

TME

Solution

TM

Leak Tester

or

Leak and Flow Tester

Operator's Manual

TMElectronics, Inc.

45 Main Street, Boylston, MA 01505

508-869-6400

www.tmelectronics.com

TABLE OF CONTENTS		PAGE
CHAPTER 1	IMPORTANT INSTRUMENT SAFETY INFORMATION	4
	Important Instrument Safety Information	4
	Safety Label Design	4
	Instrument Safety Labels	5
	Important Literature Alerts	9
	Recommended Safety Practices	9
CHAPTER 2	INTRODUCTION	11
	Introduction to the TME <i>SOLUTION</i> [™]	12
	Features of the TME <i>SOLUTION</i>	14
	TME <i>SOLUTION</i> Instrument Control Locations	16
	TME <i>SOLUTION</i> Instrument Connections	17
	TME <i>SOLUTION</i> Instrument Controls	19
	TME <i>SOLUTION</i> Installation and Power Up Instructions	20
	TME <i>SOLUTION</i> Explanation of Main Screen Display	22
	TME <i>SOLUTION</i> Explanation of Main Screen Function Keys	25
CHAPTER 3	<i>SOLUTION</i> QUICK START GUIDE	26
	Explanation of the Quick Start Guide	27
	TME <i>SOLUTION</i> Quick Start	28
	Select Test Type	29
	Set Test Parameters	30
	Run a Pressure Decay Leak Test	33
CHAPTER 4	DETAILED EXPLANATION OF THE <i>SOLUTION</i> SCREENS	34
	Explanation of the TME <i>SOLUTION</i> Main Screen	35
	TME <i>SOLUTION</i> Screen Menu Addresses	45
	Main Screen	45
	Main Menu Screen	47
	Programs List Screen	52
	Set Parameters Screen	55
	Setting Test Parameters	57
	Set Options Screen	58
	Print/Send Screen	61
	Statistics & Datalog Screen	65
	Calibration Screen	67
	Calibration Check	68
	Warning Screen	70

TABLE OF CONTENTS (continued)		PAGE
CHAPTER 5	LEAK TEST MODE	71
	Introduction to Leak Testing	72
	Delta P Curve Memorization	74
	Typical Decay Curves	75
	Establishing Test Specifications	76
	Setting the TME <i>SOLUTION</i> Test Parameters	77
	TME <i>SOLUTION</i> Normal Leak Test Cycle	79
	Programming a Normal Leak Test (Vacuum or Pressure)	81
	Running a Leak Test	86
	Using the Set Options Mode	90
CHAPTER 6	LEAK TEST WITH FLOW RATE READOUT	98
	Introduction to Leak Testing with Flow Rate Readout	99
	Pressure Decay Test Mode	100
	Setting Leak Test with Flow Rateout Test Parameters	101
	Leak Test with Flow Rate Readout Calibration	102
	Running a Leak Test with Flow Rate Readout	105
CHAPTER 7	TME SOLUTION-C CHAMBER TEST MODE	106
	Introduction to Chamber Leak Testing	107
	Setting Chamber Leak Test Mode Parameters	109
	Finding the Correct Overpressure	111
	Running a Chamber Leak Test	112
CHAPTER 8	CLAMP DRIVE OPTION AND BLEED CYCLE	113
	Using the Clamp Driver Option	114
	Using the Bleed Cycle	115
CHAPTER 9	FLOW TEST MODE-Leak and Flow Model Only	116
	Flow Testing in the TME <i>SOLUTION</i> Leak and Flow Tester	117
	Establishing Flow Test Parameters	118
	Programming a Normal Flow Test	119
	Running a Flow Test	124
APPENDIX A:	Concurrent Testing	127
APPENDIX B:	Statistics Reference	128
APPENDIX C:	TME <i>SOLUTION</i> PLC Interface	129
APPENDIX D:	Use of Flow Standard or Calibrated Orifice	132
APPENDIX E:	TAL Software	134
APPENDIX F:	Filter Drying System	137
APPENDIX G:	Specifications	140
ADDENDUM:	Custom Design Instruments	141

TABLE OF CONTENTS (continued)	PAGE
Instrument Maintenance	142
Fuse Replacement	142
Instrument Service	143
Warranty	144

IMPORTANT INSTRUMENT SAFETY INFORMATION

This section of the **SOLUTION** Operator's Manual has been written to provide the operator with important safety information related to the installation, setup and operation of the instrument. It is important:

- to read this manual before installing, setting up or using this instrument to avoid personal injury and/or instrument damage,
- to follow the safety information included in this section to avoid personal injury and/or instrument damage,
- to keep this manual for future use, and
- to review and become familiar with all instrument safety labels and their meanings.

SAFETY LABEL DESIGN

Safety labels are designed and placed on the instrument to alert the user to both potential personal injury and property damage hazards. The ANSI/ISO harmonized safety labels consist of a Hazard Severity section, a Symbol panel, and a Word Message panel.

Hazard Severity Section

The hazard severity section of the label consists of the ISO "General Warning Symbol", a specific safety color, and the appropriate signal word to convey the seriousness of the hazard.

ISO General Warning Symbol



A black triangle with a black exclamation point on a yellow background is the ISO "General Warning Symbol". It is used to alert the user to a potential personal injury hazard. The general warning symbol can be used alone or in combination with a signal word to call attention to hazard information. Obey all safety messages that follow this symbol to avoid possible injury or death.

Signal Word

The Signal Word that follows the General Warning Symbol, combined with a specific colored background, is used to convey the seriousness of the hazard.

DANGER is used to indicate an imminently hazardous situation, which, if not avoided will result in death or serious injury. The severity panel background is red for the Danger signal word.

WARNING indicates a potentially hazardous situation, which, if not avoided could result in death or serious injury. The severity panel background is orange for the Warning signal word.

CAUTION indicates a potentially hazardous situation, which, if not avoided may result in minor or moderate injury. **CAUTION** used **without** the General Warning Symbol indicates a potentially hazardous situation, which, if not avoided may result in property damage. The severity panel background is yellow for the Caution signal word.

Safety Symbol Panel

The symbol panel contains an ISO symbol chosen to convey the specific alerting message and supplement the word message.

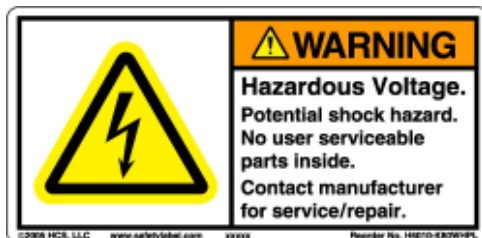
Word Message Panel

The word message panel is designed to communicate the type of hazard, the consequence of interaction with the hazard and how to avoid the hazard.

INSTRUMENT SAFETY LABELS

The following Safety Labels have been placed on the instrument to alert the user to potential safety hazards.

Hazardous Voltage Warning



The hazard severity portion of this label warns the user of a potentially hazardous situation, which, if not avoided, could result in death or serious injury. The hazard is Hazardous Voltage. This voltage is inside the instrument

The safety symbol conveys “shock” as the potential consequence of not avoiding the hazard.

The word message communicates to the operator that there is hazardous voltage that poses the potential for shock and communicates to the operator that there are **NO** user serviceable parts inside the instrument. The message directs the operator to contact the Manufacturer for Service/Repair as the means of avoiding the potential hazard.

Compressed Air Warning



The hazard severity portion of this label warns the user of a potentially hazardous situation, which, if not avoided, could result in death or serious injury. The hazard is a compressed air input pressure above the instrument rated 150 PSIG Maximum.

The safety symbol conveys the explosion/release of pressure as the potential consequence of not avoiding the use of compressed air above 150 PSIG.

The word message on the label alerts the operator that the compressed air hazard is avoided by using a compressed air source that is rated for 150 PSIG Maximum. If maximum pressure is exceeded the release of pressure could result in death or serious injury to the user. Exceeding maximum input pressure will cause property damage to the instrument.

Compressed Air Warning-300 PSIG



The hazard severity portion of this label warns the user of a potentially hazardous situation, which, if not avoided, could result in death or serious injury. The hazard is a compressed air input pressure above the instrument rated 300 PSIG Maximum.

The safety symbol conveys the explosion/release of pressure as the potential consequence of not avoiding the use of compressed air above 300 PSIG.

The word message on the label alerts the operator that the compressed air hazard is avoided by using a compressed air source that is rated for 300 PSIG Maximum. If maximum pressure is exceeded the release of pressure could result in death or serious injury to the user. Exceeding maximum input pressure will cause property damage to the instrument.

Custom Compressed Air Warning



Instruments designed to have a compressed air input pressure other than 150 or 300 PSIG Maximum will carry a Compressed Air Warning with the Maximum Compressed Air input pressure handwritten on the label.

The hazard severity portion of this label warns the user of a potentially hazardous situation, which, if not avoided, could result in death or serious injury. The hazard is a compressed air input pressure above the instrument rated Maximum PSIG indicated on the label.

The safety symbol conveys the explosion/release of pressure as the potential consequence of not avoiding the use of compressed air above the indicated PSIG.

The word message on the label alerts the operator that the compressed air hazard is avoided by using a compressed air source that is rated for indicated PSIG Maximum. If maximum pressure is exceeded the release of pressure could result in death or serious injury to the user. Exceeding maximum input pressure will cause property damage to the instrument.

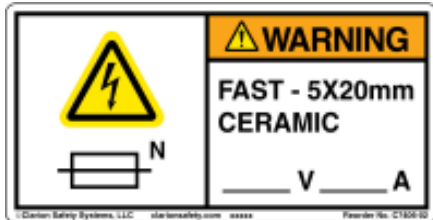
Fuse Safety Alert-Non-CE Configured Instruments



This ISO formatted label consists of the ISO “General Warning Symbol”, the fuse symbol and the required voltage and amperage rating of the instrument’s fuse.

This label is used to **CAUTION** service personnel that fuse replacement with an incorrectly rated fuse could result in minor or moderate injury or property damage to the instrument.

Fuse Safety Alert-CE Configured Instruments



The hazard severity portion of this label warns the user of a potentially hazardous situation, which, if not avoided, could result in death or serious injury. The hazard is Hazardous Voltage. This voltage is inside the instrument

The safety symbol conveys “shock” as the potential consequence of not avoiding the hazard.

The word message panel is designed to provide service personnel with the replacement fuse characteristics including fuse type, size, voltage and amperage. The Dual Fuse symbol, below the safety symbol, indicates to service personnel that the instrument requires two fuses.

IMPORTANT LITERATURE ALERTS

The signal words “**WARNING!**” and “**CAUTION!**” are integrated into sections of this manual to alert the reader/operator to important literature that is included regarding potentially hazardous situations which, if not avoided, may result in personal injury or property damage. These words appear in bold font and are embedded in the general text of the manual. Therefore, the information that follows these signal words should be read carefully to avoid personal injury and/or instrument damage.

RECOMMENDED SAFETY PRACTICES

Use of the *SOLUTION* in a manner not specified in this manual may impair the protection provided by the *SOLUTION* to other equipment.

DO NOT OPEN OR REMOVE THE INSTRUMENT COVER. There is hazardous voltage inside the instrument. Opening or removing the cover will expose the operator to a potential shock hazard and **WILL VOID THE WARRANTY.**

Do not attempt to change the **FACTORY SET** Power Supply. Refer all servicing to authorized T.M. Electronics, Inc. Service Centers.

THERE ARE NO USER SERVICEABLE PARTS INSIDE THE INSTRUMENT. Refer all servicing to authorized TM Electronics, Inc. Service Centers.

Replace a blown fuse **ONLY** with a fuse that meets the fuse specifications in this manual. Replacement of a fuse with a non-specified fuse **WILL VOID THE WARRANTY.**

The air or gas used for the instrument must be clean, dry, instrument quality air free of moisture, oil and dust. To ensure instrument quality air refer to Appendix F “Filter Drying System” or contact T.M. Electronics, Inc. for information on ordering a “Filter Drying System”. The instrument Warranty does **not** cover instrument damage due to water, water vapor, oil vapor or oil damage to the instrument. It is the customer’s responsibility to maintain dry, clean instrument quality air.

The air or gas used for the instrument must be at a recommended pressure between 90 and 150 PSIG MAX. A minimum of 60 PSIG must be supplied for proper instrument operation. For instrument models with a maximum test pressure higher than 50 PSIG, the inlet pressure must exceed the maximum test pressure by at least 10PSIG.

Do not exceed the Maximum Input Pressure of the instrument’s Compressed Air Warning label as release of pressure may expose the operator to serious injury and cause instrument damage.

Do not use the instrument near water. Do not spill any liquids into the instrument. Use caution when testing fluid filled products. Contamination of the instrument with fluids voids the Warranty

Do not place this instrument on a sloping or unstable cart, stand or table as the instrument may fall, causing serious damage to it.

Do not place any heavy objects on the power cord. Damage to the cord may cause shock or fire.

Handle with care when transporting the instrument. Save packaging for transporting or return for recalibration or servicing.

Immediately unplug the instrument from the wall outlet and refer servicing to an authorized service center under the following conditions:

- If the power supply cord or plug is damaged,
- If liquid has been spilled into the instrument,
- If the inside of the instrument has been exposed to liquid during testing, or
- If the instrument has been dropped or damaged.

CHAPTER 2 INTRODUCTION	PAGE
Introduction to the TME <i>SOLUTION</i>	12
Features of the TME <i>SOLUTION</i>	14
TME <i>SOLUTION</i> Instrument Control Locations	16
TME <i>SOLUTION</i> Instrument Connections	17
TME <i>SOLUTION</i> Instrument Controls	19
TME <i>SOLUTION</i> Installation and Power Up Instructions	20
TME <i>SOLUTION</i> Explanation of Main Screen Display	22
TME <i>SOLUTION</i> Explanation of Main Screen Function Keys	25

INTRODUCTION TO THE TME SOLUTION

Thank you for purchasing a TME SOLUTION. Please take the time to find and read the pertinent information contained in this manual for your specific instrument. This will help to ensure that you get the best possible service life from your instrument.

This manual covers the following TME SOLUTION Models: **SOLUTION Leak Tester, SOLUTION Leak and Flow Tester and the SOLUTION-C Chamber Tester**. Any reference in this manual to Flow testing is not applicable to an instrument purchased as a Leak Tester or a Chamber Tester. The TME SOLUTION is also available as a single or multi-port instrument. Multi-port instruments are either sequential or concurrent instruments. Any reference in this manual to concurrent testing is not applicable to a sequential SOLUTION.

The TME SOLUTION-C Chamber Tester is a SOLUTION Leak Tester that has the added capability of leak testing sealed devices in a chamber. The TME SOLUTION-C Chamber Tester has **no** Flow Testing capability.

This manual **does not cover Custom Models** of the TME SOLUTION. Please reference the Addendum shipped with your instrument for specific information related to your Custom SOLUTION.

A multi-port SOLUTION will be either a sequential or a concurrent instrument. A sequential instrument runs the same test on each selected port one after the other, sequentially, beginning with Port #1. A concurrent instrument runs the same test on more than one port at the same time or concurrently. For further information on Concurrent Testing see Appendix A.

The TME SOLUTION Leak and Flow Tester was designed to test devices that pass liquid or gas at a required flow rate through an intended path. Examples of such devices include filters, tubing, valves and catheters. These types of devices generally require a two-part test. The device is first flow tested to verify that flow through the device is acceptable. Then a leak test is performed to verify that there is no leakage outside of the intended flow path.

The TME SOLUTION Leak and Flow Tester performs both tests in a single cycle automatically. The tests can be done in either order: flow followed by leak or leak followed by flow. Flow tests require the flow path to be open at one end. Leak tests require a closed path. The TME SOLUTION™ is designed with an optional clamping device driver, which can activate an external fixture that seals the open end(s) of the device. Once the clamping is achieved, the leak test can be done.

For applications where occlusions or flow restrictions are the primary concern and leaks are rare, the TME SOLUTION Leak and Flow Tester can be set-up to perform only flow tests. If leakage is the main concern and flow is of no consequence, the TME SOLUTION can be set-up for leak testing.

At the completion of a test cycle, the TME *SOLUTION* indicates whether the device met the preset test limits. The highlighted "PASS" on the Main Screen Display and the green "ACCEPT" light on the front panel indicate that the device met the leak and/or flow specifications. The highlighted "FAIL" on the Main Screen display and the red "REJECT" light on the front panel indicate that the device did not meet the test specifications for the indicated test.

In a multi port instrument, the test cycle may include multiple ports. In this case the status of each port is displayed individually.

FEATURES OF THE TME SOLUTION

The TME *SOLUTION* contains several features and functions that the user should become familiar with. These features and functions are summarized below.

The pressure transducer provides state-of-the-art sensitivity and temperature stability. Integrated with the system electronics the TME *SOLUTION* achieves resolution as low as 0.0001 PSIG (0.0069 mBar)

The flow transducer is highly responsive to flow changes. The TME *SOLUTION* is typically equipped with a flow transducer with a sensitivity of 1 cc/min. For greater sensitivity, optional transducer models are available.

Self-diagnostics are part of the TME *SOLUTION* start up program. This feature assures the operator that the instrument meets its own specifications when powered up.

The 3"x 5" touch screen display consists of white figures on a colored background. The display size and contrast features provide a wide-angle view in a work station environment. The user is able to move from one screen to another by touching the appropriate address on the display screen. The alphanumeric and graphic features of the display provide ease in viewing menu options as well as visual display of test results and graphical presentation of data.

The user is able to input up to one hundred (100) programs for individual test procedures. This feature allows for fast and silent changeover of test programs.

The Key Lockout function assures operation security. Once the key lock is activated neither test functions nor data can be altered.

The push of one button activates the test cycle once the test parameters have been programmed. Data from each test is stored automatically and the highlighted test result tells the operator if the tested part is a "PASS" or "FAIL".

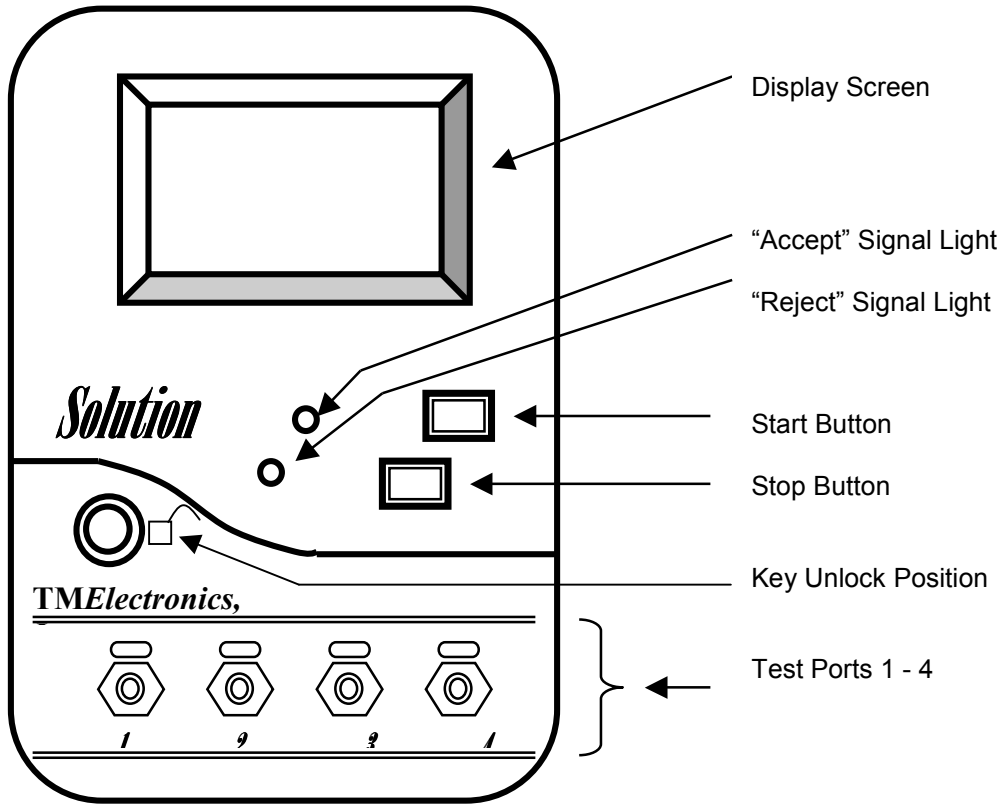
The TME *SOLUTION* is capable of logging and retaining test results in its Data Log Memory. This allows for documentation of test results by workstation or shift as well as trend analysis of the process.

The TME *SOLUTION's* statistical capabilities provide the user with immediate information on process performance. Process control statistics are calculated and presented in statistical data format on the Main Screen. Process histograms, X-Bar and Range charts are also available for graphic display. This allows for statistical analysis for process validation or process control purposes.

The TME *SOLUTION* has multiple output modes. Test results are presented visually on the touch screen display. Printer capability is available through the instrument's printer port. The connection must be made to a compatible printer. The RS232C communication port allows for computer connection and data transmission in data, stream or text format.

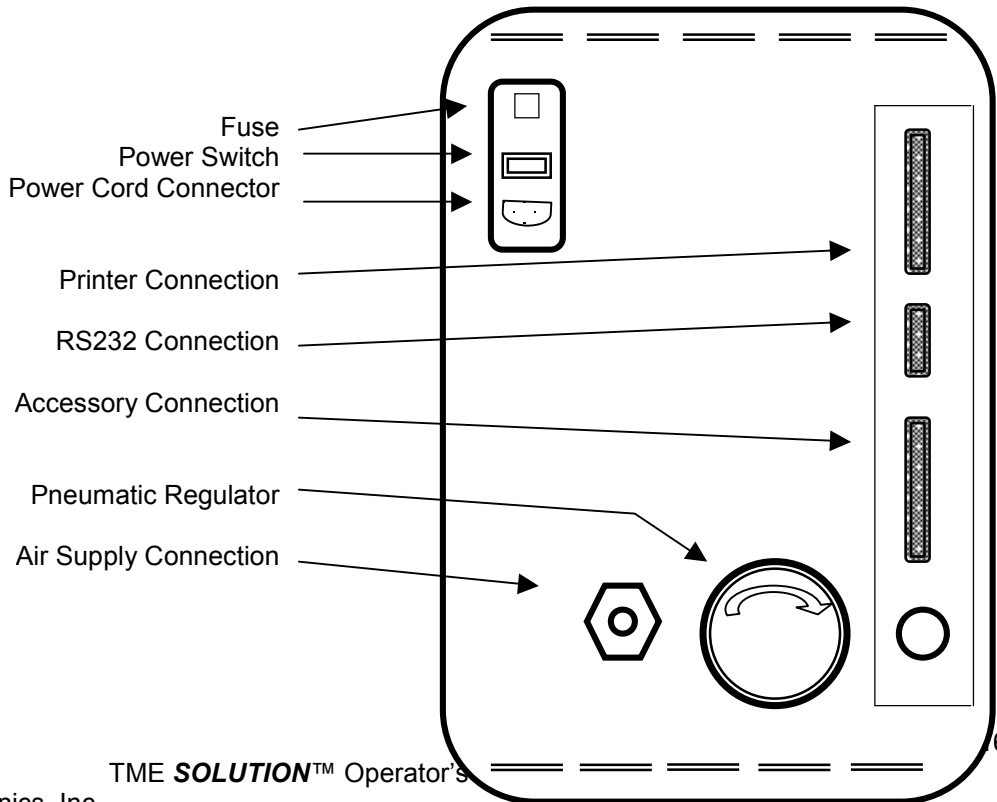
Some configurations of the TME *SOLUTION* contain a Bleed Valve Safety feature. This internal valve allows for air bleeding of a pressurized part prior to detaching the part from the test port. This safety feature prevents short bursts of air from escaping as parts are removed from the test port.

TME SOLUTION INSTRUMENT CONTROL LOCATIONS



FRONT OF INSTRUMENT

BACK OF INSTRUMENT



TME SOLUTION INSTRUMENT CONNECTIONS

Refer to "INSTRUMENT CONNECTION LOCATIONS" for location of the connections mentioned below.

AIR SUPPLY CONNECTION:
(Pneumatic) Compressed air inlet to the instrument.
Connection Type: Instrument air supply fitting is a Female Bulkhead fitting which will accept any male 1/8" NPT fitting or a standard 1/8" NPT male to 1/4" tube fitting.

WARNING! The air used for the TME SOLUTION must be clean, dry, instrument quality and at a recommended pressure between 90 and 150 PSIG MAX. A minimum of 60 PSIG must be supplied for proper operation. For models with a maximum test pressure higher than 50 PSIG, the inlet pressure must exceed the maximum test pressure by at least 10 PSIG.

To ensure instrument quality air refer to Appendix F "Filter Drying System".

TEST PORT CONNECTION:
(Pneumatic) Test air outlet. To be connected to Test Part.
Connection Type: Instrument port fitting is a Female Bulkhead 1/8" NPT that will accept the customer's required fitting. See below for information on common fittings attached directly to the bulkhead connection.

CAUTION! Use caution when testing fluid filled products. Contamination of the instrument with fluids VOIDS the Warranty.

PRINTER CONNECTION:
(Electrical) Printer output connection:
Interface: Centronics
Connection Type: DB-25 Female
Printer cord:
DB25 Male/Centronics 36 (CN36), 25C Mold

TME SOLUTION INSTRUMENT CONNECTIONS (continued)

RS232 CONNECTION: Serial port input/output connection:
(Electrical) Interface: RS232-C
Connection Type: DB-9 Female
RS232 Cord:
DB9 M/M Serial

POWER: **WARNING! POWER IS FACTORY SET-DO NOT ATTEMPT TO CHANGE**

US: 115 Volts, 50-60 Hz @ 1.5 Amps

EUROPEAN: 230 Volts, 50-60 Hz @ 1.25 Amps

POWER CORD: US: 100-125 Volts AC/Grounded Plug
UL E 204241-C, CSA LL2126-C FT2

EUROPEAN: UL/CSA #10W1-11206

UK: UL/CSA to UK with 10 Amp Fuse
#10W1-12206

FUSE (S): For use with Astrodyne AD-120 Power Supply
US: 2.5 A @ 250 volts, 300 Watts Max
Type: 5x20 mm Fast-Acting
Quantity Required-1

EUROPEAN: 2.0 A @ 250 Volts, 300 Watts Max
Type: 5x20mm Fast-Acting
Quantity Required-2

CAUTION! Fuse replacement must be with the fuse(s) specified above. Use of incorrect fuse(s) may result in damage to the instrument and VOIDS THE WARRANTY!

BULKHEAD CONNECTIONS: 1/4" (6 mm) Tube Fitting connects to Bulkhead
Common fittings that attach Male Luer Slip or Luer Lock Connector
directly to the Female Female Luer Lock Connector
Bulkhead 1/8" NPT connection 1/8" Flow Quick Disconnect with O-Ring

CUSTOM FITTINGS: Fittings Face Seal
used on instruments with no Custom Male Luer Slip Fitting
Female Bulkhead 1/8" NPT.

TME SOLUTION INSTRUMENT CONTROLS

Refer to "INSTRUMENT CONTROL LOCATIONS" for location of the controls mentioned below.

POWER SWITCH:	Turns instrument On and Off
PNEUMATIC REGULATOR:	Controls the pressure or vacuum used in the test.
START BUTTON:	Starts the test sequence.
STOP BUTTON:	Stops any test or procedure currently in progress.
KEYLOCK:	Locks the keypad to prevent program and /or program parameter changes. The OPEN Lock symbol on the control panel indicates the key is in the unlocked position. When the key is in the locked position, a CLOSED Lock symbol is displayed in the Status Bar of the <Main Screen>.
ACCEPT LIGHT:	Indicates when the result of a particular test is a "PASS" or "ACCEPT".
REJECT LIGHT:	Indicates when the result of a particular test is a "FAIL" or "REJECT".

TME SOLUTION INSTALLATION AND POWER UP INSTRUCTIONS

UNPACKING:

After taking the system out of its carton, make sure that the following parts are present:

TME *SOLUTION* Instrument,
Operator's Manual,
Air hoses, and
Keys.

Contact the factory for missing or damaged parts.

Save all packing material for transport or return to TM Authorized Service Center for Service or Recalibration.

INSTALLATION:

INSTRUMENT ENVIRONMENT

The TME *SOLUTION* should be installed in an environment with moderate temperature: 5-40°C (40-100°F), and humidity (RH<80%, noncondensing). Keep away from strong electromagnetic interference or machinery that generates large line voltage spikes.

Position the instrument so that the Mains Power Entry Module is easily accessible to allow the unit to be switched off and the Mains Power Cord to be easily disconnected from the instrument and/or the power outlet.

CONNECTIONS:

Connect the power cord of the instrument to a properly grounded outlet:

- US Units: Three pronged, properly grounded, 120 Volt (nominal) AC outlet, or
- European Units: Three pronged, properly grounded 220-240 volt AC.

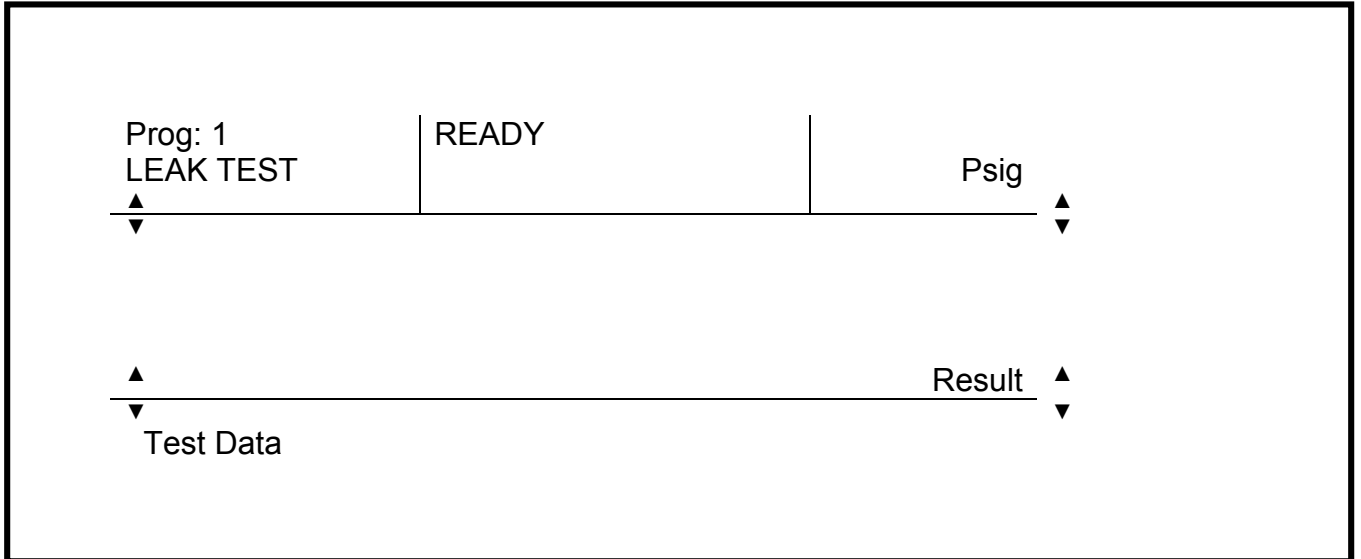
Connect the air hose from the "AIR SUPPLY" port to a compressed air outlet of maximum input pressure 150 PSIG. **WARNING!** DO NOT EXCEED 150 PSIG MAXIMUM input pressure. Exceeding maximum input pressure could result in a release of pressure, which could result in death or serious injury and/or instrument damage.

CAUTION! Instrument air must be free of moisture, oil and dust and at a standard pressure between 90 and 150 PSIG. Other pressures may be required based on customer's special requests.

POWER UP:

Turn on the TME *SOLUTION* by using the power switch in the back of the instrument. Upon start up the instrument runs three initialization phases and an automatic self-diagnostic test and displays the Main Screen.

MAIN SCREEN DISPLAY



TME SOLUTION EXPLANATION OF MAIN SCREEN DISPLAY

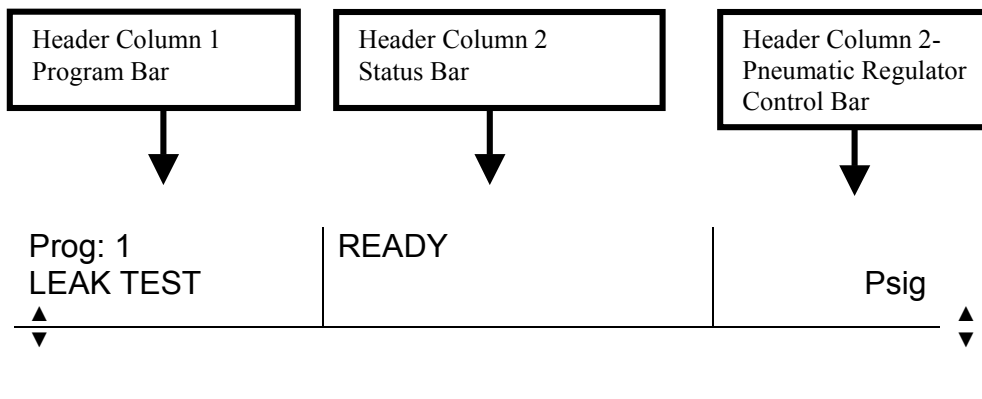
The Main Screen of the TME *SOLUTION* is divided into three rows:

1. the top row - the Header,
2. the center row - the Main Screen, and
3. the bottom row - the Footer.

Main Screen Top Row-HEADER ROW

The Main Screen Header Row is divided into three sections:

1. Header Column 1-the Program Bar
2. Header Column 2-the Status Bar, and
3. Header Column 3-the Pneumatic Regulator Control Bar



Header Column 1-PROGRAM BAR

The left column, Header Column 1, known as the Program Bar, indicates the Program number and the type of test the program parameters are set to run. In addition, this section indicates programs that are linked to each other and the type of test each is programmed to run. For example “Prog: 1 ►3”, Leak + Flow indicates that Program 1 is linked to Program 3 and that Program 1 is a Leak Test and Program 3 is a Flow Test.

Header Column 2-STATUS BAR

The middle column, Header Column 2, known as the Status Bar, indicates the status of the instrument, before, during and after tests are run. As shown above the instrument is “READY”.

Header Column 3-PNEUMATIC REGULATOR CONTROL BAR

The right column, Header Column 3, known as the Pneumatic Regulator Control Bar, displays the pressure or vacuum setting of the pneumatic regulator and the units of measure of the pneumatic regulator.

Main Screen Center Row-MAIN SCREEN

The center row of the screen is referred to as the Main Screen. This portion of the screen is blank prior to running a test. Touching this section of the screen allows the operator to go to the <Main Menu> Screen.

When a test is being run, the Main Screen displays the pressure or vacuum during the various periods of the cycle. The test result is displayed on the Main Screen after the test.

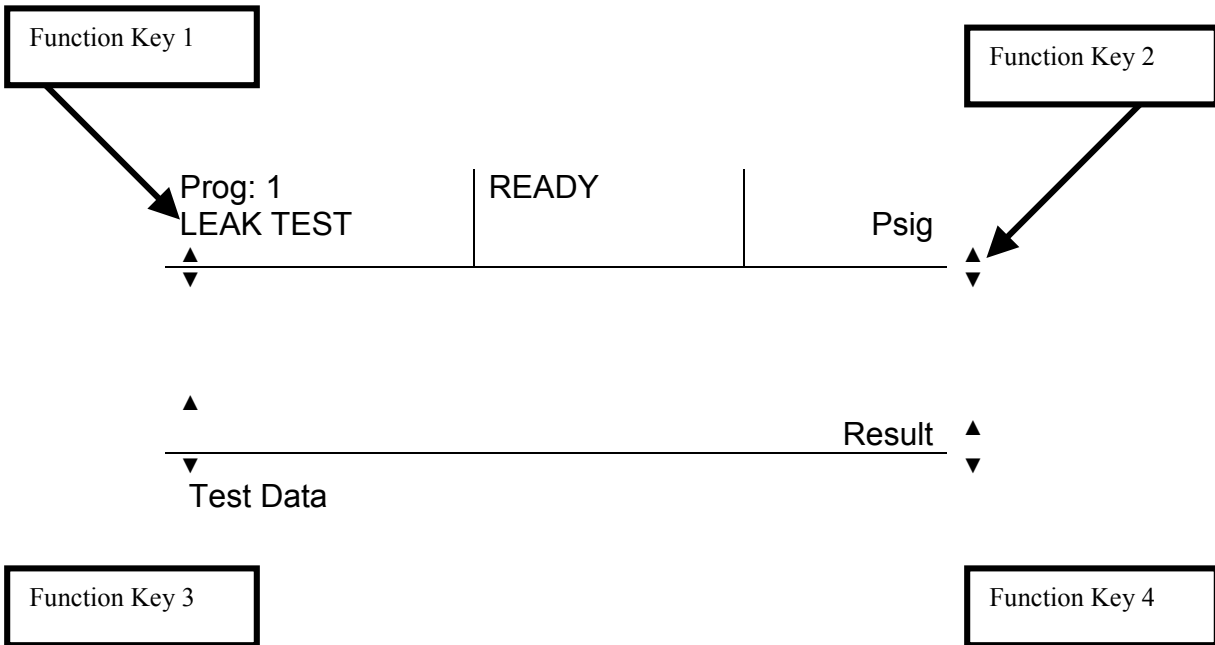
Main Screen Bottom Row-FOOTER SCREEN

The bottom row of the Main Screen is referred to as the Footer. The Footer indicates the type of data displayed. Test specific data as well as statistical analysis data are displayed in this section of the screen. Test specific data includes the program name, lot number of parts being tested, and operator identification. Additional data footer screens include cycle and test counter information. The statistical data presented in the footer include parameters specific to the statistics selected by the operator. Where graphic presentations of the data are available the graphs are displayed in the center of the Main Screen.

For more information on the Main Screen see Chapter 2-entitled “Detailed Explanation of the TME **SOLUTION** Screens”.

TME SOLUTION EXPLANATION OF MAIN SCREEN FUNCTION KEYS

The Main Screen has four Function Keys indicated by the symbol \blacklozenge . For identification purposes these keys are referred to as Function Keys 1, 2, 3 and 4 and their location is shown below:



Function Key	Select Address
Function Key 1	Moves display to Programs List Screen
Function Key 2	Moves display to Test Parameter Screen for the Program indicated in the Program Bar.
Function Key 3	While remaining in the Main Screen, the operator may scroll through the most recent test result or summarized Test or Statistical data.
Function Key 4	This function key provides graphical representation of the most recent test result or the summarized Test and Statistical data on the Main Screen.

CHAPTER 3 SOLUTION QUICK START GUIDE

PAGE

Explanation of the Quick Start Guide	27
TME <i>SOLUTION</i> Quick Start	28
Select Test Type	29
Set Test Parameters	30
Run A Pressure Decay Leak Test	33

EXPLANATION OF THE QUICK START GUIDE

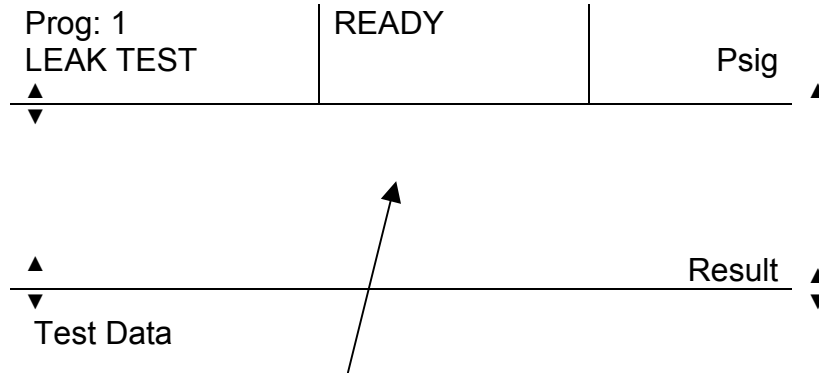
The Quick Start Guide is designed to provide instructions on how to set the test parameters for a pressure decay leak test on a single port **SOLUTION**. It is a shortened description of the test set up procedure detailed in Chapter 4. This guide is designed to teach the operator how select the desired Test Mode and enter:

- the Test Parameters,
- the Test Pressure;
- the Pressure Decay Reject Limit (Pressure Tolerance), and
- the Operator's Name.

Once the required criteria are entered the guide describes running a pressure decay leak test and gives a description of the displayed test results.

TME SOLUTION QUICK START

Upon completion of the instrument installation and power up the MAIN SCREEN is displayed as shown below.



Touch the center of the MAIN SCREEN and the <Main Menu> Screen is displayed as shown below.

<Main Menu>		
Pick a Program	Printer Reports	Alarm OFF
Set Parameters	Statistics and Datalog	Calib. Mode
Set Options		MemRef Store
Lot number:		MemRef *Clear
Operator:	Clear test Data	Exit

Touch the “Set Parameters” address and the screen will move to a <LEAK TEST> Screen.

<LEAK TEST>			
CHARGE:	0.0		Progm#
Timer	Sec.		X
SETTLE:	0.0		Test
Timer	Sec.		LEAK
TEST :	0.0		Ports
Timer	Sec.		X
DECAY :	0.00000		Names&
Maximum	Psig		Option
PRESSR:	0.00	PRESSR	5.00
Specif.	Psig	± Toler.	%
			Exit

SELECT TEST TYPE

Touch the “Test” address on the test parameter screen.

<LEAK TEST>			
CHARGE:	0.0		Prog#
Timer	Sec.		X
SETTLE:	0.0		Test
Timer	Sec.		LEAK
TEST :	0.0		Ports
Timer	Sec.		X
DECAY :	0.00000		Names&
Maximum	Psig		Option
PRESSR:	0.00	PRESSR	5.00
Specif.	Psig	± Toler.	%
			Exit

The test type will be displayed in the “Test” address. Depending on the **SOLUTION** model the “Test” address will display some or all of the following test types:

- “LEAK”,
- “FLOW”,
- “LEAK & FLOW”, or
- “FLOW AND LEAK”.
-

NOTE: The test type displayed in the “Test” address is also displayed in the Screen Address.

<LEAK TEST>			
CHARGE:	0.0		Prog#
Timer	Sec.		X
SETTLE:	0.0		Test
Timer	Sec.		LEAK
TEST :	0.0		Ports
Timer	Sec.		X
DECAY :	0.00000		Names&
Maximum	Psig		Option
PRESSR:	0.00	PRESSR	5.00
Specif.	Psig	± Toler.	%
			Exit

Select the LEAK Test mode.

SET TEST PARAMETERS

The following test times will be set for the leak test:

Charge Time: 2 seconds,
 Settle Time: 2 seconds,
 Test Time: 2 seconds,
 Decay Maximum Pressure: 0.002 Psig,
 Pressure Specified: 10.0 Psig,
 Pressure Tolerance: 1.0 Psig.

Touch the “Charge Timer” address on the <Leak Test> Screen and a numeric keypad will be overlaid on the screen.

<LEAK TEST>

CHARGE: Timer	0.0 Sec.		2.0	Units Chang
SETTLE: Timer	0.0 Sec.		1 2 3	Res
TEST : Timer	0.0 Sec.		4 5 6	±
DECAY : Maximum	0.00000 Psig		7 8 9	Clr
PRESSR: Specif.	0.00 Psig	PRESSR ± Toler	• 0	Enter

Touch the “2”, “.”, and “0” on the keypad and “2.0” will be displayed on the top left box of the keypad and in the “Charge Timer” address. **DO NOT TOUCH ENTER UNTIL ALL TEST PARAMETERS HAVE BEEN ENTERED.**

Touch the “Settle Timer” address. (Note: The selected “Charge Timer” is displayed in the “Charge Timer” address only after the “Settle Timer” address is touched. This happens for each test parameter selected.) Press “2”, “.” and “0” to enter the Settle time.

Touch the “Test Timer” address and enter “2.0” for the Test time.

Touch the “Decay Maximum” address and enter “0.002” for the Maximum Decay Pressure. If necessary, touch the “Units Change” address on the keypad to select “Psig” for the Maximum Decay Pressure.


Touch “Pressr Specif:” address to set the specified test pressure of 10.0 Psig. If necessary, select “Psig” for the units.

Touch the “Pressr ±Tolerance” address and the keypad will shift to the other side of the screen. Select “5.0” for the pressure tolerance. This is 5.0% of the 10.0 Psig selected as the Specified Pressure.

All Test Parameters have been entered. **Touch “Enter”.**

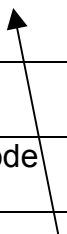
Upon touching the “Enter” address the <Main Menu> Screen will be displayed.

<Main Menu>		
Pick a Program	Printer Reports	Alarm OFF
Set Parameters	Statistics and Datalog	Calib. Mode
Set Options		MemRef Store
Lot number:		MemRef *Clear
Operator:	Clear test Data	Exit



Touch the “Set Options” address and the <OPTIONS> Screen will be displayed.

< Set Options Screen >			
Program name:	CLAMP	0.0	
	Timer	Sec.	
Lot number:	BLEED	0.0	
	Timer	Sec.	
Operator:	PAUSE	0.0	
	Timer	Sec.	
	FILL	0.0	
	Timer	Sec.	
Memory Mode OFF			Exit



Touch the “Operator” address and an alpha-numeric keypad will be displayed.

Touch the “T”, “M” and “E” keys and <TME> will appear in place of <Operator> at the top of the screen.

<TME>									<-
•	,	@	#	%	&	/		<	>
1	2	3	4	5	6	7	8	9	0
A	B	C	D	E	F	G	H	I	J
K	L	M	N	O	P	Q	R	S	T
U	V	W	X	Y	Z	Spc	▲	Exit	

Touch the “Exit” address and the display returns to the <Set Options> Screen and “TME” is displayed in the “Operator” address.

< Set Options Screen >

Program name:	CLAMP	0.0	
	Timer	Sec.	
Lot number:	BLEED	0.0	
	Timer	Sec.	
Operator:	PAUSE	0.0	
TME	Timer	Sec.	
	FILL	0.0	
	Timer	Sec.	
Memory Mode			
OFF			Exit

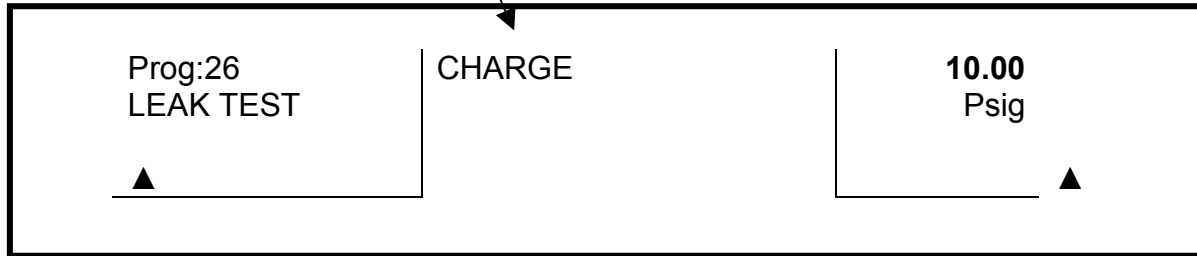
Touch the “Exit” address on the <Set Options> Screen and the <Main Menu> Screen is displayed. Touch the “Exit” address on this screen to return to the MAIN SCREEN.

Use the regulator adjustment handle on the back of the instrument to adjust the Test Pressure to read 10.00 Psig. The pressure is displayed in the upper hand box of the MAIN SCREEN. The display will change as the pressure is adjusted.

Prog:26 LEAK TEST ▲	READY	10.00 Psig ▲
-------------------------------	-------	------------------------

RUN A PRESSURE DECAY LEAK TEST

Attach a test part to the test port on the front panel of the instrument. To start the test, press the Green "START" Button. As the test proceeds, the portion of the test sequence being run—"CHARGE", "SETTLE", "TEST"—appears in place of the word "READY" on the screen,



When the test is completed the test result will appear in the center of the screen. The amount of pressure decay that occurred at the end of the specified test time is displayed numerically in the center of the screen. "PASS" or "FAIL" is displayed below the word "Decay" on the screen. "PASS" indicates that the pressure decay was less than the pressure tolerance entered previously (5.0% of 10.00 Psig or 0.5000 Psig). "FAIL" indicates that the pressure decay was above the entered tolerance. The test result is logged into the instrument's Datalog.

For more detailed information on the Leak Test Mode of the *SOLUTION* refer to Chapter 4 "LEAK TEST MODE" in this manual.

CHAPTER 4 DETAILED EXPLANATION OF THE TME *SOLUTION* SCREENS

PAGE

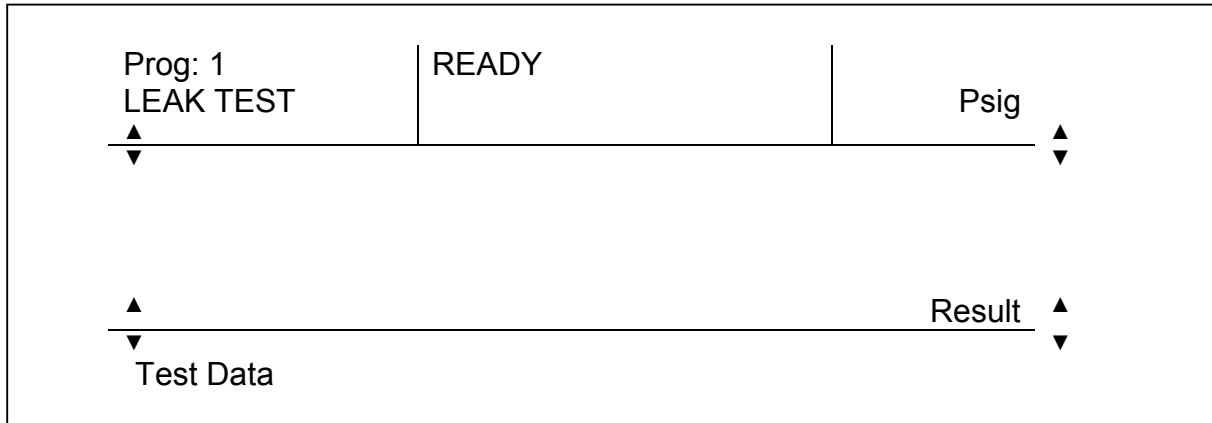
Explanation of the TME <i>SOLUTION</i> Main Screen	35
TME <i>SOLUTION</i> Screen Menu Addresses	45
Main Screen	45
Main Menu Screen	47
Programs List Screen	52
Set Parameters Screen	55
Setting Test Parameters	57
Set Options Screen	58
Print Send Screen	61
Statistics & Datalog Screen	65
Calibration Screen	67
Calibration Check	68
Warning Screen	70

EXPLANATION OF THE TME SOLUTION MAIN SCREEN

This section describes the sections of the TME SOLUTION's Main Screen, identifies the Main Screen function keys, and describes in specific detail the appearance of the instrument Status Bar and Main Screen before, during and after a test as well as the specifics on the various screens provided by the Main Screen Footer.

The main screen appears as shown below after the instrument is installed and powered up.

MAIN SCREEN



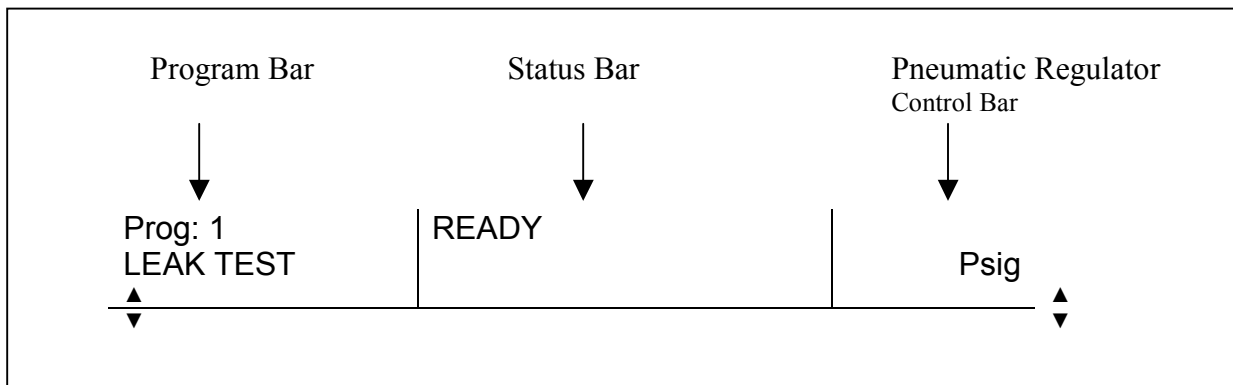
The Main Screen is divided into three sections:

1. Top row - the Header,
2. Center row - the Main Screen, and
3. Bottom row - the Footer.

Main Screen Header

The Main Screen Header is divided into three columns:

1. Header Column 1 is the Program Bar,
2. Header Column 2 is the Status Bar, and
3. Header Column 3 is the Pneumatic Regulator Control Bar.



Header Column 1-PROGRAM BAR

The left column, Header Column 1, known as the Program Bar, indicates the Program number and the type of test the program parameters are set to run. In addition, this section indicates programs that are linked to each other and the type of test each is programmed to run. For example “Prog: 1 ►3”, Leak + Flow indicates that Program 1 is linked to Program 3 and that Program 1 is a Leak Test and Program 3 is a Flow Test.

Header Column 2-STATUS BAR

The middle column, Header Column 2, known as the Status Bar, indicates the status of the instrument, before, during and after tests are run. As shown above the instrument is in the “READY” mode. This bar also indicates the period of the test cycle being run, the test number, the ACCEPT/REJECT status of the most recent test, indicates when the Memory Mode is ON, if the instrument is in the LOCK mode and tracks the number of cycles run. **(See more detail below.)**

Header Column 3-PNEUMATIC REGULATOR CONTROL BAR

The right column, Header Column 3, known as the Pneumatic Regulator Control Bar, displays the pressure or vacuum setting of the pneumatic regulator and the units of measure of the pneumatic regulator setting. This bar also displays the specified pressure at the start of sampling during each period of the test.

Note: The pneumatic regulator setting is operator set using the pneumatic regulator control knob in the back of the instrument.

Main Screen Center Row-MAIN SCREEN

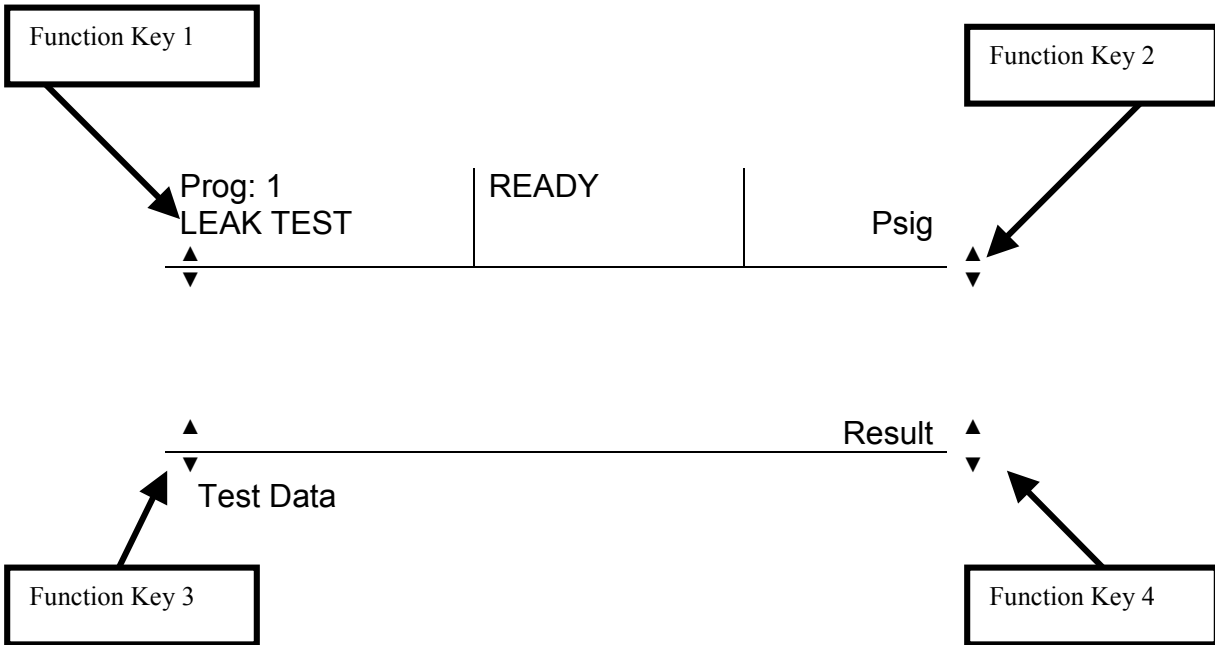
The center row of the screen is referred to as the Main Screen. This portion of the screen is blank prior to running a test. When a test is being run, the Main Screen displays the pressure or vacuum during the various periods of the cycle. The test result(s) is(are) displayed on the Main Screen after the test. In addition, the Main Screen indicates the ACCEPT/REJECT status of the test part(s), the units of test, the test number and the Memory Mode status of the instrument. The main screen is also used to display the decay curve of a part, as well as present statistical data numerically or graphically. The bottom right section of the Main Screen provides information on the data being presented on the Main Screen-Result or Statistics and the type of data-Plot, Histogram, X Bar or R Chart.

Main Screen Bottom Row-FOOTER SCREEN

The bottom row of the Main Screen is referred to as the Footer. The Footer indicates the type of data displayed. Test specific data as well as statistical analysis data is displayed in this section of the screen. Test specific data includes the program name, lot number of parts being tested, and operator identification. Additional data footer screens include cycle and test counter information. The statistical data presented in the footer include parameters specific to the statistics selected by the operator. Where graphic representations of the data are available the graphs are displayed in the center of the Main Screen.

Main Screen Function Keys

The Main Screen also has four Function Keys indicated by the symbol $\blacktriangle\blacktriangledown$. For identification purposes these keys are referred to as Function Keys 1, 2, 3 and 4 and their location is shown below:



Function Key	Select Address
Function Key 1	Provides a short cut to the Programs List Screen.
Function Key 2	Moves display to Test Parameter Screen for the Program indicated in the Program Bar.
Function Key 3	While remaining in the Main Screen, the operator may scroll through the most recent test result or summarized Test or Statistical data.
Function Key 4	This function key provides graphical representation of the most recent test result or the summarized Test and Statistical data on the Main Screen.

Instrument Status Bar

As indicated previously the instrument Status Bar provides specific information relating to the instrument and the test status.

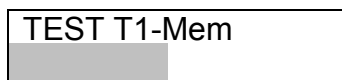
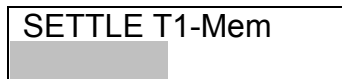
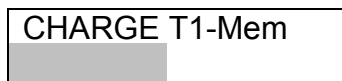
Status Bar-Power Up

Upon power up of the instrument after installation the Status Bar appears as shown below:



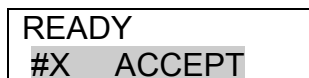
When the Start button is pressed the Status Bar indicates the time period of the test cycle being run, the test number, the Memory Mode status, the instrument LOCK mode and a moving bar indicates the % of the time period of the cycle completed. For example, the representations pictured below show that Status Bar during the Charge, Settle and Test Periods of Test 1 with the Memory Mode ON and approximately 50% of each time period completed.

Status Bar-Instrument Status during Charge, Settle and Time Periods



Status Bar-Test Complete

When a test is complete the Status Bar appears as below:



"READY" indicates that the instrument is prepared to run the next test. The number and test result indicate that "X" **cycles** have been run and that the last test was an "ACCEPT".

Note: The cycle number is related to the number of times the start button has been pressed, not the number of tests. A cycle may consist of more than one test.

Touching the Status Bar provides the operator direct access to the <Test Parameter> Screen (for the test indicated in the Program Bar), allowing the operator direct access to the program settings.

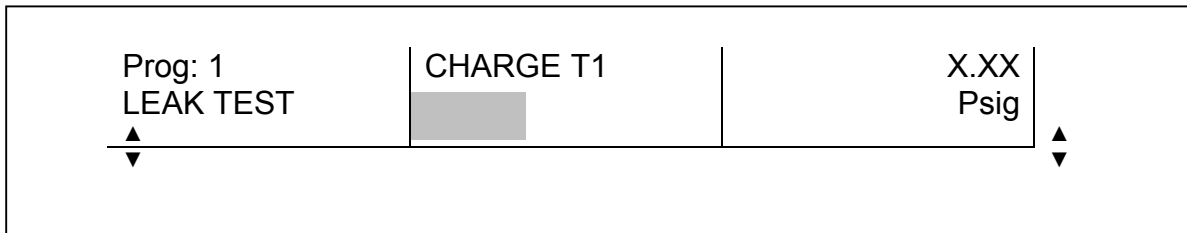
Main Screen Header Review

To review and summarize, the appearance of the Main Screen Header prior to the start of a test, while running a test, and after the completion of a test are shown below:

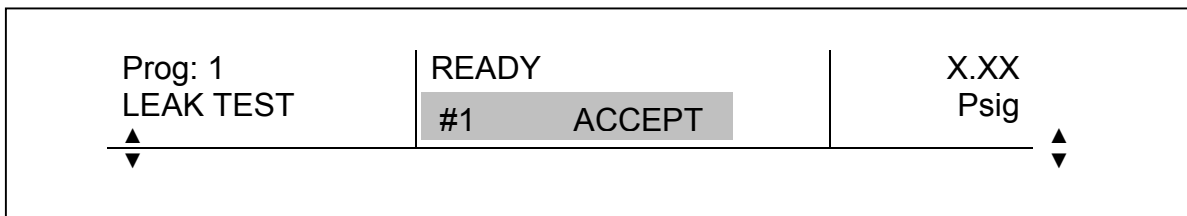
Main Screen Header-Prior to Test



Main Screen Header during Charge Period of a Test-Memory Mode “Off”-Keylock “Off”



Main Screen Header after Test Cycle



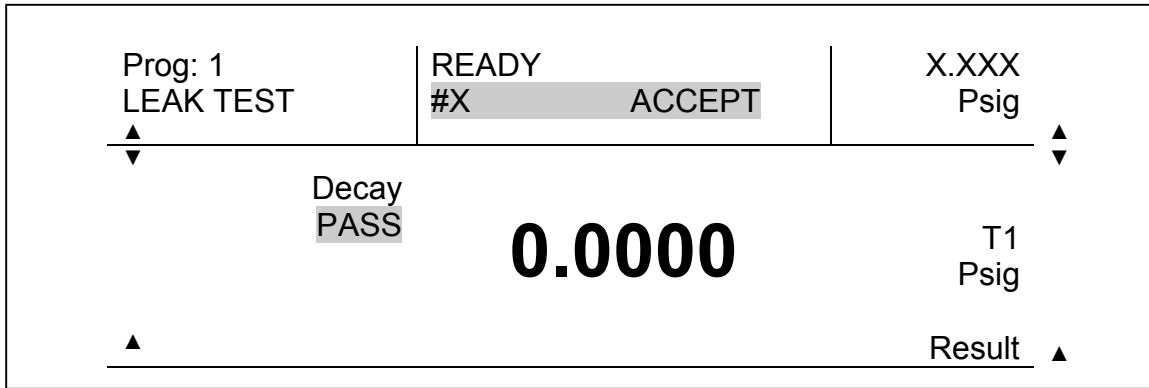
Main Screen Center

The center row of the screen is referred to as the Main Screen Center. This portion of the screen is blank prior to running a test. Touching this section of the screen allows the operator to go to the <Main Menu> Screen.

When a test is being run, the Main Screen displays the pressure during the various time periods of the cycle. At the end of the test the result is displayed in the center section of the Main Screen when the system is in the “Result” mode. This mode is indicated in the bottom right hand corner of the center of the main screen by the word “Result”.

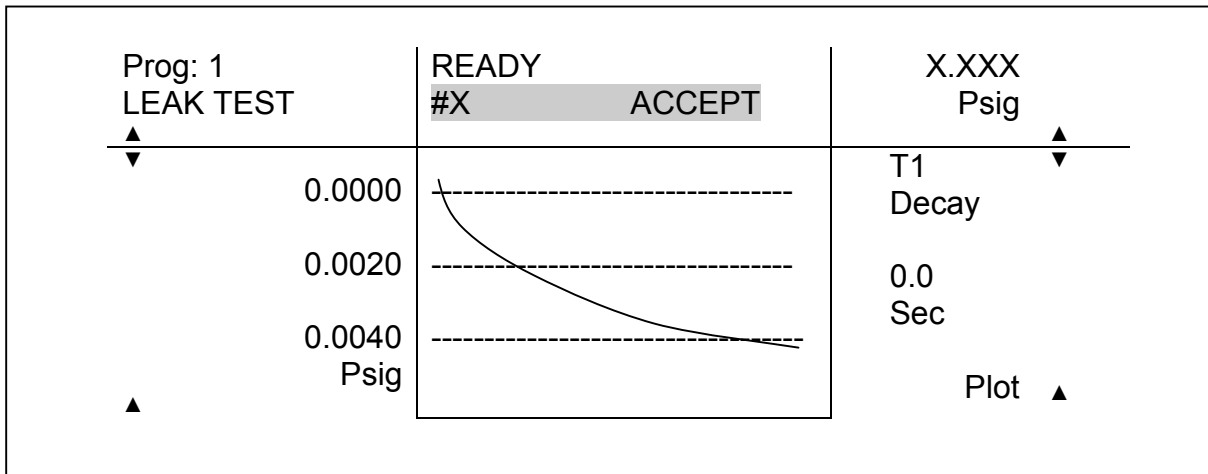
The Header and Main Screen Center are pictured below after completion of a test.

Header and Main Screen-After Test Completion-Result Mode-Test Result



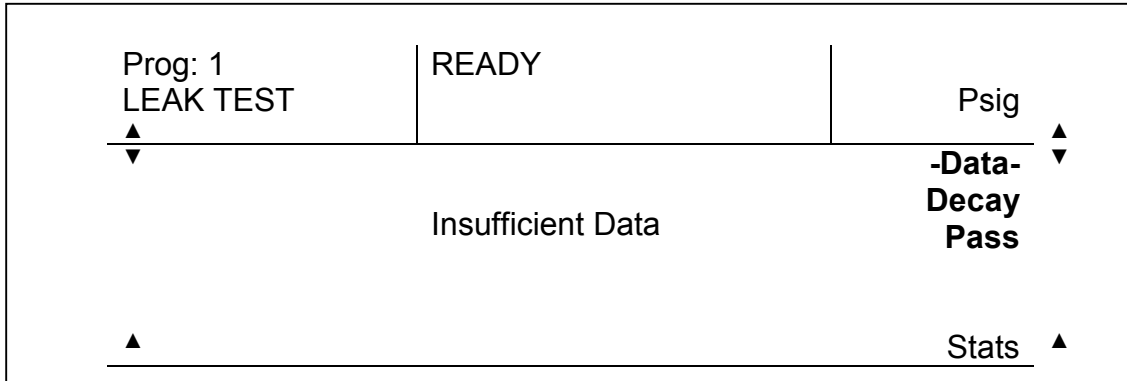
The test result may also be presented in a plot or decay curve format on the Main Screen Center as shown below

Header and Main Screen-After Test Completion-Result Mode-Test Plot



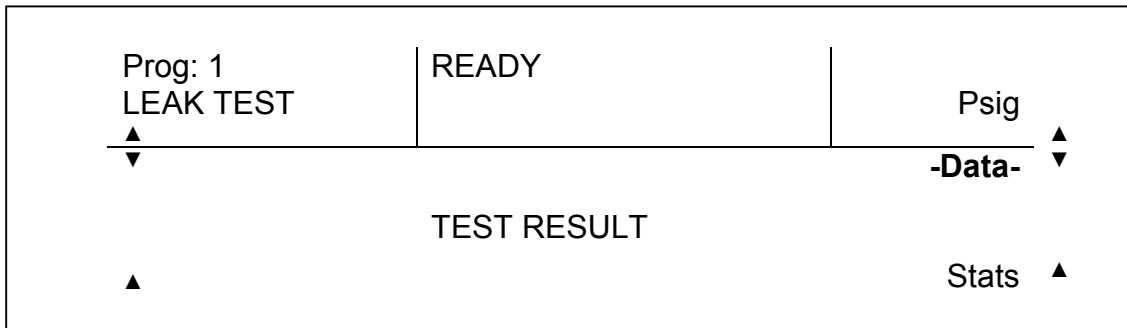
If the screen is in the “Stats” Mode (“Stats” appears in place of “Result”) when the test is complete and there is insufficient data to complete the statistical analysis, the screen indicates there is “Insufficient Data”. The informational basis for the statistical data display is presented in the upper right corner of the center section of the screen under the word “-Data-“.

Header and Main Screen-After Test Completion-“Stats” Mode-Insufficient Statistical Data Collected



If the system is in the “Stats” Mode and there is sufficient statistical data in memory the test result is displayed as shown below.

Header and Main Screen- After Test Completion-“Stats” Mode-Sufficient Statistical Data Collected



Each presentation of the Main Screen Center section in the various statistical modes is displayed below:

STAT MODE SCREENS

The Main Screen center section may be used to view graphical presentations of test statistics. The operator may choose from histogram, X Bar and R chart formats for data presentation.

Main Screen Footer

The bottom row of the Main Screen is referred to as the Footer. The Footer indicates the type of data displayed on the Main Screen. The data types include test data and Statistical Data. In the Test Data Mode the footer displays test information and data. The Footer displays in the Test Data Mode prior to and after running a test are depicted below:

Test Data Footer-Prior to running test

▲ ▼	Test Data	Result ▲ ▼
--------	-----------	------------------

Test Data Result Footer

▲ ▼	1 ACCEPT	T1 DECAY	0.000 InH2O	PASS	▲ ▼
--------	----------	----------	-------------	------	--------

The up (▲) and down (▼) arrows on the left side of the footer allow the operator to scroll through the test information. The following appear in the footer as the operator scrolls through the test data section of the display

Test Data Name Footer

This footer displays the Program name, lot number and operator identification information.

▲ ▼	Name: Lot #:	Result ▲ ▼	Oper:XXXX
--------	-----------------	------------------	-----------

Test Data Cycle Counter Footer

This footer displays the results for the number of cycles run. A cycle is one push of the Start button.

▲ ▼	CYCLES 0	ACCEPT 0	REJECT 0	Result ▲ ▼
--------	-------------	-------------	-------------	------------------

Test Data Test Counter Footer

This data summarized the test data in PASS/FAIL format.

▲ ▼	TESTS	PASS	FAIL	Result	▲ ▼
	0	0	0		

Statistical Data Footer

▲ ▼	X	σ	Max	Min	Stats	▲ ▼
--------	---	---	-----	-----	-------	--------

When the footer displays “Stat data” the up (▲) and down (▼) arrows on the bottom right of the screen provide Main Screen viewing of the various representations of the statistical representations of all program test data stored in the memory. See “**STAT MODE SCREENS**” above.

Full Main Screen Representations

The following represent the entire Main Screen during the various periods of a cycle when the screen is in the Result Mode.

Main Screen Prior to Running a Test

Prog: 1 LEAK TEST	READY	xxx.x Psig	▲ ▼
▲ ▼		Result	▲ ▼
Test Data			

Main Screen during the Charge period of Test 1 Program 1 Leak Test

Prog: 1 LEAK TEST	CHARGE T1	0.00 Psig
▲ ▼		▲ ▼
Presr	0.00	Psig
▲ ▼		▲ ▼
Test Data		Result

Main Screen at the Completion of Test 1 Program 1 Leak Test

Prog: 1 LEAK TEST	READY	Psig
▲ ▼		▲ ▼
	Decay PASS	0.0000
		T1 Psig
▲ ▼		▲ ▼
Test Data		Result

TME SOLUTION's Screen Menu Addresses

The following section of this manual discusses the operator-interactive screens in the TME SOLUTION. Accompanying each screen is a table that details each address on that screen, the screen movement after touching the address and the resulting actions that can be carried out by touching the each address on the new screen.

Prog: 1 LEAK TEST	READY		Psig
▲			▲
▼			▼
<-----	--MAIN SCREEN CENTER--	----->	
▲			Result
▼			▼
Test Data			

Main Screen Addresses

Menu Address	Select Address Result	Resulting Action
Program Bar/Function Key 1	Moves Main Screen directly to <Programs List> Screen via shortcut.	Allows operator selection of Program from <Programs List> screen. Touch "Exit" address returns operator directly to Main Screen.
Status Bar	Moves operator directly to the <Test Parameter> Screen for the test program indicated in Program Bar	Allows programming or reprogramming of a test parameter. Touch "Enter" address returns operator directly to Main Screen.
Pneumatic Regulator Control Bar/Function Key 2	See Status Bar	See Status Bar
Main Screen Center	Moves operator to <Main Menu> Screen	Allows operator to select from the Menu

Menu Address	Select Address Result	Resulting Action
Function Key 3 - Test Data displayed in Footer	Allows operator to scroll through Test data information while in the Main Screen. Provides access to Statistical Data when "Stat data" is displayed in the footer.	Test data information is displayed in the footer of Main Screen as operator scrolls through footer screens.
Function Key 3 - Stat. data displayed in Footer	Provides operator access to Statistical Data. See Function Key 4 below.	
Function Key 4	With "Stat. Data" displayed in the Left footer, the operator can scroll through the statistical representations of the test data. Operator must touch Function Key 4 to scroll through statistical displays in the Main screen.	Graphical representations of data are displayed in center of Main Screen. Operator may scroll and view Plot, Histogram, X-bar chart and R Chart as well as Result of previous test. While in this mode the operator may also scroll through test data information by touching Main Screen Function Key 3

Main Menu Screen

To go to the <Main Menu> Screen touch the center of the Main Screen. The <Main Menu> Screen below will appear on the screen.

<Main Menu>		
Pick a Program	Printer Reports	Alarm OFF
Set Parameters	Statistics and Datalog	Calib. Mode
Set Options		MemRef Store
Lot number:		MemRef *Clear
Operator:	Clear test Data	Exit

Menu Address	Select Address Result	Resulting Action
Pick a Program	Selection will move to <Programs List>	<Pick a Program> from those on the screen, OR PageUP (▲) or PageDN (▼) to scroll to a higher or lower number program OR Copy program parameters from one program to another OR Link/Unlink programs to/from each other. Touch "Exit" address to return to <Main Menu> Screen.

Menu Address	Select Address Result	Resulting Action
Set Parameters	Selection will move to the <Test Parameter> Screen for the Program Selected on the Main Menu. The <Test Parameter> Screen title indicates the type of test-Leak, Flow, Leak&Flow or Flow&Leak. The “Progm#” address indicates the Program number selected in the Main Menu Screen	Select desired test by touching “Test” address, set or change test parameters by touching each desired parameter address, OR select the number of ports by touching the “Ports” address, OR move to the <Set Options> Screen by touching the “Names&Options” address, OR return to the <Main Menu> Screen by touching the “Exit” address.
Set Options	Selection will move to the <Set Options> Screen.	Allows for entering program name, lot number, operator identification, OR setting or changing CLAMP, BLEED, PAUSE, FILL timers, OR setting Memory Mode-ON or OFF by touching “Memory Mode” address
Lot Number	Selection will move to the <Lot number> Screen	Allows for entering of a lot number OR a change to a lot number NOTE: With Data present change to a lot number moves to a Warning Screen-See “Clear Test Data” below

Menu Address	Select Address Result	Resulting Action
Operator	Selection will move to <Operator> Screen	Allows for entering of Operator identification. NOTE: With Data present a change to operator identification moves screen to a Warning Screen-See "Clear Test Data" below.
Printer Reports	Selection will move to the <Print/Send> Screen	Allows output of the last test result, Datalog, Statistics, or Programs including, if applicable, User Data to a Printer or RS232 Output by touching the appropriate addresses, OR allows advancement to a "New Page" of printed output, OR allows selection of "Autoprint" mode, OR allows selection of desired Printer Type, i.e.: Text, HP, EPSON, Continuous by touching "Printer Type" address, OR selection of RS232 Output format i.e.: Data, Text, or Stream format by touching "RS232 Output" address

Menu Address	Select Address Result	Resulting Action
Statistics and Datalog	Selection will move to the <Statistics & Datalog> Screen	Operator selects source and type of data to be used for the selected statistical analysis, OR allows for datalog viewing and output or clearing.
Clear Test Data	Selection will move to the WARNING! Screen	Notifies operator “ This Action Will Erase all Test Data ”, Operator must decide to erase data by touching “YES, ERASE” address OR decide to cancel request by touching “NO,Cancel” address.
Alarm	Selection Turns Alarm On or Off. Alarm Status is indicated in Alarm address by “ON” “OFF” indication.	In Alarm ON mode a loud beep will signal a test failure.
Calib. Mode	Selection will move to the <Calibration> Screen	

Menu Address	Select Address Result	Resulting Action
MemRef Store	Stores curve of next device tested as the Reference Curve in Memory When Memory Reference is activated the Block in Main screen reads: MemReg *Store “* Store” indicates that the Memory Reference function has been activated. NOTE: Memory Reference is only available for the first 32 test programs	When operator returns to the Main Screen the footer alerts the operator to “Connect the Reference Device(s) Press START when ready...”
MemRef Clear	Clears Reference Curve from Memory When reference curve has been cleared Main screen reads: MemRef *Clear “* Clear” indicates that the instrument Memory has been cleared of the Reference curve	
Exit	Returns operator to Main Screen	

Programs List Screen

Touch "Pick a Program" address on the <Main Menu> Screen and the screen will move to the <Programs list> screen and display 10 program options.

<Programs list>		
Program # 1	Program # 6	PageUP ▲
Program # 2	Program # 7	PageDN ▼
Program # 3	Program # 8	Copy
Program # 4	Program # 9	Link Unlink
Program # 5	Program # 10	Exit

<Pick a Program>

Menu Address	Select Address Result	Resulting Action
Program #	Touch "Program #" address to select program to run, and display returns the <Main Menu> Screen.	Touch "Exit" address on <Main Menu> Screen to return to Main Screen. Program # and type of test selected appear in Program Bar, OR Touch "Set Parameter" address on <Main Menu> screen and the selected program number screen appears with all test parameters available for verifying or setting.

Menu Address	Select Address Result	Resulting Action
PageUp (▲) or PageDN (▼)	Scroll to the next or prior 10 programs in the Program List The total number of available programs is 100.	Allows operator to select a unique program number for programming and/or use
Copy	Copy to? appears in the same location	Allows operator to copy the Highlighted program to another program #. Use PageUP(▲) or PageDN(▼) to scroll to desired Program number if it is not on the screen. Touch desired "Program Number" address to copy highlighted program parameters to the new program. After touching the new "Program Number" address the screen returns to the <Main Menu> Screen.

Menu Address	Select Address Result	Resulting Action
Link Unlink	Unlink appears in the Copy location and Link to? appears in the original location. Both positions are highlighted and blink.	Touch "Unlink" and the highlighted program is unlinked from the program it is linked to. Touch "Link to?" and touch the program the highlighted program should be linked to and the two programs are linked. The screen returns to the <Main Menu> screen. To verify linking is complete return to Main Screen and confirm that Program Bar indicates the first program number followed by an arrow and the program number of the linked program. For example: Prog:1 ► 3 indicates Program 1 is linked to Program 3. When unlinking verify previously linked program and arrow and linked program number have been deleted from the Program Bar on the Main Screen.
Exit	Returns operator to <Main Menu> Screen	

Set Parameters Screen

Touch the Set Parameters address on the <Main Menu> Screen and the screen will move to the <LEAK TEST> screen.

<LEAK TEST>			
CHARGE: Timer	0.0 Sec.		Progm# X
SETTLE: Timer	0.0 Sec.		Test LEAK
TEST : Timer	0.0 Sec.		Ports X
DECAY : Maximum	0.00000 Psig		Names& Option
PRESSR: Specif.	0.00 Psig	PRESSR ± Toler.	5.00 % Exit

Menu Address	Select Address Result	Resulting Action
Title Block	Indicates type of test	Title Block should agree with Test indicated in "Test" Address on this screen
Program #	Indicates program number highlighted and selected by operator from Program List	Touching this screen address returns operator to <Programs list> where the program # is highlighted
Test	Indicates the type of test selected. Operator selects Leak, Flow, Leak and Flow, or Flow and Leak test.	Touching this screen location changes the type of test to be programmed. The screen's title block and the test parameters displayed change to coincide with the test selected by the operator.

Menu Address	Select Address Result	Resulting Action
Ports	Touching this address block allows the operator to select the desired number of ports that will be used to run the test.	The number of ports can be set at 1, 2, 3 and 4 (or any combination thereof) depending on the number of ports in the instrument.
Names and Options	This address is a short cut to the <Set Options> Screen	Allows operator to name program, assign lot number and operator identification. Allows setting parameters for external devices. See <Set Options> Screen below.
Exit	Returns to <Main Menu> screen	
Test parameter addresses for selected test	Touch desired test parameter address, address is highlighted and keypad for number and unit selections is displayed. See "Setting Test Parameters" section below.	Allows operator to select, change or clear timers, pressure and units for each test parameter. Allows operator to view resolution of each parameter.

Setting Test Parameters

While in the <LEAK TEST> screen **touch** a test parameter address and a keypad comes up on the screen and allows the operator to set or change timers or pressure and the units of test.

<LEAK TEST>						
CHARGE:	0.0		0.1			Units
Timer	Sec.		Sec.			Chang
SETTLE:	0.0		1	2	3	Res
Timer	Sec.					
TEST :	0.0		4	5	6	±
Timer	Sec.					
DECAY :	0.00000		7	8	9	Clr
Maximum	Psig					
PRESSR:	0.00	PRESSR				
Specif.	Psig	± Toler	•	0	Enter	

<PROGRAM NAME>

To select Charge timer **touch** “Charge timer” address. Enter the desired time and units and **touch** “SETTLE Timer” address. **Touch** the desired time and units. Touch the “TEST Timer” address and proceed as above for each of the remaining parameters that need to be set. Once all parameters are set return to the <Main Menu> Screen and proceed to <Set Options>screen.

Set Options Screen

Touch the “Set Options” address on the <Main Menu> screen and the <SET OPTIONS> screen will appear on the display:

<SET OPTIONS>		
Program name:	CLAMP Timer Sec.	0.0
Lot number:	BLEED Timer Sec.	0.0
Operator:	PAUSE Timer Sec.	0.0
	FILL Timer Sec.	0.0
Memory Mode OFF		Exit

Each of these addresses allows the operator to enter specific information for the test being programmed. The following details how to enter the desired information.

Entering Program Name, Lot Number and Operator Information

To enter Program name, Lot number, or Operator information **touch** the desired address on the screen. An alphanumeric keypad comes up on the screen with the item being entered. For example when creating the program name the following screen appears:

<Program Name>									
Clr	L								<-
•	,	@	#	%	&	/		<	>
1	2	3	4	5	6	7	8	9	0
A	B	C	D	E	F	G	H	I	J
K	L	M	N	O	P	Q	R	S	T
U	V	W	X	Y	Z	Spc	▲	Exit	

To create a program name **touch** the first letter of the name, the letter appears in the center box in the top row. Up to fifteen (15) characters may be used for a program name. **Touch** “Clr” to clear the entire entry. **Touch** “<-” to back space and delete one symbol. **Touch** “Spc” to enter a space in the program name. **Touch** “▲” and this key is highlighted indicating that it is locked “ON”. When “▲” is locked “ON” the symbols above the numbers in the second row are entered when a number key is touched.

Lower case letters are entered with the “▲” key in the “ON” position when a letter is touched. When the entire program name is entered, touch “Exit” and the screen returns to the <Set Option> Screen and the Program name appears in that block on the screen.

NOTE: When a Program is given a name that name will appear in the bottom of the <Test Parameters> Screen.

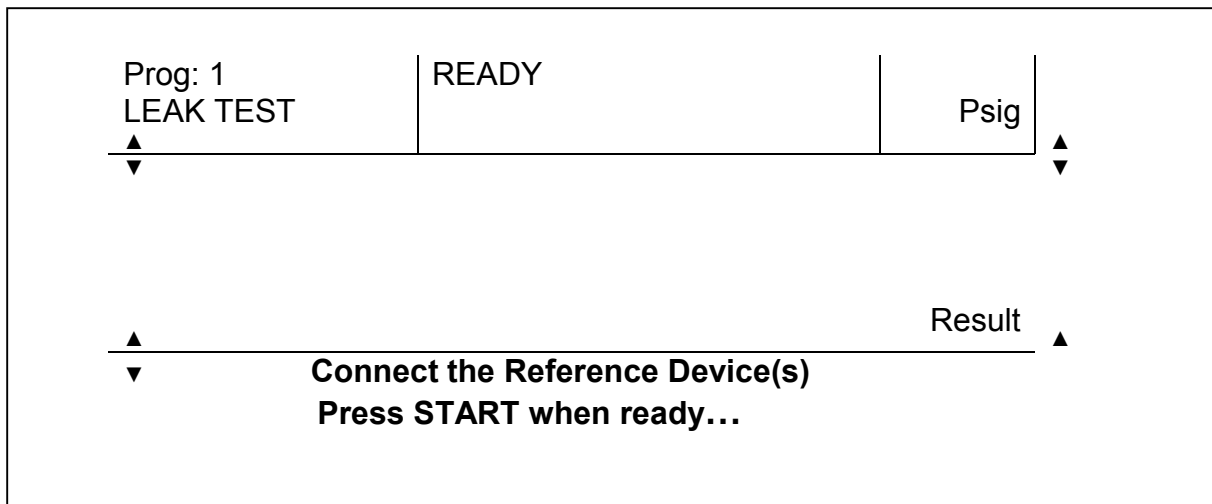
The same sequence is followed to enter the Lot number and the Operator identification.

Memory Mode-ON/OFF Selection

The Memory Mode can be turned “ON” or “OFF” by touching the “Memory Mode” address block.

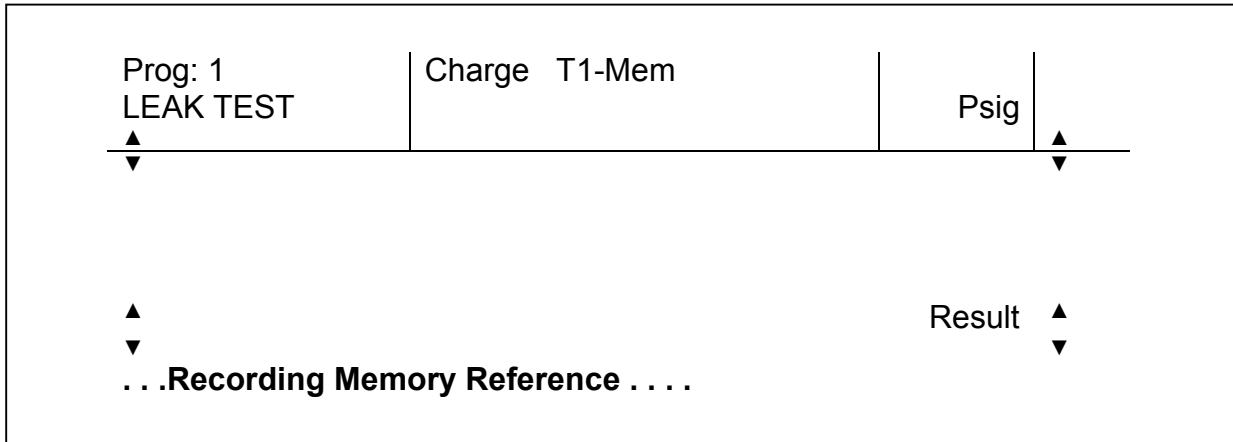
Memory Mode ON-When the Memory Mode “ON” is activated the instrument will memorize and store the test curve produced by the next item tested. This curve is stored for reference and the curve from each subsequent test is compared to the reference curve. The fact that the Memory Mode is “ON” is indicated on the Main Screen as shown below.

Main Screen Indicating Memory Mode is “On” and Instrument is prepared to memorize reference curve(s)



Prior to running any tests the operator must run a test on the memory device(s) in order to record the reference curve. When a reference device test is being run the Main screen indicates this as shown below:

Main Screen during Charge Period of Testing of Reference Device(s)



Memory Mode OFF-The memory reference curve is cleared from instrument memory.

Clamp, Bleed, Pause and Fill times are set in the same way as the test parameters are set. **Touch** the time to be set and the numeric keypad will appear on the screen. For further detail see the “Set Test Parameters” section. See Clamp, Bleed sections of this manual for more information.

When all required information has been entered in the <Set Options> screen **touch** the “Exit” address and the screen returns to the Main Menu Screen. The Lot number and Operator information appear in those addresses on the Main Menu screen.

Print/Send Screen

The TME *SOLUTION* can send data to a printer* or to a computer. The printer and the RS232 connections are located on the back of the instrument. If the printer and /or the RS232 is/are connected and ready the TME *SOLUTION* will send and print the selected data with a touch of the screen. The <Print/Send> screen is pictured below:

*

<Print/Send>		
Last test	Autoprint: ON	Test Plot
Datalog	User Data: ON	x̄ & R Charts
Statistics	Print to: PRINTER	Histog
Programs	Printer Type: TEXT	All Report
New Page	RS232 Output STREAM	Exit

The table below details the result of touching each of the indicated Menu addresses on the <Print/Send> Screen.

Menu Address	Select Address Result	Resulting Action
Last test, Datalog, Statistics, Programs, Test Plot, x-Bar & R Charts, Histogram, All Report	These addresses indicate the type of data that will be output to the selection displayed in the "Print to" address	Data is output to the printer or computer screen. If data is printed the word <Printing> appears at the bottom of the screen
New Page	Moves page currently in printer to be released and printing will begin on a new page.	
Autoprint, User Data	Allows for "ON"/"OFF" selection of "Autoprint" mode and "User Data"	
Print to	Allows selection of device data is output to and printed from.	Allows operator to select Printer or RS232 output. Selection appears in the "Print to" address

* Printer-Parallel interface (Centronics), 80 column.

Menu Address	Select Address Result	Resulting Action
Printer Type	Allows selection of mode of printer output	Allows operator to select "HP", "EPSON", "TEXT", or Continuous print out. Selection appears in the "Printer Type:" address
RS232 Output	Allows selection of mode of RS232 output	Allows operator to select "TEXT", "STREAM" or "DATA" output format
Exit	Returns to Main Screen	

The operator connects the desired output device to the TME SOLUTION™ and enters the required input in the "Autoprint", "User Data" "Print to", "Printer Type" and if applicable the "RS232" addresses on the <Print/Send> screen. To send and print the operator touches the desired selection address on the "Print/Send" screen. Printer output will be as it appears on the TME SOLUTION's display.

V2.3 RS232 Input/Output Functions

The **SOLUTION™** RS232 Port is configured as tabulated below:

Item	Setting	Remarks
Baud	9600	Not adjustable
Bits	8N1	8 data, No parity, 1 stop
Handshake	Null modem	No flow control

The RS232 Input Commands and Output Formats are detailed below for Text, Stream and Data Modes.

Input Commands

When a Single character command is received, it is interpreted immediately. All other characters are buffered until a <CR> character is entered. The buffer is then converted to a number to be used for program selection. The table below details the RS 232 commands.

Item	Code	Actions
Select Pgm#	'NN+CR'	Selects the 'NN' Program Number Redraws the Screen to Show New Number
Start	'S'	Starts a Test
Reset	'R'	Resets the Current Test
Program	'P'	Sends the Current Program Settings
Datalog	'D'	Sends the Contents of the Datalog
Statistics	'X'	Send the Statistics

Output Format

To set the RS232 Mode touch the middle of the “READY” Screen. When the <Main Menu> Screen is displayed touch the “Printer Reports” address to display the <Print/Send> Screen. Touching the “RS232” address allows selection of TEXT, STREAM or DATA mode output format.

Text Mode

Selection of this mode results in test data being sent in a printable format, including tabs, spaces, etc. This mode formats and prints the data in the same format as the “Last Test Report” format.

Stream Mode

The STREAM Mode Format sends test data in a comma-separated format. This mode is used when easily separated output is required.

Field	Bytes	Description	Example
Cycle#	5	Test cycle number	“15” : Cycle #15
Cycle Result	6	Overall result for the cycle	“ACCEPT” or “REJECT”
Test #	3	Test number	“T2”: Second test in the cycle
Stats Tag Datalog only	1	Marks the statistical tests with an asterisk (*). Used only with datalog	“*” Test included in statistics “ ” Test excluded from statistics
Test Mode	5	Type of test (Decay, Flow...etc.)	“Decay”
Data	7	Measurement	“0.0001”: Decay value
Units	5	Units of measure	“Psig”
Test result	4	Result of the test	“PASS” : Test #2 PASS
Time	6	Time	12:34a” : Time of test
End of line	1	New line marker	<CR>
Repeated times	“n”	When sending a multi-test cycle, Repeat for every test in the cycle.	When sending the datalog, Repeat for every test in the datalog.
End of block	1	New block marker	<LF>

Data Mode Format

The DATA Mode Format sends only measurement data and therefore should be selected when the test result is the only significant information required.

Field	Bytes	Description	Example
Data	7	Measurement	"0.0001" :Decay value
End of line	1	New line marker	<CR>

Statistics and Datalog Screen

<Statistics& Datalog>		
— X-UCL	Data Source	Datalog View
— X-LCL	Data Type	Datalog Print
R-UCL	Data Port	Datalog RS232
R-LCL		Datalog Clear
Calc: UCL, LCL Min: n	Sample Size [N]: x	

Menu Address	Select Address Result	Resulting Action
Data Source	Allows operator to select the source of the data to be presented or analyzed.	Operator selects Test Type - Decay, Test #'s, etc.
Data Type	Allows operator to select all "PASS" results, all "FAIL" results or both	
Data Port	Allows operator to select the ports from which the data source and type are to be selected. ALL ports, Port 1, &/or 2, &/or 3, &/or 4 etc.	
Datalog View	Displays the <Datalog> screen	This screen displays individual test information and results for all tests in the Datalog
Datalog Print	Sends the Datalog view to the printer for printing	
Datalog RS232	Sends the Datalog view to a computer screen for viewing.	
Datalog Clear	Clears all data in the Datalog	
Sample Size	Allows operator to select subgroup sample size for process control applications.	

Menu Address	Select Address Result	Resulting Action
Calc: UCL ,LCL Min:	Allows for automatic calculation of the Upper and Lower Control Limits for the Process X Bar and R Charts	
— X-UCL	X Bar upper control limit	
— X-LCL	X Bar lower control limit	
R-UCL	R chart upper control limit	
R-LCL	R chart lower control limit	

Calibration Screen

To display the <Calibration> Screen move to the <Main Menu> Screen and touch the “Calib Mode” address. This will move the display to the <Calibration Screen> as shown below.

Calibration Screen

< Calibration >			
▲TA <0-100>	XX.XX Psig	0% 0.0	Psig Set ▲
		25% 25.0	Psig Set ▼
		50% 50.0	Psig Screen Contr.
Supply: (Span)	ON	75% 75.0	Psig Time & Date
Bleed: (Zero)	OFF	100% 100.0	Psig Exit

The table below details the result of touching each of the indicated Menu addresses:

Menu Address	Select Address	Result	Resulting Action
▲T <0-100>	XX.X Psig	Allows selection of internal or port transducers for calibration check. Displays monitored pressure of transducer being checked. Indicates full range of indicated transducer and units of measure.	TA selects internal transducer for calibration check, T1 the port 1 transducer, T2 the port 2 transducer, etc.
Supply: (Span)	ON	Allows opening and closing of air supply valve.	“ON” opens air supply valve and allows pressure from regulator to reach transducers, “OFF” closes air supply valve.
Bleed: (Zero)	OFF	Allows selection of “ON” or “OFF”	In “ON” mode opens bleed valve to allow transducers to “see” atmospheric pressure, “OFF” closes the bleed valve.

Menu Address	Select Address Result	Resulting Action
Screen Contrast	Allows operator to adjust contrast on screen.	Touch “Set ▲” and “Set ▼” addresses to set desired screen appearance.
Time & Date	Allows operator to input date and time.	Touch “Set ▲” and Set ▼” addresses to set time, AM or PM, and date MM/DD/YY
Exit	Returns display to Main Screen	
0%, 25%, 50%, 100%	No operator access. For operator reference only. These addresses indicate normal calibration points as a % of the transducer’s full scale.	

Calibration Check

The following example demonstrates the procedure for checking the calibration of the transducers in the TME *SOLUTION*.

Example:

The transducer for Port 1 will be checked for its calibration using a pressure gage with a full scale of 10.000 Psig. The instrument range is 0 to 10.00 Psig.

Procedure Overview

- 1.) Select Port 1 Transducer to check
- 2.) Attach gage to Port 1
- 3.) Check Zero
- 4.) Turn Supply “ON”
- 5.) Adjust regulator to 10.00 Psig using pneumatic regulator control knob in the back of the instrument.
- 6.) Check the instrument at 2.5, 5.0 and 7.5 Psig.

Step 1-Select transducer(s) to be check

Touch the “▲T” address to select the port number to be checked. ▲T1 indicates that the Port 1 transducer is selected. The <0-10> under ▲T1 indicates the full range of this transducer.

Step 2-Attach gage to Test Port 1

Connect the gage to Test Port 1

Step 3-Check Zero

Touch the “Bleed” address. With the Bleed valve “ON” verify that the instrument displays a Psig of $0\pm\frac{1}{2}\%$ of the test gage’s full scale in the “▲T1” address.

< Calibration >			
▲ T1 <0-10>	0.0 Psig	0% 0.0	Psig Set ▲
		25% 25.0	Psig Set ▼
		50% 50.0	Psig Screen Contr.
Supply: (Span)	OFF	75% 75.0	Psig Time & Date
Bleed: (Zero)	ON	100% 100.0	Psig Exit

Step 4-Turn Supply “ON”

Touch the “Supply” address and verify that the Supply is “ON”.

< Calibration >			
▲ T1 <0-10>	0.00 Psig	0% 0.0	Psig Set ▲
		25% 25.0	Psig Set ▼
		50% 50.0	Psig Screen Contr.
Supply: (Span)	ON	75% 75.0	Psig Time & Date
Bleed: (Zero)	OFF	100% 100.0	Psig Exit

Step 5-Check Full Scale

Adjust the pneumatic pressure regulator until gage reads the full range of the transducer being checked. Full scale of Transducer 1 is 10.00 Psig. Verify that transducer #1’s pressure displayed in the “▲T1” address is within the range $10.00\pm\frac{1}{2}\%$ of the test gage’s full scale.

Step 6-Check Set Points

Adjust the pneumatic pressure regulator to 25%, 50% and 75% of the transducer’s full range-i.e.: 2.5, 5.0 and 7.5 respectively. Verify that the “▲T1” address displays a pressure at each set point that is within $\pm\frac{1}{2}\%$ of the gage’s full scale.

If any of the readings are outside of the tolerance range the instrument should be returned to the factory for Calibration.

WARNING SCREEN

The <Warning Screen> on the display when an address is touched that could result in a change in a parameter or data stored in memory.

WARNING!

ANY CHANGES WILL ERASE ALL TEST DATA

DO YOU WISH TO CONTINUE?

YES.
ERASE

NO.
CANCEL

Touch “NO” address returns operator to previous screen.

Touch “YES” address and all data in memory is cleared. Display shows “Data Erased” and beeps as this is done.

Introduction to Leak Testing	72
Delta P Curve Memorization	74
Typical Decay Curves	75
Establishing Test Specifications	76
Setting the TME <i>SOLUTION</i> Parameters	77
TME <i>SOLUTION</i> Normal Leak Test Cycle	79
Programming a Normal Leak Test (Vacuum or Pressure)	81
Running a Leak Test	86
Using the Set Options Mode	90

INTRODUCTION TO LEAK TESTING

Leaks can be detected in several different ways. Test methods range all the way from looking for a bubble (Bubble Testing) to testing for a few molecules of a tracer gas (Mass Spectrometer testing). The Bubble Test method seems efficient at first but its faults of high per unit cost due to handling, potential bacterial contamination of product, and operator “judgment” calls soon become apparent. The Mass Spectrometer Test method, on the other hand, carries a very high price tag as well as a high per unit cost. This method is more useful in testing for permeability than actual leaks.

A third test method known as the Pressure Decay Test method provides sensitive testing with simplified methods. A Pressure Decay Tester is must less costly than a Mass Spectrometer and has a lower per unit cost when compared to both the Bubble Test and the Mass Spectrometer Test. Pressure Decay testers monitor a gas pressurized part, or parts, for a decrease (or decay) in pressure during the test period. This decay is attributed to a leak in the part.

There are two types of pressure decay testers-the Differential Pressure Decay tester and the Single Ended Pressure Decay tester. As the term Differential implies, the Differential Pressure Decay test is looking for a difference in pressure decay between at least two volumes. One of these volumes should be a reference-a known non-leaker. If there is no known leak-free volume, it is difficult to determine if both units are leaking, with one leaking more than the other, or if only one unit is leaking. The Single End Tester is engineered to avoid the problems associated with reference part quality. Its simple air handling system pressurizes one unit and watches for a decay in the test pressure.

Both of these testers pressurize a gas and must deal with the physical effects of gas pressurization. When a gas is pressurized its temperature increases. This is known as “Adiabatic Heating”. As this heat dissipates, the gas temperature and pressure decrease. Additionally, if the item being tested is flexible, its walls will expand during and immediately after pressurization. This expansion will also cause a pressure decrease.

The Differential Pressure Decay tester tests two or more units at the same time in order to cancel out the non-leak decay. The Single Ended tester will either compensate for the decay, (using mechanical, electrical or mathematical compensation), or incorporate the decay into the test by utilizing long stabilization periods or curve memorization-“ ΔP ”. “ ΔP ” is equivalent to “Delta P” and refers to changes in pressure. In this Manual “ ΔP ” refers to Pressure Decay.

The TME *SOLUTION* is a Single End Pressure Decay System. As the term “pressure decay” implies, the tester is looking for a minute decrease (decay) in pressure in the tested part. The TME *SOLUTION*'s air handling system pressurizes the test volume

and monitors this pressure over time. Any decrease in the monitored pressure is known as “Pressure Decay” and is attributed to a leak.

Since the TME *SOLUTION* pressurizes a gas to perform the test, it must deal with pressure decay due to “Adiabatic Heating” and test part flexibility. The TME *SOLUTION* uses a “Settle” or equilibration period to accommodate the cooling and expansion of the gas and the test part. After the “Settle” period is completed the test cycle begins and the instrument then monitors pressure changes due to leakage from the test part.

DELTA P CURVE MEMORIZATION

The pressure decay due to adiabatic heat dissipation and expansion are factors that can influence the sensitivity of any Pressure Decay Leak Tester. The Single Ended testers have either compensated for the decay or excluded it from the test by using long, pre-test stabilization periods. This gives the Differential testers an advantage in sensitivity and speed. However, improved electronic technology has decreased this advantage.

Testers using a computer to analyze and record the pressure decay due to adiabatic heat dissipation and expansion have shown that pressure decay (Delta P) is the same for comparable parts. When pressure decay is plotted versus time a Pressure Decay Curve is created. The Pressure Decay Curve varies with the introduction of a leak into the test part. The curve changes from a characteristic round shape (exponential decay curve) to a straight line. See Typical Decay Curves below.

A microprocessor based leak tester, such as the TME *SOLUTION* is capable of evaluating and storing in memory the pressure decay curve of a leak free reference part. Once the reference part's pressure decay curve is stored in the leak tester memory, the decay curve of each subsequent unit tested can be compared to the reference unit's curve on a point by point basis at a rate of several thousands times a second. This allows the test to begin almost immediately after the unit is fully pressurized, eliminating the need for long stabilization times. Also, since the unit leak rate is being compared against the memorized ΔP curve, there is no need for the compensation mechanisms that are built into non-microprocessor based Single Ended Leak Testers. There is also no need to run test parts at the same time as the reference part as is required by Differential Pressure Decay Testers.

The TME *SOLUTION* being a microprocessor based Leak tester combines the simplicity of a Single Ended leak tester with the sensitivity and speed of a Differential Tester.

MODES OF OPERATION

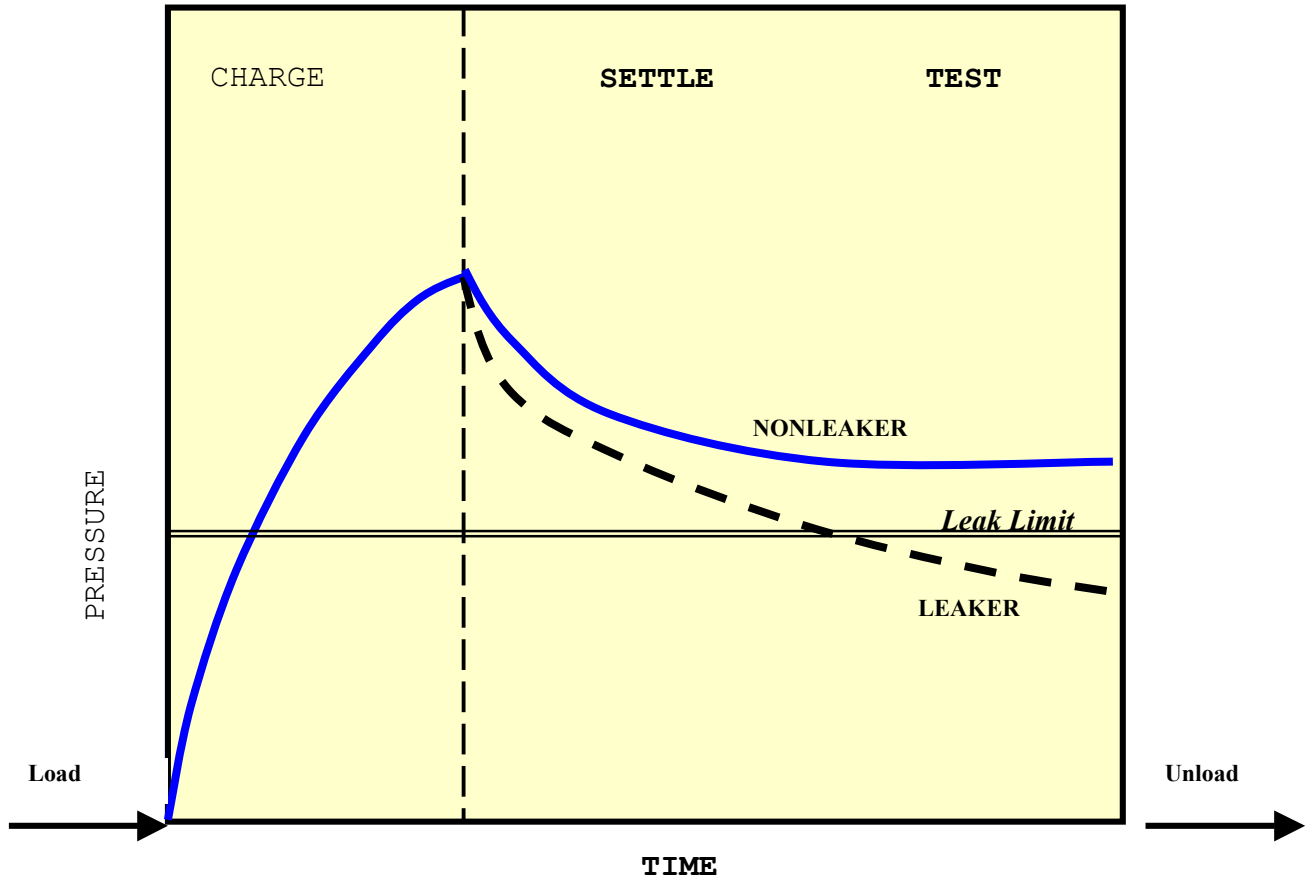
The *SOLUTION* can be used in two different modes of operation:

- Normal, or
- Memory Mode.

The Normal Mode is a straight pressure decay measurement used for parts that exhibit low heat absorption and/or low elasticity. Normal Mode in the *SOLUTION* is run with the Memory Mode OFF.

The Memory Mode or Delta P Reference Mode is used for improved speed in parts that exhibit high heat absorption and/or high elasticity. The reference mode is run with the Memory Mode ON.

TYPICAL DECAY CURVES



ESTABLISHING TEST SPECIFICATIONS

Prior to setting the *SOLUTION* controls the following information needs to be established for the item to be tested.

Product Description

The following items will influence the design of the test program.

How will the item be used? Will it contain air or liquid? What pressures will the item be subjected and for what period of time? What is the elasticity of the item? What are the heat absorption properties of the item - material, temperature, volume?

Production Requirements

What test time will fit with the production process? What is the desired sampling rate or frequency?

Define the Leak Test Specifications

In determining the test specifications consider the system's internal volume, the test temperature, the test time and the density of air versus liquid. Establish the minimum leak rate to be detected by the test.

Establish Test Parameters

Identify the test time and test pressure that will detect leaks that correlate with the results of previous test methods.

SETTING THE TME *SOLUTION* TEST PARAMETERS

SET CHARGE TIMER

This timer controls the amount of time that the *SOLUTION* will use to pressurize the part to be tested. Allow sufficient time for the pressure inside the part to reach the required test pressure. Use short charge times for small parts/volumes and long charge times for larger parts/volume items.

SET SETTLE TIMER

This timer controls the amount of time that the *SOLUTION* will allow the part to stabilize after pressurization. When setting this timer set sufficient time for the pressurized part to stabilize (equilibrate) to account for adiabatic cooling and elastic expansion.

Metallic devices, devices with large surface areas or devices that are colder than normal tend to absorb large amounts of heat from the pressurizing gas. The heat loss due to dissipation of heat to the walls of the device will show up as pressure decay during test.

Soft, flexible or otherwise compliant devices will expand when pressurized increasing the volume of the part. This volume increase will also show up as pressure decay during test. Some devices are so flexible that restraining by means of a fixture may be necessary to stop the expansion.

The settle time should be set long enough to allow the part to reach 90 to 100% of its equilibrium state. The equilibrium state is reached when the part no longer expands and the temperature of the device is the same as that of the test gas. There is no universal settle time that can be used since the time required to reach equilibrium depends on the volume of the part, its material of construction, its thickness, the test pressure and the test temperature. Settle time can only be determined through actual tests.

When the memory mode is used, shorter settle times can be set because the expansion and cooling are already part of the reference curve (ΔP), again actual tests are the only way to determining the timer settings.

SET TEST TIMER

The test timer controls the amount of time that the *SOLUTION* will check the decay of the test device. The Test Timer should be set for the time required to detect a leak. Set a short test time when detecting large leaks and a long test time to detect small leaks. To increase reliability the test timer should be set for the time required to see a minimum difference of 3 to 4 decay steps between good and bad parts. Five or more steps is most desirable. A "Decay Step" is the smallest amount of pressure decay that the instrument can detect, i.e.: resolution of the instrument.

TEST PRESSURE

Test pressure is the pressure to be used during testing. It is also known as the Specified Pressure. This pressure is set by manually turning the regulator knob at the back of the instrument until the desired pressure is displayed on the Main Screen Display in the Pneumatic Regulator Control Bar.

TEST PRESSURE TOLERANCE (\pm % OF TEST PRESSURE)

The selected test pressure tolerance is the amount that the regulator can vary and not stop a test.

If the pressure of the regulator varies outside of the tolerance range, the instrument will not allow the test to begin.

DECAY LIMIT

The decay limit is the pressure decay threshold used to determine a REJECT or FAILURE. Typically, the decay limit is set 3 to 5 decay steps above the maximum decay of an acceptable part. For example, if the maximum decay of an acceptable part is 1.0 InH₂O at a resolution of 0.2 InH₂O, the decay limit must be set at least at 1.6 or 2.0 InH₂O in order to allow a clear distinction between an acceptable and rejectable part.

NOTE: Settings of below 3 decay steps are not recommended unless the leaks are large.

GROSS LEAK

This setting is used to detect parts with large leaks during the **CHARGE** and **SETTLE** periods. The TME *SOLUTION* compares the pressure inside the part to the preset standard test pressure. If the pressure drops by an amount equivalent to the Minus tolerance on the pressure of the part then the part will be rejected

Small or rigid parts can work with a smaller \pm % tolerance of standard test pressure setting. Large or flexible parts will need a larger \pm % tolerance of the standard test pressure to allow for variations from part to part and pressure drops due to normal expansion of the part.

NOTE: A gross leak on one test port of a multichannel instrument may cause a Gross Leak failure to be indicated on all ports. A Maximum Leak Rate may need to be determined during test set up and is dependent on test application.

TME SOLUTION NORMAL LEAK TEST CYCLE

The TME *SOLUTION* Leak Test consists of three periods: CHARGE, SETTLE and TEST. The leak test begins when the START button is pressed. The part is pressurized to the specified pressure. This part of the cycle is called the CHARGE portion of the cycle or pressurization period.

If at the end of the CHARGE the pressure inside the part is less than the % tolerance setting, the device being tested is considered a “REJECT” and the result is a Gross leak failure and the cycle stops. If the pressure inside the part is within the selected pressure tolerance range the instrument will move to the “SETTLE” portion of the cycle.

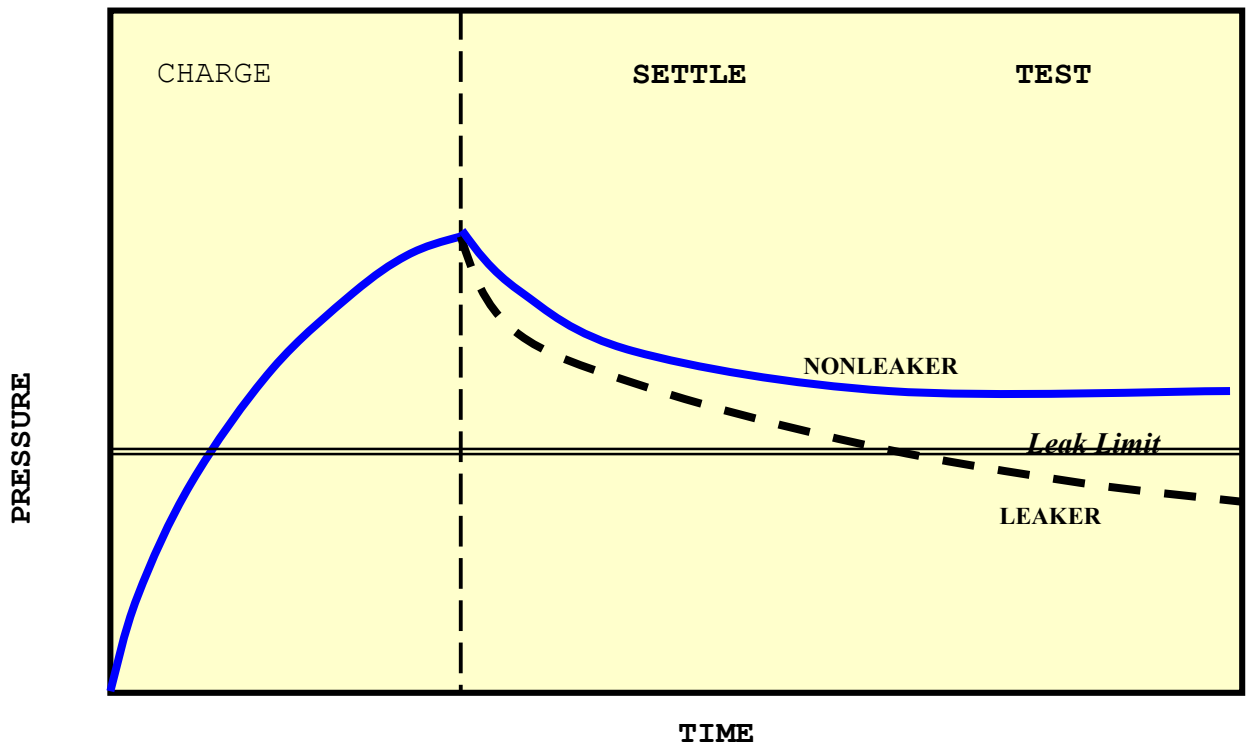
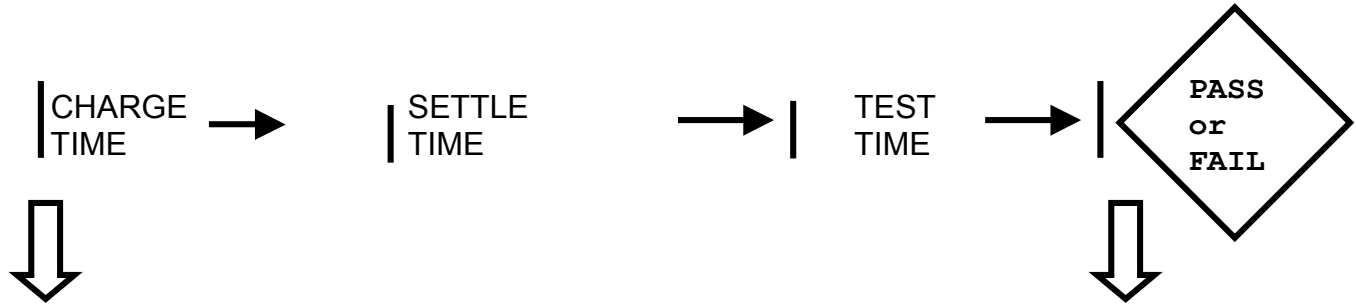
The “SETTLE” portion of the cycle allows the part to expand and cool before it goes into the “TEST” portion of the cycle. If the pressure detected is below the standard pressure tolerance during the “SETTLE” time the part is rejected as a “GROSS” leaker. The standard pressure range (\pm % Tolerance) should be set high enough so that good parts are not rejected due to their normal expansion and cooling. A “Gross” leaker decays far more than a good part, therefore, it can be detected before the actual “TEST” portion of the cycle begins. If the pressure is within the set tolerance range during the “SETTLE” time the TME *SOLUTION*[™] will initiate the “TEST” portion of the cycle.

During the “TEST” portion of the cycle the pressure decay of the part is monitored and compared to the preset Decay Limit. If the Decay exceeds the preset limit then the device is “REJECTED” and the result is displayed on the screen as “LEAK - FAIL” and the Red “Reject” light is lit up. If the decay is less than the decay limit the part is “ACCEPTED” and the display reads “LEAK - PASS” and the green “ACCEPT” light is lit up.

TME SOLUTION NORMAL LEAK TEST CYCLE

START TEST

END TEST



PROGRAMMING A NORMAL LEAK TEST (VACUUM OR PRESSURE)

The following example demonstrates the procedure for programming the TME *SOLUTION* to run a Normal Pressure Decay Leak Test.

NOTE: The TME *SOLUTION* configuration must be a pressure instrument to program a pressure decay leak test. If the instrument's configuration is a vacuum instrument, then a vacuum decay leak test must be programmed.

Program #25 will be programmed for testing a part at 10.0 psi \pm 10% for 4 seconds with a charge time of 2 seconds allowing 3 seconds for settle, and having a Decay pressure limit of 0.5 inches of water.

Procedure overview

- 1.) Select Program #25
- 2.) Set Leak Test Program Parameters:
 - Charge time: 10.0 seconds
 - Settle time: 3 seconds
 - Test time: 4 seconds
 - Decay pressure: 0.5 Psig
 - Pressure: 10 psi
 - Pressure tolerance: \pm 10%
- 3.) Adjust Pressure Regulator to Programmed Pressure
- 4.) Run the test.

Step 1-Select Program #25-

Touch the center of the Main Screen to display the Main Menu Screen. **Touch** "Pick a Program" address to display the Program list screen. **Touch** the PageUP(\blacktriangle) address or PageDN (\blacktriangledown) to move to the Program list that contains Program 25. **Touch** "Program # 25" address to bring up the Main Menu display.

Step 2-Set Leak Test Program Parameters

Touch the "Set Parameters" address on the Main Menu display to get the Program 25 Leak Test Display:

< LEAK TEST >

CHARGE: Timer	0.0 Sec.		Progm# 25
SETTLE: Timer	0.0 Sec.		Test LEAK
TEST : Timer	0.0 Sec.		Ports X
DECAY : Maximum	0.00000 Psig		Names& Option
PRESSR: Specif.	0.00 Psig	PRESSR \pm Toler.	5.00 % Exit

Note: The test to be programmed is a “Leak Test” as indicated by the screen’s title block and the word “LEAK” displayed in the test address box. If the Screen’s title block does not indicate Leak Test, **touch** the “Test” address until “LEAK” is displayed in the title block and the “Test” address.

Step 2.1-Program Charge Timer

Touch the “Charge Timer” address to bring up the keypad on the display:

<LEAK TEST>

CHARGE: Timer	0.0 Sec.		10.0		Units Chang
SETTLE: Timer	0.0 Sec.		1	2	3 Res
TEST : Timer	0.0 Sec.		4	5	6 ±
DECAY : Maximum	0.00000 Psig		7	8	9 Clr
PRESSR: Specif.	0.00 Psig	PRESSR ± Toler	•	0	Enter

Touch the keypads “1”, “0”, “•”, and “0”. As the keypads are touched the number or symbol selected is displayed in the box next to the “Units Chang” address. For example, the “10.0” seconds selected for the Charge Timer appear as shown above.

NOTE: Do not touch the “Enter” address until all program parameters have been selected. Touching the “Enter” address after selecting any of parameters will return the screen to the <Main Menu> Screen. To return to the <Leak Test> Screen touch the “Set Parameters” address.

Step 2.2-Program Settle Timer

Touch the “SETTLE Timer” address.

Verify the “CHARGE” and “SETTLE” timer addresses appear as pictured below:

CHARGE: Timer	10.0 Sec.
SETTLE: Timer	0.0 Sec.

Touch keypads “3”, “•”, and “0”.

Step 2.3-Program Test Timer

Touch the “TEST Timer” address and verify that the Timer addresses appear as pictured below:

CHARGE:	10.0
Timer	Sec.
SETTLE:	3.0
Timer	Sec.
TEST :	0.0
Timer	Sec.

Touch keypads “4”, “•”, and “0”.

STEP 2.4-Program Decay Pressure

Touch the “DECAY” address and verify that the addresses appear as pictured below:

CHARGE:	10.0
Timer	Sec.
SETTLE:	3.0
Timer	Sec.
TEST :	4.0
Timer	Sec.
DECAY :	0.0000
Maximum	Psig

Touch keypads “0”, “•”, and “5”. Touch “Units Chang” key to change units from Psig to any of the following desired units-InH₂O, kPa, mBar,Kgcm², cmH₂O, mmH₂O, InHg, mmHg, or Bar.

STEP 2.5-Program Specified Pressure

Touch the “PRESSR Specif” address and verify the “Timers”, the “Decay” and “Pressure” addresses display the following on the screen:

CHARGE:	10.0
Timer	Sec.
SETTLE:	3.0
Timer	Sec.
TEST :	4.0
Timer	Sec.
DECAY :	0.5000
Maximum	Psig
PRESSR:	0.00
Specif.	Psig

Touch keypads “1”, “0”, “•” and “0”. If necessary, **touch** the “Units Chang” address to select the desired pressure units. **Touch** the “PRESSR, Specif.” address box and verify the “Flow”, “Timer” and “Specified Pressure” addresses appear as below:

CHARGE:	10.0
Timer	Sec.
SETTLE:	3.0
Timer	Sec.
TEST :	4.0
Timer	Sec.
DECAY :	0.5000
Maximum	Psig
PRESSR:	10.00
Specif.	Psig

STEP 2.6-Program Pressure Tolerance

Touch the address location “PRESSR ± Toler.” and the entire display should appear as below:

				LEAK>	
		0.00	Units Chang		Prog# 25
1	2	3	Res		Test LEAK
4	5	6	±		Ports X
7	8	9	Clr		Names& Option
•	0	Enter	PRESSR ± Toler.	0.00 %	Exit

Touch Keypads “1”, “0” and “•”. **Touch** the “PRESSR ± Toler” address on the screen and this should appear as below on the screen:

PRESSR	10.00
± Toler.	%

Step 2.7-Enter Selected Program Parameters

Touch “Enter” and the display will return to the Main Menu Screen.

Step 2.8-View Selected Program Parameters

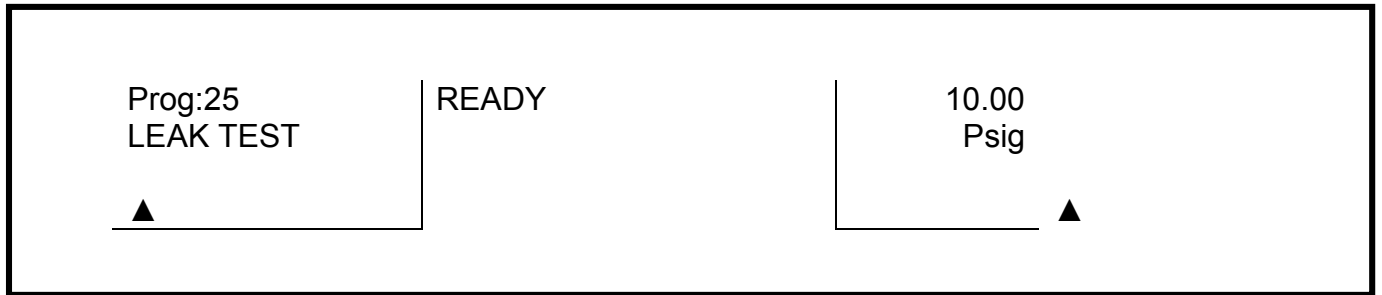
To view the Leak Test Screen **touch** the “Set Parameters” address and verify the test parameter settings.

Step 2.9-Return to Main Screen

Touch "Exit" and return to the Main Screen.

Step 3-Adjust Pressure Regulator to Programmed Pressure

While in Main Screen, turn the pressure regulator at the back of the instrument until the programmed pressure of 10.00 Psig appears in the Pneumatic Regulator Control Bar address of the Main Screen as shown below:



Step 4-Run Leak Test

See the section on **Running a Leak Test**.

RUNNING A LEAK TEST

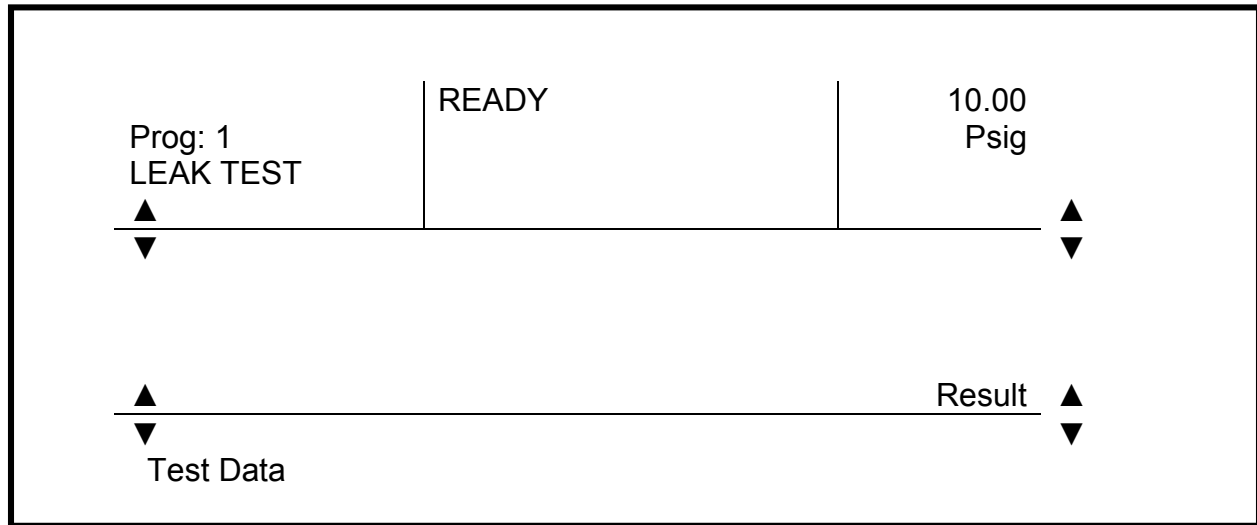
The following example explains the procedure for running a Normal Leak Test and continues with the example detailed in the section entitled “Programming a Normal Leak Test”.

Procedure Overview

- 1.) Put the instrument in “READY” Mode.
- 2.) Select program to run.
- 3.) Connect test part.
- 4.) Run the Test.
- 5.) Read the result.

Step 1-Put Instrument in “READY” Mode

With the instrument in the “READY” mode the Main Screen Display is shown below:



Step 2-Select Program to Run

Verify that the program selected is that for the program to be run. In the “PROGRAMMING A NORMAL LEAK TEST” section the program selected for the normal leak test was Program #25. Program #1 is displayed on the Main Screen above. Program #25 must be selected before the leak test is run. **Touch** the Program Bar on the Main Screen and the <Programs List> screen will be displayed. **Touch** the “PageUP ▲” address box to scroll to the screen that includes Program #25. **Touch** “Program #25” address box and it should appear as shown below:

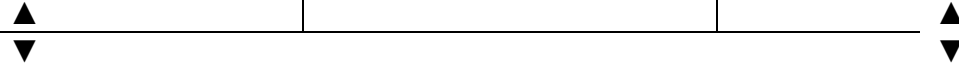
Program # 25

Touch the “Exit” address to return to the Main Screen.

The Main Screen should indicate Prog: 25 in the Program Bar as indicated below:

Main Screen Prior to Running Program #25

Prog: 25 LEAK TEST	READY	10.00 Psig
-----------------------	-------	---------------



	Result
--	--------

Test Data

Step 3-Connect Test Part

For this example the part to be tested is a stopcock in it "OFF" position.
Connect the part to the test port.

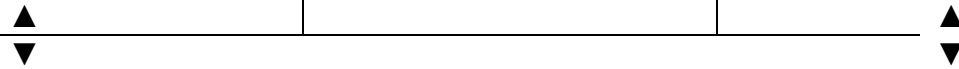
Step 4-Run the Test

Press the "START" Button.

The Main Screen will automatically display the following sequence of messages as the part is being tested.

Main Screen during the Charge period of Test 1 Program #25 Leak Test

Prog: 25 LEAK TEST	CHARGE T1	10.00 Psig
-----------------------	-----------	---------------



Presr

10.00 Psig

	Result
--	--------

Test Data

Program #25 is in the Charge portion of the Leak Test. The current pressure is 10.00 Psig.

Main Screen during the Settle period of Test 1 Program #25 Leak Test

Prog: 25 LEAK TEST	SETTLE T1	10.00 Psig
-----------------------	-----------	---------------

Presr **10.00** Psig

Result

Test Data

Program #25 is in the Settle portion of the Leak Test. The current pressure is 10.00 Psig.

Main Screen during the Test period of Test 1 Program #25 Leak Test

Prog:25 LEAK TEST	TEST T1	10.00 Psig
----------------------	---------	---------------

Presr **0.0000** Psig

Result

Test Data

Program #25 is in the Test portion of the Leak Test. The current pressure decay is 0.000 Psig.

Step 5-Read the Result

The following are the possible outcomes of the test.

Main Screen at the Completion of Test 1 Program 25 Leak Test-PASS

Prog: 25 LEAK TEST	READY	10.00 Psig
-----------------------	-------	---------------

Decay **0.3000** T1
PASS Psig

Result

Test Data

The Test 1 result was a "PASS". The final decay pressure was 0.3000 Psig units. The pressure decay in the specified Test Time was less than the allowable decay of 0.500 Psig.

NOTE: This decision was not made until the test time was completed.

Main Screen at the Completion of Test 1 Program 25 Leak Test-FAIL

Prog: 25 LEAK TEST	READY	10.00 Psig
-----------------------	-------	---------------

Decay **1.000** T1
FAIL Psig

Result

Test Data

The Test 1 result was a "FAIL". The final decay pressure was 1.000 Psig. The pressure decay in the part exceeded the allowable limit of 0.5000 Psig.

NOTE: This decision is made as soon as the limit is exceeded.

GROSS LEAK DURING CHARGE

Main Screen after test halted due to Gross Leak

Prog: 25 LEAK TEST	READY	10.00 Psig
-----------------------	-------	---------------

TEST HALTED >>> REQUIRED TEST PRESSURE:
0.10 Psig

... Press any key to continue...

Result

Test Data

USING THE SET OPTIONS MODE

The following example will demonstrate the steps to follow to set the TME *SOLUTION* Options and Memory Mode.

This example will use the same Leak test program parameters as the example used in “PROGRAMMING A NORMAL LEAK TEST” with the following exceptions:

The Program number will be #26 instead of #25 as in the previous example.

The following additional information will be included in this example:

The instrument will be run with the MEMORY MODE-ON, the program will be named “LTMemory”, Lot number “2030” will be assigned to the part and the Operator’s identification will be “TME”.

Procedure overview

- 1.) Select Program #26.
- 2.) Set Leak Test Program Parameters:
 - Charge time: 10.0 seconds
 - Settle time: 3 seconds
 - Test time: 4 seconds
 - Decay pressure: 0.5 Psig
 - Pressure: 10 psi
 - Pressure tolerance: $\pm 10\%$
- 3.) Adjust Pressure Regulator to Programmed Pressure.
- 4.) Set Options.
- 5.) Run a test using the Memory reference.
- 6.) Run a test in the Memory Mode.
- 7.) Cancel Memory Mode.
- 8.) Restore Memory Mode.

Step 1-Select Program #26-

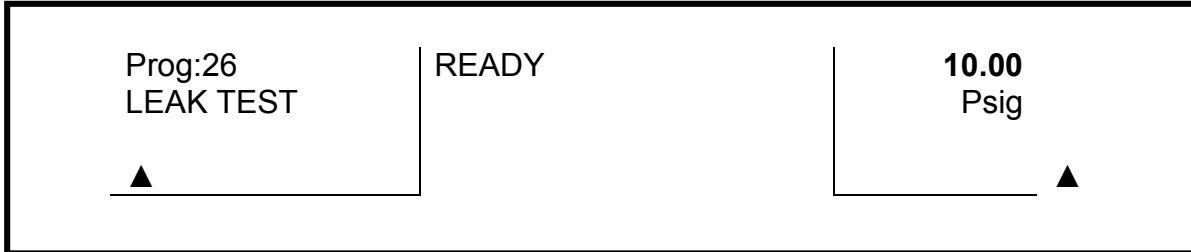
Touch the center of the Main Screen to display the <Main Menu> Screen. **Touch** the “Pick a Program” address to display the <Programs list> screen. **Touch** the “PageUP (▲)” or “PageDN (▼)” address to move to the Program list that contains Program 26. **Touch** Program # 26 address to bring up the <Main Menu> display.

Step 2-Set Leak Test Program Parameters

Touch the “Set Parameters” address on the <Main Menu> display to get the Program 26 <Leak Test> Display. Follow Steps 2.1 through 2.8 under “PROGRAMMING A NORMAL LEAK TEST” to select and enter the test parameters for Program #26, and Step 2.9 to return to the Main Screen.

Step 3-Adjust Pressure Regulator to Programmed Pressure

While in Main Screen, turn the pressure regulator knob at the back of the instrument until the programmed pressure-10.00 Psig-appears in the Pneumatic Regulator Control Bar address as shown below:



Step 4-Set Options

While in Main Screen, touch the center of the Main Screen to go to the <Main Menu> Screen. Touch the “Set Options” address in the <Main Menu> and the <Set Options> screen will be displayed as shown below:

< Set Options Screen >

Program name:	CLAMP Timer	0.0 Sec.	
Lot number:	BLEED Timer	0.0 Sec.	
Operator:	PAUSE Timer	0.0 Sec.	
	FILL Timer	0.0 Sec.	
Memory Mode OFF			Exit

To enter Program name, Lot number, or Operator **touch** the desired address on the screen. An alphanumeric keypad comes up on the screen with the screen title that of the item being entered. For example, when creating the program name the <Program Name> screen appears as shown below:

< Program Name >

Clr										<-
•	,	@	#	%	&	/		<	>	
1	2	3	4	5	6	7	8	9	0	
A	B	C	D	E	F	G	H	I	J	
K	L	M	N	O	P	Q	R	S	T	
U	V	W	X	Y	Z	Spc	▲	Exit		

To enter the program name “LTMemory” **touch** the “L” key and “L” appears in the center box in the top row as shown below:

< Program Name >

Clr	L								<-
• 1	,	@	#	%	&	/	|	<	>
A	B	C	D	E	F	G	H	I	J
K	L	M	N	O	P	Q	R	S	T
U	V	W	X	Y	Z	Spc	▲	Exit	

Continue entering each letter until the entire program name is entered. The screen will appear as shown below:

< Program Name >

Clr	LTMemory								<-
• 1	,	@	#	%	&	/	|	<	>
A	B	C	D	E	F	G	H	I	J
K	L	M	N	O	P	Q	R	S	T
U	V	W	X	Y	Z	Spc	▲	Exit	

Touch the “Exit” address and the “Program name” address in the <Set Options> Screen will be displayed as shown below:

Program name: LTMEMORY

Touch the Lot number address on the <Set Options> Screen and the <Lot number> Screen will appear as shown below:

< Lot number >

Clr									<-
• 1	,	@	#	%	&	/	|	<	>
A	B	C	D	E	F	G	H	I	J
K	L	M	N	O	P	Q	R	S	T
U	V	W	X	Y	Z	Spc	▲	Exit	

Enter the lot number “2030” by **touching** the numbers “2”, “0”, “3”, and “0”. These numbers will appear in the same location as the program name did in the prior example.

< Lot number >

Clr	2030								<-
• 1	,	@	#	%	&	/	|	<	>
A	B	C	D	E	F	G	H	I	J
K	L	M	N	O	P	Q	R	S	T
U	V	W	X	Y	Z	Spc	▲	Exit	

Touch the “Exit” address and the lot number will appear in the “Lot number” address of the Set Options Screen as shown below:

Lot number: 2030

Touch the “Operator” address on the <Set Options> Screen and follow the same steps detailed in entering the Program name to enter the Operator identification “TME”. The “Operator” address in the <Set Options> Screen will appear as shown below:

Operator: TME

To set the “Memory Mode ON” touch the “Memory Mode” address on in the <Set Options> Screen until the “ON” indicator appears in the “Memory Mode” address box as shown below:

Memory Mode ON

The <Set Options> Screen will appear as shown below after the above options have been set:

< Set Options Screen >

Program name: LTMEMORY	CLAMP Timer	0.0 Sec.	
Lot number: 2030	BLEED Timer	0.0 Sec.	
Operator: TME	PAUSE Timer	0.0 Sec.	
	FILL Timer	0.0 Sec.	
Memory Mode ON			Exit

Touch the “Exit” address to return to the <Main Menu> Screen. The entered information will appear in the <Main Menu> Screen as shown below:

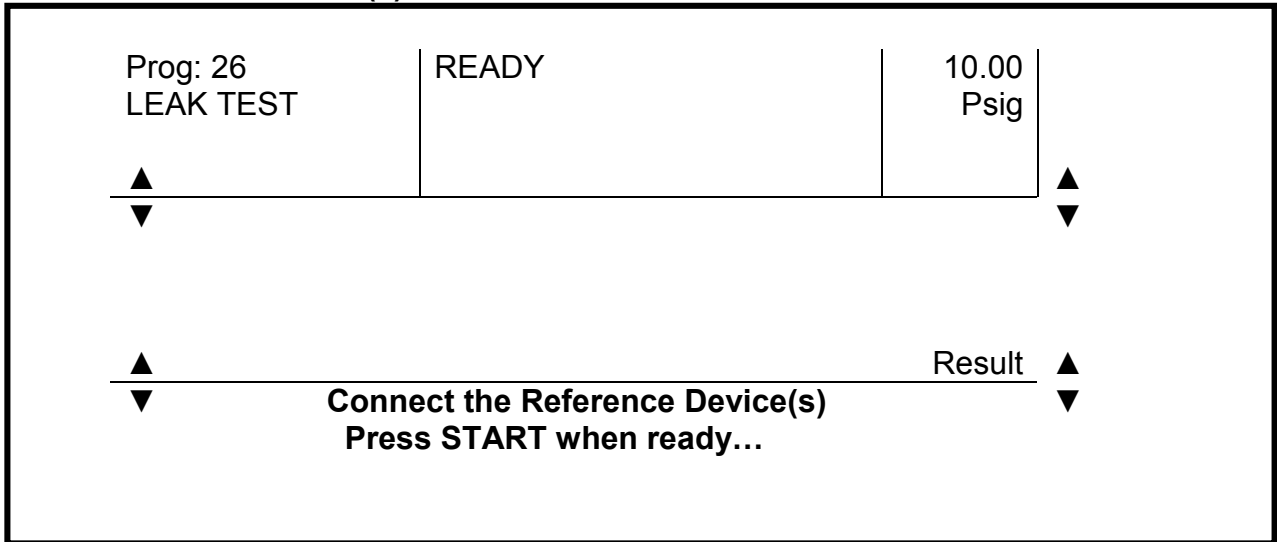
< Main >

Pick a Program LTMEMORY	Printer Reports	Alarm OFF
Set Parameters	Statistics and Datalog	Calib. Mode
Set Options		MemRef *Store
Lot number: 2030		MemRef .Clear
Operator: TME	Clear test Data	Exit

Note the “MemRef” address contains an “*” indicating that the Memory Mode is “ON”.

Touch the “Exit” address and the Main Screen will appear as shown below for Program #26, Leak Test in Memory Mode.

Main Screen indicating Memory Mode is On and instrument is prepared to memorize reference curve(s)

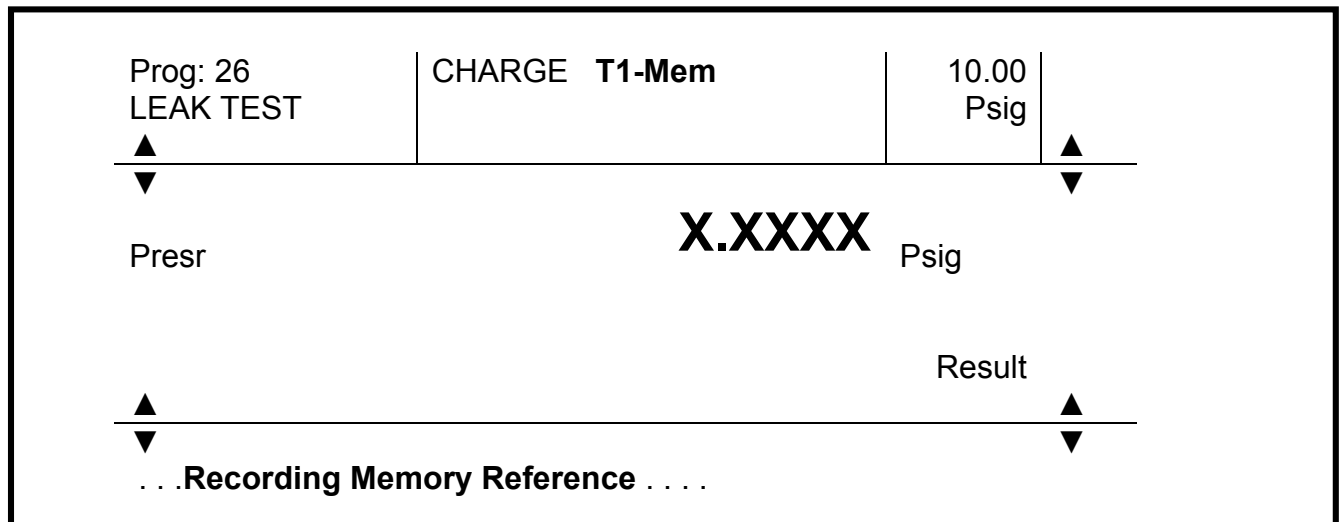


Note: Footer of Main Screen indicates Memory Mode has been turned on.

Step 5-Run a Test using the Memory Reference

Prior to running the test connect the reference device-a good, known non-leaker to the test port in order to record its characteristic reference decay curve. For this example a stopcock in the "OFF" position will be the reference device. Connect the device to the test port. Press the "START" button. The Main Screen will appear as shown below:

Main Screen During Charge Period of Testing of Reference Device(s)



Note: The footer indicates that the Memory Reference curve is being memorized for the device being tested. This is Test 1 in the Memory Mode as indicated in the Status bar.

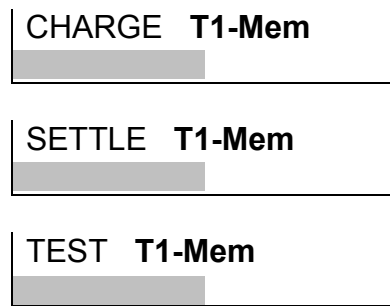
The words “SETTLE” and “TEST” will appear in place of “CHARGE” as the test proceeds. The number of decimal places on the display will change as the test portion of the cycle changes. Upon completion of the test the words

“MEMORY REFERENCE READY”

appear on the screen along with a long beep. The Main Screen then appears in the “READY” mode.

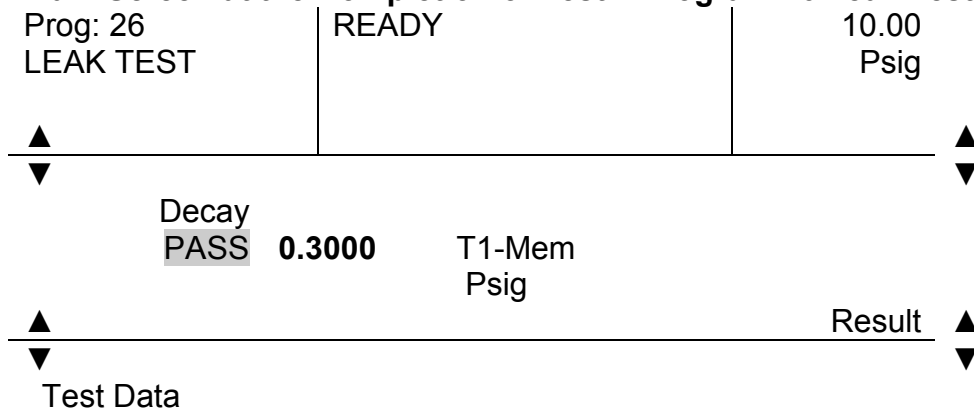
Step 6-Run a Test in the Memory Mode

After connecting the test part to the port and pressing the “READY” button the instrument will run Program # 26 Leak Test and internally compare the test part’s pressure decay to that of the reference part. During the test the fact that the test is being run in the Memory Mode is indicated in the Status bar as shown below for each portion of the test:



To verify that the Memory Mode is “ON” move to the <Set Options> Screen and note the Memory Mode in that address.

Main Screen at the Completion of Test 1 Program 26 Leak Test in Memory Mode



Step 7-Cancel Memory Mode

To cancel or turn off the Memory Mode move to the <Set Options> Screen and **touch** the Memory Mode address. If the Mode was “ON” and a reference was stored in memory the screen will go to the <Warning Screen> and the operator will have to decide to erase all test data or not. If the decision is to “Clear All Data” the Screen will

indicate “Data Erased” with a long beep as the data is being erased. The next screen will indicate “MEMORY REFERENCE CLEARED” with a long beep indicating that the memory is being cleared. The screen returns to the <Set Options> screen and the Memory Mode address indicates that the Memory Mode is “**OFF**”.

Step 8-Restore Memory Mode

To restore the Memory Mode to “ON” touch the Memory Mode Address. The <Warning Screen> will appear and the operator will need to decide to erase all data. All data must be erased prior to the Memory Mode being returned to “ON” and the reference device must be rerun as done in Step 5.

Introduction to Leak Testing with Flow Rate Readout	99
Pressure Decay Test Mode	100
Setting Leak Test with Flow Rate Readout Test Parameters	101
Leak Test with Flow Rate Readout Calibration	102
Running a Leak Test with Flow Rate Readout	105

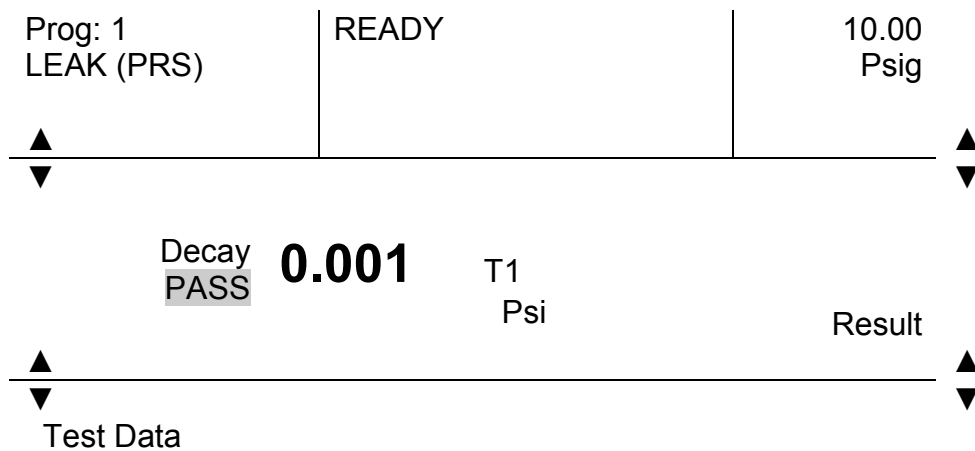
INTRODUCTION TO LEAK TESTING WITH FLOW RATE READOUT

The TME *SOLUTION* with Flow Rate Readout capability is a pressure decay leak tester customized to display leaks in both pressure and flow units. In the Pressure Decay Mode the *SOLUTION* detects leaks by measuring the decay in pressure during the selected test time. The pressure decay is displayed in pressure units-PSI, In H₂O, kPa etc.

In the Flow Rate Mode the instrument detects leaks by measuring the decay in pressure in a known volume during the test time and reports the pressure decay in flow units-CCM, etc. The Flow Rate Mode requires that the instrument be calibrated with a Certified Flow Reference Standard and a “known good part”.

PRESSURE DECAY TEST MODE

The Pressure Decay Test Mode is the standard Leak Test Mode described in Chapter 4 of this manual. To select the Pressure Decay Test Mode the operator must touch the “Test” address of the <Test Parameter> Screen until the “Test” address displays **LK-PRS**. The <Test Parameter> Screen title also displays **LK-PRS** as the selected test. Select the required test parameters and pressure units for the test. Once the parameters are selected, touch “Enter”, touch “Exit” and return to the Main Screen. When the Main Screen is displayed **LEAK (PRS)** appears in the Program section of the screen. Attach the part to be tested and press the “START” button. The result will be displayed on the Main Screen as shown below:



No calibration is required in the Pressure Decay Mode.

SETTING LEAK TEST WITH FLOW RATE READOUT TEST PARAMETERS

In the Flow Rate Test Mode the *SOLUTION* detects leaks by measuring the decay in pressure of a known volume during the test time. The measured pressure decay is then converted to and displayed in flow units such as “ccm”. To select the Leak Test with Flow Rate Readout Test Mode move to the <Test Parameter> Screen. Touch the “Test” address until the “Test” address displays “**LK-FLW**”. The screen title displays **<LEAK(FLW)>**.

Test parameters need be set prior to running the calibration cycle for the Leak Test with Flow Rate Readout.

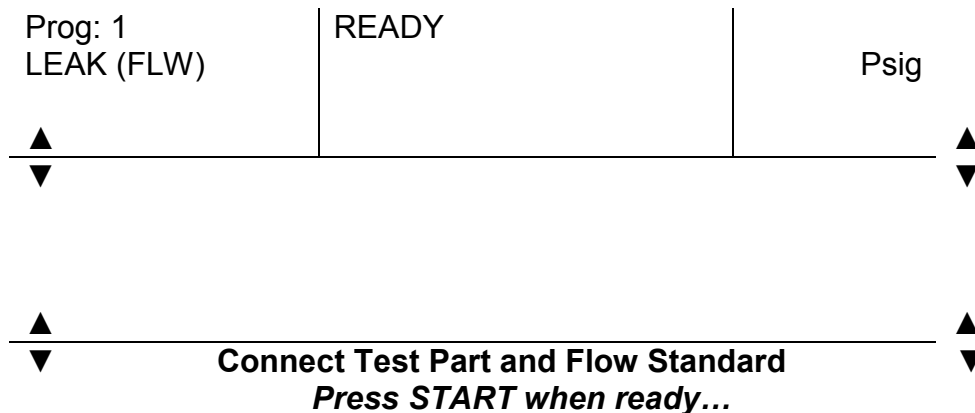
Select and enter the following test parameters:

- Charge Time,
- Settle Time,
- Test Time,
- LEAKRT Maximum-Flow value considered the maximum allowable flow rate. A test result **above** this value will be a **REJECT**, a test result **below** this value will be an **ACCEPT**,
- LEAKRT Standard-Certified Flow Reference Standard’s Nominal Value,
- Pressure-Full Scale of Certified Flow Reference Standard,
- Pressure Tolerance- $\pm 5.0\%$ or $\pm 10.0\%$,
- Program name (if needed),
- Lot Number (if needed),
- Operator (if needed),
- CLAMP Timer-0.0 Sec.,
- BLEED Timer-0.0 Sec.,
- PAUSE Timer-0.0 Sec., and
- FILL Timer-0.0 Sec.

Touch “Enter” and all of the selected test parameters will be displayed on the **<LEAK(FLW)>** Screen. Touch “Exit” to return to the Main Screen.

LEAK TEST WITH FLOW RATE READOUT CALIBRATION

In order to convert pressure decay to flow rate, the instrument must be calibrated with a certified flow standard and a known-good part. **Calibration is done using only Port #1.** If the Solution has more than one port, touch the “Ports” address. Move to the <Select ports> screen. Touch the “Clear” address and then select all ports by touching each port address. The selected port addresses are highlighted. Once the ports are selected touch “Exit” to return to the <LEAK (FLW)> screen. The selected port number should be displayed in the “Ports” address in the order they were selected. Return to the MAIN SCREEN. The screen will appear as shown below indicating that the unit is ready to run a calibration cycle.

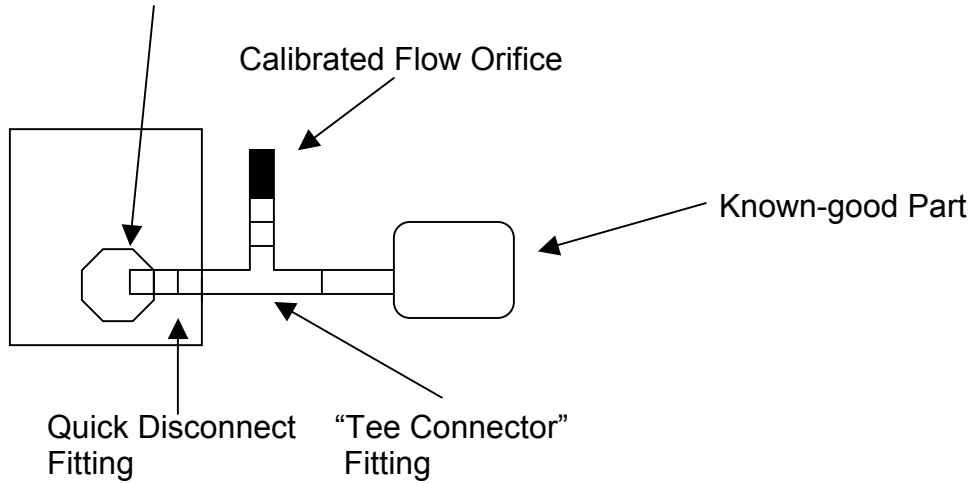


Adjust the regulator knob in the back of the instrument to maximum pressure of the flow orifice entered as the test pressure.

Attach a “Tee” fitting to the quick disconnect fitting on the test port. Connect the Certified Flow Reference Standard to the “Tee” outlet of the fitting and the Known-Good Part to “thru” outlet to the quick disconnect fitting as shown below. **Note the part MUST BE connected to the “thru” outlet of the “Tee” fitting since the calibration of the system is based on the total system volume.**

Calibration Test Set-up

SOLUTION Test Port



Use Dead End Plugs to cap off other ports if the instrument is a multi-port configuration.

Press the **“START”** button to run calibration cycle. While the calibration is being done the screen will display:

Prog: 1 LEAK (FLW)	READY	Psig
-----------------------	-------	------

Calibration Flow (Leak Rate)		
-------------------------------------	--	--

Upon successful completion of the calibration cycle appears on the screen as shown below and a long beep sounds.

Prog: 1 LEAK (FLW)	READY	Psig
-----------------------	-------	------

CALIBRATION COMPLETED

--	--	--

When a successful flow rate calibration cycle is completed, the calibration data is stored in the program currently selected. Whenever the program is recalled, the calibration data is also recalled and the instrument is ready to test the same type of part without recalibration.

Using a different program number for each type of test part provides a means of storing test parameters and calibration data for each part under its specific program number. This allows recall of a particular program without recalibration being necessary every time the program is selected.

When recalibration is necessary attach the test set up to the instrument test port and touch the “Calibrate Flow” address in the <Main Menu> screen and the instrument will run a Flow Rate Calibration cycle.

Invalid Calibration Run

If the screen displays

“INVALID CALIBRATION RUN”

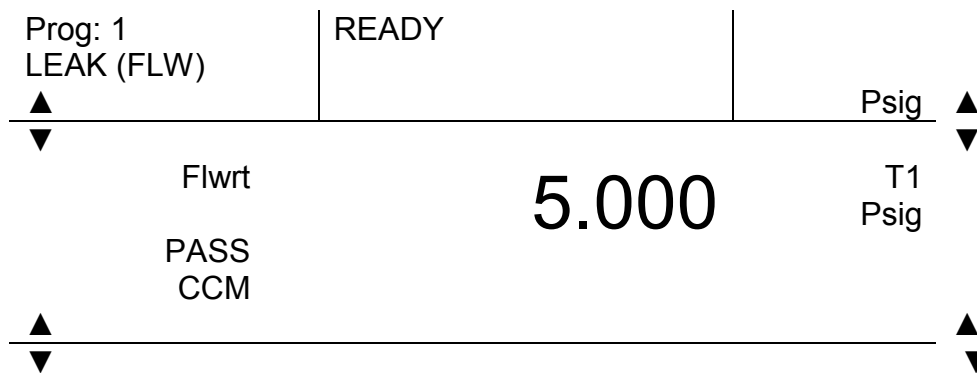
at the end of a flow rate calibration cycle it means that the pressure decay was close to zero. This could be due to:

- a Known-good part with too large a volume,
- too short a test time,
- too small a leak rate, or
- a gross leak detected during the calibration cycle.

RUNNING A LEAK TEST WITH FLOW RATE READOUT

Once a successful Flow Rate Read Out Calibration Cycle is completed the MAIN Screen is displayed and the *SOLUTION* is ready to run Flow Rate Read Out Test Cycle on the same type of part. Disconnect the “Tee” connector with the calibrated Flow Rate Standard and the Known-good part from the instrument’s test port prior to running a test part.

Connect the test part to the instrument “Test Port” using the quick disconnect fitting. Press the green “START” button to run a test. The instrument will cycle through the normal test sequence of CHARGE, SETTLE AND TEST. The test result will be displayed on the MAIN Screen as shown below:



NOTE

The calibrated Leak Test with Flow Rate Readout is only valid for the same test parts as the one used during the Flow Calibration Cycle.

If a different part is to be tested then the instrument must be calibrated with a new Known-good test part. New test parameters may also be required

If a part with a different volume than the part used during calibration is tested the flow readings will not be accurate.

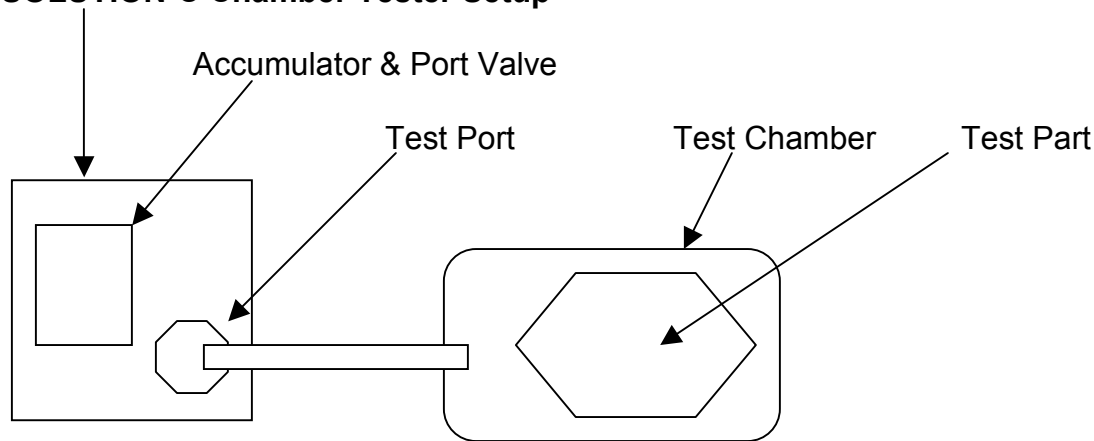
Introduction to Chamber Leak Testing	107
Setting Chamber Leak Test Mode Parameters	109
Finding the Correct Overpressure	111
Running a Chamber Leak Test	112

INTRODUCTION TO CHAMBER LEAK TESTING

The TME *SOLUTION-C* Leak Tester has all the features of the standard *SOLUTION* Leak Test instrument with the added capability of running a chamber leak test. The chamber leak test provides for leak testing of sealed packages or parts. In the Chamber Leak Test Mode the sealed test part is placed in a chamber, the chamber is pressurized to a selected test pressure and the pressure decay in the chamber is measured during the test period. The measured pressure decay is an indirect measurement of leakage into the test part.

The Chamber Leak Tester consists of an Accumulator and a port valve contained within the instrument and an external test chamber designed to contain the test part.

SOLUTION-C Chamber Tester Setup



The volume of the Accumulator is designated V_A and during test setup it is pressurized to an initial pressure of P_A . The volume and test pressure of the empty test chamber are designated V_C and P_C and those of the test part are designated V_P and P_P .

With the instrument in the Ready Mode, the port valve is in the “closed” position and the Accumulator is pressurized to a pressure higher than the actual test pressure—Overpressure. With the port valve in the closed position the Accumulator is sealed off from the test chamber and the test part, which are at atmospheric pressure.

As the test proceeds through the Charge portion of the test cycle the port valve opens and connects the Accumulator to the Test Chamber. The initial pressure of the Accumulator- P_A , drops to a lower pressure as the initial volume of air (V_A) expands from the Accumulator into the larger volume of the Accumulator and the Test Chamber less the volume of the test part in the chamber. The final volume is $(V_A+V_C-V_P)$. The final test pressure, designated P_F , is defined by the formula:

$$P_F=P_A (V_A/V_A+V_C-V_P)$$

The Overpressure setting is required to account for this pressure change during the test period. The correct Overpressure is the pressure that results in the correct test pressure with the port valve open.

An airtight test part reduces the test chamber volume by its volume (V_p) and the final pressure is higher than that observed if the test part leaks. The volume of the test chamber with a leaky part is larger resulting in a lower final pressure in the test chamber. This difference in final pressures is used to determine Gross Leaks in the *SOLUTION* Chamber Test. By setting a test pressure drop limit, known as the Maximum Pressure Drop Limit, the instrument is able to discriminate between parts that leak and parts that are airtight.

Maximum Pressure Drop Setting

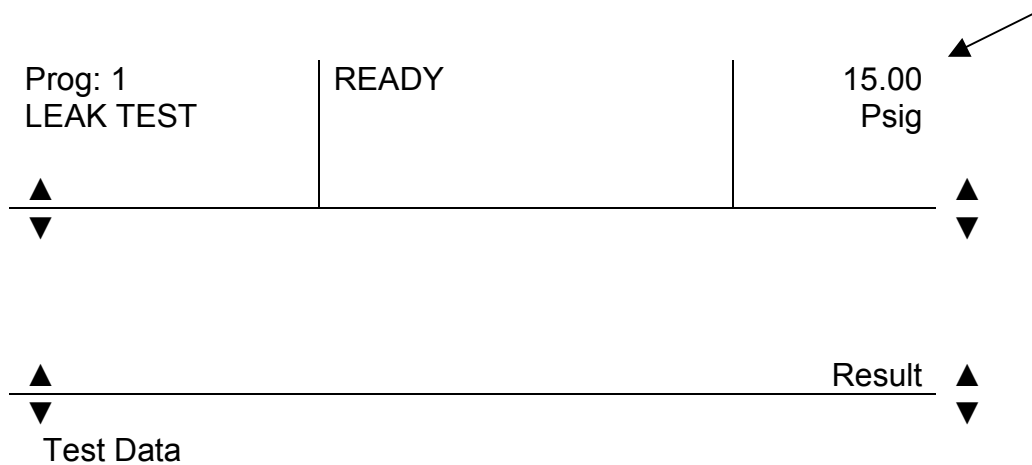
Different chamber sizes, tubing and part volumes result in different pressure drops. To account for this variation the *SOLUTION* has a setting for the maximum amount that the overpressure is allowed to drop when it is applied to a sealed test chamber containing an airtight part. This pressure is the Maximum Pressure Drop and characterized as a percentage of the Overpressure (initial pressure- P_A). When a test part causes the pressure to drop below the Maximum Pressure Drop setting the instrument will display "GROSS LEAK".

As an example, if the chamber test requires an Overpressure of 15 Psig to drop to a test pressure of 10 Psig, the pressure drop is 5 Psig or 33.3% of the 15 Psig Overpressure. The Maximum Pressure Drop should be set slightly higher than 33.3% to allow for minor volume differences in the test parts.

The Maximum Pressure Drop is also used to select the Standard Leak or Chamber Leak Test Mode. **To run a Standard Leak Test the Maximum Pressure Drop must be set to 0.00%.** To run a Chamber Leak Test the Maximum Pressure Drop value must be set to a value other than 0.00%.

SETTING CHAMBER LEAK TEST MODE PARAMETERS

While in the MAIN Screen set the Overpressure by adjusting the regulator to the desired pressure. The pressure will be displayed on the screen as shown below:



Touch the center of the screen to display the <Main> Screen. Touch the “Set Parameters” address and the <LEAK TEST> Screen is displayed.

<LEAK TEST>

CHARGE:	0.0	PRESSR	0.00	Prog#
Timer	Sec.	MaxDrop	%	25
SETTLE:	0.0	PRESSR	-0.00	Test
Timer	Sec.	MaxDrop	Psig	LEAK
TEST :	0.0			Ports
Timer	Sec.			X
DECAY :	0.00000			Names&
Maximum	Psig			Option
PRESSR:	0.00	PRESSR	0.00	
Specif.	Psig	± Toler.	%	Exit

Enter the following test parameters:

- Charge,
- Settle,
- Test,
- Decay Maximum,
- Pressure Specified, and
- Pressure Tolerance.

To turn the Chamber Leak Test Mode **ON** a % Maximum Pressure Drop value greater than “0.00” must be entered as the test parameter setting. Touch the address and enter the desired Maximum Pressure Drop %. The Maximum Pressure Drop Psig displayed

is a calculated value based on the previously entered Maximum Pressure Drop %. The Maximum Pressure Drop Psig address cannot be set by the operator.

Touch the “Name&Option” address and the <Names & Options> screen is displayed. Enter the desired Bleed Time in the “BLEED Timer” address. The Bleed time will open the chamber to relieve any residual pressure between tests. For further information on the Bleed Cycle reference Chapter 8.

Touch the “Exit” address three times to return to the MAIN SCREEN.

NOTE:

In order for the *SOLUTION-C* Leak Test Instrument to run a Standard Leak Test the Maximum Pressure Drop % setting must be set to 0.00. When the Maximum Pressure Drop % is set to 0.00% the Maximum Pressure Drop is set to 0.00 Psig automatically. When these parameters are set to Zero the Chamber Leak Test Mode is turned OFF and a Standard Leak Test can be run.

FINDING THE CORRECT OVERPRESSURE

Once the test parameters have been entered place an airtight part or a filled part in the test chamber. Press the **START** button and observe the pressure reading during the CHARGE portion of the test cycle.

If the observed pressure was **less than** the required test pressure, **increase** the Overpressure by turning the regulator knob on the back of the instrument.

If the observed pressure was **greater than** the required test pressure, **decrease** the Overpressure.

If the observed pressure was equal to the required test pressure then the correct Overpressure was set prior to the test.

Disregard PASS/FAIL/GROSS results reported during setup.

RUNNING A CHAMBER LEAK TEST

Once the correct Overpressure has been found and set, the instrument is ready to run test samples. Place the test part in the chamber and press the “START” button. When the test is complete the instrument will display the result on the screen as shown below:

Prog: 1 LEAK TEST	READY	15.00 Psig
Decay PASS	0.3000	T1 Psig
Tests 1	PASS 1	Result FAIL 0

Using the Clamp Driver Option
Using the Bleed Cycle

114
115

USING THE CLAMP DRIVER OPTION

NOTE: The Clamp Driver is a separate option, which is ordered at the time of purchase.

Clamp delay is the time from the beginning of the test that the instrument allows for the holding clamp (or fixture) to actuate fully on the test part before applying the test pressure. The clamp driver is a feature that allows the TME *SOLUTION* to control pneumatic fixtures that are used to restrain or seal the device being tested. When enabled the clamp driver energizes an external low power valve* or solenoid for the duration of the test cycle. After the test is over the valve remains de-energized until the next test.

To enable the clamp driver, set the clamp delay timer to a value higher than zero, typically between 0.5 and 1.0 seconds. The Clamp Driver Timer address appears in the <Set Options> screen.

* -CLAMP DRIVER OPTION: Low power valve, solenoid or relay=12 VDC @ 200mA. Clippard ET-3M-12V or equivalent.

USING THE BLEED CYCLE

The bleed cycle is a function of the TME *SOLUTION* that allows the release of the pressure inside the device under test after the test is done. Bleed time is useful when parts are tested at high pressures and/or restrained by a fixture. In these cases the part will be difficult or dangerous to remove from the fixture unless the pressure is exhausted or bled internally in the instrument.

In order to enable the bleed cycle set the BLEED TIMER to a value higher than zero typically between 0.5 and 1.0 seconds for small parts. The BLEED TIMER address is in the <Set Options> Screen. A typical Clamp + Bleed Test Cycle is diagrammed below:

TME SOLUTION CLAMP + BLEED TEST CYCLE DIAGRAM



NOTE: When the bleed function is used the air inside the part flows back into the instrument carrying any loose debris or dust from inside the part. To prevent contamination of the internal pneumatics of the TME *SOLUTION* the use of a filter at the front port is recommended.

CHAPTER 9 FLOW TEST MODE	PAGE
Leak and Flow Test Model Only	

Flow Testing in the TME <i>SOLUTION</i> LEAK AND FLOW TESTER	117
Establishing Flow Test Parameters	118
Programming a Normal Flow Test	119
Running a Flow Test	124

FLOW TESTING IN THE TME *SOLUTION* LEAK AND FLOW TESTER

In manufacturing and quality control, one of the most important parameters to be measured is flow. The airflow through a part can indicate whether the part is within the acceptable dimensional, seal or density tolerances.

For example, a smaller than normal flow rate in a particular section of tubing might indicate a reduction in the Internal Diameter (I.D.) of the tubing. An unusually high flow rate in a filter element might indicate lower fiber density or membrane perforation. In the extreme case, a very low or zero flow rate would indicate a partial or total occlusion of the part which might be the result of manufacturing flaws or poor bonding - welding, assembly operations, etc.

The TME *SOLUTION* uses a mass flow meter that is the state of the art in flow measurement technology to perform its flow tests. This allows accurate measurement of the flow through a part regardless of pressure or temperature.

ESTABLISHING FLOW TEST PARAMETERS

The flow test, as performed by the TME *SOLUTION*, requires the setting of the maximum and minimum acceptable flow rate limits.

- The Maximum Flow Rate limit is highest flow rate that the instrument will consider acceptable, if a part has a flow rate higher than this limit a FAIL result is displayed.
- The Minimum Flow Rate limit is lowest flow rate that the instrument will consider acceptable, if a part has a flow rate lower than this limit a FAIL result is displayed.
- The Nominal Flow Rate is not used by the instrument, but it is provided as a way to record the expected nominal value. This is intended for users who want to print reports stating Maximum, Minimum and nominal values.
- The Flow Timer is used to control the duration of the flow test. Typically, the flows rate value settles to 98% of its final value in 2 seconds. However, if the flowmeter is exposed to flowrates beyond its full scale, longer settle times are required to allow the flow meter to recover. This is particularly important with low flowmeters (10-50 ccm).

Once the flow rate of a particular part is known, the TME *SOLUTION* will compare the measured value to limits set by the operator. If the measured flow rate is within the acceptable range, the part will PASS the flow test. If the measured flow rate is outside the acceptable tolerance range the part will fail the test.

For example: If a part is to be tested using Minimum=750 ccm and Maximum=1250 ccm. Parts with flow rates BETWEEN 750 and 1250 would PASS the Flow test.

PROGRAMMING A NORMAL FLOW TEST

The following example demonstrates the procedure for programming the TME SOLUTION™ to run a Normal Flow Test.

EXAMPLE

Program 7 will be programmed to test a part with a flow range of 750-1250 ccm. The specified (test) pressure will be 2.6 psi to produce a flow of approximately 1000 ccm. The test pressure tolerance will be ±25%. The flow test time will be 2.0 seconds.

Procedure Overview

- 1.) Select Program #7.
- 2.) Set Flow Test Program Parameters:
 - Maximum Flow: 1250 ccm
 - Nominal Flow: 1000 cc(* Optional)
 - Minimum Flow: 750 ccm
 - Flow Timer: 2.0 seconds
 - Specified Pressure: 2.6 Psi
 - Pressure tolerance: ±25 %.
- 3.) Adjust Pressure Regulator to Programmed Pressure.
- 4.) Run the test.

Step 1-Select Program #7

Touch the center of the Main Screen to display the <Main Menu Screen>. **Touch** “Pick a Program” address to display the <Programs List screen>. **Touch** the “PageUP (▲)” or “PageDN(▼)” address to move to the Program list page containing Program #7. **Touch** the “Program # 7” address to bring up the <Main Menu> display.

Step 2-Set Flow Test Program Parameters

Touch the “Set Parameters” address on the Main Menu display to get the Program #7 Test Display. If Program #7 has not been programmed before the screen will display the <LEAK TEST> parameter screen. To display the <FLOW TEST> screen **touch** the “Test” address box until the word “FLOW” is displayed. The <FLOW TEST> screen will be displayed as shown:

< FLOW TEST >

FLOW :	0.00			Prog#
Maximum	CCM			7
FLOW :	0.00			Test
Nominal	CCM			FLOW
FLOW :	0.00			Ports
Minimum	CCM			X
FLOW :	0.0			Names&
Timer	Sec.			Option
PRESSR:	0.00	PRESSR	5.00	
Specif.	Psig	± Toler.	%	Exit

Step 2.1-Program Maximum Flow

Touch the “Flow Maximum” address to bring up the keypad on the display:

< FLOW TEST >

FLOW :	0.00		1250.00			Units
Maximum	CCM		CCM			Chang
FLOW :	0.00		1	2	3	Res
Nominal	CCM					
FLOW :	0.00		4	5	6	±
Minimum	CCM					
FLOW :	0.0		7	8	9	Clr
Timer	Sec.					
PRESSR:	0.00	PRESSR				
Specif.	Psig	± Toler.	.	0	Enter	

Touch the keypads “1”, “2”, “5” and “0”. The selected units will appear in the address next to the “Unit Chang” box as shown above. The units displayed in box next to the “Unit Chang” address and the Flow addresses are those required for this example. To change units when programming an actual test parameter, **touch** the “Units Chang” address until the required units are displayed in the address next to the “Units Chang” address. In addition to cubic centimeters per minute (ccm), the operator may select from the following units for leak testing:

- LPM-Liters per minute,
- CFM-Cubic feet per minute,
- CFH-Cubic feet per hour,
- GPM-Gallons per minute, or
- CIM-Cubic inches per minute.

NOTE: Do not touch the “Enter” address at this point. Touching this address will return the screen to the Main Menu Screen.

Step 2.2-Program Nominal Flow

Touch the Nominal Flow address.

Verify the “Maximum Flow” and the “Nominal Flow” addresses appear as pictured below:

FLOW :	1250.00
Maximum	CCM
FLOW :	0.00
Nominal	CCM

Touch keypads “1”, “0”, “0” and “0”.

Step 2.3-Program Minimum Flow

Touch the “Minimum Flow” address.

Verify the “Maximum”, “Nominal” and “Minimum” Flow addresses appear as pictured below:

FLOW :	1250.00
Maximum	CCM
FLOW :	1000.00
Nominal	CCM
FLOW :	0.00
Minimum	CCM

Touch keypads “7”, “5” and “0”.

Step 2.4-Program Flow Timer

Touch the “FLOW Timer” address and verify that all the “Flow” and “Flow Timer” addresses appear as pictured below:

FLOW :	1250.00
Maximum	CCM
FLOW :	1000.00
Nominal	CCM
FLOW :	750.00
Minimum	CCM
FLOW :	0.0
Timer	Sec.

Touch Keypads “2”, “.” and “0”.

Step 2.5-Specified Pressure

Touch the “Specified Pressure” address and verify that all the “Flow”, “Flow Timer” and “Specified Pressure” addresses appear as pictured below:

FLOW :	1250.00
Maximum	CCM
FLOW :	1000.00
Nominal	CCM
FLOW :	750.00
Minimum	CCM
FLOW :	2.0
Timer	Sec.
PRESSR: Specif.	0.00 Psig

Touch keypads “2”, “.” and “6”. If necessary, **touch** the “Units Chang” address to select the desired pressure units. Touch the “PRESSR, Specif.” address box and verify the “Flow”, “Timer” and “Specified Pressure” addresses appear as below:

FLOW :	1250.00
Maximum	CCM
FLOW :	1000.00
Nominal	CCM
FLOW :	750.00
Minimum	CCM
FLOW :	2.0
Timer	Sec.
PRESSR:	2.60
Specif.	Psig

Step 2.6-Program Pressure Tolerance

Touch the address location “PRESSR ± Toler.” and the entire display should appear as below:

				<FLOW TEST>		Progm#
		0.00	Units			7
		%	Chang			
1	2	3	Res			Test
4	5	6	±			FLOW
7	8	9	Clr			Ports
						X
						Names&
						Option
.	0	Enter	PRESSR	25.00		
			± Toler.	%		Exit

Touch Keypads “2” and “5” . Touch the “PRESSR ± Toler” address on the screen and this should appear as below on the screen:

PRESSR	25.00
± Toler.	%

Step 2.7-Enter Selected Program Parameters

Touch “Enter” and the display will return to the <Main Menu> Screen.

Step 2.8-View Selected Program Parameters

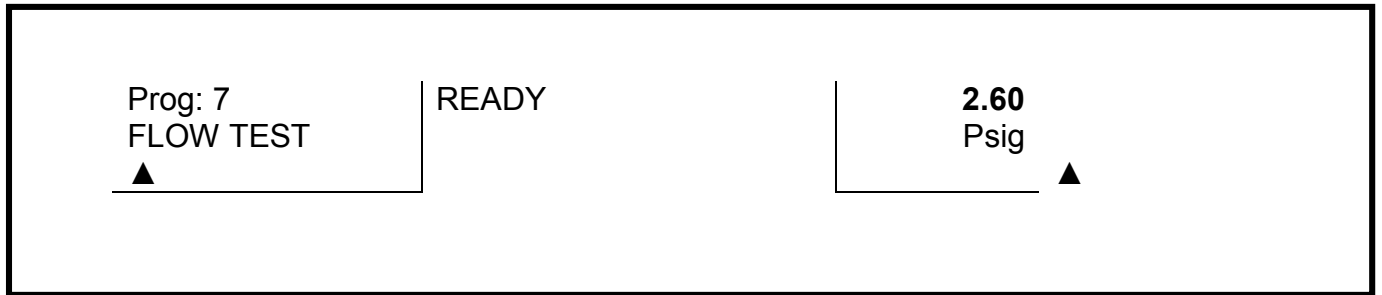
To view the Flow Test Screen **touch** the “Set Parameters” address and verify the test parameter settings.

Step 2.9-Return to Main Screen

Touch "Exit" and return to the Main Screen.

Step 3-Adjust Pressure Regulator to Programmed Pressure

While in Main Screen, turn the pressure regulator at the back of the instrument until the programmed pressure of 2.6 Psig appears in the Pneumatic Regulator Control Bar address of the Main Screen as shown below:



Step 4-Run the test

See the section on **Running a Flow Test**.

RUNNING A FLOW TEST

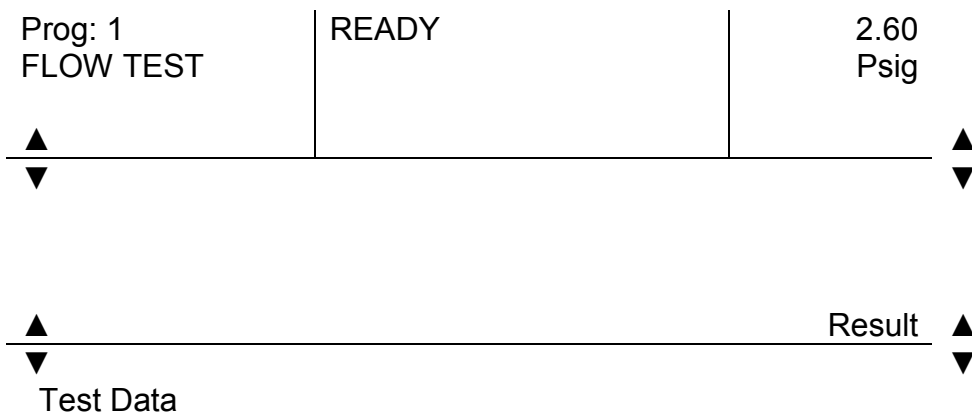
The following example explains the procedure for running a Normal Flow Test and continues with the example detailed in the section entitled Programming a Normal Flow Test.

Procedure Overview:

- 1.) Put the instrument in the “READY” Mode.
- 2.) Select Program to run.
- 3.) Connect the test part.
- 4.) Run the Test.
- 5.) Read the Results.

Step 1-Put Instrument in “READY” Mode

With the instrument in the “READY” mode the Main Screen Display is shown below:



Step 2-Select Program to Run

Verify that the program selected is that for the program to be run. In the “PROGRAMMING A NORMAL FLOW TEST” section the program selected for the normal flow test was Program #7. Program #1 is displayed on the Main Screen above. Program #7 must be selected before the flow test is run. **Touch** the Program Bar on the Main Screen and the Program List screen will be displayed. If necessary, **touch** the “PageUP ▲” address box to scroll to the Program List screen that includes Program #7. **Touch** “Program #7” address box and it should appear as shown below:

Program # 7

Touch the “Exit” address to return to the Main Screen.

The Main Screen should indicate Prog: 7 in the Program Bar as indicated below:

Main Screen Prior to Running Program #7

Prog: 7 FLOW TEST	READY	2.60 Psig
----------------------	-------	--------------

▲ ▼ ▲ ▼

▲ ▼ Result ▲ ▼

Test Data

Step 3-Connect the Test Part.

For this example the part to be tested is a stopcock in its "ON" position.
Connect the part to the test port.

Step 4-Run the Test

Press the "START" Button, The Main Screen will show the progress of the flow test.

Main Screen During Test 1 Program #7 Flow Test

Prog: 7 FLOW TEST	FLOW T1	2.60 Psig
----------------------	---------	--------------

▲ ▼ ▲ ▼

1023 CCM

▲ ▼ Result ▲ ▼

Test Data

Step 5-Read the Results

When the test is completed, the unit will display the test result in a screen like this:

Main Screen at the Completion of Test 1 Program 7 Flow Test-FAIL

Prog: 7	READY	2.61
FLOW TEST	# 1 ACCEPT	Psig
FLOW PASS		
1034 CCM		
		Result
Test Data		

The Test #1 result was a "PASS". The final flow value was 1034 CCM.

APPENDIX A-CONCURRENT TESTING

Concurrent testing consists of running the same test on more than one port at the same time or concurrently. Multiport instruments have this capability. This allows the operator to test multiple parts at the same time. To do concurrent testing in the TME *SOLUTION* the operator must determine which ports will be used.

Example:

Reference the example in “Programming a Normal Leak Test (Vacuum or Pressure)” in the Leak Test Chapter.

Leak Test Program #25 is programmed with the following parameters:

Charge time: 10.0 seconds,
Settle time: 3 seconds,
Test Time: 4 seconds,
Decay Pressure: 0.5 Psig,
Pressure: 10 psi, and
Pressure tolerance: $\pm 10\%$.

The operator determines that Ports 1, 3 and 4 will be used to test the parts. To enter this information the operator must display the <LEAK TEST> screen and **touch** the “PORT” address. The <Port> screen is then displayed. The operator **touches** the Port 1, Port 3 and Port 4 addresses on this screen. These addresses will be highlighted indicating that they have been selected. Test port 2 is not selected and will not be used for leak testing in Program #25. The operator touches the “Exit” address on the <Port> screen and returns to the <LEAK TEST> screen to proceed as described in the referenced example.

The operator must connect a test part to each of the three test ports prior to running a test. If all three ports do not have test parts attached a Gross Leak Failure will occur.

APPENDIX B: STATISTICS REFERENCE

The following formulas are used for calculating the LCL and UCL for the X Bar and R charts

X-Bar Chart: $UCL = X + (A2)R$ $LCL = X - (A2)R$

R Chart: $UCL = (D4)R$ $LCL = (D3)R$

Where X = the Average of all X values
R = the Average of the Ranges of all Subgroups
A2 = Factor from Table 1
D3 = Factor from Table 1
D4 = Factor from Table 1

TABLE 1: Factors for Determining 3 Sigma Control Limits of X-Bar and R Charts

N	A2	D3	D4
2	1.880	0	3.27
3	1.023	0	2.57
4	0.729	0	2.28
5	0.577	0	2.11
6	0.483	0	2.00
7	0.419	0.08	1.92
8	0.373	0.14	1.86
9	0.337	0.18	1.82
10	0.308	0.22	1.78
11	0.285	0.26	1.74
12	0.266	0.28	1.72
13	0.249	0.31	1.69
14	0.235	0.33	1.67
15	0.223	0.35	1.65
16	0.212	0.36	1.64
17	0.203	0.36	1.62
18	0.194	0.39	1.61
19	0.187	0.40	1.60
20	0.180	0.41	1.59

NOTE: The accuracy of the statistics routines is 2 minor digits.

APPENDIX C: TME SOLUTION PLC INTERFACE

Cycle-based Input/Outputs (Standard for: Single channel, Sequential, Concurrent)

These signals refer to the outcome of the test(s) when only one ACCEPT/REJECT criteria is needed to describe the result of the tests performed by the instrument in one test cycle. Thus in the Single channel unit the ACCEPT/REJECT refers to the one outcome of the test. In the Sequential or concurrent units these outputs refer to the Overall ACCEPT (all channels passed) or REJECT (at least one channel failed). These signals are intended for parts that must be accepted or rejected based on the results of all the channels. For example parts with multiple ports to be tested. The connections to these signals are as follows:

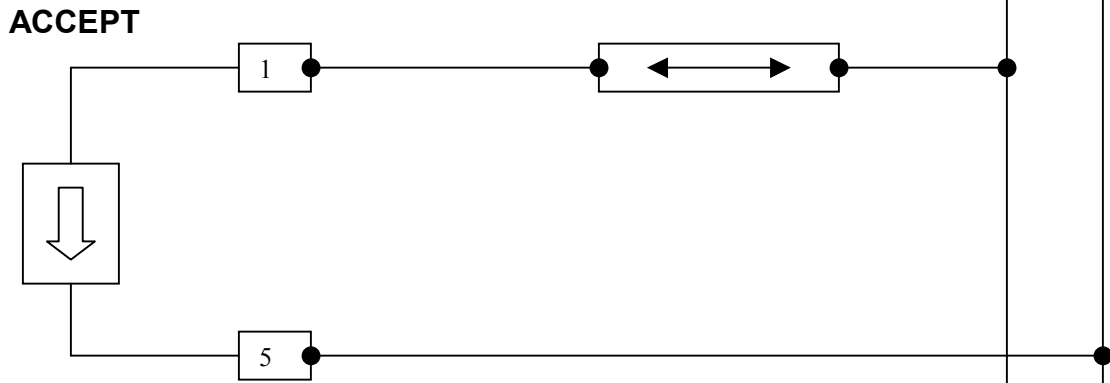
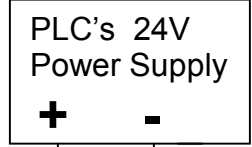
ACC Pin#	Type	Signal name	Description
1	Output-Sinking	CYCLE-ACCEPT Output	Active when ALL channels PASS
2	Output-Sinking	CYCLE-REJECT Output	Active when ANY channels FAIL
3	Output-Sinking	TEST Output	Active during the test cycle
4	Output-Sinking	NEXT Output	Active during the second test of a two-part test sequence
5	Common input	Common for sinking Outputs	Should be connected to the PLC's 24V GND (-)
9	Input-Sinking	START test input.	Actuate to START a test (t>0.25s)
6	Input-Sinking	RESET test input.	Actuate to RESET a test (t>0.25s)
10	Common-Inputs	Common for sinking Inputs	Should be connected to the PLC's 24V GND (-)

- Sinking Inputs are rated for 30V max./ 20mA
- Sinking Outputs are rated for 30Vmax. / 20mA

APPENDIX C: TME SOLUTION PLC INTERFACE (continued)

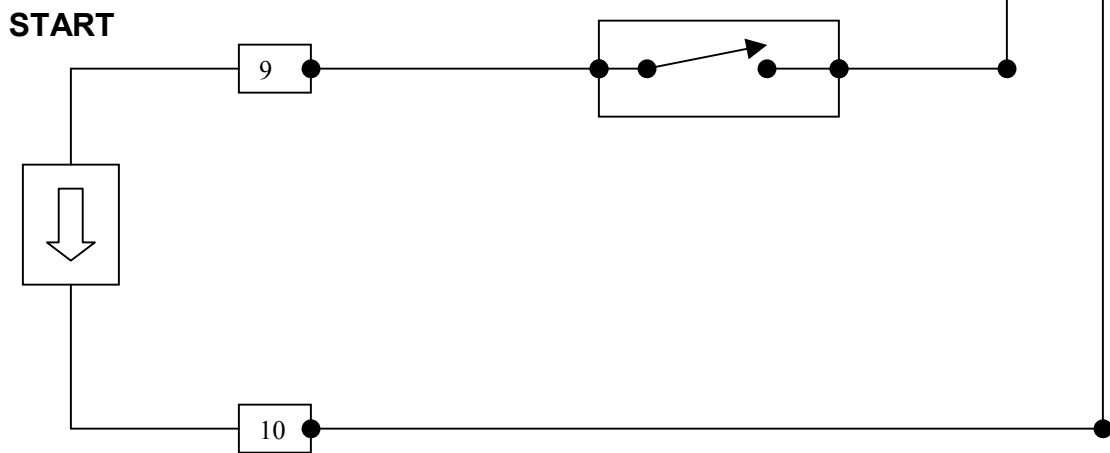
SOLUTION Sinking-Output

PLC (Sink/Source input)



SOLUTION Sinking-Input

PLC (Sink/Source Output)



APPENDIX C: TME SOLUTION PLC INTERFACE (continued)

Port-based Outputs (Optional for : Sequential, Concurrent)

These signals refer to the outcome of the individual test ports in the Sequential or Concurrent units.

These signals are intended for individual 1-port-parts tested by the instrument in one test cycle yielding multiple PASS/FAIL outputs. The connections to these signals are as follows:

ACC Pin#	Type	Signal name	Description
17	Supply input	+24V supply for all sourcing outputs.	Should be connected to the PLC's 24V Supply (+)
18	Output-Sourcing	PASS Output channel #1	Active when Channel #1 PASSEd.
19	Output-Sourcing	FAIL Output channel #1	Active when Channel #1 FAILed.
20	Output-Sourcing	PASS Output channel #2	Active when Channel #2 PASSEd.
21	Output-Sourcing	FAIL Output channel #2	Active when Channel #2 FAILed.
22	Output-Sourcing	PASS Output channel #3	Active when Channel #3 PASSEd.
23	Output-Sourcing	FAIL Output channel #3	Active when Channel #3 FAILed.
24	Output-Sourcing	PASS Output channel #4	Active when Channel #4 PASSEd.
25	Output-Sourcing	FAIL Output channel #4	Active when Channel #4 FAILed.

- Sourcing Outputs are rated 60V max / 1A

APPENDIX D: USE OF FLOW STANDARD or CALIBRATED ORIFICE

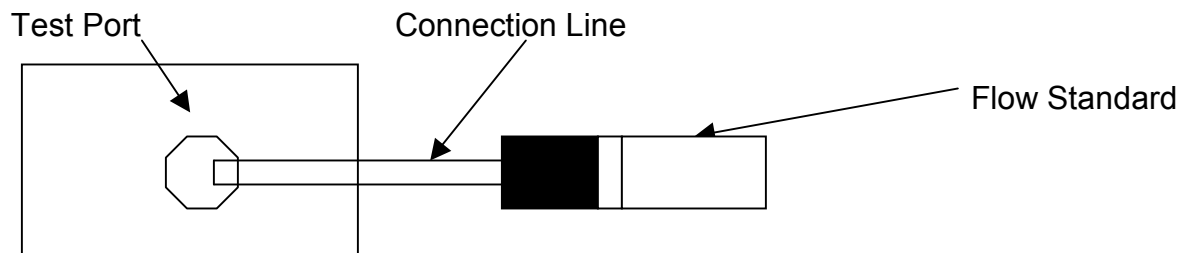
The Flow Standard or Calibrated Orifice may be used to perform a functional test of a leak or flow instrument or simulate a leak in a test part.

The following instructions assume that test parameters for the orifice being used have been programmed into the instrument.

Instrument Functional Check

These instructions assume that test parameters have been established on known good and bad parts and that these parameters have been programmed into the instrument.

Remove all fixture and test lines and items attached to the instrument. Attach the Flow Standard to the instrument with its connector line or quick disconnect fitting. Be sure nothing blocks the flow standard. Run the test.



A Flow Reading will be displayed for instruments with Mass Flow Meters. Consult the Calibration Report for the expected Flow reading.

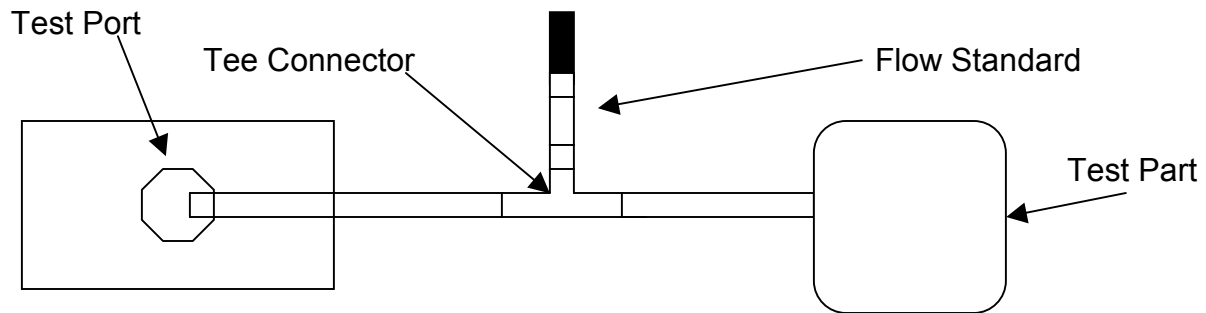
The Flow Standard can also yield a specific Pressure Decay result related to instrument test parameters and the flow specifications of the calibrated orifice. Consult T.M. Electronics, Inc. for the expected Pressure Decay Reading.

APPENDIX D: USE OF FLOW STANDARD OR CALIBRATED ORIFICE (continued)

Leak Simulation

These instructions assume that test parameters have been established on known good and bad parts and that these parameters have been programmed into the instrument

To simulate a leak in a test part the Flow standard must “Tee” into the pneumatic test circuit. This configuration will simulate the volume leak of a complete system, which includes the test part, the instrument and all connection lines. Install a “Tee” fitting on the instrument Test Port. Connect the Flow Standard to one of the “Tee” connections and a known good test part to the other connection. Run the test.



The test result will be a leak result on a good test part with a simulated leak rate equivalent to that of the flow standard. Consult the Calibration Report for the indicated leak rate.

APPENDIX E: TAL SOFTWARE

This Appendix details the configuration of TAL 3.2 Software for use with the TME *SOLUTION*. These directions provide a Quick Start Guide as well as more detailed directions. All directions are specific to a single port *SOLUTION*. **SEE the TAL 3.2 Software Manual to set up the software for a multi-channel *SOLUTION*.**

The TAL 3.2 Software allows for the ASCII output of the *SOLUTION* to be converted into keystroke data which is then presented in a spreadsheet format, such as Excel.

QUICK START FOR THE TAL WinWedge® FOR THE SINGLE CHANNEL SOLUTION

Port Setting:

Baud: 9600
Data: 8 bits
Stop: 1 bit
Parity: None
Flow: None

Select the following:

1. "DEFINE"
2. "INPUT DATA STRUCTURE"
3. "ANY CHARACTER RECEIVED" and "FIXED NUMBER OF BYTES RECEIVED"
4. Enter "42"
5. Define the data structure as follows:

Field	Bytes	Description	TAL Filter	Example
Cycle#	5	Test cycle number	NONE	"15": Cycle #15
Cycle result	6	Overall result	NONE	"ACCEPT" or "REJECT"
Test#	2	Test number	NONE	"T2": Test NUMBER
Test mode	5	Type of test	NONE	"Decay"
Data	7	Measurement	NONE	"0.0001": Decay value
Units	5	Units of measure	NONE	"Psig"
Test result	4	Result of test	NONE	"PASS": Test #2 PASS
Time	6	Time	NONE	"2:34a": Time of test
End of line	2	New line marker	IGNORE	<CRLF>

Select:

1. "MODE:"
2. "SEND KEYSTROKES TO"
3. Enter the path to "Excell.exe".
Typically: C:\WINDOWS\PROGRAM_FILES\OFFICE\EXCEL.EXE

APPENDIX E: TAL SOFTWARE (continued)

SET STREAM MODE OUTPUT FORMAT

The *SOLUTION* RS232 Mode must be set to the STREAM Mode for use with the TAL 3.2 Software. To set the RS232 Mode touch the middle of the “READY” Screen. When the <Main Menu> Screen is displayed touch the “Printer Reports” address to display the <Print/Send> Screen. Touch the “RS232” address to select the STREAM mode output format.

COMPUTER CONFIGURATION

Load the TAL 3.2 program into the computer.

A small task bar will show on the screen with titles “**File**”, “**Mode**”, “**Port**”, “**Define**”, “**Activate**”, and “**Help**”.

1. Click on “**File**”, select **New**
2. Click on “**Mode**”, select “Send Keystrokes to...”
On Title Bar select Application... Excel
Command Line...Enter the exact command path to Excel in the computer.
For example, c:\msoffice\excel\excel.exe
Click “OK”
3. Click on “**Port**”, select **Settings**
Select Connector port #,
Select Parity=even, Data bits = 7, Stop Bits=1, Flow Control = none,
Select Baud rate = 9600,
Select Output Buffer size = 1024,
Select Input Buffer size = 512.
Click “OK”
4. Click on “**Define**”, select **Input Data Record Structure**
Select “**Any Character Received**”,
Select “**Fixed Number of Bytes Received**” and
Select “**Continue**”
Enter the number 42 into the box for the complete Record Length
Click “**Continue**”

APPENDIX E: TAL SOFTWARE (continued)

Use the table below for each of the “**Field**” settings. Move the cursor to the desired field and enter the Filter and Length data presented for that field. For the “postamble” field, go to the “**Keystroke**” list to click on the correct input. Note the drop down “Keystroke” button to find added commands

Field	Filter	Length	Field Postamble
1	None	5	Tab
2	None	6	Tab
3	None	2	Tab
4	None	5	Tab
5	None	7	Tab
6	None	5	Tab
7	None	4	Tab
8	None	6	Tab
9	Ignore	2	Home; Down

4. Click “OK”
5. Return to “**Files**” and select “**Save As**” and give the program a Name
6. Click “**Activate**” and select “**Normal Mode**” to engage the program for use.

SOLUTION/TAL OPERATION

When the *SOLUTION* initially sends data to TAL, the program should activate Excel and start putting data in the columns.

APPENDIX F: FILTER DRYING SYSTEM

A Filter Drying System is recommended to ensure that only instrument quality air is used in the TME **SOLUTION**[™]. An LA-05, Filter Drying System may be purchased directly from TM Electronics, Inc. and consists of the following components:

- Coalescing Filter - 16 CFM, 150 Psig maximum at 125° F or Wilkerson M16-02-000 or ASCO #34203468,
- Desiccant Drying Filter – 10 CFM at 100 Psig; 150 Psig maximum at 125° F, or Wilkerson X03-02-000, and
- After Filter – 40 CFM, 5 μ , 150 Psig maximum at 125° F or Wilkerson F08-02-SK00 or ASCO #34204018.

Installation Responsibility and Recommendations

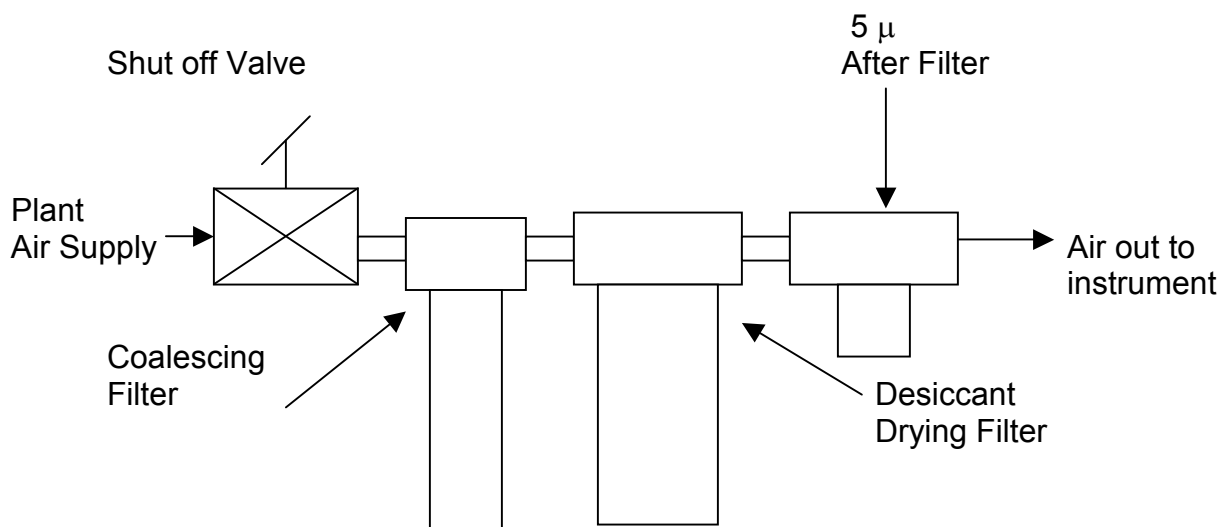
The customer is responsible for properly mounting the components to a wall or an adjacent surface.

It is recommended that the filter assembly be mounted within 10 feet from the instrument location.

It is recommended that a shut off valve be placed in line between the main air supply and the coalescing filter.

Installation

Connect the three (3) components as shown in the drawing below. Use the 1/4" NPT fittings supplied with the system.



APPENDIX F: FILTER DRYING SYSTEM (continued)

After connecting the components, mount the filter assembly in its permanent position.

Open the desiccant filter bowl and fill it with silica gel supplied with the system. Fill the filter bowl with silica gel up to 1/8" below the bowl's inner shoulder. Shake and/or tap the bowl while filling to settle the gel.

Connect the plant air supply line to the input side of the shut off valve. Connect a line from the output side of the shut off valve to the input side of the coalescing filter. If there is no shut off valve, connect the plant air supply line to the input side of the coalescing filter.

Connect an air line from the outlet of the 5 μ After Filter to the air supply connection on the back of the instrument.

Maintenance

CAUTION-The instrument Warranty does not cover water, water vapor, oil vapor or oil damage to the instrument. It is the customer's responsibility to maintain dry, clean instrument quality air.

The filter assembly should be checked on a periodic basis to assure that no water is found in the drain bowls of in any of the components. Frequency of checks should be based on the air supply quality and the frequency of use.

The coalescing filter prevents oil vapors from contaminating the desiccant drying resin. Oil contamination of the resin decreases its absorption capacity. The coalescing filter should be replaced when it appears gray, damp from contamination or when the indicator requires.

The desiccant drying material is silica gel with an indicating color. When the color is PINK the silica gel must be replaced or recharged. See the manufacturer's instructions on the insert provided for recharging directions.

The After Filter is a 5 μ particulate filter that prevents dust from the desiccant drying cartridge from entering the instrument. The filter should be monitored for discoloration or visible particulate. The 5 μ filter element can be washed and blown dry and reused.

APPENDIX F: FILTER DRYING SYSTEM (continued)

Order/Reorder Numbers for Filter Drying System Components

Filter Type	ASCO	Wilkerson
Coalescing Filter	34203468	M16-02-000
Coalescing Filter Replacement	97801005	MTP95548
Desiccant Drying Filter	N/A	X03-02-000
Desiccant Drying Filter Replacement	N/A	DRP-85-059 (2 packs/unit)
5 μ After Filter	34204018	F08-02-SK00
5 μ After Filter Replacement Element	97802070	FRP96729

APPENDIX G: TME SOLUTION SPECIFICATIONS

Dimensions	.....8 ½"W x 16"D x 10"H
Power	.....US: 115 Volts, 50-60 Hz @ 1.5 Amps.....EUROPEAN: 230 Volts, 50-60 Hz @ 1.25 Amps
Storage Environment	.....5-40°C (40-100°F), .....RH<80%, non-condensing
Operating Environment	.....5-40°C (40-100°F) .....RH<80%, non-condensing
Controls	.....Push Buttons, Touch Pad, Keylock, Power ON/OFF Switch
Test Channels	.....1,2,3 or 4; Concurrent or Sequential
Test Mode	.....Pressure or Vacuum, Single or Differential
Single Tests	.....Pressure or Vacuum; Single or Differential
Dual Tests	.....Leak/Flow; Flow Leak
Displays	.....Backlit colored LCD, 40 character x 16 line.....Alphanumeric/Graphic Display
Units	.....PSI, Inches of H ₂ O, kPa, mbar, Others are available
DATALOG Memory	.....Up to 5000 Tests
PROGRAM Memory	.....Up to 100 Linkable Test Programs
Statistics	.....Mean & Range Charts, Histograms, Mean, .....Standard Deviation, Min/Max, UCL & LCL
Manual Output	.....Test Setup Parameters, Test Results, Datalog and.....Statistics on Demand
Automatic Output	.....Current Test Results to Preset up Printer
Auxiliary Output	24 V Opto Isolated PLC Interface for Single and Multiport Configurations
Communications Port	.....RS232 Connector Program Input/Data Output
Calibration	.....NIST Traceable
Timer Ranges	.....0.1 to 1000 Seconds
PRESSURE RANGES	.....0.5-15, 1.0-50, 2.0-100, 5.0-250 Psig
VACUUM RANGE	.....0.2-28 In Hg
RESOLUTION: Decay	.....Maximum 0.0001 PSI (0.001mBAR/Sec)
FLOW RANGE (sccm)	.....Standard-250-5000 sccm.....Available-10sccm-75 LPM
FLOW RESOLUTION	.....Standard-1 sccm.....Available-0.01 sccm to 1.5 LPM
Cleaning	.....Soft cloth wetted with a glass cleaner such as Windex®

ADDENDUM: CUSTOM DESIGN INSTRUMENTS

This manual does not cover Custom Models of the TME *SOLUTION*. Please reference the Addendum shipped with the instrument for specific information related to a Custom instrument. This Operator's Manual should be reviewed prior to reviewing the Addendum as it contains information pertinent to features common to all models of the *SOLUTION*.

INSTRUMENT MAINTENANCE

WARNING! Do Not open or remove the instrument cover. There is hazardous voltage inside the instrument. Opening or removing the cover will expose the operator to a potential shock hazard and **WILL VOID THE WARRANTY.** There are no user serviceable parts inside the instrument. Refer all servicing to authorized **TMElectronics, Inc.** Service Centers

INSTRUMENT MAINTENANCE

Note **WARNINGS** and **CAUTIONS** detailed throughout this manual to prevent any damage to the instrument.

Use only a soft cloth wetted with a glass clean such as Windex® to clean the outside of the instrument.

FUSE REPLACEMENT

CAUTION! Fuse replacement must be done with the fuse(s) specified under Instrument Connections. Use of an unspecified fuse(s) may result in damage to the instrument and WILL VOID THE WARRANTY!

To replace the fuse(s), unplug the power cord from the wall outlet and from the instrument. Insert a small flat head screw driver in the opening on the top of the fuse holder cover. Twist the screw driver gently to flip the cover open. Insert the blade of the screw driver between the top of the fuse holder and its outer housing and gently twist the screw driver to release the fuse holder. Remove the holder and replace the fuse(s). Reinsert the fuse holder ensuring that the proper instrument power configuration will be visible through the opening in the cover. Replace the fuse holder cover. Plug the power cord back into the instrument and the wall outlet.

INSTRUMENT SERVICE

TM Electronics, Inc. recommends that the *SOLUTION* be recalibrated at least annually. The customer should establish an appropriate recalibration interval for the instrument. The following are some of the factors to consider when establishing a recalibration interval:

- characteristics, specifications and tolerances of the product being tested,
- frequency of use of the *SOLUTION*, and
- work environment.

Before returning any *SOLUTION* to the T.M. Electronics, Inc. for Service or Calibration contact TM's Customer Service Department at 1-508-869-6400 to obtain a Return Material Authorization Number.

WARRANTY

T.M. Electronics, Inc. warrants to the original use purchaser that it will repair or replace, at its option, any product under normal use and service that proves defective in material or workmanship, as determined by TM Electronics' inspection, within one year from the date of purchase when promptly returned to the TM Electronics factory. This warranty does not extend to damage caused by dirty air, water or water vapor, oil or oil vapor intrusion from the air supply source or from the product tested.

If TM Electronics' inspection discloses no defect in material or workmanship, repair or replacement will be made at customary charges. Freight charges are the customer's responsibility.

The foregoing warranty supersedes, voids and is in lieu of all or any other warranties, expressed or implied, and no warranty of merchantability or fitness for particular purposes is intended or made. TM Electronics' sole obligation and the original use purchaser's sole remedy is as stated above and in no event shall TM Electronics be liable for any special, direct, indirect, incidental, consequential or other damages or expenses of any nature including, without limitations, loss of profits of production time incurred by the original use purchaser or any other party.

DO NOT ATTEMPT TO OPEN THE INSTRUMENT. There are no user serviceable parts inside and opening or removing the cover **WILL VOID THIS WARRANTY.** Refer all servicing to authorized T.M. Electronics, Inc. Service Centers.

T.M. Electronics, Inc.
45 Main Street
Boylston, MA 01505
508-869-6400