Recent Changes to the Physical Layer (Chapter 8) for DeviceNet and EtherNet/IP

Brad Woodman
Molex

Technical Track
Agenda

- Introduction
- DeviceNet Chapter 8 Changes
  - Cable profiles updated for cable Drop length with current
- EtherNet/IP Chapter 8 Changes
  - Addition of M12-8 X-Coding connector
  - 1G Industrial cabling
  - Harmonizing with International standards
  - Chapter 8 new formatting with future data rates
- Earthing(Grounding) & Bonding Technical Guideline
  - Equipontential/mesh grounding vs. star grounding
  - Harmonizing with International standards
DeviceNet Cable profiles

Drop current per cable length for Thick

Formula drop current graph and table

- \[ I = \frac{0.35V}{((\text{Cable DCR} \times \text{Length of Drop}) + (\text{Contact DCR} \times \text{Number of contacts}))} \]

- Cable DCR @80°C = \( R_0 \times [1 + \alpha(T - T_0)] \)
- \( R_0 = 3.6 \text{ ohms/1000ft} \), DCR of copper at 20°C
- \( \alpha = 0.00393/\text{degrees C} \) (coefficient for copper)
- \( T = 80 \) (new temperature)
- \( T_0 = 20 \)
- Contact DCR = 0.001 ohms
- Number of contacts = 8 (4 connections with 2 contacts for each connection)
DeviceNet Cable profiles

Drop current per cable length for Thick

<table>
<thead>
<tr>
<th>Drop Length in meters (feet)</th>
<th>0</th>
<th>0.3 (1)</th>
<th>0.9 (3)</th>
<th>1.5 (5)</th>
<th>2.3 (7.5)</th>
<th>3.0 (10)</th>
<th>4.6 (15)</th>
<th>6.1 (20)</th>
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<tbody>
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<td>Maximum Current in amps</td>
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DeviceNet Cable profiles

Drop current per cable length for Thin

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<td>2.1</td>
<td>1.6</td>
<td>1.1</td>
<td>0.8</td>
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</table>
EtherNet/IP M12-8 X-Coding

M12-8 X-Coding features

► 4-pair shielded or unshielded cables
► Complaint to IEC 61076-2-109
► Sealed to both IP65 and IP67 ingress ratings
► Category 6A Connector performance to ISO/IEC 11801 & TIA-568 and IEC 60512-29-100
► Accepted by both EtherNet/IP and PROFINET specifications
► Standardized in IEC 61918 and IEC 61784-5-x series
EtherNet/IP M12-8 X-Coding

M12-8 X-Coding features

Plug connector with male pin contacts

Jack connector with female socket contacts
EtherNet/IP Adding 1G cabling

MICE Environments

- Commercial cabling (MICE 1)
- Industrial cabling (MICE 2 and MICE 3)
EtherNet/IP Adding 1G cabling

Concerns for industrial cabling

- Noise coupling
- Loss data packets, especially for Motion Control
- Shielded vs. Unshielded cables
# EtherNet/IP - Reformatting

## Layout and tables

<table>
<thead>
<tr>
<th>Service</th>
<th>PMD/MDI</th>
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<td>Data Rate</td>
<td>PMD Clause</td>
<td>PMA</td>
<td>Other relevant Clauses</td>
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<td>10BASE-T</td>
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<td>PMD ANSI X3.230-1994 Clauses 6 and 7, Clause 66</td>
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## Industrial EtherNet/IP Connector Specifications and Requirements

<table>
<thead>
<tr>
<th>Specification</th>
<th>Type</th>
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<th>M12-4 D-Coding</th>
<th>M12-8 X-Coding</th>
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<tbody>
<tr>
<td></td>
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<td>RJ-45-Shielded</td>
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<tr>
<td>Conductor</td>
<td>8 + 1 Shield</td>
<td>8</td>
<td>4</td>
<td>8</td>
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</table>
Harmonizing with standards

Standards with harmonizing activity

- ISO/IEC JTC1/SC25/WG3
- IEC SC65C JWG10
- IEC 48B WG3 & WG5
- ANSI/TIA TR42.9
Earthing (Grounding) & Bonding

Technical Guideline

➤ Guide for all CIP Networks

➤ Key definitions

- **Bonding**: Act of connecting together exposed conductive parts and extraneous conductive parts of apparatus, systems, or installations that are at essentially the same potential.

- **Earthing**: (verb) often referred to as, “Grounding” in the US influenced markets means to make an electrical connection between a given point in a system or in an installation or in equipment and the local earth.

- **Parallel Earthing Conductor or Potential Equalization cable**: a conductor connected in parallel with the screens/shields of signal and/or data cables in order to limit the current flowing through the screens.
Earthing (Grounding) & Bonding

Equipotential/mesh bonding network
Earthing (Grounding) & Bonding

Star grounding
Harmonizing with standards

Baseline standards

▶ IEC 61918 Industrial communication networks–Installation of communication networks in industrial premises
▶ IEC 61000-5-2 Electromagnetic compatibility (EMC)–Part 5: Installation and mitigation guidelines – Section 2: Earthing and cabling
▶ IEC 60364-4-44 Low-voltage electrical installations– Part 4-44: Protection for safety – Protection against voltage disturbances and electromagnetic disturbances

Standards with harmonizing activity

▶ ISO/IEC JTC1/SC25/WG3
▶ IEC SC65C JWG10
▶ ANSI/TIA TR42.16
Thank you

Any Questions?