COURSE OVERVIEW IE0020
Practical Industrial Data Communications & Telecommunications

Course Title
Practical Industrial Data Communications & Telecommunications



Course Date/Venue
Session 1: January 31-February 04, 2027/Meeting
Plus 9, City Centre Rotana, Doha, Qatar
Session 2: November 28-December 02, 2027/Meeting
Plus 9, City Centre Rotana, Doha, Qatar

3.0 CEUs (30 PDHs) AWARD

Course Reference
IE0020

Course Duration/Credits
Five days/3.0 CEUs/30 PDHs

Course Description



This practical and highly-interactive course includes various practical sessions and exercises. Practical sessions will be performed using our equipment in order to apply the theory learnt in the class.





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 purposes 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, Device net 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 devices.

Course Objectives/Outcomes & Benefits for the Participants

Upon the successful completion of this course, each participant will be able to:-

- Use and apply industrial communications and telecommunications technology as productively and economically as possible
- Apply the international communication and telecommunication standards EIA-232, 422, 423 and 485
- Explain the inner working of proprietary PLC networks and the 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 and identify the different Ethernet varieties and which are best for industry
- Apply the options for Ethernet hardware to avoid instant obsolescence and being locked in the past and describe the Open Systems Interconnection (OSI)
- Discuss the structure of the telephone system impacts industrial networks and the analog dial-up connections and modems standards
- Define the modern digital WANs and recognize the service options for corporate intranets
- Apply the basics of fiber-optic networks including cable selection for the plant floor
- Employ the LAN, WAN, Intranet, Internet, TCP/IP protocols, addressing and troubleshooting
- Create a web server for an industrial intranet and identify where web technologies can safely be used for process control

- Identify the basics of network security and the procedures that should be followed for safe operations
- Describe Smart Instrument Systems such as HART and discuss the fieldbus protocols and configurations
- Discuss the public network transport technologies and the Wide Area and Converged Networking (PSTN/PBX/Internet/Intranet)
- Explain the wireless communications and their characteristics and the Enterprise Level Process Data Communications (ERP, MES, SCADA)

Exclusive Smart Training Kit - H-STK®



*Participants of this course will receive the exclusive "Haward Smart Training Kit" (**H-STK®**). The **H-STK®** consists of a comprehensive set of technical content which includes **electronic version** of the course materials conveniently saved in a **Tablet PC**.*

Who Should Attend

This course is designed for 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 communications engineers, telecommunications engineers, electrical engineers, control engineers, instrumentation engineers, SCADA engineers, telemetry engineers, process control engineers, system engineers, network administrators, field technical support staff and project management staff.

Training Methodology

Our courses employ an interactive, learner-centred methodology that integrates theoretical knowledge with practical application. The training is delivered through a suitable combination of some or all of the following methods, selected according to the course content and learning objectives:

- Instructor-led presentations and facilitated discussions
- Practical workshops and participant presentations
- Hands-on exercises and real-world case studies
- Equipment demonstrations and technical drawings
- Hardware- and software-based simulations
- Gamification & Role Play in soft-skills courses only
- Virtual Reality (VR) and Augmented Reality (AR)
- Instructional videos and other relevant training resources

This blended approach encourages active participation, strengthens practical skills and supports the effective application of acquired knowledge in the workplace.

Learning Design & Customization

This course can be customized to the exact requirements of clients. Haward Technology is so proud of our huge capabilities in tailoring our courses to the training needs of our valued clients.

Course Certificate(s)

Internationally recognized certificates will be issued to all participants of the course who completed a minimum of 80% of the total tuition hours.

Certificate Accreditations

Haward's Certificates are accredited by the following international accreditation organizations:

- British Accreditation Council (BAC)

  Haward Technology is accredited by the **British Accreditation Council** for **Independent Further and Higher Education** as an **International Centre**. Haward's certificates are internationally recognized and accredited by the British Accreditation Council (BAC). BAC is the British accrediting body responsible for setting standards within independent further and higher education sector in the UK and overseas. As a BAC-accredited international centre, Haward Technology meets all of the international higher education criteria and standards set by BAC.

- The International Accreditors for Continuing Education and Training (IACET - USA)

  Haward Technology is an Authorized Training Provider by the International Accreditors for Continuing Education and Training (IACET), 2201 Cooperative Way, Suite 600, Herndon, VA 20171, USA. In obtaining this authority, Haward Technology has demonstrated that it complies with the **ANSI/IACET 2018-1 Standard** which is widely recognized as the standard of good practice internationally. As a result of our Authorized Provider membership status, Haward Technology is authorized to offer IACET CEUs for its programs that qualify under the **ANSI/IACET 2018-1 Standard**.

  Haward Technology's courses meet the professional certification and continuing education requirements for participants seeking **Continuing Education Units** (CEUs) in accordance with the rules & regulations of the International Accreditors for Continuing Education & Training (IACET). IACET is an international authority that evaluates programs according to strict, research-based criteria and guidelines. The CEU is an internationally accepted uniform unit of measurement in qualified courses of continuing education.

  Haward Technology Middle East will award **3.0 CEUs** (Continuing Education Units) or **30 PDHs** (Professional Development Hours) for participants who completed the total tuition hours of this program. One CEU is equivalent to ten Professional Development Hours (PDHs) or ten contact hours of the participation in and completion of Haward Technology programs. A permanent record of a participant's involvement and awarding of CEU will be maintained by Haward Technology. Haward Technology will provide a copy of the participant's CEU and PDH Transcript of Records upon request.

Course Fee

US$ 6,000 per Delegate. This rate includes H-STK® (Haward Smart Training Kit), buffet lunch, coffee/tea on arrival, morning & afternoon of each day.

Course Instructor(s)

This course will be conducted by the following instructor(s). However, we have the right to change the course instructor(s) prior to the course date and inform participants accordingly:



Mr. Sydney Thoresson, PE, BSc, is a **Senior Electrical & Instrumentation Engineer** with over **30 years** of extensive experience within the **Power & Water Utilities** and Other **Energy Sectors**. His specialization highly evolves in **Electrical Safety**, **Power System Equipment**, **Electrical Drawing**, **Electrical Forecasting**, **Transmission Networks**, **Substation**, **Distribution Networks**, **Substation Automation Systems & Application**, **Electrical** System, **HV/LV Electrical** Authorisation, **Variable Frequency Drives** (VFD), **HV/LV Equipment**, **Circuit Breaker**, **Motor Controllers**, **Hazardous Area Classification**, **Intrinsic Safety**, **Electrical Power Systems** Quality & Troubleshooting, **Protection & Relay**, **Electric & Control** System Commissioning, **Liquid & Gas Flowmetering**, Fault Analysis in **Electrical Networks & Distribution Cables**, **Custody Measurement**, **Ultrasonic Flowmetering**, **Loss Control**, **Gas Measurement**, **Process Control Instrumentation**, **Compressor Control & Protection**, **Control Systems**, Programmable Logic Controllers (**PLC**), **SCADA**, Distributed Control Systems (**DCS**) especially in **Honeywell DCS**, **H&B DCS**, **Modicon, Siemens**, **Telemecanique**, **Wonderware** and **Adrioit**. Moreover, he has vast experience in the field of Safety Instrumented Systems (**SIS**), Safety Integrity Level (**SIL**), Emergency Shutdown (**ESD**), **Flowmetering & Custody Measurement**, **Multiphase Flowmetering**, **Measurement and Control**, **Mass Measuring System Batching** (**Philips**), Arc Furnace Automation-Ferro Alloys, Walking Beam Furnace, Blast Furnace, Billet Casting Station, Cement Kiln Automation, Factory Automation and Quality Assurance Accreditation (**ISO 9000** and **Standard BS 5750**).

During Mr. Thoresson's career life, he has gained his thorough and practical experience through various challenging positions such as a **Project Manager**, **Contracts Manager**, **Managing Director**, **Technical Director**, **Divisional Manager**, **Plant Automation Engineer**, **Senior Consulting Engineer**, **Senior Systems Engineer**, **Consulting Engineer**, **Service Engineer** and **Section Leader** from several international companies such as **Philips**, **FEDMIS**, **AEG**, **DAVY International**, **BOSCH** Instrumentation and Control, **Billiton**, **Endress/Hauser**, **Petronet**, **Iscor**, **Spoornet**, **Eskom** and **Afrox**.

Mr. Thoresson is a **Registered Professional Engineering Technologist** and has a **National Higher Diploma** (**NHD**) & a **National Diploma** in **Radio Engineering** from the **Witwatersrand Technikon**. Further, he is a **Certified Instructor/Trainer**, a **Certified Internal Verifier/Assessor/Trainer** by the **Institute of Leadership & Management** (**ILM**), an active member of the International Society of Automation (**ISA**) and the Society for Automation, Instrumentation, Measurement and Control (**SAIMC**).

Course Program

The following program is planned for this course. However, the course instructor(s) may modify this program before or during the course for technical reasons with no prior notice to participants. Nevertheless, the course objectives will always be met:

Day 1

0730 – 0800	*Registration & Coffee*
0800 – 0815	*Welcome & Introduction*
0815 – 0830	***PRE-TEST***
0830 – 0930	***Introduction*** *Course Objectives ● The Manual ● What is Data Communications ● Brief Overview of "Smart" Instrumentation ● Overview of Modern Instrumentation & Control Systems*
0930 – 0945	*Break*
0945 – 1100	***Definitions, Basic Principles & Coding*** *Background to Data Communications ● Sources , Receivers and the Communications Interface ● Transmission Modes – Simplex and Duplex ● Bits , Bytes and Characters ● Parallel and Serial Communications ● Analog and Digital Signals ● The Coding of Messages – The ASCII Code ● Practical Demonstration of Coding ● Data Transmission Speeds ● The Format of Messages ● Introduction to Error Detection and Correction (EDAC) ● The Universal Asynchronous Receiver/Transmitter (UART) ● The Importance of Standards*
1100 – 1230	***Data Communications Standards*** *Null Modems ● Modem Control & Handshaking ● Trouble Shooting on RS-232 ● EIA-RS-423 Interface Standard ● EIA-RS-422 Interface Standard ● EIA-RS-485 Interface Standard ● Comparison of EIA Interface Standards ● Interface Converters ● Current Loop Interface ● Introduction to Networks ● Testing Equipment (Breakout Box, Line Analyser) ● Protocol Analyser Practical*
1230 – 1245	*Break*
1245 – 1420	***Selection and Installation of Copper Data Cables*** *Cables with Copper Conductors ● Interference and Noise (IEEE-518) ● Cable Selection and Installation Recommendations*
1420 – 1430	***Recap***
1430	*Lunch & End of Day One*

Day 2

0730 – 0930	***Modems & Interface Converters*** *Concept of a modem ● Various Modulation Techniques ● Smart Modems ● Radio Modems ● Data Compression Techniques*
0930 – 0945	*Break*
0945 – 1115	***OSI-Open Systems Interconnection*** *Modern Factory Automation & Process Control Systems ● OSI Reference Model and Standards ● Individual Layers ● Illustrative Example of OSI*
1115 – 1230	***Local Area Networks*** *LAN History ● LAN Topologies ● LAN Media Access Control techniques ● LAN Standards ● Protocols: TCP/IP ● LAN Extension and Interconnection (Bridging, Switching, Routing) ● Physical Issues ● CSMA/CD Bus (Ethernet Standard) ● Industrial Ethernet ● Token Ring ● Token Bus ● Wireless local Area networking: IEEE 802.11*

1230 – 1245	*Break*
1245 – 1330	***Error Detection*** *Feedback and Forward Error Control ● Character Redundancy Checks ● Block Redundancy Checks ● Cyclic Redundancy Checks ● Practical Demonstration on Error Checking*
1330 – 1420	***Proprietary Protocols*** *The Concept of a Protocol ● Protocol Design ● Data Processing Protocols ● ASCII Based Protocols ● Practical Demonstration of ASCII ● GE-Fanuc Genius Protocol ● Allen Bradley Data Highway Plus Protocol*
1420 – 1430	***Recap***
1430	*Lunch & End of Day Two*

Day 3

0730 – 0930	***Proprietary Protocols (cont´d)*** *Modbus History and Evolution ● Modbus Concepts and Message Structure ● Modbus Plus ● Modubs TCP/IP ● Modbus Interfacing ● Practical Demonstration of Modbus*
0930 – 0945	*Break*
0945 – 1115	***Selection of Standards & Protocols***
1115 – 1230	***Telecommunication Basics*** *Concepts: Signaling, Circuits, Channels, Lines, Trunks, ● Bandwidth, Channel Capacity. ● 2-Wire vs. 4-wire Circuits ● Full vs. Half Duplex ● Baseband, Broadband, Narrowband and Wideband ● Analogue vs. Digital Transmission ● Dial-up vs. Leased Access ● Multiplexing techniques: FDM, TDM, PCM, WDM, ● DWDM. ● Connection Oriented vs. Connectionless Communication ● Circuit Switching vs. Packet Switching ● Switching vs. Routing ● Local Area vs. Wide Area Networks ● The "Communications Cloud" ● The PSTN vs. the Internet*
1230 – 1245	*Break*
1245 – 1330	***Transmission Media*** *Introduction ● Fibre Optic ● Power System Carrier ● Microwave Radio ● Satellite Systems ● Infra-Red ● Fibre Optic Communication Concepts ● Optical Cable Selection ● Connectors*
1330 – 1420	***Smart Instrument Systems*** *Digital vs. Analog Data Transmission ● Cabling ● Remote Diagnostics and Calibration ● HART*
1420 – 1430	***Recap***
1430	*Lunch & End of Day Three*

Day 4

0730 – 0930	***Fieldbus Protocols*** *Actuator Sensor Interface (ASI) ● CANBus ● DeviceNet ● InterBus*
0930 – 0945	*Break*
0945 – 1100	***Fieldbus Protocols (cont'd)*** *Profibus DP ● Profibus PA ● Foundation Fieldbus*
1100 – 1230	***Public Network Transport Technologies*** *Analogue Switched (Dial-up): ● Public Switched Telephone Network (PSTN) ● Analogue Dedicated (Leased) Alternatives*
1230 – 1245	*Break*

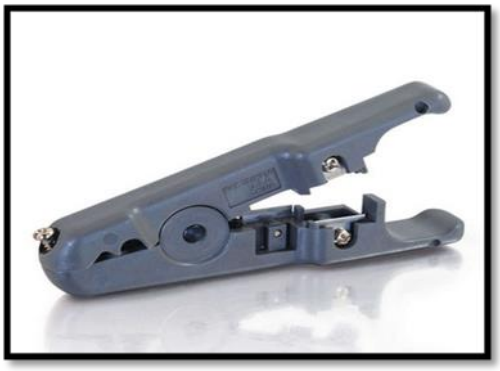
1245 – 1420	***Public Network Transport Technologies (cont'd)*** *Digital Switched (dial-up) Alternatives; Switched 56, ISDN-BRI; Frame Relay (SVC); SMDS; ATM ● Digital Dedicated (Leased) Alternatives: DDS; T-1; T-3; E-1; ISDN-PRI; B-ISDN; X.25; Frame Relay (PVC); SDH/SONET ● Signaling System #7 ● Services*
1420 – 1430	***Recap***
1430	*Lunch & End of Day Four*

Day 5

0730 – 0930	***Wide Area Networking*** *Introduction ● Metropolitan Area Networks (MANs) ● Wide Area Networks (WANs) ● Virtual Private Networks (VPNs)*
0930 – 0915	*Break*
0915 – 1045	***Converged Networks (PSTN/PBX/Internet/Intranet)*** *Definitions ● Applications: VoIP, FoIP, etc ● Protocols: Packet Transport: IPv4, Ipv6, ICMP; Packet Routing: RIP, OSPF, BGP; End-to End Reliability: TCP, UDP; Additional Supporting VoIP: Multicast IP, RTP, RTCP, RSVP, RTSP. ● WAN Transport Considerations: IP over Serial Lines; IP over Frame Relay; Voice/ Fax over Frame Relay; IP over ATM; Voice over ATM ● Hardware: H.323 Terminals; H.323 Gateways; Gatekeepers; Multipoint Control Units; Audio/ Video Codecs ● Implementation Considerations: Quality of Service (QoS): Definition; Influencing Factors; Implementation; Integrated Services (int-serv) and RSVP; Differentiated Services (diff-serv); Multiprotocol Label Switching (MPLS); Queuing and Congestion Avoidance Mechanisms*
1045 – 1230	***Wireless Communications*** *Radio/Cellular Concepts and Definitions ● Wireless Local Loop Applications ● Wireless Data Networks: Cellular Digital Packet Data (CDPD); General Packet Radio Service (GPRS) ● Cellular Voice Systems: GSM, CDMA, TDMA ● Personal Communications Service (PCS) ● Third Generation (3G) Mobile Communications Technologies: Universal Mobile Telecommunications System (UMTS) ● The Wireless Internet Initiative- MDI-ng ● Wireless Application Protocol (WAP)*
1230 – 1245	*Break*
1245 – 1315	***Enterprise Level Process Data Communications*** *The Levels: Planning, Execution, Operation ● The Technologies: ERP, MES, SCADA ● Corporate LAN Interfacing ● Corporate WAN Interfacing ● The Web: Appeal and Risk*
1315 – 1345	***Conclusion*** *Pulling all the Strands Together ● Web, Process Operation and Security Issues*
1345 – 1400	***Course Conclusion***
1400 – 1415	***POST-TEST***
1415 – 1430	*Presentation of Course Certificates*
1430	*Lunch & End of Course*

Tools & Simulator (Hands-on Practical Sessions)

Practical sessions will be organized during the course for delegates to practice the theory learnt. Delegates will be provided with an opportunity to carryout various exercises using various networking tools and equipment including the "Wireshark" software.



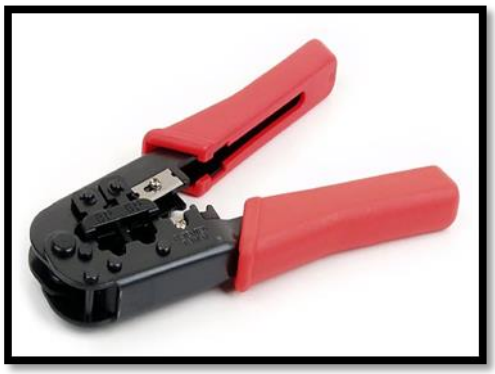
Round/flat Multi-Conductor Cutter



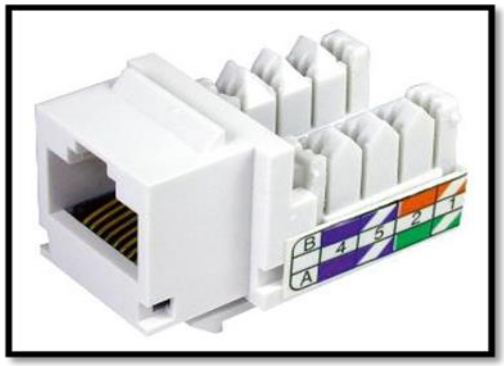
Pace Plate



Cable Tester



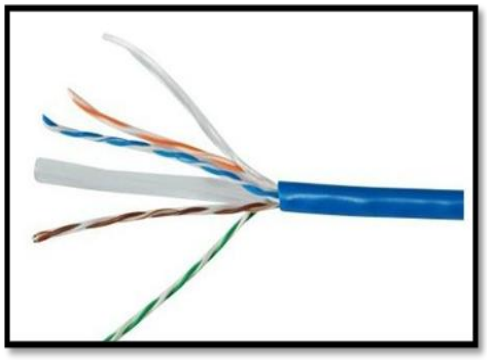
Crimping Tool



Keystone Jacks/Modular Connectors



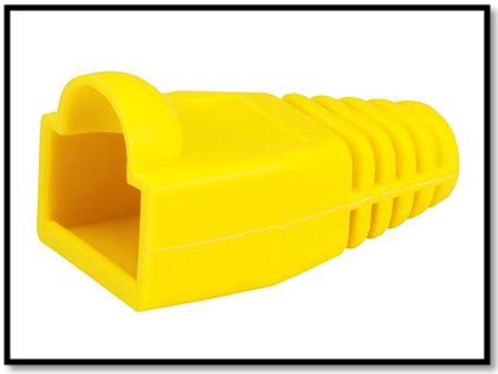
RJ45



UTP Cable and Stripper



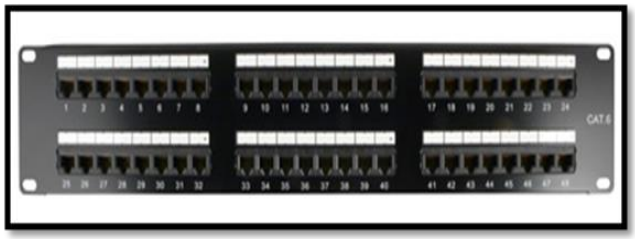
Switch



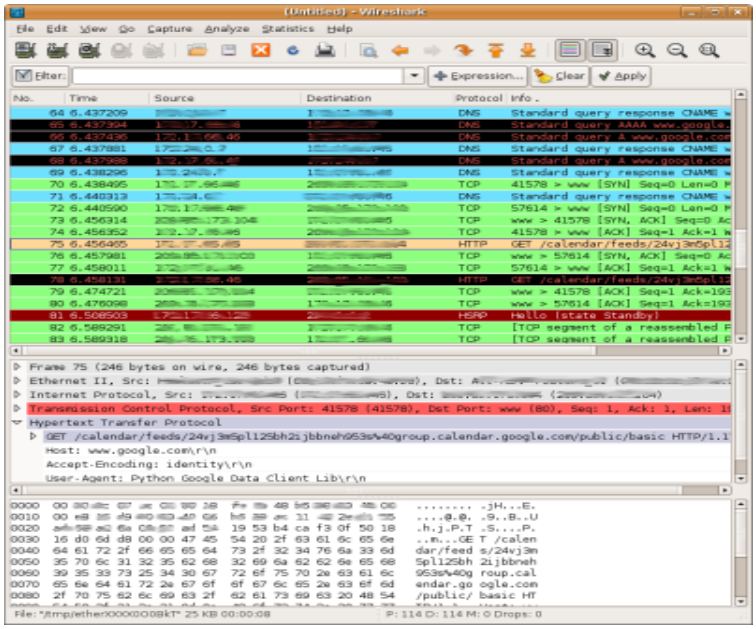
Rj-45 Color Coded Strain Relief Boots



Punchdown Tool



Patch Panel



Wireshark Software

Course Coordinator

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