El 2

A practical guide to el 2, covering the reader intent, the relationship to el 2, key evaluation criteria, common risks, and the information the intended project audience should confirm before taking the next step.

levelmeter.org
Main topic: Main Page
https://www.level-meters.com/

In the field of industrial automation and liquid management, precise level control is fundamental to operational safety and process efficiency. The designation "El 2" typically refers to a specific configuration of conductive level electrodes or a dual-point level control system. These systems are widely utilized in water treatment, chemical processing, and food production where the liquid medium possesses sufficient electrical conductivity. This guide provides a comprehensive technical overview of conductive level measurement principles, the specific application of dual-electrode configurations, and the engineering considerations necessary for successful implementation.

Understanding the Measurement Principle

Conductive level measurement is based on the electrical conductivity of the liquid being monitored. The system operates as a simple electrical circuit where the liquid acts as the conductor. An El 2 system usually consists of two primary components: the electrode probe (the sensing element) and a conductive relay or controller.

The Electrical Circuit

A low-voltage AC signal is applied to the electrodes. When the liquid level rises and touches the electrode, the circuit between the electrode and the reference point (often the metal tank wall or a separate ground electrode) is closed. This change in resistance is detected by the controller, which then toggles a relay to start or stop a pump, open a valve, or trigger an alarm.

Using AC (Alternating Current) rather than DC (Direct Current) is critical in these applications. AC prevents electrolysis and the subsequent polarization of the electrodes, which would lead to corrosion and inaccurate readings over time. The sensitivity of the controller can often be adjusted to match the specific conductivity of the medium, ranging from highly conductive acids to moderately conductive tap water.

Configurations of EI 2 Systems

The "EI 2" setup is frequently employed for point level detection, specifically for "High" and "Low" control logic. In a standard two-point control application, the system manages the filling or emptying of a vessel between two defined limits.

1. High-Level Alarm/Control: The probe is positioned at the maximum allowable level. When the liquid reaches this point, the circuit closes, signaling the controller to stop the inflow.

2. Low-Level Alarm/Control: The probe is positioned at the minimum level. When the liquid drops below this point, the circuit opens, signaling the controller to start the pump or trigger a dry-run protection alarm.

In many industrial contexts, an EI 2 assembly might consist of two active electrodes of different lengths, plus a third common/ground electrode if the tank is made of non-conductive material like plastic or fiberglass.

Technical Specifications and Selection Criteria

Selecting the correct EI 2 electrode system requires an analysis of the chemical and physical properties of the process medium. Not all liquids are suitable for conductive measurement; for instance, hydrocarbons, oils, and pure deionized water lack the necessary ions to conduct electricity.

Selection Table: Electrode Materials and Applications

Material	Conductivity Range	Temperature Limit	Common Applications
Stainless Steel (316L)	> 10 µS/cm	Up to 150°C	Potable water, wastewater, mild chemicals
Hastelloy C	> 5 µS/cm	Up to 200°C	Highly corrosive acids, oxidizing agents
Titanium	> 5 µS/cm	Up to 180°C	Seawater, brine, chlorine-rich environments
PTFE Coated Probes	> 20 µS/cm	Up to 120°C	Sticky liquids, food-grade applications

Medium Conductivity Requirements

For an EI 2 system to function reliably, the medium must have a minimum conductivity, typically measured in Microsiemens per centimeter (µS/cm). Most industrial controllers require a minimum of 5 to 10 µS/cm. If the conductivity is too low, the controller may fail to "see" the liquid, leading to overflows or pump damage.

Installation Considerations

Proper installation of EI 2 electrodes is paramount to ensuring long-term reliability and preventing false triggers. Engineers must consider the mechanical environment and the behavior of the liquid during process cycles.

Mounting and Orientation

Electrodes are typically mounted vertically from the top of the vessel. In cases where vertical space is limited, side-mounting is possible with specific curved probes, though vertical mounting is preferred to prevent sediment buildup on the insulation.

Electrode Spacing: Probes should be spaced at least 20 mm apart to prevent bridging caused by bubbles or debris.

Stilling Wells: In tanks with heavy agitation or turbulence, electrodes should be installed inside a stilling well (a perforated pipe) to prevent the liquid's surface movement from causing "chatter" in the relay.

Insulation: The non-sensing part of the electrode (the section above the target level) should be insulated to prevent false triggers from condensation or splashing.

Vessel Grounding

If the vessel is metallic (e.g., stainless steel), it can serve as the reference ground. The ground terminal of the EI 2 controller is connected directly to the tank wall. For plastic or lined tanks, a dedicated "common" electrode must be installed. This common electrode must be longer than the longest control electrode to ensure the circuit is always grounded when any other probe is in contact with the liquid.

Practical Applications of EI 2 Logic

Pump Control (Emptying/Filling)

The most common use of a dual-electrode EI 2 system is the management of a sump or a storage tank.

Emptying Logic: When the liquid reaches the upper electrode, the pump starts. The pump continues to run even after the liquid leaves the upper electrode, stopping only when the level falls below the lower electrode. This creates a "deadband" that prevents the pump from cycling on and off too rapidly (short-cycling).

Filling Logic: The pump starts when the level falls below the lower electrode and stops once it reaches the upper electrode.

Boiler Water Level Control

In steam boiler applications, El 2 probes provide high-reliability low-water cut-off (LWCO) functions. Because these probes have no moving parts, they are less prone to mechanical failure than float switches in high-pressure, high-temperature environments.

Limitations and Maintenance

While El 2 conductive systems are cost-effective and durable, they are not universal solutions. Understanding their limitations is essential for process safety.

1. Non-Conductive Media: As mentioned, these sensors cannot detect oils, fuels, or pure solvents. For these applications, radar or ultrasonic sensors are required. You can explore alternative technologies on our Main Page.

2. Coating and Fouling: If the liquid is prone to leaving a conductive film (such as certain wastewater or sludge), the film may create a conductive path between the electrode and the tank wall even after the level has dropped. This results in a "false high" reading. PTFE-coated electrodes or regular cleaning schedules are necessary in these environments.

3. Pressure Constraints: Standard electrode holders are typically rated for pressures up to 10 bar (145 psi) or 40 bar (580 psi) for specialized high-pressure versions. Exceeding these limits can cause seal failure and leaks.

Troubleshooting and FAQs

Q: Why is the pump not stopping when the liquid leaves the top electrode?

A: This is usually due to the "hold" circuit in the controller. In a two-point control system, the pump is designed to continue running until the lower electrode is cleared. If it still doesn't stop, check for conductive bridges (buildup) between the probes or moisture in the terminal head.

Q: Can I use El 2 probes in a pressurized tank?

A: Yes, provided the electrode holder is rated for the specific pressure and temperature of the vessel. Ensure the threads (usually G1/2" or NPT) are sealed with appropriate industrial sealants.

Q: How do I test the system without filling the tank?

A: You can simulate the liquid by using a wire to jump the connection between the electrode terminal and the ground/tank wall. If the relay clicks, the controller and wiring are functional.

Conclusion

The EI 2 conductive level system remains a staple of industrial liquid management due to its simplicity, lack of moving parts, and ease of integration. By selecting the appropriate materials and adhering to strict installation guidelines, engineers can implement a robust control solution for a wide variety of conductive liquids. For detailed product specifications and to compare conductive probes with other technologies like radar or hydrostatic transmitters, please visit our Main Page for comprehensive technical resources and application support.