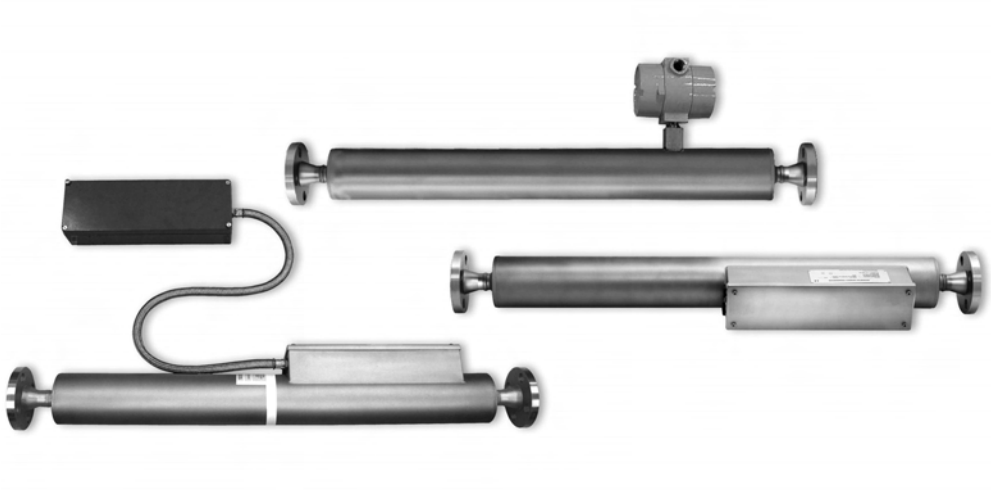
Product Data Sheet
PS-001040, Rev. C
February 2008

Micro Motion® 7845/7847 Series Density and Concentration Meters

Micro Motion density and concentration meters are built to tackle the most demanding process and fiscal applications. Rugged and reliable with very low maintenance, 7845 and 7847 straight tube meters are industry standards for on-line density measurement.



Superior precision density measurement

- Unique design delivers unparalleled measurement sensitivity and stability
- On-site accredited density laboratory for guaranteed performance.

Broadest range of density measurement

- Compliant with fiscal measurement standards
- Guarantee consistent, reliable performance over the widest density range

Superior reliability

- Cleanable, straight through sensor with low pressure drop
- Optimized design - insensitive to vibration, flow, temperature and pressure variations

7835	Peak performance density meter
7845	**High performance general purpose density meter**
7847	**High performance hygienic density meter**
7826/28	Direct insertion density meter
3098	Gas specific gravity meter
7812	Fiscal gas density meter

Micro Motion®

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Process Management

Micro Motion 7845/7847 density and concentration meters

Introduction

The 7845 and 7847 density meters are designed to tackle the most demanding of applications found in modern processing plants. The 7845, designed for general process applications, is a flexible, stainless steel, and high accuracy meter, capable of market leading density and concentration measurements in challenging applications ranging from custody transfer and interface detection to concentration control. Building on this proven design is the 7847, which is designed for hygienic applications that require high performance process control. With the inherent advantages of a low pressure drop, straight-through, and easily cleanable design, this meter is ideal for the food and beverage industries.

Both the 7845 and 7847 density meters are designed to operate with one of two electronic configurations:

- as a meter giving a frequency output to a signal converter (such as the Micro Motion 7950 and 7951)
- as a transmitter with up to 3 integral analog outputs and Modbus RS485 communications. (HART protocol communications and a remote display are also available as options)

Advantages

- Continuous measurement
- Explosion proof and intrinsically safe versions
- ATEX and CSA approvals
- IP66 Weatherproof
- 7845 is NACE compatible
- Straight-through flow path
- Pipeline quality - all welded construction
- Hermetically sealed construction
- Insensitive to mounting position, plant vibration, flow rate and pressure
- Modular electronics design
- Direct analog & digital communications outputs
- Multi-drop capability
- Remote display and HART communications options
- PC config tool for diagnostics and data logging
- Zero maintenance

Contents

Principle of operation

All Micro Motion liquid density meters operate using the same general principle that can be likened to that of a mass-spring system. When a mass on a spring is displaced and released, it will oscillate at a natural frequency until it comes to rest due to viscous damping. When a driving force is applied to the mass to overcome the effect of damping, the vibration is maintained in resonance.

As the measured product density changes, it changes the vibrating mass of the density meter, which is then detected by a change in the resonant frequency.

Features

The 7845 and 7847 density meters are factory calibrated and no on-site calibration is necessary. The calibration is traceable to UK National Standards through our on-site accredited density laboratory.

They measure line density and temperature, and calculate referred density using API tables or a matrix referral. Parameters such as °API and Specific Gravity are also available. Calculations are performed in conjunction with a signal converter (for the frequency output version) or inside integral transmitter electronics. Any of these parameters can be used to drive analog outputs (from either the signal converter or the transmitter).

The design of the 7845 and 7847 density meters ensures highly accurate and reliable results with minimal maintenance, and lower overall operating costs. The entrained gas versions of these meters also allow accurate density measurements in aerated liquids.

System capabilities

Depending on the functionality required, the 7845 and 7847 density meters can be specified in the following configurations:

- **Frequency Output** version (requires external signal converter / flow computer)
  - Intrinsically Safe (Exia) 7845 or 7847
- **Transmitter version** with integral communications (Modbus RS485 and 2 x 4-20mA outputs)
  - Intrinsically Safe (Exia) 7845 or 7847
  - HART / 3rd analog output board (optional)
  - Remote display (optional)
- **Entrained gas version** with frequency or digital communications outputs
  - Frequency Output 7845 or 7847 for non-hazardous (safe) area only
  - Transmitter version of Intrinsically Safe (Exia) 7845 or 7847

Remote display features

- Remote display requires transmitter version of the 7845 or 7847
- System configuration using keypad
- 4-line parameter display
- Hand or wall-mount operation up to 328 feet (100 meters). away from the transmitter
- Operation in hazardous areas (Intrinsically Safe 7845/7847 Transmitter only)

RS485 Multidrop when using Remote Display

Up to 24 7845 and 7847 density meters can be connected together in a multi-drop transmitter environment. Each 7845 and 7847 meter is given a unique slave address in the range 0 to 200. The Remote Display can interrogate one meter at a time, and each meter in the loop can be configured by setting the address and re-polling.

Diagnostic tool (*7845 and 7847 Meter with Transmitter*)

ADView is a software package enabling you to:

- Configure density and viscosity meters
- View and save data
- Check correct functionality

Adview is installed on a PC and interacts with the 7845 and 7847 Transmitter through one of the PC's standard serial (RS-232) port.

Adview provides many useful facilities, such as:

- Setting up a serial link to communicate with the 7845 and 7847 Transmitter
- Configuring the 7845 and 7847 Transmitter
- Displaying data is real-time, or as a graph
- Logging data to a file
- Verifying correct operation of the system, and diagnosing faults
- Loading or storing Modbus register values
- Read/write to individual Modbus registers

7950/7951 Signal Converter features

Inputs from 7845 and 7847:

- Line density (frequency)
- Temperature (PT100)

Typical 7950 and 7951 calculations:

- Line density
- Referred density
- Specific Gravity

7950 and 7951 outputs:

- Status
- Analog
- RS 232C/485
- HART

Density performance

Accuracy	±0.00035 g/cc	±0.35 kg/m^3	(Standard) [1]
	±0.0005 g/cc	±0.5 kg/m^3	(Standard) [2]
	±0.001 g/cc	±1.0 kg/m^3	(Option) [3]
	±0.005 g/cc	±5.0 kg/m^3	(Entrained Gas Option) [4]
Operating Range	Up to 3 g/cc	Up to 3000 kg/m^3	
Repeatability	±0.00005 g/cc	±0.05 kg/m^3	
	±0.001 g/cc	±1.0 kg/m^3	(Entrained Gas Option) [4]
Stability	±0.00035 g/cc	0.35 kg/m^3	(Per year)
Process Temperature Effect (Corrected) [5]	±0.00005 g/cc	±0.005 kg/m^3	(Per °C)
	±0.003 g/cc	±3 kg/m^3	(100°F)
Process Pressure Effect (Corrected) [6]	±0.000006 g/cc	±0.006 kg/m^3	(Per bar)
	±0.0004 g/cc	±0.4 kg/m	(100psi)

(1) Stated accuracy is for operating density range of 0.6 to 1.2 g/cc (600 - 1200 kg/m^3). With the transmitter electronics option, there are additional uncertainties attributable to time period measurement and 4-20mA output.

(2) Stated accuracy is for operating density range of 0.6 to 1.6 g/cc (600 - 1600 kg/m^3). With the transmitter electronics option, there are additional uncertainties attributable to time period measurement and 4-20mA output.

(3) Accuracy is for optional calibration in water - contact the sales office for further details. With the transmitter electronics option, there are additional uncertainties attributable to time period measurement and 4-20mA output.

(4) Percentage of entrained gas range 0 to 100%.

(5) This is the maximum measurement offset due to process fluid temperature changing away from the density calibration temperature.

(6) Pressure effect is defined as the change in sensor density sensitivity due to process pressure changing away from the calibration pressure. To determine factory calibration pressure, refer to calibration document shipped with the 7845/47. If data is unavailable, contact the factory.

Temperature specification

Operating Range [1]	-58 °F to +230 °F (-50 °C to +110 °C)

(1) -58 °F to 320 °F (-50 °C to +160 °C) with high temperature kit option.

Integrated temperature senor:

Technology	100 ohm PRT (4 wire)
Measurement Range	-328 °F to +572 °F (-200 °C to +300 °C)
Accuracy	BS 1904 Class, DIN 43760 Class A.

Pressure ratings

Maximum operating pressure	7845	1450 psi (100 bar) or flange limit
	7847	290 psi (20 bar) or flange limit
Test pressure	Tested to 1.5 x the maximum operating pressure	
PED compliance	Complies with European directive 97/23/EC on Pressure Equipment.	

Hazardous area classifications

ATEX Intrinsically Safe

ATEX-approved I.S. 7845/47: Certification to EN50014 and EN50020 for use in Europe

7845/47 (Frequency Output) (1)	(784x****AJ****)	ATEX II1G, EEx ia IIC T6 (Ta -40 °C...+40 °C) T4 (Ta -40°C...+70°C)
7845/47 (Transmitter) (1)	(784x****(D/H)J****) (784x****(B/F)J****)	ATEX II1G, EEx ia IIB T4 (Ta -40°C...+60°C) ATEX II1G, EEx ia IIC T4 (Ta -40°C... +60°C)
Remote Display (Optional)		ATEX II 1 G, EEx ia IIC, T4 (Ta -40°C...+60°C)

(1) Entrained gas 7845/7847 (Frequency Output) approved for use in non-hazardous areas only - See "Ordering information" on page 9.

CSA Intrinsically Safe

CSA-approved I.S. 7845/47: Certification to CSA C22-2 No 142, CSA C22-2 No 175, UL 508 and UL 913 for use in Canada/USA

7845/47 (Frequency Output) (1)	(784x****AL****)	Class I, Division 1 Groups C & D, T3C
7845/47 (Transmitter) and optional Remote Display (1)	(784x****(B/F)L****) (784x****(D/H)L****)	Class I, Division 1, Groups A, B, C & D, T4 (Single instrument) Class I, Division 1, Groups C & D, T4 (Hart Multi-drop)

(1) Entrained gas 7845/7847 (Frequency Output) approved for use in non-hazardous areas only - See "Ordering information" on page 9.

General classifications

Electo-magnetic compatibility

All versions conform to the latest international standards for EMC, and are certified compliant with:

- Emissions: EN 61326 - 1997 (Heavy Industrial Environment)
- Radiated emissions in the range 30MHz to 100MHz, and conducted emissions in the range 0.15MHz to 30MHz complying with standard EN5011
- Immunity: BS EN 50082-2: 1995

Materials of construction

Wetted parts	Stainless steel 316L
Case finish	Stainless steel 316
Flange	Stainless steel 316L

Fluid containment

Recognizing the increased emphasis on safety by chemical, hydrocarbon, and process markets alike, these Micro Motion density meters have been enhanced by the introduction of an optional outer 725 psi (50 Bar) or secondary 1450 psi (100 Bar) pressure retaining capability. In the unlikely event of an instrument failure, the meter safely contains any leakage. As a further safety feature, all welds are qualified to ASME 9/BS/EN288 standards and can undergo dye penetration testing to ASME standards if required. Furthermore, the flange welds may be x-rayed to most recognized international standards.

	Standard Containment	Optional Outer Containment	Optional Second Containment [1]
Design pressure		725 psi (50 Bar) Standard engineering practice	1450 psi (100 Bar) designed to B31.3
Yield pressure	Fitted with burst disc which will fail between 290 - 435 psi (20-30 bar)	1450 psi (100 Bar)	N/A
Failure pressure		2900 psi (200 Bar)	5727 psi (395 bar) Glass to metal seal failure

(1) Available for 7845 only - See "Ordering information" on page 9.

Weight

Weight (7845/47):	48 lb (22 kg)

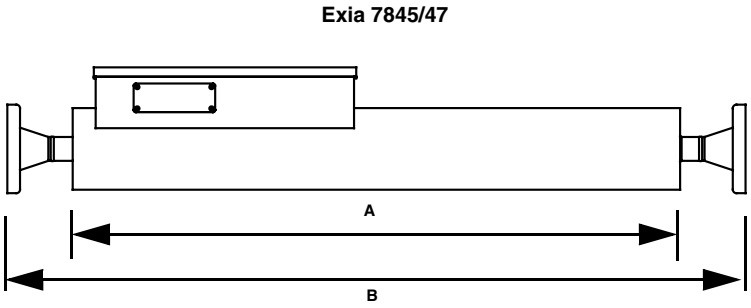
Electrical

Power supply (Frequency Output Version)	16 to 28V dc at 17mA maximum	
Power supply (Transmitter Version)	18 to 28V dc at 80mA	
Outputs (Frequency Output Version)	Current modulation on power supply line	
Outputs (Transmitter Version)	Analog	2 (+1 with HART option board)
	Accuracy	0.1% of reading plus 0.5% of full scale
	Repeatability	±0.025%
	Out-of-range	2 to 20mA on 4-20mA (Programmable alarm state)
	Pulse output (on EExia transmitter)	Open collector output. Alarm status or frequency.
	Communications (on EExia transmitter)	RS485, Modbus (standard), HART (optional).

Dimensions

Dimensions for the Intrinsically Safe 7845/7847

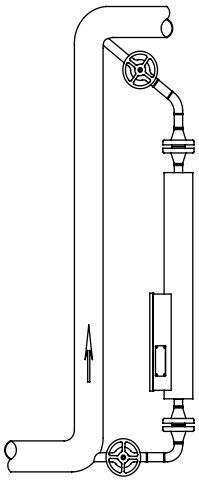
Model		Dimensions A	B
7845/7847 Exia	inches	34	40.4
	mm	863±1	1027±3



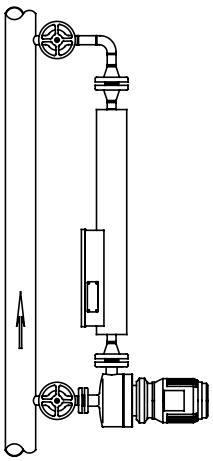
Installation

The 7845 and 7847 density meter can be mounted at any angle but it is recommended that at low flow rates, e.g. 2.7 gallons/minute (750 liters/hour), it is vertically mounted or at an incline with the liquid flowing in an upwards direction. For continuous typical flow rates, e.g. 7.4 to 11.1 gallons/minute (2000 to 3000 liters/hour), the mounting position can be selected to simplify the associated pipework and help minimize the pressure and temperature losses.

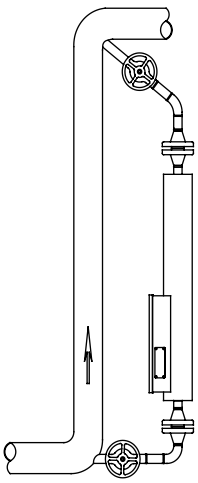
Installation examples



'S' Bend Method



Pump Method



Orifice Plate Method

Ordering information

7845 Intrinsically Safe

Model	Product description
7845	Stainless Steel Liquid Density Meter
Code	**Process connection**
C	1-inch ANSI 300 lb weld neck raised face (RF) flange
K	1-inch ANSI 600 lb weld neck raised face (RF) flange
H	DN25/PN40 weld neck flange; DIN 2635 type C face
J	DN25/PN40 weld neck flange; DIN 2635 type N grooved face
L	DN25/PN100 weld neck; DIN 2637 type E face
Z	Special
Code	**Material Options**
B	Wetted parts: 316L Stainless Steel, 316L Stainless Steel outer case
D(1)	Wetted parts: Hastelloy® bellows, 316L Stainless Steel tube, flanges and outer case. NACE
Code	**Meter outer containment**
A	Standard stainless steel, for tube mounted amplifiers or remote amplifier
B	Outer containment (1/4-inch NPT), for tube mounted amplifiers or remote amplifier
C	Secondary containment B31.3 (1/2-inch NPT), for tube mounted amplifiers or remote amplifier (up to 1450 PSI or 100 Bar)
Code	**Amplifier enclosure**
F	Tube mounted flat box in stainless steel
Code	**On-board electronics**
A	Standard base board, giving 1 x Frequency Output.
B	Advanced base board, giving 2 x 4-20mA outputs.
D	Advanced base board and HART board, giving 3x 4-20mA outputs.
E	Entrained gas option – Standard board: 1 x Frequency Output (non-hazardous area only)
F	Entrained gas option – Advanced board: 2 x 4-20mA outputs.
H	Entrained gas option – Advanced board: HART®, 3 x 4-20mA outputs,
Code	**Safety approval label**
J	ATEX Intrinsically Safe - EEx ia IIC T6 or T4
L	CSA intrinsically safe, Class 1 Div 1 Groups C and D (Canada and USA)
S	Non-hazardous area only (for entrained gas option electronics)
Code	**Default software configuration**
	Available for on-board electronics codes B, D, F, or H
A	API Degrees (Americas)
B	Base density to API tables (metric configuration)
C	Line density only
D	General Process including matrix (user data required)
	Available for on-board electronics codes A or E
T	No software to configure (Frequency on-board electronics)
Code	**Calibration**
A	Instrument standard
D	UKAS calibration (Water)
E	UKAS calibration (3 liquids)
Z	Special
Code	**Dye Penetrant and Radiographic Examination (ASME IX)**
A	None
B	Dye penetration (internal welds)
C	Dye penetration (all welds)
D	Radiography of flange welds + B above
E	Radiography of flange welds + C above
F	Radiography of flange welds

Continued on next page

(1) NACE - Incorporates Hastelloy bellows instead of Stainless Steel

Ordering information *continued*

(7845 Intrinsically Safe)

Code	Traceability
A	None
X	Certificates of material traceability (per single order)
Typical model number: 7845 C B A F A J T A A A	

Ordering information *continued*

7847 Intrinsically Safe

Model	Product description
7847	Stainless Steel Liquid Density Meter
Code	**Process connection**
C	1-inch ANSI 300 lb weld neck raised face (RF) flange
H	DN25/PN40 weld neck flange; DIN 2635 type C face
J	DN25/PN40 weld neck flange; DIN 2635 type N grooved face
P	1” sanitary fitting (Tri-Clamp compatible)
R	DN25 IDF (ISO 2853) female aseptic coupling
S	DN25 DIN 11851 female aseptic coupling
Z	Special
Code	**Material Options**
B	Wetted parts: 316L Stainless Steel, 316L Stainless Steel outer case
Code	**Meter outer containment**
A	Standard stainless steel, for tube mounted amplifiers or remote amplifier
B	Outer containment (1/4-inch NPT), for tube mounted amplifiers or remote amplifier
Code	**Amplifier enclosure**
F	Tube mounted flat box in stainless steel
Code	**On-board electronics**
A	Standard base board, giving 1 x Frequency Output,
B	Advanced base board, giving 2 x 4-20mA outputs.
D	Advanced base board and HART board, giving 3x 4-20mA outputs.
E(1)	Entrained gas option – Standard board: 1 x Frequency Output (non-hazardous area only)
F	Entrained gas option – Advanced board: 2 x 4-20mA outputs.
H	Entrained gas option – Advanced board: HART®, 3 x 4-20mA outputs,
Code	**Safety approval label**
J	ATEX Intrinsically Safe - EEx ia IIC T6 or T4
L	CSA intrinsically safe, Class 1 Div 1 Groups C and D (Canada and USA)
S(2)	Non-hazardous (safe) area only
Code	**Default configuration**
	Available for on-board electronics codes B, D, F, or H
A	API Degrees (Americas)
B	Base density to API tables (metric configuration)
C	Line density only
D	General Process including Matrix (user data required)
	Available for on-board electronics codes A or E
T	No software to configure (Frequency on-board electronics)
Code	**Calibration**
A	Instrument standard
D	UKAS calibration (Water)
E	UKAS calibration (3 liquids)
Z	Special
Code	**Dye Penetrant and Radiographic Examination (ASME IX)**
A	None
B	Dye penetration (internal welds)
C	Dye penetration (all welds)
D	Radiography of flange welds + B above
Code	**Traceability**
A	None
X	Certificates of material traceability (per single order)
Typical model number: 7847 P B A F B J C A A A	

(1) Only available with safety approval and label option S.

(2) Only available with on-board electronics option E.

Micro Motion—The undisputed leader in flow and density measurement

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.

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Benefit from expert phone, field, and application service and support made possible by more than 500,000 meters installed worldwide and 30 years of flow and density measurement experience.

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