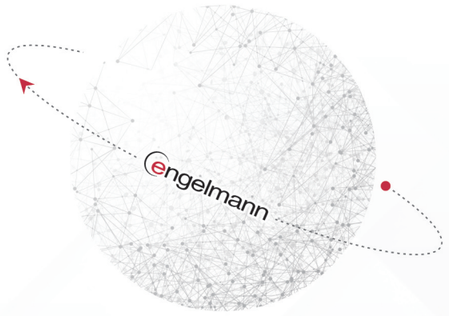

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engelmann

PRODUCT MANUAL

SMARTEST METERING TECHNOLOGY

VORTEX FLOWMETER

Since 1976

UNSERE DEVISE

IMMER NAH AM KUNDEN – ZUVERLÄSSIG UND SERVICESTARK

COMPANY PROFILE

Engelmann Sensor GmbH, founded in 1976 and headquartered in Westloch, Germany, is a well-known manufacturer of energy and flow instruments worldwide and a leader in the field of measurement. Since its establishment, Enleman has always been committed to the research and production of measuring instruments. In order to meet the needs of customers and the market, the company invests 5% of its annual revenue in the research and development and improvement of products. Enleman has over 40 years of experience in measuring instruments, and is renowned for designing and producing high-precision and highly reliable measuring instruments with high-quality standards. Having an absolute market share in Europe, it is a leading company in the field of measurement instruments in the European region, with energy instruments accounting for 25% of the market share.

In 2005, Enleman entered China and began serving the Chinese market. With the growth of user demand, in order to provide more professional services, Germany's Enlehmann Sensor Co., Ltd. established its first wholly-owned subsidiary in Beijing in 2006, tailoring solutions based on different customer measurement needs, providing customers with various product related services and technical support. After years of effort, our products cover China and assist the government and users in continuously optimizing energy consumption.

In order to promote the process of product localization, Germany's ENLEMAN Sensors Co., Ltd. established an advanced instrument manufacturing factory - ENLEMAN Instruments (Xuzhou) Co., Ltd. in early 2013, with independent production and testing capabilities for a full range of measuring products. It is a production and sales center in China. Enleman is serving new and old customers with a brand new look, providing high-quality products and solutions, and contributing to China's metrology, energy conservation and environmental protection industry.

UNSERE DEVISE

IMMER NAH AM KUNDEN – ZUVERLÄSSIG UND SERVICESTARK

CONTENTS

CONTENTS

SensoStar®

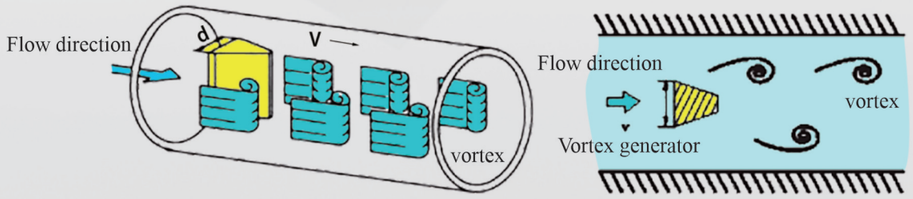
EM9600 | VORTEX FLOWMETER

M SERIES

V SERIES

VORTEX FLOW METER INTRODUCTION

Vortex flowmeter is composed of vortex generator, detection probe and corresponding electronic circuit. When the fluid flows through the vortex generator, two alternating rows of vortices are formed on its two sides, which are called Karman vortices.



$$f = S \times V/d$$

f: Vortex street occurrence frequency (Hz)
S: Average flow velocity on both sides of the vortex generator (m/s)
V:Strouhal coefficient in some certain Reynolds number range, the figure is constant) (t)
d: Width of upstream surface of vortex generator (m)

Vortex flow meters are widely used in the measurement and control of superheated steam, saturated steam, compressed air and generalgases (oxygen,nitrogen, hydrogen, natural gas, gas, etc.), water and liquids (such as water, gasoline, alcohol, benzene, etc.) in factories and mining enterprises such as heat supply, gas supply, chemical industry, environmental protection, metallurgy, textile, steel, medicine, paper making, and drainage.

SensoStar®

EM9600 VORTEX FLOWMETER

PROFESSIONAL

CONVENIENT

EFFICIENT

ADVANTAGES & CHARACTERISTICS

Provide integrated design of temperature, pressure, and flow to achieve onlinetemperature and pressure compensation.

The main body has no movable components, high reliability, long-term stability and structure simple , easy to maintain.

Flexible installation method, depending on the different process pipelines on site,can be nstalled horizontally, vertically, or tilted at different angles.

Multiple Protected mode are adopted for the circuit to resist surge and Good adaptability.

The probe adopts a piezoelectric chip vortex sensor, and the signal stable; The gauge outfit is made of stainless steel material,Strong corrosion resistance and intergranular corrosion resistance.

Brightly LCD display, Chinese menu is available and easy to operate.

The EM9600V series vortex flowmeter can measure temperatures up to 400 °C, and unique design To resist the vibration.

The output pulse frequency is linear with the actual flow rate of the measured fluid, Without drift at zero point, the performance is stable.

Use Password to limit the parameter setting.authority to avoid the misoperation.

EEPROM to protect the accumulation flow from power off, the data can be saved for 10 years.

DC24V, 3.6V battery ,the entire machine can be used for more than a year once the power unprovided.

ADVANTAGES AND FEATURE

Nominal diameter	DN15-DN400		
Medium	Gas, liquid, vapor		
Temperature	Normal type：-40～250°C	High type：-40～400°C	Special option：⩽-40°C,
Caliber and maximum pressure	⩽25MPa(DN15-DN100)	⩽10MPa (DN100-DN400)	
Material	Body: 304 stainless steel; Optional 316	Meter head: die-cast aluminum	
Ingress protection grade	IP65; Optional IP68		
Power supply	DC24V; Optional battery powered		
Measurement Range ratio	1：10-30		
Installation condition	Relative temperature：-20～55°C	Relative humidity：5～90%RH	Atmospheric pressure：86～106kPa
measurement accuracy	M-series: Conventional liquid measurement accuracy is ± 1.0%, The measurement accuracy of gas is ± 1.5%	V series: Conventional liquid measurement accuracy is ± 1.0% The measurement accuracy of gas is ± 1.0%	
Communication mode	Pulse 4-20mA analog signal, RS485 communication (Modbus RTU protocol), Hart protocol, etc		
electrical interface	ISO M20 × 1.5 internal thread	ANSI 1/2NPT internal thread	JIS G1/2 internal thread, etc

	M series	V series
Reference image		
Caliber	DN15-DN400	DN15-DN400
Pipeline	Clamping or flange	Clamping or flange
Medium	Liquid, gas, vapor	Liquid, gas, vapor
Accuracy	Liquid: 1.0%; Gas, steam: 1.5%	Liquid: 1.0%; Gas, steam: 1.5%
Temperature and pressure compensation	Optional temperature and pressure compensation	Optional temperature and pressure compensation
Temperature	-40~330℃	40~400℃(≤-40℃, customization required)
Range ratio	1:10	1:20~30
Communication mode method	waste, 4-20mA, RS485, HART, GPRS	waste, 4-20mA, RS485, HART, GPRS
Power supply	24V or power supply	24V or power supply
Pressure rating	1.6/2.5/4.0/6.3/10.0/16.0/25.0 MPa	1.6/2.5/4.0/6.3/10.0/16.0/25.0 MPa
Flow rate range	Gas and steam operating conditions flow rate ⩽ 70m/s Liquid working condition flow rate ⩽ 10m/s	Gas and steam operating conditions flow rate ⩽ 120m/s Liquid working condition flow rate ⩽ 12m/s
Generative body	Monosome	Diplomer
Display	Instantaneous flow, cumulative flow; Alarm signal	Instantaneous flow, cumulative flow; Alarm signal
Ingress protection grade	IP65 OR IP68	IP65 OR IP68

ADVANTAGE COMPARISON

Converter design

The V series converter is designed in an L-shape with wiring located on the right side, which is more user-friendly compared to traditional barreled watch cases ,and facilitates simultaneous wiring and parameter adjustment.

Anti-interference

The V series has 5 sets of for Set Individual filters Based on different flow Wave scheme to keep the flow within the entire range Maintain accuracy and precision, with MSP filtering technology, from the source of flow waveform Identify traffic and have stronger anti-interference ability。

Probe design

The V series probe adopts a unique probe design and is specially reinforced at the root to provide better strength On order to adapt various media and complex flow fields.

Vibration resistance

The Vibration resistance erformance reaches up to 1G, suitable for harsh onsite condition.

Shield Rod Design

The V series shielding rod is a cast square structure, fastened with four positioning screws at the top and bottom, and can be equipped with a water tank and sealing groove. Compared with traditional simple turning circular design, it is more secure and reliable, with good sealing performance.

TECHNICAL SPECIFICATION

CONVERSION FORMULA OF WORKING CONDITION AND STANDARD CONDITION:

$$Q_{\text{Working volume}} = Q_{\text{Standard volume}} \times \frac{0.101325}{P_{\text{gauge pressure}} + 0.101325} \times \frac{273.15 + T_{\text{Temperature}}}{293.15}$$

REFERENCE CONDITIONS:

Gas: Normal temperature and pressure air, t=20 °C, P=101.325kPa (absolute pressure), p=1.205kg/m ^{3} ;
Liquid: room temperature water, t=20 °C, p=998.2kg/m ^{3}。

REFERENCE RANGE OF FLOW UNDER WORKING CONDITIONS:

Nominal diameter (mm)	liquid		gas	
	measuring range(m³/h)	Output frequency range(Hz)	measuring range (m³/h)	Output frequency range(Hz)
15(0.5inch)	0.5-5	35-600	3-16	300-1600
20(0.8inch)	0.6-10	29-420	7-45	280-1860
25(1inch)	1.2-16	25-336	8-100	150-2000
32(1.25inch)	1.8-20	18-264	9-155	85-1500
40(1.5inch)	2-40	10-200	10-250	50-1300
50(2inch)	3-60	8-160	15-370	40-950
65(2.5inch)	4-85	6-120	28-750	33-900
80(3inch)	6.5-130	4.1-82	40-1200	25-755
100(4inch)	15-220	4.7-69	55-2500	18-795
125(5inch)	20-350	3.2-57	100-3200	18-550
150(6inch)	30-450	2.8-43	150-4000	15-350
200(8inch)	45-800	2-31	350-8000	14-320
250(10inch)	65-1250	1.5-25	550-11000	12-230
300(12inch)	95-2000	1.2-24	1100-18000	13-215
350(14inch)	130-2800	1.0-22	2000-20000	14-150
400(16inch)	180-3000	1.0-21	3000-25000	15-105

Remarks:

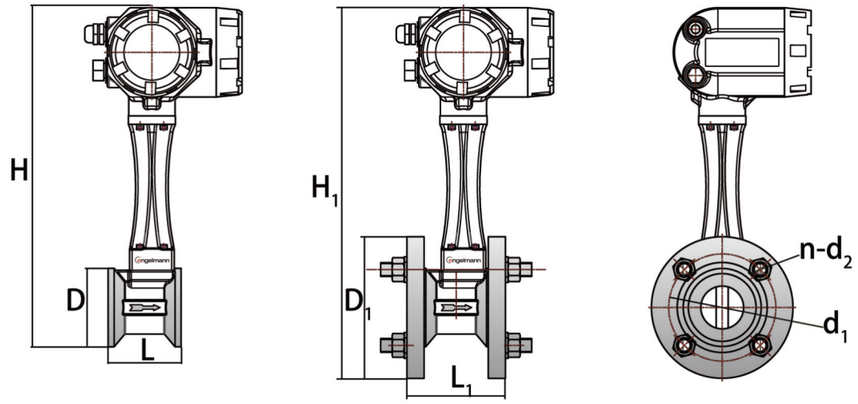
1. The operating flow is the medium volume measured by meter when the medium pass through the pipeline. The medium can be compressed, when the pipeline is with pressure , the compressed gas volume is the operating flow rate. The operating flow rate will be changed when working condition changed.

2. The medium can be compressed, when the pipeline is with pressure , the compressed gas volume is the operating flow rate. The operating flow rate will be changed when working condition changed.

3. The vortex flow meter measures the operating volume, the standard volume can be obtained after temperature and pressure compensation added. Generally, it is used for commercial counting. The volume shall be used for the gas and the mass shall be used l for the steam.

PRODUCT SIZE AND PROFILE OVERALL DIMENSIONS (STANDARD TYPE)

SCHEMATIC DIAGRAM OF FLANGE CLAMPING



FLANGE CLAMPING GENERAL ON SITE DISPLAY OVERALL DIMENSIONS

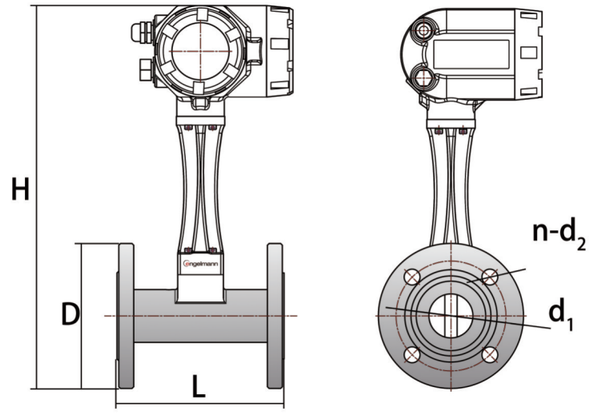
Nominal diameter	pressure rating	ordinary	ordinary	D	D1	H	H_1	d_1	d_2	n
mm	MPa	L(mm)	L(mm)	mm	mm	mm	mm	mm	mm	Number of holes
DN15	4	70	95	55	100	366	393	78	14	3
DN20		70	95	55	100	366	393	78	14	3
DN25		70	95	55	100	366	393	78	14	3
DN32		70	95	55	100	366	393	78	14	3
DN40		85	113	80	140	378	405	185	18	4
DN50		85	113	90	145	387	418	115	18	4
DN65	1.6	85	113	105	165	402	438	130	18	4
DN80		85	113	120	180	417	453	145	18	6
DN100		85	113	140	210	437	478	175	18	6
DN125		85	119	165	235	462	503	200	18	8
DN150		100	132	194	270	489	533	230	22	8

Remarks:

① The above dimensions are for clamping without temperature and pressure compensation, with an error of ± 2mm. The temperature and pressure compensation size DN15-DN32 has an increase of 15mm in length L/L1;

② Increase the height by 60mm (two heat sinks) at high temperatures (≥ 250 °C).

SCHEMATIC DIAGRAM OF FLANGE CONNECTION



Nominal diamete	pressurerating	L	D	H	d_1	d_2	n
mm	MPa	mm	mm	mm	mm	mm	Number of holes
DN15	4	170	95	397	65	14	4
DN20		170	105	402	75	14	4
DN25		170	115	407	85	14	4
DN32		170	140	420	100	18	4
DN40		170	150	425	110	18	4
DN50		170	165	432	125	18	4
DN65	1.6	190	185	455	145	18	8
DN80		190	200	470	160	18	8
DN100		200	220	490	180	18	8
DN125		200	250	520	210	18	8
DN150		200	285	550	240	22	8
DN200		200	340	605	295	22	12
DN250		240	405	665	355	26	12
DN300		240	460	715	410	26	12
DN350		320	520	715	470	26	16
DN400		320	580	830	525	30	16

Note:

Increase the height by 60mm (two heat sinks) at high temperatures (≥ 250 °C).

INSTRUMENT INSTALLATION REOUIREMENTS

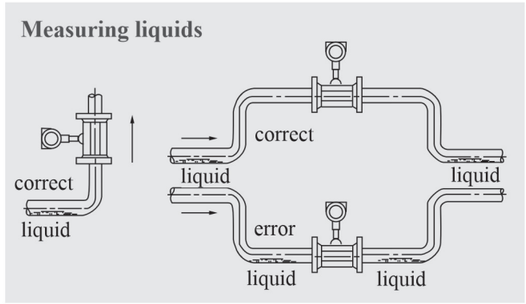
ENVIRONMENTAL REQUIREMENTS

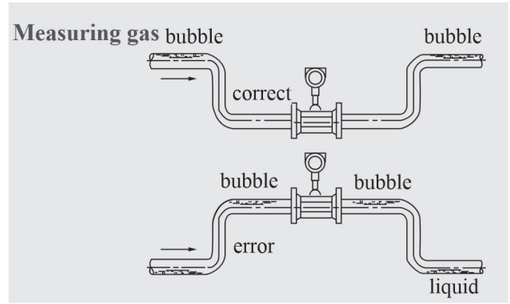
- The flow meter should be installed indoors, and if installed outdoors, there should be covered (the shielding wire should be made into a U-shaped ,and the cable should be installed from bottom to top ,in order to avoid rainwater entering the case inside of along the way)
- There should be no strong external magnetic field interference, strong electrical equipment or high-frequency equipment around the flow meter, and avoid sharing power with these equipment
- Do not share power with equipment that such as frequency converters and welding machines If necessary, install a purified device
- Avoid high temperature, cold, corrosive or extremely humid environments
- Flowmeters should be avoided pipelines strong vibrations
- In order to easy installation and maintenance afterward, the enough space around the meter is neccensary
- In case the gas with some liquid, the flow meter amounted in vertical pipeline, the gas flow direction should be from bottom to top in order to avoid the liquid into the meter's measuring tube

PIPELINE REQUIREMENTS

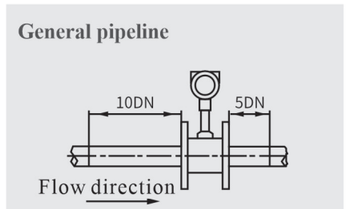
DN:Nominal diameter Unit:mm

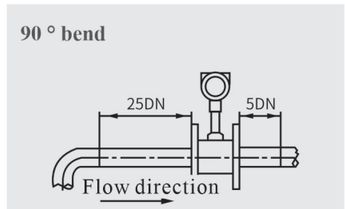
Installation position:

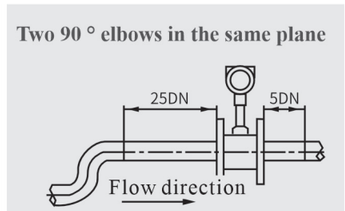


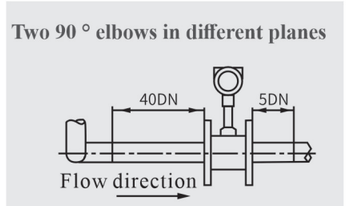


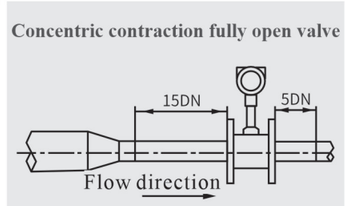
Requirements for upstream and downstream straight pipe sections:

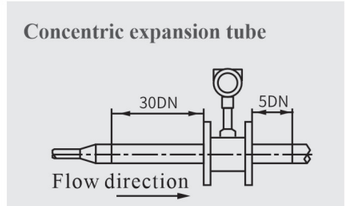


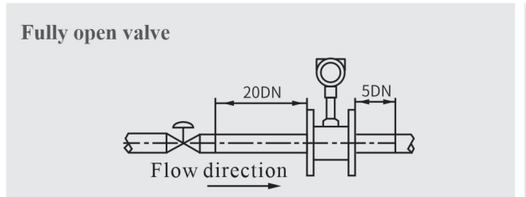


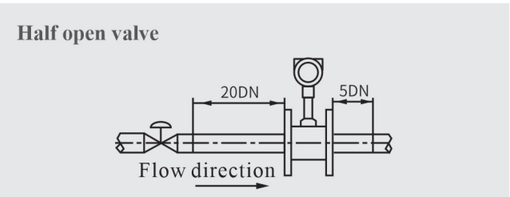












Note:
Vortex flowmeter has certain requirements for the upstream and downstream straight pipe sections of the installation point, otherwise it will affect the flow field of the medium in the pipeline and affect the measurement accuracy of the instrument.

MODEL SELECTION COMPARISON TABLE

Integrated / combined

EM9600 SERIES VORTEX FLOWMETER

STRUCTURAL STYLE

Suffix Code	Description	Notes
N	Integrated	
C	Combined	

NOMINAL DIAMETER

Suffix Code	Description	Notes
-15	DN15	0.5inch
-20	DN20	0.8inch
-25	DN25	1 inch
-32	DN32	1.25inch
-40	DN40	1.5inch
-50	DN50	2inch
-65	DN65	2.5inch
-80	DN80	3inch
-100	DN100	4inch
-125	DN125	5inch
-150	DN150	6inch
-200	DN200	8inch
-250	DN250	10inch
-300	DN300	12inch
-350	DN350	14inch
-400	DN400	16inch

CONNECTION MODE

Suffix Code	Description	Notes
A1W	ANSI 150 Clamping type	DN15-DN150
A3W	ANSI 300 Clamping type	DN15-DN150
G1W	GB 1.6MPa Clamping type	DN15-DN150
G2W	GB4.0MPa Clamping type	DN15-DN150
A1S	ANSI 150 Flange connection	DN15-DN400
A2S	ANSI 300 Flange connection	DN15-DN400
A3S	ANSI 600 Flange connection	DN15-DN400
A4S	ANSI 900 Flange connection	DN15-DN400
G1S	GB 1.6MPa Flange connection	DN3-DN400
G2S	GB 2.5MPa Flange connection	DN3-DN400
G3S	GB 4.0MPa Flange connection	DN3-DN400
G4S	GB 6.3MPa Flange connection	DN3-DN400
G5S	GB 10.0MPa Flange connection	DN3-DN400
H1S	Sanitary interface clamp type connection	DN15-DN200

ELECTRICAL INTERFACE

Suffix Code	Description
-1	ASME 1/2 NPT internal thread
-2	ISO M20x1.5 internal thread

SERIES

Suffix Code	Description
M	M-series vortex flowmeter
V	V-series vortex flowmeter

POWER SUPPLY MODE

Suffix Code	Description
1	24V
2	Battery

COMMUNICATION MODE

Suffix Code	Description	Notes
A	4-20mA、Pulse	
B	4-20mA、Pulse、HART	
C	4-20mA、Pulse、MODBUS	
D	4-20mA、Pulse、PROFIBUS	

OPTIONAL SPECIFICATIONS

Suffix Code	Description	Notes
/NF1	China (NEPSI) Flameproof	Explosion-proof
/T	Equipped with temperature compensation	Temperature compensation
/P	Equipped with pressure compensation	Pressure Compensation
/HT	The normal measurable temperature is 250 °C, and the high-temperature style can reach 400 °C	High temperature style
/D	The normal warranty is one year, and the manufacturer's two-year warranty option is available	Two year warranty
/T	The normal warranty is one year, and the manufacturer's three-year warranty option is available	Three year warranty
/S	Outdoor installation, providing lightning arrester	Lightning-protection
/B	The standard instrument box is made of stainless-steel material with visible glass windows	Instrument box
/NO	Oil prohibition treatment	

DISPLAY MODE

Suffix Code	Description	Notes
C/E	Chinese and English operation interface	
O	Independent isplay	Please select the split display method in the split converter selection table

CABLE LENGTH

Product Name	Suffix Code	Description	Notes
		Cable length	
Cable length	-5		
	-10		
	-15		
	-20		
	-25		
	-30		
	-40		
	-50		
	-60		
	-70		
	-80		
	-90		
	-100		

WHY CHOOSE US?

01 Founded in 1976, ENGELMANN has been committed to the measurement industry and is a world-renowned manufacturer.

02 EM9600V vortex flowmeter has the technical advantage of leading peers. The structure of double vortex generator and unique sensor design have better seismic and high temperature resistance performance.

03 A professional measurement technology team can customize measurement solutions for customers and solve various steam measurement problems.

APPENDIX

SATURATED STEAM DENSITY TABLE

Absolute pressure MPa	Saturated steam temperature °C	Saturated vapor density kg/m³	Absolute pressure MPa	Saturated steam temperature °C	Saturated vapor density kg/m³
0.1	99.7	0.5883	1.4	195	7.1038
0.2	120.1	1.1288	1.5	198.3	7.5928
0.3	133.4	1.6507	1.6	201.4	8.082
0.4	143.5	2.1628	1.7	204.3	8.5718
0.5	151.8	2.6683	1.8	207.1	9.0616
0.6	158.8	3.1692	1.9	209.8	9.552
0.7	164.9	3.6665	2	212.4	10.043
0.8	170.4	4.1616	2.1	214.8	10.535
0.9	174.3	4.6544	2.2	217.2	11.028
1	179.9	5.1451	2.3	219.5	11.521
1.1	184.1	5.6367	2.4	221.8	12.016
1.2	187.9	6.125	2.5	223.9	12.511
1.3	191.6	6.6143			

PARAMETER TABLE OF VORTEX FLOWMETER SELECTION

Ordering unit					
Installation position number					
Pipeline requirements	Pipeline outer diameter:			Pipe inner diameter:	
Media Properties	Media Name:			Medium density:	
	Media status:	liquid ○ gas ○		Saturated steam ○ superheated steam ○	
Process parameters	Parameter requirements	Flow range	Fluid Pressure	Fluid temperature	Notes
	Maximum value				
	Common values				
	minimum value				
Installation environment	High temperature environment ○	Explosive environment ○	Wet environment ○	Water immersion environment ○	
Compensation method	No compensation Integrated ○ temperature and pressure compensation ○ Separate temperature and pressure compensation ○				
Structural type	Clamping type ○ Flange type ○ combined ○ Cable length:				
Power supply mode	Battery ○ DC24V ○				
Flowmeter model					