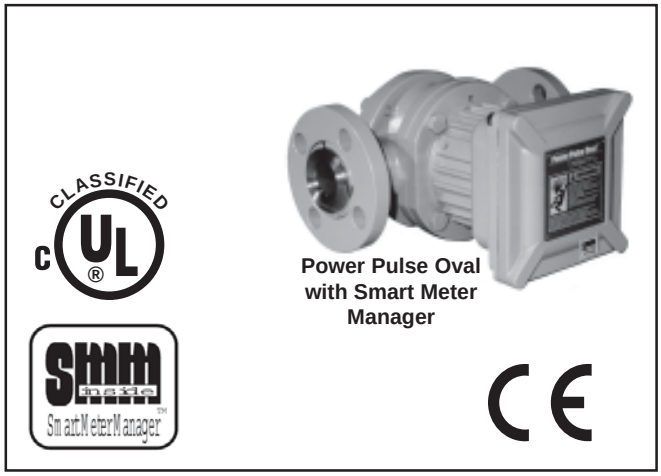
9900 Series Oval Flowmeter/Transmitter with SMART METER MANAGER™

- 2-Wire loop powered flowmeter/transmitter
- 316 Stainless steel measuring unit
- Automatic temperature compensation
- Pocketless measuring chamber
- Low pressure drop
- 2-Wire mass or volume output
- 4-20 mA analog output with HART® communication
- Smart Meter Manager™ can be located in UMB
- User configurable, scalable pulse output
- Comprehensive alarms for both process flow and internal diagnostic checks
- Easy access programming
- 10-Point meter factor linearization
- Class I, Division 1, Groups C & D; Class II, Division 1, Groups E, F & G; Type 4 Weather Proof
- Intrinsically safe
- CE compliant



"Smart Meter Manager inside" best defines the Brodie 9900 Oval Flowmeter/Transmitter. Past products have only delivered simple square wave pulse outputs that represented raw unfactored meter pulses (K-Factors).

K-Factors require additional processing by a secondary piece of electronics to convert to engineering units or factored 4-20 mA analog output. The need for secondary electronics, additional wiring and power supplies can be eliminated by using the SMART METER MANAGER™ SMM is a multivariable flow computer that fits inside the standard Brodie UMB (Universal Mounting Box). Because the SMM only requires 4-20 mA Loop power, it hooks up as a simple 2-wire transmitter. The SMM expands the capability of the Oval to include factored 2-wire, 4-20 mA output, and with ATC (Automatic Temperature Compensator) the once simple K-Factor now represents both corrected volume and mass flow. This can be in the form of a 4-20 mA output, gross total and/or inventory total. In addition, transistor contacts provide scaled pulse outputs in both net and gross values. An additional contact provides an alarm output. This expanded capability is enhanced by HART® communications and the ability to use the standard 275 HART communicator.

DESCRIPTION

The Brodie 9900 Series Oval Flowmeter/Transmitter with Smart Meter Manager™ (SMM) is a very high accuracy, positive displacement meter which utilizes microprocessor based electronics to provide multivariable flow computation and output for volumetric and mass measurement requirements. It is designed for use in the chemical, industrial, food and beverage, pharmaceutical and hydrocarbon process industries.

One of the most significant features of these meters is their ability to handle both low and high viscosity products with a low pressure drop across the meter. They are supplied in a compact, 3-piece design which uses both front and rear flanges instead of the closed-end body configuration found in traditional oval flowmeters. Available sizes are 1/2" through 3".

Brodie Smart Meter Manager (SMM)Technology

- 2-wire, loop-powered device for ease of wiring and installation
- 4-20 mA analog output with Bell-202 modulated HART communication channel
- User selectable 0% and 100% analog output ranges with optional smoothing
- Flexible (mix & match) units of measure for flowrates, totals, temperatures, densities, etc.
- Capability for two flow totalizers: Resettable and inventory
- User configurable, scalable pulse output for various engineering units
- Comprehensive alarms for both process flow and internal diagnostic checks

Flowmeters are supplied with the SMM mounted within the explosion proof UMB enclosure.

Capabilities include:

- Volumetric and Mass Measurement in selected engineering units
- Automatic Temperature Compensation
- Analog and Pulse Output to remote instrumentation
- Diagnostic and System Alarms
- 2-Wire Mass or Volume Output
- Model 275 Hand-held Interface

The Smart Meter Manager provides multivariable flow measurement capabilities that include net/gross volume, low flow cutoff, temperature compensation, accumulative and resettable totalization, product density and mass flow inference. All measure parmeters are factory set with the capability of field programming. The BERT must be located remotely.

PRINCIPLE OF OPERATION

The Oval Flowmeter accurately measures liquid flow by using a slight pressure differential to rotate a pair of oval gears located within the measuring chamber. Each complete rotation of the gears (rotors) displaces a fixed amount of liquid from the inlet to the outlet of the meter in a continuous flow pattern. When in the position as shown in Figure 1, Diagram 1, all of the driving torque resulting from differential pressure is applied to Gear A. Gear B has zero driving torque since equal areas of gear surface on opposite sides of the axis of rotation are exposed to higher inlet pressure. As the gears begin to rotate (Diagram 2), the torque applied to Gear A decreases but Gear B now has driving torque due to increased area exposed to the high pressure. At the position shown in Diagram 3, all of the driving torque is exerted on Gear B and Gear A has decreased to zero. This alternate driving action provides a smooth rotation of almost constant torque without dead spots.

Because slippage between the gears and the wall is minimal, the meter is essentially unaffected by the viscosity and lubricity of the liquids being metered.

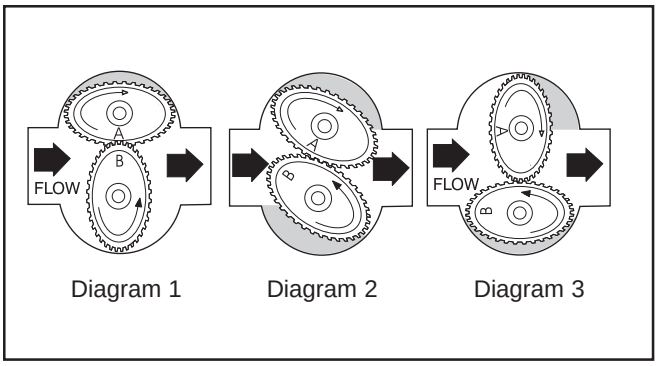


Diagram 1 Diagram 2 Diagram 3

Figure 1 Principle of Operation

SPECIFICATIONS

⚠ WARNING

Do not operate this instrument in excess of the specifications listed below. Failure to heed this warning can result in serious personal injury and/or damage to the equipment.

FLOWMETER

Viscosity

Basic viscosity classifications include:
Standard viscosity class from 0.2 to 500 centipoise
High viscosity class above 500 centipoise

Materials of Construction

Body: Stainless Steel CF8M w/Polyurethane Paint
Rotors: 316 Stainless Steel
Shafts: 316 Stainless Steel (Standard), Chrome Plated (Optional)
Rotor Bearings: Carbon (Standard) Waukesha or Carbon Ceramic (Optional) for corrosive/abrasive products
O-rings: Viton® (Standard), Teflon®, EPR, Silicon (Optional) See Model Meter Code.

Capacities: See Tables 1A (Mass) and 1B (Volumetric)

Performance

Accuracy: ±0.25% on viscosities of 5 centipoise and above
±0.05% on viscosities from 0.2 to 5 centipoise
Repeatability: ±0.05% or better
Accuracy vs. Pressure Drop: See Figure 3

Ratings

Maximum Working Temperature
(Limited to electronics)
Process Operating Temperature
Class A: -40 to 230°F (-40 to 110°C)
Class C: 230 to 356°F (110 to 180°C)
Ambient Operating Temperature:
-40°F to 150°F (-40°C to 65°C)
Storage Temperature:
-58°F to 175°F (-50°C to 79°C)

SAMA Vibration Specification:
PMC 31.1, Table2, Condition 3
For Process Pipe Mounted Instrumentation
Humidity 0-95% R.H. Non-Condensing

Stainless Steel, 150 lb. ANSI Flg.: 275 psi (1895 kPa)
Stainless Steel, 300 lb. ANSI Flg.: 720 psi (4960 kPa)

Mechanical Connections
Standard: 1/2" to 3", 150 lb. ANSI flange
Optional: 1/2" to 3", 300 lb. ANSI flange, DIN, Tri-Clover®

Electrical Classifications:

UL/cUL listed - Intrinsically Safe
Division 1, Class I, II and III, Groups A, B, C, D, E, F, G for all enclosure options
Enclosure 4X

UL/cUL listed - Non-incendive for Division 2, Class I, II, III, Groups A, B, C, D, F, G for all enclosure options
Enclosure 4X

UL/cUL listed - Hazardous locations, Explosion Proof
Class I, Division 1, Groups C, D, Class II, Division 1, Groups E, F, G; Class III Enclosure 4X, for optional explosion proof housing

CENELEC approved - Intrinsically Safe
EEx ia IIC T4. Certified to EN50020 and EN50014, for all enclosure options. Ingress Protection IP 65 per IEC 529.

CENELEC approved - Flameproof
EEx d II B T4. Certified to EN50014 and EN50018, for explosion proof housing. Ingress Protection IP 65 per IEC 529.

Certified - CE Mark; EMC Directive 89/336/EEC
- ATEX Pending

Power Supply and Maximum Load Resistance
See Figure 2.

Input Power - Derived from Analog Output
(2-wire 4-20mA loop transmitter)

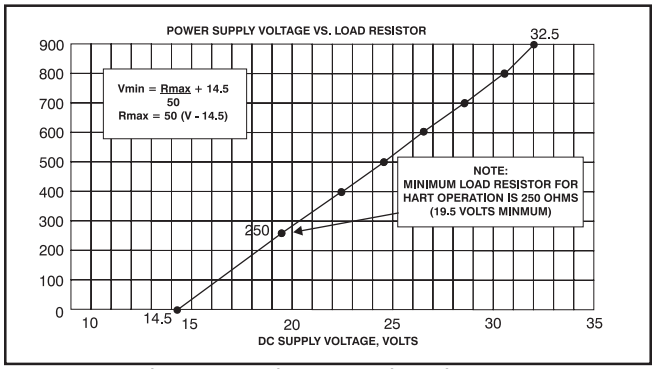


Figure 2 Maximum Load Resistance

Input Signals

RTD Temperature Input
Supports 100 ohm, platinum or copper RTD input for temperature, 3 or 4 wire

Output Signals
4-20 mA Analog Output
Update Rate: 4 times per sec.
Range: 3.8 to 22.0 mA

Contact Output
Open collector: assignable to alarm output, reverse flow indicator or manual value
Maximum off-state voltage: 30 Vdc
Maximum on-state voltage: 1.2 Vdc
Maximum on-state current: 40 mA

Standard Pulse Outputs
Type: Open collector, two channels (Two single-phase)
Frequency Range: Zero to 500 Hz
Maximum off-state voltage: 30 Vdc
Maximum on-state voltage: 1.2 Vdc
Maximum on-state current: 40 mA

Ambient Temperature Limit
-40°F to 150°F (-40°C to 65°C)
For conditions outside of range consult factory.

Loop Current Linearity
Less than 0.1% from min. to max. current

Temperature Influence on Loop Current
Less than 0.007% per °C

Loop Voltage Influence on Loop Current
Less than 0.002%/Vdc

Load Resistance Influence on Loop Current
±0.1% full scale

Dimensions
See Figure 6. For Certified Dimension Prints, contact factory

Typical Applications
Refer to Figures 7 and 8

Flow Range Capacities - M³/H																							
Size	Model Number	Cold Water			Hot Water 140 to 230° F			LPG 0.2 cP			Gasoline 0.3 to 0.7 cP			Kerosene 0.7 to 1.8 cP			Light Oil 2 to 4 cP			Heavy Oil 5 to 300 cP		
1/2"	02/52	0.3	to	1.5	0.4	to	1	0.7	to	1.8	0.4	to	1.8	0.3	to	1.8	0.15	to	2	0.08	to	2
1"	53	0.55	to	3	0.7	to	2	1.1	to	3.6	0.7	to	3.6	0.55	to	3.6	0.28	to	4	0.15	to	4
1"	55	1	to	7	1.2	to	5	1.8	to	8.5	1.2	to	8.5	1	to	8.5	0.4	to	10	0.26	to	10
1-1/2"	56	2	to	14	2.5	to	1	3.5	to	17	2.5	to	17	2	to	17	0.9	to	20	0.6	to	20
2"	57	4	to	30	5	to	20	8	to	35	5	to	35	4	to	35	2	to	40	1.2	to	40
3"	59	8	to	60	10	to	40	15	to	70	10	to	70	8	to	70	6	to	90	4	to	90

Flow Range Capacities - USGPM																							
Size	Model Number	Cold Water			Hot Water 140 to 230° F			LPG 0.2 cP			Gasoline 0.3 to 0.7 cP			Kerosene 0.7 to 1.8 cP			Light Oil 2 to 4 cP			Heavy Oil 5 to 300 cP		
1/2"	02/52	1.3	to	6.6	1.8	to	4.4	3.1	to	7.9	1.8	to	7.9	1.3	to	7.9	0.7	to	8.8	0.4	to	8.8
1"	53	2.4	to	13.2	3.1	to	8.8	4.8	to	15.9	3.1	to	15.9	2.4	to	15.9	1.2	to	17.6	0.7	to	17.6
1"	55	4.4	to	30.8	5.3	to	22.0	7.9	to	37.4	5.3	to	37.4	4.4	to	37.4	1.8	to	44.0	1.1	to	44.0
1-1/2"	56	8.8	to	61.6	11.0	to	4.4	15.4	to	74.9	11.0	to	74.9	8.8	to	74.9	4.0	to	88.1	2.6	to	88.1
2"	57	17.6	to	132.1	22.0	to	88.1	35.2	to	154.1	22.0	to	154.1	17.6	to	154.1	8.8	to	176.1	5.3	to	176.1
3"	59	35.2	to	264.2	44.0	to	176.1	66.1	to	308.2	44.0	to	308.2	35.2	to	308.2	26.4	to	396.3	17.6	to	396.3

Flow Range Capacities - LPM																							
Size	Model Number	Cold Water			Hot Water 140 to 230° F			LPG 0.2 cP			Gasoline 0.3 to 0.7 cP			Kerosene 0.7 to 1.8 cP			Light Oil 2 to 4 cP			Heavy Oil 5 to 300 cP		
1/2"	02/52	5.0	to	25.0	6.7	to	16.7	11.7	to	30.0	6.7	to	30.0	5.0	to	30.0	2.5	to	33.3	1.3	to	33.3
1"	53	9.2	to	50.0	11.7	to	33.3	18.3	to	60.0	11.7	to	60.0	9.2	to	60.0	4.7	to	66.7	2.5	to	66.7
1"	55	16.7	to	116.7	20.0	to	83.3	30.0	to	141.7	20.0	to	141.7	16.7	to	141.7	6.7	to	166.7	4.3	to	166.7
1-1/2"	56	33.3	to	233.3	41.7	to	16.7	58.3	to	283.3	41.7	to	283.3	33.3	to	283.3	15.0	to	333.3	10.0	to	333.3
2"	57	66.7	to	500.0	83.3	to	333.3	133.3	to	583.3	83.3	to	583.3	66.7	to	583.3	33.3	to	666.7	20.0	to	666.7
3"	59	133.3	to	1000.0	166.7	to	666.7	250.0	to	1166.7	166.7	to	1166.7	133.3	to	1166.7	100.0	to	1500.0	66.7	to	1500.0

Figure 3 Accuracy vs. Pressure Drop

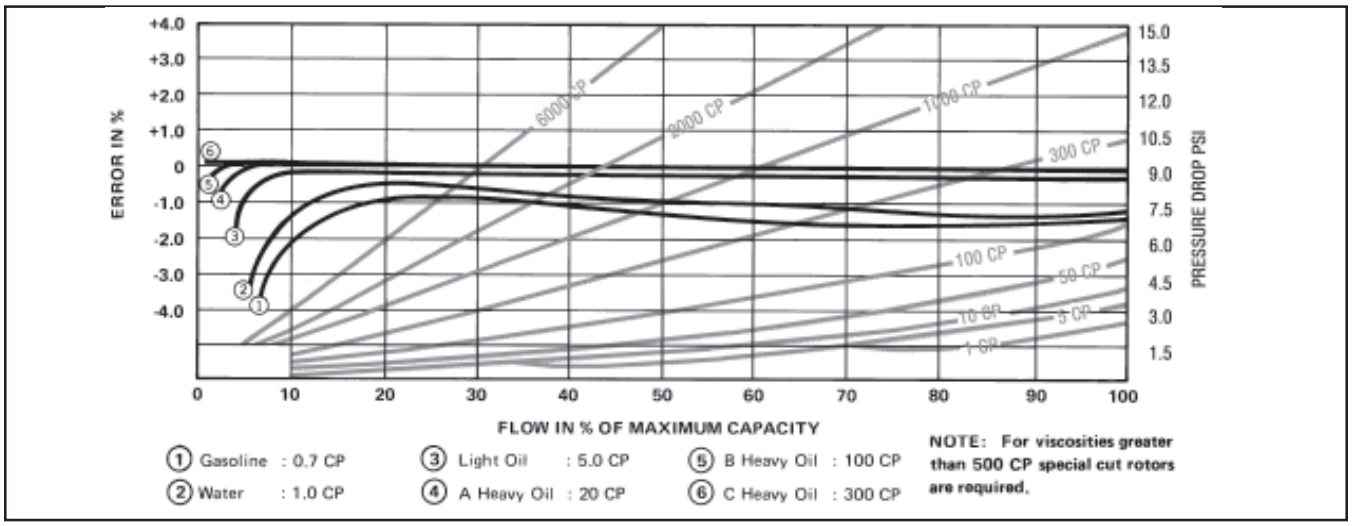


Figure 4 Pressure Loss and Flow Range for High Viscosity Liquids

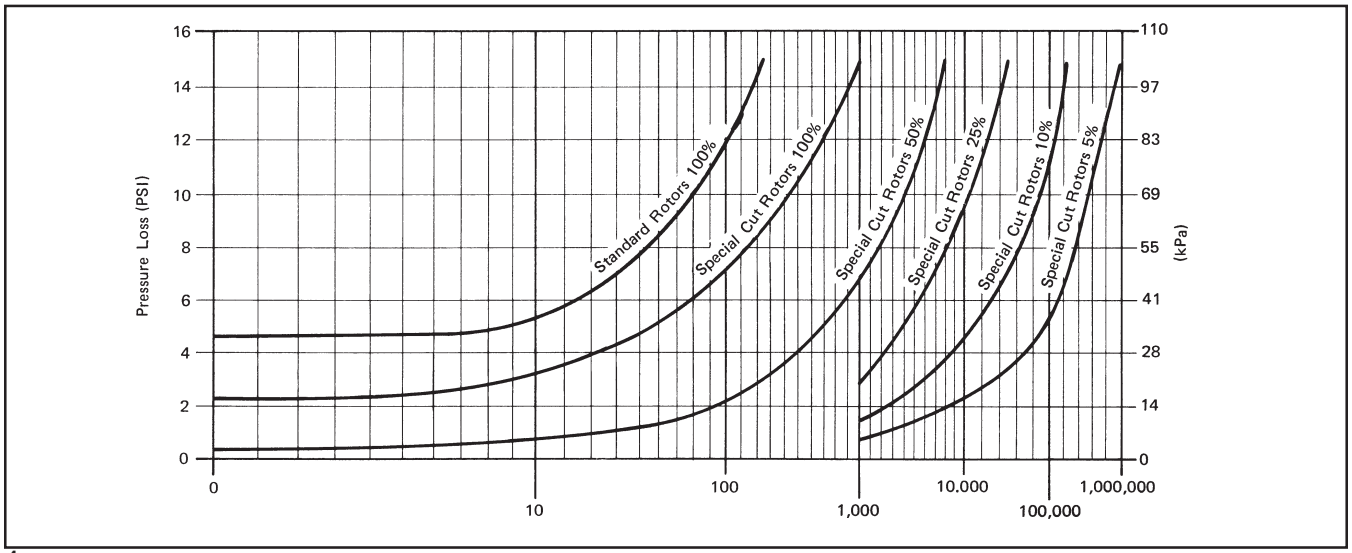
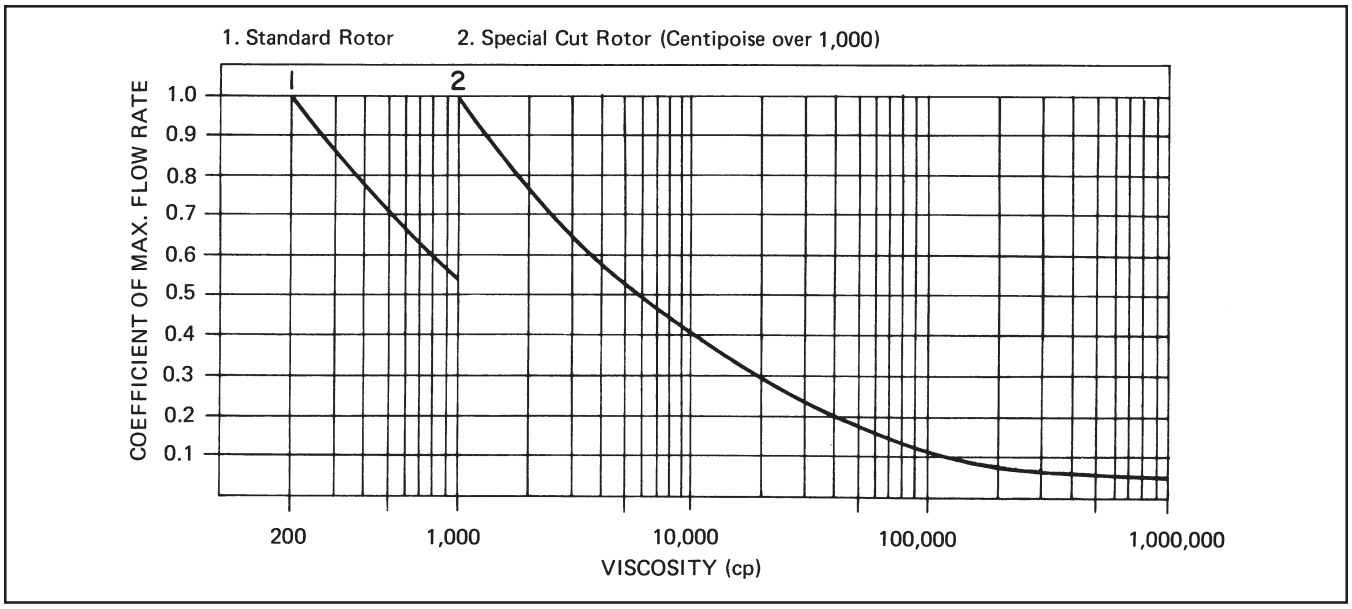
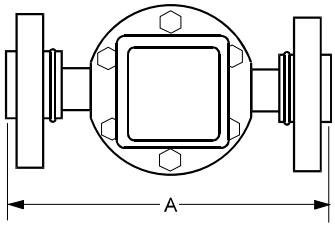
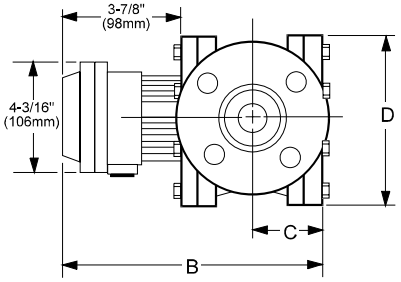


Figure 5 Relationship between Viscosity and Coefficient of Maximum Flow Rate



Mounting Dimensions
Brodie 9900 Series
Oval Flowmeter with
UMB





9900 Series Oval Flowmeter with Universal Mounting Box Only

Model Number	Connection Size (ANSI Flg)	A		B		C		D	
		in.	mm	in.	mm	in.	mm	in.	mm
9952	1/2", 150/300 lb.	8-3/4	222	6-3/4	171	1-7/16	37	5-1/8	130
9953	1", 150/300 lb.	8-3/4	222	7-3/4	196	1-15/16	49	5-1/8	130
9955	1", 150 lb.	8-3/4	222	9-1/4	235	2-11/16	68	6-1/4	158
9955	1", 300 lb.	8-3/4	222	9-5/8	245	2-7/8	73	6-1/4	158
9956	1-1/2", 150 lb.	10	254	10-3/4	273	3-7/16	87	7-1/4	184
9956	1-1/2", 300 lb.	10	254	11-1/4	286	3-11/16	96	7-1/4	184
9957	2", 150 lb.	13-3/4	349	11-1/4	292	3-13/16	99	10	254
9957	2", 300 lb.	13-3/4	349	12-3/8	314	4-1/4	108	10	254
9959	3", 150 lb.	17-3/8	441	13-3/8	340	4-3/4	121	13-3/4	349
9959	3", 300 lb.	17-3/8	441	13-3/8	340	4-3/4	121	13-3/4	349

Figure 2 Brodie Series 9900 Oval Flowmeter with Universal Mounting Box (UMB) Only

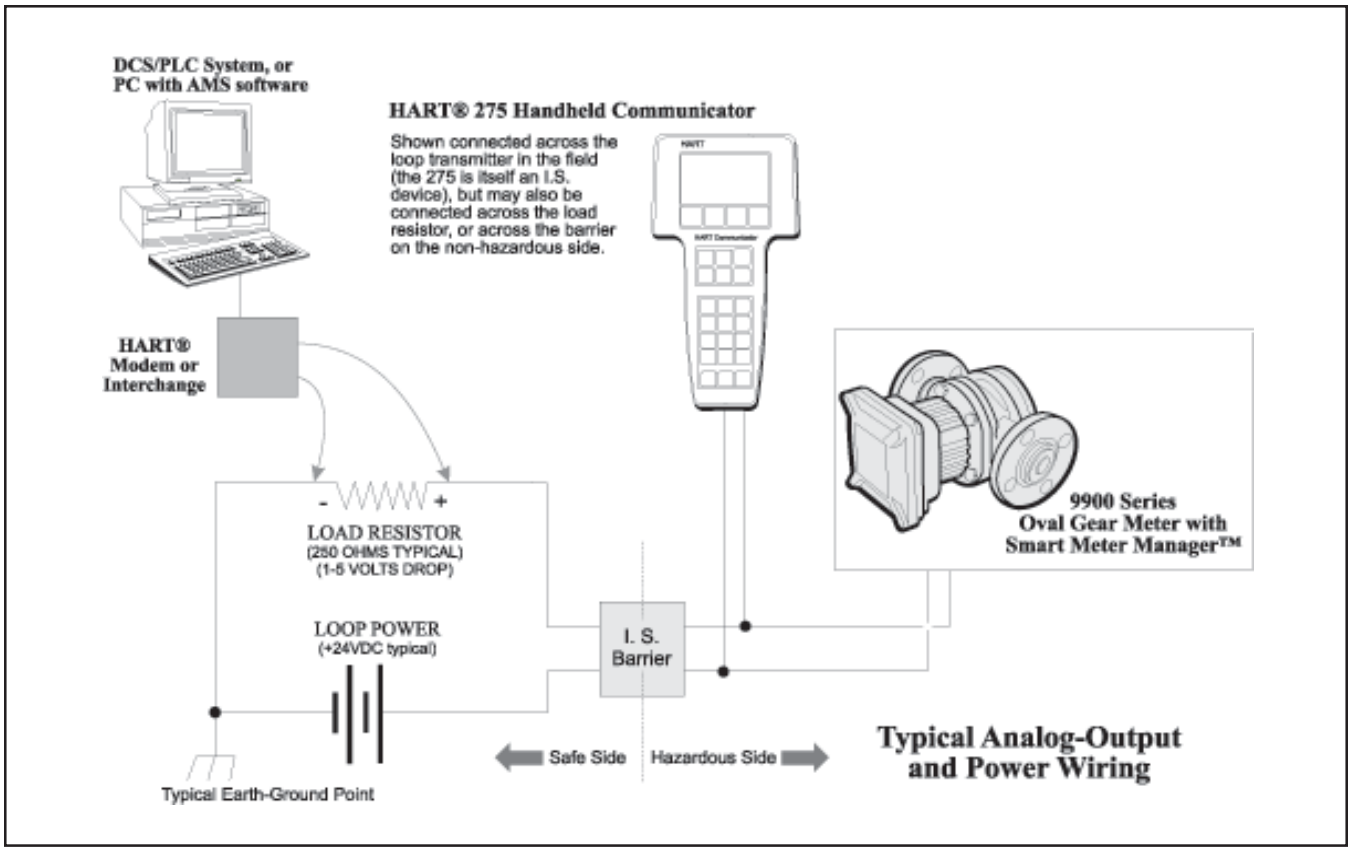


Figure 3 Typical Application: 9900 Series Oval Flowmeter with integral Smart Meter Manager

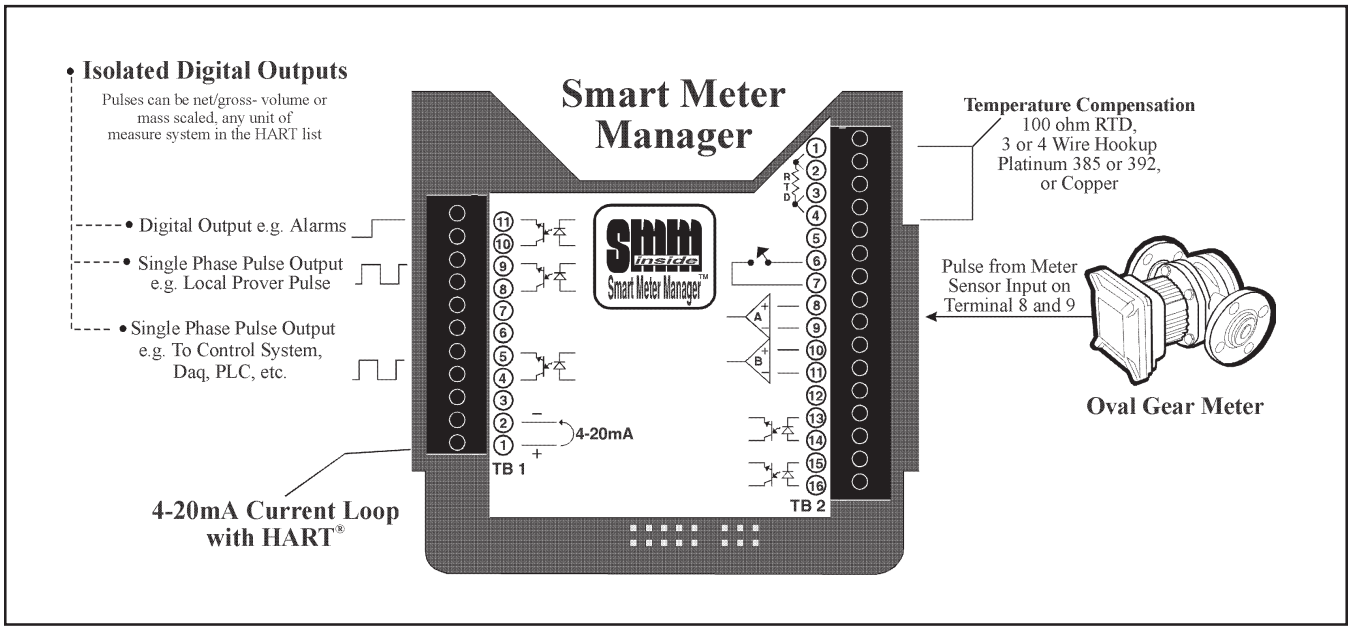


Figure 4 Typical Application: 9900 Series Oval Flowmeter with Smart Meter Manager™

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