## 3.13       Taking Manual Multi-Point Readings for FanTestic Software

In general, the multi-point test requires that the user collect pressures for a pre-test baseline, collect flows for a set of target pressures (in one or both pressurize and depressurize directions), and sometimes to collect pressures afterwards for a post-test baseline.  The collected data is entered into software such as FanTestic in order to generate results from the test which indicate the amount of leakage in the tested enclosure.

Each Standard that users comply with for collecting the data and generating the results have different sets of target pressures (based on different required maximum and minimum target pressures and number of different targets), different requirements for the baseline measurements, and different ways of calculating the results.

The method described in this section is recommended to achieve the most accurate and repeatable test results.  Skipping or reducing any of the steps may allow your test results to pass, but this does not mean that an accurate test has been performed.

In order to produce the most Retrotec has included factory defaults in FanTestic which recommend the number or baseline and target points for each of its supported standards.  Unless these recommendations are followed, tests will not be repeatable and there will not be enough data to determine what went wrong with a particular test.  Retrotec will not be able to analyze the test and recommend corrections if these recommendations are not followed.

### 3.13.1. Decide how many test points to take

Taking an accurate test means that results will be more repeatable.  Taking an inaccurate test means that re-tests of the same enclosure may show very different results.  Accurate tests results are achieved with more abundant data, taken over a longer time interval.   The EN13829 standard, for example, requires only 5 induced target pressure points but this will usually produce non-repeatable results, as the following graphs show.
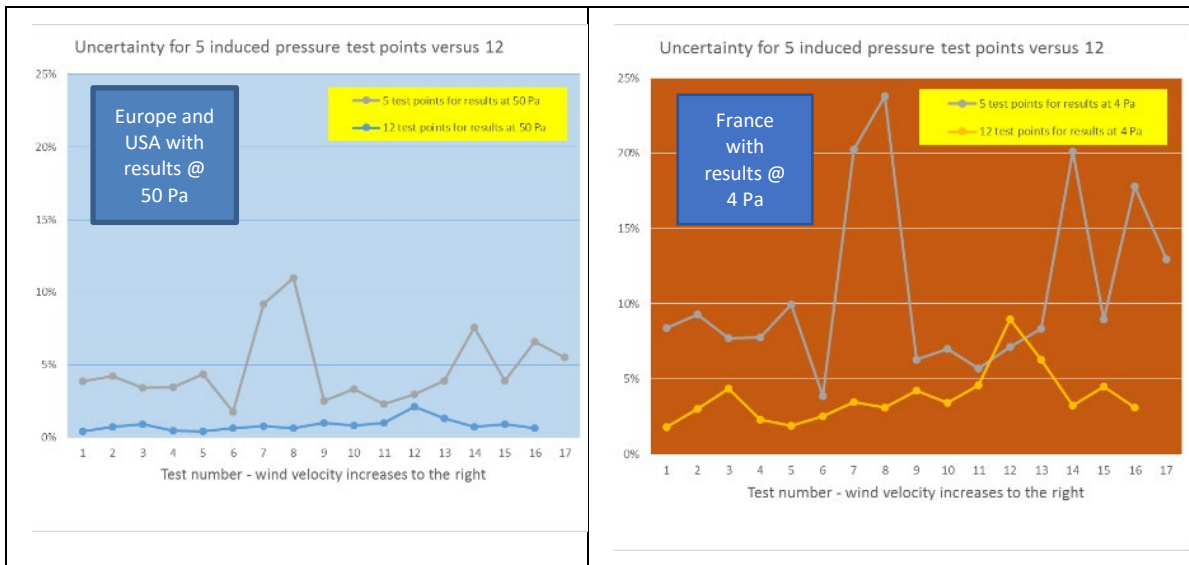
| By comparing the average through the 12 point tests (grey line) to that of the 5 point tests (blue line), you can see that taking only 5 test points instead of 12 increases uncertainty by a factor of 5 (~1% vs. ~5%). All 33 tests are identical except for wind conditions. The variation on the 5 point test line is also higher, demonstrating the unreliability of taking tests with fewer data points. | In France the uncertainty variability is more pronounced because results are referenced to 4 Pa instead of 50 Pa. Again, taking only 5 test points instead of 12 increases uncertainty of the 4 Pa results by a factor of 5 (~2% vs. ~10%). Notice also that the uncertainty at 4 Pa is twice as large as that for the results at 50 Pa, reinforcing the importance of taking more data. |

### 3.13.2. Decide whether to test in both directions

Testing in both directions means repeating the set of target pressures: placing the fan to exhaust one direction will cause depressurization and in the other direction will cause pressurization.

By testing in both directions, Uncertainty can be reduced further: usually by 50%. The EN13829 Standard states "It is recommended that two sets of measurements are made, for pressurization and depressurization." Just like testing with only 5 points, you may get passable results occasionally but if there are problems with your test you may be required to repeat it.

As long as the pressure reference for the gauge remains in the same location during the whole test (inside the enclosure or outside the enclosure), a negative sign on one of the sets of target pressure readings and a positive sign on the other set indicates that the sets were taken in different directions. That location is entered in FanTestic as Operator location. The pressure reference for the gauge is the port that is open (blue port if doing a house test because the red port has a tube connected).

### 3.13.3. Decide what is the optimum opening size on the fan (Range)

Carrying out this step first is another way to ensure a repeatable test; since uncertainty will be lowest if you can collect data for all target points on a single range. If a single range is not possible, try to arrange that there are at least three points taken on the two ranges that you end up using. It is best not to just rely on the software to advise that you're on the wrong range or you may end up with up to three ranges in a single data set. Using more than one range can change the Uncertainty by up to 2%. It is fastest to start your test on the correct range so you don't have to use extra time in the middle of collecting data.

Follow this procedure:

1. Determine the highest test pressure you will require during the test, for example 70 Pa. With the fan blowing away from you to depressurize while you are inside the building, increase fan speed using Set Speed or the control knob so pressure on Channel A rises above 70 Pa but not above 80 Pa. If you cannot reach the desired target pressure (70 Pa in this example), change to a more open range to get more flow. Getting more flow means the open area of the fan inlet must be increased so you are not looking for a higher Fan Pressure but a more open fan. If you can easily achieve 70 Pa, try a less open range that will give less air flow and try again.

2. Determine the lowest test pressure you will require during the test, for example, 15 Pa. Leaving the fan as it was at the end of the previous step, running and achieving the maximum pressure with the most restrictive possible range, decrease fan speed using Set Speed or the control knob so pressure on Channel A falls to just below 15 Pa. There will be times you cannot reach the lowest target pressure (15 Pa in this example). Either you cannot run the fan slowly enough (reach 0% speed before the target pressure reaches 15 Pa), or the flow on Channel B will not show a value (not enough fan pressure is being developed). In either case, you need to change to a more restrictive

range to develop more fan pressure.  Since you already determined the smallest range that will let you reach the maximum target pressure (in step 1), you now know that you will have to change range once during your data collection.

### 3.13.4. Measure the Baseline (Zero Flow) Pressure before the test

Commonly, test procedures require that the pre-existing pressure across the building be measured. That value is subtracted from the test pressure to uncover how much change occurred in the building pressure due to Test Fan operation.  Baseline is sometimes called Bias Pressure or Zero Flow Pressure or even Static Pressure but we will primarily use "Baseline" here.

Note that there are two main components of Baseline:  one is caused by stack pressures and the other by wind.  Stack is a building phenomenon which produces a steady pressure and is simply subtracted from the test pressure.  Wind may also cause some steady pressure which can be subtracted.  However, wind generally also causes a pressure that fluctuates over time.  This fluctuation will distort the induced (applied) pressure difference when the Blower Door is collecting data unless the measurement period is long enough to reduce the effect of the fluctuations.

The length of time the Baseline must be taken varies from Standard to Standard but mostly is not specified exactly which is why this guidance is being provided.  EN13829 states "over a period of at least 30 seconds" but does not state the required number of test points.

Recommended procedure to take the pre-test Baseline:

When manually entering data into FanTestic, set the Time Averaging on the gauge to 5 seconds for Baseline readings.  Start at 5 second averaging for manual readings since it will take you at least this long to write them down anyway.  There is a Baseline feature on the gauge but do not use it for this purpose since it was designed for single point readings.

### 3.13.5. Measure each of the target points required for the test

Use either the fan speed control knob, the gauge Set Speed control, or the gauge Set Pressure control to capture data for each of the target induced pressure points you need for the test.

When manually entering data into FanTestic, set the time averaging on the gauge to at least 20 seconds for induced pressure and flow readings.  This must be done in order to compensate for the effects of wind and to ensure that you get an average reading.  On windy days you will have to take readings for a longer period of time.  To determine if it is windy, set your gauge to 5 second averaging and check if the pressure fluctuation is above 2 Pa.  If so, double the time averaging for the induced pressure and flow readings to 40 seconds.

On the DM32, you can tap Channel A reading to activate the Hold feature so the readings don't change while you're writing them down.  On the DM-2, press the HOLD key.  Write down all your readings.

#### 3.13.5.1.   Adjust your test fan using Set Speed

All Retrotec fans have a knob for controlling speed.  You used this in the earlier check to ensure that the Range installed on the fan is correct and will allow the fan to pressurize to the desired target pressures.  You can use the knob or you can use the Set Speed button on the gauge to get to each target pressure.

To take each target pressure point:

1. Adjust fan speed to your highest target point.

2. Activate the Hold feature so the readings don't change while you're writing them down. To activate: On the DM32, tap Channel A; on the DM-2, press the HOLD key.

3. Write down all your readings.

4. Repeat for each required target pressure

### 3.13.5.2. Adjust your test fan using Set Pressure

You can use the Set Pressure button on the gauge to get to each target pressure. Using set pressure is fastest and most accurate, but heed the following warning.

**Warning:** *using Set Pressure on the gauge will allow the fan to run up to full speed should a door be opened during the test, possibly causing damage. If in doubt, adjust speeds using the control knob or Set Speed.*

To take each target pressure point:

1. Use Set Pressure on the gauge, and enter the desired target pressure.

2. Observe the flow on Channel B. Change the Range if you cannot achieve the test pressure or if no flow reading appears on Channel B.

3.

4. On the DM32, tap Channel A to activate the Hold feature so the readings don't change while you're writing them down. Press the HOLD key on the DM-2.

5. Write down all your readings.

6. Repeat for each required target pressure

## 3.13.6. Complete taking the data set for this direction

If your standard requires a post-test baseline, follow the steps as you did in section 3.13.4 when capturing the pre-test baseline.

This will complete a single Data Set for this test. Depending on the direction of fan flow, this data set will be either a Pressurization or a Depressurization Data Set.

## 3.13.7. Take another data set with fan flow in the other direction

Once the Data Set in the first direction is complete, turn the fan around and start again at section 3.13.4. Collect data until you have taken another pre-test Baseline, another set of target points and a post-test Baseline.

## 3.13.8. Enter collected data into FanTestic to get Results

Once the test is complete, you will have two Data Sets, each containing a pre-test and post-test Baseline and one will contain target points from the Depressurization data set, and the other will contain a pressurization data set.

Enter this data into FanTestic software which will give you the results you need.

When entering data in FanTestic and testing in both directions, you add data for first direction and then you add a "New Set" and enter data from the second direction. Adding a New Set will produce a single test file with both the pressurize and depressurize data in it, and FanTestic will automatically combine the results and produce the summarized data as per your selected Standard. Each standard combines the results somewhat differently. Adding a New Set is more efficient than creating a new test file for each set of data, so you can save time.
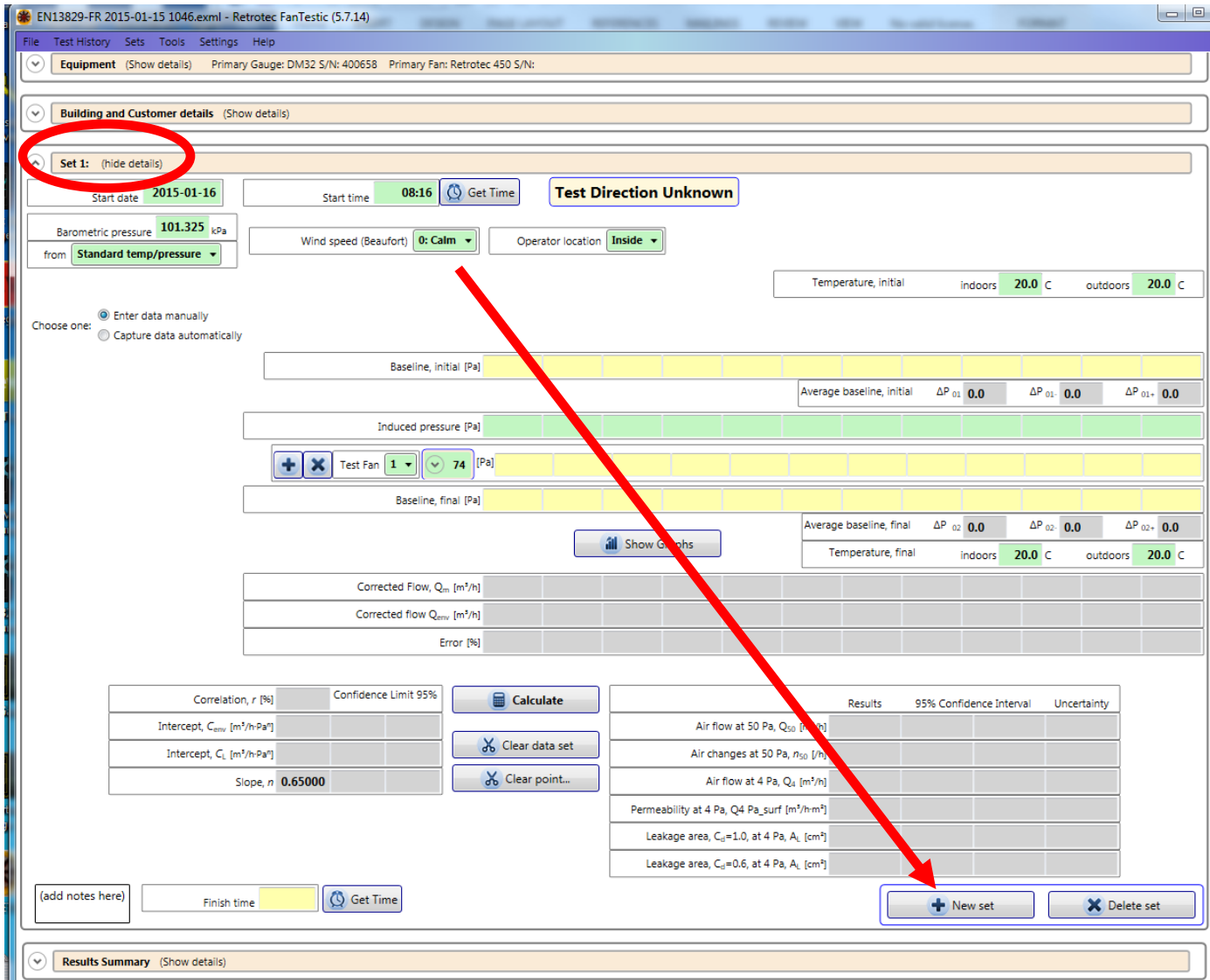


After you add a New Set, there will be two places to add data, one section for each test direction:
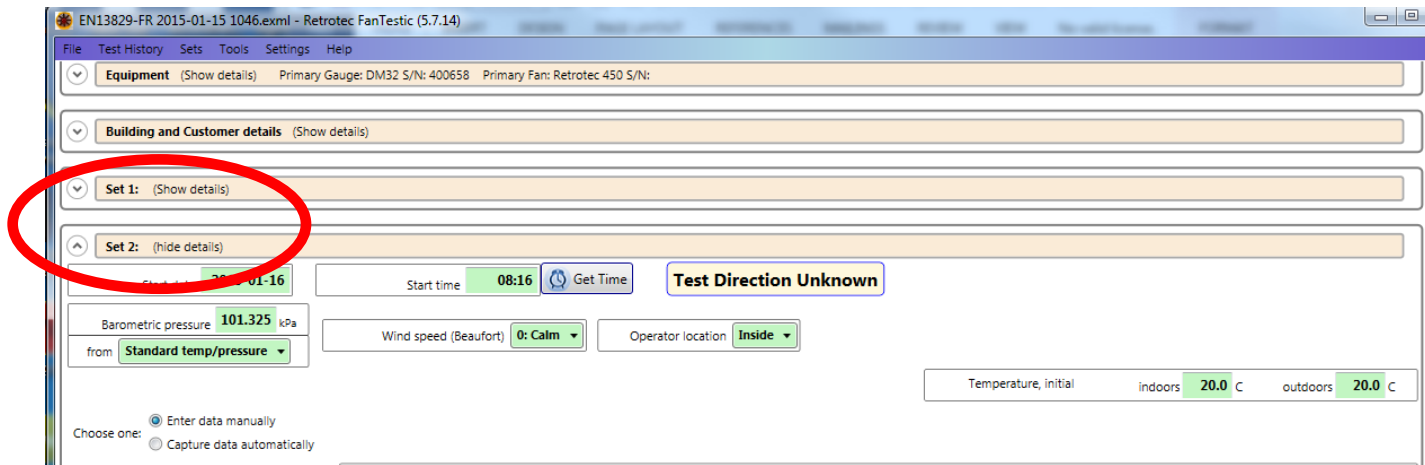
## 3.14     Completely automated results using FanTestic

You can have FanTestic do all the steps for you but at first, it is wise to follow the preceding manual procedures so you can get a feel for what the software will do for you.

Even if you do use FanTestic to control the test, it is recommended to manually check that the range you have installed on the fan is the optimum one before starting the Automatic test in FanTestic (section 3.13.3).

Ensure FanTestic is set up to test as recommended by Retrotec. Go to the Settings menu, and click "Advanced – view or change default parameters" . In the window that opens, click on "Settings" tab.

Start by clicking on "Reset to Standard Defaults" to be sure your FanTestic has the recommended values. To close this window, use the OK button at the bottom, not the x button in order to be sure your chosen parameters are saved. Only adjust if you have good reason.
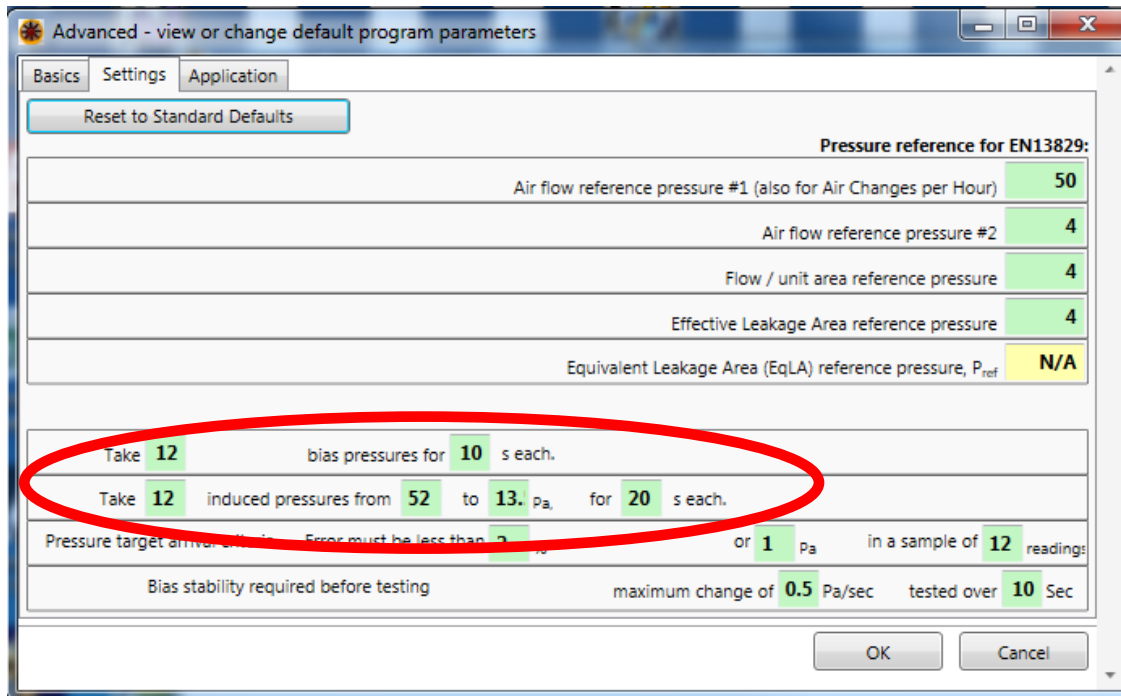
Now FanTestic will run the test for you.  Check your FanTestic manual for more details by clicking Help.
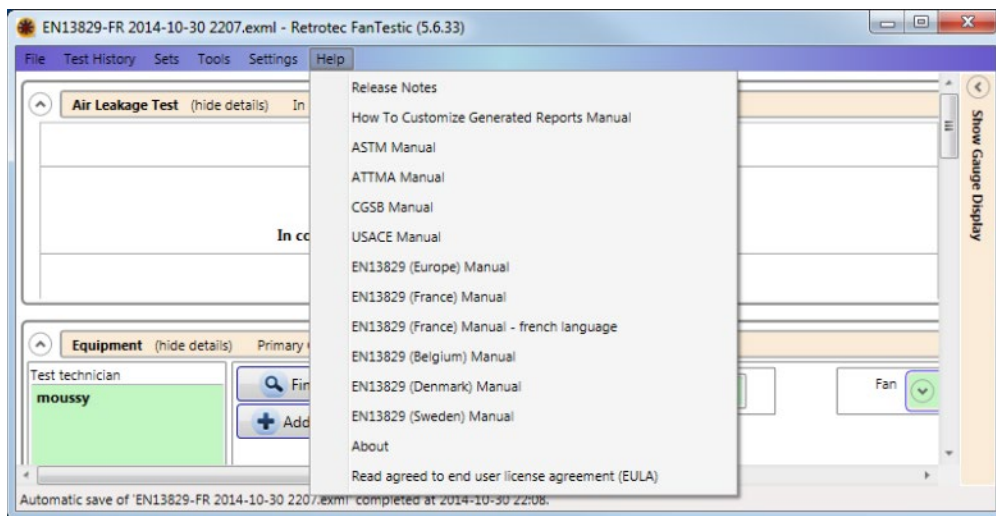


## 3.15     Basic Results from Single Point Test

Basic test results from a single-point test can be used to provide a simple and quick assessment of a building's airtightness.  The DM-2 digital gauge is capable of displaying most common calculations directly on the screen as the measurements are being made.

### 3.15.1. Air Leakage at 50 Pascal

The industry standard measurement is CFM50.  This is the airflow (in cubic feet per minute) required by the Door Fan to create a pressure difference, between the building interior and the outdoors, of

50 Pascals.  This difference is roughly equivalent to the pressure that the building experiences in a 20 mph wind.

### 3.15.2. Air Changes per hour at 50 Pa - ACH50

ACH50 is the number of complete air changes that will occur in one hour, when a building pressure of 50 Pascals is applied across the building envelope.  The value is calculated based on the volume of the enclosure, so it is a useful method of normalizing leakage rate.

### 3.15.3. Equivalent Leakage Area - EqLA 10

Equivalent leakage area 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 with reference to the outdoors.  (Discharge coefficient of 0.61)

### 3.15.4. Effective Leakage Area - EfLA 4

Effective Leakage Area calculation is defined as the area of the elliptical nozzle-shaped hole that would leak the same amount of air as the building does at a pressure of 4 Pa with reference to the outdoors.  (Discharge coefficient of 1.0)

## 3.16 Results from Multi-Point Procedure

Read Retrotec Manuals on FanTestic Software.