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About this Manual

The first part of this manual describes how to install and set up your A.I.R. Flow Test Stand and software, verify that your test stand is working properly and perform a calibration check.

The second part of this manual describes the Test Stand operation which includes how to connect a regulator for testing, performing test sequences and managing test data files. Troubleshooting information on the test stand is also provided.

Intended Audience

This document describes the operation and use of the A.I.R. Flow Test Stand and is intended for SCUBA repair technicians, or others responsible for testing or servicing SCUBA regulators and related life support equipment. It is assumed that you have familiarity with test instrumentation and principles associated with testing procedures related to SCUBA diving regulators.

Note:
It is not within the scope of this manual to neither recommend troubleshooting practices nor interpret data relating to SCUBA regulator operational performance. It is the responsibility of the technician to correctly interpret the data this test stand produces and ensure the performance of the SCUBA regulator meets the specifications of the regulator manufacturer.
How this Manual is Organized

The manual is organized as follows:

- **Section 1, “Overview,”** describes the major features of the A.I.R. Flow Test Stand, as well as the supported software.

- **Section 2, “Preparing to Use the A.I.R. Flow Test Stand,”** describes how to unpack the test stand, check the system requirements and install the test stand software under Windows XP.

- **Section 3, “Installing the Test Stand,”** describes how to connect the test stand to the computer and power source, connect to the air supply and prepare the test stand for operation.

- **Section 4, “Verifying the Operation of the Test Stand,”** describes how to perform a quick test to verify the operation of the test stand and run a calibration check of the A.I.R. Flow Test Curve.

- **Section 5, “Connecting a Test Regulator to the Test Stand,”** describes how to connect the test regulator first and second stages along with the ancillary H.P. and I.P. hose connections to the test stand.

- **Section 6, “Conducting test sequences on the Test Regulator,”** describes how to perform “Free Run Testing” and “Data Log Testing” on the Test Regulator along with hints and suggestions on managing data and records.

- **Section 7, “Troubleshooting the test stand,”** provides information that you can use to resolve problems with the test stand should they occur.

- **Appendix A, “Specifications,”** lists the specifications of the Test Stand.
Conventions Used in this Manual

The following conventions are used in this manual:

- **Notes** provide useful information or information that requires special emphasis, **cautions** provide information to help you avoid losing data or damaging your equipment, and **warnings** provide information to help you avoid catastrophic damage to yourself or your equipment.

- Items that you select or type are shown in **bold**.

Related Information

The A.I.R. Flow Test Stand was developed around the same basic instrumentation configuration as the A.I.R. Flow Analyzer produced by the Peter Built Co... Scuba Instruments developed this test stand to extend the data logging capabilities by providing an automated method of recording and tracking performance data. To this end, the methods for testing regulators follows closely with those developed by the Peter Built Co. and are reflected in the publication “SCUBA Regulator Savvy” written by Pete Wolfinger. It is recommended that users of this flow test stand refer to this publication specifically in chapters Seventeen and Eighteen to get a basic understanding of the procedures involved in regulator testing and to realize the full benefit of how this A.I.R. Flow Test Stand can save time.

Where To Get Help

Should you run into problems with installation or using the A.I.R. Flow Test Stand, the Scuba Instruments Technical Support Department is available to provide technical assistance. Refer to **Section 7** for more information.
Overview

Features

The A.I.R. Flow Test Stand – from here-on will be referred to as “Test Stand” - utilizes the latest technologies in measurement instrumentation along with latest in data acquisition hardware and software. The pressure sensors used are accurate to within ±0.5% FS at reference conditions. The Test Stand features a patented advanced DP flow sensor designed specifically for this application that provides ±1.0% FS flow measurements at standard conditions. The Test Stand utilizes a compact and efficient venturi pump and manual flow control. All components are mounted along with a data acquisition system in a compact enclosure that includes all pressure port connections and adapters. All data from the sensors in the test stand are processed and sent via USB interface to a PC.

Supported Software

The Test Stand software includes the run-time application software, USB drivers and Excel template for data logging. The software runs under Windows XP and Microsoft Office 2003 is recommended (for Excel support).

The features of the software include graphical information that is displayed along with measurement data control functions in an intuitive familiar instrument layout with analog representations of gauges as well as digital values. Two modes of measurements are provided; free-run testing or data logging. The free-run testing mode allows the technician to perform testing of the first and second stages of the regulator while making adjustments. The data logging mode allows the technician to perform diagnostic testing prior to regulator maintenance for evaluation and final testing to verify regulator performance after maintenance. All data values for Flowrate, H.P., I.P. and Vacuum are written to an Excel spreadsheet during a data log cycle. Two data log cycles are provided, one for tests emulated at high tank pressure and one for low tank pressure. The data values are displayed in Excel’s graphics format for easy diagnostic and performance evaluation.
Getting Started Procedure

Preparing to Use the A.I.R. Flow Test Stand

Unpacking

Open the shipping box and verify that the following items are present:

- A.I.R. Flow Test Stand with H.P. Hose Adapter
- USB Interface Cable
- A.I.R. Flow Test Stand Software Installation CD
- Power Supply Adapter

If an item is missing or damaged, contact Scuba Instruments. An application engineer will guide you through the appropriate steps for replacing missing or damaged items.

Once you have unpacked your Test System, check the system requirements, as described in the next section.

Note: Keep all packaging materials in case the Test Stand should need to be returned for repair from damages.
Checking the System Requirements

For reliable operation, your Test Stand requires the following:

• PC with Pentium 233 MHz (or higher) processor.
• One or more USB ports (Ver. 1.1 or Ver. 2.0).
• Windows XP (Professional Edition) operating system.
  For USB Ver. 2.0 support, make sure that you install Service Pack 2 for Windows XP. In addition, for some systems, you may have to disable standby mode.
• 64 MB (or more) of RAM; 128 MB (or more) recommended.
• One or more CD-ROM drives.
• Super VGA (800 x 600 or higher resolution) display monitor.

In addition to the requirements listed above, it is recommended that Microsoft Office, Excel 2003 be installed to support the data logging feature of the test stand.

Once you have verified that your system meets the system requirements, install the software as described in the next section.
Installing the Software

To install the software, do the following:

1. Insert the A.I.R. Flow Test Stand Software Installation CD into the CD-ROM drive.

2. Go to the “My Computer” Window and Click the CD-ROM drive icon.
   A list of three file folders appears.

3. Double Click the file folder “DTMF Drivers”.
   The “setupOEMwin32 Setup Launcher” appears.

4. Double Click “setupOEMwin32 Setup Launcher”.

6. Click Next.
   The installer copies the files to the destination directory.

7. Click Finish.

8. Go to the “CD-ROM” Window and Double Click the file folder “Regulator Flow Test Stand DP Flow Style B”

9. Double click on the “Setup” icon
   The installer prompts you for the destination location.

10. Either change the directory path and/or name using Browse or accept the default directory (C:\Programs\Flow Test Stand ), and then click Next.
    The installer prompts you to begin file installation.

11. Click Next.
    The installer copies the files to the destination directory.

12. Click Finish.

13. Create and name a file directory that will be convenient to store the data files for the test regulators and copy the Excel Template files “AIRLineDataGraph1” and “A.I.R.FlowCalibrationTest” to that directory.
Installing the Test Stand

Attaching Test Stand to the Computer

To connect the test stand to the computer, do the following:

1. Locate the USB port connection on the test stand and insert the large end of the USB cable into the connector. The connector on the test stand is recessed into the back of the enclosure as shown in the illustration below.

2. Insert the smaller flattened end of the cable connector into the USB port on the computer. If the computer is powered on and this is the first attempt in connecting the test stand to the computer, the “new hardware found” message will appear and will locate the test stand driver and complete the driver installation.

3. Locate the power connector on the test stand and plug the power converter into the test stand and plug into AC line power as shown in the illustration.

![Image of USB and Power Connectors]

Attaching Test Stand to the Air Supply

1. Locate the Low Pressure (L.P.) Quick Disconnect Male Connector (QDC) on the test stand and connect a low pressure (100-150 psi) source through a mating QDC receptacle. The receptacle is one commonly used for shop air powered tools as shown below.

   **Note:** The test stand requires a low pressure (100-150 psi) air supply for the venturi pump operation. This low pressure can be generated by a low pressure port on a diving regulator, a pressure reducing regulator, or a standard low pressure air compressor.

2. Adjust the inlet air pressure on the test stand by turning the regulator adjustment knob clockwise until the pressure gauge reads between 100 to 120 psi. The regulator has a pull-to-set/push-to-lock feature to allow locking the adjustment.
3. Install the Venturi Pump tuning stack into the outlet of the pump and tighten the nylon set screw.

Verifying the Operation of the Test Stand

Performing a quick test of the Test Stand and running a calibration check

QUICK TEST

1. On the PC, double click the “Flow Test Stand” icon to start the test program. The Test Stand window will appear along with the Excel window without an Excel file as shown in the illustration below.
2. From the Excel window, select “File” and open up the file previously downloaded to an assigned folder during installation. Select the file name “A.I.R.FlowCalibrationTest”. The Excel file will appear as shown below and will be used to check the calibration curve of the test stand only.
3. Select “Flow Test Stand” from the Windows status bar to display the main instrument panel as shown below.

4. Click the “Start/Stop Free Run Measurement” Button on the panel - the indicator will turn Green - and ensure all dial instruments read zero with digital displays dithering around zero. It is acceptable that the H.P. digital gauges will read as much as 100 psi with zero pressure input.

5. Turn the Flow Control Knob on the test stand counterclockwise and verify the Flow Rate Indicator increases along with the Vacuum Gauge reading. Adjust the flow rate to 25 CFM and verify vacuum gauge reads 2.5” H2O ±0.2”.

6. Turn the Flow Control Knob clockwise to off and Click the “Start/Stop Free Run Measurement” Button on the panel – the indicator will turn Red and all measurement stops. Note: If the “Stop Free Run Measurement” is selected during a measurement, all indicators will freeze on the last measured value.
CALIBRATION CHECK

Preliminary Conditions:

To conduct this test accurately, the band seal must not be mounted on the flow tube inlet orifice. If the band seal is mounted, the neck formed by the protruding part of the seal will restrict the air flow and produce a higher vacuum reading for the given air flow rate. The data will fall outside of the acceptable limits and can not be used to recheck the test stand at a later date.

Procedure:

1. Select the “Reset Data Log” button on the panel.
2. Select the “Start Data Log Measurement” button on the panel. The “Data Log Complete” indicator will turn Red indicating the data is being recorded.
3. Open the Flow Control Valve (counterclockwise) gradually over the flow range to a maximum of approximately 25 CFM flow rate indication. The data log cycle will take approximately 15 seconds so the manual control from 0 to 25 CFM should be coordinated with this time duration.
4. When the “Data Log Complete” indicator turns Green, the cycle is complete and the Flow Control Valve can be closed.
5. Select the Excel data sheet from the Windows status bar and verify the Data Stream has been written in the first four columns.
6. Examine the A.I.R. Flow graph and verify the calibration curve falls within the min. and max. limits on the graph as shown below.

Note: The H.P. and I.P. data is also recorded during the calibration check log cycle and can be used to check the H.P. and I.P. pressure sensors if the ports are connected to pressure sources and precision reference gauges.
Using Your A.I.R Flow Test Stand

Connecting a Test Regulator to the Test Stand

**Recommended Preliminary Conditions**

It is recommended that an H.P. Manager be used and connected to a high pressure supply source that can supply pressures greater than 3000 psi. The H.P. Manager is supplied as an option for the Test Stand.

**Connecting Regulator First / Second Stages and Regulator H.P. / I.P Hoses**

1. Install the first stage to the H.P. Manager tank valve as shown. The first stage shown in the photo uses a yoke style connector. Din connectors can also be fitted to this valve by removing the adapter plug, located in the center of the tank valve face, with an 8mm (5/16”) allen wrench.

2. Mount the second stage mouthpiece shank into the band seal on the inlet of the flow tube orifice. It is important to orientate the second stage so the air flow is directed straight through the flow tube. It may be necessary to swivel the first stage so that it does not pull the second stage out of alignment.

3. Connect a low pressure hose from the I.P. port of the regulator to the I.P. port on the Test Stand. This connection can be accomplished with a standard LP swivel hose end, or a variety of standard QDC adapters available as options for BC hoses.

4. Connect the high pressure hose supplied to the H.P. port on the regulator and attach the QDC coupler on the end of the hose to the QDC connector on the H.P. port of the Test Stand as shown.
Pressurizing The Regulator

It is always best to pressurize the regulator carefully. This is especially true for any regulator that has been rebuilt. There are two accepted ways to accomplish a "soft pressure" start for the regulator.

1. The best method is to "reduce the high pressure supply" to the tank valve by turning the pressure reducing regulator of the H.P. Manager adjustment knob counterclockwise until the output gauge reads approximately 300 psi. This procedure practically eliminates any possibility of over pressurizing the IP sensors when the valve is turned on. An additional benefit of this approach to pressurizing the regulator is that the test pressure can be increased slowly to the desired level. As the pressure is increased (clockwise rotation of the pressure reducing regulator knob), watch the IP gauge to be sure that it remains stable. If the IP pressure drifts upward (above the manufacturers’ specifications) as the pressure is increased, turn the tank valve off.

2. The most common method for soft pressurizing a regulator is simply to open the tank valve slowly while watching the IP gauge. If the IP gauge surges beyond the normal level, the tank valve is shut off immediately. It is obvious that this procedure requires some coordination and is not as foolproof as the preceding method. The other problem with this procedure is that the test pressure must be adjusted prior to turning the tank valve on. Failure to preset this pressure may result in over pressurizing the regulator.

Warning!
Ensure that the H.P. QDC on the test stand is locked securely in place.

Warning!
Be advised, that some older regulators were designed to operate at a maximum of 2250 psi. Never exceed the manufacturer’s recommended working pressure for any regulator. If you are in doubt, call the manufacturer. If a regulator is pressurized beyond its working pressure level, catastrophic failure of the yoke, first stage body, and all related parts and hoses may occur.

WARNING!
Never exceed 3400 psi (232 Bar) from the pressure reducing regulator to the tank valve mounted on the H.P. Manager.
Never pressurize any diving regulator first stage beyond the manufacturers' specifications.
Conducting Test Sequences on the Test Regulator

Performing “Free Run Tests”

1. From the Excel window, select “File” and open up the file previously downloaded to an assigned folder during installation. Select the file name “A.I.R.LineData Graph1”. Note: If a previous file exists in Excel, save and close the file out before selecting a new file. Do not close the Excel program; doing so will detach the link between the Flow Test Stand program and the Excel program and will require exiting the Test Stand program and re-initializing. The Excel file will appear as shown below and will be used for logging data on regulators under test.

2. Select “Flow Test Stand” from the Windows status bar to display the main instrument panel.

3. Click the “Start/Stop Free Run Measurement” Button on the panel - the indicator will turn Green. The gauges will read the static values before flow is initialized. The technician will be able to evaluate and make any adjustments on the regulator under test during this time.

4. Turn the Flow Control Knob on the test stand counterclockwise. At some point during this adjustment, the vacuum will have increased on the second stage to initiate flow from the regulator under test. The levels of vacuum can be measured as well as the I.P. on the gauges with respect to the flow rate for the technician to evaluate and make adjustments.

5. Turn the Flow Control Knob clockwise to off and Click the “Start/Stop Free Run Measurement” Button on the panel – the indicator will turn Red and all measurement stops. Note: If the “Stop Free Run Measurement” is selected during a measurement, all indicators will freeze on the last measured value.

Performing “Data Log Tests”

1. Select the “Reset Data Log” button on the panel.

2. Adjust the regulator on the H.P. Manager to simulate high tank pressure (approximately 3000 psi).

3. Select the “Start Data Log Measurement” button on the panel. The “Data Log Complete” indicator will turn Red indicating the data is being recorded.

4. Open the Flow Control Valve (counterclockwise) gradually over the flow range to a maximum of approximately 25 CFM flow rate indication. The data log cycle will take approximately 15 seconds so the manual control from 0 to 25 CFM should be coordinated with this time duration.

5. When the “Data Log Complete” indicator turns Green, the first data log cycle is complete and the Flow Control Valve can be closed.

6. Adjust the regulator on the H.P. Manager to simulate low tank pressure (approximately 500 psi).

7. Repeat steps 3 to 5 for the second data log cycle.
8. Select the Excel data sheet from the Windows status bar and verify the Data Stream has been written in the first four columns. Note that there may be outlier data on the boundaries (beginning and end) of both log cycles due to timing skews in the data read control. This data may be cleared so the graphs will not reflect the erroneous data. The illustration below exemplifies this condition.

9. Examine the A.I.R. Flow graphs and verify the performance of the regulator meets the manufacturers’ specification or the benchmark data.

Note: If a data log cycle is performed in error, you may repeat the log cycle as many times as necessary. In doing so, make sure you select the “Reset Data Log” button on the panel to ensure the log cycle starts at the beginning of the rows. The new log cycle will write new data over the existing. You may also clear the contents in the data columns if desired by highlighting the data fields and selecting the “Clear Contents” in the Edit menu. Caution! Do not select “Delete”.
Managing Data and Records

The A.I.R. Flow Test Stand utilizes the standard Windows Excel program which provides a powerful set of features for tracking data and generating graphic reports. The Test Stand program carries in the Excel program during initialization and provides the link for sending all sensor data to an Excel file. The program writes data to specific areas in the spreadsheet (the first 4 columns A-D) and is restricted for use. All other areas on the spreadsheet are available for use by the technician to augment and display information as needed to facilitate the complete testing record.

It is encouraged that the technician creates file directories and names for the spreadsheets in an organized method that will allow easy reference to records for future needs. This is the most powerful feature the Test Stand has to offer. For example, Benchmark data can be easily run on regulators out of the box “New” to establish a baseline performance for specific brands and model numbers. By using the statistical features in Excel, one can create an average profile on a series of benchmarks for a give model of regulator to help evaluate the performance when the same model is in for repair.

The following illustrations show a few examples of how to organize information.

This shows an example of the basic information on customer and regulator make, model, serial numbers, etc. as well as shop information.
This is an example of how graphic information can be combined with other spreadsheet information.
Troubleshooting

General Checklist

Should you experience problems using the Flow Test Stand, do the following:

1. Check that your system meets the requirements stated in Section 2.
2. Check that you have installed the device driver properly using the instructions in Section 2.
3. Check that you have installed your hardware properly using the instructions in Section 3.

If you still experience problems, try using the information in Table 1 to isolate and solve the problem. If you cannot identify the problem, refer to page 28.
<table>
<thead>
<tr>
<th>Symptom</th>
<th>Possible Cause</th>
<th>Corrective Action</th>
</tr>
</thead>
<tbody>
<tr>
<td>No response on PC instrument display panel</td>
<td>No communications between test stand and PC</td>
<td>Check USB connection on Test Stand and PC. Note: If USB cable was disconnected during operation, re-initialization will be required after the connection is restored.</td>
</tr>
<tr>
<td>Erratic or negative values on PC instrument display</td>
<td>DC Power Converter is disconnected at Test Stand or at AC receptacle</td>
<td>Connect Power Converter to Test Stand and AC receptacle</td>
</tr>
<tr>
<td>No Flowrate indication when flow is increased on flow control adjustment knob when other sensor indicators appear to be operating.</td>
<td>One or both sensor tube connections to the flow meter are disconnected</td>
<td>Check and reconnect tube connections</td>
</tr>
<tr>
<td>No vacuum indication when flow is increased on flow control adjustment knob when other sensor indicators appear to be operating.</td>
<td>Vacuum sensor tube connection to the inlet flow tube orifice is disconnected</td>
<td>Check and reconnect tube connection</td>
</tr>
<tr>
<td>No data appears to be written in the columns during a data log cycle.</td>
<td>The Data Log was not initialized before a log cycle causing data to be written outside of the data log areas.</td>
<td>Click the &quot;Data Log Rest&quot; prior to running data log cycles</td>
</tr>
<tr>
<td>&quot;</td>
<td>The Excel program is not linked with the Test Stand program due to inadvertently closing the Excel program during the operation.</td>
<td>Re initialize the Test Stand Program and ensure the Excel program is not closed during file changes.</td>
</tr>
</tbody>
</table>
Technical Support

If you have difficulty using the Test Stand, SCUBA Instruments Technical Support Department is available to provide technical assistance.

When requesting technical support, be prepared to provide the following information:

• Your product serial number
• A description of the problem you’re having
• Your contract number, if applicable

If Your Test Stand Needs Factory Service

If your Test Stand must be returned to SCUBA Instruments, do the following:

1. Record the Test Stand serial number, and then contact the Customer Service Department at (661) 702-1183 and obtain a Return Material Authorization (RMA).

2. Using the original packing materials, place the Test Stand in the protective foam packaging along with the accessories (USB Cable, Power Supply) in the shipping container and seal.

3. Return the Test Stand to the following address, making sure the RMA number is visible on the outside of the box.

   Customer Service Dept.
   SCUBA Instruments
   27520 Ave Hopkins Unit E
   Valencia, California 91355
   ☎️
## Specifications

<table>
<thead>
<tr>
<th>Specifications</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>Air Flow Generator</td>
<td>Venturi Vacuum Pump</td>
</tr>
<tr>
<td>Air Supply Requirements</td>
<td>6 CFM at 100 – 125 psig (Filtered and Dry)</td>
</tr>
<tr>
<td>Testing Flow Range</td>
<td>2.7-25 CFM</td>
</tr>
<tr>
<td>Open Chanel Vacuum Range</td>
<td>0 – 2.5” H₂O</td>
</tr>
<tr>
<td>Primary Flow Meter Type and Accuracy*</td>
<td>Differential Pressure, ± 0.5% FS</td>
</tr>
<tr>
<td>Flow DP Sensor Range and Accuracy*</td>
<td>0 – 10” H₂O, ± 1.0% FS</td>
</tr>
<tr>
<td>Vacuum Sensor Range and Accuracy*</td>
<td>-5.0-+5” H₂O, ± 1.0% FS</td>
</tr>
<tr>
<td>I.P. Sensor Range and Accuracy*</td>
<td>0 – 250 psig, ± 0.5% FS</td>
</tr>
<tr>
<td>H.P. Sensor Range and Accuracy*</td>
<td>0 – 5000 psig, ± 0.5% FS</td>
</tr>
<tr>
<td>Power Supply</td>
<td>12Vdc, 1000 mA through 100-240 VAC, 50-60 Hz Power Converter</td>
</tr>
<tr>
<td>Data Acquisition Resolution and Analog Conversion Accuracy</td>
<td>10 bits, ± 0.05%</td>
</tr>
<tr>
<td>Data Acquisition Scan Rate</td>
<td>60 msec</td>
</tr>
<tr>
<td>Data Acquisition Interface</td>
<td>USB Version 2.0</td>
</tr>
</tbody>
</table>

**Note:**

*Accuracies are stated at reference conditions: 68°F, 14.73psia.

Specifications are subject to change without notice.