Lesson 10
Practicing Monitoring via the Vehicle Radiator

This lesson will use the Vehicle Radiator to expand a test database, automatically record desired data onto a spreadsheet and move the results to Word™. It consists of a pre-lab and four labs.

Lesson 10 Pre-lab Summary

The following are described in the Lesson 10 Pre-lab. See Appendix E, page E-61.

- The Dynamic I/O Automation Server
- ActiveX Automation References
- Dialog Information

As noted in Lesson 1, Appendix B includes a cross-reference to each of these items, and to all objects and subprograms in the labs of this and later lessons.

Overview

Lab 10.1 Expanding a Vehicle Radiator Test Database
This lab will show you how to monitor temperature and pressure values while simultaneously computing mean, median, mode, variance, standard deviation, and rms values of both Vehicle Radiator parameters.

Lab 10.2 – Preparing a Vehicle Radiator Three-Column Spreadsheet
This lab will show you how to send (transfer) VEE data from your Vehicle Radiator program to Microsoft Excel™; record parameter identification in one column; and record temperature and pressure readings in two other columns.

Lab 10.3 – Using Excel™ to Document Six Sequential Vehicle Radiator Tests
This lab will show you how to send six sets of sequential tests from your Vehicle Radiator program to a single Excel™ spreadsheet.

Lab 10.4 – Moving Vehicle Radiator Information from Excel™ to Word™
This lab will show you how to copy and paste a VEE Pro/ Excel™ spreadsheet with a date & time stamp, send a graph of the temperature and pressure waveform, and add text to a Microsoft Word™ document.

Note: Review draft of individual student projects as noted in To the Instructor (page xv).

Lab 10.1 – Expanding a Vehicle Radiator Test Database

This lab will show you how to monitor temperature and pressure values while simultaneously computing mean, median, mode, variance, standard deviation, and rms values of both Vehicle Radiator parameters.

1. Clear your Work Area, deselect the Program Explorer, and maximize Main.

Determining maximum and minimum test values automatically

2. Open LAB6-4; Save As… LAB 10-1 immediately.
3. Change the Temperature object title to Temp Formulas.
4. Add extra output terminals D, E, F, and G to Temp Formulas.
5. Change the Temp Formulas expression to read:

   ```
   B=mean(A);
   C=median(A);
   D=mode(A);
   E=vari(A);
   F=sdev(A);
   G=rms(A)
   ```

   Note: Remember to enter semicolons (;) at the end of each line.
   The semicolon is optional for the last line.
6. Clone Temp sdev five times; change all Properties descriptions to agree with Figure 10.1.
   Note: You may need to move the entire program to the left so you can place the cloned objects of step 5 to the right. This movement is performed by clicking on the Work Area and moving the entire Work Area to the left.

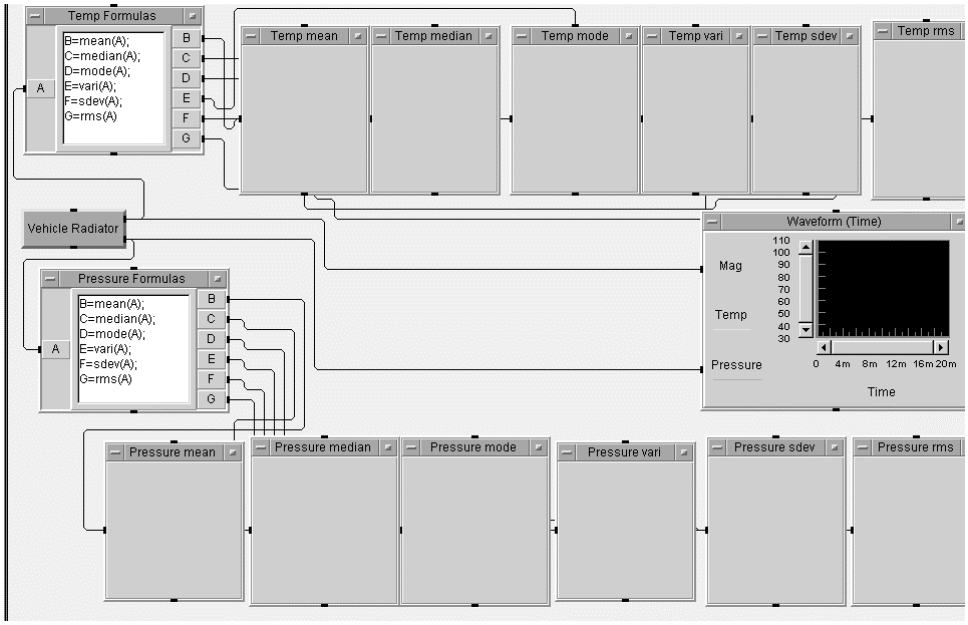


Figure 10.1. The Lab 10.1 program layout

7. Connect the six AlphaNumeric displays to their appropriate Temp Formulas output pins.
8. Delete the Pressure object.
9. Clone Temp Formulas; place it below Vehicle Radiator; change its name to Pressure Formulas.
10. Connect Pressure Formulas to the lower output pin of Vehicle Radiator.
11. Delete one Pressure AlphaNumeric display; clone the remaining object five times.
12. Label these six displays as shown in Figure 10.1; connect them to their appropriate Pressure Formulas output pins.
13. Shrink Waveform (Time) to fit between the displays as shown in Figure 10.1.
14. Save your program again.

◊ 15. Run your program several times; it should look like Figure 10.2.

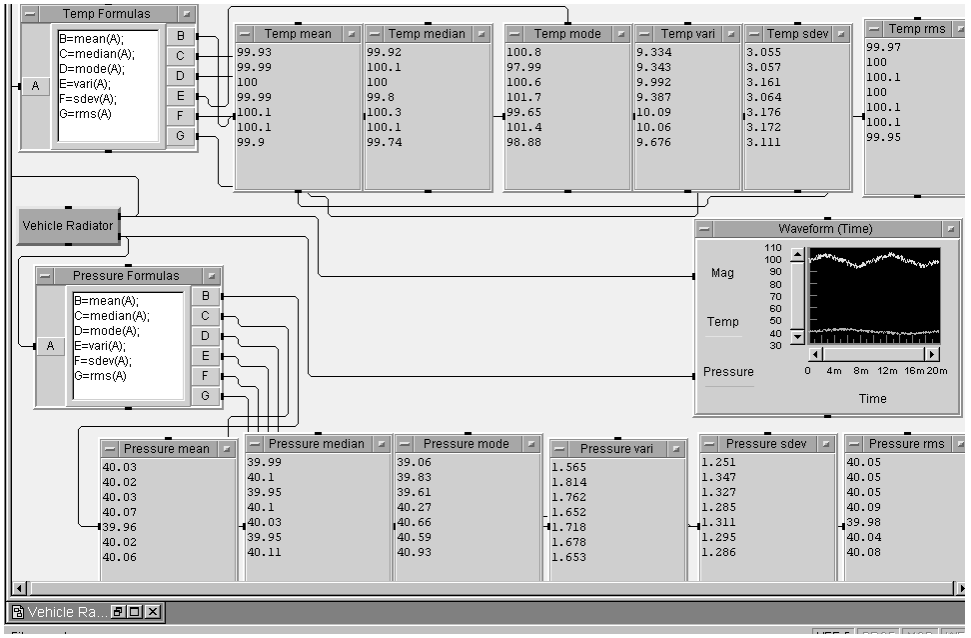


Figure 10.2. The Lab 10.1 program after several runs

16. Open the Vehicle Radiator UserObject.

◊ 17. Run your program several times with different Temp Noise Gen amplitude values and Pressure Noise Gen amplitude values by a factor of at least five; return the Vehicle Radiator UserObject to an icon; examine the change in values of the statistical parameters.

18. Close your program without saving it; open LAB10-1 again.

    Note: This will clear all previous runs and Vehicle Radiator noise settings and test runs. This is a valuable fact that will be useful to you as you change parameters that you do not need to compare with previous settings. On the other hand, changing amplitude and other values and then running the program again without closing allows you to compare values that you recorded with previous settings.

Lab 10.2 – Preparing a Vehicle Radiator Three-Column Spreadsheet

This lab will show you how to send (transfer) VEE data from your Vehicle Radiator program to Microsoft Excel™ via globals, to record parameter identification in one column, and temperature and pressure readings in two other columns that will match the parameter-identification column.

1. Clear your Work Area, deselect the Program Explorer, and maximize Main.

Preparing and transferring data to a multi-column Excel™ spreadsheet

2. Open LAB10-1; Save As… LAB10-2 immediately.
3. Cut all six temperature alphanumeric displays; cut all six pressure alphanumeric displays.
4. Select Menu Bar = > Device => UserFunction; change its name to globals.
5. Open Lab9-2 with Lab10-2 remaining open; copy the content of globals, which is the four Declare Variables icons (Declare sheet, Declare app, Declare range, Declare window); paste these four icons into the Lab10-2 globals icon; close Lab9-2.
6. Size the UserFunction globals; click on the "_" button to place it under the Main window; it will appear next to Vehicle Ra… which was minimized in LAB10-1.
7. Select Menu Bar => Device => Formula; change its name to Set up Excel Worksheet; delete its input and output pins.
8. Type the following formula into the Set up Excel Worksheet expression:

```
set sheet =CreateObject("Excel.Sheet").worksheets(1);
set app = sheet.application;
app.visible =1;
set window =app.windows(1);
window.caption = "Vehicle Radiator Test Results"
```

9. Select Menu Bar => Device => Formula; change its name to Fill in Parameters and delete is input and output pins.
10. Type the following formula into the Fill in Parameters expression:

```
sheet.cells(1,1) ="Statistic";
sheet.cells(2,1) ="mean";
sheet.cells(3,1) ="median";
sheet.cells(4,1) ="mode";
sheet.cells(5,1) ="vari";
sheet.cells(6,1) ="sdev";
sheet.cells(7,1)="rms";
sheet.cells(8,1)="date";
sheet.cells(9,1)="time"
```

11. Select Menu Bar => Device => Call; change the white-space name to Globals; connect the bottom (sequence) pin of "Call globals" to the top (sequence) pin of "Set up Excel Worksheet".
12. Connect the sequence output (bottom) pin of "Set up Excel Worksheet" to the sequence input (top) pin of "Fill in Parameters".
13. Select Menu Bar => Device => Formula; change its name to Fill in Cells; Temp.
14. Add eight Data Input terminals to Fill in Cells; Temp; change the input terminal names as follows: mean, median, mode, vari, sdev, rms, date, and time.
15. Insert the formula white space to read:

```
sheet.cells(1,2)="Temp'ture";
sheet.cells(2,2)=mean;
sheet.cells(3,2)=median;
sheet.cells(4,2)=mode;
sheet.cells(5,2)=vari;
sheet.cells(6,2)=sdev;
sheet.cells(7,2)=rms;
sheet.cells(8,2)=date;
sheet.cells(9,2)=time
```

16. Clone “Fill in Cells; Temp”; change its icon name to “Fill in Cells; Pressure”; delete the two input terminals “date” and “time”; change the white-space formula to read as follows:
    sheet.cells(1,3)="Pressure";
    sheet.cells(2,3)=mean;
    sheet.cells(3,3)=median;
    sheet.cells(4,3)=mode;
    sheet.cells(5,3)=vari;
    sheet.cells(6,3)=sdev;
    sheet.cells(7,3)=rms
    Note: The only changes, besides removing “date” and “time”, are to convert all the cell address zeros to ones.
17. Connect the six Temp Formulas output pins to the six appropriate Fill in Cells; Temp input pins.
18. Connect the six Pressure Formulas output pins to the six appropriate Fill in Cells; Pressure input pins.
19. Select Menu Bar => I/O => To => String; place this icon in the lower-left corner of Main.
20. Clone To String; place it to the right of the previous icon.
21. In the left To String transaction edit field (white space), double-click as instructed; change “a” to “now()”.
22. Change Default Format to Time Stamp Format; change the Default Field Width to Field Width: enter 24.
23. Change Date & Time to Date; DD/Month/YYYY will appear; click OK.
24. In the right To String transaction edit field; double-click; change “a” to “now()”.
25. Change Default Format to Time Stamp Format; change Date & Time to Time; HH:MM:SS will appear; leave EOL on.
26. Connect the Date To String “result” to Fill in Cells; Temp “date” input.
27. Connect the Time To String “result” to Fill in Cells; Temp “time” input.
    Note: It is not necessary to open the Fill in Cells; Temp icon as the names “date” and “time’ will appear when the pin connection is about to be made.
28. Select Menu Bar => Display => Note Pad; change its title to Document Vehicle Radiator Statistics and insert the following in its white space:
    Monitor and document vehicle radiator temperature and pressure on a three-column Excel™ spreadsheet.
29. Save your program again; your completed program should look like Figure 10.3.

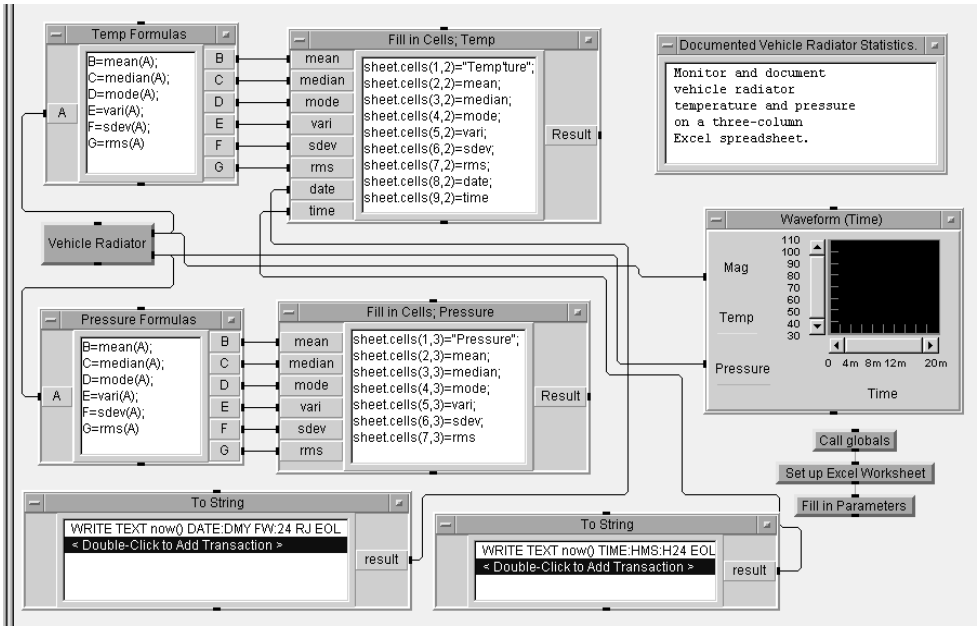
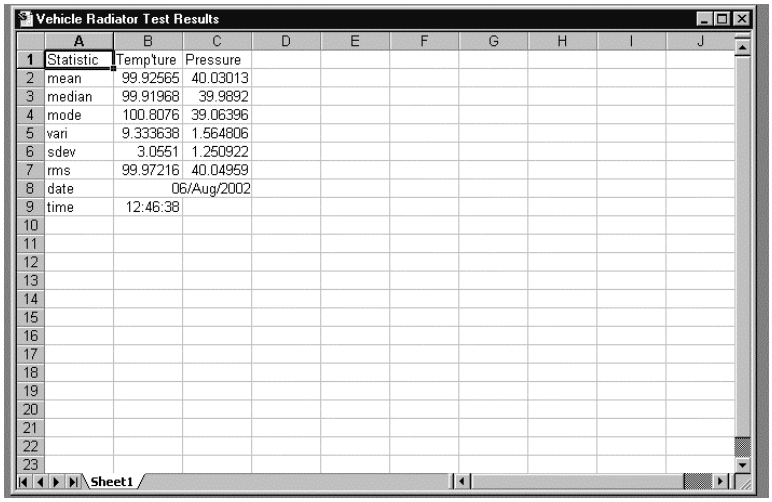


Figure 10.3. The completed Lab 10-2 program

30. Run this program.
31. Examine the Excel™ three-column spreadsheet; it should look like the one in Figure 10.4 but with a different set of values.



	A	B	C
1	Statistic	Temp'ture	Pressure
2	mean	99.92565	40.03013
3	median	99.91968	39.9892
4	mode	100.8076	39.06396
5	vari	9.333638	1.564806
6	sdev	3.0551	1.250922
7	rms	99.97216	40.04959
8	date		06/Aug/2002
9	time	12:46:38	

Figure 10.4. The three-column spreadsheet

32. The VEE Pro program should look like Figure 10.5.

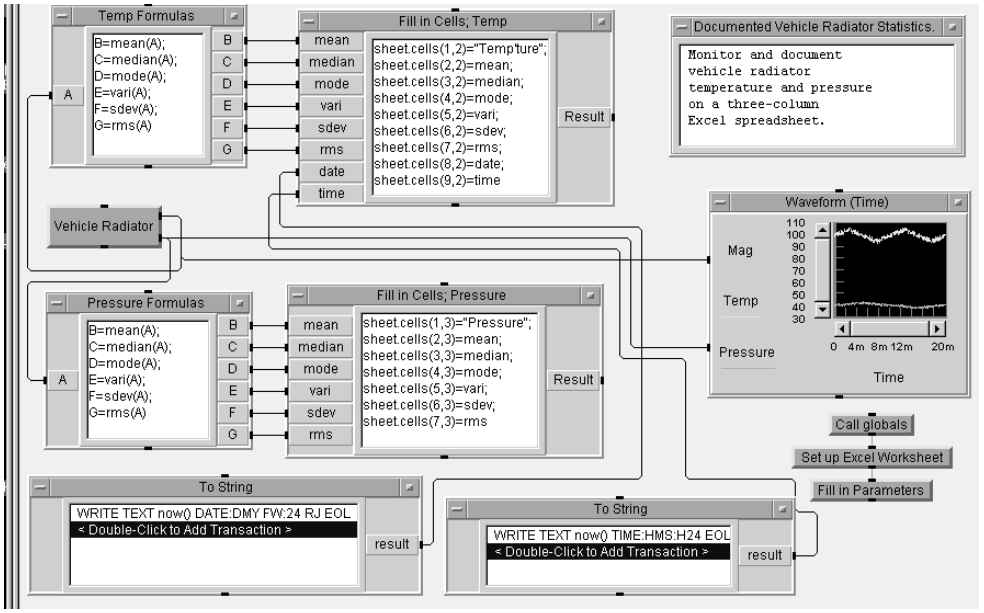


Figure 10.5. The VEE Pro program for Lab 10-2 after running

33. Close this program without saving it again.

Lab 10.3 – Using Excel™ to Document Six Sequential Vehicle Radiator Tests

This lab will show you how to send six sets of sequential tests from your Vehicle Radiator program to a single Excel™ spreadsheet.

1. Clear your Work Area, deselect the Program Explorer, and maximize Main.

Using Excel™ to document several test runs

2. Open LAB10-2; Save As… LAB10-3 immediately.
3. Close the following icons: Temp Formulas, Fill in Cells; Temp, Pressure Formulas, and Fill in Cells; Pressure.
4. Tighten the spacing between the two pairs of icons.
5. Change the wording in the Note Pad to read:

   Monitor, display, record, and document six tests of vehicle radiator temperature and pressure parameters on an Excel spreadsheet.
6. Select Menu Bar => Flow => Repeat => For Range; place under Fill in Parameters.

7. Change the For Range title to For Six Tests; change From to 1; Thru to 6; and Step to 1.
8. Connect the bottom (sequence) output of Fill in Parameters to the top (sequence) input of For Six Tests.
9. Add an input "A" to each of the two To String icons.
10. Connect both To String inputs to the data output (right side) of For Six Tests.
11. Add another input "A" to Fill in Cells; Temp.
12. Add another input "A" to Fill in Cells; Pressure.
13. Connect each of these new "A" inputs to the data output of For Six Tests.
14. Open the Fill in Cells; Temp icon; revise the white space to read:

```
sheet.cells(1,0 +2*A)="Temp'ture";
sheet.cells(2,0 +2*A)=mean;
sheet.cells(3,0 +2*A)=median;
sheet.cells(4,0 +2*A)=mode;
sheet.cells(5,0 +2*A)=vari;
sheet.cells(6,0 +2*A)=sdev;
sheet.cells(7,0 +2*A)=rms;
sheet.cells(8,0 +2*A)=date;
sheet.cells(9,0 +2*A)=time
```

15. Close the Fill in Cells; Temp to become an icon.
16. Open the Fill in Cells; Pressure icon; revise the white space to read:

```
sheet.cells(1,1+2*A)="Pressure";
sheet.cells(2,1+2*A)=mean;
sheet.cells(3,1+2*A)=median;
sheet.cells(4,1+2*A)=mode;
sheet.cells(5,1+2*A)=vari;
sheet.cells(6,1+2*A)=sdev;
sheet.cells(7,1+2*A)=rms
```

17. Close the Fill in Cells; Pressure to become an icon.
    Note: The "A" inputs causes each "sheet.cells" statement to step two cells to the right for the six tests.
18. Save this program; it should look like the one shown in Figure 10.6.

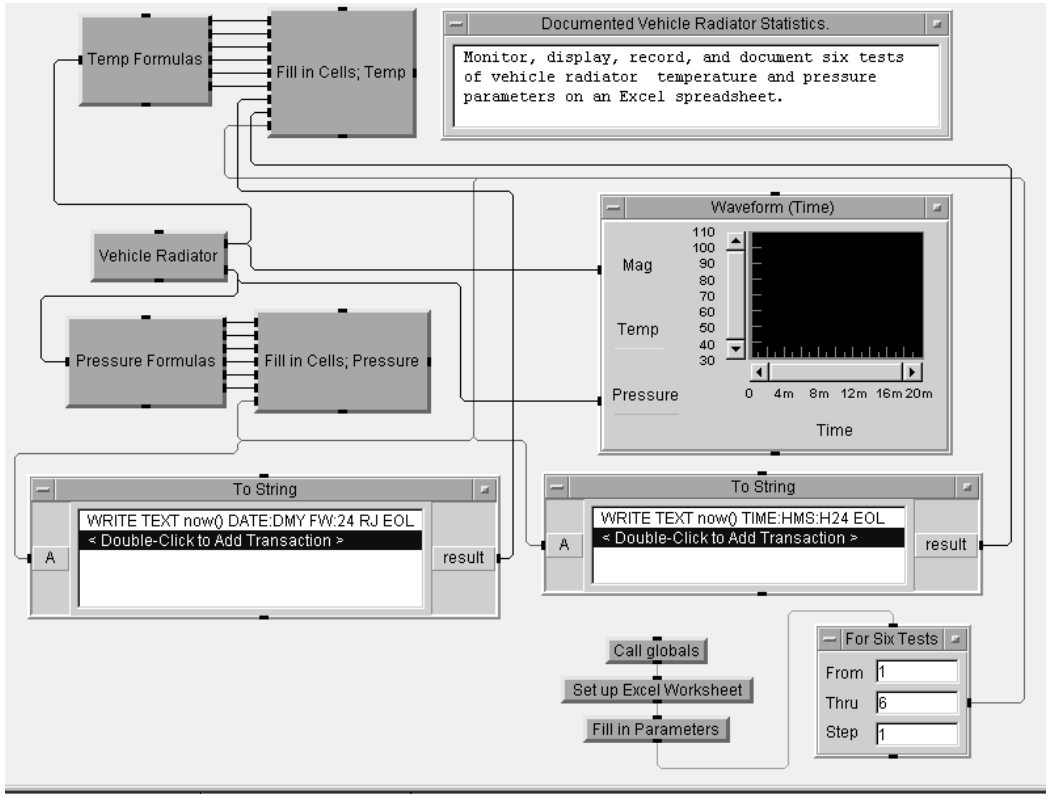
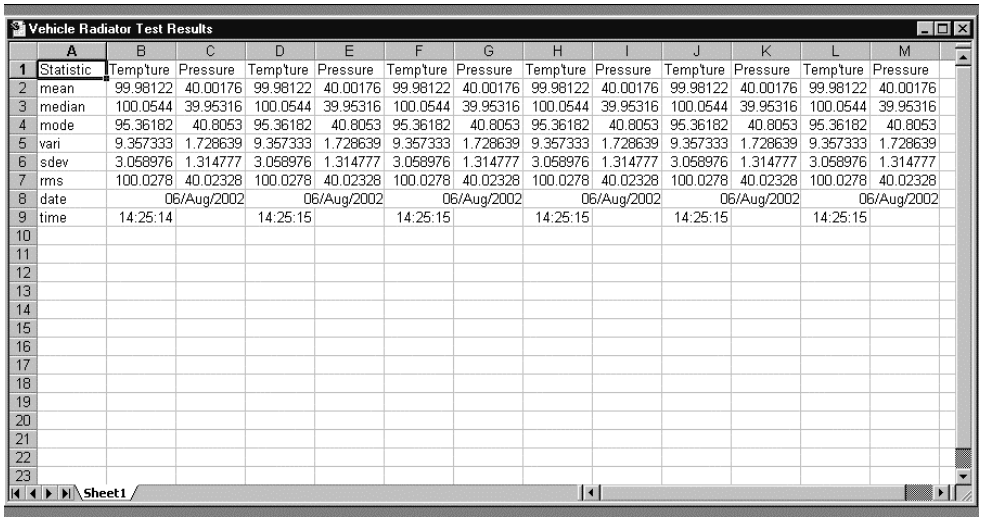


Figure 10.6. Lab 10-3 program before running

19. Run this program. The Excel™ spreadsheet should look like the one shown in Figure 10.7 but with different data values.



Vehicle Radiator Test Results

	A	B	C	D	E	F	G	H	I	J	K	L	M
1	Statistic	Temp'ture	Pressure	Temp'ture	Pressure	Temp'ture	Pressure	Temp'ture	Pressure	Temp'ture	Pressure	Temp'ture	Pressure
2	mean	99.98122	40.00176	99.98122	40.00176	99.98122	40.00176	99.98122	40.00176	99.98122	40.00176	99.98122	40.00176
3	median	100.0544	39.95316	100.0544	39.95316	100.0544	39.95316	100.0544	39.95316	100.0544	39.95316	100.0544	39.95316
4	mode	95.36182	40.8053	95.36182	40.8053	95.36182	40.8053	95.36182	40.8053	95.36182	40.8053	95.36182	40.8053
5	vari	9.357333	1.728639	9.357333	1.728639	9.357333	1.728639	9.357333	1.728639	9.357333	1.728639	9.357333	1.728639
6	sdev	3.058976	1.314777	3.058976	1.314777	3.058976	1.314777	3.058976	1.314777	3.058976	1.314777	3.058976	1.314777
7	rms	100.0278	40.02328	100.0278	40.02328	100.0278	40.02328	100.0278	40.02328	100.0278	40.02328	100.0278	40.02328
8	date	06/Aug/2002		06/Aug/2002		06/Aug/2002		06/Aug/2002		06/Aug/2002		06/Aug/2002	
9	time	14:25:14		14:25:15		14:25:15		14:25:15		14:25:15		14:25:15	
10													
11													
12													
13													
14													
15													
16													
17													
18													
19													
20													
21													
22													
23													

Sheet1

Figure 10.7. The six-test Excel™ spreadsheet

◊ 20. Try additions to these sets of data; examples are: the inclusion of max and min values.
Note: This may be awkward for you at first. You must switch back and forth between LAB10-3 and Microsoft Excel™. You must also open and close the appropriate display icons whose values should agree with those in the spreadsheet.

21. Save this revised program for your library if so desired.

Lab 10.4 – Moving Vehicle Radiator Information from Excel™ to Word™

This lab will show you how to copy and paste a VEE Pro/ Excel™ spreadsheet with a date & time stamp, send a graph of the temperature and pressure waveform, and add text to a Microsoft Word™ document.

Open your VEE Pro program and

1. Clear your Work Area, deselect the Program Explorer, and maximize Main; open LAB10-3; immediately Save As… LAB10-4.

Transferring spreadsheet(s) and graph(s) to Microsoft Word™ reports

2. Select Menu Bar => Device => ActiveX Automation References….
3. Check the Microsoft Excel and Microsoft Word boxes; click OK.
4. Open separately a new Microsoft Word™ document; title the file: VR Test Report.doc and save it. Then add a title within the document, such as: Vehicle Radiator Test Report.
5. Type an introductory description of what the reader should expect to see in your report.

The following report is a summary of the first tests of the Vehicle Radiator monitoring program. Included in this report is a copy of the program (Figure 1) that was used to perform the six tests.

Note 1: If the entire program shows on your screen, then copy using Print Screen if it has been configured for your one printer.

Note 2: If the entire program does not show on your screen, then Select All (Ctrl A), then Edit => Copy (Ctrl C) and Edit => Paste (Ctrl V) the bitmap of the VEE program into your Word document. Crop your figure to show only the VEE program.

Note 3: If you want to eliminate the right-hand and bottom desktop information, then press Alt and Print Scrn prior to pasting it into a document.

6. Choose a title for Figure 1 in the Word document.
7. Type a description of what will be on your spreadsheet that you are placing in your document. Our suggestion is:

   The following report is a copy of the spreadsheet (Figure 2) that was completed during six of the tests.
8. Choose a title for Figure 2, such as: “Results of the Six Tests”.
9. Copy and paste your spreadsheet, cropping it, if necessary, as explained in Lab 9-3.
10. Type a description of what will be on your graph that you are placing in your document. Our suggestion is:

    Also included is a graphic (Figure 3) that indicates how much the temperature and pressure deviate from a given value that is 100°F for the temperature and 40 psi for the pressure during the last test. This presentation changes somewhat for each of the six tests.
11. Choose a title for Figure 3.
12. Insert your Waveform (Time) graph, cropping it if necessary as explained in Lab 9.3.

    Note 1: You cannot access the Enable Events box for the other three objects.

    Note 2: Our report example is shown on the next two pages.
13. Insert a managerial request. Our suggestion is:

    Additional tests will be performed upon receipt of a work order with instructions.
14. Add your signature line(s).
15. Save your report if you have not done so already.
16. Close your program without saving it.
17. Close your report; print a hard copy if so desired.

    Note: If required, physically sign the report when printed as a hard copy.

Vehicle Radiator Test Report

The following report is a summary of the first tests of the Vehicle Radiator monitoring program. Included in this report is a copy of the program (Figure 1) that was used to perform the six tests.

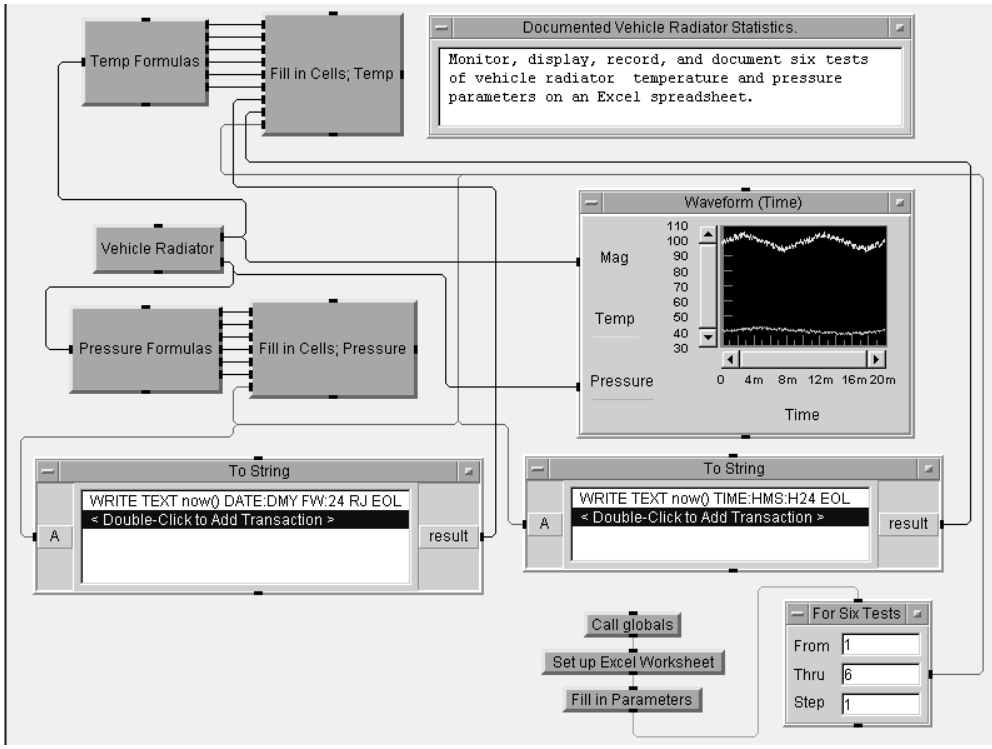


Figure 1. The six-test Vehicle Radiator program

The following report is a copy of the spreadsheet (Figure 2) that was completed during six of the tests.

	A	B	C	D	E	F	G	H	I	J	K	L	M
1	Statistic	Temp'ture	Pressure	Temp'ture	Pressure	Temp'ture	Pressure	Temp'ture	Pressure	Temp'ture	Pressure	Temp'ture	Pressure
2	mean	99.97737	39.99837	99.97737	39.99837	99.97737	39.99837	99.97737	39.99837	99.97737	39.99837	99.97737	39.99837
3	median	100.0255	39.93268	100.0255	39.93268	100.0255	39.93268	100.0255	39.93268	100.0255	39.93268	100.0255	39.93268
4	mode	101.218	39.0025	101.218	39.0025	101.218	39.0025	101.218	39.0025	101.218	39.0025	101.218	39.0025
5	vari	9.744733	1.713123	9.744733	1.713123	9.744733	1.713123	9.744733	1.713123	9.744733	1.713123	9.744733	1.713123
6	sdev	3.121656	1.308863	3.121656	1.308863	3.121656	1.308863	3.121656	1.308863	3.121656	1.308863	3.121656	1.308863
7	rms	100.0259	40.01969	100.0259	40.01969	100.0259	40.01969	100.0259	40.01969	100.0259	40.01969	100.0259	40.01969
8	date	28/Aug/2002		28/Aug/2002		28/Aug/2002		28/Aug/2002		28/Aug/2002		28/Aug/2002	
9	time	9:24:44		9:24:45		9:24:45		9:24:45		9:24:45		9:24:45	
10													

Figure 2. Results of the six tests

Also included is a graphic (Figure 3) that indicates how much the temperature and pressure deviate from a given value that is 100°F for the temperature and 40 psi for the pressure during the last test. This presentation changes somewhat for each of the six tests.

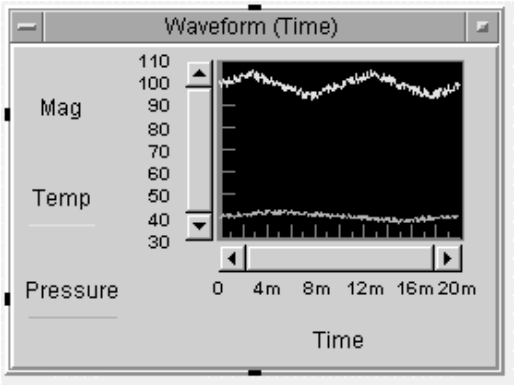


Figure 3. Graphs of the Vehicle Radiator last test

Additional tests will be performed upon receipt of a work order with instructions.

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Lesson 10 Summary

This lesson described and illustrated how to create spreadsheets using ActiveX and globals to link between VEE Pro data and a Microsoft Excel™ spreadsheet. You also learned how to compress your data, via statistics, so others can examine your test results either in their entirety or in a statistical format. Others can decide if they want to examine your recorded data in more depth prior to its compression or if they want you to perform and analyze additional tests. Next you learned how to send a spreadsheet, a graph, and then add text to a Microsoft Word™ document.

Excel™ and Word™ are accessed via ActiveX are very flexible. You are limited in their applications to your everyday test documentation only by the amount of time that you can devote to developing new and meaningful presentations. It is imperative that you consider the potential reader of your reports and spreadsheets so that you can prepare them in a standard format.

Your time is precious; so is the time of your co-workers and managers.

Lab 10.1 showed you how to monitor temperature and pressure values while simultaneously computing mean, median, mode, variance, standard deviation, and rms values of both Vehicle Radiator parameters.

Lab 10.2 showed you how to send (transfer) VEE data from your Vehicle Radiator program to Microsoft Excel™; record parameter identification in one column; and record temperature and pressure readings in two other columns.

Lab 10.3 showed you how to send six sets of sequential tests from your Vehicle Radiator program to a single Excel™ spreadsheet.

Lab 10.4 showed you how to copy and paste a VEE Pro/Excel™ spreadsheet with a date & time stamp, send a graph of the temperature and pressure waveform, and add text to a Microsoft Word™ document. (Note: Agilent VEE Pro Help Contents and Index; select the Guide to Agilent VEE Example Programs; select Microsoft Word (Windows only), and select “Send Data and Bitmap to Word97”.)

You are now ready to learn to more about using UserFunctions.