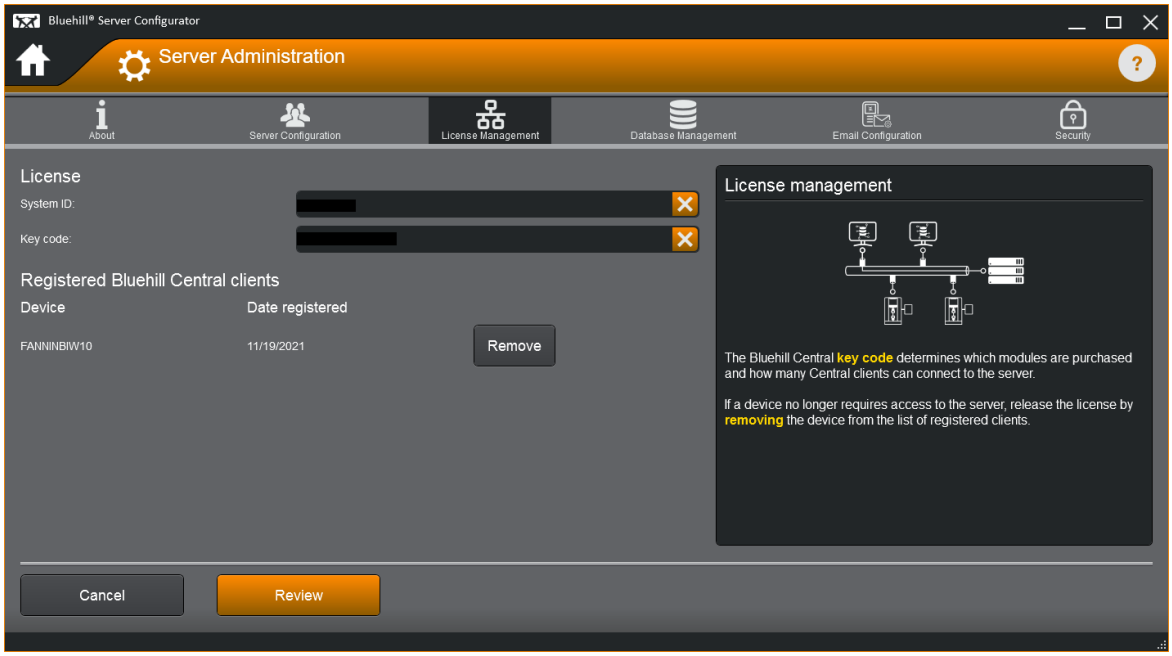
License Management menu

Remove a Registered Client from Bluehill Central

If security is enabled, you must be included in the group assigned to “Configure the system” to perform this task. Refer to Security to review the permissions.

1. Open the Bluehill Server Configurator application.
2. Select License Management on the Server Administration tab.
3. Press the Edit button.
4. Find the device name and press the associated Remove button.
5. Select Review.
6. Review the changes made under Pending changes.
7. Press Save to save the changes.

The selected device is removed from the server and the list of registered clients is updated on the License Management screen. A device can also be removed by having the specific device disconnect from Bluehill Central via the viewer application.

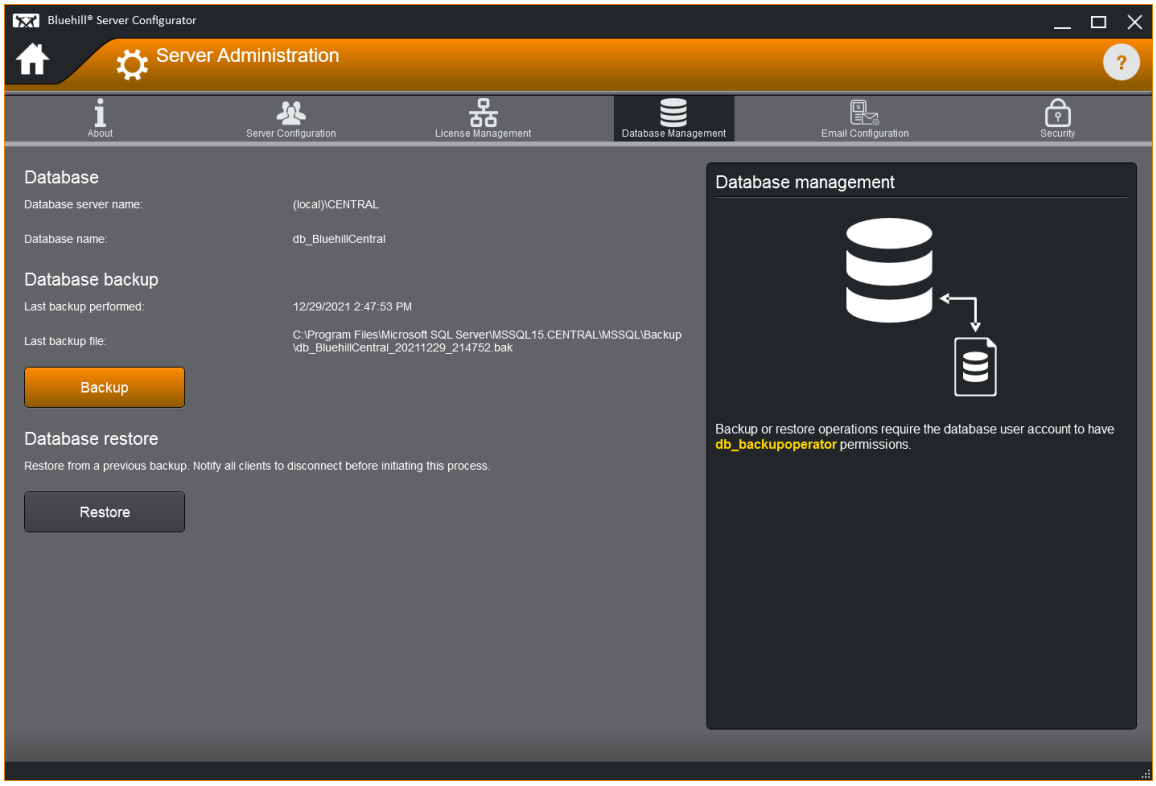


Edit License menu

Database Management

If security is enabled, only a user that is included in the group assigned to “Configure the system” can edit the settings for this screen. For these users, an **Edit** button is available to edit the settings as necessary.

Database management provides the ability to backup and restore the database for Bluehill Central. The backup creates a copy of the entire database for all Bluehill Central teams. The backup copy is saved to the SQL server backup location. The Bluehill Server Configurator application includes a time stamp identifying when the backup occurred.



Database Management menu

Create a Backup of the Bluehill Central Database

If security is enabled, you must be included in the group assigned to "Configure the system" to perform this task. Refer to **Security** to review the permissions.

1. Open the Bluehill Server Configurator application.
2. Select **Database Management** on the **Server Administration** tab.
3. Select **Backup**.
   The screen updates to show:
   - database server name.
   - database name.
   - backup location on the database server.
4. Select the **Backup** button.
   The screen returns to the Database management screen and shows the time stamp for the last backup and identifies the last backup file.

Restore the Bluehill Central Database

If security is enabled, you must be included in the group assigned to "Configure the system" to perform this task. Refer to **Security** to review the permissions.

CAUTION:

Notify all clients to disconnect before initiating this process.

1. Open the Bluehill Server Configurator application.
2. Select **Database Management** on the **Server Administration** tab.
3. Select **Restore**.
4. In the **Database backup file** field, enter the full path and file name of the database backup file.
5. In the **Restore database name** field, enter a new database name that does not already exist on the database server.
6. Enter a comment describing the changes.
7. Enter your user name and password.
8. Select the **Restore** button.

The screen returns to the Database management screen and shows the new database name under the **Database** section.

Notify all clients to reconnect to the new database name.

Email Configuration

If security is enabled, only a user that is included in the group assigned to “Configure the system” can edit the settings for this screen. For these users, an **Edit** button is available to edit the settings as necessary.

Email configuration lets you connect Bluehill Central to your mail server so that Bluehill Central can send email notifications to team members.

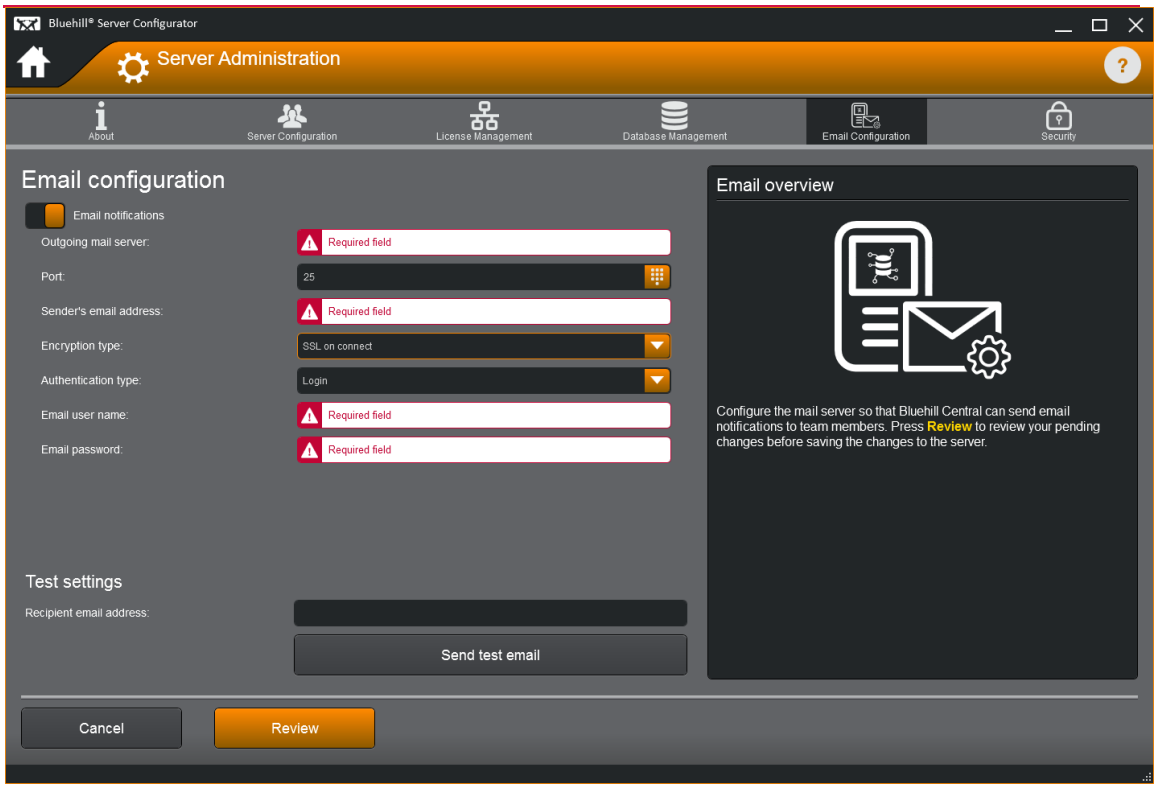
When the mail server parameters are configured, Bluehill Central can notify team members about the Traceability review status of method and sample files.

The notifications are customized for each team in the Bluehill Central application. Go to the **Notifications** screen located on the Team tab in the **Settings** module.

Configuring the email function requires the following information:

Outgoing mail server	Specify the outgoing mail server. For example, when using Microsoft Outlook, this field should contain the name of the Microsoft Exchange Server for your email system.
Port	The server port number for the outgoing mail server.
Sender’s email address	A designated email address for Bluehill Central on the mail server.
Encryption type	If necessary, select the type of encryption required for sending emails.
Authentication type	If necessary, select Login to specify the outgoing mail server requires an authorized user name and password for sending emails.
Email user name	A designated user name on the mail server for Bluehill Central.
Email password	A password for Bluehill Central.

Use the Test settings section to verify that the mail server is configured correctly. Enter an email address to receive a notice from Bluehill Central and press Send test email.



Email Configuration menu

Security for the Bluehill Server Configurator Application

Security will limit access to the server configurator, thus limiting who has access to the application and can edit the server and database settings. Both types of security specify a group of users for each type of permission.

Each type of security assigns the permissions in a different way. Refer to the topics below for more detailed information.

If security is enabled, only a user that is included in the group assigned to **Configure security** can edit the group settings for each permission. For these users, an **Edit permissions** button is available to edit the assigned groups as necessary.

Active Directory Security

The Active Directory security uses the network domain that is managed by your network administrator. The security permissions are assigned to an Active Directory group and any user that is included in that group has those rights. The groups are created and managed by the network administrator.

Groups are assigned to each permission shown for Bluehill® Server Configurator.

Active Directory security establishes team permissions rather than individual user permissions. The Active Directory groups are managed by your IT department. After a group is assigned to each permission, any changes to the users included in a group is done by the network administrator. You will need to work with your IT department to request changes to these groups.

Before enabling the Active Directory security, it is important to establish the groups that are required and the users that are included in each group. Provide this information to your network administrator to implement on the network domain. Then the security can be activated and a group assigned to each permission.

There are two common groups: **All users** and **No users**. These groups are not managed by the network administrator. These groups provide a simple way of either allowing or prohibiting all users from a specific permission.

To access any component of the Bluehill suite of products, all users must log in with the same login credentials they use to access the company network.

Windows® Security

The Windows security uses the local user accounts and groups provided by the Windows operating system. In the software, the security permissions are assigned to a group and any user that is included in that group has those rights. The user groups are created and managed via the Windows user accounts.

This type of security requires very little maintenance from within the software. After groups are assigned to the various permissions, any changes to the users included in a group is done via the Windows control panel, by any user included in the Administrators group.

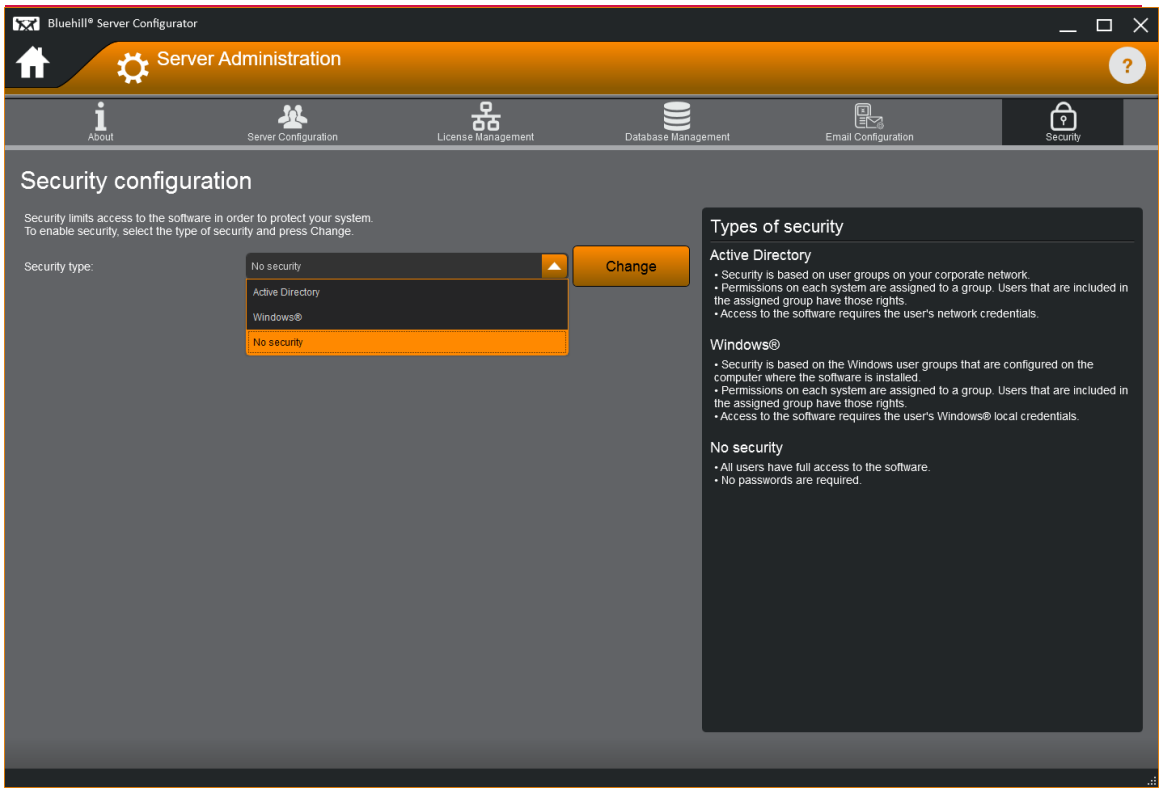
The software includes several common groups:

- **All users** - By default includes all users. There is no specific group to maintain.
- **No users** - By default excludes all users. There is no specific group to maintain.
- **Administrators** - Includes any user that is included in the Windows Administrators group.
- **Users** - Includes any user that is included in the Windows Users group.

The security feature can be enabled using just the common groups listed above. Additional groups can be created to further customize the security feature, if necessary. For example, a group can be created for each permission and then add only the users that should perform each task. It is recommended that you work with your IT department to create the user accounts and the groups that will be assigned in the software.

The permissions in the software are managed by the users included in the group assigned to **Configure security**. For these users, an **Edit** button is available to edit the assigned groups as necessary.

After the security is activated, all users must log in to the software. Users log in to the software with the login credentials assigned to their user account.



Security menu for Bluehill Server Configurator

Product support: **www.instron.com**