

With accuracy of 0.10%, the Thermo Scientific M-PULSe exceeds the API required custody transfer specification, ensuring less lost and unaccounted for product. The sleek spool and lightning fast flow computer work in tandem to deliver highly reliable flow metering data that helps optimize operations and heighten profitability.

## Thermo Scientific M-PULSe

### Multi-Path Ultrasonic Liquid Flow Measurement System



#### System Features

- 4 to 24-inch spools available in stainless or carbon steel with no moving parts
- ATEX Zone 0 (Class I Div 1) hazardous area certification
- Transducers that can be changed under line pressure without interrupting the process
- Compensation for temperature and pressure inputs in accordance with API standards
- User interfaces including keypad and laptop configuration software through RS232 and RS485
- Multiple levels of security that ensure controlled user access
- Various batching options
- Self proving function
- Flow data logs, alarms and audit trail

#### Accurate and Fast

Backed by years of ultrasonic manufacturing experience, the Thermo Scientific M-PULSe multi-path liquid flow measurement system measures transitional flow in real time for superior accuracy and less product waste, resulting in more money to the bottom line. It has proven to be independent of viscosity, is highly accurate over a wide liquid temperature range and features a non-metallic diaphragm that is optimal for corrosive applications, lowering overall maintenance costs. The M-PULSe® utilizes four-path transit time technology as well as compensation for temperature and pressure to provide the highest accuracy and repeatability attainable in a flow measurement device, making it ideal for use as a custody transfer meter for crude oil and refined products.

#### Intrinsically Safe and Compact

The revolutionary design features patented, intrinsically safe transducers that eliminate the possibility of sparks. Rated to Zone 0, the M-PULSe is certified for use in the world's most hazardous environments. When compared to other explosion-proof ultrasonic flowmeters, the spool is more compact and lighter weight. In addition, the spool has no moving parts and transducers can be replaced while the device is in use, eliminating costly downtime.

#### Easy-to-Install

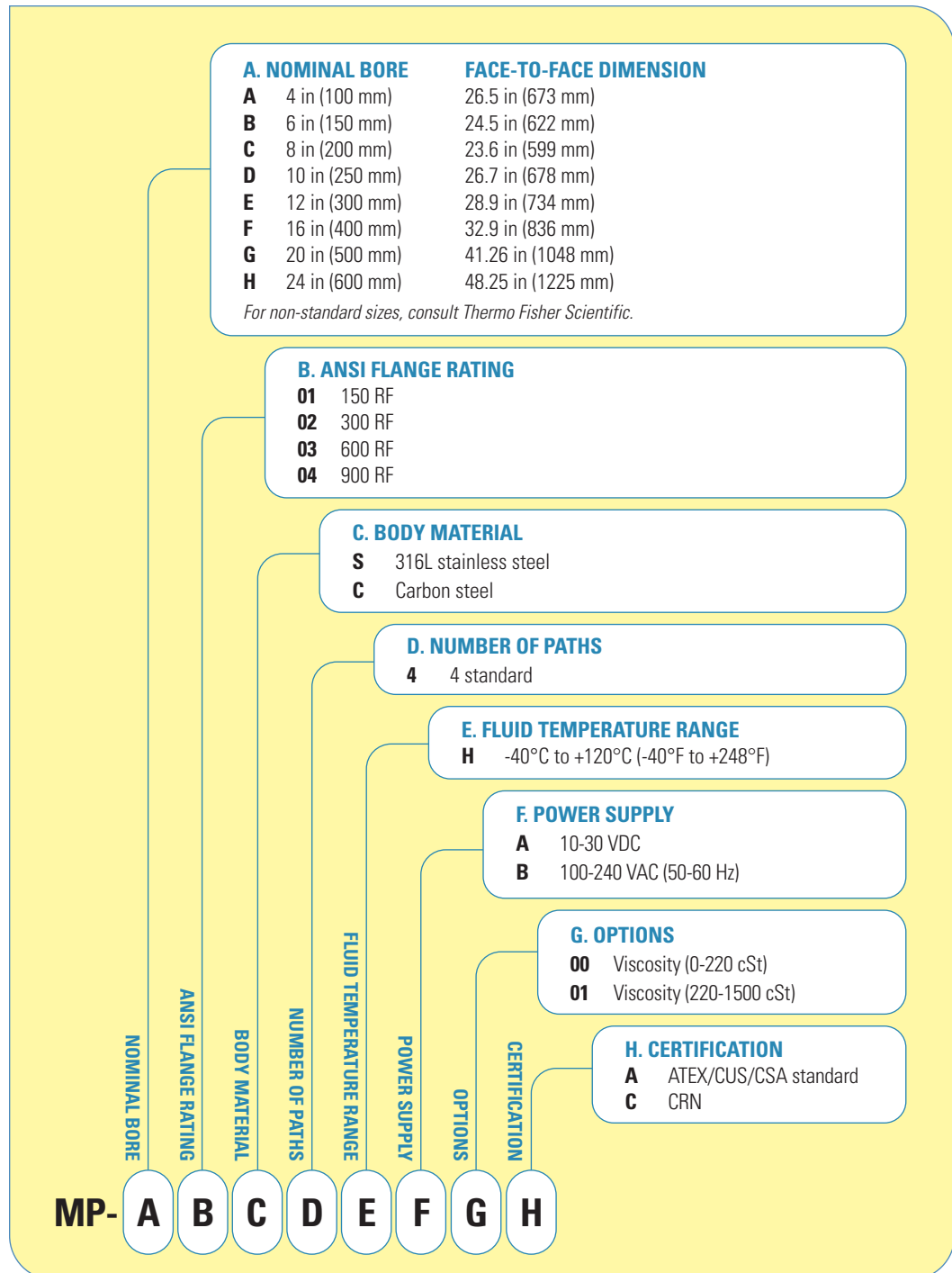
The meter-mounted termination box enables a plant technician to easily connect the M-PULSe to any existing IS or explosion-proof installation. Set-up is facilitated by a user-friendly interface. Simple point-and-click functionality ensures rapid installation and start-up.



**Flow Computer Features Built-In API Conversion Tables**

The M-PULSE spool works in conjunction with a feature-rich, lightning fast flow computer. Powered by a 32-bit industrial processor that is supported by quad digital signal processors, this flow computer incorporates all of the required API approved algorithms and software to ensure accuracy and repeatability. The unit can be mounted away from the spool piece in a Zone 2 (Div 2) or safe area. The flow computer cabinet houses the IS interface for the IS transducers and has sufficient room to accommodate barrier boards for a variety of complementary inputs such as RTD, analog temperature, pressure sensor and density meter. The unit is available with AC and DC power supply options.

**Model Configuration Guide**



**M-PULSe Turndown Ratios and Flow Ranges of Various Meter Sizes**

4-inch meter spool (ID 4.026 inch)				
Unit	Min 20:1	Max 20:1	Min 10:1	Max 10:1
GPM	78.3	1567.5	156.7	1567.5
m <sup>3</sup> /hr	17.8	356.0	35.6	356.0
BPH	112.0	2239.3	223.9	2239.3
6-inch meter spool (ID 5.761 inch)				
Unit	Min 20:1	Max 20:1	Min 10:1	Max 10:1
GPM	162.4	3249.9	324.9	3249.9
m <sup>3</sup> /hr	36.9	738.1	73.8	738.1
BPH	232.1	4642.8	464.3	4642.8
8-inch meter spool (ID 7.625 inch)				
Unit	Min 20:1	Max 20:1	Min 10:1	Max 10:1
GPM	284.6	5693.1	569.3	5693.1
m <sup>3</sup> /hr	64.6	1293.0	129.3	1293.0
BPH	406.7	8133.0	813.3	8133.0
10-inch meter spool (ID 9.562 inch)				
Unit	Min 20:1	Max 20:1	Min 10:1	Max 10:1
GPM	447.6	8952.9	895.2	8952.9
m <sup>3</sup> /hr	101.6	2033.4	203.3	2033.4
BPH	639.5	12790.0	1279.0	12790.0
12-inch meter spool (ID 11.374 inch)				
Unit	Min 20:1	Max 20:1	Min 10:1	Max 10:1
GPM	633.3	12667.6	1266.7	12667.6
m <sup>3</sup> /hr	143.8	2877.1	287.7	2877.1
BPH	904.8	18096.7	1809.7	18096.7
16-inch meter spool (ID 14.312 inch)				
Unit	Min 20:1	Max 20:1	Min 10:1	Max 10:1
GPM	1002.8	20057.2	2005.7	20057.2
m <sup>3</sup> /hr	227.7	4555.4	455.5	4555.4
BPH	1432.7	28653.2	2865.3	28653.2
20-inch meter spool (ID 17.938 inch)				
Unit	Min 20:1	Max 20:1	Min 10:1	Max 10:1
GPM	1574.6	31492.0	3149.2	31492.0
m <sup>3</sup> /hr	357.6	7152.0	715.2	7152.0
BPH	2184.9	43698.0	4369.8	43698.0
24-inch meter spool (ID 21.564 inch)				
Unit	Min 20:1	Max 20:1	Min 10:1	Max 10:1
GPM	2275.5	45510.0	4551.0	45510.0
m <sup>3</sup> /hr	516.8	10336.0	1033.6	10336.0
BPH	3157.5	63150.0	6315.0	63150.0



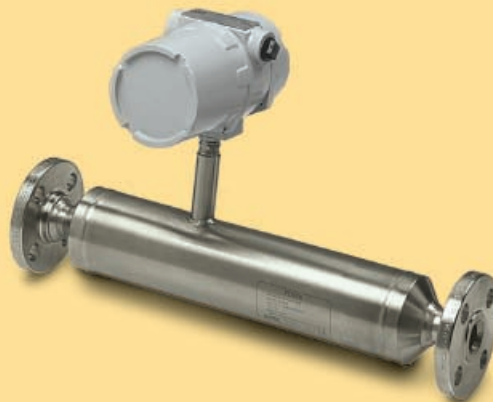
**Stainless Steel and Carbon Steel Spool Weight in Kilograms (Pounds)**

Flange Class Size	150 lb RF	300 lb RF	600 lb RF	900 lb RF
4 in (100 mm)	83 kg (183 lb)	93 kg (204 lb)	101 kg (223 lb)	119 kg (263 lb)
6 in (150 mm)	112 kg (248 lb)	130 kg (286 lb)	170 kg (374 lb)	195 kg (430 lb)
8 in (200 mm)	152 kg (336 lb)	178 kg (392 lb)	215 kg (474 lb)	283 kg (624 lb)
10 in (250 mm)	213 kg (469 lb)	246 kg (542 lb)	337 kg (743 lb)	399 kg (879 lb)
12 in (300 mm)	287 kg (633 lb)	334 kg (737 lb)	427 kg (941 lb)	528 kg (1163 lb)
16 in (400 mm)	440 kg (969 lb)	534 kg (1177 lb)	675 kg (1489 lb)	760 kg (1675 lb)
20 in (500 mm)	655 kg (1444 lb)	798 kg (1759 lb)	956 kg (2108 lb)	1142 kg (2518 lb)
24 in (600 mm)	919 kg (2026 lb)	1145 kg (2525 lb)	1351 kg (2979 lb)	1918 kg (4229 lb)

Note: Flow Computer Weight is 22 kg (48 lb)

**Reliable Density Input to M-PULSe**

Achieving accurate density input is critical during the custody transfer of petroleum products. With accuracy of  $\pm 0.1 \text{ kg/m}^3$  ( $\pm 0.0062 \text{ lb/ft}^3$ ), the Thermo Scientific Sarasota 960 density meter works in conjunction with the M-PULSe to provide rapid, repeatable measurement of liquid density. This compact device provides real-time control to enhance productivity, ensure minimal product waste and reduce costs. Contact our applications staff today to learn how our meter will improve your petroleum and clean gas applications.



## Thermo Scientific M-PULSe — Multi-Path Ultrasonic Liquid Flow Measurement System

### General Specifications

Accuracy	±0.10% over 10:1 flow range of measured value; ±0.15% over 20:1 flow range of measured value
Repeatability	±0.02% of measured value
Flow Range	+0.6 m/second to +12.2 m/second (2 ft/second to 40 ft/second) automatic bi-directional detection
Viscosity Range	Up to 1500 cSt
Operating Temperature	-40°C to +85°C (-40°F to +185°F) – Electronics
Fluid Temperature	-40°C to +120°C (-40°F to +248°F) – Transducers
Number of Ultrasonic Paths	4
History	Data log interval 1 minute to 60 minutes, Audit trail, Alarms
Units	Imperial or metric

### Flow Computer

Volumetric Correction	Implements API Ch11.1 2004. Relative density range 0.61120 to 1.16464
Low Density Fluids Calculation	Implements API TP25. Low density range extended to 0.3500 with Pressure Correction to API Ch11.2.1
Batch Options	Manual; Daily; Timed; Fixed Quantity; Multi-product
Self Proving	Works with uni-directional or bi-directional prover, small volume prover
Line Density Input Options	4-20 mA input or interfaces with Solartron, Thermo Scientific Sarasota or UGC density meters

### User Interfaces

Keyboard	4x4, metal
LCD	16x4, -20°C to +70°C (-4°F to +158°F)
Software	Thermo Scientific AutoM-PULSe, through RS232 or RS485 port
User Programming Interface	RTU and ASCII Modbus protocol

### Input/Output

Serial Ports	1 RS232: local; 2 RS232/RS485 (2-wire/4-wire)
Ethernet Port	1 port, 10/100 Mbps
A/D Converter	-0.5-5.5 V span, 14 bit A/D
Analog Input	3 x 4-20 mA inputs; one 1-5 V input
RTD Input	2 PT100 4-wire RTD inputs can be used via an interface to 2 of the 4-20 mA inputs
Density Input	2 density meter period current pulse inputs
Analog Output	1 electrically isolated 4-20 mA port with separate 24 VDC 20 mA source
Digital Output	3 solid-state relays for 250 VAC/DC, 0.1A; 1 FET, open drain
Pulse Output	1 frequency output: 0-10 KHz, with 2 outputs 90 degrees out of phase
Prover Input	2 sphere detect lines
Prover Output	4 valve control lines
Totalizer Output	2 software configurable pulse outputs

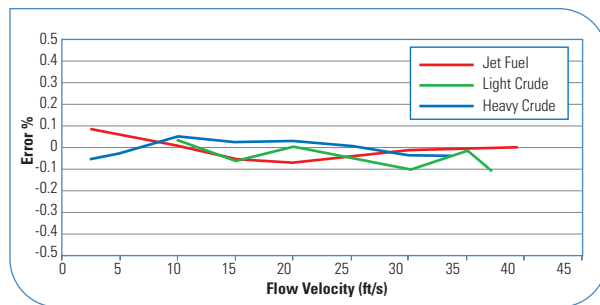
### Power Supply

Power Input	10-30 VDC or 100-240 VAC
Current Draw	10-30 VDC: less than 2A; 100-240 VAC: less than 0.5 A

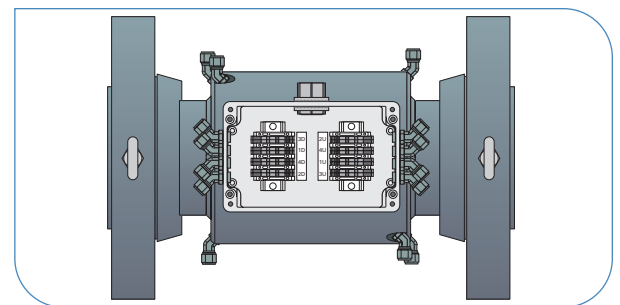
### Safety Specifications

NEMA/IP Rating	NEMA 4X/IP65
North American Hazardous Area Certification	Transducer: Class I Div 1 Groups C & D
Area Certification	Electronic Enclosure: Class I Div 2 Groups C & D
ATEX Hazardous Area Certification	Transducer: II 1 G EEx ia IIB T4 (Zone 0); Electronics Enclosure: II 3 (1) G EEx nL (ia) IIB T4 (Zone 2)
European Compliance	CE
Pressure Vessel	Meter body designed and manufactured in accordance with ASME B31.3 Process Piping Code and the Pressure Equipment Directive (PED) 97/23/EC

### Typical Accuracy/Linearity (8-inch Example)



### M-PULSe Junction Box



Custody Transfer Approval OIML R 117 class 0.3 (1995)

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