CINCINNATI TEST SYSTEMS

Your Global Leak and Function Test Solution Experts



IM

IMPORTANT INFORMATION

SENTINEL IX5

USER MANUAL

REV 2.3

06/12/2026

Information in this document is subject to change without notice and does not represent a commitment on the part of Cincinnati Test Systems, Inc. No part of the manual and/or software may be reproduced or transmitted in any form or by any means, electronic or mechanical, including photocopying, recording, or information storage and retrieval systems, for any purpose, other than the purchaser's personal use, without the express permission of Cincinnati Test Systems, Inc.

No patent liability is assumed with respect to the use of the information contained herein. While every precaution has been taken in the preparation of this book, Cincinnati Test Systems, Inc., assumes no responsibility for errors or omissions.

Because of the variety of uses for this equipment and because of the differences between this solid-state equipment and electromechanical equipment, the user of and those responsible for applying this equipment must satisfy themselves as to the acceptability of each application and use of the equipment. In no event will Cincinnati Test Systems be responsible or liable for indirect or consequential damage resulting from the use or application of this equipment.

The illustrations, charts, and layout examples shown in this manual are intended solely to illustrate the text of this manual. Because of the many parameters and requirements associated with any installation, Cincinnati Test Systems cannot assume responsibility or liability for actual use based on the illustrative uses and applications.



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.

© 2025 Cincinnati Test Systems

This page is intentionally blank.

Table of Contents

Chapter 1 – Introduction 1

Unpacking 1
Instrument Attachment & Clearance 1
Installation 1
Instrument's Touchscreen 4
Basic Touch Gestures 4
Touchscreen Care and Maintenance 4
User Interface Navigation 5
Menu Structure 8

Chapter 2 – Setup 9

Sequencing Program 9
Selection of Test Types 10
Test Type Table 12
Tooling Control 15
Programming the Inputs and Outputs 15
Hardware Configuration 15
Setting the Units of Measure 15
Setting the Leak Standard Values 16
Program Configuration 17
Pressure Select 17
Setting the Pneumatic Regulator 17
Setting the Test Parameters 17
Verifying Setup 18
Security 18
Backup the Instrument Settings 18

Chapter 3 – Pressure Decay-ΔP 19

Timer Parameters 20
Pressure Parameters 21
Test Parameters 22

Chapter 4 – Pressure Decay-ΔP/ΔT 25

Timer Parameters 26
Pressure Parameters 27
Test Parameters 28

Chapter 5 – Pressure Decay-Leak Std 31

Auto Setup Sequence 32
Timer Parameters 34
Pressure Parameters 35

Test Parameters 36
Program Calibration 39
Initiating the Program Cal Sequence 40
Performance Factor 40
Conditions for a Successful Calibration 40
Calibration Parameters 41
Chapter 6 – Occlusion 43
Timer Parameters 44
Pressure Parameters 44
Test Parameters 44
Chapter 7– Pressure Verify 47
Timer Parameters 48
Pressure Parameters 48
Test Parameters 48
Chapter 8 – Mass Flow 51
Timer Parameters 51
Pressure Parameters 53
Test Parameters 54
Program Calibration 55
Initiating the Program Cal Sequence 55
Calibration Parameters 55
Direct Flow Parameter 55
Pre-Regulation 56
Mass Flow Setup 56
Setting the Pre-Regulator 57
Pre-Regulated Devices 57
Chapter 9 – Mass Flow-Leak Std 59
Timer Parameters 60
Pressure Parameters 61
Test Parameters 62
Program Calibration 63
Initiating the Program Cal Sequence 64
Conditions for a Successful Calibration 64
Calibration Parameters 65
Direct Flow Parameter 65
Pre-Regulation 66
Mass Flow Setup 66
Setting the Pre-Regulator 67
Setting the Pre-Regulator 67
Pre-Regulated Devices 68
Chapter 10 – Ramp to ΔP Event 69

Timer Parameters 70
Pressure Parameters 70
Test Parameters 71
Chapter 11 – Ramp to Input Event 73
Timer Parameters 74
Pressure Parameters 74
Test Parameters 75
Chapter 12 – Ramp to Flow Event 77
Timer Parameters 78
Pressure Parameters 78
Test Parameters 79
Chapter 13 – Ramp to Proof 81
Timer Parameters 82
Pressure Parameters 83
Test Parameters 83
Chapter 14 – Sequence Editor 85
Sequence Editor 85
Sequence Editor parameters 87
Program Selection and Evaluation conditions 88
Program Selection 88
Evaluation conditions 88
Tooling Parameters 89
Sequence Delay 90
Prompt 90
Managing Sequence Flow 91
Sequence Calibration 92
Sequence Result screen 92
Sequence Test Configuration & Result Management 93
Chapter 15 – Diff Pressure Decay-ΔP 95
How it works 95
Test Setup 96
Timer Parameters 98
Pressure Parameters 99
Test Parameters 100
Chapter 16 – Diff Pressure Decay-ΔP/ΔT 101
How it works 101
Timer Parameters 102
Pressure Parameters 103
Test Parameters 104
Chapter 17 – Diff Decay-Leak Rate 108
How it works 108

Test Setup 109
Timer Parameters 111
Pressure Parameters 111
Test Parameters 112
Chapter 18 – Diff Pressure (DP) Decay-Leak Std 115
How it works 115
Leak Standard Pneumatic Diagrams 116
Test Setup 117
Timer Parameters 119
Pressure Parameters 120
Test Parameters 121
Program Calibration 122
Initiating the Program Cal Sequence 124
Performance Factor 124
Conditions for a Successful Calibration 124
Calibration Parameters 125
Chapter 19 – Volume 127
Timer Parameters 128
Pressure Parameters 129
Test Parameters 130
Chapter 20 – Volume, Pressure Decay-Leak Std 131
Timer Parameters 132
Pressure Parameters 134
Test Parameters (Volume) 135
Test Parameters (Pressure Decay-Leak std) 135
Chapter 21 – Differential Mass Flow 139
Timer Parameters 140
Pressure Parameters 141
Test Parameters 142
Program Calibration 144
Initiating the Program Cal Sequence 144
Conditions for a Successful Calibration 144
Calibration Parameters 145
Chapter 22 - Gross Decay-ΔP Test 147
Timer Parameters 148
Pressure Parameters 149
Test Parameters 150
Chapter 23 - Gross Decay-Leak Std Test 153
Timer Parameters 154
Pressure Parameters 155
Test Parameters 156

Program Calibration 159
Initiating the Program Cal Sequence 160
Performance Factor 160
Conditions for a Successful Calibration 160
Calibration Parameters 161
Chapter 24 – Tooling Control 163
Menus 164
Part Mark 164
Motion Configuration 165
Advance Tooling options 168
Advanced Tooling Motion Example 1 168
Advanced Tooling Motion Example 2 168
Advanced Tooling Motion Example 3 169
Advanced Tooling Motion Example 4 170
Advanced Tooling Motion Example 5 171
Chapter 25 - Accessories 173
Enhanced Fill Accessory 173
Diverter Accessory 174
Chapter 26 – Inputs and Outputs 177
Input and Output Wiring 177
Input and Output Connector Pinout 177
Typical Configuration – Sinking Inputs, Sourcing Outputs 179
Input Pinout and Wiring Table 184
Output Pinout and Wiring Table 184
25 Pin Digital IO Cable Diagram and Pinout Table 185
Programmable Inputs and Outputs Menus 186
Inputs for Program Control 186
Inputs for Program Selection 189
Inputs for Program Calibration 190
Outputs for Test Cycles 190
Outputs for Program Calibration 191
Outputs for Program Results and Test Results 192
Timing Graph 192
Chapter 27 – EtherNet/IP 195
Instrument EtherNet/IP Functionality 195
Features 195
Compatibility 195
Standard Fixed, Defined Inputs/Outputs 195
Setting EtherNet/IP User Defined Inputs and Outputs 196
Additional Reference Document 196
Establishing EtherNet/IP Communication 197

Chapter 28 – PROFINET 199
Instrument PROFINET Functionality 199
Features 199
Compatibility 199
Standard Fixed, Defined Inputs/Outputs 199
Setting PROFINET User Defined Inputs and Outputs 200
Additional Reference Document 200
Establishing PROFINET Communication 200
Chapter 29 – Communication 203
RS232 Connector Pinout 203
Establishing RS232 Communication 204
Establishing TELNET communication 204
Understanding the Header Information 205
Structure Breakdown 205
Header Field Description 205
Table of Data Type or Header Codes 205
CRC Calculation Method 206
Test Results via RS232 or Ethernet (Telnet) Communications 207
Streaming Measured Data 209
Parsing Data Packets 209
Reports 210
CTS DataHub 210
Email Setup 211
Chapter 30 - Notification 213
Chapter 31 – CTSnet 215
Initial Startup 215
Monitor Screen 217
Summary Tab 217
IO Tab 218
Results Screen 219
Results Tab 219
Counters Tab 220
Statistics Tab 220
Configuration Screen 221
Program Configuration Tab 221
Chapter 32 – User and Security 227
Activate User and New User creation 227
Activate User 227
New User creation 227
Switch User 230
Delete User 231

Security 231
Parameters 231
Chapter 33 – Features 233
Setting the Date & Time 233
Copy & Paste Programs 233
Open Internal Leak Standard 233
Selecting the Proper Internal Leak Standard 233
Changing the Functionality of the Prefill Timer 234
Exhaust Method 234
Saving a Barcode with Results 235
Exhaust Hold 235
Rules for Standard test type Exhaust hold execution 236
Rules for sequence test type Exhaust hold execution 236
Turning On/Off Target Pressure Correction 236
Ambient Factor 237
Ambient Pressure correction 237
Max Ambient Delta 238
Setting the Cal Method and Leak Standard Location 238
Autorun 239
Malfunction evaluation as Reject 239
Batch Calibration 240
Prefill Pressure Check 241
Custom Panel 241
Chapter 34 – Barcode 243
Supported Barcode Scanners 243
Barcode Scanner Requirements and Specifications 243
Supported Barcode Length 243
Supported Character Set 243
Recommended Scanner Specifications 244
Settings and Configuration 244
Connect Scanner to device 245
Verify Operation 245
Step 1: Perform a Successful Scan 245
Step 2: Check for Device Recognition 245
Troubleshooting 245
Issue: No Data Output After Scanning 246
Issue: Scanner Not Responding 246
Chapter 35 - USB Import and export 247
Import Functionality 247
Export Functionality 248
System Update 248

USB Eject Functionality 250
Data To USB Functionality 250
Chapter 36 – Self-Test and Instrument Calibration 253
Verifying a Transducer 253
Calibrating a Transducer 253
Transducer 1 Cal Menu (Pressure) 253
Transducer 2 Cal Menu (Flow) 254
Transducer 2 Cal Menu (Differential Pressure) 255
Calibrating an Electronic Regulator 255
Self-test 256
Chapter 37 – Monitor Screen Example 257
Monitor Screen Examples 257
Home screen 257
Graph Screen 258
Device IO Screen 259
IP I/O Screen 259
Chapter 38 – Results Screen Examples 261
Result Data Screens 261
Chapter 39 -Webserver 265
System Requirements 265
Viewing the Web Server 265
Home Page 265
Web Server login 266
Navigation - Web Server 266
Parameter Configuration via Web Server 270
Appendix A – Messages & Error Codes 271
Test Messages & Errors 271
Appendix B – Quik Test 281
How it works 281
Test Parameters 282
Appendix C – Environmental Drift Correction 283
How it works 283
EDC Parameters 284
Appendix D – Electronic Regulator Compensation 285
How it works 285
Test Parameters 289
Appendix E – Communication Code Tables 291
Data Type or Header Codes 291
Segment Codes 292
Test Data or Variable Identifier Codes 295
Test Evaluation String and Code 304

Index **309**
Sentinel X5 Technical Specifications **313**

Chapter 1 – Introduction

This chapter explains the external pneumatic and electrical connections and introduces the simple menu structure and navigation of the instrument.

Thank you for purchasing the Sentinel X5 precision leak test instrument. The Sentinel X5 is capable of testing using a variety of pre-packaged test algorithms designed to get you testing as quickly and easily as possible. Let's get started

Unpacking

Carefully remove the instrument from the shipping carton. Locate the power cord and test port fittings supplied with the instrument. The test port should have a **Colder™** quick connect test port with Self-Test cap. Alternatively, you may install any suitable 1/4" NPTM fitting into the manifold test port. If this is not a standard instrument, see the print packet that shipped with your instrument.

Instrument Attachment & Clearance

This wall mount device is designed to attach to a mounting plate with dimensions of 8.98 inches (228 mm) wide and 8.23 inches (209 mm) high. Two mounting options are available.

- Forward Facing: Four rear mounting holes 0.17 inches(7mm) with a pattern of 1.77 inches (45mm) for vertical and 8.23 inches (213mm) for horizontal.
- Four rear mounting holes 0.17 inches(7mm) with a pattern of 1.77 inches (45mm) for vertical and 8.23 inches (213mm) for horizontal.

Note: These recommendations are also clarified in Product drawing available on website.

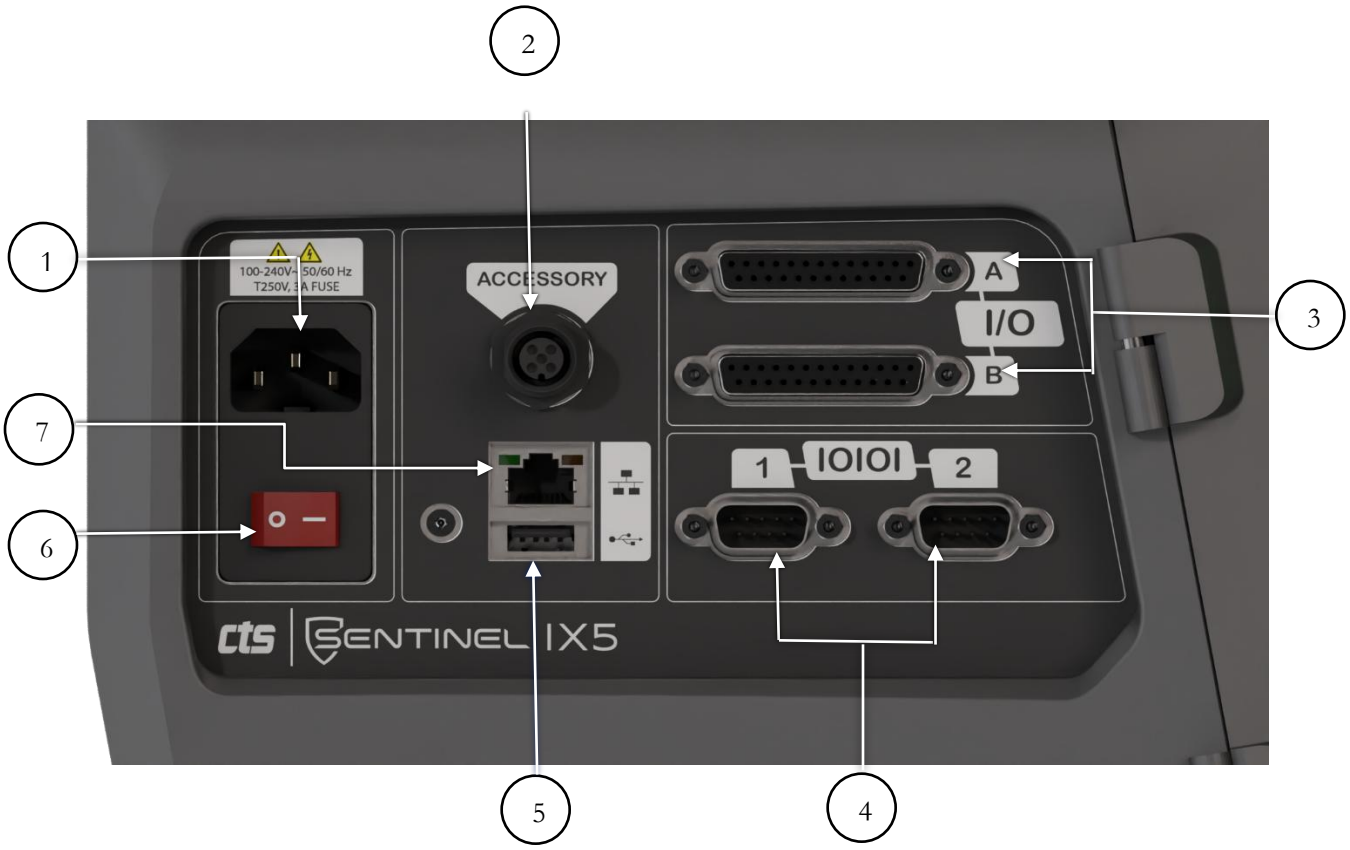
Installation

The leak test instrument is a modular, flexible instrument 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 (recommend 0.3 and 5.0-micron coalescing filter)
  - ISO 8573-1, Class 2 filters are recommended, with class 3 being acceptable.
- Vacuum for vacuum test applications
- Supply power: 100-240 VAC 50/60 Hz auto sensing/switching electrical, 110W capable

Because this is a precision instrument, it is preferable to locate this instrument at least 15 feet (5 meters) away from high electromagnetic energy devices (induction heat treat equipment and welders) whenever possible. In addition, plants having poor quality electrical power or ground systems should consider using isolation transformers on the power drops.

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



1 Power Cord Connector

2 Accessory

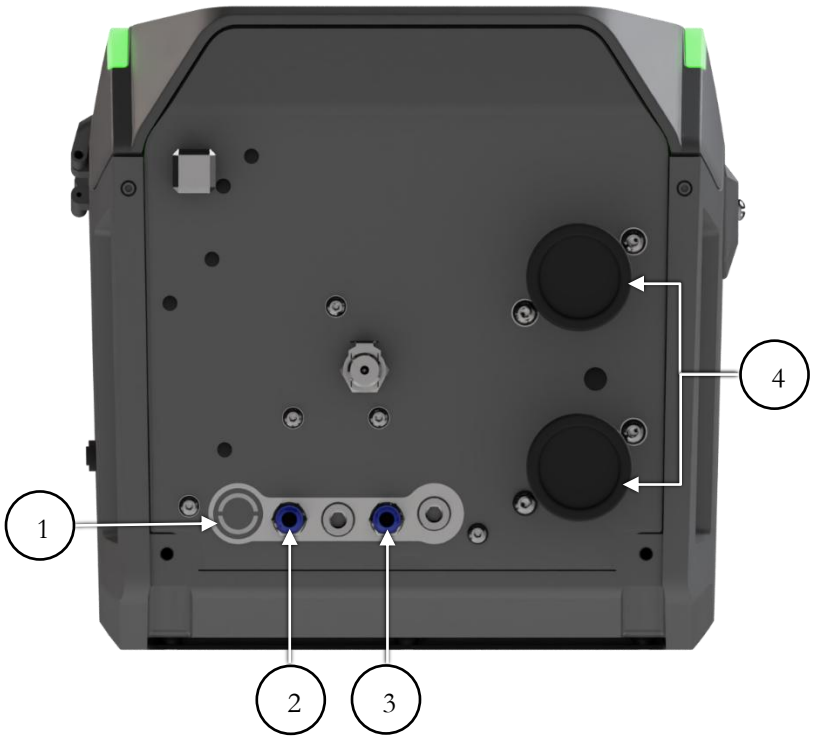
3 Hardware I/O Connector

4 Serial Ports

5 USB Barcode Input

6 Power Button

7 LAN Connection



1	Exhaust port	3	Pilot pressure supply
2	Source pressure supply	4	Regulators

Instrument's Touchscreen

This section introduces the touchscreen interface of the instrument, explaining how to interact with it and highlighting key features for optimal use.

Instrument has a responsive touchscreen that lets the user control different functions with simple gestures. The screen shows information clearly and is easy to understand, making it simple to navigate and use.

Basic Touch Gestures

- **Tap:** A quick touch with your fingertip selects an item, activates a button, or opens a menu.
- **Swipe:** Dragging your finger across the screen allows you to scroll through lists, navigate between screens, or pan across a display.
- **Pinch-to-Zoom:** Placing two fingers on the screen and moving them apart zooms in, while moving them together zooms out.

Touchscreen Care and Maintenance

- **Cleaning:** Use a soft, lint-free cloth to gently wipe the screen. Avoid using excessive moisture or cleaning agents that contain harsh chemicals or abrasives.
- **Handling:** Avoid applying excessive pressure to the screen or using sharp objects that could cause damage.
- **Touchscreen Sensitivity:** The touchscreen is designed to be responsive to light touches. Avoid wearing gloves or using objects that might interfere with touch detection.

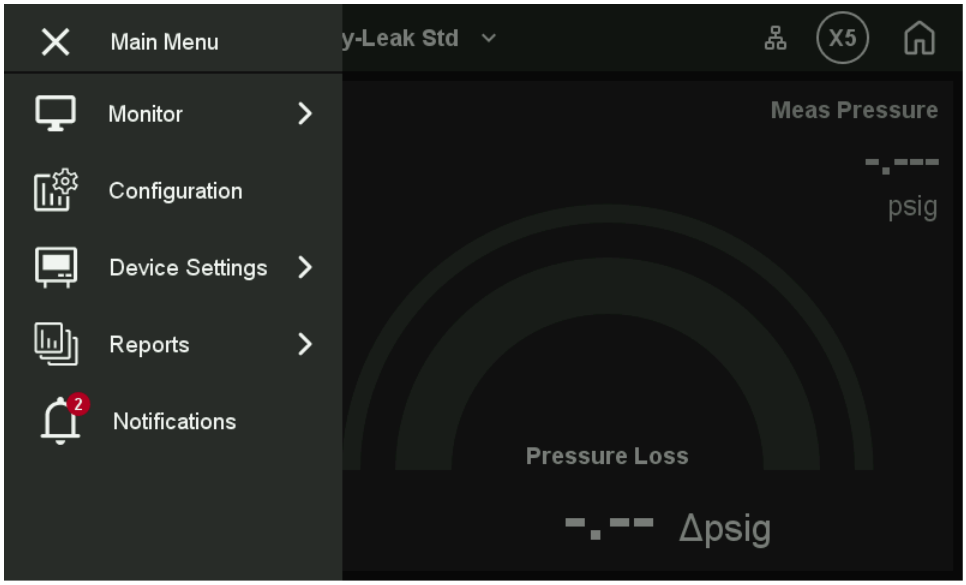
User Interface Navigation

There are multiple screens available for the instrument. This Home screen provides a comprehensive overview of the test. The touchscreen interface allows for easy interaction and control of the test procedure. The real-time display of test status, cycle time, measured pressure, and pressure loss provides immediate feedback to the operator.



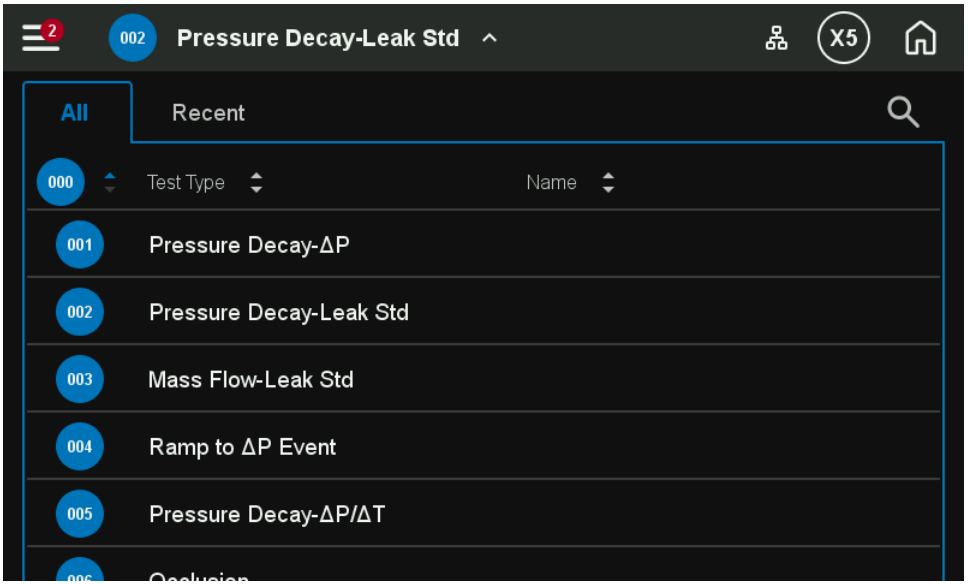
1. Menu Screen

Tapping this icon opens the main menu, providing access to other instrument functions and settings.



2. Program Selector

The upper left middle area displays the current test information like, numerical identifier for the test, full name of the current test. Dropdown arrow next to test name allows the user to select a different test from a list.



3. Status and Utilities

Top Right area contains several utility icons likes, USB icon, Network icon, USB functionality, User icon and Home icon.

	The **USB icon** on your device represents a convenient interface for managing system updates and exporting/importing data via a USB drive. This icon allows users to easily connect external devices and perform important system functions. To check the More on USB, refer the Chapter 35 - USB Import and export
	The **Network icon** provides real-time information about the instrument's communication with different interfaces, using different colors to indicate the status of each connection.
	The **USER icon** on your device allows you to quickly access information about the current user and manage user accounts. To check the more on users, refer Chapter 32 – User and Security
	The **USB functionality** on your device allows you to take snapshots of your system's current state and export those results to an external USB drive.
	**Home Icon** navigates the user back to the instrument's main home screen.

The main part of the screen is divided into distinct sections.

4. Test Status

The Upper left section displays the current state of the test. This displays the elapsed time for the current test cycle in seconds. This value updates in real-time while the test is running.

5. Custom Panel

Cycle Counters provide a valuable summary of the test results over multiple runs, giving the user insight into the overall performance and reliability of the device under test and the test setup itself. To change the custom panel, check the chapter number 30, Custom Panel

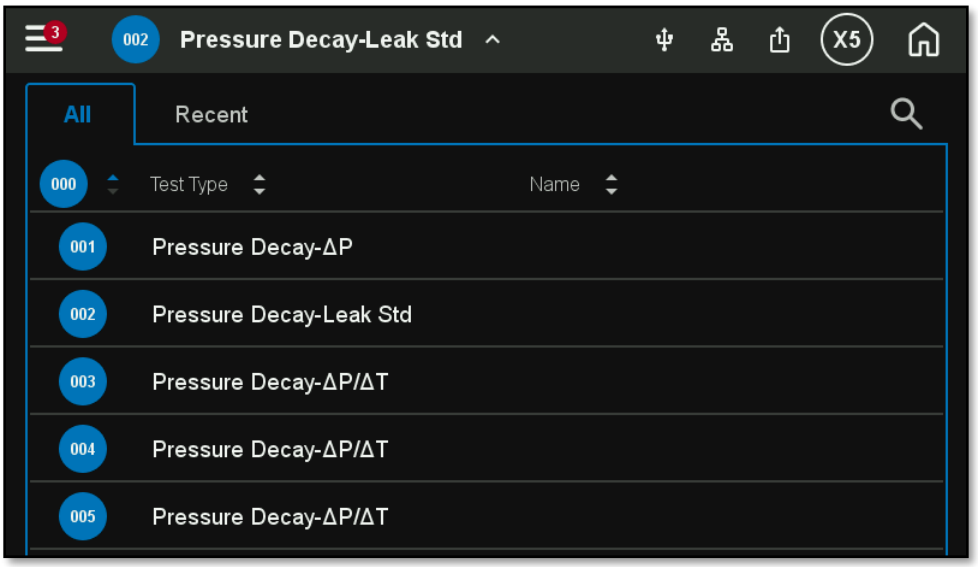
6. Test Data

The Center/Right display identifies as a Measurement Display. This area graphically and numerically presents the test results.

7. System Notifications

The Bottom section of screen displays any information that needs to be notified to the user.

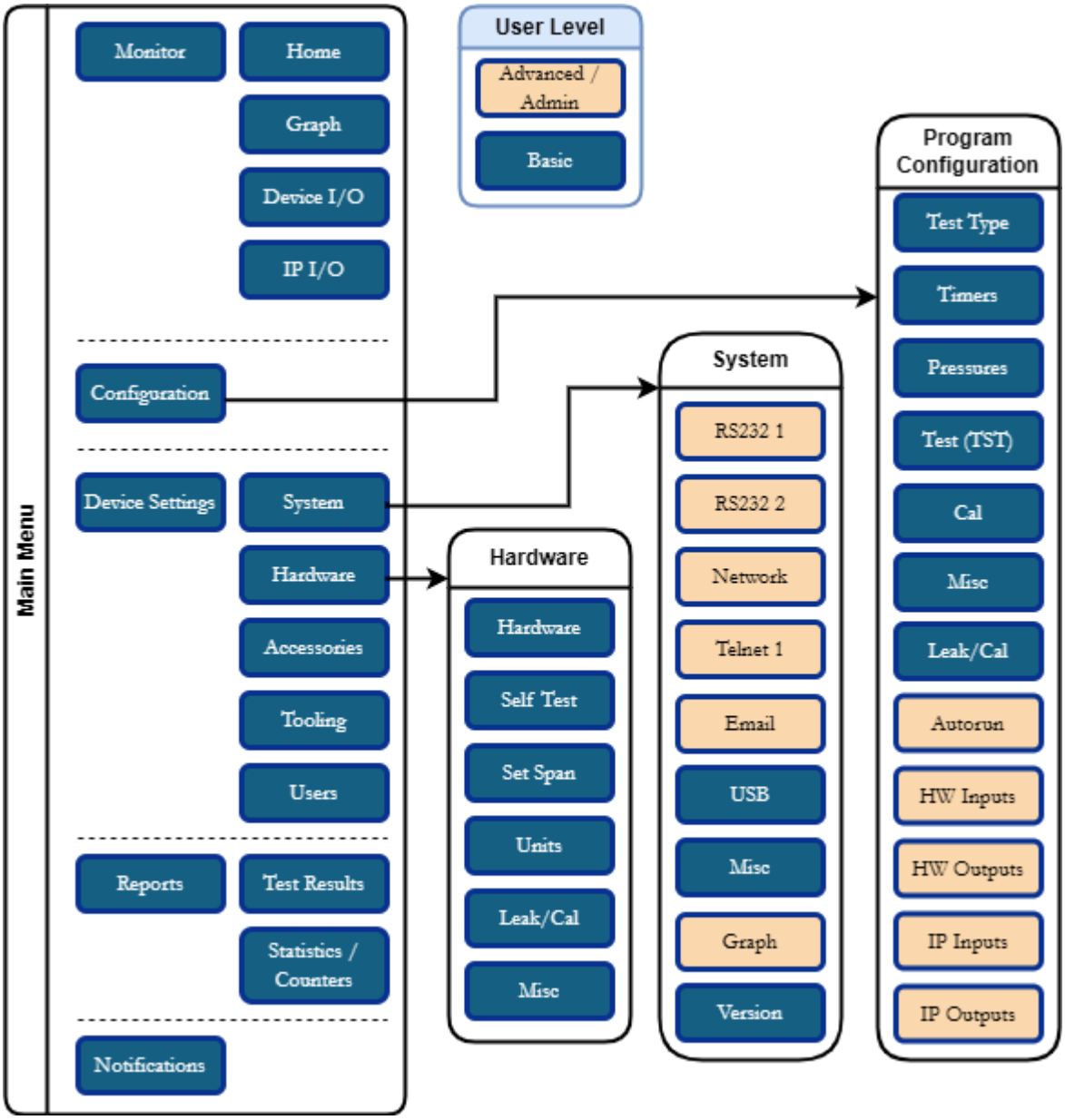
Note: The Program may also be changed using Digital I/O (see Chapter 26 – Inputs and Outputs***), using EtherNet/IP™ (see*** Chapter 27 – EtherNet/IP***), PROFINET (see*** Chapter 28 – PROFINET***) or using RS232 or Telnet Communication methods (see*** Chapter 29 – Communication***).***



The instrument can store up to 250 different programs. Switching between these programs is done with the Program Select drop-down on the home screen of the instrument. The current program is shown in the near to Main menu icon and then a three-digit number corresponding to the current program number.

Menu Structure

Below is an overview of the menu structure for the instrument.



Note: Not all menus are available for all hardware configurations and Test Types.

Chapter 2 – Setup

In this chapter, you are asked how you plan to use the instrument to conduct the test or sequence of tests for the intended application. Based on the answers, you will be directed to modify certain instrument settings.

Setting up the instrument to meet specific application requirements is most effectively accomplished by answering a few questions. These questions will guide you through the initial stages of the setup and point you to the appropriate chapters that detail specific instructions based on the answers.

It is highly recommended that each type of part being tested whether they differ in volume or construction, have their own set of parameters defined in the instrument using individual Programs. Both Pressure decay leak testing and Differential Pressure decay leak testing are a volume dependent function. Flow testing can be setup to be volume independent; however, to optimize the testing, it is recommended that each type of part have its own set of parameters. In certain cases, it is possible to group similar parts together to use the same parameters. In this case we recommend you talk to a CTS applications specialist to assure proper functionality.

Sequencing Program

The instrument is capable of conducting multiple tests on one part. For instance, it may be desirable to conduct a mass flow test and a pressure decay test on a single part (some configurations do not have mass flow capability). The instrument is also able to conduct these multiple tests on a part with multiple chambers by multiplexing through multiple test ports (if configured).

Question:

Are you planning to conduct multiple tests on one part?

Yes: It is important that you understand the concepts of Sequence Editor. See-Chapter 14 – Sequence Editor **and then come back and continue the setup.**

No: Proceed.

The instrument is capable of conducting tests on multiple parts in a set sequence (if configured). This may be done to increase the efficiency of the operator. The instrument will conduct leak tests on all four parts by multiplexing through the different test ports, one at a time.

Question:

Are you planning to conduct tests on multiple unique parts?

Yes: It is important that you understand the concepts of Sequential Linking. See the last page of Chapter 14 – Sequence Editor **and then come back and continue the setup.**

No: Proceed.

Selection of Test Types

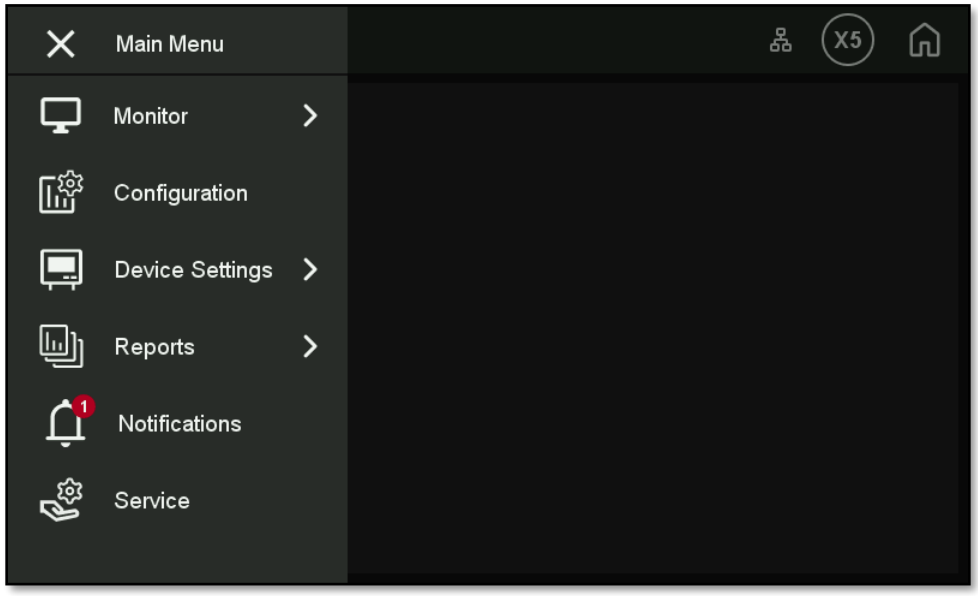
The first step in setting up the instrument is to select the type of test you want to conduct from the pre-packaged test sequences. Repeating this step under a different program number will enable you to configure up to 250 different test configurations. The **Test Type Table** on the following page includes the different test types available in the instrument, a brief description, and the associated chapter that details the pre-packaged test program. The availability of these test types is based on the hardware configuration of the instrument.

Once you have determined the appropriate test type for your application, select the specific program number from Monitor screen > drop-down menu.

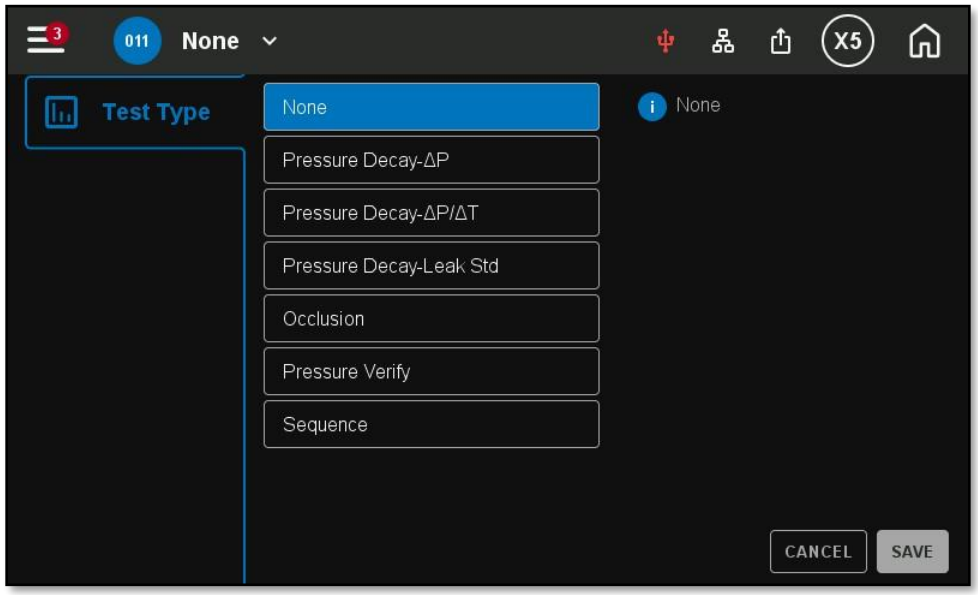
On the initial startup, the instrument will display this screen.



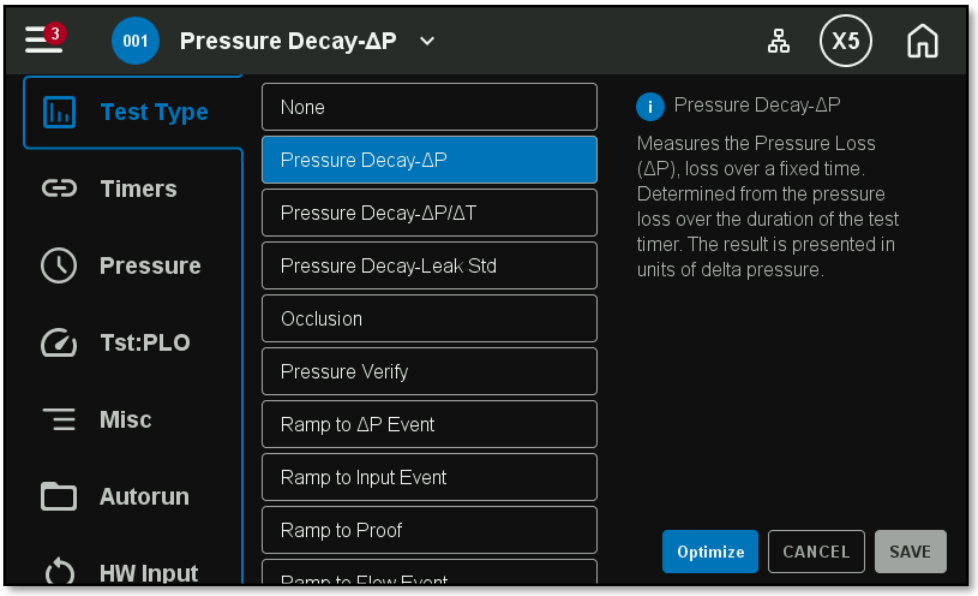
After selecting the specific program from the drop-down menu, tap on the Main menu and select the configuration menu and select the application suitable test type.



In configuration menu and select the application suitable test type.



After selecting the test type, set up the program according to timer, pressure range, limits and other functionality.



To simplify the instructions in this manual, the steps above are reduced to something similar to the following: The **Test Type** menu is located in **Main Menu > Configuration > Test Type** option.

Test Type Table

Test Type	Description
Chapter 3 – Pressure Decay-ΔP	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.
Chapter 4 – Pressure Decay-ΔP/ΔT	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.
Chapter 5 – Pressure Decay-Leak Std	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.
Chapter 6 – Occlusion	Measures the Back Pressure (part blockage). Determined from the pressure at the end of the test timer. The result is presented in units of pressure.

Test Type	Description
Chapter 7– Pressure Verify	Measures the Pressure at the isolated test port (no fill). Determined from the pressure at the end of the Test segment timer. The result is presented in units of pressure.
Chapter 8 – Mass Flow	Measures the Mass Flow needed to maintain the part at a set pressure. Typically used in applications where flow is expected. The result is presented in units of flow.
Chapter 9 – Mass Flow-Leak Std	Measures the Mass Flow needed to maintain the part at a set pressure. Typically used in low leak applications. The result is presented in units of flow.
Chapter 10 – Ramp to ΔP Event	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.
Chapter 11 – Ramp to Input Event	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.
Chapter 12 – Ramp to Flow Event	Primarily used for testing the cracking point of a check valve. Measures the point at which the flow crosses a threshold. Determines the maximum pressure before the Flow Event limit is exceeded as well as records the duration of time before the event. The results are presented in units of pressure and time.
Chapter 13 – Ramp to Proof	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 14 – Sequence Editor	The Sequence test type is designed to group test results together for a single part. Allows the user to define a sequence of operations to perform
Chapter 15 – Diff Pressure Decay-ΔP	This test type is used for conducting a pressure decay test measuring a pressure loss over time utilizing a Differential Pressure (DP) transducer. The result of this test is the pressure loss (or gain for a vacuum test) measured over a fixed period of time, presented in units of pressure.
Chapter 16 – Diff Pressure Decay-ΔP/ΔT	Calculates the Rate of Pressure Loss (ΔP/ΔT), determined from the differential loss between the test part and the reference volume, over unit time. The result is presented in units of delta pressure over delta time.

Test Type	Description
Chapter 17 – Diff Decay-Leak Rate	This test type is used for conducting a Diff Decay-Leak rate test measuring leak rate by utilizing a Differential Pressure (DP) transducer. The result of this test is the leak presented in units of flow.
Chapter 18 – Diff Pressure (DP) Decay-Leak Std	This test is used for conducting a Differential Pressure (DP) Decay Test with Leak Standard. Pressure loss is measured utilizing a Differential Pressure (DP) transducer. The pressure loss is correlated to a leak rate using a leak standard. This test requires a two-cycle calibration routine to correlate the pressure loss to a flow rate. The result of this test is presented in units of flow.
Chapter 19 – Percent Volume	This test type is used to determine the volume of a test part compared to the volume of a reference part. The reference volume is initially filled and isolated from the supply. The test part remains isolated. The reference volume pressure is measured at this point. The reference volume is then released into the test part and allowed to stabilize. The pressure of the test part is measured at this point. The two pressure measurements are then used to calculate the ratio of the test part volume to the reference volume.
Chapter 20 – Percent Volume, Pressure Decay-Leak Std	This test type is used to test for both severe and fine leaks by measuring the escape of pressure or vacuum from a reference part filled with a metered volume of pressure or vacuum. This test type is useful for parts with high elasticity, which readily change volume, by using a pre-defined volume to limit their maximum expansion during test. In addition, parts with internal openings connecting multiple volumes can be verified to be open or closed. The Percent Volume portion of this test type is used to find severe leaks, while the pressure decay – leak std portion is used to find fine leaks.
Chapter 21 – Differential Mass Flow	Differential mass flow testing is similar to mass flow testing, except that it uses a reference volume as the pressure source. The reference volume is of similar or exact design or volume of the part under test to help eliminate the measurement of flow characteristics that are not associated with a leak. Examples of this could be in products like washer bottles or catheter tubes, that expand and contract under pressure, or in adiabatic conditions where heat transfer is absent.
Error! Not a valid result for table.	Measures the pressure loss (ΔP) over time, determined from the pressure loss over the duration of the Test timer. The result is presented in units of delta pressure.
Chapter 23 - Gross Decay-Leak Std Test	Calculates the Leak Rate, based on the pressure loss over the duration of the Test timer. The result is presented in units of flow.

Tooling Control

The instrument is capable of controlling tooling to possibly eliminate the need for a PLC or other computer that would control cylinders and sealing.

Question:

Are you planning to use the Sentinel X5 to control any sealing operations?

Yes: It is important that you understand the concepts and Integrity requirements of Tooling Control. See Chapter 24 – Tooling Control **and then come back and continue the setup.**

No: Proceed.

Programming the Inputs and Outputs

The instrument comes with 12 hardware inputs and 12 hardware outputs (24VDC) that are user configurable for each program.

Question:

Are you planning to use the Sentinel X5 to control any ancillary devices using discrete I/O or EtherNet/IP™, or communicate with a PLC?

Yes: See Chapter 26 – Inputs and Outputs **- Inputs and Outputs,** Chapter 27 – EtherNet/IP**, or** Chapter 29 – Communication**, and then come back and continue the setup.**

No: Proceed.

Hardware Configuration

Setting the Units of Measure

The instrument has the capability to utilize different units of measure for each configured program. In order to keep things simple and user friendly if you always use the same units of measure, you can set the units in one place and have them apply instrument wide. This is done in the Hardware Configuration menu.

Question:

Are you planning to use the same units of measure for every program?

Yes: Select the Main Menu button > Device settings > Hardware Config icon, then select the Units icon. Change the Unit/Prec Define parameter to "Channel". Set the desired units of measure on that same screen. These units will apply to every program.

No: Select the Main Menu Device settings > Hardware Config icon, then select the Units icon. Change the Unit/Prec Define parameter to "Program". The Units icon will now appear under the Program Config menu. When a program is created, the units for the program will use the units under the Hardware Config menu as the default settings but the units can now be changed per program.

Note: The units set on the Hardware Config screen are also the units used for Self-Test, Auto Setup and transducer Set/Span routines.

Note: The precision displayed for each unit may also be set on this screen

Setting the Leak Standard Values

The instrument has the capability to utilize different leak standards for each configured program that uses a leak standard. In order to keep things simple and user friendly if you always use the same leak standard, you can set the leak standard value and pressure in one place and have it applied instrument wide to any program that uses a leak standard. This is done in the Hardware Configuration menu.

Question:

Are you planning to use the same leak standard for every program that requires a leak standard?

Yes: Select the Main Menu Device Settings > Hardware Config icon, then select the Leak/Cal icon. Change the Leak Std/Cal Define parameter to "Channel". Set the leak standard value and the pressure at which it was calibrated on that same screen. This leak standard value will apply to every program that utilizes a leak standard for calibration.

No: Select the Main Menu > Device Settings > Hardware Config icon. From the Hardware Config menu select the Leak/Cal icon. Change the Leak Std/Cal Define parameter to "Program". The leak standard parameters will now appear on the TST:XXX screen under the Program Config menu. When a program is created, the units for the program will use the leak standard value under the Hardware Config menu as the default settings but now can be changed per program.

Note: Every time the leak standard value changes due to a calibration or when a new leak standard is used this value needs to be modified to reflect the new value.

Note: The parameter that determines where the physical leak standard is located (either inside the instrument or connected to a port on the outside) is also located in the Leak/Cal menu or the TST menu. However, to view this parameter you must be in the Display User Level. To change the Display User Level, see Chapter 33 – Features.

Program Configuration

Now that you have created a program, configured the tooling and associated I/O, and set the Hardware level parameters, it is time to set the regulators to the correct test pressure.

Pressure Select

To select the proper source for the test, we need to inform the instrument which regulator to use for this program. This is located in **Main Menu > Configuration> Misc** option. The parameter called Pressure Select will need to be set to match the proper source. Find the regulator with the proper range. Locate the label that has the Source Number on it and select that source for the Pressure Select parameter. There are many possible options for this setting, depending on the hardware configuration. Options may include Pressure, Vacuum, Venturi, Tank, Reference, Flow, Internal Leak Std, Downstream Flow, or Sequential Test Ports. Instruments with only one pressure source will not allow editing of the Pressure Source parameter.

Tank Source

If the Pressure Select is configured as a Tank Source, then an additional sub-parameter "Shut Off Delay" is displayed. The Shut Off Delay is the user configured timer, defining how long to keep the Tank Source valve active after usage. During typical test operation: after the Fill valve has de-energized the Shut Off Delay timer will activate, and once expired the Tank Source valve will de-energize.

Setting the Pneumatic Regulator

Question:

Does the pressure source you are using for this program have an electronic regulator?

Yes: The electronic regulator has been setup and calibrated at the factory and is ready to use. For calibrating the electronic regulator, see Chapter 33 – Features.

No: Setting a mechanical regulator is done in the Hardware Config screen under the Set/Span menu. In order to set the regulator, the test port will need to be blocked which will allow the instrument to hold pressure. Standard units are supplied with a Colder™ quick connect fitting with an attached Self-Test cap. If this instrument is not a standard setup this may be done with a plug put in the test port. For proper plug thread specifications, consult the print set shipped with your instrument.

Setting the Test Parameters

It is time to set the test parameters to fit your application. Refer to the chapter that is associated with the test type chosen from Test Type Table earlier in this chapter.

Verifying Setup

Once you have everything programmed, run a repeatability study based on your company's quality standards to assure you are getting the results you desire.

Security

Now that the instrument is setup the way you want, make sure to lock down the parameters that you don't want changed until a Access of user. See Chapter 32 – User and Security

Backup the Instrument Settings

The setup of the instrument for one program is completed. You may now go back and setup multiple programs. Once you have completed, it is highly recommended that you save a backup of the instrument on a (FAT32) USB memory stick. For Instrument Backup and Restore see Chapter 35 - USB Import and export.

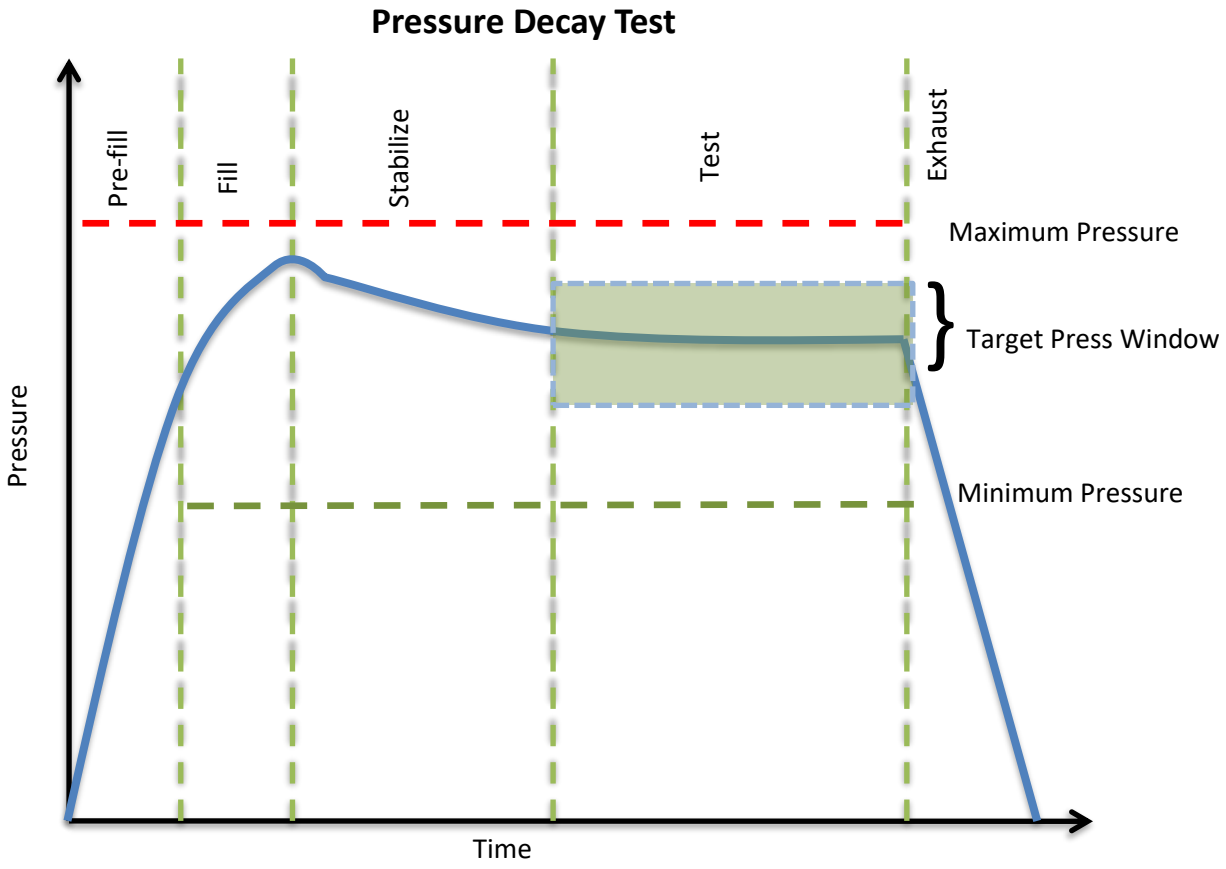
Chapter 3 – Pressure Decay-ΔP

This chapter explains the theory and parameters for conducting a pressure decay test measuring a pressure loss over time. The result of this test is the pressure loss (or gain for a vacuum test) measured over a fixed period of time, presented in units of pressure.

The basic principle of operation of a pressure decay leak test instrument is to fill the test part to a specified target test pressure, isolate the test part from the pressure or vacuum source, allow the pressure to stabilize, and then measure the pressure loss due to a leak over a defined time.

The Charts below give an overview of the parameters used to set up a Pressure Decay-ΔP Test. The Tables that follow give detailed descriptions of each parameter and also document the Display User Level associated with each parameter.

Note: To change the User Level, see Chapter 32 – User and Security



Timer Parameters

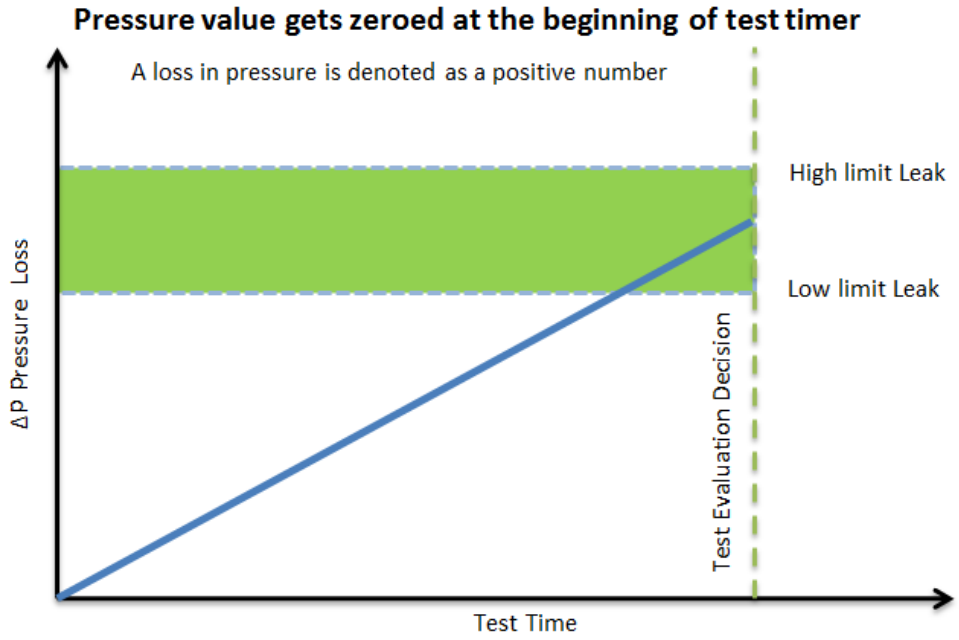
The Timers menu is located in the **Main Menu > Configuration > Timers** option..

Timer	Description	Display User Level
Prefill	Checks for excessively leaking parts or lack of pressure. May be set to "Percent of Fill Time" (default), for fixed fill time tests, or set to "Not to Exceed Time". For Changing the Functionality of the Prefill Timer, see Chapter 33 – Features. Maximum time to reach the minimum pressure. If the variable is set to "Not to Exceed Time", this segment will exit to the next once the Minimum Pressure value is reached.	Basic, Advanced, Admin
Pre-Press	Time to enable part to reach the Pre-Pressure. At the end of this timer, the instrument will continue to the Fill segment and begin filling to the Target Pressure. *This parameter is only available if the Prefill Method selected is "Pre-Pressure Time"*	Basic Advanced, Admin
Fill	Time to enable part to reach the Target Pressure. It may also be used as time to stabilize part pressure with additional air.	Basic Advanced, Admin
Stabilize	Time to stabilize part pressure while isolated from the pressure regulator. This time directly affects the repeatability of the test.	Basic Advanced, Admin
Test	The precise time over which to measure pressure drop or decay or the precise end time to measure pressure rise.	Basic Advanced, Admin
Exhaust	Time to relieve or vent part pressure before signaling the end of test. This prevents the accidental ejection of debris and protects the fixture seals from damage	Basic Advanced, Admin

Pressure Parameters

The Pressure menu is located in the **Main Menu > Configuration > Pressure** option.

Pressure	Description	Display User Level
Pre-Pressure	Target Pre-Pressure. Used as a setpoint for the Electronic Regulator during the Pre-Pressure time. *This parameter is only available if the Prefill Method selected is "Pre-Pressure Time"*	Basic Advanced, Admin
Pre-Pressure Window	The percentage (plus and minus) about the Pre-Pressure value defining the minimum and maximum pressure at the end of the Pre-Pressure time. *This parameter is only available if the Prefill Method selected is "Pre-Pressure Time"*	Basic Advanced, Admin
Minimum Pressure	The value that must be reached before the Prefill setpoint is reached and must be maintained through fill and stabilization segments or the testing cycle will end as a Severe Leak.	Basic Advanced, Admin
Target Pressure	The specified test pressure for the part. For vacuum test pressures enter a positive value if psiv was selected as the pressure unit, or enter a negative value if psig was selected as the pressure unit. ((For example, the test pressure 9.7 psia would be entered as 5 psiv or -5 psig.) Pressure loss may be corrected to the Target Pressure.	Basic Advanced, Admin
Maximum Pressure	The value that must not be exceeded at any time to complete a successful test. If the pressure goes above the Maximum Test Pressure, the testing cycle will end as an Over Pressure Malfunction.	Basic Advanced, Admin
Target Press Window	This is a window (default +/– 50%) set around the Target Pressure that must be maintained during the Test segment of the testing cycle. It generates a Target Pressure Low or High Malfunction if the actual pressure falls outside this window during test.	Advanced, Admin



Test Parameters

The Test parameters menu is located in the **Main Menu > Configuration > Test:PLO** option.

TST Parameter	Description	Display User Level
Low Limit Loss	Lower setpoint value used to evaluate test results.	Basic Advanced, Admin
High Limit Loss	Upper setpoint value used to evaluate test results.	Basic Advanced, Admin
Decay Direction	Defines the method for calculating the part pressure decay during test: Loss – charged part decreasing pressure or evacuated part decreasing vacuum, Gain – part pressure increasing from external forces.	Basic Advanced, Admin
Test Evaluation	Test results are compared to two setpoints for pass or fail status. There are three areas for evaluation of results: above high limit, between limits, and below low limit. See Table below for codes.	Advanced, Admin
Target pressure correction	Allow the instrument to perform measurement correction based upon the relationship between the target pressure and actual test pressure.	Advanced, Admin
Loss Offset	Manual compensation value which is added to the measured loss when calculating the final pressure loss for the test.	Basic Advanced, Admin
EDC Enable	Activates Environmental Drift Correction. See Appendix C – Environmental Drift Correction.	Advanced, Admin

EDC Percentage	Options include 10%, 25%, 50%, 75%, and 90%. See Appendix C – Environmental Drift Correction.	Advanced, Admin
EDC Quantity	See Appendix C – Environmental Drift Correction.	Advanced, Admin

Test Evaluation Code	Description
Above Hi Limit > Between Limits > Below Lo Limit	Three zones of evaluation for Pass and Fail
P P F	Pass if above low limit
P F F	Pass if above high limit
F P F* (default)	Pass if between high and low limits
F P P	Pass if below high limit
F F P	Pass if below low limit
P F P	Pass if above the high limit or below the low limit

Note: The Evaluation option displays High Limit (left) to Low Limit (right). On the IX5 monitor screen, readings appear from Low Limit (left) toward High Limit (right). Ensure this orientation is understood to correctly identify the test result.

This page is intentionally blank.

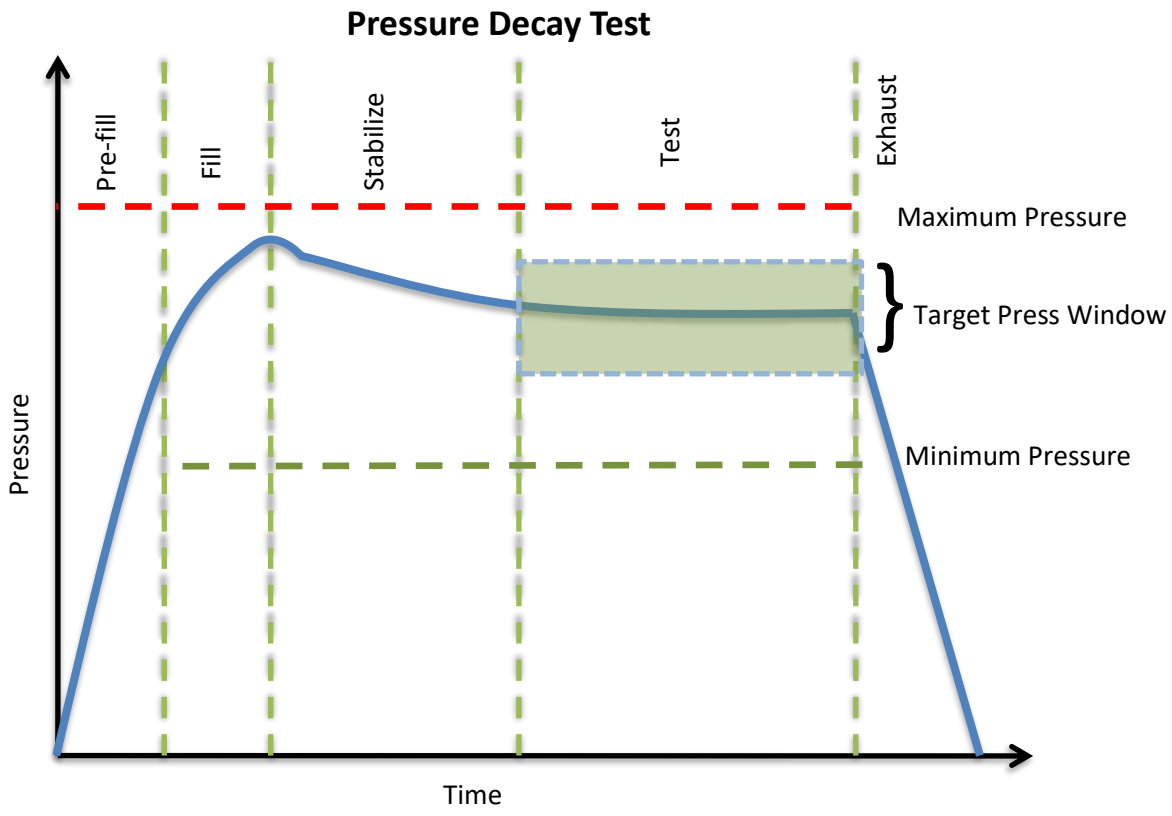
Chapter 4 – Pressure Decay-ΔP/ΔT

This chapter explains the theory and parameters for conducting a pressure decay test measuring the rate of change of pressure loss / time. The result of this test is the rate of pressure change measured over a selected unit of time.

The basic principle of operation of a pressure decay leak test instrument is to fill the test part to a specified target test pressure, isolate the test part from the source air and allow the pressure to stabilize, and then measure the pressure loss due to a leak over a defined time.

The Charts below give an overview of the parameters used to set up a Pressure Decay-ΔP/ΔT Test. The Tables that follow give detailed descriptions of each parameter and also document the Display User Level associated with each parameter.

Note: To change the User Level, see Chapter 32 – User and Security



Timer Parameters

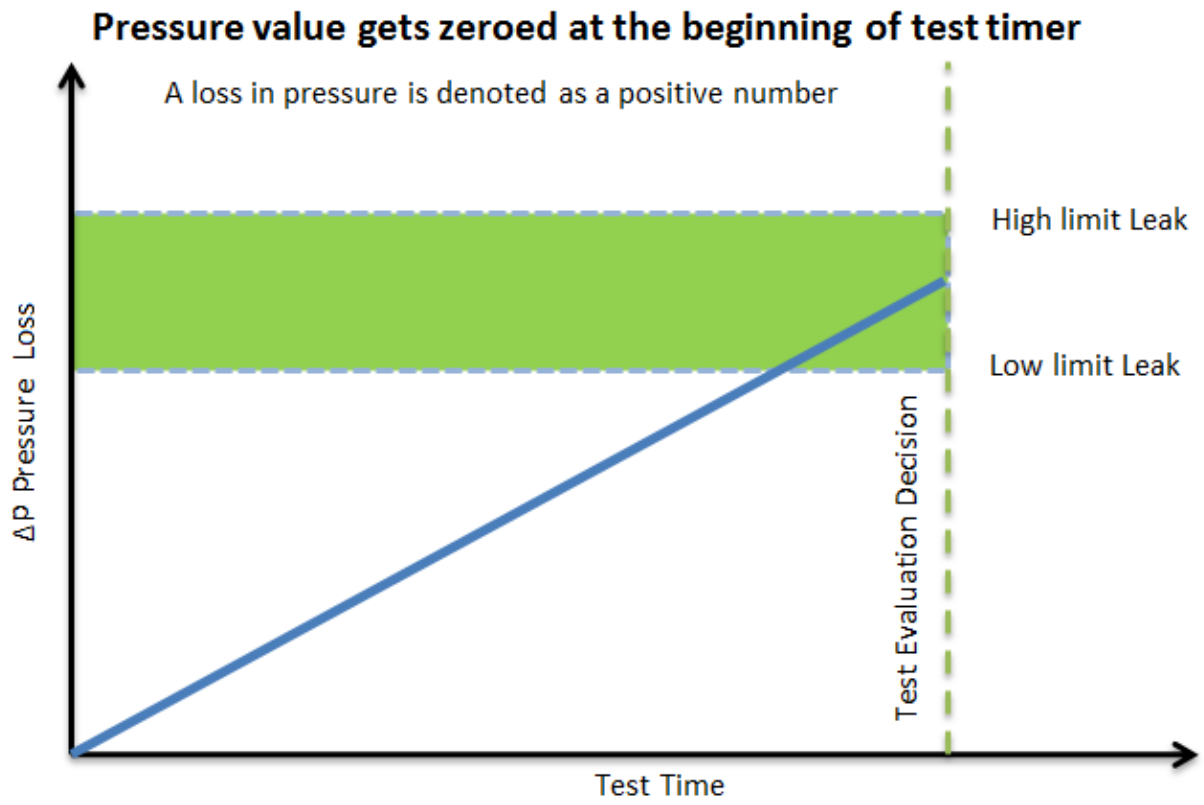
The Timers menu is located in the **Main Menu > Configuration > Timers** option..

Timer	Description	Display User Level
Prefill	Checks for excessively leaking parts or lack of pressure. May be set to "Percent of Fill Time" (default), for fixed fill time tests, or set to "Not to Exceed Time. For Changing the Functionality of the Prefill Timer, see Chapter 33 – Features. Maximum time to reach the minimum pressure. If the variable is set to "Not to Exceed Time", this segment will exit to the next once the Minimum Pressure value is reached.	Basic Advanced, Admin
Pre-Press	Time to enable part to reach the Pre-Pressure. At the end of this timer, the instrument will continue to the Fill segment and begin filling to the Target Pressure. *This parameter is only available if the Prefill Method selected is "Pre-Pressure Time"*	Basic Advanced, Admin
Fill	Time to enable part to reach the Target Pressure. It may also be used as time to stabilize part pressure with additional air.	Basic Advanced, Admin
Stabilize	Time to stabilize part pressure while isolated from the pressure regulator. This time directly affects the repeatability of the test.	Basic Advanced, Admin
Test	The precise time over which to measure pressure drop or decay or the precise end time to measure pressure rise.	Basic Advanced, Admin
Exhaust	Time to relieve or vent part pressure before signaling the end of test. This prevents the accidental ejection of debris and protects the fixture seals from damage	Basic Advanced, Admin

Pressure Parameters

The Pressure menu is located in the **Main Menu > Configuration > Pressure** option..

Pressure	Description	Display User Level
Pre-Pressure	Target Pre-Pressure. Used as a setpoint for the Electronic Regulator during the Pre-Pressure time. *This parameter is only available if the Prefill Method selected is "Pre-Pressure Time"*	Basic Advanced, Admin
Pre-Pressure Window	The percentage (plus and minus) about the Pre-Pressure value defining the minimum and maximum pressure at the end of the Pre-Pressure time. *This parameter is only available if the Prefill Method selected is "Pre-Pressure Time"*	Basic Advanced, Admin
Minimum Pressure	The value that must be reached before the Prefill setpoint is reached and must be maintained through fill and stabilization segments or the testing cycle will end as a Severe Leak.	Basic Advanced, Admin
Target Pressure	The specified test pressure for the part. For vacuum test pressures enter a positive value if psiv was selected as the pressure unit or enter a negative value if psig was selected as the pressure unit. ((For example, the test pressure 9.7 psia would be entered as 5 psiv or -5 psig.) Pressure loss may be corrected to the Target Pressure.	Basic Advanced, Admin
Maximum Pressure	The value that must not be exceeded at any time to complete a successful test. If the pressure goes above the Maximum Test Pressure, the testing cycle will end as an Over Pressure Malfunction.	Basic Advanced, Admin
Target Press Window	This is a window (default +/– 50%) set around the Target Pressure that must be maintained during the Test segment of the testing cycle. It generates a Target Pressure Low or High Malfunction if the actual pressure falls outside this window during test.	Advanced, Admin



Test Parameters

The Test parameters menu is located in the **Main Menu > Configuration > Test:DPT** Option.

TST Parameter	Description	Display User Level
Low Limit Rate	Lower setpoint value used to evaluate test results.	Basic Advanced, Admin
High Limit Rate	Upper setpoint value used to evaluate test results.	Basic Advanced, Admin
Decay Direction	Defines the method for calculating the part pressure decay during test: Loss – charged part decreasing pressure or evacuated part decreasing vacuum, Gain – part pressure increasing from external forces.	Basic Advanced, Admin
Test Evaluation	Test results are compared to two setpoints for pass or fail status. There are three areas for evaluation of results: above high limit, between limits, and below low limit. See Table below for codes.	Advanced, Admin

Target pressure correction	Allow the instrument to perform measurement correction based upon the relationship between the target pressure and actual test pressure.	Advanced, Admin
EDC Enable	Activates Environmental Drift Correction. See Appendix C – Environmental Drift Correction.	Advanced, Admin
EDC Percentage	Options include 10%, 25%, 50%, 75%, and 90%. See Appendix C – Environmental Drift Correction.	Advanced, Admin
EDC Quantity	See Appendix C – Environmental Drift Correction.	Advanced, Admin

Test Evaluation Code	Description
Above Hi Limit > Between Limits > Below Lo Limit	Three zones of evaluation for Pass and Fail
P P F	Pass if above low limit
P F F	Pass if above high limit
F P F* (default)	Pass if between high and low limits
F P P	Pass if below high limit
F F P	Pass if below low limit
P F P	Pass if above the high limit or below the low limit

Note: The Evaluation option displays High Limit (left) to Low Limit (right). On the IX5 monitor screen, readings appear from Low Limit (left) toward High Limit (right). Ensure this orientation is understood to correctly identify the test result.

This page is intentionally blank.

Chapter 5 – Pressure Decay-Leak Std

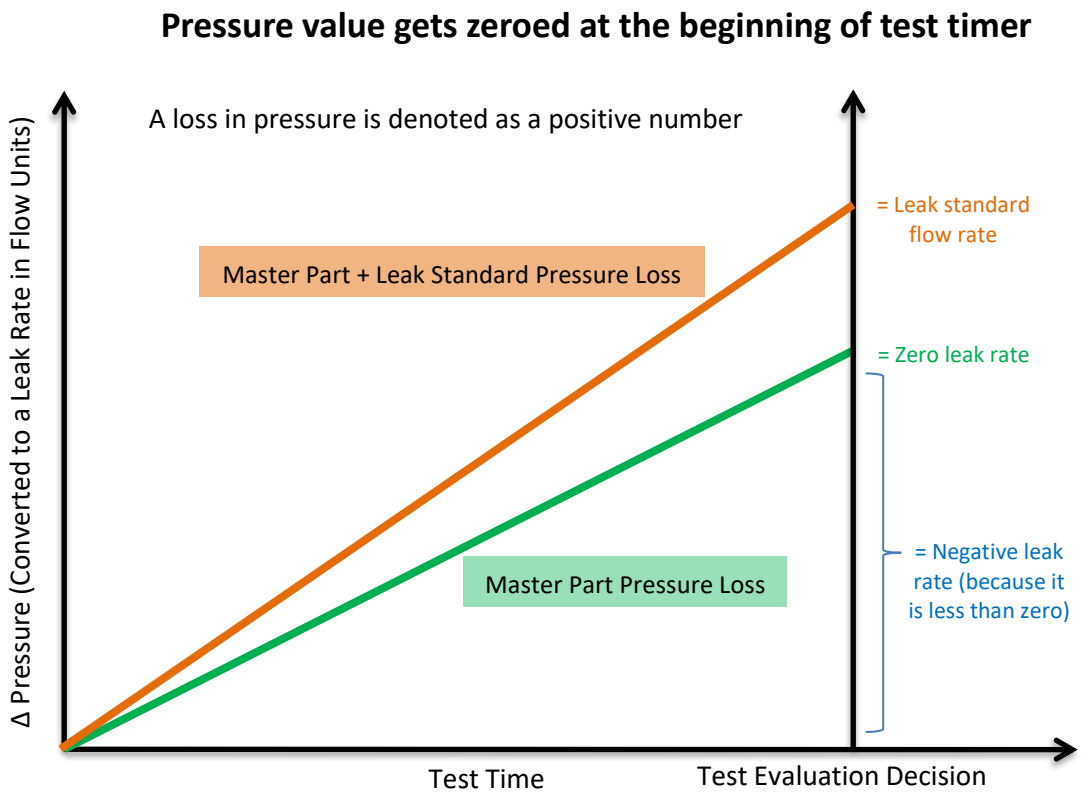
This chapter explains the theory and parameters for conducting a pressure decay test and correlating the pressure loss to a leak rate using a leak standard. This test requires a two-cycle calibration routine to correlate the pressure loss to a flow rate. The result of this test is presented in units of flow.

This test type utilizes a two-point calibration sequence with a non-leaking master part to record the zero-leak pressure loss value and the additional pressure loss value due to the flow rate of the leak standard on the second calibration cycle.

The basic principle of operation of a pressure decay leak test instrument is to fill the test part to a specified target test pressure, isolate the test part from the source air and allow the pressure to stabilize, and then measure the pressure loss due to a leak over a defined time. The leak test instrument translates the pressure loss value measured over the fixed test time to a leak or flow rate.

The charts in this chapter give an overview of the parameters used to set up a Pressure Decay Test and correlate the results to a flow rate using a leak standard. The Tables that follow give detailed descriptions of each parameter and also document the Display User Level associated with each parameter.

Note: To change the User Level, see Chapter 32 – User and Security



Auto Setup Sequence

The easiest way to setup the proper timers in the instrument, when using the leak rate test type, is by using the Auto Setup routine. The Auto Setup routine resets the Input and Output functions for a program to the default (inactive) values. Therefore, Auto Setup must be performed with the part manually sealed. After completing the Auto Setup routine, the inputs, outputs, and tooling functions for the program will need to be reconfigured.

Note: If you want to set up the program parameters manually or don't want to have to reconfigure the inputs and outputs after running Auto Setup, then proceed to

The Auto Setup routine is a unique patented process developed by Cincinnati Test Systems for the Sentinel X5 instrument that makes the initial setup of the instrument to a new test part quick, easy and efficient. The process will determine the best time sequence to test a part within the limits of a desired maximum cycle time. If the desired maximum cycle time is set too short, the final test will not produce repeatable results. Any leak test needs a certain amount of cycle time to achieve sufficient resolution and repeatability that are dependent on the part volume, leak rate, test pressure, and part characteristics. The Auto Setup routine will set the best possible test cycle within the maximum cycle time specified for the test.

Parameter	Description	Display User Level
Test Type	Set this to Pressure Decay-Leak Std.	Basic Advanced, Admin
Apply to Program #	Defines the program in which the parameters will be written. This process will overwrite the current parameters within the defined program.	Basic Advanced, Admin
Desired Cycle Time	This is the total desired time to complete the test on the part excluding tooling motions. The Auto Setup sequence will determine the best possible sequence of testing within this maximum cycle time. This optimized setup cannot produce acceptable resolution and repeatability if the total time is too short for the part volume, leak rate, test pressure, and part construction. Utilize all the available time in the manufacturing process to conduct this test. When acceptable results are achieved, you may be able to repeat the process and reduce the total cycle time.	Basic Advanced, Admin
Target Pressure	This is the specified test pressure for the part. Auto Setup will preset the Minimum Pressure at 80% and Maximum Pressure at 120%.	Basic Advanced, Admin
Pressure Select	Set to the same pressure source as you did in Chapter 2-Pressure Select.	Basic Advanced, Admin

TO BE COMPLETED

Parameter	Description	Display User Level
High Limit Leak	This is the specified leak rate for the part. Auto Setup will preset the Low Limit Leak at –20% of the High Limit Leak. It will also set the Test Evaluation to FPF. FPF means "Fail over Hi Limit, Pass between Hi and Lo Limit and Fail if under Lo Limit". These values and settings can be changed after completing the Auto Setup sequence.	Basic Advanced, Admin
Leak Std Value	This is the leak rate value on the calibrated leak standard mounted either internal to the instrument on the pneumatic manifold or using an external leak standard.	Basic Advanced, Admin
Leak Std Pressure	This is the pressure value on the calibrated leak standard.	Basic Advanced, Admin
Start Auto Setup	This starts the Auto Setup procedure.	Basic Advanced, Admin



Upon successful completion of the Auto Setup routine there is no need to continue the setup parameters in the rest of this chapter unless you want to adjust parameters.

TO BE COMPLETED

Timer Parameters

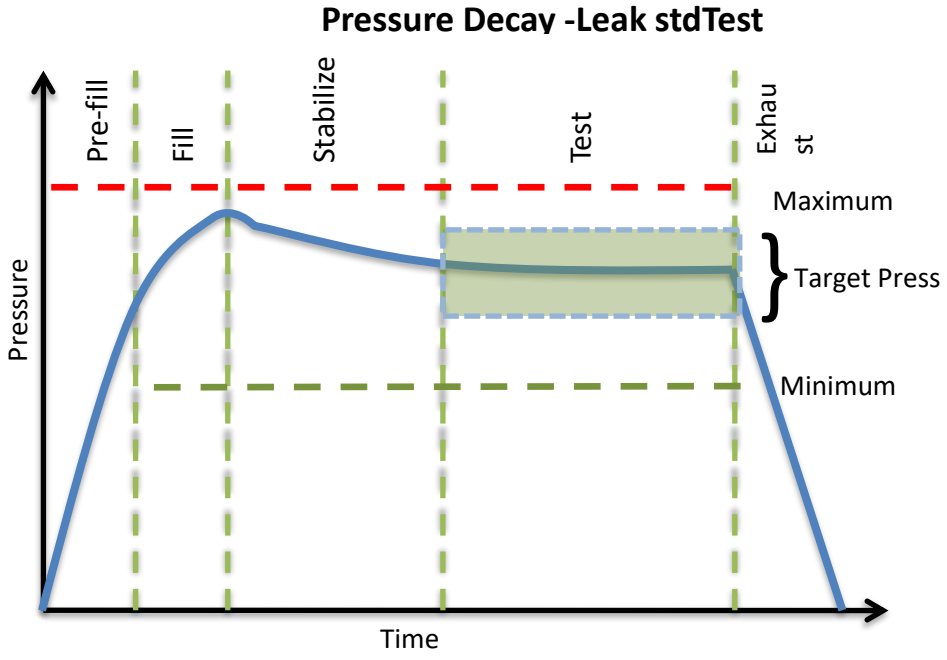
The Timers menu is located in the **Main Menu > Configuration > Timers** option.

Timer	Description	Display User Level
Prefill	Checks for excessively leaking parts or lack of pressure. May be set to "Percent of Fill Time" (default), for fixed fill time tests, or set to "Not to Exceed Time". For Changing the Functionality of the Prefill Timer, see Chapter 33 – Features. Maximum time to reach the minimum pressure. If the variable is set to "Not to Exceed Time", this segment will exit to the next once the Minimum Pressure value is reached.	Basic, Advanced, Admin
Pre-Press	Time to enable part to reach the Pre-Pressure. At the end of this timer, the instrument will continue to the Fill segment and begin filling to the Target Pressure. *This parameter is only available if the Prefill Method selected is "Pre-Pressure Time"*	Basic Advanced, Admin
Fill	Time to enable part to reach the Target Pressure. It may also be used as time to stabilize part pressure with additional air.	Basic Advanced, Admin
Stabilize	Time to stabilize part pressure while isolated from the pressure regulator. This time directly affects the repeatability of the test.	Basic Advanced, Admin
Test	The precise time over which to measure pressure drop or decay or the precise end time to measure pressure rise.	Basic Advanced, Admin
Exhaust	Time to relieve or vent part pressure before signaling the end of test. This prevents the accidental ejection of debris and protects the fixture seals from damage	Basic Advanced, Admin
Relax	Timer used during Program Cal sequence as a delay between calibration cycles to allow the master part to recover to repeatable virgin state. (Too short relax times result in decreasing pressure losses/flow results in successive tests.)	Basic Advanced, Admin

Pressure Parameters

The Pressure menu is located in the **Main Menu > Configuration > Pressure** option..

Pressure	Description	Display User Level
Pre-Pressure	Target Pre-Pressure. Used as a setpoint for the Electronic Regulator during the Pre-Pressure time. *This parameter is only available if the Prefill Method selected is "Pre-Pressure Time"*	Basic Advanced, Admin
Pre-Pressure Window	The percentage (plus and minus) about the Pre-Pressure value defining the minimum and maximum pressure at the end of the Pre-Pressure time. *This parameter is only available if the Prefill Method selected is "Pre-Pressure Time"*	Basic Advanced, Admin
Minimum Pressure	The value that must be reached before the Prefill setpoint is reached and must be maintained through fill and stabilization segments or the testing cycle will end as a Severe Leak.	Basic Advanced, Admin
Target Pressure	The specified test pressure for the part. For vacuum test pressures enter a positive value if psiv was selected as the pressure unit, or enter a negative value if psig was selected as the pressure unit. ((For example, the test pressure 9.7 psia would be entered as 5 psiv or -5 psig.) Pressure loss may be corrected to the Target Pressure.	Basic Advanced, Admin
Maximum Pressure	The value that must not be exceeded at any time to complete a successful test. If the pressure goes above the Maximum Test Pressure, the testing cycle will end as an Over Pressure Malfunction.	Basic Advanced, Admin
Target Press Window	This is a window (default +/– 50%) set around the Target Pressure that must be maintained during the Test segment of the testing cycle. It generates a Target Pressure Low or High Malfunction if the actual pressure falls outside this window during test.	Advanced, Admin



Test Parameters

The Test parameters menu is located in the **Main Menu > Configuration > Test:PLR** option.

TST Parameter	Description	Display User Level
Low Limit Leak	Lower setpoint value used to evaluate test results.	Basic Advanced, Admin
High Limit Leak	Upper setpoint value used to evaluate test results.	Basic Advanced, Admin
Decay Direction	Defines the method for calculating the part pressure decay during test: Loss – charged part decreasing pressure or evacuated part decreasing vacuum, Gain – part pressure increasing from external forces.	Basic Advanced, Admin
Test Evaluation	Test results are compared to two setpoints for pass or fail status. There are three areas for evaluation of results: above high limit, between limits, and below low limit. See Table below for codes.	Advanced, Admin
Target pressure correction	Allow the instrument to perform measurement correction based upon the relationship between the target pressure and actual test pressure.	Advanced, Admin

TST Parameter	Description	Display User Level
Min Master Loss	Minimum pressure loss allowed during the first test in the Program Cal routine. Prevents the acceptance of a calibration with a blocked part or test line.	Basic Advanced, Admin
Max Master Loss	Maximum pressure loss allowed during the first test in the Program Cal routine. Prevents the acceptance of a calibration with a leaking part or fixture leaks.	Basic Advanced, Admin
Min Mstr+Leak Loss	Minimum pressure loss allowed during the second test in the Program Cal routine. Prevents the acceptance of a calibration with a blocked part or test line.	Basic Advanced, Admin
Max Mstr+Leak Loss	Maximum pressure loss allowed during the second test in the Program Cal routine. Prevents the acceptance of a calibration with excessive pressure loss due to part or fixture leaks.	Basic Advanced, Admin
Min Leak Loss	Minimum pressure loss allowed that represents the pressure loss due to the Leak Standard used to calibrate the instrument.	Basic Advanced, Admin
Max Leak Loss	Maximum pressure loss allowed that represents the pressure loss due to the Leak Standard used to calibrate the instrument.	Basic Advanced, Admin
Min Perform Factor	Minimum value for Performance Factor calculated at completion of Program Cal routine. Resultant evaluation of ratio of Master Part Loss to Master+Leak Loss, Test Pressure, and loss due to Leak Std.	Basic Advanced, Admin
Quik Test Enable	Activates Quik Test. See Appendix B – Quik Test.	Advanced, Admin
Quik Test Timer	Options include 10%, 25%, 50%, 75%, and 90%. See Appendix B – Quik Test.	Advanced, Admin
Quik Test LL Band	See Appendix B – Quik Test.	Advanced, Admin
Quik Test HL Band	See Appendix B – Quik Test.	Advanced, Admin
EDC Enable	Activates Environmental Drift Correction. See Appendix C – Environmental Drift Correction.	Advanced, Admin
EDC Percentage	Options include 10%, 25%, 50%, 75%, and 90%. See Appendix C – Environmental Drift Correction.	Advanced, Admin
EDC Quantity	See Appendix C – Environmental Drift Correction.	Advanced, Admin

Test Evaluation Code	Description
Above Hi Limit > Between Limits > Below Lo Limit	Three zones of evaluation for Pass and Fail
P P F	Pass if above low limit
P F F	Pass if above high limit
F P F* (default)	Pass if between high and low limits
F P P	Pass if below high limit
F F P	Pass if below low limit
P F P	Pass if above the high limit or below the low limit

Note: The Evaluation option displays High Limit (left) to Low Limit (right). On the IX5 monitor screen, readings appear from Low Limit (left) toward High Limit (right). Ensure this orientation is understood to correctly identify the test result.

Note: If the instrument is configured multiple internal leak standards the user must select which leak standard is to be used in the Program. See Selecting the Proper Internal Leak Standard in Chapter 33 – Features***.***

Program Calibration

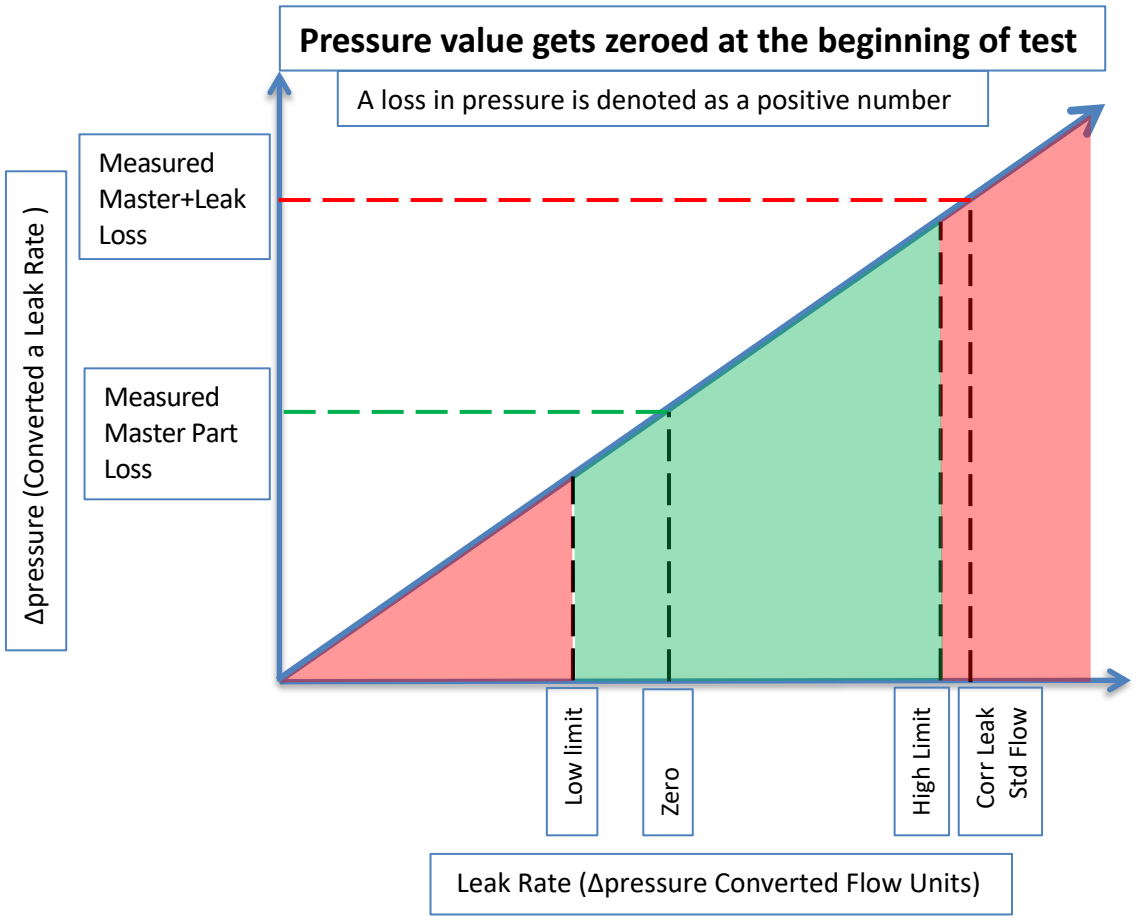
In order to convert the pressure loss measured by the instrument to a leak (flow) rate, the instrument uses a leak standard and needs to run the "Program Cal" procedure. This procedure requires at least one known non-leaking part referred to as a "master part". This procedure tests a non-leaking master part connected to the instrument using the timers and pressures established for the program. The procedure automatically tests the non-leaking master part twice with the Relax timer delay between tests. Within each program that uses a leak standard, Program Cal can be configured to use one of four methods. See **Setting the Cal Method and Leak Standard Location** in Chapter 33 – Features.

Remember: The Leak/Cal menu has a parameter called Leak Std/Cal Define that determines the location for the leak standard settings.

When set to "Channel", leak standard settings are located in the Device settings > Hardware menu.

When set to "Program", leak standard settings are located in the Main menu > Configuration.

Determine how you plan to use your leak test instrument. Review Setting the Leak Standard Values ***section on page 13. It is critical to make sure the leak standard values are set correctly for proper use. To view the Cal Method parameter, you must be in the Advanced or Admin Display User Level. To change the Display User Level, see*** Chapter 33 – Features.



Initiating the Program Cal Sequence

To initiate a Program Cal sequence, go to **Main Menu > Configuration > Cal:PLR > Program calibration option**, click **OK.** The Program Cal wizard will tell you to connect a non-leaking master part. Connect the non-leaking master part to the instrument. Push the Start button to initiate the Program Cal sequence. The system will conduct an initial test of the non-leaking master part to measure the pressure loss associated with a non-leaking part. This represents the typical offset associated with testing parts within the environment of the test system. The pressure loss value is saved as the Master Part Loss. The system will conduct a second test on a non-leaking master part with a known calibrated leak standard included in the test. The pressure loss value result for this test is saved as the Master+Leak Loss.

Performance Factor

Upon the successful completion of the Program Cal routine, the display will show the calculated Performance Factor for the calibration. The Performance Factor is an estimate of the quality of the calibration. It combines the ratio of the Hi Limit Leak result to the non-leaking master part result, the test pressure, and difference between the Hi Limit result and the non-leaking master part result to scale its anticipated performance. This value ranges from 0 to 100. It is generally desirable to have a Performance Factor of 35 to 100. The actual acceptable Performance Factor can vary depending on the desired Gage R&R performance of the test. Here is the Performance Factor equation:

Performance Factor = **Cal Ratio** x **Pressure Loss Penalty** x **Time Penalty** x **100**

The pressure loss penalty is greater for smaller pressure loss values. The time penalty is greater for shorter Test cycle timer values. Generally, longer stabilize and test cycle timer settings will produce higher Performance Factors and improved Gage R&R performance.

> ***Note: The instrument will require a Program Cal Sequence if any parameters that affect the calibration are modified.***

Conditions for a Successful Calibration

Several conditions must be met during the Program Calibration procedure for the instrument to accept and store the calibration results. The conditions are based on the following measurements or calculations:

1. Master Part Loss
    a. Must be greater than the Min Master Loss limit
    b. Must be less than the Max Master Loss limit
    c. Must be less than the Master+Leak Loss measurement
2. Master+Leak Loss
    a. Must be greater than the Min Mstr+Leak Loss limit
    b. Must be less than the Max Mstr+Leak Loss limit
    c. Must be greater than the Master Loss measurement
3. Leak Loss
    a. Must be greater than the Min Leak Loss limit
    b. Must be less than the Max Leak Loss limit
4. Performance Factor
    a. Must be greater than the Min Perform Factor limit

If the procedure does not meet these conditions, error messages are displayed at the completion of tests.

If the Program Cal routine is successfully completed, "PROGRAM CALIBRATION PASSED" will be displayed. If there are any problems during the Program Cal sequence an error will be displayed. If there is an error, see Appendix A – Messages & Error Codes.

Calibration Parameters

The Calibration parameters menu is located in the **Main Menu > Configuration > CAL:PLR** icon. These calibration parameters are values that are measured or calculated as a result of the Program Cal routine for a Pressure Decay-Leak Std test.

Parameter	Description	Display User Level
Program Calibration Button	Program Cal button Used to start the Program calibration routines.	Basic Advanced, Admin
Performance Factor	Resultant evaluation of ratio of Master Part Loss to Master+Leak loss, Test Pressure, and loss due to Leak Std.	Basic Advanced, Admin
Master Part Press	Measured pressure at the beginning of the test segment during the first test of the Program Cal process for the non-leaking master part.	Basic Advanced, Admin
Master+Leak Press	Measured pressure at the beginning of the test cycle of second test during Program Cal process for the non-leaking master part with the leak standard introduced to the pneumatic test circuit.	Basic Advanced, Admin
Master Part Loss	Measured pressure loss for the non-leaking master part during the first test of Program Cal process.	Viewable in Basic & Advanced **Editable in Admin**
Master+Leak Loss	Measured pressure loss during the second test of Program Cal for the non-leaking master part with the leak standard introduced to the pneumatic test circuit.	Viewable in Basic & Advanced **Editable in Admin**
Leak Loss	Calculated pressure loss, based upon measured pressure losses during the Program Cal routine. Corresponds to the actual pressure loss related to the leak standard.	Viewable in Basic & Advanced
Corr. Leak Std Flow	The calculated leak standard flow rate based on the Program Target Pressure, the leak standard calibrated pressure, and the leak standard calibrated flow rate.	Basic Advanced, Admin

This page is intentionally blank.

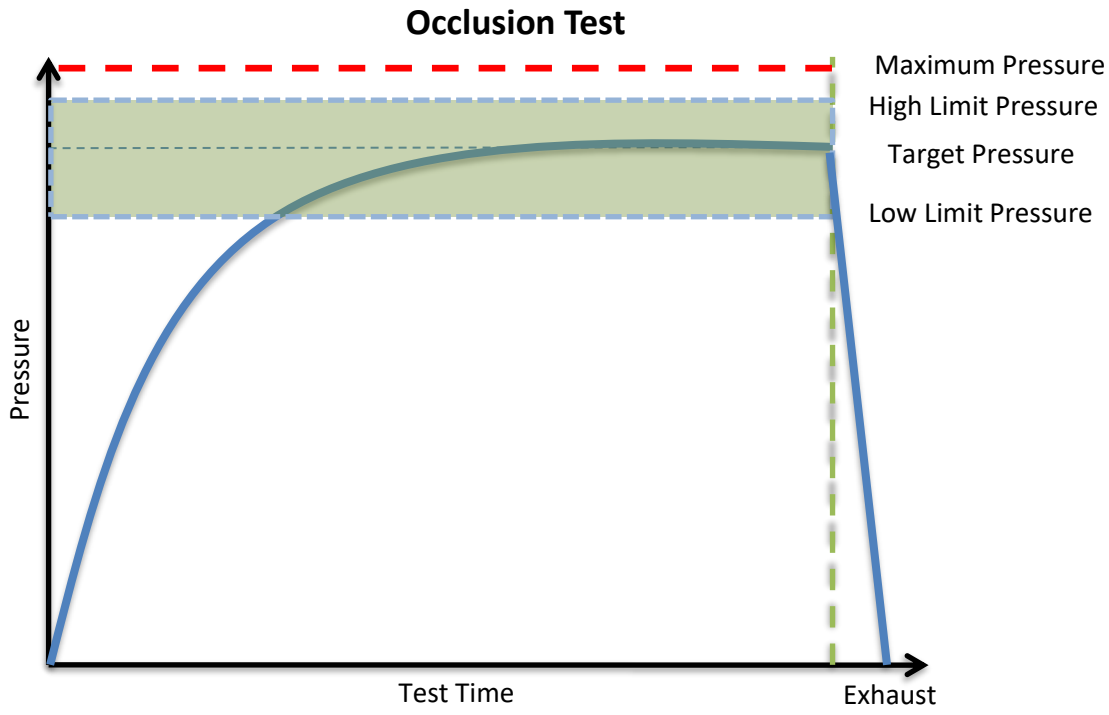
Chapter 6 – Occlusion

This chapter explains the theory and parameters for conducting an Occlusion Test. The result of this test is the measured back pressure at the expiration of the Test sequence.

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 or minimum blockage or low back pressure. High Limit Pressure indicates low flow or maximum blockage or high back pressure.

The Chart below give an overview of the parameters used to set up an Occlusion Test. The Tables that follow give detailed descriptions of each parameter and also document the Display User Level associated with each parameter.

Note: To change the User Level, see Chapter 32 – User and Security



Timer Parameters

The Timers menu is located in the **Main Menu > Configuration > Timers** option.

Timer	Description	Display User Level
Test	At the end of this timer, the instrument will read the pressure on the pressure transducer. This pressure is due to the backpressure created in the pneumatic circuit and part.	Basic Advanced, Admin
Exhaust	Time to relieve or vent part pressure before signaling the end of test. This prevents the accidental ejection of debris and protects the fixture seals from damage	Basic Advanced, Admin

Pressure Parameters

The Pressure menu is located in the **Main Menu > Configuration > Pressure** option.

Pressure	Description	Display User Level
Target Pressure	Target test pressure.	Basic Advanced, Admin
Maximum Pressure	The value that must not be exceeded at any time to complete a successful test. If the pressure goes above the Maximum Test Pressure, the testing cycle will end as an Over Pressure Malfunction.	Basic Advanced, Admin

Test Parameters

The Test parameters menu is located in the **Main Menu > Configuration > Test:OCC** option.

TST Parameter	Description	Display User Level
Low Limit Pressure	Lower setpoint value used to evaluate test results.	Basic Advanced, Admin
High Limit Pressure	Upper setpoint value used to evaluate test results.	Basic Advanced, Admin
Test Evaluation	Test results are compared to two setpoints for pass or fail status. There are three areas for evaluation of results: above high limit, between limits, and below low limit. See Table below for codes.	Advanced, Admin

Test Evaluation Code	Description
Above Hi Limit > Between Limits > Below Lo Limit	Three zones of evaluation for Pass and Fail
P P F	Pass if above low limit
P F F	Pass if above high limit
F P F* (default)	Pass if between high and low limits
F P P	Pass if below high limit
F F P	Pass if below low limit
P F P	Pass if above the high limit or below the low limit

Note: The Evaluation option displays High Limit (left) to Low Limit (right). On the IX5 monitor screen, readings appear from Low Limit (left) toward High Limit (right). Ensure this orientation is understood to correctly identify the test result.

This page is intentionally blank.

Chapter 7– Pressure Verify

This chapter explains the theory and parameters for conducting a Pressure Verify test.

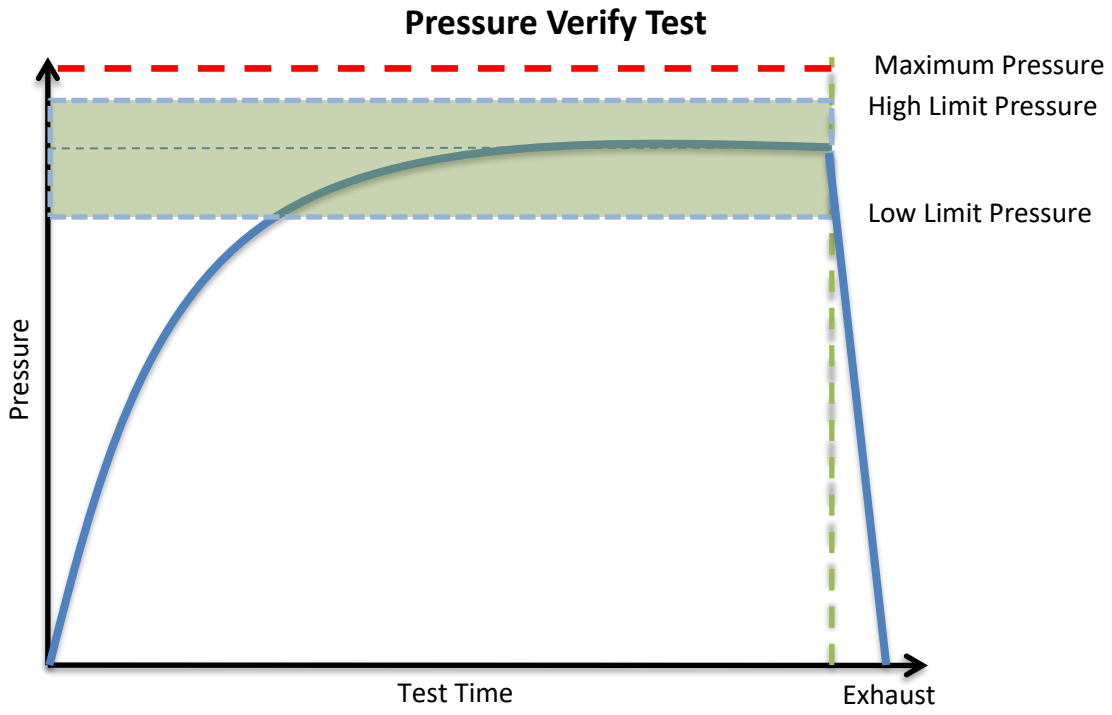
The Pressure Verify test is intended to test parts that generate vacuum or pressure, or to verify that the part was pre-charged to the correct pressure, or to verify that the part was evacuated or filled by an external source.

The principle of operation is to close the isolation valve on the internal manifold to isolate the part. The pressure transducer then reads the vacuum or pressure generated by the part or that is already in the part. At the end of the test timer, the test pressure is compared to the low limit pressure and high limit pressure settings. The Test Result is recorded with an overall ACCEPT/REJECT

If the Pressure Verify test was performed with the Self-Test cap on the test port, the only pressure measured will be the small pressure that is trapped by the isolation valve as it actuates to close.

The Tables that follow give detailed descriptions of each parameter and also document the Display User Level associated with each parameter.

Note: To change the User Level, see Chapter 32 – User and Security.



Timer Parameters

The Timers menu is located in the **Main Menu > Configuration > Timers** option.

Timer	Description	User Display Mode
Test	Amount of time allocated to each segment for execution before continuing. The pressure measurement is made at the end of the Test segment.	Basic, Advanced, Admin
Exhaust	Time to relieve or vent part pressure before signaling the end of test. This prevents the accidental ejection of debris and protects the fixture seals from damage	Basic, Advanced, Admin

Pressure Parameters

The Pressure menu is located in the **Main Menu > Configuration > Pressure** option.

Pressure	Description	User Display Mode
Maximum Pressure	The value that must not be exceeded at any time to complete a successful test. If the pressure goes above the Maximum Test Pressure, the testing cycle will end as an Over Pressure Malfunction.	Basic Advanced, Admin

Test Parameters

The Test parameters menu is located in the **Main Menu > Program Config > Test:PVF** icon.

TST Parameter	Description	User Display Mode
Low Limit Pressure	Lower setpoint value used to evaluate test results.	Basic Advanced, Admin
High Limit Pressure	Upper setpoint value used to evaluate test results.	Basic Advanced, Admin
Test Evaluation	Test results are compared to two setpoints for pass or fail status. There are three areas for evaluation of results: Above high limit, Between limits, and Below low limit. See Table below for codes	Advanced, Admin

Test Evaluation Code	Description
Above Hi Limit > Between Limits > Below Lo Limit	Three zones of evaluation for Pass and Fail
P P F	Pass if above low limit
P F F	Pass if above high limit
F P F* (Default)	Pass if between high and low limits
F P P	Pass if below high limit
F F P	Pass if below low limit
P F P	Pass if above the high limit or below the low limit

Note: the IX5 evaluation moves toward the left. Ensure you are tracking the data flow from the High Limit (Right) toward the Low Limit (Left) to correctly identify if the test result remains within the parameters.

This page is intentionally blank.

Chapter 8 – Mass Flow

This chapter explains the theory and parameters for conducting a Mass Flow Test. The result of this test is the measured flow rate at the moment the Test cycle timer decrements to zero time. This test type is typically used for applications where a "good" part is expected to flow a desired amount.

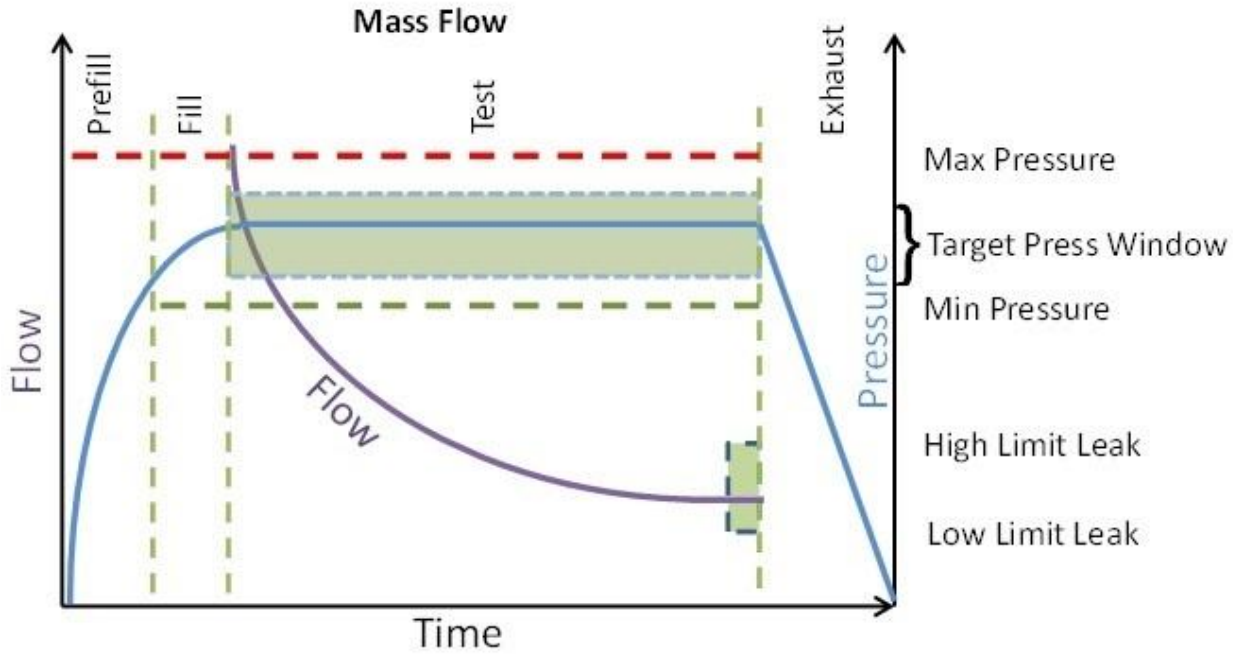
This test type utilizes a single calibration cycle with a non-leaking master part to set the zero flow value. It is important to note that this calibration process creates a linear offset of all the flow readings based on this single calibration point.

The basic principle of operation of a mass flow test leak test instrument is to fill the test part to a specified target test pressure and allow the pressure regulator to maintain the target pressure in the part. The instrument will measure the flow of air required to keep the part at the target pressure.

The Charts below give an overview of the parameters used to set up a Mass Flow Test. The Tables that follow give detailed descriptions of each parameter and also document the Display User Level associated with each parameter.

Note: To change the User Level, see Chapter 32 – User and Security

Timer Parameters



The Timers menu is located in the **Main Menu > Configuration > Timers** option.

Timer	Description	Display User Level
Prefill	Checks for excessively leaking parts or lack of pressure. May be set to "Percent of Fill Time" (default), for fixed fill time tests, or set to "Not to Exceed Time". For Changing the Functionality of the Prefill Timer, see Chapter 33 – Features. Maximum time to reach the minimum pressure. If the variable is set to "Not to Exceed Time", this segment will exit to the next once the Minimum Pressure value is reached.	Basic Advanced, Admin
Pre-Press	Time to enable part to reach the Pre-Pressure. At the end of this time, the instrument will continue to the Fill segment and begin filling in to the Target Pressure. *This parameter is only available if the Prefill Method selected is "Pre-Pressure Time"*	Basic Advanced, Admin
Fill	Time to enable part to reach the Target Pressure. It may also be used as time to stabilize part pressure with additional air.	Basic Advanced, Admin
Test	The precise time over which to measure pressure drop or decay or the precise end time to measure pressure rise.	Basic Advanced, Admin
Exhaust	Time to relieve or vent part pressure before signaling the end of test. This prevents the accidental ejection of debris and protects the fixture seals from damage	Basic Advanced, Admin
Relax	Timer used during Program Cal sequence as a delay between calibration cycles to allow the master part to recover to repeatable virgin state. (Too short relax times result in decreasing flow results in successive tests.)	Basic Advanced, Admin

Pressure Parameters

The Pressure menu is located in the **Main Menu > Configuration > Pressure** option.

Pressure	Description	Display User Level
Pre-Pressure	Target Pre-Pressure. Used as a setpoint for the Electronic Regulator during the Pre-Pressure time. *This parameter is only available if the Prefill Method selected is "Pre-Pressure Time"*	Basic Advanced, Admin
Pre-Pressure Window	The percentage (plus and minus) about the Pre-Pressure value defining the minimum and maximum pressure at the end of the Pre-Pressure time. *This parameter is only available if the Prefill Method selected is "Pre-Pressure Time"*	Basic Advanced, Admin
Minimum Pressure	The value that must be reached before the Prefill setpoint is reached and must be maintained through fill and stabilization segments or the testing cycle will end as a Severe Leak.	Basic Advanced, Admin
Target Pressure	The specified test pressure for the part. For vacuum test pressures enter a positive value if psiv was selected as the pressure unit, or enter a negative value if psig was selected as the pressure unit. ((For example, the test pressure 9.7 psia would be entered as 5 psiv or -5 psig.) Pressure loss may be corrected to the Target Pressure.	Basic Advanced, Admin
Maximum Pressure	The value that must not be exceeded at any time to complete a successful test. If the pressure goes above the Maximum Test Pressure, the testing cycle will end as an Over Pressure Malfunction.	Basic Advanced, Admin
Target Press Window	This is a window (default +/– 50%) set around the Target Pressure that must be maintained during the Test segment of the testing cycle. It generates a Target Pressure Low or High Malfunction if the actual pressure falls outside this window during test.	Advanced, Admin

Test Parameters

The Test parameters menu is located in the **Main Menu > Configuration > Test:FLW** option.

TST Parameter	Description	Display User Level
Low Limit Flow	Lower setpoint value used to evaluate test results.	Basic Advanced, Admin
High Limit Flow	Upper setpoint value used to evaluate test results.	Basic Advanced, Admin
Test Evaluation	Test results are compared to two setpoints for pass or fail status. There are three areas for evaluation of results: above high limit, between limits, and below low limit. See Table below for codes.	Advanced, Admin
Target pressure correction	Allow the instrument to perform measurement correction based upon the relationship between the target pressure and actual test pressure.	Advanced, Admin
Max Master Flow	The maximum value allowed for the Master Flow Offset parameter located on the Cal menu.	Basic Advanced, Admin
Min Master Flow	The minimum value allowed for the Master Flow Offset parameter located on the Cal menu.	Basic Advanced, Admin
EDC Enable	Activates Environmental Drift Correction. See Appendix C – Environmental Drift Correction.	Advanced, Admin
EDC Percentage	Options include 10%, 25%, 50%, 75%, and 90%. See Appendix C – Environmental Drift Correction.	Advanced, Admin
EDC Quantity	See Appendix C – Environmental Drift Correction.	Advanced, Admin
Enable Calibration	Typically used with low leak applications. Enables the Program Cal function which allows a zero offset to be created for a non-leaking master part.	Advanced, Admin

Test Evaluation Code	Description
Above Hi Limit > Between Limits > Below Lo Limit	Three zones of evaluation for Pass and Fail
P P F	Pass if above low limit
P F F	Pass if above high limit
F P F* (default)	Pass if between high and low limits
F P P	Pass if below high limit
F F P	Pass if below low limit
P F P	Pass if above the high limit or below the low limit

Note: The Evaluation option displays High Limit (left) to Low Limit (right). On the IX5 monitor screen, readings appear from Low Limit (left) toward High Limit (right). Ensure this orientation is understood to correctly identify the test result..

Program Calibration

In some applications, particularly low leak applications, it is advantageous to create a flow offset based on testing a non-leaking master part. To enable flow offset, go to **Main Menu > Configuration > TST:FLW** icon. Change the **Enable Calibration** parameter to "Yes".

Initiating the Program Cal Sequence

To initiate a Program Cal sequence, go to **Main Menu > Configuration > Cal:PLR > Program calibration option** icon, click OK**. The Program Cal** wizard will tell you to connect a non-leaking master part. Connect the non-leaking master part to the instrument. Push the Start button to initiate the Program Cal sequence. The system will conduct a test of the non-leaking part to measure the flow associated with a non-leaking part. This represents the typical offset associated with testing parts within the environment of the test system. The flow value is saved as the Master Part Offset.

> ***Note: The instrument will require a Program Cal Sequence if any parameters that affect the calibration are modified.***

One condition must be met during the Program Calibration procedure for the instrument to accept and store the calibration result. The condition is:
The Master (part) Flow must be between the Min Master Flow and Max Master Flow limits.
If the procedure does not meet this condition, an error message is displayed at the completion of test.

If the Program Cal routine is successfully completed, "PROGRAM CALIBRATION PASSED" will be displayed. If there are any problems during the Program Cal sequence an error will be displayed. See Appendix A – Messages & Error Codes.

Calibration Parameters

The Calibration parameters menu is located in **Main Menu > Configuration > CAL:FLW** option. These calibration parameters are values that are measured or calculated as a result of the Program Cal routine for a Mass Flow test.

Parameter	Description	Display User Level
Master Flow Offset	The flow value measured during a Program Calibration sequence is created as a zero offset. This value is stored in this parameter and is used as an offset to subtract from the actual flow value.	Viewable in Basic & Advanced **Editable in Admin**

Direct Flow Parameter

The Direct Flow Parameter is viewed by going to the Main menu > Configuration ->Misc option. This parameter determines how the flow transducer is inserted into the test circuit.

If the parameter is set to "Enabled: Prefill-Test" then the transducer is active during the Prefill to test timer.
If the parameter is set to "Enabled: Fill-Test" then the transducer is active during the Fill to test timer.
If the parameter is set to "Disabled", the transducer is bypassed during the Prefill and Fill timer and active only during the Test timer.

Note: It may be advantageous to use direct flow when short test cycles are needed with parts that are expected to flow a certain amount. With direct flow, the flow transducer is inserted into the test circuit earlier and gives the flow sensor the entire cycle to stabilize before making the final measurement at the end of the test segment.

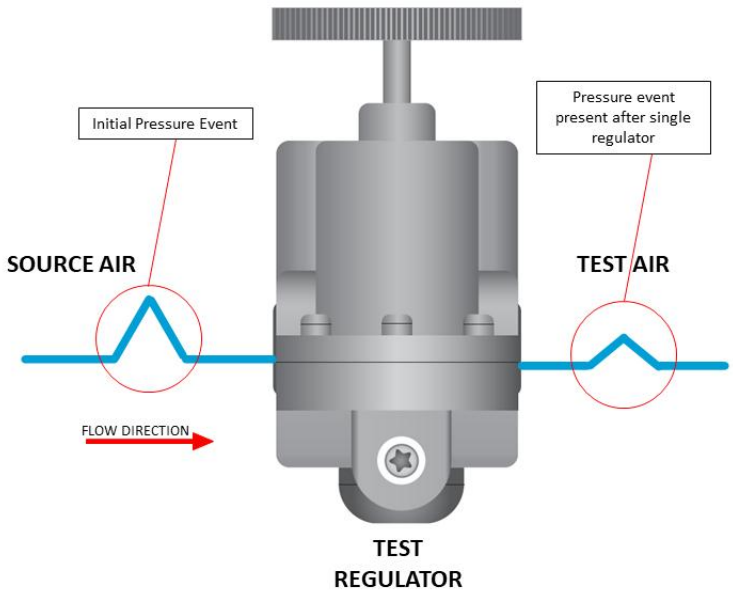
Pre-Regulation

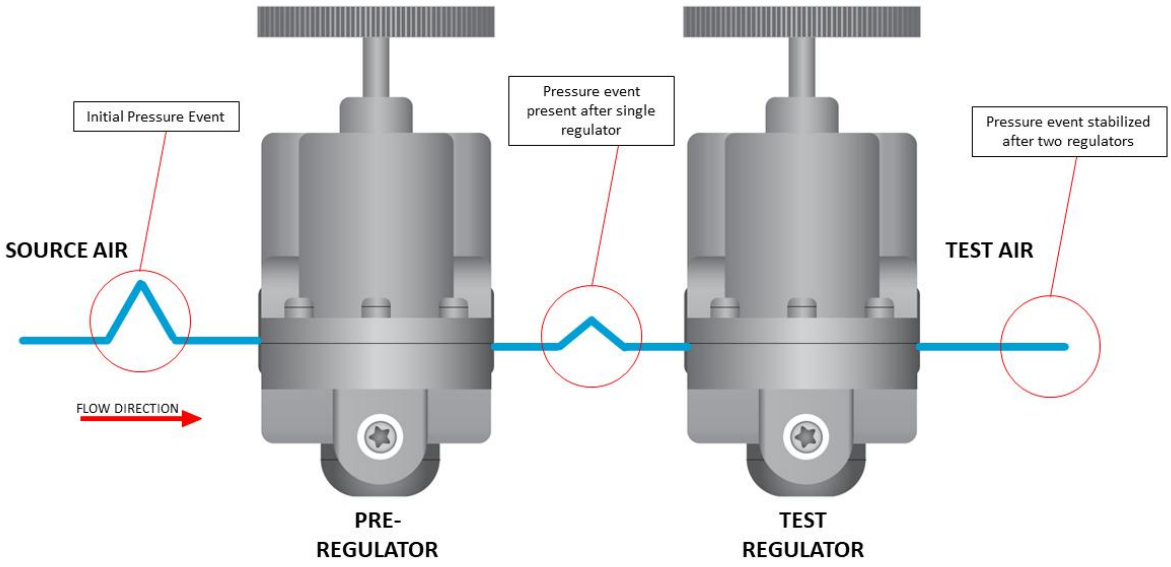
Some pneumatic circuits may feature two pressure regulators in series. The regulator closest to the pressure source is the pre-regulator and the following one is the test regulator. The purpose of the pre-regulator is either:

A. to stabilize the source air flow into the test regulator for a flow test.
B. to condition the source air for another device.

Mass Flow Setup

A pre-regulator may be used in an instrument with a flow transducer to stabilize the flow entering the test regulator. This helps provide a steadier pressure during a mass flow test. The following figure illustrates how pressure events in the compressed air source may be reduced using a pre-regulator. A pressure event may be caused by pneumatic tools or other devices being used on the same supply line.





Setting the Pre-Regulator

To set the pre-regulator pressure, navigate to the Set/Span menu as in setting the pneumatic regulator. Again, the test port must be plugged so that the instrument may hold pressure. First, back out pre-regulator fully by turning it counter-clockwise. Next, turn the knob of the test regulator clockwise until it is threaded all the way in. Then, adjust the pre-regulator to the desired pressure.

It is generally recommended that the pre-regulator be set to a pressure between 10% and 15% higher than the desired test pressure.

Once the pre-regulator is set, adjust the test regulator to the desired pressure.

Note: If the test regulator is an electronic regulator the Set/Span method cannot be used to set its pressure. Instruments like this will be factory set or have a gauge inside the cabinet

Pre-Regulated Devices

A pneumatic device may need a certain supply below typical shop air pressure to operate properly. This may be accomplished with a pre-regulator. This pre-regulator will bet factory set before shipment. If your instrument is not a standard setup, consult the prints on the USB drive that was shipped with your instrument for set point information. If the pre-regulator is meant to be used in a flow test, the pressure will not be shown in the prints because it is dependent on the flow specification. For further information, contact CTS Service.

This page is intentionally blank.

Chapter 9 – Mass Flow-Leak Std

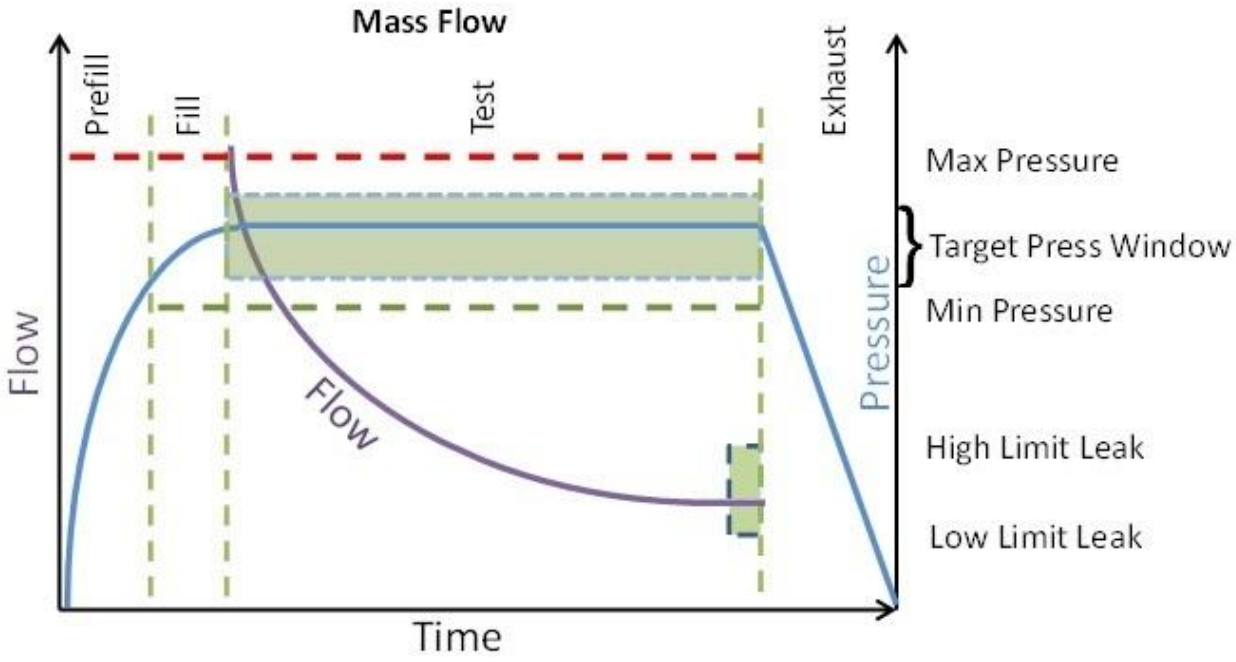
This chapter explains the theory and parameters for conducting a Mass Flow Test with a leak standard. The result of this test is the measured flow rate at the moment the Test cycle timer decrements to zero time. This test type is typically used for low leak applications.

The basic principle of operation of a mass flow test leak test instrument is to fill the test part to a specified target test pressure and allow the pressure regulator to maintain the target pressure in the part. The instrument will measure 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 value at the leak standard value. It is important to note that this calibration process creates a linear offset of the flow readings based on these two points.

The charts in this chapter give an overview of the parameters used to set up a Mass Flow Test. The Tables that follow give detailed descriptions of each parameter and also document the Display User Level associated with each parameter.

Note: To change the User Level, see Chapter 32 – User and Security



Timer Parameters

The Timers menu is located in the **Main Menu > Configuration > Timers** option.

Timer	Description	Display User Level
Prefill	Checks for excessively leaking parts or lack of pressure. May be set to "Percent of Fill Time" (default), for fixed fill time tests, or set to "Not to Exceed Time". For Changing the Functionality of the Prefill Timer, see Chapter 33 – Features. Maximum time to reach the minimum pressure. If the variable is set to "Not to Exceed Time", this segment will exit to the next once the Minimum Pressure value is reached.	Basic Advanced, Admin
Pre-Press	Time to enable part to reach the Pre-Pressure. At the end of this timer, the instrument will continue to the Fill segment and begin filling to the Target Pressure. *This parameter is only available if the Prefill Method selected is "Pre-Pressure Time"*	Basic Advanced, Admin
Fill	Time to enable part to reach the Target Pressure. It may also be used as time to stabilize part pressure with additional air.	Basic Advanced, Admin
Test	The precise time over which to measure pressure drop or decay or the precise end time to measure pressure rise.	Basic Advanced, Admin
Exhaust	Time to relieve or vent part pressure before signaling the end of test. This prevents the accidental ejection of debris and protects the fixture seals from damage	Basic Advanced, Admin
Relax	Timer used during Program Cal sequence as a delay between calibration cycles to allow the master part to recover to repeatable virgin state. (Too short relax times result in decreasing flow results in successive tests.)	Basic Advanced, Admin

Pressure Parameters

The Pressure menu is located in the **Main Menu > Configuration > Pressure** option.

Pressure	Description	Display User Level
Pre-Pressure	Target Pre-Pressure. Used as a setpoint for the Electronic Regulator during the Pre-Pressure time. *This parameter is only available if the Prefill Method selected is "Pre-Pressure Time"*	Basic Advanced, Admin
Pre-Pressure Window	The percentage (plus and minus) about the Pre-Pressure value defining the minimum and maximum pressure at the end of the Pre-Pressure time. *This parameter is only available if the Prefill Method selected is "Pre-Pressure Time"*	Basic Advanced, Admin
Minimum Pressure	The value that must be reached before the Prefill setpoint is reached and must be maintained through fill and stabilization segments or the testing cycle will end as a Severe Leak.	Basic Advanced, Admin
Target Pressure	The specified test pressure for the part. For vacuum test pressures enter a positive value if psiv was selected as the pressure unit, or enter a negative value if psig was selected as the pressure unit. ((For example, the test pressure 9.7 psia would be entered as 5 psiv or -5 psig.) Pressure loss may be corrected to the Target Pressure.	Basic Advanced, Admin
Maximum Pressure	The value that must not be exceeded at any time to complete a successful test. If the pressure goes above the Maximum Test Pressure, the testing cycle will end as an Over Pressure Malfunction.	Basic Advanced, Admin
Target Press Window	This is a window (default +/– 50%) set around the Target Pressure that must be maintained during the Test segment of the testing cycle. It generates a Target Pressure Low or High Malfunction if the actual pressure falls outside this window during test.	Advanced, Admin

Test Parameters

The Test parameters menu is located in the **Main Menu > Configuration > TST:FLC** option.

TST Parameter	Description	Display User Level
Low Limit Leak	Lower setpoint value used to evaluate test results.	Basic Advanced, Admin
High Limit Leak	Upper setpoint value used to evaluate test results.	Basic Advanced, Admin
Test Evaluation	Test results are compared to two setpoints for pass or fail status. There are three areas for evaluation of results: above high limit, between limits, and below low limit. See Table below for codes.	Advanced, Admin
Target pressure correction	Allow the instrument to perform measurement correction based upon the relationship between the target pressure and actual test pressure.	Advanced, Admin
Min Master Flow	The minimum value allowed for the first test during the Program Calibration sequence.	Basic Advanced, Admin
Max Master Flow	The maximum value allowed for the first test during the Program Calibration sequence.	Basic Advanced, Admin
Min Master + Leak Flow	The minimum value allowed for the second test during the Program Calibration sequence when the leak standard is in the test circuit.	Basic Advanced, Admin
Max Master + Leak Flow	The maximum value allowed for the second test during the Program Calibration sequence when the leak standard is in the test circuit.	Basic Advanced, Admin
Min Leak Flow	The minimum value allowed that represents the flow due to the Leak Standard used to calibrate the instrument.	Basic Advanced, Admin
Max Leak Flow	The maximum value allowed that represents the flow due to the Leak Standard used to calibrate the instrument.	Basic Advanced, Admin
Quik Test Enable	Activates Quik Test. See Appendix B – Quik Test.	Advanced, Admin
Quik Test Timer	Options include 10%, 25%, 50%, 75%, and 90%. See Appendix B – Quik Test..	Advanced, Admin
Quik Test LL Band	See Appendix B – Quik Test..	Advanced, Admin
Quik Test HL Band	See Appendix B – Quik Test..	Advanced, Admin
EDC Enable	Activates Environmental Drift Correction. See Appendix C – Environmental Drift Correction.	Advanced, Admin

EDC Percentage	Options include 10%, 25%, 50%, 75%, and 90%. See Appendix C – Environmental Drift Correction..	Advanced, Admin
EDC Quantity	See Appendix C – Environmental Drift Correction..	Advanced, Admin

Test Evaluation Code	Description
Above Hi Limit > Between Limits > Below Lo Limit	Three zones of evaluation for Pass and Fail
P P F	Pass if above low limit
P F F	Pass if above high limit
F P F* (default)	Pass if between high and low limits
F P P	Pass if below high limit
F F P	Pass if below low limit
P F P	Pass if above the high limit or below the low limit

Note: If the instrument is configured with multiple internal leak standards, the user must select which leak standard is to be used in the Program. See Selecting the Proper Internal Leak Standard in Chapter 33 – Features.

Note: The Evaluation option displays High Limit (left) to Low Limit (right). On the IX5 monitor screen, readings appear from Low Limit (left) toward High Limit (right). Ensure this orientation is understood to correctly identify the test result.

Program Calibration

In order to scale the flow transducer to the "zero flow" reading measured by testing a non-leaking part and the "reject" reading measured by testing the non-leaking part with a leak standard incorporated in the circuit, the instrument needs to run the "Program Cal" procedure. This procedure requires at least one known non-leaking part referred to as a "master part". This procedure tests a non-leaking master part in the seal fixture using the timers and pressures established for the program. The procedure automatically tests the non-leaking master part twice with the Relax timer delay between tests. Within each program that uses a leak standard, Program Cal can be configured to use one of four methods. See **Setting the Cal Method and Leak Standard Location** in Chapter 33 – Features.

Remember: The Leak/Cal menu has a parameter called Leak Std/Cal Define that determines the location for the leak standard settings.

When set to "Channel", leak standard settings are located in the Main menu > Device Settings > Hardware menu.

When set to "Program", leak standard settings are located in the Main menu > Configuration.

Determine how you plan to use your leak test instrument. Setting the Leak Standard Values ***section on page 13. It is critical to make sure the leak standard values are set correctly for proper use. To view the Cal Method parameter, you must be in the Advanced or Admin Display User Level. To change the Display User Level, see*** Chapter 33 – Features.

Initiating the Program Cal Sequence

To initiate a Program Cal sequence, go to **Main Menu > Configuration > Cal:PLR > Program calibration option**, click OK. The Program Cal wizard will tell you to connect a non-leaking master part. Connect the non-leaking master part to the instrument. Push the **Start button** to initiate the Program Cal sequence. The system will conduct an initial test of the non-leaking master part to measure the flow associated with a non-leaking part. This represents the typical offset associated with testing parts within the environment of the test system. The flow value is saved as the Master Part Flow. The system will conduct a second test on a non-leaking master part with a known calibrated leak standard included in the test. The flow value result for this test is saved as the Master+Leak Flow.

> ***Note: The instrument will require a Program Cal Sequence if any parameters that affect the calibration are modified.***

Conditions for a Successful Calibration

Several conditions must be met during the Program Calibration procedure for the instrument to accept and store the calibration results. The conditions are based on the following measurements or calculations:

1. Master Part Flow
   a. Must be greater than the Min Master Flow limit
   b. Must be less than the Max Master Flow limit
   c. Must be less than the Master+Leak Flow measurement
2. Master+Leak Flow
   a. Must be greater than the Min Mstr+Leak Flow limit
   b. Must be less than the Max Mstr+Leak Flow limit
   c. Must be greater than the Master Flow measurement
3. Leak Flow
   a. Must be greater than the Min Leak Flow limit
   b. Must be less than the Max Leak Flow limit

If the procedure does not meet these conditions, error messages are displayed at the completion of tests.

If the Program Cal routine is successfully completed, "PROGRAM CALIBRATION PASSED" will be displayed. If there are any problems during the Program Cal sequence an error will be displayed. If there is an error, see Appendix A – Messages & Error Codes.

Calibration Parameters

The Calibration parameters menu is located in the **Main Menu > Configuration > CAL:FLC** option. These calibration parameters are values that are measured or calculated as a result of the Program Cal routine for a Mass Flow test.

Parameter	Description	Display User Level
Program Calibration Button	Program Cal button Used to start the Program calibration routines.	Basic Advanced, Admin
Master Part Press	Measured pressure at the beginning of the test segment during the first test of the Program Cal process for the non-leaking master part.	Basic Advanced, Admin
Master+Leak Press	Measured pressure at the beginning of the test cycle of second test during Program Cal process for the non-leaking master part with the leak standard introduced to the pneumatic test circuit.	Basic Advanced, Admin
Master Part Flow	Measured flow for the non-leaking master part during the first test of Program Cal process.	Viewable in Basic & Advanced **Editable in Admin**
Master+Leak Flow	Measured flow during the second test of Program Cal for the non-leaking master part with the leak standard introduced to the pneumatic test circuit.	Viewable in Basic & Advanced **Editable in Admin**
Leak Flow	Calculated flow based upon measured flows during the Program Cal routine. Corresponds to the actual flow related to the leak standard.	Viewable in Basic & Advanced
Corr. Leak Std Flow	The calculated leak standard flow rate based on the Program Target Pressure, the leak standard calibrated pressure, and the leak standard calibrated flow rate.	Basic Advanced, Admin

Direct Flow Parameter

The Direct Flow Parameter is viewed by going to the Main menu > Configuration ->Misc option. This parameter determines how the flow transducer is inserted into the test circuit.

If the parameter is set to "Enabled: Prefill-Test" then the transducer is active during the Prefill to test timer.
If the parameter is set to "Enabled: Fill-Test" then the transducer is active during the Fill to test timer.
If the parameter is set to "Disabled", the transducer is bypassed during the Prefill and Fill timer and active only during the Test timer.

Note: It may be advantageous to use direct flow when short test cycles are needed with parts that are expected to flow a certain amount. With direct flow, the flow transducer is inserted into the test circuit earlier and gives the flow sensor the entire cycle to stabilize before making the final measurement at the end of the test segment.

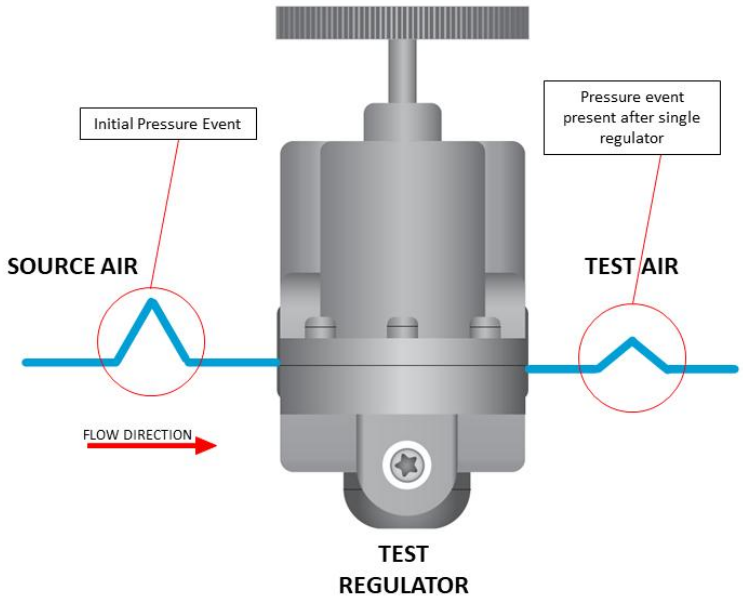
Pre-Regulation

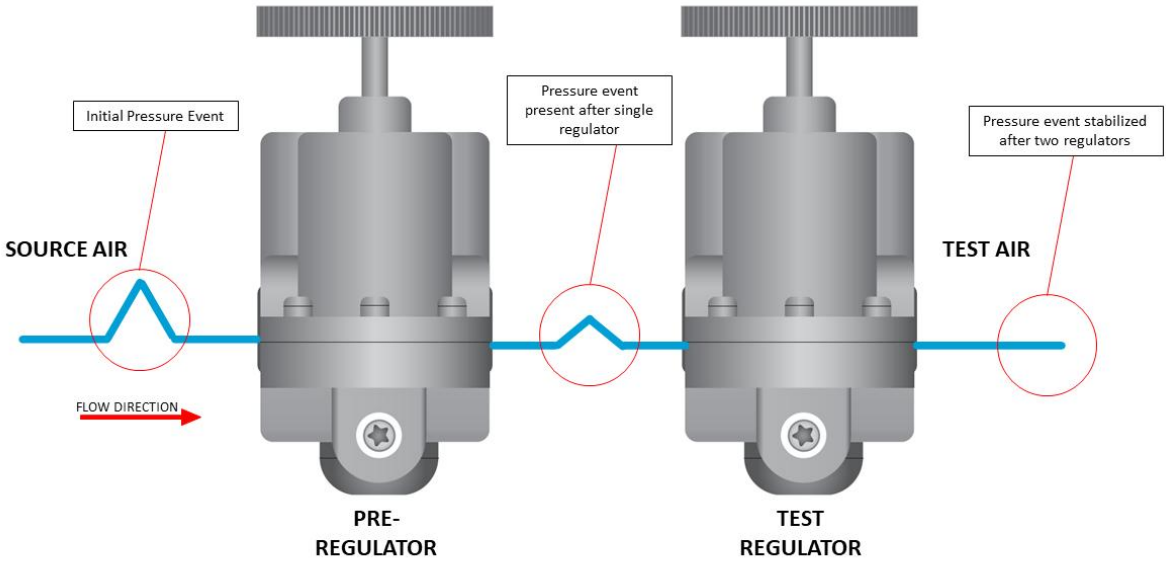
Some pneumatic circuits may feature two pressure regulators in series. The regulator closest to the pressure source is the pre-regulator and the following one is the test regulator. The purpose of the pre-regulator is either:

A. to stabilize the source air flow into the test regulator for a flow test.
B. to condition the source air for another device.

Mass Flow Setup

A pre-regulator may be used in an instrument with a flow transducer to stabilize the flow entering the test regulator. This helps provide a steadier pressure during a mass flow test. The following figure illustrates how pressure events in the compressed air source may be reduced using a pre-regulator. A pressure event may be caused by pneumatic tools or other devices being used on the same supply line.





Setting the Pre-Regulator

To set the pre-regulator pressure, navigate to the Set/Span menu as in setting the pneumatic regulator. Again, the test port must be plugged so that the instrument may hold pressure. First, back out pre-regulator fully by turning it counter-clockwise. Next, turn the knob of the test regulator clockwise until it is threaded all the way in. Then, adjust the pre-regulator to the desired pressure.

It is generally recommended that the pre-regulator be set to a pressure between 10% and 15% higher than the desired test pressure.

Once the pre-regulator is set, adjust the test regulator to the desired pressure.

Note: If the test regulator is an electronic regulator the Set/Span method cannot be used to set its pressure. Instruments like this will be factory set or have a gauge inside the cabinet

Setting the Pre-Regulator

To set the pre-regulator pressure, navigate to the Set/Span menu as in setting the pneumatic regulator. Again, the test port must be plugged so that the instrument may hold pressure. First, back out pre-regulator fully by turning it counter-clockwise. Next, turn the knob of the test regulator clockwise until it is threaded all the way in. Then, adjust the pre-regulator to the desired pressure.

It is generally recommended that the pre-regulator be set to a pressure between 10% and 15% higher than the desired test pressure.

Once the pre-regulator is set, adjust the test regulator to the desired pressure.

Note: If the test regulator is an electronic regulator the Set/Span method cannot be used to set its pressure. Instruments like this will be factory set or have a gauge inside the cabinet

Pre-Regulated Devices

A pneumatic device may need a certain supply below typical shop air pressure to operate properly. This may be accomplished with a pre-regulator. This pre-regulator will bet factory set before shipment. If your instrument is not a standard setup, consult the prints on the USB drive that was shipped with your instrument for set point information. If the pre-regulator is meant to be used in a flow test, the pressure will not be shown in the prints because it is dependent on the flow specification. For further information, contact cts Service

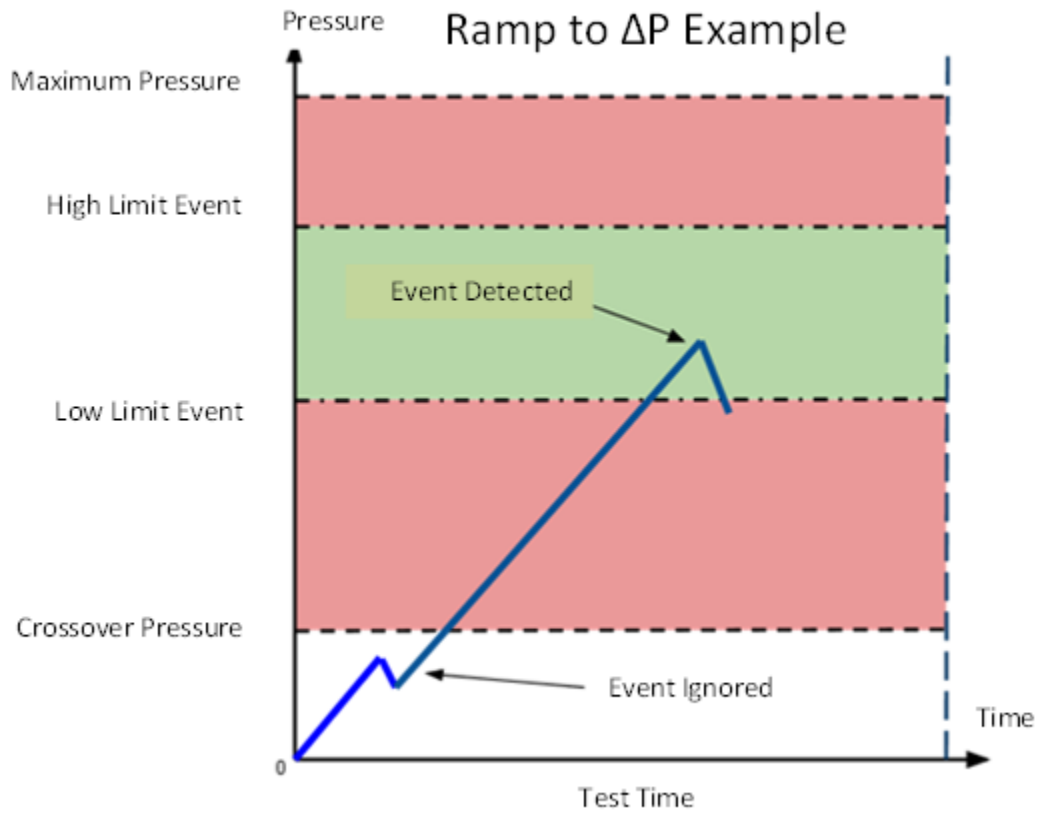
Chapter 10 – Ramp to ΔP Event

This chapter explains the theory and parameters for conducting a Ramp to 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, or by a mechanical regulator through a fixed restriction.

The Chart 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 parameter and also document the Display User Level associated with each parameter.

Note: To change the User Level, see Chapter 32 – User and Security



Timer Parameters

The Timers menu is located in the **Main Menu > Configuration > Timers** option.

Timer	Description	Display User Level
Test	Maximum duration timer that is a not-to-exceed value. If an event does not occur within this time period, the test will abort with a "NO EVENT" evaluation.	Basic Advanced, Admin
Exhaust	Time to relieve or vent part pressure before signaling the end of test. This prevents the accidental ejection of debris and protects the fixture seals from damage	Basic Advanced, Admin

Pressure Parameters

The Pressure menu is located in the **Main Menu > Configuration > Pressure** option.

Pressure	Description	Display User Level
Maximum Pressure	The value that must not be exceeded at any time to complete a successful test. If the pressure goes above the Maximum Test Pressure, the testing cycle will end as an Over Pressure Malfunction.	Basic Advanced, Admin
Ramp Method	Determines whether ramp is developed by electronic regulator, manual flow restrictor or combination of both. Options are visible only if the instrument is configured with an electronic regulator.	Basic Advanced, Admin
Starting Pressure	Starting Pressure, only when controlled by the instrument with an electronic regulator. This parameter is not visible if the Ramp Method is set to "None" or "Mech Reg, Flow Control".	Basic Advanced, Admin
Ramp Rate	Rate at which pressure is increased or decreased during the test time, only when controlled by the instrument with an electronic regulator. This parameter is not visible if the Ramp Method is set to "None", "Mech Reg, Flow Control" or "E-Reg Fixed, Flow Control".	Basic Advanced, Admin

Test Parameters

The Test parameters menu is located in the **Main Menu > Configuration > Test:RTE** option.

TST Parameter	Description	Display User Level
Low Limit Event	Lower setpoint value used to evaluate test results.	Basic Advanced, Admin
High Limit Event	Upper setpoint value used to evaluate test results.	Basic Advanced, Admin
Test Evaluation	Test results are compared to two setpoints for pass or fail status. There are three areas for evaluation of results: above high limit, between limits, and below low limit. See Table below for codes.	Advanced, Admin
Crossover Pressure	Pressure setpoint that must be crossed (ascending pressure ramp or descending pressure ramp) during the test timer before an event can be detected. This parameter prevents capturing initial part stretch or any other system noise during the ramp of pressure below this value. If set to "Zero", this requirement is disabled.	Basic Advanced, Admin
Event Type	Determines the method utilized to trap for an event: ΔP decrease from peak pressure, ΔP decrease over time or ΔP increase over time.	Basic Advanced, Admin
Event Δ Time	The period over which the pressure differential is calculated to determine if an event has occurred	Basic Advanced, Admin
Event Δ Pressure	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'.	Basic Advanced, Admin

Test Evaluation Code	Description
Above Hi Limit > Between Limits > Below Lo Limit	Three zones of evaluation for Pass and Fail
P P F	Pass if above low limit
P F F	Pass if above high limit
F P F* (default)	Pass if between high and low limits
F P P	Pass if below high limit
F F P	Pass if below low limit
P F P	Pass if above the high limit or below the low limit

Note: The Evaluation option displays High Limit (left) to Low Limit (right). On the IX5 monitor screen, readings appear from Low Limit (left) toward High Limit (right). Ensure this orientation is understood to correctly identify the test result.

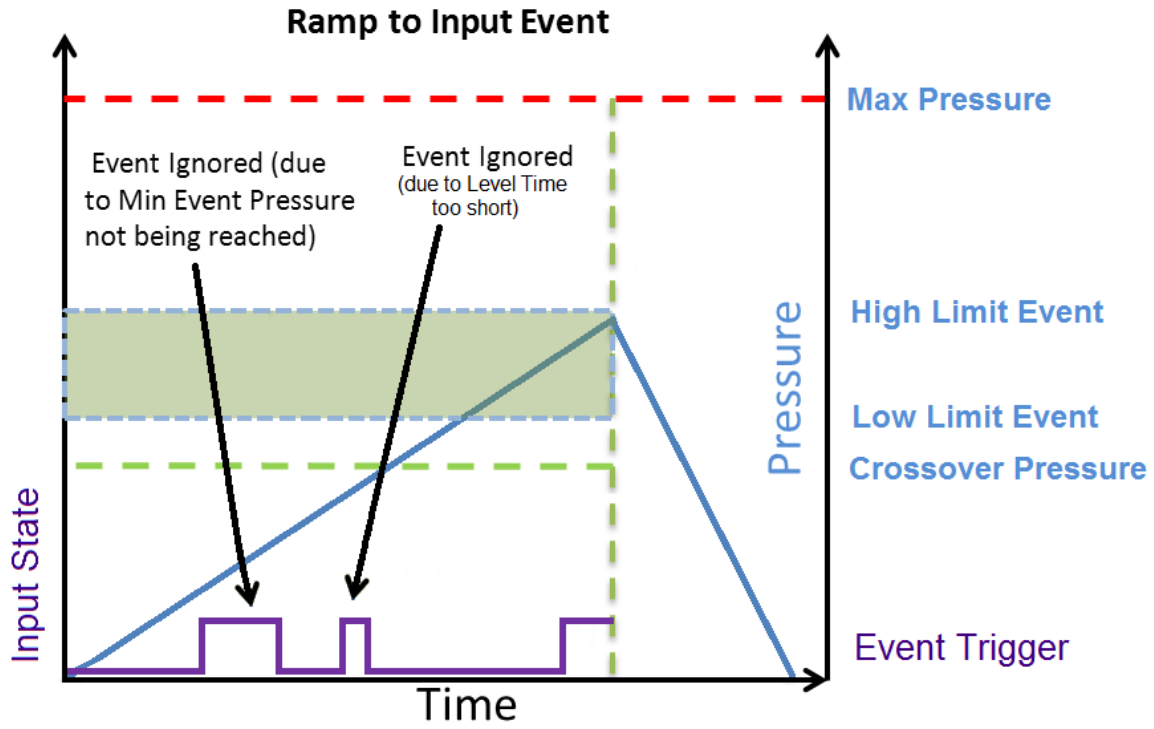
Chapter 11 – Ramp to Input Event

This chapter explains the theory and parameters 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, or by a mechanical regulator through a fixed restriction. 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 Chart 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 parameter and also document the Display User Level associated with each parameter.

Note: To change the User Level, see Chapter 32 – User and Security



Timer Parameters

The Timers menu is located in the **Main Menu > Configuration > Timers** option.

Timer	Description	Display User Level
Test	Maximum duration timer that is a not-to-exceed value. If an event does not occur within this time period, the test will abort with a "NO EVENT" evaluation.	Basic Advanced, Admin
Exhaust	Time to relieve or vent part pressure before signaling the end of test. This prevents the accidental ejection of debris and protects the fixture seals from damage	Basic Advanced, Admin

Pressure Parameters

The Pressure menu is located in the **Main Menu > Configuration > Pressure** option.

Pressure	Description	Display User Level
Maximum Pressure	The value that must not be exceeded at any time to complete a successful test. If the pressure goes above the Maximum Test Pressure, the testing cycle will end as an Over Pressure Malfunction.	Basic Advanced, Admin
Ramp Method	Determines whether ramp is developed by electronic regulator, manual flow restrictor or combination of both. Options are visible only if the instrument is configured with an electronic regulator.	Basic Advanced, Admin
Starting Pressure	Starting Pressure, only when controlled by the instrument with an electronic regulator. This parameter is not visible if the Ramp Method is set to "None" or "Mech Reg, Flow Control".	Basic Advanced, Admin
Ramp Rate	Rate at which pressure is increased or decreased during the test time, only when controlled by the instrument with an electronic regulator. This parameter is not visible if the Ramp Method is set to "None", "Mech Reg, Flow Control" or "E-Reg Fixed, Flow Control".	Basic Advanced, Admin

Test Parameters

The Test parameters menu is located in the **Main Menu > Configuration > Test:RTI** option.

TST Parameter	Description	Display User Level
Low Limit Event	Lower setpoint value used to evaluate test results.	Basic Advanced, Admin
High Limit Event	Upper setpoint value used to evaluate test results.	Basic Advanced, Admin
Test Evaluation	Test results are compared to two setpoints for pass or fail status. There are three areas for evaluation of results: above high limit, between limits, and below low limit. See Table below for codes.	Advanced, Admin
Crossover Pressure	Pressure setpoint that must be crossed (ascending pressure ramp or descending pressure ramp) during the test timer before an event can be detected. This parameter prevents capturing initial part stretch or any other system noise during the ramp of pressure below this value. If set to "Zero", this requirement is disabled.	Basic Advanced, Admin
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 specific input state for a specified duration.	Basic Advanced, Admin
Edge Type	Defines the direction of transition required on the input to d+++etermine if an event has occurred. Rising Edge is a level transition from Low to High and Falling Edge is a level transition from High to Low.	Basic Advanced, Admin
Level State	Defines the specific state the input must match to trap for an event.	Basic Advanced, Admin
Level Time	The period of time over which the input must be in the desired state to determine if an event has occurred.	Basic Advanced, Admin
Input Initial State	The required initial state of the input that is verified at the start of the test cycle.	Basic Advanced, Admin

Test Evaluation Code	Description
Above Hi Limit > Between Limits > Below Lo Limit	Three zones of evaluation for Pass and Fail
P P F	Pass if above low limit
P F F	Pass if above high limit
F P F* (default)	Pass if between high and low limits
F P P	Pass if below high limit
F F P	Pass if below low limit
P F P	Pass if above the high limit or below the low limit

Note: The Evaluation option displays High Limit (left) to Low Limit (right). On the IX5 monitor screen, readings appear from Low Limit (left) toward High Limit (right). Ensure this orientation is understood to correctly identify the test result.

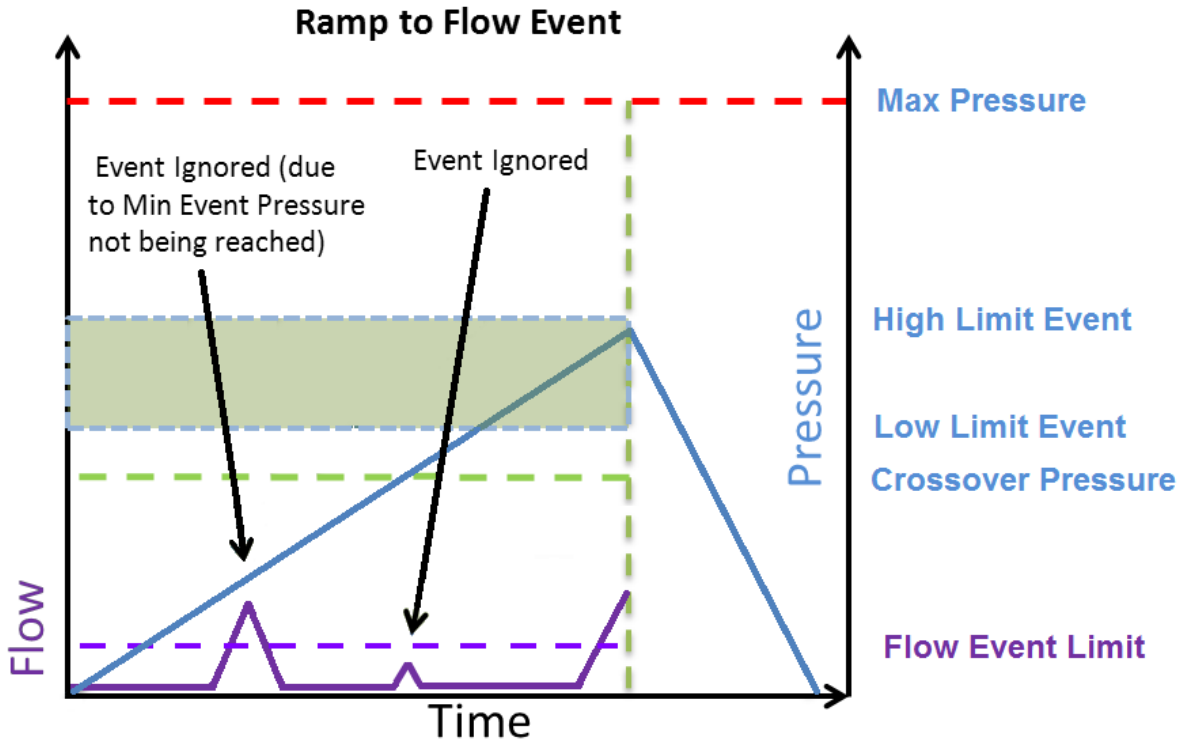
Chapter 12 – Ramp to Flow Event

This chapter explains the theory and parameters for conducting a Ramp to Flow Event Test, which is primarily used for testing the cracking point of a check valve. This test type measures the point at which the flow crosses a threshold, determines the maximum pressure before the Flow Event limit is exceeded, and records the duration of time before the event. The results are presented in units of pressure and time.

This test type is used to evaluate parts that change flow characteristics under pressure, where the change can be immediately detected by monitoring the flow on the outlet side of the device. The system pressure is either increased or decreased at a consistent rate (ramp) over a defined period of time. The pressure ramp can be controlled by the instrument via an electronic regulator, or by a mechanical regulator through a fixed restriction. The outlet side of the device is connected to the flow sensor port on the instrument and allows the instrument to measure downstream flow through the device as the pressure ramps up.

The Chart below gives an overview of the parameters used to set up a Ramp to Flow Event test. The Tables that follow give detailed descriptions of each parameter and also document the Display User Level associated with each parameter.

Note: To change the User Level, see Chapter 32 – User and Security



Timer Parameters

The Timers menu is located in the **Main Menu > Configuration > Timers** option.

Timer	Description	Display User Level
Test	Maximum duration timer that is a not-to-exceed value. If an event does not occur within this time period, the test will abort with a "NO EVENT" evaluation.	Basic Advanced, Admin
Exhaust	Time to relieve or vent part pressure before signaling the end of test. This prevents the accidental ejection of debris and protects the fixture seals from damage	Basic Advanced, Admin

Pressure Parameters

The Pressure menu is located in the **Main Menu > Configuration > Pressure** option.

Pressure	Description	Display User Level
Maximum Pressure	The value that must not be exceeded at any time to complete a successful test. If the pressure goes above the Maximum Test Pressure, the testing cycle will end as an Over Pressure Malfunction.	Basic Advanced, Admin
Ramp Method	Determines whether ramp is developed by electronic regulator, manual flow restrictor or combination of both. Options are visible only if the instrument is configured with an electronic regulator.	Basic Advanced, Admin
Starting Pressure	Starting Pressure, only when controlled by the instrument with an electronic regulator. This parameter is not visible if the Ramp Method is set to "None" or "Mech Reg, Flow Control".	Basic Advanced, Admin
Ramp Rate	Rate at which pressure is increased or decreased during the test time, only when controlled by the instrument with an electronic regulator. This parameter is not visible if the Ramp Method is set to "None", "Mech Reg, Flow Control" or "E-Reg Fixed, Flow Control".	Basic Advanced, Admin

Test Parameters

The Test parameters menu is located in the **Main Menu > Configuration > Test:RTF** option.

TST Parameter	Description	Display User Level
Low Limit Event	Lower setpoint value used to evaluate test results.	Basic Advanced, Admin
High Limit Event	Upper setpoint value used to evaluate test results.	Basic Advanced, Admin
Test Evaluation	Test results are compared to two setpoints for pass or fail status. There are three areas for evaluation of results: above high limit, between limits, and below low limit. See Table below for codes.	Advanced, Admin
Crossover Pressure	Pressure setpoint that must be crossed (ascending pressure ramp or descending pressure ramp) during the test timer before an event can be detected. This parameter prevents capturing initial part stretch or any other system noise during the ramp of pressure below this value. If set to "Zero", this requirement is disabled.	Basic Advanced, Admin
Flow Direction	Defines the direction of flow used when evaluating against limits during test	Advanced, Admin
Flow Event Limit	Minimum flow that must be obtained for the part to have successfully had an 'Event'.	Basic Advanced, Admin

Test Evaluation Code	Description
Above Hi Limit > Between Limits > Below Lo Limit	Three zones of evaluation for Pass and Fail
P P F	Pass if above low limit
P F F	Pass if above high limit
F P F* (default)	Pass if between high and low limits
F P P	Pass if below high limit
F F P	Pass if below low limit
P F P	Pass if above the high limit or below the low limit

Note: The Evaluation option displays High Limit (left) to Low Limit (right). On the IX5 monitor screen, readings appear from Low Limit (left) toward High Limit (right). Ensure this orientation is understood to correctly identify the test result.

This page is intentionally blank.

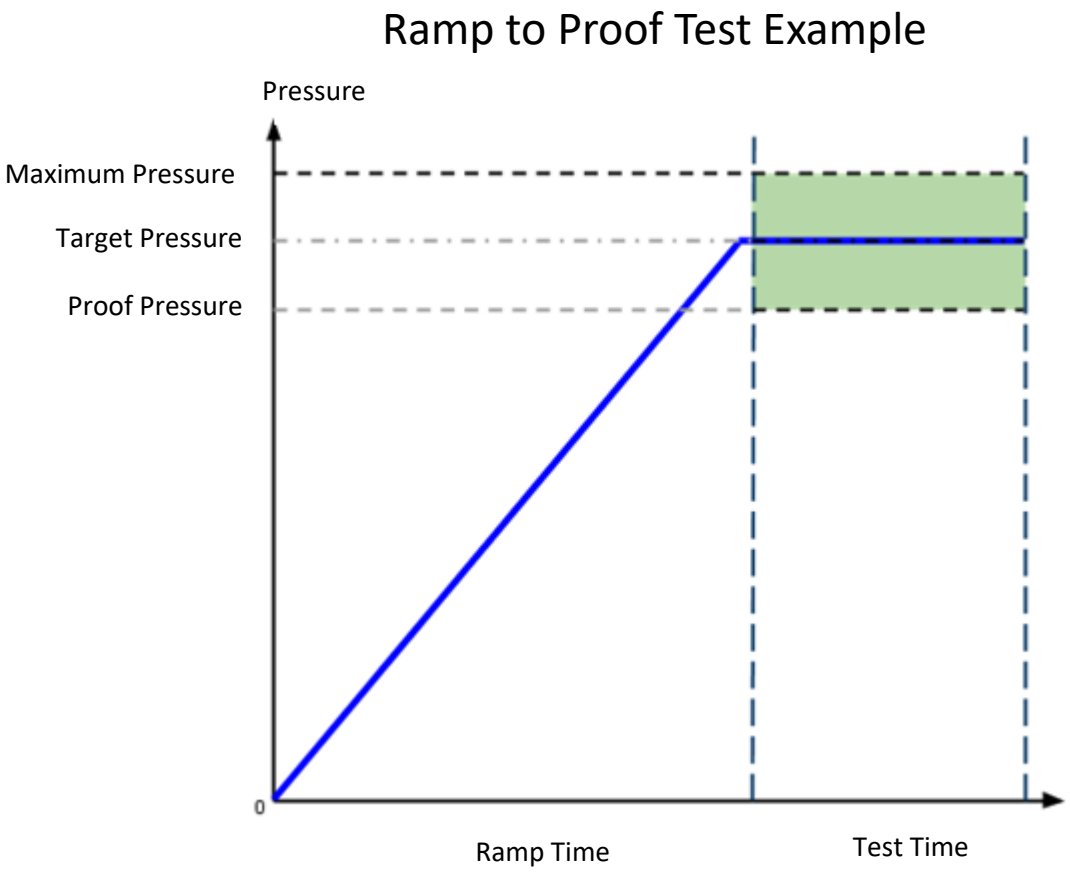
Chapter 13 – Ramp to Proof

This chapter explains the theory and parameters for conducting a 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 or by a mechanical regulator through a fixed restriction. Parts are evaluated based on whether or not pressure was achieved and maintained for the test time period.

The Charts below give an overview of the parameters used to set up a Proof Test. The Tables that follow give detailed descriptions of each parameter and also document the Display User Level associated with each parameter.

Note: To change the User Level, see Chapter 32 – User and Security



Timer Parameters

The Timers menu is located in the **Main Menu > Configuration > Timers** option.

Timer	Description	Display User Level
Ramp	Time period where the pressure ramp occurs. If an electronic regulator is installed, the instrument will increment the pressure according to the Ramp Rate up to the Target Pressure. During this period the system pressure is monitored, and if it exceeds the Maximum Pressure value the test is immediately aborted.	Basic Advanced, Admin
Test	Time period where the part is expected to maintain pressure. Ramping has completed and the system pressure is monitored; it must remain above the Proof Pressure parameter, and not exceed the Max Pressure parameter. If either scenario is violated, the test is immediately aborted.	Basic Advanced, Admin
Exhaust	Time to relieve or vent part pressure before signaling the end of test. This prevents the accidental ejection of debris and protects the fixture seals from damage	Basic Advanced, Admin

Pressure Parameters

The Pressure menu is located in the **Main Menu > Configuration > Pressure** option.

Pressure	Description	Display User Level
Maximum Pressure	The value that must not be exceeded at any time to complete a successful test. If the pressure goes above the Maximum Test Pressure, the testing cycle will end as an Over Pressure Malfunction.	Basic Advanced, Admin
Ramp Method	Determines whether ramp is developed by electronic regulator, manual flow restrictor or combination of both. Options are visible only if the instrument is configured with an electronic regulator.	Basic Advanced, Admin
Starting Pressure	Starting Pressure, only when controlled by the instrument with an electronic regulator. This parameter is not visible if the Ramp Method is set to "None" or "Mech Reg, Flow Control".	Basic Advanced, Admin
Target Pressure	Pressure at which the proof test is to be conducted. This parameter is not visible if the Ramp Method is set to "None", "Mech Reg, Flow Control" or "E-Reg Fixed, Flow Control".	Basic Advanced, Admin
Ramp Rate	Rate at which pressure is increased or decreased during the test time, only when controlled by the instrument with an electronic regulator. This parameter is not visible if the Ramp Method is set to "None", "Mech Reg, Flow Control" or "E-Reg Fixed, Flow Control".	Basic Advanced, Admin

Test Parameters

The Test parameters menu is located in the **Main Menu > Configuration > Test:PRF** option.

TST Parameter	Description	Display User Level
Proof Pressure	Minimum test pressure that must be maintained during the test time. If at any point during the test time pressure falls below this value, the test is immediately aborted, and a Fail result is generated.	Basic Advanced, Admin

This page is intentionally blank.

Chapter 14 – Sequence Editor

This chapter explains the theory and parameters for conducting multiple tests by linking programs together.

Sequence Editor

The Sequence Editor test type is designed to group test results together for a single part. Allows the user to define a sequence of operations to perform. These operations can be conditional and create decision trees to allow for a variety of different testing options.

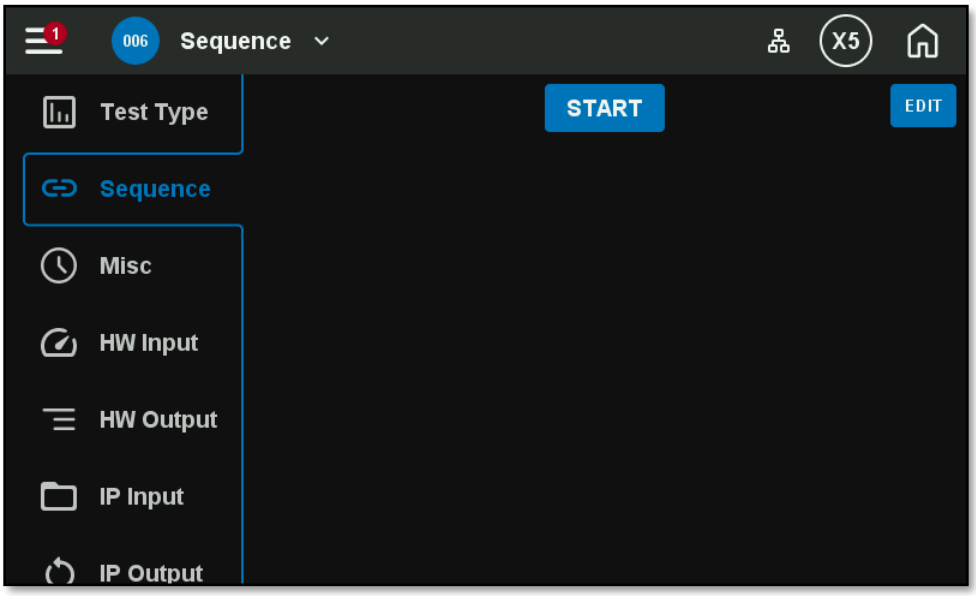
This test type facilitates the linking of individual programs into a testing sequence and provides the overall control of the tooling outputs and inputs, start and stop inputs, and program result outputs for the test sequence

The Sequence tab will allow the user to create custom sequences of programs with decision trees, tooling options, and part marking with a maximum of 50 nodes.

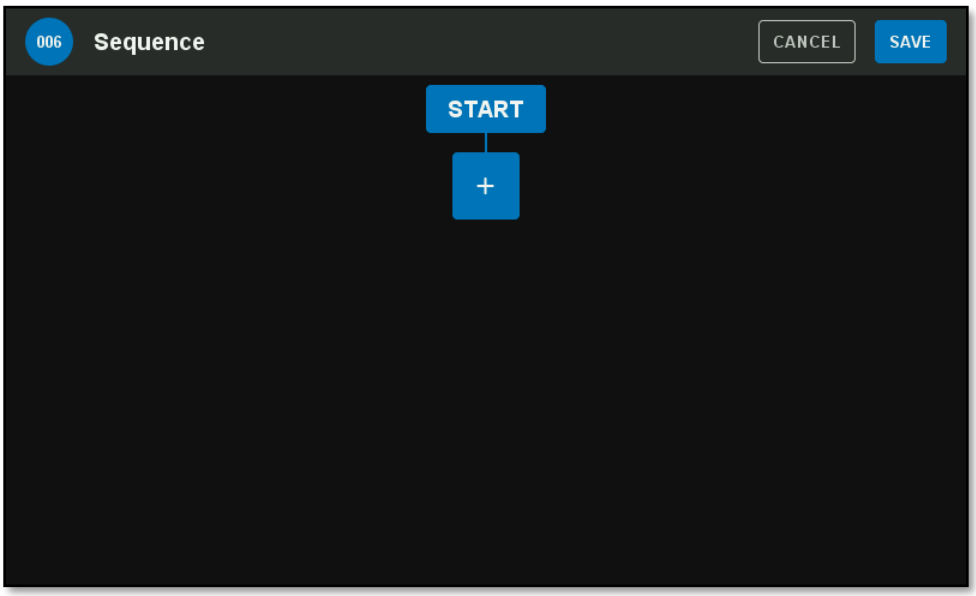
Rules for Sequence Program

1. Each Program node generates and stores its results independently.
2. If any Program node result is **Reject**, the Sequence program result will also be **Reject**. (All child results are logically ANDed.)
3. If all Program nodes are configured to use **Accept & Reject Audit***, the Sequence program result will be **"Sequence Complete"**, regardless of individual Accept or Reject results.
4. The cycle counters each program increase after each linked Program completes.
5. Tooling logic can now only be implemented within the **Sequence program**. See Advance Tooling options for details.
6. If the user starts a Sequence Program, the Monitor screen will indicate that the Sequence Program is running. The Stop/Reset event during any Programs node will not navigate the system away from the sequence Program.
7. For the sequence program's default custom panel is configured as the **'sequence'**, which displays the order of all configured program nodes.

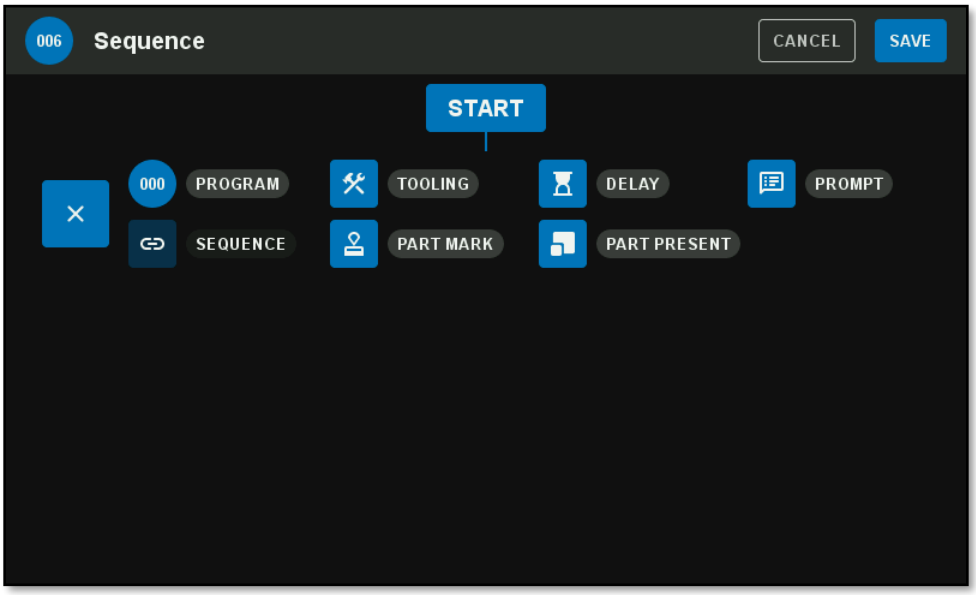
Tapping On EDIT will allow the user to begin making changes to the sequence.



Select the "+" to add the new operation to sequence. The following screen helps users to design and edit the test efficiently. The top right of the Sequence header contains the "Cancel" and "Save" button. To discards unsaved changes, press the "Cancel" button; to Saves all changes to the sequence tap on the "Save" button.



The following are the options that will display after tap on the + button.



Sequence Editor parameters

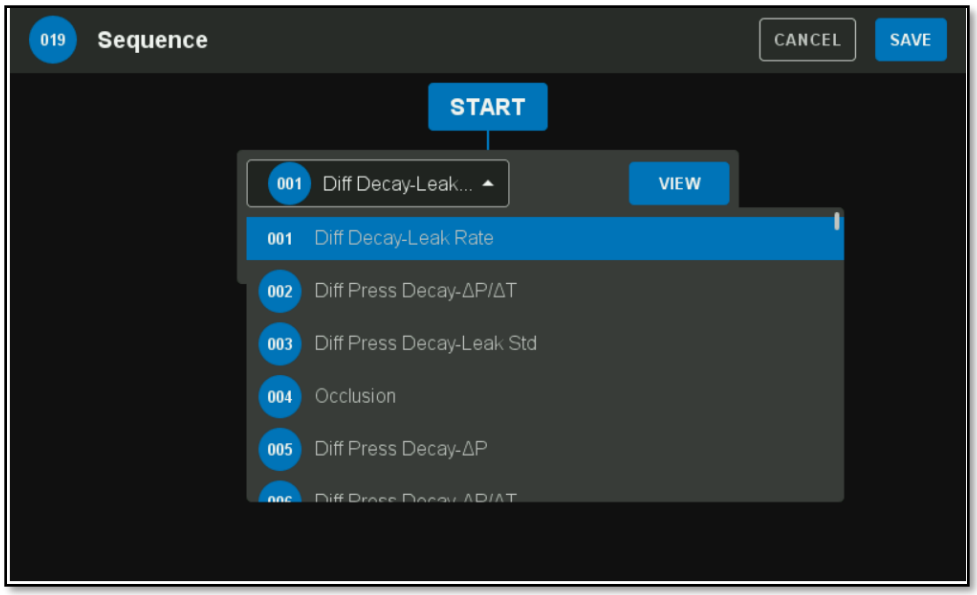
Parameter	Icon	Description
Program number		Executes a specified program
Tooling		Selects and configures the necessary tooling settings.
Delay		Introduces a time delay into the sequence.
Prompt		Displays a message or prompt to the operator.
Sequence		Links to another sequence within the program.
Part Mark		This input must go high as a response to the Part Mark (Accept, Reject, or Accept/Reject) output within the Part Mark timer

Program Selection and Evaluation conditions

The Sequence screen allows you to define, organize, and execute a series of tests. Each sequence is composed of individual steps, which can be configured to perform specific actions.

Program Selection

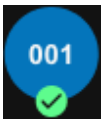
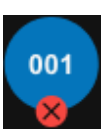
Program node displays the dropdown list for all predefined test programs from 001 to 250. Press the **"**VIEW" button next to an operation block to access its detailed configuration settings. This allows the user to customize parameters of the selected test type.



Evaluation conditions

This section of the Sequence Editor allows users to define how a sequence should proceed based on the outcome of a selected test program. You can control the logic flow based on whether a part passes, fails, or returns a specific result type, enabling smart routing and automation control.

The following dropdown list defines which test results will trigger the next step in the sequence. Options include:

Parameter	Icon	Description
Accept		Directs only accept parts for further testing using the program defined by "Accept Program". For rejects, severe leaks, and malfunctions the test sequence stops.
Reject		Directs only reject and severe leak parts for further testing using the program defined by "Reject Program". For accept and malfunction the test sequence stops.
Accept/Reject		Directs accept and reject parts for further testing using the programs defined by "Accept Program" if the test passes or "Reject Program" if the test

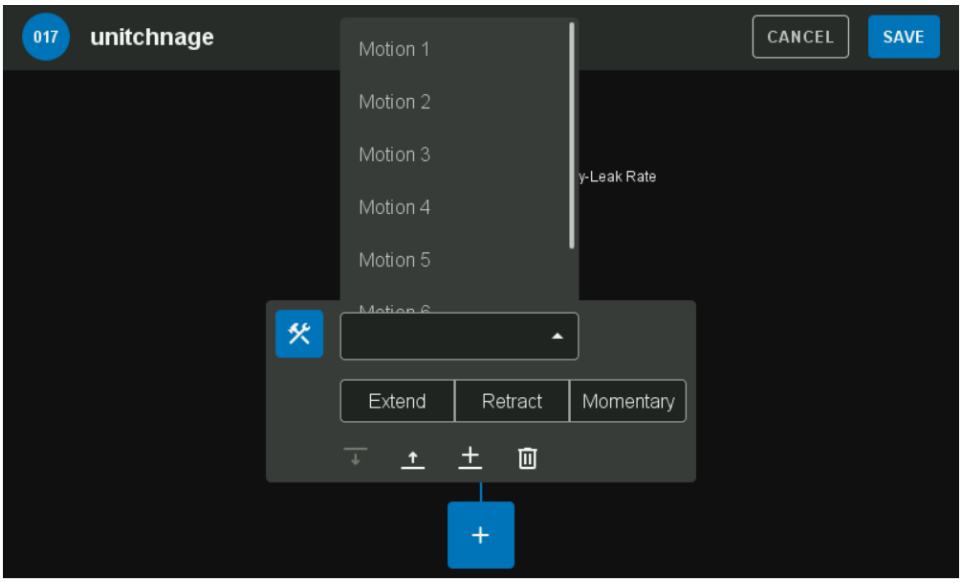
		fails occurs. For malfunctions, the test sequence stops.
Accept & Reject Audit*		Directs accept and reject parts for further testing using the programs defined by "Accept Program" if the test passes or "Reject Program" if the test fails occurs. Includes audit results along with pass/fail. For malfunctions, the test sequence stops. No impact on the overall evaluation of the part. Only use to make binary decision for the next step in the sequence.
Any		Directs accept and reject parts for further testing by one additional test program using the program defined by "Next Program" for accept, reject, or severe leak tests. For malfunctions, the test sequence stops.

Tooling Parameters

In the sequence test type the user can design a sequence for configuring and controlling various "Tooling motions". The main screen provides intuitive controls for selecting tooling motion, adjusting settings, and managing configurations.

Each tooling motion can be assigned a specific action Extend, Retract, or Momentary to control mechanical devices during test or assembly operations. A list of available motions (e.g., **Motion 1**, **Motion 2**, ... **Motion 18**) is display in the table. Check the tooling in detail Chapter 24 – Tooling Control.

Timer	Description
Tooling Extend	Initiates the "Extend" action for the currently selected motion.
Tooling Retract	Initiates the "Retract" action for the currently selected motion.
Momentary	Initiates the "Extend " action and immediately "Retract" for the currently selected motion.



Sequence Delay

There are applications where it is desirable for the instrument to pause or delay execution between the target program and the next program when utilizing the Sequence Linking. An example would be allowing the operator to manipulate a part between programs, such as opening a valve, inserting a component or any action that requires an external event to take place before testing can continue. This feature is used to pause sequence execution during one link and not another.

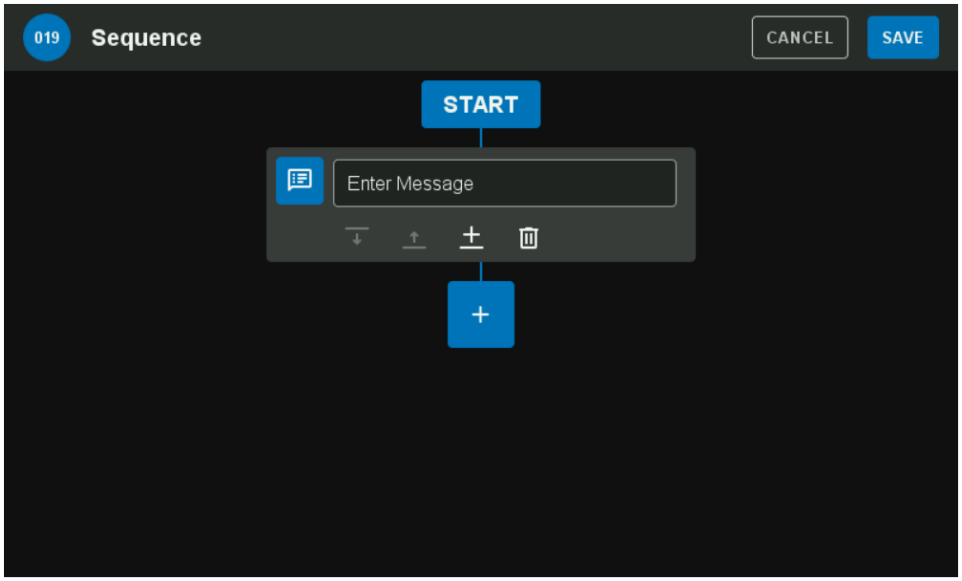
Parameter	Description
Delay	This parameter indicates the amount of time to delay after the target node, before execution can continue with the next node. The Default delay time is 5 sec.

Note: If you are using sequence test because you have part with multiple chambers and the instrument is configured with multiple test ports, remember to select the appropriate test port. This is described in the section titled.

Prompt

This is the element node, Represent specific actions or steps within your sequence. Each node typically has a descriptive label. This step is used to display a **custom message** to the operator. Common uses include Instructions for manual tasks, Precaution or setup reminders or Notifications about the next action. The label *"Enter Message"* indicates that the user needs to input the text to be displayed during execution.

The screen represents a simple sequence setup in the Sequence Editor interface, specifically showing the use of a Prompt Message step.



Managing Sequence Flow

The Sequence editor provides tools to adjust the order of nodes within a sequence, allowing you to customize the flow without recreating nodes. These controls are found in the active node editing .

Parameter	Icon	Description
Move Down		This button moves the currently selected node one position *down* in the sequence. The node will be executed later in the sequence relative to its original position. ***Note: the "Move Down" button gets disabled for the last node of the sequence.***
Move Up		This button moves the currently selected node one position *up* in the sequence. The node will be executed later in the sequence relative to its original position. ***Note: the "Move Up" button gets disabled for the first node of the sequence.***
Add node above		This button adds a node above the existing node. Click this button to insert a new step or element into your sequence test. A new, unconfigured node will appear, ready for you to define its properties.
Delete Node		This button permanently **deletes** the currently selected node from the sequence or hierarchy. Click this button to remove a node that is no longer needed.

Note: This message, "Reached Maximum node limit," indicates that you have attempted to create or add more nodes than the system allows. The X5 device allows a maximum of 50 nodes. This limit is in place to ensure optimal performance, stability, and manageability of your data.

Note: The "OK" button will dismiss the message, but you will not be able to add new nodes until the limit is no longer exceeded.

Note: The message "Sequence clean up required! Please save the current session and edit again." indicates that an inconsistency or an unfinalized operation has occurred within your current sequence test. To prevent data corruption or loss, the system requires you to save your current progress and then re-enter the editing mode to continue

Sequence Calibration

This section details the configuration and function of the new Sequence Test Type Calibration feature. The calibration menu for sequence tests is located in the system path: **Main Menu > Configuration > CAL_SEQ**.

The **CAL:SEQ** menu option will only be visible in the interface when the current sequence test configuration includes at least one leak standard test type (e.g., Pressure Decay-Leak Standard, Mass Flow-Leak Standard). If the sequence is empty or only contains non-leak standard nodes, the option will be hidden.

The calibration process now supports the configuration and calibration of up to **50 nodes**, providing greater flexibility for complex or lengthy testing requirements. For more detail theory and parameters for calibration see Program Calibration.

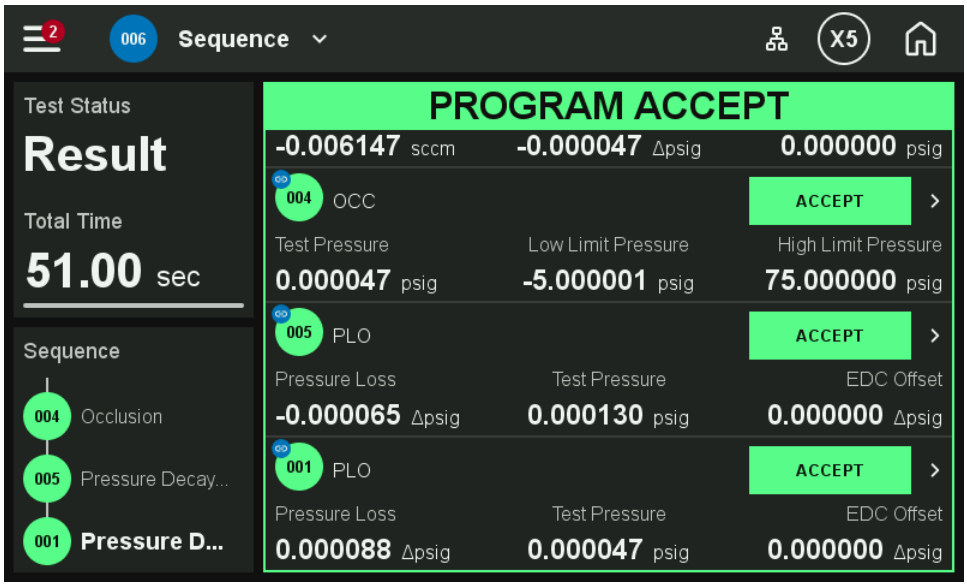
Note: The sequence calibration process can now calibrate both leak standard and non-leak standard test types of nodes within a single sequence.
Sequence calibration can only be performed on nodes located on the passing (accepted) side of the node tree structure. Calibration cannot be performed on nodes that have failed or are located on the Reject path.

Sequence Result screen

This section outlines the Sequence Test Results & Display Configuration and also covers the new display customization options found in the Misc Menu.

Two new variables have been added to the **Misc Menu** to control how results appear on the Home screen:

Parameters	Description
Result Scroll	Allow navigation through the result list via scrolling. Useful for sequences with many child programs.
Result Order	Results appear in execution order (the first test executed is at the top). Reverses the display order on the Home screen (the last test executed is at the top and order is same as Test Results Page.)



Sequence Test Configuration & Result Management

To improve on-screen identification, you can replace standard test type abbreviations (such as OCC for Occlusion or DPD for Differential Pressure Decay) with a custom text string. Navigate to the **Misc** Menu and locate the **Program Name** field. The blue circle indicator icons for any specific system flags.

The Bottom Left Panel provides a live visual of the current test hierarchy and status. As each program in the sequence runs, along with evaluation color like Red for reject/ Green for accept during execution.. Displays the relationship and progress of each child program within the sequence. Check the detail custom panel Chapter 33- Custom Panel



This page is intentionally blank.

Chapter 15 – Diff Pressure Decay-ΔP

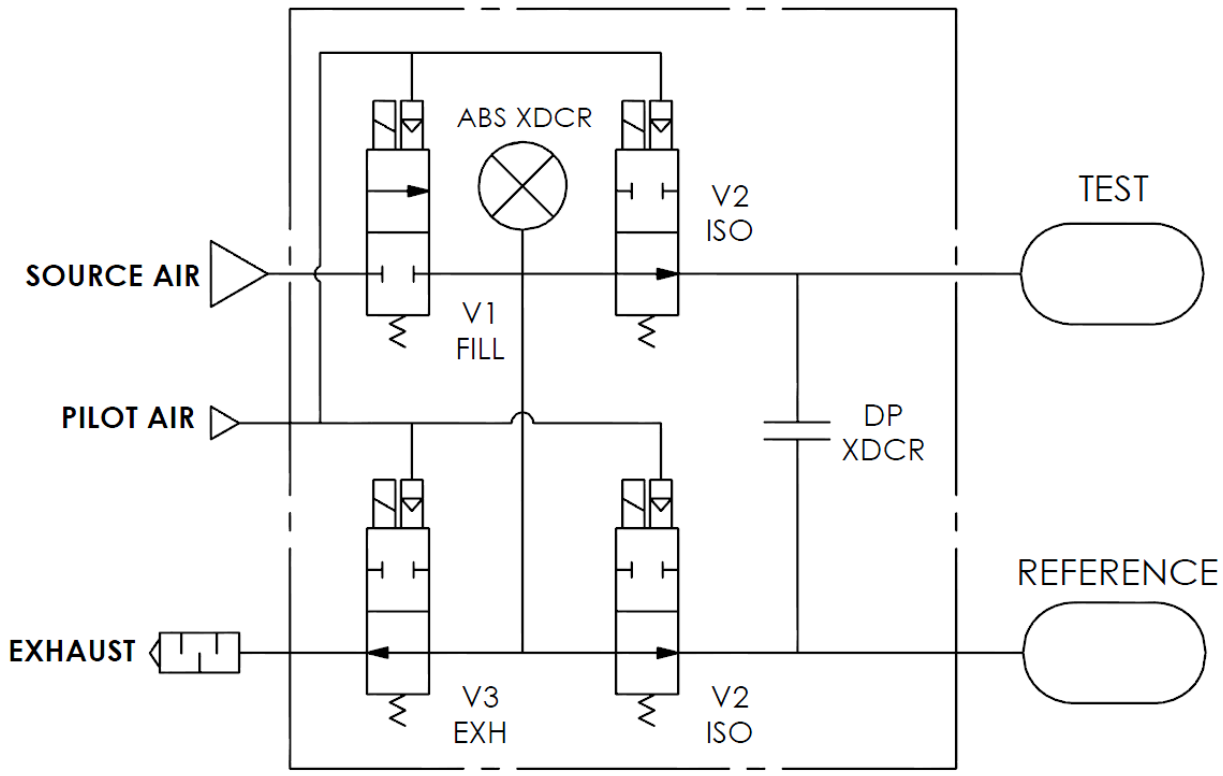
This chapter explains the theory and parameters for conducting a pressure decay test measuring a pressure loss over time utilizing a Differential Pressure (DP) transducer. The result of this test is the pressure loss (or gain for a vacuum test) measured over a fixed period of time, presented in units of pressure.

How it works

In order to detect leakage in a part, the change in pressure due to temperature and part elasticity must be allowed to settle before taking any pressure readings.

With differential pressure, a reference part volume (should be identical to the nominal test part volume) is pressurized simultaneously with the test part.

Leaks are determined by detecting the rate of pressure loss between the two parts.



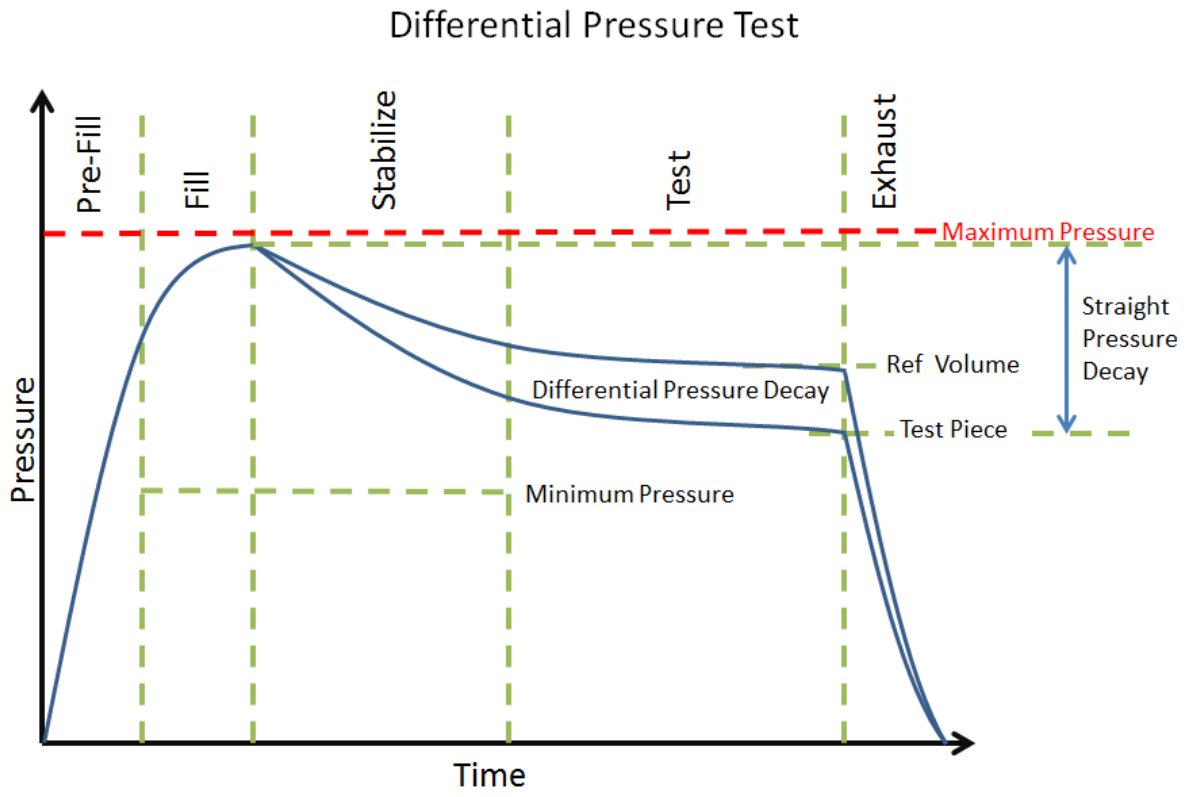
Test Setup

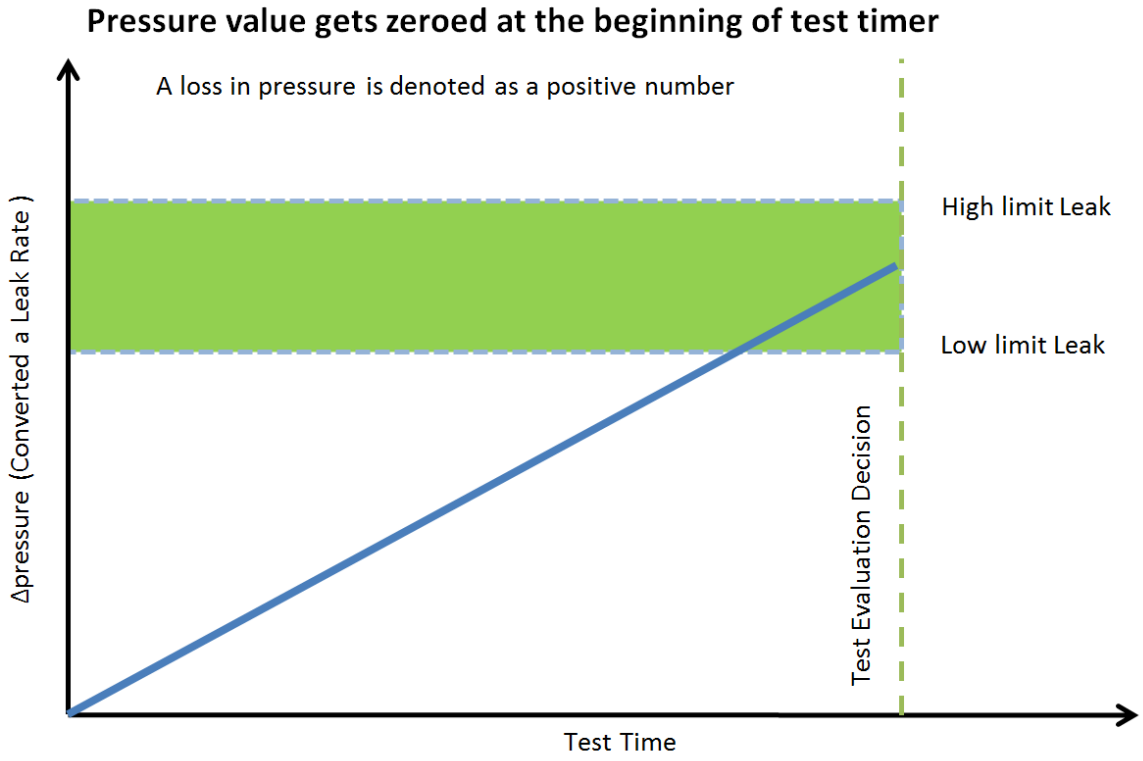
The test part and the reference volume are simultaneously pressurized to a preset pressure. The air in the system is then allowed to stabilize, with the supply valves all closed. After the stabilization time, the Differential Pressure Transducer is automatically zeroed.

During test, the pressure change in the test piece is compared to the pressure change in the reference volume, using the Differential Pressure Transducer. If the test piece is leaking, the difference will increase and be measured; an alarm limit may be set for a pass/fail decision.

The charts in this chapter give an overview of the parameters used to set up a Pressure Differential Test and correlate the results to a flow rate using a leak standard. The Tables that follow give detailed descriptions of each parameter and also document the Display User Level associated with each parameter.

Note: To change the User Level, see Chapter 32 – User and Security




Pressure value gets zeroed at the beginning of test timer
A loss in pressure is denoted as a positive number
High limit Leak
Low limit Leak
Test Evaluation Decision
Δpressure (Converted a Leak Rate)
Test Time

Timer Parameters

The Timers menu is located in the **Main Menu > Config > Timers** option.

Timer	Description	User Display Mode
Pre-Press	Amount of time allocates to each segment for execution before continuing. *This parameter is only available if the Prefill Method selected is "Pre-Pressure Time"*	Basic Advanced, Admin
Prefill	Percentage of the fill timer where the minimum pressure limit is not monitored. This allows time within the fill stage for the instrument to achieve the minimum test pressure.	Advanced, Admin
Charge	Time to enable part to reach the Charge Target Pressure. At the end of this timer, the instrument will read the pressure on the pressure transducer. *This parameter is only available if the Prefill Method selected is "Fixed Charge"*	Basic Advanced, Admin
Fill	Time to enable part to reach the Target Pressure. It may also be used as time to stabilize part pressure with additional air.	Basic Advanced, Admin
Isolation	Amount of stabilization time utilized to isolate the test part and reference volume prior to the test measurement.	Admin
Stabilize	Time to stabilize part pressure while isolated from the pressure regulator. This time directly affects the repeatability of the test.	Basic Advanced, Admin
Test	At the end of this timer, the instrument will read the pressure on the differential pressure transducer. This pressure is due to the backpressure created in the pneumatic circuit and part.	Basic Advanced, Admin
Exhaust	Time to relieve or vent part pressure before signaling the end of test. This prevents the accidental ejection of debris and protects the fixture seals from damage	Basic Advanced, Admin

Pressure Parameters

The Pressure menu is located in the **Main Menu > Configuration > Pressure** option.

Pressure	Description	User Display Mode
Minimum Pressure	Minimum test pressure that must be met within the Pre-fill timer and maintained during the Fill and Stabilization timers. This is an early indication of a major leak	Basic Advanced, Admin
Pre-Pressure	Target Pre-Pressure. Used as a setpoint for the Electronic Regulator during the Pre-Pressure time. *This parameter is only available if the Prefill Method selected is "Pre-Pressure Time"*	Basic Advanced, Admin
Target Pressure	Target test pressure. Also used as a setpoint for the Electronic Regulator.	Basic Advanced, Admin
Target Pressure Window	Percentage window is about the target pressure that must be maintained during test segment.	Advanced, Admin
Pre-Pressure Window	The percentage (plus and minus) about the Pre-Pressure value defining the minimum and maximum pressure at the end of the Pre-Pressure time. *This parameter is only available if the Prefill Method selected is "Pre-Pressure Time"*	Basic Advanced, Admin
Maximum Pressure	The value that must not be exceeded at any time to complete a successful test. If the pressure goes above the Maximum Test Pressure, the testing cycle (during Fill and Stabilization) will end as an Over Pressure Malfunction.	Basic Advanced, Admin
Charge Min Press	Minimum charge pressure that must be met within the Charge timer and maintained before the Fill timer. This is an early indication of a major leak. If the pressure is measured below the Charge Min Press at end of Charge segment, the testing cycle will end as a Below Charge Malfunction. *This parameter is only available if the Prefill Method selected is "Fixed Charge"*	Basic Advanced, Admin
Charge Target Press	Target Charge pressure. Also used as a setpoint for the Electronic Regulator in Charge segment. *This parameter is only available if the Prefill Method selected is "Fixed Charge"*	Basic Advanced, Admin
Charge Max Press	The value that must not be exceeded at end of Charge segment. If the pressure is measured above the Charge Max Press at end of Charge segment, the testing cycle will end as an Above Charge Malfunction. *This parameter is only available if the Prefill Method selected is "Fixed Charge"*	Basic Advanced, Admin

Test Parameters

The Test parameters menu is located in the **Main Menu > Configuration > Test: DPD** option.

TST Parameter	Description	User Display Mode
Low Limit Loss	Lower set point value used to evaluate test results.	Basic Advanced, Admin
High Limit Loss	Upper set point value used to evaluate test results.	Basic Advanced, Admin
Test Evaluation	Test results are compared to two setpoints for pass or fail status. There are three areas for evaluation of results: above high limit, between limits, and below low limit. See Table below for codes.	Advanced, Admin
Target pressure correction	Allow the instrument to perform measurement correction based upon the relationship between the target pressure and actual test pressure.	Advanced, Admin
Loss Offset	Manual compensation value which is added to the measured loss when calculating the final pressure loss for the test.	Basic Advanced, Admin
EDC Enabled	When enabled, Environmental Drift Correction (EDC) 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.	Advanced, Admin
EDC Percentage	Percentage (Plus and Minus) band defined by a percentage of High Limit about the Master Part Curve. EDC continually accumulates and calculates an offset for the test results.	Advanced, Admin
EDC Quantity	Number of test results utilized in calculating the EDC factor.	Advanced, Admin

Test Evaluation Code	Description
Above Hi Limit > Between Limits > Below Lo Limit	Three zones of evaluation for Pass and Fail
P P F	Pass if above low limit
P F F	Pass if above high limit
F P F* (default)	Pass if between high and low limits
F P P	Pass if below high limit
F F P	Pass if below low limit
P F P	Pass if above the high limit or below the low limit

Note: The Evaluation option displays High Limit (left) to Low Limit (right). On the IX5 monitor screen, readings appear from Low Limit (left) toward High Limit (right). Ensure this orientation is understood to correctly identify the test result.

Chapter 16 – Diff Pressure Decay-ΔP/ΔT

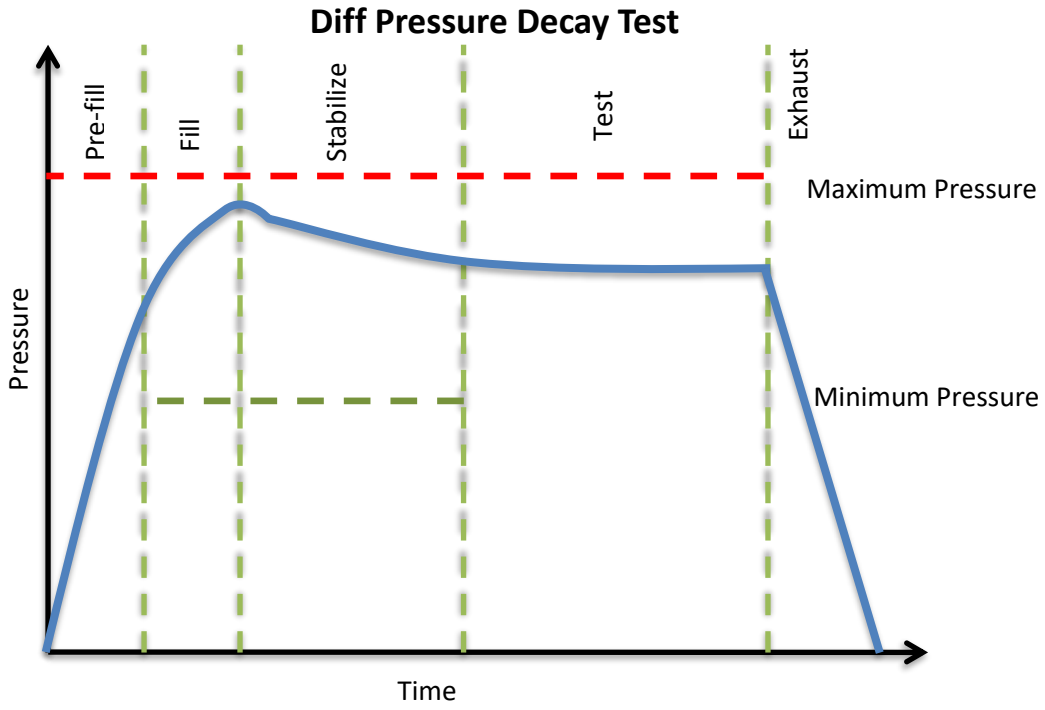
This chapter explains the theory and parameters for conducting a differential pressure decay test measuring the rate of change of a differential pressure loss over time. The result of this test is the rate of pressure change measured over the test time.

How it works

The basic principle of operation of a pressure decay leak test instrument is to fill the test part to a specified target test pressure, isolate the test part from the source air and allow the pressure to stabilize, and then measure the pressure loss due to a leak over a defined time, calculating the rate of loss.

The Charts below give an overview of the parameters used to set up a Diff Pressure Decay-ΔP/ΔT Test. The Tables that follow give detailed descriptions of each parameter and also document the Display User Level associated with each parameter.

Note: To change the User Level, see Chapter 32 – User and Security



Timer Parameters

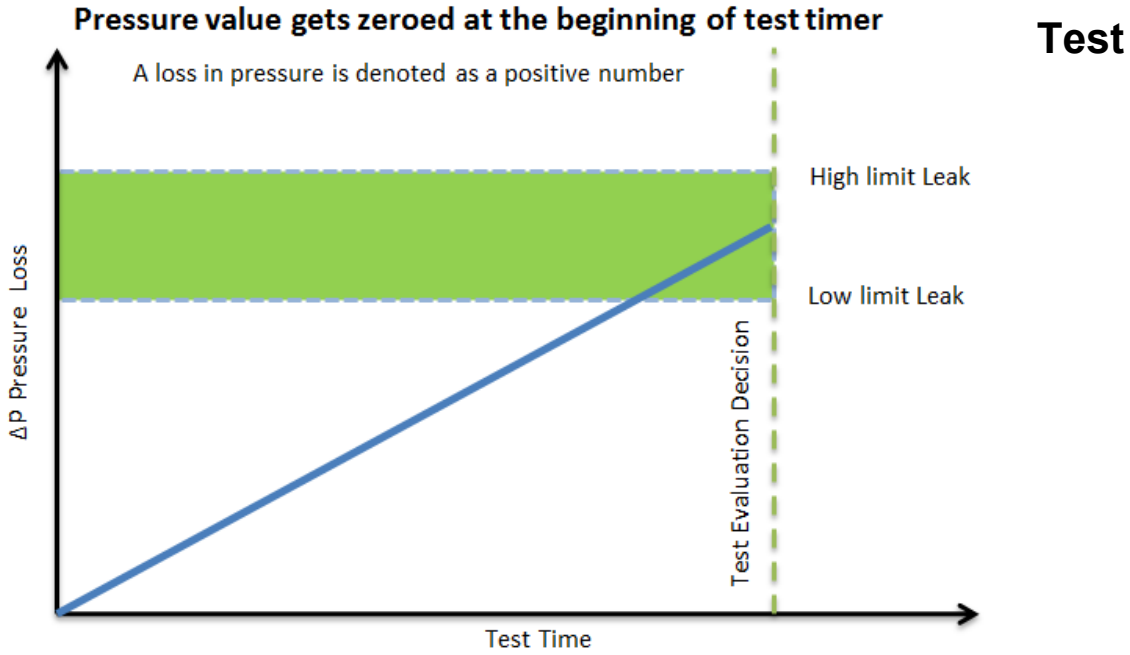
The Timers menu is located in the **Main Menu > Configuration > Timers** option.

Timer	Description	Display User Level
Prefill	Checks for excessively leaking parts or lack of pressure. May be set to "Percent of Fill Time" (default), for fixed fill time tests, or set to "Not to Exceed Time. For Changing the Functionality of the Prefill Timer, see Chapter 33 – Features. Maximum time to reach the minimum pressure. If the variable is set to "Not to Exceed Time", this segment will exit to the next once the Minimum Pressure value is reached.	Advanced, Admin
Pre-Press	Time to enable part to reach the Pre-Pressure. *This parameter is only available if the Prefill Method selected is "Pre-Pressure Time"*	Basic Advanced, Admin
Charge	Time to enable part to reach the Charge Target Pressure. At the end of this timer, the instrument will read the pressure on the pressure transducer. *This parameter is only available if the Prefill Method selected is "Fixed Charge"*	Basic Advanced, Admin
Fill	Time to enable part to reach the Target Pressure. It may also be used as time to stabilize part pressure with additional air.	Basic Advanced, Admin
Stabilize	Time to stabilize part pressure while isolated from the pressure regulator. This time directly affects the repeatability of the test.	Basic Advanced, Admin
Isolation	Amount of stabilization time utilized to isolate the test part and reference volume prior to the test measurement.	Admin
Test	The precise time over which to measure pressure drop or decay or the precise end time to measure pressure rise.	Basic Advanced, Admin
Exhaust	Time to relieve or vent part pressure before signaling the end of test. This prevents the accidental ejection of debris and protects the fixture seals from damage	Basic Advanced, Admin

Pressure Parameters

The Pressure menu is located in the **Main Menu > Configuration > Pressure** option.

Pressure	Description	User Display Mode
Pre-Pressure	Target Pre-Pressure. Used as a setpoint for the Electronic Regulator during the Pre-Pressure time. *This parameter is only available if the Prefill Method selected is "Pre-Pressure Time"*	Basic Advanced, Admin
Pre-Pressure Window	The percentage (plus and minus) about the Pre-Pressure value defining the minimum and maximum pressure at the end of the Pre-Pressure time. *This parameter is only available if the Prefill Method selected is "Pre-Pressure Time"*	Basic Advanced, Admin
Minimum Pressure	Minimum test pressure that must be met within the Pre-fill timer and maintained during the Fill and Stabilization timers. This is an early indication of a major leak	Basic Advanced, Admin
Target Pressure	Target test pressure. Also used as a setpoint for the Electronic Regulator.	Basic Advanced, Admin
Target Pressure Window	Percentage window is about the target pressure that must be maintained during test segment.	Advanced, Admin
Maximum Pressure	The value that must not be exceeded at any time to complete a successful test. If the pressure goes above the Maximum Test Pressure, the testing cycle (during Fill and Stabilization) will end as an Over Pressure Malfunction.	Basic Advanced, Admin
Charge Min Press	Minimum charge pressure that must be met within the Charge timer and maintained before the Fill timer. This is an early indication of a major leak. If the pressure is measured below the Charge Min Press at end of Charge segment, the testing cycle will end as a Below Charge Malfunction. *This parameter is only available if the Prefill Method selected is "Fixed Charge"*	Basic Advanced, Admin
Charge Max Press	The value that must not be exceeded at end of Charge segment. If the pressure is measured above the Charge Max Press at end of Charge segment, the testing cycle will end as an Above Charge Malfunction. *This parameter is only available if the Prefill Method selected is "Fixed Charge"*	Basic Advanced, Admin
Charge Target Press	Target Charge pressure. Also used as a setpoint for the Electronic Regulator in Charge segment. *This parameter is only available if the Prefill Method selected is "Fixed Charge" This parameter is only available if the Prefill Method selected is "Fixed Charge"*	Basic Advanced, Admin



Parameters

The Test parameters menu is located in the **Main Menu > Configuration > Test:DDR** option.

TST Parameter	Description	Display User Level
Low Limit Rate	Lower set point value used to evaluate test results.	Basic Advanced, Admin
High Limit Rate	Upper set point value used to evaluate test results.	Basic Advanced, Admin
Test Evaluation	Test results are compared to two setpoints for pass or fail status. There are three areas for evaluation of results: above high limit, between limits, and below low limit. See Table below for codes.	Advanced, Admin
Target pressure correction	Allow the instrument to perform measurement correction based upon the relationship between the target pressure and actual test pressure.	Advanced, Admin
EDC Enable	Activates Environmental Drift Correction. See Appendix C – Environmental Drift Correction.	Advanced, Admin
EDC Percentage	See Appendix C – Environmental Drift Correction.	Advanced, Admin
EDC Quantity	See Appendix C – Environmental Drift Correction.	Advanced, Admin

Test Evaluation Code	Description
Above Hi Limit > Between Limits > Below Lo Limit	Three zones of evaluation for Pass and Fail
P P F	Pass if above low limit
P F F	Pass if above high limit
F P F* (default)	Pass if between high and low limits
F P P	Pass if below high limit
F F P	Pass if below low limit
P F P	Pass if above the high limit or below the low limit

Note: The Evaluation option displays High Limit (left) to Low Limit (right). On the IX5 monitor screen, readings appear from Low Limit (left) toward High Limit (right). Ensure this orientation is understood to correctly identify the test result.

This page is intentionally blank.

Chapter 17 – Diff Decay-Leak Rate

This chapter explains the theory and parameters for conducting a Diff Decay-Leak rate test measuring leak rate by utilizing a Differential Pressure (DP) transducer. The result of this test is the leak presented in units of flow.

How it works

In order to detect leakage in a part, the change in pressure due to temperature and part elasticity must be allowed to settle before taking any pressure readings.

With differential pressure, a reference part volume (should be identical to the nominal test part volume) is pressurized simultaneously with the test part.

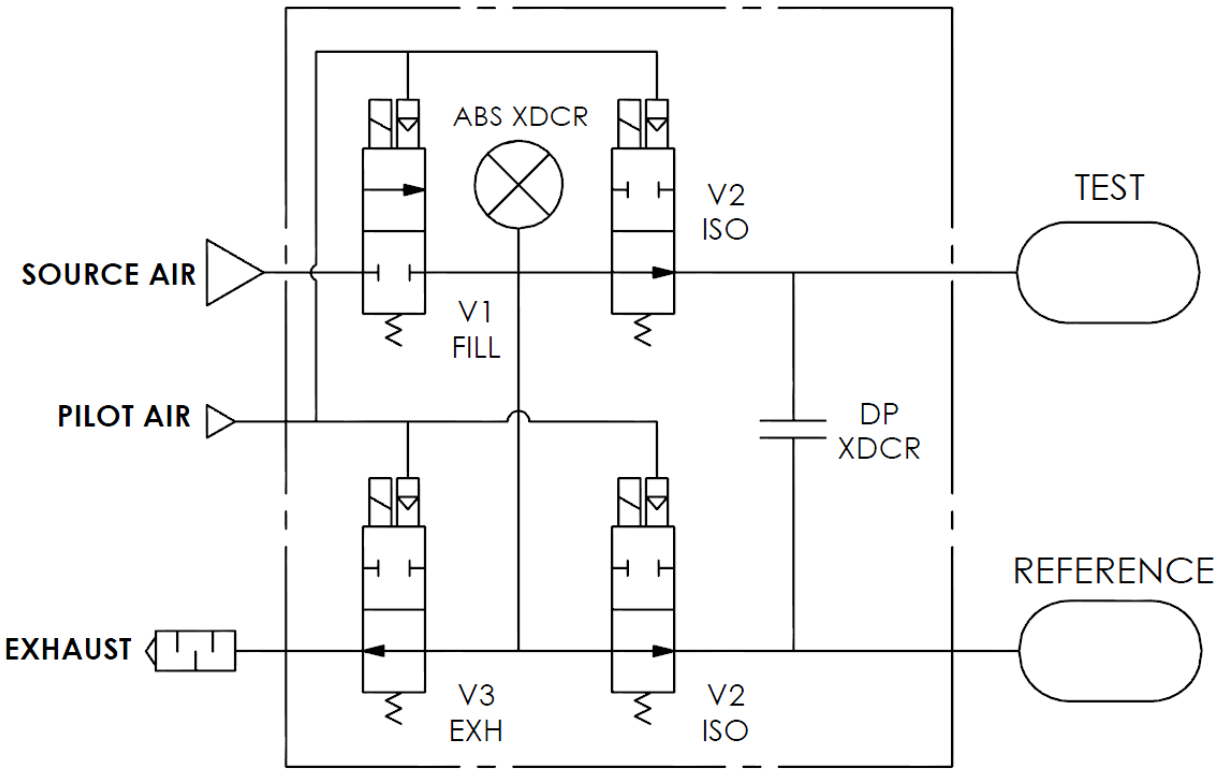
The Leak Rate is determined from the measured differential loss between the test port and the reference volume over time, using the provided known part volume. This test will NOT require calibration, and a Leak Standard is NOT required to determine the final leak rate.

The Leak rate is calculated by the following formula,

$$Q = \left(\frac{\Delta P}{\Delta t} \times \frac{V_{inst} + V_{part}}{P_{std}} \times 60.0\right) + Offset_{EDC} + Offset_{Leak\ Rate}$$

Where:

- Q = Leak Rate
- $\Delta P/\Delta t$ = Pressure Loss over time
- P_{std} = **Standard Pressure (14.696 psig)**. This parameter is configured matching Standard Pressure definition used for instrument and leak calculation
- V_{inst} = **Instrument Volume**. Volume of the instrument's isolated pneumatic circuit up to the test port. This parameter can be located at *Main Menu->Device Settings->Hardware*.
- V_{part} = **Part Volume**.



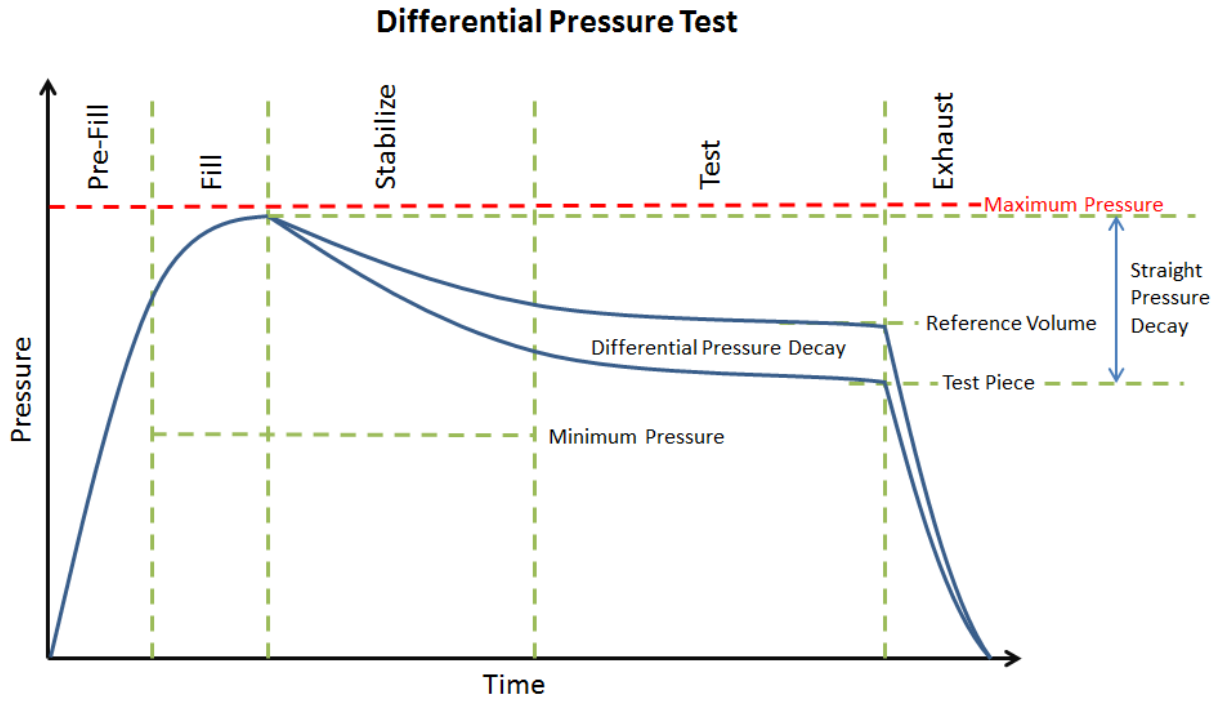
Test Setup

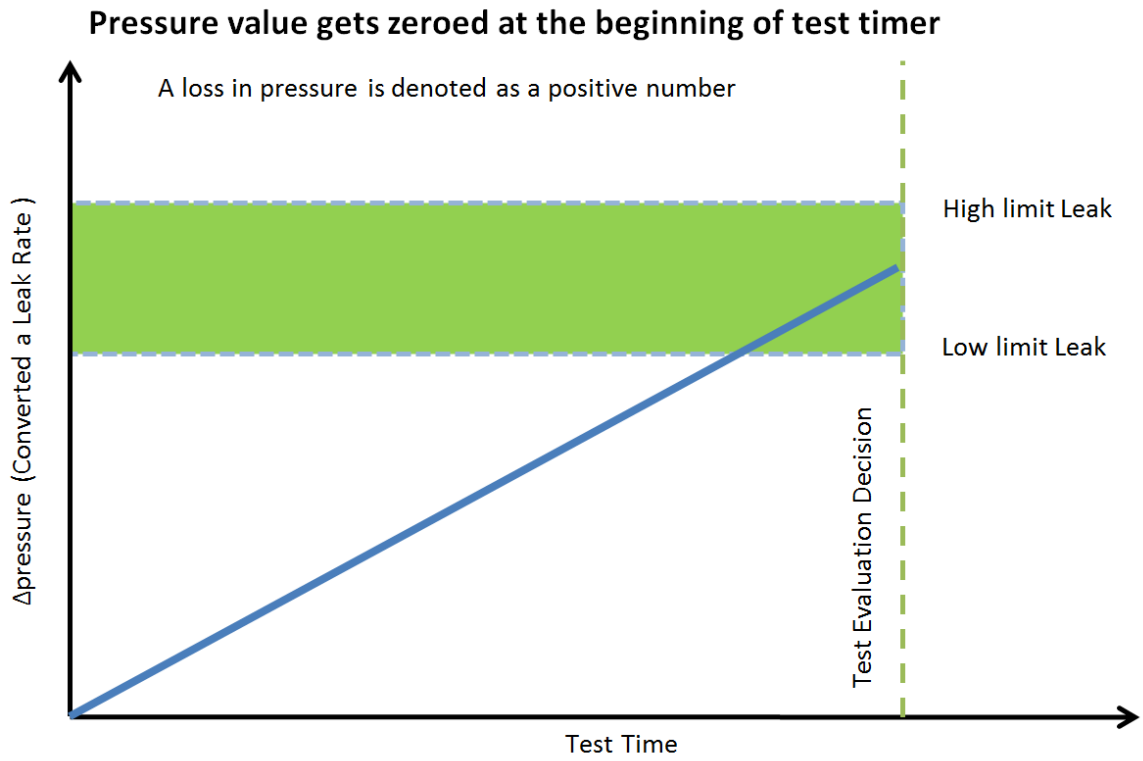
The test part and the reference volume are simultaneously pressurized to a preset pressure. The air in the system is then allowed to stabilize, with the supply valves all closed. After the stabilization time, the Differential Pressure Transducer is automatically zeroed. Before the beginning of the test measurement, the part and the reference volume are isolated from the supply valves for the time described in the Isolation parameter.

During test, the pressure change in the test piece is compared to the pressure change in the reference volume, using the Differential Pressure Transducer. If the test piece is leaking, the difference will increase and be measured; an alarm limit may be set for a pass/fail decision.

The Tables that follow give detailed descriptions of each parameter and also document the Display User Level associated with each parameter.

Note: To change the Display User Level, Chapter 32 – User and Security.


Differential Pressure Test
Pre-Fill
Fill
Stabilize
Test
Exhaust
Maximum Pressure
Straight Pressure Decay
Reference Volume
Differential Pressure Decay
Test Piece
Minimum Pressure
Pressure
Time


Pressure value gets zeroed at the beginning of test timer
A loss in pressure is denoted as a positive number
High limit Leak
Low limit Leak
Test Evaluation Decision
Δpressure (Converted a Leak Rate)
Test Time

Timer Parameters

The Timers menu is located in the **Main Menu > Configuration > Timers** option.

Timer	Description	User Display Mode
Pre-Press	Amount of time allocates to each segment for execution before continuing. *This parameter is only available if the Prefill Method selected is "Pre-Pressure Time"*	Basic Advanced, Admin
Prefill	Percentage of the fill timer where the minimum pressure limit is not monitored. This allows time within the fill stage for the instrument to achieve the minimum test pressure.	Advanced, Admin
Charge	Time to enable part to reach the Charge Target Pressure. At the end of this timer, the instrument will read the pressure on the pressure transducer. *This parameter is only available if the Prefill Method selected is "Fixed Charge"*	Basic Advanced, Admin
Fill	Time to enable part to reach the Target Pressure. It may also be used as time to stabilize part pressure with additional air.	Basic Advanced, Admin
Stabilize	Time to stabilize part pressure while isolated from the pressure regulator. This time directly affects the repeatability of the test.	Basic Advanced, Admin
Isolation	Amount of stabilization time utilized to isolate the test part and reference volume prior to the test measurement.	Admin
Test	At the end of this timer, the instrument will read the pressure on the pressure transducer. This pressure is due to the backpressure created in the pneumatic circuit and part.	Basic Advanced, Admin
Exhaust	Time to relieve or vent part pressure before signaling the end of test. This prevents the accidental ejection of debris and protects the fixture seals from damage	Basic Advanced, Admin

Pressure Parameters

The Pressure menu is located in the **Main Menu > Configuration > Pressure** option.

Pressure	Description	User Display Mode
Minimum Pressure	Minimum test pressure that must be met within the Pre-fill timer and maintained during the Fill and Stabilization timers. This is an early indication of a major leak	Basic Advanced, Admin
Pre-Pressure	Target Pre-Pressure. Used as a setpoint for the Electronic Regulator during the Pre-Pressure time. *This parameter is only available if the Prefill Method selected is "Pre-Pressure Time"*	Basic Advanced, Admin

Pressure	Description	User Display Mode
Target Pressure	Target test pressure. Also used as a setpoint for the Electronic Regulator.	Basic Advanced, Admin
Target Pressure Window	Percentage window is about the target pressure that must be maintained during test segment.	Advanced, Admin
Pre-Pressure Window	The percentage (plus and minus) about the Pre-Pressure value defining the minimum and maximum pressure at the end of the Pre-Pressure time. *This parameter is only available if the Prefill Method selected is "Pre-Pressure Time"*	Basic Advanced, Admin
Maximum Pressure	The value that must not be exceeded at any time to complete a successful test. If the pressure goes above the Maximum Test Pressure, the testing cycle (during Fill and Stabilization) will end as an Over Pressure Malfunction.	Basic Advanced, Admin
Charge Min Press	Minimum charge pressure that must be met within the Charge timer and maintained before the Fill timers. This is an early indication of a major leak. If the pressure is measured below the Charge Min Press at end of Charge segment, the testing cycle will end as a Below Charge Malfunction. *This parameter is only available if the Prefill Method selected is "Fixed Charge"*	Basic Advanced, Admin
Charge Target Press	Target Charge pressure. Also used as a set point for the Electronic Regulator in Charge segment. *This parameter is only available if the Prefill Method selected is "Fixed Charge"*	Basic Advanced, Admin
Charge Max Press	The value that must not be exceeded at end of Charge segment. If the pressure is measured above the Charge Max Press at end of Charge segment, the testing cycle will end as an Above Charge Malfunction. *This parameter is only available if the Prefill Method selected is "Fixed Charge"*	Basic Advanced, Admin

Test Parameters

The Test parameters menu is located in the **Main Menu > Configuration > Test: DDL** option.

TST Parameter	Description	User Display Mode
Low Limit Leak	Lower set point value used to evaluate test results of parts.	Basic Advanced, Admin
High Limit Leak	Upper set point value used to evaluate test results of parts.	Basic Advanced, Admin

TST Parameter	Description	User Display Mode
Test Evaluation	Test results are compared to two setpoints for pass or fail status. There are three areas for evaluation of results: above high limit, between limits, and below low limit. See Table below for codes.	Advanced, Admin
Target pressure correction	Allow the instrument to perform measurement correction based upon the relationship between the target pressure and actual test pressure.	Advanced, Admin
Part Volume	Volume of the part under test. This should include the volume of all pressurized cavities of the part, seals, fittings and tubing leading up to the instrument's test port connection.	Basic Advanced, Admin
Leak Rate Offset	Manual compensation value which is added to the final calculated leak rate for the test.	Admin
EDC Enabled	When enabled, Environmental Drift Correction (EDC) 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.	Advanced, Admin
EDC Percentage	Percentage (Plus and Minus) band defined by a percentage of High Limit about the Master Part Curve. EDC continually accumulates and calculates an offset for the test results.	Advanced, Admin
EDC Quantity	Number of test results utilized in calculating the EDC factor.	Advanced, Admin

Test Evaluation Code	Description
Above Hi Limit > Between Limits > Below Lo Limit	Three zones of evaluation for Pass and Fail
P P F	Pass if above low limit
P F F	Pass if above high limit
F P F* (default)	Pass if between high and low limits
F P P	Pass if below high limit
F F P	Pass if below low limit
P F P	Pass if above the high limit or below the low limit

Note: The Evaluation option displays High Limit (left) to Low Limit (right). On the IX5 monitor screen, readings appear from Low Limit (left) toward High Limit (right). Ensure this orientation is understood to correctly identify the test result.

Chapter 18 – Diff Pressure (DP) Decay-Leak Std

This chapter explains the theory and parameters for conducting a Differential Pressure (DP) Decay Test with Leak Standard. Pressure loss is measured utilizing a Differential Pressure (DP) transducer. The pressure loss is correlated to a leak rate using a leak standard. This test requires a two-cycle calibration routine to correlate the pressure loss to a flow rate. The result of this test is presented in units of flow.



This test type utilizes a two-point calibration sequence with a non-leaking master part to record the zero leak pressure loss value and the additional pressure loss value due to the flow rate of the leak standard on the second calibration cycle.

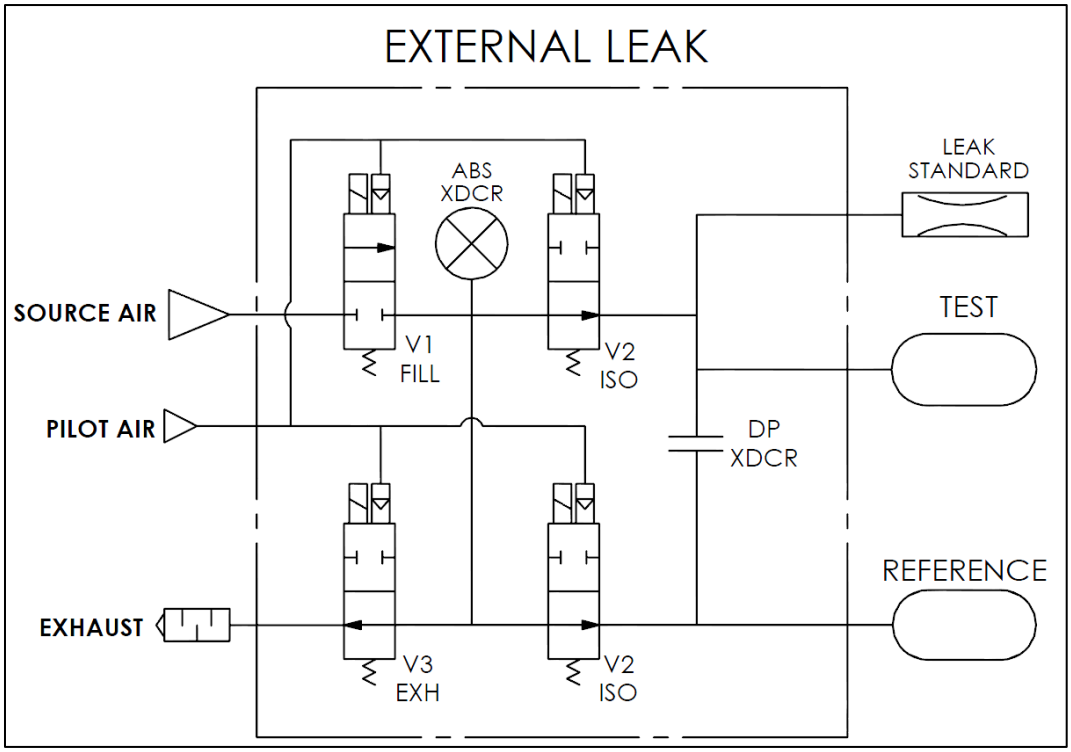
How it works

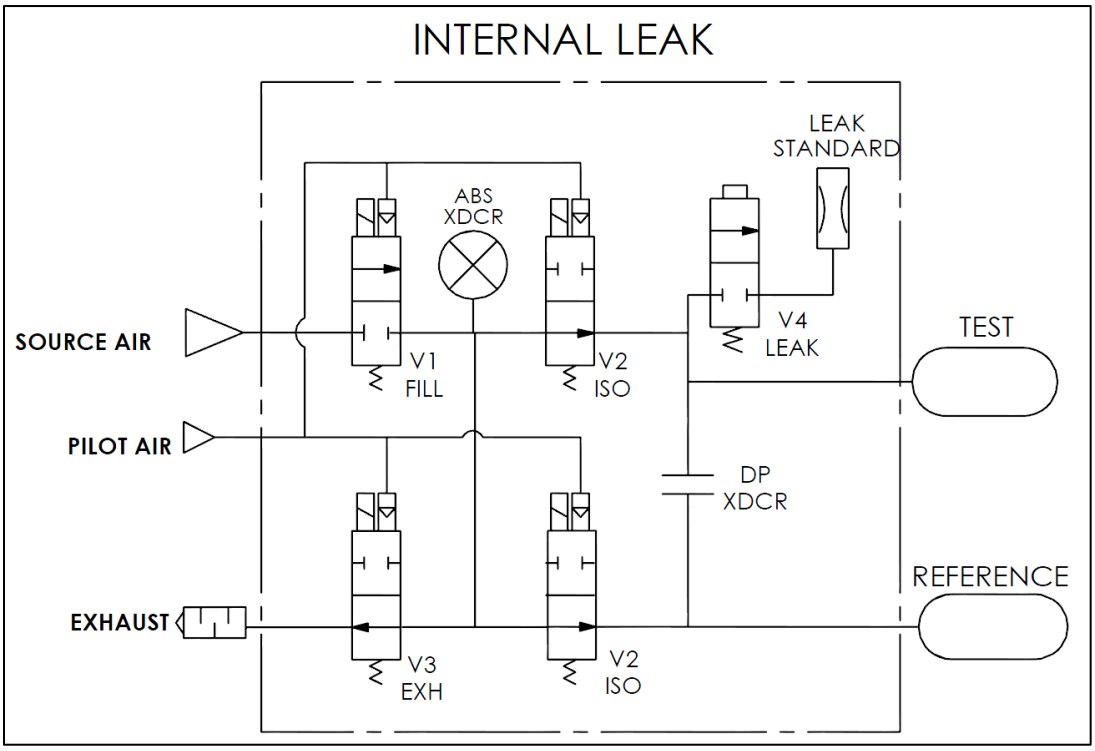
In order to detect leakage in a part, the change in pressure due to temperature and part elasticity must be allowed to settle before taking any pressure readings.

With differential pressure, a reference part volume (should be identical to the nominal test part volume) is pressurized simultaneously with the test part.

Leaks are determined by detecting the rate of pressure loss between the two parts. The instrument can be configured optionally with internal or external leak standards. External leak standards can be driven manually. Internal leak standards are driven by valves (V4) and may be manually forced open during a test to simulate a leak in the test circuit. Open Leak Std is located in **Main Menu > Device Settings > Hardware > Leak/Cal** icon.

Leak Standard Pneumatic Diagrams





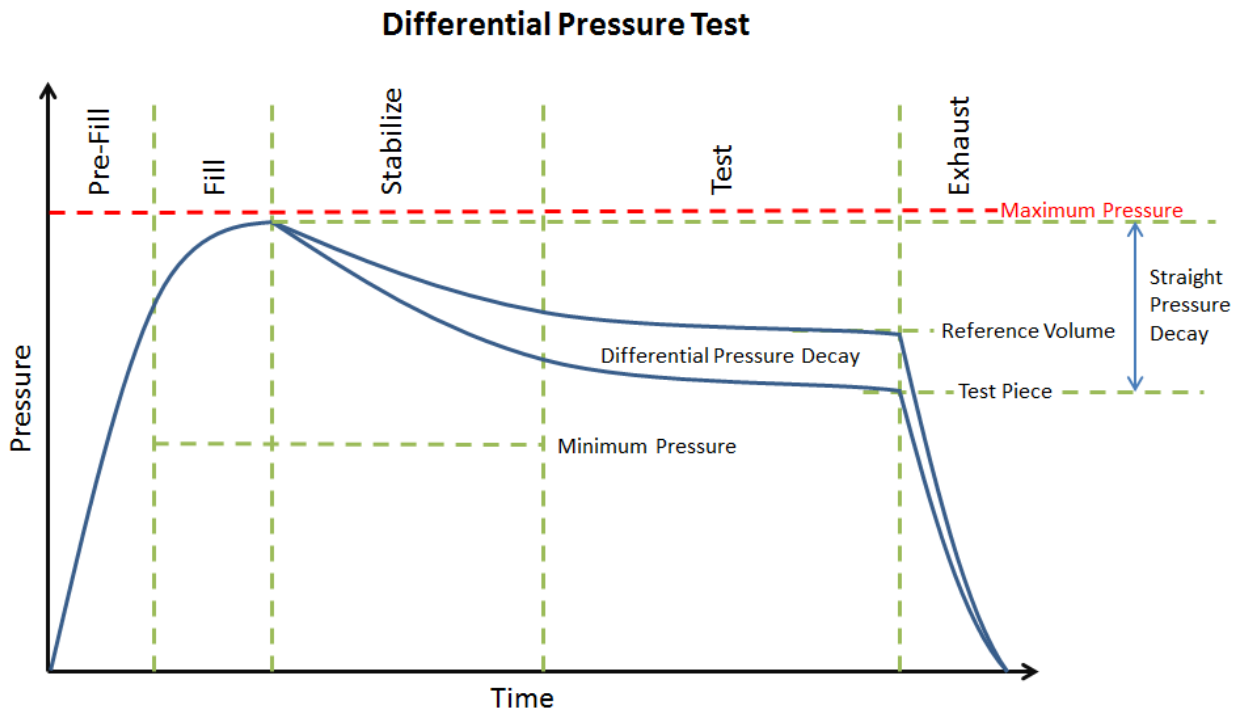
Test Setup

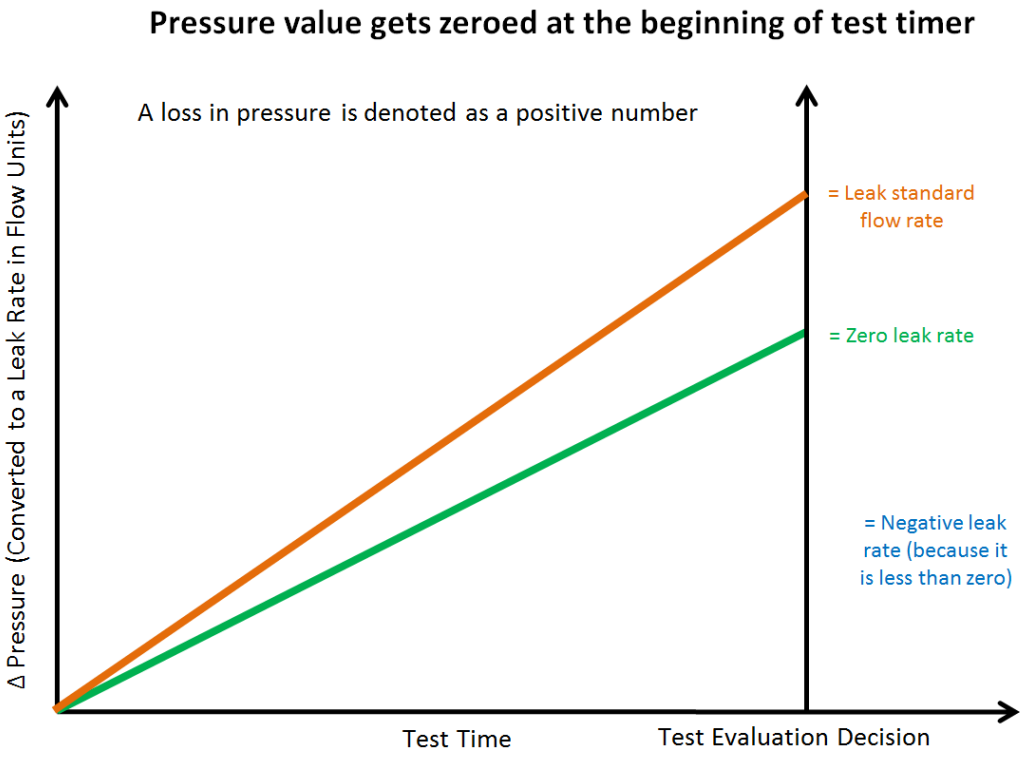
The test part and the reference volume are simultaneously pressurized to a preset pressure. The air in the system is then allowed to stabilize, with the supply valves all closed. After the stabilization time, the Differential Pressure Transducer is automatically zeroed.

During test, the pressure change in the test piece is compared to the pressure change in the reference volume, using the Differential Pressure Transducer. If the test piece is leaking, the difference will increase and be measured; an alarm limit may be set for a pass/fail decision

The charts in this chapter give an overview of the parameters used to set up a Pressure Differential Test and correlate the results to a flow rate using a leak standard. The Tables that follow give detailed descriptions of each parameter and also document the Display User Level associated with each parameter.

Note: To change the User Level, see Chapter 32 – User and Security




Pressure value gets zeroed at the beginning of test timer
A loss in pressure is denoted as a positive number
Δ Pressure (Converted to a Leak Rate in Flow Units)
= Leak standard flow rate
= Zero leak rate
= Negative leak rate (because it is less than zero)
Test Time
Test Evaluation Decision

Timer Parameters

The Timers menu is located in the **Main Menu > Configuration > Timers** option.

Timer	Description	User Display Mode
Pre-Press	Amount of time allocates to each segment for execution before continuing. *This parameter is only available if the Prefill Method selected is "Pre-Pressure Time"*	Basic Advanced, Admin
Prefill	Percentage of the fill timer where the minimum pressure limit is not monitored. This allows time within the fill stage for the instrument to achieve the minimum test pressure.	Advanced, Admin
Charge	Time to enable part to reach the Charge Target Pressure. At the end of this timer, the instrument will read the pressure on the pressure transducer. *This parameter is only available if the Prefill Method selected is "Fixed Charge"*	Basic Advanced, Admin
Fill	Time to enable part to reach the Target Pressure. It may also be used as time to stabilize part pressure with additional air.	Basic Advanced, Admin
Isolation	Amount of stabilization time utilized to isolate the test part and reference volume prior to the test measurement.	Admin
Stabilize	Time to stabilize part pressure while isolated from the pressure regulator. This time directly affects the repeatability of the test.	Basic Advanced, Admin
Test	At the end of this timer, the instrument will read the pressure on the pressure transducer. This pressure is due to the backpressure created in the pneumatic circuit and part.	Basic Advanced, Admin
Exhaust	Time to relieve or vent part pressure before signaling the end of test. This prevents the accidental ejection of debris and protects the fixture seals from damage	Basic Advanced, Admin
Relax	Timer used during Program Cal routine as a delay between calibration cycles to allow the master part to recover to repeatable virgin state. (Too short relax times result in decreasing pressure losses/flow results in successive tests.)	Basic Advanced, Admin

Pressure Parameters

The Pressure menu is located in the **Main Menu > Configuration > Pressure** option.

Pressure	Description	User Display Mode
Minimum Pressure	Minimum test pressure that must be met within the Pre-fill timer and maintained during the Fill and Stabilization timers. This is an early indication of a major leak	Basic Advanced, Admin
Pre-Pressure	Target Pre-Pressure. Used as a setpoint for the Electronic Regulator during the Pre-Pressure time. *This parameter is only available if the Prefill Method selected is "Pre-Pressure Time"*	Basic Advanced, Admin
Target Pressure	Target test pressure. Also used as a setpoint for the Electronic Regulator.	Basic Advanced, Admin
Target Pressure Window	Percentage window is about the target pressure that must be maintained during test segment.	Advanced, Admin
Pre-Pressure Window	The percentage (plus and minus) about the Pre-Pressure value defining the minimum and maximum pressure at the end of the Pre-Pressure time. *This parameter is only available if the Prefill Method selected is "Pre-Pressure Time"*	Basic Advanced, Admin
Maximum Pressure	The value that must not be exceeded at any time to complete a successful test. If the pressure goes above the Maximum Test Pressure, the testing cycle (during Fill and Stabilization) will end as an Over Pressure Malfunction.	Basic Advanced, Admin
Charge Min Press	Minimum charge pressure that must be met within the Charge timer and maintained before the Fill timers. This is an early indication of a major leak. If the pressure is measured below the Charge Min Press at end of Charge segment, the testing cycle will end as a Below Charge Malfunction. *This parameter is only available if the Prefill Method selected is "Fixed Charge"*	Basic Advanced, Admin
Charge Target Press	Target Charge pressure. Also used as a setpoint for the Electronic Regulator in Charge segment. *This parameter is only available if the Prefill Method selected is "Fixed Charge"*	Basic Advanced, Admin
Charge Max Press	The value that must not be exceeded at end of Charge segment. If the pressure is measured above the Charge Max Press at end of Charge segment, the testing cycle will end as an Above Charge Malfunction. *This parameter is only available if the Prefill Method selected is "Fixed Charge"*	Basic Advanced, Admin

Test Parameters

The Test parameters menu is located in the **Main Menu > Configuration > Test: DPL** option.

TST Parameter	Description	User Display Mode
Low Limit Leak	Lower set point value used to evaluate test results of parts.	Basic Advanced, Admin
High Limit Leak	Upper set point value used to evaluate test results of parts.	Basic Advanced, Admin
Test Evaluation	Test results are compared to two setpoints for pass or fail status. There are three areas for evaluation of results: above high limit, between limits, and below low limit. See Table below for codes.	Advanced, Admin
Target pressure correction	Allow the instrument to perform measurement correction based upon the relationship between the target pressure and actual test pressure.	Advanced, Admin
Min Mstr+Leak Loss	Minimum pressure loss allowable for the master part with Leak Standard during the calibration cycle. Use to prevent calibration to leaking master parts or fixtures.	Basic Advanced, Admin
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.	Basic Advanced, Admin
Min Leak Loss	Minimum pressure loss allowed that represents the pressure loss due to the Leak Standard used to calibrate the instrument.	Basic Advanced, Admin
Max Leak Loss	Maximum pressure loss allowed that represents the pressure loss due to the Leak Standard used to calibrate the instrument.	Basic Advanced, Admin
Min Master Loss	Minimum pressure loss allowable for the Master Part during the calibration cycle. Use to prevent calibration to the Self-Test cap.	Basic Advanced, Admin
Max Master Loss	Maximum pressure loss allowable for the Master Part during the calibration cycle. Use to prevent calibration to the Self-Test cap.	Basic Advanced, Admin
Min Perform Factor	Minimum acceptable value for the Performance Factor compared after the calibration cycle to prevent improper calibration.	Basic Advanced, Admin
EDC Enabled	When enabled, Environmental Drift Correction (EDC) 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.	Advanced, Admin
EDC Percentage	Percentage (Plus and Minus) band defined by a percentage of High Limit about the Master Part Curve.	Advanced, Admin

TST Parameter	Description	User Display Mode
	EDC continually accumulates and calculates an offset for the test results.	
EDC Quantity	Number of test results utilized in calculating the EDC factor.	Advanced, Admin

TST Parameter	Description	User Display Mode
Quik Test Enable	Activates Quik Test. See Appendix B – Quik Test.	Advanced, Admin
Quik Test Timer	Options include 10%, 25%, 50%, 75%, and 90%. See Appendix B – Quik Test.	Advanced, Admin
Quik Test LL Band	See Appendix B – Quik Test.	Advanced, Admin
Quik Test HL Band	See Appendix B – Quik Test.	Advanced, Admin

Test Evaluation Code	Description
Above Hi Limit > Between Limits > Below Lo Limit	Three zones of evaluation for Pass and Fail
P P F	Pass if above low limit
P F F	Pass if above high limit
F P F* (default)	Pass if between high and low limits
F P P	Pass if below high limit
F F P	Pass if below low limit
P F P	Pass if above the high limit or below the low limit

Note: the IX5 evaluation moves toward the left. Ensure you are tracking the data flow from the High Limit (Right) toward the Low Limit (Left) to correctly identify if the test result remains within the parameters.

Program Calibration

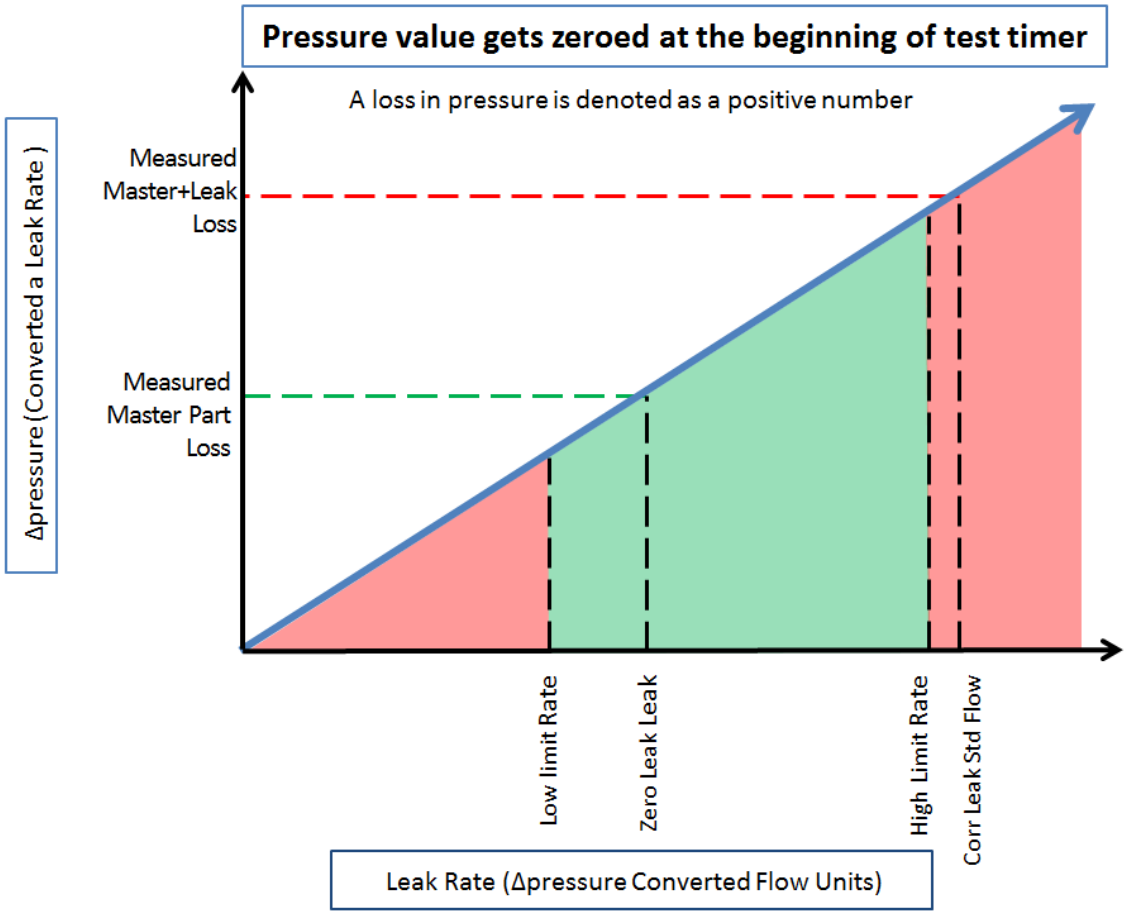
In order to convert the pressure loss measured by the instrument to a leak (flow) rate, the instrument uses a leak standard and needs to run the "Program Cal" routine. This procedure requires at least one known non-leaking part referred to as a "master part". This procedure tests a non-leaking master part connected to the instrument using the timers and pressures established for the program. The procedure automatically tests the non-leaking master part twice with the Relax timer delay between tests. Within each program that uses a leak standard, Program Cal can be configured to use one of four methods. See Setting the Cal Method and Leak Standard Location in Chapter 33 – Features.

Remember: The Leak/Cal menu has a parameter called Leak Std/Cal Define that determines the location for the leak standard settings.

When set to "Channel", leak standard settings are located in the Main menu > Device Settings > Hardware menu.

When set to "Program", leak standard settings are located in the Main menu > Configuration.

Determine how you plan to use your leak test instrument. Review Setting the Leak Standard Values *section on page 13. It is critical to make sure the leak standard values are set correctly for proper use. To view the Cal Method parameter, you must be in the Advanced or Admin Display User Level. To change the Display User Level, see* Chapter 32 – User and Security



Initiating the Program Cal Sequence

To initiate a Program Cal routine, go to **Main Menu > Configuration > Cal:PLR > Program calibration option**, click OK. The Program Cal wizard will tell you to connect a non-leaking master part. Connect the non-leaking master part to the instrument. Push the Start button to initiate the Program Cal routine. The system will conduct an initial test of the non-leaking master part to measure the pressure loss associated with a non-leaking part. This represents the typical offset associated with testing parts within the environment of the test system. The pressure loss value is saved as the Master Part Loss. The system will conduct a second test on a non-leaking master part with a known calibrated leak standard included in the test. The pressure loss value result for this test is saved as the Master+Leak Loss.

Performance Factor

Upon the successful completion of the Program Cal routine, the display will show the calculated Performance Factor for the calibration. The Performance Factor is an estimate of the quality of the calibration. It combines the ratio of the Hi Limit Leak result to the non-leaking master part result, the test pressure, and difference between the Hi Limit result and the non-leaking master part result to scale its anticipated performance. This value ranges from 0 to 100. It is generally desirable to have a Performance Factor of 35 to 100. The actual acceptable Performance Factor can vary depending on the desired Gage R&R performance of the test. Here is the Performance Factor equation:

Performance Factor = **Cal Ratio** x **Pressure Loss Penalty** x **Time Penalty** x **100**

The pressure loss penalty is greater for smaller pressure loss values. The time penalty is greater for shorter Test cycle timer values. Generally, longer stabilize and test cycle timer settings will produce higher Performance Factors and improved Gage R&R performance.

> ***Note: The instrument will require a Program Cal routine if any parameters that affect the calibration are modified.***

Conditions for a Successful Calibration

Several conditions must be met during the Program Calibration routine for the instrument to accept and store the calibration results.
The conditions are based on the following measurements or calculations:

1. DP Master Part Loss
    a. Must be greater than the Min Master Loss limit
    b. Must be less than the Max Master Loss limit
    c. Must be less than the Master+Leak Loss measurement
2. DP Master+Leak Loss
    a. Must be greater than the Min Mstr+Leak Loss limit
    b. Must be less than the Max Mstr+Leak Loss limit
    c. Must be greater than the Master Loss measurement
3. DP Leak Loss
    a. Must be greater than the Min Leak Loss limit
    b. Must be less than the Max Leak Loss limit
4. Performance Factor
    a. Must be greater than the Min Perform Factor limit

If the Program Cal routine is successfully completed, "PROGRAM CALIBRATION PASSED" will be displayed. If there are any problems during the Program Cal sequence an error will be displayed. If there is an error, see Appendix A – Messages & Error Codes.

Calibration Parameters

The Calibration parameters menu is located in the **Main Menu > Configuration > CAL: DPL** option. These calibration parameters are values that are measured or calculated as a result of the Program Cal routine for a Differential Pressure Decay-Leak Std test.

CAL Parameter	Description	User Display Mode
Program Calibration Button	Program Cal button Used to start the Program calibration routines.	Basic Advanced, Admin
Performance Factor	This is a Performance value generated by the actual calibration cycle to be compared to the Min Perform Factor input as a Test Parameter.	Basic Advanced, Admin
Master Part Press	Actual pressure data generated for the master part during the calibration cycle.	Advanced, Admin
Master+Leak Press	Actual pressure data generated for the master part with Leak Standard during the calibration cycle.	Basic Advanced, Admin
DP Master Part Loss	Differential pressure loss during the calibration cycle of the Master Part and stored to represent normal differential loss at the specified Target Pressure.	* Viewable in Basic & Advanced **Editable in Admin**
DP Master+Leak Loss	Differential pressure loss during the calibration cycle of the Master Part with Leak Standard and stored to represent normal loss + leak standard differential loss at the specified Target Pressure.	* Viewable in Basic & Advanced **Editable in Admin**
DP Leak Loss	Calculated differential pressure loss, based upon measured differential pressure losses during the Program Cal routine. Corresponds to the actual differential pressure loss related to the leak standard.	*Viewable in Basic & Advanced
Corr. Leak Std Flow	The calculated leak standard flow rate based on the Program Target Pressure, the leak standard calibrated pressure, and the leak standard calibrated flow rate.	Advanced, Admin

Note: * = These CAL parameters are for those customers who want to do CALS on a series of parts so they can manually input the ideal settings for these parameters to compare again.

This page is intentionally blank.

Chapter 19 – Volume

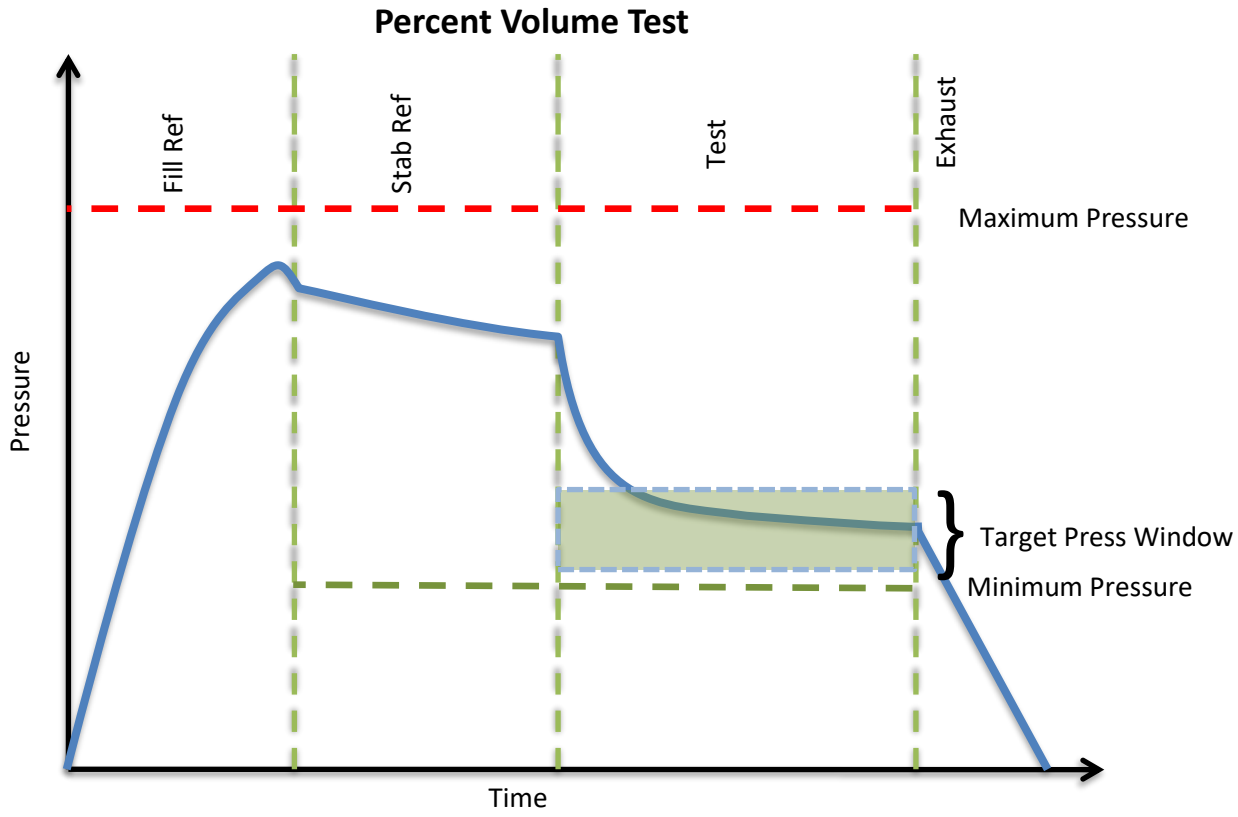
This chapter explains the theory and parameters for conducting a percent volume test for measuring the volume of a test part relative to a reference part.

The Percent Volume test type is used to test for gross leakage by measuring the escape of pressure or vacuum from a reference part filled with a metered volume of pressure or vacuum. Percent Volume test type is useful for parts with high elasticity, which readily change volume, by using a pre-defined volume to limit their maximum expansion during test. In addition, parts with internal openings connecting multiple volumes can be verified to be open or closed.

This test type is used to determine the volume of a test part compared to the volume of a reference part. The reference volume is initially filled and isolated from the supply. The test part remains isolated. The reference volume pressure is measured at this point. The reference volume is then released into the test part and allowed to stabilize. The pressure of the test part is measured at this point. The two pressure measurements are then used to calculate the ratio of the test part volume to the reference volume.

The Charts below give an overview of the parameters used to set up a Percent Volume Test. The Tables that follow give detailed descriptions of each parameter and also document the Display User Level associated with each parameter.

Note: To change the Display User Level, see Chapter 32 – User and Security



Timer Parameters

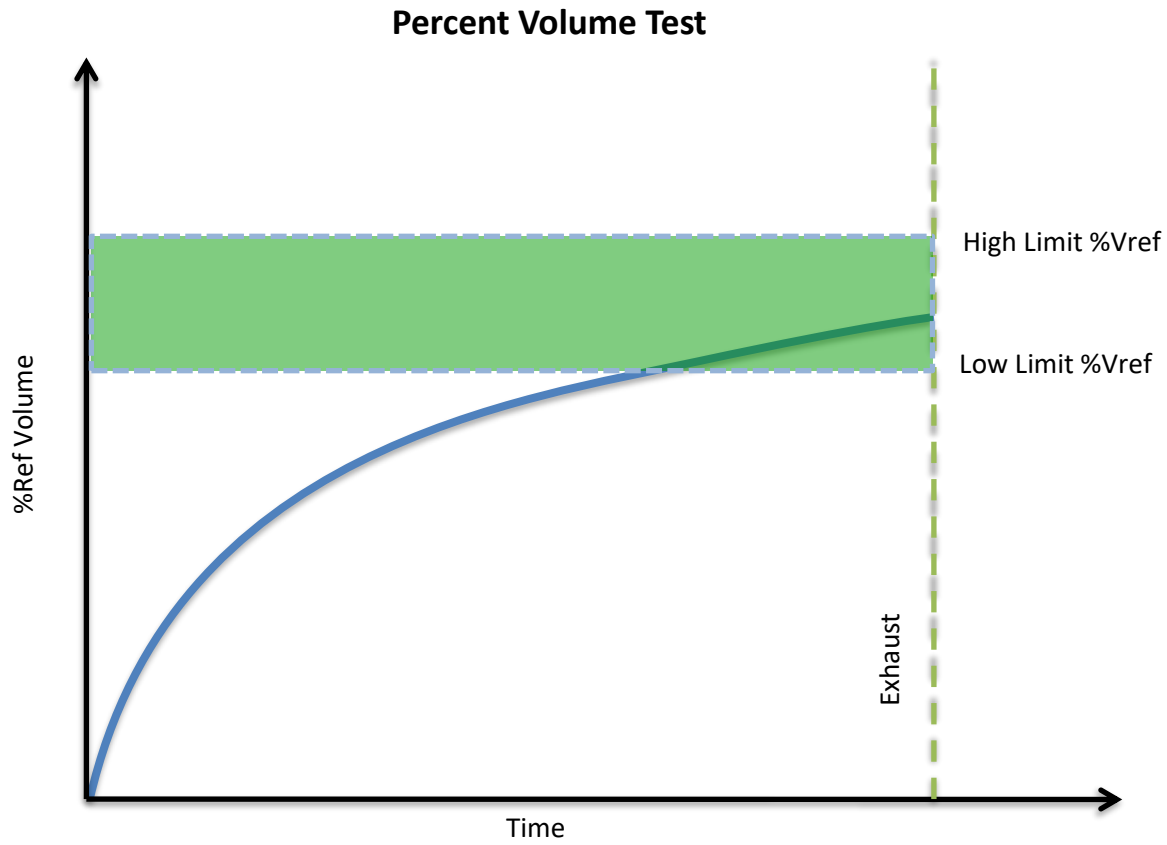
The Timers menu is located in the **Main Menu > Configuration > Timer's** icon.

Timer	Description	Display User Level
Tooling Extend	When tooling control is specified, there can be up to five extend timers for up to five tooling motions. This is a not to exceed timer when feedback is being utilized.	Advanced, Admin
Fill Ref	Time to enable reference to reach the Target Pressure. It may also be used as time to stabilize reference part pressure with additional air.	Basic Advanced, Admin
Stab Ref	Time to stabilize reference pressure while isolated from the pressure regulator and test part. This time directly affects the repeatability of the test.	Basic Advanced, Admin
Test	The precise time over which to measure the relative volume difference between the reference part and the test part.	Basic Advanced, Admin
Exhaust	Time to relieve or vent test pressure before signaling the end of test. I This prevents the accidental ejection of debris and protects the fixture seals from damage	Basic Advanced, Admin
Part Mark	This is used as the duration for an external part marking device, and not to exceed timer when feedback is being utilized	Advanced, Admin
Tooling Retract	When tooling control is specified, there can be up to five retract timers for up to five tooling motions. This is a not to exceed timer when feedback is being utilized.	Advanced, Admin

Pressure Parameters

The Pressure menu is located in the **Main Menu > Configuration > Pressure** icon.

Pressure	Description	Display User Level
Minimum Pressure	The value that must be reached before the Fill Ref setpoint is reached and must be maintained through the stabilization segment or the testing cycle will end as a Severe Leak.	Basic Advanced, Admin
Target Pressure	The specified test pressure for the part. For vacuum test pressures enter a positive value if psiv was selected as the pressure unit, or enter a negative value if psig was selected as the pressure unit. ((For example, the test pressure 9.7 psia would be entered as 5 psiv or -5 psig.) Pressure loss may be corrected to the Target Pressure.	Basic Advanced, Admin
Maximum Pressure	The value that must not be exceeded at any time to complete a successful test. If the pressure goes above the Maximum Test Pressure, the testing cycle will end as an Over Pressure Malfunction.	Basic Advanced, Admin



Test Parameters

The Test parameters menu is located in the **Main Menu > Configuration > TST: %VR** icon.

TST Parameter	Description	Display User Level
Low Limit %Vref	Lower setpoint value used to evaluate test results.	Basic Advanced, Admin
High Limit %Vref	Upper setpoint value used to evaluate test results.	Basic Advanced, Admin

Test Evaluation Code	Description
Above Hi Limit > Between Limits > Below Lo Limit	Three zones of evaluation for Pass and Fail
P P F	Pass if above low limit
P F F	Pass if above high limit
F P F* (default)	Pass if between high and low limits
F P P	Pass if below high limit
F F P	Pass if below low limit
P F P	Pass if above the high limit or below the low limit

Note: The Evaluation option displays High Limit (left) to Low Limit (right). On the IX5 monitor screen, readings appear from Low Limit (left) toward High Limit (right). Ensure this orientation is understood to correctly identify the test result.

Chapter 20 – Volume, Pressure Decay-Leak Std

This chapter explains the theory and parameters for conducting a Percent Volume, Pressure Decay Leak Test and correlating the pressure loss to a leak rate using a leak standard. This test requires a two cycle calibration routine to correlate the pressure loss to a flow rate. The result of this test is presented in units of flow.

This test type utilizes a two-point calibration sequence with a non-leaking master part to record the zero leak pressure loss value and the additional pressure loss value due to the flow rate of the leak standard on the second calibration cycle.

The Percent Volume, Pressure Decay – Leak Std test type is used to test for both severe and fine leaks by measuring the escape of pressure or vacuum from a reference part filled with a metered volume of pressure or vacuum. This test type is useful for parts with high elasticity, which readily change volume, by using a pre-defined volume to limit their maximum expansion during test. In addition, parts with internal openings connecting multiple volumes can be verified to be open or closed. The Percent Volume portion of this test type is used to find severe leaks, while the pressure decay – leak std portion is used to find fine leaks.

The basic principle of a Percent Volume, Pressure Decay Leak Test is to perform a percent volume test followed by a calibrated pressure decay leak test. Details for the basic operation of a percent volume test can be found in. Details for the basic operation of a pressure decay leak test, including how to perform the required calibration sequence, can be found in Chapter 5 – Pressure Decay-Leak Std.

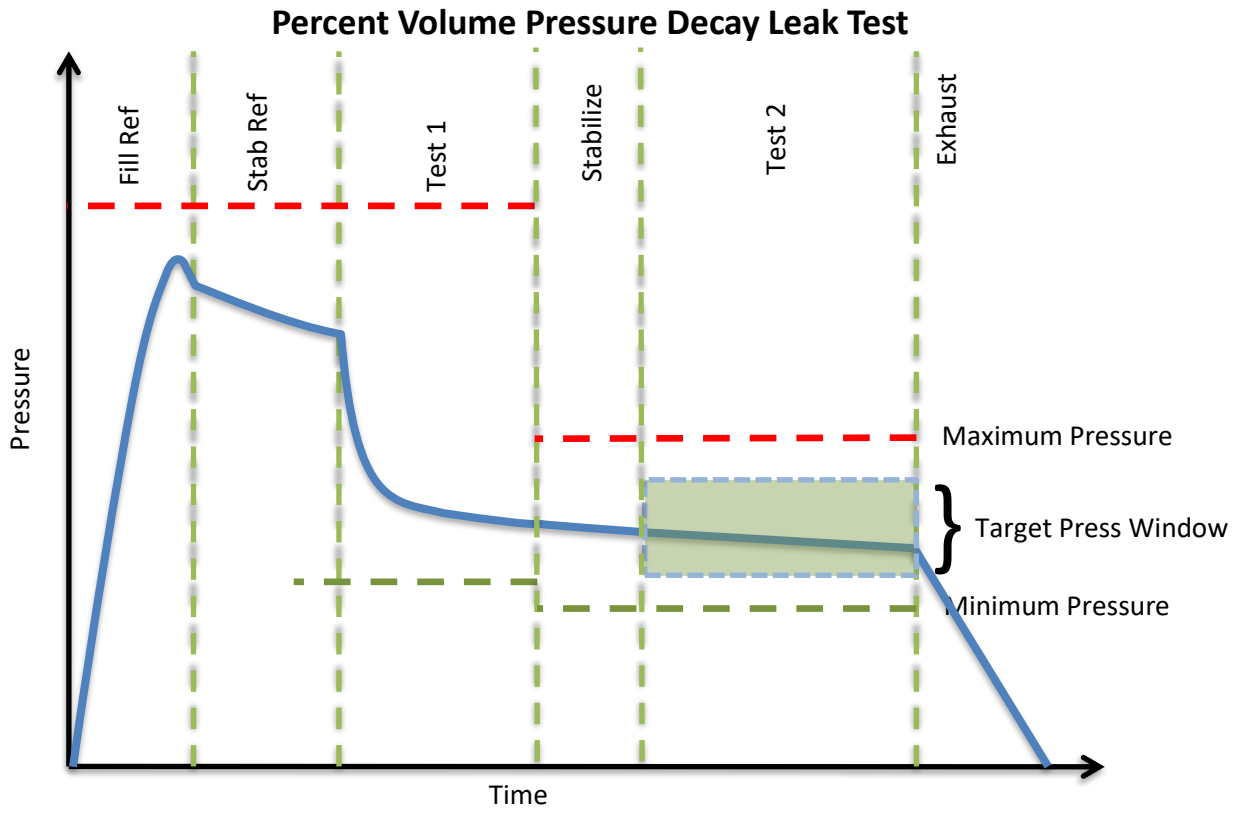
The charts in this chapter give an overview of the parameters used to set up a Percent Volume, Pressure Decay Leak Test and correlate the results of the Pressure Decay Leak Test portion to a flow rate using a leak standard. The Tables that follow give detailed descriptions of each parameter and also document the Display User Level associated with each parameter.

Note: To change the Display User Level, see Chapter 32 – User and Security

Timer Parameters

The Timers menu is located in the **Main Menu > Configuration > Timers** icon.

Timer	Description	Display User Level
Tooling Extend	When tooling control is specified, there can be up to five extend timers for up to five tooling motions. This is a not to exceed timer when feedback is being utilized.	Advanced, Admin
Fill Ref	Time to enable reference to reach the Target Pressure. It may also be used as time to stabilize reference part pressure with additional air.	Basic Advanced, Admin
Stab Ref	Time to stabilize reference pressure while isolated from the pressure regulator and test part. This time directly affects the repeatability of the test.	Basic Advanced, Admin
Test 1	The precise time over which to measure relative volume difference between the reference part and the test part.	Basic Advanced, Admin
Stabilize	Time to stabilize test part pressure and reference part pressure while isolated from the pressure regulator. This time directly affects the repeatability of the test.	Basic Advanced, Admin
Test 2	The precise time over which to measure pressure drop or decay or the precise end time to measure pressure rise.	Basic Advanced, Admin
Exhaust	Time to relieve or vent part pressure before signaling the end of test. This prevents the accidental ejection of debris and protects the fixture seals from damage	Basic Advanced, Admin
Tooling Retract	When tooling control is specified, there can be up to five retract timers for up to five tooling motions. This is a not to exceed timer when feedback is being utilized.	Basic Advanced, Admin
Part Mark	This is used as the duration for an external part marking device, and not to exceed timer when feedback is being utilized	Advanced, Admin
Relax	Timer used during Program Cal sequence as a delay between calibration cycles to allow the master part to recover to repeatable virgin state. (Too short relax times result in decreasing pressure losses/flow results in successive tests.)	Basic Advanced, Admin


Percent Volume Pressure Decay Leak Test
Fill Ref
Stab Ref
Test 1
Stabilize
Test 2
Exhaust
Pressure
Maximum Pressure
Target Press Window
Minimum Pressure
Time

Pressure Parameters

The Pressure menu is located in the **Main Menu > Configuration > Pressure** icon.

Pressure	Description	Display User Level
Minimum Pressure 1	The value that must be reached before the Fill Ref setpoint is reached, and must be maintained through the Fill Stab segment or the testing cycle will end as a Severe Leak.	Basic Advanced, Admin
Target Pressure 1	The specified test pressure for the part during the Test 1 segment. For vacuum test pressures enter a positive value if psiv was selected as the pressure unit, or enter a negative value if psig was selected as the pressure unit. (For example, the test pressure 9.7 psia would be entered as 5 psiv or -5 psig.) Pressure loss may be corrected to the Target Pressure.	Basic Advanced, Admin
Maximum Pressure 1	The value that must not be exceeded at any time during the Fill Ref, Stab Ref or test 1 segments to complete a successful test. If the pressure goes above the Maximum Test Pressure, the testing cycle will end as an Over Pressure Malfunction.	Basic Advanced, Admin
Minimum Pressure 2	The value that must maintained through Stabilize and Test 2 segments or the testing cycle will end as a Severe Leak.	Basic Advanced, Admin
Target Pressure Window	The specified test pressure for the part during the Test 2 segment. For vacuum test pressures enter a positive value if psiv was selected as the pressure unit, or enter a negative value if psig was selected as the pressure unit. ((For example, the test pressure 9.7 psia would be entered as 5 psiv or -5 psig.) Pressure loss may be corrected to the Target Pressure.	Basic Advanced, Admin
Maximum Pressure 2	The value that must not be exceeded at any time during the Stabilize or Test 2 segments to complete a successful test. If the pressure goes above the Maximum Test pressure, the testing cycle will end as an Over Pressure Malfunction.	Basic Advanced, Admin
Target Press Window 2	This is a window (default +/– 50%) set around the Target Pressure that must be maintained during the Test segment of the testing cycle. It generates a Target Pressure Low or High Malfunction if the actual pressure falls outside this window during test.	Advanced, Admin

Test Parameters (Volume)

The Test parameters menu is located in the **Main Menu > Configuration > TST:%VR1** icon.

TST Parameter	Description	Display User Level
Low Limit %Vref	Lower setpoint value used to evaluate test results.	Basic Advanced, Admin
High Limit %Vref	Upper setpoint value used to evaluate test results.	Basic Advanced, Admin

Test Parameters (Pressure Decay-Leak std)

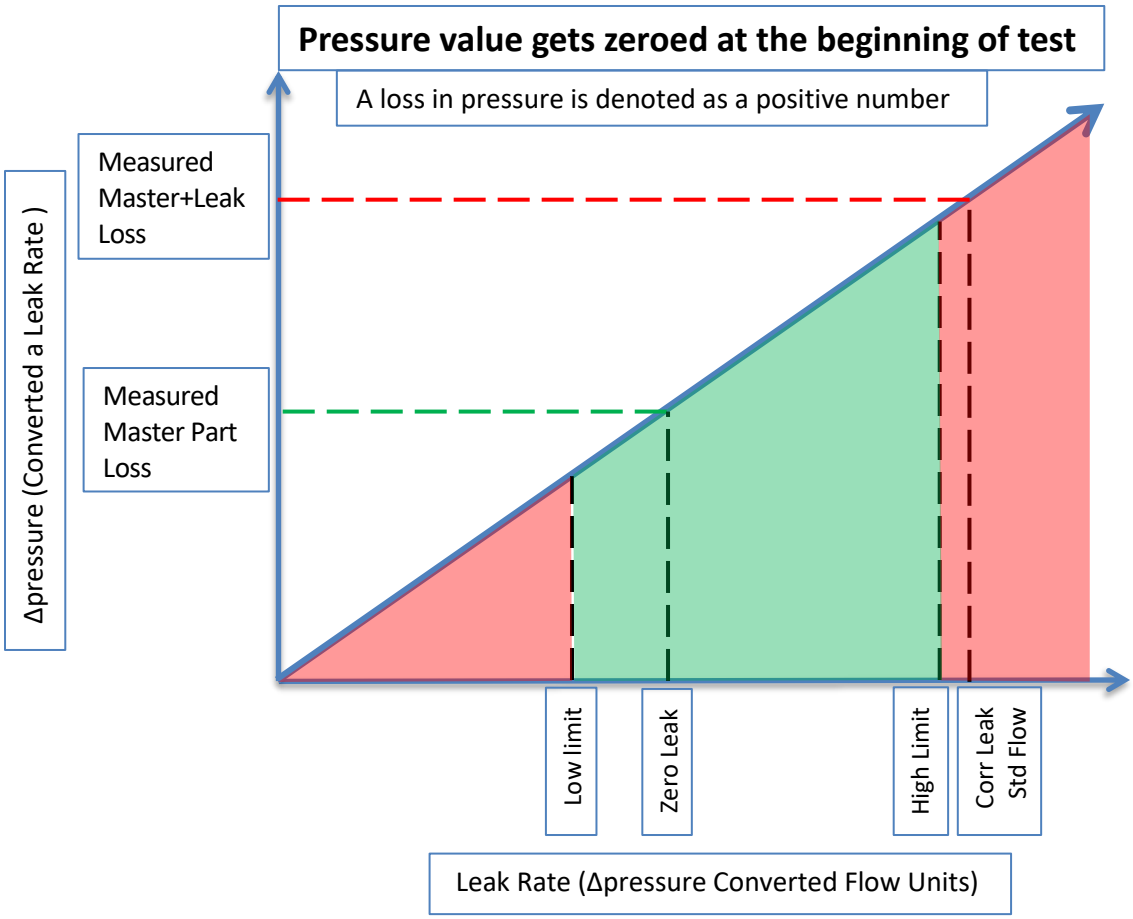
The Test parameters menu is located in the **Main Menu > Configuration > TST: PLR2** icon.

TST Parameter	Description	Display User Level
Low Limit Leak	Lower setpoint value used to evaluate test results.	Basic Advanced, Admin
High Limit Leak	Upper setpoint value used to evaluate test results.	Basic Advanced, Admin
Decay Direction	Defines the method for calculating the part pressure decay during test: Loss – charged part decreasing pressure or evacuated part decreasing vacuum, Gain – part pressure increasing from external forces.	Basic Advanced, Admin
Test Evaluation	Test results are compared to two setpoints for pass or fail status. There are three areas for evaluation of results: above high limit, between limits, and below low limit. See Table below for codes.	Advanced, Admin
Min Master Loss	Minimum pressure loss allowed during the first test in the Program Cal routine. Prevents the acceptance of a calibration of a blocked part or test line.	Basic Advanced, Admin
Max Master Loss	Maximum pressure loss allowed during the first test in the Program Cal routine. Prevents the acceptance of a calibration with a leaking part or fixture leaks.	Basic Advanced, Admin
Min Mstr+Leak Loss	Minimum pressure loss allowed during the second test in the Program Cal routine. Prevents the acceptance of a calibration with a blocked part or test line.	Basic Advanced, Admin
Max Mstr+Leak Loss	Maximum pressure loss allowed during the second test in the Program Cal routine. Prevents the acceptance of a calibration with excessive pressure loss due to part or fixture leaks. Set slightly higher than max loss during Program Cal.	Basic Advanced, Admin

Min Leak Loss	Minimum pressure loss allowed that represents the pressure loss due to the Leak Standard used to calibrate the instrument.	Basic Advanced, Admin
Max Leak Loss	Maximum pressure loss allowed that represents the pressure loss due to the Leak Standard used to calibrate the instrument.	Basic Advanced, Admin
Min Perform Factor	Minimum value for Performance Factor calculated at completion of Program Cal routine. Resultant evaluation of ratio of Master Part Loss to Master+Leak Loss, Test Pressure, and loss due to Leak Std.	Basic Advanced, Admin
Quik Test Enable	Activates Quik Test. See Appendix B – Quik Test.	Advanced, Admin
Quik Test Timer	Options include 10%, 25%, 50%, 75%, and 90%. See Appendix B – Quik Test.	Advanced, Admin
Quik Test LL Band	See Appendix B – Quik Test.	Advanced, Admin
Quik Test HL Band	See Appendix B – Quik Test.	Advanced, Admin
EDC Enable	Activates Environmental Drift Correction. See Appendix C – Environmental Drift Correction.	Advanced, Admin
EDC Percentage	Options include 10%, 25%, 50%, 75%, and 90%. See Appendix C – Environmental Drift Correction..	Advanced, Admin
EDC Quantity	See Appendix C – Environmental Drift Correction..	Advanced, Admin

Test Evaluation Code	Description
Above Hi Limit > Between Limits > Below Lo Limit	Three zones of evaluation for Pass and Fail
P P F	Pass if above low limit
P F F	Pass if above high limit
F P F* (default)	Pass if between high and low limits
F P P	Pass if below high limit
F F P	Pass if below low limit
P F P	Pass if above the high limit or below the low limit

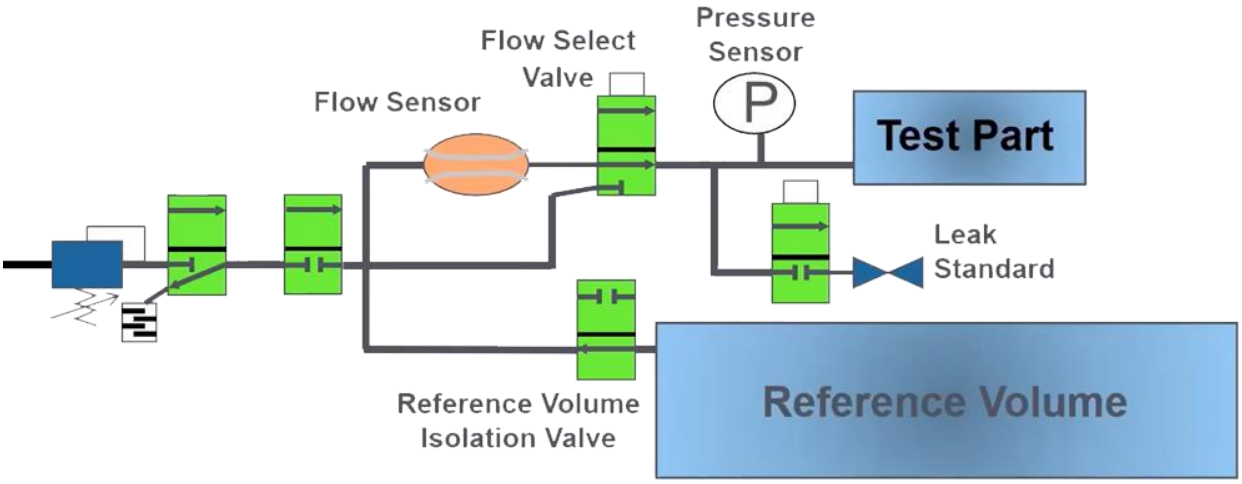
Note: If the instrument is configured multiple internal leak standards the user must select which leak standard is to be used in the Program. See Selecting the Proper Internal Leak Standard in Chapter 33 – Features***.***


Pressure value gets zeroed at the beginning of test
A loss in pressure is denoted as a positive number
Measured Master+Leak Loss
Measured Master Part Loss
Δpressure (Converted a Leak Rate)
Low limit
Zero Leak
High Limit
Corr Leak Std Flow
Leak Rate (Δpressure Converted Flow Units)

Chapter 21 – Differential Mass Flow

This chapter explains the theory and parameters for conducting a Differential Mass Flow Test. This test type is typically used especially in cases when a stable, steady source of air isn't present or when the air pressure has periods of instability when direct mass flow testing may not be the best leak testing option. When pressure is unsteady, differential mass flow testing ensures stability and repeatability, and reduces variability.

Differential mass flow testing is similar to mass flow testing, except that it uses a reference volume as the pressure source. The reference volume is of similar or exact design or volume of the part under test to help eliminate the measurement of flow characteristics that are not associated with a leak. Examples of this could be in products like washer bottles or catheter tubes, that expand and contract under pressure, or in adiabatic conditions where heat transfer is absent.



The Charts below give an overview of the parameters used to set up a Differential Mass Flow Test. The Tables that follow give detailed descriptions of each parameter and also document the Display User Level associated with each parameter.

Note: To change the User Level, see Chapter 32 – User and Security

Timer Parameters

The Timers menu is located in the **Main Menu > Configuration > Timers** option.

Timer	Description	Display User Level
Prefill	Checks for excessively leaking parts or lack of pressure. May be set to "Percent of Fill Time" (default), for fixed fill time tests, or set to "Not to Exceed Time". For Changing the Functionality of the Prefill Timer, see Chapter 33 – Features. Maximum time to reach the minimum pressure. If the variable is set to "Not to Exceed Time", this segment will exit to the next once the Minimum Pressure value is reached.	Basic Advanced, Admin
Pre-Press	Time to enable part to reach the Pre-Pressure. At the end of this time, the instrument will continue to the Fill segment and begin filling in to the Target Pressure. *This parameter is only available if the Prefill Method selected is "Pre-Pressure Time"*	Basic Advanced, Admin
Fill	Time to enable part to reach the Target Pressure. It may also be used as time to stabilize part pressure with additional air.	Basic Advanced, Admin
Test	The precise time over which to measure pressure drop or decay or the precise end time to measure pressure rise.	Basic Advanced, Admin
Exhaust	Time to relieve or vent part pressure before signaling the end of test. This prevents the accidental ejection of debris and protects the fixture seals from damage	Basic Advanced, Admin
Relax	Timer used during Program Cal sequence as a delay between calibration cycles to allow the master part to recover to repeatable virgin state. (Too short relax times result in decreasing flow results in successive tests.)	Basic Advanced, Admin

Pressure Parameters

The Pressure menu is located in the **Main Menu > Configuration > Pressure** option.

Pressure	Description	Display User Level
Minimum Pressure	The value that must be reached before the Prefill setpoint is reached and must be maintained through fill and stabilization segments or the testing cycle will end as a Severe Leak.	Basic Advanced, Admin
Target Pressure	The specified test pressure for the part. For vacuum test pressures enter a positive value if psiv was selected as the pressure unit, or enter a negative value if psig was selected as the pressure unit. ((For example, the test pressure 9.7 psia would be entered as 5 psiv or -5 psig.) Pressure loss may be corrected to the Target Pressure.	Basic Advanced, Admin
Maximum Pressure	The value that must not be exceeded at any time to complete a successful test. If the pressure goes above the Maximum Test Pressure, the testing cycle will end as an Over Pressure Malfunction.	Basic Advanced, Admin
Target Press Window	This is a window (default +/– 50%) set around the Target Pressure that must be maintained during the Test segment of the testing cycle. It generates a Target Pressure Low or High Malfunction if the actual pressure falls outside this window during test.	Advanced, Admin

Test Parameters

The Test parameters menu is located in the **Main Menu > Configuration > Test:FLD** option.

TST Parameter	Description	Display User Level
Low Limit Leak	Lower setpoint value used to evaluate test results.	Basic Advanced, Admin
High Limit Leak	Upper setpoint value used to evaluate test results.	Basic Advanced, Admin
Test Evaluation	Test results are compared to two setpoints for pass or fail status. There are three areas for evaluation of results: above high limit, between limits, and below low limit. See Table below for codes.	Advanced, Admin
Target pressure correction	Allow the instrument to perform measurement correction based upon the relationship between the target pressure and actual test pressure.	Advanced, Admin
Max Master Flow	The maximum value allowed for the Master Flow Offset parameter located on the Cal menu.	Basic Advanced, Admin
Min Master Flow	The minimum value allowed for the Master Flow Offset parameter located on the Cal menu.	Basic Advanced, Admin
EDC Enable	Activates Environmental Drift Correction. See Appendix C – Environmental Drift Correction.	Advanced, Admin
EDC Percentage	Options include 10%, 25%, 50%, 75%, and 90%. See Appendix C – Environmental Drift Correction.	Advanced, Admin
EDC Quantity	See Appendix C – Environmental Drift Correction.	Advanced, Admin
Enable Calibration	Typically used with low leak applications. Enables the Program Cal function which allows a zero offset to be created for a non-leaking master part.	Advanced, Admin

TST Parameter	Description	User Display Mode
Quik Test Enable	Activates Quik Test. See Appendix B – Quik Test.	Advanced, Admin
Quik Test Timer	Options include 10%, 25%, 50%, 75%, and 90%. See Appendix B – Quik Test.	Advanced, Admin
Quik Test LL Band	See Appendix B – Quik Test.	Advanced, Admin
Quik Test HL Band	See Appendix B – Quik Test.	Advanced, Admin

Test Evaluation Code	Description
Above Hi Limit > Between Limits > Below Lo Limit	Three zones of evaluation for Pass and Fail
P P F	Pass if above low limit
P F F	Pass if above high limit
F P F* (default)	Pass if between high and low limits
F P P	Pass if below high limit
F F P	Pass if below low limit
P F P	Pass if above the high limit or below the low limit

Note: The Evaluation option displays High Limit (left) to Low Limit (right). On the IX5 monitor screen, readings appear from Low Limit (left) toward High Limit (right). Ensure this orientation is understood to correctly identify the test result.

Program Calibration

In order to scale the flow transducer to the "zero flow" reading measured by testing a non-leaking part and the "reject" reading measured by testing the non-leaking part with a leak standard incorporated in the circuit, the instrument needs to run the "Program Cal" procedure. This procedure requires at least one known non-leaking part referred to as a "master part". This procedure tests a non-leaking master part in the seal fixture using the timers and pressures established for the program. The procedure automatically tests the non-leaking master part twice with the Relax timer delay between tests. Within each program that uses a leak standard, Program Cal can be configured to use one of four methods. See **Setting the Cal Method and Leak Standard Location** in Chapter 33 – Features.



Remember: The Leak/Cal menu has a parameter called Leak Std/Cal Define that determines the location for the leak standard settings.

When set to "Channel", leak standard settings are located in the Main menu > Device Settings > Hardware menu.

When set to "Program", leak standard settings are located in the Main menu > Configuration.

Determine how you plan to use your leak test instrument. Setting the Leak Standard Values ***section on page 13. It is critical to make sure the leak standard values are set correctly for proper use. To view the Cal Method parameter, you must be in the Advanced or Admin Display User Level. To change the Display User Level, see*** Chapter 32 – User and Security.

Initiating the Program Cal Sequence

To initiate a Program Cal sequence, go to **Main Menu > Configuration > Cal:PLR > Program calibration option**, click OK. The Program Cal wizard will tell you to connect a non-leaking master part. Connect the non-leaking master part to the instrument. Push the **Start button** to initiate the Program Cal sequence. The system will conduct an initial test of the non-leaking master part to measure the flow associated with a non-leaking part. This represents the typical offset associated with testing parts within the environment of the test system. The flow value is saved as the Master Part Flow. The system will conduct a second test on a non-leaking master part with a known calibrated leak standard included in the test. The flow value result for this test is saved as the Master+Leak Flow.

Note: The instrument will require a Program Cal Sequence if any parameters that affect the calibration are modified.

Conditions for a Successful Calibration

Several conditions must be met during the Program Calibration procedure for the instrument to accept and store the calibration results. The conditions are based on the following measurements or calculations:

4. Master Part Flow
    a. Must be greater than the Min Master Flow limit
    b. Must be less than the Max Master Flow limit
    c. Must be less than the Master+Leak Flow measurement
5. Master+Leak Flow

   a. Must be greater than the Min Mstr+Leak Flow limit
   b. Must be less than the Max Mstr+Leak Flow limit
   c. Must be greater than the Master Flow measurement
6. Leak Flow
   a. Must be greater than the Min Leak Flow limit
   b. Must be less than the Max Leak Flow limit

If the procedure does not meet these conditions, error messages are displayed at the completion of tests.

If the Program Cal routine is successfully completed, "PROGRAM CALIBRATION PASSED" will be displayed. If there are any problems during the Program Cal sequence an error will be displayed. If there is an error, see Appendix A – Messages & Error Codes.

Calibration Parameters

The Calibration parameters menu is located in the **Main Menu > Configuration > CAL:FLC** option. These calibration parameters are values that are measured or calculated as a result of the Program Cal routine for a Mass Flow test.

Parameter	Description	Display User Level
Program Calibration Button	Program Cal button Used to start the Program calibration routines.	Basic Advanced, Admin
Master Part Press	Measured pressure at the beginning of the test segment during the first test of the Program Cal process for the non-leaking master part.	Basic Advanced, Admin
Master+Leak Press	Measured pressure at the beginning of the test cycle of second test during Program Cal process for the non-leaking master part with the leak standard introduced to the pneumatic test circuit.	Basic Advanced, Admin
Master Part Flow	Measured flow for the non-leaking master part during the first test of Program Cal process.	Viewable in Basic & Advanced **Editable in Admin**
Master+Leak Flow	Measured flow during the second test of Program Cal for the non-leaking master part with the leak standard introduced to the pneumatic test circuit.	Viewable in Basic & Advanced **Editable in Admin**
Leak Flow	Calculated flow based upon measured flows during the Program Cal routine. Corresponds to the actual flow related to the leak standard.	Viewable in Basic & Advanced
Corr. Leak Std Flow	The calculated leak standard flow rate based on the Program Target Pressure, the leak standard calibrated pressure, and the leak standard calibrated flow rate.	Basic Advanced, Admin

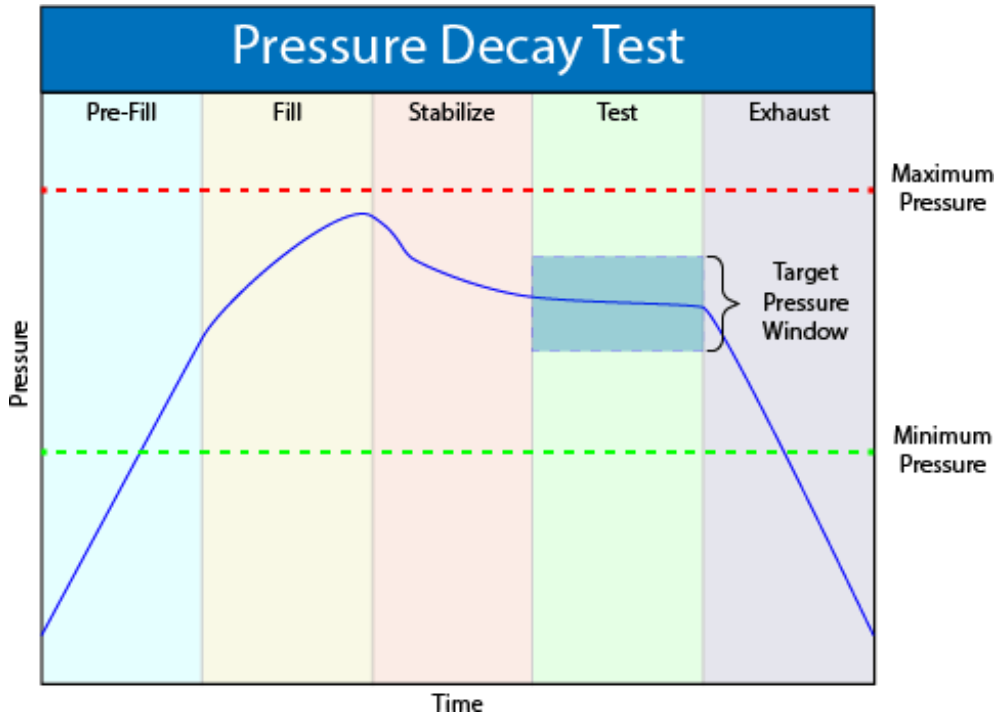
Chapter 22 - Gross Decay-ΔP Test

This chapter explains the theory and parameters for conducting a gross leak test using pressure decay test measuring a pressure loss over time. The result of this test is the pressure loss (or vacuum loss for a vacuum test) measured over a fixed period of time. This test type is typically performed with compressed air or nitrogen and should not be confused with the Gross T-Gas Decay tests described in other chapters.

The basic principle of operation of a pressure decay leak test instrument is to fill the test part to a specified target test pressure, isolate the test part from the source air and allow the pressure to stabilize, and then measure the pressure loss due to a leak over a defined time.

The Charts below give an overview of the parameters used to setup a Gross Decay ΔP Test. The Tables that follow give detailed descriptions of each parameter and also document the Display User Level associated with each parameter.

Note: To change the User Level, see Chapter 32 – User and Security



Timer Parameters

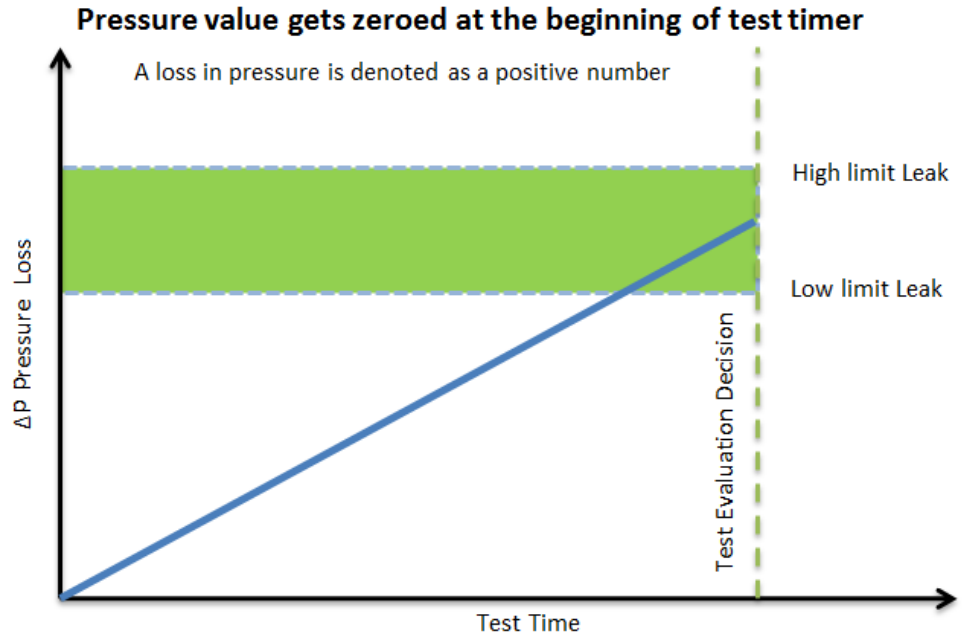
The Timers menu is located in the **Main Menu > Configuration > Timers** option..

Timer	Description	Display User Level
Prefill	Checks for excessively leaking parts or lack of pressure. May be set to "Percent of Fill Time" (default), for fixed fill time tests, or set to "Not to Exceed Time". For Changing the Functionality of the Prefill Timer, see Chapter 33 – Features. Maximum time to reach the minimum pressure. If the variable is set to "Not to Exceed Time", this segment will exit to the next once the Minimum Pressure value is reached.	Basic, Advanced, Admin
Pre-Press	Time to enable part to reach the Pre-Pressure. At the end of this timer, the instrument will continue to the Fill segment and begin filling to the Target Pressure. *This parameter is only available if the Prefill Method selected is "Pre-Pressure Time"*	Basic Advanced, Admin
Fill	Time to enable part to reach the Target Pressure. It may also be used as time to stabilize part pressure with additional air.	Basic Advanced, Admin
Stabilize	Time to stabilize part pressure while isolated from the pressure regulator. This time directly affects the repeatability of the test.	Basic Advanced, Admin
Test	The precise time over which to measure pressure drop or decay or the precise end time to measure pressure rise.	Basic Advanced, Admin
Exhaust	Time to relieve or vent part pressure before signaling the end of test. This prevents the accidental ejection of debris and protects the fixture seals from damage	Basic Advanced, Admin

Pressure Parameters

The Pressure menu is located in the **Main Menu > Configuration > Pressure** option.

Pressure	Description	Display User Level
Pre-Pressure	Target Pre-Pressure. Used as a setpoint for the Electronic Regulator during the Pre-Pressure time. *This parameter is only available if the Prefill Method selected is "Pre-Pressure Time"*	Basic Advanced, Admin
Pre-Pressure Window	The percentage (plus and minus) about the Pre-Pressure value defining the minimum and maximum pressure at the end of the Pre-Pressure time. *This parameter is only available if the Prefill Method selected is "Pre-Pressure Time"*	Basic Advanced, Admin
Minimum Pressure	The value that must be reached before the Prefill setpoint is reached and must be maintained through fill and stabilization segments or the testing cycle will end as a Severe Leak.	Basic Advanced, Admin
Target Pressure	The specified test pressure for the part. For vacuum test pressures enter a positive value if psiv was selected as the pressure unit, or enter a negative value if psig was selected as the pressure unit. ((For example, the test pressure 9.7 psia would be entered as 5 psiv or -5 psig.) Pressure loss may be corrected to the Target Pressure.	Basic Advanced, Admin
Maximum Pressure	The value that must not be exceeded at any time to complete a successful test. If the pressure goes above the Maximum Test Pressure, the testing cycle will end as an Over Pressure Malfunction.	Basic Advanced, Admin
Target Press Window	This is a window (default +/– 50%) set around the Target Pressure that must be maintained during the Test segment of the testing cycle. It generates a Target Pressure Low or High Malfunction if the actual pressure falls outside this window during test.	Advanced, Admin



Test Parameters

The Test parameters menu is located in the **Main Menu > Configuration > Test:PLO** option.

TST Parameter	Description	Display User Level
Low Limit Loss	Lower setpoint value used to evaluate test results.	Basic Advanced, Admin
High Limit Loss	Upper setpoint value used to evaluate test results.	Basic Advanced, Admin
Decay Direction	Defines the method for calculating the part pressure decay during test: Loss – charged part decreasing pressure or evacuated part decreasing vacuum, Gain – part pressure increasing from external forces.	Basic Advanced, Admin
Test Evaluation	Test results are compared to two setpoints for pass or fail status. There are three areas for evaluation of results: above high limit, between limits, and below low limit. See Table below for codes.	Advanced, Admin
Target pressure correction	Allow the instrument to perform measurement correction based upon the relationship between the target pressure and actual test pressure.	Advanced, Admin
Loss Offset	Manual compensation value which is added to the measured loss when calculating the final pressure loss for the test.	Basic Advanced, Admin
EDC Enable	Activates Environmental Drift Correction. See Appendix C – Environmental Drift Correction.	Advanced, Admin
EDC Percentage	Options include 10%, 25%, 50%, 75%, and 90%. See Appendix C – Environmental Drift Correction.	Advanced, Admin

EDC Quantity	See Appendix C – Environmental Drift Correction.	Advanced, Admin

Test Evaluation Code	Description
Above Hi Limit > Between Limits > Below Lo Limit	Three zones of evaluation for Pass and Fail
P P F	Pass if above low limit
P F F	Pass if above high limit
F P F* (default)	Pass if between high and low limits
F P P	Pass if below high limit
F F P	Pass if below low limit
P F P	Pass if above the high limit or below the low limit

Note: The Evaluation option displays High Limit (left) to Low Limit (right). On the IX5 monitor screen, readings appear from Low Limit (left) toward High Limit (right). Ensure this orientation is understood to correctly identify the test result.

This page is intentionally blank.

Chapter 23 - Gross Decay-Leak Std Test

This chapter explains the theory and parameters for conducting a gross leak test using a pressure decay test with a leak standard. The result of this test is presented in units of flow calculated from the measured pressure loss over the duration of the Test segment timer.

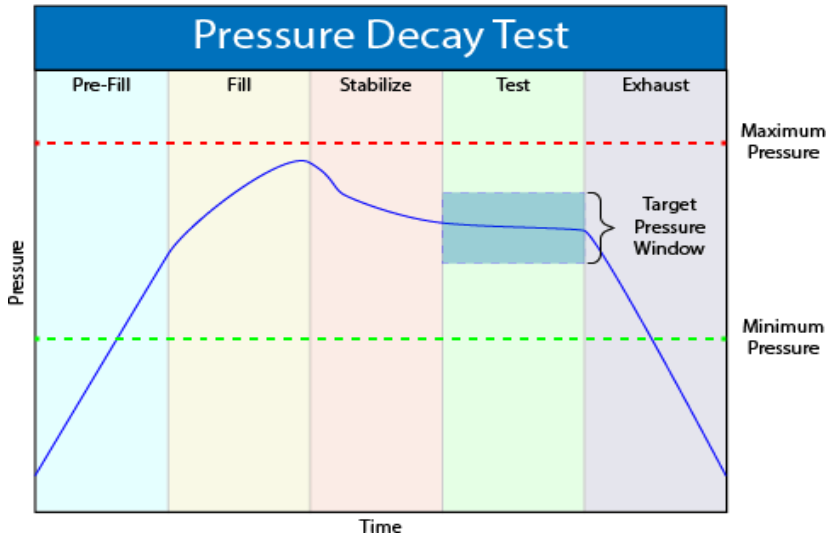
This test type is used for leak applications with a leak rate specified in flow units. This test type is typically performed with compressed air or nitrogen and should not be confused with the Gross T-Gas Decay tests described in other chapters.

The basic principle of operation of a pressure decay leak test instrument is to fill the test part to a specified target test pressure, isolate the test part from the source air and allow the pressure to stabilize, and then measure the pressure loss due to a leak over a defined time. The measured pressure loss is used to calculate a flow rate. The correlated flow rate is based on the two pressure loss values previously measured and stored in memory from calibrations cycles performed on anon-leaking master part.

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 Chart below gives an overview of the parameters used to setup a Gross Decay-Leak Std Test. The Tables that follow give detailed descriptions of each parameter and also document the Display User Level associated with each parameter.

Note: To change the User Level, see Chapter 32 – User and Security



Timer Parameters

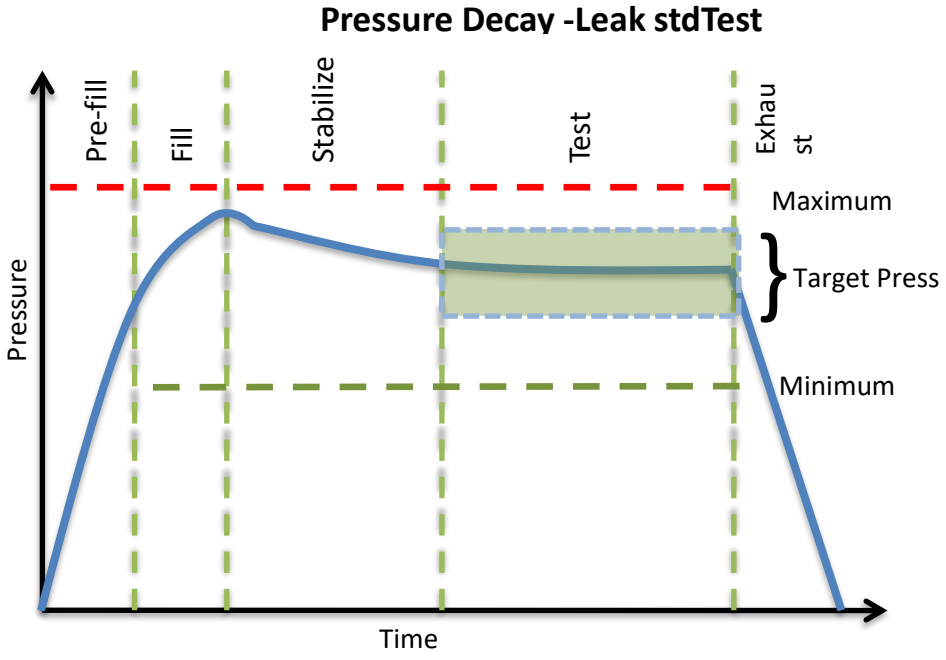
The Timers menu is located in the **Main Menu > Configuration > Timers** option.

Timer	Description	Display User Level
Prefill	Checks for excessively leaking parts or lack of pressure. May be set to "Percent of Fill Time" (default), for fixed fill time tests, or set to "Not to Exceed Time". For Changing the Functionality of the Prefill Timer, see Chapter 33 – Features. Maximum time to reach the minimum pressure. If the variable is set to "Not to Exceed Time", this segment will exit to the next once the Minimum Pressure value is reached.	Basic, Advanced, Admin
Pre-Press	Time to enable part to reach the Pre-Pressure. At the end of this timer, the instrument will continue to the Fill segment and begin filling to the Target Pressure. *This parameter is only available if the Prefill Method selected is "Pre-Pressure Time"*	Basic Advanced, Admin
Fill	Time to enable part to reach the Target Pressure. It may also be used as time to stabilize part pressure with additional air.	Basic Advanced, Admin
Stabilize	Time to stabilize part pressure while isolated from the pressure regulator. This time directly affects the repeatability of the test.	Basic Advanced, Admin
Test	The precise time over which to measure pressure drop or decay or the precise end time to measure pressure rise.	Basic Advanced, Admin
Exhaust	Time to relieve or vent part pressure before signaling the end of test. This prevents the accidental ejection of debris and protects the fixture seals from damage	Basic Advanced, Admin
Relax	Timer used during Program Cal sequence as a delay between calibration cycles to allow the master part to recover to repeatable virgin state. (Too short relax times result in decreasing pressure losses/flow results in successive tests.)	Basic Advanced, Admin

Pressure Parameters

The Pressure menu is located in the **Main Menu > Configuration > Pressure** option..

Pressure	Description	Display User Level
Pre-Pressure	Target Pre-Pressure. Used as a setpoint for the Electronic Regulator during the Pre-Pressure time. *This parameter is only available if the Prefill Method selected is "Pre-Pressure Time"*	Basic Advanced, Admin
Pre-Pressure Window	The percentage (plus and minus) about the Pre-Pressure value defining the minimum and maximum pressure at the end of the Pre-Pressure time. *This parameter is only available if the Prefill Method selected is "Pre-Pressure Time"*	Basic Advanced, Admin
Minimum Pressure	The value that must be reached before the Prefill setpoint is reached and must be maintained through fill and stabilization segments or the testing cycle will end as a Severe Leak.	Basic Advanced, Admin
Target Pressure	The specified test pressure for the part. For vacuum test pressures enter a positive value if psiv was selected as the pressure unit, or enter a negative value if psig was selected as the pressure unit. ((For example, the test pressure 9.7 psia would be entered as 5 psiv or -5 psig.) Pressure loss may be corrected to the Target Pressure.	Basic Advanced, Admin
Maximum Pressure	The value that must not be exceeded at any time to complete a successful test. If the pressure goes above the Maximum Test Pressure, the testing cycle will end as an Over Pressure Malfunction.	Basic Advanced, Admin
Target Press Window	This is a window (default +/– 50%) set around the Target Pressure that must be maintained during the Test segment of the testing cycle. It generates a Target Pressure Low or High Malfunction if the actual pressure falls outside this window during test.	Advanced, Admin



Test Parameters

The Test parameters menu is located in the **Main Menu > Configuration > Test:PLR** option.

TST Parameter	Description	Display User Level
Low Limit Leak	Lower setpoint value used to evaluate test results.	Basic Advanced, Admin
High Limit Leak	Upper setpoint value used to evaluate test results.	Basic Advanced, Admin
Decay Direction	Defines the method for calculating the part pressure decay during test: Loss – charged part decreasing pressure or evacuated part decreasing vacuum, Gain – part pressure increasing from external forces.	Basic Advanced, Admin
Test Evaluation	Test results are compared to two setpoints for pass or fail status. There are three areas for evaluation of results: above high limit, between limits, and below low limit. See Table below for codes.	Advanced, Admin
Target pressure correction	Allow the instrument to perform measurement correction based upon the relationship between the target pressure and actual test pressure.	Advanced, Admin
Min Master Loss	Minimum pressure loss allowed during the first test in the Program Cal routine. Prevents the acceptance of a calibration with a blocked part or test line.	Basic Advanced, Admin

TST Parameter	Description	Display User Level
Max Master Loss	Maximum pressure loss allowed during the first test in the Program Cal routine. Prevents the acceptance of a calibration with a leaking part or fixture leaks.	Basic Advanced, Admin
Min Mstr+Leak Loss	Minimum pressure loss allowed during the second test in the Program Cal routine. Prevents the acceptance of a calibration with a blocked part or test line.	Basic Advanced, Admin
Max Mstr+Leak Loss	Maximum pressure loss allowed during the second test in the Program Cal routine. Prevents the acceptance of a calibration with excessive pressure loss due to part or fixture leaks.	Basic Advanced, Admin
Min Leak Loss	Minimum pressure loss allowed that represents the pressure loss due to the Leak Standard used to calibrate the instrument.	Basic Advanced, Admin
Max Leak Loss	Maximum pressure loss allowed that represents the pressure loss due to the Leak Standard used to calibrate the instrument.	Basic Advanced, Admin
Min Perform Factor	Minimum value for Performance Factor calculated at completion of Program Cal routine. Resultant evaluation of ratio of Master Part Loss to Master+Leak Loss, Test Pressure, and loss due to Leak Std.	Basic Advanced, Admin
Quik Test Enable	Activates Quik Test. See Appendix B – Quik Test.	Advanced, Admin
Quik Test Timer	Options include 10%, 25%, 50%, 75%, and 90%. See Appendix B – Quik Test.	Advanced, Admin
Quik Test LL Band	See Appendix B – Quik Test.	Advanced, Admin
Quik Test HL Band	See Appendix B – Quik Test.	Advanced, Admin
EDC Enable	Activates Environmental Drift Correction. See Appendix C – Environmental Drift Correction.	Advanced, Admin
EDC Percentage	Options include 10%, 25%, 50%, 75%, and 90%. See Appendix C – Environmental Drift Correction.	Advanced, Admin
EDC Quantity	See Appendix C – Environmental Drift Correction.	Advanced, Admin

Test Evaluation Code	Description
Above Hi Limit > Between Limits > Below Lo Limit	Three zones of evaluation for Pass and Fail
P P F	Pass if above low limit
P F F	Pass if above high limit
F P F* (default)	Pass if between high and low limits
F P P	Pass if below high limit
F F P	Pass if below low limit
P F P	Pass if above the high limit or below the low limit

Note: The Evaluation option displays High Limit (left) to Low Limit (right). On the IX5 monitor screen, readings appear from Low Limit (left) toward High Limit (right). Ensure this orientation is understood to correctly identify the test result.

Note: If the instrument is configured multiple internal leak standards the user must select which leak standard is to be used in the Program. See Selecting the Proper Internal Leak Standard in Chapter 33 – Features***.***

Program Calibration

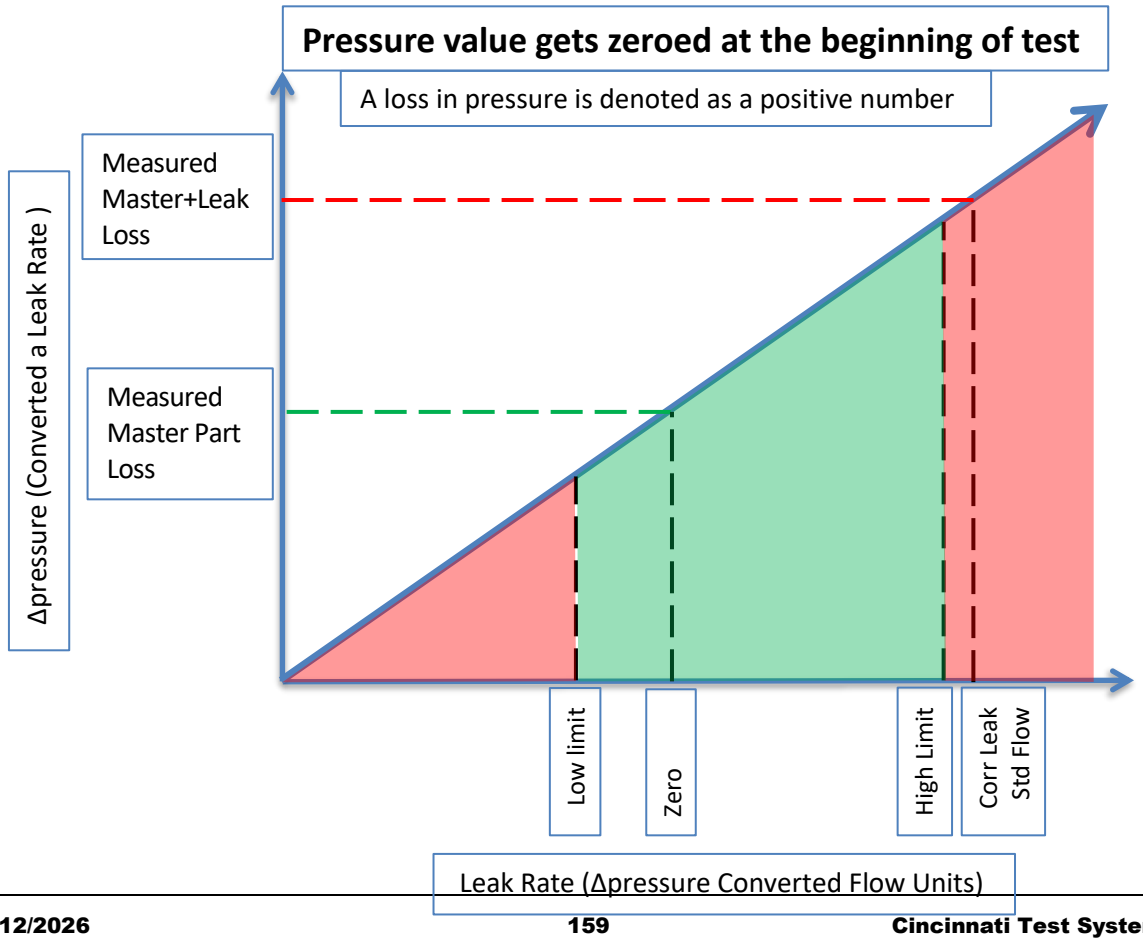
In order to convert the pressure loss measured by the instrument to a leak (flow) rate, the instrument uses a leak standard and needs to run the "Program Cal" procedure. This procedure requires at least one known non-leaking part referred to as a "master part". This procedure tests a non-leaking master part connected to the instrument using the timers and pressures established for the program. The procedure automatically tests the non-leaking master part twice with the Relax timer delay between tests. Within each program that uses a leak standard, Program Cal can be configured to use one of four methods. See **Setting the Cal Method and Leak Standard Location** in Chapter 33 – Features.

Remember: The Leak/Cal menu has a parameter called Leak Std/Cal Define that determines the location for the leak standard settings.

When set to "Channel", leak standard settings are located in the Device settings > Hardware menu.

When set to "Program", leak standard settings are located in the Main menu > Configuration.

Determine how you plan to use your leak test instrument. Review Setting the Leak Standard Values ***section on page 13. It is critical to make sure the leak standard values are set correctly for proper use. To view the Cal Method parameter, you must be in the Advanced or Admin Display User Level. To change the Display User Level, see*** Chapter 32 – User and Security.



Initiating the Program Cal Sequence

To initiate a Program Cal sequence, go to **Main Menu > Configuration > Cal:PLR > Program calibration option**, click **OK.** The Program Cal wizard will tell you to connect a non-leaking master part. Connect the non-leaking master part to the instrument. Push the Start button to initiate the Program Cal sequence. The system will conduct an initial test of the non-leaking master part to measure the pressure loss associated with a non-leaking part. This represents the typical offset associated with testing parts within the environment of the test system. The pressure loss value is saved as the Master Part Loss. The system will conduct a second test on a non-leaking master part with a known calibrated leak standard included in the test. The pressure loss value result for this test is saved as the Master+Leak Loss.

Performance Factor

Upon the successful completion of the Program Cal routine, the display will show the calculated Performance Factor for the calibration. The Performance Factor is an estimate of the quality of the calibration. It combines the ratio of the Hi Limit Leak result to the non-leaking master part result, the test pressure, and difference between the Hi Limit result and the non-leaking master part result to scale its anticipated performance. This value ranges from 0 to 100. It is generally desirable to have a Performance Factor of 35 to 100. The actual acceptable Performance Factor can vary depending on the desired Gage R&R performance of the test. Here is the Performance Factor equation:

Performance Factor = **Cal Ratio** x **Pressure Loss Penalty** x **Time Penalty** x **100**

The pressure loss penalty is greater for smaller pressure loss values. The time penalty is greater for shorter Test cycle timer values. Generally, longer stabilize and test cycle timer settings will produce higher Performance Factors and improved Gage R&R performance.

> ***Note: The instrument will require a Program Cal Sequence if any parameters that affect the calibration are modified.***

Conditions for a Successful Calibration

Several conditions must be met during the Program Calibration procedure for the instrument to accept and store the calibration results. The conditions are based on the following measurements or calculations:

5. Master Part Loss
    a. Must be greater than the Min Master Loss limit
    b. Must be less than the Max Master Loss limit
    c. Must be less than the Master+Leak Loss measurement
6. Master+Leak Loss
    a. Must be greater than the Min Mstr+Leak Loss limit
    b. Must be less than the Max Mstr+Leak Loss limit
    c. Must be greater than the Master Loss measurement
7. Leak Loss
    a. Must be greater than the Min Leak Loss limit
    b. Must be less than the Max Leak Loss limit
8. Performance Factor
    a. Must be greater than the Min Perform Factor limit

If the procedure does not meet these conditions, error messages are displayed at the completion of tests.

If the Program Cal routine is successfully completed, "PROGRAM CALIBRATION PASSED" will be displayed. If there are any problems during the Program Cal sequence an error will be displayed. If there is an error, see Appendix A – Messages & Error Codes.

Calibration Parameters

The Calibration parameters menu is located in the **Main Menu > Configuration > CAL:PLR** icon. These calibration parameters are values that are measured or calculated as a result of the Program Cal routine for a Pressure Decay-Leak Std test.

Parameter	Description	Display User Level
Program Calibration Button	Program Cal button Used to start the Program calibration routines.	Basic Advanced, Admin
Performance Factor	Resultant evaluation of ratio of Master Part Loss to Master+Leak loss, Test Pressure, and loss due to Leak Std.	Basic Advanced, Admin
Master Part Press	Measured pressure at the beginning of the test segment during the first test of the Program Cal process for the non-leaking master part.	Basic Advanced, Admin
Master+Leak Press	Measured pressure at the beginning of the test cycle of second test during Program Cal process for the non-leaking master part with the leak standard introduced to the pneumatic test circuit.	Basic Advanced, Admin
Master Part Loss	Measured pressure loss for the non-leaking master part during the first test of Program Cal process.	Viewable in Basic & Advanced **Editable in Admin**
Master+Leak Loss	Measured pressure loss during the second test of Program Cal for the non-leaking master part with the leak standard introduced to the pneumatic test circuit.	Viewable in Basic & Advanced **Editable in Admin**
Leak Loss	Calculated pressure loss, based upon measured pressure losses during the Program Cal routine. Corresponds to the actual pressure loss related to the leak standard.	Viewable in Basic & Advanced
Corr. Leak Std Flow	The calculated leak standard flow rate based on the Program Target Pressure, the leak standard calibrated pressure, and the leak standard calibrated flow rate.	Basic Advanced, Admin

Chapter 24 – Tooling Control

This chapter explains the tooling control capability of the instrument. Tooling control is a powerful feature that gives the instrument the ability to control cylinders and seal actuations.

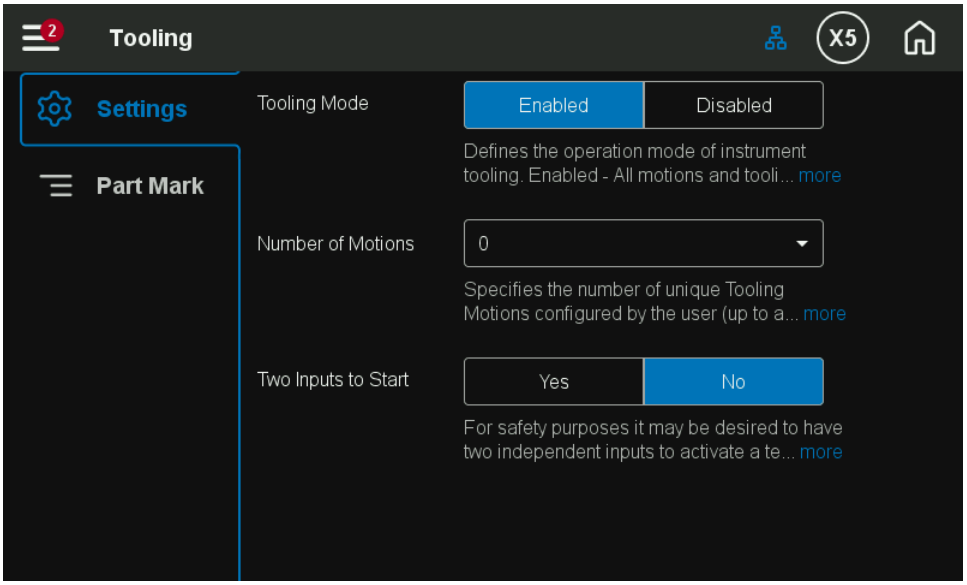
Note: The instrument must be in Advanced or Admin Display User Level to view and modify the tooling functionality. To change the Display User Level, see Chapter 32 – User and Security.

Note: The tooling motions configured in this tooling menu are applied globally and then the user can select any desired motions inside sequence program.

The instrument includes selectable digital inputs and outputs to increase the functionality and simplify the application to various test requirements. The tooling functions are defined within each program. This allows flexibility to use different tooling functions, permitting the ability to seal unique ports for each program. The tooling functions are located in **Main Menu > Device settings > Tooling** option.

It is important that all precautions be taken when using the tooling control functions of the instrument. If motions are being controlled, it is important to follow best engineering practices while designing the circuitry. This may include using integrity modules in the circuit.

In order to implement the tooling functions, they must be interfaced with the inputs and outputs. Digital inputs and outputs assigned to Tooling Motions are strictly dedicated to this purpose. These I/O points are not to be shared or re-assigned for any other system functionality and are secured against modification through the Program Configuration menu. See Chapter 26 – Inputs and Outputs.

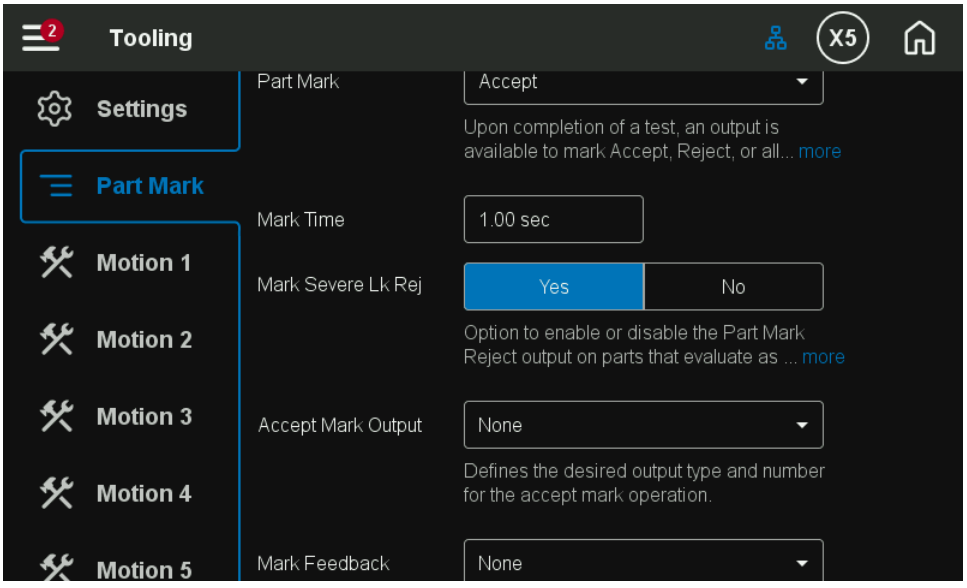


Menus

Parameter	Description	Display User Level
Tooling Mode	The options for this parameter are Enabled and Disabled. On causes the tooling motion timers to appear on the Timers menu. When **Enabled** is selected, all defined motions and tooling operations will be active and available for use. This is the default and recommended setting for normal operation. When **Disabled** is selected, all tooling motions and operations will be deactivated. This mode can be useful for maintenance, troubleshooting, or when tooling functionality is not required.	Advanced, Admin
Number of Motions	This parameter defines the number of motions intended to be used. You can have up to 18 motions.	Advanced, Admin
Two Inputs to Start	For external part safety purposes, it may be desired to have 2 independent inputs to activate a test cycle. The 2 inputs are start and cycle. Refer the chapter 26- Inputs for Program Control	Advanced, Admin

Part Mark

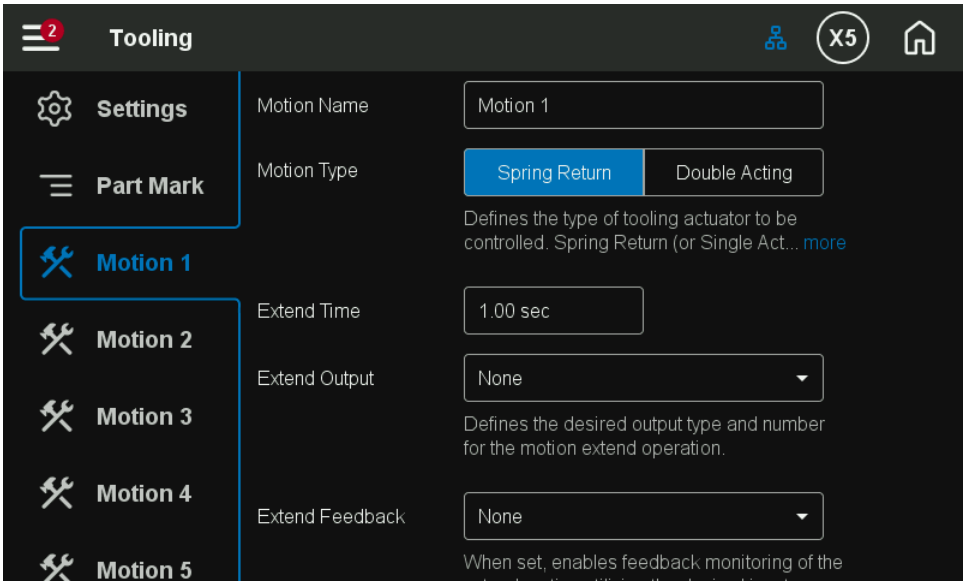
This is used as the duration for an external part marking device and is a not to exceed timer when feedback is being utilized.



Parameter	Description	Display User Level
Part Mark	The options for this parameter are Off, Accept, Reject and Accept/Reject. Upon completion of a test an output is available to mark Accept, Reject, or Accept/Reject for all programs.	Advanced, Admin
Mark Time	Specifies the duration for which the "Part mark" will be active when initiating the part mark operation. Default timer set at 1second	Advanced, Admin
Mark Severe LK Rej	Option to enable or disable the part mark reject output on parts that evaluates as severe leak	Advanced, Admin
Accept Part Mark	Define the desired Output type and number for the accept part mark	Advanced, Admin
Reject Part Mark	Define the desired Output type and number for the Rject part mark	Advanced, Admin
Mark Feedback	This input is used for confirmation that program marking device is completed and the test sequence can continue. Failure to receive this input before the end of the Part Mark Fdbk timer will cause a Malfunction result and an "ERROR: PART MARK FAULT" display.	Advanced, Admin

Motion Configuration

This section of the system, titled "Tooling," allows users to configure and manage the motion parameters for various tooling actuators connected to your system. Each "Motion" setting corresponds to a specific tooling output, enabling precise control over its operation, including motion type, timing, and feedback.



Parameter	Description	Display User Level
Motion Name	This field allows the user to assign a descriptive name to the motion. This is useful for identifying the purpose of each motion in a complex setup. Default Value as shown "Motion 1"	Advanced, Admin
Motion Type	Defines the type of tooling actuator being controlled. This setting determines how the system controls the actuator's extension and retraction. **Spring Return (or Single Acting):** Utilizes one control output. The actuator extends when the output is active and retracts (returns to its original position) by spring force when the output is inactive. **Double Acting:** Specifies the duration for which the "Extend Output" will be active when initiating the extend operation. Default timer set at 1second Utilizes two control outputs (one for extend, one for retract). The actuator extends when one output is active and retracts when the other output is active, offering powered movement in both directions. Default Value as shown is "Spring Return"	Advanced, Admin
Extend Time		Advanced, Admins
Extend Output	Defines the specific output number that will be activated to perform the motion's extend operation. The dropdown will list available output. (e.g. HW output1 to HW output12 and IP outputs1 to IP outputs16)	Advanced, Admin
Extend Feedback	If enabled by selecting Tool Ext Fdbk as one of the inputs, it is required that the Tool Extend Feedback input go high before the associated Tool Ext Timer expires. If the timer expires before the input goes high the instrument will issue a malfunction. A Stop/Reset will need to be initiated to reset the tooling. The dropdown will list available inputs. (e.g. HW output1 to HW output12 and IP outputs1 to IP outputs16)	Advanced, Admin
Retract Time	Specifies the duration for which the "Retract Output" will be active when initiating the extend operation. Default timer set as 1sec	Advanced, Admins
Retract Output	Defines the specific output number that will be activated to perform the motion's Retract operation. The dropdown will list available output. (e.g. HW output1 to HW output12 and IP outputs1 to IP outputs16)	Advanced, Admin
Retract Feedback	If enabled by selecting Tool Ret Fdbk #x as one of the inputs, it is required that the Tool Retract Feedback input go high before the associated Tool Ret Timer expires. If the timer expires before the input goes high the instrument will issue a malfunction. A Stop/Reset will need to be initiated to reset the tooling.	Advanced, Admin

	The dropdown will list available inputs. (e.g. HW output1 to HW output12 and IP outputs1 to IP outputs16)	

Advance Tooling options

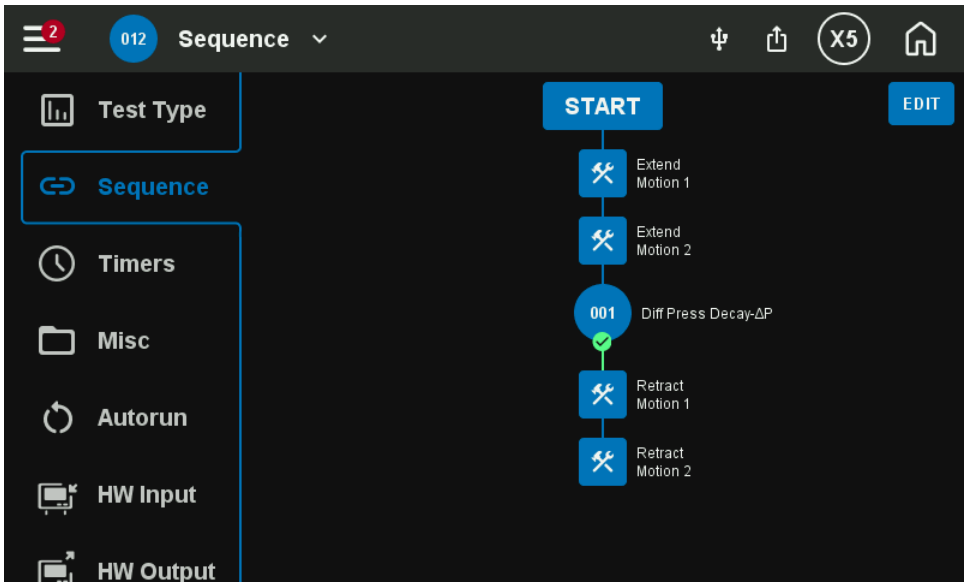
Advanced Tooling Control is used to control motions or sealing between linked programs; therefore, it is only applicable if Sequence test is being used.

There are applications where it may be required that one or more ports on the test part are blocked or opened between tests to appropriately evaluate multiple chambers of the part. To accomplish this additional part manipulation, tooling motions are required between program executions. Thus far we have covered tooling motions pre-test (Tooling Extend) and post-test (Tooling Retract), this feature adds a method for the instrument to preempt the pre/post-test tooling motions. Again, this feature is only for the Sequence test type.

On the Program Config menu select the Sequence test type. The Motion parameter defines the Tooling Motion to execute between the Target Program and the next appropriate program number. The options available for this parameter are based on the tooling Number of Motions parameter defined on the Tooling menu under the **Device settings > Tooling menu.**

Advanced Tooling Motion Example 1

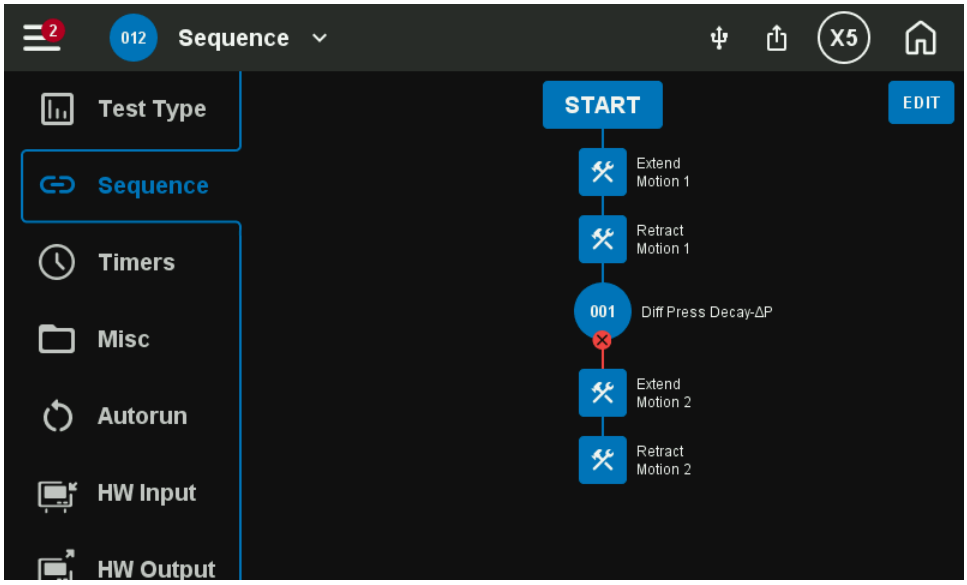
The following example of a **Sequence test** has two tooling motions, with one Accept evaluation. The first action is to "Extend Motion 1". Immediately after "Extend Motion 1", "Extend Motion 2" is executed. Once the test condition is satisfied, "Retract Motion 1" is executed. Finally, "Retract Motion 2" is executed.



Advanced Tooling Motion Example 2

Here is one more example of a Tooling motion, with on Reject evaluation. The first action is to "Extend Motion 1". Immediately after "Extend Motion 1", "Retract Motion 1" is executed. Once test condition is satisfied, the sequence proceeds to "Extend Motion 2". Finally, "Retract Motion 2" is executed.

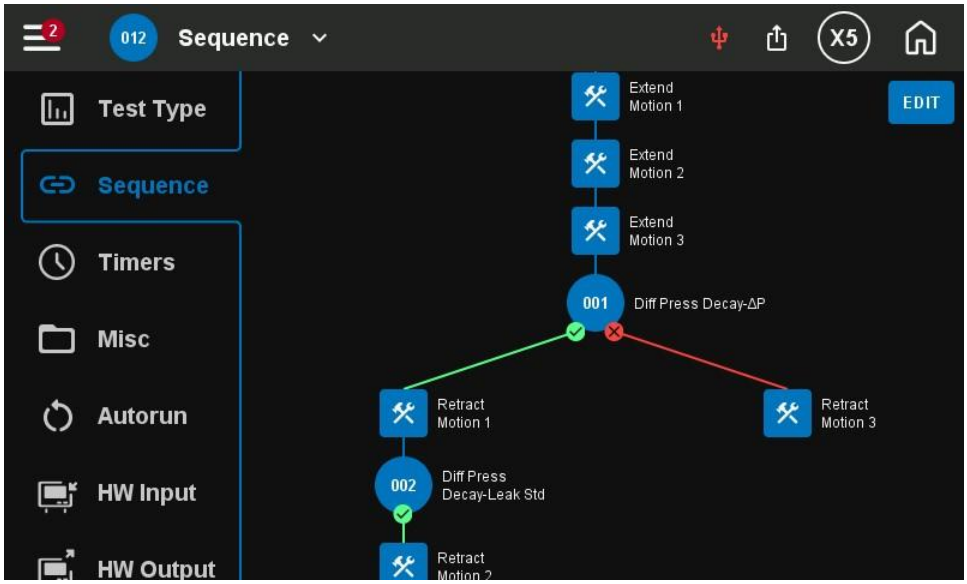
In summary, this sequence extends and retracts "Motion 1", then encounters a failed test condition, and continues to extend and retract "Motion 2".



Advanced Tooling Motion Example 3

Following is the example of example of a Tooling motion, with an Accept/Reject evaluation. The device executes the command to "Extend Motion 1", "Extend Motion 2" and "Extend Motion 3". Evaluate the test condition as accept. Once the test condition is satisfied, the sequence proceeds to "Retract Motion 1" and proceeds to execute next test condition, If the next test condition is satisfied, it proceeds to "Retract Motion 2". If the first test condition reject. The system executes the command of "Retract Motion 3".

The sequence starts by extending three motions. It then checks the first test condition. If successful, it retracts "Motion 1" and then performs a secondary test check, with further actions dependent on that result. If the initial test fails, it retracts "Motion 3".

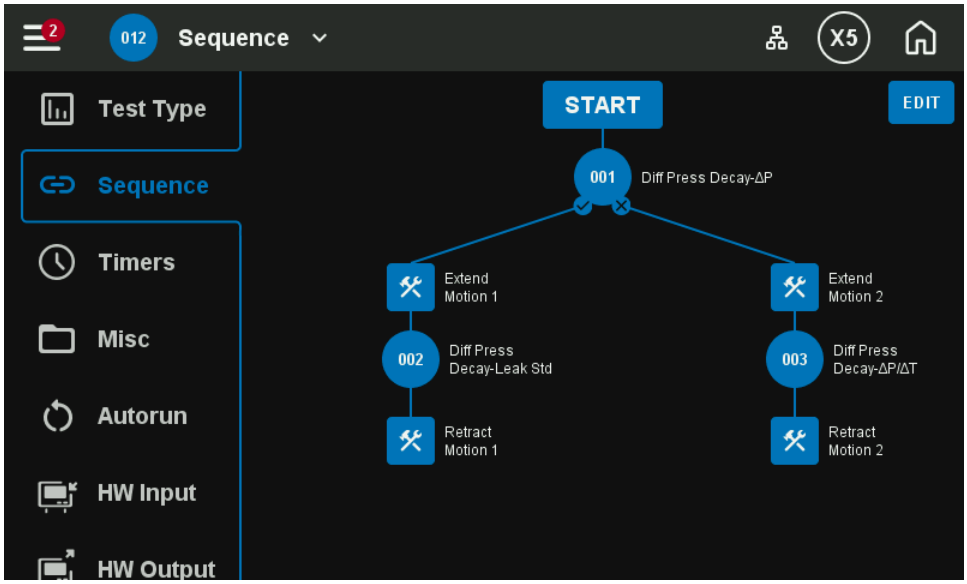


Advanced Tooling Motion Example 4

The following is an example of Tooling motion, with on Accept/Reject Audit* evaluation. The device runs the test and evaluates the condition, if test successfully pass, the system executes the command to "Extend Motion 1". After "Extend Motion 1", the system proceeds to evaluate the next test, and the system executes the command to "Retract Motion 1".

If the initial test fails, the system executes the command to "Extend Motion 2". After "Extend Motion 2", the system proceeds to evaluate the next test, and the system executes the command to "Retract Motion 2".

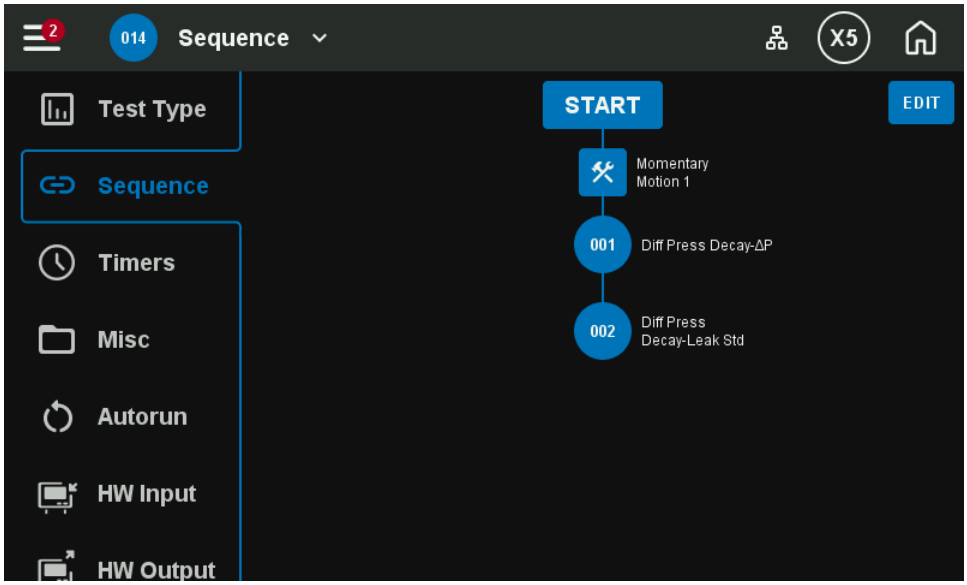
The sequence starts by checking an initial test condition. Based on the success or failure of this check, it follows one of two distinct paths. The successful path involves extending and retracting "Motion 1" with an intermediate next test execution. The failed path involves extending and retracting "Motion 2" with an intermediate next test execution.



Advanced Tooling Motion Example 5

The following is an example of Tooling motion, with on Any evaluation. The device executes "Momentary Motion 1". This implies an action that is briefly "Extend Motion 1" and then "Retract Motion 1". Immediately after "Momentary Motion 1", the device evaluated the first test and after that evaluates the second test.

The sequence initiates by momentarily activating "Motion 1." Following this, it proceeds to evaluate the first test. Once the first test has been evaluated, the sequence then moves on to evaluate the second test and finally ends.



This page is intentionally blank.

Chapter 25 - Accessories

This Chapter provides essential information about connecting and understanding the accessories used with your instrument. Proper connection and understanding of these accessories are crucial for optimal performance.

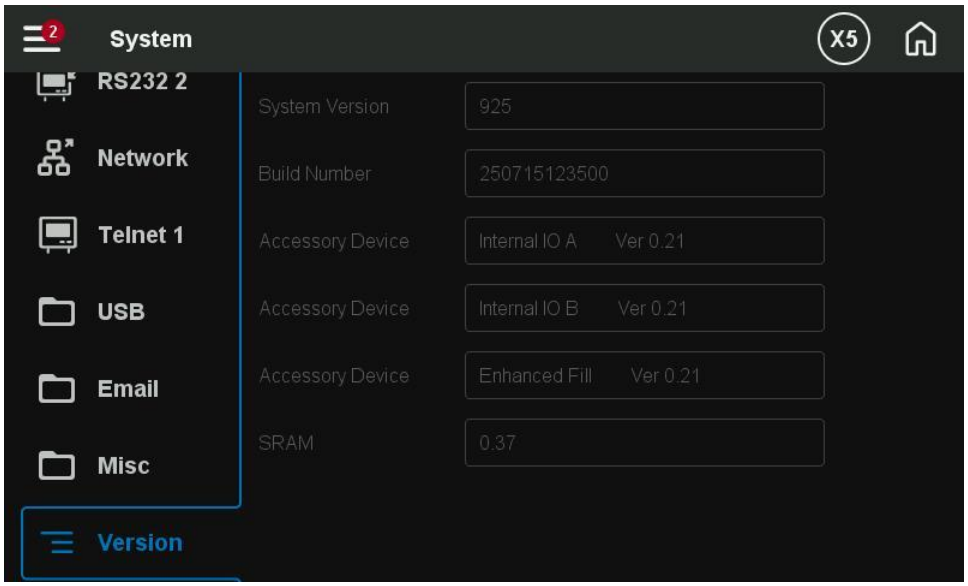
The instrument is designed to automatically detect connected accessories. The accessories discovered are then integrated into the Instrument configuration menus, allowing for seamless operation and control. Ensure the system power is off before connecting and reconnecting any accessories.

Note: Accessories Not Auto Discovered. Ensure the system power is off before reconnecting any accessories.

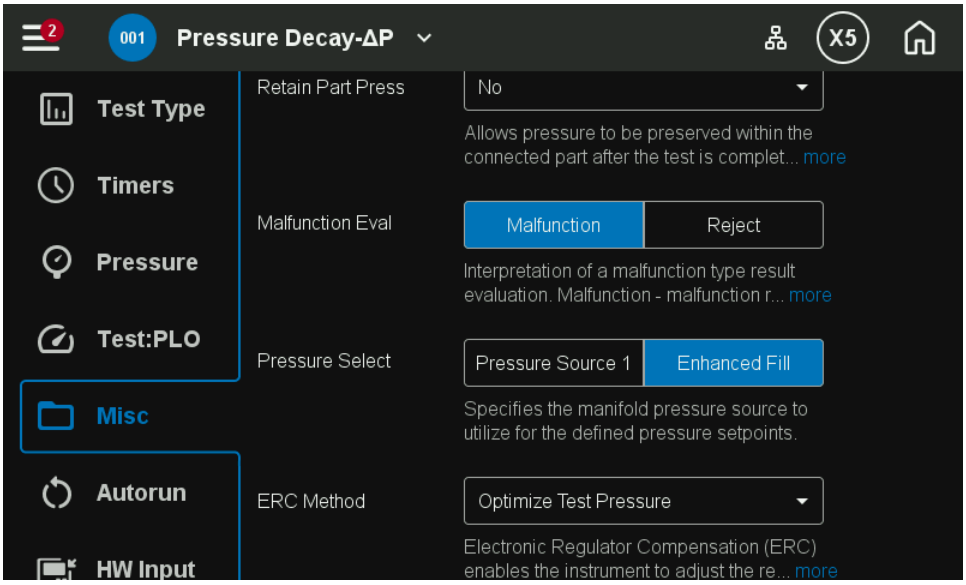
Enhanced Fill Accessory

After successfully setup, user can able to see the Enhanced fill as accessories device under **Main menu > Device settings > System ->Version.**

The Enhanced Fill option is an external operational kit that provides an additional pressure source for filling large-volume parts during testing. This option can be enabled from:
Main Menu >Configuration > Misc. > Pressure Select
The Enhanced Fill option is designed to improve fill performance and reduce fill time for applications involving large internal part volumes**.**



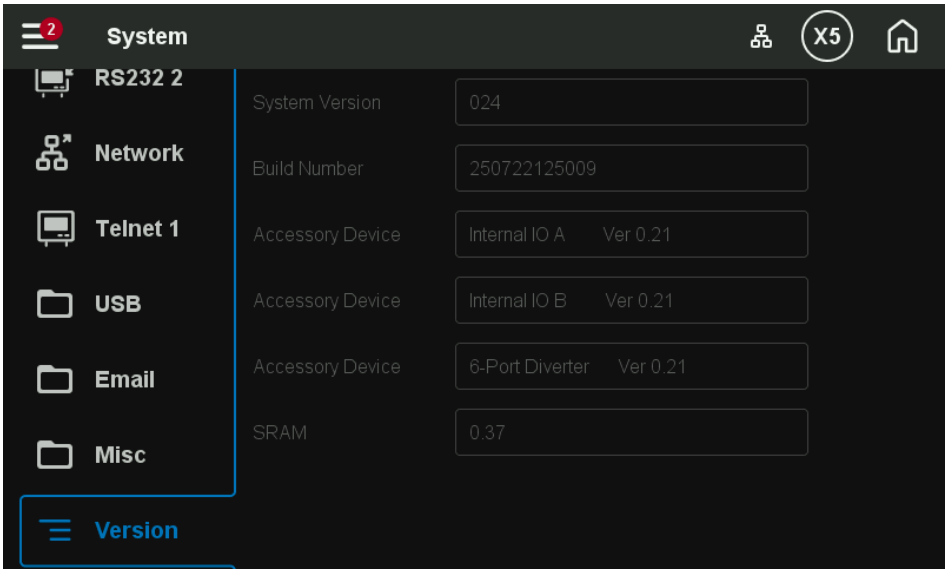
A solid green light on an enhanced fill indicates an active and stable connection to the accessory network. A flashing green light signifies a connection issue. If you observe a flashing light, check the accessory connections.



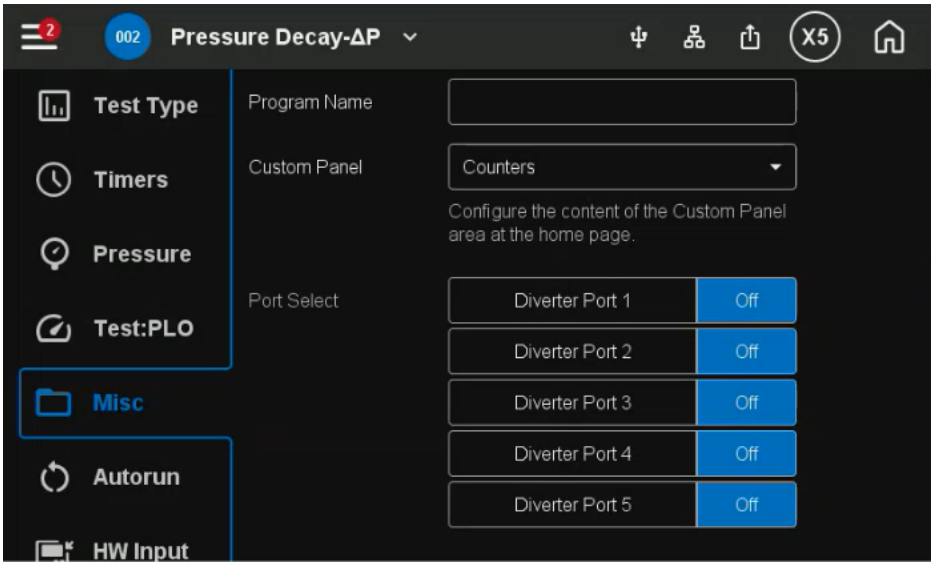
Users can select the enhanced fill option under **Configuration > Misc > pressure select** option. Enhanced Fill Accessory is supported with various Prefill Methods. It can be configured with Prefill Method as Pre-Pressure Time. In this case Pre-Press Select option can be set as Enhanced Fill. With this configuration the test will utilize Enhanced Fill Accessory to fill pressure during the Pre-Press segment.

Diverter Accessory

After successfully setup, user can able to see the Diverter as accessories device under **Main menu > Device settings > System ->Version.**



A solid green light on an Diverter Accessory indicates an active and stable connection to the accessory network. A flashing green light signifies a connection issue. If you observe a flashing light, check the accessory connections.



The Diverter Accessory option can be enabled through the **Configuration > Misc > Multi Test Port** menu. This feature allows the IX5 device to interface with multiple test ports using a single device, enhancing test throughput and enabling parallel test setups.

Each program can have its own port configuration, offering flexibility to customize test port assignments based on specific requirements. This means users can activate different sets of test ports for different programs, depending on the type or number of devices under test.

The Diverter Accessory is available in multiple variants, each supporting a different number of test ports. Currently configurations of up to six test ports are supported.

Chapter 26 – Inputs and Outputs

This chapter explains the Input and Output (I/O) capabilities of the instrument. The I/O parameters are located in ***Main Menu > Configuration > HW Input*** *and* ***HW Output*** *icons.*

> ***Note: The instrument must be in Advanced or Admin Display User Level to view and modify the Input and Output functionality. To change the Display User Level, see*** Chapter 32 – User and Security

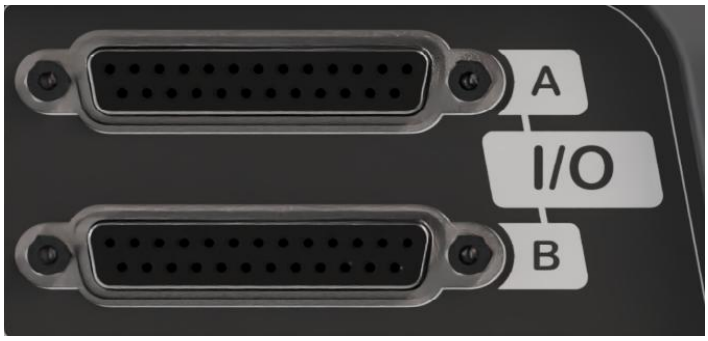
The instrument includes user selectable digital inputs and outputs to increase the functionality and simplify the application to various test requirements. The inputs and outputs are divided into two groups – Universal and Program Specific. When a Universal input or output is assigned in a program, it is automatically assigned and available within all programs. When a Program Specific input or output is assigned in a program, that particular input or output is constrained to use only the inputs or outputs within the same Functional Group. When the input or output is set to "Constrained" in a program, it will not function within that program.

In order to remove the selection of an input or an output, change the parameter to either Unassign or Unassign for all. Selecting "Unassign for all" will remove the selection of the input or output for all of the programs. Selecting "Unassign" will only remove the selection from the current program. "Unassign" is not available for Universal inputs or outputs.

Input and Output Wiring

The instrument comes equipped with 12 programmable sinking inputs and 12 programmable sourcing outputs. Both inputs and outputs are 24VDC.

The instrument is supplied with the option to select the use of internal power for the I/O supply.

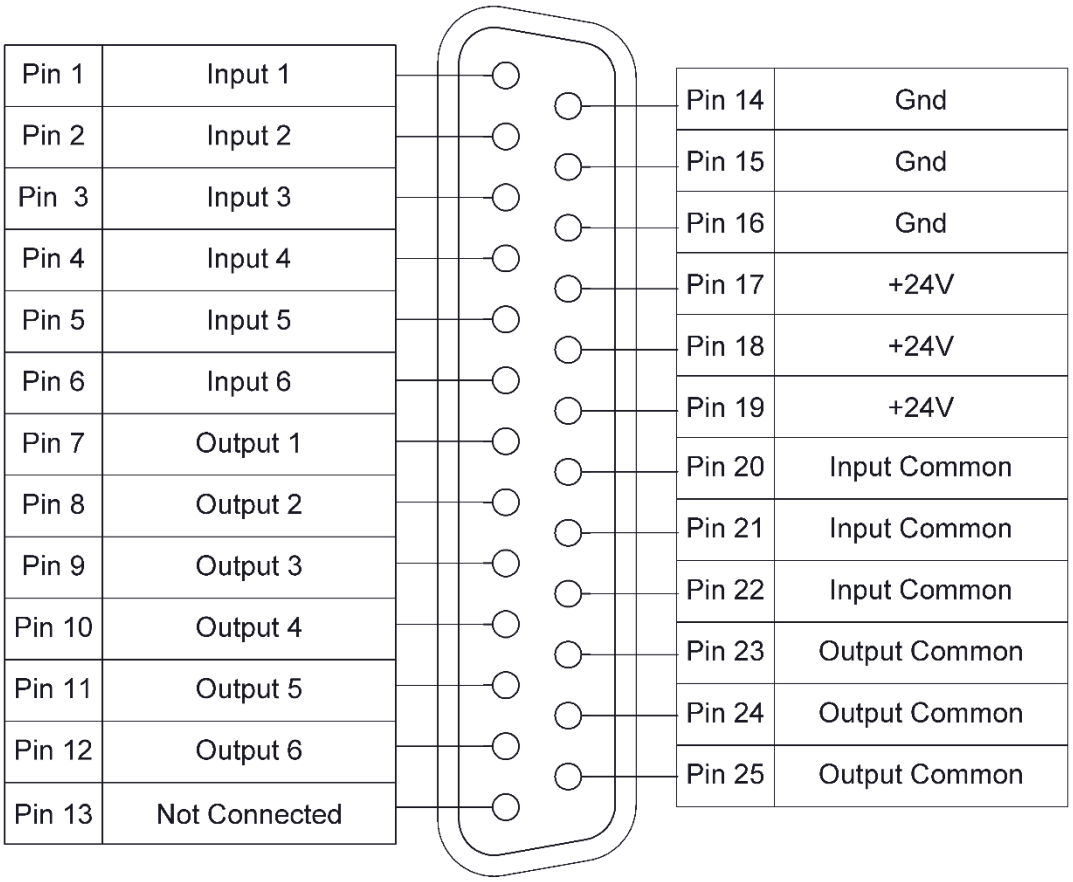


Input and Output Connector Pinout

The instrument comes equipped with 12 programmable sinking inputs and 12 programmable sourcing outputs. Both inputs and outputs are 24VDC. See Detail "A" below.

Detail A

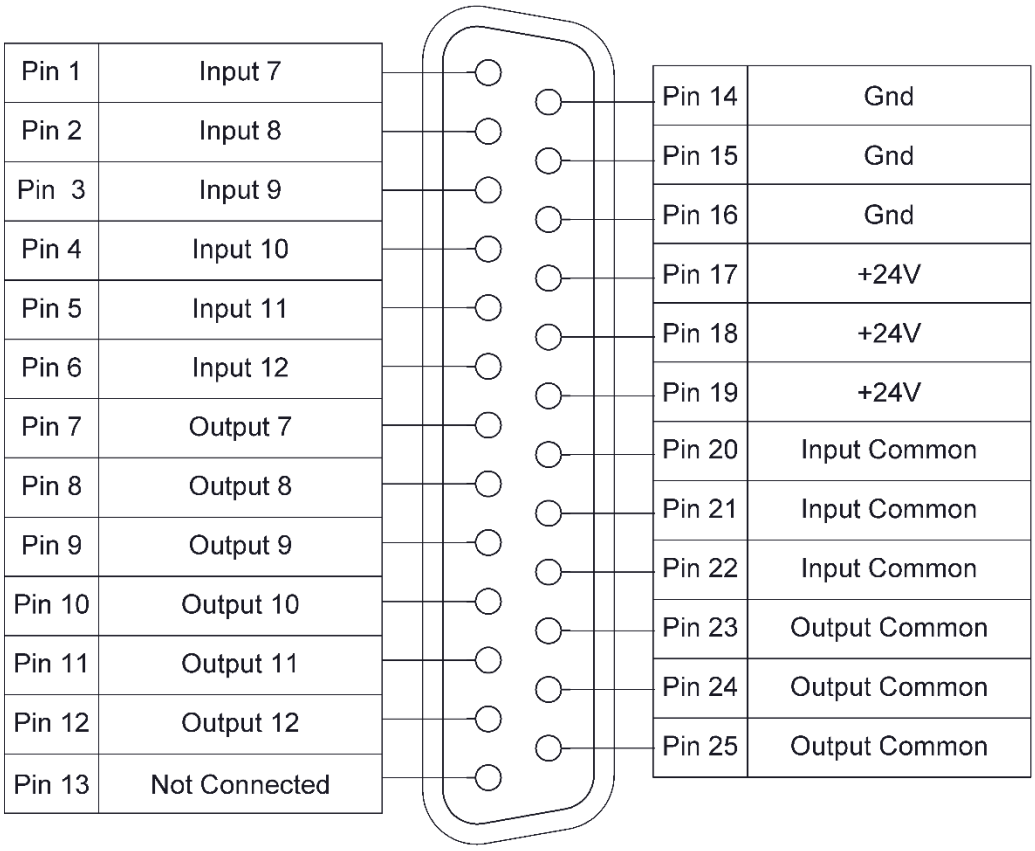
DIGITAL INPUT/OUTPUT
1-6 (24VDC NOMINAL)
TOP CONNECTOR LEVEL I/O A



I/O A Connector

Detail B

DIGITAL INPUT/ OUTPUT
7-12 (24VDC NOMINAL)
BOTTOM CONNECTOR



I/O B Connector

Maximum current draw for an individual output is 500 mA
Maximum current draw for all combined outputs are 1A
Fuse Specs can be found in the Sentinel X5 Technical Specifications

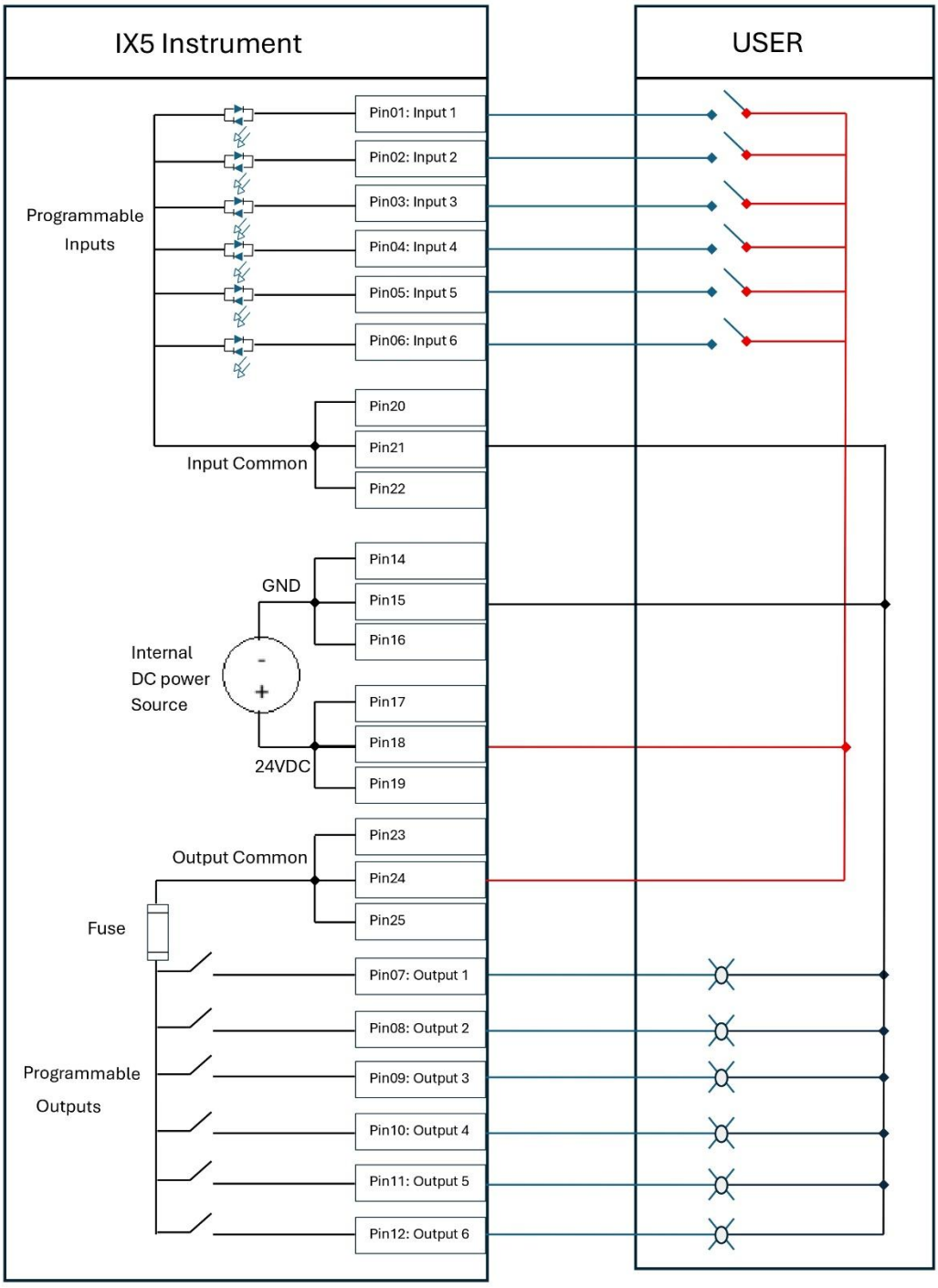
Typical Configuration – Sinking Inputs, Sourcing Outputs

Inputs run to ground and sink from powered inputs; outputs are connected to +24VDC and source power.

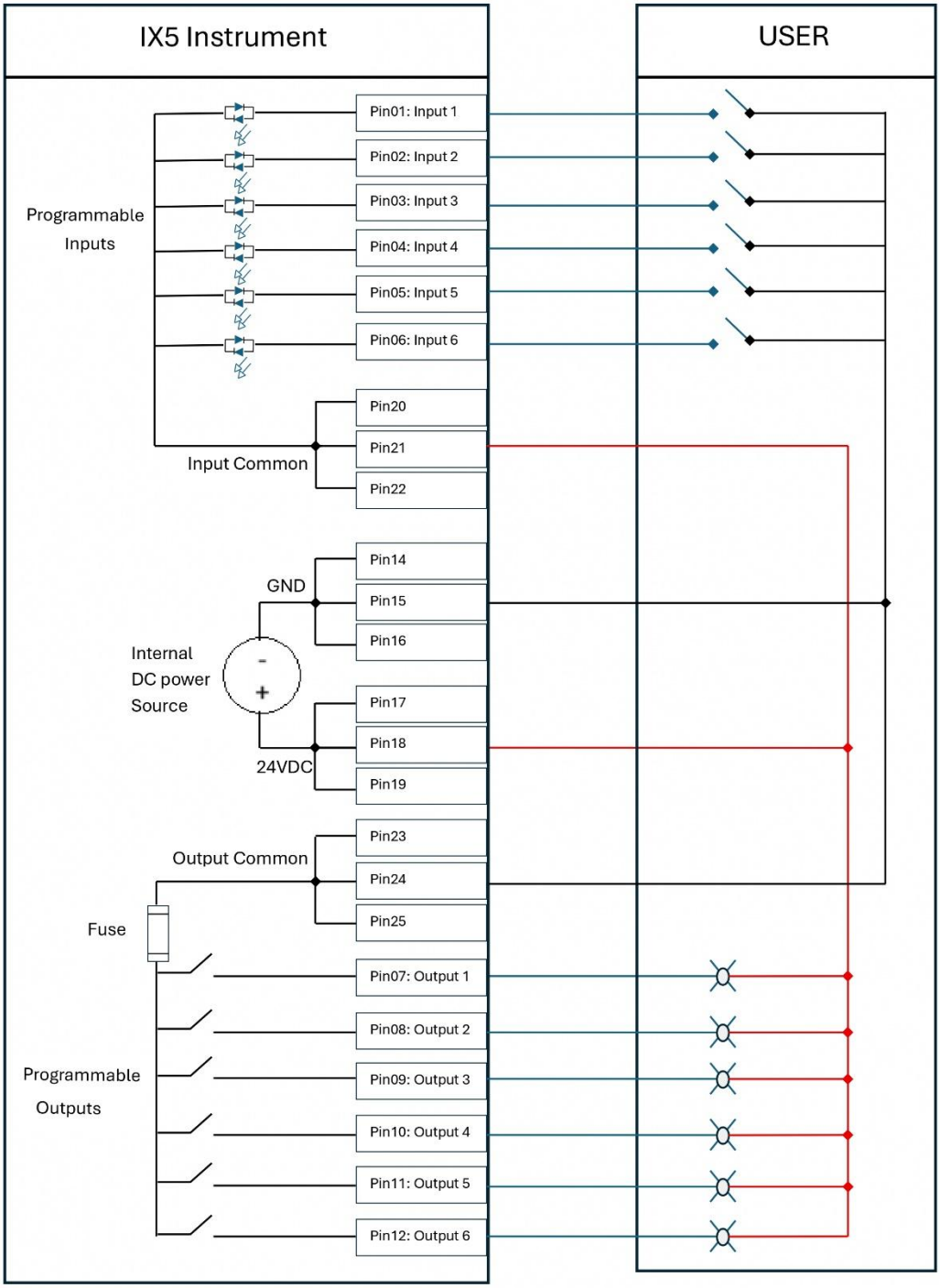
Note1: The output is protected by a standard fuse rated at 1A / 250V.

Note2: When using an external power supply, ensure the negative terminal (-ve) is connected to both GND and Common. This connection is required to maintain a uniform potential across the ground plane.

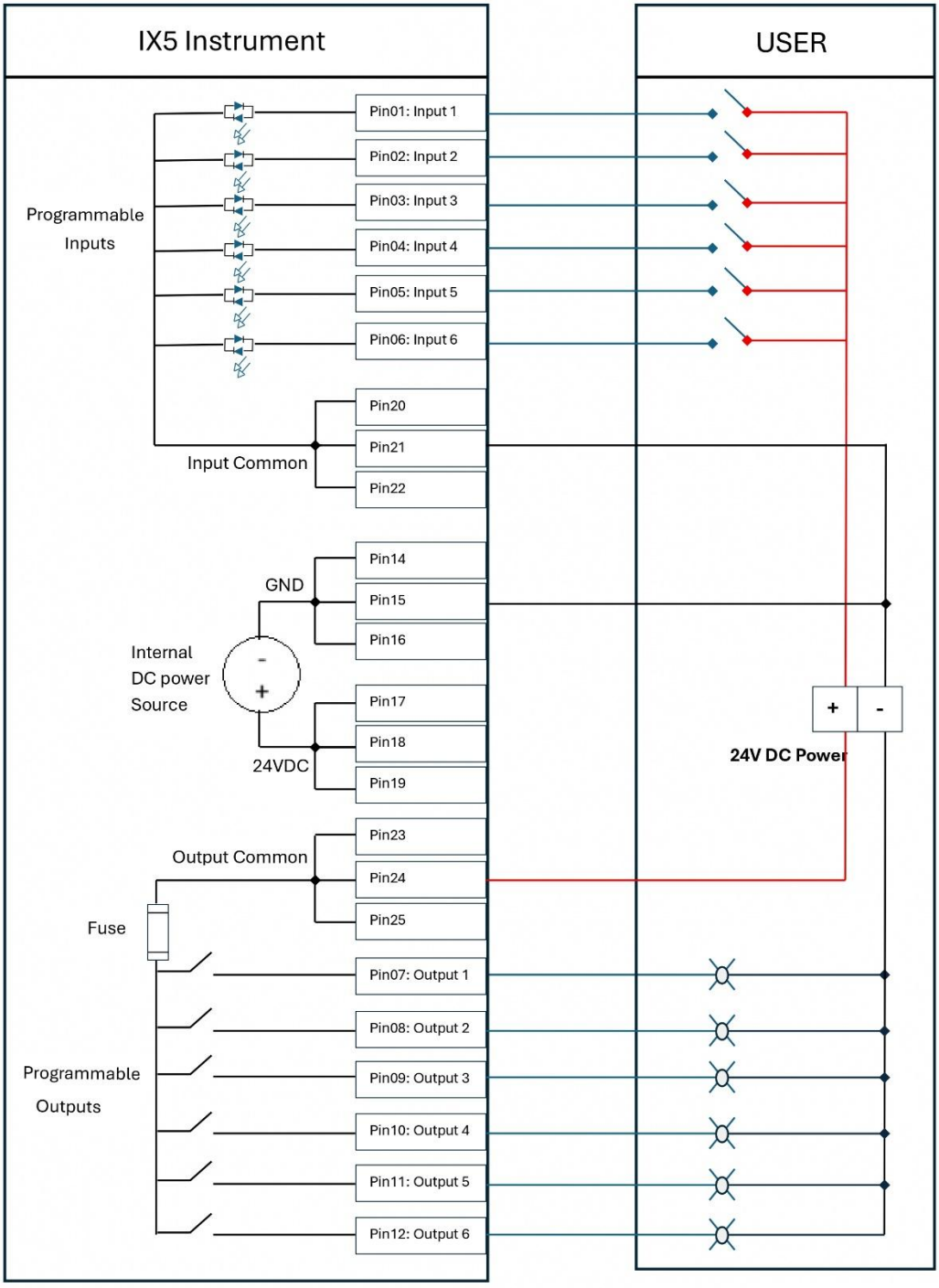
Sinking Inputs and Sourcing Outputs with Instrument Supply



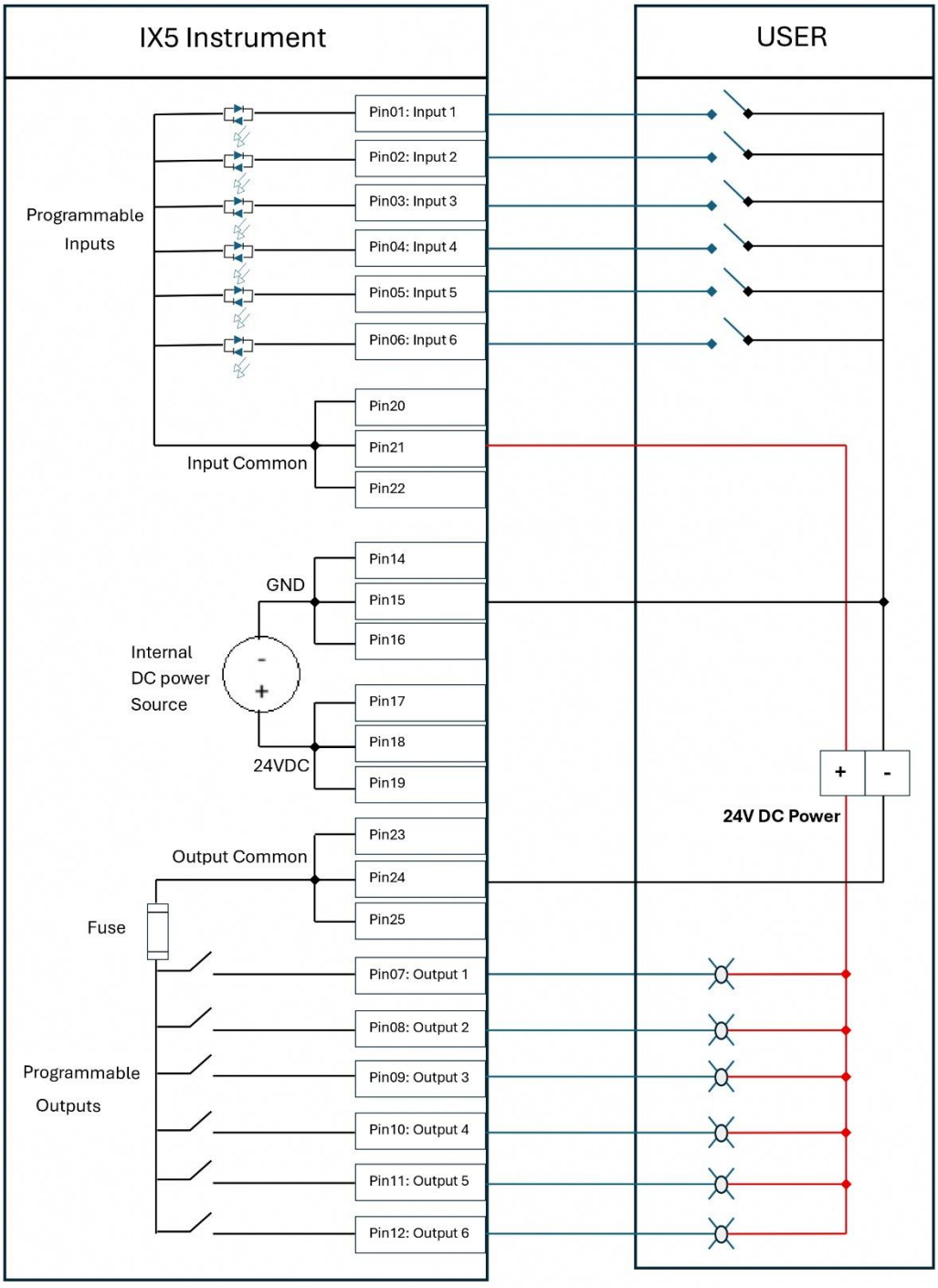
Sourcing Inputs and Sinking Outputs with Instrument Supply



Sinking Inputs and Sourcing Outputs with External Supply



Sourcing Inputs and Sinking Outputs with External Supply



Note:

Input Pinout and Wiring Table

Input	Function	Wire Color	Connector Location	Instrument Connector	Cable Connector Pin	Wire Color
1	User Selectable	Black	Top (I/O A)	1	1	Black
2	User Selectable	Brown	Top (I/O A)	2	2	Brown
3	User Selectable	Red	Top (I/O A)	3	3	Red
4	User Selectable	Orange	Top (I/O A)	4	4	Orange
5	User Selectable	Yellow	Top (I/O A)	5	5	Yellow
6	User Selectable	Green	Top (I/O A)	6	6	Green
7	User Selectable	Black	Bottom (I/O B)	1	1	Black
8	User Selectable	Brown	Bottom (I/O B)	2	2	Brown
9	User Selectable	Red	Bottom (I/O B)	3	3	Red
10	User Selectable	Orange	Bottom (I/O B)	4	4	Orange
11	User Selectable	Yellow	Bottom (I/O B)	5	5	Yellow
12	User Selectable	Green	Bottom (I/O B)	6	6	Green

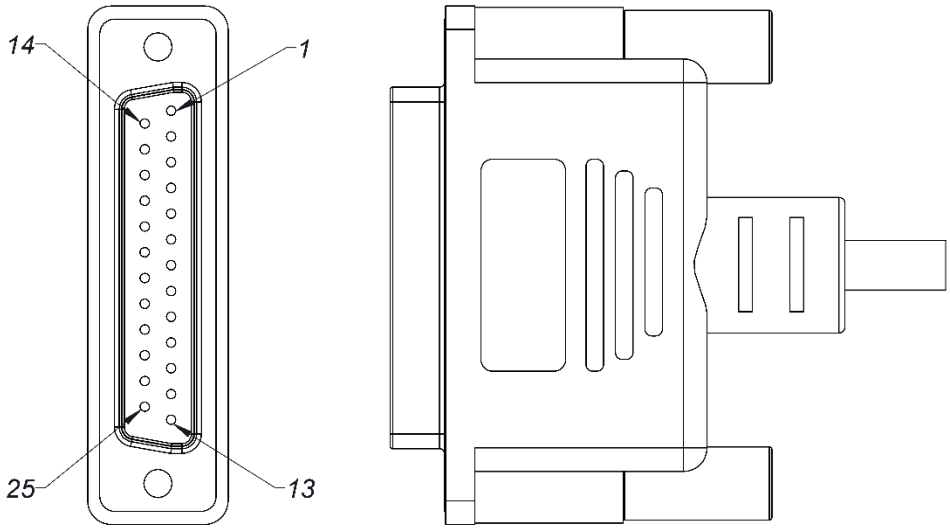
User selectable or programmable inputs are listed in a table on the next page.

Output Pinout and Wiring Table

Output	Function	Wire Color	Connector Location	Instrument Connector	Cable Connector Pin	Wire Color
1	User Selectable	Blue	Top (I/O A)	7	7	Blue
2	User Selectable	Violet	Top (I/O A)	8	8	Violet
3	User Selectable	Gray	Top (I/O A)	9	9	Gray
4	User Selectable	White	Top (I/O A)	10	10	White
5	User Selectable	Pink	Top (I/O A)	11	11	Pink
6	User Selectable	Light Green	Top (I/O A)	12	12	Light Green
7	User Selectable	Blue	Bottom (I/O B)	7	7	Blue
8	User Selectable	Violet	Bottom (I/O B)	8	8	Violet
9	User Selectable	Gray	Bottom (I/O B)	9	9	Gray
10	User Selectable	White	Bottom (I/O B)	10	10	White
11	User Selectable	Pink	Bottom (I/O B)	11	11	Pink
12	User Selectable	Light Green	Bottom (I/O B)	12	12	Light Green

User selectable or programmable outputs are listed in a table.

25 Pin Digital IO Cable Diagram and Pinout Table



CTS Part Number: ELEC-000563

PIN ID	COLOR	FUNCTION	PIN ID	COLOR	FUNCTION
1	BLACK		14	BROWN/WHITE	
2	BROWN		15	RED/WHITE	
3	RED		16	ORANGE/WHITE	
4	ORANGE		17	GREEN/WHITE	
5	YELLOW		18	BLUE/WHITE	
6	GREEN		19	VIOLET/WHITE	
7	BLUE		20	RED/BLACK	
8	VIOLET		21	ORANGE/BLACK	
9	GRAY		22	YELLOW/BACK	
10	WHITE		23	GREEN/BLACK	
11	PINK		24	GRAY/BLACK	
12	LIGHT GREEN		25	PINK/BLACK	
13	BLACK/WHITE		SHELL	DRAIN	

Programmable Inputs and Outputs Menus

Input Options
Start Channel
Start Program
Stop/Reset
Hold
Vent/Halt
Manual Reject
Program Cal
Open Leak Std
Part Present
SPC Test Part
Instrument Enable
Common
Program Select B1
Program Select B2
Program Select B3
Program Select B4
Program Select B5
Program Select B6
Program Select B7
Program Select B8
Ext Press Sw
Event Trigger
Unassign

Output Options
In Relax
Press Select
Program Cal Mode
Program Cal Master
Program Cal Leak Std
Press Select
Prefill
In Fill
Fill Valve
In Stabilize
Isolation Valve
In Test
Test Passed
Test Failed
Bellow LL
Between Lim
Above HL
In Exhaust
Program Accept
Program Reject
Malfunction
Severe Leak
Unassign

The Inputs and Outputs above are listed in their menu selection order. All of the options may not be available, depending on the test type. Descriptions of these menu options are on the following pages are in related groups

Inputs for Program Control

Input	Description
Start Channel	Starts the active Program
Start Program	Changes the Current Program to the one assigned to this input and Starts the Program.
Stop/Reset	The **Stop/Reset** input is used to terminate active tests. If the input is triggered while the tooling is engaged, the system will immediately exhaust pressure and stop the test. Note: The tooling will remain in its current position and will not retract automatically. To retract the tooling, a second **Stop/Reset** command must be issued.
Hold	The Hold input halts or suspends the testing sequence as long as this input is high. This can be used to stop the testing while awaiting some other action to occur.

Vent/Halt	Using a normal test, the **Vent/Halt** input is used to exhaust system pressure and immediately stop test. The Vent/Halt input ceases the operation of any tooling motion, removes all energy from the part by advancing through the exhaust segment and stops operation. Any programmed tooling motion required to return to the fully retracted positions must be initiated by the Stop/Reset input or stop button. While the Vent/Halt input is high, no additional test activity or tooling resets can occur.
Manual Reject	The Manual Reject is a input, which allows operators to force reject a part regardless of test measurements and terminate the test cycle early.
Common	The Start Channel and Common inputs are universal inputs, where sequence program can be set individually to use "Two Inputs to Start" logic.
Part Present	Enabled by selecting Part Present as one of the inputs, the Part Present input must be high before a start test input is received. It also must go low between tests (after any tooling motion and before the start of the tooling motion for the next test). If more than one input is set to "Part Present", test will execute only if all inputs are made high.
Ext Press Sw	Enabled by selecting Ext Press Sw as one of the inputs, the External Pressure Switch input must go high before the end of the fill segment. This input is generally used to validate that the test part is properly charged by detecting pressure downstream of a potential blockage point. For Occlusion test type where fill segment is not present, Ext Press Sw input must go high before the end of the test segment. If Ext Press Sw input is not made high during test execution, then a malfunction occurs. For more than one input of Ext Press Sw, test will execute only if all inputs are made high before test segment of Occlusion test and fill segment for other test types.
Instrument Enable	Enabled by selecting Instrument Enable as one of the inputs, the Instrument Enable input must be high before a start test input is received. If the input doesn't go high before executing any test, it shows the malfunction message. If the input goes low in between test execution, then test aborts and shows malfunction message. For more than one input of Instrument Enable, test will execute only if all inputs are made high and test aborts with malfunction message if any one input is low or made low in between test execution.
SPC Test Part	The SPC Test Part input identifies the next part to test as an SPC Part (often used when performing a test calibration verification test with a leak standard). This input must be high when receiving the Start input. This will mark the test results in the program result with an "*". Also, the test result output using the communication port will include the "*" to identify these parts for separate analysis.

Vent/Halt Request

The design of a Vent/Halt request (including initial phase of the Stop/Reset request) is to cease operation of tooling motions, remove all energy from the external part safely, and stop the operation.

A Vent/Halt request operation has multiple operations depending on the state of the instrument during testing. For better understanding, the test sequence can be broken into three basic groups: Tooling Extend, Part Testing, and Tooling Retract. The Program Evaluation (Accept Program/Reject Program/Malfunction/Severe Leak) is always appear after the Tooling Retract.

Vent/Halt – Instrument Idle state

While the instrument is idle, a high Vent/Halt input will prevent the instrument from performing any test activity or tooling reset. Any type of Start or Stop request will be ignored until the Vent/Halt input is high.

Vent/Halt – Instrument execution in sequence during Tooling Extend Group

A Vent/Halt request will cause the output related to an executing Tooling Extend to be turned off. If the extend output is completed, it will remain in its current state. Since the part has not been charged no exhaust is necessary and execution will cease. A Tooling Reset is required.

Vent/Halt – Instrument execution in sequence during Part Testing Group

A Vent/Halt request will cause the instrument to exhaust any pressure within the part (if pressure was achieved) and execution will cease. Any output relating to Tooling Extend will remain in its current state. A Tooling Reset is required.

Vent/Halt – Instrument execution In sequence during Tooling Retract Group

A Vent/Halt request will cause the output relating to the current executing Tooling Retract to be turned off. Since the part has already been exhausted, execution will cease. A Tooling Reset is required.

Stop/Reset Request

The design of a Stop request is to safely remove all energy from the external part, place the tooling into a fully retracted state, and stop operation. Depending on whether the instrument is actively testing or idle, the stop request has two modes of operations.

Stop/Reset – Instrument Testing

- If actively testing, a Stop request will cause the instrument to exhaust any pressure within the part (if pressure was achieved), and displays the stop Input message on screen.

Stop/Reset – Instrument Idle

- If the instrument is idle or the part pressure exhausted, a Stop request will cause the clear the screen and instrument back to ready state.

Stop/Reset – Instrument Testing With sequence,

- If actively testing, a Stop request will cause the instrument to exhaust any pressure within the part (if pressure was achieved), and then not execute a tooling reset sequence. To retract the tooling need to Stop/Reset input again..

Stop/Reset – Instrument Idle state with Sequence

- If the instrument is idle or in a state with the tooling extend, part pressure exhausted, final result displayed on screen with tooling retract successfully, a Stop request will cause the Tooling reset message on the screen.
- If the instrument is idle or in a state with the tooling extend, part pressure exhausted, final result displayed on screen, a Stop request will cause the tooling retract motions and display the tooling reset message on the screen.

In addition, Stop/Reset input is required:

- If a tooling motion error or a test malfunction occurs, the instrument will automatically execute a **Vent/Halt** sequence
- Tooling must be reset to fully retracted position to start next test.

Manual Reject

Manual Reject is a method which allows operators to force reject a part regardless of test measurements and terminate the test cycle early.

Rules for Standard Test Type.

- For this Manual Reject operation, you need to Manual Reject input configure either a hardware or an IP input.
- During an active test, when a manual reject I/O is triggered, the test stops immediately, "Manual Reject," evaluation appears on the monitor.
- The Program rejects the part early without Test measurements.
- This evaluation appears under Reject **Filter** section in Test results.

Rules for Sequence Test Type.

- If a Manual Reject is triggered during the execution of any node based upon sequence evaluation rules, that node is marked as "Manual Reject," its test is terminated early, execution proceeds to the next Reject path node.
- If there is no reject path defined in the execution, the sequence will stop at the node that was terminated early using Manual Reject.
- Manual Reject will not work in delay, prompt, tooling extend/retract nodes in Sequence.

Inputs for Program Selection

<table>
<tr><th>Input</th><th colspan="2">Description</th></tr>
<tr><td rowspan="6">Binary Program Selection</td><td colspan="2">Programs can be remotely selected using the Binary Program Selection inputs or using one of the communication methods: RS232 or TCP/IP. The number of required inputs for Binary Program Selection depends on the highest program number of the program to which access is required.</td></tr>
<tr><td>Program Numbers</td><td>Binary Program Inputs</td></tr>
<tr><td>1</td><td>B1</td></tr>
<tr><td>2 – 3</td><td>B1 and B2</td></tr>
<tr><td>4 – 7</td><td>B1, B2, and B3</td></tr>
<tr><td>8 – 15</td><td>B1, B2, B3, and B4</td></tr>
</table>

	16 – 31	B1, B2, B3, B4 and B5
	32 – 63	B1, B2, B3, B4, B5, and B6
	64 – 127	B1, B2, B3, B4, B5, B6, and B7
	128 - 250	B1, B2, B3, B4, B5, B6, B7 and B8

Note: Programs can also be remotely selected using one of the communication methods: RS232 or TCP/IP, see Chapter 29 – Communication.

Inputs for Program Calibration

Input	Description
Program Cal	The Program Cal input prepares the instrument to perform a Program Cal sequence. A Start input initiates the tooling motion and Program Cal sequence.
Open Leak Std	The Open Leak Standard input will open the Leak Standard Calibration valve (if equipped) during the Fill, Stabilization, Test, and Exhaust segments. The valve will only open during the testing cycle when the input is high. If the input goes low during the testing cycle, the Leak Std Calibration valve will close. This input is generally used to automatically verify the calibration of a system by indexing or placing a good part in the test fixture and adding the internal leak standard to measure a part with the leak rate equal to the internal leak standard.

Outputs for Test Cycles

Output	Description
Press Select	Pressure Select goes high during the entire test sequence from start of Prefill or Fill segment to the end of Exhaust segment. ***This output can be used as a Test Active output.***
Prefill	The Prefill output goes high during the Prefill portion of the Fill segment. This output is frequently used to control an external fast-fill valve when testing large volume parts. The external fast-fill valve opens until the instrument reaches the Minimum Pressure.
In Fill	The Fill segment output goes high during the Fill segment.
Fill Valve	This output mimics the Fill Valve functionality in the instrument. It goes high during the Prefill and Fill segments.
In Stabilize	The Stabilization segment output goes high during the Stabilization segment.
Isolation Valve	This output mimics the Isolation Valve functionality in the instrument. It goes high just prior to the fill valve closing and stays energized until the end of the Test segment.
In Test	The Test segment output goes high during the Test segment.
In Exhaust	The Exhaust segment output goes high during the Exhaust segment. This output is frequently used to open an external exhaust valve that vents the test air from the part through a larger valve for fast exhaust or to bypass the instrument and avoid polluting the instrument pneumatics with dirty part air.

Output	Description
In Relax	The relax timer output goes high during the Relax segment between the two tests of the Program Cal sequence. It would go high at the end of the first test Exhaust segment until the start of the second test Prefill or Fill segment.

Outputs for Program Calibration

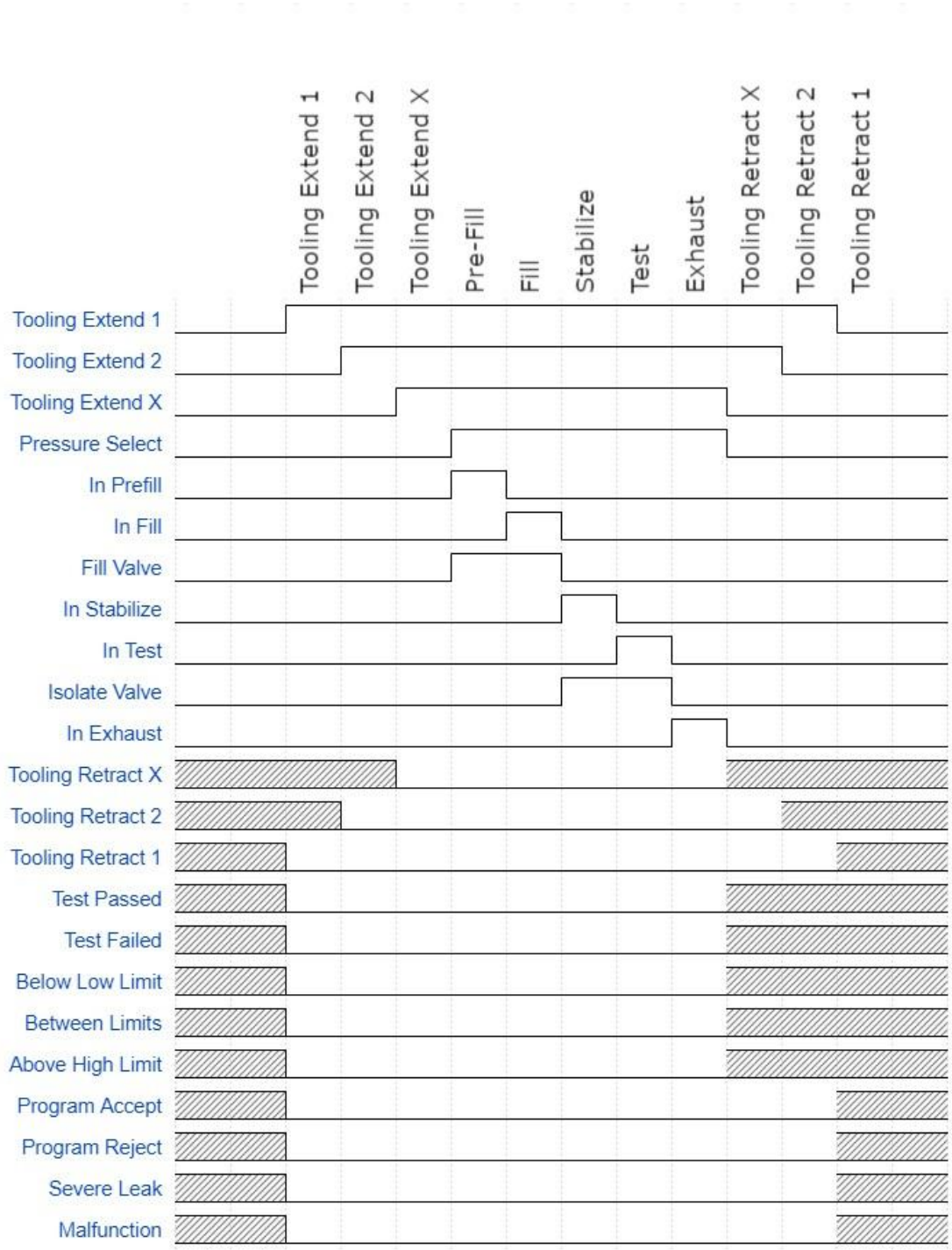
Output	Description
Program Cal Mode	The Program Cal Mode output goes high whenever the instrument is performing a Program Cal cycle. It goes high at the beginning of the Prefill or Fill timer for the first test of the Program Cal process. It stays high until the end of the Exhaust segment for the second test of the Program Cal Process.
Prog Cal Master	The Program Calibration Master output goes high during the first complete test of the Program Cal process starting at the beginning of the Prefill or Fill segment to the end of the Exhaust segment. This output is used to alert an external process that the instrument is in the first test of calibration.
Prog Cal LS	The Program Calibration Leak Standard output goes high during the second complete test cycle of the Program Cal process when the Leak Standard is added beginning with the Prefill or Fill segment to the end of the Exhaust segment. This output is used to alert an external process that the instrument is in the second test of calibration.

Outputs for Program Results and Test Results

Output	Description
Program Accept	The Program Accept output goes high at the completion of the tooling motion (if tooling is turned on) or at the completion of the Exhaust segment if the test passes.
Program Reject	The Program Reject output goes high at the completion of the tooling motion (if tooling is turned on) if the test fails. Program Rejects also include Severe Leaks when Minimum Pressure is not reached before reaching the Prefill setpoint or maintained during the Fill or Stabilization segments.
Malfunction	If a test has an error or disruption to the normal process and faults out of cycle before the normal completion, a malfunction will occur. With tooling control if the error or disruption occurs during initial tooling action, the tooling will retract. If the error or disruption occurs during the testing cycle, the test will advance immediately to exhaust and the tooling will retract automatically. The Malfunction output goes high at the end of the completion of the last tooling motion.
Severe Leak	If a test fails to reach Minimum Pressure before reaching the Prefill setpoint or fails to maintain at least the Minimum Pressure during the Fill and Stabilization segments, the instrument will exhaust the pressure in the part and output Severe Leak high.
Test Passed	Signals the completion of a test that passed at the start of the Exhaust segment. This output stays on until the start of a new test.
Test Failed	Signals the completion of a failed test at the start of the Exhaust segment. This output stays on until the start of a new test.
Below LL	Below Low Limit goes high at the start of Exhaust segment when test results are below the Low Limit setpoint and stays high until the start of the next test.
Between Lim	Between Limits goes high at the start of Exhaust segment when test results are between the Low Limit and High Limit setpoints and stays high until the start of the next test.
Above HL	Above High Limit goes high at the start of Exhaust segment when test results are above the High Limit setpoint and stays high until the start of the next test.

Timing Graph

The graph below shows the X5 outputs during a test sequence. Tooling Extend 4-8 are not being used in this example


Tooling Extend 1
Tooling Extend 2
Tooling Extend X
Pre-Fill
Fill
Stabilize
Test
Exhaust
Tooling Retract X
Tooling Retract 2
Tooling Retract 1
Tooling Extend 1
Tooling Extend 2
Tooling Extend X
Pressure Select
In Prefill
In Fill
Fill Valve
In Stabilize
In Test
Isolate Valve
In Exhaust
Tooling Retract X
Tooling Retract 2
Tooling Retract 1
Test Passed
Test Failed
Below Low Limit
Between Limits
Above High Limit
Program Accept
Program Reject
Severe Leak
Malfunction

Chapter 27 – EtherNet/IP

*This chapter explains the control capabilities of the X5 using the **EtherNet/IP™** feature. **EtherNet/IP** is a registered trademark of ODVA, Inc.*

Instrument EtherNet/IP Functionality

EtherNet/IP is an industrial communications 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
- Send/receive ASCII barcode information to be stored with test result (X5 instruments)
- User configurable soft I/O functions (16 input, 16 output)
- Test Result data for the latest test
- Real-time data streaming
- Test result summary data, and query of full result measurement information
- Latch feature for multi-device communications heartbeat monitoring

EtherNet/IP does **NOT** provide:

- Access or modification of instrument settings:
  - System 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	• Result Ready	• Current Program Number
• Stop	• Result Error	• Change Program Number
• Vent/Halt	• Result Unique ID	• Test Evaluation
• Reset	• Program Accept	• Timestamp
• Instrument Ready	• Program Reject	• Latch status
• Live streaming data	• Malfunction	• Barcode Flag
• streaming flag		

Setting EtherNet/IP User Defined Inputs and Outputs

The instrument comes equipped with 16 programmable inputs and 16 programmable outputs. The user can select up to 16 test or program specific I/O that are not in the Standard Fixed, Defined Inputs/Outputs set (described on the first page of this chapter). 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 Table in the previous chapter titled Chapter 26 – Inputs and Outputs.

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 26 – Inputs and Outputs

Additional Reference Document

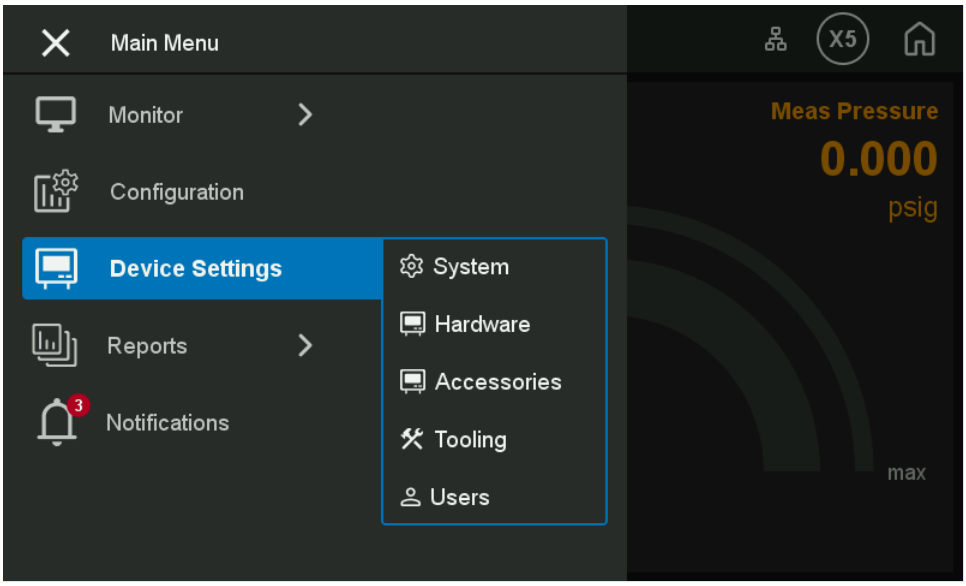
For more information on communicating with any Allen-Bradley ControlLogix or CompactLogix PLC, refer to the **EtherNet/IP AOI Integration Manual**. This document file will be located on the USB flash drive that was provided with the CTS instrument. If you cannot locate this file on the USB drive, it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

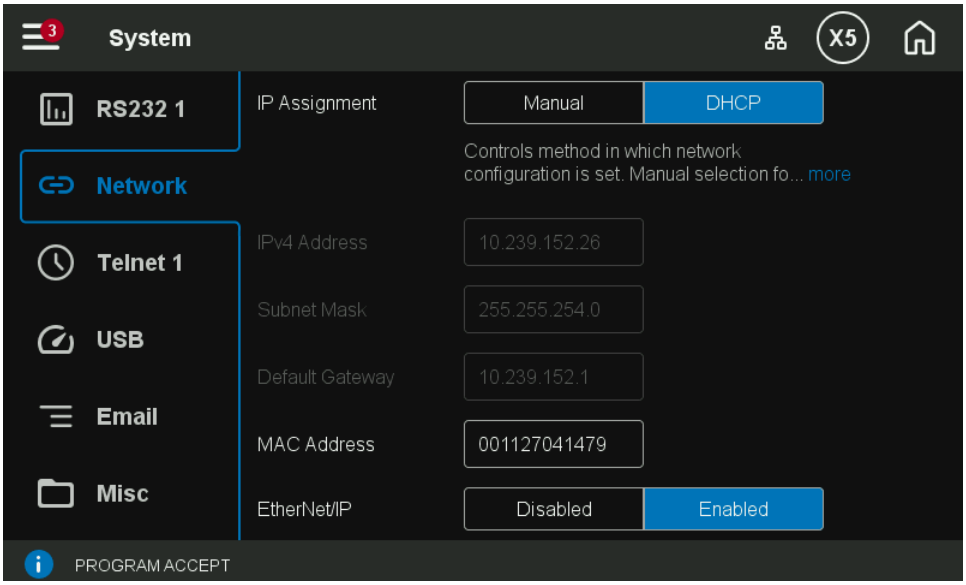
Input Options
Start Channel
Start Program
Stop/Reset
Hold
Vent/Halt
Manual Reject
Program Cal
Open Leak Std
Part Present
SPC Test Part
Instrument Enable
Common
Program Select B1
Program Select B2
Program Select B3
Program Select B4
Program Select B5
Program Select B6
Program Select B7
Program Select B8
Ext Press Sw
Event Trigger
Unassign

Output Options
In Relax
Press Select
Program Cal Mode
Program Cal Master
Program Cal Leak Std
Press Select
Prefill
In Fill
Fill Valve
In Stabilize
Isolation Valve
In Test
Test Passed
Test Failed
Bellow LL
Between Lim
Above HL
In Exhaust
Program Accept
Program Reject
Malfunction
Severe Leak
Unassign

Establishing EtherNet/IP Communication

The communication parameters are located in **Main Menu > Device Settings > System > Network** menu. The first step in establishing communication with a PLC is to set **EtherNet/IP** to "Enabled".





CAUTION: When changing the EtherNet/IP setting from "Enabled" to "Disabled", all of the user assigned IP Inputs and IP Outputs become Unassigned. This is necessary because when EtherNet/IP is no longer functional, any I/O that may cause program faults must be removed. This includes Part Present, External Pressure Switch, etc. This means that all the user assigned IP Inputs and IP Outputs must be set up again.

This page is intentionally blank.

Chapter 28 – PROFINET

*This chapter explains the control capabilities of the X5 instrument using the **PROFINET** feature.*

Instrument PROFINET Functionality

PROFINET is an industrial communication standard for data communication over Industrial Ethernet. While PROFINET offers various optional topology methods, our implementation utilizes the conventional star with standard Ethernet infrastructure devices.

Features

PROFINET provides the following capabilities:

- Standard set of I/O functionality for machine control
- Modify the current active Program
- User configurable soft I/O functions (16 input, 16 output)
- Test Result data for the latest test
- Real-time data streaming
- Send/receive ASCII barcode information to be stored with test result (X5 instruments only)

PROFINET does **NOT** provide:

- Access or modification of instrument settings:
  - System configuration
  - Hardware configuration
  - Program configuration

Compatibility

Provide full communication capabilities over PROFINET with any Siemens PLC having PROFINET Port.

Standard Fixed, Defined Inputs/Outputs

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

- Start
- Stop
- Vent/Halt
- Reset
- Program Accept
- Program Reject
- Malfunction
- Instrument Ready
- New Barcode Flag
- Child Flag
- SEQ Child Flag
- Barcode Flag
- Current Program Number
- Change Program Number
- Test Active
- Active Child Program

Setting PROFINET User Defined Inputs and Outputs

The instrument comes equipped with 16 programmable inputs and 16 programmable outputs. The user can select up to 16 test or program specific I/O that are not in the Standard Fixed, Defined Inputs/Outputs (described on the first page of this chapter). The following lists of input and output options are the same as the lists of hardware inputs and hardware outputs described in the Programmable I/O Table in the previous chapter titled Chapter 26 – Inputs and Outputs.

Input Options
Start Channel
Start Program
Stop/Reset
Hold
Vent/Halt
Manual Reject
Program Cal
Open Leak Std
Part Present
SPC Test Part
Instrument Enable
Common
Program Select B1
Program Select B2
Program Select B3
Program Select B4
Program Select B5
Program Select B6
Program Select B7
Program Select B8
Ext Press Sw
Event Trigger
Unassign

Output Options
In Relax
Press Select
Program Cal Mode
Program Cal Master
Program Cal Leak Std
Press Select
Prefill
In Fill
Fill Valve
In Stabilize
Isolation Valve
In Test
Test Passed
Test Failed
Bellow LL
Between Lim
Above HL
In Exhaust
Program Accept
Program Reject
Malfunction
Severe Leak
Unassign

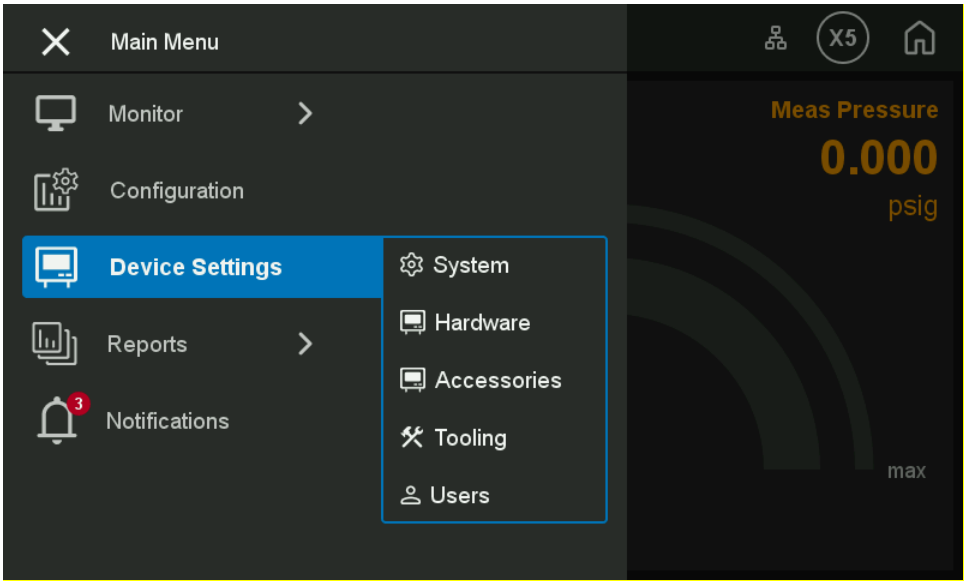
Additional Reference Document

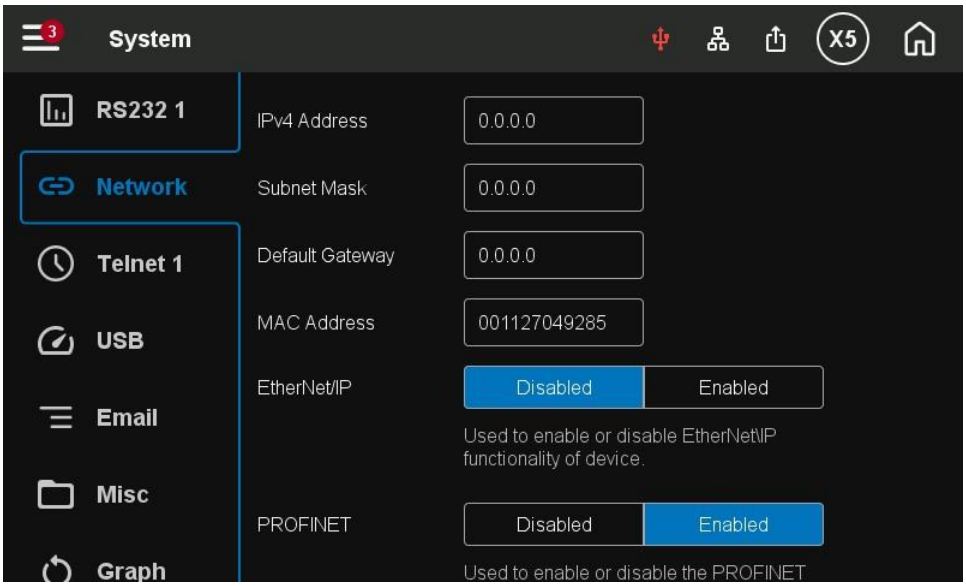
For more information on communicating with the instrument using PROFINET, refer to the **PROFINET Programmers Guide**. This document file will be located on the USB flash drive that was provided with the CTS instrument. If you cannot locate this file on the USB drive, it can be emailed to you. Contact the Cincinnati Test Systems Service department. See the back cover of this manual for contact information.

Establishing PROFINET Communication

If the PROFINET feature has been enabled for the instrument, the communication parameters are located in **Main Menu > Device Settings > System > Network** icon menu. The first step in establishing communication with a PLC is to set **PROFINET** to "Enable". Upon enabling

PROFINET, the instrument will disable Ethernet/IP, and the instrument will reboot. Upon startup, **PROFINET** will be functional. In addition, disabling PROFINET will also reboot the instrument.





CAUTION: When changing the PROFINET setting from "Enabled" to "Disabled", all of the user assigned IP Inputs and IP Outputs become Unassigned. This is necessary because when PROFINET is no longer functional, any I/O that may cause program faults must be removed. This includes Part Present, External Pressure Switch, etc. This means that all the user assigned IP Inputs and IP Outputs must be set up again.

This page is intentionally blank.

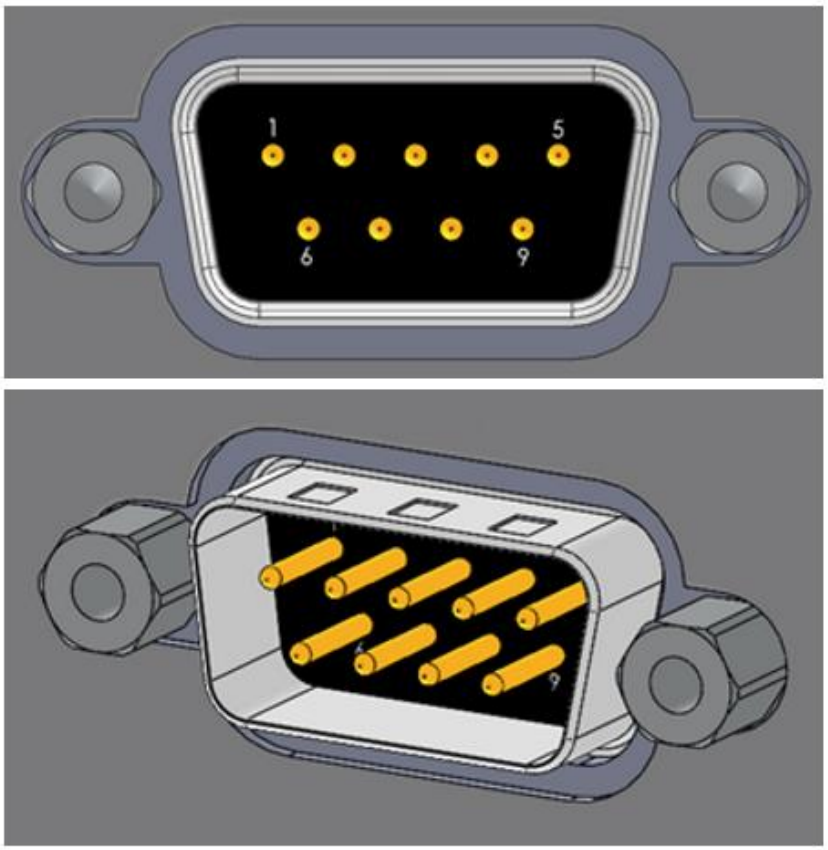
Chapter 29 – Communication

The instrument is able to communicate over RS232 and Ethernet via TELNET. This chapter explains how to setup communication with the instrument and how to decode the test results output.

The communication parameters are located in **Main Menu > Device Settings > System** option.

RS232 Connector Pinout

The pinout for the RS232 connector, located on the side of the X5, is denoted in the diagram below. Pins 1, 4, and 6 are internally connected, but are unused by the instrument.



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

Establishing RS232 Communication

The RS232 parameters are located in **Main Menu > Device Settings > System > RS232 1**. The first step in establishing RS232 communication with the instrument is to set the RS232 1 Interface parameter to "2-way" communication. Next, set the Baud parameter to match the baud rate of the device that will be communicating with the instrument. The options are: 115200, 57600, 38400, 19200, or 9600 bits per second.

Note: The instrument always uses 8 data bits. The Parity is set to "None". The instrument uses 1 stop bit. The flow control is always set to "None".

Once you have established communication with the desired device you may select whether you want the instrument to "echo" back each character it receives on the TCP/IP 1 communication port. This setting is located in the **Main Menu > Device Settings > System > RS232 1** icon.
Select RS232 1 Echo. If the parameter is set to "ON", the instrument will output an echo for each character it receives. If this parameter is set to "OFF", the instrument will not echo anything.

Establishing TELNET communication

It is highly recommended that you consult with your company's IT department regarding the configuration of placing the instrument on any network. You should get the proper settings for the following parameters from your company's IT department.

The TCP/IP parameters are located in **Main Menu > Device Settings > System > Network**. The first step in establishing Ethernet communication with the instrument is to set the IP Assignment parameter to DHCP or Manual (static IP address). If set to "DHCP", the IPv4 Address becomes a read only parameter. If set to "Manual", then you will need to set the IPV4 Address manually. You may choose to let the instrument initially get its settings with DHCP and then change the setting to Manual to edit the IPv4 Address of the instrument or lock it so that it will not change.

The Subnet Mask parameter will need to be configured next. The most common configuration for this parameter is "255.255.255.0" unless there is more than one subnet in which case a common configuration is "255.255.0.0".

The Gateway IP Address is the default gateway of the network domain.

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

Once you have established communication with the desired device you may select whether you want the instrument to "echo" back each character it receives on the TCP/IP 1 communication port. This setting is located in the **Main Menu > Device Settings > System > Telnet 1** icon. Select Telnet 1 Echo. If the parameter is set to "ON", the instrument will output an echo for each character it receives. If this parameter is set to "OFF", the instrument will not echo anything.

Understanding the Header Information

All of the information that the instrument sends over the communication ports is preempted by header information. This data is sent to help parse specific information. This header information is in the format XXYYZZZ H.
Example of received data is shown below:

```
"C7A7017	V	P1\R\TEST=1.00 sec	f "
```

Structure Breakdown

C7A7017		V		P1\R\TEST=1.00		sec		f		
XXYYZZZ	(Tab)	Data Type Code	(Tab)	Variable	(Tab)	Unit	(Tab)	Variable Type	(Space)	End of line sequence. (\r\n) (CR LF)

Note: The data is delimited by tab character and ended with a CR (Carriage Return 0x0D) and LF (Line Feed 0x0A), which is not visible on terminal directly, but it is present.

Header Field Description

Header	Actual	Description
XX	C7	8-Bit CRC in HEX. Used for error checking.
YY	A7	Sequence Code in HEX. The value increments from 01 to FF. This value can be used as a verification that all data has been received and nothing was missed by the receiving device.
ZZZ	017	Data length in HEX.
Type	V	Data Type Code. (See the Data Type Code Table below.)
Variable	P1\R\TEST=1.00	Information of Variable assignment.
Unit	sec	Variable Unit. Describes the unit of variable.
Variable Type	f	Variable Type. Describes the type of variable. (Conditional, Integer, Float, String)

Table of Data Type or Header Codes

Data Type Code	Description
V	Variable
L	List
M	Message
U	System Message
Q	Result List
T	Streaming Started
S	Streaming Value
X	Streaming Stopped
R	Result

CRC Calculation Method

The CRC is calculated using the CRC-8/SMBus standard. It uses the polynomial 0x07.

CRC Type	Result	Check	Poly	Init	RefIn	RefOut	XorOut
CRC8/SMBUS	0xF4	0xF4	0x07	0x00	False	False	0x00

Example Data String

```
"409401E  V    P1\M\EXHAUST METHOD=Dump      c "
```

Example Data Breakdown in HEX

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40
4	0	9	4	0	1	E		V		P	1	\	M	\	E	X	H	A	U	S	T		M	E	T	H	O	D	=	D	u	m	p			c			
34	30	39	34	30	31	45	09	56	09	50	31	5C	4D	5C	45	58	48	41	55	53	54	20	4D	45	54	48	4F	44	3D	44	75	6D	70	09	09	63	20	0D	0A

Note: Non-visible characters such as Tab (\t), Carriage Return (\r), and Line Feed (\n) are explicitly shown in the HEX representation.

Structure Breakdown in HEX

XX	YY	ZZZ	Tab	H	Tab	Data	EOF
40	94	01E		V		P1\M\EXHAUST METHOD=Dump c	
40	94	01E	09	56	09	50 31 5C 4D 5C 45 58 48 41 55 53 54 20 4D 45 54 48 4F 44 3D 44 75 6D 70 09 09 63 20	0D 0A

CRC Calculation

For demonstration we will use www.crccalc.com with CRC8 SMBUS (Polynomial 0x07). This link redirects with the above example with appropriate standard predefined. The calculation includes all characters starting from the 3rd character (excludes first two CRC characters) in the string up to the end of line (CR and LF). Here CRC calculated from website is 0x40. And the inside the received string XX represents CRC which is 0x40. The data considered for CRC calculation will be-

```
39 34 30 31 45 09 56 09 50 31 5C 4D 5C 45 58 48 41 55 53
54 20 4D 45 54 48 4F 44 3D 44 75 6D 70 09 09 63 20 0D 0A
```

Note: For verification we can use any online CRC calculator with appropriate standard selected or polynomial.

Length Calculation

Length is calculated from 8th character i.e. **'V'** to the 37th character i.e. **' '** (Space character). Observe the above data which highlights the length. Here the received length is 0x01E which is 30 in decimal and the calculated length is also 30

```
"409401E  V    P1\M\EXHAUST METHOD=Dump      c "
```

Test Results via RS232 or Ethernet (Telnet) Communications

To see the menu settings described below, the communication interface must be set to "2-Way" and not to "Barcode". Depending on which type of communication is being used, these settings are located in:

Main Menu > Device settings > System > RS232 1 icon > **RS232 1 Results**, or
Main Menu > Device settings > System > Telnet 1 icon > **Telnet 1 Results**.

In order for the instrument to send the test Result Data automatically once the test is complete the parameter is set to "ON". Once this parameter is turned on, the Result Field data parameters show on the screen. Each parameter may be turned on or off depending on the information that is required for to accompany each result. The Test Field parameter may be set to "All Result Information" or "First 2 Test Results". The "First 2 Test Results" will send the two primary results. The table below shows the format of the Test Result Data.

Parameter	Number of Characters	Format	Example Text	Description of Example
Channel #	4	C##	C01	Channel 1
Port #	3	N#	N1	Port 1
Program #	4	P##	P01	Program 1
Link #	3.	R##	R01	Link
L	I	HH:MM:SS.XXX	16:15:14.123	16 hrs, 15 mins, 14.123 secs
Date	9	MM/DD/YY	40179	02/01/16
Unique Id	11	##########	0000098353	Unique test number
Program Evaluation	3	#	A	Accept
SPC Flag	2	#	*	SPC Test Data Result
Barcode	41	1…40	12345	Barcode Data
Test Field	**First 2 Test Results**			
Test Type	6	###	PLR	Pressure Decay-Leak Std
Test Evaluation	3	#	P	Pass
Test Data 1	22	TDI Data Unit	LR 0.123456 sccm	Test Data Identifier - Value - Unit
Test Data 2	22	TDI Data Unit	LR 0.123456 sccm	Test Data Identifier - Value - Unit
CR				Carriage Return
LF				Line Feed

Test Field	All Result Information			
Test Type	6	###	PLR	Pressure Decay-Leak Std
Test Evaluation	3	#	P	Pass
Test Data 1	22	TDI Value Unit	LR 0.123456 sccm	Test Data Identifier - Value - Unit
Test Data 2	22	TDI Value Unit	LR 0.123456 sccm	Test Data Identifier - Value - Unit
|	|	|	|	|
Test Data X	22	TDI Value Unit	LR 0.123456 sccm	Test Data Identifier - Value - Unit
CR				Carriage Return
LF				Line Feed

Note: For the most up to date Test Data Identifier Codes, type "TABLE VARIABLE" into the instrument using the communication port. The instrument will return a list of about 550 Test Data Identifier Codes and descriptions. See the full list in Appendix E – Communication Code Tables.

Note: For the most up to date Test Evaluation Codes, type "TABLE EVALUATION" into the instrument using the communication port. The instrument will return a list of about 120 Test Evaluation Codes and descriptions. See the full list in Appendix E – Communication Code Tables.

Note: For the most up to date Program Evaluation Codes, type "TABLE RESULT" into the instrument using the communication port. The instrument will return a list of about 12 Data Program Evaluation Codes and descriptions. See the full list in Appendix E – Communication Code Tables.

Streaming Measured Data

The instrument has the ability to stream measured data using the RS232, TCP/IP or USB communication port (one or the other, not 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.

Parameter		Format	Example Text	Description of Example
Channel #	Comma Delimited	C##	C01	Channel 1
Program #	Comma Delimited	P##	P01	Program 1
Segment	Comma Delimited	XXX	PRF	Prefill Segment
Test Data	Comma Delimited	TDI Value Unit	LR 0.123456 sccm	Test Data Identifier - Value - Unit
CR				Carriage Return
LF				Line Feed

Note: For the most up to date Segment Codes, type "TABLE SEGMENT" into the instrument using the communication port. The instrument will return a list of about 120 Segment Codes and descriptions. See the full list in Appendix E – Communication Code Tables.

Note: For the most up to date Test Data Identifier Codes, type "TABLE VARIABLE" into the instrument using the communication port. The instrument will return a list of about 550 Test Data Identifier Codes and descriptions. See the full list in Appendix E – Communication Code Tables.

Parsing Data Packets

For users who are trying to parse data packets from the instrument, any line beginning with an asterisk "*" should be parsed to be ignored, as these lines will not have header information to be parsed. An example of these types of lines would be the Root menu displayed at instrument boot.

Reports

The instrument is capable of generating a variety of reports through RS232, Ethernet, Email, or USB memory port located on the front of the unit. The reports available are in the table below.

Report	Description
Cur Program Res	Reports all of the test results for the current active program. The current program can be seen in the bottom right-hand corner of the display.
All Results	Reports all of the test results in the instrument memory.
Chan Last 1000	Reports the last 1000 test results.
Chan Last 100	Reports the last 100 test results.
Chan Last 20	Reports the last 20 test results.
Chan Last Res	Reports the last test result.
Global Config	Reports all of the parameters and their settings within the Global Config menu.
Channel Config	Reports all of the parameters and their settings within the Hardware Config menu.
Cur Program Config	Reports all of the parameters and their settings within the current active program. The current program can be seen in the bottom right-hand corner of the display.
Program Config	Reports all of the parameters and their settings within the Program Config menu.
Regulator Cal	Reports the Electronic Regulator Calibration data if the instrument is configured with an electronic regulator.
Transducer Ver	Reports the Transducer Verification data of the last Transducer Verification conducted on the instrument.
Transducer Cal	Reports the Transducer Calibration data of the last Transducer Calibration conducted on the instrument.
Channel Cntrs	Reports all of the counters in the instrument.

CTS DataHub

The CTS DataHub interface is a custom interface designed to work with a QualityWorX CTS Datahub setup. When **CTS DataHub** is enabled, the QualityWorX CTS Datahub setup will be able to communicate with the X5 instrument to capture streaming and result data. This data is stored on the QualityWorX CTS Datahub setup and allows for engineers and technicians to analyze and report on a collection of data from your production line.

The CTS DataHub parameter is located in **Main Menu > Device Settings > System > Network**. When CTS DataHub is enabled, a new parameter **Configuration Key** will appear. This parameter is currently unused.

To setup QualityWorX CTS Datahub, please refer to the QualityWorX CTS Datahub Getting Started guide.

Email Setup

This section details how to configure the system to send automated reports and alerts via email. The Email setup parameters are located in **Main Menu > Device Settings > System >Email.**

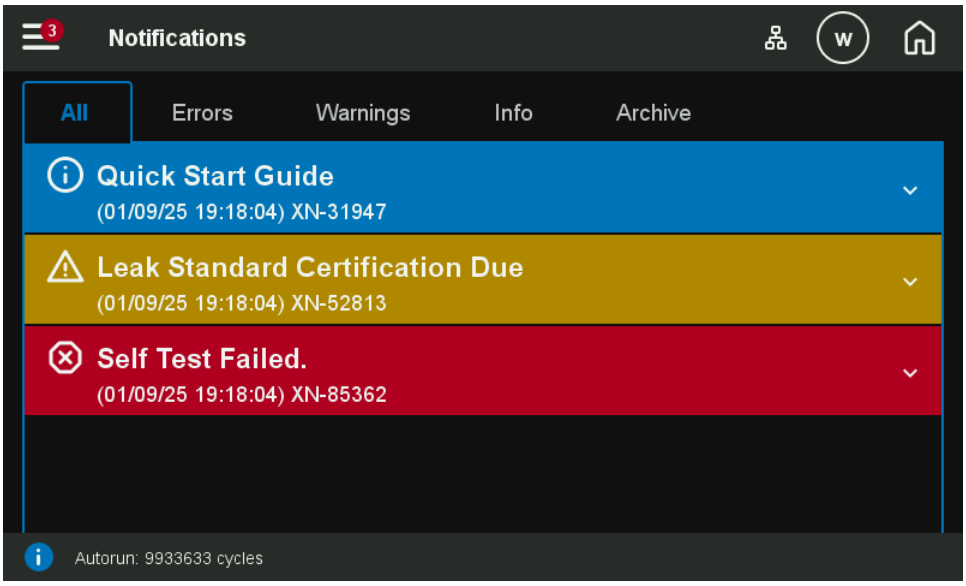
The Mail Server IP Address parameter should be set to the address of the SMTP mail server. The Subnet Mask parameter will need to be configured next. The most common configuration for this parameter is "255.255.255.0" unless there is more than one subnet in which case a common configuration is "255.255.0.0".
The Gateway IP Address is the default gateway of the network domain.

Parameter	Description
Server IPv4 Address	The IP address of the SMTP (Simple Mail Transfer Protocol) server used for sending email.(
User ID	The username required to authenticate with the SMTP server.
Email Password	The password associated with the User ID for server authentication.
From Addr:	The email address that reports and alerts will be sent *from*.
Email Report	Determines the type of report that is automatically generated and emailed to the user-defined address. Check the details Reports
Rpt Addr:	The destination email address for general **Email Reports**.
Email Alert 1 / Email Alert 2	Defines the criteria under which an alert email is triggered.
A1 Addr: / A2 Addr:	The destination email address for the respective alert configuration (Alert 1 or Alert 2).

This page is intentionally blank.

Chapter 30 - Notification

The Notifications feature allows the user to browse through various Errors, Warnings, and Additional Information that may be required during test execution. This helps keep users informed about the system's status and any necessary actions needed throughout the testing process.



The Notification indicator is displayed in the Menu icon and on the Notifications icon within the sidebar. It shows the number of notifications available. Notifications are categorized by color to indicate their significance. Blue indicates informational notifications, Red indicates errors that occurred during execution, and Yellow indicates any of the warnings occurs while handling the device. When a notification is dismissed, the active notification will be archived. By referring to the color-coded notifications, users can quickly identify the type of message and take appropriate action.

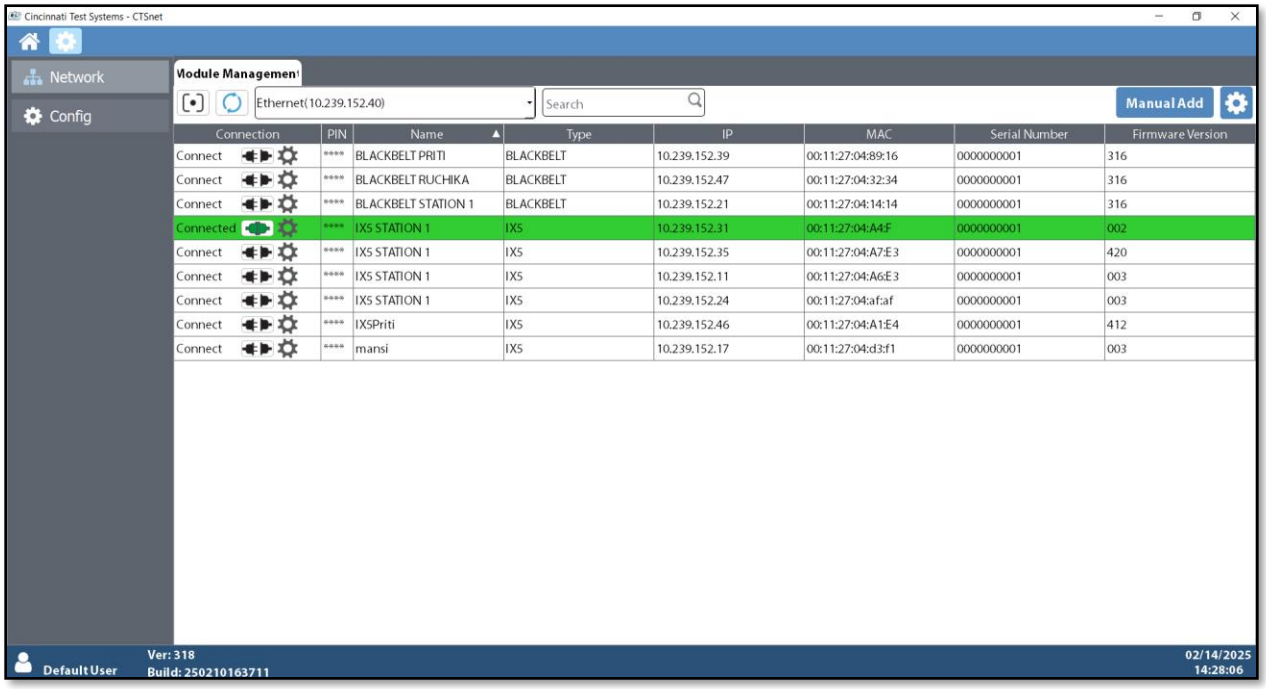
This page is intentionally blank.

Chapter 31 – CTSnet

This chapter explores the basic use of CTSnet. CTSnet is a PC based graphical user interface that allows you to control, configure and monitor your instrument, all from a single, easy-to-use application. Please refer to the quick start guide on the USB drive included with your instrument for instructions on installing the application.

Initial Startup

After Setting up your X5 instrument(s) on the network, launch CTSnet. Your instrument(s) will appear on the Module Management screen. You can connect to a X5 by pressing the connect icon on each available instrument. The connected instrument's information will turn green to indicate that it is connected.



Note: The CTSnet application can connect to Ten instrument at time.

Once a X5 instrument is connected, you will be taken to the home menu. From here you can fully control and configure the X5 instrument to your specifications. This includes running and monitoring tests and calibration



Monitor Screen

Summary Tab

The Summary tab will allow you to start, stop and hold tests. You can select the program being run by using the drop-down selector. Program calibration, if available for the selected program, can be performed from this tab as well.

The test can be visually monitored through its stages on the top plot. This plot displays the value of the primary transducer against elapsed time, as well as marking each phase of the test with color coordination. The bottom plot will display the value of the Secondary Transducer during the test phase.

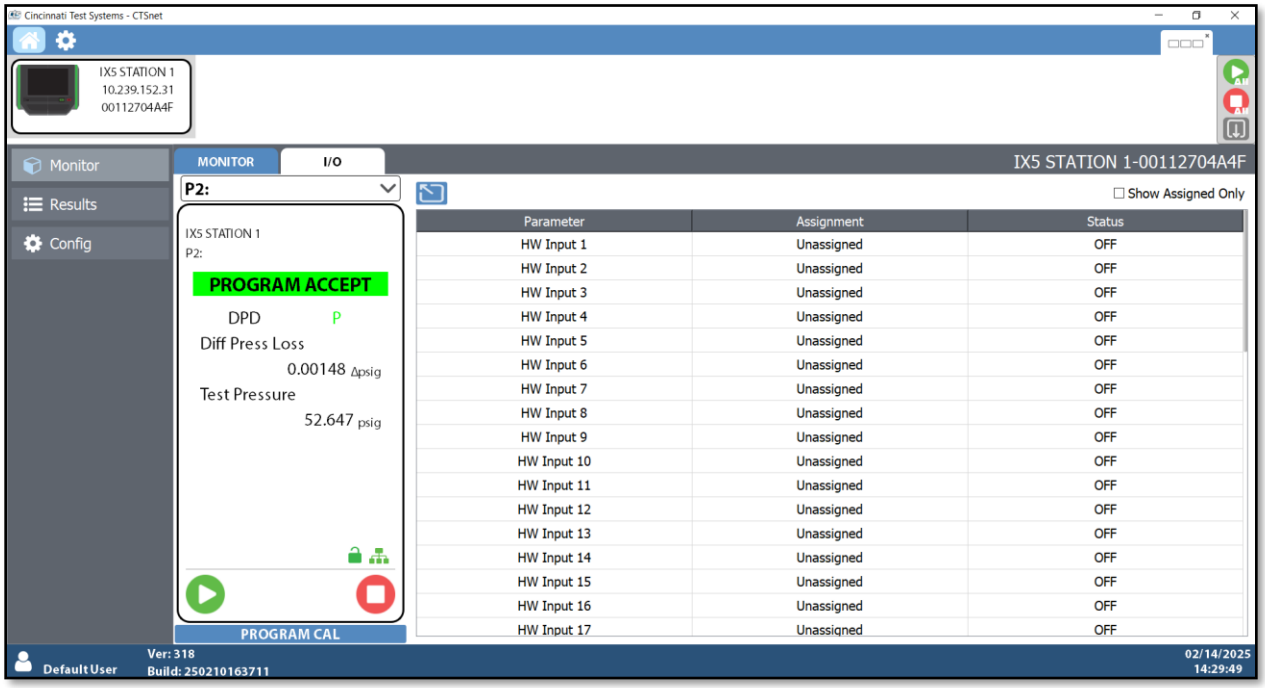
Each plot can be interacted with using the icons to the right of the plot or expanded to fit the screen with the maximize button in the upper left of the plot.



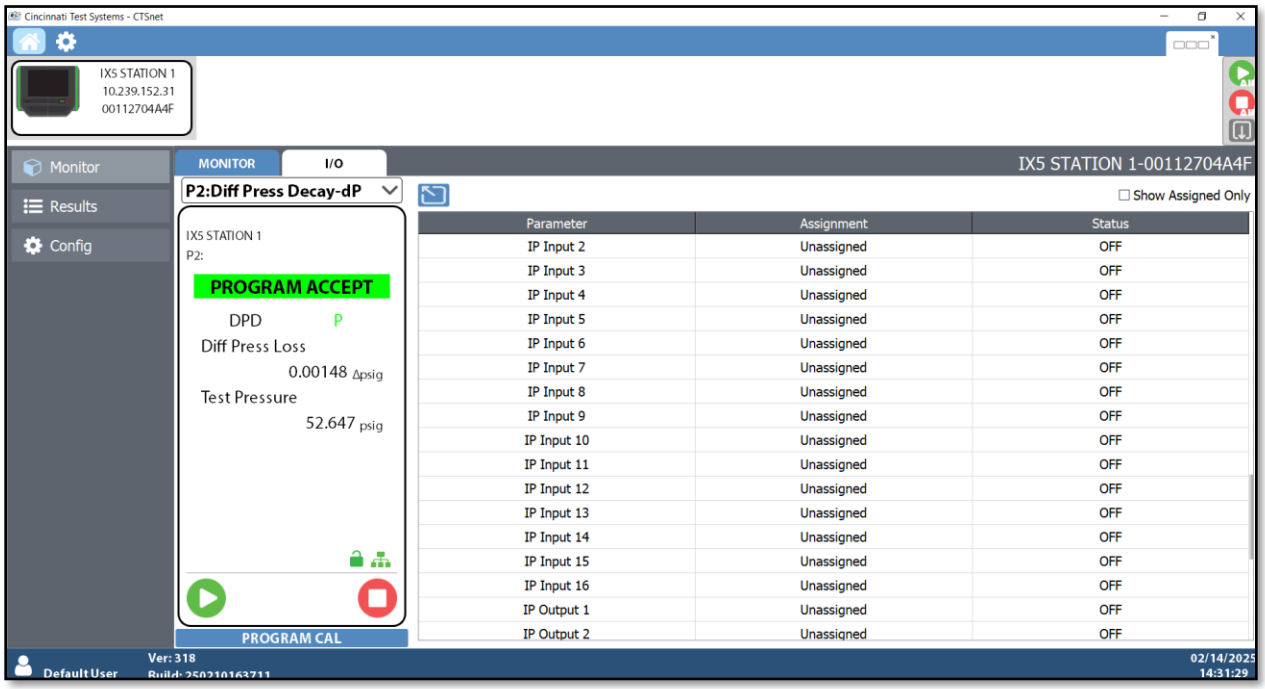
Plots shown are for demonstration, actual view may differ based upon the selected test type.

IO Tab

The I/O tab will allow you to monitor each input and output state in real time. This window can be expanded to fit the full screen by pressing the maximize button on the upper left of the I/O list.



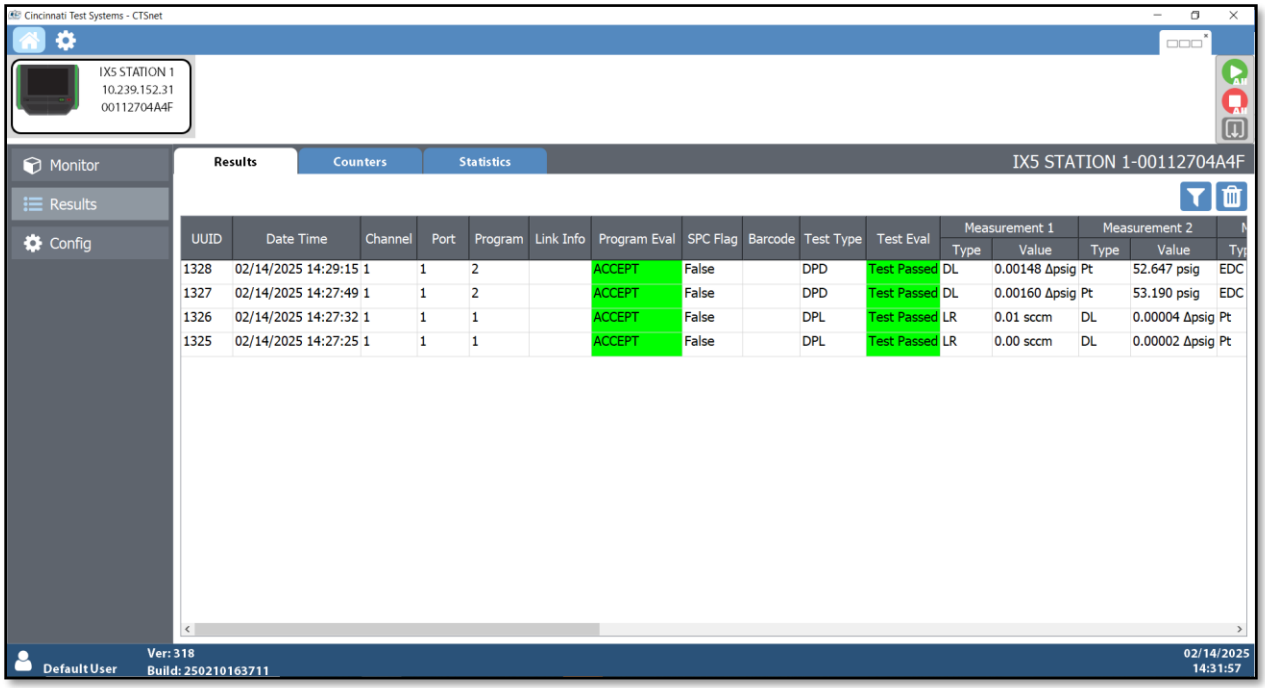
When Ethernet/IP is enabled, the Ethernet/IP IO states will also be displayed here.



Results Screen

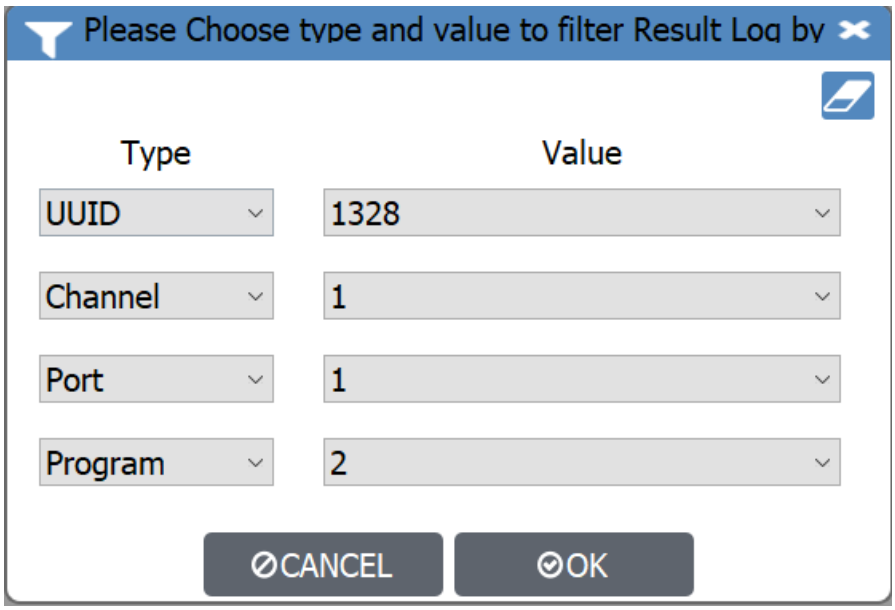
Results Tab

The Results tab displays the allowed number of results and allows for filtering by pressing the filter button. Results can also be cleared by pressing the delete button.



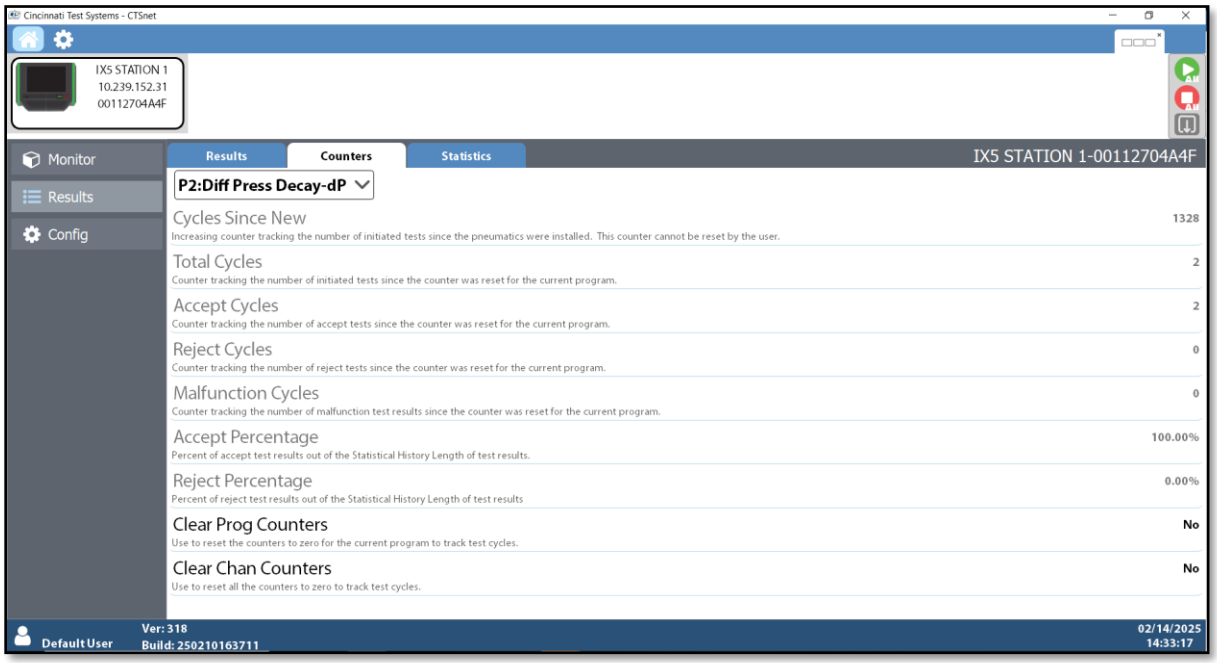
Filtering Results

You can create up to 4 filters to sort Result logs.



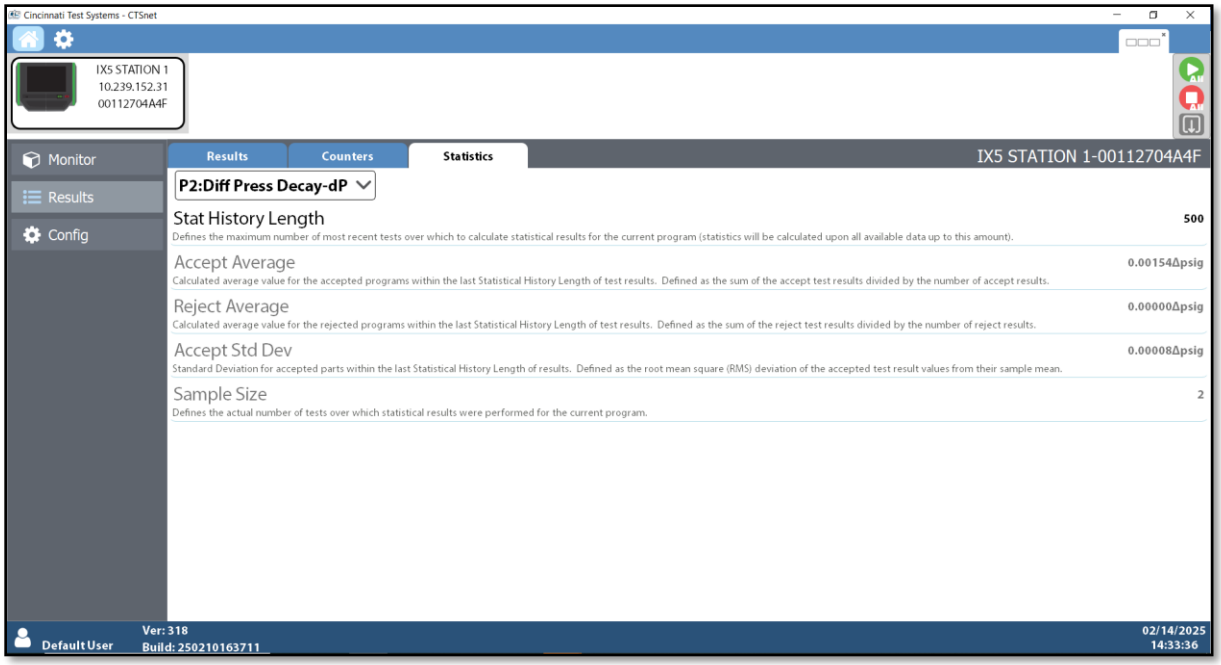
Counters Tab

The Counters tab displays the number of cycles performed on the instrument including the number of accept and reject cycles. These can be cleared to reset statistics.



Statistics Tab

The Statistics tab displays statistical analysis on the results from a selected program. The population of data can be adjusted using the Stat History Length parameter.

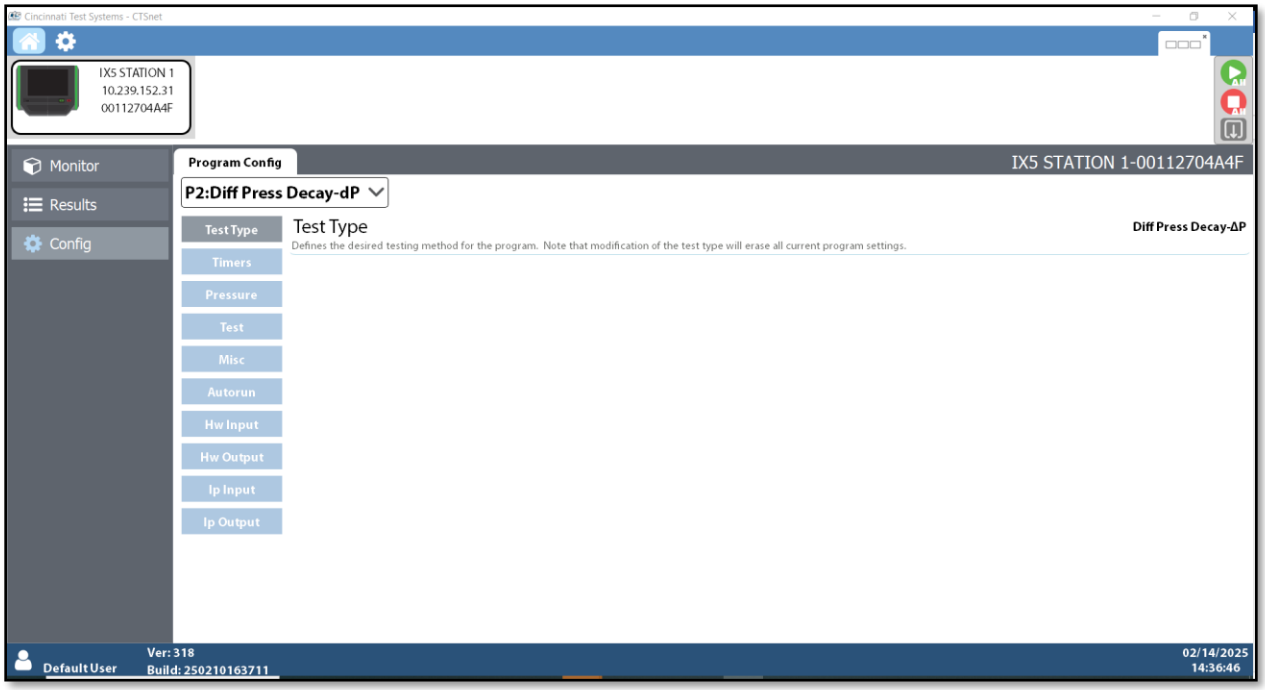


Configuration Screen

Program Configuration Tab

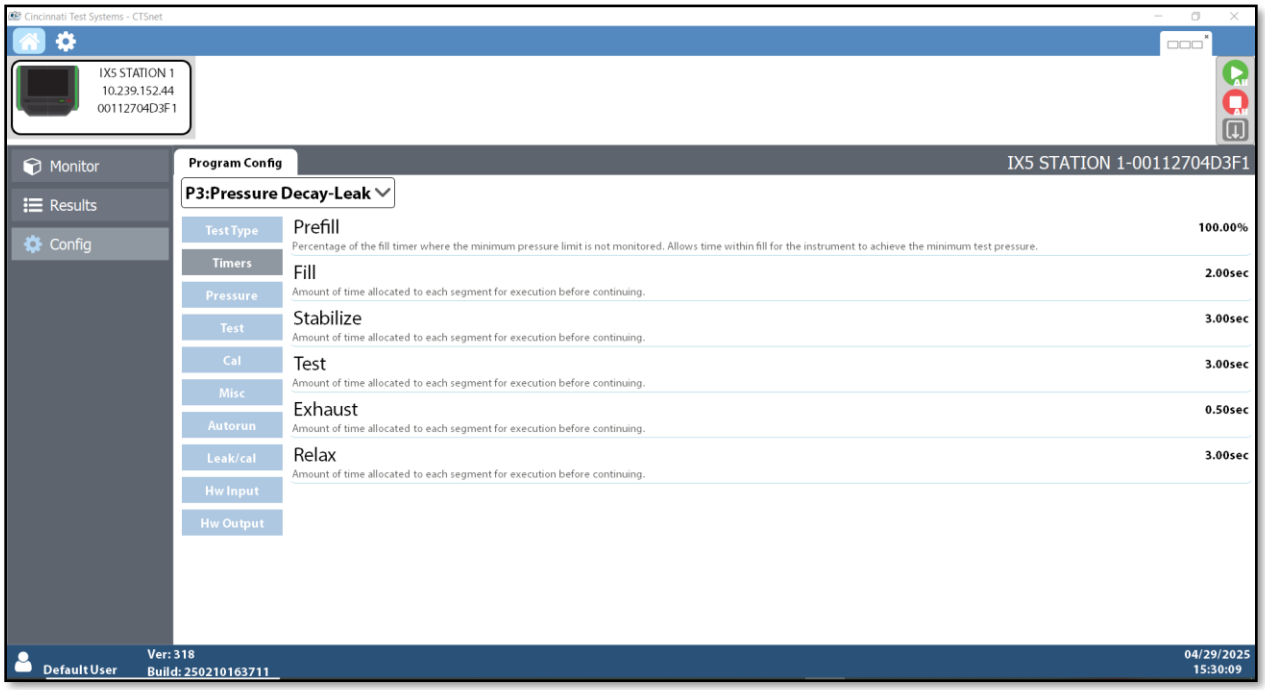
Selecting Test Types

The test type for the current program can be selected under the Tst Type menu. Refer to Chapter 2 – Setup for options. The drop-down menu at the top of the Program Config tab allows for configuration of up to 99 programs.



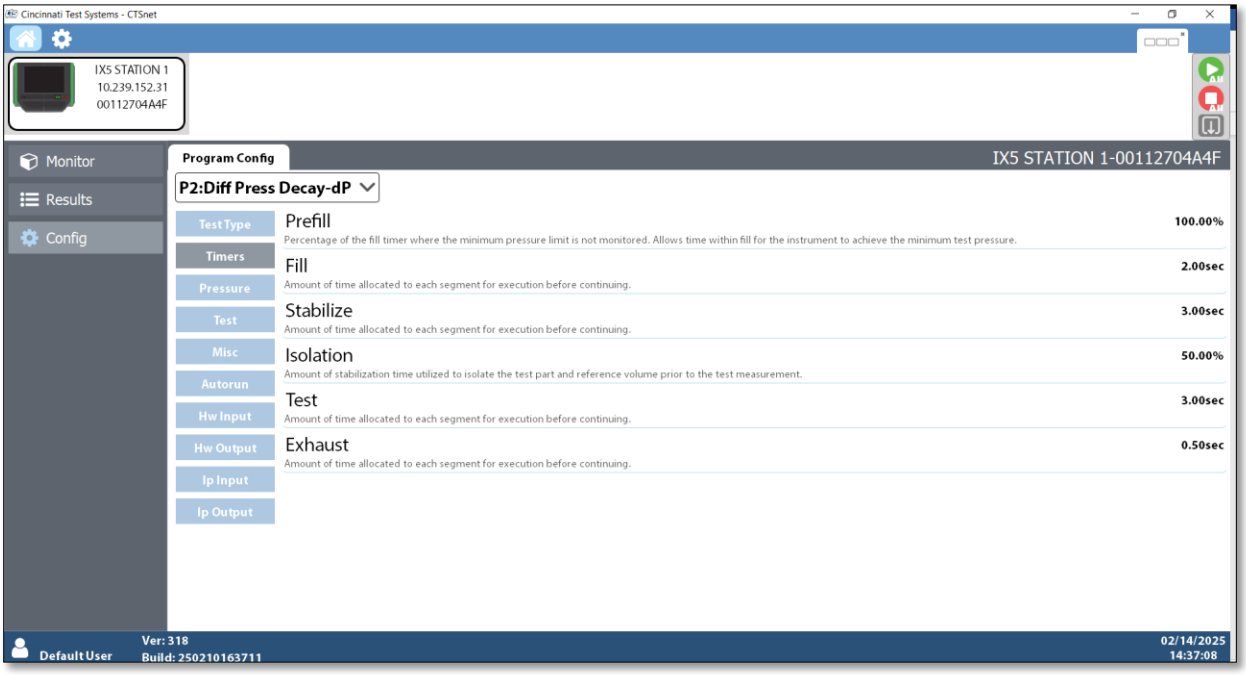
Setting Timers

Navigating to the Timers menu under the Program Config tab will allow you to set the various stage timers to the desired values. These timers may be preset at CTS for a specific set of test parameters. Please contact CTS to get information on how to set timers for your specific test. Timers are set per program and may vary depending on the selected test type.



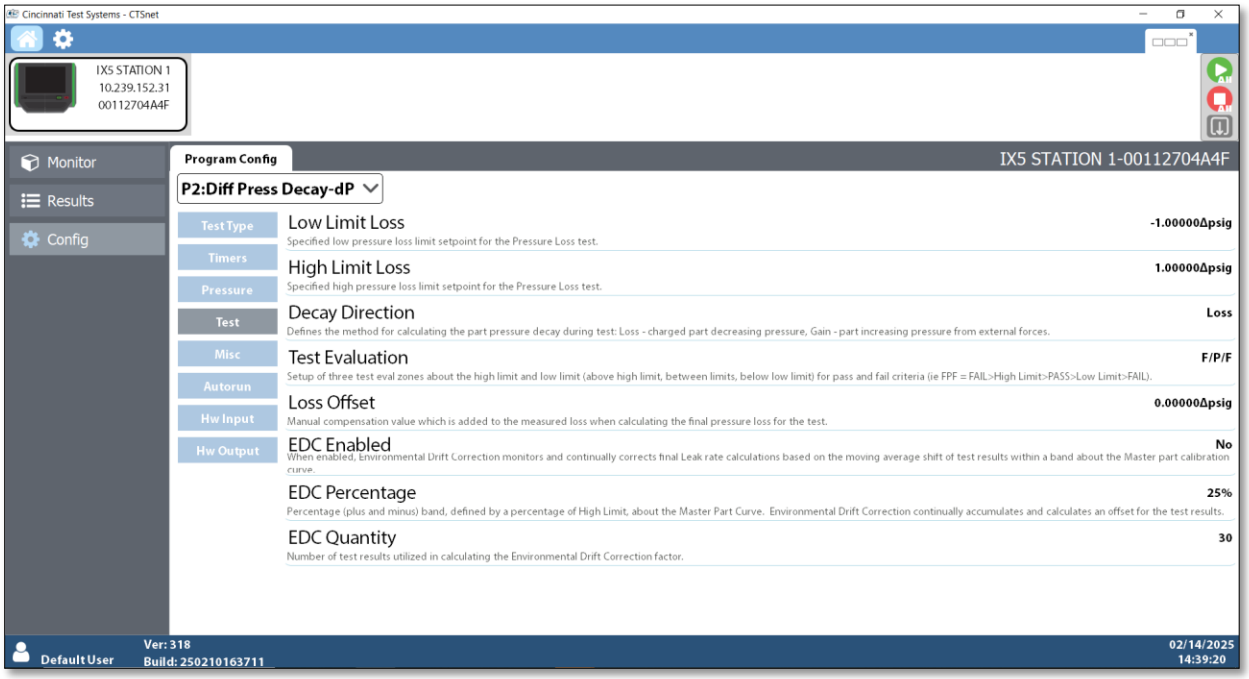
Setting Pressure

Navigating to the Pressure menu under the Program Config tab will allow you to set the target pressure for the selected test, as well as the minimum and maximum constraints for the test to continue.



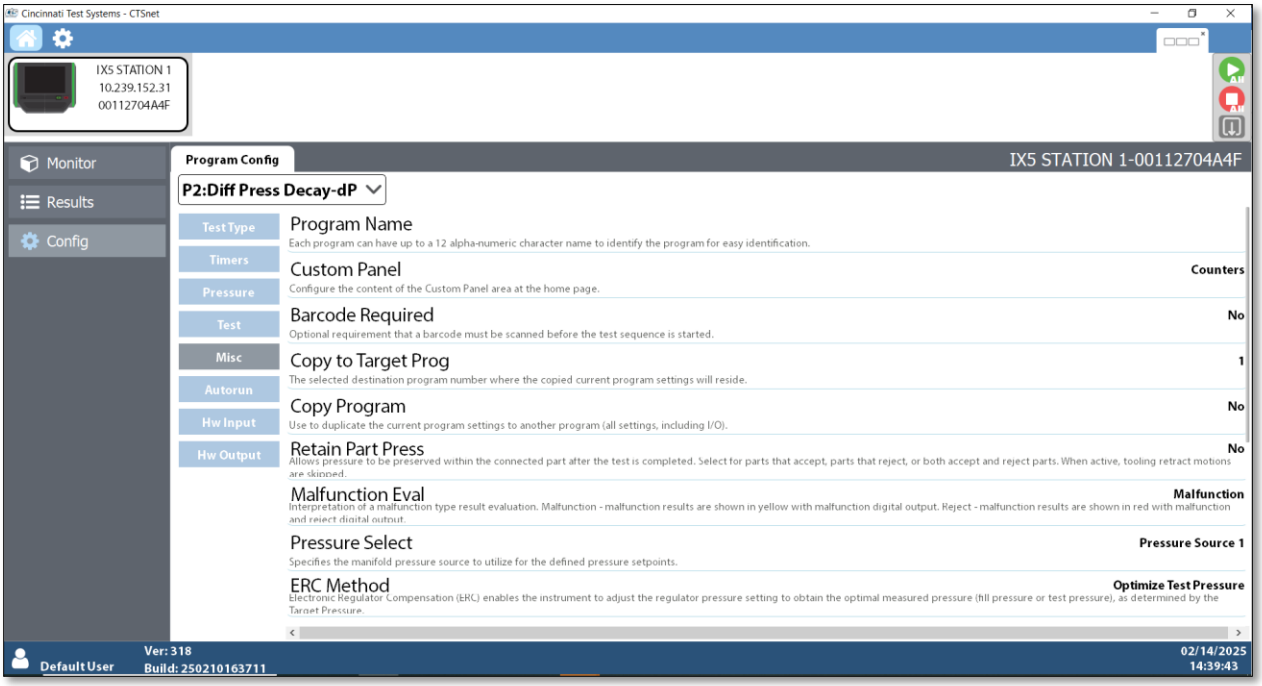
Setting Test Parameters

Navigating to the Tst menu under the Program Config tab will allow you to set the constraints of your test. For example: for a differential pressure decay test, the maximum pressure loss or gain through the test port may be configured here. Refer to the Test Type Table for setting parameters.



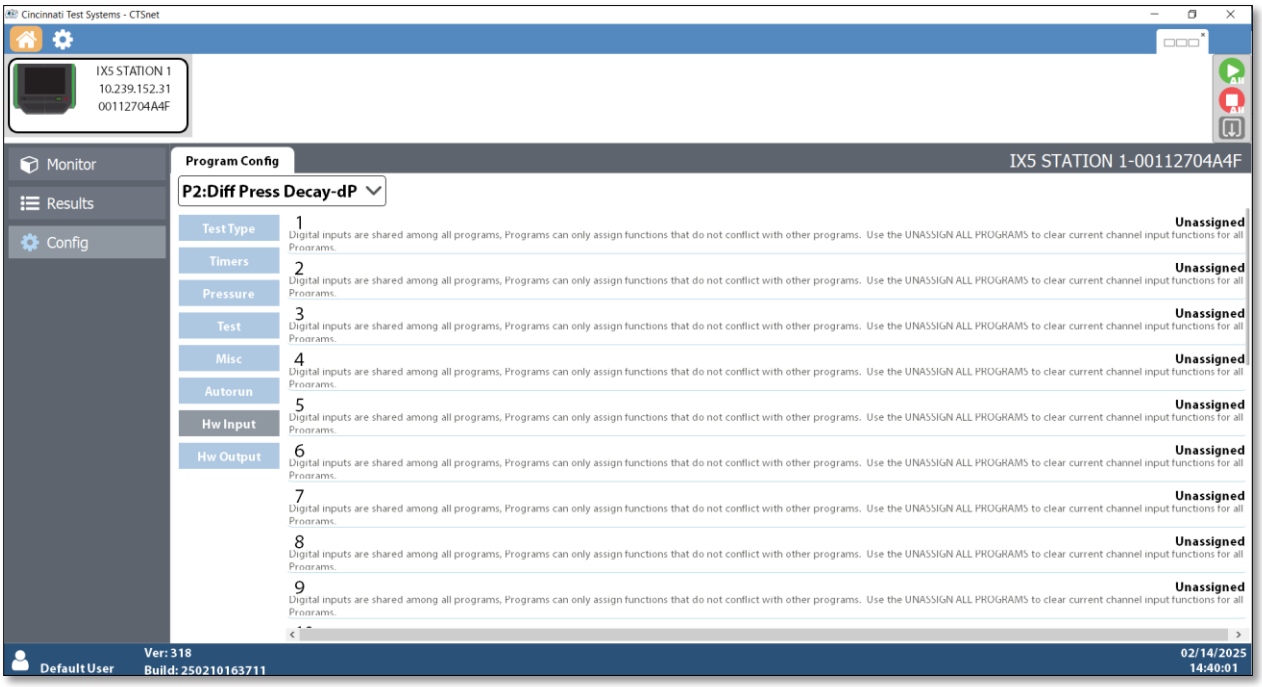
Miscellaneous settings

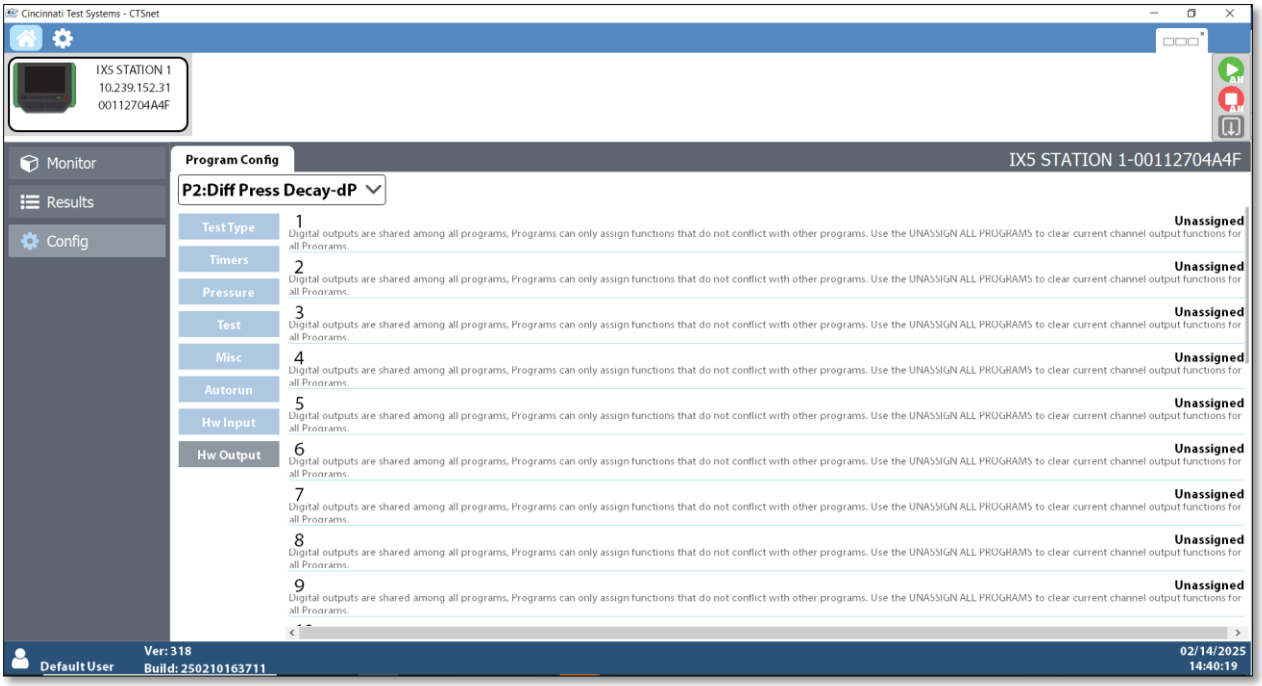
Navigating to the Misc menu under the Program Config tab will allow you to enter in a custom name for the selected program, as well as copy programs from one program to another. Various other settings, such as Electronic Regulator Control Method (if an electronic regulator is available), Prefill Method, Pressure Correction and Exhaust Method. Refer to Chapter 33 – Features for setting parameters.



Hardware Input and Output

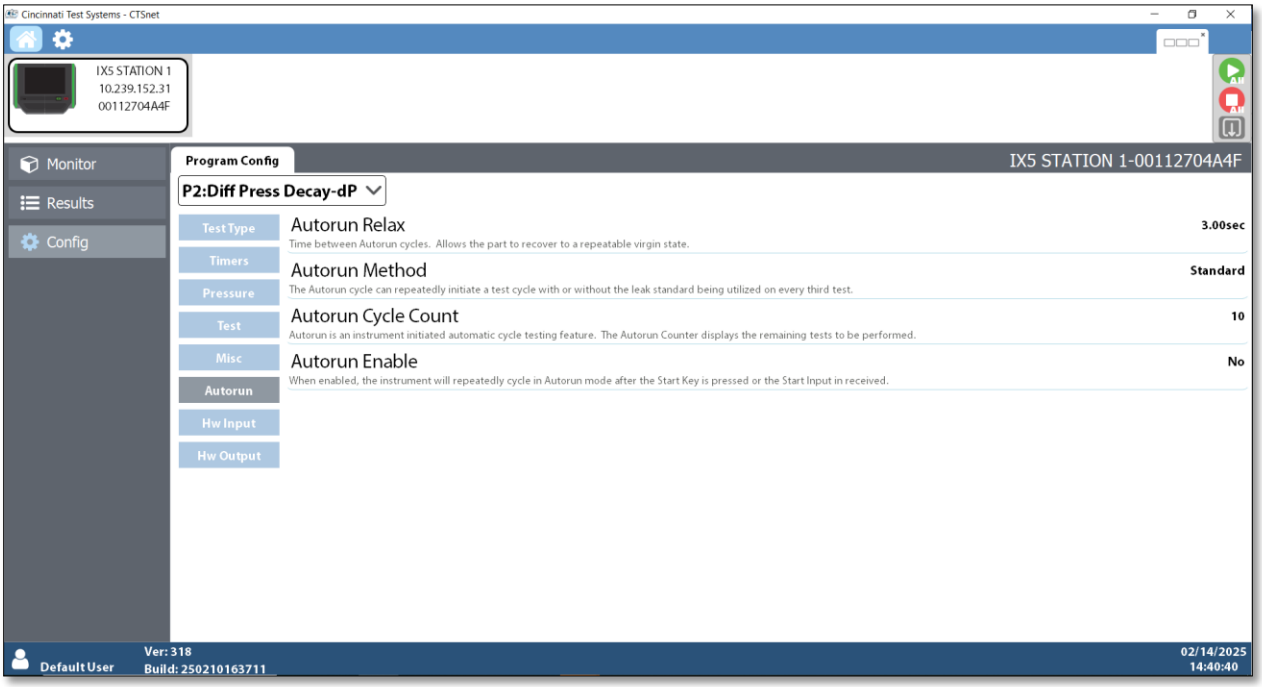
Navigating to the HW Input / Output menu under the Program Config tab will allow you to configure up to 12 inputs and 12 outputs. Refer to Chapter 26 – Inputs and Outputs for setting parameters.





Autorun

Navigating to the Autorun menu under the Program Config tab will allow you to configure automatic tests, where the selected program will be run a selected number of times. Refer to Autorun for setting parameters.



Chapter 32 – User and Security

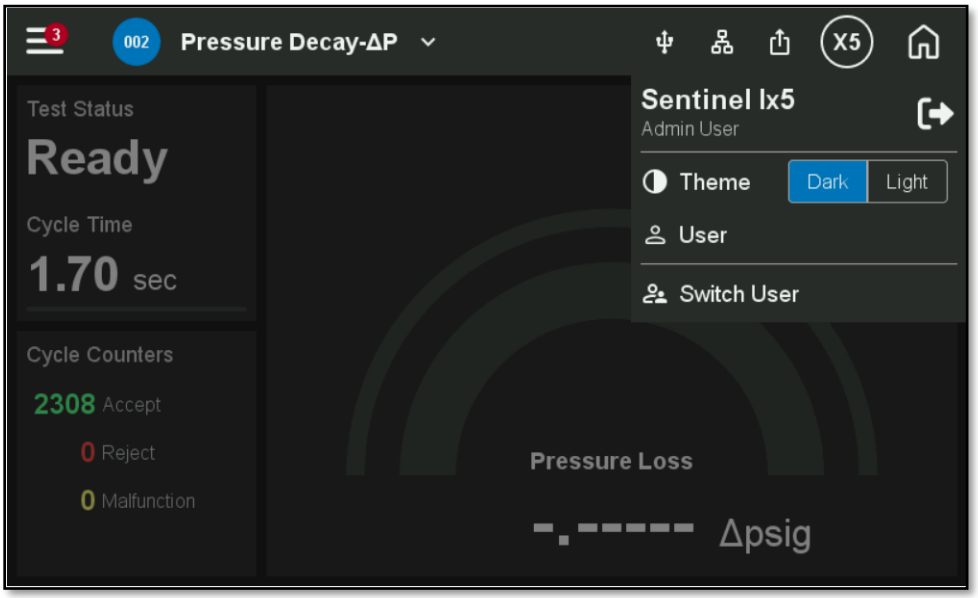
This chapter explains the activate user, New user creation and instrument security parameters. The Security menu allows flexibility in allowing access or locking functions with a password.

To configure the User setting Tap on **Main Menu > Device settings > User** menu. To make the security options enable and disable go through the users settings.

Activate User and New User creation

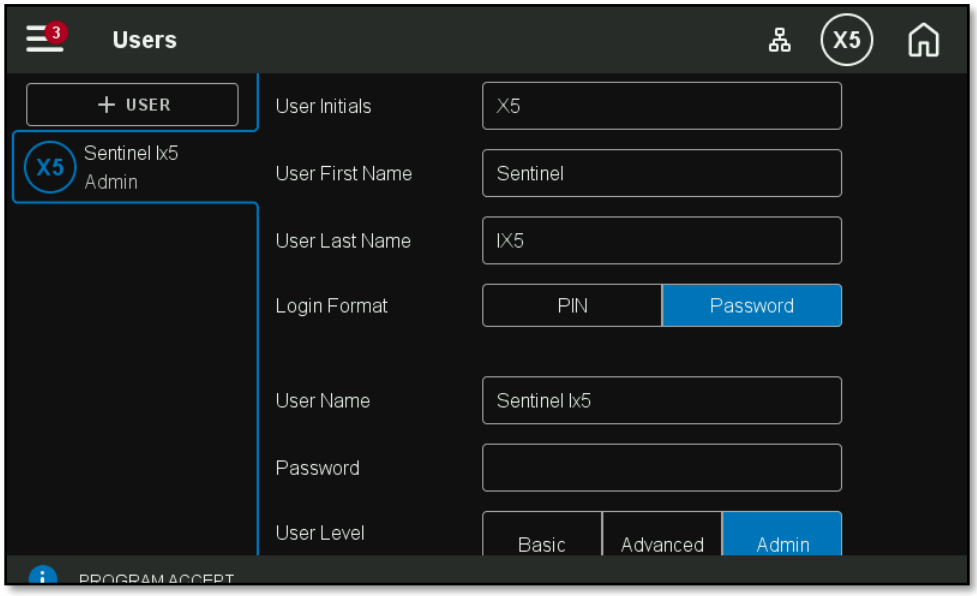
Activate User

The header displays information about the currently logged-in user, with the default user having Admin access.

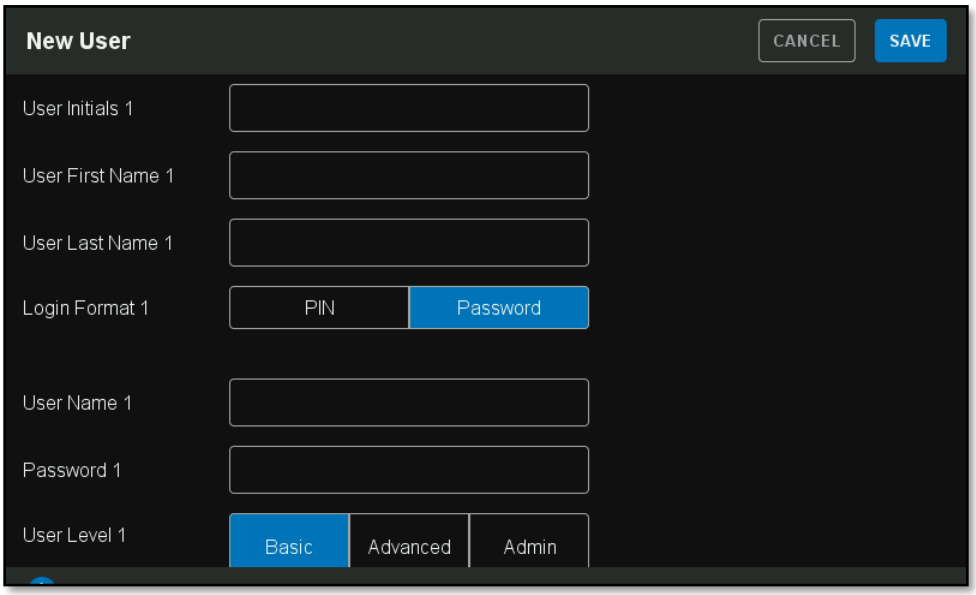


New User creation

To create a new user, go to **Main Menu** > **Device Settings** > **Users**. The screen will default to displaying information for the currently logged-in user. To add additional users, select the **+ User** option, as shown in the image below.



The instrument supports the creation of up to 25 user accounts. When adding a new user, you will be prompted to enter the required user details, as shown in the figure below. These details include Login Name, Login Format and user level. Once all required fields are filled in, confirm the information to create the new user account.

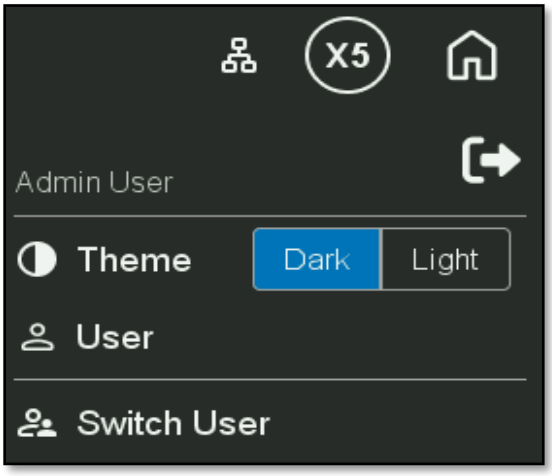


The table below describes all of the settings of new User creation

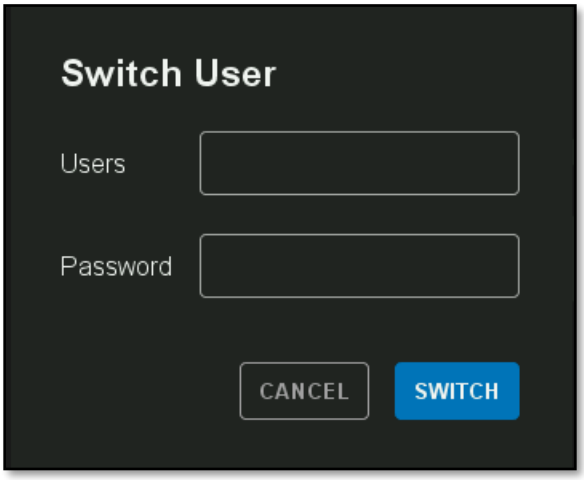
Parameter	Description	User Level
User Initials	This field allows you to enter the user's initials for quick identification.	Basic, Advance and Admin
User First Name	This field is for entering the user's first name	Basic, Advance and Admin
User Last Name	This field is for entering the user's last name	Basic, Advance and Admin
Login Format	This option lets you choose how the user will log in: PIN: The user will use a numerical Personal Identification Number (PIN) to log in. Password: The user will use a combination of letters and numbers (or potentially symbols) as their password.	Basic, Advance and Admin
User Name	This field is where you enter the unique username for the new user. This username will be used for login purposes.	Basic, Advance and Admin
Password	This field is for entering the user's password. The chosen login format (PIN or Password) will determine the type of input allowed here.	Basic, Advance and Admin
User Level	his option determines the level of access the user will have: Basic: Users with this level have limited access to system functions and features. Advanced: Users with this level have more access to system settings and features compared to Basic users. Admin: Administrators have full access to all system settings and features.	Basic, Advance and Admin
Cancel	This button discards any changes made in the "New User" screen and closes the window.	Basic, Advance and Admin
Save	This button saves the newly created user with the specified parameters and closes the window. Let me know if you have any other questions about these parameters or the user creation process.	Basic, Advance and Admin

Switch User

To switch the user locate to the User displays in the header. And select the **Switch user** option. The instrument supports multiple user accounts, allowing each operator to maintain personalized settings, preferences, and access permissions.
The "Switch User" function enables seamless transitions between different user accounts. This allows multiple users to share the instrument while retaining their unique configurations.



For enhanced security, all users are required to log in with their assigned username and password. This ensures that only authorized personnel can access and operate the instrument, and that individual settings and data are protected.



Delete User

This option is likely available to users with admin access and allows them to delete other user accounts from the system.

The system will block the deletion of a user for two conditions, if user's Auto-login feature is enabled and same user is currently active/logged in to the system.

Security

Security options are configurable through the "Enable" and "Disable" buttons within the user interface.

The table below describes all the settings in the Security menu.

Parameters

Parameter	Description	User Level
System Settings	Edit: Allow user the ability to modify various system settings, such as network configurations, date/time, and other system-level options. View: Allows the user to view the current system settings but restricts them from making any changes. Disable: The system settings get disabled not allow to user edit and view.	Basic, Advance and Admin
Hardware Settings	Edit: Provides the user with the authority to adjust hardware-related settings, such as I/O configurations and sensor calibrations. View: Enables the user to view the current hardware settings without the ability to modify them. Disable: Hardware settings get disabled not allow to user edit and view.	Basic, Advance and Admin
Program Settings	Edit: Allows the user to modify program-specific settings, such as parameters and other program-related configurations. View: Enables the user to view the current program settings without the ability to make changes. Disable: Program settings get disabled not allow to user edit and view.	Basic, Advance and Admin
Tooling Settings	Edit: Allows the user to edit Tooling settings, such as tooling time and other Tooling input/output configurations. View: Enables the user to view Tooling settings without the ability to make changes. Disable: Tooling settings get disabled not allow to user edit and view.	Basic, Advance and Admin
User Settings	Allow the user to secure the editing of user configuration parameters. Need to be in edit mode to edit this parameters.	Basic, Advance and Admin

Program Selection	Disabled: Restricts the user from selecting and running different programs on the system. Enabled: Allows the user to choose and execute different programs based on their needs.	Basic, Advance and Admin
Program Calibration	Disabled: Prevents the user from calibrating the system for specific programs. Enabled: Allows the user to perform calibration procedures for different programs.	Basic, Advance and Admin
Clear Test Results	Disabled: Prevents the user from clearing test results data. Enabled: Allows the user to clear test results data from the system.	Basic, Advance and Admin
Hold Operation	Disabled: Prevents the user from pausing or holding the test operation. Enabled: Allows the user to temporarily halt the test operation.	Basic, Advance and Admin
Reject Part Release	Disabled: Prevents the user to releasing the part on a reject. Enable: Allow user to protect releasing the part on a reject. This Functionality works only if Retract on Reject is set to "No" in the Tooling menu.	Basic, Advance and Admin
Import/Export	Disabled: Restricts the user from importing or exporting system data, such as programs, settings, or user configurations. Enabled: Allows the user to import and export system data, which can be useful for backups, sharing configurations, or transferring data between systems.	Basic, Advance and Admin
Home Lock Screen	Disabled: Allows users to access the screen without any restrictions. Enabled: Requires users to enter their credentials (username/password) before accessing the system. This adds an extra layer of security to prevent unauthorized access.	Basic, Advance and Admin
Auto Login	Allow the User to make them as default user.	Basic, Advance and Admin

Chapter 33 – Features

This chapter explains essential features of the instrument.

Setting the Date & Time

The Date and Time parameters are located in **Main Menu > Device settings > System > Misc** icon. The date and time are set at the factory. If you are in a different time zone, it may be desirable to change the date and time on the instrument. The date format can be modified with the Date Format parameter. The time format is 24 hour and cannot be changed.

Copy & Paste Programs

To simplify the setup, the instrument comes with the ability to copy all of the parameters from one program to another program. Copy Program is located in the **Main Menu > Configuration > Misc** icon of the program you want to copy. Select the **Copy to Target Prog** parameter and press **Enter**. Increment or decrement the target program number where you want to "paste" the program and press **Enter**. Then, change the **Copy Program** parameter to "Yes" and press **Enter**.

> ***Note: The copied program will overwrite all parameters in the target program. Make sure you want to overwrite this program before executing. If a program exists in the target program number, the instrument will prompt to confirm that you want to continue.***

Open Internal Leak Standard

The instrument may be configured with one or more internal leak standards. Internal leak standard valves may be manually forced open during a test to simulate a leak in the test circuit. Open Leak Std is located in the **Main Menu > Device settings > Hardware > Leak/Cal** option.

> ***Note: If the instrument is configured with an internal leak standard(s), the instrument automatically introduces the leak standard during the appropriate segments of a Program Cal routine.***

Selecting the Proper Internal Leak Standard

If the instrument is configured multiple internal leak standards the user must select which leak standard is to be used in the Program. Leak Std Select is located in **Main Menu > Device settings > Hardware > Leak/Cal** icon. The **Leak Std Select** parameter defines which leak standard is used. This must be set for each program utilized.

Changing the Functionality of the Prefill Timer

The Prefill timer function is located in **Main Menu > Configuration > Misc** option. The parameter is called **Prefill Method**. It can be set to "Percent of Fill Time", "Not to Exceed Time", "Controlled Fill", "Fixed Charge", Pre-Pressure Time

When the Prefill Method is set to "Percent of the Fill Timer", which is the default value, the Minimum Pressure must be met before the value in the Prefill is exhausted. For example, if the Fill Timer is set to 10 seconds and the Prefill Timer is set to 80% then the part must reach Minimum Pressure within 8 seconds. This allows for fixed fill times to be utilized.

When the Prefill Timer is set to "Not to Exceed Timer", the instrument will begin the cycle in the Prefill segment. Once the pressure reaches the Minimum Pressure, the instrument will exit the Prefill segment, regardless of any time remaining, and enter the Fill segment. This allows for flexible part fill times.

When the Prefill Method is set to "Controlled Fill", the instrument will begin the cycle in the Prefill Segment and will ramp up the pressure from 0 to the target pressure within the specified Prefill timer. When instrument enters the Fill segment the instrument is at target pressure.

Note: "Controlled Fill" method is available only when Electronic regulator is present in the instrument.

When the Prefill Method is set to "Fixed Charge", the instrument begin the cycle in the Charge Segment and charge the pneumatic with desired "Charge Target Press". At the end of charge timer pressure must reach "Charge Min Press" and below "Charge Max Press". Once successfully exited from the charge segment, the instrument will start to fill the part with the charged pneumatic volume.

When the Prefill Method is set to "Pre-Pressure Time", the instrument will begin the cycle in the Prefill Segment and will ramp up the pressure from 0 to the target pressure within the specified Prefill timer. When instrument enters the Fill segment the instrument is at target pressure.

Note: "Pre-Pressure Time" method is available only when Electronic regulator is present in the instrument, or when two pressure sources are present in the instrument.

Exhaust Method

The **Exhaust Method** parameter is located in **Main Menu > Configuration > Misc** option. It can be set to "Dump", "Controlled Exhaust", "External" and "Rapid".

When the Exhaust method is set to "Dump", which is the default value, the instrument will open the Exhaust valve and dump the pressure immediately after entering the Exhaust segment.

When the Exhaust Method is set to "Controlled Exhaust", when the instrument enters the Exhaust segment, the instrument will start ramping down the pressure from the last noted instrument pressure to 0 within the specified Exhaust timer. At the end of the Exhaust timer, the instrument will open the Exhaust valve and dump any remaining pressure.

When the Exhaust Method is set to "Exhaust Hold", the instrument holds the pressure in part at the end of execution after test is completed. For detailed information refer chapter 33- Exhaust Hold

When the Exhaust Method is set to "External", when an external diverter is installed and exhaust is required to be routed solely through the external diverter port.

A new "Rapid" Exhaust Method has been introduced to exhaust simultaneously via all available exhaust paths, including internal, diverter, and enhanced fill.

Note: "Controlled Exhaust" method is available only when an Electronic regulator is present in the instrument.

An external diverter must be installed and correctly configured prior to selecting this exhaust method.

Saving a Barcode with Results

Note: The instrument must be in Advanced or Admin Display User Level to view and modify the communication port functionality. To change the Display User Level, see Chapter 33 – Features.

The instrument has the capability to store barcode data with each test result. The instrument will work with any RS232 barcode scanner that has the ability to supply a barcode in an ASCII string (no longer than 40 characters) followed by a carriage return. To store the barcode information, it must be received before a Start command is received by the instrument. There is an option to require the barcode data in order for the Start command to be acknowledged.

Note: The maximum number of characters supported for barcode are 40 but the user can increase this limit up to 80 by contacting CTS service personal

The **Barcode** function is located in **Main Menu > Device settings > System > RS232 1** option **> RS232 1 Interface**. Set the parameter to "Barcode". In the same menu, set the **RS232 1 Baud** parameter to match the baud rate of the barcode scanner communication.

> ***Note: The data bits are always configured to 8. The parity is always set to None. The number of stop bits is always set to 1. The flow control is always set to None.***

If a barcode is required before a start signal is acknowledged, this parameter is located in **Main Menu > Configuration > Misc** option. Set the **Barcode Required** parameter to "Yes".

> ***Note: It is also possible to fetch Barcode Results from EtherNet/IP and PROFINET.***

Exhaust Hold

The **Exhaust Hold** method is a pressure control function used during testing in which the system maintains the pressure in the part after the test has been completed. This method ensures handling of pressure between test nodes and sequence.

Exhaust method "Hold" is located in **Main Menu > Configuration > Misc** option. Set the **Exhaust Method "Hold"**. The instrument will retain the pressure until either the part is removed from the sealing fixture or a Stop signal is initiated.

Note: The instrument must be in Advanced or Admin Display User Level to view and modify this functionality. To change the Display User Level, see Chapter 33 – Features

The Exhaust Hold method is exclusively available for configuration within Standard Test Types.This method is not supported and will not appear as a selectable option when configuring Sequence Test Types.

Rules for Standard test type Exhaust hold execution

- After a part has been tested, the exhaust segment will not execute automatically.
- A Hold icon is displayed on the monitor when the Exhaust Hold function is active.
- The system maintains pressure after the test until manually released.
- The operator must press the Stop button or using via Stop/Reset, Vent/Halt I/O, after which a "Vent/Reset" message is displayed.
- In the event of malfunctions or system errors, cycle stops and pressure will be exhausted.

Rules for sequence test type Exhaust hold execution

- Between child nodes that have exhaust hold configured, hold pressure is maintained, and the hold icon is displayed.
- During delay nodes, prompt nodes, or tooling extend/retract nodes, previous executed node pressure is maintained.
- Pressure will be exhausted at the end of the sequence.
- If the Stop button is pressed or via I/O signal is given in between, the sequence stops execution immediately.
- In the event of malfunctions or system errors, the sequence stops and pressure will be exhausted.

Turning On/Off Target Pressure Correction

In several test types the instrument uses pressure correction to enhance the performance of the instrument. There are times where pressure correction may not be desirable. For these cases, the instrument has the ability to select whether or not pressure correction is used. It is located in the **Main Menu > Configuration > Test** option. Change the **Target Pressure Correction** parameter to the desired setting.

Ambient Factor

This setting defines the amount of gain applied to changes in ambient pressure to correct measurements. The value entered here determines the sensitivity of the measurement correction to fluctuations in ambient pressure. It is in the **Main Menu > Configuration > Misc** option.

Ambient Pressure correction

The system monitors ambient pressure variations during the test using a secondary pressure sensor. Based on the detected change in part volume, a correction factor is automatically applied to the test result. It is located in the **Main Menu > Configuration > Misc** option.

This compensation method is intended for testing large, flexible-volume parts and is available only when the Expanded Pressure Decay option is enabled.

.

Max Ambient Delta

To ensure ambient pressure changes stay within an acceptable range. If this limit is exceeded, the test will automatically stop and report an malfunction.

> ***Note: "Ambient Pressure Correction" will appear as a new option in the test menu for Pressure Decay-DP and Pressure Decay-Leak Std test types.***

Setting the Cal Method and Leak Standard Location

The **Cal Method** parameter is located in the **Main Menu > Device Settings > Hardware > Leak/Cal** option when the **Leak Standard** is set to "Channel". The **Cal Method** parameter is located in the **Main Menu > Configuration > Misc** option when the **Leak Standard** is set to "Program".

Select Parameter	Description	Explanation
One Part – Int. LS	Automatic test cycling using Leak Standard located inside the instrument	Automatically tests same non-leaking master part twice; the second time using a calibrated leak standard mounted on the internal manifold.
One Part - Ext LS	Manual testing of same part using Leak Standard provided outside the instrument	Tests same non-leaking master part twice; the second time using calibrated leak standard provided externally from the instrument. The instrument will prompt the operator to attach the leak standard when it is time.
Multi-Part – Int. LS	Manual testing of two parts using a Leak Standard located inside the instrument	Tests two different non-leaking master parts using the calibrated leak standard mounted on the internal manifold. Any tooling must retract between tests to change parts. A Start signal is required either by the user interface or remotely using programmed start test logic to initiate the second test after changing non-leaking master parts.
Multi-Part – Ext LS	Manual testing of two parts using Leak Standard provided outside instrument	Tests two different non-leaking master parts using the calibrated leak standard provided externally from the instrument. Any tooling must retract between tests to change parts. A Start signal is required either by the user interface or remotely using programmed start test logic to initiate the second test after changing non-leaking master part with leak standard.

Autorun

Sometimes it is desired to have the instrument cycle automatically without any need for a person to press the Start button or send a start signal using the digital inputs. The Autorun feature is designed to accomplish this. **Autorun** is located in **Main Menu > Configuration > Autorun** option. The following menu will display on the screen.

Parameter	Description	Display User Level
Autorun Relax	The amount of time the instrument pauses in between cycles.	Advanced, Admin
Autorun Method	There are two options for this parameter. "Standard" which runs a normal leak test every cycle or "LS on 3rd" which opens the internal leak standard (if supplied) every 3rd cycle.	Advanced, Admin
Autorun Cycle Count	The number of cycles left in the Autorun sequence. This parameter is used to determine how many cycles are conducted in an Autorun.	Advanced, Admin
Autorun Enable	When this parameter is set to "Yes" a start command will initiate the Autorun sequence.	Advanced, Admin

Malfunction evaluation as Reject

Malfunction Eval is located in **Main Menu > Configuration > Misc** option with the options of **Malfunction** and **Reject**. Malfunction evaluation helps to get all the malfunction messages including all program calibration malfunctions messages either as Malfunction (Yellow color) or as Reject (Red color) as per setting done. "Malfunction" and "Program Reject", both outputs will go high if Malfunction Eval is set as **Reject.**

Batch Calibration

The Batch Calibration feature allows multiple calibration sequences to be performed. Results are averaged to calculate the final calibration values. The **Batch Calibration** parameter is located in the **Main Menu > Configuration > Leak/Cal** option and allows for enabling or disabling of batch program calibration mode. When enabled, three more parameters "Batch Layout", "Batch Quantity" & "Average Quantity" are visible to user.

Parameter	Description	Display User Level
Batch Layout	Defines the layout of batch calibration. When Batch Layout is set to "Alternating", which is the default value, the instrument performs the first 'Master' calibration, then the first 'Master+Leak' calibration, then alternates between the two for the remaining batch quantity. When Batch Layout is set to "Grouped", the instrument first performs all 'Master' calibrations, then all 'Master+Leak' calibrations.	Advanced, Admin
Batch Quantity	Defines the number of calibration sequences in the batch. Minimum value is 2 and maximum value is 25.	Advanced, Admin
Average Quantity	Defines the number of calibration sequences utilized to average calibration data out of Batch quantity. The value must be less than or equal to Batch Quantity.	Advanced, Admin

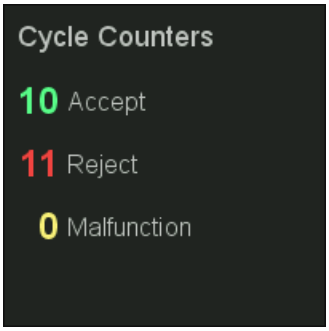
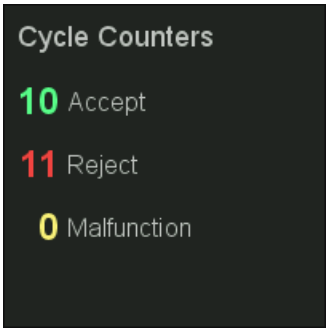
Prefill Pressure Check

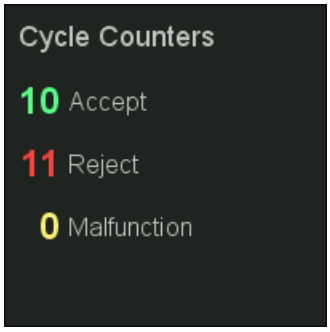
Prefill Pressure Check is located in **Main Menu > Configuration > Misc** icon with the options of **Enabled** and **Disabled.** Prefill pressure check determines the prefill pressure monitoring.
When enabled, the instrument monitors the pressure during Prefill time. When disabled, the instrument skips the pressure monitoring during Prefill time.

> ***Note:*** ***This parameter is only available if the*** **Prefill** ***Method selected is "*****Percent of Fill Time*****" or "Pre-Pressure Time".**

Custom Panel

The **Custom Panel** feature is located in the **Main Menu** > **Configuration** > **Misc**. This feature provides options for displaying content in the left-bottom area of the home screen, with the display settings, Like When set to **Image**, the part image is displayed. When set to **Counter**, the counters for the current active program are shown. When set to **Phases**, the current program phases are displayed.

	Custom Panel option set to "Counters". an "Accept" outcome could indicate successful completion of a test or process. A "Reject" outcome. This could indicate failures or deviations from expected results. A "Malfunction." This likely indicates a critical error or system failure that halted the process.
	Custom Panel option set to "Phases". It shows the Active test Phases.

	Custom Panel option set to "Image". It displays the part image.
	The Custom Panel set as Sequence option allows users to display the sequence of a test type. This option is only available for sequence test types. **Green:** Indicates an **Accept** (Pass) status for that specific program. **Red:** Indicates a **Reject** (Fail) status for that specific program. **Bule** : Indicates the test in progress.

Chapter 34 – Barcode

This document outlines the supported barcode scanners, necessary specifications, and the step-by-step process for connecting and verifying a scanner with the device.

Supported Barcode Scanners

To ensure reliable operation and data integrity, this system is designed to support a single physical barcode reader. The use of multiple concurrent readers is currently unsupported

You may purchase any of the models or a comparable alternative, provided it meets the specified technical and configuration requirements

Recommended Scanner Specifications

Barcode Scanner Requirements and Specifications

Barcode specifications are crucial for system reliability. Please ensure your barcodes strictly meet the following length and character requirements. Meeting these limits is essential to prevent display errors and data corruption.

Supported Barcode Length

The maximum supported length for the decoded data string from any barcode is 80 characters.

Note: Barcodes containing data longer than 80 characters may be truncated, resulting in incomplete or incorrect data being registered by the device.

Supported Character Set

The content encoded within the barcode must exclusively utilize characters from the comprehensive list below. Our device's input engine is configured only to accept this specific character set.

Category	Supported Characters
Numeric	0-9
Alphabetic	A-Z a-z
Punctuation	`. , ! ? ' " ``
Mathematical	+ - = * / % < >
Brackets/Enclosures	( ) [ ] { }
Special Symbols	@ # $ ^ & _ ~ |
Character	Space

The instrument correctly processes multiple simultaneous keypresses. This ensures that rapid data streams from your barcode scanner are captured in full without any characters being dropped.

When entering barcodes, the Backspace key can be used to delete the last character, the Delete key can be used to clear the entire entry, and the Numeric Keypad can be used to manually type in numbers.

Non-essential control and function keys are automatically ignored. This prevents accidental commands from disrupting your workflow and ensures that only clean barcode data is processed.

Ensure the barcode is terminated with Carriage Return and Newline.

Barcodes containing any characters not listed above are considered unsupported and may cause unexpected behavior, including failing to display correctly, data transmission errors.

Space is supported but may need consideration while parsing result from terminal or reports

Recommended Scanner Specifications

When selecting a barcode scanner, whether it is one of our recommended models or an alternative device, it must meet the following hardware and configuration requirements to function correctly with your system

Specification	Requirement	Purpose and Detail
Suffix Support	Must support adding an "Enter" (Carriage Return and newline) suffix after each scan	This suffix is critical. It automatically registers the data and acts as the 'submit' command, eliminating the need for manual input after every scan.
Barcode Types	1D or 2D barcodes (depending on your application)	The specific type (1D or 2D) depends on the format required by your application. Ensure the scanner can decode the necessary symbology's.
Communication Mode	RS232 Mode	The scanner shall support RS232 serial communication with standard DB9 connector for direct wired integration with the device. Supported baud rates are configurable from settings.
	USB HID (Keyboard) mode	The scanner must have standard USB-A plug and emulate a standard USB HID keyboard. This is essential for the device to correctly interpret the scanned data as keystrokes.

Settings and Configuration

Before connecting your barcode scanner to the device, it is critical to configure its communication settings to ensure proper data transmission.

1. Ensure your scanner is configured in Keyboard (HID) mode for USB Mode or RS232 Mode for Serial support with DB9 connector.

2. If you encounter unexpected behavior or errors, locate and scan the barcode to reset the scanner to factory defaults before attempting other configuration changes.
3. Add "Enter" (Carriage Return and Newline) after each scan.
4. Depending on your application's needs, you may need to enable specific barcode symbology or disable unnecessary ones to improve scan performance.

Connect Scanner to device

Once your barcode scanner is correctly configured for USB or Serial mode and the "Enter" suffix, follow these simple steps to establish the physical connection to your device.
For USB mode:

1. Locate a USB Port: Identify an available standard USB port (typically a rectangular USB port) present on the side of the device and down to the Ethernet port.
2. Plug in the Scanner: Connect the barcode scanners for USB cable directly into the identified USB port.
3. Automatic Recognition (Plug-and-Play): Most modern USB scanners are plug-and-play. This means your device's operating system should automatically detect the hardware and load the necessary generic drivers without requiring manual installation or additional software.
4. Wait for Initialization: Allow a few seconds (typically less than 10 seconds) for your device to fully recognize and initialize the scanner.

For Serial Mode:

1. Locate a RS232 Port: Identify available RS232 DB9 port which is present on the side of the device. Use any of the free ports on the side of the device.
2. Configuration: On instrument, goto Device Settings -> System and configure RS232 Interface as Barcode. Then set the appropriate Baud Rate.
3. Wait for Initialization: Allow a few seconds (typically less than 10 seconds) for your device to fully recognize and initialize the scanner.

Verify Operation

After connecting your scanner, perform the following two steps to confirm that it is correctly communicating data to your device and that the configuration is accurate.

Step 1: Perform a Successful Scan

a. Direct the scanner's light beam or crosshair squarely at a barcode.
b. Press and hold the trigger until you receive positive feedback, typically a beep or a flash of the scanner's light—to indicate a successful data read.

Step 2: Check for Device Recognition

c. Scan a known barcode (e.g., a product label or a test barcode you generated)
d. The numbers or text encoded in the barcode must immediately display on your device's screen.
e. Verify that the barcode data appears correctly on your device's screen.

Note: If the barcode data does not appear, or the "Enter" suffix is missing, please refer immediately to the Troubleshooting section for configuration fixes.

Troubleshooting

If you encounter issues during setup or operation, use this section to diagnose and resolve common barcode scanner problems.

Issue: No Data Output After Scanning

Symptom: You hear the beep indicating a successful read, but no barcode data appears on the device's screen.

Likely Cause	Solution
Missing "Enter" or Suffix After Scan (The scanner is missing the programming to send the Carriage Return (Enter) command after the data string.)	Scan the "Add Enter Key" configuration barcode from your scanner's user manual. This programs the scanner to automatically send an Enter/Return command after each scan.

Issue: Scanner Not Responding

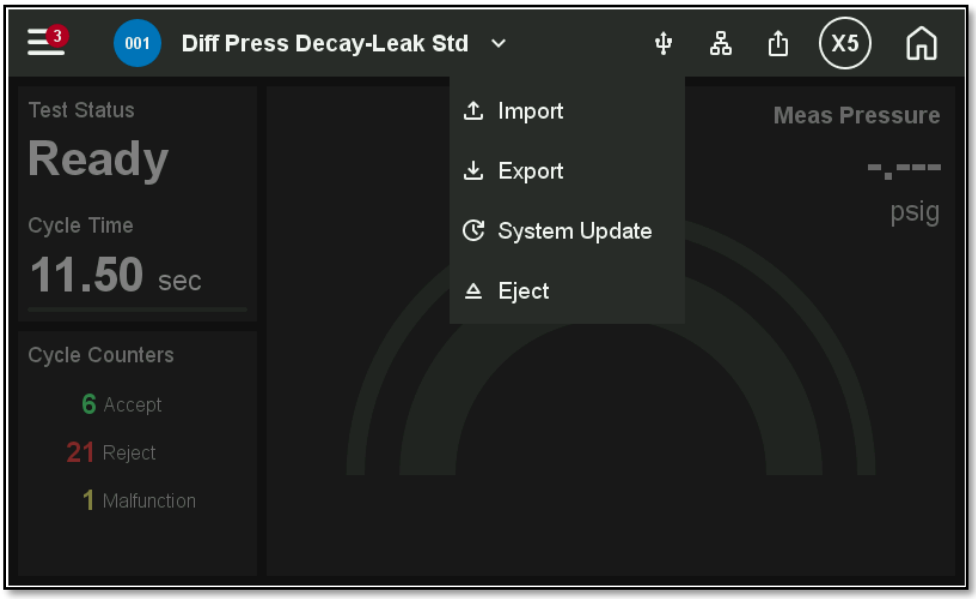
Symptom: The scanner light does not turn on, you hear no beep, and the device does not acknowledge the hardware.

Likely Cause	Solution
Configuration or Connection Error	Ensure the scanner is set to Keyboard (HID) mode. Try scanning the "Restore Default Settings" & "Add Enter Key" barcode from the user manual. Reconnect the scanner to a different port or restart your device.

Chapter 35 - USB Import and export

This chapter explains the USB functionality allows you to import instrument settings, backup and restore data, export configurations and results, perform firmware updates, and eject the USB device.

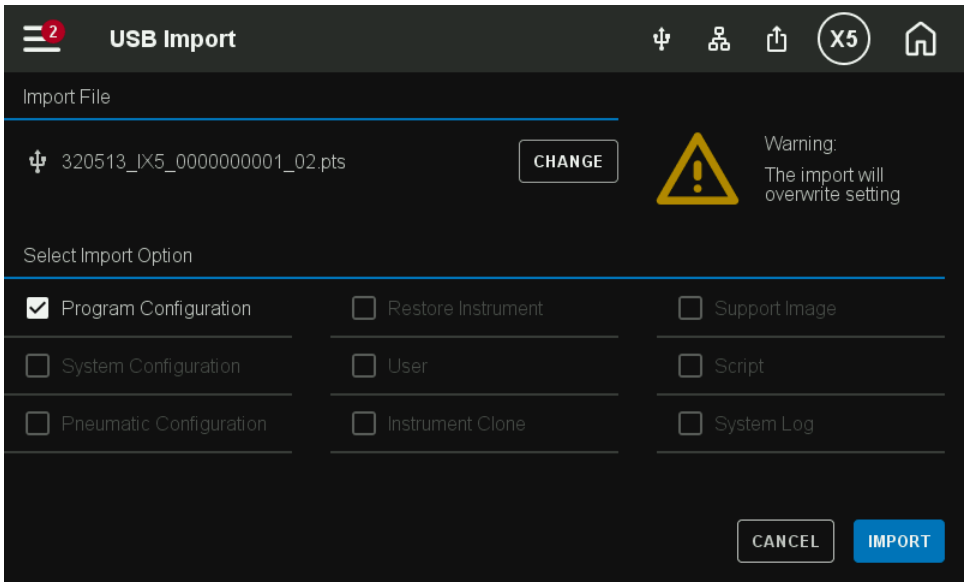
The USB functionality of your instrument is a powerful tool that allows you to manage backups, configurations, results, logs, firmware updates, and ejection of storage devices. By following the steps outlined in this manual, user can ensure your data is stored and your system stays updated for optimal performance.



Import Functionality

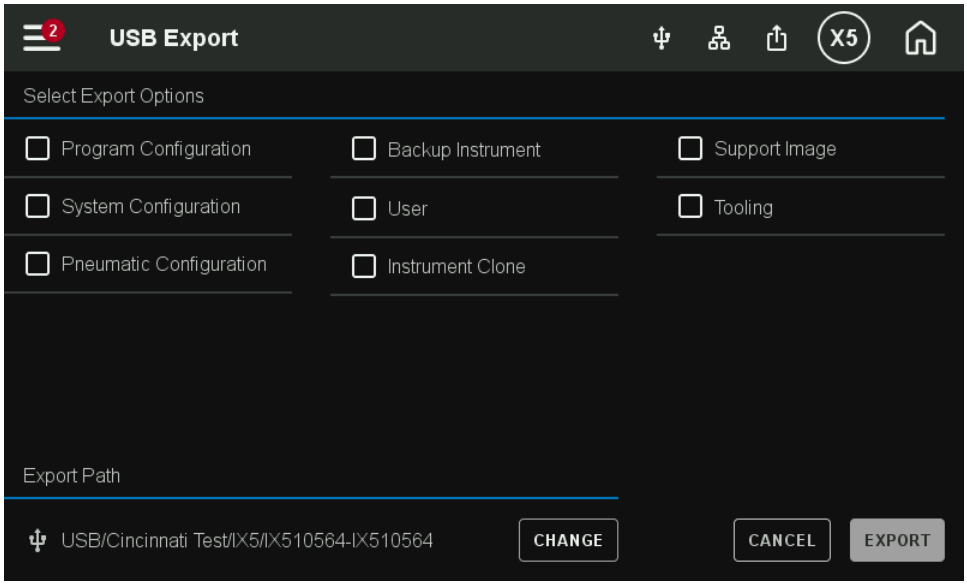
The USB functionality enables you to import a clone of your instrument's configuration, restore the backups, and Restore program data. This feature makes it easy to save and restore your instrument's settings and data.

To restore a backup file, tap the "Change" button and select the desired backup file. After selecting the file, tap the Import option to begin the restore process. Once the import is complete, tap Import again to confirm and finalize the restoration.



Export Functionality

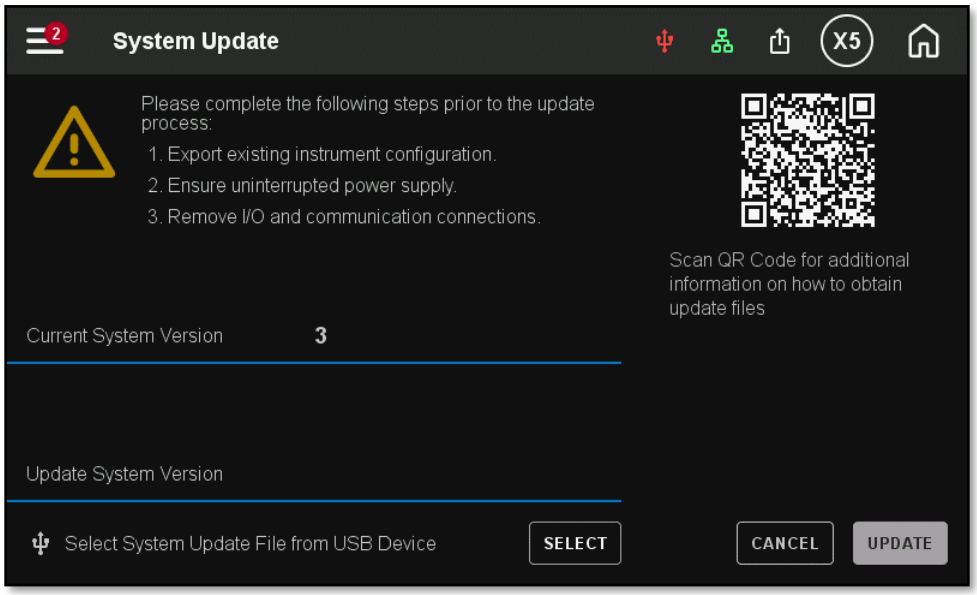
This function allows you to export the instrument's settings, configuration reports, Support image and logs to a USB device for backup, analysis, or further processing.
To export files, select the required export option and choose the destination path for saving the files. After selecting the export path, tap the Export button to start the export process.



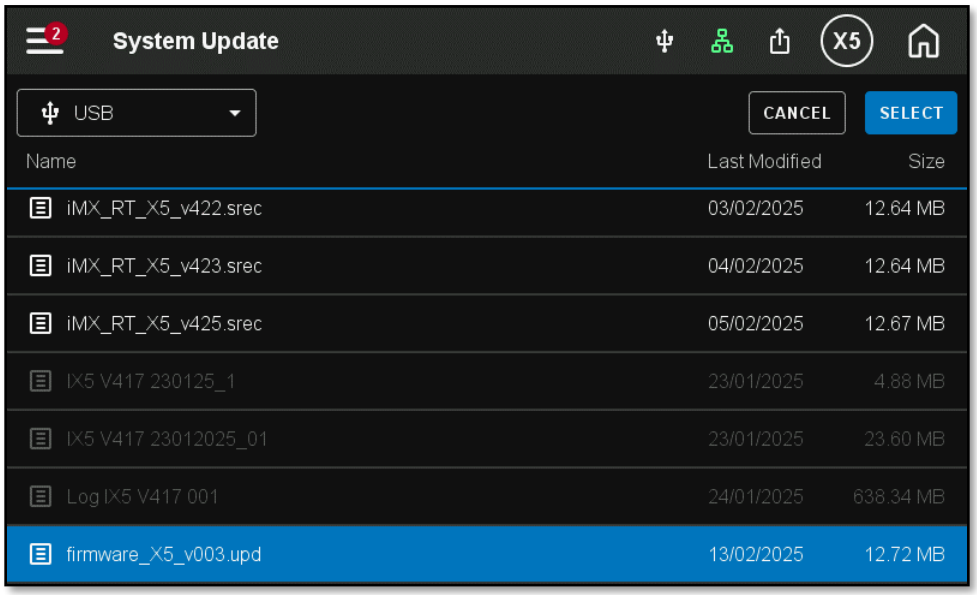
System Update

This functionality allows you to perform firmware upgrade or downgrades using a USB drive containing the desired firmware file. Keeping your firmware updated ensures that the instrument operates with the latest features and improvements.

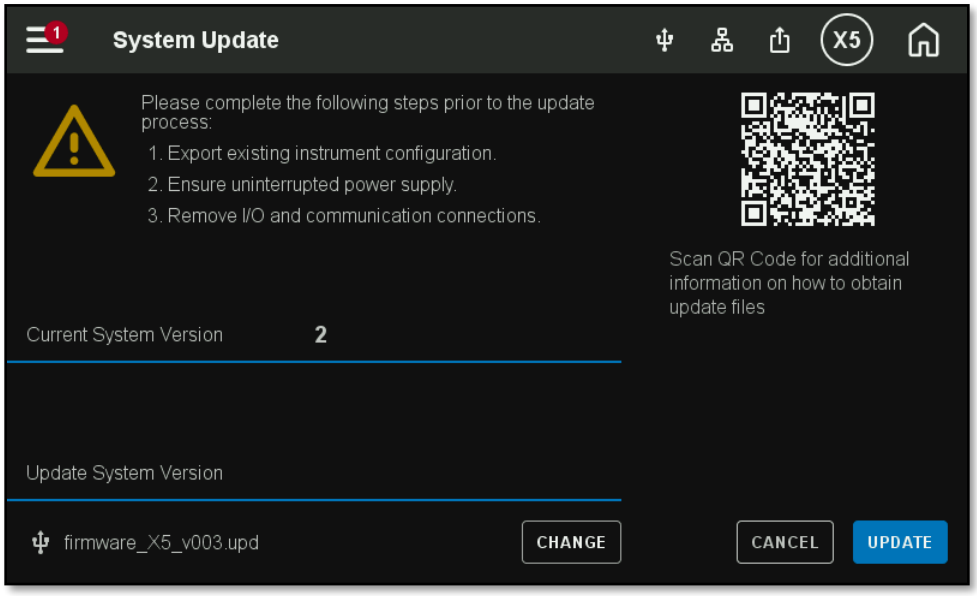
The following image outlines the process for updating the firmware on your X5 device. Please read these instructions carefully before proceeding with the update.



Navigate to the System Update screen through USB icon available in top bar on your X5 device. This screen should display the current system version and provide options for updating the firmware.
On the System Update screen, select the (.upd) "Select System Update File from USB Device" option and choose the appropriate update file from the list displayed.



After selecting the update file. Click the "UPDATE" button to begin the firmware update process.



This QR code will direct you to a website or location where Customer support and technical assistance presented.

> ***Note: If the firmware version is a minor revision all of the parameter settings will be kept the same. However, if the firmware version is a major revision all of the settings will be cleared. See the firmware documentation to determine if the firmware version you are upgrading from will cause the settings to be cleared. To be safe, always perform a Backup Instrument and Instrument Clone before updating firmware.***

USB Eject Functionality

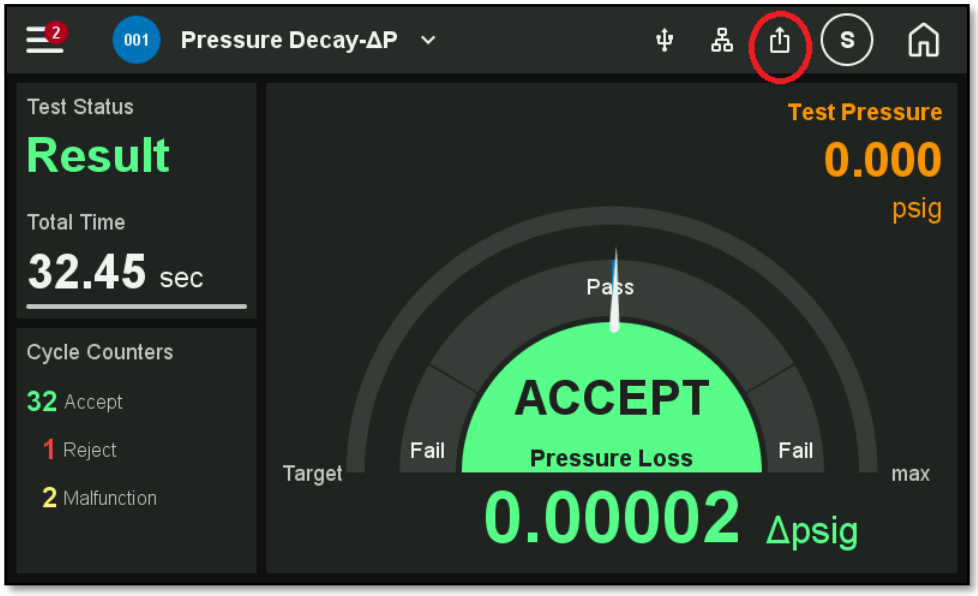
To avoid data corruption or loss, always use the proper procedure to eject the USB device from the instrument.

Note: Always use the "Eject" function before physically removing the USB drive. Removing the drive without properly ejecting, can corrupt data on the drive or cause errors on the instrument.

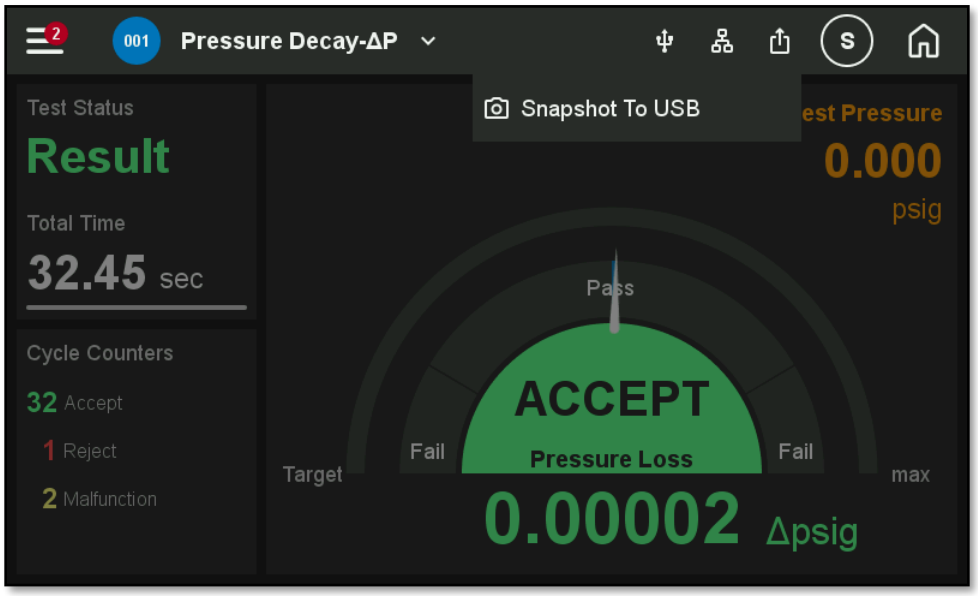
Data To USB Functionality

The instrument provides a built-in method for capturing and saving screenshots directly to a USB drive.

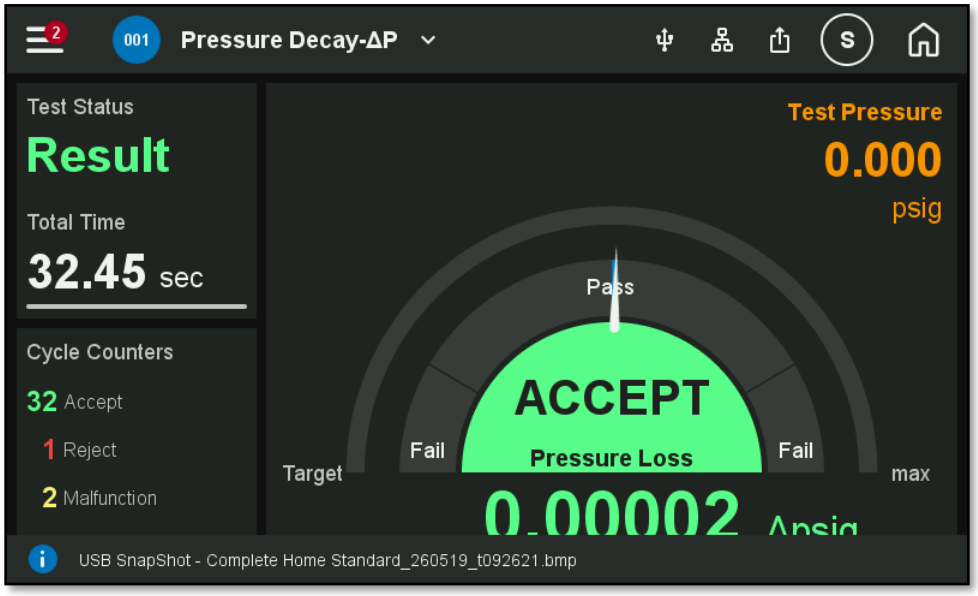
Plug your USB flash drive into an available USB port on the instrument.



From the options presented, select **Snapshot to USB**. The system will immediately capture the current screen display.



Verify that a snackbar notification appears at the bottom of the screen, confirming the file has been successfully written to the drive



Captured images are saved as bitmap (.bmp) files. The instrument automatically organizes these files into a specific directory structure on your USB drive based on the equipment. (USB_Drive:\Cincinnati Test\IX5\<Instrument Name>-<Instrument Serial>\Screen shots*.bmp)

Note: Do not remove the USB drive until this notification appears.

Chapter 36 – Self-Test and Instrument Calibration

This chapter explains the Set/Span parameters for the pressure transducer, flow transducer, and electronic regulator.

Note: Your instrument may not have a flow transducer or an electronic regulator.

These parameters are located in **Main Menu > Device settings > Hardware > Set/Span** option.

Verifying a Transducer

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 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.

> ***Note: A Transducer Verification Report may be downloaded from the instrument if desired. See the Reports section on the last page of*** Chapter 29 – Communication.

Calibrating a Transducer

The transducers have been calibrated at the factory. A calibration of the transducer should be done periodically according to the quality standards at your facility. The instrument is capable of doing a multiple point calibration. The number of points is determined by the user. You may select up to 32 points for calibration. You will need a calibrated master pressure gauge to calibrate the transducer on the instrument. On the **Set/Span** menu, select which transducer you want to calibrate. Press Enter to enable the edit function. Change the value to "Yes". The following menu will display on the screen.

Transducer 1 Cal Menu (Pressure)

Parameter	Description	Display User Level
Number of Points	The number of setpoints to be used for the transducer calibration procedure. Value must be 2 to 32.	Basic Advanced, Admin
Setpoints 2 – 32	The user is able to define the setpoints at which the calibration occurs. The number of setpoints shown is based on the number of points selected in the parameter above.	Basic Advanced, Admin
Linearity Limit	The maximum allowed linearity variance for a successful calibration.	Basic Advanced, Admin
Start Calibration	Commences the calibration procedure. A wizard will walk you through the calibration process.	Basic Advanced, Admin

Note: A Transducer Calibration Report may be downloaded from the instrument if desired. See the Reports section on the last page of Chapter 29 – Communication.

Transducer 2 Cal Menu (Flow)

Parameter	Description	Display User Level
Number of Points	The number of setpoints to be used for the transducer calibration procedure. Value must be 2 to 32.	Basic Advanced, Admin
Pressure Mode	Determines whether one pressure value is utilized for all setpoints or if individual pressure values are used for each setpoint when calibrating or verifying the transducer.	Basic Advanced, Admin
Setpoints 2 – 32	This parameter is only visible if Pressure Mode is set to "Multi Pressure". The user is able to define the setpoints at which the calibration occurs. The number of setpoints shown is based on the number of points selected in the parameter above.	Basic Advanced, Admin
Cal Pressure	This parameter is only visible if Pressure Mode is set to "Single Pressure". It is the desired pressure for all setpoints when calibrating or verifying the transducer.	Basic Advanced, Admin
Pressure Correction	Allows the instrument to perform measurement corrections when calibrating or verifying the transducer based on the relationship between the setpoint pressure and the actual measured pressure.	Basic Advanced, Admin
Linearity Limit	The maximum allowed linearity variance for a successful calibration.	Basic Advanced, Admin
Start Calibration	Commences the calibration procedure. A wizard will walk you through the calibration process.	Basic Advanced, Admin

Note: A Transducer Calibration Report may be downloaded from the instrument if desired. See the Reports section on the last page of Chapter 29 – Communication.

Transducer 2 Cal Menu (Differential Pressure)

You will need a calibrated master pressure gauge and a calibrated pressure source to calibrate the transducer on the instrument.

Parameter	Description	Display User Level
Number of Points	The number of setpoints to be used for the transducer calibration procedure. Value must be 2 to 32.	Basic Advanced, Admin
Setpoints 2 – 32	The user is able to define the setpoints at which the calibration occurs. The number of setpoints shown is based on the number of points selected in the parameter above.	Basic Advanced, Admin
Linearity Limit	The maximum allowed linearity variance for a successful calibration.	Basic Advanced, Admin
Start Calibration	Commences the calibration procedure. A wizard will walk you through the calibration process.	Basic Advanced, Admin

Note: A Transducer Calibration Report may be downloaded from the instrument if desired. See the Reports section on the last page of Chapter 29 – Communication***.***

Calibrating an Electronic Regulator

The electronic regulator has been calibrated at the factory. The instrument is capable of doing a multiple point calibration. The number of points is determined by the user. You may select up to 20 points for calibration. You will need a calibrated master pressure gauge to calibrate the electronic regulator on the instrument. On the Set/Span menu select which electronic regulator you want to calibrate. Press Enter to enable the edit function. Change the value to "Yes". The following menu will display on the screen.

Parameter	Description	Display User Level
Number of Points	The number of setpoints to be used for the electronic regulator calibration procedure. Value must be 2 to 20.	Basic Advanced, Admin
Low Limit Voltage	The user is able to define the low voltage for the calibration process.	Admin
High Limit Voltage	The user is able to define the high voltage for the calibration process.	Admin
Start Calibration	Commences the calibration procedure. A wizard will walk you through the calibration process.	Basic Advanced, Admin

Note: The Low Limit Voltage and High Limit Voltage values are disregarded if both are set to "0" (zero is the default setting). You should only change these values if the instrument is not able to automatically analyze the electronic regulator range and perform a proper calibration.

Note: The electronic regulator can remain active in between instrument test cycles, or it can be set to "Idle". This parameter is edited by going to Hardware Config and selecting the Hardware icon. The parameter is called "E-Regulator Rest" and is available in Basic Display User Level. To change the Display User Level, see Chapter 26 ***– Features.***

Note: An Electronic Regulator Calibration Report may be downloaded from the instrument if desired. See the Reports section on the last page of Chapter 29 – Communication***.***

Self-test

The device includes a self-test diagnostic verification feature that helps ensure the instrument is functioning correctly. This built-in self-test aids in maintaining accuracy and reliability of leak testing measurements. Self-test options are available under the **Hardware > Self-test** menu**.**

Parameter	Description	Display User Level
Self Test Pressure	Enter the pressure setting of the pressure source chosen to use for the Self-Test diagnostic routine.	Basic Advanced, Admin
Self Test Source	Specifies the pressure source to utilize for the Self-Test diagnostic routine.	Basic Advanced, Admin
Self test Level	Self-Test Level The instrument performs two levels of Self-Test. Level 1 is a general integrity test of the pneumatic circuit. Level 2 is more stringent and should be used when testing for low leak or flow rates. Level 2 is most stringent than the level 1.	Basic Advanced, Admin

Note: It is important that all test ports are plugged during a Self-Test. The instrument will multiplex through the test ports to verify all circuits are operating leak free.

Chapter 37 – Monitor Screen Example

This chapter is a quick reference for the screens that display when running the various tests established for your requirements.

Monitor Screen Examples

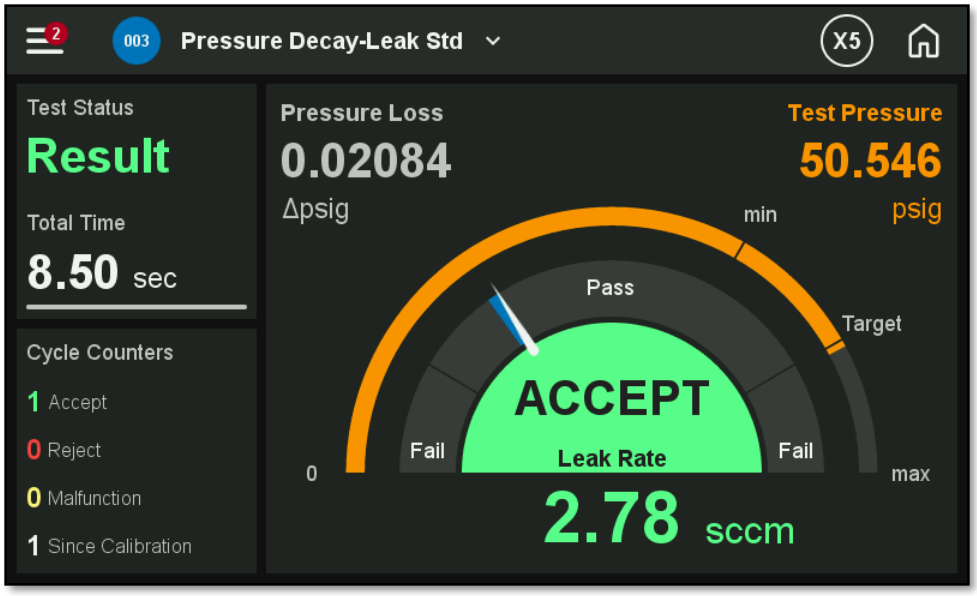
The "Monitor" screen is a central hub for observing the IX5 device's operational status and performance. It provides various tools for real-time monitoring, troubleshooting, and data visualization.

Home screen

The Monitor Screen shows the real time information of the running test. It displays detailed information such as current segment, pressure, loss along with the min max limits.

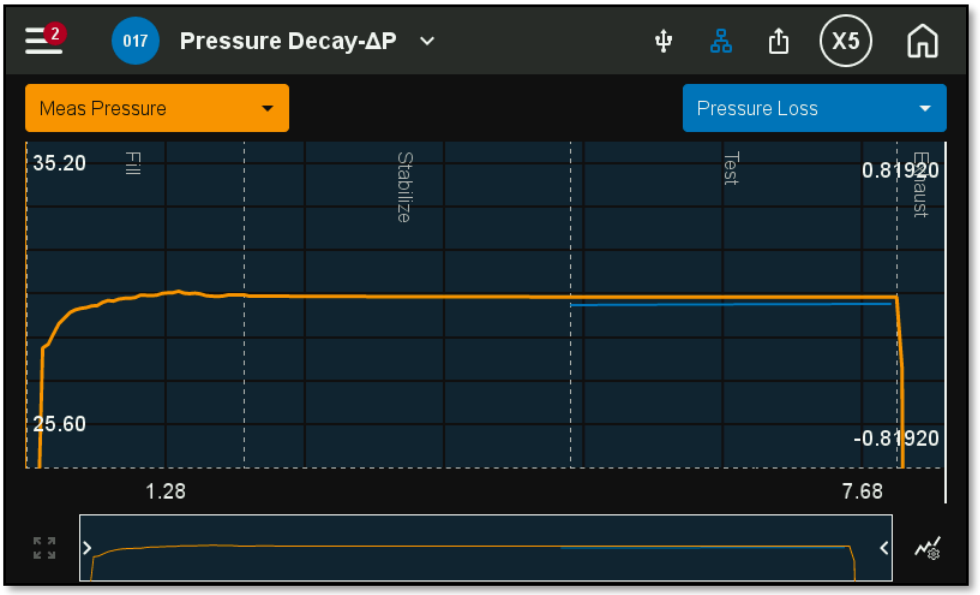


The comprehensive data of test evaluation is presented in a clear and concise manner.



Graph Screen

This graph screen provides a visual representation of selected test type, enabling users to monitor and analyze the test results effectively. The specific details of the data and the graph's behavior would depend on the IX5 device's configuration, and the test being performed.

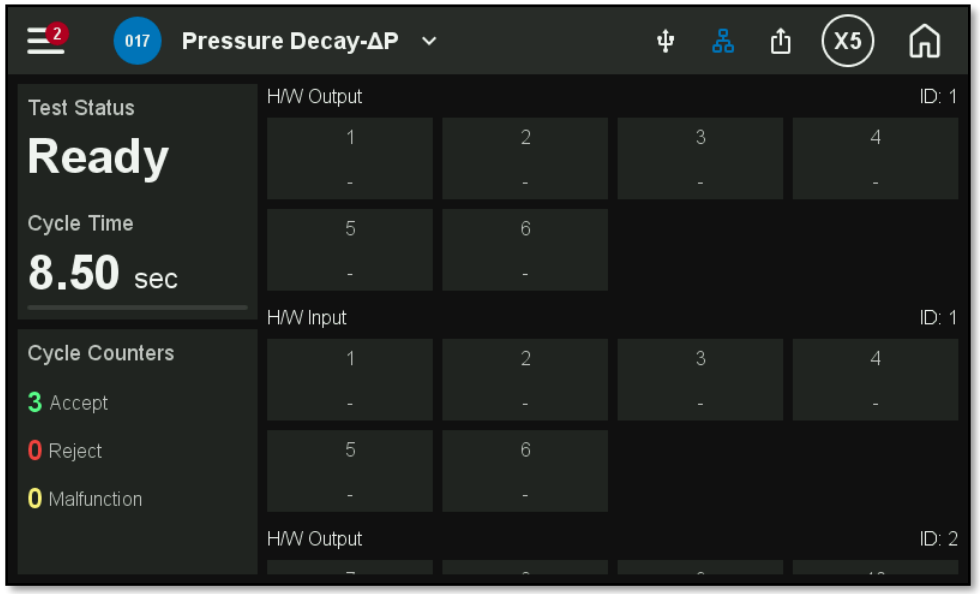


The "Graph Settings" panel provides options to customize the display and behavior of the graph within the screen. Here's a breakdown of the settings:

1. **Test Phases:** This setting controls the display of different phases or stages of the test on the graph. If enabled, the graph show distinct segments representing different parts of the test. If disabled, the graph show the entire test as a single continuous line.
2. **Min Max Lines:** This option toggles the display of minimum and maximum limit lines on the graph. When enabled, they help users quickly assess if the test results are within the specified tolerances.
3. **Cursor:** This setting controls the visibility of a cursor on the graph. When enabled, users can move the cursor along the graph to pinpoint specific data points and read their values. This is useful for detailed analysis and measurement.

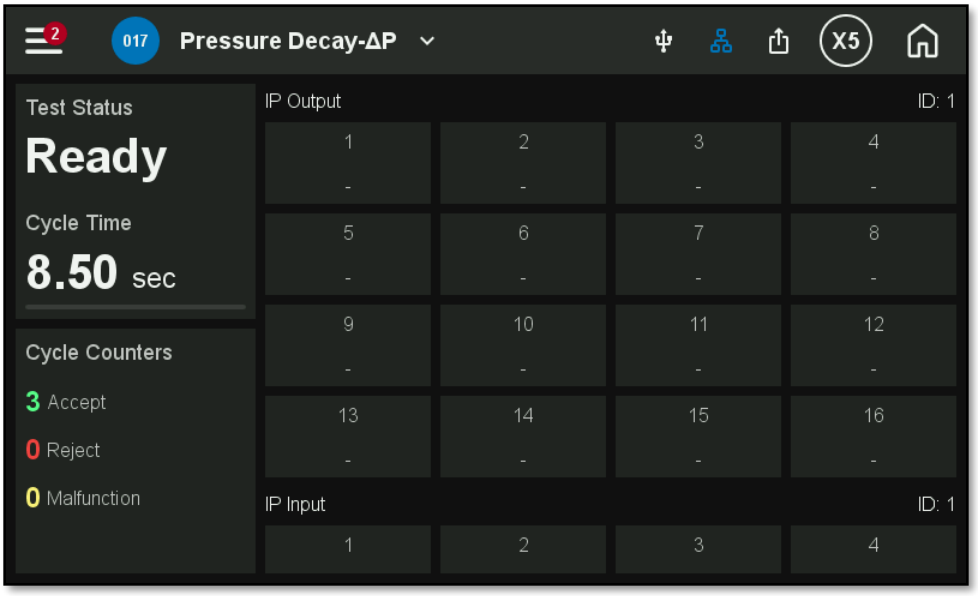
Device IO Screen

Focuses on monitoring the input/output (I/O) status of the device itself, showing the states of physical connections and signals.



IP I/O Screen

Specifically deals with monitoring the I/O status related to the IP network (Ethernet/IP), showing network communication and data exchange.

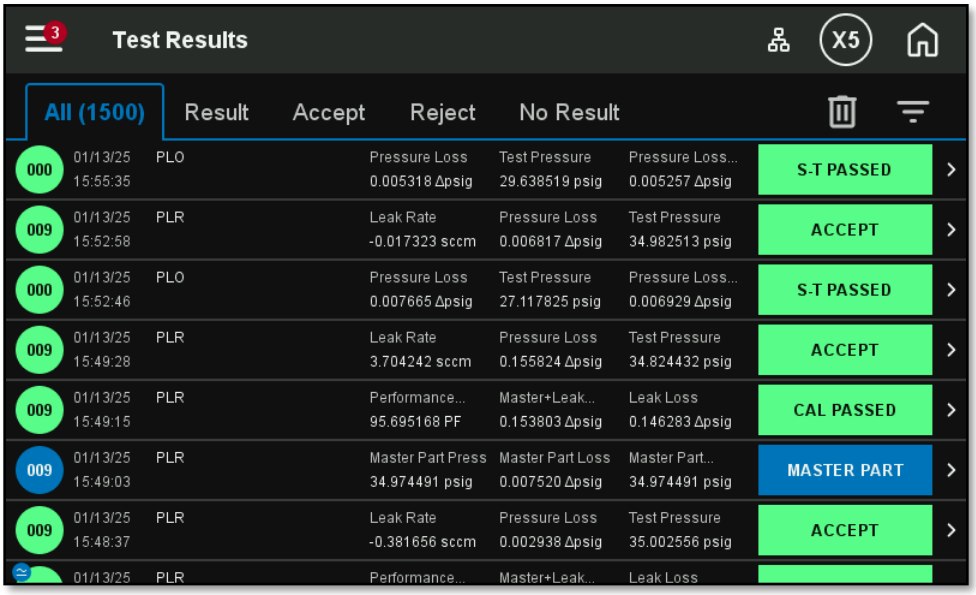

2
017
Pressure Decay-ΔP
X5
Test Status
Ready
Cycle Time
8.50 sec
Cycle Counters
3 Accept
0 Reject
0 Malfunction
IP Output
ID: 1
1 2 3 4
5 6 7 8
9 10 11 12
13 14 15 16
IP Input
ID: 1
1 2 3 4

Chapter 38 – Results Screen Examples

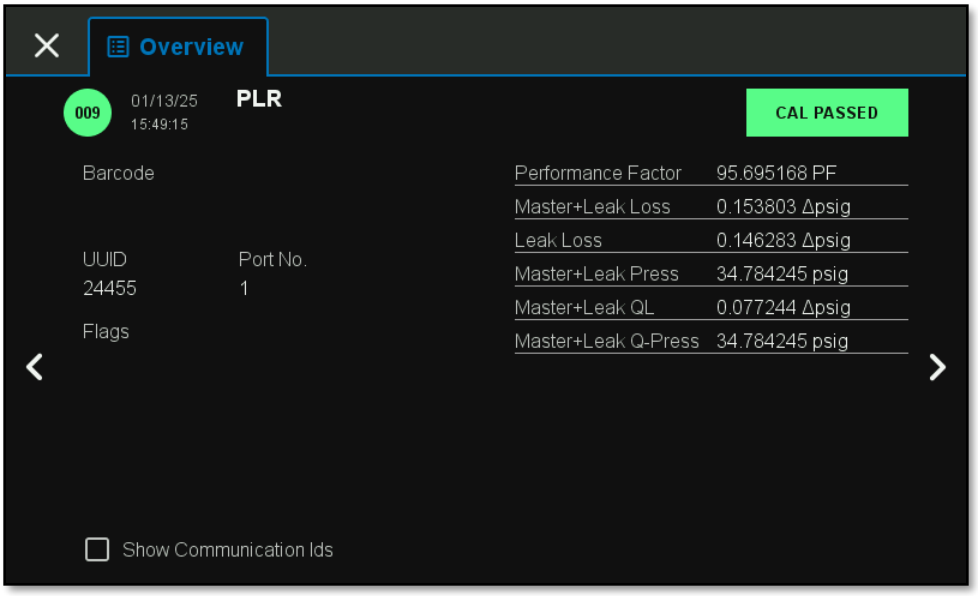
This chapter is a quick reference for the screens that display when running the various tests established for your requirements. These are examples; your screens will display similar but different data.

Result Data Screens

The **Result Screen** is designed to provide a comprehensive list of the test results for monitoring. This screen is structured to display detailed data for each test and shows information at a glance.

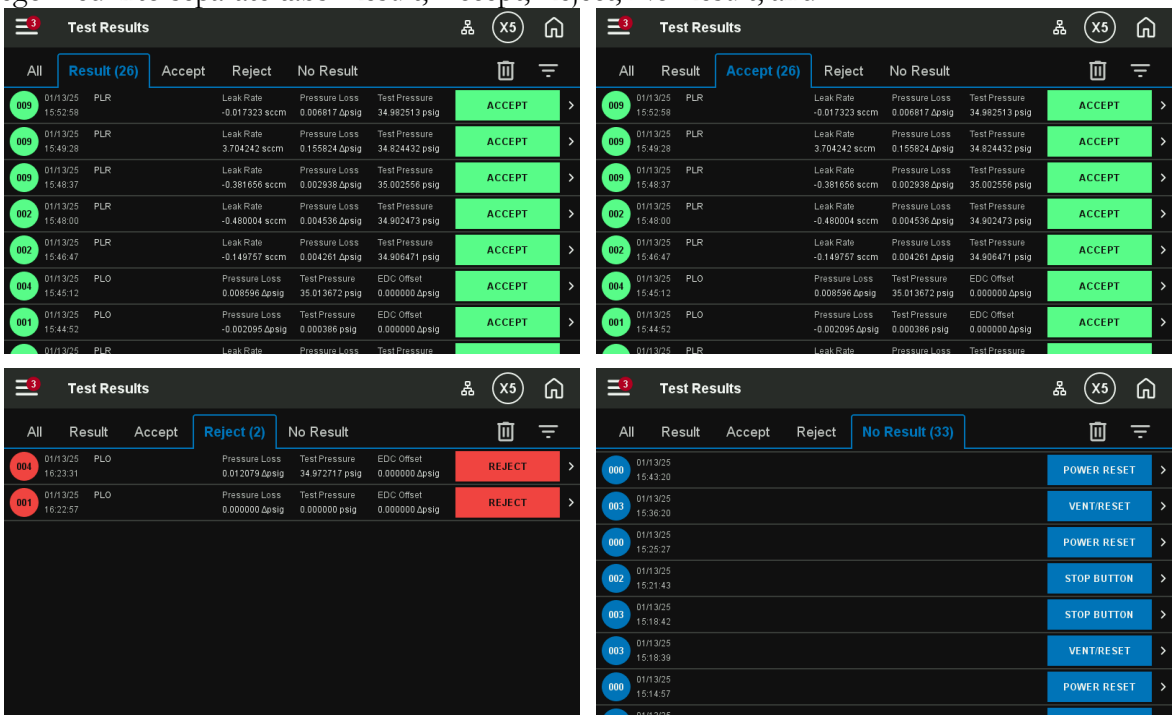


The **Result Overview Screen** shows detailed information of any selected result. It has buttons on either side to show details of next or previous result.



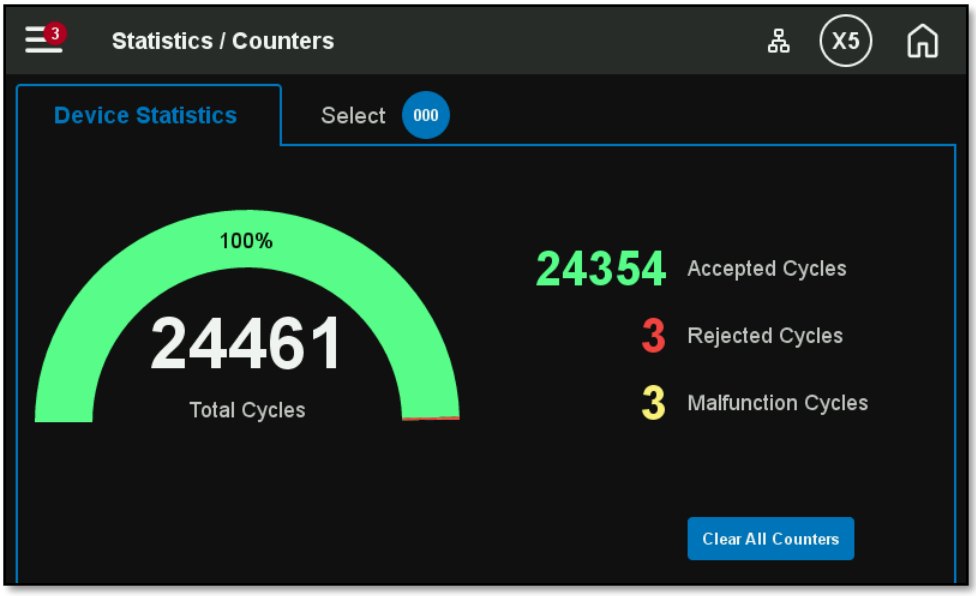
Result Sorting

The result screen includes a feature to organize test results based on their evaluation status, categorized into separate tabs: Result, Accept, Reject, No Result, and All.

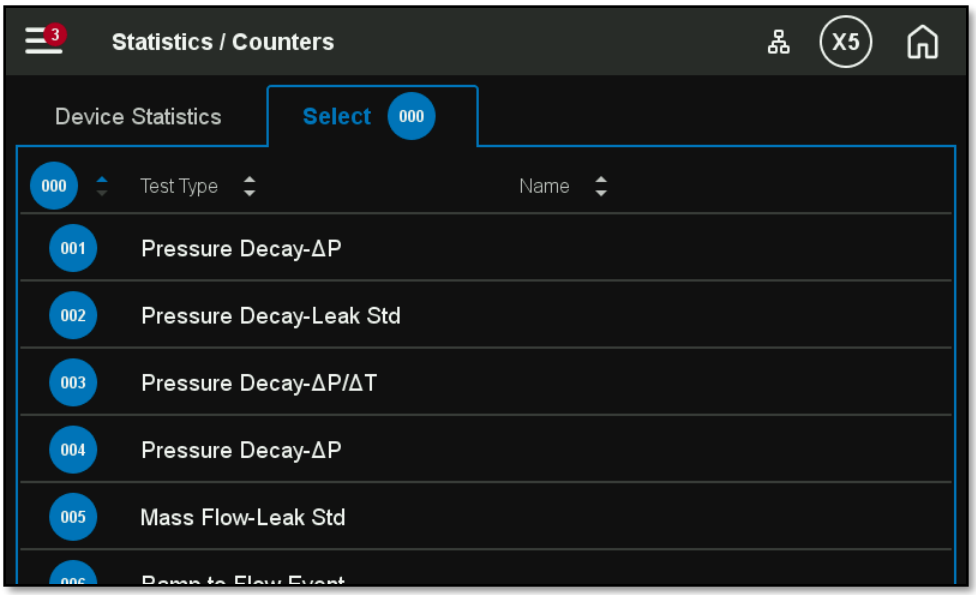


Counter Screen

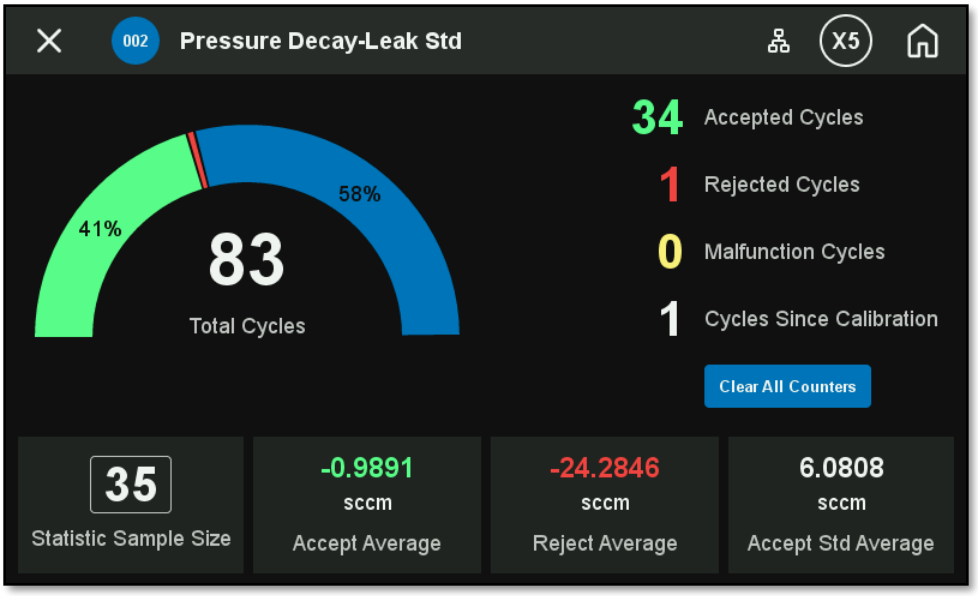
The Counter Screen displays the total counter of program, categorized into Accept, Reject, and Malfunction cycles.



Device Statistics Screen (Program Specific)
This screen displays the data of particular program which can be obtained by selecting the appropriate program for the list.



After Selecting the program this screen displays the Statistics data along with the total counter of program, categorized into Accept, Reject, Malfunction cycles and cycles since calibration*(Only applicable for Leak-Std test types).*


002
Pressure Decay-Leak Std
X5
34
Accepted Cycles
1
Rejected Cycles
0
Malfunction Cycles
1
Cycles Since Calibration
Clear All Counters
41%
58%
83
Total Cycles
35
Statistic Sample Size
-0.9891
sccm
Accept Average
-24.2846
sccm
Reject Average
6.0808
sccm
Accept Std Average

Chapter 39 -Webserver

The instrument provides a rich web server to control and configure the instrument. The Web Server can be used to display and update configuration, backup/restore instrument configurations, upgrade instrument firmware, and navigate remotely.

System Requirements

To use the Web Server, you must have the following:

- a TCP/IP-based network
- a web browser installed on your computer, preferably either Google Chrome 149.0X or Microsoft Internet Explorer 146.0X and above

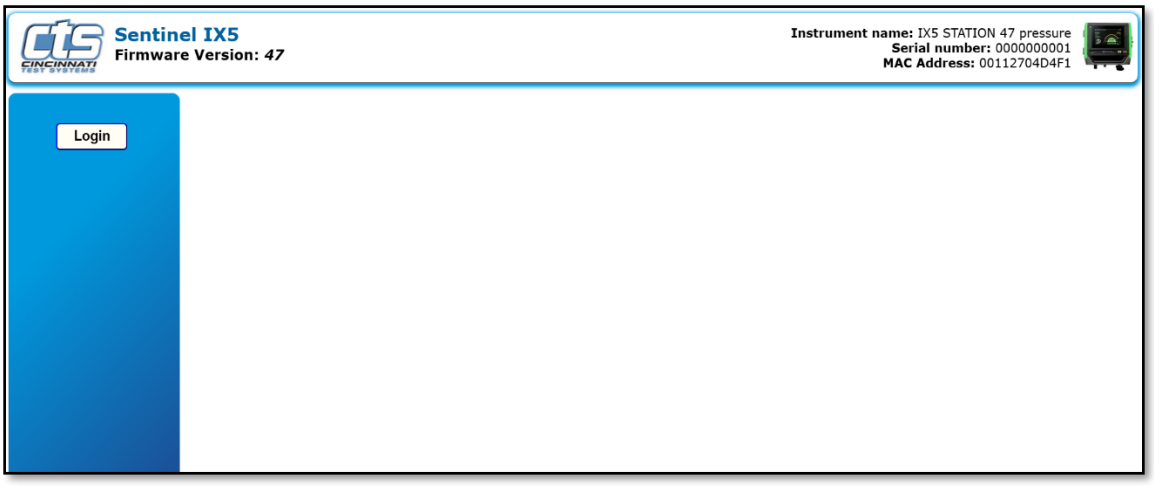
Note: The web server can be accessed from any operating system that supports the TCP/IP protocol and a web browser. You cannot view the embedded web server pages from outside a firewall.

Viewing the Web Server

Launch your web browser. In the Address or Go to field, type the IP address assigned to the instrument (for example: http://192.168.1.1). For more details on setting up the IP address on the instrument, refer to Chapter 29 – Communication

Home Page

The top section will always display the Identity information (Instrument name, Firmware Version, Serial number, and MAC address) of the instrument. The Home page is shown in Figure 1.



Web Server login

Once you click **Login**, the web server will prompt you for a User Name and Password. You must login with the appropriate username and password to access the webserver features. For more details on security, please refer to Chapter 32 – User and Security.



Navigation - Web Server

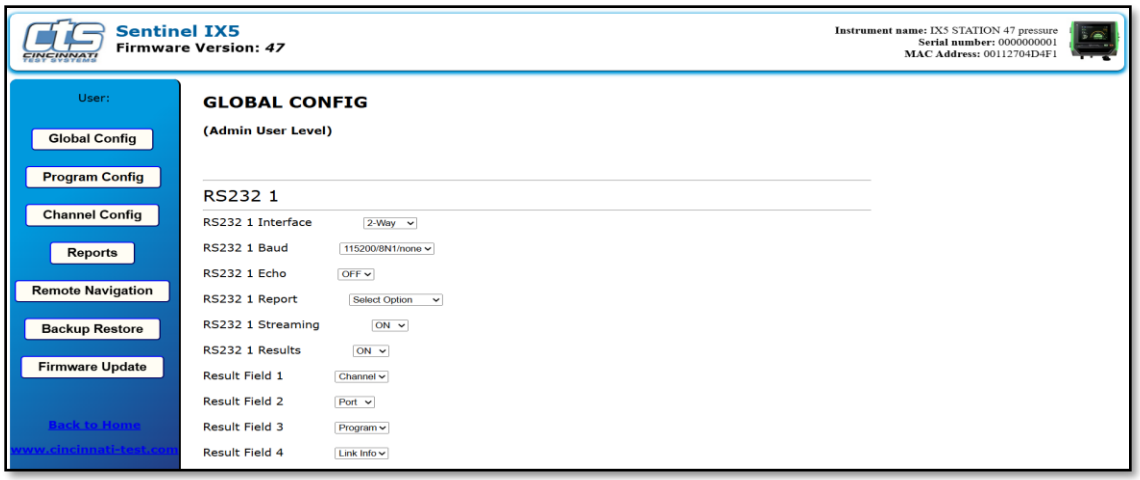
The left section lists all available menus. Clicking a menu in the left section will update the right section with content for the selected menu.



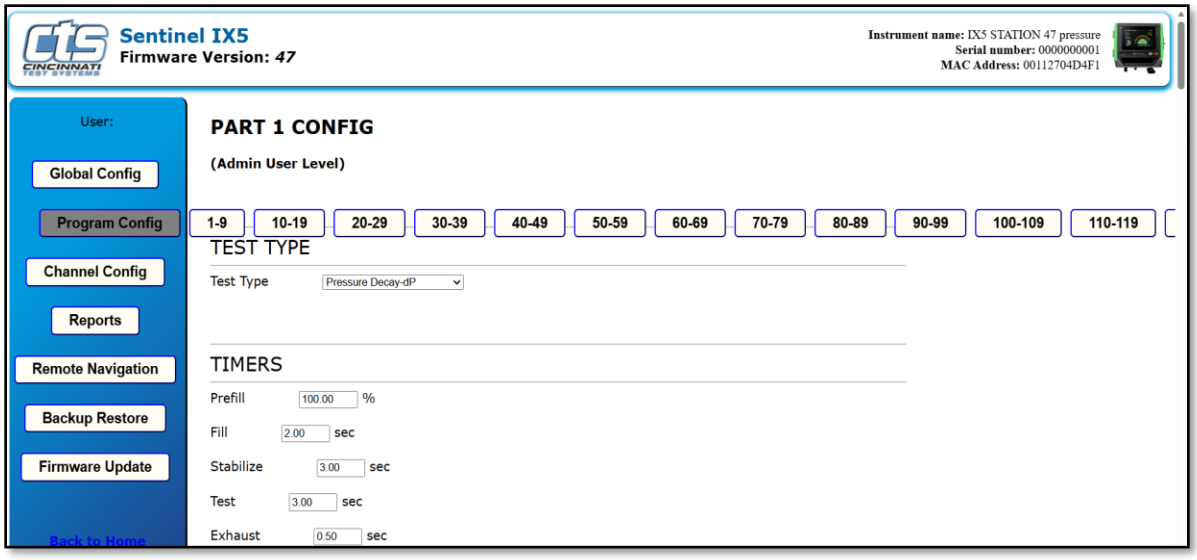
The **Channel config** page allows you to configure Channel Config parameters for the instrument.



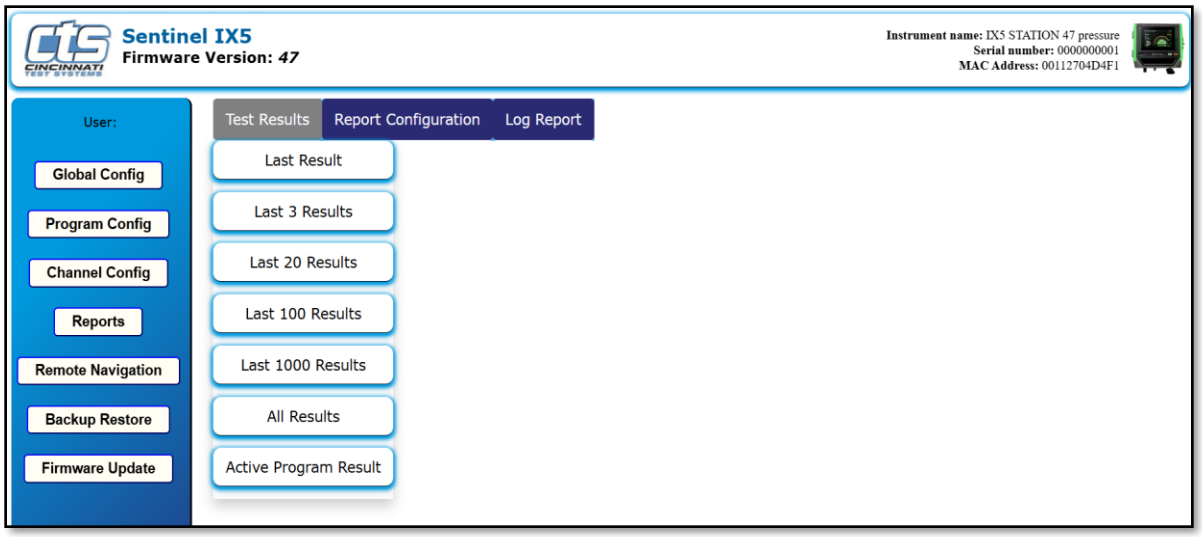
The **Global config** page allows you to configure Global Config parameters for the instrument.



The **Program config** page allows user to configure Program Config parameters for the selected program. To select a program, move the cursor onto "**Program Config**" menu. This will display available slots in the instrument i.e. 1-9, 10-19, 20-29, 30-39, 40-49, 50-59, 60-69, 70-79,….110-119. Hold the cursor on 1-9 slot to display list of programs under it. Select the required program. Information for this program will be displayed. This same technique can be used to select and configure any other available program.



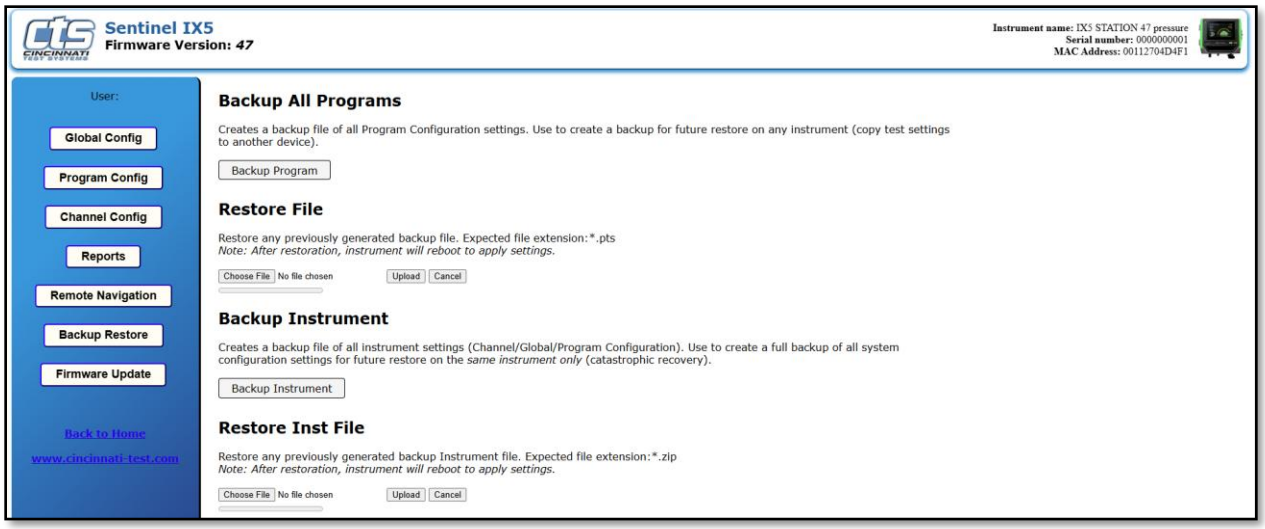
The **Reports** menu allows user to generate a various Reports for the instrument. Click Reports menu so display Test Results, Report Configuration and Log Reports tab. As per below screenshots, expand individual tabs to display available report selections. User can choose any report and view information as required.



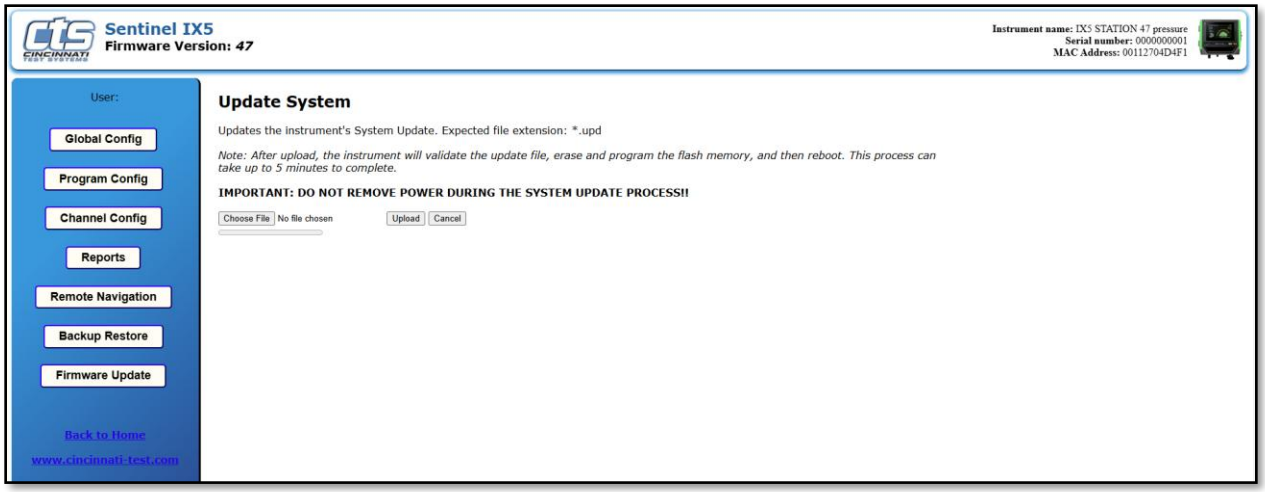
The **Navigation** page gives user a similar user interface to the one available on the front display of the instrument.



The **Backup Restore** page allows user to generate a backup file of all the Program Configuration settings and Restore any previously generated backup file.

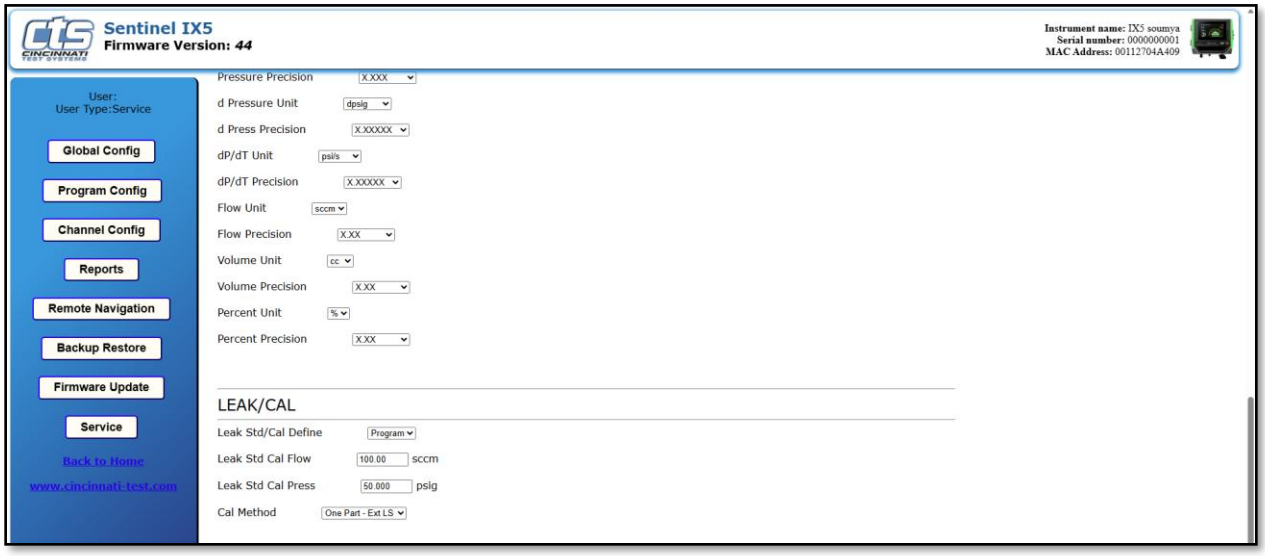


The **Firmware Update** page allows user to update the instrument's main controller firmware, co-processor firmware, IO-Board firmware.
Instrument support for loading and storing firmware update packages (*.upd) through the X5 web server interface, aligning functionality with the USB firmware update process.



Parameter Configuration via Web Server

User can edit parameters listed on the right section of webpage. Once the value of any editable parameter is changed, the updated value gets displayed with background color "Yellow." "**Edit in progress, Please wait…"** message is displayed to the user.. After some time the message disappears and the changed parameter is displayed with white background.



Appendix A – Messages & Error Codes

This appendix is a quick reference for the messages and error codes that display on the screen and through the communication ports.

Test Messages & Errors

Note: For the most up to date Test Message and Error Codes type "TABLE EVALUATION" into the instrument using the communication port. The instrument will return a list of Data Type Codes and descriptions. (This table contains the same list of codes found in the 1st table of Appendix E – Communication Code Tables***.)***

Message	Code	Description
Program Accept	A	Program evaluation was successful, for multiple tests – all tests passed.
Auto Setup Seq Complete	AC	The Auto Setup Sequence is complete.
Ambient Delta>Max Ambient Delta	AD	Whin inserted more pressure that Max ambient delta on transducer. This results in a Malfunction.
Program Calibration Failed	AF	The test type is one that is capable of conducting a program calibration and this sequence was not successful.
Master Part Complete	AM	The test type is one that is capable of conducting a program calibration. The first phase of the sequence is complete.
Program Calibration Passed	AP	The test type is one that is capable of conducting a program calibration and this sequence was successful.
Error: Anti-tie Down	AT	The two inputs (Start and Common) are not held high during all of the "extend" tooling motions. There is no resultant output.

Message	Code	Description
Error: Barcode Req to Start	BR	The instrument was expecting a barcode value to be received over the RS232 port. The Barcode Required parameter was set to "Yes", which requires a barcode before a start command is enabled.
Master+Leak Loss<Master Loss	C1	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 results in a Malfunction.
Master Part Loss>Max Mstr+Leak Loss	C2	The pressure loss during the first test of Program Cal on the master part exceeded the Max Mstr+Leak Loss setpoint. This results in a Malfunction.
Master +Leak Loss>Max Mstr+Leak Loss	C3	The pressure loss during the second test of Program Cal on the master part exceeded the Max Mstr+Leak Loss setpoint. This results in a Malfunction.
Master Flow>Max M+L Flow	C4	The flow value during the first sequence of Program Cal on the master part exceeded the Max Mstr+Leak Flow setpoint. This results in a Malfunction.
Master Flow<Min Master Flow	C5	The master flow value was less than the Min Master Flow setpoint.

Message	Code	Description
Master+Leak Flow>Max M+L Flow	C6	The flow value during the second sequence of Program Cal on the master part exceeded the Max Mstr+Leak Flow setpoint. This results in a Malfunction.
Master Flow>Max Master Flow	C7	The flow value during the first sequence of Program Cal on the master part exceeded the Max Master Flow setpoint. This results in a Malfunction.
Master+Leak Flow<Master Flow	C8	The flow value during the second sequence of Program Cal on the master part was less than the measured Master Flow value. This results in a Malfunction.
Master Loss<Min Master Loss	C9	The pressure loss reading during the first test of Program Cal cycle was less than the Min Master Loss setpoint. This results in a Malfunction.
Cal Program Accept	CA	The Program Calibration was successful.
Calculation Error	CE	This result occurs from illegal program configurations, calculation errors when trying to convert vacuum pressures to positive pressure readings, and other occurrences.
Cal Required - Limit Exceeded	CF	Not Used.
Min Perf Factor Error	CM	The Performance Factor calculated at the end of Program Cal exceeds the Minimum Performance Factor set in the Test Factors.

Message	Code	Description
Calibration Required-Parameters Changed	CP	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.
Cal Program Reject	CR	The Program Calibration was not successful.
DP Transducer Fault	DF	Not Used.
DP Transducer Over Range	DO	Not Used.
DP Transducer Zero Bad	DZ	Not Used.
Elec Regulator Cal Complete	EC	The Electronic Regulator Calibration was successful.
Elec Regulator Cal Error	EE	The Electronic Regulator Calibration was not successful.
Part Evac Fault	EF	Not Used.
Prog Error	EP	There was an error with the program. Please contact the CTS Service department.
System Error - Service Req	ER	There was an error with the instrument. Please contact the CTS Service department.
Flow Transducer Over Range	FO	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	FX	The flow sensor measured a value out of its range. The instrument stopped the test sequence to prevent damage to the sensor.
Flow Transducer Zero Bad	FZ	The flow transducer was not sending the proper voltage. The instrument checks to make sure that the flow transducer is within range before the test sequence begins.

Message	Code	Description
Helium Background Fault	HF	Not Used.
Invalid Calibration Data	ID	The calibration data has been corrupted or not properly entered. Please calibrate the unit again.
I/O Fault	IF	Not Used.
Input Stop High	IH	The EtherNet/IP and PROFINET Stop functionality is High.
Invalid I/O Configuration	IO	Not Used.
Invalid Program Selected	IP	The program selected does not exist or has not been configured.
Input Vent/Halt High	IV	The EtherNet/IP and PROFINET Vent/Halt functionality is High.
Master Loss>Max Master Loss	L0	The pressure loss reading during the first test of Program Cal cycle was greater than the Max Master Loss setpoint. This results in a Malfunction.
Master+Leak Loss<Min Master+Leak Loss	L1	The pressure loss value during the second sequence of Program Cal on the master part was less than the Min Master +Leak Loss setpoint. This results in a Malfunction
Leak Loss<Min Leak Loss	L2	Measured Leak Loss of Program Cal was less than Min Leak Loss setpoint. This results in a Malfunction.
Leak Loss >Max Leak Loss	L3	Measured Leak Loss of Program Cal was greater than Max Leak Loss setpoint. This results in a Malfunction
Master+L Flow <Min Master+L Flow	L4	The flow value during the second sequence of Program Cal on the master part was less than the Min Master+Leak Flow setpoint. This results in a Malfunction.
Leak Flow<Min Leak Flow	L5	Measured Leak Flow of Program Cal was less than Min Leak Flow setpoint. This results in a Malfunction.
Leak Flow>Max Leak Flow	L6	Measured Leak Flow of Program Cal was greater than Max Leak Flow setpoint. This results in a Malfunction

Message	Code	Description
Error: Duplicate Target Link	LD	The same child program cannot be in the same link structure. If it is desired to conduct the same test twice you will need to copy the program.
Leak Std Select Config Error	LE	Configuration Error. The instrument was not configured properly.
Error: Link Execution Loop	LL	There was an error in the Linking Execution.
Error: No Links Defined	LN	The instrument was expecting a link that did not exist.
Error: Dissimilar Link Order	LO	When the instrument conducts a Program Calibration sequence on linked programs, the links must execute in the same order for both the first and second sequences for Program Calibration.
Error: Link Program is Parent	LP	A Parent Program may not be a link target.
Error: Link Prog Undefined	LU	The linked program is undefined.
Error: Part Mark Fault	MF	The part mark feedback input did not receive the input in time.
No Event Occurred	NE	In a test that is looking for an event, this is the result when one does not occur.
Above Target Pressure	PA	The instrument will stop conducting a test if the pressure rises above the target pressure window setting.
Below Target Pressure	PA	The instrument will stop conducting a test if the pressure drops below the target pressure window setting.
Part Not Changed	PC	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.

Message	Code	Description
Part Configuration Error	PE	There was an error in the way the program was configured.
Part Not Full	PF	This is an error in the Auto Setup Sequence that can occur if the instrument fails to fill the part to the desired pressure.
Test Pressure Low	PL	Test pressure was below Minimum Pressure during fill cycle. This results in a severe leak.
Test Pressure High	PH	Test pressure was above the Maximum Pressure during fill or stabilization cycles resulting in a Malfunction.
Error: Part Not Present	PP	The part present input is set for the active program and the input was not received.
Part Not Stabilized	PS	This is an error in the Auto Setup Sequence that can occur if the instrument fails to stabilize the part.
Part Not Exhausted	PX	This is an error in the Auto Setup Sequence that can occur if the instrument fails to exhaust the part.
Sequence Complete	QC	Sequence Complete
Program Reject	R	Program evaluation was not successful, for multiple tests – if any test fails, the part is rejected
Part Reject - Level 1	R1	Not Used.
Part Reject - Level 2	R2	Not Used.
Part Reject - Level 3	R3	Not Used.
Source Pressure Exceeded	RX	The source pressure set by the factory on the hardware configuration menu was exceeded.
Stop Button Pressed	SB	The stop button or input was received.

Message	Code	Description
Start Common Input Low	SC	Not Used.
Pressure Select Config Error	SE	Configuration Error. The instrument was not configured properly.
Self-Test Failed	SF	The Self-Test failed.
Error: Stop Input High	SH	The instrument cannot start a test if the Stop input is high.
Stop Input Received	SI	Stop Input Received.
Severe Leak	SL	Severe Leak indicates the test process did not achieve Minimum Pressure before reaching the Prefill setpoint or failed to maintain Minimum Pressure during fill or Stabilization timers. This results in a Program Reject.
Self-Test Passed	SP	Self-Test process indicates no internal leak.
System Pressure Exceeded	SX	The system pressure of the unit was exceeded.
Tooling Not Reset	TE	If a tooling error occurs involving any motions, there will be a tooling error. Before the start of the next test, the tooling needs to be reset by the Stop/Reset input. This results in a Malfunction.
Error: Two-Input Req to Start	TI	Both Start Test and Common must go high to start a test.
Test Port Select Config Error	TP	The instrument configuration is not correct.
Error: Tooling not Retracted	TR	The instrument may not start a sequence if all of the tooling is not retracted.
Tooling Reset	TS	Most tooling errors or some test errors may require a tooling reset with the Stop/Reset input. After completion of the reset, this confirmation message is displayed.

Message	Code	Description
Error: Tooling not Extended	TX	If the instrument is configured for tooling feedback this error will occur if the tooling feedback input is not received within the time allocated.
Vent Part Reset Tooling	VR	Message sent when retain part pressure and tooling are both configured to be used. This message is sent upon a reset.
Transducer Cal Complete	XC	The transducer calibration is complete and was successful.
Transducer Cal Error	XE	There was an error when trying to calibrate the transducer.
Pressure Transducer Fault	XF	Not used.
External Switch did not go high	XH	The External Pressure Switch input did not go high before the end of the fill timer. This results in a Malfunction.
External Switch did not go low	XL	The External Pressure Switch input did not go low between tests. This results in a Malfunction.
Transducer Over Range	XO	During the testing process the pressure exceeded the range of the transducer. This results in a Malfunction.
Transducer Verify Complete	XV	The transducer verification sequence is complete.
Transducer Zero Bad	XZ	The pressure transducer's atmospheric pressure reading at the beginning of the testing cycle is outside of tolerance. This results in a Malfunction.

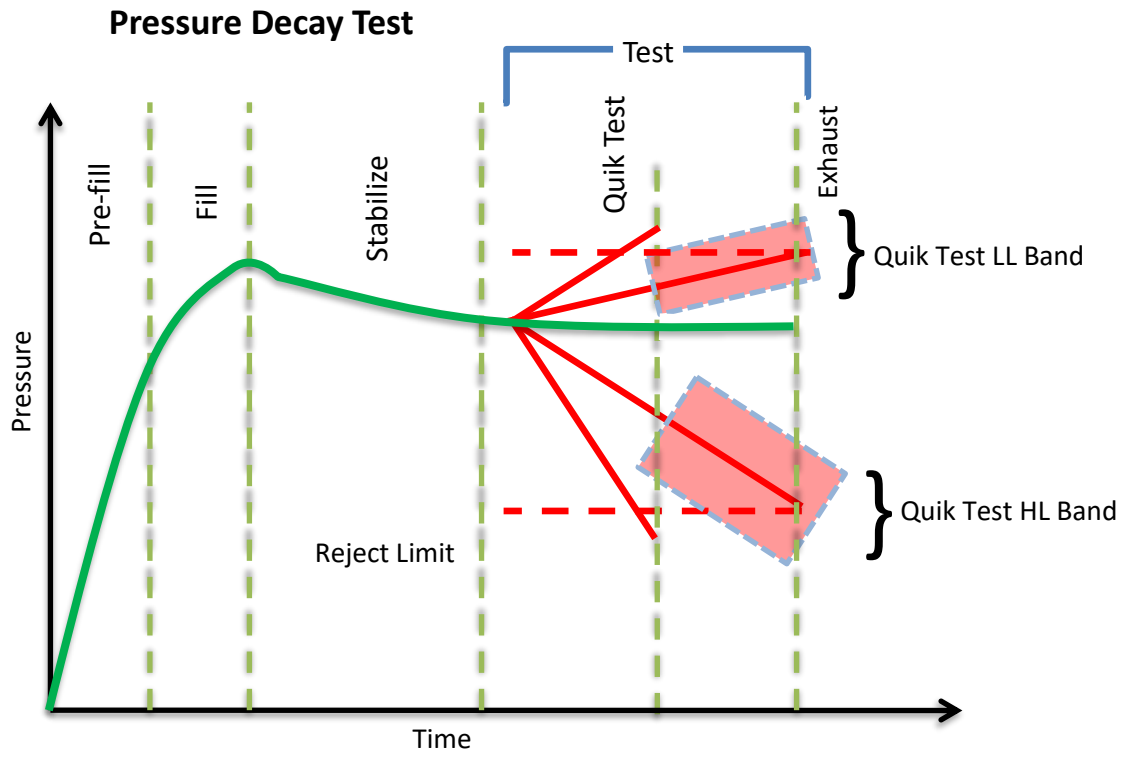
Appendix B – Quik Test

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.



The prior chart shows the master part curve, the Low Limit with its Quik LL Test band limit, and the High Limit with its Quik HL Test band limit. If the pressure loss is within either the Quik LL Test band or Quik Test HL 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 establishing the "QT Test Timer" at 10, 25, 50, 75, or 90% and setting "Quik Test" to OFF. A Program Calibration 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.

Test Parameters

The Quik Test parameters menu is located in **Main Menu > Configuration > TST:XXX** option.

TST Parameter	Description	Display User Level
Quik Test Enable	Activates Quik Test.	Advanced, Admin
Quik Test Timer	Defines the time as a percent of the Test sequence when the Quik Test function result is calculated.	Advanced, Admin
Quik Test LL Band	The leak (flow) rate band around the Low Limit within which the tests will continue to completion. This value is the amount above and below the nominal. For example, if this value is set to 0.5 scc/m and the Low limit is set to -5.0 scc/m, the entire Quik Test LL Band is -4.5 to -5.5 scc/m.	Advanced, Admin
Quik Test HL Band	The leak (flow) rate band around the High Limit within which the tests will continue to completion. This value is the amount above and below the nominal. For example, if this value is set to 1.0 scc/m and the High limit is set to 10.0 scc/m, the entire Quik Test LL Band is 9.0 to 11.0 scc/m.	Advanced, Admin

Appendix C – Environmental Drift Correction

This appendix explains the theory and parameters for implementing the Environmental Drift Correction feature.

How it works

The Environmental Drift Correction routine helps to maintain the calibration of the system by continuously monitoring and calculating a correction factor for changes in the test conditions. This routine dynamically compensates for slow changes in the test environment such as room temperature changes, part temperature changes, test air temperature changes, part elasticity changes, part absorption characteristics, etc. These factors influence the dynamics of how the test part reacts to the testing process and the determination of the leak rate. "Environmental Drift Correction" defines how wide of a band around the Master Part Loss or Master Part Flow value will be considered as normal variations in flow rate for a non-leaking part. The "Environmental Drift Correction" (+EDC %) is based on High Limit. The instrument continuously calculates a running average of test results that fall within the band (EDC %) 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 "Environmental Drift Correction" are 10%, 25%, 50%, 75%, and 90%. The sample size is set as EDC quantity (3 or greater). Flexible parts require a greater "Environmental drift correction" than rigid parts.

The "Environmental Drift Correction" 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.

EDC Parameters

The EDC parameters menu is located in **Main Menu > Configuration > TST:XXX** option.

TST:XXX Parameter	Description	Display User Level
EDC Enable	Enables Environmental Drift Compensation	Advanced, Admin
EDC Percentage	Defines the band about the master part curve where test values are saved to calculate EDC drift. Set as a percentage of the High Limit parameter. Options include 10%, 25%, 50%, 75%, and 90%.	Advanced, Admin
EDC Quantity	Defines the number of test results within the EDC band used to calculate drift.	Advanced, Admin

Environmental Drift Correction (EDC) 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 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.

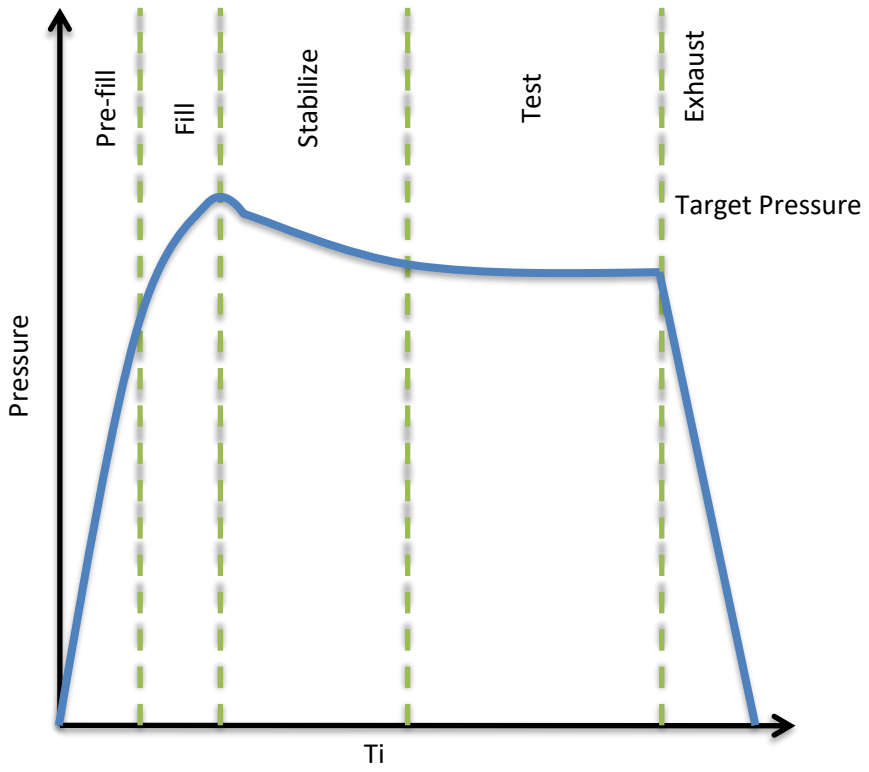
Appendix D – Electronic Regulator Compensation

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

How it works

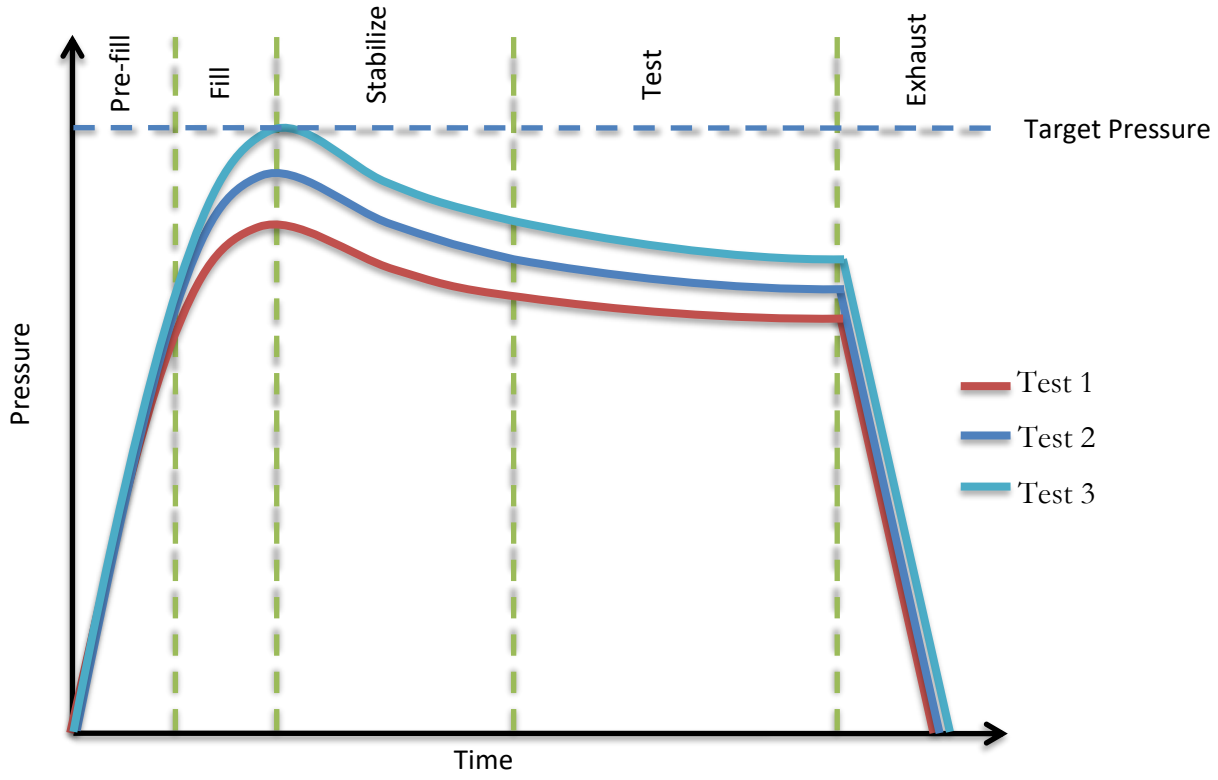
The Electronic Regulator Compensation (ERC) routine helps the instrument to compensate for electronic regulator calibration error (drift from calibrated setpoint). This allows the instrument to reach the desired target pressure. The ERC method can be set to "*Optimize* Fill *Pressure*", "*Optimize* Test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



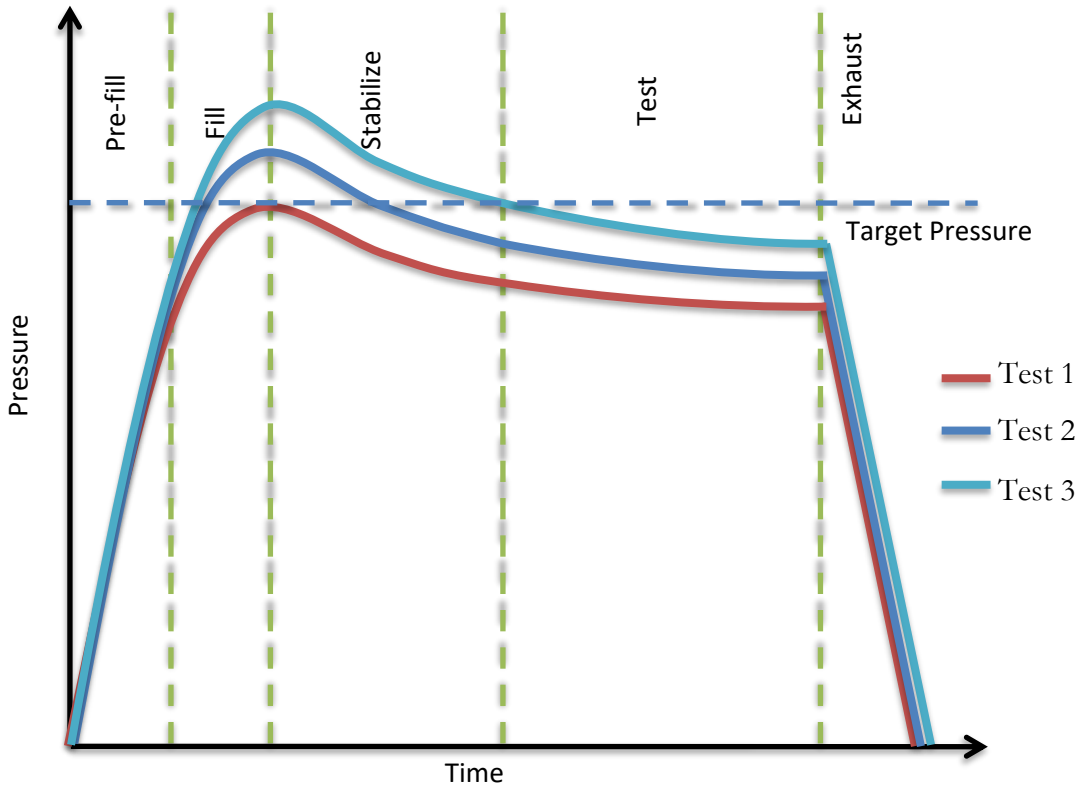
In the "Optimize Fill Pressure" method, ERC enables the instrument to adjust the regulator pressure setting to obtain the **optimal measured fill pressure**, as determined by the Target pressure.

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.

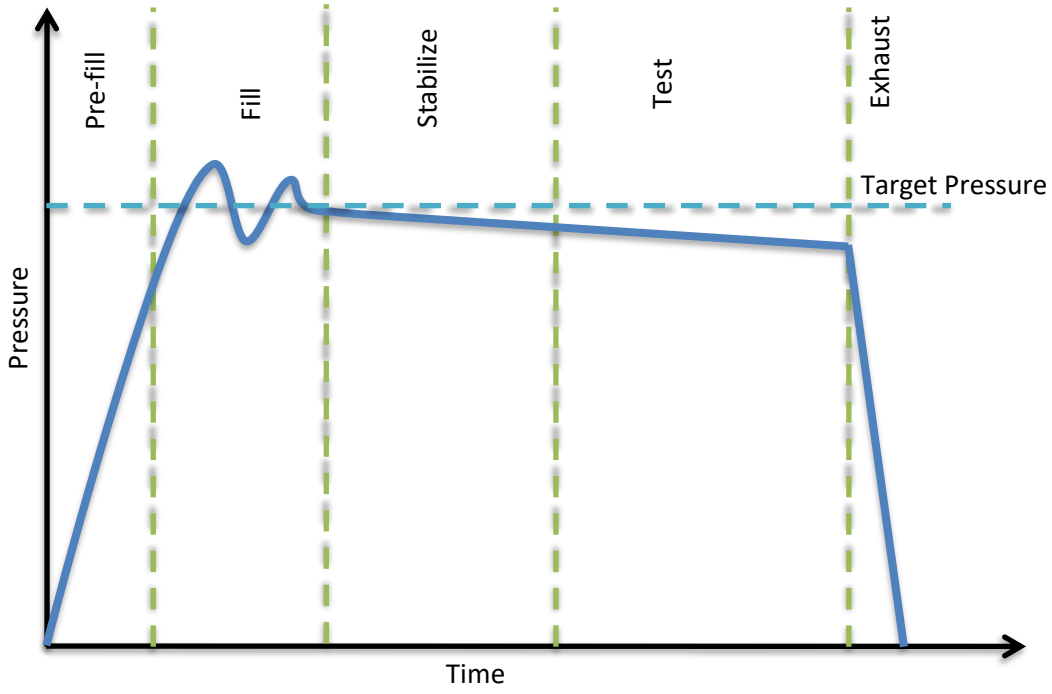


In the "Optimize Test Pressure" method, ERC enables the instrument to adjust the regulator pressure setting to obtain the **optimal measured test pressure**, as determined by the Target pressure.

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.



In the "Optimize Source Pressure" method, the electronic regulator will be continuously adjusted during the fill segment to force the measured fill pressure to match the desired target pressure for the test.



Note:

1. ***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.***
2. ***The "Optimize Source Pressure" method does not depend on the history of previous Accept tests. Every time you run this test; the instrument will regulate pressure to the desired target pressure for that test only.***

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
    a. ERC Method
    b. ERC Target Window
    c. ERC Offset Limit
    d. ERC Quantity

Test Parameters

The ERC Test parameters menu is located in **Main Menu > Configuration > MISC** option.

TST Parameter	Description	Display User Level
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.	Advanced, Admin
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. *This parameter is only available if the ERC Method selected is "Optimize Test Pressure" or "Optimize Fill Pressure"*	Admin
ERC Offset Limit	Maximum correction value, defined as a percentage of the target pressure, allowed for the ERC routine. *This parameter is only available if the ERC Method selected is "Optimize Test Pressure" or "Optimize Fill Pressure"*	Admin
ERC Quantity	Maximum number of test results within the ERC target window used to calculate the ERC pressure offset. *This parameter is only available if the ERC Method selected is "Optimize Test Pressure" or "Optimize Fill Pressure"*	Admin
ERC Increment Limit	Limits the maximum electronic regulator incremental adjustment for the ERC routine, Defined as the percentage of the window between the target pressure and the min/max pressure. *This parameter is only available if ERC Method selected is "Optimize Source Pressure"*	Admin
ERC Crossover Limit	Defines the number of times the pressure must crossover the desired target pressure when determining the period response rate of the electronics regulator. *This parameter is only available if ERC Method selected is "Optimize Source Pressure"*	Admin
ERC Rate/Period	Percentage of the electronic regulator response period used to determine the ERC routine response rate *This parameter is only available if ERC Method selected is "Optimize Source Pressure"*	Admin

This page is intentionally blank.

Appendix E – Communication Code Tables

This appendix lists the codes that are referenced in the notes of Chapter 29 – Communication.

Each table can be generated within the communications interface by providing the associated command denoted.

Data Type or Header Codes

type "TABLE HEADER"

Sr. No	Data Type Code	Description
1	V	Variable Edit
2	L	List
3	M	Message
4	Q	Result List
5	T	Streaming Started
6	S	Streaming Value
7	X	Streaming Stopped
8	R	Result Value

Test Evaluation Codes

type "TABLE Result"

Sr. No	Test Evaluation Code	Description
1	P	TEST PASSED
2	F	TEST FAILED
3	E	TEST ERROR
4	S	TEST SKIPPED
5	X	TEST FAILED - LEVEL 1
6	Y	TEST FAILED - LEVEL 2
7	Z	TEST FAILED - LEVEL 3
8	M	AUTO-CAL MASTER PART
9	L	AUTO-CAL LEAK STANDARD PART
10	N	TEST FAILED - NO EVENT
11	C	TEST COMPLET
12	B	AUTO-CAL BATCH COMPLETE

Segment Codes

type "TABLE SEGMENT"

Hex Code	Test Data Identifier Code	Description
0x02	PRI	Internal - Pre-Seq
0x03	PSI	Internal - Post-Seq
0x04	ESI	Internal - Empty-Seq
0x05	PRI	Internal - Evaluate Part Result
0x06	CSI	Internal - Link Control Seq
0x0B	SPR	Setup - Pre-Seq
0x0C	SPS	Setup - Post-Seq
0x0D	SPL	Setup - Pressure Select
0x0E	SMF	Setup - Manifold Fill
0x0F	SMI	Setup - Manifold Isolate
0x10	SME	Setup - Manifold Exhaust
0x1B	PRF	Prefill until Pressure
0x1C	PRF	Prefill/Fill
0x1D	PRP	Prefill Pre-Pressure
0x1E	PRC	Prefill - Charge Volume
0x23	FGN	General Fill
0x24	FRF	Fill Reference
0x25	FLL	Fill (without pressure monitoring)
0x26	FRP	Fill Ramp
0x27	FST	Fill Tracer
0x28	SGL	Fill Tracer Gross
0x29	SPF	Fill Step
0x2A	EST	Fill Evac
0x2B	CST	Fill Clean
0x2C	FFL	Fill until Full
0x32	STG	General Stabilize
0x33	SFS	Stabilize Tracer
0x34	SGS	Stabilize Tracer Gross
0x35	BAL	Stabilize DP Xdcr Balance

Hex Code	Test Data Identifier Code	Description
0x36	STE	Stabilize Evac
0x37	SSD	Stabilize Step Dwell
0x38	CLN	Stabilize Chamber Cleanup
0x39	STS	Stabilize until Slope
0x3A	SDP	Stabilize for DP
0x3B	SXT	Stabilize for Xdcr Test
0x3C	STF	Stabilize for Flow
0x3D	STR	Stabilize Reference Volume
0x3E	SNW	Stabilize Tracer Wait
0x3F	SDP	Stabilize Balance DP
0x42	PLR	Pressure Decay - Leak Standard Test
0x43	DPT	Rate of Pressure Loss Test
0x44	OCC	Occlustion Test (Backpressure)
0x45	%VR	Percent of Reference Volume Test
0x46	PLO	Pressure Loss Test
0x47	RTE	Ramp to Pressure Event Test
0x48	PRF	Proof Test
0x49	RTF	Ramp to Flow Event Test
0x4A	RFT	Refrigerant Fill
0x4B	RTI	Ramp to Digital Input Event Test
0x4C	SNF	Sniffer Test
0x4D	SNG	Sniffer Gross Test
0x4E	PRS	Step Proof
0x4F	DPL	Differential Pressure Decay - Leak Standard Test
0x50	SVD	Evac Test
0x51	DPD	Differential Pressure Decay Test
0x52	DPD	Differential Pressure Decay Test (no abs pressure)
0x53	FLD	Differential Mass Flow - Leak Standard Test
0x54	FLW	Mass Flow Test

Hex Code	Test Data Identifier Code	Description
0x56	DPL	Differential Pressure Decay - Leak Standard Test (no abs pressure)
0x57	DDL	Differential Pressure Decay - Leak Rate (volume calculated)
0x58	DDR	Differential Pressure Decay - Rate of Pressure Loss Test (no abs pressure)
0x59	XDR	Transducer Test
0x5A	PVF	Pressure Verify
0x5F	EXH	Exhaust
0x60	EXP	Exhaust until Pressure
0x64	EXE	Exhaust until Empty
0x65	REV	Exhaust - Re-Evacuate
0x66	REC	Exhaust - T-Gas
0x67	CHA	Exhaust - Chamber Output Rest
0x6A	SST	Sequence - Start Node
0x6B	SQP	Sequence - Program Node
0x6C	SQD	Sequence - Delay Node
0x6D	SPM	Sequence - Part Mark Node
0x6E	STL	Sequence - Tooling Node
0x6F	SPR	Sequence - Prompt Node
0x70	SPP	Sequence - Part Present Node
0x71	SAD	Sequence - Add Node
0x72	SEQ	Sequence - Sequence Node
0x82	LKC	Link Control
0x83	SEQ	Link Decision
0x8C	AR	Autorun Relax
0x8D	RL	Calibration Relax
0x8E	DLY	Delay
0xA0	TMC	Tooling Motion Control
0xA1	EXT	Tooling Motion Extend
0xA2	RET	Tooling Motion Retract
0xA3	PMK	Tooling Part Mark
0xA4	SLE	Tooling Seal Extend
0xA5	SLR	Tooling Seal Retract
0xB1	SSR	Setup - Set Regulator

Hex Code	Test Data Identifier Code	Description
0xB2	ERA	Setup - Electronic Regulator Analyze
0xB3	ERZ	Setup - Electronic Regulator Zero
0xB4	ERS	Setup - Electronic Regulator Setpoint
0xB5	STR	Setup - Transducer Residual
0xB6	PTZ	Setup - Pressure Transducer Zero
0xB7	FTZ	Setup - Flow Transducer Zero
0xB8	PTS	Setup - Pressure Transducer Setpoint
0xB9	FTS	Setup - Flow Transducer Setpoint
0xBA	DPS	Setup - DP Transducer Setpoint
0xBB	PTV	Setup - Pressure Transducer Verification
0xBC	FTV	Setup - Flow Transducer Verification
0xBD	SI1	Setup - Sniffer Init
0xBE	SI2	Setup - Sniffer Init 2
0xBF	SD1	Setup - Sniffer idle
0xC0	MVX	Setup - Mix Verification
0xC1	SCI	Setup - Scale Init
0xC2	APC	Setup - Atmospheric Pressure Check
0xC3	DTZ	Setup - DP Transducer Zero
0xC4	DTV	Setup - DP Transducer Verification
0xC8	HVC	Chamber - hardvac control
0xC9	CBC	Chamber - blower control
0xCA	CIO	Chamber - inlet blower on
0xCB	CIF	Chamber - inlet blower off
0xCC	CC1	Chamber - circulation on
0xCD	CO1	Chamber - outlet blower on
0xCE	CO0	Chamber - outlet blower off
0xCF	CC0	Chamber - circulation off
0xD0	CCX	Chamber - accumulation rest
0xD1	CPC	Chamber - clamshell purge rings control
0xD2	CPO	Chamber - clamshell purge rings option
0xD3	CPR	Chamber - clamshell purge rings rest
0xD4	CPG	Chamber - Exh/Purge

Hex Code	Test Data Identifier Code	Description
0xD5	CV0	Chamber - vent off
0xD6	CE1	Chamber - evacuate on
0xD7	CE0	Chamber - evacuate off
0xD8	CP0	Chamber - pre-purge
0xD9	REF	Refrigerant Fill
0xDA	RCX	Refrigerant CS Isolation
0xDB	RFX	Refrigerant Stabilize
0xDC	RPS	Refrigerant Part Switch
0xDD	RVN	Refrigerant Vent
0xDE	RCF	Refrigerant Iso Off
0xDF	RFS	Stabilize Scale
0xE0	RFM	Refrigerant Manual Fill
0xE1	RFE	Refrigerant Evac
0xE4	TSG	Station - Tooling Settings
0xE5	TSM	Station - Tooling Motion
0xE6	TSP	Station - Part Mark

Test Data or Variable Identifier Codes

type "TABLE Variable

Hex Code	Test Data Identifier Code	Description
0x001	ET	Elapsed Time
0x002	T	Timer
0x003	TI	Iso Delay Timer
0x004	TT	Test Sel Timer
0x005	TV	Valve Delay Timer
0x006	TQ	Quik Test Timer
0x007	TT	Test Execution Time
0x008	PSL	Pressure Select
0x009	PP	Proof Pressure
0x00A	PMN	Minimum Pressure
0x00B	PMX	Maximum Pressure
0x00C	PG	Target Pressure
0x00D	Pt	Test Pressure
0x00E	PM	Master Part Press
0x00F	PML	Master+Leak Press
0x010	PCL	Leak Std Cal Press
0x011	PST	Self Test Pressure
0x012	P	Meas Pressure
0x013	P	Instrument Pressure
0x014	P	Master Gauge Press
0x015	ML	Master Part Loss
0x016	MLR	Master Part Loss Rd
0x017	LLL	Low Limit Loss
0x018	HLL	High Limit Loss
0x019	LL	Master+Leak Loss
0x01A	LLR	Master+Leak Loss Rd
0x01B	PLP	Predicted Loss
0x01C	PL	Pressure Loss
0x01D	PLR	Pressure Loss Rd
0x01E	XML	Max Mstr+Leak Loss
0x01F	MML	Min Master Loss
0x020	XLF	Max Mstr+Leak Flow
0x021	MMF	Min Master Flow
0x022	XMF	Max Master Flow
0x023	MMF	Min Master Flow
0x024	MF	Master Part Flow
0x025	MFR	Master Part Flow Rd
0x026	LF	Master+Leak Flow

Hex Code	Test Data Identifier Code	Description
0x027	LFR	Master+Leak Flow Rd
0x028	MO	Master Flow Offset
0x029	PF	Performance Factor
0x02A	MPF	Min Perform Factor
0x02B	FCM	Force Cal Mode
0x02C	FCC	Force Cal Cycles
0x02D	FCT	Force Cal Time
0x035	RL	Loss Rate
0x036	RLR	Loss Rate Rd
0x037	QP	Quik Test Pressure
0x038	QL	Quik Loss
0x039	QF	Quik Flow
0x03A	LLQ	Low Limit Leak
0x03B	HLQ	High Limit Leak
0x03C	PQ	Predicted Leak
0x03D	LR	Leak Rate
0x03E	CLF	Corr. Leak Std Flow
0x03F	LFC	Leak Std Cal Flow
0x040	LCD	Leak Std Cal Date
0x041	LRC	Leak Std Recert
0x042	EVL	Test Evaluation
0x043	VFL	Virtual Flow
0x044	FL	Flow
0x045	QTE	Quik Test Enable
0x046	QHL	Quik Test HL Band
0x047	QLL	Quik Test LL Band
0x048	EDE	EDC Enabled
0x049	EDP	EDC Percentage
0x04A	EDQ	EDC Quantity
0x04B	EDC	EDC Offset
0x04C	UP	Pressure Unit
0x04D	UDP	Pressure Unit
0x04E	UF	Flow Unit
0x04F	UT	Time Unit
0x050	UV	Voltage Unit
0x051	UC	Current Unit
0x052	UTM	Temperature Unit
0x053	STS	Self Test Source

Hex Code	Test Data Identifier Code	Description
0x054	XT	Transducer
0x055	XZW	Xdcr Zero Window
0x056	XCL	Xdcr Curr Limit
0x057	XZC	Xdcr Zero Check
0x058	XT	Xdcr Tare
0x059	XTG	Xdcr Tare Range
0x05A	XFR	Xdcr Residual
0x05B	XFC	Xdcr Filter Code
0x05C	XC	Transducer Cal
0x05D	XC1	Xdcr Zero AD Cal
0x05E	XC2	Xdcr Span AD Cal
0x05F	XC3	Xdcr Zero Base Cal
0x060	XC4	Xdcr Span Base Cal
0x061	XZL	Xdcr Zero LL
0x062	XZH	Xdcr Zero HL
0x063	XBL	Xdcr Zero Lwin
0x064	XBH	Xdcr Zero Hwin
0x065	XCX	Xdcr Cal X Array
0x066	XCY	Xdcr Cal Y Array
0x067	REG	Regulator
0x068	RC1	EReg Zero DA Cal
0x069	RC2	EReg Span DA Cal
0x06A	RC3	EReg Zero Base Cal
0x06B	RC4	EReg Span Base Cal
0x06C	AD	Analog A/D
0x06D	DA	Analog D/A
0x06E	COF	Continue on Fail
0x06F	STL	Self Test Level
0x070	STS	START SELF TEST
0x071	OLS	Open Leak Std
0x072	LSC	Leak Std Chk
0x073	SR	SET REGULATOR
0x074	PDL	Press Delta Limit
0x075	RVP	Retain Volume Press
0x077	NAM	Program Name
0x078	TTY	Test Type
0x07A	ARC	Autorun Cycle Count
0x07B	ARM	Autorun Method

Hex Code	Test Data Identifier Code	Description
0x07C	ARE	Autorun Enable
0x07D	PTX	Test Passed Text
0x07E	FTX	Test Failed Text
0x07F	NUM	Number of Programs
0x080	SF	Standard Flow
0x081	IF	Instrument Flow
0x082	VLV	Valve Number
0x083	V	V
0x084	CSN	Cycles Since New
0x085	CT	Total Cycles
0x086	CA	Accept Cycles
0x087	CR	Reject Cycles
0x088	CM	Malfunction Cycles
0x089	CSC	Cycles Since Cal
0x08A	CCP	Clear Prog Counters
0x08B	CCS	Clear Chan Counters
0x08C	CCR	Clear Chan Results
0x08D	WIN	Stat History Length
0x08E	AAV	Accept Average
0x08F	RAV	Reject Average
0x090	ASD	Accept Std Dev
0x091	ASP	Accept SPC Std Dev
0x092	SAM	Sample Size
0x093	APC	Accept Percentage
0x094	RPC	Reject Percentage
0x095	MPC	Malfunction Percent
0x096	Dt	Date
0x097	Tm	Time
0x098	I/O	I/O ID
0x09B	PKP	Peak Pressure
0x09C	Ain	Analog Input
0x09D	Aot	Analog Output
0x09E	RR	Ramp Rate
0x09F	XIZ	Xdcr Zero Inter Cal
0x0A0	XIS	Xdcr Span Inter Cal
0x0A1	PT	Target Pressure
0x0A2	Ser	Serial Number
0x0A3	Stn	Channel Number

Hex Code	Test Data Identifier Code	Description
0x0A4	PRG	Program Number
0x0A5	SP	Starting Pressure
0x0A6	XOP	Crossover Pressure
0x0A7	LLE	Low Limit Event
0x0A8	HLE	High Limit Event
0x0A9	ASM	AutoSetup Method
0x0AA	EDP	Event P
0x0AB	Pt	Apply to Program #
0x0AC	SAS	Start AutoSetup
0x0AD	TTY	Test Type
0x0AE	Pt	Target Pressure
0x0AF	LSV	Leak Std Value
0x0B0	LSP	Leak Std Pressure
0x0B1	Tcy	Desired Cycle Time
0x0B2	EPV	Estimated Part Size
0x0B3	TM	Tooling Mode
0x0B4	Mot	Number of Motions
0x0B5	Fdb	Tooling Feedback
0x0B6	2in	Two Inputs to Start
0x0B7	ATD	Anti-Tie-Down
0x0B8	RR	Retract on Reject
0x0B9	PM	Part Mark
0x0BA	PMF	Part Mark Feedback
0x0BB	Tm	Timer Mode
0x0BC	PPC	Part Present Check
0x0BD	Mot	Motion Number
0x0BE	ESC	Ext Switch Low Chk
0x0BF	SP	Standard Pressure
0x0C0	ALR	Alt Leak Rate
0x0C1	PTU	P/ T Unit
0x0C2	QPT	Quantity Points
0x0C3	CPT	Consecutive Points
0x0C4	COL	Cutoff Limit
0x0C5	ERE	ERC Enabled
0x0C6	ETW	ERC Target Window
0x0C7	ERQ	ERC Quantity
0x0C8	CLP	Check Limit Percent
0x0C9	DPI	DP iso Percent

Hex Code	Test Data Identifier Code	Description
0x0CA	DML	DP Master Part Loss
0x0CB	DMR	DP Mstr Part Lss Rd
0x0CC	DLL	DP Master+Leak Loss
0x0CD	PLR	DP Mstr+Lk Loss Rd
0x0CE	MSR	Mark Severe Lk Rej
0x0CF	ENT	Enable Tooling I/O
0x0D0	VHT	Vent/Halt Tooling
0x0D1	CPP	Copy Program
0x0D2	CTP	Copy to Target Prog
0x0D3	CSN	Clear Since New Ctr
0x0D4	ENC	Enable Calibration
0x0D5	XMN	Xdcr Base Min
0x0D6	XMX	Xdcr Base Max
0x0D7	BR	Barcode Required
0x0D8	MQ	Master Part QL
0x0D9	MQR	Master Part QL Rd
0x0DA	LQ	Master+Leak QL
0x0DB	LQR	Master+Leak QL Rd
0x0DC	MQF	Master Part QF
0x0DD	MQF	Master Part QF Rd
0x0DE	LQF	Master+Leak QF
0x0DF	LQF	Master+Leak QF Rd
0x0E0	PMQ	Master Part Q-Press
0x0E1	PLQ	Master+Leak Q-Press
0x0E2	MQD	DP Master Part QL
0x0E3	MQD	DP Mstr Part QL Rd
0x0E4	LQD	DP Master+Leak QL
0x0E5	LQD	DP Mstr+Lk QL Rd
0x0E6	SXT	Start Xdcr Test
0x0E7	SNR	SNR
0x0E8	ENB	E-NOB
0x0E9	FNB	FF-NOB
0x0EA	LLP	Low Limit Pressure
0x0EB	HLP	High Limit Pressure
0x0EC	NLK	Number of Links
0x0ED	TPP	Target Program
0x0EE	APP	Accept Program
0x0EF	RPP	Reject Program

Hex Code	Test Data Identifier Code	Description
0x0F0	NPP	Next Program
0x0F1	EVC	Eval Condition
0x0F2	LV	Launch Validation
0x0F3	LLV	Low Limit %Vref
0x0F4	HLV	High Limit %Vref
0x0F5	P%V	Part %Vref
0x0F6	Pp	Part Pressure
0x0F7	Pr	Ref Pressure
0x0F8	ERR	E-Regulator Rest
0x0F9	PCR	Target Press Corr
0x0FA	UV	Volume Unit
0x0FB	UP	Percent Unit
0x0FC	PP	Pressure Precision
0x0FD	DPP	Press Precision
0x0FE	PTP	P/ T Precision
0x0FF	FP	Flow Precision
0x100	VLP	Volume Precision
0x101	TP	Time Precision
0x102	VP	Voltage Precision
0x103	CP	Current Precision
0x104	TMP	Temp Precision
0x105	%P	Percent Precision
0x106	LCD	Leak Std/Cal Define
0x107	PSL	Pressure Select
0x108	UPD	Unit/Prec Define
0x109	CC	Capability Code
0x10A	PC	Pneumatic Code
0x10B	VC	Valve Code
0x10C	NOP	Number of Options
0x10D	OPT	Option
0x10E	VAN	Valve A Num - Opt
0x10F	VBN	Valve B Num - Opt
0x110	VCN	Valve C Num - Opt
0x111	VDN	Valve D Num - Opt
0x112	VAT	Valve A Type - Opt
0x113	VBT	Valve B Type - Opt
0x114	VCT	Valve C Type - Opt
0x115	VDT	Valve D Type - Opt

Hex Code	Test Data Identifier Code	Description
0x116	VAP	Valve A PWM - Opt
0x117	VBP	Valve B PWM - Opt
0x118	VCP	Valve C PWM - Opt
0x119	VDP	Valve D PWM - Opt
0x11A	VPW	Valve PWM
0x11B	PRR	Pressure Restrict
0x11C	PSL	Pressure Select
0x11D	RMX	EReg Span DA Cal
0x11E	MPP	Max System Pressure
0x11F	STL	Self Test Loss
0x120	FEL	Flow Event Limit
0x121	LSS	Leak Std Select
0x122	RPP	Retain Part Press
0x123	RCP	Retention Cutoff
0x124	PTS	Part Seal
0x125	PRF	Prefill
0x126	ARR	Autorun Relax
0x127	FPR	Fill Pressure
0x128	RPM	Ramp Method
0x129	XV	Transducer Verify
0x12A	SXV	START VERIFICATION
0x12B	VNP	Number of Points
0x12C	VPS	Setpoint Pressure
0x12D	PSP	Setpoint Pressure
0x12E	DFL	Direct Flow
0x12F	PFM	Prefill Method
0x130	SXC	START CALIBRATION
0x131	XNP	Number of Points
0x132	XSP	Setpoint Pressure
0x133	XCP	Cal Pressure
0x134	LNL	Linearity Limit
0x135	XPM	Pressure Mode
0x136	XPC	Pressure Correction
0x137	XCS	Setpoint Pressure
0x138	XCI	Instrument Pressure
0x139	XCF	Instrument Flow
0x13A	XCA	Analog Value
0x13B	XCM	Master Reading

Hex Code	Test Data Identifier Code	Description
0x13C	XCV	Master Value
0x13D	XCD	Last Cal Date
0x13E	XCT	Last Cal Time
0x13F	XCB	Atm Pressure
0x140	LIN	Linearity
0x141	XVS	Setpoint Pressure
0x142	XVI	Instrument Pressure
0x143	XVF	Instrument Flow
0x144	XVM	Master Reading
0x145	XVV	Master Value
0x146	XVD	Verify Date
0x147	XVT	Verify Time
0x148	RC	Elec Regulator Cal
0x149	SRC	START CALIBRATION
0x14A	RNP	Number of Points
0x14B	RVL	Low Limit Voltage
0x14C	RVH	High Limit Voltage
0x14D	RCS	Setpoint Voltage
0x14E	RCI	Instrument Pressure
0x14F	RCA	Analog Value
0x150	RCV	Master Value
0x151	RCD	Last Cal Date
0x152	RCT	Last Cal Time
0x153	RAN	Number of Points
0x154	RAS	Analysis Voltage
0x155	RAP	Analysis Pressure
0x156	RVL	Low Limit Voltage
0x157	RVH	High Limit Voltage
0x158	RAT	Analysis Percent
0x159	RDT	Reg Dwell Timer
0x15A	VSP	Setpoint Voltage
0x15B	RSI	Result Information
0x15C	MOR	Master Flow Offset
0x15D	PTS	Port Select
0x15E	LMP	Link Motion Preempt
0x15F	LKM	Link Motion
0x160	EXP	Execution Pause
0x161	DLT	Delay Timer

Hex Code	Test Data Identifier Code	Description
0x162	ERC	ERC Method
0x163	EDT	Event T
0x164	EVT	Event Type
0x165	EVP	Event Pressure
0x166	EIL	ERC Increment Limit
0x167	ERP	ERC Rate/Period
0x168	ECL	ERC Crossover Limit
0x169	EOL	ERC Offset Limit
0x16A	ETW	ERC Target Window
0x16B	MSP	Max Pressure - Opt
0x16C	LLF	Low Limit Flow
0x16D	HLF	High Limit Flow
0x16E	PFL	Part Flow
0x16F	PRI	Programmable Input
0x170	PRO	Programmable Output
0x171	RDI	Restore Default I/O
0x172	PPR	Pre-Pressure
0x173	PPW	Pre-Pressure Window
0x174	PPS	Pre-Press Select
0x175	PPE	Pre-Press Enable
0x176	EVA	Evacuation Source
0x177	ETP	Evacuation Setpoint
0x178	TRA	T-Gas Source
0x179	ETP	Fine T-Gas Target
0x17A	CRA	Clean Part Source
0x17B	CTG	Target Pressure
0x17C	NTP	Sample Points
0x17D	MSL	Reject Rate
0x17E	RRT	Reject Rate Total
0x17F	NPS	Number of Steps
0x180	STP	Target Press
0x181	ESN	External Sniffer
0x182	CLM	Clamshell
0x183	EVD	Vacuum Decay
0x184	SN	Step Number
0x185	GPT	Gross Fill Pulse
0x186	GLT	Gross T-Gas Target
0x187	GLF	Gross T-Gas Fill

Hex Code	Test Data Identifier Code	Description
0x188	EVM	Allow Evac Limit
0x189	TMN	Fine T-Gas Min
0x18A	TMX	Fine T-Gas Max
0x18B	CMN	Clean Min Pressure
0x18C	CMX	Maximum Pressure
0x18D	GLD	Gross T-Gas Decay
0x18E	TTF	TracerMate Flags
0x18F	FLF	Fine T-Gas Fill
0x190	TRM	T-Gas Recovery
0x191	SCP	Start Clean Part
0x192	ACT	Auto-Cycle Tst Mode
0x193	SGN	Sample Gas Number
0x194	CTR	Clean Part Timer
0x195	DVF	Vent During Fill
0x196	STW	Target Window
0x197	FTA	Fill
0x198	FTA	Dwell
0x199	PEV	Part Evacuation
0x19A	PSV	Part Sniffer Type
0x19B	STV	Step Target Press
0x19C	DVM	Test Mode
0x19D	SPT	Gross Wait
0x19E	TLR	T-Gas Leak Rate
0x19F	CLR	Cumulative Leak
0x1A0	PNM	Sniffer Test Point
0x1A1	IPR	Close Inner Purge
0x1A2	CFS	Cleanup Setpoint
0x1A3	SIO	Sniffer Init
0x1A4	PTG	Gross Prefill
0x1A5	PTF	Prefill
0x1A6	SPM	Fine Wait
0x1A7	TLU	Leak Rate Unit
0x1A8	TLP	Leak Rate Precision
0x1A9	SEV	Leak Rate Window
0x1AA	MV	T-Gas Mix Verify
0x1AB	MTS	T-Gas Source
0x1AC	MVH	Leakrate High Limit
0x1AD	MVL	Leakrate Low Limit

Hex Code	Test Data Identifier Code	Description
0x1AE	RLV	T-Gas LeakStd Value
0x1AF	MVM	T-Gas Leak Rate
0x1B0	MVS	Start Mix Verify
0x1B1	MVT	T-Gas Fill Timer
0x1B2	FMV	Finish Mix Verify
0x1B3	DVO	Device Mode
0x1B4	SMP	Sample Time
0x1B5	GLN	Gross T-Gas Min
0x1B6	GLX	Gross T-Gas Max
0x1B7	ERV	Re-Evac After Test
0x1B8	TBF	LD Background Limit
0x1B9	TML	LD Min T-Gas Setpt
0x1BA	CHV	Chamber Volume
0x1BB	TLK	Test Leak Rate
0x1BC	TR1	Cleanup Delay
0x1BD	CHP	Chamber Pressure
0x1BE	GPS	Gross Sample
0x1BF	FPS	Fine Sample
0x1C0	FLD	Fine T-Gas Decay
0x1C1	MVF	T-Gas Tgt Press
0x1C2	RLC	Run Leak Calibrate
0x1C3	CAP	Calibrate Percent
0x1C4	MTM	Min T-Gas Mode
0x1C5	PET	Part Evac Limit
0x1C6	EXD	Evacuation Xdcr
0x1C7	CEF	Chmbr Evac Limit
0x1C8	CCD	Ch Evac Valve Dly
0x1C9	AZD	Autozero Delay
0x1CA	TEP	T-Gas Exh Press
0x1CB	CRS	Chmbr Crossover
0x1CC	CRF	Pre-Purge
0x1CD	CHO	Chmbr Post-Purge
0x1CE	CHM	Post-Purge Method
0x1CF	CEV	Chmbr Evac Close
0x1D0	LCF	Correction Factor
0x1D1	MSO	MS Iso Open Delay
0x1D2	AZE	Autozero Enable
0x1D3	TSM	T-Gas Sampling

Hex Code	Test Data Identifier Code	Description
0x1D4	LDZ	Device Zero
0x1D5	LDT	Dev Zero Delay
0x1D6	T	Timer
0x1D7	MST	Mass Spec Purge
0x1D8	PCT	Chmbr Post-Purge
0x1D9	SCT	Scale Type
0x1DA	UW	Weight Unit
0x1DB	PW	Weight Precision
0x1DC	MNT	Min Tare Weight
0x1DD	MXT	Max Tare Weight
0x1DE	WGT	Refrigerant Weight
0x1DF	TW	Target Weight
0x1E0	SSW	Starting Src Weight
0x1E1	XPR	Pressure Reference
0x1E2	XUP	Pressure Unit
0x1E3	XPP	Pressure Precision
0x1E4	XUF	Flow Unit
0x1E5	XFP	Flow Precision
0x1E6	APC	Atm Pressure Check
0x1E7	EPR	Pressure Reference
0x1E8	EUP	Pressure Unit
0x1E9	EPP	Pressure Precision
0x1EA	ERA	Atm Pressure
0x1EB	MFO	Manual Fill
0x1EC	REO	Refrigerant Vent
0x1ED	CID	REF Iso Delay
0x1EE	RFC	Fill Close Delay
0x1EF	MFT	Manual Fill
0x1F0	RST	Stabilize
0x1F1	FSW	Final Src Weight
0x1F2	REX	Refrigerant Vent
0x1F3	RED	Refrgnt Vent Close
0x1F4	VWO	Residual Offset
0x1F5	TWN	Min Fill Weight
0x1F6	TWX	Max Fill Weight
0x1F7	WLL	Low Limit
0x1F8	WHL	High Limit
0x1F9	XID	Xdcr Iso Delay

Hex Code	Test Data Identifier Code	Description
0x1FA	EMP	Ext Xdcr Pressure
0x1FB	ESP	Exhaust Setpoint
0x1FC	CPT	Consecutive Points
0x1FD	PEX	Partial Exhaust
0x1FE	LAV	Leak Alarm Volume
0x1FF	ROS	Reject on Slope
0x200	RSP	Slope Window
0x201	RSR	Slope Change/Sec
0x202	CPS	TLR Change/Sec
0x203	AER	Permit Early Reject
0x204	NBC	Number of Barcodes
0x205	AAA	Accum Autozero
0x206	ASA	Short Autozero
0x207	RXM	Pre-Evac Exhaust
0x208	SCL	T-Gas LeakStd Value
0x209	SZL	LD Zero Val Min
0x20A	SZH	LD Zero Val Max
0x20B	SRL	LD Leak Val Min
0x20C	SRH	LD Leak Val Max
0x20D	SCO	Cal Offset
0x20E	SCF	Cal Coefficient
0x20F	SCR	Reject Rate Percent
0x210	LDU	Leak Det Unit
0x211	LDP	Leak Det Precision
0x212	DL	Diff Press Loss
0x213	DLR	Diff Press Loss Rd
0x214	RFL	Reference Loss
0x215	DP	Diff Pressure
0x216	XAN	Xdcr Zero LL
0x217	XAX	Xdcr Base Max
0x218	XRL	Xdcr Risidual Limit
0x219	XRW	Xdcr Risidual Warn
0x21A	BCM	Barcode Method
0x21B	STM	Self Test Method
0x21C	STN	Self Test Program
0x21D	CST	Custom Self Test
0x21E	ETY	Edge Type
0x21F	ILS	Level State

Hex Code	Test Data Identifier Code	Description
0x220	ILT	Level Time
0x221	IIS	Input Initial State
0x222	IET	Event Type
0x223	IS	Input State
0x224	LOF	Loss Offset
0x225	DD	Decay Direction
0x226	CGP	Chmbr Pre-Purge
0x227	CGT	Chmbr Pre-Purge
0x228	OTL	Open T-Gas Leak Std
0x229	CTF	Continue to Fill
0x22A	CLR	Cal Required
0x22B	LKL	Leak Loss
0x22C	LKF	Leak Flow
0x22D	MML	Max Master Loss
0x22E	MML	Min Mstr+Leak Loss
0x22F	XLL	Max Leak Loss
0x230	MLL	Min Leak Loss
0x231	MLF	Min Mstr+Leak Flow
0x232	MLF	Min Leak Flow
0x233	XLF	Max Leak Flow
0x234	CTE	Continue to Evac
0x235	CTX	Continue T-Gas Exh
0x236	BC	Batch Calibration
0x237	BQ	Batch Quantity
0x238	BL	Batch Layout
0x239	DKL	DP Leak Loss
0x23A	AQ	Average Quantity
0x23B	ME	Malfunction Eval
0x23C	SOD	Shut Off Delay
0x23D	SDL	ST DP Low Limit
0x23E	SDH	ST DP High Limit
0x23F	STL	ST TPL Low Limit
0x240	STH	ST TPL High Limit
0x241	SRL	ST RPL Low Limit
0x242	SRH	ST RPL High Limit
0x243	PPC	Prefill Press Check
0x244	EM	Exhaust Method
0x245	CMP	Charge Min Press

Hex Code	Test Data Identifier Code	Description
0x246	CXP	Charge Max Press
0x247	CTP	Charge Target Press
0x248	CPR	Charge Pressure
0x249	VLD	Valve Detection
0x24B	Ps	Standard Pressure
0x24C	Vi	Instrument Volume
0x24D	Vp	Part Volume
0x24E	LRO	Leak Rate Offset
0x24F	t	Test Time
0x250	ISO	Isolation
0x251	CC	Configuration Code
0x252	LRO	Leak Rate Offset
0x253	FDC	T-Gas Fill Option
0x254	HVU	Hard Vac Unit
0x255	HVP	Hard Vac Precision
0x256	VTP	Hard Vac Setpoint
0x257	DHU	Hard Vac Unit
0x258	DHP	HardVac Precision
0x259	TGE	T-Gas Evaluation
0x25A	FD	Flow Direction
0x25B	USF	Unit Scaling Factor
0x25C	APC	Ambient Press Corr
0x25D	AF	Ambient Factor
0x25E	LCM	Loss Calc Mode
0x25F	AP	Ambient Pressure
0x260	STF	Self Test Flow
0x261	XFP	Xdcr Filter Pass
0x262	XFS	Xdcr Filter Size
0x263	EXM	Execution Mode
0x264	PCL	PROGRAM CALIBRATION
0x265	NOC	Number Of Child
0x266	CNA	Connection A
0x267	CNB	Connection B
0x268	TLN	Tooling Name
0x269	PTM	Prompt Message
0x26A	SQH	Sequence Handle
0x26B	SQM	Manipulation
0x26C	SAT	Available Type

Hex Code	Test Data Identifier Code	Description
0x26D	SLS	List Selection
0x26E	SLE	List Eval Selection
0x26F	STO	Tooling Operation
0x270	CPO	Custom Panel
0x271	AC	Ambient Correction
0x272	AD	Ambient Delta
0x273	MAD	Max Ambient Delta
0x274	VEN	Valve E Num - Opt
0x275	VFN	Valve F Num - Opt
0x276	VET	Valve E Type - Opt
0x277	VFT	Valve F Type - Opt
0x278	VEP	Valve E PWM - Opt
0x279	VFP	Valve F PWM - Opt
0x27A	MN	Motion Name
0x27B	MT	Motion Type
0x27C	EXT	Extend Time
0x27D	EXO	Extend Output
0x27E	EXF	Extend Feedback
0x27F	RTT	Retract Time
0x280	RTO	Retract Output
0x281	RTF	Retract Feedback
0x282	MTP	Port Select
0x283	MOT	Motion
0x284	SCA	SEQUENCE CALIBRATION

Test Evaluation String and Code

type "TABLE EVALUATION"

Hex Code	Test Data Identifier Code	Description
0x01	A	PROGRAM ACCEPT
0x02	R	PROGRAM REJECT
0x03	R1	PART REJECT - LEVEL 1
0x04	R2	PART REJECT - LEVEL 2
0x05	R3	PART REJECT - LEVEL 3
0x06	AP	PROGRAM CALIBRATION PASSED
0x07	AF	PROGRAM CALIBRATION FAILED
0x08	AM	MASTER PART COMPLETE
0x09	SP	SELF-TEST PASSED
0x0A	SF	SELF-TEST FAILED
0x0B	QC	SEQUENCE COMPLETE
0x0C	SL	SEVERE LEAK
0x0D	PL	TEST PRESSURE LOW
0x0E	PH	TEST PRESSURE HIGH
0x0F	PB	BELOW TARGET PRESSURE
0x10	PA	ABOVE TARGET PRESSURE
0x11	HF	HELIUM BACKGROUND FAULT
0x12	EF	PART EVAC FAULT
0x13	XZ	TRANSDUCER ZERO BAD
0x14	XO	TRANSDUCER OVER-RANGE
0x15	FZ	FLOW TRANSDUCER ZERO BAD
0x16	FO	FLOW TRANSDUCER OVER-RANGE
0x17	FX	ERROR: EXCESSIVE FLOW
0x18	PE	PROGRAM CONFIGURATION ERROR
0x19	EP	PROG ERROR
0x1A	CE	CALCULATION ERROR
0x1B	IP	INVALID PROGRAM SELECTED
0x1C	ID	INVALID CALIBRATION DATA
0x1D	IO	INVALID I/O CONFIGURATION
0x1E	IF	I/O FAULT
0x1F	CQ	CAL REQUIRED - LIMIT EXCEEDED

Hex Code	Test Data Identifier Code	Description
0x20	CP	CAL REQUIRED - PARAM CHANGED
0x21	CM	MIN PERF FACTOR ERROR
0x22	C1	MASTER+LEAK LOSS<MASTER LOSS
0x23	C2	MASTER LOSS>MAX M+L LOSS
0x24	C3	MASTER+LEAK LOSS>MAX M+L LOSS
0x25	C4	MASTER FLOW>MAX M+L FLOW
0x26	C5	MASTER FLOW<MIN MASTER FLOW
0x27	C6	MASTER+LEAK FLOW>MAX M+L FLOW
0x28	C7	MASTER FLOW>MAX MASTER FLOW
0x29	C8	MASTER+LEAK FLOW<MASTER FLOW
0x2A	C9	MASTER LOSS<MIN MASTER LOSS
0x2B	L0	MASTER LOSS>MAX MASTER LOSS
0x2C	SB	STOP BUTTON PRESSED
0x2D	SI	STOP INPUT RECEIVED
0x2E	SH	ERROR: STOP INPUT HIGH
0x2F	SC	START COMMON INPUT LOW
0x30	AT	ERROR: ANTI-TIE DOWN
0x31	PP	ERROR: PART NOT PRESENT
0x32	PC	ERROR: PART NOT CHANGED
0x33	XL	EXT SWITCH DID NOT GO LOW
0x34	XH	EXT SWITCH DID NOT GO HIGH
0x35	TE	ERROR: TOOLING NOT RESET
0x36	TX	ERROR: TOOLING NOT EXTENDED
0x37	TR	ERROR: TOOLING NOT RETRACTED
0x38	TS	TOOLING RESET
0x39	MF	ERROR: PART MARK FAULT
0x3A	PN	PART NOT FULL
0x3B	PX	PART NOT EXHAUSTED
0x3C	PS	PART NOT STABILIZED
0x3D	AC	AUTOSETUP SEQ COMPLETE
0x3E	DZ	DP TRANSDUCER ZERO BAD

Hex Code	Test Data Identifier Code	Description
0x3F	DO	DP TRANSDUCER OVER-RANGE
0x40	TI	ERROR: TWO-INPUT REQ TO START
0x41	BR	ERROR: BARCODE REQ TO START
0x42	DF	DP TRANSDUCER FAULT
0x43	LN	ERROR: NO LINKS DEFINED
0x44	LL	ERROR: LINK EXECUTION LOOP
0x45	LP	ERROR: LINK PROG IS PARENT
0x46	LU	ERROR: LINK PROG UNDEFINED
0x47	LO	ERROR: DISSIMILAR LINK ORDER
0x48	LD	ERROR: DUPLICATE TARGET LINK
0x49	CA	CAL PROGRAM ACCEPT
0x4A	CR	CAL PROGRAM REJECT
0x4B	PF	PRESSURE TRANSDUCER FAULT
0x4C	NE	NO EVENT OCCURRED
0x4D	SX	SYSTEM PRESSURE EXCEEDED
0x4E	SE	PRESSURE SELECT CONFIG ERROR
0x4F	LE	LEAK STD SELECT CONFIG ERROR
0x50	VR	VENT PART RESET TOOLING
0x51	XC	TRANSDUCER CAL COMPLETE
0x52	XE	TRANSDUCER CAL ERROR
0x53	XV	TRANSDUCER VERIFY COMPLETE
0x54	EC	ELEC REGULATOR CAL COMPLETE
0x55	EE	ELEC REGULATOR CAL ERROR
0x56	ER	SYSTEM ERROR - SERVICE REQ
0x57	TP	TEST PORT SELECT CONFIG ERROR
0x58	RX	SOURCE PRESSURE EXCEEDED
0x59	RL	PRE-PRESSURE LOW
0x5A	RH	PRE-PRESSURE HIGH
0x5B	SN	ERROR: SNIFFER NOT READY
0x5C	SU	SNIFFER UNITS MISMATCH
0x5D	SM	SNIFFER MODE MISMATCH

Hex Code	Test Data Identifier Code	Description
0x5E	TB	T-GAS BACKGROUND FAULT
0x5F	TM	T-GAS MIN LEAK RATE FAULT
0x60	TC	T-GAS CHAMBER CLEANUP FAULT
0x61	ST	SNIFFER TYPE MISMATCH
0x62	SR	SNIFFER READY INPUT FAULT
0x63	CX	CHAMBER EVACUATION FAULT
0x64	RF	CHAMBER RISE FAULT
0x65	WC	SCALE CONFIG ERROR
0x66	WR	SCALE NOT READY
0x67	WS	SCALE NOT STABLE
0x68	WL	SCALE WEIGHT LOW
0x69	WH	SCALE WEIGHT HIGH
0x6A	WB	WEIGHT BELOW MIN
0x6B	WA	WEIGHT ABOVE MAX
0x6C	OC	ATMOSPHERIC PRESSURE COMPLETE
0x6D	OE	ATMOSPHERIC PRESSURE ERROR
0x6E	XP	EXTERNAL XDCR PRESS
0x6F	MS	MAN FILL SWITCH
0x70	IS	ISOLATION FAILURE
0x71	S1	LD ZERO < MIN
0x72	S2	LD ZERO > MAX
0x73	S3	LD LEAK < MIN
0x74	S4	LD LEAK > MAX
0x75	PV	PROCESS FAULT
0x76	PR	POWER RESET
0x77	IC	INVALID INPUT CONFIGURATION
0x78	IE	INPUT INITIAL STATE ERROR
0x79	MC	MASS SPEC CONTAMINATION
0x7A	FC	CHAMBER PRESSURE HIGH
0x7B	IX	CHAMBER CROSSOVER INPUT FAULT
0x7C	IR	CHAMBER RISE INPUT FAULT

Hex Code	Test Data Identifier Code	Description
0x7D	TF	T-GAS PART FILL FAULT
0x7E	TL	T-GAS LEAK STD FAULT
0x7F	L1	MASTER+LEAK LOSS<MIN M+L LOSS
0x80	L2	LEAK LOSS<MIN LEAK LOSS
0x81	L3	LEAK LOSS>MAX LEAK LOSS
0x82	L4	MASTER+LEAK FLOW<MIN M+L FLOW
0x83	L5	LEAK FLOW<MIN LEAK FLOW
0x84	L6	LEAK FLOW > MAX LEAK FLOW
0x85	AL	MASTER+LEAK PART COMPLETE
0x86	VF	VALVE LOAD FAULT
0x87	EI	ERROR: INSTRUMENT NOT ENABLED
0x88	CL	CHARGE PRESSURE LOW
0x89	CH	CHARGE PRESSURE HIGH
0x8A	CO	CHAMBER XDCR OVER-RANGE
0x8B	PI	SNIFF PRESENT INP FAULT
0x8C	F1	CLAM FLOW FLT 1
0x8D	F2	CLAM FLOW FLT 2
0x8E	F3	CLAM FLOW FLT 3
0x8F	F4	CLAM FLOW FLT 4
0x90	F5	CLAM FLOW FLT 5
0x91	NA	RES UNAVAILABLE
0x92	AO	AMBIENT TRANSDUCER OVERRANGE
0x93	AD	AMB DELTA > MAX AMB DELTA
0x94	VH	ERROR: VENT/HALT INPUT HIGH
0x95	IH	ERROR: IP STOP INPUT HIGH
0x96	IV	ERROR: IP VENT/HALT INPUT HIGH
0x97	FF	FLOW TRANSDUCER FAULT
0x98	BF	AMBIENT TRANSDUCER FAULT
0x99	CF	CHAMBER TRANSDUCER FAULT
0x9A	TO	TOOLING CONFIGURATION ERROR
0x9B	TU	TOOLING FAULT

This page is intentionally blank.

Index

Adjust Parameters, 33
Auto Setup, 8, 16, 32, 33
Autorun, 230
Backup Instrument Settings, 18
Barcode, 226
Binary Program Selection, 178
Cal Method, 39, 63, 118, 119, 140, 155, 229
Calibration Parameters, 41, 55, 65, 121, 141, 157
Channel Configuration, 15, 16, 184, 188, 238
Common, 176, 250, 256, 257
Communication, 179, 188, 189, 192, 238, 239, 240, 241
Crossover Pressure, 71, 75, 79
CTSnet LT, 204
Diff Decay-Leak Rate, 105
Diff Pressure (DP) Decay-Leak Std, 111
Diff Pressure (DP) Decay-ΔP, 93
Diff Pressure Decay-ΔP/ΔT, 99
Differential Pressure Decay-Leak Std, 121
Differential Pressure Transducer, 14, 94, 106, 111, 113
Digital IO Cable Diagram, 174
Direct Flow Parameter, 55, 65
Display User Level, 17, 19, 25, 31, 39, 43, 47, 51, 59, 63, 69, 81, 119, 123, 127, 135, 140, 155
EDC, 22, 23, 29, 37, 54, 62, 63, 98, 102, 110, 117, 118, 132, 138, 146, 147, 153, 262, 263
EDC Parameters, 263
Edge Type, 75
Electromagnetic Energy Devices, 1
Electronic Regulator, 17, 69, 70, 73, 74, 77, 78, 81, 82, 83, 238, 241
Electronic Regulator Calibration, 199, 241, 253
Electronic Regulator Calibration Report, 241
Environmental Drift Correction, 22, 29, 37, 54, 62, 98, 102, 110, 117, 132, 138, 146, 153, 262, 263
E-Regulator Rest, 241
Ethernet Port, 2
EtherNet/IP, 184, 185, 186, 189, 190
Example, 196, 198, 225, 246
Exhaust, 2, 20, 26, 34, 44, 48, 52, 60, 70, 74, 78, 82, 96, 100, 108, 115, 124, 128, 136, 144, 150, 179, 180, 181, 227
FAT32, 18
Features, 20, 26, 34, 52, 60, 136, 144, 150, 188
Fill, 20, 26, 34, 52, 56, 60, 65, 96, 100, 108, 115, 136, 144, 150, 179, 180, 181, 225
Fill the Test Part, 19, 25, 31, 51, 59, 99
Fuses, 2
Global Configuration, 184, 188
Hardware Inputs, 8, 189
Hardware Outputs, 8, 189
Hold, 175
HW Inputs, 170
HW Outputs, 170
I/O Connections, 2
I/O Wiring, 171
Input Initial State, 75
Inputs, 15, 170, 175, 178, 186, 188, 189, 190
Inputs and Outputs, 158, 170, 185
IP Inputs, 8, 186, 190
IP Outputs, 8, 186, 190
Leak Flow, 65, 141
Leak Flow, 64
Leak Flow, 141
Leak Loss, 41, 157
Leak Loss, 40
Leak Loss, 120
Leak Loss, 156
Leak Standard, 14, 16, 37, 38, 39, 63, 93, 94, 111, 113, 117, 118, 120, 121, 127, 132, 140, 153, 154, 155, 179, 180, 224, 229
Leak Standard Values, 16, 39, 63, 119, 140, 155
Leak Std Select, 224, 254
Level State, 75
Level Time, 75
Link, 90, 254, 255
Main Menu, 8, 16
Manifold, 229
Mass Flow, 13, 51, 59, 135
Mass Flow-Leak Std, 59
Master Flow Offset, 54, 55, 138
Master Part, 12, 31, 39, 40, 41, 51, 54, 55, 59, 63, 64, 65, 98, 110, 111, 115, 117, 118, 120, 121, 127, 128, 138, 140, 141, 155, 156, 157, 229, 251, 252, 254, 255, 257, 261, 262, 263
Master Part Flow, 64, 65, 140, 141, 262
Master Part Loss, 37, 40, 41, 120, 121, 132, 153, 156, 157, 251, 262
Master Part Press, 41, 65, 141, 157
Master+Leak Flow, 64, 65, 140, 141, 251, 252
Master+Leak loss, 41, 157
Master+Leak Loss, 37, 40, 41, 120, 121, 132, 153, 156, 157, 251
Master+Leak Press, 41, 65, 141, 157
Max Leak Flow, 62
Max Master + Leak Flow, 62
Max Master Flow, 62
Message & Error Codes, 250
Min Leak Flow, 62
Min Master + Leak Flow, 62
Min Master Flow, 54, 55, 62, 138, 251
Monitor Screens, 8
Multiple Unique Parts, 9
Non-Leaking Master Part, 39, 40, 55, 63, 64, 111, 118, 120, 140, 155, 156

Number of Motions, 159, 162
Occlusion, 43
Open Leak Std, 111, 179, 224
Orifice, 229
Outputs, 15, 170, 179, 181, 186, 188, 189, 190
Parent Program Linking, 9, 13, 85, 90, 162
Parsing Data, 198
Part Mark, 255
Part Present, 87, 176, 186, 190
Pass and Fail, 23, 29, 38, 45, 49, 54, 63, 71, 76, 79, 98, 103, 110, 118, 126, 132, 139, 147, 154
Performance Factor, 37, 40, 41, 117, 120, 121, 153, 156, 157, 252
Pneumatic Regulator, 17
Prefill, 20, 21, 26, 27, 34, 35, 52, 53, 60, 61, 96, 100, 108, 115, 125, 136, 137, 144, 145, 150, 151, 179, 180, 181, 198, 225, 257
Prefill Timer Function, 225
Pressure Correction, 228
Pressure Decay-Leak Std, 31, 127
Pressure Decay-ΔP, 19
Pressure Decay-ΔP/ΔT, 25
Pressure Parameters, 27, 35, 44, 48, 53, 61, 70, 74, 78, 83, 137, 151
Pressure Regulator, 20, 26, 34, 43, 51, 59, 96, 100, 108, 115, 128, 144, 150, 255, 256, 257, 258
Pressure Select, 17
Pressure Verify, 47
PROFINET, 188
Program Cal, 8, 34, 36, 37, 39, 40, 41, 52, 54, 55, 60, 63, 64, 65, 115, 118, 120, 121, 128, 131, 132, 136, 138, 140, 141, 150, 152, 153, 155, 156, 157, 179, 180, 224, 251, 252, 254, 260
Program Calibration, 39, 40, 55, 62, 63, 64, 118, 120, 140, 155, 156, 250, 252, 255, 261
Program Configuration, 17, 184, 252
Program Evaluation Codes, 197
Program Select Buttons, 7
Programmable Inputs and Outputs, 189
Programmable Inputs and Outputs Menus, 185, 189
Proof Pressure, 83
Quik Test, 37, 62, 118, 132, 138, 153, 260, 261
Ramp Method, 70, 74, 78, 83
Ramp Rate, 70, 74, 78, 82, 83
Ramp to Flow Event, 77
Ramp to Input Event, 73
Ramp to Proof, 81
Ramp to ΔP Event, 69
Relax, 34, 39, 52, 60, 63, 128, 136, 140, 150, 155, 179, 230
Reports, 199, 240
RS232, 7, 8, 178, 179, 193, 196, 198, 199, 226, 250
RS232 Port, 2
Security, 8, 18
Segment Codes, 271
Self-Test, 8, 16, 47, 117, 224, 225, 251, 257, 258
Self-Test Failed, 257
Self-Test Passed, 257
Sequential Linking, 10
Setup, 8, 9, 18, 94, 113
Severe Leak, 21, 27, 35, 53, 61, 125, 130, 137, 145, 151, 177, 178, 181, 257
SPC, 176, 196
Stabilization Time, 94, 97, 99, 101, 106, 108, 109, 113, 116
Stabilize, 20, 26, 34, 94, 96, 99, 100, 106, 108, 113, 115, 120, 128, 130, 144, 150, 179
Stabilize Time, 19, 25, 31
Stabilize Time, 251
Stabilize Time, 257
Start Program, 175
Stop/Reset, 175, 176, 177, 178, 257
Streaming, 188, 198
Target Pressure, 20, 21, 26, 27, 32, 34, 35, 41, 44, 52, 53, 60, 61, 65, 82, 83, 96, 97, 100, 101, 108, 109, 115, 116, 121, 125, 130, 136, 137, 141, 144, 145, 150, 151, 157, 255
Target Test Pressure, 19, 25, 31, 44, 51, 59, 97, 99, 101, 109, 116
TCP/IP, 193, 196
Technical Specifications Summary, 290
TELNET, 193
Test, 20, 26, 34, 44, 48, 52, 60, 70, 74, 94, 96, 99, 100, 102, 108, 113, 115, 117, 124, 128, 130, 136, 144, 150
Test Data Identifier Codes, 197
Test Evaluation, 22, 23, 28, 29, 33, 38, 45, 48, 49, 54, 63, 71, 75, 76, 79, 97, 98, 102, 103, 110, 117, 118, 126, 131, 132, 139, 146, 147, 154, 184, 188, 196, 197, 260, 261
Test Evaluation Codes, 197
Test Failed, 181
Test Parameters, 17, 22, 28, 36, 44, 48, 54, 62, 71, 75, 79, 83, 98, 102, 109, 117, 126, 131, 138, 146, 152, 261, 268
Test Passed, 181
Test Port, 257
Test Results, 48, 98, 102, 109, 110, 117, 118, 126, 131, 262
Test Time, 31, 261
Test Time, 97
Test Time, 97
Test Time, 117
Test Time, 125
Test Type, 8, 12, 17, 32, 175, 185, 196, 197, 228, 250
Test Type Menu, 12
Test Type Table, 10
Timer Parameters, 20, 26, 34, 44, 48, 52, 60, 70, 74, 78, 82, 96, 100, 115, 124, 128, 136, 144, 150
Tooling Control, 15, 124, 128, 158, 162
Tooling Extend, 89, 124, 128, 162, 177
Tooling Motion, 124, 128, 162
Tooling Option, 159
Tooling Retract, 89, 124, 128, 162, 177
Transducer, 13, 14, 44, 55, 56, 63, 65, 93, 94, 96, 100, 105, 106, 108, 111, 113, 115, 140, 238, 239, 240, 253, 258
Transducer Calibrate, 238, 240
Transducer Calibration Report, 238, 239, 240
Transducer Verification Report, 238
Transducer Verify, 238
Transducer Zero Bad, 253, 258
TST Parameter, 22, 28, 36, 44, 48, 54, 62, 71, 75, 79, 83, 102, 126, 131, 138, 146, 152, 261, 263, 268
Two Inputs to Start, 176
Units of Measure, 15
USB Memory Stick, 18
Vent/Halt, 175, 176, 177, 178, 184, 188

This page is intentionally blank.

Sentinel X5 Technical Specifications

Outside Physical Dimensions

X5 Wall mount configuration, 12” w x 9.25” h x 8.75” d (305 x 235 x 220 mm)

Electrical Specifications

Supply power: 100-240 VAC, 50/60 Hz

Air Quality

ISO 8573-1:2010[2:2:2] Compressed air or nitrogen only

Environmental Factors

Operating temperature Range: 5°C to 40° C (41°F to 104°F)

Maximum humidity 90% relative humidity, non-condensing

Digital I/O

12 inputs and 12 outputs with expansion capabilities, 24 V - 1 A max. Tooling control up to 18 motions.

Instrument weight

13-16 lbs (6-7 kg)

Contact Cincinnati Test Systems Service Department

By phone 513-202-5108 or by email service@cincinnati-test.com 8am-5pm eastern US

For after-hours, 24/7 emergency phone support, call 513-202-5174