



Coriolis Mass Flowmeter

30 common interview questions and answers for a Coriolis flow meter.

Part 1: Fundamental Principles

1. What is the working principle of a Coriolis flow meter?

A Coriolis meter works on the **Coriolis effect**. Inside the meter, one or two tubes are vibrated at their natural frequency. As fluid flows through these vibrating tubes, the inertia of the fluid causes the tubes to twist. The amount of this twist is measured by sensors and is **directly proportional** to the **mass flow rate** of the fluid. 🧪

2. Why is it called a true "mass" flow meter?

It is a true mass flow meter because the twisting force it measures is a direct result of the **mass** of the fluid moving through the tubes. Unlike volumetric meters, its measurement is independent of changes in the fluid's temperature, pressure, viscosity, or density.

3. How does a Coriolis meter also measure density?

The flow tubes are constantly vibrated at their natural resonant frequency. This frequency depends on the stiffness of the tubes and their total mass (the mass of the tubes plus the mass of the fluid inside).

- A **denser** fluid has more mass, which **lowers** the tube's vibration frequency.
- A **less dense** fluid has less mass, which **increases** the tube's vibration frequency. The transmitter continuously monitors this frequency to calculate the fluid's density in real-time.

4. What are the three primary measurements a Coriolis meter provides?

It provides three direct, independent measurements from a single instrument:



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1. **Mass Flow Rate**
2. **Fluid Density**
3. **Fluid Temperature** (from an internal RTD sensor)

5. How does a Coriolis meter calculate volumetric flow?

It doesn't measure volume directly. It calculates it using the two values it *does* measure directly: mass flow and density. **Volumetric Flow = Mass Flow / Density** This is a highly accurate calculation because it is based on two precise, real-time measurements.

Part 2: Components and Construction

6. What are the main components of a Coriolis meter?

- **Flow Tubes:** One or two tubes, often U-shaped or straight, that the fluid flows through.
- **Drive Coil:** An electromagnetic coil that vibrates the tubes.
- **Pickup Sensors:** A pair of sensors that detect the twist in the vibrating tubes.
- **Transmitter:** The electronics that control the system and calculate the measurements.
- **Housing:** A robust case to protect the internal components.

7. What is the purpose of the drive coil?

The drive coil is an electromagnet that is pulsed on and off, pushing and pulling on the tubes to keep them vibrating at their precise natural resonant frequency, similar to how you push a swing to keep it going.

8. How do the pickup sensors work?

The pickup sensors are essentially a magnet and a coil on opposite sides of each tube. As the tubes vibrate and twist, they move closer to and farther from the sensors, inducing a voltage. The transmitter measures the **time difference** between the signals from the inlet-side sensor and the outlet-side sensor. This tiny time difference is what corresponds to the mass flow rate.



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9. What is the difference between a straight-tube and a bent-tube Coriolis meter?

- **Bent-Tube (U-Tube):** The most common design. The U-shape allows for high sensitivity and accuracy in a compact design.
- **Straight-Tube:** Uses a single or double straight tube. This design has a lower pressure drop and is self-draining, making it ideal for **hygienic applications** (food, pharma) or for slurries where product can get trapped in bends.

10. What is the temperature sensor used for?

An RTD is mounted on the flow tube to measure the process temperature. This reading is used by the transmitter to compensate for any tiny changes in the tube's metal stiffness (elasticity) due to temperature, which ensures the highest accuracy.

Part 3: Application and Installation

11. What are the ideal applications for a Coriolis meter?

They are ideal for applications requiring the highest accuracy or for difficult fluids. Key uses include:

- **Custody Transfer:** Billing for high-value products where mass is the contractual unit.
- **Dosing and Batching:** Precisely measuring ingredients by mass in food, pharma, and chemical processes.
- **Difficult Fluids:** Measuring viscous fluids, slurries, adhesives, and coatings.
- **Concentration Measurement:** Using the density reading to determine the concentration of solutions (e.g., sugar content [Brix] or acid strength).



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12. What is the single biggest enemy of a Coriolis meter?

Two-phase flow, specifically **entrained gas or air bubbles** in a liquid stream. The gas disrupts the tube vibration and, because it has very little mass, causes the meter to read erratically and inaccurately.

13. Does a Coriolis meter require straight pipe runs?

No. This is a major advantage. Because it directly measures mass using an induced force, it is **independent of the upstream flow profile**. It can be installed directly after elbows, valves, or pumps without the need for straight runs.

14. What are the key considerations for mounting a Coriolis meter?

- **Orientation:** It must be installed in an orientation that ensures the tubes remain **100% full of the process fluid**. For liquids, it should be self-draining for any gas bubbles. For gas, it should be self-draining for any liquid condensate.
- **Support:** The meter can be very heavy and is sensitive to external stress. It must be firmly supported, and the adjacent piping must be supported independently.

15. Can a Coriolis meter measure gas flow?

Yes, but they are primarily designed for liquids. Measuring gas is more challenging due to the very low mass (and therefore small Coriolis force) of the gas. Specialized meters with larger tubes are often used for gas applications, but technologies like thermal mass or ultrasonic are more common.



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Part 4: Performance and Characteristics

16. What is the typical accuracy of a Coriolis meter?

Coriolis meters are the most accurate flow meters available, with typical mass flow accuracy between **±0.1% to ±0.2%** of reading. High-accuracy models can achieve ±0.05%.

17. What is the turndown ratio of a Coriolis meter?

They have an exceptionally wide **turndown ratio**, often **100:1** or even higher. This makes them extremely versatile for applications with widely fluctuating flow rates.

18. What is the "zero-point" of a Coriolis meter, and why is it important?

The **zero-point** is the transmitter's reading when the pipe is full but there is **no flow**. **Zeroing the meter** is a critical commissioning step where you tell the transmitter to treat the current sensor signal (caused by any minor installation stresses) as the true zero. This is essential for achieving good accuracy, especially at very low flow rates.

19. How does fluid viscosity affect a Coriolis meter?

A major advantage of the Coriolis meter is that it is virtually **immune to the effects of fluid viscosity**. The inertial principle of measurement does not depend on the fluid's flow characteristics.

20. What is a key limitation of Coriolis meters regarding pressure drop?

Coriolis meters, especially the bent-tube designs, can introduce a **higher pressure drop** compared to full-bore meters like magnetic or ultrasonic types. This must be considered in system design and pump sizing.



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Part 5: Comparison with Other Meters

21. How does a Coriolis meter compare to a magnetic flow meter?

- **Coriolis:** Measures **mass**, works on **any fluid** (conductive or non-conductive), and also measures density. Has a higher pressure drop.
- **Magnetic:** Measures **volume**, works **only on conductive liquids**, and has zero pressure drop.

22. How does a Coriolis meter compare to a thermal mass flow meter?

- **Coriolis:** Measures mass using inertia. Works for both **liquids and gases**. Measures density directly.
- **Thermal:** Measures mass using heat transfer. Works for **gases only**. Does not measure density.

23. Why would you choose a Coriolis meter over a high-accuracy ultrasonic meter for custody transfer?

You would choose a Coriolis meter if the primary contractual unit is **mass**, or if the fluid's **density is expected to change**. The Coriolis meter measures mass directly, while the ultrasonic meter measures volume, which would then need to be corrected for density using a separate densitometer, adding complexity and potential error.

Part 6: Troubleshooting and Maintenance

24. A Coriolis meter's reading is fluctuating wildly. What is the most likely cause?

The most likely cause is **two-phase flow** (gas bubbles in a liquid). The meter is trying to measure the chaotic mix, causing the tube vibration to become unstable.



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25. The density reading from a Coriolis meter seems incorrect. What should you check?

- **Incomplete Filling:** The tubes must be **100% full**. Any trapped gas will cause the density to read low.
- **Coating/Buildup:** If a solid material is coating the inside of the tubes, it adds mass and will cause the density to read falsely high.
- **Incorrect Zeroing:** A poor zero-point can affect the density reading.

26. What does a "Drive Gain" diagnostic value tell you?

Drive Gain is a measure of how much power the transmitter needs to apply to the drive coil to keep the tubes vibrating correctly. A **high or increasing Drive Gain** is a key indicator of a problem, such as coating/buildup on the tubes, a partial blockage, or two-phase flow.

27. What maintenance does a Coriolis meter require?

Because they have **no moving parts**, they are generally very low-maintenance. The primary activity is **periodic verification of the zero-point**.

28. Can a Coriolis meter measure flow in both directions?

Yes. The twisting effect works equally well in both directions. All modern Coriolis meters are **bidirectional**.

29. The transmitter is showing a "Tube Damped" alarm. What does this mean?

This means something is preventing the tubes from vibrating freely. The most common causes are **two-phase flow**, a very high fluid viscosity (beyond the meter's limit), or a partial blockage in the tubes.

30. In your opinion, what is the most versatile flow meter technology?

The **Coriolis flow meter** is arguably the most versatile. It can measure almost any fluid (liquids, gases, slurries), is unaffected by most fluid properties, offers the highest accuracy, measures



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mass and density directly, and requires no straight pipe runs. Its main drawbacks are its high cost and pressure drop. 🔧