PressureWEB Leak Location Tool Operation Instructions

Application Description

The PressureWEB™ Leak Location Tool is a web browser application that is available with PressureWEB Version 3.0 and higher. Because it is included with the PressureMAP/PressureWEB installation media and installed automatically with PressureWEB, it does not require separate user installation and configuration.

The Leak Location Tool uses conventional graphing methods to determine the location of a leak or multiple leaks in a pressurized cable. You can use the application to plot a graph using footage and pressure reading measurements (the default setting) or pneumatic resistance and pressure reading measurements. The majority of the instructions and descriptions below address the more common method of using pressure readings and footage measurements. An explanation of how to use the second method is described at the end of this document.

Preliminary Graphing Requirements

Field Information

In order to use the Leak Location Tool effectively and achieve the greatest accuracy, the following prerequisite field information is required:

1. The general location of the leak must be known. To determine this, four to six pressure readings should be taken. In a single fed cable, pressure drops to the point of a leak and, from there, remains constant to the end of the pneumatic section—assuming there is only one leak in the cable section. In a dual feed system, cable pressures will begin to rise once the leak has been passed.

2. Cables in the area of the leak must be pneumatically separate from one another. Interlacing in the suspected leak area affects the pneumatic resistance of the cable and will distort the pressure picture portrayed in the graph.

3. The size, length and gauge of the cable section in question must be determined. The response of a pneumatic section to air flow and air pressure is affected by any change in the pneumatic resistance of the cable. If the section of cable to be graphed changes in pneumatic resistance, the resistance versus pressure method must be used to plot the leak.

4. Accurate pressure readings are needed at all test valve locations near the leak. Ideally, measurements should be taken within 1/3 to one mile of the

suspected leak. The smaller the search area, the easier it is to pinpoint the location of the leak.

5. Valve-to-valve distance measurements should be taken between pressure readings. The wall-to-wall distance between utility holes will not alone produce the desired accuracy—the footage inside the utility holes should also be added on.

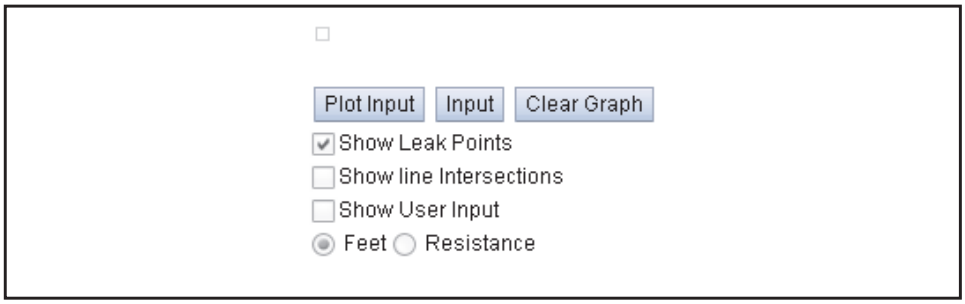
How the Leak Location Tool Works

Test Run

Before you use the Leak Location Tool to graph a leak from data obtained from the field, you may want to spend a few minutes becoming familiar with how it works. As you will see, it's a simple and straightforward graphing application that provides quick and consistent results.

Procedure:

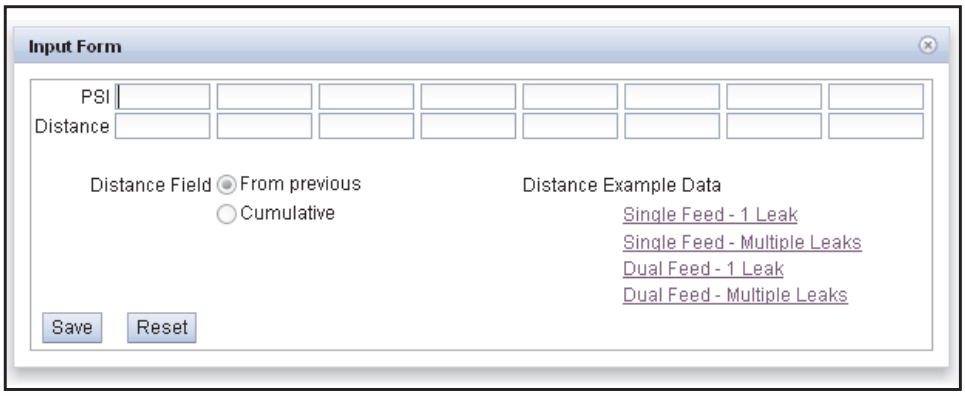
1. Launch PressureWEB and place your mouse pointer on the *Tools* link located on PressureWEB's main navigation bar. Then select the *Leak Location Tool* link from the submenu displayed. When the application loads, PressureWEB's active browser window is replaced with a new screen containing the Leak Location Tool's simple Control Menu (Sample 1). There are three blue-colored activation buttons provided: *Plot Input*, *Input* and *Clear Graph*. The check boxes and radio buttons located below them are used after you have entered your graphing information, as explained below.



Sample 1: Control Menu

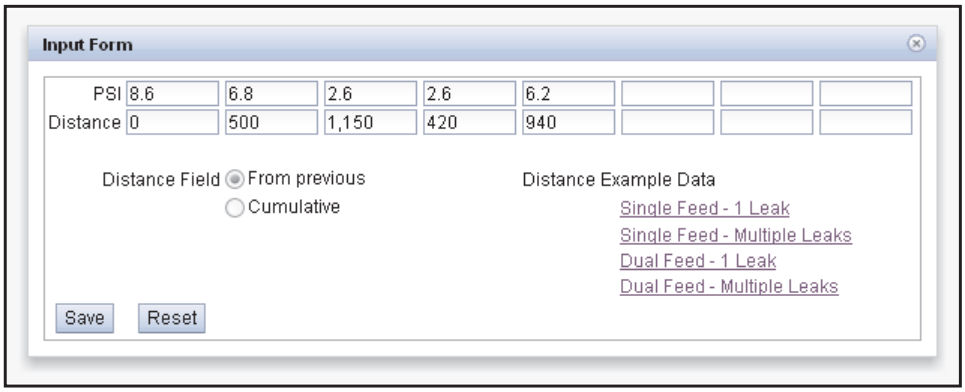
Viewing a Sample Graph

2. To get a feel for how the graphing application works, you may want to look at a sample or two. Click the *Input* button on the Control Menu to generate the application's Input Form (Sample 2). Notice that this moveable window contains empty cells for inputting PSI and Distance information, plus options for specifying how the distance information will be calculated: distance between measurements (from previous) or cumulative distance. Located to the right of these Distance Field radio buttons are four hyperlinks that provide example data for four types of leaks.



Sample 2: Input Form

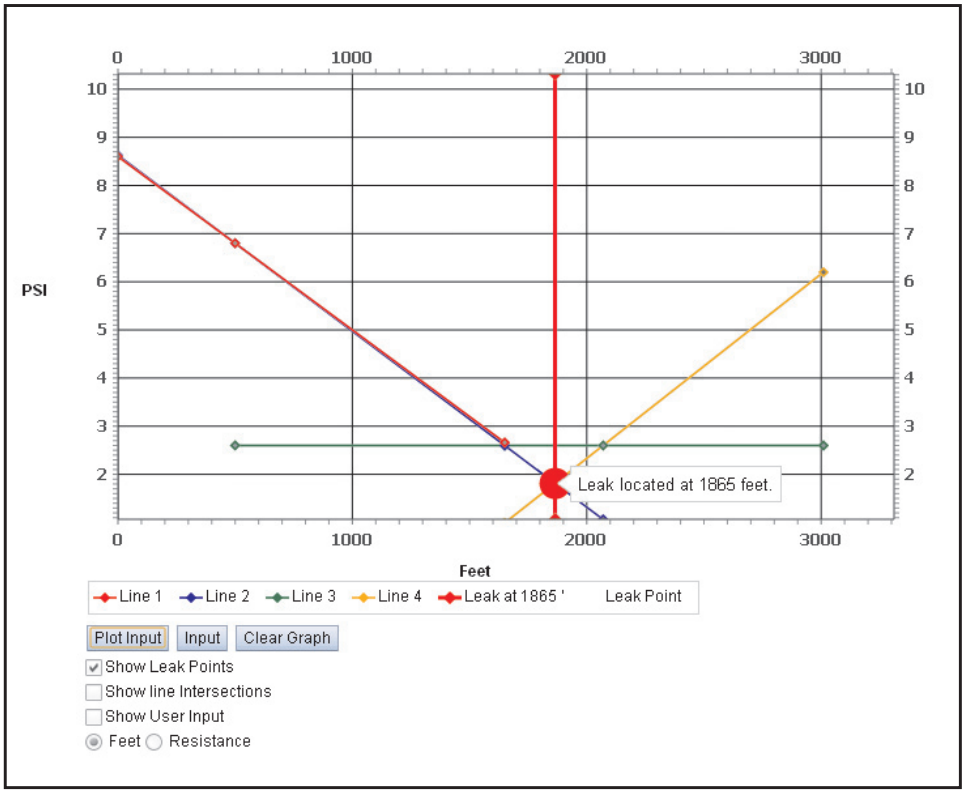
3. Click one of the links and notice that the PSI and Distance cells become populated with sample data for the type of leak selected.



Sample 3: Input Form with Data

4. Press the *Save* button in the lower left portion of the Input Form. This action stores the pressure and distance information and closes the form.

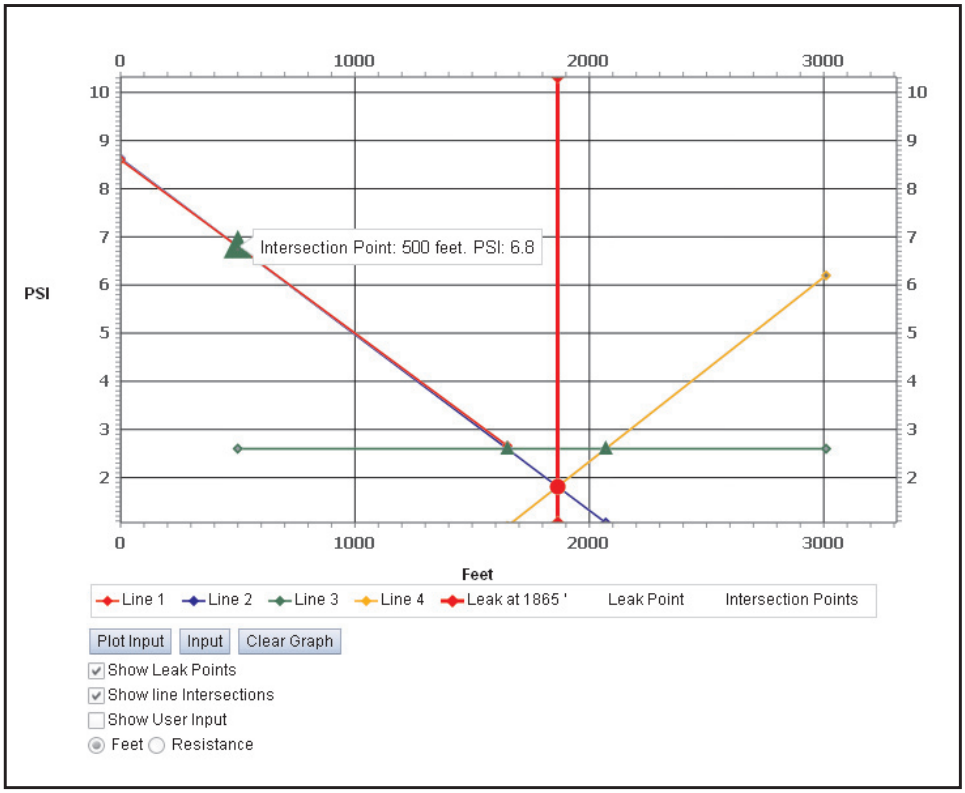
5. Next click the *Plot Input* button. Notice that a graph displays at the top left portion of the browser screen. A color legend is provided directly below the graph to help you identify the plotted lines and leak(s) locations (Sample 4).



Sample 4: Graph Sample, Dual Feed Section, One Leak

In the Dual Feed - 1 Leak selection, for example, there are four lines used to draw the graph, plus a slightly thicker vertical red line, which indicates the position of the leak on the graph. If you place your mouse pointer on the red circle located on the vertical line, an information box displays which indicates how far the leak is, in feet, from the first measurement point. The legend box below the graph also provides this information, plus color coding for the lines used to plot the leak location.

Note: You can also choose to view line intersection data on your graph. Simply click the *Show Line Intersections* check box in the Control Menu and then click *Plot Input*. The graph will be redrawn, the intersection points will change to solid green triangles, and the legend box will indicate that intersection points have been enabled (Sample 5). Now when you place your mouse pointer over one of the intersection points, an information box will appear and display both the cumulative distance in feet from the zero distance reference and the appropriate psi value.



Sample 5: Dual Feed Section, One Leak, Intersection Points Displayed

When you are finished viewing the sample graph, you can check any of the other samples listed by: 1) clicking the *Input* button on the Control Menu to display the Input Form; 2) clicking the desired hyperlink (notice that, when you do, the data inside the PSI and Distance boxes changes); 3) selecting the *Save* button; and, 4) clicking the *Plot Input* button to generate the new output.

Plotting a Leak Using PSI and Footage

Now that you have an idea of how the graphing application looks and works, you can get to work plotting a leak. Make sure that you have access to the required distance and pressure measurements taken in the field. Once this information is available, follow the simple steps listed below:

Procedure:

1. Launch the application as described in step 1 above; or, if you have been working with the application, simply click the *Input* button to generate the Input Form. If the PSI and Distance data fields contain information, press *Reset*. This will clear any previous pressure readings and distance information.

Type of Footage Measurement

2. Select the method you used when taking distance measurements. If your recorded footage calculations are cumulative—starting from the first reading location to the end—click the *Cumulative* radio button on the form. If you recorded valve-to-valve distances along the way, make sure the *From previous* button is checked.

3. Click inside the data field box closest to the PSI heading and enter your first pressure reading. The application accepts readings up to hundredths of an inch (example, 7.55 psi).

4. Enter zero (0) in the Distance box directly below. The first distance entry (starting point) will always be zero.

5. Continue entering pressure readings and distance measurements, making sure that the information you transcribe from your field notes is accurate.

6. When you have finished, press the *Save* button located on the bottom of the form.

7. Now you are ready to plot your pressure reading information. Select the *Plot Input* button to generate a graph for the cable section. The graph will identify all of the leaks in the section, if applicable, and provide distance information for each.

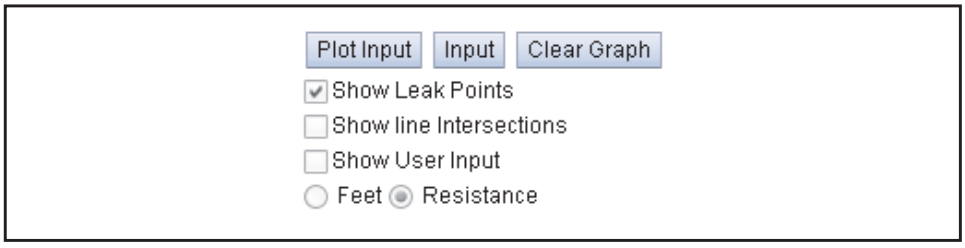
Plotting a Leak Using PSI and Resistance

Required Information

The second graphing method can be used when the leaking cable changes pneumatic resistance anywhere between the first and last pressure measurement points. When taking pressure readings and distance measurements at points along the cable, you will also need to identify and record the type of conductor insulation, conductor gauge and number of pairs in the sheath. This information, along with the PSI and distance measurements, can be inputted into the Leak Location Tool to find the location of the leak.

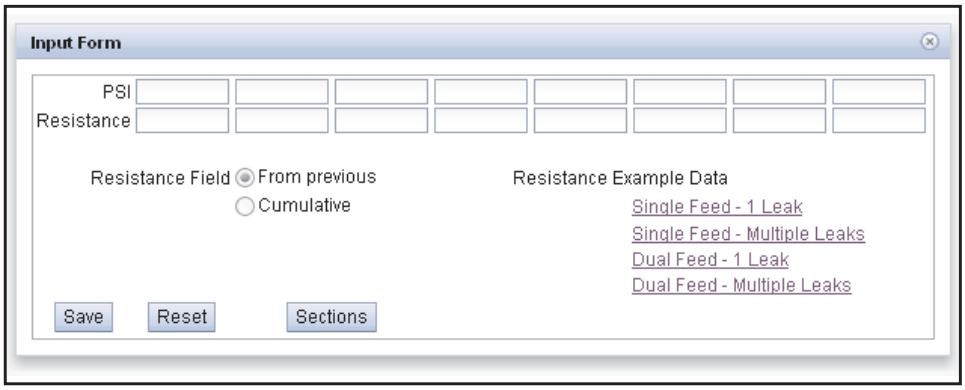
Procedure:

1. Launch the application, as described in the preceding sections, and use the mouse pointer to click the *Resistance* radio button at the bottom right of the Control Menu (see below).



Sample 1: Control Menu

2. Next click on the *Input* button. This action produces the Input Form shown in Sample 7.



Sample 7: Input Form (for PSI/Resistance Graphing)

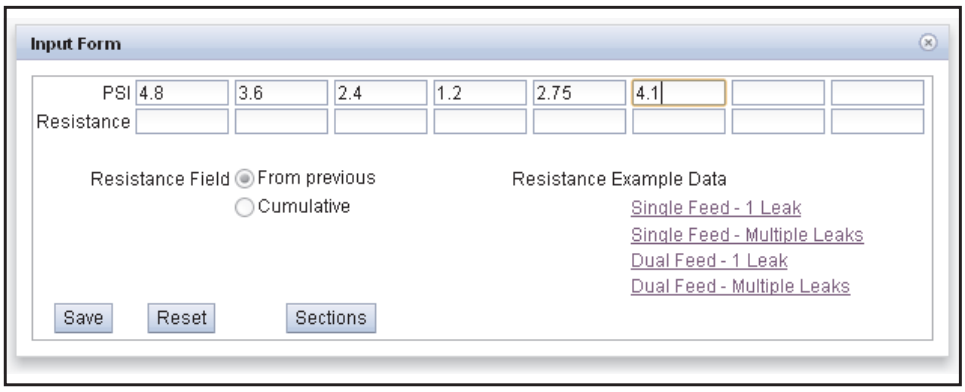
Notice that this form differs slightly from the one used for the PSI / Footage graphing method. It includes a row of input boxes for pneumatic resistance information rather than footage information. It also includes a *Sections* control button.

Graphing Pneumatic Resistance Per Section

3. The simplest method of graphing by pneumatic resistance is to use resistance values that are calculated between successive pressure measurement points (not cumulative resistance). This method is the application's default setting (*Resistance Field,* From previous).

4. One method of entering graphing data into the application is to enter all of the recorded pressure readings first, followed by the pneumatic resistance information. For example, click inside the data box closest to the *PSI* heading on the top row of the form, and enter the first pressure reading taken on the cable. Continue inputting the other recorded PSI readings in succession in the next available data boxes (see sample below).

   Please note that the application accepts readings up to hundredths of an inch (example, 6.55 psi).

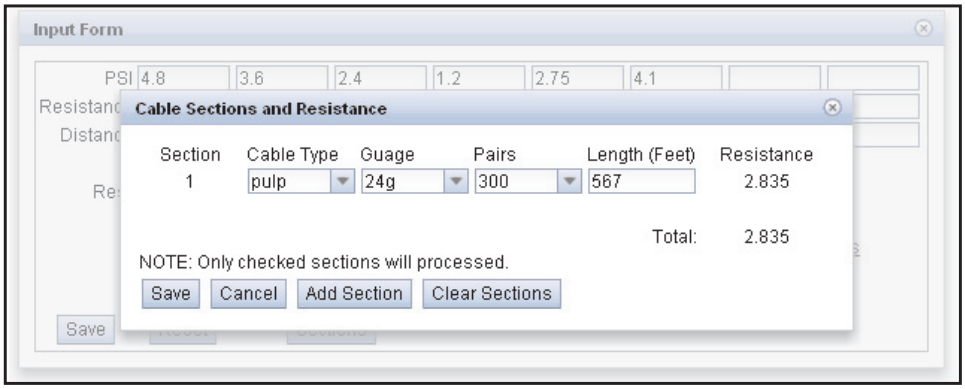


Sample 8: Input Form (with PSI Readings)

5. Now enter the pneumatic resistance information for the graph in the second row of data boxes. Start by entering zero in the first box located next to the *Resistance* title. The first pneumatic resistance entry (starting point) will always be zero. Please note that the application does not accept a whole number entry (0) here; you will need to enter 0.0 to avoid an error warning.

   To make it easy to determine the pneumatic resistance values of the remaining cable sections, the Leak Location Tool includes another input form or calculation box, called the Cable Section and Resistance Form (Sample 9).

6. Click on the Input Form's blue *Sections* button to generate the Cable Section and Resistance Form. As you can see in the example below, this form makes it possible for you to select the Cable Type, Gauge and Number of Pairs for each section. You can also specify the distance (footage) of the cable section.



Sample 9: Cable Sections and Resistance Form

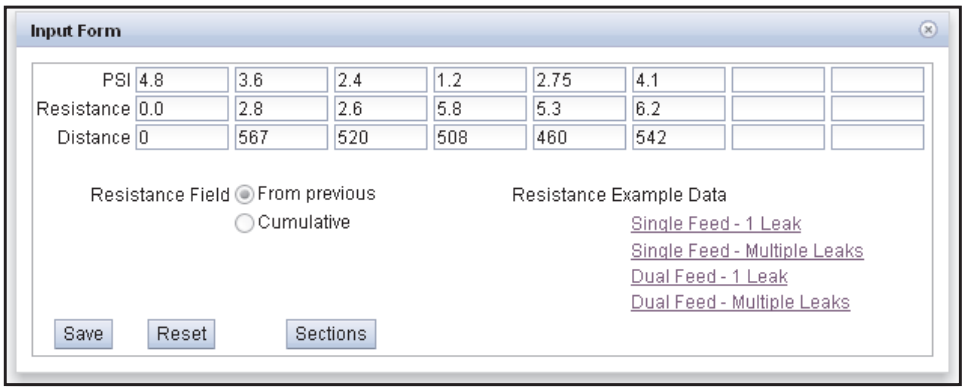
Enter Cable Type, Gauge, # of Pairs, and Length

7. Use the form's drop down menus to select each cable component; then type the length in feet between pressure readings in the appropriate box. After you enter this information, the application displays the pneumatic resistance value for the specified length of cable (in this case, 2.835).

   A few things happen when you use this calculation tool: 1) as you enter a value in the *Length (Feet)* data box, the original Input Form is populated with a third row of data boxes, labeled *Distance*; and 2) both the Input Form and the application's Control Menu become inactive until you save your data or cancel your entries using the two buttons in the bottom left of the screen. In either case, it will be necessary to manually close the Cable Section Resistance Calculation Form before you can transpose the calculated data into the Input Form.

8. At this point you can save your Section 1 calculated resistance value and press the X located in the upper right corner of the form to close it, or you can continue to calculate the pneumatic resistance values of the remaining sections before you save your entries. The quickest method is to add the other sections before you close the form.

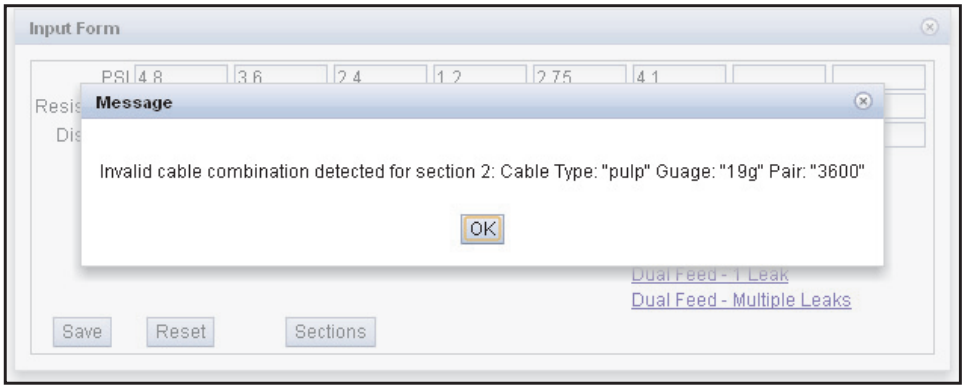
Press the *Add Section* button at the bottom of the form to generate a row of data boxes for Section 2. Select the cable information from the drop down menus and type the distance information. Repeat this procedure for all remaining cable sections (Sample 10).



Sample 10: Cable Sections and Resistance Form (Multiple Entries)

Important: Make sure that you do not mistakenly press the *Clear Selections* button. Doing so will delete any entries and calculations that have been made. The *Clear Selection* button is used only when you wish to start over and enter new information.

9. When you have finished entering the necessary data, press the *Save* button to record your information. Please note that if your data entry is incorrect or incompatible with the parameters of the application, you will see a message similar to the one below.



Sample 11: Sample Warning Message

10. If this case, press *OK*, make the necessary correction(s) and then re-save the information. When you do the Cable Section Resistance Calculation Form disappears, and the Input Form become active.

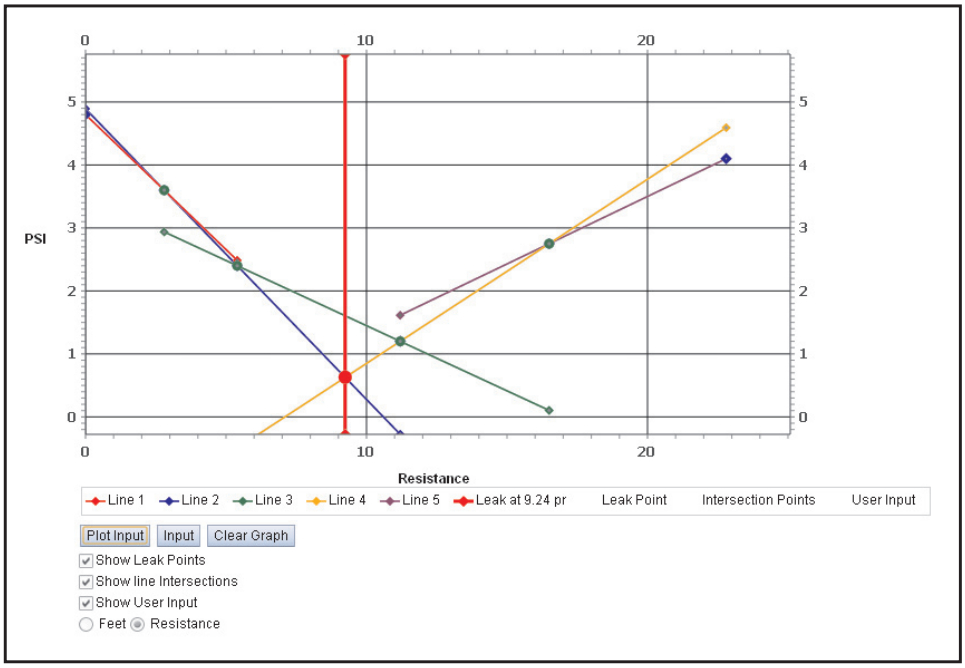
    Note: In this version of the Leak Location Tool, the distance and resistance information from the Cable Section Resistance Calculation Form does not automatically populate the corresponding data boxes on the Input Form. Consequently, you will need to enter this information manually.

11. Enter the pneumatic resistance and distance information carefully into the appropriate boxes on the Input Form. To reference the calculated values from the Cable Sections and Resistance Form, toggle between forms by: a) pressing the *Sections* button on the Input Form to display the calculation information, and b) cancelling the Cable Section Resistance Calculation Form (pressing corner X button).

12. When you have finished updating the Input Form, double check it for accuracy, make corrections if necessary, and save your data by clicking the *Save* button. After you select *Save*, the Input Form will disappear, and you can plot the information on a graph.

Plotting the Graph

13. Select the *Plot Input* button, and a graph with your results will display (similar to what is shown below).



Sample 12: Resistance/PSI Graph, Dual Feed Section, One Leak

As you can see in the example above, the leak is located in the third section of cable between the 2.4 psi and 1.2 psi reading points. This is the section connected by the green intersection line. The total pneumatic resistance at the projected leak location is 9.24.

Find Manual Conversion

This value can be converted to a distance measurement by: 1) adding the calculated pneumatic resistance of the first two sections (the 3-24 pulp cable sections), 2) then dividing that sum by the total pneumatic resistance for the second cable type (the 2-26 pulp cable), and 3) multiplying the result by 1,000.

In the example above the first two sections have calculated pneumatic resistance values of 2.8 and 2.6 (Sample 10). The second cable type, the 2-26 pulp cable, has a pneumatic resistance value per 1,000 feet of 11.5. This is enough information to calculate the position of the leak between reading points 3 and 4.

Calculation:

1) $2.8 + 2.6 = 5.4$

2) $5.4 \div 11.5 \times 1{,}000 = 469.565217$

In this graph the leak is located 469.5 feet away from the third pressure measurement location, or approximately 38.5 feet from the fourth measurement point.