CINCINNATI TEST SYSTEMS

SENTINEL

Blackbelt Pro™

User Manual

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CAUTION – When you see this warning symbol on the product, refer to the instruction manual for information before proceeding.

CAUTION – To avoid personal injury due to electric shock, disconnect all power services before servicing.

If this instrument is not used according to the instructions of this manual, the protection provided by this equipment design may be compromised.

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Contents

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Introduction

The Sentinel Blackbelt Pro is our next generation of multi-test, multi-port, test instrument. It manages and executes up to 4 part tests synchronous or asynchronous, under the control of one instrument. Blackbelt Pro supports leak, flow, pressure, vacuum, and ramp testing in one instrument with concurrent or sequential test capabilities

Unpacking

Carefully remove the instrument from its shipping carton. Locate the power cord and any test port peripherals supplied with the instrument. You may install the included fittings, or any suitable 1/8” NPT male thread fitting, into the test ports.

Figure i-1. Benchtop Instrument

Figure i-2. Wall Mount Instrument

Controls and User Interface

There are two mechanical buttons on the Blackbelt Pro instrument: **Run/Pause** and **Stop**. All other control is performed on the touchscreen or by regulator knobs.

There are many settings to customize test programs or to configure the instrument.

Tap 

to enter the **Edit** mode. Tap 

to return to the **Run** mode.

Installation

The instrument should be connected to an un-switched power source. If utilized as part of the machine design, light curtains and safety control circuits should only interrupt the I/O power, not the instrument power.

An 88-264 VAC 50/60 Hz auto sensing/switching electrical power supply is required for operation. An I/O switch is required to select internal or external 24 VDC electrical power for the inputs and outputs.

Install the instrument at least 15 feet away from sources of strong electromagnetic radiation (such as induction heat-treating equipment and welders). If reliable power and a grounded line are not available, consider using isolation transformers for the instrument.

Note: Always be certain that there is nearly zero voltage (< 1 V) difference between the neutral and earth ground wires connected to the instrument when supplying power.

The Blackbelt Pro is designed to operate in a manufacturing, clean room, or lab environment. To operate trouble-free it requires clean, dry instrument air for test and pilot air (0.3- and 5.0-micron coalescing filters are recommended; available separately). A vacuum is required for vacuum test applications (unless the venturi option is configured).

Supply Connections

Mount the instrument in the desired location for your facility. Connect the inlet air or vacuum supply to the inlet port shown in the pneumatic diagram supplied with your instrument. These connections will vary depending on the instrument setting. Do not install oilers upstream from the instrument. Install the recommended 0.3 and 5.0 micron coalescing filters (available separately) in the air supply connected to the instrument. Using a filtered air supply will help to reduce future maintenance requirements. Replace the filter elements quarterly as preventive maintenance.

Port	Connection Type	Pressure Rating
P1	1/4″ Push to Connect Fitting	Vacuum-200 psig
Pilot	1/8″ Push to Connect Fitting	0-90 psig
P2	1/4″ Push to Connect Fitting	Vacuum-200 psig
Hi Press	1/8″ FNPT	0-500 psig

Hardware Overview

Figure i-3. Benchtop Model Front Connections

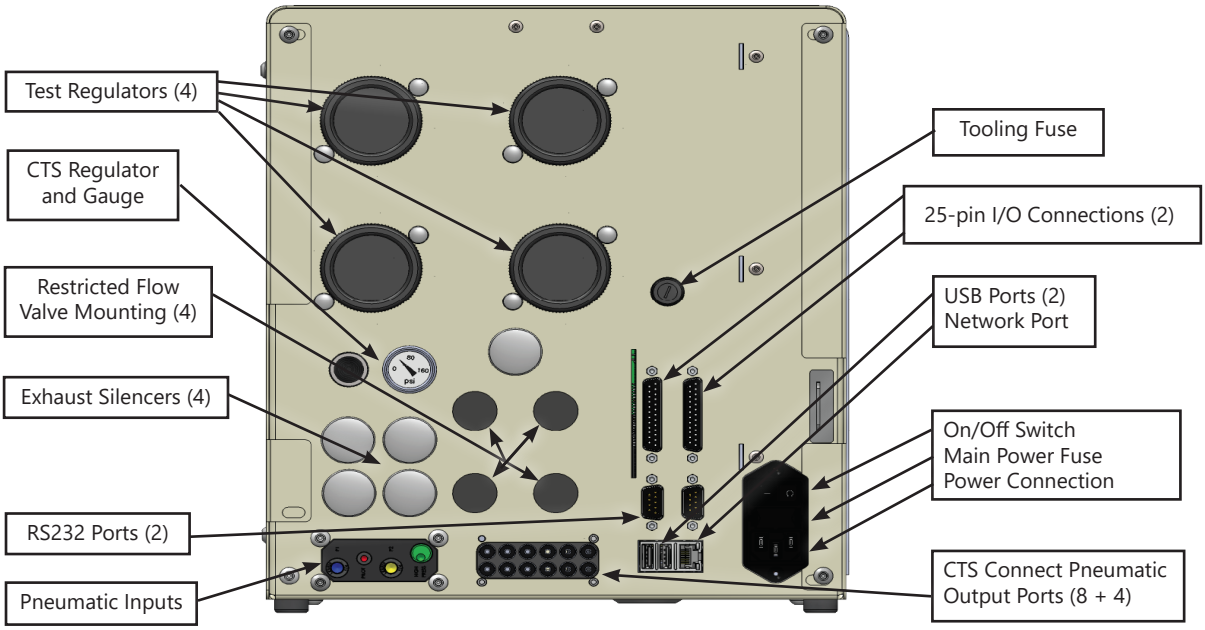


Figure i-4. Benchtop Model Rear Connections

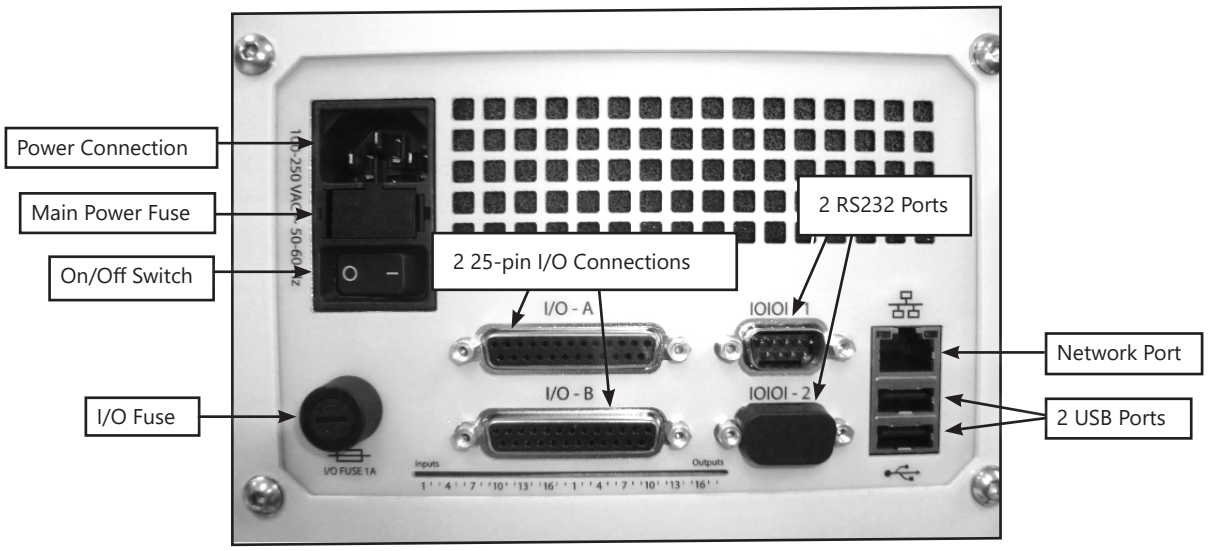


Figure i-5. Wall Mount Model Electrical Connector Panel

The connector panel is located on the left side of the instrument. There are two 25-pin digital I/O ports (I/O-A and I/O-B), two 9-pin RS232 serial ports (IOIO-1 and IOIO-2), one RJ45 network port and two USB ports. See “Figure 10-5. Benchtop and Wall Mount I/O Ports for connecting devices” on page 132 for more details on the 25 pin connectors.

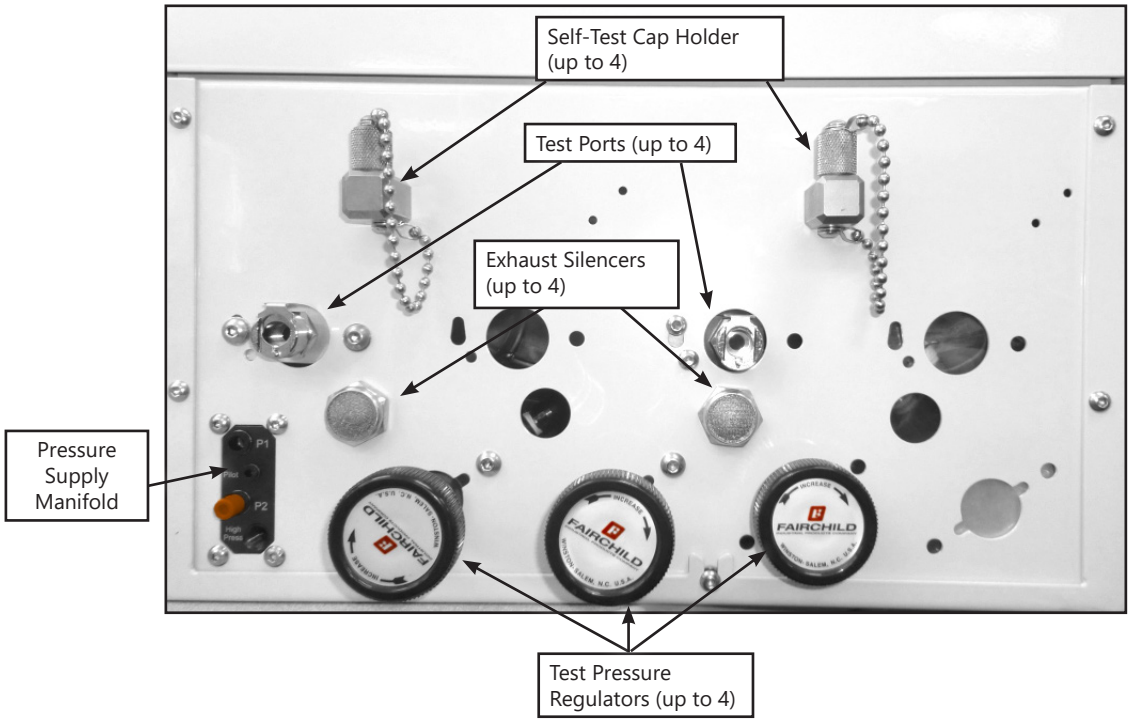


Figure i-6. Wall Mount Model Pneumatic Connector Panel

Figure i-7. Wall Mount Model Front Connections

Test Types

The following types of test are possible using the Blackbelt Pro.

TEST TYPE	DESCRIPTION
Pressure Decay ΔP Chapter 13	Measures the Pressure Loss (ΔP) over a fixed time. Determined from the pressure loss over the duration of the test timer. The result is presented in units of delta pressure.
Pressure Decay ΔP/ΔT Chapter 14	Measures the pressure loss (ΔP/ΔT) over unit time. Determined from the pressure loss over the duration of the test timer divided by the test time. The result is presented in units of delta pressure over delta time.
Pressure Decay-Leak Std Chapter 15	Calculates the Leak Rate, based on pressure loss. Determined from the pressure loss over the duration of the test timer relating to the pressure loss of the leak standard and of the non-leaking master part. The result is presented in units of flow.
Occlusion Chapter 16	This test measures back pressure (part blockage). Determined from the pressure at the end of the occlusion test timer. The result is presented in units of pressure.
Pressure Verify Chapter 17	A test to verify pressure or vacuum generated by the test part. The result is presented in units of pressure.
Mass Flow Chapter 18	This test measures the mass flow needed to maintain the part at a set pressure. Typically used in applications where flow is expected, or where the part is stretchy or large in volume. The result is presented in units of flow.
Mass Flow-Leak Std Chapter 19	This test measures the mass flow needed to maintain the part at a set pressure. Typically used in low leak applications, or where the part is stretchy or large in volume. This test type utilizes a two-point calibration sequence with a non-leaking master part to set the zero flow value and the flow value at the leak standard value. The result is presented in units of flow.
Ramp to ΔP Event Chapter 20	Measures the peak pressure before a Pressure Loss (ΔP) Event. Determines the maximum pressure before the pressure loss limit is exceeded as well as records the duration of time before the event. The results are presented in units of pressure and time.
Ramp to Input Event Chapter 21	Measures the pressure at an Input Event. During test pressure ramp, monitors for trigger event on a digital input, then determines the pressure as well as records the duration of time before the event. The results are presented in units of pressure and time.
Ramp to Proof Chapter 22	Designed to make sure component can hold a pressure for a fixed period of time. Result determined from the maximum pressure during the test and duration of the test timer. The result is presented in units of pressure.

Chapter 1
Navigation

Home Screen Overview

Figure 1-1. The Home Screen

Navigation Control Gestures

To interact with the Blackbelt Pro touchscreen, **tap** elements to select. Flyout menus are available for some items. **Long press** an item to display a flyout menu. **Drag** to pan, scroll lists, or move column headings. If there are many rows and/or columns, they may run off the bottom or right side of the screen. Use **drag** or **flick scroll** gestures.

*Note that there are only two mechanical buttons on the Blackbelt Pro instrument: Start/Pause and Stop. **Press** is the action for mechanical buttons. All other references in this manual refer to touching on-screen objects. **Tap** on-screen keys or icons. **Tap** or **Long Press** program names and on-screen segments in the Program screens, in the Hardware: Manifolds screen and in the Hardware: Devices screen.*

Home Icon

Tap  at any time to return to the **Home** screen. This is useful when the function you want to use is blocked by the current screen (for instance if you want to add a program but are currently viewing system settings).

Main Menu Icon

Tap  to display six options: **Program**, **Hardware**, **Results**, **Settings**, **Events** and **Safe Shutdown**. See chapters 3, 4, 5, 6, and 11 for more details.

Safe Shutdown

Warning: Use the **Safe Shutdown** feature before turning off the power switch. This is required to prevent data corruption.

Back Icon

Tap  to go back to the previous screen.

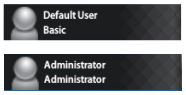
Test Display Windows

On the **Home** screen, active data displays here during a test, for each part tested. See “Figure 1-2. Program selection menu” on page 5.

User Icon

The User icon displays the current User Account name and access level.

Tap the User icon to open the User Accounts menu. Long press the User icon to access a numeric keyboard dialog that allows logging in to a user account from any screen or menu. Logging in with a SmartKey adds a key symbol to the User icon. See “Chapter 7: User Login & Security” on page 79 for



more information.

Title Bar with Active Program Name

This area displays the title of the active test program. Tap 

to access the program drop-down list. The Title Bar is visible and Program selection is possible only from the **Home** screen or from the **Program** settings menu. In other menus, it gives the location name with breadcrumbs if the name is too long.

Instrument Name

The instrument name is alphanumeric. It can be edited to any descriptive name, such as Blackbelt Pro 01. See “Miscellaneous Settings” on page 74 for details about changing the instrument name.

Instrument Serial Number

The serial number (0000000001) is set by the manufacturer and is not editable.

Contextual Information (Help) Icon

Tap  , then tap any object or text with a red border to read information about the item.  appears red when active. Tap  again to resume normal use.

Run/Edit Mode Indicator

This control object is a toggle-style indicator. The active mode is colored. The inactive mode is gray.

You must be in **Edit** mode to make changes. 

You must be in **Run** mode to run programs. 

A save 

option will also display here when a change has been made to a part or test setting. When you tap 

you will be prompted to **Save** or **Cancel** your

changes.

Date

The date is formatted MM/DD/YYYY (02/27/2015). To edit the date, tap  →  . From the **Misc Settings**, tap **Date**. To edit the date format, tap  →  , then tap **Date Format**.

Time

The time is displayed in 24-hour format (08:24:59). To edit the time, tap  →  . From the **Misc Settings**, tap **Time**.

USB Icon

 displays to the left of the Date and Time when a USB drive is mounted for collecting reports, capturing screenshots, firmware updates, instrument backup, instrument cloning and instrument restore functions One USB icon appears for each one of the 3 USB ports that are occupied. Tap  to unmount the USB drive.

RS232 Connected Status Icon

 Displays to the left of the Date and Time when the instrument is connected to a PLC or computer through one of the RS232 ports. The icon disappears when the serial connection is dropped. See “Chapter 6: Settings” on page 71 for more information about connecting with RS232.

Telnet Connected Status Icon

 Displays to the left of the Date and Time when the instrument is connected to a PLC or computer through the Ethernet port. The icon disappears when the Telnet connection is dropped. See “Chapter 6: Settings” on page 71 for more information about connecting with Telnet.

Program Selection Menu

Tap the **Title Bar** 

to display a dropdown menu of available programs. Tap the name of the program that you wish to run.

Figure 1-2. Program selection menu

Program Name

The name of the test program will be displayed in the Program List and the Title Bar.
To change a Program Name, see “Edit the Program Name” on page 21.
To change a Part Name, see “Part Settings” on page 35.

Program Submenu Flyout

Long press a program name until a flyout menu appears. You may then tap an additional option: **Select Program**, **Add to Favorites,** or **Delete Program.**

The Delete Program option is visible in **Edit** mode.

Favorite Programs Selector

Tap  to display the list of favorite programs. A white box appears around the star when the selector is active. Tap  again to return to the list of all programs.

To make any program a favorite, long press the **Title Bar** 

until a flyout menu appears, then tap **Add to Favorites**.

Deleting Programs

When a program is no longer needed it can be deleted.

Tap 

to enter **Edit** mode. Tap 

.

Long press the program name until a flyout menu appears.

Tap **Delete Program**, then tap **YES** to confirm.

Tap 

→ **Save**.

Customizing and Creating New Programs

Existing programs may be customized.

Tap 

. Tap the program you want to edit.

Tap  , then tap  . Tap the program segment that you want to edit.

Tap 

to enter **Edit** mode and make the desired changes.

Tap 

, then tap 

→ **Save**.

To create a new program, see “Chapter 3: Create a Test” on page 21.

Copy Programs

The Blackbelt Pro has the ability to copy programs and paste to create new program with same configuration.

Tap 

to enter **Edit** mode. Tap 

Long press the desired **Program name** until flyout menu appears.

Tap **Copy Program**, then tap Yes to confirm.

New button 

appears. Tap **Paste Button**, then tap Yes.

The newly created program will be loaded and displayed on screen.

Tap 

→ **Save**.

Copy Programs to other instrument

The Blackbelt Pro has the ability to copy programs from one instrument to another. Create a backup of the instrument. Tap 

to enter Edit mode, then tap 
→ 

→ 

. Select the **Backup Instrument** option to create a backup. To restore programs on another instrument, unmount the USB, and plug the USB into the other instrument. Tap 
→ 

→ 

. Select **Restore Instrument** and select the backup of the instrument. Select Next, and three options will be checked: **Settings**, **Hardware Config**, and **Programs**. Uncheck **Settings** and **Hardware Config** to copy over programs only. See “USB Menu” on page 76 for more information

Note The Blackbelt Pro will only copy programs to if every part has the same capability code and pneumatic code that are setup at the factory. The Copy Programs feature also only works on backups that were creating on Firmware versions 262 or later.

Preloaded Sample Programs

Some sample programs are already configured on the instrument. The programs available are dependent on the types of manifold installed in the instrument.

The following preloaded programs may be available:

Self-Test

Occlusion

Occlusion & Pressure Decay

Tooling & Occlusion & Pressure Decay

Multi-Part with Autorun

Mulit-Port (Demo Engine)

Pressure Verify

Mass Flow

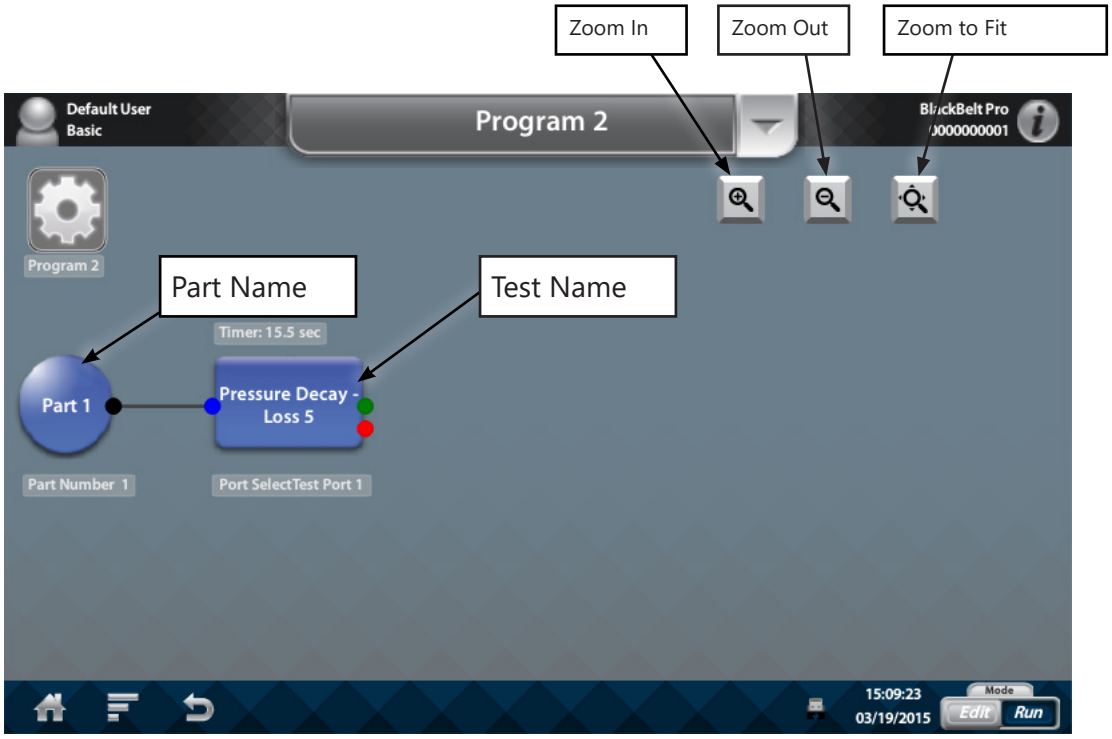


Figure 1-3. A sample program screen

Part Settings

Tap → → Mode Edit Run to enter **Edit** mode.

If necessary, tap the zoom controls to adjust the detail for this program on the screen.

Tap the **Part** segment Part 1 that you wish to edit.

The Part settings menu displays.

Figure 1-4. Part edit screen

Make changes, then tap Mode Save Run → **Save**.

Note: Settings displayed with a blue background can be edited. In the example above, the settings for Autorun, Part Start and Stop/Reset are displayed with a gray background. Those settings cannot be edited by the Default User because they require Advanced access level. In other cases, a user may not be allowed to edit settings based on security settings in their user account. See *"Chapter 7: User Login & Security" on page 79 for* more details.

Instrument Settings

You can review and configure your Blackbelt Pro instrument **Settings** as needed.

Tap  →  then tap  to enter **Edit** mode.

Make changes, then tap  → **Save**.

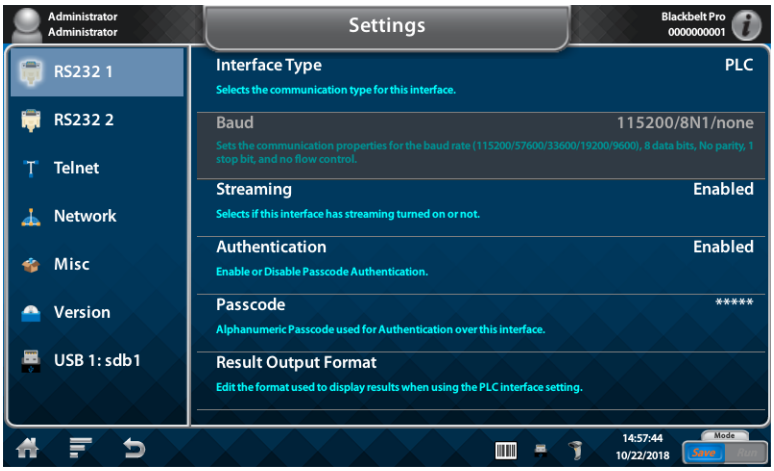


Figure 1-5. Settings options

See “Chapter 6: Settings” on page 71 for more information.

Colored Error Status in Programs

Colored segments and menus indicate configurations are missing or wrong.

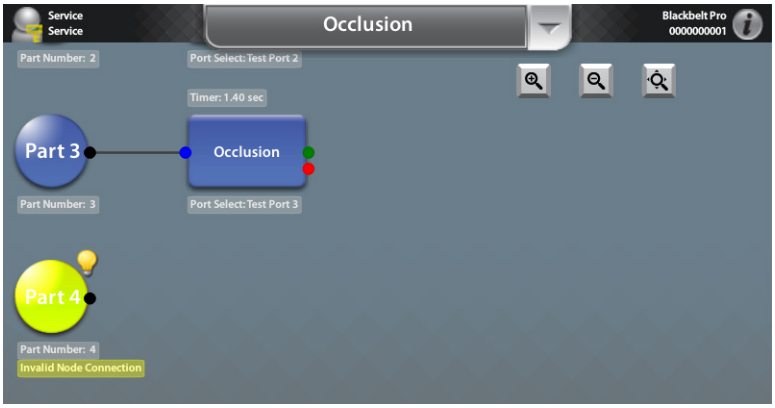


Figure 1-6. Part level program screen - missing test segment.

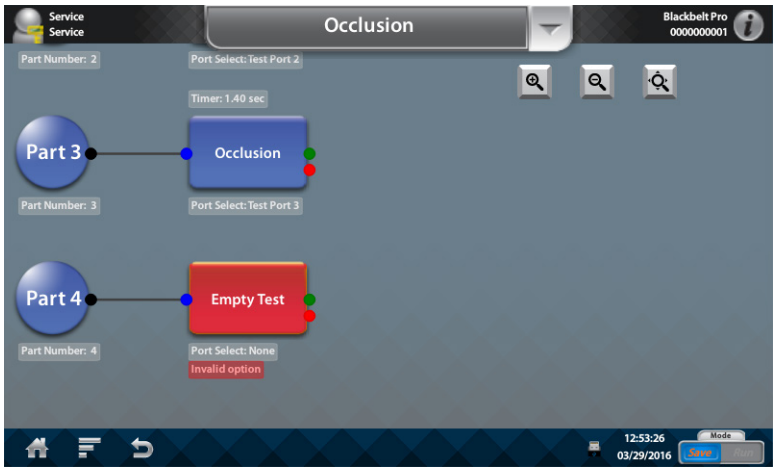


Figure 1-7. Part level program screen - test not configured.

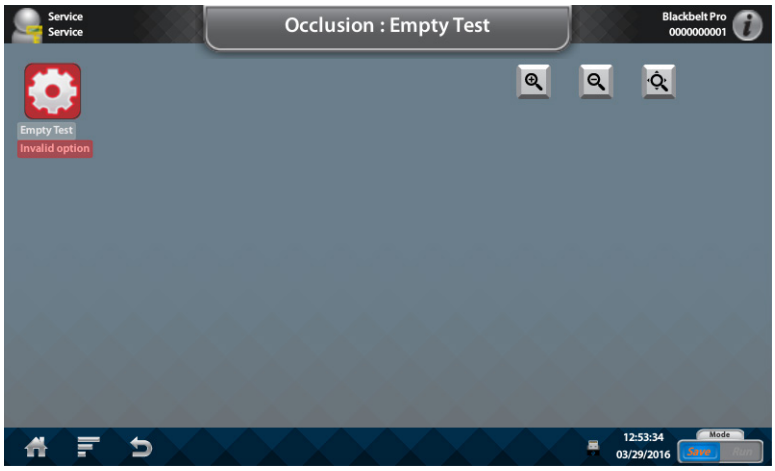


Figure 1-8. Test level program screen - no test configured.

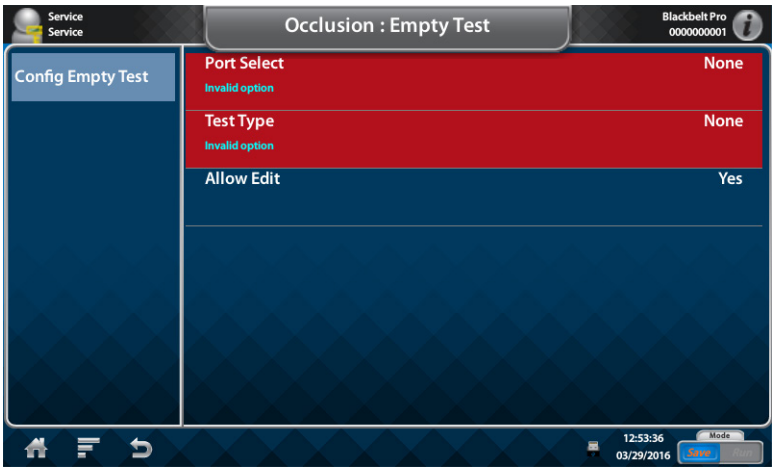


Figure 1-9. Test settings menu - missing test port and test type

Colored Error Status in Hardware

Colored segments and menus indicate configurations are missing or wrong.

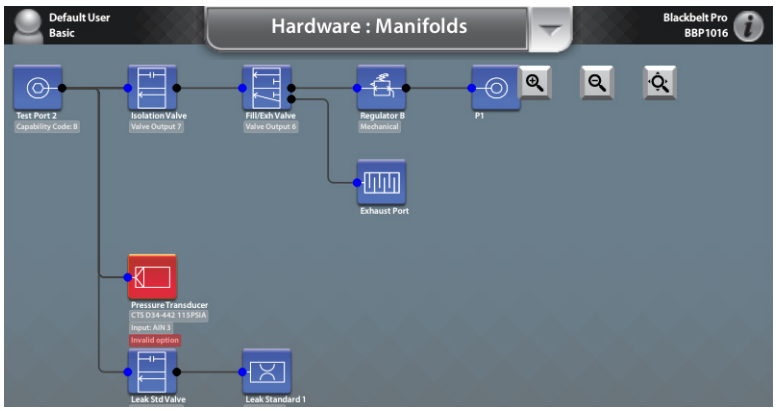


Figure 1-10. Hardware screen - Pressure Transducer is not properly

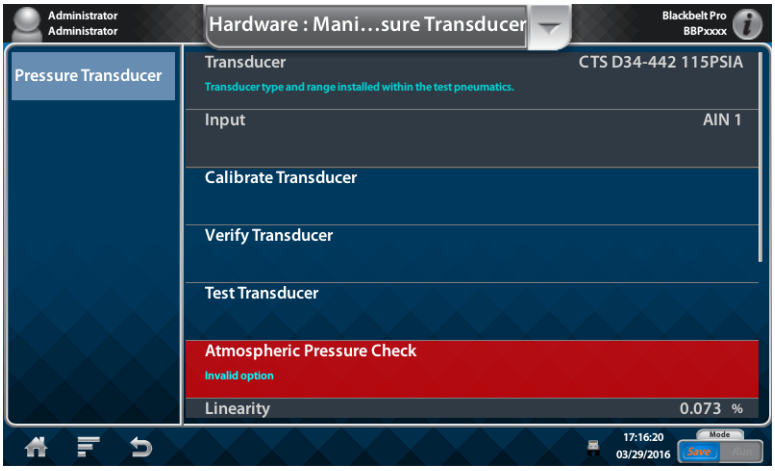


Figure 1-11. Hardware Menu - Atmospheric Pressure Check is not properly configured.

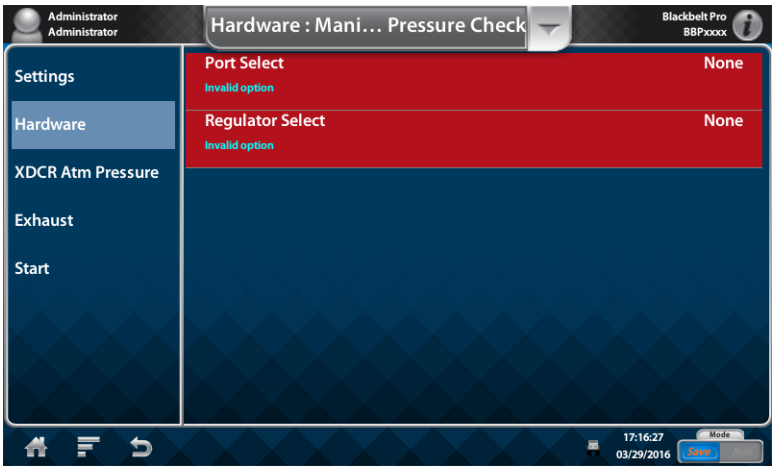


Figure 1-12. Hardware Menu - Test Port and Regulator Setting are not properly configured.

Barcode Scanner Connected Status Icon

Barcode  icon displays to the left of the Date and Time when the instrument is connected to a recognized barcode scanner. The icon disappears when the serial connection is dropped. See “Chapter 8: Communication” on page 87 for more information about connecting with a barcode scanner.

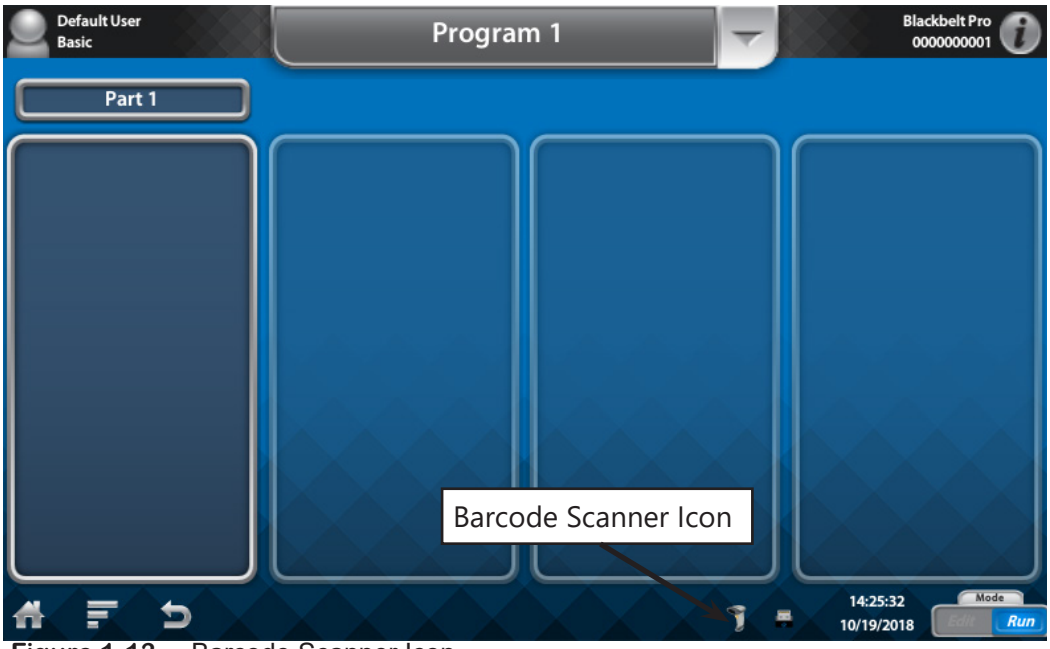


Figure 1-13. Barcode Scanner Icon

Chapter 2
Run Sample Tests

The Blackbelt Pro ships with Self-Test and one or more programs that are compatible with the hardware installed. These programs allow you to test the instrument after connecting power, shop air, and vacuum. Preloaded programs are located in the programs list. (All manifolds are capable of running an occlusion test and a pressure decay-loss test.) The hardware installed to your instrument will determine what additional tests may be available.

Note that there are only two mechanical buttons on the Blackbelt Pro instrument: Start/Pause and Stop which are used extensively in this chapter. All references to tap or long press in this chapter refer to on-screen objects or text menu items.

Run a Sample Program

If necessary, tap to return to the **Home** Screen.

Tap Program 1, then tap **Occlusion**.

If necessary, tap 1-10 or A-Z indicator to sort the list of programs as you prefer.

Remove the Self-Test cap from the cap holder and place it in the test port. Repeat this procedure to insert any other Self-Test caps that are present on the instrument.

Explore the Hold and Stop Controls

Press . When the test cycle completes, press to see the test run again.

Press to stop the test before it completes.

Press , then immediately press again. This puts the instrument in **HOLD**. **HOLD** status appears on the run screen. The **HOLD** timer increments, indicating how long the instrument is in **HOLD**. Press again to take the instrument out of **HOLD**.

See the Program Run

This is an example of an Occlusion test. You may see a different test in your instrument The results of test pass or test fail will be similar to the following screenshots.

Observe the test running on the **Home** screen.

When the test is running, the time and pressure are displayed in the Test Run Window. A horizontal bar graph shows the pressure relative to Pass or Fail limits.

Figure 2-2. Run a Test

At the end of the test cycle, if the pressure is within the Pass limits, it will result in a Test Pass and a Part Accept.
See Figure 2-3.

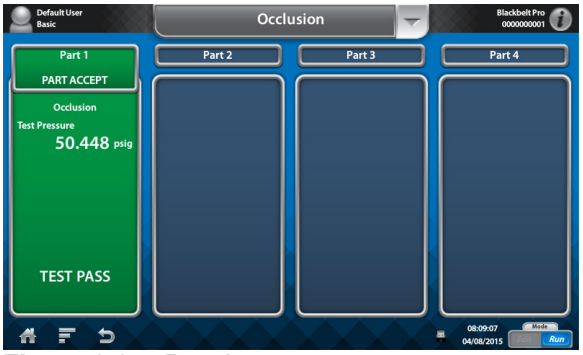


Figure 2-3. Part Accept

At the end of the test cycle, if the pressure is in above the reject limit, the Occlusion test will result in a Test Fail and a Part Reject. See Figure 2.4

Figure 2-4. Part Reject

The segment timer begins decreasing from where it was paused.

View the Graph Port Screen

Tap the **Test Display Window** for an active test port. The **Graph Port** screen appears. A pressure vs. time graph displays as the occlusion test runs.

Press  and observe the graph as the test runs.

Press  during the test to put the instrument in **HOLD** again.

Press  again to resume the test or press  to stop the test.

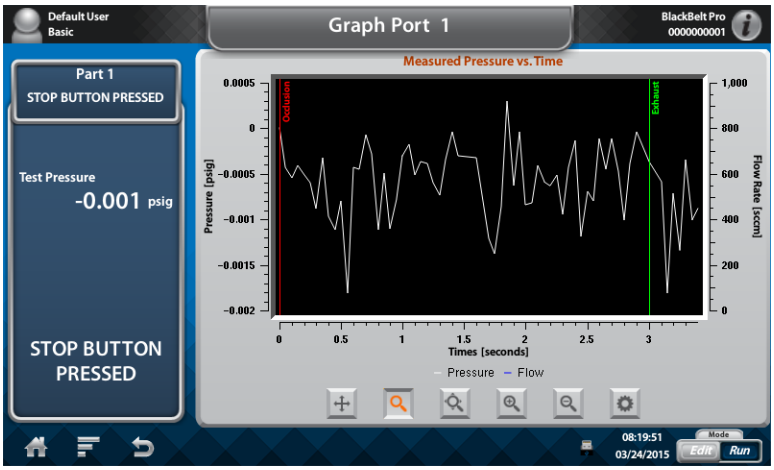


Figure 2-1. Graph Port Screen

Below the graph are the following pan and zoom navigation controls.

Tap or long press  or  screen to zoom in or out.

With  (zoom) selected, you can drag a box on the screen to zoom in.

With  (pan) selected, you can drag to move the graph at the current zoom level.

Tap  (zoom to fit) to return to the original, full image fit, or minimum zoom level.

Tap  (gear) to change settings for the **Graph Port** screen.

Tap  or  to return to the **Home** screen.

Other Possible Sample Programs

Try running any other sample programs that may be present to experience the features of the Blackbelt Pro.

If necessary, tap  to return to the **Home** screen.

Tap 

. Review the list of sample programs in the programs dropdown list. Tap a program name. Press  to observe the test running on screen. Other sample programs are described in the following section.

Standard Sample Programs

P0: Self-Test. This program uses a long pressure decay-loss test to verify the integrity of each manifold. It can be performed at the maximum pressure capable, but Self-Test is typically performed at the same pressure the regulator is set to run production leak tests.

P1: Multi-Part with Autorun - This program is used to run the instrument repeatedly. The instrument cycles thousands of times to test the hardware before it is delivered. The regulator for each test port is typically set at the leak standard specified pressure or half of the maximum manifold pressure.

P2: Occlusion - This test is typically used as a blockage test. If there is enough flow so that the measured pressure is below the High Limit Pressure setting, the test result is an accept. If flow through a part is restricted and measured pressure is above the High Limit Pressure setting, the occlusion test result is a reject. The occlusion test limits can be set to pass the occlusion test if the Self-Test cap is inserted in the test port or fail the occlusion test if the Self-Test cap is removed from the test port.

P3: Occlusion+Pressure Decay - This program combines an occlusion test and a pressure decay-loss test. If the occlusion test results in a pass, the pressure decay test runs. If the occlusion test results in a fail, the pressure decay test is skipped. The occlusion test limits can be set to pass the occlusion test if the Self-Test cap is inserted in the test port or fail the occlusion test if the Self-Test cap is removed from the test port.

P5: Multi-Port (Demo Engine) - This program combines a pressure decay-loss test on each of the available test ports into one part. Although the tests have names of automotive engine cavities, the test names could be renamed for appliance or medical components.

P6: Pressure Verify - This program measures pressure or vacuum generated by test parts. The only pressure measured with the Self-Test caps on the test ports will be the small pressure that is trapped by the isolation valve as it actuates to close.

Optional Sample Programs

P4: Tooling+Occ+Press Decay - If the instrument is sold with tooling, this optional program combines tooling extend, an occlusion test, a pressure decay test, and tooling retract. There is no activity on the graph during the tooling segments if this program is observed on the **Graph Port** screen.

P7: Mass Flow - If the instrument is sold with mass flow capability, there will be a program to run a mass flow test on any test ports that support this test type.

If necessary, tap  to return to the **Home** screen.

Tap 

→ 

→ **Mass Flow**.

Press  and observe the test running on the screen.

To view the **Graph Port** screen during a mass flow test, tap the **Test Display Window** for any active test port. The **Graph Port** screen displays a **pressure** vs. time graph during the prefill and fill cycles. The pressure scale is on Y-axis on the left side of the screen. The **Graph Port** screen displays a blue **flow** vs. time graph during the test cycle. The flow scale is on Y-axis on the right side of the screen.

Tap  or  to return to the **Home** screen.

P8: Pressure Decay-Leak Std - If the instrument is sold with one or more leak standards there will be a program to run a Pressure Decay-Leak test on any test ports that support this test type.

If necessary, tap  to return to the **Home** screen.

Tap 

→ 

→ **Pressure Decay-Leak Std**.

Press  and observe the test running on the screen. If you want to view the **Graph Port** screen during a mass flow test, tap the **Test Display Window** for any active test port. The **Graph Port** screen displays a **pressure** vs. time graph during the prefill and fill cycles. The pressure scale is on Y-axis on the left side of the screen.

Tap  or  to return to the **Home** screen.

Chapter 3
Create a Test

Note: Start/Pause and Stop mechanical buttons are used in this chapter.

All references to tap, drag, or long press refer to on-screen objects or text menu items.

Create a New Program

If necessary, tap to return to the **Home** screen. Tap Mode Edit Run to enter **Edit** mode.

Tap Program 1 → + Add.

A new, empty program appears.

This is the ***part level*** program screen.

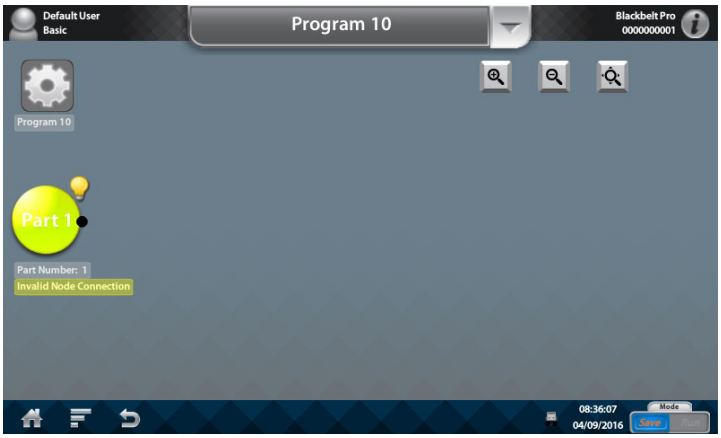


Figure 3-1. New Empty **Part** Program

Edit the Program Name

Tap .

Tap **Program Name**.

Figure 3-2. New Empty Program Menu

Use the on-screen alphanumeric keypad to edit the program name (26 characters maximum).

Tap OK, then tap Mode Save Run → **Save**.

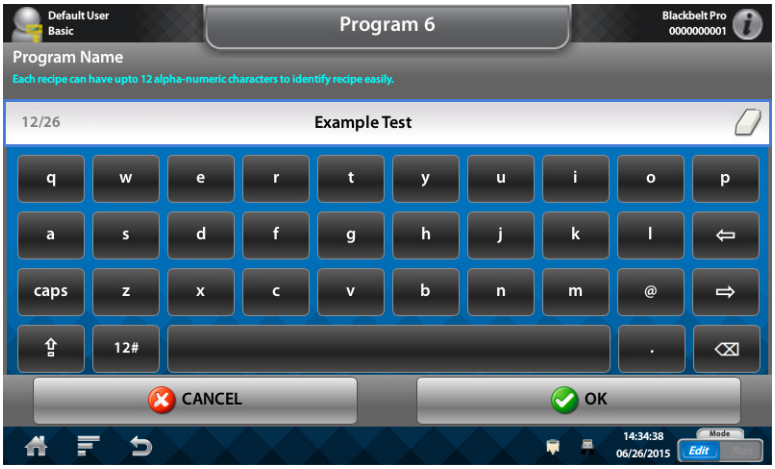


Figure 3-3. Program Name Editing

Add a Test

Long press Part 1. From the flyout menu, tap **Insert After** (or tap **Add** if no other segments are present), then tap **New Test.**

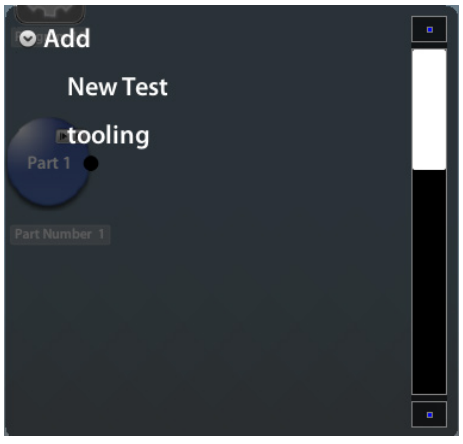


Figure 3-4. Flyout Menu

Tap  on the the ***part level*** program screen.

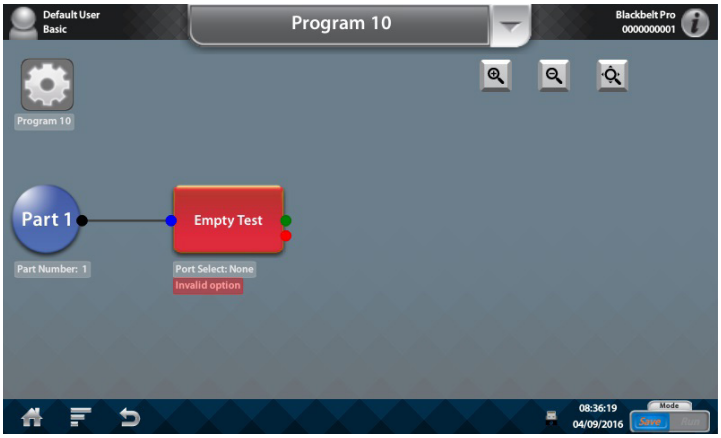


Figure 3-5. New Empty Test **- Part Level** Program screen

Tap  on the ***test level*** program screen.

Figure 3-6. New Empty Test - **Test Level** Program screen

Tap **Port Select**,

tap **Test Port 1**, →  ,

tap **Test Type,**

tap **Occlusion** →  ,

tap  → **Save.**

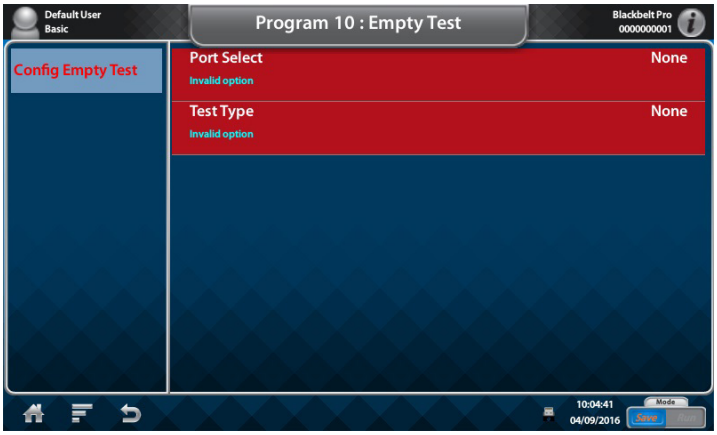


Figure 3-7. Empty Test - Text Menu

Note that the port number refers to the available test ports on the instrument in ascending order from left to right. Choosing a test port enables test types compatible with the manifold connected to that test port. Depending on your installed manifolds, multiple ports may be available for selection.

Run the New Program

If necessary, tap  to return to the **Home** screen. Before you can run the new program, you must select it from the program list.

Tap 

, then tap the new **Program #: P#** at the bottom of the list. If the list of programs is long enough your new program may not be visible. Drag the list to scroll down to the new entry, then tap the new program name, **Program #: P#** at the bottom of the list.

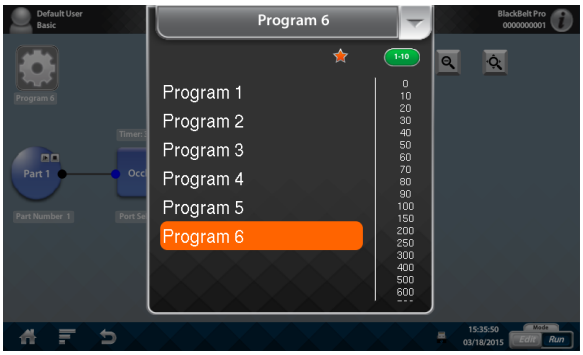


Figure 3-8. Select a Program

Press  . Observe the test running.

Change Test Settings

Tap  → 

.→ 

→ 

. This is the ***test level*** program screen.

The **Program** screen displays hardware options and the test cycle segments for an occlusion test. Note that all test segments can be accessed from the **Program** screen.

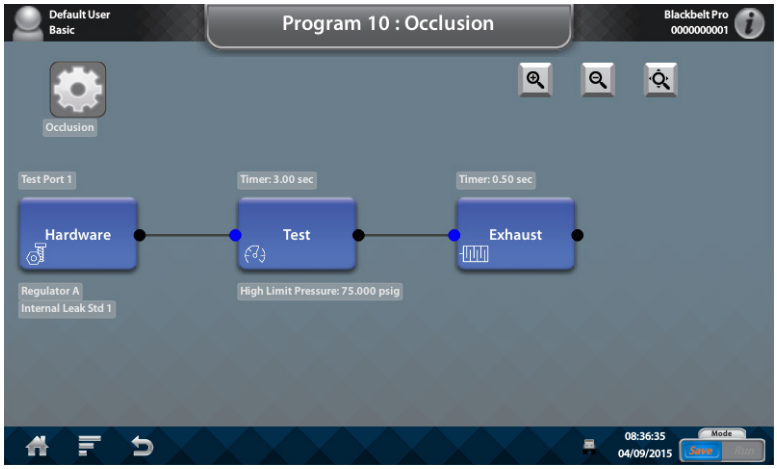


Figure 3-9. Occlusion Test - **Test Level** Program Screen

Tap  to open the settings menu. Access each menu screen to change settings and add events. Note that all test segments can be accessed from the text menu.

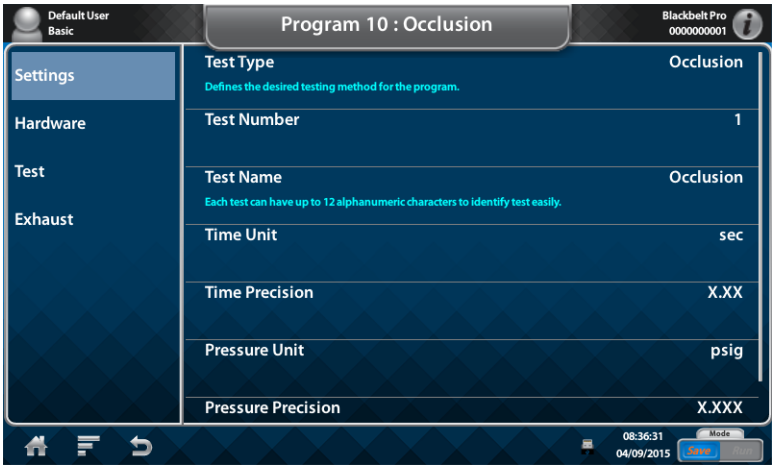


Figure 3-10. Occlusion Test - Text Menu Settings

Changing Test Types

Tap  →  →  →  →  , then tap **Test Type**.

Tap **Pressure Decay ΔP** →  .

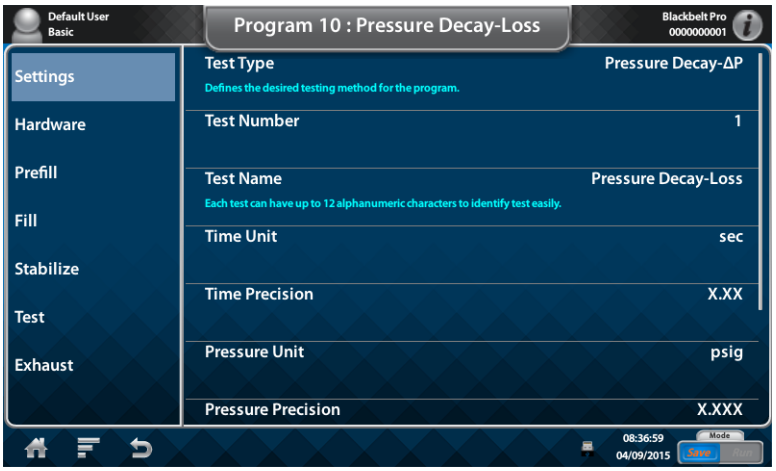


Figure 3-11. Pressure Decay-Loss Test - Text Menu Settings

Edit a Test Name

Tap **Test Name**. Use the Alphanumeric keyboard to edit the name. Tap 

Setting Units of Measure for Tests

The instrument can utilize multiple units of measure in a program. The units for each test are set in the  Settings segment on the ***test level*** program screen.

To change units of measure for test segments, tap 

to enter **Edit** mode.

Tap  → 

, then tap the **test segment** that you want to edit. Tap  and select from **Time Unit**, **Time Precision**, **Pressure Unit**, or **Pressure Precision**.

If there are any tooling devices in the program, there will also be settings for **Time Unit** and **Time Precision** in the  Settings segment on the ***part level*** program screen. These settings affect all tooling devices in this program.

Open The Leak Standard Valve

If the instrument has an internal leak standard mounted in the manifold it can be manually opened. The **Open Leak Std** menu setting is found in the Hardware segment menu, located in the ***test level*** program screen. The leak standard will remain open until it is manually closed, even through power cycles of the instrument. The Pressure Verify test type does not include the **Open Leak Std** menu setting. See also **Change the Leak Standard Values** in “Chapter 4: Hardware”.

Edit Test Pressures and Test Timers

Review the timer values and the upper and lower pressure limit values for each cycle of the test in this menu. Setting the pressure limits in each cycle allows for possible pressure spikes in the Fill cycle and reducing the allowable pressure limits in other cycles. Tap  to return to the ***test level*** program screen, where the test cycle timers are displayed above and the minimum and maximum pressure limits are displayed below each test segment. Tap 

→ **Save** when all changes have been made.

Tap  to return to the **Home** screen. Run the new Pressure Decay ΔP program.

Prefill Exit Criteria

The prefill segment has two exit criteria: **Min Press Achieved** and **Time Expired**. The default setting is **Min Press Achieved**. At this setting, upon reaching the minimum pressure, the instrument will exit the prefill segment and enter the fill segment regardless of any time remaining on the prefill timer. If the minimum pressure is not met before the prefill timer is exhausted, the test will end with a severe leak result.

Time Expired allows the use of fixed fill times. As the prefill timer decrements to zero, the instrument will exit the prefill segment and enter the fill segment, provided that the measured pressure is between the minimum and maximum limits for the prefill segment.

Pressure Limit Check

Note: Advanced users can edit Pressure limit Check.

The Instrument has capability to monitor pressure limit. With Pressure Limit Check, the instrument can monitor pressure continuously, mark a pressure goalpost at end of segment timer, or disable monitoring.

If the setting is Continuous, the instrument monitors pressure continuously during **Fill/Stabilize** segments. This is the default setting for **Pressure Limit Check**.

If the setting is **Time Expired**, the instrument checks pressure when **Fill/Stabilize** segment timer expires.

If the settings is **Disabled**, the instrument does not monitor the pressure in **Fill/Stabilize** segments.

Turn Pressure Correction On or Off

Note: Advanced users can see and edit Pressure Correction.

The instrument uses **Pressure Correction** for pressure decay and mass flow test types by default, to enhance the performance of the instrument. If Pressure Correction is **Disabled**, the Target Pressure setting does not appear in the Test cycle menu. Pressure Correction is disabled in the Self-Test program so it will run at any test pressure.

If Pressure Correction is **Enabled**, the instrument performs measurement corrections based on the ratio of the Target Pressure over the actual test pressure. The measurement corrections are applied to pressure loss values, leak rate results and mass flow readings. For example, if the Target Pressure is set to 50 psig but the test is actually performed at 40 psig, the pressure loss values and the leak rate, or the mass flow reading would be multiplied by a factor of 1.25. In another example, if the Target Pressure is set to 60 psig but the test is actually performed at 80 psig, the pressure loss values and the leak rate, or the mass flow reading is multiplied by a factor of 0.75.

Determine if you need enhanced correction and choose accordingly whether to enable or disable this feature. The Pressure Correction setting can be found in Test cycle menus for all pressure decay and mass flow test types, See chapters 12, 13, 14, 17, and 18 for more information.

Add Test Sequences

Add additional tests or tooling as needed. Multiple tests can be added in sequence. For example, an occlusion test might run before a pressure decay test. Tests can also be linked by accept or reject decisions. The following sections describe insertion of additional Test segments, and Tooling segments.

Tap  → 

. → 

to enter **Edit** mode. Long press 

From the flyout menu, tap **Add,** then tap **On Pass**, **On Fail** or **On Pass/Fail.**

Tap **New Test or Tooling** (tooling is covered in the next section).

Tap 

. segment and make changes to the menu settings as needed.

Tap 

→ **Save** to save your changes.

Copy and Paste Test Segment

Long press 

(or any other test type segment that you want to copy).

From the flyout menu, tap **Copy**. Once the test is stored in memory, there are several options for where to paste it:

Option 1: Long press 

, tap **Insert After** > **Paste**.

Option 2: Long Press 

, tap **Insert After** > **Paste**.

Option 3: Long press an existing Test segment, tap **Insert Before** or **Insert After on Pass** > **Paste**.

Note The copied test can be pasted multiple times, until another action is performed or the changes are saved.

Note: If copied from a different Part, the pasted test segment will need Hardware

segment edits to set the Port Select, Regulator Select, and possibly the leak standard before the program can be run.

Tap 

→ **Save** to save your changes.

Copy and Paste Part Segment

Long press 

(or any other part segment that you want to copy),

From the flyout menu, tap **Copy Part**. Once the test is stored in memory, there are a couple of options for where to paste it:

Option 1: In the *current* program long press  , from the flyout menu, tap **Paste Part**.

Option 2: In a *different* program long press  , from the flyout menu, tap **Paste Part**.

Note The pasted test segment will need Hardware segment edits to set the Port Select, Regulator Select, and possibly the leak standard before the program can be run.

Tap 

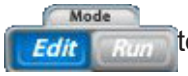
→ **Save** to save your changes.

Add Execution Pause to a Program

There are applications where it is desirable for the instrument to pause or delay execution between the tests. An example would be allowing the operator to manipulate a part between tests, such as opening a valve, inserting a component or any action that requires an external event to take place before testing can continue.

User can add Execution Pause at the Program level and with user selectable options of "**Continue on Start**" or "**Continue after Delay**". When "**Continue on Start**" is selected the user is prompted for a Start signal (Start button, Digital input or Start command) which will be displayed on the screen and execution will resume after giving the Start input. When "**Continue after Delay**" is selected, test execution will be paused for "**Delay Timer**" specified by the user.

Tap  → 

→ 

to enter **Edit** mode. Long press 

From the flyout menu, tap **Add** or **Insert After**, then Tap 

and Tap Exit Criteria, then tap on required option (see below table for details on options available) and you can modify. **Exit** condition. The default **Exit** condition is "**Continue on Start**", and you can modify it to "**Continue after Delay**". If user Tap on "**Continue after Delay**", the new variable name "**Delay Timer**" will be appeared, **Delay Timer** (only visible if Continue after Delay) this timer can be configured changed for amount of time to pause before continuing the test execution. Tap "**Delay Timer**" Modify the Timer as needed and then Tap 

Tap 

Save.  Tap to return to the Program screen.

Available parameters for Execution Pause

Menu	Description
Exit Criteria	"**Continue on Start**" - If you select this then selected user prompt asking for Start signal (Start button, Digital input or Start command) will be displayed on the screen and execution will resume after giving the start input "**Continue after Delay**" - If you select the new variable name "Delay Timer" will be appeared.
Delay Timer	This parameter indicates the amount of time to delay before execution of next test. The Delay timer is only visible when the Exit criteria set to Continue after Delay, otherwise the parameter has no affect.

Edit Execution Pause Time Unit and Time Precision Settings

Tap  → 

→ 

Besides the Program Name, the Program Settings menu now also includes **Time Unit** and **Time Precision** (digits to the right of the decimal) for Execution pause delay timer. If there are no execution pause delay timer segments in the program these settings will not be available.

Remove Execution Pause

To remove Execution pause from a program, enter Edit mode. Tap 

Long press 

From the flyout menu, tap Delete. Tap 

→**Save**.

Add Tooling to a Program

Tooling control is necessary to advance seals before a test and retract seals after a test. Multiple tooling events can be added in series. For each tooling control event before a test (to extend), it is typical to also add a tooling control event after the test (to retract) unless the tooling utilizes spring return and no time is required for return.

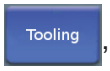
Tap  → 

→ 

to enter **Edit** mode.

Long press 

. From the flyout menu, tap **Add** or **Insert After,** then tap **Tooling**.

Tap 

, tap **Device Select**, then tap an **available device**.

(See “Chapter 11: Tooling and I/O” and “Chapter 12: Events” on page 137 for more information about creating a hardware device.)

Tap 

. Modify the **Timer** as needed.

Tap 

→ **Save**. Tap  to return to the **Program** screen.

Edit Tooling Time Unit and Time Precision Settings

Tap  → 

→ 

Besides the Program Name, the Program Settings menu now also includes **Time Unit** and **Time Precision** (digits to the right of the decimal) for tooling. If there are no tooling segments in the program these settings will not be available.

Remove Tooling

To remove tooling from a program, enter **Edit** mode. Tap 

Long press 

. From the flyout menu, tap **Delete**. Tap 

→ **Save**.

Edit a Part Name and Change Part Settings

Tap 

to enter **Edit** mode. Tap  → 

→ 

, then tap **Part Name**.

Editing the part name is optional; if all test parts are the same, then Part 1 may be acceptable.

Use the alpha-numeric keypad to edit the part name (up to 26 characters), then tap 

.

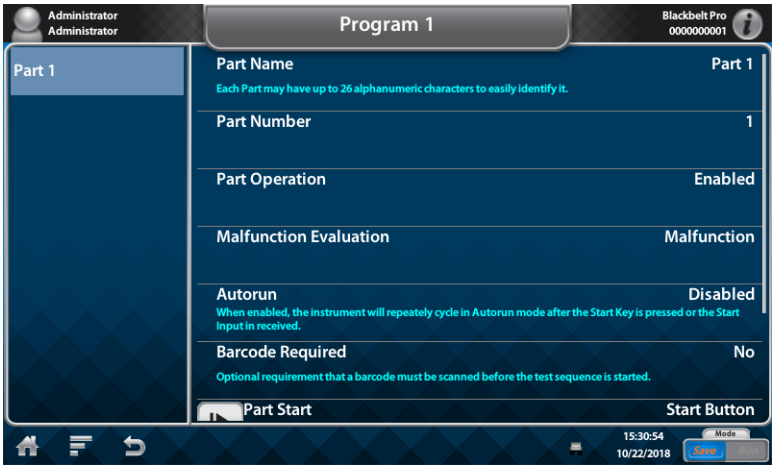


Figure 3-12. Part Settings

The following settings are available in the Part Settings menu.

Menu	Description
Part Name	Part Name can have up to 26 alphanumeric characters to identify the part.
Part Number	The part number refers to the physical part you are testing.
Malfunction Evaluation	When configured as Reject, it will treat any malfunction as a Reject
Part Calibration Method	Defines physical part requirements for Program Calibration and Leak Standard selection.
Calibration Relax Timer	The amount of time the instrument “rests” between segments of the calibration cycle. Available when part calibration method is set to One Part.
Autorun	When enabled, the instrument will repeatedly cycle in Autorun mode after the Start button is pressed or a Start Input is received. This setting enables additional Autorun settings. **Requires Advanced access level to edit.**
Autorun Cycle Count	Autorun is an instrument-initiated automatic cycling test feature. Autorun Cycle Count is the number of tests cycles run before the automatic test cycling stops. **Visible when Autorun is enabled, requires Advanced access level to edit.**
Autorun Relax	Time between Autorun cycles allows the part to recover to a repeatable state. **Visible when Autorun is enabled, requires Advanced access level to edit.**
Autorun Method	The Autorun cycle can repeatedly initiate a test cycle with or without the leak standard being applied on every third test cycle. **Visible when Autorun is enabled, requires Advanced access level to edit.**

Menu	Description
Part Start	This setting selects whether the Start button or a start input will start a test. **Requires Advanced access level to edit.**
Stop/Reset	The Stop/Reset input is available to stop tests and retract tooling. When a stop/reset input is received the test cycle goes immediately through a Vent/ Halt routine and then advances to retract the tooling. The Malfunction output (if programmed) will go high at the end of the last tooling motion for errors defined as malfunctions. **Requires Advanced access level to edit.**
Add Event	An event is an optional polled input or status output in the program. **Requires Advanced access level to see and edit, visible in Edit mode.**

*Note: The Part Number refers to the physical part to be tested. Options are limited to 4 because there are 4 test ports on the instrument; therefore, only 4 parts can be tested concurrently (simultaneously). The test port is set in the **test level** Hardware menu.*

Review the settings. Edit any of the menu options, then tap 

.

(See “Chapter 12: Events” on page 137 for more information about managing events.)

Tap 

→ **Save** when you are finished making changes.

Part Operation

If you don’t want to run a part, this is the procedure to disable part operation.

 → 

→ 

, then tap **Part Operation**.

Select **Disabled** tap **OK**.

Tap 

→ **Save** when you are finished making changes.

Now the part will not execute on Program run.

Part Calibration

If the test type requires a calibration, this is the procedure to perform a calibration. Tap  → 

→ 

, then tap **Part Calibration**.

Repeat these steps for any other parts that you wan to calibrate. Each time that Part Calibration is tapped, the Home screen is displayed with a Part Calibration dialog in the Test Display Window. The controls in the dialog are **CANCEL** or **OK**. When all the parts are ready to calibrate, tap **OK** in each Part Calibration dialog.

Note: You must tap each **OK** individually because the touchscreen does not support multi-touch commands.

Note: An alternative to tapping **OK** to start the first cycle of the Part calibration is to use the Start Part event input.

Autorun

Autorun causes the instrument to cycle automatically without any need for input.

Figure 3-13. Autorun Options

Note that Autorun and its associated settings are only available for Advanced users.

To enable Autorun, tap 

to enter **Edit** mode. Tap  → 

→ 

.

Tap **Autorun**. Tap **Enabled**, then tap 

.

With Autorun enabled, several additional options become available on the **Part Settings** screen. Tap any of these options to change their configuration.

Tap **Autorun Cycle Count** to define the number of cycles that will run automatically. Use the on-screen numeric keypad to type a number, then tap 

.

Tap **Autorun Relax** to define a period of time the instrument will wait between cycles. Use the on-screen numeric keypad to type a number, then tap 

.

Tap **Autorun Method** to set up how automatic cycles will be performed. Tap **Standard** to only perform the test cycle, or tap **Leak Std on Every 3rd** to utilize a leak standard on every third test. Tap 

.

Tap 

→ **Save** when you are finished making changes.

Chapter 4
Hardware

Most of the Blackbelt Pro hardware is configured by Cincinnati Test Systems and cannot be modified. However, some functions can be adjusted. To make *any* hardware changes, the current user account permissions must be set to **Allow Hardware Edit**.

See “Chapter 7: User Login & Security” on page 79 for details.

To perform hardware tasks, tap  → 

. If 

, is displayed in the Title Bar, tap 

, then tap **Manifolds**.

Tapping  → 

will continue to display the **Hardware: Manifolds** screen until **Hardware:Devices** is selected. See “Chapter 4: Hardware” or see “Chapter 11: Tooling and I/O” and “Chapter 12: Events” for more information about devices.

Set Mechanical Regulator Pressure

From the **Hardware: Manifolds** screen, tap 

.

Place the Self-Test cap in the test port of the regulator that you are setting.

Tap **Set Regulator** → 

to continue.

The fill valve opens, and remains open until you press 

again. The instrument pressure displays on the screen.

Figure 4-1. Regulator Settings

Adjust the regulator knob to the desired pressure. Tap 

when finished.

Alternate Method: If your user account does not allow you to edit hardware settings, place the Self-Test cap in the test port for the regulator that you are setting. Starting from the **Home** screen, press  . Press  again to put the instrument in **HOLD** while the program is in a fill cycle. Observe the pressure on the screen. Adjust the mechanical regulator knob to the desired pressure. Press  to stop the program.

Set Pre-Regulator Pressure

If the Blackbelt Pro is ordered with a mass flow configuration, a . regulator may be present in the pneumatic circuit, inside or outside of the instrument enclosure. A pre-regulator must be set to a higher pressure than the target pressure regulator, typically 10 psig higher than the desired test pressure.

Figure 4-2. Pre-Regulator Settings

A pre-regulator is set using the Alternative Method to set Mechanical Regulator Pressure above; however during the procedure the target regulator pressure must be temporarily set to a higher pressure setting than the pre-regulator so the pre-regulator pressure can be measured. This process may also require raising the maximum pressure setting if using the alternate method (see above).After the pre-regulator pressure is set, the target regulator pressure can be reduced to the desired pressure. If the maximum pressure was raised to set the pre-regulator, it should be returned to its original setting.

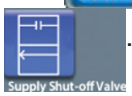
Note: If the pre-regulator is located outside the instrument enclosure, it must not be used to regulate pilot air for the pilot air controlled valves in the instrument. When a pilot air regulator is used, it must be set to a minimum pressure of 65 psig.

Supply Shut-off Valve

In instrument, incoming air can be disabled using Supply Shut-off Valve This can provide ability to disable the incoming air supply, either to preserve Tank Air supply, to limit air compressor consumption or to quiet the instrument between tests. The Shut-off valve will get off after **Shut-off Delay** configured, on isolate part and exhaust part pneumatic actions.

To perform hardware tasks, Tap  → 

and Tap 

to enter Edit mode. From the Hardware: Manifolds screen, Tap 

. The following menu displays.

Menu	Description
Valve Code	Define value type for shut-off value in the primary pneumatic circuit installed within the instrument.
Valve Output	User selectable output to control this valve.
Valve PWM	Define shut-off value PWM rate.
Shut-off Delay	. The Make the valve off after Shut-off Delay configured in isolate part and exhaust part pneumatic actions.

From above menu option Modify the **Shut-off delay** when you have finished modifying settings, when you Tap 

you will be prompted to Save or Cancel your changes

Calibrate an Electronic Regulator

Advanced access level is required to calibrate an electronic regulator. A calibrated master pressure gauge is also required to calibrate the electronic regulator.

The electronic regulator is capable of up to a 20-point calibration. The number of points is determined by the user. Cincinnati Test Systems typically calibrates electronic pressure regulators with 20 points for very high accuracy across the full range.

Tap  → 

→ 

.

The following menus appear.

Menu	Description
Regulator Identifier	Alphabetic identity of the regulator used in this hardware configuration.
Regulator	Pressure Regulator type installed within the test pneumatics.
Output	The analog output connector number to which this electronic regulator is connected.
Calibrate Regulator	Setup and launch of a stepped sequence to calibrate the electronic regulator at each setpoint with an external reference.

Tap **Calibrate Regulator**. The following menus appear.

Menu	Description
Settings	
Time Unit	Unit of measurement displayed for timers for the program.
Time Precision	Displayed digits of precision for all time unit values.
Hardware	
Port Select	Specifies the test port to utilize for the test.
Regulator Select	Specifies the regulator to utilize for the test.
Analyze	
Pressure Reference	Determines what the pressure transducer references as zero pressure.
Reg Dwell Timer	Duration of time after each setpoint during the electronic regulator analysis sequence before recording the instrument pressure
EReg Cal Method	Method to pick range of setpoints for electronic regulator calibration routine. Manual settings may be necessary if pressure or vacuum source is more limited than the capable range of the regulator.
Analysis Percent	Defines the cutoff percent when determining the functional voltage range of the electronic regulator.
Zero	
Timer	Amount of time allocated to each segment for execution before continuing.

Menu	Description
Setpoint	
Timer	Amount of time allocated to each segment for execution before continuing.
Number of Points	Defines the number of setpoints to utilize when calibrating or verifying the electronic regulator. Value may be 2 to 20 for an electronic regulator.
Exhaust	
Timer	Amount of time allocated to each segment for execution before continuing.
Start	
Start Calibration	Launches the electronic regulator calibration sequence, which will advance through each setpoint and pause, to allow calibration of the regulator to an appropriate external reference. **Instrument must be in Run mode to Start Calibration.**

Tap 

to enter **Edit** mode. Configure the calibration as needed, then tap 

→ **Save**.

Tap **Start**. Connect a master pressure gauge to the test port that you are calibrating before proceeding. Tap **Start Calibration**. Tap 

to continue (tap 

at any time to quit).

The test port pressurizes and the transducer analyzes the pressure regulator performance for 30 seconds. Tap 

when available.

Tap **Master Gauge Press**, then use the on-screen numeric keypad to enter the pressure value shown on the master gauge. Tap 

to accept the value. Tap 

again to continue.

The pressure regulator increases its pressure to the next target pressure setting and the process repeats. You must perform the process once for each point of calibration you have selected for the regulator. For example, in a 5 point calibration, the process will occur 5 times. **Electronic Regulator Calibration** results can be viewed on the **Results: All** screen or shared via USB on the **Results: Custom** screen. See “Chapter 5: Results” on page 63 for more details.

Calibrate a Pressure Transducer

This process launches the transducer calibrate sequence, which advances through each setpoint and pauses to allow calibration of the transducer to an appropriate external reference gauge. Advanced access level is required to calibrate a pressure transducer.

A calibration or verification of the transducer should be done periodically according to the quality standards at your facility. The instrument is capable of performing a multiple-point calibration. The number of calibration set points can be modified. Cincinnati Test Systems typically calibrates pressure transducers with 6 points for very high accuracy across the full range. A calibrated master pressure gauge is required to calibrate the pressure transducer on the instrument.

From the **Hardware: Manifolds** screen, tap 

.

The following menus appear.

Menu	Description
Transducer	Transducer type and range installed within the test pneumatics.
Input	The analog input connector number to which this pressure transducer is connected.
Calibrate Transducer	Launches the transducer calibration sequence, to allow calibration of the transducer.
Verify Transducer	Launches the transducer verification sequence, to allow verification of the transducer.
Test Transducer	Launches the transducer test sequence, to allow testing of the transducer.
Linearity	Transducer linearity, calculated over the cal setpoints (defined as percent of full scale).
Last Cal Date	Date of the last successful transducer calibration.
Last Cal Time	Time of the last successful transducer calibration.
Verify Date	Date of the last transducer verify sequence.
Verify Time	Time of the last transducer verify sequence.

Note: The pressure transducer values are generated by the calibration process and cannot be modified directly.

Tap **Calibrate Transducer**. The following menus appear.

Calibrate Menu	Description
Settings	
Time Unit	Unit of measurement displayed for timers for the program.
Time Precision	Displayed digits of precision for all time unit values.
Pressure Unit	Unit of measurement for all test pressure values for the program.
Pressure Precision	Displayed digits of precision for all pressure unit values.
Hardware	
Port Select	Specifies the test port to utilize for the test.
Regulator Select	Specifies the regulator to utilize for the test.
Analyze	
No settings are available under this category.	
Zero	
No settings are available under this category.	
Setpoint	
Number of Points	Defines the number of setpoints to utilize when calibrating or verifying the pressure transducer. Value may be 2 to 32 for a pressure transducer or a mass flow transducer.
Setpoint Pressure #	The user is able to define the setpoints for calibrating or verifying this transducer The number of setpoints shown is based on the Number of Points setting. All setpoints must be in ascending or descending order.
Linearity Limit	If non-zero, defines the maximum allowable value for a successful transducer calibration. Value is read-only.
Xdcr Zero Window	Defines the barometric pressure limits to calculate the Transducer Zero Low/High Window. Visible to Advanced users, value is read-only.
Exhaust	
Timer	Amount of time allocated to each segment for execution before continuing.
Start	
Start Calibration	Launches transducer calibration sequence to calibrate transducer to an external reference. **Instrument must be in Run mode to Start Calibration.**

Review all settings. If changes are required, tap 

to enter **Edit** mode.

Make any necessary changes, then tap 

→ **Save** and proceed to calibration.

Tap **Start**. Connect a master pressure gauge to the test port that you are calibrating before proceeding. Tap **Start Calibration**. Tap 

to continue (tap 

at any time to quit).

The instrument analyzes the transducer performance at atmospheric pressure on the

test port for 30 seconds. Observe the target pressure indicated by **Setpoint Pressure 1**.

Adjust the pressure regulator so that the instrument pressure reads a pressure close to the **Setpoint Pressure 1** value. Tap Set → **Master Gauge Pressure**, then use the on-screen numeric keypad to type the measured pressure displayed on the master gauge → OK.

Tap OK again to continue. The process repeats for each point of calibration, using a new **Setpoint Pressure** value each time. For example, in a 5 point calibration, the process will occur 5 times.

Transducer Calibration results can be viewed on the **Results: All** screen or shared via USB on the **Results: Custom** screen. See “Chapter 5: Results” on page 63 for more details.

Verify Pressure Transducer Calibration

This process launches the transducer verify sequence, which advances through each setpoint, pausing to allow verification of the transducer to an appropriate external reference gauge. Advanced access level is required to verify a pressure transducer.

The number of verification set points can be modified. Cincinnati Test Systems typically verifies pressure transducers with 6 points for very high accuracy across the full range.

The transducer verification process is very similar to the calibration process. You must enter the external master gauge value at each point to step through the sequence. You will need a calibrated master pressure gauge to verify the pressure transducer on the instrument. You will be prompted to input values so the Transducer Verification Report has this data for later review. This feature does not affect the calibration of the instrument.

From the **Hardware: Manifolds** screen, tap 

.

Tap **Verify Transducer**. The following menus appear.

Verify Menu	Description
Settings	
Time Unit	Unit of measurement displayed for timers for the program.
Time Precision	Displayed digits of precision for all time unit values.
Pressure Unit	Unit of measurement for all test pressure values for the program.
Pressure Precision	Displayed digits of precision for all pressure unit values.
Hardware	
Port Select	Specifies the test port to utilize for the test.
Regulator Select	Specifies the regulator to utilize for the test.
Verify Setpoint	
Number of Points	Defines the number of setpoints to utilize when calibrating or verifying the pressure transducer. Value may be 2 to 32 for a pressure transducer or a mass flow transducer.
Setpoint Pressure #	The user is able to define the setpoints for calibrating or verifying this transducer The number of setpoints shown is based on the Number of Points setting. *All setpoints must be in ascending or descending order.*
Exhaust	
Timer	Amount of time allocated to each segment for execution before continuing.
Start	
Start Verification	Launches the transducer verification sequence to calibrate transducer to an external reference. **Instrument must be in Run mode to Start Verification.**

Review all settings. If changes are required, tap 

to enter **Edit** mode.

Make any necessary changes, then tap 

→ **Save** and proceed to verification.

Tap **Start**. Connect a master pressure gauge to the test port that you are verifying before proceeding. Tap **Start Verification**. Tap 

to continue (tap 

at any time to quit).

The instrument pressurizes the test port.

Observe the target pressure indicated by **Setpoint Pressure 1**. Adjust the pressure regulator so that the master gauge reads a pressure close to **Setpoint Pressure 1**.

Tap **Master Gauge Pressure**, then use the on-screen numeric keypad to type the measured pressure displayed on the master gauge. Tap 

→ 

.

Tap 

to continue. The process repeats for each point of calibration, using a new **Setpoint Pressure** value each time. For example, in a 5 point calibration, the process will occur 5 times.

Transducer Verification results can be viewed on the **Results: All** screen or shared via USB on the **Results: Custom** screen. See “Chapter 5: Results” on page 63 for more details.

Test a Pressure Transducer

This process launches the transducer test sequence, which advances through each setpoint and pauses to allow testing of the pressure transducer and analog-to-digital circuit performance. Advanced access level is required to test a pressure transducer.

Performing a test of the transducer may be requested by a Cincinnati Test Systems Field Service Engineer while troubleshooting your instrument over the telephone. The instrument is capable of performing a multiple-point transducer test. The number of calibration set points can be modified. You must plug a Self-Test cap into the test port to test the pressure transducer on the instrument.

From the **Hardware: Manifolds** screen, tap 

.

Tap **Test Transducer**. The following menus appear.

Test Menu	Description
Settings	
Time Unit	Unit of measurement displayed for timers for the program.
Time Precision	Displayed digits of precision for all time unit values.
Pressure Unit	Unit of measurement for all test pressure values for the program.
Pressure Precision	Displayed digits of precision for all pressure unit values.
Hardware	
Port Select	Specifies the test port to utilize for the test.
Regulator Select	Specifies the regulator to utilize for the test.
Test	
Minimum Resolution	Low limit of resolution use to evaluate test results for a pass or fail result.

Test Menu	Description
Number of Points	Defines the number of setpoints to utilize when calibrating or verifying the pressure transducer. Value may be 2 to 32 for a pressure transducer or a mass flow transducer.
Setpoint Pressure #	The user is able to define the setpoints for calibrating or verifying this transducer The number of setpoints shown is based on the Number of Points setting. *All setpoints must be in ascending or descending order.*
Exhaust	
Timer	Amount of time allocated to each segment for execution before continuing.
Start	
Start Xdcr Test	Use to launch an internal test for each transducer installed to determine their individual performance. **Instrument must be in Run mode to Start Xdcr Test.**

Review all settings. If changes are required, tap 

to enter **Edit** mode.

Make any necessary changes, then tap 

→ **Save** and proceed to testing.

Tap **Start**. Connect a Self-Test cap to the test port that you are testing before proceeding. Tap **Start Xdcr Test**. Tap 

to continue (tap 

at any time to quit).

Observe the target pressure indicated by Setpoint Pressure 1.

Adjust the pressure regulator so that the instrument pressure reads a pressure close to the **Setpoint Pressure 1** value. Tap 

. the instrument analyzes the transducer performance at the setpoint pressure.

Tap 

again to continue. The process repeats for each point of calibration, using a new **Setpoint Pressure** value each time. For example, in a 5 point calibration, the process will occur 5 times.

The result of the transdu cer test is displayed at the top of the screen. Tap 

to return to the previous test transducer menu.

Transducer Test results can be viewed on the **Results: All** screen or shared via USB on the **Results: Custom** screen. See “Chapter 5: Results” on page 63 for more details.

Atmospheric Pressure Check

This process launches the pressure transducer atmospheric pressure check sequence, which will read the local atmospheric pressure and calculate the appropriate zero window for all gauge pressure measurements. This is necessary when the instrument transducers are calibrated and then the instrument is relocated to an area where the atmospheric pressure is substantially different. For example, if the instrument leaves the Cincinnati Test Systems factory with a transducer calibrated at an elevation of 522 feet above sea level and is installed at a customer's facility located at a different altitude, .It is not necessary for barometric pressure fluctuations due to weather fronts. Advanced access level is required to test a pressure transducer.

From the **Hardware: Manifolds** screen, tap 

.

Tap **Atmospheric Pressure Check**. The following menus appear.

Test Menu	Description
Settings	
Time Unit	Unit of measurement displayed for timers for the program.
Time Precision	Displayed digits of precision for all time unit values.
Pressure Unit	Unit of measurement for all test pressure values for the program.
Pressure Precision	Displayed digits of precision for all pressure unit values.
Hardware	
Port Select	Specifies the test port to utilize for the test.
Regulator Select	Specifies the regulator to utilize for the test.
XDCR Atm Pressure	
Timer	Amount of time allocated to each segment for execution before continuing..
Iso Delay Timer	
Xdcr Zero Window	Defines the window (+/-) around the barometric pressure value utilized to calculate the Transducer Zero Low/High Window parameters..
Exhaust	
Timer	Amount of time allocated to each segment for execution before continuing.

Test Menu	Description
Start	
Atm Pressure Check	Launches the transducer atmospheric pressure check sequence, which will read the local atmospheric pressure and calculate the appropriate zero window for all gauge pressure measurements. **Instrument must be in Run mode to Start Atm Pressure Check.**

Review all settings. If changes are required, tap 

to enter **Edit** mode.

Make any necessary changes, then tap 

→ **Save** and proceed to checking.

Tap **Start**. Tap **Atm Pressure Check.** Remove all connections to the test port that you are checking before proceeding. Tap 

to continue (tap 

at any time to quit).

The process is automatic and takes about 5 seconds to complete.

The result of the atmospheric pressure check is displayed at the top of the screen. It should display the following:

ATMOSPHERIC PRESSURE - Analysis complete. Local pressure value stored.

Tap 

to return to the previous test transducer menu.

Atmospheric Pressure Check results can be viewed on the **Results: All** screen or shared via USB on the **Results: Custom** screen. See “Chapter 5: Results” on page 63 for more details.

Calibrate a Mass Flow Transducer

This process launches the transducer calibrate sequence, which advances through each setpoint and pauses to allow calibration of the mass flow transducer. Advanced access level is required to calibrate a mass flow transducer.

A calibration or verification of the transducer should be done periodically according to the quality standards at your facility. The instrument is capable of performing a multiple-

point calibration. The number of calibration set points can be modified. Cincinnati Test Systems typically calibrates mass flow transducers with 11 points for very high accuracy across the full range. See **Number of Points** setting.

The instrument is capable of performing a single pressure calibration or a multiple pressure setpoint calibration. See **Pressure Mode** setting. You will need a calibrated master flow control source or leak standard(s) to calibrate the mass flow transducer on the instrument.

From the **Hardware: Manifolds** screen, tap  .

The following menus appear.

Menu	Description
Transducer	Transducer type and range installed within the test pneumatics.
Input	The analog input connector number to which this mass flow transducer is connected.
Calibrate Transducer	Launches the transducer calibration sequence, which will advance through each setpoint and pause, to allow calibration of the transducer to an appropriate external reference.
Verify Transducer	Launches the transducer verification sequence, which will advance through each setpoint and pause, to allow verification of the transducer to an appropriate external reference.
Test Transducer	Launches the transducer test sequence, to allow testing of the transducer.
Linearity	Transducer linearity, calculated over the calibration setpoints and defined as a percent of full scale (highest value during calibration).
Last Cal Date	Date of the last successful transducer calibration.
Last Cal Time	Time of the last successful transducer calibration.
Verify Date	Date of the last transducer verify sequence.
Verify Time	Time of the last transducer verify sequence.

Note that the mass flow transducer values are generated by the calibration process and cannot be modified directly.

The setpoint pressures in the instrument are examples. Modify the pressure values to fit the match the leak standards and edit the number of points to equal the number of leak standards that will be used for the calibration process plus one. The zero flow setpoint should be calibrated at the target pressure with the Self-Test cap on the test port.

The setpoint pressures in the Blackbelt Pro must match the pressures for the calibrated

leak standards that will be used for the flow sensor calibration. The flow transducer must be calibrated with flow rates in ascending or descending order.

Tap **Calibrate Transducer**. The following menus appear.

Calibrate Menu	Description
Settings	
Time Unit	Unit of measurement displayed for timers for the program.
Time Precision	Displayed digits of precision for all time unit values.
Pressure Unit	Unit of measurement for all test pressure values for the program.
Pressure Precision	Displayed digits of precision for all pressure unit values.
Flow Unit	Flow Unit: Unit of measurement for all the flow values for the program.
Flow Precision	ΔP/ΔT Precision: Displayed digits of precision for all flow unit values.
Hardware	
Port Select	Specifies the test port to utilize for the test.
Regulator Select	Specifies the regulator to utilize for the test.
Analyze	
No settings are available under this category.	
Zero	
No settings are available under this category.	
Cal Setpoint	
Number of Points	Defines the number of setpoints to utilize when calibrating or verifying the this mass flow transducer. Value may be 2 to 32 for a pressure transducer or a mass flow transducer.
Pressure Mode	Determines whether one pressure value is utilized for all setpoints or individual pressure values for each setpoint when calibrating or verifying the transducer.
Cal Pressure	Desired pressure for all setpoints when calibrating or verifying this transducer in single Pressure Mode.
Setpoint Pressure X	The user is able to define the setpoints for calibrating or verifying this transducer. The number of setpoints shown is based on the Number of Points setting. All setpoints must be in ascending or descending order.
Pressure Correction	Allows the instrument to perform measurement corrections when calibrating or verifying transducers based on the relationship between the setpoint pressure and the actual pressure.
Linearity Limit	If non-zero, defines the maximum allowable value for a successful transducer calibration. Value is read-only.
Xdcr Zero Window	Defines the window (+/-) around the barometric pressure value utilized to calculate the Transducer Zero Low/High Window parameters. Visible to Advanced users, value is read-only.
Exhaust	
Timer	Amount of time allocated to each segment for execution before continuing.
Start	

Calibrate Menu	Description
Start Calibration	Launches the transducer calibration sequence, which will advance through each setpoint and pause, to allow calibration of the transducer to an appropriate external reference. **Instrument must be in Run mode to Start Calibration.**

Review all settings. If changes are required, tap 

to enter **Edit** mode.

Make any necessary changes, then tap 

→ **Save** and proceed to calibration.

Tap **Start**. Connect a Self-Test cap to the test port that you are calibrating before proceeding. Tap **Start Calibration**. The instrument analyzes the transducer performance at atmospheric pressure on the test port for 10 seconds.

Observe the target pressure indicated by **Setpoint Pressure 1**.

Tap 

to continue (tap 

at any time to quit).

Adjust the pressure regulator if necessary so that the instrument pressure displays a pressure close to the **Setpoint Pressure 1** value. Observe the flow value. Tap **Standard Flow**. Use the on-screen numeric keypad to change the **Standard Flow** value to 0. Tap 

to accept the value you entered. Observe that the **Standard Flow** matches the value you entered. Tap 

again to continue to the next setpoint.

Insert leak standard 1 (the lowest flowing leak standard) or a calibrated flow control source into the test port. Tap 

.

Observe the target pressure indicated by **Setpoint Pressure 2**.

Tap 

to continue (tap 

at any time to quit).

Adjust the pressure regulator if necessary so that the instrument pressure displays a pressure close to the **Setpoint Pressure 2** value. Observe the flow value. Tap **Standard Flow**. Use the on-screen numeric keypad to change the **Standard Flow** value. Tap 

to accept the value you entered. Observe that the **Standard Flow** matches the value you entered. Tap 

again to continue to the next setpoint.

The process repeats for each point of calibration, using a new **Setpoint Pressure** value and leak standard each time. For example, in a 5 point calibration, the process will occur 5 times. When the last setpoint has been completed, tap 

. The mass flow transducer menu will be displayed.

The mass flow transducer calibration results can be viewed on the Results: All screen or shared via USB on the **Results: Custom** screen. See “Chapter 5: Results” on page 63 for more details.

Verify Mass Flow Transducer Calibration

This process launches the transducer verify sequence, which advances through each setpoint, pausing to allow verification of the mass flow transducer. Advanced access level is required to verify a mass flow transducer.

The number of verification set points can be modified. See **Number of Points** setting. Cincinnati Test Systems typically verifies mass flow transducers with 11 points for very high accuracy across the full range.

The transducer verification process is very similar to the calibration process. You must enter the flow value at each point to step through the sequence. You will need a calibrated master flow control source or leak standard(s) to verify the mass flow transducer on the instrument. You will be prompted to input values so the transducer verification results are saved for later review. This feature does not affect the flow calibration of the instrument.

From the **Hardware: Manifolds** screen, tap  .

Tap **Verify Transducer**. The following menus appear.

Verify Menu	Description
Settings	
Time Unit	Unit of measurement displayed for timers for the program.
Time Precision	Displayed digits of precision for all time unit values.
Pressure Unit	Unit of measurement for all test pressure values for the program.
Pressure Precision	Displayed digits of precision for all pressure unit values.
Flow Unit	Flow Unit: Unit of measurement for all the flow values for the program.
Flow Precision	ΔP/ΔT Precision: Displayed digits of precision for all flow unit values.
Hardware	
Port Select	Specifies the test port to utilize for the test.
Regulator Select	Specifies the regulator to utilize for the test.
Verify Setpoint	
Number of Points	Defines the number of setpoints to utilize when calibrating or verifying the this mass flow transducer. Value may be 2 to 32 for a pressure transducer or a mass flow transducer.
Pressure Mode	Determines whether one pressure value is utilized for all setpoints or individual pressure values for each setpoint when calibrating or verifying the transducer.
Cal Pressure	Desired pressure for all setpoints when calibrating or verifying this transducer in single Pressure Mode.
Setpoint Pressure X	The user is able to define the setpoints for calibrating or verifying this transducer. The number of setpoints shown is based on the Number of Points setting. All setpoints must be in ascending or descending order.
Pressure Correction	Allows the instrument to perform measurement corrections when calibrating or verifying transducers based on the relationship between the setpoint pressure and the actual pressure.
Exhaust	
Timer	Amount of time allocated to each segment for execution before continuing.
Start	
Start Verification	Launches the transducer calibration sequence, which will advance through each setpoint and pause, to allow calibration of the transducer to an appropriate external reference. **Instrument must be in Run mode to Start Verification.**

Review all settings. If changes are required, tap 

to enter **Edit** mode.

Make any necessary changes, then tap 

→ **Save** and proceed to calibration.

Tap **Start**. Connect a Self-Test cap, or the lowest flowing leak standard, or a calibrated flow control source to the test port that you are calibrating before proceeding.

Tap **Start Verification**.

Observe the target pressure indicated by **Setpoint Pressure 1**.

Tap 

to continue (tap 

at any time to quit).

Adjust the pressure regulator if necessary so that the instrument pressure displays a pressure close to the **Setpoint Pressure 1** value. Observe the flow value. Tap **Standard Flow**. Use the on-screen numeric keypad to change the **Standard Flow** value. Tap 

to accept the value you entered. Observe that the **Standard Flow** matches the value you entered. Tap 

again to continue to the next setpoint.

Insert a leak standard (the next lowest flowing leak standard) into the test port or adjust the calibrated flow control source. Tap 

.

Observe the target pressure indicated by **Setpoint Pressure 2**.

Tap 

to continue (tap 

at any time to quit).

Adjust the pressure regulator if necessary so that the instrument pressure displays a pressure close to the **Setpoint Pressure 2** value. Observe the flow value. Tap **Standard Flow**. Use the on-screen numeric keypad to change the **Standard Flow** value. Tap 

to accept the value you entered. Observe that the **Standard Flow** matches the value you entered. Tap 

again to continue to the next setpoint.

The process repeats for each point of calibration, using a new **Setpoint Pressure** value and leak standard each time. For example, in a 5 point calibration, the process will occur 5 times. When the last setpoint has been completed, tap 

. The mass flow

transducer menu will be displayed.

The mass flow transducer verification results can be viewed on the **Results: All** screen or shared via USB on the **Results: Custom** screen. See “Chapter 5: Results” on page 63 for more details.

Test a Mass Flow Transducer

This process launches the transducer test sequence, which advances through each setpoint and pauses to allow testing of the mass flow transducer and analog-to-digital circuit performance. Advanced access level is required to test a mass flow transducer.

Performing a test of the transducer may be requested by a Cincinnati Test Systems Field Service Engineer while troubleshooting your instrument over the telephone. The instrument is capable of performing a multiple-point transducer test. The number of calibration set points can be modified. You must plug a Self-Test cap into the test port to test the mass flow transducer on the instrument.

From the **Hardware: Manifolds** screen, tap  .

Tap **Test Transducer**.

The following menus appear.

Test Menu	Description
Settings	
Time Unit	Unit of measurement displayed for timers for the program.
Time Precision	Displayed digits of precision for all time unit values.
Pressure Unit	Unit of measurement for all test pressure values for the program.
Pressure Precision	Displayed digits of precision for all pressure unit values.
Hardware	
Port Select	Specifies the test port to utilize for the test.
Regulator Select	Specifies the regulator to utilize for the test.
Test	
Minimum Resolution	Defines the minimum allowable value for a successful transducer test.
Number of Points	Defines the number of setpoints to utilize when calibrating or verifying the this mass flow transducer. Value may be 2 to 32 for a pressure transducer or a mass flow transducer.

Test Menu	Description
Setpoint Pressure X	The user is able to define the setpoints for calibrating or verifying this transducer. The number of setpoints shown is based on the Number of Points setting. All setpoints must be in ascending or descending order.
Exhaust	
Timer	Amount of time allocated to each segment for execution before continuing.
Start	
Start Xdcr Test	Launches the transducer calibration sequence, which will advance through each setpoint and pause, to allow calibration of the transducer to an appropriate external reference. **Instrument must be in Run mode to Start Xdcr Test.**

Review all settings. If changes are required, tap 

to enter **Edit** mode.

Make any necessary changes, then tap 

→ **Save** and proceed to calibration.

Tap **Start**. Connect a Self-Test cap to the test port that you are verifying before proceeding. Tap **Start Xdcr Test**. Tap 

to continue (tap 

at any time to quit).

Observe the target pressure indicated by **Setpoint Pressure 1**.

Adjust the pressure regulator so that the instrument pressure reads a pressure close to the **Setpoint Pressure 1** value. Tap 

. the instrument analyzes the transducer performance at the setpoint pressure.

Tap 

again to continue. The process repeats for each point of calibration, using a new **Setpoint Pressure** value each time. For example, in a 5 point calibration, the process will occur 5 times.

The result of the transducer test is displayed at the top of the screen. Tap 

to return to the previous test transducer menu.

The mass flow transducer test results can be on the **Results: All** screen or shared via USB on the **Results: Custom** screen. See “Chapter 5: Results” on page 63 for more details.

Run a Self-Test

The Self-Test checks the integrity of the instrument‘s pneumatic circuit to isolate potential leaks. By isolating the instrument from the test part and from external tooling and plumbing, this test verifies that the instrument is leak-free and performing properly.

The instrument runs a **Self-Test** on all test ports to verify that all internal pneumatic circuits are leak-free. Verify that all test ports are plugged using a Self-Test cap. The Self-Test program must be run with the supplied Self-Test cap for each test port. Do not substitute a master test part because doing so will increase the test volume and decrease the sensitivity of the **Self-Test**.

The **Self-Test** program settings cannot be edited.

Adjust the pressure regulator if necessary before running the **Self-Test** program. The test pressure should match the maximum pressure at which you plan to run production leak tests. However, the Self-Test program will run at any pressure.

From the **Home** screen, tap 

.

Tap the **Self-Test** program.

Press  and observe the Self-Test running on the **Home** screen. When the Self-Test program is finished, the test result will be **Pass** or **Fail** for each test port.

Remember to reconnect the test ports to the test lines before resuming production testing.

Change Leak Standard Values

If the instrument has been ordered with an internal leak standard, it may be desirable to check the pressure and flow values. If the leak standard is changed or re-certified, it may be necessary to edit the pressure or flow values.

From the **Hardware: Manifolds** screen, tap 

. The following menu displays.

Menu	Description
Leak Std number	Uniquely identifies this leak standard in this manifold. If there are multiple leak standards in the same manifold enumeration begins with the number 1.
Leak Std Calibrated Flow	Flow value at which the Calibrated Leak Standard was certified.
Leak Std Calibrated Pressure	Pressure at which the Calibrated Leak Standard was certified.

Modify the leak standard values as needed. When you have finished modifying the leak standard settings, tap 

→ **Save**.

Note: These settings will change in all programs that use this leak standard. To edit the leak standard values in a single leak test without affecting the leak standard values in all other programs, Edit the leak standard values in the Test segment Hardware menu. “Chapter 15: Pressure Decay Leak Std” and “Chapter 19: Mass Flow–Leak Std” make use of the leak standard values.

If the instrument has been ordered with an internal leak standard, verify that the leak test is properly calibrated by testing a non-leaking master part with and without the leak standard valve open. For more information, see the section ““Open The Leak Standard Valve” on page 26

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Chapter 5
Results

A variety of information from the instrument is reported on the **Results** screen, which always defaults to the most recently viewed tab (even after an instrument restart).

Column headings on the **Results: All** and **Results: Custom** screens can be re-ordered. Tap and drag a heading left or right, to reposition it.

The Results: All Screen

The default view of the **Results: All** screen can be seen below.

Figure 5-1. All Results Screen

The default order of the column headings is:

Date	**Time**	**Unique ID**	**User**	**Program**	**Part**
Part Eval	**Test Eval**	**Test #**	**Test Type**	**Flags**	**Meas1**
Meas2	**Meas3**	**Meas4**	**Meas5**	**Meas6**	**Meas7**
Meas8	**Meas9**				

The Results: Custom Screen

The default view of the **Results: Custom** screen can be seen below. In this example, no columns have been added yet.

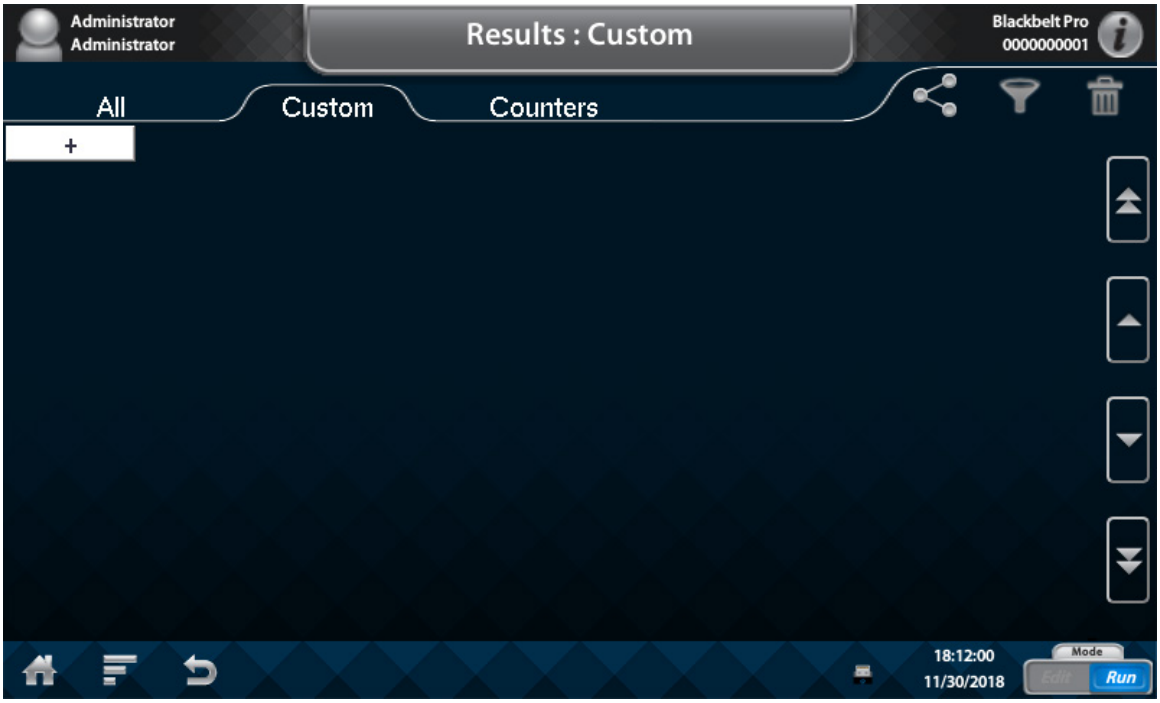


Figure 5-2. Custom Results Screen - Empty Template

A custom results report can be created by any user on the **Results: Custom** screen. If you are on the **Results** screen but not yet on the **Results: Custom** screen, tap the **Custom** tab.

To add a heading, tap the **+** column heading.

Tap **Content**. From the list of available headings, tap the desired item. Tap **OK**.

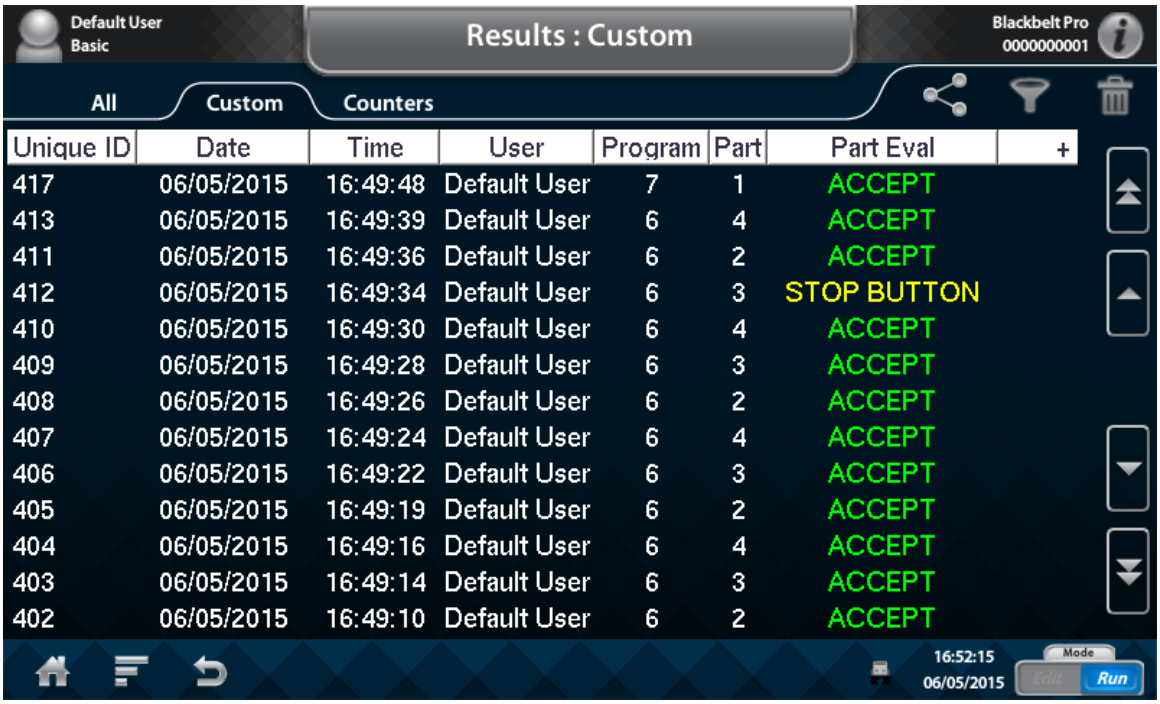


Figure 5-3. Custom Results Screen With Column Headings Added

Repeat this process to add more headings. The options for adding fields are dependent on the test types that have been run and therefore what fields are available in the database to be selected. Each heading can be used once. The selected headings and their order will remain in effect for custom reports until they are changed.

Save Results to USB

The results generated by the Results: Custom screen can be saved to a USB flash drive by using Share  . Results can be saved in either the **Edit** or **Run** mode.

On the **Results: Custom** screen, tap  , then tap the target USB device (if there is only one USB flash drive inserted, the only option will be USB 0).

Tap the “Number of Results” selector.

From the drop down menu, tap Last 20, Last 100, Last 1000, or All Results. Tap **OK**.

Tap  to unmount the USB drive before removing the flash drive from the USB port.

The Results: Counters Screen

The **Results: Counters** screen can be seen below. This screen reports the number of cycles performed by the current manifold(s).

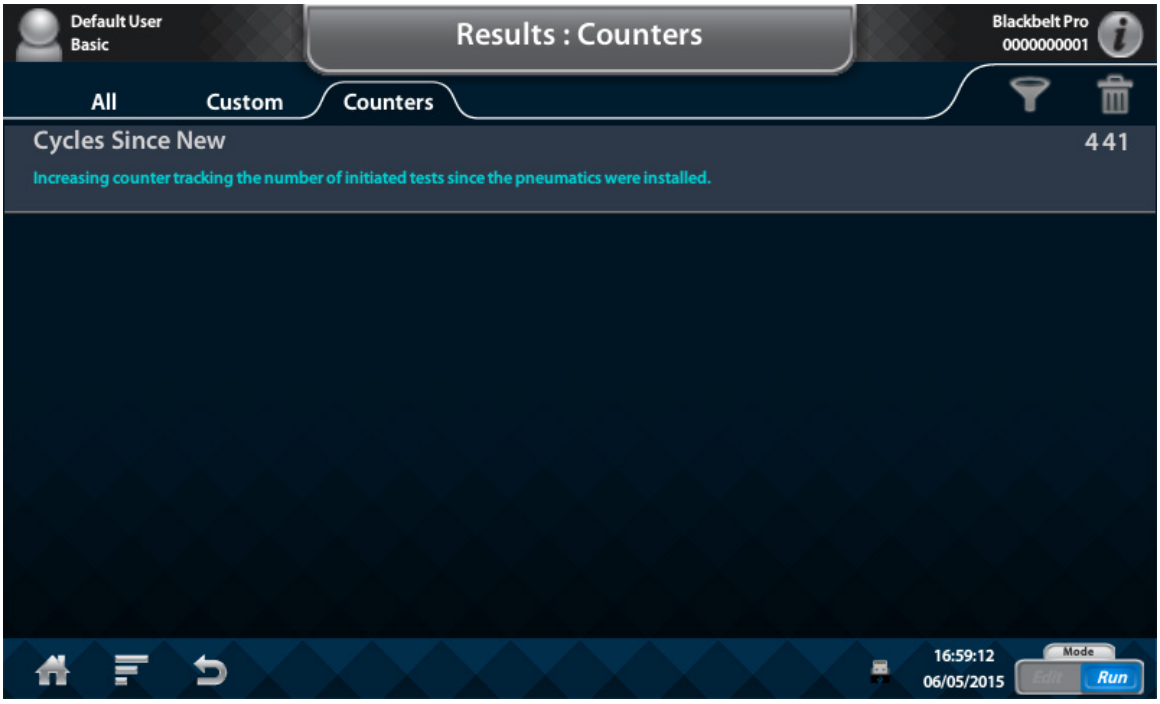


Figure 5-4. Results: Counters Screen

Set Filters

Filters can be set on each **Results** screen. To set a filter, tap  . You can add up to 4 filters by selecting an item in the **Type** menu and a value for that type in the **Value** menu.

Type	Value
Date	Start and end dates.
User	All users who ran parts matching other filters.
Program	All programs that match the other filters.
Part	1, 2, 3, or 4 (all parts that match the filters).
Eval	All evaluations that match the other filters.
Measurement	All test measurements that match the other filters.
None	The default option, unless another filter is selected.

On the **Results: Counters** screen, filters can be set for **Program** and **Part**.

Clear Parts Counters and Delete All Results

On the **Results: Counters** screen, all of the counters can be cleared as follows:

Tap  , then tap **YES** to confirm.

Note that a user is blocked from clearing all the counters if Allow Reset Counters is set to No in their user account security settings. See"Chapter 7: User Login & Security" on page 79 for more details.

On the **Results: All** or **Results: Custom** screen, all results can be deleted as follows:

Tap  , then tap **YES** to confirm.

Note that a user is blocked from deleting all results data if Allow Delete Results Data is set to No in their user account security settings. See "Chapter 7: User Login & Security" on page 79 for more details.

Result Log Max Size

The Blackbelt Pro instrument has the ability to change the maximum size of the result log. This is dependent on the value set for the "**Result Log Max Size**" parameter.

"**Result Log Max Size**" is a parameter available under the **Settings -> Misc** page.

This parameter is only available to Administrator level users.

The user can set the "**Result Log Max Size**" in megabytes to a maximum of 2048 MB.

2048 MB is the default value for the parameter.

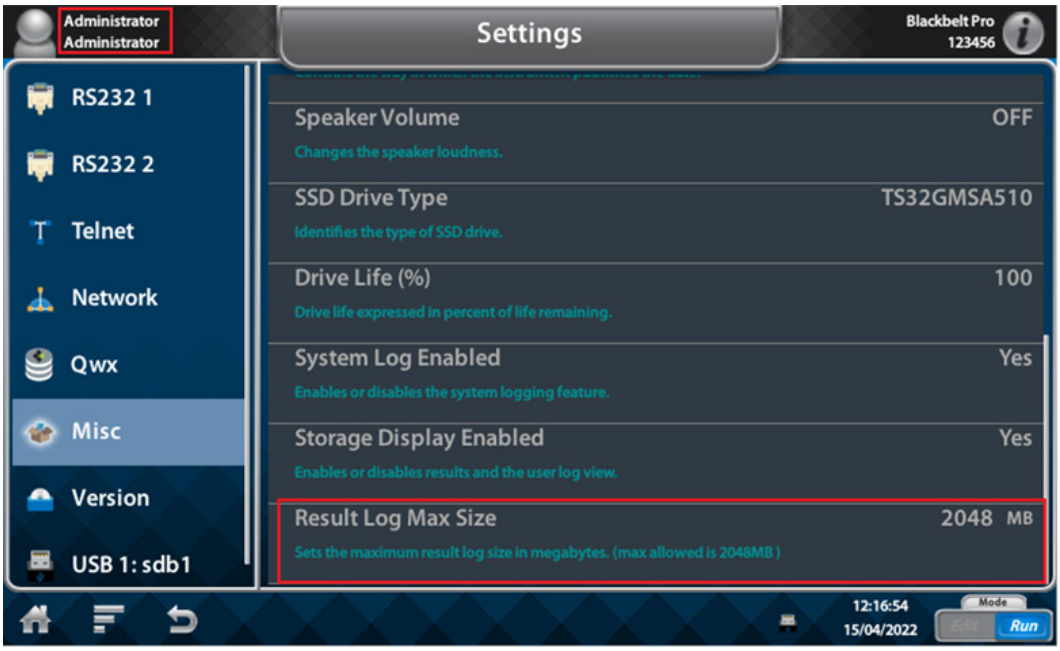


Figure 5-5. Settings page Result Log Max Size Added

The size of the results page displayed to the user depends on the value of "**Result Log Max Size**". As shown in the screenshot below, enter the desired size and click OK.

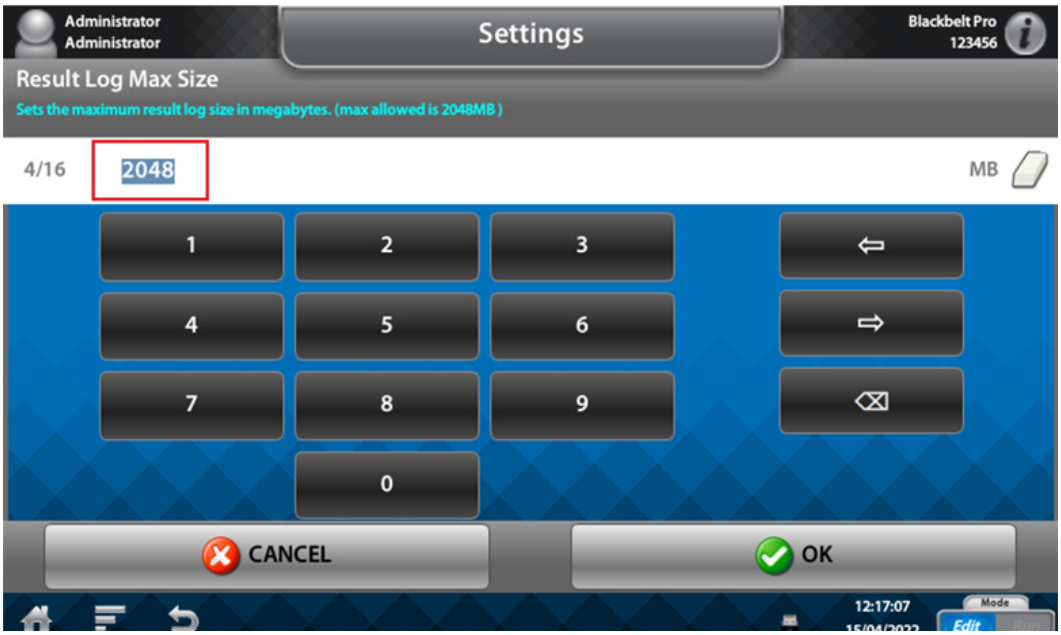


Figure 5-6. Settings window

Navigate to the results page and check the amount of results displayed.

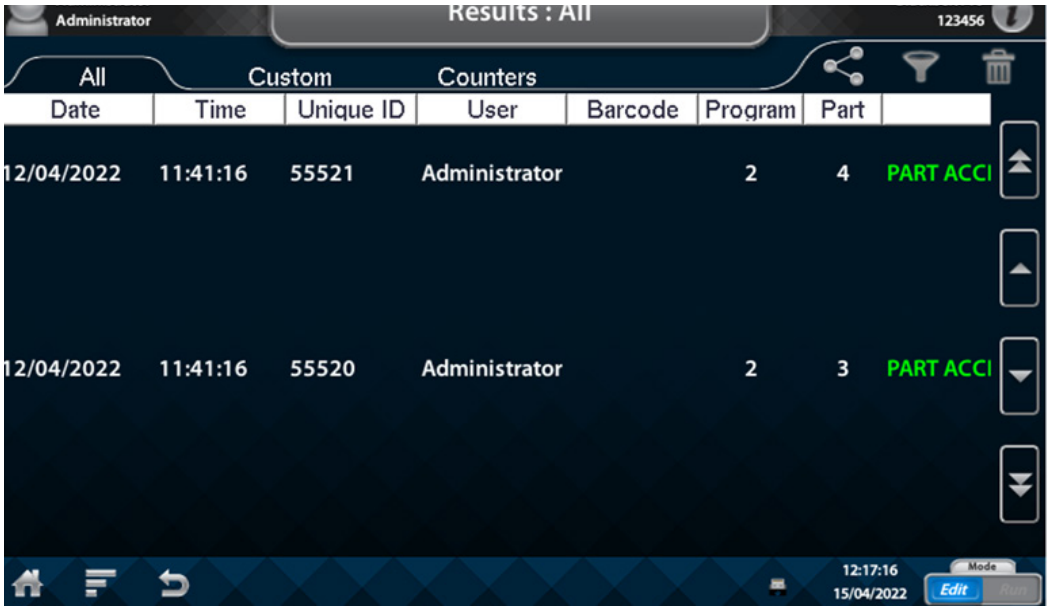


Figure 5-7. Result All Screen

If there is an attempt to set the value greater than 2048 MB, the following error message is displayed.

The result log max size cannot exceed 2048 MB.

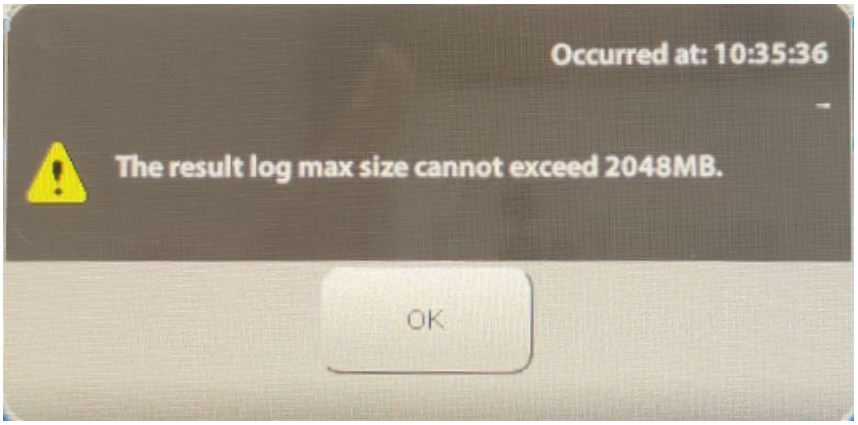


Figure 5-8. Error message

Chapter 6
Settings

Locate the **Settings** menu by tapping → . The following menu displays:

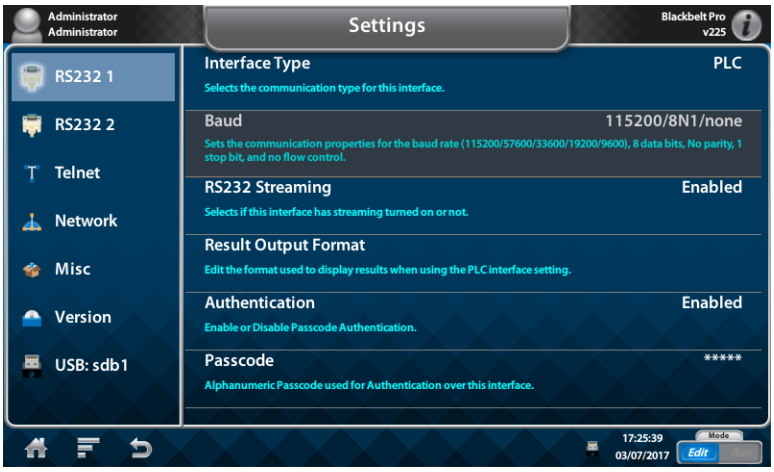


Figure 6-1. Settings Screen

RS232 and Telnet Settings

RS232 and Telnet settings control how your Blackbelt Pro communicates with other devices. See “Chapter 8: Communication” on page 87 for more information about configuring these settings.

Advanced users can modify port functions. See “Chapter 7: User Login & Security” on page 79 for information about user privileges.

Network

It is recommended that you consult with your company‘s IT department regarding the method for placing the instrument on any network.

Locate the network settings by tapping → → Network.

The following menu displays:

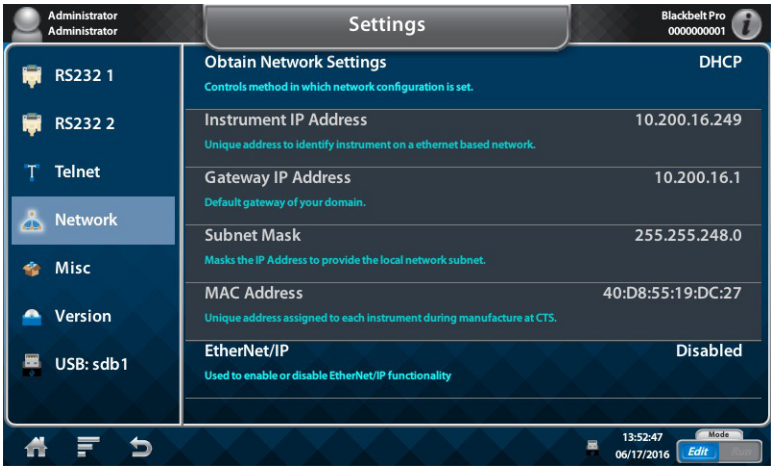


Figure 6-2. Network Settings

The following menu items are available.

Menu	Description
Obtain Network Settings	Controls method in which network configuration is set.
Instrument IP Address	Unique IP address to identify this instrument on an Ethernet based network.
Gateway IP Address	Default gateway of your domain.
Subnet Mask	Subdivision of network IP address. Consult your IT administrator for this setting.
MAC Address	Unique address assigned to each instrument during manufacture at CTS.
EtherNet/IP	Used to enable or disable EtherNet/IP functionality.

Tap  →  → 

.

To edit the settings, tap 

to enter **Edit** mode.

Tap **Obtain Network Settings**. **DHCP** is the default setting. This will allow the instrument to acquire the proper network settings from the network router. When set to **DHCP**, the instrument IP Address and the Gateway IP Address are read-only.

To change any of the settings or to lock an IP address, tap **Manual** → 

.

Tap **Instrument IP Address**. This value is chosen automatically in DHCP. Use the onscreen numeric keypad to type a new IP address for the instrument. Tap 

.

Tap **Gateway IP Address**. You should get this information from your company‘s IT department. Use the numeric keypad to type an address. Tap 

.

Tap **Subnet Mask**. Use the numeric keypad to type a mask. The most common setting is 255.255.255.0 unless there is more than one subnet, in which case a common setting is 255.255.0.0. Tap 

.

The **MAC Address** is the hardware address of the instrument. This number is read only.

Tap 

→ **Save** when you are finished making changes.

Miscellaneous Settings

Tap 

to enter **Edit** mode. Tap  →  → 

.

The following menu displays:

Figure 6-3. Misc Settings

The following menu items are available.

Menu	Options
Instrument Name	User-defined name that identifies this instrument.
Serial Number	Unique number assigned to this instrument by Cincinnati Test Systems, not editable.
Language	Allows the user to change the base language for the display
Time	This is the instrument time setting, always expressed in 24 hour format.
Date	This is the instrument date setting, the format can be changed.
Date Format	Controls the format in which the instrument displays the date
Light Feature Brightness	Controls the intensity level of the LED light feature, **only on benchtop model instruments.**
Speaker Volume	Controls the volume of the instrument's system sounds.

To rename your Blackbelt Pro, tap **Instrument Name**. Type a new name using the on-screen alphanumeric keypad. Tap 

.

The instrument is a multi-language instrument and may be modified. Instrument supports Chinese, Spanish and English languages

To change the time displayed on the instrument, tap **Time**. Tap **+** and **-** to adjust the hour

and minutes, then tap OK.

To change the date displayed on the instrument, tap **Date**. Tap **+** and **-** to adjust the month, day, and year, then tap OK.

To change the order in which date components are displayed, tap **Date Format**. Tap the desired format, then tap OK.

To adjust instrument volume, tap **Speaker Volume**. Tap a volume: **High**, **Low**, or **Off**, then tap OK.

Tap Mode Save Run → **Save** when you are finished making changes.

Note: *The language cannot be changed via communication interface, however can be changed only via the user Interface menu (Monitor screen). Communication interface like RS232 and Telnet supports only English language.*

Note: *The instrument must be in Advanced or Admin Display User Level to view and modify the instrument Language.*

System Version & Build Number

Locate the system version and build number information by tapping → Settings → Version. Something similar to the following menu displays:

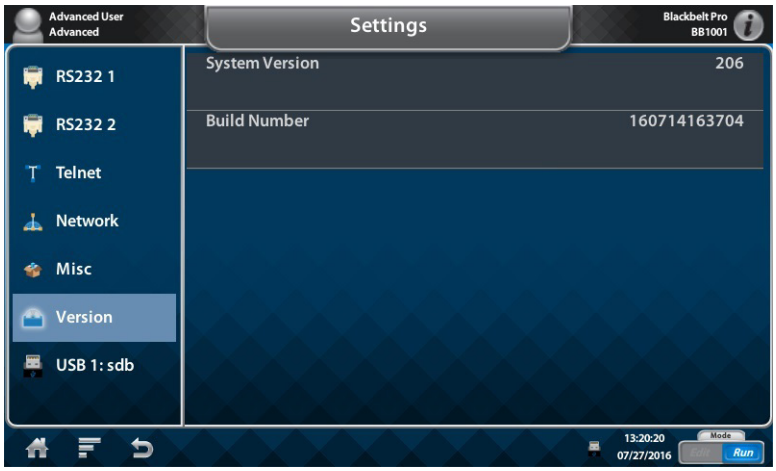


Figure 6-4. Version Screen

The information on this screen is read-only.

Test Results via RS232 or Telnet Communications

To send test result data automatically once a test is complete, a **Result Output Format** must be defined for **RS232 or Telnet** (depending on which is used).

See “Chapter 8: Communication” and refer to the heading “RS232 Connector Pinout” on page 89 for more information.

USB Menu

Insert a USB mass storage drive into any of the three USB ports. This allows detailed communications with the instrument. Tap 

to enter **Edit** mode, then tap  → 

→ 

.

The following menu items are available.

Menu	Description
Generate Report	Generates a user selected report that is written to the mass storage drive.
Unmount	Allows the mass storage drive to be safely unmounted.
Format Drive	The user can format the mass storage drive to FAT32 (the format required by the instrument).
Backup Instrument	Opens a file dialog and shows progress of the instrument Backup.
Clone Instrument	Opens a file dialog and shows progress of the instrument Clone. **Requires Advanced access level to see and edit.**
Restore Instrument	Opens a file dialog to selecdt the location of the Restore Data. **Requires Advanced access level to see and edit.**

To generate a report on the USB mass storage drive, tap **Generate Report**. Tap the type of report to generate, then tap 

. See “USB Reports” on page 77 for more information.

To remove the USB mass storage drive, tap **Unmount,** then tap **YES** to confirm.

To format a USB mass storage drive for use with the Blackbelt Pro, tap **Format Drive**, then tap **YES** to confirm.

Note that formatting the USB mass storage drive will delete any files it contains.

To back the current state of the instrument up on the USB mass storage drive, tap **Backup Instrument**. A progress bar displays briefly.

To create a clone of your current configuration, tap **Clone Instrument**. This process creates a clone of the current configuration that can be used to set up additional instruments. A progress bar displays for several minutes.

Note: Cincinnati Test Systems field service engineers can restore a clone or backup. Request assistance if restoration is necessary. See the last page of this manual for contact information.

Tap 

→ **Save** when you are finished making changes.

USB Reports

The instrument is capable of generating a variety of reports for delivery through USB. The following menu items are available.

Report	Description
Settings Report	Reports all the settings within the Settings menu.
All Programs Report	Part setup information for all available programs.
Current Program Report	Part setup information for the current program.
Hardware Report	Reports all the settings within the Hardware menus.
System Log	A System Log report may be requested by CTS Service Engineers when troubleshooting problems.
User Log Report	Reports the settings for every user in the system as well as the common settings for all users.

Reports can be generated in one of three formats: CSV, Excel, and PDF. To select an output format, tap  →  → 

., go to Output Format. From the menu, select the desired format.

The User Log Report is only available for users with Advanced access or greater

Note: All reports generated comes with English language irrespective of the current language selection.

Report visibility

The visibility of reports can be either enabled or disabled. Tap  → 

, select MISC menu, click on “Storage Display Enabled”. Select “No” to hide the report tabs in the result menu and “Yes” to view the report tabs in the result menu

Chapter 7
User Login & Security

All User Settings

The following settings apply to all users on the system. These settings can be found under the “All Users” menu in the User Accounts menu.

Menu	Description
Inactive Login Expiration	Users who do not access their accounts for a specified number of days will have their accounts blocked until an administrator unblocks their account. A value of zero indicates no expiration.
Password Expiration	Defines the number of days after which a password is invalid and must be changed. A value of zero is used to indicate no expiration.
Inactivity Timeout	Defines the amount of time before a user is logged out due to inactivity. A value of zero indicates no timeout.
Max Login Attempts	Defines the number of attempts to log in before a user account is blocked. An administrator will need to unblock the account.
Login Banner	When Enabled, the instrument will display a banner message upon user login, defined in the Login Banner Message.
Login Banner Message	A banner message that is displayed any time the user logs in.
Required Comments	When Enabled, forces all users to provide a reason for any changes to the system.
Smart Key	When Enabled, gives the ability for users to insert a paired Smart Key to log into the system. See Chapter 7 on how to bind a Smart Key

New User Setup

The options to log in and edit security settings are accessed on the **User Accounts** screen. Instrument security and editing permissions are defined for each user.

There are three user access levels: **Basic, Advanced**, and **Admin**. User access to features can be configured to a fine degree for groups of users or for individuals. The current user name is recorded to a log with each program change and with each test that a user runs.

The instrument has the ability to have up to 250 different users at once. This includes the two user accounts, **Administrator** and **Default User**, set up at the factory.

User Types

Basic users have editing privileges for all programs and hardware. **Basic** users cannot edit a user account, and cannot access advanced configuration settings.

Advanced users can effect powerful changes to the instrument, as described throughout this manual. **Advanced** users should be limited to a few well-trained experts.

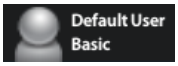
Admin users are primarily used to manage other accounts. **Admin** accounts may create and modify other non-admin user accounts.

Factory Set User Accounts

Two users accounts are set up at the factory: **Administrator** and **Default User**. The **Administrator** is a powerful, unique account, primarily used to manage other accounts. The **Administrator** may create and modify user accounts, but cannot change his or her account name. The **Administrator** can (and should) change his or her password.

The **Default User** is a Basic user account that allows all users core access to the instrument. The **Default User** cannot be renamed; additional **Basic** user accounts must be created if accounts for individual operators are needed.

Login

Tap 

to log in.

Notice that the User icon displays the user's access level. When you first activate your Blackbelt Pro, the stock **Admin** and **Default** User accounts are the only accounts available.

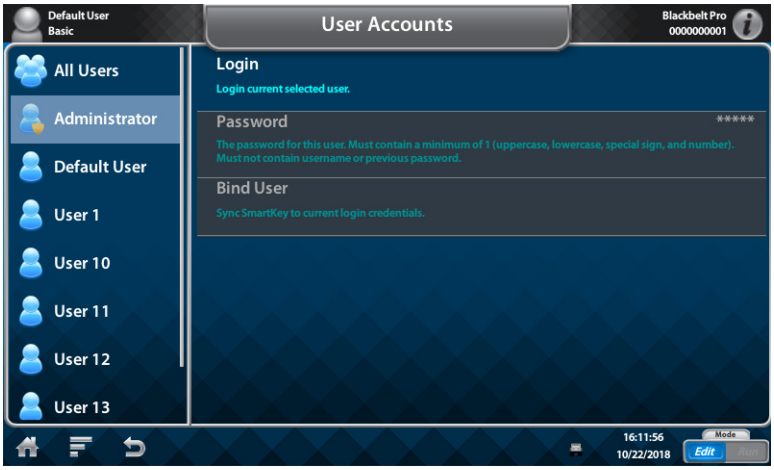


Figure 7-1. User Settings

Tap **Admin** → **Login**.

When prompted for a password, type **1111** on the on-screen numeric keypad and tap **Enter**. The **Admin** account is logged in with **Administrator**-level access.

Warning! By default all Blackbelt Pro instruments ship with the password 1111. This password provides initial access to the Admin account and all new accounts. Because this password is identical across all instruments, it is not secure. Assign a new password to the Admin account immediately.

Assign a new, unique password to the **Admin** account. To enter a new password, tap **Password**. Tap  to erase the default password or simply begin typing a new password (up to 16 characters) with the numeric keypad, then tap **OK**.

There are several restrictions on the password:

- The password must be different from the previous password
- The new password must differ from the previous password by a number of characters
- The password must not contain the account or User ID in any form
- The password must contain at least one capital letter, one small letter, one special character, and one number

Tap **Logout**, then log in using your new password.

Add a New User and Set Security Permissions

Log in as the Administrator.

Tap 

to enter **Edit** mode. Tap **Add User**. The new user is highlighted. Edit user settings for the selected user.

To change the **User Name**, tap **User Name**.

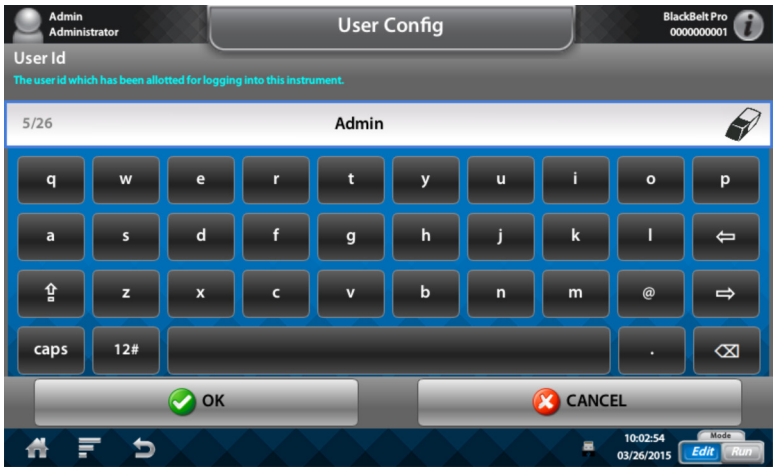


Figure 7-2. Alphanumeric Keypad

Tap  or simply begin typing a new name with the alphanumeric keypad. Tap 

.

The following security menu items are available to assign (or deny) to a user.

Menu	Description
Login/Logout	Log in as the selected user. Select user name from drop-down list, tap numeric password, tap Enter. If a user is logged in, log out and return to the Default User. The Default User cannot be logged out.
User Name	The user name which has been allotted for logging into this instrument.
Password	The password for allowing this user to log into this instrument.
Access Level	Limits the menu options that are visible to the user. Set the currently selected user security access level.
Bind User	Sync SmartKey to current login credentials.
Delete User	Delete currently selected user account from this instrument.
Allow Touchscreen Access	User can access program selection, login, view programs, graphs, reports, and hardware.
Allow Program Change	User can select programs and run tests.
Allow Run Tests	User can run tests.
Allow Program Calibration	User can calibrate programs with a leak standards or apply mass flow zero offset.
Allow Program Edit	User can edit program: Time, Pressure, Leak, Flow, and enable Pressure Correction, EDC and Quik Test.
Allow Instrument Edit	User can edit: Instrument Name, Date, Time, Com Ports Telnet and Network settings.
Allow Hardware Edit	User can edit leak standards, calibrate pressure transducers, flow sensors, and electronic regulators.

Menu	Description
Allow Backup / Restore	User can backup and restore the instrument using a USB flash drive. The configuration must have the same pneumatic code and capability code to restore settings. Flow cal uploads flow sensor calibration.
Allow Delete Results Data	User can delete all instrument test result history.
Allow Reset Counters	User can reset all instrument counters to zero (except Cycles Since New).

Tap 

→ **Save** to save your changes.

SmartKey

A SmartKey can be used to log into the Blackbelt Pro. Insert the SmartKey into the SmartKey port to bypass the login routine. Two blank SmartKeys ship with each instrument. More SmartKeys can be purchased from Cincinnati Test Systems.

To bind a user to a SmartKey, Insert a blank SmartKey into the SmartKey port.

Tap 

to enter **Edit** mode.

Tap 

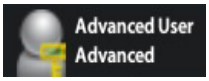
and log in as the **Administrator**.

Tap the **user name** for the user you want to bind to the SmartKey, then tap **Bind User**. When prompted, tap **Save**. You are notified that the bind was successful; tap **OK**. Tap 

→ **Save** when you are finished making changes.

If the SmartKey is inserted into a new instrument, you will be prompted to log in as Administrator and add the account. To un-bind a user from a SmartKey, simply bind a new user to the key.

When a SmartKey is inserted, the User icon has an additional yellow key symbol on the user Icon.



Audit Trail

The audit trail is a history of actions taken by users over the last month. The Blackbelt Pro records all major actions and any changes made to the system. Any items added to the audit trail will have an associated time and date stamp along with the name of the user who performed the action.

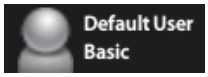
When a user makes a change to the system, the user must provide a reason for change that will be recorded in the audit trail. The user can select **Setup, Maintenance, Calibration, Change Control**, or **Other**. If **Other** is chosen, the user must type in a reason.

Because the Blackbelt Pro only stores actions for the last month, it is recommended that the audit trails are saved to an external USB drive periodically, or use the autosave feature.

Autosave Feature

The audit trail can automatically be saved to an external USB drive.

To enable the autosave feature, tap 

to enter Edit mode. Tap 

→**Log** → **Share** → **Autosave** to make the update. When autosave is enabled, the Blackbelt Pro will periodically check for new actions in the audit trail. When there are enough unsaved items in the audit trail, the Blackbelt Pro will generate a new file with the new actions in the USB drive. 

→ **Save** when you are finished making changes.

Like with reports, the format of the generated files can be .csv, .xlsx, or .pdf

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Chapter 8
Communication

This chapter describes the communication interface available in the Blackbelt Pro. This interface is available for both RS232 serial and Telnet communication methods. The interface allows for remote instrument control, and provides a simple-to-parse, customizable test result data output.

The following topics describe valid commands for the Blackbelt Pro when communicating with a controller or computer using terminal emulation software. Cincinnati Test Systems recommends HyperTerminal, PuTTy, RealTerm, or Tera Term for this purpose.

Communication Settings

Before communicating with the Blackbelt Pro, appropriate settings must be configured.

To configure for RS232, tap 

to enter **Edit** mode. Tap  → 

.

Tap **RS232 1** or **RS232 2**. Tap **Interface Type** → **PLC** → 

.

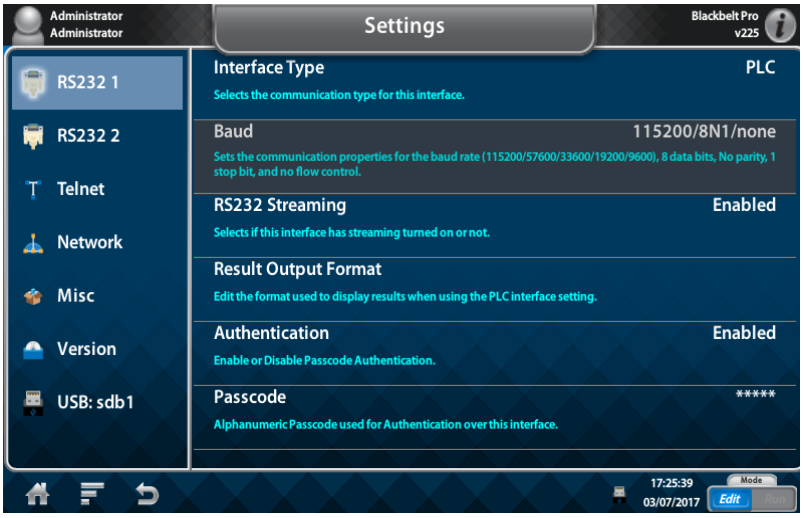


Figure 8-1. RS232 Communication Settings

Tap 

→ **Save** when you are finished making changes.

To configure for Barcode, tap 

to enter **Edit** mode. Tap  → 

. Tap **RS232 1** or **RS232 2**. Tap **Interface Type**→ **Barcode** → 

.

To configure for Telnet, tap 

to enter **Edit** mode.

Tap  → 

. Tap **Telnet**. Tap **Interface Type** → **PLC** → 

.

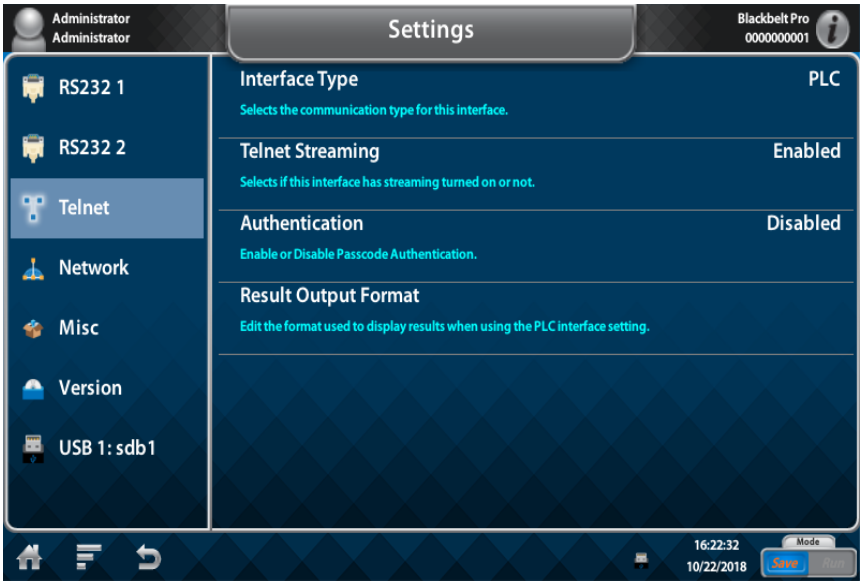


Figure 8-2. Telnet Communication Settings

When configuring **RS232** or **Telnet**, the following communication menus are available.

Menu	Options
Interface Type	Selects the communication type for this interface.
Baud	Sets the communication properties for the baud rate (115200/57600/33600/19 200/9600). For all baud rates, the settings are 8 data bits, No parity, 1 stop bit, and no flow control. Not available for Telnet.
Telnet Streaming	Select if this interface has streaming turned on or not
Result Output Format	Edit the format used to display results when using the PLC interface setting.
Authentication	If enabled, the instrument requires authentication via passcode to permit communication through the interface. This is typically set to Disabled when communicating with a PLC. **Requires Advanced access level to see and edit.**
Passcode	The password for allowing remote login. **Requires Advanced access level to see and edit.**

RS232 Connector Pinout

The Pinout for the **RS232** connector, located on the side of Wall-mount and back of Bench-top Blackbelt Pro, is denoted in the diagram below. Pins 1.4 and 6 are internally connected, but are unused by instrument.

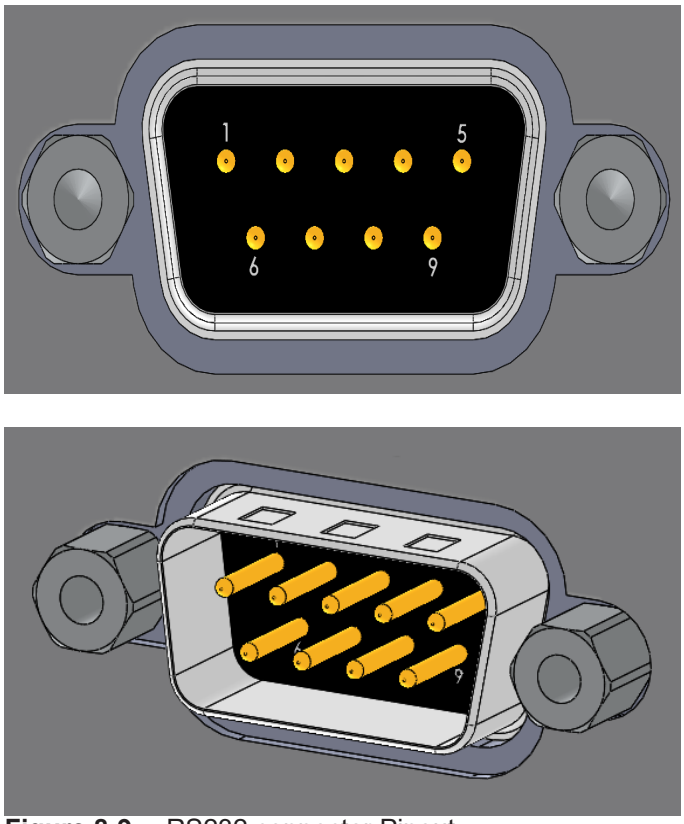


Figure 8-9. RS232 connector Pinout

1	DCD
2	RX
3	TX
4	DTR
5	Ground
6	DSR
7	RTS
8	CTS
9	Not Connected

Result Output Format

When configuring **RS232** or **Telnet**, **Result Output Format** allows you to define what results are delivered over the specified communication connection. The procedure for selecting the contents of the results string is as follows.

From the Settings screen, tap 

to enter **Edit** mode.

Tap **RS232 1** or **RS232 2** or **Telnet**.

Tap **Results Output Format**.

Tap the **Content** selector. Tap a data field name from the pop up menu list.

Tap **Add**. Repeat the last 3 steps to add another data field.

A quicker alternative method may be to tap **Add** repeatedly. All the data files will stack up in order from left to right. For any data fields that are unwanted, long press the **data field name** until a dialog opens. Tap **Yes** to delete the unwanted data field.

If data field names are not in the desired order, tap and drag them left or right to the desired position.

In the lower left corner of this menu there is a tick box to enable **Fixed Width** format There is also a **Delimiter** selector. The options are: **Comma**, **Tab**, **Semicolon**, **Space**, and **Pipe**.

Tap 

→ **Save** when you are finished making changes.

Communication Structure

The PLC interface displays the following behavior.

Each packet (transmitted or received) follows the basic format below:

<ASCII_DATA><CR>

Where **<ASCII_DATA>** is any ASCII string defined below (case insensitive), and **<CR>** is the Carriage Return character (Hex 0x0D), which marks the end of the packet.

If authentication is enabled, then upon initial connection the instrument responds with:

PASSCODE=?

Until a passcode is provided, any received packets will return this response. To provide authorization credentials, provide the following:

PASSCODE=<string><CR>

Where **<string>** is the user-defined **Passcode** value as configured in the **RS232** or **Telnet** interface menus.

An invalid passcode returns:

PASSCODE=?

Invalid entry

A valid passcode returns:

PASSCODE=AUTHORIZED

Valid entry

The interface can operate in different modes, described as types. At this time, only **PLC** is available. This is an ASCII interface, designed for PLC operation. To read the interface type, provide the following:

INTERFACE

This returns the following:

INTERFACE=<type>

Remote Control

The instrument can be controlled with commands. The following command <action> options are available:

START starts the currently selected program, like the physical Start button. However, **START** overrides the current user's security permissions.

STOP stops the currently selected program, like the physical Stop button. However, **STOP** overrides the current user's security permissions.

To send a command, provide the following:

COMMAND=<action><CR>

A valid command will return:

COMMAND=<action>

An invalid command will return:

COMMAND=ERROR

When the Blackbelt Pro is not actively testing, the currently selected **Program Number** can be changed. To read the active **Program Number**, provide the following:

PROGRAM<CR>

This returns the following:

PROGRAM=<integer>

To write the active Program Number, provide the following:

PROGRAM=<integer><CR>

This returns the following:

PROGRAM=<integer>

If the selected Program Number is invalid or the Program Number cannot be changed, the response will provide the current active **Program Number**.

The operational status of the instrument can be polled for confirmation that the

instrument is ready for a test operation. Possible **<state>** options are:

READY

The instrument is ready for test operation.

NOT READY

The instrument is either actively testing, or not able to test.

To read the operational status, provide the following:

STATUS<CR>

This returns the following:

STATUS=<state>

Test Results Data Output

Results are provided as defined by the **Result Output Format** setting. The result packets are generated as follows:

RESULT=<USER_DEFINED>

The instrument type, serial number, and version number can be identified, to confirm the proper connected instrument.

To read the instrument type, provide the following:

TYPE<CR>

This returns the following:

TYPE=BBPRO

To read the instrument serial number, provide the following:

SERIAL<CR>

This returns the following:

SERIAL=<ASCII_SERIAL>

To read the instrument firmware version data, provide the following:

VER<CR>

This returns the following multi-line response:

VER=

*** SYSTEM VERSION=X**

*** BUILD NUMBER=X**

*** UCM VERSION=X**

*** UIM VERSION=X**

*** TCM VERSION=X**

*** TM VERSION=X**

*** GUI DATABASE VERSION=X**

*** TCM DATABASE VERSION=X**

Where **<x>** is the integer value representing the version number.

A help menu is available for syntax reference. To view the help menu, provide the following:

HELP<CR>

This returns a verbose response described in detail in “Example Commands” on page 97.

Streaming Measured Data

The instrument has the ability to stream measured data using RS232 or TCP/IP communication port (both simultaneously) in real time while the test is being conducted. This data may be collected and used for analysis. The data is comma delimited. The table below shows the format of the streaming data.

The streaming data is turned on or off using Tap 

to enter **Edit** mode.Tap 

to enter **Edit** mode. Tap  → 

. Tap **RS232 1** or **RS232 2** or **Telnet.** Tap s**treaming** → **Enabled** → 

.

Tap 

→ **Save** when you are finished making changes.

Parameter		Format	Example Text	Description of Example
Program	Comma Delimited	<PROG>,<TEST>,<PORT>	10,1,1	Program 10
Test	Comma Delimited	<PROG>,<TEST>,<PORT>	10,1,1	Test 1
Port	Comma Delimited	<PROG>,<TEST>,<PORT>	10,1,1	Port 1
Segment Node	Comma Delimited	XXX	STG	3 character node abbreviation i.e. stabilize
Test Data			P 0.001 psig	Test Data Identifier [SPACE] Value [SPACE] Unit
CR				Carriage Return
LF				Line Feed

Note: The buadrate has to be 115200 which is not configurable, since the amount of data possibly streamed on multi-ports (up to 4 streaming at once), we cannot guarantee operation unless baud rate is max 115200.

Note: For most up to date Test Segment identifier codes see the full list in See "Appendix G: Communication Code Tables"

Data Output Parsing Tips

To define a parser for receiving data from the instrument, the following basic rule-set to match all received packets could be utilized to categorize the data. A packet is defined as **<ASCII_DATA><CR>**. Using the carriage return delimiter, the interface stream can be packetized and a text match performed with the beginning characters of each packet.

Match on the following packet text beginning with:

PASSCODE

INTERFACE

COMMAND

PROGRAM

STATUS

RESULT

TYPE

SERIAL

VER

HELP

QUIT

*

Any packet that does not begin with the above can be discarded as a malformed packet. If there are features that you do not require, simply remove that text from the match set. Only look for packets that are needed, discarding all unused packets.

Note that there are no undocumented commands available, in order to protect the stability of the instrument. If any new commands are added in future updates, the help menu and user manual documentation will be updated accordingly.

Note: If we are actively running one program user not able to change program by using command

Example Commands

The following commands can be sent to the Blackbelt Pro, with the following responses.

Command	Response	Description
	PASSCODE=?	send anything before authentication
passcode=1234<CR>	PASSCODE=?	example of a wrong password sent
passcode=7G_q<CR>	PASSCODE=AUTHORIZED	example of a correct password sent
interface<CR>	INTERFACE=PLC	read interface
interface=plc<CR>	INTERFACE=PLC	write interface
command=<CR>	COMMAND=ERROR	send unspecified command
command=start<CR>	COMMAND=START	received start command
command=stop<CR>	COMMAND=STOP	received stop command
program<CR>	PROGRAM=1	read current program
program=2<CR>	PROGRAM=2	change to different program
status<CR>	STATUS=READY	read status while instrument is idle
status<CR>	STATUS=NOT READY	read status during testing
type<CR>	TYPE=Blackbelt Pro	read instrument type
serial<CR>	SERIAL=0000000001	read instrument serial number
ver<CR>	VER= * SYSTEM VERSION=206 * BUILD NUMBER=160714163704 * UCM VERSION=148 * UIM VERSION=009 * TCM VERSION=138 * TM VERSION=4 * GUI DATABASE VERSION=69234 * TCM DATABASE VERSION=0	read instrument system versions
quit		drop connection with instrument
Safe_Shutdown	SAFE_SHUTDOWN	safe shut down via communications

Command	Response	Description
help<CR>	help ********** * Command=Start or Stop: Starts or stops the current program * Program=XX: Changes the current program * * Interface: Returns current interface type * * Status: Returns if the instrument is ready or not * * Result: Current instrument result * * Type: Returns the instrument type * * Serial: Returns the instrument serial number * * Ver: Returns the instrument version * * Quit: Quits this session * * Help: Displays this menu * **********	request help

Terminal Emulator Software Configuration

A variety of tools can be configured to communicate with the Blackbelt Pro.

Acceptable configurations of each are shown in the following sections.

HyperTerminal Serial Port Configuration and Example Commands

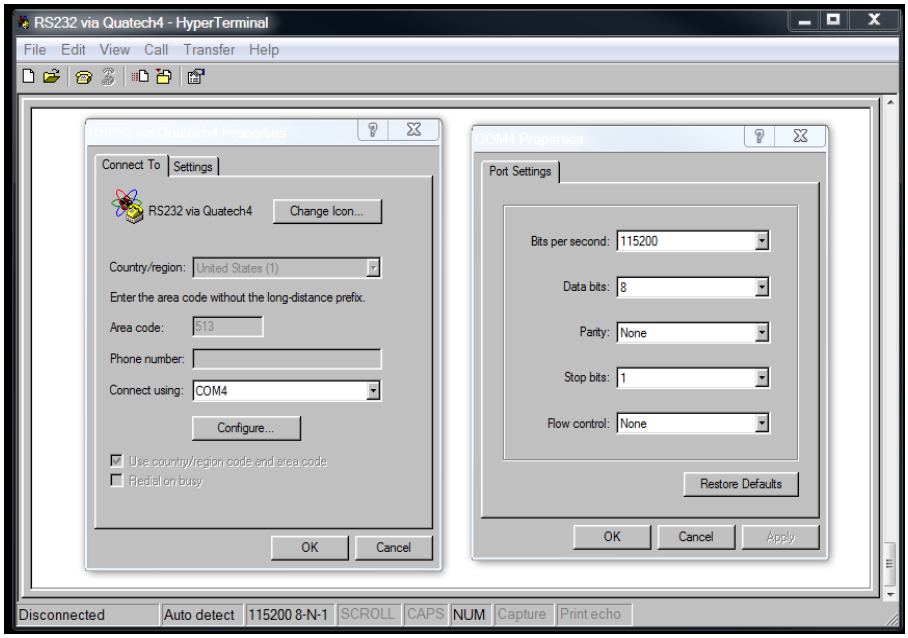


Figure 8-3. HyperTerminal Serial Port Configuration

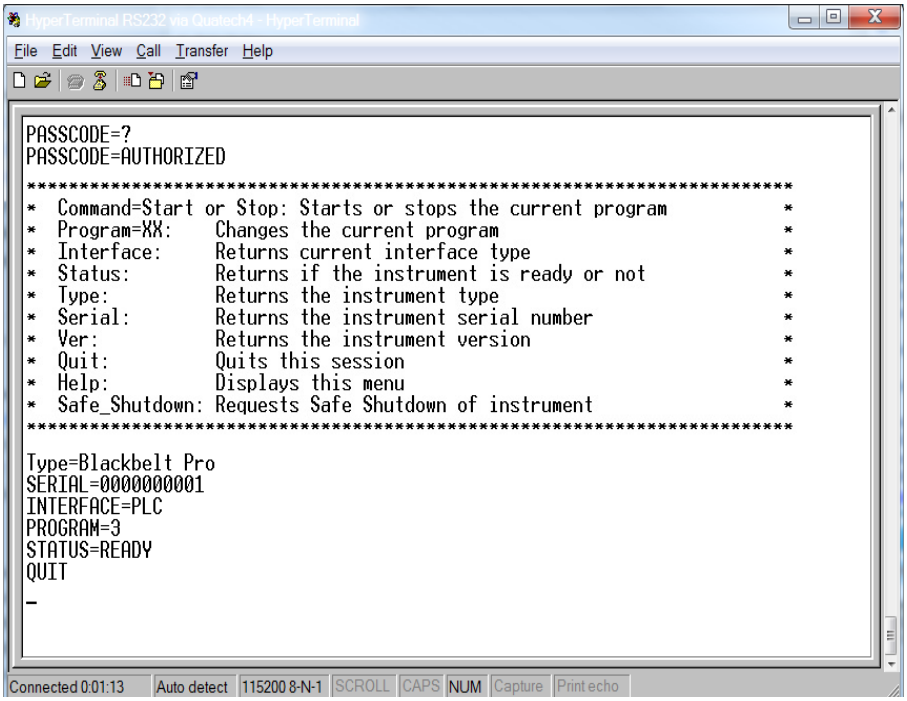


Figure 8-4. Serial Communication with HyperTerminal

PuTTY Serial Port Configuration and Example Commands

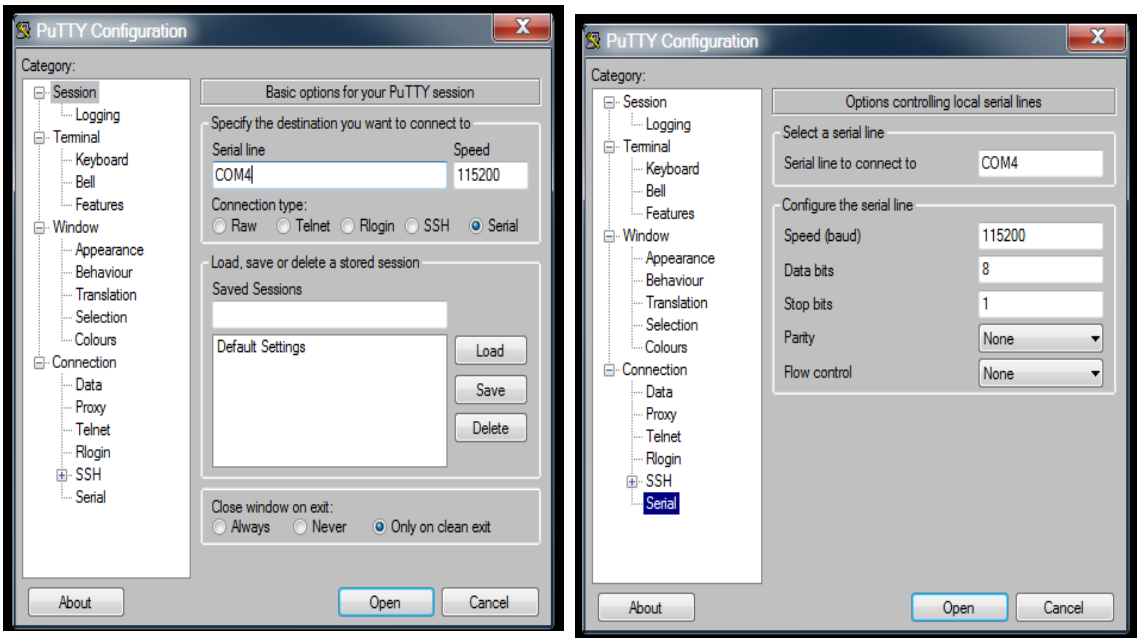


Figure 8-5. PuTTY Serial Port Configuration

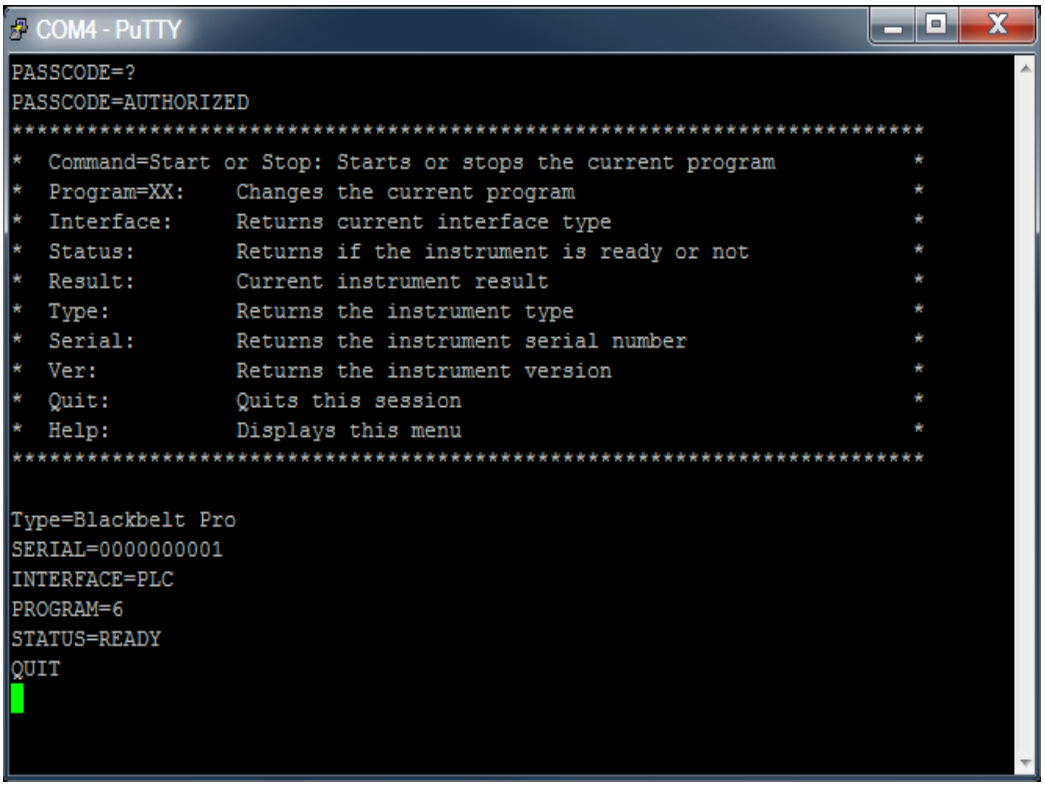


Figure 8-6. Serial Communication with PuTTY

RealTerm Serial Port Configuration and Example Commands

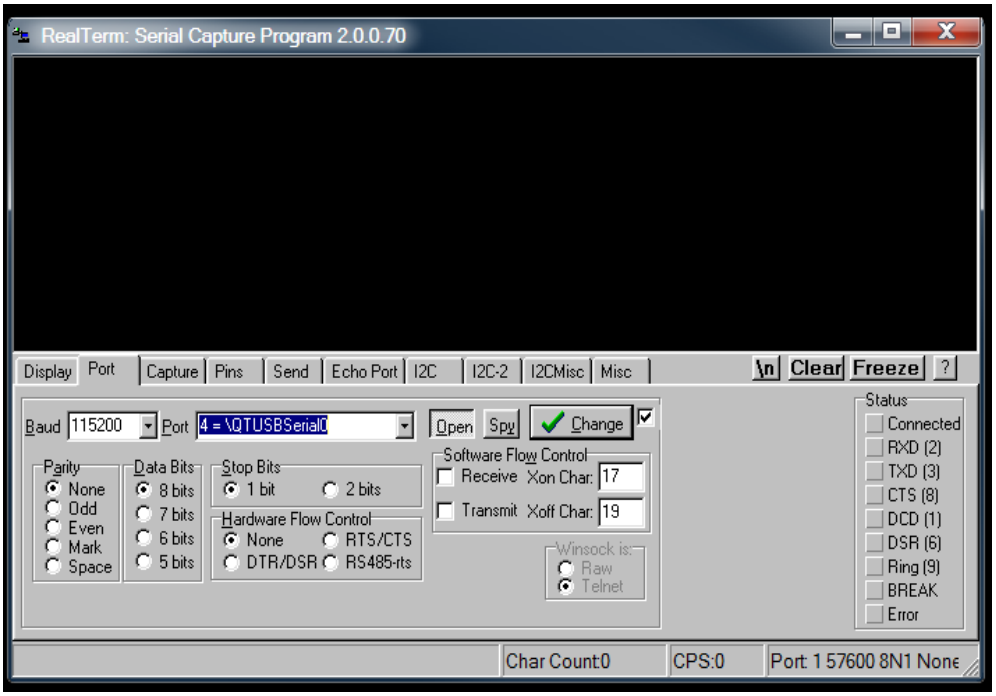


Figure 8-7. RealTerm Serial Port Configuration

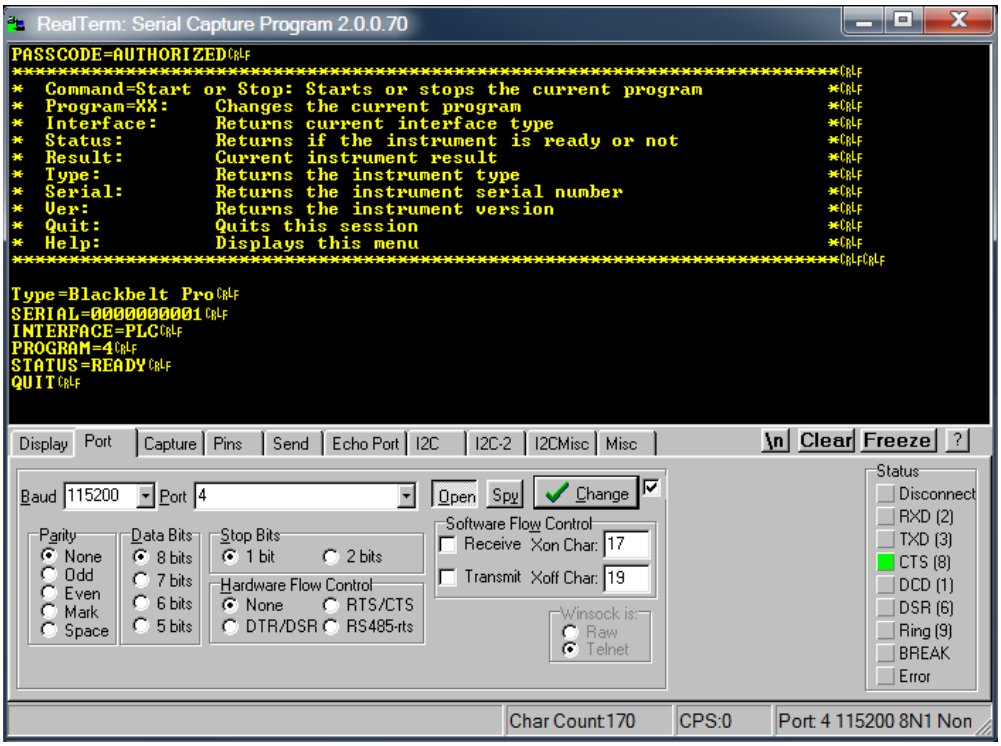


Figure 8-8. Serial Communication with RealTerm

Tera Term Serial Port Configuration and Example Commands

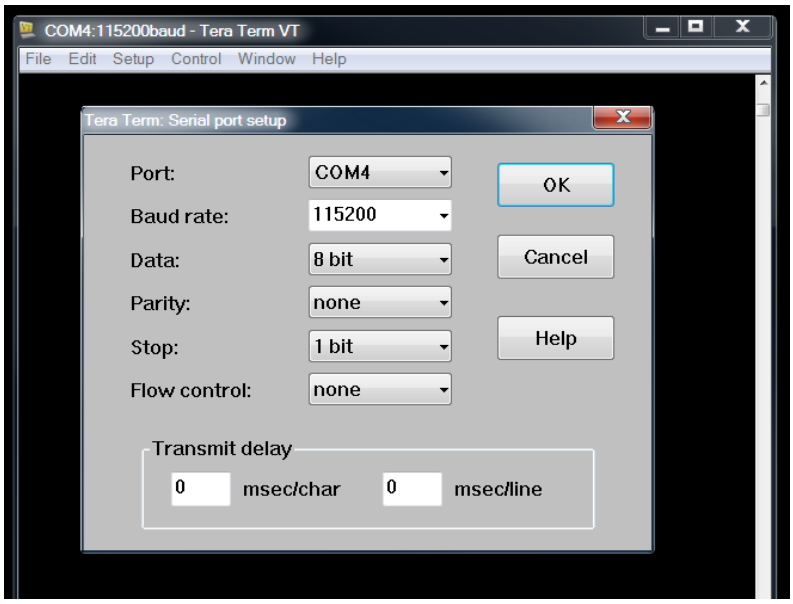


Figure 8-10. Tera Term Serial Port Configuration

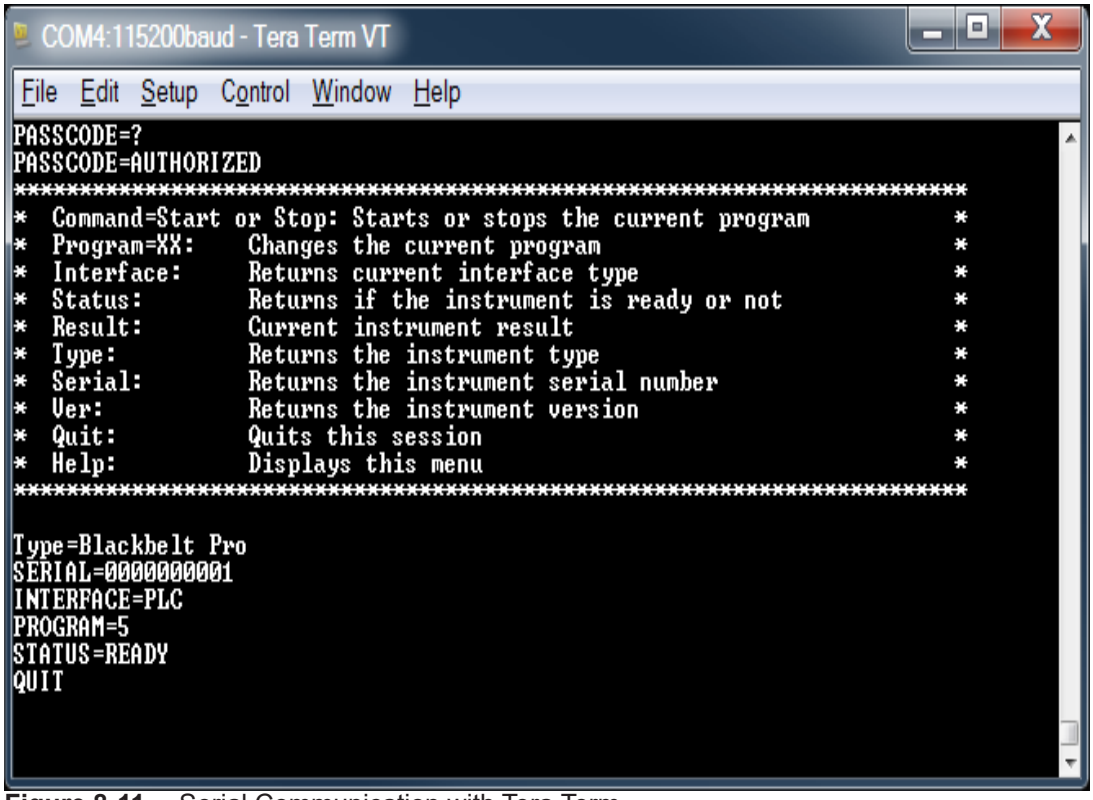


Figure 8-11. Serial Communication with Tera Term

PuTTY Telnet Configuration and Example Commands

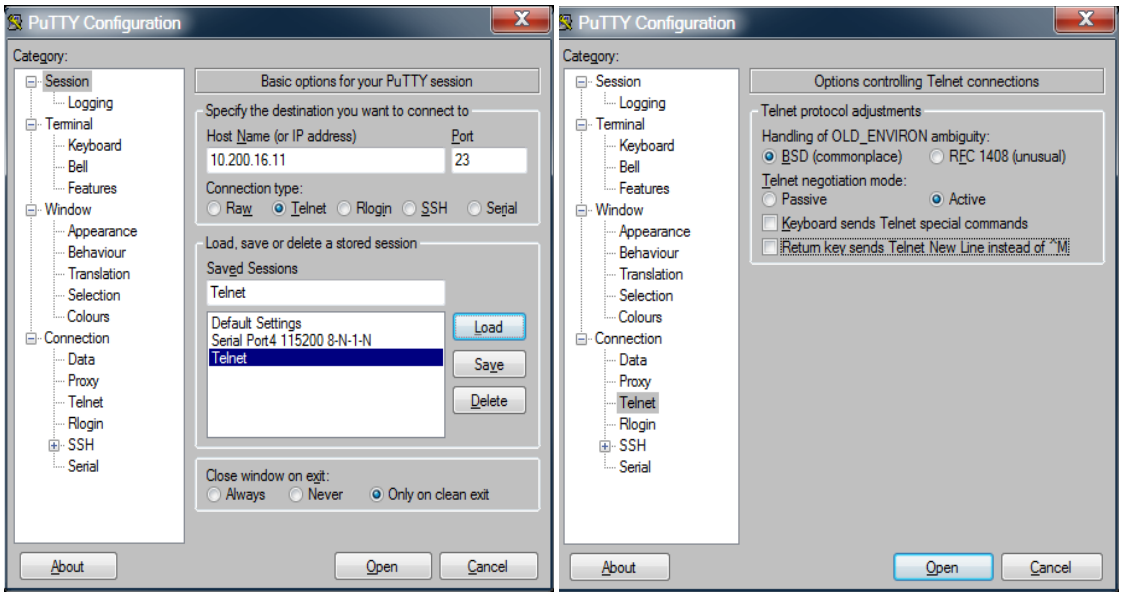


Figure 8-12. PuTTY Telnet Configuration

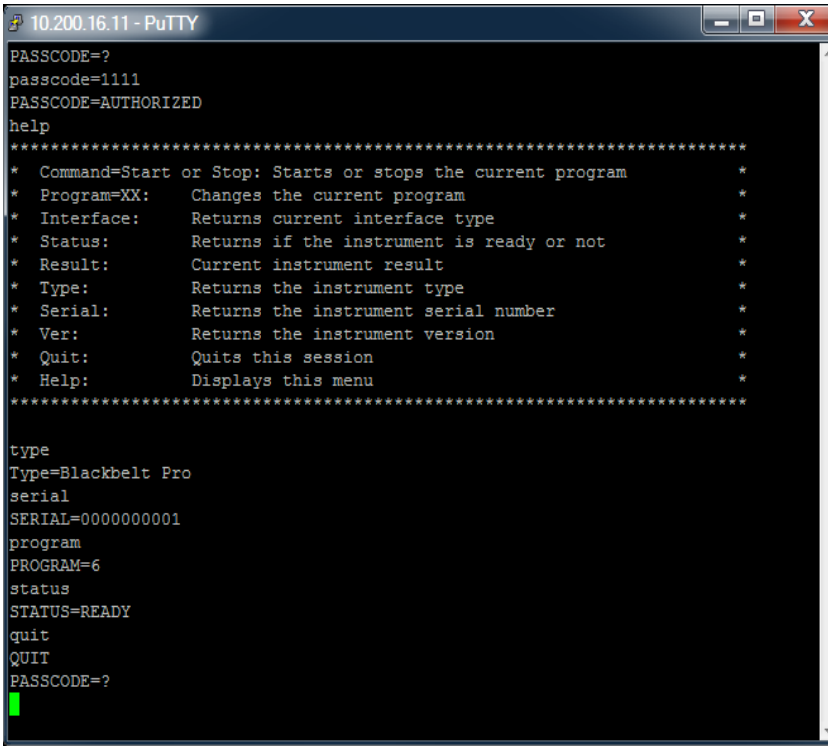


Figure 8-13. Telnet Communication with PuTTY

RealTerm Telnet Configuration and Example Commands

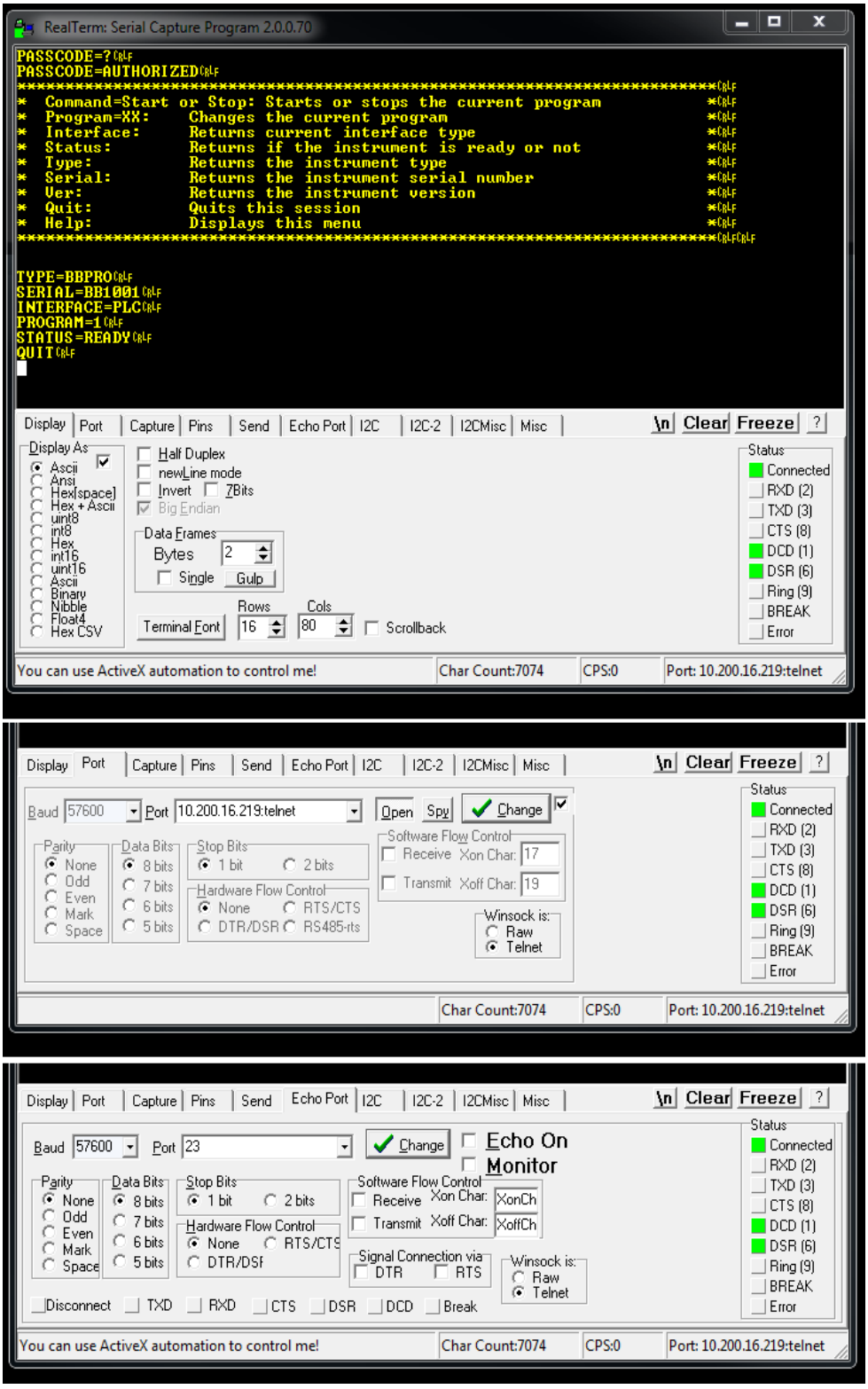


Figure 8-14. Telnet Communication with RealTerm and Configuration Screens

HyperTerminal Telnet Configuration and Example Commands

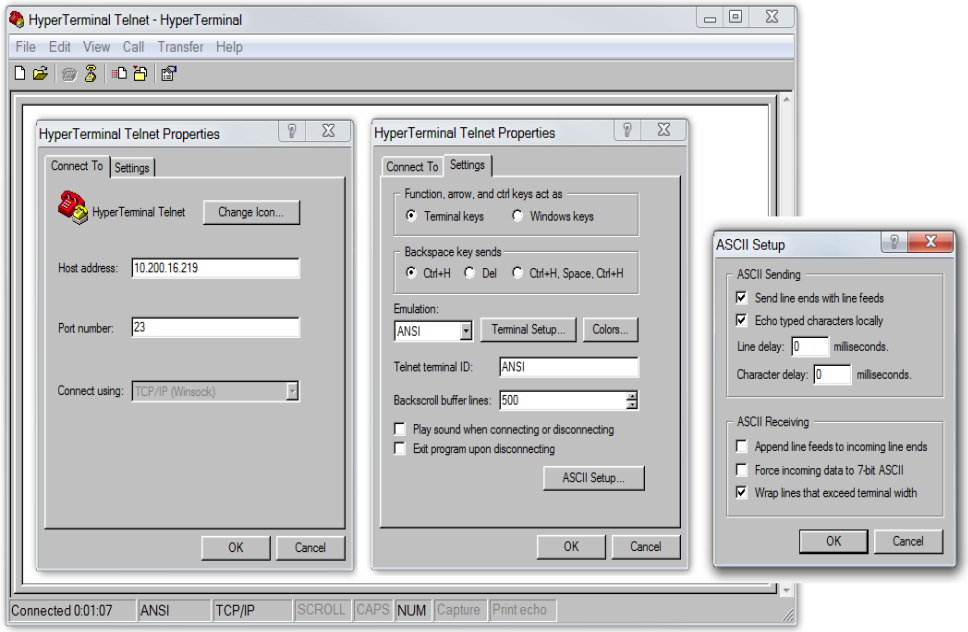


Figure 8-15. HyperTerminal Telnet Configuration

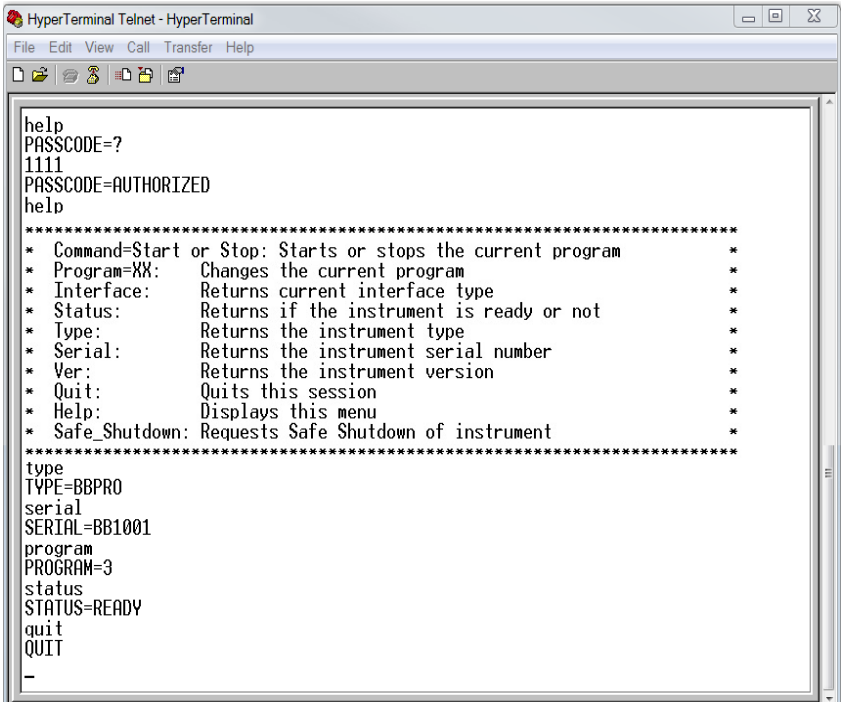


Figure 8-16. Telnet Communication with HyperTerminal

Tera Term Telnet Configuration and Example Commands

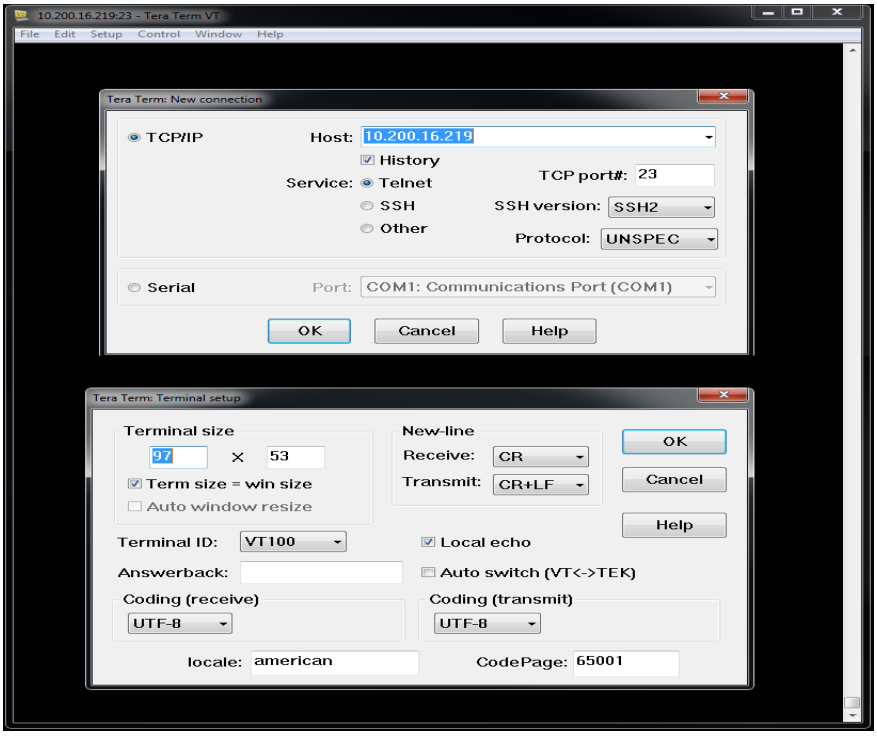


Figure 8-17. Tera Term Telnet Configuration

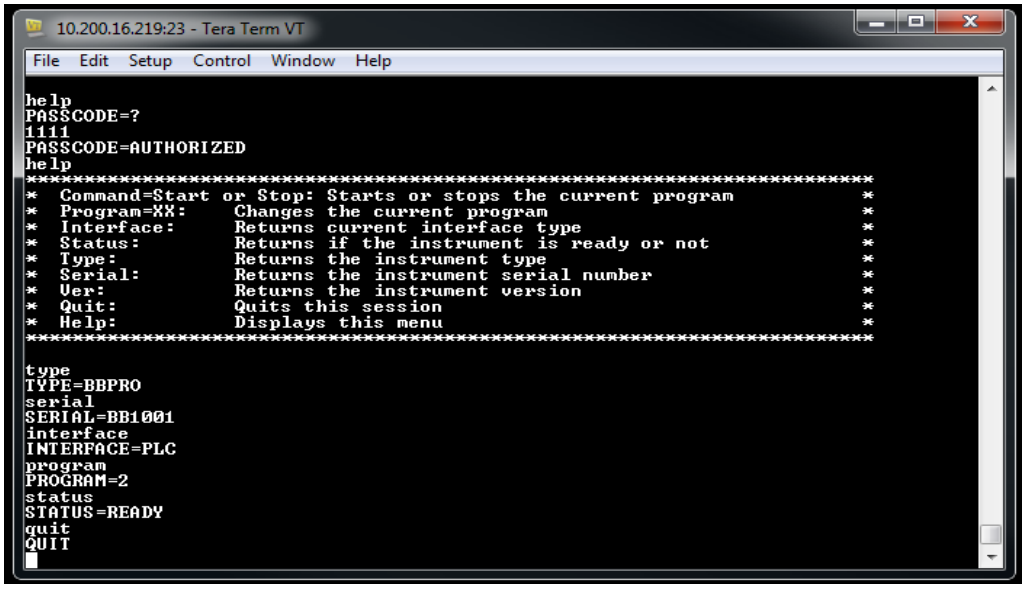


Figure 8-18. Telnet Communication with Tera Term

Scanning a barcode

There are three ways to scan a barcode into a Blackbelt Pro instrument. The first two methods involve setting the Interface Type to either PLC or Barcode, which are described below. The third method is to plug in a barcode scanner, which is also described below.

PLC Interface Type

When the serial or telnet interface method is set to PLC, there are two methods available to send a barcode to the Blackbelt Pro.

The first method is to send ‘barcode=”Barcode text”’. The barcode text will be processed as described in “Scanning a barcode” section below.

The second method is to send ‘barcode:X=”Barcode text”’. The X in the method represents the part this barcode must be attached to. This allows for full test automation as no user selection prompt will be displayed.

Barcode Interface Type

To configure for Barcode functionality, tap [Edit Icon] to enter Edit mode. Tap  →  .Tap **RS232 1** or **RS232 2.** Tap **Interface Type→ Barcode →** 

. Tap 

→ **Save** when you are finished making changes.

When the serial interface method is set to Barcode, the Blackbelt Pro will take any input on the serial port followed by a carriage return and process it as described in “Scanning a barcode” section below.

The following menus will appear in the part node found in the program menu.

Menu	Description
Barcode Required	Selects if a barcode is required before a test starts.
Barcode Method	Sets the method (Unique/Batch) used to attach barcodes to test results. When set to Unique, the barcode is used for a single result. When set to Batch, the barcode is used for multiple results until cleared.
Start Barcode Value	Sets the value used to start the part.
Start Barcode Mask	Sets the portion of the barcode value used to start the part.

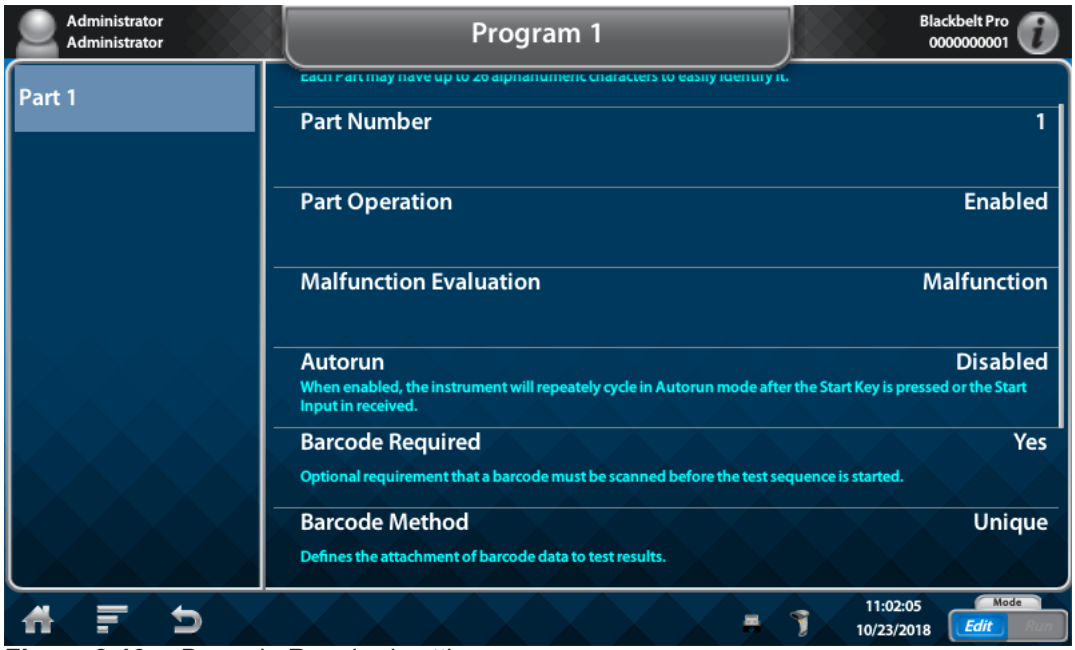


Figure 8-19. Barcode Required setting

USB Barcode

When a USB barcode scanner is plugged into any of the three USB ports, the Blackbelt Pro will recognize the barcode scanner. After the barcode scanner is installed, a new scanner icon will show up at the icon bar. Any data sent by the barcode scanner will be processed as described in “Scanning a barcode” section below.

Scanning a barcode

After a barcode has been scanned by, the barcode is first matched against program and start part. If one of these matches, the instrument will perform the function and the barcode will not be passed on. Otherwise, the barcode will be attached to a part if commanded, or a popup will display prompting the user to attach the barcode to a part.

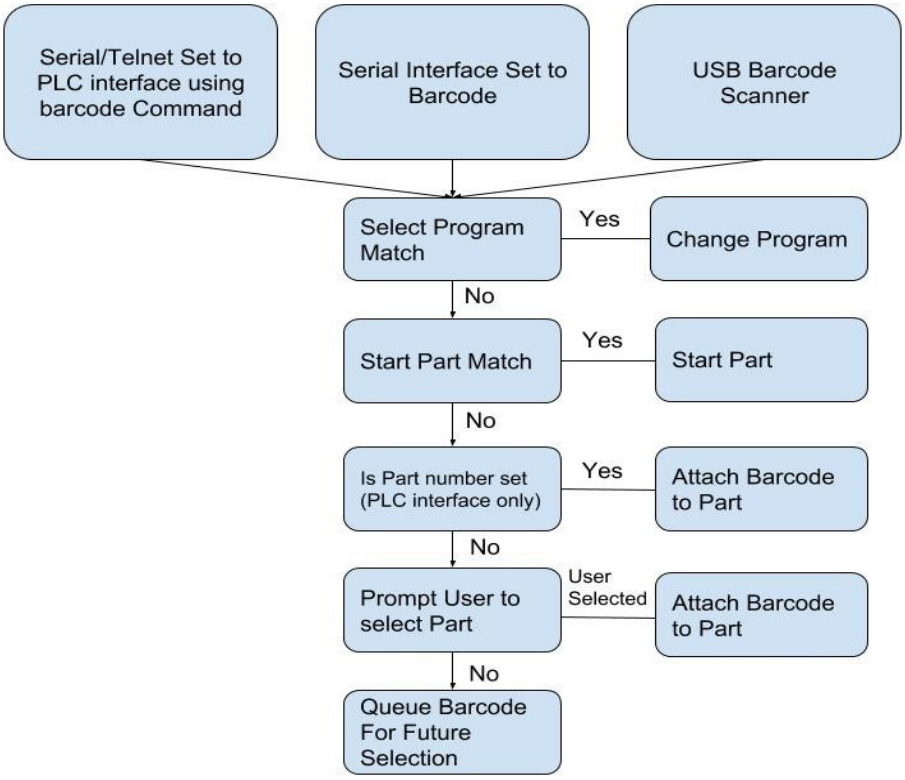


Figure 8-20. Scanning Barcode

Program Selection via Barcode

Under **Hardware → Devices**, a new option shows up to allow a user to create a "Barcode Program Select" block. This new option contains the following parameters.

Menu	Description
Number of Programs	Defines the number of Program Selects to be provided. This value has a default value of 1 with a maximum value of 10
Program Select	Defines the program that will be selected when a barcode is received that matches the defined Value/Mask pair as defined below
Barcode Value	Defines a barcode value that, when paired with the Barcode Mask, will be used to select the new program as defined by the Program Select.
Barcode Mask	Defines a barcode mask that, when paired with the Barcode Value, will be used to select the new program as defined by the Program Select.

The Barcode Value and Barcode Mask are used as a pair to define the characters from the barcode that will be used to select the new program. Only the characters from the barcode Value with a corresponding '#' symbol in the Mask are matched against the received barcode. for example:

This pair matches the first 4 characters of any barcode being 1234:
Value: 1234
Mask: ####

This pair will match the characters "PGM_3" at offset 3-7 in any barcode received:
Value: 00_PGM_3_00
Mask: XXX#####XXX

Any trailing characters in the received barcode are ignored.

If the mask is shorter than the input value, any characters after where the mask ends are also ignored.

Note that any scanned barcode used to for program select will not be available to be attached to a part. A new barcode will need to be scanned if a barcode is required to be attached to a part.

Barcode Start Part

When the barcode option under Start Part is selected, two new variables appear in the part configuration.

Menu	Description
Start Barcode Value	The barcode value that, when paired with the Start Barcode Mask, will be used to start the part.
Start Barcode Mask	The barcode mask that, when paired with the Start Barcode Value, will be used to start the part.

The matching used by this pair is the same as that for the “Barcode Program Select” values described above. As with Barcode Program Select, note that the barcode will not be available to be attached to a part. A new barcode will need to be scanned if a barcode is required to be attached to a part. See the examples above for a description.

Barcode Popup Menu

When a barcode is intended to be attached to a part and no part # is applied via the PLC interface, then it is up to the user to select which part the barcode should be attached to. In this case, a window similar to Figure 8-21 will be displayed. The boxes above the part boxes are each barcode strings that have come in and need to be attached to a part. The following rules apply to this selection menu.

User Prompt Window definition

When a barcode is intended to be attached to a part and no part # is applied via the PLC interface then it is up to the user to select which part the barcode should be attached to. In this case a window similar to below figure will be displayed.

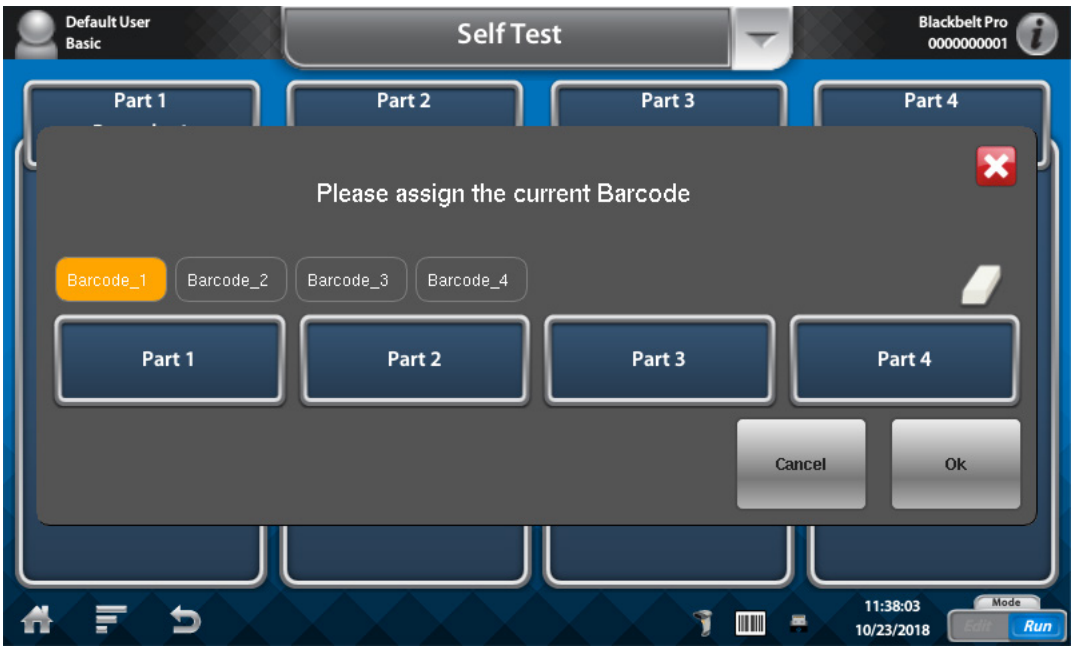


Figure 8-21. Scanned Barcode autoincrement

The orange box above the part box is each barcode string that has come in and needs to be attached. The following rules apply to this selection menu.

Auto-barcode Increment is the default method for selecting barcodes. Whenever a barcode is attached to a part, the next scanned barcode will automatically be selected.

If there are more barcodes than the number of available parts, or if a user manually selects a barcode, or the user closes the barcode window and presses the barcode icon at the bottom of the screen, autoincrement will be disabled.

If autoincrement is off, then the same barcode may be assigned to multiple parts. When autoincrement is off, a cancel button will appear as shown in below figure

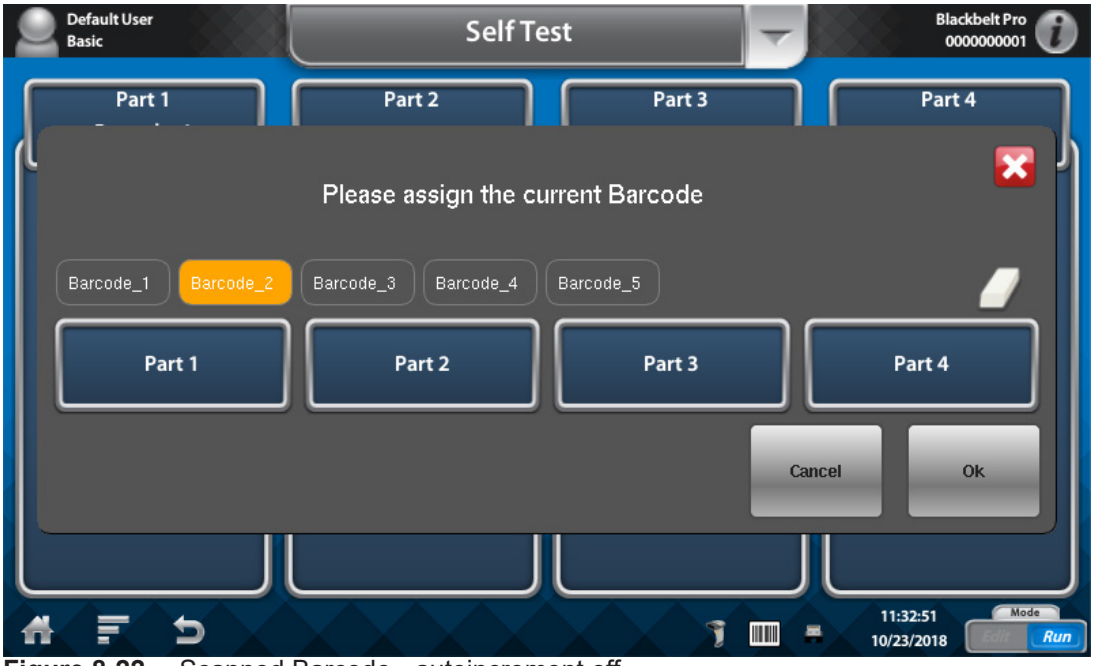


Figure 8-22. Scanned Barcode - autoincrement off

The barcode is cleared when a program change occurs. Barcodes attached to parts will also be cleared for user selection if that part is started.

The user can also clear a barcode that was accidentally scanned by selecting the barcode and pressing the eraser button. The barcode will be removed as long as it is not attached to a part.

Figure 8-23. Scanned Barcode - attached to parts

Chapter 9
QualityWorX

This Chapter explains the custom interface designed to interface with **QualityWorX™**. **QualityWorX™** is a stand-alone turnkey solution that aggregates data from Blackbelt Pro devices. You can view this data on monitor running **Sciemetric Studio** - a suite of analytic software which allows plant engineers and technicians to analyze and report on data from your production line.

QWX (QualityWorX) Settings

The QWX settings parameters are located in Main *Menu* > *Settings* > *Qwx* menu. The first step in establishing communication is to set QualityWorX to “Enable”. See “Figure 9-1. Network Settings Menu” below.

To set up the QualityWorX functionality, tap → → Qwx.

To edit the settings, tap Mode Edit Run to enter **Edit** mode.

To enable QualityWorX Communication, tap **QualityWorx** → **Enabled** → OK.

Tap Mode Save Run → **Save** when you are finished making changes.

Figure 9-1. Network Settings Menu

Host Setting

To make communication with QualityWorX server, set **Host IP Address** or **Hostname** (local or web). Setting parameter located in *Main Menu* > *Settings* > *Qwx* menu

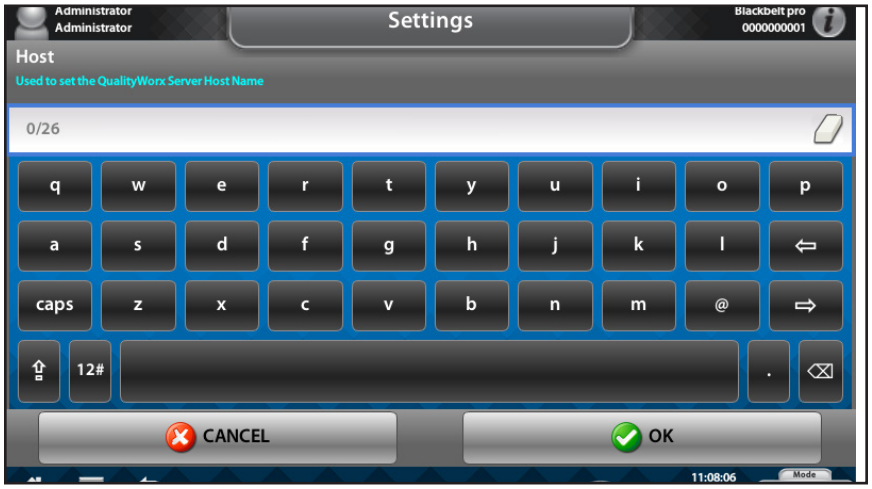


Figure 9-2. Host Setting

Port Number Setting

Configure **Port Number** the QualityWorX server expecting communication on. Default port number if 6100. **Port Number** located in *Main Menu* > *Settings* > *Qwx* menu

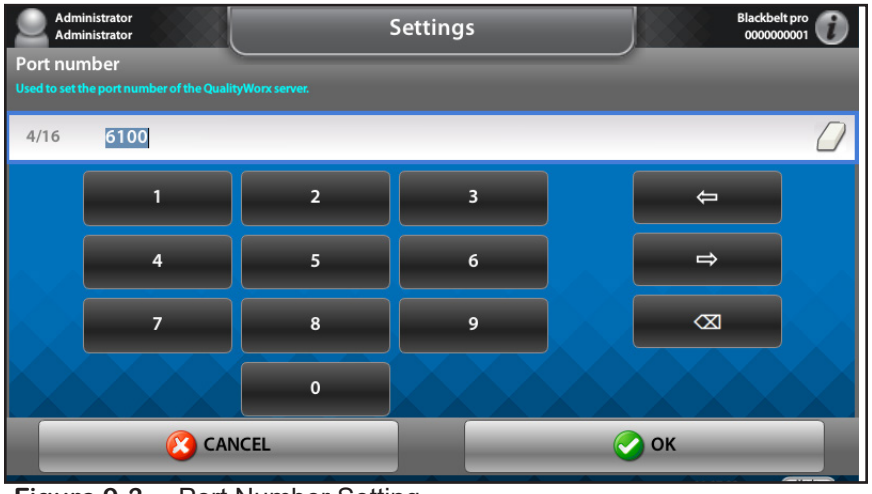


Figure 9-3. Port Number Setting

Token Setting

Set the Token for enterprise services (Refer Enterprise Token to get Token from Sciemetric Studio), located in *Main Menu* > *Settings* > *Qwx* menu .

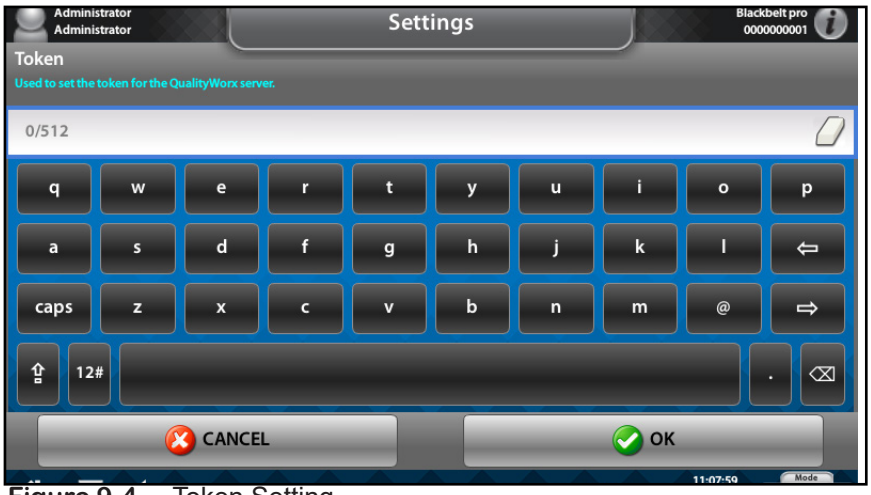


Figure 9-4. Token Setting

Part Type setting

Part Type is the group for parts ran on instruments on a line. Set **Part Type** located in *Main Menu* > *Settings* > *Qwx* menu

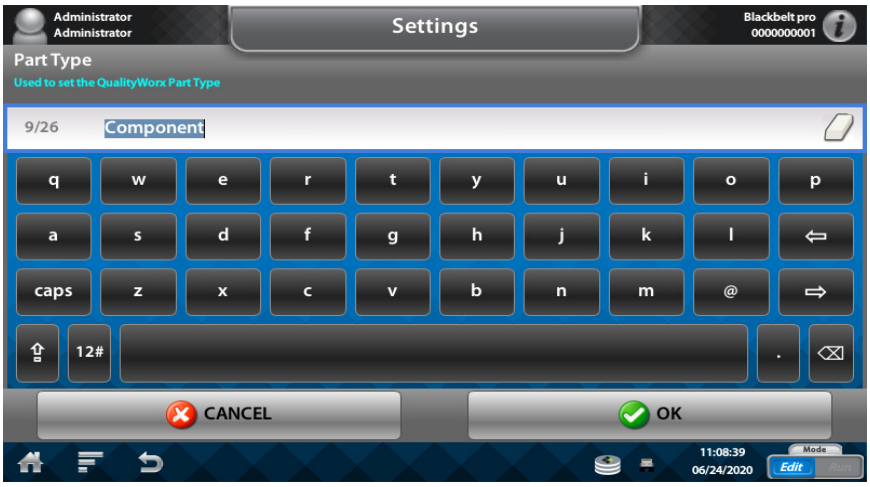


Figure 9-5. Part Type Setting

Part Section Setting

Part Section is a sub-group for parts ran on the instrument. Set **Part Section** located in *Main Menu* > *Settings* > *Qwx* menu

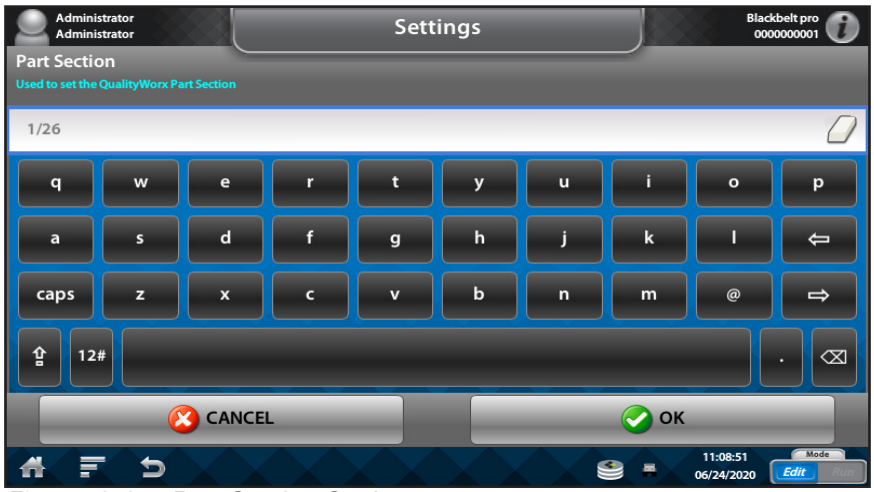


Figure 9-6. Part Section Setting

Schema Setting

Schema for the QualityWorX server. Current version only support Schema 3.0. **Schema** located in *Main Menu* > *Settings* > *Qwx* menu.

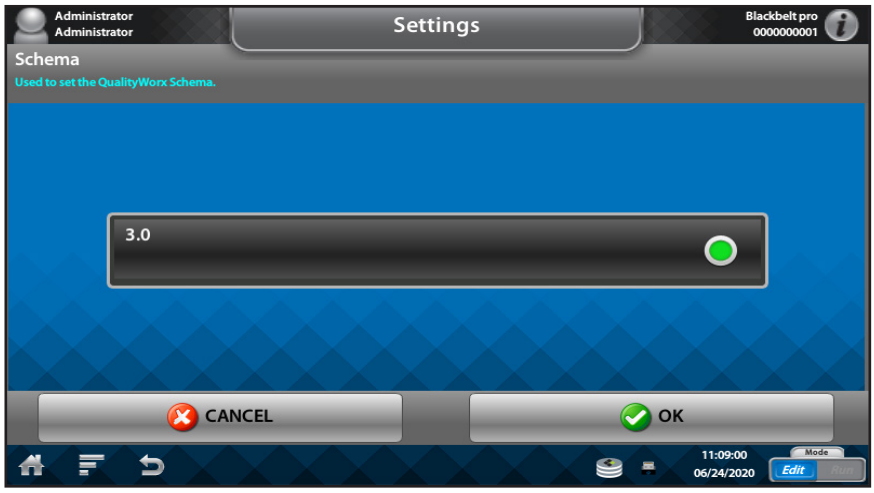


Figure 9-7. Schema Setting

Barcode is Serial Number

If want to use Barcode as Serial number of tested part, enable **Barcode is Serial Number** setting located in *Main Menu* > *Settings* > *Qwx* menu.

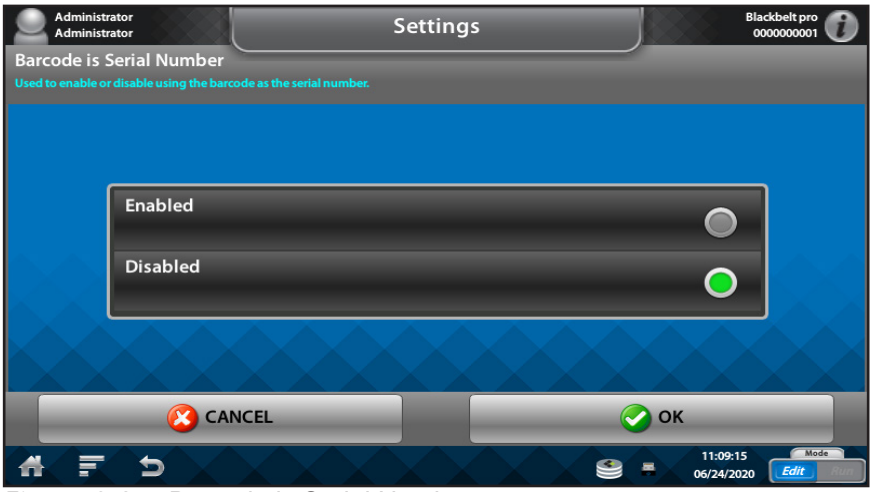


Figure 9-8. Barcode is Serial Number

Instrument Name

I**nstrument name** located in **Main Menu > Settings > Misc**, is used to identify parts in QualityWorX.

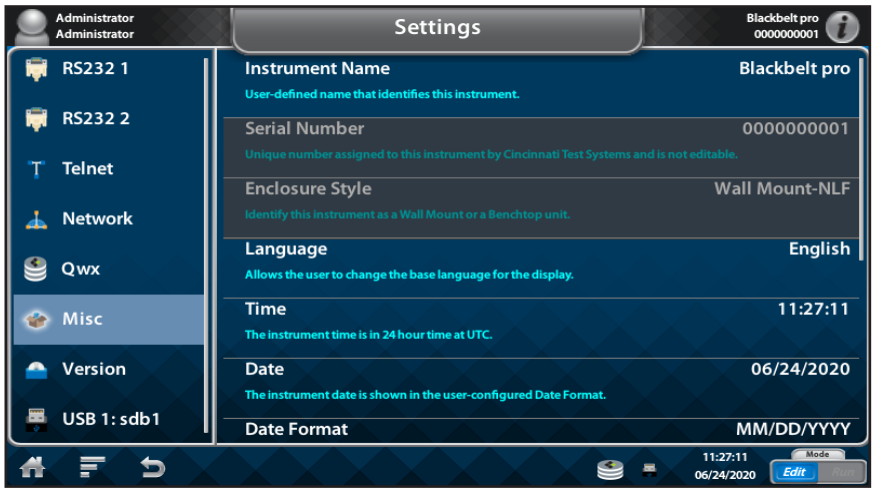
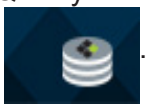


Figure 9-9. Miscellaneous Settings

QualityWorX Log

Blackbelt Pro Instrument provide the QualityWorX activity log when QualityWorX enabled. Once QualityWorX enabled,  . icon will get appears in status bar.

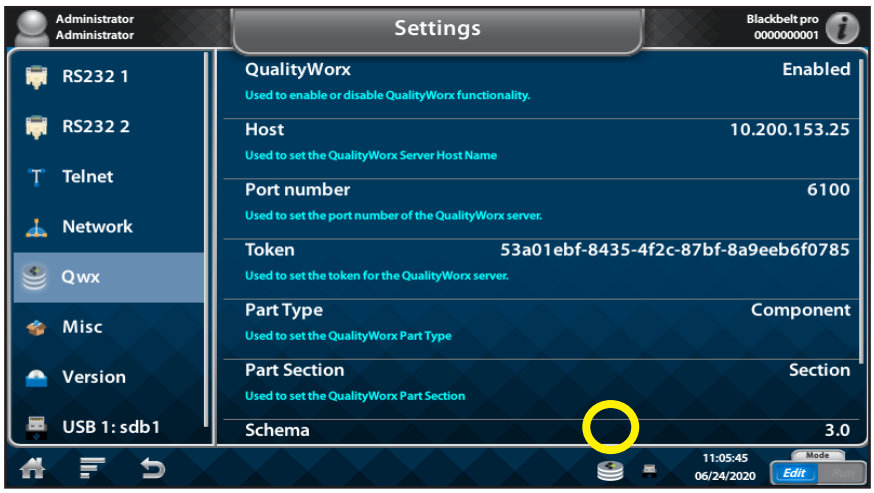


Figure 9-10. QualityWorX Icon

When click on  icon, QualityWorX log screen appears on the top of screen.

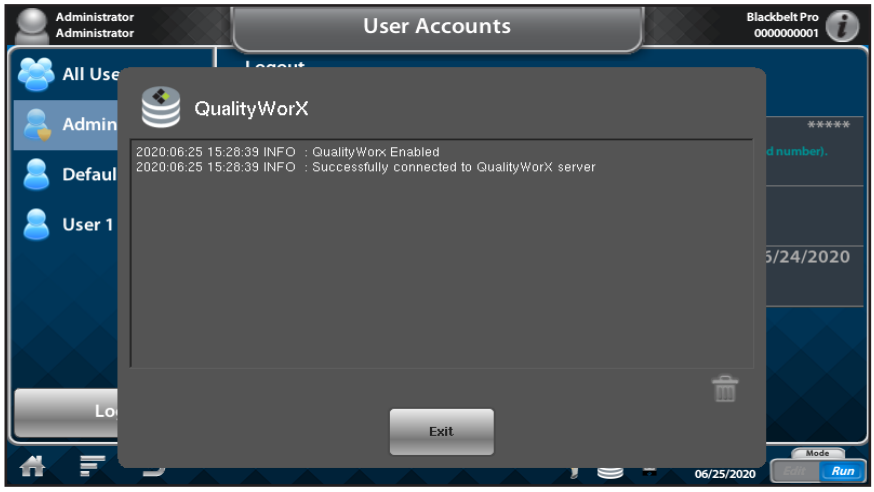


Figure 9-11. QualityWorX log screen

Whenever there is QualityWorX connection error, QWX status icon  show notification. When clicked it QualityWorX log screen with error displayed.

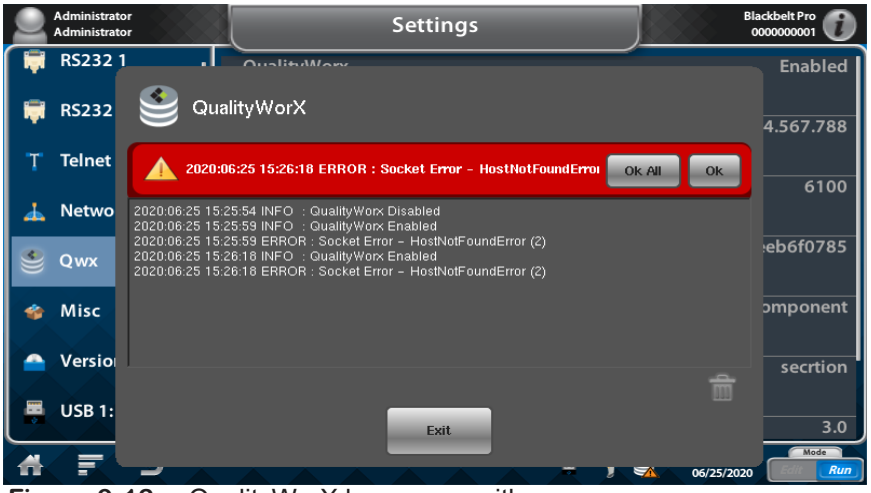


Figure 9-12. QualityWorX log screen with error

To Clear all notifications Press  .

To Clear last notification Press  .

To Clear all log information Press  .

To exit notification screen Press  .

Enterprise Token

Enterprise customers require a token to be entered for information to be collected.

Follow below instruction to get enterprise token and fill in instrument.

Open Sciemetric Studio either by click on application icon on your desktop 

. Or by running sciemetric studio application from start menu.

Once Sciemetric Studio application running you will see below page:

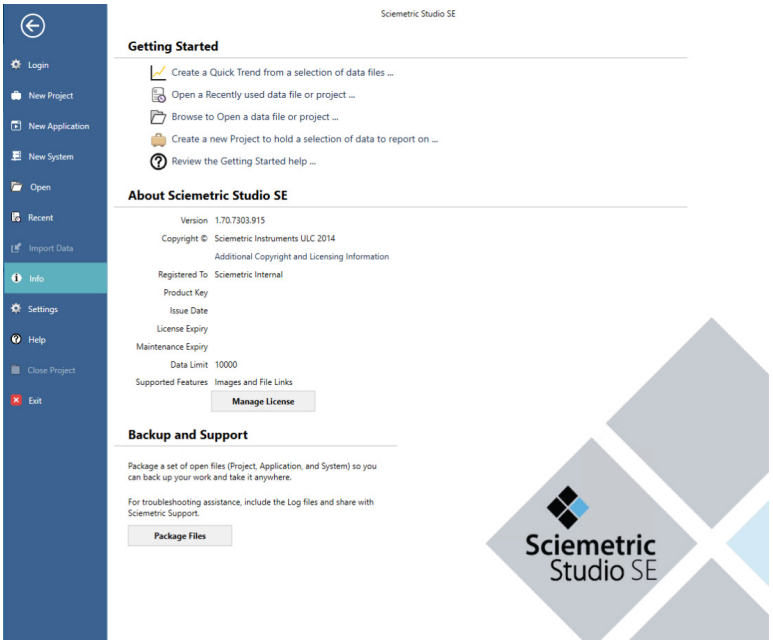
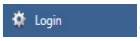
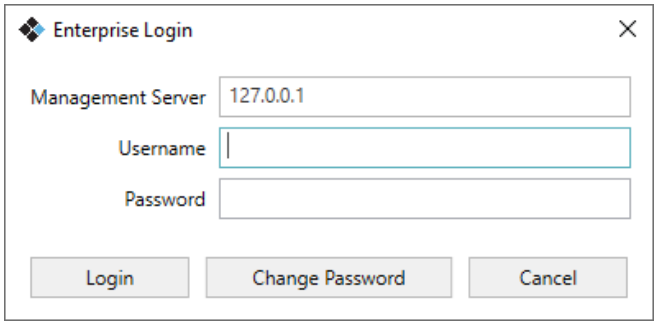


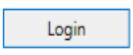
Figure 9-13. Sciemetric Studio

Login to Sciemetric studio by selecting 

.

Enter Username and Password



Select 

Select Enterprise Settings you will see below page

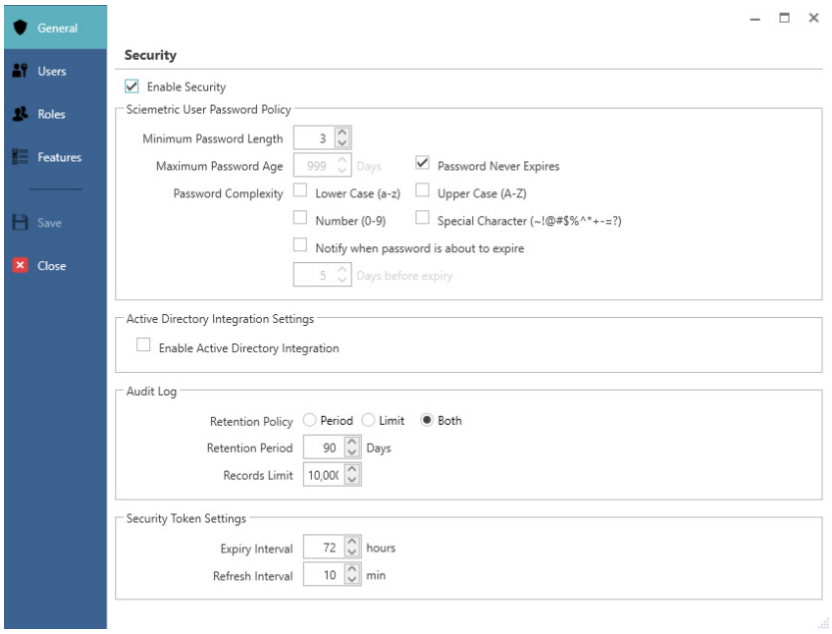


Figure 9-14. Enterprise settings

Select Users you will see below page

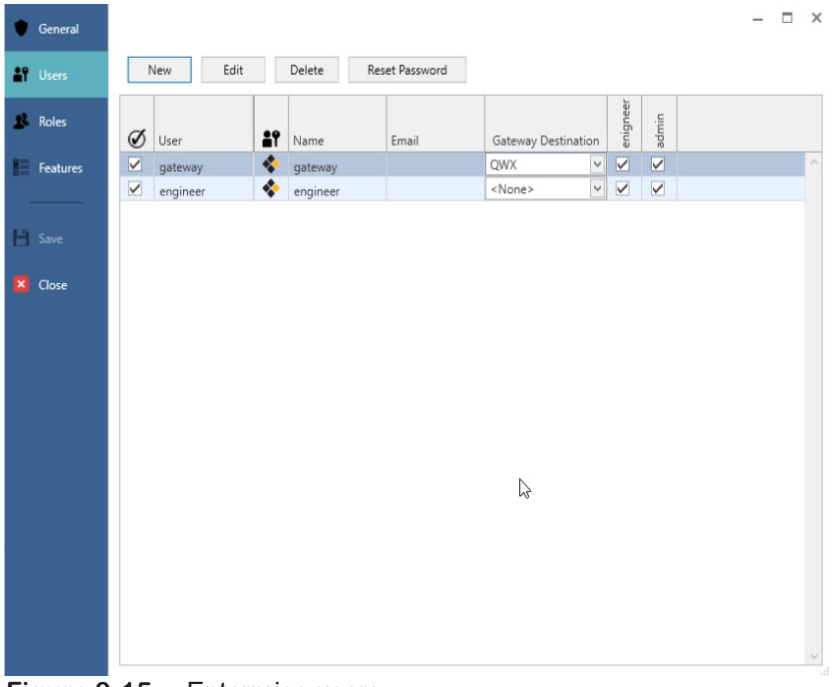
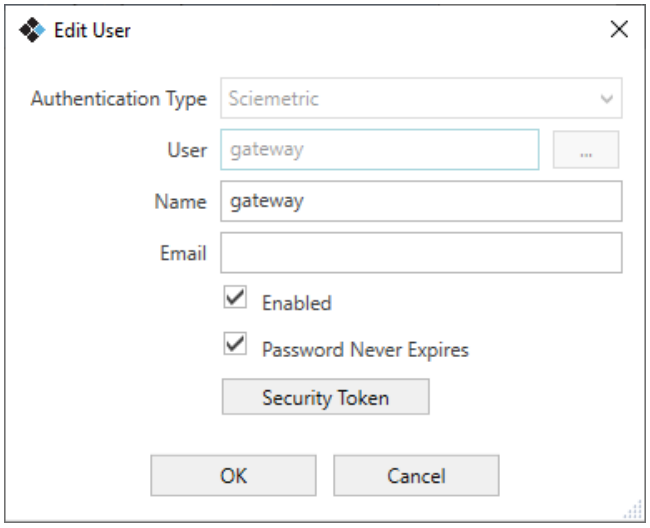
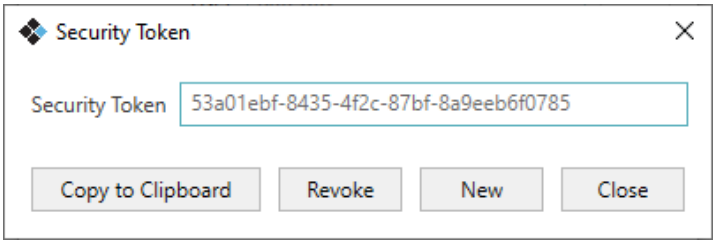


Figure 9-15. Enterprise users

Select “**gateway**” user and click Edit you will see below page



Select “**Security Token**” to see token



Note down Token, and select Close .

Once you have Token go the *Main Menu* > *Settings* > *Qwx*.

To edit the **Token**, tap 

to enter **Edit** mode. Select Token to edit, and fill noted Token. Press OK.

Tap 

→ **Save** when you are finished making changes.

Chapter 10
EtherNet/IP

This chapter explains the control capabilities of the Blackbelt Pro using the **EtherNet/IP**™ feature. This enables the instrument to be fully controlled via Ethernet communication. **EtherNet/IP** is a registered trademark of ODVA, Inc.

Instrument EtherNet/IP™ Functionality

EtherNet/IP is an industrial communication standard which encompasses the Common Industrial Protocol (CIP™) deployed over standard Ethernet technology (IEEE 802.3 with TCP/IP). While EtherNet/IP offers various optional topology methods, our implementation utilizes the conventional star with standard Ethernet infrastructure devices.

Features

EtherNet/IP provides the following capabilities:

- Standard set of I/O functionality for machine control
- Modify the current active Program
- User configurable soft I/O functions (32 input, 32 output)
- Test result summary data, and query of result measurement information
- Obtain Network Settings, modify IP Address, Subnet Mask, and Default Gateway

EtherNet/IP does **NOT** provide:

- Real-time test data streaming
- Access or modification of instrument settings:
  - Settings configuration
  - Hardware configuration
  - Program configuration

Compatibility

Provide full communication capabilities over EtherNet/IP™ with any Allen-Bradley ControlLogix® or CompactLogix PLC™.

Standard Fixed, Defined Inputs/Outputs

Enabling EtherNet/IP allows a set of fixed defined I/O points that are preconfigured are already part of EtherNet/IP structure. The following functionality is accessible by these predefined features.

- Start
- Stop
- Vent/Halt
- Program Accept
- Program Reject
- New Result Available flag reset
- Result Ready
- Result Error
- Result Unique ID
- Timestamp
- Malfunction
- Current Program Number
- Change Program Number
- Test Evaluation
- Instrument Ready

Setting EtherNet/IP User Defined Input and Output Events

The instrument comes equipped with 32 programmable inputs and 32 programmable outputs. The user can select up to 64 test or program specific I/O that are not in the Standard Fixed, Defined I/O set (described in the previous section). The following lists of input and output options are the same as the lists of hardware inputs and outputs described in the Programmable I/O Tables in “Chapter 12: Events”. See those tables on page 125, page 130, and page 132.

Menu Location		Input Event Options	Output Event Options
Part Level	Settings	Part Start	Part Accept
		Stop/Reset	Part Reject
		Part Hold	Part Malfunction
		Start Part Calibration	Part Severe Leak
		Open Leak Standard	Part Ready
		Part Present	Part Active
		Part Reset	

Menu Location		Input Event Options	Output Event Options
Test Level	Settings		Test Active
			Test Passed
			Test Failed
	Prefill		In Prefill
	Fill		In Fill
	Stabilize		In Stabilize
	Test		In Test
			Below Low Limit
			Between Limits
			Above High Limit
	Exhaust		In Exhaust

Menu Location		Input Event Options	Output Event Options
Hardware Devices	Tooling Device		Extend Event
			Retract Event
	Program Select	Program Select Bit #	
		Program Select	
	Light Feature		Port Pass
			Port Fail
			Port Active
	Instrument Control	Vent/Halt	Accept Part
		Start Part	Reject Part
		Stop Part	Malfunction Part
		Calibrate Part	Active Part

Menu Location		Input Event Options	Output Event Options
	Alarm Control		Alarm Event

The Inputs and Outputs in the previous table are listed in their menu selection order. All of the options may not be available, depending on the test type and the tooling control setting (On or Off and Number of Motions). Descriptions of these menu options can be found in Chapter 11 – Inputs and Outputs.

Additional Reference Documents

For more information on communicating with any Allen-Bradley ControlLogix or CompactLogix PLC, refer to the **EtherNet/IP AOI Integration Manual**. This document file will be located on the USB flash drive that was provided with the CTS instrument. If you cannot locate this file on the USB drive, it can be emailed to you. Contact the Cincinnati Test Systems Service department. See the back cover of this manual for contact information.

For those who need low level programming for EtherNet/IP, refer to the **Programmers Reference Manual.** This document file will be located on the USB flash drive that was provided with the CTS instrument. If you cannot locate this file on the USB drive, it can be emailed to you. Contact the Cincinnati Test Systems Service department. See the back cover of this manual for contact information.

Establishing EtherNet/IP Communication

Note Only Advanced users can enable and configure EtherNet/IP setting.

See “Chapter 7: User Login & Security” on page 79 for more information about user privileges. See “Chapter 6: Settings” on page 71 for more information about the Network menu settings.

The network communication parameters are located in Main Menu > Settings > Network menu. The first step in establishing communication with a PLC is to set EtherNet/IP to “Enable”. See “Figure 10-1. Network Settings Menu” below.

To set up the EtherNet/IP functionality, tap → → Network.

To edit the settings, tap Mode Edit Run to enter **Edit** mode.

To enable EtherNet/IP Communication, tap **EtherNet/IP** → **Enabled** → OK.

Tap Mode Save Run → **Save** when you are finished making changes.

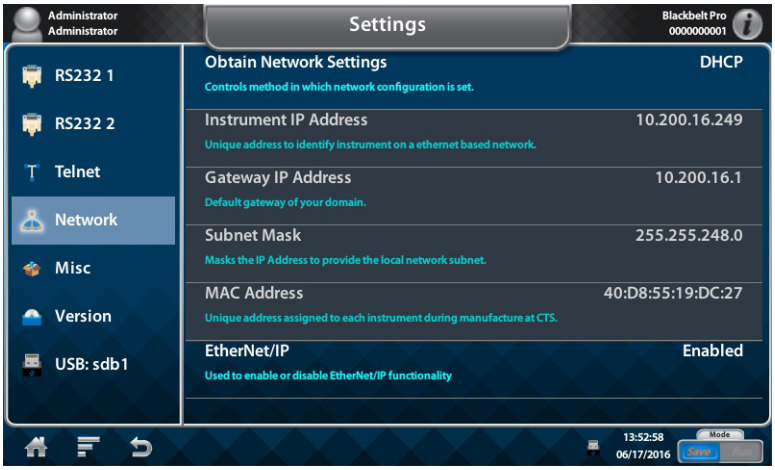


Figure 10-1. Network Settings Menu

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Chapter 11
Tooling and I/O

Figure 10-1. Hardware Devices Screen

The Blackbelt Pro supports limited tooling functionality using external hardware.

To configure tooling, tap → Hardware. Tap Hardware : Manifolds, then tap **Devices** to view the **Hardware: Devices** screen. After displaying the **Hardware: Devices** screen, tapping → Hardware will continue to display the **Hardware: Devices** screen until you select **Hardware: Manifolds** or until the instrument is rebooted.

Add a Tooling Device Segment and Configure

Advanced user level is required to add or configure tooling devices.

Tap Mode Edit Run to enter **Edit** mode.

On the **Hardware: Devices** screen, long press Settings.

From the flyout menu, tap **Add Tooling Device**.

A blank Tooling Device segment is added to the screen. Scroll to the bottom, if necessary to see the new segment. Tap the new **Tooling Device** segment.

The empty Hardware Device Tooling Device Settings menu displays.

Tap **Tooling Type → Extend/Retract →** 

.

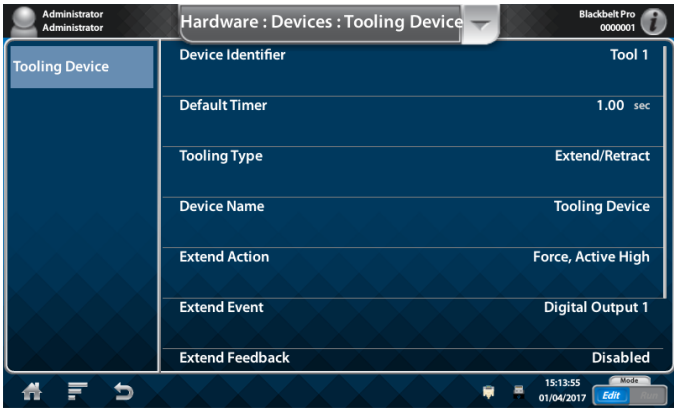


Figure 10-2. Hardware Device Tooling Device Settings

Modify Tooling Device settings as needed. The following menu options are available.

• Menu	• Description
• Device Identifier	• Tap an identifier from a list of available numbers. • **Requires Advanced user access to see and edit.**
• Default Timer	• Amount of Time allocated when tooling is being Retract when the Reset operation is performed. This is also being used as a default time value for newly added Extend or Retract device in the Program.
• Tooling Type	• Determines the type of tool attached. A Tooling Type must be selected to enable further settings. Currently only Extend/Retract (for seals) is available.
• Device Name	• The name by which the device will be identified in instrument menus.
• Extend Action	• The mechanical action by which a tool is extended or a seal is activated.
• Extend Event	• Specifies which digital output is associated with this tooling motion.
• Extend Feedback	• Disabled is the only option at this time.
• Retract Action	• The mechanical action by which a tool is retracted or a seal is deactivated.
• Retract Event	• Specifies which digital output is associated with this tooling motion. *Not visible when Retract Action is set to Spring.*
• Retract Feedback	• Disabled is the only option at this time. *Not visible when Retract Action is set to Spring.*

Tap 

→ **Save**.

Define Tooling Time Settings for a Program

The time settings for tooling in a program are located in the  Settings menu on the ***part level*** program screen. For more details, see ”Edit Tooling Time Unit and Time

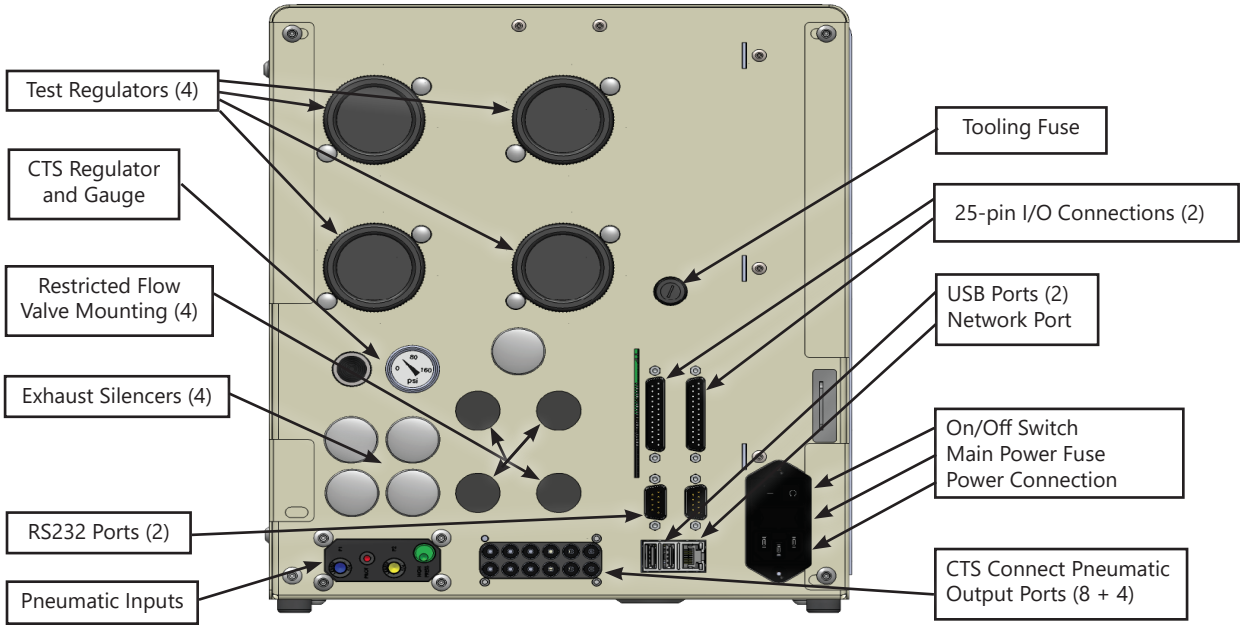


Figure 10-3. Bench Mount Model Rear Connections

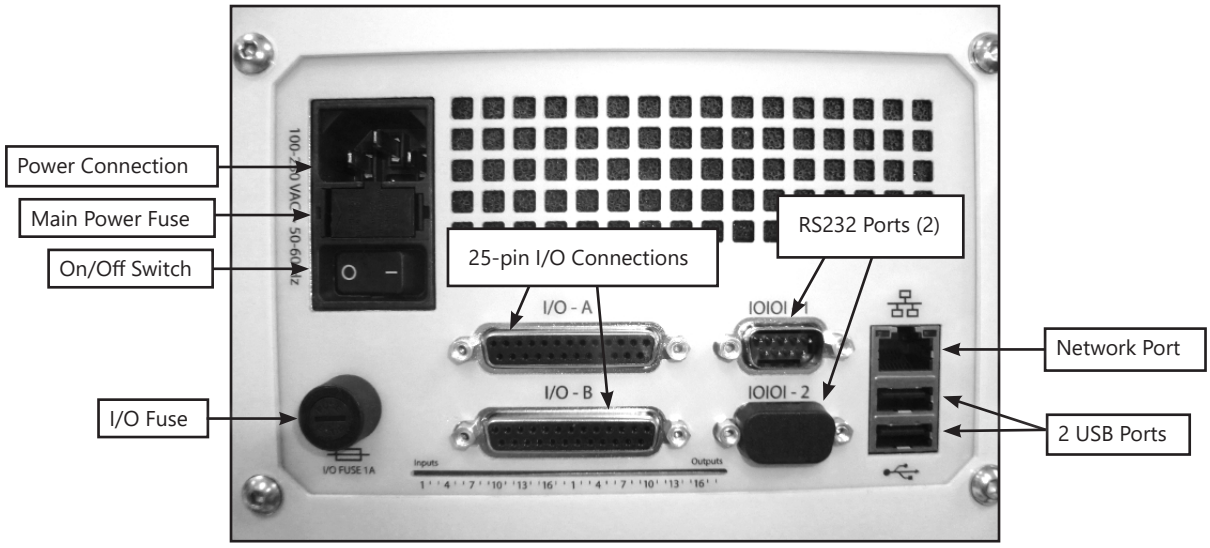


Figure 10-4. Wall Mount Model Electrical Connector Panel

Precision Settings" on page 34.

The connector panel is located on the left side of the instrument. There are two 25-pin digital I/O ports (I/O-A and I/O-B), two 9-pin RS232 serial ports (IOIO-1 and IOIO-2),

one RJ45 network port and two USB ports.

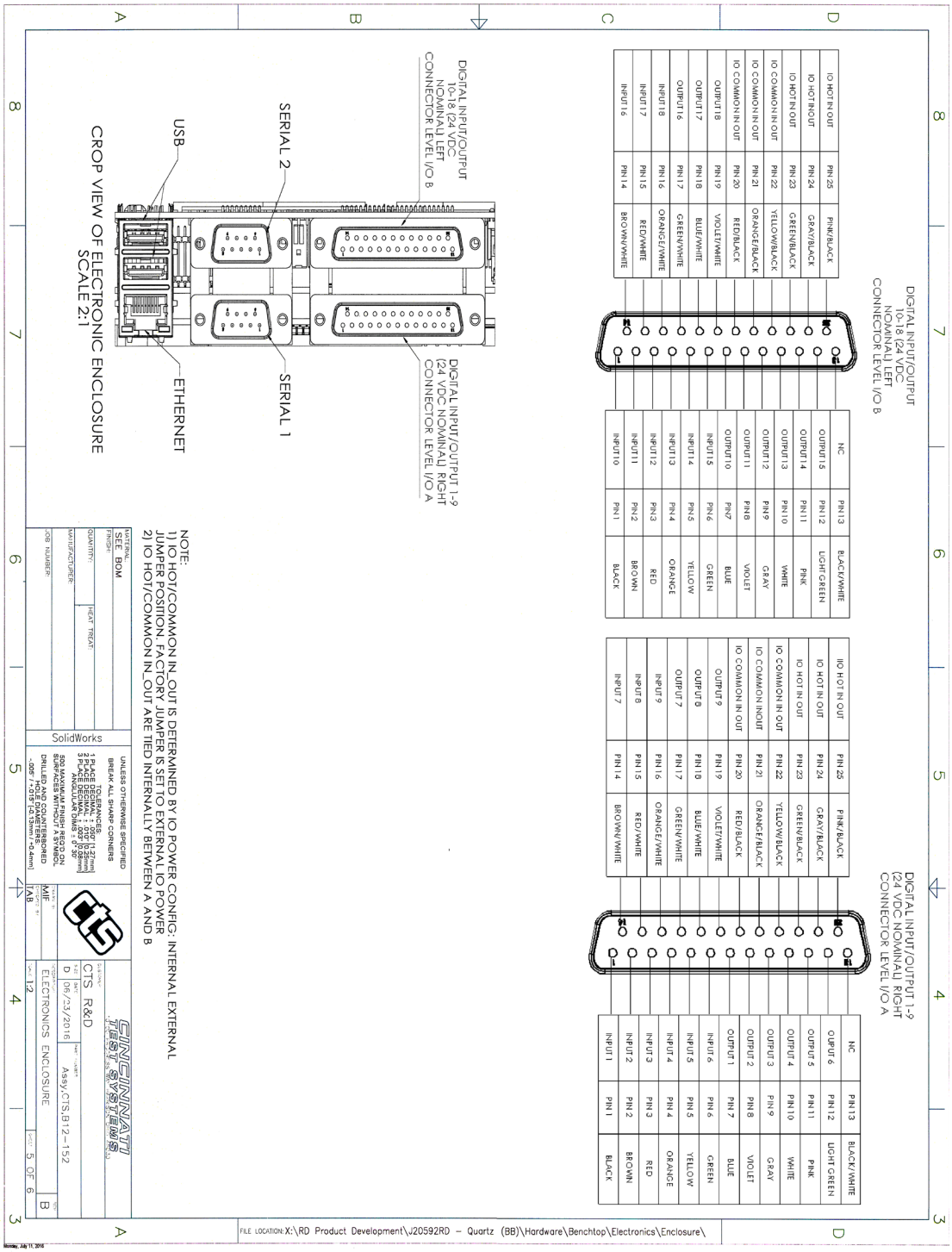
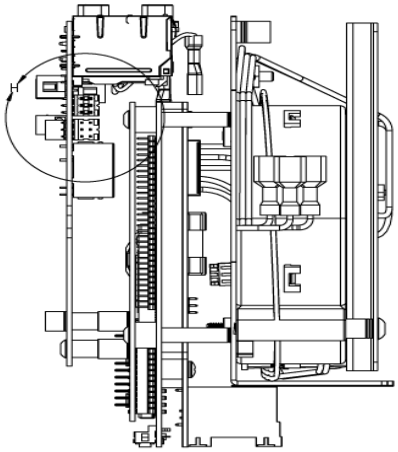
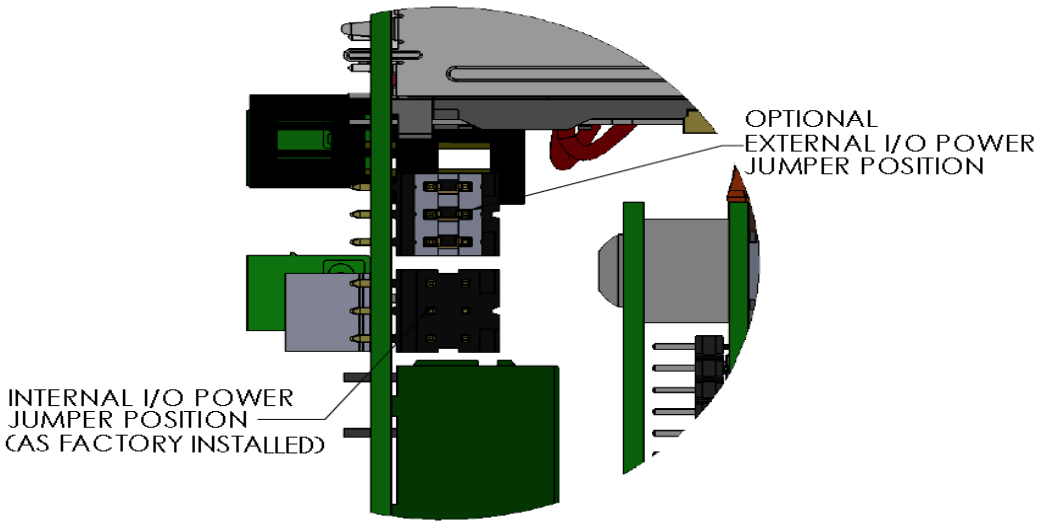


Figure 10-5. Benchtop and Wall Mount I/O Ports for connecting devices



BOTTOM VIEW OF ELECTRONIC ENCLOSURE



DETAIL H

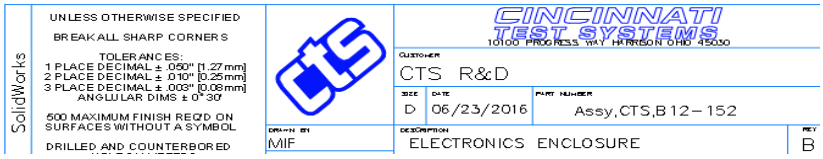


Figure 10-6. Benchtop Internal/External Power I/O Jumper Setting

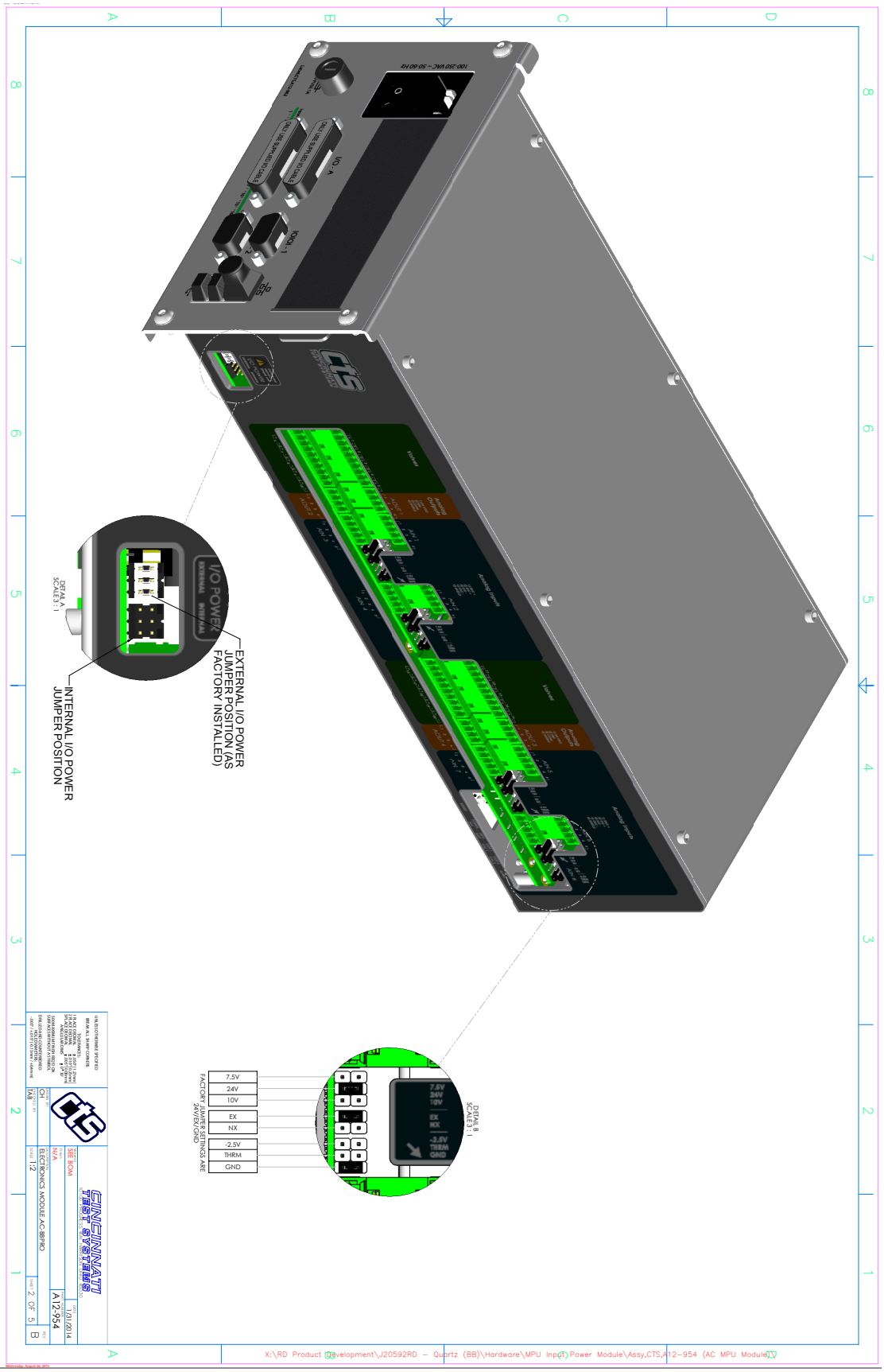


Figure 10-7. Wall Mount I/O Ports for connecting devices

Internal or External Power I/O Jumper Setting

The Blackbelt Pro instrument features the option to use internal power for the I/O supply or an external power supply. On the previous two pages, you will see I/O Jumper in location D-4 in of the benchtop model drawing and in location A-5 of the wall mount model drawing.

For Blackbelt Pro instruments with the **wall mount enclosure**, the I/O Jumper is factory set to **External I/O Power**. If using the internal power supply is desired, the I/O Jumper must be changed. For Blackbelt Pro instruments with the **benchtop enclosure**, the I/O Jumper is factory set to **Internal I/O Power**. If using the external power supply is desired, the I/O Jumper must be changed.

The Blackbelt Pro benchtop and wall mount models have a digital output current draw fuse.
The maximum current draw for an individual output is 1 amp.
The maximum current draw for all combined outputs is 1 amp.
If a fuse needs to be replaced, see pages vii and viii for the fuse location and see the electrical specifications on the last page of this document (rear cover) for fuse specs.

Additional Information on configuring tooling outputs can be found in “Chapter 11: Tooling and I/O”.

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Chapter 12
Events

An event is an input to, or an output from the test program or hardware device menus. Events are used to link the instrument to switches, sensors, lights or a PLC. For example, switches can start or stop a test, sensors can indicate position or a pressure, or tooling can be extended or retracted. Inputs and outputs are connected to external devices through one of two 25-pin I/O ports on the outside of the instrument enclosure and/or through EtherNet/IP. For more information, see “Chapter 10: EtherNet-IP”. See “Chapter 11: Tooling and IO” for for more information on electrical connections and specifications. Two mating I/O cables are supplied with each Blackbelt Pro instrument order. Additional I/O cables can be purchased from Cincinnati Test Systems.

Add Event to Part or Test Segments

Add Event is the method which allows the user to add a new event type to select menus in the **Part**, **Tooling** and **Test** segments. Events are added to specific locations based on their desired scope and function. These functions can be a form of action or operation, a confirmation or a notification of state. Events are typically directional: From the instrument to a device (output), or from a device to the instrument (input).

The **Add Event** setting is visible to **Advanced** users when in **Edit** mode. It is always the last menu item when it is available. See the table on page 139 for the specific menus where **Add Event** can be found. After an event is added, it will appear in the menu, set to **None** (the default setting). The setting can remain set to **None** if the event is present but not in use. After a new event is saved, the event and its settings are visible to **Basic** users.

Tap 

to enter **Edit** mode.

Tap a **Part** or **Test** segment. In the options for the element, tap **Add Event**.

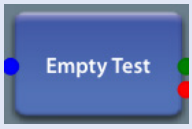
Tap the new event. The menu includes options that are appropriate for an input or an output. The event menu also includes an option to **Remove Event** if it is no longer desired. When you are finished, tap 

→ **Save** to save your changes.

*Note: Adding events to the **Part, Test,** or **Tooling** segments must be done each time a new program is created. It is also possible to add events in the **Hardware:Devices Instrument Control** menu where the event settings will work with all current and future programs. See the next section of this chapter for more details.*

Part Level Events and Test Level Events Menus

The following table lists the Program menus where **Add Event** appears, and what options the resultant events offer.

Screen Location	Left Pane	Right Pane	Options	Direction
Part Level (Part Name) 	Part	Add Event	Part Start Stop/Reset Part Hold Start Part Calibration ** Open Leak Standard Part Present*** Part Reset Part Accept Part Reject Part Malfunction Part Severe Leak Part Ready Part Active	Input * Input * Input Input Input Input Input Output Output Output Output Output Output
Test Segment Level (Test Type) 	Settings	Add Event	Test Active Test Passsed Test Failed	Output Output Output
	Prefill	Add Event	In Prefill	Output
	Fill	Add Event	In Fill	Output
	Stabilize	Add Event	In Stabilize	Output
	Test	Add Event	In Test Below Low Limit Between Limits Above High Limit	Output Output Output Output
	Exhaust	Add Event	In Exhaust	Output

Note: The mechanical Start and Stop buttons on the front of the instrument are internal inputs and do not utilize the external inputs. By default, all 4 parts in a program have* **Part Start *set to the Start button and* **Part Stop** *set to the Stop/Reset button.* **Part Start** *can be set to* ***None*** *for any parts that are not desired to run when the Start button is pressed.*

***Note: Start Part Calibration is only available for the test types that require calibration.*

Note that not all test types have all test segments. For example, a Mass Flow test has

no Stabilize segment and an Occlusion test has only Test and Exhaust cycles.

****Note: Part Present In case if the status input (e.g. Digital input) is already high and if user Run the test then “Part not Changed” message will be appeared for that particular part, so to run the test assigned part present input (Digital or Ethernet) need to be toggled (low to high).*

Add Event Using The Hardware: Devices Screen

To set Hardware: Devices events, tap  → 

. If 

is displayed in the Title Bar, tap Hardware: Devices 

,

Now tapping  → 

will continue to display the **Hardware: Devices** screen until **Hardware:Manifolds** is selected.

Examples of the Hardware: Devices screen can be seen in “Figure 11-1. Hardware: Devices Screen - Displaying All Possible Devices” on page 143.

Hardware: Devices Program Select

The number of Program Select menu settings dependent on how many programs will be selected by digital inputs. Tap 

to enter **Edit** mode. Tap 

, tap **Number of Programs**. Use the on-screen numeric keypad to enter the number of test programs you will use. Remember to add one more for Program 0 Self-Test, to get the right number of Select Bits. Tap **Program Select Bit 1**, then select an available digital input *for the least significant bit*, then tap **OK**. Repeat this for the higher numbered, more significant bits. The **Program Select** digital input requires a 50 mSec delay after the Program Select Bits go high, to trigger the instrument to change to the desired program.

Binary Mapping can be used to reduce the number of digital inputs if there are more programs in the instrument, than will be selected by using this digital input method. A **Lookup Table** is created on this Program Select menu to reference program numbers. The default option for the Binary Mapping setting is **Direct**, where no lookup table is displayed or used.

When you are finished editing, tap 

→ **Save** to save your changes.

Hardware: Devices Instrument Control

The Instrument Control device is pre-populated with all possible events. The complete list of events can be seen in the Hardware: Devices Menu, in the Instrument Control row and in the Hardware: Devices worksheet on the following pages. The worksheet is intended to be printed or copied and then filled in from an engineering drawing to make programming the instrument easier.

To set a digital input or output for an Instrument Control event, tap 

to enter **Edit** mode, tap 

, tap the event you want to set, tap an available input or output, tap **OK**. Repeat this procedure if more input or output events are desired. The event menu also includes a **None** option if it is no long desired.

When you are finished, tap 

→ **Save** to save your changes.

Hardware: Devices Alarm Control

Using this feature user can add alarm for the scenario of “**On Part Reject**”. Whenever the alarm condition occurs, it will beep for 3 secs on user specified output of Alarm, Digital output or Ethernet/IP output.

To set a digital output for an **Alarm Control** event, tap 

to enter **Edit** mode, Tap 

and select Alarm Mode to “**On Part Reject**”. Select the event you want to set from Alarm Event parameter options. User can select None option for Alarm event when it is no longer desired.

When you are finished, tap 

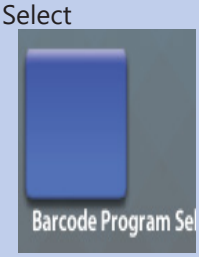
→**Save** to save your changes.

Figure 11-1. Hardware: Devices Screen - Displaying All Possible Devices

Hardware: Devices Menus

The following table lists the 6 types of hardware devices and their options.

Screen Location	Left Pane	Right Pane	Options	Direction
Hardware: Devices: Tooling Device Segment 	Tooling Device	Extend Event Retract Event (if Retract Action is not set to Spring)	Digital Output 1--18 EtherNet/IP Output 1--32 Digital Output 1--18 EtherNet/IP Output 1--32	Output Output
Hardware: Devices: Program Select Segment 	Program Select	Program Select Bit # Program Select	Digital Input 1--18 EtherNet/IP Input 1--32 Digital Input 1--18 EtherNet/IP Input 1--32	Input Input
Hardware: Devices: Light Feature Segment * 	Light Feature	Port Pass Port Fail Port Active	Digital Output 1--18 Indicator Green, Port # EtherNet/IP Output 1--32 Digital Output 1--18 Indicator Red, Port # EtherNet/IP Output 1--32 Digital Output 1--18 Indicator White, Port # EtherNet/IP Output 1--32	Output Output Output
Hardware: Devices: Instrument Control 	Instrument Control	Vent/Halt Start Part Stop Part Calibrate Part Accept Part Reject part Malfunction Part Active Part	Digital Input 1--18 EtherNet/IP Output 1--32 Digital Output 1--18 EtherNet/IP Output 1--32	Input Output

Hardware: Devices: Alarm Control 	Alarm Control	Alarm Mode Alarm Event	On Part Reject Alarm Digital Output 1--18 EtherNet/IP Output 1--32	Output
Hardware: Devices: Barcode Program Select 	Barcode Program Select	Number of Program Program Select # Value # Mask #	1 to 10 1 to 1000	Input

* Note: The Hardware Devices Light Feature segment is a feature that is displayed in the Sentinel Blackbelt Pro benchtop model but not in the wall mount model.

You can copy or print this page, then fill out the form and use it to assist with programming the Blackbelt Pro Instrument Control menu.

Hardware: Devices **Instrument Control Worksheet**			
Instrument Control			Digital I/O port #
	Vent/Halt	(In)	
	Start Part 1	(In)	
	Stop Part 1	(In)	
	Calibrate Part 1	(In)	
	Accept Part 1	(Out)	
	Reject Part 1	(Out)	
	Malfunction Part 1	(Out)	
	Active Part 1	(Out)	
	Start Part 2	(In)	
	Stop Part 2	(In)	
	Calibrate Part 2	(In)	
	Accept Part 2	(Out)	
	Reject Part 2	(Out)	
	Malfunction Part 2	(Out)	
	Active Part 2	(Out)	
	Start Part 3	(In)	
	Stop Part 3	(In)	
	Calibrate Part 3	(In)	
	Accept Part 3	(Out)	
	Reject Part 3	(Out)	
	Malfunction Part 3	(Out)	
	Active Part 3	(Out)	
	Start Part 4	(In)	
	Stop Part 4	(In)	
	Calibrate Part 4	(In)	
	Accept Part 4	(Out)	
	Reject Part 4	(Out)	
	Malfunction Part 4	(Out)	
	Active Part 4	(Out)	

The Events Screen

LEDs identified as **Inputs 1-18** and **Outputs 1-18** illuminate when the inputs or outputs are energized. The **Events** screen also displays inputs and outputs.

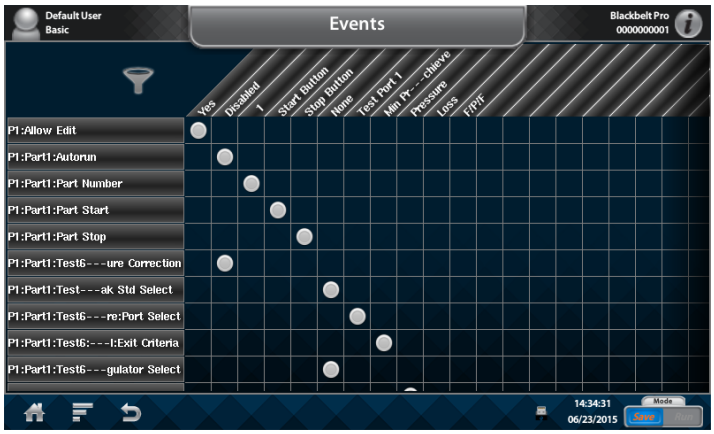


Figure 11-2. Events Screen

To view the **Events** screen, From the Home screen, tap  > 

.

Each row on the **Events** screen represents an event. Colons separate the program number, part number, and event name. Each column header is an input or output in the current program. A white circle marks where related events and inputs/outputs intersect. When a test is running, energized inputs/outputs and their associated events turn yellow, and the circle marking their intersection turns green. If a connection remains energized between tests, the indicator colors will also remain.

If there are many rows and columns of events, they may run off the bottom or right side of the screen. Use a **drag** or a **flick scroll** gesture to navigate the **Events** screen depending whether you want to move a short distance or a long distance.

The Events Filter

Any event or input/output can be included in a filter. Up to 3 filters can be set to get a specific result. To clear any filters that have been set, change the **Type** to **None** for all filters. Filters are cleared when the instrument is turned off and restarted. Each filter type has the following possible values.

Type	Values
Program	Available program numbers.
Device	Available part numbers.
Test	Available test numbers.
Tooling	Available tooling numbers.
Event	Any event on the **Events** screen.
Interface	Any Interface on the **Events** screen.
None	No value may be selected.

Example 1

An event filter can be set to show every program where tooling is used.

Tap  . Tap the **Type pick list box**, then tap **Tooling**.

Tap the **Value pick list box**, then tap a **Tooling #**. Tap **OK**.

Example 2

An event filter can be set to show every event that drives an I/O point.

Tap  . Tap the **Type pick list box**, then tap **Event**.

Tap the **Value pick list box**, then tap an **available Event item**. Tap **OK**.

Example 3

Two event filters can be set to show every event in a single program and single part.

Tap  . Tap the **Type pick list box**, then tap **Program**. Tap the **Value pick list box**, then tap a **Program #**. Tap the second **Type pick list box**, then tap **Device**. Tap the second **Value pick list box**, then tap a **Part #**. Tap **OK**.

Chapter 13
Pressure Decay–ΔP

In a pressure decay leak test, the instrument fills the test part to a specified target pressure, isolates the test part from source air, and allows the pressure to stabilize. The instrument measures the pressure loss in the part over a defined time.

This chapter describes the settings that can be modified for this test type.

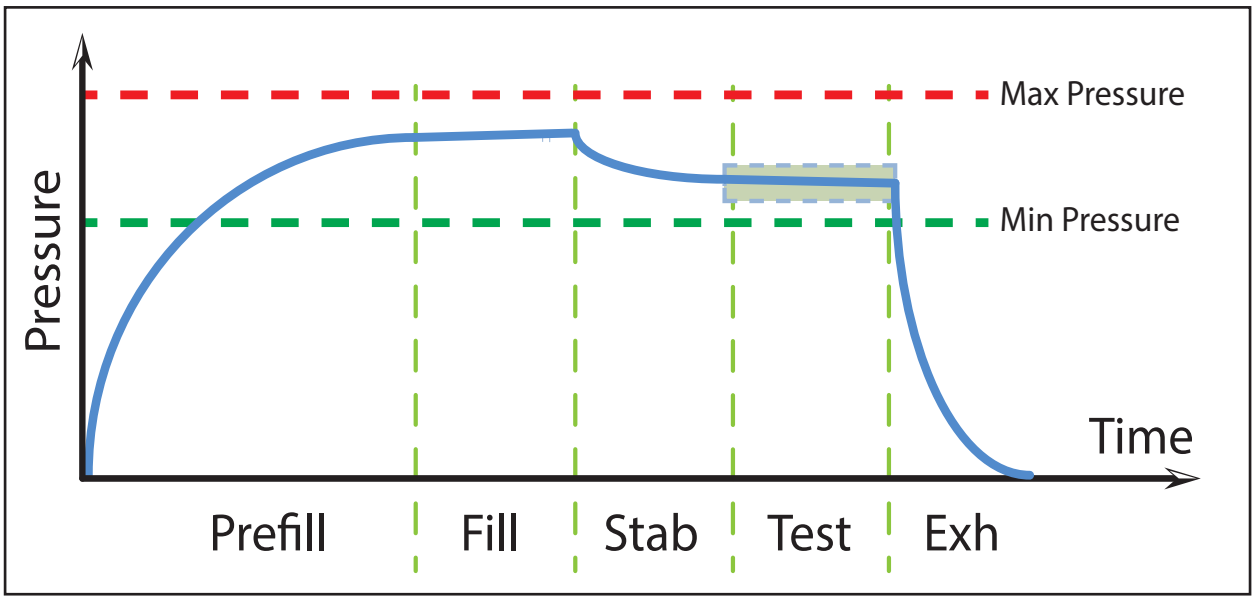


Figure 12-1. Pressure Decay Test Graph

Configure the Test

To set properties for any test, tap 

to enter **Edit** mode.

Tap 

and choose the program in which you want to make changes.

Tap  → 

. Tap the test you want to modify, then tap  .

Modify settings as needed. Note: Some settings require Advanced access level to edit.

The following menus are available in a **Pressure Decay ΔP** test.

Menu	Description
Settings	
Test Type	Test Type options are dependent on the manifold and its capabilities.
Test Number	The number of the test.
Test Name	The name of the test. It could be a test type or a specific port on the test part.
Time Unit	Time Unit: Unit of measurement displayed for timers for the program.
Time Precision	Time Precision: Displayed digits of precision for time unit values.
Pressure Unit	Pressure Unit: Unit of measurement for all test pressure values for the program.
Pressure Precision	Pressure Precision: Displayed digits of precision for all pressure unit values.
Δ Pressure Unit	Unit of measurement for all the pressure loss over time values for the program.
Δ Pressure Precision	Displayed digits of precision for all pressure loss unit values.
Hardware	
Port Select	Specifies the test port to utilize for the test.
Regulator Select	Specifies the regulator to utilize for the test.
Flow Restriction	When enabled, inserts the flow restriction into the fill path for the selected pressure source
Leak Std Select	Specifies the Leak Standard to utilize for the test. A leak standard must be selected to enable other Leak Std settings. **Requires Advanced access level to edit.**
Leak Std Calibrated Flow	Flow value at which the Calibrated Leak Standard was certified.
Leak Std Calibrated Pressure	Pressure at which the Calibrated Leak Standard was certified.

Menu	Description
Open Leak Std	Forces open the Leak Standard valve during normal testing.
Prefill	
Timer	Amount of time allocated to each segment for execution before continuing.
Exit Criteria	Necessary condition that must be met to successfully advance to the next segment. **Requires Advanced access level to edit.**
Minimum Consecutive Timer	Minimum consecutive time that pressure must be above minimum setpoint before continuing. **Requires Advanced access level to edit.**
Minimum Pressure	The lowest pressure needed to complete the segment.
Maximum Pressure	The highest pressure permitted during the segment.
Fill	
Timer	Amount of time allocated to each segment for execution before continuing.
Minimum Pressure	Minimum test pressure that must be maintained during the Fill timer.
Maximum Pressure	Maximum test pressure allowed during the Fill timer.
Stabilize	
Timer	Amount of time allocated to each segment for execution before continuing.
Minimum Pressure	Minimum test pressure that must be maintained during the Stabilization timer.
Maximum Pressure	Maximum test pressure allowed during the Stabilization timer.
Test	
Timer	Amount of time allocated to each segment for execution before continuing.
Target Pressure	Desired test pressure for all leak tests.
Low Limit Loss	Specified low pressure loss limit setpoint for the Pressure Loss test.
High Limit Loss	Specified high pressure loss limit setpoint for the Pressure Loss test.
Test Evaluation	Setup of three test eval zones about the high limit and low limit (above high limit, between limits, below low limit) for pass and fail criteria (i.e. FPF= Fail>High Limit>Pass>Low Limit>Fail). **Requires Advanced access level to edit.**
Minimum Pressure	Test pressure to meet in Prefill timer and be sustained through Fill and Stabilize timers.
Maximum Pressure	Maximum test pressure allowed during the Fill and Stabilize timers.
Pressure Correction	If enabled, the instrument performs measurement corrections based on the ratio between the target pressure over the actual test pressure. **Requires Advanced access level to edit.**
Decay Direction	Defines the method for calculating the part pressure decay during test.

Menu	Description
EDC	When enabled, Environmental Drift Correction monitors and continually corrects final Leak rate calculations based on the moving average shift of test results within a band about the Master Part calibration curve. This setting enables subsequent EDC settings. **Requires Advanced access level to edit.**
EDC Percentage	Percentage band (+/-) defined by a percentage of High Limit, about the Master Part curve. **Requires Advanced access level to edit.**
EDC Quantity	Number of test results utilized in calculating the Environmental Drift Correction factor. **Requires Advanced access level to edit.**
Exhaust	
Timer	Amount of time allocated to each segment for execution before continuing.

*Note: Some menus also include Add Event as the last option. Advanced users can see and add events when in **Edit** mode. See "Chapter 12 Events" on page 137 for more information on what menus also include Add Event.*

Tap 

→ **Save** when you are finished.

Pressure Decay Timing Diagram

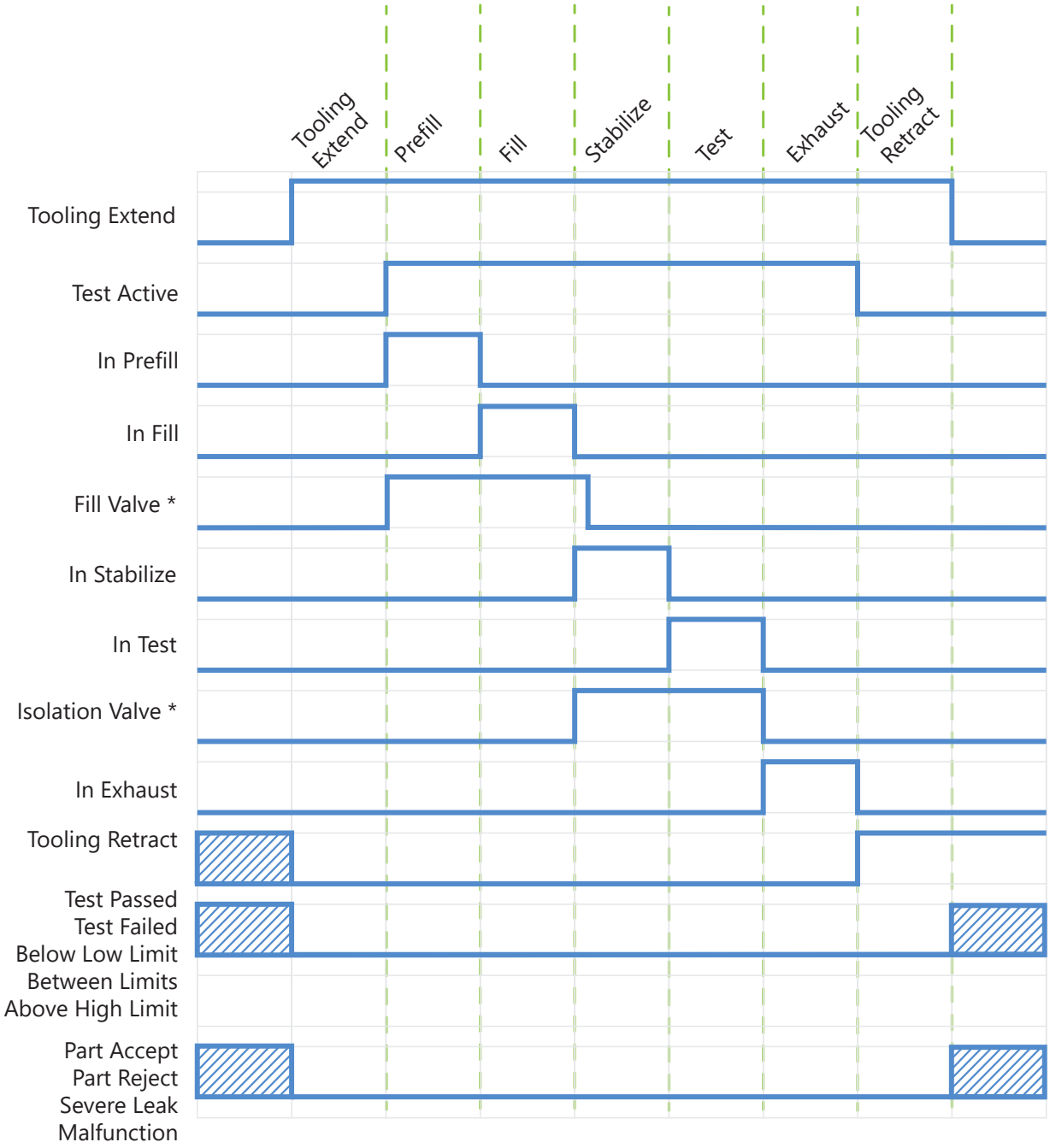


Figure 12-2. Timing Diagram

** Note: The Fill Valve and the Isolation Valve in the timing diagram above are shown to indicate the timing of the valves in this test type. They are not programmable events.*

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Chapter 14
Pressure Decay–ΔP/ΔT

In a pressure decay leak test, the instrument fills a test part to a specified target test pressure, isolates the test part from source air, and allows the pressure to stabilize. The instrument measures the pressure loss in the part over a defined time.

This chapter describes the settings that can be modified for this test type.

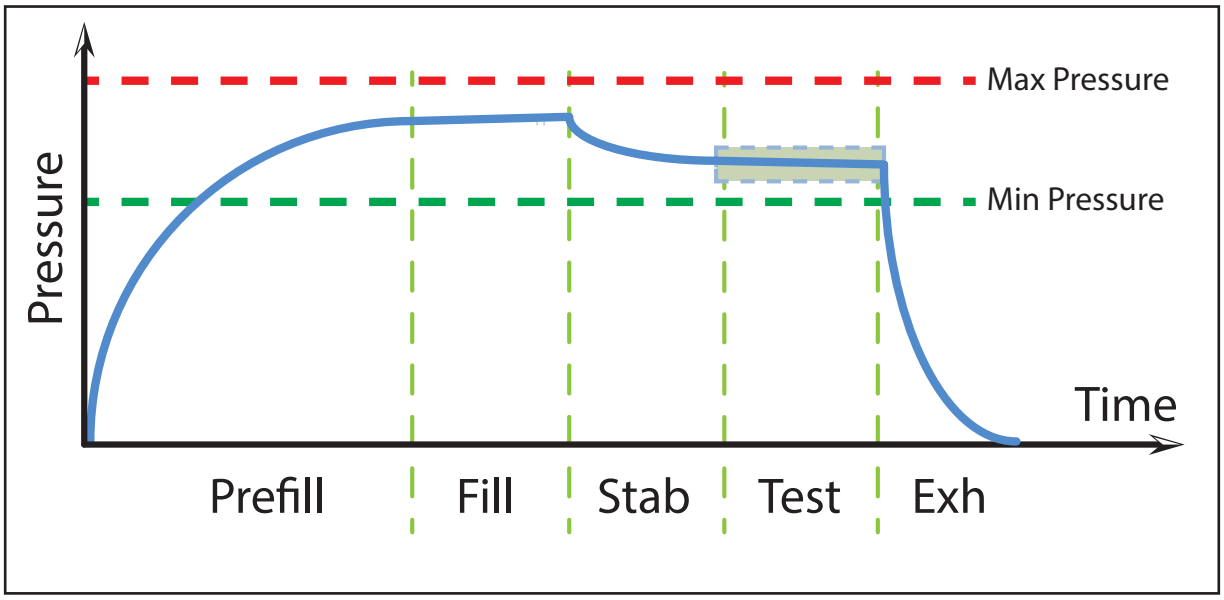

Figure 13-1. Pressure Decay Test Graph

Configure the Test

To set properties for any test, tap 

to enter **Edit** mode.

Tap 

and choose the program in which you want to make changes.

Tap  → 

. Tap the test you want to modify, then tap  .

Modify settings as needed. Note: Some settings require Advanced access level to edit.

The following menus are available in a **Pressure Decay ΔP/ΔT** test.

Menu	Description
Settings	
Test Type	Test Type options are dependent on the manifold and its capabilities.
Test Number	The number of the test.
Test Name	The name of the test. It could be a test type or a specific port on the test part.
Time Unit	Time Unit: Unit of measurement displayed for timers for the program.
Time Precision	Time Precision: Displayed digits of precision for time unit values.
Pressure Unit	Pressure Unit: Unit of measurement for all test pressure values for the program.
Pressure Precision	Pressure Precision: Displayed digits of precision for all pressure unit values.
ΔP/ΔT Unit	Unit of measurement for all the pressure loss over time values for the program.
ΔP/ΔT Precision	Displayed digits of precision for all pressure loss over time unit values.
Hardware	
Port Select	Specifies the test port to utilize for the test.
Regulator Select	Specifies the regulator to utilize for the test.
Flow Restriction	When enabled, inserts the flow restriction into the fill path for the selected pressure source
Leak Std Select	Specifies the Leak Standard to utilize for the test. A leak standard must be selected to enable other Leak Std settings. **Requires Advanced access level to edit.**
Leak Std Calibrated Flow	Flow value at which the Calibrated Leak Standard was certified.

Menu	Description
Leak Std Calibrated Pressure	Pressure at which the Calibrated Leak Standard was certified.
Open Leak Std	Forces open the Leak Standard valve during normal testing.
Prefill	
Timer	Amount of time allocated to each segment for execution before continuing.
Exit Criteria	Necessary condition that must be met to successfully advance to the next segment. **Requires Advanced access level to edit.**
Minimum Consecutive Timer	Minimum consecutive time that pressure must be above minimum setpoint before continuing. **Requires Advanced access level to edit.**
Minimum Pressure	The lowest pressure needed to complete the segment.
Maximum Pressure	The highest pressure permitted during the segment.
Fill	
Timer	Amount of time allocated to each segment for execution before continuing.
Minimum Pressure	Minimum test pressure that must be maintained during the Fill timer.
Maximum Pressure	Maximum test pressure allowed during the Fill timer.
Stabilize	
Timer	Amount of time allocated to each segment for execution before continuing.
Minimum Pressure	Minimum test pressure that must be maintained during the Stabilization timer.
Maximum Pressure	Maximum test pressure allowed during the Stabilization timer.
Test	
Timer	Amount of time allocated to each segment for execution before continuing.
Target Pressure	Desired test pressure for all leak tests.
Low Limit Rate	Specified low limit rate of pressure loss setpoint used to evaluate parts.
High Limit Rate	Specified high limit rate of pressure loss setpoint used to evaluate parts.
Test Evaluation	Setup of three test eval zones about the high limit and low limit (above high limit, between limits, below low limit) for pass and fail criteria (i.e. FPF= Fail>High Limit>Pass>Low Limit>Fail). **Requires Advanced access level to edit.**
Minimum Pressure	Test pressure to meet in Prefill timer and be sustained through Fill and Stabilize timers.
Maximum Pressure	Maximum test pressure allowed during the Fill and Stabilize timers.
Pressure Correction	If enabled, the instrument performs measurement corrections based on the ratio between the target pressure over the actual test pressure. **Requires Advanced access level to edit.**
Decay Direction	Defines the method for calculating the part pressure decay during test.

Menu	Description
EDC	When enabled, Environmental Drift Correction monitors and continually corrects final Leak rate calculations based on the moving average shift of test results within a band about the Master Part calibration curve. This setting enables subsequent EDC settings. **Requires Advanced access level to edit.**
EDC Percentage	Percentage band (+/-) defined by a percentage of High Limit, about the Master Part curve. **Requires Advanced access level to edit.**
EDC Quantity	Number of test results utilized in calculating the Environmental Drift Correction factor. **Requires Advanced access level to edit.**
Exhaust	
Timer	Amount of time allocated to each segment for execution before continuing.

*Note: Some menus also include Add Event as the last option. Advanced users can see and add events when in **Edit** mode. See "Chapter 12 Events" on page 137 for more information on what menus also include Add Event.*

Tap 

→ **Save** when you are finished.

Pressure Decay Timing Diagram

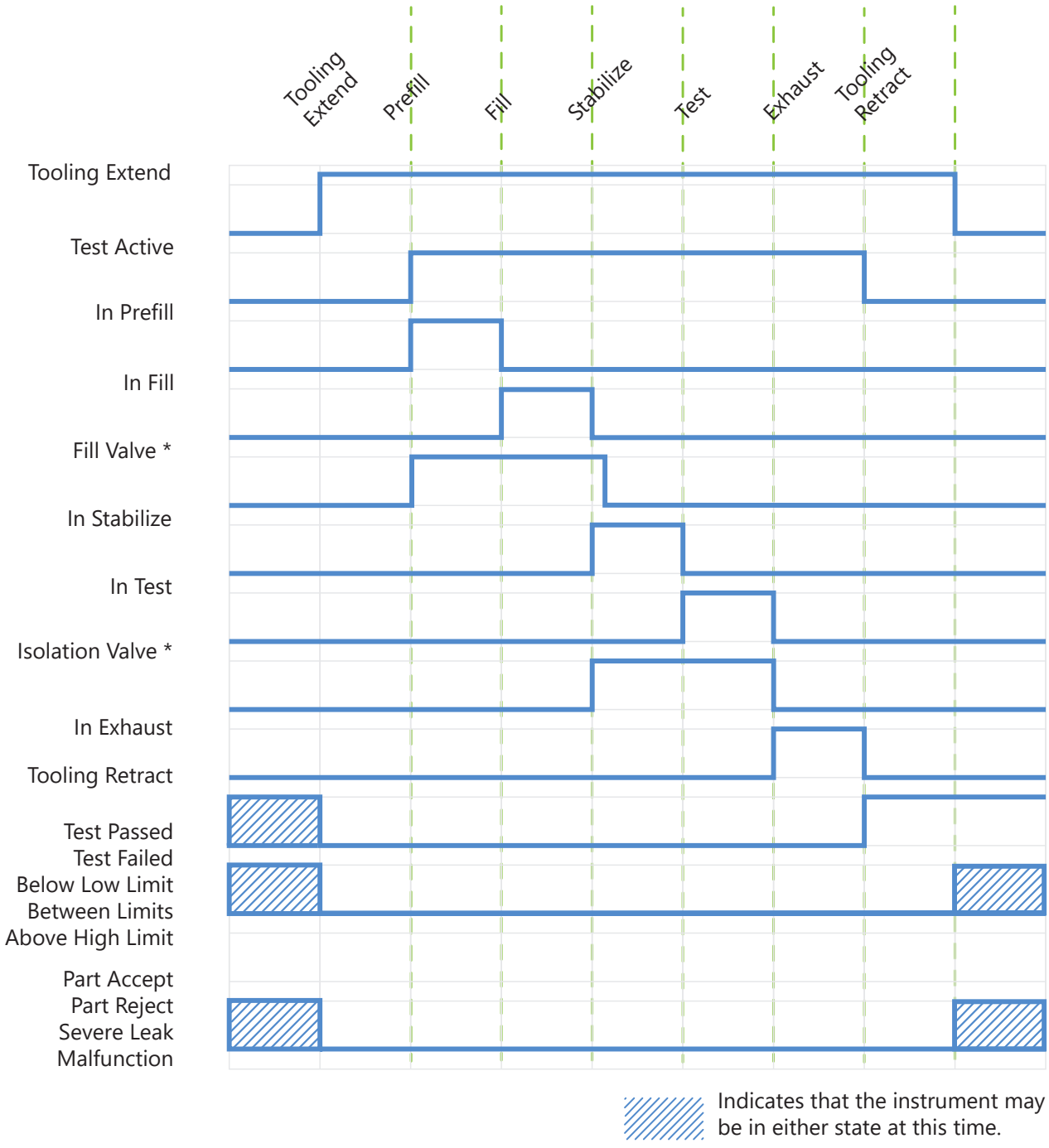

Figure 13-2. Timing Diagram

** Note: The Fill Valve and the Isolation Valve in the timing diagram above are shown to indicate the timing of the valves in this test type. They are not programmable events.*

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Chapter 15
Pressure Decay–Leak Std

In a pressure decay leak test, the instrument fills a test part to a specified test pressure, isolates the test part from source air, and allows the pressure to stabilize. The instrument then measures the pressure loss over a defined time. The leak test instrument translates the pressure loss over the fixed test time to a leak or flow rate. For a visual representation, see the pressure vs. time graphs on the next page.

This chapter describes the settings that can be modified for this test type.

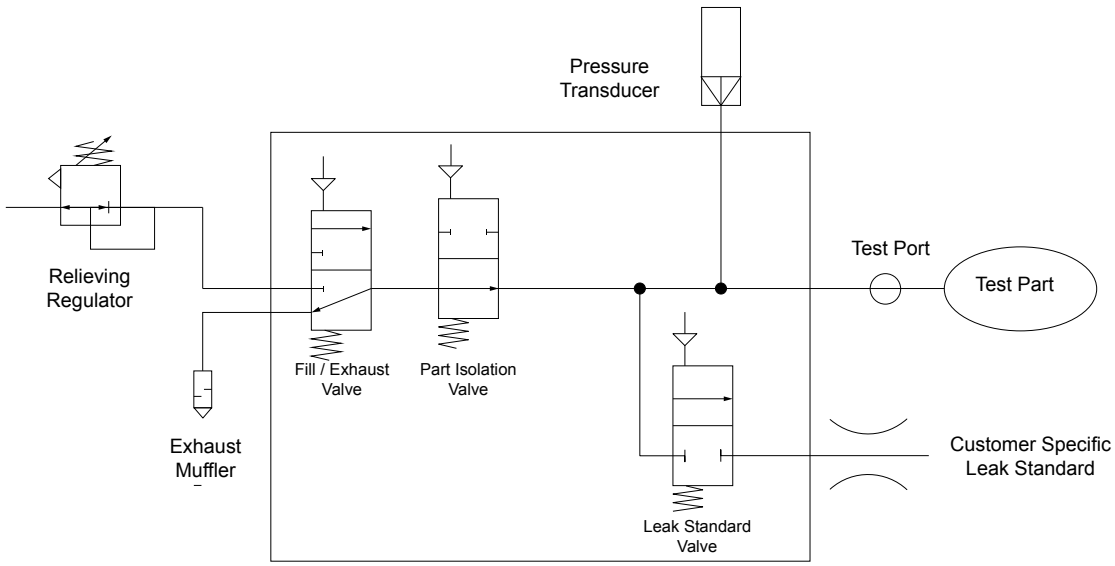

Figure 14-1. Pressure Decay Leak Standard Pneumatic Manifold Schematic

These figures show the details of Pressure Decay-Leak Std calibration profiles.

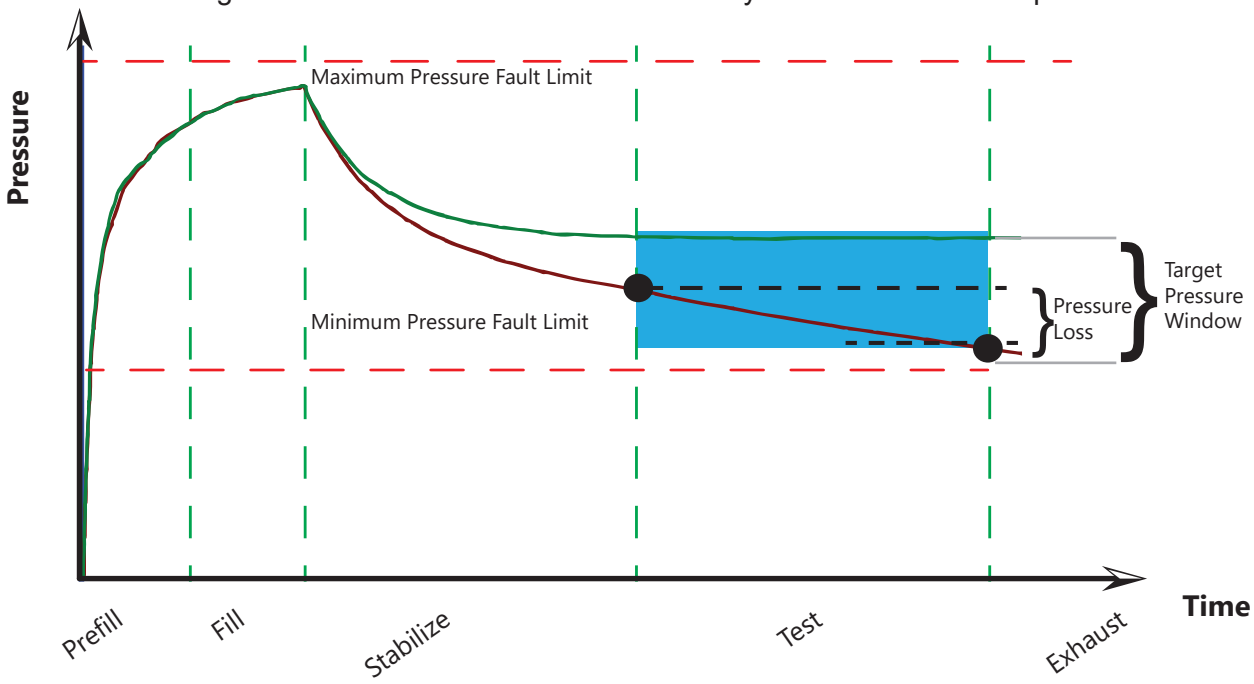

Figure 14-3. Pressure Decay Calibration Test Graph

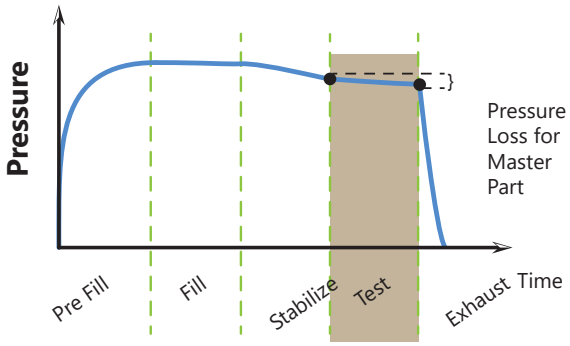

Figure 14-4. Cal Cycle 1 - Master Part

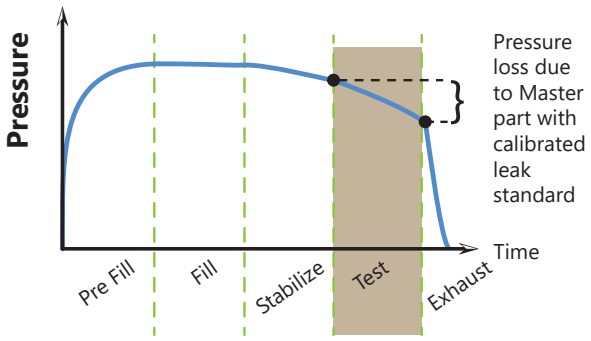

Figure 14-5. Cal Cycle 2 - Master+Leak

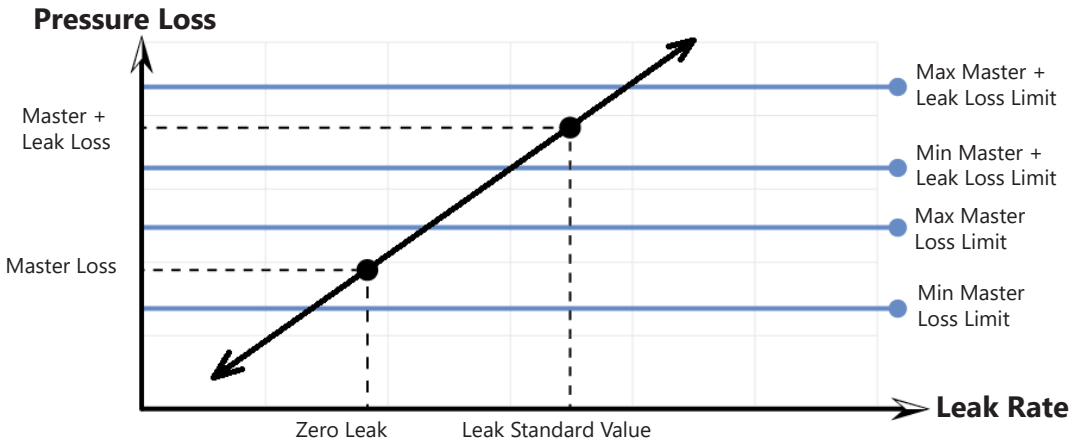

Figure 14-6. Pressure Loss Conversion for △Pressure Converted to Leak Rate

Configure the Test

To set properties for any test, tap 

to enter **Edit** mode.

Tap 

and choose the program in which you want to make changes.

Tap  → 

. Tap the test you want to modify, then tap  .

Modify settings as needed. Note: Some settings require Advanced access level to edit.

The following menus are available in a **Pressure Decay Leak Std** test.

Menu	Description
Settings	
Test Type	Test Type options are dependent on the manifold and its capabilities.
Test Number	The number of the test.
Test Name	The name of the test. It could be a test type or a specific port on the test part.
Time Unit	Time Unit: Unit of measurement displayed for timers for the program.
Time Precision	Time Precision: Displayed digits of precision for time unit values.
Pressure Unit	Pressure Unit: Unit of measurement for all test pressure values for the program.
Pressure Precision	Pressure Precision: Displayed digits of precision for all pressure unit values.
Δ Pressure Unit	Unit of measurement for all the pressure loss over time values for the program.
Δ Pressure Precision	Displayed digits of precision for all pressure loss unit values.
Flow Unit	Unit of measurement for all the flow values for the program.
Flow Precision	Displayed digits of precision for all pressure loss over time unit values.
Calibration Status	Indicates the calibration status of this test. In Edit mode, tap to change the status. Options include: Invalidate Settings (the program must be calibrated before it can be run) or Force Validation (to allow the program to run without performing a calibration cycle). **Requires Advanced access level to edit.**
Hardware	
Port Select	Specifies the test port to utilize for the test.
Regulator Select	Specifies the regulator to utilize for the test.
Flow Restriction	When enabled, inserts the flow restriction into the fill path for the selected pressure source
Leak Std Select	Specifies the Leak Standard to utilize for the test. A leak standard must be selected to enable other Leak Std settings. **Requires Advanced access level to edit.**
Leak Std Calibrated Flow	Flow value at which the Calibrated Leak Standard was certified.

Menu	Description
Leak Std Calibrated Pressure	Pressure at which the Calibrated Leak Standard was certified.
Open Leak Std	Forces open the Leak Standard valve during normal testing. Once opened, it will always remain open until closed with this setting.
Prefill	
Timer	Amount of time allocated to each segment for execution before continuing.
Exit Criteria	Necessary condition that must be met to successfully advance to the next segment. **Requires Advanced access level to edit.**
Minimum Consecutive Timer	Minimum consecutive time that pressure must be above minimum setpoint before continuing. **Requires Advanced access level to edit.**
Minimum Pressure	The lowest pressure needed to complete the segment.
Maximum Pressure	The highest pressure permitted during the segment.
Fill	
Timer	Amount of time allocated to each segment for execution before continuing.
Minimum Pressure	Minimum test pressure that must be maintained during the Fill timer.
Maximum Pressure	Maximum test pressure allowed during the Fill timer.
Stabilize	
Timer	Amount of time allocated to each segment for execution before continuing.
Minimum Pressure	Minimum test pressure that must be maintained during the Stabilization timer.
Maximum Pressure	Maximum test pressure allowed during the Stabilization timer.
Test	
Timer	Amount of time allocated to each segment for execution before continuing.
Target Pressure	Desired test pressure for all leak tests.
Low Limit Leak	Specified low limit leak rate or flow value setpoint used to evaluate parts.
High Limit Leak	Specified high limit leak rate or flow value setpoint used to evaluate parts.
Test Evaluation	Setup of three test eval zones about the high limit and low limit (above high limit, between limits, below low limit) for pass and fail criteria (i.e. FPF= Fail>High Limit>Pass>Low Limit>Fail). **Requires Advanced access level to edit.**
Minimum Pressure	Test pressure to meet in Prefill timer and be sustained through Fill and Stabilize timers.
Maximum Pressure	Maximum test pressure allowed during the Fill and Stabilize timers.
Pressure Correction	If enabled, the instrument performs measurement corrections based on the ratio between the target pressure over the actual test pressure. **Requires Advanced access level to edit.**
Decay Direction	Defines the method for calculating the part pressure decay during test.

Menu	Description
Min Master Loss	Minimum pressure loss allowable for the Master Part with Leak Standard during the calibration cycle; use to prevent calibration to the Self-Test cap.
Max Mstr+Leak Loss	Maximum pressure loss allowable for the Master Part with Leak Standard during the calibration cycle; use to prevent calibration to leaking Master Parts or fixtures.
Min Perform Factor	Minimum acceptable value for the Performance Factor compared after the calibration cycle to prevent improper calibrations.
Performance Factor	Calculated value representing the performance of the leak test, calculated after the calibration cycle.
Master Part Press	Measured pressure at the midpoint of the Test segment for the Master Part during the calibration process. **Requires Advanced access level to edit.**
Master+Leak Press	Measured pressure at the midpoint of the Test segment for the Master Part with Leak Standard during the calibration process. **Requires Advanced access level to edit.**
Master Part Loss	Pressure loss during the calibration cycle of the Master Part and stored to represent normal loss at the specified Target Pressure. **Requires Advanced access level to edit.**
Master+Leak Loss	Pressure loss during the calibration cycle of the Master Part with the Leak Standard and stored to represent normal loss + Leak Standard loss at the specified Target Pressure. **Requires Advanced access level to edit.**
Leak Std Calibrated Flow	The flow value at which the calibrated leak standard is certified.
Leak Std Calibrated Pressure	Pressure at which the Calibrated Leak Standard was certified.
Corrected Leak Std Flow	Certified Leak Standard flow rate value at the Target Pressure, corrected for the actual pressure used to calibrate the instrument.
Quik Test	Quik Test function projects the leak rate based on the pressure loss curve at the Quik Test timer. This setting enables subsequent Quik Test settings. **Requires Advanced access level to edit.**
Quik Test Timer	Percentage of Test timer when program is evaluated for early pass/fail or continue testing. **Requires Advanced access level to edit.**
Quik Test LL Band	Window +/- around Low Limit where the full test time must be used to evaluate the program. **Requires Advanced access level to edit.**
Quik Test HL Band	Window +/- around High Limit where the full test time must be used to evaluate the program. **Requires Advanced access level to edit.**

Menu	Description
EDC	When enabled, Environmental Drift Correction monitors and continually corrects final Leak rate calculations based on the moving average shift of test results within a band about the Master Part calibration curve. This setting enables subsequent EDC settings. **Requires Advanced access level to edit.**
EDC Percentage	Percentage band (+/-) defined by a percentage of High Limit, about the Master Part curve. **Requires Advanced access level to edit.**
EDC Quantity	Number of test results utilized in calculating the Environmental Drift Correction factor. **Requires Advanced access level to edit.**
Exhaust	
Timer	Amount of time allocated to each segment for execution before continuing.

*Note: Some menus also include Add Event as the last option. Advanced users can see and add events when in **Edit** mode. See "Chapter 12 Events" on page 137 for more information on what menus also include Add Event.*

Tap 

→ **Save** when you are finished.

See "Appendix B: Quik Test" on page 209 for more information about using the Quik Test feature.

Pressure Decay Timing Diagram

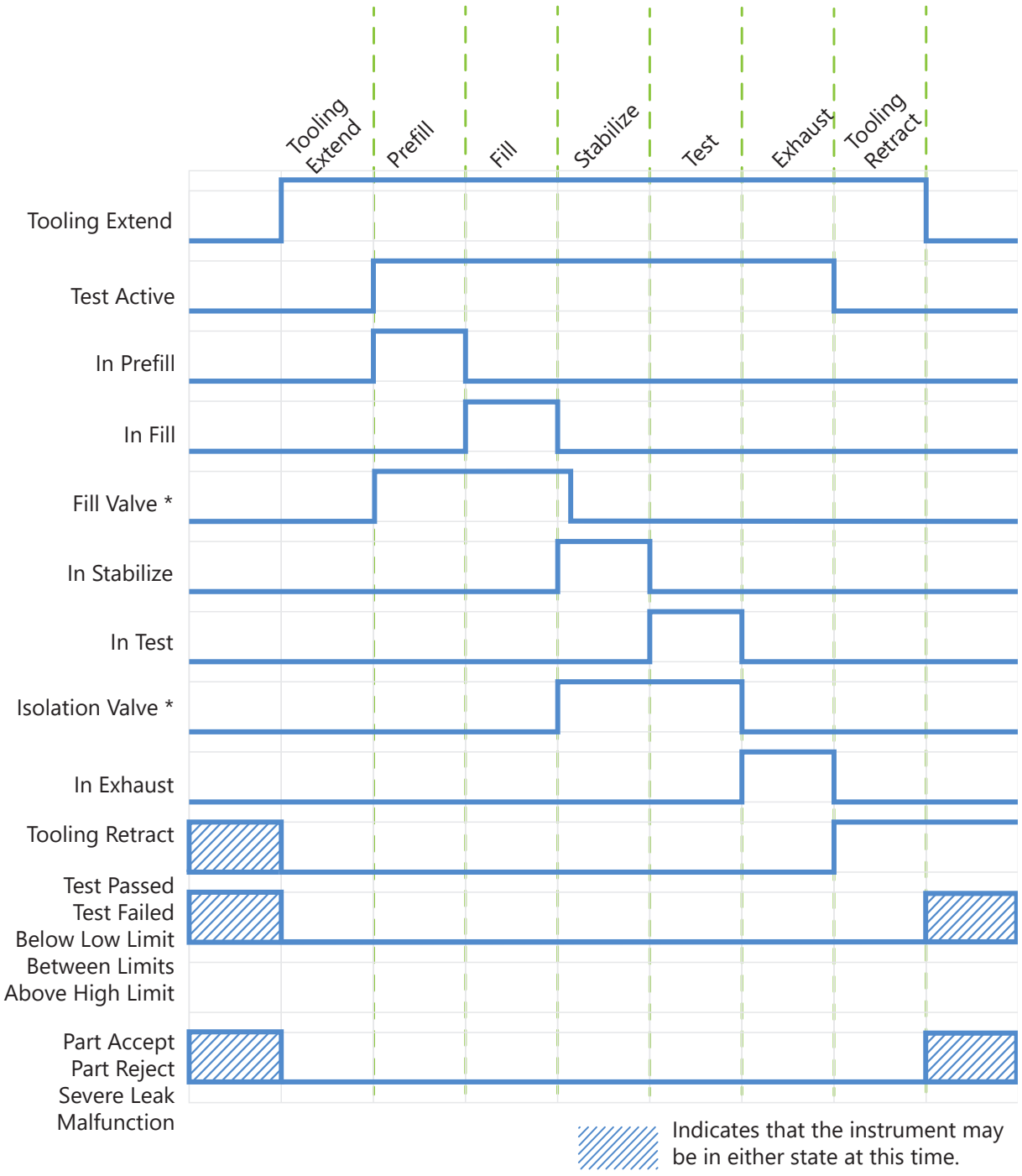

Figure 14-2. Timing Diagram

** Note: The Fill Valve and the Isolation Valve in the timing diagram above are shown to indicate the timing of the valves in this test type. They are not programmable events.*

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Chapter 16
Occlusion

The occlusion test is a back pressure test. The part is pressurized throughout the test from a fixed pressure regulator setting. At the end of the test timer the actual test pressure is compared to the low limit pressure and high limit pressure settings. Low limit pressure indicates high flow, minimum blockage, or low back pressure. High limit pressure indicates low flow, maximum blockage, or high back pressure.

This chapter describes the settings that can be modified for this test type.

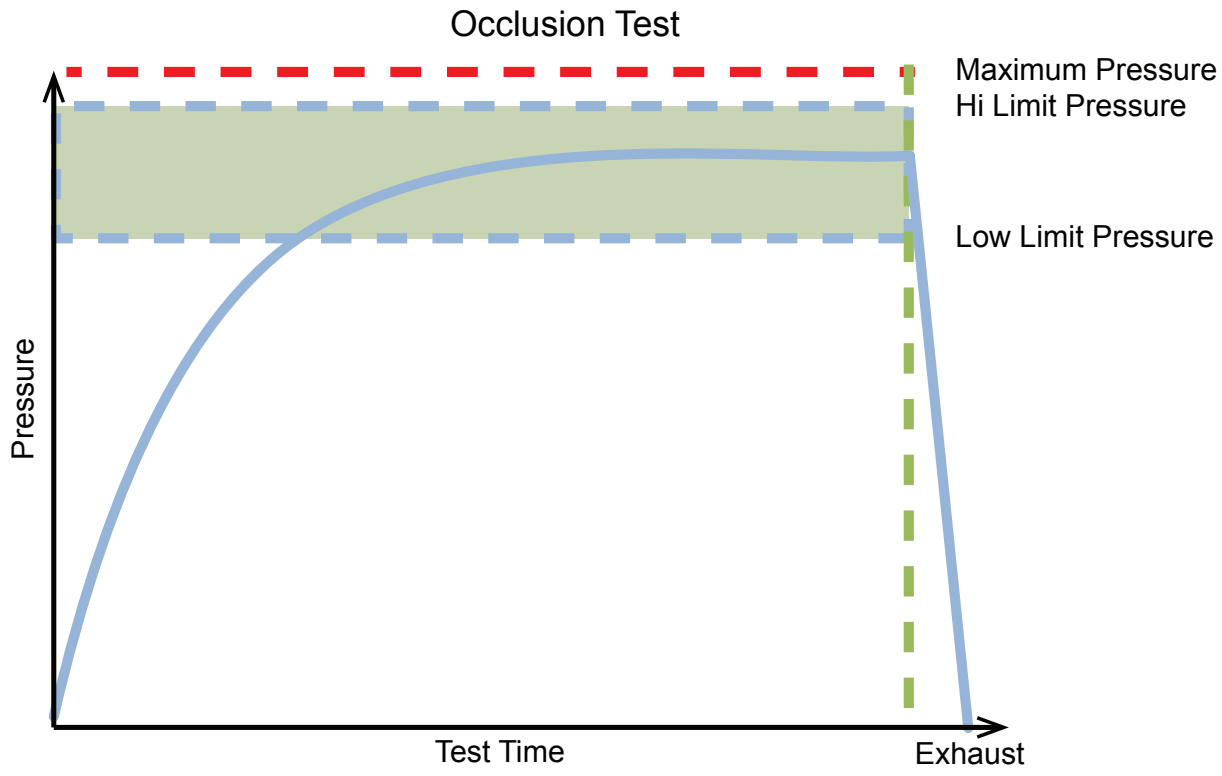

Figure 15-1. Occlusion Test Graph

Configure the Test

To set properties for any test, tap 

to enter **Edit** mode.

Tap 

and choose the program in which you want to make changes.

Tap  → 

. Tap the test you want to modify, then tap  .

Modify settings as needed. Note: Some menu items require Advanced access level to edit.

The following menus are available in an **Occlusion** test.

Menu	Description
Settings	
Test Type	Test Type options are dependent on the manifold and its capabilities.
Test Number	The number of the test.
Test Name	The name of the test. It could be a test type or a specific port on the test part.
Time Unit	Time Unit: Unit of measurement displayed for timers for the program.
Time Precision	Time Precision: Displayed digits of precision for time unit values.
Pressure Unit	Pressure Unit: Unit of measurement for all test pressure values for the program.
Pressure Precision	Pressure Precision: Displayed digits of precision for all pressure unit values.
Hardware	
Port Select	Specifies the test port to utilize for the test.
Regulator Select	Specifies the regulator to utilize for the test.
Leak Std Select	Specifies the Leak Standard to utilize for the test. A leak standard must be selected to enable other Leak Std settings. Available for advanced users only.
Leak Std Calibrated Flow	Flow value at which the Calibrated Leak Standard was certified.
Leak Std Calibrated Pressure	Pressure at which the Calibrated Leak Standard was certified.
Open Leak Std	Forces open the Leak Standard valve during normal testing.

Menu	Description
Test	
Timer	Amount of time allocated to each segment for execution before continuing.
Low Limit Pressure	Specified low limit pressure setpoint used to evaluate parts.
High Limit Pressure	Specified high limit pressure setpoint used to evaluate parts.
Test Evaluation	Setup of three test eval zones about the high limit and low limit (above high limit, between limits, below low limit) for pass and fail criteria (i.e. FPF= Fail>High Limit>Pass>Low Limit>Fail). Available for advanced users only.
Maximum Pressure	Maximum test pressure allowed during the Fill and Stabilize timers.
Exhaust	
Timer	Amount of time allocated to each segment for execution before continuing.

*Note: Some menus also include Add Event as the last option. Advanced users can see and add events when in **Edit** mode. See "Chapter 12 Events" on page 137 for more information on what menus also include Add Event.*

Tap 

→ **Save** when you are finished.

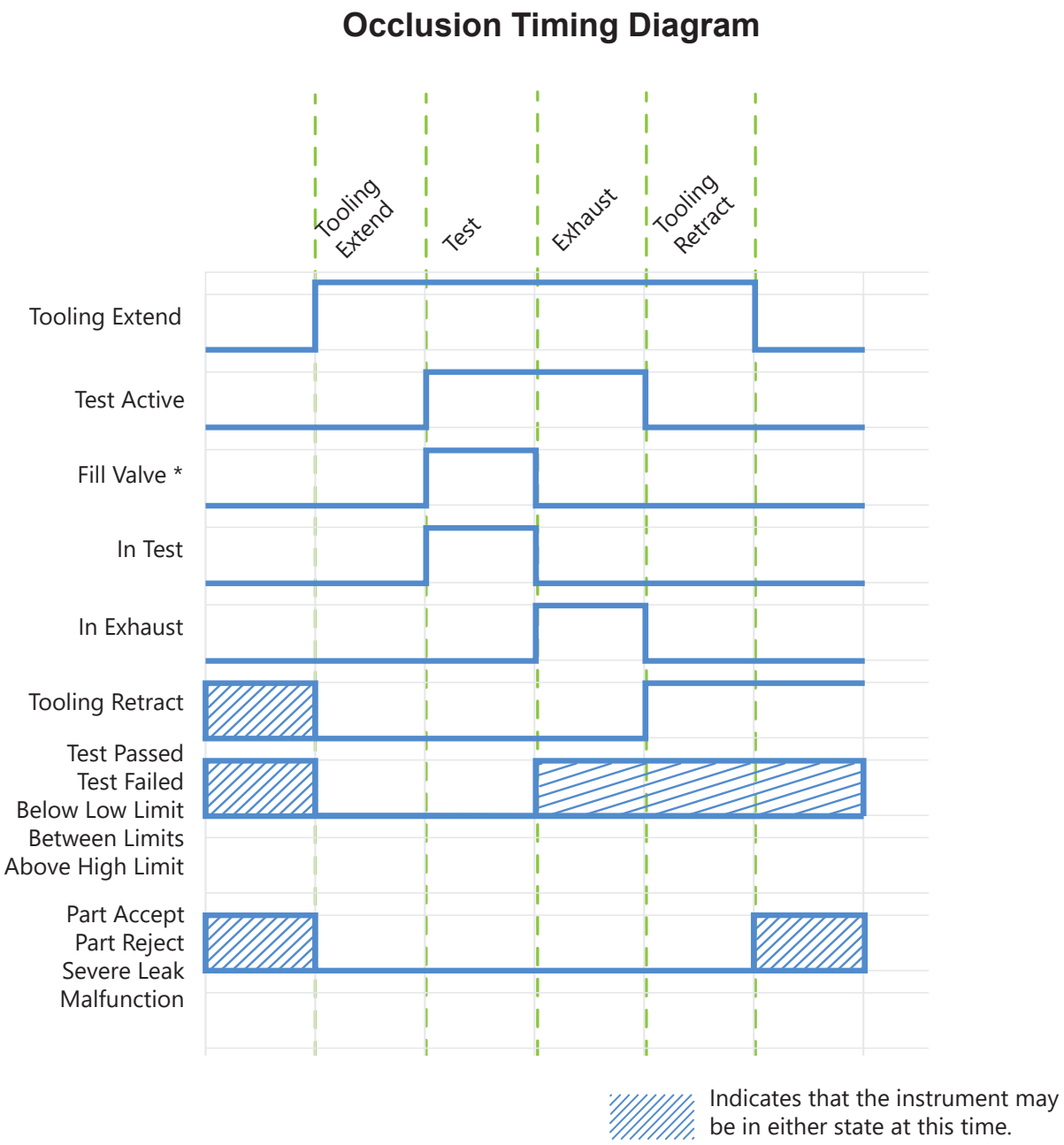

Figure 15-2. Timing Diagram

** Note: The Fill Valve in the timing diagram above is shown to indicate the timing of the valve in this test type. It is not a programmable event.*

Chapter 17
Pressure Verify

The Pressure Verify test is intended for parts that generate pressure or vacuum. The part is isolated by a closed isolation valve. The pressure transducer then reads the pressure or vacuum generated by the part. At the end of the test timer, the test pressure is compared to the low limit pressure and high limit pressure settings.

Another reason to use the Pressure Verify test type could be to fill through a test part using another manifold in the instrument or external source from the instrument. When the pressure reading taken at the test port for this part reads the target pressure, then it can be concluded that the part has filled. This test method can prove that check valves or blockages inside the part are not preventing the part from fully filling with pressure or being evacuated with a vacuum source.

There is no pressure vs. time graph shown for the Pressure Verify test type because the graph could take any shape. For example, the diagram could be pressure or vacuum, it could take the form of an asymtotic curve (similar to the occlusion test graph), a slow ramp, or an instantaneous change of state.

The following pages describe the settings that can be modified for this test type.

Configure the Test

To set properties for any test, tap 

to enter **Edit** mode.

Tap 

and choose the program in which you want to make changes.

Tap  → 

. Tap the test you want to modify, then tap  .

Modify settings as needed. Note: Some menu items require Advanced access level to edit.

The following menus are available in a **Pressure Verify** test.

Menu	Description
Settings	
Test Type	Test Type options are dependent on the manifold and its capabilities.
Test Number	The number of the test.
Test Name	The name of the test. It could be a test type or a specific port on the test part.
Time Unit	Time Unit: Unit of measurement displayed for timers for the program.
Time Precision	Time Precision: Displayed digits of precision for time unit values.
Pressure Unit	Pressure Unit: Unit of measurement for all test pressure values for the program.
Pressure Precision	Pressure Precision: Displayed digits of precision for all pressure unit values.
Hardware	
Port Select	Specifies the test port to utilize for the test.
Test	
Timer	Amount of time allocated to each segment for execution before continuing.
Low Limit Pressure	Specified low limit pressure setpoint used to evaluate parts.
High Limit Pressure	Specified high limit pressure setpoint used to evaluate parts.
Test Evaluation	Setup of three test eval zones about the high limit and low limit (above high limit, between limits, below low limit) for pass and fail criteria (i.e. FPF= Fail>High Limit>Pass>Low Limit>Fail). Available for advanced users only.
Maximum Pressure	Maximum test pressure allowed during the Fill and Stabilize timers.
Exhaust	
Timer	Amount of time allocated to each segment for execution before continuing.

*Note: Some menus also include Add Event as the last option. Advanced users can see and add events when in **Edit** mode. See "Chapter 12 Events" on page 137 for more information on what menus also include Add Event.*

Tap 

→ **Save** when you are finished.

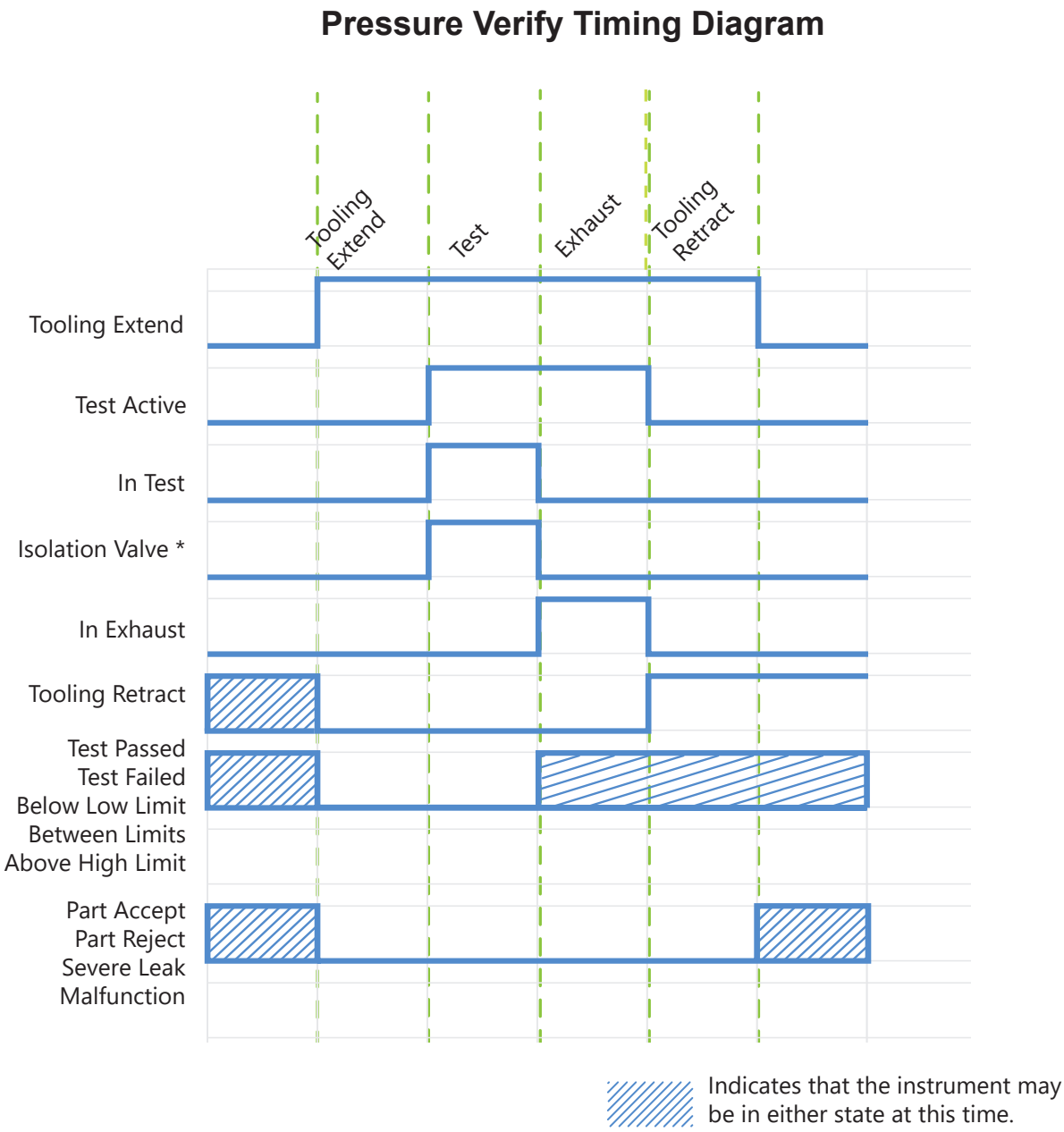

Figure 16-1. Timing Diagram

** Note: The Isolation Valve in the timing diagram above is shown to indicate the timing of the valve in this test type. It is not a programmable event.*

Chapter 18
Mass Flow

The result of this test is the measured flow rate at the expiration of the test sequence. This test type is typically used for applications where a “good” part is expected to flow a specific amount. During the test, the instrument fills the test part to a specified target test pressure and allows the pressure regulator to maintain the proper pressure in the part. The instrument measures the flow of air required to keep the part at the target pressure.

This chapter describes the settings that can be modified for this test type.

Note that changes to the air supplied to the instrument can cause variation of test

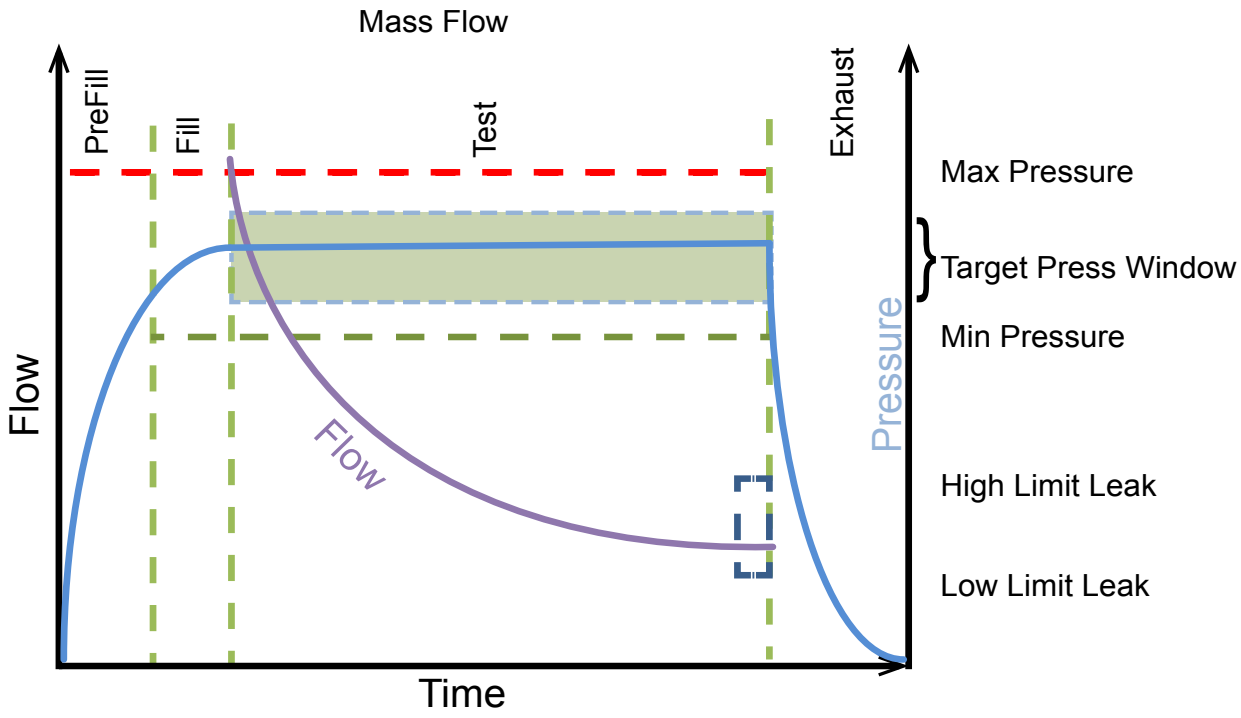

Figure 17-1. Mass Flow Test Graph

results. The use of a regulated accumulator tank prior to the instrument is recommended

to ensure constant supply pressure during the test. The size of the accumulator should be such that the pressure in the accumulator remains more than 10% above test pressure and does not vary more than 2% during test cycle. For tests where fill time is a significant portion of the overall test time, higher supply pressure can reduce fill times.

Configure the Test

To set properties for any test, tap 

to enter **Edit** mode.

Tap 

and choose the program you want to modify.

Tap  → 

. Tap the test you want to modify, then tap  .

Modify settings as needed. Note: Some settings require Advanced access level to edit.

The following menus are available in a **Mass Flow** test.

Menu	Description
Settings	
Test Type	Test Type options are dependent on the manifold and its capabilities.
Test Number	The number of the test.
Test Name	The name of the test. It could be a test type or a specific port on the test part.
Time Unit	Time Unit: Unit of measurement displayed for timers for the program.
Time Precision	Time Precision: Displayed digits of precision for time unit values.
Pressure Unit	Pressure Unit: Unit of measurement for all test pressure values for the program.
Pressure Precision	Pressure Precision: Displayed digits of precision for all pressure unit values.
Flow Unit	Select units of flow (sccs, scch, etc.) in which testing is measured.
Flow Precision	Displayed digits of precision for all flow unit values.
Hardware	
Port Select	Specifies the test port to utilize for the test.
Regulator Select	Specifies the regulator to utilize for the test.
Flow Restriction	When enabled, inserts the flow restriction into the fill path for the selected pressure source
Leak Std Select	Specifies the Leak Standard to utilize for the test. A leak standard must be selected to enable other Leak Std settings. **Requires Advanced access level to edit.**
Leak Std Calibrated Flow	Flow value at which the Calibrated Leak Standard was certified.

Menu	Description
Leak Std Calibrated Pressure	Pressure at which the Calibrated Leak Standard was certified.
Open Leak Std	Forces open the Leak Standard valve during normal testing.
Prefill	
Timer	Amount of time allocated to each segment for execution before continuing.
Exit Criteria	Necessary condition that must be met to successfully advance to the next segment. **Requires Advanced access level to see and edit.**
Minimum Consecutive Timer	Minimum consecutive time that pressure must be above minimum setpoint before continuing. **Requires Advanced access level to edit.**
Minimum Pressure	The lowest pressure needed to complete the segment.
Maximum Pressure	The highest pressure permitted during the segment.
Fill	
Timer	Amount of time allocated to each segment for execution before continuing.
Minimum Pressure	Minimum test pressure that must be maintained during the Fill timer.
Maximum Pressure	Maximum test pressure allowed during the Fill timer.
Test	
Timer	Amount of time allocated to each segment for execution before continuing.
Target Pressure	Desired test pressure for all leak tests.
Low Limit Flow	Specified low limit flow setpoint used to evaluate the test.
High Limit Flow	Specified high limit flow setpoint used to evaluate the test.
Test Evaluation	Setup of three test eval zones about the high limit and low limit (above high limit, between limits, below low limit) for pass and fail criteria (i.e. FPF= Fail>High Limit>Pass>Low Limit>Fail). **Requires Advanced access level to edit.**
Minimum Pressure	Test pressure to meet in Prefill timer and be sustained through Fill and Stabilize timers.
Maximum Pressure	Maximum test pressure allowed during the Fill and Stabilize timers.
Pressure Correction	If enabled, the instrument performs measurement corrections based on the ratio between the target pressure over the actual test pressure. **Requires Advanced access level to see and edit.**
Max Master Flow	Maximum flow allowable for the Master Part during the calibration cycle; use to prevent calibration to leaking Master Parts or fixtures.

Menu	Description
Min Master Flow	Minimum flow allowable for the Master Part during the calibration cycle; use to prevent calibration to the Self-Test cap.
(this table continues onto the next page)	
EDC	When enabled, Environmental Drift Correction monitors and continually corrects final Leak rate calculations based on the moving average shift of test results within a band about the Master Part calibration curve. This setting enables subsequent EDC settings. **Requires Advanced access level to edit.**
EDC Percentage	Percentage band (+/-) defined by a percentage of High Limit, about the Master Part curve. **Requires Advanced access level to edit.**
EDC Quantity	Number of test results utilized in calculating the Environmental Drift Correction factor. **Requires Advanced access level to edit.**
Enable Calibration	If enabled, the user can perform a program calibration sequence that will store the Master Flow Offset. The offset will be applied to all test results.
Exhaust	
Timer	Amount of time allocated to each segment for execution before continuing.

*Note: Some menus also include Add Event as the last option. Advanced users can see and add events when in **Edit** mode. See "Chapter 12 Events" on page 137 for more information on what menus also include Add Event.*

Tap 

→ **Save** when you are finished.

Mass Flow Timing Diagram

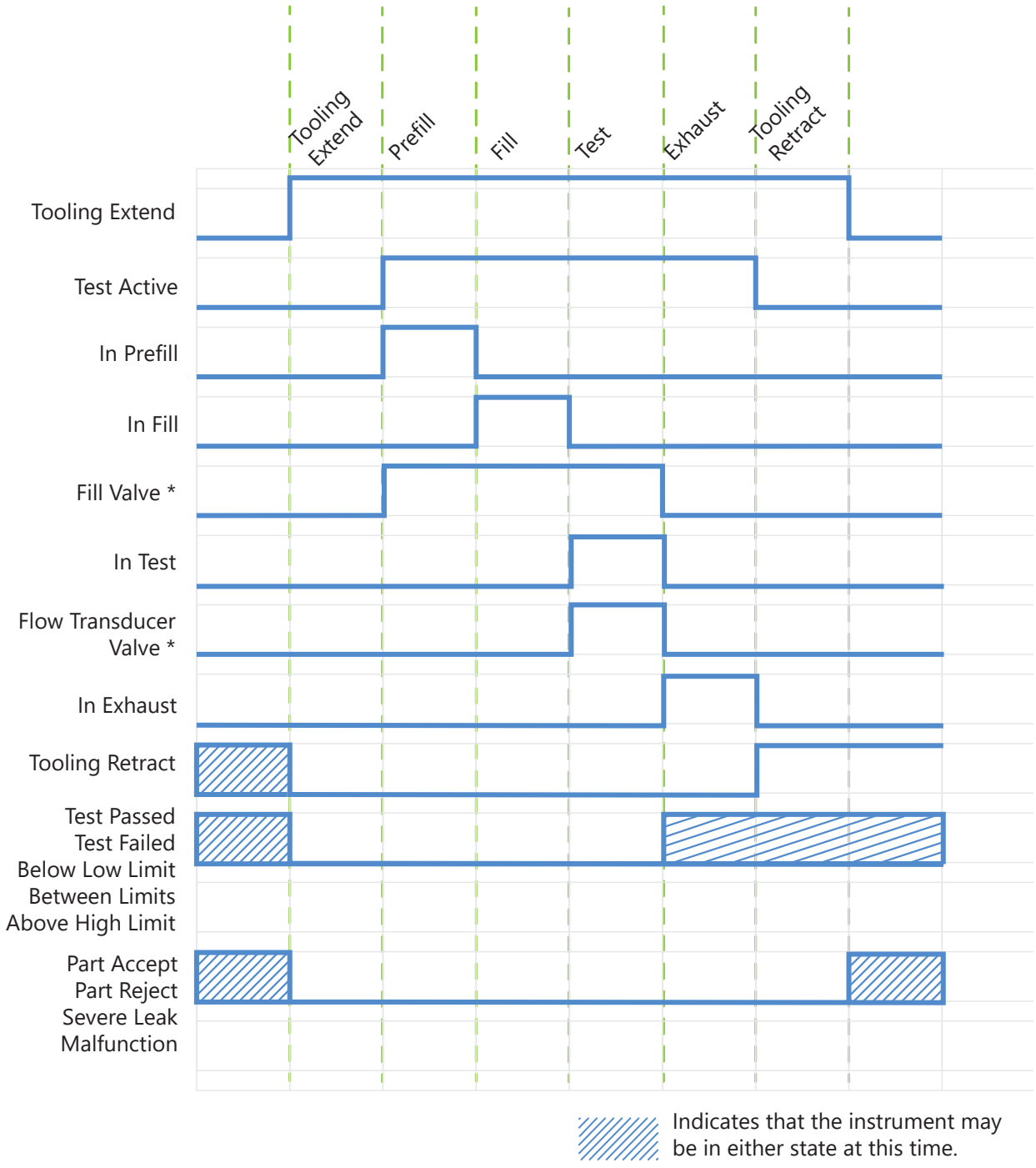

Figure 17-2. Timing Diagram

** Note: The Fill Valve and the Flow Transducer Valve in the timing diagram above are shown to indicate the timing of the valves in this test type. They are not programmable events.*

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Chapter 19
Mass Flow–Leak Std

This test type is typically used for low-leak applications. During the test, the instrument fills the test part to a specified target test pressure and allows the pressure regulator to maintain the proper pressure in that part. The instrument measures the flow of air required to keep the part at the target pressure.

This test type utilizes a two point calibration sequence with a non-leaking master part to set the zero flow value and the flow rate at the leak standard value. This calibration process creates a linear offset of the flow readings based on these two points.

This chapter describes the settings that can be modified for this test type.

Note that changes to the air supplied to the instrument can cause variation of test results. The use of a regulated accumulator tank prior to the instrument is recommended to ensure constant supply pressure during the test. The size of the accumulator should be such that the pressure in the accumulator remains more than 10% above test pressure and does not vary more than 2% during test cycle. For tests where fill time is a significant portion of the overall test time, higher supply pressure can reduce fill times.

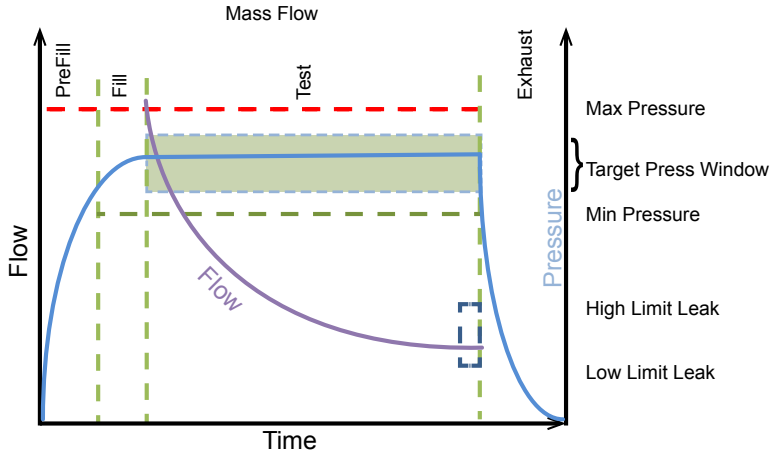

Figure 18-1. Mass Flow-Leak Std Test Graph

Configure the Test

To set properties for any test, tap 

to enter **Edit** mode.

Tap 

and choose the program in which you want to make changes.

Tap  → 

. Tap the test you want to modify, then tap  .

Configure the test. Note: Some menu items require Advanced access level to edit.

The following menus are available in a **Mass Flow-Leak Std** test.

Menu	Description
Settings	
Test Type	Test Type options are dependent on the manifold and its capabilities.
Test Number	The number of the test.
Test Name	The name of the test. It could be a test type or a specific port on the test part.
Time Unit	Time Unit: Unit of measurement displayed for timers for the program.
Time Precision	Time Precision: Displayed digits of precision for time unit values.
Pressure Unit	Pressure Unit: Unit of measurement for all test pressure values for the program.
Pressure Precision	Pressure Precision: Displayed digits of precision for all pressure unit values.
Flow Unit	Select units of flow (sccs, scch, etc.) in which testing is measured.
Flow Precision	Displayed digits of precision for all flow unit values.
Calibration Status	Indicates the calibration status of this test. In **Edit** mode, tap to change the status. Options include: Invalidate Settings (the program must be calibrated before it can be run) or Force Validation (to allow the program to run without performing a calibration cycle). **Requires Advanced access level to edit.**
Hardware	
Port Select	Specifies the test port to utilize for the test.
Regulator Select	Specifies the regulator to utilize for the test.
Flow Restriction	When enabled, inserts the flow restriction into the fill path for the selected pressure source
Leak Std Select	Specifies the Leak Standard to utilize for the test. A leak standard must be selected to enable other Leak Std settings. **Requires Advanced access level to edit.**
Leak Std Calibrated Flow	Flow value at which the Calibrated Leak Standard was certified.
Leak Std Calibrated Pressure	Pressure at which the Calibrated Leak Standard was certified.

Menu	Description
Open Leak Std	Forces open the Leak Standard valve during normal testing. Once opened, it will always remain open until closed with this setting.
Prefill	
Timer	Amount of time allocated to each segment for execution before continuing.
Exit Criteria	Necessary condition that must be met to successfully advance to the next segment. **Requires Advanced access level to edit.**
Minimum Consecutive Timer	Minimum consecutive time that pressure must be above minimum setpoint before continuing. **Requires Advanced access level to edit.**
Minimum Pressure	The lowest pressure needed to complete the segment.
Maximum Pressure	The highest pressure permitted during the segment.
Fill	
Timer	Amount of time allocated to each segment for execution before continuing.
Minimum Pressure	Minimum test pressure that must be maintained during the Fill timer.
Maximum Pressure	Maximum test pressure allowed during the Fill timer.
Test	
Timer	Amount of time allocated to each segment for execution before continuing.
Target Pressure	Desired test pressure for all leak tests.
Low Limit Leak	Specified low limit leak rate or flow value setpoint used to evaluate parts.
High Limit Leak	Specified high limit leak rate or flow value setpoint used to evaluate parts.
Test Evaluation	Setup of three test eval zones about the high limit and low limit (above high limit, between limits, below low limit) for pass and fail criteria (i.e. FPF= Fail>High Limit>Pass>Low Limit>Fail). **Requires Advanced access level to edit.**
Minimum Pressure	Test pressure to meet in Prefill timer and be sustained through Fill and Stabilize timers.
Maximum Pressure	Maximum test pressure allowed during the Fill and Stabilize timers.
Pressure Correction	If enabled, the instrument performs measurement corrections based on the ratio between the target pressure over the actual test pressure. **Requires Advanced access level to edit.**
Max Mstr+Leak Flow	Maximum flow allowable for the Master Part with Leak Standard during the calibration cycle; used to prevent calibration to leaking Master Parts or fixtures. **Requires Advanced access level to edit.**
Min Master Flow	Minimum flow allowable for the Master Part with Leak Standard during the calibration cycle; used to prevent calibration to Self-Test cap.
Master Part Press	Measured pressure at the midpoint of the Test segment for the Master Part during the calibration process. **Requires Advanced access level to edit.**

Menu	Description
Master+Leak Press	Measured pressure at the midpoint of the Test segment for the Master Part with Leak Standard during the calibration process. **Requires Advanced access level to edit.**
Master Part Flow	Flow during the calibration cycle of the Master Part and stored to represent normal flow at the Target Pressure. **Requires Advanced access level to edit.**
Master+Leak Flow	Flow during the calibration cycle of the Master Part with Leak Standard and stored to represent normal flow + Leak Standard flow at the Target Pressure. **Requires Advanced access level to edit.**
Corrected Leak Std Flow	Certified Leak Standard flow rate value at the Target Pressure, corrected for the actual pressure used to calibrate the instrument.
Quik Test	Quik Test function projects the leak rate based on the pressure loss curve at the Quik test timer. This setting enables subsequent Quik Test settings. **Requires Advanced access level to edit.**
Quik Test Timer	Percentage of Test timer when program is evaluated for early pass/fail or continue testing. **Requires Advanced access level to edit.**
Quik Test LL Band	Window +/- around Low Limit where the full test time must be used to evaluate the program. **Requires Advanced access level to edit.**
Quik Test HL Band	Window +/- around High Limit where the full test time must be used to evaluate the program. **Requires Advanced access level to edit.**
EDC	When enabled, Environmental Drift Correction monitors and continually corrects final Leak rate calculations based on the moving average shift of test results within a band about the Master Part calibration curve. This setting enables subsequent EDC settings. **Requires Advanced access level to edit.**
EDC Percentage	Percentage band (+/-) defined by a percentage of High Limit, about the Master Part curve. **Requires Advanced access level to edit.**
EDC Quantity	Number of test results utilized in calculating the Environmental Drift Correction factor. **Requires Advanced access level to edit.**
Exhaust	
Timer	Amount of time allocated to each segment for execution before continuing.

*Note: Some menus also include Add Event as the last option. Advanced users can see and add events when in **Edit** mode. See "Chapter 12 Events" on page 137 for more information on what menus also include Add Event.*

Tap 

→ **Save** when you are finished.

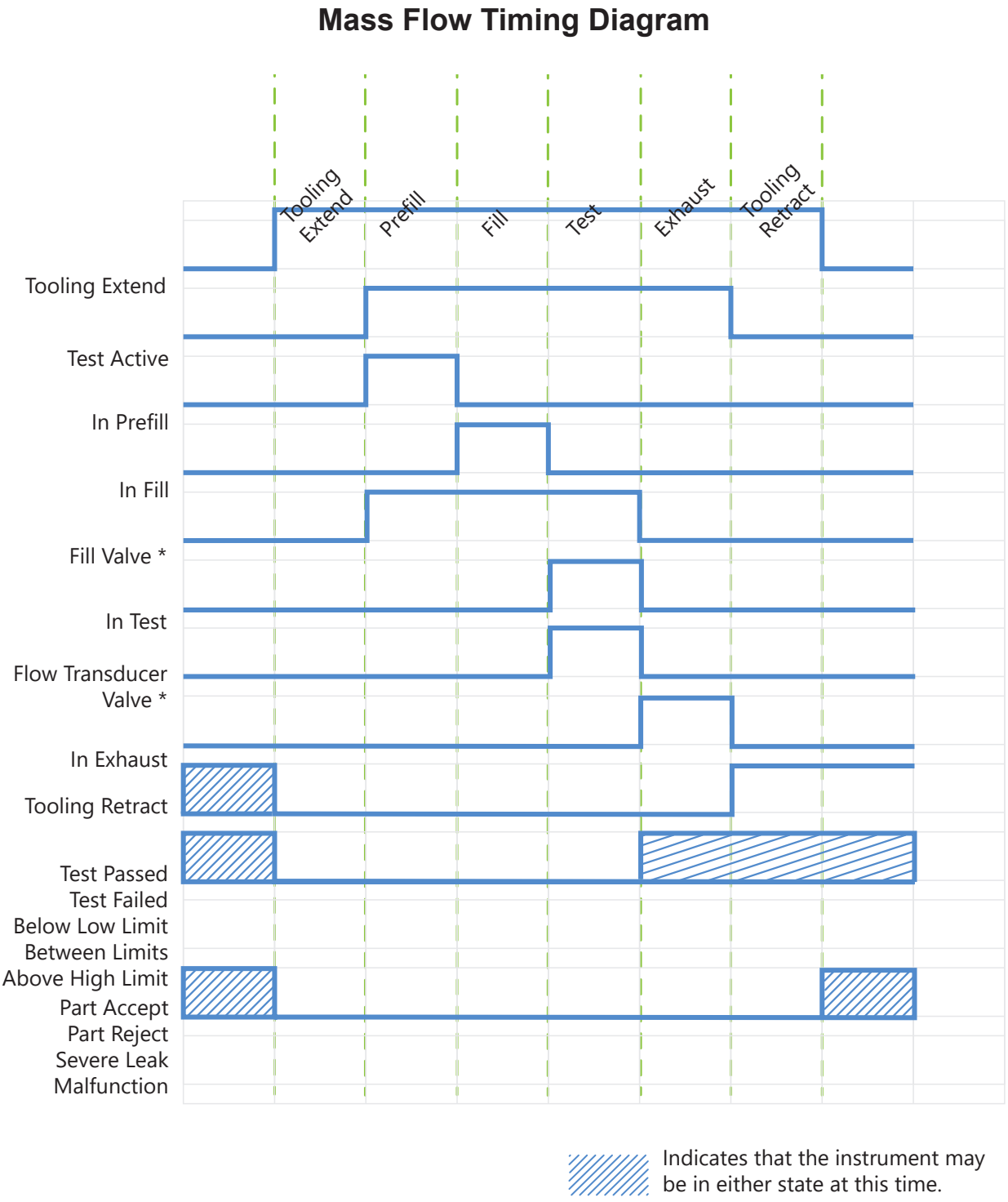

Figure 18-2. Timing Diagram

** Note: The Fill Valve and the Flow Transducer Valve in the timing diagram above are shown to indicate the timing of the valves in this test type. They are not programmable events.*

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Chapter 20
Ramp to ΔP Event

This chapter explains the theory and parameters for conducting a Ramp to ΔP Event Test. The result of this test is the measured pressure at the point in time an event occurs and the duration of time before the event.

A test type to evaluate parts that 'crack' or drastically change state under pressure that can be immediately detected by monitoring for a sudden significant change in system pressure. The system pressure is typically increased at a consistent rate (ramp) over a defined period of time. The pressure ramp can be controlled by the instrument with an electronic regulator.

The diagram below gives an overview of the parameters used to set up a Ramp to Event Test. The tables that follow give detailed descriptions of each menu setting. .

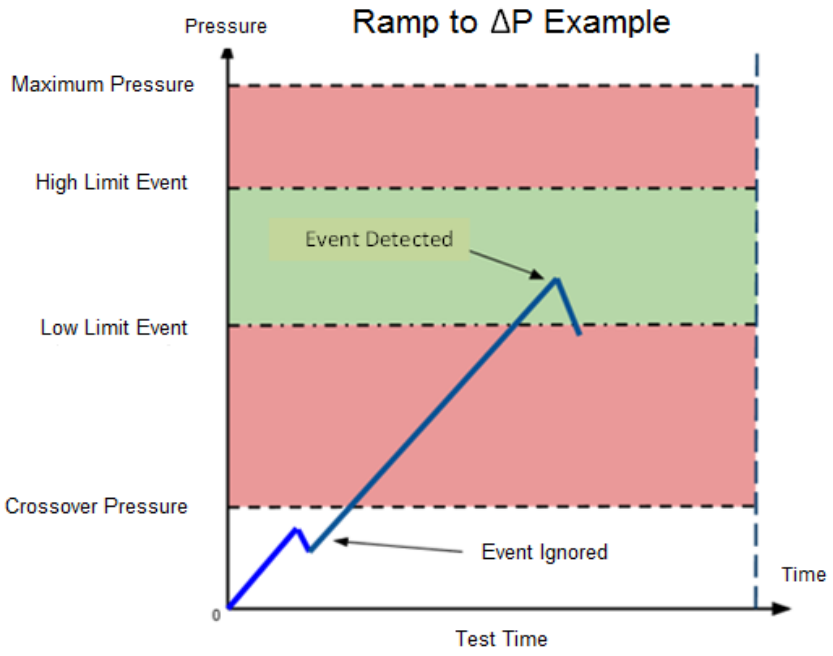

Figure 19-1. Ramp to ΔP Event Test Graph

This chapter describes the settings that can be modified for this test.

Configure the Test

To set properties for any test, tap 

to enter **Edit** mode.

Tap 

and choose the program in which you want to make changes.

Tap  → 

. Tap the test you want to modify, then tap  .

Configure the test. Note: Some menu items require Advanced access level to edit.

The following menus are available in a **Ramp to ΔP Event Test**.

Menu	Description
Settings	
Test Type	Test Type options are dependent on the manifold and its capabilities.
Test Number	The number of the test.
Test Name	The name of the test. It could be a test type or a specific port on the test part.
Time Unit	Unit of measurement displayed for timers for the program.
Time Precision	Displayed digits of precision for time unit values.
Pressure Unit	Unit of measurement for all test pressure values for the program.
Pressure Precision	Displayed digits of precision for all pressure unit values.
Δ Pressure Unit	Unit of measurement for all the pressure loss over time values for the program.
Δ Pressure Precision	Displayed digits of precision for all pressure loss unit values.
Hardware	
Port Select	Specifies the test port to utilize for the test.
Regulator Select	Specifies the regulator to utilize for the test.
Regulator Setpoint Pressure	
ERC Method	Electronic Regulator Compensation (ERC) enables the instrument to adjust the regulator pressure setting to obtain the optimal measured pressure (fill pressure or test pressure), as determined by the Target Pressure.
Leak Std Select	Specifies the Leak Standard to utilize for the test. A leak standard must be selected to enable other Leak Std settings. **Requires Advanced access level to edit.**
Leak Std Calibrated Flow	Flow value at which the Calibrated Leak Standard was certified.
Leak Std Calibrated Pressure	Pressure at which the Calibrated Leak Standard was certified.

Menu	Description
Open Leak Std	Forces open the Leak Standard valve during normal testing. Once opened, it will always remain open until closed with this setting.
Test	
Timer	Amount of time allocated to each segment for execution before continuing.
Ramp Method	Defines the physical harware and method utilized to generate the pressure ramp.
Starting Pressure	Initial pressure setpoints for the electronic regulator at the beginning of the ramp.
Ramp Rate	Rate at which pressure is increased by the electronic regulator during the Ramp timer.
Maximum Pressure	Maximum test pressure allowed during the Fill and Stabilization timers.
Low Limit Event	Specified low limit event setpoint used to evaluate parts.
High Limit Event	Specified high limit event setpoint used to evaluate parts.
Test Evaluation	Setup of three test eval zones about the high limit and low limit (above high limit, between limits, below low limit) for pass and fail criteria (ie FPF = FAIL>High Limit>PASS>Low Limit>FAIL). **Requires Advanced access level to edit.**
Crosover Pressure	Pressure setpoint that must be attained (via ascending or descending pressure ramp)during the test timer before an event can be detected.
Event Type	Determines the method utilized to trap for an event ΔP decrease from the peak pressure, ΔP decrease over a time period ΔT, ΔP increase over a time period ΔT (decrease is defined as a pressure change towards atmosphere).
Event ΔP	Minimum pressure differential (defined by the event type as the peak pressure minus current pressure or the change in pressure over the event time) that must be obtained for the part to have successfully had an event.
Exhaust	
Timer	Amount of time allocated to each segment for execution before continuing.

*Note: Some menus also include Add Event as the last option. Advanced users can see and add events when in **Edit** mode. See "Chapter 12 Events" on page 137 for more information on what menus also include Add Event.*

Tap 

→ **Save** when you are finished.

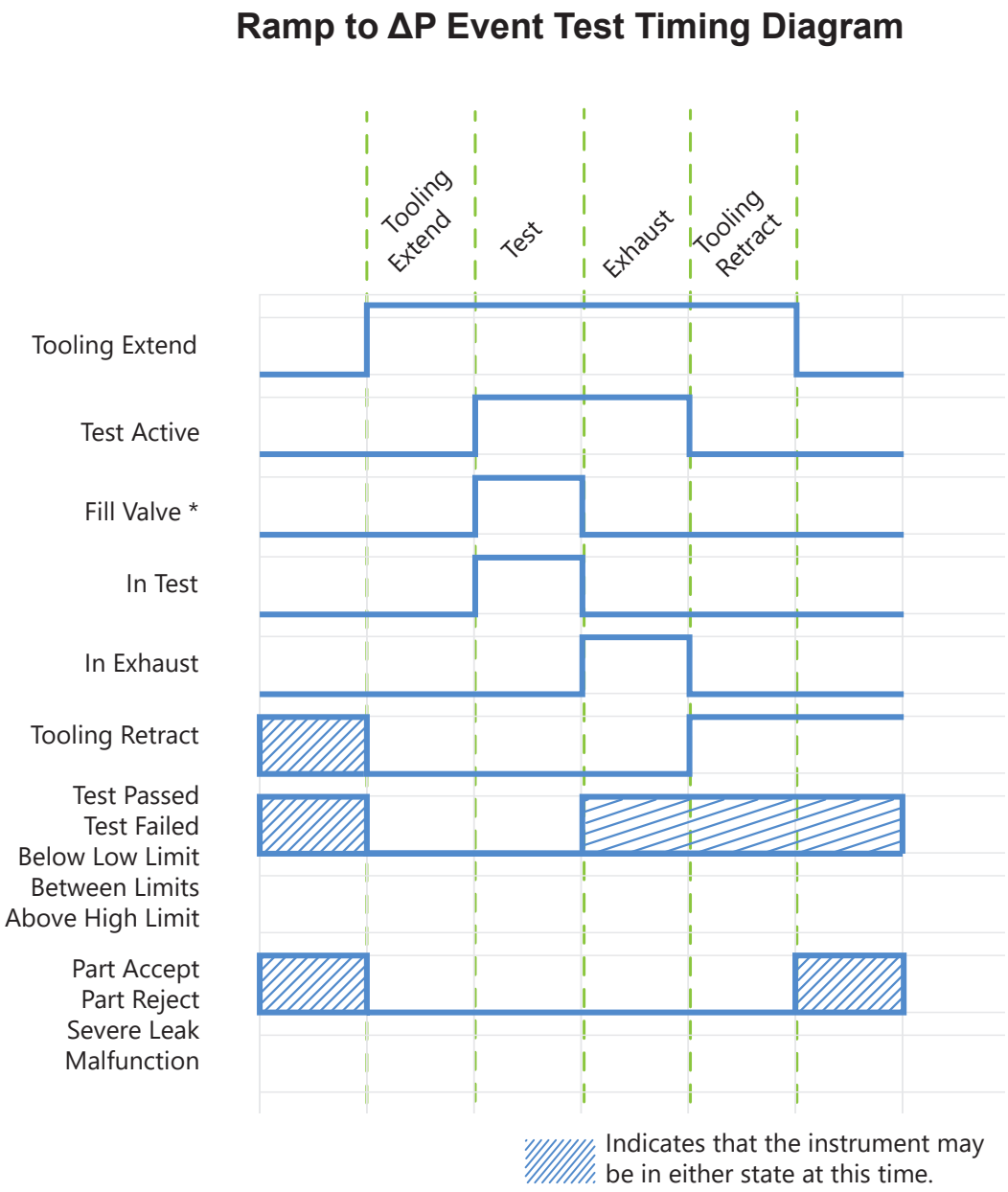

Figure 19-2. Timing Diagram

** Note: The Fill Valve in the timing diagram above is shown to indicate the timing of the valve in this test type. It is not a programmable event.*

Chapter 21
Ramp to Input Event

This chapter explains the theory and settings for conducting a Ramp to Input Event Test, which is primarily used for testing the electrical state of a device. This test type measures the pressure at which the trigger event input occurs, determines the maximum pressure before the event is trapped, and records the pressure and duration of time before at the moment of the trigger event. The results are presented in units of pressure and time.

This test type is used to evaluate parts that change state under pressure, where the change can be immediately detected by monitoring a pressure switch, flow switch, or other device with a digital input. The system pressure is either increased or decreased (ramp) over a defined period of time. The pressure ramp can be controlled by the instrument via an electronic regulator. The digital input on the instrument which is set to Event Trigger and monitors for a rising or falling edge or a level change from high to low or low to high. The Event Trigger can be ignored if the duration is less than the Level Time setting.

The diagram below gives an overview of the parameters used to set up a Ramp to Input Event test. The tables that follow give detailed descriptions of each menu setting.

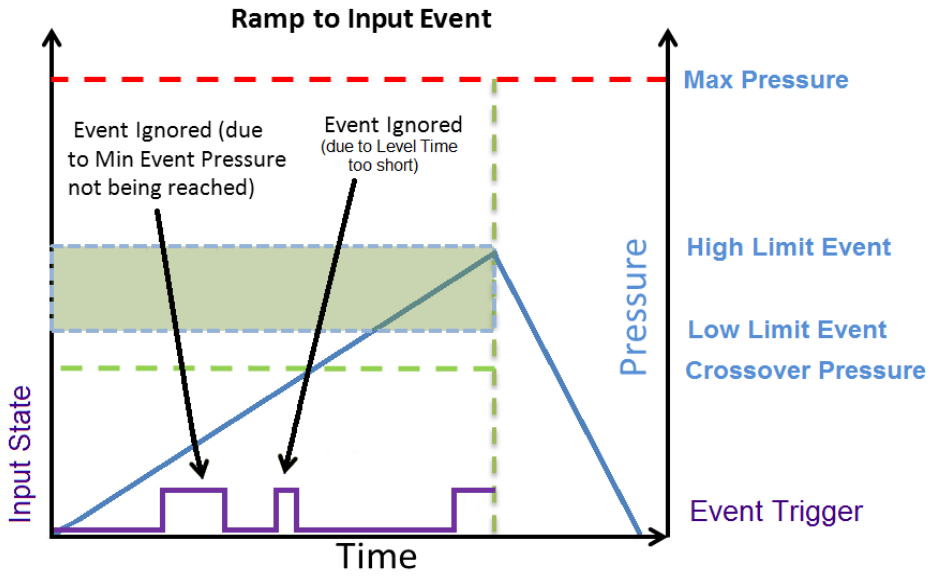

Figure 20-1. Ramp to Input Event Test Graph

This chapter describes the settings that can be modified for this test type.

Configure the Test

To set properties for any test, tap 

to enter **Edit** mode.

Tap 

and choose the program in which you want to make changes.

Tap  → 

. Tap the test you want to modify, then tap  .

Configure the test. Note: Some menu items require Advanced access level to edit.

The following menus are available in a **Ramp to Input Event Test**.

Menu	Description
Settings	
Test Type	Test Type options are dependent on the manifold and its capabilities.
Test Number	The number of the test.
Test Name	The name of the test. It could be a test type or a specific port on the test part.
Time Unit	Unit of measurement displayed for timers for the program.
Time Precision	Displayed digits of precision for time unit values.
Pressure Unit	Unit of measurement for all test pressure values for the program.
Pressure Precision	Displayed digits of precision for all pressure unit values.
Hardware	
Port Select	Specifies the test port to utilize for the test.
Regulator Select	Specifies the regulator to utilize for the test.
Regulator Setpoint Pressure	
ERC Method	Electronic Regulator Compensation (ERC) enables the instrument to adjust the regulator pressure setting to obtain the optimal measured pressure (fill pressure or test pressure), as determined by the Target Pressure.
Leak Std Select	Specifies the Leak Standard to utilize for the test. A leak standard must be selected to enable other Leak Std settings. **Requires Advanced access level to edit.**
Leak Std Calibrated Flow	Flow value at which the Calibrated Leak Standard was certified.
Leak Std Calibrated Pressure	Pressure at which the Calibrated Leak Standard was certified.
Open Leak Std	Forces open the Leak Standard valve during normal testing. Once opened, it will always remain open until closed with this setting.
Test	
Timer	Amount of time allocated to each segment for execution before continuing.
Ramp Method	Defines the physical harware and method utilized to generate the pressure ramp.
Starting Pressure	Initial pressure setpoints for the electronic regulator at the beginning of the ramp.
Ramp Rate	Rate at which pressure is increased by the electronic regulator during the Ramp timer.
Maximum Pressure	Maximum test pressure allowed during the Fill and Stabilization timers.
Low Limit Event	Specified low limit event setpoint used to evaluate parts.
High Limit Event	Specified high limit event setpoint used to evaluate parts.

(this table continues onto the next page)

Menu	Description
Test Evaluation	Setup of three test eval zones about the high limit and low limit (above high limit, between limits, below low limit) for pass and fail criteria (ie FPF = FAIL>High Limit>PASS>Low Limit>FAIL). **Requires Advanced access level to edit.**
Crosover Pressure	Pressure setpoint that must be attained (via ascending or descending pressure ramp)during the test timer before an event can be detected.
Event Type	Determines the method utilized to trap for an event: Edge (Rising or Falling) type requires a directional change in input state, Level type requires a spedific input state for a specified duration.
Edge Type	Defines the direction of transition required on the input to determe if an event has occurred. (Options are Rising or Falling.)
Input Initial State	The required initial state of the inut that is verified at the start of the test cycle.
Event Trigger	(choose which digital input to monitor)
Exhaust	
Timer	Amount of time allocated to each segment for execution before continuing.

*Note: Some menus also include Add Event as the last option. Advanced users can see and add events when in **Edit** mode. See “Chapter 12 Events” on page 137 for more information on what menus also include Add Event.*

Tap 

→ **Save** when you are finished.

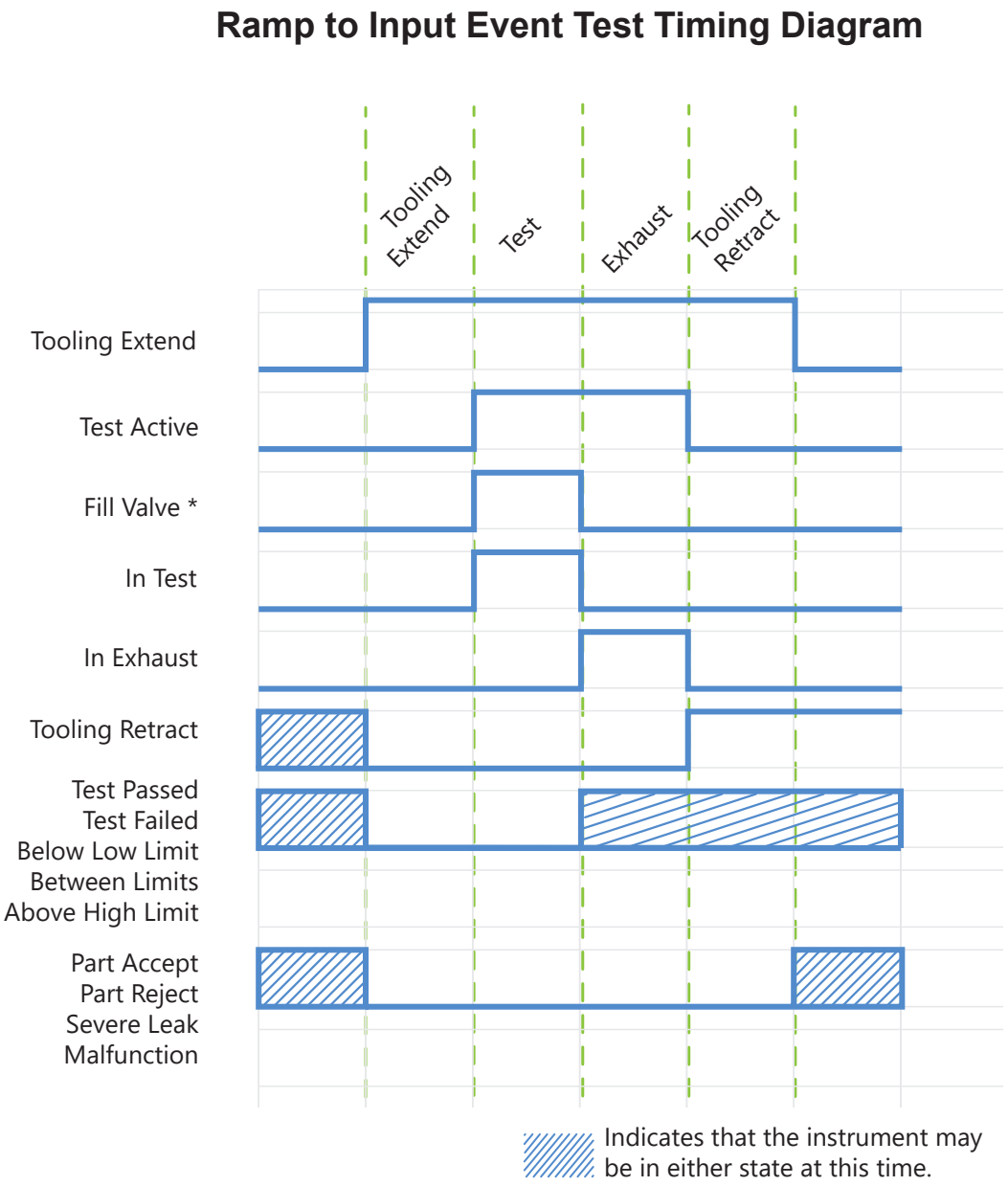

Figure 20-2. Timing Diagram

** Note: The Fill Valve in the timing diagram above is shown to indicate the timing of the valve in this test type. It is not a programmable event.*

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Chapter 22
Ramp to Proof

This chapter explains the theory and settings for conducting a Ramp to Proof Test. The result of this test is the maximum measured pressure during the ramp and test sequences.

The system pressure is either increased or decreased at a consistent rate (ramp) over a period of time, and then held at pressure for an additional period of time. The pressure ramp can be controlled by the instrument with an electronic regulator. Parts are evaluated based on whether or not pressure was achieved and maintained for the test time period.

The diagram below give an overview of the parameters used to set up a Proof Test. The tables that follow give detailed descriptions of each menu setting.

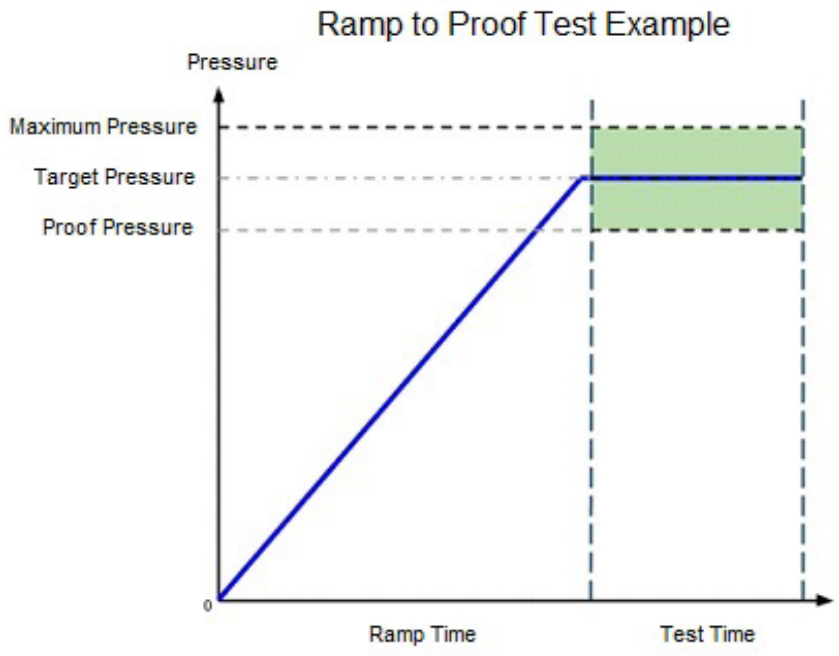

Figure 21-1. Ramp to Proof Test Graph

This chapter describes the settings that can be modified for this test type.

Configure the Test

To set properties for any test, tap 

to enter **Edit** mode.

Tap 

and choose the program in which you want to make changes.

Tap  → 

. Tap the test you want to modify, then tap  .

Configure the test. Note: Some menu items require Advanced access level to edit.

The following menus are available in a **Ramp to Proof Test**.

Menu	Description
Settings	
Test Type	Test Type options are dependent on the manifold and its capabilities.
Test Number	The number of the test.
Test Name	The name of the test. It could be a test type or a specific port on the test part.
Time Unit	Unit of measurement displayed for timers for the program.
Time Precision	Displayed digits of precision for time unit values.
Pressure Unit	Unit of measurement for all test pressure values for the program.
Pressure Precision	Displayed digits of precision for all pressure unit values.
Hardware	
Port Select	Specifies the test port to utilize for the test.
Regulator Select	Specifies the regulator to utilize for the test.
Regulator Setpoint Pressure	
ERC Method	Electronic Regulator Compensation (ERC) enables the instrument to adjust the regulator pressure setting to obtain the optimal measured pressure (fill pressure or test pressure), as determined by the Target Pressure.
Leak Std Select	Specifies the Leak Standard to utilize for the test. A leak standard must be selected to enable other Leak Std settings. **Requires Advanced access level to edit.**
Leak Std Calibrated Flow	Flow value at which the Calibrated Leak Standard was certified.
Leak Std Calibrated Pressure	Pressure at which the Calibrated Leak Standard was certified.
Open Leak Std	Forces open the Leak Standard valve during normal testing. Once opened, it will always remain open until closed with this setting.
Fill	

Menu	Description
Timer	Amount of time allocated to each segment for execution before continuing.
Maximum Pressure	Maximum test pressure allowed during the Fill and Stabilization timers.
Ramp Method	Defines the physical harware and method utilized to generate the pressure ramp.
Starting Pressure	Initial pressure setpoints for the electronic regulator at the beginning of the ramp.
Target Pressure	Target pressure that is to be achieved by the electronic regulator
Ramp Rate	Rate at which pressure is increased by the electronic regulator during the Ramp timer.
Test	
Timer	Amount of time allocated to each segment for execution before continuing.
Maximum Pressure	Maximum test pressure allowed during the Fill and Stabilization timers.
Proof Pressure	Minimum pressure that must be maintained during the Test timer.
Add Event	
Exhaust	
Timer	Amount of time allocated to each segment for execution before continuing.

*Note: Some menus also include Add Event as the last option. Advanced users can see and add events when in **Edit** mode. See "Chapter 12 Events" on page 137 for more information on what menus also include Add Event.*

Tap 

→ **Save** when you are finished.

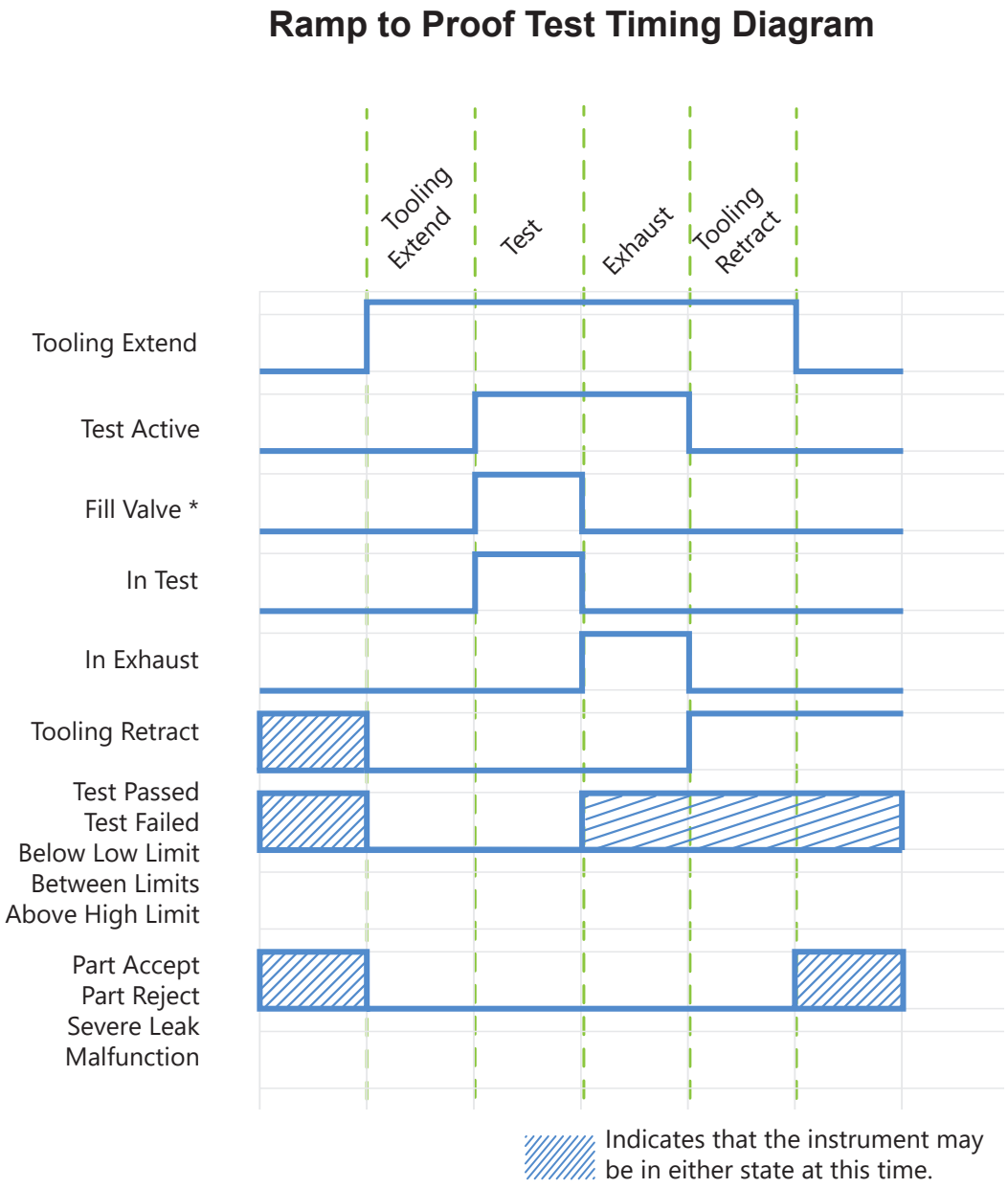

Figure 21-2. Timing Diagram

** Note: The Fill Valve in the timing diagram above is shown to indicate the timing of the valve in this test type. It is not a programmable event*

Appendix A
Messages & Error Codes

The following messages and error codes appear on-screen and through the communication ports.

Message	Description	Corrective Actions
Program Accept	Program evaluation was successful for multiple tests; all tests passed.	
AutoSetup Seq Complete	The autosetup sequence is complete.	
Program Calibration Failed	The test type can conduct a program calibration and this sequence was not successful.	
Master Part Complete	The test type can conduct a program calibration. The first phase of the sequence is complete.	
Program Calibration Passed	The test type can conduct a program calibration and this sequence was successful.	
Master+Leak Loss<Master Loss	During the program cal routine, the instrument measured a greater pressure loss for the master part by itself than for the master part with the leak in the second test. This resulted in a malfunction.	Increase the stabilization and possibly test time. Verify the leak standard.
Master Part Loss> Max Mstr+Leak Loss	The pressure loss during the first test of program cal on the master part exceeded the maximum Mstr+Leak loss set point. This results in a malfunction.	Check the seals and master part for leaks, or extend stabilization timer. Check that Max Mstr+Leak Loss was correctly set.
Master +Leak Loss > Max Mstr+Leak Loss	The pressure loss during the second test of program cal on the master part exceeded the max mstr+leak loss set point. This results in a malfunction.	Check the seals and master part for leaks, or extend stabilization timer. Check for leaks about leak standard. Check that max mstr+leak loss was correctly set.

Message	Description	Corrective Actions
Master Flow>Max M+L Flow	The flow value during the first sequence of program cal on the master part exceeded the max mstr+leak flow set point. This results in a malfunction.	Check the seals and master part for leaks, or extend fill or test timers. Check that max mstr+leak flow was correctly set.
Master Flow<Min Master Flow	The master flow value was less than the min master flow setpoint.	Check that the min master flow setpoint was set correctly. Verify the test line is connected to the test port and not the Self-Test cap.
Master+Leak Flow>Max M+L Flow	The flow value during the second sequence of program cal on the master part exceeded the max mstr+leak flow set point. This results in a malfunction.	Check the seals and master part for leaks, or extend fill or test timers. Check the leak standard. Check that max mstr+leak flow was correctly set.
Master Flow>Max Master Flow	The flow value during the first sequence of program cal on the master part exceeded the max master flow set point. This results in a malfunction.	Check the seals and master part for leaks, or extend fill or test timers. Check that max master flow was correctly set.
Master+Leak Flow<Master Flow	The flow value during the second sequence of program cal on the master part was less than the max master flow set point. This results in a malfunction.	Check the seals and master part for leaks, or extend fill or test timers. Check the leak standard. Check that max master flow was correctly set.
Master Loss<Min Master Loss	The pressure loss reading during the first test of program cal cycle for a pressure decay test was less than the min master loss set point. This results in a malfunction.	Check for blockage in the test line of part.
Cal Program Accept	The program calibration was successful.	
Calculation Error	This result occurs from illegal program configurations, calculation errors when trying to convert vacuum pressures to positive pressure readings, and similar occurrences.	Correct the Target Pressure settings or turn off Pressure Correction. Both settings are located in the Test cycle menu.
Cal Required - Limit Exceeded		
Min Perf Factor Error	The performance factor calculated at the end of program cal exceeds the minimum performance factor set in the test factors.	Check that the minimum performance factor was correctly set. Increase stabilize and test timers.

Message	Description	Corrective Actions
Calibration Required-Parameters Changed	The stabilization or test timers, target pressure, leak std flow, or Leak Std pressure have been changed since the last calibration and therefore the part needs to be recalibrated. There is no output resultant.	Recalibrate the instrument for this program.
Cal Program Reject	The program calibration was not successful.	
Elec Regulator Cal Complete	The electronic regulator calibration was successful.	
Elec Regulator Cal Error	The electronic regulator calibration was not successful.	Check the wiring of the electronic regulator. Check that the entry of each pressure calibration point was correct.
Part Evac Fault	Not Used.	
Prog Error	There was an error with the program. Please contact the factory.	
System Error - Service Req	There was an error with the instrument. Please contact the factory.	
Flow Transducer Over Range	The flow sensor measured a value out of its range. The instrument stopped the test sequence to prevent damage to the sensor.	
Error: Excessive Flow	The flow sensor measured a value out of its range. The instrument stopped the test sequence to prevent damage to the sensor.	
Error: Excessive Flow	Prog Error.	Check the flow sensor wiring. If this happens multiple times, replace the flow sensor.
Helium Background Fault	Not Used.	
Invalid Calibration Data	The calibration data has been corrupted or improperly entered. Please calibrate the unit again.	
I/O Fault	Not Used.	
Invalid I/O Configuration	Not Used.	
Invalid Program Selected	The program selected does not exist or has not been configured.	Check BCD Input programming.

Message	Description	Corrective Actions
Leak Std Select Config Error	Configuration Error. The instrument was not configured properly.	
No Event Occurred	An expected event did not occur.	
Above Target Pressure	The instrument will stop conducting a test if the pressure rises above the target pressure window setting.	Check pressure regulator setting, cut seals, bad parts, or tooling control pressure by testing with master part.
Below Target Pressure	The instrument will stop conducting a test if the pressure drops below the target pressure window setting.	Check pressure regulator setting, cut seals, bad parts, or tooling control pressure by testing with master part.
Part Not Changed	The present input signal did not go low between tests to indicate that the part was removed from the fixture after the last test. This results in a Malfunction.	Remove the part after each test.
Part Configuration Error	There was an error in the way the program was configured.	
Part Not Full	This is an error in the AutoSetup Sequence that can occur if the instrument fails to fill the part to the desired pressure.	
Test Pressure Low		
Test Pressure High		Check pressure regulator setting and tooling control pressures.
Error: Part Not Present	The part present input is set for the active program and the input was not received.	Check the part presence sensor and input wiring.
Part Not Stabilized	This is an error in the AutoSetup Sequence that can occur if the instrument fails to stabilize the part.	
Part Not Exhausted	This is an error in the AutoSetup Sequence that can occur if the instrument fails to exhaust the part.	
Sequence Complete	Sequence complete.	
Program Reject	Program evaluation was not successful, for multiple tests; if any test fails, the part is rejected.	
Part Reject - Level 1	Not Used.	
Part Reject - Level 2	Not Used.	
Part Reject - Level 3	Not Used.	

Message	Description	Corrective Actions
Source Pressure Exceeded	The source pressure set by the factory on the hardware configuration menu was exceeded.	
Stop Button Pressed	The Stop button or a stop part input was received.	
Start Common Input Low	Not Used.	
Pressure Select Config Error		
Self-Test Failed	Self-Test Failed.	Make sure the test line was removed and the test port plugged before the test was conducted. One of the internal valves may be leaking.
Error: Stop Input High	The instrument cannot start a test if the Stop input is high.	
Stop Input Received	Stop Input Received.	
Severe Leak	The test process did not achieve Minimum Pressure before reaching the Prefill set point, or failed to maintain Minimum Pressure during fill or Stabilization timers. This results in a Program Reject.	Check pressure regulator setting, cut seals, bad parts, or tooling control pressure by testing with master part.
Self-Test Passed	Self-Test process indicates no internal leak.	
System Pressure Exceeded	The system pressure of the unit was exceeded.	Check the pressure source and regulators.
Tooling Not Reset	A tooling error has occurred, and the tooling needs to be reset by the Stop/Reset input. This results in a Malfunction.	Push the Stop/Reset Input and possibly Common to return the tooling to the Start position.
Test Port Select Config Error	The instrument configuration is not correct.	
Error: Tooling not Retracted	The instrument may not start a sequence if all of the tooling is not retracted.	
Tooling Reset	Most tooling errors or some test errors may require a tooling reset with the Stop/Reset input. After completion of the reset, this message appears.	

Message	Description	Corrective Actions
Error: Tooling not Extended	If the instrument is configured for tooling feedback this error will occur if the tooling feedback input is not received within the time allocated.	Check feedback sensor and input wiring. Make sure the tooling motion feedback timer is set properly.
Vent Part Reset Tooling	Message sent when retain part pressure and tooling are both configured to be used. This message is sent upon a reset.	
Transducer Cal Complete	The transducer calibration is complete and was successful.	
Transducer Cal Error	There was an error when trying to calibrate the transducer.	Check transducer wiring.
Pressure Transducer Fault	Not used.	
External Switch did not go high	The External Pressure Switch input did not go high before the end of the fill timer. This results in a Malfunction.	Check the pressure switch. Make sure that the path to the pressure switch is not blocked.
External Switch did not go low	The External Pressure Switch input did not go low between tests. This results in a Malfunction.	Check pressure switch to make sure it is functioning.
Transducer Over Range	During the testing process the pressure exceeded the range of the transducer. This results in a Malfunction.	Check the pressure regulator setting.
Transducer Verify Complete	The transducer verification sequence is complete.	
Transducer Zero Bad	The pressure transducer's atmospheric pressure reading at the beginning of the testing cycle is outside of tolerance. This results in a Malfunction.	Perform transducer calibration routine in Self-Test.

Appendix B
Quik Test

This appendix explains the theory and parameters for reducing the test time for obviously good and obviously bad parts, without sacrificing the accuracy for marginal parts. This capability is called Quik Test in the instrument. Quik Test is available in the Pressure Decay-Leak Std test type that conducts a Program Calibration using a leak standard.

How it works

Most manufacturing processes produce the desired quality of product a high majority of the time. These parts easily pass the leak test being performed on them. Conversely, most defective parts reject by a wide margin. Quik Test monitors the pressure or flow signal during the test and ends the test early for parts that easily pass or easily reject. Any marginal parts that are within the parameters set by the Quik Test HL (High Limit) Band and Quik Test LL (Low Limit) Band will utilize the entire Test time to ensure the accuracy of the result.

At the desired time in the Test sequence determined by the Quik Test Percent parameter the instrument calculates the projected leak rate and compares it with the Quik Test Low Limit and High Limit Bands. If the projected leak rate is within either of these two bands, the test continues to the end of the test timer. If the instrument's projected leak rate is outside of these bands, it will stop the test, output the results according to the Test Evaluation criteria, and display the projected leak rate.

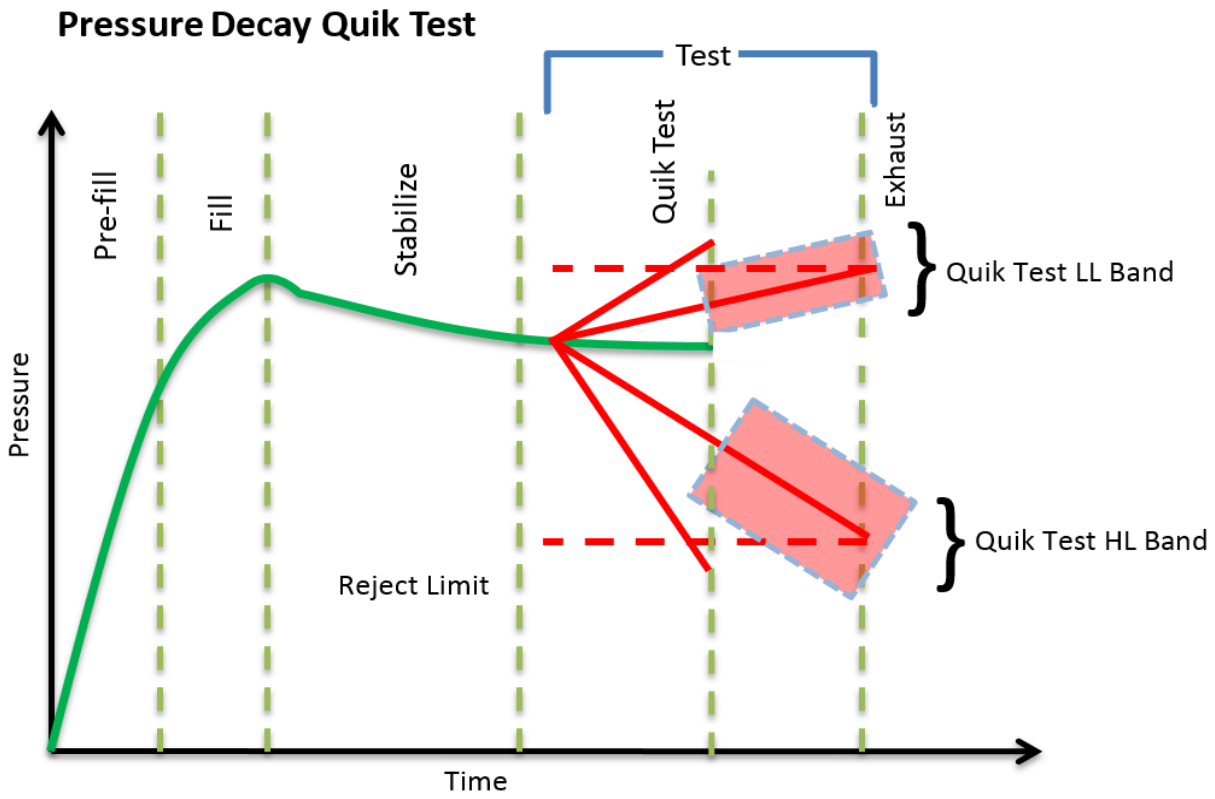

Figure 23-2. Pressure Decay-Leak Std Quik Test Graph

The prior chart shows the master part curve, the Low Limit with its LL Quik Test band limit, and the High Limit with its HL Quik Test band limit. If the pressure loss is within either the LL Quik Test band or HL Quik test band at the QT% of Test Timer, the test will continue and complete the entire test cycle. If the results are outside the limit bands at the QT% of Test Timer, the test will stop and the test result will reflect the Test Evaluation criteria. Setting narrow bands about the Low Limit and High Limit is a very aggressive approach that will greatly limit the number of tests that run to the end of the test timer. Set wider bands as a more conservative approach to Quik Test.

An initial analysis of Quik Test should be performed before actually implementing this feature by setting “Quik Test” to Enabled and establishing the “Quik Test Timer” at 10, 25, 50, 75, or 90% of the normal Test segment timer. A Program Cal must be

performed after setting the “Quik Test Timer” to measure the typical leak response curve for the test. Test production parts over a reasonable time (up to 1000 parts in various production conditions). The instrument projects a leak rate at the Quik Test Timer and then completes the full test cycle and calculates the leak rate for the complete test. The instrument stores the test results that include both the actual complete test result and a projected test result based on the Quik Test measurement. By comparing the two leak rate results, a percent of error for the Quik Test feature can be calculated. If the results are satisfactory, the Quik Test feature can be implemented by setting appropriate High Limit and Low Limit Bands based on the test comparison and enabling Quik Test. This feature will save the time difference between a full test time and the Quik Test Time for almost all of the accepted parts and most of the rejected parts. If the results are not consistent to each other, test further by increasing the Quik Test Timer, re-calibrate the instrument, and compare the results again.

Quik Test Settings Menu

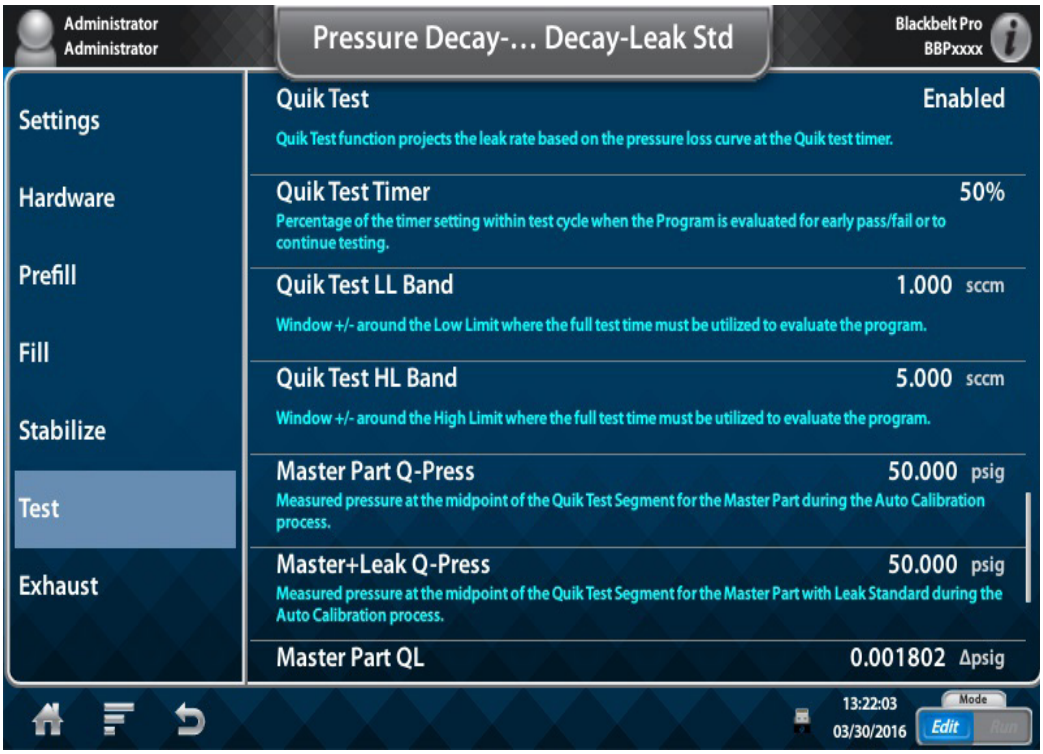

Figure 23-1. Pressure Decay-Leak Std Menu Displaying Quik Test Options

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Appendix C
Environmental Drift Correction

Environmental drift correction (EDC) continuously monitors, and corrects for, slow changes in the test environment. These changes include changes to room temperature, part temperature, test air temperature, part elasticity, part absorption, and more.

EDC defines how wide of a variance around the **Master Part Loss** or **Master Part Flow** value will be considered normal for a non-leaking part. The instrument continuously calculates a running average of test results that fall within this percentage about the original non-leaking master part curve. It corrects each future result by the calculated drift determined from previous test results. The drift value is calculated as shown.

$$\text{Environmental Drift Correction} = \frac{\Sigma n \text{ Flow}}{n} - \text{Master Part Flow}$$

Typical settings for EDC are 10%, 25%, 50%, 75%, and 90%. The sample size is set as EDC quantity (3 or greater). Flexible parts require greater correction than rigid parts. The EDC effectively defines how much shift can occur. This limits the routine from continuing to compensate for possible growing leaks in the seal or test pneumatics.

Environmental Drift Correction (EDC) will reset upon any of the following conditions:

1. Instrument power-cycle (due to limitations in instrument non-volatile storage)
2. Change of any variables that affect EDC calculations:
    a. EDC Configuration change (modification the variables: EDC Enabled, EDC Percentage, or EDC Quantity)
    b. Test Limit change (modification of the variable: High Limit [Loss/Leak/Rate])
3. Program idle time-out: 1 hour elapsed since last test on matching program number

Note: The act of changing the selected active program does not reset the Environmental Drift Correction feature. A user can switch between multiple programs (EDC data is stored per program), as long as the amount of time from the last time the similar program number was run does not exceed the 1 hour time-out.

To configure EDC for a test, tap  to return to the **Home** screen if necessary.

Tap 

, then tap the **program name** containing the test for which you want to configure EDC. Tap  → 

.

Tap the test to modify, then tap  . Tap 

to enter **Edit** mode, then tap **Test**.

The following settings control EDC.

EDC Settings	Description
EDC	When enabled, Environmental Drift Correction monitors and continually corrects final Leak rate calculations based on the moving average shift of test results within a band about the Master Part calibration curve.
EDC Percentage	Percentage band (plus and minus), defined by a percentage of High Limit, about the Master Part curve.
EDC Quantity	Number of test results utilized in calculating the Environmental Drift Correction factor.

Note Only Advanced users can enable and configure EDC.

To enable EDC, tap **EDC** → **Enabled** → 

.

To choose the percentage used to calculate variance, tap **EDC Percentage**. Tap the desired percentage (**10%, 25%, 50%, 75%, or 90%)**, then tap 

.

To set the number of tests used to calculate drift correction, tap **EDC Quantity**. Type the desired number using the on-screen numeric keypad, then tap 

.

Enable and configure EDC as needed, then tap 

→ **Save**.

Appendix D - Electronic Regulator Compensation

This appendix explains the theory and parameters for implementing the Electronic Regulator Compensation (ERC) feature.

How it works

The Electronic Regulator Compensation (ERC) routine helps the instrument to compensate for electronic regulator calibration error (drift from calibrated setpoint). This allows the instrument to reach the desired target pressure. The ERC method can be set to “Optimize Fill Pressure” or “Optimize Test Pressure”, or “Optimize Source Pressure”.

The below graph represents a test with ERC disabled. In this example, the electronic regulator is not calibrated for Target Pressure, so the pressure set during the test has deviated.

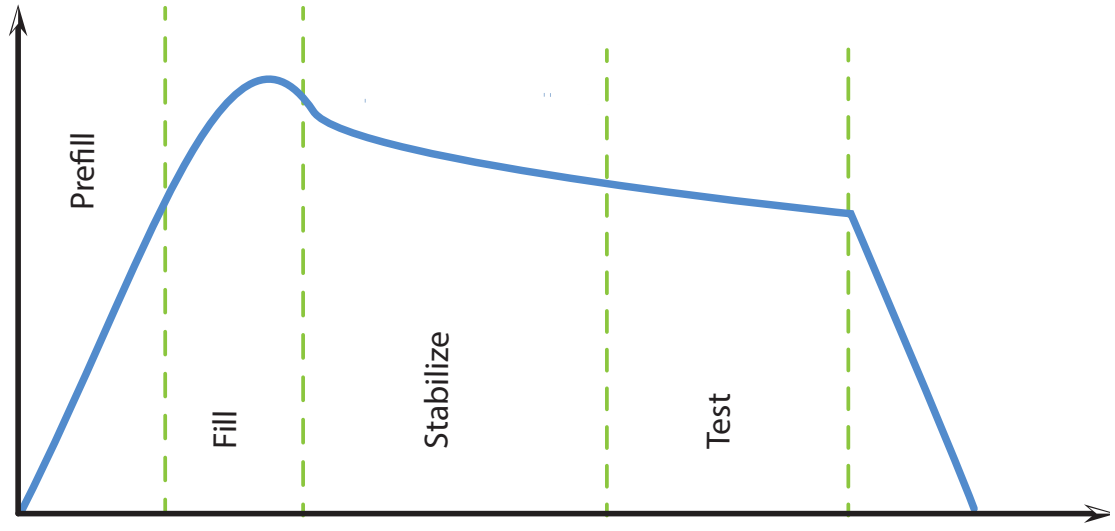

Figure 1 ERC Method Disabled

In the **Optimize Test Pressure** method, ERC enables the instrument to adjust the regulator pressure setting to obtain the optimal measured test pressure, as determined by the **Target pressure**.

In this method, the electronic regulator setpoint is adjusted on subsequent tests to force the measured test pressure to match the target pressure, based upon the stored result history of previous passed tests.

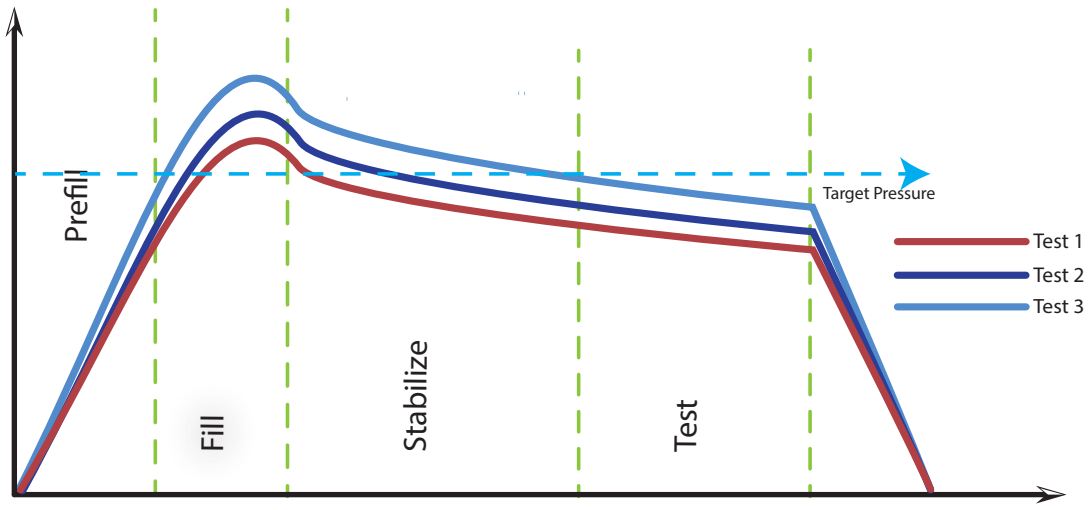

Figure 2: ERC Method Optimize Test Pressure

In the **Optimize Fill Pressure** method, ERC enables the instrument to adjust the regulator pressure setting to obtain the optimal measured fill pressure, as determined by the **Regulator Setpoint Pressure**.

In this method, the electronic regulator setpoint is adjusted on subsequent tests to force the measured fill pressure to match the target pressure, based upon the stored result history of previous passed tests

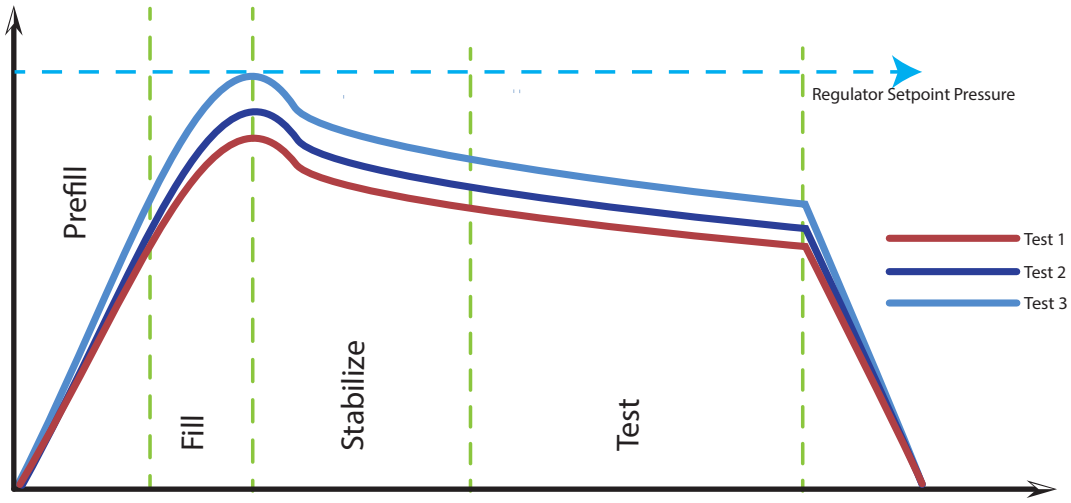

Figure 3: ERC Method Optimize Test Pressure

Note: The performance of "Optimize Test Pressure" or "Optimize Fill Pressure" methods depends on multiple iterations since it is based on the history of previous Accept tests. For these ERC methods, only tests that pass with the measured pressure that is inside the ERC target window will be added to the history.

ERC will reset based on any of the following conditions:

1. Instrument power-cycle (due to limitations in instrument non-volatile storage)

2. Change of any variable that affect ERC calculation
   - ERC Method
   - ERC Target Window
   - ERC Offset Limit
   - ERC Quantity

   To set ERC Parameters for any test, tap 

to enter **Edit** mode.

   Tap 

and choose the program you want to modify.

   Tap  → 

. Tap the test you want to modify, then tap →**Hardware**.

   The following parameters are available for ERC configuration:

Menu	Description
ERC Method	ERC method enables the instrument to adjust the regulator pressure setting to obtain the optimal measured pressure (fill pressure or test pressure), as determined by the Target Pressure.
ERC Target Window	Percentage (plus and minus) window about the target pressure, defining the maximum allowable test pressure to be utilized in the calculation for the ERC routine.
ERC Offset Limit	Maximum correction value, defined as a percentage of the target pressure, allowed for the ERC routine.
ERC Quantity	Maximum number of test results within the ERC target window used to calculate the ERC pressure offset.

Appendix E
Tables

The following table gives examples of the result output formats used by the Blackbelt Pro. The left column list could be used as the headers for a table of test results data output strings sent from the RS232 or Telnet ports.

Result Output Format Table

Measurement	Description	Example
Channel	Channel number (not used).	C01
Port	Test Port.	N1
Program	Test Program Number.	P04
Parent	Parent program number if used.	R01
Date	Date test started.	2/6/2015
Time	Time test stared.	15:22:47
Unique ID	Unique 32-bit integer for this test record.	12566
Evaluation	Evaluation code.	A
SPC Flag	Indicates if the SPC input was high.	-
Barcode		No_barcode
Test type	Pressure decay with leak standard.	PLR
Test Evaluation		P
Measurement Name	Leak Rate.	0.000559 sccm
Measurement Name	Pressure loss during the test timer.	0.000023 dpsig
Measurement Name	Test Pressure.	-0.000042 psig
Measurement Name	EDC Offset.	0.000000 sccm
Measurement Name	Predicted Leak.	0.000000 sccm
Measurement Name	Quik Loss.	0.000000 dpsig
Measurement Name	Quik Test Pressure.	-0.000042 psig
Measurement Name	Low Limit Leak.	-6.957539 sccm
Measurement Name	High Limit Leak.	27.831831 sccm
Measurement Name	Corr. Leak Std Flow.	34.789928 sccm
Measurement Name	Master Part Loss.	0.000000 dpsig
Measurement Name	Master+Leak Loss.	0.749999 dpsig
Measurement Name	Master Part QL.	0.000000 dpsig
Measurement Name	Master+Leak QL.	0.749999 dpsig
Measurement Name	Fill Pressure.	-0.000042 psig

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Appendix F
FAQ

Q.

Why does the Blackbelt Pro instrument give a calculation error when attempting to set up a vacuum decay test?

A.

The default value for a Target Pressure is 50 psig. If you are setting up a vacuum decay test, set the Target Pressure to the actual vacuum level, for example, -5 psig or 5 psiv. Alternatively, disabling **Pressure Correction** in the impacted test segment(s) may resolve the issue.

Q.

Why does the Blackbelt Pro instrument give a Minimum Pressure error in the Test segment when I have set my Target Pressure to -5 psig and that is what the instrument is reading through Fill and Stabilize segments?

A.

When setting the Minimum Pressure and Maximum Pressure limits, use this rule: Set the Minimum Pressure limit between zero and the Target Pressure and set the Maximum Pressure more negative than the Target Pressure.

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Appendix G
Communication Code Tables

This appendix lists the codes that are referenced in the notes of Chapter 8 – Communication. Each table can be generated within the communications interface by providing the associated command denoted.

Segment Codes

	Segment Codes	Description
1	MOT	Tooling retract/extr
2	T	Tooling reset
3	PRE	Prefill segment
4	FIL	Fill Segment
5	STB	Stabilize segment
6	EXH	Exhaust segment
7	PRT	Relax segment
8	ARR	Autorun relax
9	TDC	Pressure decay Loss test segment
10	TDR	Pressure decay rate test segment
11	TDL	Pressure decay Leak std test segment
12	TOC	Occlusion test segment
13	TPV	Pressure verify test segment
14	TFO	Mass Flow test segment
15	TFL	Mass Flow Leak Std test segment
16	STR	Set Regulator
17	ERA	E Regulator Analyze
18	ERS	E regulator Setpoint
19	ERZ	E regulator Zero
20	XDR	Pressure transducer Analyze
21	XDS	Pressure transducer calibration
22	XDZ	Pressure transducer Zero
23	XDV	Pressure transducer verification
24	XAP	Pressure transducer ATM pressure check
25	FTR	Mass Flow transducer Analyze
26	FTZ	Mass Flow transducer Zero

	Segment Codes	Description
27	FTS	Mass Flow transducer Setpoint
28	FTV	Mass Flow transducer verification

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Blackbelt Pro Technical Specifications

Outside Physical Dimensions

Benchtop model (L x W x H): 559 x 275 x 327 (mm) 22 x 10.8 x 12.9 (inches)

Wall mount model (L x W x H): 262 x 430 x 384 (mm) 10.3 x 16.9 x 15.1 (inches)

Electrical Specifications

Supply power: 88-264 VAC 50/60 Hz auto sensing/switching

Instrument may operate at ± 10% of nominal voltage

Input power fuse: 3 Amp 250VAC, slow, 5X20MM, glass

I/O driver fuse: 1 Amp 250VAC, fast, 5X20MM, glass

Output current limit for each output: 1 amp max

Output current limit for all outputs combined: 1 amp max

Environmental Factors

Operating temperature Range: 5°C to 40° C (41°F to 104°F)

Maximum humidity 90% relative humidity, non-condensing

Maximum operating altitude 2,500 meters (8,200 feet)

Indoor use only, IP20

Inlet Ports	Connection Type & Max Pressure Rating
P1 1/4” plastic tubing push in fitting	Vacuum to 200 psi*
Pilot 1/8” plastic tubing push in fitting	65 to 105 psi
P2 1/4” plastic tubing push in fitting	Vacuum to 200 psi*
Hi Press 1/8” FNPT	0 to 500 psi

* See label on instrument enclosure to determine whether port is for pressure or vacuum

Air Cleanliness Specifications

Max Particulate Size: 0.3 micron

Max Dew Point: -30°C

Max Oil: 0.1mg/m3

Recommended Filter Sets (each set includes 5.0 micron and 0.3 micron filters)

SENTINEL -FILTER SET: SMALL -- for parts less than 300 ml

SENTINEL -FILTER SET: MEDIUM -- for parts from 300 ml to 13,000 ml

SENTINEL -FILTER SET: LARGE -- for parts larger than 13,000 ml

Contact Cincinnati Test Systems Customer Service Dept.

By phone 513-202-5108 or by email service@cincinnati-test.com 8am-5pm eastern US

For after-hours emergency phone support, call 513-202-5174 (24 hours x 7 days)

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