



Course Description

Course Name

CVS 101: Thermal Imaging Fundamentals

(Part Number P/N 107-0001-11)

Summary Description

This course provides an introduction to infrared (IR) technology and covers the fundamentals of thermal imaging. Topics include the electromagnetic spectrum, infrared cameras and optics, thermal imaging versus other night vision technologies, factors that influence image quality, and the interpretation of thermal images. The course develops fluency with the relevant terminology, concepts and industry jargon, and cultivates the ability to think “in terms of IR.” The course includes demonstrations that are designed to develop familiarity with thermal infrared cameras and images.

Course Duration

The course duration is typically 8 hours, and can be varied depending on the audience comprehension level, the activities used, and the amount of training material covered. The course can be offered as a 1 day stand-alone course or combined with other related courses in a multi-day sequence.

Intended Audience

This course is intended for anyone involved with thermal imaging, including customers/users of thermal imaging products across all market segments and applications, and anyone who is involved with the design, development, manufacture, sales, installation and support of thermal imaging systems and components.

Course Prerequisites

The course is intended as an entry point to thermal imaging education and has no prerequisites. Students will benefit from having a foundation in basic math and algebra.

Course Objectives

Knowledge/Understanding: After taking the course, the student will:

- Have a basic understanding of infrared radiation in general
- Be familiar with IR terminology and industry jargon
- Understand characteristics of IR energy, especially in relation to the visible spectrum and other wavelength ranges
- Be familiar with some of the applications where IR imaging provides value and where it has limitations
- Be familiar with thermal imaging technology, including camera systems and components, IR detectors, lenses, and electronics.

Skills/Behavior: Upon completion, the student will **be able to**:

- Describe characteristics of the IR spectrum, including:
 - Underlying source of IR emission (molecular energy)
 - Wavelengths and sub-bands (NIR, MWIR, LWIR, etc.)
 - Emission, reflection, absorption, and conduction
 - Attenuations due to atmosphere and other materials
- Distinguish between detection of visible and IR spectrums, and among thermal IR sub-bands
- Describe advantages and limitations of thermal imaging in comparison to visible imaging (daylight TV or DLTV), night vision, and other competing solutions
- Describe the two primary detector technologies and how their distinguishing characteristics affect cost and performance, including:
 - Underlying physics (photon detection vs. resistance change)
 - Sensor materials
 - Cooled/uncooled
 - Overall construction and vacuum packaging
 - Physical characteristics of sensor
- Describe camera system characteristics and how their distinguishing characteristics affect cost and performance, including
 - Lens materials, aperture, focal length,
 - cooler and other components
- Describe how the camera component choices impact performance, cost, suitability to an application, and so on
- Interpret thermal images; when presented with a thermal image or video, recognize and describe its characteristics and features
- Interpret thermal camera specifications and describe how the relative value of a given specification affects cost and performance.
- Use standard performance measurements and terminology to describe the relative advantages and disadvantages of one camera compared to another.

Note: This course primarily focuses on IR technology and thermal imaging applications, rather than the features and operations of any particular cameras. The course includes only limited hands-on experience. Refer to the course catalog for more information regarding other courses.

Course Materials

Students will be provided with a training manual that includes a hardcopy of the slide presentation(s). A certificate of completion will be provided to all attendees.

Course Capacity

As the course is primarily lecture-based rather than lab-based, the number of students is limited strictly by the training room capacity. Typically the roster will include 12-15 students at a time.