

PRODUCT CATALOGUE

A complete range of flow measuring instruments

2026 Edition · 37 products across 8 categories

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IE Glass Tube Variable Area Flow Meters

VARIABLE AREA FLOWMETERS – GLASS TUBE

Description

IE Glass Tube Variable Area Flow Meters are intended for general in line and bypass metering applications where operating conditions are within the limitations of glass metering tubes. A wide range of capacities and options is available. These packed gland meters are constructed to withstand the stresses and vibrations inherent in industrial piping installations.



IE GLASS TUBE VARIABLE AREA FLOW METERS

Design Features

- Dowel pin, side plate construction
- Detachable flow scales
- Precision bore ribbed borosilicate glass metering tubes
- Externally adjustable packing glands
- Connections can be rotated 360° at 90° intervals
- Laminated safety glass shielding
- 10 to 1 rangeability
- Scale length of 127 mm, 150 mm and 250 mm
- Standard floats are interchangeable in tubes of given flow meter size
- Wide choice of float types and capacity ranges

Specifications

WARNING: Do not operate this instrument in excess of the specifications listed below. Failure to heed warning may result in serious personal injury or damage to equipment. Glass metering tubes are designed for operation up to the maximum operating pressures and temperatures as specified herein. Due to the inherent brittle characteristics of glass and conditions beyond our control, breakage could result below specified operating conditions. Possible glass tube breakage represents a potential hazard to operating personnel; therefore, operator protection should be supplied where operating pressures may exceed 50 psig. A customer supplied safety shield constructed of 1/2- inch acrylic plastic may be used or the glass tube meter may be replaced with an all-metal meter.

Performance

Industrial Accuracy: +2% of full scale from 100% to 10% of scale reading. Calibrated Accuracy: +1% of full scale from 100% to 10% of scale reading. Repeatability: 0.5% of full scale

Table 1 - Pressure Ratings

Meter Size	Max. Operating Pressure (Kg/cm2g)
2	35.1
6	31.6
7	24.6
8	21.0
9	12.3
10	7.0
12	5
13	5

Table 2 - Connections

Meter Size	Model 1110 In & Out Horizontal (Screwed)	Model 1114 In & Out Vertical (Screwed)	Model 1140 In & Out Horizontal (Flanged)	Model 1144 In & Out Vertical (Flanged)
2 - 6	1/4"	1/4"	1/2"	1/2"
7 - 8	1/2"	1/2"	1/2"	1/2"
9	3/4"	3/4"	3/4"	3/4"
10	1"	1"	1"	1"
12	1-1/2"	1-1/2"	1-1/2"	1-1/2"
13	1-1/2"	2"	1-1/2"	2"

Pressure Drop

See Capacity Tables

Scales

Nominal lengths: 127mm, 150mm and 250 mm

Type: Standard: Detachable aluminium plate; Optional: Detachable 316 stainless steel plate

Graduations: Choice of direct reading, arbitrary millimetre or 0-100 linear with calibration curves or percentage of maximum flow with factor tag.

Materials of Construction

METERING TUBES

Borosilicate glass

FLOATS

Sizes 2-6: (Spherical) Tungsten Carbide, Glass or 316 Stainless Steel; Sizes 8-13: Standard: 316 Stainless Steel; Optional: Aluminium, Teflon or Hastelloy C

END FITTINGS

Steel, 316 stainless steel, hastelloy C, brass

PACKINGS

Standard: Neoprene; Optional: Viton, Teflon

O-RINGS

Standard: Neoprene; Optional: Viton, Teflon

SIDE PLATES

Standard: Steel; Optional: 316 Stainless Steel

GLAND RINGS

Standard: Steel; Optional: 316 Stainless Steel

WINDOW BEZELS

Standard: Aluminium; Optional: Stainless Steel

GLAND FOLLOWERS

Standard: Steel; Optional: 316 Stainless Steel

FASTNERS

304 Stainless Steel

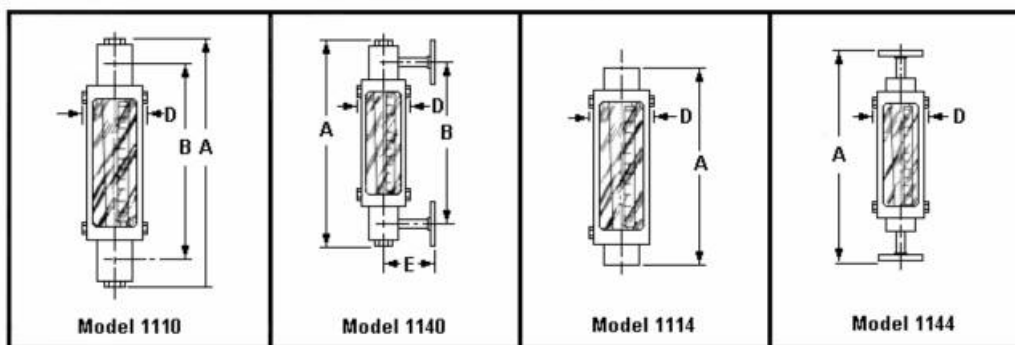
SIDE PLATE GASKETS

Asbestos

COATINGS (Optional)

Epoxy painting of external surfaces of end fittings, gland rings, gland followers and both surfaces of side plates. (Window frames, bolts and dowel pins not coated.)

Figure 1 – Dimensions in mm (for Certified Prints write to Factory)



Meter Size	Model 1110 & 1140						Model 1114		Model 1144		All Meters
	Nominal Scale Length						Nominal Scale Length		Nominal Scale Length		
	127 MM			250 MM			127 MM	250 MM	127 MM	250 MM	
	A	B	E	A	B	E	A	A	A	A	
2-6*	257.2	218.3	88.9	-	-	-	244.5	-	377.8	-	61.9
7&8	390.5	292.1	88.9	517.5	419.1	88.9	304.8	431.8	454	581	82.6
9	431.8	317.5	101.6	558.8	444.5	101.6	311.2	438.2	450.9	577.9	95.3
10	454	317.5	101.6	581	444.5	101.6	311.2	438.2	444.5	571.5	112.7
12	511.2	393.7	127	638.2	520.7	127	403.2	530.2	542.9	669.9	112.7
13	539.8	393.7	127	666.8	520.7	127	384.2	511.2	523.9	650.9	123.8

*Available in 150 MM scale length only and dimensions are identical to 127 MM meters.

Table 4 – Capacities (150mm Tubes)

Meter Size	Tube Number	Float Number	Maximum Flow Rates					
			Water		Air	H ₂	He	
			CCM	ΔP (iwc)	SLPM			ΔP (iwc)
2	R-2-15-AAA	G2	0.54	0.1	0.049	0.102	0.0444	0.18
		S2	2.49	0.58	0.146	0.322	0.144	0.67
		C2	4.9	1.16	0.245	0.594	0.268	1.24
	R-2-15-AA	G2	1.11	0.1	0.096	0.209	0.0916	0.18
		S2	4.93	0.58	0.265	0.631	0.293	0.67
		C2	9.33	1.16	0.43	1.12	0.533	1.24
	R-2-15-D	G2	5.75	0.1	0.37	1.03	0.491	0.18
		S2	20.6	0.58	0.82	2.52	1.39	0.67
		C2	33.2	1.16	1.22	3.88	2.28	1.24
	R-2-15-A	G2	18.3	0.1	0.95	2.63	1.54	0.18
		S2	52.1	0.58	1.9	5.57	3.42	0.67
		C2	81.8	1.16	2.8	8.2	5.16	1.24
	R-2-15-B	G2	52.8	0.1	2.35	8.01	5.02	0.18
		S2	133	0.58	4.6	15.9	10.3	0.67
		C2	199	1.16	6.6	22.9	14.9	1.24
6	R-2-15-C	G2	84.6	0.1	3.8	12.9	8	0.18
		S2	218	0.58	7.6	26.1	16.7	0.67
		C2	326	1.16	10.4	37.6	24.4	1.24
	R-6-15-A	G6	200	0.2	8.6	29.9	19.2	0.36
		S6	493	1.17	16.4	58.9	38.3	1.34
		C6	726	2.32	23	83.3	55.2	2.49
	R-6-15-B	G6	573	0.2	23.5	85.9	55.3	0.36
		S6	1350	1.17	43	160	109	1.34
		C6	1950	2.32	60	222	152	2.49

Table 6 – Capacities (250mm Tubes Low Pressure Drop)

Meter Size	Tube Number	Float Number	Float Material	Maximum Flow Rates		
				Air	H ₂ O	ΔP
				SLPM	LPM	(iwc)
7	R-7M-25-1	SPO OL	Aluminum	11.3	0.36	0.59
			316 SS	19.5	0.63	1.61
			Aluminum	25.1	0.81	0.8
	R-8M-25-2	8-RV-2	316 SS	44.6	1.44	1.61
			Aluminum	34.1	1.10	1.05
			316 SS	62.2	2.00	1.49
	R-9M-25-1	SPO OL	Aluminum	103.9	3.35	0.93
			316 SS	161.3	5.20	2.41
			Aluminum	128.7	4.15	1
	R-10M-25-1	10-RV-15	316 SS	195.4	6.29	2.81
			Aluminum	163.3	5.26	0.8
			316 SS	254.8	8.21	1.61
10	R-10M-25-3	12-RV-65	Aluminum	221.8	7.14	1.13
			316 SS	340.8	10.98	1.89
			Aluminum	340.6	10.97	1.21
	R-12M-25-4	12-RV-65	316 SS	599.1	19.30	2.17
			Aluminum	617.4	19.89	1.29
			316 SS	1087.7	35.03	2.57
	R-13M-25-1	13-RV-168	Aluminum	700	22.55	1.81
			316 SS	1310.3	42.20	3.72
			Aluminum	1077	34.69	2.21
	R-13M-25-3	13-RV-168	316 SS	2091.1	67.35	4.9

Table 5 Capacities (250mm Tubes)

Meter Size	Tube Number	Float Number	Maximum Flow Rates					
			Water		Air			
			LPM	ΔP (iwc)	VIS LIMIT	SLPM	ΔP (iwc)	
6	R-6M-25-1A	G6	0.28	0.2	1	12.3	0.36	
		S6	0.68	1.17	1	22.8	1.34	
7	R-7M-25-1	G7	0.58	-	1	24	-	
		S7	1.48	-	1	50	-	
8	R-8M-25-2	8-RV-3	2.08	2	2	62.87	3	
		8-RV-8	2.95	5	3.3	91.19	6	
		8-RV-14	3.94	8	4.6	121.21	9	
		8-RV-31	5.68	17	6	173.32	19	
		8-RS-8	3.79	6	1.7	117.51	7	
		8-RS-14	5	11	1.8	155.19	12	
		8-RS-31	7.15	22	2.6	219.76	25	
		8-LJ-48	11.39	45	1	353.72	51	
	R-8M-25-4	8-RV-3	2.95	4	2	89.77	4	
		8-RV-8	4.13	7	3.7	126.02	8	
		8-RV-14	5.49	12	5.4	166.52	14	
		8-RV-31	7.8	23	7	235.62	28	
		8-RS-8	5.3	10	1.8	164.52	11	
		8-RS-14	6.93	17	1.9	214.1	19	
		8-RS-31	9.8	33	3.1	301.89	37	
		8-LJ-48	18.47	93	1	573.47	106	
9	R-9M-25-1	9-RV-33	7.19	5	10	223.28	6	
		9-RV-87	11.66	12	15	355.7	14	
		9-RS-33	9.54	7	2.4	296.23	8	
		9-RS-87	15.29	14	3.4	476.91	16	
		9-LJ-160	26.04	31	1	808.5	35	
		9-LJ-160	26.04	31	1	808.5	35	
	R-9M-25-3	9-RV-33	9.58	6	11	295.94	7	
		9-RV-87	14.84	14	17	460.2	16	
		9-RS-33	12.26	7	2.4	380.9	8	
		9-RS-87	19.38	17	3.5	600.38	20	
		9-LJ-160	36.53	43	1	1134.02	49	
		9-LJ-160	36.53	43	1	1134.02	49	
10	R-10M-25-1	10-RV-64	17.18	8	14	511.18	9	
		10-RV-138	24.3	17	22	753.31	19	
		10-RS-64	21.35	15	3.7	662.78	17	
		10-RS-138	30.36	21	5	942.47	23	
		10-LJ-238	56.43	52	1	1752.15	59	
		10-LJ-238	56.43	52	1	1752.15	59	
	R-10M-25-3	10-RV-64	23.77	11	15	729.52	13	
		10-RV-138	33.46	23	23	1022.35	26	
		10-RS-64	29.67	15	3.7	910.49	17	
		10-RS-138	41.37	29	5.5	1284.44	33	
		10-LJ-238	87.43	98	1	2714.6	112	
		10-LJ-238	87.43	98	1	2714.6	112	
12	R-12M-25-4	12-RV-221	35.31	8	28	1070.78	9	
		12-RV-343	44.32	12	35	1334.44	14	
		12-RS-221	47.16	9	4	1434.41	10	
		12-RS-343	58.4	13	4.3	1777.08	15	
		12-LJ-740	113.55	31	1	3491.86	36	
		12-LJ-740	113.55	31	1	3491.86	36	
	R-12M-25-5	12-RV-221	65.14	10	29	2022.44	11	
		12-RV-343	79.3	15	36	2448.26	17	
		12-RS-221	84.78	12	4.2	2601.19	14	
		12-RS-343	101.82	18	4.5	3161.16	20	
		12-LJ-740	255.83	65	1	7944.05	75	
		12-LJ-740	255.83	65	1	7944.05	75	
13	R-13M-25-1	13-RV-510	75.47	12	40	2309.5	14	
		13-RV-760	90.05	18	50	2718.72	20	
		13-RS-510	101.78	15	7.3	3067.06	17	
		13-RS-760	120.55	21	9	3709.92	24	
		13-LJ-1394	206.66	46	1	-	-	
		13-LJ-1394	206.66	46	1	-	-	
	R-13M-25-3	13-RV-510	120.29	17	42	3707.09	19	
		13-RV-760	142.32	24	52	4395.27	27	
		13-RS-510	153.29	23	6.6	4759.23	26	
		13-RS-760	187.55	32	9.3	5822.89	36	
		13-LJ-1394	373.2	92	1	-	-	
		13-LJ-1394	373.2	92	1	-	-	

* - These floats are not recommended for gas service unless operating pressure (downstream) exceeds 30 psig
 All gas flows are at 14.7 psia and 70°F

Table 7 - Capacities (127mm Tubes)								Table 8 - Capacities (127mm Tubes extension floats)							
Meter Size	Tube Number	Float Number	Maximum Flow Rate					Meter Size	Tube Number	Float Number	Maximum Flow Rates				
			Water			Air					Water			Air	
			LPM	DP IWC	VIS. LIMIT	SLPM	DP IWC				LPM	DP IWC	VIS. LIMIT	SLPM	DP IWC
8	R-8M-127-1	8-RV-3	1.9	2	2	58.1	2	8	R-8M-127-1	8-EV-30	5.7	11	8.5	176.3	12.6
		8-RV-8	2.8	3	3.3	85.2	4			8-ES-30	7.6	13	1.4	235	14.5
		8-RV-14	3.6	6	4.6	111.9	6			8-EV-135*	12.1	46.7	13.8	376	52.5
		8-RV-31*	5.2	11	6	158.6	13			8-ES-135*	15.1	52.9	2	470.1	64.9
		8-RS-8	3.5	4	1.7	108	4		R-8M-127-4	8-EV-30	8.7	14	11.4	270.3	14.5
		8-RS-14	4.6	6	1.8	142.5	7			8-ES-30	10.6	16	1.7	329	17.5
		8-RS-31*	6.4	13	2.6	197.7	15			8-EV-135*	18.9	63.4	17.8	587.6	68
		8-LJ-48*	9.8	22	1	304.2	25			8-ES-135*	21.6	66.4	2.5	669.8	75.2
	R-8M-127-4	8-RV-3	2.7	2	2	83.3	2	9	R-9M-127-1	9-EV-60	10.6	8.1	12.8	329	9.5
		8-RV-8	3.9	4	3.7	118.7	5			9-ES-60	14.4	9.1	2	446.6	10.6
		8-RV-14	5.1	7	5.4	154.6	8			9-EV-190*	17	25	16.8	528.8	26.4
		8-RV-31*	7	14	7	213.3	15			9-ES-190*	22.7	27.3	2.5	705.1	32.7
		8-RS-8	4.9	5	1.8	152.7	6		R-10M-127-1	10-EV-100	22.7	10.2	19.5	705.1	12
		8-RS-14	6.4	8	1.9	197.7	10			10-ES-100	28.4	12.4	2.8	881.4	14.3
		8-RS-31*	8.7	16	3.1	267.6	18			10-EV-270*	34.1	25.5	24.5	1057.6	30.7
		8-LJ-48*	16.7	35	1	512.6	40			10-ES-270*	49.2	31.1	3.8	1527.7	34.7
9	R-9M-127-1	9-RV-33	6.4	4.6	10	198.2	6	10	R-10M-127-3	10-EV-100	30.3	13.2	23	940.1	15.3
		9-RV-87*	10	11.5	15	310	13			10-ES-100	39.7	16.1	3.4	1233.9	17.3
		9-RS-33	8.3	5.3	2.3	256.3	6			10-EV-270*	51.1	31.9	30	1586.5	35.7
		9-RS-87*	13.1	13	3.4	406	15			10-ES-270*	68.1	38.2	4.4	2115.3	37.7
		9-LJ-160*	22.4	26.6	1	694	31		R-12M-127-1	12-EV-285	41.6	9.9	27	1292.7	11.6
		R-10M-127-1	10-RV-64	16.2	7	14	502			8	12-ES-285	53	10.6	3.9	1645.2
10-RV-138*	22.5		14	22	697	16	12-EV-453*			56.8	15	32	1762.7	18.3	
10-RS-64	20.4		8.4	3	634	10	12-ES-453*		75.7	17.3	4.7	2350.3	19.3		
10	R-10M-127-1	10-RS-138*	28.1	16.2	5	870	19		R-12M-127-3	12-EV-285	83.3	11.9	39	2585.3	14.2
		10-LJ-238*	51.7	36	1	1604	41			12-ES-285	106	17	44	3290.4	22.6
		10-RV-64	22.8	9.2	15	689	11			12-EV-453*	113.6	13.9	5.8	3525.5	16.2
	R-10M-127-3	10-RV-138*	30.3	17.2	23	941	20		12-ES-453*	143.8	19	6.6	4465.6	24.6	
		10-RS-64	28.6	11.4	3.7	872.3	13	R-13M-127-1	13-EV-505	132.5	15.9	50	4113	17.9	
		10-RS-138*	37.6	21	5.5	1179	24		13-ES-505	170.3	19.9	7.2	5288.2	22.9	
10-LJ-238*	85.1	61	1	2640	70	13-EV-865*	174.1		23.1	59	5405.7	28.7			
12	R-12M-127-1	12-RV-221	32.6	8	28	997.7	9		R-13M-127-1	13-ES-865*	227.1	30.7	8.5	7050.9	33.7
		12-RV-343*	40.7	12	35.5	1233.3	14	R-13M-127-3		13-RV-510	115.1	16	42	3540	18
		12-RS-221	43.5	8	4	1333.9	10			13-RV-760*	132.1	22	52	4083.7	25
		12-RS-343*	52.9	13	4.3	1605.7	15			13-RS-510	156.3	20	7.6	4853	23
	R-12M-127-3	12-LJ-740*	92	28	1	2826.3	32		13-RS-760*	176	27	9.3	5464	31	
		12-RV-221	62.9	10	29	1915.9	11	13-LJ-1394*	355	70	1	-	-		
		12-RV-343*	74.5	14	36	2274.1	17								
		12-RS-221	82.6	12	4.2	2540.3	13								
13	R-13M-127-1	12-RS-343*	93.6	16	4.5	2883	19								
		12-LJ-740*	272.5	57	1	-	-								
		13-RV-510	73	12	40	2216	14								
		13-RV-760*	86.7	17	50	2628.1	20								
	R-13M-127-3	13-RS-510	99.4	14	7.3	2982.1	16								
		13-RS-760*	118.5	20	9	3571.2	23								
		13-LJ-1394*	179.6	38	1	-	-								
		13-RV-510	115.1	16	42	3540	18								
R-13M-127-3	13-RV-760*	132.1	22	52	4083.7	25									
	13-RS-510	156.3	20	7.6	4853	23									
	13-RS-760*	176	27	9.3	5464	31									
	13-LJ-1394*	355	70	1	-	-									

* - These floats are not recommended for gas service unless operating pressure (downstream) exceeds 30 psig
 All gas flows are at 14.7 psia and 70°F

VARIABLE AREA FLOWMETERS – GLASS TUBE

Description

The IE high accuracy glass tube variable area flow meter is intended for use where the accuracy required is higher than that obtainable with the standard 250 mm scale length flow meter. Each high accuracy flow meter is individually calibrated to a guaranteed accuracy. High accuracy glass tube variable area flow meters are furnished with the same rigid case construction and other features of the standard glass tube variable area flow meters.



IE HIGH ACCURACY GLASS TUBE VARIABLE AREA FLOW METERS

Design Features

- Dowel-pin side plate construction
- Detachable direct reading scales
- Heavy wall precision bore ribbed borosilicate glass metering tubes
- Externally adjustable packing glands
- Ten to one range
- Connections rotatable through 360° in 90° intervals
- One quarter inch thick laminated safety glass
- Nominal scale length 600 mm
- Choice of float types and capacity ranges

Materials Of Construction

METERING TUBES – ribbed borosilicate glass

Floats

– Standard: 316 SS Optional: Aluminum, Hastelloy C, Teflon
END FITTINGS – 316 SS, steel, Hastelloy C & Brass. For other materials contact factory. PACKING MATERIALS – Standard: Neoprene Optional: Teflon
SIDE PLATE – Standard: Steel Optional: 316 SS
GLAND RINGS – Standard: Steel Optional: 316 SS
GLAND FOLLOWERS – Standard: Steel Optional: 316 SS
SAFETY GLASS SHIELD – Aluminum BOLTS – 304 SS
OPTIONAL COATING – Epoxy

Specifications

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

Scales

Nominal length – 600 mm, engraved direct reading aluminum detachable scales
PRESSURE DROP – Refer capacity table

Performance

Industrial accuracy: +1% of reading from 100% to 10% of full scale
Calibrated accuracy: +0.5% of reading from 100% to 20% of full scale
Repeatability: +0.25% of instantaneous reading



REPRESENTATIVE CONFIGURATIONS

Meter Size	Maximum Pressure (PSIG) at 121.1°C	Maximum Temperature Degrees C
6	450	121.1
7	350	121.1
8	300	121.1
9	175	93.3
10	100	93.3
12	75	93.3
13	60	93.3

- Pressure ratings are based on static pressure applicable at 93.3°C

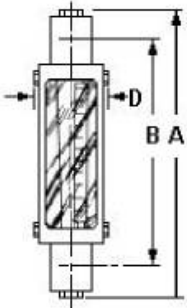
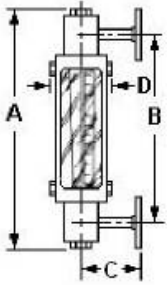
CONNECTIONS

Meter Size	Model 1110	Model 1140
	Inlet & Outlet Horizontal Screwed	Inlet & Outlet Horizontal Flanged
6 to 8	1/2"	1/2"
9	3/4"	3/4"
10	1"	1"
12	1-1/2"	1-1/2"
13	2"	2"

Optional Equipment

ALARM – Optical alarm for high or low flow signal

Dimensions – MM (For certified prints, write to factory)

Meter	Model 1110 & 1140					
	A	B	C	D		
6	863.6	765.2	88.9	82.6	Model 1110	Model 1140
7 & 8	863.6	765.2	88.9	82.6		
9	904.9	790.6	101.6	95.3		
10	927.1	790.6	101.6	112.7		
12	908.1	790.6	127.0	112.7		
13	998.5	852.5	127.0	123.8		

Capacities

Meter Size	Tube Number	Float	Water (LPM)			Air (SLPM)	
			Maximum Flow Rates			Lowest	Highest
			Lowest	Highest		Lowest	Highest
6	R-6L-600-G1	RV	0.189	0.567		5.663	16.990
		RS	0.378	0.757		11.326	22.653
7	R-7L-600-G1	RV	0.605	1.211		19.821	33.980
		RS	0.908	1.514		28.317	45.307
			Water (LPM)	Pressure Drop IWC	Viscosity Immunity	Air (SLPM)	Pressure Drop IWC
8	R-8M-600-2	8-RV-3	2.16	2	2.0	65.99	3
		8-RV-8	3.10	5	3.3	95.72	6
		8-RV-14	4.13	8	4.6	127.44	9
		8-RV-31*	5.94	17	6.0	181.81	19
		8-RS-8	3.97	6	1.7	124.61	7
		8-RS-14	5.22	11	1.8	162.84	12
		8-RS-31*	7.49	22	2.6	230.24	25
9	R-9M-600-1	9-RV-33	7.68	5	10.0	240.72	6
		9-RV-87*	12.49	12	15.0	380.90	14
		9-RS-33	10.22	6	2.3	317.18	7
		9-RS-87*	16.35	14	3.4	509.76	16
10	R-10M-600-1	10-RV-64	21.35	10	3.0	669.77	12
		10-RV-138*	24.30	17	22.0	753.31	19
		10-RS-64	21.35	10	3.0	669.77	12
		10-RS-138*	30.36	21	5.0	979.87	23
12	R-12M-600-4	12-RV-221	35.31	8	28.0	1070.78	9
		12-RV-343*	44.32	12	35.0	1334.44	14
		12-RS-221	47.16	9	4.0	1434.41	10
		12-RS-343*	58.40	13	4.3	1777.08	15
13	R-13M-600-3	13-RV-510	120.55	17	42.0	3707.09	19
		13-RV-760*	142.32	24	52.0	4395.26	27
		13-RS-510	160.94	23	7.6	5001.31	26
		13-RS-760*	187.55	32	9.3	6165.26	36

VARIABLE AREA FLOWMETERS – GLASS TUBE

Description

IE Teflon lined glass tube variable area flow meter is intended for flow measurement of gases and liquids on applications where the operating conditions are within the limitations of glass metering tubes. The high degree of corrosion resistance achieved in these instruments combined with packed gland tube construction make them suitable for chemical petrochemical, food, pharmaceuticals, water treatment and other industries.



IE TEFLON LINED GLASS TUBE VARIABLE AREA FLOW METERS

Design Features

- Rugged construction
- Heavy wall precision bore ribbed borosilicate glass metering tubes
- Simple assembly procedure
- Aluminum window frame for strength
- One quarter inch thick laminated safety glass
- Quick tube exchange
- Ten-to-one range
- Detachable direct reading scales
- Scale length of 127 mm, 150 mm and 250 mm
- Standard float types interchangeable in tubes of given meter size
- Choice of float types and capacity ranges
- Teflon lined end fittings

Materials Of Construction

METERING TUBES – Borosilicate glass FLOATS – Standard: 316 SS Optional: Hastelloy C, Teflon END FITTINGS – Teflon lined PACKING MATERIALS – Teflon SIDE PLATE – Standard: Steel Optional: 316 SS GLAND RINGS – Standard: Steel Optional: 316 SS GLAND FOLLOWERS – Standard: Steel Optional: 316 SS SAFETY GLASS SHIELD – Aluminum BOLTS – 304 SS OPTIONAL COATING – Epoxy

Specifications

WARNING: Do not operate this instrument in excess of the specifications listed below. Failure to heed warning may result in serious personal injury or damage to equipment. **SCALES** Nominal lengths: 127mm, 150mm and 250 mm Standard: Detachable aluminum; Optional: 316 stainless steel Graduations: Choice of direct reading, arbitrary millimeter or 0-100 linear with calibration curves or percentage of maximum flow with factor tag. **PRESSURE DROP** – Refer capacity table **PERFORMANCE** Industrial accuracy: +2% of full scale from 100% to 10% of full scale. Calibrated accuracy: +1% of full scale from 100% to 10% of full scale. **Repeatability** – 0.5% of full scale

Meter Size	Maximum Pressure (PSIG) at 121.1OC	Maximum Temperature Degrees C
6	450	121.1
7	350	121.1
8	300	121.1
9	175	93.3
10	100	93.3
12	75	93.3
13	60	93.3

- Pressure ratings are based on static pressure applicable at 93.3°C

Table 1 – Capacities (150mm Tubes)

Meter Size	Tube Number	Float Number	Maximum Flow Rates			
			Water	Air	H ₂	He
			CCM	SLPM		
2	R-2-15-AAA	G2	0.54	0.049	0.102	0.0444
		S2	2.49	0.146	0.322	0.144
		C2	4.9	0.245	0.594	0.268
	R-2-15-AA	G2	1.11	0.096	0.209	0.0916
		S2	4.93	0.265	0.631	0.293
		C2	9.33	0.43	1.12	0.533
	R-2-15-D	G2	5.75	0.37	1.03	0.491
		S2	20.6	0.82	2.52	1.39
		C2	33.2	1.22	3.88	2.28
	R-2-15-A	G2	18.3	0.95	2.63	1.54
		S2	52.1	1.9	5.57	3.42
		C2	81.8	2.8	8.2	5.16
	R-2-15-B	G2	52.8	2.35	8.01	5.02
		S2	133	4.6	15.9	10.3
		C2	199	6.6	22.9	14.9
	R-2-15-C	G2	84.6	3.8	12.9	8
		S2	218	7.6	26.1	16.7
		C2	326	10.4	37.6	24.4
6	R-6-15-A	G6	200	8.6	29.9	19.2
		S6	493	16.4	58.9	38.3
		C6	726	23	83.3	55.2
	R-6-15-B	G6	573	23.5	85.9	55.3
		S6	1350	43	160	109
		C6	1950	60	222	152

Table 2 – Capacities (250mm Tubes)

Table 2 – Capacities (250mm Tubes)															
Meter Size	Tube Number	Float Number	Maximum Flow Rates					Meter Size	Tube Number	Float Number	Maximum Flow Rates				
			Water			Air					Water			Air	
			LPM	ΔP (iwc)	VIS LIMIT	SLPM	ΔP (iwc)				LPM	ΔP (iwc)	VIS LIMIT	SLPM	ΔP (iwc)
6	R-6M-25-1A	G6	0.28	0.2	1	12.3	0.36	10	R-10M-25-1	10-RV-64	17.18	8	14	511.18	9
		S6	0.68	1.17	1	22.8	1.34			10-RV-138*	24.3	17	22	753.31	19
7	R-7M-25-1	G7	0.58	-	1	24	-			10-RS-64	21.35	15	3.7	662.78	17
		S7	1.48	-	1	50	-			10-RS-138*	30.36	21	5	942.47	23
8	R-8M-25-2	8-RV-3	2.08	2	2	62.87	3			10-LJ-238*	56.43	52	1	1752.15	59
		8-RV-8	2.95	5	3.3	91.19	6		10-RV-64	23.77	11	15	729.52	13	
		8-RV-14	3.94	8	4.6	121.21	9		10-RV-138*	33.46	23	23	1022.35	26	
		8-RV-31*	5.68	17	6	173.32	19		10-RS-64	29.67	15	3.7	910.49	17	
		8-RS-8	3.79	6	1.7	117.51	7		10-RS-138*	41.37	29	5.5	1284.44	33	
		8-RS-14	5	11	1.8	155.19	12		10-LJ-238*	87.43	98	1	2714.6	112	
		8-RS-31*	7.15	22	2.6	219.76	25		12-RV-221	35.31	8	28	1070.78	9	
		8-LJ-48*	11.39	45	1	353.72	51		12-RV-343*	44.32	12	35	1334.44	14	
	R-8M-25-4	8-RV-3	2.95	4	2	89.77	4		12-RS-221	47.16	9	4	1434.41	10	
		8-RV-8	4.13	7	3.7	126.02	8		12-RS-343*	58.4	13	4.3	1777.08	15	
		8-RV-14	5.49	12	5.4	166.52	14		12-LJ-740*	113.55	31	1	3491.86	36	
		8-RV-31*	7.8	23	7	235.62	28		12-RV-221	65.14	10	29	2022.44	11	
		8-RS-8	5.3	10	1.8	164.52	11		12-RV-343*	79.3	15	36	2448.26	17	
		8-RS-14	6.93	17	1.9	214.1	19		12-RS-221	84.78	12	4.2	2601.19	14	
		8-RS-31*	9.8	33	3.1	301.89	37		12-RS-343*	101.82	18	4.5	3161.16	20	
		8-LJ-48*	18.47	93	1	573.47	106		12-LJ-740*	255.83	65	1	7944.05	75	
9	R-9M-25-1	9-RV-33	7.19	5	10	223.28	6	13	R-13M-25-1	13-RV-510	75.47	12	40	2309.5	14
		9-RV-87*	11.66	12	15	355.7	14			13-RV-760*	90.05	18	50	2718.72	20
		9-RS-33	12.26	7	2.4	296.23	8			13-RS-510	101.78	15	7.3	3067.06	17
		9-RS-87*	15.29	14	3.4	476.91	16			13-RS-760*	120.55	21	9	3709.92	24
		9-LJ-160*	26.04	31	1	808.5	35			13-LJ-1394	206.66	46	1	-	-
		R-9M-25-3	9-RV-33	9.58	6	11	295.94		7	13-RV-510	120.29	17	42	3707.09	19
	9-RV-87*		14.84	14	17	460.2	16		13-RV-760*	142.32	24	52	4395.27	27	
	9-RS-33		12.26	7	2.4	380.9	8		13-RS-510	153.29	23	6.6	4759.23	26	
	9-RS-87*		19.38	17	3.5	600.38	20		13-RS-760*	187.55	32	9.3	5822.89	36	
	9-LJ-160*		36.53	43	1	1134.02	49		13-LJ-1394	373.2	92	1	-	-	

Table 3 – Capacities (127mm Tubes)

Table 3 – Capacities (127mm Tubes)															
Meter Size	Tube Number	Float Number	Maximum Flow Rates					Meter Size	Tube Number	Float Number	Maximum Flow Rates				
			Water			Air					Water			Air	
			LPM	ΔP (iwc)	VIS LIMIT	SLPM	ΔP (iwc)				LPM	ΔP (iwc)	VIS LIMIT	SLPM	ΔP (iwc)
8	R-8M-127-1	8-RV-3	1.9	2	2	58.1	2	10	R-10M-127-3	10-RV-64	22.8	9.2	15	689	11
		8-RV-8	2.8	3	3.3	85.2	4			10-RV-138*	30.3	17.2	23	941	20
		8-RV-14	3.6	6	4.6	111.9	6			10-RS-64	28.6	11.4	3.7	872.3	13
		8-RV-31*	5.2	11	6	158.6	13			10-RS-138*	37.6	21	5.5	1179	24
		8-RS-8	3.5	4	1.7	108	4			10-LJ-238*	85.1	61	1	2640	70
		8-RS-14	4.6	6	1.8	142.5	7		12-RV-221	32.6	8	28	997.7	9	
		8-RS-31*	6.4	13	2.6	197.7	15		12-RV-343*	40.7	12	35.5	1233.3	14	
		8-LJ-48*	9.8	22	1	304.2	25		12-RS-221	43.5	8	4	1333.9	10	
	R-8M-127-4	8-RV-3	2.7	2	2	83.3	2		12	R-12M-127-1	12-RS-343*	52.9	13	4.3	1605.7
		8-RV-8	3.9	4	3.7	118.7	5	12-LJ-740*			92	28	1	2826.3	32
		8-RV-14	5.1	7	5.4	154.6	8	12-RV-221			62.9	10	29	1915.9	11
		8-RV-31*	7	14	7	213.3	15	12-RV-343*			74.5	14	36	2274.1	17
		8-RS-8	4.9	5	1.8	152.7	6	12-RS-221			82.6	12	4.2	2540.3	13
		8-RS-14	6.4	8	1.9	197.7	10	12-RS-343*		93.6	16	4.5	2883	19	
		8-RS-31*	8.7	16	3.1	267.6	18	12-LJ-740*		272.5	57	1	-	-	
		8-LJ-48*	16.7	35	1	512.6	40	R-13M-127-1		13-RV-510	73	12	40	2216	14
	9	R-9M-127-1	9-RV-33	6.4	4.6	10	198.2			6	13-RV-760*	86.7	17	50	2628.1
			9-RV-87*	10	11.5	15	310		13	13-RS-510	99.4	14	7.3	2982.1	16
			9-RS-33	8.3	5.3	2.3	256.3		6	13-RS-760*	118.5	20	9	3571.2	23
			9-RS-87*	13.1	13	3.4	406		15	13-LJ-1394*	179.6	38	1	-	-
			9-LJ-160*	22.4	26.6	1	694	31	13	R-13M-127-3	13-RV-510	115.1	16	42	3540
10	R-10M-127-1	10-RV-64	16.2	7	14	502	8	13-RV-760*			132.1	22	52	4083.7	25
		10-RV-138*	22.5	14	22	697	16	13-RS-510			156.3	20	7.6	4853	23
		10-RS-64	20.4	8.4	3	634	10	13-RS-760*			176	27	9.3	5464	31
		10-RS-138*	28.1	16.2	5	870	19	13-LJ-1394*			355	70	1	-	-
		10-LJ-238*	51.7	36	1	1604	41								

Specifications subject to change without any notice

VARIABLE AREA FLOWMETERS – GLASS TUBE

Description

The Series 1400 Flowmeters are intended for services where the advantages of glass tube indicating flowmeter are normally ruled out by service pressures above the safe operating pressures of glass tubes. A pressure equalizing system balances the pressure on the wall of the tube and permits operation at pressures up to 3000 PSI.



IE HI-PRESSURE (GLASS TUBE) INDICATING FLOW METERS

Design Features

- Through-bolted gage-glass housing
- Resilient sealing gasket on 1450 Series requiring moderate torque for sealing
- Flat asbestos gaskets on 1410 Series
- MS-33656 type o-ring seal between end fittings and gage chamber
- Internals removable without disturbing gage bolts
- Special equalizing vent on inlet fitting
- Metering tube sealed by a spring against a tube seal gasket to prevent bypass flow around tube
- Heavy tempered glass window front and back
- Detachable scales
- Vertical or horizontal NPT or flanged connections

Floats Spherical

Glass, 316 Stainless Steel, Carbonyl

Gage Glass Bodies

Carbon Steel, 316 Stainless Steel

End Fittings

Carbon Steel, 316 Stainless Steel

Gage Glass Gasket

Series 1410: Flat Asbestos; Series 1450: Standard Viton-A

Structural Members

Center Chamber: Steel or 316 Stainless Steel; Covers: Steel

Specifications

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

Scales

Nominal Lengths – 150 mm engraved on detachable metal plates. Graduations – Direct reading, Arbitrary millimetre with flow calibration curves, percentage of maximum flow with factor tag.

Performance

Industrial Accuracy: + full scale from 100% down to 10% of reading for all scale lengths. ISA Spec. 2-S-10. Calibrated Accuracy: + 1% full scale. ISA Spec. 1-S-10. Repeatability: 0.5% full scale

Flange Rating	-20°F to 100°F	200°F	300°F	400°F
150 lb. (Steel)*	285	260	230	200
150 lb (316 SS)	275	240	215	195
300 lb. (Steel)*	740	675	685	635
300 lb. (316 SS)	720	620	560	515
600 lb. (Steel)*	1480	1350	1315	1270
600 lb. (316 SS)	1440	1240	1120	1030

* Psia at indicated temperature

Capacities

Meter Size	Tube No.	Float Material	Max. Flow Rate	
			Water (cc/min.)	Air (SLPM)
2	R-2-15-AAA	Glass	0.54	0.049
		Stainless Steel	2.49	0.146
		Carboloy	4.9	0.245
	R-2-15-AA	Glass	1.11	0.096
		Stainless Steel	4.93	0.265
		Carboloy	9.33	0.43
	R-2-15-D	Glass	5.75	0.37
		Stainless Steel	20.6	0.82
		Carboloy	33.2	1.22
	R-2-15-A	Glass	18.3	0.95
		Stainless Steel	52.1	1.9
		Carboloy	81.8	2.8
6	R-2-15-B	Glass	52.8	2.35
		Stainless Steel	133.	4.6
		Carboloy	199.	6.6
	R-2-15-C	Glass	84.6	3.8
		Stainless Steel	218.	7.6
		Carboloy	326.	10.4
	R-6-15-A	Glass	200.	8.6
		Stainless Steel	493.	16.4
		Carboloy	726.	23.
6	R-6-15-B	Glass	573.	23.5
		Stainless Steel	1350.	43.
		Carboloy	1950.	60.

Optional Equipment Available

Non-frosting gage glass
Tab for fitting gage chambers
Integral steam heating ducts
Special connections: High Pressure metal to metal
compression tube fittings, steel or stainless.

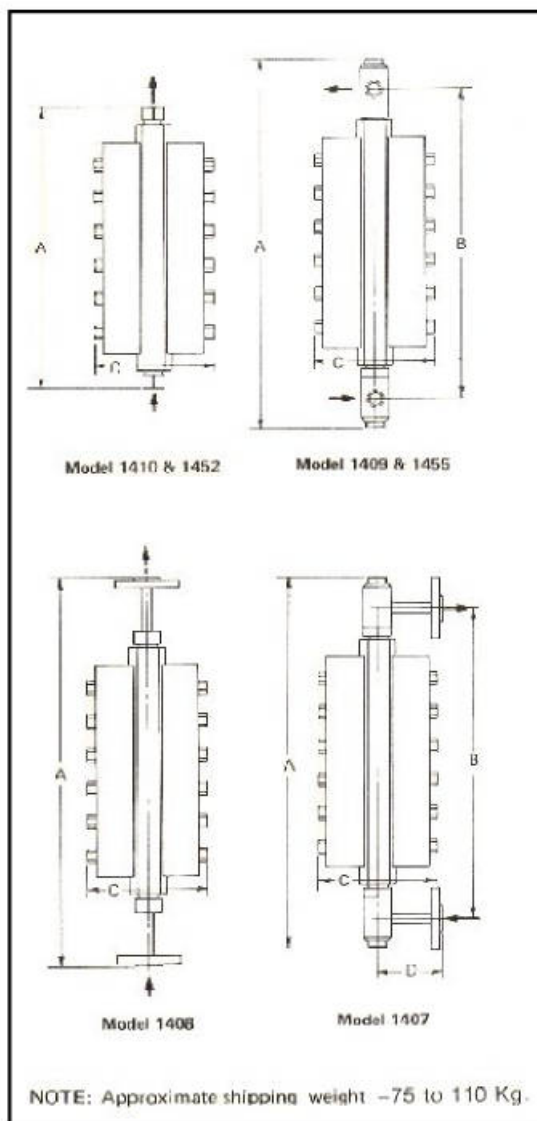
Ordering Information

To order, please specify:

1. Complete flow metering data:
Type of fluid
Maximum, Minimum, normal flows
Temperature, Pressure
Viscosity, Specific Gravity
Maximum allowable pressure drop
2. Model number and size of flowmeter
3. Connection arrangement and orientation
4. Materials of construction
5. Scale data and float type required
6. Options if desired

Dimensions (For Certified Prints, Write To Factory.)

MODEL NO.	CONN SIZE MM	DIMENSIONS (MM)			
		A	B	C	D
1410	1/4" NPT	322.26	--	139.76	--
1452	1/4" NPT	322.26	--	139.70	--
1409	1/4" NPT	423.86	336.55	131.76	--
1455	1/4" NPT	423.86	336.55	139.70	--
1408	1/2" FLG	438.15	--	131.76	--
1407	1/2" FLG	423.86	336.55	131.76	88.9



Specifications subject to change without notice.

Hi-Pressure Armored Flow Indicator Series 3600

VARIABLE AREA FLOWMETERS – METAL TUBE

Description

The Armored Flow Indicator is a reliable, inexpensive flow meter for purge service at elevated pressures. The meter is especially useful for metering coolants, pump seal fluids, lubricants under pressure, opaque fluids, and similar applications. The flow rate is measured by the movement of a tapered plug in a fixed orifice. Indication is by an external tubular follower coupled magnetically to an extension of the tapered plug.



HI-PRESSURE ARMORED FLOW INDICATOR SERIES 3600

Design Features

- Ten-to-one rangeability
- Flanged, threaded, or socket weld connections
- Disassembly for cleaning without removal from line
- Standard direct reading, detachable scales
- Laminated safety glass window
- (Optional) Reed switch operated alarm relay

Materials Of Construction

METER BODY & TRIM: Steel or 316 Stainless Steel
 METERING PLUG, ORIFICE, EXTENSION & MAGNET. CAPSULE: 316 Stainless Steel
 EXTENSION WELL: 316 Stainless Steel
 O-RINGS: Neoprene; Silicone, Viton available.
 EXTENSION CASE: Steel (Indicator), Aluminium (Alarm).

Scales

Length – 1-1/2" Material – Black anodized aluminium
 Graduations – GPH water (1/2" size), GPM water (1" & 1- 1/2" sizes), SCFH Air (1/2" meters only). Special graduations available as options

Performance

Industrial Accuracy: Air or Water +10% of full scale reading.
 Calibrated Accuracy: Air or Water + 5% of full scale reading.
 Repeatability: Within 1% of full scale.

Connections

Vertical inlet, Horizontal Outlet Model 3600 - Socket-weld connections
 Model 3601 – Flanged connections, all ratings
 Model 3602 – NPT threaded connections

Capacities and Pressure Drop

1/2" NPT			1" NPT		1-1/2" NPT	
Air SCFH	Water GPH	Pressure Drop PSI	Water GPM	Pressure Drop PSI	Water GPM	Pressure Drop PSI
30	5	--	5	1.75	18	2.00
60	15	1.25	10	3.75	30	2.75
140	30	1.50	15	4.75	40	4.75
330	50	1.00	--	--	50	5.75
620	100	1.50	--	--	--	--
1400	180	3.25	--	--	--	--
2300	300	5.00	--	--	--	--

Notes: All airflows given are at 14.7 psia and 70°F.
1" and 1-1/2" meters not recommended for gas service.
All meters have a 10 to 1 capacity range.
Minimum operating pressure (downstream) on gas service 35 psig.

Optional Equipment

INDICATING ALARMS *

Models 6331 and 6332: Up to 2 magnetic switches and relays (SPDT) Non explosion proof Aluminium side and back plates, plastic shield, non-purge connections.

Models 6631 and 6632: Upto 2 magnetic switches and relays. Explosion proof, non-purge.

NON-INDICATING (BLIND) ALARM *

Model 6631 and 6632: Up to 2 magnetic switches and relays. Explosion proof, non-purge.

*SPDT relay: contact rating – 16 amperes at 115 v ac resistive. 8 amperes at 115 v ac inductive.

FLANGED CONNECTIONS

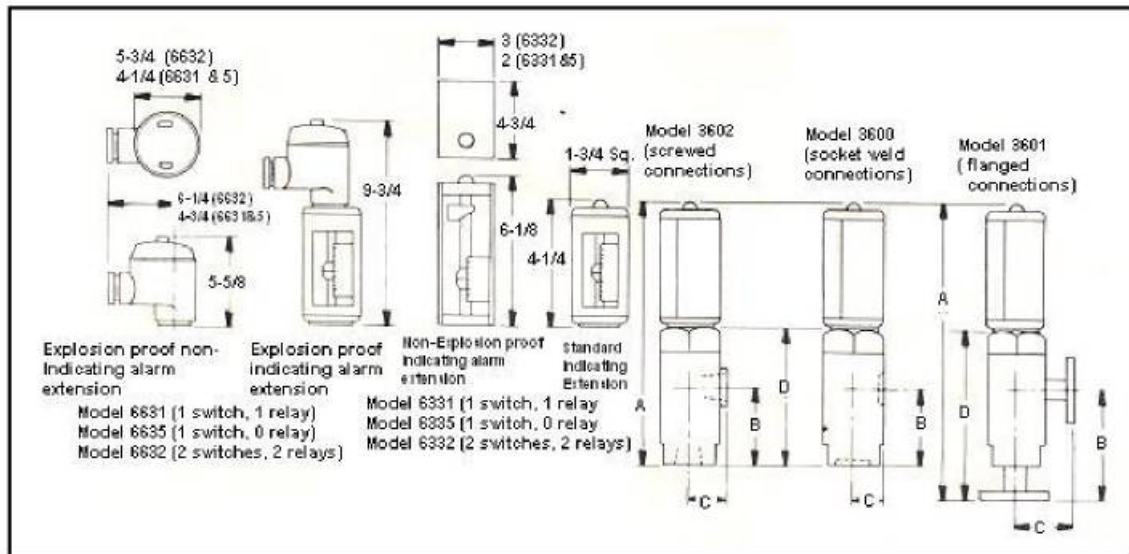
150lb., 300lb., or 600 lb. RF ANSI flanges in steel or 316 Stainless Steel only.

CONSTANT DIFFERENTIAL FLOW CONTROLLER (See DS-8800-8900):

Model Series 8800 for constant downstream pressure service – Integrally piped to inlet connection. Model Series 8900 for constant upstream pressure service – integrally piped to outlet connection.

Specifications subject to change without notice.

Dimensions



Conn. Size	3602				3600				3601			
	A	B	C	D	A	B	C	D	A	B	C	D
1/2	7-5/8	2-1/16	7/8	3-7/16	7-5/8	2-1/16	7/8	3-7/16	9-1/16	3-1/2	3-1/2	4-7/8
1	10-1/16	3-3/4	2-1/8	5-7/8	10-1/16	3-3/4	2-1/8	5-7/8	12-7/16	6-1/8	4	8-3/16
1-1/2	13	5-15/16	1-7/8	8-13/16	13	5-15/16	1-7/8	8-13/16	17-3/16	10-1/8	6-1/8	12-15/16

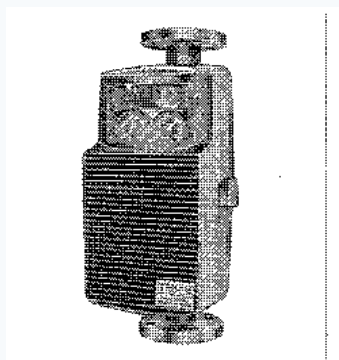
All dimensions in inches.

IE AR-MET Armored Rotameters

VARIABLE AREA FLOWMETERS – METAL TUBE

Description

The Model 3620-30 AR-MET Rotameters are intended for applications where high pressures, temperatures, or corrosive conditions preclude the use of conventional glass tubes. The Model 3611-5500X Series instruments are metal tube flowmeters designed primarily for difficult metering services involving solids-bearing liquids which tend to settle or crystallize in crevices or stagnant pockets, or those which require easily sterilized fittings. The flow is vertically straight through the instrument, and there is no extension well above or below the metering body. Indication and transmission are accomplished by a Series 5500 instrument mounted adjacent to the metering tube and actuated by a magnet imbedded in the float.



IE AR-MET ARMORED ROTAMETERS

Design Features

- Ten-to-one rangeability
- Simplified piping and reduced space requirements
- Permanent magnetic link between metering float and motion position transmitter
- Precision swaged metering tube
- Heavy duty welded float and guide construction
- Guide cartridges easily removable for cleaning
- Optional purged or square-broached guide cartridges
- Interchangeable, standardized floats in a given meter size
- Provided with pneumatic transmitter, solid-state electrical transmitter, flow indicator, or alarm
- Nominal scale lengths of 127 mm
- Flanges, threaded, or socket weld connections

Materials of Construction

Metering tube and flanges — all 316 stainless steel, or all 316 stainless steel with Teflon lining; carbon steel end fittings with 316 stainless tube; 316 stainless tubes with steel end fittings and Teflon lining. For Hastelloy or Monel construction, consult factory. Floats, extensions & cartridges: 316 Stn. Stl., Hastelloy C, Teflon Alloy 20, Monel. Gaskets & O-rings: standard cryogenic to +32°F Teflon; 32°F to 250°F Buna-N; 250°F to 450°F Viton; 450°F to 1000°F metal O-ring. Spool pieces (recommended optional equipment) — carbon steel and 316 stainless steel.

Performance

Industrial accuracy: $\pm 2\%$ of maximum scale from 100% down to 10% of scale reading (conforms to ISA R.P. 16.2, Spec. 2-S-10). Calibrated accuracy: $\pm 1\%$ of maximum scale from 100% down to 10% of scale reading (conforms to ISA R.P. 16.2, Spec. 1-S-10). Rangeability 10 to 1 (5 to 1 in lined meters). Repeatability: 0.5% full scale. Linearity: within 1%. Maximum temperature: 1000°F.

■ Optional Equipment

- Transmitting extensions — indicating pneumatic (Bulletin DS-5500), indicating electrical (Bulletin DS-5520)
- Indicating extensions — Model 5510 Indicator and Model 5618 Mag/Na/Vue
- Indicating alarm extension — Model 6300 (size 8 and larger only)
- Inlet spool pieces — carbon steel and 316 Str. Stl. (standard)
- Special flange facings — flat face, ring joint, tongue and groove
- Inverted meters for steam service



Instrumentation Engineers Pvt. Ltd.

Plots 1, 2, 3, Phase III, IDA Jeedimetla, Hyderabad 500 055, India
Tel: +91 40 2309 5147 · sales@ieflowmeters.com · www.ieflowmeters.com

DS-3611/3620/3630
February 1985

**Capacities
Model 3611**

Meter Size Tube Taper	Float Type	Water Max. Flow Rate		Pressure Drop Inches W.C.		Air Max. Flow Rate		Viscosity immunity Ceiling (Cs.)
		gpm	lpm	Water	Air	scfm	slpm	
7	V	0.8	3.0	4	5	3.5	99	5
8	V	1.2	4.5	19	21	5.0	142	10
8	U	2.0	7.6	28	32	8.3	235	10
8	S	3.0	11.4	61	69	12.5	354	2
9	V	5.0	18.9	114	130	20.8	589	10
9	U	4.0	15.1	49	56	16.6	470	10
9	S	6.0	22.7	183	209	24.9	705	2
10	V	4.3	16.3	11	12	17.8	504	18
10	U	7.0	26.5	31	36	29.1	824	15
10	S	8.5	32.2	14	15	35.3	1000	2
10	S	10.0	37.9	40	45	41.5	1175	2
11	V	9.0	34.1	22	26	37.4	1059	18
11	U	15.0	56.8	61	70	62.3	1764	15
11	S	13.5	51.1	36	41	56.0	1586	2
11	LV	22.0	83.3	105	120	91.3	2585	1
11	LS	34.0	128.7	235	269	141.1	3996	1
11	LS	38.0	143.8	274	313	157.7	4466	1
12	V	21.0	79.5	25	29	87.2	2469	25
12	U	36.0	136.3	64	73	149.4	4231	25
12	V	28.0	106.0	36	41	116.2	3290	25
12	S	48.0	181.7	93	106	193.2	5641	3
12	LV	82.0	310.4	230	263	340.3	9636	1
12	LS	88.0	333.1	247	282	365.2	10341	1
13	V	45.0	170.3	20	23	166.8	5290	70
13	U	75.0	283.9	51	59	311.3	8815	60
13	V	64.0	242.2	29	33	265.6	7521	60
13	LV	100.0	378.5	69	79	415.0	11752	1
13	LV	120.0	454.2	94	108	498.0	14102	1
13	LV	205.0	775.9	184	210	850.8	24092	1
15	V	50.0	189.3	20	23	207.5	5876	130
15	U	170.0	643.5	50	58	705.5	19978	125
15	S	200.0	757.0	80	92	830.0	23503	5
15	V	90.0	340.7	41	47	373.5	10576	125
15	S	225.0	851.6	90	102	933.8	26442	5
15	LS	300.0	1135.5	142	164	1245.0	35255	1
16	V	90.0	340.7	-	-	373.5	10576	-
16	U	250.0	946.3	-	-	1037.5	29379	-
16	U	100.0	378.5	-	-	415.0	11752	-
16	S	500.0	1892.5	-	-	2075.0	58758	-
18	V	600.0	2271.0	-	-	2490.0	70509	-
18	S	850.0	3217.3	-	-	3527.5	99898	-
18	S	2500.0	9462.5	-	-	10375.0	293789	-

All flow ranges are 10:1 except Teflon lined meters.
 Do not use Model 3611 on gas service below 50 psig without factory approval.

CAPACITIES

(For A Revision Ar-Mets) Models 3623A, 3621A, 3622A, 3633A, 3634A, 3635A

Meter Size Tube Taper*	Float Number	Water Max. Flow Rate		Pressure Drop Inches W.C.		Air Max. Flow Rate		Viscosity Immunity Ceiling (Cs.)
		gpm	lpm	Water	Air	scfm	slpm	
7 1.40	7-AV-22** 7-AV-29**	0.6 0.86	2.2 3.3	4 6	5 7	2.5 3.5	70.8 100.0	5 5
8 1.21	8-AV-30	1.0	3.8	9	10	4.1	117	10
	8-AV-34	1.42	5.38	11	13	5.85	166	10
	8-AV-57	1.85	7.01	18	21	7.62	216	10
	8-AV-113**	2.46	9.32	38	44	10.1	287	7
	8-AV-158**	3.10	11.7	60	69	12.8	362	7
	8-AS-158**	4.0	15.2	66	76	16.5	467	2
8 1.35	8-AV-30	2.0	7.6	12	14	8.2	233	10
	8-AV-34	2.6	9.9	16	19	10.7	303	10
	8-AV-57	3.25	12.3	30	35	13.4	379	10
	8-AV-113**	4.3	16.3	55	63	17.7	502	7
	8-AV-158**	5.3	20.1	67	77	21.8	618	7
	8-AS-158**	7.0	26.5	90	104	28.8	817	2
10 1.21	10-AV-55	3.4	12.9	5	6	14.0	397	18
	10-AV-108	5.0	19.0	11	13	20.6	583	18
	10-AV-174	6.2	23.5	18	21	25.5	723	15
	10-AV-289**	8.1	30.7	26	30	33.4	945	15
	10-AS-289**	10.8	40.9	32	37	44.5	1,260	2
10 1.35	10-AV-55	5.74	21.8	8	9	23.6	670	18
	10-AV-108	9.03	34.2	17	20	37.2	1,054	18
	10-AV-174	10.5	39.8	25	29	43.3	1,225	15
	10-AV-289**	14.8	56.1	45	52	61.0	1,727	15
	10-AS-289**	20.8	78.8	70	81	85.7	2,427	2
	10-AV-498**	27.8	105	125	144	114	3,244	2
	10-AS-325**	36.0	136	152	175	148	4,200	1
12	12-AV-213	16.6	63.0	11	13	68.4	1,937	25
	12-AV-388	23.5	89.1	21	24	96.8	2,742	25
	12-AV-605**	30.5	116	32	37	126	3,559	25
	12-AS-605**	41	155	43	50	169	4,784	3
	10-AS-812**	78	296	125	144	321	9,100	1
13 1.35	13-AV-231	24.1	91.3	8	9	99.3	2,812	70
	13-AV-561	37.8	143	17	20	156	4,418	70
	13-AV-923	51.5	195	27	31	212	6,004	60
	13-AV-1323**	63.3	240	39	45	261	7,392	60
	13-AS-1323**	89.4	339	58	67	368	10,422	5
	13-AV-1697**	102	387	72	83	420	11,895	10
	13-AV-1203**	150	568	60	70	618	17,502	1
	13-AS-1550**	207	784	205	236	653	24,157	1
15 1.35	15-AV-486	56.5	214	9	11	233	6,599	130
	15-AV-1398	84.1	318	41	47	346	9,799	125
	15-AV-2048**	114	432	45	52	470	13,311	125
	15-AV-2885**	141	534	50	58	581	16,454	125
	15-AS-2885**	207	784	60	92	853	24,157	5
	15-AS-2798**	310	1,175	142	164	1,277	36,165	1
16 1.35	MV	90	340	—	—	373	10,563	—
	MV	250	946	—	—	1,040	29,453	—
	MS	100	378.5	—	—	415	11,753	—
	MS	500	1,892	—	—	2,080	58,906	—

NOTES:

1. All air flows are listed at 70°F & 14.7 psia.

* Ratio of tube Outlet I.D. to Inlet I.D.

** Floats marked require a minimum of 30 psig operating back pressure for satisfactory operation on Gas Service.

Model 3623, Size 7,8,10, flanged meter, Vertical Inlet, Horizontal Outlet Pressure Rating is determined by flanges.

Model 3621, Size 12,13,15, flanged meter, Vertical Inlet, Horizontal Outlet Pressure Rating is determined by flanges.

Model 3622, Size 7,8,10 Threaded Connection, Vertical Inlet, Horizontal Outlet Pressure Rating: 1500 psig @ 200°F.

Model 3633, Size 7,8,10, flanged meter, Horizontal Connections, Pressure Rating is determined by flanges.

Model 3634, Size 7,8,10 Socketweld, Horizontal Connections, Pressure rating: 1500 psig @ 200°F.

Model 3635, Size 7,8,10, Threaded, Horizontal Connections, Pressure Rating: 1500 psig @ 200°F.

(Model 3620-30)

Dimensions (For certified dimension prints, write to factory.)

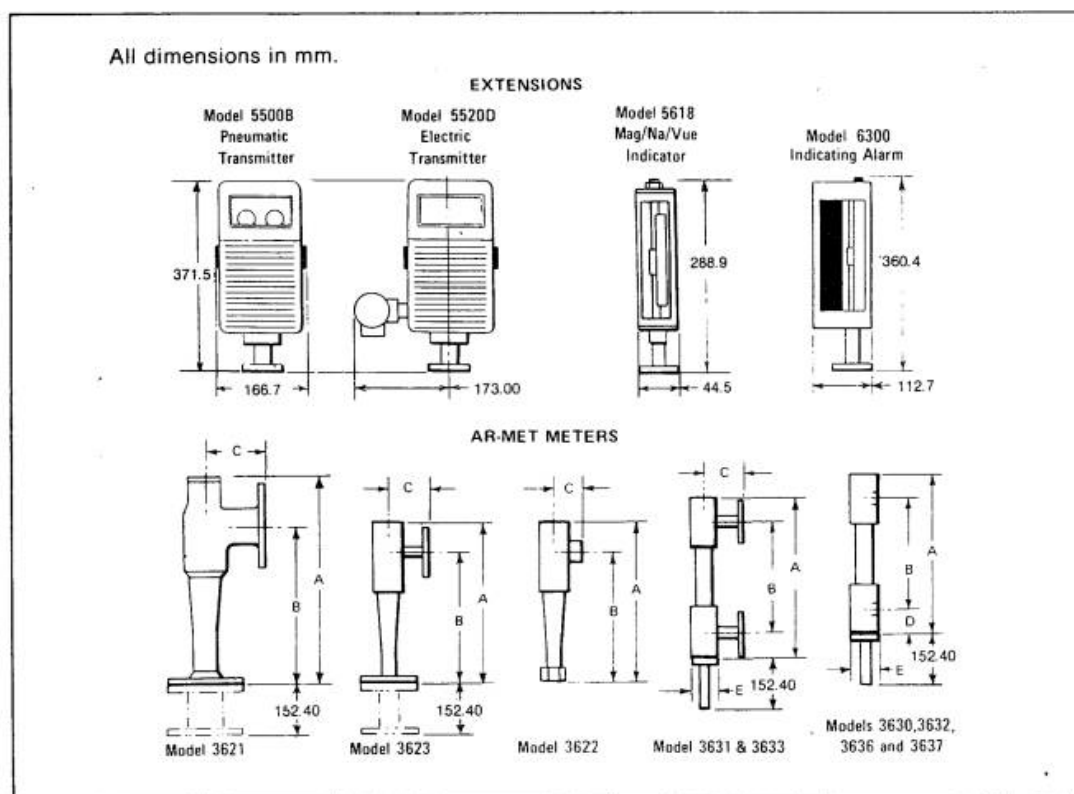
Model Number	Meter Size	Conn. Size (Inches)	A in mm	B in mm	C (in mm)				D in mm	E in mm	Max. Working** Pressure of Meter Body (PSI at 200°F)
					150 lb.	300 lb.	600 lb.	1500 lb.			
3623* (flgd.)	7, 8 & 10	1	355.6	317.5*	88.9	101.6*	114.3	127			up to 1500
3621* (flgd.)	12	1½	402.8	368.3*	101.6*	114.3*	120.7	139.7			up to 1500
	13	2	449.3	393.7*	114.3*	127	146.1	165.1			
	15	3	525.5	457.2*	139.7*	152.4*	177.8	203.2			
	16	4	466.7	385.6	165.1	177.8	203.2	241.3			
	18	6"	584.2	419.1	203.2	215.9	266.7	317.5			up to 1500
3633 (flgd.)	7 & 8	½	365.1	279.4	88.9*	101.6*	108	127	47.6	50.8	up to 1500
	10	1									
3622 threaded	7 & 8	½	387.4	349.3		47.6					up to 1500
	10	1									
3632, 3637 (threaded)**** & 3630, 3636 (socket weld)****	7 & 8	½	317.5	228.6					44.5	50.8***	3620 & 3632
	10	1	419.1	288.9					65.1	76.2	up to 3000
	12	1½	419.1	288.9					65.1	101.6	3636 & 3637
	13	1½	419.1	288.9					65.1	101.6	up to 6000
3635 (threaded)	7 & 8	½	365.1	279.4					47.6	50.8	up to 1500
	10	1									

* Dimensions are those recommended by ISA RP-16.2

** For higher ratings, write to factory. Maximum working pressure for the meter is determined by the flange rating or the meter body rating, whichever is lower.

*** 3000 lb. rating. 'C' dimension for 600 lb. rating is 3 inches.

**** Limited availability.



Note: Models 3621, 3622, & 3623 require 6" clearance for float extension on inlet end. When meter is furnished with surge springs, a longer spool piece may be required. Consult factory.

Specifications

PERFORMANCE

Industrial Accuracy: Meter specified to have an accuracy of +2% of maximum scale from 100% down to 10% of scale reading. Conforms to ISA R.P. 16.2, Spec. 2-S-10. Calibrated Accuracy: Meter specified to have an accuracy of +1% of maximum scale from 100% down to 10% of scale reading. Conforms to ISA R.P. 16.2, Spec. 1-S-10.

RATINGS

Maximum non-shock pressure vs temperature for ANSI standard pipe flanges. Maximum recommended working pressure is determined by the flange rating or the meter rating, whichever is lower.

Flange Rating	Steel (PSIG at indicated temperature)					
	100°F	200°F	300°F	400°F	500°F	600°F
150 lb.	285	260	230	200	170	140
300 lb.	740	675	655	635	600	550
600 lb.	1480	1350	1315	1270	1200	1095

Flange Rating	316 Stainless Steel					
	100°F	200°F	300°F	400°F	500°F	600°F
150 lb.	275	240	215	195	170	140
300 lb.	720	620	560	515	480	450
600 lb.	1440	1240	1120	1030	955	905

Note: For 3620-30 meters cooling fins are required for temperatures over 500° below 32°F

MAXIMUM WORKING PRESSURE OF METER BODY ONLY

Meter Size	7	8	10	12	13	15	16
PSI at 200°F	1500	1500	1200	1500	1000	1350	1100

MAXIMUM TEMPERATURE- 1000° F

RANGE — 10 to 1 (5 to 1 in lined meters).

REPEATABILITY — 0.5% full scale.

LINEARITY — Within 1%

Optional Equipment

Transmitting Extensions:
Indicating Pneumatic (See Bulletin DS 5500)
Indicating Electrical (See Bulletin DS-5520)

Indicating Extensions:
Model 5510 Indicator and Model 5618 Mag/Na/Vue

Indicating Alarm Extension:
Model 6300 (For Size 8 and larger only)

Inlet Spool Pieces:
Carbon Steel and 316 Stn. Stl. (Standard)

Special Flange Facings:
Flat Face, Ring Joint, Tongue and Groove

Inverted Meters for Steam Service

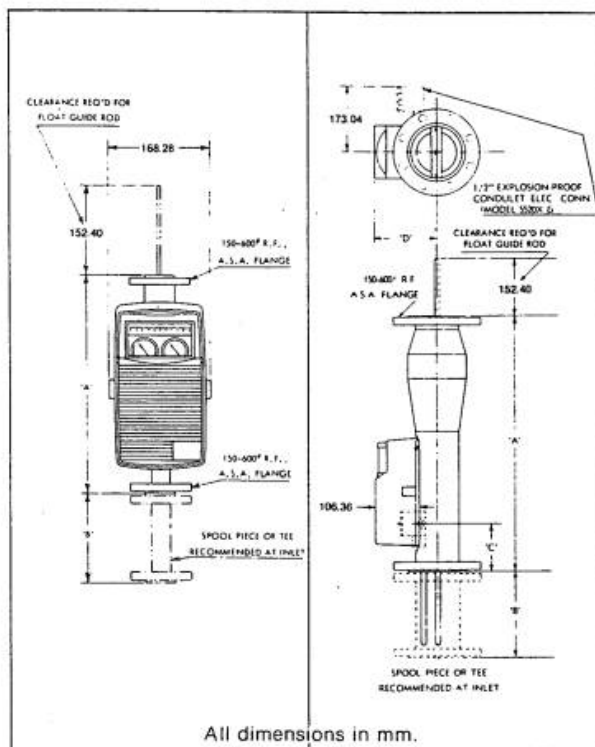
Ordering Information

To order, please specify:

1. Model number and size of rotameter
2. Connection arrangement and orientation
3. Materials of construction
4. Scale data and float type required
5. Options if desired
6. Complete flow metering data:
Type of fluid
Maximum, minimum, normal flows
Temperature, pressure
Viscosity, specific gravity
Maximum allowable pressure drop

Dimensions and Weights (For Certified Prints, Write to factory)
(Model 3611)

Meter Size	Conn. Size	Dimensions in mm				Approx. Wt. (Kgs)	
		A	B	C	D	Meter only	Gross weight
7	1"	368.3	152.4	135	114	7.25	11.34
8	1"	368.3	152.4	135	114	7.25	11.34
10	1"	374.7	152.4	135	122	8.16	18.14
12	1½"	412.8	152.4	162	132	9.07	20.41
13	2"	419.1	152.4	167	141	15.88	22.68
15	3"	596.9	152.4	157	146	27.22	38.56
16	4"	673.1	152.4	106	159	34.02	54.43



All dimensions in mm.

IE Metal Tube Rotameters

VARIABLE AREA FLOWMETERS – METAL TUBE

Description

The IE Model 3809 Metal Tube Rotameter is a rugged, all metal flow meter. Indication is provided by means of a magnetic coupling where a magnet, encapsulated in the float, is coupled to a rotary magnet in the rear of the indicator, thus turning the dial indicator mounted on the meter. Optional alarm and Electrical Transmitters are also available. (Refer DS 5000 for Transmitters).



IE METAL TUBE ROTAMETERS

Design Features

- Straight through flow path construction
- No float extension outside meter body
- No spools required
- Flanged connections
- Easy to read scale graduated in flow units
- Permanent magnetic link between metering float and indicator

Specifications

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

Performance

Standard Accuracy: +2% Full Scale Optional Accuracy: +1% Full Scale Repeatability 0.5% Full Scale

Flanges

Standard: 316 SS Optional: Steel, 316L SS, HASTELLOYS C, 304 SS, 321 SS

Instrument Case

Standard: Die cast aluminium with Neoprene gasket Optional: Epoxy painted

Limit Switches

Two electronic limit switches can be installed in the indicator of the Model 3809 to allow initiation of signalling or switching functions on pre-set flow values. The limit switch operates using a slot initiator that is inductively actuated by an interrupter mounted on the pointer spindle. Any flow value can be used for setting the limit value by rotating the interrupter around the spindle. Technical Data LIMIT SWITCH POWER SUPPLY: 8 Vdc ACTIVE AREA CLEAR: >2.2mA ACTIVE AREA OBSCURED : < 1mA SELF-INDUCTANCE: 160 H (only relevant for hazardous operation) SELF-CAPACITANCE: 40nF (only relevant for hazardous operation) AMBIENT TEMPERATURE: -25 to 100°C PROTECTION CATEGORY: IP65 Electrical characteristics in conformance with DIN 19 234 or NAMUR.



Threaded

Flange face

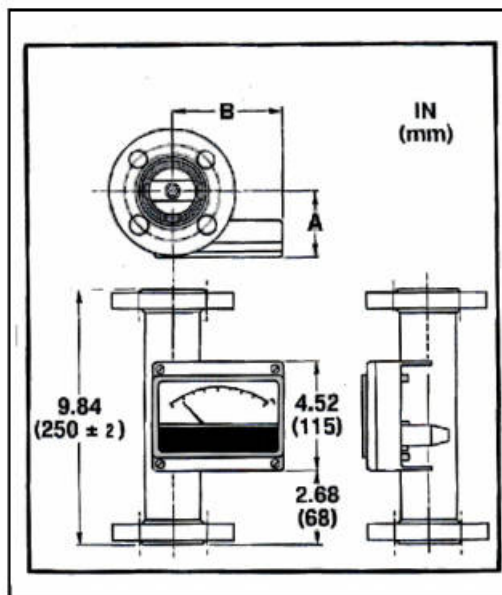
REPRESENTATIVE CONFIGURATIONS

Capacities

Size	FLOAT #	Maximum Flow Capacity		Pressure Drop
		WATER LPM	AIR SLPM ¹⁾	
7	287A	0.19	5.88	40
	287	0.33	10.2 ²⁾	40
	288A	0.60	18.6	38
	288	0.95	29.7 ²⁾	38
	289	1.83	56.9 ²⁾	38
8	283	3.5	109.3 ²⁾	30
	284	5.5	171.3 ²⁾	36
	285	9.5	295.1 ²⁾	38
	286	15	465.6 ²⁾	38
10	279	18.92	569	40
	290	28.33	884	40
	280	37.83	1,212	42
	281	53.33	1,653	42
12	275	80	2,463	55
	276	108.33	3,341	67
	277	150	4,616	78
	278	191.67	5,947	100
13	271	225	6,910	70
	272	266.67	8,269	78
	273	308.33	9,515	82
	274	416.67	12,915	105
15	308A	500	15,533	123
	308B	666.67	20,717	142
16	308C	833.3	25,900	170
	308D	1,000	31,067	210

¹⁾Air flows are given at 14.7 psia, 70°F

²⁾Range 5:1



Connection Size	A	B
1/2"	55mm	80mm
1"	65mm	100mm
1-1/2"	75mm	110mm
2"	80mm	115mm

Figure 1 Dimensions

IE Sho-Flo Glass Tube Purge Flow meters

VARIABLE AREA FLOWMETERS – LOW-COST / PURGE

Description

IE Sho-Flo Flow Meters are economical means of Flow rate indication. These flow meters are ideal for Purge Service, Seal oil systems, bearing lubrication and cooling water flow indication. They are available only in standard materials of construction.



IE SHO-FLO GLASS TUBE PURGE FLOW METERS

Design Features

- Ten to one rangeability
- Side Plate Construction
- Detachable direct reading scales
- Heavy wall, precision bore, borosilicate glass metering tube
- Interchangeability of tubes and floats
- Tube sealed on compression gasket by threaded seal spindle
- Tube removable without requiring disassembly of flow indicator
- Piping connections rotatable through 360° at 90° intervals
- Easily panel mounted
- Optional needle control valves and flow controllers

Specifications

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

Performance

Standard accuracy: 1350 - + 10% of Full Scale; 1355 - + 5% of Full Scale Repeatability Within 1/2% of instantaneous reading for Model 1350 and 1/4% of instantaneous reading for Model 1355

Materials Of Construction

METERING TUBES: Borosilicate glass FLOATS: 316 SS, Glass and Tungsten Carbide END FITTINGS: Brass, 316SS, Aluminium SIDE PLATES: Std. Black Anodised (Aluminium) OPTIONAL: 316 Stn. Stl. TUBE PACKING: Neoprene & Viton FLOAT STOPS: Teflon SAFETY SHIELDING: Clear Plastic Connections Threaded – 1/8" or 1/4" connections with optional lock nuts. Optional Equipment Integral needle control valves Integral flow controllers Flush mounting plastic bezel Multi-tube Construction up to 3 tubes Sho-Flo Glass Tube Purge Rotameter Visit us at : www.ieflowmeters.com



Meter body With valve Flanged top

REPRESENTATIVE CONFIGURATIONS

Table 1 – Capacities 1350

METER SIZE	FLOAT MATERIAL	WATER (CC/MIN)	MAX. FLOWRATE AIR (SCFH)
2	GLASS	13.5	1.34
	316 SS	38	2.9
4	GLASS	73	7.5
	316 SS	210	13.5
5	GLASS	110	11.5
	316 SS	320	25
6	GLASS	420	46
	316 SS	750	80

Table 2 – Capacities 1355

METER SIZE	TUBE NO.	FLOAT MATERIAL	MAX. FLOW RATE			
			WATER (CC/MIN.)	AIR (SLPM)	HYDROGEN (SLPM)	HELIUM (SLPM)
2	R-2-15-AAA	GLASS	0.537	0.049	0.102	0.0444
		316 SS	2.49	0.146	0.322	0.144
		CARBOLOY	4.90	0.245	0.594	0.263
	R-2-15-AA	GLASS	1.11	0.096	0.209	0.916
		316 SS	4.93	0.265	0.631	0.293
		CARBOLOY	9.33	0.43	1.12	0.533
	R-2-15-D	GLASS	5.75	0.37	1.03	0.491
		316 SS	20.60	0.82	2.52	1.39
		CARBOLOY	33.20	1.22	3.88	2.28
	R-2-15-A	GLASS	18.30	0.95	2.63	1.54
		316 SS	52.10	1.90	5.57	3.42
		CARBOLOY	81.80	2.80	8.20	5.16
	R-2-15-B	GLASS	52.80	2.35	8.01	5.02
		316 SS	133.00	4.6	15.90	10.30
		CARBOLOY	199.00	6.6	22.90	14.90
	R-2-15-C	GLASS	84.60	3.8	12.90	8.00
		316 SS	218.00	7.6	26.10	16.70
		CARBOLOY	326.00	10.4	37.60	24.40
6	R-6-15-A	GLASS	200.00	8.6	29.90	19.20
		316 SS	493.00	16.4	58.90	38.30
		CARBOLOY	726.00	23.0	83.30	55.20
	R-6-15-B	GLASS	573.00	23.5	85.90	55.30
		316 SS	1350.00	43.0	160.00	109.00
		CARBOLOY	1950.00	60.0	222.00	152.00

NOTE: All airflows given are at 14.7 PSIA and 70°F

Specifications subject to change without notice

IE-Mite Plastic Body Purge Rotameter

VARIABLE AREA FLOWMETERS – LOW-COST / PURGE

Description

IE Mite Purge Rotameter is designed for general non-corrosive service as a practical approach to low flow rate indication at lowest cost. The tapered metering tube (Sizes 1-8) is integrally machined in the plastic body. A standard direct reading scale engraved on the body affords maximum simplicity of installation and operation. The IE Mite meter is ideal for non-critical purge applications where high accuracy of flow measurement is not required.



IE-MITE PLASTIC BODY PURGE ROTAMETER

Design Features

- O-ring seal prevents overstressing of body
- Scales directly etched in meter body
- Inert to a wide range of chemical agents
- High impact strength meter body
- Multi-tube construction

Materials Of Construction

Meter: Acrylic Plastic Fittings: Brass, 316 stainless steel
Floats: Spherical Pyrex Glass, 316 Stn. Stl. O-rings: Neoprene

Performance

Standard Accuracy: + 10% of full scale Calibrated Accuracy: + 5% of full scale Reproducibility Within 1% of instantaneous reading Scale length Sizes 1-7 ... Nominal, 37 mm Sizes 8... Nominal, 65 mm Graduations Direct reading; standard scales for air and water. Millimeter or arbitray, with air or water calibration curves.



REPRESENTATIVE CONFIGURATIONS

Capacities Table

Meter Size	Float Material	Air		Water	
1-38	Glass	38	SCCM		
1-38	Stn. Stl.	189	SCCM		
2-38	Glass	944	SCCM	16	CCM
2-38	Stn. Stl.	2.12	SLPM	50	CCM
4-38	Glass	4.72	SLPM	90	CCM
4-38	Stn. Stl.	8.5	SLPM	250	CCM
6-38	Glass	23.6	SLPM	650	CCM
6-38	Stn. Stl.	42.5	SLPM	1.2	LPM
7-38	Stn. Stl*.	106.2	SLPM	3.47	LPM
8-75	Stn. Stl.	184.06	SLPM	7.57	LPM
8-75	Stn. Stl.	283.17	SLPM	11.36	LPM
8-75	Stn. Stl.	424.76	SLPM	17.03	LPM

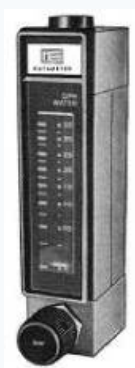
*Plumb Bob

IE-MITE "37" Low Flow Armored Flowmeter

VARIABLE AREA FLOWMETERS – LOW-COST / PURGE

Description

The IE Ar-Mite "37" is a low-flow, low-cost metal tube flowmeter with all-wetted parts of 316 stainless steel. The magnetically-coupled indicator is housed in a high-impact, polyester housing. The unit is designed as a practical and economical approach to low flow rate indication for liquids and gases where glass tube meters are undesirable because of high pressure or difficult to handle fluids.



IE-MITE "37" LOW FLOW ARMORED FLOWMETER

Design Features

- All-wetted metal parts 316 Stainless Steel
- Impact resistant, polyester housing
- Front panel mounting
- Compact Size

Scales

Nominal length – 65 mm Types – direct-reading scales in English or metric units for air at STP or water, millimetre reference with air or water calibration data sheet.

Connections

1/4" Female NPT – Horizontal Inlet and Outlet

Accuracy

Standard accuracy + 10%, full scale

Repeatability

Within 2% of instantaneous reading.

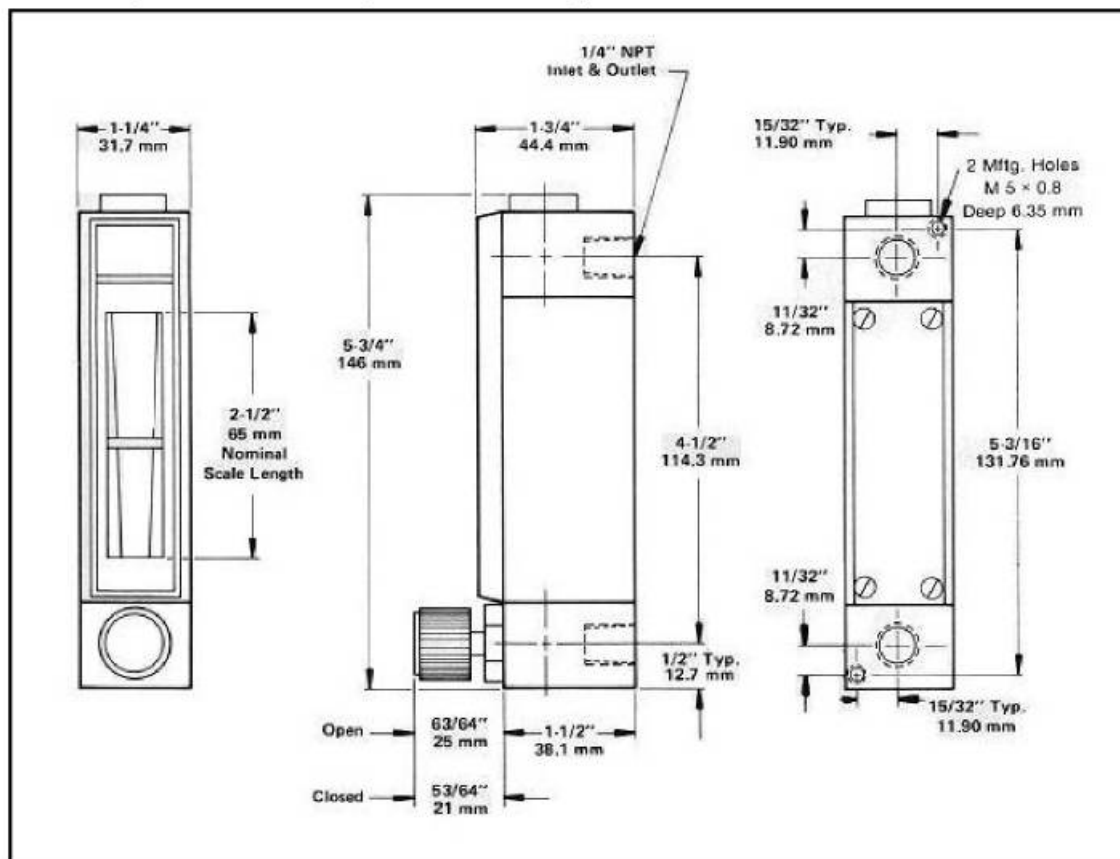
Materials Of Construction

METER TUBE, FITTINGS, CLEAN-OUT PLUG, FLOAT STOP – 316 Stainless Steel HOUSING – Glass-Fitted Polyester FLOAT – 316 Stainless Steel (integral magnet) VALVE PLUG OR OPTIONAL VALVE – 316 Stainless Steel O-RINGS – Standard – Viton, Optional – Neoprene Optional Equipment IE Line III Valve – Inlet only Integrally-piped flow controller for constant upstream or Special Scales.

Meter Size	Flow Range					
	Water		Air ++			
	gph	lph	scfh	m3n/h	in/h	Slpm
1	.035-.35	.13-1.3	.2-2.2	--	5.7-57	.1-1.0
2	.095-.95	.36-3.6	.5-5	--	13-130	.2-2.3
3	.28-2.8	1-10.6	1.3-13	.034-.34	--	.6-6.0
4	.55-5.5	2.1-21	2.4-24	.063-.63	--	1.1-11
5	1.1-11	4.2-42	5.5-55	.14-1.44	--	2.6-26

++ Capacities are at metering conditions of 70 °F (21.1 °C)

Dimensions (For certified dimension prints, write to factory.)



Specifications subject to change without notice.

IE 5522T Indicating Electrical Transmitter

VARIABLE AREA FLOWMETERS – ACCESSORIES

Description

The IE Model 5522T Electrical Transmitters provide local flow rate indication and remote electrical signals linear with flow rate for various types of process instrumentation. They can be used with IE Metal Tube and Glass Tube Rotameters, and can be either extension-mounted or close-coupled on the meter. The Model 5522T is normally furnished in one of several complete electrical transmitting systems; compatible with all commonly used dc milliamp and millivolt process instrumentation. It can also be furnished in a low-cost, direct input system for ac null balance recorders. Each system includes a transmitter and the necessary solid-state electronic equipment to provide the proper signal range for the associated display or control instrumentation. A flowmeter is normally specified as part of the system. Flowmeter and transmitter are calibrated together and shipped as an assembly package.



IE 5522T INDICATING ELECTRICAL TRANSMITTER

Design Features

- Analog output signal exactly linear with flow rate
- Reliable operation - direct local flow rate indication on a 4-1/2" scale, independent of electrical power and transmitted signal
- Loop powered 2 wire design with 4-20 mA dc flow signal
- Convenient field calibration check without interrupting fluid flow
- Unaffected by vibration; suitable for wide ambient temperature ranges or corrosive environments
- Electrical mechanism can be removed with flowmeter on stream, without disturbing local flow rate indication
- Superior flowmeter float motion translating and linearizing system - no linkages or linearity adjustments
- Interchangeable with other IE flowmeter alarm signalling, indication, and pneumatic transmission functional accessories
- Transmitter and field-mounted electronics designed in accordance with IS-2148-1981 recommendations for explosion proof Groups iiA, iiB requirements
- Dust-tight, weather proof case (IP-65, IS-2147-1962)
- A wide range of options for both transmitters and transmitter systems is available

The IE Model 5522T Electrical Transmitters consist of a magnetically actuated indicating mechanism and a split differential transformer with a movable core. A magnet mounted in the flowmeter's float or float extension turns a magnetic position converter which includes an iron helix in an aluminium mandrel. The leading edge of this helix is continuously attracted by the magnet so that the converter rotates as the float moves up and down. There is no physical linkage between the flowmeter float and the position converter to affect the flowmeter's accuracy. A pointer fixed to the position converter indicates float position (instantaneous flow rate) on the horizontal indicating scale. The transmitter section consists of a modified (split) differential transformer and a magnetic cam characterized in accordance with flow data. A constant ac voltage excites the differential transformer's primary. The position converter system imparts a rotary motion to the cam, changing its position within the active coil winding. The resulting output voltage from the secondary winding is directly proportional to the flow through the flowmeter. The constant ac voltage for the transformer's primary is obtained from an associated power supply, a preamplifier-oscillator, or an ac recorder.

E:mail::sales@ieflowmeters.com Model 5522T Indicating Electrical Transmitter





Model 5522T
Indicating Electrical Transmitter

Specifications

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

Electrical Classification:

CMRS approved explosion proof for Groups iiA, iiB and intrinsically safe for Groups iiA, iiB and iiC

Range:

10% to 100% of maximum flow

Accuracy:

±2% of full scale (standard)

±1% of full scale (optional)

Sensitivity and Repeatability:

±1% of full scale

Indicating Scale:

4-1/4" active length. Calibrated in any standard units of gravimetric or volumetric flow, 10 to 100% of flow or arbitrary graduations with calibration curve. 10 to 1 range (standard) others are optional.

Ambient Temperature Limits:

-17°C to 65°C (0°F to 150°F)

Ambient Relative Humidity:

Maximum 90%

Output:

4-20 mA dc

Response Time:

0.7 seconds

Supply:

24 Vdc ± 10%

Maximum Load (including line resistance):

600 ohms

Maximum working pressure (for extension wells only when used with 3620 series):

Standard - 1500 psig up to 200°F

Optional - 3000 or 6000 psig up to 200°F

NOTE: Refer to the appropriate meter specification for the pressure limits of the flowmeter.

Materials of Construction:

Case - Aluminium

Window - Glass

Gasket - Silicone sponge

Paint - Precision tan

Extension well - 316 Stainless steel including purge line and adapter

Compatible IE Equipment:

Glass tube Rotameters - Refer to DS-1110-1140 for complete details.

Metal tube Rotameters - Refer to DS-3611-3620-3630 for complete details.

Optional Equipment:

Electrical heating, steam tracing of extension well, cooling (or radiating) fins or case air purge.

ORDERING INFORMATION

To order, please specify:

1. Model number
2. Type of flowmeter
3. Connection arrangement and orientation
4. Quantity required
5. Minimum, normal and maximum operating temperature
6. Minimum, normal and maximum operating pressure
7. Minimum, normal and maximum flow rate
8. Wetted material
9. Type of Fluid
10. Unusual system conditions
11. Units of registration
12. Options if desire

FLUID TEMPERATURE GUIDE				
Model	Standard	Low Temperature	High Temperature	Ultra High Temperature
5522T Close Coupled (3611/1100)	33 – 250°F	0 – 32°F	251 – 400°F	401 – 500°F
5522T Extension Mounted (3620 Series)	33 – 250°F	0 – 32°F	351 – 450°F	451 – 700°F

IE Model 5850E Mass Flow Controller

MASS FLOWMETERS & CONTROLLERS

Description

The IE Model 5850E Mass Flow Controller accurately measures and controls gas flows. The heart of the system is the removable flow sensor which produces an electrical output signal linear with flow rate used for indicating, recording and/or control purposes. It eliminates the need for continuous monitoring and readjustment of gas pressures to provide a stable gas flow.



IE MODEL 5850E MASS FLOW CONTROLLER

Design Features

- Improved response for low command changes
- Easy maintenance
- Fast flow response to command changes
- Negligible flow overshoot/undershoot
- Removable sensor
- Insensitive to mounting attitude
- Wide flow range (up to 30 slpm N₂)
- End accessible zero and span potentiometers
- Jumper selectable response time
- Electrically activated valve override
- Jumper selectable external valve control
- Low command flow cutoff
- Normally closed valve
- Mechanically and electrically compatible with other mass flow controllers
- Corrosion resistant valve available

Principle Of Operation

The operating principle of the IE Mass Flow Controller is thermodynamic. A precision power supply directs heat to the midpoint of the sensor tube carrying a constant percentage of the flow. On the same tube equidistant upstream and downstream of the heat input are resistance temperature measuring elements. With no flow, the heat reaching each temperature element is equal. With increasing flow, the flow stream carries heat away from the upstream element, T₁, and an increasing amount towards the downstream element, T₂. An increasing temperature difference develops between the two elements, and this difference is proportional to the amount of gas flowing or the mass flow rate. A bridge circuit interprets the temperature difference and an amplifier provides the output to the control circuitry as well as a 0-5 Vdc output signal. The control circuitry compares the command setpoint to the flow signal and positions the precision solenoid control valve. When the command signal is below 2% of full scale, the control valve is positioned to fully closed. The control

SPECIFICATIONS

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

Flow Ranges

Any range from zero to 3 sccm** to zero to 30,000 sccm nitrogen equivalent

**Standard pressure and temperature in accordance with SEMI (Semiconductor Equipment and Materials Institute) proposed standard: 0°C and 101 kPa (760 Torr.)

Performance

Accuracy: $\pm 1\%$ full scale including linearity at calibrated conditions. $\pm 1.5\%$ full scale for flow rates greater than 20 slpm.

Repeatability

0.25% of rate

Response Time

Standard less than 3 seconds to within 2% of full scale of final value for a 0 to 100% command changes

Control Range

50 to 1

Sensitivity to Mounting Attitude

$\pm 0.5\%$ F.S. maximum deviation from specified accuracy after rezeroing.

Temperature Sensitivity

Zero: to Less than $\pm 0.075\%$ F.S. per degree C
Span: Less than $\pm 1.0\%$ F.S. shift from original calibration over 10-50°C range (50-122°F)

Pressure Sensitivity

$\pm 0.03\%$ per psi up to 200 psig (N₂)

Command Input Voltage

0 to 5 VDC (200 K ohms input resistance)

Output Signal

0 to 5 Vdc into 2000 ohms (or greater) load.

Max. Operating Pressure

1500 psig; 5-50 psid pressure drop (minimum pressure drop depends on gas and range)

Temperature, Ambient/Gas

41 to 149°F (1 to 65°C)

Leak Integrity

1×10^{-9} atmosphere cc/sec. Helium

Power Requirements

+15 Vdc ($\pm 5\%$) at 35 mA dc
-15 Vdc ($\pm 5\%$) at 180 mA dc
3.5 watts power consumption

Materials of Construction

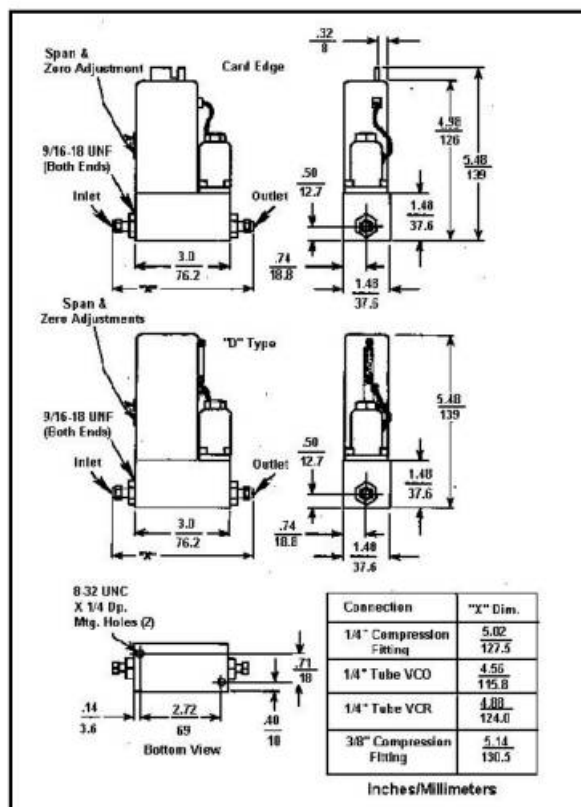
Wetted Parts – Standard: Stainless Steel with Viton.
Optional: Kalrez or Buna-N.

Connections

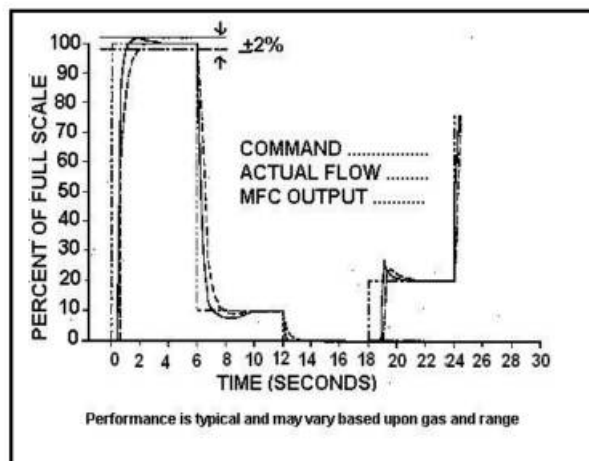
Standard 9/16-18 UNF with Stainless Steel
Compression Fittings: Optional: VCO and VCR.

Electrical Connections

Card Edge connector (gold plated) or
D-type, 15-pin connector (DA-15P).



Dimensions



Model 5850E Performance Curve 1 slpm N₂ @ 25 psig

Specifications subject to change without any notice.

MASS FLOWMETERS & CONTROLLERS

Description

The IE Model 5851E Mass Flow Controller accurately measures and controls gas flows. The heart of the system is the removable flow sensor which produces an electrical output signal linear with flow rate used for indicating, recording and/or control purposes. It eliminates the need for continuous monitoring and readjustment of gas pressures to provide a stable gas flow.



IE MODEL 5851E HIGH FLOW MASS FLOW CONTROLLER

Design Features

- Improved response for low command changes
- Easy maintenance
- Fast flow response to command changes
- Negligible flow overshoot/undershoot
- Removable sensor
- Insensitive to mounting attitude
- Wide flow range (up to 100 slpm N₂, 200 slpm H₂)
- End accessible zero and span potentiometers
- Jumper selectable soft start
- Electrically activated valve override
- Jumper selectable external valve control
- Low command flow cut-off
- Normally closed valve
- Corrosion resistant valve

Principle Of Operation

The operating principle of the IE Mass Flow Controller is thermodynamic. A precision power supply directs heat to the midpoint of the sensor tube carrying a constant percentage of the flow. On the same tube equidistant upstream and downstream of the heat input are resistance temperature measuring elements. With no flow, the heat reaching each temperature element is equal. With increasing flow, the flow stream carries heat away from the upstream element, T₁, and an increasing amount towards the downstream element, T₂. An increasing temperature difference develops between the two elements, and this difference is proportional to the amount of gas flowing or the mass flow rate. A bridge circuit interprets the temperature difference and an amplifier provides the output to the control circuitry as well as a 0-5 Vdc output signal. The control circuitry compares the command setpoint to the flow signal and positions the precision solenoid control valve. When the command signal is below 1% of full scale, the control valve is positioned to fully closed. The control valve can be latched fully open or closed by activating the valve override circuit.

SPECIFICATIONS

WARNING: Do not operate this instrument in excess of the specifications listed below.

Flow Ranges

Any full scale flow rate from 10 slpm** to 100 slpm nitrogen equivalent, up to 200 slpm H₂.

**Standard pressure and temperature in accordance with SEMI (Semiconductor Equipment and Materials Institute) standard: 0°C and 101 kPa.

Ratings

Maximum Operating Pressure 1500 psig, 10-50 psid pressure drop (minimum pressure drop depends on gas range)

Temperature: Ambient/gas 40 to 150° F (5 to 65° C)

Performance

Accuracy: $\pm 1\%$ full scale including linearity at calibrated conditions.

Repeatability

0.25% of rate

Response Time

Less than 3 seconds to within 2% of full scale of final value for a 0 to 100% command change.

Control Range

50 to 1

Sensitivity to Mounting Attitude

$\pm 0.5\%$ F.S. maximum deviation from specified accuracy after rezeroing.

Temperature Sensitivity

Zero: to Less than $\pm 0.075\%$ F.S. per degree C
Span: Less than $\pm 1.0\%$ F.S. shift from original calibration over 10-50°C range.

Pressure Sensitivity

$\pm 0.03\%$ per psi up to 200 psig (N₂)

Command Input Voltage

0 to 5 VDC (200 K ohms input resistance)

Output

0 to 5 Vdc into 1000 ohms (or greater) load. Maximum ripple 3mV.

Leak Integrity

1×10^{-9} atmosphere scc/sec. Helium

Power Requirements

+15 Vdc ($\pm 5\%$) at 350 mA dc
-15 Vdc ($\pm 5\%$) at 350 mA dc
10.5 watts power consumption

Materials of Construction

Wetted Parts – Standard: Stainless Steel with Viton.
Optional: Kalrez or Buna-N.

Connections

Standard 9/16-18 UNF with Stainless Steel
Compression Fittings: Optional: VCO and VCR.

Electrical Connections

Card Edge connector (gold plated) or
D-type connector (DA-15P).

Dimensions

See Figure 2.

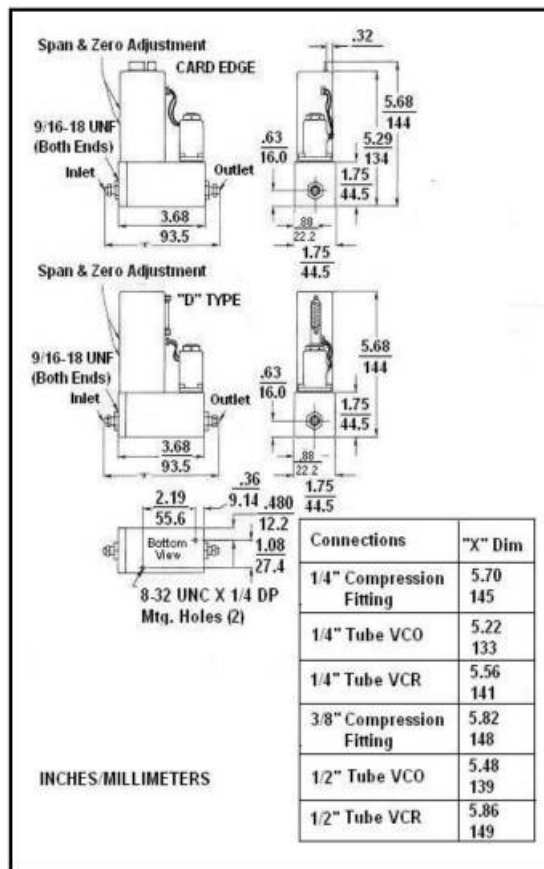
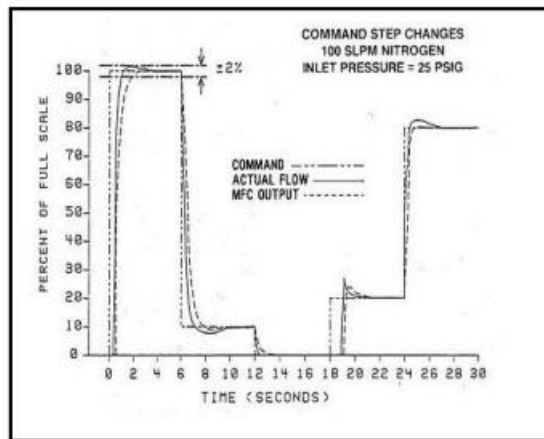


Figure 2. Dimensions



Model 5850E Performance Curve 1 slpm N₂ @ 25 psig

Specifications subject to change without any notice.

IE Model 5860E Mass Flowmeters

MASS FLOWMETERS & CONTROLLERS

Description

The IE 5860E Mass Flow meter is a mass flow instrument for accurately measuring gas flows. The heart of the system is the flow sensor which produces an electrical output signal linear with flow rate used for an electrical output signal linear with flow rate used for indicating and/or recording. Many options are offered to provide a versatile system of mass flow measurement.



IE MODEL 5860E MASS FLOWMETERS

Design Features

- Mass flow measurement
- Fast Response – flow signal less than 3 seconds to 98% of final value
- +1% full scale accuracy including linearity
- Flow Rates – 0-3 sccm to 0-30 slpm
- Repeatability - +0.25% of rate
- Linear 0-5 Vdc output signal
- All wetted parts are 316 Stainless Steel
- Sensor has no moving parts
- All solid state electronics
- Compact
- Removable sensor
- Insensitive to mounting attitude

Principle Of Operation

The operating principle of the IE Mass Flowmeter is thermodynamic. A wire wound heating element directs heat to the midpoint of the bypass sensor tube. A predetermined portion of the total flow, flows through the bypass sensor tube. On the same tube, equidistant upstream and downstream of the heat input, are resistance temperature measuring elements. With no flow, the heat reaching each temperature element is equal. With increasing flow, the flowstream carries heat away from the upstream element, T1, and an increasing amount towards the downstream element, T2. An increasing temperature difference is proportional to the amount of gas flowing or the mass flow rate. A bridge circuit interprets the temperature difference and an amplifier provides the 0-5 Vdc output signal

Specifications

WARNING: Do not operate this instrument in excess of the specifications listed below. Failure to heed warning may result in serious personal injury or damage to equipment. . Model 5860E Mass Flowmeter

FLOW RANGES

3 sccm to 30 slpm* (nitrogen equivalent)

*Standard pressure and temperature in accordance with SEMI (Semiconductor Equipment and Materials Institute) standard: 0°C and 101.3 kPa (760 Torr.)

Ratings

Maximum Operating pressure: 4500 psi (31.03 Mpa)
Temperature: Ambient Operating 40 to 150°F (5 to 65°C)
Non-operating - 13 to +212°F (-25 to 100°C)

Performance

Accuracy: $\pm 1\%$ full scale including linearity at calibrated conditions. $\pm 1.5\%$ full scale including linearity for flow ranges greater than 20 slpm.

Repeatability

0.25% of rate

Response Time

Less than 3 seconds to within 2% of full scale of final value for a 0 to 100% flow step.

Useable Range

50 to 1

Sensitivity to Mounting Attitude

$\pm 0.5\%$ F.S. maximum deviation from specified accuracy after rezeroing.

Temperature Sensitivity

Zero: Less than $\pm 0.075\%$ F.S. per degree C
Span: Less than $\pm 1.0\%$ F.S. shift from original calibration over 10-50°C range

Power Supply Sensitivity

+ 0.09% full scale per % power supply voltage variation

Output Signal

0 to 5 Vdc into 3000 ohms (or greater) load. Maximum ripple 3 mV

Leak Integrity

1 x 10⁻⁹ atmosphere scc/sec. Helium

Power Requirements

+15 Vdc ($\pm 5\%$) at 35 mA dc
-15 Vdc ($\pm 5\%$) at 35 mA dc
10.5 watts power consumption

Materials of Construction

Fittings and Transducer Assembly – Wetted parts 316
Stainless Steel
O-rings and Gaskets – Standard: Viton*

Electrical Connections

D-type, 15-pin connector (DA-15P).

Dimensions

See Figure 2.

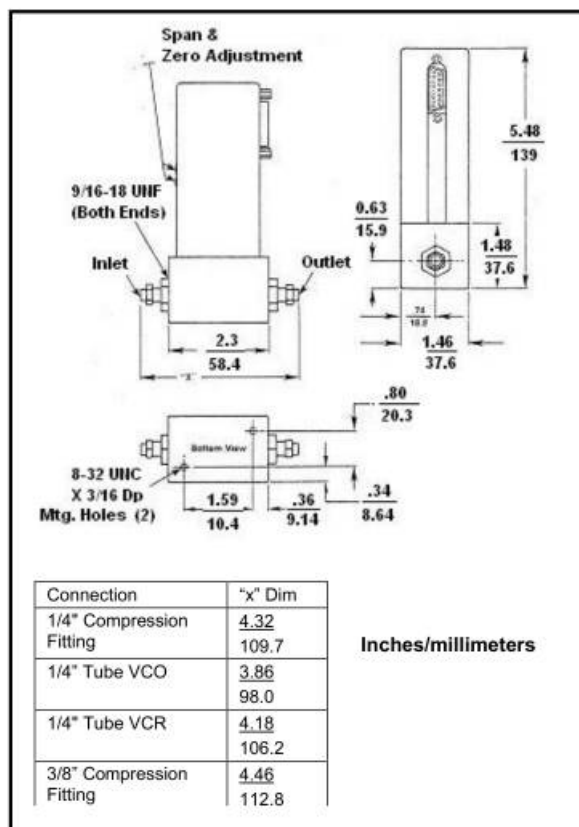


Figure 2 Dimensions

ACCESSORIES

Model 5821: Power supply to power up to 5 units
Model 5839: Digital Indicator
Model 5875: Power Supply/Indicator (upto 4 sensors)
Filters
Open Frame Power Supplies

ORDERING INFORMATION

1. Meter size
2. Liner material
3. Electrode material
4. Pressure and temperature requirements (ambient and process)
5. Flow rate (normal, maximum, minimum)
6. Electrical requirements
7. output(s) required
8. Liquid to be metered (name, conductivity)
9. Meter orientation (horizontal or vertical)
10. Accessories required

Specifications subject to change without any notice.

IE Mass Flow Secondary Electronics

MASS FLOWMETERS & CONTROLLERS

Description

IE Model 5896 Mass Flow Secondary Electronics powers, controls and indicates the flow rate of a single mass flow controller. The unit contains a dc power supply, an LED indicator and a command set-point potentiometer. The 3-1/2 digit LED indicator is adjustable to display flow as a percentage of maximum flow or in engineering units. The multi-turn potentiometer has a turns counter for accurately setting the flow command.



Design Features

- Panel mounting enclosure
- Field adjustable LED display in percent or engineering units
- Compatible with all IE mass flow controllers
- Remote output

Specifications

Caution: Do not operate this instrument in excess of the specifications listed below. Digital Indicator 3-1/2 digit LED, percentage or full scale or engineering units. Display Range 0.200 to 1999 with selectable decimal location. Display flashes to indicate overrange.

Accuracy

+0.5% +LSD Temperature Range - Ambient 0 to 50°C Power Input 220 Vac, 50 Hz (Standard). 115 Vac, 60 Hz (Optional) Power Output +15 Vdc +5% 300 mA - 15 Vdc +5% 300 mA Signal Inputs 0-5 Vdc flow signal from mass flow controller +5 Vdc reference Connections 15 pin sub-miniature 'D' connector for flow controller 3 pin ac power (2 meter power cord supplied) Command Potentiometer 10 turns with turns counter. 2,000 ohms +0.25% linearity, 0.1% resolution

Principle Of Operation

The 5896 provides dc power, a command signal to a single mass flow controller, and accepts the flow output signal for display. The power supply accepts 220/115 Vac and produces +15 Vdc to power the mass flow controller. The 0-5 Vdc command signal can be generated from the mass flow controllers 5 Vdc reference and the potentiometer on the 5896. The flow signal drives the LED display. The LED display is field adjustable to report flow rate in percent of full scale or engineering units.

Ordering Information

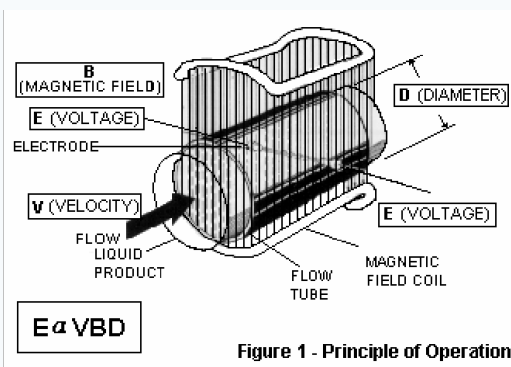
- Meter size
- Liner material
- Electrode material
- Pressure and temperature requirements (ambient and process)
- Flow rate (normal, maximum, minimum)
- Electrical requirements
- output(s) required
- Liquid to be metered (name, conductivity)
- Meter orientation (horizontal or vertical)
- Accessories required Specifications subject to change without any notice. Model 5896 Mass Flow Secondary Electronics

IE Mag-Cell Electromagnetic Flow Meters

MAGNETIC FLOWMETERS

Description

The IE Mag-Cell electromagnetic flow meter is a solid state, obstructionless, flow rate measuring device, which is capable of measuring a wide range of conductive liquids, clear or slurried. The Mag-Cell is comprised of two basic parts: a flow transmitter, which becomes a part of the pipeline, and a signal converter. A magnetic field is generated by compact high-density field coil mounted to a short section of straight pipe. As a conductive liquid passes through the pipe section and its magnetic field, a voltage is generated that is directly proportional to the velocity of the conductive liquid. The voltage induced is sensed by electrodes mounted at right angles to the magnetic field and in contact with the conductive liquid or slurry. The electrodes are insulated from the pipe by a non-conductive liner that encapsulates all wetted parts of the pipe. From the electrodes the voltage is transmitted to a signal conditioner where it is conditioned to the desired output signal(s). The IE Mag-Cell employs a keyed bi-directional D.C. field and digital electronics to establish new criteria in wide rangeability, high accuracy and low power consumption. Meter operation is independent of span setting. The Mag-Cell generates an open collector frequency (proportional to liquid velocity) of 10kHz at maximum flow rate. Convenient terminal connections are provided to permit local or remote verification of proper meter operation. Analog current and factored/scaled pulse outputs are available for integral or remote mounting.



IE MAG-CELL ELECTROMAGNETIC FLOW METERS

Design Features

- Stable Operation: Flow measurement is unaffected by changes in temperature, pressure, specific gravity, viscosity and/or conductivity above a minimum of 3 Micromhos/cm, over a wide range of ambient temperatures
- DC Magnetic Field: Bi-directionally driven magnetic field
- Automatic Zero - 75 times per sec
- Low Power Consumption
- Interchangeable Electronics
- Potted Coil Housing
- Separate Sealed Customer Wiring Compartment
- Digital Analog Span
- Accuracy: +0.5% of rate
- Compact wafer designed minimum lay length for ease of

Installation

- Light Weight
- Unobstructed flow and low pressure drop

Principle Of Operation

Magnetic flow meters can only be used to measure conductive liquids. In a magnetic flow meter, the liquid is the conductor. Operation of the magnetic flow meter is explained by Faraday's Law, which simply states "the voltage induced across any conductor as it moves at right angles through a magnetic field is proportional to the velocity of that conductor". Faraday's formula: $E = V \times B \times D$ Where: E = The voltage that is generated by the flow of the conductive liquid through the magnetic field of the flow meter. V = The average velocity of the conductive liquid through the cross section of the flow meter. B = The magnetic field strength generated by the field coils. D = The distance between the electrodes which detect the signal voltage (E) that is generated.



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As indicated in Figure 1, a magnetic field is constructed throughout the entire cross section of the flow tube. If this magnetic field is considered as the measuring element of the magnetic flow meter, it may be seen that the measuring element is exposed to the hydraulic conditions throughout the entire cross section of the flow meter.

LINER

The Mag-Cell Teflon liner insulates the electrodes and process liquid from the meter body to prevent the flow tube from short circuiting the flow generated signal voltage.

The Teflon liner affords maximum flexibility in process application as it is suitable for acids, caustics and mild abrasives.

ELECTRODES

The standard Mag-Cell electrode material is 316L Stainless Steel. Ultrasonic electrode cleaning option is not available. However, like the Mag-Flo, the Mag-Cell uses very high input impedance amplifiers. Therefore, coatings with resistance approaching 10 M Ohms on the Mag-Cell electrodes will not normally affect performance.

GROUNDING

Proper earth grounding is required to eliminate stray current and voltage that may be transmitted through the piping system and/or process liquid, or induced by electromagnetic fields in the same area as the magnetic flow meters. Grounding straps are provided with the Mag-Cell and must be properly connected to the mating piping flanges on each end of the Mag-Cell to assure a proper grounding path to the liquid.

MATERIALS OF CONSTRUCTION

Metering tube: 304 Stainless Steel

COIL HOUSING: Steel, Aluminium (½" & 1")

ELECTRONICS HOUSING: Die cast aluminium

PAINT AND PRIMER: Epoxy enamel, Zinc chromate primer, Maximum temperature approximately 93°C

LINER: Teflon, Maximum process temperature 149°C

ELECTRODES: Standard: 316L Stainless Steel; Optional: Tantalum, Titanium, Hastelloy C, Platinum-Iridium

CONNECTIONS

Mechanical: Wafer style ½" through 8" – See ratings below

ELECTRICAL: Two ¾" conduit openings

RECOMMENDED WIRE SIZE: Line power – 12 AWG, Signal – 18 AWG

SPECIFICATIONS

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

CAPACITIES: Meter range: 1 to 10 metres/second or 1 to 10 feet/second, jumper selectable with no special calibration required. (Refer to Table 1)

ACCURACY: System: ±0.5% of the rate from 1 unit per second to 10 units per second (1 unit = 1 foot or meter) ±0.005 units per second below 1 unit per second

Analog Output: Add ±0.1% full scale to above accuracy specifications.

REPEATABILITY: 0.25% of rate

PRESSURE LIMITS: 740 psig @ 40°C

TEMPERATURE: Ambient: -18 to 65°C; Process refer to Table 2

PRESSURE DROP: Equal to an equivalent piece of straight pipe.

MINIMUM CONDUCTIVITY: 3 Micromhos/cm

POWER REQUIREMENTS: Selectable by jumper plug – 115 Vac or 230 Vac, ±15%; 47-63 Hz; 10-30 Vdc

POWER CONSUMPTION: 15 Watts maximum

ANALOG OUTPUT: The span of the analog output (20mA dc) is selected using direct reading detent switches to set a maximum velocity for 20 mA dc output between 1.000 m/sec and 10.000 m/sec, regardless of meter calibration. The standard analog output is 4-20 or 0-20 mA dc into a 1000 ohm maximum load.

DIGITAL OUTPUT: The output option board can be set to provide a factored and/or scaled pulse output. Factoring, to convert to engineering unit output (GPM, LPM, M³/HR, etc.), is accomplished by dividing the pulse output frequency by 1.000 to 15.000 using direct reading detent switches (1.000 to F.000). Scaling is accomplished by setting field-selectable jumper for divide by 1, 10, 100, 1000 or 10,000.

Table 1 Capacity Table – Velocity-to-Flow Conversion Factors 0.15" to 8"

Table 1 Capacity Table – Velocity-to-Flow Conversion Factors 0.15" to 8"																
Meter			Flow in gpm Units = Feet						Flow in gpm Units = Meters						Guideline Flow 6 ft/sec	
Model	Size		1.000 ft/sec		10.000 ft/sec		Low Flow Cut- off ⁽¹⁾		1.000 m/sec		10.000 m/sec		Low Flow Cut- off ⁽¹⁾			
	In	mm	gpm	lpm	gpm	lpm	gpm	lpm	gpm	lpm	gpm	lpm	gpm	lpm	gpm	lpm
7481E	0.15	4	0.055	0.21	0.55	2.1	0.001	0.004	0.18	0.68	1.8	6.8	0.004	0.02	0.33	1.3
7482E	0.3	8	0.22	0.83	2.2	8.3	0.005	0.02	0.72	2.7	7.2	27	0.02	0.06	1.3	4.9
7485E	½	15	0.86	3.3	8.6	33	0.02	0.08	2.8	10.6	8	106	0.06	0.23	5	19
7401E	1	25	2.3	8.7	23	87	0.05	0.20	7	28	75	284	0.16	0.6	14	53
7415E	1 ½	40	5.5	21	55	208	1.03	0.48	18	68	180	681	0.41	1.6	36	136
7402E	2	50	9.1	34	91	344	0.21	0.79	30	113	300	1136	0.69	2.6	55	208
7403E	3	80	21	80	213	806	0.48	1.8	70	265	700	2650	1.6	6	128	485
7404E	4	100	37	138	365	1382	0.85	3.2	120	454	1200	4542	2.8	10	220	833
7406E	6	150	83	314	830	3142	1.9	7.2	270	1022	2700	10220	6.2	24	495	1874
7408E	8	200	152	575	1520	5753	3.5	13	500	1893	5000	18925	11.5	44	915	3463

* All values are approximate – actual values will depend on flow tube K-factor

(1) Low flow cut-off is 2.3% of the selected analog setting adjustable from 23 Hz as listed in the above table through 230 Hz at the MAXIMUM FULL SCALE ANALOG SETTING AT 10 FEET OR 10M PER SECOND

Table 2 Maximum Working Pressures and Temperatures					
Materials (Liner)	Characteristics (Liner)	Available in Meter Sizes	Pressure kPa 150/300 lb. Flanges		
			40°C	93°C	149°C
Teflon	Chemical Resistant	0.15" through 8"	5202 kPa	4745 kPa	4605 kPa
			Maximum Allowable Liquid Temperature (1) 149°C		

Note (1): Temperature limits may vary depending on liquid being metered.

REMOTE ELECTRONICS

It is also possible to use the Model 3560 Remote Electronics with the Mag-Cell. These electronics provide analog, digital outputs and rate indication 0-100% or engineering units. Eight digit totalizers are also available. The Model 3560 may be mounted up to 1,000 feet from the flow tube.

VELOCITY TO FLOW CONVERSION FACTORS

Table 3 provides its approximate flow conversion factors for the mag-cell flow meter. Actual values are based on the individual meter k-factor for each flow tube, which will vary slightly among meters of the same size. The k-factor for a particular flow tube is stamped on the stainless steel tagged permanently affixed to the flow tube coil housing. Approximate M_{ax} values are listed in table 1.

Table 3 Conversion Factors	
ft ³ /sec	2.228×10^{-3}
ft ³ /min	1.337×10^{-1}
ft ³ /hr	8.021
ft ³ /day	1.925×10^2
cc ³ /min	3.785×10^3
litre/sec	6.309×10^{-2}
litre/min	3.785
m ³ /hr	0.227
m ³ /day	5.451

$$Q_{max} = \frac{600,000}{K}$$

Maximum Flow Capacity: (Q max.) in gpm

Conversion Factors:

$$\text{To convert } Q = \frac{600,000}{K - \text{factor}} \text{ in gpm}$$

Example: Find Q max expressed in litres/sec:

K-factor = 19355 pulses/gal

$$Q = \frac{600,000 \text{ pulses/min}}{19,355 \text{ pulses/gal}} = 30.999 \text{ gpm}$$

$$30.999 \text{ gpm} \times 6.309 \times 10^{-2} = 1.956 \text{ litres/sec}$$

OPTIONAL EQUIPMENT

PROTECTIVE GROUNDING ORIFICE

In installations where the pipeline is lined (rubber, glass, Teflon, etc.) or of a non-conductive material (PVC, etc.) it is necessary to provide an adequate ground path to the metered liquid.

The protective grounding orifice protects the upstream edge of the meter liner from excessive wear and provides a ground path to the liquid. Standard material for the protective grounding orifice is 316 stainless steel. Tantalum is an available option.

GENERAL INSTALLATION DESIGN INFORMATION

Prior to installation design, the following recommendations should be considered:

When installing the meter, it is important to consider its location. Electromagnetic fields of high intensity may disturb the normal operation. For this reason, it is desirable to locate the flow meter away from large electric motors, transformers, communications equipment, etc. wherever possible.

The flow meter should be kept in its shipping the container until ready for installation. Shipping plugs should remain in conduit connections until the conduit is connected and sealed.

For accurate operation, it is mandatory that the flow meter be installed so that the flow tube will be completely full of process liquid under all operating conditions. When the meter is only partially filled, even though the electrodes are covered, an inaccurate measurement will result.

It is desirable that the meter be installed in a vertical pipe run with flow upward. In slurry applications, the vertical position ensures a more even distribution of solids under all flow conditions and minimises the chances of suspended solids adhering to the flow tube.

The position of the flow tube in relation to other devices in the system is also important in assuring system accuracy. Any upstream tee, elbows, valves, etc. should be placed at least five pipe diameters from the flow head to minimise any obstruction or flow disturbances.

LIQUID FLOW CHARACTERISTICS

The characteristics of the liquid to be metered, the liquid flow parameters and the environment of the meter are determining factors in the accuracy of a particular meter.

CONDUCTIVITY – electrical conductivity is simply a way of expressing the ability of a liquid to conduct electricity. Just as copper is a better conductor than steel wire, some liquids are better conductors than others. Of even greater importance, however, is the fact that some liquids have a little or no conductivity.

The conductivity of a metered liquid must be at least three Micromhos/cm for use with the flow meter. The conductivity of the liquid can change throughout the process operation as long as it is homogeneous and remains above the three Micromhos/cm threshold.

ACIDS/CAUSTICS – the chemical composition of the product to be measured must be compatible with the meter liner and electrodes to assure maximum service life from the meter.

Refer to the publication such as the corrosion survey, national association of corrosion engineers, etc., to determine the compatibility of the liner for the process liquid. Many process slurries or liquids are designated by the generic name but may contain other substances which affect its corrosion characteristics; therefore, operating experience is often the best guide in determining the corrosive nature of the product in specific applications. In cases where there is

no operating experience, it may be necessary to conduct material compatibility tests.

VELOCITY – the maximum (full-scale) liquid velocity must be in the range of 1.000 m/sec (3.28 ft/sec) to 10.000 m/sec (32.8 ft/sec) for optimum meter operation. The velocity through the meter can be controlled by properly sizing the meter. For optimum accuracy, the minimum velocity should be maintained above 1.000 m/sec.

ABRASIVE SLURRIES – abrasive slurries may be handled with this magnetic flow meter provided consideration is given to the concentration of the solids in the slurry and their abrasiveness. The abrasiveness of the slurry may affect the service life of the flow tube and electrodes. Velocity of the product should be limited to 2 m/sec (6.5 ft/sec) maximum. An ideal slurry installation would have the meter in the vertical position with flow upward. This would insure a uniform distribution of solids and avoid having the solids settled in the tube during no flow conditions.

SLUDGE AND GREASE BEARING LIQUIDS – sludges and grease bearing liquids should be measured at higher velocities, above 2 m/sec (6.5 ft/sec) minimum in order to reduce the coating tendencies of the material.

TEMPERATURE – liquid temperature is generally not a problem provided that it is within the flow tube limits -18°C to 149°C for Teflon.

ORDERING INFORMATION

1. Meter size
2. Liner material
3. Electrode material
4. Pressure and temperature requirements (ambient and process)
5. Flow rate (normal, maximum, minimum)
6. Electrical requirements
7. output(s) required
8. Liquid to be metered (name, conductivity)
9. Meter orientation (horizontal or vertical)
10. Accessories required

IE Mag-Flo Electromagnetic Flowmeter

MAGNETIC FLOWMETERS

Description

The IE Mag-Flo electromagnetic flow meter is a solid state, obstructionless, flow rate measuring device, which is capable of measuring a wide range of conductive liquids, clear or slurried. The Mag-Flo is comprised of two basic parts: a flow transmitter, which becomes a part of the pipeline, and a signal converter. A magnetic field is generated by compact high-density field coil mounted to a short section of straight pipe. As a conductive liquid passes through the pipe section and its magnetic field, a voltage is generated that is directly proportional to the velocity of the conductive liquid. The voltage induced is sensed by electrodes mounted at right angles to the magnetic field and in contact with the conductive liquid or slurry. The electrodes are insulated from the pipe by a non-conductive liner that encapsulates all wetted parts of the pipe. From the electrodes the voltage is transmitted to a signal conditioner where it is conditioned to the desired output signals(s). The IE Mag-Flo employs a keyed bi-directional D.C. field and digital electronics to establish new criteria in wide rangeability, high accuracy and low power consumption. Meter operation is independent of span setting. The Mag-Flo generates an open collector frequency (proportional to liquid velocity) of 10kHz at maximum flow rate. Convenient terminal connections are provided to permit local or remote verification of proper meter operation. Optional analog current or factored/scaled pulse outputs are available for integral or remote mounting.



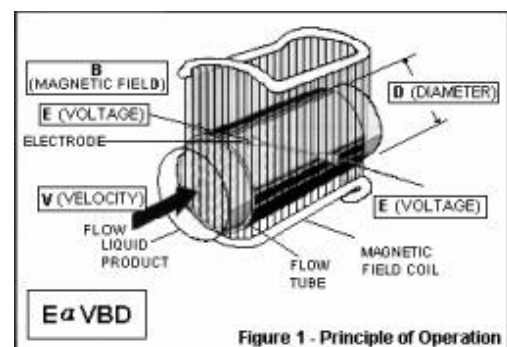
IE MAG-FLO ELECTROMAGNETIC FLOWMETER

Design Features

- Accuracy: +0.5% of rate
- Pulsed DC Magnetic
- Automatic Zero up to 75 times/sec
- Low Uniform Power Consumption
- Interchangeable Electronics (Integral or Remote)
- Digital Range Adjustment 1 fps to 10 m/sec
- Air Purge Connections
- Field Replaceable Components: Coils, Electrodes (1- 1/2" and larger), and wiring can be field serviced

Principle Of Operation

Magnetic flow meters can only be used to measure conductive liquids. In a magnetic flow meter, the liquid is the conductor. Operation of the magnetic flow meter is explained by Faraday's Law, which simply states "the voltage induced across any conductor as it moves at right angles through a magnetic field is proportional to the velocity of that conductor". Faraday's formula: $E \propto V \times B \times D$ Where: E = The voltage that is generated by the flow of the conductive liquid through the magnetic field of the flow meter. V = The average velocity of the conductive liquid through the cross section of the flow meter. B = The magnetic field strength generated by the field coils. D = The distance between the electrodes which detect the signal voltage (E) that is generated.



As indicated in Figure 1, a magnetic field is constructed throughout the entire cross section of the flow tube. If this magnetic field is considered as the measuring element of the magnetic flow meter, it may be seen that the measuring element is exposed to the hydraulic conditions throughout the entire cross section of the flow meter.

MATERIALS OF CONSTRUCTION

Metering tube: Standard – 304 SS; Optional – 316 SS

Metering tube liner: Teflon, Neoprene, Polyurethane or Gum Rubber (1/2" – 1" Teflon only)

Coil housing: Steel

Electronics housing: Die cast aluminium (Integral); Epoxy coated steel (Remote)

Paint and primer: Epoxy enamel, zinc chromate primer (Maximum Temperature 93°C)

Electrodes: Standard – 316 SS; Optional – Tantalum, Titanium, Hastelloy C276, Platinum, Monel or Carpenter 20

SPECIFICATIONS

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

capacities: Meter range: 1 to 10 metres/second or 1 to 10 feet/second, jumper selectable with no special calibration required. (Refer to Table 1)

Temperature: Ambient: -15 to 65°C; Process refer to Table 3

Pressure drop: Equal to an equivalent piece of straight pipe.

Minimum conductivity: 3 Micromhos/cm

Power requirements: Selectable by jumper plug – 115 Vac or 230 Vac, $\pm 15\%$; 47-63 Hz; 10-30 Vdc

Power consumption: 15-Watts maximum

Analog output: The span of the analog output (20mA dc) is selected using direct reading detent switches to set a maximum velocity for 20 mA dc output between 1.000 m/sec and 10.000 m/sec, regardless of meter calibration. The standard analog output is 4-20 or 0-20 mA dc into a 1000-ohm maximum load.

Digital output: The output option board can be set to provide a factored and/or scaled pulse output. Factoring, to convert to engineering unit output (GPM, LPM, M3/HR, etc.), is accomplished by dividing the pulse output frequency by 1.000 to 15.000 using direct reading detent switches (1.000 to F.000). Scaling is accomplished by setting field-selectable jumper for divide by 1, 10, 100, 1000 or 10,000.

Output load: Load = (supply Vdc – 4 Vdc)*50 ohms; 0 - 800 ohms for units powered by ac or 20 Vdc; 0 - 300 ohms at 10 Vdc input; 0 - 1000 ohms at 24 Vdc input; Reduce 50 ohms per volt when dc is less than 20 volts.

Output over range: 120% without fold-over or latch-up.

Table 1 – Capacities (All values are approximate – actual values depend on tube K-factor)

Meter Model	Meter Size	Flow in LPM Velocity ft/sec			Flow in LPM Velocity mt/sec			Guideline flow @ 6 ft/sec
		1 ft/sec	10 ft/sec	Low Flow Cut-Off	1 m/sec	10 m/sec	Low Flow Cut-Off	
7585	1/2"	2.3	23	0.02	7.5	75	0.2	15.1
7501	1"	7.9	79	0.2	26.5	265	0.6	49.2
7515	1-1/2"	24.2	242	0.6	79.5	795	1.8	143.8
7502	2"	37.1	371	0.8	128.7	1287	3.0	234.7
7503	3"	98.4	984	2.3	321.7	3217	7.6	590.5
7504	4"	166.5	1665	3.8	548.8	5488	12.5	1006.8
7506	6"	374.7	3747	8.7	1230.1	12301	28.4	2244.5
7508	8"	643.4	6434.5	15.2	2108.3	21082.4	45.4	3853.1
7510	10"	1006.8	10068	22.7	3300.5	33005	75.7	6033.3
7512	12"	1423.2	14232	34.1	4666.9	46669	106	8909.9
7514	14"	1718.4	17184	37.9	5639.7	56397	128.7	10317.9
7516	16"	2259.6	22596	53	7418.6	74186	170.3	13569.2
7518	18"	2876.6	28766	68.1	9443.6	94436	215.7	17267.2
7520	20"	3546.5	35465	83.3	11635.1	116351	268.7	21275.5
7524	24"	5117.3	51173	117.3	16786.5	167865	386.1	30700.1
7530	30"	7993.9	79939	185.5	26230.1	262301	601.8	47974.9
7536	36"	11756.2	117562	268.7	38569.2	385692	885.7	70556.2
7542	42"	15953.8	159538	367.1	52346.5	523465	1203.6	95745.4
7548	48"	20904.6	209046	480.7	68584.2	685842	1578.3	125427.3
7554	54"	25908.3	259083	594.2	84973.3	849733	1953.1	155445.0

Accuracy: System: $\pm 0.5\%$ of the rate from 1 unit per second to 10 units per second (1 unit = 1 foot or meter) ± 0.005 units per second below 1 unit per second

Analog Output: Add $\pm 0.1\%$ full scale to above accuracy specifications.

Repeatability: 0.25% of rate

Pressure limits: Refer to Table 2 & 3

Low flow cut off: Factory set to 2.3% of analog span.

PZR (Positive Zero Return): Drives the output from the electronics to 0 Hz frequency and 4-mA dc upon a dry contact closure. The dry contact closure is user provided and can be activated by a pump or valve control switch. It should be used to prevent erratic output whenever process control results in the flowhead becoming empty.

Table 2 – Pressure Limits

Meter Size	Flange Rating (psi)	Teflon Liner (psi @ 300°F)	Gum Rubber Liner (psi @ 185°F)	Neoprene Liner (psi @ 185°F)	Polyurethane Liner (psi @ 150°F)
½" – 16"	150	230	260	260	270
	300	655	685	685	705
18" – 24"	150	230	260	260	270
30"	150	150	150	150	150
36"	150	-	150	150	150
42"	150	-	150	150	150
48"	150	-	150	150	150
54"	150	-	150	150	150

LIQUID FLOW CHARACTERISTICS

The characteristics of the fluid to be metered and the environment of the meter are determining factors in the accuracy of a particular meter.

Table 3 – Maximum Working Temperatures

Material	Characteristics	Maximum Liquid Temp.
Teflon	Chemical Resistant	149°C
Neoprene	Abrasion Resistant	85°C
Gum Rubber	Abrasion Resistant	85°C
Polyurethane	Abrasion Resistant	65°C

A. Conductivity

Electrical conductivity is simply a way of expressing the ability of the liquid to conduct electricity. Just as copper wire is a better conductor than steel wire, some liquids are better conductors than others. However, of even greater importance is the fact that some liquids have little or no conductivity. The conductivity of the metered liquid must be at least three Micromhos/cm for use with the flowmeter. The conductivity of the liquid can change through the process operation as long as it remains above the three Micromhos/cm threshold.

B. Acids/Caustics

The chemical composition of the product to be measured must be compatible with the meter liner and electrodes to assure maximum service life from the meter. Refer to a standard publication to determine the correct liner material for the process liquid. Many process slurries or liquids are designated by a generic name but may contain other substances which affect its corrosion characteristics; therefore, operating experience is often the best guide in determining the corrosive nature of the product in specific applications. In cases where there is no operating experience, it may be necessary to conduct material compatibility tests.

C. Velocity

The liquid velocity must be in the range of 1 to 10 m/sec (32.81 ft/sec) for optimum meter operation. The velocity through the meter can be controlled by properly sizing the meter. For optimum accuracy, the minimum velocity should be above one unit per second (one foot for electronics set in the feet mode or one meter for electronics set in the meters mode).

D. Abrasive Slurries

Abrasive slurries may be handled with this magnetic flowmeter, provided consideration is given to the concentration of the solids in the slurry and their abrasiveness. The abrasiveness of the slurry may affect the service life of the flow tube and electrodes. Velocity of the

product should be limited to approximately 2 m/sec (6.5 ft/sec) maximum. An ideal slurry installation would have the meter in a vertical position with flow upward. This would ensure a uniform distribution of solids and avoid having the solids settle in the flow tube during no flow conditions.

E. Sludge and Grease Bearing Liquids

Sludges and grease bearing liquids should be measured at higher velocities, above 2-m/sec (6.5 ft/sec) minimum in order to reduce the coating tendencies of the material. For a quick reference, refer to Table 1 and the guideline number.

F. Temperature

Liquid temperature is generally not a problem provided that it is within the flow tube liner limits (Refer to Table 3).

G. Liners

Magnetic flow meters are constructed with metallic tubes and flanges. It is necessary, therefore, to incorporate a non-conductive lining material to insulate the electrodes and liquid from the meter body to prevent the flow tube from short-circuiting the generated signal voltage. The selection of a specific liner material depends on three conditions: abrasion, corrosion and temperature. In a questionable application, information may be gained by knowledge of any lining existing in the intended pipeline. The user must make final choice of a liner material. Refer selections available under MATERIALS OF CONSTRUCTION.

H. Electrodes

Abrasion and corrosion must be considered in the selection of electrode material. Several types are available in field replaceable or non-field replaceable designs. The electrodes in the Mag-Flo are field replaceable in all 1-1/2" and larger size flow tubes. Meters for sanitary service or those meters with platinum or tantalum electrodes, are non-field replaceable. Because the electrodes are in contact with the process liquid, it is necessary to drain the meter before removing the electrodes. The replaceable electrode assembly consists of the electrode, available in several designs, and a non-field replaceable electrode housing. To prevent corrosion of the electrode and electrode housing, both must be of the same material. Coatings with a resistance of up to 1 x 10⁻¹² k ohms on the electrodes will not normally affect performance; so most installations will not require electrode-cleaning options. The field replaceable feature enables changing from standard to bullet nose electrodes which project into the higher velocity portion of the process stream to enhance self cleaning by velocity energy. For coating process liquids, ultrasonic or heated/ultrasonic electrodes are available.

I. Grounding

Grounding is required to eliminate stray current and voltage, which may be transmitted through the piping system, the process liquid, or induced by electromagnetic fields in the same area as the flow meter. Grounding is achieved by connecting the piping system and flow meter to a proper earth ground. Grounding straps from each meter flange to the pipe-mating flange may be used but are not normally required.

1. In conductive piping systems, the 'third wire' safety ground to the power supply and a conductive path between the flowmeter and the piping flanges is normally all that is required.
2. In non-conductive or lined piping systems, at least one grounding ring or probe (12" flow meters and larger), must be supplied to provide a conductive path from the process liquid to the flowmeter.

Grounding rings are flat plate rings, which serve two functions. One function is grounding and the other is liner protection, depending on the application. Protective orifices are used in installations where the process liquid is abrasive. The leading edge of the liner is exposed to excessive wear from being impinged against by the slurry. To minimise this wear, a protective orifice is placed at the inlet end of the flow tube to cover the face and leading edge of the liner.

Grounding rings are used in installations where the pipeline is lined or made of a non-conductive material and it is necessary to provide a ground path to the liquid from the flow tube. This is accomplished by installing at least one grounding ring at the inlet end of the meter. A second grounding ring may also be required at the outlet end of the meter for liner protection. The grounding ring at the inlet of the meter may also function as a protective orifice. For flow meters 12" and larger, grounding probes are often a more economical method of sensing liquid potential than grounding rings. Probes are available in pairs for installation in 3/4" NPT taps adjacent to each end of the flow meter and easily assembled by connecting the straps from the grounding probes to the flow meter using the threaded holes in the flanges.

GENERAL INSTALLATION/DESIGN INFORMATION

Prior to installing the flow meter, the following installation recommendations should be considered.

When installing the flowmeter, it is important to consider its location. Electromagnetic fields of high intensity may disturb the normal operation. For this reason, it is desirable to locate the flowmeter away from large electric motors, transformers, communications equipment, etc.

For accurate operation, it is mandatory that the flowmeter be installed so the flow tube will be completely full of process liquid under all operating conditions. When the meter is only partially filled, even though electrodes are covered, an inaccurate measurement will result. It is desirable that the meter be installed in a vertical pipe run with flow upward. In slurry applications, the vertical position ensures a more even distribution of solids under all flow conditions and minimises the chances of suspended solids adhering to the flow tube.

The position of the flow tube, in relation to other devices in the system, is also important in assuring system accuracy. Any upstream tee, elbows, valves, etc., should be placed at least five pipe diameters from the flow head to minimise any obstructions or flow disturbances.

NOTE: Installation in vertical line with flow-up through the meter is preferred to assure that the meter is filled with liquid under all conditions.

NOTE: Electronics box on Mag-Flo can be oriented for access in either horizontal or vertical piping arrangements if specified at the time of order placement.

In some installations, due to space limitations, the standard mounting of the integral electronics/terminal enclosure cannot be used. The enclosure can be rotated in 90 degrees increments for these installations.

The customer must supply gaskets for each flow head, selecting them for compatibility with the piping and process conditions. The gaskets, flow head flanges and mating pipe flanges must be thoroughly dusted with gasket talk powder prior to installation. This is a precaution to prevent flowhead liner damage if the flow head must be removed from the line.

In order to prevent liner damage in applications where the meter must routinely be removed from the process piping, grounding rings, protective orifices or spool pieces should be installed.

NOTE: The flowmeter will measure flow in either direction by changing a jumper in the electronics assembly.

Location:

When selecting a location, remember that most electrodes, electrode leads, coils and printed circuit boards are field replaceable. Access should be provided to the meter to permit replacement of these parts.

COMPLETE REMOTE ELECTRONICS (CRE)

The CRE may be mounted up to 1,000 feet from the flow head (cable distance).

NOTE: Stray magnetic and electrostatic fields may cause some disturbance in operation. For this reason it is desirable to locate the electronics away from large electric motors, transformers, communication equipment, etc.

The CRE should be mounted to a vibration free wall or column with consideration given to reading the indicator/totalizer and servicing the internals.

NOTE: The CRE enclosure is rated for weather and corrosion resistance (NEMA 4X). However, whenever possible, the CRE should be located out of direct exposure to the elements. Consideration should also be given to protecting the enclosure from mechanical and/or chemical abuse.

The following wiring practices should be followed:

1. Conduit should conform to any applicable safety regulations and be sealed to prevent moisture entry.
2. The conduit should not run parallel to any power lines. If the conduit must cross a power line, it should cross at a right angle.
3. Conduits should not be run close to large induction equipment.
4. Do not run more than four bundles from four flowmeters in a single conduit.
5. The following conduit routing should be followed. The conduit numbers indicate their position from left to right

at the bottom of the unit, followed by the size of the conduit for each connection.

(3/4" NPT) Coil Drive and Electrode Cables

(3/4" NPT) Input Power

(3/4" NPT) Signals Out

(1/2" NPT) Pneumatic Purge

6. Field coil and electrode signal cable, must be a four conductor, 0.5mm², individually shielded and twisted pair, along with overall shielding.

The remote electronics should be wired in accordance with the wiring diagram adjacent to the terminal block.

IE MAG CALIBRATOR MODEL 7797

IE Mag Calibrator Model 7797 is the recommended way to calibrate IE Series III Magnetic Flowmeter Electronics. The Calibrator produces a simulated flow signal of 12 meters/second to replace the transmitter (flow head) input. A second digital output of 0.000 to 9.999 units/second is used to range the analog output. The following is a detailed description of Calibrator and the calibration procedure for the electronics. The Calibrator front panel contains five pushbutton switches, one four-station thumbwheel switch and two LED's. The functions of the switches are as follows:

Velocity Thumbwheel Switches

The VELOCITY switches are used when calibrating the analog output sections of the electronics when the factor option board is not supplied. The four-digit number (X.XXX) represents the flowmeter's full-scale flow velocity in the units selected (units are determined by the setting of the flowmeter electronics in either feet or meters). During the calibration procedure, the setting of the velocity switches may be changed to check other ranges.

Flow Head/Analog Switch

The FLOW HEAD position is used when adjusting the reference voltage of Series III electronics. The ANALOG position enables the velocity switches on the front panel of the calibrator. The velocity switches allow you to set the full-scale flow velocity when calibrating the analog section of the flowmeter electronics.

Full Scale/Zero Switch

The FULL SCALE/ZERO switch is used for both flow head and analog calibrations. During a flow head calibration, the full-scale position sends a representation of the electrode signal to the flowmeter electronics. This enables the operator to adjust the reference voltage as described for the flow head

switch at both full scale and zero values. The full-scale position sends a simulated 12 m/sec, or ft/sec, signal to the electronics (see Feet/Meters Switch below). The zero position sends a "no flow" signal to the flowmeter electronics. During an analog calibration, the full-scale position will output a signal to the flowmeter electronics equivalent to the setting of the velocity switches. When adjusting the full-scale analog output, the velocity switches should be set to process full-scale velocity. The zero position will output a zero velocity signal enabling the analog zero to be set.

Feet/Meters Switch

The position of this switch must match the setting of jumper J7 on the signal conditioner board of the flowmeter electronics; if the electronics under calibration are set to operate in the feet mode, the calibrator must be set to feet also.

Load/No Load Switch

During the calibration procedure for the Series III electronics, a coil load must be provided. For integral electronics with the six-pin jumper plug on the calibrator connector (J2), use the 7797 calibrator with the NO LOAD switch position key depressed. For remote electronics (CRE), which has a cable attached to the six-pin connector (J2), use the 7797 calibrator with the LOAD switch position key out.

Forward/Reverse Switch

This switch determines the phase of the calibrator output representing the electrode signal. The switch setting is determined by the position of the jumper J13/12 on the Signal Conditioner Board. If the jumper is in the J13 (forward flow) position, set the calibrator to FORWARD and if the jumper is in the J12 (reverse flow) position, set the calibrator to REVERSE.

ORDERING INFORMATION

The following information is required when ordering:

1. Meter Size
2. Connection Type and Rating
3. Liner Material
4. Electrode Material and Type
5. Pressure and Temperature Requirements (Process and Ambient)
6. Flow Rate: Normal, Maximum and Minimum
7. Electrical Requirements
8. Output Required
9. Name and conductivity of liquid to be measured
10. Accessories Required

Series 3560 Complete Remote Electronics

MAGNETIC FLOWMETERS

Description

The IE Series 3560 Complete Remote Electronics, hereafter referred to as the CRE, (Models 3561, 3562, and 3563) is for use with either IE Mag-Flo or IE Mag-Cell electromagnetic flowmeter elements. These electronics convert the low level voltage output of the electromagnetic flowmeter element into digital frequency and analog current outputs for process flow rate indication and/or totalization. The CRE can be mounted as much as 1000 feet from the pipeline-mounted electromagnetic flowmeter element eliminating the need for supplying line voltage at the electromagnetic flowmeter element and permitting convenient, accessible location of the CRE. The IE CRE is designed for survival and serviceability. The wall or pipe stand mounted enclosure is weatherproof (IP-67), with analog indicator or totalizer, depending on the selected model. In addition, the CRE is designed to be suitable for location in areas classified as Gr. IIA & Gr. IIB by the Central Mining Research Institute (CMRI) (Only for explosion proof version). The analog output is derived from a Standard Three Board Printed Circuit Module mounted in the main chassis. The analog output is selected with four direct-reading digital detent selection switches for selecting the velocity at which a 20 mAdc output is provided. This maximum output velocity may be set between 1.000 and 10.000 which represent meters per second or feet per second. The digital output is that a factored and scaled pulse (digital) output to provide an output in pulses per engineering unit (10 pulses per litre, etc.). The digital output is selected with four direct reading-digital detent switches by entering the K-factor of the electromagnetic flowmeter flowhead as a number between 1.000 and 15.000 (F.000). The order of magnitude of the K-Factor is selected by the position of a single eight-position dip switch representing a value of 1, 10, 100, 1,000 or 10,000. Thus, a K-Factor value is selectable between 1.000 and 150.00*10³. This range will suffice for any Mag-Cell and Mag-Flo electromagnetic flowmeter flowhead. The Three Board Printed Circuit Module is the same regardless of whether it is used for remote or integral mounting. As a result, interchangeability is maximised and spare parts stocking is minimised.



SERIES 3560 COMPLETE REMOTE ELECTRONICS

Design Features

- Accuracy +/- 0.5% of rate
- DC Magnetic Field Drive -- bi-directionally excited up to 37-1/2 times each second
- Automatic Zero -- no adjustments required. Zero voltage reference dynamically verified up to 75 times/sec
- Interchangeable Electronics -- interchangeable with any 3560 remotely mounted electronics modules. No test equipment required

Instrumentation Engineers Pvt. Ltd.

Plots 1,2,3 Phase III, IDA Jeedimetla, Hyderabad 500 055
Tel:+91-40-3095147,Fax:+91-40-3096401

- Digital Full Scale Setting -- Simplified span selection without affecting calibration
- Wall or Pipe Stand Mounting.
- Remote Mount -- up to 1,000 feet.
- Positive Zero Return -- drives the output from the magnetic flowmeter to zero indication on a dry contact closure.
- Low Flow Cut-off -- 2.3% of analog span setting.
- Built-in Test Signal -- enables local verification of meter zero and span, and remote verification of proper operation of the electronics.
- Range Selection -- 1.0 to 10.0 m/sec. or 1.0 to 10.0 ft/sec. for full scale output selected by jumper position.
- Digital Span Adjustment -- set span of analog output using direct reading digital detent switches.
- Low Power Consumption -- approximately 15 watts regardless of meter size or type.
- Easy access -- hinged instrument panel swings out for internal access.

PRINCIPLE OF OPERATION

The input to the Series 3560 CRE is a low level voltage proportional to the velocity of a conductive liquid or slurry through the magnetic field of a Mag-Cell, Mag-Flo electromagnetic flowmeter flowhead. For specific detail regarding the principle of operation for electromagnetic flowmeters, refer to Design Specifications DS-7400 for Mag-Cell, DS-7500 for Mag-Flo.

The low level voltage is converted to a frequency proportional to that voltage, to a maximum of 10kHz at a flow velocity of 10,000 units per second. This output serves as the input to the Output Printed Circuit Board where additional signal conversion is accomplished.

The Output Printed Circuit Board utilises two modes; to provide an analog current output and factored scaled (digital) pulse output. In the CRE configuration, the type of output is selected by proper wiring hook-up at the output terminals of the CRE.

SPECIFICATIONS

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

POWER REQUIREMENTS

Standard: 230 Vac +/-15%, 50/60 Hz; 115 Vac +/-15%, 50/60 Hz; 10-30 Vdc

POWER FUSE RATINGS

230 Vac .25A; 115 Vac .5A; 10-30 Vdc 2A.

POWER CONSUMPTION

Approximately 15 watts

RECOMMENDED WIRE SIZE

Between electromagnetic flowmeter and CRE

- a. Coil Drive: 14 AWG; Alpha 2472 or Belden 8720 or equal.
- b. Electrode Signal (low level voltage); 20 AWG; Alpha 2411 or Belden 8762 or equal.

WIRING TO CRE

- a. AC Power Cable: 12 AWG, three conductor.
- b. Electrode Signal (low level voltage); 20 AWG; Alpha 2411 or Belden 8762 or equal.
- c. Totalizer Reset: 18 AWG, general purpose.
- d. PZR Activate: 18 AWG, general purpose.
- e. Ground Cable: Third wire ground of ac power cable

FULL SCALE LIQUID VELOCITY

1.000 to 10.000 m/sec, or 1.00 to 10.000 ft/sec. (jumper selected)

OPERATING TEMPERATURE LIMITS

Electronics: -15°C to +65°C

LCD Display (Totalizer only): 0°C to 50°C

STORAGE TEMPERATURE LIMITS

-15°C to 65°C

CAPACITIES

As specified in the individual meter design specifications, reference DS-7400 and DS-7500.

PERFORMANCE SPECIFICATIONS

Accuracy: $\pm 0.5\%$ of flow rate from 1.0 m/sec. to 10.0 m/sec.

± 0.005 unit/sec below flow rate of 1.0 unit/sec.

ANALOG OUTPUT

Add $\pm 0.1\%$ full scale to above Performance Specifications.

REPEATABILITY

0.25%

INPUT SIGNALS

Low level voltage proportional to flow velocity from IE dc field electromagnetic flowmeter element. (Minimum conductivity - three micromhos per centimetre).

OUTPUT SIGNALS (STANDARD)

Isolated 0-10 kHz open collector unscaled pulse

Options

Analog: Isolated 4-20 mAdc into 0-1,000 ohm load. Used to drive integral rate indicator (1-100% standard, direct reading optional), and available for re-transmission.

Digital: Isolated factored/scaled open collector/TTL output. Pulse width inversely proportional to frequency with 50/50 duty cycle.

The open collector pulse has no voltage but will accept an external power supply to 30 Vdc, 500 mA.

PZR (Positive Zero Return) drives to zero indication, (4 mAdc, etc.) the output from the CRE on a dry contact closure. The dry contact closure is supplied by others and can be used to prevent an erratic output whenever process control results in the electromagnetic flowmeter element becoming empty. If the electromagnetic flowmeter element does not empty under operating or standby conditions, it is not necessary.

Materials of Construction

HOUSING: IP-67
enclosure for wall or pipe stand mounting.

Serviceability

Serviceability of the CRE is enhanced by modular construction. Two self-retaining screws permit release of the hinged, gasketed outer door of the CRE enclosure. The hinged door of the CRE is of steel and provides for mounting of indicators and/or totalizers, depending on the CRE model selected. Wiring connections to the rear of the analog indicator or totalizer are quick release push-type connectors to eliminate cumbersome wiring interconnection for indicator/totalizer change-out.

All CRE components are mounted in a steel main chassis secured by four (4) self-retaining screws. This permits rapid change-out of the complete main chassis with a minimum of down-time. In its basic configuration, the CRE provides a frequency output and an analog current output with local 0-100% rate indication. These outputs are derived from the Signal Conditioning Module comprised of a steel chassis with three 4" x 7" printed circuit boards. The bottom printed circuit board is the Power Supply Board that converts line voltage to dc instrument operating power. The middle board in the stack is the Signal Conditioner Board that contains factory set calibration adjustments and the top board is the Digital/Analog Factor Board. This one convenient drop in module not only services the 3560 remote converters but also services all flanged and Mag-Cells with integral electronics.

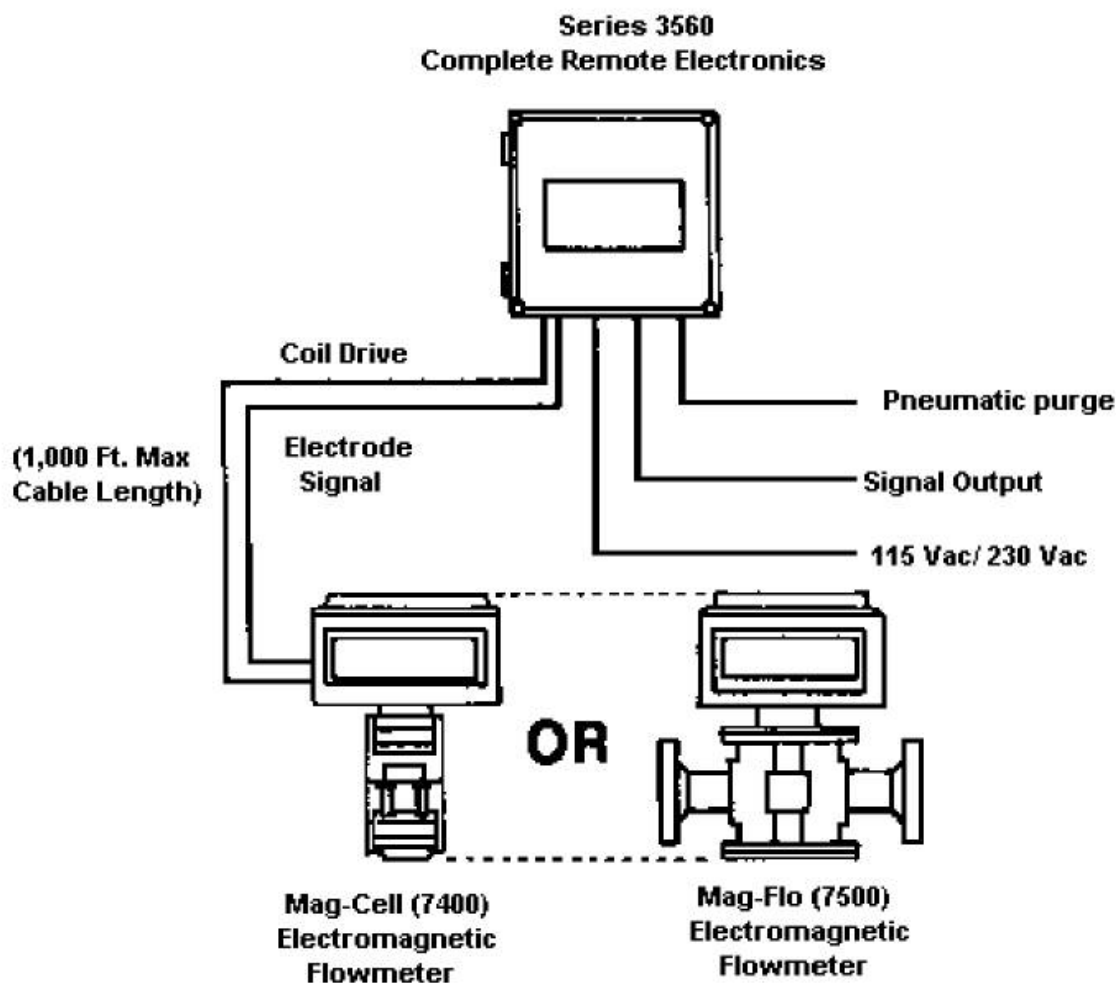


Figure 1 Typical Installation Series 3560 Remote Electronics

3560 COMPLETE REMOTE ELECTRONICS (CRE) MODEL CODING	
MODEL	DESCRIPTION
356	IE CRE - Complete Remote Electronics for Models 7400 Mag-Cell and 7500 Mag-Flo Magnetic Flowmeters
CODE	ACCESSORIES
13	8 digit LCD INDICATING totalizer
33	Rate Meter (ANALOG)
CODE	MOUNTING
2A	Wall Mounting
3A	Pipe Mounting
CODE	RATE INDICATOR SCALE
2C	0-100%
3C	Customer Specified Direct Reading
CODE	INPUT VOLTAGE
1	115 Vac, 15 Va Maximum
2	230 Vac, 15 Va Maximum
4	10-30 Vdc, 15 Watts Maximum
CODE	ENCLOSURE TYPE
A	Weather proof
B	Explosion proof

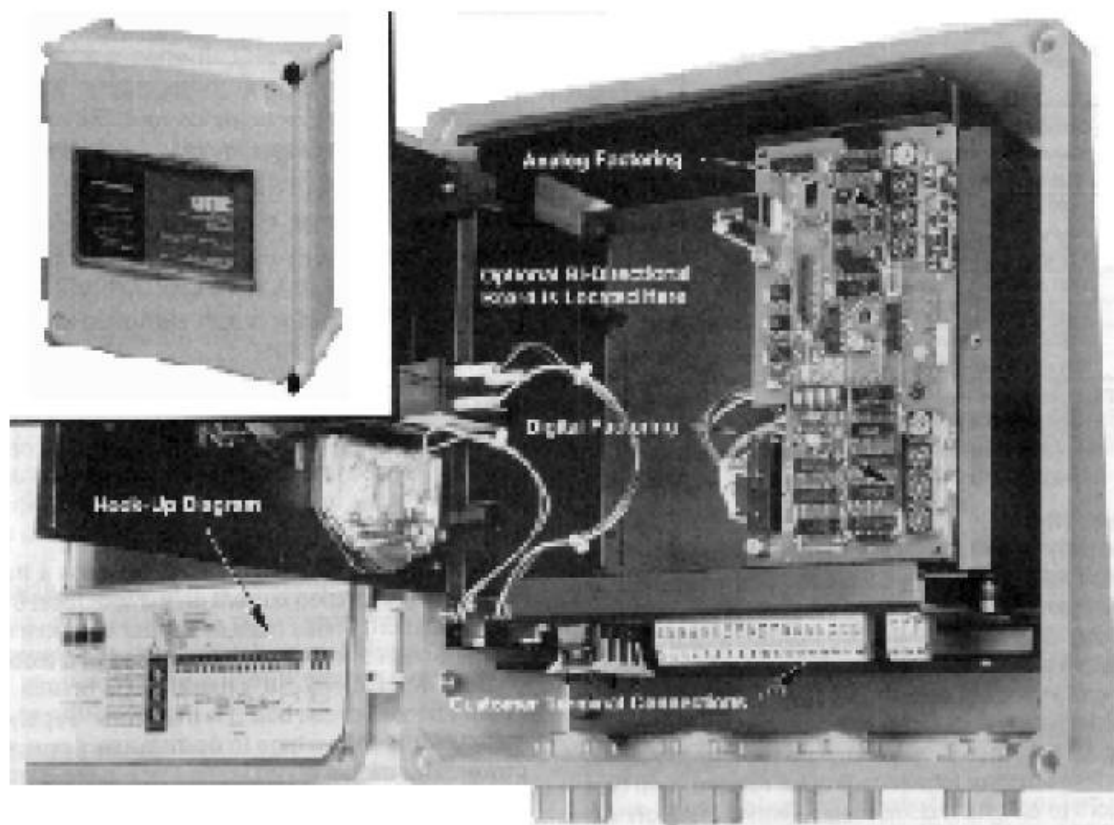


Figure 2. Outside/Inside View of CRE Box

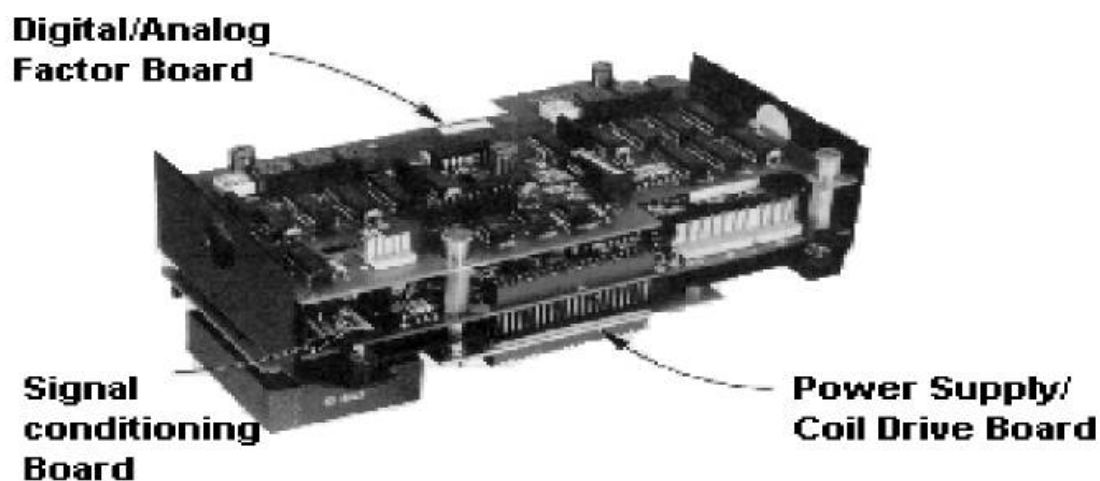


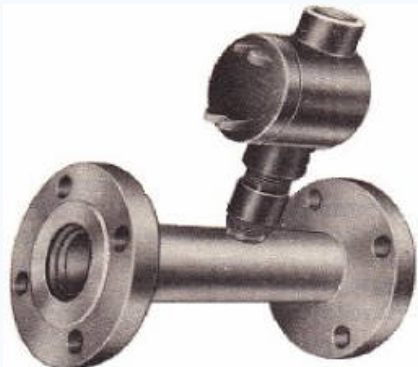
Figure 3 Support Bracket Module Assembly

IE Turbine Flow Meters

TURBINE FLOWMETERS

Description

Parity Turbine Flowmeters The IE Parity Turbine Flowmeter line exemplifies all the proven and known advanced techniques in the Art of Measurement by the Turbine Principle. The meter's clean lines and simple configuration of components assure higher flow rates, extended flow range and sustained performance capability. The Parity Turbine Flowmeter is designed for use within the guidelines of API Standard 2534. (The Measurement of Liquid Hydrocarbons by Turbine Meter Systems), and the test procedures of API Standard 2531, (Mechanical Displacement Meter Provers). **ML Turbine Flowmeters** The IE ML Turbine Flowmeter is a self contained volumetric flow measuring device with the exclusive capacity of primary electrical output for registration, instrumentation and control. Combined in one compact package, the ML Turbine Flowmeter offers the advantages of both the positive displacement meter and turbine meter. It has excellent performance capacity and reliability and its compact size, high flow rates and broad flow ranges are typical of turbine flowmeter.



IE TURBINE FLOW METERS

Design Features

- Output linear with flow rate
- Rangeability 5 to 1 (4" ML) & 7 to 1 (1/2" Parity). 10 to 1 (3/4" through 6" Parity, 6" ML Turbine)
- Explosion proof amplifier housing
- Superior accuracy and repeatability
- Compact design
- Low maintenance cost – few moving components, no lubrication required, readily accessible for service
- Carbon-graphite bearing (Industrial/Instrument grade turbines) – no lubrication required
- Tungsten Carbide bearings (High accuracy grade turbines) – no lubrication required
- Variety of readout instruments available
- Dual output capacity – electrical (ML Turbine)
- Magnetic coupling drive sealed line fluid (ML Turbine)
- No stuffing boxes, packing glands or dynamic O-ring seals (ML Turbine). Series 2900 Parity Turbine Flowmeter with NPT Threaded Connections. Series 2900 Parity Turbine Flowmeter with ANSI R.F. Flanged Connections ML Turbine Flowmeter (With Optional Condulet)



PRINCIPLE OF OPERATION

PARITY TURBINE FLOWMETERS

IE Parity Turbine Flowmeters are volumetric flow measuring and transmitting devices that produce output signals directly proportional to the flow rate of the liquid product being measured.

The primary output of the 1/2" size is a high resolution signal that is amplified and shaped by an integral amplifier built into the reluctance type, motion sensing pick-off. The resulting output is a 0-10 Vdc square wave pulse.

The primary output of the 3/4" through 6" sizes is a 15mv. R.M.S. minimum pulse emanating from a reluctance type, magnetic pick-off. With the addition of an optional, direct mounted, explosion-proof preamplifier, this wave pulse can be shaped and fed directly to totalizing counters, digital readout devices or process control equipment. All sizes of the Parity Turbine Flowmeters can accommodate up to two pick-offs.

ML TURBINE FLOWMETERS

ELECTRICAL

The flow of liquid product through the meter turns the meter's rotor assembly. The passage of the rotor shroud through a magnetic field generates an electrical signal which is immediately amplified and shared by an amplifier mounted directly on the meter. This wave pulse can then be fed directly to the desired instrumentation for readout or control. The ML Turbine Flowmeter accommodates up to two primary electrical signals.

APPLICATIONS

1/2" THROUGH 2"

A small, economical meter, the Parity Turbine Flowmeter is engineered for a wide range of applications and can be used on fuel metering systems, chemical and petroleum products, and other industrial applications requiring low cost and accurate flow measurement. It is also available for use on corrosive liquids.

3" THROUGH 6"

PIPELINE CONTROL:

Custody Transfer – tanker and barge loading – unloading – product loss control – security (safety) – accounting – sales – tax.

BLENDING:

Medium and light crude oils and finished (hydrocarbon) products.

SPECIFICATIONS

CAPACITIES:

Parity Turbine Industrial/Instrument grade (1/2" through 2")
 - Refer to Table 1

Parity Turbine High Accuracy grade (3/4" through 6")
 - Refer to Table 2

ML Turbine (4" and 6") – Refer to Table 3

PERFORMANCE

Meter

Accuracy/Linearity

Industrial Grade: = +/- 1.0% of flow rate on viscosity between 0.3 and 3 centistokes. (1/2" through 2" meters)

Instrument Grade: = +/- 0.5% of flow rate on viscosity between 0.3 and 3 centistokes. (3/4" through 2" meters).

High Accuracy Grade: = +/-0.25% of flow rate on viscosity between 0.3 and 3 centistokes. (3/4" through 2" meters)

High Accuracy Grade: = +/-0.15% of flow rate (3" through 6" meters).

Flow Range

5 to 1 (4" ML Turbine)

7 to 1 (1/2" Parity turbine)

10 to 1 (3/4" through 6" Parity, 6" ML Turbine)

Repeatability

Industrial/Instrument Grade: +/- 0.05% (1/2" through 2" meters)

High Accuracy Grade: +/- 0.02% (3/4" through 6" meters)

Pressure Ratings

MS and NPT Meters

Industrial/Instrument Grade: 5,000 PSI (34,500 kPa) maximum (1/2", 3/4" and 1" sizes)

Industrial/Instrument Grade: 3,500 PSI (24,150 kPa) maximum (1-1/2" and 2" sizes)

High Accuracy Grade: 3,000 PSI (20,700 kPa) maximum (3/4" through 2" sizes).

ANSI Flanged Meters:

Flowmeters from 1/2" through 6" sizes are available with ANSI B16.5 R.F. flanges.

Standard: 150 lb. through 600 lb.

Optional : 900 lb. through 2500 lb.

ANSI Pressure/Temperature corresponding to flanges used.

Temperature:

Industrial/Instrument Grade (1/2" through 2") Motion sensing pick-off with built-in amplifier:
 -40° F to +230 °F (-40 °C to +110 °C)

Magnetic pick-off:
 -100° F to +225 °F (-73 °C to +107 °C)

High temperature Magnetic pick-off
 -100° F to +450 °F (-73 °C to +232 °C)

High Accuracy Grade (3/4" through 2")
 Standard magnetic pick-off:

-100° F to +500 °F (-73 °C to +260 °C)

Low temperature magnetic pick-off:
 -350° F to +100 °F (-212 °C to +38 °C)

High Temperature magnetic pick-off:
 -0° F to +660 °F (-18 °C to +316 °C)

High Accuracy Grade (3" through 6")
 Standard magnetic pick-off:

-20° F to +180 °F (-29 °C to +82 °C)

Low temperature magnetic pick-off:
 -30° F to +400 °F (-34 °C to +204 °C)

Extreme low temperature pick-off:(SS meters only):
 -350° F to +400 °F (-212 °C to +204 °C)

ML Turbine

Standard: -20° F to +180 °F (-29 °C to +82 °C)

Optional : -30° F to +400 °F (-34 °C to +204 °C)

Pick-off

Motion sensing pick-off with built-in amplifier:

Standard: 1/2" meter

Optional: 3/4" through 2" Industrial/Instrument grade meters

Power required: 10-18 Vdc at 20mA (quiescent)

Frequency Range: 1-2000 Hz

Output Signal: 0-10 volt, square wave dc pulse,
 20mA dc into a 500 ohm load (12 Vdc)

Output Impedance: 200 ohm effective

Magnetic pick-off, Low and High temperature magnetic pick-offs:

Standard: Magnetic pick-off 3/4" through 2" meters

Optional: High temperature pick-off 3/4" through 2" meters. Low temperature pick-off 3" through 6" meters.

Output Signal: 15 mV R.M.S. minimum at minimum flow rate. Maximum AC voltage varies with meter size, up to a maximum of 8 Vac for a 2" meter.

Preamplifier

Preamplifier is optional for 3/4" through 6" meters (not available for 1/2" size meter)

Power required: 6-26 Vdc at 20 mA minimum

Input Sensitivity: 5 mV peak-to-peak at 5Hz

Frequency Range : 4 to 10000 Hz

Output Signal: 0 to 5 volts pulsating dc TTL Logic Signal
 Transmitting range up to 3000 feet (914 meters) with Belden 8770, 3 Conductor Shielded, 18 Gauge Stranded cable terminated into 4.7K ohm load. Signal transmission less preamp not to exceed 300 feet (91.4 m)

Temperature : -30° F to +180 °F (-34 °C to +85 °C)

Materials of Construction:

Housing (1/2" through 2"): 316 Stainless Steel

(3" through 6"): Standard: Steel,

Optional: 316 Stainless Steel.

Flanges: (1/2" through 2"): 316 Stainless Steel (3" through 6"):

Standard: Steel, Optional: 316 Stainless Steel

Internals: (1/2" through 4" Parity): Stainless Steel (4", 6" ML and 6" Parity): Standard: Stainless Steel and Aluminium, Optional: All Stainless Steel

Bearings: (Industrial/Instrument Grade 1/2" through 2"): Carbon-Graphite (High Accuracy Grade 1/2" through 6"):

Tungsten Carbide

Ball Bearing: (ML Turbine, Sealed from metered liquid and prelubricated for life at factory): Stainless Steel.

Connections:
Mechanical

Flowmeters from 1/2" through 2" sizes are available with MS tubing, NPT threaded connections

Flowmeters from 1/2" through 6" sizes are available with ANSI B16.5 RF flanges.

Electrical

Standard meter will be equipped with one reluctance type pick-off.

Standard:

1/2" meter, Motion sensing pick-off with built-in amplifier. Non-explosion proof with pigtail leads. 3/4" through 6" meters, Magnetic pick-off. Non explosion proof with two-pin type AN connector.

Optional:

3/4" through 2" Industrial/Instrument grade meters, Motion sensing pick-off with built-in amplifier. Non-explosion proof with pigtail leads. 3/4" through 2" meters, High temperature magnetic pick-off. Non-explosion proof with two-pin type AN connector.

3" through 6" meters, Low temperature magnetic pick-off. Non-explosion proof with two-pin type AN connector.

3/4" through 6" meters, Preamplifier with Class 1, Group D, Division 1, Explosion proof housing with terminal strip. 1/2" through 2" Industrial/Instrument grade meters, Class 1, Groups C & D, Division 1, Explosion proof Additional pick-off.

Note:

On meters with MS and NPT connections additional pick-off will be 180° mechanical. On flanged meters, additional pick-off will be mounted 90° electrical.

Rotor shroud – Standard 6" – Optional 3" and 4"

Recommended on 3" and 4" when metering products with viscosities above 4.3 centistokes.

TABLE 1 – CAPACITIES (1/2" THROUGH 2" INDUSTRIAL/INSTRUMENT GRADE PARITY TURBINES)

METER SIZE	LINEAR FLOW RANGE				EXTENDED FLOW RANGE		K FACTOR		PRESSURE DROP	
	MINIMUM		MAXIMUM							
	GPM	LPM	GPM	LPM	GPM	LPM	C/GAL	C/LIT	PSI	KPa
1/2"	1	3.8	7	26.5	--	--	13000	3435	12	83
3/4"	3	11.4	30	113.6	45	170.3	4250	1125	10	69
1"	6	22.7	60	227.1	88	333.1	975	258	8	55
1-1/2"	15	56.8	150	567.8	188	711.6	435	115	7	48
2"	25	94.6	250	946.3	325	1230.1	200	53	5	34

TABLE 2 – CAPACITIES (3/4" THROUGH 6" HIGH ACCURACY GRADE PARITY TURBINES)

METER SIZE	LINEAR FLOW RANGE				EXTENDED FLOW RANGE		K FACTOR		PRESSURE DROP	
	MINIMUM		MAXIMUM							
	GPM	LPM	GPM	LPM	GPM	LPM	C/GAL	C/LIT	PSI	kPa
3/4"	2	7.6	20	75.7	25	94.6	4200	1109	9	62
1"	7	26.5	70	265.0	88	333.1	900	238	14	97
1-1/2"	15	56.8	150	567.8	188	711.6	400	106	13	90
2"	30	113.6	300	1135.5	375	1419.4	180	48	14	97
3"	70	264.9	700	2649.5	910	3444.4	48	13	3	21
4"	129	488.3	1295	4901.6	1610	6093.9	24	6	3	21
6"	294	1112.8	2940	11127.9	3780	14307.3	24	6	3	21

TABLE 3 – CAPACITIES (4" and 6" ML TURBINES)

METER SIZE	LINEAR FLOW RANGE				EXTENDED FLOW RANGE		K FACTOR		PRESSURE DROP	
	MINIMUM		MAXIMUM							
	GPM	LPM	GPM	LPM	GPM	LPM	C/GAL	C/LIT	PSI	kPa
4"	259	980.3	1295	4901.6	1610	6093.9	24	6	3	21
6"	294	1112.8	2940	11127.9	4130	15632.0	24	6	3	21

Note: For larger sizes consult Factory

IE BiRotor Flowmeters

POSITIVE DISPLACEMENT METERS

Description

IE BiRotor Meter is a positive displacement meter utilized in the most demanding applications requiring accuracy, long life and ruggedness.. ACCURACY is attained by the unique BiRotor design, which features two finely balanced rotors. An adjustor, incorporated on the meter, is calibrated at the factory for maximum accuracy within the meters flow range. LONG LIFE is assured because the meter does not contain any oscillating, reciprocating, sliding parts or cranks to wear or disturb the balanced rotary action. In addition, the materials incorporated within the meter assembly were selected specifically for the wide range of petroleum and industrial products to be exposed to the meter assembly. RUGGEDNESS is provided in the double case housing fabricated from steel castings and drawn steel plates. This protects the meter from adverse forces, such as pipe strain, vibration or external damage which the meter can be exposed to.



IE BIROTOR FLOWMETERS

Principle Of Operation

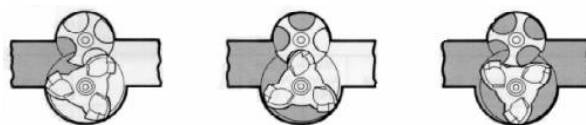
The two aluminium spiral fluted rotors within the measuring chamber are dynamically balanced, but hydraulically unbalanced. (Refer to Figure 1). As the product enters the intake of the measuring unit chamber, the two rotors divide the product into precise segments of volume momentarily and then return these segments to the outlet of the measuring unit chamber. During this "liquid transition", the rotation of the two rotors is directly proportional to the flow rate of liquid thruput. A gear train located outside the measuring unit chamber conveys mechanical rotation of the rotors to a mechanical or electronic register for totalization of the liquid thruput.

Design Features

- Mounting can be either vertically or horizontally
- Applicable to either pump or gravity flow applications
- Calibration can be easily achieved while the meter is under pressure and with no loss of liquid product
- Conforms with international standards of flowmeter accuracy

Accessories

- The wide range of accessories such as preset counters, pulse transmitters, control valves and strainers enable the meter assembly to be adapted to a wide range of liquid measurement or control systems



	MODEL NO	DATA SHEET NO.	APPLICATIONS	MAXIMUM CAPACITY				
				US gpm	Imp gpm	bph	lit/ min	Cu mtrs/hr
GROUP 1	BA-31	(S)DS-T.T (OIL)	Industrial products and pump-operated tank trucks metering petroleum products	60	50	--	227	--
	B-31T			60	50	--	227	--
	BI-42			100	83	--	378	--
	BI-42T			100	83	--	378	--
	BI-52			150	125	--	570	--
GROUP 2	BA-33	(S)DS-T.T (LPG)	1) Industrial Products and pump-operated tank trucks metering LPG	60	50	--	227	--
	BA-33T			60	50	--	227	--
	BI-43		2) Chemical and industrial liquids	100	83	--	378	--
	BI-43T			100	83	--	378	--
GROUP 3	B-40DB	(S)DS-(B-40DB)	Small custody transfer crude and refined petroleum and Industrial products	100	83	143	378	23
	B-50DB			150	125	214	568	34
GROUP 4	B-43	M1043-10	Chemical, industrial liquids and petroleum products	80	67	115	300	18
	B-43H			80	67	115	300	18
				80	67	115	300	18
	B-53			120	100	170	450	27
	B-53H			120	100	170	450	27
				120	100	170	450	27
GROUP 5	B-54	M1043-10	Small pipelines LACT units	120	100	170	450	27
	B-55			120	100	170	450	27
GROUP 6	B-60CB	(S)DS-(B-60CB)	Tank truck fuel oil pump operational gravity operational	300	250	428	1135	68
	B-61CB			250	210	357	950	57
				150	125	214	570	34
	B-61CB-1			250	210	357	950	57
GROUP 7	B-62DB	M1062-10	Loading racks, Chemical and industrial liquids	250	208	357	946	57
	B-72DB			425	354	607	1609	97
	B-82DB			600	500	857	2271	136
	B-92DEB			1000	833	1429	3785	227
	BA-89	(S)DS-(BA-89)	Axial Design	1000	833	1429	3785	227
				1000	833	1429	3785	227
GROUP 8	B-63DEB	(S)-(B-63DEB)	High pressure metering, Refinery and pipeline.	250	208	357	946	57
	B-64DEB			250	208	357	946	57
	B-65DEB			250	208	357	946	57
	B-73DEB			425	354	607	1609	97
	B-74DEB			425	354	607	1609	97
	B-75DEB			425	354	607	1609	97
	B-83DEB			600	500	857	2271	136
	B-84DEB			600	500	857	2271	136
	B-85DEB			600	500	857	2271	136
	B-93DEB			1000	833	1429	3785	227
	B-94DEB			1000	833	1429	3785	227
	B-95DEB			1000	833	1429	3785	227

MINIMUM/MAXIMUM TEMPERATURE	MAXIMUM PRESSURE		CONNECTIONS	APPROX. SHIPPING WEIGHT-LBS
	psi	kPa		
Standard -20°F to +150°F (-29°C to +66°C)	150	1034	1-1/2" NPT threaded inlet & outlet	40
	150	1034	1-1/2" NPT threaded inlet & outlet	40
	150	1034	2" NPT threaded inlet & outlet	60
	150	1034	2" NPT threaded inlet & outlet	60
	150	1034	2" NPT threaded inlet & outlet	60
Standard -20°F to +150°F (-29°C to +66°C)	350	2413	1-1/2" or 2" NPT threaded inlet & outlet	45
	350	2413	1-1/2" or 2" NPT threaded inlet & outlet	45
	350	2413	1-1/2" or 2" NPT threaded inlet & outlet	112
	350	2413	1-1/2" or 2" NPT threaded inlet & outlet	112
Standard -20°F to +150°F (-29°C to +66°C)	125	862	2" 150 lb ANSI flanged or 2" NPT threaded inlet & outlet	70
Optional +325°F (163°C)	125	862	2" 150 lb ANSI flanged or 2" NPT threaded inlet & outlet	75
Standard -20°F to +150°F (-29°C to +66°C)	300	2068	1-1/2" NPT threaded inlet & outlet	95
	275	1896	1-1/2" 150lb ANSI flanged inlet & outlet	95
	300	2068	1-1/2" 300lb ANSI flanged inlet & outlet	95
	300	2068	2" NPT threaded inlet & outlet	140
	245	1896	2" 150 lb ANSI flanged inlet & outlet	140
	350	2068	2" 300 lb ANSI flanged inlet & outlet	140
Standard -20°F to +150°F (-29°C to +66°C)	720	4964	2" 300 lb ANSI flanged inlet & outlet	195
Optional +450°F (232°C)	1440	9928	2" 600 lb ANSI flanged inlet & outlet	213
Standard -20°F to +150°F (-29°C to +66°C)	125	862	3" NPT threaded inlet & outlet	100
	125	862	3" NPT threaded inlet & outlet	138
	50	345	3" NPT threaded inlet & outlet	138
	125	862	3" NPT threaded inlet & outlet	119
Standard -20°F to +150°F (-29°C to +66°C)	150	1034	3" 150lb ANSI flanged inlet & outlet	98
	150	1034	3" 150lb ANSI flanged inlet & outlet	147
	150	1034	4" 150lb ANSI flanged inlet & outlet	323
	150	1034	6" 150lb ANSI flanged inlet & outlet	650
	150	1034	6" 150lb ANSI flanged inlet & outlet	265
Standard -20°F to +150°F (-29°C to +66°C)	275/300	1896/2068	3" -150lb/3" -300lb	210
	720	4964	3" -300lb	285
	1440	9928	3" -600lb	452
	275/300	1896/2068	3" -150lb/3" -300lb	215
	720	4964	3" -300lb	325
	1440	9928	3" -600lb	455
	275/300	1896/2068	4" -150lb/4" -300lb	450
	720	4964	4" -300lb	739
	1440	9928	4" -600lb	960
	275/300	1896/2068	6" -150lb/6" -300lb	740/758
	720	4964	6" -300lb	1393
	1440	9928	6" -600lb	1495

IE Piston Meters

POSITIVE DISPLACEMENT METERS

Description

The IE-Piston Meter is a versatile, rugged meter of extremely simple design. A full complement of registers, pulsers and read-out accessories are available. It is possible to apply this meter line to a broad application range, from mechanical totalization and batching to remote display of total volume, flow rate, and remote batch control. With the addition of our Pulse-to-Analog Signal Converters, electrical or pneumatic signals can be produced that will drive all standard indicators, recorders, controllers, and can be used as feed-back signals to computers. Accuracy – Repeatability With the IE-Piston Meter, the basic accuracy rating has been established, using water as the testing liquid. Flow ranges have been extended to the limits covered by an accuracy rating of $\pm 0.5\%$ and a reasonable pressure drop value. This is then, a total variation over the recommended range of each size meter. Final calibration of each meter is accomplished through proper selection of calibration gearing. In this way the flow curve is positioned as close as possible to the 100% line on the proof chart. The IE-Piston Meter can continually reproduce this curve to a repeatability rating of within $\pm 0.1\%$ Entrained Solids By definition, the IE-Piston Meter is used for the measurement of liquids. In order to provide the high level of accuracy associated with this meter, all mating parts must be machined to very close tolerances. The result is a limited capability to pass entrained solid particles. Viscosity Liquid viscosity must be given consideration when sizing any meter. The concern is to control pressure drop limits across the meter in order to provide realistic service life. An increase in viscosity produces a proportionate increase in pressure drop for any given flow rate. For this reason the upper flow range ratings are lowered when the liquid viscosity exceeds 200 CP (1000 ssu). This is then, a limitation dictated by pressure drop, not by accuracy. As a general rule, liquids in the 0.2 CP to 0.8 CP range are very effective solvents, and as such not only have a very low viscosity but also have very poor lubricating qualities. Holding the accuracy limits to $\pm 0.5\%$ restricts the recommended flow range. Pressure drop in these cases is not the controlling factor. With liquids having viscosities of 1 CP to 200 CP there is generally an improvement in lubricity. This combination of conditions provides the broadest flow range ratings with sustained $\pm 0.5\%$ accuracy.



IE PISTON METERS

Design Features

- The data contained in the selection guide will make it possible to easily and accurately select the proper size IE Piston Meter for a wide variety of liquid measurement applications. Principle advantages of the IE-Piston Meter
- Highly dependable meter performance
- Long service life characteristics
- Very practical accuracy
- Good repeatability
- Extremely reasonable cost
- Low maintenance
- Inexpensive replacement parts

Selecting Meter Size:

Both viscosity of the liquid at operating conditions and acceptable materials of construction should be known at this point

1. Find the meter size by first finding the proper viscosity group in the Meter Size Selection Chart.
2. Within this group select the proper piston material column.
3. Move down this column until required flow rate is covered by the flow range values given.

The high flow limits shown represent a reasonable service life factor for the meter under continuous duty service. This is interpreted to mean an 8 hour service day.

4. From this point on the chart, move horizontally to the right to find the IE-Piston Meter size in the intersecting vertical column headed by the proper materials of construction.

The number given in this intersecting block identifies the meter size covering your requirements.

5. All piston materials are not available with every body material. Verify selection in chart adjacent to selection chart.

Explanation of Viscosity Groups: Assuming Specific Gravity of (1)

Liquids given are viscosity reference only –

- I. Up to 30 SSU (20 TO .75 centipoises)
Liquids range from Freon 12, to Water at 90°F (32°C) and above. Included are Ether; Toluene; M.E.K; Carbon Tetrachloride.
- II. 31 to 450 SSU (1 to 90 CPS)
Liquids from Water at 80°F (27°C) (and below) to Olive Oil. Included are Ammonia; Blood; Sulphuric Acid; Turpentine; SAE 10 Oil at 80°F (27°C)
- III. 500 to 1000 SSU (110 to 220 CPS)
Liquids such as SAE 30 Oil at 100°F (38°C); Sucrose 64 to 68 Brix at 70°F (21°C); Grade 4 Road Tar at 120°F (49°C); Corn Starch 24°B at 70°F (21°C)
- IV. 2000 to 5000 SSU (440 to 1100 CPS)
Liquids such as paints; Castor Oil; Ketchup; Glycerine at 79°F (26°C); RC-1 Blended Asphalt at 100°F (38°C); Black Liquor at 122°F (50°C)
- V. 10,000 to 20,000 SSU (2,200 to 4,400 CPS)
Printers Ink; Wood Resin at 200°F (93°C); RC-4 Blended Asphalt at 140°F (60°C); Bunker "C" Oil at 100°F (38°C).
- VI. 25,000 to 50,000 SSU (5,000 to 11,000 CPS)
Liquids such as Honey at 70°F (21°C); Black strap Molasses at 70°F (21°C); Road Tar Grade 8 above 100°F (38°C); Corn Syrup at 41°B at 80°F (27°C)

Meter Size Selection Chart (Capacities in GPM)

I & II UP to 450 SSU (.20 to 90 CPS)			III & IV 500 to 5000 SSU (110 to 1100 CPS)			V 10,000 TO 20,000 SSU (2,200 TO 4,400 CPS)			VI 25,000 to 50,000 SSU (5,000 to 11,000 CPS)			Meter Body Material			
Piston Material			Piston Material			Piston Material			Piston Material			Bronze	Iron	Steel	Stn Stl
Alum	Bronze NiResist	Tefzel	Alum	Bronze NiResist	Tefzel	Alum	Bronze NiResist	Tefzel	Alum	Bronze NiResist	Tefzel	Meer Size	Meter Size	Meter Size	Meter Size
¾" -7	1-5	--	½" -7	½" -5	--	½" -5	½" -3½	--	¼" -3	¼" -2	--	3/8x1/2	3/8x1/2	3/8x1/2	--
1½" -15	2-10	--	1" -15	1½" -10	--	1-8	1½" -5	--	½" -4	¾" -2½	--	½"	½"	½"	--
2½" -25	4-20	5-25	1½" -25	3-20	3-25	1-18	2-14	2-18	1-12	2-10	2-12	¾"	¾"	¾"	¾"
4-40	6-30	10-50	3-40	5-30	7-50	2-33	3-25	5-35	2-20	3-15	4-22	1"	1"	1"	1"
7-70	10-50	20-100	6-70	8-50	15-100	5-48	7-34	10-62	4-25	5½" -18	8-32	1½"	1½"	1½"	1½"
12-120	15-80	30-150	10-120	12-80	20-150	9-52	11-58	15-70	8-32	10-35	10-40	2"	2"	2"	2"

Body- Piston – Chamber Material

Body	Bronze	Iron	Steel	Stn. Stl.
Piston	Aluminium Bronze	Aluminium Bronze Ni-Resist	Aluminium Bronze Ni-Resist	Tefzel
Chamber	Bronze	Ni-Resist Bronze	Ni-Resist Bronze	Stn. Stl.

Piston Material/Temperature Limits.

Piston	Temperature	
	°F	°C
Aluminium	250	121
Bronze	300	149
Ni-Resist	300	149
Tefzel	200	93

Before final temperature rating is established, the piston material temperature limit must be verified.

Pressure (PSIG) Temperature °F

Case Material	Model Number	Size Connection	Max. Safe Working Pressure		Max. Safe Working Temperature	
			PSI	kPa	°F	°C
Bronze	ER-11L	1/2" NPT	150	1034	200	93
	ER-11	1/2" NPT	150	1034	200	93
	ER-12	3/4" NPT	150	1034	200	93
	ER-13	1" NPT	150	1034	200	93
	ER-15	*1-1/2"	125	862	200	93
	ER-16	*2"	125	862	200	93
Cast Iron	ER-11L	1/2" NPT	150	1034	200	93
	ER-11	1/2" NPT	150	1034	200	93
	ER-12	3/4" NPT	150	1034	200	93
	ER-13	1" NPT	150	1034	200	93
	ER-15	*1-1/2"	125	862	200	93
	ER-16	*2"	125	862	200	93
Cast Steel	ER-11LHP	1/2" NPT	400	2758	300	149
	ER-11HP	1/2" NPT	400	2758	300	149
	ER-12HP	3/4" NPT	400	2758	300	149
	ER-13HP	1" NPT	400	2758	300	149
Cast Steel	ER-15HP	†1-1/2"	275	1896	300	149
	ER-16HP	†2"	275	1896	300	149
	ER-15HP	**1-1/2"	400	2758	300	149
	ER-16HP	**2"	400	2758	300	149
Stainless Steel		3/4" NPT	150	1034	200	93
		1" NPT	150	1034	200	93
		†1-1/2"	150	1034	200	93
		†2"	150	1034	200	93

* ANSI 125 lb. Flat Faced Flanges

**ANSI 300 lb Flat Face Flanges

† ANSI 150 lb Raised Face Flanges

Readout Function Selection Chart

The following chart provides a ready reference to all of the standard functions to which the IE-Piston Meters can be Applied by size. Further description and index to specification bulletins is given on the page entitled "Register/Readout Selection Guide"

(+= available; 0=not available)

Meter Size	Totalization		Batching				Flow Rate			Output Signals			
	Mech.	Elect.	Manual	Mech.	Elect.	Pneu.	Tac(1)	Elect.	Pneu.	Digital	Analog	Digital	Analog
(2) 3/8 x 1/2	+	+	+	0	+	+	+	+	+	+	+	+	+
(2) 1/2	+	+	+	0	+	+	+	+	+	+	+	+	+
3/4	+	+	+	+	+	+	+	+	+	+	+	+	+
1	+	+	+	+	+	+	+	+	+	+	+	+	+
1-1/2	+	+	+	+	+	+	+	+	+	+	+	+	+
2	+	+	+	+	+	+	+	+	+	+	+	+	+

(1) Self-Contained Tachometer Generator Driven by meter.

(2) Mechanical automatic temperature compensation is available with all sizes except 3/8" x 1/2" and 1/2".

REGISTER/READOUT SELECTIVE GUIDE

TOTALIZING

Mechanical Series 10

Horizontal straight reading register 6-digit non-reset odometer, with full dial sweep hand. Weight 2 lbs., Height 2-1/4".

BATCHING

Electrical – Local

Large Dial Preset Register with 5-digit display (maximum reading 99,999) is linked to the knockoff switch assembly. Once the predetermined batch is attained, the knockoff switches provide single or two-stage trip signal to operate valve, pump, alarm, etc.

Electronic (Remote) Model 412 S

Two-stage batch pre-set with L.E.D. 5-digit display. Maximum batch setting is 99,999. For panel mounting. Operated by impulse contractors on IE-Piston-Meter.

Electrical Model

Panel mounted meter operated by analog signal. High Speed pulse generator on Piston Meter produces frequency signal that is fed to Model PMI FA converter. Analog voltage output is fed to panel meter.

OUTPUT SIGNAL

Electrical Digital (Pulse)

High Frequency Pulse Generator – This is a photo-pulse unit which produces a 1 to 9 V square wave signal. Power Required: 135 mA 12 Vdc

Electrical Analog

The High Frequency Pulse Generator signal is fed into the Model 400 PMI. Choice of Analog signals are: 0-100 mv, 0-5 v, 0-10 v, 1-5 ma, 4-20 ma, 10-50 ma, 0-5 ma, 0-20 ma, 0-50 ma.

Specifications subject to change without notice

POSITIVE DISPLACEMENT METERS

Description

The IE Twin Rotor Meter is a positive displacement flow meter that is designed to measure the total throughput of liquid products. It is unique in that it does not use any sliding vanes or reciprocating parts nor are there any shock loads on the mechanism during operation resulting from the shifting of off-balance masses. The Electronic Totalizer located on the output shaft on the counter drive gearing, permits the operator at the time of installation, to adjust the output of the measuring unit to read in an exact number of units of volume. Thus the Electronic Totalizer allows an adjustment of accuracy of the meter calibration. This Twin rotor meter is primarily designed for gravity operation up to 570 LPM but may be used in pump installations where flows do not exceed 950 LPM and the working pressure is under 125 PSI (862 kPa).



Model B-60CB IE Twin Rotor Meter

TANK TRUCK & INDUSTRIAL METERS B-60CB/B-61CB

Principle Of Operation

The principle of operation of the IE Twin Rotor Meter is embodied in the function of the two rotors, which are the only moving parts within the measuring unit. They are always dynamically balanced but hydraulically unbalanced. The rotors are not in metal-to-metal contact with one another or with the housing in which they rotate. They are maintained in proper timed relationship with one another by helical gears. They divide the volume being measured into segments, separate each segment from the flowing stream momentarily, and then return them to the stream. The segments of flow are counted and the results are transferred to a totalizing counter. (See Figure 1).

Materials Of Construction

Body and Housing Carbon Steel Rotors Aluminium Timing Gears Stainless Steel Bushings Rulon* Ball Bearings Stainless Steel O-Rings Viton *Tradename of Dixon Corporation.

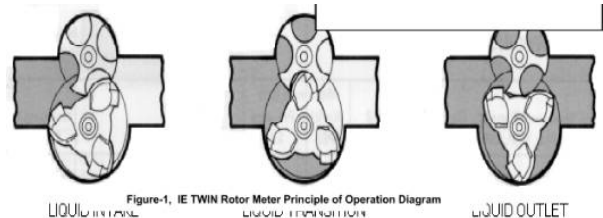


Figure-1. IE TWIN Rotor Meter Principle of Operation Diagram

Specification: -

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

Maximum Working Pressure: -

125 psig

Accuracy: -

± 0.25%

Operating Temperature: -

-Maximum of 150°F (66°C)

-Minimum of -20°F (-29°C)

Connections: -

3" ANSI 150 RF

SPECIFICATION OF ELECTRONIC TOTALIZER:

- Microprocessor based electronics
- 6 digit totalizer
- Rate of flow Indication
- Non resettable Totalization
- Replaceable Lithium battery (once in every 3 years)
- Programmable accuracy adjustor

ORDERING INFORMATION

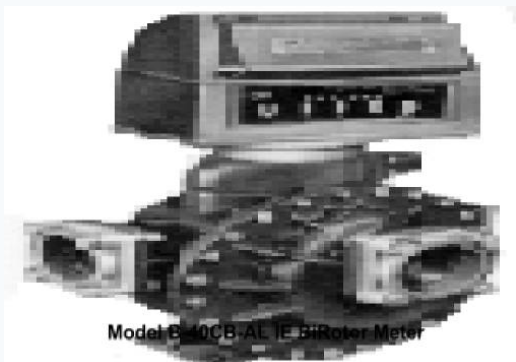
1. Liquid to be metered, specific gravity and viscosity
2. Liquid Operating Temperature
3. Maximum and minimum flow rate
4. Operating line pressure
5. Read-out functions and specifications
6. Units of registration

All-Aluminium BiRotor Meter B-40CBAL

POSITIVE DISPLACEMENT METERS

Description

IE all-aluminium positive displacement meters offer the exclusive BiRotor principle of true rotary operation – no sliding, oscillating or reciprocating parts. A rugged but simple design plus two rotors that are statically and dynamically balanced means long life and low maintenance costs. The all-aluminium BiRotor meter occupies a minimum of space and comes in a variety of flange configurations, permitting versatility in any piping arrangement. They are recommended for aircraft refueling, hydrant pits, hydrant carts, fueler trucks or any service requiring meters of all-aluminium construction. A wide variety of counters and accessories are available.



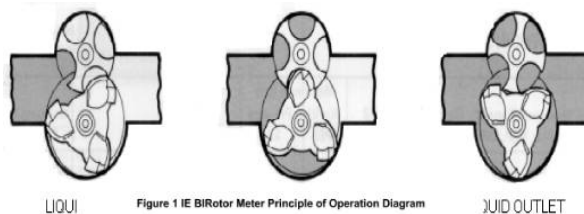
ALL-ALUMINIUM BIROTOR METER B-40CBAL

Design Features

- Two rotors with no metal-to-metal contact are the only moving parts in the measuring chamber
- Friction-free stainless steel ball bearing rotor mountings assure greater accuracy and lower pressure drop
- Simple dry adjustment permits calibration while the meter is under pressure without loss of liquid
- Unit-built assemblies are easily accessible for inspection, cleaning or replacement
- BiRotor meters are reversible and do not require reversing gears
- Temporary overspeeding will not damage a BiRotor Meter

Principle Of Operation

The two spiral fluted rotors within the measuring chamber are dynamically balanced, but hydraulically unbalanced. (Refer to Figure 1). As the product enters the intake of the measuring unit chamber, the two rotors divide the product into precise segments to the outlet of the measuring unit chamber. During this “liquid transition”, the rotation of the two rotors is directly proportional to the liquid throughput. A gear train located outside the measuring unit chamber conveys mechanical rotation of the rotors to a mechanical or electronic register for totalization of the liquid throughput.



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

SPECIFICATIONS (Standard Meters)

Materials of construction:

Outer Housing and Cover – aluminium
Counter Base Plate – aluminium

Measuring Unit:

Body and End Covers – aluminium
Rotors – aluminium
Rotor Shafts – nitralloy
Rotor Bearings – stainless steel
Counter Drive Shafts – stainless steel
Counter Drive Gears – stainless steel
Drive Shaft Bushings – teflon

All-Aluminium meters have only aluminium or stainless steel in contact with the liquid product.

Product temperature Range: -20°F to 150°F
-29°C to 66°C

ACCESSORIES

The wide range of accessories such as preset counters, pulse transmitters, control valves, large numerical registers, ticket printers and strainers enable the meter assembly to be adapted to a wide range of liquid measurement or control systems.

RECOMMENDED SPARE PARTS

O-Rings
Gaskets

ORDERING INFORMATION

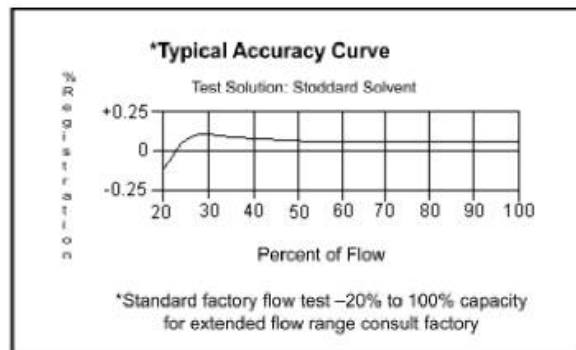
In order to accurately process an order, such information as product to be metered, product viscosity, product temperature range, ambient temperature range, rate of flow, operating pressure, units of registration, accessories required and optional features needed must be specified by the customer.

CAPACITY, CONNECTIONS and

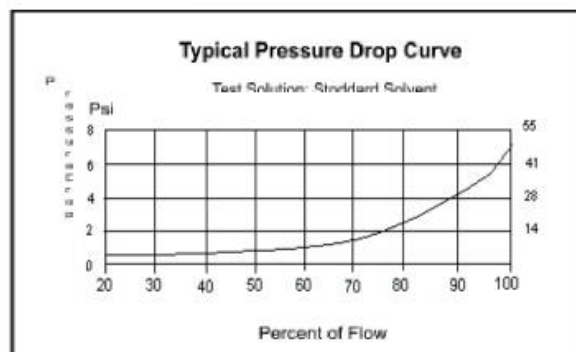
APPROXIMATE SHIPPING WEIGHT

Model	Maximum Capacity Gasoline, Light Oil				Maximum Safe Working Pressure		Connections	Shipping Weight*	
	US GPM	IMP. GPM	Lit/ MIN	Bbls./ Hrs.	PSI	KPa		Lbs.	Kg.

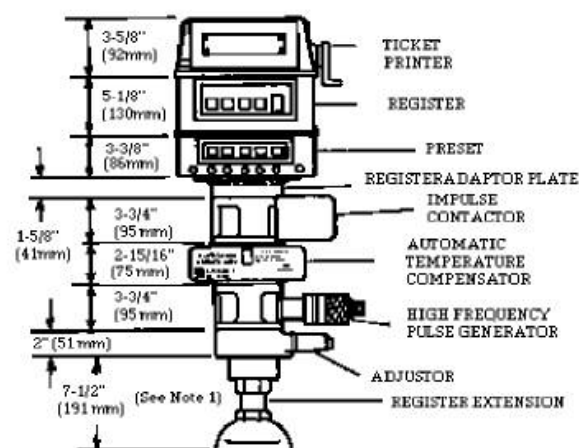
PERFORMANCE



PRESSURE DROP



TYPICAL ACCESSORY "STACK-UP"



B-40CB-AL	100	80	375	140	125	861	2" Screwed Connections 1-1/2" Screwed Connections	62	28
-----------	-----	----	-----	-----	-----	-----	--	----	----

REGISTRATION



SERIES 10

Horizontal Straight
Reading 6-digit, Non-
Reset, Height: 1-7/8"



LARGE DIAL REGISTER AND PRINTER –
Printer available as Accumulative type (7-digit)
To show batch size by totalizer differences.
Zero start (6-digit) shows batch size directly
without reference to totalised registration.



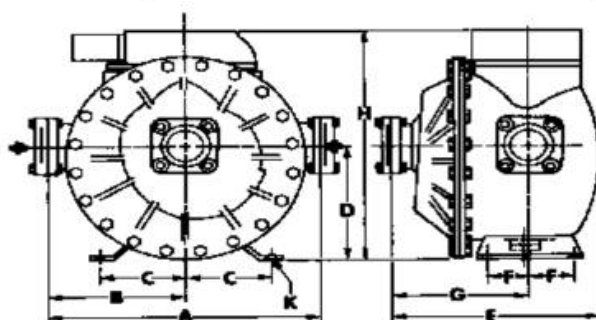
LARGE DIAL REGISTER – Large Visible Reset

Totalizing Register featuring one-handed reset
operation. Consists of a 5-digit reset totalizer
and an 8-digit non-reset totalizer.



**LARGE DIAL REGISTER, PRINTER AND
PRESET –** Fully automatic 4 or 5-digit
mechanical preset for single or two-stage
electric control. First stage adjustable from 3 to
9, or from 20 to 90 by 10's. Final stage
trimmable to stop at 0. Electrical switches have
two positions and one to four single pole,
double throw switches. Printer optional.

DIMENSIONS (For Certified Dimension Prints Contact Factory)



Meter Model	Mm Inches	Dimensions									
		A	B	C	D	E	F	G	H	J	K
B-40CB-AL	mm	318	159	106	165	233	52	163	332		14
		12-1/2	6-1/4	4-5/32	6-1/2	9-3/16	2-1/16	6-7/16	13-1/16		9/16

Biorotor Meter B-70CB

POSITIVE DISPLACEMENT METERS

Description

IE BiRotor Meter is a positive displacement meter utilized in the most demanding applications requiring accuracy, long life and ruggedness. The Model B-70CB retains a high accuracy over a flow range of 55 to 550 gpm. Accuracy is attained by the unique BiRotor design, which features two finely balanced rotors. An adjustor, incorporated on the meter, is calibrated at the factory for maximum accuracy within the meters flow range. Long life is assured because the meter does not contain any oscillating, reciprocating, sliding parts or cranks to wear or disturb the balanced rotary action. In addition, the materials incorporated within the meter assembly were selected specifically for the wide range of petroleum and industrial products to be exposed to the meter assembly. Ruggedness is provided in the double case housing fabricated from steel castings and drawn steel plates. This protects the meter from adverse forces, such as pipe strain, vibration or external damage which the meter can be exposed to.



BIROTOR METER B-70CB

Principle Of Operation

The two aluminium spiral fluted rotors within the measuring chamber are dynamically balanced, but hydraulically unbalanced. (Refer to Figure 1). As the product enters the intake of the measuring unit chamber, the two rotors divide the product into precise segments of volume momentarily and then return these segments to the outlet of the measuring unit chamber. During this "liquid transition", the rotation of the two rotors is directly proportional to the liquid throughput. A gear train located outside the measuring unit chamber conveys

Design Features

- Mounting can be either vertically or horizontally
- Applicable to either pump or gravity flow applications
- Calibration can be easily achieved while the meter is under pressure and with no loss of liquid product
- Conforms with international standards of flowmeter accuracy

Accessories

- The wide range of accessories such as preset counters, pulse transmitters, control valves, large numerical registers, ticket printers and strainers enable the meter assembly to be adapted to a wide range of liquid measurement or control systems. SPECIFICATIONS (Standard Meters) WARNING: Do not operate this instrument in excess of the specifications listed below. Failure to heed warning may result in serious personal injury or damage to equipment

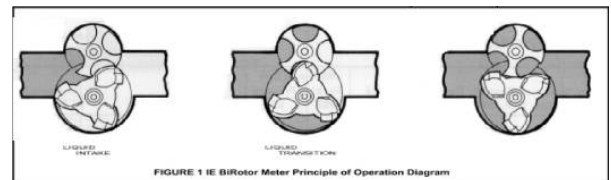
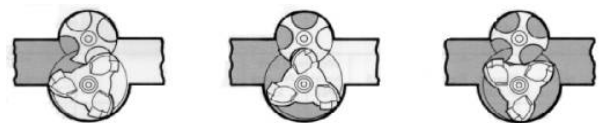


FIGURE 1 IE BiRotor Meter Principle of Operation Diagram



Materials of construction:

Housing: Welded steel construction combining steel

Castings and drawn steel plate

Measuring Unit: Rotors – heat treated Aluminum (Std.)

Rotor Shafts – ground and polished Nitralloy

Rotor Bearings – Stainless Steel

Body and End Covers – Nickel Cast Iron

Counter Base Plate: Body – Steel

O-ring – Viton (standard)

Counter Base Drive Gears – Stainless Steel

Drive Shafts – Stainless Steel

Drive Shaft Ball Bearing – Stainless Steel

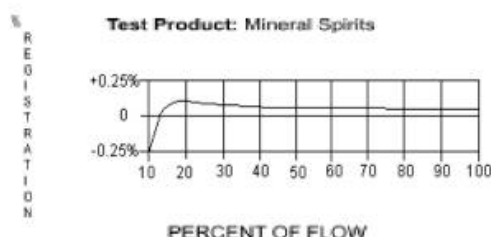
Flanges:

3" or 4" 150 lb. ANSI RF.

Pressure Rating:

150 psi (1034 kPa) maximum.

TYPICAL ACCURACY CURVE



Standard factory flow test – 20% to 100% capacity.

For extended range – consult factory.

Product temperature Range:

-20°F to 150°F; -29°C to 66°C.

Flow Capacity:

55 to 550 U.S. gpm; 46 to 458 imp. gpm; 79 to 785 Bbls.
Per hour; 208 to 2,082 liters per minute

Shipping Weight and Volume (approximate)

147lb. @ 3.13 ft³, 67 kg @ 0.09 m³

Dimensions

See Figure 2

Optional Meter Assemblies

Optional BiRotor Meter Assemblies can be obtained with any of the following specifications:

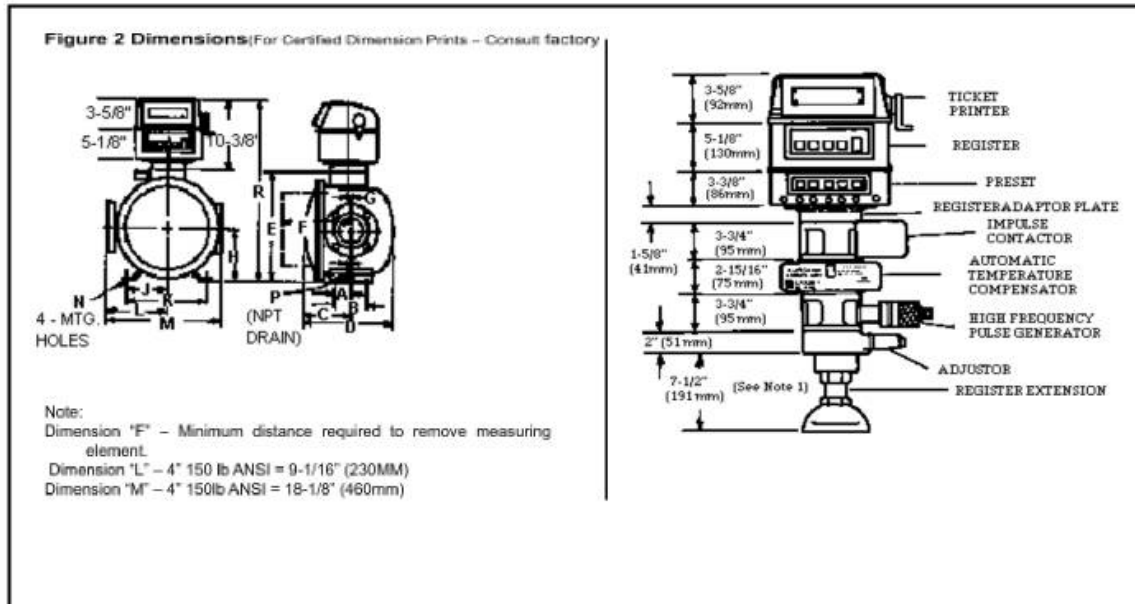
1. All ferrous Materials of Construction.
2. Liquid product temperature ranges up to 325°F (163°C).
3. Extra rotor clearance for viscosities above 10,000 S.S.U. (2,157 Centistokes)
4. Steam jacketed meter housing up to 325°F (163°C).
5. Custom inlet and outlet connections.

For additional optional features, contact factory.

ORDERING INFORMATION

- 1) Liquid to be metered, specific gravity and viscosity.
- 2) Liquid operating temperature.
- 3) Maximum and minimum flowrate.
- 4) Operating line pressure.
- 5) Read-out functions and specifications.
- 6) Units of registration.
- 7) Accessories and options required.

DIMENSIONS - Typical Accessory "Stack-Up"



Specifications Subject to Change Without Notice

6.

IE Sight Flow Indicators

FLOW INDICATORS & SIGHT GLASSES

Description

IE Sight Flow indicators are offered in three models; plain, drip-lip, and flapper. All units have two viewing windows of high-strength tempered glass. They are available in steel and 316SS, with either flanged or threaded connections. Model Plain: Indicators are used in application to detect the presence or absence of the process fluid, or its characteristics. The absence of a specialized flow indicator allows the plain indicator to be mounted in any position. The indicator should be used with readily visible fluids which can be unidirectional or bidirectional flows. Model Drip Lip: Indicators are used with low flow applications. Drops form on the drip lip which is visible through the sight glass. This indicator requires vertical mounting with flow from top to bottom. The fluid level in the outlet line must be lower than the indicator so that the drip lip sight glass area is constantly drained. Model Flapper: Indicators are used with most applications. A flapper indicates flow by its position. While it is not intended to be a check valve, its design inherently resists flow reversals. This indicator can be used for horizontal or vertical mounting with the exception of vertical down flow.

Design Features

- Tempered glass windows
- ANSI RF flanges
- Suitable for pressure up to 600 psig (See Tables)
- Will withstand 250°F thermal shock

Specifications

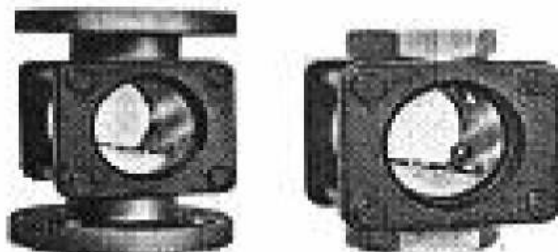
Caution: Do not operate this instrument in excess of the specifications listed below. Failure to heed warning may result in serious personal injury or damage to equipment. Model 8001A Model 8002A

Plain

Model 8011A Model 8012A

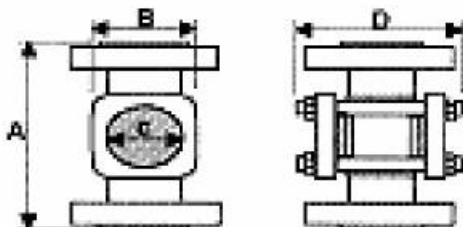
Drip Lip

Model 8021A Model 8022A



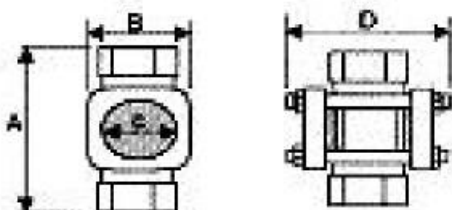
IE SIGHT FLOW INDICATORS

Flanged IE Sight Indicators



Flange Size	A	B	C	D
1"	6	3-3/8	2-3/16	4-3/4
1-1/2"	7	4-5/8	2-11/16	6
2"	7	4-5/8	2-11/16	6
3"	10	6-1/4	4	7-1/2
4"	10	6-1/4	4	8-1/2

All Dimensions given in Inches



Connection Size (NPT)	A	B	C	D
1/2"	5	3-3/8	2-3/16	4-3/4
3/4"	5	3-3/8	2-3/16	4-3/4
1"	5	3-3/8	2-3/16	4-3/4
1-1/2"	5-1/2	4-5/8	2-11/16	6
2"	5-1/2	4-5/8	2-11/16	6

All Dimensions given in Inches

Pressure Ratings:

8001A Series – Flanged Connections

Flange Size (Inches)	PSIG AT 200°F	
	150 # RF	300 # RF
1 – 16	240	440
>18	240	--

8002A Series – NPT Connections

Connection Size (Inches NPT)	Pressure Rating (PSIG at 200°F)
1/2	600
3/4	600
1	600
1-1/2	450
2	450

Temperature Ratings:

Maximum Working Temperature

Teflon - 450°F

Asbestos - 500°F

Neoprene - 180°F

Maximum Thermal Shock - 250°F

Materials of Construction:

Bodies – Steel or Stainless Steel

Window Cover Plates – Standard: Steel,

Optional: Stainless Steel

Window Gaskets – Standard: Neoprene

Optional: Asbestos or Teflon

Windows – Tempered Glass

Flanges – Steel or Stainless Steel

Dimensions:

See Figure 1.

Bolt & Nut Torque Values:

Size	Torque
1/2, 3/4, 1, 1-1/2, 2	15 Foot Pounds
3	20 Foot Pounds
4	45 Foot Pounds

IE Sight Flow Indicators

FLOW INDICATORS & SIGHT GLASSES

Description

IE Sight Flow indicators are offered in three models; plain, drip-lip, and flapper. All units have two viewing windows of high-strength tempered glass. They are available in steel and 316SS, with either flanged or threaded connections. Model Plain: Indicators are used in application to detect the presence or absence of the process fluid, or its characteristics. The absence of a specialized flow indicator allows the plain indicator to be mounted in any position. The indicator should be used with readily visible fluids which can be unidirectional or bidirectional flows. Model Drip Lip: Indicators are used with low flow applications. Drops form on the drip lip which is visible through the sight glass. This indicator requires vertical mounting with flow from top to bottom. The fluid level in the outlet line must be lower than the indicator so that the drip lip sight glass area is constantly drained. Model Flapper: Indicators are used with most applications. A flapper indicates flow by its position. While it is not intended to be a check valve, its design inherently resists flow reversals. This indicator can be used for horizontal or vertical mounting with the exception of vertical down flow.

Design Features

- Tempered glass windows
- ANSI RF flanges
- Suitable for pressure up to 600 psig (See Tables)
- Will withstand 250°F thermal shock

Specifications

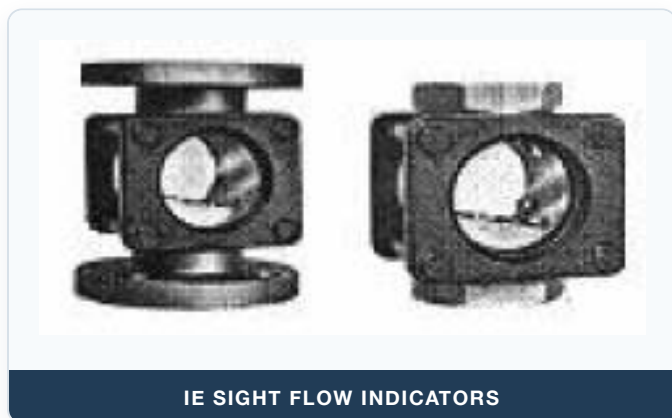
Caution: Do not operate this instrument in excess of the specifications listed below. Failure to heed warning may result in serious personal injury or damage to equipment. Model 8001A Model 8002A

Plain

Model 8011A Model 8012A

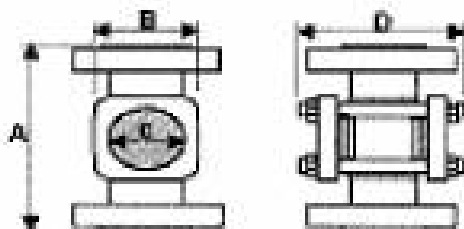
Drip Lip

Model 8021A Model 8022A



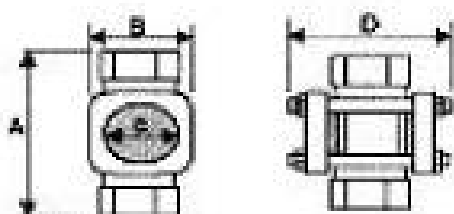
IE SIGHT FLOW INDICATORS

Flanged IE Sight Indicators



Flange Size	A	B	C	D
1"	5	3-3/8	2-3/16	4-3/4
1-1/2"	7	4-5/8	2-11/16	6
2"	7	4-5/8	2-11/16	6
3"	10	6-1/4	4	7-1/2
4"	10	6-1/4	4	8-1/2

All Dimensions given in Inches



Connection Size (NPT)	A	B	C	D
1/2"	5	3-3/8	2-3/16	4-3/4
3/4"	5	3-3/8	2-3/16	4-3/4
1"	5	3-3/8	2-3/16	4-3/4
1-1/2"	5-1/2	4-5/8	2-11/16	6
2"	5-1/2	4-5/8	2-11/16	6

All Dimensions given in Inches

Pressure Ratings:

8001A Series – Flanged Connections

Flange Size (Inches)	PSIG AT 200°F	
	150 # RF	300 # RF
1 – 16	240	440
>18	240	—

8002A Series – NPT Connections

Connection Size (Inches NPT)	Pressure Rating (PSIG at 200°F)
1/2	600
3/4	600
1	600
1-1/2	450
2	450

Temperature Ratings:

Maximum Working Temperature

Teflon - 450°F

Asbestos - 500°F

Neoprene - 180°F

Maximum Thermal Shock - 250°F

Materials of Construction:

Bodies – Steel or Stainless Steel

Window Cover Plates – Standard: Steel,

Optional: Stainless Steel

Window Gaskets – Standard: Neoprene

Optional: Asbestos or Teflon

Windows – Tempered Glass

Flanges – Steel or Stainless Steel

Dimensions:

See Figure 1.

Bolt & Nut Torque Values:

Size	Torque
1/2, 3/4, 1, 1-1/2, 2	15 Foot Pounds
3	20 Foot Pounds
4	45 Foot Pounds

IE Thru-Flow Indicator with Electrical Transmitter

FLOW INDICATORS & SIGHT GLASSES

Description

IE Thru-Flow 3800 series (3804-Screwed & 3809-flanged) is a rugged, all metal flowmeter. Indication is provided by means of a magnetic coupling where a magnet, encapsulated in the float, is coupled to a rotatable magnet in the rear of the indicator, thus turning the dial indicator mounted on the meter. Optional Electrical Transmitter model 5000 is available for transmitting flow reading as a 4 to 20 mA signal. .



IE THRU-FLOW INDICATOR WITH ELECTRICAL TRANSMITTER

Design Features

- Straight-through flow path construction
- No float extension outside the meter body
- No spools required
- Flanged/Screwed connections
- Easy-to-read scale graduated in flow units or percent of maximum flow with factor
- Permanent magnetic link between metering float and indicator/transmitter

Principle Of Operation

The Model 5000 Two Wire Smart Flow Transmitter provide remote electrical signal linear with flow rate. The angular movement of pointer is sensed by a non-contact sensor. The signal obtained is linearised by a low power micro controller. The micro controller retransmits the signal as a 4-20 mA Analog signal linearly, proportional to the flow indication. Micro Controller also has facility to adjust the dampening constant for pulsating flows.

Specifications

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

Performance

Standard Accuracy: + 2% Full Scale Optional Accuracy: + 1% Full Scale Repeatability 0.5% Full Scale

Materials Of Construction

METER TUBE, FLOAT AND FLANGES Standard: 316 SS Optional: 316L SS, HASTELLOY C, 304 SS, 321 SS

Flanges

Standard: 150 lbs. RF ANSI B 16.5 Optional: 300 lbs. RF, 600 lbs. RF – for higher ratings , consult factory.

Instrument Case

Standard: Die cast aluminium with Neoprene gasket Optional: Epoxy painted

Technical Data for Transmitter

Power Supply : 12 TO 36 Vdc

Current Consumption : Approximately 25 mA

Ambient Operating Temperature : 0-55°C

Protection Category: To DIN 400 050: IP65

Two-Wire System: 4 TO 20 mA/max. 600 Ohm

Temperature Influence: <0.05% °c (0.03°F)

Power Influence: <0.2% for 12V to 36V change at Input terminals.

Load Resistance Dependence: <0.2% for 0 to RA (max).

Max. Load Resistance Two-Wire System.

$$R_A = \frac{U_B - 12}{I_A}$$

I_A

R_A = Load Resistance in K ohms

U_B = power supply Voltage in Volts.

I_A = max. output current in mA

Capacities

Size	Conn. Size	Float	Maximum Flow Capacity		Pre. Drop " WC
			Water LPM	Air SLPM ¹⁾	
7	1/2"	287	0.33	10.2 ²⁾	78
		288	0.95	29.7 ²⁾	48
		289	1.83	56.9 ²⁾	60
8	1/2"	283	3.5	109.3 ²⁾	30
		284	5.5	171.3 ²⁾	36
		285	9.5	295.1 ²⁾	60
		286	15	465.6 ²⁾	64
10	1"	279	18.92	569	42
		290	28.33	884	48
		280	37.83	1,212	55
		281	53.33	1,653	90
12	1-1/2"	275	80	2,463	66
		276	108.33	3,341	78
		277	150	4,616	90
		278	191.67	5,947	132
13	2"	271	225	6,910	121
		272	266.67	8,269	139
		273	308.33	9,515	163
		274	416.67	12,915	181
15	3"	308A	500	15,533	164
		308B	666.67	20,717	199
16	4"	308C	833.3	25,900	247
		308D	1,000	31,067	289

¹⁾ Air flows are given at 14.7 psia, 70°F

²⁾ Range 5:1

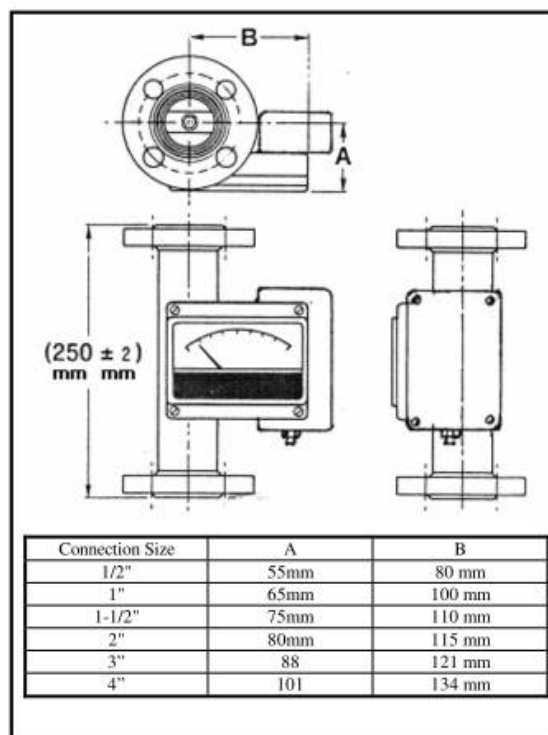


Figure 1 Dimensions

ORDERING INFORMATION

1. Model
2. Size
3. Quantity required
4. Minimum, normal and maximum flow rate with flow units.
5. Process fluid, density and viscosity at operating conditions
6. Scale graduation
7. Minimum, normal and maximum operating temperature and pressure.
8. Wetted material

Specifications subject to change without notice.

VARIABLE AREA FLOWMETERS – ACCESSORIES

Description

The IE Mag/Na/Larm is a magnetically actuated alarm switch system used to warn of abnormal flow conditions. It can be furnished on any flowmeter which uses an extension- type metering float, including instruments also provided with indicating and transmitting extensions. Single or multiple magnetically actuated switches can be positioned over the entire flowmeter range. A weather tight case protects the entire unit.



IE MAG/NA/LARM – MAGNETIC FLOW RATE ALARM

Design Features

- Vibration-proof, dry reed switches – Contacts are hermetically sealed in glass. Long life – Tested for a half-million operating cycles under normal load conditions. Reversible switch can be changed to make or break contact on rising flow. SPDT relay standard (DPDT relay optional). Explosion proof construction available. Switch setting easily adjusted in the field

Materials Of Construction

EXTENSION WELL: Standard – 316 Stn. Stl.

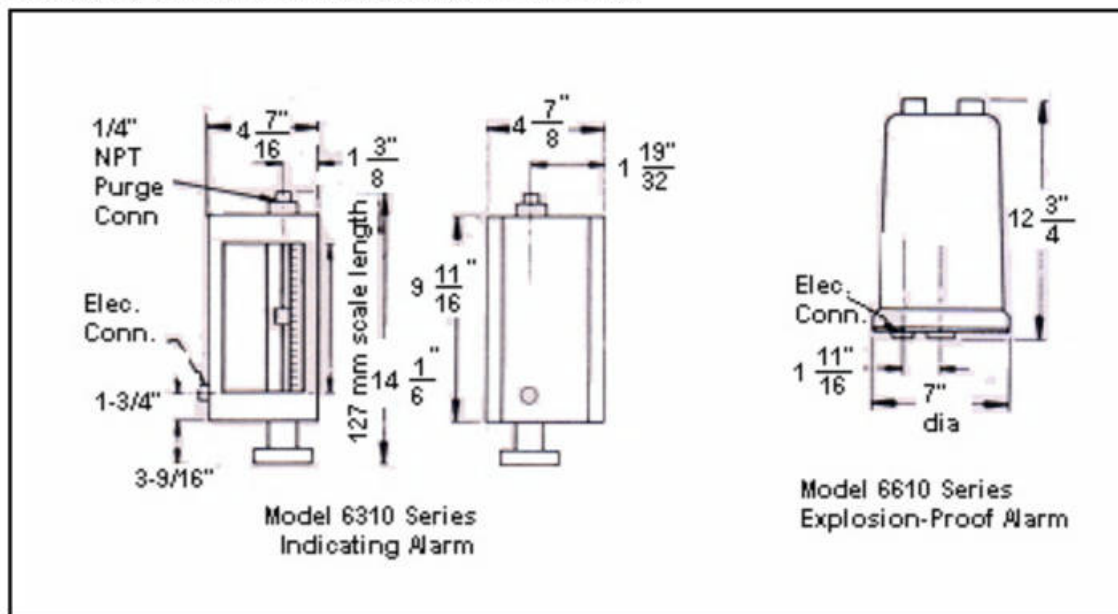
Specifications

SENSITIVITY: Unit is capable of detecting one millimetre of float movement. POWER REQUIREMENTS: 220 Vac 50 Hz standard, 110- 125 Vac optional MAGNETIC SWITCH: One millisecond make and break; rhodium-plated contacts rated at 0.25 amperes, 115 Vac resistive load. RELAY: SPDT in a dust-tight enclosure, rated at 3 amperes inductive load, 6 amperes resistive load, 220 Vac 50 Hz. MAX. CASE AMBIENT TEMPERATURE : 250°F HOUSING: Models 6311, 6411 – NEMA 1; Models 6511, 6611, 6631 – NEMA 7 (Meets Class 1, Group D, Division 1, requirements.); Models 6211, 6331 – NEMA 12 MAX. NUMBER OF CONTACT SWITCHES: 6200 (Blind) 2 switches and relays, 4 switches without relay. 6300 (Indicating) 3 switches and relays, 4 switches without relays. 6500 and 6600 3 switches and relays, 4 switches without relays.

Principle Of Operation

In operation, when the flow rises or falls into the area of the alarm setting, the magnet on the float assembly causes the dry reed switch to actuate thereby triggering the warning device which may be a horn, whistle, bell or panel light. Due to the inherent low power capability of the reed switch, a relay is normally used. The Mag/Na/Larm can be used with either glass or metal tube flowmeters.

Dimension (For certified dimension prints, write to factory.)



Ordering Information:

The Mag/Na/Larm flow rate alarms are designated by a 6000 series number. The second, third and fourth digits further describe the specific units as follows:

Type of Alarm		Flowmeter Float Travel		Switch/Relay Arrangement	
Description	2nd Digit	Description	3rd Digit	Description	4th Digit
Blind, no purge, sheet metal case	2	5" (127 MM)	1	1 Switch with Relay	1
Indicating, w/top purge, side plate constructed case	3	3" (75MM)	2	2 Switches with 2 Relays	2
Blind, w/top purge, side plate constructed case	3	1-1/2" (38MM)	3	3 Switches with 3 Relays	3
Blind, w/top purge, side plate constructed case	4	3" (75 MM)	2	2 Switches with 2 Relays	2
Explosion – proof, with purge	5	1-1/2" (38MM)	3	3 Switches with 3 Relays	3
Explosion – proof, no purge	6	Others	9	2 Switches with 2 Relays	2
Integral in 5500 Series flowmeter transmitter case	9			4 Switches with 4 Relays	4
				1 Switch, no Relays	5
				2 Switches, no Relays	6
				3 Switches, no Relays	7
				4 Switches, no Relays	8
				Other combinations	9

Specifications subject to change without notice.

IE MAG/NA/LARM – Model 7930

VARIABLE AREA FLOWMETERS – ACCESSORIES

Description

The IE Model 7930 MAG/NA/LARM II is a magnetically actuated alarm switch designed for use on the IE 1100 Series Full-View* Flowmeter. The alarm can be used on any Full-View, sizes 8 through 13 with ribbed tube and scale lengths of 127 mm, 250 mm and 600 mm. The MAG/NA/LARM II consists of a dry reed switch, a SPDT relay, and a special metering float containing a magnet. The reed switch is mounted on an adjustable bracket located on the inner side of the flowmeters' side plate, and adjacent to the metering tube. The magnet imbedded in the float activates the reed switch as the float passes by the reed switch. The reed switch triggers the SPDT relay which is mounted inside a small metal enclosure on the outer side of the flowmeters' side plate. The relay, in turn, operates the user's alarm device. The MAG/NA/LARM II can be supplied mounted on the meter if specified at time of initial order, or can be field installed on an existing Full-View by the user. The 7930 Alarm is available with either one or two reed switches and relays allowing low and/or high flow alarm set points.



IE MAG/NA/LARM – MODEL 7930

Design Features

- Vibration-proof, hermetically-sealed, dry reed switch immune to shock and vibration
- Long-life reed switch tested for half-million operating cycles under normal load conditions
- Easily field installed on existing flowmeters

Power Requirements

220 Vac 50 Hz standard, 110-125 Vac optional

Magnetic Reed Switch

One millisecond make and break; rhodium plated contacts. Maximum reed switch contact ratings: 115 volt 50/60 Hz, 40W non-inductive; 125 Vdc, 0.1 amps (and suppression, recommended); or 220 Vac, 20W, Low voltage ac or dc, 25W intermittent.

Relay

Standard SPDT in a dust-tight enclosure. Contacts rated at 3 amps inductive, 6 amps resistive load, 220 Vac 50 Hz.

Ambient Temperature Limit

250°F (122°C) maximum

Sensitivity

Reed switch is capable of detecting one millimeter of float movement. Full-View Flowmeter with Model 7930 MAG/NA/LARM II, Front View Full-View flowmeter, with Model 7930 MAG/NA/LARM II, Rear View with Relay Cover removed.



OPTICAL SENSOR ALARM – Electronic Alarm

VARIABLE AREA FLOWMETERS – ACCESSORIES

Description

The IE Optical Sensor Alarm is an electronic alarm system used to warn of abnormal flow conditions. It is specifically designed to be mounted on IE Sho-Rate “50” and “150” single and multi-tube flowmeters. Because it utilizes an optical sensor, there is no restriction on the float material. Either 1 or 2 alarm set-points can be positioned over the entire range of the flowmeter.



OPTICAL SENSOR ALARM – ELECTRONIC ALARM

Design Features

- Economical alternative to traditional offerings with- out any sacrifice in performance
- Optical alarm sensor – no restriction on float material
- Field adjustable sensor sensitivity for a wide variety of process conditions
- SPDT alarm relay
- NEMA 4 electronics housing
- Standard electronics compatible with one or two alarm sensors
- Easy field modification of existing Sho-Rates
- Momentary or latch alarm output urations
- AC or DC input power compatible
- For use with single or multi-tube Sho-Rate. Model 7940 Optical Sensor Alarm With Model 1355 Sho-Rate “150”



Cable entries

Enclosure

REPRESENTATIVE CONFIGURATIONS

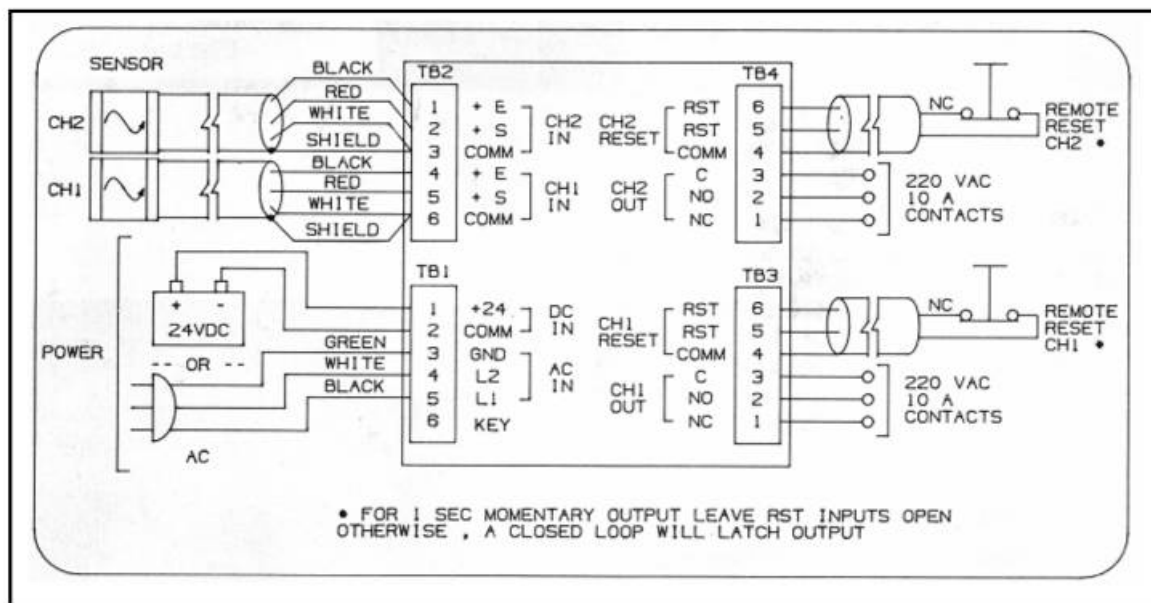


Figure 2 Schematic Diagram

SPECIFICATIONS

Detection Method

One infrared LED Photo Sensor. Second sensor optionally available.

Temperature Limits

Sensor – 32 to 200° F
Housing – 40 to 120° F

Operating Voltage

115/230 Vac, 25W Max; 24 Vdc, 20W Max.

Output Contact Rating

One dry contact, form C relay per sensor. Relay rating 10 Amp at 120 Fac SPDT. 2 contacts available.

Output Duration

Jumper selectable momentary (1 second) or latch

Sensor Connection

Terminal Block. See Figure 2

Integral Alarm Indication

Red/Green LED integral to electronics housing-one per contact. Not visible with electronics housing cover in place.

Materials of Construction

Sensor Housing – Molded plastic
Electronics Housing – Molded plastic, NEMA r
Sensor Interconnection Cable – 6 ft of shielded cable.

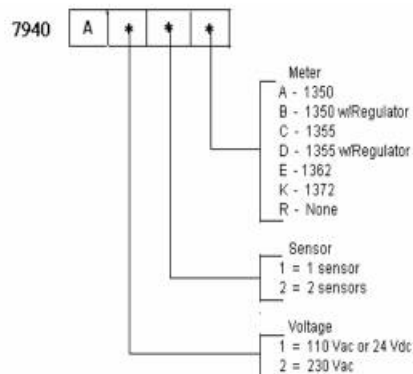
Dimensions

See Figure 1

Sho-rate Options Not Available with Alarm

Direct read metal scale
Front of panel mounting

Model Number Code



ORDERING INFORMATION

To order, please specify

1. Model number
2. Sho-rate model to be used with
3. Number of sensors per tube (two maximum)
4. Operating voltage

Specifications subject to change without notice.

IE Model 300 Electronic Indicating Totalizer

GENERAL INSTRUMENTATION

Description

The IE Model 300 Electronic Indicating Totalizer is a microprocessor based instrument designed to be used in conjunction with primary flow sensors which have a pulse, contact closure, magnetic pick-off or 4-20mA current output. The main function of the unit is to provide flow indication and totalization. The Model 300 factors input signals into engineering units and provides a direct display of flow rate as well as total flow. Selection of counter configuration (reset to zero and inventory totalization), as well as input scaling, decimal locations, are all entered on the sealed front key pad. The Model 300 is available in two basic configurations. One is a panel mounted version and another is an explosion proof version.



IE MODEL 300 ELECTRONIC INDICATING TOTALIZER

Design Features

- Micro-processor based
- Flow Rate Indication
- Totalization
- Moisture resistant sealed front panel
- 16x2 alphanumeric dot matrix LCD display
- Unscaled and factored outputs
- Non-volatile memory
- AC/DC power option available

Specifications

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

Accuracy

Total Display: + 1 count Rate Display: 3 significant digits; resolution 2% or better Mode of Operation Flow rate indication and Totalization Flow rate indication and cumulative totalization Totalization and cumulative totalization Temperature Operating Temperature: -18 to 65oC Power Requirements 24 Vdc 230/115 Vac + 15%, 50/60 Hz Instrumen

Materials Of Construction

Explosion Proof Housing - Cast Aluminum Weather Proof Housing - Sheet Steel Front Panel Controls Indication: 16x2 alphanumeric dot matrix LCD display Data entry: 4 button membrane keypad Scaling: Scaling factor is an eight digit number entered in by scientific notation. The incoming pulses are multiplied by this scaling factor to obtain the engineering quantity for display. Input Signals Pulse: 0-10 kHz; minimum pulse width 30 microseconds. VL: 0 to 10 Vdc. VH: 3 to 28 Vdc Current: 4-20mA current loop or 4-20mA current input Pick-off: Magnetic pickoff input (20mV to 2V) Output Signals Power: 12 Vdc + 10% regulated, 100 mA (AC/DC Versions only). 24Vdc for current loop (4-20mA) TTL/Open Collector scaled/unscaled. Open collector output sinks up to 100 mA at 28 V. 4-20mA corresponding to flow rate Specifications subject to change without notice.

IE MODEL 300 INDICATING TOTALIZER MODEL CODING									
MODEL	DESCRIPTION								
0300-	MICRO PROCESSOR BASED INDICATING TOTALIZER								
	CODE	LINE VOLTAGE							
	1	115 Vac							
	2	230 Vac							
	3	24 Vdc							
	CODE	INPUT SIGNAL							
	A	4-20 MA							
	B	PULSE							
	C	PICK-OFF							
	D	CURRENT LOOP (24V INTEGRAL)							
	CODE	OUTPUTS							
	0	NONE							
	1	4-20 MA							
	2	OPEN COLLECTOR PULSE							
	3	0-5 V TTL PULSE							
	4	UNSCALED OPEN COLLECTOR PULSE							
	5	UNSCALED 5 V TTL PULSE							
	6	4-20 MA & SCALED OPEN COLLECTOR PULSE							
	7	4-20 MA & UNSCALED OPEN COLLECTOR PULSE							
	8	4-20 MA & SCALED 5 V TTL PULSE							
	9	4-20 MA & UNSCALED 5 V TTL PULSE							
	CODE	OPTIONS							
	A	NONE							
	B	RS 232 C CONNECTIVITY (WEATHER PROOF ONLY)							
	CODE	BATCHING COUNTER WEATHER PROOF ONLY							
	0	NONE							
	1	SINGLE STAGE (WEATHER PROOF ONLY)							
	2	TWO STAGE (WEATHER PROOF ONLY)							
	3	DIGITAL CONTROL VALVE (WEATHER PROOF ONLY)							
	CODE	PRIMARY INSTRUMENT POWER							
	A	NONE							
	B	12V DC							
	CODE	ALARM TYPE							
	0	NONE							
	1	SINGLE SPDT (WEATHER PROOF ONLY)							
	2	DOUBLE SPDT (WEATHER PROOF ONLY)							
	CODE	ENCLOSURE TYPE							
	A	WEATHER PROOF							
	B	EXPLOSION PROOF							

0300- 2 A 1 A 0 A 0 A TYPICAL MODEL NUMBER

April 04, 2000.

IE Spill-Save Anti-Spill Device

GENERAL INSTRUMENTATION

■ Description

The IE Spill-Save anti-spill device is the most flexible and inexpensive instrument to ensure two important interlocks; Loading Arm Contact and Overspill Detect Contact. These two interlocks are continuously monitored by the IE Autoload System to prevent loss of product at the time of loading.

■ Design Features

- - Simple design – ease of use - Rugged construction – maintenance free - Ensures prevention of product loss - Certified to be used in Ex.D. IIa, IIb areas - CMRS & CCOE approved

■ Principle Of Operation

The instrument has two interlocks; Loading Arm Contact and Spill-Save. It has a spring loaded plate having a reed switch contact. When the device is inserted in the truck, contact closure is completed and the signal sent to the Autoload System. If the device is removed at any point of time during the delivery cycle the system sends a signal to the valve to shut down. The Spill-Save contact is float operated. A short tube protrudes into the tank compartment. Within this tube is a float, which is buoyant. In case of over flow due to any reason, the product raises in the inserted tube thereby raising the float. This completes a contact closure. This is a normally – open Autoload System. When contact closure is completed the Autoload System sends a signal to the valves to shut down and also sends an alarm signal to the operator at the control room to shut down the pumps.

■ Materials Of Construction

Body – Aluminium Connections 2 - wire connection to IE Autoload Batcher for Loading arm contact 2 – wire connection to IE Autoload Batcher for Spill-Save contact Area Classification Flame Proof Ex.D. IIa, IIb as per IS:2148-1981 Weather Proof to IP-67 as per IS:2147-1962 CMRS & CCOE approved Reference Drawing EK092H500

GENERAL INSTRUMENTATION

Description

IE Prover Electronics is a Microprocessor based instrument, which is designed to be used in Terminal Automation projects to do the periodical proving of the meters used. This is based on high speed micro controller. The Prover Electronics consists of a front panel LCD back lit graphical display and a keyboard on the front panel. This is interfaced with prover tank of 2000 litres capacity and to a digital control valve. This can be hooked up to any of the meter for which the proving is required.

Design Features

- iiA iiB Explosion Proof enclosures
- Liquid crystal display with back lighting graphical
- Watchdog timer function
- Digital valve control for flow rate control & Volumeter Batch control
- Proving Tank certified by Weight & Measures Dept
- RS 232/RS 485 Interface

Principle Of Operation

The outlet of the meter is connected to the prover pipe line and the flow rate is set through front panel in the Prover Electronics, the fluid will be collected in a prover tank on pressing start button of prover electronics. On tank full the sensor will send a signal to the prover electronics and the digital valve at the prover tank will be closed. The Prover Electronics will be fed with pulses from meter under proving during the prover tank filling. On completion of the prover cycle the Prover Electronics will calculate the K-Factor for the particular flow rate i.e. set. In the same fashion the number of cycles are repeated at different flow rates and the K-Factors are calculated. T

Specifications

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

Inputs

- Pulse input from meter under proving
- Sensor signal from prover tank

Outputs

- Front panel display LCD back lit graphical
- RS / RS 485 terminal for data communication with P.C
- Digital valve control signal to control the flow rate set for the prover run

GENERAL INSTRUMENTATION

■ Description

When Batch Controller is installed in control room of Terminal Automation project, a console is required in the field to be accessed by truck filling staff and drivers. IE Remote Interface Terminal will fulfill this requirement. IE RIT is a microprocessor based instrument with a LCD back lit graphical display and front panel keyboard and alarm/status indicating lamps. This will send signals to Batch Controller and receive controls from the same on RS 232 / RS 485 depending upon the density and distance of the loading points from control room. A matched protocol for data communication between IE Batch Controller and IE RIT is also supplied with this.

■ Design Features

- iiA iiB Explosion Proof enclosures
- Liquid crystal display with back lighting graphical
- Watchdog timer
- RS 232/RS 485 serial port to be connected to Batcher

■ Principle Of Operation

RIT will be accessed by front panel keyboard and the signals are transmitted to Batcher and the Data is received by RIT on RS 232 / RS 485 depending upon the distance and the digital valve operation is then controlled by RIT by truck driver/filling operator. RIT will also display data of truck under loading on graphical display. Also sends and receives data of the truck under loading to Batcher.

■ Specifications

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

■ Inputs

Serial data from Batcher on RS 232/RS 485.

■ Outputs

- Signal to Digital Control Valve
- Serial Data to Batcher on RS 232/RS 485
- LCD Graphical display with back light

IE Auto Load Inventory Control System

GENERAL INSTRUMENTATION

Description

The IE Auto Load Inventory Control System control unit is a compact electronic preset designed to provide precise delivery of petroleum, industrial and chemical products. The control unit easily adapts to any type of pulsed output flow meter and all types of two stage control valves. The control unit utilizes advanced high-speed microcomputer technology which provides unlimited flexibility. Programming the control unit is easily performed by simply selecting the desired options from built-in menus. Available enclosures include iiA iiB Explosion Proof, and rack mount. Delivered quantities are displayed on a large 8 character numeric display. Operator prompts and program menus are presented on a 32 character alphanumeric display. A four push-button keypad provides push buttons Function Select, Digit Select, Digit/DP Advance Stop and Enter/Start. These are used for entering values for the various user selectable parameters in addition to the batch delivery quantities.

Design Features

- IIA IIB EXPLOSION PROOF ENCLOSURES
- TWO LIQUID CRYSTAL DISPLAYS WITH BACK LIGHTING, 8-CHARACTER NUMERIC AND 2X16

Two Data Communication Channels

INSTANTANEOUS FLOW RATE INDICATION 0DIGITAL TIME AND TEMPERATURE DISPLAYS (WHEN MODE IS ACTIVATED)

Principle Of Operation

The IE Auto Load Inventory Control System control unit offers a unique approach of providing a wide selection of options in the microcomputer firmware while keeping the hardware simple, permitting maximum flexibility. Simple programming of the unit is required for the specific functions required by the application. It can be set up as a simple batch totalizer or as a self contained full featured inventory control system by selecting from hundreds of options resident in the microcomputer's firmware. Once the Auto Load is set up, operation is simple and easy. Operating instructions are presented on the display screen to assist the operator. The instructions displayed will vary depending on how the Auto Load is configured by the site engineer.

Specifications

WARNING: Do not operate this instrument in excess of the specifications listed below. Failure to heed w

Inputs

Pulse Input 12 Vdc Configuration: Threshold - 6 Vdc +1 Vdc; Hysteresis - 0.5 Vdc; Input Resistance - 12.1 kOhm; Maximum Input Voltage - 30 Vdc; Maximum Input Frequency - 10 kHz 5 Vdc Configuration: Threshold - 2.2 Vdc +0.5 Vdc; Hysteresis - 0.25 Vdc; Input Resistance - 23.0 kOhm; Maximum Input Voltage - 30 Vdc; Maximum Input Frequency - 10 kHz 20 mA Configuration: Threshold - 7.8 mA; Hysteresis - 1 mA; Input Resistance - 772 Ohm; Maximum Input Voltage - 20 Vdc; Maximum Input Frequency 10 kHz Digital Inputs Nominal Input Voltage: 12 Vdc; Maximum Input Voltage - 30 Vdc; Threshold - 6 Vdc +1 Vdc; Hysteresis - 1 Vdc; Input Resistance - 1.95 kOhm; Minimum Pulse Width - 10 ms Permissive Power Detect Input Input Voltage: 90 Vac to 270 Vac; 47 Hz to 63 Hz; Input Impedance - 56 kOhm minimum PRTD Input Connection Type: Three wire with provision for terminating a fourth wire; PRTD Type: DIN 43760 Standard with a temperature coefficient of 0.00385 Ohm/Ohm/deg. C; Drive Current: 1 mA nominal Current Loop Inputs

Input Resistance - 250 Ohm; Nominal Input Current - 4-20 mA; Maximum Input Current - 45 mA

OUTPUTS

Digital Outputs

Maximum Off State Voltage - 60 Vdc; Maximum On State Voltage - 0.35 Vdc ($I=0.25$ amp); Maximum Current - 1.0 amp; Maximum Frequency - 100 Hz; Minimum Pulse Width - 5 ms

AC Solid State Relays

Load Voltage - 24 Vdc to 280 Vac; 25 Hz to 70 Hz; Maximum Current - 1.5 amp; Maximum Off State Leakage - 6 mA; Maximum On State Voltage Drop - 1.6 Vac

DC Solid State Relays

Load Voltage - 3.0 Vdc to 60 Vdc; Load Current - 0.01 amp dc to 1.5 amp dc; Maximum Off State Leakage - 1.0 mA dc; Maximum On State Voltage Drop - 1.85 Vdc

DC Power Sources for Use with Pulsers, Digital Inputs and Current Loop Transmitters

+12 Vdc Regulated at 110 mA, Fused at 250 mA
 +24 Vdc Unregulated at 100 mA, 1% ripple maximum, fused at 250 mA

AC Power Sources for use with relays

Line Power Fused at 3 amps; Permissive Power Fused at 3 amps

ENVIRONMENTAL SPECIFICATIONS

Temperature

iiA iiB Enclosures

Operating: -20 to 50°C

Storage: -40 to 70°C

Rack Mount

Operating: 0 to 40°C

Storage: 60°C

Thermal Shock

No harmful effect for operating ($< 1^{\circ}\text{C}/\text{Min.}$) or storage ($< 3^{\circ}\text{C}/\text{Min.}$)

Humidity

Division 1 and 2: 0-100%

Rack Mount: 0-95%

PROGRAMMING

The control unit contains four basic programming modes which permit the user to configure each unit for the specific application. The programming variables are selected from a built in menu and are advanced by using the select and repeat keys.

Programming Modes			
Setup	Status	Archive	Test

In the control unit's setup mode, menus are presented for selection in the following:

Delivery	I/O Configurations
Factors	T&P Compensation
Alarms	Data Communications

Valve Control

Select from digital or conventional two stage valve control with independent selections for low flow start, low flow stop and final stop.

Valve Control Error Limit

When digital valve control is selected, the control tolerance for the programmed flow rate is entered as a percentage value. If the flow rate exceeds the tolerance, the valve is signaled to adjust (open or close) as required to maintain the programmed flow rate.

K-Factor Linearization

Flow meter accuracy is maintained with programmable multi-point linearization. Apply these meter factors to the digital valve flow rate set points for maximum flow meter accuracy.

Voltage Selection

Configure the Auto Load for 230 Vac or 115 Vac, 50 or 60 Hz operation by installing program jumpers on the customer connector board.

Permissive Sense

Use the permissive power input circuit as a safety device or to verify operational integrity such as: ground connectors, high level or dead main interrupts.

Data Acquisition

Two separate digital signals are provided for net and/or gross outputs. The outputs may be factored from 0.1 to 10.0 for each unit quantity delivered. Pulse widths (5.0 to 25.0 milliseconds) are adjustable and selections are made from the menu.

Preset Options

Three options are available including conventional numeric, repeat previous or select from four preprogrammed values. In addition, minimum and maximum allowable preset values may be programmed.

Operator View Group

Up to nine separate user selectable variables may be configured for instantaneous operator viewing. These parameters may be viewed but not changed by the operator and often include:

Flow Rate	Relay Status
Temperature	Delivered Gross
Pressure	Delivered Net
Current Time	Status Registers
Density	Preset Quantity
K-Factor	Preset Remaining
Meter Factor	

Display Test Enable

Engage the local display test function as necessary for display segment checks if required by the local weights and measures authority.

Operator I.D. Codes

Operational security controls may be implemented by requiring the operator to input a numeric access code of eight digits or less.

Alarms

Built in programmable alarm conditions are user selectable and may be programmed to monitor one or more of the following conditions:

Low Flow Rate	Preset Over Delivery Quantity
High Flow Rate	Preset Under Delivery Quantity
Valve Failure	Pulse Security Error
	Data Communications Error

Alarm Actions

An internal menu permits selection of desired responses when an alarm condition occurs. The responses are:

- Off (no response)
- Display Only
- Display and Close an Alarm Contact
- Display, Alarm and Stop the Control Unit
- Display, Alarm, Stop and Lock the Control Unit

Digital Output Signals

User programmable output relays provide flexibility for a broad range of control unit applications. Output relays K-1 through K-10 with Digital Outputs DO-1 and DO-2 provide a total of twelve configurable outputs which may be assigned for:

Pump Contact	N.C. Valve Stem Switch
N.O. Valve Pilot	Auxiliary Contacts 1-6
N.C. Valve Pilot	Data Acquisition Net/Gross
N.O. Valve Stem Switch	Alarm Annunciator

Relay Options

The control unit can be ordered with 5 ac, 10 ac or 5 ac/5 dc solid state relays.

Meter Pulse Inputs

Program the control unit to accept the meter pulse signal which suits the application. The 10 kHz input may be configured for a 5 Vdc, 12 Vdc, 5 mA or 20 mA threshold level.

Pulse Security

Connect a dual channel pulse signal, 90 degrees out of phase for Level 'B' pulse integrity.

Analog Inputs

Two 4-20 mAdc analog inputs are provided for pressure, density or temperature. If pressure and density inputs are used, a separate RTD input is available for high precision temperature sensing.

Temperature Compensation

From the menu, select the temperature compensation method by linear equation or API Tables 6A, B or C, 24, 24A or B, 54, 54A, B or C.

Pressure Compensation

If correction for pressure effects on the fluid are desired, the pressure transmitter scaling, i.e., upper limit, lower limit and offset are programmed via the keypad. Compressibility (K-factor) sources are selectable from API 11.2.1, 11.2.2, 11.2.1.M OR 11.2.2.M.

Density Compensation

Density inputs either manual or via the analog current loop may be used when the API Table option is selected for temperature corrections as the fluid's density is a function of the CTL calculation.

Data Communications

Full two way data communications are provided for remote access using either computer mode or terminal mode. In communications port 1, select RS232 for serial communications or RS-485. Communications port 2 is dedicated for RS-485 for multi-drop configurations. Program these ports with unique data rates, word size, stop/parity bits, and communications port time out settings for customer configuration to suit the host equipment.

Status Registers

All control unit parameters may be viewed on the local display or by using a remote access computer for monitoring:

Operating Status	Auxiliary Contact Status
Alarm Status	Totalizer Status
Meter Factor Status	Flow rate Status
Delivery Status	Temperature Density/Pressure Status

Archive Registers

An archive memory storage of past transactions is maintained constantly even after a power outage. These registers may be set to free run or halt when full. These registers are user programmable for selection of:

Transaction Number	Net Quantity Delivered
Start Time	Effective Temperature
Completion Time	Alarm Status
Preset Quantity	Date
Gross Quantity Delivered	

Data Logging

Connect a serial interface printer to communications port 1 to record transactions details such as:

Drive I.D.	Net Total
Unit Address	Time In
Gross Delivered	Time Out
Net Delivered	Effective Temperature
Gross Total	

Data Security

Program data is secured with a wire sealable mechanical switch plus a user defined 8 digit access code.

Quantity Control Valves

GENERAL INSTRUMENTATION

Description

The IE Models 787, 788 and 789 Quantity Control Valves are normally closed, two-stage electrical valves designed for precise, accurate shutoff of petroleum products. They are available in both in-line and angle configurations for load rack applications. In operation the valve reduces the flow rate of a predetermined amount of product at specific quantities to guarantee smooth, positive shutoff. Operational functions may include low flow startup when used with a time delay circuit or the IE Control Electronics. The Model 787 provides maximum flow rate control as well as two-stage shutoff. This is accomplished by using a Model 1787 pilot to sense differential pressure across the meter or orifice face. An electrically controlled solenoid pilot, Model 1788, is used with the Model 788 Control Valve to provide two-stage closing. The valve is either open, closed or held in a low-flow state. Series 789 valves provide maximum flow rate control as well as two-stage shutoff. This is accomplished by using a Model 1789 Pilot to monitor downstream pressure.

Design Features

- Accurate Two-Stage Shutoff
- Minimizes Surge Pressure and Line Shock
- Provides Maximum Flow Rate Control
- Positive, Accurate Shutoff
- In-line or Angle Body Designs (4" and 6")
- Uniform Speed of Response
- Fail-safe Shutoff

Principle Of Operation

The IE Quantity Control System consists of four primary pieces of equipment: flow meter, preset counter, sequencing switches, and two-stage shutoff valve. The meter is the primary flow measuring device. The preset counter is used to determine the volume of liquid to be controlled by the valve at predetermined settings. The sequential switches convert the mechanical motion of the batch controlling mechanism of the preset counter to electrical signals used to control the solenoid pilots of the control valve. The control valve operates on a balanced piston principle. An electrically operated solenoid controlled pilot module positions the valve piston by increasing or decreasing hydraulic pressure against the top of the piston as dictated by sequencing switches. When pressure on both sides of the valve piston is equalized, a spring (located on top of the piston) acts as a differential force and closes the valve. When the pressure against the bottom of the piston exceeds the pressure (plus the force of the spring) exerted on the top, the quantity control valve is designed to close in two distinct stages. As the preset counter reaches the first stage of shutoff, a cam located in the preset trips the shutoff ring causing the sequence switches to place the valve in the first stage (low flow) shutoff position. The first stage closure reduces the flow rate through the valve to approximately 10 to 20 percent of the rated capacity of the meter. The cam trips the shutoff ring again and the sequencing switches place the valve in the closed, or no flow position.

Applications

- Two-stage quantity control valves are suited for those applications requiring precise measurement shutoff. Table 1 Control Functions Series Control Functions Two-stage shutoff plus maximum flow rate control achieved by sensing differential pressure across a meter or an orifice plate. Two-stage shutoff only. Two-stage shutoff plus back pressure control achieved by sensing and controlling valve outlet pressure

Table 1 Control Functions

Series	Control Functions
787	Two-stage shutoff plus maximum flow rate control achieved by sensing differential pressure across a meter or an orifice plate.
788	Two-stage shutoff only.
789	Two-stage shutoff plus back pressure control achieved by sensing and controlling valve outlet pressure.

SPECIFICATIONS

Materials of Construction

MAIN VALVE

Main Valve Body: Steel, ASTM-A216-GR-WCB, 150 lb.. ANSI (Optional 300 lb. ANSI)

Main Valve Cylinder Assembly: Ductile Iron, Nickel coated

Main Valve Piston: Bronze (Optional Stainless Steel)

Seat Ring: Steel, Nickel coated

O-Rings: Viton

Other Internal parts: Stainless Steel

PILOT MODULE

Pilot Body: Steel with Stainless Steel internals

Tubing and Fittings: Steel (Optional Steel and Stainless Steel)

Ratings

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

Maximum Working Pressure: 275 psi

Maximum Operating Pressure Differential: 175 psid

Maximum Working Temperature: 66°C (Optional 121°C)

Sizes Available: 2" through 10"

Table 2 Valve Capacity Data

Valve Size	2"	3"	4"	6"	8"	10"
*CV-gpm	86	186	309	688	1296	2040

*CV based on wide open valve utilizing water at 16°C

Table 3 Solenoid Electrical Data*

Voltage	Current (In Rush)	Current (Holding)
120/60 ac	0.7 amps	0.33 amps
220/60 ac	0.35 amps	0.17 amps

*Class I, Division I, Groups C & D, Class II, Division I, Groups E, F & G

Preset Switch Enclosure Electrical Data

Voltage: 125 or 250 Vac, Current: 15 amps, Class I, Group D

Micro Switch Enclosure Electrical Data

Voltage: 125, 250 or 440 Vac, Current: 20 amps Class I, Division I, Groups C and D, Class II, Division I, Groups E, F and G

Table 4 Pilot Module Spring Ranges

Spring Range	Application
0-20 psi	Standard for 787: Controls flow rate by sensing differential pressure. Standard for 789: Controls back pressure by sensing outlet pressure, top loading to atmosphere, or similar installation.
10-50 psi	Standard for 789: Delivery to closed system (Bottom Loading)
30-130 psi	Delivery through 789 to closed system which required more than 60 psi outlet pressure for control.

OPERATIONAL SEQUENCE

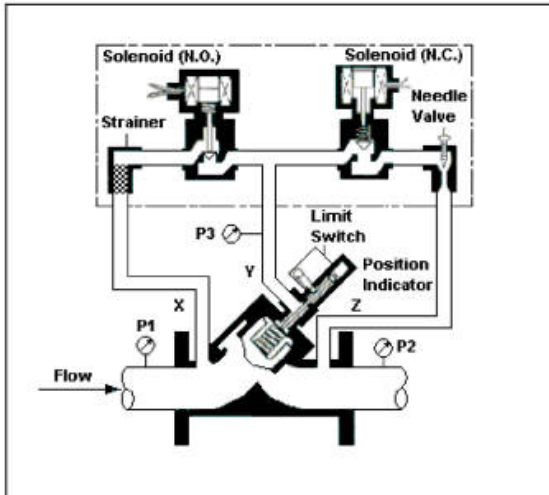
Closed Position - The normally closed solenoid is closed. The normally open solenoid is open. Y-port (P3) to Z-port (P2) is closed. X-port (P1) and Y-port (P3) pressures are balanced. The main valve spring being the differential force, closes the piston and keeps it seated. Reference Figure 1.

Figure 1 Closed Position - Model 788C

Low Flow Position - The normally closed solenoid is closed. The normally open solenoid is closed. Y-port (P3) to Z-port (P2) is closed. X-port (P1) to Y-port (P3) is closed. NOTE: The product cannot flow to or from the bop of the piston (Y-port). The piston is locked hydraulically in the low flow position. During the transition stage, from high flow to low flow, the normally closed solenoid was closed and the normally open solenoid was open (X-port to Y-port was open) During the closing cycle the limit switch was activated causing the normally opened solenoid to be closed, thus hydraulically locking the valve in an intermediate position. Reference Figure - 2

L

Figure 2 Low Flow Position - Model 788C



Full Open - No Control - The normally closed solenoid is open. The normally open solenoid is closed. Y-port (P3) is open to Z-port (P2). X-port (P1) is closed off by the normally open solenoid. The pressure on the bottom of the piston (P1) is greater than the pressure at P3 plus the spring force. Reference Figure 3.

Figure 3 Full Open/No Control - Model 788C

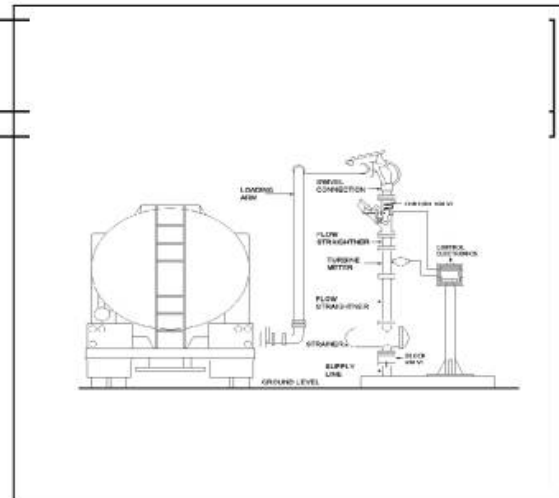
TYPICAL INSTALLATIONS

Dimensions (See Figure 6)



INSTRUMENTATION ENGINEERS PVT. LTD.

Plots 1,2,3 Phase III, IDA Jeedimetla, Hyderabad 500 055
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The most common application of the IE Two-stage Electrical Control Valves is for truck loading of petroleum products. As shown in Figures 4 and 5, the valve is used with the IE Positive Displacement Flow Meter and IE Turbine flow meters. In both installations the IE Control electronics is the primary batch and control device.

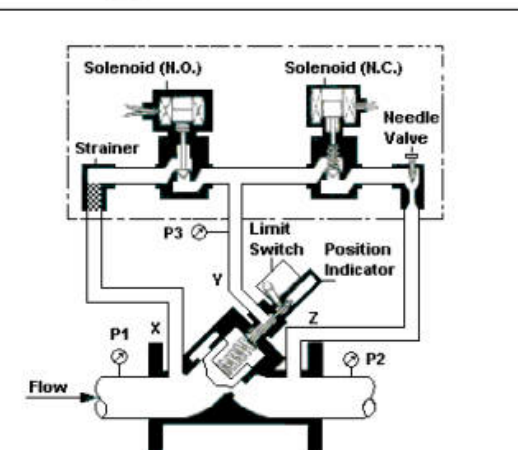
Figure 4 Typical Application - Top Loading

Figure 5 Typical Application - Bottom Loading

D

Optional Equipment

- Stainless Steel Main Valve Piston
- Adjustable Thermal Relief
- Manual Override
- Closing Speed Control



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Low Flow Start up

Recommended Spare Parts: O-Rings

ORDERING INFORMATION

When ordering, the following information must be provided:

1. Size
2. Product, Viscosity and Specific Gravity
3. Minimum and Maximum Operating Temperatures
4. Minimum and Maximum Flow Rates
5. Minimum and Maximum Operating Pressure
6. Control Functions to be performed
7. Flange Connections
8. Control Pilot Materials
9. Tubing Materials
10. Main Valve Piston Materials

 FLOW METERS The Measure of Excellence...	
	Quantity Control Valves

Figure 6 Dimensions

Dimensions (mm)

A	BCDE Valve Size						
	150 lb.	300 lb.	150 lb.	300 lb			
2"	260	267	81	84	257	73	248
3"	279	333	89	108	283	86	254
4"	330	368	102	118	286	108	260
6"	432	454	111	117	400	194	305
8"	565	591	119	132	445	197	330
10"	673	708	135	152	502	241	356

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FLOW CONTROLLERS & ACCESSORIES
Description

IE Flow controllers are designed to maintain a constant differential pressure across an integral manual flow regulating valve. An internal diaphragm actuated control valve is positioned by the incoming fluid pressure on one side of the diaphragm, and outlet pressure plus spring action on the other side. Variation in the supply and/or discharge pressure disturb the balance of forces on the diaphragm, causing the control valve to open or close, thus maintaining a fixed differential across the manual flow regulating valve. The Series 8800 controllers are for all the liquid and gas flow with constant downstream pressure. Series 8900 controllers are for all liquid and gas flow with constant upstream pressure.



INTEGRAL FLOW CONTROLLERS FOR GAS AND LIQUID SERVICES

Design Features

- No external piping – integral, needle valve eliminates the sources of leakage in externally piped needle valves
- Integral or separate flow controller and rotameter assemblies
- Wide range of models for high and low flow rates
- Operating pressures up to 1000 psi, temperatures upto to 300°F
- Easily Panel mounted
- Models for constant upstream or downstream pressure service. Ratings, Capacities, Connections Pressure Rating (PSI) Capacity Range Total Pressure Drop (PSI) Connection Sizes Inches (NPT) Model No. Brass, Alu m. Stn. Stl. Water Air (STP)*** Min Max Inlet Outlet Maximum Temp

Ratings

- Diaphragm Material 8800D ¼
 - ** 8802D ¼ ¼ 8900D
 - ** ¼ 8902D ¼ ¼ 8805D -- 1000 cc/min 15 gph scf/min 110 scfh ¼ ¼ Neoprene 180°F 8810 ¼ ¼ 8910 ¼ ¼ 8815 -- 1000 0.1 gpm 2.5 gpm 0.4 scfm 9.0 scfm ¼ ¼ 8830B -- 0.6 gpm 8.0 gpm 2.4 scfm 35 scfm ¾ ¾ Teflon 300°F
- Notes: ** Capacities for gas flow are based on air at 14.7 psia and 70°F. Pressure, temperature and flow are measured downstream of the controller for 8800 Series, upstream for 8900 Series. *** Untapped connection: Must be used integral with IE Sho-Rate meters. October 2007. Sho-Rate "150" Flowmeter with Optoal Integral Flow Controller

Ratings, Capacities, Connections

Model No.	Pressure Rating (PSI)		Capacity Range				Total Pressure Drop (PSI)		Connection Sizes Inches (NPT)		Maximum Temp. Ratings Diaphragm Material
	Brass, Alu m.	Stn. Stl.	Water		Air (STP)***		Min	Max	Inlet	Outlet	
8800D	250	300	50 cc/min	15 gph	100 scc/min	110 scfh	10	300	1/4	***	Neoprene 180°F
8802D	250	300					10	300	1/4	1/4	
8900D	250	300					10	150	***	1/4	
8902D	250	300					10	150	1/4	1/4	
8805D	--	1000					10	300	1/4	1/4	
8810	250	300	0.1 gpm	2.5 gpm	0.4 scfm	9.0 scfm	15	150	1/4	1/4	Teflon 300°F
8910	250	300					15	150	1/4	1/4	
8815	--	1000					15	150	1/4	1/4	
8830B	--	300	0.6 gpm	8.0 gpm	2.4 scfm	35 scfm	25	75	3/4	3/4	

Notes: ** Capacities for gas flow are based on air at 14.7 psia and 70°F. Pressure, temperature and flow are measured

II. Models : 8844 & 8944

Description

IE NRS Flow controllers are designed to accurately adjust and maintain small gas and liquid flows. Model 8844 is designed to control flows when downstream pressure is constant and upstream pressure is variable. Model 8944 is designed for constant upstream, variable downstream pressure applications.

Design Features

Integral 1/8" tubing fittings
Performance tested on Helium
Non-rotating needle control valve
Six interchangeable needle tapers for increasing flow ranges
Bubble-tight, o-ring seal shut-off – Can't be damaged by over tightening.

Specifications

CONNECTIONS

Standard: Needle taper No. 1, 2 & 3 -1/8" NPT
Needle Taper No. 4, 5 & 6 – requires 1.4" connections.

PRESSURE DROP

Minimum: 15 psi; Maximum: 300 psi

Capacities

Helium gas at 50 psig, valve full open

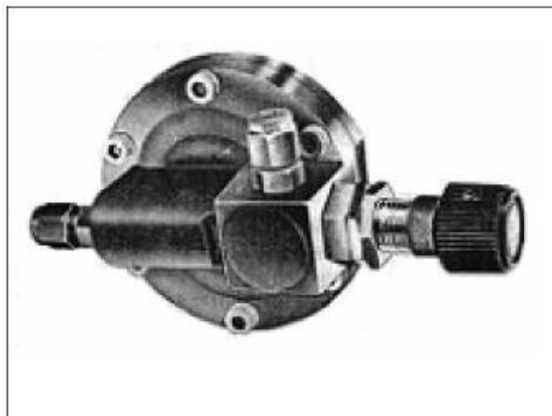
Needle Taper	SEC/MIN	
	Model 8844 **	Model 8944
1	150	300
2	450	900
3	900	1,700
4	3,500	7,000
5	10,000	20,000
6	40,000	55,000

Flow capacities will vary for different gases and pressures.

** These capacities are for 50 psig supply, atmospheric exhaust. Downstream pressure in excess of atmospheric (14.7 psia) will increase capacity.

Ordering information

- Model number of flow controller
- Aluminium/Brass or Stainless Steel Body
- Size 1 through 6 needle value.



Materials of construction

CONTROLLER BODY – Aluminium, 316 Stainless Steel, Brass

CONTROLLER DIAPHRAGM – Standard: Neoprene on Aluminium Brass body, Teflon on stainless Steel.

NEEDLE – 316 Stainless Steel

NEEDLE VALVE SEAT – Brass (Al. & Brass body) 316 Stainless Steel (Stainless Steel body)

O-RINGS – Standard : Neoprene (Al. & Brass body), Viton (Stainless Steel body)

PRESSURE RATINGS

Al. & Brass body: 250 psig; Stainless Steel body: 300 psig

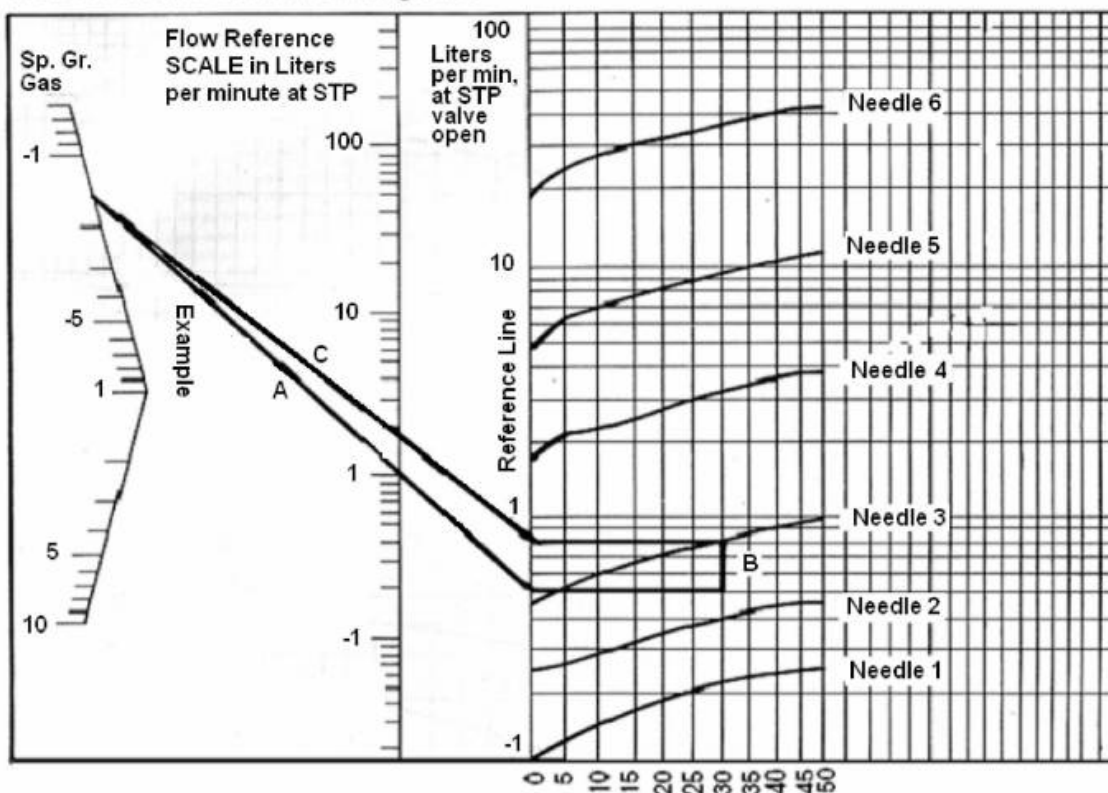
TEMPERATURE RATINGS

Neoprene: 180°F; Teflon: 300°F

Water (Liquid Sp. Gr. 1.0)

Needle Taper	CC/MIN			
	Model 8844		Model 8944	
	Min.	Max.	Min.	Max.
2	0.29	7.4	0.29	7.5
3	1.10	19.0	1.10	19.0
4	1.90	49.0	1.90	45.0
5	3.20	144.0	3.20	145.0
6	11.00	365.0	11.00	500.0

Model 8844 Flow Controller Sizing Table



Needle Size Determination

The correct controller valve needle size suitable for control of a specific gas at a given flow rate and outlet pressure may be determined by using the table above. Proceed with the above description and refer to the example as shown in the table.

- Draw line "a" from specific gravity through desired flow rate to Reference Line. Extend the "a" horizontally to known value of outlet pressure as shown in example.
- Note relationship between termination point of the "a" and the six needle taper curves. Any needle taper whose curve is above this point may be used. Maximum resolution will be achieved by using the needle taper whose curve is immediately above the termination point.
- Maximum flow that may be achieved with a needle taper can be determined by drawing vertical line "b" up to the desired needle taper curve. Draw a horizontal line from intercept point to Reference Line as shown and continue line "c" from Reference Line to specific gravity of gas.
- Where line "c" intersects Flow Reference Scale, read maximum flow capacity for selected needle at given flow conditions.

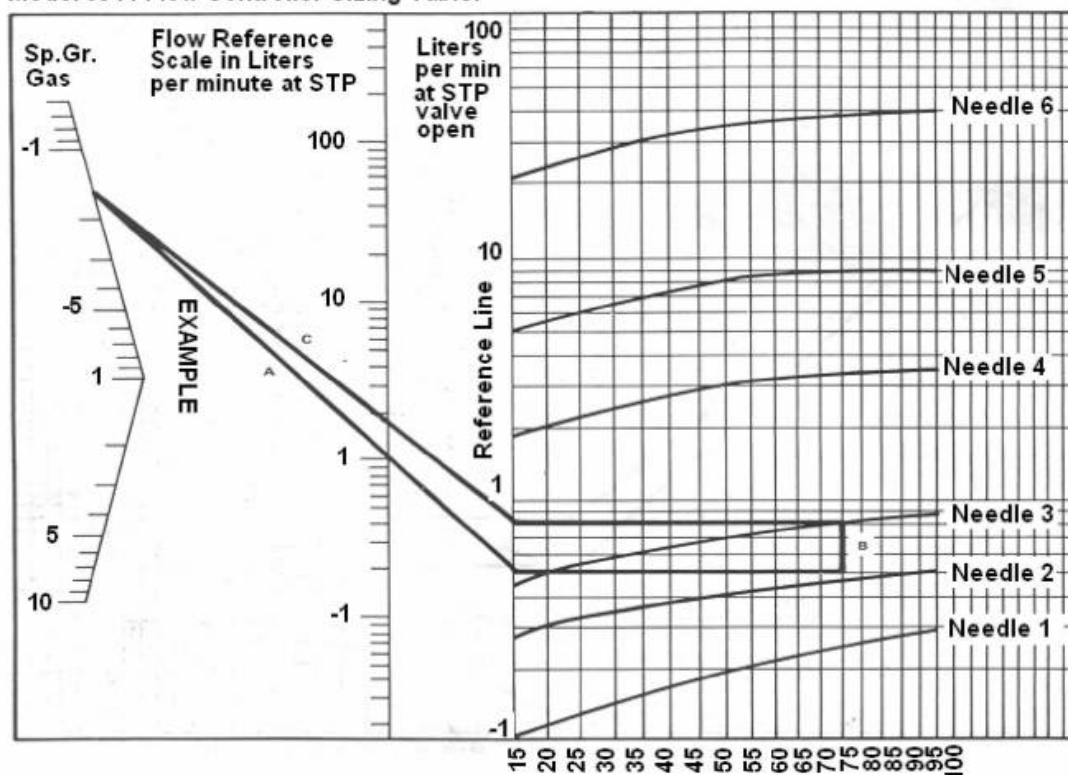
EXAMPLE

Gas – Helium with Specific Gravity of 0.13

Desired Flow Rate – 1 Liter/minute

Outlet Pressure – 30 psi.

Model 8944 Flow Controller Sizing Table.



Needle Size Determination

The correct controller valve needle size suitable for control of a specific gas at a given flow rate and supply pressure may be determined by using the table above. Proceed with the above description and refer to the example as shown in the table.

- Draw line "a" from specific gravity through desired flow rate to Reference Line. Extend the "a" horizontally to known value of outlet pressure as shown in example.
- Note relationship between termination point of the "a" and the six needle taper curves. Any needle taper whose curve is above this point may be used. Maximum resolution will be achieved by using the needle taper whose curve is immediately above the termination point.

C. Maximum flow that may be achieved with a needle taper can be determined by drawing vertical line "b" up to the desired needle taper curve. Draw a horizontal line from intercept point to Reference Line as shown and continue line "c" from Reference Line to specific gravity of gas.

- Where line "c" intersects Flow Reference Scale, read maximum flow capacity for selected needle at given flow conditions.

EXAMPLE

Gas – Helium with Specific Gravity of 0.13

Desired Flow Rate – 1 Liter/minute

Supply Pressure – 75 psi