INTRODUCTION TO INSTRUMENTATION AND PROCESS CONTROL

Single Class Capacity: 12
Duration: 3 Days - 24 Hours

Understand instrumentation and process control to become more valuable as your multi-skill set expands. You'll spend approximately 50% of the time working with various instruments and controllers. You will learn to program and connect input/output devices, as well as how to troubleshoot process controls including sensors, transmitters, controllers, and final elements. The benefit of this seminar is being able to find, understand, and fix electrical problems more easily, thereby reducing downtime.

WHAT THIS COURSE COVERS

- Basic Concepts
- Piping and Instrument Diagrams (P and ID's)
- Control Technologies
- Basic Electrical and Math Concepts
- Pressure Instrumentation and Measurements
- Temperature Instrumentation and Measurements
- Flow Instrumentation and Measurements
- Level Instrumentation and Measurements
- Density, Specific Gravity, and Analysis
- Manipulating the Process
- Troubleshooting
- Controllers
- Control Systems

WHO SHOULD TAKE THIS?

- Apprentice and experienced HVAC technicians
- Supervisors working on or who oversee employees working on 50V or greater equipment
- Maintenance Technicians
- HVAC maintenance and Repair Technicians
- Energy management personnel
- Fire Alarm Technicians
- Electricians
- Plant & facility maintenance technicians
- Building engineers
- Stationary engineers

COURSE OUTCOMES

- Use various instruments to measure temperature, pressure, flow rate, level and position, pH, and analysis of weight and density.
- Understand the differences between open and closed-loop controls, feedback and feed forward controls, PLC, DCS, and stand-alone controllers.
- Find out how analog signals are produced, processed, and protected from noise and differences in proportional, PI and PID control strategies.
- Understand what causes errors in instruments and how to minimize and troubleshoot them.
- Learn to calibrate transmitters and tune controllers.

Every NTT course is eligible for CEUs (or Continuing Education Units) with your governing board approval or your states approval.

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COURSE AGENDA

BASIC CONCEPTS
- Purposes for control systems
- Terminology
- Signal types
- Shielding and grounding
- Signal conversion
- Final control elements

PIPING AND INSTRUMENT DIAGRAMS (P AND IDS)
- Line symbols
- Instrument identification tags
- Instrument bubbles
- Loop diagrams

CONTROL TECHNOLOGIES
- Local manual, remote electrical
- Local pneumatic
- Remote analog/digital

BASIC ELECTRICAL AND MATH CONCEPTS
- Applications to instruments
- Electrical principles and symbols
- Series/parallel circuits

PRESSURE INSTRUMENTATION & MEASUREMENTS
- Pressure measurement devices- U-tube manometer, bourdon gauge, bellows gauge, piezoelectric

TEMPERATURE INSTRUMENTATION AND MEASUREMENTS
- Measurement devices and techniques
- Bimetallic temperature measurement
- Filled capillary and bulb, thermocouple, resistance temperature detector (RTD), thermistors, thermowells, infrared

FLOW INSTRUMENTATION AND MEASUREMENTS
- Flow measurement methods
- Factors influencing flow measurement
- Flow measurement devices—orifice plates, venturi tube, flow nozzle, elbow taps, pitot tube, parshall flume, magnetic flowmeter (Mag meter), vortex shedding meter, turbine meter, target flowmeter, ultrasonic, variable area rotameter, 2oriolis meter, nutating disc

LEVEL INSTRUMENTATION AND MEASUREMENTS
- Level measurement methods—sight glass, differential pressure level measurement, bubbler, displacer level sensor, float level sensors, capacitance, radiation-based, radar and ultrasonic level sensors

DENSITY, SPECIFIC GRAVITY AND ANALYSIS
- Density and specific gravity measurement
- Monitoring and analyzing pH, conductivity

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COURSE AGENDA (CONT)

MANIPULATING THE PROCESS

- Final control element
- Actuators, valve positioners, I/P, valves
- Variable frequency drives

TROUBLEHOOTING

- Testing for open/short circuits
- Troubleshooting/maintenance suggestions

CONTROLLERS

- Control modes—proportional, integral, derivative
- Tuning feedback controllers—¼ decay, Zeigler-Nichols, damped oscillation
- Ratio, cascade and feed-forward control

CONTROL SYSTEMS

- Overview of PLCs, DCS and SCADA systems

HANDS ON LAB EXERCISES

- Density and specific gravity measurement
- Sensor checkout
- Hookup to calibration stands
- Transmitter calibration check
- Program/tune controller
- Simulate and source 4-20mA-DC signals
- Set up of differential pressure, temperature, and other process-simulation devices
- Calibration or set up with hand-held calibrator
- Checking current output with VOM & tracing around loop

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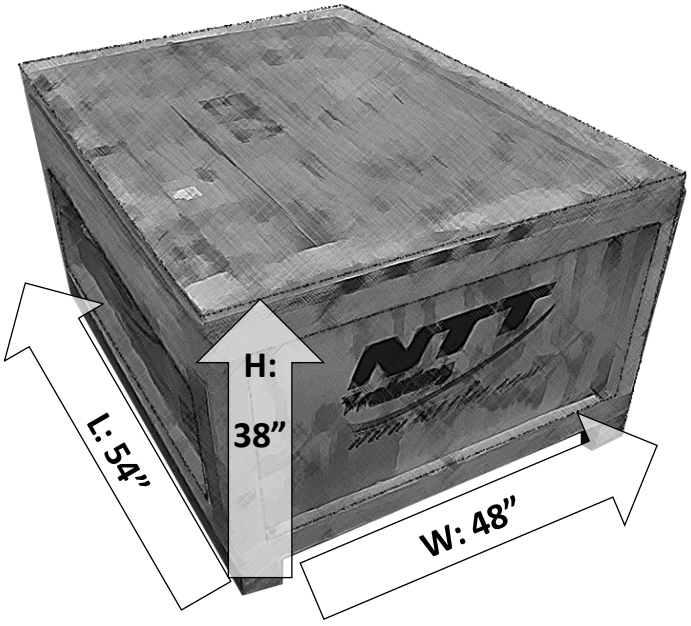
EQUIPMENT & MATERIALS

NTT TO PROVIDE

- 3 days (24 contact hours) of on-site instruction
- Textbooks, "Introduction to Instrumentation and Process Control," "Instrumentation and Process Control Lab Manual"
- "Supertech" (a pocket reference for instrument technicians)
- Classroom consumables
- Completion certificates
- Shipping, instructor fees and travel expenses

SHIPPING

- 2 Crates:
- 1 crate @ 37" x 57" x 28" (38 lbs.)
- 1 crate @ 48" x 54" x 38" (570 lbs.)



CLIENT TO PROVIDE

- Classroom, with easy access, of 750 square feet or greater.
- Projection screen, white board and/or flip chart(s).
- A dock facility or a forklift to unload the training equipment.
- A pallet jack to move the crates around after they have been unloaded may also be needed.
- The equipment should be placed in the training room for the NTT instructor to test and setup prior to the start of training.