
# Levels of interoperability

For single-pair multidrop with bus powering

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# Interoperability

> *A standard sacrifices features and performance to gain interoperability.*
>
> 802.3 member

> *All options are mandatory.*
>
> Bob Metcalfe

Many of the discussion we have today are rooted in stakeholders having different needs and expectations in the level of interoperability a standard provides.



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# Levels of interoperability

**Full interoperability**

- Many companies
- No additional specification
- Many device combinations
- User installed
- Expected to work

**Partner ecosystem**

- Few companies
- Additional specification possible
- Limited device combinations
- User or company installed

**Engineered systems**

- Single company
- Controlled specification
- Controlled device combinations
- Company installed
- Tested to work

The use-case / industry tends to determine which level of interoperability is required.



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# What is needed for full interoperability ?

By full interoperability we mean that two devices that are connected together “work”. That entails:

- It is physically possible to connect them through a cable (matching connectors)
- PHYs are connected in a compatible way (correct pinout)
- PHYs use compatible signaling
- Compatible MACs — fully defined
- In case of power: compatible powering system
- Higher layer compatibility (not an 802.3 concern with a few exceptions)



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# How do we create a standard which offers full interoperability without getting in the way of engineered systems ?

- The Reverse Connector Choice
- Two Stage Standard

# The Reverse Connector Choice

## “A device using connector X at the MDI/PI shall meet the following requirements: …”

Instead of mandating a connector, the standard ties a number of requirements to the use of a certain connector. If the mentioned connector is not used, those requirements do not apply.
Examples:

- it implies a certain voltage range
- PDs are required to pass a certain amount of current (in case of daisy chain)
- it implies certain assumptions about DC channel resistance
- A subset of data modes such that communication always works

# A Two Stage Standard

In this approach two Clauses are created, each with their own PICS.

**The base Clause** contains all the requirements to achieve a working system in the context of engineered systems.

**The system Clause** contains additional requirements required to achieve full system-to-system interoperability (such as connector choices and restrictions of option permutations).

# Functions in a powering scheme

The powering standards 802.3 PoE & PoDL have a number of functions:

| | |
|---|---|
| **Detection** | checks if a certain piece of equipment is capable and willing to receive power. |
| **Classification** | is a two-way negotiation about power needs and power allocation. Can also be used to negotiate the voltage level. |
| **Inrush** | limits the amount of current when initial power is applied. |
| **Power limits** | Protects the PSE and cabling from overloads. |
| **Power removal** | Removes voltage when the load (PD) is disconnected. |

A bus powering scheme will need some of the above functions as well, but there are significant differences compared to a one-on-one system like PoE.



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# Detection

Detection ensures that power is not applied unless a PD is connected. With a bus powering system we make use of implicit detection: if the device has a connector is Type X, that is sufficient to indicate that it is capable of handling power with the properties associated with connector X.

PSEs will not need to perform detection, power may always be applied.

Looking back at PoE, it would be a good idea to require every 10BASE-T port (regardless of connector) to not sustain damage when exposed to up to 60V. (Update: CG did this, good!)

# PSE main requirements

The PSE requirements such as operating voltage, current sourcing capability, DC resistance specification of the channel, can all be tied to the connector Type.

For example:

| | **Connector X** | **Connector Y** |
|---|---|---|
| Operating voltage | 54 V to 57 V | 10 V to 12 V |
| Current output | 0.5 A to 2 A | 0.25 A to 0.5 A |
| Polarity | defined for X | defined for Y |
| Minimum wire gauge | 24 AWG | 22 AWG |
| Data | ? | ? |



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# Lighting use-case

In order to use a 10SPE system for lighting controls (and this probably holds for building automation as a whole), a **full interoperability** level is needed.
Complies with 802.3xx (where xx is the multidrop project) means:

- Defined cost-effective connector
- A simple and plug&play powering scheme
- With 16 nodes supported or better
- With 50 meter of length or better
- Data always works (no permutations where devices can’t communicate)
- Using AWG24 cable
- Fast DLL classification (1 second)


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