

DATA COMMUNICATION & FIELDBUS SYSTEM



GENTEX[®]
TRAINING CENTER



Introduction

Modern plants depend on digital networks that carry measurement, control, and diagnostic data between field devices and control systems. The Data Communication & Fieldbus System Training Course explains how these networks work and how engineers design, install, and troubleshoot them. Participants study serial communication basics, the OSI model, and the leading industrial protocols, including HART, PROFIBUS, FOUNDATION Fieldbus, Modbus, and PROFINET. Furthermore, the programme covers segment design, cabling, grounding, intrinsic safety, and fault diagnosis with real instruments. Delivered by Gentex Training Center over five days, this programme suits instrumentation, control, and automation professionals. As a result, participants reduce downtime and commission networks with far greater confidence.

Data Communication & Fieldbus System Course Objectives

- Explain serial communication principles, including RS-232, RS-422, and RS-485 physical layers.
- Describe the OSI seven-layer model and map industrial protocols onto its layers.
- Compare point-to-point 420 mA loops with digital fieldbus architectures.
- Configure HART communication and use handheld communicators for device setup.
- Design PROFIBUS DP and PA segments according to IEC 61158 and IEC 61784 requirements.
- Apply FOUNDATION Fieldbus H1 function blocks, scheduling, and link master concepts.
- Implement Modbus RTU and Modbus TCP addressing, registers, and error checking.
- Apply intrinsic safety methods, including FISCO and entity concepts, in hazardous areas.
- Diagnose network faults using oscilloscopes, bus analysers, and segment testers.
- Integrate fieldbus networks with DCS, PLC, SCADA, and asset management systems.



Course Methodology

- Technical sessions built on recognised IEC and ISA standards.
- Protocol demonstrations using live device and controller setups.
- Hands-on configuration exercises with HART, PROFIBUS, and Modbus devices.
- Segment design calculations covering voltage drop, current budget, and cable length.
- Fault-finding workshops using bus analysers and signal measurement tools.
- Case studies drawn from plant commissioning and troubleshooting projects.

Who Should Take This Course

- Instrumentation and control engineers and technicians.
- Automation, DCS, and PLC engineers supporting process plants.
- Maintenance engineers responsible for field device networks.
- Commissioning and start-up engineers on capital projects.
- Electrical engineers working with industrial communication systems.
- System integrators and automation project consultants.
- Plant operations staff who supervise digital instrumentation assets.

Data Communication & Fieldbus System Course Outlines

Day 1: Data Communication Fundamentals

- Analogue versus digital signal transmission in process plants.
- Serial communication: RS-232, RS-422, and RS-485 standards.
- Baud rate, framing, parity, and error detection methods.

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- The OSI seven-layer reference model explained.
- Network topologies: bus, star, ring, and tree.
- Transmission media: twisted pair, fibre optic, and wireless links.
- Noise, attenuation, shielding, and grounding principles.

Day 2: HART and Smart Instrumentation

- The 420 mA loop and HART signal superimposition.
- HART command structure, universal and device-specific commands.
- Handheld communicator and DD/EDDL device configuration.
- Multidrop mode, burst mode, and WirelessHART basics.
- Device diagnostics and predictive maintenance data.
- Loop wiring, load resistance, and barrier considerations.
- Practical exercise: configuring a HART transmitter.

Day 3: PROFIBUS and PROFINET Networks

- PROFIBUS DP and PA architecture and differences.
- Master class 1 and class 2 roles and token passing.
- Segment design: spurs, couplers, terminators, and repeaters.
- GSD files, addressing, and device commissioning steps.
- PROFINET on Industrial Ethernet: real-time classes and switches.
- IEC 61158 and IEC 61784 standard requirements.
- Practical exercise: building and testing a PROFIBUS segment.

Day 4: FOUNDATION Fieldbus and Modbus

- FOUNDATION Fieldbus H1 and HSE architecture.





- Function blocks, control in the field, and macrocycle scheduling.
- Link active scheduler and device addressing.
- Power supply, conditioners, and current budget calculation.
- Modbus RTU and TCP frame structure, registers, and CRC checking.
- Gateways and protocol conversion between systems.
- Practical exercise: commissioning a fieldbus segment.

Day 5: Safety, Diagnostics, and Integration

- Hazardous area classification and intrinsic safety principles.
- FISCO, entity concept, and certified barrier selection.
- Fault diagnosis with oscilloscopes, bus analysers, and segment testers.
- Common failures: short circuits, noise, reflections, and weak signals.
- Documentation, segment records, and loop drawings.
- Integration with DCS, PLC, SCADA, and asset management platforms.
- Industrial network cyber security and IEC 62443 awareness.

Conclusion

By successfully completing the Data Communication & Fieldbus System Training Course, participants will have acquired solid knowledge of serial communication, the OSI model, HART, PROFIBUS, FOUNDATION Fieldbus, Modbus, and PROFINET, together with segment design, intrinsic safety, and structured fault diagnosis. In addition, they will commission and maintain industrial networks with greater accuracy and confidence. Gentex Training Center delivers this programme through hands-on exercises and real plant cases, so participants apply their new knowledge immediately.



FAQs for the Data Communication & Fieldbus System course

Q1 What is the "Data Communication & Fieldbus System" course about?

The course explains how digital networks carry data between field instruments and control systems. It covers serial communication, the OSI model, major industrial protocols, segment design, intrinsic safety, fault diagnosis, and integration with plant control platforms.

Q2 What are the key benefits of the "Data Communication & Fieldbus System" course?

Participants commission networks correctly the first time and locate faults far faster. Furthermore, they cut wiring costs, use device diagnostics for planned maintenance, and avoid unsafe installations. As a result, plants experience less unplanned downtime and lower maintenance spending.

Q3 What skills will I gain from the "Data Communication & Fieldbus System" course?

Participants gain industrial data communication fundamentals, fieldbus network design and configuration, protocol troubleshooting and diagnostics, and hazardous area and network safety compliance. These four skills support reliable instrumentation networks across process, utility, and manufacturing plants.



Q4 What tools, methods, or standards are covered in the "Data Communication & Fieldbus System" course?

The programme covers RS-232, RS-422 and RS-485, the OSI model, HART and WirelessHART, PROFIBUS DP and PA, PROFINET, FOUNDATION Fieldbus H1 and HSE, Modbus RTU and TCP, IEC 61158, IEC 61784, FISCO, IEC 62443, bus analysers, and segment testers.

Q5 How is the "Data Communication & Fieldbus System" course applied in real-world practice?

Engineers apply it when designing segments for new plants, commissioning smart transmitters, tracing intermittent bus faults, replacing failed devices, and connecting field networks to DCS and asset management systems. In addition, maintenance teams use device diagnostics to plan interventions.