



Z-AXIS

INTEGRITY THROUGH
— INNOVATION —



Z-Series User Guide

For Your Safety

Install all equipment according to local safety codes.

Here are some additional safety guidelines when working with the Z Series Leak Testers:

- Wear eye protection when working with compressed gas.
- Beware that hazardous voltages could be present inside the enclosure.
- Only when you understand the procedure, and you know exactly how to complete the task, should you attempt any maintenance procedure discussed in this guide.



Warning! Disconnect power before removing cover.



Caution! Equipment requires clean, dry air supply.

Non-compliance may void the warranty.



If clean dry air is supplied to the unit, there are no set preventative maintenance schedules.

THREE YEAR LIMITED WARRANTY

Z-axis, Inc. Limited Warranty

Z-AXIS INC. products are manufactured to a very high standard, however when located in physically hostile environments or when operated under non-specification voltage or pressure conditions, warranty may be voided.

Please refer to your user manual for more detailed information.

Z-AXIS INC., therefore, warrants only as follows: Supply clean dry air only to the unit.

Each unit is identified by serial number in a permanent record of the company. If at any time with-in three years after any Z-AXIS INC. product has been shipped to a customer (user), it fails to perform according to Z-AXIS INC. literature, the product, with written explanation of the problem, may be returned, freight prepaid, to Z-AXIS INC. for examination, repair or replacement at Z-AXIS INC. expense (labor and material). All such returns must have prior Z-AXIS INC. customer service authorization before returning. If, upon examination, Z-AXIS INC. determines that abusive practices, non-filtered and dried air or destructive environment of operation or a combination of these factors is responsible for improper performance of the product, all labor and materials costs involved shall be at the expense of the customer.

Z-AXIS INC. is not liable for special, indirect or consequential damages that may result from use, failure or malfunction of the product and any recovery against Z-AXIS INC. may not be greater than the purchase price paid for the product.

Introduction:

The Z1, Z5, and Z8 series of Multi-Function Leak Testers are the next generation of products from Zaxis, designed to meet today's quality assurance demands.

Their compact size enables them to be used near to tooling and operators, utilizing a small footprint of bench top space. By reducing the internal and pneumatic volume, the test sensitivity increases, and test times can be decreased. The small internal volume combined with integrated sensors and a 32bit ADC (analog to digital converter) allow Z-axis to offer a leak tester with the highest sensitivity on the market. The Z-series are available with all the available test types previously supplied by Z-axis. Some of these test types include pressure or vacuum decay, mass flow, burst, pressure cracking, sealed component (chamber). Custom test sequencing applications are also available. The Z1, Z5, and Z8 can be configured to have from one to four test channels in a sequential or concurrent configuration.

This guide covers the **Z1, Z5, and Z8 units. The screens will be identical in functions, but will have differing spacing based on the display size. All of the current functions and features are described in this manual. Your tester could differ in installed features. See the additional documentation supplied with your unit.**

Safety and Emissions:

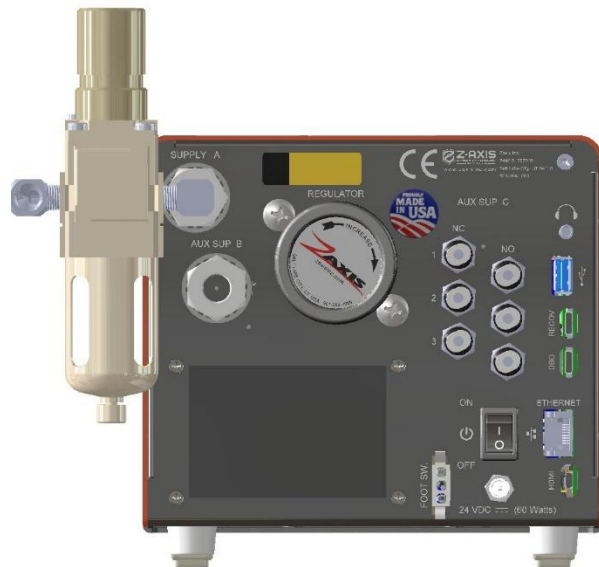


Certificate of conformity available upon request.

Operating Environment Conditions:

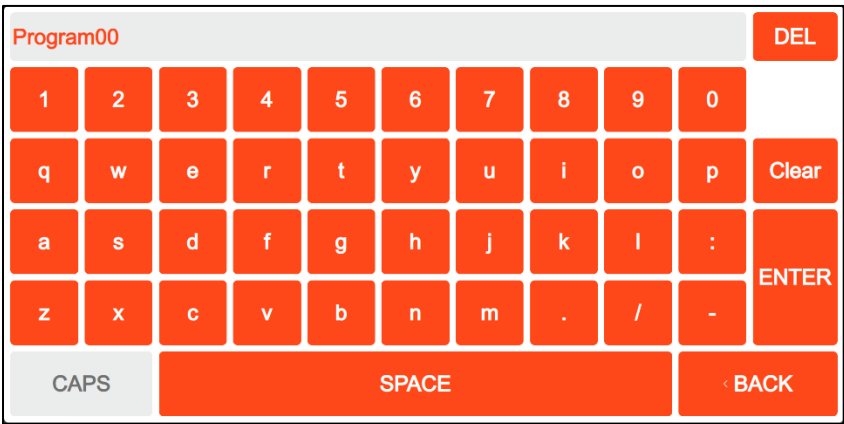
Indoor use only

- ❖ Operating temperature range: 5-40° C
- ❖ Maximum relative humidity: 80%
- ❖ Main supply voltage: 24VDC, 48W
- ❖ Altitude: up to 2000 meters
- ❖ Supply Air Pressure: 8.3 bar max. (unless otherwise specified)
 - Supply air must be clean and dry.
(5-micron filtration recommended)

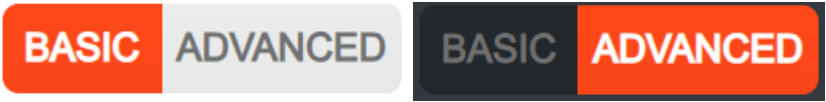


Data input

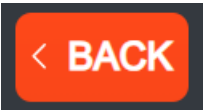
Two input screens are used throughout Z Series setup and operation; they are the Numeric and Alpha-Numeric Keypad screens. The Numeric Keypad screen is used to input values for timer and limit fields. The Alpha-Numeric Keypad screen is used in fields such as the program name field.



Program settings, and option selections that are active, are in orange.



In secondary menus, the BACK button will return to the prior screen.



Besides touch inputs, the display can also accept other touch-gestures. Sliding a finger to the side will increase or decrement the current program number. Sliding a finger up and down will change between base menus.

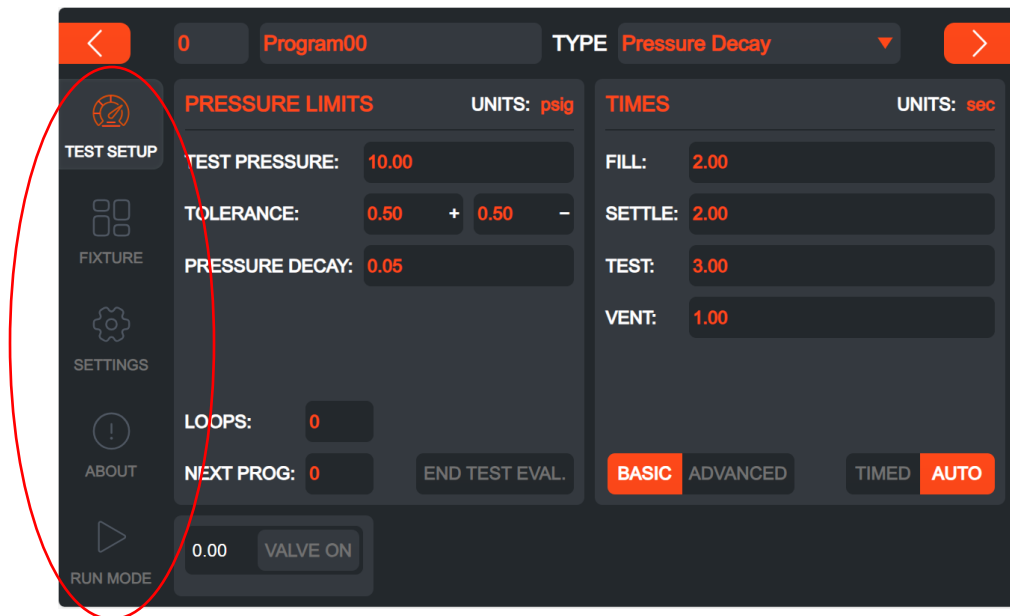
Navigation

The unit will always boot into the run mode, and in the last program selected unless overridden by the I/O or Ethernet IP command. The main display window shows a pressure over time graph of the test.



To access the test setup and settings screens, press the 'Test Setup' area in the lower left corner of the screen, or swipe up on the screen.

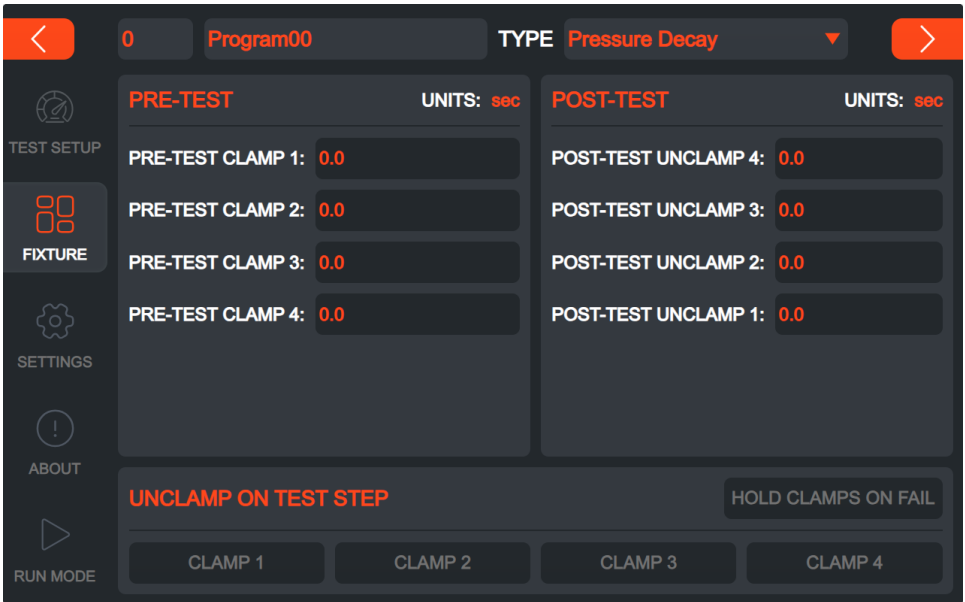
The initial screen will be the test setup for the current test.



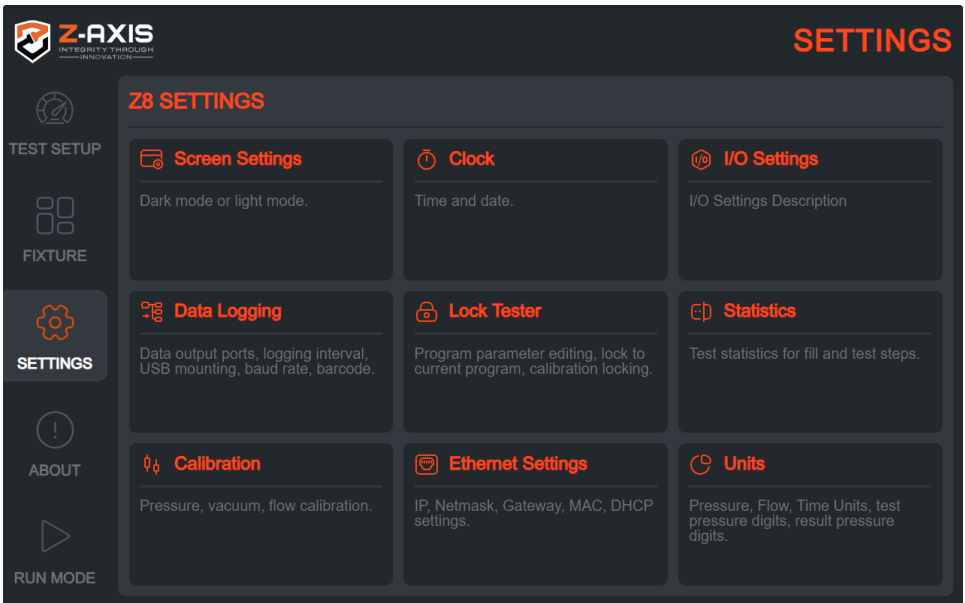
TEST SETUP has all the timers, limits, and settings for the tests.

All the additional menus are selected from the column on the left side of the screen.

FIXTURE has timers for fixture actuation valves used in securing the part to the tester with added tooling. The timers are program dependent. Press the arrow keys, select the program # field, or swipe to the side to change programs.



SETTINGS menu holds controls for screen settings, clock, I/O, data logging, lock screens, statistics, calibration, Ethernet settings and engineering units.

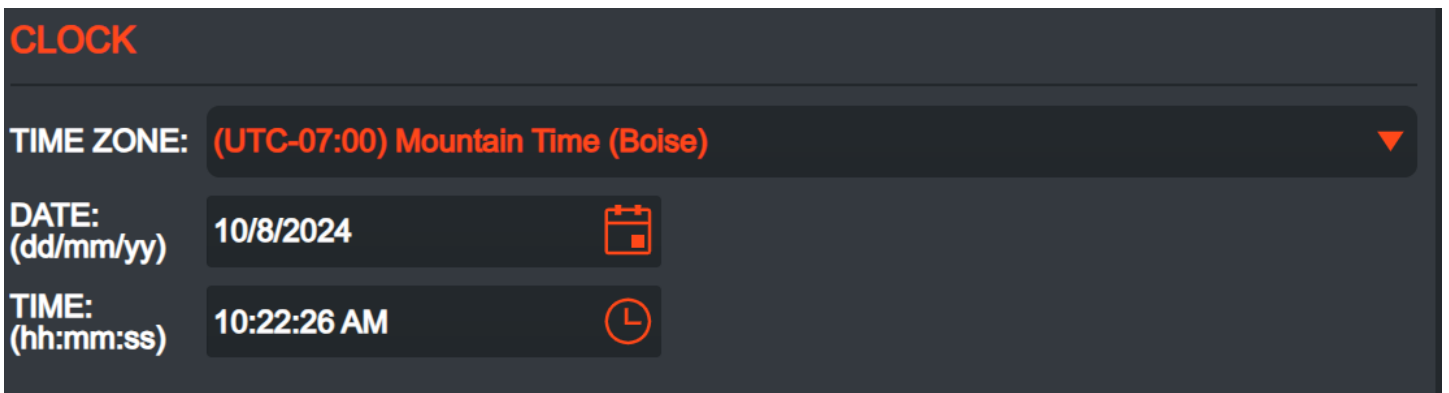


Screen Settings



This menu has the selection for the two display color schemes. This affects the background color. The active selections on the screen will be in orange.

Clock



The date and time will be set by the factory. You can adjust the time zone to reflect your location. This date and time stamp will be displayed in the data collection output string.

I/O Settings

I/O SETUP

BINARY PROGRAM SELECTION BITS

OFF **ON**

RESULT OUTPUT PULSE WIDTH

1000.00ms

0 for latched outputs

ACKNOWLEDGE FAILURE

OFF **ON**

PROGRAM START MODE:

INPUT 1

INPUT 1 & 2 (ANTI-TIE)

INPUT 1 & START BUTTON

HIBERNATE AFTER 30 MIN

OFF **ON**

< **BACK**

 **I/O TEST**

Binary program selection bits, toggle this control to enable program selection via I/O inputs. Each stored program can be selected by a digital bit pattern. When ON this action will disable the program number select on the front display and will always return to the program selected by the active inputs. If there are no active input bits, the test displayed will be Program 0.

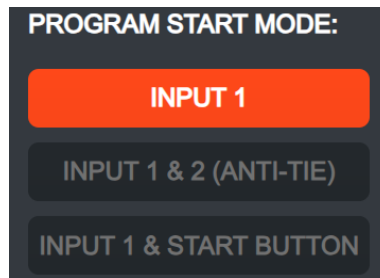
Below is a sample chart showing program selections and their corresponding bit pattern.

To achieve a program number in the first column, energize the input (1-7) for the corresponding bit pattern to achieve the value using the binary value of the input. For example '4 (8)' This is input #4 and it has a binary value of 8. Energizing this input only would select program #8. Adding inputs together will sum their respective values.

Program #	Input						
	9 (64)	8 (32)	7 (16)	6 (8)	5 (4)	4 (2)	3 (1)
0	0	0	0	0	0	0	0
1	0	0	0	0	0	0	1
2	0	0	0	0	0	1	0
3	0	0	0	0	0	1	1
4	0	0	0	0	1	0	0
5	0	0	0	0	1	0	1
10	0	0	0	1	0	1	0
25	0	0	1	1	0	0	1
63	0	1	1	1	1	1	1
99	1	1	0	0	0	1	1

The program selection should be asserted 100msec before a start input.

I/O Settings (cont.)



There are three variations of cycle start methods:

Input 1: Activating input 1 on the I/O connection will start the cycle. The input starts the test on the rising edge of the signal. This selection is the default, and allows the I/O **or** start button to run initiate the test.

Input 1 & 2 (Anti-tie): This option is used when an operator needs to be clear of movement in the fixture. Two separate switches must be contacted within 300msec of each other, one switch cannot be held closed while the other is triggered. Both switches must be held through the entire first clamping timer. If any switch is released, the test will abort.

Input 1 & Start Button: This option has a condition to be met before the test can proceed. Input 1 on the I/O connector must be held active before the START button is pressed. If the input is released before the test ends, the test will abort. A typical application would be for a door switch on a safety enclosure.

Result Output Pulse Width

At the end of the test cycle the pass/fail status will be presented via the outputs of the I/O. The length of time these outputs are held high can be adjusted. If the value is set to zero, the output will be latched on until the next cycle starts.

The current requirement to activate an input is 50mA.

The max current that can be supplied from and output is 350mA.

I/O Connection Pinout

	<i>Description</i>	<i>Pin #</i>
IN 1	START	26
IN 2	START (ANTI-TIE ENABLED)	27
IN 3	BCD 1 (LSB)	28
IN 4	BCD 2	21
IN 5	BCD 3	22
IN 6	BCD 4	23
IN 7	BCD 5	24
IN 8	BCD 6	25
IN 9	BCD 7 (MSB)	16
IN 10	NOT USED	17
IN 11	NOT USED	18
IN 12	ABORT	19
+24VDC	User to Supply +24VDC	20
OUT 1	BUSY	1
OUT 2	GLOBAL PASS	2
OUT 3	GLOBAL FAIL	3
OUT 4	CH 1 FAIL	4
OUT 5	CH 2 FAIL	5
OUT 6	CH 3 FAIL	6
OUT 7	CH 4 FAIL	7
OUT 8	CH 1 PASS	8
GND	User to supply Common	9
OUT 9	CH 2 PASS	10
OUT 10	CH 3 PASS	11
OUT 11	CH 4 PASS	12
OUT 12	NOT USED	13
+24VDC	Shared with Pin 20	14
GND	User to supply Common	15

PLUG:

CONN PLUG CPC 28POS REV SER 2 – Tyco Electronics – Part #206039-1 (Digi-Key #A1380-ND)

BACKSHELL:

CONN CABLE CLAMP CPC SIZE 17 – Tyco Electronics – Part #206070-8 (Digi-Key #A32516-ND)

PINS:

CONN PIN 24-28AWG GOLD CRIMP –Tyco Electronics – Part #66507-4 (Digi-Key #A23004CT-ND)

The plug, back shell, and pins will be supplied if the I/O module is purchased without a cable at time of manufacture.

Pre-wired cables from Z-axis:

Part number #300914, (20ft length standard)

Data Logging

ZAXIS TESTER TYPE SETUP

SERIAL **OFF** **BARCODE SCANNER:**

ETHERNET **RESULT ONLY** ☐ **BARCODE REQUIRED TO START TEST**

THUMBDRIVE **RES + INTERVAL** ☐ **START TEST ON SCAN**

INTERVAL: **100** **ms** **DEBUG LOGS:**

SAVE LOG TO USB

There are three ways to collect test result data from the Z series testers. The first column selects the data transfer method, the second column specifies the type of data.

Serial connection uses the USB on the rear of the tester

Ethernet connects to an external computer via the Ethernet jack on the rear of the unit. Third party software can be used to gather the data string. (examples HyperTerminal, PuTTY, RealTerm).

A standard USB thumb drive can be plugged into any USB port. This data will be saved in a CSV file.

Result Only – gives the following data string.

(Header for descriptive purpose, not printed in data string) Values are [TAB]delimited.

Date	Time	Program #	Program Name	Test Type	Result	Value
01/26/09	11:10:34	01	PROG 1	PD	Pass	0.0201
01/26/09	11:12:42	02	PROG 2	Flow	Pass	103.21
01/26/09	11:13:50	01	PROG 1	PD	Leak	0.1305

Res +Interval – Gives a pressure/flow reading output based on the time selection. A sample string is below.

(Header for descriptive purpose, not printed in data string)

Step	Time	S	Reading
Fill	0.5	s	22.65
Fill	0.4	s	99.56
Fill	0.3	s	99.55
Fill	0.2	s	99.43
Fill	0.1	s	99.43
Fill	0.0	s	99.25
Test	0.9	s	99.24
Test	0.8	s	99.22
Test	0.7	s	99.20

Test	0.6	s	99.15
Test	0.5	s	99.13
Test	0.4	s	99.13
Test	0.3	s	99.13
Test	0.2	s	99.13
Test	0.1	s	99.13
Test	0.0	s	99.13

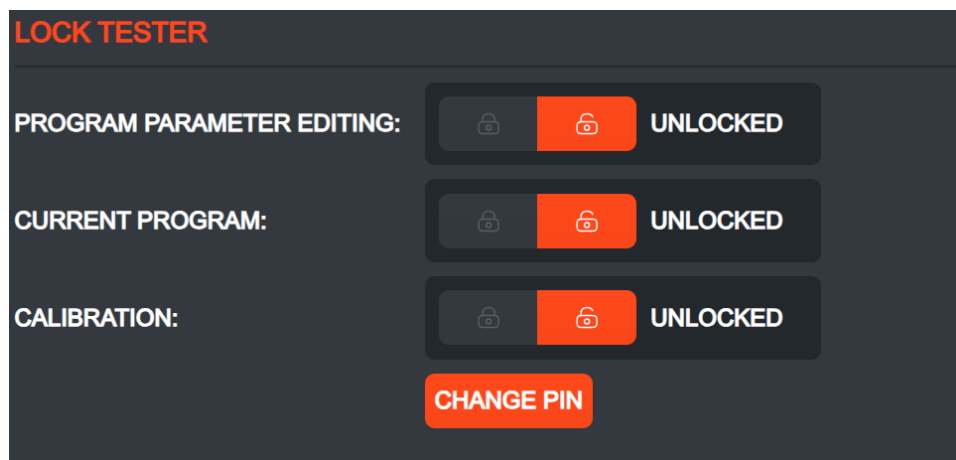
01/26/09	11:10:50	01	PROG 0	Flow2	Pass	99.13
----------	----------	----	--------	-------	------	-------

The time interval is a minimum of 100msec and maximum of 60000msec.

Barcode Reader

The barcode reader option allows for scanned data to be appended to the data string, typically for device traceability. The first option to enable is to require a barcode before a test can start. The second is to start the test when the barcode is received. The terminating character for an input string is [CR][LF] (carriage return, line feed).

Lock Tester

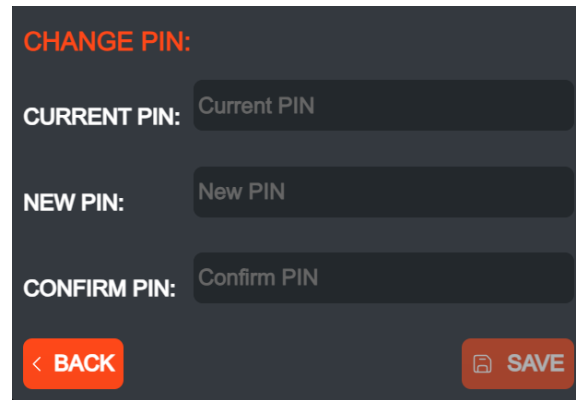


Locking the 'program parameter editing' will allow the parameters to be viewed but not changed.

Locking 'current program' will not allow the program to change from the last program in memory. If programs are linked, locking on the first in line will allow the tests to progress. At the end of the cycle the test will return to the locked program.

Locking 'calibration' will not allow the calibration menu to be accessed.

For the locked screens to be active, the PIN number must be set first. From the factory the PIN is set as 'blank' (not zeros). The PIN is a 4-digit number.



CHANGE PIN:

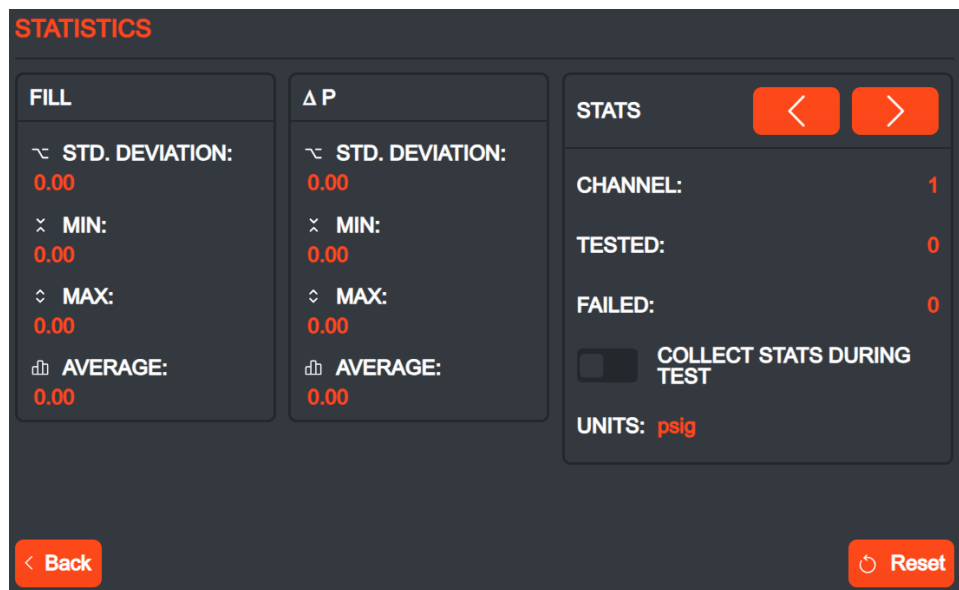
CURRENT PIN:

NEW PIN:

CONFIRM PIN:

< BACK SAVE

Statistics



STATISTICS

FILL	ΔP	STATS
$\sim$ STD. DEVIATION: 0.00	$\sim$ STD. DEVIATION: 0.00	CHANNEL: 1
$\times$ MIN: 0.00	$\times$ MIN: 0.00	TESTED: 0
$\diamond$ MAX: 0.00	$\diamond$ MAX: 0.00	FAILED: 0
$\bar{d}$ AVERAGE: 0.00	$\bar{d}$ AVERAGE: 0.00	☐ COLLECT STATS DURING TEST
		UNITS: psig

< Back Reset

When enabled (collect stats during test) slider. Simple statistics will be kept for the Fill and Test step. Multichannel unit data can be cycled through with the arrow keys.

Calibration

Introduction to Calibration

In technical language, **calibration** refers to the process used to determine accuracy. It is the comparison of a measuring instrument against a standard to establish the possible errors in a specific range.

Calibration is of such importance that the United States Government created an agency called the National Institute of Standards and Technology (NIST) that is tasked to maintain standards for values of SI units and industrial standards, calibration has become a helpful tool in providing the traceability of their subjects of study by adhering to the basic standards of calibration. **All Zaxis calibrations are traceable to standards set by the NIST.**

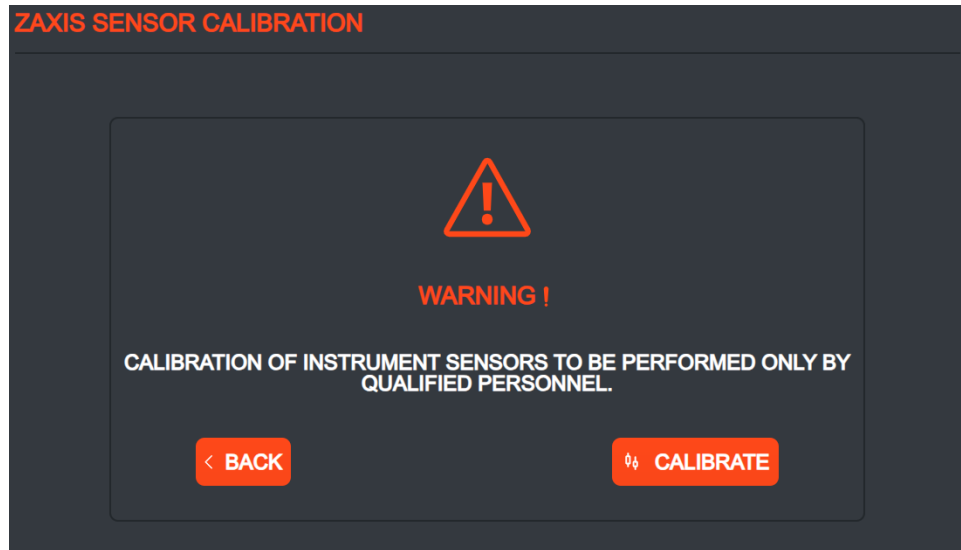
The calibration on Z-series units can use up to ten calibration points throughout the range of the sensor to correct the linearity of the sensor output. All ten points are dynamic, meaning they can be adjusted to match where the user needs the best accuracy across the range.

In the calibration mode the pneumatic assembly will open to bring pressure, vacuum, or flow to the test port. The sensors will also be active to show the current reading. With a pressure or flow standard attached to the test port the machine is taught the values from the standard.

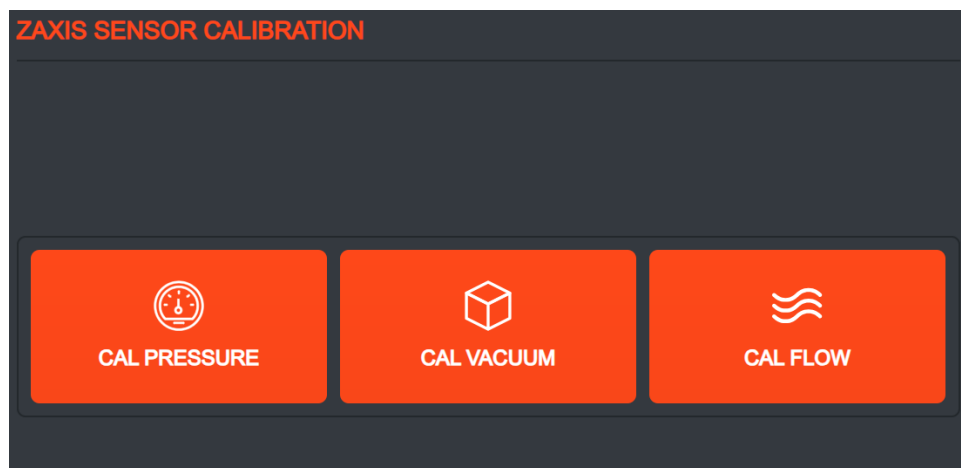
Two procedures will be outlined, Calibration Verification and Calibration Modification. All Z-series models are initially calibrated at our facility. The verification procedure should be the most used, it reads the current values but makes no changes. If the calibration needs to be modified, then use the modification procedure.

The recommended calibration cycle (or interval) is set for 12 months from the factory. This can be modified by the user to suit their needs. It is recommended to have a baseline or functional test at a shorter interval to catch possible problems before the calibration procedure.

Important: Calibration of this instrument is for the sensor only (not a leak calibration) and is factory set. Leak standards can be obtained from Zaxis Inc. and can be used as a transfer standard to establish applicable leak rates. All standards should have at least four tiers of uncertainty. i.e. Z-series calibration tolerance is 0.25% FS (full scale) therefore pressure standards should be at least equal to or less than 0.0625% FS.



Selecting the calibrate button will open the sensor selection screen. A warning box will appear. To continue into the calibration screens press '**Calibrate**'.



Three sensor types are shown Pressure, Vacuum, and Flow. Even though all three sensor types are shown each unit will have model specific sensors installed. For details see the calibration report shipped with the tester.

Pressure Calibration (manual regulator)

With clean dry air supplied and the unit powered on, do the following.

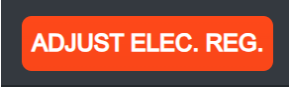
1. Enter pressure calibration screen and connect the test port of the Z-series to the pressure standard.
2. Select the sensor number to be calibrated in the upper right corner. (Concurrent models have multiple sensors to calibrate)
3. To apply regulated air to the sensor, press the **Valves**: "ON" button.
4. Adjust the regulator to the desired pressure reading on the **pressure standard** and compare the reading of the sensor. (Upper right corner)
5. Repeat step 5 for all required calibration points.

Exit by pressing the 'back' button do not save any changes you might have accidentally made.

Electronic Regulator (Optional Item)

With the optional electronic regulator installed, adjusting the pressure output is done through the software buttons on the touch screen. The calibration procedure will follow as listed in this manual; the only difference is how the regulator is adjusted to achieve the set points.

In the calibration screen and additional button is available: This button will open the regulator control screen.



ADJUST ELEC. REG.

The image shows a digital control interface for a pressure regulator. On the left, under the heading 'VALUE NAME:', there is a grid of 11 buttons numbered 0 through 10. Buttons 0-9 are arranged in two columns (0-5 on the left, 6-10 on the right), and button 10 is centered below buttons 4 and 5. To the right of this grid, under the heading 'CURRENT PRESSURE:', there are three stacked digital displays, each showing '0.00' in orange text. Below these displays are six adjustment buttons: '+', '++', '+++' in the top row, and '-', '--', '---' in the bottom row. A red '< BACK' button is located in the bottom right corner of the interface.

Once the valves are open (step 3 from above) six buttons will be used for manually controlling the output pressure.

+ Small Increase, ++Medium Increase, +++ Large Increase

- Small Decrease, -- Medium Decrease, ---Large Decrease

The buttons on the left side (0 through 10) are the previous settings of the regulator for each numbered calibration point; these buttons can be used to 'jump' to the previously set pressure before beginning the fine-tuning process.

A live pressure reading is shown in the upper right corner.

Once the desired pressure is maintained pressing the 'Back' button will return to the calibration screen where Cal Points can be set.

NOTE: To decrease the effects of hysteresis, perform the adjustments of the electronic regulator in the upward direction, that is, approach the target from a lower value without going over.

To change or fine tune a set point, do the following.

With clean dry air supplied and the unit powered on, do the following.

1. Enter the pressure calibration screen. Select the sensor number to be calibrated in the upper right corner. (Concurrent models have multiple sensors to calibrate)
2. For the 'zero' calibration point leave the test port open to atmosphere. Press the 'Zero/Tare' button. The currently selected sensor should adjust to 0.00.
3. Attach the pressure standard to the test port.
4. To apply regulated air to the sensor, press the **Valves**: "ON" button.
5. Adjust the regulator to the desired pressure reading on the **pressure standard**.
6. Press the value field of the calibration point to be changed. A keypad will appear, enter the value as shown on the pressure standard. After pressing the enter button, the sensor value should match the pressure standard.
7. Repeat step 5 and 6 for all required calibration points.

Calibration points should be incremental, with point 1 being the lowest value. Values do not need to be whole numbers.

Special Note: Sequential models can trap a small amount of pressure internally between the channel selection valve and the pressure transducer. Make sure to open the valves to clear any pressure before pressing the TARE button.

Flow Calibration –

The calibration procedure is similar to pressure and vacuum. The pressure standard is changed for a flow standard and needle valve. The supply regulator is typically set to 10psi and the needle valve is set downstream from the flow standard. Adjustments made to the flow by the needle valve will affect the amount of flow in the system as read by the flow standard.

Ethernet Settings

TCP/IP SETTINGS

IP ADDRESS:	10.100.110.148
NETMASK:	255.255.255.0
GATEWAY:	10.100.110.1
METHOD:	☐ STATIC ☒ DHCP
MAC ADDRESS:	00:14:2D:EA:08:9A
STATUS:	Connected

[< BACK](#)[SAVE](#)

For data collection or command and control with the Ethernet IP protocol and IP address can be manually assigned or dynamically written by the host device via the DHCP.

Units (Engineering)

ZAXIS UNITS AND RESOLUTION

PRESSURE DIGITS:	RESULT DIGITS:	PRESSURE UNITS:	FLOW DIGITS:
XX.	XX.	psig	SCCM
XX.X	XX.X	mbar	SLM
XX.XX	XX.XX	mmHg	TIME UNITS:
XX.XXX	XX.XXX	inH2O	SECONDS
	XX.XXXX	kPa	MINUTES
	XX.XXXXX	cmH2O	ATM. PRESSURE:
		inHg	14.70 PSIA

< BACK

The resolution of the test pressure and result values can be adjusted to the users preference.

The engineering units can also be changed. The base unit of the machine is 'psig'. If another unit is selected, the tester must be returned to psig for calibration.

The flow units can be changed between standard cubic centimeters per minute (sccm) and standard liters per minute (slpm).

The time base can be changed from seconds (default) to minutes.

ABOUT screen

MULTI-FUNCTIONAL LEAK TESTER	
TESTER SERIAL#	8000-24A8
ZAXIS FIRMWARE	REV# 5.1
COPYRIGHT 2024-2034	ZAXIS INC.
(801) 264-1000	WWW.ZAXISINC.COM
	

This screen hold information about the firmware revision of the unit as well as the serial number. When consulting the factory have this information in hand to help expedite support.

Test Parameter Selection

Pressure Decay

The screenshot shows a software interface for configuring a Pressure Decay test. At the top, there's a header with a back arrow, a program number '0', the name 'Program00', a 'TYPE' dropdown set to 'Pressure Decay', and a forward arrow. On the left is a vertical sidebar with icons for TEST SETUP (selected), FIXTURE, SETTINGS, ABOUT, and RUN MODE. The main area is divided into two columns. The left column, titled 'PRESSURE LIMITS' with units 'psig', contains fields for 'TEST PRESSURE: 10.00', 'TOLERANCE: 0.50 + 0.50 -', 'PRESSURE DECAY: 0.05', 'LOOPS: 0', and 'NEXT PROG: 0'. Below these is an 'END TEST EVAL.' button. The right column, titled 'TIMES' with units 'sec', contains fields for 'FILL: 2.00', 'SETTLE: 2.00', 'TEST: 3.00', and 'VENT: 1.00'. At the bottom right are buttons for 'BASIC' (selected), 'ADVANCED', 'TIMED', and 'AUTO'. At the bottom left, there's a '0.00' display and a 'VALVE ON' button.

The basic test setup is all on one page for easy viewing and modification.

Test Pressure: This is the pressure that will be applied to the device under test.

Tolerance: This plus and minus tolerance (of the test pressure) is the limit that guarantees the part achieved the appropriate test pressure. The typical recommendation is 10% of the test pressure. If the device under test fails to achieve the pressure tolerance in the fill step, an error of Lo Pressure will result. If the supply regulator is changed and applies greater than the test pressure the fill step will stop and provide an error of High Pressure.

Pressure Decay: This is the amount of decay (during the Test step) that will trigger a failure and a message of Leak.

Fill: This is the amount of time to allow the device under test to be filled to test pressure.

Settle: After the fill step, the internal valves close to incoming pressure. This traps pressure in the device with the on board pressure sensor. This timer allows for part movement or thermodynamics to nullify. If the pressure falls below the minus tolerance, the test will stop and an error of GROSS will be reported.

Test: This is the amount of time the unit will monitor the decay to compare against the pressure decay limit for pass/fail status.

The test step can use the 'END TEST EVAL' button. When selected, this forces the test step timer to run completely to the end. Normal operation stops the test when the decay value is reached.

Vent: This is not considered a part of the test for pass/fail criteria. This timer allows for the part to vent to atmosphere. It is used with the 'TIMED' and 'AUTO' selection button. Using timed will run the timer to completion. Auto will open the vent valve until the test pressure reaches a safe value (0.5psi for units below 100psi and 5.0psi for units above).

Loops: A test can be set to run itself a certain amount of time. Entering a non-zero value will run the test that amount of times. The test must pass to continue the loop.

Next Program: This field will link multiple test together. Enter the test number of the test to link to.

All programs in the link chain must pass to continue. At the end of a link the test will return to the first in line. Setting this value to the same number as itself sets the test to only run a single cycle.

Advanced Menu

The screenshot shows a software interface for configuring a pressure decay test. At the top, there are navigation arrows, a program number '0', the program name 'Program00', and a dropdown menu for 'TYPE' set to 'Pressure Decay'. On the left is a vertical sidebar with icons for 'TEST SETUP', 'FIXTURE', 'SETTINGS', 'ABOUT', and 'RUN MODE'. The main area is divided into several sections: 'PRESSURE LIMITS' with fields for 'TEST PRESSURE: 10.00', 'TOLERANCE: 0.50' (with '+' and '-' buttons), and 'PRESSURE DECAY: 0.05'; 'TEST LIMIT' with 'INCR: 0.00 psig', 'VOL: 0.00 cc', and an 'ENABLE INCR. LIMIT' checkbox; 'LOOPS: 0' and 'NEXT PROG: 0' with an 'END TEST EVAL.' button; and 'TIMES PRE FILL:' with 'TIME: 0.00 sec' and 'PRESSURE: 0.00 psig'. At the bottom, there are three buttons: 'PRE FILL' (highlighted in orange), 'RAMP FILL', and 'AUTO FILL'. A 'BASIC' button is also visible next to the 'ADVANCED' button.

The advanced menu keeps timers and limits not widely used.

INCR: This limit allows for an upper window to be created for the test step limit. A value will be entered and the ENABLE INCR LIMIT box must be selected.

VOL: This option allows the user to see the test decay converted to a volumetric leak rate cc/min. Enter the amount of total test volume (part, tubing, tooling, etc.) this calculation has no bearing on pass/fail status. The value will be shown in the run mode below the test result.

TIMES PRE FILL: This additional test step is prior to the fill step. It is typically used for large volume filling. There are three function modes for this step. Each mode differs on how the part is filled. It will only be used if the pneumatics are installed for its use. This step can be used with either manual regulators or electronic regulators as the supply pressure.

PRE FILL – Bulk Fill of large volume

Manual Reg: The timer field will specify the amount of time a secondary regulator will supply to the test port. The pressure field will be ignored.

Electronic Reg: The timer field will specify the amount of time the regulator will supply to the test port. The pressure field will specify the pressure output for the regulator. For example, to 'bulk fill' with an electronic regulator you would specify a time for the step and set the pressure at a value higher than the test pressure (typically it would be set to full scale). Once the pre fill timer expires, the standard fill step can be used to 'top off' to the exact test pressure.

RAMP FILL – Ramp rate set fill

Manual Reg: The timer field would specify the amount of time for a secondary regulator with a flow control valve to supply to the test port. The flow control valve (needle valve) would be manually set at the ramp rate required.

Electronic Reg: The timer field would specify the time limit for the ramp, the pressure field would specify the amount of pressure per time increment. For example, setting the timer to 5sec and the pressure to 3psi would ramp the pressure at 3psi per second for 5 seconds ending near 15psi.

AUTO FILL – Fill until set value is reached

Manual Reg: The timer field would specify the amount of time a secondary regulator would supply to the test port. This regulator is typically set above the required test pressure. The pressure field would specify the amount of pressure reached that would stop the timer and move to the next active step of the test. The test will also step on if the timer expired before the value is reached.

The electronic regulator is not used in this mode.

Building a Pressure Decay Leak Test

A pressure decay test is performed using three timer driven steps. Each step has a set of limits, and they must all pass for the entire cycle to be considered a pass. External factors and intrinsic elements of pressure testing will need to be compensated. The test setup will go a long way in ensuring an accurate and repeatable process.

The following setpoints and timers are the minimum values needed to run a pressure decay test. Each value will be listed, and guidelines will be given for making these selections.

Test Pressure - This may already be a given on your part specifications. If no pressure has been specified use the following as guidelines.

- a. Use the lowest pressure possible. As test pressures increase, cycle times will need to increase to manage the thermodynamic and elastomeric creep effects.
- b. Use a test pressure that will not cause damage to the part.
- c. Keep in mind operator safety in case of a catastrophic failure during the cycle.

Test pressure tolerance - The test pressure will have a set of tolerance limits; these are a plus and minus format. Start with $\pm 10\%$ of the test pressure. Once the total cycle has been written, the effects of supply pressure variation can be found, and this limit can be tightened or loosened as needed.

Fill Step - Depending on your part volume, some experimentation will be needed to find this value. For volumes <100mL use 5 seconds for larger volumes start at 10 seconds. The minimum value should be the amount of time it takes to reach the test pressure and be stable for 1 second. For parts that are 'soft' or compliant, more time should be allowed to allow the part to expand at pressure. The same can be said as the pressure increases the fill time should follow.

An example of the influence of the fill time is to run a test with the minimum fill and record the amount of pressure change at the end of the test. Run a second test with the fill time doubled. The pressure change at the end of the test will be significantly reduced. The part hasn't become more leak tight, but the effects of compressed air and compliance have been reduced. The goal should be to reduce these effects so that decay from actual air leaving the part can be seen.

If the part fails to reach test pressure minus the tolerance or exceeds the test pressure plus tolerance, the test will stop and display a LO PRESSURE or HI PRESSURE error. This indicates that the part is leaking so badly that the regulator cannot reach the specified pressure.

Settle Step – This step is used to transition the internal fill valves closed. There should be sufficient time to allow any pressure 'ringing' affects to settle out before the test step. 1 to 2 seconds should be a starting point. The settle timer should not be set to zero. If the pressure drops during this timer greater than the minus tolerance of the test pressure, the test will stop and display a GROSS leak error.

Test Step – The test step will look for 'fine' leaks. If the thermodynamic and/or compliance have been nullified in previous steps, the pressure change that will take place will be from air leaving the part. This time should be set long enough to separate the decay value of a good part and a part with

the manufacturing defect. A good 'rule of thumb' is to keep this difference in decay to a 3:1 ratio. A 'Bad' part should decay three times more than a good part. A good starting point is 3-5 seconds. Smaller leak rates will require more time to achieve a decay reading. True air leaks will look like a linear drop (for a finite time) if the graph shows more of an asymptotic drop, this is an indication that thermodynamics or compliance is still affecting the test. This may be acceptable if the amount of decay on a bad part is able to achieve the 3:1 ratio to a good part.

Decay – This value can be as simple as using known failures to find the amount of decay in the test step. If a leak rate specification is provided Z-axis can manufacture that specification into a physical form called a leak master. By running a known good part in conjunction with the leak master will yield a decay that is equivalent to the leak specification. Multiple parts should be used to find nominal and failure values. A single part should not be tested multiple times. It should be allowed to rest for 60-120seconds between tests to allow it to return to a virgin state as would be presented in the manufacturing process.

Building an Occlusion Test

An Occlusion test will evaluate the device under test for a blockage in the flow path. There are three main choices for test types to perform this test, each has its own strengths and weaknesses.

From the simplest to the more complex, the three test types for occlusion are 1. Backpressure, 2. Pressure Release, 3. Flow.

The Backpressure test places a known good part on the test port with the opposite end open to atmosphere. The test pressure is set while the part flows out to atmosphere. This sets the test pressure in a dynamic state. If the open end were to be temporarily blocked, you would see the test pressure rise well above where the indicated pressure was set. If another part is added with an occlusion, the backpressure created by that occlusion would cause the pressure to rise. The limits on the test pressure would be set to reject this part. This test is primarily run with the Fill step of the occlusion test. This test can take place very quickly as soon as the part reaches the steady test pressure.

The Pressure Release test places a device on the test port and a blocking valve on the outlet of the device. The part is filled with the test pressure in the static mode (set while the part is blocked). During the test step the blocking valve opens to allow the part to be vented while the pressure transducer monitors the pressure. A good device will vent quickly, an occluded device will vent at a slower pace. The test time would then be adjusted such that good parts reach a decay threshold before the timer expires. The failing parts would not reach the threshold in the same amount of time.

The flow test is more complex due to the need of additional pneumatics and a flow sensor. It also is more costly due to these components. A good device is placed on the test port. The test pressure is set while the device is open to atmosphere. Both the test pressure and flow values must be achieved for the part to pass. Typically, an electronically controlled regulator will be used to adjust the test pressure to be the same across all devices. This way the flow differences show up in the units of flow.

Mass Flow

The screenshot shows a software interface for configuring a Mass Flow test. At the top, there are navigation arrows, a program number '1', the name 'Program 01', and a 'TYPE' dropdown set to 'Flow'. The interface is divided into two main columns: 'PRESSURE LIMITS' and 'TIMES'. The 'PRESSURE LIMITS' column includes fields for 'TEST PRESSURE' (5.00), 'VALUE' (0.50 with +/- buttons), 'FLOW LIMIT' (UNITS: sccm), 'FLOW TOLERANCE' (10.00 with +/- buttons), 'LOOPS' (0), and 'NEXT PROG' (1). The 'TIMES' column includes fields for 'FILL' (2.00), 'TEST' (3.00), and 'VENT' (1.00), with a 'UNITS: sec' label. Below these columns are buttons for 'END TEST EVAL.', 'BASIC' (selected), 'ADVANCED', 'TIMED', and 'AUTO'. At the bottom, there are four channel status indicators, each showing a value (0.08, 0.00, 0.00, 0.00) and a 'VALVE ON' button, with channel labels 'CHAN. 1' through 'CHAN. 4'. A left sidebar contains icons for 'TEST SETUP', 'FIXTURE', 'SETTINGS', 'ABOUT', and 'RUN MODE'.

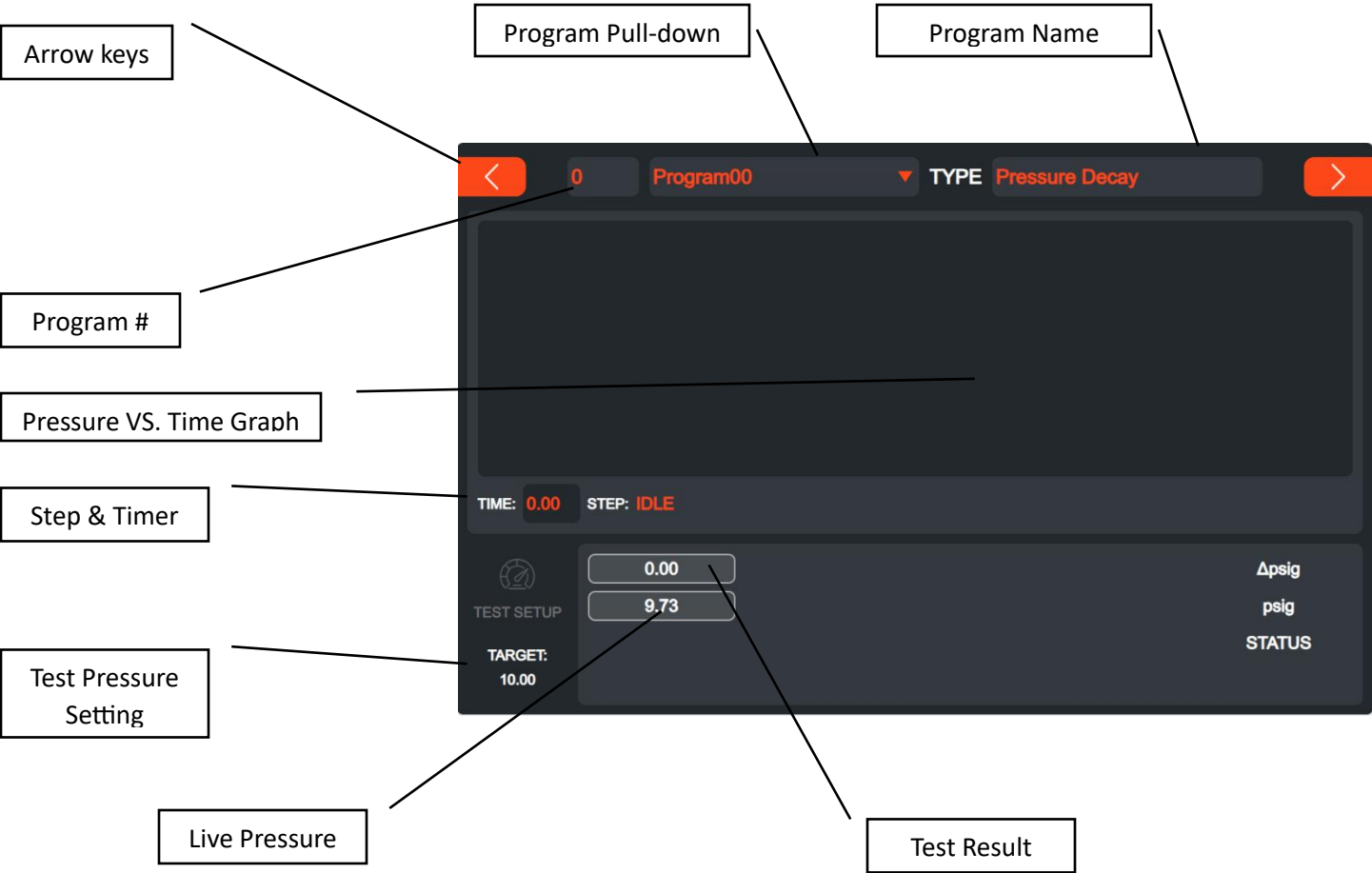
The flow test type shares some controls similar to the pressure decay test.

The flow test is in two parts. The part is first filled to the backpressure prescribed by the specifications. Then the flow through the part is measured.

Fill: The amount of time to get the part to the backpressure. If the unit is equipped with a manual regulator the test step can be used solely to fill and measure. If the electronic regulator is installed, the fill step must be used as the feedback to make corrections is only done in the fill step. The electronic regulator's output is frozen during the test step.

Test: The amount of time to measure the flow. This value is typically very fast if the fill step was used to achieve backpressure. This amount of time should be when the backpressure is stable and the flow does not change.

Run Screens



Run Mode Pass



Run Mode Fail



Replacement Parts

Each Z-Series unit is built with options for its particular application. The pneumatics can differ from unit-to-unit. Below are the common parts for each valve test type that could be considered wear items.

Spider Valve Repair Kit – Operator for standard type 1 valves.

Z/N 400199

Type 2 Cylinder block – The moving valve parts of type two valve string (complete assembly)

Z/N 300432

Type 1 Service Kit – A complete test manifold with type 1 valves and sensor (with wired connections)

15PSI – Z/N 400317

30PSI - Z/N 400318

100PSI - Z/N 400319

Type 3 Service Kit - A complete test manifold with type 3 valves and sensor (with wired connections)

500PSI - Z/N 400388

Fittings:

Male Luer x 1/8" NPT-M (Stainless) - Z/N 100057

Male Luer Lock x 1/8" NPT-M (Stainless) - Z/N 100261

Female Luer x 1/8" NPT-M (Stainless) - Z/N 100056