
LEGACY INDUSTRIAL PROTOCOLS

IEEE 802.3 10Mbps Single Twisted Pair Ethernet
Study Group

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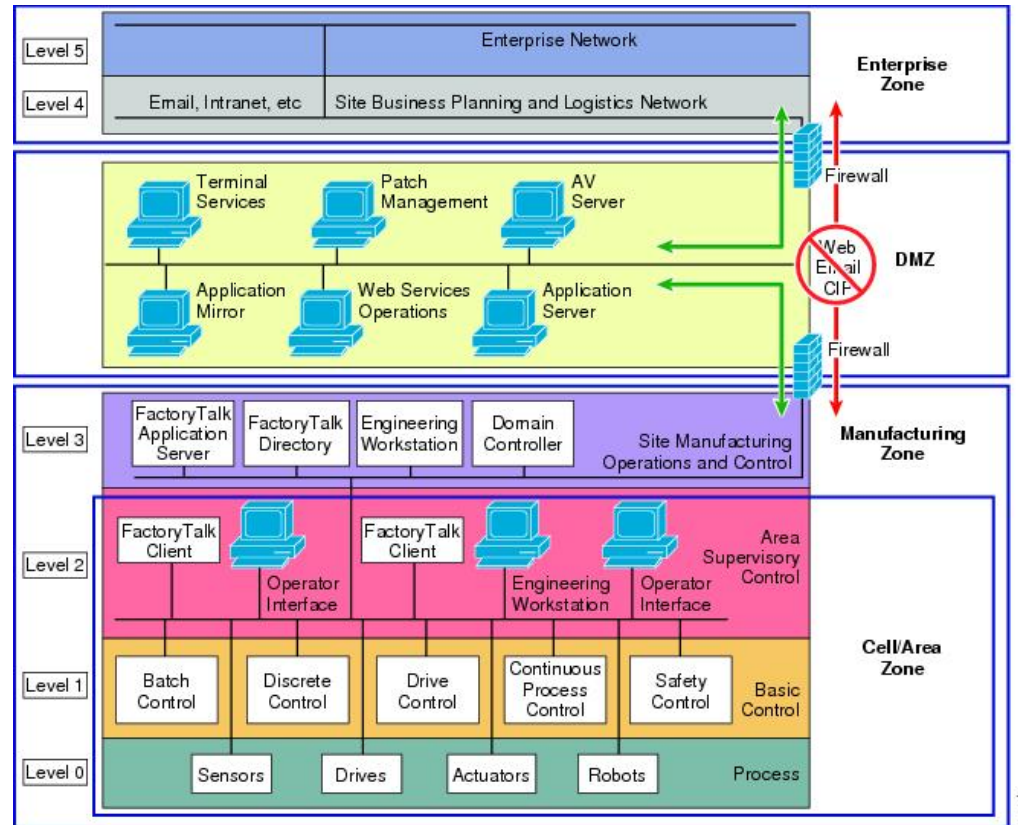
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Scope of Presentation

- Consider legacy industrial network cables impacted by 10 Mbs Single Twisted Pair Ethernet adoption
- Discuss cable types and network topologies that have a high value of reuse in brownfield installations
- Greenfield Industrial applications that benefit from 10 Mbs Single Twisted Pair Ethernet adoption

Purdue Control Hierarchy

Purdue Control Hierarchy



3 Main Industrial Automation Disciplines



Discrete Automation

- Examples: manufacturing lines, individual machines, work cells with automated machinery



Hybrid Automation

- Examples: breweries, distilleries



Process Automation

- Examples: refineries, petrochemical plants

Legacy Industrial Cabling - Reuse

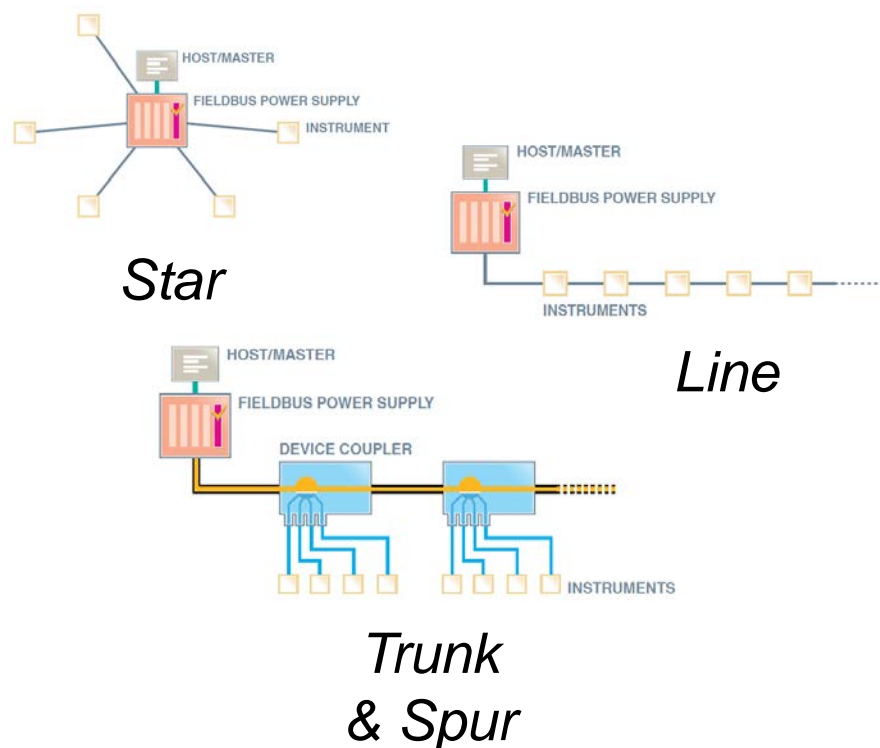
- Common practice in Process Automation applications
 - Upgrades typically take the form of DCS active hardware and software
 - Re-use viable sensors and low voltage networks at edge
- Customers hope that existing cabling infrastructure can be repurposed as extended reach single pair Ethernet
 - Media cost is not significant compared to the labor to remove and replace



*Wire Marshalling
Cabinet*

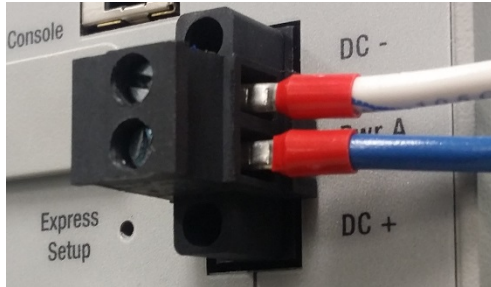
High Value of Reuse - Foundation H1

- Based on IEC-61158-2
- Power and communication on the same cable
- 3 common topologies
 - Star
 - Line
 - Trunk and Spur
- 100 ohm characteristic impedance
- Up to 4 repeaters can be used to extend to 9500 meters

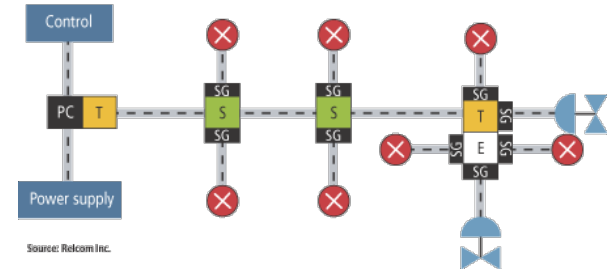


Type	Cable Description	Size	Max Length
A	Shielded, twisted pair	18 AWG	6232 ft / 1900 m
B	Multiple twisted pair with shield	22 AWG	3936 ft / 1200 m
C	Multiple twisted pair without shield	26 AWG	1312 ft / 400 m
D	Multi-core, without twisted pairs and having an overall shield	16 AWG	656 ft / 200 m

Foundation H1- Connections



A Foundation fieldbus connection system

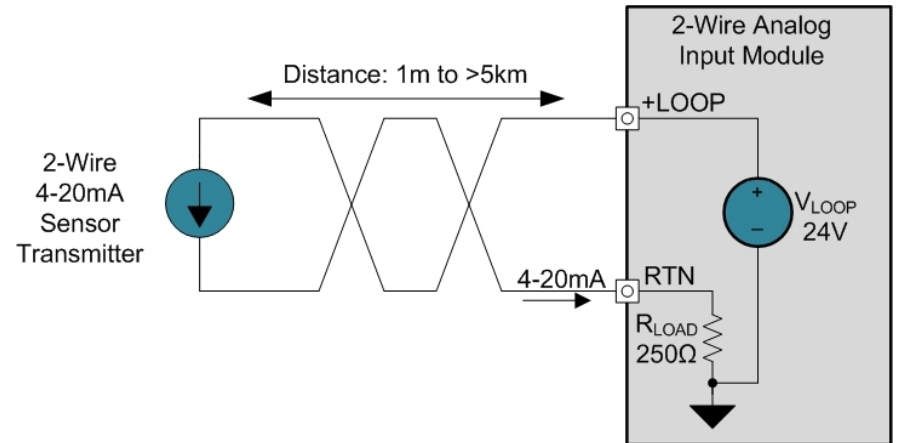


- Instrument end terminations are usually ferruled wires landed in a terminal strip (photo #1)
- Device end terminations are typically hardened connections like M12 or 7/8" 4-pole connectors (photo #2)

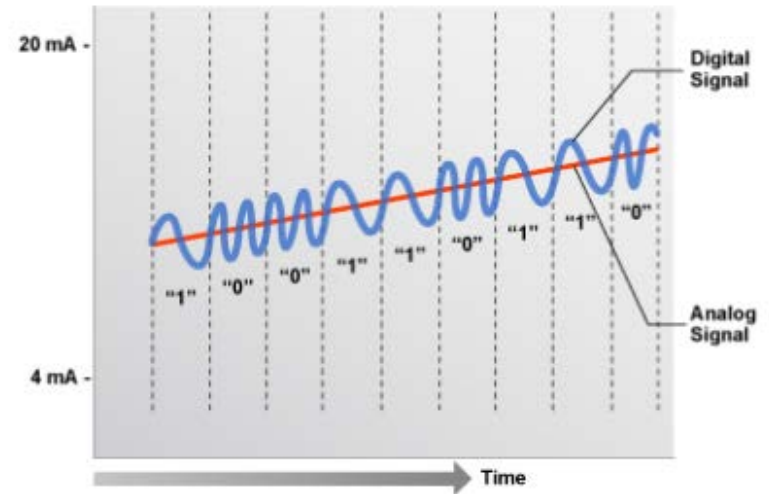
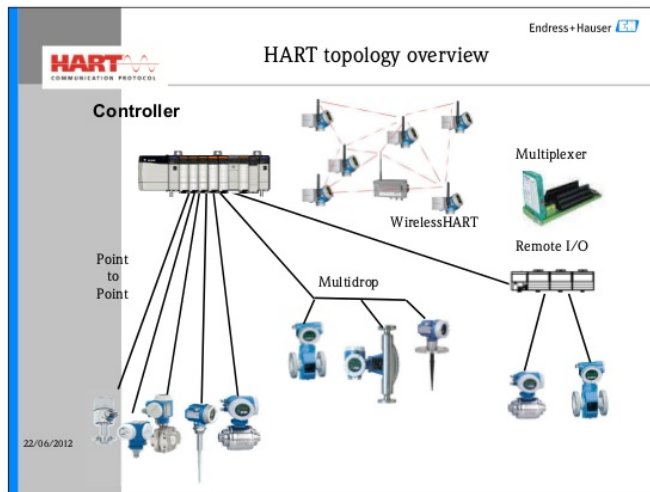
Foundation Fieldbus H1 Connections

4-20 milliamps

- Topology
 - Typically Star
 - One current loop per variable
- Ground loops possible if independent current loops are not properly isolated



HART - Highly Addressable Remote Transducer



Note: Drawing not to scale

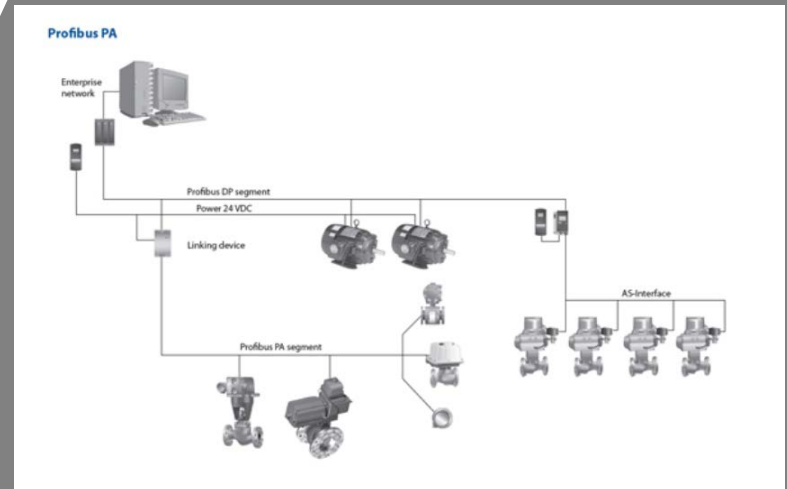
Digital over Analog

- Topologies
 - Point-to-Point Mode
 - Multi-Drop Mode
 - Remote I/O

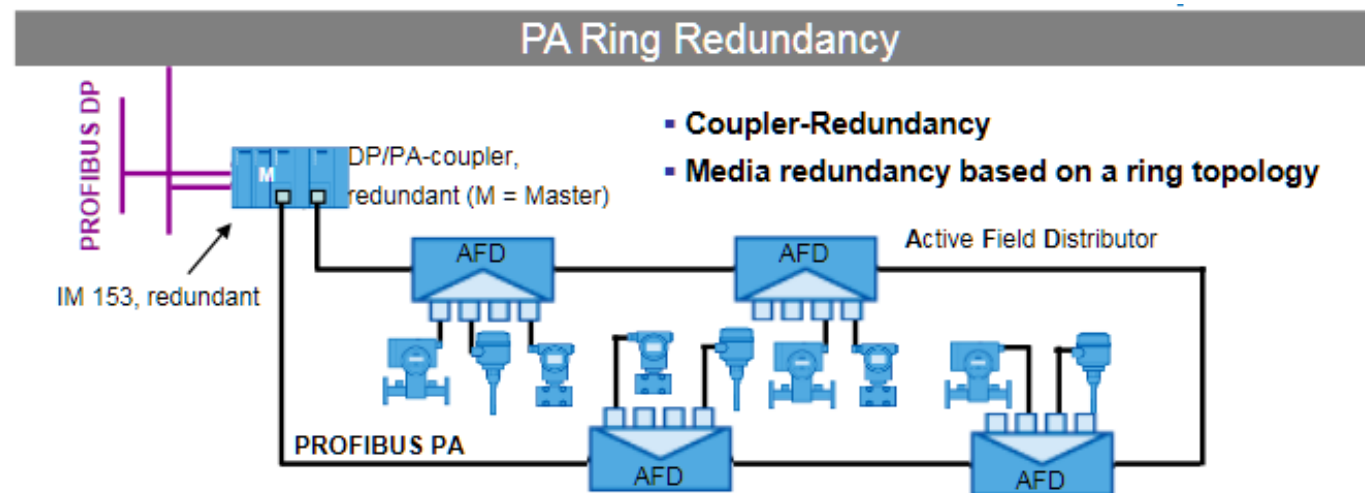
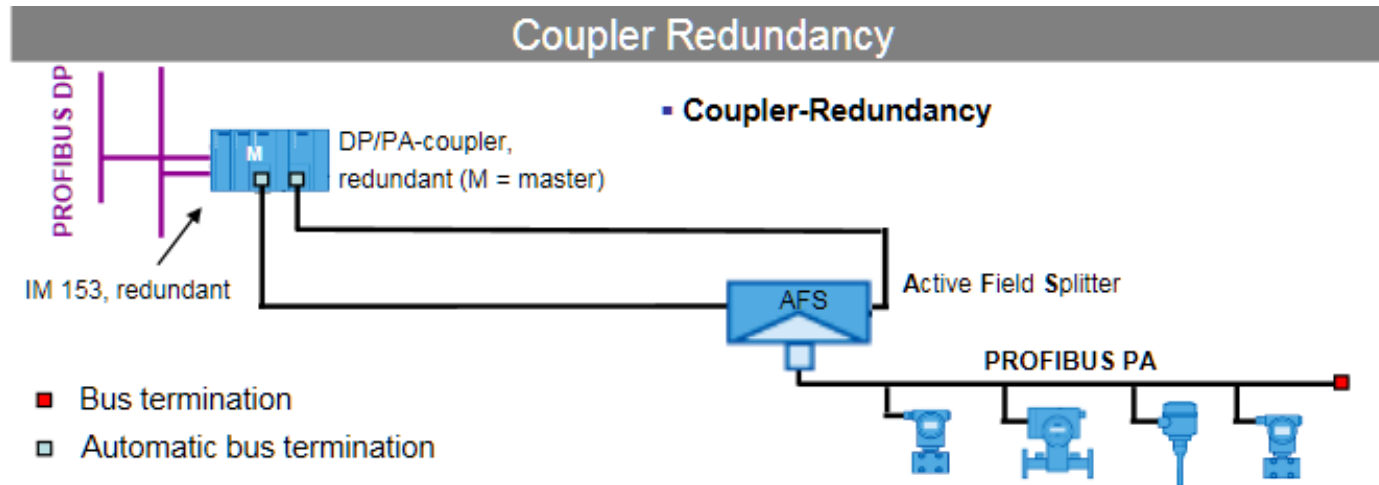
The main process variable is transmitted via the analog (4 – 20 mA) channel. All other information is communicated via a digital channel superimposed on the analog signal using Bell 202 FSK.

PROFIBUS PA

- Based on IEC-61158-2
- Shielded Twisted Pair Cable
- 100 ohm characteristic impedance
- Transmission speed determines cable length and vice versa, ranging from 1200 meters @ 9.6 kbps to 100 meters @ 12000 kbps



PROFIBUS PA



Summary

- Considered legacy industrial network cables impacted by 10 Mbs Single Twisted Pair Ethernet adoption
- Discussed cable types and network topologies that have a high value of reuse in brownfield installations
- Greenfield Industrial applications that benefit from 10 Mbs Single Twisted Pair Ethernet adoption