



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

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Technical Track

- ▶ 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

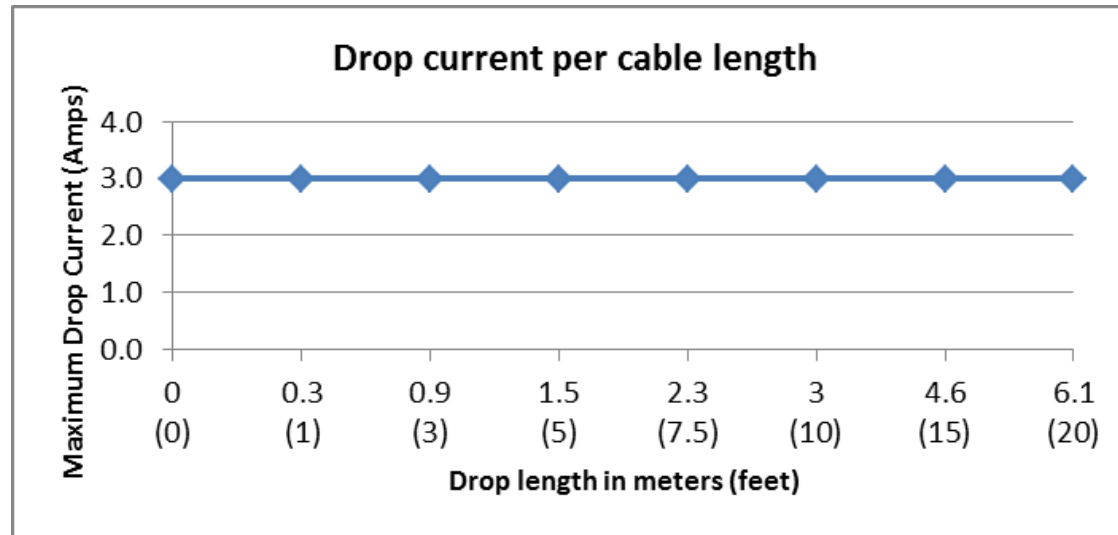
DeviceNet Cable profiles

Drop current per cable length for Thick

- ▶ Formula drop current graph and table
 - $I = 0.35V / [(Cable\ DCR * Length\ of\ Drop) + (Contact\ DCR * Number\ of\ contacts)]$
 - Cable DCR @80°C = $R_0 * [1 + \alpha(T - T_0)]$
 - $R_0 = 3.6\ ohms/1000ft$, DCR of copper at 20°C
 - $\alpha = 0.00393/degrees\ C$ (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

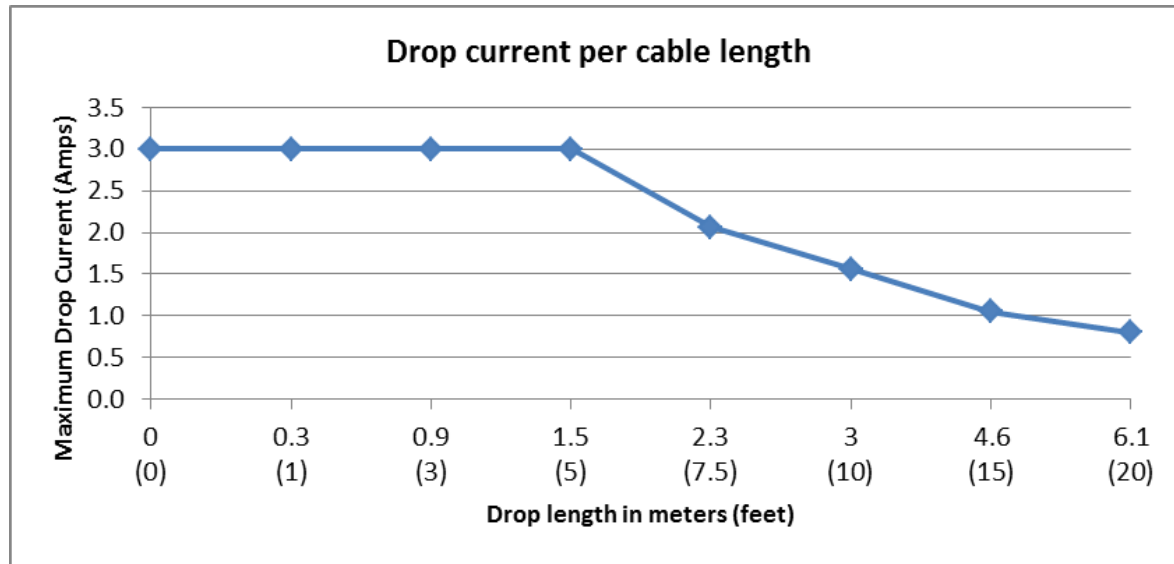
Drop current per cable length for Thick



Drop Length in meters (feet)	0	0.3 (1)	0.9 (3)	1.5 (5)	2.3 (7.5)	3.0 (10)	4.6 (15)	6.1 (20)
Maximum Current in amps	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0

DeviceNet Cable profiles

Drop current per cable length for Thin



Drop Length in meters (feet)	0	0.3 (1)	0.9 (3)	1.5 (5)	2.3 (7.5)	3.0 (10)	4.6 (15)	6.1 (20)
Maximum Current in amps	3.0	3.0	3.0	3.0	2.1	1.6	1.1	0.8

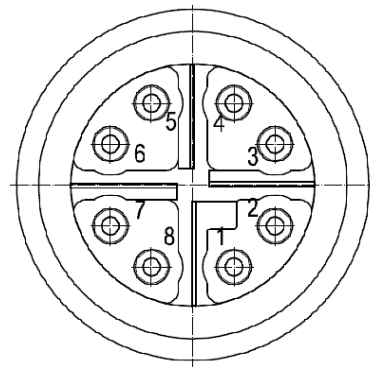
EtherNet/IP M12-8 X-Coding

M12-8 X-Coding features

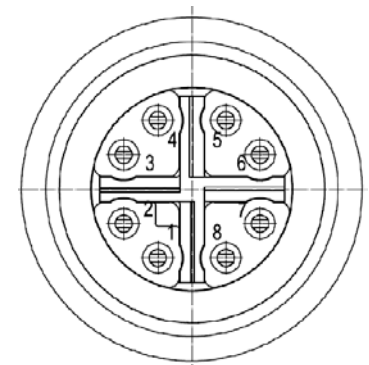
- ▶ 4-pair shielded or unshielded cables
- ▶ Complaint to IEC 61076-2-109
- ▶ Sealed to both IP65 and IP67 ingress ratings
- ▶ Category 6_A Connector performance to ISO/IEC 11801 & TIA-568 and IEC 60512-29-100
- ▶ Accepted by both EtherNet/IP and PROFINET specifications
- ▶ Standardized in IEC 61918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

EtherNet/IP M12-8 X-Coding

M12-8 X-Coding features



**Plug connector with
male pin contacts**

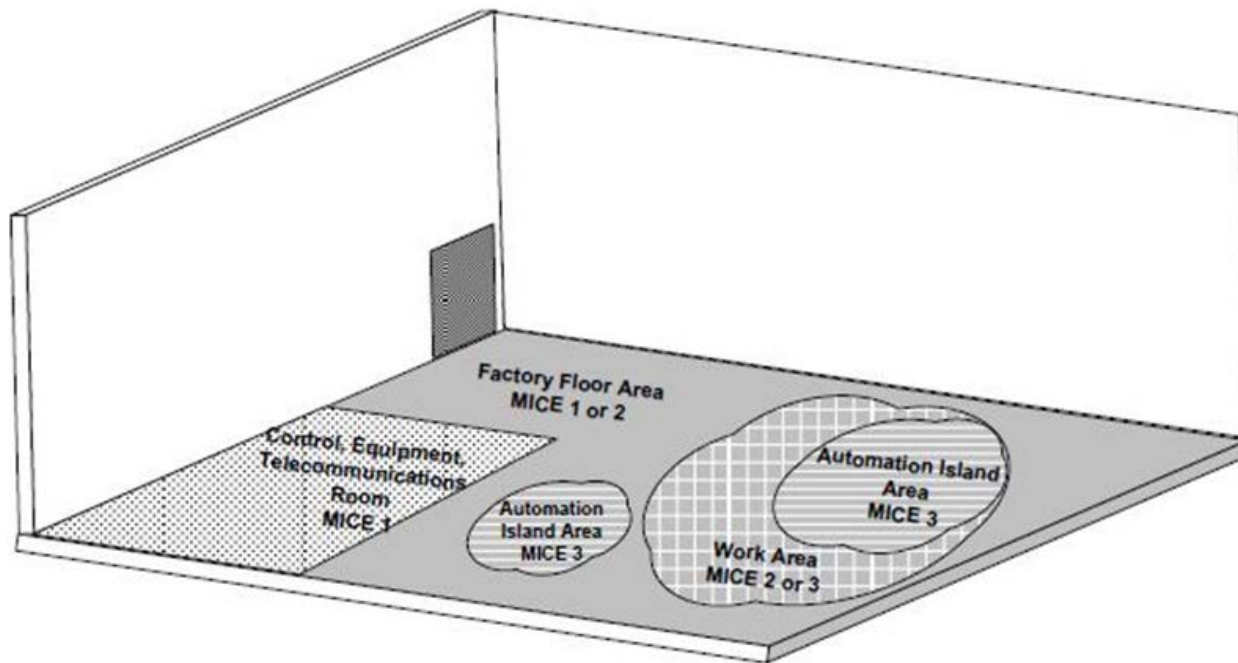


**Jack connector with
female socket contacts**

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

Service	PMD/MDI			
Data Rate	PMD Clause	PMA	Other relevant Clauses	Auto Negotiation
10BASE-T	9	14	ANSI X3.263-1995	
100BASE-X	24		ISO/IEC 9314, ANSI X3T12 (FDDI)	
100BASE-TX	25		ANSI X3.263-1995	
1000BASE-X	36	36	PMD ANSI X3.230-1994 Clauses 6 and 7 , Clause 66	37
1000BASE-T	40	40		28

Industrial Ethernet/IP Connector Specifications and Requirements				
Specification	Type			
Electrical	RJ-45-Shielded	RJ-45	M12-4 D-Coding	M12-8 X-Coding
Conductors	8 + 1 Shield	8	4	8
Insertion Loss	ANSI/TIA-568-C.2 Category 5E	ANSI/TIA-568-C.2 Category 5E	IEC 61076-2-101	IEC 61076-2-109
RL	ANSI/TIA-568-C.2 Category 5E	ANSI/TIA-568-C.2 Category 5E	IEC 61076-2-101	IEC 61076-2-109
NEXT Loss	ANSI/TIA-568-C.2 Category 5E	ANSI/TIA-568-C.2 Category 5E	IEC 61076-2-101	IEC 61076-2-109

Harmonizing with standards

Standards with harmonizing activity

- ▶ ISO/IEC JTC1/SC25/WG3
- ▶ IEC SC65C JWG10
- ▶ IEC 48B WG3 & WG5
- ▶ ANSI/TIA TR42.9

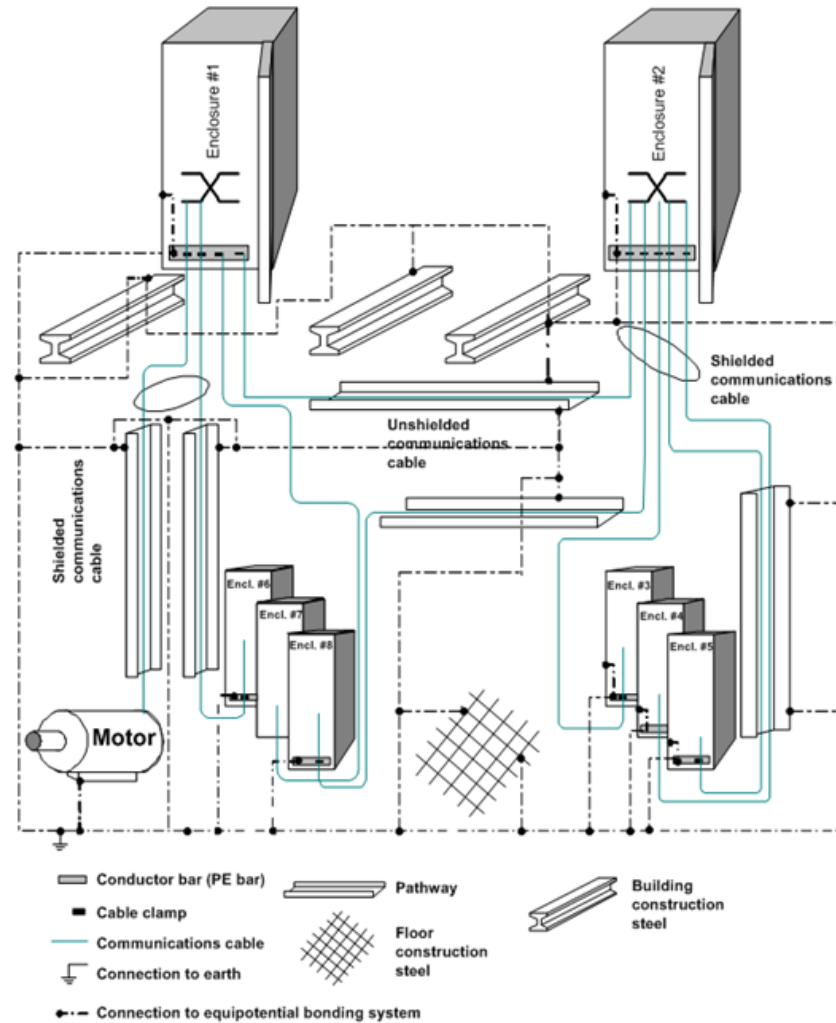
Earthing (Grounding) & Bonding

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.

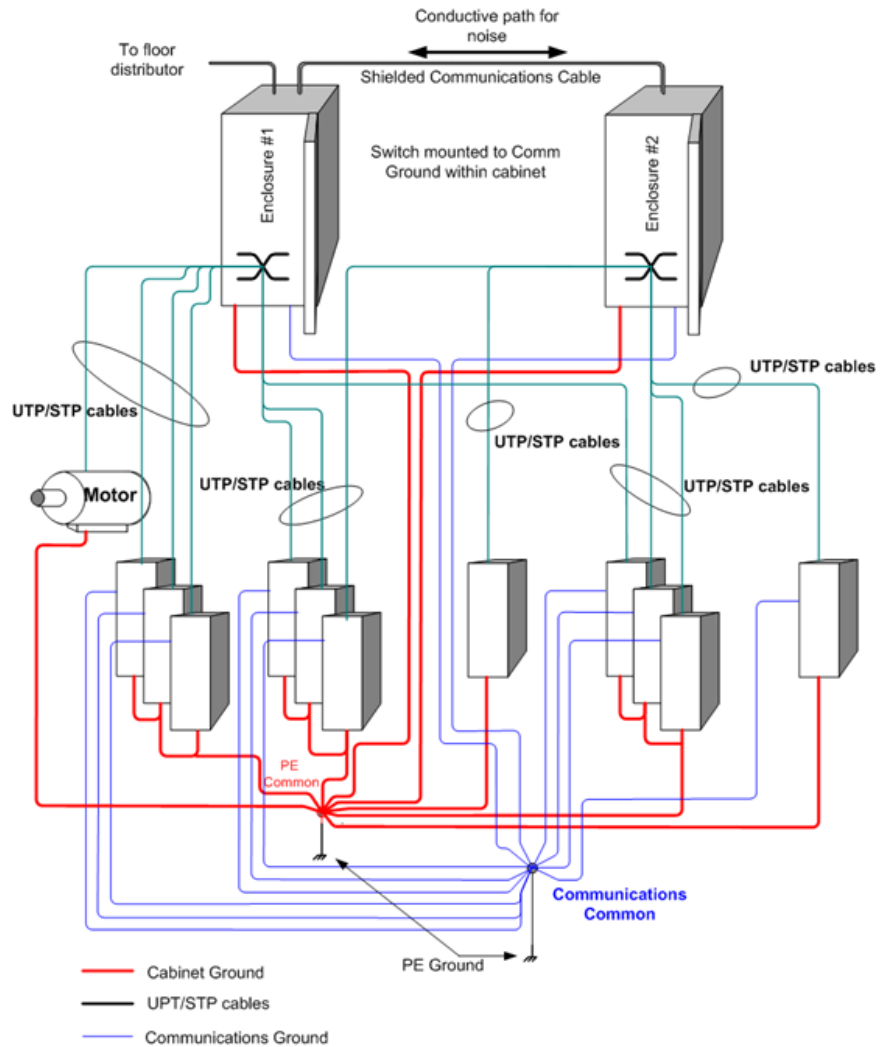
Earthing (Grounding) & Bonding

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 ?