

# Digital Electronics Assembly Methods

## Course Outcome Summary

### Course Information

<b>Organization</b>	Madison Area Technical College
<b>Developers</b>	Dr. Alberto Rodriguez
<b>Development Date</b>	3/1/2009
<b>Course Number</b>	10-605-118
<b>Instructional Level</b>	Associate Degree/College Transfer/Certificate
<b>Instructional Area</b>	Ag, Engineering, Bus & App Tech
<b>Division</b>	Engineering
<b>Potential Hours of Instruction</b>	85
<b>Total Credits</b>	3

### Description

Course includes Schematic and PCB component identification, Engineering Notation, Basics of Digital Gates, IC Numbering Systems, Through Hole and Surface mount footprint identification, Through Hole and Surface Mount (SMT) soldering and rework training (IPC-610-D), Lead Free (RoHS) soldering and rework training, IPC-610-D and RoHS rework criteria, Dual source de-soldering training, Surface mount fine pitch drag soldering training, Electronic assembly training.

### Target Population

Open to the general public

### Types of Instruction

Instruction Type	Contact Hours	Credits
Face to Face	85	3

### Textbooks

*IPC-A-610.*

*J-STD-001.*

*IPC 7711/21 related DVDs.*

### Learner Supplies

Boogie Board Computer Kit.

XY-Tronic soldering iron tips.

safety glasses.

### Prerequisites

We strongly recommend that students take the math sequence of Algebra 1 (20-804-202) and Algebra 2 (20-804-203) to best prepare them for this course. In addition, a high school physical science course is highly recommended.

### Exit Learning Outcomes

#### Core Abilities

- A. Science and Technology
- B. Self Management

### Program Outcomes

- A. Use learning skills to integrate knowledge and understanding as you analyze, configure, troubleshoot, measure and/or program systems and devices.
- B. Apply acquire skills and learn new skills to meet the changing needs of the industry.

### External Standards

IPC-A-610 Certification  
 IPC-J-STD-001 Certification  
 IPC-7711/21 Certification

### Competencies

- A. **Identify through hole and surface mount (SMT) digital electronics components.**
  - Linked Core Abilities**
  - Science and Technology
  - You will demonstrate your competence by:**
    - A.1. completing a component identification laboratory activity
    - A.2. completing a component identification unit examination
    - A.3. completing a component identification in-class formative assessment activity
  - Performance will be successful when the learner:**
    - A.1. identifies through hole and surface mount digital
    - A.2. identifies through hole and surface mount digital electronics components on the bench
    - A.3. completes the IPC DVD on component identification
    - A.4. computes resistor values using the resistor color code
    - A.5. computes capacitance values using the capacitor number code
    - A.6. computes proper component magnitude using engineering notation
  - Learning Objectives**
    - A.1. Assemble through hole and surface mount technology PCBs
    - A.2. Recognize the different between RoHS compliant components and standard leaded components
    - A.3. Identify a wide variety of component footprints
    - A.4. Identify and read a Bill of Materials
- B. **Judge the acceptability of through hole and surface mount electronic assemblies (IPC-610-D).**
  - Linked Core Abilities**
  - Science and Technology
  - You will demonstrate your competence by:**
    - B.1. completing with acceptable standards the electronics assembly laboratory activities
    - B.2. completing with acceptable standards the electronics assembly unit examination
    - B.3. completing with acceptable standards the electronics assembly in-class formative assessment activities
  - Performance will be successful when the learner:**
    - B.1. describes purpose and application of IPC-A-610
    - B.2. describes soldering criteria, including lead free connections
    - B.3. describes soldering requirements for connecting to terminals
    - B.4. describes soldering requirements for plated-through holes
    - B.5. describes surface mounting criteria for chip components, leadless and leaded chip carriers

- B.6. describes swaged hardware and head sink requirements of mechanical assemblies
- B.7. describes component mounting criteria for DIPs, socket pins, and card edge connectors
- B.8. describes jumper wire assembly requirements
- B.9. describes solder fillet dimensional criteria for all major SMT component groups
- B.10. describes soldering problems, such as tombstoning, dewetting, voiding, etc
- B.11. describes criteria for component damage, laminant conditions, cleaning and coating

#### **Learning Objectives**

B.1. Identify the qualities that make a soldering joint acceptable for surface mount and through hole technology both leaded and lead free

### **C. Use materials, methods and verification criteria for producing high quality soldered interconnections (IPC-J-STD-001).**

#### **Linked Core Abilities**

Science and Technology

#### **You will demonstrate your competence by:**

- C.1. completing the J-STD-001 laboratory activities
- C.2. completing the J-STD-001 unit examination
- C.3. completing the J-STD-001 in class formative assessment activities

#### **Performance will be successful when the learner:**

- C.1. describes the general requirements, such as safety, tools and electrostatic discharge (ESD)
- C.2. describes wire and terminal assembly requirements, demonstrations and laboratory
- C.3. describes through-hole technology requirements
- C.4. describes surface mount technology requirements
- C.5. describes general soldered connection acceptance requirements (including lead-free RoHS)
- C.6. describes machine and reflow soldering process requirements
- C.7. describes test methods and related standards

#### **Learning Objectives**

- C.1. Through hole and surface mount hand soldering skills
- C.2. Wire and terminal hand assembly
- C.3. Distinguish between lead free and Leaded assemblies
- C.4. Inspect lead free and leaded soldering joints

### **D. Rework and repair electronic assemblies (IPC-7711 & 7721).**

#### **Linked Core Abilities**

Science and Technology

#### **You will demonstrate your competence by:**

- D.1. completing the rework and repair laboratory activities
- D.2. completing the rework and repair unit examination
- D.3. completing the rework and repair in-class formative assessment activities

#### **Performance will be successful when the learner:**

- D.1. identifies product classifications, skill levels, tools and materials
- D.2. performs basic surface mount and through hole component removal
- D.3. prepares tin surface mount lands for component installation
- D.4. demonstrates rework using primary heating methods: conductive, convective, etc.
- D.5. demonstrates handling of electronic assemblies
- D.6. demonstrates wire splicing procedures
- D.7. performs through hole component removal and installation
- D.8. performs CHIP and MELF rework procedures
- D.9. performs SOIC/SOT, J-lead and QFP rework
- D.10. performs printed wiring board circuit and laminate repair

D.11. demonstrates conformal coating removal

**Learning Objectives**

D.1. D-solder through hole and surface mount with both leaded and lead free components

D.2. C wire harnesses and perform proper wire splicing