

Today's Industrial Ethernet Cabling Solutions for Harsh Environments

Peter Kauwenberg, Product Manager Industrial Cables EMEA, Belden

Loredana Coscotin, Product Marketing Manager Industrial Cables EMEA, Belden



BELDEN
SENDING ALL THE RIGHT SIGNALS



Industrial Ethernet

Industrial Networking

- Ethernet has had a very rapid expansion and a migration to harsh environments: **digital information transmitted from switches to Ethernet-enabled devices**
- Interface with wide range of devices such as controllers, I/Os, drives, robots
- **Harsh environments demand for specific cable designs**
- **Standard grade ethernet** placed in industrial-type mission critical applications **increase the risk of network faults and downtime**



Ethernet Is Moving Into Ever Harsher Environments

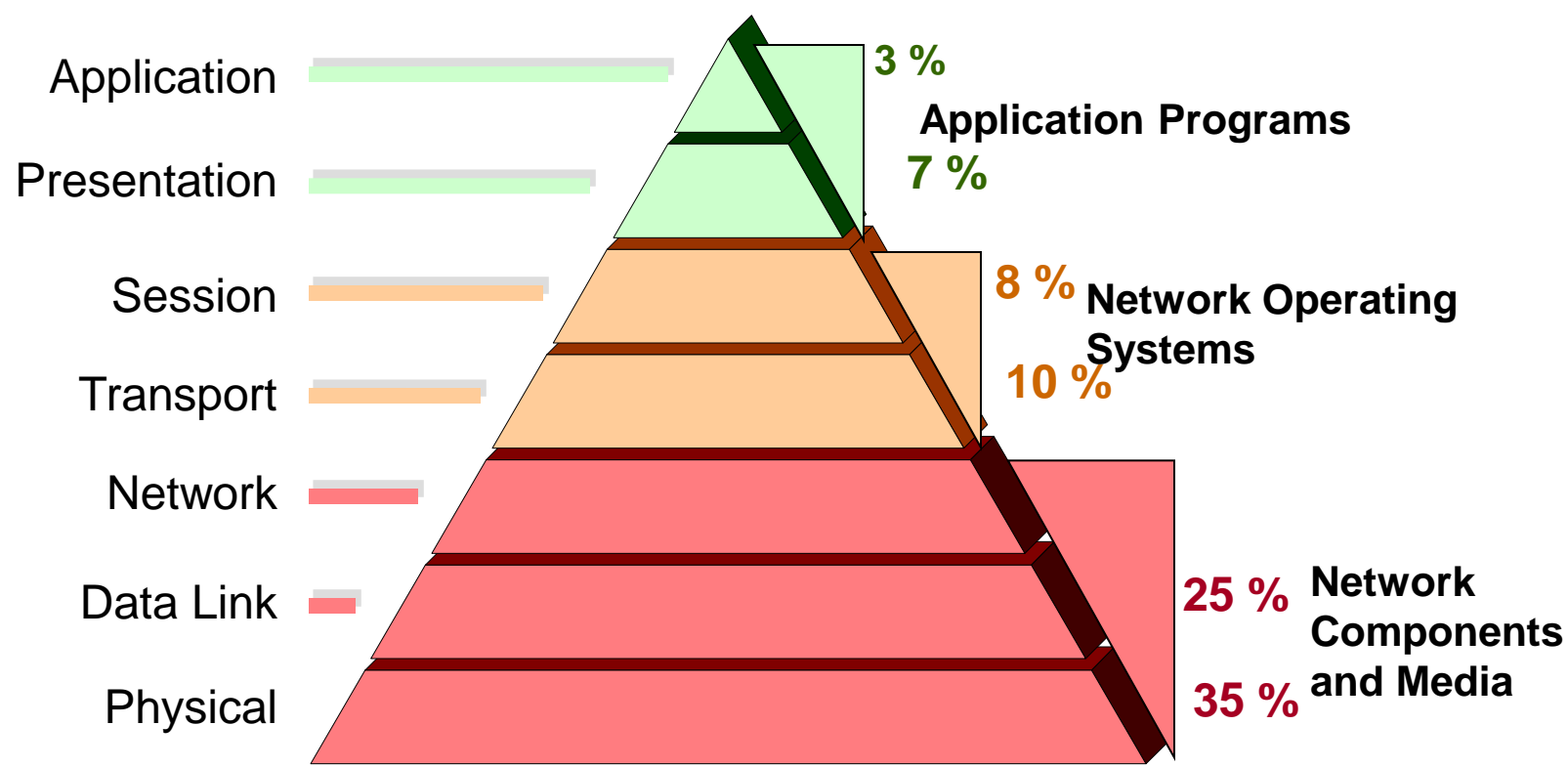
Industrial Ethernet

The Importance of the Right Networking Cable



Industrial Ethernet

What causes network faults?



Consequences of Downtime

Operator safety compromised



- Health
- Regulatory issues

Intermittent signal—stop production line

- Scrap

Inconsistent performance

- Stopped production

Reduced service life

- Increased service calls
- Early replacement



Cost of downtime

Automotive Plant	+ \$10,000/hour
Power Plant	+ \$45,000/hour
Oil Pipeline	+ \$25,000/hour

Industrial Ethernet

What causes cable failures?

Not the right grade cable for the application

- Not any data cable can withstand **industrial tough environments**

The environment and application is not considered

- Make sure you understand the details of the environment of the cable infrastructure
- Take into account the specific application requirements, understand the cable exposure and select the cable features accordingly
- Even when industrial ethernet is specified, the application needs to be considered!



Industrial Ethernet



Why not any data cable for tough environments?

Industrial Ethernet

Stranded conductors for improved flexibility

Foil + braid shield for RFI/EMI protection

Industrial grade outer jacket



Commercial Ethernet

Solid conductors, not fit for high flex application

Foil shield

Commercial grade jacket



Know Your Cable Is Up To The Job!

Industrial Ethernet

Belden's Tested Performance

Belden has carried out extensive testing to compare the physical and electrical performance of commercial with industrial cables.



Abrasion



Cold Bend



Crushing



Cut-through



High
Temperature



Oil Resistance



UV Exposure



Water
Immersion



Cold Impact

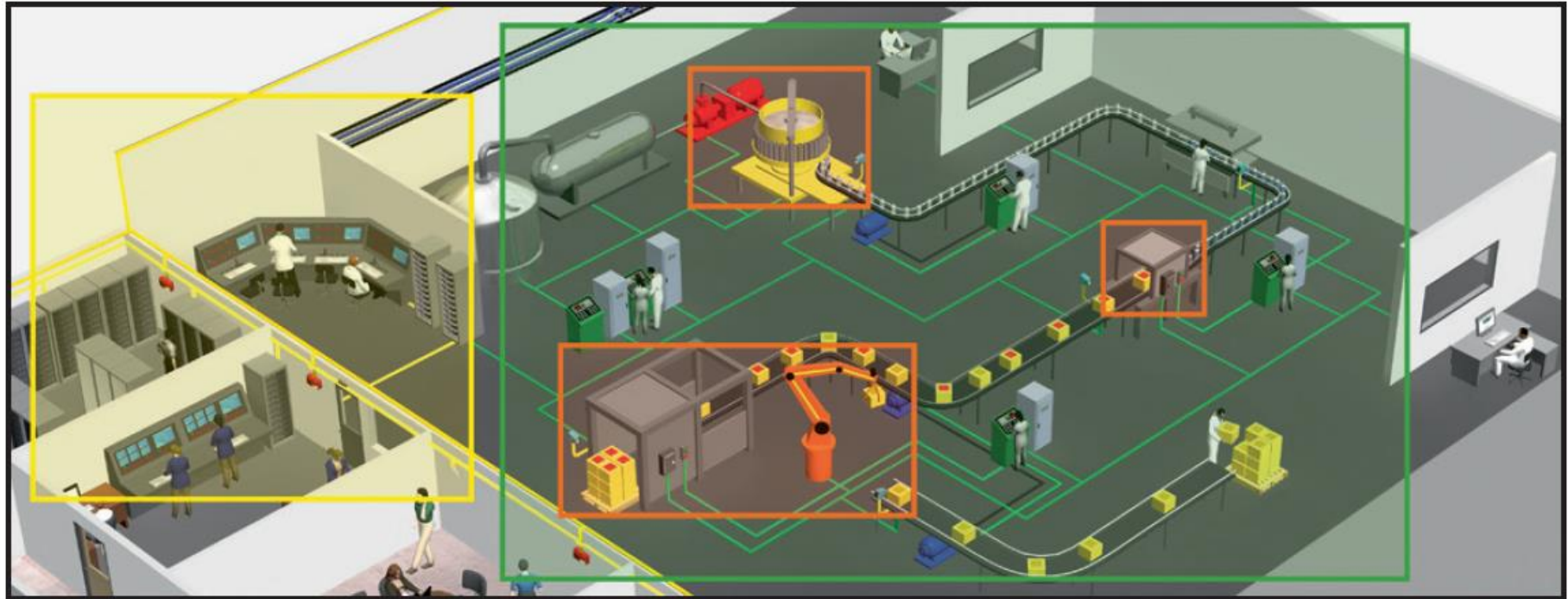
Tests Clearly Indicate a Commercial-grade Cable is Never Suitable for Extreme Conditions Inherent in Industrial Environments!

Industrial Ethernet





Specify Ethernet for Your Application!

Know Your Environment



 Cabinet Control Room and Permanent Installation

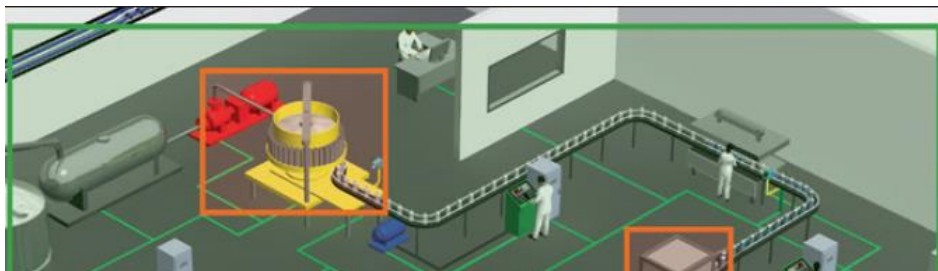
 Factory Floor and Moderate Flexing

 On-Machine and Continuous Flexing

Industrial Ethernet

Know Your Environment

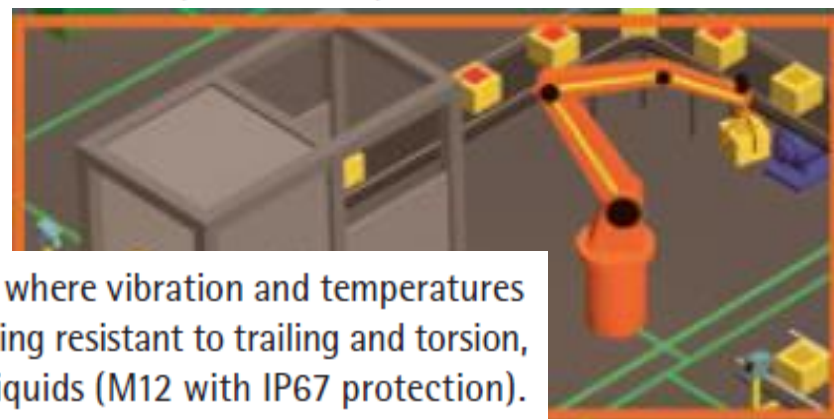
Permanent Installation range is suitable for cabinets, control rooms and telecommunication rooms: enclosed environments, where vibration is limited. In these applications, a solid conductor is the right choice, future-proofed with high bandwidth capability.



Moderate Flexing range is aimed at the factory floor and work areas where there are raised levels of vibration, and cables are likely to be exposed to oil, chemicals, rough handling, abrasion, UV radiation, temperature variations, and electronic noise (EMI and RFI).



Continuous Flexing range is for use on the machine itself, where vibration and temperatures are high to very high, and the need is for highly flexible cabling resistant to trailing and torsion, as well as a high level of connectivity protection against liquids (M12 with IP67 protection).



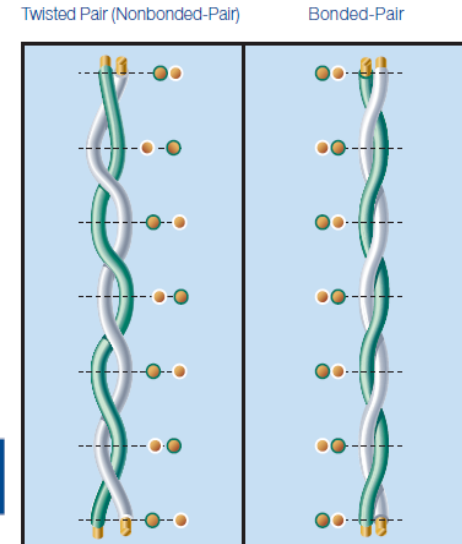
Industrial Ethernet

Twisted Pair vs Bonded Pair

Belden's Patented Bonded-Pair Technology:

- No gaps between the conductor pairs means that the conductor-to-conductor spacing, or centricity, is always uniform
- With a uniform centricity, the cable offers excellent and consistently reliable electrical performance
- Installable Performance® is achieved – the affixing of the insulation of the cable pairs and the uniform centricity translate to superior electrical performance, even after the cable has been subjected to the bending, pulling and twists inherent in the installation process

Function	Bonded-Pair	Twisted Pair (Nonbonded-Pair)
Performance after bending, pulling and twists inherent in the installation process	Higher	Lower
Electrical Stability	Higher	Lower



Since Bonded-pair Cables Do Not Gap, They Have A Greater Immunity To Noise Due To Stable Centricity

Industrial Ethernet

Industrial Grade Ethernet Cable Availability



Industrial Ethernet



Largest product breadth on the market!



DataTuff Cable and Connectivity

DataTuff® Industrial Ethernet and Profinet

Applications: Permanent Installation, Moderate Flexing and Continuous Flexing (Trailing and Torsion)

DataTuff Specials

Cat 5e 2 & 4 pairs, Cat 6, Cat 7

100 Mb/s, through 1 Gb/s, to 10 Gb/s

Various jackets

Shielded: braid & shield, unshielded

Twisted Pair & Bonded Pair

RJ45 patch cords

The image shows a brochure for Belden's DataTuff Industrial Ethernet Solutions. At the top is the Belden logo with the tagline 'SENDING ALL THE RIGHT SIGNALS'. Below the logo is the title 'DataTuff® Industrial Ethernet Solutions'. The main visual is a large photograph of a factory floor with several yellow robotic arms. To the left of this main image is a vertical strip of three smaller images: the top one shows a robotic arm, the middle one shows a person in a blue shirt working on a machine, and the bottom one shows a close-up of industrial equipment. At the bottom left of the brochure is the slogan 'Be certain. Belden.' and at the bottom right is the text 'The Best Fit for Your Industrial Ethernet Application - from the Cabinet to the Machine'.

Industrial Ethernet

DataTuff Specials

Data Rates	Category	Special Environmental Issues									Description*	Part. No.	
		Weld-Splatter Resistance	CMX/ Outdoor	Underground (burial)	Gasoline Resistance	Oil Resistance I & II	MSHA	Hi/Lo Temp	600V UL AWM Rated	Armored			
INDUSTRIAL ETHERNET													
1 Gb/s	Cat 5e	✓	–	–	–	–	–	–	–	–	Weld-splatter resistant, Continuous Flex – 10 million cycles, TPE jacket	7938A	
1 Gb/s	Cat 5e	–	✓	–	–	–	✓	–	–	–	Double PVC jacket	11700A <i>EtherNet/IP.</i>	
1 Gb/s	Cat 5e	–	–	–	–	✓	–	–	–	–	Double PVC jacket	11700A2	
1 Gb/s	Cat 5e	–	–	–	–	–	–	–	–	✓	AL Interlocked Armor, PVC jacket	121700A	
1 Gb/s	Cat 5e	–	✓	–	–	–	✓	–	–	–	PVC jacket	7923A <i>EtherNet/IP.</i>	
1 Gb/s	Cat 5e	–	–	–	✓	–	–	✓	–	–	Plenum Rated – High & Low Temp, FEP jacket	7928A <i>EtherNet/IP.</i>	
1 Gb/s	Cat 5e	–	–	✓	–	–	–	–	–	–	Halogen Free – Waterblocked Burial, Polyethylene jacket	7934A <i>EtherNet/IP.</i>	
1 Gb/s	Cat 5e	–	✓	–	–	–	✓	–	✓	–	600 V UL AWM, MSHA Approved, PVC jacket, Shielded	7958A <i>EtherNet/IP.</i>	
10 Gb/s	Cat 6	–	✓	–	–	–	–	–	✓	✓	Double PVC jacket, Shielded	7953A <i>EtherNet/IP.</i>	
10 Gb/s	Cat 6	–	–	–	✓	–	–	✓	–	–	Plenum Rated–High & Low Temp, FEP jacket	7931A	
10 Gb/s	Cat 6	–	–	–	–	–	–	–	–	✓	AL Interlocked Armor, PVC jacket	121872A	

*All cables are Bonded Pair design, solid conductor, unshielded – unless specified differently

Industrial Ethernet

The Importance of the Right Patching and Splicing Tool



Industrial Ethernet

Industrial Networking

- The market shows a clear trend in the growing use of both Industrial Ethernet and fiber infrastructures in industrial networks
- MIPP™ addresses this by allowing the connection of both fiber and copper cables in a single solution

MIPP™ Fiber Splice Box

MIPP™ Copper Patch Panel

MIPP™ Mix



MIPP™ - The industrial-strength patch panel from Belden

Industrial Ethernet

MIPP™ Fiber Splice Box

- Splice tray and multiple fingers for easy fiber management
- Up to three cable entries for single fiber module
- High port density with up to **72 fiber counts** (for a single MIPP™)



Type of Adapters

Single Fiber Modules

(up to 12 fiber connections)

- 6 x SC duplex adapters
- 6 x SC metal duplex adapters
- 6 x LC duplex adapters
- 6 x ST duplex adapters
- 6 x ST metal duplex adapters
- 6 x E-2000™ duplex adapters

Double Fiber Modules

(up to 24 fiber connections)

- 12 x SC duplex adapters
- 12 x SC metal duplex adapters
- 12 x LC duplex adapters
- 12 x ST duplex adapters
- 12 x ST metal duplex adapters
- 12 x E-2000™ duplex adapters

Fiber Applications

- Multimode: OM1, OM2, OM3 and OM4
- Singlemode: OS2 and OS2/APC



Accessories for the MIPP™ Fiber Splice Box
Brilliance connectors

Industrial Ethernet

MIPP™ Copper Patch Panel



- High variety of media and connectors:
 - RJ45 copper keystone jacks (unshielded and shielded, Cat 5e, Cat 6, Cat 6A)
 - RJ45 copper coupler (unshielded and shielded, Cat 6A)

Type of Keystone

Single Copper Modules

- 2 or 4 x RJ45 keystone unshielded
- 2 or 4 x RJ45 keystone shielded
- 2 or 4 x RJ45 coupler unshielded
- 2 or 4 x RJ45 coupler shielded

Type of Cable Categories

- Cat 5e unshielded and shielded
- Cat 6 unshielded and shielded
- Cat 6A unshielded and shielded



Accessories for the MIPP™ Copper Patch Panel
DataTuff® for cables and patch cords

Industrial Ethernet

A large offshore oil rig is silhouetted against a clear blue sky. The rig's complex structure, including cranes and platforms, is visible. A flare on the left side of the rig is emitting a bright orange flame. The rig is situated in the middle of a body of water, with the horizon line visible at the bottom of the frame.

Not any data cable can withstand industrial environments

Even when industrial ethernet is specified, the application needs to be considered!

Belden understands Industrial Ethernet!



Thank you!

Industrial Ethernet