Strain Measuring Systems Short Course

STRAIN MEASURING SYSTEMS – FIVE DAYS

This program is presented in a format that includes several hands-on laboratory exercises. Liberal use of demonstrations and case studies provides attendees with a first-hand opportunity to learn how to select the procedures and techniques best suited to their strain measurement needs.

The program begins with an overview of stress analysis principles. Following a review of the performance characteristics of the strain gage and selection criteria, several laboratory projects are conducted in which strain gages are bonded, electrical connections completed, environmental protection applied and installation integrity verified. The strain data are then collected with measuring instrumentation and compared to calculated theoretical values. In a more advanced laboratory projects, a basic weighing scale is constructed and calibrated, and a three-element strain gage rosette is used to measure strains and calculate the pressure in a thin-walled vessel. In the course of these laboratory projects, all attendees have an opportunity to use three popular adhesive systems.

A thorough review of strain gage instrumentation is augmented by numerous demonstrations and hands-on experiments that highlight important features of modern strain measuring instruments. Digital data acquisition principles and practices are discussed, including the relationship between the sampling rate and signal frequency. Anti-aliasing techniques are demonstrated and the phase relationship of input to output are described. The use of strain gages and related instrumentation in transducer applications is also explored. Special-purpose sensors are reviewed, with emphasis on their application to strain measurements and structural test programs.

The course ends with a discussion of methods for locating stress concentrations in a complex strain field using modern optical techniques.

Provision is made for attendees to discuss their specific test requirements with members of the Vishay Micro-Measurements technical staff.

Topics include:

Concepts of Stress and Strain
- Uniaxial and Biaxial Strain
- Hooke's Law
- Principal Stresses and Strains
- Superposition Concept

Strain Gage Characteristics
- Backings and Sensing Elements
- Performance Characteristics

Gage Installation Techniques
- Bonding Methods
- Leadwire Installation
- Environmental Protection

Transducers
- Design Considerations
- Bridge Circuits

Instrumentation Considerations
- Wheatstone Bridge Circuitry
- Bridge Excitation and Thermal Effects
- Leadwire Effects
- Bridge Balance Control
- Shunt Calibration and Calibrators
- Static/Dynamic Strain Measurement
- Switching and Multiplexing
- Electrical Noise Control
- Checkout and Troubleshooting

Full-Field Strain Measurements
- Locating Stress Concentrations
- Interpreting the Strain Field
- Selection and Applications of PhotoStress®

Case Histories