Operation Manual

rev-2013-12-02

Software

FanTestic (ASTM)

FanTestic

Retrotec's latest *Building Air Leakage Test* software

Many new features including:

- ✓ Small and versatile XML data storage with reports in Microsoft Word 2007
- ✓ Cost of air leakage analysis, ventilation and natural air-change calculations
- ✓ Automatic updating over the Internet
- ✓ Fully compliant with ASTM, the USACE Protocol, and European norms
- ✓ Manual or fully automatic operation

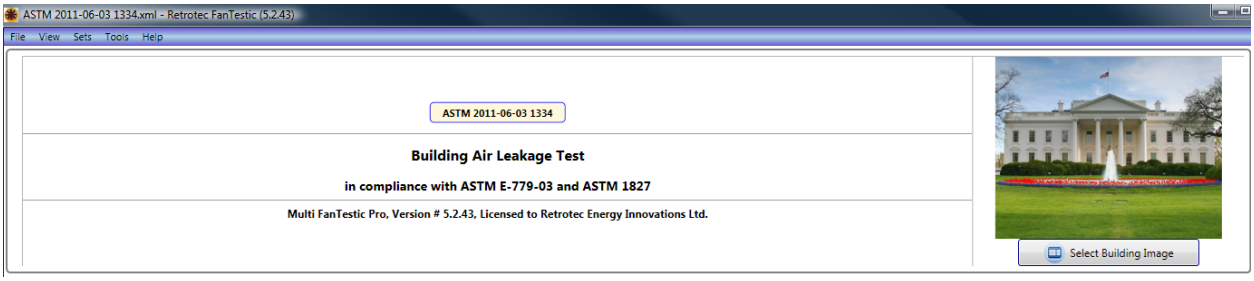
Manual data entry requires:

- ✓ Computer running Windows XP, Windows Vista or Windows 7
- ✓ Internet connection with Microsoft Internet Explorer, Mozilla Firefox or Chrome
- ✓ Microsoft Word 2007 (or Word 2003 with 2007 support add-in)

Automatic data collection requires:

- ✓ Manual data entry requirements
- ✓ A Retrotec door fan

FanTestic software will automatically control the fan speed and take from 2 to 20,000 readings with no operator involvement.



1 Table of Contents

1 Basic Instructions

1.1 Video Instructions

The following videos explain the steps to be taken:

- Installation and Single-Point Tests
- Infiltration and Single-Point Tests
- The Infiltration Cost
- Multi-Point Tests
- Graphing and Other Options
- Depressurize
- Pressurize
- Opening and Saving Tests

For more Retrotec videos on other topics, visit http://www.youtube.com/user/RetrotecEnergy

1.2 Minimum system requirements

- Windows XP (SP2 or greater), Vista, or Windows 7
- Processor: 1 GHz
- RAM: 512 MB
- Disk space: 600MB (32-bit) or 1.5 GB (64-bit)
- .NET 4.0 framework (will update automatically with the FanTestic installation)
- Microsoft Word 2003 with 2007 support add-on.

1.3 Download the software

Go to: http://www.retrotec.com/software/fantestic/publish.html

a) Once the web page opens, click on the "Install" button.

b) Do not double click the "setup.exe" file when the download has completed. Instead, right click the "setup.exe" file , and select *Run as administrator* to start the installation.

c) After installation, click the *Start Menu* → *All Programs* →*Retrotec* → *FanTestic.*

The FanTestic icon on your desktop can be used to start the program.

d) Obtain a license before the Trial Version expires, and instructions how to activate the license, by contacting sales@retrotec.com

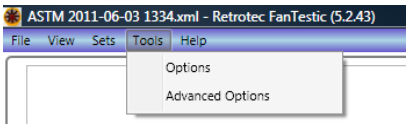
1.4 Download the Retrotec DM-2 Gauge Driver

Download and install the Retrotec Device (DM-2) Driver by going to:
http://retrotec.com/support/software-downloads

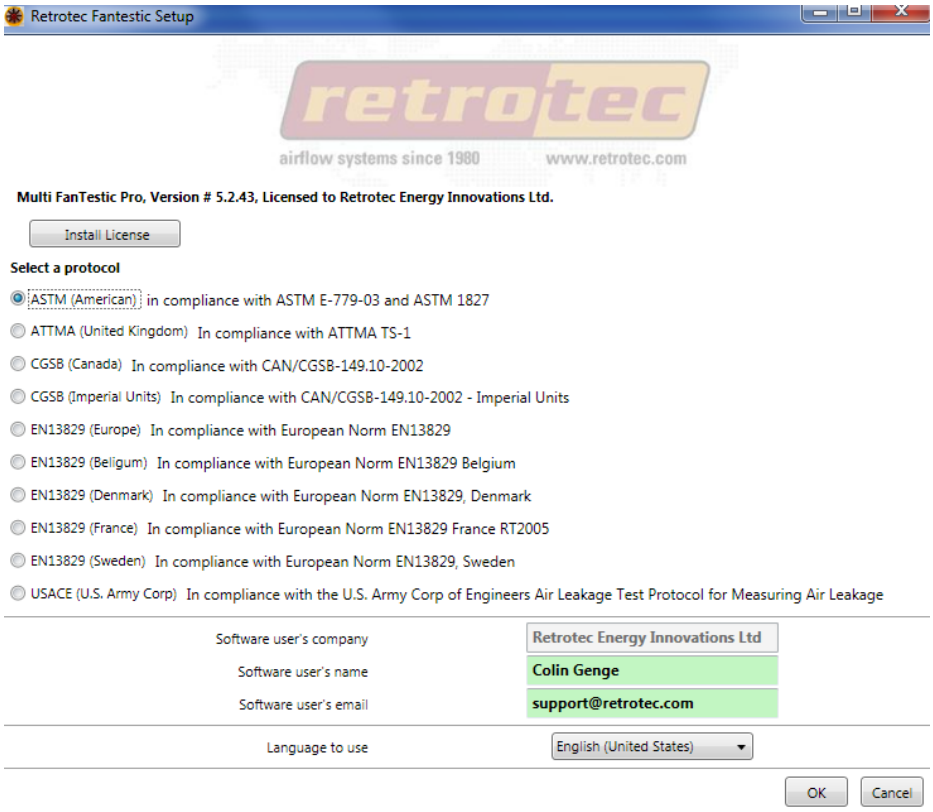
1.5 Initial set-up

- The first time you run FanTestic, you need to apply some basic settings, which can also be accessed using *Tools* → *Options*. Alternatively, you can also use *Tools* → *Advanced Options* for

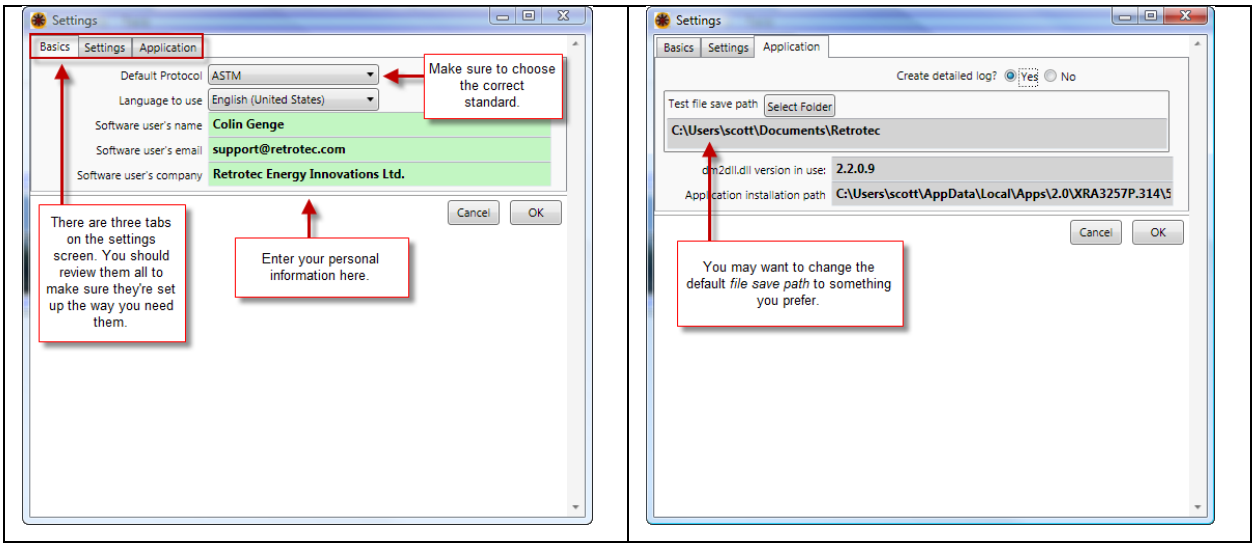
testing parameters. Changes can be made any time, but the program must be restarted for the changes to take effect. Watch the videos above that explain the following steps.



***Options*:**



***Advanced Options*:**

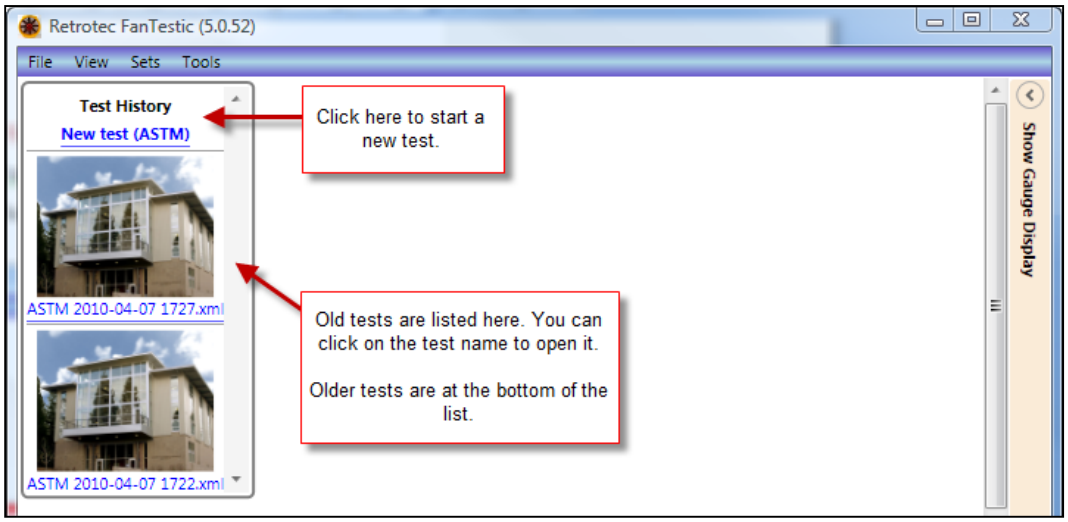


Basics tab	*Application* Tab
Choose *ASTM* as your default protocol and the language you wish to use. Close and reopen the program for changes to become effective.	This tab displays the location of the FanTestic on your computer, and where the test results will be stored.

2 Perform a New Manual Test

2.1 Beginning the Test

To start a new test click on the *New test* on the main page, or find it under *File* → *New*. Make sure *New Test* on the main page (or at the top of the window) is followed by *ASTM (American).* If not, go to *Tools* → *Advanced Options* → *Basics* tab and change the *Default Protocol* to *ASTM*. You may need to restart the program if this change is not active immediately.



2.2 General Overview

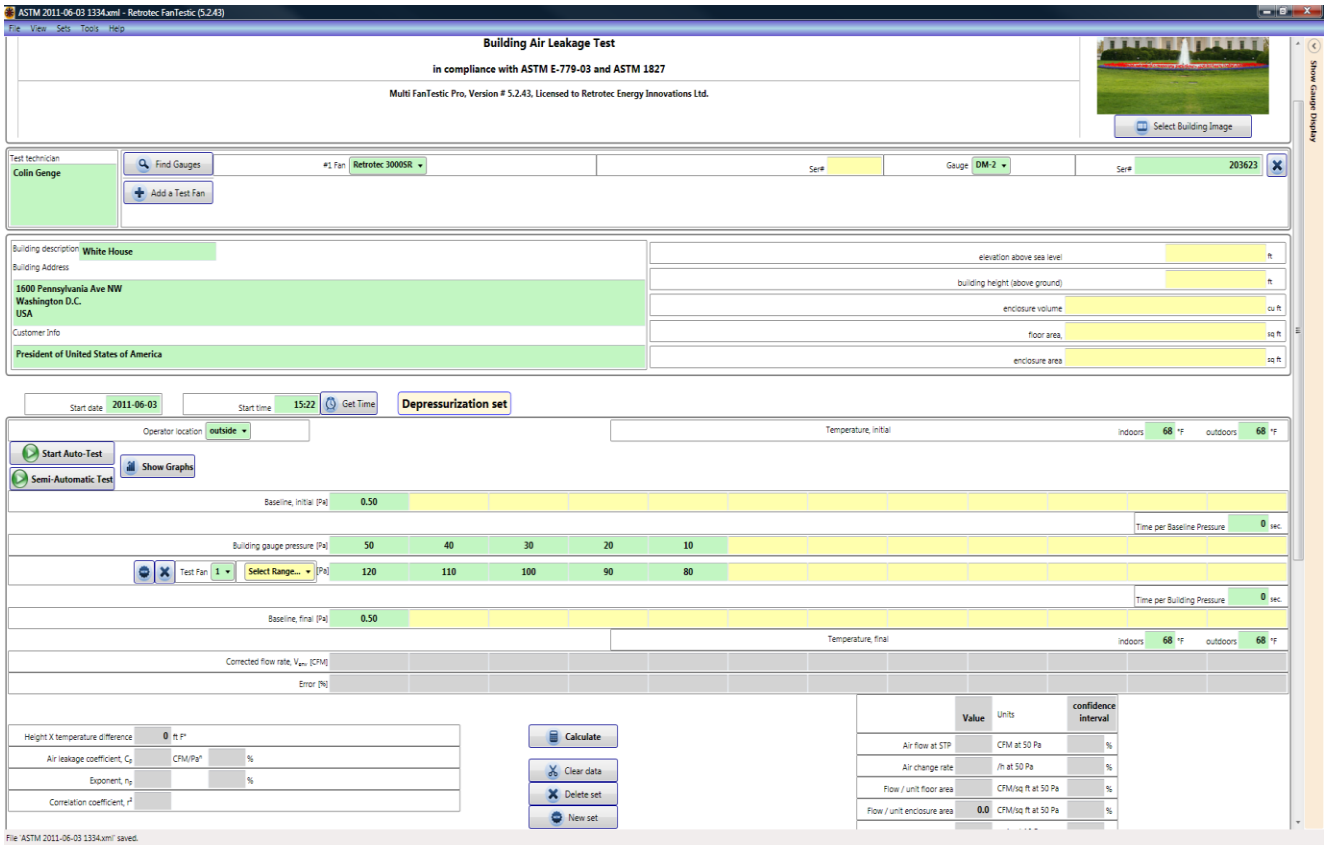
Manually enter your data into all the yellow boxes. They will turn green after entry. Press the Calculate button once all the data is entered in order to view the results. See an example and detailed instructions below.

2.2.1 Baseline /bias pressure values

These values should be entered into the *Bias Pressure, Initial [Pa]* line. According to the ASTM protocol, a single bias pressure reading taken over 10 seconds is required.

- This can be done by using the **[Baseline]** function on the DM-2 gauge
- Or by increasing time averaging to 10 seconds and recording the value after this period

More than one bias pressure point can be entered into the *Bias Pressure, Initial [Pa]* line, if the test performed required this.



2.3 Input data for air leakage tests

- *#1 Fan*

  Enter the model of the fan used in your system as per the following table:

System:	Q32, Q33	Q46, Q56	Q4E, Q5E, QMG	Q4E, Q5E, QMG
Fan model:	Retrotec DU200 two pressure ports on fan connected	Retrotec 2000	Retrotec 3000	Retrotec 3000SR two pressure ports on fan connected

- *elevation above sea level*

  This value is used to perform a small correction to the air flow rate.

- *building height above ground*

  This value is used to make the H*eight x temperature difference* calculation, which must be under 1140 (ft °F) in order to be in compliance with ASTM.

- *enclosure volume*

  Enter the building volume in cubic feet. This is only needed if you want a result that requires volume, such as air changes. If you include the basement, perform the test with the door between the basement and the building open.

- *floor area*

  Enter the floor area of the building in square feet. This is only needed if you want a result that requires floor area, such as CFM per square foot of floor area, or the natural infiltration

rate, or the mechanical ventilation guideline. Include all floors that are intentionally heated. If you have included the basement in your volume calculation, also include the basement in the floor area calculation.

- *Enclosure Area*
  Enter the above grade surface area of the exterior envelope of the building, in square feet. This is only needed if you want a result that requires enclosure area such as flow per unit of enclosed area. Include all surfaces separating the conditioned space of the building from unconditioned spaces (e.g. exterior walls**,** floors over unheated and vented crawlspaces, surfaces separating the building and the attic, etc.).

- *Start date*
  The date is entered automatically by the computer in the format yyyy-mm-dd.

- *Start Time*
  24 hour time is automatically entered by the computer when you start a new test.

- *Operator location*
  This is simply whether the operator is located inside or outside during the test (inside is typical). This is used to determine Pressurize and Depressurization test directions using the sign (positive or negative) of the *Building gauge pressure* point.

- *Temperature, initial*
  This is the indoor and outdoor temperature at the start of the test.

- *Baseline pressure, initial [Pa]*
  Enter the pressure once the building is prepared for the test, before turning on the fan. This should be a series of readings with the time averaging set at a minimum of 10 seconds for at least one minute.

- *Building gauge pressure [Pa]*
  This is the test pressure created in the building as a result of the door fan running and as read on the building pressure gauge.

- *Test Fan* [1]
  This is the fan model appearing on the first line of the test, which is followed by the range. This range must match the range on the door fan being used for the test. This is followed by one or more flow pressure signal or flow readings as read from Channel B of the gauge.

- *Baseline pressure, final [Pa]*
  This is the pressure at the end of the test taken for the same time period as the initial bias pressure reading. Both the initial and final bias pressure values are averaged to correct the building gauge pressure readings.

- *Temperature, final*
  The indoor and outdoor temperature defaults to the initial values entered previously but can be overwritten.

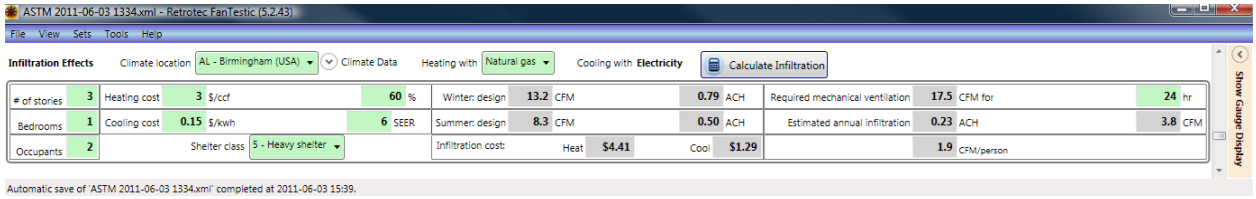
- *Finish time*
  Enter the finish time of the test manually.

2.4 Infiltration Effects

2.4.1 Input Data for Infiltration Effects

The Infiltration Effects section uses the air leakage measurement results from the previous section to calculate the effects of infiltration on the building.

- Select *Climate location* from the pull-down menu or enter climate data into the drop-down box labeled *Climate Data*. Fill in all the data in the yellow boxes (see below for descriptions) and press the Calculate Infiltration button.



- *Heating with*

  Click on the fuel type used for heating. The choices are: electricity, natural gas, propane, wood, oil or heat pump.

- *Number of stories*

  Enter the number of stories above grade which is used in the infiltration model to estimate annual average and design infiltration rates.

- *Bedrooms*

  Enter the number of bedrooms for the building being tested. This number is used to determine ventilation requirements. The occupancy of the building is assumed to be the number of bedrooms plus one, or the number of occupants (see below), whichever is larger.

- *Occupants*

  Enter the number of occupants that are living in the building. When determining the occupancy of a building, the program uses either the number of occupants or the number of bedrooms plus one, whichever is greater.

- *Heating cost*

  Enter the fuel cost for the selected heating fuel type. Comparable fuel costs to provide the same amount of heat at 100% efficiency would be: electricity $0.10/Kwh, natural gas $2.93/ccf, propane $2.71/US gal, wood $520/chord, oil $4.03/US gal or heat pump $0.30 Kwh with HSFP of 10.

- *Cooling cost*

  Enter the cost per KWh for the cooling system. For example, enter 0.08 if your electrical rate is 8 cents per KWh.

- *%*

  Enter the annual efficiency (i.e. AFUE) for the heating system. For example, for a gas furnace with an 84.5% AFUE, enter 84.5.

- *SEER*

  Enter the SEER rating for the cooling system, typically 10 to 20 for new systems.

- *Shelter class*

  Click on the appropriate building wind shielding class. This wind shield factor is used in the infiltration model which estimates natural infiltration rates.

  1. *Exposed*

     No obstructions.
  2. *Light exposure*

     Few obstructions, a few trees or a small shed.
  3. *Moderate exposure*

     Some obstructions within two building heights, thick hedge, solid fence or one neighboring building.
  4. *Well Shielded/Unexposed*

     Obstructions around most of the perimeter, building or trees within 30 feet in most directions; typical suburban shielding.
  5. *Heavy shelter*

     Very heavy shielding; large obstructions surrounding the perimeter within two building heights; typical downtown shielding.

2.4.2 Results for Infiltration Effects

- *Winter: design* and *Summer: design* [CFM, ACH]

  The estimated design infiltration rates are expressed in Cubic Feet per Minute (CFM), and Air Changes per Hour (ACH).

  The program estimates the design winter and summer infiltration rates that are used to calculate winter and summer peak loads for the purpose of sizing heating and cooling equipment. The calculated design infiltration rates can be used in ACCA Manual J load calculations in lieu of the estimation procedures listed in Manual J. The estimation procedure uses the design wind speed and temperature difference values input into the Climate Information Screen, and are based on the calculation procedures listed in the ASHRAE Fundamentals Handbook, Chapter on Infiltration and Ventilation.

- *Infiltration cost* (*Heat*/*Cool*)

  The program estimates the annual cost associated with air leakage, both for heating and cooling.

  Note: Cooling cost procedure is based on sensible loads only. In hot humid climates, latent loads due to air leakage can be greater than the sensible loads which are estimated by this procedure.

- *Required mechanical ventilation*

  This value is the recommended whole building ventilation rate to be supplied on a continuous basis (24 hours per day) using a mechanical ventilation system and is based on 7.5 CFM per person (or number of bedrooms plus one, whichever is greater), plus 1 CFM per 100 square feet of floor area. This guideline assumes that in addition to the mechanical ventilation, natural infiltration is providing 2 CFM per 100 square feet of floor area. For buildings where the estimated annual natural infiltration rate (based on the air leakage test) is greater than 2 CFM per 100 square feet of floor area, the recommended mechanical

ventilation rate is reduced to provide ventilation credit for excess infiltration. In these cases, the recommended mechanical ventilation rate is reduced by the following amount:

0.5 x (estimated annual natural infiltration rate (CFM) – 0.02 CFM x sq. ft. of floor area)

If continuous ventilation is not going to be provided then the number of hours per day that the ventilation system will be running must be input in order to determine the required mechanical ventilation rate for the reduced time.

- *Estimated annual infiltration*

  This value is calculated using the LBL infiltration model using air leakage measurement results for the building, and climate data for the building location. The driving forces for this infiltration are wind and stack pressure that impose themselves upon the air leaks in the building. The result is the average air flow rate of outside air infiltrating into the building over one year, divided by the volume of the building and expressed as ACH. This result is also expressed in CFM and CFM per person where the number of persons is taken to be the number of occupants or the number of bedrooms +1, whichever is greater.

Notes on Ventilation Guidelines:

ASHRAE Standard 62.2 also contains requirements for local kitchen and bathroom mechanical exhaust systems. These local exhaust systems may be incorporated into a whole building ventilation strategy. Consult Standard 62.2 for more information on ventilation strategies and specific requirements and exceptions contained in the Standard.

Compliance with the ventilation guideline does not guarantee that a moisture or indoor air quality (IAQ) problem will not develop. Many factors contribute to indoor air quality including ventilation rates, sources and locations of pollutants, and occupant behavior. Additional testing (including combustion safety testing) is needed to fully evaluate air quality in buildings. In many cases, a combination of pollutant source control and mechanical ventilation will be required in order to ensure adequate indoor air quality.

3 Perform a New Automatic Test

3.1 Before performing the automatic test:

a) Videos to demonstrate how to run a New Automatic Test

- Prepare for an Auto-Test
- Auto-Test Settings
- Auto-Test Part 1
- Auto-Test Part 2

b) Before performing an automatic test, the panels, fans and gauges must be set up properly to perform a test. Make sure to achieve the minimum and maximum pressures required for your automatic test, manually prior to the run, to ensure that your fan is on the correct range. Ensure that your gauge is displaying the correct device and correct range configuration. Adjust Mode to

display the maximum and minimum flows. If *TOO LOW* appears, you must change to a lower range and try again since this will cause the test to stop (review quick guide on page 3 for your system). Make sure both the building pressures and flows can be achieved for the range of pressures required for your test before starting Auto-Test.

c) For the automatic test you'll need:

- A computer with a high speed USB port
- A cable to connect the regular USB on your computer the mini USB on your DM-2A
- An Ethernet style cable to connect your DM-2 to a Retrotec Q series system

d) Make sure that you have downloaded and installed the Retrotec Device (DM-2) Driver: http://retrotec.com/residential/SupportCenter/DeviceDrivers.aspx

e) Open the software program, and ensure the protocol is displayed as ASTM (after clicking *Tools*/Advanced *Options*/*Basics*). The Settings should be reviewed because this will dictate how the automatic test is to be performed. The default settings can be changed before any test.

3.2 Test Settings

Open the Settings tab (*Tools* → Advanced *Options* → *Settings* tab); many of the settings can be changed to accommodate user-defined testing procedures. Use the default test settings to run a test according to the default protocol rules. Change these settings if the need arises.

3.2.1 *Cover fans before taking a reading?*

Selecting *Yes* will cause the software to stop after the initial bias pressure readings have been taken in order for the user to uncover the fan(s). Select *No* for a nonstop test in which test pressure will be taken immediately following initial bias pressure readings.

3.2.2 *Show calculation warning?*

Warnings will appear if insufficient building information is provided (i.e. no building volume was entered, therefore ACH50 cannot be calculated). Choose *Yes* to view the calculation warnings.

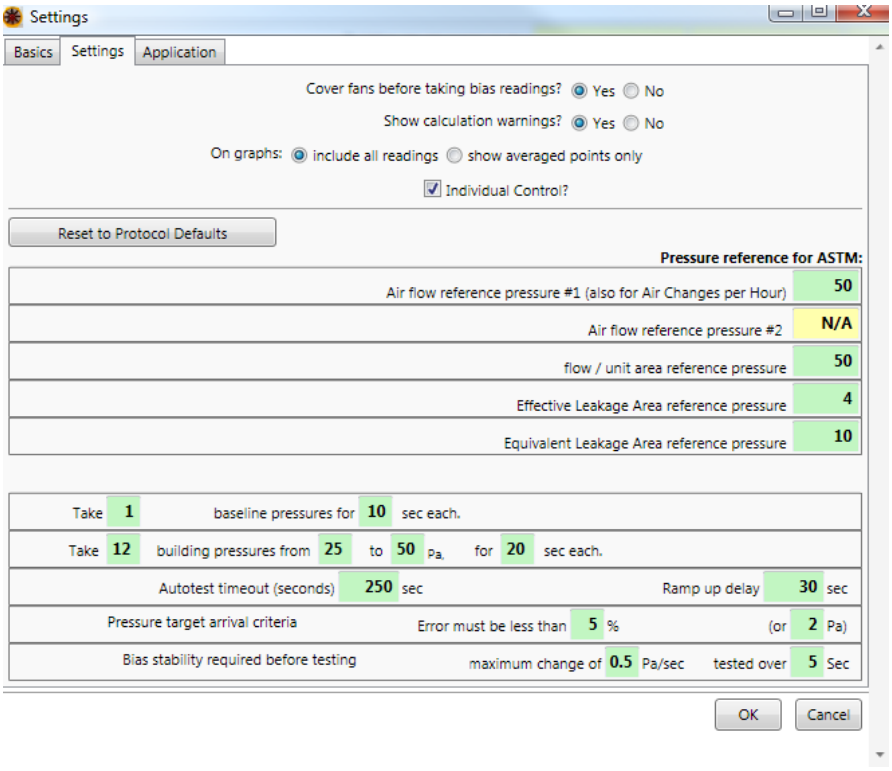
3.2.3 *On graph*

Choose to show all readings on the graphs, or simply the single point which is the average of all readings at any particular door fan test pressure.

3.2.4 *Individual Control?*

This refers to the manner in which the fans in a multi-fan setup are controlled. Individual control *on* is the default setting, and will ensure that each fan is controlled by its own gauge and pressure reference, to the defined setpoint (i.e. 50Pa). With individual control unchecked, or off, the primary gauge, and the primary gauge's pressure reference, will control all fans to itself. This may result in "dueling" fans, in which case one takes over and runs up to a speed of 100%, while the other fans decrease to 0% speed.

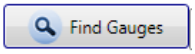
Using a fan splitter under default conditions will override individual control.



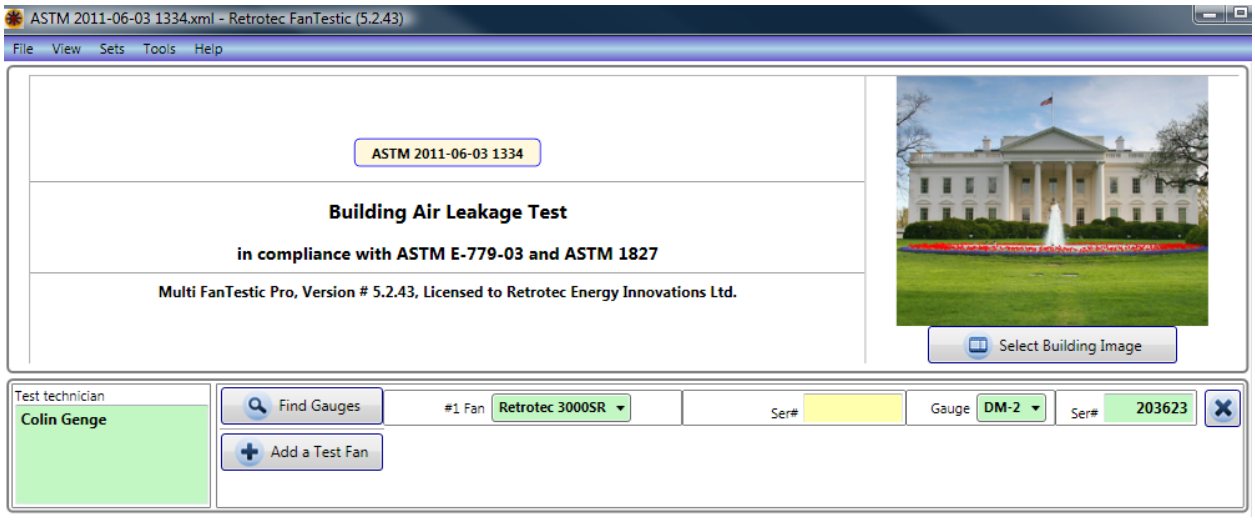
3.3 Connect Your Gauge to the Computer

3.3.1 Set up your Retrotec Q series door fan.

3.3.2 Connect your DM-2 to the computer with the supplied USB to mini USB cable.

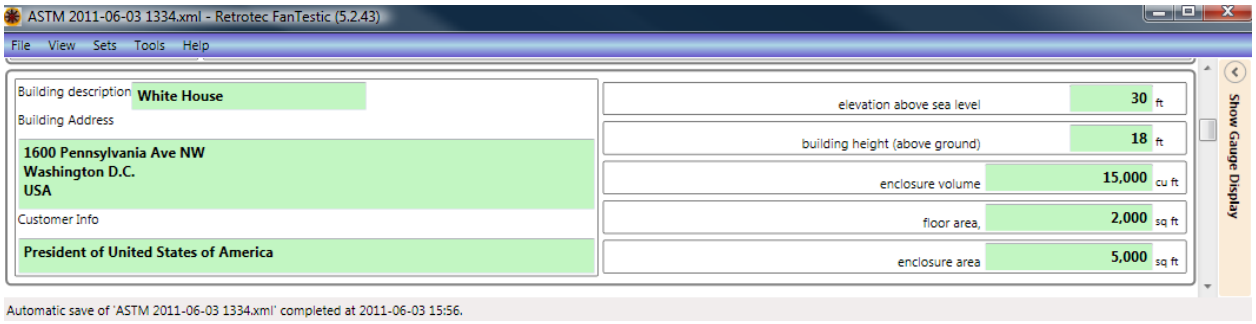
Press the 

button. The FanTestic software will find the gauge, model and serial number which will be automatically filled in. The Device and Range Configuration displayed on the DM-2 will also be displayed in the software but the serial number of the fan must be entered manually. If the device or range configuration is incorrect it can be changed in the software at any time.



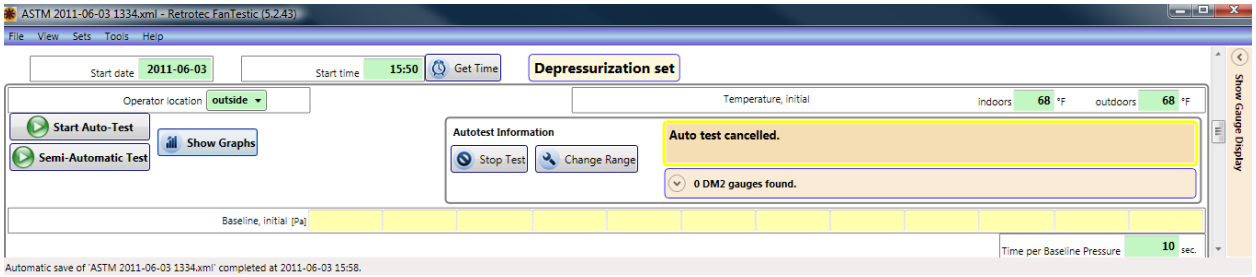
3.3.3 Enter building description and dimensions (now or later)

Do not enter date and time now because the computer will complete that automatically later. Fill out the options (seen in the image below) as if performing a manual test (see 3. Input Data for an Air Leakage Test above). You can enter average wind speed at this point, or after the test is performed.



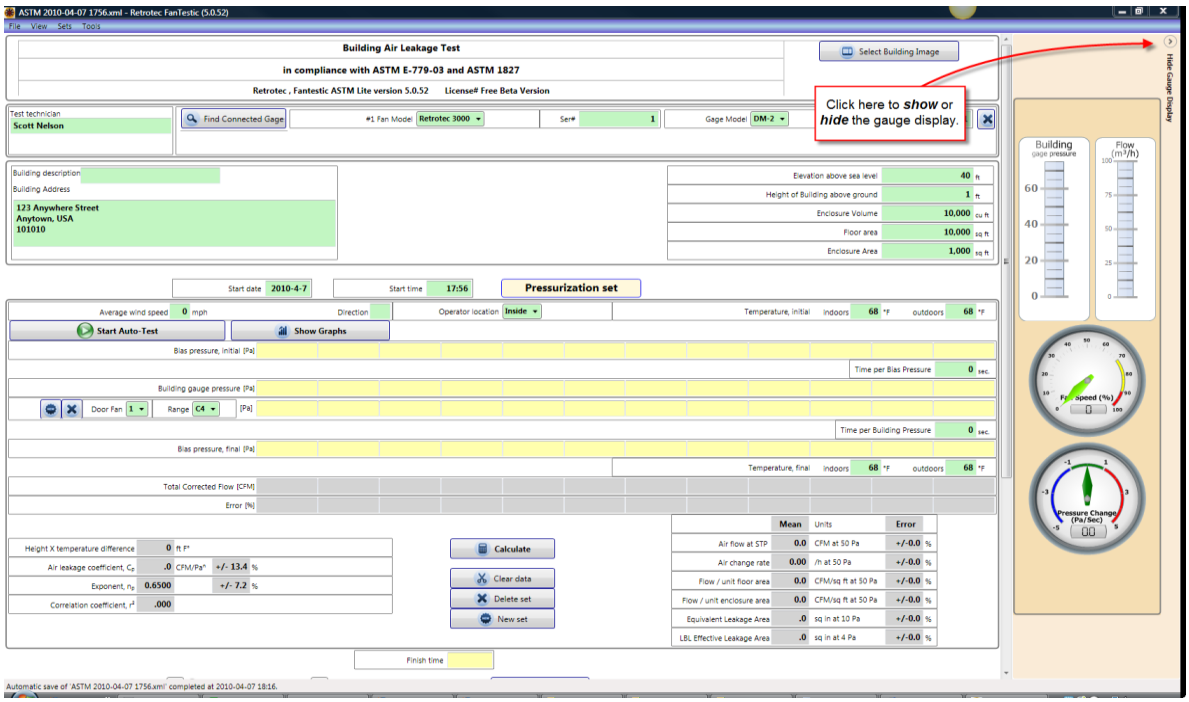
3.3.4 Start the Auto-Test.

Press the Start Auto-Test button. From then on data out will appear on a regular basis until the test is completed. The final temperature must be added manually in order to complete the test. Data may be changed in any one of the green boxes but must be re-calculated after changed by pushing the Calculate button. The *Finish time* will be filled in automatically at the end of the test on auto test mode, unlike manual mode where it must be put in manually.

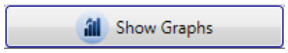


3.4 Viewing the Gauges During a Test

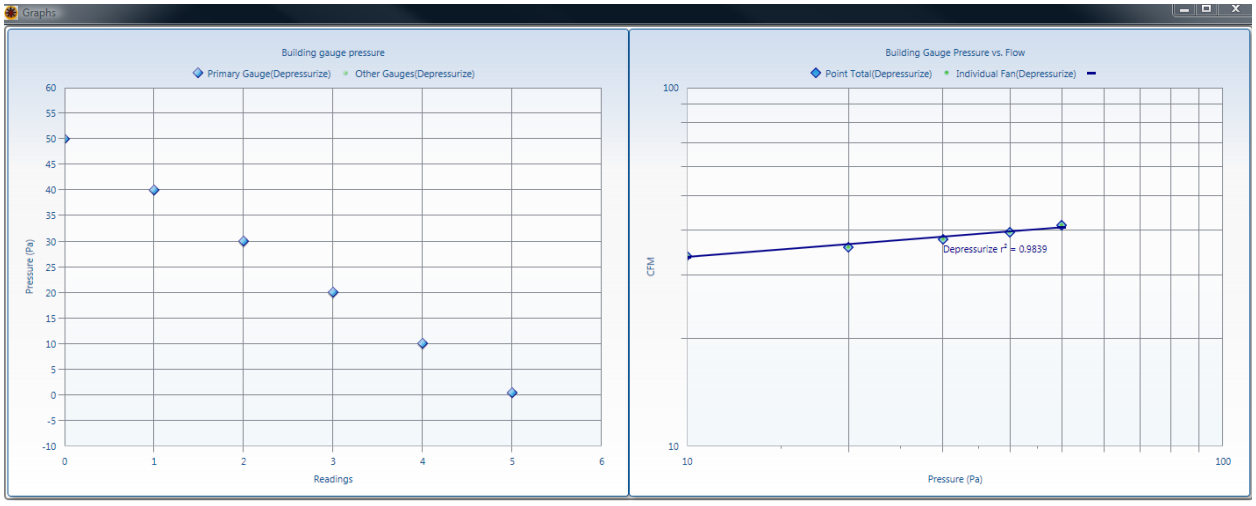
FanTestic provides a gauge display while running tests that allows you to see your test in action. You can *show* or *hide* the gauge display by clicking on the arrow in the upper right hand corner of the FanTestic window.



3.5 Graphical Analysis during a Test

FanTestic provides a graphical display by pressing the 

button. The graphs will come up in a separate window that can be opened and closed at any time.



4 Perform a new Semi-Automatic Test

NOTE: The Semi-Automatic Test is still in its developmental “beta” mode and has not been thoroughly tested by Retrotec. Use at your own risk.

4.1 Understanding the Semi-Automatic Test Mode

The Semi-Automatic Test feature allows you to run a manual test on the computer, with automatic control of the test settings. This feature provides a way to take test points under user-defined

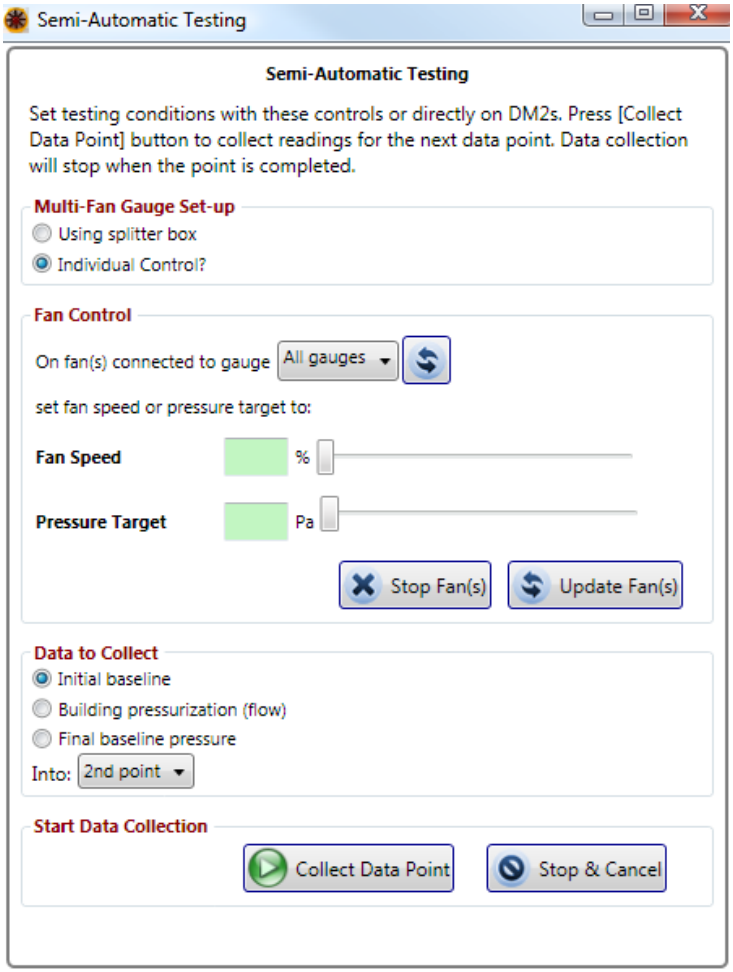
conditions, and at intervals of time that are also user-defined. It is as if a manual test was being completed, but instead of physically writing down the results from the gauge screen, the software program will record values more accurately and calculate results, like it does during an automatic test. This feature will also allow a tester to repeat a test point that may have gone awry for whatever reason during an automatic test, by selecting the appropriate input cell point and re-taking that data point.

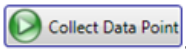
4.2 How to use the Semi-Automatic Test feature

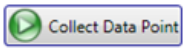
1. Press 

. Click **[OK]** to accept the warning message (as in the NOTE above).
2. A small window will pop up that will act as the control window for this data collection option.
3. If the test is a multi-fan setup (i.e. more than one fan), select the appropriate choice between *using splitter box* or *individual control*. Note that *individual control* is the default in FanTestic, and refers to the way the fans are controlled by the DM2s (see 3.2.4).
4. Fans can be controlled either by setting the speed, or by setting the target building pressure. Enter the desired fan speed or building pressure into the appropriate green box, or use the slider to increase/decrease speed and/or pressure. Push 

to start the fans at the speed/pressure selected, or to update them if the speed or pressure value has been changed.
5. Determine what type of point is to be taken (bias pressure initial or final, or building pressure). This point can be put into the next empty or incomplete cell in FanTestic, or you can choose which of the 12 cells to put it in (by selecting the appropriate choice in the drop-down box).



6. If taking bias pressures, make sure *Initial bias pressure* or *Final bias pressure* is selected, and the appropriate input cell has been selected (step 5), and then press 

. If taking door fan test pressures, once satisfied with the building pressure/fan speed, press the 

button to have the data point taken in the software program.

5 Changing Ranges

It becomes necessary to change ranges during a test due to *flow too low* (not enough flow through the fan) or the inability to reach a pressure target (fan speed up to 100%). This can happen during a manual test, an automatic test, or a semi-automatic test.

NOTE: it is recommended that the tester induce pressures over the full range (10 and 60 Pa) prior to performing the test, to ensure that one flow range can satisfy all pressures, to avoid changing ranges.

5.1 Manual Test Range Change

5.1.1 Changing the range during the test

If *TOO LOW* appears on the gauge:

- Increase flow pressure (restrict the flow) by installing a smaller flow range (ex. start at C8, put in two more plugs for C6).
- Make sure this flow range change is recorded in your notes/test form.

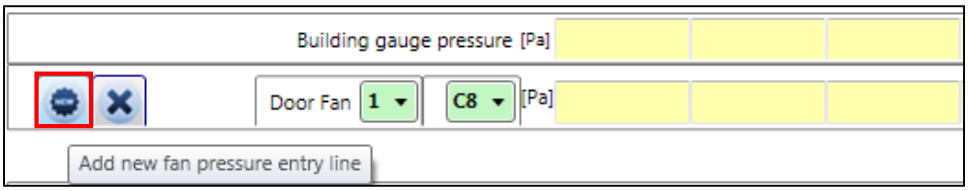
If the fan is close to 100% fan speed without achieving the target pressure:

- Decrease flow pressure (increase the flow) by installing a larger flow range (ex. start at C8, remove C range plate for B).
- Make sure this flow range change is recorded in your notes/test form.

5.1.2 Entering manual test data with range change

Transfer the data from your notes/test form into the building pressure and door fan pressure lines in FanTestic. Add a new door fan pressure line for each range change by pushing  (New).

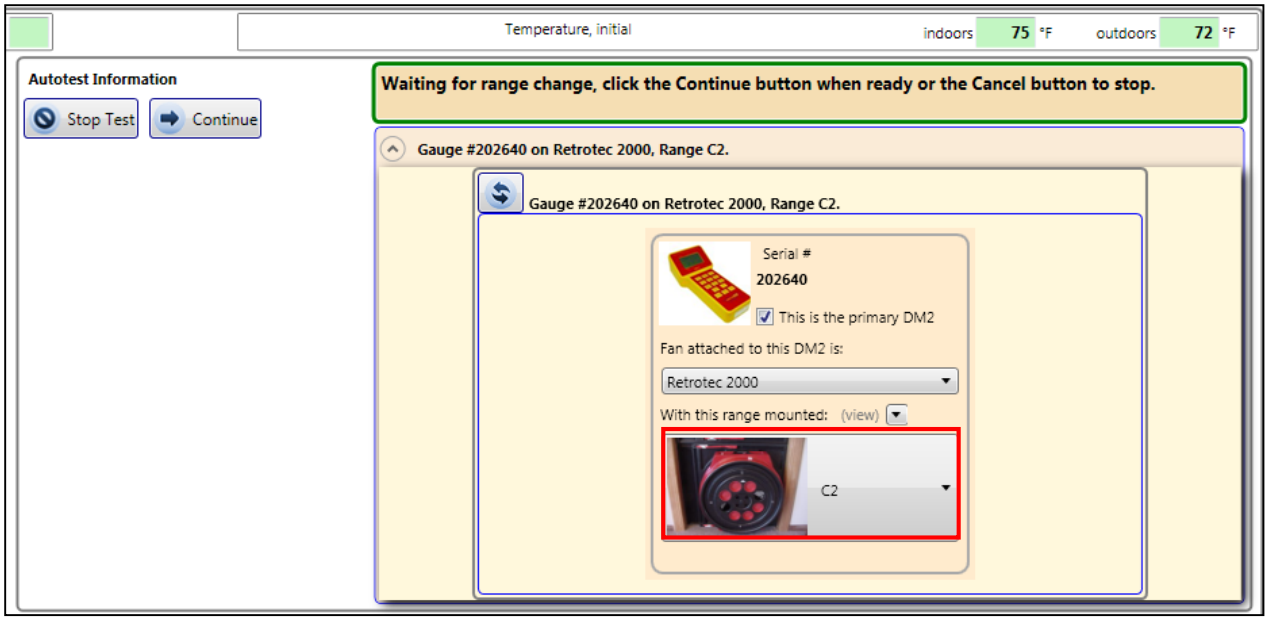
Enter the appropriate fan pressure data into the correct door fan pressure line, depending on the flow range used during the test. In the example below, the first three target pressures were achieved with the C8 range plate; the following three required a smaller range plate (C6), and are therefore on a different line.



Building gauge pressure [Pa]	-50.1	-42.3	-35.5	-27.5	-22.9	-15.9
Door Fan 1 C8 [Pa]	55.1	47.4	38			
Door Fan 1 C6 [Pa]				47.3	40	32.3

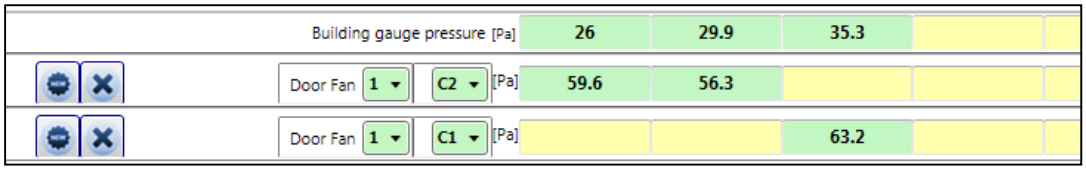
5.2 Automatic Test Range Change

The same issue may arise during an automatic test as in a manual test, in which the flow range must be changed. FanTestic will automatically pause the test and request the tester to change ranges, if fan pressures become too low or the target cannot be reached.



Use the dropdown box, highlighted in the image above, to select the new range.

Click  to continue the test on the new range.



6 Adding and Removing Data Sets

Add a set to include a test in the opposite direction, or to complete a second set in the same direction after sealing leaks. Delete a set that should not be included in the averaged results at the bottom of the test sheet.

6.1 Adding Sets

To add a new set of data to an existing project, simply click the  button. All previously entered environmental data will be duplicated for this new set, but not the test results. Therefore, you could easily run before and after tests, or pressurization and depressurization tests (tests in both directions).

6.2 Removing Sets

You can add as many new sets as your needs require; if you decide that some of these sets are no longer necessary, click the  button within that particular data set, and follow the prompt. This will be a permanent deletion, so be sure to save the project beforehand.

6.3 Clear data

Clear data set allows the user to clear any data that had been entered into that particular set.

7 Test Results

7.1 Air leakage test results

- *Height x temperature difference*

  This value is the product of the height and temperature difference which must be under 1140 (ft °F) in order to be in compliance with ASTM.

- *Air leakage coefficient* (C) and *Exponent* (n_p)

  A Building Leakage Curve will be created after at least two points have been entered, which is used to estimate the leakage rate of the building at any pressure. This curve will be more accurate (line of best fit) after at least three points have been entered. If you have conducted a single point test, the program assumes an exponent (n) of 0.65. The Building Leakage Curve is defined by the following equation:

  $Q = C \times P^n$ where:

  Q is airflow (in CFM)
  C is the Coefficient
  P is the pressure difference between the inside and outside of the building
  n is the exponent

  Example: calculate the airflow needed to create a 5 Pa pressure if:

  C = 110.2 n = 0.702

  Q, the airflow (at 5 Pa) = $110.2 \times 5^{0.702} = 341$ CFM.

  It would take 341 CFM to cause a 5 Pa pressure change in this building.

- *+/- %*

  This is the 95% confidence limit for the results. It essentially means that 19 times out of 20 the results will statistically fall within this error limit.

- *Correlation Coefficient, r^2*

  This is a measure of how well the data fits the curve and must be between 0.98 and 1.0.

- *Air flow at STP*

  This is the airflow in CFM calculated from the curve fit at the pressure shown and corrected to Standard Temperature and Pressure of 20°C and 101.325 kPa.

- *Air change rate*

  The Air Changes per Hour (often ACH at 50 Pa) is another commonly used measure of building air tightness. ACH at 50 Pa is the number of complete air changes that will occur in one hour when a 50 Pascal pressure is applied across the building envelope. ACH at 50 Pa is a useful method of adjusting (or normalizing) the leakage rate by the size (volume) of the building. If the building volume is not entered, ACH50 will not be calculated.

  ACH at 50 Pa = (CFM50 x 60) / building volume [cuft]

- *Flow per unit floor area*

  This is the flow divided by the floor area of the building. This normalized flow rate adjusts the leakage rate by the size (floor area) of the building. If you did not enter the floor area, this result will not be calculated.

- *Flow per unit of enclosure area*

This is the measured flow divided by the above grade surface area. It is a useful method of adjusting (or normalizing) the leakage rate by the amount of envelope surface through which air leakage can occur. Experience has shown that for buildings above 1.0, very large cost-effective reductions in infiltration can often be achieved using door fan guided infiltration and insulation techniques. In the 0.5 to 1.0 range, it is often more difficult to achieve economical improvements in airtightness. If you did not enter an Above Grade Surface Area value, it will not be calculated.

- *Equivalent Leakage Area (EqLA)*
  EqLA is defined as the area of a hole in a thin panel that would leak the same amount of air as the building does at a pressure of 10 Pa. The EqLA is used in the AIM infiltration model (used in the HOT2000 simulation program). It most closely approximates physical hole sizes found in buildings - for example, a 1 inch by 36 inch crack under a door will measure about 36 square inches of EqLA.

- *LBL Effective Leakage Area (ELA)*
  This ELA was developed at the Lawrence Berkeley Laboratory (LBL) and is used in their infiltration model. The ELA is defined as the area of a elliptical nozzle-shaped hole that would leak the same amount of air as the building does at a pressure of 4 Pascals. ELA is at least 39% smaller than EqLA.

7.2 Mean Results

If both depressurization and pressurization test sets are completed, the results will appear in the image below (left). The average of the results from each test set are included in this table. The reason behind performing an air leakage test in both directions is to average out any potential pressure problems there might be in one direction over the other (like blowing open a damper in one direction, but sucking it closed it in the other).

7.3 Reduction Results

	Mean	Units	confidence interval	
Air flow at STP	5620	CFM at 50 Pa	+/-0.051	%
Air change rate	4.215	/h at 50 Pa	+/-0.051	%
Flow / unit floor area	1.174	CFM/sq ft at 50 Pa	+/-0.050	%
Flow / unit enclosure area	1.174	CFM/sq ft at 50 Pa	+/-0.050	%
Equivalent Leakage Area	567.5	sq in at 10 Pa	+/-0.194	%
LBL Effective Leakage Area	298.0	sq in at 4 Pa	+/-0.338	%

	Reductic	Units
Air flow at STP	-77.80	CFM at 50 Pa
Air change rate	-3.111	/h at 50 Pa
Flow / unit floor area	-0.16	CFM/sq ft at 50 Pa
Flow / unit enclosure area	-0.10	CFM/sq ft at 50 Pa
Equivalent Leakage Area	-11.60	sq in at 10 Pa
LBL Effective Leakage Area	-7.605	sq in at 4 Pa

Reduction results will appear in the place of *Mean* (below, right) when two sets have been run in the same direction. This is done in order to discover the quantity of leakage rate reduction that can be achieved after having sealed some of the leaks discovered during the first test.

7.4 Deviation Statement

The Deviation Statement lists the test conditions and resulting measures that must be taken and achieved respectively, during a building air leakage test in order for the test to comply with ASTM.

Deviation Statement	
Tested in both directions	Yes
Height X temperature difference less than 1180	Yes
Outdoor temperature between 45 and 95 F	Yes
Five or more building pressure test points used	Yes
Bias taken for 10 seconds or more	Yes
Building pressures taken for 10 seconds or more	Yes
Exponent is >=0.50 and <=1.0	Yes
Correlation coefficient >=0.98	Yes

It must be looked at after every air leakage test is complete. If a test technician is unfamiliar with ASTM, it is also advantageous to look at it before a test is performed. The test technician must verify that all of the lines in the Deviation Statement read *Yes*, to confirm that the test complies with ASTM.

8 Saving, Printing and Exporting Results

8.1 Saving Results

FanTestic stores results automatically and uses the yyyy-mm-dd a time in the suffix of the file name. The *Save As* feature allows the operator to add more description to the file name. The original test may be saved and then a second *Save As* copy may be manipulated if necessary so that the original data is always kept intact. Results are normally saved on your local C: Drive under Documents\Retrotec\tests.

8.2 Print

FanTestic will print the data as-is, i.e. only what is on the interface screen. Go to *File* → *Print*, and you can either generate a PDF document or print a paper copy. This will essentially print a screen shot of the FanTestic interface.

8.3 Generate Report

FanTestic includes a built-in template for reports generated from automatic or manual test runs. To generate a report, select *File* → *Generate Report*. This will automatically open a Word document containing a report with the data from your test. These will be stored on your local C: Drive under Documents\Retrotec\reports. Once the Word document is open, you can print it directly.

8.4 Export Data to Excel

FanTestic includes a template for raw data to be exported to Microsoft Excel, in order to view all readings that went into each test point on the software page. To export data, select *File* → *Export Data* (Excel). This process takes a few minutes, especially for large files, so allow it to process even if it appears to be frozen. Once completed, an Excel spreadsheet document will open containing all data readings taken during the test. These will be stored in the same location as the reports (C: My Documents\Retrotec\reports).

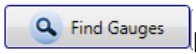
9 Open an Existing Project

To open a project that has already been completed and saved, there are several options:

- The main/opening screen for FanTestic displays previously completed tests in the left hand window (with photos, if they have been included). Click the one you would like to open.

- Go to: *File* → *Open* and a pop-up Windows Explorer window will display all tests saved without images.
- Go to: *View* → *Test History* – the left hand list of all saved tests will appear, the same as the one displayed on the opening screen for FanTestic.

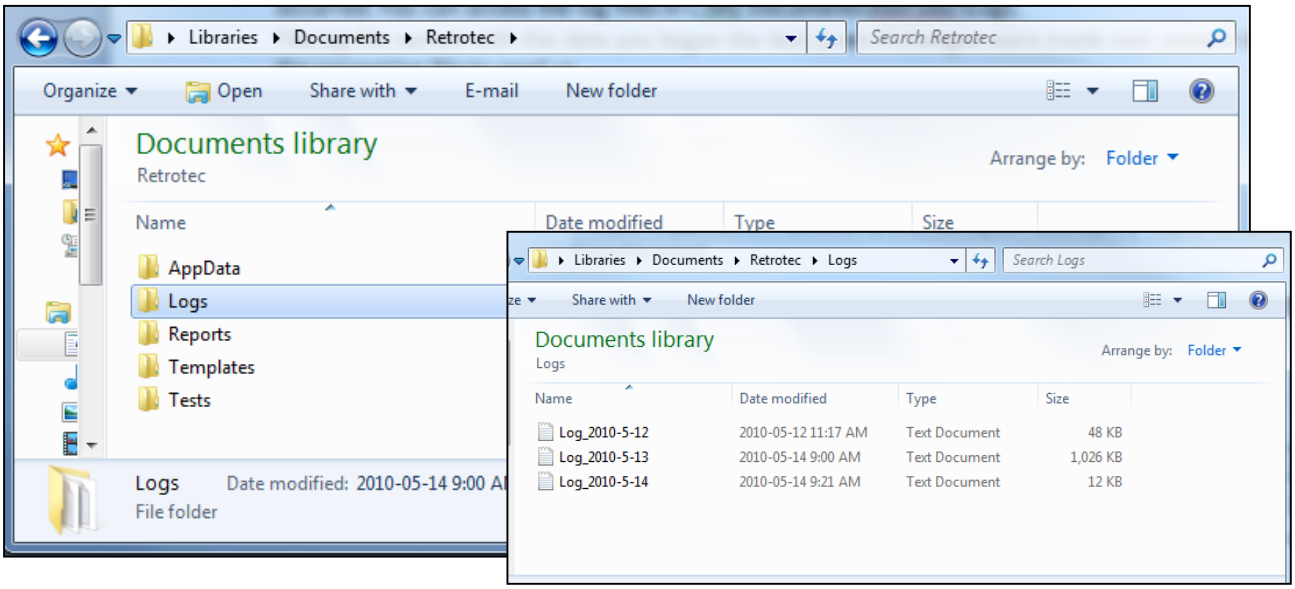
10 Troubleshooting and Tech Support

Problem	Solution
Cannot generate reports in FanTestic	• Make sure you are using the most recent version of Microsoft Word (2007) • If you are using an earlier version (2003 or earlier), please download a free compatibility pack here that will allow you to open/edit/save Word 2007 documents. • If this does not fix the problem, contact us.
Cannot run an auto-test – DM2-to-computer connection not functional	• You must download the DM2 driver from Retrotec's website in order to get the computer to recognize the DM2 gauge. You can access this driver here. • Make sure to first right click "setup.exe" and select *Run as administrator* to install it, instead of double-clicking the file. • If the driver is downloaded and functional, unplug the DM2 from the computer, turn it off, turn it back on after 10 seconds and re-plug it back in. Try the  button once more. • If this does not fix the problem, contact us.

If you experience a problem that you cannot fix by troubleshooting, please make sure you have the latest version of FanTestic software. To do this, connect to the internet and restart FanTestic – if there has been an update since your current version, you will be prompted to download the latest updates. If you are still having problems with the updated software, follow these steps:

- For Technical Support**,** E-mail bugs, comments or suggestions to: bugs@retrotec.com
- In your report, include the following documents/answers:
    - What standard protocol are you using? (*Tools* → *Options* → *Basics tab* → *Default Protocol*)
    - What version of Microsoft Office are you using? (98, 2003, 2007)
    - Log File

      Every test has an associated log file that is saved on your C: drive, in the Retrotec folder. These logs will display to us every step taken in the testing procedure and will help to determine where the problem occurred. You can access the log files in C: My Documents\Retrotec\Logs. The correct log file to send will be named with the date you began the test (even if changes were made over several days).



- The .xml file

  The .xml files can be found in the C:My Documents\Retrotec\Tests folder, and are saved in the same fashion as log files. The name of the .xml file is the date you began the test. Send the .xml file with the same name/date as the log file.

- A screenshot

  Screenshots are a way to show our tech support staff what your error looks like on your screen. This will help us, along with the background information (log and .xml files), to determine the best approach to fix the problem. To capture an image of the screen you are currently looking at, push the **[Print Scrn]** button on your keyboard. In order to attach this image as a file for us to view, you must paste it into a document. To do this, open a new Microsoft Word or Paint document, right click on your mouse and select *Paste* (or *Edit* → *Paste*). The captured image of your screen should appear in the document. You can now save this document and include it as an attachment when you submit your information to us.

11 Purchase License

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