

Picomag

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



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In the landscape of industrial automation and process control, the requirement for precise, compact, and cost-effective measurement of conductive liquids has led to the development of specialized instrumentation. The Picomag series represents a significant shift in electromagnetic flow measurement, moving away from the large, flange-mounted traditional meters toward compact, threaded versions designed for secondary circuits and utility applications. While industrial facilities often focus heavily on vessel inventory via level measurement, the integration of compact flowmeters like the Picomag provides the necessary data for a complete mass balance and system efficiency analysis.

This guide examines the engineering principles, application criteria, and installation requirements for the Picomag, providing process engineers with the technical foundation needed to integrate these devices into existing automation frameworks.

Measurement Principles of Electromagnetic Flowmeters

The Picomag operates on the electromagnetic principle, specifically Faraday's Law of Induction. This principle dictates that a conductor moving through a magnetic field induces an electrical voltage. In the context of industrial flow measurement, the conductive liquid acting as the conductor flows through a pipe of diameter (d) within a magnetic field of constant strength (B).

As the liquid moves at a certain velocity (v), it generates a voltage (E) that is directly proportional to the flow velocity. The mathematical relationship is expressed as:

$$E = B \cdot v \cdot d$$

Inside the Picomag, two electrodes are positioned opposite each other on the pipe wall to pick up this induced voltage. Because the magnetic field strength and the pipe diameter are known constants, the electronics can calculate the flow velocity based on the measured voltage. This velocity is then converted into a volumetric flow rate.

One of the primary advantages of this principle is that the measurement is independent of fluid properties such as pressure, density, and viscosity, provided the medium meets a minimum threshold of electrical conductivity. In addition to flow, the Picomag utilizes its internal sensors to measure the temperature and electrical conductivity of the medium, offering a multi-variable output from a single process connection.

| Technical Specifications and Key Features

The Picomag is engineered for applications where space is at a premium and digital integration is a priority. Unlike traditional electromagnetic flowmeters that require extensive cabling and large housings, these units consolidate the sensor and transmitter into a single, compact body.

| Multi-Parameter Measurement

Beyond volumetric flow, the device provides real-time data on:

1. **Temperature:** Integrated sensors monitor the process medium temperature, which is critical for cooling circuits and heat exchange monitoring.
2. **Conductivity:** By monitoring the conductivity of the liquid, the device can detect changes in fluid composition or the presence of cleaning agents in CIP (Clean-in-Place) processes.
3. **Totalizer:** The device maintains an internal count of the total volume passed, essential for billing or batching applications.

| Communication and Integration

The Picomag is designed for the modern "Smart Factory" environment. It features:

IO-Link: A standardized point-to-point communication interface that allows for seamless integration into most PLC architectures.

Bluetooth Connectivity: Enables commissioning and diagnostics via a smartphone or tablet using specialized apps, which is particularly useful for units installed in hard-to-reach locations.

Configurable Outputs: Users can toggle between current outputs, pulse outputs, or switch outputs depending on the control system requirements.

| Application Suitability and Industry Use Cases

The Picomag is specifically optimized for utility applications rather than primary process lines involving highly abrasive or corrosive chemicals. Its construction typically involves high-quality stainless steel and PEEK (Polyether ether ketone) wetted parts, making it suitable for a variety of industrial fluids.

| Water Treatment and Distribution

In water treatment facilities, monitoring the flow of chemicals for pH adjustment or disinfection is critical. The compact nature of the Picomag allows it to be installed on dosing skids where space is limited. It is frequently used to monitor the flow of demineralized water, provided the conductivity remains above the required threshold (typically $>20 \mu\text{S/cm}$).

| Cooling and Heating Circuits

In manufacturing plants, cooling water is vital for preventing machinery overheating. The Picomag monitors both the flow rate and the temperature of the cooling water. If a pipe becomes partially blocked or a pump fails, the flow rate drop is detected immediately, while a rise in temperature indicates inefficient heat exchange. This dual monitoring helps prevent equipment downtime.

Industrial Automation and Tooling

For CNC machines and large-scale industrial tools, the Picomag monitors the flow of lubricants and coolants. Its ability to communicate via IO-Link means that the machine controller can receive digital data without the signal degradation often associated with analog 4-20mA loops in high-interference environments.

Selection Criteria and Comparison Table

When selecting a Picomag unit, engineers must match the sensor size to the expected flow range and pipe dimensions. Selecting a meter that is too large may result in poor accuracy at low flow rates, while a meter that is too small will induce a significant pressure drop.

Feature	DN15 (1/2")	DN20 (3/4")	DN25 (1")	DN50 (2")
Measuring Range (L/min)	0.1 to 25	0.2 to 50	0.4 to 100	2.0 to 750
Max. Pressure (bar)	16	16	16	16
Medium Temp. Range	-10 to +70°C	-10 to +70°C	-10 to +70°C	-10 to +70°C
Accuracy (Flow)	±0.8% o.r.	±0.8% o.r.	±0.8% o.r.	±0.8% o.r.
Process Connection	G 1/2"	G 3/4"	G 1"	G 2"

Note: "o.r." stands for "of reading". Accuracy may vary based on installation conditions and fluid conductivity.

Installation Considerations and Best Practices

To ensure the accuracy and longevity of a Picomag installation, several engineering guidelines must be followed. Electromagnetic flowmeters are sensitive to the flow profile of the liquid.

| Piping Requirements

Straight Runs: While the Picomag is more forgiving than some flow technologies, it is best practice to have at least 5xDN (5 times the pipe diameter) of straight pipe upstream and 2xDN downstream from the meter. This helps to stabilize turbulence caused by elbows, valves, or pumps.

Full Pipe Requirement: The electromagnetic principle requires the pipe to be completely full of liquid. If the pipe is only partially full, the meter will read incorrectly or report an error. For this reason, installing the meter in a vertical pipe with an upward flow direction is the preferred orientation.

Avoid Cavitation: Ensure the meter is not installed at the highest point of a piping system where air pockets can collect, or immediately before a free pipe outlet.

| Grounding and Conductivity

Because the meter measures very small voltages, it is essential that the fluid and the meter are at the same electrical potential. In plastic piping systems, grounding rings or specific grounding procedures must be used to ensure a stable reference point. Additionally, the fluid must have a minimum conductivity, usually 20 $\mu\text{S}/\text{cm}$. It is not suitable for oils, hydrocarbons, or highly purified deionized water (DI water) with zero conductivity.

| Limitations and Operational Constraints

While the Picomag is a versatile tool, it is not a universal solution for all fluid measurement needs. Understanding its limitations is key to avoiding measurement failure.

1. **Conductivity Dependency:** It cannot measure non-conductive fluids. For applications involving oils, fuels, or gases, alternative technologies like ultrasonic or Coriolis meters are required.

2. **Temperature Limits:** Standard Picomag units are typically rated up to 70°C (158°F). Applications involving high-pressure steam or high-temperature process fluids will exceed the thermal limits of the PEEK measuring tube and internal electronics.

3. **Solids Content:** While it can handle some suspended solids, large or abrasive particles can damage the internal lining or interfere with the electrode contact, leading to drift in the measurement.

| Integration with Level Measurement Systems

In a comprehensive industrial setup, flow measurement and level measurement are complementary. While a level transmitter monitors the volume of liquid currently stored in a tank, the Picomag monitors the rate at which that liquid is being added or removed.

For example, in a chemical blending tank, a radar level meter provides the primary inventory data. However, the Picomag on the inlet line provides the high-speed data required for precise batching control. Discrepancies between the integrated flow total and the change in tank level can also serve as an early warning system for leaks in the piping network. For engineers looking to optimize their entire liquid management system, reviewing the various Main Page options for level instrumentation alongside flow data is the best approach to achieving total process transparency.

| Frequently Asked Questions (FAQs)

Q: Does the Picomag require periodic calibration?

A: While electromagnetic flowmeters are known for their long-term stability due to the lack of moving parts, periodic verification is recommended. This can often be done in-situ using the device's internal diagnostics and Heartbeat Technology, or by comparing the output against a master meter.

Q: Can the Picomag be used in outdoor installations?

A: Most Picomag units carry an IP65/67 rating, making them resistant to dust and temporary immersion. However, if installed outdoors, it is recommended to use a sunshade to protect the display from UV degradation and to prevent extreme temperature swings from affecting the electronics.

Q: How do I configure the device if I don't have an IO-Link master?

A: The Picomag features an integrated Bluetooth interface. By downloading the manufacturer's app on a mobile device, you can configure all parameters, including output signals, units of measure, and display settings, without needing a physical connection to a PLC.

Q: What happens if there is air in the pipe?

A: The Picomag includes an "Empty Pipe Detection" feature. If the electrodes are not fully submerged in the conductive liquid, the device will trigger an error status and the flow output will typically drop to zero or a pre-defined error value to prevent false readings in the control system.

By adhering to these technical guidelines and understanding the specific strengths of electromagnetic technology, engineers can successfully deploy the Picomag to improve the efficiency and reliability of their industrial fluid systems.