Chapter 5
Wiring Diagrams
March 29, 2010

Wiring Projects
- Electronic schematics are required to completely describe how the wiring will be connected to the components.
- The Cad Technician will develop the wiring list from the schematic.

Wire List

<table>
<thead>
<tr>
<th>Wire No.</th>
<th>Size Awg</th>
<th>Item No.</th>
<th>Color</th>
<th>Wire Type</th>
<th>Condition</th>
<th>Ty</th>
<th>Condition</th>
<th>Length</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>22</td>
<td>1</td>
<td>Red</td>
<td>AWG-22</td>
<td>Solder</td>
<td>#2</td>
<td>Lug</td>
<td>10</td>
</tr>
<tr>
<td>2</td>
<td>26</td>
<td>3</td>
<td>White</td>
<td>AWG-26</td>
<td>Solder</td>
<td>#1</td>
<td>Lug</td>
<td>14</td>
</tr>
<tr>
<td>3</td>
<td>24</td>
<td>5</td>
<td>Black</td>
<td>AWG-24</td>
<td>Solder</td>
<td>#2</td>
<td>#6</td>
<td>16</td>
</tr>
<tr>
<td>4</td>
<td>20</td>
<td>4</td>
<td>Black</td>
<td>AWG-20</td>
<td>Solder</td>
<td>#1</td>
<td>Solder</td>
<td>14</td>
</tr>
<tr>
<td>5</td>
<td>18</td>
<td>5</td>
<td>Black</td>
<td>#18</td>
<td>Solder</td>
<td>#2</td>
<td>Solder</td>
<td>10</td>
</tr>
<tr>
<td>6</td>
<td>18</td>
<td>22</td>
<td>Black</td>
<td>AWG-18</td>
<td>Solder</td>
<td>#1</td>
<td>Solder</td>
<td>10</td>
</tr>
<tr>
<td>7</td>
<td>18</td>
<td>6</td>
<td>Black</td>
<td>AWG-18</td>
<td>Solder</td>
<td>#2</td>
<td>Solder</td>
<td>10</td>
</tr>
</tbody>
</table>

- The wire list will contain the basic information from the schematic and additional information including:
  - Color of wire
  - Gage of wire
  - Length of wire
  - Entry in parts list
  - Condition at terminals

Wiring Parts Lists

<table>
<thead>
<tr>
<th>Item No.</th>
<th>Description</th>
<th>Qty</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Wire #22 AWG 22 ga stranded teflon coated</td>
<td>250</td>
</tr>
<tr>
<td>2</td>
<td>Wire #22 AWG 22 ga stranded teflon coated</td>
<td>250</td>
</tr>
<tr>
<td>3</td>
<td>Wire #22 AWG 22 ga stranded teflon coated</td>
<td>250</td>
</tr>
<tr>
<td>4</td>
<td>Wire #22 AWG 22 ga stranded teflon coated</td>
<td>250</td>
</tr>
<tr>
<td>5</td>
<td>Wire #22 AWG 22 ga stranded teflon coated</td>
<td>250</td>
</tr>
<tr>
<td>6</td>
<td>Wire #22 AWG 22 ga stranded teflon coated</td>
<td>250</td>
</tr>
<tr>
<td>7</td>
<td>Lug #6 Crimp</td>
<td>9</td>
</tr>
<tr>
<td>8</td>
<td>Solder 40/20</td>
<td>A/R</td>
</tr>
</tbody>
</table>

Wire Termination
- The method to be used is dictated by the terminal to which the wire must be attached.
- The Cad Technician will specify the method on the drawing.
Specifying Connections

Point to Point Wiring Drawings

- Used to show engineering, manufacturing and service personnel the wiring between and across components.
- The point to point diagram will contain all of the information necessary to make or follow all components.
- This wiring diagram may be included on the assembly drawing.

Point to Point Diagrams

- Will show the wiring paths on a background of components.
- Will show the general physical arrangement of the component parts.
- Not necessarily to scale.
- Wires will be shown on equal spacing, as this is easier for the reader to follow.

Point to Point Diagrams Rules

- Minimize jogs in lines
- Run lines with a minimum of crosses
- Space lines a minimum of 1/4” apart.
- Separate every third or fourth line with a wider spacing when long groups of lines run parallel to each other.
- Label components on the right side.
- Use large bold letters for identifying components
- Smaller lettering for internal terminals
- Component numbering should follow the location and identification given to it when mounted in the chassis

Simple Point to Point Diagram
Complex Point to Point Diagram

Pictorial Point to Point Diagrams
- Simple point to point drawings with a small number of wires and a simple chassis layout may be drawn as 3 dimensional pictorials.

Pictorial Point to Point Drawing

Highway Wiring Diagrams
- Highway wiring diagrams will group the wires together into major paths called highways.
- Organizing the wiring this way, allows the Cad Technician to show many wires within a small area.
- The highway diagram will show the actual physical arrangement of the components, just as in the point to point diagrams.

Highway Wiring Diagrams

Baseline Wiring Diagrams
- Similar to highway wiring diagrams in that they bundle many wires together into a baseline.
- The baseline wiring diagrams differ from highway wiring diagrams in that the location of components is not accurate in the baseline diagram.
- The baseline diagram will simply show the components in a straight lines.
- Wires are shown entering the bundle from 90 degrees without any accurate location/direction.
Baseline Wiring Diagrams

- Add a construction line down the center of the paper
- Line up components on either side of the line
- Draw short lines from each component to the bundle entering the bundle at ninety degrees
- Identify the color and destination of each wire
- Make the center line a dark bold line

Note: Baseline drawings are not normally used for assembly instructions but rather for service manuals and maintenance instructions

Interconnection Diagrams

- Show the wiring between different electronic units and between subassemblies.
- Similar to a point to point diagram
- Each electronic unit must be identified, called out and assigned a title and drawing number.
- Subassemblies are to be shown in phantom lines
- Internal connection of electronic components are not shown

Cable Assembly Drawing

- Contain all of the information required to assemble the cable.
  - Complete parts list
  - Drawing showing all components
  - Reference designations for each component
  - Wiring diagram showing internal components of the cable
  - General notes required for assembly
Wire Harness Assembly Drawings

- Wire harness assembly drawings are the only wiring drawings drawn to exact scale.
- Being exactly to scale is important as these drawings are used to create exactly to scale components, (much like a template).
- Harness drawings must be accompanied by a wiring list and parts list.
Wire Harness Drawings
- Accuracy is critical
- By creating a template/drawing the need for expensive highly skilled electrical technicians for assembly is eliminated.
- Quality control is made easier.
- The wire installation from the harness is less than what it would be for individual wires.

Designing the Wiring Harness
- The designer must know the exact locations of the components to be hooked up
- Wires are routed into/through the harness by being secured to retaining harness posts
- The wires will be wrapped around the starting post and secured to the end post.

Wiring Harness Design
- Lacing or strapping will be used to bundle the individual wires into one secure/permanent bundle.
- Once the wires are permanently bundled together and secured to the harness posts they may be lifted off of the routing board, and a new duplicate harness will be started.

Wiring Harness
- Once the harness has been assembled it will be installed.
- The Cad Technician must provide clear instructions for the assembly process.
- Each wire within the bundle must be clearly identified by color, number or destination.
- Numbered wires will be tagged on both ends with the identifying number.
- Wires identified by destination will have a tag at the exact location where it is to terminated identifying it.
- A wire list must accompanying harness wires identified by color or number.
Identifying Harness Wires

- **Color ID**
- **Tagged**
- **Destination**

Flexible Printed Wire

- Flexible printed wire is created in an extremely cost effective automated process.
- It is used whenever practical for mass production.
- The wiring is etched into a thin film that is shaped to fit the

Typical Notes for Wiring Drawings

- This drawing used with:
  - Assembly Dwg #
  - Schematic Dwg.
  - Wiring Diagram
- Wiring lengths determined by prototype.
- Wiring coding per MIL-STD-681
- Wiring must conform to ________.
- Soldering must conform to ____________.

Typical Notes for Wiring Diagrams

- Lace harness at each break out point and every _____ inches in-between.
- Apply cable straps at each breakout point and every ______ inches in-between.
- Unless otherwise specified all wires are ______.

Reference Designations

- Reference designations will be identical to those on the schematic except for component sockets which are prefixed “X”.

Component Representation

- Component representation is a simplified outline of the component as seen from the wiring side view.

Lab Assignment

- Chapter 5 Activity 3