HDMF Electromagnetic Flow Meter

Operation & maintenance

Manual

REV January, 2010

Features

- Wide Application
- High Accuracy
- Simple Operation and Maintenance
- Advanced Technology
- Customer-built

Table of Contents

1. Introduction

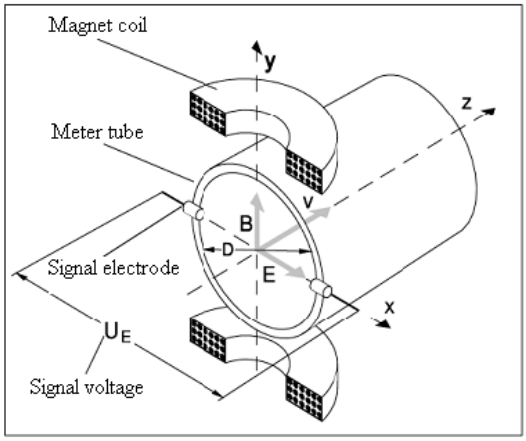
This technical information brochure contains technical specifications of the HDMF electromagnetic flow meter series and provides installation instructions for end users and design engineers.

1. Product type

Electromagnetic Flow meter for the measurement of conductive fluid flow in closed pipes. The principle of measurement is based upon Faraday's laws of electromagnetic induction.

2. Principle of Operation

Faraday's law of electromagnetic induction states that an inductive voltage is generated when a conductor moves through a magnetic field. This principle is used as the basis of flow measurement in the HDMF electromagnetic flow meter. In the electromagnetic flow meter, the flowing fluid corresponds to the moving conductor as described in Faraday's law.



UE ∞ B * D * v

The induced voltage UE is directly proportional to magnetic field intensity (B), electrode spacing (D) and average fluid velocity (v).
Since magnetic field intensity (B) and the electrode spacing (D) are constant values, induced voltage UE is therefore directly proportional to the average flow velocity (v).

Q = (Π * D2) / 4 * v therefore UE ∞ Q

The equation for calculating volumetric flow rate (Q) shows that the induced voltage (UE) is linear and directly proportional to the average velocity (v). In the flowmeter transmitter, the induced voltage (UE) from the electrodes is used to calculate volumetric flow rate (Q) based upon the pipe's internal diameter.
UE = Induced voltage
B = Magnetic field strength
D = Electrode spacing
V = Fluid velocity

3 Product Styles, Features and Applications

3.1 Product Styles

An electromagnetic flowmeter is comprised of a flow tube and a transmitter. Two product styles are available:

Compact type
Transmitter is integral with flow tube

Remote type
Transmitter is remote from flow tube

3.2 Features

Available Sizes	ISO: DN15...DN3000
	US: 1/2"...56"
Accuracy	Standard: ±0.5% (0.6m/sec to 15 m/sec)
	Optional: ±0.2% (1.0m/sec to 15 m/sec)
Measurement Range	Up to: 381,704 m3/hr
	1,727,305 gal/min
Maximum Flow Velocity	12m/sec
Measurement Resolution	±1mm/sec
Turndown	Up to 1500:1
Process Connections	GB Flange
	JIS Flange
	DIN Flange (DIN 2501)
	ANSI Flange (B16.5)
	Wafer Design
Lining Materials	Neoprene
	PTFE
	Polyurethane
	PFA
	Tefzel
	(PFA and Tefzel lining available with wire net reinforcement for negative pressure applications)
Electrode Materials	316L Stainless Steel
	Hastelloy-C22
	Hastelloy-B10
	Titanium
	Tantalum
	Platinum/iridium Alloy
	Tungsten Carbide Coated 316L Stainless Steel
Removable Electrode	In-situ Electrode Maintenance and Replacement Option Available
Housing Protection Class	IP65
	IP67 (Compact versions only)
	IP68 (Remote Versions Only)
Remote Transmitter	Pipe Mount or Wall Mount
Available Power Supplies	85...265VAC
	16...36VDC
Transmitter Configuration	Front Panel Keypad
Options	Hand Held Infrared Programmer
Output Signals	1 x Active Current Output
	1 x Passive Current Output
	1 x Frequency / Pulse Output
Status Outputs	2 x Contact / Status Outputs for Upper and Lower Flow Limit
Digital Communication	RS485 Modbus, HART

3.3 Applications

The HDMF electromagnetic flowmeter range is designed to measure the volumetric flow of conductive liquids and slurries within closed pipelines in industries such as water & wastewater, chemical, petroleum, metal production, power, pharmaceutical, food & beverage, pulp & paper, etc. The HDMF is the ideal instrument for measuring:

. Acidic & alkali fluids
. Paint
. Viscous fluids and slurries
. Water & wastewater flows

Note: the minimum conductivity of the measured flow must be ⩾ 5 μS/cm for the meter to function correctly.

4 Specifications

4 Specifications

Sizes	Flanged (Metric)	DN15…DN3000	
	Flanged (US)	1/2"…56"	
	Wafer Design	DN15…DN100	
Nominal Pressure	GB,JIS and DIN Flange	0.6 MPa, 1.0 MPa, 1.6 MPa, 4.0 MPa	
	ANSI Flange	Class 150, Class 300	
	Wafer Design	1.6 MPa, 4.0 MPa	
	For additional pressure requirements, please contact manufacturer		
Accuracy (pulse output)	Standard	±0.5% (0.6m/sec to 12 m/sec)	
	Optional	±0.2% (1.0m/sec to 12 m/sec)	
Measurement Resolution	±1mm/sec		
Max Flow Tube Velocity	SI:	49 ft/s	
	US:	12 m/s	
Ambient Temperature	-25…+55°C / -13…+131°F		
Relative Humidity	5%…90%		
Conductivity	≥5 μS/cm		
Transmitter Mounting Availability	Compact type	Sizes: DN15…DN1000 1/2"…40"	
	Remote type	Sizes: DN15…DN3000 1/2"…56"	
	Note 1: Cable between flow tube and remote transmitter is type SMFE100 Note 2: Remote unit supplied with 10m cable as standard Note 3: Max cable length is 200m (650ft)		
	Material	**SI**	**US**
Liner Material Options	Neoprene (std)	DN15…DN3000	1/2"…56"
	PTFE	DN15…DN1000	1/2"…40"
	Polyurethane	DN15…DN300	1/2"…12"
	PFA	DN15…DN250	1/2"…10"
	PFA with optional wire reinforcement	DN80…DN250	3"…10"
	Tefzel	DN15…DN250	1/2"…10"
	Tefzel with optional wire reinforcement	DN80…DN250	3"…10"
Electrode Material Options	316L stainless steel (std)	DN15…DN3000	1/2"…56"
	Hastelloy – C22	DN15…DN1000	1/2"…40"
	Hastelloy – B10	DN15…DN1000	1/2"…40"
	Titanium	DN15…DN250	1/2"…10"
	Tantalum	DN15…DN250	1/2"…10"
	Platinum/iridium Alloy	DN15…DN250	1/2"…10"
	316L with tungsten carbide coating	DN15…DN600	1/2"…24"

Grounding Options	Flange Grounding		DN15…DN3000	1/2″…56″
	Grounding Ring		DN15…DN250	1/2″…10″
	Electrode Grounding		DN50…DN3000	2″…56″
	Inlet protection ring		DN50…DN300	2″…12″
	Type	**Liner**	**Standard**	**Optional**
Max Process Temperature Limits	Compact	Neoprene	80°C / 176°F	120°C / 248°F
		PTFE	80°C / 176°F	120°C / 248°F
		Polyurethane	80°C / 176°F	-
		PFA	80°C / 176°F	120°C / 248°F
		Tefzel	80°C / 176°F	-
	Remote	Neoprene	80°C / 176°F	120°C / 248°F
		PTFE	80°C / 176°F	120°C / 248°F 180°C / 356°F
		Polyurethane	80°C / 176°F	-
		PFA	80°C / 176°F	120°C / 248°F
		Tefzel	80°C / 176°F	-
Environmental Protection Class	Compact		IP 65	IP67
	Remote		IP 65	IP 68
Power Supply Options	85…265VAC / 45…63Hz, 20VA			
	16…36VDC, 16VA			
Display	2 or 3 line backlit LCD			
Configuration Access	Front panel keypad			
	Hand held infrared remote control (optional)			
Output Signals	Active analog current output	Max load resistance	0…1.5kΩ for 0…10mA 0…750Ω for 4…20mA	
		Accuracy = same as pulse output ±0.1% of rate		
		Option: HART Protocol		
	Passive analog current output	Requires 24Vdc external supply to operate		
		Accuracy = same as pulse output ±0.1% of rate		
	Pulse / frequency and alarm outputs	Optically isolated open collector output powered either internally or externally Int. power: 28VDC with 1.2kΩ pull-up resistor Ext. power: ⩽36VDC, max current 250mA		
	Digital Communications	RS485 Modbus		
		HART (superimposed on current output)		
		All interfaces have built in lightning protection		
Electrical isolation	Isolation between all I/O and input power no less than 500V			
	Isolation between all I/O and ground no less than 500V			
	Isolation between flow tube and transmitter outputs no less than 500V			
Standard	JB/T 9248-1999 Electromagnetic Flowmeter			

5. Accuracy

Standard calibration (pulse output):

±0.5% of reading (flow velocity >0.6 m/s) or ±3mm/s of reading (flow velocity ⩽0.6 m/s)

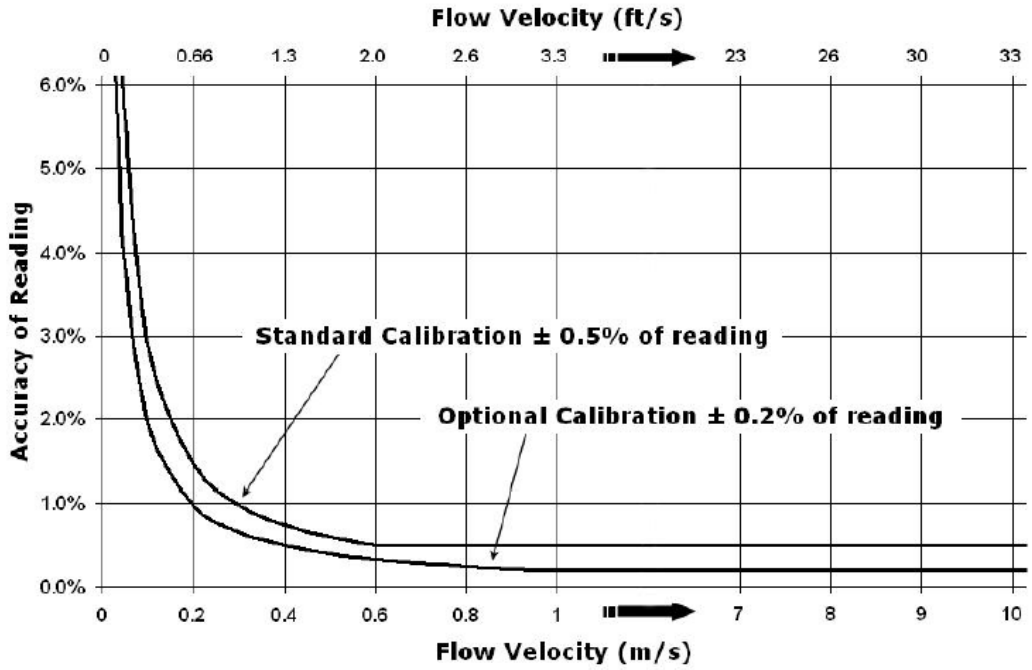
±0.5% of reading (flow velocity >1.97 ft/s) or ±0.01 ft/s of reading (flow velocity ⩽1.97 ft/s)

Optional high accuracy calibration (pulse output):

±0.2% of reading (flow velocity>1.0 m/s) or ±2 mm/s of reading (flow velocity ⩽1.0 m/s)

±0.2% of reading (flow velocity>3.28 ft/s) or ±0.006 ft/s of reading (flow velocity ⩽3.28 ft/s)

Analog Output Accuracy: Same as pulse output plus ±0.1% of rate.



Flowmeter Error Curve

Accuracies stated under reference conditions per JB/T9248 – 1999:
. Ambient Temperature: 20°C (68°F) ±2°C (3.6°F)
. Relative Humidity: 60% ... 70%
. Power supply: AC: 85 ... 265 VAC / 45 ... 63Hz or DC: 18...36V
. Installation conditions:
. Straight upstream section with length > 10×Pipe. Downstream section >5 Pipe.
. Warm-up time before testing: 30 minutes

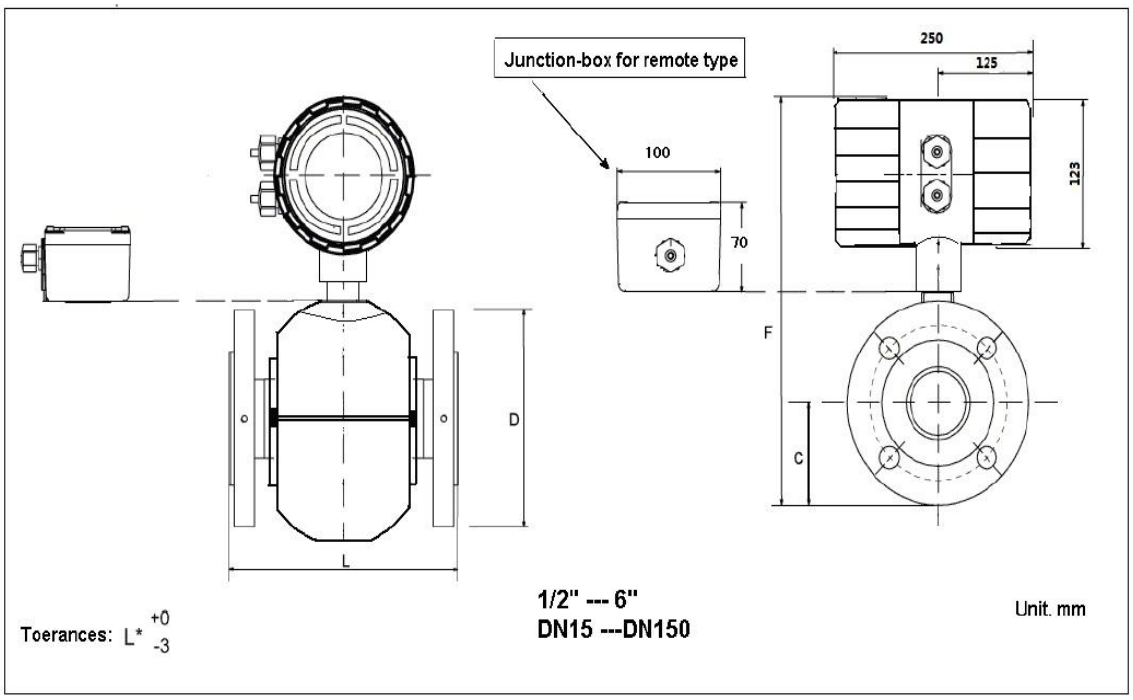
6 Velocity / Flow Charcteristics

Nominal Diameter		Full scale flow (m3/h)			Full scale flow (US Gal/min)		
mm	Inches	v=0.3 m/s	v=1.0 m/s	v =15m/s	v=1.0 ft/s	v=3.0 ft/s	v=49 ft/s
		Min		Max	Min		Max
15	½	0.1909	0.6362	9.543	0.6120	1.836	29.99
20	¾	0.3393	1.131	16.96	1.377	4.131	67.47
25	1	0.5301	1.767	26.51	2.448	7.344	120.0
32	1½	0.8686	2.895	43.43	3.825	11.47	187.4
40	1½	1.357	4.524	67.86	5.508	16.52	269.9
50	2	2.121	7.069	106.0	9.792	29.38	479.8
65	2½	3.584	11.95	179.2	15.30	45.90	749.7
80	3	5.429	18.10	271.4	22.03	66.10	1080
100	4	8.482	28.27	424.1	39.17	117.5	1919
125	5	13.25	44.18	662.7	61.20	183.6	2999
150	6	19.09	63.62	954.3	88.13	264.4	4318
200	8	33.93	113.1	1696	156.7	470.0	7677
250	10	53.01	176.7	2651	244.8	734.4	11995
300	12	76.34	254.5	3817	352.5	1058	17273
350	14	103.9	346.4	5195	479.8	1439	23510
400	16	135.7	452.4	6786	626.7	1880	30708
450	18	171.8	572.6	8588	793.1	2379	38864
500	20	212.1	706.9	10603	979.2	2938	47981
600	24	305.4	1018	15268	1410	4230	69092
700	28	415.6	1385	20782	1919	5758	94042
800	32	542.9	1810	27144	2507	7520	122830
900	36	687.1	2290	34353	3173	9518	155457
1000	40	848.2	2827	42412	3917	11750	191922
1200	48	1221	4072	61073	5640	16921	276368
1400	56	1663	5542	83127	7677	23031	376168
1600	-	2171	7238	108574	10027	30081	491321
1800	-	2748	9161	137414	12690	38071	621829
2000	-	3393	11310	169647	15667	47001	767690
2200	-	4105	13685	205273	18957	56872	928904
2400	-	4886	16286	244292	22561	67682	1105473
2600	-	5734	19114	286703	26477	79432	1297396
2800	-	6650	22167	332508	30708	92123	1504672
3000	-	7634	25447	381705	35251	105753	1727302

Flow (m3/h) = 0.00282744 × D2 × V (D = mm, V = m/s)

Flow (US Gal/min) = 2.44799 × D2 × V (D = inch, V = ft/s)

7. RB FLOW TUBE DIMENSION



7.1.1 DN15 ... DN150 Dimensions (GB, DIN Sizes)

Nominal Size	Nominal Pressure Class	Dimensions			Bolt information						OD of flange (D)		Approximate weight	
					Diameter of Bolt Circle (K)		Diameter of Bolt Holes (A)		Number of bolts (n)					
GB,DIN		L	C	F	1.6	4.0	1.6	4.0	1.6	4.0	1.6	4.0	1.6	4.0
mm	MPa	mm	mm	mm	mm	mm	mm	mm	n	n	mm	mm	kg	kg
15	1.6 or 4.0	200	48	315	65	65	14	14	4	4	95	95	7	7
20		200	53	325	75	75	14	14	4	4	105	105	9	9
25		200	58	330	85	85	14	14	4	4	115	115	11	11
32		200	70	380	100	100	18	18	4	4	140	140	12	12
40		200	75	380	110	110	18	18	4	4	150	150	13	13
50		200	83	385	125	125	18	18	4	4	165	165	14	14
65		200	93	405	145	145	18	18	4	8	185	185	22	23
80		200	100	420	160	160	18	18	8	8	200	200	26	28
100		250	118	455	180	190	18	22	8	8	235	235	28	32
125		250	135	500	210	220	18	26	8	8	270	270	35	41
150		300	150	500	240	250	22	26	8	8	300	300	38	44

7.1.2 ½" ... 6" Dimensions (ANSI, Metric Units)

Nominal Size	Nominal Pressure Class	Dimensions			Bolt information						OD of flange (D)		Approximate weight	
					Diameter of Bolt Circle (K)		Diameter of Bolt Holes (A)		Number of bolts (n)					
ANSI		L	C	F	150	300	150	300	150	300	150	300	150	300
inch	ANSI	mm	mm	mm	mm	mm	mm	mm	n	n	mm	mm	kg	kg
15	150 or 300	200	48	315	60.5	66.5	15.7	15.7	4	4	89	95	8	8
20		200	59	325	69.9	82.6	15.7	19.1	4	4	99	117	10	10
25		200	62	330	79.2	88.9	15.7	19.1	4	4	108	124	11	13
32		200	67	380	88.9	98.6	15.7	19.1	4	4	117	133	11	13
40		200	78	380	98.6	114.3	15.7	22.4	4	4	127	155	12	16
50		200	83	385	120.7	127	19.1	22.4	4	8	152	165	14	16
65		200	96	405	139.7	149.4	19.1	22.4	4	8	178	191	24	27
80		200	105	420	152.4	168.1	19.1	22.4	4	8	191	210	28	33
100		250	127	455	190.5	200.2	19.1	22.4	8	8	229	254	32	40
125		250	140	500	215.9	235	22.4	22.4	8	8	254	279	38	51
150		300	159	500	241.3	269.7	22.4	22.4	8	8	279	318	41	60

7.1.3 ½" ... 6" Dimensions (ANSI, English Units)

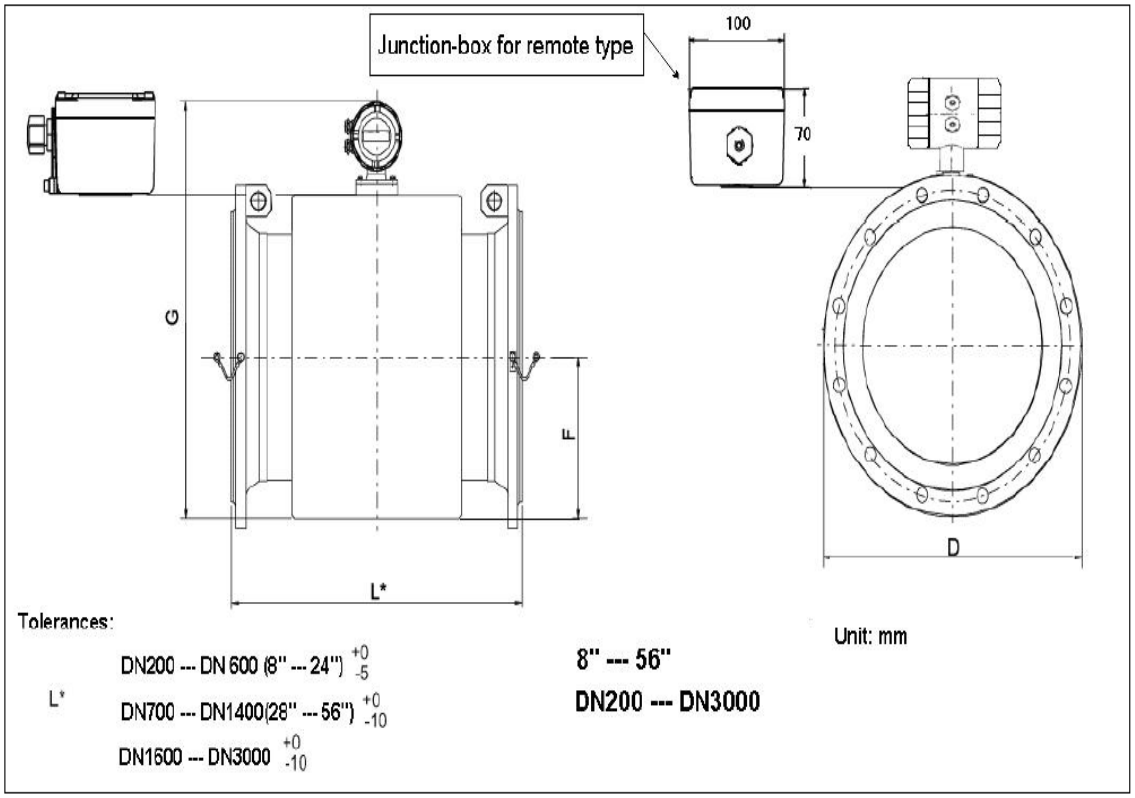
Nominal Size	Nominal Pressure Class	Dimensions			Bolt information						OD of flange (D)		Approximate weight	
					Diameter of Bolt Circle (K)		Diameter of Bolt Holes (A)		Number of bolts (n)					
ANSI		L	C	F	150	300	150	300	150	300	150	300	150	300
inch	ANSI	inch	inch	inch	inch	inch	inch	inch	n	n	inch	inch	lb	lb
15	150 or 300	7.87	1.89	12.4	2.38	2.62	0.62	0.62	4	4	3.50	3.75	18	19
20		7.87	2.32	12.8	2.75	3.25	0.62	0.75	4	4	3.88	4.62	21	23
25		7.87	2.46	12.99	3.12	3.50	0.62	0.75	4	4	4.25	4.88	26	28
32		7.87	2.64	14.96	3.50	3.88	0.62	0.75	4	4	4.62	5.25	25	30
40		7.87	3.07	14.96	3.88	4.50	0.62	0.88	4	4	5.00	6.12	28	36
50		7.87	3.27	15.16	4.75	5.00	0.75	0.88	4	8	6.00	6.50	31	36
65		7.87	3.77	15.94	5.50	5.88	0.75	0.88	4	8	7.00	7.50	53	59
80		7.87	4.14	16.54	6.00	6.62	0.75	0.88	4	8	7.50	8.25	62	73
100		9.84	5.02	17.91	7.50	7.88	0.75	0.88	8	8	9.00	10.0	71	89
125		9.84	5.52	19.69	8.50	9.25	0.88	0.88	8	8	10.0	11.0	84	112
150		11.81	6.27	19.69	9.50	10.62	0.88	0.88	8	8	11.0	12.5	91	132

Other connection styles and pressure classes can be supplied to customer specification. Please contact manufacturer.

Notes:

1) “L” distance is increased 3mm (0.12”) when a grounding flange is installed.
2) “L” distance is increased 5mm (0.2”) when a protection flange at inlet is installed.
3) “L” distance is increased 16mm (0.63”) when a lining protection flange is installed.
4) Approximate weights are for remote flow tube only. For compact type, transmitter weight of 3.5 kg (7.7 lb) should be added to the values in the tables above.

7.2. DN200 ... DN3000 / 8” ... 56” Dimensions



7.2.1 DN200 ... DN600 Dimensions (GB/DIN)

Nominal Size	Nominal Pressure Class	Dimensions			Bolt information						OD of flange (D)		Approximate weight	
					Diameter of Bolt Circle (K)		Diameter of Bolt Holes (A)		Number of bolts (n)					
GB,DIN		L	C	F	1.0	1.6	1.0	1.6	1.0	1.6	1.0	1.6	1.0	1.6
mm	MPa	mm	mm	mm	mm	mm	mm	mm	n	n	mm	mm	kg	kg
200	1.0 or 1.6	350	170	540	295	295	22	22	8	12	340	340	45	46
250		450	203	600	350	355	22	26	12	12	395	405	67	71
300		500	230	660	400	410	22	26	12	12	445	460	94	103
350		550	260	720	460	470	22	26	16	16	505	520	145	158
400		600	290	780	515	525	26	30	16	16	565	580	180	197
450		600	320	840	565	585	26	30	20	20	615	640	215	242
500		600	358	915	620	650	26	33	20	20	670	715	245	293
600		600	420	1040	725	770	30	36	20	20	780	840	335	418

7.2.2 8" ... 24" Dimensions (ANSI / Metric Units)

Nominal Size	Nominal Pressure Class	Dimensions			Bolt information						OD of flange (D)		Approximate weight	
					Diameter of Bolt Circle (K)		Diameter of Bolt Holes (A)		Number of bolts (n)					
ANSI		L	C	F	150	300	150	300	150	300	150	300	150	300
inch	ANSI	mm	mm	mm	mm	mm	mm	mm	n	n	mm	mm	kg	kg
8	150 or 300	350	191	540	298.5	330.2	22.4	25.4	8	12	343	381	52	80
10		450	223	600	362	387.4	25.4	28.4	12	16	406	445	84	120
12		500	261	660	431.8	450.9	25.4	31.8	12	16	483	521	125	171
14		550	293	720	476.3	514.4	28.4	31.8	12	20	533	584	179	257
16		600	324	780	539.8	571.5	28.4	35.1	16	20	597	648	213	334
18		600	356	840	577.9	628.7	31.8	35.1	16	24	635	711	264	417
20		600	388	915	635	685.8	31.8	35.1	20	24	699	775	311	474
24		600	458	1040	749.3	812.8	35.1	41.1	20	24	813	914	423	690

7.2.3 8" ... 24" Dimensions (ANSI, English units)

Nominal Size	Nominal Pressure Class	Dimensions			Bolt information						OD of flange (D)		Approximate weight	
					Diameter of Bolt Circle (K)		Diameter of Bolt Holes (A)		Number of bolts (n)					
ANSI		L	C	F	150	300	150	300	150	300	150	300	150	300
inch	ANSI	inch	inch	inch	inch	inch	inch	inch	n	n	inch	inch	lb	lb
8	150 or 300	13.78	7.52	21.26	11.75	13.0	0.88	1.00	8	12	13.5	15.0	116	176
10		17.72	8.77	23.62	14.25	15.25	1.00	1.12	12	16	16.0	17.5	185	264
12		19.69	10.27	25.98	17.0	17.75	1.00	1.25	12	16	19.0	20.5	277	377
14		21.65	11.52	28.35	18.75	20.25	1.12	1.25	12	20	21.0	23.0	395	568
16		23.62	12.77	30.71	21.25	22.5	1.12	1.38	16	20	23.5	25.5	471	736
18		23.62	14.02	33.07	22.75	24.75	1.25	1.38	16	24	25.0	28.0	583	919
20		23.62	15.27	36.02	25.0	27.0	1.25	1.38	20	24	27.5	30.5	687	1045
24		23.62	18.02	40.94	29.5	32.0	1.38	1.62	20	24	32.0	36.0	934	1521

Other connection styles and pressure classes can be supplied to customer

specification. Please contact manufacturer.

Notes:

1) "L" distance is increased 4mm (0.16") when a grounding flange is installed.
2) "L" distance is increased 8mm (0.32") when a protection flange at inlet is installed.
3) "L" distance is increased 20mm (0.79") when a lining protection flange is installed.
4) Approximate weights are for remote flow tube only. For compact type, transmitter weight of 3.5 kg (7.7 lb) should be added to the values in the tables above.

7.2.4 DN700 ... DN1400 Dimensions (GB/DIN)

Nominal Size	Nominal Pressure Class	Dimensions			Bolt information						OD of flange (D)		Approximate weight	
					Diameter of Bolt Circle (K)		Diameter of Bolt Holes (A)		Number of bolts (n)					
GB,DIN		L	C	F	0.6	1.0	0.6	1.0	0.6	1.0	0.6	1.0	0.6	1.0
mm	MPa	mm	mm	mm	mm	mm	mm	mm	n	n	mm	mm	kg	kg
700	0.6 or 1.0	700	448	910	810	840	26	30	24	24	860	895	435	509
800		800	508	1215	920	950	30	33	24	24	975	1015	545	626
900		900	558	1315	1020	1050	30	33	24	28	1075	1115	655	756
1000		1000	615	1430	1120	1160	30	36	28	28	1175	1230	810	935
1200		1200	728	1605	1340	1380	33	39	32	32	1405	1455	875	1051
1400		1400	838	1830	1560	1590	36	42	36	36	1630	1675	1235	1453

7.2.5 28" ... 56" Dimensions (ANSI / Metric Units)

Nominal Size	Nominal Pressure Class	Dimensions			Bolt information						OD of flange (D)		Approximate weight	
					Diameter of Bolt Circle (K)		Diameter of Bolt Holes (A)		Number of bolts (n)					
ANSI		L	C	F	150	300	150	300	150	300	150	300	150	300
inch	ANSI	mm	mm	mm	mm	mm	mm	mm	n	n	mm	mm	kg	kg
28	150 or 300	27.56	18.15	37.8	31.3	33.74	0.87	1.42	40	36	32.95	36.26	1074	1613
32		31.5	20.76	49.61	35.43	38.5	0.87	1.65	48	32	37.05	41.5	1357	2257
36		35.43	23.09	53.54	39.76	42.87	1.02	1.77	44	32	41.61	46.14	1728	2765
40		39.37	25.07	58.66	44.13	46.89	1.18	1.77	44	40	46.26	50.12	2228	3419
48		47.24	29.76	65.35	52.56	55.75	1.30	2.01	44	40	54.8	59.49	2606	4410
56		55.12	34.76	74.41	60.75	65.0	1.30	2.36	60	36	62.99	69.49	3506	6951

7.2.6 28" ... 56" Dimensions (ANSI, English units)

Nominal Size	Nominal Pressure Class	Dimensions			Bolt information						OD of flange (D)		Approximate weight	
					Diameter of Bolt Circle (K)		Diameter of Bolt Holes (A)		Number of bolts (n)					
ANSI		L	C	F	150	300	150	300	150	300	150	300	150	300
inch	ANSI	inch	inch	inch	inch	inch	inch	inch	n	n	inch	inch	lb	lb
28	150 or 300	27.56	18.15	37.8	31.3	33.74	0.87	1.42	40	36	32.95	36.26	1074	1613
32		31.5	20.76	49.61	35.43	38.5	0.87	1.65	48	32	37.05	41.5	1357	2257
36		35.43	23.09	53.54	39.76	42.87	1.02	1.77	44	32	41.61	46.14	1728	2765
40		39.37	25.07	58.66	44.13	46.89	1.18	1.77	44	40	46.26	50.12	2228	3419
48		47.24	29.76	65.35	52.56	55.75	1.30	2.01	44	40	54.8	59.49	2606	4410
56		55.12	34.76	74.41	60.75	65.0	1.30	2.36	60	36	62.99	69.49	3506	6951

7.2.7 DN1600 ... DN3000 Dimensions (GB/DIN)

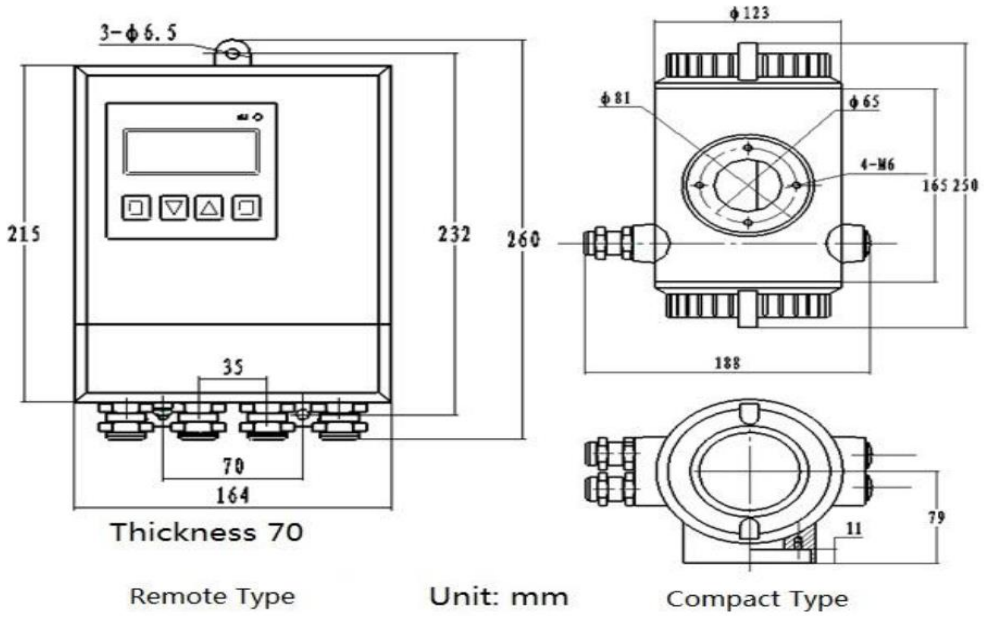
Nominal Size	Nominal Pressure Class	Dimensions			Bolt information						OD of flange (D)		Approximate weight	
					Diameter of Bolt Circle (K)		Diameter of Bolt Holes (A)		Number of bolts (n)					
GB,DIN		L	C	F	0.25	0.6	0.25	0.6	0.25	0.6	0.25	0.6	0.25	0.6
mm	MPa	mm	mm	mm	mm	mm	mm	mm	n	n	mm	mm	kg	kg
1600	0.25 or 0.6	1600	915	2180	1730	1760	30	36	40	40	1790	1830	1496	1555
1800		1800	1023	2380	1930	1970	30	39	44	44	1990	2045	1993	2085
2000		2000	1133	2580	2130	2180	30	42	48	48	2190	2265	2459	2610
2200		2200	1238	2680	2340	2390	33	42	52	52	2405	2475	2648	2830
2400		2400	1343	2890	2540	2600	33	42	56	56	2605	2685	3070	3310
2600		2600	1453	3110	2740	2810	33	48	60	60	2805	2905	3539	3875
2800		2800	1558	3320	2960	3020	36	48	64	64	3030	3115	4604	4930
3000		3000	1658	3480	31600	3220	36	48	68	68	3230	3315	5214	5580

Other connection styles and pressure classes can be supplied to customer specification. Please contact manufacturer.

Notes:

1) Approximate weights are for remote flow tube only. For compact type, transmitter weight of 3.5kg (7.7 lb) should be added to the values in the tables above.

7.3 Transmitter Dimensions



7.3.1 General Specification and Application

7.3.1.1 Features

- Programmable low frequency square wave field excitation, improving measurement stability and reducing power consumption
- Implementing 16 bits MCU, providing high integration and accuracy
- Full-digital processing, high noise resistance and reliable measurement
- Low EMI switching power supply, providing wide mains range adaptability, high efficiency and low temperature rising
- User-friendly operation interface
- High definition LCD display with backlight and -20℃ - +70℃ temperature range
- Forward and reverse measurement
- Three independent 10-digit totalizer: forward, reverse and net totalizer, convenient for metering or billing
- RS485 interface supporting up to 2km distance at 14400 bps communication
- Intelligent empty pipe detection and electrodes resistance measurement diagnosing empty pipe and electrodes contamination accurately.
- Implementing 'Rate-Of-Change Limit' technology to eliminate sharp electrical noise contained in the flow signal and stabilize the display and outputs
- Totalizer remote control function, providing a contact for starting and stopping totalizing which is convenient for calibration synchronization or batch processing
- System self-diagnosis function
- Non-volatile memory, securing parameter settings and measurement data
- Optional real-time clock, power-failure and history data logging function ,storing up to 30 days measurement records

■ Two versions available: remote and compact

7.3.1.2 Main Application

The HDMF converter, together with magnetic-inductive sensor, forms a microprocessor-controlled accurate measurement unit. The HDMF converter can be used for fluid flow speeds up to 15 m/s for a minimum conductivity of 5□S/cm. The main application range of the HDMF widely covers a variety of fields:

- ♦ Chemical and petroleum industry
- ♦ Metallurgy industry
- ♦ Water and waste water
- ♦ Agriculture and irrigation
- ♦ Food and beverage industry
- ♦ Pharmaceutical industry

7.3.1.2.1 Working Conditions

Ambient temperature: -10 to + 60℃;
Relative humidity: 5% to 90%;
Power supply: AC 85 to 265V, 45 to 63Hz
DC 16 to 30V
Power consumption: < 15W with sensor

7.3.1.2.2 Testing Condition

Ambient temperature: 20℃±2℃
Relative humidity: 45% to 85%
Power supply: AC 220±2%
Power frequency: 50Hz±5%
Ripple: < 5%。
Warming time: 30min

7.3.2 Technical Data

The HDMF converter is compliant to Standard "JB/T 9248-1999 Electromagnetic Flow Meter".

7.3.2.1 General Specification

7.3.2.1.1 Meter Size (mm)

The HDMF converter supports the following meter size:

3, 6, 10, 15, 20, 25, 32, 40, 50, 65, 80, 100, 125, 150, 200, 250, 300, 350, 400, 450, 500, 600, 700, 800, 900, 1000, 1100, 1200, 1300, 1400, 1600, 1800, 2000, 2200, 2400, 2600, 2800, 3000

7.3.1.2.2 Flow Range

The HDMF is capable of measuring flow speed from 0.3m/s to 15m/s. The minimum measurable speed can be one percent (1%) of the full range.

7.3.1.2.3 Accuracy

The HDMF converter combined with sensor is tested under testing condition mentioned above. The accuracy is given in Table 2.1

DN mm	Flow Range m/s	Accuracy
3 to 20	< 0.3	±0.25%FS
	0.3 to 1	±1.0R
	1 to 15	±0.5%R
25 to 600	0.1 to 0.3	±0.25%FS
	0.3 to 1	±0.5%R
	1 to 15	±0.3%R
700 to 3000	< 0.3	±0.25%FS
	0.3 to 1	±1.0%R
	1 to 15	±0.5%R
%FS: error of full span; %R: error of rate		

Table 2.1 Accuracy of the HDMF converter

7.3.1.2.4 Repeatability

Repeatability error < ±0.1%.

7.3.1.2.5 Current output

Current output: fully-isolated 0 - 10mA / 4 - 20mA

(a) Load resistance: 0 - 10mA, 0 to 1.5kΩ;
4 - 20mA, 0 to 750Ω.

(b) Basic error: add ±10μA on top of the measurement error

7.3.1.2.6 Frequency Output

Frequency output is proportional to the flow percentage of the full range. The HDMF provides fully isolated transistor open collector frequency output ranged from 1 to 5000 Hz. The external DC power supply should not exceed 35V and maximum collector current is 250mA.

7.3.1.2.7 Pulse Output

The converter can output up to 5000cp/s pulse series, which is dedicated to external totalization. Pulse factor is defined as volume or mass per pulse. It can be set to 0.001L/p,

0.01L/p, 0.1L/p, 1L/p, 2L/p, 5L/p, 10L/p, 100L/p, 1m^3/p, 10 m^3/p, 100 m^3/p or 1000 m^3/p. Pulse width is selectable from auto, 10ms, 20ms, 50ms, 100ms, 150ms, 200ms, 250ms, 300ms, 350ms and 400ms. Photo-coupler isolated transistor open collector circuit is used for pulse output. The external DC power supply should not exceed 35V and maximum collector current is 250mA.

7.3.1.2.8 **Flow Direction Indication**

The HDMF converter is capable of measuring both forward and reverse flow and recognizing its direction. The converter outputs 0V low level for forward flow, while +12V high level for reverse flow.

7.3.1.2.9 **Alarm Output**

Two channels of photo-coupler isolated open collector circuit are used for alarm signal output. There are two alarm outputs: high limit alarm and low limit alarm. The external DC power supply should not exceed 35V and maximum collector current is 250mA.

7.3.1.2.10 **Communication**

The RS485 or RS232C communication interface is embedded in the converter and supports data transfer up to 2km at 14400bps. Surge absorber is optional to protect the interface and converter.

7.3.1.2.11 **Damping Constant**

Damping time is selectable from 0.2 to 100s.

7.3.1.2.12 **Electrical Isolation**

The isolation voltage between analog input and analog output is not less than 500V;

The isolation voltage between analog input and alarm power supply is not less than 500V;

The isolation voltage between analog input and AC power supply is not less than 500V;

The isolation voltage between analog output and AC power supply is not less than 500V;

The isolation voltage between analog output and earth is not less than 500V;

The isolation voltage between pulse output and AC power supply is not less than 500V;

The isolation voltage between pulse output and the earth is not less than 500V;

The isolation voltage between alarm output and AC power supply is not less than 500V;

The isolation voltage between alarm output and the earth is not less than 500V.

7.3.1.2.13 **Input Contact**

External contact ON (close) or OFF (open) signal can be used to remotely control the start/stop or reset of internal counter.

7.3.2 **Keypad and Display**

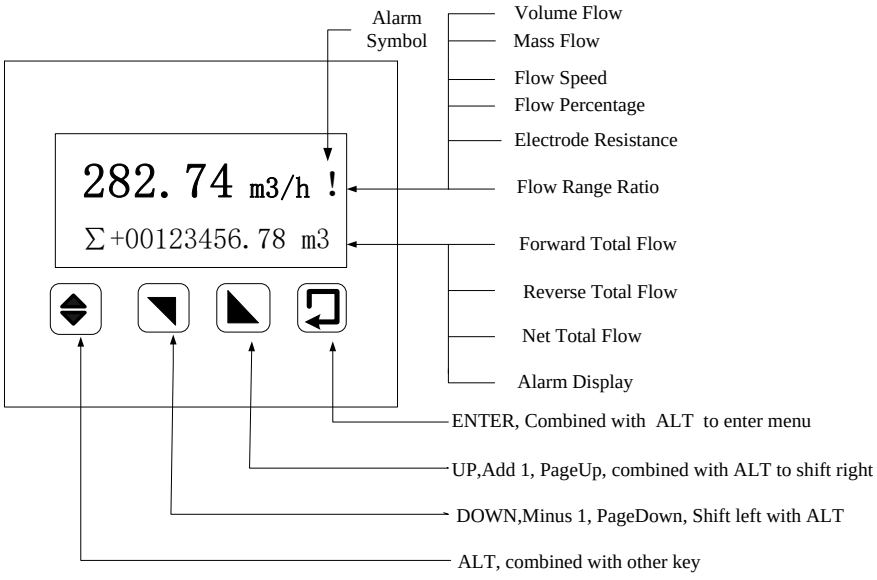


Fig 2.1 (a) Remote Type: Keypad and LCD Display

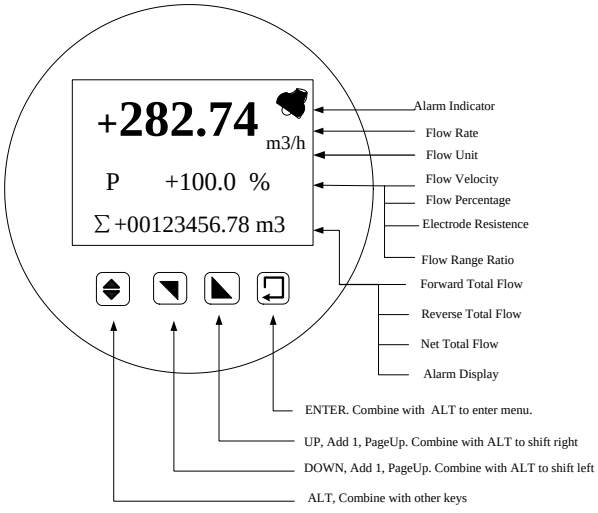


Fig 2.1(b) Compact Type: Keypad and LCD Display

Notes: Hold ALT key and press ENTER key, the converter will display a login page and password is required. Input proper password and press ENTER again. The system enters into the setup mode. To exit from setup mode and return to measurement mode, hole ENTER key for a couple of seconds. The system can automatically return to measurement mode if no key is pressed for 3 minutes.

7.3.2.3. Terminal Block and Marks

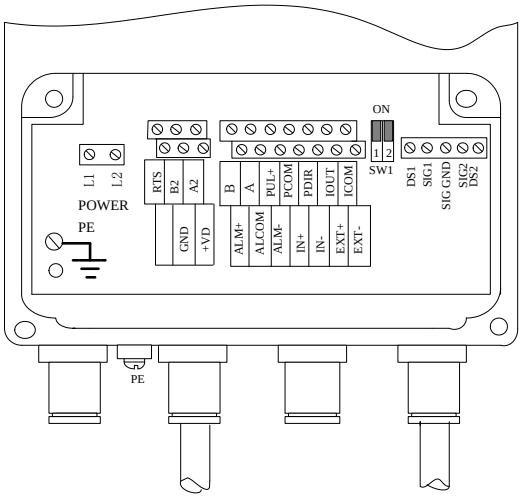


Fig 2.2(a) Remote Type: Terminals and Marks

The definition of terminals and their marks for remote type converter is given as below:

DS1	Shield drive 1
SIG1	Signal input 1
SIG GND	Signal Ground
SIG2	Signal input 2
DS2	Shield drive 2
EXT+	Coil excitation +
EXT-	Coil excitation -
IOUT	Current output +
ICOM	Current output -
PUL+	Frequency/pulse output +
PCOM	Frequency/pulse output -
PDIR	Flow direction indicator +
ALM-	Low alarm output +
ALM+	High alarm output +
ALCOM	Alarm output -
A	RS485 communication A
B	RS485 communication B
IN+	Input contact +
IN-	Input contact -
L1(+)	220V(24V +) input
L2(-)	220V(24V -) input

The dip switch SW1 is set to ON to supply +12V power to pulse output. If external power is used, turn the switch to OFF.

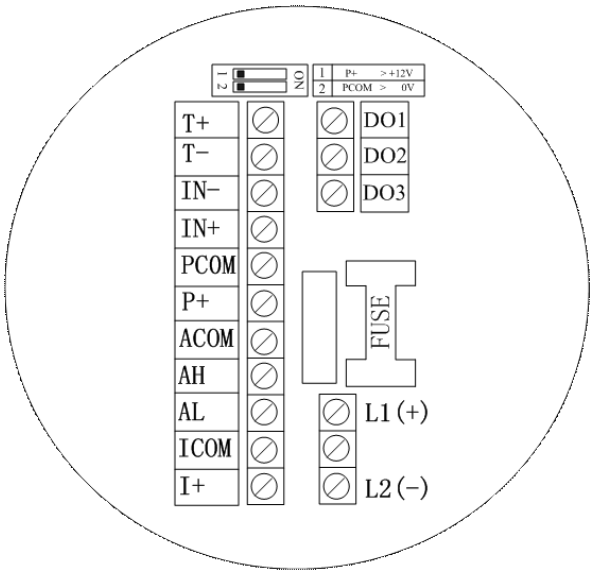


Fig 2.2(b) Compact Type: Terminals and Marks

The definition of terminals and their marks for compact type converter is given as below:

T +	RS485-A
T-	RS485-B
IN-	Input contact -
IN+	Input contact +
PCOM	Frequency/pulse output -
P+	Frequency/pulse output +
ACOM	Alarm output -
AH	High flow alarm output +
AL	Low flow alarm output +
ICOM	Current output -
I+	Current output +
L1(+)	220V(24V +) input
L2(-)	220V(24V -) input
DO1-DO3	Reserved

The dip switch SW1 is set to ON to supply +12V power to pulse output. If external power is used, turn the switch to OFF.

7.3.2.4 Wiring Cable

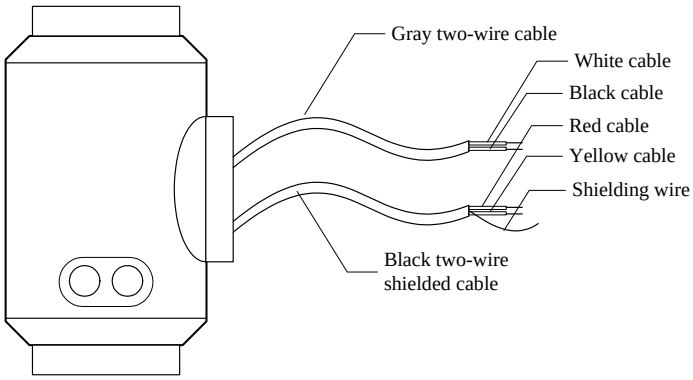


Fig 2.3 Cables for wiring

As shown in Fig 2.3, the converter has two connection cables depicted as below:

- White twist pair: 12-core red for field exciting +
  12-core black for field exciting -
- Black shielded twist pair: 10-core red for signal 1;
  13-core blue signal 2
  shielding layer for signal ground

7.3.2.4 Cable for flow signal

When the conductivity of the fluid to be measured is greater than 50μS/cm, RVVP2×32/0.2 PVC cable with shielding net can be used for flow signal transmission and its length should not exceed 100 meters. Signal cable wiring is shown in Fig 2.3.

To reduce the effect of capacitive distribution of cable, the converter provides equipotential shielding drive. When the conductivity is less than 50μS/cm or for long distance transmission, two-core double equipotential shielding cable, e.g. STT3200 or BTY signal cable, is strongly recommended.

7.3.2.4.2 **Cable for Filed Exciting**

Two-core isolated soft rubber cable can be used for field exciting. The type of YHZ-2×1mm^2 is recommended. The length is same as the signal cable.

7.3.2.4.3 Power Supply Cable

Two-core isolated soft rubber cable, e.g. YHZ-2×1mm^2, is recommended. Cable resistance should be taken into account if DC power supply is used. When using 24V DC power supply, the cable resistance should not be greater than 10Ω。

7.3.2.4.4 Cable for Current Output

For current output, total resistance of cable and load should not exceed 750Ω.

Connection of current output refers to the Fig 2.4 as below.

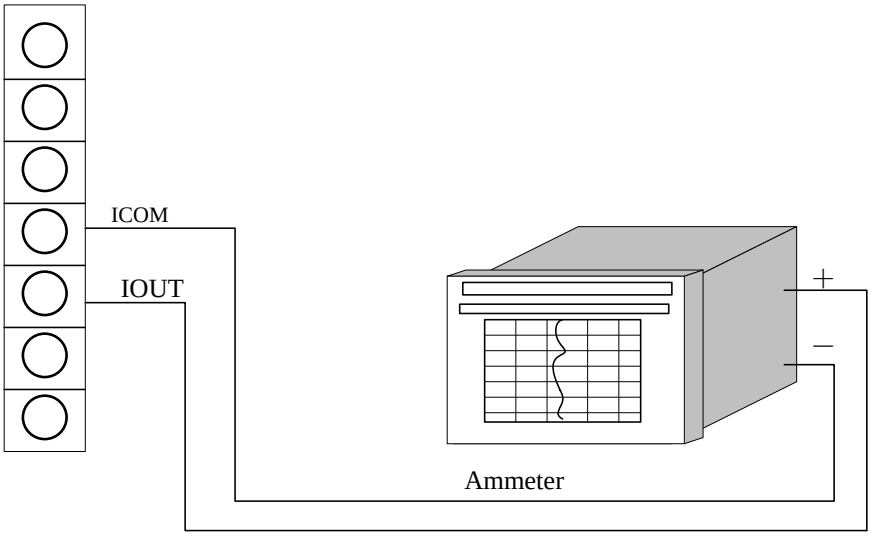


Fig 2.4 Wiring of current output

7.3.2.4.5 Wiring of Digital Output

Outputs of frequency (pulse), high/low alarm and flow direction indication are transistor open collector (TOC) output. External power supply and loads are needed when applying, refer to Fig 2.5.

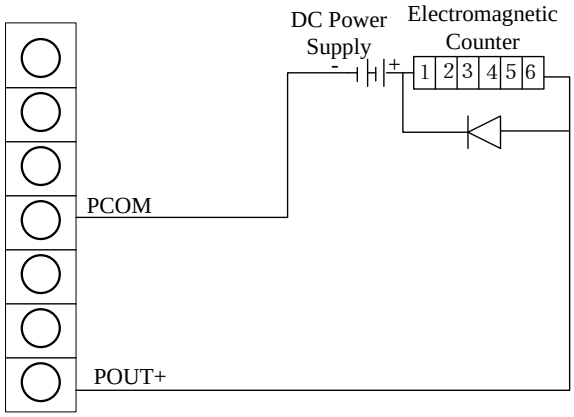


Fig 2.5 (a) Example of electromagnetic counter connection

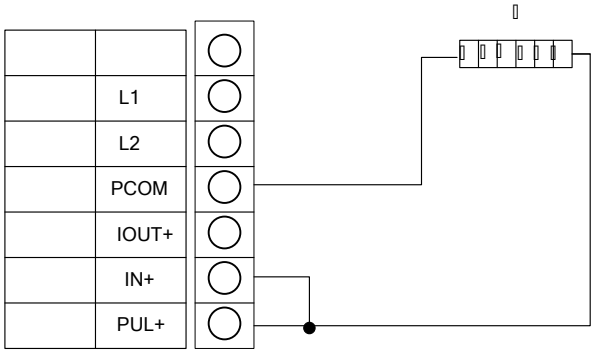


Fig 2.5 (b) Example of electrical counter connection

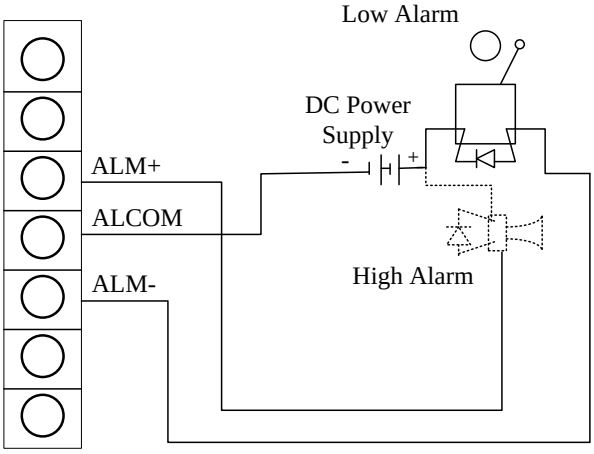


Fig 2.5 (c) Example of alarm output connection

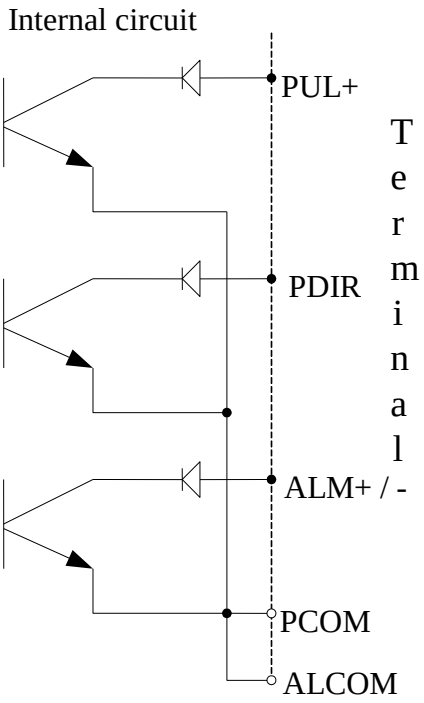


Fig 2.5 (d) Example of transistor open collector connections

7.3.2.4.6 Wiring of contact input

Contact input is controlled by external switch or relay ON/OFF signal shown in Fig 2.6. The contact resistance should be less than 5Ω.

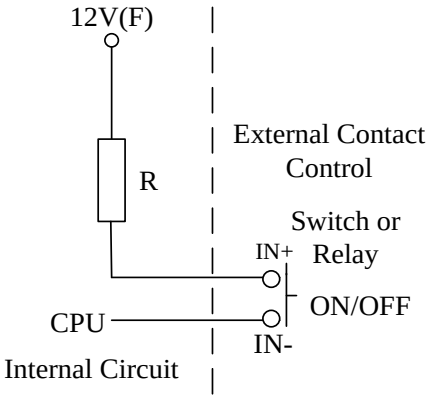


Fig 2.6 Contact Input Control

7.3.2.5 Grounding

The terminal PE on the case should be connected to the earth by a copper wire with cross-section area not less than 1.6mm^2. The grounding resistance should not exceed 10Ω.

7.3.2.6 Digital Output

Digital output refers to frequency/pulse and status output. The frequency and pulse output share one terminal. It is, therefore, that only one output is available at one time.

7.3.2.6.1 Frequency Output

Frequency output is proportional to flow percentage:

$$F = Flow\ Percentage \times Frequency\ Range$$

Where, the upper range value of frequency output is adjustable from 0 to 5000Hz.

Frequency output is usually used for control application since it corresponds to the flow percentage. For metering purpose, it is better to take advantage of pulse output.

7.3.2.6.2 Pulse Output

As mentioned above, pulse output is often used for metering. To avoid losing pulse count, it is important to select proper pulse factor and pulse width according to the application.

At a certain flow rate, more pulse counts and higher accuracy are obtained in a same period if higher pulse factor is chosen. The counter, however, may overflow in a short time of period. If low pulse factor is chosen, fewer pulses are output and the same counter lasts longer.

If electromagnetic counter is used, attention should be paid to choose proper pulse

width. The counter may consume a lot of power with large pulse width, while lose count with small one.

The pulse output differs from the square wave frequency output. The pulse series may not be uniform. To measure pulse, therefore, it is better to choose counter instead of frequency meter.

7.3.2.6.3 Terminals for Frequency/pulse Output

PUL+: Frequency/pulse output +
PCOM: Frequency/pulse output -

7.3.2.6.4 Status Output

The converter outputs three status signals: high alarm, low alarm and flow direction indication. The terminals used for them are ALM+, ALM- and PDIR respectively and they share one common terminal COM.

PUL+, ALM+, ALM-, and PDIR are all transistor open collector output. External load and power supply are therefore necessary. The examples of wiring are given below.

Fig 2.7 shows the case that the digital output signal directly connects user's digital input device.

The connection with a photo-coupler is given in Fig 2.8. Generally, 10mA current is needed to drive a photo-coupler. The load resistance R is around E/10mA. If E ranges from 5 to 24V, the resistance R should be 0.5 to 2.5kΩ.

Fig 2.9 illustrates the connection of the digital output with a relay. D is a surge-absorbing diode, which is usually embedded in the relay. If not, an external one is necessary.

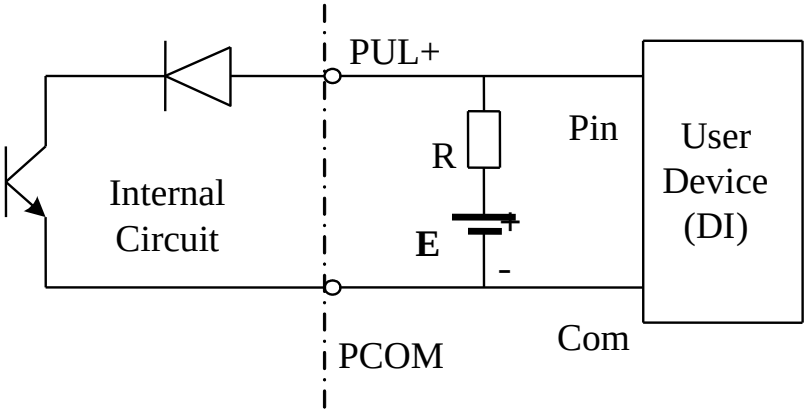


Fig 2.7 Digital Output Direct Connection

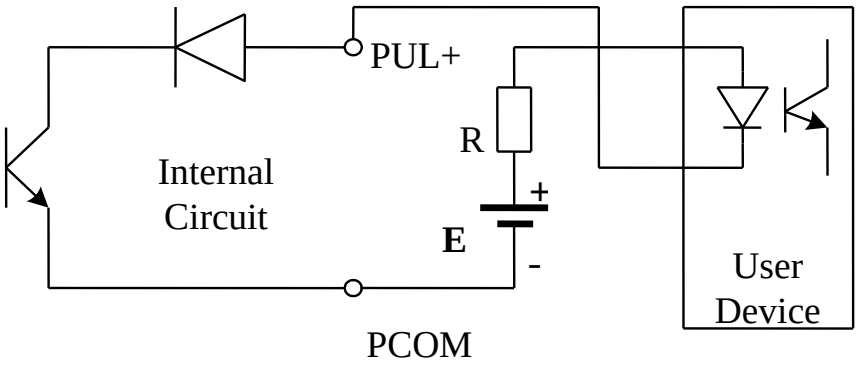
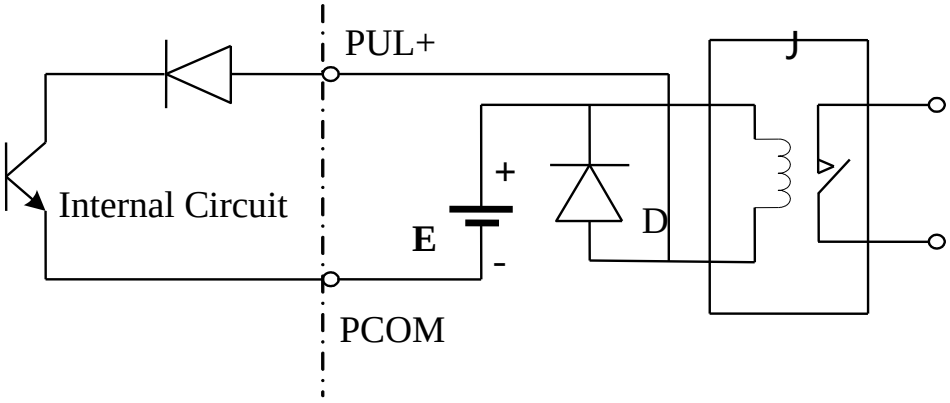


Fig 2.8 Connection with photo-coupler (e.g. PLC)



8 Fig 2.9 Connection with relay (e.g. PLC)

7.3.2.7 **Analog Output**

Analog current output is powered from internal 24V DC power supply, and can drive load resistance up to 750Ω.

Current output is proportional to flow percentage:

$$I_O = FlowPercentage \bullet CurrentRange + CurrentZero$$

To improve the definition of current output, it is suggested that proper flow range be set. The converter provides an auto-range-shift function to adjust flow range automatically.

Analog output is calibrated by the manufacturer with accurate test rig before shipping. In most cases, it is not necessary for user to adjust again. However, follow these steps if recalibration needed.

a) Preparation

Connect an ammeter of 0.1% accuracy (alternatively, connect a 100Ω high accuracy resistance and a voltmeter of 0.1% accuracy). Turn on the converter and warm-up for 15 minutes.

b) Current Zero Adjustment

Enter into setup mode and select ‘Current Zero’ menu item. Adjust the factor value until the ammeter reads 4±0.004mA (or voltmeter reads 0.4±0.0004V). Press ENTER to confirm setting.

c) Current Range Adjustment

Select ‘Current Max’ menu item and enter. Adjust the factor value until the ammeter reads 20±0.004mA (or voltmeter reads 2±0.0004V). Press ENTER to confirm setting.

After calibration, the converter can output high accuracy current signal of linearity better than 0.1%.

7.3.2.8 Contact Control Input

By controlling the ON/OFF of contact input, a high/low level signal is transferred to CPU to control the start/stop or reset of internal totalizer.

If ‘Stop Totalizer’ function is enabled, a contact ON signal can stop the internal counter, while an OFF signal starts it.

The three internal totalizers can be cleared remotely by a contact ON signal if ‘Reset Totalizer’ Function is active.

7.3.3 Parameter Setting

The meter has two running modes: Automatic Measurement Mode and Parameter Setting Mode.

After power-on, the meter enters measurement mode automatically. Under this mode, the meter fulfills all measurement functions, displays data and outputs signals.

There are four keys on the keypad. They can be used to enter the parameter setting mode and change the meter’s configuration. The key operation does not affect the measurement and the output.

7.3.3.1 Key Function

7.3.3.1.1Automatic Measurement Mode

DOWN:	Scroll bottom line display;
UP:	Scroll top line display;
ALT + ENTER:	Enter into setting mode;
ENTER:	Return to measurement mode.

7.3.3.1.2Parameter Setting Mode

DOWN:	Subtract one form the digit at the cursor;
UP:	Add one on the digit at the cursor
ALT + DOWN:	Cursor shifts left
ALT + UP:	Cursor shifts right
ENTER:	Enter/exit submenu;
ENTER:	Return to measurement mode if held for 2 seconds at any location

Notes:

(1) When using ALT key, hold ALT first and then press UP or DOWN.

(2) Under setting mode, the meter returns to measurement mode automatically if no key is pressed for 3 minutes.
(3) When adjusting flow zero, UP or DOWN key can be used to change the sign (+/-).
(4) When setting flow range, UP or DOWN key can be used to change flow unit.

7.3.3.2 Parameter Setting Operation

To setup the meter, changing to setting mode from measurement mode is the first step. Enter ALT + ENTER key in measurement mode to pop a login page and password is required to enter. Input authorized password and press ENTER again to confirm. The converter enters into setting mode if the password is approved, otherwise it returns to measurement display.

7.3.3.2.1Menu Items

HDMF converter setting menu consists of 42 items. Many of them are set up by manufacturer before shipping. It is not necessary to change them when applying. There are only a few of them to be set by user according to the application. The menu items are listed in Table 3.1.

Table 3.1 Operation Menu

Item No.	Menu Display	Setting Method	Password Level	Value Range
1	Language	Option	1	Chinese/English
2	Sensor Size	Option	1	3 - 3000mm
3	Flow Range	Modify	1	0 - 99999
4	Auto Rng Chg	Option	1	ON / OFF
5	Damping	Option	1	0 - 100 s
6	Flow Dir.	Option	1	Fwd/ Res
7	Flow Zero	Modify	1	+/-0.000
8	L.F. Cutoff	Modify	1	0 - 99%
9	Cutoff Enble	Option	1	ON / OFF
10	Rate-Of-Chng	Modify	1	0 - 30%
11	Limit Time	Modify	1	0 - 20 s
12	Total Unit	Option	1	0.0001L - 1 m3
13	Flow Density	Modify	1	0.0000 - 3.9999
14	Current Type	Option	1	4-20mA/0-10mA
15	Pulse Output	Option	1	Frq/ Pulse
16	Pulse Factor	Option	1	0.001L - 1 m3
17	Freq Max	Modify	1	1 - 5999 Hz
18	Comm Address	Modify	1	0 - 99
19	Baudrate	Option	1	600 - 14400
20	EmpPipe Det.	Option	1	ON / OFF

21	EmpPipe Alm	Modify	1	200.0 KΩ
22	Hi ALM Enble	Option	1	ON / OFF
23	Hi Alm Limit	Modify	1	000.0 - 199.9%
24	Lo Alm Enble	Option	1	ON / OFF
25	Lo Alm Limit	Modify	1	000.0 - 199.9%
26	RevMeas.Enbl	Option	1	ON/OFF
27	Sensor S/N	Modify	2	000000000000-999999999999
28	Sensor Fact.	Modify	2	0.0000 - 3.9999
29	Field Mode	Option	2	Mode 1,2,3
30	Multiplying	Modify	2	0.0000 - 3.9999
31	F. Total Set	Modify	3	0000000000 - 9999999999
32	R.Total Set	Modify	3	0000000000 - 9999999999
33	Input Contrl	Option	3	Disable/Stop Tot/Reset Tot
34	Clr Totalizr	Password	3	00000 - 59999
35	Clr Tot. Key	Modify	3	00000 - 59999
36	Date –y/m/d *	Modify	3	99/12/31
37	Time-h/m/s *	Modify	3	23/59/59
38	Password L1	Modify	3	0000 - 9999
39	Password L2	Modify	3	0000 - 9999
40	Password L3	Modify	3	0000 - 9999
41	Current Zero	Modify	4	0.0000 - 1.9999
42	Current Max	Modify	4	0.0000 - 3.9999
43	Meter Factor	Modify	4	0.0000 - 3.9999
44	Convtr S/N	Modify	4	0000000000-9999999999
45	Sys Reset	Password	4	

* Item No. 36 and 37 are optional and only effective for the converter with real clock and power failure recording function.

7.3.3.2 .2 Meter Parameter Description

The setting parameters determine the operation status, calculation method and output mode of the flow meter. Properly setting meter parameter can make the meter work in best condition and higher accuracy of display and output can be obtained.

There are five levels of password, where level 0 - 3 are open for user and level 4 reserved for manufacturer. Level 1 to 2 passwords are changeable by higher level password-holder, e.g. Level-3 password.

Meter setting can be browsed by entering any level of password. However, higher level password is needed to change settings.

- Password Level-0 (default value 0521): fixed and browsing only;
- Password Level-1 (default value 7206): changeable and authorized to modify menu item 1 to 25;
- Password Level-2 (default value 3110): changeable and authorized to modify menu item 1 to 29;

- Password Level-3 (default value 2901): fixed and authorized to modify menu item 1 to 38;
- Password Level-4 (reserved): fixed and authorized to modify any menu item including resetting system.
- Totalizer Reset Password (default value 36666): changeable in menu item 'Clr Tot. Key 'and authorized to clear the three internal counter.

It is suggested that Level-3 password be held by manager or supervisor while Level-0 to 2 passwords be kept by operator. The Level-3 password can also be used to change the password for totalizer resetting.

7.3.2.2.1 Sensor Size

HDMF-2500 converter supports sensor diameter ranging from 3 to 3000mm, which can be chosen by pressing UP or DOWN key.

7.3.2.2.2 Flow Range

Flow range refers to the upper range value (URV) of flow rate. The URV is relative to flow percentage and output signal. At the analog output the amount of the measured values in the range 0 up to URV is displayed linear to the current range 4 to 20mA, at the frequency output to the frequency range 0 to the end frequency. The low flow cutoff and flow limit alarm relates to flow range as well. The maximum measurable flow rate, however, is not limited to the flow range as long as the flow speed does not exceed 15m/s.

In this menu item, user can also choose unit of flow rate. For volume flow, L/s, L/min, L/h, m^3/s, m^3/min and m^3/h are available; while for mass flow, kg/s、kg/m、kg/h、t/s、t/m、t/h can be selected from. It is up to the habits and application requirements to pickup a proper unit.

7.3.2.2.3 Auto Rng Chg

The converter has a function called Auto-Range-Change that is usually used for control system with wide flow range variation. The primary flow range is the value given by menu item 'Flow Range'. The second flow range (lower range) is obtained by selecting range ratio 1:2, 1:4 or 1:8 of primary one.

Fig 3.1 illustrates how the flow range is changed automatically. To safely change range and avoid vibration of display and output, a 5% to 10% hysteresis is added at the change point.

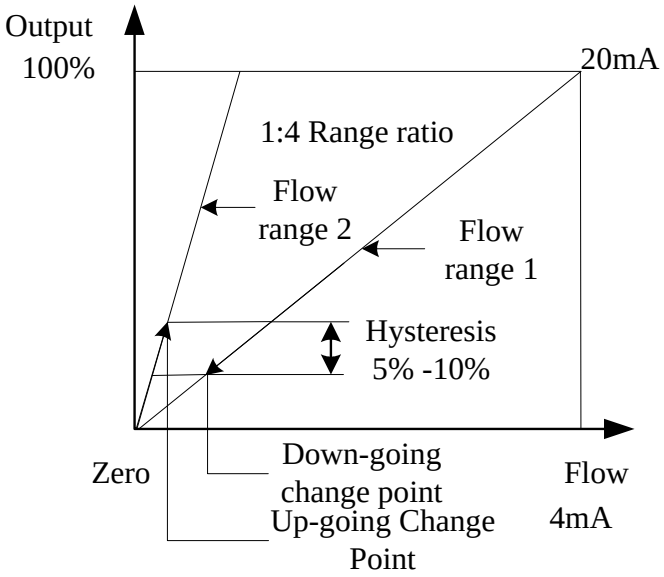


Fig 3.1 Illustration of Auto-Range-Change

7.3.2.2.4 Damping

Long damping constant can improve the stability of display and output and is suitable to flow control application; while short damping constant has short response time and is suitable to the totalization of pulse flow. Damping time is selectable from 0.2s to 100s.

7.3.2.2.5 Flow Dir.

If the displayed direction sign is not agreed to the actual flow direction, change this item to the opposite option.

7.3.2.2.6 Flow Zero

To conduct zero adjustment, the fluid in the sensor pipe must be held still. The flow zero is displayed by flow speed and the unit is m/s. The display of flow zero is shown below:

FS=○○.○○○m/s ±○○○○○

On the LCD, the top line displays the measured zero point while the bottom line shows the adjustment value. If the FS is not equal to 00.000m/s, adjust the sign and value on bottom line until FS back to nil. Remind again: to adjust the flow zero, the sensor pipe must be filled and the fluid must be kept still. The flow zero adjustment value is an important constant of the meter and should be printed on the calibration sheet and label. The value should include the sign and amount by unit of m/s.

7.3.2.2.7 L.F. Cutoff and Cutoff Enble

Low flow cutoff is set in percentage relative to flow range. If Cutoff is enabled and flow is lower than the set value, the display of flow rate, speed and percentage and signal outputs are forced to nil. If the item is disabled, no action is taken.

7.3.2.2.8 Rate-Of-Chng and Limit Time

'Rate-of-change' limit technique is used to eliminate application-related high electrical noise contained in the process flow signal.

To check electrical noise, two parameters are defined: 'Rate-of-change' limit and 'Control limit time'. If the sampled flow value exceeds the set rate-of-change limit value based on the averaged flow rate value up until the sampled time, the system will reject that sampled value and instead the averaged value including the rate-of-change limit value in place of the rejected sampled value will be output. However, if the limit-exceeding sampled value continues for the same flow direction for more than the preset control limit time, that data will be used as output signal. Fig 3.2 illustrates the effect of noise-suppressing by rate-of-change limit.

The value of rate-of-change limit can be set from 0 to 30% of flow range and limit time ranges from 0 to 20 seconds. If either of the two parameters is set to nil, the function is disabled.

The rate-of-change limit function is not suitable for short period measurement and flow meter calibration.

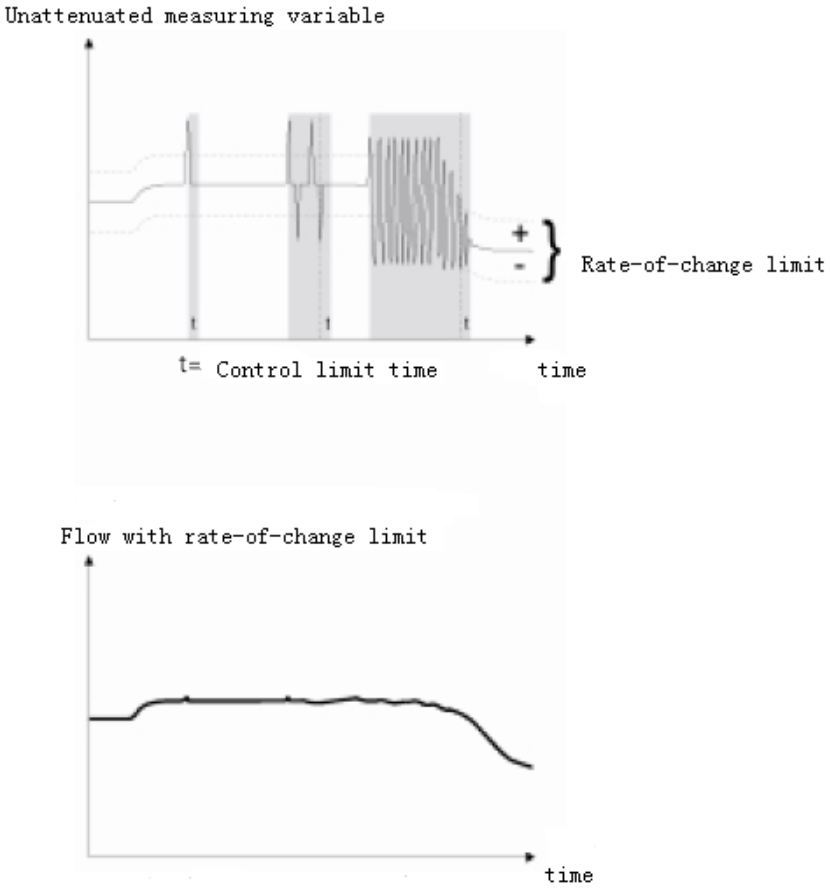


Fig 3.2 Example for the effect of rate-of-change limit

7.3.2.2.9 Total Unit

The converter has three 10-digit counters and the maximum counts are 9999999999. The total flow unit can be L, m^3, kg or t (metric ton) with a multiplying factor of 0.001,

0.01, 0.1, 1, 10, 100 or 1000.

7.3.2.2.10 Flow Density

The converter is capable of measuring mass flow if fluid density is set. The density can be set from 0.0001 to 3.9999 and the mass unit is determined automatically by flow unit. The density should be set to 1.0000 (default value) if not used. Otherwise, measurement data will be forced to nil.

7.3.2.2.11 Current Type

Current output type is selectable from 4-20mA to 0-10mA.

7.3.2.2.12 Pulse Output

Two types of pulse output are available to choose from: frequency output mode and pulse output mode. The meter outputs continuous square wave pulse under frequency mode, while pulse series under pulse mode. Frequency output is usually used for flow rate measurement and short period of time totalization. Pulse output can be connected to an external counter directly and is often used for long period of time totalization.

As mentioned hereinbefore, transistor open collector circuit is used for frequency and pulse output. Therefore, the external DC power supply and load are necessary.

7.3.2.2.13 Pulse Factor

Pulse factor is defined as: pulse counts per unit volume or mass. The setting of pulse factor is detailed in Section 2.1.7 and 2.6.2.

7.3.2.2.14 Freq Max

Frequency range corresponds to the upper range value of flow rate, or 100% of flow percentage in other word. Maximum frequency is selectable from 1 to 5999Hz.

7.3.2.2.15 Comm Address and Baudrate

Substation address is needed when using RS485 communication. The address can be set from 01 to 99. Baud rate is the transmission speed between main and sub station. It is selectable from 600, 1200, 2400, 4800, 9600, 14400bps. Remind: the baud rate must be the same as that of the main computer.

7.3.2.2.16 EmpPipe Det.

This item is used to enable or disable the empty-pipe detector. If enabled, the meter will force the display value, analog output and digital output to nil when the sensor pipe is not full.

7.3.2.2.17 EmpPipe Alm.

This item is to set the electrode alarm trip value. Constant current source method is employed to measure the resistance between two electrodes. The variation of the resistance is checked by CPU and CPU recognizes if the pipe is empty or the electrodes are contaminated. The resistance is calculated as following:

$$R \approx 1/d\sigma$$

where, d = electrode radius

σ = Fluid conductivity

The electrodes resistance is usually between 5 to 50kΩ。The variation of the resistance relates to the surface status of electrodes and variation of fluid characteristic. If the sensor is filled with fluid, abnormal resistance signal is detected and empty pipe alarm is output.

The electrode alarm trip value is determined based on the first-time measured electrode resistance. After the installation of the flowmeter, measure the resistance between the electrodes when the sensor pipe is filled. Record the resistance value and take it as a basis. Usually, set the trip value as 3 times of the original resistance recorded.

7.3.2.2.18 Hi ALM Enble

User can enable or disable the high limit alarm.

7.3.2.2.19 Hi Alm Limit

High alarm limit value is set in percentage of the upper range of flow rate. The parameter ranges from 0% to 199.9%. The meter outputs alarm signal when the flow percentage is higher than this value.

7.3.2.2.20 Lo Alm Enble

User can enable or disable the low limit alarm.

7.3.2.2.21 Lo Alm Limit

Low alarm limit value is set in percentage of the upper range of flow rate. The parameter ranges from 0% to 199.9%. The meter outputs alarm signal when the flow percentage is lower than this value.

7.3.2.2.22 Sensor S/N

Sensor serial number records the information of the sensor equipped with the converter and ensure them match up when installing.

7.3.2.2.23 Sensor Fact.

The sensor factor is set according to the calibration sheet supplied by the manufacturer. Usually this factor has been set up by the manufacturer before shipping. It is an important value that determines the accuracy of measurement. Do not change it without calibration.

7.3.2.2.24 Field Mode

The converter offers three field exciting modes based on the exciting frequency. Mode 1 is the most-commonly used one and suitable for most cases. Mode 2 and 3 are low-frequency exciting modes and are better for large size meter to measure water. The calibration should be taken under the same exciting mode as that used for measurement.

7.3.2.2.25 RevMeas.Enbl: Reverse Measurement Enable

If RevMeas.Enbl is set to ON, the converter displays flow and outputs signals when flow direction is reversed. If OFF, the converter displays no flow and does not output signals when reversing.

7.3.2.2.26 Multiplying

This item is a multiplying factor selectable from 0.0000 to 3.9999. When calculating the flow rate and total, this factor is taken into account. It is often used to measure the flow in the open channel. If not applied, set the value to 1.0000.

7.3.2.2.27 F. Total Set and R. Total Set

Presetting of forward and reverse total counter is designed to start counting from the existing reading when replacing a converter or flowmeter. It provides a continuous total flow read which is convenient for management.

7.3.2.2.28 Input Contrl

As mentioned in Sec. 2.8, this menu item is set to select the function of contact input. There are three options to be chosen from: 'input disabled', 'stop totalizer' and 'reset totalizer'. The converter disables the contact input if 'input disabled' is selected. The contact input is used to start/stop totalizer controlled by ON/OFF switch signal if 'stop totalizer' function is active. If 'reset totalizer' function is enabled, ON (close) contact signal will clear the three internal total flow counters.

7.3.2.2.29 Clr Totalizr

Enter the 'Totalizer Reset Password' in this menu item and press ENTER to confirm. The converter clears the three internal counter and restart counting if password matched.

7.3.2.2.30 Clr Tot. Key

The 'Totalizer Reset Password' is changeable in this menu item if Level-3 password is entered. Remind: keep the new password in a safe place.

7.3.2.2.31 Date –y/m/d and Time-h/m/s

These items are used to change the internal real time clock if equipped.

7.3.2.2.32 Password L1 ,Password L2 and Password L3

To change the Level-1 to Level-3 passwords, use Level-4 or higher level password to enter and change these two items.

7.3.2.2.33 Current Zero and Current Max

Adjust the current output zero point and upper range value as detailed in Sec. 2.7. It is not suggested that user make any adjustment since it has been setup to the best condition by the manufacturer.

7.3.2.2.34 Meter Factor

This factor is used by the manufacturer to normalize the excitation current and amplifier signal of the converter. DO NOT change it.

7.3.2.2.35 Convtr S/N

This serial number records the manufacturing date and code of converter. DO NOT change it.

7.3.2.2.36 Sys Reset

This item is reserved for the manufacturer to re-initialize the converter. After system resetting, all settings are set to default values automatically.

7.4

Self-diagnosis and troubleshooting

7.4.1 Self-diagnosis

HDMF converter is not repairable for user. Do not open the converter case.

The self-diagnosis function of the converter is capable of displaying alarm information except power supply or hardware failures. A '!' symbol is displayed on the right corner of LCD top-line and malfunction information can be read from the bottom-line by pressing DOWN key. User may check the flowmeter according to the alarm information. Some examples of alarms are given below:

Coil Alm
Elctrd Alm
EpPipe Alm
Low Alarm
High Alarm

7.4.2Troubleshooting

7.4.2.1 No display

a) Check the connection of power supply;
b) Check fuse;
c) Check the voltage of power supply;
d) Check if the LCD contrast can be adjusted. Adjust it if possible;
e) Return to base, if a) to d) are OK.

7.4.2.2 Coil Alarm

a) Check if terminal EXT+ and EXT- are open;
b) Check if coil resistance is less than 150Ω;

c) Replace converter if a) and b) are OK.

7.4.2.3 Empty Pipe Alarm and Electrodes Alarm

a) Check if the sensor pipe is filled with fluid;
b) Check the connection of signal wiring;
c) Connect the terminal SIG1, SIG2 and SIG GND. If the alarm display disappears, it is confirmed the converter is normal. The alarm may be caused by the bubble in the fluid;
d) For electrodes alarm, measure the resistance between two electrodes with a multimeter. The read should be between 3 to 50kΩ. Otherwise, the electrodes are contaminated or covered.

7.4.2.5

7.4.2.5

High Alarm

Increase the flow range.

7.4.2.6Low Alarm

Reduce the flow range.

7.4.2.7Inaccurate Measurement

a) Check if the sensor pipe is filled with the fluid to be measured.
b) Check the wiring;
c) Check if the sensor factor and flow zero are the same as those on the calibration sheet.

Remark:

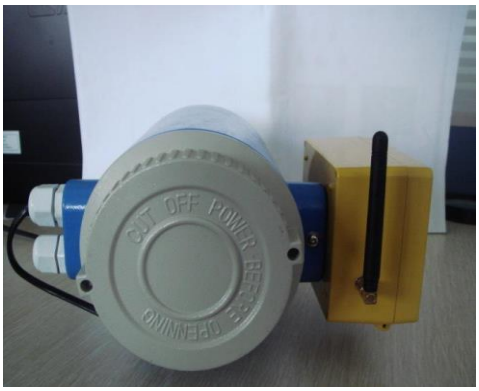
To change excitation current from 250mA to 125mA, simply remove the R14 resistor on power board for compact type, or R115(above R114）for remote type.

7.5 Electromagnetic Flowmeter with GPRS DTU

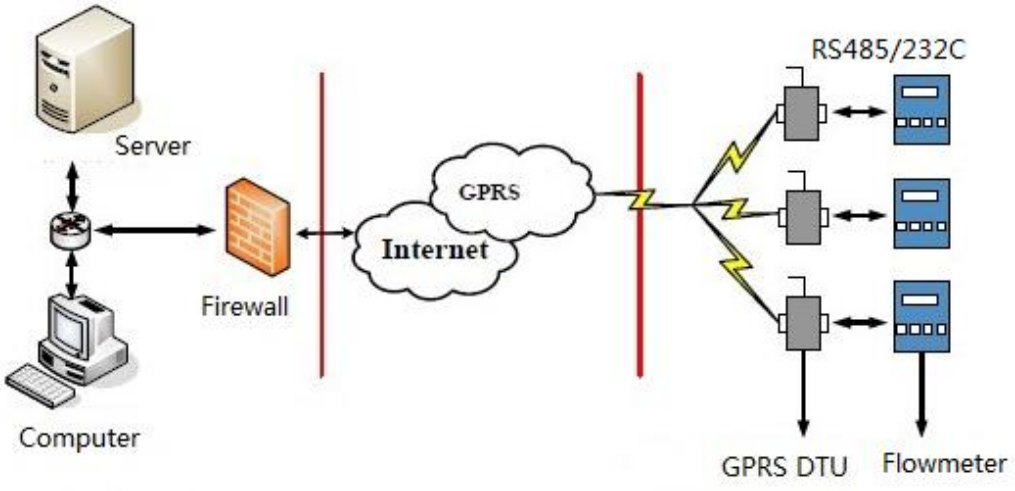
7.5.1. Basic Features

The HDMF electromagnetic flowmeter integrated with GPRS DTU can provides the following basic functions for users to implement the wireless connections:

. Collection of real-time flow data, including flow rate, velocity, percentage, forward total flow, reverse total flow, alarms and pipe size, etc.;
. Setup or change of the parameters of the flowmeter from remote;
. Supporting of MODBUS communication protocol;
. A set of computer software available for user to monitor the status of flowmeter, manage the flow data, and export or print data report;
. Automatic reconnection if disconnected;
. Supporting dynamic IP address

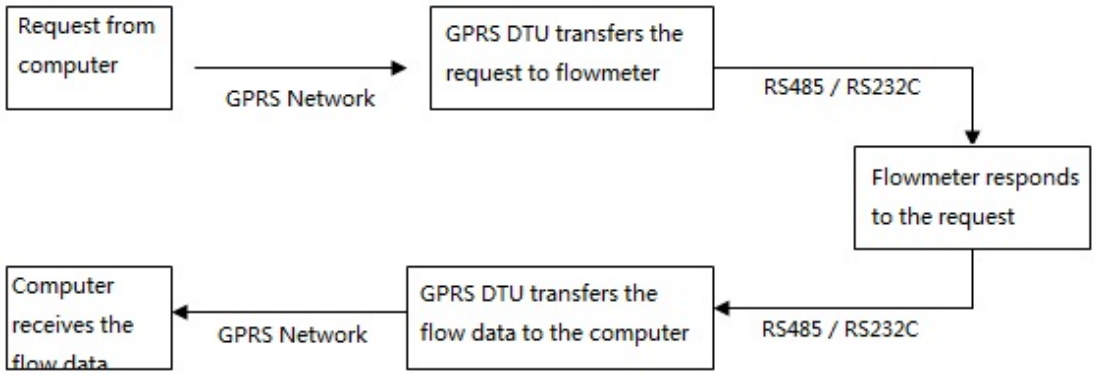


7.5.2 The GPRS network prototype



7.5.3 The Illustration of Data Flow

The following figure illustrates the procedure of data flow.



7.5.4 System Requirements

The minimum requirements to form a GPRS flow monitor system are as following:

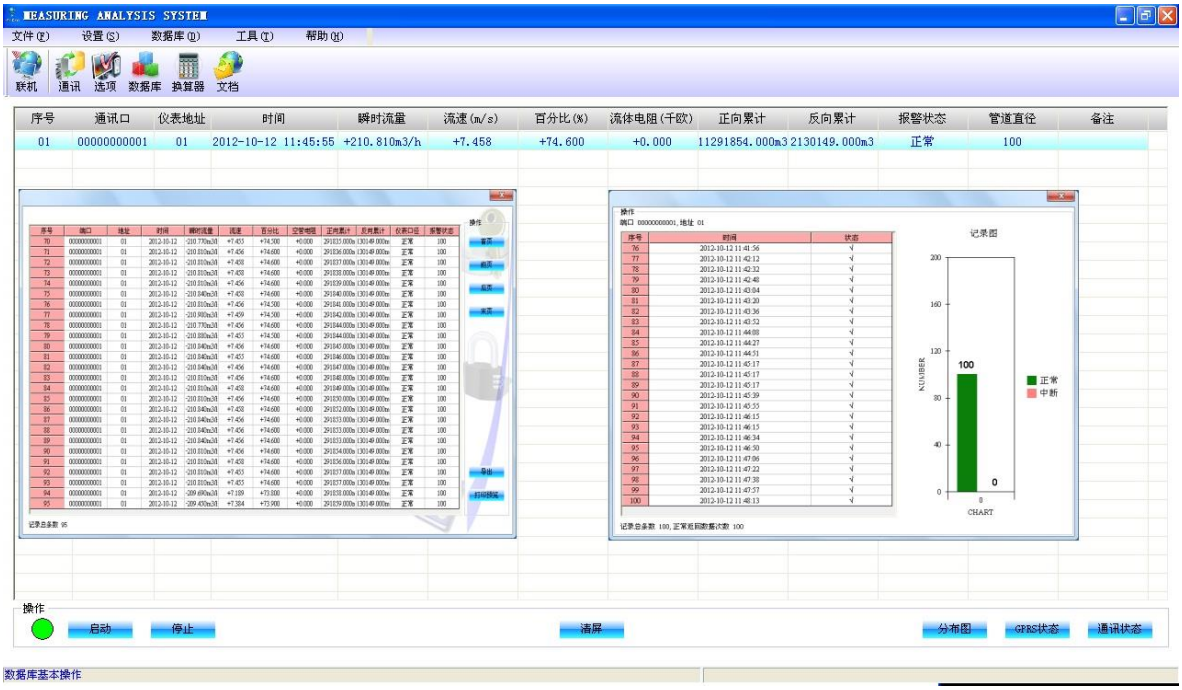
. An electromagnetic flowmeter with RS485 or RS232C interface;

. A GPRS DTU module;

. A SIM card with GPRS service (normally 5MB data flow per month);
. A computer with Internet access;
. A set of computer software to manage the wireless data

7.5.5 GPRS Data Management Software

. Supporting multi-language, i.e. English or your language by order;
. MODBUS communication protocol;
. Real-time flow data collection and status monitor;
. Data transfer intervals configurable;
. Supporting of data history enquiry, chart and report export;
. Monitoring of wireless connection status;
. Automatic reconnection if disconnected



7.5.6 General specifications of GPRS DTU module

- Frequency Band: Dual band 2G, GSM 900/1800, compliant to GSM phases 2 / 2+, GPRS class 10, GPRS class 8;
- Code: CS1~CS4
- Network protocol: TCP and UDP;
- Support: TTL, RS485 and RS232C;
- SIM interface: 3V/1.8V interface;
- Self-monitoring and automatic reconnection;
- Transfer rate: 300~115200bits/s;
- Wide power supply: 5 - 30 VDC;
- Power consumptions: 10mA standby (12VDC), 40 – 100mA working current (12VDC);

7.6. Electromagnetic Flowmeter MODBUS Protocol V2.0

7.6.1. The Protocol

1) Interface: RS485 or RS232

2) RTU mode

3) Data Format:

- 1 start bit
- 8 bits data, the least significant bit first
- Non parity check
- 1 stop bit

4) CRC checksum

5) MODBUS function code: 03

6) Flow Data Register Address：

Register Addresses	Data Format	Variables
40000	IEEE754 Float Inverse	Flow rate
40002	IEEE754 Float Inverse	Total flow

7) Example

Master computer sends:

01	03	00	00	00	04	44(CRC Low)	09(CRC High)

The flowmeter responses:

01	03	08	X0	X1	X2	X3	X4	X5	X6	X7	CRC Low	CRC High

X0 X1 X2 X3 represent the flow rate, an IEEE754 inverse float. X4 X5 X6 X7 represent the total flow, an IEEE754 inverse float.

7.6.2. Wiring

1) Remote Type:

- RS485 interface: A2(terminal) - A;
  B2(terminal) - B;

2) Compact Type

- RS485 interface: T+(terminal) - A;
  T-(terminal) - B.

8 Notes for Application

8.1 Necessary conditions for operation and accurate measurement

1) The measured fluid must be conductive. Minimum conductivity ≥5μs/cm.

2) The pipeline must be fully filled to ensure accurate measurement.

3) The grounding of the flow measurement system must be good.
4) The installation of the flow meter should meet the requirements of the straight pipe section upstream and downstream.
5) The flow meter should be kept from a strong magnetic field.

8.2 Selecting Size

The HDMF is designed to continuously and accurately measure liquid flow within the rated flow range of 0.3 ... 15m/s (1 ... 49 ft/s). Generally the diameter selected for a flow meter is equal to that of pipeline it is installed as it is generally easier to install, meets the process working conditions and has no pressure loss.
In some operating conditions (e.g. low velocity slurry flow), to ensure reliable operation, a smaller meter is recommended to increase flow velocity in order to prevent sedimentation and therefore measurement errors.
For a large diameter pipeline with stable flow at low velocity, a smaller diameter flowmeter is recommended as this reduces cost while at the same time ensuring the meter is operating in its optimum velocity range for greater accuracy.
In order to accommodate a smaller meter in a pipeline, reducers are necessary before and after the flowmeter. It is important to install reducers with a center cone angle no greater than 15° to ensure a consistent flow profile. Straight pipe run requirements upstream and downstream of the meter must be met in the

installation otherwise accuracy may be compromised.

8.3 Recommended Flow Velocity

The optimum flow range for many applications is 1 ... 5 m/s (3.3 ... 16 ft/s). Taking into consideration accuracy, economy and long life, a flowmeter operating in this range will be of high accuracy, good linearity and low pressure loss, while abrasion to the lining and electrodes caused by fluid should be limited.
The recommended flow range for a fluid stream containing solid particles is 1 ... 3 m/s (3.3 ... 10 ft/s). Excessive abrasion to meter lining and electrodes caused by the suspended solid particles will be avoided because of the lower flow velocity.
The recommended flow range for a fluid that might deposit material in the pipeline is 2 ... 5 m/s (6.5 ... 16 ft/s). Higher flow velocity is necessary to eliminate excessive deposition. In addition, vertical meter installation will also help to eliminate deposition.

8.4 Fluid contacting parts

The parts contacting with the process fluid include lining, electrodes and grounding flange. Material corrosion and abrasion resistance data along with process operating temperature must be taken into account when specifying meter wetted materials to ensure the meter is suitable for the application it is selected for.

8.5 Lining Properties

Neoprene is most commonly used for non- corrosive or weak corrosives, such as process water, wastewater, sewage, weak acid and alkali fluids.
PTFE has excellent compatibility to chemicals and has extremely good resistance to corrosive materials. It has poor performance to abrasive solutions and vacuum/negative pressure conditions.
PFA and Tefzel do not have the same chemical compatibility as PTFE, but have superior abrasion resistance. PFA and Tefzel linings are available with wire netting reinforcement to give improved vacuum/negative pressure performance.
Polyurethane rubber has extremely good abrasion resistance, but poor acid and alkali corrosion resistance. Its abrasion resistance is 10 times that of natural rubber, making it a suitable lining material for process fluids such as coal tar, pulp, sewage, etc.

8.6 Electrodes

A variety of different materials options are available for electrodes. Meters can be specified with various electrode material options depending upon the specific corrosion and abrasion resistance requirements of the process.
Available materials include:
. 316L Stainless Steel

. Hastelloy-C22 and B10 (Nickel Alloys)
. Titanium
. Tantalum
. Platinum/iridium alloy

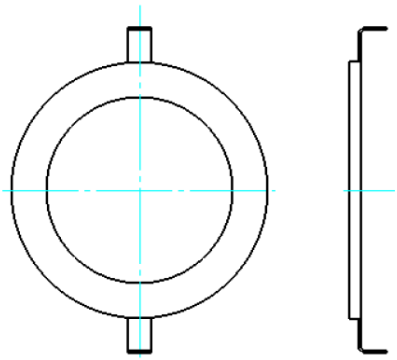
This range of materials covers nearly all chemical fluids. In order to select the right material for any particular application, it is important to consider the degree of corrosiveness of the fluid at process conditions: temperature, density, flow velocity, etc. For abrasive applications, carbide coated stainless steel material is available.


Electrode Removal Accessory in Place

Some HDMF flowmeter models are also available with an in-situ electrode replacement option. In applications where electrodes require replacement on a regular basis, this option allows for their replacement without having to shut down the pipeline. An electrode removal accessory with process isolation valve is simply attached to the electrode mounting point and used to withdraw the electrode from the line. The new electrode is installed using the reverse procedure to removal.

8.7 Grounding Ring and Grounding Electrode

When installed in a plastic pipe or metal pipe with insulating lining, a grounding point at the flow tube is necessary in order to ensure reliable operation of the meter. Grounding can be achieved by fitting a grounding ring or a third electrode in the flow tube.



Grounding Ring

Stainless steel is commonly used for grounding ring, but for more exotic materials, a grounding electrode is more commonly fitted. Made from the same material as the flow measurement electrodes, the grounding electrode establishes a reference potential and avoids any polarization caused by dissimilar materials, resulting to accurate and reliable flow measurement.

9 HDMF Flow Tube Installations

Installation locations and positions vary dramatically depending upon the end users requirements. In general, electromagnetic flowmeters can be installed in horizontal, vertical and sloped orientations, but if the meter is not properly installed, performance may be less than specification. In order to get the best measurement performance, the following general installation requirements should be considered:

- The meter flow tube should be fully filled with process liquid at all times the meter is on-line.
- Measurement in partially filled pipes is highly inaccurate and unreliable.
- When installed in a Horizontal line, the electrode axis should be horizontal across the pipe whenever possible.
- Installation should allow upstream and downstream straight runs of at least 5 pipe . Upstream and at least 3 pipe ○ downstream.
- The meter must be installed with the flow direction marker on its body in the direction of the actual flow.
- Adequate space should be allowed around the flowmeter for maintenance and service access.
- Reducers can be installed on the both ends of the flowmeter when the pipe diameter does not coincide with the flowmeter diameter. The reducers should have a cone angle of no more than 15°.
- When installing reducers, it is recommended that straight runs of 5 pipes. upstream and 3 pipe ○ downstream be included to provide confidence that flowmeter accuracy is maintained.
- Strong magnetic fields and vibration around the electromagnetic flowmeter

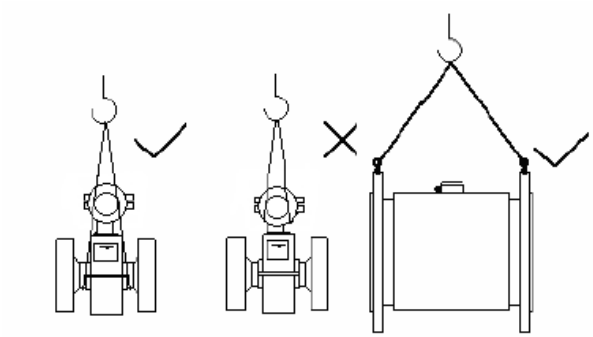
should be avoided.

- Solid, secure support should be provided for the pipes on both sides of the flowmeter to prevent undue stress being placed upon the meter and flanges.
- Transmitters should be installed in locations where they are not constantly subjected to water spray or the possibility of flooding to prevent water ingress into the electronic unit.

9.1 Installation Hints and Tips

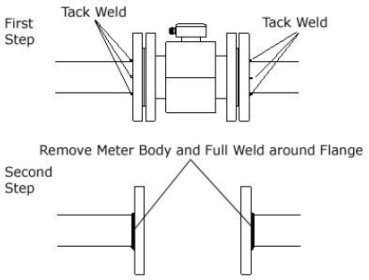
Lifting Instructions

Under no circumstances lift the meter its by transmitter enclosure or junction Safety First - when moving and positioning flow tubes, always ensure lifting equipment is in good condition and its lifting capacity is adequate for the weight of the meter.



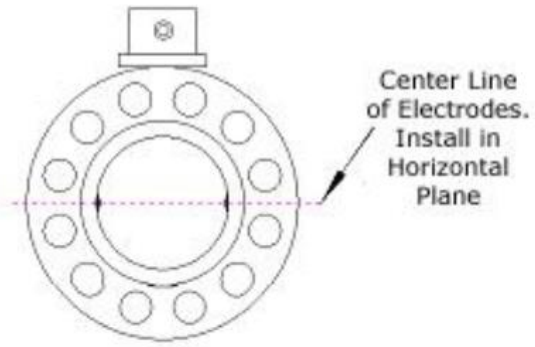
Protect Lining From Heat

When carrying out hot work around an installed flow meter, care must be taken to prevent flow tube lining from being heated and damaged. Always remove flow meter body before full welding around flanges.



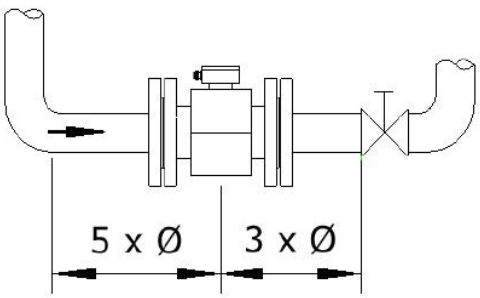
Horizontal Installation

The meter can be mounted in any position in a horizontal installation. It is recommended that the meter is installed with the electrodes in or close to the horizontal plane to ensure that any passing air or bubbles do not interfere with the measurement.



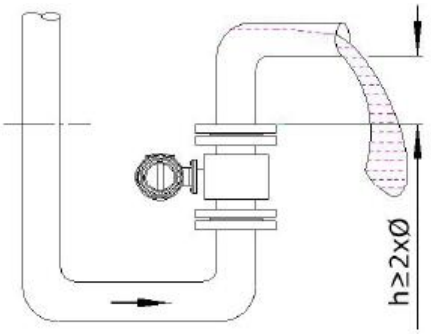
Straight Pipe Run Requirement

The flow meter should be installed with the necessary minimum straight pipe runs both upstream and downstream. Always install in a place where the pipeline will remain full of liquid.



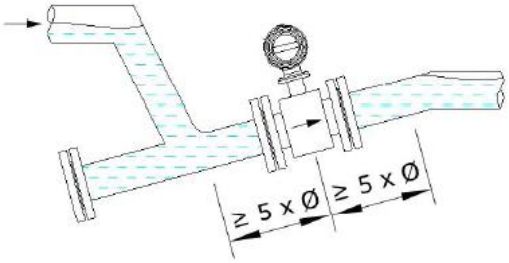
Vertical Installation

If installing in a vertical pipe, it is highly recommended that flow direction is upwards to guarantee that the pipe remains full at all times. Ensure upstream and downstream straight pipe run requirements are met.



Installation in Partially Filled Pipes

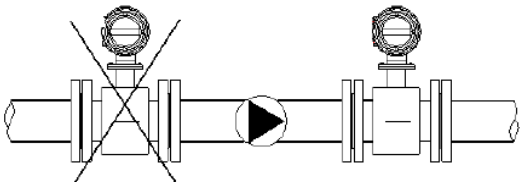
To ensure that the meter remains full when used in a partially filled pipeline, a wet trap method such as an inclined dip or downwards U tube should be employed. A drain/clean out port should be installed at the lowest point for maintenance



purposes. Where there is a possibility of solids being deposited in the line, do not install the meter at the lowest point to avoid the possibility of deposition in the meter body itself.

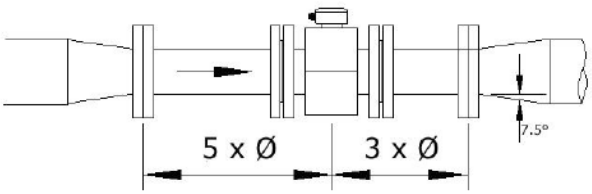
Avoid Installing Upstream of a Pump

Avoid installing a mag flow meter on the suction side of a pump as this may create negative pressure in the line and damage the meter lining. Wherever possible, always install downsteam of a pump.



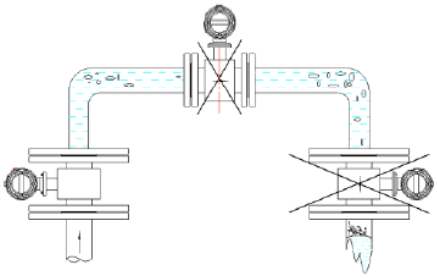
Ensure Straight Pipe Run Requirements are met when Reducing Pipe Diameter

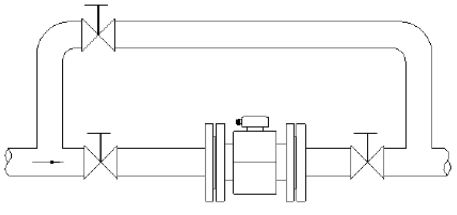
When the pipe diameter is reduced to accommodate a flow meter, it is recommended that straight run pipe length requirements both upstream and downstream are built into the installation. It is further recommended that reducers with a center cone angle no greater than 15° be used to ensure the consistency of the liquid flow profile.



Avoid Areas Where Air Accumulates and Open Pipe Outlets

The meter must remain full of liquid in order to operate correctly. Avoid high points in pipes where air may tend to accumulate and vertical



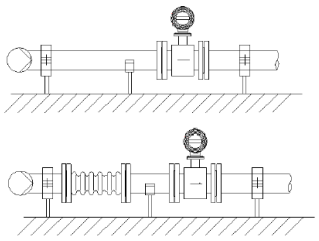


outlet legs.

Bypass Line for Easier Maintenance

It is good practice to install a bypass around a meter to allow maintenance access without the need to shut down the line. Ensure upstream and downstream straight pipe run requirements are met.

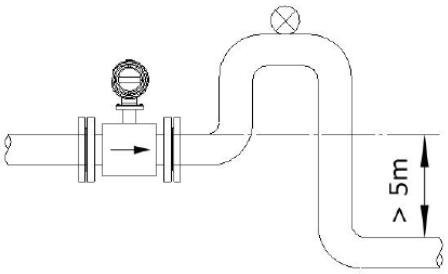
Avoid Strong Vibration



Piping should be securely fixed where there are vibrations present. It is recommended that the transmitter be mounted remotely in these installations. For installations with severe vibration, a flexible coupling is recommended to prevent the transmission of vibration through the pipe to the flow tube. In all cases, the flow meter should be properly supported upstream and downstream to prevent undue stress being placed upon the meter and flanges. NEVER support a meter on it's casing as this can cause internal damage to the meter coils.

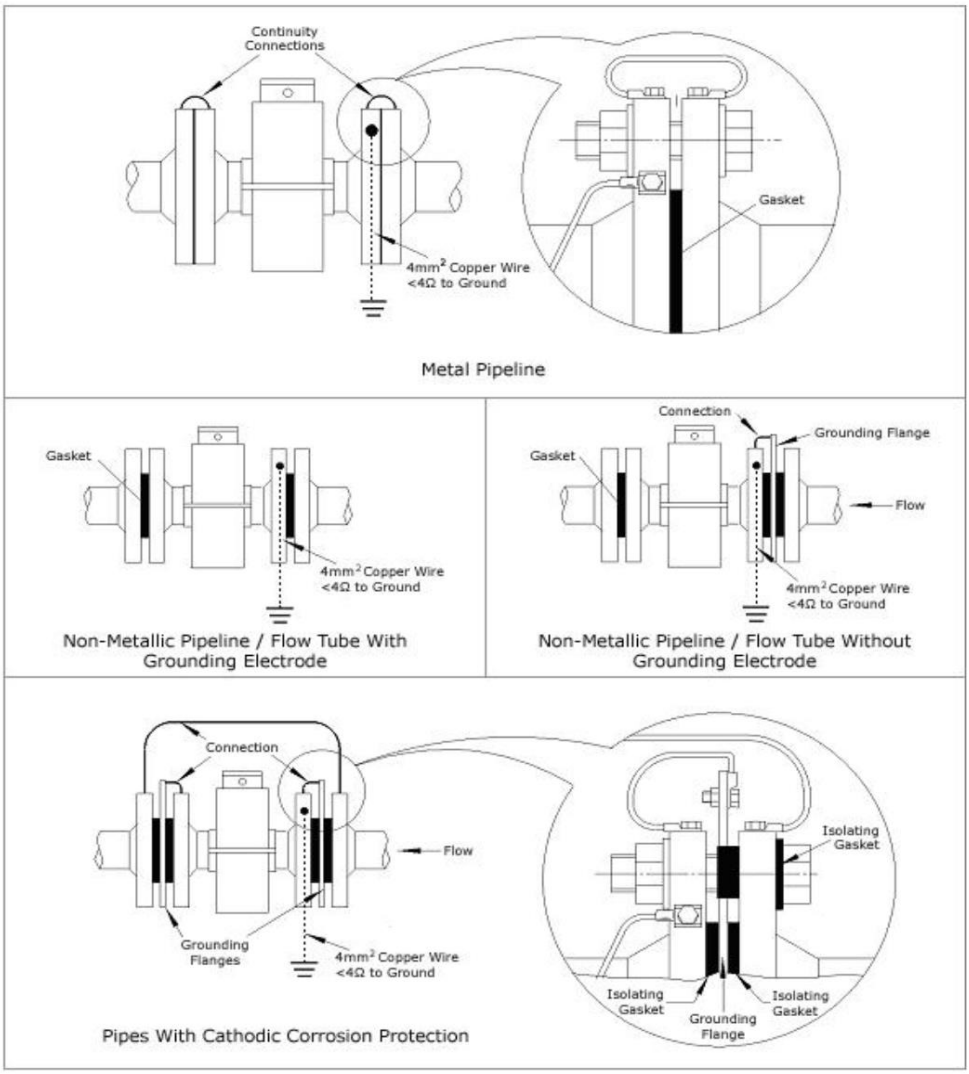
Avoid Negative Pressure Situations

Where the pipe system has a fall of over 5m after a meter installation, it is advisable to install a vent or vacuum breaker above the meter to prevent damage to the meter liner.

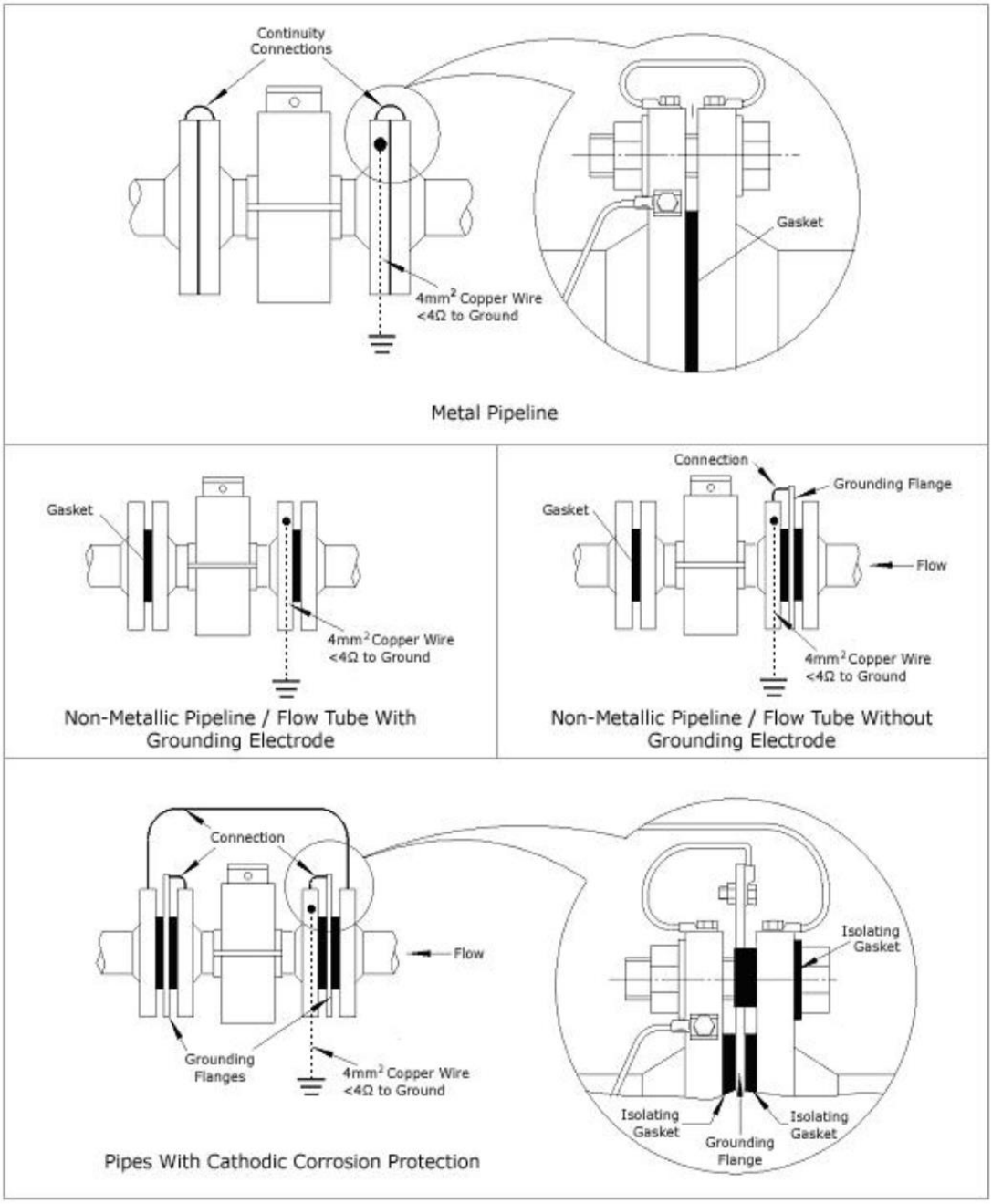


9.2 Flowmeter Grounding

The flowmeter must be properly grounded for reliable operation. The flow meter should be installed and grounded depending upon the pipe type and site conditions.


Continuity Connections
Gasket
4mm² Copper Wire <4Ω to Ground
Metal Pipeline
Gasket
4mm² Copper Wire <4Ω to Ground
Non-Metallic Pipeline / Flow Tube With Grounding Electrode
Connection
Grounding Flange
Gasket
Flow
4mm² Copper Wire <4Ω to Ground
Non-Metallic Pipeline / Flow Tube Without Grounding Electrode
Connection
Flow
Grounding Flanges
4mm² Copper Wire <4Ω to Ground
Isolating Gasket
Isolating Gasket
Grounding Flange
Isolating Gasket
Pipes With Cathodic Corrosion Protection

10 HDMF Transmitters



The instrument has two operation modes: measurement mode and setup mode. When powered up, the instrument automatically enters measurement mode and immediately begins to measure flow rate within the meter flow tube. In setup mode, the instrument configuration menu is accessed and instrument parameters can be adjusted to the users' desired configuration via the three front panel keys. Setup mode access is protected by up to 5 passwords, each intended for use by different classes of users with different access requirements. Return to measurement mode after viewing and/or changing any parameter is simply achieved by pressing a key for 3 seconds.

When in setup mode, if there is no key operation for 3 minutes, the instrument automatically returns to measurement mode.

10.1 Alarm Functions

The HDMF transmitter will indicate and report a variety of alarm conditions and diagnostics:
. Empty pipe alarm
. Excitation coil failure
. High Flow
. Low Flow

Upon empty pipe alarm (empty pipe, partial fill or low conductivity), the analog output and frequency outputs are set to zero signal. The flow meter can additionally be configured to register zero flow through the meter setup menu. Empty pipe alarm is also indicated on the instrument display. Excitation Coil Failure is a built in diagnostic function within the instrument and is indicated on the front panel display.

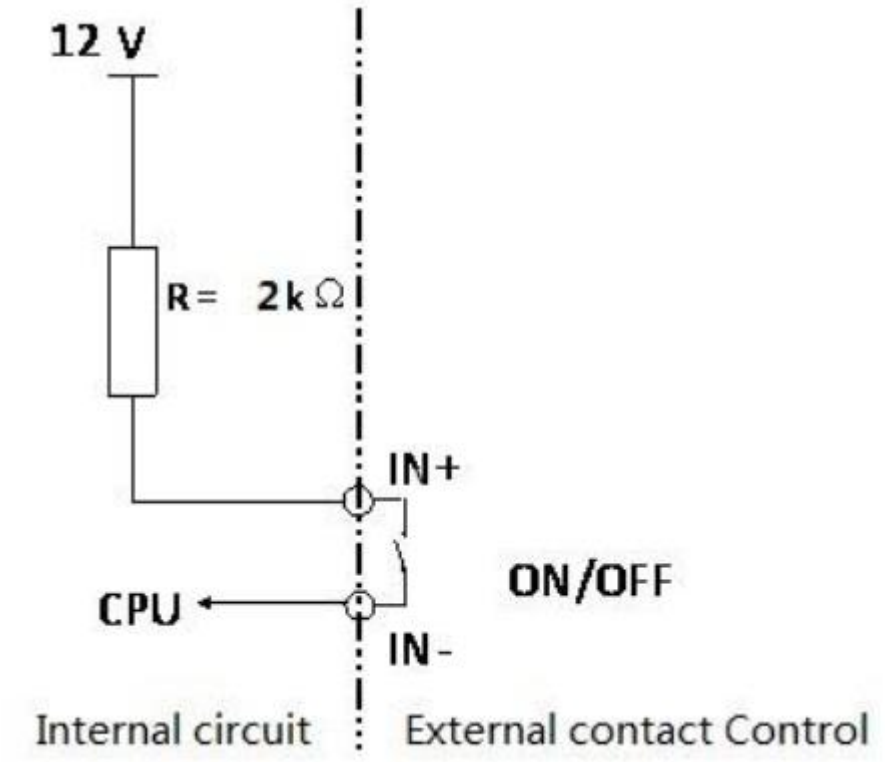
The HDMF has two dedicated flow limit alarm outputs that can be used to signal high or low flow condition. Limit values are set as a percentage of flow range between 0 ... 199.9% of flow range. When the flow percentage is greater than (less than) the actual value, the instrument outputs an alarm signal while simultaneously displaying the alarm condition on the front panel display.

10.2 Pulse/Frequency Output

The HDMF transmitter is equipped with a pulse frequency output that can be used for totalization or as a scaled frequency output of flow rate. The pulse/frequency output can be configured to either operate in reverse flow conditions or to read zero.
Frequency Mode
Output flow range can be set between 0 and 1...5kHz
Pulse Mode
Max output = 5000pulse/sec. The pulse width is programmable between 10 ... 400mS and is a
square wave at high frequency.
Output pulses resolution can be set to:
0.001...1.0 m3/pulse
0.001...1.0 liter/pulse
0.001...1.0 USGal/pulse
0.001...1.0 UKGal/pulse

10.3 Internal Power Supply for Open Collector Outputs

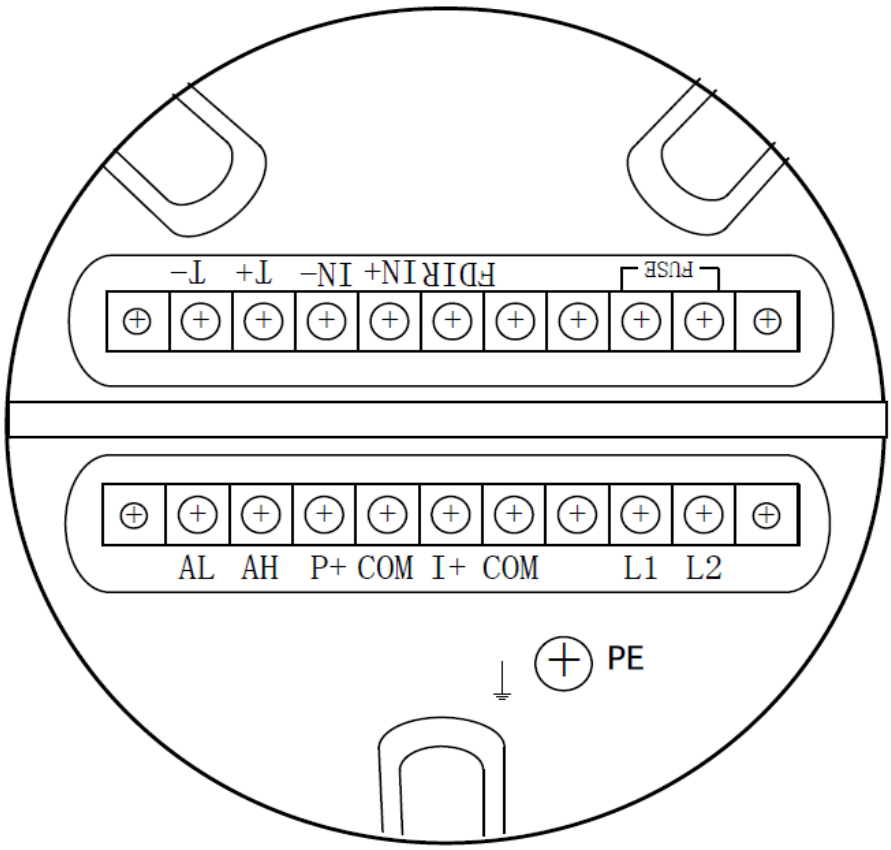
The alarm and pulse/frequency outputs are open collector type and can be powered internally or externally.
The HDMF is equipped with an internal power supply for powering the open collector outputs in the absence of an external source. To use the internal power supply, connect IN+ with the output terminals. Internal power is +12V and pull-up resistance is kΩ.



Caution: When internal power is used, do not connect external power to these outputs when the transmitter is supplying power to them as this may result in damage to the transmitter.

10.4 Connection Terminals

Wiring terminals are accessed through the back of the instrument. To access terminals, power down the instrument, remove back cover and then use a screw driver to connect the wire and terminals. Reassembly is the reverse procedure.



10.4.1 Compact-type Terminal Function Table

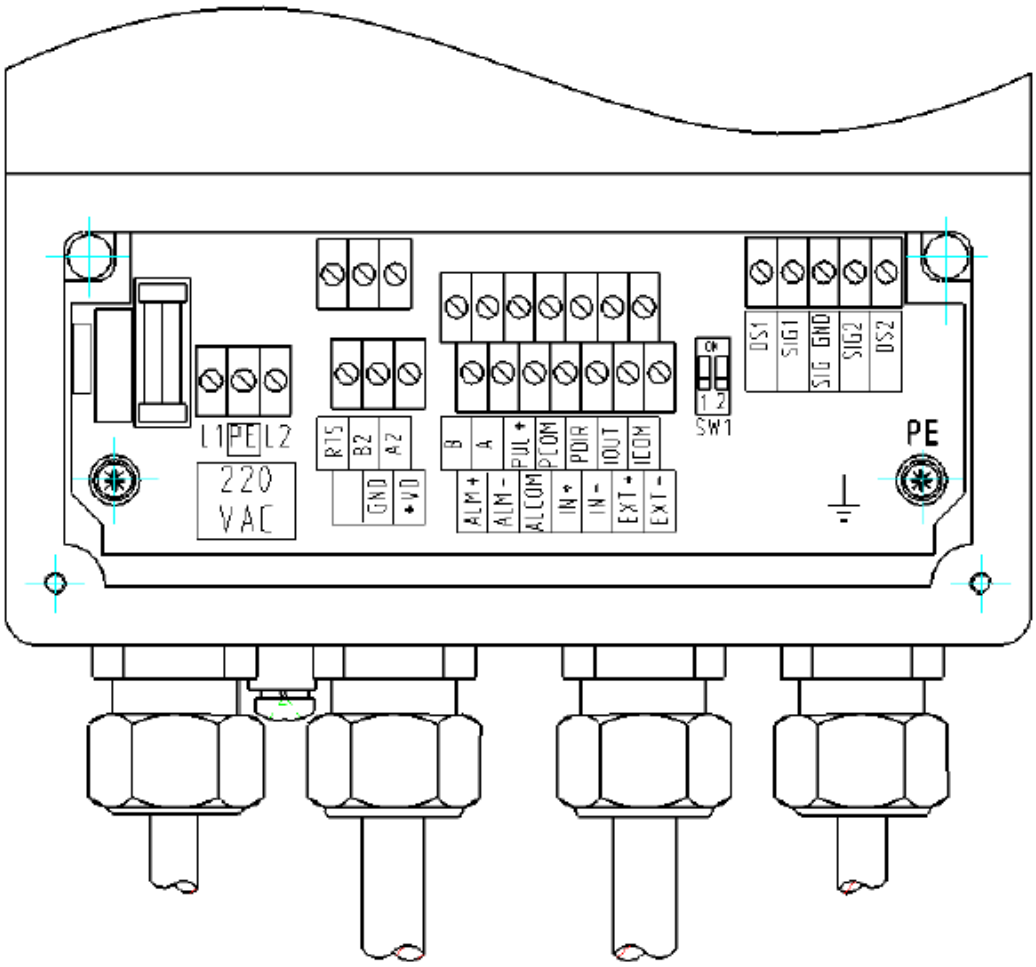
AL	Flow Low Alarm +ve	T+	RS-485 A
AH	Flow High Alarm +ve	T-	
RS-485 B		P+	
Frequency / Pulse Output +ve		IN+	
Input contact +		COM	
Alarm/flow direction/ pulse output -ve		IN-	
Input contact -		I+	
Current output +		FDIR	
Flow direction indicator +ve		COM	
Current output -			
L1 220VAC L(24VDC +)			

L2 220VAC N(24VDC -) PE Power Ground

10.4.2 Remote-type Terminal Function Table

DS1	Shield Drive 1	IOUT	Current output +
SIG1	Signal Input 1	ICOM	Current output -
SIG GND	Signal Ground	PUL+	Frequency/pulse output +
SIG2	Signal Input 2	PCOM	Frequency/pulse output -
DS2	Shield Drive 2	PDIR	Flow direction indicator +
Ext+	Coil Excitation +	A	RS-485 A
EXT-	Coil Excitation -	B	RS-485 B
L1	220VAC L(24VDC +)	ALM-	Flow Low Alarm +ve
L2	220VAC N(24VDC -)	ALM+	Flow High Alarm +ve
A2	Profibus-DP A	ALCOM	Alarm output -ve
B2	Profibus-DP B	IN+	Input contact +
RTS	Profibus-DP RTS	IN-	Input contact -
GND	Profibus-DP GND	+VO	Profibus-DP +5V
PE	Power ground		

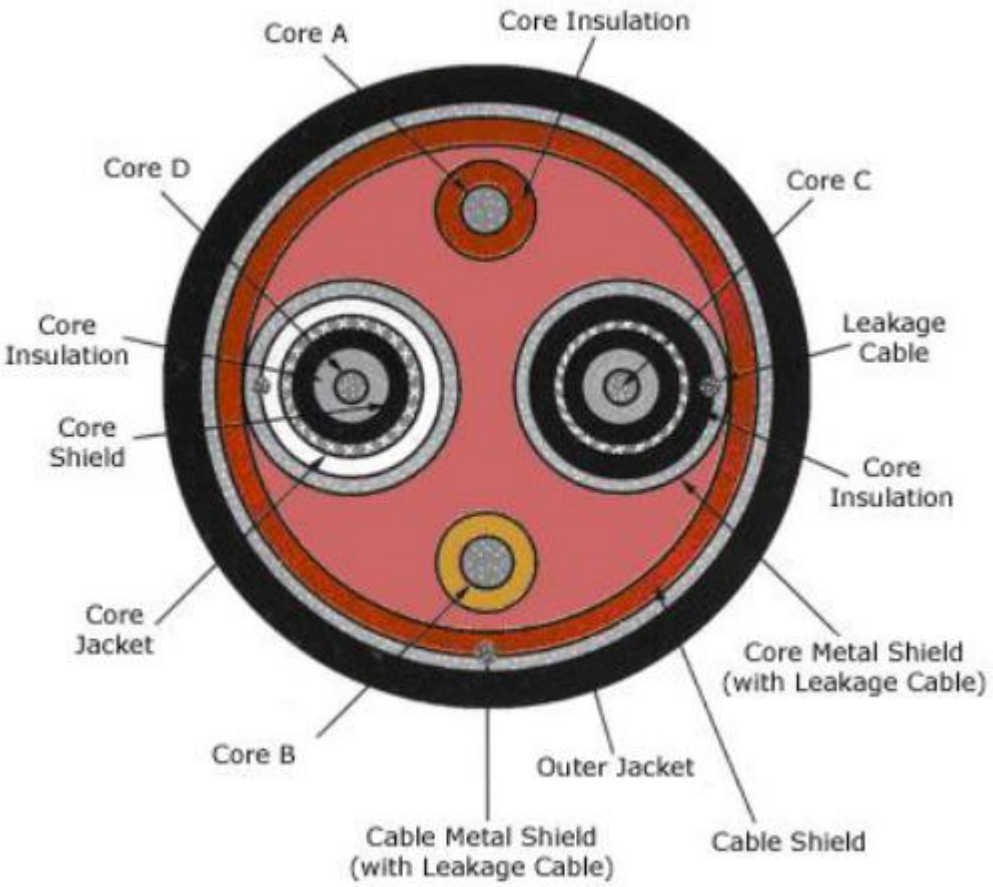
Remark: The dip switch SW1 is set to ON to supply +12V power to pulse output. If external power is used, turn the switch to OFF.



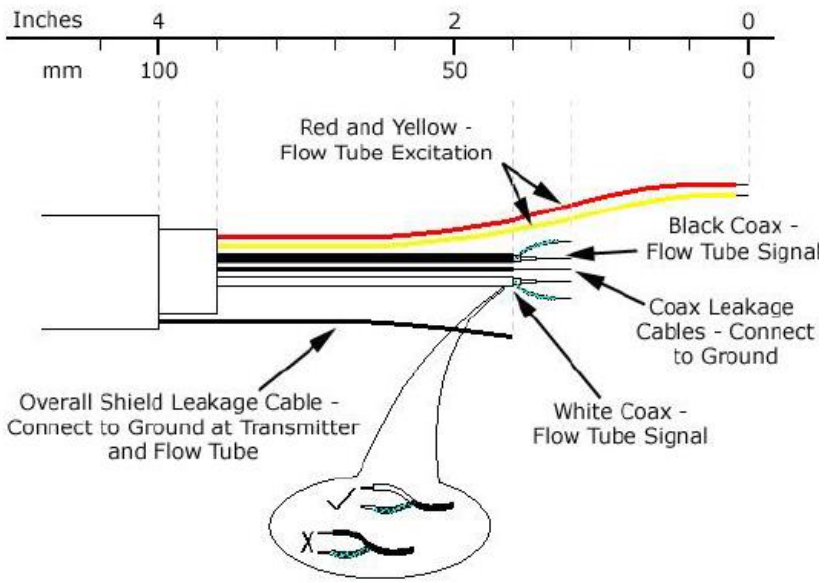
10.5 Connection of Remote Transmitter and Flow Tube

A remote type sensor and transmitter must be connected together using SMFE100 type cable. The cable has 4 separate cores: 2 are coaxial conductors each with two shielded layers and two are standard PVC insulated wire. The cable has an overall shield and PVC covering. The cable must be carefully terminated and connected to ensure meter performance.

Note: there is a dark semi-conducting layer beneath the braided shield of the coax conductors. This must be removed when terminating the cables.

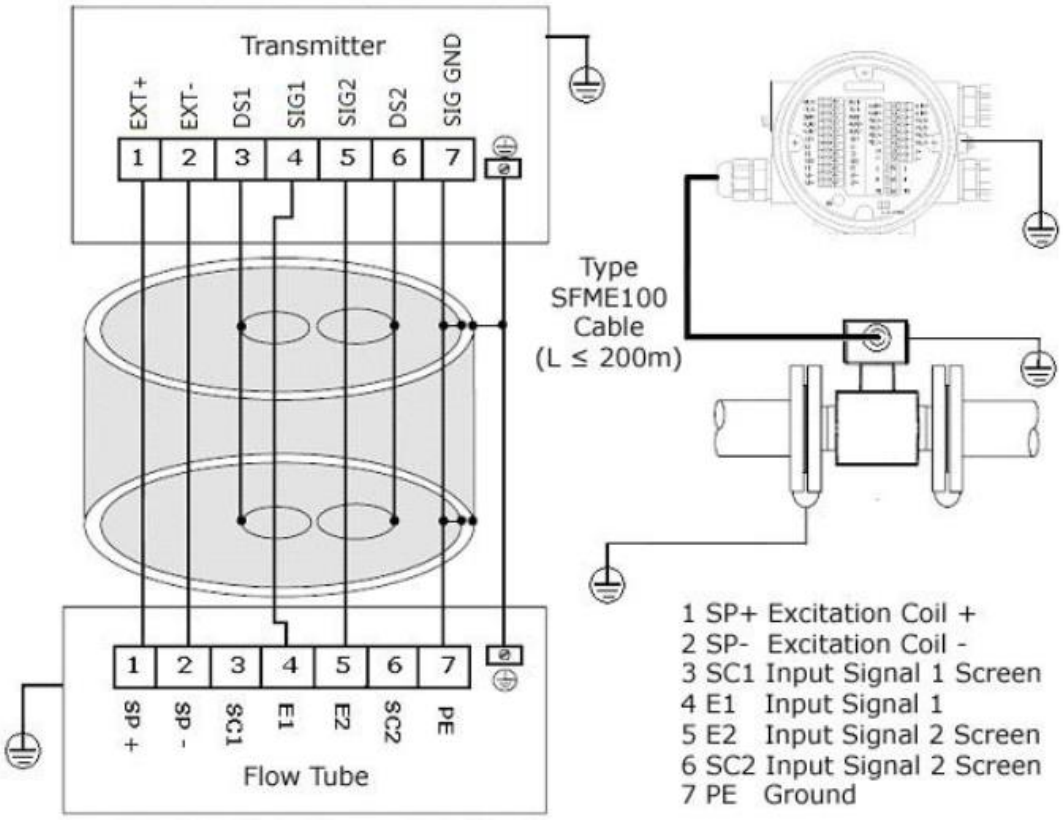


Cable structure



Cable Preparation

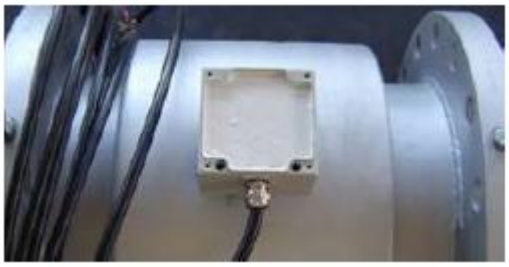
10.6 Transmitter to Flow Tube Connection



Interconnection between the transmitter and flow tube adopts a one-to-one wiring method. The cable is special-purpose type SMFE100 and must not exceed 200m (650ft) in length. Remote transmitter sets are supplied with a 10m (33ft) cable as standard. Longer lengths must be specified at the time of order.

Caution: If the instrument is to be installed in a very wet environment or in a place apt to be flooded, watertight conduit and seals must be fitted to prevent water ingress into the transmitter housing and flow tube termination box.

Remote models can be specified with environmental protection to IP68. In this case, the signal cable will be terminated in the flow tube terminal box at the factory and filled with sealant before shipment.



IP68 Option - Sealed Termination Box

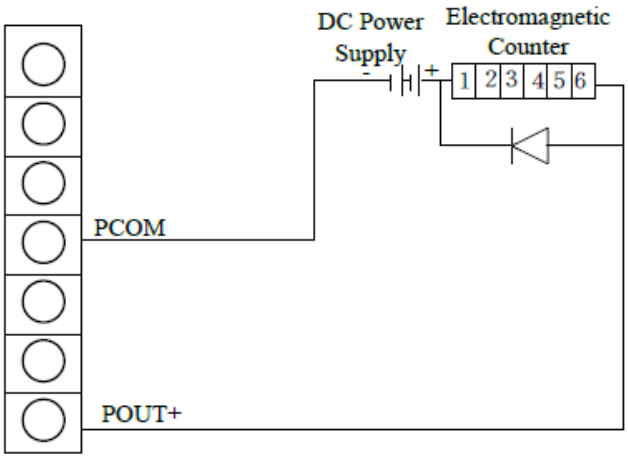
10.7 Output wiring

Output cables and power cables are supplied by the user and should be sized according to load current requirements and local code.

10.7.1 Pulse/Frequency Output Connection Detail

The HDMF transmitter has one port that can be configured for either pulse or frequency output. When configured for frequency operation, the output will give a varying frequency output based upon flow reading. The frequency output is 1 and 5000Hz and can be ranged for any flow range by the user. When configured for pulse operation, the output will give a pulse for a user set volume of flow. Pulse outputs are commonly used for external totalization of flow throughput.
The pulse / frequency output is an Open Collector type and usually powered from an external source. The load connected to the outputs must be calculated to ensure that the maximum current rating is not exceeded. The connected power source must not exceed 36Vdc and the maximum current drain through the open collector output must not exceed 250mA. When supplying external power, jumper S1-1 on the cable termination panel must be removed.

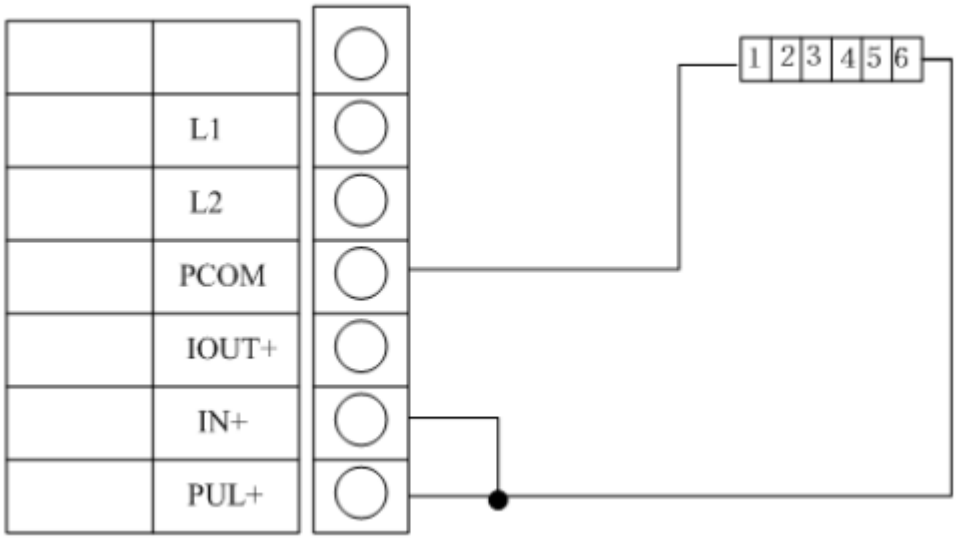
10.7.1.1 Electromagnetic Counter Connection Detail



A typical use of the pulse output is to connect it to an external electromagnetic counter to maintain a remote record of total flow through the meter.

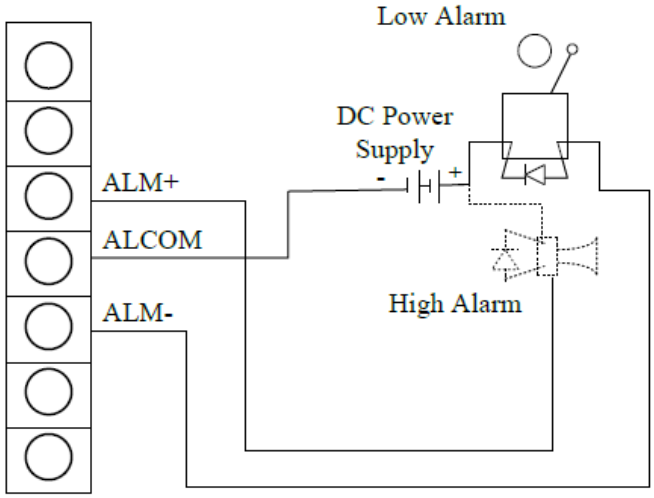
Note: when using an inductive load such as an electromagnetic counter, a diode should be installed as shown in the figure above to protect the output from power surges.

10.7.1.2 Electronic Counter Connection Detail



When connecting to SCADA or PLC systems, the pulse/frequency output should be configured so as not to exceed the maximum input frequency capability of the units input. Most PLC and SCADA system inputs are resistive, so a protection diode is often not required.

10.7.2 Alarm Output Connection Detail



Note: when using an inductive load such as a relay, a diode should be installed as shown in the figures above to protect the output. When supplying external power, the dip switch SW1 should be turned off.

10.8 Analog Outputs

The HDMF transmitter has two analog outputs, one active and one passive. The provision of both an active and a passive output provides the user with total flexibility of connection to external devices and systems. The current outputs can be configured for either 0...10mA or 4...20mA operation. Flow range is

configured to suit the users' requirements through the transmitter setup menu. The relationship between analog current output and flow as follows:

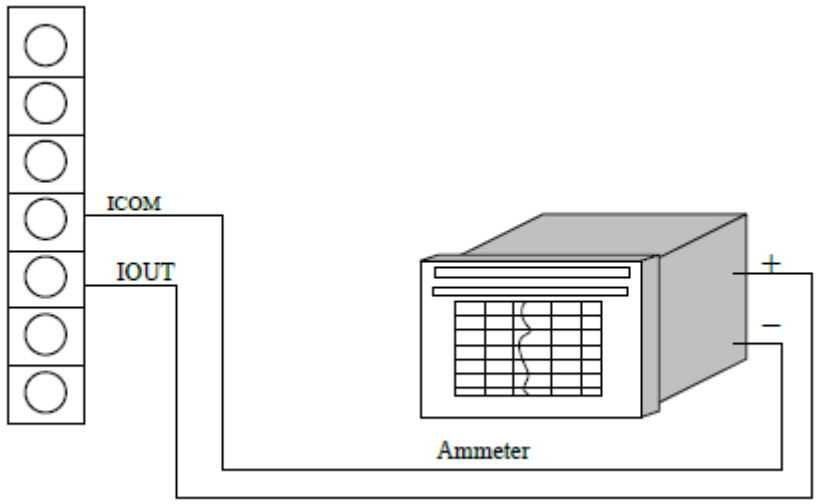
$$Io = \frac{Measurement\ Range}{Full\ Range\ Value} x\ Current\ Range + Zero\ Current$$

For 4...20mA, Zero_Current is 4, Current_Range is 16

For 0...10mA, Zero_Current is 0, Current_Range is 10

For the best analog output resolution, users should choose an appropriate range of the flowmeter output signal.

10.8.1 Active Current Output Connection Detail



The internal analog output supply is 24V. When configured for 4 ... 20mA, the maximum load resistance is 750Ω. Do not connect external power to this output as this may result in damage to the transmitter.

10.8.2 Passive Current Output Connection Detail

Passive analog output MUST be indicated when ordering; otherwise active current output is default. The passive analog output requires the connection of an external 24Vdc power supply in order to operate. It is ideal for connection to SCADA and PLC systems where complete input modules are powered from a common supply.

When passive analog output is applied, IOUT is to be connected to 24V+ while ICOM to 24V ground.

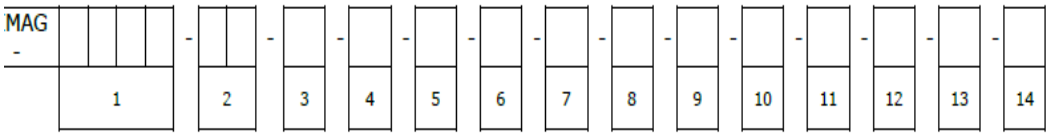
11 Accessories

11.1 VMX Flow Tube Simulator

Before shipping from the factory, the flowmeter has been thoroughly adjusted and tested to ensure it is working correctly. The VMX Simulator can be used to check the operation of the HDMF transmitter and to loop check and fine tune the

analog outputs to connected equipment.

12 Models HDMF Electromagnetic Flow Meter Ordering Code



1 Nominal Diameter(mm)/ [inches] (1)

0015 [½"]	0100 [4"]	0450 [18"]	1400 [56"]
0020 [¾"]	0125 [5"]	0500 [20"]	1600
0025 [1"]	0150 [6"]	0600 [24"]	1800
0032 [1¼]	0200 [8"]	0700 [28"]	2000
0040 [1½]	0250 [10"]	0800 [32"]	2200
0050 [2"]	0300 [12"]	0900 [36"]	2400
0065 [2½]	0350 [14"]	1000 [40"]	2600
0080 [3"]	0400 [16"]	1200 [48"]	3000

2 Flange Rating (1)

02	0.25 MPa	*1600 ... 3000*
06	0.6 MPa	*700 ... 3000*
10	1.0 MPa	*200 ... 1400*
16	1.6 MPa	*15 ... 600*
20	ANSI Class 150	*15 ...1400*
40	4.0 MPa	*15 ... 150*
50	ANSI Class 300	*15 ... 1400*
AA	Special	

3 Electrode Material

1	316L Stainless Steel
3	Hastelloy C-22
4	Hastelloy B-10
5	Titanium
6	Tantalum
7	Platinum / Iridium Alloy
8	Tungsten Coated Stainless Steel

4 Lining Material

1	Neoprene	*≤ 3000*
2	PTFE	*≤ 1000*
3	Polyurethane	*≤ 300*
4	PFA	*≤ 250*
5	FEP(F46)	*≤ 250*
6	PFA with Wire Net	*80 ... 250*
7	Tefzel with Wire Net	*80 ... 250*

5 Grounding and Lining Protection

0	Flange ground	*15 ... 3000*
1	Earth ring	*15 ... 250*
2	Ground electrode	*50 ... 3000*
3	Inlet protection ring	*50 ... 3000*

6 Max. Process Temperature

A	80°C	*All Linings*
B	120°C	*Neoprene / PTFE / PFA / Tefzel*
C	180°C	*PTFE only*

7 Environmental Protection Class

1	IP65
2	IP67 (Compact Type Only)
3	IP68 (Remote Type Only)

8 Explosion Proofing

1	None
2	Ex DE IIC T6

9 Configuration – sensor/transmitter

1	Compact (15 ... 1000)
2	Remote (with 10m cable)(2)

10 Power Supply

A	AC: 85 ... 265 VAC / 45 ... 63Hz
D	DC: 18 ... 36 VDC

11 Display and Programming

2	2 line LCD display + keypad programming
3	3 line LCD display + keypad programming

12 Output and Input

0	Basic Configuration (current, pulse and contact outputs)
2	Basic Configuration + RS485
3	Basic Configuration + HART

13 Calibration Specification

1	3 point, 0.5% accuracy
2	3 point, 0.2% accuracy
3	Special

14 Flow Tube Configuration

1	Flange Type	*15 ... 3000*
2	Flange type with removable electrodes	*15 ... 3000*
3	Wafer Type	*15 ... 100*

(1) Line size selection will be inches for ANSI Class 150/300 rating selection, DIN size for all other ratings

(2) Order longer cable length separately

13. Electromagnetic Flowmeter Application Worksheet

Customer Name		
Contact		
Tel/Fax/Email		
Project Name		
Tag.No		
	Process Parameters	
Pipe Spec / Material		
Process Connection		
Fluid Type		
Max Flow		
Nor. Flow		
Min. Flow		
Fluid Temperature		
Operating Pressure		
Measuring range		
Power Supply	85 --- 265 VAC or 16 --- 36 VDC	
Accuracy % required	(±0.5 or ±0.2)	
	Manufacturers Configuration Sheet	
Nominal Diameter mm		
Nominal pressure MPa		
Electrode Material		
Lining Material		
Grounding/ Protection		
Temperature Rating		
IP Protection Class		
EX Certification		
Configuration	Compact or Remote	
Power Supply	85 --- 265 VAC or 16 --- 36 VDC	
Programming Display		
Input/output signal		
Inspection		
Connection type		
Electric connection		
Special signal cable		
Mating Flange Set		
Accessory 1		
Accessory 2		
Model Number	AIMAG-	
Remark		