

## **Delphi Packard Summer Intern 2000 Fiber Optic Star Measurement System**

### **Internship Overview:**

Justin DeGuire, Computer Information Systems major, developed a system for Delphi Packard Electric as an internship project. This system automates the testing of dB loss within fiber optic networks. This project and its results are presented on subsequent pages. Justin's faculty advisor on the project is [Thomas Bodnovich](#), Associate Professor of [Computer Science and Information Systems](#).

### **Department:**

187 EMC Technology / Data Communications

### **Supervisor:**

Kin P. Moy

### **What is EMC Technology?**

Electro Magnetic Compatibility (EMC) is about the ability of different items of electrical equipment to work together without suffering the effects of interference. Equipment should also operate without interfering with broadcast and communications signals and be immune to normal levels of such signals. EMC implies that a system will not generate unacceptable levels of conducted or radiated signals which could cause interference to other well designed products. Systems should also be designed in such a way that normal ambient levels of electrical noise will not cause degradation of performance they must have an adequate level of immunity.

### **Summer Project Objectives:**

#### **Why?**

187 needed custom automated test software to increase test efficiency and accuracy from present manual operation. Prior to this software everything was done by hand. The instrument was controlled manually and all data collection was typed manually into an Excel spreadsheet, which left room for error considering the amount of data that needed to be recorded.

#### **How?**

The software was written using a visual programming test instrument language called HP VEE 5.0. HP VEE is also used in many existing measurement systems within the department, so it was the language of choice.

### **Programming Language:**

HP VEE stands for Hewlett-Packard Visual Engineering Environment.

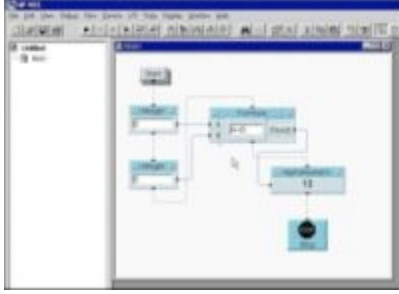
HP VEE has two parts; development and run-time environments.

Currently HP VEE is the development standard for the department.

For more information about HPVEE go to <http://www.agilent.com>.

Note: The product is now called Agilent VEE since the instrument division of Hewlett-Packard broke off from the computer hardware division of Hewlett-Packard and changed it's name to Agilent.

### **HP VEE Development Environment Screen Shot:**



Here is a snap shot of the development environment of HP VEE. As you can see, writing the actual code is similar to creating a flow chart. Writing code in this manner is very different compared to other languages, but this writing style makes debugging easy. Writing code in this manner also gives you the ability to write usable code quickly.

[hpvee.jpg \[42k\]](#)

### **Fiber Optic Star Measurement System:**

Department Data Communication needed some custom software to efficiently and accurately measure and document the dB loss within a Fiber Optic Star network. This network topology will be used in future automobiles. Originally, dB loss measurements on these networks were performed by hand.

### **Fiber Optic Star Measurement System will:**

- Maintain a record of all measurements
- Set all reference levels
- Performs the test with instrumentation control
- Designed with option of performing test with either optical or electrical sources
- Reference and tolerance levels are completely configurable

### **Result:**

- Reduce test time by 95%
- Enhance measurement/data accuracy
- Increase through-put of the lab
- Optimize engineer's time

### **Fiber Optic Star:**



A assembled Fiber Optic Star.

[star\\_ass.jpg \[195k\]](#)



A dis-assembled Fiber Optic Star.

[star\\_disass.jpg \[183k\]](#)

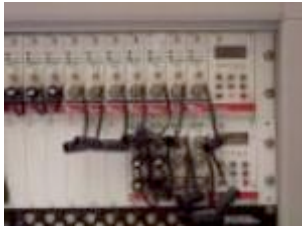
**What is a Fiber Optic Star?**

A Fiber Optic Star is a new bus technology, which is being developed to communicate with multimedia devices in an automobile. This fiber optic bus is capable of signal transmissions rates of up to 110 megabits per second and can support up to 50 channels of audio and 20 channels of TV-quality compressed video. Since the Fiber Optic Star is a star topology there is no concern of losing all of the multimedia devices if one of the optical cables break. Also the fiber optic cable is immune to electromagnetic interference (EMI) and generates no emissions, which provides vehicle occupants crystal-clear audio and video without negatively affecting other vehicle systems.

**RIFOCS Custom Built Rack:**

RIFOCS Fiber Optic Meters and Electrical & Optical Sources.

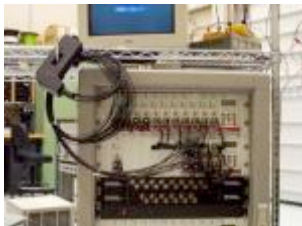
[rifocs.jpg \[273k\]](#)

**RIFOCS Close Up:**

A close up of the RIFOCS Optical Sources and Meters.

[led\\_closeup.jpg \[293k\]](#)

I used a RIFOCS custom built rack, which contained 12 optical power meters, 11 electrical power meters, 12 optical power sources, and 11 electrical power sources, to measure the amount of power loss through the Fiber Optic Star. To find out more information about RIFOCS visit <http://www.rifocs.com>.

**Test Procedure:**

Test procedure with the RIFOCS Custom Built Rack and a Fiber Optic Star.

[FO\\_test\\_setup.jpg \[291k\]](#)

The Fiber Optic Star has seven input cables and seven output cables. Correspondingly, these cables are marked one through seven. Before measuring the insertion loss of the star you must calibrate each optical source (LED) on the RIFOCS rack. To calibrate each LED you have to connect a straight

fiber optic cable, with no optical ribbon inside, that is the exact length of the fiber optic cables on the star, which you are measuring. Once this cable is connected to a LED and to a power meter, the software is attempting to reach a specific target level on the power meter. The software reaches this target level by increasing or decreasing the strength or drive level of the LED. The software will eventually reach the target level that has been specified. Once the first LED is at its drive level you then continue to calibrate all the other LED's on the RIFOCS rack.

After all of the LED's have been calibrated, you can continue to measure the insertion loss of the fiber optic star. Connect all seven optical inputs of the fiber optic star to the optical power sources (LEDs) on the RIFOCS rack. Once connected, continue to connect up all seven optical outputs, of the fiber optic star, to the RIFOCS power meters. Once all the inputs and outputs are connected you can continue running the software, which will measure the insertion loss.

### Fiber Optic Star Measurement System:



Fiber Optic Star Measurement System snap shot.

[star\\_system.jpg \[52k\]](#)

Star Measurement System Software forces you to execute the set levels procedure before attempting to execute the test star procedure, which measures the loss in a fiber optic star. For an accurate test result, the fiber optic sources (LEDs) must be calibrated prior to each star measurement. The reason for forcing the person, who is testing the fiber optic star, is so that he doesn't forget to calibrate before each star measurement. It forces you by not being able to press any other command button other than the set levels. Once you have calibrated the fiber optic sources then you can click/execute the test star procedure.

Once you execute the set levels procedure a message pops up stating to properly connect the reference cable from fiber optic source 1 to fiber optic power meter 1. If you don't have the reference cable connected correctly to the meter or source, the software will warn you of an error and pause until this error is corrected. Once you have the reference cable properly attached you can click on the channel 1 button, which the software will communicate with the fiber optic source until the reference level is reached. Once the reference level for that fiber optic source is achieved a message pops up to connect the reference cable from fiber optic source 2 to fiber optic power meter 1. Once the reference cable is connected, the software will calculate the reference level for this fiber optic source. You will eventually do this calibration procedure until you have all seven fiber optic sources calibrated.

Once the drive characterization is complete you then can click/execute the test star procedure. Once you execute this procedure all of the fiber optic sources are turned off and the first fiber optic source is turned on. With this fiber optic source on, the software takes all seven measurements on the fiber optic power meters and logs the results. It then continues to turn fiber optic source 1 off and fiber optic source 2 on. It then goes to take all seven fiber optic power meter measurements again. It does this loop until all 49 measurements are taken. When each measurement is taken the software determines if the fiber optic star is connected properly or not. If it is okay then an " O " is displayed in the corresponding block. If something is wrong or not connect correctly then an " X " is placed in the corresponding block.



© Copyright: Delphi Automotive System 2000



One University Plaza  
Youngstown, OH 44555  
Phone toll-free 877-GO-TO-YSU (877-468-6978)  
Copyright © 2000 Youngstown State University, all rights reserved.