



# ICE092

# Practical Industrial Data Communication and Telecommunications

## Course Introduction:

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Industrial data communication is characterized by its operating environment. Electromagnetic interference (EMI), long distances and physical barriers set industrial communications apart from typical business office requirements. Conventional equipment usually lacks the versatility to adapt to the unique requirements of data monitoring and process control. In response to the growing needs in industrial data communications, a number of purpose developed industrial data communications devices have entered the marketplace. Their designs are a result of field experience in solving difficult data communications problems and optimizing characteristics for all aspects of reliability and economy. With so many different standards on the market today, the debate is not about what is the best - be it Foundation Fieldbus, Profibus, Devicenet or Industrial Ethernet but rather about selecting the most appropriate technologies and standards for a given application and then ensuring that best practice is followed in designing, installing and commissioning the data communications links to ensure they run fault-free. The industrial data communications systems in your plant underpin your entire operation. It is critical that you apply best practise in designing, installing and fixing any problems that may occur. This course distils all the tips and tricks with the benefit of many years of experience and gives the best proven practices to follow.

Ethernet, TCP/IP and the Internet technologies are reshaping the way that control, data transfer, and maintenance are being carried out in industrial plants around the world. In this course, you will learn more about the latest developments in networking, including practical tips on testing TCP/IP based networks and where to safely use an industrial Web intranet. You will also explore the strengths and weakness of competing network technologies, including leased services such T1/T3, Frame Relay or ADSL, and private systems such as short haul modems and fiber optics. Special focus will be placed on the questions of security in the industrial setting.

This course provides a thorough understanding of modern industrial data communication including basic communication principles, hardware interfaces such as RS232, communication protocols: ASCII based protocol, Modbus and other industrial protocols in peer-to-peer or network environment. The course provides "**hands-on**" work experience in using communication protocols handshaking techniques for various modern smart instruments and device.

## Course Objectives:

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**Upon successful completion of this course, the delegates will be able to:**

- Apply traditional and current serial standards, such as EIA-232, 422, 423 and 485, in industrial plant floor settings.
- Learn the inner working of proprietary PLC networks.
- Understand Local Area Network (LAN) topologies and protocols.

- Compare media access techniques such as CSMA/CD, token passing and master/slave.
- Describe design methods for LANs using Ethernet.
- Understand the different Ethernet varieties and which are best for industry.
- Know your options for Ethernet hardware to avoid instant obsolescence and being locked in the past.
- Understand the Open Systems Interconnection (OSI)
- Expand your understanding of LAN, WAN intranet and Internet concepts
- Understand the how structure of the telephone system impacts industrial networks
- Understand analog dial-up connections and modems standards
- Understand modern digital WANs and the service options for corporate intranets
- Learn the basics of fiber-optic networks, including cable selection for the plant floor
- Understand the TCP/IP protocols, addressing, and troubleshooting
- Learn how to create a web server for an industrial intranet
- Understand where web technologies can safely be used for process control
- Learn the basics of network security and the procedures that should be followed for safe operations
- Understand the Smart Instrument Systems such as HART
- Understand the Fieldbus Protocols and Configurations
- Understand the Public Network Transport Technologies
- Understand the Wide Area and Converged Networking (PSTN/PBX/Internet/Intranet)
- Understand the Wireless Communications and their characteristics
- Understand the Enterprise Level Process Data Communications (ERP, MES, SCADA)

## Who Should Attend?

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This course is intended for all engineers with a need to understand the techniques required to use and apply modern industrial communications and telecommunications technology as productively and economically as possible. This includes engineers, telecommunications engineers, electrical engineers, instrumentation engineers, SCADA engineers, telemetry engineers, process control engineers, system engineers, network administrators, field technical support staff and project management staff.

## Course Outline:

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### Day 1:

#### **INTRODUCTION**

- Overview of the course
- OSI model
- Systems engineering approach

- Attributes of typical communications systems
  - Media
  - Physical connections
  - Protocols
  - Applications
- General issues
  - Noise
  - Earthing and grounding
  - Shielding
  - Protection against dust and moisture (IP ratings)

## Day 2:

### **FUNDAMENTALS**

- Copper/fiber
  - Cable standards
  - Cable distribution standards
  - Connector standards
  - EMC conformance standards
  - Splicing
  - Connector attachment
  - Drivers and detectors
  - Grounding
  - Termination
  - Protection against transients
- Physical layer standards
  - EIA-232
  - EIA-485
  - 4-20 mA
  - IEC 61158-2 (Intrinsic safety)
- Industrial networks
  - Industrial Ethernet
  - ASi
  - DeviceNet
  - Profibus
  - Foundation Fieldbus
  - Modbus Plus
  - Data Highway Plus
  - HART
  - Ethernet/IP

- ControlNet
- ProfiNet
- Foundation Fieldbus HSE
- Industrial protocols
  - TCP/IP
  - Modbus
  - Modbus TCP
  - DNP3
  - 60870 SCADA
- Other technologies
  - VSAT
  - Wireless LAN
  - Wireless point to point

### **Day 3:**

#### **SELECTION METHODOLOGY**

- Which standards/technologies to use:
  - Field management (device) level
  - Process management (operator) level
  - Business management (enterprise) level
  - Long distance SCADA/telemetry links

### **Day 4:**

#### **INSTALLATION METHODOLOGY**

- Copper cabling and connectors
  - System design
  - Installation
  - Tips, tricks and pitfalls
- Fiber cabling and connectors
  - System design
  - Installation
  - Tips, tricks and pitfalls
- Wireless
  - System design
  - Installation
  - Tips, tricks and pitfalls

### Day 5:

#### **COMMISSIONING/TESTING/ TROUBLESHOOTING**

- Copper infrastructure
- Fiber infrastructure
- Wireless infrastructure
- Networks
  - Physical layer issues (OSI Layer 1)
  - Data link layer issues (OSI Layer 2)
  - Network layer issues (OSI Layer 3)
  - Transport layer issues (OSI Layer 4)
  - Application and "user" layer issues (OSI Layers 7-"8")
  - Client/server issues

#### **CONCLUSION**

## **Course Methodology:**

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**A variety of methodologies will be used during the course that includes:**

- (30%) Based on Case Studies
- (30%) Techniques
- (30%) Role Play
- (10%) Concepts
- Pre-test and Post-test
- Variety of Learning Methods
- Lectures
- Case Studies and Self Questionnaires
- Group Work
- Discussion
- Presentation

## **Course Certificate:**

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**International Center for Training & Development (ICTD)** will award an internationally recognized certificate(s) for each delegate on completion of training.

## Course Fees:

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**To be advised as per course location.** This rate includes participant's manual, and-Outs, buffet lunch, coffee/tea on arrival, morning & afternoon of each day.

## Course Timings:

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### Daily Course Timings:

08:00 - 08:20	Morning Coffee / Tea
08:20 - 10:00	First Session
10:00 - 10:20	Coffee / Tea / Snacks
10:20 - 12:20	Second Session
12:20 - 13:30	Lunch Break & Prayer Break
13:30 - 15:00	Last Session

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