How Intrinsic Safety affects PHY Design

Markus Wucher, Harald Müller

Endress + Hauser

Motivation

- Harmonization on objectives for industrial (Factory, Building and Process industry) and automotive use of 10 Base SPE
- Our goal is a fast standardization and early start on “10 Base SPE Study group”
  - Optional “Multi-Drop” function for short length 15m
  - Optional “power” via 2-wire twisted pair cable 15m, 40m,200m,1000m
  - Optional “Internal or external Termination”
  - Optional “Diagnosis function” for short and long reach
  - Support for the objective “Do not preclude working within an Intrinsically Safe device and system as defined in IEC 60079”
- These use cases are more for the implementation of the PHY and should not be separate objectives
  => Based on one or more PHY designs, detail work inside task force

Scope: Optional “Multi-Drop” function for short length 15m

- Some use cases inside automotive and process industries require a “Multi-Drop” function for short length 15m
- Proposal: Optional function of PHY for short length up to 15m
- “Multi-Drop” Mode is not required for 40m, 200m and 1000m length
- => Based on one or more PHY designs, detail work inside task force

Scope: Optional “power” via 2-wire twisted pair cable 15m, 40m, 200m, 1000m

- Some use cases inside industrial (Factory, Building and Process industry) and automotive require “power” via 2-wire twisted pair cable
- Proposal: Optional “power” via 2-wire twisted pair cable 15m, 40m, 200m, 1000m
- => Based on one or more PHY designs, detail work inside task force

Scope: Optional “Internal or external Termination”

- IS requires resistors for current limiting
- For this application in the range of ~20 .. 50 Ω
- Very specific requirements on:
  - Distances, Power, Warming, ….
- Can be part of a serial termination resistance
- Proposal: Optional “Internal or external Termination”
- => Based on one or more PHY designs, detail work inside task force

Scope: Support for the objective “Do not preclude working within an Intrinsically Safe device and system as defined in IEC 60079”

- **Adjustable Transmit Voltage**
  - Data signal voltages add up to a DC-voltage
  - Thus, the DC-voltage must be reduced compared to the allowed voltage
  - Since we are only using 200m for IS, the signal voltage can be smaller than for 1000m, allowing for more DC-Voltage
  - Support of 2 PHY transmit level 1-1.5 Vp-p and 2-3 Vp-p, detail work inside task force and PHY implementation

Scope: Support for the objective “Do not preclude working within an Intrinsically Safe device and system as defined in IEC 60079”

- **DC free signal**
  - The communication signal is coupled to the line via capacitors
  - This decouples it from the optional power transmission
  - Requirement: **The transmit signal needs to be DC free**

  => Based on one or more PHY designs, detail work inside task force

Things not affecting the PHY

- No need for any special or additional certification.
- No need for tolerating any unusual voltages, temperatures, etc.
- Currents, clearances etc. are not required to be designed for IS by the PHY. This is taken care of by discrete components.

Conclusion of PHY-Requirements

- Optional “Multi-Drop” function for short length 15m
- Optional “power” via 2-wire twisted pair cable
  15m, 40m, 200m, 1000m
- Optional “Internal or external Termination”
- Optional “Diagnosis Function” for short and long reach
- Support for the objective “Do not preclude working within an Intrinsically Safe device and system as defined in IEC 60079”
  - Support of 2 PHY transmit level 1-1.5 Vp-p and 2-3 Vp-p
  - The transmit signal needs to be DC free

- These use cases are more for the implementation of the PHY and should not be separate objectives
  => Based on one or more PHY designs, detail work inside task force

THANK YOU!