

**TME BT-1000-V5 PACKAGE TESTER
OPERATOR'S MANUAL**

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INTRODUCTION

THE TM ELECTRONICS PACKAGE TESTING SYSTEM

Evaluation of the integrity of a sealed package (porous or non-porous) by inflating it to its point of failure, the BURST TEST, has been a test standard in the packaging industry since 1980. Porous and non-porous packages alike have been tested using the CREEP TEST. In the past, most package test instruments have been able to perform these basic tests. Now, with the arrival of the BT-1000, additional testing can be done on each package. A LEAK TEST, and a CREEP TO FAILURE TEST along with four dual tests – CREEP/BURST, CREEP/LEAK, LEAK/BURST, and LEAK/CREEP TO FAILURE have been added to increase the value of your BT-1000.

Automatic operation of the principal test setup parameters – pressure and flow – has been added to increase the accuracy and repeatability of your BT-1000. Repeatability of the burst and creep test is also improved by refining the method used to introduce air pressure into a sealed package. Air leakage around the probe entry is eliminated with a patented device that seals the entry probe to the package by means of an adhesive disc. The PACKAGE PORT™ provides a consistent, repeatable input of air to your test sample, and is the fundamental factor allowing the BT-1000 to perform a leak test.

FEATURES OF THE BT-1000

The BT-1000 is a versatile package test system designed to test various sizes and styles of packages. Some features of the BT-1000 are:

- Burst test, Creep test, Creep to Failure test and Leak Test.
- Dual tests – combining tests gives you a better picture of the quality of the package being tested by testing the package using two different methods.
- Statistics are included, showing X-bar and R control charts as well as a histogram on the display.
- Multiple displays, including statistics, plotted test results, large numerical results, and a datalog display, give the operator or quality team as much information as possible about the packages being tested.
- RS-232-C communication combined with a computer lets you save all the test data on a computer's disk drive for future processing.
- Key lock – Locking the set-up parameters during a test run is important to prevent any inadvertent changes.
- Simplicity is designed into the BT-1000 by using a familiar ATM format that guides you through each step in every test.
- Test datalog – the result of the previous one thousand (1000) tests are stored in non-volatile memory and can be listed on the display or printed.

EXPLANATION OF TESTS

BURST TEST – CREEP TEST – CREEP TO FAILURE TEST – LEAK TEST

Burst testing is the standard test for a TM Electronics BT-1000. However, to understand more about the integrity of the package being tested, our BT-1000 is also equipped with a CREEP TEST, CREEP TO FAILURE, and LEAK TEST. The availability of these four test modes is extremely useful due to the variety of packages being tested and the different parameters to be met. **See *ASTM F-1140 Test Method for Burst and Creep Tests* or *ASTM F-2054 Test Method for Burst and Creep Testing Using Restraining Plates*.**

Burst Testing: This form of test pressurizes a package to its failure point. This is accomplished by presetting the pressure and flow to a point above the point of failure.

Creep Testing: This form of test holds the pressure on a package for a given time. A package that bursts during this test is considered a failure. A package that does not burst during this test is acceptable.

Creep to Failure: This form of test holds the pressure on a package until the seal peels apart and fails. The “time to failure” becomes a measure of the seal strength.

Leak Test: This form of test pressurizes a package to a given pressure and stabilizes the package for a given period and then monitors the pressure decay inside the package. A pre-determined pressure decay determines the acceptability of the package.

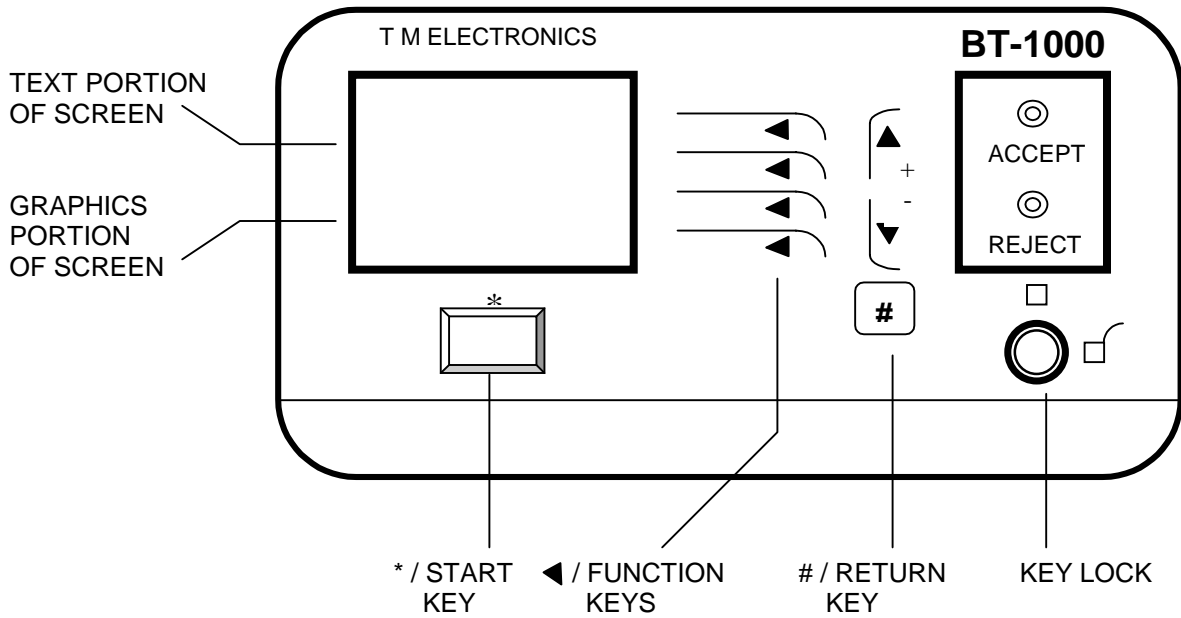
It is important to examine the tested package after a burst test, creep test, creep to failure test or a leak test. Thoroughly checking where the seal broke or the package split gives a better idea of where the stressed points are. To test a package properly, a burst test, a creep test and a creep to failure test should be performed. These tests can be performed on porous or non-porous packages. On non-porous packages a leak test can be added.

Using the patented TME Package-Port™ : The Package-Port™ was invented by TME to enhance the repeatability of testing many package materials as well as to make possible the pressure decay leak test for non-porous material packages.

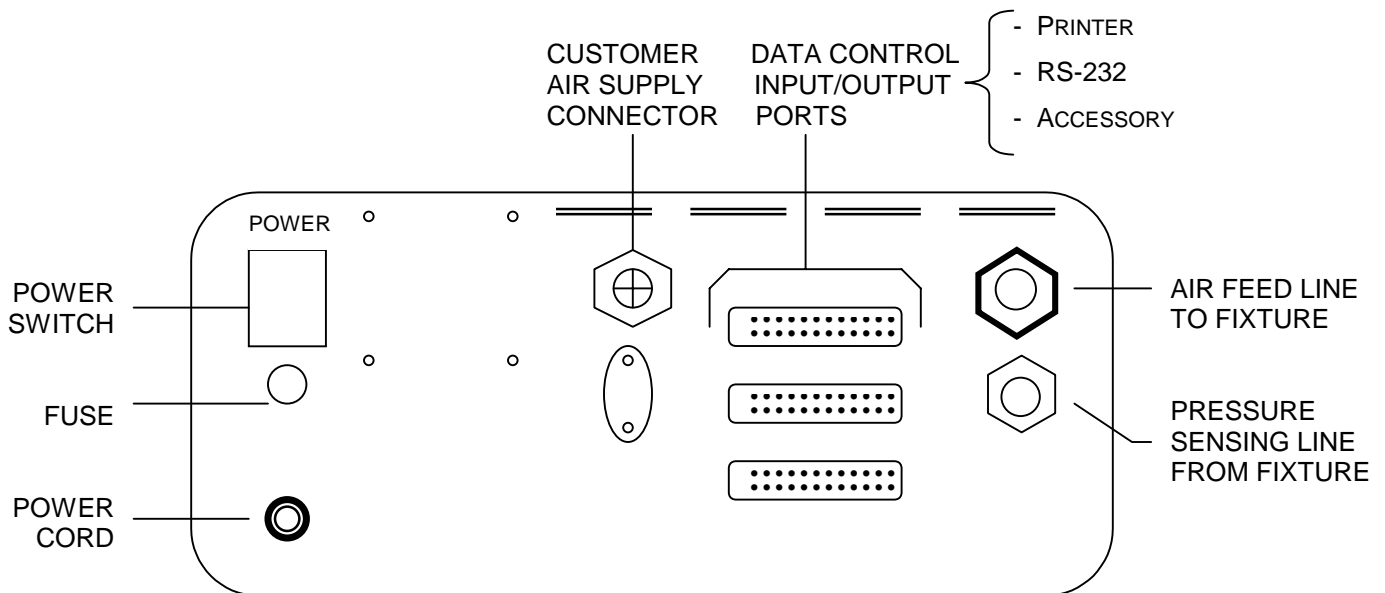
Using the TME Closed Package Probe: The Closed Package Probe is designed to use with the TME Package-Port™. CAUTION: When using the Closed Package Probe, the package *must be rotated 90-180°* after penetration of the package to prevent the cut flap from blocking the sensor tube (see Appendix C).

INSTRUMENT CONTROL LOCATIONS

FRONT PANEL



REAR PANEL



CONNECTORS

Refer to “INSTRUMENT CONTROL LOCATIONS” for location of the parts mentioned below.

AIR SUPPLY CONN: Compressed air inlet to the instrument – standard fitting
Pneumatic for plastic tubing of ¼” O.D.

Note: The BT-1000 can use either air or nitrogen. It must be clean, dry and instrument quality. The recommended input pressure is between 90 and 150 PSIG, at 8-10 CFM capacity.

AIR FEED LINE: Air outlet, to be connected to the part(s) to be tested via a
Pneumatic 3/8” tube and a standard fixture. Standard: 3/8” Male Quick Connect (Colder).

PRESSURE SENSING: Connection of the transducer to the part(s) line
Pneumatic to be tested via a 5/32” tube and a standard fixture. Standard: Male Quick Connect (Colder).

PRINTER: Printer output connection.
Electrical Interface: Centronics
Type: DB-25 female

RS232: Serial port input/output connection.
Electrical Interface: RS232-C
Type: DB-25 male

ACC: Accessories control connection.
Electrical Interface: Proprietary
Type: DB-25 female

POWER CORD: 100-125 VAC / Grounded plug.

CONTROLS

POWER SWITCH: Turns instrument ON/OFF.

KEY LOCK: Locks key pad to prevent parameter or datalog changes (the open lock symbol indicates that keypad is UNLOCKED, and the closed lock symbol indicates it is LOCKED).

ACCEPT LIGHT: Indicates when the result of a Creep or Leak test is a PASS or ACCEPT.

REJECT LIGHT: Indicates when the result of a Creep or Leak test is a FAIL or REJECT.

Note: No pass/fail criteria can be input for the Burst or CTF tests.

KEY PAD

* / START	This button starts a procedure or returns to menu from a secondary screen.
< / CONTROL	<ol style="list-style-type: none">1. Indicates a choice in the items displayed on an associated screen.2. Activates the HELP screen in the “Ready” mode.
+ / UP ARROW	<p>Raises the values of parameters when in the specific test set-up procedure.</p> <ul style="list-style-type: none">• When pushed once, the number will advance one step per push.• When held, the number will quickly count up ten (10) steps. At that point, the cursor will advance to the next digit and count up ten (10) steps. This will proceed until the last digit and the maximum reading is reached. <p>→ When pressed in ready mode, accesses the TEST DATA MENU screen.</p> <p>→ When pressed in certain setup procedures will move indicator arrow up.</p> <p>→ While in the datalog viewing screen, will scroll the data up</p>
- / DOWN ARROW	<p>Lowers the values of parameters when in specific test procedures.</p> <ul style="list-style-type: none">• When pushed once, the number will advance one step per push.• When held, the number will quickly count up ten (10) steps. At that point, the cursor will advance to the next digit and count up ten (10) steps. This will proceed until the last digit and the maximum reading is reached. <p>→ While in the datalog viewing screen, will scroll the data down</p>
# / RETURN	Returns procedure to MAIN MENU screen, or the “Ready” screen in some menus.

INSTALLATION

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

- The BT-1000 instrument.
- Air supply tube (1/4" PE tubing).
- Instrument/fixture dual connection tube (3/8" and 5/32" dual tubing) – if supplied with a fixture
- Keys (2)
- Calibration Certificate
- Options (if ordered):
 - TS-01 – Open Package Test Fixture
 - TS-02 – Closed Package Test Fixture
 - One set of Package Ports (included only with TS-02 Fixture)
 - One roll of 1000 discs – Package Port Adhesive (included only with the TS-02 Fixture)

Consult with the factory for missing or damaged parts.

LOCATION: The BT-1000 should be installed in an environment with moderate temperature, humidity and static electricity. Keep away from strong RF or electromagnetic interference or machinery that generates large line voltage spikes.

CONNECTION: Connect the power cord of the instrument to a three prong, 120 volt AC outlet.

Connect the enclosed air hose from the "AIR SUPPLY" port to a compressed air outlet. The air must be "instrument quality", free of moisture, oil and dust, and at a pressure between 90 and 120 PSIG.

Note: The warranty DOES NOT APPLY to failures due to poor quality air supply.

POWER UP

Turn on the BT-1000 by using the power switch located on the back of the instrument. The instrument starts its automatic self-diagnostic test, the following message will be displayed:

*	T. M. ELECTRONICS	*
*		*
*	BT-1000-50 V5	*

DATE	TIME	
INITIALIZING SENSORS 60.0		

During this time the ACCEPT and REJECT lights are kept ON to verify that they are operational. After the initialization, it is possible that the instrument will display an error message. Should this happen, call TM Electronics at (508) 856-0500 for technical support.

After the initialization is complete, the BT-1000 will display the first MAIN MENU screen. This signals that the instrument completed all the internal diagnostics and is ready to start testing.

MAIN MENU

When you turn on your BT-1000 it will proceed through an initialization cycle. During this time the instrument will be performing diagnostics on its pneumatics and electronics. This portion of the manual describes the MAIN MENU functions. After initialization the first screen of the main menu will appear on the display. The screen and functions are illustrated below.

SCREEN

FUNCTIONS

MAIN	MENU	1/3	V
BURST	TEST	MODE	<
CREEP	TEST	MODE	<
C/T/F	TEST	MODE	<
LEAK	TEST	MODE	<

- ← Main Menu screen 1 of 3
- Use the **DOWN ARROW/-** to proceed to the next menu screen
- Choose an option using the appropriate '<' key.

NEXT MENU:

MAIN	MENU	2/3	V	^	#
CREEP + BURST		MODE	<		
CREEP + LEAK		MODE	<		
LEAK + BURST		MODE	<		
LEAK + C/T/F		MODE	<		

- ← Main Menu screen 2 of 3
- Use the **DOWN ARROW/-** to Proceed to the next menu screen
Use the **UP ARROW/+** or the **RETURN/#** sign to return to the previous screen.
- Choose an option using the appropriate '<' key.

NEXT MENU:

MAIN	MENU	3/3	^	#
OUTPUT REPORTS			<	
STATISTICS DATA			<	
MISC. CONTROL			<	
CALIBRATION MODE			<	

- ← Main Menu screen 3 of 3
- Use the **UP ARROW/+** or the **RETURN/#** sign to return to the previous screen.
- Choose an option using the appropriate '<' key.

BURST TEST

The objective of the **Burst Test process** is to supply adequate back pressure inside the package to yield a force large enough to separate the package seals. Generally, larger packages will have a lower burst pressure than smaller. The flow rate into the package is determined by both the pressure regulator and the flow valve settings. The regulator will supply higher flow rates with higher pressure settings. The flow valve has sixteen (16) predetermined settings (from 1 to 16), with 1 giving minimum flow and 16 giving maximum flow. Timer values control the maximum amount of time that the Burst test will run. Typical burst tests may run 0.5 to 10 seconds depending on materials and size. When pressure and flow parameters have been established the Timer is usually set at two times the average time to burst.

For porous materials, the internal back pressure is a function of input flow rate of air and the flow rate out of the package due to material porosity. Non-porous materials do not leak air, therefore the internal back pressure can be controlled with the regulator and fill rate controlled with the flow value.

CHOOSING BURST TEST PARAMETERS

Burst test setup parameters may be chosen manually or by using the “Auto-Set” feature of the BT-1000 (see Page 14).

Caution: When using the “Auto-Set” feature, the instrument will choose values from a limited test matrix of values. These values are only approximations of test parameters based on a limited set of test packages. Resultant values should only be used as a starting point for correctly identifying setup parameters based on running a sample lot of packages that may have materials or process variables inherent in the package sealing process.

Burst values may be chosen manually by inputting of the Pressure, Timer and Flow values. The values chosen will be a function of the package material type, porous or non-porous, and package size.

Enter the BURST TEST MODE by pressing the top ‘<’ key while in the first screen of the MAIN MENU, and the Burst settings screen will be displayed. The screen and functions are illustrated below:

BURST SETTINGS	*	#
PRESSR	: 0.0 PSIG	<
TIMER	: 0.0 SEC.	<
FLOW	: 0 {POROUS}	<
PROGRAMS/AUTO-SET		<

← Use the ***/START** Key to proceed with the test using the current settings.

Use the **#/RET** Key to return to the Menu.

Use the appropriate ‘<’ Key to manually change a setup parameter.

Use the fourth ‘<’ to start the automatic setup procedure or to store and recall setup programs.

When one of the setup parameters is chosen by pushing the appropriate ‘<’ key, the modification screen will appear on the display.

The first ‘<’ key brings up the Pressure Change screen.

The second ‘<’ key brings up the Timer change screen.

The third ‘<’ key brings up the flow change screen.

BURST TEST (Continued)

The fourth '<' key will enable the PROGRAMS/AUTO-SET function. The parameter change screen is described on Page 16.

Determining Parameters for Non-Porous Materials

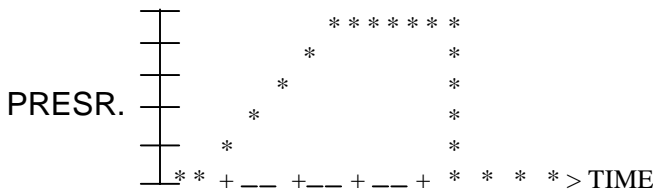
When testing non-porous materials, the Burst test settings can be determined by starting at mid-range, i.e. pressure = 25 psig, flow = 8, and timer setting of 5 seconds. After running one test, view the "Test Plot" screen and compare your results to the examples below:



The Ideal Burst Curve

The pressure ramps up at a constant rate (typical for non-porous materials).

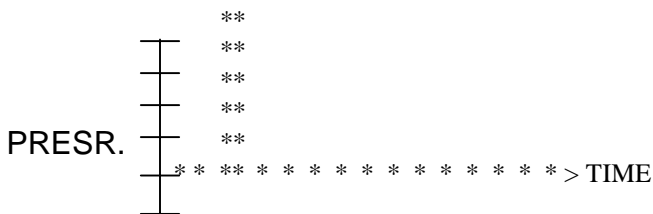
**Pressure/Flow settings are correct.



The Delayed "Burst" Curve

The pressure leveled off at a value for a significant percentage of the test time, then a "burst" occurred.

**Increase pressure and/or flow.



The Sharp "Burst" Curve

The pressure curve rises steeply followed by a burst (typical for non-porous materials).

**Decrease flow for non-porous materials.

Repeat this process until you achieve a plot resembling the ideal burst curve shown above. Timer values can be adjusted to scale the plot to a typical 2-3 second burst time. Set the timer to approximately twice the burst time.

Determining Parameters for Porous Materials

For porous materials, the selection of Pressure and Flow values is chosen based on the porosity of the package materials and the area of the porous material. Remember that, in principle, more air must flow into the package than flows out of the porous wall to allow a back pressure to develop inside the package.

Selecting a pressure and flow setting for porous packages generally depends on package porous material area. For small packages (less than 16 in² porous materials) a pressure setting of 20 psi and flow setting of 10-12 might burst the package consistently. Burst timer, as seen on the "Test Plot" screen, should be greater than 0.5 seconds. An initial timer setting of 5 seconds

BURST TEST (Continued)

can be tried first. If burst times are too short, then decrease flow values. If burst times are too long or the timer says "TOVR", then increase flow rates to maximum in steps or increase pressure value above the 20psi level to increase the regulator output flow.

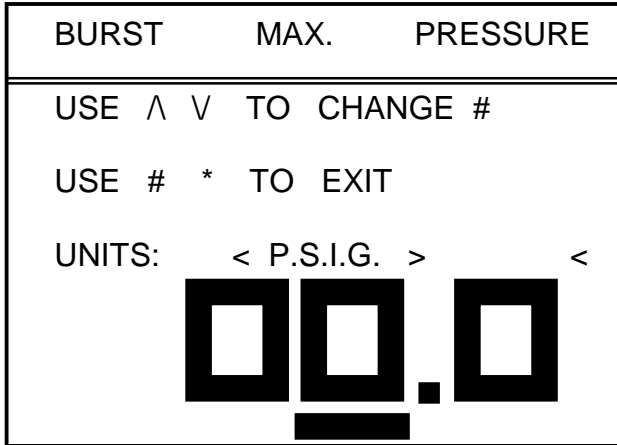
For larger packages (64 in² or above), a setting of 50psi can be tried first with flow values at f = 8. Again, decrease flow or pressure values if the burst time is too short (less than 0.5 seconds) or increase flow values, in steps, if burst time is too long or the timer says "TOVR".

Note: Porous barrier materials will vary even within lots of packages. When testing porous barrier packages several samples should be run to determine that 90% or more packages will burst on testing.

PARAMETER CHANGE SCREEN

This procedure is used throughout the BT-1000. Any time a parameter needs to be changed, this screen will be displayed. Push the top '<' key to access the following screen. The screen and functions are illustrated below.

SCREEN



FUNCTIONS

- Use the second '<' key to change the Display units.
- Use the UP ARROW/+ to increase the maximum burst pressure available to burst the package.
- Use the DOWN ARROW/ - to decrease the maximum burst pressure available.
- Use the RETURN/# key to return to the SETTINGS screen.
- The cursor line will be below the digit being changed.

Using this screen is very simple. The UP arrow key increases the parameter while using the down arrow decreases the parameter. Either the * / **START** or the # / **RETURN** key will exit the screen. The final number displayed on the screen when exiting will be the set point for the parameter.

Changing the units in the pressure change screen is the same procedure as changes in the flow change screen. In the pressure change screen pressing the second '<' key will toggle between In. H₂O and PSIG. In the flow change screen, pressing the second '<' key will toggle between *porous* and *airtight* modes.

NOTE:

- The maximum pressure available is 50 PSIG (1384 In. H₂O) or 100 psi for BT-1000-100.
- The flow settings are numerical reference points to allow you to return to the same setting easily. There are sixteen (16) different flow settings (note: 1 is low flow, 16 is high flow).
- The maximum time available is 999.9 seconds.

Combinations of pressure regulator and flow number settings will provide a continuous scale of output air flow to the package. Once a combination of pressure and flow settings is chosen the instrument will repeat the output air flow each time that combination is used.

PROGRAMS/AUTO-SET

Once the setup parameters have been established by the instrument or the operator, the option of storing them in non-volatile memory is available. Up to ten different programs can be stored for each of the eight (8) different test modes. In addition, a function designed to find the BURST setup values for a package has been built into the BT-1000

Choosing the PROGRAMS/AUTO-SET option will display the following screen. The screen and its functions are illustrated below.

SCREEN

BURST SETTINGS	Λ	V	#
RECALL PROGRAM	#0	<	
STORE PROGRAM	#0	<	
AUTOSET :	AIRTIGHT	<	
AUTOSET :	POROUS	<	

FUNCTIONS

Use the 'Λ' key to increase the program number to be used.

Use the 'V' key to decrease the program Number to be used.

Use Pound key to return to BURST SETTINGS screen.

- Use the first '<' key to recall a program.
- Use the second '<' key to store a program.*

*Note that a program number must be selected first to store or recall a program.

C. Autoset : Airtight

Use the third '<' key to automatically find and set the BURST parameters for airtight packages. *Airtight packages are those that are not breathable, usually made of films, foils or laminates.*

D. Autoset: Porous

Use the fourth '<' key to automatically find and set the BURST parameters for a POROUS package. *Porous packages are those that are breathable.* Generally porous packages contain sections made from materials that allow the passage of air (Tyvek[®] or paper). The amount of air flow to burst a porous package depends on the porosity and area of the breathable surface. The "Auto-Set" mode has a limited matrix to determine package test parameters. Once a group of settings is determined, several more packages should be tested to optimize the test parameters to achieve the typical burst curve and determine materials consistency for those test parameters.

NOTE: When storing a program, the current setup parameters become the program parameters for that specific program number. **ANY PREVIOUS PARAMETERS SAVED IN THAT PROGRAM NUMBER WILL BE LOST.** Also, when a program is recalled the program parameters become the current parameters, and **ANY PREVIOUS SETUP PARAMETERS WILL BE LOST.**

AUTO SETTINGS – BURST MODE ONLY

This function is designed to give the operator an idea of what the setup parameters should be used on a given package. The parameters **are not designed** to be the final set points for every package tested. They may work better on one package than on another. If the recommended parameters do not give a precise and repeatable burst, simply adjust one or all of the parameters to give a more precise test. When either the third or fourth '<' key is pressed the program moves into the automatic parameter setting feature, and the following screen is displayed. The screen and its functions are illustrated below.

SCREEN

ENTER ROUGH SIZE	#
SMALL : A< 16 Sq In.	<
MEDIUM : A< 64 Sq In.	<
LARGE : A< 144 Sq In.	<
XLARGE : A< 400 Sq In.	<

FUNCTIONS

- ← Auto Settings screen
- Use #/RETURN to return to the previous screen.
- a. Choose a package size by using the appropriate "<" key.

After attaching your package onto your test fixture, select the rough size that most closely matches your package. To make estimating easier, the area of the pouch (physical size) is used in place of its internal volume.

Once a size has been chosen the BT-1000 will begin testing the package to estimate the maximum pressure, time, and flow required for a burst test. TWO MINUTES is the longest time this auto-setup procedure will take, and when complete, the setup parameters will be calculated and displayed in the BURST SETTINGS screen. During the auto-setup procedure the following screen is displayed:

Screen at end of Auto-Set:

POROUS (AIRTIGHT) AUTO SETUP		
SETTING FLOW	:	DONE
SETTING PRESSURE	:	DONE
SETUP TEST	:	@

BURST SETTINGS		*	#
PRESSR	:	5.15 PSIG	<
TIMER	:	47.4 SEC	<
FLOW#	:	10 AIRTIGHT	<
PROGRAMS/AUTO-SET			<

BURST TEST READY MODE

When the * / Start key is pushed in the BURST SETTINGS screen the following Burst test screen is displayed.

BURST		READY		*	Λ	#
PART#	:					H
E-TIME	:					E
RESULT	:					L
STATUS	:					P
BURST		PRESSR.		[In H2O]		
		□		□		
		□		□		
*	█					

←

BURST mode is being used.
 READY to begin a test.
 */ START begins the test.
 Λ goes to the Datalog
 # / RETURN returns to main menu

- a. Use the first or second '<' key to display the help screen. The Help screen shows test parameters and directions on moving to output screens.
- b. Use the third and fourth '<' key to change the result display to any of the functional outputs (datalog, counter, test plot or statistics). Only the bottom half of the display will change.

See the description of each screen following in “Display Screens”.

DISPLAY SCREENS

When the BT-1000 is in the “ready” mode of any test (see the above screen) the operator will be able to change the result display by pushing either of the bottom two “<” keys. The third key scrolls through the display styles in one direction, and the fourth key scrolls through the styles in the reverse direction. There are eight different result displays accessible. They are:

- | | | | |
|----|---------------------------|---|--|
| 1. | A LARGE NUMERICAL READOUT | - | one inch tall display of the test pressure |
| 2. | THE TEST RESULT COUNTERS | - | totals of the test results |
| 3. | A GRAPHIC TEST PLOT | - | an X-Y PLOT of pressure vs. time |
| 4. | A DATALOG LISTING | - | a listing of the last eight test results stored in the Datalog |
| 5. | STATISTICAL DATA | - | Mean (AVG), MIN, MAX, STANDARD DEVIATION, and RANGE |
| 6. | HISTOGRAM | - | A five bar histogram ($\pm 3\sigma$ range) |
| 7. | AN \bar{X} CHART | - | A running \bar{X} -chart of the results |
| 8. | AN R CHART | - | A running R-chart of the results. |

HELP SCREEN

{	3:00 PM	6/1/93	}
PRESSR	:	10	PSIG
TIMER	:	3	SEC.
FLOW	:	4	{ POROUS }
PROG.	:	1	
' * '	:	TO START TO TEST	
' # '	:	TO EXIT TO MAIN	
' + '	:	DATALG/STATS/REPORTS	
' < ' 3&4	:	CHANGE DISPLAY MODE	

A help screen, shown here, is provided to display the time, date, and setup parameters, as well as a reminder of the function of the main keys. It is accessible any time the display is in the READY state by pressing either of the top two ' < ' keys.

1. You must hold down the HELP < key to continually view the screen.
2. When using the # key the program returns to the Main Menu. The “Test Plot” of the last test will be erased when you exit. If the “Overwrite Warn” feature (see Page 40) is NOT engaged, then ALL TEST DATA IN THE DATALOG WILL BE ERASED when returning to the “Ready” mode.
3. Use the “+” (up arrow) key to Print or View (output) data to avoid using Main Menu.
4. Printed output of the Datalog, statistics and charts are accessed directly from the “Ready” mode using the “+” (up arrow) key. The datalog can be downloaded via the RS232 port to an attached computer.

RUNNING THE BURST TEST

Once the Burst Test set up parameters are entered (see Burst Test Setup Procedure), pushing the * / Start key begins the test. Once the test is begun, it will automatically continue until the package fails or the time runs out, at which time the air flow will shut off and the result will be displayed on the screen. Upon completion the following screen is displayed.

BURST	READY	*	Λ	#
PART#	:	1	3:00p	H
E-TIME	:	65%		E
RESULT	:	35.0	In H2O	L
STATUS	:	BURST		P
BURST	PRESSR.	[In H2O]		
		35.0		

- Time is the time of day of the test.
- Part# is the datalog number since the beginning of this series.
- E-Time is a percentage of the “time” Setting in test parameters
- Result is the maximum pressure reached in the package prior to failure with the chosen units of measurement.
- Status is Burst or time over (Tovr)*.

Pressing the */START key again begins the test without returning to any other menu screen. During the test a line will expand along the bottom of the screen. This is a time line. If the burst occurs prior to the time standard being reached, the time line will stop, indicating approximately when the package burst in the cycle. If the time line expands all the way across the screen, the package has not burst and the time is over (T-Ovr). This time line appears on the bottom of every “single-test” test screen, not on “dual test” screens.

Notes:

- The Accept/Reject limit lights are not functional in the Burst mode. No limits can be input for burst values.*
- Description of Results:*
 - The first line of the Results screen shows the Part Number associated with the current test in the datalog. (If tracking is required, mark each package with this part number). The time of day is also indicated on this line and is stored in the datalog.*
 - E-Time is the elapsed time from the test beginning to end. If the package bursts, then it is the time from the start of the test to the time it took to burst. E-Time is shown as a percentage (%) of the “Timer” in the setup parameters (see previous discussion) since the test may have any time from 0.1 – 999.9 seconds input.*
 - The Result value is the tested value for the peak internal pressure at which the package ruptured (burst pressure). The value will be read in units chosen during the “Pressure” setup parameter screen. This value is usually in psi or In H₂O pressure units.*

RUNNING THE BURST TEST (Continued)

- d. *The status reading is either “Burst” or “T-ovr”. A Burst value indicates that the package ruptured and was recorded before the “Timer” setting elapsed, or timed out. A value of “T-Ovr” indicates that the package did not rupture (burst) before the “Timer” setting elapsed. A “T-Ovr” value is an invalid test. The data shown will not be used in statistical calculations, although the data will be recorded in the datalog.*

3. Using the Test Plot Screen

One of the eight data output screens is the “Test Plot”. This screen is one of the most powerful tools available in the BT-1000 instrument. The Test Plot screen shows the actual result of Pressure and Time reaction inside the test package volume. Using the Test Plot an operator can determine:

- 1. The peak pressure at Burst*
- 2. The time to burst*
- 3. The fill rate of the package to burst*
- 4. If the test is a delayed burst*
- 5. The characteristic curve of a set of package materials and process conditions*
- 6. If the seal has multiple seals, an observation of each burst pressure can be made.*

The Test Plot is an efficient tool to aid in establishing Pressure and Flow parameters in new packages. The Test Plot can be printed and used to compare packages in different lots or compare characteristics for trouble-shooting process condition changes.

DATA REVIEW SCREENS

Pressing the ' +/UP ARROW ' key in the READY MODE, the TEST DATA MENU is displayed. There are four options provided in the Test Data Menu:

SCREEN	FUNCTIONS										
<table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 80%;">TEST DATA MENU</td> <td style="width: 20%; text-align: center;">#</td> </tr> <tr> <td style="text-align: center;">VIEW DATALOG</td> <td style="text-align: center;"><</td> </tr> <tr> <td style="text-align: center;">OUTPUT REPORTS</td> <td style="text-align: center;"><</td> </tr> <tr> <td style="text-align: center;">SET STATISTICS</td> <td style="text-align: center;"><</td> </tr> <tr> <td style="text-align: center;">SET CONTRAST</td> <td style="text-align: center;"><</td> </tr> </table>	TEST DATA MENU	#	VIEW DATALOG	<	OUTPUT REPORTS	<	SET STATISTICS	<	SET CONTRAST	<	<p>← Use RETURN/# key to return to the previous screen.</p> <p>a. Choose an option using the appropriate "<" key.</p>
TEST DATA MENU	#										
VIEW DATALOG	<										
OUTPUT REPORTS	<										
SET STATISTICS	<										
SET CONTRAST	<										

VIEW DATALOG

Choosing the "VIEW DATALOG" option displays the following screen:

TEST DATALOG	^	v	#
FIRST : 10:26 am			
LAST : 4:18 pm			
DATA [In H2O]			#: 4
NUM	TIME	DATA	RSLT
1	10:26	65.5	BURS
2	10:28	65.0	BURS
3	10:35	64.5	BURS
4	10:45	66.0	BURS

← Use the "^" key to scroll up.
Use the "v" key to scroll down
Use the "#" key to return to the READY MODE.

The Test Data screen may also be accessed from the Main Menu. However, if you leave the "Ready Mode" and EXIT to the Main Menu, then the Test Plot will be erased.

Caution: Leaving the "Ready Mode" to the Main Menu and re-entering the "Burst" (Creep, CTF or Leak) Mode will ERASE the Datalog – UNLESS the WARN OVERWRITE toggle is set to "yes" (see Page 40).

DATA REVIEW SCREENS – Cont.

OUTPUT REPORTS

(See *Caution for Data Review Screens on previous page*)

To facilitate record keeping, the BT-1000 is equipped to send the test results and other information to an attached, compatible printer or to the RS232 port.. Test results will be sent automatically to the printer or output to an attached computer through the RS232 port. To output other stored data use the following screen:.

SCREEN

OUTPUT REPORTS	#
OUTPUT LAST TEST	<
OUTPUT SETTINGS	<
OUTPUT DATALOG	<
OUTPUT STATISTICS	<

FUNCTIONS

- ← Output Reports screen.
Use the #/RETURN Key to return to the MAIN MENU screen.
- Choose an option using the appropriate “<” key.

Using the OUTPUT LAST TEST function sends the results of the last test to the printer. If the BT-1000 is in test plot mode, the last test result will be followed by a printed plot of the test curve.

Using the OUTPUT SETTINGS function sends the setup parameters and program number of the current test to the printer.

Using the OUTPUT DATALOG function will send the contents of the datalog to the printer.

Using the OUTPUT STATISTICS function will send the statistical calculations, the Histogram, the X-Bar chart, and the R chart to the printer.

DATA REVIEW SCREENS – Cont.

SET STATISTICS

The BT-1000 offers statistical operations that can be either manually entered and changed, or automatically calculated. These operations are accessed from the “Test Data Menu” using the + up arrow in Ready mode or the second Main Menu screen. Push the “<” key across from the STATISTICS DATA option and the following screen will be displayed. See Caution for Data Review screens.

STATS.	SETTINGS	^	V	#
X UCL:	0.0	In H2O	<	<
X LCL:	0.0	In H2O		
R UCL:	0.0	In H2O		
R LCL:	0.0	In H2O		
SIZE,N	0			
TO CHANGE PARAMETERS USE ^ OR V THEN < TO ENTER SELECTION				
CALCULATE UCL & LCL				



Use the ARROW UP/+ key or the ARROW DOWN/- key to position pointer alongside of the parameter to change.

Use the #/RETURN Key to return to the “Ready” screen or Main Menu

- Use one of the top three “<” keys to manually change a setup parameter.
- Use the bottom “<” key to calculate the upper and lower control limits for X & R charts from the current datalog set.

The following definitions apply to the previous screen:

- \bar{X} - The average of the readings in a sample of N tests.
- R - The Range of the difference between the minimum and maximum readings.
- UCL - Upper Control Limits
- LCL - Lower Control Limits
- N - Sample Size (or sub groups in a test run for the Control Charts).

The modification screen for the statistics settings is the same as the modification screen for the Burst test settings. If you need to review it, see the BURST TEST SETUP PROCEDURE.

The sample size is the number of tests averaged to determine one point on the \bar{X} or R control charts. Every test result is recorded in the datalog, and the averages are calculated based on the sample size, N. A maximum of 20 samples are allowed.

The LCL or UCL can be entered or changed manually based on operator calculations, or the BT-1000 can calculate the LCL for them. The BT-1000 calculations are based only on the test results stored in the datalog. Each point of the X and R chart is an average of the number of tests.

DATA REVIEW SCREENS – Cont.

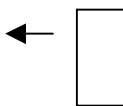
SET CONTRAST

The contrast of the screen can be adjusted for ease of reading. The screen and its functions are illustrated below.

SCREEN

DISPLAY CONTRAST #
USE ^ V TO CHANGE #
USE # * TO EXIT
100

FUNCTIONS

- 
- Use the RETURN/# key to return to the READY screen.
 - Use the UP ARROW/ + to increase the contrast (maximum value 125).
 - Use the DOWN ARROW/- to decrease contrast.

CREEP TEST

The Creep Test is a pressure hold test. The BT-1000 will hold the set pressure on the package for the length of time selected.

CREEP TEST SETUP PROCEDURE

The BT-1000 can test both porous and non-porous packages. When setting the flow, the operator will tell the instrument which style of package is being tested by setting the toggle in the "FLOW SETTING" screen to porous or air-tight. This adjustment is more critical for porous packages since the porosity of the package is being matched by the air flow. If the BT-1000 cannot consistently hold the selected pressure, the flow may need to be increased or decreased depending of the pressure inside the package. If the test pressure is generally more than the entered pressure, the flow may need to be decreased. If the pressure is generally less than the entered pressure, the flow may need to be increased.

If the package is very large, the creep test pressure required will be very small, causing the air to flow into the package at a very slow rate due to the regulator output characteristic. To decrease the fill time required a "Prefill" option can be added to the instrument controls.

(SEE PREFILL SETUP INSTRUCTIONS IN "DISPLAY CONTROL")

There is no Auto-Set program for the creep test. This is because the operator must decide how long the creep test is to continue, how much pressure the package needs to see, and what flow is required to optimize the pressure for a given package size and porosity. To set the pressure, a good rule of thumb is to start the creep test pressure at 80% of the Burst pressure. Not all seal materials will hold 80% of the Burst Pressure. Some experimentation may be required to establish a creep pressure value. To choose the CREEP TEST MODE option, push the second "<" key labeled CREEP TEST and the following screen will be displayed.

CREEP SETTINGS	*	#
PRESSR : 0.0 PSIG	<	
TIMER : 0.0 SEC.	<	
FLOW : 0 {POROUS}	<	
PROGRAMS	<	

Use the #/RETURN Key to return to the Main Menu.

Use the */START key to proceed with the test using the existing settings.

- a. Use the appropriate "<" key to manually change setup parameters
- b. Use the bottom "<" key to store a setup program, or to recall a previously memorized program.

CREEP TEST (Continued)

When setting the creep test parameters the same setup procedure is used as when setting the Burst test parameters. To refresh your memory, see “BURST TEST SETUP PROCEDURE”.

NOTE: The pressure and time values are selected by the user according to his/her own validation requirements. The “Creep Test” is a pass/fail test. If the package does not rupture before the end of time cycle, a “Pass” light will illuminate. Conversely a drop in pressure will signal a “Reject” light.

RUNNING THE CREEP TEST

After setting the Creep test parameters, push the */START key and the following screen will appear.

PRESET	PARAMETERS
SETTING FLOW :	
ATTACH PACKAGE AND PRESS START KEY :	
SETTING PRESSURE :	

Setting the Flow will take only a few seconds.

Non-Porous (Airtight) Packages:

In the non-porous mode, the instrument will move automatically to set the pressure.

Porous Packages:

After the flow is set, in the porous mode, the display will ask the operator to attach a package and press start. During this time the BT-1000 is pre-setting the pressure. This procedure can take as long as 30 seconds, but it is only necessary once in a test run.

If the BT-1000 cannot set the desired pressure on a porous package using the entered flow rate, three beeps will sound, indicating that the flow rate must be increased. If the flow rate is optimal, the pressure will be preset, and the following Creep Test screen will be displayed indicating the test is ready to begin.

CREEP	READY	*	^	#
PART# :			H	
E-TIME :			E	
RESULT :			L	
STATUS :			P	
CREEP PRESSR. [In H2O]				

← CREEP mode is being used. READY to begin a test. */START begins the test. ^ goes to the datalog #/RETURN returns to main menu.

- Use the first or second “<” key to display the help screen.
- Use the third and fourth “<” keys to change the result display.

Running the Test: Porous or Non-Porous Packages

Pressing the */START key begins the test. If the display is in NUMERICAL SCREEN, a line will expand along the bottom of the screen during the test. This is a time line. If a burst occurs prior to the time standard being reached, the time line will stop, indicating approximately when the package burst in the cycle. If the time line expands all the way across the screen, the package has not burst and is acceptable. The test result screen and help functions are the same as in the BURST MODE. To refresh your memory, see RUNNING THE BURST TEST.

CREEP TEST – Con't.

The E-Time is the accept/reject deciding factor of the Creep test. If the E-Time is anything less than 100%, the package has failed. The following results are reported in the STATUS line after the Creep test is complete:

- PASS - The package has not failed during the entire test.
- FAIL - The package opened the seal at some time during the test.
- BAD PKG - The package opened the seal prior to reaching the test pressure.

The RESULTS line reports the pressure reached during the test.

The next test is ready to be run again from the results screen. Push */START to begin.

While running the creep test there is bound to be a certain amount of fluctuation in the reading. This is due primarily to inconsistencies in the package along with the resolution of the BT-1000. You can expect to hold at least ± 1 inch of water at all times. If there is more fluctuation than that, the flow may need to be adjusted up or down depending on which direction the pressure is moving (see CREEP TEST SETUP procedure).

CREEP TO FAILURE

The Creep to Failure Test is a pressure hold test similar to the Creep test. However, the package is pressurized to a predetermined pressure which is then held until one or more seals fail (the internal pressure will cause the seal to “creep” and open). The “Time to Failure” is a variable measure of the seal’s shear resistance.

CREEP TO FAILURE TEST SETUP PROCEDURE

During the Creep to Failure test, the package is pressurized to a point that will open a seal on every package, including acceptable packages. This is done by adjusting the pressure and flow until the package seals open after the desired amount of time (typically 15 - 30 seconds). The amount of time it takes to creep through the seal determines its strength. A package that takes the full set time or very close to the full set time is a strong package. A weakened seal will take somewhat less time to creep through. The amount of time permissible is based on user evaluations of acceptability.

To choose the CREEP TO FAILURE TEST MODE option push the second “<” key labeled CREEP TO FAILURE TEST and the following screen will be displayed.

C/T/F SETTINGS	*	#
PRESSR : 0.0 PSIG	<	
TIMER : 0.0 SEC.	<	
FLOW : 0 SET#	<	
PROGRAMS	<	

Use the #/RETURN key to return to the Main Menu.

Use the */START key to proceed with the test using the existing settings.

- a. Use the appropriate “<” key to manually change a setup parameter.
- b. Use the bottom “<” key to store a setup program, or to recall a previously memorized setup program.

NOTE: There is no Auto-Set program for the Creep to Failure test.


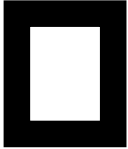
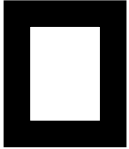
The Creep to Failure test parameters are set using the same procedure as the Burst test. To refresh your memory, see BURST TEST SETUP PROCEDURE.

Notes:

1. Accept/Reject lights are not functional for the C-T-F- test. No limits on the “Time to Failure” can be set.
2. Some experimentation is required to establish pressure and time values for the C-T-F test. A time value of the mean “time to failure” should be set as the center of the time range. In this way the statistical output charts will be more valuable in monitoring process trends. Longer “time to failure” indicates stronger seals while shorter times indicate weaker seals.

RUNNING THE CREEP TO FAILURE TEST

When the */START key is pushed in the CREEP TO FAILURE SETTINGS screen the following Burst Test screen is displayed.

C/T/F	READY	* ^ #
PART# :		H
E-TIME :		E
RESULT :	15.0 SEC.	L
STATUS :	BURST	P
C/T/F PRESSR.	[In H2O]	
		

C/T/F mode is being used.
 READY to begin a test.
 */START begins the test.
 ^ goes to the datalog.
 #/RETURN returns to main menu.

- Use the first or second "<" key to display the help screen.
- Use the third and fourth "<" key to change the result display.

Pressing the */START key begins the test. The test result screen and help functions are the same as in the BURST MODE. To refresh your memory, see RUNNING THE BURST TEST.

The following results are reported in the STATUS line after the Creep to Failure test is complete:

- BURST - The package has ruptured the seal (burst).
- TOVR - The package has not burst prior to the end of the test.
- BAD PART - The package burst prior to reaching the test pressure.

The RESULTS line reports the time to failure. A shorter time indicates a weaker seal.

The next test is ready to be run again from the results screen. Push */START to begin.

LEAK TEST

LEAK TEST SETUP PROCEDURE

Choose the LEAK TEST MODE option by pushing the fourth “<” key while in the first screen of the MAIN MENU. The following screen will be displayed.

LEAK	SETTINGS	*	∧	V	#
CHARGE	: 0.0	SEC.	<	<	
SETTLE	: 0.0	SEC.			
TEST	: 0.0	SEC.			
FINE	: 0.0	InH2O			
PRESS	: 0.0	PSIG			
FLOW	: 0	SET#			
TO CHANGE PARAMETERS USE ∧ OR V THEN < TO ENTER SELECTION					
PROGRAMS					<

Use the */START key to proceed with the test using the existing settings.

Use the #/RETURN key to return to the Main Menu.

- Use the ARROW UP/+ key or the ARROW DOWN/- key to position pointer along side of the parameter to change.
- Use one of the top three “<” keys to change a setup parameter
- Use the bottom “<” key to STORE a setup program, or RECALL a previously memorized setup program.

Refer to “PARAMETER CHANGE SCREEN” (pg. 15) for instructions on how to set a test parameter.

NOTE: There is no Auto-Set program for the Leak Test.

CHOOSING TEST PARAMETERS

The “Leak Test” is a pressure decay test for the internal package volume. The choice of settings depends on several factors, including the size (expanded volume of the package), the flexibility (materials) of the package, the seal strength (burst or creep value), and the leak rate to be detected.

Because some flexible packages are designed to peel open, the test pressure chosen for leak testing should not open or damage the seal bond. Although the user should determine this pressure, a rule of thumb would keep the test pressure below one third of the burst pressure value.

The leak rate detected in a pressure decay test is a function of package volume and time of the test:

$$Q(cc/sec) = \frac{\Delta P(atm) * V(cc)}{\Delta t(sec)}$$

LEAK TEST (Continued)

The leak rate detected will be most sensitive at smaller internal package volumes. A metal restraining plate fixture to restrict package movement (prevent ballooning) will increase test sensitivity. Call TME for further information on the use of restraining plate fixtures.

The **Charge Timer** is set depending on the size of the package and the flow value. For most packages at low test pressures a flow value of 12-16 usually works. The Charge time must be long enough to completely fill the package to the setup pressure (Press) with several seconds to spare.

The **Settle Timer** is set depending on package flexibility. The package volume must stabilize BEFORE THE TEST TIME BEGINS. An expanding package will show a decay (decrease) in internal pressure that might be interpreted as a leak when no leak really exists. The pressure reading on the display during the Settle time should not decrease more than one or two least significant digits.

The **Test Timer** is set depending on the leak rate to be detected. From the above equation, one can see that longer test times provide the opportunity to find smaller leaks. However, the use of long test times may not be practical due to material flexibility or temperature changes in the environment, which will affect pressure values.

The **Fine** value is the pressure decay limit allowed before a package is said to have a leak. This value is chosen based on the pressure and time settings (discussed above) and an actual leaking package or a theoretical calculation or flow standard used in the system.

The **Pressure** value is chosen based on the ability of the package (and restraining system, if used) to hold a pressure without damage to the seals. The Pressure may also be chosen based on the ability to detect a given leak size or leak rate.

The **Flow** setting for the BT-1000 can be set from 1 – 16. A setting of 1 restricts the flow rate from the regulator to small flows and a value of 16 does not appreciably restrict the flow from the regulator. Generally flexible packages will require lower pressure regulator settings, which will therefore have small output flows. Using a higher flow setting of 12-16 will allow faster fill rates and minimize Charge time requirements.

Notes:

1. The Accept/Reject indicator lights will function along with the audible alarm during the Leak Test. The Reject light and Alarm will engage if the pressure decay value meets or exceed the Fine leak setting limit.
2. The Test Plot does not function in Leak mode.
3. The datalog will record the decay value at the end of each test time. Large leaks, called gross leaks, which are rejected in Charge or Settle modes, will indicate 999.9 pressure value. The gross leaks will not be used in statistical calculations.

RUNNING THE LEAK TEST

Pushing the */START key begins the test. Once the test is begun, it will automatically continue until the package fails or the time runs out, at which time the air flow will shut off and the result will be displayed on the screen. Upon completion the following screen is displayed.

LEAK	READY	* ^ #	
TIME :	3.00	█	H
PART # :	1		E
RESULT :	0.6 ln H2O		L
STATUS :	PASS		P
DECAY PRESSR. [ln H2O]			
█	□	█	□

Press # to start a test
 Press ^ to output screen
 Press # to return to main menu

- a. Time is the time of day of the test.
- b. Part # is a consecutive number since the beginning of this series.
- c. Result is the pressure decay inside the package during the test.
- d. Status is PASS or FAIL.

During the test, a time line will expand along the bottom of the screen indicating the time during each cycle of the test. The line expands all the way across during each cycle. The location on the top line that has the word "READY" changes as the test proceeds to indicate the cycle (i.e., CHARGE, SETTLE, or TEST).

DUAL TESTS

The second screen of the MAIN MENU provides a selection of dual tests – CREEP+BURST, CREEP+LEAK, LEAK+BURST, and LEAK+CREEP-TO-FAILURE. Since all the dual tests have the same format, one test will serve as an example for all of them. Each dual test uses the current single test setup for its parameters in each section of the test. *Note: Using dual test will result in values that might differ from single tests.*

For example, the Creep+Burst test will take the setup from the current Creep test and the setup from the current Burst test and combine them into the CREEP+BURST test. To set different parameters for the Creep+Burst test, go into the individual Creep or Burst test setup procedure and make the appropriate changes. When finished changing the parameters in the single test format, return to the dual test menu and push the “<” key across from the dual test being run to display the following screen.

CREEP + BURST MODE	*	#
<p>PRESS “ * “ TO USE THE CURRENT SETTINGS FOR THE SINGLE TESTS IN THE DUAL TEST</p>		
PROGRAMS/AUTO-SET		<

- ← CREEP+BURST is the name of the dual test being run.
- Use the */START key to begin the test.
- Use #/RETURN key to return to the Main Menu.
- a. Use the fourth “<” key to automatically determine and set the setup parameters.

Pushing the */START key begins the test and displays the following screen.

CREEP	BURST	*	#
TIME	:	3:00	
PART #	:	1	
CREEP			
RESULT	:	28.0 InH2O	
STATUS	:	PASS	
BURST			
RESULT	:	10.0 In H2O	
STATUS	:	BURST	

- ← CREEP+BURST mode being used.
- */START begins the test.
- #/RETURN to return to Main Menu.

NOTES:

1. There is no help screen available in the dual test section.
2. Since data are mixed results the datalog does not function in the dual test mode. Values can be recorded using an attached printer, which will print each test result.

PROGRAMS

To STORE or RECALL a program setup, push #/RETURN to return to the previous screen. Then, push the fourth “<” key to display the following screen.

CREEP+BURST TEST	∧	V	#
RECALL PROGRAM	#1	<	
STORE PROGRAM	#1	<	

← Running the CREEP+BURST DUAL test.
Use the “∧” key to increase the program #.
Use the “V” key to decrease the program number.
Use the “#” key to return to CREEP+BURST SETTINGS screen.

- a. Use the first “<” key to recall a program.
- b. Use the second “<” key to store a program.
- c. Use the fourth “<” key to set the length of time of the pause between the Creep test and the Burst test.

WARNING: When recalling a setup program from a Dual test memory, any existing parameters in the individual test will be lost. If you do not want to lose those parameters, go into each test and store the existing parameters in its memory.

OUTPUT REPORTS

To simplify record keeping, the BT-000 is equipped to send the test results and other information to a printer. The test results will automatically be sent to an attached, compatible printer. To send the other information to the printer, push the -/DOWN ARROW in the MAIN MENU screen until the third screen. Then, push the first "<" key to display the following screen.

OUTPUT REPORTS	#
OUTPUT LAST TEST	<
OUTPUT SETTINGS	<
OUTPUT DATALOG	<
OUTPUT STATISTICS	<

Output Reports screen

Use the #/RETURN key to return to the MAIN MENU screen.

- a. Choose an option using the appropriate "<" key.

Using the OUTPUT LAST TEST function sends the results of the last test to the printer.

Using the OUTPUT SETTINGS function sends the setup parameters of the last test to the printer. When the BT-1000 has just been turned on, the default is the BURST test.

Using the OUTPUT DATALOG function will send the contents of the datalog to the printer.

Using the OUTPUT STATISTICS function will send the statistical calculations, the Histogram, the X-Bar chart, and the R-Bar chart to the printer.

RS232-C PORT

The BT-1000 permits the transmission of datalog information to an external computer or datalogging device that will accept an ASCII data stream. The RS232C, DB 25 connector is located on the BT-1000 rear panel. The RS-232C configuration is NULL. It is *important that a serial RS232 cable ONLY be used for connecting to the external device. DO NOT use a Null Modem Cable or Adapter.* The output configuration of the data stream is shown in Appendix "A".

Only datalog information is transmitted to the external device. Settings and statistical information inside the BT-1000 programs are not transmitted. Datalog information may then be used in any program format the user chooses.

Datalog information is transmitted after every test. When collecting data the user must set up the data receiving device to properly collect the data stream. Typical installations include the use of MS Hyperterminal® found on most Windows® operating systems. Other software may be utilized to convert the ASII datastream directly to "keystroke" format which can be directly loaded into most spreadsheet formats. Contact TME for information on compatible program software.

NOTE: The RS232C connection is for output data only. No input information for instrument control can be accepted.

STATISTICS

STATISTICS MODE

The BT-1000 set in statistics display mode can calculate the basic statistics of a series of tests stored in the datalog. The statistics calculate for valid test data only. T-Ovr and "Reject" data are not calculated. The statistics display mode looks like this:

STATISTICAL DATA			
COUNT	:	7	TESTS
AVG	:	10.00	Psig
STD	:	0.50	Psig
MAX	:	12.00	Psig
MIN	:	7.00	Psig
RANGE	:	5.00	Psig

AVG = mean of all the valid tests

STD = standard deviation of the tests

HISTOGRAM MODE

When set to the HISTOGRAM display mode, the BT-1000 calculates and displays a 5-bar histogram with a range of $\pm 3\sigma$. The HISTOGRAM screen looks like this:

HISTOGRAM			[Psig.]
Cells	f%	fc	#: 10
0.00	10	1	*
1.00	20	2	**
2.00	50	5	*****
3.00	20	2	**
4.00	0	0	
5.00	---	---	-----
Ends	100	10	W: 1.00

Legend

Cells : interval boundaries
 f% : percentual frequency
 fc : frequency
 W : interval width
 # : number of valid tests

Readings

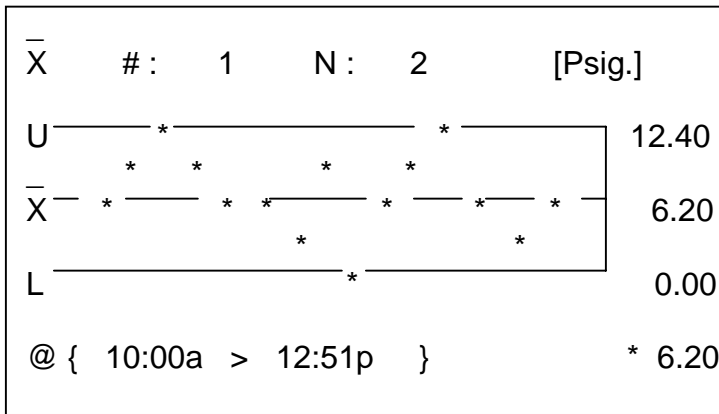
#: 10 = There are 10 valid tests in the datalog.
 W: 1.00 = The cell (interval) width is 1.00 Psig.

Cell #1 : 0.00 -> 1.00 = holds 10% (1 test) of the samples
 Cell #2 : 1.00 -> 2.00 = holds 20% (2 tests) of the samples.
 Cell #3 : 2.00 -> 3.00 = holds 50% (5 tests) of the samples.
 Cell #4 : 3.00 -> 4.00 = holds 20% (2 tests) of the samples.
 Cell #5 : 4.00 -> 5.00 = holds 0% (0 tests) of the samples.

STATISTICS Con't.

CONTROL CHARTS MODE

When set to the X or R charts display, the BT-1000 calculates and displays a control chart that is displayed like this:



\bar{X} : Chart type
 # : Number of tests in next subgroup
 N : Subgroup size
 U : UCL (Upper Control Limit)
 L : LCL (Lower Control Limit)
 \bar{X} : Center Line
 ← Last subgroup point plotted

The limits for the control charts can be either manually entered and changed, or automatically calculated. These operations are accessed from the Test Data Menu (accessed from the + Up Arrow key) or thesecond Main Menu screen. Push the “<” key across from the STATISTICS DATA option and the following screen is used to display/modify the parameters. **(CAUTION: Returning to the Main Menu may lose the datalog if the OVERWRITE WARN key is set at NO).**

STATS. SETTINGS		Λ	V	#
\bar{X}	UCL:	0.0	In H2O	< <
\bar{X}	LCL:	0.0	In H2O	
R	UCL:	0.0	In H2O	
R	LCL:	0.0	In H2O	
SIZE, N		0		
TO CHANGE PARAMETERS USE Λ or V THEN < TO ENTER SELECTION				
CALCULATE UCL & LCL				<

← Use the ARROW UP/+ key or the ARROW DOWN/- key to position pointer alongside of the parameter to change.

 Use the #/RETURN key to return to the Main Menu.

- Use one of the top three “<” keys to change a setup parameter.
- Use the bottom “<” key to calculate the upper and lower control limits for X & R charts.

The following definitions apply to the previous screen:

- \bar{X} : The average of the readings in a sample of N tests.
- R : The range of the difference between the minimum and maximum readings.
- UCL: Upper Control Limits.
- LCL: Lower Control Limits.
- N : Sample size (sub groups in a test run) – number of tests averaged to determine one point on the charts. N must be set between 2 and 20.

The LCL or UCL can be entered or changed manually based on operator calculations, or the BT-1000 can calculate them. The BT-1000 calculations are based only on the test results stored in the datalog. Each point on the X and R chart is an average of the number of tests in N.

ALARM, WARNING, PREFILL AND BLEED

To access any of these settings, press the third “<” key from the third page of MAIN MENU. The following screen will be displayed:

MISC. SETTINGS	^	v	#	
REJECT ALARM :	ON/OFF	<		< Toggles alarm bell ON/OFF.
WARN OVERWRITE:	YES/NO	<		< Toggles Datalog erase warning YES/NO
PREFILL TIME (SEC):	0	<		< Set the prefill timer (optional)
BLEED TIME (SEC):	0	<		< Set the bleed timer (optional)

REJECT ALARM (AUDIBLE)

The Reject Alarm is designed to alert the operator when a failure has occurred. It is only useful in the CREEP test and the LEAK TEST since they are the only tests that can detect a reject.

WARN OVERWRITE

This WARNING alerts the operator when data will be lost due to changing tests or setup parameters. Going out of a particular test mode signals to the instrument that a different test is going to be run, or different parameters are going to be entered. In either case, the statistics based on the Datalog are no longer applicable and a new set will be begun. This will destroy any existing data. To prevent the loss of data if the same test is being continued, a DATA WARNING is displayed to alert the operator to the impending data loss.

CAUTION: WE RECOMMEND THAT THE OVERWRITE WARNING BE SET TO “YES” TO ALWAYS PROVIDE THE USER THE OPTION TO SAVE THE CURRENT DATALOG.

DATA STORAGE OPTIONS FOR DATALOG & STATS	
• START NEW DATALOG	
+ ADD TO PREV. DATA	
# EXIT TO MAIN	

The Datalog Warning warns the operator that continuing the operation will destroy past test data.
 The “#”/Return key will return the program to the MAIN MENU to save or print the datalog.
 The “+”/START key continues into the test and erases the past datalog.
 The “+”/UP ARROW key continues into the test and adds the new data to the previous data.

PREFILL (OPTIONAL)

When testing larger than normal packages the time it takes to fill the package can sometimes be very long. To avoid an extended waiting period for each test, the BT-1000 can be equipped with a prefill function. The operator simply adjusts the amount of time necessary to fill the package prior to pressurization.

BLEED (OPTIONAL)

When equipped with the optional bleed valve, the BT-1000 will exhaust the pressure inside the part at the end of each test.

The BT-1000 provides a calibration menu which allows access to the pressure reading calibration, factory-set flow rates, contrast & time adjustments. To reach the calibration menu, press the fourth “<” key from the third page of the main menu. The instrument will respond with the following screen:

SENSING RANGE CAL.	<
FLOW RATES CALIBR.	<
ADJUST CONTRAST	<
SET TIME & DATE	<

Pressure readings calibration
Flow number adjustments
LCD display contrast control
Time and date adjustment.

The last two items in the menu (“ADJUST CONTRAST” and “SET TIME & DATE”) can be accessed/modified at any time without any special considerations.

The items “SENSING RANGE CAL.” and “FLOW RATES CAL.” require a different procedure depending on what is to be done to the instrument:

IF THE BT-1000 CALIBRATION IS TO BE CHECKED:

Follow all the instructions and disregard references to adjustments and calibration. Start from the section “SENSING RANGE CALIBRATION”.

IF THE BT-1000 IS TO BE CALIBRATED:

Warning:
Internal calibration should be performed only by qualified instrument and/or metrology technicians familiar with electro-pneumatic instrumentation and equipped with proper calibration equipment. REMOVAL OF THE INSTRUMENT COVER voids the factory warranty. Calibration traceability becomes the responsibility of the instrument owner when this procedure is followed.

REMOVE POWER FROM THE BT-1000 BY TURNING OFF THE POWER SWITCH THEN UNPLUG THE POWER CORD.

WARNING

DANGEROUS POTENTIALS EXIST AT SEVERAL POINTS THROUGHOUT THIS INSTRUMENT. WHEN THE INSTRUMENT IS OPERATED WITH THE COVER REMOVED, DO NOT TOUCH EXPOSED CONNECTIONS OR COMPONENTS.

Remove the top cover from the instrument, locate the “JP4” jumper (in the small board towards the back/left corner of the BT-1000), move the jumper to the “CALIB” position. Then reconnect the power cord to the AC outlet and turn the instrument back ON.

SENSING RANGE CALIBRATION

This function is used to check/adjust the pressure calibration of the BT-1000. To access, press the top “<” key, then a short reset sequence will follow ending in this display:

PRESSR. CALIBR. SETUP

1 : CONNECT STANDARD
TO FILLING PORT.

2 : OPEN SENSING PORT
TO ATMOSPHERE

PRESS * WHEN READY

These setup steps must be followed before actual calibration of the instrument can begin.

Connect a pressure standard to the filling port (large OD tubing).

Open the sensing line to Atmosphere (small OD tubing). When the setup steps have been completed press the “*” key. The “CAL. SENSOR OFFSET” will follow.

PRESSURE SENSOR OFFSET CALIBRATION

CAL. SENSOR OFFSET

OFFSET: 52 DIGITS

SET PT1 FOR: 50 DIG.
(VALID: 10-90)

..... PRESS ANY KEY

If checking calibration, verify that the offset is within the 10-90 digits acceptable range.

If calibrating, set POT1 to read 50 digits.

: This line shows the current offset.

: Target offset during calibration (50) use POT1

: Acceptable range (10-90) if checking calibration

: When done setting the offset, press any key.

The “CAL. SENSING RANGES” screen will follow.

PRESSURE SENSOR SPAN CALIBRATION

This function is used to check/adjust the different pressure ranges of the pressure transducer in the BT-1000. The pressure range is calibrated in five segments (sub-ranges) of the total span:

CAL. SENSING RANGES

READING: 0.00 PSIG

R1 [0-2.5 PSIG] PT3

SPAN: 0.0 %FS

SPAN: 0.00 Psig

SET PRSR: + - <1&2

USE * TO SET OFFSET

USF <4 FOR UNITS

R1: 0.0-2.5 R3: 5.0-10 R5: 25-50 [Psig]

R2: 2.5-5.0 R4: 10-25 (Main span adjustment)

: This line shows the current pressure reading.

: R1 = Range#1 , [0-2.5 Psig] = Limits of Range 1

: PT3 – Adjustment pot. For range#1 POT3.

: Reading from the Span range in % of span.

: Reading from the Span range pressure units.

: Use the up/dn arrows to raise/lower pressure.

: Use the “*” key to recheck the offset.

: Use the <4 key to change the pressure units.

Calibration check procedure: Use the up/dn arrows to set the following pressures: 2.5, 5.0, 10.0, 25.0, and 50.0 Psig. Verify that the readings of the BT-1000 are within $\pm 0.5\%$ of **10 psig below 10 psig, or $\pm 0.5\%$ of 50 psig above 10 psig** of the readings from Pressure standard being used. If adjustments are needed refer to the next section; otherwise, press “#” to return to the CALIBRATION MENU.

CALIBRATION PROCEDURE:

Ranges 1, 2, 3 and 4 can be adjusted independently. Range 5 is the master range that adjusts the span of the transducer. Changes to range 5 (POT#0) will affect all the other ranges; therefore it must be calibrated first.

Use the up/dn arrows to set the following pressures, always pressing “*” to verify that the offset is still in range:

- Set 50.0 Psig (Range5) and adjust POT0 until reading = 50.0 Psig, check offset.
- Set 2.0 Psig (Range1) and adjust POT3 until reading = 2.0 Psig, check offset.
- Set 4.5 Psig (Range2) and adjust POT4 until reading = 4.5 Psig, check offset.
- Set 9.5 Psig (Range3) and adjust POT5 until reading = 9.5 Psig, check offset.
- Set 24.0 Psig (Range4) and adjust POT6 until reading = 24.0 Psig, check offset.

This completes the pressure sensor calibration. Proceed to the flow calibration section to complete calibration.

CHECKING FACTORY SETTINGS FOR OUTPUT FLOW *

This function is used to check/adjust the factory setting flow rates assigned to the flow numbers used in the BT-1000. To access, press the second “<” key from the calibration menu, then a short reset sequence will follow ending in this display:

These setup steps must be followed before actual flow check of the instrument can begin:

FLOW RATE CALIBR.	Connect a Flow Standard to the filling port (large OD tubing).
1: CONNECT STANDARD TO FILLING PORT.	Open the sensing line to Atmosphere (small OD tubing).
2: OPEN SENSING PORT TO ATMOSPHERE	
PRESS * WHEN READY	When setup has been completed, press the “*” key.

* Note that there is no flow transducer in the instrument. The BT-1000 only measures pressure or pressure changes with its internal pressure transducer in the four test modes. Flow settings are for instrument reproducibility only.

FACTORY FLOW CHECK (Cont.)

The flow rates are checked/adjusted in two groups:

Low flows \pm 3 scfh, @ 10 Psig

High flows \pm 5 slmp, @ 7.5 Psig

#1: 5 scfh (2.3 slmp)	#5: 25 scfh (12 slmp)	#9: 20 slmp	#13: 40 slmp
#2: 10 scfh (4.7 slmp)	#6: 30 scfh (14 slmp)	#10: 25 slmp	#14: 45 slmp
#3: 15 scfh (7.0 slmp)	#7: 35 scfh (16 slmp)	#11: 30 slmp	#15: 60 slmp
#4: 20 scfh (9.3 slmp)	#8: 40 scfh (19 slmp)	#12: 35 slmp	#16: 65 slmp

FLOW	RATES	CALIB.
+ - :	SET FLOW RATE	:
* :	NEXT FLOW #	:
# :	EXIT CALIB.	:
PRESSR:	10.00 Psig	:
FLOW # :	9 AIRTIGHT	:

Use up/dn keys to adjust the flow rate.
 Use "*" to go to the next flow number.
 Test pressure being used (automatically set).
 Flow number being checked/adjusted.

When this procedure begins, the BT-1000 sets the pressure to 10.0 psig and the flow to #1. Use a flow gauge to measure the flow rate coming out of the filling line and compare it to the table shown above.

If any adjustments are needed use the up/dn keys until the desired flow rate is achieved. Then press the "*" key to go to the next flow number. When the BT-1000 sets a low flow number (1-8), it will first open the flow to its maximum value (\cong 70 slmp), therefore a flow gauge capable of handling 70 slmp is recommended. A bypass can be set up to divert the excess flow when changing flow numbers.

The BT-1000 will automatically set the correct pressure to check/adjust the current flow number. The instrument will cycle through flow number 1-16 then back to 1 by pressing the "*" repeatedly.

When all the adjustments have been completed press the "#" key to exit.

NOTE:

When pressure calibration is completed, GMP procedures require that a next calibration label be applied to the instrument. It is preferable to apply the label over one cover fastener to prevent changes without label removal.

REMOVE POWER FROM THE BT-1000 BY TURNING OFF THE POWER SWITCH AND UNPLUG THE POWER CORD.

Replace the calibration lock jumper "JP4" back in the "LOCK" position, then put the cover back on the instrument, reconnect the power cord and turn the instrument back ON. This completes the calibration and flow check procedure of the BT-1000.

SET TIME AND DATE

This procedure is used to change or correct the time and date. Under normal operation neither the time nor the date will need to be changed. However, the BT-1000 is set for eastern time, so if it is used in a different time zone the time will need to be corrected. Pressing the fourth “<” key in the CALIBRATION MODE menu displays the following screen:

SET TIME & DATE		Λ	V	#
HOURS	: 8	[1 - 12]	<	█
AM / PM	: 0	[0 = AM]		
MINUTES	: 0	[0 - 59]		
DATE	: 1	[1 - 31]		
MONTH	: 1	[1 - 12]		
YEAR	: 93	[93 +]		
PICK ITEM WITH Λ & V				
USE < 1 & 2 TO CHANGE				
{ 8:00 AM 1/1/01 }				
ENTER NEW TIME / DATE <				

Use the +/ARROW UP key or the -/ARROW DOWN key to position pointer alongside of the item to change.

Use the #/RETURN Key to return to the Main Menu.

- Use the top ‘<’ key to increase the item.
- Use the second “<” key to decrease the item.
- Use the fourth “<” key to set the changes.

After all the changes are made, **the fourth “<” key must be pressed** to accept all the changes and set the clock and calendar. If the fourth “<” key is not pressed, no changes will be made, and all items will return to their previous settings.

SET CONTRAST

DISPLAY	CONTRAST	#
USE Λ V TO CHANGE #		
USE # * TO EXIT		
1	00	

Use the RETURN/# key to return to the READY screen.

Use the UP ARROW/+ to increase the contrast.

Use the DOWN ARROW/- to decrease the contrast.

The range of adjustment is between 75 and 125.

NOTE: The LCD contrast is affected by cold temperatures. It is recommended that the instrument warm up for one half hour prior to making adjustments.

F.A.Q.'s

Q: How do I use PREFILL and BLEED?

A: If your instrument is not equipped with the PREFILL or BLEED options, set them to zero by repeatedly pressing their function key. After the count of ten, they will reset to zero. If you do have either of these options installed, refer to the MISCELLANEOUS CONTROL section of this manual.

Q: How do I change the test units?

A: In any test the units can be changed from the **change pressure** screen by pressing the second "<" key.

Q: When trying to creep test a porous package, the BT-1000 displayed this screen:

UNABLE TO SET PRESSURE

- a) burst occurred
- b) low line pressure
- c) insufficient flow

What is wrong?

A: The instrument tried to set the required pressure through the specified flow setting and was unsuccessful. This can be caused because the selected flow setting was too low, the part might have burst or popped off the fixture, or in some cases the line pressure might not have enough flow capability.

Q: How can I get a printout of a test curve?

A: Select the "TEST PLOT" display mode, then press "+" to get the print menu, select OUTPUT REPORTS, then pick LAST TEST.

Q: When I try to store or recall program #0 the BT-1000 just beeps.

A: Valid program numbers are #1 through #10 for each test mode.

Q: The BT-1000 display garbled data and behaves erratically. How can I reset it?

A: The BT stores test parameters, results and other settings in permanent memory. Sometimes due to power surges, electrostatic discharges or heavy interference the permanent memory can become garbled. To reset it, follow this sequence:

- a) Turn the instrument OFF
- b) Press and hold the top "<" key
- c) Turn power back ON
- d) Release the top "<" key.

The BT will reset all memories and devices.

Q: When I turned the BT-1000 on these messages appeared:

RESET: ZERO PRESSURE
RESET: ZERO FLOW
RESET: COMPLETE

Then it started normally.

A: The BT was performing a total reset that clears all pneumatics and electronics (see previous question).

BT-1000-V5 RS-232C PORT CONFIGURATION

COMM CONFIGURATION	HARDWARE CONFIGURATION (NULL MODEM)		
-----	-----		
BAUD RATE : 1200	GND	:	pin 1, 7
WORD SIZE : 7 BITS	Txd	:	pin 3
STOP BITS : 1 BITS	Rxd	:	pin 2
PARITY : EVEN	RTS	:	(pin 4)
	CTS	:	(pin 5)
			RTS & CTS ARE TIED TOGETHER INTERNALLY
	DTR	:	(pin 20)
	DSR	:	(pin 6)
	DCD	:	(pin 8)
			DTR, DSR & DCD TIED TOGETHER INTERNALLY

BT-1000 RS232 PORT DATA STREAM

FIELD	LENGTH	EXAMPLE	/	DESCRIPTION
-----	-----	-----	-----	-----
PART NUMBER	5 BYTES	"00123"		TEST NUMBER = 123
PRESSURE DATA	5 BYTES	"123.4"		MEASUREMENT 123.4
ELAPSED TIME	5 BYTES	"100.0"		TIME - 100%
RESULT CODE	1 BYTE	"0"		0 = BAD TEST 3 = ACCEPT 1 = TIME OVER 4 = REJECT 2 = BURST
UNITS CODE	1 BYTE	"0"		0 = Psig 1 = In H2O
TEST MODE	1 BYTE	"0"		0 = BURST 2 = C-T-F 1 = CREEP 3 = LEAK
TEST TIME	6 BYTES	"1234am"		HHMMam - 12:34 am
TEST DATE	6 BYTES	"070494"		MMDDYY - 07/04/94
END OF LINE	1 BYTE	ASCII #13		"CR"
END OF TRANS:	1 BYTE	ASCII #10		"LF"

APPENDIX C: USING THE PACKAGE PORT™ AND CLOSED PACKAGE PROBE

For the most consistent results in applying the BT-1000 pneumatic and sensing system to the package test, TM Electronics invented and patented the Package Port™. This device seals the pneumatic path from the instrument to the inside of the package under test.

The Package Port™ is a simple device which seals its flexible inner diameter to the taper lock, outer diameter of the instrument Closed Package Probe Assembly. The flanged surface of the Package Port™ has a double sided adhesive disk applied for each test. The adhesive disk is then fastened to the package surface. The thin adhesive couples the package and Package Port™.

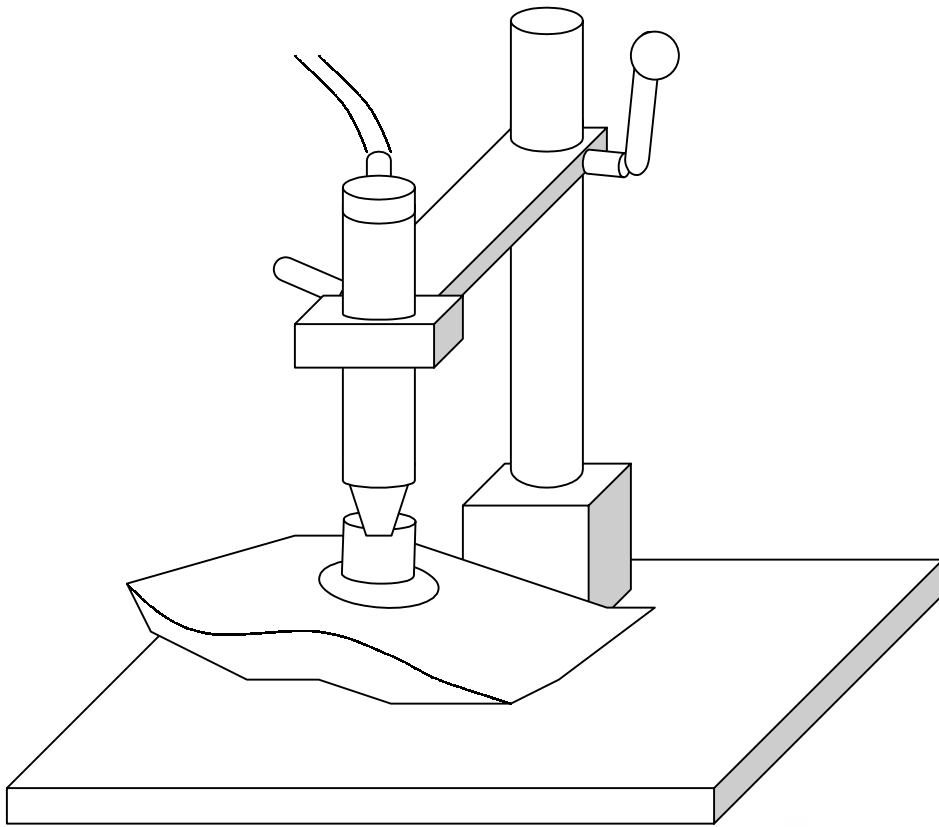
The Closed Package Probe is an assembly of an air supply tube and a sensing tube which have separate couplings to the BT-1000 instrument. It is important to provide the sensing tube with an unobstructed path inside the package. This usually requires that after penetration of the package surface with the cutting diameter of the Probe as it enters the Package Port™ that the package be rotated 90-180 degrees from the initial penetration position. The symptom of a blocked sensing tube is a high level of pressure after a Burst test is complete, or variations in pressure during a Creep test. These symptoms result from the cut flap of material blocking the sensing tube.

The steps for using the Closed Package Probe and Package Port™ are:

1. From the roll of Package Port™ adhesive, peel off the top release paper.
2. With a Package Port™ in hand, firmly press the flange on the adhesive.
3. Gently roll the flange away from the adhesive roll, thus leaving the adhesive attached to the Package Port™ flange.
4. Press the port on the package. Locate the Package Port™ approximately in the center of the package under test.
5. Place the Package Port™ and attached package under the Closed Package Probe. Push the Probe cutting surface into the Package Port™ and into the package through its outer material layer. Insure that the Probe tip is completely through the material and the top of the Probe needle angle is in the package.
6. Rotate the Package Port™ and attached package 90 to 180 degrees from the entry position to clear the Probe sensing tube.
7. Check to be sure that you did not puncture the opposite side of the package material with the Probe cutting tip.
8. Activate the BT-1000 test cycle.

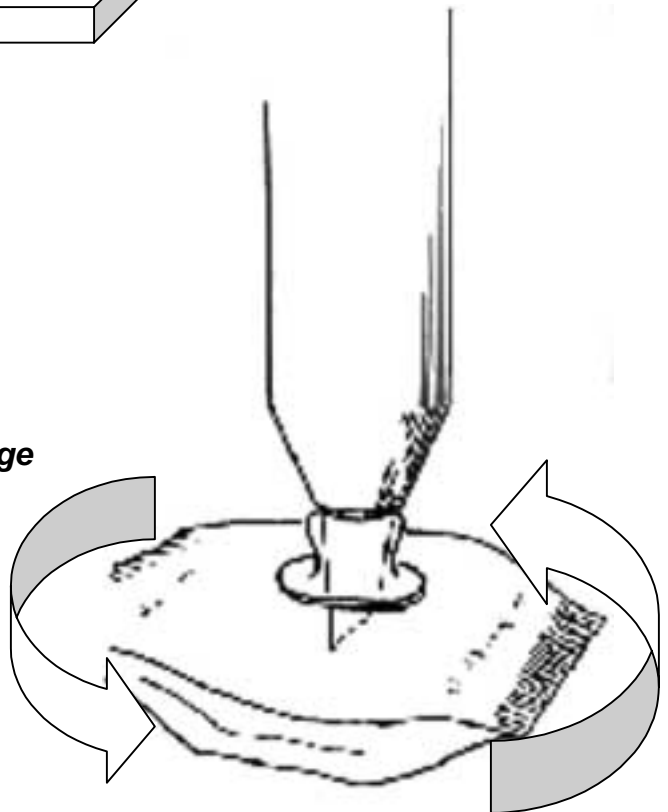
When the test is complete:

- Remove the package and Package Port™ from the probe.
- Remove the Package Port™ from the package.
- Check the flange of the Package Port™ to be sure that the adhesive stayed on the package. If it is attached to the flange, then peel it off. Do not apply multiple layers of adhesive to the Package Port™
- Package Ports™ are reusable unless cracked or torn.



1. Install Package Port™ on packages
2. Insert probe tip into port and package.

When loading package onto the Closed Package Probe, rotate the package 90 to 180 degrees after the needle pierces the package surface.



BT-1000 SPECIFICATIONS

DIMENSIONS	13"W x 15"D x 6 1/2 " W
POWER	115V, 60 Hz, 150 Watt
CONTROLS	Electronic Pressure Control Electronic Flow Control Push Buttons, Keylock, Power ON/OFF Switch, Key Pad.
SINGLE TESTS AVAILABLE	Leak, Burst, Creep, Creep to Failure
DUAL TESTS AVAILABLE	Creep/Leak, Creep/Burst, Leak/Burst, Leak/Creep to Failure
DISPLAY	LCD 20 Character x 16 Line Alphanumeric/Graphic Display
DISPLAY UNITS	Inches of H ₂ O, PSIG (other units optional)
DATALOG MEMORY	Saves up to 1000 test results
PROGRAM MEMORY	Saves up to 80 test programs (ten per mode)
STATISTICS	X-bar Chart, R Chart, Histograms
PRINTER OUTPUT	80 Character, Epson compatible
COMPUTER OUTPUT	RS-232 output of test results and datalog
PRESSURE SETTING RANGE	0.36 PSIG (10 In. H ₂ O) to 50 PSIG (1384 In. H ₂ O)
PRESSURE SETTING ACCURACY	2 In. H ₂ O
READING ACCURACY	± 0.5% of 10 PSIG below 10 PSIG ± 0.5% of 50 PSIG above 10 PSIG **
READING RESOLUTION	.5 In. H ₂ O / 0.02 PSIG

**Revised 4/29/02

WARRANTY

TM 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 or production time incurred by the original use purchaser or any other party.

TM Electronics, Inc.