

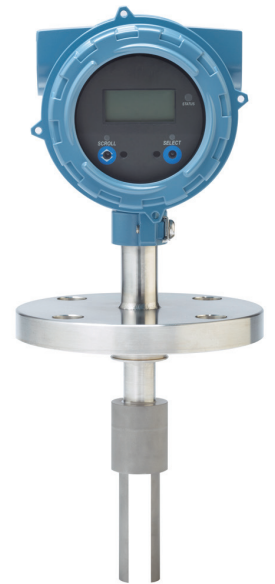
FORK DENSITY METER (FDM) IN SLURRY APPLICATIONS

In many industries, the measurement of slurry density or concentration is required.

Slurries - liquids mixed with solids - can vary from sand, cement, mud, metal, gypsum, kaolin (limestone/china clay), bauxite, oversaturated brine, white, green and black liquor, etc.

Nucleonic density meters are often used in these applications, but due to safety concerns and increased legislation, industries are looking to alternative technologies for a solution.

The Micro Motion Fork Density Meter (FDM) can be confidently offered as an alternative solution, having been proven with over 25 years of experience in the toughest of slurry applications. Emerson's Micro Motion FDM vibrating fork technology is accurate, robust and reliable, simple to install and operates requiring almost no maintenance.



FDM Installation

Many installation factors can affect meter performance and operation. This document outlines best practice recommendations and design considerations to help ensure your customer's system operates accurately and efficiently in slurry applications. A good installation can be the difference in reducing waste or optimizing product quality. It can also have significant effects on erosion, corrosion or coating, extending the life of the meter and increasing the product value for the customer.

What do I need to consider?

Flow Rate / Velocity

With a minimum velocity of about 1 m/sec the fork should be installed as follows:

- Fork tines recessed in a T-piece (pipe shroud)
- With Toolkit sizing, the distance to recess the tines from the inner tube wall will be defined (Figure 1)

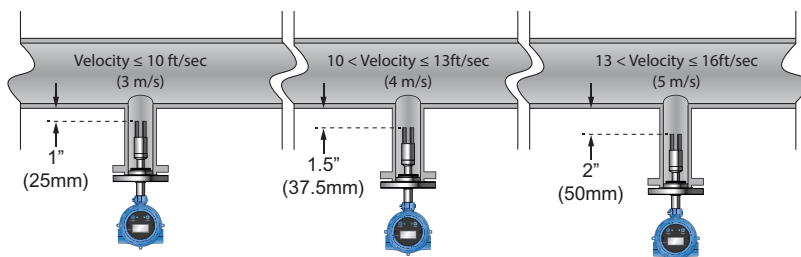


Figure 1.

- Gap between tines should be vertical in the T-piece – solids drop down, entrained gas will go up (Figure 2)
- Viscosity of the product should not exceed a maximum of 200 cP to ensure proper product refreshment in the T-piece

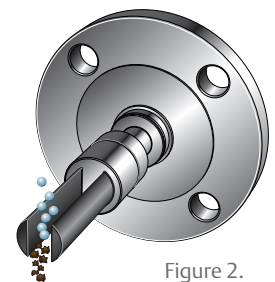


Figure 2.

If the velocity is too low or too high, the process pipe will have to be adapted. Typical mounting practices with slurries is to expand the pipe diameter to lower the velocity to the desired level.

- If this technique is used, the piping must maintain 20 inches (500mm) of upstream straight run (both sides for bidirectional flow applications) to avoid jet effect and a resulting 'spray' on the fork tines. (Figure 3)

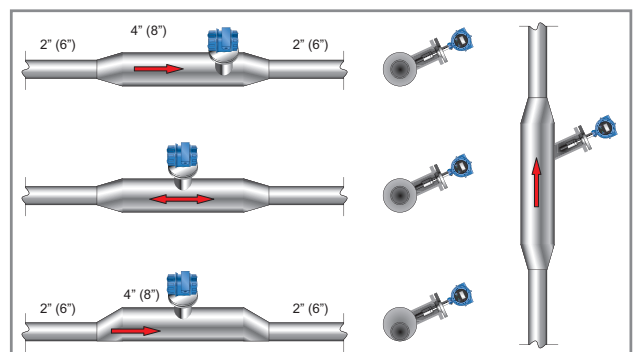


Figure 3. Expanding pipe section examples to meet velocity guidelines (side view)

Particle Size

- Solids preferably <150µm and maximum 50% dry solids (however applications have been successfully realized up to 1 mm particle size)
- For bigger quantities of %dry solids, use a tube density meter (model CDM100 - consult factory for application support)

Inclined Orientation

To avoid clogging due to solids, the T-piece should be:

- 3 inch (DN80) diameter, schedule 80 (with “schedule 80 boundary” - sensor calibration)
- T-piece vertically inclined at an angle of 25° (Figure 4)
- Purge/drain connection located on the upper part of the T-piece (optional)
- Thermal isolation INCLUDING the flange to avoid possible crystallization

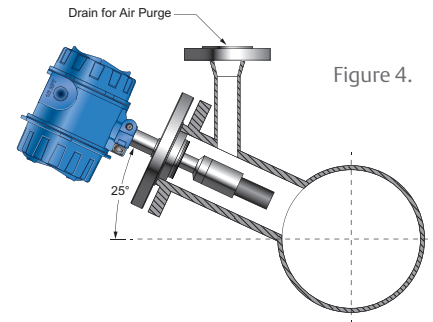


Figure 4.

Material Selection

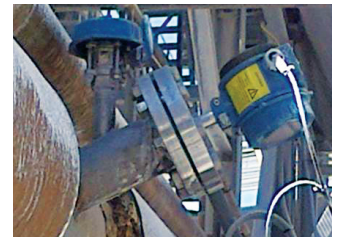
Select wetted parts and tine coating based on the following considerations:

Application Conditions	Best Practice / Selection
Chemical Corrosion	Consult the Micro Motion corrosion guide
Solids and Erosive Applications	Nickel Alloy provides better erosion resistance than SST or Titanium
Coating/Crystallization	Select DLC coating option to reduce build up
Soft Solids, Non-Coating, Non-Corrosive Applications	Select 316L or 304 SST

Consult the Micro Motion metallurgist or density and viscosity application specialist in case of doubt.

Where has it been done before?

- **Oil and Gas:** brine storage, sand and mud slurries, filter press dryer
- **Chemical:** %concentration, evaporator control
- **Power:** flue gas desulfurization (limestone, China clay, kaolin, gypsum, chalcmlk), coal floating ash
- **Pulp & Paper:** white, green and black liquor, starch control, bleaching (TiO2)
- **Metals & Mining:** bauxite slurry, magnetite slurry, ore waste, gypsum slurry waste
- **Water and Wastewater:** mud, sand slurry
- **Marine:** dredging companies (dredge treatment)
- **Food & Beverage:** sugar refineries (limestone and waste mud) and breweries (waste pulp)



COMPETITIVE COMPARISON

	FDM	Nucleonic
Safety	<ul style="list-style-type: none"> • All welded construction • No moving parts • Easy-to-clean 	<ul style="list-style-type: none"> • Non-environmental/health friendly technology • Many countries do not allow this technology by law
Cost of Ownership	<p>LOW</p> <ul style="list-style-type: none"> • No maintenance or moving parts • Minimum start up and installation costs • Meter health diagnostics (KDV) standard 	<p>HIGH</p> <ul style="list-style-type: none"> • Periodic extra cost at source removal disposal and recycling • Yearly validation, paperwork • 3x initial purchase cost, typical
Ease of Use	<ul style="list-style-type: none"> • Multiple outputs and communication protocols • Density, specific gravity, %concentration • 4-20mA's, time period signal, RS485, FOUNDATION fieldbus, HART, WirelessHART 	<ul style="list-style-type: none"> • Yearly retraining of the personnel • Specialized and certified “nucleonic” engineers req. • Licensing requirements
Performance	<ul style="list-style-type: none"> • Repeatable measurement • Fast reponse to process change, 1-3 sec. typ. 	<ul style="list-style-type: none"> • Experiences problems with drifting measurement • Requires periodic meter adjustments • Slow response time, 10-30 seconds typically

