

Uson

Sprint^{iQ} Owner's Guide



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1.1 SAFETY CONSIDERATIONS

Electrical and pneumatic (or air pressure) hazards are the two primary areas of concern when operating leak-testing equipment.



CAUTION: If the equipment is used in a manner not specified in this manual, the protection provided by the equipment may be impaired.

1.1.1 PNEUMATIC HAZARDS



WARNING: Avoid Personal injury and/or Equipment Damage. Tested parts must be secured in place mechanically or be enclosed/covered to avoid personal injury or equipment damage. Securing tested parts with air coupled devices only is NOT sufficient. Loss of power or air pressure, or multiple reset/abort inputs while the vent step is running will immediately de-energize any couple/clamp valves.



WARNING: Always wear eye protection when working with pressurized air. Disconnect all pressure sources when working with internal components of Uson equipment.

1.1.1.1 FIXTURE CONSIDERATIONS

Fixture safety considerations vary depending on the fixture being leak tested.¹ However, the following hazards of working with pressurized systems should be given serious consideration before operating the Sprint iQ:

- High-pressure pneumatic air systems are exponentially more hazardous as the pressure increases, or as the volume of a system increases. Testing equipment subjected to consistently high-pressure ranges has an increased probability of becoming unable to permanently resist the effects of such pressure.
- Observe caution when working with nonreactive gases or liquids above their boiling points (even at lower pressures), especially when larger volumes of gases are involved. It is essential that relief valves, rupture disks, and pressure regulators are employed to ensure safety.
- Even at moderate pressures, pressurized systems can present a hazard in the form of pressurized air escaping from a leak or a failure. The hazard of flying particles is added when a sight glass or glass flow meter is introduced to the system. The sudden burst of a part could generate sufficient sound concussion to cause hearing damage.

1.Jackson, Charles N., Jr., Sherlock, Charles N., technical editors, and Moore, Patrick O., editor. "Safety Aspects of Leak Testing." Nondestructive Testing Handbook, third edition: Vol. 1, Leak Testing. Columbus, OH: American Society for Nondestructive Testing (1998): p 136.

1.1.2 ELECTRICAL HAZARDS



Always exercise caution when working with electricity.

Always use a replacement fuse of the same type and rating as the original. Failure to do so may be hazardous and can cause damage to the equipment.

1.1.3 GENERAL SAFETY ISSUES

Perform operations, maintenance, or troubleshooting procedures only after reading and comprehending all manuals and materials supplied with the Sprint iQ.

1.1.4 MATERIALS DISPOSAL

Uson is committed to meeting the requirements of the European Union (EU) Waste Electrical and Electronic Equipment (WEEE) Directive. Uson products that are within the scope of the Directive are labelled with a crossed-out "wheelie-bin" symbol, as required by the Directive. It indicates that the product was placed on the market after August 13, 2005 and that end users should segregate the product from other waste at end-of- life.

The detailed requirements vary considerably throughout the EU, and the Uson WEEE compliance approach varies among countries.



2.1 FAST-TRACK SETUP

- Connect clean, dry supply air.
- Connect peripheral devices, if any.
- Connect the power supply and turn on Sprint iQ. Turn the power connector's collar until it is finger-tight to ensure a good connection.
- Use the back panel switch to turn on the Sprint iQ.
- Turn the Lockout Keyswitch to the *program* position (vertical).
- Set the units of measure to use for pressure, flow volume, and flow time.
- Enter test parameters for the first program to run.
- Enter test parameters for additional programs if you are using more than one program.
- Set communication values for the connected peripherals, if used.
- Turn the Lockout Keyswitch to *run* position (horizontal). Before turning over the tester to operator-level personnel, it is strongly advised to remove the key to safeguard the settings.
- Sprint iQ is now ready to use.



Do not allow the power supply's ventilation slots to be blocked. The power supply has an automatic fan that runs as necessary to prevent overheating.

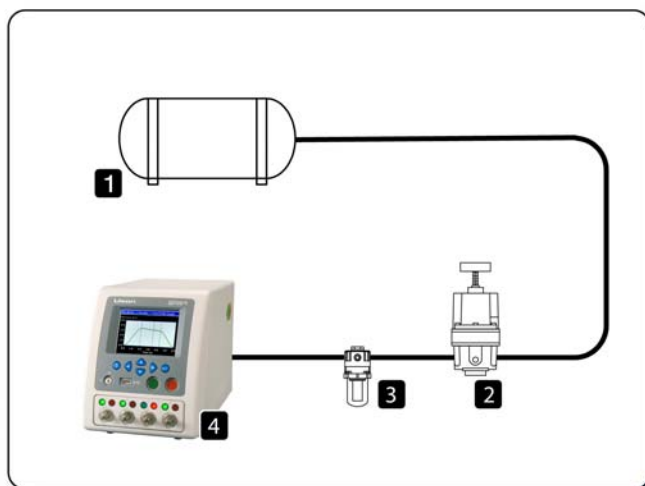
2.1.1 SPRINT IQ REQUIRES CLEAN DRY AIR

Before connecting air (or other gas) to Sprint iQ, make certain the supply air is clean and dry and pressure doesn't exceed the maximum input listed on the rear panel.



Water vapor, particulates, and excessive pressure can damage Sprint iQ's internal components and affect product testing

Supply air is connected to the 1/8-inch female NPT bulkhead on the back of Sprint iQ.



- 1** Compressor
- 2** Step-down regulator
- 3** Mist and Particulate Filter
- 4** Sprint iQ

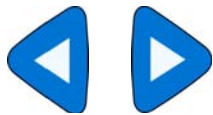
2.2 FRONT PANEL FEATURES

The front panel has an LCD display, keypad, Lockout keyswitch, USB port, and **Stop** and **Start** buttons.

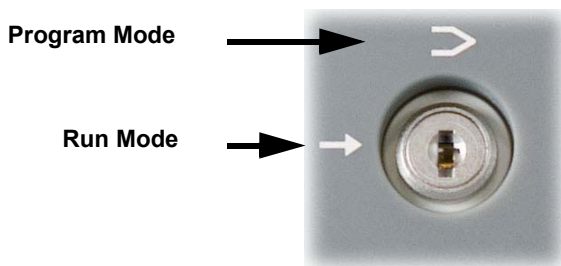


- 1 Display.** The Sprint iQ has a 5.7" diagonal 320 x 240 color graphic liquid crystal display (LCD) with backlight.

2 Keypad. The keypad has 6 keys:

- **Exit.** Use the **Exit** key to exit the Run Mode Options Menu mode and return to the Run display. It is also an “escape” key, allowing parameter entry to be aborted without saving changes. 
- **Enter.** Use the Enter key to select the chosen item. This key is also used to save a value that has been entered. This may be a highlighted item or an entry. If it is not desired to save an entry, use the **Exit** key instead. 
- **Increment and Decrement (Up and Down).** These keys are used to move up and down. They are most often used when moving through the Test Parameters screen. These keys will also change digits and characters in the Parameter Editor of certain menus. 
- **Next and Previous (Left and Right).** These keys are used to set parameters. They are most often used to move along in menu selections to the desired entry. 

- 3 Lockout Keyswitch.** Sprint iQ is in Run mode when the keyswitch is horizontal. Turn the keyswitch counter-clockwise from the vertical position to enter Run mode. Program mode allows changing the operating parameters of the tester and should be used only by supervisors or administrators of the tester. The keyswitch in illustration below is in the vertical position.



The Keyswitch provides security for the important settings of the tester such as test parameters.

Supervisors and Administrators are advised to set the Sprint iQ to Run Mode for the Operator's use and then remove the key.

- 4 USB 2.0 Port.** The port can communicate with USB devices. A memory stick can be inserted and recognized as Drive C:. There is also a similar USB port on the back panel. Only one port may be used at a time.



Unlike personal computers, the Sprint iQ does not support user-loadable device drivers, so it is not compatible with certain USB memory sticks. The following USB memory sticks have been tested and work with the Sprint iQ:

- - All Uson-supplied memory sticks
- - SanDisk "Cruzer Micro" 1 GB memory stick
- - SanDisk models SDCZ2-128, and SDCZ2-256, and SDCZ2-512.

- 5 Start and Stop Switches.** The front panel has a *green Start* switch and a *red Stop* switch. The green switch is used to start the test. The red switch is used to abort a test in progress.

2.2.1 PASS/FAIL LIGHTS

The most convenient test result indicators to observe are the pass and fail lights. A green and red light is assigned for each installed channel.

A green pass light signals that the test cycle was completed and all test values were within tolerances stored in the program that ran on that channel.



A red fail light indicates that at least one test parameter went out of tolerance at some time during a test cycle. The fail light turns on if a gross leak occurred, a pressure error value is exceeded, or the product exceeded an established pressure or flow tolerance. Repeated failures can indicate Sprint iQ or external fixtures have set-up problems.

If a fail light turns on during a test, the operator can check the status box on the Run display for a descriptive message (see *“Status Box Messages” on page 14.*)

2.2.2 BACK PANEL COMPONENTS

1 Pressure Regulator 1
(if ordered)

2 Pressure Regulator 2
(if ordered)

3 Coupling Ports
(number varies with
tester configuration)

4 Fuse

5 Power Switch

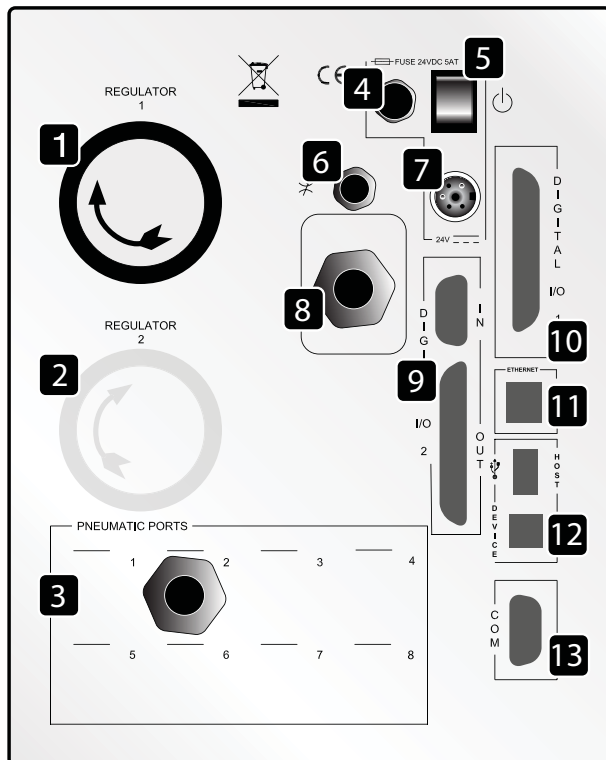
6 Needle Valve
(depends on
configuration)

7 Power Supply
Connector

8 Air Supply
Connection

9 Not Used

10 Digital I/O
(Optional)



11 Ethernet Port (Optional)

12 USB 2.0 Ports:
One Type A and One Type B

13 Serial Com Port

2.2.3 CONNECTING POWER

1. Check that the power switch on the back panel of the tester is OFF.
2. Referring to the figure below, connect the **1** AC power cord to the **2** power supply. (The type of power cord supplied with Sprint iQ will vary, depending on the country.)
3. Attach the **3** DC output power cord to the rear panel of the tester at location shown on page 7 at location **7**. Lock it in position by turning the connector collar so that it firmly grips the receptacle.
4. Finally, connect the AC power cord to the facility power receptacle. The green light on the power supply should now be illuminated indicating that the power supply is receiving AC power.

Before switching the tester ON, be sure that the power supply is located in a position where it will be open to air flow and stable.



2.2.4 SWITCH-ON THE TESTER

Turn the lockout keyswitch to the horizontal (Run) position.

When the power supply is connected correctly as previously explained, press the power switch on the rear panel to turn on the tester.

The tester will begin its initialization process and display a “splash screen” showing the firmware version number.

Initialization will continue as the splash screen remains until the tester finishes and shows the Run Mode display.

2.2.5 RUN MODE DISPLAY OVERVIEW

Sprint iQ shows the Run Mode display during all test cycles in every test mode. If multiple programs are linked, Sprint iQ shows the run display for the program currently running.

Run Mode - Program #1 ¹		
Test Pressure ²	Tested ³	Rejects ⁴
10.000 Psi	0	0
Ch 1		
Ch 2		
Ch 3	⁵	
Ch 4		
⁶ P Decay Mode	⁷ Step Countdown	⁸ Status

- 1** Program Header. Ninety-nine programs may be stored in Sprint iQ's memory. The header shows the program number and program name that is currently selected for running.
- 2** Test Pressure Column. This column displays real-time pressure measurements. At the end of a Vent step it shows the

pressure that was measured at the beginning of the step.
Shows preset pressure before a test is started.

- 3** Tested Box. Shows number of tests. Counts total times pass and fail lights turn on. Counts up to a maximum of 65,535.

During networked operation, the background color indicates the status of Network Audit. The colors indicate:

White: Option disabled,

Green: All results saved,

Yellow: Results buffered ready to be saved,

Red: Error system failed to save results.

Run Mode - Program #1					
Test Pressure		Tested	Rejects		
10,000 Psi		12	2		
Ch 1					
Ch 2					
Ch 3					
Ch 4					
P Decay					
Mode	Step Countdown	Status			

White

Run Mode - Program #1					
Test Pressure		Tested	Rejects		
10,000 Psi		12	2		
Ch 1					
Ch 2					
Ch 3					
Ch 4					
P Decay					
Mode	Step Countdown	Status			

Green

Run Mode - Program #1					
Test Pressure		Tested	Rejects		
10,000 Psi		12	2		
Ch 1					
Ch 2					
Ch 3					
Ch 4					
P Decay					
Mode	Step Countdown	Status			

Yellow

Run Mode - Program #1					
Test Pressure		Tested	Rejects		
10,000 Psi		12	2		
Ch 1					
Ch 2					
Ch 3					
Ch 4					
P Decay					
Mode	Step Countdown	Status			

Red

Network Logging Status Indicators

- 4** Rejects Box. The number of rejected (failed) tests is shown here. This number reflects the number of times the fail light has turned on. The maximum count is 65,535.

The background color indicates the status of the Result Counter Save operation. The colors indicate:

White: Option disabled,

Green: Counters have been saved,

Yellow: Counters have not been saved.

Run Mode - Program #1		
Test Pressure	Tested	Rejects
10,000 Psi	12	2
Ch 1		
Ch 2		
Ch 3		
Ch 4		
P Decay		
Mode	Step Countdown	Status

White

Run Mode - Program #1		
Test Pressure	Tested	Rejects
10,000 Psi	12	2
Ch 1		
Ch 2		
Ch 3		
Ch 4		
P Decay		
Mode	Step Countdown	Status

Green

Run Mode - Program #1		
Test Pressure	Tested	Rejects
10,000 Psi	12	2
Ch 1		
Ch 2		
Ch 3		
Ch 4		
P Decay		
Mode	Step Countdown	Status

Yellow

Result Counter Status Indicators

- 5** Channel Number/Bar Graph/ Status readout. The left column shows the Channel Number and pressure at that channel. The middle column displays a color bar graph to help monitor progress on that channel. The bar graph shows an analog trend of what the current test program is measuring. This helps to show whether values are going up or down, and how rapidly values change. The right column shows the pass/fail status information for the last test completed on that channel. Only active channels are displayed.

- 6** Mode Box. The testing mode is shown in this box. Sprint iQ can operate in many modes such as pressure decay (P Decay), flow, burst, etc. This box shows an abbreviated display of what test type Sprint iQ is set to run.
- 7** Step Countdown Box. The time of each phase counts down during a test. The phases vary depending on the type of test being run.
- 8** Status Box. Shows what phase a test is in and possible reasons for an unsuccessful test.

2.2.6 MODE BOX MESSAGES

Mode Box Display

The test mode is shown in the Mode Box **6**. If Sprint is set to run linked tests, the Mode Box shows the first test type in a series. Note that no tester will have all of the listed tests installed.

Mode Box Display	Selected Test
Back P	Back Pressure
Crack	Crack
P Creep	Pressure Creep
Flow	Flow
Flow FF	Flow Fast Flush
Gauge	Gauge
P Burst	Pressure Burst
P Decay	Pressure Decay
P Occ	Pressure Occlusion
P Occ Rate	Pressure Occlusion Rate
P Rise	Pressure Rise
P Rise Rate	Pressure Rise Rate
P SC	Pressure Sealed Component
PD Rate	Pressure Decay Rate
V Burst	Vacuum Burst
V Decay	Vacuum Decay
V Occ	Vacuum Occlusion
V Occ Rate	Vacuum Occlusion Rate
V Rise	Vacuum Rise
V Rise Rate	Vacuum Rise Rate
V SC	Vacuum Sealed Component
VD Rate	Vacuum Decay Rate

2.2.7 STATUS BOX MESSAGES

The status box on Sprint iQ's run display shows information before, during, and after a test. Three kinds of facts are displayed in the status box-test type set to run, test phase, and results of the completed test.

Status Box Messages

These are some of the messages which may display while the Sprint iQ operates.

Couple X	One or more coupling valves have opened, or a test is in a wait period to allow an external fixture to activate.
EOC	End of cycle.
Fill	Product is being filled with air.
Isolate	A test is in isolate stage to ensure a valve is in the correct state before another is activated.
Pre-Fill	Product is being pre-filled with air.
Stabilize	The programmed stabilize time is counting down.
Test	The test phase is in progress.
Uncouple X	One or more coupling valves have opened, or a test is in a wait period to allow an external fixture to activate
Vent	The test part is open to atmospheric pressure.

Channel Pass/Fail Messages

These are some of the messages that may appear in the right column of the channel display.

Pass	The last test on this channel passed.
Min	The value of the measurement step was below the minimum limit.
Max	The value of the measure step was above the maximum limit.
Gross	Gross pressure error. Pressure exceeded tolerance during the stabilization phase. If not a defective part, check seals.
UserABT	Abort: Stop switch was pressed.
HiBurst	Burst above max setpoint
HiCrack	Crack above max setpoint
LoBurst	Burst below min setpoint
LoCrack	Crack below min setpoint
NoBurst	Burst not detected
NoCrack	Crack not detected
Reject	Creep reject condition
LowP	The test ended because the pressure was lower than expected during the Fill step. (The pressure was not within the set error limit.)
Perr	Pressure not achieved during flow fill step.

2.2.8 TEST PARAMETERS

Test parameters are setpoints and tolerances that tell Sprint iQ how to conduct a test and decide whether a product is accepted or rejected. Test parameters are set in Sprint iQ's Test Parameters menu.

When Test Parameters are Available

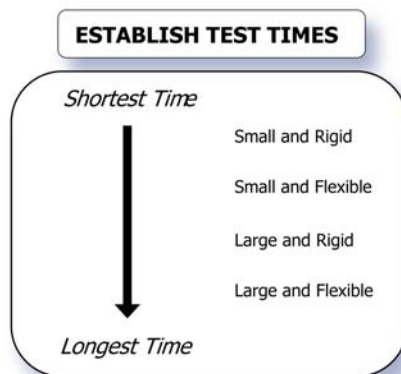
If existing test values are at hand, begin by simply entering those values into the Sprint iQ. Once all values are set correctly, the Sprint iQ is ready for fine tuning.

When Test Parameters are not Available

If there are no established test values, some experimenting is needed to arrive at values for pressures, flow rates, and times best suited to the product. Little effort is required to program Sprint iQ after test parameters are established. Yet, coming up with test values takes consideration when starting from scratch.

Setting Test Time

As test times are developed, keep in mind the size and material of parts to be tested. Parts that are both small and rigid typically require short test times. Parts that are both large and flexible generally require longer test times.



Avoid the Tendency to “Over-Test”

Optimum setup values are typically established after trial and error when working with known good and bad product samples. One point to keep in mind is not to over-test product. Avoid

setting leak tolerances too tight with the idea that absolutely no leak is acceptable. Through experimentation you'll probably find that a small pressure drop occurs simply due to how your product behaves during pressurization. Many products create conditions that merely appear to be small leaks when pressurized.

2.2.8.1 FINE TUNING

After you've entered the basic parameters into a program, you're ready to fine-tune your setup. A few tips:

- If not using external fixtures, set coupling time to zero.
- If product blows out of external fixtures, make sure you have a long enough coupling time.
- If you get gross failures when testing a flexible product, try increasing fill time or evacuate (for vacuum tests) time.
- Add fill and stabilize time to slow the decay rate and make it more consistent.
- If your test doesn't need a dump valve to vent product pressure after testing, set the vent parameter to off.
- In a flow test, set test time long enough for the product under test to fill and produce a stable flow rate.
- If repeated parts failures of good parts occur, try widening the pressure error tolerance or adding more fill or evacuate (for vacuum tests) time.

2.2.9 PUT SPRINT IQ TO WORK

When everything is programmed and checked out, you're ready to put Sprint iQ to work and start testing products. A few tips:

- Explain controls and run display messages to operators.
- Keep external connections to the product under test as straight, rigid, and direct as possible. Flexible connections can cause inconsistent readings.
- Put Sprint iQ in a place where the pressure regulator and other controls on the back won't get moved around or damaged.

2.2.10 START OPTIONS

The Sprint iQ has options that modify the way it accepts the start input. These options are useful for integrating the Sprint iQ with fixtures that seal on the test part.

Start Options are first categorized as being Local (Front Panel) or Remote (digital inputs on the back panel). This option category is mutually exclusive in that front panel push-buttons are ignored totally when the Remote Option is selected, and vice versa.

2.2.10.1 LOCAL START OPTION

The Local Start Option enables the two front panel push-button switch for starting and stopping a test. The green button starts the test. The red button stops or aborts the test.

2.2.10.2 REMOTE START OPTION

The Remote Start Option enables three digital inputs for controlling how the test is started and stopped. The name of the three digital inputs and their description is:

1. Remote Start: a closure that starts the test

2. Remote Start Enable: a closure that indicates a condition that it is safe to start a test (optional dependent on Remote Start Policy)
3. Remote Stop: a closure that aborts the test (optional)

The operations of these three inputs are modified by the Remote Start Policy that has been selected. **There are several remote start policies:** Fixture Lid Start, Interlock Start, Anti-Tie-Down Start, Conventional, Serial Port Start, Foot Switch Start, Front or Remote Start.

Fixture Lid Start

The Remote Start input starts the test cycle. Remote Start must continue to be asserted throughout the test cycle, otherwise, its release aborts the test. Also, Remote Stop can optionally be used to abort the test cycle at any time. The Remote Start Enable input is not used for this start policy and is ignored.

Interlock Start

The Remote Start input starts the test cycle, if Remote Start Enable is already asserted. Typically, Remote Start Enable is connected to a test fixture interlock switch that indicates when it is safe to test. After this condition is attained, some user action is required that asserts the Remote Start input thus starting the test cycle. If Remote Start Enable is released before the test cycle has finished, the test cycle is aborted. Also, Remote Stop can optionally be used to abort the test cycle at any time.

Anti-Tie-Down Start

This start policy requires an external device that implements anti-tie-down operation. The output of this external device is connected to the Remote Start input. The test cycle is started when the anti-tie-down device asserts the Remote Start input for the duration of the coupling time (or times if there are multiple couplings). The intent is to keep the operator's hands safe on the

anti-tie-down device and away from pinch points while the fixture is moving to close and seal on the test part. The test cycle is aborted if the anti-tie-down device releases the Remote Start input before the coupling time(s) have completed. Remote Stop can optionally be used to abort the test cycle at any time. The Remote Start Enable input is not used for this start policy and is ignored.

Conventional Start

The Remote Start Enable input state is ignored for this start policy and a test cycle is started when the Remote Start input is asserted. The Remote Stop input will abort the test when asserted.

Serial Port Start

The Serial Input option allows a start, program selection, and other various functions to be selected via the 9 pin serial port. (See *"Serial Input Commands Option" on page 6-13.*)

Foot Switch Start

The Foot Switch option allows a test cycle to be started when the remote start input is asserted and aborted via the front panel stop button.

Front or Remote Start

The Front or Remote start option allows a test cycle to be started using either the front panel buttons or remote inputs.



WARNING: When using this option, additional safety considerations and protection must be implemented to avoid Personal injury and/or Equipment damage.

2.2.1.1 IN CASE OF TROUBLE

Many difficulties encountered when setting up a new tester are caused by simple things. Address the items in the checklist below to ensure the tester is being operated correctly.

Setup Checklist

- Is the power supply connected to the back panel and is it receiving power (the power supply's green light is lit)?
- Is supply air connected to Sprint iQ?
- Is the supply air clean and dry? Air that contains moisture, oil, or hard particulate **will** damage Sprint iQ.
- Is the supply air within the correct pressure range?
- Has the pressure regulator changed from when the test pressure was set? A change will cause pressure errors.
- Has the LOCKOUT keyswitch been set in the appropriate position for the desired task (Run vs. Program mode)?
- Is the product to be tested attached to the test port during all flow tests? Without product, the resulting high flow could damage the flow sensor.
- Has the sensor calibration been changed?
- Are engineering units set in the correct units of measure?

If the problem persists, call Uson for help.

+1 281-671-2000

3.1 STARTING TESTS WHILE IN THE MENU SYSTEM

While using the menu system, for safety reasons, the **Start** Switch (or the ability to accept a start command) is sometimes disabled. The tester will not start a test while navigating in any part of the menu system which has the word “menu” in the title *except* while in the Results Menu in Run Mode. In this case, the tester will accept start commands so that the operator can view the test data on the graphs.

The tester will not start when it is in an alarm warning or error state.

The **Stop** Switch is always enabled *except* when starting from a remote point.

3.2 NAVIGATION

There are two menu systems. One is accessed by pressing Enter at the Run screen and allows easy access to basic features. The other menu system is accessed in Program Mode and allows in-depth changes to system.

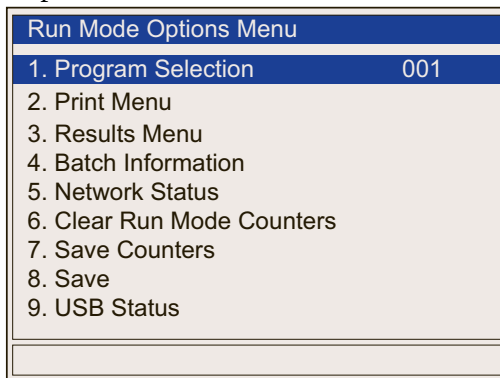
The menu which is accessed from Run Mode is discussed beginning on the following page.



Sprint iQ is available in many configurations, so each tester may not display every menu item shown in the following pages.

3.2.1 RUN MODE OPTIONS MENU

Press the **Enter** button  while at the run screen to access the Run Mode Options Menu.



Use the **Up** and **Down** keys to highlight the option name and press **Enter** to select. For example, press **Enter** when Program Selection is highlighted and the “Parameter Editor” will appear (as seen on [page 3-4](#)). The “Parameter Editor” permits easily changing values by using the arrow keys.

Allowable entries in this case are 001 to 100 and are made with the **Left** and **Right** keys. To accept changes, press the **Enter** key. To abort a change without saving press the **Exit** key. Use the exit key after all changes are made to return to the previous menu.

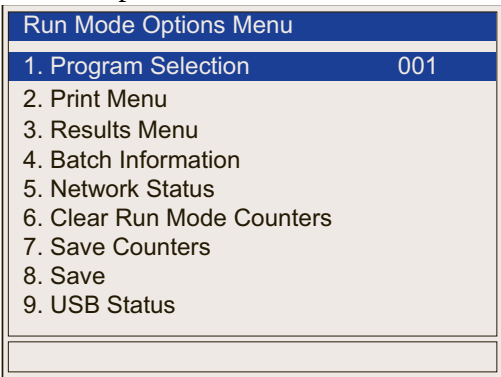
If a selected item is a *menu*, e.g., Print Menu, then pressing **Enter** will open the Print Menu instead of a Parameter Editor. After selections are finished in that menu, exiting will return to the previous menu.

If the parameter entry is numeric, use the **Left** and **Right** keys to position the cursor over the digit to change and then press the **Up** or **Down** keys to change it.

The number of digits to enter may vary from what may be shown in this manual as that number often depends on the type of units or number formats chosen in setup.

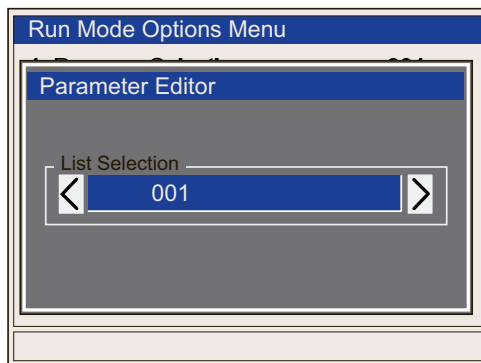
This symbol  shows that entries will repeatedly cycle through the range of values when using the **Left** and **Right** keys. This symbol  shows that the **Left**, **Right**, **Up**, and **Down** keys are used to make entries. Press **Exit** from the Run Mode Options Menu main display to return to the Run Mode display.

In all cases, if a menu item refers to a feature that is not available, the item will be dimmed and the highlight bar will skip over them. This is the top-level menu while in Run Mode.



Program Selection.....See [page 3-4](#)
Print MenuSee [page 3-5](#)
Results Menu.....See [page 3-6](#)
Batch InformationSee [page 3-12](#)
Network Status.....See [page 3-13](#)
Clear Run Mode Counters.....See [page 3-14](#)
Save CountersSee [page 3-14](#)
SaveSee [page 3-14](#)
(Only available when options are changed.)
USB StatusSee [page 3-14](#)
(Display only, enabled or disabled.)

1. Program Selection [RUN MODE OPTIONS MENU]



Program Selection will allow selecting a program or will be display-only depending on how Program Selection access is setup in the Setup Menu. When access is permitted, selecting Program Selection will open the Parameter Editor so that the program can be changed.

(Use **Left** / **Right** keys to select the program number.)

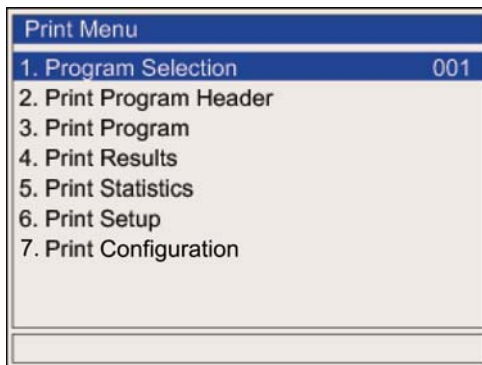
Parameter Editor

1 to 100 ↩

The remaining menu items are explained on the following pages. To help with staying oriented in the list, the opening menu and any sub-menus are shown. The blue-colored text shown in brackets such as [RUN MODE OPTIONS MENU] shows the parent menu of the current item.

Always bear in mind that not all functions and items shown here may be available on every Sprint iQ model.

2. Print Menu [RUN MODE OPTIONS MENU]



1. Program Selection [PRINT MENU]

Parameter Editor

1 to 100 ↩ (Program number)

2. Print Program Header [PRINT MENU]

This selection will print the program header.

3. Print Program [PRINT MENU]

Prints the selected program.

4. Print Results [PRINT MENU]

Prints the results.

5. Print Statistics [PRINT MENU]

Prints the statistics.

6. Print Setup [PRINT MENU]

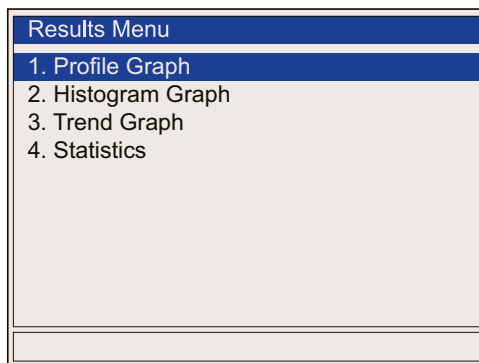
Prints the setup.

7. Print Configuration [PRINT MENU]

Prints the factory configuration.

For further information, see *"Printing Reports" on page 6-19.*

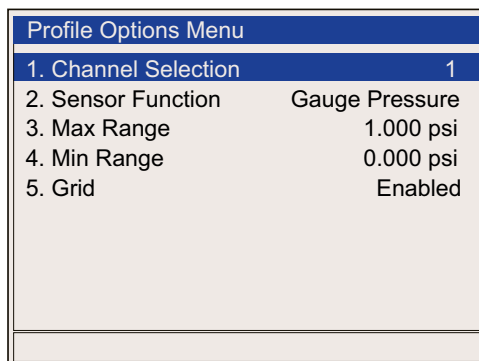
3. Results Menu [RUN MODE OPTIONS MENU]



1. Profile Graph [RESULTS MENU]

Highlight Profile Graph and press **Enter** to see the graph display. Press the **Enter** again at the graph display to go to the Profile Options Menu below.

Profile Options Menu

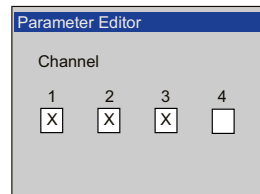


1. Channel Selection [[PROFILE OPTIONS MENU](#)]

Channel Selection can be changed *only* on concurrent testers.

Parameter Editor

On concurrent testers, use checkboxes to select the desired channels as in the example at right:



The screenshot shows a dialog box titled "Parameter Editor". Inside, there is a section labeled "Channel" with four checkboxes numbered 1 through 4. Checkboxes 1, 2, and 3 are checked (marked with an 'X'), while checkbox 4 is unchecked.

1	2	3	4
☒	☒	☒	☐

2. Sensor Function [[PROFILE OPTIONS MENU](#)]

Parameter Editor

Gauge Pressure Flow ↺

3. Max Range [[PROFILE OPTIONS MENU](#)]

Parameter Editor

+00.000 to 99.999 ←↑↓→

4. Min Range [[PROFILE OPTIONS MENU](#)]

Parameter Editor

+00.000 to 99.999 ←↑↓→

5. Grid [[PROFILE OPTIONS MENU](#)]

Use the Parameter Editor to enable or disable a grid superimposed on the graph.

2. Histogram Graph [RESULTS MENU]

The histogram shows the counts of the last 1,000 tests performed arranged in groups, called “bins”, of the selected measurement units. The count resets after a power cycle unless Save Data Log is enabled.

Highlight Histogram Graph and press **Enter** to see the graph display. Press **Enter** again at the graph display to go to the Histogram Option Menu below.

Histogram Option Menu

Histogram Option Menu	
1. Program Selection	001
2. Channel Selection	1
3. Number of Bins	10
4. Max Range	1.000 psi
5. Min Range	0.000 psi
6. Grid	Disabled

1. Program Selection [HISTOGRAM OPTION MENU]

Parameter Editor

001 to 100 ↩

2. Channel Selection [HISTOGRAM OPTION MENU]

Parameter Editor

1 → 2 → 3 → 4 ↩

3. Number of Bins [HISTOGRAM OPTION MENU]

Parameter Editor

1 to 20 ↩

4. Max Range [HISTOGRAM OPTION MENU]

Parameter Editor

00.000 to ±99.999 ←↑↓→

5. Min Range [HISTOGRAM OPTION MENU]

Parameter Editor

00.000 to ± 99.999 $\leftarrow \uparrow \downarrow \rightarrow$

6. Grid [HISTOGRAM OPTION MENU]

Use the Parameter Editor to enable or disable a grid superimposed on the graph.

3. Trend Graph [RESULTS MENU]

The trend graph shows the counts of the last 1,000 tests performed with respect to measurement. The count resets after a power cycle or a reset. In Burst, Crack, and Creep tests, the measurement reading is the peak pressure.

Highlight Trend Graph and press **Enter** to see the graph display. Press the **Enter** again at the graph display to go to the Trend Graph Options Menu below.

Trend Graph Options Menu

Trend Graph Options Menu	
1. Program Selection	001
2. Channel Selection	1
3. Max Range	1.000 psi
4. Min Range	0.000 psi
5. Grid	Disabled

1. Program Selection [TREND GRAPH OPTIONS MENU]

Parameter Editor

001 to 100 $\leftarrow$

2. Channel Selection [TREND GRAPH OPTIONS MENU]

Parameter Editor

1 $\rightarrow$ 2 $\rightarrow$ 3 $\rightarrow$ 4 $\leftarrow$

3. Max Range [TREND GRAPH OPTIONS MENU]

Parameter Editor

00.000 to ± 99.999 $\leftarrow \uparrow \downarrow \rightarrow$

4. Min Range [TREND GRAPH OPTIONS MENU]

Parameter Editor

00.000 to ± 99.999 $\leftarrow \uparrow \downarrow \rightarrow$

5. Grid [TREND GRAPH OPTIONS MENU]

Use the Parameter Editor to enable or disable a grid superimposed on the graph.

4. Statistics [RESULTS MENU]

Only the Program Selection item can be modified on this display. All other items are view only.

Statistics	
1. Program Selection	001
2. Pass Count	0
3. Reject Count	0
4. Test Count	0
5. Pass Average	0.000 psi
6. Reject Average	0.000 psi
7. Total Average	0.000 psi
8. Pass Std Dev	0.000 psi
9. Reject Std Dev	0.000 psi

1. Program Selection [STATISTICS]

Use the Parameter Editor to select the program that has the statistics to view.

2. Pass Count [STATISTICS]

The number of passed tests.

3. Reject Count [STATISTICS]

The number of tests that have gone through to End of Cycle (EOC) and failed. Aborted tests are not counted.

4. Test Count [\[STATISTICS\]](#)

The number of tests.

5. Pass Average [\[STATISTICS\]](#)

The average measurement of passed tests.

6. Reject Average [\[STATISTICS\]](#)

The average measurement of rejected tests.

7. Total Average [\[STATISTICS\]](#)

The total average measurement of tests.

8. Pass Std Deviation [\[STATISTICS\]](#)

The standard deviation of the passed tests measurements.

9. Reject Std Deviation [\[STATISTICS\]](#)

The standard deviation of the rejected tests measurements.

10. Total Std Deviation [\[STATISTICS\]](#)

The standard deviation of the total of the test measurements.

11. Minimum [\[STATISTICS\]](#)

The minimum measurement recorded for the selected program.

12. Maximum [\[STATISTICS\]](#)

The maximum measurement recorded for the selected program.

4. Batch Information [RUN MODE OPTIONS MENU]

Batch Information	
1. Batch Remaining Count	0
2. Batch Size	3
3. Reset Batch Remaining Count	
4. Site Code	
5. Operator ID	
6. Model Number	
7. Lot Code	
8. Serial Number	
9. Save	

Batch size defines the number of parts to be tested in a batch. Many of the items on this menu must be enabled from the Batch Processing Menu for them to be user-changeable while in Run mode; otherwise, they will be display-only.

1. Batch Remaining Count [BATCH INFORMATION]

Shows how many items are remaining in the current batch.

2. Batch Size [BATCH INFORMATION]

Shows the size of the current batch as set in Program mode. If enabled in the Batch Processing Menu, the size can be also be changed in Run mode.

3. Reset Batch Remaining Count [BATCH INFORMATION]

Highlight this entry and press Enter to reset the count to the batch size.

4.—8. Customizable data tag fields [BATCH INFORMATION]

By default, these fields are set to the following values.

Field 1	Site Code
Field 2	Operator ID
Field 3	Model Number

Field 4 Lot Code

Field 5 Serial Number

If set in the Batch Processing Menu, these items can be changed to a customized name that can be up to 20 alphanumeric characters.

9. Save [BATCH INFORMATION]

This item will darken when an item has been changed that must be saved before exiting the menu.

5. Network Status [RUN MODE OPTIONS MENU]

Network Status	
1. Network Driver	Enabled
2. IP Connection	Disabled
3. FTP Connection	Disabled
4. Data Transfer	Disabled
5. Audit Results Remaining	0
6. Error Code	000000

This screen is display-only and shows the status of the network. This menu shows how each part of the network is functioning.

If a connection problem exists, it will be reported here. This menu makes it possible to see how each part of the network is functioning and showing what part of the connection may have difficulties.

The Data Transfer item changes to the enabled state when a data transfer is in progress.

Audit Results Remaining indicates the number of results held within the data log which have not been saved to the network audit file.

This panel should be checked while tests are being performed and when network errors are reported to determine the nature of the problem.

An error code, which may be useful in troubleshooting will also be shown if a problem exists. If there are no problems, the code will be 000000 as shown. A list of error codes is at *page 3-53*.

6. **Clear Run Mode Counters** [RUN MODE OPTIONS MENU]

Select this option to clear the counters.

7. **Save Counters** [RUN MODE OPTIONS MENU]

This option will save the counters.

8. **Save** [RUN MODE OPTIONS MENU]

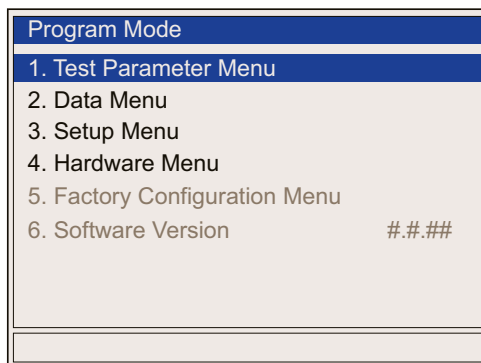
This option is grayed-out unless changes are made to the Results Menu. Select **Save** to save those changes.

9. **USB** [RUN MODE OPTIONS MENU]

Display only (enabled or disabled.)

3.2.2 PROGRAM MODE MENU

Turn the **Lockout Keyswitch** to the vertical position to go to the Program Mode Menu. The ability to use the menu item will vary depending on the configuration of the particular tester.



Highlight the first item, Test Parameter Menu, and press **Enter**. The Test Parameter Menu will open and the display will appear as shown below. The navigation method is similar in all menus.

Test Parameter MenuSee [page 3-16](#)

Data MenuSee [page 3-29](#)

Setup MenuSee [page 3-41](#)

Hardware Menu.....See [page 3-44](#)

Factory Configuration Menu....(Factory use only)

Software Version(Display only)

1. Test Parameter Menu [TOP LEVEL PROGRAM MODE]

Test Parameter Menu	
1. Program Number	001
2. Program Name	001
3. Test Type	Pressure Decay Rate
4. Channel Selection	1
5. Sample Interval	0.1s
6. Sample Channel	1
7. Couple Menu	
8. Fast Fill Menu	
9. Regulator Selection	Main: 10.000 psi

1. Program Number [TEST PARAMETER MENU]

Select the program number with which to work.

Parameter Editor

001 to 100 ↩

2. Program Name [TEST PARAMETER MENU]

This item allows the creation of a customized alphanumeric name for the program.

Parameter Editor (Character Input)

A to z, 0 to 9 ←↑↓→

3. Test Type [TEST PARAMETER MENU]

Not all test types listed below will be available on any individual tester. Test types are dependent on regulator selection (i.e., a vacuum decay test requires selecting a vacuum regulator in order to select a vacuum decay test).

Parameter Editor

Pressure Decay → Pressure Decay Rate → Vacuum
 Decay → Vacuum Decay Rate → Pressure
 Occlusion → Pressure Occlusion Rate → Vacuum
 Occlusion → Vacuum Occlusion Rate → Pressure
 Burst → Vacuum Burst → Crack Pressure →

Pressure Creep → Vacuum Creep → Flow Back
Pressure ↩

4.Channel Selection [TEST PARAMETER MENU]

This item allows selecting the channel(s) to use for the test.

For all tester types *except* concurrent:

Parameter Editor

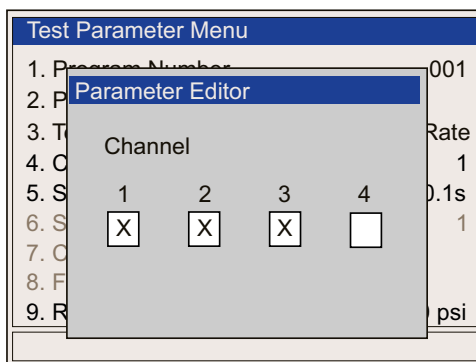
1 → 2 → 3 → 4 ↩

(Choose the channel for the test. The numbers available are limited by the number of installed channels.)

For concurrent testers only:

Parameter Editor

A Parameter Editor opens to allow selecting the channels to use.



Use the arrow keys and Enter to check the desired channels. The example above shows channels 1 through 3 are selected for use.

(The channels available are limited by the number of installed channels.)

5. Sample Interval [TEST PARAMETER MENU]

The sample interval timer sets the periodic time interval for outputting the sensor readings to the serial port during the test cycle. The values are tab-delimited and can be stored to file via Hyper Terminal and used with Excel to display sensor profiles.

Parameter Editor

Off → 0.1 sec to 1.0 sec ↩

6. Sample Channel [TEST PARAMETER MENU]

Parameter Editor

When using a sample interval on a Concurrent test, this feature enables the user to select channel for the sensor readings.

7. Couple Menu [TEST PARAMETER MENU]

Note: The number of couple outputs varies with tester configuration.

An explanation of the use of couple valves is given in the Reference Chapter on page [page 6-33](#).

Couple Menu	
1. Program Selection	001
2. Couple Output	1
3. Couple Operation	Clamp
4. Couple Control	Off
5. Couple Time	0.0s
6. Occlusion Release	Off

1. Program Selection [COUPLE MENU]

Displays the selected program.

2. Couple Output [COUPLE MENU]

Parameter Editor

1 → 2 → 3 → 4 ↩

3. Couple Operation [COUPLE MENU]

Parameter Editor

Clamp Routing ↩

The Clamp Option sets the outputs at the start of the sequence and they remain on for the duration of the test sequence and then uncouple. This ensures the outputs are not released until the vent step has been performed at the end of the test cycle. This is the default setting.

The Routing Option allows the couple output to be changed on subsequent tests controlled by the setting of the next program's Couple Control parameter in the sequence. The Routing couple outputs change state when the next program is started and there is no additional time control. The routing outputs are cleared at the start of the uncouple sequence



The Routing option can permit the output to change state when the component is pressurized. Appropriate safety precautions must be observed.

4. Couple Control [COUPLE MENU]

Parameter Editor

On → Off ↩

5 Couple Time [COUPLE MENU]

Parameter Editor

000.0 to 999.9 ←↑↓→

Setting the couple time will set a delay before the next operation. A zero time will give a very small delay due to code execution.

The default settings for couple parameters: control and time are set to off and 0.0 respectively.

6. Occlusion Release [COUPLE MENU]

Parameter Editor

On → Off ↩

Although it is not possible to enable multiple couples with one timer, it is possible to control them within 10ms of each other. For example, to enable Couples 1 and 2 at nearly the same time, enable both, then set Couple 1 time to 0, set Couple 2 time to the largest required coupling time for both of those valves. ***Couple 1 will have a 10 ms head start on Couple 2, but this duration is insignificant in most applications.***

The same holds true for more concurrent couples, or sets of concurrent couples.

Example:

Couple	State	Time
1	On	0
2	On	1
3	On	0
4	On	2

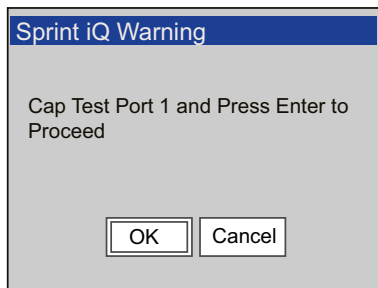
Couples 1 and 2 come on at virtually the same time, 1 second later couples 3 and 4 come on at virtually the same time, and then the test starts 2 seconds after that.

8. Fast Fill Menu [TEST PARAMETER MENU]

Fast Fill Menu	
1. Program Selection	001
2. Regulator Selection	
3. Pressure	10.000 Psi
4. Pressure Tol.	10.000 Psi
5. Fill Time	0.0s
6. Vent Time	0.0s

1. Program Selection [FAST FILL MENU]
Displays the selected program.
2. Regulator Selection [FAST FILL MENU]
Select the desired regulator
3. Pressure [FAST FILL MENU]
Parameter Editor
00.000 to 99.999 ←↑↓→
4. Pressure Error [FAST FILL MENU]
Parameter Editor
00.000 to 99.999 ←↑↓→
5. Fill Time [FAST FILL MENU]
Parameter Editor
00.0 to 99.9 ←↑↓→
6. Vent Time [FAST FILL MENU]
Parameter Editor
00.0 to 99.9 ←↑↓→
9. Regulator Selection [TEST PARAMETER MENU]
Parameter Editor
Cycles through installed regulators ↻
10. Test Pressure [TEST PARAMETER MENU]

This menu item varies in behavior depending on the type of regulator selected. If a manual regulator is selected, this warning will appear:



Cap test port 1 and press Enter as instructed. Adjust the regulator until the pressure reads the desired value and press Enter when finished.

For an electronic regulator, there is no need to cap the port as it will have no flow. Simply use the Parameter Editor to set the pressure value and press Enter when finished.

11. Pressure Tol. [TEST PARAMETER MENU]

Parameter Editor

00.000 to 99.999 ←↑↓→

12. Ramp Method [TEST PARAMETER MENU]

The Ramp method can be set to **Manual** when factory Pneumatic Manual Ramp option is enabled or **Electronic** when the electronic regulator is fitted. The Ramp Start and Ramp Rate parameters can only be modified when the Electronic Method is selected.

Note: The factory manual ramp parameter is automatically enabled when burst/crack/creep option is selected and can only be disabled when an electronic regulator is fitted.

13. Ramp Start [TEST PARAMETER MENU]

The Parameter Editor is available to adjust the value of the Ramp Start only if an electronic regulator is installed.

14. Ramp Rate [TEST PARAMETER MENU]

The Ramp Rate is available only if an electronic regulator is installed.

15. Flow Range [TEST PARAMETER MENU]

This is a view-only parameter.

16. Fill Time [TEST PARAMETER MENU]

Parameter Editor

000.0 to 999.9 ←↑↓→

17. Stab Time [TEST PARAMETER MENU]

Parameter Editor

000.0 to 999.9 ←↑↓→

Stab time is not available for Occlusion tests.

18. Test Time [TEST PARAMETER MENU]

Parameter Editor

000.0 to 999.9 ←↑↓→

19. Vent Time [TEST PARAMETER MENU]

Parameter Editor

000.0 to 999.9 ←↑↓→

20. Vent Check [TEST PARAMETER MENU]

Allows the operator to disable or enable the vent safety check.

21. Leak Calibration Menu [TEST PARAMETER MENU]

Leak Calibration Menu	
1. Program Selection	001
2. Leakrate Format	###.##
3. Leakrate Units	ml/s
4. Leak Master Value	1.00 ml/s
5. Common Cal Data	Off
6. Channel	1
7. Perform Comp/Cal Tests	
8. Comp. Value	0.000 psi
9. Cal. Value	0.000 psi

Note: This selection is unavailable unless a Pressure Decay Rate, Pressure Occlusion Rate, or Vacuum Occlusion Rate program is selected.

1. Program Selection [LEAK CALIBRATION MENU]

Displays the selected program.

2. Leakrate Format [LEAK CALIBRATION MENU]

Parameter Editor

(cycle through decimal formats)

3. Leakrate Units [LEAK CALIBRATION MENU]

Parameter Editor

ml/s → ml/m → ml/hr → cc/s → cc/m ↩

4. Leak Master Value [LEAK CALIBRATION MENU]

Parameter Editor

0000.00 to 9999.99 ←↑↓→

5. Common Cal Data [LEAK CALIBRATION MENU]

(Concurrent testers only)

Parameter Editor

Off → On ↩

6. Channel [LEAK CALIBRATION MENU]

(Concurrent testers only, channels have to be selected in the Test Parameter Menu in order to be selected in the Leak Calibration Menu)

7. Perform Comp/Cal Tests [LEAK CALIBRATION MENU]

Selecting this item will open the Leak Calibration Menu. For a full explanation this menu see "*Leak Calibration Using the Leak Calibration Menu*" on page 5-1.

8. Comp. Value [LEAK CALIBRATION MENU]

Parameter Editor

00.000 to 99.999 ←↑↓→

9. Cal. Value [LEAK CALIBRATION MENU]

Parameter Editor

00.000 to 99.999 ←↑↓→

10. PSN Ratio [LEAK CALIBRATION MENU]

(Displays as Error if Comp Value is set to zero).

22. Pass/Reject Limit Menu [TEST PARAMETER MENU]

Pass/Reject Limit Menu	
1. Program Selection	001
2. Common Limits	Off
3. Channel	1
4. Reject Maximum	0.100 psi
5. Reject Minimum	0.000 psi
6. Pass Criteria	In Band
7. Event Limit	0.000 psi

1. Program Selection [PASS/REJECT LIMIT MENU]

Displays the selected program.

2. Common Limits [PASS/REJECT LIMIT MENU]

Parameter Editor

On > Off ↩

3. Channel [PASS/REJECT LIMIT MENU]

4. Reject Maximum [PASS/REJECT LIMIT MENU]

Parameter Editor

+00.000 to 99.999 ←↑↓→

5. Reject Minimum [PASS/REJECT LIMIT MENU]

Parameter Editor

+00.000 to 99.999 ←↑↓→

6. Pass Criteria [PASS/REJECT LIMIT MENU]

Parameter Editor

In Band → Above Reject Max →

Below Reject Min ↩

7. Event Limit [PASS/REJECT LIMIT MENU]

Parameter Editor

00.000 to 99.999 ←↑↓→

To understand how Pass/Reject limits work in a test, See
"Understanding Pass/Reject Limits" on page 4-2.

23. Jump Menu [TEST PARAMETER MENU]

Jump Menu	
1. Program Selection	001
2. On Pass Pause Time	0.0s
3. On Pass Automatic Advance	Off
4. On Pass Vent	On
5. On Pass Next Program	Off
6. On Reject Pause Time	0.0s
7. On Reject Automatic Advance	Off
8. On Reject Vent	On
9. On Reject Next Program	Off

1. Program Selection [JUMP MENU]

Displays the selected program.

2. On Pass Pause Time [JUMP MENU]

Parameter Editor

000.0 to 999.9 ←↑↓→

3. On Pass Automatic Advance [JUMP MENU]

Jump when the test passes to the program selected in On Pass Next Program (see [page 3-28.](#))

Parameter Editor

On → Off ↩

4. On Pass Automatic Vent [JUMP MENU]

Parameter Editor

On → Off ↩

5. On Pass Next Program [JUMP MENU]
 Parameter Editor
 Off → 001 to 100 ↩
6. On Reject Pause Time [JUMP MENU]
 Parameter Editor
 000.0 to 999.9 ←↑↓→
7. On Reject Automatic Advance [JUMP MENU]
 Parameter Editor
 On → Off ↩
8. On Reject Vent [JUMP MENU]
 Parameter Editor
 On → Off ↩
9. On Reject Next Program [JUMP MENU]
 Parameter Editor
 Off → 001 to 100 ↩

2. Data Menu [TOP LEVEL PROGRAM MODE]

Data Menu	
1. Clear All Run Mode Counters	
2. Save Counters	Timer Interval
3. Counter Interval	1m
4. Clear Data Log	
5. Save Data Log	Disabled
6. Batch Processing Menu	
7. Audit Menu	
8. Import Menu	
9. Export Menu	

1. Clear All Run Mode Counters [DATA MENU]

Clear the counters by highlighting and pressing **Enter**. A window will open to confirm the operation. Highlight **Yes** and press **Enter** to clear the counters. Select **No** to abort.

2. Save Counters [DATA MENU]

Choose how the result counters will be saved.

Parameter Editor

Timer Interval → Disabled → On EOC ↩

Timer Interval: The counters are saved on a time interval selected in Counter Interval. This option is recommended for cycle times less than one minute. This will minimize the writing to the memory and prolong its life. However, do not power-off the Sprint iQ until the timer interval is finished or the unsaved counts will be lost.

Disabled: Result counters are not saved and will be lost when the tester is switched off.

On EOC: Result counters are saved at the end of the test cycle. Note that a single save is performed when multiple EOC events have been queued on fast test cycles to improve cycle times.

The default setting is Timer Interval.

3. Counter Interval [DATA MENU]

Set the interval for saving the result counters.

Parameter Editor

Off → (1 - 60 min. interval) 

This selection is available only when Timer Interval is used for Save Counters.

Note: Do not power-off the Sprint iQ until the timer interval is finished or the unsaved counts will be lost.

4. Clear Data Log [DATA MENU]

This selection will clear the entire data log. When selected, a warning will ask for confirmation of the request.

During network operation, a warning is displayed when selecting Clear Data Log when held results have not been saved to the network audit file. The user may then choose to proceed to clear the information and lose any remaining audit data or cancel the operation.

5. Save Data Log [DATA MENU]

The default setting is disabled. When enabled, Sprint iQ retains test results even while powered off.

Parameter Editor

Disabled → Enabled 

6. Batch Processing Menu [DATA MENU]

Batch Processing Menu	
1. Batch Control	Enabled
2. Batch Size	4
3. Batch Remaining Count	1
4. Reset Batch Remaining Count	
5. Run Mode Batch Size	Yes
6. Counting Method	Channel
7. Batch Size Auto Reset	Yes
8. Batch Field Menu	
9. Save	

1. Batch Control [BATCH PROCESSING MENU]

This item enables or disables batch control, as desired.

2. Batch Size [BATCH PROCESSING MENU]

Batch size defines the number of parts to be tested. If Counting Method is per Test Cycle, then each test cycle counts as 1 part, regardless of the number of active channels. If Counting Method is per Channel, then each test cycle on each active channel counts as 1 part.

Use the Parameter Editor to enter a batch size up to a value of 99999.

Parameter Editor

0 to 99999 ←↑↓→

3. Batch Remaining Count [BATCH PROCESSING MENU]

This is a display-only item that shows the remaining count left in the current batch.

When the batch is exhausted, if Auto Reset is not enabled, the following message is shown:

*“Batch Completed, New Batch Details Required
Before a Test can be Performed”*

4. Reset Batch Remaining Count [BATCH PROCESSING MENU]

Select this item to reset the count to zero immediately.

5. Run Mode Batch Size [BATCH PROCESSING MENU]

Use the Parameter Editor to set Yes to permit the batch size to be changed from the Batch Information Menu in Run Mode

Parameter Editor

Yes → No 

6. Counting Method [BATCH PROCESSING MENU]

Set the counting method to Test Cycle or Channel.

Parameter Editor

Channel → Test Cycle 

7. Batch Size Auto Reset [BATCH PROCESSING MENU]

When the batch is completed, it will reset automatically to the selected batch size.

8. Batch Field Menu [BATCH PROCESSING MENU]]

Batch Field Menu	
1. Field	2
2. Field Entry Control	Program Mode
3. Field Name	Operator ID
4. Value	
5. By Channel	No

This menu is used to set the values for each of the 5 data tag fields used in batch processing.

1. Field [BATCH FIELD MENU]

Select field 1 through 5

Parameter Editor

1 → 2 → 3 → 4 → 5 ↵

2. Field Entry Control [BATCH FIELD MENU]

Parameter Editor

Program Mode → Run Mode → Test →
Disabled ↵

3. Field Name [BATCH FIELD MENU]

Use the Parameter Editor to enter up to 20 characters
of alpha-numeric data for the field name.

4. Value [BATCH FIELD MENU]

Use the Parameter Editor to enter up to 20 characters
of alpha-numeric data for the current value if By
Channel (below) is set to Yes.

5. By Channel [BATCH FIELD MENU]

Set By Channel to Yes or No.

Parameter Editor

Yes → No ↵

9. Save [BATCH PROCESSING MENU]

Select Save and press Enter to accept the changes made to
the Batch Processing Menu.

7. Audit Menu [DATA MENU]

Audit Menu	
1. Audit Printout	Disabled
2. Audit USB	Enabled
3. Audit Network	Disabled
4. Network Update Timer	1m
5. Audit Filename	FILENA-.TXT
6. Audit Format	Standard
7. Audit Format Menu	
8. Audit Selection	All Results

This menu allows selecting the various options for logging data.

Note: Tests often finish before the various logs have had time to be completely written. Sprint iQ will not respond to operator input to make changes to parameters until the writing is finished. After a test finishes, always wait 30 seconds before attempting to change program parameters or switching off the tester if logging is enabled.

It is not allowed to select multiple destinations for the audit log. It can be sent to only one destination at a time.

1. Audit Printout [AUDIT MENU]

Use this parameter to send the audit log to the serial port.

Parameter Editor

Enabled → Disabled 

2. Audit USB [AUDIT MENU]

Use this parameter to send the audit log to the USB device.

Parameter Editor

Enabled → Disabled 

3. Audit Network [AUDIT MENU]

If the network connection is defined, the audit log can be sent to the network if this parameter is enabled.

Parameter Editor

Enabled → Disabled 

Note: A warning dialog is displayed when selecting the Audit Network or Audit File options when results held within the data log have not been saved to the network audit file. The user can proceed to clear the information and lose any remaining audit data or cancel.

4. Network Update Time [AUDIT MENU]

The Network Update Time parameter can be set from Off to 60 minutes in 1 minute intervals with a default value of 1 minute. The Off setting will update the network after every test. When a value is set, the network is updated at the interval rate set.

Parameter Editor

Off → 1m to 60m 

Try changing the setting if you experience problems while logging results from multiple testers on the network.

5. Audit Filename [AUDIT MENU]

The default filename is FILENAME.TXT. Use the Parameter Editor to enter a new 8-character filename for the audit log if desired. (The .TXT extension is fixed and cannot be changed.) The Parameter Editor allows only uppercase letters to be entered.

6. Audit Format [AUDIT MENU]

The Selections available are none, standard, custom, Sprint LC. **Note:** Space is the delimiter for standard format and output is then terminated by CRLF.

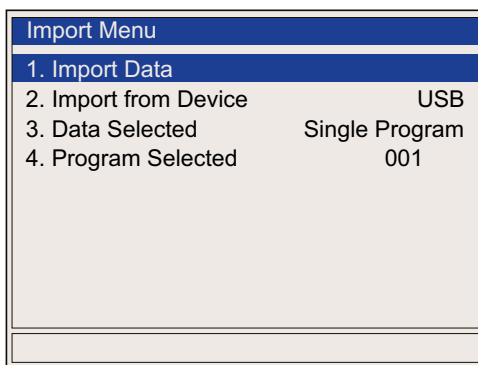
7. Audit Format Menu [AUDIT MENU]

This provides various elements to configure the audit file. It can be configured using 1-20 fields of different types and delimiters. (Opens under custom audit format selection.)

8. Audit Selection [AUDIT MENU]

Selects which results to save (all results, pass results, or reject results).

8. Import Menu [DATA MENU]



1. Import Data [IMPORT MENU]

Connect the device to copy from and highlight **Import Data** and press **Enter** to copy the files.

File copy

Press **Enter** to continue; **Exit** to abort

2. Import from Device [IMPORT MENU]

USB or network importing available. (Ensure network is connected and enabled.)

3. Data Selected [IMPORT MENU]

Parameter Editor

Single program → Test Channel → Setup →
Batch → System → *Config → All Programs ↩

*For Uson use only, when available.

4. Program Selected [IMPORT MENU]

This selection is only available when Single Program is chosen in “Data Selected” above.

Parameter Editor

001 to 100 ↩

9. Export Menu [DATA MENU]

Export Menu	
1. Export Data	
2. Export Device	USB
3. Data Selected	Single Program
4. Program Selected	001

1. Export Data [EXPORT MENU]

Connect the device to copy to and highlight **Export Data** and press **Enter** to copy the files.

File Copy

Press **Enter** to continue; **Exit** to abort

2. Export Device [EXPORT MENU]

USB and network exporting available. (Ensure network is connected and enabled.)

3. Data Selected [EXPORT MENU]

Parameter Editor

Single program → Test channel → Setup → Config
→ Result Summary → Data Log → Batch →

System → All programs ↩

4. Program Selected [EXPORT MENU]

This selection is available only when Single Program is selected in “Data Selected” above.

List Selection

001 to 100 ↩

10. Program Copy Menu

Program Copy Menu	
1. Copy From	test 001
2. Copy To	002
3. Perform Copy	

1. Copy From

Parameter Editor

001 to 100

2. Copy To

Parameter Editor

001 to 100

3. Perform Copy:

To copy, press the **Enter** key, a warning message appears, select **Yes** to continue or **No** to Cancel.

11. File System Menu [\[DATA MENU\]](#)

File System Menu	
1. Drive	B:
2. Total Bytes	1943040
3. Free Bytes	1495296
4. Used Bytes	447744
5. Bad Bytes	0
6. Path	B: /
7. Entry	[.]
8. Time	
9. Date	
10. Path	B: / PROGRAMS /
11. Find First Entry	

This menu's functions provide advanced capability to alter the file system in the tester which, if misused, could cause inadvertent program deletion or undesirable tester operation.

1. Drive [\[FILE SYSTEM MENU\]](#)

Use the Parameter Editor to select Drive **A:** or **B:** The ram used for temporary storage of data files is at A:. The B: drive is the flash memory which holds all data files that persist over a power cycle.

2 - 6. Read-only information about the selected drive.

7. Entry [\[FILE SYSTEM MENU\]](#)

Shows the current entry, if any.

8. Time [\[FILE SYSTEM MENU\]](#)

Shows the time of the current entry.

9. Date [\[FILE SYSTEM MENU\]](#)

Shows the date of the current entry.

10. Entry Size [\[FILE SYSTEM MENU\]](#)

Shows the size of the current entry.

11. Find First Entry [\[FILE SYSTEM MENU\]](#)

Highlight this item and press **Enter** to find the first item in the selected directory.

12. Find Next Entry [FILE SYSTEM MENU]

Highlight this item and press **Enter** to cycle through the next entries in the selected directory.

13. Delete Entry [FILE SYSTEM MENU]

The item shown in Entry will be deleted when Delete Entry is highlighted and **Enter** is pressed. (A warning box will ask for confirmation before the delete operation proceeds.) A directory may not be deleted unless it is empty.

14. Format Drive [FILE SYSTEM MENU]

Formats the selected drive. This selection is for use at the factory only.

3. Setup Menu [TOP LEVEL PROGRAM MODE]

Setup Menu	
1. Pressure Unit	psi
2. Flow Unit	slm
3. Sensor Auto Zero	Enabled
4. EOC Action	None
5. Couple Mode	Selectable
6. Remote Start	Off
7. Program Selection	Front Panel
8. Program Input Decode	Binary
9. Time	09:42:53

Setup Menu (Cont'd)	
10. Date	02:21:2017
11. Language	English
12. Display Contrast	50%
13. Audio Control	Medium
14. Audio Timeout	20s
15. Results Timeout	30s
16. Fill Gross Result	Abort

1. Pressure Unit [SETUP MENU]

Parameter Editor

psi → mbar → bar → KPa → Kg/cm² → mmH₂O →
cmH₂O → inH₂O → mmHg → cmHg → inHg ↵

2. Flow Unit [SETUP MENU]

Parameter Editor

sccm → scchr → slm → slm → slmhr ↵

3. Sensor Auto Zero

Parameter Editor

Enabled → Disabled ↵

This option enables the auto zero function which prevents trapped air from interfering with the accuracy of a test. This step vents all channels immediately

before a test begins and also tares the sensor to zero while it is exposed to atmosphere. The duration the auto zero step is 0.2 seconds.

4. EOC Action [SETUP MENU]

Parameter Editor

None → Hold on Reject ↩

5. Couple Mode [SETUP MENU]

Parameter Editor

Selectable → Assigned ↩

Selectable: selects the current couple operation and is the default selection.

Assigned: defines a single couple and uncouple step where the couple selected corresponds to the channel selection for the test.

6. Remote Start [SETUP MENU]

This selection is not available unless Remote Start has been enabled by Uson.

Parameter Editor

Off → Conventional → Fixture → Anti Tie Down →
Inter Lock → Serial Port ↩

7. Program Selection [SETUP MENU]

Parameter Editor

Front Panel → Remote Port → Program Mode →
Serial Port ↩

8. Program Input Decode [SETUP MENU]

This item is only available when Remote Port is selected.

Parameter Editor

Binary → BCD ↩

9. Time [SETUP MENU]

Parameter Editor (Time [hh:mm:ss])

Hour:Minutes:Seconds ⬅⬆⬇➡

10. Date [SETUP MENU]
Parameter Editor (Date [mm/dd/yyyy])
Month:Day:Year ←↑↓→
11. Language [SETUP MENU]
Parameter Editor
English (USA) → English (UK) → German →
Spanish ↩
12. Display Contrast [SETUP MENU]
Parameter Editor
1% to 100% ↩
13. Audio Control [SETUP MENU]
Parameter Editor
Off → Low → Medium → High ↩
14. Audio Timeout [SETUP MENU]
Parameter Editor
0 s to 60 s ↩
15. Result Time Out [SETUP MENU]
This controls the pass and fail indicators' time.
Parameter Editor
1s to 60 s ↩
16. Fill Gross Result [SETUP MENU]
Parameter Editor
Abort→ Reject ↩

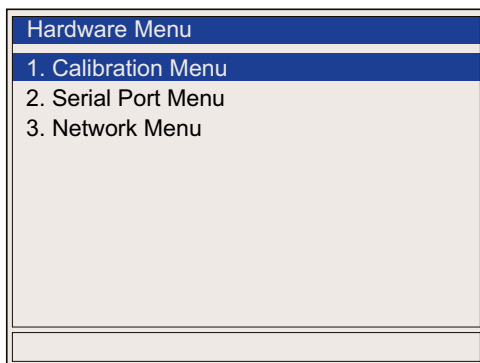
This option determines the result state to be set for a gross leak condition detected at the end of the fill step.
Selections are: Abort (default) and Reject.

The default setting is Abort, which will cause the test or a linked series of tests to terminate immediately on detecting a gross leak condition and reports an Abort

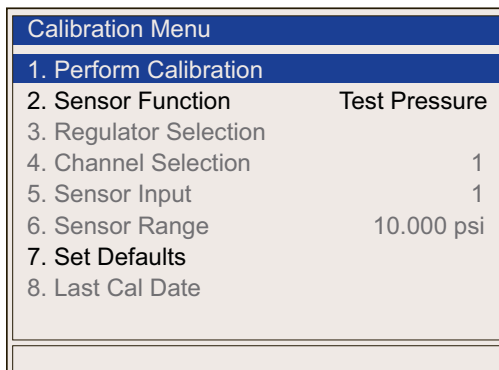
result. The abort result is not included in the Run Mode or program statistic reject counts.

The Reject selection will allow the linked series of tests to continue when jump on a reject result is set and the gross leak condition will set a reject result. The Run Mode and associated program statistic reject counts will be incremented to record the event.

4. Hardware Menu [TOP LEVEL PROGRAM MODE]



1. Calibration Menu [HARDWARE MENU]



Contact a qualified Uson representative for sensor calibration.

2. Serial Port Menu [\[HARDWARE MENU\]](#)

Serial Port Menu	
1. Baud Rate	9600
2. Data Bits	1
3. Parity	None
4. Stop Bits	1
5. Apply	

Use the Serial Port Menu to set the characteristics of the serial port. These parameters must be set to match the characteristics of the external serial device or communication may be intermittent or impossible.

1. Baud Rate [\[SERIAL PORT MENU\]](#)

Parameter Editor

2400 → 4800 → 9600 → 19200 → 38400 →
57600 ↩

2. Data Bits [\[SERIAL PORT MENU\]](#)

Parameter Editor

5 → 6 → 7 → 8 ↩

3. Parity [\[SERIAL PORT MENU\]](#)

Use the Parameter Editor to select **None**, **Even**, or **Odd** parity.

4. Stop Bits [\[SERIAL PORT MENU\]](#)

Use the Parameter Editor to select **1**, **1.5**, or **2** stop bits.

5. Apply [\[SERIAL PORT MENU\]](#)

Select **Apply** to accept changed parameters. This item is only selectable any serial port setting is changed.

3. Network Menu [\[HARDWARE MENU\]](#)

Network Menu	
1. IP Configuration	DHCP
2. IP Address	000.000.000.000
3. Subnet Mask	255.255.255.000
4. Default Gateway	000.000.000.000
5. FTP Address	000.000.000.000
6. FTP User Name	
7. FTP Password	*****
8. FTP Status Interval	1m
9. Perform Network Reset	

Sprint iQ can send the data logs to an FTP location on a network.

You may need the help of your site IT professional to provide the IP addresses, username, password, and FTP location you will be using as well as to help you make an informed decision about whether to use DHCP or a Static IP configuration.

1. IP Configuration [\[NETWORK MENU\]](#)

Parameter Editor

DHCP → Static → Disabled 

2. IP Address [\[NETWORK MENU\]](#)

If using a static IP configuration enter the fixed IP address using the Parameter Editor.

3. Subnet Mask [\[NETWORK MENU\]](#)

If using a static IP configuration enter the Subnet Mask value using the Parameter Editor.

4. Default Gateway [\[NETWORK MENU\]](#)

If using a static IP configuration enter the gateway address using the Parameter Editor.

5. FTP Address [\[NETWORK MENU\]](#)

Use the Parameter Editor to enter the address of the FTP location where the data files are to be sent.

6. FTP User Name [NETWORK MENU]

Use the Parameter Editor to enter a case-sensitive user name, up to 20 characters are allowed. The user name will be displayed at the right once it is entered.

7. FTP Password [NETWORK MENU]

Use the Parameter Editor to enter the case-sensitive password for the FTP location; up to 20 characters are allowed. Asterisks hide the password at the menu level. The password may be seen and edited by pressing **Enter** to open the Parameter Editor.

8. FTP Status Interval [NETWORK MENU]

The Status Interval time parameter sets the maximum time interval between FTP server communications. This check maintains the FTP connection between extended test cycle intervals and reduces the need to reopen the connection when saving the test results. This parameter is set to a default value of 1 minute and can be set to Off or 1 to 60 minutes in 1 minute intervals.

9. Perform Network Reset [NETWORK MENU]

Highlight this item and press **Enter** to re-establish communication across the network and log in to the FTP site. This ensures that the data connection has been correctly made. If any errors occur, they will be seen at the bottom of the screen and in the Network Status display (Item 10).

10. Network Status [NETWORK MENU]

This screen is display-only and shows the status of the

Network Status	
1. Network Driver	Enabled
2. IP Connection	Disabled
3. FTP Connection	Disabled
4. Data Transfer	Disabled
5. Audit Results Remaining	0
6. Error Code	000000

network. If a connection problem exists, it will be reported here. This menu makes it possible to see how each part of the network is functioning and showing what part of the connection may have difficulties.

The Data Transfer item changes to the enabled state when a data transfer is in progress.

Audit Results Remaining indicates the number of results held within the data log which have not been saved to the network audit file.

This panel should be checked while tests are being performed and when network errors are reported to determine the nature of the problem.

An error code, which may be useful in troubleshooting will also be shown if a problem exists. If there are no problems, the code will be 000000 as shown. A list of error codes is at page [page 3-53](#).

11. Ping Test Menu [NETWORK MENU]

The ping test is a communication test that sends a small information packet to the target site and expects a reply.

If the message is sent and acknowledged as expected then the Ping Test Successful message will be seen in the status line at the bottom of the screen

A failed ping test indicates a network setup or other network error. Logging to the FTP site on the network *will not work* if ping test does not work.

Ping Test Menu	
1. Perform Ping Test	
2. Target Address	000.000.000.000
3. Number of Bytes	1
4. Ping Time Interval	1s
5. Number of Requests	1

Note: When changing the network settings to DHCP or Static, a network reset (refer to Perform Network Reset) is required before performing a ping test.

1. Perform Ping Test [\[PING TEST MENU\]](#)

Highlight and press **Enter** to start the ping test.

2. Target Address [\[PING TEST MENU\]](#)

Use the Parameter Editor to enter the destination address of the ping. This is normally the same address used for the FTP site.

3. Number of Bytes [\[PING TEST MENU\]](#)

Use the Parameter Editor to set this value from 1 to 9 bytes.

4. Ping Time Interval [\[PING TEST MENU\]](#)

This is the time between ping attempts when using more than one requests in menu item 5. Use the

Parameter Editor to set this value between 1 and 99 seconds.

5. Number of Requests [\[PING TEST MENU\]](#)

Up to 9 requests can be set from the Parameter Editor. When set to greater than one, the status display at the bottom of the screen will show the requests as they progress.

3.2.3 FTP SETUP GUIDELINES

Guidelines are presented here for use by your IT department to aid in supporting the File Transfer Protocol (FTP) capability of Sprint iQ. When FTP setup is properly implemented, Sprint iQ will have the following logging capabilities:

- Each Sprint iQ can login to the FTP server.
- Each Sprint iQ machine can create a directory hierarchy that separates each machine by means of serial number.
- Sprint iQ log files can be transferred to the FTP server for use at a different time than when operations are in progress.
- Sprint iQ can create log files. (It cannot delete files. The user or network administrator performs log file removal.)
- Sprint iQ updates its log files by means of an append operation. (The user must not lock or modify files while Sprint iQ file write operations are in progress.)

The setup guidelines are broad in nature, since some details depend on the type of FTP server available. However, these recommendations should ease the integration of the FTP logging feature.

1. Sprint iQ can use either DHCP or Static IP addressing. Static IP is recommended, as it avoids the need to have a DHCP server.
2. Provide a static IP address of the FTP server. This address is entered into each Sprint iQ on the network and is used to obtain a connection to the FTP server from the Sprint iQ client. Sprint iQ uses this feature to transfer logging files to the FTP server.

3. Provide a static IP address assigned to the Sprint iQ FTP client (if not using DHCP) and enter it into Sprint iQ. Multiple Sprint iQ machines each require their own unique IP address suitable for FTP client operation.
4. Create one user account and password on the FTP server that can be used by all Sprint iQ machines. This account should be given FTP privilege, be able to create folders (sub-directories), and have extended privilege for reading, writing, and appending files. The assigned Username and password must be entered into each Sprint iQ.
Note: The ability to append to existing files may be disabled for some FTP servers. This option *must* be enabled if the Sprint iQ is to log test results to the FTP server.
5. Typical FTP servers can be configured with or without time-outs. Be aware that if time-outs are used, this can affect the logging operation of Sprint iQ in a negative way.
 - a. Idle Timeout

If your FTP server has an Idle Timeout configured for it, it must be set to at least 60 seconds. The recommended value is 120 seconds.
 - b. Session Timeout

For continuous testing, it is best to disable the Session Timeout for the FTP server, if possible, as the Sprint iQ will need to log back in each time the session times out. If this is not possible, setting the Session Timeout to its maximum value is recommended.
6. Other considerations are disk space, log file deletion, the number of clients that one FTP server can support, etc. These details are determined by the user, but can have an impact on the logging operation of Sprint iQ.

3.2.3.1 FTP ERROR CODES

8125	Data connection already open, transfer starting.
8150	File status okay, about to open data connection.
8200	Command successful.
8202	Command not implemented, superfluous at this site.
8213	File status.
8214	Help message.
8220	Service ready for new user.
8221	Service closing control connection.
8225	Data connection already open, no transfer in progress.
8226	Closing data connection.
8230	User logged in, proceed.
8250	Requested action okay, completed.
8257	Pathname is current directory.
8258	Command on (or off).
8331	User name okay, need password.
8350	Requested file action pending further information.
8421	Service not available, closing control connection.
8425	Can't open data connection.
8426	Connection closed, transfer aborted.
8451	Requested action aborted, local error in processing.
8452	Requested action not taken.
8500	Syntax error, command unrecognized.
8501	Syntax error in parameters or arguments.

- 8502 Command not implemented.
- 8503 Bad sequence of commands.
- 8504 Command not implemented for that parameter.
- 8505 No such file or directory.
- 8506 Usage error.
- 8522 Transfer error bytes written.
- 8530 Error in user login.
- 8550 Requested action not taken due to error.
- 8551 Requested action aborted.
- 8553 Requested action not taken due to system error.

4.1 INTRODUCTION

Sprint iQ ships with several factory-installed programs with default parameters. These may be kept or changed by the user to suit the actual day-to-day testing requirements.

Although the preset values are useful as a starting point in programming, these values will usually need to be modified to suit the particular product in use and the testing method desired.

Sprint iQ is remarkably configurable: the programs may be modified in all the ways available in accordance with the features installed in the tester. With its ability to store 99 programs, the Sprint iQ is proven to be adaptable and versatile.

A suitably-outfitted Sprint iQ can perform a variety of tests sequentially or concurrently and with linking possible between programs. The basic tests listed below can be made available to use as modular building blocks for a product test system.

This section explains programming highlights of the following types of tests:

- Decay (Pressure or Vacuum)
- Back-Pressure Flow
- Occlusion
- Flow Measurement
- Leak Check using Flow
- Burst
- Creep
- Crack (similar to burst testing, but with two sensors)

4.1.1 UNDERSTANDING PASS/REJECT LIMITS

The Sprint iQ allows the pass criteria to be defined in three ways.

- In Band
- Above Reject Max
- Below Reject Min

Note: In a Pressure Decay test the Sprint iQ defines a pressure loss as a positive value. At the start of the test time the pressure starts at zero and a loss of test pressure from that point is displayed as a positive change. Any increase in pressure would be displayed as a negative value.

In Band

The normal pass criteria is *In Band*. The test is accepted when the measured value is between the min and max limits. If the test result is above the max then “Max” is displayed as the result status. If the test result is below the min then “Min” is displayed as the result status.



Above Reject Maximum

When set to *Above Reject Maximum* the test is accepted when the measured value is above the min or max limits. If the test result is between the min and max then “Max” is displayed as the reject result. If the test result is less than the min then “Min” is displayed as the result status.



Below Reject Minimum

When set to *Below Reject Minimum* the test is accepted when the measured value is below the min or max limits. If the test result is between the min and max then “Min” is displayed as the reject result. If the test result is greater than the max then “Max” is displayed as the result status.



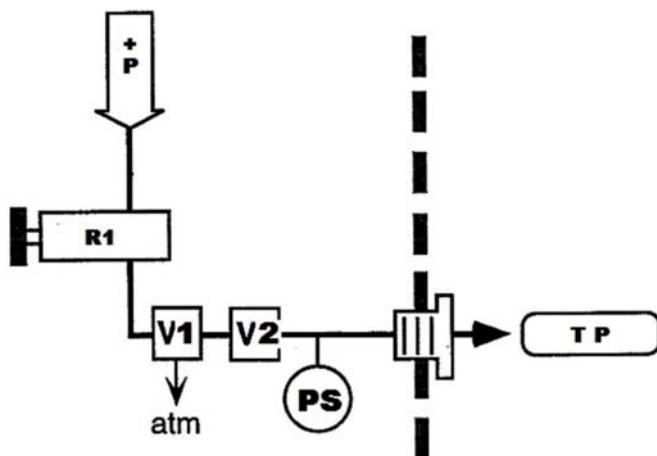
Note: There are three possible status results, Pass, Min or Max. This allows three bands to be defined for data collection purposes. Values for both min and max should always be entered. They may be set to the same value if desired. If the min is set greater than the max then the test will always fail.

Pass/Reject limits are set using the menu shown on [page 3-25](#).

4.1.2 DECAY TESTING

Decay testing is used to test products for leaks by trapping air inside a product (either pressure or vacuum) and then measuring pressure change over time. The tester intelligently interprets when pressure or vacuum is used and automatically adjusts readouts and graphs to give the correct presentation.

Pressure Decay Testing

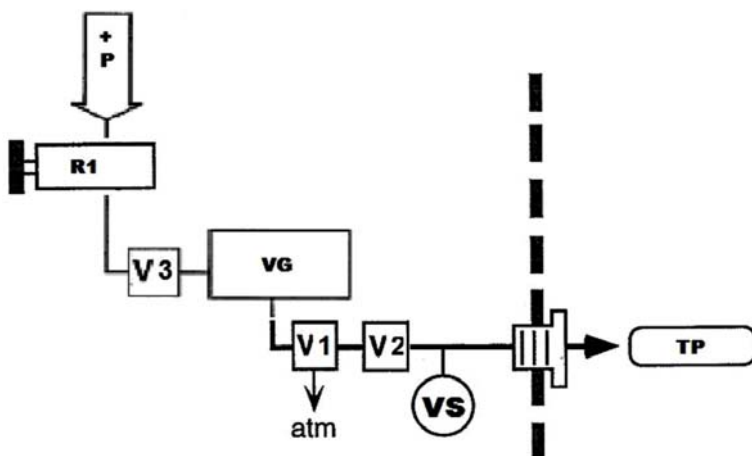


1. The part to be tested [TP] is attached to the test port and the test is started.
2. Sprint iQ pressurizes the part with pressure [+P] to the desired test pressure set by the pressure regulator [R1] by opening valves [V1] and [V2] during the Fill step.
3. At the end of the Fill step, pressure is then trapped inside the part as [V2] closes. After a slight delay, [V1] closes allowing the line between [V1] and [V2] to be vented to atmosphere through [V1]. This way, any leakage through [V2] will typically cause the tester to see this leakage and

fail all tests. The extra valve allows for a fail-safe configuration.

4. Trapped pressure inside the test circuit is held through the Stabilize step and then measured by Sprint iQ's pressure sensor [PS] during the Test step.
5. If the part exceeds the programmed leak tolerance (pressure drop over time or quantified leak rate), Sprint iQ's display shows why the part failed and displays the pressure loss or leak rate in user defined units of measure.
6. At the end of Test step, pressure trapped in the part is vented to atmosphere through [V1] by opening [V2] during the Vent step, and Sprint iQ is ready to make the next test.

Vacuum Decay Testing



Sprint iQ can be equipped with either:

- a built-in venturi vacuum generator that produces the negative pressure needed to test parts of typically small volume (< 1 liter) which must be subjected to vacuum up to 25 inHg/ 12.5 psig.

- an external vacuum pump capable of producing the negative pressure needed to test parts of larger volume (> 1 liter) and/or increased negative pressure (> 25 inHg/ 12.5 psig).

Incorporating a negative pressure sensor, vacuum source (typically), regulator, valves, and logic control, the Sprint iQ handles the task of vacuum testing within a small enclosure.

Most applications can be conducted using Sprint iQ's pneumatically-driven internal venturi vacuum source. The venturi means low noise, no heat, and no maintenance. Also, because the system is so small, it can be placed very close to the test part. With the venturi, no added floor space is required because the vacuum source is right inside Sprint iQ's standard enclosure.

1. The part to be tested [TP] is attached to the test port and the test is started.
2. Positive pressure [+P] is applied to the vacuum generator [VG] through valve [V3]. The vacuum level is set by the pressure regulator [R1].
3. Negative pressure is supplied from [VG] to the test port by opening valves [V1] and [V2] during the Fill step.
4. At the end of the Fill step, negative pressure is then trapped inside the part as [V2] closes. After a slight delay, [V1] and [V3] close allowing the line between [V1] and [V2] to be vented to atmosphere through [V2]. This way, any leakage through [V2] will typically cause the tester to see this leakage and fail all tests.
5. Trapped negative pressure inside the test circuit is held through the Stabilize step and then measured by the tester's vacuum sensor [VS] during the Test step.
6. If part exceeds the programmed leak tolerance (vacuum loss over time or quantified leak rate), the tester's display

shows why the part failed and displays the vacuum loss or leak rate in user defined units of measure.

7. At the end of Test step, negative pressure trapped in the part is vented to atmosphere through [V1] by opening [V2] only during the Vent step, and the tester is ready to make the next test.

4.1.2.1 DECAY TEST PARAMETERS

Parameters which must be set in a decay test:

- Test Pressure
- Pressure Error
- Couple Time
- Fill Time (Evacuate Time)
- Stabilization Time
- Test Time
- Vent (0 or time)
- Reject Maximum (maximum decay)
- Product Volume (optional, to calculate cc/m)
- Next Program

4.1.2.2 TEST PRESSURE

Test pressure is the amount of pressure the product is subjected to during a test. Test pressure is a preset value both stored in the program and set with the pressure regulator. If the regulator is adjusted or inadvertently moved after the target test pressure is set, Sprint iQ stops the test and shows an error in the run display.

The preset test pressure should be very close to the actual pressure from which the product starts to drop. If not, the pressure regulator may have been moved or there is a problem with the supply air to the tester.

When talking about test pressure, we speak about two possible values:

- Preset Test Pressure is the pressure you set using the pressure regulator on Sprint iQ's rear panel. The pressure value is the "ideal" or target test pressure.
- Actual Test Pressure is the pressure the product is subjected to during a test. The actual pressure could be different from the preset test pressure due to variations in product and small changes in the test system. For this reason, you set the pressure error tolerance to allow for a range of acceptable test pressure. The pressure error tolerance is the acceptable difference between the actual test pressure and the target test pressure.

4.1.2.3 PRESSURE ERROR

Pressure error is important because:

- it tells Sprint to stop the test if the pressure goes too far above the preset test pressure.
- it tells Sprint to stop the test if the pressure doesn't get close enough to the preset test pressure.

In a pressure decay test, the pressure error is set as an equal plus and minus tolerance around a nominal test pressure value. Enter the number in pressure units and Sprint iQ sets both the high and low pressure error values. Sprint iQ monitors pressure error during the fill and stabilization phases of a pressure decay leak test.

In a flow test, pressure error is checked at the end of test time to allow for the necessary pressure drop caused by the flow.

4.1.2.4 TIMERS IN DECAY TESTS

Couple Time

Couple time is used as a delay causing Sprint iQ to wait for a preset period after start is activated and before Sprint iQ supplies air to the part to be tested. Couple time can be used in either a manual or automated operation.

If coupling valves are used, the valves turn on at the start of the test and turn off when the test is finished.

Couple time is generally the period in which the pneumatic or mechanical fixtures are applied to seal the product from atmosphere. Often used in open-ended products such as tubing, catheters, and containers.

If external fixtures are not used, set the couple time to zero time (off).

Fill Time

At the start of fill time, a valve opens to pressurize the product. Fill duration depends on the size and construction of the part to be tested. Optimum fill time pressurizes the part fast enough for a good throughput, yet not so fast that the product is still expanding during test phase. Large products require a longer fill time than smaller products. At the end of fill time, Sprint iQ closes the supply air valve and pressure is trapped inside both the part and Sprint iQ's test circuit.

In a test using vacuum, fill time is actually evacuation (evac) time.

Stab Time

This time is provided to let pressure settle before going into the test phase. Best established through trial and error, stabilization time varies depending on product characteristics. Start with stabilize and test times that are equal to each other. The Stabilize

time is used to get the maximum separation and repeatability in test results between a known good part and a borderline failure. If the same part is tested repeatedly and the leak result is inconsistent, you probably need to increase the stabilization time. The smaller the leak, the longer the time.

Test Time

In a pressure decay test, test time is the period when Sprint iQ takes measurements to determine the amount of pressure drop from a stabilized pressure. The instant the test enters test phase, Sprint iQ takes the first pressure reading and stores this value **P1**. At the end of test phase, Sprint iQ takes a final reading and holds this value as **P2**. The difference between **P1** and **P2** is the total test pressure loss over the test time. Test time must be long enough to distinguish between good and bad parts. The smaller the leak the longer the time.

Vent Time

Set vent to specific time or 0 for off. When active, vent opens a valve at the end of test time to vent the product and Sprint iQ's test circuit. If the operator or automated equipment removes the products and vents the pressure, then vent is generally unnecessary (unless test pressures are more than 50 psig) and this parameter should be set to off. Vent is valuable when multiple tests are linked and you need to vent pressure before starting the next step in the series.

4.1.2.5 DELTA PRESSURE

The Delta Pressure is the amount of pressure change from the first pressure measurement in test phase (**P1**) to the last pressure measurement in test phase (**P2**). Decay rate is the pressure drop divided by time.

$$\frac{P1 - P2}{\text{Test Time}} = \text{Decay Rate}$$

Although Sprint iQ takes continuous pressure measurements from the start of fill time, only two readings are used to calculate the pressure drop-the first reading at the start of test phase and the last reading at the end of test phase. Sprint iQ uses the pressure drop to compare to the maximum allowable loss (known as the reject maximum) to decide whether a product is accepted as good or rejected as bad. The reject limit you enter into the parameters menu is generally a low pressure value, such as 0.050 psig, because the reject pressure is the drop from the first pressure reading, not the full pressure on the scale.

Reject Maximum, Reject Minimum (Reject Limits)

This is the setting for the pressure limits allowed in a product during the test phase before a reject is triggered. These settings are made in the **Pass/Reject Limit Menu** under the **Test Parameters Menu** (see [page 3-25](#)). The level is the difference between the actual test pressure (**P1**) and the test pressure unit values you enter. The menu allows easily selecting how the limits will be used as **Pass Criteria** to decide the outcome of the test. For example, if the “In Band” Pass Criteria is chosen, if the pressure is equal to or within the max and min setting at the end of test phase, the product passes; if not, it rejects. If vent is set on, the dump valve opens and vents the pressure to atmosphere.

Gross Leak

A gross leak is detected when pressure drops below the negative pressure error during stabilization time. When a gross leak is detected, Sprint iQ stops the test and shows Gross in the status box on the run display.

A gross leak is generally caused by a product having a severe defect or because external fixtures are not sealing the product. If you repeatedly get gross error messages and neither the product or the fixture seals appear to be the problem; consider increasing the fill time, the pressure error tolerance, or both. Also at fault could be the test pressure setting. Make sure the pressure regulator has not been moved and the actual applied pressure closely matches the preset test pressure.

4.1.3 BACK-PRESSURE FLOW TEST

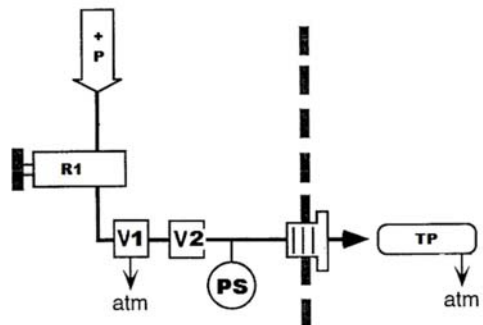
Many devices are constructed with large passages that not only must remain open but also be open a minimum amount to function normally when in use. In some cases, the part's passages have a sufficient tolerance that more precise testing such as mass flow is not necessary or within the project's budget.

A back-pressure test is typically suitable for parts with large passages and therefore high flow rates. An occlusion test, discussed on [page 4-16](#), is typically used on smaller parts

Sprint iQ testers can conduct back-pressure flow testing by using the same basic pneumatic circuit employed in pressure decay. The programming is the only difference since the part is not expected to maintain pressure. The part is continuously pressurized while air is escaping to atmosphere through the passages being checked. The residual pressure (back-pressure) seen at the parts inlet is measured and must remain within a specific range of pressure defined by reject maximum and reject minimum to pass the test. Thanks to the commonality of test circuits, it is possible (and quite common) to conduct pressure decay tests followed by back-pressure flow tests.

How Back-Pressure Flow Testing Works

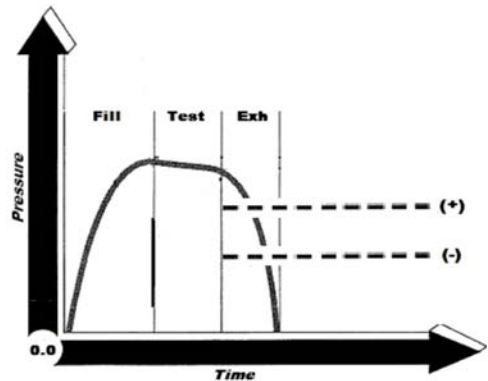
1. The upstream end of the part to be tested [TP] is attached to the test port and the downstream end of the part is left unsealed and open to atmosphere.



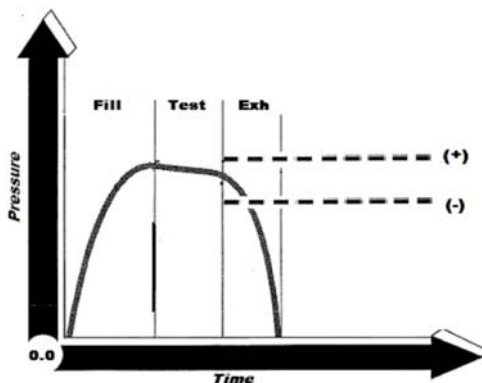
2. Part is pressurized with positive pressure [+P] to the desired test pressure set by the pressure regulator [R1] by opening valves [V1] and [V2] throughout the test.
3. At the end of Test step, Sprint iQ looks for a specific back-pressure using its pressure sensor [PS].
4. If the measured back-pressure during the Test step is outside accept/reject setpoints entered into the test program, the Sprint iQ's display shows why the part failed.
5. At the end of the test, any remaining pressure trapped in the part is vented to atmosphere through [V1] by opening [V2] only, and Sprint iQ is ready to make the next test.

Rejected Vs. Accepted Tests

The figure illustrates a typical back-pressure flow test sequence in which the part under test fails the evaluation. The part in this example fails because the residual back-pressure seen at the inlet of the part (while the outlet is vented to atmosphere) was not within the established limits (reject minimum and maximum), indicating that the passage was the wrong size.



The figure to the right shows a typical back-pressure flow test in which the part passes the evaluation. In this example, the residual back-pressure seen at the part's inlet (while the outlet is vented to atmosphere) was within the established reject minimum and reject maximum limits, indicating that the passage was the correct size.



4.1.4 OCCLUSION (BLOCKAGE) TEST

An occlusion test (also called a blockage test or a gross pressure loss test) is a method of testing in which pressure in an open product must drop below a set level for a pass condition.

Occlusion tests are generally used to evaluate products that have openings to check for potential blockages or obstructions of the flow path. Generally, occlusion tests are used on parts which are not large enough to work well with a back-pressure test.

All occlusion test parameters are the same as in a pressure decay test. The reject maximum and reject minimum is the reverse of a pressure decay leak test. Rather than expecting the part to hold pressure we now expect the pressure to flow to atmosphere. In an occlusion test, a good part is expected to leak (or flow) so the reject value must be greater than a given value.

For simplicity, the definitions of all the parameters or how to program will not be explained here. For more information see the explanation of a pressure decay test.

Occlusion Test Examples

The same pneumatic circuit employed in pressure decay testing is used in occlusion testing; only the programming is different.

Thanks to the commonality of test circuits, it is possible to conduct pressure decay tests followed by occlusion tests. This is easy to accomplish with Sprint iQ's program linking ability.

Typically, a pressure decay test is conducted first, then the product is opened to atmosphere and an occlusion test is made.

Sealing the Product

Occlusion tests can be conducted by using a clamping device to seal the product during the fill time and releasing the seal to allow the product to flow to atmosphere. Alternatively, the product can be opened to the atmosphere throughout the entire test.

An occlusion test can be run with or without a clamping device to seal off the product. Examples of both are given below.

Occlusion Test with External Seal

The occlusion test can be set up to work like this:

1. The operator connects a product to the test port and the open end of the product is placed in the sealing (clamping) fixture. The operator then pushes the START switch. Or the start could be activated by automated equipment.
2. The couple timer provides delay time needed to activate the fixture before starting the test. A coupling valve can be used to supply air to the fixture and hold the seal until the test ends.
3. At the end of couple time, the pressure decay valve opens and fills the product with air. Sprint goes into the stabilize phase only if test pressure is within the pressure error tolerance at the end of the fill phase.
4. At the end of fill time, valves close trapping air inside the product including the Sprint iQ's internal test circuit. Stabilization time lets the pressurized product settle before Sprint iQ starts taking pressure drop readings. For large flow rates stabilization time is not needed and can be set to zero.
5. At the end of stabilization time, Sprint iQ starts looking for a drop in pressure from the stabilized pressure. Sprint iQ goes into test phase only if test pressure is within the pressure error tolerance.
6. During test time, the coupling is released and the test part is opened to atmosphere. Sprint iQ compares the pressure drop to the set limits. IF the pressure decay (or pressure loss) is greater than the reject minimum at the end of test time, the pass indicator lights up. The fail light turns on if

the pressure is less than or equal to the reject minimum.

Messages in the status box stay on until the next test.

7. If the vent parameter is set a time other than zero, the vent valve vents the product to atmosphere. If another test is linked to the occlusion test, Sprint iQ goes to the next linked test in the series as long as the product passed all tests.
8. At the end of all linked tests, the operator (or automated machinery) removes the product and Sprint iQ is ready to begin the next test.

Test Time Occlusion Test Pass

The product is pressurized while the clamping fixture seals the open end of the product. The pressure drops below the reject limit within the established test time after the sealing device opens and allows the product to flow to atmosphere.

The significant pressure drop in the product indicates that the product under test flows freely to atmosphere and thus is not blocked.

Test Time Occlusion Test Fail

If the flow path were to be blocked, the product would fail because the air loss from the product would not be enough for pressure to drop more than the reject minimum in the test time.

Occlusion Test without Seal

The occlusion test can also be set up to work like this:

1. The operator connects a product to the test port and the open end of the product is allowed to flow to atmosphere. The operator then pushes the START switch. Or the start could be activated by automated equipment.

2. The couple timer will not be used for this test. (The couple timer provides delay time needed to activate the fixture before starting the test.)
3. At the start of fill time, the pressure decay valve opens and fills the product with air.
4. If the part is blocked the test pressure will rise too high during the fill time, above the pressure error limit, and the test will fail. This is a fast test for a relatively large change in the flow rate. At the end of fill time, valves close stopping the flow of air to the product.
5. Stabilization time will not be used in this test. (For large flow rates stabilization time would allow the pressure to flow out before pressure drop readings can be taken in the test time.) Sprint iQ goes into test phase only if test pressure is within the pressure error tolerance by the end of the fill phase. (Again, no stabilize time is needed for large flow rates.)
6. During test time, Sprint iQ compares the pressure drop to the reject minimum. IF the pressure decay (or pressure loss) is greater than the reject minimum at the end of test time, the pass indicator lights up. The fail light turns on if the pressure is less than or equal to the reject minimum. Messages in the status box stay on until the next test.
Note: If the fill time check is sufficient for your needs, the test time may be set to 0.1 second and a small decay value entered to allow this portion of the test to always pass.
7. If the vent parameter is set to a time, the vent valve vents the product to atmosphere. If another test is linked to the occlusion test, Sprint iQ goes to the next linked test in the series as long as the product passed all tests.
8. At the end of all linked tests, the operator (or automated machinery) removes the product and Sprint iQ is ready to begin the next test.

The product is pressurized during fill time, and the pressure is not able to rise above the pressure error limit. The test part's flow path is open to atmosphere throughout the test.

Test pressure is set while flowing

When setting the test pressure a known good part is used rather than simply blocking the test port. By flowing through a part the pressure can be set at the level expected when the flow path is open.

Fill Time Occlusion Test Pass

The significant flow through product keeps the test pressure from rising and thus is not blocked.

Fill Time Occlusion Test Fail

If the flow path were to be blocked, the test pressure will rise indicating that the flow path is blocked. The test will fail in the fill time because the pressure is above the pressure error limit.

4.1.5 FLOW TEST

Introduction

A flow test continuously supplies air to a product under test and measures the amount of air flowing through the product and going to atmosphere. In a flow test, Sprint iQ uses at least one mass flow sensor to measure the air flow, and a pressure transducer to monitor the air pressure.

The flow test can be configured to measure air flow through a product and to pass that product if air flow is between the minimum and maximum limits set in the program. Flow tests are often used to check for blocked passages in small tubing and other low-flow devices.

Most parameters in a flow test are the same as a pressure decay test with three exceptions. (1) A flow test has no stabilization phase. (2) Instead of one reject setpoint, a flow test has both reject minimum and reject maximum flow setpoints. (3) Pressure error is checked only at the end of test time.

4.1.5.1 FLOW TEST PARAMETERS

Parameters in a flow test-

- Test Pressure
- Pressure Error
- Stab Time
- Couple Time (if external fixtures are used)
- Fill Time (only required on large products)
- Test Time
- Vent (0 or time)
- Max Flow (maximum flow)
- Min. Flow (minimum flow)
- Next Program

**Protect the Flow Sensor**

Do NOT run a flow test unless product is attached to Sprint iQ's test port. Without this restriction, the high flow rate could damage the flow sensor.

Pressure Error in a Flow Test

Pressure error is used to make sure pressure is at the target level to perform a flow test. This is necessary because flow rate changes as pressure changes. Pressure error in a flow test functions much like pressure error in a pressure decay test except pressure error is checked at the end of the test phase. Figure 53.

Pressure error is set by entering one pressure number. Sprint iQ sets the positive and negative pressure error around the nominal test pressure.

If air pressure at the end of test time is below the minimum pressure error value, Sprint iQ stops the test. If vent is active, Sprint iQ vents the air to atmosphere. In this case, Sprint iQ displays an error message in the status box on the run display.

Flow Test Stabilization

Make sure the stab time is long enough for the product to reach a steady flow rate.

Flow Setpoints

Besides pressure error tolerance, flow testing requires two independent setpoints for flow rates- minimum and maximum flow. To pass a flow test, the product must be within the pressure tolerance and also within both flow setpoints at the end of test time.

If both the pressure error and flow tolerance are exceeded during a test, the pressure error will be displayed because pressure error has priority over flow tolerance.

If the air flow measured by Sprint iQ's mass flow sensor is below the minimum setpoint at the end of test phase, Sprint iQ turns on

the reject light and shows LOW in the status box on the run display.

If vent is active, the dump valve opens and pressure is vented to atmosphere.

Fill time in a Flow Test

Use the fill time in a flow test to get the product pressurized and flowing properly before taking flow readings. This protects the flow sensor from overpressure and provides more consistent flow readings.

If vent is active, the vent valve opens and pressure is vented to atmosphere.

4.1.5.2 LEAK TEST USING FLOW

You can use Sprint iQ to check for leaks using flow. When setting up this kind of test, you set the minimum flow rate to zero. The maximum flow setting is then set to the maximum flow rate you wish to accept. The exact flow rate depends on your product characteristics and specifications.

When to use a flow leak test

A leak test using flow is often an excellent option when certain conditions apply. If your product is small and the acceptable leak rate is relatively high, a leak test using flow can be much faster than a pressure decay test. This is because a flow test conducted on a small product requires no fill or stabilization time. Typical leak tolerances used in flow leak testing are roughly 1.0 sccm for small rigid products, and 5.0 sccm or greater for larger and more flexible products.

If the acceptable leak rate is relatively small (less than the rates discussed above) a pressure decay test is probably your best choice for leak testing. Call Uson to discuss your special testing

needs. We specialize in helping test engineers come up with the very best tests for a wide range of products.

When setting the maximum flow setpoint, you'll need to experiment to find the best setting. The maximum flow setting is typically quite high above zero to allow for high speed testing-the reason to use a flow leak test in the first place. If the maximum flow setting is set too close to zero and the time is kept short, a high number of rejects could occur simply due to inconsistencies among the products tested. Atmospheric and room pressure changes could also cause errors if the maximum setpoint is set too close to zero.

**Protect the Flow Sensor**

Do NOT run a flow test unless product is attached to Sprint iQ's test port. Without this restriction, the high flow rate could damage the flow sensor.

In a leak test using flow, you have the option of using fill time or going straight to test phase. Fill time is usually needed for large parts that need to fill with air before they start flowing. Small parts can often do without fill time because they fill up and start flowing immediately. The flow rate is displayed for both during the fill and test phases.

4.1.5.3 FLOW SENSOR OVER PRESSURE LIMITS

The flow sensor in the Sprint iQ can be damaged by too much pressure. The Sprint iQ automatically monitors the pressure and will stop a flow test if the pressure is too high. The below table shows the maximum pressure associated with each flow range.

Flow Range	Over Pressure Limit
10 sccm	15 psig Max
50 sccm	15 psig Max
200 sccm	15 psig Max
1,000 sccm	15 psig Max
5,000 sccm	60 psig Max
20,000 sccm	60 psig Max

4.1.6 BURST TEST

In burst testing, Sprint iQ looks for devices to open at some point during pressurization and rapidly drop toward zero pressure. Achieving the burst is the desired outcome of the test. When the burst occurs in the correct pressure range and time period, Sprint iQ gives a pass indication. Test engineers often use a burst test to check pressure relief mechanisms designed to open within a preset pressure range. Burst tests are also used to check the friction relief-point of hydraulic and pneumatic devices.

Flow Control

Use Sprint iQ's built-in flow control on the back of the tester to set the pressure increase, also called ramp rate. Trial and error is used to adjust the flow control to get the best rate of pressure increase.

A burst test is built around two test conditions:

1. Peak Pressure (P)

Peak Pressure is a constantly updated value before the burst. Sprint iQ uses the peak pressure reading as the starting point to measure the event value. After the event the final peak value is compared to the minimum and maximum burst setpoints to decide whether the product is accepted or rejected.

2. Event (E)

Event is the amount of pressure drop from the peak pressure. When a burst occurs product opens to atmosphere and the pressure begins to rapidly drop to zero pressure.

Event Value (End of Test Trigger)

Event value is a setpoint entered in the parameters menu. Event value is the peak pressure minus the event pressure. In other words, how much the pressure drop is needed from a peak pressure to be considered a real burst. For example, an event value setting of 0.2 psig means the product must drop at least 0.2 psig below the peak pressure to trigger an end of test and a pass/fail decision.

Parameters in a Burst Test

Burst testing uses some of the same parameters used in pressure decay and flow testing, with three major differences:

1. A burst test has only couple and test timers.
2. Pressure error is not used in a burst test.
3. A burst test uses a trigger or threshold setting called an event value, which is a drop in pressure from a peak pressure reading immediately before the product opens to atmosphere.

Parameters to be set in a burst test:

- Test Pressure
- Couple Time
- Test Time
- Vent (0 or time)
- Max Burst (maximum burst level)
- Min Burst (minimum burst level)
- Burst Event (amount of pressure drop to be detected)
- Next Program

Minimum and Maximum for Burst

Minimum and maximum setpoints establish a window in which a burst event must take place to be a pass. If the burst occurs below the minimum setpoint, the test is stopped and LoBurst appears in the status box on the run display. The fail light turns on.

If pressure goes above the maximum setpoint without the product bursting, Sprint iQ stops the test and shows HiBurst in the status box on the run display. The fail light turns on.

If product fails to reach a peak pressure above the maximum burst setpoints before the end of the test phase, Sprint iQ stops the test and shows NoBurst in the status box on the run display.

4.1.7 CREEP TEST

A creep test is often used to test products such as blister packages that need to hold a certain amount of air pressure without failing but are expected to increase in size or “creep up” during the test. A creep test is selected by selected the Pressure Creep test type in the Test Parameters Menu.

Use the Pass/Reject Limit Menu to select the Reject Maximum pressure. This causes Sprint iQ to pass product reaching this pressure setting. Products not reaching this setting in the allowed test time are rejected. Products opening to atmosphere (bursting) before reaching the setting setpoint are also rejected.

An Event Limit pressure must also be set in the Pass/Reject Limit Menu. This limit sets the limit of allowable pressure variation events permitted as the pressure ramps. For example, if set to 1 psi, a jump event of 1 psi during the test will cause the test to reject the product.

The Event Limit should not be set to zero, as it will cause all creep tests to fail.

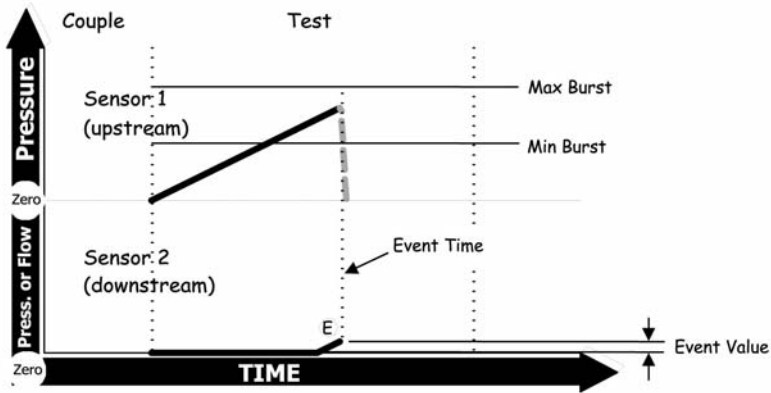
4.1.8 CRACK TEST

Crack testing is a test in which the Sprint iQ is used to detect a slight opening or change in pressure. Crack testing is used in devices such as valves intended to open a certain pressure range. Because a crack is desired, a pass indication is given if the crack happens within established tolerances.

Crack testing is related to burst testing. A burst test is used with products that open quickly to atmosphere and create a dip in pressure called an event. In some products the event is too small or the pressure does not drop at all. A crack test uses a second

sensor downstream from the part to catch a pressure rise or flow coming out of the part.

Crack Test Pass



Downstream Sensing

In some test parts, the crack (pressure change) is so gradual or low in magnitude that the sensor can't detect the pressure change. This isn't a fault of the sensor, rather the placement of the sensor in the test circuit becomes an issue. Being upstream from the product, the normal sensor is subjected to constant makeup air.

To test products that open slowly or merely "weep," Uson can provide a separate sensor used downstream from the cracking device to detect very slight pressure or flow changes. In this arrangement, the downstream sensor measures the small pressure or flow variations caused by changes in the product being tested. This arrangement works if downstream air can be routed back to Sprint iQ.

The Crack Event

For a crack test, Sprint iQ is equipped with two sensors. The standard transducer measures the pressure rise being feed to the test part, on the upstream side. The second sensor is the downstream sensor. The crack event is a change in pressure or flow on the downstream side of the test part. This downstream sensor can be either a pressure or flow sensor.

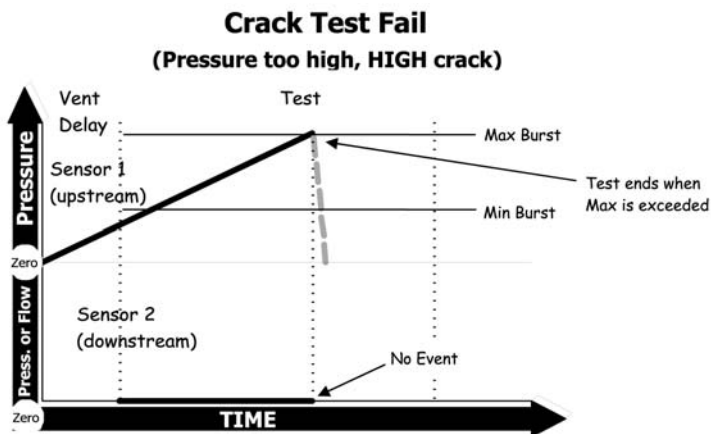
Two measured values are associated with an event value:

- The peak pressure attained. (Upstream side)
- The amount of pressure or flow rise. (Downstream side)

Both sensors are monitored at the same time. To register as a pass, the upstream peak pressure must be within the min and max crack window AND the downstream pressure or flow must exceed the event setting. For example, if the event is set at 0.05 psig, the down stream pressure is monitored till it increases more than 0.05 psig. At that time: the peak upstream pressure must fall within the minimum and maximum crack settings for the test to pass.

Programming a Crack Test

The parameters of a crack test are set in the same manner as a burst test.



4.1.9 SEALED COMPONENT TESTING

A Sprint iQ sequential tester is capable of performing Sealed Component pressure and vacuum tests if specially equipped for such tests. This type of test can be employed when the test component is completely sealed, and has no ports or openings. The component is tested by placing it in a custom-built test chamber. The chamber should be constructed so that the internal volume is only slightly greater than the volume of the test component.

The test is performed by pressurizing a metered volume and then dumping the known pressured volume of air into a test chamber containing the sealed component. A larger pressure change occurs for leaking components. The resulting pressure drop depends on the metered volume, test component volume and the dead volume within the test chamber (i.e. test chamber volume minus test component volume) which are application dependent.

The sealed component test performs the following steps: Fill, Isolate, Test and Vent.

The Fill step operates a valve to pressurize only the metered volume connected to it. The Isolate step operates a valve to isolate the regulator from the metered volume.

The test step energizes the selected channel valves to connect the test part to the pressurized volume. During this step the resulting pressure change is shown as a delta value in the test value fields (i.e. center column on the Run Mode screen).

4.1.1.0 PASS/REJECT JUMPS

The Sprint iQ tester has additional control to link the test programs together based on either a pass or reject condition. This feature also adds the ability to pause the test sequence between linked test programs.

Jump Menu	
1. Program Selection	001
2. On Pass Pause Time	0.0s
3. On Pass Automatic Advance	Off
4. On Pass Vent	On
5. On Pass Next Program	Off
6. On Reject Pause Time	0.0s
7. On Reject Automatic Advance	Off
8. On Reject Vent	On
9. On Reject Next Program	Off

On Pass vs. On Reject

The settings are separated into two groups On Pass and On Reject. The lines associated with On Pass control actions that are only executed if the part passes and the test is accepted. The lines associated with On Reject control actions that are only executed if the part fails and the test is rejected.

4.1.1.1 TIMERS

Timers are set in tenths of seconds, and each timer can be set to a maximum of 999.9 seconds. Timers are adjustable for pressure decay, flow, and burst testing. Timers for each test type have identical functions for each test mode, yet the number of possible timers may vary with each test type as seen in this listing:

Timers Used in Decay

- Couple Time
- Fill Time
- Stab Time
- Test Time
- Vent Time

Timers Used in Flow Testing

- Couple Time
- Fill Time
- Stab Time
- Test Time
- Vent Time

Timers Used in Burst Testing

- Couple Time
- Test Time (will stop sooner when event is sensed)
- Vent Time

In Run Mode, the display shows the time in the box labeled Step Countdown. All timers count down from the preset value to zero. The Status box shows what phase the test is in during timer countdown.

LEAK CALIBRATION

5.1 LEAK CALIBRATION USING THE LEAK CALIBRATION MENU

Leak Calibration is sometimes known as *comp and cal* or *test calibration*. It is only required if a leak rate is to be computed, and not just a pressure change

All Sprint iQ tests that measure a rate are subject to leak calibration. These tests are:

- Pressure Decay Rate
- Vacuum Decay Rate
- Pressure Occlusion Rate
- Vacuum Occlusion Rate

Leak calibrating the tester is an important process necessary to deliver accurate and repeatable rate measurements.

5.1.1 OVERVIEW OF LEAK CALIBRATION FOR LEAK RATE

Leak calibration is a two-step process. First, the test is run with a non-leaking master part to establish the characteristic pressure change of the part and the pneumatic system. This result is referred to as the Comp value. The second test is run with a traceable Leak Master (e.g., traceable to the NIST in the USA) to introduce a known leak to the master part. This process establishes pressure loss caused by a leak, and the resulting value is referred to as Cal.



Leak calibration is necessary for each channel and after creating a new test. Re-calibration will also be necessary after making program changes (such as changing step durations), installing a new sensor, and replacing sealing components.

5.1.2 LEAK CALIBRATION PROCEDURE

The diagram below is a guide to understanding the relationship of the menus used in the leak calibration procedure that follows.

Program Mode	
1. Test Parameter Menu	
2. Data Menu	
3. Setup Menu	
4. Hardware Menu	
5. Factory Configuration Menu	
6. Software Version	###.###

PROGRAM MODE MENU

Test Parameter Menu	
11. Pressure Tol.	XXX psi
12. Ramp Start	XXX psi
13. Ramp Rate	XXX psi/s
14. Flow Range	XXXX smlm
15. Fill Time	X s
16. Stab Time	X s
17. Test Time	X s
18. Vent Time	X s
19. Leak Calibration Menu	

TEST PARAMETER MENU

Leak Calibration Menu	
1. Program Selection	001
2. Leakrate Format	###.###
3. Leakrate Units	ml/s
4. Leak Master Value	1.00 ml/s
5. Common Cal Data	Off
6. Channel	1
7. Perform Comp/Cal Tests	
8. Comp. Value	0.000 psi
9. Cal. Value	0.000 psi

LEAK CALIBRATION MENU

Procedure:

1. With the Keylock Switch in Program Mode, highlight **Test Parameter Menu** and press **Enter**.
2. At the **Test Parameter Menu**, choose the test program with the appropriate test type as shown on page 1. Also, be sure to set the **Test Pressure** to the desired value. All values on this menu should be those values intended for use during actual parts testing. (If no value is currently known for Pressure Tolerance, a reasonable starting point is 10% of max pressure.)
3. Select **Leak Calibration Menu** and press **Enter**.
4. At the **Leak Calibration Menu**, set the **Leakrate Format** to the desired number of decimal places.
5. Set the **Leakrate Units** to the desired units of measure.
6. Set the **Leak Master Value** to the value known for the leak master at the test pressure in use.
7. Set Channel to the channel to be used. We assume channel 1 in this example. (Concurrent testers only: Channels have to be selected in the Test Parameter Menu in order to be selected in the Leak Calibration Menu)
8. For this example set **Common Cal Data** to **Off**. The special use of this item is explained on page 5.
9. Highlight **Perform Comp/Cal Tests** and press **Enter**. This will open a continuation of the Leak Calibration Menu. This menu allows selecting Comp, Comp & Cal, or Cal cycle(s) as the Operation. For this example, set the Operation to **Comp & Cal**.
10. Attach a *non-leaking* part to port 1.
11. Note that the bottom of the screen states: **Start Comp Test**. Press the **Start Button** to begin Comp.
12. The test will cycle through its usual steps and stop with a green light.

13. Attach the leak master in-line with the non-leaking part.
14. The bottom of the display should show: **Start Cal Test**.
15. Press the **Start Button** to begin Cal.
16. The steps should cycle through as before and result in a green pass light. At this point the bottom of the display will show: **Comp/Cal Complete**.
17. The screen now shows the calculated Comp, Cal, and PSN Ratio. (If unfamiliar with the significance of these values, they are explained page 6 and page 7.)
18. Proceed to other channels, if available and/or desired, and perform the Comp and Cal procedure on them until all are finished.

On sequential testers, changing the channel requires temporarily returning to the Test Parameter menu to select the channel. On concurrent testers, the channel may be changed while remaining at the Leak Calibration menu.

19. At the Leak Calibration Menu, highlight **Save** and press **Enter** to save the values and return to the previous menu. You may alternatively choose to exit without saving, if desired.

5.1.2.1 COMMON CAL DATA

In a concurrent tester, you may decide that your test fixture is such that a comp and cal on one channel is suitable for all channels. In such special cases, you may choose to set **Common Cal Data to On**.

5.1.3 PRESSURE CHANGE CALC. (LEAK RATE)

In tests such as Pressure Decay Rate, Sprint iQ calculates the leak rate from the pressure change over time using values derived from the following formulae.

Variable Definitions for the Calculations:

CalRate = Leak Master Leak Value (user-entered value)

Tare = Measure at the Start of a Step

EndMeasure = Measure at the End of a Step

Compensation:

$$\text{Comp Value} = \text{EndMeasure}_{\text{comp}} - \text{Tare}_{\text{comp}} \text{ (using non-leaking master part)}$$

Calibration:

$$\text{Cal Value} = \text{EndMeasure}_{\text{cal}} - \text{Tare}_{\text{cal}} - \text{Comp (using Leak Master)}$$

Test:

$$\text{Leak} = \frac{(\text{EndMeasure}_{\text{test}} - \text{Tare}_{\text{test}} - \text{Comp})}{\text{Cal}} \times \text{CalRate}$$

The **Comp Value** and **Cal Value** can be seen (and edited) on the Leak Calibration Menu.

The concept previously known to many as the “comp/cal ratio” is employed in the Sprint iQ as the **Pneumatic Signal/Noise Ratio** (PSN ratio) and is discussed page 7. Like the Comp Value and Cal Value, the PSN ratio appears on the Leak Calibration Menu.

5.1.4 PNEUMATIC SIGNAL/NOISE RATIO

The larger the PSN Ratio, which is the Cal Value divided by the Comp Value, the more repeatable the test will be. The PSN Ratio can be as small as 0.5 if +/- 10% test repeatability is sufficient.

So for pressure decay tests, the following rules are strongly recommended:

Comp Value less than or equal to 3 times the Cal value

PSN Ratio (Cal / Comp) $\geq$ 0.5

Cal Value $\geq$ 0.05% of full scale of the sensor

For PSN Ratio, the larger the better. Longer test times typically yield a larger PSN Ratio.

If the Comp Value is set to zero, the PSN Ratio will display as Out of Range.

6.1 GENERAL SPECIFICATIONS

Display: 5.7" Diagonal 320 x 240 Color Graphic Backlit LCD

Languages:

English (UK and US), Spanish, German
(user selectable). Custom languages also available

Program/Setup Storage: 100

(99 alpha-numeric namable & 1 diagnostic)

Test Channels Available:

1, 2, 3 or 4 (sequential or concurrent)

Pressure Ranges Available:

3, 6, 10, 20, 30, 60, 90, 110, 150, 200, 300,
400, 500 psig.

Custom ranges also available.

Maximum Pressure Display Resolution:

0.0001 psig (range dependant)

Vacuum Ranges Available:

-15 psig

Vacuum Display Resolution:

0.001 psig (range dependant)

Repeatability: 0.03% of Full Scale

Pressure/Vacuum Units of Measure:

psig, mbar, inHg, mmHg, inH₂O, mmH₂O, kPa,
kg/cm² (user selectable), Bar, cmH₂O, mmHg, cmHg

Mass Flow Ranges Available:

4, 10, 50, 200, 500, (15 psig max)
1000, 5000, 20000, 50000 sccm (60 psig max).
Custom ranges also available

Maximum Mass Flow Display Resolution:

0.01 sccm (range dependant)

Mass Flow Sensor Repeatability:

0.5% of Full Scale

Mass Flow Units of Measure:

sccs, sccm, scch, smls, smlm, smlh, sls, slm, slh
(user selectable)

Base Unit Dimensions:

8.9" W x 15.0" D x 10.8"H"
(216 mm W x 381 mm D x 267 mm H)

With Expansion Chassis:

8.9" W x 16.2" D x 14.8"H"
(216 mm W x 411 mm D x 376 mm H)

Power Supply:

100-240VAC 50/60Hz (Auto Sensing & Switching)

6.2 STANDARD FEATURES

- High Performance 24-Bit Analog to Digital (A-D) Converter
- Leak Rate in sccm or P (pressure change)
- True Volumetric Calibration Capable (Compensation & Calibration)
- Low System Volume for Maximum Sensitivity
- Dual USB Communication Ports (Front & Rear)
- RS-232 Serial Communication Port
- Program Linking and Jumps (Pass/Fail Selectable)
- Program Backup via USB Flash
- Real Time Clock
- Internal Test Data Storage of Last 250 Cycles (Each Test Channel)
- Test Data Downloading via USB Flash
- Programming Protection by Security Key (CFR21 Part 11 Compliant)

6.3 OPTIONAL FEATURES

- Additional Regulator
- Bar Code Reader
- Continuous Fill
- Coupling Ports (up to 8 and can accommodate up to 4 four-way valves)
- Data Statistics & Histograms
- Downstream Sensor
- Electronic Programmable Regulator
- Ethernet/LAN Communication Port
- Extended Chassis

- Fast Fill
- Foot Switch
- High Pressure
- High-Pressure Coalescent Filter
- Manual Ramp for Electronic Regulator
- Mist Separator and Filter
- NIST Traceable Leak & Flow Orifices
- PLC Interface with Remote BCD Program Selection (11 Defined Inputs / 11 Defined Outputs)
- Power Line Filter
- Serial Input Commands
- Vent Delay on Downstream Sensor

6.4 DIGITAL I/O PIN ASSIGNMENTS

Digital I/O is an optional feature. The connector may be found in the location shown on page 2-7.

For the conditions which activate the ALARM outputs, see *"Digital I/O Alarm Codes"* on page 6-7.

6.4.1 INPUT VOLTAGE

The I/O inputs, such as the Start input, are single-ended, 24VDC $\pm$ 4V.

6.4.2 OUTPUT VOLTAGE

The I/O outputs are 24V dry-contact relay operated.

FUNCTION	PIN NO.
START (+)	1
START ENABLE (+)	20
ABORT (+)	2
BCD 0 (+)	21
BCD 1 (+)	3
BCD 2 (+)	22
BCD 3 (+)	4
BCD 4 (+)	23
BCD 5 (+)	5
BCD 6 (+)	24
BCD 7 (+)	6
INPUTS RETURN (-)	25
PASS 1 +	7
PASS 1 -	26
FAIL 1 +	8
FAIL 1 -	27
PASS 2 +	9
PASS 2 -	28
FAIL 2 +	10
FAIL 2 -	29
PASS 3 +	11
PASS 3 -	30
FAIL 3 +	12
FAIL 3 -	31
PASS 4 +	13
PASS 4 -	32
FAIL 4 +	14
FAIL 4 -	33
READY +	15
READY -	34
EOC +	16
EOC -	35
ALARM +	17
ALARM -	36
N/C	18
N/C	37
N/C	19

6.4.3 DIGITAL I/O POWER RATING

The I/O connector is used to connect the Sprint iQ to a Programmable Logic Controller (PLC) or other automation equipment. Be aware that it is possible to damage the interface when connecting to non-PLC loads such as incandescent lamps, motors, or other high-inrush devices.

Be certain that any customized circuitry adheres to the output specifications given below or risk damage to the Sprint iQ.

Maximum Switching Load: 10VA

Maximum Switching Current: 0.5A

Maximum Switching Voltage: 100VDC

Maximum Continuous Current: 1.5A

Uson has made a robust interface well suited for its intended purpose of driving a PLC. However, the user assumes all risks associated with making customized connections to the interface, other than to a PLC, if such connections are outside the limits of the specifications given.

6.4.4 DIGITAL I/O ALARM CODES

These are the errors which set the alarm output and generate an dialogue message.

Errors Relating to file Audit file operations:

NETWORK_AUDIT

“Audit Network Error: Check Network Connection”

RAM_FILE_NOT_CREATED

“Audit Network Error: Ram File Not Created”

RAM_FILE_DOES_NOT_EXIST

“Audit Network Error: Ram File does not Exist

RAM_FILE_NOT_DELETED

“Audit Network Error: Ram File Not Deleted”

NETWORK_AUDIT_PATH_INVALID

“Audit Network Error: Invalid Path”

AUDIT_BUFFER_FULL,

“Audit Buffer Full”

AUDIT_UPDATE_TIMEOUT

“Audit Network Error: Invalid Path”

USB_AUDIT

“Audit Error: Check USB Connection”

Errors Relating to Running a Test, start errors:

NETWORK_CONNECTION_LOST

“Start Error: Network Audit is Enabled and network is disconnected”

USB_MSD_REMOVED

“Start Error: USB Audit is enabled and requires USB MSD to be inserted”

Errors Relating to DataBase operations:

NOT_READY_TO_RUN_BAD_RAM

“Error Ram Drive”

NOT_READY_TO_RUN_BAD_DFLASH

“Error Flash Drive”

NOT_READY_TO_RUN_CONFIG

“Error Config File”

NOT_READY_TO_RUN_TESTCHAN

“Error Sensor Calibration File”

NOT_READY_TO_RUN_VALIDATION

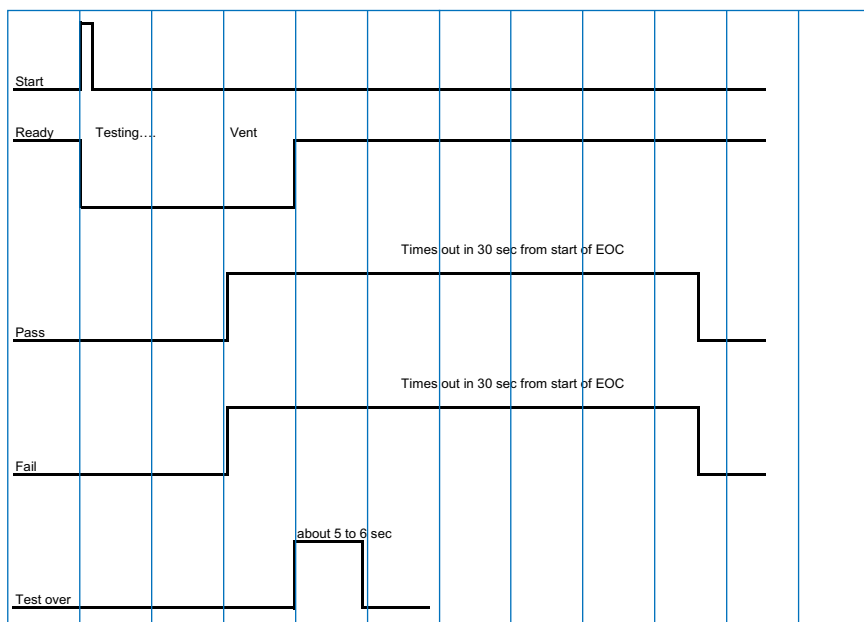
“Error Invalid Data”

6.4.5 REMOTE OUTPUT TIMING

Remote outputs adhere to the following rules:

- EOC turns off after a set period of 5 seconds *unless* the next test starts and forces it off earlier.
- The result outputs turn off after a set period of 30 seconds from the start of the EOC.
- The Result outputs and EOC are turned off after the EOC times out when Program Mode is selected.
- The Ready relay output closed state indicates when the tester is ready to perform a test.
- The Alarm relay output closed state indicates a warning or error condition exists.
- Pass and Fail outputs timeout 30 seconds from EOC.

The following chart illustrates the relationship of these rules.

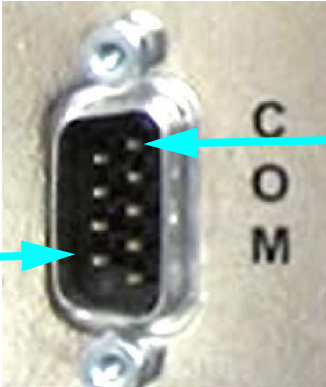


6.5 SERIAL OUTPUT TEST RESULT TEXT

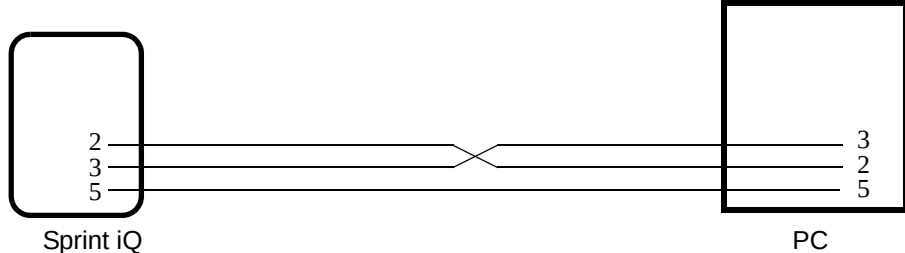
The exact text output available from the serial port for each end-of-cycle result is given below:

Test Result (TR)	Output Text
TR_PASS	PASS
TR_REJECT_MAX	HIGH
TR_REJECT_MIN	LOW
TR_GROSS	GROSS
TR_NO_BURST	NO
TR_LO_BURST	LOW
TR_HI_BURST	HIGH
TR_NO_CRACK	NO
TR_LO_CRACK	LOW
TR_HI_CRACK	HIGH
TR_ABORT	ABORT
TR_CREEP_REJ	REJECT

6.6 RS-232 CONNECTION

SPRINT IQ PINS		NAME
	2	RD
	3	TD
	5	GND
	7	RTS
	8	CTS

Connect the Sprint iQ to a PC with a Null Modem Cable



The most simple way to connect the Sprint iQ to a PC serial port is to use a null modem cable. This type of cable crosses pins 2 and 3 and the ground wire carries straight through as shown above.

The Sprint iQ serial port is a DTE device, the same as a PC. This is why the transmit and receive wires must be crossed in the cable. If the Sprint iQ is being connected to a printer (a DCE device), then the cable carries pins 2 and 3 straight through.

Use pins 7 and 8 if hardware handshaking is required. Usually this is only required when one device has to wait for the other device to be ready, e.g., when sending data to a slow printer with a small buffer. Refer to the device manual for the cable recommended by the manufacturer for connecting to a DTE device (the Sprint iQ).

As always with serial communication, both devices must be set to identical baud rates or the data will be scrambled or lost.

6.7 SERIAL INPUT COMMANDS OPTION

The Serial Input Commands option is a purchased option which allows various functions to be selected via the serial port. The command format and the available functions are listed below:

6.7.1 COMMAND FORMAT

The input command string has the following fixed format:

#XXXXXX-XXXP:YY:ZZZ[CR]

Where:

#	Indicates the start of an input command.
XXXXXX-XXXP	The Serial Number of the target Sprint iQ.
:	Field Separator.
YY	The function code to be performed.
:	Field Separator.
ZZZ	The Program Number. This value is dependent on the function specified. The value 000 should be set for non program related commands.

6.7.2 REPLY FORMAT

A reply messages will be returned to acknowledge the received command input.

A valid command reply message format:

#SiQ Ok(0):

An invalid input command will produce the following error reply message format:

#SiQ Error(x): Message.

x	Message
1	Invalid Format.
2	Invalid Serial Number.
3	Invalid Command.
4	Invalid Program Number.
5	Invalid Counter Access.

6.7.3 TEST FUNCTIONS

The following codes request Run Mode test control functions:

Code	Description
TP	Selects the program to be tested when the Setup Remote Program parameter is set to serial.
TR	Resets the hold on fail conditions or Aborts a test when the Setup Remote Start parameter is set to Serial.
TS	Starts a test when the Setup Remote Start parameter is set to Serial. A valid program number will select the test to be started when the Setup Remote Program parameter is set to Serial. Note: Setting 000 will start the currently selected program.

6.7.4 PRINT FUNCTIONS

The following codes output requested information via the serial port.

Code	Description
PC	Prints the program counters specified by the program number.
PF	Prints the instrument configuration details.
PH	Prints the program and header details by the program number.
PP	Prints the program details specified for the program number.
PS	Prints the Setup details.
PT	Prints the Statistics information.

6.7.5 COUNTER FUNCTIONS

The following codes clear information and can only be performed when a test is not being performed. An Invalid Counter Access error will be reported if a test is in progress.

Code	Description
CA	Clears all counters and data log.
CD	Clears the data log
CP	Clears the program counters and statistics specified by the program number. A 000 value indicates all programs are to be cleared.
CR	Clears run mode counters.

6.7.6 STATUS FUNCTIONS

The following codes request status information which is returned in the following reply format:

#SiQ Status(x): Message

Code	Description	Reply Data
SA	Reports the Alarm status.	0: No Alarm 1: Alarm
SM	Reports the Mode selected.	0: Program Mode 1: Run Mode
SP	Reports the Program number selected.	x: Program Number
ST	Reports the Test status.	0: No Test 1: Test
SR	Reports decimal value of 16 bit status word. Bit: Data. 15: Mode selected. 14: Alarm Status. 13: Test Status 8 to 12: 0 0 to 7: Program number	x: Register

6.8 PRINTING REPORTS

The Sprint iQ can create reports and log files using ASCII characters and transmit these records via the serial port.

For example, the Audit Printout can be used to direct the test results to a PC via HyperTerminal through the serial com Port.

The ethernet port handles reports and logs similar to the USB and serial port except that it will use File Transfer Protocol (FTP) to write log files to a networked drive. To setup the LAN interface, the user must specify the FTP address and the name of the file to be written. The log file is formatted identically to the Sprint iQ's serial port and USB log file output. The Sprint iQ appends its output, including the results of each test, to the network-based log file.

The following is an example of printing Program Header and then Test Results. See *"2. Print Menu [run mode options*

menu]" on page 3-5.

```
*****
TESTER # 000000-003P      PROGRAM PARAMETERS      PROGRAM: 1      Test Type: P Decay

    Test Press : 60.000
    Press Error : 1.300
    Prefill Time : None
    Prefill Vent Time : None
    Fill Time : 5.0
    Stabilize Time : 2.0
    Test Time : 5.0
    Vent Time : 2.0
    Coupling :          None
    Couple Time :
    Hold/Fail : Off
    Reject Limits : ---   Chan1
    Pass Criteria :      Window
    Reject Max :          0.100
    Reject Min :          -0.100
    Program Jumps : ---   OnPass   OnReject
    Jump Dest :          None      None
    Pause Time :
    Auto Advance :
*****

Cycle  Prog   Test      Chan   Value   Units   Result
4      1      P Decay Ch1    0.010   Psi    PASS    07/16/07 10:04:34
5      1      P Decay Ch1    0.008   Psi    PASS    07/16/07 10:09:41
6      1      P Decay Ch1    0.001   Psi    PASS    07/16/07 10:14:15
7      1      P Decay Ch1    0.000   Psi    PASS    07/16/07 10:15:12
8      1      P Decay Ch1   -0.002   Psi    PASS    07/16/07 10:18:54
                                ABORT    07/16/07 10:19:29
                                ABORT    07/16/07 10:23:02

                                ABORT 07/16/07 10:23:14
```

Next is an example of the output when Print Setup is selected.
 See *"2. Print Menu [run mode options menu]" on page 3-5.*

```
*****
TESTER # 000000-003P      SETUP PARAMETERS

    Pressure Units : Psi
    Flow Units : smlm
    Remote Start : Off
    Reset Mode : None
    Program Selection : Front Panel
    Program Input Decode : Binary
    Language : American
    Display Contrast : 45
    Audio Control : Off
    Audio Timeout : 0
    Auto Rollover : Disabled
*****
```

Below is an example of selecting Print Results.

```
*****  
PROGRAM 1  TOTAL TESTED [3]  # PASSED [3]  # REJECTED [0]  
*****
```


6.9 CONVERTING PRESSURE TO FLOW RATE

You can determine the leak rate in flow units (cubic centimeters per minute) based on the pressures (**P1** less **P2**) measured by Sprint iQ. In a pressure decay test, Sprint iQ holds the pressure drop on the main digital readout-large numerals in the center of the LCD. The pressure drop is the delta pressure (P) in the formula.

Delta time (t) is the test timer value set in Sprint iQ's pressure decay program (provided the test passes). Because this timer is set in seconds, merely divide by 60 to get the delta time in minutes.

Volume is the part volume plus Sprint iQ's internal test circuit (generally between 5.0 cubic centimeters and 15.0 cubic centimeters depending on model) plus the volume of connections between Sprint iQ's test port and the product. The total volume (for our example) must be in cubic centimeters.

Atmosphere is the barometric pressure in pounds per square inch (roughly 14.7 psi at sea level). This number changes with weather conditions.

$$\text{Leak Rate} = \frac{\Delta P * \text{Volume}}{\Delta t * \text{atm}}$$

$$\text{cc/m} = \frac{\text{psig} * \text{cubic centimeters}}{\text{minutes} * \text{psi}}$$

6.10 CONCEPTS APPLICABLE TO TESTING

Pressure

In physics, pressure is a force measured in terms of its distribution over an area of an opposing force. This is expressed as force (F) divided by unit area (A) of the surface area to which the force is applied. Air pressure most commonly refers to a force exerted uniformly in all directions. $\text{Force} \times \text{Area} = \text{pressure}$.

Absolute pressure is pressure measured with respect to zero pressure (a very high vacuum)

Gauge pressure is pressure measured with respect to surrounding air pressure (the pressure exerted by the weight of the atmosphere).

Barometric pressure is the surrounding pressure caused by the atmosphere. At average sea level, barometric pressure is about 14.7 pounds per square inch, or 29.9 inches of mercury. This is equivalent to 101.3 Kilopascals.

Negative Pressure (Vacuum)

A vacuum can be defined as a volume of space that contains no matter. For practical purposes, this means a volume where as much matter as possible has been removed. A perfect vacuum does not exist even in the depths of space. Any given volume will probably contain one or more particles of matter or one or more units of energy, which is the equivalent of matter (relativity). Even a vacuum with no measurable energy level is only a “virtual” vacuum.

Air Composition

The atmosphere is composed almost entirely of oxygen and nitrogen in their diatomic forms (two atoms bound together by chemical forces). Diatomic nitrogen makes up about 78%

of the total molecules in the atmosphere. Diatomic oxygen represents nearly 21%. The inert noble gas, argon, accounts for about 0.9%, and the remaining 0.1% is composed of many trace gases, the most significant being carbon dioxide and water vapor. Carbon dioxide makes up only 325 parts per million of the atmosphere by volume. Water vapor is present in highly variable quantities ranging from 0 to 4% by volume.

Air Density

If the atmosphere were like water and incompressible, pressure would decrease uniformly as you went up. In reality, the atmosphere is compressible and density (mass per unit volume) is proportional to pressure. This relationship, called Boyle's Law, implies that density decreases with height in the atmosphere: As height increases, less mass remains above a given point; therefore less pressure is exerted. At sea level, the density of air is about 1 kg per cubic meter (8 oz. per cubic foot). Both pressure and density decrease by about a factor of 10 for every 16 km (10 miles) increase in altitude.

Density does not depend solely on pressure. For a given pressure, density is inversely proportional to temperature. This relationship, known as Charles' Law, implies that the depth of an air column bounded by two constant-pressure surfaces will increase as the temperatures in the column decreases.

Density varies mostly with pressure over large vertical distances; at constant height, pressure variation with temperature becomes important. In the low atmosphere, air is heavy, with a stable mass of roughly one kilogram per cubic meter (1 oz./cubic foot). A room of 500 cubic meters (650 cubic yards) thus contains 0.05 metric ton of air. At an altitude of 3 km (2 miles), however, density is 30% less than at sea level.

This difference in air density can cause variations in flow readings from one location to another when elevations are quite different and no corrections are made.

Sprint IQ measures true air flow in units standardized to 29.92 inHg (14.68 psi) at 20 degrees C. Although the Sprint IQ's measurements are accurate and traceable to NIST standards, flow readings could be different if the tester is used at drastically different altitudes. This is not a tester fault; rather, conditions have changed and Sprint IQ measures this difference. At a high altitude, air is less dense than air at a lower elevation. When compressed to the same relative pressure, the air will exhibit a density shift when compared with air compressed to the same relative pressure at a lower level.

Difference in air density is the primary reason users can observe slightly different results when temperature and gauge pressures are identical. For this reason, it is important to establish all test parameters at the same altitude and under the same conditions in which the tester will be used.

Compensation may be necessary to reconcile air density variations between the two locations if measurements are made at different altitudes.

Fluids vs. Solids

The distinguishing feature of a fluid (gas or liquid), in contrast to a solid, is how easily the fluid can be deformed. If a shearing force, even a very small force, is applied to a fluid, the fluid will move and continue to move as long as the shear acts on it. For example, the force of gravity causes water poured from a cup to flow. Water continues to flow as long as the cup is tilted. If the cup is turned back up, the flow stops because the gravitational force is then exactly balanced by force of the cup wall.

Gas vs. Liquid

Unlike liquids, gases cannot be poured from one open container into another, but they deform under shear stress just the same. Because shear stresses result from relative motion, stresses are equivalent whether the fluid flows past a stationary object or the object moves through the fluid.

Although a fluid can deform easily under an applied force, the fluid's viscosity creates resistance to this force. The viscosity of gases, which is much less than that of liquids, increases slightly as the temperature increases, whereas that of liquids decreases when the temperature increases. Fluid mechanics is mostly concerned with Newtonian fluids, or those in which stress, viscosity, and rate of strain are linearly related.

Pressure and Density

Pressure and density are considered mechanical properties of the fluid, although they are also thermodynamic properties related to the temperature and entropy of the fluid. For a small change in pressure, the density of a gas is essentially unaffected. For this reason, gas and all liquids can be considered incompressible. If density changes are significant in flow problems, however, then the flow must be considered compressible. Compressibility affects results when the speed of the flow approaches the speed of sound.

Fluid Flow-Real Fluids

Equations concerning the flow of real fluids are complex. In turbulent flow, the equations are not completely known. Laminar flow is described by the Navier-Stokes equations, for which answers can be derived only in simple cases. Only by using large computers can answers be derived in more complex flow situations. Experimentation is still important for fully correlating theory with actual flow.

Laminar vs. Turbulent Flow

When flow velocity increases, the flow becomes unstable, and changes from laminar to turbulent flow. In turbulent flow, gas particles start moving in highly irregular and difficult-to-predict paths. Eddies form and transfer momentum over distances varying from a few millimeters, as in controlled laboratory experiments, to several meters, as in a large room or other structure. Equations for turbulent flow are more complex than the formulas for laminar flow. For most answers, they require empirical relations derived from controlled experiments.

Whether a flow is laminar or turbulent generally can be determined by calculating the Reynolds number (Re) of the flow. The Reynolds number is the product of the density (designated by the Greek lower-case letter rho { ρ }), a characteristic length L, and a characteristic velocity v, all divided by the coefficient of viscosity (designated by the Greek lower-case letter mu { μ }): **Re = (ρ)LV/ μ :**

Reynolds Number (Re)

The Reynolds number is dimensionless, a pure number. As long as Re is small, the flow remains laminar. When the Reynolds number becomes greater than a critical value, the flow becomes turbulent. With ρ , L, and μ constant, Re varies simply as velocity changes. For flow in smooth round pipes, critical value is about 2,000, with L equal to the diameter of the pipe.

Pascal's Law

In 1653, Blaise Pascal came up with the idea that in a fluid at rest, the pressure on any surface exerts a force perpendicular to the surface and independent of the direction or orientation of the surface. Any added pressure applied to the fluid is transmitted equally to every point in the fluid. Pascal used his

idea to invent the hydraulic press. Pascal's principle is often used in devices that multiply an applied force and transmit it to a point of application. Examples include the hydraulic jack, and the pneumatic cylinder.

Gas Laws

The actions of gases under varying conditions of temperature, pressure, and volume can be described and predicted by a set of equations, or gas Laws. These Laws were determined by measurements of actual gases and are valid for all substances in a gaseous state.

Measurements on gases were first published by Robert Boyle in 1660. He figured out that if an enclosed amount of gas is compressed until it is half its original volume while the temperature is kept constant, the pressure will be doubled. Quantitatively, Boyle's Law is: $PV = \text{Constant}$, where the value of the constant depends on the temperature and the amount of gas present.

Relationships between the temperature of the gas and its volume while keeping the pressure unchanged were studied by Jacques Charles. He saw a steady increase in the volume as the temperature went up, finding that for every degree Celsius rise in temperature, the gas volume increase by $1/273$ of its volume at zero degrees C.

Charles's Law and Kelvin Temperature

Charles's observations led to the absolute (Kelvin) temperature scale, since the gas, according to the equation, would have zero volume at -273 degrees C. The absolute temperature scale was defined by Kelvin so that absolute temperature equals negative 273 degrees C and each absolute degree is the same size as a Celsius degree. The modern value for absolute zero is -273.15 degrees C. This temperature scale allows Charles's Law to be written $V/T = \text{Constant}$, where V

is the volume of the gas, T is the temperature on the absolute scale, and the constant depends on the pressure and the amount of gas present.

In 1802, Joseph Gay-Lussac played around with the relationship between pressure and temperature and came up with an equation a lot like Charles's Law: $P/T = \text{Constant}$.

Generalized Gas Law

We can combine Boyle's, Charles's, and Gay-Lussac's Laws to express this generalized gas Law: **$PV/T = \text{Constant}$** , where the value of the constant depends on the amount of gas present and t is the absolute (or Kelvin) temperature.

Ideal Gas Law

The Ideal Gas Law can be written in a slightly different manner from the Generalized Gas Law: **$PV/T = nR$** , or **$PV = nRT$** . When written this way, it is called the Ideal-Gas Law. R is the gas constant, and n is the number of moles of gas. The gas constant can be examined experimentally as $R = 0.082$ liter atm/Kelvin moles. Knowing R , the fourth variable can be evaluated if any three are known.

The gas Laws are valid for most gases at moderate temperatures and pressures. At low temperatures and high pressures, gases deviate from the above Laws because the molecules are moving slowly at low temperatures and they are closer together on the average at higher pressures.

Ideal vs. Real Gas

Gases are typified as ideal or real. The ideal gas follows certain gas Laws exactly, whereas a real gas closely follows these Laws only at low density. Ideal behavior can be ascribed to a real gas if its molecules are separated by very large distances, so that intermolecular attraction is negligible.

Adiabatic Process

(ad-ee-uh-bat-ik)

Adiabatic compression and expansion are thermodynamic processes in which the pressure of a gas is increased or decreased without any exchange of heat energy with the surroundings. Any process that occurs without heat transfer is called an adiabatic process.

The adiabatic compression or expansion of a gas can occur if the gas is insulated from its surroundings or if the process takes place quickly enough to prevent any significant heat transfer. This is essentially the case in a number of important devices, including air compressors.

An adiabatic expansion is usually accompanied by a decrease in the gas temperature. This can be observed in a common aerosol can, which becomes cold after some compressed gas is released. The reason for the temperature drop is that the gas is released too quickly to absorb any significant heat energy from its surroundings. Work performed in expanding the released gas drains some internal energy of the gas still in the can, making it colder. After the can metal becomes cold, however, the process is no longer adiabatic.

In a similar fashion, adiabatic compression usually increases the temperature of a gas, since work is done on the system by the surroundings. For example, when air is pumped into an automobile tire, the air temperature rises as a result of adiabatic compression.

6.1 1 TERMINOLOGY REFERENCE

Abort a test, how to: Press the red STOP button during the test. An aborted test will register on the Tested and Rejects counters.

ASCII: The binary code used for representing characters.

Atmosphere (1): In this guide, atmosphere means room air pressure. Atmospheric pressure is nearly synonymous with barometric pressure-an external force pushing on all sides of every object on earth's surface. During a flow test, product being tested must flow into atmosphere, which causes a resistance to flow called back pressure. Room atmosphere can change due to fluctuations in air conditioning or changing weather conditions.

Atmosphere (2): The word atmosphere can refer to a unit of measure equal to pressure at average sea level. By convention, one atmosphere equals 14.7 psi. To say a test was taken at one atmosphere means the test was made at (or converted to) average sea level.

Barometric Pressure: Also called atmospheric pressure. The force of air pressing down on the earth. Barometric pressure changes with elevation and weather conditions. Sprint's regulator compensates for changes in barometric pressure to provide a constant relative output.

Bulkhead Fitting: A connection passing through a panel or enclosure. Standard bulkheads on the front have a #10 by 32 pitch machine thread.

Burst Test: One of Sprint iQ's possible operating modes in addition to pressure decay and flow. A burst test slowly fills a product through a flow valve set by users. After the burst, pressure rapidly drops to near zero. Sprint iQ captures the pressure immediately before the product

ruptures or in some way opens to atmosphere. Burst mode is useful for testing pop-off valves, package seals, or devices that open to atmosphere after reaching a certain pressure.

Cal Value: Cal Value = Pressure change during the leak test step with a calibrated leak master – the Comp Value.

Comp and Cal: Leak rate calibration

Comp Value: Pressure change during the leak test step with a non-leaking master

Concurrent: Testing multiple ports or multiple parts at the same time is known as concurrent testing. If the tester has multiple test ports and tests them all at the same time, it is called a concurrent tester. See Sequential.

Contrast: The contrast of the LCD can be adjusted for the best viewing using the Display Contrast setting in the Setup Menu.

Counter, Tested:

Firmware versions prior to 2.2.1: Sprint iQ records the total number of tests performed (both pass and fail) and number of rejects (fail only). Running totals are displayed to operators in the tested and reject boxes on the run display. Counters may be cleared from the Program Mode Data Menu.

Firmware versions 2.2.1 and later: The Tested counter now indicates the number of test cycles performed and not the number of tests performed by the test cycle. This operates identically to Uson's *Sprint LC*. This method of counting is intended to indicate the number of components tested instead of the number of tests performed. Note that a test cycle may consist of one or more tests to be performed on selected channels and

assumes the additional tests are performed the same component.

The counter is incremented by the number of active channels specified by the first program tested in a test cycle and not the number of tests performed, i.e., the count increments by one for sequential mode and by the number of active channels for concurrent mode. The **Tested** counter value displayed on the Run Mode screen is updated at the End of Cycle and not at each test.

Coupling Port: The coupling port supplies air pressure to product sealing fixtures or other external pneumatic components.

Coupling Pressure: The air pressure supplied to external fixtures. Coupling pressure must be greater than the test pressure and the same as the incoming line pressure unless additional pneumatic components are added.

Coupling Time: A delay timer used to apply a clamp or seal to product under test before the product is filled with air. Coupling time gives fixtures enough time to seal product before Sprint iQ applies test pressure.

Coupling Valves: The coupling valves are programmable and can be used to do many different things:

1. Control coupling actions on a multi-port tester so that each port has separate control, i.e. one coupling per test port. The coupling would be set to be active when the test port is active. An example is a four-channel concurrent test. All of the couplings would need to be activated at the same time at the start of a test and released at the same time at the end of a test. If it is desired to do a test with only two of the four ports it can be set up to only activate those couplings.

2. Do a sequence of tests that require the part to be sealed or vented differently for each test. An example of this would be a pressure decay test followed by an occlusion test on a catheter. In the leak test two couplings would be set to seal on both the proximal and distal ends of the catheter. During the occlusion test the coupling for the distal end would be released to create a path to atmosphere.
3. A variation of this could be a single occlusion test that needs the distal end sealed for the fill time and then open for the test time. (This is the reason for the occlusion release function.) Two couplings are active at the start of the test and one released for the test time.
4. Another example would be a test part that has multiple ports to be sealed in a particular order or in different combinations for different tests in a sequence. This is common for check valves or parts that incorporate a check valve. A given port may need to be sealed in one test and then open in another test to verify that the check valve will open in one direction and close in the other. This may require that more than one coupling valves activate at the same time and is then one is released in a subsequent test.
5. It is also possible to have applications that require combinations of the above examples.

Example: To enable Couples 1 and 2 at the same time, enable both, then set Couple 1 time to 0, set Couple 2 time to the largest required coupling time for both of those valves. Couple 1 will have a 10 ms head start on Couple 2, but this duration is insignificant in most applications. (30ms maximum time between 4 couplings).

Same for more “concurrent” couples, or sets of concurrent couples.

Example:

Couple	State	Time
1	On	0
2	On	1
3	On	0
4	On	2

Couples 1 and 2 come on at virtually the same time, 1 second later couples 3 and 4 come on at virtually the same time, and then the test starts 2 seconds after that.

An explanation of the programming setup for the valves is given [3-18](#).

Crack Test: A crack test is setup to measure the pressure at which a product, like a check valve, opens and allow air to flow through. It is used with parts that do not open quickly enough to cause a drop in the upstream pressure. An optional downstream sensor is required to measure a device that opens very slowly. Crack testing differs from burst testing because the product does not suddenly drop to zero pressure as in a burst test.

Creep Test: A creep test is setup to verify that a part can withstand a minimum proof pressure. The minimum burst and maximum burst values are set to the same pressure. This tells Sprint to redefine the pass/fail criteria. If the ramping pressure during the test reaches this value then the part is considered good.

Decay Test: A test type which may be either a pressure decay or vacuum decay test.

Decay: The amount of pressure change a product can sustain during a test period before going out of an established

tolerance. This applies to both pressure and vacuum decay testing.

Electronic Regulator: An optional device that automatically adjusts the test pressure to a preset value. Multiple test programs with multiple test pressures may be linked together if this option is installed. It also provides a way to avoid having the operator manually adjust the pressure for different test pressures. (Also *see “Electronic Programmable Regulator” on page 50*)

Evacuate Time: The time duration to apply a vacuum to the test product in tests such as a decay test (vacuum).

Event: The instant pressure drops below the event value during a burst or creep test. Sprint iQ monitors pressure during a burst test or creep test and holds the maximum pressure value measured before the event (pressure drop) occurred.

Factory-Configured Programs: Uson ships Sprint iQ with a few programs already set up out of the 100 positions available to hold test programs. These programs can be retained, modified, or replaced as desired.

Fail Light: The fail light for a channel turns on whenever a test exceeds established parameters. The light is extinguished when the next test starts.

Fill Time: The time duration to apply test pressure to the product in tests such as a decay test (pressure).

Firmware: The set of instructions stored in programmable read-only memory (PROM) that tell Sprint how to operate. Firmware cannot be altered by the customer.

Firmware Version (finding): The version of firmware running Sprint iQ is briefly displayed in the startup screen

when the tester is first turned on and is also visible on the Program Mode screen.

Fixturing: A fixture is a device connected externally to Sprint iQ. Fixtures can be mechanical, electrical, pneumatic, or combinations of all. Typical fixtures are pneumatic clamps that seal products during a pressure decay or flow test. Sprint can supply air from the coupling port to operate pneumatic fixtures. Customers must specify at order whether they want coupling pressure to be line or test pressure. Many fixturing options are possible.

Flow Control: Sprint iQ has a built-in flow control to provide a slow pressure increase (ramp up) needed for burst and crack testing. Users can precisely set the flow control for the exact pressure build-up required for the product to be tested. After the flow control is set for a particular product, the needle valve need not be adjusted again.

Flow Master: A measuring instrument or certified restrictor that can be connected to Sprint iQ as part of the sensor calibration for flow. The flow standard must have adequate accuracy, stability, and repeatability needed to calibrate Sprint iQ. The flow standard must have current calibration documentation if the customer requires accuracy traceability.

Flow: The amount of air passing through an object measured in cubic centimeters or liters per time period (minute, second, or hour).

Flow Transducer: A device that converts gas flow into electrical signals. The type of transducer used in Sprint is a mass flow transducer, which is both accurate and compensated for room temperature influences.

Flow Test: A flow test involves pushing air through a product at a set pressure and measuring the resultant flow sensor. Flow testing can be used in two ways:

(1) Flow Leak Detection: Product is filled with air at a set pressure and then sealed from atmosphere in a pressure decay test. Any flow above zero indicates a leak.

(2) Flow Measurement: Air is pushed through a product at a set pressure and allowed to flow to atmosphere. The amount of air movement through product is measured by the flow sensor. Sprint iQ's digital readout shows flow rate in units that can be selected by the customer.

Gauge Pressure: A force referenced to barometric pressure. Sprint uses a gauge regulator to keep the pressure constant as barometric pressure changes.

Gross Leak: A leak that causes a drop below the negative pressure error during the stabilization phase. Typically, when a product under test has a gross leak, pressure cannot build high enough to reach test pressure.

If Sprint iQ indicates a gross leak in good products, a larger pressure error value may be needed. This is often the case when testing large product or products constructed of flexible materials. See Pressure Error.

Hardware Calibration: A sometimes-used term for sensor calibration.

Help: Get technical help from Uson by calling +1 281-671-2000. Help is available during normal business hours, USA Central Time Zone.

Interface Communication: between Sprint and a peripheral device such as a PLC, computer or printer. Sprint has many interface options such as an I/O port for discrete communication, an ethernet port, and serial port for test

result output. The serial port uses a serial protocol known as RS-232 to communicate. The interface is setup in the Serial Port Menu reached through the Hardware Menu.

I/O (Input/Output): Devices or connections used by computers and Sprint iQ to communicate with other devices such as Programmable Logic Controllers (PLCs). See PLC

Interlumen testing: This type of testing is done on catheters. Air is routed to the catheter for outer wall integrity, occlusion, and interlumen leak testing. By opening the valves to atmosphere, the leak tester checks for leaks between the lumens (crosstalk). Precision engineered pneumatics and fixtures can be provided to seal catheter skives to allow mass flow measurements to be made for each lumen.

Jump: In the Test Parameter Menu use the Jump Menu to link programs in a variety of ways.

Keypads: The six blue buttons on Sprint iQ's front panel used to enter program values and other setup information.

LCD: Abbreviation for liquid crystal display. Sprint iQ's display is an LCD device that provides setup prompts, menu options, test results, and other system information.

Leak Calibration: (Sometimes called Comp and Cal or Test Calibration) Leak Calibration is only required if a leak rate is to be computed and not just a pressure change. Leak Calibration requires a master, non-leaking part and a certified leak master with a known leak rate at a specified pressure.

Leak Rate: A pressure drop over time can be stated as a leak rate. For example -0.02 psi per second is a leak rate. A leak rate can also be stated in flow units, such as 4 cc/minute.

Leak Test: See Pressure Decay Test, Flow Test.

Line Conditioner: An optional device external to Sprint iQ that filters out noise from the AC power line input. Line conditioners are especially useful when Sprint iQ is connected to automated machines that produce electrical noise.

Linked Programs: Two or more programs can be linked (consecutively connected) to perform multiple actions during a single test cycle. For example, a flow program can be set to follow a decay program so that when the operator presses the START switch, Sprint iQ runs through a flow test then goes to a decay test. If the product goes out of parameter at any point in either test, the fail light turns on and the test ends.

Lockout Keyswitch: This keyed switch locks out operators from Sprint's setup, sensor calibration, and leak calibration functions. The only way to access programming screens is to use the key and turn the switch to program (vertical) position.

Main Digital Readout: In the center of Sprint iQ's run display screen, the main digital readout is visible when Sprint is in run condition. This readout shows the pressure and flow values during pressure decay, flow, and burst testing. The way the main digital readout functions varies with each testing mode.

Measurement Units: See Units of Measure.

Menu: A menu is a list or set of options or program settings.

Modes: Sprint has many possible test modes: i.e. pressure decay, flow, burst, etc. Sprint shows the current mode or test type in the test mode box on Sprint's run display.

NIST: National Institute of Standards and Technology (USA)

Occlusion Test: Occlusion testing is used to test products open passages by trapping pressure inside a product and then measuring an expected pressure loss.

Operator: The person who attaches products to Sprint, presses the START button, and monitors the test. For the purposes of this guide, the operator is separate from the user. Users typically handle Sprint's setup and programming.

Pass Light: Sprint's green indicator. The pass light turns on after the tester completes a test that remains within the established parameters.

PLC: Abbreviation for Programmable Logic Controller. Industrial-strength computers designed to accept analog inputs and to provide output for process control. PLC's are used in a variety of automated control situations. Sprint can send discrete test results to and accept signals to tell Sprint when to begin a test from a PLC through the tester's I/O port. Sprint can also send quantified test results over its RS-232 output. See I/O

Pressure Decay: Also called pressure drop or delta pressure. The pressure change from the first measurement to the last measurement made during the test phase of a test. See Reject Level

Pressure Decay Test: Pressure decay testing is used to test products for leaks by trapping pressure inside a product and then measuring pressure loss. The abbreviation P Decay is often used in this guide to refer to pressure decay.

Pressure Error: Sprint iQ uses pressure limits (setpoints) above and below the test pressure to ensure that a valid test is performed on each product. If a pressure error occurs during the Fill step, the error will be reported and

end the test on that channel. If the error occurs during the Stabilize step, the channel will report a Gross leak.

Pressure Regulator: The Sprint iQ can be configured to support up to 3 regulator inputs depending upon the model type and option configurations. (Also *see “Electronic Programmable Regulator” on page 50*)

The regulator inputs are defined as:

Main: Default input which is used as the standard common regulated supply for all test channels on a sequential tester and common regulator concurrent tester or channel 1 for the independent regulator concurrent tester. The regulated supply can be a manual or electronic pressure regulator, a vacuum regulator supplied by an external or internal vacuum supply or vacuum venturi controlled by a manual or electronic pressure regulator. Sensor 1 configuration will define the operating range of the regulated supply input.

Auxiliary: The second regulated supply which is fitted as an option. This allows the user to select a second common manual regulated supply for the fast fill option or as an alternative test pressure for all test channels within a sequential tester and common regulator concurrent tester or as channel 2's test pressure for the independent regulator concurrent tester. The regulated supply can be manual pressure regulator, a vacuum regulator supplied by an external or internal vacuum supply or a vacuum venturi controlled by a manual pressure regulator.

Sensor 2 configuration will define the operating range regulated supply input for the independent regulator concurrent tester and Sensor 1 configuration for the other tester types.

Venturi (or Auxiliary 2), the third regulated input is reserved for a vacuum input when pressure and vacuum tests are required. The regulated supply can be a vacuum regulator supplied by an external or internal vacuum supply or a vacuum venturi controlled by a manual or electronic pressure regulator.

Pressure Standard: A precision measuring instrument that can be connected to Sprint as part of sensor calibration for pressure or flow. The pressure standard must have the required accuracy, stability, and repeatability to measure Sprint's output. The pressure standard must have current calibration documentation if the customer needs to prove accuracy traceability.

Pressure: The relative force of a compressed air or gas. Sprint iQ is generally configured to use PSIG, which is the force of compressed gas relative to barometric pressure.

Pressure Transducer: An electro-mechanical device (also called a sensor) that converts pneumatic pressure into electrical signals. Sprint's pressure transducers are rugged, accurate, repeatable, and have a very low internal volume.

Programming: Entering values to setup the tester. Also called setup or data entry.

Program: Data (such as test pressure, test time, and reject levels) entered by the user and stored in nonvolatile RAM. A program is setup in Sprint's parameters screen. When multiple programs are linked, the programs become a test cycle. See also Stored Programs.

PSIG: Pounds per Square Inch Gauge. A unit of measurement for air pressure measured with respect to local atmospheric pressure.

PSN Ratio: Pneumatic Signal/Noise Ratio. The larger the PSN Ratio, which is the Cal Value divided by the Comp Value, the more repeatable the test will be. The PSN Ratio can be in the range of 0.2 to 0.25 if +/- 10% test repeatability is sufficient.

Ramp Up: To slowly increase pressure by routing test pressure through the flow control valve located on the back of Sprint. Various ramp rates can be established by adjusting Sprint's built-in flow control.

Reject Minimum and Reject Maximum: The amount of pressure change allowed in a test. These values are set in the Pass/Reject Limit menu under the Test Parameters menu. Some tests require both setpoints to be set (providing a window or zone for test evaluation) while others require only one (test outcome depends on if the level is reached or passed). See page 25.

Rise Test: A test type which can be either a pressure rise or vacuum rise test. The results are expressed as a positive value if the pressure change is in the expected direction or negative if otherwise. E.g., a typical pressure decay test will have a positive value consistent with a positive pressure delta where the pressure is actually decreasing.

RS-232: A serial communications protocol used by most computers and computer peripherals. Sprint iQ uses an RS-232 protocol to send test result data to printers and computers.

Run: When the lockout key is in the horizontal position, Sprint is in Run Mode. Sprint iQ is set to run when used in production testing. The only other keyswitch condition is Program Mode (lockout key in vertical position).

Run Display: The Run Display is the screen visible when the lockout key is in run (horizontal) position. This display is visible to the operator during testing.

Run/Program Switch: See Lockout Keyswitch.

SCCM: Abbreviation for Standard Cubic Centimeters per Minute. This is a flow measurement standardized to 68 degrees Fahrenheit and 14.7 psi (average sea level)

Security key: A USB device that unlocks capabilities which may be available for the tester.

Sensor: Sprint iQ uses two kinds of sensors-a pressure sensor and a flow sensor. As an option, remote sensors can be connected to Sprint for automated processes.

Sensor Calibration: Comparison of a device (such as Sprint iQ) to a standard that is in turn calibrated to an even more accurate standard.

Sensor Calibration Menu: Sensor calibration allows comparison for Sprint iQ to pressure or flow standards. The calibration screen shows Sprint iQ's actual reading and the pre-programmed target value the technician compares to the pressure or flow standard. Calibration should be conducted only by qualified technicians who have proper training and equipment.

Sequential: Testing one test or one part after another is known as sequential testing. If the tester has multiple test ports and test them one at a time in a sequence, it is called a sequential test. See Concurrent

Setpoint: A programmable threshold value (usually a minimum and maximum value) used to establish a testing tolerance.

Sprint iQ: In this guide, the word Sprint iQ refers to the base-model Sprint iQ air tester. Your particular tester will

probably not have all the options explained in this owner's guide.

Stab.: Abbreviation for stabilization. A time interval following fill phase that allows product to settle before Sprint starts the measurement phase. Longer stabilization times are often required in products constructed of flexible materials.

Start Switch: The green pushbutton.

Startup Screen: The first screen that briefly appears on Sprint's LCD when the power is switched on. This screen briefly shows the version of firmware running the tester.

Stop Switch: The red pushbutton. Pressing this switch will always abort a test in progress.

Stored Programs: A set of instructions (parameters) that can be set by the customer to run a variety of tests. There are a total of 100 programs available. Users can alter stored programs to meet specific product testing needs. Programs are configured in Sprint iQ's Test Parameters Menu and are kept in non-volatile RAM.

Stored Programs, changing from one to the other: In run condition, press the ENTER keypads to go to the Run Options Menu. Change the current program to another stored program and press Enter to save the new selection.

Supply Air: Sprint's standard fitting is a 1/8 inch female NPT bulkhead. Air must be clean, dry, and free of oil. Unless the tester is a custom, the maximum supply pressure must not exceed 150 psig.

Test Parameter Menu: This menu is the first menu highlighted when the Keyswitch switch is turned to Program mode. This is the primary menu for entering the values that define the test and how it is to be conducted.

Target: A pre-programmed number that Uson stores in firmware used to calibrate Sprint iQ's pressure and flow sensors. The target value is matched to a pressure or flow standard to create a lookup table for sensor linearity adjustment.

Test Circuit: The pneumatic tubing, fittings, valves, and sensors that make up the internal air passages. The volume of gas trapped inside the pressure decay test circuit is about 6.5 cubic centimeters on the LC-PO single channel model.

Test Cycle: A test cycle is all Sprint-controlled testing activities that occur from the time the START switch is pressed to the time the operator removes the tested product. One test cycle can have multiple tests by linking programs in Sprint's parameters screen. Multiple tests in one cycle is sometimes called a test series.

Test Phases: Each testing mode (decay, flow, and burst) has individual phases or intervals of testing. Pressure decay has four possible time intervals that can be set: coupling, fill, stabilization, and test. A flow test has three phases: coupling, fill and test. A burst test has just two possible phases: coupling and test.

Test Port: The bulkhead fitting (or fittings) on Sprint iQ's front panel. The product to be tested is connected to the test port. From the test port, Sprint iQ can supply positive pressure or vacuum for a variety of leak and flow tests. Customized Sprints could have multiple test ports. See Bulkhead.

Test Pressure: A positive value indicating the level of air pressure used to inflate the product under test. Test pressure is set by adjusting the air regulator on the back of Sprint iQ. Test pressure can only be set if Sprint iQ has

supply air connected and the output port is blocked with a leak-tight cap. This limitation can be overcome with an electronic regulator. See Electronic Regulator

Test Vacuum: A negative value indicating the level of vacuum applied to the product under test.

Timers: Sprint iQ uses microprocessor timers to establish time intervals for a variety of test functions. Time values are set in the parameters screen to control coupling time, fill time, stabilization time, and test time. Timers are calibrated in seconds. See Parameters Screen

Units of Measure: Sprint iQ can display pressure, flow, and time in several user-selectable measurement units. Changing units of measure if made through the Setup Menu which is accessed from the initial Program Mode menu.

User: For purposes of this guide, the user is the person who sets up and enters test parameters into the Sprint iQ. It is the operator who handles the day-to-day product testing with the Sprint iQ.

Vacuum Error: A negative quantity indicating the magnitude of the vacuum.

Valves: Sprint iQ contains modular solenoid valves that direct the flow of air through the measurement circuits. The number, type, and arrangement of valves in a Sprint tester is dependant on the model and configuration.

Vent: After Sprint iQ completes a decay test, a valve can be activated to open the product and Sprint's internal test circuit to atmosphere. The action of releasing pressure to atmosphere is called vent. If vent is not required (for instance, if you want to unplug product to vent pressure), set Vent to No.

Venturi, Electronic: This option is used to produce a vacuum level and requires an inlet pressure between 55.0 to 101.5 psi depending upon the vacuum required. This option is only available when the Fairchild 120 psi regulator is used as the Main test regulator. To support this option the pneumatic arrangement is configured to use the pneumatic regulator output via the main regulator selection valve when pressure is required by the test or connects output to the venturi input when vacuum is required by the test.

Zero and Span: A sometimes-used term for sensor calibration.

6.12 ELECTRONIC PROGRAMMABLE REGULATOR

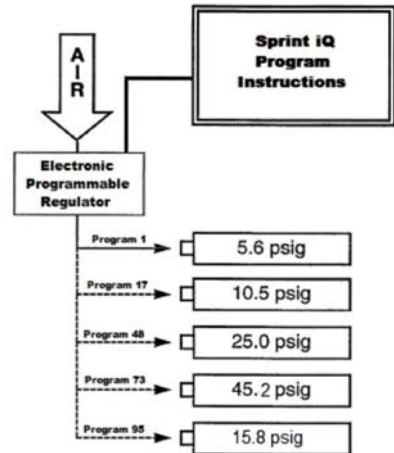
When conducting multiple tests using different test pressures, users face the problem of constantly adjusting manual pressure regulators. A cracking pressure test (often used for valve testing) frequently requires multiple ramp rates. Operators must adjust manual flow controls to various ramp rates needed for the different tests. Manual pressure controls are subject to operator error when setting test pressure. And inadvertently bumping the regulator control is a possibility when using the equipment in production settings.

Sprint iQ's Electronic Programmable Regulator option is a sophisticated electro-pneumatic device programmed by setup personnel to supply exact test pressures. The Electronic Programmable Regulator can also be set to slowly increase pressure over time. This provides a variety of consistent ramp rates often used in burst and crack (valve) testing.

Also, because the regulator is programmed using Sprint iQ's security key, it can supply different test pressures or ramp rates for each of Sprint iQ's stored programs and no operator adjustment is needed (or possible) without possession of the security key.

How it Works

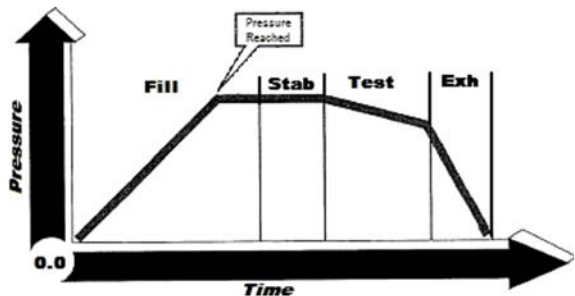
1. Sprint iQ is set to Program mode.
2. In the Program setup screen, setup personnel digitally enter test pressure values using Sprint iQ's normal programming methods.
3. Unique test pressures can be entered for each of Sprint iQ's stored programs. As many as 100 different test pressures can be entered.
4. When in Run mode, the Electronic Programmable Regulator automatically goes to the set test pressure to provide the desired pressure or ramp rate for one or multiple parts.



Test Pressure

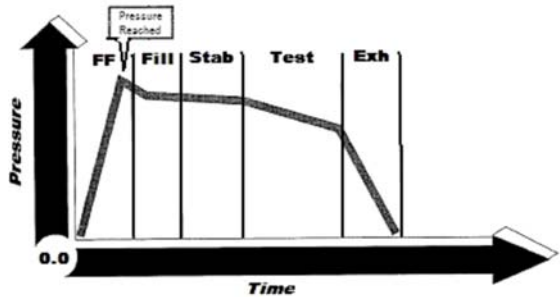
Test Pressure is the pressure to which Sprint iQ inflates the test part before beginning to look for a pressure drop

over time. The Electronic Programmable Regulator automatically adjusts to achieve the target test pressure.



The Electronic Programmable Regulator can also be used instead of the Fast Fill option.

A program preceding the actual test program is created which contains no active test limits but is set to a target



pressure higher than the actual leak test pressure. This higher pressure fills the test part faster (equivalent to a Fast Fill). After this step is completed, the first program links to the actual test program with the target test pressure.

Ramp Rate

Ramping is used in burst, crack and creep testing. Ramp Rate is an increase in pressure over time. Sprint iQ's Electronic Programmable Regulator precisely controls the ramping pressure.

Often, cycle time can be saved and burst or crack event sensitivity increased by quickly jumping to a minimum starting pressure (without ramping) below the typical pressure where a burst or crack event is expected. A ramp can then be started until the event occurs. The Electronic Programmable Regulator option is ideal for this purpose (not possible with a standard Burst or Crack equipped tester where pressure must start at or near zero pressure).

To program a ramp, the user first enters a starting pressure and then a rate in pressure units per second. For example, if 45 psig ramp starting pressure and 10 psig/s ramp rate is entered, at the start of the test cycle, pressure will immediately go to 45 pounds per square inch pressure then increase at a rate of 10 pounds per square inch every second.

6.13 SPRINT IQ BARCODE READER SETUP

The Sprint iQ barcode reader is an option that can be used with batch processing to transfer barcode data.

The Power Scan barcode device (part #054501) must be configured as follows:

1. Set Interface selection to **USB-KBD**.
2. Set Keyboard nationality to desired language.
3. Set Data Format terminator to **Enter**.

Note: For better alignment, enable the aiming system.

6.13.1 SETTING UP BARCODE READER FOR BATCH PROCESSING

1. Enter Batch Processing Menu: (Data Menu > Batch Processing Menu).
 - **Enable** Batch Control.
2. Enter Batch Field Menu:
 - Select desired field 1 to 5 for the barcode entry with a max of 5 barcode readings.
3. Enter specified value to scan Barcode:

Note: A second scan overwrites the previous setting.

4. **Exit** menu.

5. **Save**.

Note: If the scanner is not recognized, cycle power with the barcode reader plugged in.

(For Batch Processing information, see *"4. Batch Information [run mode options menu]" on page 3-12.*)

6.13.2 LOG BARCODE DATA:

1. Enter Data Menu: (Data Menu > Audit Menu).
2. **Enable** logging method: (Serial, USB, or network).
3. Enter Audit Format Menu:
 - Select desired field, 1 to 20.

Note: Set Audit format to **Custom** to log Batch field data.

4. Set Type:
 - Set the type to the Batch Field that matches the fields set in Batch control (see *“Setting up Barcode Reader for Batch Processing” on page 53*).
5. Enter **Run Mode** to save settings.

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