

LeakMaster

700 Series Leak Testers
V9.0.104



Operation Manual

Designed and Manufactured by:
LeakMaster Inc.

LeakMaster

Specializing in Leak and Flow Testing Systems

Ph. 812-437-8378

www.leakmasterusa.com

OPERATION MANUAL

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2 *Safety*

It is extremely critical to read this manual in its entirety before starting the unit up. Throughout this manual, special notes are used to bring attention to possible conditions that may cause personal injury or damage to the system under certain circumstances. These notes are:

WARNING:

Tells you that personal injury may result if procedures are not followed correctly.

IMPORTANT:

Directs your attention to information that is critical to the understanding and use of a specific product or procedure.

2.1 **SETUP SAFETY**

2.1.1 **Shipping and Receiving**

All system components are carefully packed for protection during transit. Upon receipt, all components should be carefully inspected for transit damage. If damage is apparent, notify LeakMaster Inc. and the carrier for claims inspection.

2.1.2 **Cleaning**

Clean all system components thoroughly to remove any foreign material that may have accumulated during shipment.

2.1.3 **Adjustments**

All system functions must be adjusted and operated only by those authorized personnel who have read and who thoroughly understand the descriptions of the various functions presented in this manual.

The setting of timers, pressures, outputs, etc. is chosen by the user for optimum operation. Any change in these settings by untrained personnel may jeopardize both system and user safety and cause a drop in efficiency.

Always refer to the correct assembly instructions and to the appropriate schematics when performing any service functions.

2.2 GENERAL SAFETY

Before attempting to perform any service functions, all users and service personnel should read this manual to become familiar with the complete operation of the system. Becoming familiar with system operation will greatly reduce the possibility of accidents or injury.

IMPORTANT!

ONLY QUALIFIED OPERATORS AND MAINTENANCE PERSONNEL, WHO HAVE COMPLETE AND CORRECT KNOWLEDGE OF ALL SYSTEM OPERATIONS SHOULD PERFORM ANY OPERATIONS AND MAINTENANCE PROCEDURES.

Always follow these warnings and safety procedures:

- **SAFETY GLASSES MUST BE WORN AT ALL TIMES.**
- **Keep all areas clean and neat. Dirty work areas with hazards such as debris, oil or water on the floor may cause someone to fall, resulting in serious personal injury.**
- **DO NOT operate solenoid valves by hand, as dangerous and unexpected motions can occur.**
- **Close all doors on the controller enclosure and any other remote mounted equipment during operation.**
- **Before attempting to power-up the system or any remote mounted equipment, make sure that no one is working on or near any components.**
- **Make sure that all tools, parts, etc. are not in a position to cause interference with system operation.**
- **Make sure that the air system is deactivated before performing any service functions.**
- **Deactivate system power before performing any maintenance.**
- **Make sure that all peripheral devices are properly grounded to minimize the effects of electromagnetic interference (EMI) or radio frequency interference (RFI).**

2.3 ELECTRICAL SAFETY

WARNING!

ALL ELECTRICAL/ELECTRONIC TROUBLESHOOTING AND REPAIR MUST BE PERFORMED BY QUALIFIED AND PROPERLY TRAINED PERSONNEL.

!!! DANGER !!!

DO NOT touch electrically live components. Before performing any maintenance procedures, make sure that the main switch is in the "OFF" position.

Always follow these electrical system safety procedures:

- **Remove all items, such as rings, metal necklaces and watches. These are electrical hazards.**
- **Medical alert jewelry should be worn with caution.**
- **Wear safety glasses without metal rims or metal side shields.**
- **Use insulated tools when working on electrical equipment to reduce the possibility of shock.**
- **Know the amount of voltage present in all areas before troubleshooting.**
- **Make sure that all capacitors are discharged before handling.**
- **Use approved fuse pullers when changing fuses.**
- **Do not use jumper wires or fuse substitutes to replace regularly specified fuses.**
- **Always use fuses of a smaller capacity than the safe capacity of the line or equipment it serves.**
- **Before working on any circuit, check the circuit with the proper tester to determine if any voltage is present.**
- **Be familiar with the proper handling of an electrical fire, keep carbon dioxide and dry powder fire extinguishers accessible at all time**

3 Introduction

3.1 FOREWORD

Please read this manual in its entirety. LeakMaster is not responsible for damages to this unit due to inappropriate use.

3.2 THEORY OF OPERATION

3.2.1 How Pressure Decay Leak Testing Works

Pressure Decay leak testing is a method used to detect leaks in the 2 – 500 sccm leak rate range with test pressure @ 500psi and below. The pressure loss characteristics of a master part with and without a known leak rate are memorized. Production parts are then referenced to these characteristics.

Pressure decay is a volume dependent test. If the production part volume is variable, the test results will be variable as well. Therefore this type of testing is typically used on parts that have fixed volumes. This means that the part does not vary in dead air volume from part to part.

Pressure decay (or vacuum decay) is a method where a test part is pressurized and the air is then trapped by valves. The pressure loss characteristics of a master part with and without a known leak rate are memorized. Production parts are then referenced to these characteristics. But how does the tester determine leak rates?

3.2.1.1 How does the tester determine leak rates? (Pressure Decay)

Air leak rates are determined by the Ideal Gas Law which is calculating a simple algebraic equation. SCCM (standard cubic centimeters per minute) is the most commonly used unit of measure for pressure decay leak testing.

Leak Rate (sccm) = (Pressure Loss in PSI) (Volume in cm³) (60)/ (Time) (14.7)

When a tester is calibrating (or learning) a test part, the unknown part of the equation is volume.

The first major parameter that is memorized during a calibration sequence is the amount of pressure loss or rise that occurs inside a “zero leak” master part. This is known as the **COMP** value because this value is compensated out of every test during production.

The second major parameter that is memorized during a calibration sequence is the amount of pressure loss that occurs inside a master part with a known calibrated leak orifice introduced. This is known as the **CAL** value. After the CAL value is determined, the volume can be calculated by using the equation above.

The tester will then assume that all production parts have this same test volume (for that particular program).

During production, the leak rate is the unknown part of the equation. Once the tester determines the pressure drop of the production part, it then calculates the leak rate.

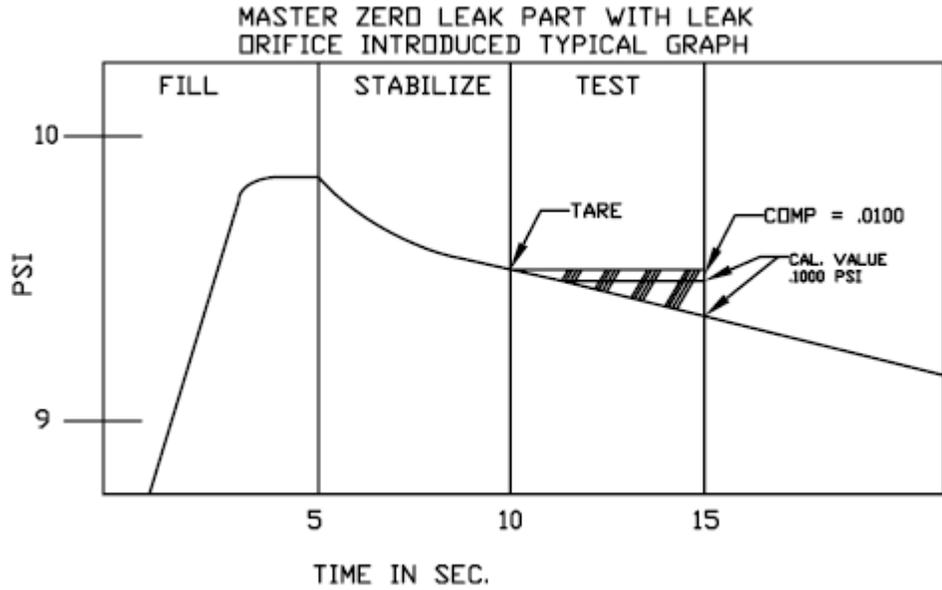
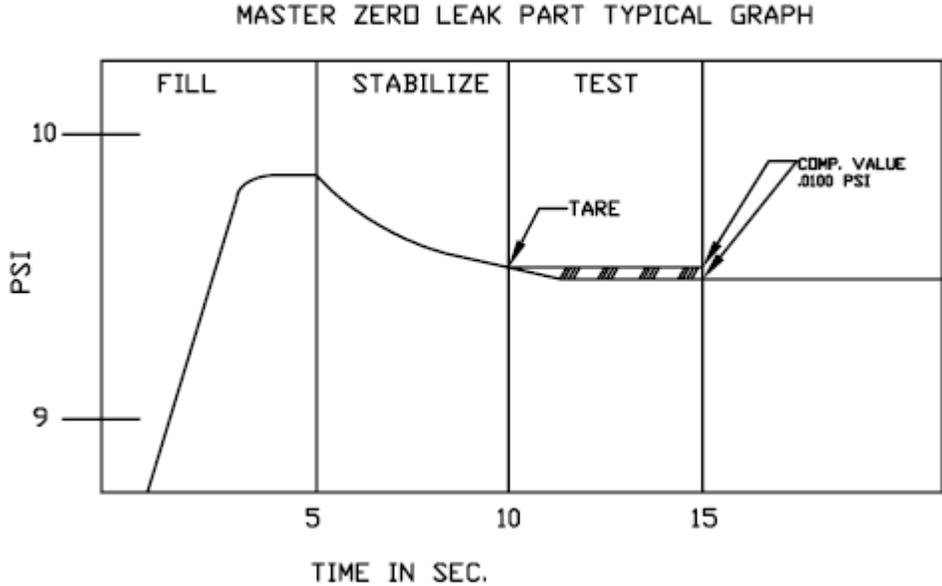
Typical Pressure Decay Test Sequence:

1. **Fill Step:** The Fill/Exhaust valve turns on to allow air to fill the test part.
2. **Isolate Step:** The Isolation (ISO) valve closes to trap the air in the test part.
3. **Stabilize Step:** The test pressure is allowed to stabilize.
4. **Test Step:** The tester monitors pressure loss during the test step to determine leak rate.
5. **Exhaust Step:** The Isolation (ISO) valve turns off to allow the remaining air in the part to be exhausted through the test manifold.

A LEAK FREE MASTER PART IS ABSOLUTELY REQUIRED TO PROPERLY CALIBRATE A TEST PROGRAM!!

A leak free master part is one of the most critical parts of setting up an accurate leak tester. Make sure to create a master part if testing to SCCM leak rates.

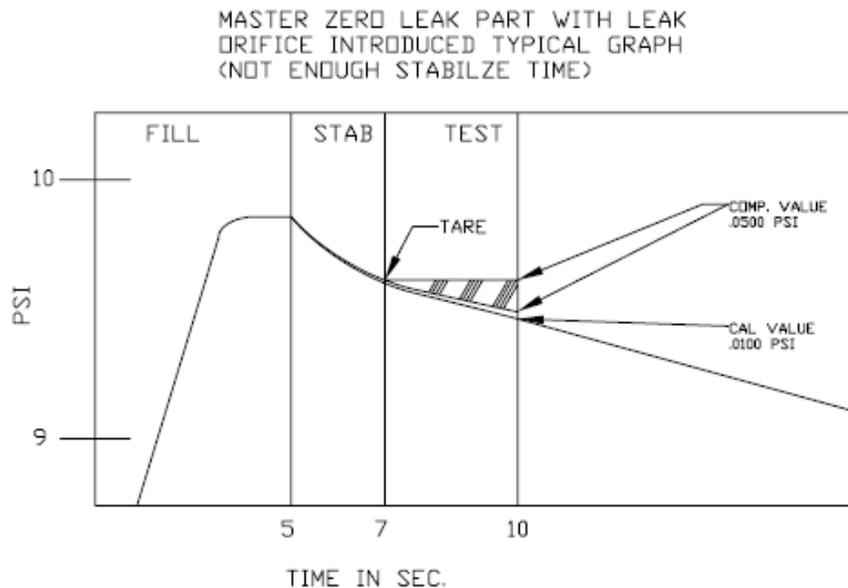
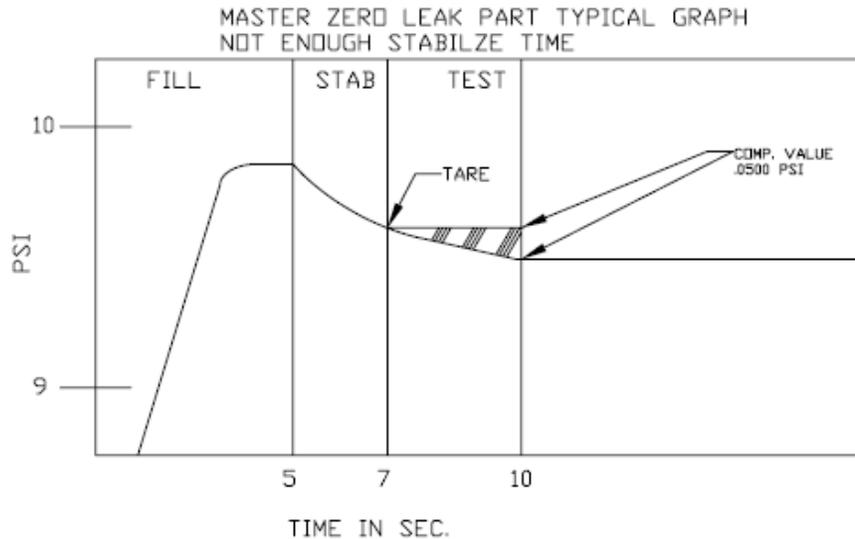
Typical Graphs of a Good Calibration Sequence



Notice the difference between the comp and cal values. The cal value is 10 times greater than the comp value. This would typically produce very repeatable test results.

Cal/Comp should be at least 5 or greater to achieve repeatable results.

Typical Graphs of a Poor Calibration Sequence



Notice the difference between the comp and cal values. The comp value is 5 times greater than the cal value. This would typically produce very unrepeatable test results.

Cal/Comp should be at least 5 or greater to achieve repeatable results. Cal/Comp is .2 in this example. More stabilize time would be required to improve this test setup.

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3.2.2 How Differential Pressure Leak Testing Works

Differential Pressure leak testing is a method used to detect leaks in the .1 – 5 sccm leak rate range with test pressure @ 500psi and below. The pressure loss characteristics of a master part with and without a known leak rate are memorized. Production parts are then referenced to these characteristics.

Differential Pressure is a volume dependent test. If the production part volume is variable, the test results will be variable as well. Therefore this type of testing is typically used on parts that have fixed volumes. This means that the part does not vary in dead air volume from part to part.

Differential Pressure is a method where a reference part and a test part are pressurized and the air is then trapped by valves. The difference in pressure between the two parts determines the pressure loss of the test part. The pressure loss characteristics of a master part with and without a known leak rate are memorized. Production parts are then referenced to these characteristics.

3.2.2.1 How does the tester determine leak rates? (Differential Pressure)

Air leak rates are determined by a gas Law which is calculating a simple algebraic equation. SCCM (standard cubic centimeters per minute) is the most commonly used unit of measure for differential pressure leak testing.

Leak Rate (sccm) = (Pressure Loss in PSI) (Volume in cm³) (60)/ (Time) (14.7)

When a tester is calibrating (or learning) a test part, the unknown part of the equation is volume.

The first major parameter that is memorized during a calibration sequence is the amount of pressure loss or rise that occurs inside a “zero leak” master part. This is known as the **COMP** value because this value is compensated out of every test during production.

The second major parameter that is memorized during a calibration sequence is the amount of pressure loss that occurs inside a master part with a known calibrated leak orifice introduced. This is known as the **CAL** value. After the CAL value is determined, the volume can be calculated by using the equation above.

The tester will then assume that all production parts have this same test volume (for that particular program).

During production, the leak rate is the unknown part of the equation. Once the tester determines the pressure drop of the production part, it then calculates the leak rate.

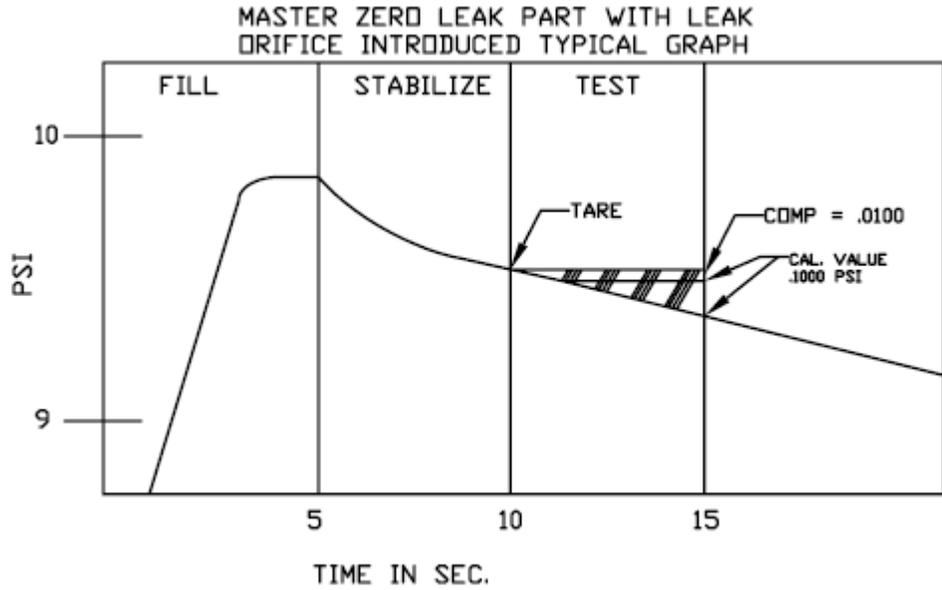
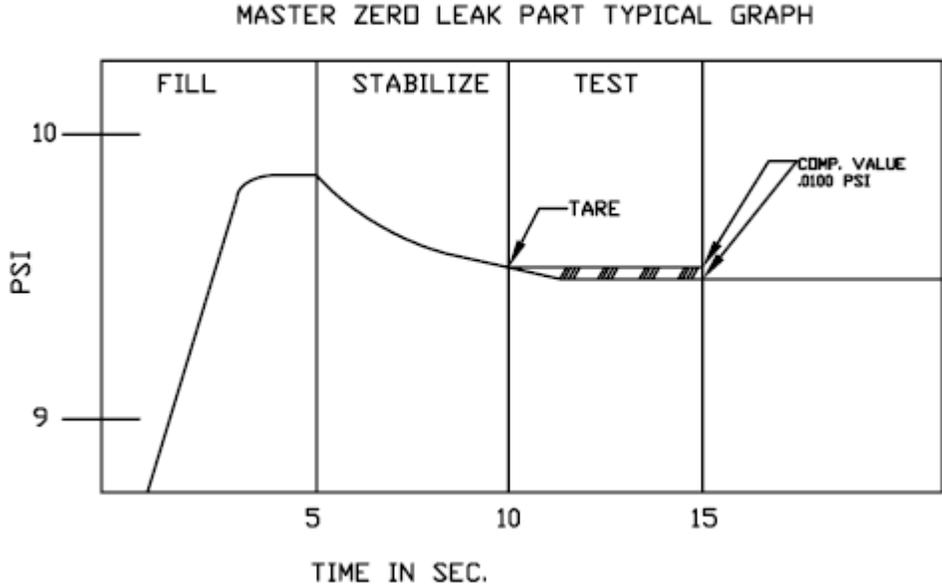
Typical Differential Pressure Test Sequence:

1. **Fill Step:** The Fill/Exhaust valve turns on to allow air to fill both the reference part and the test part.
2. **Isolate Step:** The Isolation (ISO) valve closes to trap the air in the reference part and the test part.
3. **Stabilize Step:** The test pressure is allowed to stabilize in both parts.
4. **Test Step:** The tester monitors pressure loss of both parts during the test step to determine leak rate.
5. **Exhaust Step:** The Isolation (ISO) valve turns off to allow the remaining air in the part to be exhausted through the test manifold.

A LEAK FREE MASTER PART IS ABSOLUTELY REQUIRED TO PROPERLY CALIBRATE A TEST PROGRAM!!

A leak free master part is one of the most critical parts of setting up an accurate leak tester. Make sure to create a master part if testing to SCCM leak rates.

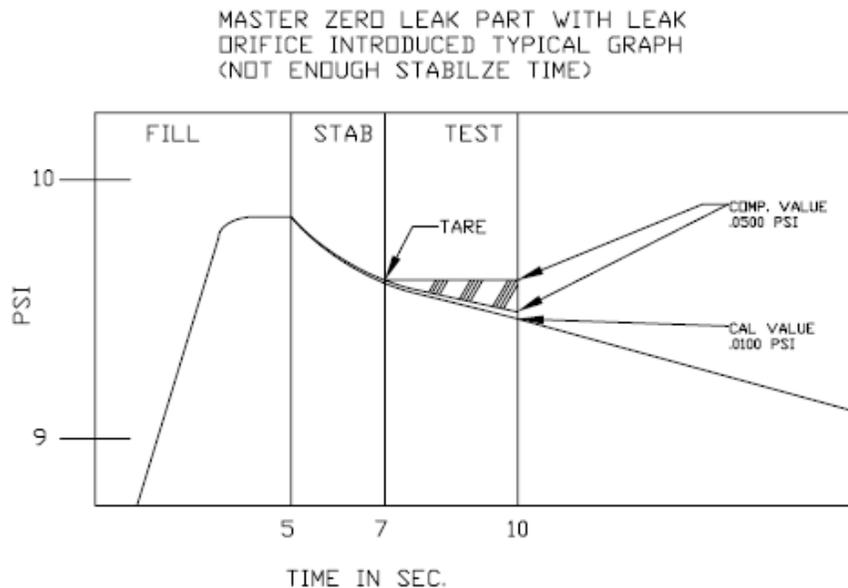
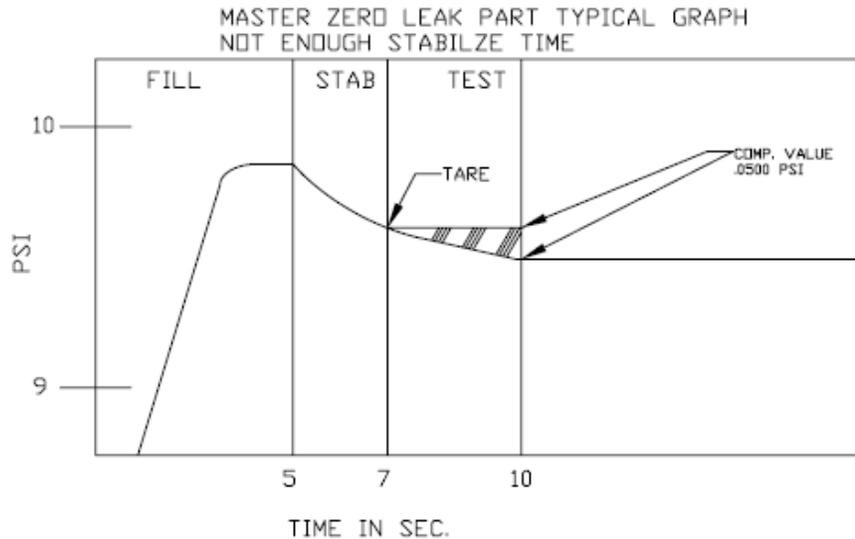
Typical Graphs of a Good Calibration Sequence



Notice the difference between the comp and cal values. The cal value is 10 times greater than the comp value. This would typically produce very repeatable test results.

Cal/Comp should be at least 5 or greater to achieve repeatable results.

Typical Graphs of a Poor Calibration Sequence



Notice the difference between the comp and cal values. The comp value is 5 times greater than the cal value. This would typically produce very unrepeatable test results.

Cal/Comp should be at least 5 or greater to achieve repeatable results. Cal/Comp is .2 in this example. More stabilize time would be required to improve this test setup.

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3.2.3 How Mass Flow Leak Testing Works

Mass Flow leak testing is a method used to detect leaks of 100 sccm and up.

Mass Flow is a method where a test part is pressurized, and the replacement air required to maintain the set point pressure is then measured by the mass flow meter to measure the leak rate.

3.2.3.1 How does the tester determine leak rates? (Mass Flow)

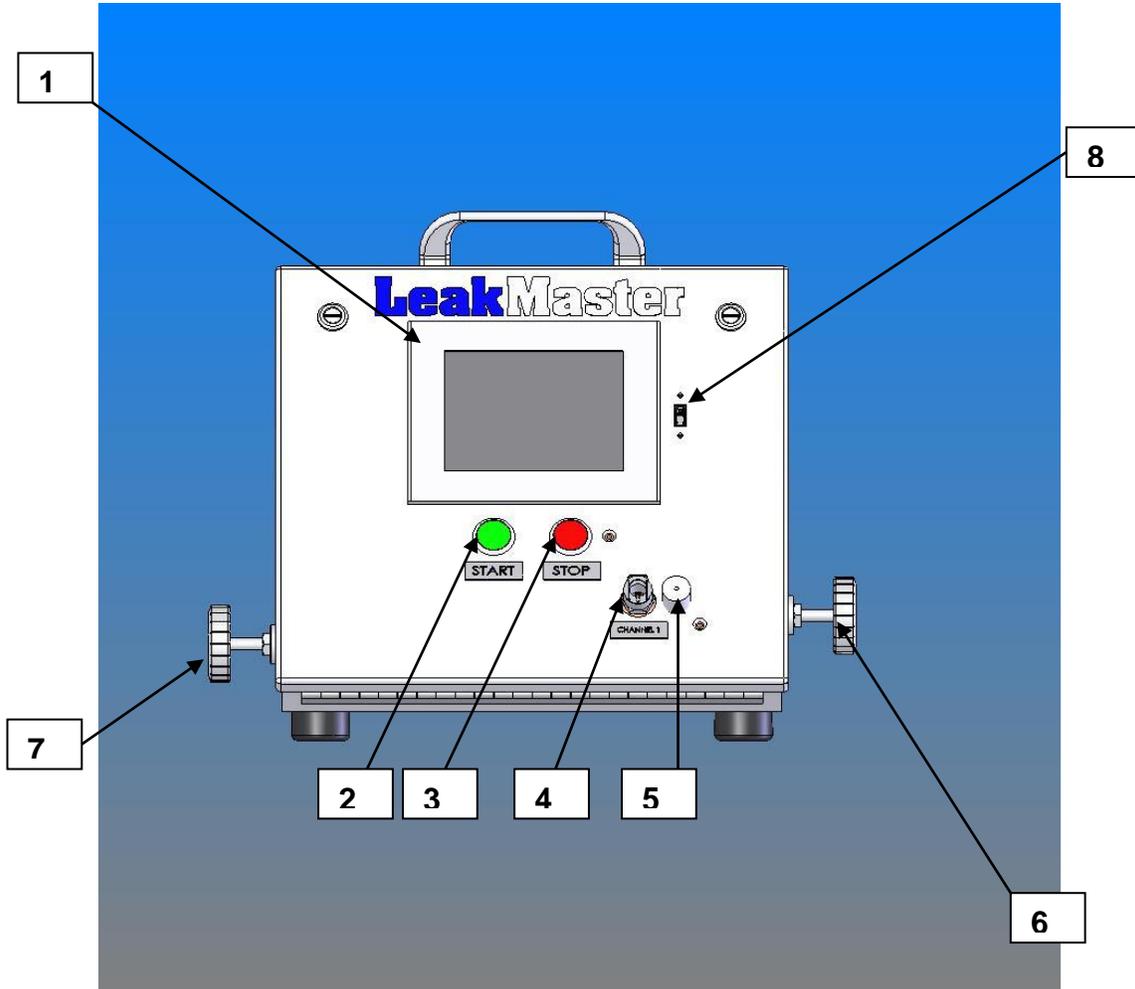
The tester will fill the test part for a determined amount of time. After the stabilize time expires, the test valve turns on. This will then measure the replacement air being supplied to the test part during the test step. At the end of the Test Time the final leak rate will be displayed.

Typical Mass Flow Test Sequence:

1. **Fill Step:** The Fill/Vent Valve turns on to allow air to fill the test part.
2. **Stabilize Step:** The Fill Valve turns off and the Test Valve turns on to stabilize the air pressure in the test part.
3. **Test Step:** The tester measures replacement air into the test part during the test step to determine leak rate.
4. **Exhaust Step:** The Fill/Vent Valve turns off to allow the remaining air in the part to be exhausted through the test manifold.

3.3 BENCHTOP COMPONENT IDENTIFICATION

3.3.1 Tester Front Panel



1. Operator Interface Touch Screen
2. Start Push Button (Pass Light)
3. Stop Push Button (Stop Light)
4. Channel 1 Test Port
5. Manifold Plug
6. Channel 1 Test Pressure Regulator
7. Channel 2 Test Pressure Regulator, or Dual Pressure Regulator (Optional)
8. USB interface connector

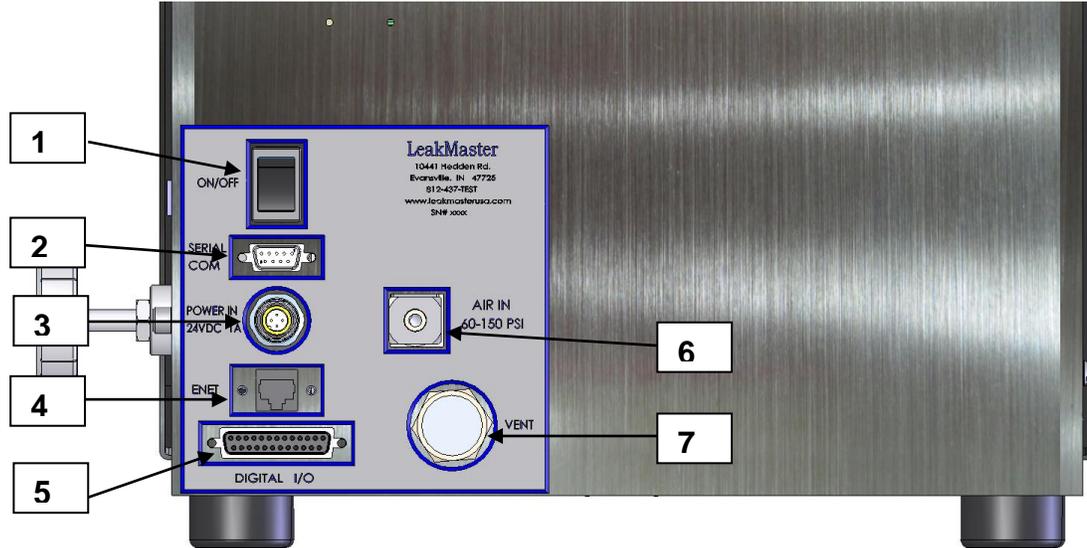
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3.3.2 Tester Rear Panel



1. ON/OFF Power Switch
2. Modbus RS485 Communication Port (or Optional Profibus Port if purchased)
3. Power Connector (+24VDC only)
4. RJ45 Ethernet Port
5. Digital I/O Connector (DB25 connector)
6. Air Supply Input (60-150 PSI) (1/4"NPT)
7. Vent Port (Exhaust air from test part) (1/4"NPT)

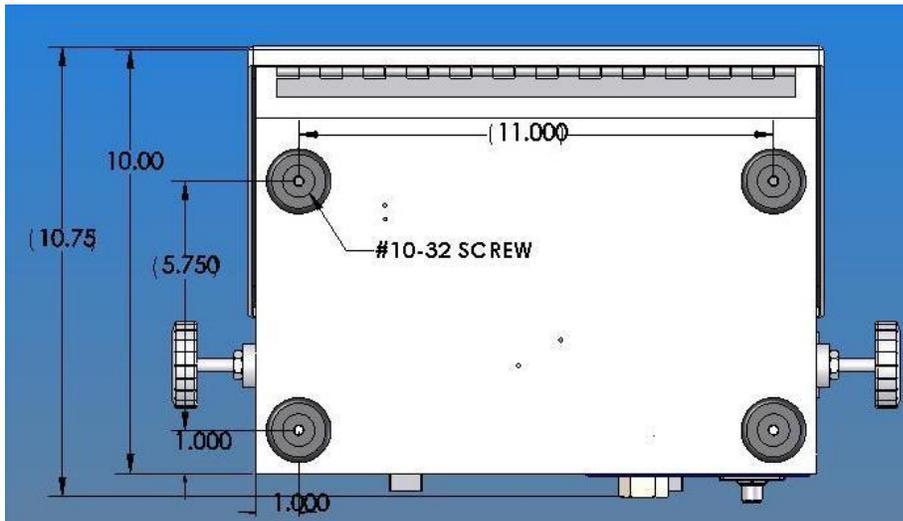
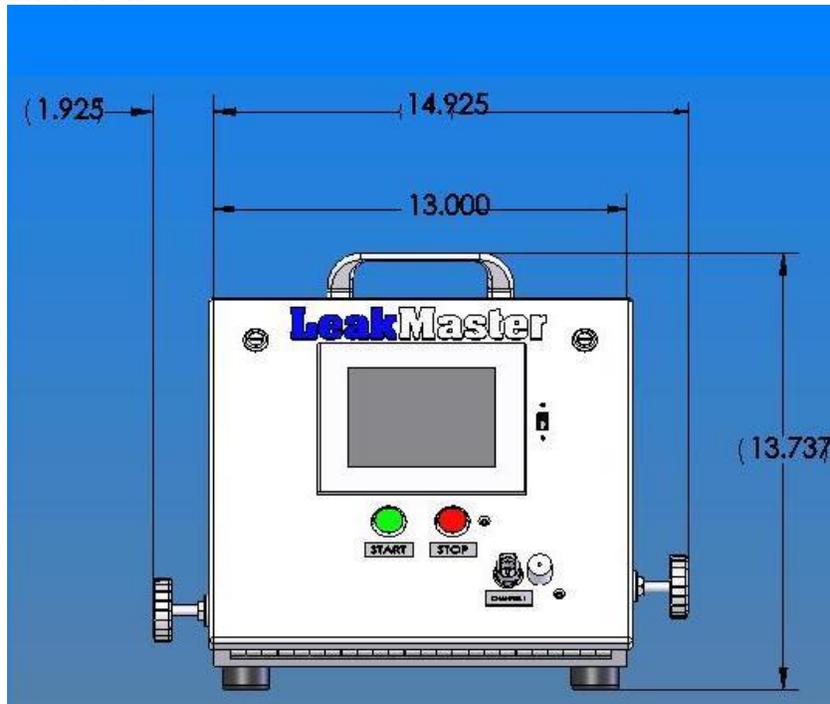
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3.3.3 Dimensions



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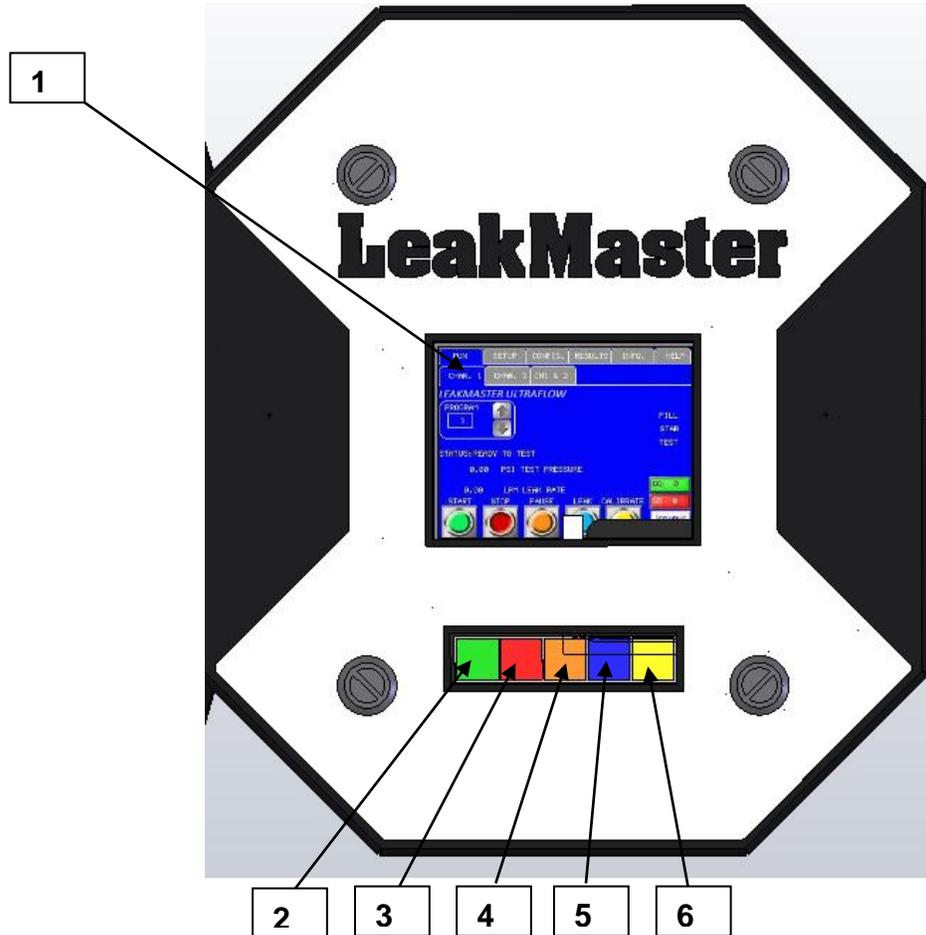
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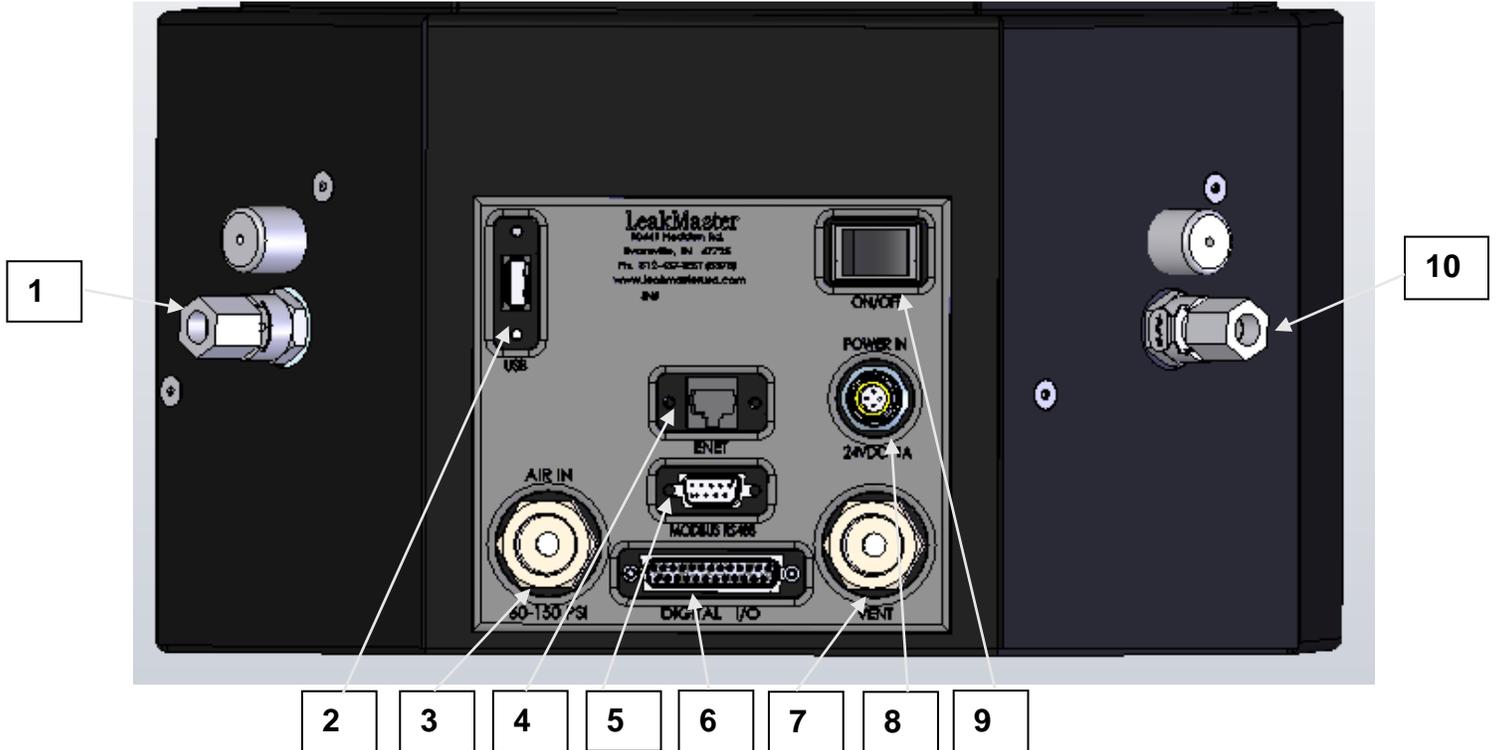
3.4 MACHINE MOUNT COMPONENT IDENTIFICATION

3.4.1 Tester Front Panel



1. Operator Interface Touch Screen
2. Start Push Button
3. Stop Push Button
4. Pause Button
5. Leak Button (turns on/off the internal calibrated leak standard)
6. Calibrate Button

3.4.2 Tester Bottom Panel



1. Channel 1 Test Port
2. USB Port
3. Air Supply Input (60-150 PSI) (1/4"NPT)
4. RJ45 Ethernet Port
5. Modbus RS485 Communication Port
6. Digital I/O Connector (DB25 connector)
7. Vent Port (Exhaust air from test part) (1/4"NPT)
8. Power Connector (+24VDC only)
9. On/Off Switch
10. Channel 2 Test Port (if dual channel option is ordered)

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3.5 PNEUMATIC SUPPLY

IMPORTANT:

The pneumatic input supply should be minimum of 60 psig but must not exceed 150 psig. **Always provide clean, dry air into the tester. Leakmaster recommends a .3 micron air filter for the incoming supply air. A .3 micron air prep unit can be purchased as an option.** It is critical to provide clean dry air for the proper functionality of the leak tester. If dirty/wet air is supplied through the tester, any damages due to this problem are not covered under warranty.

4 Spare Parts List

The standard 700PD Spare Parts List

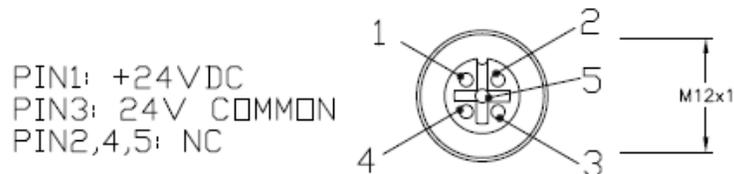
<u>Qty</u>	<u>Part Number</u>	<u>Material/Description</u>
1	RBKF-D12-V7-T4-L10-C0	BUTTON SEAL, FOR ISO VALVE CYL, VITON 80 DUROMETER
10	9452K19	TEST PLUG O-RING, 7/16" OD, 5/16" ID (10 pack)
1	40CB-S1-04	QUICK CONNECT BODY, 1/4 NPT MALE, FULL FLOW
1	40CB-PB13-04	QUICK CONNECT STEM, 1/4 NPT FEMALE, FULL FLOW
1	9452K78	O-RING, 1 1/4" OD, 1 1/8" ID, SEAL FOR CYLINDER MOUNT
1	283-2745-ND	3 AMP 1/4"X1 1/4" GLASS FUSE
1	AN20-02	MUFFLER 1/4" NPT
1	VP342RK-5MZE1-02NA	SINGLE SOL. VALVE 24VDC, VAC-150PSIG, FILL VALVE
1	NCQ8B106-012-DAO00003	LM AIR OPERATED VALVE, SPRING RETURN
1	VQZ115-5MB1-M5-PRF	SINGLE SOL. VALVE 24VDC, SYJ SERIES, PILOT VALVE
1	137806	6011 SERIES 2 WAY VALVE, 24VDC

5 Electrical Wiring

5.1 POWER WIRING

IMPORTANT:

The standard 700PD leak tester is power by **24VDC**. **Do not connect anything other than 24VDC to connector on the back of the tester.** A standard unit draws .5A at 24VDC. Leakmaster recommends a power supply that will supply a minimum of 1A. The tester can draw approximately .5-1A depending upon the options purchased. A 120V – 24VDC power supply can be supplied as an option. The 24VDC connection is on the back of the unit. This connector is an M12 (Euro) 5 pin connector. A standard M12 (Euro) 4 pin or 5 pin cable can be used to supply the power into connector. Pin 1 (Brown) is the +24V connection. Pin 3 (Blue) is the 24V common.



The standard tester is supplied with a power cable as shown below unless the option 120V power adapter is provided. An M12 (Euro) style connector can be used for this connection.



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5.1.1 OPTIONAL 120V POWER ADAPTER

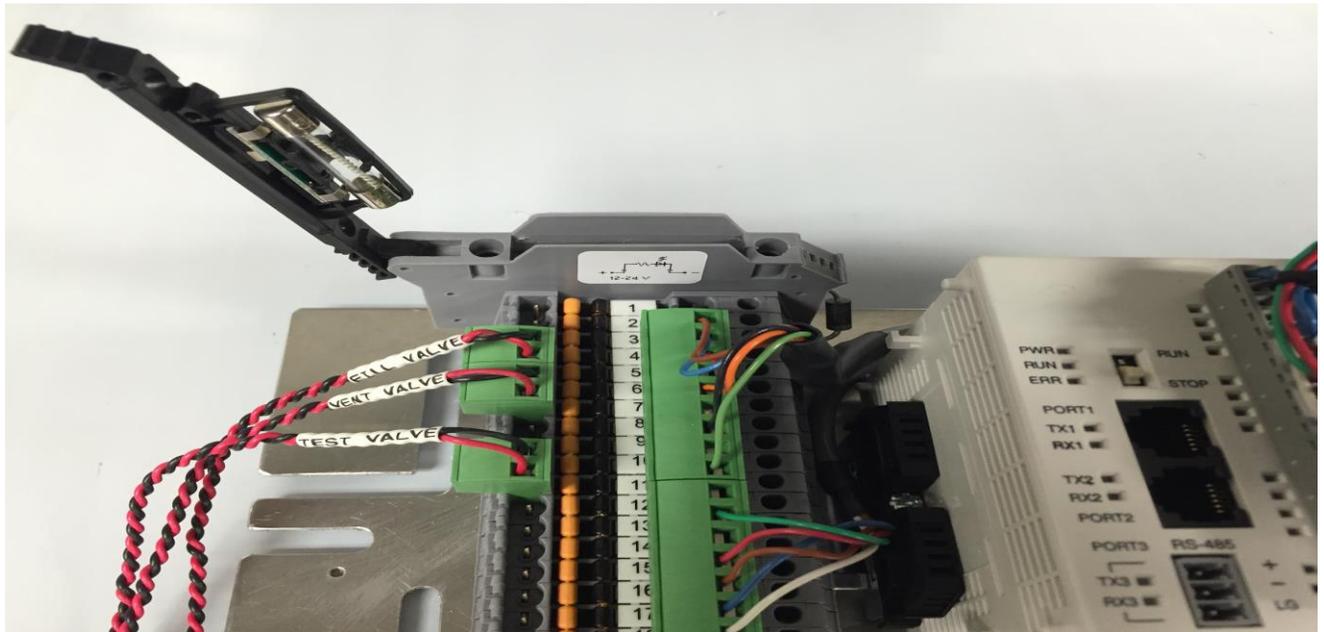
If the optional 120V power adaptor is purchased, a power supply is supplied instead of the power cable shown above. The power adapter is shown in the picture below. Plug the 120VAC end into a 120VAC receptacle. Plug the other end into the 24V power connector on the back of the tester. This power supply provides 24VDC with a maximum output of 4A.



5.2 FUSING

IMPORTANT:

The tester is supplied with a Bussman MDL 3A fuse located inside the fused terminal block. Leakmaster recommends a Bussman MDL3A fuse if replacement is ever necessary. Leakmaster provides 1 spare Bussman MDL 3A fuse that is taped to the door of the enclosure. **Make sure to disconnect the incoming power when changing out a fuse.** This fuse can be changed by pivoting the lever arm of the fused terminal block as shown below.



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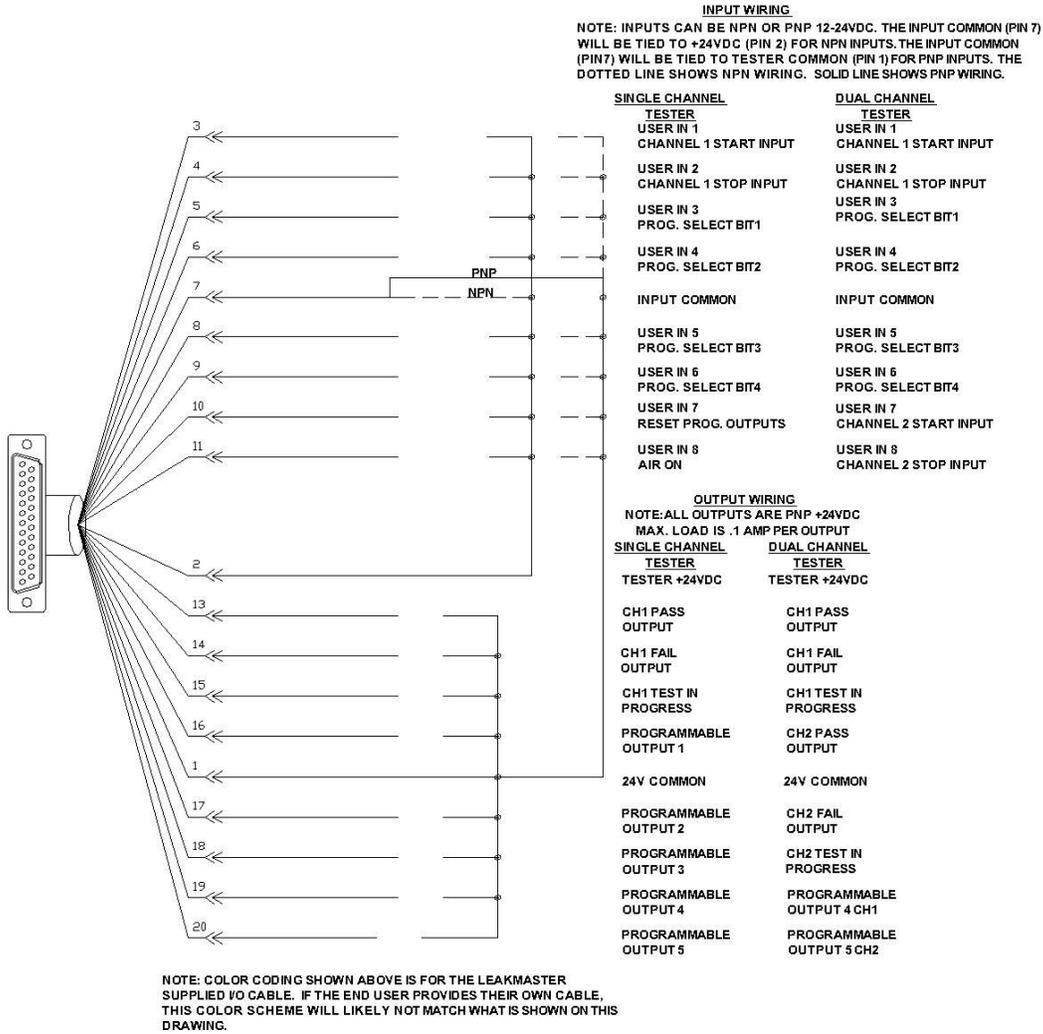
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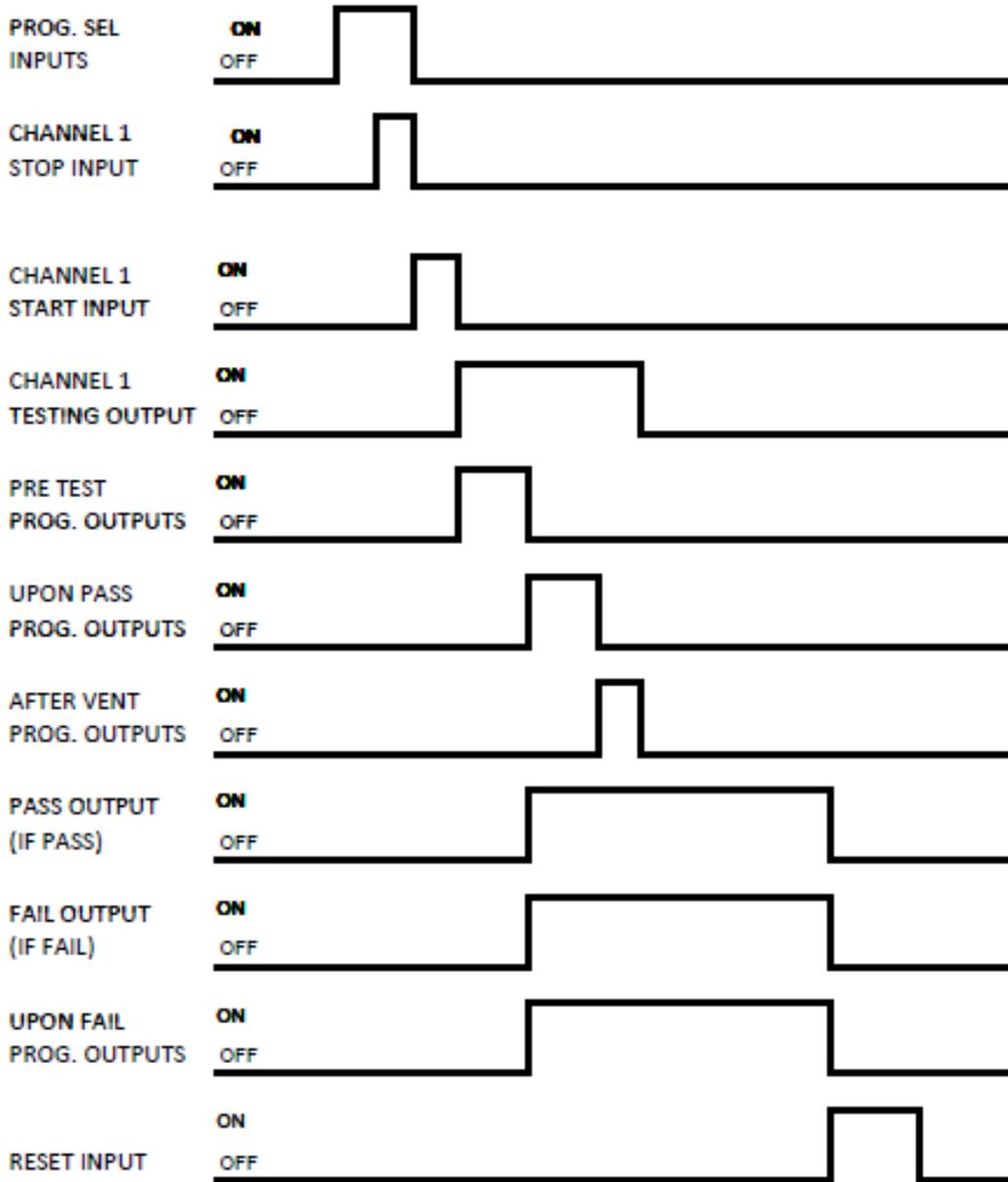
5.3 INPUTS/OUTPUTS

5.3.1 Digital I/O Wiring (DB25 connector)

The diagram below shows how to interface the DB25 Digital I/O Connector to a PLC or PC for automatic operation. The digital inputs can be configured as NPN or PNP input devices. The outputs from the tester are always +24VDC PNP (provides a +24V output).



5.3.2 I/O TIMING CHART



5.3.3 INPUT/OUTPUT DESCRIPTIONS
SINGLE CHANNEL LEAK TESTER INPUTS/OUTPUTS

The following is a list of the inputs/outputs and their functions for a single channel 700PD leak tester.

INPUTS

USER IN 1 “CHANNEL 1 START INPUT”: This input is used to start the test. When this input goes high, the tester will start a leak test sequence.

USER IN 2 “CHANNEL 1 STOP INPUT”: This input is used to stop the test and also to select the program to run. When this input goes high, the tester will stop the leak test sequence if the tester is testing. This input is also used in conjunction with the Program Select Bits. After you set the Program Select Bits, select the correct program to run, then cycle the Stop Input high, to accept the program selection. Refer to the I/O timing chart to see the example.

USER IN 3-6 “CHANNEL PROGRAM SELECT BIT 1-4”: These inputs are used to automatically select a program. These inputs are BCD inputs that are mapped to the program select register. These inputs are only read when the leak tester is not in cycle. These inputs can select program 1-15 only. Therefore you must set the appropriate inputs high before the test is started. Refer to the I/O timing chart to see the example.

Example of program selection:

USER IN3	USER IN4	USER IN5	USER IN6	PROG. SELECTED
1	0	0	0	= 1
0	1	0	0	= 2
1	1	0	0	= 3
0	0	1	0	= 4
1	0	1	0	= 5
0	1	1	0	= 6
1	1	1	0	= 7
0	0	0	1	= 8
1	0	0	1	= 9
0	1	0	1	= 10
1	1	0	1	= 11
0	0	1	1	= 12
1	0	1	1	= 13
0	1	1	1	= 14
1	1	1	1	= 15

USER IN 7 “RESET PROG. OUTPUTS”: This input is used to reset the “UPON FAIL PROGRAMMABLE OUTPUTS”.

USER IN 8 “AIR ON”: This input is used to enable air flow through the test port when the tester is not in cycle. This is typically used for troubleshooting purposes. If you want to try to find a leak after a failure, you can turn on this input to pressurize the part, and then look for the leak. When this input goes low, the part will be vented immediately.

OUTPUTS

“CH 1 PASS OUTPUT”: This output goes high immediately when a test is passed successfully. When this output goes high, it stays high until the next test cycle is initiated.

“CH 1 FAIL OUTPUT”: This output goes high immediately upon a test failure. When this output goes high, it stays high until the next test cycle is initiated.

“CH 1 TEST IN PROGRESS”: This output goes high immediately when the test is started. This output stays high until the completion of test (until the Vent step is completed).

“PROGRAMMABLE OUTPUT 1-5”: These outputs are programmed on the setup screen. These outputs can be independently programmed for each test program. They can be set high or low when the “PRETEST TIMER” begins, upon pass, after the vent step, and upon test failure. These programmable outputs enable the leak tester to control a complete work cell. For example, most leak test stations require a clamp or seal cylinder tooling and part marking cylinder tooling. Below is an example of how to set these programmable outputs to control a work cell.

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Example station control: PROGRAMMABLE OUTPUT 1 is connected to a seal cylinder solenoid valve and PROGRAMMABLE OUTPUT 2 is connected to a marker cylinder (to mark the good parts).

Programming Example:



1. At the start of the test “PROGRAMMABLE OUTPUT 1” will turn on to energize the solenoid. The seal cylinder will extend to seal the part (make sure to set the “PRETEST DELAY” timer with enough time to seal the part before the Fill Step begins).
2. Upon passing the test, the programmable outputs will take the state that is programmed in the “UPON PASS” column. In this example the seal cylinder output remains on (to keep the part secure) and the marker cylinder (PROGRAMMABLE OUTPUT 2) will turn on to energize the marker solenoid. The marker cylinder will extend to mark the part as a passed test. The “UPON PASS” outputs remain in the programmed state until the Vent step is complete.
3. After the Vent step, the programmable outputs will take the state that is programmed in the “AFTER VENT” column. The programmable outputs will remain in this state until the next cycle is started. In this example, all of the outputs are programmed “OFF”. This will deenergize the solenoids and the clamp and marker cylinder will return to home position.
4. Upon failing a test, the programmable outputs will take the state that is programmed in the “UPON FAIL” column. In this example, “PROGRAMMABLE OUTPUT 1” is set to be high. This will enable the seal cylinder to remain clamped to force the user to acknowledge the failure. The “RESET” input going high will reset the “UPON FAIL” outputs. The “UPON FAIL” outputs take priority over the “AFTER VENT” outputs. The programmable outputs will remain in this state until the next cycle is started or until the “RESET” input is set high.

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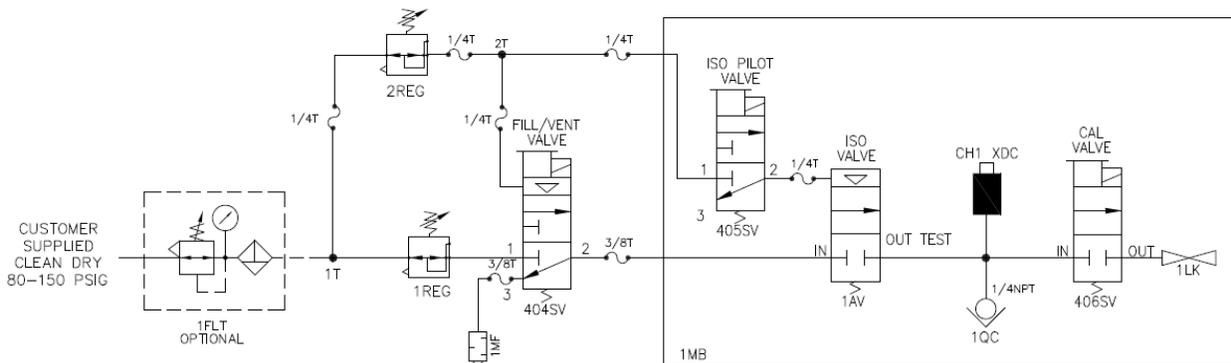
6 PNEUMATIC PLUMBING

6.1 INTERNAL PNEUMATICS SCHEMATIC

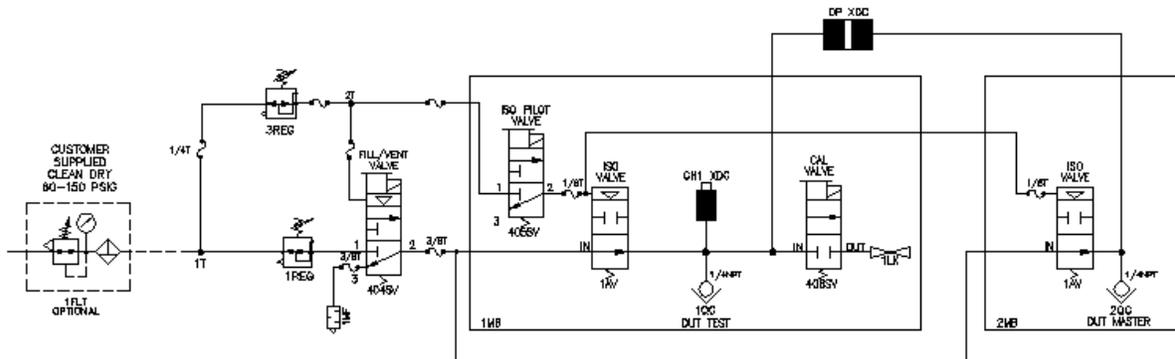
IMPORTANT:

It is extremely important to provide only clean/dry air into the back of the test unit. LeakMaster can provide an optional filter that bolts directly to back of the tester. If this option is not purchased, the user is responsible to ensure that the air being supplied to the test unit is clean and dry by usage of a coalescing filter that will filter to at least 5 microns.

6.2 700PD STANDARD PNEUMATIC SCHEMATIC



6.3 700 DIFFERENTIAL PRESSURE PNEUMATIC SCHEMATIC



7 NAVIGATING THROUGH THE TESTER TABS

7.1 POWER UP DEFAULT SCREEN

The screen shown below is the Run Screen. This screen is the one displayed upon power up on a single channel tester. A dual channel tester will power up to the CH1 & 2 tab by default, so the user can view and run both channels at the same time. You must be on the RUN tab to be able to run a leak test. If CHAN. 1 sub tab is selected, then only channel 1 will run. If CHAN. 2 sub tab is selected, then only channel 2 will run. If CH1 & 2 sub tab is selected, then both channels will run.



SINGLE CHANNEL POWER UP



DAUL CHANNEL POWER UP

7.1.1 TAB DESCRIPTIONS

Any of the tabs at the top are Main Tabs. These tabs can be pressed to navigate/view the other setting screens at any time. Simply press the desired tab to navigate to the desired screen. Many of these tabs have sub tabs below. The blue tab or sub tab is the active tab. The gray tabs are inactive until pressed.

RUN TAB: This is the actual run screen. You must be on this tab to run the tester.

This screen provides all of the controls to and status messages for the user to run the tester. This tab contains 3 sub tabs to view each or both individual channel.

SETUP TAB: This tab will allow the user to setup test parameters and limits for each leak test program. This tab contains sub tabs for setting up Channel 1 and Channel 2 test programs, independently.

CONFIG. TAB: This tab contains sub tabs for viewing and setting up general settings such as I/O viewing, changing the date, setting up a capability study, zeroing and spanning the transducers, and software license entry.

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INFO. TAB: This tab displays general information about the tester such as, tester serial number, tester part number, software license status, tester version number, and date and time.

HELP TAB: This tab enables the user to enable a USB screen capture feature.

SUB TABS: Sub tabs are divisions or sub categories of main tabs. The blue sub tabs are active. The gray sub tabs are inactive until pressed. Channel 2 sub tabs are only active if the tester is configured as a dual (2) channel tester.

7.2 RUN TAB

7.2.1 RUN TAB (CHAN. 1 OR CHAN.2 SUB TAB)

The screen shown below is the Run Screen for Channel 1. This screen is the one displayed upon power up on a single channel tester. This screen must be displayed to run a test cycle.



1. PROGRAM BOX: This box displays the program name and number of the currently selected leak test program. The user can change the program by pressing the up or down buttons to increment or decrement the program number by one or the user can touch the program number box to manually enter the program number with a numeric entry popup.
2. STATUS: This displays the current status of the leak tester.
3. TEST PRESSURE: This displays the current pressure seen on the transducer.
4. PRESSURE LOSS: Displays the pressure loss of the previous test. This value gets zeroed at the beginning of the test cycle and starts displaying live pressure loss values at the beginning of the test step.

5. LEAK RATE: Displays the leak rate in sccm (standard cubic centimeters per minute) of the previous test. This value gets zeroed at the beginning of the test cycle and is displayed at the end of the test step.
6. START: When pressed by the user, the leak test cycle will begin.
7. STATUS LIGHT: Illuminates green upon passing a test. Illuminates red upon failing a test. Flashes yellow during the test.
8. FILL STEP STATUS: Displays the remaining fill time left during the fill step. Displays a red X upon failure during the fill step. Displays a green check mark upon passing the fill step.
9. STAB STEP STATUS: Displays the remaining time left during the stabilize step. Displays a red X upon failure during the stabilize step. Displays a green check mark upon passing the stabilize step.
10. TEST STEP STATUS: Displays the remaining time left during the test step. Displays a red X upon failure during the test step. Displays a green check mark upon passing the test step.
11. CALIBRATION RELAX STATUS: Only displayed during the calibration relax step. Displays the remaining amount of relax time left after the compensation step.
12. PASSED PART COUNTER: Displays the number of passed parts. This counter can be reset by pressing and holding the green indicator for 1 sec.
13. FAILED PART COUNTER: Displays the number of rejected parts. This counter can be reset by pressing and holding the red indicator for 1 sec.
14. GRAPH VIEW: Pressing this button will display the pressure graph of the transducer. This is used to help troubleshoot and for setup purposes.
15. STOP: When pressed by the user, the leak test cycle will be stopped immediately.
16. PAUSE: When pressed by the user, the leak test cycle will be paused in the current step. Pressing the button again will resume the test.
17. LEAK: When pressed by the user, leak mode will be enabled. Leak mode turns on the cal valve which introduces the installed calibrated leak orifice into the test circuit.
18. CALIBRATE: When pressed by the user, the calibrate mode will be enabled.

7.2.2 RUN TAB (CH1 & 2 SUB TAB)

The screen shown below is the Run Screen for Channels 1 and 2. This screen must be displayed to run a test cycle on channel 1 and 2 at the same time.



1. STATUS: This displays the current test status of channel 2.
2. TEST PRESSURE: This displays the current pressure seen on the channel 2 transducer.
3. PRESSURE LOSS: Displays the pressure loss of the previous test on channel 2. This value gets zeroed at the beginning of the test cycle and starts displaying live pressure loss values at the beginning of the test step.
4. LEAK RATE: Displays the leak rate in sccm (standard cubic centimeters per minute) of the previous test on channel 2. This value gets zeroed at the beginning of the test cycle and is displayed at the end of the test step.
5. STATUS LIGHT channel 2: Illuminates green upon passing a test. Illuminates red upon failing a test. Flashes yellow during the test.
6. PROGRAM BOX: This box displays the program name and number of the currently selected leak test program for channel 2. The user can change the program by pressing the program number box to manually enter the program number with a numeric entry popup.

7. PASSED PART COUNTER: Displays the number of passed parts on channel 2. This counter can be reset by pressing and holding the green indicator for 1 sec.
8. FAILED PART COUNTER: Displays the number of rejected parts on channel 2. This counter can be reset by pressing and holding the red indicator for 1 sec.
9. STATUS: This displays the current test status of channel 1.
10. TEST PRESSURE: This displays the current pressure seen on the channel 1 transducer
11. PRESSURE LOSS: Displays the pressure loss amount of the previous test on channel 1. This value gets zeroed at the beginning of the test cycle and starts displaying live pressure loss values at the beginning of the test step.
12. LEAK RATE: Displays the leak rate in sccm (standard cubic centimeters per minute) of the previous test on channel 1. This value gets zeroed at the beginning of the test cycle and is displayed at the end of the test step.
13. STATUS LIGHT channel 1: Illuminates green upon passing a test. Illuminates red upon failing a test. Flashes yellow during the test.
14. PROGRAM BOX: This box displays the program name and number of the currently selected leak test program for channel 1. The user can change the program by pressing the program number box to manually enter the program number with a numeric entry popup.
15. PASSED PART COUNTER: Displays the number of passed parts on channel 1. This counter can be reset by pressing and holding the green indicator for 1 sec.
16. FAILED PART COUNTER: Displays the number of rejected parts on channel 1. This counter can be reset by pressing and holding the red indicator for 1 sec.

7.3 SETUP TAB

This tab will allow the user to setup test parameters and limits for each leak test program. This tab contains sub tabs for setting up Channel 1 and Channel 2 test programs independently.

7.3.1 PASSWORD ENTRY



Upon pressing the SETUP TAB, the ENTER PASSWORD popup will be displayed. The password must be entered to gain access to the SETUP TAB. The password is the serial number of the tester. In this example the serial number of the tester is 1111. Use the keys shown to enter in the serial number of the tester and press the ENTER key when finished. The serial number can be found on the back of the tester or on the INFO. TAB.

7.3.2 SETUP TAB (CHAN.1 or CHAN. 2 SUB TAB)

The screen shown below is the Setup Screen for Channel 1. This screen enables the user to setup program timers, test limits, program name, pressure unit selection, programmable output setup, and to view calibration data for each program. The CHAN. 1 and CHAN. 2 sub tab are identical.



Items 1-6 are the program timers in the test sequence order from top to bottom (1-6).

1. PRETEST DELAY TIMER: The pretest delay step is the set amount of time after that must expire after the start signal received before the fill or prefill step starts. Enter this amount (if desired) by pressing the box to enable the numeric entry popup.
2. PREFILL TIMER: This entry is only displayed when the dual pressure (fast fill) option is installed in the tester. When enabled the option valve will turn on for the set amount of time entered. Enter this amount by pressing the box to enable the numeric entry popup.
3. FILL TIMER: The fill valve will turn on for the set amount of time entered. Make sure to set enough time to completely fill the part to the desired test pressure. Enter this amount by pressing the box to enable the numeric entry popup.

4. STAB TIMER: The fill valve will turn off and the ISO (isolate) valve will turn on for the set amount of time entered. Once the ISO valve is on, the air will be trapped in the test part. The stabilize step allows the part to stabilize (relax, cool, warm, stretch, etc.) Enter this amount by pressing the box to enable the numeric entry popup.
5. TEST TIMER: The ISO (isolate) valve will remain on. The tester monitors and records the pressure loss data for the amount of time entered. Enter this amount by pressing the box to enable the numeric entry popup. When the test timer expires, the total pressure loss is recorded and the leak rate is calculated (sccm mode only).
6. VENT TIMER: The ISO (isolate) turn off causing the air in the test part to vent through the FILL/VENT valve. Enter this amount by pressing the box to enable the numeric entry popup. Make sure to enter in enough time to completely vent the part. (This timer is ignored when the optional NC external exhaust option is installed, this is only available for the option 500 psi 700HPD leak tester.)
7. TEST TYPE: This is a drop down menu that allows the user to select the desired test type for the current program. The choices in the menu are PRESSURE SCCM, PRESSURE LOSS, VACUUM SCCM, VACUUM LOSS, METERED VOLUME SCCM, METERED VOLUME PRESSURE LOSS. SCCM test type calculates the leak rate in sccm. PRESSURE LOSS test type tests parts based upon the pressure lost during the test time and does not calculate an SCCM leak rate. Select the desired test in the drop down menu and press the ENTER key to select.

“PRESS. LOSS” mode will look for a pressure loss during the test step and make pass/fail judgments based upon the results compared to the set min and max limits. This mode is commonly used in the medical industry for testing medical components.

“SCCM LOSS” mode will look for a specific leak rate in SCCM. This type of test requires a calibration to a known leak orifice installed in the test manifold. This mode is commonly used in the automotive industry. When this mode is enabled, the Test volume, Comp value, and Cal Value at the bottom of the screen will have numeric values displayed. The calibration status will also be displayed.

8. PROGRAM NAME: This allows the user to name each individual program with a desired name or number value. Press the box to enable the alphanumeric popup entry. Press enter when entry is complete.

Items 9-12 are the program test limits. The pressure must remain between the MIN and MAX PRESSURE limits during the test. After the Test step the Leak Rate must be between the MIN and MAX LEAK RATE limits. If the pressure or leak rate does not fall inside these limits, the test will fail. If the pressure and leak rate does fall inside these limits, the test will pass.

9. MIN PRESS: Pressing this numeric entry will pop up a numeric entry pad. A number can be entered into this entry pad for the Minimum Test Pressure in the selected pressure unit. This is a gross leak check to ensure that the part reaches a minimum pressure after the Fill and Stab Timer has expired.
10. MAX PRESS: Pressing this numeric entry will pop up a numeric entry pad. A number can be entered into this entry pad for the Maximum Test Pressure for the test in the selected pressure unit. This is a check to ensure that the part does not exceed the maximum pressure after the Fill Timer has expired.
11. MIN LEAK RATE: Pressing this numeric entry will pop up a numeric entry pad. A number can be entered into this entry pad for the Minimum Leak Rate Parameter. This entry will either be in the selected pressure units or SCCM units, depending upon the "Test Type" selected.
12. MAX LEAK RATE: Pressing this numeric entry will pop up a numeric entry pad. A number can be entered into this entry pad for the Maximum Leak Rate Parameter. This entry will either be in the selected pressure units or SCCM units, depending upon the "Test Type" selected.
13. CAL RELAX TIME: The cal relax timer is the delay between the first and second step of the calibration process. This time allows the part to relax back to a normal state between the two tests. Make sure to set enough time to completely restabilize the part. Enter this delay time by pressing the box to enable the numeric entry popup.
14. PROGRAM BOX: This box displays the program name and number of the program currently being viewed. The user can change the program by pressing the up or down buttons to increment or decrement the program number by one or the user can touch the program number box to manually enter the program number with a numeric entry popup.

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15. UNIT SELECT: When pressed, a popup window will be displayed as shown in the figure below. The user can then select the desired pressure units. Press the close (red X in the upper right corner) to close the window.



16. SET OUPUTS: When pressed, a popup window will be displayed as shown in the figure below. The user can set the programmable outputs as desired. Programmable output descriptions are described in the I/O section of the manual.



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17. JUMP SETTINGS: When pressed, a popup window will be displayed as shown in the figure below. This allows a user to set the tester to jump other programs based upon certain conditions.



For this example we are starting on program #1. If the part fails program #1, the tester will jump to program #2 and wait for a start signal. If the part passes program #1 the tester will jump to program #3 and wait for a start signal. Program #2 & #3, once complete (or if the stop button is pressed), will jump back to Program #1 (the original starting program).

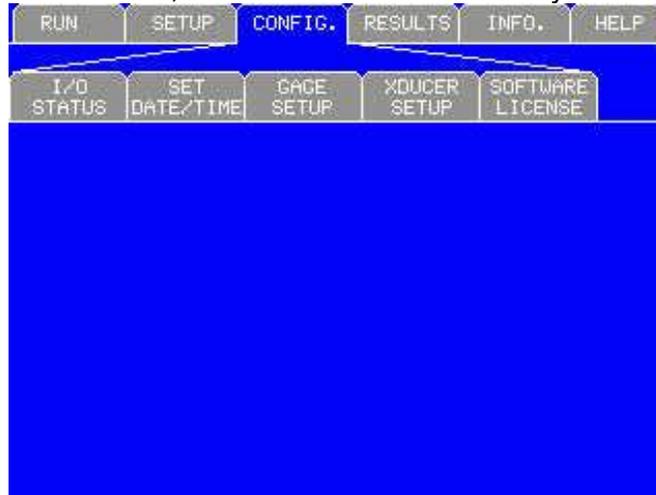
Items 18-21 are calibration data displays

18. VOLUME: This is the calculated test volume after a successful calibration.
19. COMP: This is the Compensation Value after a successful calibration. The Compensation Value is the pressure loss or gain of a zero leak part.
20. CAL: This is the Calibration Value after a successful calibration. The Calibration Value is the pressure loss of a zero leak part with the internally installed calibrated leak orifice introduced into the test circuit.
21. CAL STATUS: This indicates the calibration status of the currently viewed program. A green check indicates calibration complete. A red x indicates calibration not complete. NA is displayed if calibration is not applicable to the program (the calibration is not applicable for pressure loss testing).
22. LEAK ORIFICE VALUE: Pressing this numeric entry will pop up a numeric entry pad. A number can be entered into this entry pad for the Leak Value of the calibrated leak orifice installed in the test manifold in SCCM (standard cubic centimeters per minute). This value must be updated upon installation or changing of the installed leak orifice.

23. SAVE: The SAVE PB must be pressed when any program settings are changed or the changes will not take effect.

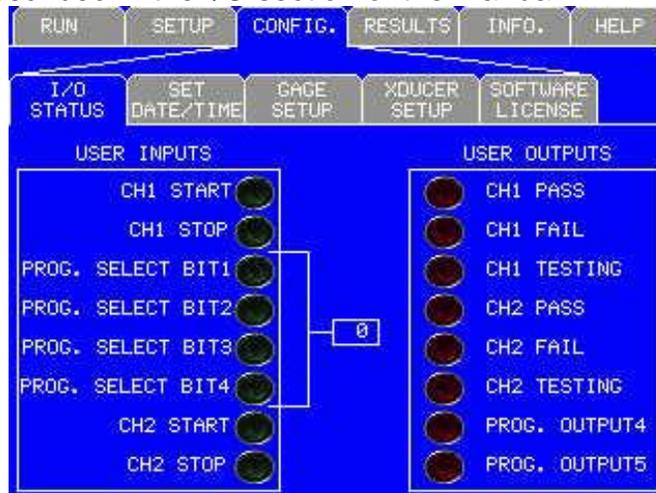
7.4 CONFIG TAB

This tab contains sub tabs for viewing and setting up general settings such as I/O viewing, changing the date, setting up a capability study, zeroing and spanning the transducers, and software license entry.



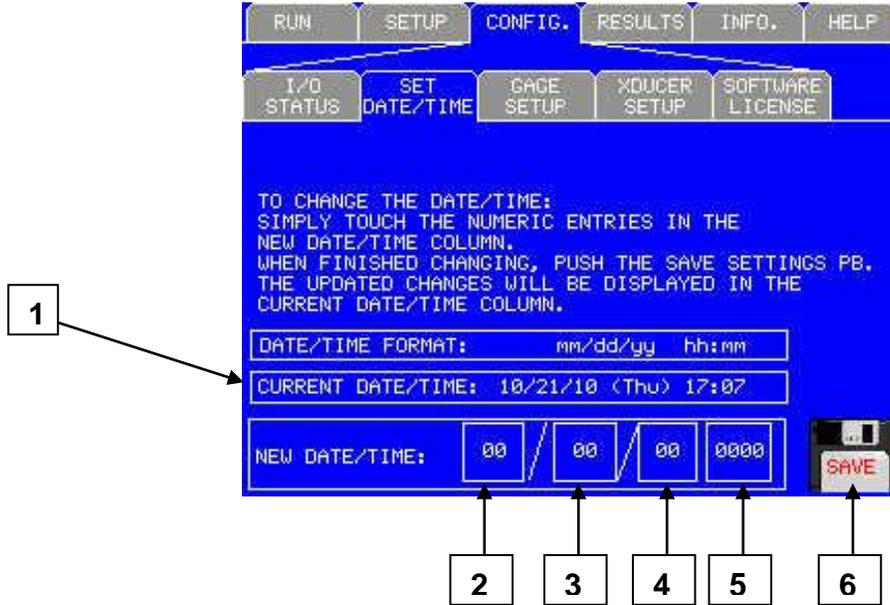
7.4.1 I/O STATUS SUB TAB

The I/O STATUS sub tab displays the current status of USER inputs and outputs. The USER outputs can be set on and off by pressing the indicator lights. This enables the user to toggle on/off the outputs for troubleshooting purposes. The description and timing of the I/O is described in the I/O section of the manual.



7.4.2 SET DATE/TIME SUB TAB

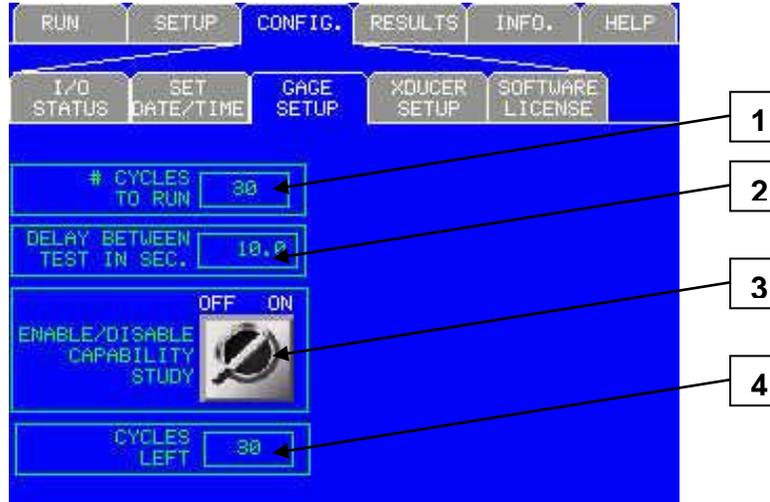
The SET/DATE TIME sub tab enables the user to set the date and time to the current date and time.



1. CURRENT DATE/TIME: This column displays the current date and time in the tester.
2. MONTH ENTRY: Press this square to enable the popup numeric entry. Enter in the current month number, then press enter to complete. This is only enabled after software activation is complete.
3. DAY ENTRY: Press this square to enable the popup numeric entry. Enter in the current day of the month, then press enter to complete. This is only enabled after software activation is complete.
4. YEAR ENTRY: Press this square to enable the popup numeric entry. Enter in the current year, then press enter to complete. This is only enabled after software activation is complete.
5. TIME ENTRY: Press this square to enable the popup numeric entry. Enter in the current time (24 hour format), then press enter to complete.
6. SAVE: The SAVE PB must be pressed for any changes to take effect.

7.4.3 GAGE SETUP SUB TAB

The GAGE SETUP sub tab will enable the user to set the tester to run a set amount of cycles with a set delay in between each cycle automatically. This is useful when running a gage capability study. When CAPABILITY STUDY MODE is enabled, the tester will run the set amount of tests. Upon completion, the CAPABILITY MODE will automatically be disabled.



1. # CYCLES TO RUN: Pressing this numeric entry will pop up a numeric entry pad. The user can enter the number of cycles to run for the capability study.
2. DELAY BETWEEN TESTS IN SEC.: Pressing this numeric entry will pop up a numeric entry pad. The user can enter the amount of time in between each test cycle.
3. ENABLE/DISABLE CAPABILITY STUDY SWITCH.: Pressing this button when the switch is in the "OFF" position, will enable the automatic capability mode. Pressing the button when the switch is in the "ON" position, will turn off the capability mode.
4. CYCLES LEFT: This displays the number of cycles left until the completion of the capability study.

7.4.4 XDUCER SETUP SUB TAB (CHAN.1 OR CHAN.2)

The XDUCER SETUP sub tab enables the user to zero and span the transducer of the desired channel. Zeroing of the transducer should be done upon startup. The transducer is zeroed at the factory, but the zero value will differ at different elevations. The zero and span function will eliminate this deviation from the factory setup.

The zero function is simple. Simply ensure that the test port (on the front of the tester) is open and push the “Zero” button. You may need to fine tune the zero point with the up/down arrows to get the PSIG Pressure value to be exactly zero.

To span the transducer, connect a digital pressure gauge to the test port (on the front of the tester) and turn on the air. Adjust the regulator to full scale pressure (or the highest pressure available below the full scale pressure). Push the span adjust up/down arrows until the pressure displayed on the tester matches the displayed value of the digital pressure gauge connected to the test port.



1. MIN PRESSURE: Displays the minimum pressure value of the installed transducer in Bar absolute.
2. MAX PRESSURE: Displays the maximum pressure value of the installed transducer in Bar absolute.
3. ZERO: Pressing this button will zero the installed transducer. If the PSIG PRESSURE value displayed does not show zero, you may need to use the ZERO ADJUST UP/DOWN arrows to fine tune the zero value.
4. ZERO ADJUST UP: Pressing this button will adjust the zero value up in increments of .001 psi each time it is pressed

5. ZERO ADJUST DOWN: Pressing this button will adjust the zero value down in increments of .001 psi each time it is pressed.
6. SPAN ADJUST UP: Pressing this button will adjust the span multiplier up in small increments each time it is pressed.
7. SPAN ADJUST DOWN: Pressing this button will adjust the span multiplier down in small increments each time it is pressed.
8. AUTO ZERO EVERY CYCLE SWITCH: Pressing this button when the switch is in the "OFF" position, will enable the automatic zero mode. Pressing the button when the switch is in the "ON" position, will turn off the automatic zero mode. When the AUTO ZERO mode is enabled, the transducer is zeroed at the beginning of every test cycle. This is sometimes necessary for applications with low test pressures (below 2 psi).

7.4.5 SOFTWARE LICENSE SUB TAB



The SOFTWARE LICENSE sub tab enables the owner to enter the software license number (key code). The license number will be issued to the owner upon final payment of the final invoice for the machine. The temporary license expires 60 days after shipment from the factory. A popup warning will be displayed 3 times before the actual expiration date.

In the event of license expiration the tester will be disabled and the screen below will be displayed. A 30 day extension can be activated by entering 812437 into the license number entry.



7.5 RESULTS TAB

The RESULTS tab displays the data collected for channel 1 or channel 2. The results table will hold the last 5000 test results. Once 5000 is reached the oldest result will be pushed out of the table. The file is saved as a csv (comma separated value) file. A folder is automatically created on the USB stick when saved for the first time. The folder name created for channel 1 data is called SAMP01. The folder name created for channel 2 data is called SAMP02. The file name is saved as a four digit number. Example file name: 1222 (The 1 designates the channel number, the 222 designates the Julian day of the year).



1. SAVE USB: Pressing the SAVE USB PB (when a USB memory stick is installed in the USB port on the front of the tester) will save the collected results to the USB memory stick in csv file format. This file can be opened with a PC using Excel or Word Pad.
2. DELETE: Pressing the DELETE PB will clear all of the collected results in the table. The DELETE PB must be held for 2 seconds to delete. This delay prevents inadvertent deleting of results.
3. ARROW LEFT: Pressing this button will shift the table columns to the left to view the left most columns of data.
4. ARROW RIGHT: Pressing this button will shift the table columns to the right to view the right most columns of data.
5. DOWN ARROW: Pressing this button will scroll to the bottom of the data table. The most recent tests are at the bottom of the table.
6. UP ARROW: Pressing this button will scroll data up in increments of 7 rows.

7.5.1 SAVING COLLECTED DATA TO USB MEMORY

The RESULTS tab displays the data collected for channel 1 or channel 2. The results table will hold the last 5000 test results. Once 5000 is reached the oldest result will be pushed out of the table. The file is saved as a csv (comma separated value) file. A folder is automatically created on the USB stick when saved for the first time. The folder name created for channel 1 data is called SAMP01. The folder name created for channel 2 data is called SAMP02. The file name is saved as a four digit number. Example file name: 1222 (The 1 designates the channel number, the 222 designates the Julian day of the year). The USB memory stick must be formatted for FAT 32 (typically FAT 32 is the standard format for most USB memory sticks).

Example of data file viewed in Excel:

Date	Time	Leak Rate	Test Press.	Press.Loss	Pass/Fail	Prog.#	Units	SN#	CH#
10/10/2017	15:36:47	-0.117	2.554	-0.0011	1	1	0	1390	2
10/10/2017	16:08:31	0	-0.011	0	0	1	0	1390	2
10/10/2017	16:08:47	0	-0.012	0	0	1	0	1390	2
10/10/2017	16:19:42	0	-0.011	0	0	1	0	1390	2
10/10/2017	16:20:00	-0.053	2.527	-0.0005	1	1	0	1390	2
10/10/2017	16:20:23	0	2.365	0	0	1	0	1390	2

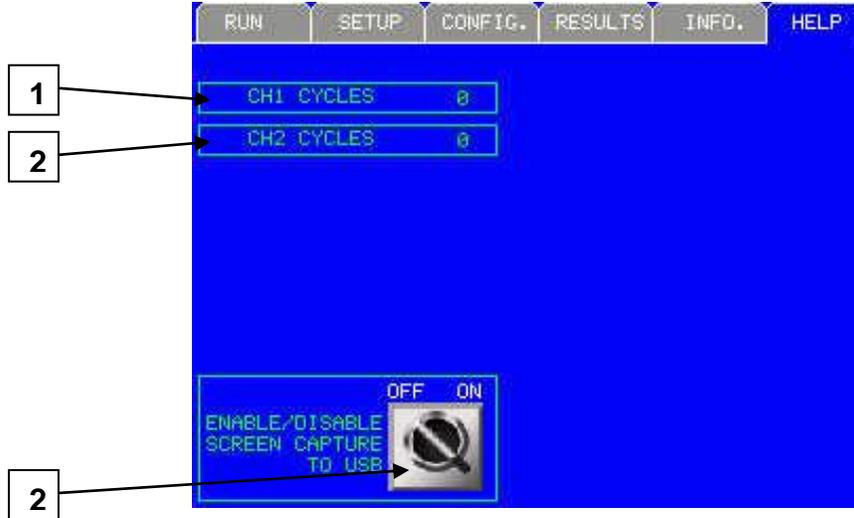
7.6 INFO. TAB

The INFO. Tab displays the tester part number, serial number, software version, software activation status, and the date/time.



7.7 HELP TAB

The HELP Tab displays the lifetime cycle counters for each channel and a USB screen capture tool that enables the user to save screen shots to a USB memory stick.



1. CH1 CYCLES: Lifetime cycle counter for channel 1.
2. CH2 CYCLES: Lifetime cycle counter for channel 2.
3. ENABLE/DISABLE SCREEN CAPTURE TO USB SWITCH: Pressing this button when the switch is in the “OFF” position, will enable the SCREEN CAPTURE mode. Pressing the button when the switch is in the “ON” position, will turn off the SCREEN CAPTURE mode. When the SCREEN CAPTURE mode is enabled, whatever is displayed on the screen will be continuously saved to USB memory. This mode is useful for support at Leakmaster. If the user needs help/support from the Leakmaster, the most difficult part is trying to see what the user is seeing. With the SCREEN CAPTURE mode, the user can run test cycles, view setup/program data, and have the screen shots saved to USB memory. These files can then be sent to Leakmaster for a quick evaluation of the problem.

8 LEAK TEST VERIFICATION PROCEDURES

The following is a list of procedures for verifying that the tester is working properly. Any time the master “zero leak” part is tested, the test results should be 0 sccm (+/- 5% of the reject leak rate). Any time that the master “zero leak” parts are tested during “LEAK SIMULATE MODE”, the test results should be +/- 5% of the value of the installed calibrated leak.

Example: reject leak rate = 10 sccm,

Master part test should be between -.5 to .5 sccm.

Master part with 10 sccm orifice introduced should be between 9.5 – 10.5 sccm.

Zero Leak Verification should be done by following the following steps:

1. Place the master parts into the test fixture.
2. Engage the cycle start button.
3. After the cycle is complete, the test results should be 0 +/- 5% of the reject leak rate or installed calibrated leak).

Leak Verification should be done by following the following steps:

1. Place the master parts into the test fixture.
2. Engage the “Leak PB” to enable Leak Mode.
3. Engage the cycle start button.
4. After the cycle is complete, the test results should be the value of the installed calibrated leak orifice (+/- 5% of the installed calibrated leak).

If the verification procedure does not produce the results as described above, you should recalibrate the tester or check to ensure that your internal leak orifice is not clogged.

8.1 Program Calibration

Auto Calibration should only be done if the verification procedure above fails or when running the program for the first time.

1. Push the AUTO CAL PB on the operator interface. The machine status should display “CALIBRATION MODE ENABLED”.
2. Load the master “zero leak” part into the test fixture.
3. Engage the start button.
4. The machine will run through a test cycle to memorize the zero leak characteristics. When the cycle is complete, the status display should display “COMPENSATION STEP COMPLETE”.
5. After the Calibration Relax Timer expires, the second test will start.
6. The tester will run through a test cycle to memorize the reject leak characteristics. When the cycle is complete, the status display should display “CALIBRATION COMPLETE”.
7. Remove the master “zero leak” part.
8. The machine is ready for production testing.

If after calibrating the tester, the tester still does not produce a repeatable test result, more test or stabilize time will need to be added to the test program.

8.2 Metered Volume Program Calibration

Auto Calibration should only be done if the verification procedure fails or when running the program for the first time.

1. Push the AUTO CAL PB on the operator interface. The machine status should display "CALIBRATION MODE ENABLED".
2. Load the master "zero leak" part into the test fixture.
3. Close and Lock Fixture
4. Engage the start button.
5. The machine will run through a test cycle to memorize the zero leak characteristics. When the cycle is complete, the status display should display "COMPENSATION STEP COMPLETE".
6. Install Leak Orifice into the master part, before relax timer expires.
7. After the Calibration Relax Timer expires, the second test will start.
8. The tester will run through a test cycle to memorize the reject leak characteristics. When the cycle is complete, the status display should display "CALIBRATION COMPLETE".
9. Remove the master "zero leak" part.
10. The machine is ready for production testing.

If after calibrating the tester, the tester still does not produce a repeatable test result, more test or stabilize time will need to be added to the test program.

9 **TESTER STATUS MESSAGES**

9.1 **Status Messages and Probable Causes**

The following is a list of the Test Status Messages.

- “READY TO TEST” This message is displayed when the tester is ready for the next test.
- “TEST DELAY STEP” This message is displayed at the beginning of a test if the PRE TEST DELAY TIMER is set.
- “PREFILL STEP” This message is displayed while the test is in the “Pre Fill Step” (sometimes referred to as Fast Fill).
- “FILL STEP” This message is displayed while the test is in the “Fill Step” (also the evacuation step when vacuum testing). This is when the part is being filled or extracted of air.
- “STABILIZE STEP” This message is displayed while the test is in the “Stabilize Step”. This is when the part is allowed to stabilize after being filled or extracted of air.
- “TEST STEP” This message is displayed while the test is in the “Test Step”. This is when the part is actually monitored for pressure drop or pressure rise (depending on the test type).
- “VENTING TEST PART” This message is displayed while the test is in the “Vent Step”. This is when the test step is done and the air in the part is vented to atmosphere.
- “FILL PRESSURE LOW (PRESSURE FELL BELOW MIN PRESS. LIMIT SETTING)” This message is displayed when the test pressure falls below the minimum pressure limit after the fill step. This failure usually occurs due to a large leak in the test part, leaks in seal tooling, or if the test pressure regulator is set too low.
- “FILL PRESSURE HIGH (PRESSURE EXCEEDED MAX FILL PRESS. LIMIT SETTING)” This message is displayed when the test pressure exceeds the maximum pressure limit after the fill step. This failure usually occurs due to test pressure regulator being set too high.
- “STABILIZE PRESSURE TOO LOW (PRESSURE FELL BELOW MIN PRESS. LIMIT SETTING)” This message is displayed when the test pressure falls below the minimum pressure limit after the stabilize step. This failure usually occurs due to a large leak in the test part or leaks in seal tooling.
- “LEAK RATE LOW (LEAK RATE FELL BELOW MIN LEAK LIMIT SETTING)” This message is displayed when the leak rate falls below the minimum leak rate limit. This failure usually occurs when the leak rate is too far in the negative direction. This is caused when the part heats up

the air in the test part, causing the air to expand and create a pressure increase during the test. This can also be caused when seal tooling slowly creeps during the test cycle. Seal creep causes the volume to be reduced during the test cycle, creating a pressure increase during the test.

- “LEAK RATE HIGH (LEAK RATE EXCEEDED MAX LEAK LIMIT SETTING)” This message is displayed when the leak rate exceeds the maximum leak rate limit. This is usually caused by a leaking part. It can also be caused by leaky seal tooling.
- “PART PASSED ALL TESTS” This message is displayed upon successful completion of the test cycle.
- “PROGRAM NEEDS TO BE CALIBRATED (PUSH CALIBRATE PB TO ENABLE CALIBRATION MODE)” This message is displayed when the selected program to run has not been calibrated yet. The tester will not run this program until the calibration procedure has been completed. A program will need to be calibrated any time the Fill, Stab, or Test timers are modified.
- “CALIBRATION MODE ENABLED (PRESS START TO CALIBRATE, STOP TO CANCEL)” This message is displayed after the calibration push button has been pressed and the calibration mode is enabled.
- “COMPENSATION STEP OF CALIBRATION PROCESS (TESTER MEMORIZES MASTER PART TRAITS)” This message is displayed during the first test of a calibration sequence.
- “CALIBRTION MODE: COMPENSATION STEP DONE (ALLOWS PART TO RELAX UNTIL RELAX TIME DONE)” This message is displayed after the completion of the first test of a calibration sequence. This message will remain displayed until the calibration relax timer expires.
- “CALIBRATION MODE: CAL STEP ENABLED (MEMORIZING REJECT LEAK TRAITS OF MASTER PART)” This message is displayed during the second test of a calibration process.
- “CH1 PD TRANSDUCER IS NOT COMMUNICATING (TESTER WILL NOT RUN UNTIL THIS IS FIXED)” This message is displayed if the channel 1 digital transducer is not communicating with the CPU. This is usually caused by the cable not being connected or if the transducer has been damaged.
- “CH2 PD TRANSDUCER IS NOT COMMUNICATING (TESTER WILL NOT RUN UNTIL THIS IS FIXED)” This message is displayed if the channel 2 digital transducer is not communicating with the CPU. This is usually caused by the cable not being connected or if the transducer has been damaged.
- “CURRENT PROGRAM HAS NOT BEEN PROGRAMMED (GOTO SETUP TAB TO SET THE PROGRAM UP!)” This message is displayed when the selected program to run has no program timer settings setup yet.

10 COMMUNICATIONS

10.1 MODBUS SERIAL COMMUNICATIONS

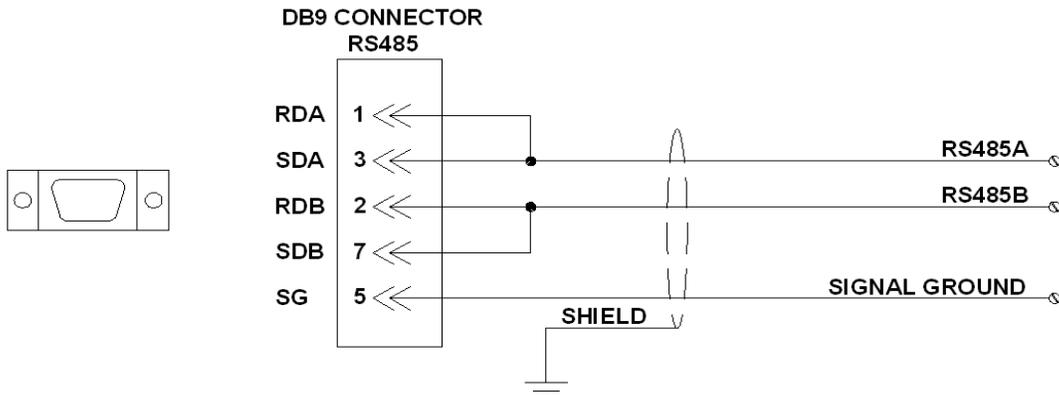
This option is a standard option. If the Ethernet IP or Profibus option is installed, then the Modbus option will not function on this tester. This is an RS485 connection, not RS232.

10.1.1 Modbus Configuration

Driver: Modbus RTU
 Protocol: RS485 2-wire
 Slave Address: 2 (default)
 Baud: 19200 (default)
 Parity: EVEN
 Stop Bits: 1
 Data Bits: 8
 Control Line: No Handshaking

10.1.2 Wiring

The diagram below shows the pinout of the DB9 connector located on the back of the leak tester. The left side shows the Leakmaster DB9 connector wiring. The other end of the cable will be landed to the PLC/PC that will be communicating with the leak tester. Refer to the PLC/PC manual for proper wiring of the other end of the cable.



Plug the cable into the DB9 Modbus RS485 port on the back of the tester.

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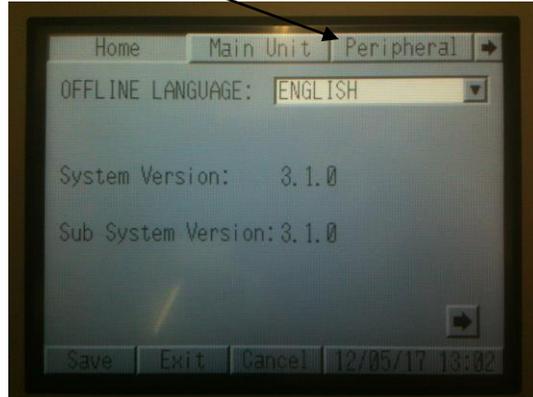
10.1.3 Changing Modbus Slave Address/Baud Rate

The following is a list of instructions for changing the Modbus slave address for the leak tester. The default slave address is 2. You can also change the Baud Rate Settings as well.

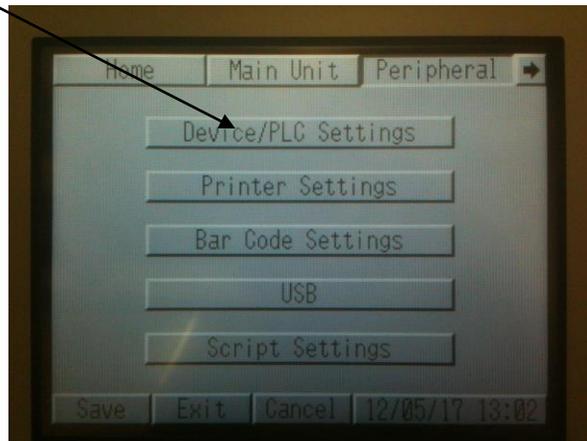
1. Touch the upper right corner of the screen, then immediately touch the lower left corner of the screen. An additional list will be displayed. Press the Offline button.



2. Push the Peripheral tab.

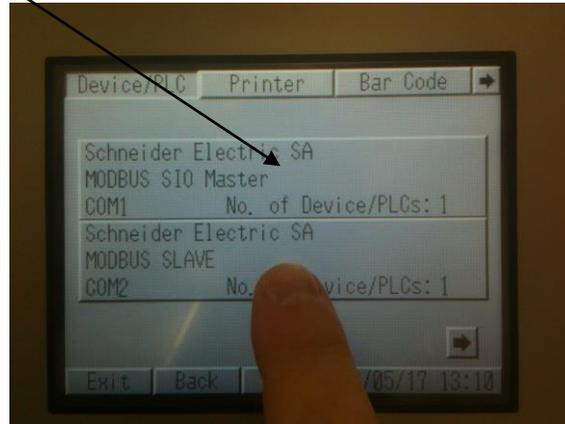


3. Push the Device/PLC Settings button

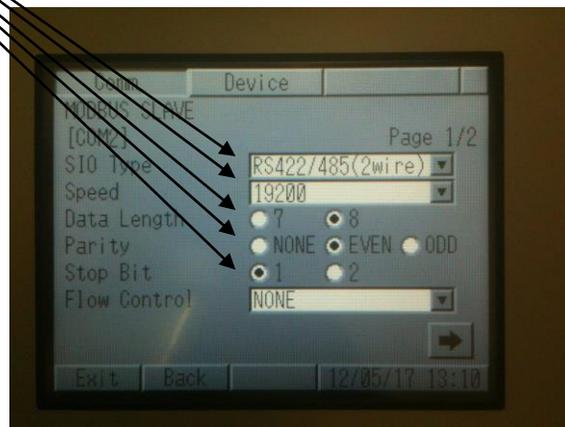


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4. Push the bottom Schneider Electric SA, Modbus Slave, **COM2** as shown below. Do not press the top button (COM 1). Making changes to COM1 settings will leave the tester non functional.



5. You can make changes to the Baud Rate Settings by pushing on the desired settings in white.



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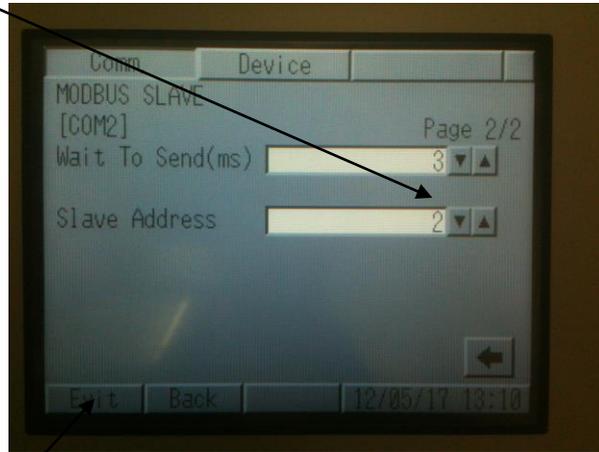
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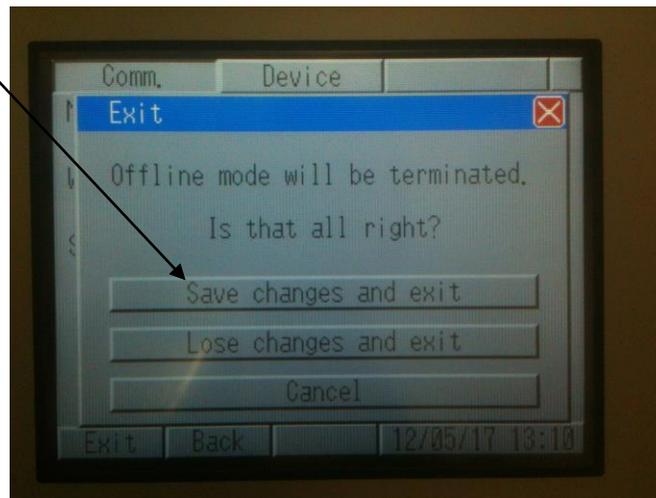
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6. Push the arrow button to access the screen that will allow Slave Address Changes. Press the up or down arrows in the Slave Address column until you have selected the desired Address number.



7. Push the Exit button when finished changing the address.

8. Push the Save changes and exit button.



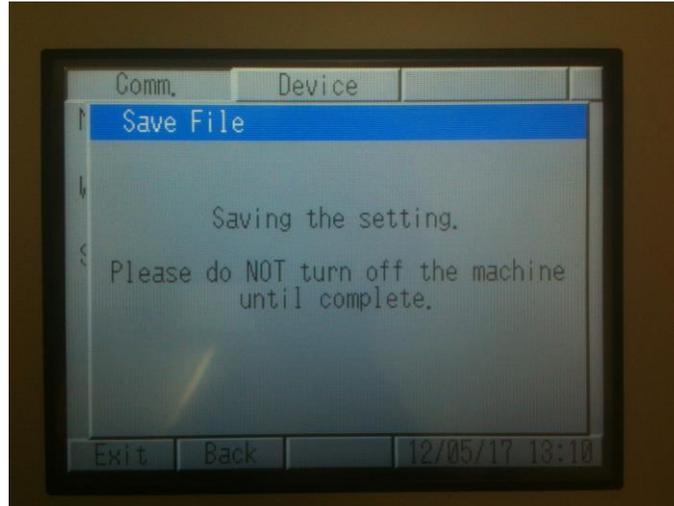
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9. Upon pressing the Save changes and exit, the screen below will be displayed.



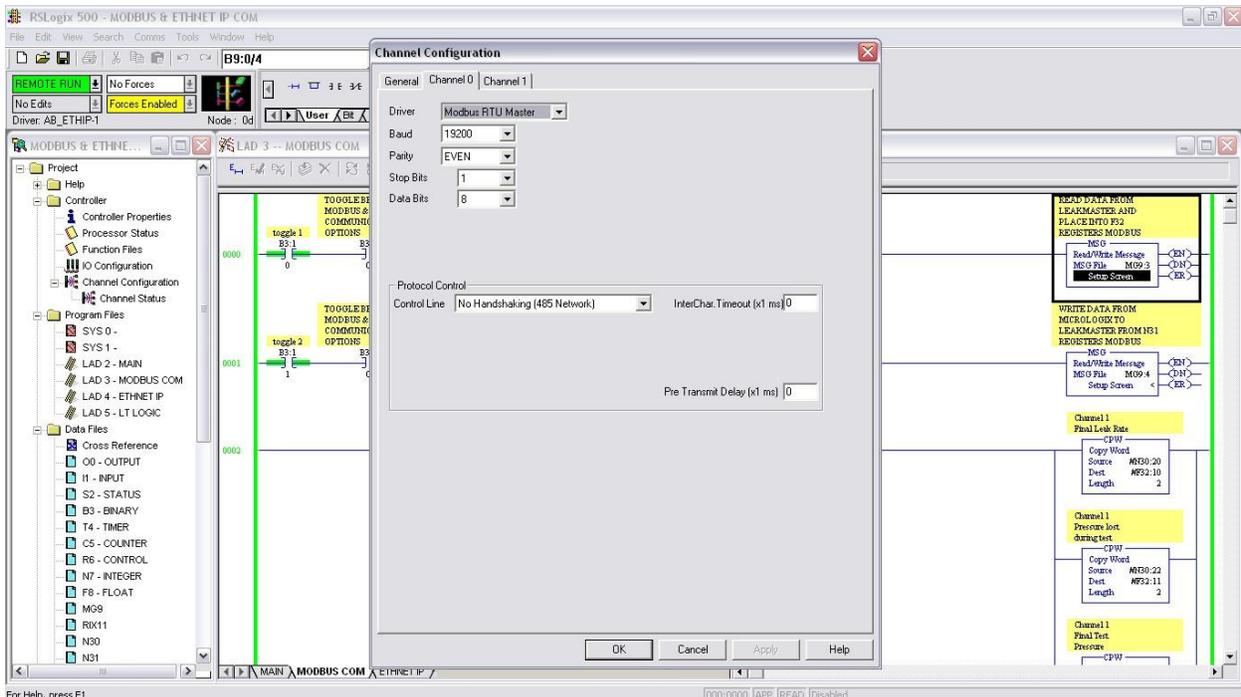
10. At this point, the address has been changed. The tester will reboot and should be ready to run upon reboot.

10.1.4 AB Micro Logix Setup

The following is how to setup a program for AB Micro Logix using Modbus protocol. Click on the channel configuration in the project tree and enter in the following settings.

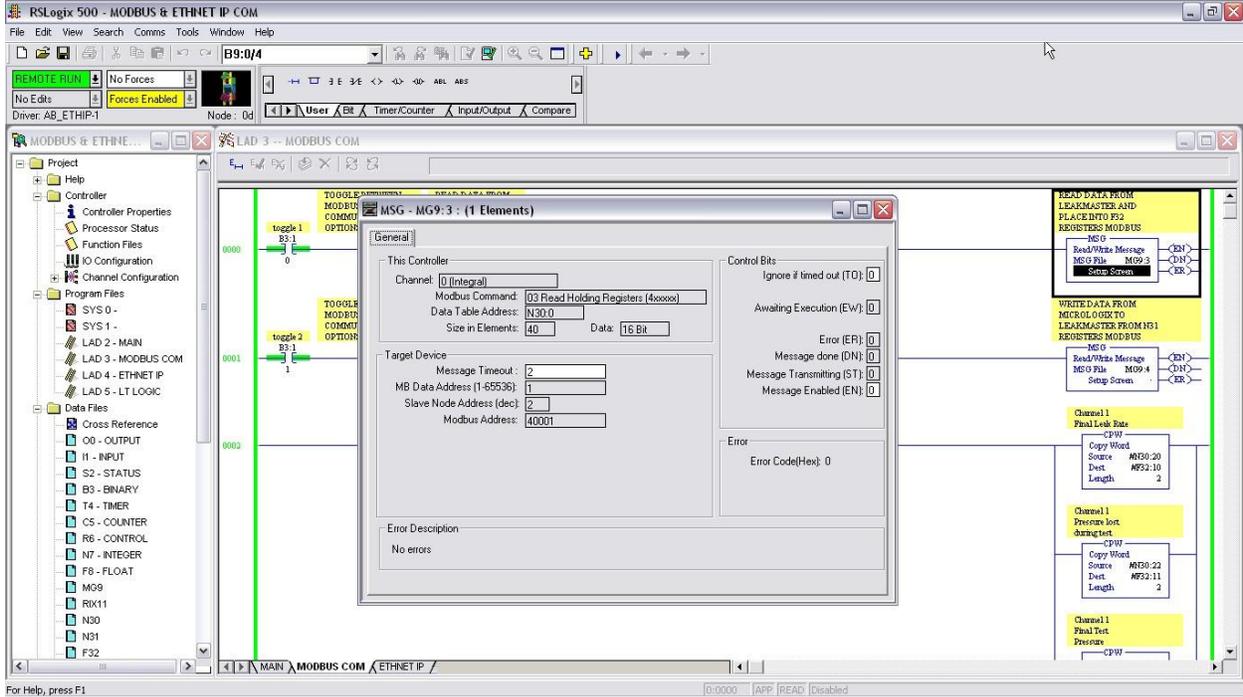
Driver: Modbus RTU Master
Baud: 19200
Parity: EVEN
Stop Bits: 1
Data Bits: 8

Protocol Control
Control Line: No Handshaking (485 Network)

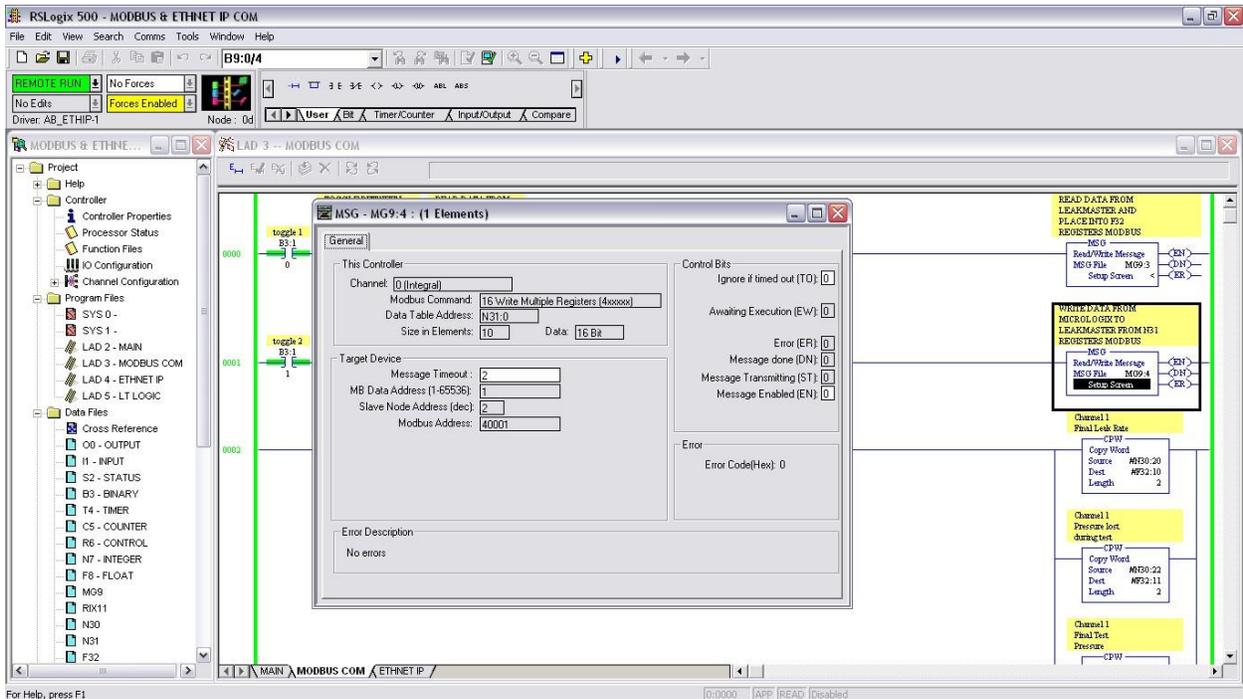


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Next you will need to setup two message instructions. The first message instruction is setup as follows.



The next message instruction is setup as follows.



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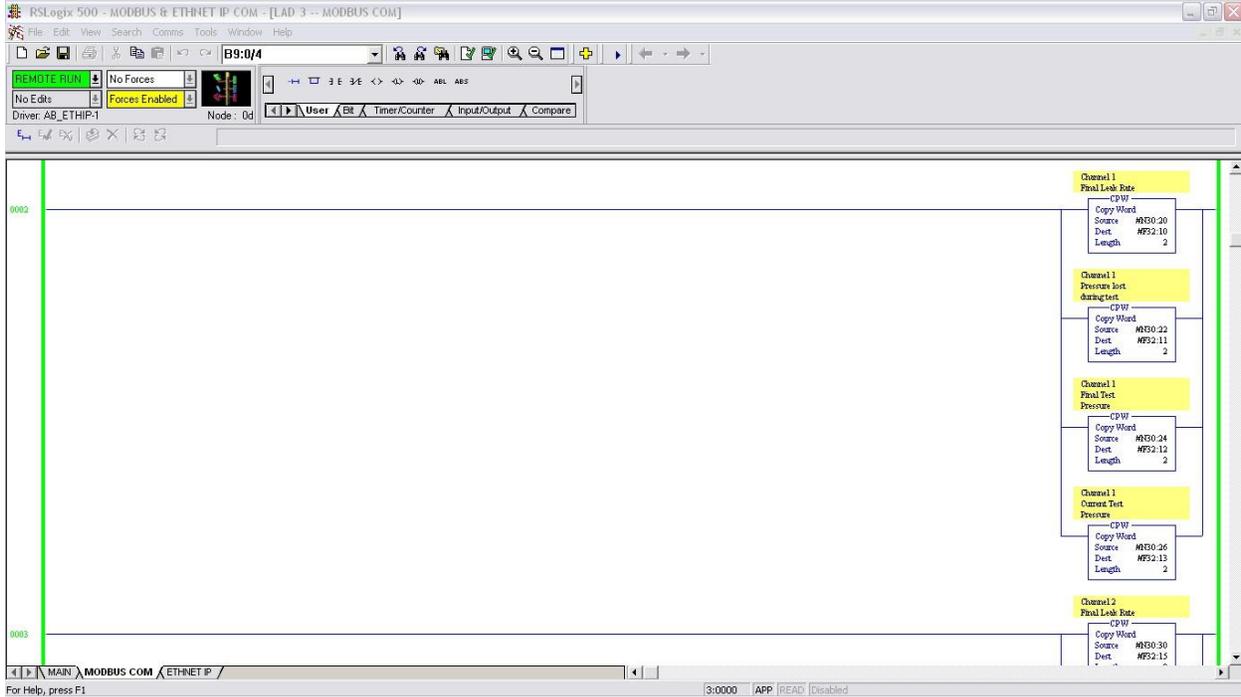
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Now we will need to do four copy word (CPW). This will move the data from two 16Bit words and put them into one 32 Bit word.



At this point the Modbus configuration is complete. Please refer to the sample program to see how to implement the I/O or see the address mapping and descriptions below.

10.1.5 Modbus Address Mapping

<u>Leakmaster Tag</u>	<u>Type</u>	<u>Modbus Address</u>	<u>Function</u>
CH1_PROG_SEL_OPT_COMMS	16 Bit Word	40001	Load a value (1-15) into this register to select the program that you want to run for channel 1.
CH1_START_INPUT_OPT_COMMS	Bit Address	40003,00	Set this bit high to start a test on channel 1.
CH1_STOP_INPUT_OPT_COMMS	Bit Address	40003,01	Set this bit high to stop a test that has already started on channel 1.
CH1_RESET_OUTPUTS_OPT_COMMS	Bit Address	40003,02	Set this bit high to reset the programmable outputs (sets them low).
CH1_AIR_ON_OPT_COMMS	Bit Address	40003,03	Set this bit high to enable test air on channel 1 test port.
CH1_CALIBRATE_INPUT_OPTION_COMMS	Bit Address	40003,04	Set this bit high to enable Channel 1 Calibration.
CH1_LEAK_MODE_ENABLE_OPT_COMMS	Bit Address	40003,05	Set this bit high to activate Channel 1 Leak Mode.

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CH1_PROG_SELECTED_OPT_COMMS	16 Bit Word	40052	The tester will load the value of the currently selected program for channel 1.
CH1_PASS_OPT_COMMS	Bit Address	40053,00	Bit will go high upon passing a test on channel 1. Bit will go low upon starting a test on channel 1.
CH1_FAIL_OPT_COMMS	Bit Address	40053,01	Bit will go high upon failing a test on channel 1. Bit will go low upon starting a test on channel 1.
CH1_TESTING_OPT_COMMS	Bit Address	40053,02	Bit will go high and stay high during entire test on channel 1. Bit will go low upon completion of vent step n channel 1.
CH1_COMP_CAL_ENABLED_OPT_COMMS	Bit Address	40053,03	Bit will go high and stay high during entire test on channel 1. Bit will go low upon completion of vent step n channel 1.
CH1_FILL_ACTIVE_OPT_COMMS	Bit Address	40053,04	Bit will go high and stay high during fill step on channel 1. Bit will go low upon completion of fill step.
CH1_STABILIZE_ACTIVE_OPT_COMMS	Bit Address	40053,05	Bit will go high and stay high during stabilize step on channel 1. Bit will go low upon completion of stabilize step.
CH1_TESTING_ACTIVE_OPT_COMMS	Bit Address	40053,06	Bit will go high and stay high during test step on channel 1. Bit will go low upon completion of test step.
CH1_LEAK_RATE_OPT_COMMS	32 Bit Float	40062	The tester will loads the leak rate of the last test ran on channel 1 into this register. This register is set to 0 at the start of every test.
CH1_PRESS_LOSS_OPT_COMMS	32 Bit Float	40064	The tester will load the pressure loss value of the last test ran on channel 1 into this register. This register is set to 0 at the start of every test.
CH1_FINAL_PRESS_OPT_COMMS	32 Bit Float	40066	The tester will load the final test pressure of the last test ran on channel 1 into this register. This register is set to 0 as the start of every test.
CH1_ACTUAL_PRESSURE_OPT_COMMS	32 Bit Float	40068	The test loads the current pressure seen on the transducer on channel 1 into this register.

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10.2 ETHERNET IP COMMUNICATIONS

This option is not a standard option. This must be purchased and installed prior to delivery of the tester.

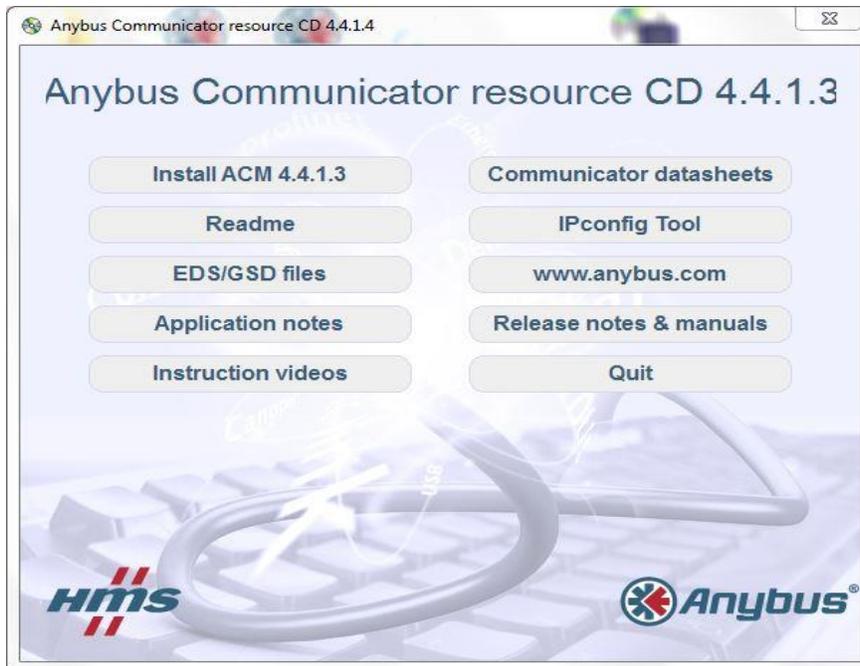
10.2.1 Wiring

Plug an Ethernet cable from the Ethernet IP network into the back of the tester in the Ethernet port.



10.2.2 IP Configuration Software

Insert Anybus CD (included with packet) and click on “Install ACM 4.4.1.3 to install the Anybus Configurator Software. This software will allow the user to change the default IP address of the leak tester. Default IP address is 192.168.0.171, Subnet 255.255.255.0.



10.2.3 Set the IP Address of the Tester

Once you have the Anybus IP Configurator software installed, follow the steps below to change the IP address of the device.

1. Double-Click on the Anybus Configurator software icon as shown below.



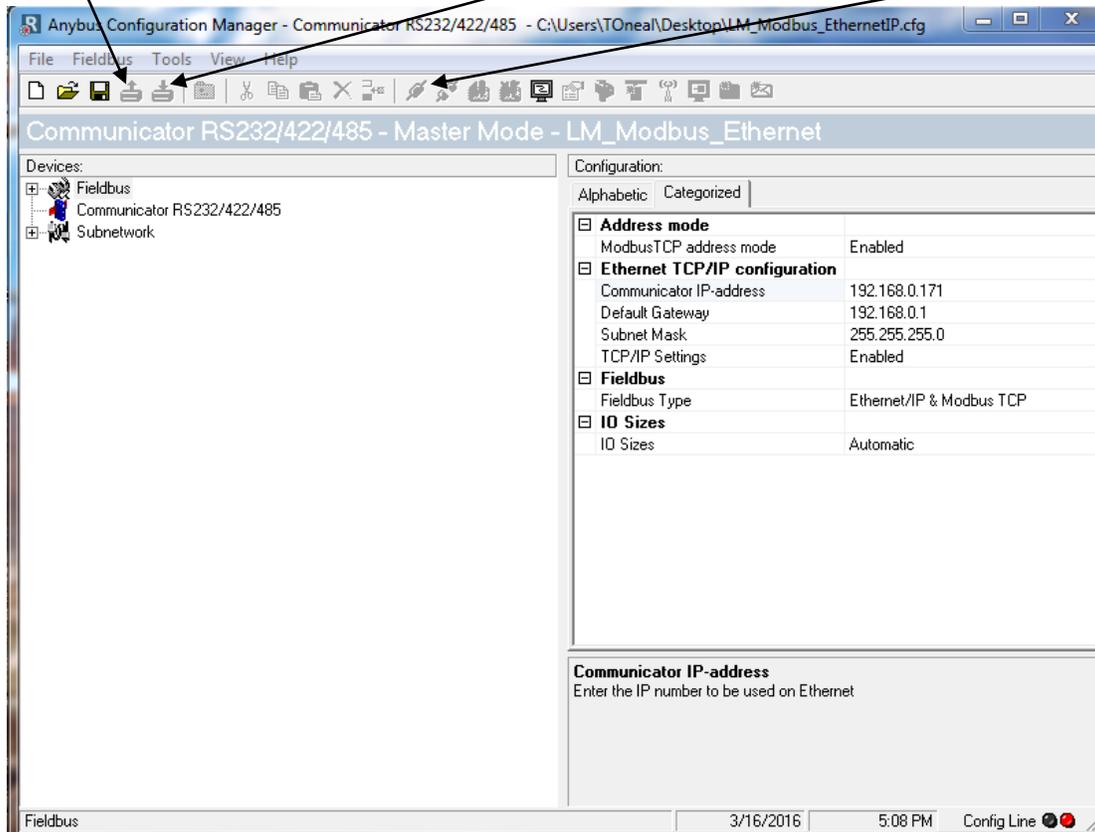
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- The Anybus IPconfig window shown below will pop up upon opening. Make sure that your PC is connected to the leak tester. Keep in mind that you will likely have to change the IP address of your PC initially to find the device. Press the Upload From Communicator RS232/422/485. Then double click the IP address, Gateway, or Subnet Mask and make changes as needed. Once complete press the Download to Communicator RS232/422/485 and the changes are complete.

Upload Anybus Program

Download Anybus Program

Com Port Connect



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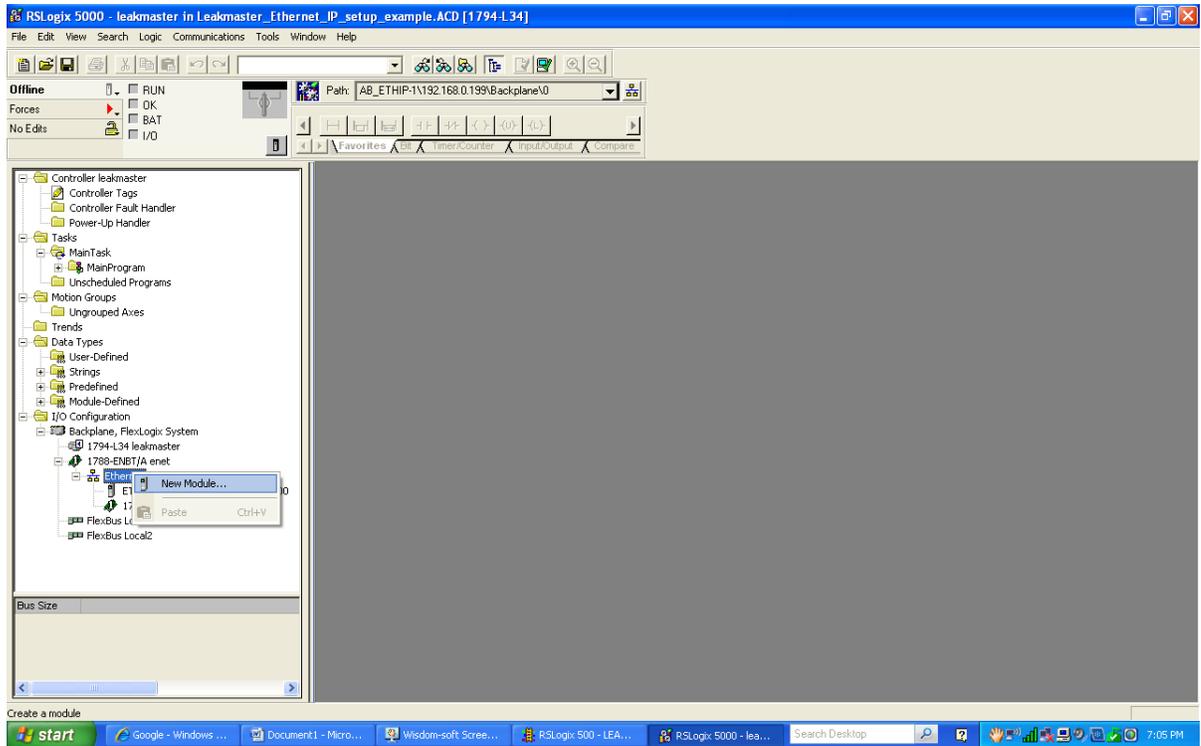
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10.2.4 AB Control Logix Setup

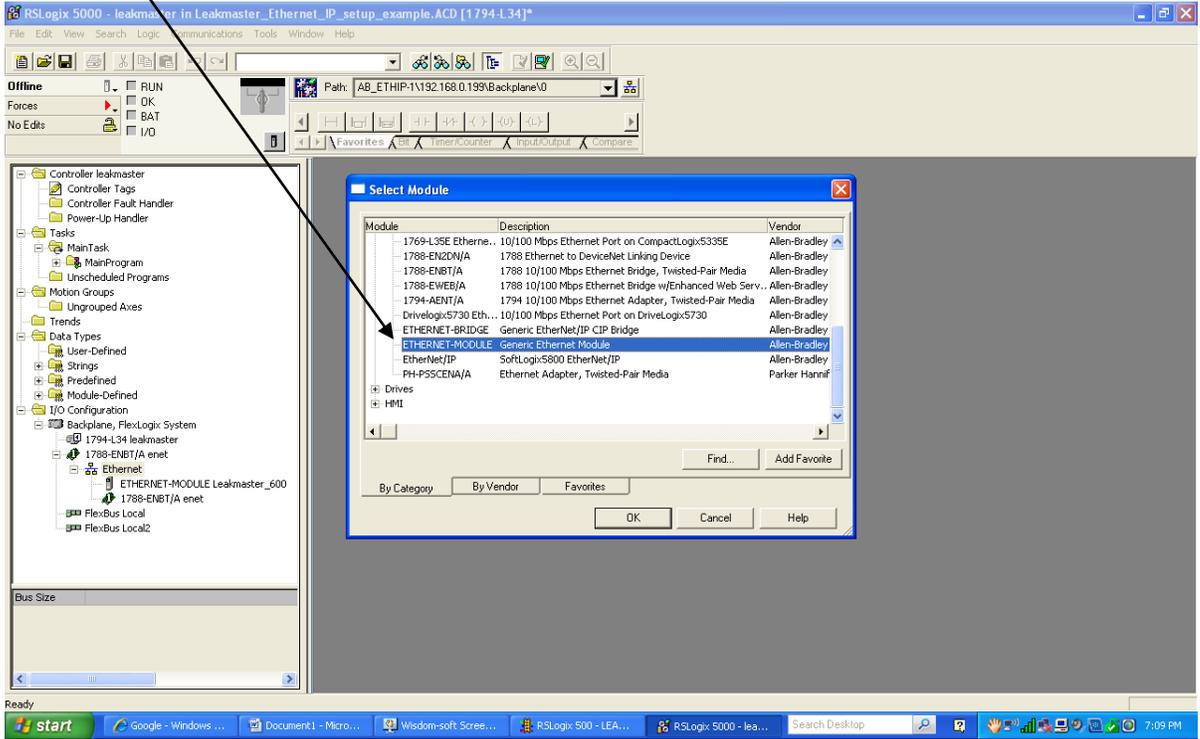
The following steps display the steps required to introduce the tester to a Control Logix controls system. A sample Control Logix Program is included on the Leakmaster USB memory stick. This program comments all of the used addresses.

- 1) Once you have your Logix program started, Add a Generic Ethernet Module as shown below.

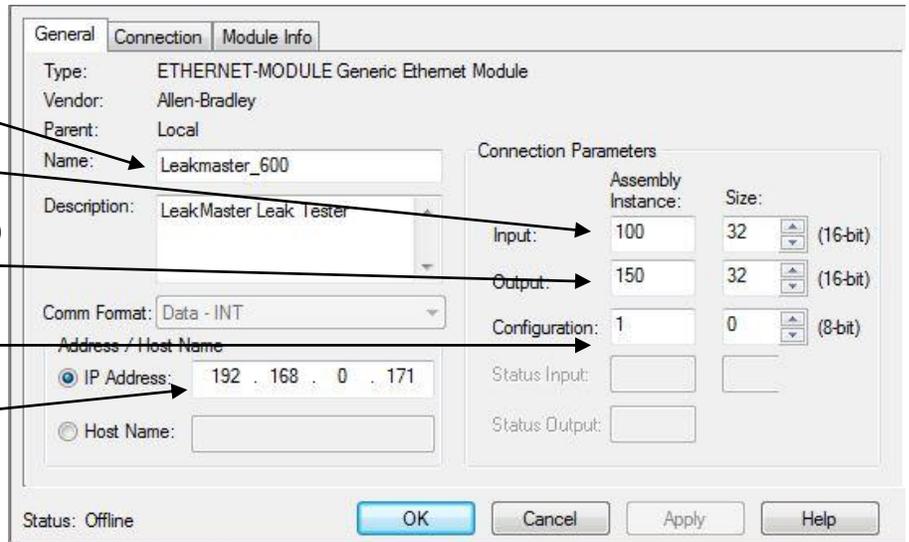


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- 2) Select the ETHERNET-MODULE (Generic Ethernet Module) as shown below.



- 3) Name the Module
- 4) Set Input Assy Inst. to 100
Set Input Size to 32
- 5) Set Output Assy Inst. to 150
Set Input Size to 32
- 6) Set Config. Assy Inst. to 1
Set Config. Size to 0
- 7) Assign the IP Address



Ethernet I/O Mapping

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After the Ethernet Module has been setup, the following Data points will be automatically created as shown below on the two screen shots. The I/O shown below already has comments in the Description column (they will not be present until the user enters them in or imports them from the example Control Logix program included in Leakmaster USB stick).

Input Data:

Scope: <input type="text" value="Leakmaster_Ethk"/>		Show: All Tags		Y. Enter Name Filter...		
Name	Value	Force Mask	Style	Data Type	Description	
+ Leakmaster_600:C	{...}	{...}		AB:ETHERNET_MO...		
- Leakmaster_600:I	{...}	{...}		AB:ETHERNET_MO...		
- Leakmaster_600:I.Data	{...}	{...}	Decimal	INT[32]		
+ Leakmaster_600:I.Data[0]		1	Decimal	INT	Channel 1 Program Selected	
+ Leakmaster_600:I.Data[1]		2	Decimal	INT	Channel 1 Status Bits	
+ Leakmaster_600:I.Data[2]		0	Decimal	INT	Channel 2 Program Selected	
+ Leakmaster_600:I.Data[3]		0	Decimal	INT	Channel 2 Status Bits	
+ Leakmaster_600:I.Data[4]		0	Decimal	INT		
+ Leakmaster_600:I.Data[5]		0	Decimal	INT		
+ Leakmaster_600:I.Data[6]		0	Decimal	INT		
+ Leakmaster_600:I.Data[7]		0	Decimal	INT		
+ Leakmaster_600:I.Data[8]		0	Decimal	INT		
+ Leakmaster_600:I.Data[9]		0	Decimal	INT		
+ Leakmaster_600:I.Data[10]		-2621	Decimal	INT	Channel 1 Leak Rate	
+ Leakmaster_600:I.Data[11]		17095	Decimal	INT		
+ Leakmaster_600:I.Data[12]		0	Decimal	INT	Channel 1 Pressure Loss	
+ Leakmaster_600:I.Data[13]		0	Decimal	INT		
+ Leakmaster_600:I.Data[14]		26369	Decimal	INT	Channel 1 Final Pressure	
+ Leakmaster_600:I.Data[15]		16903	Decimal	INT		
+ Leakmaster_600:I.Data[16]		10188	Decimal	INT	Channel 1 Actual Pressure	
+ Leakmaster_600:I.Data[17]		15947	Decimal	INT		
+ Leakmaster_600:I.Data[18]		0	Decimal	INT		
+ Leakmaster_600:I.Data[19]		0	Decimal	INT		
+ Leakmaster_600:I.Data[20]		0	Decimal	INT		
+ Leakmaster_600:I.Data[21]		0	Decimal	INT		

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Output Data:

Scope: <input type="text" value="Leakmaster_Eth0"/> Show: All Tags				Enter Name Filter...		
Name	Value	Force Mask	Style	Data Type	Description	
+ Leakmaster_600:C		{...}	{...}		AB:ETHERNET_MO...	
+ Leakmaster_600:I		{...}	{...}		AB:ETHERNET_MO...	
- Leakmaster_600:O		{...}	{...}		AB:ETHERNET_MO...	
- Leakmaster_600:O.Data		{...}	{...}	Decimal	INT[32]	
+ Leakmaster_600:O.Data[0]		1		Decimal	INT	Channel 1 Program Select Register
+ Leakmaster_600:O.Data[1]		0		Decimal	INT	Channel 2 Program Select Register
+ Leakmaster_600:O.Data[2]		0		Decimal	INT	Channel 1 Control
+ Leakmaster_600:O.Data[3]		0		Decimal	INT	Channel 2 Control
+ Leakmaster_600:O.Data[4]		0		Decimal	INT	
+ Leakmaster_600:O.Data[5]		0		Decimal	INT	
+ Leakmaster_600:O.Data[6]		0		Decimal	INT	
+ Leakmaster_600:O.Data[7]		0		Decimal	INT	
+ Leakmaster_600:O.Data[8]		0		Decimal	INT	
+ Leakmaster_600:O.Data[9]		0		Decimal	INT	
+ Leakmaster_600:O.Data[10]		0		Decimal	INT	
+ Leakmaster_600:O.Data[11]		0		Decimal	INT	
+ Leakmaster_600:O.Data[12]		0		Decimal	INT	
+ Leakmaster_600:O.Data[13]		0		Decimal	INT	
+ Leakmaster_600:O.Data[14]		0		Decimal	INT	
+ Leakmaster_600:O.Data[15]		0		Decimal	INT	
+ Leakmaster_600:O.Data[16]		0		Decimal	INT	
+ Leakmaster_600:O.Data[17]		0		Decimal	INT	
+ Leakmaster_600:O.Data[18]		0		Decimal	INT	
+ Leakmaster_600:O.Data[19]		0		Decimal	INT	
+ Leakmaster_600:O.Data[20]		0		Decimal	INT	

At this point the Ethernet IP configuration is complete. Please refer to the sample program to see how to implement the I/O or see the address mapping and descriptions on the following page.

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RSLogix/Studio 5000 Ethernet I/O Mapping Descriptions

<u>Tag Address</u>	<u>Description</u>	<u>Function</u>
Leakmaster_600:I.DATA[0]	Channel 1 Program Selected	The tester will load the value of the currently selected program for channel 1.
Leakmaster_600:I.DATA[1].0	Channel 1 Pass	Bit will go high upon passing a test on channel 1. Bit will go low upon starting a test on channel 1.
Leakmaster_600:I.DATA[1].1	Channel 1 Fail	Bit will go high upon failing a test on channel 1. Bit will go low upon starting a test on channel 1.
Leakmaster_600:I.DATA[1].2	Channel 1 Testing	Bit will go high and stay high during entire test on channel 1. Bit will go low upon completion of vent step n channel 1.
Leakmaster_600:I.DATA[1].3	Channel 1 Comp/Cal Enabled	Bit will go high and stay high during entire test on channel 1. Bit will go low upon completion of vent step n channel 1.
Leakmaster_600:I.DATA[1].4	Channel 1 Fill Step Active	Bit will go high and stay high during fill step on channel 1. Bit will go low upon completion of fill step.
Leakmaster_600:I.DATA[1].5	Channel 1 Stabilize Step Active	Bit will go high and stay high during stabilize step on channel 1. Bit will go low upon completion of stabilize step.
Leakmaster_600:I.DATA[1].6	Channel 1 Testing Step Active	Bit will go high and stay high during test step on channel 1. Bit will go low upon completion of test step.
Leakmaster_600:I.DATA[10]	Channel 1 Leak Rate	The tester will load the leak rate of the last test ran on channel 1 into this register. This register is set to 0 at the start of every test.
Leakmaster_600:I.DATA[12]	Channel 1 Pressure Loss	The tester will load the pressure loss value of the last test ran on channel 1 into this register. This register is set to 0 at the start of every test.
Leakmaster_600:I.DATA[14]	Channel 1 Final Pressure	The tester will load the final test pressure of the last test ran on channel 1 into this register. This register is set to 0 as the start of every test.
Leakmaster_600:I.DATA[16]	Channel 1 Actual Pressure	The test loads the current pressure seen on the transducer on channel 1 into this register.
Leakmaster_600:O.DATA[0]	Channel 1 Program Select Register	Load a value (1-15) into this register to select the program that you want to run for channel 1.

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Leakmaster_600:O.DATA[2].0	Channel 1 Start	Set this bit high to start a test on channel 1.
Leakmaster_600:O.DATA[2].1	Channel 1 Stop	Set this bit high to stop a test that has already started on channel 1.
Leakmaster_600:O.DATA[2].2	Channel 1 Reset Programmable Outputs to 0	Set this bit high to reset the programmable outputs (sets them low).
Leakmaster_600:O.DATA[2].3	Channel 1 Air On	Set this bit high to enable test air on channel 1 test port.
Leakmaster_600:O.DATA[2].4	Channel 1 Calibration Mode Enable	Set this bit high to enable Channel 1 Calibration.
Leakmaster_600:O.DATA[2].5	Channel 1 Leak Mode Enable	Set this bit high to activate Channel 1 Leak Mode.

10.2.5 AB MicroLogix 1100/1400 Setup

The following steps display the steps required to introduce the tester to a MicroLogix 1100 or 1400 controls system. A sample RSLogix 500 Program is included on the Leakmaster USB memory stick for reference. This reference program comments all of the used addresses in the Ethernet communications. All data is transferred via the MSG "Message" instruction in the RSLogix 500 programming software.

- 1) Once you have your RSLogix 500 program started, add the following data files to the project:
 - a. MG9, 3 Elements (This data file is required for the MSG instructions)
 - b. RIX11, 3 Elements (This data file is required for the MSG instructions)
 - c. N30, 32 Elements (These are the data points that are read from the Leakmaster tester)
 - d. N31, 32 Elements (These are the data points written from your PLC to the Leakmaster tester)
 - e. F32, 16 Elements (These are the data points that are read from the Leakmaster tester in Floating Point format)
- 2) Once you have your data files added to the project, you are now ready to add the MSG instructions as shown in the screenshot below. Leakmaster highly recommends copying and pasting these instructions from the sample project directly into your own project to ensure all MSG instructions are configured properly.

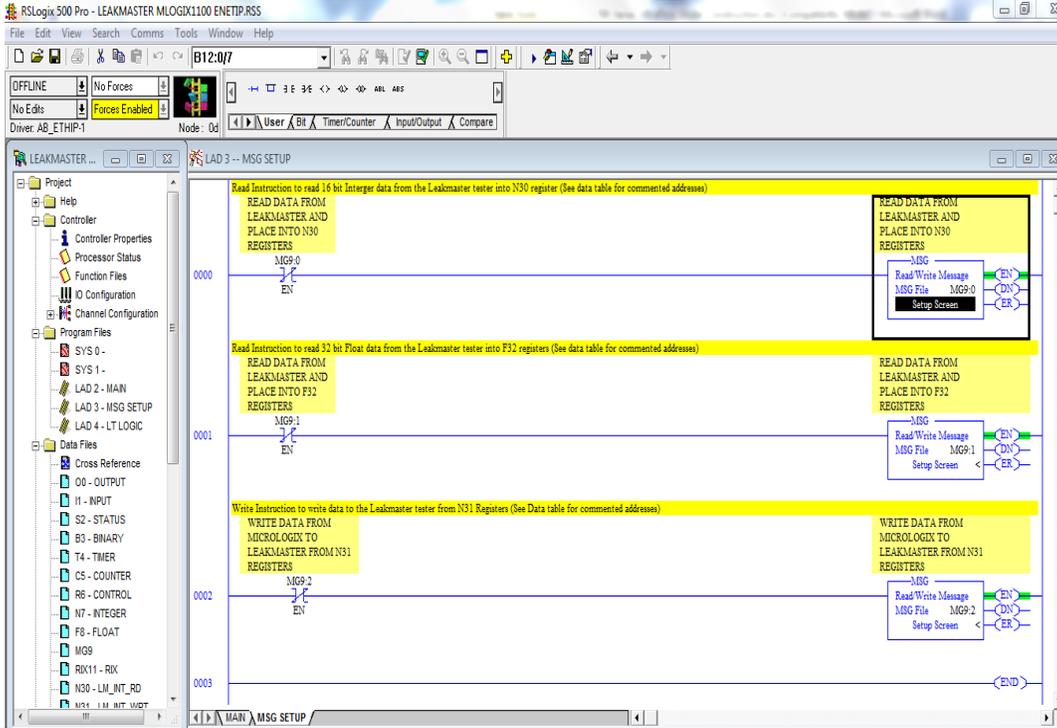
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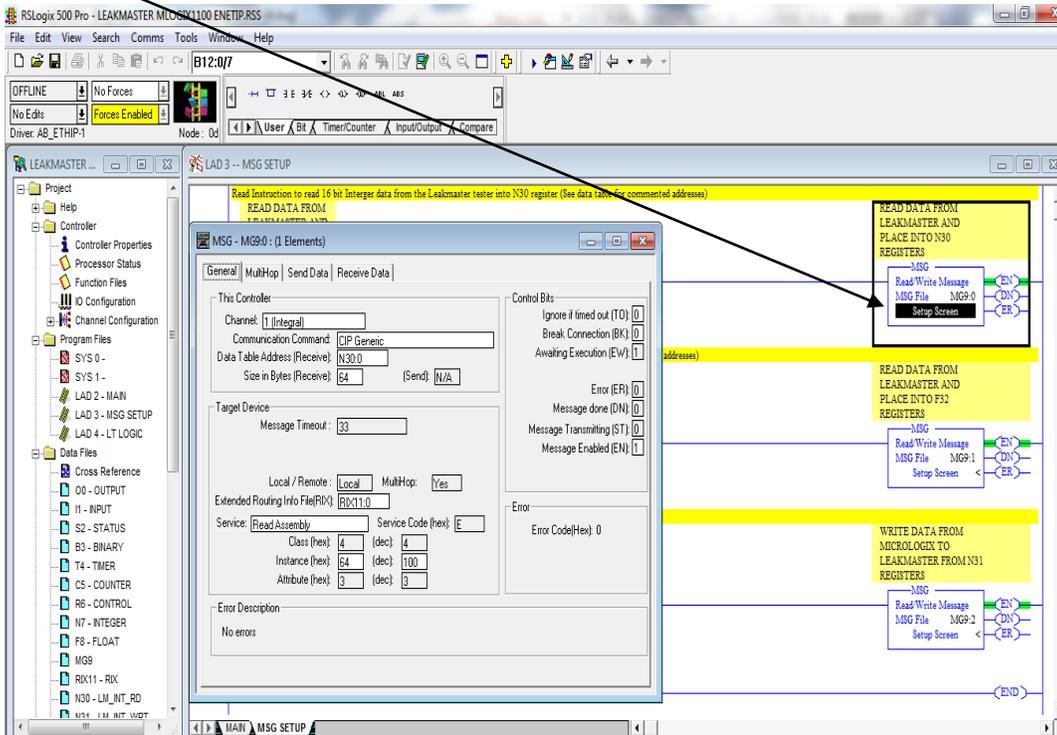
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3) Double Click the Setup Screen tab on the first MSG instruction.



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- 4) Fill out all columns as shown below . When finished click the MultiHop tab.

The screenshot shows the 'MSG - MG9:0 : (1 Elements)' window with the 'General' tab selected. The 'This Controller' section contains the following fields: Channel (1 (Integral)), Communication Command (CIP Generic), Data Table Address (Receive) (N30:0), and Size in Bytes (Receive) (64) and (Send) (N/A). The 'Target Device' section includes Message Timeout (33), Local / Remote (Local), MultiHop (Yes), Extended Routing Info File (RIX) (RIX11:0), Service (Read Assembly), and Service Code (hex) (E). Below these are fields for Class (hex: 4, dec: 4), Instance (hex: 64, dec: 100), and Attribute (hex: 3, dec: 3). The 'Control Bits' section has: Ignore if timed out (TO) (0), Break Connection (BK) (0), Awaiting Execution (EW) (1), Error (ER) (0), Message done (DN) (0), Message Transmitting (ST) (0), and Message Enabled (EN) (1). The 'Error' section shows Error Code (Hex): 0. The 'Error Description' section shows 'No errors'.

- 5) Type the IP address of the tester in the "To Address" Column.

The screenshot shows the 'MSG - MG9:0 : (1 Elements)' window with the 'MultiHop' tab selected. It features a table with columns: From Device, From Port, To Address Type, and To Address. The table contains one entry: From Device (This MicroLogix), From Port (Channel 1), To Address Type (EtherNet/IP Device (str.)), and To Address (192.168.0.171). Above the table are buttons for 'Ins = Add Hop' and 'Del = Remove Hop'. An arrow points to the 'To Address' cell.

From Device	From Port	To Address Type	To Address
This MicroLogix	Channel 1	EtherNet/IP Device (str.)	192.168.0.171

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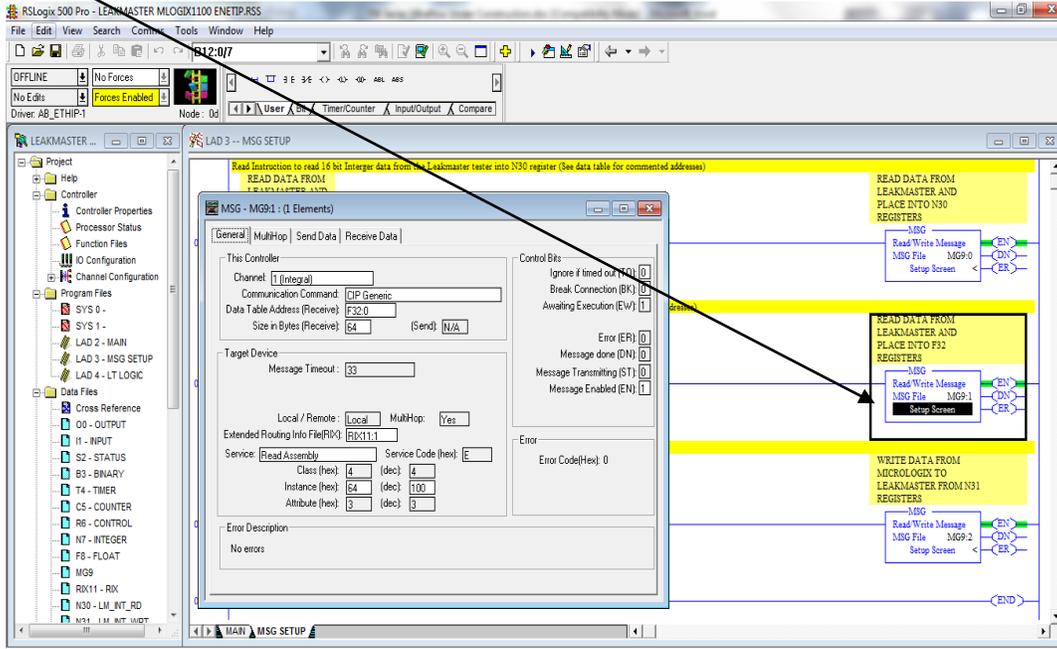
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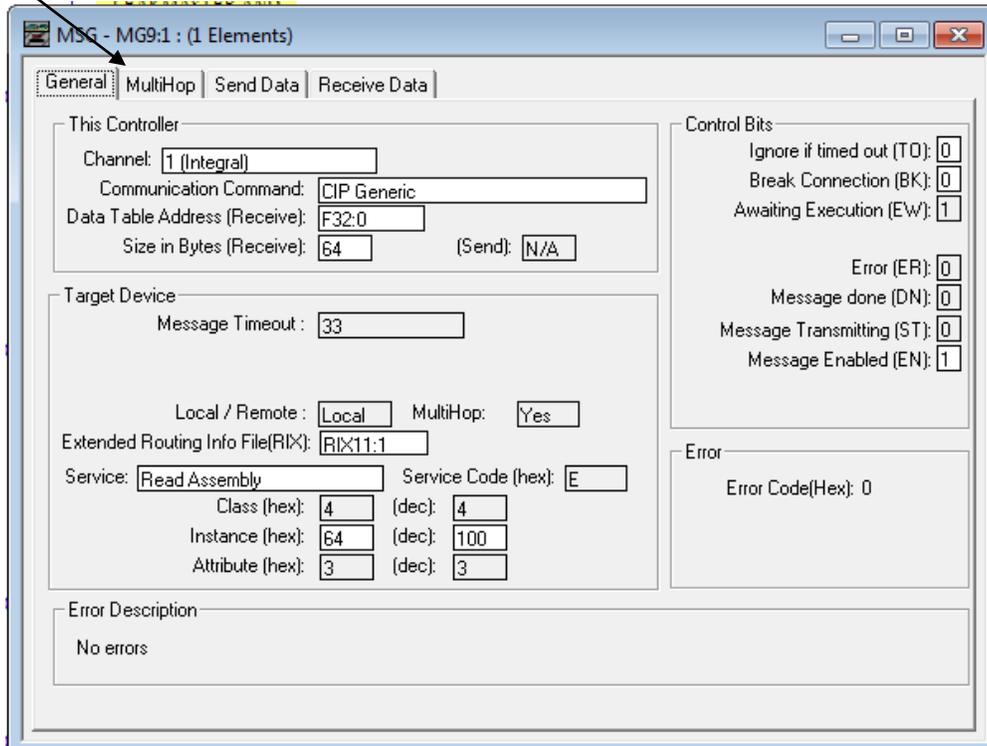
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6) Double Click the Setup Screen tab on the second MSG instruction.



7) Fill out all columns as shown below . When finished click the MultiHop tab.



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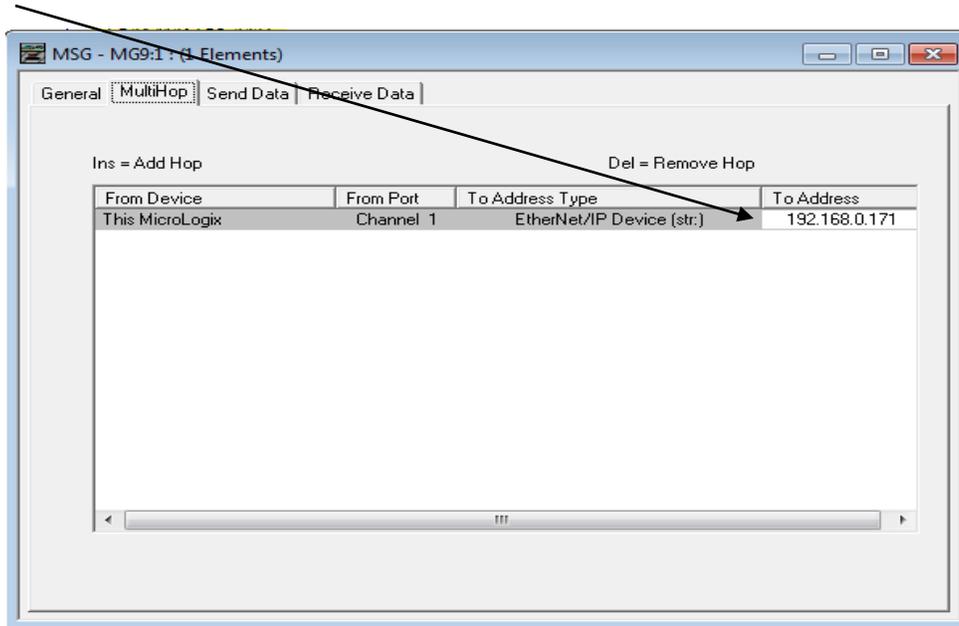
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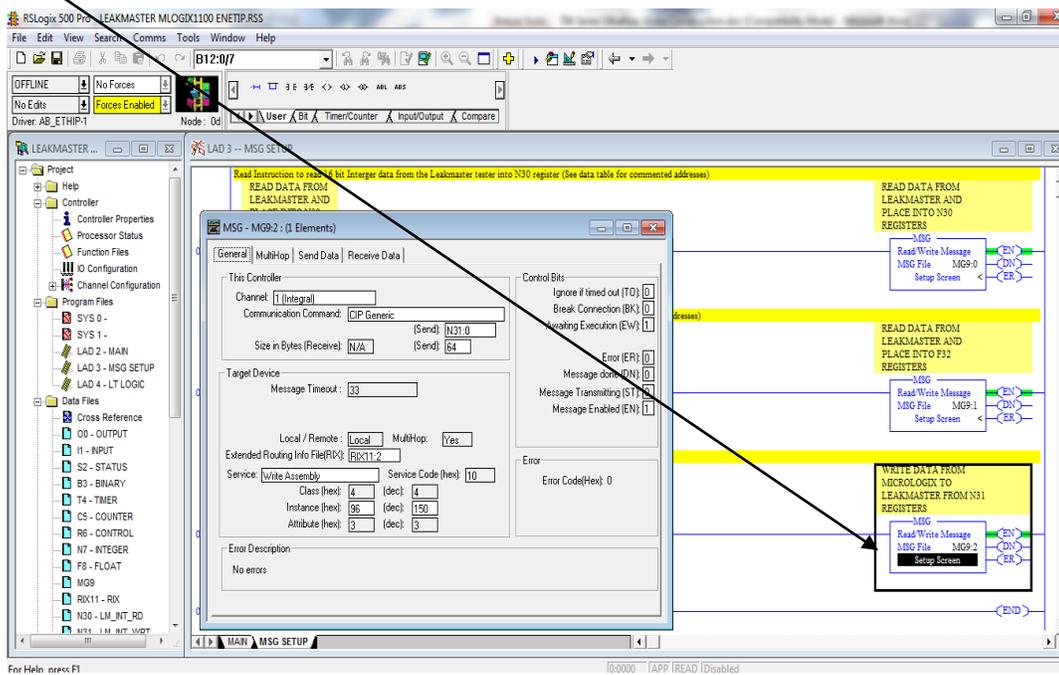
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8) Type the IP address of the tester in the To Address Column.



9) Double Click the Setup Screen tab on the third MSG instruction.



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10) Fill out all columns as shown below . When finished click the MultiHop tab.

MSG - MG9:2 : (1 Elements)

General | MultiHop | Send Data | Receive Data

This Controller

Channel:

Communication Command:

Size in Bytes (Receive): (Send):

(Send):

Target Device

Message Timeout :

Local / Remote : MultiHop:

Extended Routing Info File(RIX):

Service: Service Code (hex):

Class (hex): (dec):

Instance (hex): (dec):

Attribute (hex): (dec):

Control Bits

Ignore if timed out (TO):

Break Connection (BK):

Awaiting Execution (EW):

Error (ER):

Message done (DN):

Message Transmitting (ST):

Message Enabled (EN):

Error

Error Code(Hex):

Error Description

No errors

11) Type the IP address of the tester in the To Address Column.

MSG - MG9:2 : (1 Elements)

General | MultiHop | Send Data | Receive Data

Ins = Add Hop Del = Remove Hop

From Device	From Port	To Address Type	To Address
This MicroLogix	Channel 1	EtherNet/IP Device (str.)	192.168.0.171

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At this point the Ethernet IP configuration is complete. Please refer to the sample program to see how to implement the I/O or see the address mapping and descriptions on the following page.

RSLogix500 Ethernet I/O Mapping Descriptions

<u>Address</u>	<u>Description</u>	<u>Function</u>
N30:0	Channel 1 Program Selected	The tester will load the value of the currently selected program for channel 1.
N30:1/0	Channel 1 Pass	Bit will go high upon passing a test on channel 1. Bit will go low upon starting a test on channel 1.
N30:1/1	Channel 1 Fail	Bit will go high upon failing a test on channel 1. Bit will go low upon starting a test on channel 1.
N30:1/2	Channel 1 Testing	Bit will go high and stay high during entire test on channel 1. Bit will go low upon completion of vent step n channel 1.
N30:1/3	Channel 1 Comp/Cal Enabled	Bit will go high and stay high during entire test on channel 1. Bit will go low upon completion of vent step n channel 1.
N30:1/4	Channel 1 Fill Step Active	Bit will go high and stay high during fill step on channel 1. Bit will go low upon completion of fill step.
N30:1/5	Channel 1 Stabilize Step Active	Bit will go high and stay high during stabilize step on channel 1. Bit will go low upon completion of stabilize step.
N30:1/6	Channel 1 Testing Step Active	Bit will go high and stay high during test step on channel 1. Bit will go low upon completion of test step.
F32:5	Channel 1 Leak Rate	The tester will load the leak rate of the last test ran on channel 1 into this register. This register is set to 0 at the start of every test.
F32:6	Channel 1 Pressure Loss	The tester will load the pressure loss value of the last test ran on channel 1 into this register. This register is set to 0 at the start of every test.
F32:7	Channel 1 Final Pressure	The tester will load the final test pressure of the last test ran on channel 1 into this register. This register is set to 0 as the start of every test.
F32:8	Channel 1 Actual Pressure	The test loads the current pressure seen on the transducer on channel 1 into this register.
N31:0	Channel 1 Program Select Register	Load a value (1-15) into this register to select the program that you want to run for channel 1.

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N31:0/0	Channel 1 Start	Set this bit high to start a test on channel 1.
N31:0/1	Channel 1 Stop	Set this bit high to stop a test that has already started on channel 1.
N31:0/2	Channel 1 Reset Programmable Outputs to 0	Set this bit high to reset the programmable outputs (sets them low).
N31:0/3	Channel 1 Air On	Set this bit high to enable test air on channel 1 test port.
N31:0/4	Channel 1 Calibration Mode Enable	Set this bit high to enable Channel 1 Calibration.
N31:0/5	Channel 1 Leak Mode Enable	Set this bit high to activate Channel 1 Leak Mode.
N30:2	Channel 2 Program Selected	The tester will load the value of the currently selected program for channel 2.
N30:3/0	Channel 2 Pass	Bit will go high upon passing a test on channel 2. Bit will go low upon starting a test on channel 2.
N30:3/1	Channel 2 Fail	Bit will go high upon failing a test on channel 2. Bit will go low upon starting a test on channel 2.
N30:3/2	Channel 2 Testing	Bit will go high and stay high during entire test on channel 2. Bit will go low upon completion of vent step n channel 2.
N30:3/3	Channel 2 Comp/Cal Enabled	Bit will go high and stay high during entire test on channel 2. Bit will go low upon completion of vent step n channel 2.
N30:3/4	Channel 2 Fill Step Active	Bit will go high and stay high during fill step on channel 2. Bit will go low upon completion of fill step.
N30:3/5	Channel 2 Stabilize Step Active	Bit will go high and stay high during stabilize step on channel 2. Bit will go low upon completion of stabilize step.
N30:3/6	Channel 2 Testing Step Active	Bit will go high and stay high during test step on channel 2. Bit will go low upon completion of test step.
F32:10	Channel 2 Leak Rate	The tester will load the leak rate of the last test ran on channel 2 into this register. This register is set to 0 at the start of every test.
F32:11	Channel 2 Pressure Loss	The tester will load the pressure loss value of the last test ran on channel 2 into this register. This register is set to 0 at the start of every test.
F32:12	Channel 2 Final Pressure	The tester will load the final test pressure of the last test ran on channel 2 into this register. This register is set to 0 as the start of every test.
F32:13	Channel 2 Actual Pressure	The test loads the current pressure seen on the transducer on channel 2 into this register.

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N31:1	Channel 2 Program Select Register	Load a value (2-25) into this register to select the program that you want to run for channel 2.
N31:1/0	Channel 2 Start	Set this bit high to start a test on channel 2.
N31:1/1	Channel 2 Stop	Set this bit high to stop a test that has already started on channel 2.
N31:1/2	Channel 2 Reset Programmable Outputs to 0	Set this bit high to reset the programmable outputs (sets them low).
N31:1/3	Channel 2 Air On	Set this bit high to enable test air on channel 2 test port.
N31:1/4	Channel 2 Calibration Mode Enable	Set this bit high to enable Channel 2 Calibration.
N31:1/5	Channel 2 Leak Mode Enable	Set this bit high to activate Channel 2 Leak Mode.

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10.3 PROFINET COMMUNICATIONS

This option is not a standard option. This must be purchased and installed prior to delivery of the tester.

10.3.1 Wiring

Plug cable from the Profinet network into the back of the tester in the ENET port.



Figure 10.3.1 – PROFINET Cable Connection.

10.3.2 PLC Configuration

The PLC system hardware configuration is done solely with the Siemens Step7 tool. In order to configure the bus it is necessary to set up the PLC and Controller hardware first. In this example we are using an S7315-2 CPU and a 2A power supply with a standard rack. Start the Simatic software and create a new project. Right click on the project name, in this case Default and insert a Simatic 300 Station as shown below.

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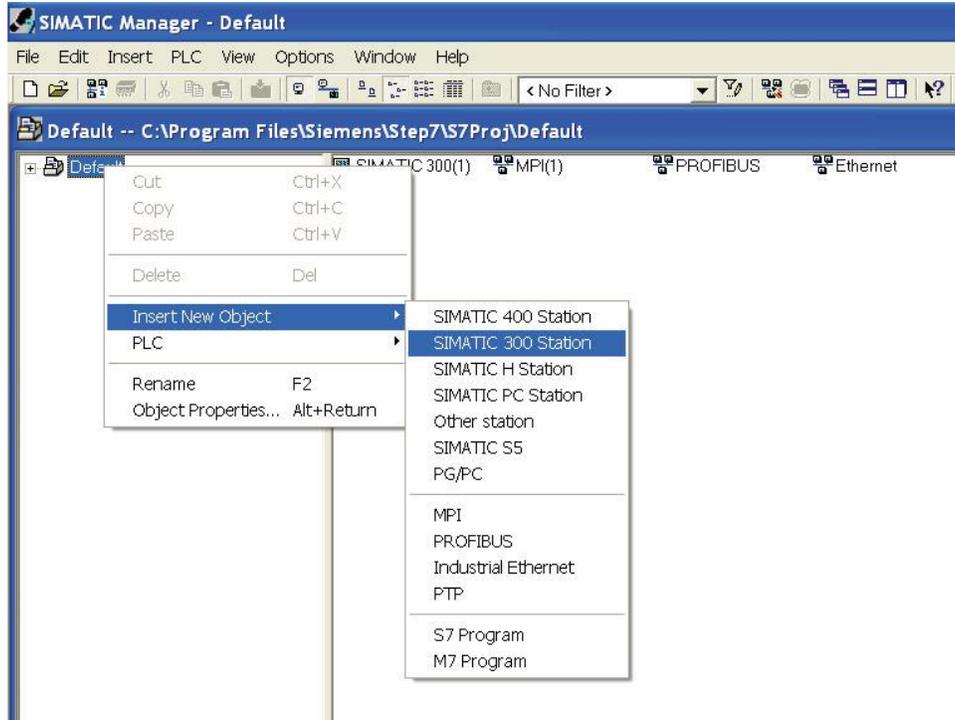


Figure 10.3.2 - Inserting a new PLC.

Then double click on the new SIMATIC 300 station and on Hardware to open the hardware configuration.

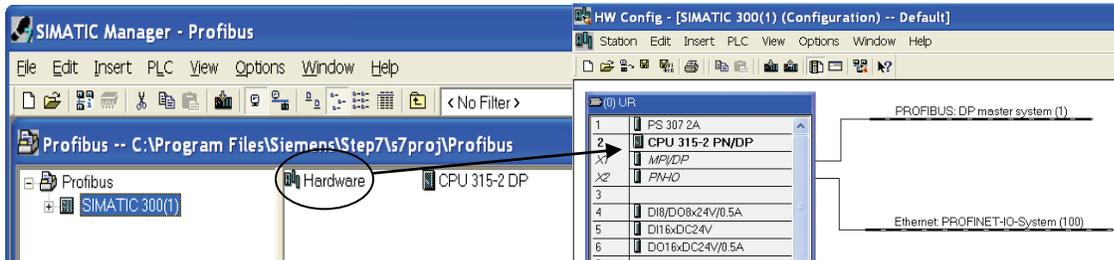


Figure 10.3.3 - Opening the hardware configuration. The right figure shows the network when completed.

Add a rail, the power module, the PLC and the PROFINET module as shown below. In this case the PLC is configured for both PROFIBUS and PROFINET. In this case slots 4-6 are used for I/O modules.

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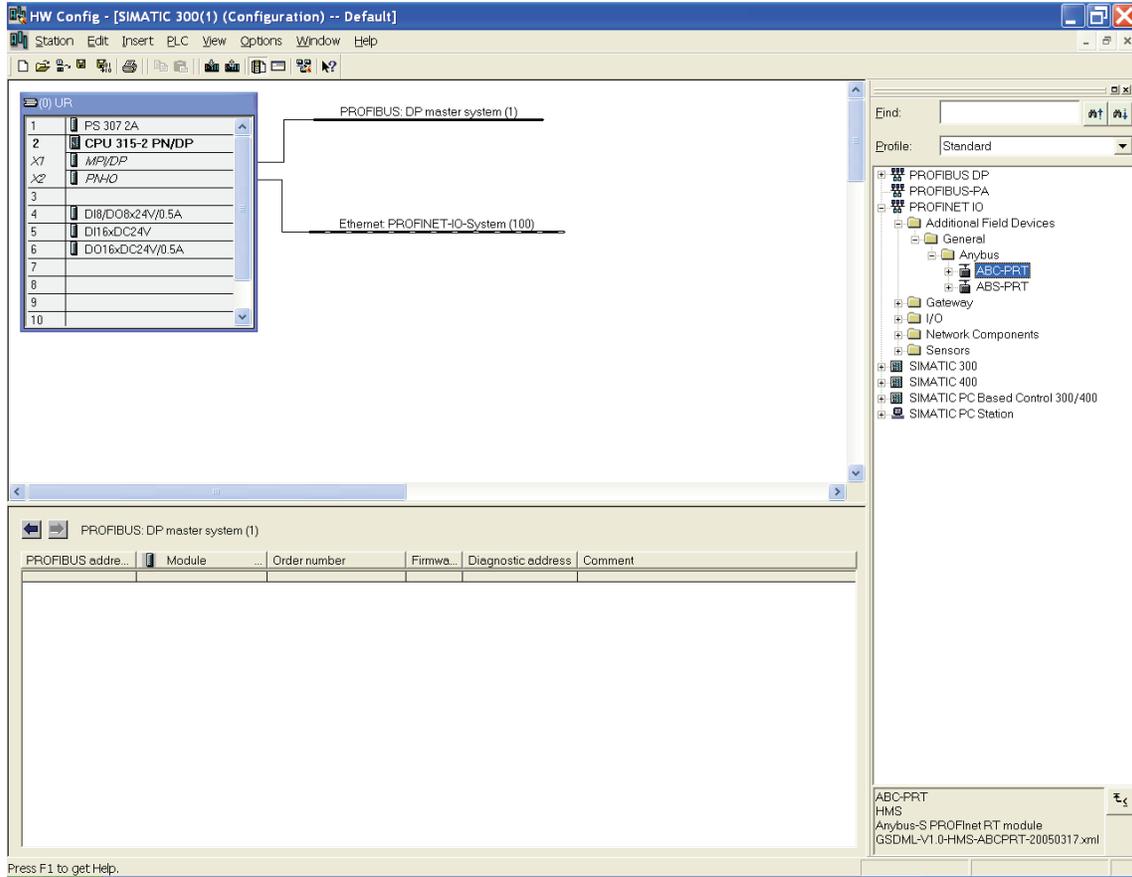


Figure 10.3.4 - Adding the hardware to the configuration.

The next step is to double click on the PN-IO, PROFINET IO Controller module, to configure the PROFINET IO network. Click on properties in the dialogue as shown below.

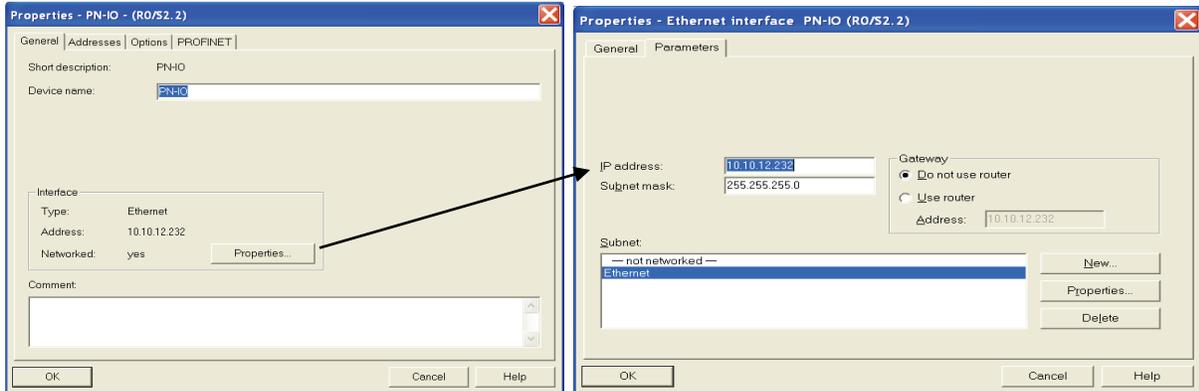


Figure 10.3.5 - Changing the properties of the PROFINET IO module and defining a new PROFINET IO network.

Then click on new to define a new network.

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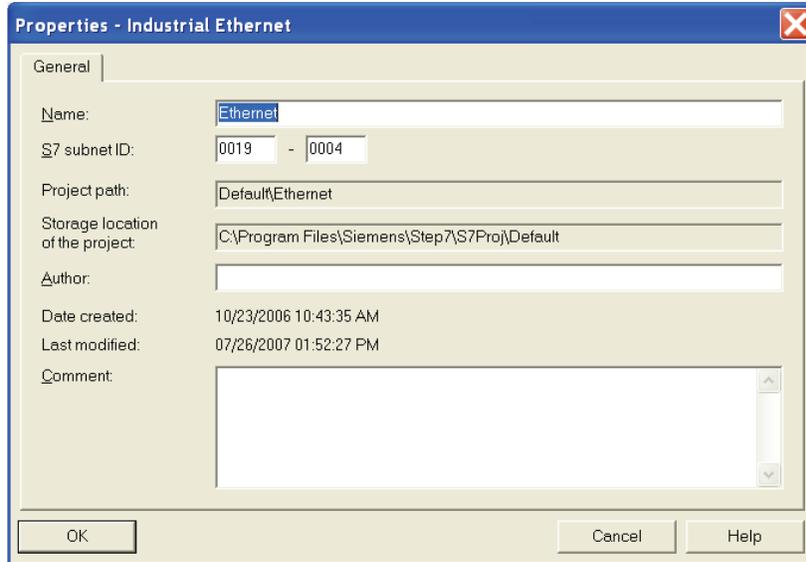


Figure 10.3.6 - Configuring the properties of the PROFINET IO network.

Select the desired settings and press OK.

When the PLC hardware is set up it will look like described in the figure below. In this case a PLC with both PROFIBUS and PROFINET modules are configured.

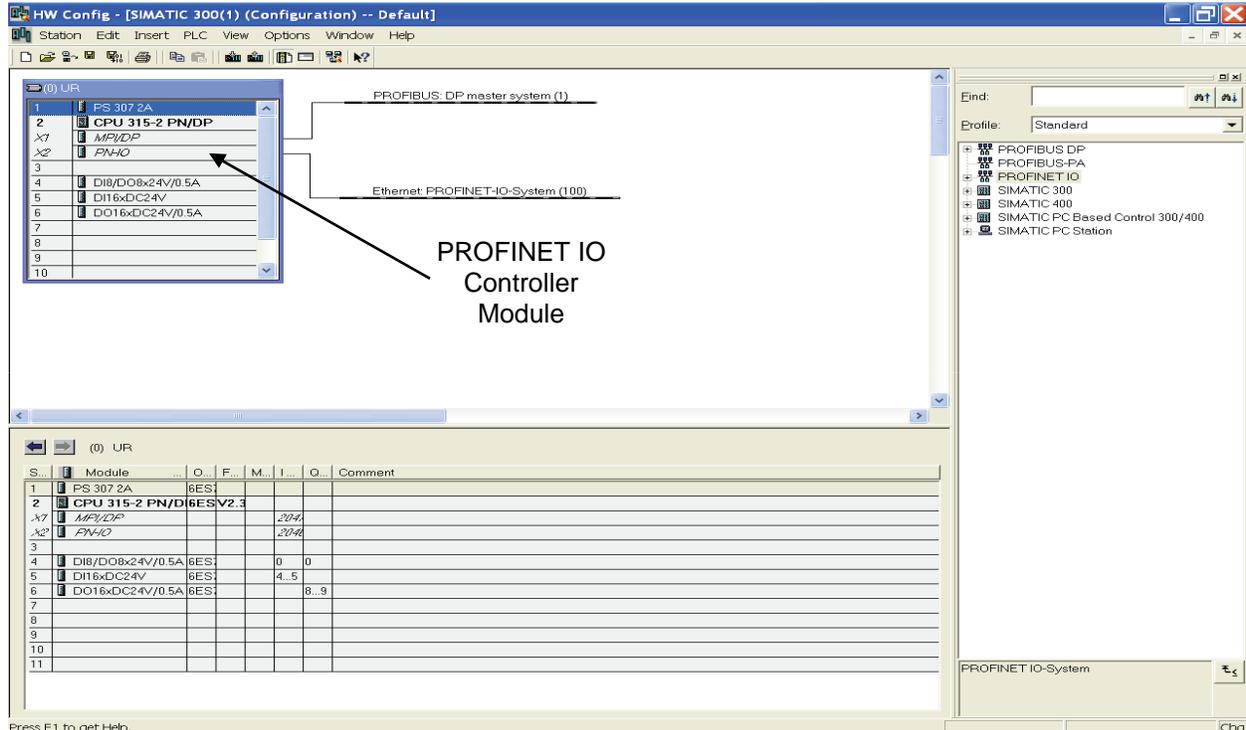


Figure 10.3.7 - PLC with empty bus.

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10.3.3 PROFINET IO Configuration

It is then necessary to configure the Anybus module itself. Firstly the GSD-file has to be imported. This is described in the following chapter. Then the IP address has to be configured. Finally the input and output data area sizes and offset address for the PLC memory are to be configured.

10.3.3.1 Importing the GSD File

It is necessary to import the Anybus GSD-file to the configuration tool in order to include the Anybus Module. In this case an Anybus Slave module is added as a slave in the network. The GSD-file can be downloaded at HMS1 webpage.

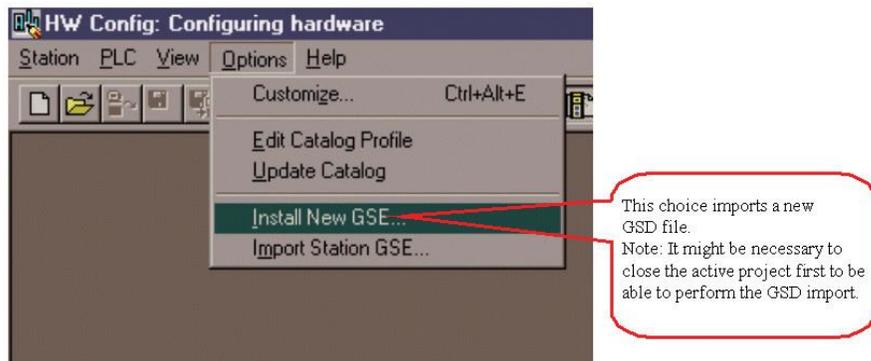


Figure 10.3.8 - Install a new GSD file in "HW Config".

Open the Options menu as seen above and select Install New GSE.

10.3.3.2 Adding Anybus Module to Configuration

The Anybus module can be found in the hardware catalogue after the GSD file has been imported.

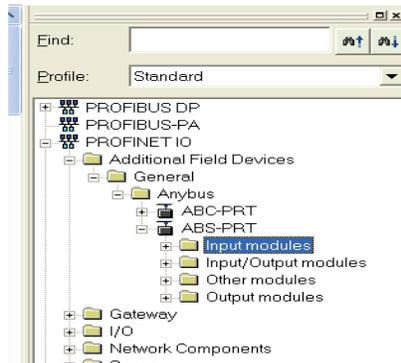


Figure 10.3.9 - The Anybus module in the Hardware Catalogue.

It is now possible to include the Anybus slave in the network.

Open up the “Anybus-S PRT” entry in the hardware catalogue and drag and drop the Anybus module on to the network, see description in Figure 10.3.10.

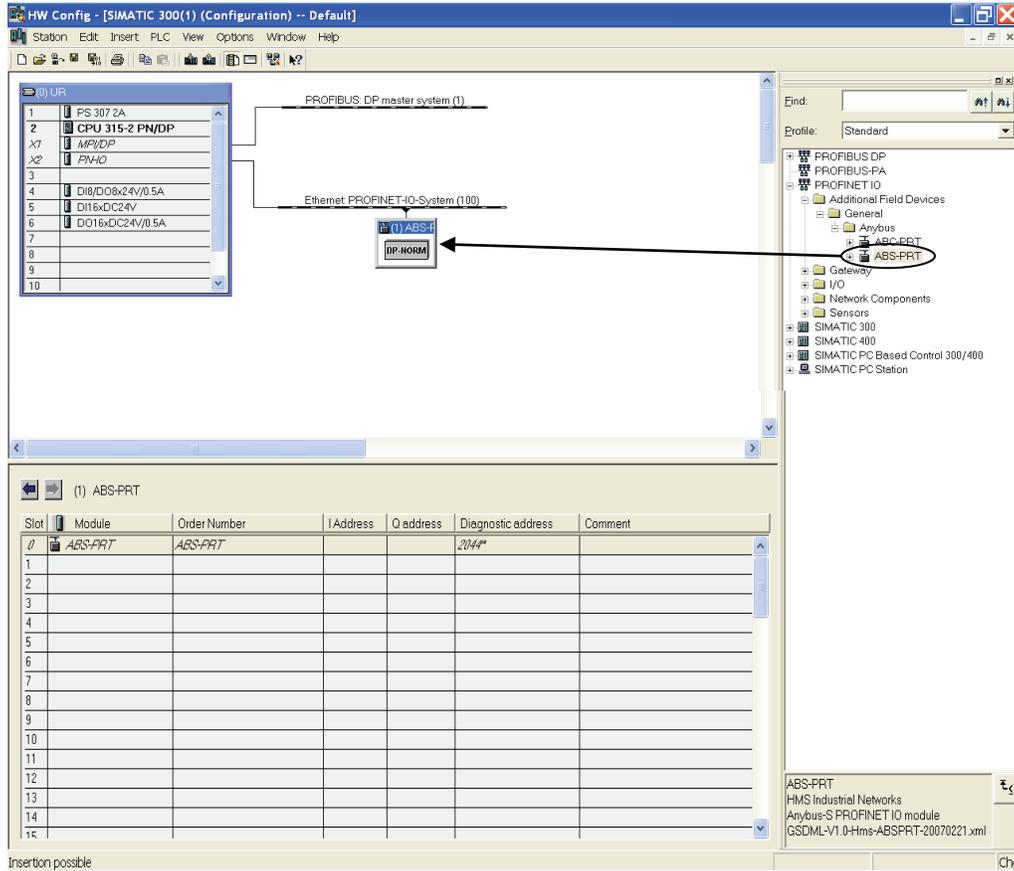


Figure 10.3.10 - Drag and drop the Anybus module to the network.

10.3.3.3 Configure IP Address and Device Name

Each node on the PROFINET network has to have a unique IP address and Device name. A description of how to configure the Device name and IP setting follows below.

To assign the Device Name open the PLC menu and select the Edit Ethernet Node function as seen below.

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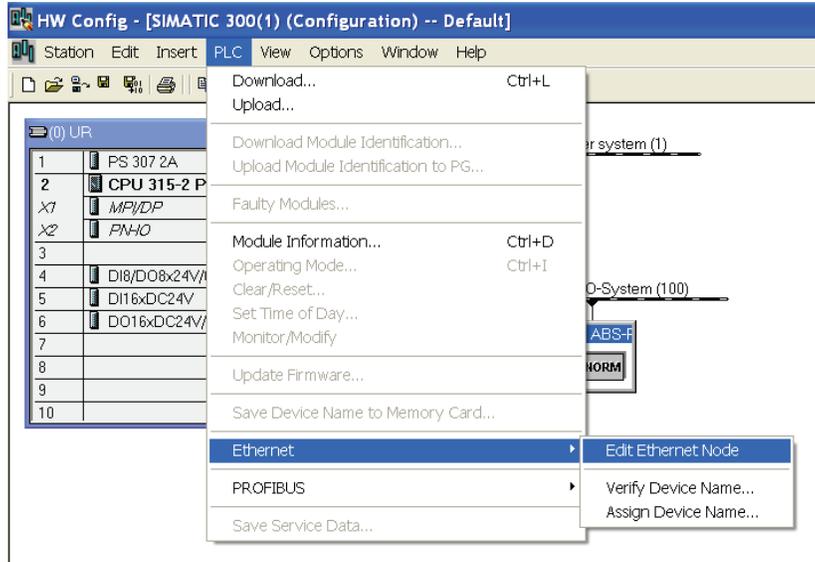


Figure 10.3.11 - Opening the Edit Ethernet Node function.

After selecting the Edit Ethernet Node function, press the browse button and start scanning the network.

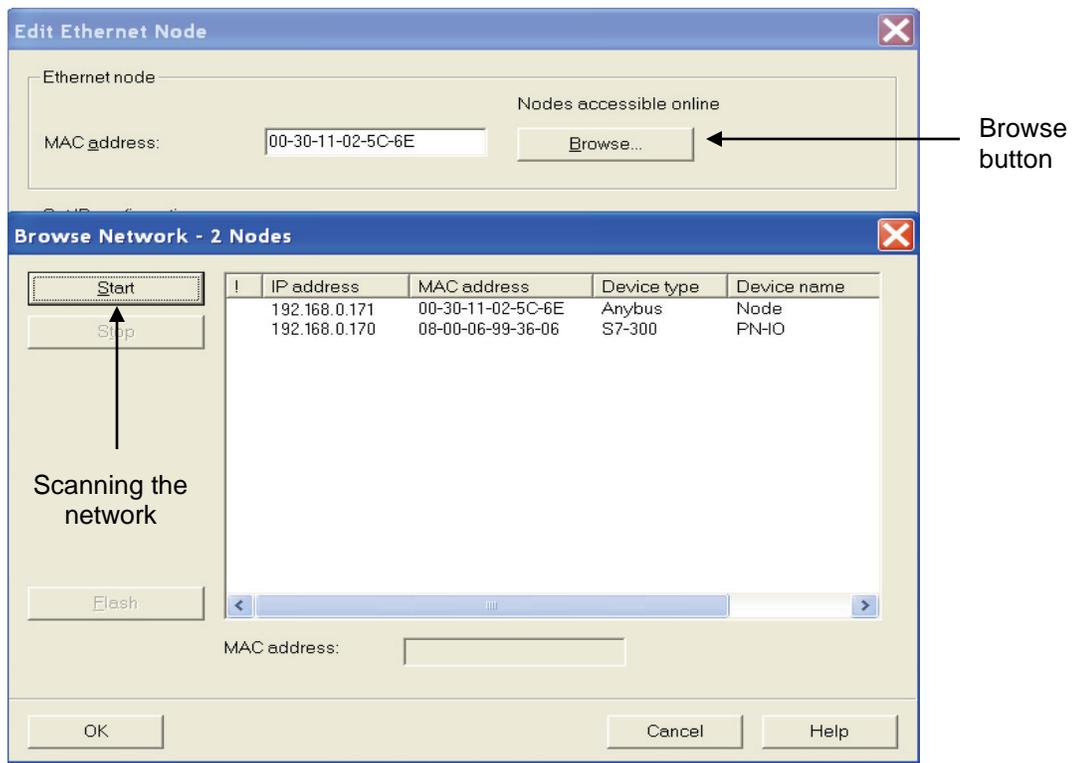


Figure 10.3.12 - Browsing the Ethernet Nodes.

Then select the desired node to edit and click on OK. The module is easily identified by the MAC ID.

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When this is done assign the node the desired Device Name. If desired it is also possible to set the IP settings manually as shown below.

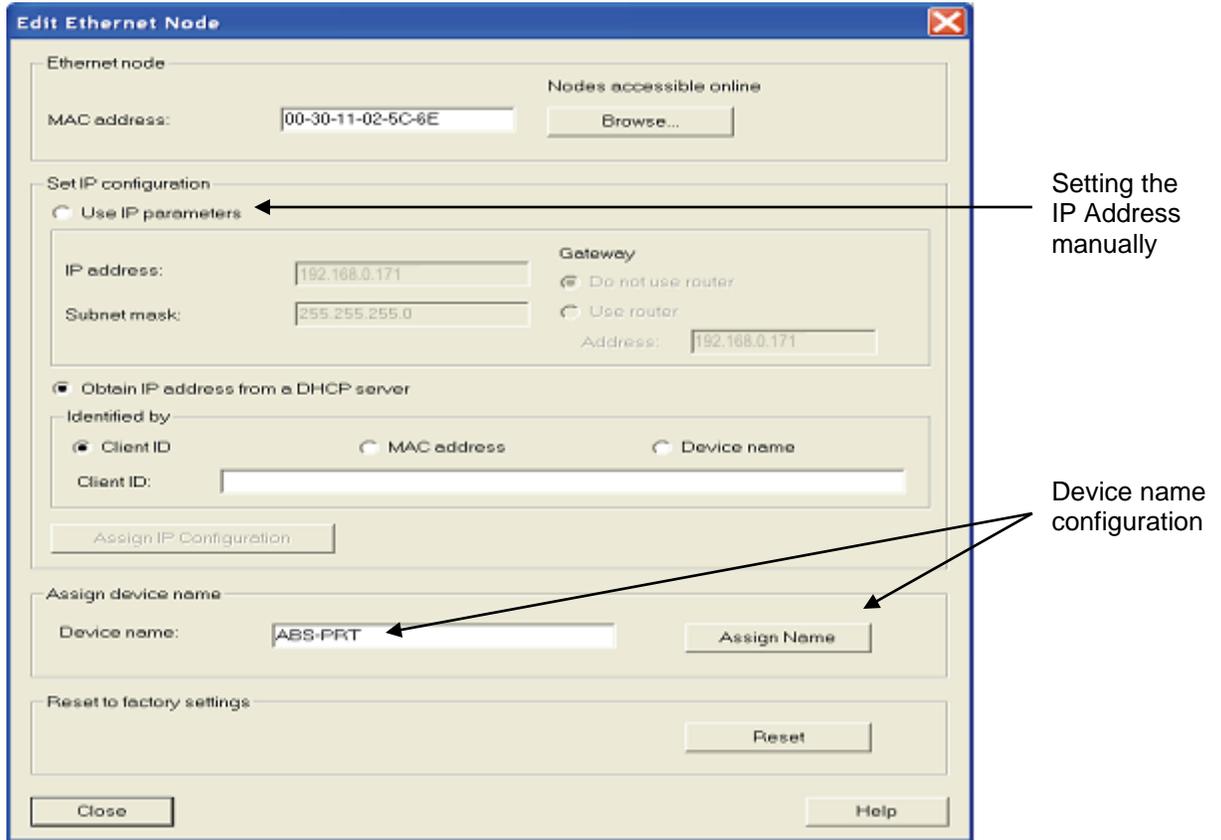


Figure 10.3.13 - Assigning the Device Name.

When the Anybus PROFINET IO module is to be used for the first time in the network, a Device Name needs to be set for the module. The Device Name must be unique within the network. The name assigned in this case is ABS-PRT. After editing the Device name make sure to press the Assign Name button.

When the Device Name has been set it must be verified that the same Device name is used in the Hardware configuration. To do this double click on the Anybus module in the hardware configuration as shown in Figure 10 Drag and drop the Anybus module to the network. The window shown below will then appear.

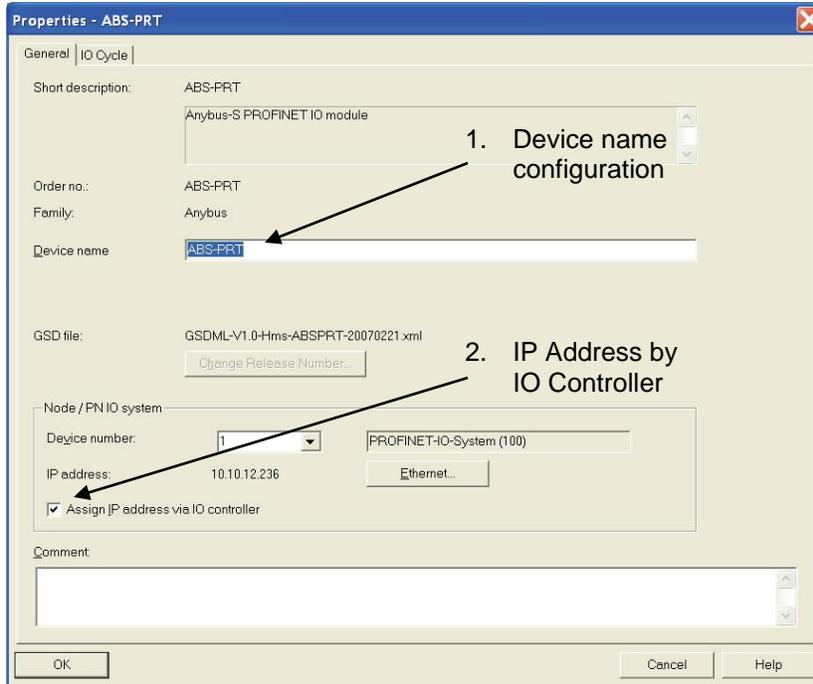


Figure 10.3.14 - Verifying the Device Name.

The first step is to check out the used Device Name(Note 1). Verify that the same name is used as assigned to the Anybus module as shown in Figure 13 Assigning the Device Name.

Secondly the recommendation is to let the IO Controller to set the IP address, but it is also possible to configure the IP address manually by unchecking the box (Note 2).

10.3.3.3 Configure IO Mapping

The module required for integration of the LeakMaster Anybus module is the 64 byte combination Input/Output module. Please see the illustration below.

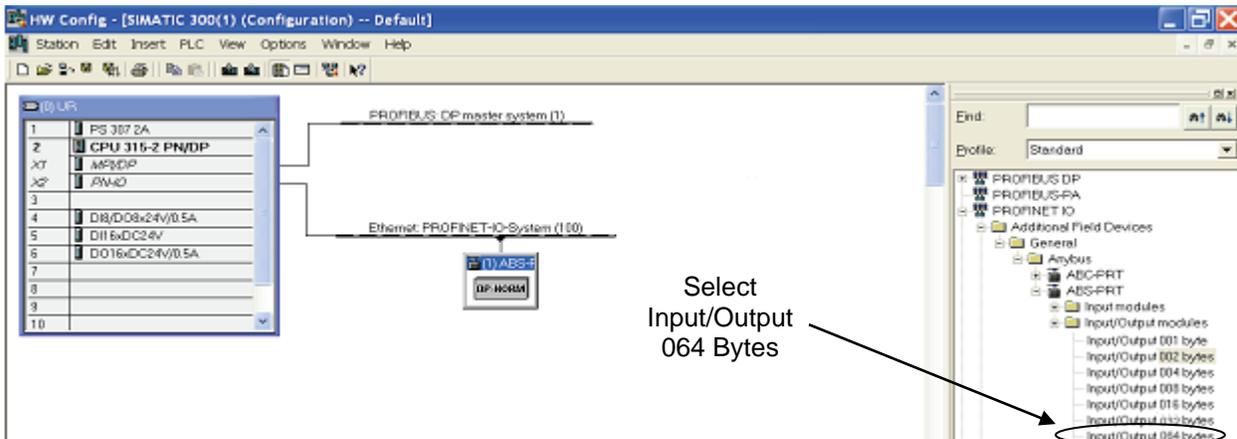


Figure 10.3.15 – Selecting IO Input/Output Module.

By double clicking on a module in the “module list” it is possible to set the offset addresses. See example in the next figure.

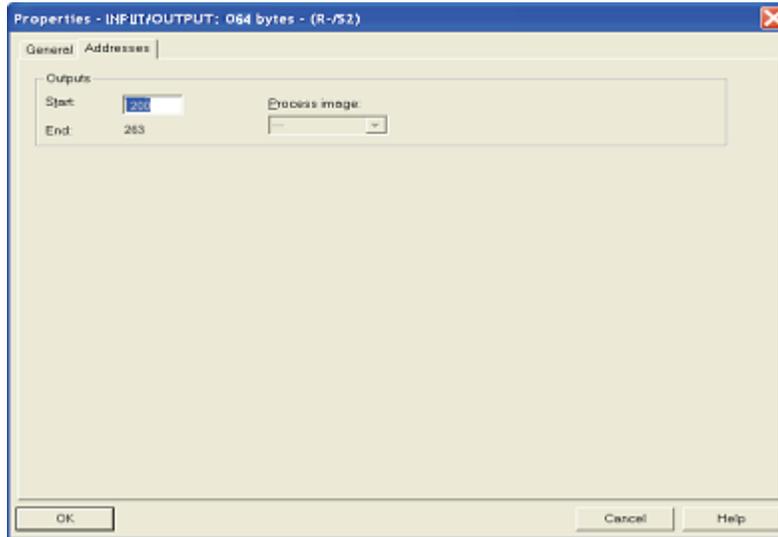


Figure 10.3.16 – Adjusting the offset address.

The offset addresses can be chosen freely but certain restrictions may apply depending on what CPU is used.

When all the above settings are done it is possible to perform a download of the configuration to the PLC. Press the Save and Compile button and then the Download button.

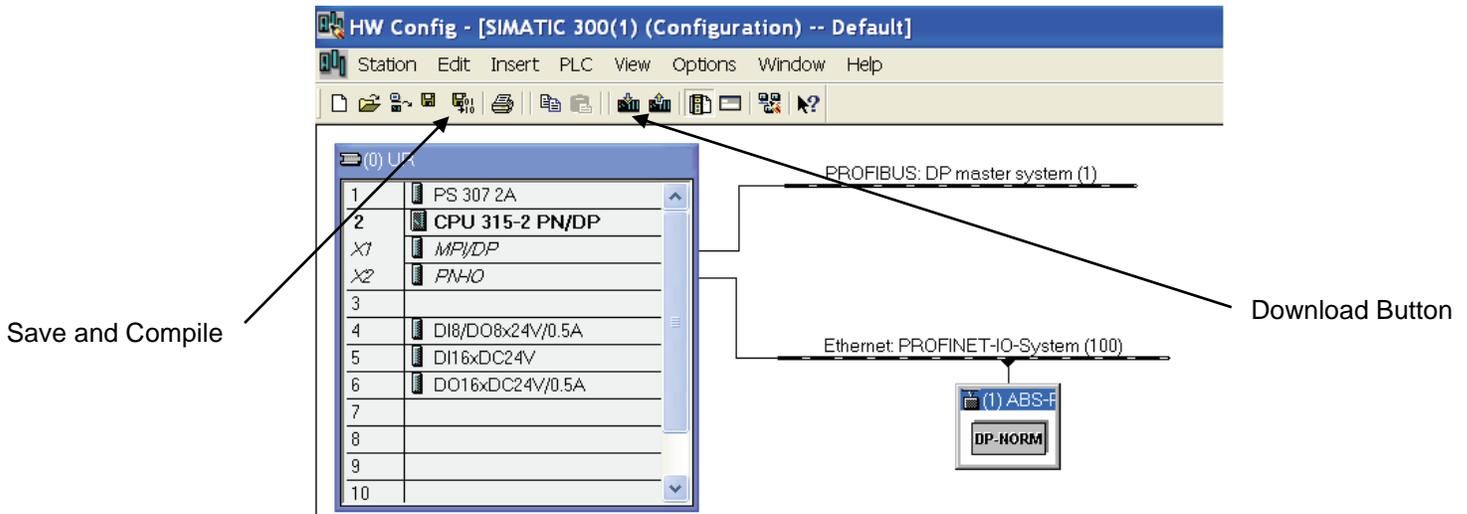


Figure 10.3.17 – Downloading the configuration to the PLC.

The bus will then go online and start data exchange when the PLC is set to run mode.

10.3.4 PROFINET IO Mapping Description

The I/O module in the previous section is mapped to IB200 thru IB263 and QB200 thru QB263. These I/O locations are custom configured by the user for each particular application. The mapping table in this document will refer to these addresses (200 thru 263) for illustration purposes only. The byte offset values in the mapping table (n = starting register, n+1, n+2, etc...) will be added to the actual I/O registers assigned by the user. The I/O mapping for the LeakMaster test unit is as follows:

Input Name	Input Function	Input Type	Input Address	Byte Offset
Not Assigned	N/A	Word Address	IW200	n
CH1 PROGRAM SELECTED	The tester will load the value of the currently selected program for channel 1.	Word Address	IW202	n+2
CH1 PASS	Bit will go high upon passing a test on channel 1. Bit will go low upon starting a test on channel 1.	Bit Address	I205.0	n+5 bit 0
CH1 FAIL	Bit will go high upon failing a test on channel 1. Bit will go low upon starting a test on channel 1.	Bit Address	I205.1	n+5 bit 1
CH1 TESTING	Bit will go high and stays high during entire test on channel 1. Bit will go low upon completion of vent step in channel 1.	Bit Address	I205.2	n+5 bit 2
CH 1 COMP/CAL ENABLED	The tester will load the value of the currently selected program for channel 2.	Word Address	I205.3	n+5 bit 3
CH 1 FILL STEP ACTIVE	Bit will go high and stays high during fill step on channel 1. Bit will go low upon completion of fill step.	Bit Address	I205.4	n+5 bit 4
CH 1 STABILIZE STEP ACTIVE	Bit will go high and stays high during stabilize step on channel 1. Bit will go low upon completion of stabilize step.	Bit Address	I205.5	n+5 bit 5
CH 1 TESTING STEP ACTIVE	Bit will go high and stays high during testing step on channel 1. Bit will go low upon completion of testing step.	Bit Address	I205.6	n+5 bit 6
Inputs Not Assigned	For Future Use	Byte Addresses	IB210 thru IB221	n+10 thru n+21
CH1 LEAK RATE	The tester will load the leak rate of the last test ran on channel 1 into this register. This register is set to 0 at the start of every test.	Double Word Address	ID224	n+24
CH1 PRESSURE LOSS	The tester will load the pressure loss value of the last test ran on channel 1 into this register. This register is set to 0 at the start of every test.	Double Word Address	ID228	n+28
CH1 FINAL PRESSURE	The tester will load the final test pressure of the last test ran on channel 1 into this register. This register is set to 0 as the start of every test.	Double Word Address	ID232	n+32
CH1 ACTUAL PRESSURE	The test loads the current pressure seen on the transducer on channel 1 into this register.	Double Word Address	ID236	n+36

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Inputs Not Assigned	For Future Use	Byte Addresses	IB238 thru IB263	n+38 thru n+63
Output Name	Output Function	Output Type	Output Address	Byte Offset
CH1 PROGRAM SELECT	Load a value (1-15) into this register to select the program that you want to run for channel 1.	Word Address	QW200	n+0
CH1 START INPUT	Set this bit high to start a test on channel 1.	Bit Address	Q205.0	n+5 bit 0
CH1 STOP INPUT	Set this bit high to stop a test that has already started on channel 1.	Bit Address	Q205.1	n+5 bit 1
CH1 RESET OUTPUTS	Set this bit high to reset the channel 1 programmable outputs (sets them low).	Bit Address	Q205.2	n+5 bit 2
CH1 AIR ON	Set this bit high to send test air out the channel 1 test port.	Bit Address	Q205.3	n+5 bit 3
CH1 CALIBRATION MODE ENABLE	Set this bit high to start a calibration on channel 1.	Bit Address	Q205.4	n+5 bit 4
CH1 LEAK MODE ENABLE	Set this bit high to enable leak mode on channel 1.	Bit Address	Q205.5	n+5 bit 5
Outputs Not Assigned	For Future Use	Byte Addresses	QB210 thru QB263	n+10 thru n+63

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