Isolation Rewrite Proposal

IEEE P802.3da 10 Mb/s Single Pair Multidrop

Jason Potterf
Cisco
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Small Stuff

Align General Safety Text with Clause 147

188.10.1 General Safety

Equipment subject to this clause shall conform to the general safety requirements in J.2 or IEC 61010-1, as appropriate.

~~All equipment subject to this clause is expected to conform to IEC 60950-1, IEC 62368-1, or IEC 61010-1.~~

Justification: Align with 147.10.1 and remove deprecated reference to IEC 60950-1

Remove Telephony Voltage Section

~~188.10.3 Telephony voltages~~

~~The use of building wiring brings with it the possibility of wiring errors that might connect telephony voltages to a DTE. Other than voice signals, the primary voltages that can be encountered are the "battery" and ringing voltages. Although there is no universal standard, the following maximums generally apply: Battery voltage to a telephone line is generally 56 V DC, applied to the line through a balanced 400 Ω source impedance. Ringing voltage is a composite signal consisting of an AC component and a DC component. The AC component is up to 175 Vp at 20 Hz to 60 Hz with a 100 Ω source resistance. The DC component is 56 V DC with 300 Ω to 600 Ω source resistance. Large reactive transients can occur at the start and end of each ring interval. Care should be taken to avoid such connections as they can damage equipment.~~

~~Application of any of the above voltages to the TCI of a DTE in non-automotive applications shall not preclude conformance with 188.10.1 and 188.10.2.~~

Justification: This text appears in Clause 104 but not Clause 147. Deleting this aligns it with other relevant PHY clauses.

Big Picture

Destroying the Environment

“Electrical Isolation Environments”

MPoE Environment A: When a mixing segment, with all its associated interconnected equipment, is entirely contained within a single low-voltage power distribution system and within a single building.
(Somewhat isolated)

MPoE Environment B: When a mixing segment crosses the boundary between separate power distribution systems or the boundaries of a single building.
(More Isolated)

MPoE Environment C: When a mixing segment, with all its associated interconnected equipment, is entirely contained within a single low-voltage power distribution system contained within a single cabinet, vehicle, machine, or other power domain where ground loops are unlikely to occur.
(Less isolated)

“Electrical distribution system types”

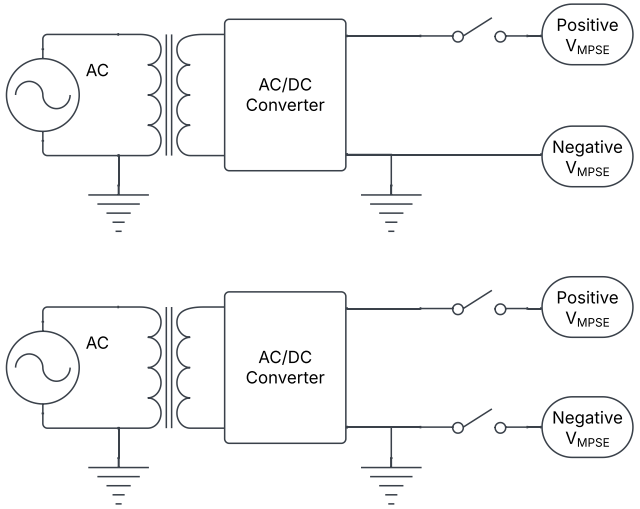
Isolated MPoE power distribution system: A mixing segment that crosses ground references, the boundary between separate power distribution systems, or the boundaries of a single building.

Grounded MPoE power distribution system: When a mixing segment, with all its associated interconnected equipment, shares a common, continuous ground.

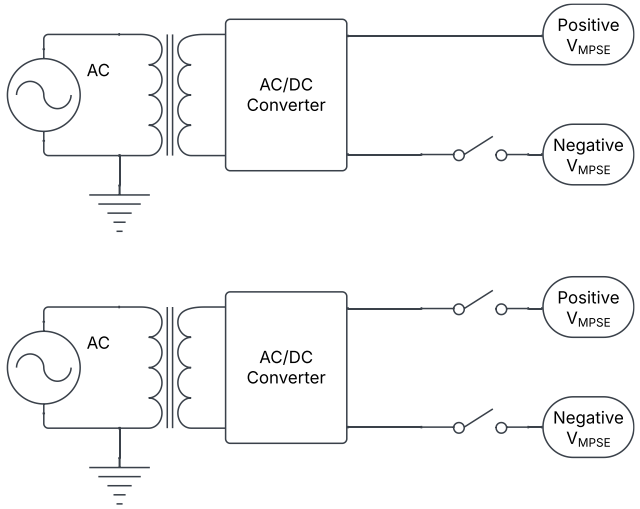
Justification: In PoE, the meaning of Environments A & B was hidden behind a letter designator, was rarely referenced and was often ignored. Let’s say what we mean using familiar terms!

Grounding Requirements

Grounded MPoE power distribution system



Isolated MPoE power distribution system



Note: Grounded MPoE MPSEs and MPDs *shall be labeled* to indicate they are ***grounded***

Actual Text

189.6.2 Electrical distribution system compatibility

MPoE permits two approaches to electrical isolation of the MPI to allow MPoE to adapt to common power distribution systems encountered in the environments where MPoE is likely to be deployed. The first approach targets low-voltage systems that intentionally ground one conductor, such as a Protective Extra-Low Voltage (PELV) system. The second approach targets low-voltage systems that prohibit intentional grounding of any conductor, such as a Safety Extra-Low Voltage (SELV) system.

Justification: New text that provides an overview of the two system types and clearly indicates the intent to offer compatibility with either legacy PELV or SELV systems.

189.6.2.1Electrical distribution system types

There are two electrical power distribution system types that require different approaches to grounding. They are as follows:

Isolated MPoE power distribution system: A mixing segment that crosses ground references, the boundary between separate power distribution systems, or the boundaries of a single building.

Grounded MPoE power distribution system: When a mixing segment, with all its associated interconnected equipment, shares a common, continuous ground.

Justification: Environment A, B, and C are conceptually combined to become Isolated MPoE, Environment C text is modified to become Grounded MPoE.

189.6.2.1.1 Isolated MPoE requirements

Isolated MPDs and MPSEs shall provide isolation between all accessible external conductors, including frame ground (if any), and all MPI leads, including those not used by the MPD or MPSE. Any equipment that can be connected to an MPSE or MPD through a non-MPI connector that is not isolated from the MPI leads needs to provide isolation between all accessible external conductors, including frame ground (if any), and the non-MPI connector. External accessibility to conductors is specified in Section 5.4.10.1 b) of IEC 62368-1:2023.

Attachment of a mixing segment via an MPI of an MPD or MPSE that has multiple instances of an MPI requires electrical isolation between each segment and the protective ground of the MPSE or MPD.

This electrical isolation shall meet the isolation requirements as specified in Annex J.1 with electrical strength test c) details being replaced by: “An impulse test consisting of a 1500 V, 10/700 waveform, applied 10 times, with a 60 s interval between pulses. The shape of the impulses is 10/700 (10 µs virtual front time, 700 µs virtual time to half value)”, as defined in ITU-T Recommendation K.44.

An multiport MPSE does not require electrical power isolation between mixing segments. A multiport MPD or combination MPSE and MPD requires electrical power isolation between mixing segments.

An Isolated MPSE shall switch the more negative conductor. It is allowed to switch both conductors.

Justification: Consolidates isolation requirements into this one section. Remove NID language as there will be no NIDs in an MPoE system. Clarify that a multi-port MPSE can omit port to port isolation, but a multiport MPD cannot, nor an MPSE/MPD combination device. Retain negative conductor switching language.

189.6.2.1.2 Grounded MPoE requirements

A Grounded MPSE or MPD does not require electrical power isolation between mixing segments and shall provide the means to connect the negative VMPSE or VMPD power rail to ground.

A Grounded MPSE shall switch the more positive conductor. It is allowed to switch both conductors.

Justification: Removed PoDL isolation language as we are permitting these systems to have their power rails grounded. To ensure power switching is not bypassed by this ground connection, positive rail switching is mandatory.

189.7.8 Labeling

It is recommended that the MPSE or MPD (and supporting documentation) be labeled in a manner visible to the user with at least the following parameters:

a) System type (i.e., “Type 0”, “Type 1”, or “Type 0/1”).
b) Port type (e.g., 10BASE-T1M, TIA Category, or ISO Class).
c) “MPSE” or “MPD” as appropriate.
d) MPoE ~~Environment~~ distribution system compatibility type (e.g., ~~Environment A, B, or C~~ Isolated or Grounded).
e) Maximum continuous power supplied or consumed in units of Watts.
f) Maximum current supply capacity or consumption in units of Amperes.
g) For MPDs only, unit loads for each compatible operating voltage range.
h) For Isolated MPoE MPSEs or MPDS, ~~I~~indicate any non-MPI connectors which are not isolated from the MPI leads.
i) Any applicable safety warnings.

Grounded MPSEs and MPDs permitted in 189.6.2.1.2 shall clearly indicate that it is only compatible with Grounded MPoE system. It should also indicate if the MPI(s) are internally grounded or intended to be grounded at an external connection point.

Justification: Grounded MPSEs and MPDs break with legacy PoE grounding schemes. Thus, the labeling of grounded MPSEs and MPDs will be mandatory.

Questions to Consider

- Is one set of isolation requirements sufficient for isolated systems?
- Should grounded systems have *some* minimal impedance between the data pins and the power rails?
- Is there a more modern way to describe PELV and SELV that is consistent with IEC 62368-1?

Discussion