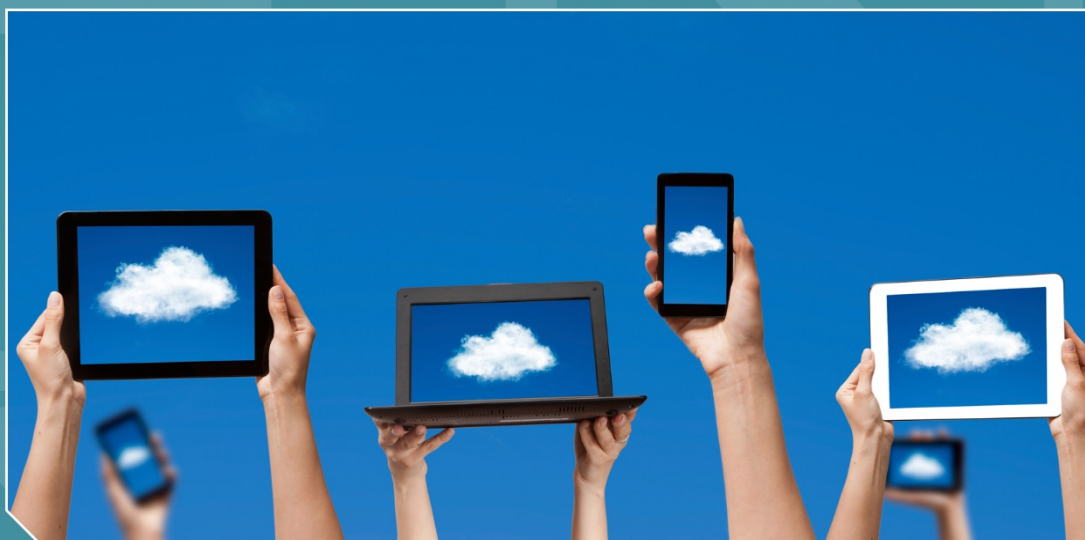


UNITEC SENS-IT



Citizen Science Operating Procedure

UniTec Sens-It Citizen Science Operating Procedure

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UniTec Sens-It



The UniTec Sens-It is a small gas-sensing device that can measure volatile organic compounds (VOCs). This sensor is used to measure VOCs in applications such as urban air quality, roadside pollution, and (solid waste) landfill monitoring. This operating procedure explains what you need to do to collect high-quality VOC data using the Sens-It for your monitoring project.

What Are VOCs?

VOCs are common pollutants in both indoor and outdoor environments. VOCs are emitted as gases from many common household and office products including paints, floor wax, cleaning supplies, cosmetics, pesticides, building materials, home furnishings, copiers and printers, permanent markers, and glues and adhesives. Automotive fuels are also made up of organic chemicals, increasing VOC concentrations near roadways and urban areas. All of these products and sources can release organic compounds during use and sometimes during storage. These VOC compounds can have both short- and long-term adverse health effects.

What You Will Need

- ❖ UniTec Sens-It
- ❖ 12 volt (V) power supply
- ❖ Data acquisition (Daq) hardware (see below)—this operating procedure assumes use of a Personal Daq/55 (IOtech, Inc., Cleveland, OH)
- ❖ Personal computer (PC) system
- ❖ USB (Universal Serial Bus) cable

Data Acquisition System

A data acquisition system measures electrical or physical conditions—such as voltage, current, temperature, and pressure—and stores the information in digital form for analysis. Typically, signals from sensors are recorded, converted to digital information, and stored by a computer. The data acquisition system therefore consists of a sensor, data acquisition and measurement hardware, and a computer with programmable software. This procedure assumes the use of an IOtech Personal Daq/55 data acquisition module connected to the UniTec Sens-It and to a PC running a Windows 95 or higher operating system. By way of example, we have also included measurements of relative humidity (RH), temperature, and pressure in this procedure. The Personal Daq/55 uses DaqView software, which you will need to install on the PC before collecting data. If you are using other data acquisition hardware, procedures should be similar, but it is recommended that you consult your data acquisition module User's Manual for details of your specific configuration.

Important Considerations

- ❖ The UniTec Sens-It is delivered already calibrated by the manufacturer. However, the UniTec Sens-It requires semi-annual (twice per year) calibration to function properly. The unit should be returned to the manufacturer for this service.
- ❖ According to the manufacturer, the UniTec Sens-It sensor is not designed for indoor use, and its use indoors could lead to unreliable response and/or loss of calibration.
- ❖ The UniTec Sens-It is 'powered-on' as soon as it is connected to the power source. To turn the unit off, simply disconnect it from the power source. The manufacturer recommends the UniTec Sens-It remain on, once operation begins, to prevent loss of calibration. If the sensor is left off for more than one day, let it run for 24 – 48 hours to stabilize.
- ❖ The manufacturer notes that vapors from silicone rubber, bitumen, and oil-based paint can interfere with normal sensor operation. Carefully assess the sensor's surrounding environment before collecting data and consider using protective housings of materials such as steel or unpainted aluminum.

Preparing the Device

Making the connections

To collect data with the UniTec Sens-It, you first need to connect the device to a 12 V DC power supply and to a data acquisition module, commonly called a data logger, which will record the measurements. This procedure uses a Daq/55 data logger. The Daq/55 uses a USB cable for data collection (Figure 1). A single cable to a PC provides high-speed communication and power to the Daq/55. Use the four colored wires, shown in Figure 2, to connect the components as shown in Figure 3.



Figure 1

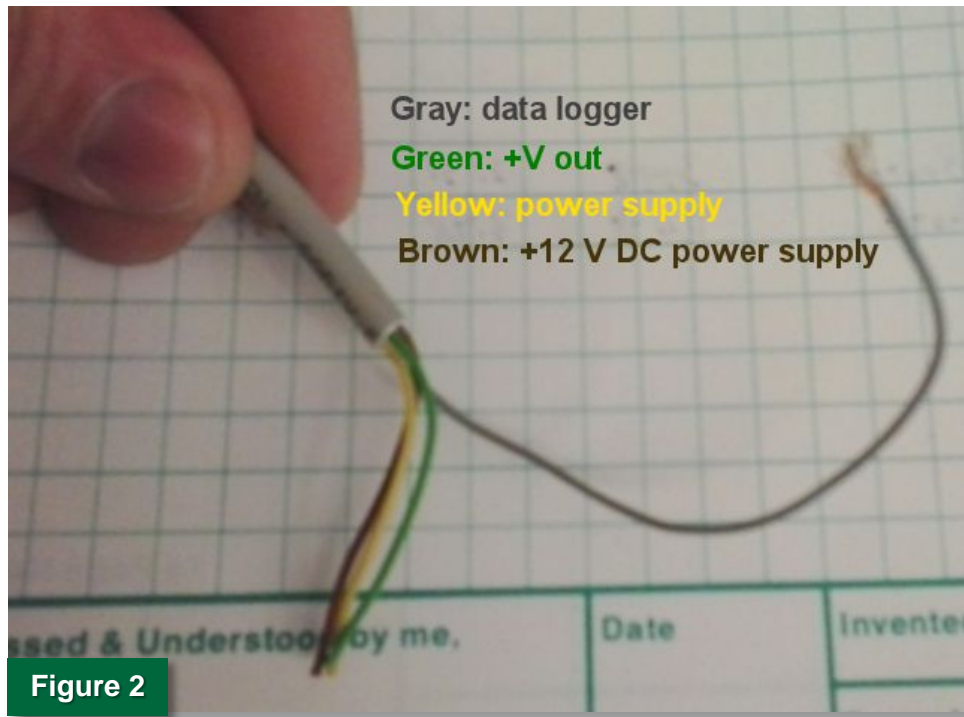


Figure 2

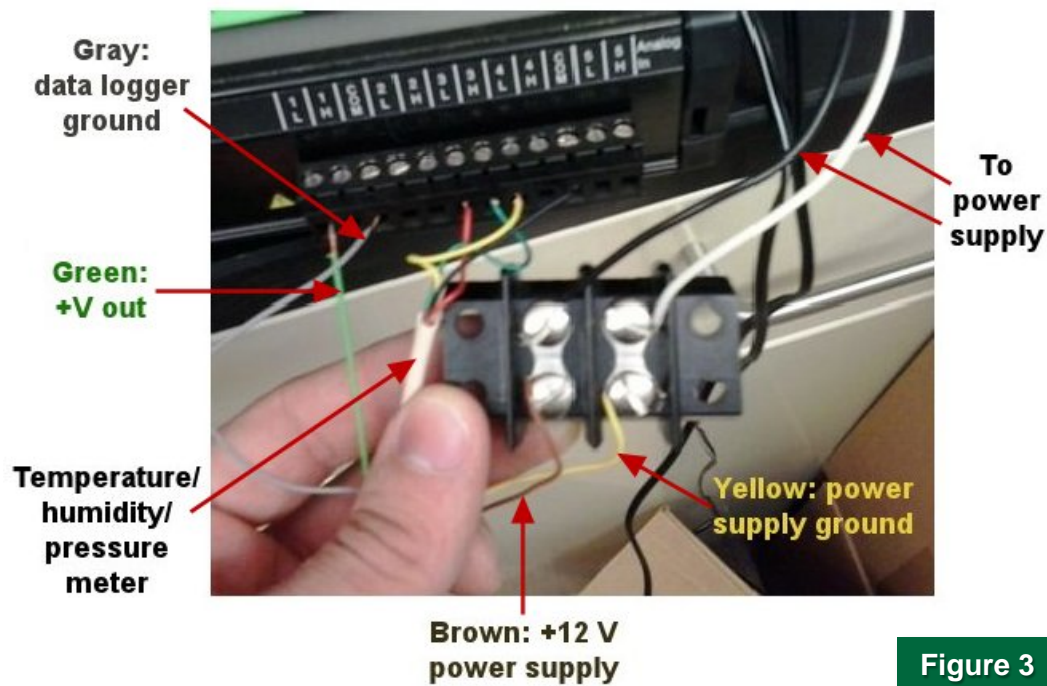


Figure 3

Installing the Software

The only software required for monitoring VOCs with the UniTec Sens-It is the Personal DaqView software that operates the Daq/55 data acquisition module. This software must be installed on a computer that meets the following requirements:

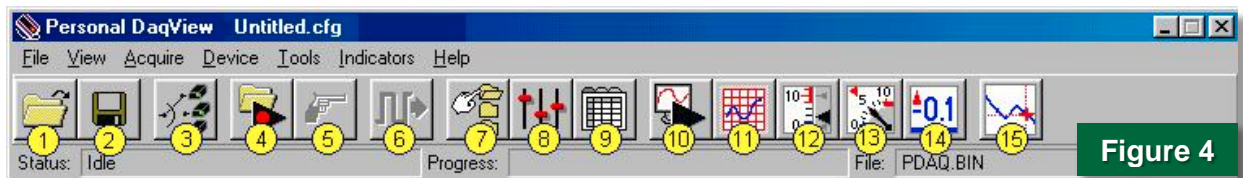
- ❖ PC with Pentium® processor and available USB port
- ❖ Microsoft Windows 95, version 4.00.950 b with USB supplement to OSR2.1, at a minimum (**Note:** Windows 98 or higher is strongly recommended)
- ❖ 16 MBytes (Megabytes) of Random Access Memory (RAM) (**Note:** 32 MBytes or greater is recommended)
- ❖ 'Energy Save' mode is disabled

Procedure: Install Software

1. Insert the Personal DaqView software CD into the PC's CD-ROM drive and wait for the PC to automatically access the CD.
2. Select '**Personal Daq Support**' from the Data Acquisition Software Master Setup screen.
3. Click '**Start Install**'.
4. When installation is complete, select the "**Exit viewing Readme file**" radio button for important information not available elsewhere.
5. Exit the program.
6. Remove the CD.
7. Shutdown the PC.

Configuring the Sampling Parameters

Sampling parameters must be specified in the Personal DaqView software before beginning data collection. In Windows, double click the '**Personal DaqView**' icon to open the software. Once the program is running, the software will automatically identify the UniTec Sens-It and bring up the main control window (Figure 4).



Procedure: Configure Channels



1. Click the '**Configure Channel Settings**' button (9) on the main control window toolbar, which will open the **Channel Configuration** window (Figure 5). (Note that the example also shows settings for humidity, temperature, and pressure.)
2. On the **Analog Input** tab, set **Scale** to **1.0** and **Offset** to **0.0** by double clicking in each field.
3. Press the **Play** button (▶) at any time during recording to update the **Reading** field in real time with the data from each channel.

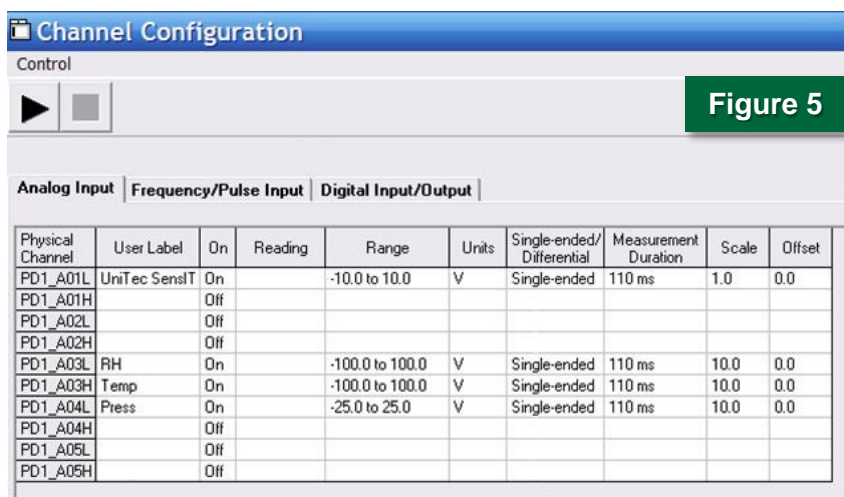


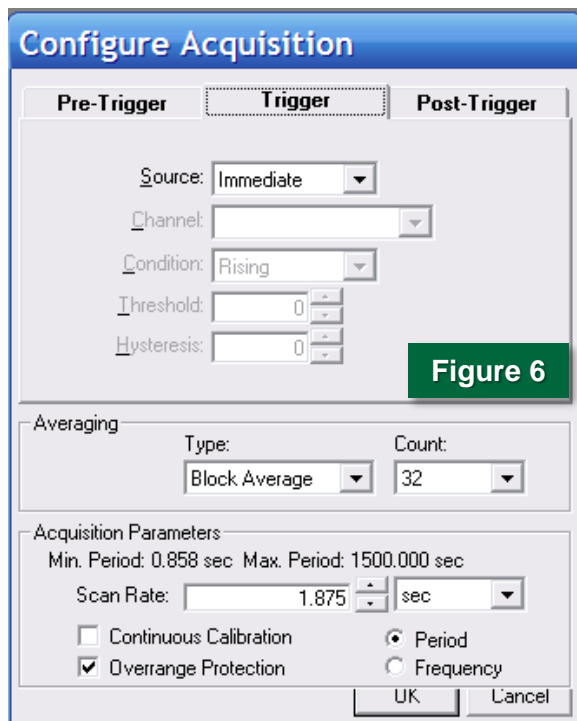
Figure 5

Procedure: Configure Data Acquisition



1. Click the '**Configure Acquisition**' button (8) on the main control window toolbar.
2. Select the '**Trigger**' tab (Figure 6) and set **Source** to **Immediate** using the pull-down menu.
3. In the **Averaging** section of the screen, use the pull-down menu to set '**Type**' to '**Block Average**' and '**Count**' to '**32**' as shown. This means that averages will be calculated and recorded for each block of 32 measurements.
4. Set '**Scan Rate**' in the '**Acquisition Parameters**' section of the same screen to '**1.875 sec**'. This will result in a text file being updated every minute with an average of 32 immediate measurements taken 1.875 seconds apart.

- Under the '**Post-Trigger**' tab (Figure 7), use the pull-down menu to set '**Stop On**' to '**Duration**'. Then set '**Duration**' to '**1440 Scans**'. This will create a text file that stops updating after 1440, 1-min measurements, or 24 hours.



Configure Acquisition

Pre-Trigger **Trigger** **Post-Trigger**

Source: Immediate

Channel:

Condition: Rising

Threshold: 0

Hysteresis: 0

Figure 6

Averaging

Type: Block Average

Count: 32

Acquisition Parameters

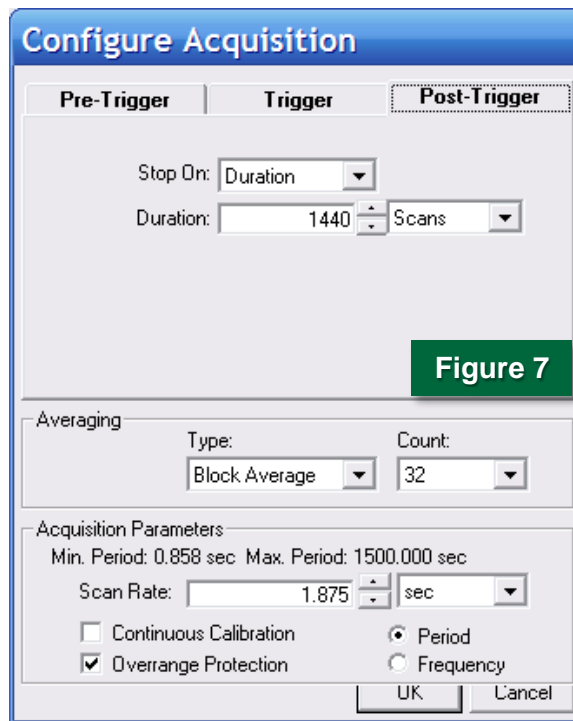
Min. Period: 0.858 sec Max. Period: 1500.000 sec

Scan Rate: 1.875 sec

☐ Continuous Calibration ☒ Period

☒ Overrange Protection ☐ Frequency

UK Cancel



Configure Acquisition

Pre-Trigger **Trigger** **Post-Trigger**

Stop On: Duration

Duration: 1440 Scans

Figure 7

Averaging

Type: Block Average

Count: 32

Acquisition Parameters

Min. Period: 0.858 sec Max. Period: 1500.000 sec

Scan Rate: 1.875 sec

☐ Continuous Calibration ☒ Period

☒ Overrange Protection ☐ Frequency

UK Cancel

Procedure: Configure Data Destination



- Click the '**Configure Data Destination**' button (7) on the main control toolbar.
- In the **Configure Data Destination** window (Figure 8), assign a **Folder** where you want the data to be stored.
- Create a **File** name to contain the data.
- Use the '**Auto Rearm**' feature to create a sequence of text files so that recording of data will continue with the creation of a new file after the **Stop On** duration set in step 5 of **Configure Acquisition** has been reached. Each file created using Auto Rearm will have a number appended to the end of the file name that indicates its position in the sequence as shown in Figure 8.

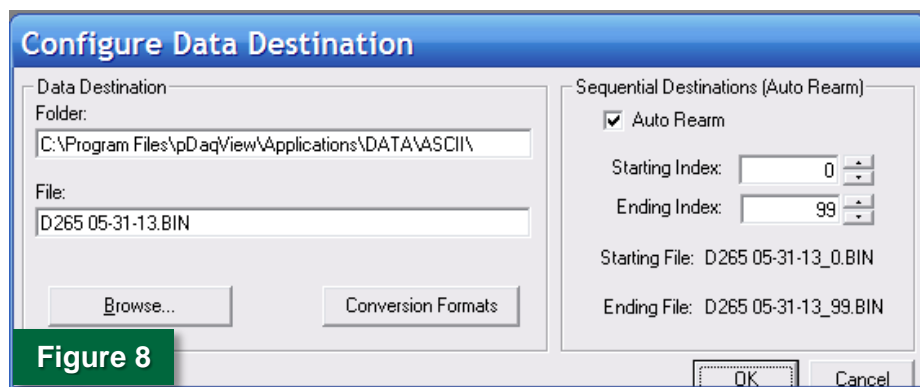


Figure 8

Routine Data Collection

Once the data logger is properly connected to the PC and the UniTec Sens-It, the system is ready to begin collecting data.


Recording Data

The Personal Daq/55 records the signals received from the UniTec Sens-It as voltage (V) in a text file that can be transferred easily to spreadsheet software for simple processing. The Daq/55 records time, date, and the output of any sensors connected to it, including VOC concentration from the UniTec Sens-It, measured in volts, as 1-min averages (Figure 9). The values for each property (e.g., time, date, etc.) are separated, or 'delimited', by tabs. Any non-alphanumeric character can be used to separate the values, but the most common delimiters are the comma, tab, and colon. Most spreadsheet programs are able to read data from a text file in a delimited format. If you are using a data acquisition module other than the Daq/55, consult the User's Manual for the delimiter character used by your system to separate data.

Time	Date	UniTecSensIT V	RH V	Temp V	Pressure V
13:19:17	4/7/2014	3.984241e-001	4.998264e+001	2.537650e+001	5.752491e-001
13:20:17	4/7/2014	3.964681e-001	5.000421e+001	2.537579e+001	5.742620e-001
13:21:17	4/7/2014	3.938829e-001	4.999302e+001	2.537883e+001	5.768103e-001
13:22:17	4/7/2014	3.921506e-001	4.996727e+001	2.539292e+001	5.745931e-001
13:23:17	4/7/2014	3.911617e-001	4.993842e+001	2.539864e+001	5.747180e-001
13:24:17	4/7/2014	3.904738e-001	4.995338e+001	2.538865e+001	5.746834e-001
13:25:17	4/7/2014	3.897746e-001	4.997390e+001	2.537875e+001	5.744178e-001
13:26:17	4/7/2014	3.894053e-001	4.998032e+001	2.537827e+001	5.746856e-001
13:27:17	4/7/2014	3.885799e-001	4.997795e+001	2.537798e+001	5.750498e-001
13:28:17	4/7/2014	3.885727e-001	4.999352e+001	2.536587e+001	5.748873e-001
13:29:17	4/7/2014	3.877690e-001	5.000674e+001	2.536261e+001	5.747119e-001
13:30:17	4/7/2014	3.874370e-001	5.000388e+001	2.535847e+001	5.750039e-001
13:31:17	4/7/2014	3.873967e-001	5.001428e+001	2.535662e+001	5.751761e-001
13:32:17	4/7/2014	3.876912e-001	4.998433e+001	2.536291e+001	5.749873e-001
13:33:17	4/7/2014	3.883863e-001	5.000031e+001	2.535519e+001	5.753161e-001
13:34:17	4/7/2014	3.885810e-001	5.000215e+001	2.535622e+001	5.751333e-001
13:35:17	4/7/2014	3.888131e-001	5.000776e+001	2.535042e+001	5.750768e-001

Figure 9

Procedure: Acquire Data

1. In Windows, double click the '**Personal DaqView**' software icon to open the software.
2. Using the main control toolbar, ensure all sampling parameters are properly configured for channel, acquisition, and data destination as described above.
3. Click the record button () on the toolbar to begin recording data.

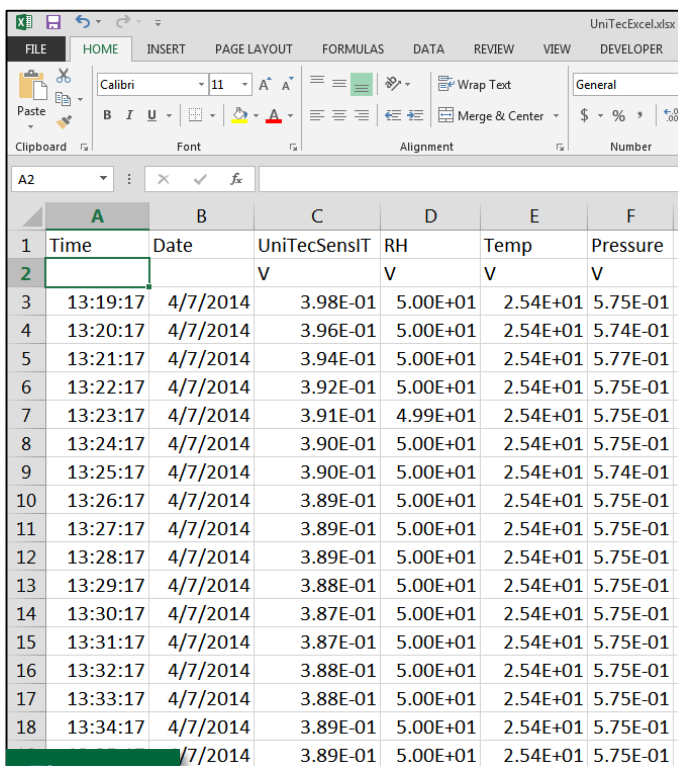
Data acquisition will continue until the sequence specified using **Auto Rearm** is complete.

Processing Data

To process the data collected from the UniTec Sens-It, you will need to transfer the text file created by the data logger into a spreadsheet. When using the Daq/55, data are stored as tab-delimited text files that can be imported into a spreadsheet. We have assumed the use of Microsoft Excel spreadsheet software for this procedure.

Procedure: Process Data

1. Open a new Microsoft Excel spreadsheet and select **Data > Get External Data > From Text**.
2. When prompted, use Windows Explorer to navigate to the folder containing the text file previously specified in the '**Configure Data Destination**' window.
3. When prompted, in the next screens select '**Delimited**' and '**Tab-delimited**'.
4. Press '**Finish**' to display the data in columns in the Excel spreadsheet (Figure 10).



	A	B	C	D	E	F
1	Time	Date	UniTecSensIT	RH	Temp	Pressure
2			V	V	V	V
3	13:19:17	4/7/2014	3.98E-01	5.00E+01	2.54E+01	5.75E-01
4	13:20:17	4/7/2014	3.96E-01	5.00E+01	2.54E+01	5.74E-01
5	13:21:17	4/7/2014	3.94E-01	5.00E+01	2.54E+01	5.77E-01
6	13:22:17	4/7/2014	3.92E-01	5.00E+01	2.54E+01	5.75E-01
7	13:23:17	4/7/2014	3.91E-01	4.99E+01	2.54E+01	5.75E-01
8	13:24:17	4/7/2014	3.90E-01	5.00E+01	2.54E+01	5.75E-01
9	13:25:17	4/7/2014	3.90E-01	5.00E+01	2.54E+01	5.74E-01
10	13:26:17	4/7/2014	3.89E-01	5.00E+01	2.54E+01	5.75E-01
11	13:27:17	4/7/2014	3.89E-01	5.00E+01	2.54E+01	5.75E-01
12	13:28:17	4/7/2014	3.89E-01	5.00E+01	2.54E+01	5.75E-01
13	13:29:17	4/7/2014	3.88E-01	5.00E+01	2.54E+01	5.75E-01
14	13:30:17	4/7/2014	3.87E-01	5.00E+01	2.54E+01	5.75E-01
15	13:31:17	4/7/2014	3.87E-01	5.00E+01	2.54E+01	5.75E-01
16	13:32:17	4/7/2014	3.88E-01	5.00E+01	2.54E+01	5.75E-01
17	13:33:17	4/7/2014	3.88E-01	5.00E+01	2.54E+01	5.75E-01
18	13:34:17	4/7/2014	3.89E-01	5.00E+01	2.54E+01	5.75E-01
		7/2014	3.89E-01	5.00E+01	2.54E+01	5.75E-01

Figure 10

For Additional Help

Sens-It Installation Guide, UniTec Srl, www.unitec-srl.com, last accessed May 13, 2015.

Personal Daq/50 Series: USB Data Acquisition Modules, User's Manual, IOtech, Inc., 25971 Cannon Road, Cleveland, OH 44146-1833, http://www.mccdaq.com/PDFs/manuals/personal_daq50_series.pdf, last accessed May 13, 2015.

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