

# Interfacing Sensors with Computer Controls

## Course Outcome Summary

### Course Information

|                                       |                            |
|---------------------------------------|----------------------------|
| <b>Organization</b>                   | MATC Truax Campus          |
| <b>Developers</b>                     | William Lorenz             |
| <b>Development Date</b>               | 4/28/2006                  |
| <b>Course Number</b>                  | 32-414-321                 |
| <b>Instructional Level</b>            | Two Year Technical Diploma |
| <b>Potential Hours of Instruction</b> | 72                         |
| <b>Total Credits</b>                  | 3                          |

### Description

Applies various sensors to analog input modules of programmable controllers and to A/D converters for computer systems. Sensor fundamentals and basic interface techniques are studied with emphasis on practical sensors for measuring temperature, pressure, force and light. Students learn about analog to digital (A/D) and digital to analog (D/A) converters and instrumentation electronics necessary to condition signals from industrial process sensors. Students interface sensors to Programmable Logic Controllers (PLCs) and learn PLC programming techniques for converting raw sensor values into useful quantities.

### Types of Instruction

| Instruction Type       | Contact Hours | Credits |
|------------------------|---------------|---------|
| Classroom Presentation | 36            | 3       |
| On-Campus Lab          | 36            |         |

### Textbooks

Keith Brindley. *Sensors and Transducers*. Heinemann Professional Publishing. 1988.

Harry N. Norton. *Handbook of Transducers*. Prentice Hall. 1989.

Wallace J. Tompkins and John C. Webster, ed.. *Interfacing Sensors to the IBM PC*. Prentice Hall. 1988.

---. *Sensym Solid-State Sensor Handbook*. Sensym Inc.. **Source:** Sunnyvale, CA.

---. *Integrated and Discrete Semiconductors*. Allegro MicroSystems, Inc.. 1991. **Source:** Worcester, MA.

### Learner Supplies

### Prerequisites

Electronics Circuits for Maintenance (32-414-318)

### Exit Learning Outcomes

#### Core Abilities

- A. Communicate effectively
- B. Demonstrate critical thinking
- C. Develop a sense of personal, social, professional, and work ethics
- D. Develop global awareness
- E. Use mathematics effectively
- F. Use science and technology
- G. Develop self-awareness
- H. Learn effective social interaction
- I. Communication
- J. Critical thinking
- K. Ethics
- L. Global and cultural perspectives
- M. Mathematics
- N. Science and Technology
- O. Self-management
- P. Social interaction

### **Program Outcomes**

- A. Analyze, configure, troubleshoot and assist in designing and measuring electrical and electronic circuits and systems
- B. Learn new technologies and procedures, adapting this knowledge to effectively advance in the field and/or matriculate into the "plus two" section of a Bachelors of Science in Electrical Engineering Technology (BSEET) program
- C. Employ computer based tools to effectively complete technical tasks
- D. Work effectively in a team environment
- E. Communicate clearly and effectively in speaking and writing with peers, engineers, teams and customers using appropriate technologies including audio, visual and graphics
- F. Employ motor and analytical skills to solve problems
- G. Use time management, project management and safety skills while contributing to an engineering project

### **Competencies**

- A. **Examine sensor types and applications**  
**You will demonstrate your competence:**
  - A.1. By submitting completed homework
  - A.2. On a written evaluation
  - A.3. In lab performance**Your performance will be successful when:**
  - A.1. Homework includes visually identifying sensor types
  - A.2. Homework includes identifying proper sensor application
  - A.3. you examine various sensor types
  - A.4. you summarize the application of sensors in manufacturing processes
  - A.5. you discriminate between different sensors and the integration to manufacturing cell
- B. **Explore appropriate interfacing techniques**

**You will demonstrate your competence:**

- B.1. By submitting completed homework
- B.2. On a written evaluation
- B.3. In lab performance

**Your performance will be successful when:**

- B.1. homework includes identifying interface possibilities with proprietary software and hardware equipment
- B.2. homework includes identifying analog and digital converters
- B.3. homework includes identifying operational amplifiers
- B.4. you summarize simple sensor interfacing with computer control
- B.5. you install simple sensor inputs to computer control project
- B.6. you gather data and colate it from your sensor project

**C. Align sensors with practical data gathering processes**

**You will demonstrate your competence:**

- C.1. By submitting completed homework
- C.2. On a written evaluation
- C.3. In lab performance

**Your performance will be successful when:**

- C.1. Homework includes investigating components required for computer interface
- C.2. Homework includes identifying shielding requirements and grounding techniques
- C.3. Homework includes investigating computer hardware/software required for correct sensor communication
- C.4. you summarize practical data gathering techniques
- C.5. you identify computer hardware/software required for correct sensor communication
- C.6. you install components required for computer interface
- C.7. you complete the shielding requirements and grounding techniques on your project
- C.8. you integrate computer software required for correct sensor communication on you project

**D. Study automated manufacturing processes**

**You will demonstrate your competence:**

- D.1. By submitting completed homework
- D.2. On a written evaluation
- D.3. In lab performance

**Your performance will be successful when:**

- D.1. homework includes differentiating between manufacturing cells, assembly lines and robotics
- D.2. homework includes analyzing programmable logic controllers operational software
- D.3. homework includes adapting programmable logic controller interfaces to sensors
- D.4. you summarize automated manufacturing types
- D.5. you operate manufacturing cells, assembly lines, or robotics to better understand production processes

**E. Choose practical sensors for measuring temperature, pressure, force and light**

**You will demonstrate your competence:**

- E.1. By submitting completed homework
- E.2. On a written evaluation
- E.3. In lab performance

**Your performance will be successful when:**

- E.1. homework includes identifying fundamentals of temperature, pressure and light sensors
- E.2. homework includes articulating support interface cards and other hardware needs to operate temperature, pressure and light sensors
- E.3. you examine practical sensors applications to manufacturing
- E.4. you integrate temperature, pressure, and light sensors to manufacturing cell
- E.5. you operate and adjust sensors in your manufacturing cell project

**F. Study analog to digital (a/d) and digital to analog (d/a) converters used for interfacing sensors**

**You will demonstrate your competence:**

- F.1. By submitting completed homework
- F.2. In lab performance

**Your performance will be successful when:**

- F.1. homework includes identifying a/d and d/a converters
- F.2. homework includes identifying the applications of a/d and d/a converters in sensing devices
- F.3. you install a/d and d/a converters on an operating manufacturing cell

**G. Use instrumentation electronics necessary to condition signals from process sensors**

**You will demonstrate your competence:**

- G.1. By submitting completed homework
- G.2. On a written evaluation
- G.3. In lab performance

**Your performance will be successful when:**

- G.1. homework includes identifying electronic interference/noise sources
- G.2. homework includes identifying correct shielding and grounding techniques
- G.3. homework includes matching the correct cables to interface boards
- G.4. you summarize methods of dealing with signal interference/noise and degradation
- G.5. you examine the condition of signals from sensors integrated to your manufacturing cell project

**H. Integrate sensors with PLCs**

**You will demonstrate your competence:**

- H.1. By submitting completed homework
- H.2. In lab performance

**Your performance will be successful when:**

- H.1. homework includes identifying interface board connections for specific PLC Types
- H.2. you make wire connections for sensor inputs
- H.3. you make wire connections in DIN rail for peripheral devices needed to operate sensor inputs
- H.4. you navigate through PLC ladder logic software to complete software to

hardware integration

**I. Acquaint yourself with PLC programming language to convert raw sensor values into useful quantities for your project**

**You will demonstrate your competence:**

- I.1. By submitting completed homework
- I.2. In lab performance

**Your performance will be successful when:**

- I.1. assignments include interpreting PLC programming language
- I.2. you program PLC to accommodate your sensors for your project
- I.3. you activate your PLC manufacturing cell and successfully sequence it