Your Global Automation Partner

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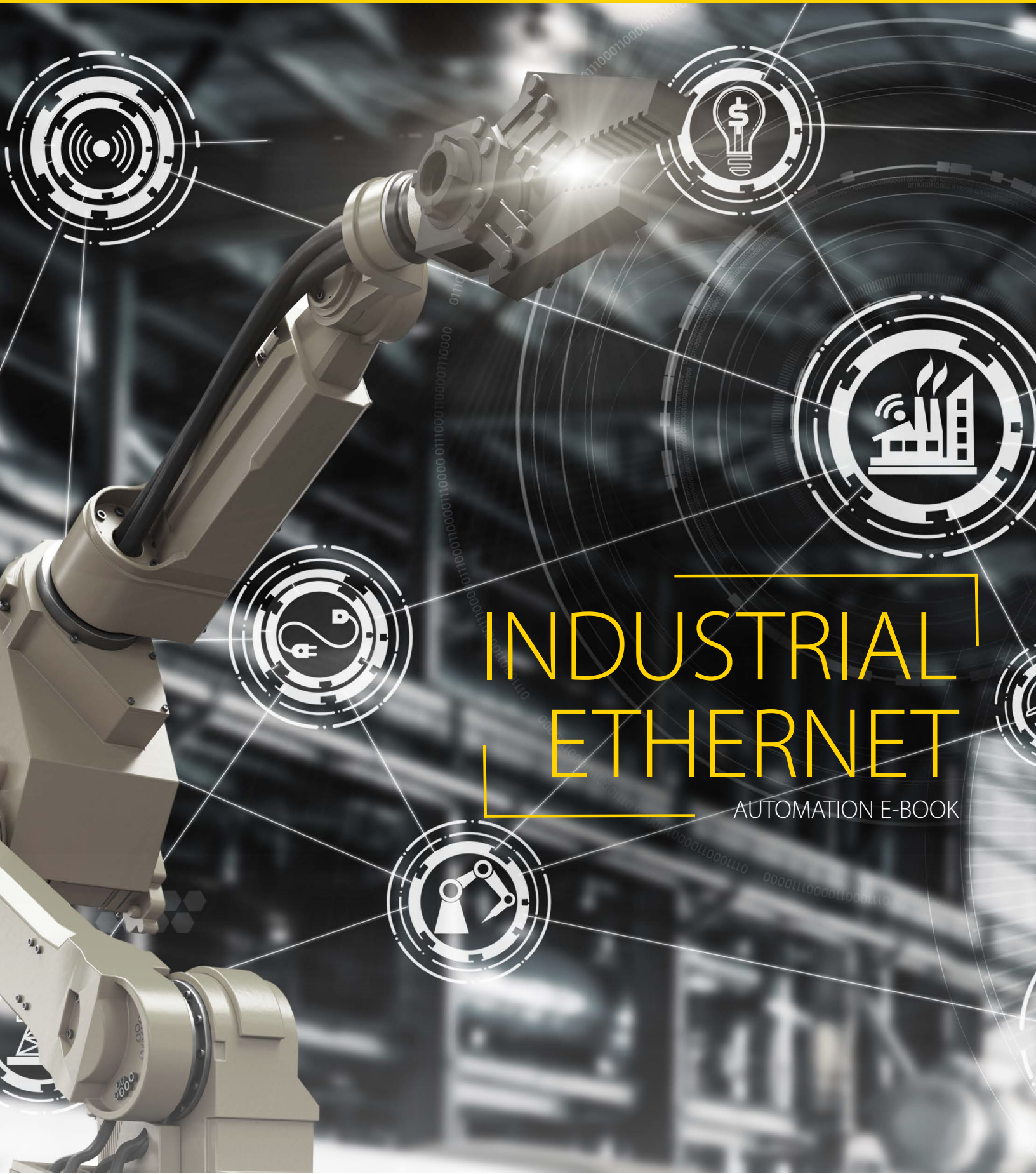


INDUSTRIAL ETHERNET

AUTOMATION E-BOOK

CONTENT

HISTORY OF ETHERNET

Ethernet was co-developed by engineers Bob Metcalfe and David Boggs starting in 1973 while they were working at Xerox PARC on the research staff. This is where some of the first personal computers were being developed and their task was to create a system where several computers could share a printer. Their invention allowed multiple computers to communicate and share files, which was a significant technological advancement at the time.

While its origins are in connecting personal computers, Ethernet has now gained a strong foothold in industrial networking. As companies continually search for faster and improved solutions for their factory, logistics and process automation applications, many are discovering and choosing industrial Ethernet for its rugged design and ability to reduce expenses and increase communication capability

Bob Metcalfe

David Boggs

Photo Credit: www.ethernethistory.com

BENEFITS OF INDUSTRIAL ETHERNET IN AUTOMATION

Industrial Ethernet benefits users by utilizing tools and techniques familiar to traditional office communication systems. However, through the use of rugged components, users may now apply Ethernet to industrial applications, such as the factory or shop floor. Industrial grade components can tolerate demanding conditions such as extreme temperatures, shock, vibration, and washdown applications.

Rugged Design
Stands up to flex, shock, vibration, washdown

Increase Communication Speed
Faster data sharing, troubleshooting

Gain Efficiencies
More precise production control

Wider Temperature Range
Can be used outdoors or in challenging environments

IMPLEMENTING ETHERNET TECHNOLOGY
THE GUIDE

A powerful tool for gaining efficiencies in an industrial environment is reliable network connectivity -- providing the highest level of visibility, control, and flexibility. By understanding the need for top-to-bottom connectivity plus the various challenges and considerations associated with implementing industrial network protocols, users can maximize data acquisition and operational efficiencies.

This white paper will assist users in selecting the ideal communication solution to suit individual application needs.

INDUSTRIAL ETHERNET PROTOCOLS

Ethernet provides the ability to use a number of protocols in the same facility, facilitating data transfer across the entire plant floor as well as plant-to-plant globally via secure network connections. Moving more data in a faster time-frame is helping drive continued growth of many protocols.

COMMON PROTOCOLS:

EtherNet/IP™

This communication protocol is supported by the ODVA and is designed for use in industrial automation and process control applications. It takes the Common Industrial Protocol (CIP) and implements it onto the foundation of Ethernet. EtherNet/IP provides users with tools to deploy standard Ethernet technology for industrial applications.

PROFINET

PROFINET is a communication protocol used in industrial applications that enables data to be exchanged quickly between controllers and devices like I/O blocks, RFID readers and more. PROFINET is 100% Ethernet-compatible according to IEEE standards.

EtherCAT®

EtherCAT offers the ability to apply Ethernet to applications that require very short and quick upload times. It uses a unique approach known as "processing on the fly", in which data is processed while passing through the device, allowing EtherCAT to operate at higher speeds than other protocols.

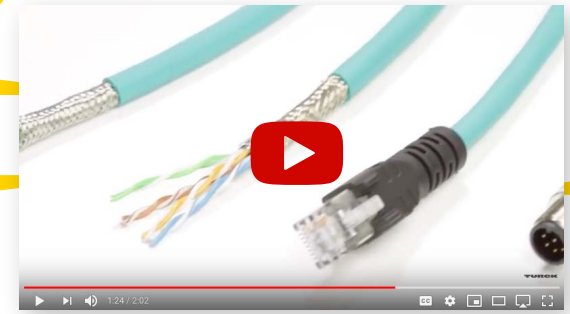
Modbus

Modbus TCP/IP is used often in industrial environments due to its ease of deployment and maintenance, and because it was developed specifically with industrial applications in mind. Modbus TCP is the Modbus RTU protocol with a TCP interface running on Ethernet.

ETHERNET CATEGORIES AND CABLE CONSTRUCTION

There are three main categories of Ethernet cable that are commonly used for industrial applications: CAT5e, CAT6, and CAT6a. Which one you choose depends on required performance, budget, installation, environment and other factors.

This video will explore the differences between the categories of Ethernet, and how cables are constructed to meet the requirements of these categories.



PLAY VIDEO

CATEGORY CABLES AT-A-GLANCE

The categories of Ethernet refer to the speed and frequency of the data exchanged. While earlier generations of Ethernet cable categories have been obsoleted, newer versions with faster data transmission speeds are still being developed.

CAT5e

CAT5e Ethernet improved upon earlier CAT5 cable. The "e" stands for enhanced with better noise cancellation capabilities than its predecessor while remaining at a lower price point. It offers 1000 Mbps transmission speed and 100 MHz maximum bandwidth.

CAT6

CAT6 allows for the same speeds as CAT5e, but with a broader bandwidth, up to 250 MHz.

CAT6a

An augmented version of CAT6, CAT6a was the first twisted pair copper cable to achieve 10Gbps performance, at up to 100 meters. Maximum bandwidth of 500 MHz.

CAT7

A further enhancement for 10Gbps communication, CAT7 cable allows for a max bandwidth of 600 MHz. It is ideal for the backbone of larger networks, where substantial amounts of data are being transferred.

KEEP YOUR COMMUNICATION NETWORK UP AND RUNNING

INDUSTRIAL VS COMMERCIAL ETHERNET CABLE

Don't let the lower cost of commercial cables put your industrial network and machine performance at risk. Get more reliable data transfer with industrial Ethernet cables designed for the factory floor. When making your cable selection, be sure to note the following important considerations.

INDUSTRIAL (Factory Grade)	Factors to Consider	COMMERCIAL (Office Grade)
Extruded	Jacket	Tubed
High	Strand Count	Low
Millions of Cycles	Flex Rate	Static Only
-40 °C to +80 °C	Temp Range	around 30 °C
Industrial Approvals	Approvals	Air Spaces (plenum or riser)
Tinned Copper	Wire	Bare Copper
UV Oil Ozone Sunlight Moisture Weld Spatter	Resistance to the Elements	None

WHITE PAPER

The environment on the typical factory floor is tough. Cables can be exposed to oils, moisture, temperature changes, abrasion, and even corrosive chemicals. On top of that, motion or flexing can also put stress on the cable. A commercial Ethernet cable is not built to withstand these conditions.

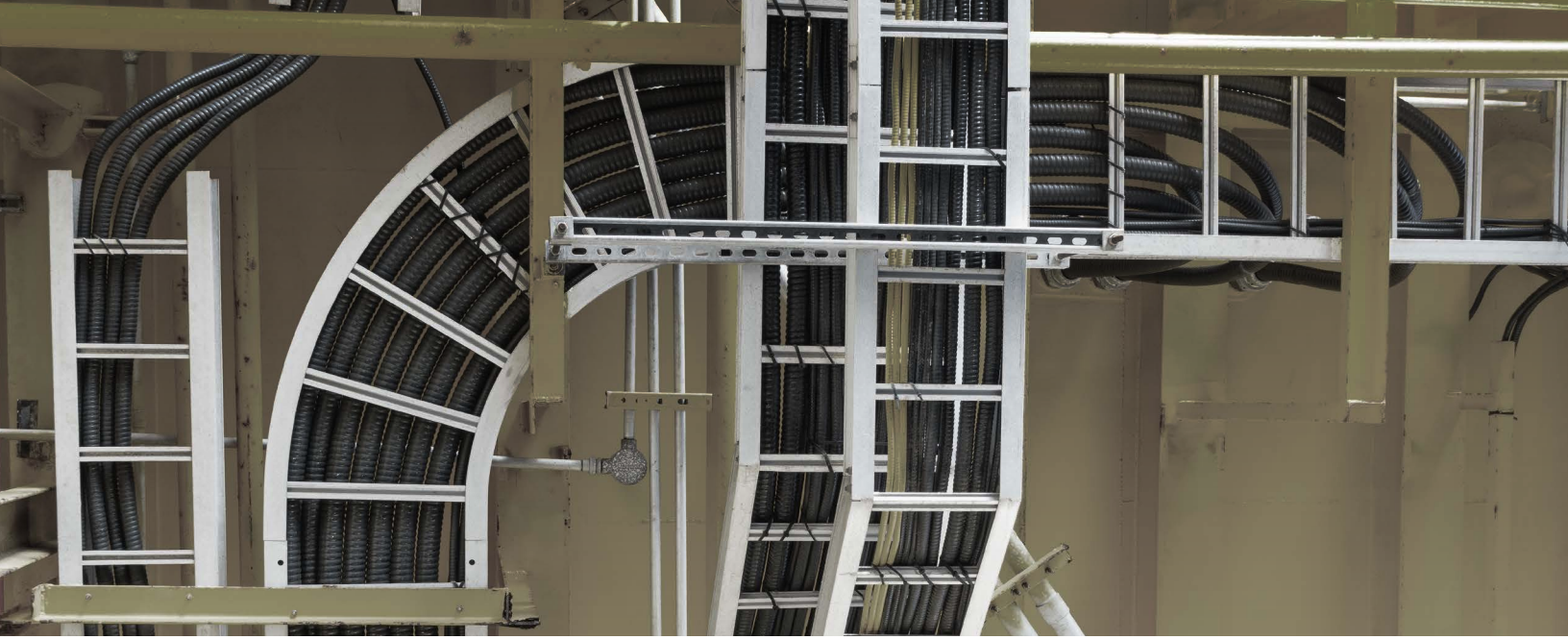
There is a lot of misinformation and plenty of half-truths surrounding industrial Ethernet, so it's important to be cautious where you get your information. Know your application, and always keep in mind the environmental differences.

PLAY VIDEO

Your Global Automation Partner

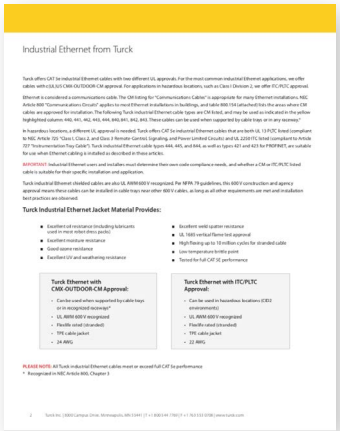
Reduce Downtime in Your Distribution Center with More Reliable Industrial Ethernet

Smart warehouses are connecting more data into the network than ever before using Industrial Ethernet. Don't let non-industrial grade Ethernet cable put your warehouse communication in jeopardy. Safeguard against future network failures with Turck. Our connectivity solutions are more rugged – standing up to the toughest industrial use. From optimizing enterprise level data communication to ensuring real-time communication at a robotic pick station, our connectivity experts design reliability and toughness into every solution we make.



INDUSTRIAL ETHERNET CABLE GUIDE
FOR USE IN CABLE TRAYS

Cable trays are a common way of installing Ethernet and other cable types, ensuring the cables stay organized and are routed properly. Only certain types of cable are rated for installation in trays per the National Electrical Code. Knowing the correct NEC codes for your installation can play a large part in the connectivity you choose. Click below to see a guide for using cable in trays.


Industrial Ethernet from Turck

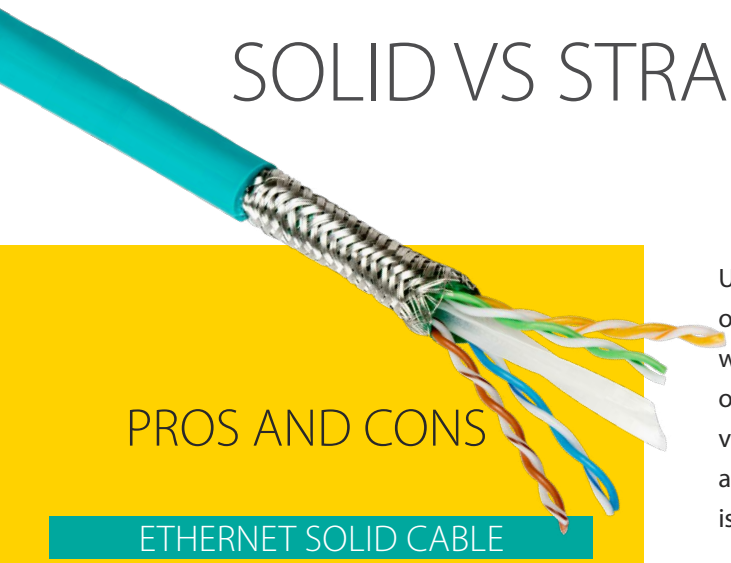
BROCHURE

INDUSTRIAL ETHERNET CONNECTIVITY QUICK GUIDE

Turck offers a complete line of molded Industrial Ethernet cordsets to facilitate network installation, resulting in faster start-up and fewer wiring errors. These robust cables are available with stranded or solid conductors, and with or without shielding. Download this helpful guide to learn more.

QUICK GUIDE

SOLID VS STRANDED ETHERNET CABLE
KEY CONSIDERATIONS



PROS AND CONS

ETHERNET SOLID CABLE

Applications: Ideal for backbone or long runs, fixed installations

Pros: Physically stronger and easier to work with

Cons: Not intended for flexing applications

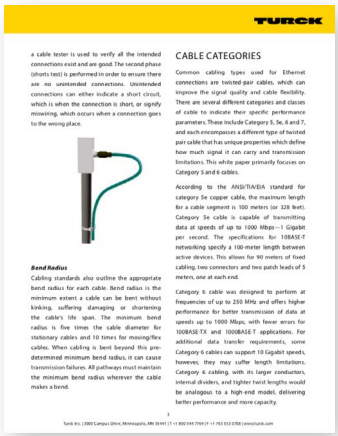
ETHERNET STRANDED CABLE

Applications: Shorter runs, or installation with movement

Pros: Ideal for flexing applications with frequent mate/demating, c-track, or high flex robotics

Cons: Does not meet as long of lengths as solid cable

Unsure whether to purchase solid or stranded cables? The answer to which one to choose often depends on the application. Identifying the various cable categories, classes and types and their distinctions is critical. By recognizing these classifications, as well as the uses and purposes for stranded and solid cables, users can select the ideal cable to meet their application requirements. Download the white paper to learn more.


TURCK

a cable tester is used to verify all the intended connections exist and are good. The second phase (shorts test) is performed in order to ensure there are no unintended connections. Unintended connections can either indicate a short circuit, which is when the connection is short, or signify miswiring, which occurs when a connection goes to the wrong place.

Bend Radius

Cabling standards also outline the appropriate bend radius for each cable. Bend radius is the minimum extent a cable can be bent without kinking, suffering damaging or shortening the cable's life span. The minimum bend radius is five times the cable diameter for stationary cables and 10 times for moving/flex cables. When cabling is bent beyond this pre-determined minimum bend radius, it can cause transmission failures. All pathways must maintain the minimum bend radius wherever the cable makes a bend.

CABLE CATEGORIES

Common cabling types used for Ethernet connections are twisted-pair cables, which can improve the signal quality and cable flexibility. There are several different categories and classes of cable to indicate their specific performance parameters. These include Category 5, 5e, 6 and 7, and each encompasses a different type of twisted pair cable that has unique properties which define how much signal it can carry and transmission limitations. This white paper primarily focuses on Category 5 and 6 cables.

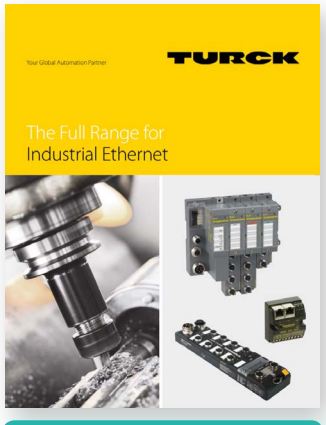
According to the ANSI/TIA/EIA standard for category 5e copper cable, the maximum length for a cable segment is 100 meters (or 328 feet). Category 5e cable is capable of transmitting data at speeds of up to 1000 Mbps—1 Gigabit per second. The specifications for 10BASE-T networking specify a 100-meter length between active devices. This allows for 90 meters of fixed cabling, two connectors and two patch leads of 5 meters, one at each end.

Category 6 cable was designed to perform at frequencies of up to 250 MHz and offers higher performance for better transmission of data at speeds up to 1000 Mbps, with fewer errors for 100BASE-TX and 1000BASE-T applications. For additional data transfer requirements, some Category 6 cables can support 10 Gigabit speeds, however, they may suffer length limitations. Category 6 cabling, with its larger conductors, internal dividers, and tighter twist lengths would be analogous to a high-end model, delivering better performance and more capacity.

WHITE PAPER

FIELDBUS SOLUTIONS FOR INDUSTRIAL ETHERNET

Intelligent field devices make moving from one protocol to another or simply implementing a fieldbus system for the first time simple. Take a look at our Fieldbus Guide to see the full range of fieldbus smart field devices with Turck's multiprotocol capability. These products are self-configuring and offer a seamless transition to Ethernet, whichever common industrial Ethernet protocol that may be.



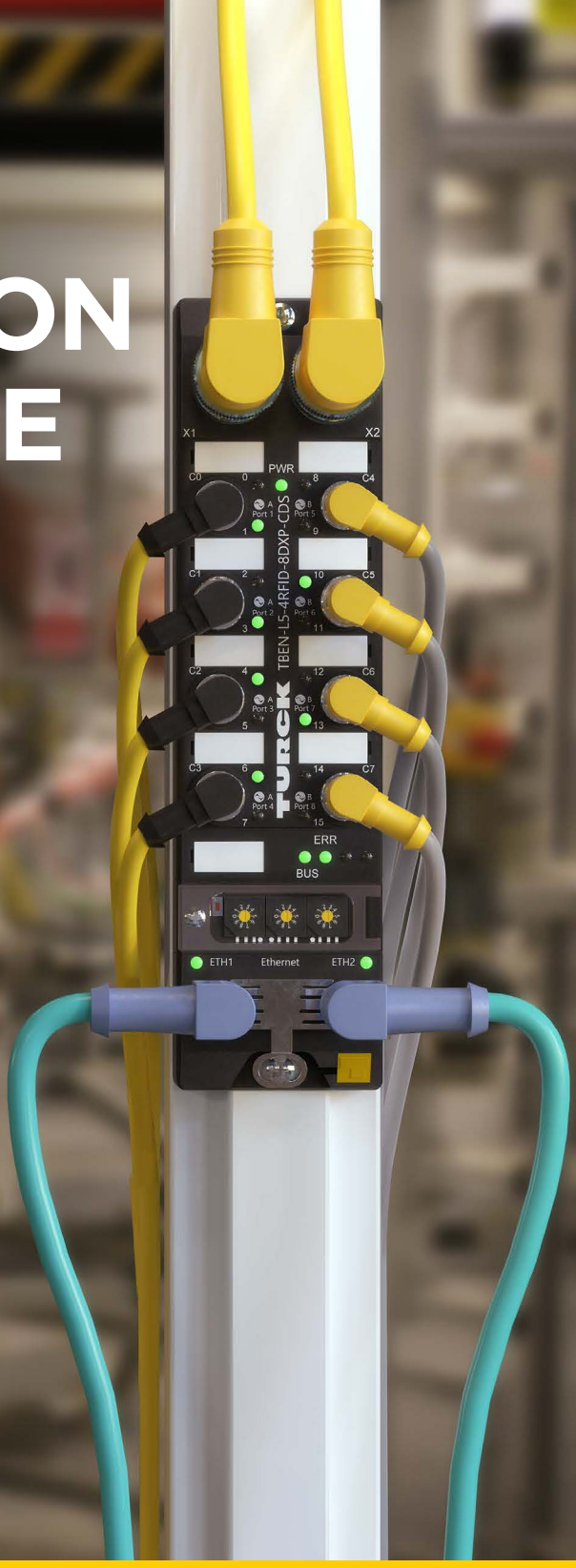
BROCHURE

ONE DEVICE
MULTIPLE PROTOCOLS

Multiprotocol I/O devices automatically self-configure to the active fieldbus protocol on each power-up. They are simple and intuitive, allowing easy transition between multiple common industrial Ethernet protocols without the need to physically switch parts.
Check out Turck's line of multiprotocol devices, including on-machine, in-cabinet, block, and modular I/O.

EXPAND COMMUNICATION & CONSOLIDATE WIRING?

TURCK
FINDS
A WAY.



When an automotive manufacturer needed to minimize its machine footprint, Turck engineered a rugged power distribution, network and safety I/O solution for maximum flexibility.

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ABOUT TURCK

Whether you need a simple or more complex solution, Turck offers an extensive technology portfolio of sensors, connectivity, fieldbus technology and custom engineered solutions.

Partner with Turck to reduce downtime, optimize manufacturing, improve network communication, identify and track products, plus much more. Our rugged products stand up to high temperatures, washdown environments, weld slag, and the rugged conditions found in the toughest applications. Our team of highly-trained engineers help you find your ideal solution.

Can't find what you are looking for? Our engineers can design an application-specific solution. Add in world-class service and support, and Turck is there for you throughout your product's life cycle.

CONNECTIVITY

With hundreds of cut-to-measure bulk cable options plus a vast range of connectors and harnesses, Turck has many in-stock options ready to ship to you. Consolidate wiring, connect sensors and distribute power and signals more cost-effectively with Turck.

FIELDBUS TECHNOLOGY

Streamline your industrial control applications with fieldbus technology from Turck. Our solutions range from distributed I/O to PLCs and FLCs to junction boxes, RFID and more! Turck's fieldbus products support most major industrial network protocols for better communication flexibility.

SENSORS

Turck's rugged and reliable sensors include inductive, ultrasonic, pressure, instrumentation, encoders and more. From simple to advanced applications, we have a solution – even for challenging environments like welding cells and washdown areas.

CUSTOM SOLUTIONS

Can't find what you are looking for? From specialty connectivity solutions to our industrial panel shop, Turck can customize many of its products to meet your exact needs. Challenge us with something new!