Micro Motion® 7827 Digital Viscosity Meter

Micro Motion® viscosity meters are built to tackle the most demanding process and control applications. Rugged and reliable direct insertion meters with very low maintenance, they provide fully integrated “fit and forget” viscosity measurement.

**High accuracy viscosity and density measurement**
- Multi-variable measurement of viscosity, density and temperature
- Unique direct insertion design in lengths up to 13 ft (4 m)
- Viscosity measurement up to 20,000 cP

**Greatest installation flexibility**
- Continuous, real-time measurement in pipelines, slipstreams and tanks
- Superior diagnostics and parameter calculations including referred viscosity and viscosity index
- Comprehensive communications and control capability

**Superior reliability and safety**
- Optimized design – insensitive to vibration, temperature, and pressure variations

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**Micro Motion®**

**EMERSON**
Process Management
The Micro Motion® 7827 digital viscosity meter is an accurate measurement instrument used for continuous real-time process control of liquid viscosity and density in pipeline, slipstream/bypass and tank installations.

**About the 7827 Digital Viscosity Meter**

The 7827 digital viscosity meter is used for measurement or control of on-line process viscosity. The meter is used in applications requiring continuous on-line viscosity measurement in pipelines and tanks. The 7827 meter is available as a long-stemmed version for top mounting in open or closed tanks.

The 7827 digital viscosity meter works with the Micro Motion Model 7950 or Model 7951 signal converter to directly measure on-line viscosity, density, and temperature — allowing a true measurement of dynamic and kinematic viscosity. Additionally, parameters such as referred viscosity, referred density, and viscosity index can also be determined using the signal converters’ built-in calculations. These calculations are based on API and ASTM D341 standards.

With its multiple digital and analog communication connections, PID control, and alarm contacts, the combination of the 7827 meter with the 7950/7951 signal converter allows you to manage complex process and control applications where on-line measurements need to be referenced to laboratory conditions.

**Advantages**

- Fully integrated “fit and forget” digital viscosity and density measurement for monitoring and control
- Continuous, fast response digital measurement for closed loop control
- Measurements of viscosity and density at line and reference conditions
- Operates at viscosities up to 20,000 cP
- No moving parts means virtually no maintenance
- Integral Class B PT100 temperature sensor
- Hazardous-area approved (ATEX and CSA)
- Long-stemmed version is suitable for use on open and closed tanks and available in stem lengths up to 13 ft (4 m)
- Insensitive to vibration
- Direct insertion meter suitable for high-line pressure

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Typical applications

- Heavy fuel oil (HFO) heater control to burners and engines
- Lube oil viscosity control
- Interface detection in multi-product pipelines
- Mass flow, when used in conjunction with a volumetric flow meter
- Product mixing and blending

Typical industries

- Oil and petrochemical
- Refining
- Power
- Heavy Fuel Oil (HFO) blending and bunkering

Principle of operation

The 7827 digital viscosity meter uses a vibrating fork technology to measure density and viscosity. As the liquid density changes, it affects the vibrating mass of the meter. The change in vibrating mass then affects the resonant frequency. Viscosity is a function of the bandwidth, which is an indication of the damping associated with the liquid.

The following figure illustrates how the 7827 meter with a 7950/7951 signal converter uses the resonant frequencies at point A (the lower –3 db point) and at point B (the upper –3 db point) to digitally calculate the density, bandwidth and quality factor. These measurements then give digitally determined values of fluid density and viscosity.
Features

The 7827 digital viscosity meter works with the Model 7950 or Model 7951 signal converter to measure line viscosity, density, and temperature; and, calculate referred viscosity and base density using ASTM and API tables. Additionally, parameters such as °API and specific gravity also can be determined using the signal converter's built in calculations. Any of these parameters can be used to drive mA outputs from the signal converter. See “7950/7951 signal converter features”.

Installation and application flexibility

The 7827 meter can be easily installed in a slipstream/bypass, pipeline, open tank, pressurized vessel, or flow-through sample chamber. The availability of a choice of construction materials and connections allow this meter to be used in a wide range of applications.

Low maintenance required

Because the 7827 digital viscosity meter has no moving parts, minimal maintenance is required, leading to lower overall operating costs.

The vibrating forks are available with PFA coating to assist self-cleaning. PFA is ideal for hydrocarbon applications. Care should be taken if the PFA coating is to be used in a corrosive application. Please consult your local Micro Motion sales office.

Raw frequency output electronics

The 7827 digital viscosity meter is designed to operate with the Micro Motion Model 7950 and Model 7951 signal converters. See “7950/7951 signal converter features” below.

No field calibration required

The 7827 digital viscosity meter is factory-calibrated and no field calibration is required. The calibration is traceable to UK National Standards through the Micro Motion onsite accredited laboratory.

Auto-ranging measurement

Each factory calibration is designed to achieve maximum accuracy. The calibration measurements are: 0.5 to 10 cP, 10 to 100 cP, 100 to 1000 cP, and 1000 to 12,500 cP. An auto-ranging facility is provided for applications where the liquid viscosity extends over one or more of the current operating calibrated ranges.

Fluid characterization using viscosity

Because the 7827 meter is used with a 7950/7951 signal converter, complex measurements of liquid viscosity at conditions away from line temperature and pressure can be performed. Parameters such as viscosity at reference temperature and viscosity index are available.

7950/7951 signal converter features

Inputs from meter:

- Line viscosity (bandwidth)
- Line density (frequency)
- Temperature (PT100)

Typical 7950/7951 calculations:

- Referred kinematic viscosity
- Line dynamic/kinematic viscosity
- Referred density
- Specific gravity
- % concentration

7950/7951 outputs:

- Status
- Four 4–20 mA outputs (optional: 8)
- RS-232C/485
**Performance**

<table>
<thead>
<tr>
<th>Specification</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Viscosity Calibrated Range</td>
<td>0.5 to 12,500 cP</td>
</tr>
<tr>
<td>Maximum Viscosity Operating Range</td>
<td>0.5 to 20,000 cP (using up to four calibrated ranges)</td>
</tr>
<tr>
<td>Viscosity Accuracy</td>
<td>±1% full scale of the operating calibrated range</td>
</tr>
<tr>
<td>Viscosity Repeatability</td>
<td>±0.5% of reading</td>
</tr>
<tr>
<td>Density Calibrated Range</td>
<td>0.65 to 1.25 g/cc</td>
</tr>
<tr>
<td>Maximum Density Operating Range</td>
<td>0 to 3 g/cc</td>
</tr>
<tr>
<td>Density Accuracy</td>
<td>±0.001 g/cc of reading</td>
</tr>
<tr>
<td>Density Repeatability</td>
<td>±0.0001 g/cc</td>
</tr>
<tr>
<td>Process Temperature Effect (Corrected) (1)</td>
<td>0.0001 g/cc (per °C)</td>
</tr>
</tbody>
</table>

(1) Temperature effect is the maximum measurement offset due to process fluid temperature changing away from the factory calibration temperature.

**Temperature specification**

<table>
<thead>
<tr>
<th>Specification</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Process</td>
<td>Short-stem version −40 °F to +185 °F (−40 °C to +85 °C)</td>
</tr>
<tr>
<td></td>
<td>Long-stem version −58 °F to +392 °F (−50 °C to +200 °C)</td>
</tr>
<tr>
<td>Ambient</td>
<td>−40 °F to +185 °F (−40 °C to +85 °C)</td>
</tr>
</tbody>
</table>

**Integral temperature sensor**

<table>
<thead>
<tr>
<th>Technology</th>
<th>100 Ohms RTD (4 wire)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Accuracy</td>
<td>PT100 BS1904 Class B, DIN 43760 Class B</td>
</tr>
</tbody>
</table>
Pressure ratings

<table>
<thead>
<tr>
<th>Maximum operating pressure(^{(1)})</th>
<th>Short-stem version</th>
<th>3000 psi (207 bar)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Long-stem version</td>
<td>1450 psi (100 bar)</td>
</tr>
</tbody>
</table>

Test pressure

Tested to 1.5 x the maximum operating pressure

PED compliance

Outside the scope of European directive 97/23/EC on Pressure Equipment.

(1) Actual maximum operating pressures are limited by the process connection rating.

Hazardous area classifications

**ATEX**

ATEX-approved: Certification for use in Europe

ATEX II2G Ex d IIC, T4

**CSA C-US**

CSA-approved: Certification for use in Canada and USA

Class I, Division 1 Groups C & D, T4

General classifications

Electromagnetic compatibility

All versions conform to the latest international standards for EMC, and are compliant with EN 61326/IEC 61326.

Environment

- Weather rating: IP66
Materials of construction

<table>
<thead>
<tr>
<th>Wetted parts</th>
<th>Available in 316L Stainless steel, 304L Stainless steel, Alloy C22, Alloy B3, Alloy 400</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tine finish</td>
<td>Standard, electro-polished, or PFA laminated(^1) finishes available</td>
</tr>
<tr>
<td>Electronics enclosure</td>
<td>Short-stem version</td>
</tr>
<tr>
<td></td>
<td>Sand cast low copper alloy</td>
</tr>
<tr>
<td></td>
<td>Polyurethane paint finish</td>
</tr>
<tr>
<td></td>
<td>Long-stem version</td>
</tr>
<tr>
<td></td>
<td>Sand cast low copper alloy, or stainless steel</td>
</tr>
<tr>
<td></td>
<td>Polyurethane paint finish</td>
</tr>
</tbody>
</table>

\(^1\) PFA is applied only to the tines for its anti-stick properties not for corrosion protection.

Weight

<table>
<thead>
<tr>
<th>Weight</th>
<th>Short-stem version</th>
<th>14.8 lb (6.7 kg) typical</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Long-stem version</td>
<td>Dependent on stem length (contact factory)</td>
</tr>
</tbody>
</table>

Electrical

| Power supply requirement (from signal converter) | 23 to 27 VDC, 50 mA |
| Outputs                                           | Viscosity and density Frequency |
|                                                  | Temperature 100 Ohms RTD (4 wire) |
| Electrical connection                             | Screw terminal, cable entry to suit ½” NPT gland (20 mm adaptor available) |
Dimensions

7827 Short Stem

Cone-seat connection details

Dimensions in inches (mm)

Flange connection details

Dimensions in inches (mm)
7827 Long Stem

Open-tank connection (cast housing)

Dimensions in inches (mm)

- Electronic housing
- External Earth connector
- Lower nodal mass
- Long stem 1.5\* SCH 80 tube
- Vibrating element

Mounting hardware is customer specific, and is not supplied.

Pipe must be securely clamped in at least two places along this length.

Stem lengths up to 13 ft (4 m) are available as an ETO purchase.

Open-tank connection (stainless steel housing)

Dimensions in inches (mm)

- Amplifier housing
- Cover lock screw M4 x 5 ST.STL - Kept captive by data label
- Upper nodal mass
- Lower nodal mass
- Long stem 1.5\* SCH 80 tube
- Vibrating element

Mounting hardware is customer specific, and is not supplied.

Pipe must be securely clamped in at least two places along this length.

Stem lengths up to 13 ft (4 m) are available as an ETO purchase.
**Closed-tank connection (cast housing)**

*Dimensions in inches (mm)*

- **Amplifier housing**
  - Cover lock screw M4 x 5 ST.STL - Kept captive by data label

- **Electronic housing**
  - External Earth connector

- **External Earth screw**
  - Data label

- **Lower nodal mass**

- **Vibrating element**

- **Long stem 1.5× SCH 80 tube**

- **Dimensions**
  - 5.5 (140)
  - 5 (128)
  - 11.4 (290)

Stem lengths up to 13 ft (4 m) are available as an ETO purchase.

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**Closed-tank connection (stainless steel housing)**

*Dimensions in inches (mm)*

- **Amplifier housing**
  - Cover lock screw M4 x 5 ST.STL - Kept captive by data label

- **Amplifier housing**
  - External Earth screw

- **Upper nodal mass**

- **Vibrating element**

- **Long stem 1.5× SCH 80 tube**

- **Dimensions**
  - 5.7 (145)
  - 19.68 (500)
  - 1.38 (35)
  - 11.4 (290)

Stem lengths up to 13 ft (4 m) are available as an ETO purchase.

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**Closed-tank connection (cast housing)**

*Dimensions in inches (mm)*

- **Amplifier housing**
  - Data label

- **Amplifier housing**
  - External Earth screw

- **Lower nodal mass**

- **Vibrating element**

- **Long stem 1.5× SCH 80 tube**

- **Dimensions**
  - 11.4 (290)
  - 5.5 (140)

Stem lengths up to 13 ft (4 m) are available as an ETO purchase.
Installation

7827 Short Stem

A variety of installation accessories, can be provided, such as weldolets, for direct pipeline insertion or flow-through chambers, which provide the optimum environment for the short-stemmed 7827 meters.

7827 Long Stem

Open-tank installation example

For open-tank installations, the long-stemmed 7827 is clamped to a structure.

The position of the clamp determines the insertion depth.

Closed-tank installation example

For closed-tank installations, the long-stemmed 7827 needs a factory fitted flange attachment.

To vary the insertion depth, a standoff section with flange (not supplied) can then be used.
### Ordering Information

<table>
<thead>
<tr>
<th>Model</th>
<th>Product description</th>
</tr>
</thead>
<tbody>
<tr>
<td>7827</td>
<td>Digital viscosity meter, frequency output (for use with signal converters / flow computers 7950 / 7951 or similar)</td>
</tr>
</tbody>
</table>

#### Code: Material of wetted parts

**Available with all stem length codes:**
- **A**: 316L Stainless steel, standard finish
- **C**: 316L Stainless steel, electro-polished finish
- **F**: 316L Stainless steel, PFA laminated tines
- **Z**: ETO material

#### Code: Amplifier system

**Available only with stem length codes A or Z:**
- **A**: Frequency output ATEX II Ex d IIC T4 (< 200 °C)
- **B**: Frequency output CSA Class 1 Div 1 Groups C & D (< 200 °C)

**Available for stem length codes C or Z:**
- **G**: Frequency output – Safe area only (< 200 °C)
- **H**: Frequency output ATEX II Ex d IIC T4 (< 150 °C) [T4 (−40 °C < Ta < +110 °C)]
- **J**: Frequency output CSA (C-US) Class 1 Div 1 Groups C & D (< 160 °C)

#### Code: Amplifier enclosure

**Available with all stem length codes:**
- **A**: Aluminium alloy [T4 (< 40 °C < Ta < +110 °C)]

**Available for stem length codes C or Z:**
- **C**: Stainless steel

#### Code: Process connections

**Available with all stem length codes:**
- **A**: 2" ANSI CL150 raised-face (RF) flange EN1092
- **B**: 2" ANSI CL300 raised-face (RF) flange EN1092
- **C**: 2" ANSI CL600 raised-face (RF) flange EN1092
- **G**: 50 mm DN50/PN40 DIN 2527
- **R**: 50 mm DN50/PN16 DIN 2527
- **Z**: ETO process connection

**Available only with stem length codes A or Z:**
- **N**: 1.5" Cone seat compression fitting

#### Code: Stem length

- **A**: 0 mm: no stem extension and with standard spigot
- **C**: 500 mm / 20° (with removable transit cover)
- **Z**: ETO stem length *(1)*

*(1) Stem lengths up to 13 ft (4 m) are available as an ETO purchase.*
## Ordering Information

<table>
<thead>
<tr>
<th>Code</th>
<th>Default configuration</th>
</tr>
</thead>
<tbody>
<tr>
<td>T</td>
<td>No software configuration – frequency output only</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Code</th>
<th>Calibration range</th>
</tr>
</thead>
<tbody>
<tr>
<td>B</td>
<td>0.5 to 100 cP</td>
</tr>
<tr>
<td>C</td>
<td>0.5 to 1000 cP</td>
</tr>
<tr>
<td>F</td>
<td>10 to 1000 cP</td>
</tr>
<tr>
<td>Z</td>
<td>ETO calibration range</td>
</tr>
</tbody>
</table>

**Available only with calibration type code A:**

<table>
<thead>
<tr>
<th>Code</th>
<th>Calibration range</th>
</tr>
</thead>
<tbody>
<tr>
<td>D</td>
<td>0.5 to 12500 cP</td>
</tr>
<tr>
<td>E</td>
<td>10 to 12500 cP</td>
</tr>
<tr>
<td>G</td>
<td>100 to 12500 cP</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Code</th>
<th>Calibration type</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>Free stream</td>
</tr>
<tr>
<td>Z</td>
<td>ETO calibration type</td>
</tr>
</tbody>
</table>

**Available with all stem length codes:**

<table>
<thead>
<tr>
<th>Code</th>
<th>Factory Set</th>
</tr>
</thead>
<tbody>
<tr>
<td>B</td>
<td>Reserved for future use</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Code</th>
<th>Traceability</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>None</td>
</tr>
<tr>
<td>X</td>
<td>Certificates of material traceability (per single order)</td>
</tr>
</tbody>
</table>

**Typical model number:** 7827AAAAATBABA

(1) *Available with calibration range B only.*
World-leading Micro Motion measurement solutions from Emerson Process Management deliver what you need most:

**Technology leadership**

Micro Motion introduced the first reliable Coriolis meter in 1977. Since that time, our ongoing product development has enabled us to provide the highest performing measurement devices available.

**Product breadth**

From compact, drainable process control to high flow rate fiscal transfer—look no further than Micro Motion for the widest range of measurement solutions.

**Unparalleled value**

Benefit from expert phone, field, and application service and support made possible by more than 750,000 meters installed worldwide and over 30 years of flow and density measurement experience.