

KEL DIFFERENTIAL PRESSURE FLOWMETERS



Flow
Pressure
Level
Temperature
measurement
monitoring
control



- Rugged Metal Construction
- Flow Rate to 2000 GPM
- Linear Scale
- For Horizontal or Vertical Pipes
- Threaded or Wafer-Style Fittings
- Able to Withstand High Pressure Surges
- Easy to Maintain
- Ranges Can Be Modified in the Field
- Optional Alarms and 4-20 mA Output
- Metric Ranges & BSP Threads Available

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Model:
KEL

Features

- Rugged Metal Construction
- Flow Rate to 2000 GPM
- Linear Scale
- For Horizontal or Vertical Pipes
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The KEL series of liquid flowmeters is designed specifically for applications in difficult environments. Metal housings, insensitivity to magnetic fields, and the ability to withstand large overpressures without damage, combine to make the KEL a tough performer. Designed with the industrial user in mind, the KEL is easy to use, to read and to maintain.

Easy to Use

The KEL's design addresses three key usage issues:

(1) To protect the sensing mechanism, the pressure diaphragm's deflection is stopped by contact with the body of the sensor housing. This means that the membrane is not subject to mechanical damage during overpressure events such as surges or "water hammer." Aside from inlet/outlet requirements, location of meter installation is not an issue from a mechanical standpoint.

(2) The brass and brass-cast iron KEL meters feature an orifice mechanism which does not require recalibration after replacement. Repairs or scale changes can be made easily by the user in the field. There is no need to return the meter to the factory.

(3) On a KEL with switches, actuation occurs through direct contact with the pressure diaphragm's mechanical linkage. This reliance on direct contact, rather than magnetic coupling, makes the KEL ideal in applications which normally cause magnet failure due to the presence of large electro-magnetic fields.



KOBOLD KEL Flowmeter

Easy to Read

All KEL flowmeters come with either 5:1 or 2:1 max:min flow turndown. The 5:1 meters are typically used in wide range metering applications. The 2:1 units are used in process monitoring situations, or in any installation requiring reduced pressure loss (see flow vs. pressure loss table.) This specialization offers superior scale resolution to a one-size-fits-all approach.

To make the flow easy to read, the KEL has a large 4 1/2" dial face with the measurement units evenly spaced on its perimeter. This even spacing is possible since the meter movement is linear with flow. The internal mechanism that linearizes the flow also dampens out needle vibration, making it possible to truly read the flow rate, rather than guess at it.

Easy to Maintain

The orifice portion of the KEL is connected to the pressure sensing section via ducts bored into the meter casing. Since the KEL requires no pulsation snubbers because of its built-in damping, these ducts are made large enough for easy cleaning. The larger ducts make the KEL less sensitive to fouling in the first place.

With costly downtime in mind, the stainless steel KELs allow the pressure sensing portion of the meter to be isolated from the orifice portion while the system is pressurized. This eliminates the need to interrupt the user's process. An isolation mechanism makes sure that no valuable operating time need be lost to perform unscheduled sensor maintenance.



General Specifications

Accuracy: ±5% of full scale
Maximum Pressure: 230 PSIG
Fluid Temperature Range
No Switch: -4°F to 250°F
with Viton Seals: -4°F to 300°F
With Switches
Standard: -4°F to 200°F
High Temp: -4°F to 250°F
Electrical Protection: NEMA 3R
Optional: NEMA 4 (Std. for meters w/ switch)

SPDT Switch Specifications

Repeatability: ±2% of full scale
Hysteresis: 10% of full scale
Voltage Rating: 0 - 460 VAC
Current Rating: 0 - 15 A
Inductive Load Max: 380 VAC @ 15 A
 230 VDC @ 0.03 A
 30 VDC @ 5 A

Materials of Construction

Brass-Cast Iron Meters

Non-Wetted Parts
Housing: Aluminum alloy coated with alodine & epoxy compound
 Acrylic Plastic
Dial Crystal:
Wetted Parts
Fittings
1/2" to 1 1/2": Brass
2" to 8": Epoxied cast iron
Diaphragm Housing: Brass
Diaphragm: Fiber reinforced Buna-N & 316 SS (EPDM optional)
Seals: Buna-N
Optional: Viton® or EPDM
Other: 316 SS, Nylon®

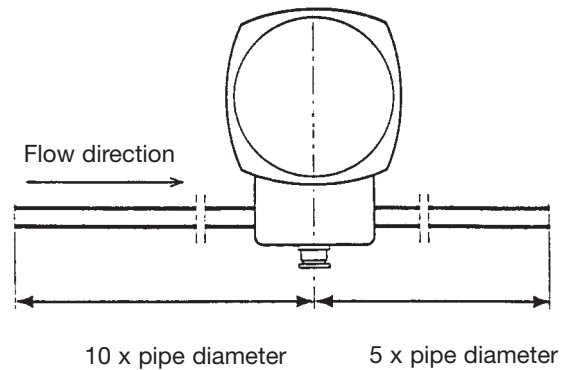
Stainless Steel Meters

Non-Wetted Parts
Housing: Aluminum alloy coated with alodine & epoxy compound
 Acrylic Plastic
Dial Crystal:
Wetted Parts
Fittings: 316 SS
Diaphragm Housing: 316 SS
Diaphragm: Fiber reinforced Viton® & 316 SS (EPDM optional)
Seals: Viton®
Optional: EPDM
Other: 316 SS

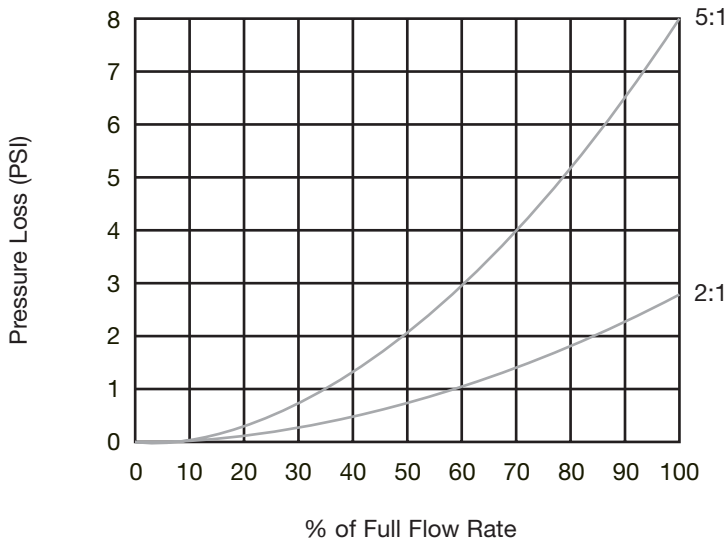
Piping Requirements

In order for the KEL to function properly and accurately, lengths of nominally sized straight piping must be plumbed into the unit at the inlet and outlet fittings.

Inlet Length: 10 x pipe diameter
Outlet Length: 5 x pipe diameter



Pressure Loss vs. Flow Rate

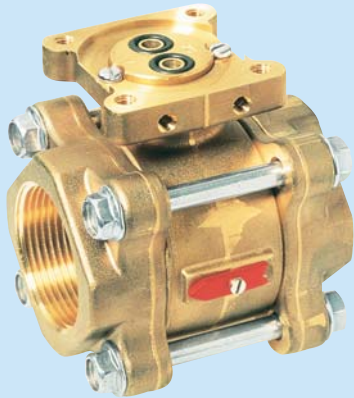


Pressure Losses

The KEL determines the rate of flow by measuring the pressure loss across a calibrated orifice. The total pressure loss through the meter is as shown in the table to the left.

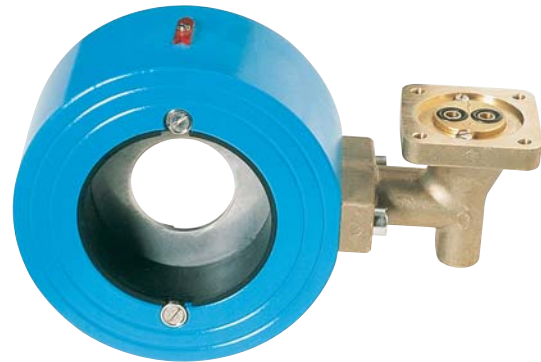
This pressure loss data was collected using water as the test liquid.

All standard meters have a 5:1 turn-down. The 2:1 turn-down and pressure behavior can be obtained as an option. Contact your representative for further information.



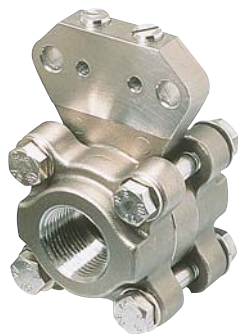
Threaded Brass

- Available in 1/2" to 1 1/2" NPT
- User Modifiable Ranges
- Brass, SS, Buna-N, Nylon wetted parts (Viton, EPDM optional)



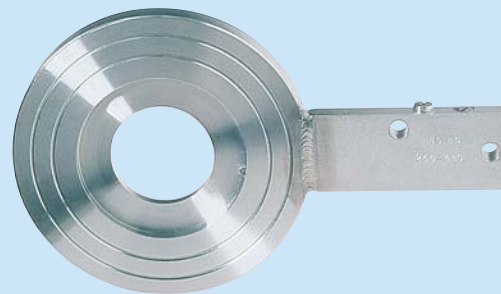
Brass/Cast Iron Wafer-Style Flange

- Available in 1/2" to 8" ANSI Flange Sizes
- User Modifiable Ranges
- 1/2"-1 1/2": Brass, SS, Buna-N, Nylon wetted parts (Viton, EPDM optional)
- 2" - 8": Brass, Epoxy coated Cast Iron, Buna-N, Nylon wetted parts (Viton, EPDM optional)



Threaded Stainless Steel

- Available in 1/2" to 1" NPT
- Excellent Resistance to Corrosive Chemicals
- SS, Viton wetted parts (EPDM optional)
- Unitized Body & Orifice
- Indicator Isolation Mechanism Standard



Stainless Steel Wafer-Style Flange

- Available in 1/2" to 8" ANSI Flange Sizes
- Excellent Resistance to Corrosive Chemicals
- SS, Viton wetted parts (EPDM optional)
- Unitized Body & Orifice
- Indicator Isolation Mechanism Standard



Features

- 4-20 mA output
- Two setpoint relays standard
- 20 segment bar graph flow indicator for local indication
- Same rugged construction as all KELs

The need to be informed about plant operations from moment to moment is becoming ever more necessary in this era of rigorous process control. It's not surprising then, that the KEL is also available in a version with 4-20 mA analog communications capability.

The KEL's analog output is driven by the pressure sensor diaphragm. This ensures that the analog output signal is linear with flow and makes interfacing the KEL with an external indicator, or a process control computer system, a pain-free process.

In addition to the transmitter, two independently adjustable setpoint relays are incorporated into the circuit board. The relays may be configured for process limit conditions, or to signal power failure.

Mechanical Specifications

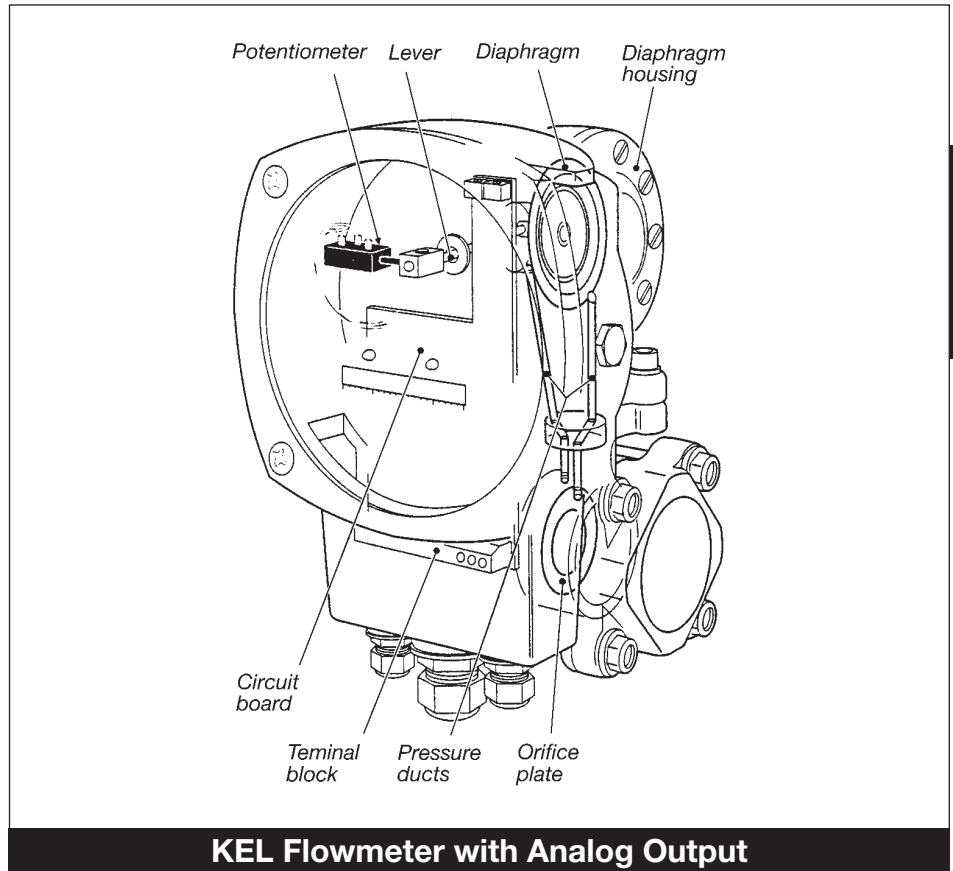
- Accuracy:** ±5% of full scale
- Repeatability:** ±2% of full scale
- Maximum Pressure:** 230 PSIG
- Operating Temp:** 32 to 150°F

Electrical Specifications

- Supply Voltage:** 24 VDC
- Current Draw:** 100 mA
- Output Signal:** 4-20 mA into 500 Ω max.
- Electrical Protection:** NEMA 4

Relay Specifications

- Form:** SPDT
- Repeatability:** ±2% of full scale
- Hysteresis:** 10% of full scale
- Max Voltage Rating:** 250 VAC resistive
30 VDC resistive
- Max Current Rating:** 7 A resistive
- Max Power Rating:** 1750 VA / 210 W
- Min Load Rating:** 0.1 VDC @ 10 mA



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KEL Flowmeter with Analog Output



Fittings	Ranges (GPM)	Switch Only		Meter w/o Switches		Meter with Two Switches		Meter with 4-20 mA and Two Switches	
		Brass	SS	Brass	SS	Brass	SS	Brass	SS
1/2" NPT	0.1 - 0.5	KEL-2101	KEL-2201	KEL-4101	KEL-4201	KEL-6101	KEL-6201	KEL-8101	KEL-8201
	0.25 - 1.25	KEL-2102	KEL-2202	KEL-4102	KEL-4202	KEL-6102	KEL-6202	KEL-8102	KEL-8202
	0.5 - 2.5	KEL-2103	KEL-2203	KEL-4103	KEL-4203	KEL-6103	KEL-6203	KEL-8103	KEL-8203
	1 - 5	KEL-2104	KEL-2204	KEL-4104	KEL-4204	KEL-6104	KEL-6204	KEL-8104	KEL-8204
	1.5 - 7.5	KEL-2105	KEL-2105	KEL-4105	KEL-4205	KEL-6105	KEL-6205	KEL-8105	KEL-8205
	2 - 10	KEL-2106	KEL-2206	KEL-4106	KEL-4206	KEL-6106	KEL-6206	KEL-8106	KEL-8206
3/4" NPT	1 - 5	KEL-2111	KEL-2111	KEL-4111	KEL-4211	KEL-6111	KEL-6211	KEL-8111	KEL-8211
	1.5 - 7.5	KEL-2112	KEL-2212	KEL-4112	KEL-4212	KEL-6112	KEL-6212	KEL-8112	KEL-8212
	2 - 10	KEL-2113	KEL-2213	KEL-4113	KEL-4213	KEL-6113	KEL-6213	KEL-8113	KEL-8213
	4 - 20	KEL-2114	KEL-2214	KEL-4114	KEL-4214	KEL-6114	KEL-6214	KEL-8114	KEL-8214
1" NPT	1.5 - 7.5	KEL-2121	KEL-2221	KEL-4121	KEL-4221	KEL-6121	KEL-6221	KEL-8121	KEL-8221
	3 - 15	KEL-2122	KEL-2222	KEL-4122	KEL-4222	KEL-6122	KEL-6222	KEL-8122	KEL-8222
	4 - 20	KEL-2123	KEL-2223	KEL-4123	KEL-4223	KEL-6123	KEL-6223	KEL-8123	KEL-8223
	5 - 25	KEL-2124	KEL-2224	KEL-4124	KEL-4224	KEL-6124	KEL-6224	KEL-8124	KEL-8224
	6 - 30	KEL-2125	KEL-2225	KEL-4125	KEL-4225	KEL-6125	KEL-6225	KEL-8125	KEL-8225
1 1/2" NPT	2 - 10	KEL-2141	KEL-2241	KEL-4141	—	KEL-6141	—	KEL-8141	—
	5 - 25	KEL-2142	KEL-2242	KEL-4142	—	KEL-6142	—	KEL-8142	—
	10 - 50	KEL-2143	KEL-2243	KEL-4143	—	KEL-6143	—	KEL-8143	—
	15 - 75	KEL-2144	KEL-2244	KEL-4144	—	KEL-6144	—	KEL-8144	—
1/2" ANSI	0.1 - 0.5	KEL-3101	KEL-3201	KEL-5101	KEL-5201	KEL-7101	KEL-7201	KEL-9101	KEL-9201
	0.25 - 1.25	KEL-3102	KEL-3202	KEL-5102	KEL-5202	KEL-7102	KEL-7202	KEL-9102	KEL-9202
	0.5 - 2.5	KEL-3103	KEL-3203	KEL-5103	KEL-5203	KEL-7103	KEL-7203	KEL-9103	KEL-9203
	1 - 5	KEL-3104	KEL-3204	KEL-5104	KEL-5204	KEL-7104	KEL-7204	KEL-9104	KEL-9204
	1.5 - 7.5	KEL-3105	KEL-3205	KEL-5105	KEL-5205	KEL-7105	KEL-7205	KEL-9105	KEL-9205
	2 - 10	KEL-3106	KEL-3206	KEL-5106	KEL-5206	KEL-7106	KEL-7206	KEL-9106	KEL-9206
3/4" ANSI	1 - 5	KEL-3111	KEL-3211	KEL-5111	KEL-5211	KEL-7111	KEL-7211	KEL-9111	KEL-9211
	1.5 - 7.5	KEL-3112	KEL-3212	KEL-5112	KEL-5212	KEL-7112	KEL-7212	KEL-9112	KEL-9212
	2 - 10	KEL-3113	KEL-3213	KEL-5113	KEL-5213	KEL-7113	KEL-7213	KEL-9113	KEL-9213
	4 - 20	KEL-3114	KEL-3214	KEL-5114	KEL-5214	KEL-7114	KEL-7214	KEL-9114	KEL-9214
1" ANSI	1.5 - 7.5	KEL-3121	KEL-3221	KEL-5121	KEL-5221	KEL-7121	KEL-7221	KEL-9121	KEL-9221
	3 - 15	KEL-3122	KEL-3222	KEL-5122	KEL-5222	KEL-7122	KEL-7222	KEL-9122	KEL-9222
	4 - 20	KEL-3123	KEL-3223	KEL-5123	KEL-5223	KEL-7123	KEL-7223	KEL-9123	KEL-9223
	5 - 25	KEL-3124	KEL-3224	KEL-5124	KEL-5224	KEL-7124	KEL-7224	KEL-9124	KEL-9224
	6 - 30	KEL-3125	KEL-3225	KEL-5125	KEL-5225	KEL-7125	KEL-7225	KEL-9125	KEL-9225
1 1/2" ANSI	2 - 10	KEL-3141	KEL-3241	KEL-5141	KEL-5241	KEL-7141	KEL-7241	KEL-9141	KEL-9241
	5 - 25	KEL-3142	KEL-3242	KEL-5142	KEL-5242	KEL-7142	KEL-7242	KEL-9142	KEL-9242
	10 - 50	KEL-3143	KEL-3243	KEL-5143	KEL-5243	KEL-7143	KEL-7243	KEL-9143	KEL-9243
	15 - 75	KEL-3144	KEL-3244	KEL-5144	KEL-5244	KEL-7144	KEL-7244	KEL-9144	KEL-9244



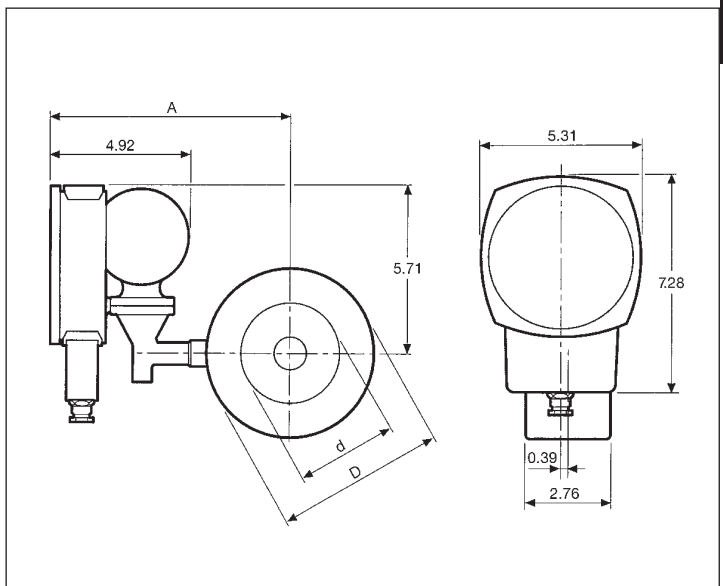
Fittings	Ranges (GPM)	Switch Only		Meter w/o Switches		Meter with Two Switches		Meter with 4-20 mA and Two Switches	
		Brass	SS	Brass	SS	Brass	SS	Brass	SS
2" ANSI	2 - 10	KEL-3151	KEL-3251	KEL-5151	KEL-5251	KEL-7151	KEL-7251	KEL-9151	KEL-9251
	10 - 50	KEL-3152	KEL-3252	KEL-5152	KEL-5252	KEL-7152	KEL-7252	KEL-9152	KEL-9252
	20 - 100	KEL-3153	KEL-3253	KEL-5153	KEL-5253	KEL-7153	KEL-7253	KEL-9153	KEL-9253
	25 - 125	KEL-3154	KEL-3254	KEL-5154	KEL-5254	KEL-7154	KEL-7254	KEL-9154	KEL-9254
3" ANSI	10 - 50	KEL-3161	KEL-3261	KEL-5161	KEL-5261	KEL-7161	KEL-7261	KEL-9161	KEL-9261
	20 - 100	KEL-3162	KEL-3262	KEL-5162	KEL-5262	KEL-7162	KEL-7262	KEL-9162	KEL-9262
	40 - 200	KEL-3163	KEL-3263	KEL-5163	KEL-5263	KEL-7163	KEL-7263	KEL-9163	KEL-9263
	50 - 250	KEL-3164	KEL-3264	KEL-5164	KEL-5264	KEL-7164	KEL-7264	KEL-9164	KEL-9264
4" ANSI	20 - 100	KEL-3171	KEL-3271	KEL-5171	KEL-5271	KEL-7171	KEL-7271	KEL-9171	KEL-9271
	40 - 200	KEL-3172	KEL-3272	KEL-5172	KEL-5272	KEL-7172	KEL-7272	KEL-9172	KEL-9272
	60 - 300	KEL-3173	KEL-3273	KEL-5173	KEL-5273	KEL-7173	KEL-7273	KEL-9173	KEL-9273
	100 - 500	KEL-3174	KEL-3274	KEL-5174	KEL-5274	KEL-7174	KEL-7274	KEL-9174	KEL-9274
6" ANSI	50 - 250	KEL-3181	KEL-3281	KEL-5181	KEL-5281	KEL-7181	KEL-7281	KEL-9181	KEL-9281
	100 - 500	KEL-3182	KEL-3282	KEL-5182	KEL-5282	KEL-7182	KEL-7282	KEL-9182	KEL-9282
	150 - 750	KEL-3183	KEL-3283	KEL-5183	KEL-5283	KEL-7183	KEL-7283	KEL-9183	KEL-9283
	200 - 1000	KEL-3184	KEL-3284	KEL-5184	KEL-5384	KEL-7184	KEL-7284	KEL-9184	KEL-9284
8" ANSI	100 - 500	KEL-3191	KEL-3291	KEL-5191	KEL-5291	KEL-7191	KEL-7291	KEL-9191	KEL-9291
	150 - 750	KEL-3192	KEL-3292	KEL-5192	KEL-5292	KEL-7192	KEL-7292	KEL-9192	KEL-9292
	250 - 1250	KEL-3193	KEL-3293	KEL-5193	KEL-5293	KEL-7193	KEL-7293	KEL-9193	KEL-9293
	400 - 2000	KEL-3194	KEL-3294	KEL-5194	KEL-5294	KEL-7194	KEL-7294	KEL-9194	KEL-9294

NEMA 4 Option, Available on all Meters: - standard on models with switches or analog output	- D
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Dimensions: Brass/Cast Iron Wafer Meters

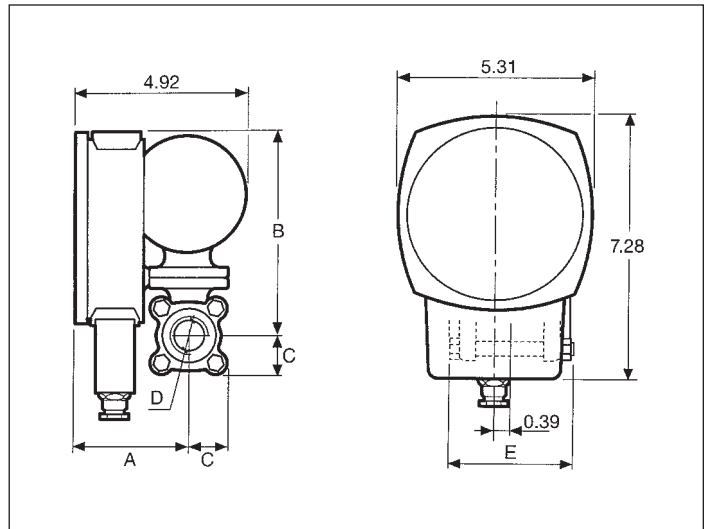
Model	Dimensions (inches)			Weight (lbs)
	d	D	A	
1/2"	0.63	2.09	6.30	9.2
3/4"	0.87	2.48	6.46	10.3
1"	1.18	2.87	6.73	10.8
1 1/2"	1.69	3.70	7.17	13.0
2"	2.17	4.29	7.48	13.9
3"	3.23	5.67	8.15	17.3
4"	4.21	6.46	8.54	19.8
6"	6.26	8.62	9.65	24.9
8"	8.15	10.79	10.75	33.5





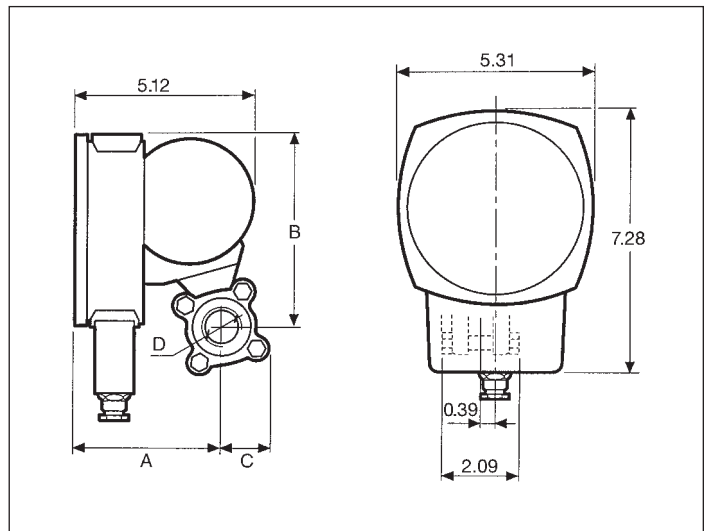
Dimensions: Threaded Brass Meters

Model	Dimensions (inches)				Weight (lbs)
	A	B	C	E	
1/2"	3.35	5.91	1.18	3.15	7.9
3/4"	3.35	5.91	1.18	3.15	7.9
1"	3.35	5.91	1.18	3.15	7.9
1 1/2"	3.74	6.30	1.57	3.54	9.9



Dimensions: Threaded Stainless Steel Meters

Model	Dimensions (inches)			Weight (lbs)
	A	B	C	
1/2"	4.33	5.12	1.38	7.3
3/4"	4.33	5.12	1.38	7.3
1"	4.33	5.12	1.38	7.3



Dimensions: Stainless Steel Wafer Meters

Model	Dimensions (inches)			Weight (lbs)
	d	D	A	
1/2"	0.67	2.09	6.69	6.8
3/4"	0.87	2.48	7.28	7.0
1"	1.14	2.87	7.60	7.3
1 1/2"	1.69	3.70	8.07	7.7
2"	2.17	4.29	8.66	8.1
3"	3.23	5.67	9.37	9.2
4"	4.21	6.46	9.76	9.9
6"	6.30	8.62	10.87	12.3
8"	8.15	10.79	11.93	15.4

