

## Water Treatment Instrumentation and Control for Small Water Systems

Drinking water operators interact with industrial control systems and field instrumentation daily. Having a baseline understanding of the concepts these devices and systems use to relay this information is essential to effective process control management.

### Water Treatment Instrumentation and Control for Small Water Systems (6-hour block)

#### Training Objectives and Learning Outcome:

This 6-hour course will provide drinking water treatment plant operators an opportunity to learn the important principles, trends, and technologies to improve instrumentation and control systems within specific water and wastewater facilities and processes.

Attendees will learn:

- How to read instruments and make proper adjustments to maintain smooth operation of water treatment processes
- About operational characteristics of field monitoring instruments. Primarily pressure, flow, and temperature
- How to understand and interpret basic water laboratory procedures to assess water quality
- To recognize signs that indicate equipment may not be performing properly, how to identify the source of the problem and take corrective action
- About control and feedback strategies for pumping, chemical feed, and Supervisory Control and Data Acquisition (SCADA) systems
- How to analyze daily production values and peak flow rates, pressures, and well levels
- How to evaluate the operation of equipment
- How to inspect equipment and abnormal conditions

#### Schedule:

Start Time	End time	Topic	Time (Minutes)	Contact Hours	Notes
8:30	8:45	Introductions and opening activity	15	0.25	Introductions, agenda, pre-test
8:45	9:30	Basic electrical terms	45	0.75	Define the basic electrical terms that will be used to describe the properties of control system circuits. AC versus DC power, volts, hertz, amperage, power factor. Single versus three phase power.
9:30	9:45	Break	15		

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Start Time	End time	Topic	Time (Minutes)	Contact Hours	Notes
9:45	10:30	Basic electrical concepts	45	0.75	Basic electrical theory focused on the concepts most relevant to low voltage signaling circuits. Ohms law and its practical use in control circuitry.
10:30	10:45	Class activity part 1	15	0.25	Common control issues from the attendee's experience will be analyzed
10:45	11:00	Break	15		
11:00	11:45	Control system types	45	0.75	Compare and contrast the differences between the 3 main types of control system configurations: Electromechanical, Hybrid, and Digital. How and when each is used going into the advantages and disadvantages of each system.
11:45	12:00	Class activity part 2	15	0.25	Most confusing control issues from the attendee's experience will be analyzed
12:00	13:00	Lunch	60		
13:00	13:30	Control system signals	30	0.50	Detailed look at common control system signals. Discrete, analog, and digital signals will be defined. Definitions will be coupled with real world examples and the reasons for their configuration. Common feedback loops and their use in water utility automation systems.
13:30	14:00	Control system circuit testing and troubleshooting	30	0.50	Common signal and circuit issues to be discussed. Issues like open loop, ground loop, voltage drop (and others) will be defined and example troubleshooting scenarios will be worked though. Both in groups and as a class.

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Start Time	End time	Topic	Time (Minutes)	Contact Hours	Notes
14:00	14:15	Break	15		
14:15	14:30	Class activity part 3	15	0.25	Let's build a control system using standard components. Tabletop activity.
14:30	15:15	Process control instrumentation troubleshooting and maintenance	45	0.75	Common issues with water utility related field instruments to be discussed. Loop tuning, verifications, calibrations, and common maintenance practices will be defined, and real-world examples provided for the most common water quality and process control instruments.
15:15	15:30	Break	15		
15:30	16:15	Process control methods and SCADA system overview	45	0.75	Common process control methods and strategies coupled with simple troubleshooting methods. How SCADA systems interact with field components, store data, and ways to make screens more valuable to operators. How to spot stale data on trends.
16:15	16:25	Session wrap-up	10	0.17	Q&A, post-test, and closing remarks
16:25	16:30	Evaluations	5	0.08	Pass out evaluations and collect before attendees exit the room.
16:30		Adjourn	<b>Total time:</b>	<b>6.00</b>	