

People for Process Automation

CSN11439

# Flow Calibration with Adjustment

30226021-2725740

3003250812

Purchase order number

CA-3004788346-20 / Endress+Hauser Flowtec

Order N°/Manufacturer

72F25-SM0AA8PAB4AA

Order code

PROWIRL 72 F 1"

Transmitter/Sensor

F2069F16000

Serial N°

FQIT-100

Tag Nº

FCP-6.F

Calibration rig

66.15811 us.gal/min

 $( \triangleq 100\%)$ 

Calibrated full scale

Service interface

Calibrated output

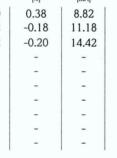
79.467 Imp./dm<sup>3</sup>

Calibration factor

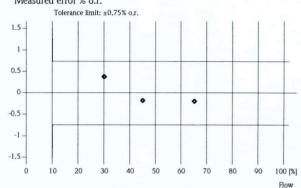
79.7 °F

Water temperature

Flow [%]	Flow [us.gal/min]	Duration [s]	V target [us.gal]	V meas. [us.gal]	∆ o.r.* [%]	Outp.**
30.0	19.8	30.2	9.9820	10.020	0.38	8.82
45.0	29.8	30.2	14.969	14.942	-0.18	11.18
65.3	43.2	30.2	21.726	21.682	-0.20	14.42
-	-	-	-	-	-	
- "	1-	-	-	-	-	-
-	-	-		-	-	-
-	-	-	-	-	-	-
-	-	-	-	-	-	-
-	-	-	-	-	-	-
-	-	-	-	-	-	



Measured error % o.r.



\*o.r.: of rate

For detailed data concerning output specifications of the unit under test, see Technical Information (TI), chapter Performance characteristics.

The calibration is traceable to the N.I.S.T. through standards certified at preset intervals.

Endress+Hauser Flowtec operates ISO/IEC 17025 accredited calibration facilities in Reinach (CH), Cernay (FR), Greenwood (USA), Aurangabad (IN) and Suzhou (CN).

02-23-2012

Date of calibration

Endress+Hauser Flowtec, Division USA 2330 Endress Place Greenwood, IN 46143

S. Newcomer

Operator

Certified acc. to ISO 9001, Reg.-N° 030502.2 ISO 14001, Reg.-Nº EMS561046

Scott Newsomer

<sup>\*\*</sup>Calculated value (4 - 20 mA)



# Abnahmeprüfzeugnis nach EN 10204 - 3.1 Inspection certificate acc. to EN 10204 - 3.1

Zeugnis-Nr./Certificate No. CA - 3004788346 Seite/Page 1 von/of 1

Es wird bescheinigt, dass die gelieferten Erzeugnisse den Vereinbarungen bei der Bestellung entsprechen. Darüber hinaus wird bescheinigt, dass bei der Herstellung der nachstehend aufgeführten Erzeugnisse die vorgeschriebenen Prüfungen und/oder die zusätzlich aufgeführten Prüfungen nach den bestehenden Prüfvorgaben durchgeführt und die erforderlichen Freigaben erteilt wurden. Die unten aufgeführten Prüfungen wurden unter Aufsicht einer dazu autorisierten, unabhängigen Stelle durchgeführt.

It is certified that the products supplied are in compliance with the requirements of the order. Furthermore, it is confirmed that during the manufacturing of the subsequently listed products the specified inspections and/or the additionally ordered tests have been performed according to the valid procedures and the necessary releases have been given. The subsequently listed inspections have been performed by especially authorized personnel.

Kunde/Customer

: Husky Oil Operations Ltd.

CA - T9V 1A9 - Lloydminster

Kunden Bestell-Nr./Customer Order No.

: 8400439875

E+H-Auftrags-Nr./E+H Order No.

: 3003250812

Pos./Item	Menge/Oty.	Produktbezeichnung/Description	
20	1	72F25-SM0AA8PAB4AA	
		PROWIRL 72 F 1"	
		S/N.: F2069F16000	
		Tag-Nr.: FQIT-100	

# Abnahmeprüfzeugnisse nach EN 10204 - 3.1/Inspection Certificates acc. to EN 10204 - 3.1:

Grundkörper/Meter body: 6017. Uni Deritend

Prozessanschluss/Process connection: JK33, Pradeep metals limited

Sensor/Sensor: 254069, 422929, Kurt Schneider AG

Schraube/Screw: 3A286, Bossard AG

# Drucktest Messsystem/Pressure Test Measuring System:

Druck/Pressure: 100 bar, Dauer/Duration: 3' 00", Medium/Fluid: Wasser/Water

Alle Tests wurden mit Erfolg bestanden./All tests were passed successfully.

Datum/Date 02-23-2012

Jeff Griffin

Endress+Hauser Flowtec, Division USA

Abnahmebeauftragter

Greenwood, IN 46143 USA

Inspector

Dieses Dokument wurde elektronisch nach EN 10204 erstellt und ist ohne Unterschrift gültig. This document was generated electronically acc. to EN 10204 and is valid without signature.



Endress & Hauser Flowtec AG Tschudin / K. Ruetsch Kägenstrasse 7 Postfach 4153 Reinach

13. März 2009

# Abnahmeprüfzeugnis 3.1

Bestell-Nr.:

R03/2046003420

Lieferschein-Nr.:

Bestelldatum:

17.10.2008

Lieferscheindatum:

Auftrags-Nr.:

1881346

Positions-Nr.:

KD-Art-Nr.:

50103215

Menge:

59'000 Stück

# Beiliegendes Abnahmeprüfzeugnis

Die beiliegende Kopie wurde aus dem Vorgabe – Dokument erstellt und enthält alle Angaben für deren Zuordnung zu den geprüften Produkten.

# BOSSARD

Bossard AG Engineering Postlach 1257 CH-6301 Zug

3.1.002582/09

# CERTIFICATE OF INSPECTION (ACCORDING EN10204-3.1)

PURCHASER: BOSSARD AG

**CERT NO: Q0901** 

PO# NO.: 8086556

DATE: 2009/1/2

ITEM: DIN912 HEX CAP SOCKET SCREW SUS 316 (A4) M5X12

**PART NO.: 1234005** 

**LOT NO.: 97C148** 

**QUANTITY: 60** 

MPCS

SAMPLE SIZE: 10

PCS ·

PROD NO.: 97C148-001

UNIT: MM

CHARACTERISTICS	SPECIFICATION	<b>ACTUAL RESULT</b>	RESULT
Head Diameter	8.28 ~ 8.50	8.40 ~ 8.42	OK
Head Height	4.82 ~ 5.00	4.90 ~ 4.97	OK
Major Diameter	4.83 ~ 4.97	4.86 ~ 4.90	OK
Tolerance On Length	11.65 ~ 12.35	11.68 ~ 11.78	OK
Ring Gauge (Go & Not Go Gauge)			OK
Head Mark "DQ A4-70"			OK
Key Engagement Min	2.50 ~	2.58	OK

# **CHEMICAL COMPOSITION (wt%)**

HEAT	Cr	Cu.	Mn	Mo	N	Ni	P	S	Si	C
NUMBER	x100	x100	×100	x100	xPPM	x100	x1000	x1000	x100	x100
3A286	1654.00	315.00	84.00	202.00	0.00	1055.00	30.00	1.00	31.00	1.50

# **REMARK:**

**BOSSARD** 

Bossard AG Engineering Postfach 1257 CH-6301 Zug

3.1 002 582/09

Q.C. MANAGER:

INSPECTED BY: TER

T8074

REGISTERED (CERT NO.4M4Y00)

DATE: 2010/02/05

TIME: 13:56:56

# (ACCORDING EN10204-3.1)

PAGE: 1 OF 1

BUYER: BOSSARD

BOSSARD AG

	NO.: 97C148	
LUI	MAJ., 57 L. 140	

P.O.NO.: 8088556

INSPECTION DATE: 2008/12/30

	EM IO.	DESCRIPTION		SHIPMENT		NO. PCS TESTED		TORSIONAL STRENGTH	
Г	1	DIN912 HEX CAP SOCKET SCREW 318 (A4) M5X12	316 (A4)	59.00 M	3A286	8	649		97C148-001
			}	1	<u>}</u> :	١.	Mitnes 2		}
				·1			1	1	Į.

CHEMICAL ANAYSIS %

	477777				·					
	C	Cr	Cu	Mn	Mo	N T	Ni	P	S Si	
Heatno	x100	x100	x100	x100	x100	xPPM	x100	x1000	x1000 x	100
3A286	1.50	654.00	315.00	84.00	202.00	.00	1.055.00	30.00	1.00 31	.Da

BOSSARD

Bossard AG Engineering Postfach 1257 CH-6301 Zug

3.1 002 582/09

Q.C. MANAGER: <u>C.Y. Wang</u> INSPECTOR BY: <u>Grace Lin</u>



T/R/006A(1)

Inspection Certificate (EN 10204/3.1)

ENDRESS+HAUSER FLOWTEC (I) PVT. LTD. Customer:

Aurangabad

Inspection No.:-Date :-

:-

26E24 /32 25.04.11

Page

01 of 02

Manufacturer :-

**Uni Deritend Limited** 

Brahmanwada Road, Shinde Village, Nashik - 422 101, India Phone : 280 2165, 280 1444, 653 3572 Fax : 91 95253 280 1455 E-Mall : uni\_deritend@sancharnet.in

Article

**Investment Castings** 

Order No.

20474895 DTD 28.03.11

20479022 DTD 09.04.11

20479023 DTD 09.04.11

Inv. No.

31200218 DTD 25.04.11

31200219 DTD 25.04.11

31200222 DTD 25.04.11

Contract No. :

2046004209 dtd 01.10.10

Technical Specifications / Requirements: Delivery Instruction doc No. 50105699 rev. C

Material

Cast Stainless Steel

According to : CF3M according to ASTM A351

1.4408 and AD 2000 A4, W5, W10 (EN10213)

Delivery Condition :-

**Un-Machined** 

**Melting Process** :-Marking

**Induction Melting** 

Heat No. Brand of the Manufacturer , Material

Brand of the Manufacturer : U

Inspector's Stamp : UN1

**Extend of Delivery:** 

Item No.	No. of Pieces	Article	Heat No.	Test No.
	2		5520	-
ſ	59		5968	-
Work Code	12	Motor Body DW F2F W/O F	6015	-
026E0024	107	Meter Body PW F25 W/O FL 330501-0000 Index - E (50104935)	6017	-
026E0024		330301-0000 fildex - L (30104933)		-
				-
				-

# **Chemical Analysis:**

Heat No.	С	Si	Mn	P	S	Cr	Ni	Мо
Min.	•	-	-	-	-	18.00	9.00	2.00
Max.	0.030	1.500	1.500	0.040	0.030	20.00	12.00	2.50
5520	0.024	1.195	1.342	0.033	0.017	18.343	9.825	2.129
5968	0.029	0.811	0.921	0.022	0.013	18.232	9.470	2.073
6015	0.029	0.831	1.033	0.030	0.014	18.099	9.508	2.192
6017	0.029	0.891	1.003	0.027	0.014	18.191	9.498	2.196
	·							
<del></del>								

The requirements are fulfilled as per Annex:

(Ref.AD 2000 Merkblatt WO Certificate No.07 202 1423 WZ 1088/08 ) Certified by TUV NORD

Place: Nashik

Date:

25.04.11

Annex:

Authorized Signatory

email: unideritend@sanchamet.in

A Neterwala Group Company

Brahmanwada Road At & Post : Shinde Village, Tel :+91 253 280 2165 / 280 1444 / 653 3572 / 280 1555

Tal. :Nasik, Dist : Nasik, 422 101 Fax :+91 253 2801455

Maharashtra, India

Regd Office: Liberty building, 3rd floor, New Marine Lines, Mumbai 400020. Tel.22066231/61 Fax: 22082113





## **TEST RESULTS**

T/R/006A(1)

Inspection Certificate (EN 10204/3.1)

Customer: ENDRESS+HAUSER FLOWTEC (I) PVT. LTD.

Aurangabad

Inspection No.: :-26E24 /32

Date 25.04.11 :-Page No. :-02 of 02

**Uni Deritend Limited** 

Gut No. 496 Brahmanwada Road, Shinde Village, Nashik - 422 101, India Phone : 280 2165, 280 1444, 653 3572 Fax : 91 95253 280 1455 E-Mail : uni\_deritend@sancharnet.in

Work Code

026E0024

Article

Meter Body PW F25 W/O FL 330501-0000 Index - E (50104935)

## Annex:

# **Mechanical Tests:**

	Dimn: Speci		Sp	ecim	en	ė	Proof %	Proof	Strength		of	2 = (. 3 = (	]/cm²) %) Cry	Impac st. Pro	Impact ct strength portion	
Test No. / Heat No.	Thickness / Ø	Width	Location	Direction	Position	Test Temperature	Yield Point Pr Stress 0.2%	Yield Point P	Tensile Stre	Elongation	Reduction o	5 = (	mm 10 %) lardne:	•	Expansion	on
	mm	mm				Co	N/mm²	N/mm²	Rm	A %	Z		Values			
	] """ ]							1.7	N/mm²		%	1	2	3	Σ/n	Hardness
Min.						Ambient temp	205.00	230.00	485.00	30.00	1		80J At room Temp.			-
Max.						te A	-	-	-	-			-		]	237
5520		-	in	tegr	al	-do-	257.96	315.04	544.88	49.88	-	180	168	176	174.67	156-175
5968		-	in	tegr	al	-do-	235.65	288.05	538.46	59.65	-	176	166	176	172.67	156-175
6015		-	in	tegr	al	-do-	234.34	262.60	545.25	56.36	-	170	168	174	170.67	140-167
6017		-	in	tegr	al	-do-	275.64	327.52	544.65	44.97	_	172	158	170	166.67	159-180
-	├									<u> </u>						
	┼													<del> </del>	<del> </del>	

**Heat Treatment** 

Solution annealing

Radiography

Satisfactory - within acceptance level DIN 1690-2 :-

L.P. test

Satisfactory. Test is carried out as per approved procedure No. T-001/LPT/MT Rev-

00 dtd 02.04.07 (Ref EN-571-1)

Severity level S3/V3 according to 1690 part 2 - confirmed

Hardness as per ASTM E140/2

Testing is done as per clause no. B6.2 of your delivery instruction No. 50105699 rev.C Castings are in pickled condition

Place :- Nashik

Date :-

25.04.11

**Authorized Signatory** 

email: unideritend@sanchamet.in

A Neterwala Group Company

Brahmanwada Road,

Tel : +91 253 280 2165 / 280 1444 / 653 3572 / 280 1555

TÜV TUV NORD

At & Post : Shinde Village

Tal.: Nasik, Dist: Nasik, 422 101 Fax :+91 253 2801455

Maharashtra, India

Regd Office: Liberty building, 3rd floor, New Marine Lines, Mumbai 400020. Tel.22066231/61 Fax: 22082113





# Pradeep Metals Limited Manufacturers of Precision Closed Die Forgings

MATERIAL TEST CERTIFICATE ACC. TO EN10204 - 3.1 (LAB/FM/03/01)

AD 2000 Merkblatt Certificate No.: 1448289 PED 97/23/EC Certificate No.

: 412/2010/MUC

ENDRI	ESS+ HA	AUŠER FI	OWTE	C (1) PV	T.LTD.					Cert.	No.		3174		
M-171	TO 175,	WALUJ M	IIDC, A	URANG.	ABAD					Date			16/10/20	11	
PIN-43	1136							-		Invoi	ce No.		1759		
MAHA	RARAS	TRA.								Date	_		16/10/20	11	
										Clien	t Ref.		A01/2052	0026	
		•		•						Date			30/08/20	11	
Materia		104 Accord						Meltin					CTION	•	
DA CAT		N10222-5 &						Proces Heat			NACE	WITH	AOD RO	DUTE	
PM No 5793		Part Nan			o./Drg.No 104967		t Code K33	12		Qty 135	SI	HREE J.	Mill AY JAGDA	MBA	
31.73		300/40 316			1000 Rev.		11.55	12	50	Nos.	S1	<b>FAINLE</b>	SS STEEL	LTD.	
Chemic	al Com	position (%	<del>(6)</del>			•		•	•	•			1 202 IND/Q 202 IND/Q-		
	C	Mn	Si	P	S	Cr	Ni	Mo	C	u	v	ΑΊ	N	C.E	
Min	-	_		-	0.015	16.50	10.00	2.00	_	• _	_	_	-	1	
Max	Max 0.030 2.00 1.00 0.045 0.030 18.00 13.00 2.50 0.11														
Actual	0.018		0.35	0.041	0.022	16.95	10.05	2.07			- ,	•	0.064		
		letallurgica	•												
Tensile	Testing	Done as p	er A-370	0/DIN E	N10002-1	1				Notch size (mm) 10x10x55  Impact (L)					
	UTS	YS	YS			long.%			act (T)		Notch size (mm) 10x10x55    Impact (L)   at ( )				
	N/mm²	N/mm <sup>2</sup> 0.2%	N/mn 1.0%		40	50mm A5		at ( Roc 60	om Ten Joule	np)		а	t ( ) Joule		
Min	515.0	205.0	225.0	0 -		35.0	1	2	3	Avg	1	2	3	Avg	
Max	690.0	<u> </u>	-			-	-	-	-	<u> </u>	-		·   -	<u> </u>	
<u> </u>	565.32	336.13	353.9				0 190	192	196	192	l				
	dness 0/3000	Min.	<del>,-</del>	Max		237	A	ctual	1	43-156					
				eatment							licrostr				
		NNEALEC			UENCH						<u> </u>		ABSENT	· 	
Technic		Technical					EN 1022		<b>-2000</b> ,	W0,W2	,W9,W	/10,EN	10272	•	
Requir	ement	Inspection Material			imension		EN 1093 4 / F3161								
	}	Marking		#UVII	-				ED 40 1	.4404/F:	316L/F3	316 JK	33 P2 MB-	332	
Remar	ks :			_		1							Metals I		
		rer mark				: PM						/ GLT	_		
		ccording t				: 6508-1	Æ18				//				
		ix-up testi				: OK	EACTO	ĎΨ			(	数档	(1)		
		s per EN I Radiation		-2/A31N	I AZOZE	: 5A 11S	raciu	KY				WAS A	8		
		Radiation greement v		V SUD da	ated Feb	2010							<u>-</u>		
		M								STAM				nspector	

Certified that the material described herein has been inspected and tested, and conform to the requirements of the contract or purchase order

1

Kurt Schneider AG Tempelstrasse 1 3608 Thun / Allmendingen SVTI - Zulassung:

SVTI - Permission:

KIS.PQ.5400101

Umstempelungsbescheinigung

von Werkstoffen mit Abnahmeprüfzeugnis nach EN 10204-3.1

Certificate of transferidentification of Qualities with certificate of material tests according to EN 10204-3.1

Nr. / No.: 11122901

Besteller:

**Endress + Hauser Flowtec AG** 

Purchaser: CH - 4153 Reinach

Gegenstand Article		Schmiedestücke orgings	Zeugnis Report								
Benennung Description	Liefer – Abmessungen Deliver-dimensions	Hersteller Producer	Nr. No.	Typ Type	Werkstoffe Qualities	Schmelze - Nr. Heat - No.	Probe - Nr. Test - No.	Kontroll – stempel Control-mark			
PW 77/72	Elektrode	Acciaierie Valbruna	MEST 083957/2011	3.1	1.4301	254069	129801980	<b>(H)</b>			
PW 77	Membrane eingeschr. in Elektrode	Acciaierie Valbruna	MEST 083939/2011	3.1	1.4435	422929	129801740	<b>(</b>			
								`			

Anlagen Annex: 2 Zeugnisse /Reports

Ort : Location:

Thun/Allmendingen

Datum :

29.12.2011

Firmenstempel / Unterschrift : Company stamp / Signature :

Wir bescheinigen, dass die Umstempelung gemäss obiger Liste durch unseren Sachverständigen erfolgte. We confirm that the transferidentification occured according to our surveyor.

KURT SCHNEIDER AG

Feinmechanik
Tempelstrasse 1
3608 THUN/ALLMENDINGEN
Tel. 033 334 70 20 Fax 033 334 70 30





**CERTIFICATO DI COLLAUDO ABNAHMEPRUEFZEUGNIS** INSPECTION CERTIFICATE CERTIFICAT DE RECEPTION EN 10204 (2005), 3.1

36100 VICENZA (Italia) - Viale della scienza, 25 z.l. Stab.: 39100 BOLZANO (Italia) - Via A. Volta, 4

Cliente / Beceler/Pure VALBRUNA AG NEUENBURGSTRASSE 54 POSTFACH 212 3282-BARGEN BEI AARBERG - CH -- CH

Produttore: STABILIMENTO DI BOLZANO

Stato di ternitura: - Abgeschreckt Geschaelt

Avviso di Spedizione: D-BZ11004953 Lieleranzelpe Pacting lat/B.L.

Ordine nr: 22'772 KURT SCHNEIDER

Tipo di Elaborazione: E+AOD

Certificato nr: MEST083957/2011/

Conferma ordine nr: El10009061

Marchio di Fabbrica:

Punzone del Collaudatore:



Specifiche:

ints / Exigences KURT SCHNEIDER 2009 1.4307/304L A ASME SA479 2010 S30400/03 A (1) EN 10272 2007 1.4307 A

(0) ACCORDING TO EN 10272,2000 (1) SEC.II PT.A 2010 EDITION

AD 2000-M. W 2 2006 1.4307 A (0) ASTM A479 2010A S30400/03 A NACE MR0103 2007 S30400/03 A

AISI 304/304L EN 10272 2007 1.4301 A NACE MR0175° 2003 S30400/03 A (2)

(0) AD 2000-M. W 10 REV. 2003 (2) \* ISO 15156-3. Tec. corrigendum 1:2005/02/15 & 2:2005/09/01

Qualitá: 1.4301/1.4307/304/304L / S30403

Marca: AISL

Punzonatura: 1.4301/1.4307/304/304L

Pos. Rr.	Oggetto	Dimensioni - mm:	Tolleranza	Lunghezza - mm	Colata	Pezzi	Peso - KG	Lotto nr.
Pos. rv.	Gegenetand	Abmessingen	Tolleranz.	Large	Schmelze	Stickzahi	Gewicht	Loure.
Item rv.	Product description	Dimension	Allowance	(Langth	Heat	Pieces	Weight	Lot nr.
Nr. de poste	Descrip, du produit	Dimension	Tollerance	Longueur	Coulée	Pieces	Polits	Lot nr.
0010	Rund	45,000	k12	3000 / 3090	254069		5650.0	129801980

		Test	on delivi	ery condition Prü		T ALLO STA			njeba sobre e	material esi	come en	regado				
TEST	Provetta/Protestale Speciment/Protestale Languism Spine. Broke Diete. Diete Welle Diete. Telebrase	°C	Posiz. Beggio	Snervamento Structperas Yeld Street Linta studios	Snervamento fractiparas Vista limis Unita alarique	Rosistenza Zugledgiet Tereto trangti Resistenza è vaccion	Bruch: Eba Alban	perial Perial	Elvach Reducito	One cong in di ana		lesilens beset Video Audience KV			UF02Z8 Heate Heatens Denve	3
,	Ling, dark, spale (TIM		1)	Rp 0,2% N/mm2	Rp 1% N/mm2	Rm N/mm2	A5 %	E 4d %	- Z %	RA %		J			HB	
Action	Valori richlesti 1		n ax	205	210	515 680	45	30	•	40		100			215	
Α	10.00	20	L	331	374	629	52	54	70	70	242	229	232	182		
В	10.00	20	L	332	378	634	50	52	69	69	238	234	230	184		L

TEST		min:	max	
A	Korngroesse nach ASTM E112			6

# Analisi chimica

Colata Atest Schmetre/Coulde	min - max 0,030	1,00	2,00	18,00 19,50	8,00 10,00	0,045	0,030	0,100	-	•	•		-	
	C %	Si %	Mn %	Cr%	Ni%	P%	S %	N %		.,	]		ļ. ———	
254069	0,020	0,38	1,64	18,15	B,01	0,031	0,025	0,086				l	i 	

I.Korrosion nach EN ISO 3651-2A Sensibilisierung: T1: OK Corresion test per EN ISO 3651-2A sensitized T1 : OK

Controlled rolled

Im Einvernehmen mit TUV BAYERN (Juli 1972).

Gegenzeichnungsverzicht durch TUV BAYERN (21.05.1979).

Sono state soddisfatte tutte le condizioni richieste Die gestellen Antonderungen eind R. Anlage erfüllt The material has been lunkined in sopordence with the requirements La material & sié trousé conforme aux exigences Controllo antimescolanza: OK

Controllo visivo e dimensionale: soddista te esigenze Besichtigung und Ausmessung; ohne Besintands Varual Inspection and dimensional checkursatistic

Melted and manufactured in Italy No welding or weld repair

Material free from Mercury contamination

We declare that the finished product is checked for radioactive contamination through Portal System when it leaves the production plant.

The Quality Management System is Certified acc. Pressure Equipment Directive [97/23/EC] Annex 1,s.,4.3 by TUEV and LLOYD'S

Il collaudatore di stabilimento / der Werkssachverständige/ Works inspector / L'agent d'usine Bolzano,25/07/11 Pagina - 1 di 2 M. Rizzoty Kul (Mod. MCE2)





# **CERTIFICATO DI COLLAUDO ABNAHMEPRUEFZEUGNIS** INSPECTION CERTIFICATE CERTIFICAT DE RECEPTION EN 10204 (2005), 3.1

36100 VICENZA (Italia) - Viale della scienza, 25 z.i. Stab.: 39100 BOLZANO (Italia) - Via A. Volta, 4

Cilente / Besteller/Puro VALBRUNA AG NEUENBURGSTRASSE 54 POSTFACH 212 3282-BARGEN BEI AARBERG - CH -- CH

Produttore: STABILIMENTO DI BOLZANO

Stato di fornitura: - Abgeschreckt Geschaelt

Avviso di Spedizione: D-BZ11004953

Ordine nr. 22 772 KURT SCHNEIDER

Tipo di Elaborazione: E+AOD

Certificato nr: MEST083957/2011/

Conferma ordine nr. El10009061 Werke/Our Order/Riel m.

Marchio di Fabbrica:

Punzone del Collaudatore:



Any act of tampering, modification, alteration, counterfeiting and/or falsification and/or any other action which modifies the contents of this test certificate shall constitute a violation of applicable civil and criminal laws. Acclaierie Valbruna shall protect its rights and interests before any competent count, authority and jurisdiction.

The supplied product conforms to requirements expressly requested by the purchaser and conforms to requirements expressly requested by the purchaser and conforms to requirements specified norms and standards. Should the product be used for more severe, critical and/or in any case different applications than those the material is generally intended for, any different and/or supplementary requirements shall be specifically demanded, at least, upon order of the Product by the Purchaser. Accidente Valbruna SpA shall not be responsible for any improper use of the Products.

Bolzano,25/07/11 (Mod, MCE2)

il collaudatore di stabilimento / der Werkssachverständige/ Works Inspector / L. agent d' usine M. Rizzotta Kuns

Pagina - 2 di 2





**CERTIFICATO DI COLLAUDO ABNAHMEPRUEFZEUGNIS INSPECTION CERTIFICATE** CERTIFICAT DE RECEPTION EN 10204 (2005), 3.1

36100 VICENZA (Italia) - Viale della scienza, 25 z.i. Stab.: 39100 BOLZANO (Italia) - Via A. Volta, 4

Cliente / Bastelle/Purc VALBRUNA AG NEUENBURGSTRASSE 54 POSTFACH 212 3282-BARGEN BEI AARBERG - CH - CH

Produttore: STABILIMENTO DI BOLZANO

Stato di tornitura: - Abgeschreckt Geschaelt

Avviso di Spedizione: D-BZ11004952

Ordine nr: 22'773 KURT SCHNEIDER

Tipo di Elaborazione: E+AOD

Certificato nr: MEST083939/2011/

Conferma ordine nr: El10009059 Werks/Dur Ordes/Ref nr.

Marchio di Fabbrica:

Punzone del Collaudatore:



Specifiche:

KURT SCHNEIDER 2009 1.4435/316L A ASME SA479 2010 S31600/03 A (1)

NACE MR0103 2007 S31600/03 A

BN 2 97 1.4435 A ASTM A479 2010A S31600/03 A NACE MR0175\* 2003 S31600/03 (2)

AD 2000-M. W 2 2006 1.4435 A (0) EN 10272 2007 1.4435 A

(0) ACCORDING TO EN 10272,2000

(1) SEC.II PT.A 2010 EDITION

(0) AD 2000-M. W 10 REV. 2003 (2) \* ISO 15156-3. Tec. corrigendum 1 2005/02/15 & 2 2005/09/01

Qualitá: 1.4435/316/316L / S31603

Marca: APMLD2

Punzonatura: 1.4435/316/316L

	Oggetto	Dimensioni - mm	Tolleranza	Lunghezza - mm:	Colata	Pezzi	Peso - KG	Lotto nr.
	Gagenziand	Abnassungen	Toleranz	Lange	Schmelze	Stockzahi	Genteht	Loem.
	Product description	Cimension	Alowance	Langth	Heat	Placas	Weight	Lot m.
	Descrip, du produit	Olmension	Telerance	Langueur	Coulse	Placas	Potts	Lot m.
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Anti-tra-	ri richiesti 1	mi ma		205	235	515 700	40	30	•	40		100			215	
A	10.00	20	L	279	308	582	56	58	72	72	260	252	269	174		
В	10.00	20	L	275	311	57B	58	60	72	72	267	260	261	174		ŀ

TEST		min	max	
В	Komgroesse nach ASTM E112			5

# Analisi chimica

Colata /Hest Schmelze/Coulée	min - max 7,70	0,030	1,00	2.00		2,50 3,00	12,50 14,00	0,050	0,045	0,030	0,100	:	-	•	-
	FE-BN	C %	Si %	Mn %	Cr %	Mo %	Ni %	Ti %	P %	S %	N %				
422929	6,12	0,017	0,45	1,74	17,19	2,52	12,75	0,008	0,028	0,023	0,072				

I.Korrosion nach EN ISO 3651-2A Sensibilisierung: T1: OK Corrosion test per EN ISO 3651-2A sensitized T1: OK

Annealed 1060° C/H2O.

Im Einvernehmen mit TUV BAYERN (Juli 1972).

Gegenzeichnungsverzicht durch TUV BAYERN (21.05.1979).

Sono state soddisfatte tutte le condizioni richieste Ote gestellen Antordeningen shid it. Artage ertitit: The material has been furtished in accordance with the requir Le material à eté trouvé conforme aux extgences

Controllo antimescolanza: OK

Controllo visivo e dimensionale: soddista le esigenze ing und Ausmessi pection and dimen

Melted and manufactured in Italy No welding or weld repair

Material free from Mercury contamination

We declare that the finished product is checked for radioactive contamination through Portal System when it leaves the production plant. The Quality Management System is Certified acc. Pressure Equipment Directive [97/23/EC] Annex 1 s. 4.3 by TUEV and LLOYD'S

Bolzano,25/07/11  Bolzano,25/07/11	agina - 1 di 2
--	----------------





DUALITY MANAGEMENT SYSTEM

# CERTIFICATO DI COLLAUDO ABNAHMEPRUEFZEUGNIS INSPECTION CERTIFICATE CERTIFICAT DE RECEPTION EN 10204 (2005), 3.1

36100 VICENZA (Italia) - Viale della scienza, 25 z.l. Stab.: 39100 BOLZANO (Italia) - Via A. Volta, 4

Cliente / Beasign Purhase/Chini VALBRUNA AG NEUENBURG STRASSE 54 POSTFACH 212 3282-BARGEN BEI AARBERG - CH --CH

Produttore: STABILIMENTO DI BOLZANO

Stato di fornitura: - Abgeschreckt Geschaelt

Avviso di Spedizione: D-BZ11004952 Univerziolge Patring 1978 L.

Ordine nr. 22' 773 KURT SCHNEIDER

Tipo di Elaborazione: E+AOD

Certificato nr: MEST083939/2011/

Conferma ordine nr: El10009059

Marchio di Fabbrica: Zelchen des Liefermverkes Trade mark Sigis de l' usine produtrice

usine produtrice



Punzone del Collaudatore: Stempel des Werkssachverständigen Impector a stemp/Polisjön de l' assayau

(MR)

Any act of tampering, modification, alteration, counterfeiting and/or faisification and/or any other action which modifies the contents of this test certificate shall constitute a violation of applicable civil and criminal laws. Acclaierie Valbruna shall protect its rights and interests before any competent court, authority and jurisdiction.

The supplied product conforms to requirements expressly requested by the purchaser and conforms to requirements specified by certified norms and standards. Should the product be used for more severe, critical and/or in any case different applications than those the material is generally intended for, any different and/or supplementary requirements shall be specifically demanded, at least, upon order of the Product by the Purchaser. Acclairer Valorina SpA shall not be responsible for any improper use of the Products.

Bolzano,25/07/11

(Mad. MCE2)

Il collaudatore di stabilimento / der Werkssachverständige// Works inspector / L' agent d' usine

M. Rizzotla Kul

Pagina - 2 di 2

# **Parameter Setting**

30190353-2725740

3003250812

Purchase order number

3004788346-20 / Endress+Hauser Flowtec

Order N°/Manufacturer

72F25-SM0AA8PAB4AA

Order code

F2069F16000

Serial Nº

The below parameters are set according to your order.

Please refer to the Operating Manual for any parameters not mentioned.

Device software

Communication type:

Device revision

Meter body type (MB)

Measuring unit type

Units

Unit volume flow
Unit mass flow

Unit corrected volume flow

Totalizer

Unit volume totalizer
Unit mass totalizer

Unit corrected volume totalizer

User interface

Language

Assign line 1

Assign line 2

100% value

Process parameters

Application

Operating temperature

PROWIRL 72 F

Transmitter/Sensor

1"

Nominal diameter

FQIT-100

Tag Nº

V1.06.00

HART

Dev:6/DD.1 [ID 56(hex)]

332

Volume flow

us.gal/min

lb/min

Sm3/hr

us.gal

lb

Sm<sup>3</sup>

English

Flow

Liquid

Totalizer 1

70 us.gal/min

68 °F

02-23-2012

Date

Endress+Hauser Flowtec, Division USA 2330 Endress Place Greenwood, IN 46143



# **Parameter Setting**

30190353-2725740

Current output 1

Assign current output

Value 20 mA

Current span

Failsafe mode

Time constant

Pulse output 1

Assign pulse

Pulse value

Output signal Failsafe mode

Pulse width

Volume flow

70 us.gal/min

4-20 mA HART US Maximum current

5 s

Volume flow

0.056 us.gal

passive/positive

Fallback value

20 ms

02-23-2012

Date

Endress+Hauser Flowtec, Division USA 2330 Endress Place Greenwood, IN 46143



















# **Return Authorization Policy**

# Repair and Calibration of Used Equipment

Endress+Hauser must assign a Return Authorization (RA) number to any instrument you plan to return for factory repair or calibration service. Please mark the Return Authorization (RA) number clearly on all shipping cartons and paperwork. No product returns are accepted without an RA number. Endress+Hauser will return to the sender at the sender's expense all packages that do not have the RA number clearly marked on them.

Within the USA, RA requests for factory repair and calibration service can be handled 24 hours a day online. Please visit our website at:

# www.us.endress.com/factorvrepair.

You will be prompted to provide the necessary information and within minutes you will receive your RA number and complete shipping instructions. The issuance of an RA number does not automatically mean that a repair will be covered under warranty. An Endress+Hauser associate will contact you regarding the disposition of your returned equipment.

When requesting an RA number, please be prepared to provide the following information:

Customer name
Customer shipping address
Customer billing address
Customer phone number
Customer contact
Customer contact e-mail address
Equipment type
Original sales order or purchase order number
Reason for return
Failure description, if applicable
Process material(s) to which the equipment has been
exposed
Material used to de-contaminate and clean equipment
New purchase order number for the repair or

OSHA Hazard Communication Standard 29CFR 1910.1200 mandates that we take specific steps to protect our employees from exposure to potentially hazardous materials. All equipment must be completely cleaned and decontaminated before being returned. If the equipment being returned was exposed to a hazardous substance as defined by OSHA, a letter certifying that the equipment has been decontaminated, as well as a copy of the required Material Safety Data Sheets (MSDS) for each hazardous substance identified must be included with the returned equipment.

# Before returning used equipment:

- Each package must be clearly marked with an RA number
- A Declaration of Hazardous Materials and Decontamination must be included inside the package
- A duplicate Declaration of Hazardous Materials and Decontamination must be visibly attached to the outside of the package
- An MSDS for each substance that has come in contact with the equipment must be included inside the package
- A duplicate MSDS must be visibly attached to the outside of the package

To get a return authorization number for repair or calibration service by phone, please call:

In the US: 800-642-8737 In Canada: 800-668-3199

Note: If you are requesting a return for credit, contact the Endress+Hauser sales department at 888-ENDRESS to first determine if an RA number will be issued.

For repair and calibration in other countries, please visit **www.endress.com** 



calibration

# **Notes on Safety**



# Warning!

Electrical shock could cause death or serious injury. If the sensor is installed in a high voltage environment and a fault or installation error occurs, high voltage may be present on the transmitter leads and terminals.

Safe and secure operation of the transmitter can only be guaranteed if the operating instructions and all safety notes are read, understood and followed.

### Correct use

The manufacturer cannot be held responsible for damage caused by misuse of the unit.

Separate Ex documentation should be obtained for measurement systems in hazardous areas. The installation conditions and connection values indicated in these instructions must be followed!

## Installation, commissioning and operation

The unit is constructed using the most up to date production equipment and complies to the safety requirements of the local guidelines. However, if it is installed incorrectly or misused, certain application dangers can occur. Installation, wiring and maintenance of the unit must only be done by trained skilled personnel who are authorized to do so by the plant operator. This skilled staff must have read and understood these instructions and must follow them to the letter. The plant operator must make sure that the measurement system has been correctly wired to the connection schematics.

### Hazardous areas

When installing the unit in a hazardous area the national safety requirements must be met. Make sure that all personnel are trained in these areas. The measurement and safety values must be followed in all these installations.

## Returns

Please follow the Return Authorization Policy on the back of this sheet.

# Safety pictograms and symbols

Symbol	Meaning
Note!	Note!  Notes draw attention to activities or procedures that can have a direct influence on operation or trigger an unforeseen device reaction if they are not carried out properly.
Caution!	Caution! Cautions draw attention to activities or procedures that can lead to persons being injured or to incorrect device operation if they are not carried out properly.
Varning!	Warning! Warnings draw attention to activities or procedures that can lead to persons being seriously injured, to safety risks or to the destruction of the device if they are not carried out properly.

Symbol	Meaning
FM APPROVED	Explosion protected, type examined operating equipment If this icon is on the device's nameplate, the device can be used in hazardous areas.
(Ex)	
<u>₹x</u>	Hazardous area  This symbol identifies the hazardous area in the diagrams in these Operating Instructions.  Devices that are used in hazardous areas or cables for such devices must have the corresponding type of protection.
<b>₽</b>	Safe area (non-hazardous areas) This symbol identifies the non-hazardous area in the diagrams in these Operating Instructions.  Devices in non-hazardous areas must also be certified if connection cables run through a hazardous area.

Though the information provided herein is believed to be accurate, be advised that the information contained herein is NOT a guarantee of satisfactory results. Specifically, this information is neither a warranty nor guarantee, expressed or implied, regarding performance;

merchantability, fitness, or other matter with respect to the products; and recommendation for the use of the product/process information in conflict with any patent. Please note that Endress+Hauser reserves the right to change and/or improve the product design and specifications without notice.















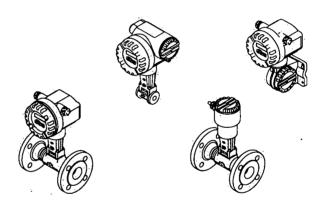




**Brief Operating Instructions** 

# Proline Prowirl 72

Vortex Flow Measuring System



These Brief Operating Instructions are **not** intended to replace the Operating Instructions provided in the scope of supply. Detailed information is provided in the Operating Instructions and the additional documentation on the CD-ROM supplied.

Depending on the device version, the complete device documentation consists of:

- ■Brief Operating Instructions (this document)
- ■Operating Instructions
- **■**Description of Device Functions
- ■Approvals and safety certificates
- Safety instructions in accordance with the approvals for the device (e.g. explosion protection, pressure equipment directive, etc.)
- ■Additional device-specific information



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Endress+Hauser

Proline Prowirl 72 Safety instructions

# 1 Safety instructions

# 1.1 Designated use

The measuring device is used to measure the volume flow of saturated steam, superheated steam, gases and liquids. If the process pressure and process temperature are constant, the measuring device can also output the flow as the calculated mass flow and corrected volume flow.

- Any use other than that described here compromises the safety of persons and the entire measuring system and is, therefore, not permitted.
- The manufacturer is not liable for damage caused by improper or non-designated use.

# 1.2 Installation, commissioning and operation

- The measuring device must only be installed, connected, commissioned and maintained by qualified and authorized specialists (e.g. electrical technicians) in full compliance with the instructions in these Brief Operating Instructions, the applicable norms, legal regulations and certificates (depending on the application).
- The specialists must have read and understood these Brief Operating Instructions and must follow the instructions they contain. If you are unclear on anything in these Brief Operating Instructions, you must read the Operating Instructions (on the CD-ROM). The Operating Instructions provide detailed information on the measuring device.
- ■The measuring device should only be installed in the pipe in a de-energized state free from outside loads or strain.
- Repairs may only be performed if a genuine spare parts kit is available and this repair work is expressly permitted.
- •If performing welding work on the piping, the welding unit may not be grounded by means of the measuring device.

# 1.3 Operational safety

- The measuring device is designed to meet state-of-the-art safety requirements, has been tested, and left the factory in a condition in which it is safe to operate. Relevant regulations and European standards have been observed.
- The information specified on the warning notices, nameplates and connection labels fitted on the measuring device must be observed. These contain important data, including information on the permitted operating conditions, the application of the measuring device and data on materials.
- •The measuring device must be wired in accordance with the wiring diagrams and connection labels. Interconnecting must be permitted.
- All parts of the measuring device must be integrated into the potential matching system of the plant.
- The cables, tested cable glands and tested dummy plugs must suit the prevailing operating conditions, e.g. the temperature range of the process. Housing openings that are not used need to be sealed with dummy plugs.

Endress+Häuser 3

The measuring device can only be used in conjunction with fluids to which all the wetted parts of the measuring device are adequately resistant.

With regard to special fluids, including fluids used for cleaning, Endress+Hauser will be happy to assist in clarifying the corrosion-resistant properties of wetted materials.

However, minor changes in temperature, concentration or in the degree of contamination in the process may result in variations in corrosion resistance. Unsuitable material can lead to leakage of corrosive process media and injure personnel and/or cause damage in the plant. For this reason, Endress+Hauser does not accept any responsibility with regard to the corrosion resistance of wetted materials in a specific application. The user is responsible for the choice of suitable wetted materials in the process.

### ■Hazardous areas

Measuring devices for use in hazardous areas are labeled accordingly on the nameplate. Relevant national regulations must be observed when operating the device in hazardous areas. The Ex documentation on the CD-ROM is an integral part of the entire device documentation. The installation regulations, connection data and safety instructions provided in the Ex documentation must be observed. The symbol on the front page provides information on the approval and certification body ( Europe, USA, Canada). The nameplate also bears the documentation number of this Ex documentation (XA\*\*\*\*D/../..).

- For measuring systems used in SIL 2 applications, the separate manual on functional safety (on the CD-ROM) must be observed.
- Hygienic applications

Measuring devices for hygienic applications have their own special labeling. Relevant national regulations must be observed when using these devices.

- Pressure instruments
  - Measuring devices for use in systems that need to be monitored are labeled accordingly on the nameplate. Relevant national regulations must be observed when using these devices. The documentation on the CD-ROM for pressure instruments in systems that need to be monitored is an integral part of the entire device documentation. The installation regulations, connection data and safety instructions provided in the Ex documentation must be observed.
- Endress+Hauser will be happy to assist in clarifying any questions on approvals, their application and implementation.

#### 1.4 Safety conventions



# /!\ Warning!

"Warning" indicates an action or procedure which, if not performed correctly, can result in injury or a safety hazard. Comply strictly with the instructions and proceed with care.



#### Caution!

"Caution" indicates an action or procedure which, if not performed correctly, can result in incorrect operation or destruction of the device. Comply strictly with the instructions.



"Note" indicates an action or procedure which, if not performed correctly, can have an indirect effect on operation or trigger an unexpected response on the part of the device.

Proline Prowirl 72 Installation

# 2 Installation

# 2.1 Transporting to the measuring point

- Transport the measuring device to the measuring point in the original packaging.
- The covers or caps fitted to the process connections prevent mechanical damage to the sensors during transportation and storage. For this reason, do not remove the covers or caps until immediately before installation.





To transport the unit, use slings slung around the process connections or use lugs (if available).



Risk of injury! The device can slip.
The center of gravity of the measuring device may be higher than the holding points of the slings.
Always ensure that the device cannot slip or turn around its axis.

Do not lift measuring devices by the transmitter housing or the connection housing in the case of the remote version. Do not use chains as they could damage the housing.

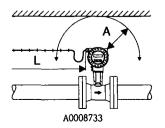
# 2.2 Installation conditions

It is advisable to support heavy sensors for mechanical reasons (to protect the piping).

### 2.2.1 Dimensions

For the dimensions of the measuring device, see the associated Technical Information on the CD-ROM.

# 2.2.2 Mounting location



Recommended minimum distance in all directions (A): 100 mm (3.94 in)

Required cable length (L): L + 150 mm (5.91 in) Installation Proline Prowirl 72

### 2.2.3 Orientation

The device can basically be installed in any position in the piping.

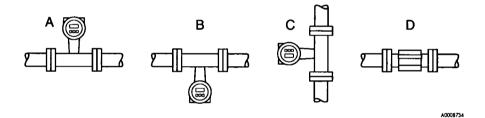
Please note the following points however:

- The arrow indicated on the device must always point in the direction of flow.
- Measuring the flow of liquids in vertical pipes:
  - -There is vertical upward flow in the pipe = orientation recommended to avoid partial pipe filling (see graphic, orientation A).
  - -There is vertical downward flow in the pipe = in this orientation it must be ensured that the measuring tube is always completely full.
- ■In order to ensure that the maximum permissible amblent temperature for the transmitter is not exceeded, the following orientations (see graphic) should be selected:
  - -Orientation A, C, D  $\rightarrow$  for a fluid temperature  $\geq$  200 °C (392 °F)

### Caution!

If the fluid temperature is  $\geq$  200 °C (392 °F), orientation B is **not** permitted for wafer versions (Prowirl 72W) with nominal diameters DN 100 (4") and DN 150 (6").

-Orientations A, B, D  $\rightarrow$  for very cold fluids (e.g. liquid nitrogen)



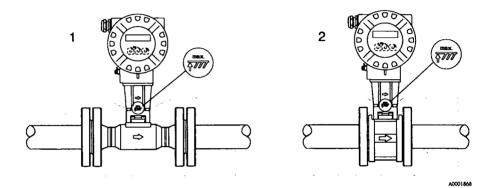
Endress+Hauser

Proline Prowirl 72 Installation

### 2.2.4 Thermal insulation

Some fluids require suitable measures to avoid loss of heat or heat supply at the sensor. A wide range of materials can be used to provide the required thermal insulation.

When insulating, please ensure that a sufficiently large area of the housing support is exposed. The uncovered part helps heat transfer and protects the electronics from overheating (or undercooling). The maximum permitted insulation level is indicated in the following graphic (1 = flanged version, 2 = wafer version). These apply equally to both the compact version and the remote version of the sensor.



# Caution!

Risk of electronics overheating!

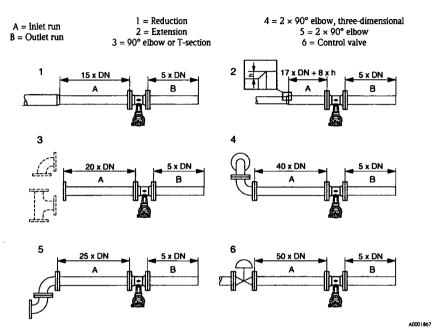
- Make sure that the adapter between the sensor and transmitter and the connection housing of the remote version are always exposed.
- ■Note that a certain orientation might be required, depending on the fluid temperature  $\rightarrow$   $\trianglerighteq$  6
- ■For information on the permitted temperature ranges → see the Operating Instructions on the CD-ROM

Endress+Hauser 7

Installation Proline Prowirl 72

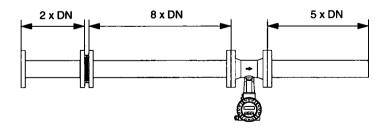
#### 2.2.5 Inlet and outlet runs

The following inlet and outlet runs must be taken into account. The longest inlet run shown must be observed if two or more flow disturbances are present.



# Perforated plate flow conditioner

A specially designed perforated plate flow conditioner, available from Endress+Hauser, can be installed if it is not possible to observe the inlet runs required. The flow conditioner is fitted between two piping flanges and centered with the mounting bolts. Generally, this reduces the inlet run required to  $10 \times DN$  with complete accuracy.

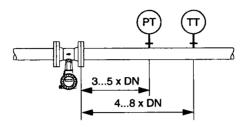


A0001887

Proline Prowirl 72 Installation

# Outlet runs with pressure and temperature measuring points

If pressure and temperature measuring points are installed after the device, please ensure there is a large enough distance between the device and the measuring point so there are no negative effects on vortex formation in the sensor.



A0003780

## 2.2.6 Vibrations

The correct operation of the measuring system is not influenced by plant vibrations up to 1 g, 10 to 500 Hz. Consequently, the sensors require no special measures for attachment!

#### 2.3 Post-installation

# Mounting the sensor

# Caution!

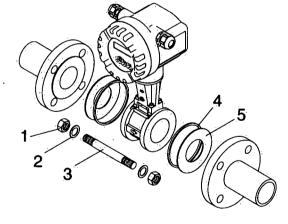
- ■Prior to installing the measuring device in the piping, remove all traces of transport packaging and any protective covers from the sensor.
- Make sure that the internal diameters of seals are the same as, or greater than, those of the measuring tube and piping. Seals projecting into the flow current have a negative effect on the vortex formation after the bluff body and cause inaccurate measurement.
- The direction of the arrow on the measuring tube must match the direction of flow.
- Lengths:
  - -Prowirl W (wafer version): 65 mm (2.56 in)
  - -Prowirl F (flanged version) → associated Technical Information on CD-ROM

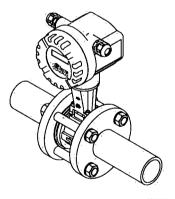
# Mounting Prowirl W

The centering rings supplied are used to mount and center the wafer-style devices.

- 1 = Nut 2 = Washer
- 3 = Tie rod

 Centering ring 5 = Seal



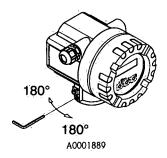


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Proline Prowirl 72 Installation

# 2.3.2 Turning the transmitter housing

## Turning the aluminum field housing



The electronics housing can be rotated continuously 360° on the housing support.

Release the lock screw.

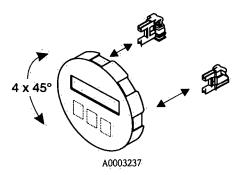
Turn the transmitter housing to the desired position (max. 180° in each direction to the stop).

Note!

There are recesses in the rotating groove at 90° stages (only compact version). These help you align the transmitter more easily.

Retighten the lock screw.

# 2.3.3 Turning the onsite display



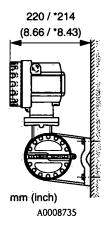
Unscrew cover of the electronics compartment from the transmitter housing.

Remove the display module from the transmitter retainer rails.

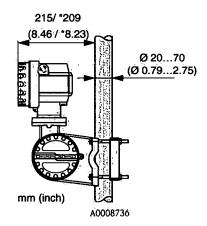
Turn the display to the desired position (max. 4 × 45° in each direction) and reset it onto the retaining rails. Screw the cover of the electronics compartment firmly back onto the transmitter housing.

# 2.3.4 Mounting the transmitter (remote version)

# Mounted directly on the wall



# Pipe mounting



Caution!

If the device is mounted to a warm pipe, make sure that the housing temperature does not exceed the maximum permissible value:

Standard: -40 to +80 °C (-40 to +176 °F)

EEx d version: -40 to +60 °C (-40 to +140 °F)

ATEX II 1/2 GD version/dust ignition-proof: -20 to +55 °C (-4 to +131 °F)

# 2.4 Post-installation check

- ■Is the measuring device damaged (visual inspection)?
- ■Does the measuring device correspond to the specifications at the measuring point?
- ■Is the serial number of sensor and the connected transmitter the same?
- ■Are the measuring point number and labeling correct (visual inspection)?
- ■Correct internal diameter and correct surface roughness/quality?
- •Sensor orientation correctly selected in terms of type, fluid properties and fluid temperature?
- Does the arrow on the sensor point in the direction of flow in the pipe?
- ■Is the measuring device protected against moisture and direct sunlight?
- ■Is the measuring device protected against overheating?

#### 3 Wiring



## Note!

- ■Use a connecting cable with a continuous operation temperature between -40 °C (-40 °F) and the max. permitted ambient temperature plus 10 °C (plus 18 °F).
- ■Conductor cross-section: max. 2.5 mm<sup>2</sup> (14 AWG)
- ■A shielded connecting cable must be used.
- ■Route the connecting cable so it is securely seated.
- Pay particular attention to company-internal grounding concepts and national installation regulations and guidelines.
- Seal the cable entries and covers tight.

# Caution!

Risk of damaging the electronic components!

Connect the connecting cable  $\rightarrow$  in accordance with the connection data on the nameplate or the connection data in the Operating Instructions or the Ex documentation on the CD-ROM.

# In addition, for the remote version:

# Caution!

Risk of damaging the electronic components!

- Only connect sensors and transmitters with the same serial number.
- The remote version must be grounded. In doing so, the sensor and transmitter must be connected to the same potential matching.
- ■Observe the cable specifications of the connecting cable → Operating Instructions on the CD-ROM.



## Note!

Install the connecting cable securely to prevent movement.

# In addition, for measuring devices with fieldbus communication:

# Caution!

Risk of damaging the electronic components!

- ■Observe the cable specification of the fieldbus cable → Operating Instructions on the CD-ROM.
- •Keep the stripped and twisted lengths of cable shield as short as possible.
- ■Screen and ground the signal lines → Operating Instructions on the CD-ROM.
- If the shielding of the cable is grounded at more than one point in systems without additional potential equalization, power supply frequency equalization currents can occur that damage the cable or the shielding. In such instances, the shielding of the cable only has to be grounded on one side. This means that it may not be connected to the ground terminal of the housing. The shield that is not connected should be insulated!

# In addition, for Ex-certified measuring devices:



# ♠ Warning!

When wiring Ex-certified measuring devices, all the safety instructions, wiring diagrams, technical information, etc. of the related Ex documentation must be observed → Ex documentation on the CD-ROM.

#### Connecting the various housing types 3.1

Wire the unit using the terminal assignment diagram inside the cover.

# 3.1.1 Compact version, Ex i / non-Ex

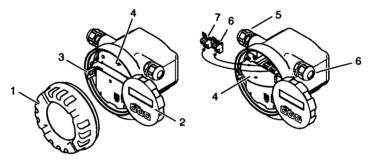


#### Transmitter connection:

- Connection diagram in the electronics compartment
  - Connecting cable
- For optional output with HART version

3

Connection compartment, Ex i / non-Ex transmitter housing



ACCOUNTER

- Electronics compartment cover
- Display module 2
- Retaining rail for display module 3
- Connection compartment cover
- 5 Cable gland for connecting cable
- Cable gland for optional output for HART version
- Terminal connector for connecting cable
- Terminal connector for optional output for HART version

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# 3.1.2 Compact version, Ex d

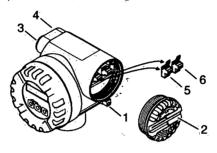


### Transmitter connection:

- Connection diagram inside the connection compartment cover
- 2 Power supply cable/signal cable
- 3 Optional frequency output with HART version

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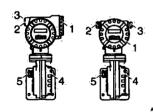
# Connection compartment, Ex d transmitter housing



A0008742

- Securing clamp for connection compartment cover
- 2 Connection compartment cover
- 3 Cable gland for connecting cable
- 4 Cable gland for optional output for HART version
- 5 Terminal connector for connecting cable
- 6 Terminal connector for optional output for HART version

# 3.1.3 Remote version (transmitter), Ex i and Ex d



#### Transmitter connection:

- Connection diagram inside the connection compartment cover
- 2 Connecting cable
- 3 Optional output with HART version

## Connecting cable connection:

- 4 Connection diagram inside the connection compartment cover
- 5 Sensor/transmitter connecting cable

3.1.4 Remote version (sensor)



#### Connecting cable connection:

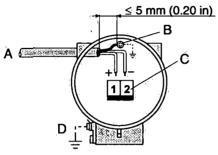
- 4 Connection diagram inside the connection compartment cover
- 5 Sensor/transmitter connecting cable

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# 3.2 Special points to note when connecting the transmitter

# 3.2.1 Stripping the ground cable for fieldbuses

When connecting the ground cable in the case of fieldbuses (PROFIBUS PA and FOUNDATION Fieldbus), attention should be paid to the maximum permissible stripping length.



- A Fieldbus cable
- B Ground terminal
  Between the stripped fieldbus cable
  and the ground terminal, the cable
  shielding should not exceed a length
  of 5 mm (0.20 in)
- C Terminal connector
- D Ground terminal (external, only relevant for remote version)

A0003784

# 3.2.2 Pulse/frequency modulation (PFM), flow computer

Connection for outputting PFM signals, flow computer → Operating Instructions on CD-ROM.

# 3.3 Degree of protection

The devices meet all the requirements for IP 67.

After mounting in the field or service work, the following points have to be observed to ensure that IP 67 protection is retained:

- ■Install the measuring device in such a way that the cable entries do not point upwards.
- ■Do not remove the seal from the cable entry.
- Remove all unused cable entries and plug them with suitable drain plugs.



Tighten the cable entries correctly.



The cables must loop down before they enter the cable entries ("water trap").

# 3.4 Post-connection check

- ■Are cables or the device damaged (visual inspection)?
- Does the supply voltage match the specifications on the nameplate?
- ■Are the power supply and signal cables connected correctly?
- ■Do the cables used comply with the necessary specifications?
- ■Do the mounted cables have adequate strain relief and are they routed securely?
- ■Is the cable type route completely isolated? Without loops and crossovers?
- ■Are all of the screw terminals correctly tightened?
- ■Are all the cable entries installed, firmly tightened and correctly sealed?
- ■Cable routed as a "water trap" in loops?
- •Are all the housing covers installed and correctly tightened?

# In addition, for measuring devices with fieldbus communication:

- Are all the connecting components (T-boxes, junction boxes, connectors, etc.) connected with each other correctly?
- Has each fieldbus segment been terminated at both ends with a bus terminator?
- Has the max, length of the fieldbus cable been observed in accordance with the specifications?
- Has the max, length of the spurs been observed in accordance with the specifications?
- ■Is the fieldbus cable fully shielded and correctly grounded?

#### 4 Hardware settings

This section only deals with the hardware settings needed for commissioning. All other settings (e.g. output configuration, write protection, etc.) are described in the associated Operating Instructions on the CD-ROM.



No hardware settings are needed for measuring devices with HART and FOUNDATION Fieldbus-type communication.

#### 4.1 **Device address**

Has to be set for measuring devices with the following communication methods:

■PROFIBUS PA

The device address can be configured via:

- ■Miniature switches → see description below
- Device functions/Operating program FieldCare → see Operating Instructions on the CD-ROM

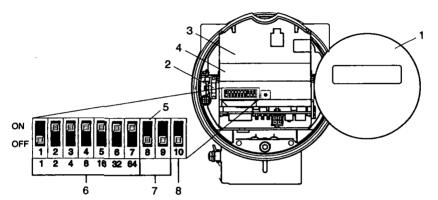
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#### Addressing via miniature switches

#### Marning!

Risk of electric shock! Risk of damaging the electronic components!

- ■All the safety instructions for the measuring device must be observed and all the warnings hee $ded \rightarrow 14$ .
- •Use a workspace, working environment and tools purposely designed for electrostatically sensitive devices.



- Local display module
- Retaining rails of local display module 2
- Plastic cover 3
- I/O board cover (COM module)

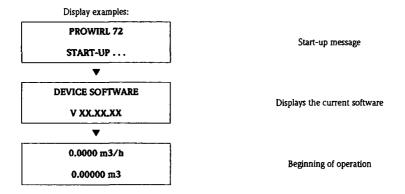
- DIP switch:
- 1 to 7 = device address (factory setting = 126)
- 8 to 9 = not assigned
- 10 = type of addressing
  - ON = hardware addressing
  - OFF = software addressing (factory setting)
- a. Switch off the power supply before opening the device.
- b.Unscrew cover of the electronics compartment from the transmitter housing.
- c.Remove the display module from the retaining rails and refit onto the right retaining rail with the left side (this secures the display module).
- d. Fold up the plastic cover.
- e.Fold up the cover of the I/O board (COM module).
- f.Configure the device address using DIP switches 1 to 7.
- g. Activate hardware addressing using DIP switch 10 (= ON).
- h.Installation is the reverse of the removal procedure.

#### 5 Commissioning

#### 5.1 Switching on the measuring device

On completion of the installation (successful post-installation check), wiring (successful post-connection check) and after making the necessary hardware settings, where applicable, the permitted power supply (see nameplate) can be switched on for the measuring device.

When the power supply is switched on, the measuring device performs a number of power-up checks and device self-checks. As this procedure progresses the following messages can appear on the onsite display:



The measuring device starts operating as soon as the startup procedure is complete. Various measured values and/or status variables appear on the display.

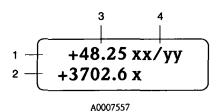


If an error occurs during startup, this is indicated by an error message.

The error messages that occur most frequently when a measuring device is commissioned are described in the Troubleshooting section  $\rightarrow 26$ .

#### 5.2 Operation

#### 5.2.1 Display elements

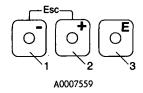


Display lines/fields Main line for primary measured values Additional line for additional measured variables/status variables Current measured values Engineering units/time units

#### 5.2.2 Operating elements

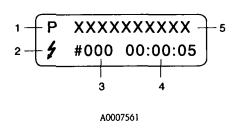


The operating elements described here are only available for measuring devices with local operation. Measuring devices without local operation are operated via the fieldbus in question.



Operating keys (-) Minus key for entering, selecting (+) Plus key for entering, selecting Enter key for calling the function matrix, saving When the +/- keys are pressed simultaneously (Esc): Exit the function matrix step-by-step: > 3 sec. = cancel data input and return to the measured value display

#### 5.2.3 Displaying error messages

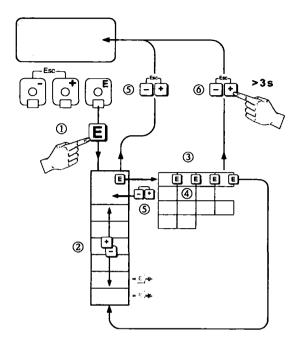


Type of error: P = Process error, S = System error Error message type: 7 = Fault message, ! = Notice message Error number Duration of the last error that occurred: Hours: Minutes: Seconds Error designation List of the most common error messages during commissioning → 🖹 26 List of all error messages, see associated Operating Instructions on the CD-ROM

#### 5.3 Navigating within the function matrix



The procedure described here only applies to measuring devices with local operation. Measuring devices without local operation are operated via the fieldbus in question.



A0007562

- 1.  $\blacksquare$   $\rightarrow$  Enter the function matrix (starting with measured value display)
- 2.⊕ → Select the group (e.g. OPERATION)
  - □ → Confirm selection
- 3.  $\bigcirc$   $\rightarrow$  Select function (e.g. LANGUAGE)
- 4. $\stackrel{1}{\Box}$  → Enter code **72** (only for the first time you access the function matrix)
  - □ → Confirm entry
  - ☐ → Change function/selection (e.g. ENGLISH)
  - □ → Confirm selection
- 5.  $\bigcirc$   $\rightarrow$  Return to measured value display step by step
- 6.  $\longrightarrow$  > 3 s  $\rightarrow$  Return immediately to measured value display

#### 5.4 Calling the Commissioning Quick Setup



The procedure described here only applies to measuring devices with HART communication. Measuring devices with PROFIBUS PA and FOUNDATION Fieldbus communication do not have a Commissioning Quick Setup.

All the functions needed for commissioning are called up automatically with the Quick Setup. The functions can be changed and adapted to the process in question.

- 1.[ $\varepsilon$ ]  $\rightarrow$  Enter the function matrix (starting with measured value display)
- 2. □ → Select the group QUICK SETUP
  - [ ∈ ] → Confirm selection
- 3.QUICK SETUP COMMISSIONING function appears.
- 4. Intermediate step if configuration is blocked:
  - $\stackrel{\text{Pl}}{\rightarrow}$  Enter the code **72** (confirm with 10) and thus enable configuration
- 5. ♣ → Go to Commissioning Quick Setup
- 6. → Select YES
  - $|\varepsilon| \rightarrow \text{Confirm selection}$
- $7.11 \rightarrow$  Start Commissioning Quick Setup
- 8. Configure the individual functions/settings:
  - -Via <sup>1</sup>3-key, select option or enter number
  - -Via | E |-key, confirm entry and go to next function
  - -Via -key, return to Setup Commissioning function (settings already made are retained)

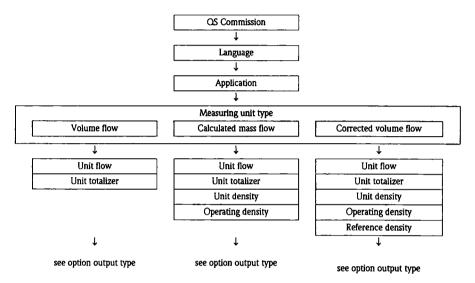
All the available functions of the measuring device and their configuration options as well as additional Quick Setups, if available, are described in detail in the Operating Instructions. The related Operating Instructions can be found on the CD-ROM.

The measuring device is ready for operation on completion of the Quick Setup.

#### 5.4.1 Flowchart of "Commissioning" Quick Setup

The display returns to the QUICK SETUP COMMISSIONING cell if you press the ESC key combination 10 during interrogation.

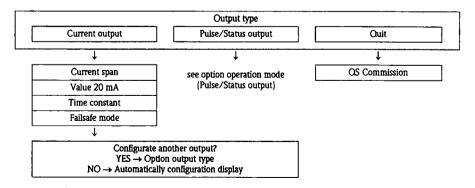
#### Options language, application and measuring variable



#### Option output type

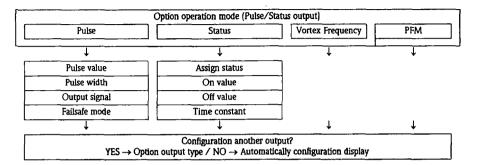
Only the output (current output or pulse/status output) not yet configured in the current Quick Setup is offered for selection after the first cycle.

The "YES" option appears as long as a free output is still available. "NO" is the only option displayed when no further outputs are available.

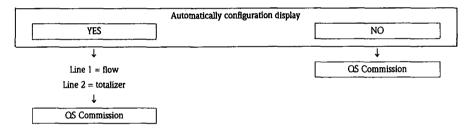


#### Option operation mode (Pulse-/Status output)

The "YES" option appears as long as a free output is still available. "NO" is the only option displayed when no further outputs are available.



#### Automatically configuration display



#### 5.5 Software settings

#### 5.5.1 Device address

Has to be set for measuring devices with the following communication methods:

■PROFIBUS PA: Device address range: 0 to 126, factory setting 126

The device address can be configured via:

- ■Miniature switches → see Hardware settings → 19
- ■Device functions/Operating program FieldCare → see Operating Instructions on the CD-ROM

#### 5.6 Troubleshooting

A complete description of all the error messages is provided in the Operating Instructions on the CD-ROM.

#### Note!

The output signals (e.g. pulse, frequency) of the measuring device must correspond to the higher-order controller.

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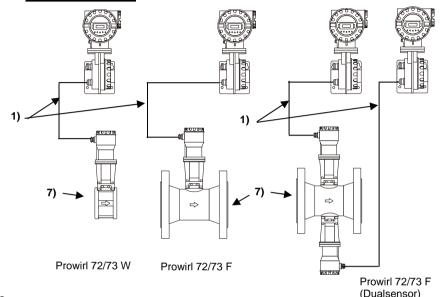
People for Process Automation

\*KA00030D/06/EN/14.11 71154534 FM#SGML 9:0

#### **Hazardous Locations**

Class I Division 1 Groups ABCD or Class I Zone 1 Group IIC Class II Division 1 Groups EFG Class III

#### **Remote version**



#### Sensor:

	Max. medium temperature							
	T6 2)   T5 2)   T4   T3   T2   T1							
Ta = 40°C	80°C	95°C	130°C	190°C	290°C	440°C		
Ta = 60°C		95°C	130°C	190°C	290°C	440°C		
Ta = 85°C			130°C	190°C	290°C	440°C		

PROWIRL 7\*\* \*\*-\*\*0\*\*\*N\*\*\*\*\*, PROWIRL 7\*\* \*\*-\*\*5\*\*\*N\*\*\*\*\*, PROWIRL 7\*\* \*\*-\*\*B\*\*\*N\*\*\*\*\*, PROWIRL 7\*\* \*\*-\*\*G\*\*\*N\*\*\*\*\*;

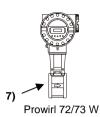
	Max. medium temperature								
	T6 <b>2)</b> T5 <b>2)</b> T4 T3 T2 - T								
Ta = 40°C	80°C	95°C	130°C	190°C	280°C				
Ta = 60°C		95°C	130°C	190°C	280°C				
Ta = 85°C			130°C	190°C	280°C				

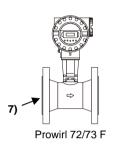
#### Transmitter:

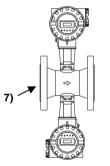
PROWIRL 7\*\* \*\*-\*\*\*\*\*P\*\*\*\*\*:

	T6 <b>2)</b>	T5 <b>2)</b>	T4 - T1
Ta =	40°C	60°C	60°C

#### **Compact version**







Prowirl 72/73 F (Dualsensor)

	Max. medium temperature								
	T6 2) T5 2) T4 T3 T2								
Ta = 40°C	80°C	95°C	130°C	190°C	290°C	440°C			
Ta = 60°C		95°C	130°C	190°C	290°C	440°C			

PROWIRL 7\*\* \*\*-\*\*0\*\*\*N\*\*\*\*\*, PROWIRL 7\*\* \*\*-\*\*5\*\*\*N\*\*\*\*\*, PROWIRL 7\*\* \*\*-\*\*B\*\*\*N\*\*\*\*\*, PROWIRL 7\*\* \*\*-\*\*G\*\*\*N\*\*\*\*\*;

	Max. medium temperature							
	T6 <b>2)</b>	T5 <b>2)</b>	T4	T3	T2 - T1			
Ta = 40°C	80°C	95°C	130°C	190°C	280°C			
Ta = 60°C		95°C	130°C	190°C	280°C			

#### Notes:

1. Applicable Control Drawings

Drawing-No.	Model Codes:
FES0076 B	Prowirl 7** **-*****P****
FES0076-0001 B	Prowirl 7** **-****P****A, Prowirl 7** **-****P****W,
	Prowirl 7** **-*****P****H, Prowirl 7** **-*****P****K

- 2) Max. cable length for intrinsically safe installation of remote sensor is 100m for using cable parameters  $L_{Cable} = 1 mH/km$  and  $C_{Cable} = 1 \mu F/km$
- 3) Temperature class T6 and T5 is not allowed for versions of Profibus PA and Fieldbus Foundation (not for PROWIRL 7\*\* \*\*-\*\*\*\*\*P\*\*\*\*H and PROWIRL 7\*\* \*\*-\*\*\*\*\*P\*\*\*\*K)
- 4) Caution: Use supply wires suitable for 10°C above maximum ambient temperature
- Caution: Surface temperature of transmitter enclosure can exceed 70°C depending on ambient temperature or medium temperature
- 6) Dust tight seals must be used at conduit entries for Class II and III installation
- 7) The Prowirl 72/73 is Factory Sealed. This means that a conduit seal is not required within 18 inches (450mm) of the enclosure.
- 8) Prowirl 72/73 is a Dual Seal device in accordance with ANSI/ISA-12.27.01-2003
- 9) Prowirl 72 and Prowirl 73 transmitter is intended for installation to Service Interface FXA 193 when using the PROLINE EX-ZWEILEITER-KABEL (blue cable)
- 10) Sensor of remote version and interior of measuring tube of remote and compact version are permissible for use in Zone 0

					==0	^~=^			
							Gesehen		
Compact Version, Remote version							Ex-geprüft	03.09.07	BDA
PROWIRL 72,	P	ROWIR	Ľ	.73 (XP-	-version)		Geprüft		
CSA CONTROL DRAWING							Gezeichnet	18.6.03	Bn
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	С		Н		Genehmigung weder vervielfält	igt werden	Ersatz für:		
	В	03.09.07 / BDA	G		Diese Zeichnung darf ohne uns	sere			
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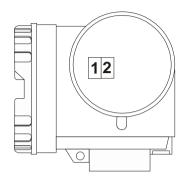


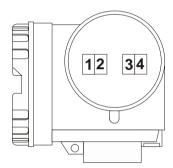
**FES0076 B** 

Flowtec AG, Kaegenstrasse 7, CH-4153 Reinach BL1, Postfach

#### **Hazardous Locations**

Class I Division 1 Groups ABCD or Class I Zone 1 Group IIC Class II Division 1 Groups EFG Class III





#### Prowirl 7\* \*\*-\*\*\*\*\*P\*\*\*\*A

#### **Division 1 and Division 2 installation**

1) Terminal 1 and 2

Supply voltage: U ≤ 36 Vdc  $U_{max} = 250 \text{ Vdc}$ 

Signal current: 4 ... 20 mA (max. 25 mA)

#### Prowirl 7\* \*\*-\*\*\*\*\*P\*\*\*\*H and Prowirl 7\* \*\*-\*\*\*\*\*\*P\*\*\*\*K

## **Division 1 and Division 2 installation**

2) Terminal 1 and 2

Supply voltage: U ≤ 36 Vdc

 $U_{max} = 250 \text{ Vdc}$ 

#### Prowirl 7\* \*\*-\*\*\*\*\*P\*\*\*\*W

#### **Division 1 and Division 2 installation**

3) Terminal 1 and 2

Supply voltage: U ≤ 36 Vdc

 $U_{max} = 250 \text{ Vdc}$ 

Signal current: 4 ... 20 mA (max. 25 mA)

4) Terminal 3 and 4

Pulse Output:  $U \le 30 V$ 

 $U_{max} = 250 \text{ Vdc}$ 

Signal current: ≤ 30 mA

## Class II, III installation

5) Transmitter circuit wiring in conduit in accordance with the Canadian Electrical Code.

#### Notes:

- Installation of transmitter circuit wiring according to Canadian Electrical Code using threaded conduit.
- **WARNING** Terminal compartment: KEEP COVER TIGHT WHEN CIRCUITS ARE ALIVE OR THE AREA IS KNOWN TO BE HAZARDOUS
- Control room equipment may not use or generate over 250Vrms.
- WARNING: SUBSTITUTION OF COMPONENTS MAY IMPAIR INSTRINSIC SAFETY.

Aenderungen:	A B C	10.12.03 / Bn F 03.09.07 / BDA G		Alle gesetzlichen Urheberrecht Diese Zeichnung darf ohne uns Genehmigung weder vervielfält	Mat. Nr.: 71069250  Ersatz für:			
	D E	J K		noch dritten Personen und Kor zugängig gemacht werden.	Ersteller: FES/ File: M:\ZEICH		<b>ID 1113</b> _B_070903.doc	
CSA CONTROL DRAWING PROWIRL 72, PROWIRL 73 (XP-version)						Gezeichnet Geprüft	18.6.03	Bn
·			Ex-geprüft	03.09.07	BDA			
						Gesehen	0004	



FES00/6-0001 B



# **Certificate of Compliance**

**Certificate:** 1355901 (LR 82598) **Master Contract:** 160686

**Project:** 2310054 **Date Issued:** July 30, 2010

**Issued to:** Endress + Hauser Flowtec AG

Kagenstrasse 7

Reinach, Basel Land 4153

**Switzerland** 

**Attention: Daniel Bosshard** 

# The products listed below are eligible to bear the CSA Mark shown



Edward Foo

**Issued by:** Edward Foo, C.E.T.

#### **PRODUCTS**

CLASS 2258 04 - PROCESS CONTROL EQUIPMENT - Intrinsically Safe, Entity - For

**Hazardous Locations** 

#### Class I, Zone 0, Group IIC:

Class I, Division 1, Groups A, B, C and D; Class II, Division 1, Groups E, F and G; Class III; Type 4X:

• PROWIRL 72/73F/W/X\*\*-\*\*\*\*\*N\*\*\*\*\* Flowmeters, supply rated 30Vdc, 50mA (total). Intrinsically Safe with integral or remote sensor, having Entity Parameters, Temperature Codes and Maximum Ambient Temperatures per Control Drawing No. FES0067. Dual Seal Device, MWP 250 bar / 3625 psi max.

Note: "\*" in the Model Number may be any number or letter representing specific options.

CLASS 2258 03 - PROCESS CONTROL EQUIPMENT - Intrinsically Safe and Non- Incendive Systems - For Hazardous Locations

#### Class I, Zone 2, Group IIC:

Class I, Division 2, Groups A, B, C and D; Class II, Division 1, Groups E, F and G; Class III; Type 4X:

• PROWIRL 72/73F/W/X\*\*-\*\*\*\*\*N\*\*\*\*\* Flowmeters, supply rated 30Vdc, 50mA (total). Remote Sensor (where applicable) is Non-Incendive for Division 2 / Zone 2 when connected to the Non-Incendive field

DQD 507 Rev. 2009-09-01 Page: 1



**Certificate:** 1355901 (LR 82598) **Master Contract:** 160686

**Project:** 2310054 **Date Issued:** July 30, 2010

circuit of the transmitter. Temperature Codes and Maximum Ambient Temperatures per Control Drawing No. FES0067. Dual Seal Device, MWP 250 bar / 3625 psi max.

Note: "\*" in the Model Number may be any number or letter representing specific options.

#### Class I, Zone 1, Group IIC:

Class I, Division 1, Groups A, B, C and D; Class II, Division 1, Groups E, F and G; Class III; Type 4X:

• PROWIRL 72/73F/W/X\*\*-\*\*\*\*\*\*P\*\*\*\*\* Flowmeters, supply rated 36Vdc, 1.5W. Explosion-Proof with integral or remote Intrinsically Safe sensor. The measuring tube of the compact sensor and the entire remote sensor are suitable for Zone 0 locations. Temperature Codes and Maximum Ambient Temperatures per Control Drawing No. FES0076. Seal Not Required. Dual Seal Device, MWP 250 bar / 3625 psi max.

Note: "\*" in the Model Number may be any number or letter representing specific specific options.

#### APPLICABLE REQUIREMENTS

CAN/CSA C22.2 No. 0-M91 (R2001) - General Requirements - Canadian Electrical Code, Part II

CSA Std. C22.2 No. 142-M1987 (R2004) - Process Control Equipment

ANSI/ISA-12.27.01-2003 - Requirements for Process Sealing Between Electrical Systems and Flammable or Combustible Process Fluids

CSA Std. C22.2 No. 25-1966 - Enclosures for Use in Class II, Groups E, F and G Hazardous Locations

CSA-C22.2 No. 30-M1986 - Explosion-Proof Enclosures for Use in Class I Hazardous Locations

CAN/CSA-C22.2 No. 94-M91 - Special Purpose Enclosures

CAN/CSA-C22.2 No. 1010.1-92 - Safety Requirements for Electrical Equipment for Measurement, Control, and Laboratory Use, Part 1: General Requirements

CAN/CSA-C22.2 No. 157-92 - Intrinsically Safe and Non-Incendive Equipment for Use in Hazardous Locations

CSA Std. C22.2 No. 213-M1987 - Non-Incendive Electrical Equipment for Use in Class I, Division 2 Hazardous Locations

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# Supplement to Certificate of Compliance

Certificate: 1355901 Master Contract: 160686

The products listed, including the latest revision described below, are eligible to be marked in accordance with the referenced Certificate.

## **Product Certification History**

Project	Date	Description
2310054	July 30, 2010	Update to include alternative display Module SD01, minor report and drawing revisions; and deletion of Class No. 2252 03.
1968417	December 5, 2007	Update to cover Dual Seal markings
1531525	April 13, 2004	Update of Report 160686-1355901 to cover revised Drawings, Legacy File LR 82598

#### **History**

1403955 Oct 10, 2003 Update to cover: 1) New explosion-proof version including addition of Commoduls 330413 and 330415; 2) New model codes; 3) New sensor for high pressure version Prowirl F; 4) Revised drawings; 5) Connection of FXA193 Service Interface.

1355901 Oct 3, 2002 Original Certification.



FM Approvals
1151 Boston Providence Turnpike
P.O. Box 9102 Norwood, MA 02062 USA
T: 781 762 4300 F: 781-762-9375 www.fmapprovals.com

# **CERTIFICATE OF COMPLIANCE**

# HAZARDOUS (CLASSIFIED) LOCATION ELECTRICAL EQUIPMENT

This certificate is issued for the following equipment:

PROWIRL Vortex Flowmeter

PROWIRL 7abcc-defghiklmnop. Vortex Flowmeter.

IS/I,II,III/1/ABCDEFG/T\* – FES0068, FES0068-0001, FES0068-0003, Entity; FES0068-0002, FISCO; Type 4X

I/0/AEx ia/IIC/T\* – FES0068, FES0068-0001, FES0068-0003, Entity; FES0068-0002,

FISCO; Type 4X

NI/I/2/ABCD/T\* – FES0068-0004; Type 4X NI/I/2/IIC/T\* – FES0068-0004; Type 4X

DIP/II,III/1/EFG/T\*; Type 4X

#### **Entity Parameters:**

I/O option A (4-20mA, HART Pülse, Entity) or W (4-20mA, HART, Entity):
Terminals 1 and 2: Vmax = 30 V, Imax = 300 mA, Pi = 1 W, Ci = 5.3 nF, Li = 0 μH
Terminals 3 and 4: Vmax = 30 V, Imax = 300 mA, Pi = 1 W, Ci = 0 nF, Li = 0 μH

I/O Option H (Profibus PA, FISCO) or K (Foundation Fieldbus, FISCO): Vmax = 17.5 V, Imax = 500 mA, Pi = 5.5 W, Ci = 5 nF, Li = 10 µH

I/O Option H (Profibus PA, Entity) or K (Foundation Fieldbus, Entity): Vmax = 17.5 V, Imax = 500 mA, Pi = 5.5 W, Ci = 5 nF, Li = 10  $\mu$ H or Vmax = 24 V, Imax = 250 mA, Pi = 1.2 W, Ci = 5 nF, Li = 10  $\mu$ H

a = Type of electronic: 2 or 3.

b = Type of sensor: F, W or X.

cc = Size: any double number or letter.

d = Material: any single number or letter.

e = Process connection: any single number or letter.

3015769 Page 1 of 4



f = Sensor: 0, 1, 2, 3, 4, 5, 6, 7, B, C, F, G, H, or X.

g = Sealing of sensor: any single number or letter.

h = Calibration: any single number or letter.

i = Certificates: any single number or letter.

k = Approvals: N.

I = Version: A, E, F, J, K or L.

m = Cable gland: any single number or letter.

n = Display: any single number or letter.

o = Software: any single number or letter.

p = I/O's: A, H, K, W or X.

#### Special conditions of use:

1. For installation instructions and the Temperature Class (\*) which applies to specific models, ambient temperatures (Ta), and process medium temperatures (Tmed), refer to Control Drawing FES0068.

#### II. PROWIRL Vortex Flowmeter

#### PROWIRL 7abcc-defghiklmnop

XP-AIS-DIP/I,II,III/1/ABCDEFG/T\* - FES0077, FES0077-0001; Type 4X XP-AIS/I/1/IIC/T\* - FES0077, FES0077-0001; Type 4X

a = Type of electronic: 2 or 3.

b = Type of sensor: F, W or X.

cc = Size: any double number or letter.

d = Material: any single number or letter.

e = Process connection: any single number or letter.

f = Sensor: 0, 1, 2, 3, 4, 5, 6, 7, B, C, F, G, H, or X.

g = Sealing of sensor: any single number or letter.

h = Calibration: any single number or letter.

i = Certificates: any single number or letter.

k = Approvals: P.

I = Version: A, E, F, J, K or L.

m = Cable gland: B.

n = Display: any single number or letter.

o = Software: any single number or letter.

p = I/O's: A, H, K, W or X.

#### Special conditions of use:

1. For installation instructions and the Temperature Class (\*) which applies to specific models, ambient temperatures (Ta), and process medium temperatures (Tmed), refer to Control Drawing FES0077.



## **Equipment Ratings:**

#### Compact and Remote Versions

Intrinsically Safe for use in Class I, II & III, Division 1, Groups A, B, C, D, E, F & G; Class I, Zone 0, AEx ia IIC in accordance with Entity requirements when installed per FM Control Drawings FES0068, FES0068-0001, FES0068-0003, FES0068-0004 or in accordance with FISCO requirements when installed per FM Control Drawing FES0068-0002; Nonincendive for use in Class I, Division 2, Groups A, B, C & D, and Class I, Zone 2, Group IIC; Dust-Ignitionproof for use in Class II & III Division 1, Groups E, F & G Hazardous (Classified) indoor/outdoor (Type 4X) Locations

#### II. Compact and Remote Versions

Explosionproof Apparatus with Intrinsically Safe electronic compartment for Class I, Division 1, Groups A, B, C & D, when installed per FM Control Drawings FES0077 and FES0077-0001; Dust-Ignitionproof for Class II & III, Division 1, Groups E, F & G Hazardous (Classified) indoor/outdoor (Type 4X & IP67) Locations

FM Approved for:

Endress + Hauser Flowtec AG Kaegenstrasse 7 CH-4153 Reinach Switzerland

41.67.

10013.83



This certifies that the equipment described has been found to comply with the following Approval Standards and other documents:

Class 3600	1998
Class 3610	2010
Class 3611	2004
Class 3615	2006
Class 3810	2005
ANSI/ISA-82.02.01	2004
NEMA 250	1991

Original Project ID: 3015769

Approval Granted: December 5, 2002

Subsequent Revision Reports / Date Approval Amended

ı	Report Number	Date	Report Number	Date
3	3017442	May 1, 2003		
3	3018695	November 24, 2003		
	3020410	June 3, 2004		
•	100406	July 28, 2010		
•	100805	September 9 2	DID	

FM Approvals LLC

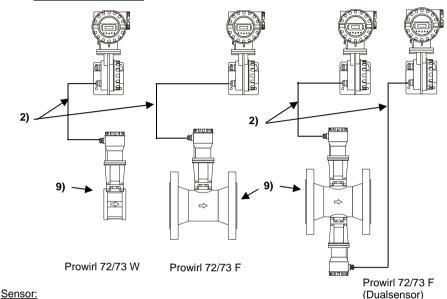
J. E. Marquedant Group Manager, Electrical

9 September 2010

#### **Hazardous Locations**

Class I Division 1 Groups ABCD or Class I Zone 1 Group IIC Class II Division 1 Groups EFG Class III

#### **Remote version**



PROWIRL 7\*\* \*\*-\*\*1\*\*\*N\*\*\*\*\*, PROWIRL 7\*\* \*\*-\*\*2\*\*\*N\*\*\*\*\*, PROWIRL 7\*\* \*\*-\*\*3\*\*\*N\*\*\*\*\*, PROWIRL 7\*\* \*\*-\*\*4\*\*\*N\*\*\*\*\*, PROWIRL 7\*\* \*\*-\*\*7\*\*\*N\*\*\*\*\*, PROWIRL 7\*\* \*\*-\*\*7\*\*\*N\*\*\*\*\*, PROWIRL 7\*\* \*\*-\*\*C\*\*\*N\*\*\*\*\*, PROWIRL 7\*\* \*\*-\*\*C\*\*\*N\*\*\*\*\*, PROWIRL 7\*\* \*\*-\*\*F\*\*\*N\*\*\*\*\*, PROWIRL 7\*\* \*\*-\*\*H\*\*\*N\*\*\*\*\*\*

Max. medium temperature T6 2) T5 2) T4 Т3 T1 374°F 176°F 203°F 266°F 554°F 824°F Ta = 104°FTa = 140°F 203°F 266°F 374°F 554°F 824°F Ta = 185°F266°F 374°F 554°F 824°F

PROWIRL 7\*\* \*\*\_\*\*0\*\*\*P\*\*\*\*\*, PROWIRL 7\*\* \*\*\_\*\*5\*\*\*P\*\*\*\*\*, PROWIRL 7\*\* \*\*\_\*\*B\*\*\*P\*\*\*\*\*, PROWIRL 7\*\* \*\*\_\*\*G\*\*\*P\*\*\*\*\*;

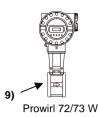
	Max. medium temperature								
	T6 2) T5 2) T4 T3 T								
Ta = 104°F	176°F	203°F	266°F	374°F	536°F				
Ta = 140°F		203°F	266°F	374°F	536°F				
Ta = 185°F			266°F	374°F	536°F				

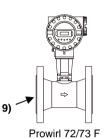
#### Transmitter:

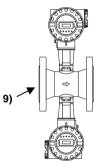
PROWIRL 7\*\* \*\*-\*\*\*\*\*P\*\*\*\*\*:

	T6 <b>2)</b>	T5 <b>2)</b>	T4 - T1
Ta =	104°F	140°F	140°F

#### **Compact version**







Prowirl 72/73 F (Dualsensor)

PROWIRL 7\*\* \*\*-\*\*1\*\*\*N\*\*\*\*\*, PROWIRL 7\*\* \*\*-\*\*2\*\*\*N\*\*\*\*\*, PROWIRL 7\*\* \*\*-\*\*3\*\*\*N\*\*\*\*\*, PROWIRL 7\*\* \*\*-\*\*4\*\*\*N\*\*\*\*\*, PROWIRL 7\*\* \*\*-\*\*6\*\*\*N\*\*\*\*\*, PROWIRL 7\*\* \*\*-\*\*7\*\*\*N\*\*\*\*\*, PROWIRL 7\*\* \*\*-\*\*C\*\*\*N\*\*\*\*\*, PROWIRL 7\*\* \*\*-\*\*F\*\*\*N\*\*\*\*\*\*, PROWIRL 7\*\* \*\*-\*\*H\*\*\*N\*\*\*\*\*\*

	Max. medium temperature						
	T6 <b>2)</b>	T5 <b>2)</b>	T4	T3	T2	T1	
Ta = 104°F	176°F	203°F	266°F	374°F	554°F	824°F	
Ta = 140°F		203°F	266°F	374°F	554°F	824°F	

PROWIRL 7\*\* \*\*-\*\*0\*\*\*P\*\*\*\*\*, PROWIRL 7\*\* \*\*-\*\*5\*\*\*P\*\*\*\*\*, PROWIRL 7\*\* \*\*-\*\*B\*\*\*P\*\*\*\*\*
PROWIRL 7\*\* \*\*-\*\*G\*\*\*P\*\*\*\*\*:

	Max. medium temperature						
	T6 <b>2)</b>	T5 <b>2)</b>	T4	T3	T2		
Ta = 104°F	176°F	203°F	266°F	374°F	536°F		
Ta = 140°F		203°F	266°F	374°F	536°F		

#### Notes:

1) Assignment of Control Drawings:

Drawing-No.	Model Codes:
FES0077 A	Prowirl 7** **-*****P****
FES0077-0001 A	Prowirl 7** **-****P****A, Prowirl 7** **-*****P****W,
	Prowirl 7** **-****P****H, Prowirl 7** **-*****P****K

- 2) Max. cable length for intrinsically safe installation 100m for using cable parameters  $L_{\text{Cable}} = 1 \text{mH/km} / 0.3 \mu \text{H/ft}$  and  $C_{\text{Cable}} = 1 \mu \text{F/km} / 300 \mu \text{F/ft}$
- 3) Temperature class T6 and T5 is not allowed for versions of Profibus PA and Fieldbus Foundation (not for PROWIRL 7\*\* \*\*-\*\*\*\*\*P\*\*\*\*\*H and PROWIRL 7\*\* \*\*-\*\*\*\*\*P\*\*\*\*K)
- Caution: Use supply wires suitable for 50°F above maximum ambient temperature
- 5) Caution: Surface temperature of transmitter enclosure can exceed 158°F depending on ambient temperature or medium temperature
- Dust tight seals must be used at conduit entries for Class II and III installation

  6) The Provid 72/73 is Factory Sealed. This means that a conduit seal is not required.
- 6) The Prowirl 72/73 is Factory Sealed. This means that a conduit seal is not required within 18 inches (450mm) of the enclosure.
- 7) The Prowirl 72/73 is a Dual Seal Device in accordance to ANSI/ISA-12.27.01-2003
- 8) Prowirl 72 and Prowirl 73 transmitter is intended for installation to Service Interface FXA 193 when using the PROLINE EX-ZWEILEITER-KABEL (blue cable)
- 9) Sensor of remote version and interior of measuring tube of remote and compact versions are permissible for use in Zone 0

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FM CONTROL [	)R	AWING	;			Massstab	Gezeichnet	08.09.03	Bn
PROWIRL 72, P	PROWIRL 72, PROWIRL 73 (XP-version)						Geprüft		
Compact Version, Remote version							Ex-geprüft	10.12.03	Bn
							Gesehen		
								·	



Aenderungen

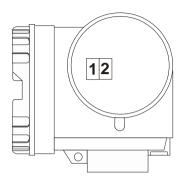
| FES0077 A

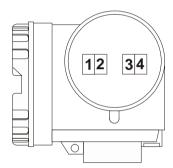
Flowtec AG, Kaegenstrasse 7, CH-4153 Reinach BL1, Postfach

A 10.12.03 / Bn F

#### **Hazardous Locations**

Class I Division 1 Groups ABCD or Class I Zone 1 Group IIC Class II Division 1 Groups EFG Class III





#### Prowirl 7\* \*\*-\*\*\*\*\*P\*\*\*\*A

#### **Division 1 and Division 2 installation**

1) Terminal 1 and 2

Supply voltage: U ≤ 36 Vdc

 $U_{max} = 250 \text{ Vdc}$ 

Signal current: 4 ... 20 mA (max. 25 mA)

#### Prowirl 7\* \*\*-\*\*\*\*\*P\*\*\*\*H and Prowirl 7\* \*\*-\*\*\*\*\*\*P\*\*\*\*K

## **Division 1 and Division 2 installation**

2) Terminal 1 and 2

Supply voltage: U ≤ 36 Vdc

 $U_{max} = 250 \text{ Vdc}$ 

#### Prowirl 7\* \*\*-\*\*\*\*\*P\*\*\*\*W

#### **Division 1 and Division 2 installation**

3) Terminal 1 and 2

Supply voltage: U ≤ 36 Vdc

 $U_{max} = 250 \text{ Vdc}$ 

Signal current: 4 ... 20 mA (max. 25 mA)

4) Terminal 3 and 4

Pulse Output:  $U \le 30 V$ 

 $U_{max} = 250 \text{ Vdc}$ 

Signal current: ≤ 30 mA

## Class II, III installation

5) Transmitter circuit wiring in conduit in accordance with the NEC ANSI/NFPA 70

#### Note:

- Installation of transmitter circuit wiring according to National Electrical Code using threaded conduit.
- **WARNING** Terminal compartment:

KEEP COVER TIGHT WHEN CIRCUITS ARE ALIVE OR THE AREA IS KNOWN TO BE HAZARDOUS

- 8) Control room equipment may not use or generate over 250Vrms.
- 9) WARNING: SUBSTITUTION OF COMPONENTS MAY IMPAIR INSTRINSIC SAFETY.

FM CONTROL DRAWING PROWIRL 72, PROWIRL 73 (XP-version)						Massstab	Gezeichnet Geprüft Ex-geprüft	08.09.03	Bn
							Gesehen	10.12.03	Bn



FES0077-0001 A

















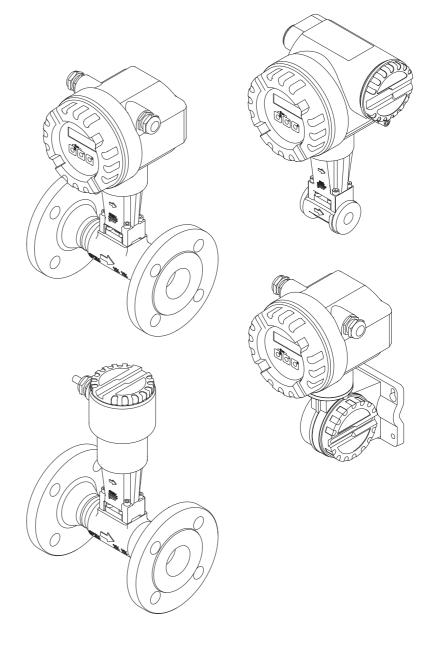


# Operating Instructions

# Proline Prowirl 72 HART

Vortex flow measuring system





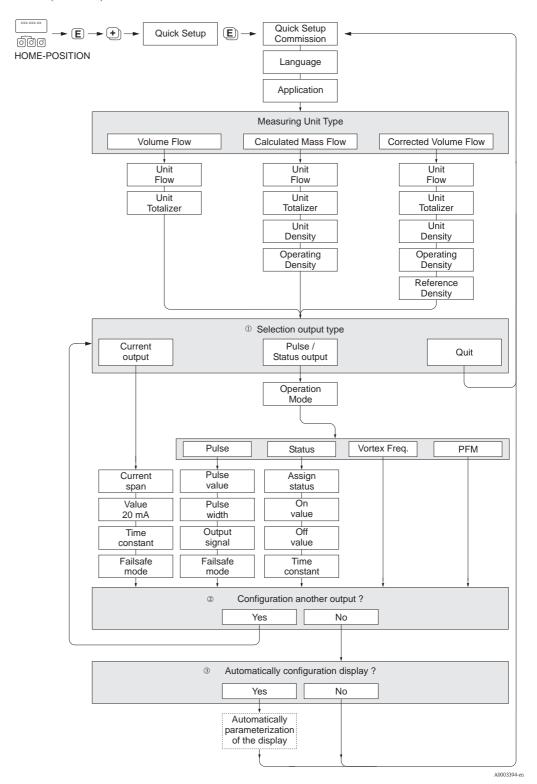


# **QUICK SETUP** for rapid commissioning



Note!

More detailed information on running Quick Setup menus can be found in the "Commissioning" section ( $\rightarrow \stackrel{\triangle}{=} 39$ ).



- Note!

  The individual functions are described in the "Description of Device Functions" section ( $\rightarrow$   $\stackrel{\square}{=}$  75). ■ The display returns to the QUICK SETUP COMMISSIONING cell (→ 🖹 82) if you press the 🖹 key combination (Esc) during parameter interrogation.
- ① Only the output (current output or pulse/status output) not yet configured in the current Quick Setup is offered for selection after the first cycle.
- ② The "YES" option appears as long as a free output is available. "NO" is displayed when no further outputs are available.
- ③ When "YES" is selected, the flow is assigned to line 1 of the local display and the totalizer to line 2.

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Proline Prowirl 72 Safety instructions

# 1 Safety instructions

# 1.1 Designated use

The measuring system is used to measure the volume flow of saturated steam, superheated steam, gases and liquids. If the process pressure and process temperature are constant, the measuring device can also output the flow as a calculated mass flow or corrected volume flow.

In the event of incorrect use or use other than that designated, the operational safety of the measuring devices can be suspended. The manufacturer accepts no liability for damage arising as a result.

# 1.2 Installation, commissioning and operation

Note the following points:

- Assembly, electrical installation, commissioning and maintenance of the device must be carried out by trained, qualified specialists authorized to perform such work by the facility's owneroperator. The specialist must have read and understood these Operating Instructions and must follow the instructions they contain.
- The device must be operated by persons authorized and trained by the facility's owner-operator. Strict compliance with the instructions in these Operating Instructions is mandatory.
- In the case of special fluids (incl. fluids for cleaning), Endress+Hauser will be happy to assist in clarifying the corrosion resistance properties of wetted materials. However, small changes in temperature, concentration or the degree of contamination in the process can result in changes to the corrosion resistance properties. Unsuitable material can lead to leakage of corrosive process media and injure personnel and/or cause damage in the plant. Therefore, Endress+Hauser cannot guarantee or accept liability for the corrosion resistance properties of wetted materials in a specific application. The user is responsible for choosing suitable wetted materials in the process.
- If carrying out welding work on the piping, the welding unit may not be grounded by means of the measuring device.
- The installer must ensure that the measuring system is correctly wired in accordance with the wiring diagrams.
- Always observe the regulations applicable in your country governing the operation, maintenance and repair of electrical devices. Special instructions relating to the device can be found in the relevant sections of this documentation.

# 1.3 Operational safety

Note the following points:

- Measuring systems for use in hazardous environments are accompanied by separate "Ex documentation", which is an integral part of these Operating Instructions. Strict compliance with the installation instructions and ratings as stated in this supplementary documentation is mandatory.
  - The symbol on the front of the Ex documentation indicates the approval and the certification center (a Europe, a USA, a Canada).
- The measuring system complies with the general safety requirements in accordance with EN 61010-1 and the EMC requirements of IEC/EN 61326 and NAMUR Recommendations NE 21, NE 43 and NE 53.
- For measuring systems used in SIL 2 applications, the separate manual on functional safety must be observed.
- The manufacturer reserves the right to modify technical data without prior notice. Your Endress+Hauser distributor will supply you with current information and updates to these Operating Instructions.

Safety instructions Proline Prowirl 72

#### 1.4 Return

The following procedures must be carried out before a flowmeter requiring repair or calibration, for example, is returned to Endress+Hauser:

- Always enclose a fully completed "Declaration of Contamination" form with the device. Only then can Endress+Hauser transport, examine and repair a returned device.
- Enclose special handling instructions if necessary, for example a safety data sheet as per Regulation (EC) No 1907/2006 REACH.
- Remove all fluid residues. Pay special attention to the grooves for seals and crevices which could contain residues.

This is particularly important if the fluid is hazardous to health, e.g. flammable, toxic, caustic, carcinogenic.



#### Note!

You will find a master copy of the "Declaration of Contamination" form at the back of this manual.



#### Warning!

- Do not return a measuring device if you are not absolutely certain that all traces of hazardous substances have been removed, e.g. substances which have penetrated crevices or diffused through plastic.
- Costs incurred for waste disposal and injury (caustic burns, etc.) due to inadequate cleaning will be charged to the owner-operator.

# 1.5 Notes on safety conventions and icons

The devices are designed to meet state-of-the-art safety requirements, have been tested, and left the factory in a condition in which they are safe to operate. The devices comply with the applicable standards and regulations in accordance with EN 61010-1 "Safety requirements for electrical equipment for measurement, control and laboratory use". The devices can, however, be a source of danger if used incorrectly or for anything other than their designated use.

Consequently, always pay particular attention to the safety instructions indicated in these Operating Instructions by the following symbols:



#### Warning

"Warning" indicates an action or procedure which, if not performed correctly, can result in injury or a safety hazard. Comply strictly with the instructions and proceed with care.



#### Caution!

"Caution" indicates an action or procedure which, if not performed correctly, can result in the incorrect operation or destruction of the device. Comply strictly with the instructions.



#### Note!

"Note" indicates an action or procedure which, if not performed correctly, can have an indirect effect on operation or trigger an unexpected response on the part of the device.

Proline Prowirl 72 Identification

# 2 Identification

# 2.1 Device designation

The "Proline Prowirl 72" flow measuring system consists of the following components:

- Proline Prowirl 72 transmitter
- Prowirl F or Prowirl W sensor

Two versions are available:

- Compact version: transmitter and sensor form a single mechanical unit.
- *Remote version*: sensor is mounted separate from the transmitter.

## 2.1.1 Nameplate of the transmitter and sensor

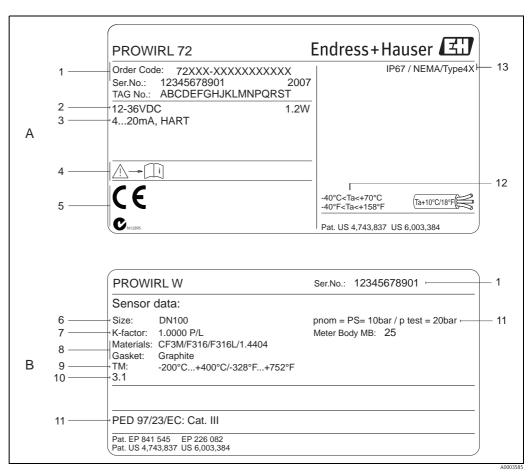


Fig. 1: Nameplate specifications for transmitter and sensor (example)  $A = nameplate \ on \ transmitter, \ B = nameplate \ on \ sensor \ (only \ compact \ version)$ 

- 1 Order code/serial number: see the specifications on the order confirmation for the meanings of the individual letters and digits
- 2 Power supply: 12 to 36 V DC, power consumption: 1.2 W
- 3 Available outputs: Current output 4 to 20 mA
- 4 Observe device documentation
- 5 Reserved for certificates, approvals and additional information on the device version
- 6 Nominal diameter
- 7 Calibration factor
- 8 Material of measuring tube and seal
- 9 Fluid temperature range
- 10 Reserved for information on special products
- 11 Data regarding Pressure Equipment Directive (optional)
- 12 Permitted ambient temperature range
- 13 Degree of protection

Identification Proline Prowirl 72

## 2.1.2 Sensor nameplate (remote)

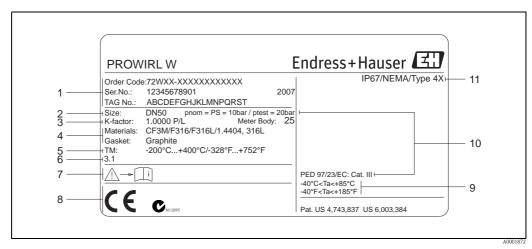


Fig. 2: Nameplate specifications for remote sensor version (example)

- 1 Order code/serial number: see the specifications on the order confirmation for the meanings of the individual letters and digits.
- 2 Nominal diameter
- 3 Calibration factor
- 4 Material of measuring tube and seal
- 5 Fluid temperature range
- 6 Reserved for information on special products
- 7 Observe device documentation
- 8 Reserved for certificates, approvals and additional information on the device version
- 9 Permitted ambient temperature range
- 10 Data regarding Pressure Equipment Directive (optional)
- 11 Degree of protection

## 2.1.3 Service nameplate

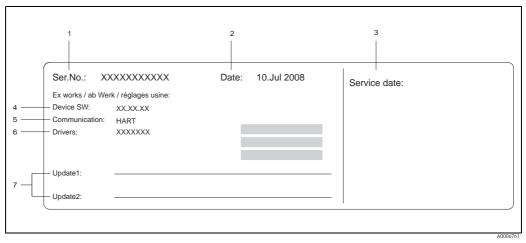


Fig. 3: Service nameplate specifications for transmitter (example)

- 1 Serial number
- 2 Date of manufacturing
- 3 Service date
- 4 Device software
- 5 Type of device communication (e.g. HART)
- 6 Version of device software currently installed
- 7 Space for update entries

Proline Prowirl 72 Identification

# 2.2 Certificates and approvals

The devices are designed in accordance with good engineering practice to meet state-of-the-art safety requirements, have been tested, and left the factory in a condition in which they are safe to operate. The devices comply with the applicable standards and regulations in accordance with EN 61010-1"Safety requirements for electrical equipment for measurement, control and laboratory use" and the EMC requirements as per IEC/EN 61326.

The measuring system described in these Operating Instructions thus complies with the statutory requirements of the EC Directives. Endress+Hauser confirms successful testing of the device by affixing to it the CE mark and issuing the CE Declaration of Conformity.

The measuring system meets the EMC requirements of the "Australian Communications and Media Authority (ACMA)".

# 2.3 Registered trademarks

**GYLON®** 

Registered trademark of Garlock Sealing Technologies, Palmyar, NY, USA

**HART®** 

Registered trademark of the HART Communication Foundation, Austin, USA

INCONEL®

Registered trademark of Inco Alloys International Inc., Huntington, USA

KALREZ® and VITON®

Registered trademarks of E.I. Du Pont de Nemours & Co., Wilmington, USA

Applicator<sup>®</sup>, FieldCare<sup>®</sup>, Fieldcheck<sup>®</sup>, Field Xpert<sup>TM</sup>

Registered or registration-pending trademarks of Endress+Hauser Flowtec AG, Reinach, CH

Installation Proline Prowirl 72

# 3 Installation

# 3.1 Incoming acceptance, transport, storage

#### 3.1.1 Incoming acceptance

On receipt of the goods, check the following points:

- Check the packaging and the contents for damage.
- Check the shipment, make sure nothing is missing and that the scope of supply matches your order.

## 3.1.2 Transport

Please note the following when unpacking or transporting to the measuring point:

- The devices must be transported in the container supplied.
- Devices with nominal diameters DN 40 to 300 ( $1\frac{1}{2}$  to 12") may not be lifted at the transmitter housing or at the connection housing of the remote version when transporting ( $\rightarrow \square 4$ ). Use carrier slings when transporting and put the slings around both process connections. Avoid chains as these could damage the housing.



#### Warning!

Risk of injury if the measuring device slips.

The center of gravity of the entire measuring device might be higher than the points around which the slings are slung.

Therefore, when transporting, make sure that the device does not unintentionally turn or slip.

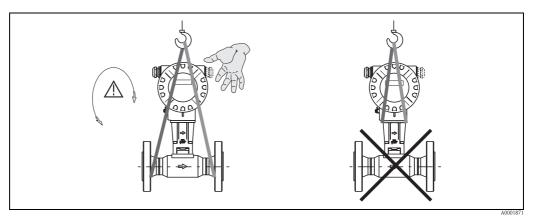


Fig. 4: Instructions for transporting sensors with DN 40 to 300 (11/2 to 12")

3.1.3 Storage

Note the following points:

- Pack the measuring device in such a way as to protect it reliably against impact for storage (and transportation). The original packaging provides optimum protection.
- The permissible storage temperature is:
  - Standard: -40 to +80 °C (-40 to +176 °F)
  - ATEX II 1/2 GD version/dust ignition-proof: –20 to +55 °C (–4 to +131 °F)
- Protect the measuring device against direct sunlight during storage in order to avoid unacceptably high surface temperatures.

Proline Prowirl 72 Installation

## 3.2 Installation conditions

Note the following points:

■ The measuring device requires a fully developed flow profile as a prerequisite for correct volume flow measurement. The inlet and outlet runs therefore have to be taken into account  $(\rightarrow \stackrel{\triangle}{=} 16)$ .

- The maximum permitted ambient temperatures ( $\rightarrow$   $\stackrel{ }{=}$  63) and fluid temperatures ( $\rightarrow$   $\stackrel{ }{=}$  64) must be observed.
- Pay particular attention to the notes on orientation and piping insulation ( $\rightarrow \stackrel{\triangle}{=} 14$ ).
- Verify that the correct nominal diameter and pipe standard (DIN/JIS/ANSI) were taken into account when ordering since the calibration of the device and the achievable accuracy depend on these factors. If the mating pipe and the device have different nominal diameters/pipe standards, an inlet correction can be made via the device software by entering the actual pipe diameter (→ 🖹 104, MATING PIPE DIAMETER function).
- $\blacksquare$  The correct operation of the measuring system is not influenced by plant vibrations up to 1 g, 10 to 500 Hz.
- For mechanical reasons, and in order to protect the piping, it is advisable to support heavy sensors.

#### 3.2.1 Dimensions

All the dimensions and lengths of the sensor and transmitter are provided in the separate "Technical Information" document.

#### 3.2.2 Installation location

We recommend you observe the following dimensions to guarantee problem-free access to the device for service purposes:

- Minimum spacing (A) in all directions = 100 mm (3.94 in)
- Necessary cable length (L): L + 150 mm (5.91 in)

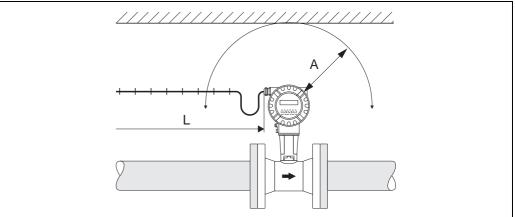


Fig. 5: Minimum spacing

A Minimum spacing in all directions

L Cable length

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Installation Proline Prowirl 72

## 3.2.3 Orientation

Make sure that the direction of the arrow on the nameplate of the sensor matches the direction of flow (direction in which the fluid flows through the pipe).

The device can basically be installed in any orientation. However, note the following points:

Orientation	instance in any orientation	High fluid temperature (TM) ≥ 200 °C (392 °F)	Low fluid temperature (TM)
Fig. A: Vertical orientation	A0009522	Recommended (①)	Recommended (①)
Fig. B: Horizontal orientation Transmitter head up	A0009523	Not permitted for Prowirl 72W DN 100 (4") / DN 150 (6") (②)	Recommended
Fig. C: Horizontal orientation Transmitter head down	A0009524	Recommended (④)	
Fig. D: Horizontal orientation Transmitter head at front with display pointing downwards	A0009525	Recommended (④)	Recommended (③)

Proline Prowirl 72 Installation

① In the case of liquids, there should be upward flow in vertical pipes to avoid partial pipe filling (Fig. A).

Caution!

Disruption in flow measurement!

In case of vertical orientation and downward flowing liquid, the piping has always to be completely filled.

② ( Caution!

Danger of electronics overheating!

If fluid temperature is  $\geq$  200 °C (392 °F), orientation B is not permitted for the wafer version (Prowirl 72W) with nominal diameters DN 100 (4") and DN 150 (6").

In order to make sure that the maximum ambient temperature ( $\rightarrow \triangleq$  63) is not exceeded, we recommend the following orientations:

- ③ In the case of hot fluids (e.g. steam or fluid temperature (TM)  $\geq$  200 °C (392 °F)): orientation C or D
- ④ In the case of very cold fluids (e.g. liquid nitrogen): orientation B or D

#### 3.2.4 Heat insulation

Some fluids require suitable measures to avoid heat transfer at the sensor. A wide range of materials can be used to provide the required insulation.

When insulating, please ensure that a sufficiently large area of the housing support is exposed. The uncovered part serves as a radiator and protects the electronics from overheating (or undercooling). The maximum insulation height permitted is illustrated in the diagrams. These apply equally to both the compact version and the sensor in the remote version.

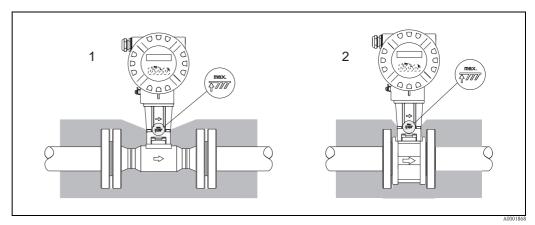


Fig. 6:  $1 = Flanged \ version, 2 = Wafer \ version$ 

( | |

#### Caution!

Danger of electronics overheating!

- Always keep the adapter between the sensor/transmitter and the connection housing of the remote version free of insulating material.
- Note that a certain orientation might be required, depending on the fluid temperature ( $\rightarrow = 14$ ).
- Observe information on the permissible temperature ranges ( $\rightarrow \stackrel{\triangleright}{=} 63$ ).

Installation Proline Prowirl 72

#### 3.2.5 Inlet and outlet run

As a minimum, the inlet and outlet runs shown below must be observed to achieve the specified accuracy of the device. The longest inlet run shown must be observed if two or more flow disturbances are present.

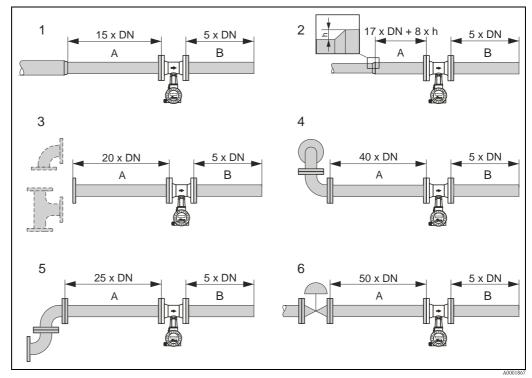


Fig. 7: Minimum inlet and outlet runs with various flow obstructions

- A Inlet run
- B Outlet run
- h Difference in expansion
- 1 Reduction
- 2 Extension
- 3 90° elbow or T-section
- 4 2 × 90° elbow 3-dimensional
- 5  $2 \times 90^{\circ}$  elbow
- 6 Control valve



#### Note!

A specially designed perforated plate flow conditioner can be installed if it is not possible to observe the inlet runs required ( $\rightarrow \stackrel{\triangle}{=} 17$ ).

#### Outlet runs with pressure and temperature measuring points

If pressure and temperature measuring points are installed after the device, please ensure there is a large enough distance between the device and the measuring point so there are no negative effects on vortex formation in the sensor.

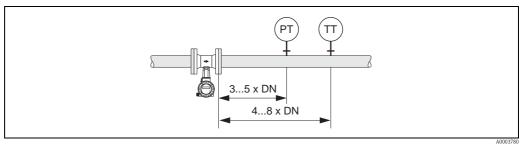


Fig. 8: Installation of pressure measuring point (PT) and temperature measuring point (TT)

Proline Prowirl 72 Installation

#### Perforated plate flow conditioner

A specially designed perforated plate flow conditioner, available from Endress+Hauser, can be installed if it is not possible to observe the inlet runs required. The flow conditioner is fitted between two piping flanges and centered with mounting bolts. Generally, this reduces the inlet run required to  $10 \times DN$  with complete accuracy.

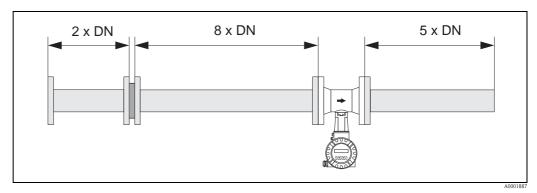


Fig. 9: Perforated plate flow conditioner

Calculation examples (SI units) for the pressure loss of flow conditioners:

The pressure loss for flow conditioners is calculated as follows:  $\Delta p \ [mbar] = 0.0085 \cdot \rho \ [kg/m^3] \cdot v^2 \ [m/s]$ 

```
■ Example with steam p=10 bar abs t=240 °C \rightarrow \rho=4.39 kg/m³ v=40 m/s \Delta p=0.0085 \cdot 4.39 \cdot 40^2=59.7 mbar
```

$$\begin{split} & \quad \textbf{Example with $H_2O$ condensate (80 °C)} \\ & \quad \rho = 965 \text{ kg/m}^3 \\ & \quad v = 2.5 \text{ m/s} \\ & \quad \Delta p = 0.0085 \cdot 965 \cdot 2.5^2 = 51.3 \text{ mbar} \end{split}$$

 $\rho$  : density of the process medium v : average flow velocity

## 3.2.6 Vibrations

The correct operation of the measuring system is not influenced by plant vibrations up to 1 g, 10 to 500 Hz. Consequently, the sensors require no special measures for attachment.

## 3.2.7 Limiting flow

Information on limiting flow is provided under the "Measuring range" ( $\rightarrow$   $\stackrel{ }{=}$  59) and "Limiting flow" ( $\rightarrow$   $\stackrel{ }{=}$  66) sections in the Technical Data chapter.

Installation Proline Prowirl 72

## 3.3 Installation

## 3.3.1 Mounting the sensor



Caution!

Please note the following prior to mounting:

- Prior to installing the measuring device in the piping, remove all traces of transport packaging and any protective covers from the sensor.
- Make sure that the internal diameters of seals are the same as, or greater than, those of the measuring pipe and piping. Seals projecting into the flow current have a negative effect on the vortex formation after the bluff body and cause inaccurate measurement. The seals provided by Endress+Hauser for the wafer version have therefore an inner diameter with a bigger inner diameter than the piping.
- Ensure that the arrow on the measuring pipe matches the direction of flow in the piping.
- Lengths:
  - Prowirl W (wafer version): 65 mm (2.56 in)
  - Prowirl F (flanged version)  $\rightarrow$  See Technical Information TI00070D/06/EN.

#### Mounting Prowirl W

The centering rings supplied are used to mount and center the wafer-style devices. A mounting kit consisting of tie rods, seals, nuts and washers can be ordered separately.

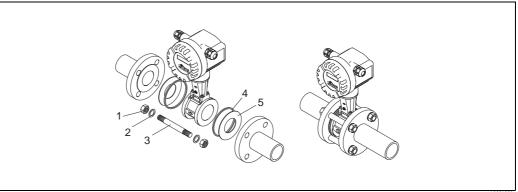


Fig. 10: Mounting the wafer version

- 1 Nut
- 2 Washer
- 3 Tie rod
- 4 Centering ring (is supplied with the device)
- 5 Seal

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Proline Prowirl 72 Installation

## 3.3.2 Rotating the transmitter housing

The electronics housing can be rotated continuously 360° on the housing support.

- 1. Release the lock screw.
- 2. Turn the transmitter housing to the desired position (max. 180° in each direction to the stop).



There are recesses in the rotating groove at  $90^{\circ}$  stages (only compact version). These help you align the transmitter easier.

3. Tighten the safety screw.

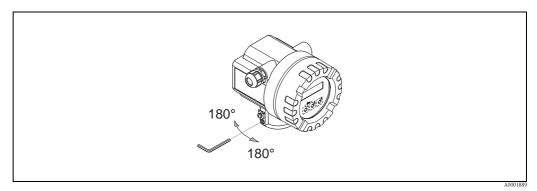


Fig. 11: Rotating the transmitter housing

## 3.3.3 Rotating the local display

- 1. Unscrew the cover of the electronics compartment from the transmitter housing.
- 2. Remove the display module from the transmitter retainer rails.
- 3. Turn the display to the desired position (max.  $4 \times 45^{\circ}$  in each direction) and reset it onto the retaining rails.
- 4. Screw the cover of the electronics compartment firmly back onto the transmitter housing.

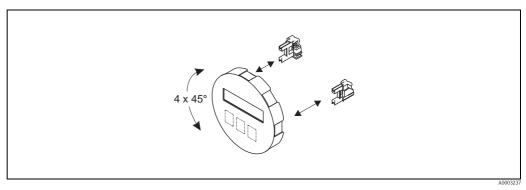


Fig. 12: Rotating the local display

Installation Proline Prowirl 72

## 3.3.4 Mounting the transmitter (remote)

The transmitter can be mounted in the following ways:

- Wall mounting
- Pipe mounting (with separate mounting kit, accessories  $\rightarrow \stackrel{\triangle}{=} 44$ )

The transmitter and the sensor must be mounted separate in the following circumstances:

- Poor accessibility,
- lack of space,
- extreme ambient temperatures.



#### Caution!

Danger of electronics overheating!

If the device is mounted to warm piping, make certain that the housing temperature does not exceed the max. permissible temperature value.

- Standard: -40 to +80 °C (-40 to +176 °F)
- EEx-d version: -40 to +60 °C (-40 to +140 °F)
- ATEX II 1/2 GD version/dust ignition-proof: -20 to +55 °C (-4 to +131 °F)

Mount the transmitter as illustrated in the diagram.

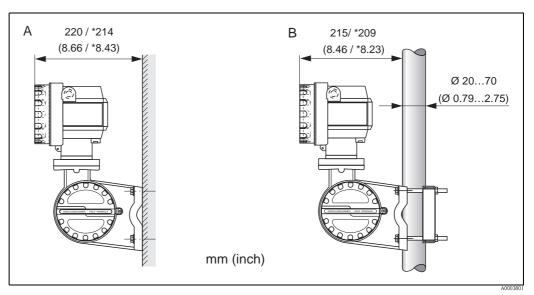


Fig. 13: Mounting the transmitter (remote version)

- A Direct wall mounting
- B Pipe mounting
- \* Dimensions for version without local operation

## 3.4 Post-installation check

Perform the following checks after installing the measuring device in the piping:

Device condition and specifications	Notes
Is the device damaged (visual inspection)?	-
Do the process temperature/pressure, ambient temperature, measuring range etc. correspond to the specifications of the device?	→ 🖹 59
Installation	Notes
Does the arrow on the pipe or on the sensor match the direction of flow through the pipe?	_
Are the measuring point number and labeling correct (visual inspection)?	-
Is the orientation chosen for the sensor correct, in other words suitable for sensor type, fluid properties (outgassing, with entrained solids) and fluid temperature?	→ 🖹 13
Process environment / process conditions	Notes
Is the measuring device protected against moisture and direct sunlight?	-

Proline Prowirl 72 Wiring

## 4 Wiring



Warning!

When connecting Ex-certified devices, please refer to the notes and diagrams in the Ex-specific supplement to these Operating Instructions.

Please do not hesitate to contact your Endress+Hauser representative if you have any questions.

## 4.1 Connecting the remote version

## 4.1.1 Connecting the sensor



Caution!

Risk of damaging the electronic components!

- Ground the remote version. In doing so, connect the sensor and transmitter to the same potential matching.
- When using the remote version, only connect the sensor to the transmitter with the same serial number.
- 1. Remove the cover of the connection compartment of the transmitter (a).
- 2. Remove the cover of the connection compartment of the sensor (b).
- 3. Feed the connecting cable (c) through the appropriate cable entries.
- 4. Wire the connecting cable between the sensor and transmitter in accordance with the electrical connection diagram  $\rightarrow \square$  14, wiring diagram in screw cap.
- 5. Tighten the glands of the cable entries on the sensor housing and transmitter housing.
- 6. Screw the cover of the connection compartment (a/b) back onto the sensor housing or transmitter housing.

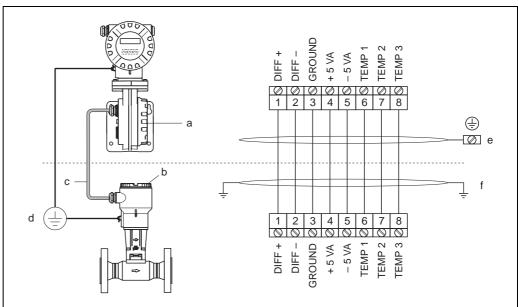


Fig. 14: Connecting the remote version

- a Connection compartment cover (transmitter)
- b Connection compartment cover (sensor)
- c Connecting cable (signal cable)
- d Identical potential matching for sensor and transmitter
- e Connect shielding to ground terminal in transmitter housing and keep as short as possible

f Connect shielding to cable strain relief clamp in connection housing

Wire colors (color code in accordance with DIN 47100):

Terminal No.: 1 = white; 2 = brown; 3 = green; 4 = yellow; 5 = gray; 6 = pink; 7 = blue; 8 = red

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Wiring Proline Prowirl 72

## 4.1.2 Cable specification, standard connecting cable

The specifications of the cable connecting the transmitter and the sensor of the remote version are as follows:

- $4 \times 2 \times 0.5 \text{ mm}^2$  (AWG 20) PVC cable with common screen (4 pairs)
- Conductor resistance according to DIN VDE 0295 class 5 or IEC 60228 class 5: 39  $\Omega$ /km
- Capacity core/screen: < 400 pF/m (122 pF/ft)
- Cable length: max. 30 m (98 ft)
- Operating temperature: -40 to +105 °C (-40 to +221 °F)

## 4.1.3 Cable specification, armored connecting cable

The optionally available armored connecting cable between transmitter and sensor possesses the following specifications:

- $4 \times 2 \times 0.5 \text{ mm}^2$  (AWG 20) PVC cable with common screen (4 pairs)
- Conductor resistance according to DIN VDE 0295 class 5 or IEC 60228 class 5: 39  $\Omega$ /km
- Extensively resistant against acids, bases and specific oils
- A galvanized braided steel wire forms the total shield
- Outer sheath: smooth, uniform, round
- Cable length: max. 30 m (98 ft)
- Operating temperature: -30 to +70 °C (-22 to +158 °F)

## 4.2 Connecting the measuring unit

## 4.2.1 Connecting the transmitter



Warning!

- When connecting Ex-certified devices, please refer to the notes and diagrams in the Ex-specific supplement to these Operating Instructions.
- Ground the remote version. In doing so, connect the sensor and transmitter to the same potential matching.



Note!

• Observe national regulations governing the installation of electrical equipment.

#### Connecting the transmitter, non-Ex, Ex-i and Ex-n version ( $\rightarrow$ $\square$ 15)

- 1. Unscrew the cover (a) of the electronics compartment from the transmitter housing.
- 2. Remove the display module (b) from the retaining rails (c) and refit onto the right retaining rail with the left side. This secures the display module.
- 3. Loosen the screws of the cover of the connection compartment (d) and fold down the cover.
- 4. Push the cable for the power supply/current output through the cable gland (e). *Optional: push the cable for the pulse output through the cable gland (f).*
- 5. Tighten the cable glands (e / f) ( $\rightarrow$   $\stackrel{\triangle}{=}$  26).
- 6. Pull the terminal connector (g) out of the transmitter housing and connect the cable for the power supply/current output ( $\rightarrow \square 17$ ).

Optional: pull the terminal connector (h) out of the transmitter housing and connect the cable for the pulse output ( $\rightarrow \square 17$ ).



The terminal connectors (g / h) are pluggable, i.e. they can be plugged out of the transmitter housing to connect the cables.

7. Plug the terminal connectors (g / h) into the transmitter housing.



The connectors are coded so you cannot mix them up.

8. Fold up the cover of the connection compartment and tighten the screws (d).

Proline Prowirl 72 Wiring

- 9. Remove the display module (b) and fit onto the retaining rails (c).
- 10. Screw the cover of the electronics compartment (a) onto the transmitter housing.
- 11. Only remote version: Secure the ground cable to the ground terminal (see  $\rightarrow \square 17$ , C).

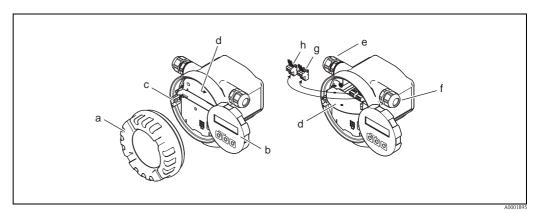


Fig. 15: Procedure for connecting the transmitter Non-Ex, Ex-i and Ex-n version

- a Cover of electronics compartment
- b Display module
- c Retaining rail for display module
- d Cover of connection compartment
- e Cable gland for power supply/current output cable
- f Cable gland for pulse output cable (optional)
- g Terminal connector for power supply/current output
- h Terminal connector for pulse output (optional)

### Procedure for connecting the transmitter, Ex-d version ( $\rightarrow \square 16$ )



#### Warning!

When connecting Ex-certified devices, please refer to the notes and diagrams in the Ex-specific supplement to these Operating Instructions.

- 1. Open the clamp (a) securing the cover of the connection compartment.
- 2. Unscrew the cover (b) of the connection compartment from the transmitter housing.
- 3. Push the cable for the power supply/current output through the cable gland (c). *Optional: push the cable for the pulse output through the cable gland (d).* 
  - Note!

Devices with a TIIS approval are equipped in general with one cable gland only.

- 4. Tighten the cable glands (c / d) ( $\rightarrow \stackrel{\triangle}{=} 26$ ).
- 5. Pull the terminal connector (e) out of the transmitter housing and connect the cable for the power supply/current output ( $\rightarrow \boxed{2}$  17).

Optional: pull the terminal connector (f) out of the transmitter housing and connect the cable for the pulse output  $\rightarrow \square 17$ ).



The terminal connectors (e / f) are pluggable, i.e. they can be plugged out of the transmitter housing to connect the cables.

6. Plug the terminal connectors (e / f) into the transmitter housing.

Note

The connectors are coded so you cannot mix them up.

- 7. Screw the cover (b) of the connection compartment onto the transmitter housing.
- 8. Tighten the clamp (a) securing the cover of the connection compartment.
- 9. Only remote version: secure the ground cable to the ground terminal ( $\rightarrow \square 17$ , C).

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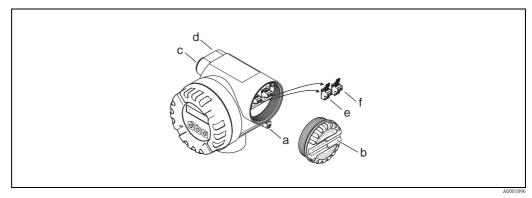


Fig. 16: Procedure for connecting the transmitter Ex-d version

- a Clamp securing cover of connection compartment
- b Cover of connection compartment
- c Cable gland for power supply/current output cable
- d Cable gland for pulse output cable (optional)
- e Terminal connector for power supply/current output
- f Terminal connector for pulse output (optional)

#### Wiring diagram

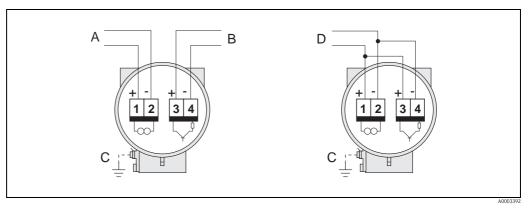


Fig. 17: Assignment of terminals

- A Power supply/current output
- B Optional pulse/status output
- C Ground terminal (only relevant for remote version)
- D PFM wiring (pulse/frequency modulation)

## 4.2.2 Terminal assignment

Terminal No. (inputs/outputs)		
Order variant	1-2	3-4
72***_******W	HART current output	-
72***-*******A	HART current output	Pulse/status output

HART current output

Galvanically isolated, 4 to 20 mA with HART

Pulse/status output

Open collector, passive, galvanically isolated,  $U_{max}=30~V,$  with 15 mA current limiting,  $R_i=500~\Omega,$  can be configured as pulse or status output

Proline Prowirl 72 Wiring

## 4.2.3 Connecting HART

Users have the following connection options at their disposal:

- Direct connection to transmitter by means of terminals 1 (+) / 2 (-)
- Connection across the 4 to 20 mA circuit.



#### Note!

- lacksquare The measuring circuit's minimum load must be at least 250  $\Omega$  .
- For the connection, also refer to the documentation issued by the HART Communication Foundation, and in particular HCF LIT 20: "HART, a technical summary".
- 1. After commissioning: Switch HART write protection on or off  $(\rightarrow \stackrel{\triangle}{=} 38)$ .

#### Connecting the HART handheld terminal

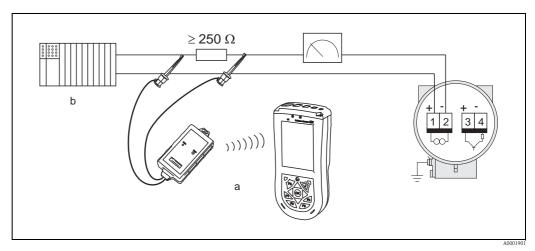


Fig. 18: Electrical connection of the HART handheld terminal Field Xpert SFX100

- a HART handheld terminal Field Xpert SFX100
- b Additional switching units or PLC with transmitter power supply

#### Connecting the PC with the operating software

A HART modem (e.g. "Commubox FXA195") is required for connecting a PC with operating software (e.g. "FieldCare").

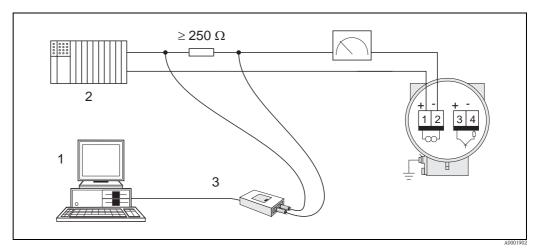


Fig. 19: Electrical connection of a PC with operating software

- 1 PC with operating software
- 2 Additional switching units or PLC with passive input
- 3 HART modem, e.g. Commubox FXA195

Wiring Proline Prowirl 72

## 4.3 Degree of protection

The devices fulfill all the requirements for IP 67 (NEMA 4X) degree of protection.

Compliance with the following points is mandatory following installation in the field or servicing in order to ensure that IP 67 (NEMA 4X) protection is maintained:

- The housing seals must be clean and undamaged when inserted into their grooves. Dry, clean or replace the seals if necessary. If the device is used in a dust atmosphere, only use the associated Endress+Hauser housing seals.
- All housing screws and screw caps must be firmly tightened.
- The cables used for connection must be of the specified outside diameter ( $\rightarrow$  🖹 62, cable entries).
- Tighten the cable glands to ensure they are leak-tight (Point  $\mathbf{a} \to \mathbf{a} \to \mathbf{a}$  20).
- To prevent moisture from penetrating the entry (Point  $\mathbf{b} \to \square$  20), the cables must form a loop hanging downwards ("water trap") upstream from the cable entry.
- Install the measuring device in such a way that the cable entries do not point upwards.
- Remove all unused cable entries and insert plugs instead.
- Do not remove the grommet from the cable entry.

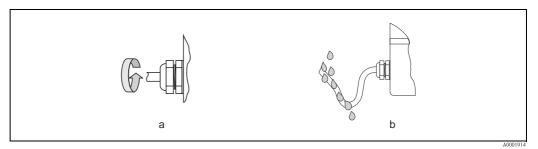


Fig. 20: Installation instructions for cable entries

4.4 Post-connection check

Perform the following checks after completing electrical installation of the measuring device:

Device condition and specifications	Notes
Are cables or the device damaged (visual inspection)?	-
Electrical connection	Notes
Does the supply voltage match the specifications on the nameplate?  Non-Ex: 12 to 36 V DC (with HART: 18 to 36 V DC)  Ex-i and Ex-n: 12 to 30 V DC (with HART 18 to 30 V DC)  Ex-d: 15 to 36 V DC (with HART 21 to 36 V DC)	-
Do the cables used comply with the specifications?	→ 🖹 22, → 🖺 62
Do the cables have adequate strain relief?	_
Are the cables for power supply/current output, frequency output (optional) and grounding connected correctly?	→ 🖹 22
Only remote version: is the connecting cable between sensor and transmitter connected correctly?	→ 🖹 21
Are all terminals firmly tightened?	-
Are all the cable entries installed, tightened and sealed?  Cable run with "water trap"?	→ 🖹 26
Are all the housing covers installed and tightened?	-

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# 5 Operation

## 5.1 Display and operating elements

The local display enables you to read all important parameters directly at the measuring point and configure the device using the "Quick Setup" or the function matrix.

The display consists of two lines; this is where measured values and/or status variables (e.g. bar graph) are displayed. You can change the assignment of the display lines to different variables to suit your needs and preferences ( $\rightarrow \ge 85$ , USER INTERFACE function group).

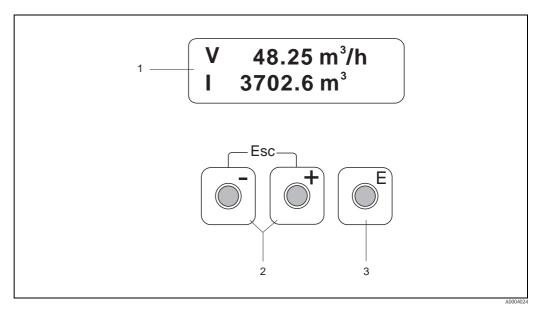


Fig. 21: Display and operating elements

1 Liquid crystal display

Two-line display of measured values, dialog texts and fault and notice messages. The display as it appears during standard measuring mode is known as the HOME position (operating mode).

- Top line: shows main measured values, e.g. volume flow.
- Bottom line: shows additional measured variables and status variables, e.g. totalizer reading, bar graph, tag name.
- 2 Plus/minus keys
  - Enter numerical values, select parameters
  - Select different function groups within the function matrix

Press the 🕆 keys simultaneously to trigger the following functions:

- Exit the function matrix step by step  $\rightarrow$  HOME position
- Press  $\stackrel{\circ}{=}$  keys (Esc) longer than 3 seconds  $\rightarrow$  return directly to the HOME position
- Cancel data entry
- 3 Enter key
  - HOME position  $\rightarrow$  Entry into the function matrix
  - Save the numerical values you input or settings you changed

Proline Prowirl 72 Operation

#### 5.2 The function matrix: layout and use



#### Note!

Note the following points:

- General notes and instructions → 🖹 29
- The function matrix  $\rightarrow$   $\stackrel{\triangle}{=}$  75
- The detailed description of all the functions  $\rightarrow$   $\stackrel{\triangle}{=}$  75

The function matrix consists of two levels:

■ Function groups

The function groups are the highest-level grouping of the control options for the measuring device. A number of functions is assigned to each function group.

■ Functions

You select a function group in order to access the individual functions for operating and configuring the measuring device.

Operate the function matrix as follows:

- HOME position: press the  $\blacksquare$  key  $\rightarrow$  enter the function matrix
- Select a function group (e.g. CURRENT OUTPUT). 2.
- Select a function (e.g. TIME CONSTANT)

Change parameter/enter numerical values:

- $\perp$  /  $\square$  keys $\rightarrow$  select or enter enable code, parameters, numerical values
- key→ save your entries
- Exit the function matrix:
  - Press the  $\stackrel{\text{d}}{=}$  keys (Esc) longer than 3 seconds → HOME position
  - Repeatedly press the  $\frac{1}{2}$  keys (Esc)  $\rightarrow$  return step by step to the HOME position

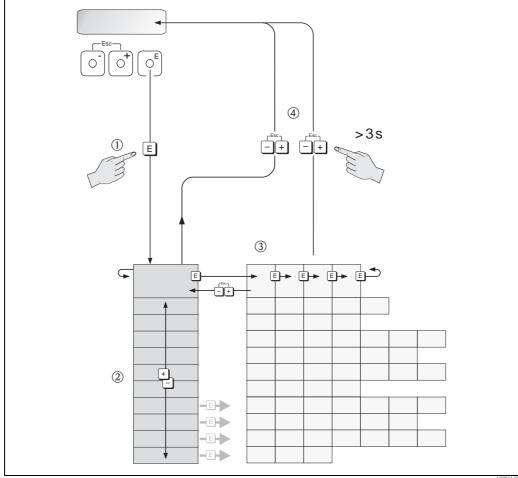


Fig. 22: Selecting and configuring functions (function matrix)

Proline Prowirl 72 Operation

#### 5.2.1 General notes

The Quick Setup menu ( $\rightarrow \stackrel{\square}{=} 41$  and  $\rightarrow \stackrel{\square}{=} 82$ ) is adequate for commissioning with the necessary standard settings. Complex measuring operations on the other hand necessitate additional functions that you can configure as necessary and customize to suit your process parameters. The function matrix, therefore, comprises a multiplicity of additional functions which, for the sake of clarity, are arranged in a number of function groups.

Comply with the following instructions when configuring functions:

- You select functions as described ( $\rightarrow \ge 28$ ).
- You can switch off certain functions (OFF). If you do so, related functions in other function groups will no longer be displayed.
- Certain functions prompt you to confirm your data entries. Press : to select "SURE [YES]" and press the E key to confirm. This saves your setting or starts a function, as applicable.
- Return to the HOME position is automatic if no key is pressed for 5 minutes.
- Programming mode is automatically disabled if you do not press a key within 60 seconds following return to the HOME position.



#### Note!

- All functions are described in detail, as is the function matrix itself on  $\rightarrow$   $\stackrel{\triangle}{=}$  75
- The transmitter continues to measure while data entry is in progress, i.e. the current measured values are output via the signal outputs in the normal way.
- If the power supply fails, all preset and configured values remain safely stored in the EEPROM.

## 5.2.2 Enabling the programming mode

The function matrix can be disabled. Disabling the function matrix rules out the possibility of inadvertent changes to device functions, numerical values or factory settings.

A numerical code (factory setting = 72) has to be entered before settings can be changed. If you use a code number of your choice, you exclude the possibility of unauthorized persons accessing data. Function ACCESS CODE  $\rightarrow \blacksquare 83$ 

Comply with the following instructions when entering codes:

- If programming is disabled and the key combination is pressed in any function, a prompt for the code automatically appears on the display.
- If "0" is entered as the private code, programming is always enabled.
- Your Endress+Hauser service organization can be of assistance if you mislay your private code.

#### 5.2.3 Disabling the programming mode

Programming is disabled if you do not press a key within 60 seconds following automatic return to the HOME position.

You can also disable programming by entering any number (other than the private code) in the ACCESS CODE function.

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## 5.3 Error messages

## **5.3.1** Type of error

Errors which occur during commissioning or measuring operation are displayed immediately. If two or more system or process errors are present, the error with the highest priority is the one shown on the display.

The measuring system distinguishes between two types of error:

- *System error*: this group includes all device errors, for example communication errors, hardware errors, etc. ( $\rightarrow \stackrel{\triangle}{=} 48$ ).
- *Process error:* this group includes all application errors, for example, e.g. "DSC SENS LIMIT"  $(\rightarrow \stackrel{\triangle}{=} 50)$ .

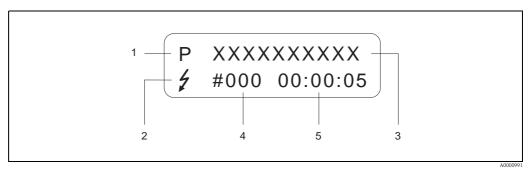


Fig. 23: Error messages on the display (example)

1 Error type: P = process error, S = system error

- 2 Error message type: \( \frac{1}{2} = \text{fault message, } ! = notice message (definition: see below) \)
- 3 Error designation: e.g. DSC SENS LIMIT = device being operated near application limits
- 4 Error number: e.g. #395
- Duration of last error to occur (in hours : minutes : seconds), display format, OPERATION HOURS function  $\rightarrow \stackrel{\cong}{} 110$

## 5.3.2 Types of error message

Users have the option of weighting system and process errors differently, by defining them as **Fault messages** or **Notice messages**. This is specified by means of the function matrix ( $\rightarrow \stackrel{\triangle}{=} 109$ , SUPERVISION function group).

Serious system errors, e.g. electronic module defects, are always identified and classed as "fault messages" by the measuring device.

Notice message (!)

- The error in question has no effect on the outputs of the measuring device.
- Displayed as  $\rightarrow$  exclamation mark (!), type of error (S: system error, P: process error)

Fault message (4)

- The error in question has a direct effect on the outputs. The response of the outputs (failsafe mode) can be defined by means of functions in the function matrix ( $\rightarrow \stackrel{\triangle}{=} 52$ ).
- Displayed as  $\rightarrow$  lightning flash ( $\frac{1}{2}$ ), type of error (S: system error, P: process error)



Note!

Error messages can be output via the current output in accordance with NAMUR NE 43.

Proline Prowirl 72 Operation

#### 5.4 Communication

In addition to via local operation, the measuring device can also be configured and measured values obtained by means of the HART protocol. Digital communication takes place using the 4 to 20 mA HART current output ( $\rightarrow \stackrel{\triangle}{=} 25$ ).

The HART protocol allows the transfer of measuring and device data between the HART master and the field devices for configuration and diagnostics purposes. HART masters, such as a handheld terminal or PC-based operating programs (such as FieldCare), require device description (DD) files. They are used to access all the information in a HART device. Such information is transferred solely via "commands".

There are three different command classes:

■ Universal commands

All HART devices support and use universal commands. These are associated with the following functionalities for example:

- Recognizing HART devices
- Reading off digital measured values (flow, totalizer, etc.)
- Common practice commands:

Common practice commands offer functions which are supported and can be executed by many but not all field devices.

■ Device-specific commands:

These commands allow access to device-specific functions which are not HART standard. Such commands access individual field device information, (among other things), such as low flow cut off settings etc.



#### Note!

The measuring device has access to all three command classes. List of all "Universal Commands" and "Common Practice Commands"  $\rightarrow \stackrel{\triangle}{=} 33$ 

## 5.4.1 Operating options

For the complete operation of the measuring device, including device-specific commands, device description (DD) files are available to the user to provide the following operating aids and programs:



#### Note

If the transmitter is configured via HART, you have to disconnect a circuit for the HART input and achieve the connection according to  $\rightarrow \square$  18 or  $\rightarrow \square$  19.

#### Field Xpert HART Communicator

Selecting device functions with a HART Communicator is a process involving a number of menu levels and a special HART function matrix.

The HART operating instructions in the carrying case of the HART handheld terminal contain more detailed information on the device.

#### "FieldCare" operating program

FieldCare is Endress+Hauser's FDT-based plant asset management tool and allows the configuration and diagnosis of intelligent field devices. By using status information, you also have a simple but effective tool for monitoring devices. The Proline flowmeters are accessed via a service interface or via the service interface FXA193.

#### "SIMATIC PDM" operating program (Siemens)

SIMATIC PDM is a standardized, manufacturer-independent tool for the operation, configuration, maintenance and diagnosis of intelligent field devices.

#### "AMS" operating program (Emerson Process Management)

AMS (Asset Management Solutions): program for operating and configuring devices.

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## 5.4.2 Current device description files

The following table illustrates the suitable device description file for the operating tool in question and then indicates where these can be obtained.

#### HART protocol:

TITULE PLOTOCOL.		
Valid for device software:	1.05.XX	→ DEVICE SOFTWARE function
HART device data Manufacturer ID: Device ID:	11 <sub>hex</sub> (ENDRESS+HAUSER) 56 <sub>hex</sub>	→ MANUFACTURER ID function → DEVICE ID function
HART version data:	Device Revision 6/ DD Revision 1	
Software release	06.2010	
Operating program	Sources for obtaining device descri	ptions
Handheld terminal Field Xpert	Use update function of handheld terminal	
FieldCare / DTM	<ul> <li>www.endress.com → Download</li> <li>CD-ROM (Endress+Hauser order number 56004088)</li> <li>DVD (Endress+Hauser order number 70100690)</li> </ul>	
AMS	www.endress.com $\rightarrow$ Download	
SIMATIC PDM	www.endress.com $\rightarrow$ Download	

Tester/simulator:	Sources for obtaining device descriptions
Fieldcheck	Update via FieldCare with the flow device FXA193/291 DTM in the Fieldflash module



#### Note!

The "Fieldcheck" tester/simulator is used for testing flowmeters in the field. When used in conjunction with the "FieldCare" software package, test results can be imported into a database, printed out and used for official certification. Contact your Endress+Hauser representative for more information.

## 5.4.3 Device variables and process variables

Device variables:

The following device variables are available via the HART protocol:

ID (decimal)	Device variable
0	OFF (not assigned)
1	Flow
250	Totalizer

#### Process variables:

At the factory, the process variables are assigned to the following device variables:

- Primary process variable (PV)  $\rightarrow$  flow
- Secondary process variable (SV)  $\rightarrow$  totalizer
- lacktriangle Third process variable (TV) ightarrow not assigned
- Fourth process variable (FV)  $\rightarrow$  not assigned

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# 5.4.4 Universal/common practice HART commands

The following table contains all the universal and common practice commands supported by the measuring device.

	mand no. T command / access type	Command data (numeric data in decimal form)	Response data (numeric data in decimal form)	
Univ	Universal commands			
0	Read the unique device identifier Access type = Read	None	The device identifier provides information on the device and manufacturer; it cannot be altered.	
			The response consists of a 12-byte device ID:  - Byte 0: fixed value 254  - Byte 1: manufacturer ID, 17 = Endress+Hauser  - Byte 2: device type ID, 56 = Prowirl 72  - Byte 3: number of preambles  - Byte 4: rev. no. universal commands  - Byte 5: rev. no. device-spec. commands  - Byte 6: software revision  - Byte 7: hardware revision  - Byte 8: additional device information  - Byte 9-11: device identification	
1	Read the primary process variable Access type = Read	None	<ul> <li>Byte 0: HART unit ID of the primary process variable</li> <li>Byte 1-4: primary process variable (= flow)</li> </ul>	
			Note! Manufacturer-specific units are represented using the HART unit ID "240".	
2	Read the primary process variable as current in mA and percentage of the set measuring range Access type = Read	None	<ul> <li>Byte 0-3: current current of the primary process variable in mA</li> <li>Byte 4-7: percentage of the set measuring range</li> </ul>	
	Access type = Read		Primary process variable = flow	
3	Read the primary process variable as current in mA and four (preset using command 51) dynamic process variables Access type = Read	None	<ul> <li>24 bytes are sent as a response:</li> <li>Byte 0-3: current of the primary process variable in mA</li> <li>Byte 4: HART unit ID of the primary process variable</li> <li>Byte 5-8: primary process variable</li> <li>Byte 9: HART unit ID of the secondary process variable</li> <li>Byte 10-13: secondary process variable</li> <li>Byte 14: HART unit ID of the third process variable</li> <li>Byte 15-18: third process variable</li> <li>Byte 19: HART unit ID of the fourth process variable</li> <li>Byte 20-23: fourth process variable</li> </ul>	
			Factory setting:  Primary process variable = flow Secondary process variable = totalizer Third process variable = not assigned Fourth process variable = not assigned Note! Manufacturer-specific units are represented using the HART unit ID "240".	
6	Set HART short-form address Access type = Write	Byte 0: desired address (0 to 15)  Factory setting:  0  Note!  With an address > 0 (multidrop mode), the current output of the primary process variable is fixed to 4 mA.	Byte 0: active address	

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Command no. HART command / access type		Command data (numeric data in decimal form)	Response data (numeric data in decimal form)	
11	Read unique device identification using the TAG (measuring point designation) Access type = Read	Byte 0-5: TAG	The device identifier provides information on the device and manufacturer; it cannot be altered.  The response consists of a 12-byte device ID if the given TAG matches the one saved in the device:  Byte 0: fixed value 254  Byte 1: manufacturer ID, 17 = Endress+Hauser  Byte 2: device type ID, 56 = Prowirl 72  Byte 3: number of preambles  Byte 4: rev. no. universal commands  Byte 5: rev. no. device-spec. commands  Byte 6: software revision  Byte 7: hardware revision  Byte 8: additional device information  Byte 9-11: device identification	
12	Read user message Access type = Read	None	Byte 0-24: user message  Note! You can write the user message using command 17.	
13	Read TAG, TAG description and date Access type = Read	None	<ul> <li>Byte 0-5: TAG</li> <li>Byte 6-17: TAG description</li> <li>Byte 18-20: date</li> <li>Note!</li> <li>You can write the TAG, descriptor and date using Command 18.</li> </ul>	
14	Read sensor information on the primary process variable Access type = Read	None	<ul> <li>Byte 0-2: serial number of the sensor</li> <li>Byte 3: HART unit ID of the sensor limits and measuring range of the primary process variable</li> <li>Byte 4-7: upper sensor limit</li> <li>Byte 8-11: lower sensor limit</li> <li>Byte 12-15: minimum span</li> <li>Note!</li> <li>The data relate to the primary process variable (= flow).</li> <li>Manufacturer-specific units are represented using the HART unit ID "240".</li> </ul>	
15	Read output information of the primary process variable Access type = Read	None	<ul> <li>Byte 0: Alarm selection ID</li> <li>Byte 1: ID for transfer function</li> <li>Byte 2: HART unit ID for the set measuring range of the primary process variable</li> <li>Byte 3-6: end of measuring range, value for 20 mA</li> <li>Byte 7-10: start of measuring range, value for 4 mA</li> <li>Byte 11-14: attenuation constant in [s]</li> <li>Byte 15: ID for write protection</li> <li>Byte 16: ID for OEM dealer, 17 = Endress+Hauser</li> <li>Primary process variable = flow</li> <li>Note!</li> <li>Manufacturer-specific units are represented using the HART unit ID "240".</li> </ul>	
16	Read the device production number Access type = Read	None	Byte 0-2: production number	
17	Write user message Access = Write	You can save any 32-character text in the device with this parameter. Byte 0-23: desired user message	Displays the current user message in the device: Byte 0-23: current user message in the device	
18	Write TAG, TAG description and date Access = Write	You can save an 8-character TAG, a 16-character TAG description and a date with this parameter:  - Byte 0-5: TAG  - Byte 6-17: TAG description  - Byte 18-20: date	Displays the current information in the device:  - Byte 0-5: TAG  - Byte 6-17: TAG description  - Byte 18-20: date	

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	nand no. Command / access type	Command data (numeric data in decimal form)	Response data (numeric data in decimal form)		
Comr	Common practice commands				
34	Write attenuation constant for primary process variable Access = Write	Byte 0-3: attenuation constant of the primary process variable in seconds  Factory setting:  Primary process variable = flow	Displays the current attenuation constant in the device: Byte 0-3: attenuation constant in seconds		
35	Write measuring range of the primary process variable Access = Write	Write the desired measuring range:  Byte 0: HART unit ID for the primary process variable  Byte 1-4: end of measuring range, value for 20 mA  Byte 5-8: start of measuring range, value for 4 mA  Factory setting:  Primary process variable (vol. flow)  Note!  If the HART unit ID does not suit the process variable, the device will continue with the last valid unit.	The measuring range currently set is shown as the response:  - Byte 0: HART unit ID for the set measuring range of the primary process variable  - Byte 1-4: end of measuring range, value for 20 mA  - Byte 5-8: start of measuring range, value for 4 mA (is always at "0")  Note!  Manufacturer-specific units are represented using the HART unit ID "240".		
38	Device status reset "configuration changed" Access = Write	None	None		
40	Simulate output current of the primary process variable Access = Write	Simulation of the desired output current of the primary process variable.  An entry value of 0 exits the simulation mode: Byte 0-3: output current in mA  Factory setting: Primary process variable = flow	The current output current of the primary process variable is displayed as a response: Byte 0-3: output current in mA		
42	Perform device setting Access = Write	None	None		
44	Write unit of the primary process variable Access = Write	Specify the unit of the primary process variable.  Only units which are suitable for the process variable are accepted by the device: Byte 0: HART unit ID  Factory setting: Primary process variable = flow  Note!  If the HART unit ID written does not suit the process variable, the device will continue with the last valid unit.  If you change the unit of the primary process variable, this has an impact on the 4 to 20 mA output.	The current unit code of the primary process variable is displayed as a response: Byte 0: HART unit ID  Note! Manufacturer-specific units are represented using the HART unit ID "240".		
48	Read extended device status Access = Read	None	The current device status is displayed in extended form as the response: Coding: table $\rightarrow \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ $		
50	Read assignment of the device variables to the four process variables Access = Read	None	Display of the current variable assignment of the process variables:  - Byte 0: device variable ID to the primary process variable  - Byte 1: device variable ID to the secondary process variable  - Byte 2: device variable ID to the third process variable  - Byte 3: device variable ID to the fourth process variable  - Byte 3: device variable ID to the fourth process variable  - Byte 3: device variable ID to the fourth process variable  - Byte 3: device variable ID to the fourth process variable  - Factory setting:  - Primary process variable: ID 1 for flow  - Secondary process variable: ID 250 for totalizer  - Third process variable: ID 0 for OFF (not assigned)  - Fourth process variable: ID 0 for OFF (not assigned)		

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Command no. HART command / access type		Command data (numeric data in decimal form)	Response data (numeric data in decimal form)
53	Write device variable unit Access = Write	This command sets the unit of the given device variables. Only those units which suit the device variable are transferred:  — Byte 0: device variable ID  — Byte 1: HART unit ID  ID of the supported device variables: See data → 🖹 32  Note!  If the written unit does not suit the device variable, the device will continue with the last valid unit.	The current unit of the device variables is displayed in the device as a response:  - Byte 0: device variable ID  - Byte 1: HART unit ID  Note!  Manufacturer-specific units are represented using the HART unit ID "240".
59	Specify number of preambles in message responses Access = Write	This parameter specifies the number of preambles which are inserted in the message responses: Byte 0: number of preambles (2 to 20)	As a response, the current number of the preambles is displayed in the response message: Byte 0: number of preambles
109	Burst mode control Access = Write	This parameter switches the burst mode on and off.  Byte 0:  0 = burst mode off  1 = burst mode on	The value set in byte 0 is shown as the response.

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## 5.4.5 Device status / error messages

You can read the extended device status, in this case, current error messages, via Command "48". The command delivers bit-encoded information (see table below).



#### Note

Detailed information on the device status messages and error messages, and how they are rectified, can be found on  $\rightarrow \stackrel{\cong}{=} 48$ 

Byte Bit	Error no.	Short error description $\rightarrow \blacksquare 48$
0-0	001	Serious device error
0-1	011	Measuring amplifier has faulty EEPROM
0-2	012	Error when accessing data of the measuring amplifier EEPROM
0-3	021	COM module: faulty EEPROM
0-4	022	COM module: error when accessing data of the EEPROM
0-5	111	Totalizer checksum error
0-6	351	Current output: the current flow is outside the set range.
0-7	Not assigned	-
1-0	359	Pulse output: the pulse output frequency is outside the set range.
1-1	Not assigned	-
1-2	379	Device being operated in the resonance frequency.
1-3	Not assigned	-
1-4	Not assigned	-
1-5	394	DSC sensor defective, no measurement
1-6	395	DSC sensor being operated near application limits, device failure probable soon.
1-7	396	Device finds signal outside the set filter range.
2-0	Not assigned	-
2-1	Not assigned	-
2-2	399	Pre-amplifier disconnected
2-3	Not assigned	-
2-4	Not assigned	-
2-5	Not assigned	-
2-6	501	New amplifier software version or data being loaded into device. No other commands possible at this point.
2-7	502	Uploading the device data.  No other commands possible at this point.
3-0	601	Positive zero return active
3-1	611	Current output simulation active
3-2	Not assigned	-
3-3	631	Simulation pulse output active
3-4	641	Simulation status output active
3-5	691	Simulation of response to error (outputs) active
3-6	692	Simulation measurand
3-7	Not assigned	-
4-0	Not assigned	-
4-1	Not assigned	-
4-2	699	Current adjustment active
4-3	698	Device test active
4-4	029	Checksum ROM

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Byte Bit	Error no.	Short error description $\rightarrow $ $ 148 $
4-5	421	Flow range exceeded
4-6	Not assigned	-
4-7	Not assigned	_

## 5.4.6 Switching HART write protection on/off

A DIP switch on the amplifier board provides the means of activating or deactivating the HART write protection. If HART write protection is enabled, it is not possible to change parameters via the HART protocol.



Warning!

Risk of electric shock.

Exposed components carry dangerous voltages.

Make sure that the power supply is switched off before you remove the cover of the electronics compartment.

- 1. Switch off power supply.
- 2. Unscrew the cover of the electronics compartment from the transmitter housing.
- 3. Remove the display module (a) from the retaining rails (b) and refit onto the right retaining rail with the left side. This secures the display module.
- 4. Fold up the plastic cover (c).
- 5. Set the DIP switch to the desired position. Position A (DIP switch at front)  $\rightarrow$  HART write protection disabled Position B (DIP switch at rear)  $\rightarrow$  HART write protection enabled
  - Note

The current status of the HART write protection is displayed in the WRITE PROTECTION function.  $\rightarrow \stackrel{\triangle}{=} 101$ 

6. Installation is the reverse of the removal procedure.

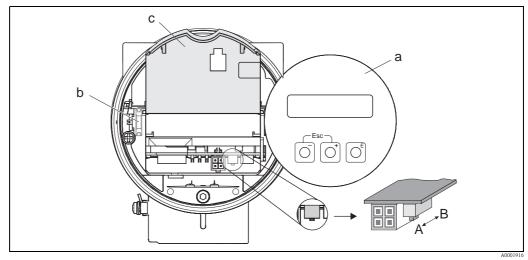


Fig. 24: DIP switch for switching HART write protection on and off

- a Local display module
- b Retaining rails of local display module
- c Plastic cover
- A Write protection disabled (DIP switch at front)
- B Write protection enabled (DIP switch at rear)

Proline Prowirl 72 Commissioning

# 6 Commissioning

## 6.1 Function check

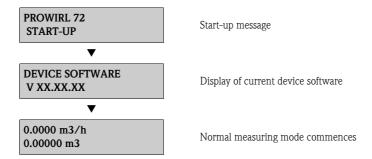
Make sure that all final checks have been completed before you commission your measuring point:

- Checklist for "post-installation check"  $\rightarrow$   $\stackrel{\triangleright}{=}$  20
- Checklist for "post-connection check"  $\rightarrow$  🖹 26

## 6.2 Switching on the measuring device

Having completed the function check, switch on the supply voltage.

After approx. 5 seconds, the device is ready for operation! The device then performs internal test functions and the following sequence of messages is shown on the local display:



The measuring device starts operating once the startup process is completed. Various measured values and/or status variables appear on the display (HOME position).



#### Note!

If startup fails, an appropriate error message is displayed, depending on the cause. The error messages that occur most frequently during commissioning are described in the "Troubleshooting" section ( $\rightarrow \stackrel{\cong}{=} 47$ ).

Commissioning Proline Prowirl 72

## 6.3 Commissioning after installing a new electronics board

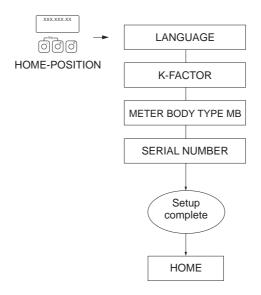
After startup the device checks whether a serial number is present. If this is not the case, the following setup is started. For information on how to install a new electronics board, please refer to  $\rightarrow \stackrel{\triangle}{=} 54$ 

## 6.3.1 "Commissioning" setup



Note!

- As soon as a serial number has been entered and saved this setup is no longer available. If wrong information for a parameter is entered during the setup, it can be corrected in the appropriate function via the function matrix.
- The required information (apart from language) is indicated on the device's name plate and the inner side of the display cover ( $\rightarrow \stackrel{\triangle}{=} 9$ ). Additionally, the meter body MB index and the calibration factor are indicated on the device's meter body.



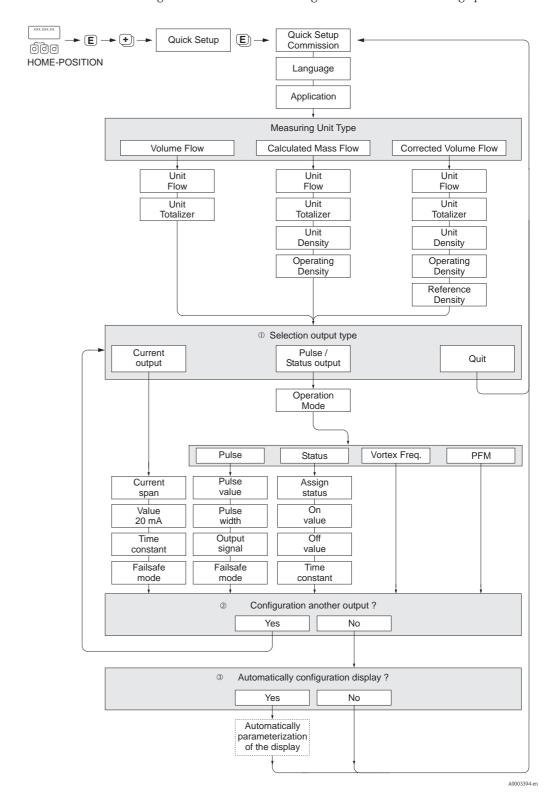
А0006765-ег

Fig. 25: The setup starts once a new electronics board is installed if no serial number is available.

Proline Prowirl 72 Commissioning

## 6.4 "Commissioning" Quick Setup

The "Commissioning" Quick Setup menu guides you systematically through all the important functions of the measuring device that have to be configured for standard measuring operation.



Commissioning Proline Prowirl 72



Note!

- The individual functions are described in the "Description of Device Functions" section ( $\rightarrow \stackrel{\triangle}{1}$  75).
- The display returns to the QUICK SETUP COMMISSIONING cell (→ 

  82) if you press the key combination (Esc) during parameter interrogation.
- ① Only the output (current output or pulse/status output) not yet configured in the current Quick Setup is offered for selection after the first cycle.
- ② The "YES" option appears as long as a free output is available. "NO" is displayed when no further outputs are available.
- ③ When "YES" is selected, the flow is assigned to line 1 of the local display and the totalizer to line 2.

#### Example of configuration No. 1 (volume unit)

You want to measure the flow of water.

The flow should be displayed in the volume flow unit  $m^3/h$ .

The following settings must be made in the "Commissioning" Quick Setup:

- APPLICATION: LIQUID
- MEASURING UNIT TYPE: VOLUME FLOW
- UNIT FLOW: m³/h ■ UNIT TOTALIZER: m³
- Output configuration

#### Example of configuration No. 2 (mass unit)

You want to measure superheated steam with a constant temperature of 200 °C and a constant pressure of 12 bar. According to IAPWS-IF97, the density at operating conditions is  $5.91 \text{ kg/m}^3$ . (IAPWS = International Association of Process Water and Steam).

The flow should be displayed in the mass flow unit kg/h.

The following settings must be made in the "Commissioning" Quick Setup:

- APPLICATION: GAS/STEAM
- MEASURING UNIT TYPE: CALCULATED MASS FLOW
- UNIT FLOW: kg/h
- UNIT TOTALIZER: t
- UNIT DENSITY: kg/m<sup>3</sup>
- OPERATING DENSITY: 5.91
- Output configuration

#### Example of configuration No. 3 (corrected volume unit)

You want to measure compressed air with a constant temperature of 60  $^{\circ}$ C and a constant pressure of 3 bar. The density at operating conditions is 3.14 kg/m³, the density of air at reference operating conditions (0  $^{\circ}$ C, 1013 mbar) 1.2936 kg/m³.

The flow should be displayed in the corrected volume flow unit Nm<sup>3</sup>/h.

The following settings must be made in the "Commissioning" Quick Setup:

- APPLICATION: GAS/STEAM
- MEASURING UNIT TYPE: CORRECTED VOLUME FLOW
- UNIT FLOW: Nm³/h
- UNIT TOTALIZER: Nm³
- UNIT DENSITY: kg/m<sup>3</sup>
- OPERATING DENSITY: 3.14
- REFERENCE DENSITY: 1.2936
- Output configuration

Proline Prowirl 72 Maintenance

## 7 Maintenance

The flow measuring system requires no special maintenance.

## 7.1 Exterior cleaning

When cleaning the exterior of measuring devices, always use cleaning agents that do not attack the surface of the housing and the seals.

## 7.2 Pipe cleaning

Do not use a pipe cleaning pig.

## 7.3 Replacing seals

## 7.3.1 Replacing sensor seals

Under normal circumstances, wetted seals need not be replaced. Replacement is necessary only in special circumstances, for example if aggressive or corrosive fluids are incompatible with the seal material.



Note!

- The time span between the individual replacement procedures depends on the fluid properties.

## 7.3.2 Replacing housing seals

The housing seals must be clean and undamaged when inserted into their grooves. The seals must be dried, cleaned or replaced if necessary.



Note!

If the device is used in a dust atmosphere, only use the associated Endress+Hauser housing seals.

Accessories Proline Prowirl 72

## 8 Accessories

Various accessories, which can be ordered separately from Endress+Hauser, are available for the transmitter and the sensor. Your Endress+Hauser service organization can provide detailed information on the order codes in question.

# 8.1 Device-specific accessories

Accessory	Description	Order code
Proline Prowirl 72	Transmitter for replacement or for stock. Use the order code	72XXX - XXXXX ******
transmitter	to define the following specifications:	
	■ Approvals	
	<ul> <li>Degree of protection / version</li> </ul>	
	■ Cable entries	
	■ Display / operation	
	■ Software	
	■ Outputs / inputs	

# 8.2 Measuring principle-specific accessories

Accessory	Description	Order code
Mounting kit for Prowirl 72W	Mounting kit for wafer comprising:  Threaded studs  Nuts incl. washers  Flange seals	DKW** - ***
Mounting kit for transmitter	Mounting kit for remote version, suitable for pipe and wall mounting.	DK6WM -B
Memograph M graphic display recorder	The Memograph M graphic display recorder provides information on all the relevant process variables. Measured values are recorded correctly, limit values are monitored and measuring points analyzed. The data are stored in the 256 MB internal memory and also on a DSD card or USB stick. Memograph M boasts a modular design, intuitive operation and a comprehensive security concept. The ReadWin® 2000 PC software is part of the standard package and is used for configuring, visualizing and archiving the data captured. The mathematics channels which are optionally available enable continuous monitoring of specific power consumption, boiler efficiency and other parameters which are important for efficient energy management.	RSG40 - ********
Conversion kits	Several conversion kits are available, e.g.:  Conversion of Prowirl 77 to Prowirl 72 or 73  Conversion of a compact version to a remote version	DK7UP - **
Flow conditioner	To reduce the inlet run downstream of flow disturbances.	DK7ST - ***
Pressure transmitter Cerabar T	Cerabar T is used to measure the absolute and gauge pressure of gases, steams and liquids (compensation with RMC621 for example).	PMC131 - **** PMP131 - ****
Pressure transmitter Cerabar M	Cerabar M is used to measure the absolute and gauge pressure of gases, steams and liquids.  Can also be used for reading external pressure values into Prowirl 73 via the burst mode.  Can also be ordered with ready-activated burst mode.  Can also be used for reading external pressure values into Prowirl 73 via PROFIBUS PA (only absolute pressure).	PMC41 - ********* PMP41 - ******* PM*4* - ******H/J9***
Pressure transmitter Cerabar S	Cerabar S is used to measure the absolute and gauge pressure of gases, steams and liquids.  Can also be used for reading external pressure values into Prowirl 73 via the burst mode.  Can also be ordered with ready-activated burst mode.  Can also be used for reading external pressure values into Prowirl 73 via PROFIBUS PA or FOUNDATION Fieldbus (only absolute pressure).	PMC71 - ***********************************

Proline Prowirl 72 Accessories

Accessory	Description	Order code
RTD temperature Omnigrad TR10	Multipurpose temperature sensor. Mineral-insulated insert with thermowell, terminal head and extension neck.	TR10 - ******R/T****
Active barrier RN221N	Active barrier with power supply for safe separation of 4 to 20 mA standard signal circuits:  Galvanic isolation of 4 to 20 mA circuits Elimination of ground loops Power supply of two-wire transmitters Can be used in Ex area (ATEX, FM, CSA, TIIS) Optional: relay output	RN221N - **
Process display RIA250	Multifunctional 1-channel display unit with universal input, transmitter power supply, limit relay and analog output.	RIA250 - *****
Process display RIA251	Digital display unit for looping into 4 to 20 mA current loop; can be used in Ex area (ATEX, FM, CSA).	RIA251 - **
Field display RIA261	Digital field display unit for looping into 4 to 20 mA current loop; can be used in Ex area (ATEX, FM, CSA).	RIA261 - ***
Process transmitter RMA422	Multifunctional 1-2 channel top-hat rail device with intrinsically safe current inputs and transmitter power supply, limit value monitoring, mathematic functions (e.g. difference ascertain) and 1-2 analog outputs.  Optional: intrinsically safe inputs, can be used in Ex area (ATEX).  Possible applications: e.g.  Leak detection  delta heat (between two Prowirl measuring points)  Totalizing (of flows in two pipes)	RMA422 - *****
Overvoltage protection HWA562Z	Overvoltage protection for restricting overvoltage in signal lines and components.	51003575
Overvoltage protection HWA569	Overvoltage protection for restricting overvoltage in Prowirl 72 and other sensors for direct mounting on the device.	HAW569 - **1A
Energy Manager RMC621	Universal Energy Manager for gas, liquids, steam and water. Calculation of volumetric flow and mass flow, corrected volume, heat flow and energy.	RMC621 - *******
Heat computer RMS621	Steam and heat computer for industrial energy balancing of steam and water.	RMS621-******
	Calculation of the following applications:  Steam mass  Steam heat quantity  Net steam heat quantity  Steam heat differential  Water heat quantity  Water heat differential	
	Simultaneous calculation of up to three applications per device.	

Accessories Proline Prowirl 72

# 8.3 Communication-specific accessories

Accessory	Description	Order code
HART Communicator Field Xpert handheld terminal	Handheld terminal for remote configuration and for obtaining measured values via the current output HART (4 to 20 mA) and FOUNDATION Fieldbus (FF).	SFX100 - ******
	Contact your Endress+Hauser representative for more information.	
Fieldgate FXA320	Gateway for remote interrogation of HART sensors and actuators via Web browser:  2-channel analog input (4 to 20 mA)  4 binary inputs with event counter function and frequency measurement  Communication via modem, Ethernet or GSM  Visualization via Internet/Intranet in the web browser and/or WAP cellular phone  Limit value monitoring with alarm by e-mail or SMS	FXA320 - ****
Fieldgate FXA520	<ul> <li>Synchronized time stamping of all measured values</li> <li>Gateway for remote interrogation of HART sensors and actuators via Web browser:</li> <li>Web server for remote monitoring of up to 30 measuring points</li> <li>Intrinsically safe version [EEx ia]IIC for applications in hazardous areas</li> <li>Communication via modem, Ethernet or GSM</li> <li>Visualization via Internet/Intranet in the web browser and/or WAP cellular phone</li> <li>Limit value monitoring with alarm signaling via e-mail or SMS</li> <li>Synchronized time stamping of all measured values</li> <li>Remote diagnosis and remote configuration of connected HART devices</li> </ul>	FXA520 - ****
FXA195	The Commubox FXA195 connects intrinsically safe Smart transmitters with HART protocol to the USB port of a personal computer. This makes the remote operation of the transmitters possible with the aid of configuration programs (e.g. FieldCare). Power is supplied to the Commubox by means of the USB port.	FXA195 – *

# 8.4 Service-specific accessories

Accessory	Description	Order code
Applicator	Software for selecting and planning flowmeters.  The Applicator can be downloaded from the Internet or ordered on CD-ROM for installation on a local PC.  Contact your Endress+Hauser representative for more information.	DXA80 - *
Fieldcheck	Tester/simulator for testing flowmeters in the field. When used in conjunction with the "FieldCare" software package, test results can be imported into a database, printed out and used for official certification. Contact your Endress+Hauser representative for more information.	50098801
FieldCare	FieldCare is Endress+Hauser's FDT-based plant asset management tool. It can configure all intelligent field units in your system and helps you manage them. By using the status information, it is also a simple but effective way of checking their status and condition.	See the product page on the Endress+Hauser Web site: www.endress.com
FXA193	Service interface from the measuring device to the PC for operation via FieldCare.	FXA193 - *

Proline Prowirl 72 Troubleshooting

# 9 Troubleshooting

## 9.1 Troubleshooting instructions

Always start troubleshooting with the following checklist if faults occur after commissioning or during operation. This takes you directly (via various queries) to the cause of the problem and the appropriate remedial measures.

Check the display	
No display visible and no	1. Check the supply voltage $\rightarrow$ Terminals 1, 2
output signals present	2. Measuring electronics defective $\rightarrow$ order spare parts $\rightarrow$ $\bigcirc$ 53
No display visible but output signals are present	1. Check whether the ribbon-cable connector of the display module is correctly plugged into the amplifier board $\rightarrow$ $\stackrel{\text{l}}{=}$ 54
	2. Display module defective $\rightarrow$ order spare parts $\rightarrow$ $\stackrel{\triangle}{=}$ 53
	3. Measuring electronics defective $\rightarrow$ order spare parts $\rightarrow$ $\stackrel{\triangle}{=}$ 53
Display texts are in a	1. Switch off power supply.
foreign language.	2. Press the 🗄 keys simultaneously and switch on the measuring device again.
	The display text will appear in English and is displayed at 50% contrast.
Measured value indicated, but no signal output at the current or pulse output	Measuring electronics defective $\rightarrow$ order spare parts $\rightarrow$ $\stackrel{\triangle}{=}$ 53
_	

#### Error messages on display

Errors which occur during commissioning or operation are displayed immediately or once the set delay time has elapsed ( $\rightarrow \equiv 109$ , ALARM DELAY function). Error messages consist of a variety of icons. The meanings of these icons are as follows (example):

- Type of error: S = System error, P = Process error
- Error message type: \( \frac{1}{2} = \text{Fault message} \), \( \frac{1}{2} = \text{Notice message} \)
- **DSC SENS LIMIT** = Error designation (device being operated near application limits)
- 03:00:05 = Duration of error to occur (in hours, minutes and seconds), display format, OPERATION HOURS function
   → Page 110
- #395 = Error number

Note!

- See the information on  $\rightarrow \stackrel{\triangle}{=} 30$
- The measuring system interprets simulations and positive zero return as system errors, but displays them as notice messages only.

Error message on display	System error (device error)→ 🖹 48 Process error (application error)→ 🖹 50
▼	
Other errors (without error message)	

# Other errors (without error message) Some other error has occurred. Diagnosis and remedial measures→ 50

Troubleshooting Proline Prowirl 72

## 9.2 System error messages

Serious system errors are **always** recognized by the device as "fault messages" and are indicated with a lightning flash (+) on the display! Fault messages have a direct effect on the outputs. Simulations and positive zero return, on the other hand, are only classed and displayed as "notice messages".



#### Caution!

In the event of a serious fault, a flowmeter might have to be returned to the manufacturer for repair. Important procedures must be carried out before you return a measuring device to Endress+Hauser  $(\rightarrow \mathbb{R} 8)$ .

Always enclose a fully completed "Declaration of Contamination" form with the device. A copy of the form can be found at the end of these Operating Instructions.



#### Note!

Also observe the information on  $\rightarrow \stackrel{\triangle}{=} 30$  and  $\rightarrow \stackrel{\triangle}{=} 52$ .

Туре	Error message / No.	Cause	Remedy / spare part ( $\rightarrow$ 🖹 53)
۶ = Fau	stem error alt message (with an effect o tice message (without an eff	on the outputs) fect on the outputs)	
No. #	$0xx \rightarrow Hardware\ error$		
S 4	CRITICAL FAIL. # 001	Serious device error	Replace the amplifier board.
S 4	AMP HW EEPROM # 011	Amplifier: faulty EEPROM	Replace the amplifier board.
S 4	AMP SW EEPROM # 012	Amplifier: error when accessing data of the EEPROM.	Contact your Endress+Hauser service organization.
S 4	COM HW EEPROM # 021	COM module: faulty EEPROM	Replace COM module.
S 4	COM SW EEPROM # 022	COM module: error when accessing data of the EEPROM	Contact your Endress+Hauser service organization.
S 4	CHECKSUM TOT. # 111	Totalizer checksum error	Contact your Endress+Hauser service organization.
S !	RANGE CUR.OUT # 351	Current output: the current flow is outside the set range.	Change full scale value entered.     Reduce flow.
S !	RANGE PULSE # 359	Pulse output: the pulse output frequency is outside the set range.	<ol> <li>Increase pulse value.</li> <li>When entering the pulse width, select a value that can still be processed by a connected totalizer (e.g. mechanical totalizer, PLC, etc.). Determine pulse width:         <ul> <li>Method 1: enter the minimum time for which a pulse has to be present at a connected totalizer in order to be recorded.</li> <li>Method 2: enter the maximum (pulse) frequency as a half "reciprocal value" for which a pulse has to be present at a connected totalizer in order to be recorded.</li></ul></li></ol>
S 4	RESONANCE DSC # 379	The device is being operated in the resonance frequency.  Caution!  If the device is operated in the resonance frequency, this can result in damage which can lead to complete device failure.	Reduce flow.
S 4	DSC SENS DEFCT # 394	The DSC sensor is defective, measurement no longer takes place.	Contact your Endress+Hauser service organization.

Proline Prowirl 72 Troubleshooting

Type	Error message / No.	Cause	Remedy / spare part ( $\rightarrow$ 🖹 53)
S !	DSC SENS LIMIT # 395	The DSC sensor is being operated near application limits, device failure is probable soon.	If this message is permanently displayed, contact your Endress+Hauser service organization.
S 4	SIGNAL>LOW PASS # 396	The device finds the signal outside the set filter range.  Possible causes:  The flow is outside the measuring range.  The signal is caused by a strong vibration which is intentionally not measured and is outside the measuring range.	<ul> <li>Check whether the device was installed in the flow direction.</li> <li>Check whether the right option was selected in the APPLICATION function (→  102).</li> <li>Check whether the operating conditions are within the specifications of the measuring device.</li> <li>Example:         <ul> <li>flow is above measuring range which means that the flow may have to be reduced.</li> </ul> </li> </ul>
			If the checks do not solve the problem, please contact your Endress+Hauser service organization.
S \$	PREAMP. DISCONN. # 399	Pre-amplifier disconnected.	Check the connection between the preamplifier and amplifier board and establish the connection if necessary.
S !	SWUPDATE ACT. # 501	New amplifier software version or data being loaded into device.  No other commands possible at this point.	Wait until the procedure is complete. The device is automatically restarted.
S !	UP-/DOWNL. ACT # 502	Uploading the device data. No other commands possible at this point.	Wait until the procedure is complete.
S !	POS. ZERO-RET. # 601	Positive zero return active.  Caution! This message has the highest display priority.	Switch off positive zero return.
S !	SIM. CURR. OUT # 611	Current output simulation active.	Switch off simulation.
S !	SIM. PULSE # 631	Pulse output simulation active.	Switch off simulation.
S !	SIM. STAT. OUT # 641	Status output simulation active.	Switch off simulation.
S \$	SIM. FAILSAFE # 691	Simulation of failsafe mode (outputs) active.	Switch off simulation.
S !	SIM. MEASURAND # 692	Simulation of a measured variable active (e.g. mass flow).	Switch off simulation.
S !	DEV. TEST ACT. # 698	The measuring device is being checked on site via the "Fieldcheck" testing device and simulator.	-
S !	CURRENT ADJUST # 699	Current adjustment is active.	Quit current adjustment.

Troubleshooting Proline Prowirl 72

## 9.3 Process error messages

Process errors can be defined as either "Fault" or "Notice" messages and can thereby be weighted differently. This is determined via the function matrix ( $\rightarrow$  Page 109, ERROR CATEGORY function).



#### Note!

- The listed error message types below correspond to the factory setting.
- Also observe the information on  $\rightarrow$   $\stackrel{\triangle}{=}$  30 and  $\rightarrow$   $\stackrel{\triangle}{=}$  52.

Туре	Error message / No.	Cause	Remedy / spare part
<b>4</b> = Fa₁	P = Process error  F = Fault message (with an effect on the outputs)  ! = Notice message (without an effect on the outputs)		
P !	FLOW RANGE # 421	The current flow velocity exceeds the limit value specified in the LIMIT VELOCITY function ( $\rightarrow$ 105).	Reduce the flow.

## 9.4 Process errors without messages

You may have to change or correct settings in certain functions of the function matrix in order to rectify faults. The functions outlined below (e.g. FLOW DAMPING) are described in detail in the "Description of device functions" section ( $\rightarrow \stackrel{\triangleright}{=} 75$ ).

Symptoms	Remedial measures
No flow signal	<ul> <li>In the case of liquids: check whether the piping is completely filled. The piping must always be completely filled for accurate and reliable flow measurement.</li> <li>Check whether all the packaging material, including the meter body protective covers, was completely removed before mounting the device.</li> <li>Check whether the desired electrical output signal was connected correctly.</li> </ul>
Flow signal even though there is no flow	Check whether the device is exposed to particularly strong vibrations. If so, a flow can be displayed even if the fluid is at a standstill, depending on the frequency and direction of the vibration.
	Remedial measures at the device:  ■ Turn the sensor 90°. Observe the installation conditions when doing so (→ 🖹 13). The measuring system is most sensitive to vibrations which follow in the direction of the sensor. Vibrations have less of an effect on the device in the other axes.  ■ The amplification can be altered using the AMPLIFICATION function. → 🖺 108
	Remedy through constructive measures during installation:  If the source of the vibration (e.g. pump or a valve) has been identified, the vibrations can be reduced by decoupling or supporting the source.  Support the pipe near the measuring device.
	If these measures do not solve the problem, your Endress+Hauser service organization can adjust the filters of the device to suit your special application.

Proline Prowirl 72 Troubleshooting

Symptoms	Remedial measures
Incorrect or highly-fluctuating flow signal	<ul> <li>The fluid is not sufficiently single-phase or homogeneous.         Prerequisite for precise and reliable flow measurement:             — Single-phase and homogeneous fluid             — Completely full pipe</li> <li>In many instances, the following measures can be taken to improve the measurement result even under non-ideal conditions:             — In the case of liquids with a low gas content in horizontal pipes, install the device with the head pointing downwards or to the side. This improves the measuring signal since the sensor is not in the area where gas accumulates when this type of installation is used.             — In the case of liquids with a low solids content, avoid installing the device with the electronics housing pointing downwards.             — In the case of steam or gases with a low liquid content, avoid installing the device with the electronics housing pointing downwards.             — The inlet and outlet runs must be present as per the installation instructions (→</li></ul>
The fault cannot be rectified or some other fault not described above has occurred.	<ul> <li>The following options are available for tackling problems of this nature:</li> <li>Request the services of an Endress+Hauser service technician If you contact our service organization to have a service technician sent out, the following information is needed:  – A brief description of the error with information on the application.  – Nameplate specifications (→  ) 9): order code and serial number</li> <li>Return devices to Endress+Hauser</li> <li>1. The measured listed in the "Return" section (→  ) 8) must be carried out before you return a measuring device requiring repair or calibration to Endress+Hauser.</li> <li>2. Enclose a fully completed "Declaration of Contamination" form with the flowmeter. A copy of the form can be found at the end of these Operating Instructions.</li> <li>Replace the transmitter electronics</li> <li>Order spare parts for the meter electronics directly from your Endress+Hauser service organization (→  ) 53).</li> </ul>

Troubleshooting Proline Prowirl 72

# 9.5 Response of outputs to errors



Note!

The failsafe mode of the totalizer, current output, pulse output and status output can be configured by means of various functions in the function matrix.

Positive zero return and error response:

You can use positive zero return to set the signals of the current, pulse and status outputs to their fallback value, for example when operation has to be interrupted while a pipe is being cleaned. This function has priority over all other device functions; simulations are suppressed, for example.

Response of outputs and totalizers to errors		
	Process/system error present	Positive zero return activated
Caution! System or process e	errors defined as "notice messages" have no effect whatsoever on the outputs. Refer also to the i	nformation on $\rightarrow \stackrel{\triangle}{=} 30$ .
Current output	MIN. CURRENT Depends on the option selected in the CURRENT SPAN function. If the current span is: 4 to 20 mA HART NAMUR → output current = 3.6 mA 4 to 20 mA HART US → output current = 3.75 mA	Output signal corresponds to zero flow.
	MAX. CURRENT 22.6 mA	
	HOLD VALUE Measured value display on the basis of the last saved value preceding occurrence of the fault.	
	ACTUAL VALUE Measured value output is based on the current flow measurement. The fault is ignored.	
Pulse output	FALLBACK VALUE Signal output → 0 pulse output HOLD VALUE Measured value display on the basis of the last valid flow value before the fault occurred.	Output signal corresponds to zero flow.
	ACTUAL VALUE  Measured value output is based on the current flow measurement. The fault is ignored.	
Status output	In the event of a fault or power supply failure: Status output → not conductive	No effect on the status output.
Totalizer	STOP The totalizer stops at the last value before the alarm condition occurred. HOLD VALUE The totalizer continues to count the flow on the basis of the last valid flow data (before the foult cocurred).	The totalizer stops.
	fault occurred).  ACTUAL VALUE  The totalizer continues to count the flow on the basis of the current flow data. The fault is ignored.	

Proline Prowirl 72 Troubleshooting

#### 9.6 Spare parts

Chap. 9.1 contains detailed troubleshooting instructions. The measuring device, moreover, provides additional support in the form of continuous self-diagnosis and error messages. Troubleshooting can entail replacing defective components with tested spare parts. The illustration below shows the available scope of spare parts.



You can order spare parts directly from your Endress+Hauser service organization by providing the serial number printed on the transmitter's nameplate.  $(\rightarrow \stackrel{\triangleright}{=} 9)$ .

Spare parts are shipped as sets comprising the following parts:

- Spare part
- Additional parts, small items (screws, etc.)
- Installation instructions
- Packaging

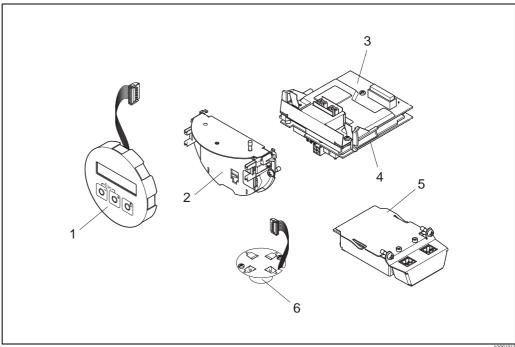


Fig. 26: Spare parts for transmitter Proline Prowirl 72

Local display module

- Board holder
- 3 I/O board (COM module), Non-Ex, Ex-i and Ex-n version
- Amplifier board
- I/O board (COM module), Ex-d version
- Pre-amplifier

Troubleshooting Proline Prowirl 72

# 9.6.1 Installing and removing electronics boards

For information on the software settings after installing a new electronics board  $\rightarrow \triangleq 40$ 

#### Non-Ex, Ex-i and Ex-n version



Warning!

When connecting Ex-certified devices, please refer to the notes and diagrams in the Ex-specific supplement to these Operating Instructions.

Please do not hesitate to contact your Endress+Hauser representative if you have any questions.



Caution!

Electrostatic charge!

Risk of damaging electronic components or impairing their function (ESD protection).

- Use a workplace with a grounded working surface, purpose-built for electrostatically sensitive devices!
- Use only genuine Endress+Hauser parts.

Procedure when installing/removing electronics boards ( $\rightarrow \square 27$ )

- 1. Unscrew the cover (a) of the electronics compartment from the transmitter housing.
- 2. Remove the local display module (b) from the retaining rails (c).
- 3. Attach the local display module (b) to the right retaining rail (c) with the left side. This secures the local display module.
- 4. Loosen the fixing screws (d) of the cover of the connection compartment (e) and fold down the cover.
- 5. Pull terminal connector (f) out of the I/O board (COM module) (q).
- 6. Fold up the plastic cover (g).
- 7. Remove the signal cable connector (h) from the amplifier board (s) and release from the cable holder (i).
- 8. Remove the ribbon cable connector (j) from the amplifier board (s) and release from the cable holder (k).
- 9. Remove the local display module (b) from the right retaining rail (c).
- 10. Fold down the plastic cover (g) again.
- 11. Release both screws (1) of the board holder (m).
- 12. Pull the board holder (m) out completely.
- 13. Press the side latches (n) of the board holder and separate the board holder (m) from the board body (o).
- 14. Replace the I/O board (COM module) (q):
  - Loosen the three fixing screws (p) of the I/O board (COM module).
  - Remove the I/O board (COM module) (q) from the board body (o).
  - Set a new I/O board (COM module) on the board body.
- 15. Replace the amplifier board (s):
  - Loosen fixing screws (r) of the amplifier board.
  - Remove the amplifier board (s) from the board body (o).
  - Set a new amplifier board on the board body.
- 16. Installation is the reverse of the removal procedure.

Proline Prowirl 72 Troubleshooting

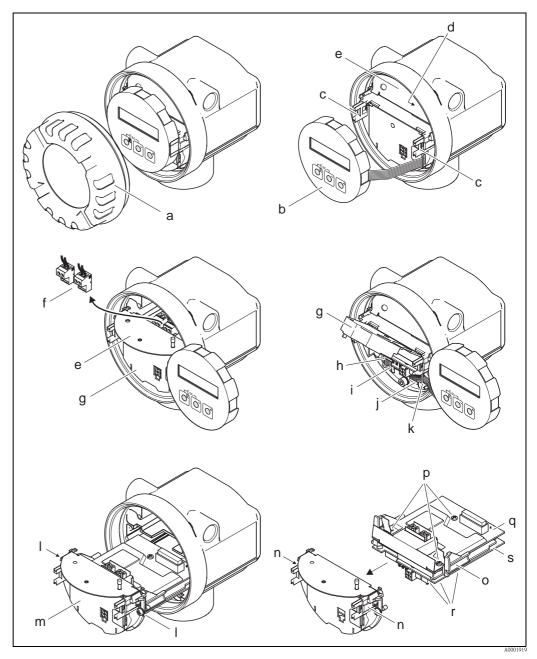


Fig. 27: Installing and removing electronics boards Non-Ex, Ex-i and Ex-n version

- a Cover of electronics compartment
- b Local display module
- c Retaining rails for local display module
- d Fixing screws for cover of connection compartment
- e Cover of connection compartment
- f Terminal connector
- g Plastic cover
- h Signal cable connector
- i Retainer for signal cable connector
- j Display module ribbon-cable connector
- k Retainer for ribbon-cable connector
- l Board holder threaded connection
- m Board holder
- n Board holder latches
- o Board body
- p I/O board (COM module) threaded connection
- q I/O board (COM module)
- r Amplifier board threaded connection
- s Amplifier board

Troubleshooting Proline Prowirl 72

#### Ex-d version



Warning!

When connecting Ex-certified devices, please refer to the notes and diagrams in the Ex-specific supplement to these Operating Instructions.

Please do not hesitate to contact your Endress+Hauser representative if you have any questions.



Caution!

Electrostatic charge!

Risk of damaging electronic components or impairing their function (ESD protection).

- Use a workplace with a grounded working surface, purpose-built for electrostatically sensitive devices!
- Use only genuine Endress+Hauser parts.

Procedure when installing/removing electronics boards ( $\rightarrow \square 28$ )

#### Installing/removing the I/O board (COM module)

- 1. Release securing clamp (a) of the connection compartment cover (b).
- 2. Unscrew the cover (b) of the connection compartment from the transmitter housing.
- 3. Disconnect terminal connector (c) from the I/O board (COM module) (e).
- 4. Release threaded connection (d) of the I/O board (COM module) (e) and pull out the board slightly.
- 5. Disconnect connection cable plug (f) from the I/O board (COM module) (e) and remove the board completely.
- 6. Installation is the reverse of the removal procedure.

#### Installing/removing the amplifier board:

- 1. Unscrew the cover (g) of the electronics compartment from the transmitter housing.
- 2. Remove the local display module (h) from the retaining rails (i).
- 3. Fold up the plastic cover (j).
- 4. Remove ribbon-cable connector of the local display module (h) from the amplifier board (t) and release from the cable holder.
- 5. Remove the signal cable connector (k) from the amplifier board (t) and release from the cable holder.
- 6. Release the fixing screw (1) and fold down the cover (m).
- 7. Release both screws (n) of the board holder (o).
- 8. Pull out the board holder (o) slightly and disconnect connecting cable plug (p) from the board body.
- 9. Pull the board holder (o) out completely.
- 10. Press the side latches (q) of the board holder and separate the board holder (o) from the board body (r).
- 11. Replace the amplifier board (t):
  - Loosen fixing screws (s) of the amplifier board.
  - Remove the amplifier board (t) from the board body (r).
  - Set a new amplifier board on the board body.
- 12. Installation is the reverse of the removal procedure.

Proline Prowirl 72 Troubleshooting

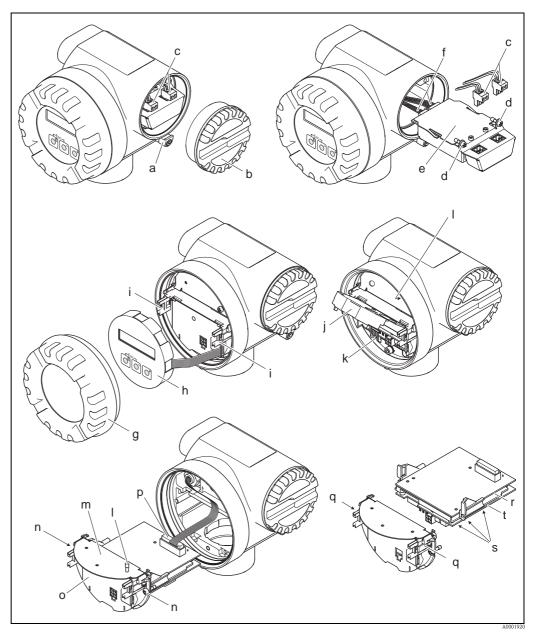


Fig. 28: Installing and removing electronics boards Ex-d version

- a Clamp securing the cover of the connection compartment
- b Cover of connection compartment
- c Terminal connector
- d I/O board (COM module) threaded connection
- e I/O board (COM module)
- f Connecting cable plug I/O-module
- g Cover of electronics compartment
- h Local display module
- i Retaining rails for local display module
- j Plastic cover
- k Signal cable connector
- l Fixing screws for cover of connection compartment
- m Connection compartment cover
- n Board holder threaded connection
- o Board holder
- p Connecting cable plug
- q Board holder latches
- r Board body
- s Amplifier board threaded connection
- t Amplifier board

Troubleshooting Proline Prowirl 72

# 9.7 Return

→ 🖹 8

# 9.8 Disposal

Observe the regulations applicable in your country!

# 9.9 Software history



Note!

 $\label{thm:continuous} Up load/download\ between\ different\ software\ versions\ is\ normally\ only\ possible\ with\ special\ service\ software.$ 

Date	Software version	Software modification	Documentation	
06.2010	V 1.05.XX	Software extension:  ■ Implementation of a calibration history	BA00084D/06/EN/01.11 71128081	
12.2008	V 1.04.XX	Software extension:  New functionalities:  New languages: Russian, Japanese, Chinese	BA084D/06/en/11.08 71081840	
01.2007	V 1.03.XX	Software extension: Flanged devices with reduced inner diameter (R Type, S Type)  New functionalities: Device software displayed (NAMUR Recommendation NE 53) Supervision of maximum flow velocity in the device (incl. warning message)	BA084D/06/en/01.07 71039102	
11.2004	Amplifier: V 1.02.XX	Software extension: ■ SIL 2 conformity as of V: 1.02.01 (03.2005) ■ Correction of diameter mismatch for devices with weld-on flanges  New functionalities: ■ Operation in Polish and Czech as of V 1.02.01	BA084D/06/en/12.05 71008404	
07.2003	Amplifier: Upload/download via HART using ToF Tool - Fieldtool Package		BA084D/06/en/12.03 50103643	
01.2003	Amplifier: V 1.00.00	Original software  Compatible with:  ToF Tool - Fieldtool Package  HART communicator DXR275 (OS 4.6 or higher) and DRX 375 with rev. 1 or higher, DD rev. 1		

# 10 Technical data

# 10.1 Technical data at a glance

# 10.1.1 Application

The measuring system is used to measure the volume flow of saturated steam, superheated steam, gases and liquids. If the process pressure and process temperature are constant, the measuring device can also output the flow as the calculated mass flow and corrected volume flow.

### 10.1.2 Function and system design

Measuring principle

Vortex flow measurement on the principle of the Karman vortex street.

Measuring system

The measuring system consists of a transmitter and a sensor:

- Transmitter Prowirl 72
- Prowirl F or W sensor

Two versions are available:

- Compact version: Transmitter and sensor form a single mechanical unit.
- Remote version: Sensor is mounted separate from the transmitter.

## 10.1.3 Input

Measured variable

- lacktriangledown Volumetric flow (volume flow) ightarrow is proportional to the frequency of vortex shedding after the bluff body.
- The output variables are volume flow or, if the process conditions are non-varying, calculated mass flow or corrected volume flow.

Measuring range

The measuring range depends on the fluid and the pipe diameter.

Start of measuring range:

See Technical Information TI00070D/06/EN

Full scale value:

Liquids:  $v_{max} = 9 \text{ m/s} (30 \text{ ft/s})$ 

Gas/steam: see table

Nominal diameter	<b>v</b> <sub>max</sub>
Standard version: DN 15 (½")	
R Style: DN 25 (1") > DN 15 ( $\frac{1}{2}$ ")	46 m/s (151 ft/s) or Mach 0.3
S Style: DN 40 (1½") >> DN 15 (½")	(depending on which value is smaller)
Standard version: DN 25 (1"), DN 40 ( $1\frac{1}{2}$ ")	
R Style:	
$-DN 40 (1\frac{1}{2}") > DN 25 (1")$	75 m/s (246 ft/s) or Mach 0.3
− DN 50 (2") > DN 40 (1½")	(depending on which value is smaller)
S Style:	
- DN 80 (3") >> DN 40 (1½")	
Standard version: DN 50 to 300 (2 to 12")	
R Style:	
– DN 80 (3") > DN 50 (2")	120 m/s (394 ft/s) or Mach 0.3
– Nominal diameters larger than DN 80 (3")	(depending on which value is smaller)
S Style:	
- DN 100 (4") >> DN 50 (2")	Calibrated range: up to 75 m/s (246 ft/s)
– Nominal diameters larger than DN 100 (4")	



#### Note!

By using the selection and planning program "Applicator", you can determine the exact values for the fluid you use. You can obtain the Applicator from your Endress+Hauser sales center or on the Internet under www.applicator.com.

#### K-factor range:

The table is used for orientation purposes. The range in which the K-factor can be is indicated for individual nominal diameters and designs.

Nominal diameter		K-factor range [pul./dm <sup>3</sup> ]		
DIN	ANSI	72F	72W	
DN 15	1/2"	390 to 450	245 to 280	
DN 25	1"	70 to 85	48 to 55	
DN 40	11/2"	18 to 22	14 to 17	
DN 50	2"	8 to 11	6 to 8	
DN 80	3"	2.5 to 3.2	1.9 to 2.4	
DN 100	4"	1.1 to 1.4	0.9 to 1.1	
DN 150	6"	0.3 to 0.4	0.27 to 0.32	
DN 200	8"	0.1266 to 0.1400	_	
DN 250	10"	0.0677 to 0.0748	-	
DN 300	12"	0.0364 to 0.0402 –		

# 10.1.4 Output

### Outputs, general

The following measured variables can generally be output via the outputs.

Measured variable	Current output	Pulse output	Status output	
Volume flow	If configured	If configured	Limit value (flow or totalizer)	
Mass flow	If configured	If configured If configured		
Corrected volume flow	If configured	If configured	Limit value (flow or totalizer)	

#### Output signal

#### Current output:

- 4 to 20 mA with HART
- Full scale value and time constant (0 to 100 s) can be set

#### Pulse/status output:

Open collector, passive, galvanically isolated

- $\blacksquare$  Non-Ex, Ex-d version:  $U_{max}=36$  V, with 15 mA current limiting,  $R_i=500~\Omega$
- $\blacksquare$  Ex-i and Ex-n version:  $U_{max} = 30$  V, with 15 mA current limiting,  $R_i = 500~\Omega$

The pulse/status output can be configured as:

- Pulse output:
  - Pulse value and polarity can be selected ( $\rightarrow = 91$ )
  - Pulse width adjustable (0.005 to 2 s)
  - Pulse frequency max. 100 Hz
- Status output:

Can be configured for error messages or flow limit values

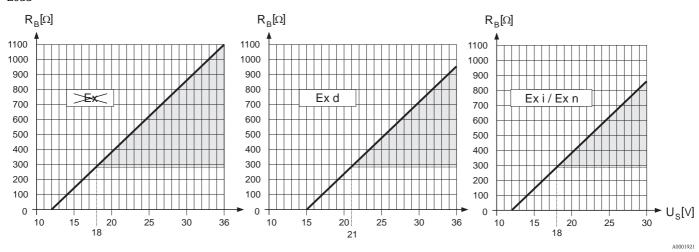
60

- Vortex frequency:
  - Direct output of unscaled vortex pulses 0.5 to 2850 Hz (e.g. for connecting to a flow computer RMC621)
  - Pulse ratio 1:1
- PFM signal (pulse/frequency modulation): For external connection with flow computer RMC or RMS621.

Signal on alarm

- Current output: failsafe mode can be selected (e.g. in accordance with NAMUR Recommendation NE 43)
- Pulse output: failsafe mode can be selected
- Status output: "not conductive" during fault

Load



The area marked in gray indicates the permissible load (with HART: min. 250  $\Omega$ )

The load is calculated as follows:

$$R_{_B} \; = \; \frac{(U_{_S} \! - U_{_{KI}})}{(I_{_{max}} \! - 10^{\text{-}3})} = \; \frac{(U_{_S} \! - U_{_{KI}})}{0.022} \label{eq:RB}$$

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 $R_B$  Load, load resistance

Supply voltage:

- Non-Ex = 12 to 36 V DC
- Ex-d = 15 to 36 V DC
- Ex-i and Ex-n = 12 to 30 V DC

 $U_{K\lambda}$  Terminal voltage:

- Non-Ex = min. 12 V DC
- Ex-d = min. 15 V DC
- Ex-i and Ex-n = min. 12 V DC

*I<sub>max</sub>* Output current (22.6 mA)

Low flow cut off

Switch points for low flow cutoff are selectable.

Galvanic isolation

All electrical connections are galvanically isolated themselves.

10.1.5	Power supply
--------	--------------

	10.1.5 Fower supply
Electrical connection	→ 🖹 21
Supply voltage	Non-Ex: 12 to 36 V DC (with HART: 18 to 36 V DC) Ex-i and Ex-n: 12 to 30 V DC (with HART 18 to 30 V DC) Ex-d: 15 to 36 V DC (with HART: 21 to 36 V DC)
Cable entry	Power supply and signal cables (outputs):  ■ Cable entry M20 × 1.5 (6 to 12 mm / 0.24 to 0.47")  ■ Cable entry M20 × 1.5 for armored signal cable (9.5 to 16 mm / 0.37 to 0.63")  ■ Thread for cable entry: ½" NPT, G ½", G ½" Shimada
Cable specification	<ul> <li>Permitted temperature range:         <ul> <li>Standard cable: -40 °C (-40 °F) to max. permissible ambient temperature plus 10 °C (18 °F)</li> <li>Armored cable: -30 to +70 °C (-22 to +158 °F)</li> </ul> </li> <li>Remote version →</li></ul>
Power supply failure	<ul> <li>Totalizer stops at the last value determined.</li> <li>All settings are kept in the EEPROM.</li> <li>Error messages (incl. value of operated hours counter) are stored.</li> <li>10.1.6 Performance characteristics</li> </ul>
	10.1.6 Performance characteristics
Reference operating conditions	Error limits following ISO/DIN 11631:  +20 to +30 °C (+68 to +86 °F)  2 to 4 bar (29 to 58 psi)  Calibration rig traced to national standards  Calibration with the process connection corresponding to the particular standard
Maximum measured error	<ul> <li>Volume flow (liquid):</li> <li>&lt; 0.75% o.r. for Re &gt; 20000</li> <li>&lt; 0.75% o.f.s for Re between 4000 and 20000</li> <li>Volume flow (gas/steam):</li> <li>&lt; 1% o.r. for Re &gt; 20000 and v &lt; 75 m/s (246 ft/s)</li> <li>&lt; 1% o.f.s for Re between 4000 and 20000</li> <li>o.r. = of reading, o.f.s = of full scale value, Re = Reynolds number</li> </ul>
	Diameter mismatch correction
	In the Prowirl 72 shifts in the calibration factor which are caused by a diameter mismatch between the device and the mating pipe can be corrected ( $\rightarrow \stackrel{\cong}{} 104$ ). The diameter mismatch should only be corrected within the limit values listed below for which test measurements have also been performed.
	Flange connection:  ■ DN 15 (½"): ±20% of the internal diameter  ■ DN 25 (1"): ±15% of the internal diameter  ■ DN 40 (1½"): ±12% of the internal diameter  ■ DN ≥50 (2"): ±10% of the internal diameter
	Wafer:  ■ DN 15 (½"): ±15% of the internal diameter  ■ DN 25 (1"): ±12% of the internal diameter  ■ DN 40 (1½"): ±9% of the internal diameter  ■ DN ≥50 (2"): ±8% of the internal diameter

Repeatability

 $\pm 0.25\%$  o.r. (of reading)

### Reaction time/ step response time

If all configurable functions are set to 0, you must reckon with a reaction time/step response time of 200 ms for vortex frequencies as of 10 Hz. Other settings require a reaction time/step response time of 100 ms to be added to the total filter reaction time for vortex frequencies as of 10 Hz.

- FLOW DAMPING  $\rightarrow$  106
- DISPLAY DAMPING → 🖹 86
- TIME CONSTANT (current output) → 🖹 89
- TIME CONSTANT (status output) → 🖹 97

# Influence of ambient temperature

Current output (additional error, in reference to the span of 16 mA)

- Zero point (4 mA): average  $T_k$ : 0.05%/10K, max. 0.6% over the entire temperature range of -40 to +80 °C (-40 to +176 °F)
- Span (20 mA): average  $T_k$ : 0.05%/10K, max. 0.6% over the entire temperature range of -40 to +80 °C (-40 to +176 °F)

Digital outputs (pulse output, PFM, HART)

Due to the digital measuring signal (vortex pulse) and further digital processing, there is no interface-related error from changing ambient temperature.

# 10.1.7 Operating conditions: installation

#### Installation instructions

→ 1 13

Inlet and outlet run

**→** 16

# 10.1.8 Operating conditions: environment

#### Ambient temperature range

#### Compact version

- Standard: -40 to +70 °C (-40 to +158 °F)
- EEx-d version: -40 to +60 °C (-40 to +140 °F)
- ATEX II 1/2 GD version/dust ignition-proof: -20 to +55 °C (-4 to +131 °F)
- Display can be read between -20 to +70 °C (-4 to +158 °F)

### Remote version sensor

- Standard:-40 to +85 °C (-40 to +185 °F)
- with armored cable: -30 to +70 °C (-22 to +158 °F)
- ATEX II 1/2 GD version/dust ignition-proof: -20 to +55 °C (-4 to +131 °F)

### Remote version transmitter

- Standard: -40 to +80 °C (-40 to +176 °F)
- with armored cable: -30 to +70 °C (-22 to +158 °F)
- EEx-d version: -40 to +60 °C (-40 to +140 °F)
- ATEX II 1/2 GD version/dust ignition-proof: -20 to +55 °C (-4 to +131 °F)
- Display can be read between -20 to +70 °C (-4 to +158 °F)
- Version up to -50 °C (-58 °F) on request

To protect the measuring device from direct sunlight when installing the unit outdoors, a protective cover (order number 543199–0001) is recommended. This applies in particular to warmer climates with high ambient temperatures.

Storage temperature	Standard: $-40$ to $+80$ °C ( $-40$ to $+176$ °F) ATEX II 1/2 GD version/dust ignition-proof: $-20$ to $+55$ °C ( $-4$ to $+131$ °F) Version up to $-52$ °C ( $-62$ °F) on request
Degree of protection	IP 67 (NEMA 4X) in accordance with EN 60529
Vibration resistance	Acceleration up to 1 g (at factory setting of the gain), 10 to 500 Hz, following IEC 60068-2-6
Electromagnetic compatibility (EMC)	To IEC/EN 61326 and NAMUR Recommendation NE 21

# 10.1.9 Operating conditions: process

# Medium temperature

DSC sensor (differential switched capacitor; capacitive sensor)					
DSC standard sensor	-40 to +260 °C (-40 to +500 °F)				
DSC high/low temperature sensor	-200 to +400 °C (-328 to +752 °F)				
DSC sensor Inconel (PN 63 to 160, Class 600, JIS 40K)	-200 to +400 °C (-328 to +752 °F)				
DSC sensor titanium Gr. 5 (PN 250, Class 900 to 1500 and butt-weld version)	−50 to +400 °C (−58 to +752 °F)				
DSC sensor Alloy C-22	-200 to +400 °C (-328 to +752 °F)				

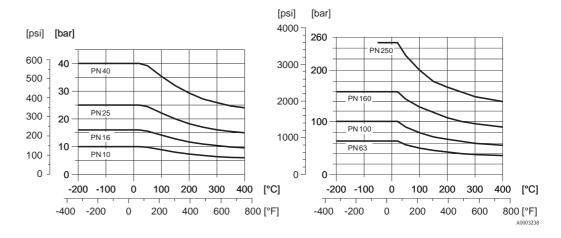
Seals	
Graphite	-200 to +400 °C (-328 to +752 °F)
Viton	-15 to +175 °C (+5 to +347 °F)
Kalrez	−20 to +275 °C (−4 to +527 °F)
Gylon (PTFE)	-200 to +260 °C (-328 to +500 °F)

Sensor	
Stainless steel	-200 to +400 °C (-328 to +752 °F)
Alloy C-22	-40 to +260 °C (-40 to +500 °F)
Special version for high fluid temperatures (on request)	-200 to +450 °C (-328 to +842 °F) -200 to +440 °C (-328 to +824 °F), Ex version

Medium pressure

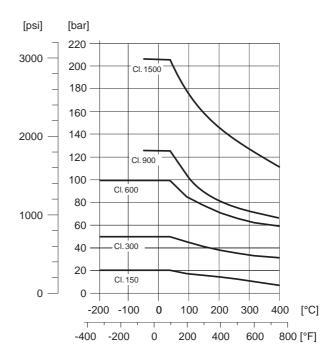
Pressure-temperature curve to EN (DIN), stainless steel

PN 10 to 40  $\rightarrow$  Prowirl 72W and 72F PN 63 to 250  $\rightarrow$  Prowirl 72F



Pressure-temperature curve to ANSI B16.5, stainless steel

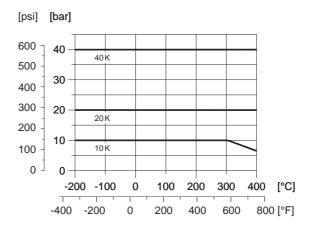
Class 150 to 300  $\rightarrow$  Prowirl 72W and 72F Class 600 to 1500  $\rightarrow$  Prowirl 72F



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Pressure-temperature curve to JIS B2220, stainless steel

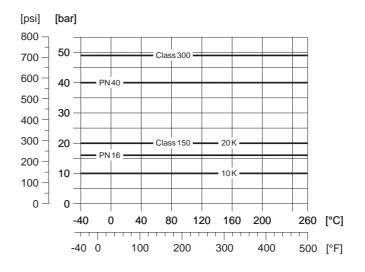
10 to 20K  $\rightarrow$  Prowirl 72W and 72F 40K  $\rightarrow$  Prowirl 72F



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Pressure-temperature curve to EN (DIN), ANSI B16.5 and JIS B2220, Alloy C-22

PN 16 to 40, Class 150 to 300, 10 to 20K  $\rightarrow$  Prowirl 72F



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Limiting flow

See information on  $\rightarrow$   $\stackrel{\triangle}{=}$  59 ("Measuring range")

Pressure loss

The pressure loss can be determined with the aid of the Applicator. The Applicator is software for selecting and planning flowmeters. The software is available both via the Internet (www.applicator.com) and on a CD-ROM for local PC installation.

# 10.1.10 Frequency ranges for air and water

For further media, e.g. steam, you can find information in the Applicator.

Prowirl 72W (SI units)

DN (DIN)	Air (at 0 °C, 1.013 bar)		Water (at 20 °C)			K-factor	
	Corrected volume flow ( $\dot{V}$ ) in [ $m^3/h$ ]		Volu	ıme flow (V	[Pulse/dm <sup>3</sup> ]		
	$\dot{V}_{min}$ $\dot{V}_{max}$ Frequency range [Hz]		$\dot{V}_{\min}$	<b>V</b> <sub>max</sub>	Frequency range [Hz]	Min. to max.	
DN 15	4	35	330 to 2600	0.19	7	10.0 to 520	245 to 280
DN 25	11	160	180 to 2300	0.41	19	5.7 to 300	48 to 55
DN 40	31	375	140 to 1650	1.1	45	4.6 to 200	14 to 17
DN 50	50	610	100 to 1200	1.8	73	3.3 to 150	6 to 8
DN 80	112	1370	75 to 850	4.0	164	2.2 to 110	1.9 to 2.4
DN 100	191	2330	70 to 800	6.9	279	2.0 to 100	1.1 to 1.4
DN 150	428	5210	38 to 450	15.4	625	1.2 to 55	0.27 to 0.32

Prowirl 72W (US units)

DN (ANSI)	Air (at 32 °F, 14.7 psia)			Water (at 68 °F)			K-factor
	Corrected volume flow ( <b>V</b> ) in [scfm]		Vol	ume flow (\	[Pulse/dm <sup>3</sup> ]		
	$\dot{V}_{min}$ $\dot{V}_{max}$ Frequency range [Hz]		$\dot{V}_{\min}$	$\dot{V}_{max}$	Frequency range [Hz]	Min. to max.	
1/2"	2.35	20.6	330 to 2600	0.84	30.8	10.0 to 520	245 to 280
1"	6.47	94.2	180 to 2300	1.81	83.7	5.7 to 300	48 to 55
11/2"	18.2	221	140 to 1650	4.84	198	4.6 to 200	14 to 17
2"	29.4	359	100 to 1200	7.93	321	3.3 to 150	6 to 8
3"	65.9	806	75 to 850	17.6	722	2.2 to 110	1.9 to 2.4
4"	112	1371	70 to 800	30.4	1228	2.0 to 100	1.1 to 1.4
6"	252	3066	38 to 450	67.8	2752	1.2 to 55	0.27 to 0.32

# Prowirl 72F (SI units)

DN (DIN)	Air	Air (at 0 °C, 1.013 bar)			Water (at	20 °C)	K-factor
	Corrected volume flow $(\dot{\mathbf{V}})$ in $[m^3/h]$			Volu	ıme flow (\	/) in [m <sup>3</sup> /h]	[Pulse/dm <sup>3</sup> ]
	$\dot{V}_{min}$	<b>V</b> <sub>max</sub>	Frequency range [Hz]	$\dot{V}_{\min}$	<b>V</b> <sub>max</sub>	Frequency range [Hz]	Min. to max.
DN 15	3	25	330 to 2850	0.16	5	14.0 to 600	390 to 450
DN 25	9	125	200 to 2700	0.32	15	6.5 to 340	70 to 85
DN 40	25	310	150 to 1750	0.91	37	4.5 to 220	18 to 22
DN 50	42	510	120 to 1350	1.5	62	3.7 to 170	8 to 11
DN 80	95	1150	80 to 900	3.4	140	2.5 to 115	2.5 to 3.2
DN 100	164	2000	60 to 700	5.9	240	1.9 to 86	1.1 to 1.4
DN 150	373	4540	40 to 460	13.4	550	1.2 to 57	0.3 to 0.4
DN 200	715	8710	27 to 322	25.7	1050	1.0 to 39	0.1266 to 0.14
DN 250	1127	13740	23 to 272	40.6	1650	0.8 to 33	0.0677 to 0.0748
DN 300	1617	19700	18 to 209	58.2	2360	0.6 to 25	0.0364 to 0.0402

# Prowirl 72F (US units)

DN (ANSI)	Air (at 32 °F, 14.7 psia)				Water (at	68 °F)	K-factor
	Corrected volume flow ( <b>V</b> ) in [scfm]			Vol	ume flow (	<b>V</b> ) in [gpm]	[Pulse/dm <sup>3</sup> ]
	$\dot{V}_{min}$	<b>V</b> <sub>max</sub>	Frequency range [Hz]	$\dot{\mathbf{V}}_{\min}$	<b>V</b> <sub>max</sub>	Frequency range [Hz]	Min. to max.
1/2"	1.77	14.7	380 to 2850	0.70	22.0	14.0 to 600	390 to 450
1"	5.30	73.6	200 to 2700	1.41	66.0	6.5 to 340	70 to 85
1 ½"	14.7	182	150 to 1750	4.01	163	4.5 to 220	18 to 22
2"	24.7	300	120 to 1350	6.6	273	3.7 to 170	8 to 11
3"	55.9	677	80 to 900	15.0	616	2.5 to 115	2.5 to 3.2
4"	96.5	1177	60 to 700	26.0	1057	1.9 to 86	1.1 to 1.4
6"	220	2672	40 to 460	59.0	2422	1.2 to 57	0.3 to 0.4
8"	421	5126	27 to 322	113	4623	1.0 to 39	0.1266 to 0.14
10"	663	8087	23 to 272	179	7265	0.8 to 33	0.0677 to 0.0748
12"	952	11 595	18 to 209	256	10391	0.6 to 25	0.0364 to 0.0402

#### 10.1.11 Mechanical construction

Design, dimensions See Technical Information TI00070D/06/EN

Weight See Technical Information TI00070D/06/EN

#### Material

#### Transmitter housing

- Powder-coated die-cast aluminum AlSi10Mg
  - In accordance with EN 1706/EN AC-43400
     (EEx d version: cast aluminum EN 1706/EN AC-43000)

#### Sensor

#### Flanged version

- Pressure ratings up to PN 40, Class 300, 20K:
  - Stainless steel, A351–CF3M (1.4408), in compliance with AD2000 (temperature range -10 to +400 °C/ +14 to +752 °F) as well as in compliance with NACE MR0175–2003 and MR0103–2003
  - Alloy C-22, 2.4602, (A494-CX2MW/N26022), in compliance with NACE MR0175-2003 and MR0103-2003
- Pressure ratings up to PN 160, Class 600, 40K:
  - Stainless steel, A351–CF3M (1.4408), in compliance with AD2000 (temperature range -10 to  $+400\,^{\circ}\text{C/}$  +14 to  $+752\,^{\circ}\text{F}$ ) as well as in compliance with NACE MR0175–2003 and MR0103–2003
- Pressure ratings PN 250, Class 900 to 1500 and butt-weld version:
  - Stainless steel, 316Ti/316L (1.4571), NACE available on request

#### Wafer version

- Pressure ratings up to PN 40, Class 300, 20K:
  - Stainless steel, A351–CF3M (1.4408), in compliance with AD2000 (temperature range -10 to +400 °C/ +14 to +752 °F) as well as in compliance with NACE MR0175–2003 and MR0103–2003

#### Flanges

- EN (DIN)
  - Stainless steel, A351-CF3M (1.4404), in compliance with NACE MR0175-2003 and MR0103-2003
  - DN 15 to 150 with pressure ratings to PN 40 and all devices with integrated diameter reduction (R Style, S Style): construction with weld-on flanges made of 1.4404 (AISI 316L).
     All nominal diameters PN 63 to 160 as well as nominal diameters DN 200 to 300 to PN 40: fully cast construction A351-CF3M (1.4408), in compliance with NACE MR0175-2003 and MR0103-2003
  - Pressure rating PN 250 1.4571 (316Ti, UNS S31635), in compliance with NACE MR0175– 2003 and MR0103–2003 available on request
- ANSI and IIS
  - Stainless steel, A351-CF3M, in compliance with NACE MR0175-2003 and MR0103-2003
  - ½ to 6" with pressure ratings to Class 300 and DN 15 to 150 with pressure ratings to 20K and all devices with integrated diameter reduction (R Style, S Style): construction with weld-on flanges made of 316/316L, in compliance with NACE MR0175-2003 and MR0103-2003. All nominal diameters Class 600, 40K as well as nominal diameters DN 200 to 300 to Class 300, 20K: fully cast construction A351-CF3M, in compliance with NACE MR0175-2003 and MR0103-2003
  - Pressure ratings Class 900 to 1500: 316/316L, in compliance with NACE MR0175-2003 and MR0103-2003 available on request
- Alloy C-22 version (EN/DIN/ANSI/JIS)
  - Alloy C-22, 2.4602, (A494-CX2MW/N26022), in compliance with NACE MR0175-2003 and MR0103-2003

### DSC sensor (differential switched capacitor)

- Wetted parts (marked as "wet" on the DSC sensor flange):
- Standard for pressure ratings up to PN 40, Class 300, JIS 40K:
   Stainless steel 1.4435 (316/316L), in compliance with NACE MR0175-2003 and MR0103-2003
- Pressure ratings PN 63 to 160, Class 600, 40K:
   Inconel 718 (2.4668/N07718, according to B637), in compliance with NACE MR0175-2003 and MR0103-2003
- Pressure ratings PN 250, Class 900 to 1500 and butt-weld version: titanium Gr. 5 (B-348; UNS R50250; 3.7165)
- Alloy C-22 sensor:
   Alloy C-22, 2.4602/N 06022; in compliance with NACE MR0175-2003 and MR0103-2003

#### Non-wetted parts

■ Stainless steel 1.4301 (304)

#### Support

- Stainless steel, 1.4308 (CF8)
- Pressure ratings PN 250, Class 900 to 1500 and butt-weld version: 1.4305 (303)

#### Seals

- Graphite
  - Pressure rating PN 10 to 40, Class 150 to 300, JIS 10 to 20K: Signaflex Folie Z (BAM-tested for oxygen applications)
  - Pressure rating PN 63 to 160, Class 600, JIS 40K: Sigraflex Hochdruck<sup>TM</sup> with stainless steel sheet reinforcement made of 316(L) (BAM-tested for oxygen applications, "high quality in terms of TA Luft (German Clean Air Act)")
  - Pressure rating PN 250, Class 900 to 1500: Grafoil with perforated stainless steel reinforcement made of 316
- Viton
- Kalrez 6375
- Gylon (PTFE) 3504 (BAM-tested for oxygen applications, "high quality in terms of TA Luft (German Clean Air Act)")

### 10.1.12 Human interface

Display elements	<ul> <li>Liquid crystal display, two-line, plain text display, 16 characters per line</li> <li>Display can be configured individually, e.g. for measured variables and status variables, totalizers</li> </ul>
Operating elements	<ul> <li>■ Local operation with three keys (+, -, ■)</li> <li>■ Quick Setup for quick commissioning</li> <li>■ Operating elements accessible also in Ex zones</li> </ul>
Remote operation	Operation via:  HART protocol FieldCare (software package from Endress+Hauser for complete configuration, commissioning and diagnosis)

## 10.1.13 Certificates and approvals

	• •
CE approval	→ 🖹 11
C-Tick mark	→ 🖹 11
Ex approval	More information on the Ex approvals can be found in the separate Ex documentation.
Pressure measuring device approval	The measuring devices can be ordered with or without PED (Pressure Equipment Directive). If a device with PED is required, this must be ordered explicitly. For devices with nominal diameters less than or equal to DN 25 (1"), this is neither possible nor necessary.  With the identification PED/G1/III on the sensor nameplate, Endress+Hauser confirms conformity with the "Basic safety requirements" of Appendix I of the Pressure Equipment Directive 97/23/EC.  Devices with this identification (with PED) are suitable for the following types of fluid:  Fluids of Group 1 and 2 with a steam pressure of greater or less than 0.5 bar (7.3 psi)  Unstable gases  Devices without this identification (without PED) are designed and manufactured according to good engineering practice. They correspond to the requirements of Art. 3, Section 3 of the Pressure Equipment Directive 97/23/EC. Their application is illustrated in Diagrams 6 to 9 in Appendix II of the Pressure Equipment Directive 97/23/EC.
Functional safety	SIL 2 in accordance with IEC 61508/IEC 61511-1 Following the link http://www.endress.com/sil, you will find an overview of all Endress+Hauser devices for SIL applications including parameters like SFF, MTBF, $PFD_{avg}$ etc.

# Other standards and guidelines

## ■ EN 60529

Degrees of protection by housing (IP code)

■ EN 61010-1

Safety requirements for electrical equipment for measurement, control and laboratory use

■ IEC/EN 61326

Electromagnetic compatibility (EMC requirements)

■ NAMUR NE 21

Electromagnetic compatibility (EMC) of industrial process and laboratory control equipment

■ NAMUR NE 43

Standardization of the signal level for the breakdown information of digital transmitters with analog output signal.

■ NAMUR NE 53

Software of field devices and signal-processing devices with digital electronics

■ NACE standard MR0103-2003

Standard Material Requirements - Materials Resistant to Sulfide Stress Cracking in Corrosive Petroleum Refining Environments

■ NACE standard MR0175-2003

Standard Material Requirements - Sulfide Stress Cracking Resistant Metallic Materials for Oilfield Equipment

■ VDI 2643

Measurement of fluid flow by means of vortex flowmeters.

■ ANSI/ISA-S82.01

Safety Standard for Electrical and Electronic Test, Measuring, Controlling and Related Equipment - General Requirements. Pollution degree 2, Installation Category II

■ CAN/CSA-C22.2 No. 1010.1-92 Safety Standard for Electrical Equipment for Measurement and Control and Laboratory Use. Pollution degree 2, Installation Category II

## 10.1.14 Ordering information

Your Endress+Hauser service organization can provide detailed ordering information and information on the order codes on request.

#### 10.1.15 Accessories

Various accessories, which can be ordered separately from Endress+Hauser, are available for the transmitter and the sensor ( $\rightarrow$   $\stackrel{\triangle}{=}$  44). Your Endress+Hauser service organization can provide detailed information on the order codes of your choice.

#### 10.1.16 Documentation

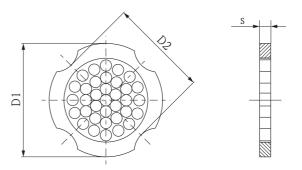
- Flow measurement (FA00005D/06/EN)
- Technical Information Proline Prowirl 72F, 72W, 73F, 73W (TI00070/06/EN)
- Associated Ex documentation: ATEX, FM, CSA etc.
- Related documentation for Pressure Equipment Directive Proline Prowirl 72/73 (SD00072D/06/EN)
- Functional Safety Manual (Safety Integrity Level)

# 10.2 Dimensions of flow conditioner

Dimensions according to:

- EN 1092-1 (DIN 2501)
- ANSI B16.5
- JIS B2220

Material 1.4404 (316/316L), in compliance with NACE MR0175-2003 and MR0103-2003



Δ00010

- 11: The flow conditioner is fitted at the outer diameter between the bolts.
- D2: The flow conditioner is fitted at the indentations between the bolts.

#### Dimensions of flow conditioner according to EN (DIN)

DN	Pressure rating	Centering diameter [mm]	D1 / D2 *	s [mm]	Weight [kg]
15	PN 10 to 40 PN 63	54.3 64.3	D2 D1	2.0	0.04 0.05
25	PN 10 to 40 PN 63	74.3 85.3	D1 D1	3.5	0.12 0.15
40	PN 10 to 40 PN 63	95.3 106.3	D1 D1	5.3	0.3 0.4
50	PN 10 to 40 PN 63	110.0 116.3	D2 D1	6.8	0.5 0.6
80	PN 10 to 40 PN 63	145.3 151.3	D2 D1	10.1	1.4
100	PN 10/16 PN 25/40 PN 63	165.3 171.3 176.5	D2 D1 D2	13.3	2.4
150	PN 10/16 PN 25/40 PN 63	221.0 227.0 252.0	D2 D2 D1	20.0	6.3 7.8 7.8
200	PN 10 PN 16 PN 25 PN 40	274.0 274.0 280.0 294.0	D1 D2 D1 D2	26.3	11.5 12.3 12.3 15.9
250	PN 10/16 PN 25 PN 40	330.0 340.0 355.0	D2 D1 D2	33.0	25.7 25.7 27.5
300	PN 10/16 PN 25 PN 40	380.0 404.0 420.0	D2 D1 D1	39.6	36.4 36.4 44.7

<sup>\*</sup> D1  $\rightarrow$  The flow conditioner is fitted at the external diameter between the bolts.

 $D2 \rightarrow$  The flow conditioner is fitted at the indentations between the bolts.

Dimensions of flow conditioner according to ANSI

D	N	Pressure rating	Centering diameter mm (in)	D1 / D2 *	s mm (in)	Weight kg (lbs)
15	1/2"	Cl. 150 Cl. 300	50.1 (1.97) 56.5 (2.22)	D1 D1	2.0 (0.08)	0.03 (0.07) 0.04 (0.09)
25	1"	Cl. 150 Cl. 300	69.2 (2.72) 74.3 (2.93)	D2 D1	3.5 (0.14)	0.12 (0.26)
40	11/2"	Cl. 150 Cl. 300	88.2 (3.47) 97.7 (3.85)	D2 D2	5.3 (0.21)	0.3 (0.66)
50	2"	Cl. 150 Cl. 300	106.6 (4.20) 113.0 (4.45)	D2 D1	6.8 (0.27)	0.5 (1.1)
80	3"	Cl. 150 Cl. 300	138.4 (5.45) 151.3 (5.96)	D1 D1	10.1 (0.40)	1.2 (2.6) 1.4 (3.1)
100	4"	Cl. 150 Cl. 300	176.5 (6.95) 182.6 (7.19)	D2 D1	13.3 (0.52)	2.7 (6.0)
150	6"	Cl. 150 Cl. 300	223.9 (8.81) 252.0 (9.92)	D1 D1	20.0 (0.79)	6.3 (14) 7.8 (17)
200	8"	Cl. 150 Cl. 300	274.0 (10.8) 309.0 (12.2)	D2 D1	26.3 (1.04)	12.3 (27) 15.8 (35)
250	10"	Cl. 150 Cl. 300	340.0 (13.4) 363.0 (14.3)	D1 D1	33.0 (1.30)	25.7 (57) 27.5 (61)
300	12"	Cl. 150 Cl. 300	404.0 (15.9) 402.0 (16.5)	D1 D1	39.6 (1.56)	36.4 (80) 44.6 (98)

<sup>\*</sup> D1  $\rightarrow$  The flow conditioner is fitted at the external diameter between the bolts.

Dimensions of flow conditioner according to JIS

DN	Pressure rating	Centering diameter [mm]	D1 / D2 *	s [mm]	Weight [kg]
	10K	60.3	D2	2.0	0.06
15	20K	60.3	D2	2.0	0.06
	40K	66.3	D1	2.0	0.06
	10K	76.3	D2	3.5	0.14
25	20K	76.3	D2	3.5	0.14
	40K	81.3	D1	3.5	0.14
	10K	91.3	D2	5.3	0.31
40	20K	91.3	D2	5.3	0.31
	40K	102.3	D1	5.3	0.31
	10K	106.6	D2	6.8	0.47
50	20K	106.6	D2	6.8	0.47
	40K	116.3	D1	6.8	0.5
	10K	136.3	D2	10.1	1.1
80	20K	142.3	D1	10.1	1.1
	40K	151.3	D1	10.1	1.3
	10K	161.3	D2	13.3	1.8
100	20K	167.3	D1	13.3	1.8
	40K	175.3	D1	13.3	2.1
	10K	221.0	D2	20.0	4.5
150	20K	240.0	D1	20.0	5.5
	40K	252.0	D1	20.0	6.2
200	10K	271.0	D2	26.3	9.2
200	20K	284.0	D1	26.3	9.2
250	10K	330.0	D2	33.0	15.8
250	20K	355.0	D2	33.0	19.1
200	10K	380.0	D2	39.6	26.5
300	20K	404.0	D1	39.6	26.5

 $<sup>^{\</sup>star}$  D1  $\rightarrow$  The flow conditioner is fitted at the external diameter between the bolts.

 $<sup>\</sup>mathrm{D2} \to \mathrm{The}$  flow conditioner is fitted at the indentations between the bolts.

 $<sup>\</sup>mbox{D2} \rightarrow \mbox{The flow conditioner}$  is fitted at the indentations between the bolts.

# 11 Description of device functions

# 11.1 Illustration of the function matrix

Groups/function groups	5	Functions			
MEASURED VALUES	→ <b>1</b> 77	FLOW	VORTEX FREQUENCY	VELOCITY	
<b>\</b>					
SYSTEM UNITS	→ 🖹 78	MEASURING UNIT TYPE	UNIT FLOW	UNIT DENSITY	UNIT TEMPERATURE
<b>↓</b>		UNIT LENGTH	TEXT ARBITRARY VOLUME UNIT	FACTOR ARBITRARY Volume Unit	FORMAT DATE/TIME
QUICK SETUP	→ 🖹 82	QUICK SETUP COMMISSIONING			
<b>\</b>					
OPERATION	→ 🖹 83	LANGUAGE	ACCESS CODE	DEFINE PRIVATE CODE	STATUS ACCESS
<b>↓</b>		ACCESS CODE COUNTER			
USER INTERFACE	→ 🖹 85	ASSIGN LINE 1	ASSIGN LINE 2	100% VALUE	FORMAT
<b>↓</b>		DISPLAY DAMPING	CONTRAST LCD	TEST DISPLAY	
TOTALIZER   ↓	→ 🖹 87	SUM FAILSAFE MODE	OVERFLOW	UNIT TOTALIZER	RESET TOTALIZER
CURRENT OUTPUT	→ 🖹 89	CURRENT SPAN	VALUE 20 mA	TIME CONSTANT	FAILSAFE MODE
<b>↓</b>		ACTUAL CURRENT	SIMULATION CURRENT	VALUE SIMULATION CURRENT	
PULSE/STATUS OUTPUT	→ 🖹 91	OPERATION MODE	PULSE VALUE	PULSE WIDTH	OUTPUT SIGNAL
		FAILSAFE MODE	ACTUAL PULSE	SIMULATION PULSE	VALUE SIMULATION PULSE
1		ASSIGN STATUS	ON-VALUE	OFF-VALUE	TIME CONSTANT
<b>↓</b>		ACTUAL STATUS OUTPUT	SIMULATION SWITCH POINT	VALUE SIMULATION SWITCH POINT	
COMMUNICATION	→ 🖹 101	TAG NAME	TAG DESCRIPTION	FIELDBUS ADDRESS	WRITE PROTECTION
SOMMONIONION	, = IVI	BURST MODE	MANUFACTURER ID	DEVICE ID	,, MILIKOILOIION
$\downarrow$		20.01 111022		22.13010	
PROCESS PARAMETER	→ <b>1</b> 02	APPLICATION	OPERATION DENSITY	REFERENCE DENSITY	OPERATION TEMPERATURE
		MATING PIPE DIAMETER	ON-VALUE LOW FLOW CUT OFF	OFF-VALUE LOW FLOW CUT OFF	VELOCITY WARNING
$\downarrow$		LIMIT VELOCITY			
SYSTEM PARAMETER	→ 🖹 106	POSITIVE ZERO RETURN	FLOW DAMPING		

Groups/function group	S	Functions			
SENSOR DATA	→ <b>1</b> 107	CALIBRATION DATE	K-FACTOR	K-FACTOR COMPENSATED	NOMINAL DIAMETER
<b>↓</b>	_	METER BODY MB	TEMPERATURE COEFFICIENT SENSOR	AMPLIFICATION	
SUPERVISION	→ 🖹 109	ACTUAL SYSTEM CONDITION	PREVIOUS SYSTEM CONDITIONS	ASSIGN SYSTEM ERROR	ERROR CATEGORY
<b></b>	_	ALARM DELAY	SYSTEM RESET	OPERATION HOURS	
<b>*</b>					•
SIMULATION SYSTEM	→ 🖹 111	SIMULATION FAILSAFE MODE	SIMULATION MEASURAND	VALUE SIMULATION MEASURAND	
<u> </u>	_				
SENSOR VERSION	→ <b>1</b> 112	SERIAL NUMBER	SENSOR TYPE	SERIAL NUMBER DSC SENSOR	
<b>\</b>	_				•
AMPLIFIER VERSION	→ <b>1</b> 112	DEVICE SOFTWARE	HARDWARE REVISION NUMBER AMPLIFIER	SOFTWARE REVISION NUMBER AMPLIFIER	HARDWARE REVISION NUMBER I/O MODULE

# 11.2 MEASURED VALUES

Function description, M	Function description, MEASURED VALUES group			
FLOW	<ul> <li>Description         The flow currently measured appears on the display. The appropriate unit is taken from the UNIT FLOW function (→</li></ul>			
	e.g. 5.545 dm <sup>3</sup> /min; 1.4359 kg/h; 731.63 gal/d			
VORTEX FREQUENCY	<b>Description</b> The vortex frequency currently measured appears on the display. This function is only used for a plausibility check.			
	<b>Display</b> 5-digit floating-point number, including unit Hz e.g. 120.23 Hz			
VELOCITY	<b>Description</b> The flow velocity through the device appears on the display. This is calculated from the current flow through the device and the cross-sectional area flowed through. Unit on the display depends on UNIT LENGTH $(\rightarrow \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \$			
	<b>Display</b> 5-digit floating point number, incl. unit: m/s; ft/s			

### 11.3 SYSTEM UNITS

#### Function description, SYSTEM UNITS group

# MEASURING UNIT TYPE

#### Description

Use this function to select the desired type of unit which the measuring device should use to output the flow.

#### Unit types:

- Volumetric flow (volume flow)
   Is measured by the measuring device. No other calculation takes place.
- Calculated mass flow
   Is calculated using the measured volume flow and the value entered in the OPERATION DENSITY function (→ 102).
- Calculated corrected volume flow Is calculated using the measured volume flow and the ratio between the two values that were entered in the OPERATION DENSITY (→ 102) and REFERENCE DENSITY function (→ 102).



The "calculated mass flow" and "calculated corrected volume flow" unit types are calculated with fixed values for OPERATING DENSITY and REFERENCE DENSITY.

- If the process conditions are known and do not change, select these two types of unit.
- If the process conditions are not known or if the process conditions could change, we recommend you use a flow computer (e.g. Compart DXF351 or RMC621). Even when the process conditions change, these flow computers can calculate the flow correctly by means of pressure and temperature compensation.

#### Options

VOLUME FLOW CALCULATED MASS FLOW CORRECTED VOLUME FLOW (calculated)

#### Factory setting

See the parameter printout provided. The parameter printout is an integral part of these Operating Instructions.



If  $\overline{\text{the}}$  type of unit is changed, you are asked whether the totalizer should be reset to 0. This message has to be confirmed before the measuring device accepts the new type of unit; otherwise the measuring device continues to use the type of unit previously active.

#### Function description, SYSTEM UNITS group

#### UNIT FLOW

#### Description

For selecting the unit required and displayed for the flow. Depending on what is selected in the MEASURING UNIT TYPE function ( $\rightarrow$   $\trianglerighteq$  78), only the associated units (volume, mass or corrected volume) are displayed here.

The unit you select here is also valid for:

- Flow display
- Current output (value 20 mA)
- Pulse/status output (pulse value; on-value/off-value)
- On-value low flow cut off
- Simulation measurand



Note!

The unit for the totalizer is independent of the option selected here; it is selected in the UNIT TOTALIZER function ( $\rightarrow \stackrel{\text{le}}{\Rightarrow} 87$ ).

The following time units can be selected:

s = second, m = minute, h = hour, d = day

#### Options (MEASURING UNIT TYPE function = VOLUME FLOW)

#### Metric:

Cubic centimeter  $\rightarrow$  cm<sup>3</sup>/time unit

Cubic decimeter  $\rightarrow$  dm<sup>3</sup>/time unit

Cubic meter  $\rightarrow$  m<sup>3</sup>/time unit

 $Milliliter \rightarrow ml/time unit$ 

Liter  $\rightarrow$  1/time unit

Hectoliter → hl/time unit

 $Megaliter \rightarrow Ml/time unit MEGA$ 

#### 115.

Cubic centimeter  $\rightarrow$  cc/time unit

Acre foot  $\rightarrow$  af/time unit

Cubic foot  $\rightarrow$  ft<sup>3</sup>/time unit

Fluid ounce  $\rightarrow$  ozf/time unit

Gallon  $\rightarrow$  US gal/time unit

Mega gallon  $\rightarrow$  US Mgal/time unit Barrel (normal fluids: 31.5 gal/bbl)  $\rightarrow$  US bbl/time unit NORM.

Barrel (beer: 31.0 gal/bbl) → US bbl/time unit BEER

Barrel (petrochemicals: 42.0 gal/bbl)  $\rightarrow$  US bbl/time unit PETR.

Barrel (filling tanks: 55.0 gal/bbl) → US bbl/time unit TANK

#### Imperial:

Gallon  $\rightarrow$  imp. gal/time unit

Mega gallon  $\rightarrow$  imp. Mgal/time unit

Barrel (beer: 36.0 gal/bbl)  $\rightarrow$  imp. bbl/time unit BEER

Barrel (petrochemicals: 34.97 gal/bbl)  $\rightarrow$  imp. bbl/time unit PETR.

#### Arbitrary volume unit:

This option does not appear unless a volume unit was defined via the TEXT ARBITRARY VOLUME UNIT function ( $\rightarrow \stackrel{\triangle}{=} 81$ ).

#### Factory setting

See the parameter printout provided. The parameter printout is an integral part of these Operating Instructions.

#### Options (MEASURING UNIT TYPE function = CALCULATED MASS FLOW)

#### Metric:

 $Gram \to g/time\ unit$ 

Kilogram → kg/time unit

Metric ton  $\rightarrow$  t/time unit

#### US:

Ounce  $\rightarrow$  oz/time unit (US)

Pound  $\rightarrow$  lb/time unit

Ton  $\rightarrow$  ton/time unit

#### Factory setting

See the parameter printout provided. The parameter printout is an integral part of these Operating Instructions.

(Continued on next page)

Function description, S	YSTEM UNITS group
UNIT FLOW (continued)	Options (MEASURING UNIT TYPE function = CORRECTED VOLUME FLOW)  Metric: Standard liter → Nl/time unit Standard cubic meter → Nm³/time unit  US: Standard cubic meter → Sm³/time unit Standard cubic feet → Scf/time unit Factory setting See the parameter printout provided. The parameter printout is an integral part of these Operating Instructions.
UNIT DENSITY	Prerequisite This function is <b>only</b> available if the CALCULATED MASS FLOW or CORRECTED VOLUME (calculated) values were selected in the MEASURING UNIT TYPE function (→ 🖹 78).  Description For selecting the unit required and displayed for the density. The density is selected in the
	OPERATION DENSITY (→ ■ 102) and REFERENCE DENSITY function (→ ■ 102).  Options  Metric: g/cm³ g/cc kg/dm³ kg/l kg/m³ SD* 4 °C, SD 15 °C, SD 20 °C SG* 4 °C, SG 15 °C, SG 20 °C US: lb/ft³ lb/US gal lb/US bbl NORM (normal fluids) lb/US bbl PETR. (petrochemicals) lb/US bbl TANK (filling tanks)  Imperial: lb/imp. gal lb/imp. bbl BEER (beer) lb/imp. bbl PETR. (petrochemicals)  Factory setting See the parameter printout provided. The parameter printout is an integral part of these Operating Instructions.  * SD = specific density, SG = specific gravity The specific density is the ratio of fluid density to water density (at water temperature = 4, 15, 20 °C).
UNIT TEMPERATURE	Description For selecting the unit required and displayed for the temperature. The temperature is entered in the OPERATION TEMPERATURE function (→ 🖹 103).  Options °C (CELSIUS) K (KELVIN) °F (FAHRENHEIT) R (RANKINE)  Factory setting Depends on country → 🖺 113

Function description, SY	/STEM UNITS group
UNIT LENGTH	<b>Description</b> For selecting the unit required and displayed for the length unit of the nominal diamete in the NOMINAL DIAMETER function ( $\rightarrow \triangle 107$ ).
	Options MILLIMETER INCH
	Factory setting Depends on country $\rightarrow \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ $
TEXT ARBITRARY VOLUME UNIT	Prerequisite The function is <b>only</b> available if VOLUME FLOW was selected in the MEASURING UNIT TYPE function ( $\rightarrow \stackrel{\triangle}{1}$ 78).
	<b>Description</b> For entering a text for a volume flow unit of the user's choice. The related time unit is selected in the UNIT FLOW function ( $\rightarrow \stackrel{\triangle}{=} 79$ ). The volume unit defined in this function is offered as a possible option (arbitrary volume unit) in the UNIT FLOW function ( $\rightarrow \stackrel{\triangle}{=} 79$ ).
	User input xxxx (max. 4 characters) Valid characters are A-Z, 0-9, +, -, decimal point, white space or underscore
	Factory setting "" (no text)
	Example See example of FACTOR ARBITRARY VOLUME UNIT function (→ 🖹 81)
FACTOR ARBITRARY VOLUME UNIT	Prerequisite  The function is <b>only</b> available if a text was entered in the TEXT ARBITRARY VOLUME UNIT function ( $\rightarrow \triangle 81$ ).
	<b>Description</b> For defining a quantity factor (without time) for the arbitrary volume flow unit. The volume unit on which this factor is based is one liter.
	User input 5-digit floating-point number
	Unit Text arbitrary volume unit / liter
	Factory setting
	Example You want to measure saturated steam at 180 °C constant and display the heat flow. Take the following values from a table document (e.g. IAPWS-IF97):  Density: 5.158 kg/m³ Enthalpy: 2777.22 kJ/kg
	1 m <sup>3</sup> steam thus has an enthalpy of 2777 kJ/kg $\cdot$ 5.158 kg/m <sup>3</sup> = 14323 kJ/m <sup>3</sup> . 1 liter corresponds to 14.323 kJ.
	In the TEXT ARBITRARY VOLUME UNIT function, enter "KJ" as the name of the volum unit for example. The entry appears as an option in the UNIT FLOW function. In the FACTOR ARBITRARY VOLUME UNIT function, the value 14.323 would have to be entered.
FORMAT DATE/TIME	<b>Description</b> Selection of the format of date and time. This indicates or must be entered, if the calibration factor in function SENSOR DATA is changed (e.g. after a Re calibration).
	Options MM/DD/YY 24H DD.MM.YY 24H MM/DD/YY 12H A/P DD.MM.YY 12H A/P
	Factory setting DD.MM.YY 24H

# 11.4 QUICK SETUP

Function description, QUICK SETUP group	
QUICK SETUP COMMISSIONING	Description Starts the Quick Setup menu for commissioning. For an exact description of the Commissioning Quick Setup, see →   Options NO YES
	Factory setting NO

# 11.5 OPERATION

Function description, OPERATION group	
LANGUAGE	<b>Description</b> For selecting the language in which all messages are shown on the local display. If you press the $\frac{\Theta}{2}$ keys simultaneously at startup, the language defaults to "ENGLISH".
	Options with standard display: ENGLISH DEUTSCH FRANCAIS ESPANOL ITALIANO NEDERLANDS NORSK SVENSKA SUOMI PORTUGUES POLSKI CESKY
	Available in addition with the graphical display option: CHINESE JAPANESE RUSSIAN
	Factory setting Depends on country → 🖹 113
ACCESS CODE	Description All data of the measuring system are protected against inadvertent change. Programming is disabled and the settings cannot be changed until a code is entered in this function. If the ♣ keys are pressed in any function, the measuring system automatically goes to the function. If programming is locked, a prompt to enter a code appears on the display. You can enable programming by entering the private code (factory setting = 72, → ♣ 83, DEFINE PRIVATE CODE function).
	<ul> <li>The programming levels are disabled if the operating elements are not pressed within 60 seconds following a return to the HOME position.</li> <li>Programming can also be disabled by entering any number (other than the private code) in this function.</li> <li>Your Endress+Hauser representative can be of assistance if you mislay your private code.</li> </ul>
	User input Max. 4-digit number: 0 to 9999
DEFINE PRIVATE CODE	Description     Use this function to specify the private code for enabling programming.     ■ Programming is always enabled if the code defined = 0.     ■ Programming has to be enabled before this code can be changed. When programming is disabled this function cannot be edited, thus preventing others from accessing your personal code.
	User input Max. 4-digit number: 0 to 9999
	Factory setting 72
STATUS ACCESS	<b>Description</b> The access status for the function matrix appears on the display.
	Display ACCESS CUSTOMER (parameters can be modified) LOCKED (parameters cannot be modified)

Function description, OPERATION group	
ACCESS CODE COUNTER	<b>Description</b> The number of times the private and service code was entered to access the device appears on the display.
	<b>Display</b> Integer
	Factory setting 0

# 11.6 USER INTERFACE

Function description, USER INTERFACE group	
ASSIGN LINE 1	<b>Description</b> For assigning a display value to the main line (top line of the local display). This value is displayed during normal operation.
	Options OFF FLOW FLOW IN %
	Factory setting FLOW
ASSIGN LINE 2	<b>Description</b> For assigning a display value to the additional line (bottom line of the local display). This value is displayed during normal operation.
	Options OFF FLOW FLOW IN % TOTALIZER TAG NAME OPERATING/SYSTEM CONDITIONS FLOW BAR GRAPH IN %  Factory setting TOTALIZER
100% VALUE	Prerequisite This function is only available if one of the following options was selected: ■ The FLOW IN % option in the ASSIGN LINE 1 function ■ The FLOW IN % or FLOW BAR GRAPH IN % option in the ASSIGN LINE 2 function
	Description Use this function to enter the flow value which should be shown on the display as the 100% value.  If a value was specified for the VALUE 20 mA function (→  89) when ordering, this value is also used here as the factory setting.
	User input 5-digit floating-point number
	Factory setting Depends on nominal diameter, fluid and country $\rightarrow 113$
FORMAT	<b>Description</b> For selecting the number of decimal places for the display value in the main line.
	<ul> <li>Note that this setting only affects the reading as it appears on the display, it has no influence on the accuracy of the system's calculations.</li> <li>The places after the decimal point as computed by the measuring device cannot always be displayed, depending on this setting and the engineering unit. In these instances an arrow appears on the display between the measured value and the engineering unit (e.g. 1.2 →kg/h), indicating that the measuring system is computing with more decimal places than can be shown on the display.</li> </ul>
	Options XXXXX XXXX.X - XXX.XX - XX.XXX
	Factory setting XX.XXX

Function description, USER INTERFACE group	
DISPLAY DAMPING	<b>Description</b> For entering a time constant defining how the display reacts to severely fluctuating flow variables, either very quickly (enter a low time constant) or with damping (enter a high time constant).
	<ul> <li>The setting 0 seconds switches off damping.</li> <li>The reaction time of the function depends on the time specified in the FLOW DAMPING function (→  106).</li> </ul>
	User input 0 to 100 seconds
	Factory setting 5 seconds
CONTRAST LCD	Description  For adjusting the display contrast to suit local operating conditions.  If you press the ⅓ keys simultaneously at startup, the language defaults to "ENGLISH" and the contrast is reset to the factory setting.
	User input 10 to 100%
	Factory setting 50%
TEST DISPLAY	<b>Description</b> Use this function to test the operability of the local display and its pixels.
	Test sequence:
	1. Start the test by selecting ON.
	2. All pixels of the main line and additional line are darkened for minimum 0.75 seconds.
	3. The main line and additional line show an "8" in each field for minimum 0.75 seconds.
	4. The main line and additional line show a "0" in each field for minimum 0.75 seconds.
	5. The main line and additional line show nothing (blank display) for minimum 0.75 seconds.
	6. When the test is completed, the local display returns to its initial state and displays the option OFF.
	Options OFF ON
	Factory setting OFF

# 11.7 TOTALIZER

Function description, TOTALIZER group	
SUM	Description  The total for the totalizer's measured variable aggregated since measuring commenced appears on the display.  The totalizers' response to errors is defined in the FAILSAFE MODE function (→ 🖹 88).  Display  Max. 7-digit floating-point number, including unit (e.g. 15467.4 m³)
OVERELOW	
OVERFLOW	<b>Description</b> The total for the totalizer's overflow aggregated since measuring commenced appears on the display.
	Total flow is represented by a floating-point number consisting of max. 7 digits. You can use this function to view higher numerical values (>9999999) as overflows. The effective quantity is thus the total of the SUM function ( $\rightarrow \stackrel{\triangle}{=} 87$ ) plus the value displayed in the OVERFLOW function ( $\rightarrow \stackrel{\triangle}{=} 87$ ).
	<b>Display</b> Integer with exponent, including sign and unit, e.g. 2 E7 kg
	<b>Example</b> Reading after 2 overflows: 2 E7 kg (= 20000000 kg) The value displayed in the SUM function = 196 845.7 kg Effective total quantity = 20196845.7 kg
UNIT TOTALIZER	Description For selecting the unit for the measured variable assigned to the totalizer.  Options (MEASURING UNIT TYPE assigned to VOLUME FLOW)  Metric: Cubic centimeter → cm³ Cubic decimeter → dm³ Cubic decimeter → m³ Milliliter → ml Liter → 1 Hectoliter → hl Megaliter → Ml MEGA  US: Cubic centimeter → cc Acre foot → af Cubic foot → ft³ Fluid ounce → oz f Gallon → US gal Mega gallon → US Mgal Barrel (normal fluids: 31.5 gal/bbl) → US bbl NORM.FL. Barrel (beer: 31.0 gal/bbl) → US bbl BEER Barrel (petrochemicals: 42.0 gal/bbl) → US bbl TANK  Imperial: Gallon → imp. gal Mega gallon → imp. Mgal Barrel (beer: 36.0 gal/bbl) → imp. bbl BEER Barrel (petrochemicals: 34.97 gal/bbl) → imp. bbl PETROCH.  Arbitrary volume unit: This option does not appear unless a volume unit was defined via the TEXT ARBITRARY VOLUME UNIT function (→ ■ 81).  Factory setting Depends on country → ■ 113
	(Continued on next page)

Function description, TOTALIZER group	
UNIT TOTALIZER (continued)	Options (MEASURING UNIT TYPE assigned to CALCULATED MASS FLOW) Metric: Gram $\rightarrow$ g Kilogram $\rightarrow$ kg Metric ton $\rightarrow$ t
	US: Ounce $\rightarrow$ oz (US) Pound $\rightarrow$ lb Ton $\rightarrow$ ton
	Factory setting Depends on country $\rightarrow \stackrel{\triangle}{=} 113$
	Options (MEASURING UNIT TYPE assigned to CORRECTED VOLUME FLOW) Metric: Norm liter $\rightarrow$ NI Norm cubic meter $\rightarrow$ Nm <sup>3</sup>
	US: Standard cubic meter $\rightarrow$ Sm <sup>3</sup> Standard cubic feet $\rightarrow$ Scf
	Factory setting Depends on country →   113
RESET TOTALIZER	Description Resets the sum and overflow in the totalizer selected to 0 (=RESET).  Options NO YES
	Factory setting NO
FAILSAFE MODE	<b>Description</b> For selecting the behavior of the totalizer in an alarm condition.
	Options  STOP  The totalizer does not continue to count the flow if a fault is present. The totalizer stops at the last value before the alarm condition occurred.
	HOLD VALUE  The totalizer continues to count the flow on the basis of the last valid flow data (before the fault occurred).
	ACTUAL VALUE  The totalizer continues to count on the basis of the current flow data. The fault is ignored.
	Factory setting STOP

## 11.8 CURRENT OUTPUT

CURRENT SPAN	<b>Description</b> Use this function to specify the current span. You can configure the current output either in accordance with the NAMUR recommendation or for the values common in the United States.
	Options 4-20 mA HART NAMUR 4-20 mA HART US
	Factory setting
	See the parameter printout provided. The parameter printout is an integral part of these Operating Instructions.
VALUE 20 mA	<b>Description</b> Assign a value to the 20 mA current. The appropriate unit is taken from the UNIT FLOV function ( $\rightarrow \stackrel{\triangle}{=} 79$ ).
	User input 5-digit floating-point number
	Factory setting
	See the parameter printout provided. The parameter printout is an integral part of these Operating Instructions.
TIME CONSTANT	Description  Use this function to select a time constant defining how the current output signal react to severely fluctuating measured variables, either very quickly (low time constant) or with damping (high time constant).  The reaction time of the function also depends on the time specified in the FLOW DAMPING function (→ ≜ 106).
	User input
	Fixed-point number: 0 to 100 s
	Factory setting 5 s
FAILSAFE MODE	<b>Description</b> The dictates of safety render it advisable to ensure that the current output assumes a predefined state in the event of a fault. Use this function to define the response of the current output to fault. The setting you select here affects only the current output. It has no effect on other outputs or the display (e.g. totalizers).
	Options
	MIN. CURRENT Depends on the option selected in the CURRENT SPAN function ( $\rightarrow \blacksquare$ 89). If the current span is: 4 to 20 mA HART NAMUR $\rightarrow$ output current = 3.6 mA
	4 to 20 mA HART US → output current = 3.75 mA  MAX. CURRENT  22.6 mA
	HOLD VALUE  Measured value output is based on the last measured value saved before the error occurred.
	ACTUAL VALUE  Measured value output is based on the current flow measurement. The fault is ignored
	Factory setting MAX. CURRENT
ACTUAL CURRENT	Description The current computed actual value of the output current appears on the display.
	<b>Display:</b> 3.60 to 22.60 mA

### Function description, CURRENT OUTPUT group SIMULATION Description CURRENT Activates simulation of the current output. ■ The notice message #611 "SIMULATION CURRENT OUTPUT" ( $\rightarrow$ 🖹 49) indicates that simulation is active. $\,\blacksquare\,$ The value which should be output at the current output is defined in the VALUE SIMULATION CURRENT function ( $\rightarrow \stackrel{\triangleright}{=} 90$ ). ■ The measuring device continues to measure while simulation is in progress, i.e. the current measured values are output correctly via the other outputs and the display. The setting is not saved if the power supply fails. **Options** OFF ON Factory setting OFF VALUE SIMULATION Prerequisite CURRENT The function is ${\bf only}$ available if the ON option was selected in the SIMULATION CURRENT function ( $\rightarrow \stackrel{\triangleright}{=} 90$ ). Description Use this function to define an arbitrary value (e.g. $12\ \text{mA}$ ) to be output at the current output. This value is used to test downstream devices and the measuring device itself. Simulation is started by confirming the simulation value with the $\[ \]$ key. If the $\[ \]$ key is pressed again afterwards, the prompt "End simulation" (NO/YES) appears. If you choose "NO", simulation remains active and the group selection is called up. The simulation can be switched off again via the SIMULATION CURRENT function. If you choose "YES", you end the simulation and the group selection is called up. The setting is not saved if the power supply fails. Floating-point number: 3.60 to 22.60 mA Factory setting 3.60 mA

### 11.9 PULSE/STATUS OUTPUT

### Function description, PULSE/STATUS OUTPUT group OPERATION MODE Description Use this function to specify whether the output functions as a pulse output or status output. The functions available will vary in this function group, depending on which option you select here. ■ If PFM is selected, the CURRENT OUTPUT group ( $\rightarrow$ 🖹 89) is no longer available. Current simulation is automatically activated with a simulation value of 4 mA. If the transmitter was wired for pulse-frequency modulation ( $\rightarrow$ $\stackrel{\triangle}{=}$ 24), the HART protocol is not available. ■ If VORTEX FREQUENCY and PFM are selected, the vortex pulses are passed on directly. The low flow cut off is taken into account. **Options PULSE STATUS** VORTEX FREQUENCY (→ 🖹 60) PFM (→ 🖹 60) Factory setting **PULSE** PULSE VALUE Prerequisite The function is **only** available if PULSE was selected in the OPERATION MODE function $(\rightarrow 1 91)$ . Description Use this function to define the flow at which a pulse should be output. These pulses can be totaled by an external totalizer and the total flow since measuring started can be recorded in this way. Select the pulse value in such a way that the pulse frequency does not exceed a value of 100 Hz with maximum flow. The appropriate unit is taken from the function UNIT FLOW function ( $\rightarrow \stackrel{\triangle}{=} 79$ ). User input 5-digit floating-point number Factory setting See the parameter printout provided. The parameter printout is an integral part of these Operating Instructions.

#### PULSE WIDTH

#### Prerequisite

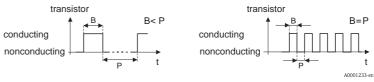
The function is **only** available if PULSE was selected in the OPERATION MODE function  $(\rightarrow \stackrel{\triangle}{=} 91)$ .

#### Description

Use this function to enter the pulse width of the output pulses. When entering the pulse width, select a value that can still be processed by an external totalizer (e.g. mechanical totalizer, PLC, etc.).

If the selected pulse width cannot be maintained (interval P < pulse width B entered), a system error message is generated after approx. 5 seconds buffer time/idling time: "#359 RANGE PULSE" ( $\rightarrow \stackrel{\triangle}{=} 48$ ). The reason for not being able to maintain the pulse width could be that the pulse number or frequency, which result from the pulse value entered ( $\rightarrow \stackrel{\triangle}{=} 91$ , PULSE VALUE function) and the current flow, are too big.

Pulses are **always** generated with the pulse width (B) entered in this function. The intervals (P) between the individual pulses are automatically configured. However, they must at least correspond to the pulse width (B=P).



 $B = Pulse \ width \ entered \ (the \ illustration \ applies \ to \ positive \ pulses)$ 

P = Intervals between the individual pulses

#### User input

5 to 2000 ms

#### Factory setting

20 ms

#### **OUTPUT SIGNAL**

#### Prerequisite

The function is **only** available if the PULSE option was selected in the OPERATION MODE function ( $\rightarrow \stackrel{\triangle}{=} 91$ ).

#### Description

For adapting the polarity of the pulse signals to the requirements during operation.

#### Options

PASSIVE - POSITIVE

PASSIVE - NEGATIVE

#### Factory setting

PASSIVE – POSITIVE

#### Explanation

PASSIVE = power is supplied to the pulse output by means of an external power supply.

Configuring the output signal level (POSITIVE or NEGATIVE) determines the quiescent behavior (at zero flow) of the pulse output. The internal transistor is activated as follows:

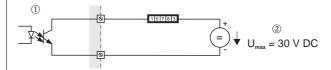
- If POSITIVE is selected, the internal transistor is activated with a positive signal level
- If NEGATIVE is selected, the internal transistor is activated with a negative signal level (0 V)



The output signal levels of the pulse output depend on the external wiring (see examples).

#### Example for passive output circuit (PASSIVE)

If PASSIVE is selected, the pulse output is configured as an open collector.



A00012

- ① Open collector
- ② External power supply

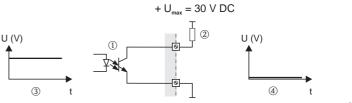


Note!

For continuous currents up to 25 mA ( $I_{\text{max}} = 250 \text{ mA} \div 20 \text{ ms}$ ).

#### Example for output configuration PASSIVE-POSITIVE

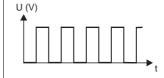
Output configuration with an external pull-up resistor. In the quiescent state (at zero flow), the output signal level at the terminals is 0 Volt.



A0004687

- ① Open collector
- ② Pull-up resistor
- ③ Transistor activation in "POSITIVE" quiescent state (at zero flow)
- 4) Output signal level in quiescent state (at zero flow)

In the operating state (flow present), the output signal level changes from 0 Volt to a positive voltage level.



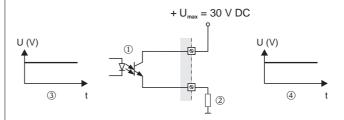
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(Continued on next page)

# OUTPUT SIGNAL (continued)

#### Example for output configuration PASSIVE-POSITIVE

Output configuration with an external pull-down resistor. In the quiescent state (at zero flow), a positive voltage level is measured via the pull-down resistor.



① Open collector

- ② Pull-up resistor
- ③ Transistor activation in "POSITIVE" quiescent state (at zero flow)
- (4) AusgangssiOutput signal level in quiescent state (at zero flow)

In the operating status (flow present), the output signal level changes from a positive voltage level to 0 Volt.

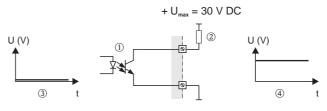


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#### Example for output configuration PASSIVE-NEGATIVE

Output configuration with an external pull-up resistor. In the quiescent state (at zero flow), the output signal level at the terminals is at a positive voltage level.



① Open collector

- 2 Pull-up resistor
- ③ Transistor activation in "NEGATIVE" quiescent state (at zero flow)
- 4 Output signal level in quiescent state (at zero flow)

In the operating status (flow present), the output signal level changes from a positive voltage level to 0 Volt.



A0001981

Function description, P	ULSE/STATUS OUTPUT group
FAILSAFE MODE	Prerequisite This function is <b>only</b> available if PULSE was selected in the OPERATION MODE function (→ 🖹 91).
	<b>Description</b> The dictates of safety render it advisable to ensure that the pulse output assumes a predefined state in the event of a fault. Use this function to define this state. The setting you select here affects only the pulse output. It has no effect on other outputs or the display (e.g. totalizers).
	Options
	FALLBACK VALUE 0 pulse output.
	HOLD VALUE  Measured value output is based on the last measured value saved before the error occurred.
	ACTUAL VALUE Measured value output is based on the current flow measurement. The fault is ignored.
	Factory setting FALLBACK VALUE
ACTUAL PULSE	Prerequisite The function is <b>only</b> available if PULSE was selected in the OPERATION MODE function (→ 🗎 91).
	<b>Description</b> The computed actual value of the output frequency appears on the display.
	Display: 0 to 100 pulse/second
SIMULATION PULSE	Prerequisite The function is <b>only</b> available if PULSE was selected in the OPERATION MODE function (→ 🗎 91).
	<b>Description</b> Use this function to simulate the pulse output.
	<ul> <li>The notice message #631 "SIM. PULSE" (→</li></ul>
	Note! The setting is not saved if the power supply fails.
	Options
	OFF
	COUNTDOWN  The pulses specified in the VALUE SIMULATION PULSE function ( $\rightarrow \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \$
	CONTINUOUSLY Pulses are continuously output with the pulse width specified in the PULSE WIDTH function ( $\rightarrow \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \$
	Note! Simulation is started by confirming the CONTINUOUSLY option with the key. If the key is pressed again afterwards, the prompt "End simulation" (NO/YES) appears. If you choose "NO", simulation remains active and the group selection is called up. The simulation can be switched off again via the SIMULATION PULSE function. If you choose "YES", you end the simulation and the group selection is called up.
	Factory setting

Endress+Hauser 95

OFF

## VALUE SIMULATION PLUSE

#### Prerequisite

The function is **only** available if COUNTDOWN was selected in the SIMULATION PULSE function ( $\rightarrow \stackrel{\cong}{=} 95$ ).

#### Description

Use this function to specify the number of pulses (e.g. 50) which are output during the simulation. This value is used to test downstream devices and the measuring device itself. The pulses are output with the pulse width specified in the PULSE WIDTH function  $(\rightarrow \ \ \ \ \ \ \ \ \ \ \ \ )$  22). The on/off ratio is 1:1.

Simulation is started once the specified value is confirmed with the  $^{\text{E}}$  key. The display remains at 0 if the specified pulses have been transmitted.

Simulation is started by confirming the simulation value with the  $\[E]$  key. If the  $\[E]$  key is pressed again afterwards, the prompt "End simulation" (NO/YES) appears. If you choose "NO", simulation remains active and the group selection is called up. The simulation can be switched off again via the SIMULATION PULSE function. If you choose "YES", you end the simulation and the group selection is called up.



The setting is not saved if the power supply fails.

#### User input

0 to 10000

#### Factory setting

0

#### **ASSIGN STATUS**

#### Prerequisite

The function is **only** available if STATUS was selected in the OPERATION MODE function ( $\rightarrow \stackrel{\text{le}}{=} 91$ ).

#### Description

Use this function to assign a switching function to the status output.

- The status output displays quiescent current behaviour, in other words the output is closed (transistor conductive) when normal, error-free operation is in progress.
- Pay particular attention to the illustrations and detailed information on the switching behaviour of the status output ( $\rightarrow$   $\stackrel{\square}{=}$  99).
- If you select OFF, the only function shown in this function group is the ASSIGN STATUS function.

#### **Options**

OFF

ON (operation)

FAULT MESSAGE

NOTICE MESSAGE

FAULT MESSAGE or NOTICE MESSAGE

LIMIT FLOW

LIMIT TOTALIZER

#### Factory setting

FAULT MESSAGE

#### ON-VALUE

#### Prerequisite

This function is **only** available if LIMIT FLOW or LIMIT TOTALIZER was selected in the ASSIGN STATUS function ( $\rightarrow$   $\stackrel{\triangle}{=}$  96).

#### Description

Use this function to assign a value to the switch-on point (status output pulls up). The value can be greater or less than the switch-off point. Only positive values are permitted.

The appropriate unit is taken from the UNIT FLOW function ( $\rightarrow$   $\stackrel{\triangle}{=}$  79) or UNIT TOTALIZER function ( $\rightarrow$   $\stackrel{\triangle}{=}$  87).

#### User input

5-digit floating-point number

#### Factory setting

Depends on the setting selected in the ASSIGN STATUS function

- If the LIMIT VALUE FLOW option is selected: depends on the nominal diameter, fluid and country  $\rightarrow$   $\stackrel{ }{=}$  113
- If TOTALIZER LIMIT VALUE was selected: 0

Function description, PULSE/STATUS OUTPUT group		
OFF-VALUE	Prerequisite The function is <b>only</b> available if LIMIT FLOW or LIMIT TOTALIZER was selected in the ASSIGN STATUS function ( $\rightarrow \blacksquare$ 96).	
	Description  Use this function to assign a value to the switch-off point (status output deenergized).  The value can be greater or less than the switch-on point. Only positive values are permitted.  The appropriate unit is taken from the UNIT FLOW function (→ ♣ 79).	
	User input 5-digit floating-point number	
	Factory setting Depends on nominal diameter, fluid and country (→ 🗎 113)	
TIME CONSTANT	<b>Prerequisite</b> The function is <b>only</b> available if LIMIT FLOW was selected in the ASSIGN STATUS function ( $\rightarrow \stackrel{\cong}{=} 96$ ).	
	Description Use this function to select a time constant defining how the measuring signal reacts to severely fluctuating measured variables, either very quickly (low time constant) or with damping (high time constant).  The purpose of damping, therefore, is to prevent the status output changing state continuously in response to fluctuations in flow.  The reaction time of the function depends on the time specified in the FLOW DAMPING function (→ 106).	
	User input 0 to 100 s	
	Factory setting 0 s	
ACTUAL STATUS OUTPUT	<b>Prerequisite</b> The function is <b>only</b> available if STATUS was selected in the OPERATION MODE function ( $\rightarrow \stackrel{\triangle}{=} 91$ ).	
	<b>Description</b> The current status of the status output appears on the display.	
	Display: NOT CONDUCTIVE CONDUCTIVE	
SIMULATION SWITCH POINT	Prerequisite  The function is only available if the STATUS option was selected in the OPERATION MODE function $(\rightarrow \stackrel{\triangle}{=} 91)$ .	
	<b>Description</b> Use this function to activate simulation of the status output.	
	<ul> <li>Active simulation is indicated by notice message #641 "SIMULATION STATUS OUTPUT" (→</li></ul>	
	The setting is not saved if the power supply fails.	
	Options OFF ON	
	Factory setting OFF	

## VALUE SIMULATION SWITCH POINT

#### Prerequisite

The function is **only** available if ON was selected in the SIMULATION SWITCH POINT function ( $\rightarrow \stackrel{\triangle}{=} 97$ ).

#### Description

Use this function to define the switching behaviour of the status output during the simulation. This value is used to test downstream devices and the measuring device itself.

You can change the switching behaviour of the status output during the simulation. The prompt "CONDUCTIVE" or "NOT CONDUCTIVE" appears if the  $^{+}$  or  $^{-}$  key is pressed. Select the desired switching behaviour and start the simulation with the  $^{-}$  key. If the  $^{-}$  key is pressed again afterwards, the prompt "End simulation" (NO/YES) appears. If you choose "NO", simulation remains active and the group selection is called up. The simulation can be switched off again via the SIMULATION SWITCH POINT function.

If you choose "YES", you end the simulation and the group selection is called up.

The setting is not saved if the power supply fails.

#### User input

NOT CONDUCTIVE CONDUCTIVE

#### Factory setting

NOT CONDUCTIVE

## 11.10 Information on the response of the status output

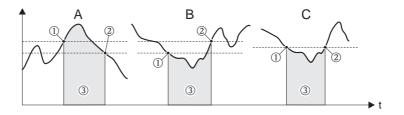
### General information

If the measured variable in question reaches these predefined values, the status output switches as shown in the illustrations below.

#### Status output configured for limit value

The status output switches as soon as the current measured variable undershoots or overshoots a defined switch point.

Application: monitoring flow or process-related boundary conditions.



- ①  $ON \le SWITCH-OFF\ POINT\ (maximum\ safety)$
- ② ON > SWITCH-OFF POINT (minimum safety)
- 3 Status output switched off (not conductive)

### Switching behaviour of the status output

function	Status		Open collect (transi	r
ON (operation)	System in operation	XXX.XXX.XX	Conductive	22 23
	System not in operation (power supply failed)		Not conductive	22
Fault message	System OK	XXX.XXX.XX	Conductive	22
	(System or process error) Fault ▼ failsafe mode of outputs/inputs and totalizers		Not conductive	22
Notice message	System OK	XXX.XXX.XX	Conductive	22
	(System or process error) Fault ▼ continuation of operation	XXXXXXX Officer	Not conductive	22 23

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function	Status		Open collect (transi	
Fault message or notice message	System OK	XXX.XXX.XX	Conductive	22 S 23
	(System or process error) Fault ▼ failsafe mode or Notice ▼ continuation of operation	××××××××××××××××××××××××××××××××××××××	Not conductive	© 22 © 23
Limit value Volume flow Totalizer	Limit value not overshot or undershot	~~~	Conductive	© 22 © 23
	Limit value overshot or undershot	<u></u>	Not conductive	© 22 © 23

## 11.11 COMMUNICATION

Function description, COMMUNICATION group		
TAG NAME	Description Use this function to enter a tag name for the measuring device. You can edit and read this tag name via the local display or the HART protocol User input Max. 8-character text, permitted characters are: A-Z, 0-9, +,-, punctuation marks Factory setting	
	"" (no text)	
TAG DESCRIPTION	Description Use this function to enter a tag description for the measuring device. You can edit and read this tag description via the local display or the HART protocol. User input	
	Max. 16-character text, permitted characters are: A-Z, 0-9, +,-, punctuation marks	
	Factory setting "" (no text)	
FIELDBUS ADDRESS	<b>Description</b> Use this function to define an address for the exchange of data with the HART protocol.  A constant 4 mA current is applied with addresses 1 to 15.	
	User input 0 to 15	
	Factory setting 0	
WRITE PROTECTION	Description  Use this function to check whether the measuring device can be write-accessed.  Write protection is activated and deactivated by means of a DIP switch on the amplifier board (→ ≜ 38).	
	Display:  OFF (execution status) = Data exchange possible  ON = Data exchange disabled	
BURST MODE	Description Use this function to activate cyclic data exchange of the process variables flow and sum to achieve faster communication.	
	Options OFF ON	
	Factory setting OFF	
MANUFACTURER ID	Description The manufacturer number in decimal numerical format appears on the display.	
	<b>Display:</b> 17 = (11 hex) for Endress+Hauser	
DEVICE ID	Description The instrument number in hexadecimal numerical format appears on the display.  Display: 56 = (86 dec) for Prowirl 72	

## 11.12 PROCESS PARAMETER

Function description, PROCESS PARAMETER group		
APPLICATION	<b>Description</b> For specifying the state of aggregation of the fluid.	
	Options GAS/STEAM LIQUID	
	If the option selected in this function is changed, the values in the following functions have to be adapted:  ■ VALUE 20 mA → 🖹 89,  ■ PULSE WIDTH → 🖺 92,  ■ 100% VALUE (line 1) → 🖺 85  ■ 100% VALUE (line 2) → 🖺 85	
	If the option selected in the function is changed, you are asked whether the totalizer should be reset to 0. We recommend you confirm this message and reset the totalizer.	
	<b>Factory setting</b> See the parameter printout provided. The parameter printout is an integral part of these Operating Instructions.	
OPERATION DENSITY	Prerequisite  This function is <b>only</b> available if CALCULATED MASS FLOW or CORRECTED VOLUME FLOW was selected in the MEASURING UNIT TYPE function ( $\rightarrow \stackrel{\triangle}{=} 78$ ).	
	Description  Use this function to enter a fixed value for the density at process conditions. This value is used to calculate the calculated mass flow and the corrected volume flow (see MEASURING UNIT TYPE function → 1 78).	
	The appropriate unit is taken from the UNIT DENSITY function ( $\rightarrow \trianglerighteq$ 80). If the option selected in the function is changed, you are asked whether the totalizer should be reset to 0. We recommend you confirm this message and reset the totalizer.	
	User input 5-digit floating-point number	
	<b>Factory setting</b> See the parameter printout provided. The parameter printout is an integral part of these Operating Instructions.	
REFERENCE DENSITY	Prerequisite  The function is <b>only</b> available if CORRECTED VOLUME FLOW was selected in the MEASURING UNIT TYPE function (→ 🗎 78).	
	Description	
	Use this function to enter a fixed value for the density at reference/standard conditions. This value is used to calculate the corrected volume flow (see MEASURING UNIT TYPE function $\rightarrow \stackrel{\triangle}{}$ 78).	
	The appropriate unit is taken from the UNIT DENSITY function ( $\rightarrow \stackrel{\triangleright}{=} 80$ ). If the option selected in the function is changed, you are asked whether the totalizer should be reset to 0. We recommend you confirm this message and reset the totalizer.	
	User input 5-digit floating-point number	
	<b>Factory setting</b> See the parameter printout provided. The parameter printout is an integral part of these Operating Instructions.	

#### Function description, PROCESS PARAMETER group

#### OPERATION TEMPERATURE

#### Description

Use this function to specify a fixed value for the process temperature. The appropriate unit is taken from the UNIT TEMPERATURE function ( $\rightarrow \stackrel{\triangle}{=} 80$ ).



#### Note!

This setting does not change the permitted temperature range of the measuring system. Pay attention to the temperature application limits specified in the product specifications  $(\rightarrow \ \ \ )$  64).

The sensor (measuring pipe and bluff body) expands differently depending on the existing process temperature. This has a proportional effect on the accuracy of the measuring system since the device was calibrated at a fixed calibration temperature of 20 °C (293 K). However, this effect on the current measured value and the internal totalizer can be compensated by entering an average process temperature in this function. If the process temperature is subject to severe changes, we recommend you use a flow computer (e.g. RMC621 or RMS621). These flow computers can compensate the effect on the K-factor by means of temperature compensation. If a flow computer is used, the value of the factory setting (20 °C, 293.15 K, 68 °F, 527.67 R) must be specified in this function.

#### User input

5-digit floating-point number

#### Factory setting

20 °C / 293.15 K / 68 °F / 527.67 R

#### Function description, PROCESS PARAMETER group

## MATING PIPE DIAMETER

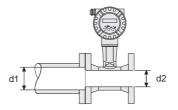
#### Description

The device has diameter mismatch correction. This can be activated by entering the actual value of the mating pipe (see Fig., d1) in this function.

If the mating pipe (d1) and the measuring pipe (d2) have different diameters, this alters the flow profile. A diameter mismatch can occur if:

- The mating pipe has a different pressure rating to that of the measuring device.
- The mating pipe has another schedule to that of the measuring device (e.g. 80 instead
  of 40), for ANSI.
- The mating pipe is made of another material, in the case of DIN.

To correct any resulting shift in the calibration factor, enter the actual value of the mating pipe (d1) in this function.



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Fig. 29: Mating pipe (d1)

d1 > d2

d1 = Mating pipe diameter

d2 = Measuring pipe diameter

- The inlet correction is switched off if 0 is entered in the function.
- The appropriate unit is taken from the UNIT LENGTH function ( $\rightarrow \ge 81$ ).
- Mismatches between diameters can only be corrected within the same nominal diameter class (e.g. DN 50/2").
- If the internal diameter of the process mating flange is larger than the internal diameter of the Vortex flange, you must reckon with an additional uncertainty of typically 0.1% (of the reading) per 1 mm deviation.
- If the internal diameter of the process mating flange is smaller than the internal diameter of the Vortex flange, you must reckon with an additional uncertainty of typically 0.2% (of the reading) per 1 mm deviation.
- The diameter mismatch should only be corrected within the limit values listed below for which test measurements have also been performed.

#### Flange connection:

DN 15 (½"):  $\pm 20\%$  of the internal diameter DN 25 (1"):  $\pm 15\%$  of the internal diameter DN 40 (1½"):  $\pm 12\%$  of the internal diameter DN  $\geq 50$  (2"):  $\pm 10\%$  of the internal diameter

#### Wafer:

DN 15 (½"):  $\pm$ 15% of the internal diameter DN 25 (1"):  $\pm$ 12% of the internal diameter DN 40 (1½"):  $\pm$ 9% of the internal diameter DN  $\geq$ 50 (2"):  $\pm$ 8% of the internal diameter

#### User input

5-digit floating-point number

#### Factory setting

U

Function description, PROCESS PARAMETER group		
ON-VALUE LOW FLOW CUT OFF	Description Use this function to enter the on-value for low flow cut off. Low flow cut off is switched on if the value entered is not equal to 0. As soon as the low flow cut off is active, an inverted plus sign is shown on the display.	
	The appropriate unit is taken from the UNIT FLOW function ( $\rightarrow$ $\ $ $\ $ $\ $ 79). The on-value can be set to a value corresponding to a Reynolds number of Re = 20000. This has the effect that measurements in the non-linear range are not evaluated. The Reynolds number and the flow (with Reynolds number = 20 000) can be determined using the Endress+Hauser "Applicator" software ( $\rightarrow$ $\ $ $\ $ $\ $ $\ $ 46).	
	User input 5-digit floating-point number	
	Factory setting Below the standard measuring range	
OFF-VALUE LOW FLOW CUT OFF	<b>Description</b> Use this function to enter the off-value (b) for low flow cut off. Enter the off-value as a positive hysteresis (H) from the on-value (a).	
	b 2 2 H	
	Fig. 30: Example for the behavior of low flow cutoff	
	O Flow rate [volume/time] t Time a ON-VALUE LOW FLOW CUTOFF = 20 m³/h b OFF-VALUE LOW FLOW CUTOFF = 10% c Low flow cutoff active 1 Low flow cutoff is switched on at 20 m³/h 2 Low flow cutoff is switched off at 22 m³/h H Hysteresis	
	User input Integer 0 to 100%	
	Factory setting 50%	
VELOCITY WARNING	<b>Description</b> Use this function to activate flow velocity supervision (ON). If the fluid velocity exceeds the value entered in the LIMIT VELOCITY function ( $\rightarrow \stackrel{\triangle}{=} 105$ ) the device issues the notice message "#421 FLOW RANGE" ( $\rightarrow \stackrel{\triangle}{=} 50$ ).	
	Options OFF (function switched off) ON	
	Factory setting OFF	
LIMIT VELOCITY	Description Enter the maximum allowable flow velocity (limit velocity). By switching on the VELOCITY WARNING function (→ 🗎 105), a warning message is output once the limit velocity is overshot.	
	The unit on the display depends on the UNIT LENGTH (→ 🖹 81): m/s; ft/s	
	User input 5-digit floating-point number	
	Factory setting 75 m/s	

## 11.13 SYSTEM PARAMETER

Function description, SYSTEM PARAMETER group			
POSITIVE ZERO RETURN	<b>Description</b> Use this function to interrupt evaluation of measured variables. This is necessary when a pipe is being cleaned, for example.		
	The setting acts on all functions and output If positive zero return is active, the notic $(\rightarrow \stackrel{\triangle}{=} 49)$ .		ET." is displayed
	Options OFF ON (signal output is set to the value for z	zero flow)	
	Factory setting OFF	,	
FLOW DAMPING	Description  For setting the filter depth. This reduces the sensitivity of the measuring signal to interference peaks e.g. in the event of high solids content, gas bubbles in the fluid, etc. The measuring system reaction time increases with the filter setting.  The flow damping acts on the following functions and outputs of the measuring devices.		in the fluid, etc.
	Function Function  AMPLIFICATION FLOW DAMPING	→ Function DISPLAY DAMPING  → Function TIME CONSTANT	<ul><li>→ Display</li><li>→ Current output</li></ul>
		→ Function  TIME CONSTANT	→ Status output  A0010343-en
	User input 0 to 100 s Factory setting 1 s		

## 11.14 SENSOR DATA

# Function description, SENSOR DATA group

All sensor data, such as the calibration factor or nominal diameter, are set at the factory.

(") Caution

Under normal circumstances these settings may not be changed because changes affect numerous functions of the entire measuring system, and the accuracy of the measuring system in particular.

If you have any questions on these functions contact your Endress+Hauser service organization.

CALIBRATION DATE	<b>Description</b> The alteration date and time, when the K-FACTOR was changed (e.g. after a re-calibration), appears on the display.
	<b>Display</b> e.g. 100 P/1 (pulse per liter)
K-FACTOR	<b>Description</b> The current calibration factor of the sensor appears on the display.
	The K-factor is also given on the nameplate, the sensor and the calibration protocol under "K-fct.".
	<b>Display</b> e.g. 100 P/1 (pulse per liter)
K-FACTOR Compensated	<ul> <li>Description The current compensated calibration factor of the sensor appears on the display. The following are compensated: <ul> <li>The temperature-dependent expansion of the sensor (→ 103).</li> <li>Diameter steps in the inlet of the device (→ 104).</li> </ul> </li> <li>Display</li> </ul>
	e.g. 102 P/1 (pulse per liter)
NOMINAL DIAMETER	The nominal diameter of the sensor appears on the display.  Display e.g. DN 25
METER BODY MB	<b>Description</b> The type of meter body (MB) of the sensor appears on the display.
	<ul> <li>Use this function to specify the nominal diameter and the sensor type.</li> <li>The meter body MB is also given on the parameter printout and the nameplate.</li> </ul>
	<b>Display</b> e.g. 71
TEMPERATURE COEFFICIENT SENSOR	Description  The temperature effect on the calibration factor appears on the display. Due to changes in temperature, the meter body expands differently, depending on the material. The expansion has an effect on the K-factor.
	<b>Display</b> 4.8800*10 <sup>-5</sup> / K (stainless steel) 2.6000*10 <sup>-5</sup> / K (Alloy C-22)

#### Function description, SENSOR DATA group

#### AMPLIFICATION

#### Description

Devices are always optimally configured for the process conditions you specified.

Under certain process conditions, however, interference signals (e.g. strong vibrations) can be suppressed or the measuring range extended by adjusting the amplification. The amplification is configured as follows:

- A larger value can be entered for the amplification if the fluid is slow-flowing, the density is low and there are minor disturbance influences (e.g. plant vibrations).
- A smaller value can be entered for the amplification if the fluid is fast-flowing, the density is high and there are strong disturbance influences (e.g. plant vibrations).



Incorrectly configured amplification can have the following effects:

- The measuring range is limited in such a way that small flows cannot be recorded or displayed. In this instance, the value for the amplification must be increased.
- Undesired interference signals are registered by the device which means that a flow is recorded and displayed even if the fluid is at a standstill. In this instance, the value for the amplification must be reduced.

#### **Options**

 $1\ to\ 5\ (1=smallest\ amplification,\ 5=largest\ amplification)$ 

#### Factory setting

3

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## 11.15 SUPERVISION

Function description, SUPERVISION group		
ACTUAL SYSTEM CONDITION	Description The current system status appears on the display.  Display SYSTEM OK or The fault/notice message with the highest priority.	
PREVIOUS SYSTEM CONDITIONS	<b>Description</b> The last 16 fault and notice messages appear on the display.	
ASSIGN SYSTEM ERROR	Description All system errors appear on the display. If you select an individual system error you can change its error category: ■ Each individual message can be selected using the → and → key. ■ If the □ key is pressed twice, the ERROR CATEGORY function is called up. ■ Use the → key combination or select "CANCEL" (in the system error list) to exit the function.  Display List of system errors	
ERROR CATEGORY	Description Use this function to define whether a system error triggers a notice message or a fault message. If you select FAULT MESSAGES, all outputs respond to an error in accordance with their defined failsafe mode.  ■ Press the ■ key twice to call up the ASSIGN SYSTEM ERROR function (→ ■ 109).  ■ Use the → key combination to exit the function.  Options NOTICE MESSAGE (display only) FAULT MESSAGE (outputs and display)	
ALARM DELAY	Description  Use this function to enter a time span for which the criteria for an error always have to be satisfied before a fault or notice message is generated. Depending on the setting and the type of error, this suppression acts on the display, the current output and the pulse/status output.  Note!  If this function is used, fault and notice messages are delayed by the time corresponding to the setting before being forwarded to the higher-level controller (PCS, etc.). Therefore, check in advance whether a delay of this nature could affect the safety requirements of the process. If fault and notice messages may not be suppressed, a value of 0 seconds must be entered here.  User input  O to 100 s (in steps of one second)  Factory setting  O s	

Function description, SUPERVISION group		
SYSTEM RESET	<b>Description</b> Use this function to restart (reset) the measuring device.	
	Options	
	NO The device is not restarted.	
	RESTART SYSTEM Restart without disconnecting main power. In doing so, all the data (functions) are accepted unchanged.	
	RESET DELIVERY Restart without disconnecting main power. The saved settings of the delivery status (factory settings) are accepted as a result.	
	Factory setting NO	
OPERATION HOURS (pending)	<b>Description</b> The hours of operation of the device appear on the display.	
	Display Depends on the number of hours of operation elapsed: Hours of operation < 10 hours → display format = 0:00:00 (hr:min:sec) Hours of operation 10 to 10 000 hours → display format = 0000:00 (hr:min) Hours of operation > 10 000 hours → display format = 000000 (hr)	

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## 11.16 SIMULATION SYSTEM

Function description, SII	MULATION SYSTEM group
SIMULATION FAILSAFE MODE	Description Use this function to set all inputs, outputs and the totalizer to their error-response modes, in order to check whether they respond correctly. During this time, the message #691 "SIMULATION FAILSAFE" appears on the display (→ 🖺 49).
	Options OFF ON
	Factory setting OFF
SIMULATION MEASURAND	<b>Description</b> Use this function to set all the inputs, outputs and the totalizer to their flow-response modes, in order to check whether they respond correctly. During this time, the message "#692 SIMULATION MEASURAND" appears on the display (→
	<ul> <li>Note!</li> <li>The measuring device can only be used for measuring to a certain extent while the simulation is in progress.</li> <li>The setting is not saved if the power supply fails.</li> </ul>
	Options OFF FLOW
	Factory setting OFF
VALUE SIMULATION MEASURAND	Prerequisite Function is <b>only</b> available if the SIMULATION MEASURAND function (→ 🗎 111) is active.
	<b>Description</b> Use this function to specify an arbitrary value (e.g. 12 dm <sup>3</sup> /s) to check downstream devices or the measuring device itself.
	The appropriate unit is taken from the UNIT FLOW function ( $\rightarrow$ $\stackrel{\triangle}{=}$ 79).
	Note! The setting is not saved if the power supply fails.
	User input 5-digit floating-point number
	Factory setting 0

## 11.17 SENSOR VERSION

Function description, SENSOR VERSION group			
SERIAL NUMBER	<b>Description</b> The serial number of the sensor appears on the display.		
SENSOR TYPE	<b>Description</b> The sensor type (e.g. Prowirl F) appears on the display.		
SERIAL NUMBER DSC SENSOR	<b>Description</b> The serial number of the DSC sensor appears on the display.		

## 11.18 AMPLIFIER VERSION

Function description, AMPLIFIER VERSION group			
DEVICE SOFTWARE	<b>Description</b> Use this function to display the current device software version.		
HARDWARE REVISION NUMBER AMPLIFIER	<b>Description</b> Use this function to view the hardware revision number of the amplifier board.		
SOFTWARE REVISION NUMBER AMPLIFIER	<b>Description</b> Use this function to view the software revision number of the amplifier board.		
HARDWARE REVISION NUMBER I/O MODULE	<b>Description</b> Use this function to display the hardware revision number of the I/O module.		

Proline Prowirl 72 Factory settings

## 12 Factory settings

## 12.1 SI units (not for USA and Canada)

### 12.1.1 Units of length and temperature

	Unit
Temperature	°C
Length	mm

## 12.1.2 Language

Country	Language	Country	Language
Australia	English	Norway	Norsk
Belgium	English	Austria	Deutsch
Denmark	English	Poland	Polski
Germany	Deutsch	Portugal	Portugues
England	English	Sweden	Svenska
Finland	Suomi	Switzerland	Deutsch
France	Francais	Singapore	English
The Netherlands	Nederlands	Spain	Espanol
Hong Kong	English	South Africa	English
India	English	Thailand	English
Italy	Italiano	Czechia	Cesky
Luxembourg	Francais	Hungary	English
Malaysia	English	Other countries	English

### 12.1.3 100% value line 1 and line 2

The factory settings in the table are given in the dm<sup>3</sup>/s unit. If another unit is selected in the UNIT FLOW function ( $\rightarrow \stackrel{\triangle}{=} 79$ ), the corresponding value is converted and displayed in the selected unit.

Nominal diameter DN		Flange		Wafer	
DIN [mm]	ANSI [in]	Gas [dm³/s]	Liquid [dm³/s]	Gas [dm³/s]	Liquid [dm³/s]
15	1/2"	7.2	1.4	8	2
25	1"	32	4	48	6
40	11/2"	80	10	80	16
50	2"	160	16	160	20
80	3"	320	40	400	48
100	4"	560	64	640	80
150	6"	1280	160	1600	160
200	8"	2400	320	-	-
250	10"	4000	480	-	_
300	12"	5600	640	-	-

Factory settings Proline Prowirl 72

### 12.1.4 Unit totalizer

Flow	Unit
Volume flow	$m^3$
Calculated mass flow	kg
Corrected volume flow	Nm <sup>3</sup>

### 12.1.5 Switch-on point and switch-off point for Prowirl W

The factory settings in the table are given in the dm<sup>3</sup>/s unit. If another unit is selected in the UNIT FLOW function ( $\rightarrow \stackrel{\text{le}}{=} 79$ ), the corresponding value is converted and displayed in the selected unit.

Nominal diameter DN		G	as	Liquid	
DIN [mm]	ANSI [in]	On-value [dm³/s]	Off-value [dm³/s]	On-value [dm³/s]	Off-value [dm <sup>3</sup> /s]
15	1/2"	13	10	2.1	1.7
25	1"	49	40	5.9	4.8
40	1½"	110	94	14	11
50	2"	190	150	22	18
80	3"	420	340	50	41
100	4"	710	580	85	70
150	6"	1600	1300	190	160
200	8"	_	-	-	_
250	10"	_	_	_	_
300	12"	_	_	-	-

### 12.1.6 Switch-on point and switch-off point for Prowirl F

The factory settings in the table are given in the dm<sup>3</sup>/s unit. If another unit is selected in the UNIT FLOW function ( $\rightarrow \stackrel{\triangle}{=} 79$ ), the corresponding value is converted and displayed in the selected unit.

Nominal diameter DN		G	as	Liquid	
DIN [mm]	ANSI [in]	On-value[ dm <sup>3</sup> /s]	Off-value [dm <sup>3</sup> /s]	On-value [dm <sup>3</sup> /s]	Off-value [dm <sup>3</sup> /s]
15	1/2"	7.7	6.3	1.5	1.2
25	1"	38	31	4.6	3.8
40	11/2"	94	77	11	9.2
50	2"	160	130	19	15
80	3"	350	290	42	35
100	4"	610	500	73	60
150	6"	1400	1100	170	140
200	8"	2700	2200	320	260
250	10"	4200	3400	500	410
300	12"	6000	4900	720	590

Proline Prowirl 72 Factory settings

## 12.2 US units (only for USA and Canada)

## 12.2.1 Units of length and temperature

	Unit
Temperature	°F
Length	inch

### 12.2.2 Language

	Language
USA	English
Canada	English

### 12.2.3 100% value line 1 and line 2

The factory settings in the table are given in the US gal/min (GPM) unit. If another unit is selected in the UNIT FLOW function ( $\rightarrow$   $\stackrel{\triangle}{=}$  79), the corresponding value is converted and displayed in the selected unit.

Nominal d	iameter DN	Flange		Wa	ıfer
DIN [mm]	ANSI [inch]	Gas [US gal/min]	Liquid [US gal/min]	Gas [US gal/min]	Liquid [US gal/min]
15	1/2"	110	22	120	32
25	1"	550	63	760	95
40	1 ½"	1300	160	1300	250
50	2"	2500	250	2500	310
80	3"	5100	630	6300	760
100	4"	8900	1000	10000	1300
150	6"	20000	2500	25 000	2500
200	8"	38000	5100	-	_
250	10"	63000	7600	_	-
300	12"	89000	10000	_	_

### 12.2.4 Unit totalizer

Flow	Unit
Volume flow	US gal
Calculated mass flow	lb
Corrected volume flow	Sm <sup>3</sup>

Factory settings Proline Prowirl 72

### 12.2.5 Switch-on point and switch-off point for Prowirl W

The factory settings in the table are given in the unit US gallons/min. If another unit is selected in the UNIT FLOW function ( $\rightarrow$   $\stackrel{\triangleright}{=}$  79), the corresponding value is converted and displayed in the selected unit.

Nominal di	ameter DN	G	Gas Liquid		uid
DIN [mm]	ANSI [inch]	On-value [US Gal/min]	Off-value [US Gal/min]	On-value [US Gal/mins]	Off-value [US Gal/min]
15	1/2"	200	160	34	27
25	1"	780	640	94 7	
40	1 1/2"	1800 1500 220		220	180
50	2"	2900	2400	350	290
80	3"	6600	5400	790	650
100	4"	11000 9200 1400		1400	1100
150	6"	25000 21000 3000		3000	2500
200	8"			-	-
250	10"	-	-	-	-
300	12"			-	

## 12.2.6 Switch-on point and switch-off point for Prowirl F

The factory settings in the table are given in the unit US gallons/min. If another unit is selected in the UNIT FLOW function ( $\rightarrow \stackrel{\triangle}{=} 79$ ), the corresponding value is converted and displayed in the selected unit.

Nominal di	ameter DN	G	as	Liquid		
DIN [mm]	ANSI [inch]	On-value [US Gal/min]	Off-value [US Gal/min]	On-value [US Gal/min]	Off-value [US Gal/min]	
15	1/2"	120	100	24	19	
25	1"	610	500	73	60	
40	11/2"	1500	1200	1200 180		
50	2"	2500	2000	300	240	
80	3"	5600 4600		6700	550	
100	4"	9700	7900	1200	950	
150	6"	22000	18000	2600	2200	
200	8"	42000	35000	5100	4100	
250	10"	67000	54000	8000	6500	
300	12"	95000	78 000	11000	9400	

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A	CONTRAST LCD (fct.)	
Accessories	Counter	
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ACTUAL SYSTEM CONDITION (fct.)	Current output	0.0
Actual value	ACTUAL CURRENT (fct.)	
ACTUAL CURRENT (fct.)	CURRENT SPAN (fct.)	
ACTUAL PULSE (fct.)	Electrical connection	
ALARM DELAY (fct.)	FAILSAFE MODE (fct.)	
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People for Process Automation

# Declaration of Hazardous Material and De-Contamination

# Erklärung zur Kontamination und Reinigung

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## **Technical Information**

## Proline Prowirl 72F, 72W, 73F, 73W

Vortex flow measuring system Reliable flow measurement of gas, steam and liquids





#### Application

For the universal measurement of the volume flow of gases, steam and liquids.

The mass flow of steam, water (as per IAPWS-IF97 ASME), natural gas (as per AGA NX-19/AGA8-DC92 detailed method/AGA8 Gross Method 1/SGERG-88), compressed air, other gases and liquids can also be calculated with the aid of integrated temperature measurement and by reading in external pressure values (Prowirl 73).

Maximum range of applications thanks to:

- Fluid temperature range from -200 to +400 °C (-328 to +752 °F)
- Pressure ratings up to PN 250/Class 1500
- Sensor with integrated (optional) diameter reduction by one line size (R Style) or two line sizes (S Style)
- Dualsens version (optional) for redundant measurements with two sensors and electronics

#### Approvals for:

- ATEX, FM, CSA, TIIS, NEPSI, IEC
- HART, PROFIBUS PA, FOUNDATION Fieldbus
- Pressure Equipment Directive, SIL 2

#### Your benefits

The robust **Prowirl sensor**, tried and tested in over 200 000 applications, offers:

- High resistance to vibrations, temperature shocks, contaminated fluids and water hammer
- No maintenance, no moving parts, no zero-point drift ("lifetime" calibration)
- Software initial settings save time and costs

#### Additional possibilities:

- Complete saturated steam or liquid-mass measuring point in one single device
- Calculation of the mass flow from the measured variables volume flow and temperature in the integrated flow computer
- External pressure value read-in for superheated steam and gas applications
- External temperature value read-in for delta heat measurement



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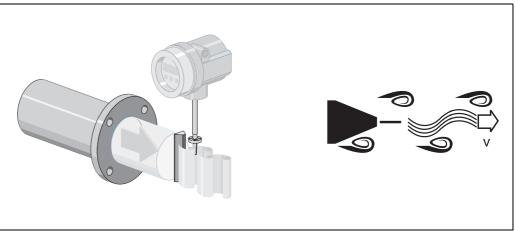
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## Function and system design

#### Measuring principle

Vortex meters work on the principle of the Kármán vortex street. When fluid flows past a bluff body, vortices are alternately formed on both sides with opposite directions of rotation. These vortices each generate a local low pressure. The pressure fluctuations are recorded by the sensor and converted to electrical pulses. The vortices develop very regularly within the permitted application limits of the device. Therefore, the frequency of vortex shedding is proportional to the volume flow.



The calibration factor (K-factor) is used as the proportional constant:

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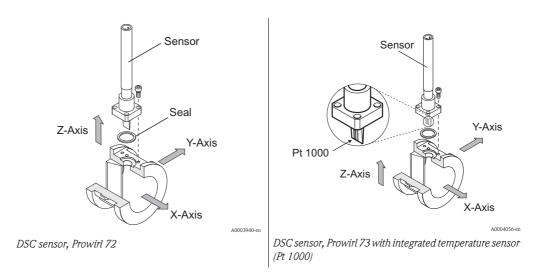
- Within the application limits of the device, the K-factor only depends on the geometry of the device. It is independent of the fluid velocity and the fluid properties viscosity and density. In this way, the K-factor is also independent of the type of matter that is to be measured, regardless of whether this is steam, gas or liquid.
- The primary measuring signal is already digital (frequency signal) and linear to the flow. After production, the K-factor is determined in the factory by means of calibration and is not subject to longterm or zero-point drift.
- The device does not contain any moving parts and does not require maintenance.

#### The capacitive sensor

The sensor of a vortex flowmeter has a major influence on the performance, robustness and reliability of the whole measuring system.

The robust DSC sensor – with an integrated temperature measurement (Pt 1000) with Prowirl 73 – is burst-tested and vibration and temperature-shock-tested (temperature shocks of 150 K/s). The Prowirl uses the tried-and-tested capacitive measuring technology of Endress+Hauser applied in over 200 000 measuring points worldwide.

The DSC (differential switched capacitance) sensor patented by Endress+Hauser has complete mechanical balancing. It only reacts to the measured variable (vortex), not to vibrations. Even in the event of pipe vibrations, the smallest of flows can be reliably measured at low density thanks to the unimpaired sensitivity of the sensor. Thus, the wide turndown is also maintained even in the event of harsh operating conditions. Vibrations up to 1 g, in frequencies up to 500 Hz in every axis (X, Y, Z), do not affect the flow measurement. Due to its design, the capacitive sensor is also particularly mechanically resistant to temperature shocks and water hammers in steam lines.



#### "Lifetime" calibration

Experience has shown that recalibrated Prowirl devices exhibit a very high degree of stability compared to their original calibration: The recalibration values were all within the original measuring accuracy specifications of the devices.

Various tests and simulation procedures carried out on devices by filing away the edges of Prowirl's bluff body found that there was no negative impact on the accuracy up to a rounding diameter of 1 mm (0.04").

Generally the following statements are true:

- Experience has shown that if the fluid is non-abrasive and non-corrosive (e.g. most water and steam applications), the meter's edges will never show rounding at the edges that is 1 mm (0.04") or more.
- If the rounding of the meter's edges is always 1 mm (0.04") or less, the meter will never show a calibration shift that is out of the meter's original specifications.
- Typically, the bluff body's edges exhibit a small rounding that is less than 1 mm (0.04"). The meter, however, is calibrated with this rounded edge. Therefore, the meter will stay within the tolerance specifications as long as the additional wear and tear of the edge does not exceed an additional 1 mm (0.04").

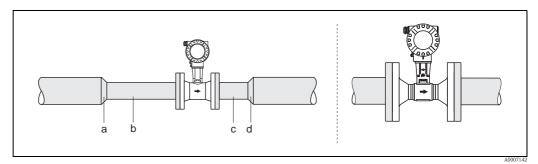
Thus, the Prowirl product line offers calibration for life if the measuring device is used in non-abrasive and non-corrosive fluids.

#### Sensor with integrated nominal diameter reduction

In many applications, the nominal diameter of the customer's pipe does not correspond to the nominal diameter that is optimum for a vortex meter as the flow velocity is too low for vortex formation after the bluff body. This is expressed in a signal loss in the lower flow range. To reduce the nominal diameter by one or two steps, and thus increase the flow velocity, it is common practice nowadays to fit such measuring points with the following adapters:

- Reducer (a)
- Straight pipe segment (b) as the inlet run (min.  $15 \times DN$ ) in front of the vortex meter
- Straight pipe segment (c) as the outlet run (min.  $5 \times DN$ ) after the vortex meter
- Expansion (d

Endress+Hauser is now offering the Prowirl 72/73 vortex meter with integrated nominal diameter reduction for such applications.



Left: Traditional means for reducing pipeline section Right: Nominal diameter reduction by using Prowirl with integrated line size reduction

Nomenclature for Prowirl vortex meters (flanged devices) with integrated nominal diameter reduction:

- Prowirl 72F/73F "R Style": single reduction of line size, e.g. from DN 80 (3") to DN 50 (2")
- Prowirl 72F/73F "S Style": double reduction of line size, e.g. from DN 80 (3") to DN 40 (1½") (S = "super" reduced)

These models offer the following benefits:

- Cost and time saving as the adapter pieces with inlet and outlet runs are completely replaced by one single device (additional inlet and outlet runs to be considered → \( \biglie \) 25)
- Measuring range extended for lower flow rates
- Lower risk (of incorrect measuring device layout) in the planning phase as R Style and S Style measuring devices have the same lengths as standard flanged devices. Each device type can be used alternatively without making complicated changes to the layout.
- Accuracy specifications identical to those for standard devices

#### Temperature measurement (Prowirl 73)

In addition to the volume flow, the Prowirl 73 also measures the fluid temperature. The temperature is measured by means of a temperature sensor Pt 1000 which is located in the paddle of the DSC sensor, i.e. directly in the fluid ( $\rightarrow \stackrel{\triangle}{=} 4$ ).

### Flow computer (Prowirl 73)

The electronics of the Prowirl 73 have an integral flow computer. With the aid of this flow computer other process variables can be calculated from the primary measured variables (volume flow and temperature), e.g.:

- The mass flow and heat flow of saturated steam and water in accordance with IAPWS-IF97/ASME
- The mass flow and heat flow of superheated steam (at constant pressure or pressure read in via HART/ PROFIBUS PA/FOUNDATION Fieldbus) in accordance with IAPWS-IF97/ASME
- The mass flow and corrected volume flow of gases (at constant pressure or pressure read in via HART/PROFIBUS PA/FOUNDATION Fieldbus), e.g. compressed air and natural gas AGA NX-19, AGA8-DC92, ISO12213-2, AGA8 Gross Method 1 and SGERG-88 (see below). Additional gases can be programmed using the real gas equation.

In the case of 4 to 20mA HART devices, the following gases are preprogrammed:

Ammonia	Helium 4	Nitrogen
Argon	Hydrogen (normal)	Oxygen
Butane	Hydrogen chloride	Propane
Carbon dioxide	Hydrogen sulfide	Xenon
Chlorine	Krypton	Mixtures of up to 8 components of
Ethane	Methane	these gases
Ethylene (ethene)	Neon	

The heat flow (energy) of these gases is calculated as per ISO 6976 - based on the net calorific value or gross calorific value.

- Optional with PROFIBUS PA and FOUNDATION Fieldbus: natural gas AGA NX-19 (corrected volume flow and mass flow);
  - Optional for 4 to 20 mA HART: natural gas AGA NX-19, AGA8-DC92, ISO 12213-2, AGA8 Gross Method 1, SGERG-88 (corrected volume flow, mass flow, heat flow).
  - For natural gas AGA NX-19, AGA8 Gross Method 1 and SGERG-88, the gross calorific value or the net calorific value can be entered to calculate the heat flow (energy). For AGA8-DC92 and ISO 12213-2, the data for the gross calorific value and net calorific value are stored in the device according ISO 6976.
- The mass flow of any liquid (linear equation). The gross calorific value or the net calorific value can be entered to calculate the heat flow (energy).
- Delta heat between saturated steam and condensate (second temperature value read in via HART) in accordance with IAPWS-IF97/ASME.
- Delta heat between warm water and cold water (second temperature value read in via HART) in accordance with IAPWS-IF97/ASME.
- In saturated steam measurements, the pressure of the steam can also be calculated from the measured temperature and output in accordance with IAPWS-IF97/ASME.

The mass flow is calculated as the product of (volume flow × operating density). In the case of saturated steam, water and other liquids, the operating density is a function of the temperature. In the case of superheated steam and all other gases, the operating density is a function of the temperature and pressure.

The corrected volume flow is calculated as the product of (volume flow  $\times$  operating density), divided by the reference density. In the case of water and other liquids, the operating density is a function of the temperature. In the case of all other gases, the operating density is a function of the temperature and pressure.

The heat flow is calculated as the product of (volume flow  $\times$  operating density  $\times$  specific enthalpy). In the case of saturated steam and water, the operating density is a function of the temperature. In the case of superheated steam, natural gas NX-19, natural gas AGA8-DC92, natural gas ISO 12213-2, natural gas AGA8 Gross Method 1 and natural gas SGERG-88, the operating density is a function of the temperature and pressure.

### Diagnostic functions (Prowirl 73)

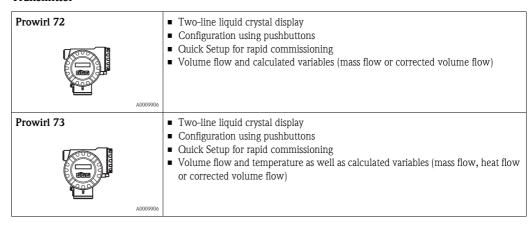
Extensive diagnostic options, such as retracing fluid and ambient temperatures, extreme flows etc., are also optionally available for the measuring device.

#### Measuring system

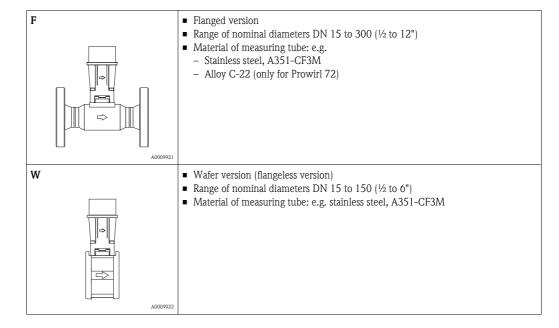
The measuring system comprises a sensor and a transmitter. Two versions are available:

- Compact version: sensor and transmitter form a mechanical unit.
- $\blacksquare$  Remote version: sensor is mounted separate from the transmitter (up to max. 30 m / 98 ft).

#### Transmitter



#### Sensor



## Input

#### Measured variable

#### Prowirl 72

- Volumetric flow (volume flow) is proportional to the frequency of vortex shedding after the bluff body.
- The following can be output as the output variable:
  - Volume flow
  - Mass flow or corrected volume flow (if process conditions are constant)

#### Prowirl 73

- Volumetric flow (volume flow) is proportional to the frequency of vortex shedding after the bluff body.
- The temperature can be output directly and is used to calculate the mass flow for example.
- The following can be output as the output variable:
  - The measured process variables volume flow and temperature
  - The calculated process variables mass flow, heat flow or corrected volume flow

#### Measuring range

The measuring range depends on the fluid and the nominal diameter.

#### Start of measuring range

Depends on the density and the Reynolds number ( $Re_{min} = 4000$ ,  $Re_{linear} = 20000$ ).

The Reynolds number is dimensionless and is the ratio of inertial forces to viscous forces of the fluid. It is used for characterizing the flow. The Reynolds number is calculated as follows:

$$Re \ = \frac{ \ 4 \cdot Q \ [m^3/s] \cdot \rho \ [kg/m^3] }{ \pi \cdot di \ [m] \cdot \mu \ [Pa\cdot s] } \qquad \qquad Re \ = \frac{ \ 4 \cdot Q \ [ft^3/s] \cdot \rho \ [lb/ft^3] }{ \pi \cdot di \ [ft] \cdot \mu \ [0.001 \ cP] }$$

A0003794

 $\textit{Re} = \textit{Reynolds number}; \ \textit{Q} = \textit{flow}; \ \textit{di} = \textit{internal diameter}; \ \mu = \textit{dynamic viscosity}, \ \rho = \textit{density}$ 

DN 15...25 
$$\rightarrow$$
 v  $_{min.}^{*}=\frac{6}{\sqrt{\rho [kg/m^{3}]}}$  [m/s] DN 40...300  $\rightarrow$  v  $_{min.}^{*}=\frac{7}{\sqrt{\rho [kg/m^{3}]}}$  [m/s]

1/2...1"  $\rightarrow$  v  $_{min.}^{*}=\frac{4.92}{\sqrt{\rho [lb/ft^{3}]}}$  [ft/s] 11/2...12"  $\rightarrow$  v  $_{min.}^{*}=\frac{5.74}{\sqrt{\rho [lb/ft^{3}]}}$  [ft/s]

#### Full scale value

Liquids:  $v_{max} = 9 \text{ m/s} (30 \text{ ft/s})$ 

Gas/steam: see table

Nominal diameter	<b>v</b> <sub>max</sub>
Standard version: DN 15 (1/2")	
R Style: DN 25 (1") > DN 15 (1/2")	46 m/s (151 ft/s) or Mach 0.3
S Style: DN 40 (1½") >> DN 15 (½")	(depending on which value is smaller)
Standard version: DN 25 (1"), DN 40 (1½")	
R Style:	
$-DN 40 (1\frac{1}{2}") > DN 25 (1")$	75 m/s (246 ft/s) or Mach 0.3
$-DN 50 (2") > DN 40 (1\frac{1}{2}")$	(depending on which value is smaller)
S Style:	
– DN 80 (3") >> DN 40 (1½")	
Standard version: DN 50 to 300 (2 to 12")	
R Style:	
– DN 80 (3") > DN 50 (2")	120 m/s (394 ft/s) or Mach 0.3
– Nominal diameters larger than DN 80 (3")	(depending on which value is smaller)
S Style:	
- DN 100 (4") >> DN 50 (2")	Calibrated range: up to 75 m/s (246 ft/s)
– Nominal diameters larger than DN 100 (4")	



#### Notel

By using the selection and planning program "Applicator", you can determine the exact values for the fluid you use. You can obtain the Applicator from your Endress+Hauser sales center or on the Internet under www.endress.com.

<sup>\*</sup> with amplification 5

#### K-factor range

The table is used for orientation purposes. The range in which the K-factor can be is indicated for individual nominal diameters and designs.

Nominal diameter		K-factor range (pulses/dm³)	
DIN/JIS	ANSI	72F / 73F	72W / 73W
DN 15	1/2"	390 to 450	245 to 280
DN 25	1"	70 to 85	48 to 55
DN 40	1 ½"	18 to 22	14 to 17
DN 50	2"	8 to 11	6 to 8
DN 80	3"	2.5 to 3.2	1.9 to 2.4
DN 100	4"	1.1 to 1.4	0.9 to 1.1
DN 150	6"	0.3 to 0.4	0.27 to 0.32
DN 200	8"	0.1266 to 0.1400	-
DN 250	10"	0.0677 to 0.0748	-
DN 300	12"	0.0364 to 0.0402	-

#### Measuring range for gases [m3/h or Nm3/h]

In the case of gases, the start of the measuring range depends on the density. With ideal gases, the density  $[\rho]$  or corrected density  $[\rho_N]$  can be calculated using the following formulae:

$$\rho \, [kg/m^3] = \, \frac{\rho_N \, [kg/Nm^3] \cdot P \, [bar \, abs] \cdot 273.15 \, [K]}{T \, [K] \cdot 1.013 \, [bar \, abs]} \\ \rho_N \, [kg/Nm^3] = \, \frac{\rho \, [kg/m^3] \cdot T \, [K] \cdot 1.013 \, [bar \, abs]}{P \, [bar \, abs] \cdot 273.15 \, [K]} \\ \rho \, [lb/ft^3] = \, \frac{\rho_N \, [lb/SCF] \cdot P \, [psia] \cdot 530 \, [^\circ R]}{T \, [^\circ F + 460] \cdot 14.7 \, [psia]} \\ \rho_N \, [lb/SCF] = \, \frac{\rho \, [lb/ft^3] \cdot T \, [^\circ F + 460] \cdot 14.7 \, [psia]}{P \, [psia] \cdot 530 \, [^\circ R]}$$

The following formulae can be used to calculate the volume [Q] or corrected volume  $[Q_N]$  in the case of ideal gases:

$$\begin{array}{lll} O_{1}\left[m^{3}/h\right] = & \frac{O_{1}\left[Nm^{3}/h\right] \cdot T_{2}\left[K\right] \cdot 1.013 \left[bar \ abs\right]}{P_{2}\left[bar \ abs\right] \cdot 273.15 \left[K\right]} & O_{1}\left[Nm^{3}/h\right] = & \frac{O_{2}\left[m^{3}/h\right] \cdot P_{2}\left[bar \ abs\right] \cdot 273.15 \left[K\right]}{T_{2}\left[K\right] \cdot 1.013 \left[bar \ abs\right]} \\ O_{2}\left[t^{3}/h\right] = & \frac{O_{3}\left[Nm^{3}/h\right] \cdot P_{2}\left[bar \ abs\right] \cdot 273.15 \left[K\right]}{P_{2}\left[bar \ abs\right] \cdot 273.15 \left[K\right]} \\ O_{3}\left[t^{3}/h\right] = & \frac{O_{3}\left[t^{3}/h\right] \cdot P_{2}\left[bar \ abs\right] \cdot 273.15 \left[K\right]}{P_{2}\left[bar \ abs\right] \cdot 273.15 \left[K\right]} \\ O_{3}\left[t^{3}/h\right] = & \frac{O_{4}\left[t^{3}/h\right] \cdot P_{2}\left[bar \ abs\right] \cdot 273.15 \left[K\right]}{P_{2}\left[bar \ abs\right] \cdot 273.15 \left[K\right]} \\ O_{3}\left[t^{3}/h\right] = & \frac{O_{4}\left[t^{3}/h\right] \cdot P_{2}\left[bar \ abs\right] \cdot 273.15 \left[K\right]}{P_{2}\left[bar \ abs\right] \cdot 273.15 \left[K\right]} \\ O_{4}\left[t^{3}/h\right] = & \frac{O_{5}\left[t^{3}/h\right] \cdot P_{2}\left[bar \ abs\right] \cdot 273.15 \left[K\right]}{P_{2}\left[bar \ abs\right] \cdot 273.15 \left[K\right]} \\ O_{5}\left[t^{3}/h\right] = & \frac{O_{5}\left[t^{3}/h\right] \cdot P_{2}\left[bar \ abs\right] \cdot 273.15 \left[K\right]}{P_{2}\left[bar \ abs\right] \cdot 273.15 \left[K\right]} \\ O_{5}\left[t^{3}/h\right] = & \frac{O_{5}\left[t^{3}/h\right] \cdot P_{2}\left[bar \ abs\right] \cdot 273.15 \left[K\right]}{P_{2}\left[bar \ abs\right] \cdot 273.15 \left[K\right]} \\ O_{6}\left[t^{3}/h\right] = & \frac{O_{6}\left[t^{3}/h\right] \cdot P_{2}\left[bar \ abs\right] \cdot 273.15 \left[K\right]}{P_{2}\left[bar \ abs\right] \cdot 273.15 \left[K\right]} \\ O_{6}\left[t^{3}/h\right] = & \frac{O_{6}\left[t^{3}/h\right] \cdot P_{2}\left[bar \ abs\right] \cdot 273.15 \left[K\right]}{P_{2}\left[bar \ abs\right] \cdot 273.15 \left[K\right]} \\ O_{7}\left[t^{3}/h\right] = & \frac{O_{7}\left[t^{3}/h\right] \cdot P_{2}\left[bar \ abs\right] \cdot 273.15 \left[K\right]}{P_{2}\left[bar \ abs\right] \cdot 273.15 \left[K\right]} \\ O_{7}\left[t^{3}/h\right] = & \frac{O_{7}\left[t^{3}/h\right] \cdot P_{2}\left[bar \ abs\right] \cdot 273.15 \left[K\right]}{P_{2}\left[bar \ abs\right] \cdot 273.15 \left[K\right]} \\ O_{7}\left[t^{3}/h\right] = & \frac{O_{7}\left[t^{3}/h\right] \cdot P_{2}\left[bar \ abs\right] \cdot 273.15 \left[K\right]}{P_{2}\left[bar \ abs\right] \cdot 273.15 \left[K\right]} \\ O_{7}\left[t^{3}/h\right] = & \frac{O_{7}\left[t^{3}/h\right] \cdot P_{2}\left[bar \ abs\right] \cdot 273.15 \left[K\right]}{P_{2}\left[bar \ abs\right] \cdot 273.15 \left[K\right]} \\ O_{7}\left[t^{3}/h\right] = & \frac{O_{7}\left[t^{3}/h\right] \cdot P_{2}\left[bar \ abs\right] \cdot 273.15 \left[K\right]}{P_{2}\left[bar \ abs\right] \cdot 273.15 \left[K\right]} \\ O_{7}\left[t^{3}/h\right] = & \frac{O_{7}\left[t^{3}/h\right] \cdot P_{2}\left[bar \ abs\right] \cdot 273.15 \left[K\right]}{P_{2}\left[bar \ abs\right] \cdot 273.15 \left[K\right]} \\ O_{7}\left[t^{3}/h\right] = & \frac{O_{7}\left[t^{3}/h\right] \cdot P_{2}\left[bar \ abs\right] \cdot 273.15 \left[K\right]}{P_{2}\left[bar \ abs\right] \cdot$$

T = Operating temperature, P = operating pressure

#### Input signal

#### HART input functionality (Prowirl 73)

Prowirl 73 (4 to 20 mA HART) is able to read in an external pressure, temperature or density value. The following order options are required for this purpose:

- Prowirl 73: output/input → option W (4–20 mA HART) or A (4–20 mA HART + frequency)
- $2 \times \text{active barrier RN221N-x1}$  (for x: A = for non-hazardous areas, B = ATEX, C = FM, D = CSA)
- If reading in pressure: 1 × Cerabar M or Cerabar S in burst mode (Activated burst mode must be noted with the order of the Cerabar M or S. Otherwise the burst mode must be activated locally either with FieldCare or with a HART handheld (FieldXpert).)

When this functionality is used, the following signals can be made available to the control system, e.g. in an application with superheated steam:

- Pressure as 4 to 20 mA signal
- Temperature
- Mass flow

#### Pressure input (PROFIBUS PA, FOUNDATION Fieldbus)

An external pressure value function block can be read in with Prowirl 73 (bus version). The following order options are required for this purpose:

#### PROFIBUS PA:

- Prowirl 73 → output/input → option H (PROFIBUS PA)
- Cerabar M  $\rightarrow$  electronics/display  $\rightarrow$  option P or R;  $\rightarrow$  ceramic sensor  $\rightarrow$  option 2F, 2H, 2M, 2P or 2S Cerabar S Evolution  $\rightarrow$  output/operation  $\rightarrow$  option M, N or O;  $\rightarrow$  d:sensor range  $\rightarrow$  option 2C, 2E, 2F, 2H, 2K, 2M, 2P or 2S

#### FOUNDATION Fieldbus (FF):

- Prowirl 73 → output/input → option K (FOUNDATION Fieldbus)
- Cerabar S Evolution → output/operation → option P, Q or R; → d:sensor range → option 2C, 2E, 2F, 2H, 2K, 2M, 2P or 2S

## **Output**

## Prowirl 72

By means of the outputs in the 4 to 20 mA/HART version of Prowirl 72, the volume flow and, if process conditions are constant, the calculated mass flow and corrected volume flow can be output via the current output and optionally via the pulse output or as a limit value via the status output.

### Prowirl 73

By means of the outputs in the 4 to  $20\ mA/HART$  version of Prowirl 73, the following measured variables can generally be output:

	4 to 20 mA HART measuring devices				FOUNDATION	
	Current output	Frequency output (only for output option A)	Pulse output (only for output option A)	Status output (only for output option A)	PROFIBUS - PA (4 AI Blocks)	FOUNDATION Fieldbus FF (7 AI Blocks)
Saturated steam	<ul> <li>Volume flow/mass flow/heat flow</li> <li>Temperature</li> <li>Saturation steam pressure</li> </ul>	<ul> <li>Volume flow/mass flow/heat flow</li> <li>Temperature</li> <li>Saturation steam pressure</li> </ul>	■ Volume ■ Mass ■ Heat	Volume flow/mass flow/heat flow limit value Temperature limit value Totalizer limit value Velocity limit value Calculated saturated steam pressure limit value	<ul><li>Totalizer</li><li>Optional:</li></ul>	■ Volume flow/mass flow/heat flow ■ Temperature ■ Saturation steam pressure ■ Specific enthalpy ■ Frequency ■ Flow velocity ■ Totalizer ■ Optional: - Reynolds number - Electronics temperature
Superheated steam	<ul> <li>Volume flow/mass flow/heat flow</li> <li>Temperature</li> <li>External pressure (if it can be read in)</li> </ul>	<ul> <li>Volume flow/mass flow/heat flow</li> <li>Temperature</li> <li>External pressure (if it can be read in)</li> </ul>	<ul><li>Volume</li><li>Mass</li><li>Heat</li></ul>	<ul> <li>Volume flow/mass flow/heat flow limit value</li> <li>Temperature limit value</li> <li>Totalizer limit value</li> <li>Velocity limit value</li> <li>External pressure limit value (if it can be read in)</li> </ul>	<ul> <li>Volume flow/mass flow/heat flow</li> <li>Temperature</li> <li>Specific enthalpy</li> <li>Frequency</li> <li>Flow velocity</li> <li>Totalizer</li> <li>Optional:         <ul> <li>Reynolds number</li> <li>Electronics temperature</li> </ul> </li> </ul>	<ul> <li>Volume flow/mass flow/heat flow</li> <li>Temperature</li> <li>Specific enthalpy</li> <li>Frequency</li> <li>Flow velocity</li> <li>Totalizer</li> <li>Optional:         <ul> <li>Reynolds number</li> <li>Electronics temperature</li> </ul> </li> </ul>
Water	<ul> <li>Volume flow/mass flow/heat flow/corrected volume flow</li> <li>Temperature</li> <li>External pressure (if it can be read in)</li> </ul>	<ul> <li>Volume flow/mass flow/heat flow/corrected volume flow</li> <li>Temperature</li> <li>External pressure (if it can be read in)</li> </ul>	<ul> <li>Volume</li> <li>Mass</li> <li>Heat</li> <li>Corrected volume</li> </ul>	Volume flow/mass flow/heat flow/corrected volume flow limit value Temperature limit value Totalizer limit value Velocity limit value External pressure limit value (if it can be read in)	<ul> <li>Volume flow/mass flow/heat flow/corrected volume flow</li> <li>Temperature</li> <li>Specific enthalpy</li> <li>Frequency</li> <li>Flow velocity</li> <li>Totalizer</li> <li>Optional:         <ul> <li>Reynolds number</li> <li>Electronics temperature</li> </ul> </li> </ul>	<ul> <li>Volume flow/mass flow/heat flow/corrected volume flow</li> <li>Temperature</li> <li>Specific enthalpy</li> <li>Frequency</li> <li>Flow velocity</li> <li>Totalizer</li> <li>Optional:         <ul> <li>Reynolds number</li> <li>Electronics temperature</li> </ul> </li> </ul>

	4 to 20 mA HART measuring devices				EOUNDATION	
	Current output	Frequency output (only for output option A)	Pulse output (only for output option A)	Status output (only for output option A)	PROFIBUS - PA (4 AI Blocks)	FOUNDATION Fieldbus FF (7 AI Blocks)
Compressed air	<ul> <li>Volume flow/mass flow/heat flow/corrected volume flow</li> <li>Temperature</li> <li>External pressure (if it can be read in)</li> </ul>	<ul> <li>Volume flow/mass flow/heat flow/corrected volume flow</li> <li>Temperature</li> <li>External pressure (if it can be read in)</li> </ul>	■ Volume ■ Mass ■ Corrected volume	<ul> <li>Volume flow/mass flow/heat flow/corrected volume flow limit value</li> <li>Temperature limit value</li> <li>Totalizer limit value</li> <li>Velocity limit value</li> <li>External pressure limit value (if it can be read in)</li> </ul>	flow/corrected volume flow  Temperature Compressibility Frequency Flow velocity Totalizer	<ul> <li>Volume flow/mass flow/corrected volume flow</li> <li>Temperature</li> <li>Compressibility</li> <li>Frequency</li> <li>Flow velocity</li> <li>Totalizer</li> <li>Optional:         <ul> <li>Reynolds number</li> <li>Electronics temperature</li> </ul> </li> </ul>
Ar, NH3, C4H10, CO2, CO, C12, C2H6, C2H4, He 4, H2 (normal), HCI, H2S, Kr, CH4, Ne, N2, O2, C3H8, Xe*	<ul> <li>Volume flow/mass flow/heat flow/corrected volume flow</li> <li>Temperature</li> <li>External pressure (if it can be read in)</li> </ul>	<ul> <li>Volume flow/mass flow/heat flow/corrected volume flow</li> <li>Temperature</li> <li>External pressure (if it can be read in)</li> </ul>	<ul> <li>Volume</li> <li>Mass</li> <li>Heat</li> <li>Corrected volume</li> </ul>	<ul> <li>Volume flow/mass flow/corrected volume flow limit value</li> <li>Temperature limit value</li> <li>Totalizer limit value</li> <li>Velocity limit value</li> <li>External pressure limit value (if it can be read in)</li> </ul>	→ Use real gas equation	No data → Use real gas equation
Mixtures of up to 8 of the components above	<ul> <li>Volume flow/mass flow/heat flow/corrected volume flow</li> <li>Temperature</li> <li>External pressure (if it can be read in)</li> </ul>	<ul> <li>Volume flow/mass flow/heat flow/corrected volume flow</li> <li>Temperature</li> <li>External pressure (if it can be read in)</li> </ul>	<ul><li>Mass</li><li>Heat</li><li>Corrected volume</li></ul>	<ul> <li>Volume flow/mass flow/corrected volume flow limit value</li> <li>Temperature limit value</li> <li>Totalizer limit value</li> <li>Velocity limit value</li> <li>External pressure limit value (if it can be read in)</li> </ul>	→ Use real gas equation	No data → Use real gas equation
Real gas equation	■ Volume flow/mass flow/corrected volume flow ■ Temperature ■ External pressure (if it can be read in)	<ul> <li>Volume flow/mass flow/corrected volume flow</li> <li>Temperature</li> <li>External pressure (if it can be read in)</li> </ul>	<ul><li>Mass</li><li>Corrected volume</li></ul>	■ Volume flow/mass flow/corrected volume flow limit value ■ Temperature limit value ■ Totalizer limit value ■ Velocity limit value ■ External pressure limit value (if it can be read in)	flow/corrected volume flow Temperature Frequency Flow velocity Totalizer Optional:	<ul> <li>Volume flow/mass flow/corrected volume flow</li> <li>Temperature</li> <li>Frequency</li> <li>Flow velocity</li> <li>Totalizer</li> <li>Optional: electronics temperature</li> </ul>

<sup>\*</sup> Argon, ammonia, butane, carbon dioxide, carbon monoxide, chlorine, ethane, ethylene (ethene), helium 4, hydrogen (normal), hydrogen chloride, hydrogen sulfide, krypton, methane, neon, nitrogen, oxygen, propane, xenon

	4 to 20 mA HART measuring devices				POLINIDATION	
	Current output	Frequency output (only for output option A)	Pulse output (only for output option A)	Status output (only for output option A)	PROFIBUS - PA (4 AI Blocks)	FOUNDATION Fieldbus FF (7 AI Blocks)
Natural gas AGA NX- 19	<ul> <li>Volume flow/mass flow/heat flow/corrected volume flow</li> <li>Temperature</li> <li>External pressure (if it can be read in)</li> </ul>	■ Volume flow/mass flow/heat flow/corrected volume flow ■ Temperature ■ External pressure (if it can be read in)	<ul> <li>Volume</li> <li>Mass</li> <li>Heat</li> <li>Corrected volume</li> </ul>	<ul> <li>Volume flow/mass flow/corrected volume flow limit value</li> <li>Temperature limit value</li> <li>Totalizer limit value</li> <li>Velocity limit value</li> <li>External pressure limit value (if it can be read in)</li> </ul>	<ul> <li>Volume flow/mass flow/corrected volume flow</li> <li>Temperature</li> <li>Supercompressibility</li> <li>Frequency</li> <li>Flow velocity</li> <li>Totalizer</li> <li>Optional:         <ul> <li>Reynolds number</li> <li>Electronics temperature</li> </ul> </li> </ul>	<ul> <li>Volume flow/mass flow/corrected volume flow</li> <li>Temperature</li> <li>Supercompressibility</li> <li>Frequency</li> <li>Flow velocity</li> <li>Totalizer</li> <li>Optional:         <ul> <li>Reynolds number</li> <li>Electronics temperature</li> </ul> </li> </ul>
Natural gas AGA8-DC92 detailed method	<ul> <li>Volume flow/mass flow/heat flow/corrected volume flow</li> <li>Temperature</li> <li>External pressure (if it can be read in)</li> </ul>	■ Volume flow/mass flow/heat flow/corrected volume flow ■ Temperature ■ External pressure (if it can be read in)	<ul> <li>Volume</li> <li>Mass</li> <li>Heat</li> <li>Corrected volume</li> </ul>	<ul> <li>Volume flow/mass flow/heat flow/corrected volume flow limit value</li> <li>Temperature limit value</li> <li>Totalizer limit value</li> <li>Velocity limit value</li> <li>External pressure limit value (if it can be read in)</li> </ul>	→ Use natural gas AGA NX-19 or real gas equation	No data  → Use natural gas AGA NX-19 or real gas equation
Natural gas ISO 12213-2	<ul> <li>Volume flow/mass flow/heat flow/corrected volume flow</li> <li>Temperature</li> <li>External pressure (if it can be read in)</li> </ul>	■ Volume flow/mass flow/heat flow/corrected volume flow ■ Temperature ■ External pressure (if it can be read in)	<ul> <li>Volume</li> <li>Mass</li> <li>Heat</li> <li>Corrected volume</li> </ul>	<ul> <li>Volume flow/mass flow/heat flow/corrected volume flow limit value</li> <li>Temperature limit value</li> <li>Totalizer limit value</li> <li>Velocity limit value</li> <li>External pressure limit value (if it can be read in)</li> </ul>	No data → Use natural gas AGA NX-19 or real gas equation	No data → Use natural gas AGA NX-19 or real gas equation
Natural gas AGA8 Gross Method 1	<ul> <li>Volume flow/mass flow/heat flow/corrected volume flow</li> <li>Temperature</li> <li>External pressure (if it can be read in)</li> </ul>	■ Volume flow/mass flow/heat flow/corrected volume flow ■ Temperature ■ External pressure (if it can be read in)	<ul> <li>Volume</li> <li>Mass</li> <li>Heat</li> <li>Corrected volume</li> </ul>	<ul> <li>Volume flow/mass flow/heat flow/corrected volume flow limit value</li> <li>Temperature limit value</li> <li>Totalizer limit value</li> <li>Velocity limit value</li> <li>External pressure limit value (if it can be read in)</li> </ul>	→ Use natural gas AGA NX-19 or real gas equation	No data → Use natural gas AGA NX-19 or real gas equation

<sup>\*</sup> Argon, ammonia, butane, carbon dioxide, carbon monoxide, chlorine, ethane, ethylene (ethene), helium 4, hydrogen (normal), hydrogen chloride, hydrogen sulfide, krypton, methane, neon, nitrogen, oxygen, propane, xenon

		4 to 20 mA HART		COLINDATION		
	Current output	Frequency output (only for output option A)	Pulse output (only for output option A)	Status output (only for output option A)	PROFIBUS - PA (4 AI Blocks)	FOUNDATION Fieldbus FF (7 AI Blocks)
Natural gas SGERG-88	<ul> <li>Volume flow/mass flow/heat flow/corrected volume flow</li> <li>Temperature</li> <li>External pressure (if it can be read in)</li> </ul>	<ul> <li>Volume flow/mass flow/heat flow/corrected volume flow</li> <li>Temperature</li> <li>External pressure (if it can be read in)</li> </ul>	<ul><li>Mass</li><li>Heat</li><li>Corrected volume</li></ul>	<ul> <li>Volume flow/mass flow/heat flow/corrected volume flow limit value</li> <li>Temperature limit value</li> <li>Totalizer limit value</li> <li>Velocity limit value</li> <li>External pressure limit value (if it can be read in)</li> </ul>	No data  → Use natural gas AGA NX-19 or real gas equation	No data → Use natural gas AGA NX-19 or real gas equation
User-defined liquid	■ Volume flow/mass flow/heat flow/corrected volume flow ■ Temperature	<ul> <li>Volume flow/mass flow/heat flow/ corrected volume flow</li> <li>Temperature</li> </ul>	<ul> <li>Volume</li> <li>Mass</li> <li>Heat</li> <li>Corrected volume</li> </ul>	<ul> <li>Volume flow/mass flow/corrected volume flow limit value</li> <li>Temperature limit value</li> <li>Totalizer limit value</li> <li>Velocity limit value</li> </ul>	flow/corrected volume flow Temperature Frequency Flow velocity Totalizer Optional:	<ul> <li>Volume flow/mass flow/corrected volume flow</li> <li>Temperature</li> <li>Frequency</li> <li>Flow velocity</li> <li>Totalizer</li> <li>Optional: electronics temperature</li> </ul>
Water delta heat application	■ Volume flow/mass flow/heat flow/corrected volume flow ■ Temperature ■ External temperature	<ul> <li>Volume flow/mass flow/heat flow/corrected volume flow</li> <li>Temperature</li> <li>External temperature</li> </ul>	<ul> <li>Volume</li> <li>Mass</li> <li>Heat</li> <li>Corrected volume</li> </ul>	■ Volume flow/mass flow/heat flow/corrected volume flow limit value ■ Temperature limit value ■ Totalizer limit value ■ Velocity limit value ■ External temperature limit value		No data
Saturated steam delta heat application	<ul> <li>Volume flow/mass flow/heat flow</li> <li>Temperature</li> <li>External temperature</li> </ul>	<ul> <li>Volume flow/mass flow/heat flow</li> <li>Temperature</li> <li>External temperature</li> </ul>	<ul><li>Volume</li><li>Mass</li><li>Heat</li></ul>	<ul> <li>Volume flow/mass flow/heat flow limit value</li> <li>Temperature limit value</li> <li>Totalizer limit value</li> <li>Velocity limit value</li> <li>External temperature limit value</li> </ul>		No data

If configured, the following calculated measured variables can also be displayed via the local display in

 $^{\star} \text{ Argon, ammonia, butane, carbon dioxide, carbon monoxide, chlorine, ethane, ethylene (ethene), helium 4, hydrogen (normal), hydrogen chloride, hydrogen (normal), hydrogen (nor$ 

If configured, the following calculated measured variables can also be displayed via the local display in Prowirl 73:

■ Density

sulfide, krypton, methane, neon, nitrogen, oxygen, propane, xenon

- Specific enthalpy
- Saturation steam pressure (for saturated steam)
- Z-factor
- Flow velocity

#### Output signal

#### Prowirl 72

#### Current output:

- 4 to 20 mA with HART,
- Full scale value and time constant (0 to 100 s) can be set

#### Pulse/status output:

- Open collector, passive, galvanically isolated
  - Non-Ex, Ex d/XP version:  $U_{\text{max}}$  = 36 V, with 15 mA current limiting,  $R_{i}$  = 500  $\Omega$
  - Ex i/IS and Ex n version:  $U_{max}$  = 30 V, with 15 mA current limiting,  $R_{i}$  = 500  $\Omega$

The pulse/status output can be configured as:

- Pulse output:
  - Pulse value and polarity can be selected
  - Pulse width can be configured (0.005 to 2 s)
  - Pulse frequency max. 100 Hz
- Status output:

Can be configured for error messages or flow limit values

- Vortex frequency:
  - Direct output of unscaled vortex pulses 0.5 to 2850 Hz (e.g. for connecting to an RMC621 flow computer)
  - Pulse ratio 1:1
- PFM signal (pulse/frequency modulation):
   With external connection via flow computer RMC621 or RMS621

#### PROFIBUS PA interface:

- PROFIBUS PA in accordance with EN 50170 Volume 2, IEC 61158-2 (MBP), galvanically isolated
- Current consumption = 16 mA
- Error current FDE (fault disconnection electronic) = 0 mA
- Data transmission rate: supported baudrate = 31.25 kBit/s
- Signal encoding = Manchester II
- Function blocks: 1 × Analog Input, 1 × totalizer
- Output data: volume flow, calculated mass flow, corrected volume flow, totalizer
- Input data: positive zero return (ON/OFF), totalizer control
- Bus address can be set at the device via DIP switches

#### FOUNDATION Fieldbus interface:

- FOUNDATION Fieldbus H1, IEC 61158-2, galvanically isolated
- Current consumption = 16 mA
- Error current FDE (fault disconnection electronic) = 0 mA
- Data transmission rate: supported baudrate = 31.25 kBit/s
- Signal encoding = Manchester II
- Function blocks: 2 × Analog Input, 1 × Discrete Output
- Output data: volume flow, calculated mass flow, corrected volume flow, totalizer
- Input data: positive zero return (ON/OFF), totalizer reset
- Link Master (LM) functionality is supported

#### Prowirl 73

#### Current output:

- 4 to 20 mA with HART,
- Full scale value and time constant (0 to 100 s) can be set

#### Frequency output, pulse/status output:

- Frequency output (optional): open collector, passive, galvanically isolated
  - Non-Ex, Ex d/XP version:  $U_{max}$  = 36 V, with 15 mA current limiting,  $R_{i}$  = 500  $\Omega$
  - Ex i/IS and Ex n version:  $U_{max}$  = 30 V, with 15 mA current limiting,  $R_{i}$  = 500  $\Omega$

The pulse/status output can be configured as:

- Frequency output:
  - End frequency 0 to 1000 Hz (fmax = 1250 Hz)
- Pulse output:
  - Pulse value and polarity can be selected
  - Pulse width can be configured (0.005 to 2 s)
  - Pulse frequency max. 100 Hz
- Status output:

Can be configured for error messages or flow values, temperature values, pressure limit values

- Vortex frequency:
  - Direct output of unscaled vortex pulses 0.5 to 2850 Hz (e.g. for connecting to an RMC621 flow computer)
  - Pulse ratio 1:1

#### PROFIBUS PA interface:

- PROFIBUS PA in accordance with EN 50170 Volume 2, IEC 61158-2 (MBP), galvanically isolated
- Current consumption = 16 mA
- Error current FDE (fault disconnection electronic) = 0 mA
- Data transmission rate: supported baudrate = 31.25 kBit/s
- Signal encoding = Manchester II
- Function blocks: 4 × Analog Input, 2 × totalizer
- Output data: volume flow, mass flow, corrected volume flow, heat flow, temperature, density, specific enthalpy, calculated steam pressure (saturated steam), operating Z-factor, vortex frequency, electronics temperature, Reynolds number, velocity, totalizer
- Input data: positive zero return (ON/OFF), totalizer control, absolute pressure, display value
- Bus address can be set at the device via DIP switches

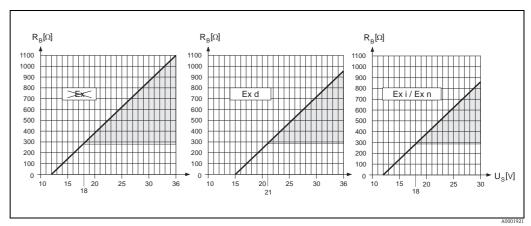
#### FOUNDATION Fieldbus interface:

- FOUNDATION Fieldbus H1, IEC 61158-2, galvanically isolated
- Current consumption = 16 mA
- Error current FDE (fault disconnection electronic) = 0 mA
- Data transmission rate: supported baudrate = 31.25 kBit/s
- Signal encoding = Manchester II
- Function blocks: 6 × Analog Input, 1 × Discrete Output, 1 × Analog Output
- Output data: volume flow, mass flow, corrected volume flow, heat flow, temperature, density, specific enthalpy, calculated steam pressure (saturated steam), operating Z-factor, vortex frequency, electronics temperature, Reynolds number, velocity, totalizer 1 + 2
- $\blacksquare$  Input data: positive zero return (ON/OFF), totalizer reset, absolute pressure
- Link Master (LM) functionality is supported

#### Signal on alarm

- $\blacksquare \ \ \text{Current output: error response can be selected (e.g. in accordance with NAMUR Recommendation NE 43)}$
- Pulse output: error response can be selected
- Status output: "not conducting" in event of fault

Load



The area shaded gray refers to the permitted load (for HART: min. 250  $\Omega)$  The load is calculated as follows:

$$R_{_B} \; = \; \frac{(U_{_S} \! - U_{_{KI}})}{(I_{_{max}} - 10^{\text{-3}})} = \; \frac{(U_{_S} \! - U_{_{KI}})}{0.022}$$

 $R_B$  Load, load resistance

 $\overline{U_S}$  Supply voltage: non-Ex = 12 to 36 V DC; Ex d /XP= 15 to 36 V DC; Ex i /IS and Ex n = 12 to 30 V DC

Terminal voltage: non-Ex = min. 12 V DC; Ex d/XP = min. 15 V DC; Ex i/IS and Ex n = min. 12 V DC

 $I_{max}$  Output current (22.6 mA)

Low flow cut off

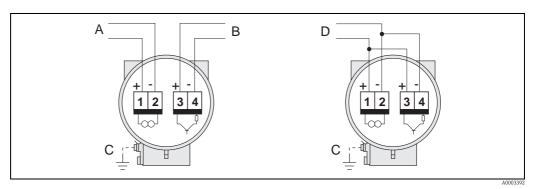
Switch points for low flow cut off can be selected as required.

Galvanic isolation

All electrical connections are galvanically isolated from one another.

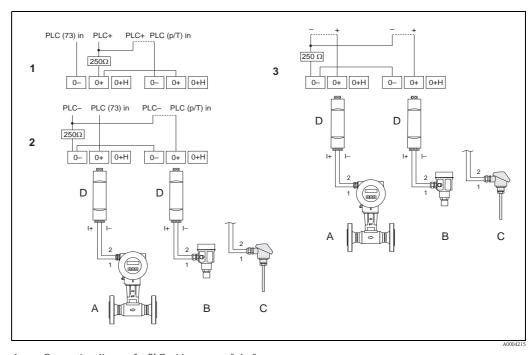
## Power supply

#### **Electrical connection**



- A HART: power supply, current output
  - -PROFIBUS PA: 1 = PA+, 2 = PA-
  - FOUNDATION Fieldbus: 1 = FF+, 2 = FF−
- B Optional pulse output (not for PROFIBUS PA and FOUNDATION Fieldbus), can also be operated as:
  - Status output
  - Only Prowirl 73: frequency output
  - Only Prowirl 73: as a PFM output (pulse/frequency modulation) together with an RMC621 or RMS621 flow computer
- C Ground terminal (relevant for remote version)
- D Only Prowirl 72: PFM (pulse/frequency modulation) wiring for connecting to flow computer RMC621 or RMS621

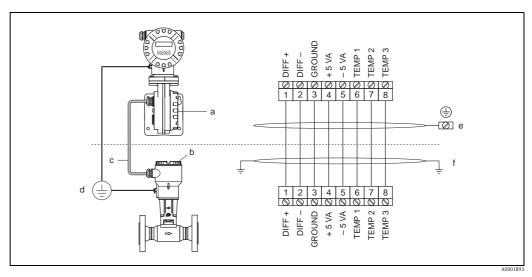
#### Wiring HART input



- 1 Connection diagram for PLC with common "plus" Dotted line = alternative wiring when only the signal of the Prowirl 73 is fed to the PLC.
- 2 Connection diagram for PLC with common "minus" Dotted line = alternative wiring when only the signal of the Prowirl 73 is fed to the PLC.
- 3 Connection diagram without PLC
  Dotted line = wiring without connection to external components (e.g. recorder, displays, Fieldgate, etc.)

 $A = Prowirl\ 73,\ B = pressure\ sensor\ (Cerabar\ M),\ C = temperature\ sensor\ (Omnigrad\ TR10)\ or\ other\ external\ measuring\ devices\ (HART-enabled\ and\ burst-enabled),\ D = active\ barrier\ RN221N$ 

## Wiring remote version



Connecting the remote version

- $a = Connection \ compartment \ cover \ (transmitter)$
- *b* = Connection compartment cover (sensor)
- c = Connecting cable (signal cable)
- d = Identical potential matching for sensor and transmitter
- e = Connect shielding to ground terminal in transmitter housing and keep as short as possible
- f = Connect shielding to cable strain relief clamp in connection housing

Wire colors (color code according to DIN 47100):

Terminal number: 1 = white; 2 = brown; 3 = green; 4 = yellow, 5 = gray; 6 = pink; 7 = blue; 8 = red

Optionally available with armored signal cable. Been suitable for static laying and flexible applications with free movement without tensile load and without obligatory guidance. For layings in dry and damp areas, in the soil as well as in the external area.

#### Supply voltage

#### HART:

- Non-Ex: 12 to 36 V DC (with HART: 18 to 36 V DC)
- Ex i/IS and Ex n: 12 to 30 V DC (with HART: 18 to 30 V DC)
- Ex d/XP: 15 to 36 V DC (with HART: 21 to 36 V DC)

#### PROFIBUS PA and FOUNDATION Fieldbus:

- Non-Ex: 9 to 32 V DC
- Ex i/IS and Ex n: 9 to 24 V DC
- Ex d/XP: 9 to 32 V DC
- $\blacksquare$  Current consumption  $\rightarrow$  PROFIBUS PA: 16 mA, FOUNDATION Fieldbus: 16 mA

#### Cable entries

Power supply and signal cables (outputs):

- Cable entry M20 × 1.5 (6 to 12 mm / 0.24 to 0.47")
- Cable entry M20  $\times$  1.5 for armored signal cable (9.5 to 16 mm / 0.37 to 0.63")
- Thread for cable entry: ½" NPT, G ½", G ½" Shimada
- Fieldbus connector

### Cable specifications

Permitted temperature range:

- $\blacksquare$  Standard cable: -40 °C (-40 °F) to maximum permissible ambient temperature plus 10 °C (18 °F)
- Armored cable: -30 to +70 °C (-22 to +158 °F)

### Power supply failure

- Totalizer stops at the last value determined.
- All settings are kept in the EEPROM.
- Error messages (incl. value of operated hours counter) are stored.

## Performance characteristics

## Reference operating conditions

Error limits following ISO/DIN 11631:

- +20 to +30 °C (+68 to +86 °F)
- 2 to 4 bar (29 to 58 psi)
- Calibration rig traceable to national calibration standards
- Calibration with the process connection corresponding to the standard in question

#### Maximum measured error

#### Prowirl 72

- Liquid:
  - < 0.75% o.r. for Re > 20000
  - < 0.75% o.f.s for Re between 4000 and 20000
- Gas/steam:
  - < 1% o.r. for Re > 20000 and v < 75 m/s (246 ft/s)
  - < 1% o.f.s for Re between 4000 and 20000
- o.r. = of reading, o.f.s = of full scale value, Re = Reynolds number

#### Prowirl 73

- Volume flow (liquid):
  - < 0.75% o.r. for Re > 20000
  - < 0.75% o.f.s for Re between 4000 and 20000
- Volume flow (gas/steam):
  - < 1% o.r. for Re > 20000 and v < 75 m/s (246 ft/s)
  - < 1% o.f.s for Re between 4000 and 20000
- Temperature:
  - $< 1^{\circ}$ C  $/ 1.8^{\circ}$ F (T  $> 100^{\circ}$ C  $/ 212^{\circ}$ F, saturated steam and for liquids at ambient temperature);
  - < 1% o.r. [K] (gas)

Rise time 50% (agitated under water, following IEC 60751): 8 s

- Mass flow (saturated steam):
  - For flow velocities 20 to 50 m/s (66 to 164 ft/s), T > 150 °C / 302 °F (423 K)
    - < 1.7% o.r. (2% o.r. for remote version) for Re > 20000
    - < 1.7% o.f.s (2% o.f.s for remote version) for Re between 4000 and 20000
  - For flow velocities 10 to 70 m/s (33 to 230 ft/s), T > 140 °C / 284 °F (413 K)
    - < 2% o.r. (2.3% o.r. for remote version) for Re > 20000
    - < 2% o.f.s (2.3% o.f.s for remote version) for Re between 4000 and 20000
- Mass flow of superheated steam and gas (air, natural gas AGA NX-19, AGA8-DC92, ISO 12213-2, AGA8
   Gross Method 1, SGERG-88, preprogrammed gases does not apply to the real gas equation):



#### Note!

A Cerabar S device has to be used for the measuring errors listed below. The measured error used to calculate the error in the measured pressure is 0.15%.

- $<1.7\% \ o.r. \ (2.0\% \ o.r. \ for \ remote \ version) \ for \ Re>20000 \ and \ process \ pressure <40 \ bar \ abs \ (580 \ psi \ abs)$
- < 1.7% o.f.s. (2.0% for remote version) for Re between 4000 and 20000 and process pressure < 40 bar abs (580 psi abs)
- < 2.6% o.r. (2.9% o.r. for remote version) for Re > 20000 and process pressure < 120 bar abs (1740 psi abs)
- < 2.6% o.f.s. (2.9% o.r. for remote version) for Re between 4000 and 20000 and process pressure < 120 bar abs (1740 psi abs)
- Mass flow (water):
  - < 0.85% o.r. (1.15% o.r. for remote version) for Re > 20000
  - < 0.85% o.f.s (1.15% o.f.s for remote version) for Re between 4000 and 20000
- Mass flow (customer-defined liquids):

To specify the system accuracy, Endress+Hauser requires information on the type of liquid and its operating temperature, or information in tabular form on the dependency between the liquid density and temperature. Example: Acetone is to be measured at fluid temperatures between 70 and 90 °C (158 and 194 °F). The parameters TEMPERATURE VALUE (here 80 °C / 176 °F), DENSITY VALUE (here 720.00 kg/m³) and EXPANSION COEFFICIENT (here 18.0298  $\times$  10E-4 1/°C) have to be entered in the transmitter for this purpose. The overall system uncertainty, which is smaller than 0.9% for the example cited above, is made up of the following measuring uncertainties: Uncertainty of volume flow measurement, uncertainty of temperature measurement, uncertainty of the density-temperature correlation used (incl. the resulting uncertainty of density).

■ Mass flow (other fluids):

Depends on the pressure value specified in the device functions and the fluid selected. An individual error observation must be carried out.

o.r. = of reading, o.f.s = of full scale value, Re = Reynolds number

#### Diameter mismatch correction

Both Prowirl 72 and 73 can correct shifts in the calibration factor, e.g. caused by a change in the diameter between the device flange (e.g. ANSI, 2", Sched. 80) and the mating pipe (ANSI, 2", Sched. 40). The diameter mismatch should only be corrected within the limit values listed below, for which test measurements have also been performed.

#### Flange connection:

- DN 15 ( $\frac{1}{2}$ "): ±20% of the internal diameter
- DN 25 (1"):  $\pm 15\%$  of the internal diameter
- DN 40 ( $1\frac{1}{2}$ "): ±12% of the internal diameter
- DN  $\geq$  50 (2"):  $\pm$ 10% of the internal diameter

#### Wafer.

- DN 15 ( $\frac{1}{2}$ "): ±15% of the internal diameter
- DN 25 (1"):  $\pm 12\%$  of the internal diameter
- DN 40 (1½"):  $\pm$ 9% of the internal diameter
- DN  $\geq$  50 (2"):  $\pm$ 8% of the internal diameter

If the standard internal diameter of the process connection ordered for the measuring device and the internal diameter of the mating pipe differ, an additional measuring uncertainty must be added for every 1 mm diameter deviation.

#### Repeatability

 $\pm 0.25\%$  o.r. (of reading)

## Reaction time/step response time

If all the configurable functions for filter times (flow damping, display damping, current output time constant, frequency output time constant, status output time constant) are set to 0, a reaction time/step response time of 200 ms must be reckoned with for vortex frequencies as of 10 Hz. For other settings, a reaction time/step response time of 100 ms must always be added to the total filter reaction time for vortex frequencies as of 10 Hz.

## Influence of ambient temperature

#### Current output (additional error, in reference to the span of 16 mA):

- Zero point (4 mA):
- Average Tk: 0.05%/10K, max. 0.6% over the entire temperature range -40 to +80 °C (-40 to 176 °F)
- Span (20 mA):
  - Average Tk: 0.05%/10K, max. 0.6% over the entire temperature range -40 to +80 °C (-40 to 176 °F)

## Digital outputs (pulse output, PFM, HART, frequency output; Prowirl 73 only)

Due to the digital measuring signal (vortex pulse) and further digital processing, there is no interface-related error from changing ambient temperature.

## Operating conditions: installation

#### **Installation instructions**

Vortex meters require a fully developed flow profile as a prerequisite for correct volume flow measurement. Make sure that the direction of the arrow on the nameplate of the sensor matches the direction of flow (direction of fluid flow through the pipe).

The device can generally be installed in any position in the piping. However, note the following points:

Orientation		High fluid temperature (TM) ≥ 200 °C (392 °F)	Low fluid temperature (TM)
Fig. A: Vertical orientation	A0009522	Recommended (①)	Recommended (①)
Fig. B: Horizontal orientation Transmitter head up	A0009523	Not permitted for Prowirl 73 W DN 100 (4")/DN 150 (6") (②)	Recommended (③)
Fig. C: Horizontal orientation Transmitter head down	A0009524	Recommended (④)	
Fig. D: Horizontal orientation Transmitter head at front with display pointing downwards	A0009525	Recommended (4)	Recommended

① In the case of liquids, there should be upward flow in vertical pipes to avoid partial pipe filling (see Fig. A).

Caution!

Disruption in flow measurement!

To guarantee the flow measurement of liquids, the measuring tube must always be completely full in pipes with vertical downward flow.

② ( Caution!

Danger of electronics overheating!

If fluid temperature is  $\geq$  200 °C (392 °F), orientation B is not permitted for the wafer version (Prowirl 73 W) with nominal diameters DN 100 (4") and DN 150 (6").

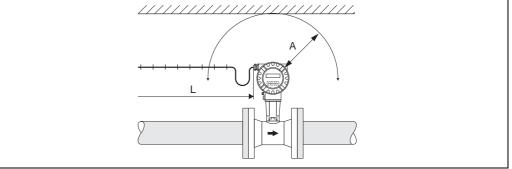
In order to ensure that the maximum permissible ambient temperature for the transmitter is not exceeded ( $\rightarrow \stackrel{\cong}{}$  27), we recommend the following orientations:

- $^{3}$  Select orientation C or D for hot fluids (e.g. steam or fluid temperature (TM) ≥ 200 °C (392 °F)
- ④ Select orientation B or D for very cold fluids (e.g. liquid nitrogen)

#### Minimum spacing and cable length

To ensure problem-free access to the measuring device for service purposes, we recommend you observe the following dimensions:

- Minimum spacing (A) in all directions = 100 mm (3.94")
- Necessary cable length (L): L + 150 mm (5.91")



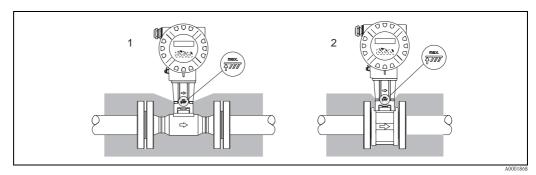
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#### Rotating the electronics housing and the display

The electronics housing can be rotated continuously  $360^{\circ}$  on the housing support. The display unit can be rotated in  $45^{\circ}$  stages. This means you can read off the display comfortably in all orientations.

### Piping insulation

When insulating, please ensure that a sufficiently large area of the housing support is exposed. The uncovered part serves as a radiator and protects the electronics from overheating (or undercooling). The maximum insulation height permitted is illustrated in the diagrams. These apply equally to both the compact version and the sensor in the remote version.

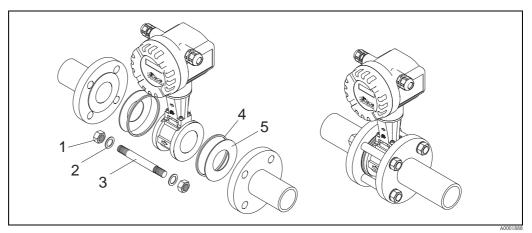


 $1 = Flanged\ version$ 

2 = Wafer version

#### Wafer version mounting set

The centering rings supplied are used to mount and center the wafer-style devices. A mounting set consisting of tie rods, seals, nuts and washers can be ordered separately.



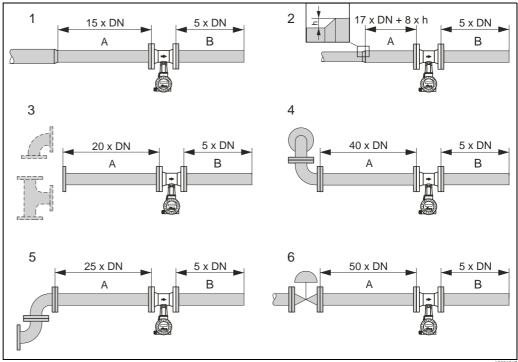
Mounting wafer version

- *1* = *Nut*
- 2 = Washer
- 3 = Tie rod
- 4 = Centering ring (is supplied with the device)
- 5 = Seal

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#### Inlet and outlet run

As a minimum, the inlet and outlet runs shown below must be observed to achieve the specified accuracy of the device. The longest inlet run shown must be observed if two or more flow disturbances are present.



Minimum inlet and outlet runs with various flow obstructions

A = Inlet run

B = Outlet run

h = Difference in expansion

1 = Reduction

2 = Extension

 $3 = 90^{\circ}$  elbow or T-piece

 $4 = 2 \times 90^{\circ}$  elbow, 3-dimensional

 $5 = 2 \times 90^{\circ} \text{ elbow}$ 

6 = Control valve

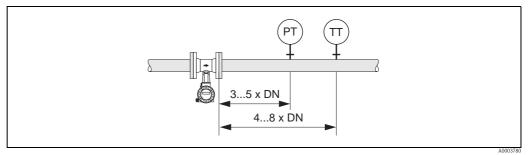


#### Note

A specially designed perforated plate flow conditioner can be installed if it is not possible to observe the inlet runs required ( $\rightarrow \stackrel{\cong}{=} 26$ ).

#### Outlet runs with pressure and temperature measuring points

If pressure and temperature measuring points are installed after the device, please ensure there is a large enough distance between the device and the measuring point so there are no negative effects on vortex formation in the sensor.



PT = Pressure measuring point

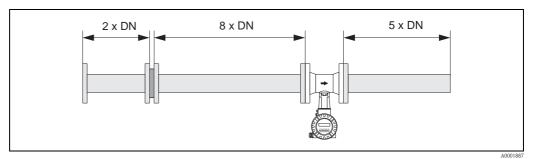
TT = Temperature measuring point

Endress+Hauser 25

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#### Perforated plate flow conditioner

A specially designed perforated plate flow conditioner, available from Endress+Hauser, can be installed if it is not possible to observe the inlet runs required. The flow conditioner is fitted between two piping flanges and centered with the mounting bolts. Generally, this reduces the inlet run required to  $10 \times DN$  with complete accuracy.



The pressure loss for flow conditioners is calculated as follows:  $\Delta p \, [mbar] = 0.0085 \cdot \rho \, [kg/m^3] \cdot v^2 \, [m/s]$ 

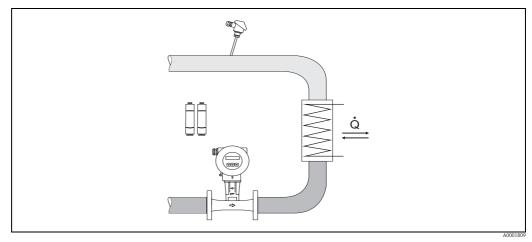
Example with steam 
$$\begin{split} p &= 10 \text{ bar abs} \\ t &= 240 \text{ °C} \rightarrow \rho = 4.39 \text{ kg/m}^3 \\ v &= 40 \text{ m/s} \\ \Delta p &= 0.0085 \cdot 4.39 \cdot 40^2 = 59.7 \text{ mbar} \end{split}$$

Example with  $H_2O$  condensate (80 °C)  $\begin{aligned} \rho &= 965 \text{ kg/m}^3 \\ v &= 2.5 \text{ m/s} \\ \Delta p &= 0.0085 \cdot 965 \cdot 2.5^2 = 51.3 \text{ mbar} \end{aligned}$ 

 $\rho$  : density of the process medium v : average flow velocity

### Installation for delta heat measurement (Prowirl 73 HART)

- The second temperature measurement takes place by means of a separate sensor and is read in via HART.
- Prowirl 73 generally has to be installed on the steam side for saturated steam delta heat measurement.
- For water-delta heat measurement, Prowirl 73 can be installed on both the cold side and the warm side.
- $\blacksquare$  The inlet and outlet runs specified above must be observed.



Layout for delta heat measurement of saturated steam and water

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## Operating conditions: environment

## Ambient temperature range

- Compact version:
  - Standard: -40 to +70 °C (-40 to +158 °F)
  - EEx-d/XP version: -40 to +60 °C (-40 to +140 °F)
  - ATEX II 1/2 GD version/dust ignition-proof; –20 to +55 °C (–4 to +131 °F)
  - Display can be read between -20 and +70 °C (-4 and +158 °F)
- Remote version sensor:
  - Standard:-40 to +85 °C (-40 to +185 °F)
  - with armored cable: -30 to +70 °C (-22 to +158 °F)
  - ATEX II 1/2 GD version/dust ignition-proof: -20 to +55 °C (-4 to +131 °F)
- Remote version transmitter:
  - Standard: -40 to +80 °C (-40 to +176 °F)
  - with armored cable: -30 to +70 °C (-22 to +158 °F)
  - EEx-d/XP version: -40 to +60 °C (-40 to +140 °F)
  - ATEX II 1/2 GD version/dust ignition-proof: –20 to +55 °C (–4 to +131 °F)
  - Display can be read between -20 and +70 °C (-4 and +158 °F)
  - Version up to -50 °C (-58 °F) (on request)

When mounting outside, protect from direct sunlight with a protective cover (order number 543199-0001), especially in warmer climates with high ambient temperatures.

#### Storage temperature

- Standard: -40 to +80 °C (-40 to +176 °F)
- ATEX II 1/2 GD version/dust ignition-proof: -20 to +55 °C (-4 to +131 °F)
- Version up to -52 °C (-62 °F) (on request)

#### Degree of protection

IP 67 (NEMA 4X) in accordance with EN 60529

#### Vibration resistance

Acceleration up to 1 g (at factory setting of the gain), 10 to 500 Hz, following IEC 60068-2-6

## Electromagnetic compatibility (EMC)

to IEC/EN 61326 and NAMUR Recommendation NE 21

## Operating conditions: process

## Medium temperature range

## Prowirl 72

DSC sensor (differential switched capacitor; capacitive sensor)	
DSC standard sensor	-40 to +260 °C (-40 to +500 °F)
DSC high/low temperature sensor	-200 to +400 °C (-328 to +752 °F)
DSC sensor Inconel (PN 63 to 160, Class 600, JIS 40K)	–200 to +400 °C (–328 to +752 °F)
DSC sensor titanium Gr. 5 (PN 250, Class 900 to 1500 and butt-weld version)	–50 to +400 °C (–58 to +752 °F)
DSC sensor Alloy C-22	-200 to +400 °C (-328 to +752 °F)

Seals	
Graphite	-200 to +400 °C (-328 to +752 °F)
Viton	-15 to +175 °C (+5 to +347 °F)
Kalrez	-20 to +275 °C (-4 to +527 °F)
Gylon (PTFE)	-200 to +260 °C (-328 to +500 °F)

Sensor	
Stainless steel	−200 to +400 °C (−328 to +752 °F)
Alloy C-22	-40 to +260 °C (-40 to +500 °F)
Special version for high fluid temperatures (on request)	-200 to +450 °C (-328 to +842 °F) -200 to +440 °C (-328 to +824 °F), Ex version

## Prowirl 73

DSC sensor (differential switched capacitor; capacitive sensor)					
DSC standard sensor					
DSC sensor Inconel (PN 63 to 160, Class 600, JIS 40K)	-200 to +400 °C (-328 to +752 °F)				

Seals	
Graphite	-200 to +400 °C (-328 to +752 °F)
Viton	-15 to +175 °C (+5 to +347 °F)
Kalrez	−20 to +275 °C (−4 to +527 °F)
Gylon (PTFE)	-200 to +260 °C (-328 to +500 °F)

Sensor	
Stainless steel	-200 to +400 °C (-328 to +752 °F)
Special version for high fluid temperatures (on request)	-200 to +450 °C (-328 to +842 °F) -200 to +440 °C (-328 to +824 °F), Ex version

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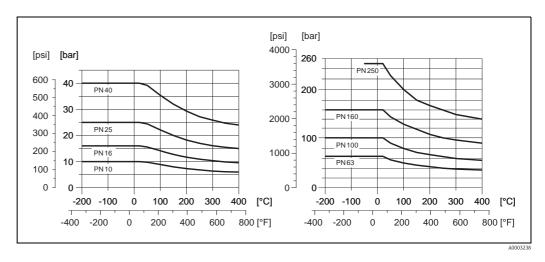
### Medium pressure

#### Prowirl 72

Pressure-temperature curve to EN (DIN), stainless steel

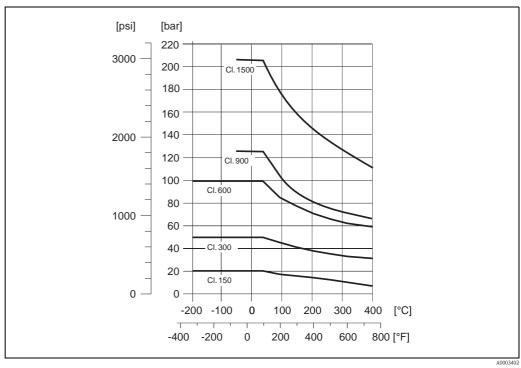
PN 10 to 40  $\rightarrow$  Prowirl 72W and 72F

PN 63 to 250  $\rightarrow$  Prowirl 72F



Pressure-temperature curve to ANSI B16.5, stainless steel

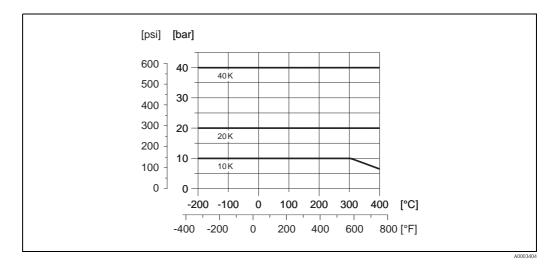
Class 150 to 300  $\rightarrow$  Prowirl 72W and 72F Class 600 to 1500  $\rightarrow$  Prowirl 72F



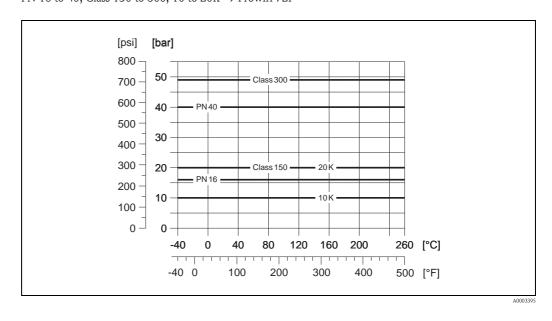
A0003402

Pressure-temperature curve to JIS B2220, stainless steel:

10 to 20K  $\rightarrow$  Prowirl 72W and 72F 40K  $\rightarrow$  Prowirl 72F



Pressure-temperature curve to EN (DIN), ANSI B16.5 and JIS B2220, Alloy C-22 PN 16 to 40, Class 150 to 300, 10 to  $20K \rightarrow Prowirl 72F$ 

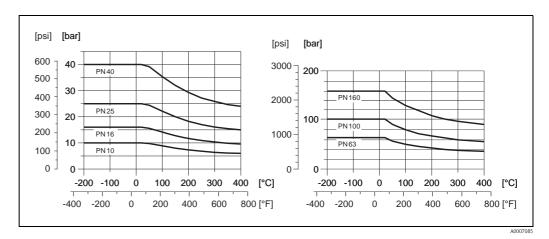


30

#### Prowirl 73

Pressure-temperature curve to EN (DIN), stainless steel

PN 10 to 40  $\rightarrow$  Prowirl 73W and 73F PN 63 to 160  $\rightarrow$  Prowirl 73F



Pressure-temperature curve to ANSI B16.5 and JIS B2220, stainless steel

ANSI B16.5:

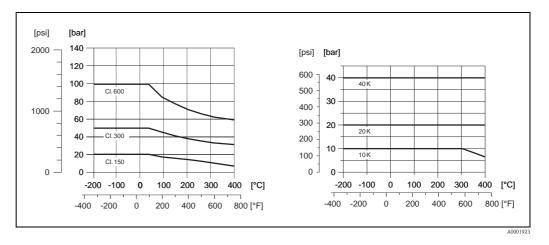
Class 150 to 300  $\rightarrow$  Prowirl 73W and 73F

Class 600 → Prowirl 73F

JIS B2220:

10 to 20K  $\rightarrow$  Prowirl 73W and 73F

40K → Prowirl 73F



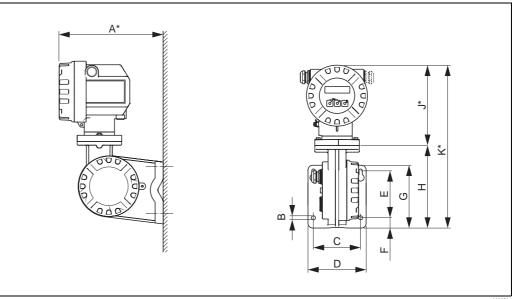
Pressure loss

The pressure loss can be determined with the aid of the Applicator. The Applicator is software for selecting and planning flowmeters. The software is available both via the Internet (www.applicator.com) and on a CD-ROM for local PC installation.

## Mechanical construction

### Design, dimensions

### Dimensions of transmitter, remote version



А	В	С	D	Е	F	G	Н	J	K
mm	mm	mm	mm	mm	mm	mm	mm	mm	mm
(inch)	(inch)	(inch)	(inch)	(inch)	(inch)	(inch)	(inch)	(inch)	(inch)
220	Ø 8.6 (M8)	100	130	100	21	144	170	170	340
(8.66)	(Ø 0.34 (M8))	(3.94)	(5.12)	(3.94)	(0,83)	(5.67)	(6.69)	(6.69)	(13.39)

- $\ensuremath{^{\star}}$  The following dimensions differ depending on the version:
- The dimension 220 mm (8.66") changes to 214 mm (8.43") in the blind version (without local operation).
- The dimension 170 mm (6.69") changes to 183 mm (7.20") in the Ex d/XP version.
   The dimension 340 mm (13.39") changes to 353 mm (13.90") in the Ex d/XP version.

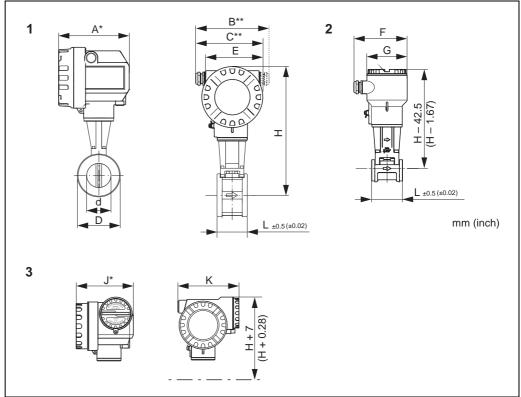


The transmitter housing has one cable gland or cable entry. Measuring devices with a pulse, frequency or status output have two cable glands or cable entries (devices with TIIS approval only have one cable gland).

# Dimensions of wafer versions Prowirl 72W, 73W

Wafer version for flanges to:

- EN 1092-1 (DIN 2501), PN 10 to 40
- ANSI B16.5, Class 150 to 300, Sch. 40
- JIS B2220, 10 to 20K, Sch. 40



A000359

- 1 = Standard as well as Ex i/IS and Ex n version
- 2 = Remote version
- $3 = Ex \ d \ version \ (transmitter)$

A	В	С	Е	F	G	J	K
mm	mm	mm	mm	mm	mm	mm	mm
(inch)	(inch)	(inch)	(inch)	(inch)	(inch)	(inch)	(inch)
149	161 to 181	141 to 151	121	105	95	151	157
(5.87)	(6.34 to 7.13)	(5.55 to 5.94)	(4.76)	(4.13)	(3.74)	(5.94)	(6.18)

- $^{\star}$  The dimensions change as follows in the blind version (without local operation):
- Standard, Ex i/IS and Ex n version: The dimension 149 mm (5.87") changes to 142 mm (5.59") in the blind version.
- Ex d/XP version: The dimension 151 mm (5.94") changes to 144 mm (5.67") in the blind version.
- \*\* The dimension depends on the cable gland used.



The transmitter housing has one cable gland or cable entry. Measuring devices with a pulse, frequency or status output have two cable glands or cable entries (devices with TIIS approval only have one cable gland).

DN	1	d	D	H <sup>1)</sup>	L	Weight <sup>2)</sup>
DIN/JIS	ANSI	mm (inch)	mm (inch)	mm (inch)	mm (inch)	kg (lbs)
15	1/2"	16.5 (0.65)	45.0 (1.77)	247 (9.73)	65 (2.56)	3.0 (6.62)
25	1"	27.6 (1.09)	64.0 (2.52)	257 (10.1)	65 (2.56)	3.2 (7.06)
40	11/2"	42.0 (1.65)	82.0 (3.23)	265 (10.4)	65 (2.56)	3.8 (8.38)
50	2"	53.5 (2.11)	92.0 (3.62)	272 (10.7)	65 (2.56)	4.1 (9.04)
80	3"	80.3 (3.16)	127.0 (5.00)	286 (11.3)	65 (2.56)	5.5 (12.13)
100 (DIN)	_	104.8 (4.13)	157.2 (6.19)	299 (11.8)	65 (2.56)	6.5 (14.33)
100 (JIS)	4"	102.3 (4.03)	157.2 (6.19)	299 (11.8)	65 (2.56)	6.5 (14.33)
150	6"	156.8 (6.18)	215.9 (8.51)	325 (12.8)	65 (2.56)	9.0 (19.85)

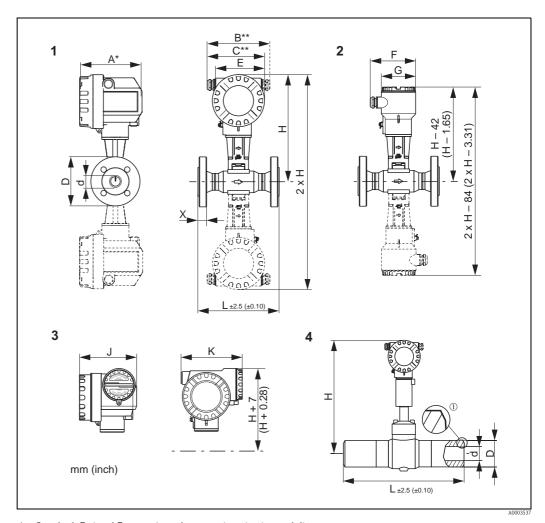
<sup>1)</sup> The dimension H increases by 29 mm (1.14") for Prowirl 72 (high-temperature version and for the version with a DSC sensor made of Alloy C-22) and for Prowirl 73 (version with extended temperature range).

<sup>2)</sup> The weight data refer to the compact version. The weight increases by 0.5 kg (1.1 lbs) for Prowirl 72 (high-temperature version and for the version with a DSC sensor made of Alloy C-22) and for Prowirl 73 (version with extended temperature range).

## Dimensions of flanged versions (standard devices) Prowirl 72F, 73F

Flange connection dimensions in accordance with flange standard:

- EN 1092-1 (DIN 2501), Ra = 6.3 to 12.5 µm
- Raised face to:
  - EN 1092–1 Form B1 (DIN 2526 Form C), PN 10 to 40, Ra = 6.3 to 12.5  $\mu m$  , optional with groove to EN 1091–1 Form D (DIN 2512 Form N)
  - EN 1092-1 Form B2 (DIN 2526 Form E), PN 63 to 100, Ra = 1.6 to 3.2  $\mu$ m<sup>1) 2)</sup>
  - DIN 2526 Form E, PN 160 to 2503), Ra = 1.6 to 3.2  $\mu m^{1)}$
- ANSI B16.5, Class 150 to  $1500^{1)2}$ , Ra = 125 to 250  $\mu in^{2}$
- JIS B2220, 10 to 40K<sup>1)</sup>, Ra = 125 to 250 µin
- 1) Prowirl 73F: PN 63 to 160, Class 600 and 40K
- <sup>2)</sup> Prowirl 73F: only Class 150 to 600
- <sup>3)</sup> Prowirl 73F: only PN 160



- $\it 1 = Standard, Ex~i ~and ~Ex~n~version~;~d: connection~pipe~internal~diameter$
- 2 = Remote version
- 3 = Ex d / XP version (transmitter)
- 4 = Butt-weld version (only available for Prowirl 72)
- ① Groove type 22 in accordance with DIN 2559 Dotted line: Dualsens version

A	В	С	Е	F	G	J	K
mm	mm	mm	mm	mm	mm	mm	mm
(inch)	(inch)	(inch)	(inch)	(inch)	(inch)	(inch)	(inch)
149	161 to 181	141 to 151	121	113	85	151	161
(5.87)	(6.34 to 7.13)	(5.55 to 5.94)	(4.76)	(4.45)	(3.35)	(5.94)	(6.34)

- $\mbox{\ensuremath{^{\star}}}$  The dimensions below change as follows in the blind version (without local operation):
- Standard, Ex i/IS and Ex n version: The dimension 149 mm (5.87") changes to 142 mm (5.59") in the blind version.
   Ex d/XP version: The dimension 151 mm (5.94") changes to 144 mm (5.67") in the blind version.

  \*\* The dimension depends on the cable gland used.

Note!

The transmitter housing has one cable gland or cable entry. Measuring devices with a pulse, frequency or status output

"I THE recognition of the bare one cable gland" have two cable glands or cable entries (devices with TIIS approval only have one cable gland).

DN	Pressure rating	d	D	H <sup>2)</sup>	L	Х	Weight <sup>3)</sup>
		[mm]	[mm]	[mm]	[mm]	[mm]	[kg]
15 <sup>4)</sup>	PN 40	17.3	95.0	248	200	16	5
	PN 160	17.3	105.0	288	200	23	7
	PN 250 <sup>1)</sup>	16.1	130.0	310	248	26	15
	Butt-weld <sup>1)</sup>	16.1	23.4	310	248	-	9
	PN 40	28.5	115.0	255	200	18	7
	PN 100	28.5	140.0	295	200	27	11
$25^{4)}$	PN 160	27.9	140.0	295	200	27	11
	PN 250 <sup>1)</sup>	26.5	150.0	310	248	28	16
	Butt-weld <sup>1)</sup>	24.3	35.6	310	248	-	9
	PN 40	43.1	150.0	263	200	18	9
	PN 100	42.5	170.0	303	200	31	15
40	PN 160	41.1	170.0	303	200	31	15
	PN 250 <sup>1) 4)</sup>	38.1	185.0	315	278	34	21
	Butt-weld <sup>1)4)</sup>	38.1	48.3	315	278	-	9
	PN 40	54.5	165.0	270	200	20	11
50	PN 63	54.5	180.0	310	200	33	17
	PN 100	53.9	195.0	310	200	33	19
	PN 160	52.3	195.0	310	200	33	19
	PN 250 <sup>1) 4)</sup>	47.7	200.0	306	288	38	23
	Butt-weld <sup>1) 4)</sup>	47.7	60.3	306	288	-	9
	PN 40	82.5	200.0	283	200	24	16
	PN 63	81.7	215.0	323	200	39	24
00	PN 100	80.9	230.0	323	200	39	27
80	PN 160	76.3	230.0	323	200	39	27
	PN 250 <sup>1) 4)</sup>	79.6	255.0	311	325	46	41
	Butt-weld <sup>1) 4)</sup>	79.6	101.6	311	325	-	13
	PN 16	107.1	220.0	295	250	20	18
	PN 40	107.1	235.0	295	250	24	21
	PN 63	106.3	250.0	335	250	49	39
100	PN 100	104.3	265.0	335	250	49	42
	PN 160	98.3	265.0	335	250	49	42
	PN 250 <sup>1) 4)</sup>	98.6	300.0	323	394	54	64
	Butt-weld <sup>1) 4)</sup>	98.6	127.0	323	394	-	21
	PN 16	159.3	285.0	319	300	22	30
	PN 40	159.3	300.0	319	300	28	37
150	PN 63	157.1	345.0	359	300	64	86
	PN 100	154.1	355.0	359	300	64	88
	PN 160	146.3	355.0	359	300	64	88
	PN 250 <sup>1) 4)</sup>	142.8	390.0	339	566	68	152
	Butt-weld <sup>1) 4)</sup>	142.8	177.8	339	566	_	53

Flanged vers	ions (standard de	evices) to EN	1092-1 (DIN	2501)			
Prowirl 72F,	73F						
DN	Pressure rating	d	D	H <sup>2)</sup>	L	X	Weight <sup>3)</sup>
		[mm]	[mm]	[mm]	[mm]	[mm]	[kg]
	PN 10	207.3	340.0	348	300	42	63
200	PN 16	207.3	340.0	348	300	42	62
200	PN 25	206.5	360.0	348	300	42	68
	PN 40	206.5	375.0	348	300	42	72
	PN 10	260.4	395	375	380	48	88
250	PN 16	260.4	405	375	380	48	92
230	PN 25	258.8	425	375	380	48	100
	PN 40	258.8	450	375	380	48	111
	PN 10	309.7	445	398	450	51	121
3004)	PN 16	309.7	460	398	450	51	129
300%	PN 25	307.9	485	398	450	51	140
	PN 40	307.9	515	398	450	51	158

<sup>1)</sup> In contrast to the other versions, devices have a sensor in the bluff body. Only available for 72F.

Flanged versions (standard devices) to ANSI B16.5 Prowirl 72F, 73F											
DN	Pressur	re rating	d	D	H <sup>2)</sup>	L	X	Weight <sup>3)</sup>			
			mm	mm	mm	mm	mm	kg			
			(inch)	(inch)	(inch)	(inch)	(inch)	(lbs)			
		Cl. 150	15.7	88.9	248	200	11.2	5			
	Schedule 40	CI. 150	(0.62)	(3.50)	(9.77)	(7.88)	(0.44)	(11)			
	Scriedule 40	Cl. 300	15.7	95.0	248	200	14.2	5			
		C1. 300	(0.62)	(3.74)	(9.77)	(7.88)	(0.56)	(11)			
		Cl. 150	13.9	88.9	248	200	11.2	5			
		CI. 150	(0.55)	(3.50)	(9.77)	(7.88)	(0.44)	(11)			
1/2" 4)		Cl. 300	13.9	95.0	248	200	14.2	5			
,2	Schedule 80	GI. 300	(0.55)	(3.74)	(9.77)	(7.88)	(0.56)	(11)			
		Cl. 600	13.9	95.3	288	200	23	6			
		GI. 000	(0.55)	(3.75)	(11.35)	(7.88)	(0.91)	(13)			
		Cl. 1500 <sup>1)</sup>	14.0	120.6	310	262	22.3	13			
		CI. 1500	(0.55)	(4.75)	(12.21)	(10.32)	(88.0)	(29)			
		Butt-weld <sup>1)</sup>	14.0	21.3	310	248	-	9			
			(0.55)	(0.84)	(12.21)	(9.77)	(-)	(20)			
		Cl. 150	26.7	107.9	255	200	15.7	6			
	Schedule 40	GI. 150	(1.05)	(4.25)	(10.05)	(7.88)	(0.62)	(13)			
	beliedule 40	Cl. 300	26.7	123.8	255	200	19.1	7			
		GI. 300	(1.05)	(4.88)	(10.05)	(7.88)	(0.75)	(15)			
		Cl. 150	24.3	107.9	255	200	15.7	6			
		OI. 150	(0.96)	(4.25)	(10.05)	(7.88)	(0.62)	(13)			
1" 4)		Cl. 300	24.3	123.8	255	200	19.1	7			
1		C1. 500	(0.96)	(4.88)	(10.05)	(7.88)	(0.75)	(15)			
	Schedule 80	Cl. 600	24.3	124.0	295	200	27	9			
	Schedule 00	GI. 000	(0.96)	(4.89)	(11.62)	(7.88)	(1.06)	(20)			
		Cl. 1500 <sup>1)</sup>	24.3	149.3	310	287.7	28.4	17			
		OI. 1500 /	(0.96)	(5.88)	(12.21)	(11.34)	(1.12)	(37)			
		Butt-weld <sup>1)</sup>	24.3	33.4	310	248	_	9			
		Dutt-weiu /	(0.96)	(1.32)	(12.21)	(9.77)	(-)	(20)			

<sup>&</sup>lt;sup>2)</sup> The dimension H increases by 29 mm for Prowirl 72 (high-temperature version and for the version with a DSC sensor made of Alloy C-22) and for Prowirl 73 (pressure ratings up to PN 40, Cl. 300, 20K).

<sup>&</sup>lt;sup>3)</sup> The weight data refer to the compact version. The weight increases by 0.5 kg for Prowirl 72 (high-temperature version and for the version with a DSC sensor made of Alloy C-22) and for Prowirl 73 (pressure rating up to PN 40, Cl. 300, 20K). The weight is increased by 6 kg for the Dualsens version.

<sup>4)</sup> Not available as Dualsens version.

DN	Pressu	re rating	d	D	H <sup>2)</sup>	L	Х	Weight <sup>3</sup>
			mm	mm	mm (in ab)	mm (in ab)	mm (in ab)	kg
			(inch) 40.9	(inch) 127.0	(inch) 263	(inch) 200	(inch) 17.5	(lbs) 8
	Cabadula 40	Cl. 150	(1.61)	(5.00)	(10.36)	(7.88)	(0.69)	(18)
	Schedule 40	Cl. 300	40.9	155.6	263	200	20.6	10
		GI. 500	(1.61)	(6.13)	(10.36)	(7.88)	(0.81)	(22)
		Cl. 150	38.1 (1.50)	127.0 (5.00)	263 (10.36)	200 (7.88)	17.5 (0.69)	(18)
41/11		O. 000	38.1	155.6	263	200	20.6	10
1½"		Cl. 300	(1.50)	(6.13)	(10.36)	(7.88)	(0.81)	(22)
	Schedule 80	Cl. 600	38.1	155.4	303	200	31	13
	benedule of	<b>0.1</b> 000	(1.50)	(6.12)	(11.94)	(7.88)	(1.22)	(29)
		Cl. 1500 <sup>1) 4)</sup>	38.1 (1.50)	177.8 (7.01)	315 (12.41)	305.8 (12.05)	31.7 (1.25)	20 (44)
			38.1	48.3	315	278	(1.23)	9
		Butt-weld <sup>1)4)</sup>	(1.50)	(1.90)	(12.41)	(10.95)	(-)	(20)
		Cl. 150	52.6	152.4	270	200	19.1	10
	Schedule 40	01. 150	(2.07)	(6.00)	(10.64)	(7.88)	(0.75)	(22)
		Cl. 300	52.6 (2.07)	165.0 (6.50)	270 (10.64)	200 (7.88)	22.4 (0.88)	12 (26)
			49.2	152.4	270	200	19.1	10
		Cl. 150	(1.94)	(6.00)	(10.64)	(7.88)	(0.75)	(22)
2"		C1. 300	49.2	165.0	270	200	22.4	12
		C1. 300	(1.94)	(6.50)	(10.64)	(7.88)	(88.0)	(26)
	Schedule 80	Cl. 600	49.2	165.1	310	200	33	14
			(1.94) 49.3	(6.50) 215.9	(12.21)	(7.88)	(1.30)	(31)
		Cl. 1500 <sup>1) 4)</sup>	(1.94)	(8.51)	(12.06)	(13.55)	(1.50)	(66)
		Butt-weld <sup>1) 4)</sup>	47.7	60.3	306	288	_	9
		butt-weig'	(1.88)	(2.38)	(12.06)	(11.35)	(-)	(20)
		Cl. 150	78.0	190.5	283	200	23.9	15
	Schedule 40		(3.07)	(7.51) 210.0	(11.15)	(7.88)	(0.94)	(33.08
		C1. 300	(3.07)	(8.27)	(11.15)	(7.88)	(1.12)	(41.90
		01 150	73.7	190.5	283	200	23.9	15
		Cl. 150	(2.90)	(7.51)	(11.15)	(7.88)	(0.94)	(33.08
		Cl. 300	73.7	210.0	283	200	28.4	19
3"			(2.90)	(8.27) 209.6	(11.15)	(7.88)	(1.12)	(41.90
		Cl. 600	(2.90)	(8.26)	(12.73)	200 (7.88)	39 (1.54)	22 (48.51
	Schedule 80	01 0001)(1)	73.7	241.3	311	349	38.1	37
		Cl. 900 <sup>1) 4)</sup>	(2.90)	(9.51)	(12.25)	(13.75)	(1.50)	(81.59
		Cl. 1500 <sup>1) 4)</sup>	73.7	266.7	311	380.4	47.7	49
			(2.90)	(10.51)	(12.25)	(14.99)	(1.88)	(108.05
		Butt-weld <sup>1) 4)</sup>	73.7 (2.90)	95.7 (3.77)	311 (12.25)	325 (12.81)	(-)	13 (28.67
		0. 150	102.4	228.6	295	250	24.5	22
	Schedule 40	Cl. 150	(4.03)	(9.01)	(11.62)	(9.85)	(0.97)	(48.51
	Scriedule 40	Cl. 300	102.4	254.0	295	250	31.8	30
			(4.03)	(10.01)	(11.62)	(9.85)	(1.25)	(66.15
		Cl. 150	97.0 (3.82)	228.6 (9.01)	295 (11.62)	250 (9.85)	24.5 (0.97)	22 (48.51
		0/ ***	97.0	254.0	295	250	31.8	30
4"		Cl. 300	(3.82)	(10.01)	(11.62)	(9.85)	(1.25)	(66.15
4		Cl. 600	97.0	273.1	335	250	49	43
	Schedule 80	51. 000	(3.82)	(10.76)	(13.20)	(9.85)	(1.93)	(94.82
		Cl. 900 <sup>1) 4)</sup>	97.3	292.1	323	408	44.4 (1.75)	57 (125.69
			(3.83)	(11.51)	(12.73)	(16.08) 427	(1.75) 53.8	71
		Cl. 1500 <sup>1) 4)</sup>	(3.83)	(12.26)	(12.73)	(16.82)	(2.12)	(156.50
		Butt-weld <sup>1) 4)</sup>	97.3	125.7	323	394		21
		Duit-Meig., .,	(3.83)	(4.95)	(12.73)	(15.52)	(-)	(46.31

0	versions (stan 72F, 73F	idard devices) t	o ANSI B16.	.5				
DN	Pressu	re rating	d	D	H <sup>2)</sup>	L	X	Weight <sup>3)</sup>
			mm	mm	mm	mm	mm	kg
			(inch)	(inch)	(inch)	(inch)	(inch)	(lbs)
		Cl. 150	154.2	279.4	319	300	25.4	34
	Schedule 40	CI. 130	(6.08)	(11.01)	(12.57)	(11.82)	(1.00)	(74.97)
	Schedule 40	Cl. 300	154.2	317.5	319	300	36.6	50
		C1. 500	(6.08)	(12.51)	(12.57)	(11.82)	(1.44)	(110.25)
		Cl. 150	146.3	279.4	319	300	25.4	34
		GI. 150	(5.76)	(11.01)	(12.57)	(11.82)	(1.00)	(74.97)
		Cl. 300	146.3	317.5	319	300	36.6	50
6"		0000	(5.76)	(12.51)	(12.57)	(11.82)	(1.44)	(110.25)
U	Schedule 80	Cl. 600	146.3	355.6	359	300	64	87
		0000	(5.76)	(14.01)	(14.14)	(11.82)	(2.52)	(191.84)
		Cl. 900 <sup>1) 4)</sup>	131.8	381.0	339	538	55.6	131
			(5.19)	(15.01)	(13.36)	(21.20)	(2.19)	(288.86)
		Cl. 1500 <sup>1) 4)</sup>	146.3	393.7	339	602	82.5	173
			(5.76)	(15.51)	(13.36)	(23.72)	(3.25)	(381.47)
		Butt-weld <sup>1) 4)</sup>	146.3	168.3	339	566	_	53
			(5.76)	(6.63)	(13.36)	(22.30)	(-)	(116.87)
		Cl. 150	202.7	342.9	348	300	42	64
8"	Schedule 40		(7.99)	(13.51)	(13.71)	(11.82)	(1.65)	(141.12)
		Cl. 300	202.7	381.0	348	300	42	76
			(7.99)	(15.01)	(13.71)	(11.82)	(1.65)	(167.58)
		Cl. 150	254.5	406.4	375	380	48	92
10"	Schedule 40		(10.03)	(16.01)	(14.78)	(14.97)	(1.89)	(202.86)
10		Cl. 300	254.5	444.5	375	380	48	109
			(10.03)	(17.51)	(14.78)	(14.97)	(1.89)	(240.35)
12" 4)		Cl. 150	304.8	482.6	398	450	60	143
	Schedule 40		(12.01)	(19.01)	(15.68)	(17.73)	(2.36)	(315.32)
		Cl. 300	304.8	520.7	398	450	60	162
		Cl. 300	(12.01)	(20.52)	(15.68)	(17.73)	(2.36)	(357.21)

<sup>1)</sup> In contrast to the other versions, devices have a sensor in the bluff body. Only available for 72F.

<sup>&</sup>lt;sup>2)</sup> The dimension H increases by 29 mm (1.14") for Prowirl 72 (high-temperature version and for the version with a DSC sensor made of Alloy C-22) and for Prowirl 73 (pressure ratings up to PN 40, Cl. 300, 20K).

<sup>&</sup>lt;sup>3)</sup> The weight data refer to the compact version. The weight increases by 0.5 kg (1.1 lbs) for Prowirl 72 (high-temperature version and for the version with a DSC sensor made of Alloy C-22) and for Prowirl 73 (pressure ratings up to PN 40, Cl. 300, 20K). The weight increases by 6 kg (13.2 lbs) for the Dualsens version.

<sup>4)</sup> Not available as a Dualsens version.

DN	<b>2F, 73F</b> Pressure r	nting	d	D	H <sup>1)</sup>	L	Х	Weight <sup>2</sup>
DIN	Pressure i	aung	[mm]	[mm]	[mm]	[mm]	[mm]	(kg)
	Schedule 40	20K	16.1	95	248	200	14	5
15 <sup>3)</sup>	Schedule 80	20K	13.9	95	248	200	14	5
15	Schedule 80	40K	13.9	115	288	200	23	8
	Schedule 40	20K	27.2	125	255	200	16	7
$25^{3)}$	Schedule 80	20K	24.3	125	255	200	16	7
25	Schedule 80	40K	24.3	130	295	200	27	10
	Schedule 40	20K	41.2	140	263	200	18	9
40	Schedule 80	20K	38.1	140	263	200	18	9
40	Schedule 80	40K	38.1	160	303	200	31	14
	Schedule 40	10K	52.7	155	270	200	16	10
	Schedule 40	20K	52.7	155	270	200	18	10
50	Schedule 80	10K	49.2	155	270	200	16	10
30	Schedule 80	20K	49.2	155	270	200	18	10
	Schedule 80	40K	49.2	165	310	200	33	15
	Schedule 40	10K	78.1	185	283	200	18	14
	Schedule 40	20K	78.1	200	283	200	22	15
80	Schedule 80	10K	73.7	185	283	200	18	14
	Schedule 80	20K	73.7	200	283	200	22	15
	Schedule 80	40K	73.7	210	323	200	39	24
	Schedule 40	10K	102.3	210	295	250	18	18
	Schedule 40	20K	102.3	225	295	250	24	21
100	Schedule 80	10K	97.0	210	295	250	18	18
	Schedule 80	20K	97.0	225	295	250	24	22
	Schedule 80	40K	97.0	240	335	250	49	36
	Schedule 40	10K	151.0	280	319	300	22	33
	Schedule 40	20K	151.0	305	319	300	28	40
150	Schedule 80	10K	146.3	280	319	300	22	33
	Schedule 80	20K	146.3	305	319	300	28	40
	Schedule 80	40K	146.6	325	359	300	64	77
200	Schedule 40	10K	202.7	330	348	300	42	58
200	Schedule 40	20K	202.7	350	348	300	42	64
250	Schedule 40	10K	254.5	400	375	380	48	90
250	Schedule 40	20K	254.5	430	375	380	48	104
2003)	Schedule 40	10K	304.8	445	398	450	51	119
3003)	Schedule 40	20K	304.8	480	398	450	51	134

<sup>1)</sup> The dimension H increases by 29 mm for Prowirl 72 (high-temperature version and for the version with a DSC sensor made of Alloy C-22) and for Prowirl 73 (pressure ratings up to PN 40, Cl. 300, 20K).

<sup>2)</sup> The weight data refer to the compact version. The weight increases by 0.5 kg for Prowirl 72 (high-temperature version and for the version with a DSC sensor made of Alloy C-22) and for Prowirl 73 (pressure rating up to PN 40, Cl. 300, 20K). The weight is increased by 6 kg for the Dualsens version.

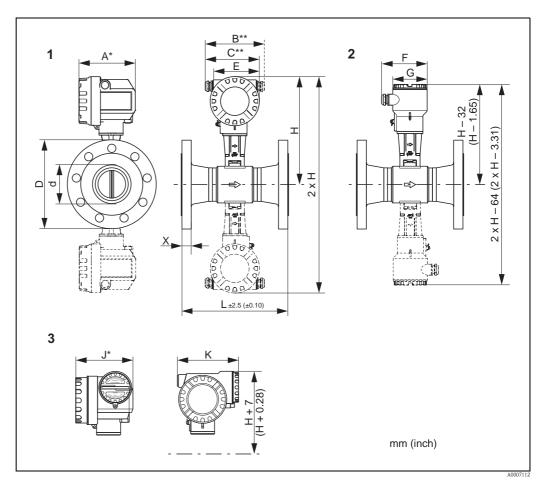
<sup>3)</sup> Not available as Dualsens version.

# Dimensions of flanged versions "R Style" (single reduction of line size) Prowirl 72F, 73F $\,$

Versions with integrated line size reduction (hydraulically effective cross-section smaller than connection nominal diameter) offering improved measurement in the lower flow range.

Flange connection dimensions in accordance with flange standard:

- EN 1092-1 (DIN 2501), Ra = 6.3 to 12.5  $\mu m$
- $\blacksquare$  Raised face to: EN 1092-1 Form B1 (DIN 2526 Form C), PN 10 to 40, Ra = 6.3 to 12.5  $\mu m$ , optional with groove to EN 1091-1 Form D (DIN 2512 Form N)
- ANSI B16.5, Class 150 to 300, Ra = 125 to 250 μin
- JIS B2220, 10 to 20K, Ra = 125 to 250 μin



1 = Standard, Ex i and Ex n version; d: connection pipe internal diameter

 $2 = Remote \ version$ 

 $3 = Ex \ d \ /XP \ version \ (transmitter)$ 

Dotted line: Dualsens version

A	В	С	Е	F	G	J	K
mm	mm	mm	mm	mm	mm	mm	mm
(inch)	(inch)	(inch)	(inch)	(inch)	(inch)	(inch)	(inch)
149	161 to 181	141 to 151	121	113	85	151	161
(5.87)	(6.34 to 7.13)	(5.55 to 5.94)	(4.76)	(4.45)	(3.35)	(5.94)	(6.34)

- $\mbox{\ensuremath{^{\star}}}$  The dimensions below change as follows in the blind version (without local operation):
- Standard, Ex i/IS and Ex n version: The dimension 149 mm (5.87") changes to 142 mm (5.59") in the blind version.
- Ex d/XP version: The dimension 151 mm (5.94") changes to 144 mm (5.67") in the blind version. \*\* The dimension depends on the cable gland used.

The transmitter housing has one cable gland or cable entry. Measuring devices with a pulse, frequency or status output have two cable glands or cable entries (devices with TIIS approval only have one cable gland).

DN	Inner	Pressure	d	D	H1)	L	X	Weight <sup>2</sup>
	diameter	rating	[mm]	[mm]	[mm]	[mm]	[mm]	[kg]
25 <sup>3)</sup>	15	PN 40	22.0	115	248	200	18.0	6
403)	25	PN 40	30.0	150	255	200	21.0	10
50	40	PN 40	45.0	165	263	200	22.0	12
80	50	PN 40	56.5	200	270	200	25.0	16
100	80	PN 16	87.0	220	283	250	22.0	20
100	80	PN 40	87.0	235	283	250	26.5	23
150	100	PN 16	112.0	285	295	300	25.0	36
150	100	PN 40	112.0	300	295	300	31.0	42
		PN 10	146.3	340	319	300	24.0	48
200	150	PN 16	146.3	340	319	300	24.0	48
	130	PN 25	146.3	360	319	300	30.0	55
		PN 40	146.3	375	319	300	36.5	63

- 1) The dimension H increases by 29 mm for Prowirl 72 (high-temperature version and for the version with a DSC sensor made of Alloy C-22) and for Prowirl 73 (pressure ratings up to PN 40, Cl. 300, 20K).
- $^{2)}\,$  The weight data refer to the compact version. The weight increases by 0.5 kg for Prowirl 72 (high-temperature version and for the version with a DSC sensor made of Alloy C-22) and for Prowirl 73 (pressure rating up to PN 40, Cl. 300, 20K). The weight is increased by 6 kg for the Dualsens version.
- 3) Not available as Dualsens version.

	versions	(R Style) to	ANSI B16.	5					
DN	Internal		e rating	d	D	H <sup>1)</sup>	L	X	Weight <sup>2)</sup>
	diame-			mm	mm	mm	mm	mm	kg
	ter			(inch)	(inch)	(inch)	(inch)	(inch)	(lbs)
		Sched. 40	C-11 40 C1 150		108.0	248	200	18	6
		Scried, 40	Cl. 150	(0.87)	(4.26)	(9.77)	(7.88)	(0.71)	(13.23)
		Sched, 40	Cl. 300	22.0	124.0	248	200	22.0	8
1"3)	1/2"	Sched. 40	CI. 300	(0.87)	(4.89)	(9.77)	(7.88)	(0.87)	(17.64)
1 -7	72	Sched, 80	Cl. 150	22.0	108.0	248	200	18.5	6
		Scried, 60		(0.87)	(4.26)	(9.77)	(7.88)	(0.73)	(13.23)
		Sched. 80	C1. 300	22.0	124.0	248	200	22.0	8
				(0.87)	(4.89)	(9.77)	(7.88)	(0.87)	(17.64)
		Sched. 40	Cl. 150	30.0	127.0	255	200	18.0	7
		Scried, 40	CI. 130	(1.18)	(5.00)	(10.0)	(7.88)	(0.71)	(15.44)
		Sched, 40	Cl. 300	30.0	155.4	255	200	25.0	10
11/2" 3)	1"	Sched. 40	CI. 300	(1.18)	(6.12)	(10.0)	(7.88)	(0.99)	(22)
172	1	Sched, 80	Cl. 150	30.0	127.0	255	200	18.0	7
ı		Scried, 60	CI. 130	(1.18)	(5.00)	(10.0)	(7.88)	(0.71)	(15.44)
		Sched. 80	C1 300	30.0	155.4	255	200	25.0	10
		ociica. 00	Cl. 300	(1.18)	(6.12)	(10.0)	(7.88)	(0.99)	(22.05)

	Flanged versions (R Style) to ANSI B16.5 Prowirl 72F, 73F												
DN	Internal		e rating	d	D	H1)	L	X	Weight <sup>2)</sup>				
	diame-		, and the second	mm	mm	mm	mm	mm	kg				
	ter			(inch)	(inch)	(inch)	(inch)	(inch)	(lbs)				
		Sched. 40	Cl. 150	45.0	152.4	263	200	20.0	10				
		Scried, 40	CI. 130	(1.77)	(6.00)	(10.36)	(7.88)	(0.79)	(22.05)				
		Sched. 40	Cl. 300	45.0	165.1	263	200	25.0	12				
2"	11/2"	ociica, 40	61. 500	(1.77)	(6.50)	(10.36)	(7.88)	(0.99)	(26.46)				
2	1 / 2	Sched. 80	Cl. 150	45.0	152.4	263	200	20.0	10				
		ocnea. oo	01. 150	(1.77)	(6.00)	(10.36)	(7.88)	(0.79)	(22.05)				
		Sched. 80	Cl. 300	45.0	165.1	263	200	25.0	12				
				(1.77)	(6.50)	(10.36)	(7.88)	(0.99)	(26.46)				
		Sched. 40	Cl. 150	56.5	190.5	270	200	23.9	15				
				(2.22)	(7.50)	(10.6)	(7.87)	(0.94)	(33.08)				
		Sched. 40	Cl. 300	56.5	209.6	270	200	28.9	(49.51)				
3"	2"			(2.22)	(8.25)	(10.6)	(7.88)	(1.14)	(48.51)				
		Sched. 80	Cl. 150	56.5 (2.22)	190.5 (7.50)	270 (10.6)	200 (7.87)	23.9 (0.94)	15 (33.08)				
				56.5	209.6	270	200	28.9	22				
		Sched. 80	C1. 300	(2.22)	(8.25)	(10.6)	(7.87)	(1.14)	(49)				
				87.0	228.6	283	250	24.5	22				
		Sched. 40	Cl. 150	(3.43)	(9.00)	(11.1)	(9.84)	(0.96)	(48.51)				
				87.0	254.0	283	250	31.8	31				
			Cl. 300	(3.43)	(10.0)	(11.1)	(9.84)	(1.25)	(68.36)				
4"	3"		01.450	87.0	228.6	283	250	24.5	22				
		Sched. 80	Cl. 150	(3.43)	(9.00)	(11.1)	(9.84)	(0.96)	(48.51)				
		6.1.1.00	01 200	87.0	254.0	283	250	31.8	31				
		Sched. 80	Cl. 300	(3.43)	(10.0)	(11.1)	(9.84)	(1.25)	(68.36)				
		Sched. 40	Cl. 150	112.0	279.4	295	300	25.5	38				
		Scried, 40	CI. 130	(4.41)	(11.0)	(11.6)	(11.8)	(1.00)	(83.79)				
		Sched. 40	Cl. 300	112.0	317.5	295	300	38.5	55				
6"	4"	Scried, 40	G1. 500	(4.41)	(11.8)	(11.6)	(11.8)	(1.52)	(121)				
	4	Sched. 80	Cl. 150	112.0	279.4	295	300	26.0	38				
		octica, oo	01. 150	(4.41)	(11.0)	(11.6)	(11.8)	(1.02)	(83.79)				
		Sched. 80	Cl. 300	112.0	317.5	295	300	39.0	55				
		,		(4.41)	(11.8)	(11.6)	(11.8)	(1.54)	(121.28)				
		Sched. 40	Cl. 150	146.3	342.9	319	300	28.4	55				
8"	6"			(5.76)	(13.5)	(12.6)	(11.8)	(1.12)	(121.28)				
		Sched. 40	Cl. 300	146.3	381	319	300	41.1	75				
1) 771 11 1 7		20 (1	(5.76)	(15.0)	(12.6)	(11.8)	(1.62)	(165.38)					

<sup>1)</sup> The dimension H increases by 29 mm (1.14") for Prowirl 72 (high-temperature version and for the version with a DSC sensor made of Alloy C-22) and for Prowirl 73 (pressure ratings up to PN 40, Cl. 300, 20K).

<sup>&</sup>lt;sup>2)</sup> The weight data refer to the compact version. The weight increases by 0.5 kg (1.1 lbs) for Prowirl 72 (high-temperature version and for the version with a DSC sensor made of Alloy C-22) and for Prowirl 73 (pressure ratings up to PN 40, Cl. 300, 20K). The weight increases by 6 kg (13.23 lbs) for the Dualsens version.

<sup>3)</sup> Not available as a Dualsens version.

U	Flanged versions (R Style) to JIS B2220 Prowirl 72F, 73F												
DN	Inner	Pressure	e rating	d	D	H1)	L	X	Weight <sup>2)</sup>				
	diamet			[mm]	[mm]	[mm]	[mm]	[mm]	[kg]				
	er												
25 <sup>3)</sup>	15	Sched. 40	20K	22.0	125	248	200	18.5	7				
25	13	Sched. 80	20K	22.0	125	248	200	18.5	7				
403)	25	Sched. 40	20K	30.0	140	255	200	18.5	8				
40	23	Sched. 80	20K	30.0	140	255	200	19.0	8				
		Sched. 40	10K	45.0	155	263	200	20.0	10				
50	40	Sched. 40	20K	45.0	155	263	200	22.0	10				
30	40	Sched. 80	10K	45.0	155	263	200	20.0	10				
		Sched. 80	20K	45.0	155	263	200	22.0	10				
		Sched. 40	10K	56.5	185	270	200	22.0	13				
80	50	Sched. 40	20K	56.5	200	270	200	26.5	16				
80		Sched. 80	10K	56.5	185	270	200	22.0	13				
		Sched. 80	20K	56.5	200	270	200	27.0	16				
		Sched. 40	10K	87.0	210	283	250	22.0	17				
100	80	Sched. 40	20K	87.0	225	283	250	25.5	20				
100	80	Sched. 80	10K	87.0	210	283	250	22.0	17				
		Sched. 80	20K	87.0	225	283	250	26.0	20				
		Sched. 40	10K	112.0	280	295	300	31.0	36				
150	100	Sched. 40	20K	112.0	305	295	300	37.5	46				
150	100	Sched. 80	10K	112.0	280	295	300	31.5	36				
		Sched. 80	20K	112.0	305	295	300	37.5	46				
200	150	Sched. 40	10K	146.3	330	319	300	26.5	45				
200	130	Sched. 40	20K	146.3	350	319	300	31	53				

<sup>&</sup>lt;sup>1)</sup> The dimension H increases by 29 mm for Prowirl 72 (high-temperature version and for the version with a DSC sensor made of Alloy C-22) and for Prowirl 73 (pressure ratings up to PN 40, Cl. 300, 20K).

<sup>&</sup>lt;sup>2)</sup> The weight data refer to the compact version. The weight increases by 0.5 kg for Prowirl 72 (high-temperature version and for the version with a DSC sensor made of Alloy C-22) and for Prowirl 73 (pressure rating up to PN 40, Cl. 300, 20K). The weight is increased by 6 kg for the Dualsens version.

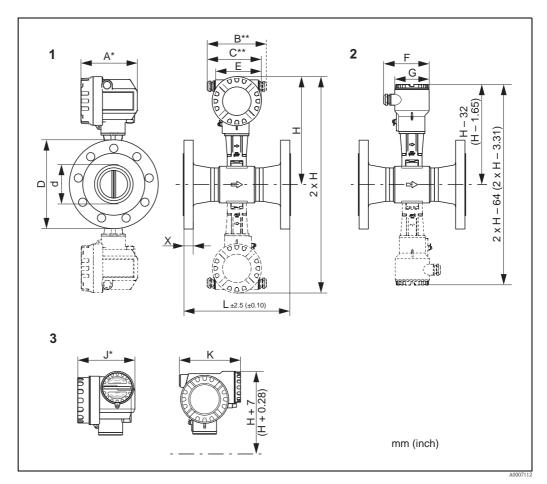
<sup>3)</sup> Not available as Dualsens version.

# Dimensions of flanged versions "S Style" (double reduction of line size) Prowirl 72F, 73F

Versions with integrated line size reduction (hydraulically effective cross-section smaller than connection nominal diameter) offering improved measurement in the lower flow range.

Flange connection dimensions in accordance with flange standard:

- EN 1092-1 (DIN 2501), Ra = 6.3 to 12.5  $\mu m$
- $\blacksquare$  Raised face to: EN 1092-1 Form B1 (DIN 2526 Form C), PN 10 to 40, Ra = 6.3 to 12.5  $\mu m$ , optional with groove to EN 1091-1 Form D (DIN 2512 Form N)
- ANSI B16.5, Class 150 to 300, Ra = 125 to 250 μin
- JIS B2220, 10 to 20K, Ra = 125 to 250 μin



1 = Standard, Ex i and Ex n version; d: connection pipe internal diameter

 $2 = Remote \ version$ 

 $3 = Ex \ d/XP \ version \ (transmitter)$ 

Dotted line: Dualsens version

A	В	С	Е	F	G	J	K
[mm]	[mm]	[mm]	[mm]	[mm]	[mm]	[mm]	[mm]
(inch)	(inch)	(inch)	(inch)	(inch)	(inch)	(inch)	(inch)
149	161 to 181	141 to 151	121	113	85	151	161
(5.87)	(6.34 to 7.13)	(5.55 to 5.94)	(4.76)	(4.45)	(3.35)	(5.94)	(6.34)

 $<sup>\</sup>mbox{\ensuremath{^{\star}}}$  The dimensions below change as follows in the blind version (without local operation):

- Standard, Ex i/IS and Ex n version: The dimension 149 mm (5.87") changes to 142 mm (5.59") in the blind version.
- Ex d/XP version: The dimension151 mm (5.94") changes to 144 mm (5.67") in the blind version. \*\* The dimension depends on the cable gland used.

The transmitter housing has one cable gland or cable entry. Measuring devices with a pulse, frequency or status output have two cable glands or cable entries (devices with TIIS approval only have one cable gland).

	Flanged versions (S Style) to EN 1092-1 (DIN 2501) Prowirl 72F, 73F											
DN	Inner	Pressure	d	D	H1)	L	X	Weight <sup>2)</sup>				
	diameter	rating	[mm]	[mm]	[mm]	[mm]	[mm]	[kg]				
40	15	PN 40	22	150	248	200	21.0	9				
503)	25	PN 40	30	165	255	200	21.0	11				
80	40	PN 40	45	200	263	200	25.5	16				
100	50	PN 16	62	220	270	250	24.0	19				
100	30	PN 40	62	235	270	250	27.5	22				
150	80	PN 16	92	285	283	300	25.0	32				
150	00	PN 40	92	300	283	300	32.0	42				
		PN 10	112	340	295	300	26.0	48				
200	100	PN 16	112	340	295	300	27.0	48				
200	100	PN 25	112	360	295	300	33.5	59				
		PN 40	112	375	295	300	38.5	69				
		PN 10	202.7	395	319	380	24	64				
250	150	PN 16	202.7	405	319	380	27	66.5				
230	130	PN 25	202.7	425	319	380	32	79				
		PN 40	202.7	450	319	380	39	103				

<sup>1)</sup> The dimension H increases by 29 mm for Prowirl 72 (high-temperature version and for the version with a DSC sensor made of Alloy C-22) and for Prowirl 73 (pressure ratings up to PN 40, Cl. 300, 20K).

 $<sup>^{2)}\,</sup>$  The weight data refer to the compact version. The weight increases by 0.5 kg for Prowirl 72 (high-temperature version and for the version with a DSC sensor made of Alloy C-22) and for Prowirl 73 (pressure rating up to PN 40, Cl. 300, 20K). The weight is increased by 6 kg for the Dualsens version.

<sup>3)</sup> Not available as Dualsens version.

	Flanged versions (S Style) to ANSI B16.5 Prowirl 72F, 73F										
DN	Internal	Pressur	e rating	d	D	H <sup>1)</sup>	L	Х	Weight <sup>2)</sup>		
	diame-			mm	mm	mm	mm	mm	kg		
	ter			(inch)	(inch)	(inch)	(inch)	(inch)	(lbs)		
				22	127.0	248	200	19.0	8		
		Sched. 40	Cl. 150	(0.87)	(5.00)	(9.76)	(7.87)	(0.75)	(17.64)		
				22	155.4	248	200	27.0	11		
		Sched. 40	Cl. 300	(0.87)	(6.12)	(9.76)	(7.87)	(1.06)	(24.26)		
11/2"3)	1/2"			22	127.0	248	200	19.5	8		
		Sched. 80	Cl. 150	(0.87)	(5.00)	(9.76)	(7.87)	(0.77)	(17.64)		
				22	155.4	248	200	27.0	11		
		Sched. 80	Cl. 300	(0.87)	(6.12)	(9.76)	(7.87)	(1.06)	(24.26))		
				30	152.4	255	200	21.0	10		
		Sched. 40	Cl. 150	(1.18)	(6.00)	(10.0)	(7.87)	(0.83)	(22.05)		
		0.1.1.40	01 000	30	165.1	255	200	26.0	13		
2"3)	1 11	Sched. 40	Cl. 300	(1.18)	(6.50)	(10.0)	(7.87)	(1.02)	(28.67)		
2"3)	1"	6.1.1.00	01 150	30	152.4	255	200	21.0	10		
		Sched. 80	Cl. 150	(1.18)	(6.00)	(10.0)	(7.87)	(0.83)	(22.05)		
		Cabad 00	Cl. 300	30	165.1	255	200	26.0	13		
		Sched. 80	CI. 300	(1.18)	(6.50)	(10.0)	(7.87)	(1.02)	(28.67)		
		Sched. 40	Cl. 150	45	190.5	263	200	25.0	17		
		Scried. 40	CI. 130	(1.77)	(7.50)	(10.4)	(7.87)	(0.98)	(37.49)		
		Sched. 40	Cl. 300	45	209.6	263	200	37.9	22		
3"	1½"	Scried. 40	CI. 300	(1.77)	(8.25)	(10.4)	(7.87)	(1.49)	(48.51)		
3	3 172	Sched. 80	Cl. 150	45	190.5	263	200	25.0	17		
		ociica, oo		(1.77)	(7.50)	(10.4)	(7.87)	(0.98)	(37.49)		
		Sched. 80	80 Cl. 300	45	209.6	263	200	37.9	22		
		ocnea. oo	01. 000	(1.77)	(8.25)	(10.4)	(7.87)	(1.49)	(48.51)		
		Sched. 40	Cl. 150	62	228.6	270	250	26.5	23		
		belieu. 10	01. 150	(2.44)	(9.00)	(10.6)	(9.84)	(1.04)	(50.72)		
		Sched. 40	Cl. 300	62	254.0	270	250	31.8	31		
4"	2"			(2.44)	(10.00)	(10.6)	(9.84)	(1.25)	(68.36)		
		Sched. 80	Cl. 150	62	228.6	270	250	26.5	23		
				(2.44)	(9.00)	(10.6)	(9.84)	(1.04)	(50.72)		
		Sched. 80	Cl. 300	62	254.0	270	250	31.8	31		
				(2.44)	(10.0)	(10.63)	(9.84)	(1.25)	(68.36)		
		Sched. 40	Cl. 150	92	279.4	283	300	26.5	40		
				(3.62)	(11.0)	(11.1)	(11.8)	(1.04)	(88.20)		
		Sched. 40	Cl. 300	92	317.5	283	300	41.5	(122.20)		
6"	3"			(3.62)	(12.5)	(11.1)	(11.8)	(1.63)	(132.30)		
		Sched. 80	Cl. 150	92 (3.62)	279.4	283 (11.1)	300 (11.8)	27.0 (1.06)	40 (88.20)		
				92	(11.0)	, ,	, ,		,		
		Sched. 80	Cl. 300	(3.62)	317.5 (12.5)	283 (11.1)	300 (11.8)	42.0 (1.65)	60 (132.30)		
	-			112	342.9	295	300	28.4	61		
		Sched. 40	Cl. 150	(4.41)	(13.5)	(11.6)	(11.8)	(1.12)	(134.51)		
8"	4"			112	381.0	295	300	47.5	92		
		Sched. 40	Sched. 40	Sched. 40	Cl. 300	(4.41)	(15.0)	(11.6)	(11.8)	(1.87)	(202.86)
				202.7	406.4	319	380	31.4	91		
		Sched. 40	Cl. 150	(7.98)	(16)	(12.6)	(15.0)	(1.24)	(200.66)		
10"	6"			202.7	444.5	319	380	46.9	129		
		Sched. 40	Cl. 300	(7.98)	(17.5)	(12.6)	(15.0)	(1.85)	(284.45)		
1) The dimension H increases by 29 mm (1.14") for Prowirl 72 (high-temperature version and for the version											

<sup>1)</sup> The dimension H increases by 29 mm (1.14") for Prowirl 72 (high-temperature version and for the version with a DSC sensor made of Alloy C-22) and for Prowirl 73 (pressure ratings up to PN 40, Cl. 300, 20K).

 $<sup>^{2)}</sup>$  The weight data refer to the compact version. The weight increases by 0.5 kg (1.1 lbs) for Prowirl 72 (high-temperature version and for the version with a DSC sensor made of Alloy C-22) and for Prowirl 73 (pressure ratings up to PN 40, Cl. 300, 20K). The weight increases by 6 kg (13.23 lbs) for the Dualsens version. <sup>3)</sup> Not available as a Dualsens version.

0	versions 72F, 73F	(S Style) to	JIS B2220						
DN	Inner	Pressure	e rating	d	D	H1)	L	X	Weight <sup>2)</sup>
	dia-			[mm]	[mm]	[mm]	[mm]	[mm]	[kg]
	meter			, ,	, ,	, ,	, ,	, ,	,
403)	15	Sched. 40	20K	22	140	248	200	20.5	8
40	13	Sched. 80	20K	22	140	248	200	20.5	8
		Sched. 40	10K	30	155	255	200	20.5	9
50 <sup>3)</sup>	25	Sched. 40	20K	30	155	255	200	21.0	11
30%	23	Sched. 80	10K	30	155	255	200	20.5	9
		Sched. 80	20K	30	155	255	200	21.0	11
		Sched. 40	10K	45	185	263	200	22.0	13
00	40	Sched. 40	20K	45	200	263	200	25.5	17
80	40	Sched. 80	10K	45	185	263	200	22.0	13
		Sched. 80	20K	45	200	263	200	25.5	17
		Sched. 40	10K	62	210	270	250	25.5	17
100	50	Sched. 40	20K	62	225	270	250	29.0	21
100	50	Sched. 80	10K	62	210	270	250	26.0	17
		Sched. 80	20K	62	225	270	250	29.5	21
		Sched. 40	10K	92	280	283	300	31.0	34
150	0.0	Sched. 40	20K	92	305	283	300	38.5	45
150	80	Sched. 80	10K	92	280	283	300	31.5	34
		Sched. 80	20K	92	305	283	300	39.0	45
200	100	Sched. 40	10K	112	330	295	300	33.5	50
200	100	Sched. 40	20K	112	350	295	300	43.5	67
250	150	Sched. 40	10K	202.7	400	319	380	30.5	73
250	150	Sched. 40	20K	202.7	430	319	380	37	95

<sup>1)</sup> The dimension H increases by 29 mm for Prowirl 72 (high-temperature version and for the version with a DSC sensor made of Alloy C-22) and for Prowirl 73 (pressure ratings up to PN 40, Cl. 300, 20K).

<sup>&</sup>lt;sup>2)</sup> The weight data refer to the compact version. The weight increases by 0.5 kg for Prowirl 72 (high-temperature version and for the version with a DSC sensor made of Alloy C-22) and for Prowirl 73 (pressure rating up to PN 40, Cl. 300, 20K). The weight is increased by 6 kg for the Dualsens version.

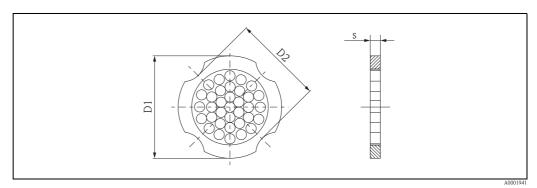
<sup>3)</sup> Not available as Dualsens version.

# Dimensions of flow conditioner to EN (DIN)/ANSI/JIS (accessory)

Dimensions to:

- EN 1092-1 (DIN 2501)
- ANSI B16.5
- JIS B2220

Material 1.4404 (316/316L), in compliance with NACE MR0175-2003 and MR0103-2003.



D1: The flow conditioner is fitted at the external diameter between the bolts.

D2: The flow conditioner is fitted at the indentations between the bolts.

Flow cond	litioner to EN (DIN)				
DN	Pressure rating	Centering diameter [mm]	D1/D2 *	s [mm]	Weight [kg]
15	PN 10 to 40 PN 63	54.3 64.3	D2 D1	2.0	0.04 0.05
25	PN 10 to 40 PN 63	74.3 85.3	D1 D1	3.5	0.12 0.15
40	PN 10 to 40 PN 63	95.3 106.3	D1 D1	5.3	0.3 0.4
50	PN 10 to 40 PN 63	110.0 116.3	D2 D1	6.8	0.5 0.6
80	PN 10 to 40 PN 63	145.3 151.3	D2 D1	10.1	1.4
100	PN 10/16 PN 25/40 PN 63	165.3 171.3 176.5	D2 D1 D2	13.3	2.4
150	PN 10/16 PN 25/40 PN 63	221.0 227.0 252.0	D2 D2 D1	20.0	6.3 7.8 7.8
200	PN 10 PN 16 PN 25 PN 40	274.0 274.0 280.0 294.0	D1 D2 D1 D2	26.3	11.5 12.3 12.3 15.9
250	PN 10/16 PN 25 PN 40	330.0 340.0 355.0	D2 D1 D2	33.0	25.7 25.7 27.5
300	PN 10/16 PN 25 PN 40	380.0 404.0 420.0	D2 D1 D1	39.6	36.4 36.4 44.7

<sup>\*</sup> D1  $\rightarrow$  The flow conditioner is fitted at the external diameter between the bolts.

 $<sup>\</sup>mathrm{D2} \to \mathrm{The}$  flow conditioner is fitted at the indentations between the bolts.

DN		Pressure rating	Centering diameter	D1 / D2 *	S	Weight
DIN		Tressure rading	mm (inch)	D1 / D2	mm (inch)	kg (lbs)
15	1/2"	Cl. 150	50.1 (1.97)	D1	2.0 (0.08)	0.03 (0.07)
		Cl. 300	56.5 (2.22)	D1		0.04 (0.09)
25	1"	Cl. 150	69.2 (2.72)	D2	3.5 (0.14)	0.12 (0.26)
		Cl. 300	74.3 (2.93)	D1		
40	11/2"	Cl. 150	88.2 (3.47)	D2	5.3 (0.21)	0.3 (0.66)
		Cl. 300	97.7 (3.85)	D2	, , ,	, ,
50	2"	Cl. 150	106.6 (4.20)	D2	6.8 (0.27)	0.5 (1.1)
		Cl. 300	113.0 (4.45)	D1	, , ,	, ,
80	3"	Cl. 150	138.4 (5.45)	D1	10.1 (0.40)	1.2 (2.6)
		Cl. 300	151.3 (5.96)	D1	, ,	1.4 (3.1)
100	4"	Cl. 150	176.5 (6.95)	D2	13.3 (0.52)	2.7 (6.0)
		Cl. 300	182,6 (7.19)	D1	, ,	, ,
150	6"	Cl. 150	223.9 (8.81)	D1	20.0 (0.79)	6.3 (14)
		Cl. 300	252.0 (9.92)	D1	, ,	7.8 (17)
200	8"	Cl. 150	274.0 (10.8)	D2	26.3 (1.04)	12.3 (27)
		Cl. 300	309.0 (12.2)	D1	, ,	15.8 (35)
250	10"	Cl. 150	340.0 (13.4)	D1	33.0 (1.30)	25.7 (57)
		Cl. 300	363.0 (14.3)	D1	, ,	27.5 (61)
300	12"	Cl. 150	404.0 (15.9)	D1	39.6 (1.56)	36.4 (80)
		Cl. 300	402.0 (15.8)	D1	` ′	44.6 (98)

<sup>\*</sup> D1  $\rightarrow$  The flow conditioner is fitted at the external diameter between the bolts. D2  $\rightarrow$  The flow conditioner is fitted at the indentations between the bolts.

DN	itioner to JIS  Pressure rating	Centering diameter	D1/D2 *	S	Weight
		[mm]		[mm]	[kg]
	10K	60.3	D2	2.0	0.06
15	20K	60.3	D2	2.0	0.06
	40K	66.3	D1	2.0	0.06
	10K	76.3	D2	3.5	0.14
25	20K	76.3	D2	3.5	0.14
	40K	81.3	D1	3.5	0.14
	10K	91.3	D2	5.3	0.31
40	20K	91.3	D2	5.3	0.31
	40K	102.3	D1	5.3	0.31
	10K	106.6	D2	6.8	0.47
50	20K	106.6	D2	6.8	0.47
	40K	116.3	D1	6.8	0.5
	10K	136.3	D2	10.1	1.1
80	20K	142.3	D1	10.1	1.1
	40K	151.3	D1	10.1	1.3
	10K	161.3	D2	13.3	1.8
100	20K	167.3	D1	13.3	1.8
	40K	175.3	D1	13.3	2.1
	10K	221.0	D2	20.0	4.5
150	20K	240.0	D1	20.0	5.5
	40K	252.0	D1	20.0	6.2
200	10K	271.0	D2	26.3	9.2
200	20K	284.0	D1	26.3	9.2
250	10K	330.0	D2	33.0	15.8
230	20K	355.0	D2	33.0	19.1
300	10K	380.0	D2	39.6	26.5
300	20K	404.0	D1	39.6	26.5

 $D1 \rightarrow$  The flow conditioner is fitted at the external diameter between the bolts.  $D2 \rightarrow$  The flow conditioner is fitted at the indentations between the bolts.

### Weight

- Weight of Prowirl 72W, 73W  $\rightarrow$  🖹 33 ff.
- Weight of Prowirl 72F, 73F  $\rightarrow$  🖹 35 ff.
- Weight of flow conditioner to EN (DIN)/ANSI/JIS  $\rightarrow$   $\stackrel{\triangle}{=}$  49 ff.

#### Material

### Transmitter housing

- Powder-coated die-cast aluminum AlSi10Mg
  - In accordance with EN 1706/EN AC-43400 (EEx d/XP version: cast aluminum EN 1706/EN AC-43000)

#### Sensor

# Flanged version

- Pressure ratings up to PN 40, Class 300, 20K:
  - Stainless steel, A351-CF3M (1.4408), in compliance with AD2000 (temperature range -10 to +400 °C/ +14 to +752 °F) as well as in compliance with NACE MR0175-2003 and MR0103-2003
  - Alloy C-22, 2.4602, (A494-CX2MW/N26022), in compliance with NACE MR0175-2003 and MR0103-2003 (only for Prowirl 72)
- Pressure ratings up to PN 160, Class 600, 40K:
  - Stainless steel, A351–CF3M (1.4408), in compliance with AD2000 (temperature range -10 to  $+400\,^{\circ}\text{C/}$  +14 to  $+752\,^{\circ}\text{F}$ ) as well as in compliance with NACE MR0175–2003 and MR0103–2003
- Pressure ratings PN 250, Class 900 to 1500 and butt-weld version (only for Prowirl 72):
  - Stainless steel, 316Ti/316L (1.4571), NACE available on request

#### Wafer version

- Pressure ratings up to PN 40, Class 300, 20K:
  - Stainless steel, A351-CF3M (1.4408), in compliance with AD2000 (temperature range -10 to +400 °C/ +14 to +752 °F) as well as in compliance with NACE MR0175-2003 and MR0103-2003

# **Flanges**

- EN (DIN)
- Stainless steel, A351-CF3M (1.4404), in compliance with NACE MR0175-2003 and MR0103-2003
- DN 15 to 150 with pressure ratings to PN 40 and all devices with integrated diameter reduction (R Style, S Style): construction with weld-on flanges made of 1.4404 (AISI 316L).
  - All nominal diameters PN 63 to 160 as well as nominal diameters DN 200 to 300 to PN 40: fully cast construction A351-CF3M (1.4408), in compliance with NACE MR0175-2003 and MR0103-2003
- Pressure rating PN 250 (only for Prowirl 72) 1.4571 (316Ti, UNS S31635), in compliance with NACE MR0175-2003 and MR0103-2003 available on request
- ANSI and JIS
  - Stainless steel, A351-CF3M, in compliance with NACE MR0175-2003 and MR0103-2003
  - -1/2 to 6" with pressure ratings to Class 300 and DN 15 to 150 with pressure ratings to 20K and all devices with integrated diameter reduction (R Style, S Style): construction with weld-on flanges made of 316/316L, in compliance with NACE MR0175-2003 and MR0103-2003.
    - All nominal diameters Class 600, 40K as well as nominal diameters DN 200 to 300 to Class 300, 20K: fully cast construction A351–CF3M, in compliance with NACE MR0175-2003 and MR0103-2003
  - Pressure ratings Class 900 to 1500: 316/316L, in compliance with NACE MR0175-2003 and MR0103-2003 available on request
- Alloy C-22 version (EN/DIN/ANSI/JIS)
  - Alloy C-22, 2.4602, (A494-CX2MW/N26022), in compliance with NACE MR0175-2003 and MR0103-2003

# DSC sensor (differential switched capacitor)

- Wetted parts (marked as "wet" on the DSC sensor flange):
  - Standard for pressure ratings up to PN 40, Class 300, JIS 40K:
    - Stainless steel 1.4435 (316/316L), in compliance with NACE MR0175-2003 and MR0103-2003
  - Pressure ratings PN 63 to 160, Class 600, 40K:
    - Inconel 718 ( $\overline{2.4668/N07718}$ , according to B637), in compliance with NACE MR0175-2003 and MR0103-2003
  - Pressure ratings PN 250, Class 900 to 1500 and butt-weld version (only for Prowirl 72): titanium Gr. 5 (B-348; UNS R50250; 3.7165)
  - Alloy C-22 sensor (only for Prowirl 72):
     Alloy C-22, 2.4602/N 06022; in compliance with NACE MR0175-2003 and MR0103-2003

# Non-wetted parts

■ Stainless steel 1.4301 (304)

# **Support**

- Stainless steel, 1.4308 (CF8)
- Pressure ratings PN 250, Class 900 to 1500 and butt-weld version (only for Prowirl 72): 1.4305 (303)

# Seals

- Graphite
  - Pressure rating PN 10 to 40, Class 150 to 300, JIS 10 to 20K: Sigraflex Folie Z (BAM-tested for oxygen applications)
  - Pressure rating PN 63 to 160, Class 600, JIS 40K: Sigraflex Hochdruck  $^{TM}$  with stainless steel sheet reinforcement made of 316(L)
    - (BAM-tested for oxygen applications, "high quality in terms of TA Luft (German Clean Air Act)"
  - $-\,$  Pressure rating PN 250, Class 900 to 1500: Grafoil with perforated stainless steel reinforcement made of 316
- Viton
- Kalrez 6375
- Gylon (PTFE) 3504 (BAM-tested for oxygen applications, "high quality in terms of TA Luft (German Clean Air Act)"

# Human interface

Display elements	Liquid crystal display, double-spaced, plain text display, 16 characters per line Display can be configured individually, e.g. for measured variables and status values, totalizers
Operating elements (HART)	Local operation with three keys , , , , )  Quick Setup for quick commissioning  Operating elements accessible also in Ex-zones
Remote operation	Operation via:  HART DDOGIBLIS DA

- PROFIBUS PA
- FOUNDATION Fieldbus
- FieldCare (software package from Endress+Hauser for complete configuration, commissioning and diagnosis)

# Certificates and approvals

# **CE mark**The measuring system described in these Operating Instructions complies with the legal requirements of the EU Directives. Endress+Hauser confirms this by affixing the CE mark to it and by issuing the CE Declaration of Conformity.

# C-tick mark The measuring system meets the EMC requirements of the "Australian Communications and Media Authority (ACMA)".

### Ex-approval

- Ex i/IS and Ex n:
  - ATEX/CENELEC

III/2G, EEx ia IIC T1 to T6 (T1 to T4 for PROFIBUS PA and FOUNDATION Fieldbus) II1/2GD, EEx ia IIC T1 to T6 (T1 to T4 for PROFIBUS PA and FOUNDATION Fieldbus) II1G, EEx ia IIC T1 to T6 (T1 to T4 for PROFIBUS PA and FOUNDATION Fieldbus) II2G, EEx ia IIC T1 to T6 (T1 to T4 for PROFIBUS PA and FOUNDATION Fieldbus) II3G, EEx nA IIC T1 to T6 X (T1 to T4 X for PROFIBUS PA and FOUNDATION Fieldbus)

- FM

Class I/II/III Div. 1/2, Group A to G; Class I Zone 0, Group IIC

- CSA

Class I/II/III Div. 1/2, Group A to G; Class I Zone 0, Group IIC

Class II Div. 1, Group E to G

Class III

NEPSI

Ex ia IIC

Ex nA

- Ex d/XP:
  - ATEX/CENELEC

II1/2G, EEx d [ia] IIC T1 to T6 (T1 to T4 for PROFIBUS PA and FOUNDATION Fieldbus) II1/2GD, EEx ia IIC T1 to T6 (T1 to T4 for PROFIBUS PA and FOUNDATION Fieldbus) II2G, EEx d [ia] IIC T1 to T6 (T1 to T4 for PROFIBUS PA and FOUNDATION Fieldbus)

– FM

Class I/II/III Div. 1, Groups A to G

CSA

Class I/II/III Div. 1, Groups A to G

Class II Div. 1, Groups E to G

Class III

- TIIS

Ex d [ia] IIC T1

Ex d [ia] IIC T4

More information on the Ex-approvals can be found in the separate Ex-documentation.

# Pressure measuring device approval

The measuring devices can be ordered with or without PED (Pressure Equipment Directive). If a device with PED is required, this must be ordered explicitly. For devices with nominal diameters less than or equal to DN 25 (1"), this is neither possible nor necessary.

- With the identification PED/G1/III on the sensor nameplate, Endress+Hauser confirms conformity with the "Basic safety requirements" of Appendix I of the Pressure Equipment Directive 97/23/EC.
- Devices with this identification (with PED) are suitable for the following types of fluid:
  - Fluids of Group 1 and 2 with a steam pressure greater than or smaller and equal to 0.5 bar (7.3 psi)
  - Unstable gases
- Devices without this identification (without PED) are designed and manufactured according to good engineering practice. They correspond to the requirements of Art. 3, Section 3 of the Pressure Equipment Directive 97/23/EC. Their application is illustrated in Diagrams 6 to 9 in Appendix II of the Pressure Equipment Directive 97/23/EC.

# Certification FOUNDATION Fieldbus

The flowmeter has successfully passed all test procedures and is certified and registered by the Fieldbus FOUNDATION. The device thus meets all the requirements of the following specifications:

- Certified to FOUNDATION Fieldbus Specification
- The device meets all the specifications of the FOUNDATION Fieldbus-H1.
- Interoperability Test Kit (ITK), revision status 4.5 (device certification number available on request): The device can also be operated with certified devices of other manufacturers.
- Physical Layer Conformance Test of the Fieldbus FOUNDATION

### Certification PROFIBUS PA

The flowmeter has successfully passed all test procedures and is certified and registered by the PNO (PROFIBUS User Organization). The device thus meets all the requirements of the following specifications:

- Certified to PROFIBUS PA Profile Version 3.0 (device certification number: on request)
- The device can also be operated with certified devices of other manufacturers (interoperability)

# Other standards and guidelines

#### ■ EN 60529

Degrees of protection by housing (IP code)

### ■ EN 61010-1

Safety requirements for electrical equipment for measurement, control and laboratory use

# ■ IEC/EN 61326

Electromagnetic compatibility (EMC requirements)

### ■ NAMUR NE 21

Electromagnetic compatibility (EMC) of industrial process and laboratory control equipment

### NAMUR NE 43

Standardization of the signal level for the breakdown information of digital transmitters with analog output signal

# ■ NAMUR NE 53

Software of field devices and signal-processing devices with digital electronics

# ■ NACE Standard MR0103-2003

Standard Material Requirements - Materials Resistant to Sulfide Stress Cracking in Corrosive Petroleum Refining Environments

# ■ NACE Standard MR0175-2003

 $Standard\ Material\ Requirements-Sulfide\ Stress\ Cracking\ Resistant\ Metallic\ Materials\ for\ Oilfield\ Equipment$ 

### ■ VDI 2643

Measurement of fluid flow by means of vortex flowmeters.

### ■ ANSI/ISA-S82.01

Safety Standard for Electrical and Electronic Test, Measuring, Controlling and Related Equipment - General Requirements. Pollution degree 2, Installation Category II

### ■ CAN/CSA-C22.2 No. 1010.1-92

Safety Standard for Electrical Equipment for Measurement and Control and Laboratory Use. Pollution degree 2, Installation Category II

- The International Association for the Properties of Water and Steam Release on the IAPWS Industrial Formulation 1997 for the Thermodynamic Properties of Water and Steam
- ASME International Steam Tables for Industrial Use (2000)
- American Gas Association (1962)
   A.G.A. Manual for the Determination of Supercompressibility Factors for Natural Gas PAR Research Project NX-19.
- American Gas Association Transmission Measurement Committee Report No. 8 (AGA8), November 1992. American Petroleum Institute MPMS Chapter 14.2: Compressibility and Supercompressibility for Natural Gas and Other Hydrocarbon Gases.
- ISO 12213 Natural gas (2006) Calculation of compression factor
  - Part 2: Calculation using molar composition analysis (ISO 12213-2)
  - Part 3: Calculation using physical properties (ISO 12213-2)
- GERG Groupe Européen des Recherches Gazières (1991): Technical Monograph TM 5 Standard GERG
  Virial Equation for Field Use. Simplification of the input data requirements for the GERG Virial Equation an alternative means of compressibility factor calculation for natural gases and similar mixtures. Publishing
  house of Verein Deutscher Ingenieure (Association of German Engineers), Düsseldorf.
- ISO 6976-1995: Natural gas Calculation of calorific values, density, relative density and Wobbe index from composition.
- Gas Processors Association GPA Standard 2172-96
- American Petroleum Institute API MPMS 14.5 (1996). Calculation of Gross Heating Value, Relative Density and Compressibility Factor for Natural Gas Mixtures from Compositional Analysis.

# Functional safety

Prowirl 72: SIL 2 in accordance with IEC 61508/IEC 61511-1 Prowirl 73: SIL 1

Following the link http://www.endress.com/sil you will find an overview of all Endress+Hauser devices for SIL applications including parameters like SFF, MTBF, PFD<sub>avg</sub> etc.

# Ordering information

Ordering information and detailed information on the order code can be obtained from your Endress+Hauser Service Organization.

## Additional ordering information for Prowirl 72

Prowirl 72 can also be ordered as a preconfigured unit. For this purpose, the following information is needed when ordering:

- Operating language
- Process temperature
- Type of fluid: liquid or gas/steam
- 20-mA value: measured value at which a current of 20 mA should be set.
   Time constant and failsafe mode (min. current, max. current, etc.)
- Also pulse value, pulse duration, output signal and failsafe mode if the measuring device has a pulse output.
- Average operating density incl. unit if the flow is to be output in mass units.
- Operating and reference density of the fluid including the unit if the flow is to be output in corrected volume units
- $\blacksquare$  Assignment of the first and second line on the local display and desired unit for the totalizer.

The measuring device can be reset to the delivery state indicated in the order at any time.

# Additional ordering information for Prowirl 73

Prowirl 73 can also be ordered as a preconfigured unit. For this purpose, the following information is needed when ordering:

- Operating language
- Type of fluid: saturated steam, superheated steam, water, compressed air, natural gas AGA NX-19, AGA8-DC92, ISO12213-2, AGA8 Gross Method 1, SGERG-88 (optional), gas or gas mixture, customer-defined liquid, gas volume, liquid volume, water delta heat (only for 4 to 20 mA HART), saturated steam delta heat (only for 4 to 20 mA HART).
- Average operating pressure (in bar absolute) or whether the pressure should be read into Prowirl 73 from an external sensor (possible for superheated steam, compressed air, natural gas AGA NX-19, AGA8-DC92, ISO12213-2, AGA8 Gross Method 1, SGERG-88, gas or gas mixture).
- Average ambient pressure (in bar absolute) if the pressure is read into Prowirl 73 from an external pressure sensor.
- $\blacksquare$  Reference pressure and temperature if corrected volume units are selected as an output.
- For applications with natural gas AGA NX-19, mol-% nitrogen and mol-% carbon dioxide are also required; for applications with natural gas AGA8 Gross Method 1 and SGERG-88, mol-% hydrogen and mol-% carbon dioxide are required. Additionally to the mol-% the AGA NX-19, the AGA8 Gross Method 1 as well as the SGERG-88 need the indication of the relative density (relative density = ratio of the density of natural gas to that of air at reference operating conditions).
- For customer-defined liquid applications, the average operating temperature, the density the fluid has at this temperature and the linear expansion coefficient of the fluid are also required. These values can also be calculated by Endress+Hauser if the customer specifies the fluid and operating temperature or if the dependency between the fluid density and the temperature is made available in tabular form.
- 4-mA value: measured value (e.g. 50 kg/h) at which a current of 4 mA should be output, incl. unit.
- 20-mA value: measured value (e.g. 1000 kg/h) at which a current of 20 mA should be output, incl. unit, time constant and failsafe mode (min. current, max. current, etc.)
- Pulse value incl. unit (if the measuring device has a pulse output), pulse duration, output signal and failsafe mode.
- Assignment of the first and second line on the local display and desired unit for the totalizer. In addition, you
  can also tell us what fault values apply for temperature and pressure, where applicable.
- Optional: configuration of the extended diagnostic functions, e.g. maximum/minimum temperature, maximum flow velocity, etc.

The measuring device can be reset to the delivery state indicated in the order at any time.

# Product structure for flanged devices "R Style" and "S Style" (with diameter reduction)

R Style		Single reduction of line size (>)
7*F	RF -*******	DN 25 (1") > DN 15 (½")
	RG -*******	DN 40 (1½") > DN 25 (1")
	RJ -********	DN 50 (2") > DN 40 (1½")
	RK -*******	DN 80 (3") > DN 50 (2")
	RM-*******	DN 100 (4") > DN 80 (3")
	RN -*******	DN 150 (6") > DN 100 (4")
	RR-*******	DN 200 (8") > DN 150 (6")
S Style		Double reduction of line size (>>)
7*F	SF -*******	DN 40 (1½") >> DN 15 (½")
	SG -********	DN 50 (2") >> DN 25 (1")
	SJ -********	DN 80 (3") >> DN 40 (1½")
	SK -********	DN 100 (4") >> DN 50 (2")
	SM-********	DN 150 (6") >> DN 80 (3")
	SN -********	DN 200 (8") >> DN 100 (4")
	SR -*******	DN 250 (10") >> DN 150 (6")

# **Accessories**

 $Various\ accessories,\ which\ can\ be\ ordered\ separately\ from\ Endress+Hauser,\ are\ available\ for\ the\ transmitter\ and\ the\ sensor.\ Detailed\ information\ on\ the\ order\ code\ in\ question\ can\ be\ obtained\ from\ your\ Endress+Hauser\ representative.$ 

# Device-specific accessories

Accessory	Description	Order code
Transmitter	Transmitter for replacement or for stock. Use the order code	72XXX - XXXXX ******
Proline Prowirl 72/73	to define the following specifications:	73XXX - XXXXX ******
	<ul><li>Approvals</li></ul>	
	<ul> <li>Degree of protection/version</li> </ul>	
	<ul> <li>Cable entry</li> </ul>	
	<ul> <li>Display/operation</li> </ul>	
	- Software	
	■ Outputs/inputs	

# Measuring principle-specific accessories

Accessory	Description	Order code
Mounting kit for Prowirl 72/73W	Mounting kit for wafer comprising:  Threaded studs  Nuts incl. washers  Flange seals	DKW** - ***
Mounting kit for transmitter	Mounting kit for remote version, suitable for pipe and wall mounting.	DK6WM - B
Memograph M graphic display recorder	The Memograph M graphic display recorder provides information on all the relevant process variables. Measured values are recorded correctly, limit values are monitored and measuring points analyzed. The data are stored in the 256 MB internal memory and also on a DSD card or USB stick. Memograph M boasts a modular design, intuitive operation and a comprehensive security concept. The ReadWin® 2000 PC software is part of the standard package and is used for configuring, visualizing and archiving the data captured. The mathematics channels which are optionally available enable continuous monitoring of specific energy consumption, boiler efficiency and other parameters which are important for efficient energy management.	RSG40 - ********
Flow conditioner	To reduce the inlet run downstream of flow disturbances.	DK7ST - ***
Pressure transmitter Cerabar T	Cerabar T is used to measure the absolute and gauge pressure of gases, steams and liquids (compensation with RMC621 for example).	PMC131 - **** PMP131 - ****
Pressure transmitter Cerabar M	<ul> <li>Cerabar M is used to measure the absolute and gauge pressure of gases, steams and liquids.</li> <li>Can also be used for reading external pressure values into Prowirl 73 via the burst mode.</li> <li>Can also be ordered with ready-activated burst mode (special product with version 9=TSPSC2821).</li> <li>Can also be used for reading external pressure values into Prowirl 73 via PROFIBUS PA (only absolute pressure).</li> </ul>	PMC41 - *********** PMP41 - ******** PM*4* - ******H/J9***
Pressure transmitter Cerabar S	Cerabar S is used to measure the absolute and gauge pressure of gases, steams and liquids.  Can also be used for reading external pressure values into Prowirl 73 via the burst mode.  Can also be ordered with ready-activated burst mode (special product with version 9=TSPSC2822).  Can also be used for reading external pressure values into Prowirl 73 via PROFIBUS PA or FOUNDATION Fieldbus (only absolute pressure).	PMC71 - ***********************************
RTD temperature Omnigrad TR10	Multipurpose temperature sensor, mineral-insulated insert with thermowell, terminal head and extension neck.  Together with a HART-compatible transmitter, it can be used for to read the temperature into Prowirl 73 in the burst mode.	TR10 - ******R/T**** THT1-L**

Accessomy	Description	Onder code
Accessory	Description  Active barries with power supply for sefe generation of 4 to	Order code
Active barrier RN221N	Active barrier with power supply for safe separation of 4 to 20 mA standard signal circuits:	RN221N - *1
10.022111	Galvanic isolation of 4 to 20 mA circuits	
	■ Elimination of ground loops	
	<ul> <li>Power supply of two-wire transmitters</li> </ul>	
	■ Can be used in Ex area (ATEX, FM, CSA, TIIS)	
	■ HART input-compatible (e.g. for reading in an external	
	pressure value)	
	Note!	
	If RN221N - *3 is used for the HART input, this results in an error message for Prowirl 73 and can not be used for pressure	
	compensation.	
Process display	Multifunctional 1-channel display unit:	RIA250 - *****
RIA250	■ Universal input	KIAZ30 -
KII 1250	<ul><li>Transmitter power supply</li></ul>	
	■ Limit relay	
	■ Analog output	
Process display	Digital display unit for looping into 4 to 20 mA current loop;	RIA251 - **
RIA251	can be used in Ex area (ATEX, FM, CSA).	
Field display	Digital field display unit for looping into 4 to 20 mA current	RIA261 - ***
RIA261	loop; can be used in Ex area (ATEX, FM, CSA).	
Process transmitter	Multifunctional 1-2 channel top-hat rail device	RMA422 - ******
RMA422	with intrinsically safe current inputs and transmitter power	
	supply, limit value monitoring, mathematic functions (e.g. difference ascertain) and 1-2 analog outputs.	
	Optional: intrinsically safe inputs, can be used in Ex area	
	(ATEX).	
	Possible applications: leak detection, delta heat (between two	
	Prowirl measuring points), totalizing (of flows in two pipes)	
	etc.	
Overvoltage protection	Overvoltage protection for restricting overvoltage in signal	51003575
HAW562Z	lines and components.	
Overvoltage protection HAW569	Overvoltage protection for restricting overvoltage for direct mounting to Prowirl 73 and other devices.	HAW569 - **1A
Heat computer RMS621	Steam and heat computer for industrial energy balancing of	RMS621-******
	steam and water. Calculation of the following applications:	
	<ul><li>Steam mass</li><li>Steam heat quantity</li></ul>	
	Net steam heat quantity  Net steam heat quantity	
	Steam delta heat	
	■ Water heat quantity	
	■ Water delta heat	
	Simultaneous calculation of up to three applications per	
	device.	
Energy Manager	Universal Energy Manager for gas, liquids, steam and water.	RMC621 - *******
RMC621	Calculation of volumetric flow and mass flow, standard	
	volume, heat flow and energy.	
Application Manager	Electronic recording, display, balancing, control, saving,	RMM621 - *******
RMM621	event and alarm monitoring of analog and digital input	
	signals. Values and states determined are output by means of analog and digital output signals. Remote transmission of	
	alarms, input values and calculated values using a PSTN or	
	GSM modem.	
Conversion kits	Several conversion kits are available, e.g.:	DK7UP - **
	■ Conversion of Prowirl 77 to Prowirl 72 or 73	
	■ Conversion of a compact version to a remote version	
Weather protection	Protective hood against direct sunshine.	543199-0001
cover		

# Communication-specific accessories

Accessory	Description	Order code
HART Communicator Field Xpert handheld terminal	Handheld terminal for remote configuration and for obtaining measured values via the current output HART (4 to 20 mA) and FOUNDATION Fieldbus (FF).	SFX100 - ******
	Contact your Endress+Hauser representative for more information.	
Fieldgate FXA320	Gateway for remote interrogation of HART sensors and actuators via Web browser:  2-channel, analog input (4 to 20 mA)  4 binary inputs with event counter function and frequency measurement  Communication via modem, Ethernet or GSM  Visualization via Internet/Intranet in Web browser and/or WAP cellular phone  Limit value monitoring with alarms sent by e-mail or SMS	FXA320 - ****
Et 11 . EV 1500	Synchronized time-stamping of all measured values	EVASOO ++++
Fieldgate FXA520	Gateway for remote interrogation of HART sensors and actuators via Web browser:  Web server for remote monitoring of up to 30 measuring points  Intrinsically safe version [EEx ia]IIC for applications in Ex area  Communication via modem, Ethernet or GSM  Visualization via Internet/Intranet in Web browser and/or WAP cellular phone  Limit value monitoring with alarms sent by e-mail or SMS  Synchronized time-stamping of all measured values  Remote diagnosis and remote configuration of connected HART devices	FXA520 - ****
	If Fieldgate FXA520 is used for the HART input, this results in an error message for Prowirl 73 and is not recommended.	
Fieldgate FXA720	Gateway for remote interrogation of PROFIBUS sensors and actuators via Web browser:  - Web server for remote monitoring of up to 30 measuring points  - Intrinsically safe version [EEx ia]IIC for applications in Ex area  - Communication via modem, Ethernet or GSM  - Visualization via Internet/Intranet in Web browser and/or WAP cellular phone  - Limit value monitoring with alarms sent by e-mail or SMS  - Synchronized time-stamping of all measured values  - Remote diagnosis and remote configuration of connected HART devices	FXA720 - ****

# Service-specific accessories

Accessory	Description	Order code
Applicator	Software for selecting and planning flowmeters. The Applicator can be downloaded from the Internet or ordered on CD-ROM for installation on a local PC.  Contact your Endress+Hauser representative for more information.	DXA80 - *
Fieldcheck	Tester/simulator for testing flowmeters in the field. When used in conjunction with the "FieldCare" software package, test results can be imported into a database, printed out and used for official certification. Contact your Endress+Hauser representative for more information.	50098801
FieldCare	FieldCare is Endress+Hauser's FDT-based plant asset management tool. It can configure all intelligent field units in your system and helps you manage them. By using the status information, it is also a simple but effective way of checking their status and condition.	See the product page on the Endress+Hauser Web site: www.endress.com
FXA193	Service interface from the measuring device to the PC for operation via FieldCare.	FXA193 - *

# **Documentation**

- Operating Instructions Proline Prowirl 72
- Operating Instructions Proline Prowirl 72 PROFIBUS PA
- Operating Instructions Proline Prowirl 72 FOUNDATION Fieldbus
- Operating Instructions Proline Prowirl 73
- Operating Instructions Proline Prowirl 73 PROFIBUS PA
- Operating Instructions Proline Prowirl 73 FOUNDATION Fieldbus
- Related Ex-documentation: ATEX, FM, CSA, etc.
- Supplementary documentation on "Information on the Pressure Equipment Directive"

# Registered trademarks

- GYLON®
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People for Process Automation















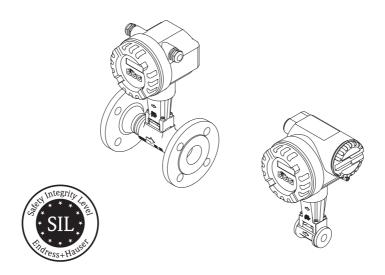




# Functional Safety Manual

# Proline Prowirl 72, 73

Vortex flow measuring system with 4–20 mA output signal



### Application

Monitoring of maximum and/or minimum flow in systems which are required to comply with particular safety system requirements as per IEC/EN 61508 and IEC/EN 61511-1.

The measuring device fulfils the requirements concerning:

- Functional safety in accordance with IEC/EN 61508 and IEC/EN 61511-1
- Explosion protection (depending on the version)
- Electromagnetic compatibility as per EN 61326-3-2 and NAMUR recommendation NE 21

# Your benefits

- For flow monitoring (Min., Max., range) up to SIL 2 for Prowirl 72 independently assessed (Functional Assessment) by exida.com as per IEC/EN 61508 and IEC/EN 61511-1
- For flow monitoring (Min., Max., range) up to SIL 1 for Prowirl 73 independently assessed (Functional Assessment) by exida.com as per IEC/EN 61508 and IEC/EN 61511-1
- Continuous measurement
- Measurement is virtually independent of product properties
- Permanent self-monitoring
- Easy installation and commissioning



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# SIL Declaration of Conformity

#### Prowirl 72



Ole Koudal Endress+Hauser Flowtec AG Kägenstrasse 7, 4153 Reinach

SIL Declaration of Conformity Prowirl 72 Functional Safety of a flow measuring device according to IEC 61508/IEC 61511

Endress+Hauser Flowtec AG, Kägenstrasse 7, 4153 Reinach declares as manufacturer, that the flow measuring device

# Prowirl 72 (4...20 mA)

is suitable for the use in a safety instrumented system up to SIL-2 according to IEC 61511-1 if the enclosed safety instructions are observed.

The FMEDA with analysis of the safety critical and dangerous faults provides under the assumption of a functional test cycle of 4 years the following parameters for the worst case of the tested configurations:

SIL (Safety Integrity Level) : 2 HFT (Hardware Failure Tolerance) : 0 1)

Device Type : Type B (complex component)

SFF (Safe failure fraction) : > 80%

PFD<sub>avg</sub> (Probability of Failure on Demand)<sup>2)</sup> :  $\leq 3.056 \times 10^{-3}$ 

Failure rates according to IEC 61508

1) according to clause 11.4 of IEC 61511-1

2) The PFD<sub>avg</sub> values are also within the range for SIL-2 according to ISA S84.01.

The assessment of the proven-in-use demonstration covers the device and its software (as of software version 1.00.00, in use since March 2003) including the modification process.

Reinach, 18.01.2005

Endress+Hauser Flowtec AG Project Manager FEV/OK

SIL Konformitätserklärung 72 e.doc /

Prowirl72-en-konformitaet.pdf

#### Prowirl 73



Ole Koudal Endress+Hauser Flowtec AG Kägenstrasse 7, 4153 Reinach

SIL Declaration of Conformity Prowirl 73 Functional Safety of a flow measuring device according to IEC 61508

Endress+Hauser Flowtec AG, Kägenstrasse 7, 4153 Reinach declares as manufacturer, that the flow measuring device

# Prowirl 73 (4...20 mA)

is suitable for the use in a safety instrumented system up to SIL-1 if the enclosed safety instructions are observed.

The FMEDA with analysis of the safety critical and dangerous faults provides under the assumption of a functional test cycle of 10 years the following parameters for the worst case of the tested configurations:

SIL (Safety Integrity Level) : 1 HFT (Hardware Failure Tolerance) : 0

Device Type : Type B (complex component)

SFF (Safe failure fraction) : > 80%PFD<sub>avg</sub> (Probability of Failure on Demand) 1) :  $\le 7.90 \times 10^{-3}$ 

Failure rates according to IEC 61508

 $\lambda_{du}$  (failure rate dangerous undetected faults) : 181 x 10<sup>-9</sup> /h (181 FIT)  $\lambda_{dd}$  (failure rate dangerous detected faults) : 462 x 10<sup>-9</sup> /h (462 FIT)  $\lambda_{su}$  (failure rate safe undetected faults) : 431 x 10<sup>-9</sup> /h (431 FIT)  $\lambda_{sd}$  (failure rate safe detected faults) : 17 x 10<sup>-9</sup> /h (17 FIT)

1) The  $PFD_{avg}$  values are also within the range for SIL-2 according to ISA S84.01.

Reinach, 18.01.2005

Endress+Hauser Flowtec AG Project Manager FEV/OK

SIL Konformitätserklärung 73 e.doc /

Prowirl73-en-konformitaet.pdf

# Introduction

# Depiction of a safety system (protection function)

The following tables define the achievable Safety Integrity Level (SIL) or the requirements regarding the "Average Probability of Failure on Demand" (PFD $_{\rm AVG}$ ), the "Hardware Fault Tolerance" (HFT) and the "Safe Failure Fraction" (SFF) of the safety system. The specific values for the Prowirl measuring system can be found in the tables in the Appendix.

In general, the following permitted failure probability of the complete safety function applies, depending on the SIL for systems which must react on demand – e.g. a defined max. flow exceeded – (Source: IEC 61508, Part 1):

SIL	PFD <sub>AVG</sub>
4	$\geq 10^{-5} \text{ to} < 10^{-4}$
3	$\geq 10^{-4} \text{ to} < 10^{-3}$
2	$\geq 10^{-3} \text{ to} < 10^{-2}$
1	$\geq 10^{-2} \text{ to} < 10^{-1}$

The following table shows the achievable SIL as a function of the safe failure fraction and the hardware fault tolerance of the complete safety system for type B systems (complex components, for definition see IEC 61508, Part 2):

SFF	HFT		
	0	1 (0)1)	2 (1)1)
< 60%	Not permitted	SIL 1	SIL 2
60 % to < 90 %	SIL 1	SIL 2	SIL 3
90 % to < 99 %	SIL 2	SIL 3	
≥ 99 %	SIL 3		

- 1) In accordance with IEC 61511-1 (section 11.4.4), the HFT can be reduced by one (values in brackets) if the devices used meet the following conditions:
  - The device is proven in use
  - Only process-relevant parameters can be changed at the device (e.g. measuring range, ...)
  - Changing the process–relevant parameters is protected (e.g. password, jumper,  $\dots$  )
  - The function has a SIL requirement of less than 4

The Prowirl 72 measuring system meets these conditions, the Prowirl 73 measuring system is not proven in use.



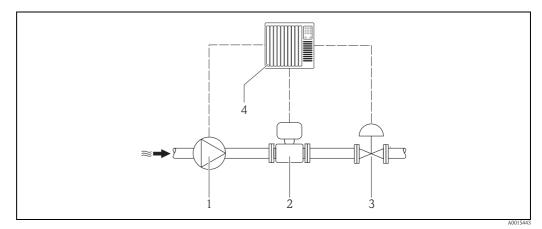
### Note!

General information on functional safety (SIL) is available at:

www.de.endress.com/SIL and in Competence Brochure CP002Z "Functional Safety in the Process Industry – Risk Reduction with Safety Instrumented Systems" (available in the download section of the Endress+Hauser website: www.endress.com  $\rightarrow$  Download  $\rightarrow$  Document code: CP002Z).

# Layout of measuring system with Prowirl 72, 73

### System components



System components

- 1 Pump
- 2 Measuring device
- 3 Valve
- 4 Automation system

An analog signal (4-20 mA) proportional to the flow rate is generated in the transmitter. This is sent to a downstream automation system where it is monitored to determine whether it falls below or exceeds a specified limit value.



### Note!

- The automation system is also capable of reading in additional process variables, such as pressure or temperature, in order to calculate a mass flow or corrected volume flow using this information and the volume flow measured by Prowirl 72, 73.
- To ensure an intrinsically safe power supply to the Prowirl 72, 73, an active barrier (e.g. RN221N) can also be switched between the automation system and the Prowirl 72, 73:



 $\rightarrow$  Share of active barrier in the "average Probability of Failure on Demand" (PFD<sub>avg</sub>).



### Votel

- The safety-related signal is the 4 to 20 mA analog output signal of the measuring device. All safety functions refer exclusively to current output 1.
- The measuring device must be protected against unauthorized access  $\rightarrow$  see "Locking" section ( $\rightarrow \stackrel{\triangle}{=} 8$ ).
- The application program in the safety automation system is designed in such a way that "fail high" and "fail low" failures are detected by the safety function regardless of the effect (safe or dangerous).
- If communication also takes place via the HART protocol in the Prowirl 72/73 measuring device, HART write protection must be activated  $\rightarrow$  see the "Locking" section ( $\rightarrow \stackrel{\square}{=} 8$ ).

The characteristic values determined (see appendix) apply only to the current output (4 to 20 mA) of the following versions:

- Prowirl 72/73\*\*\*-\*\*\*\*\*\*\*\*\*\*A

# Safety function data



### Note!

8 hours is set for the time between when the failure occurs and the failure is eliminated (MTTR).

# Supplementary device documentation

The following documentation must be available for the measuring system:

Device type	Operating Instructions incl. Description of Device Functions
Prowirl 72	BA00084D/06
Prowirl 73	BA00094D/06

This document also includes information on application limits and ambient conditions as well as the functional specifications of the current output.

Furthermore, for devices with explosion protection approvals the relevant safety instructions in the accompanying Ex documentation (XA) must be followed.

# Configuration and installation instructions

#### Installation instructions

Instructions for the correct installation of the measuring device can be found in the Operating Instructions (BA) supplied  $\rightarrow$  see "Supplementary device documentation" ( $\rightarrow \stackrel{\triangle}{}$  7).

# Suitability of the measuring device

Carefully select the nominal diameter of the measuring device in accordance with the application's expected flow rates. The maximum flow rate during operation must not exceed the specified maximum value for the sensor. In safety-related applications, it is also recommended to select a limit value for monitoring the minimum flow rate that is not smaller than 5 % of the specified maximum value of the sensor.

The measuring device must be used correctly for the specific application, taking into account the medium properties and ambient conditions. Carefully follow instructions pertaining to critical process situations and installation conditions from the device documentation.



Please contact your Endress+Hauser sales office for further information.

# Configuration instructions

The measuring device can be configured in various ways in process control protection systems:

- Via onsite operation (LCD display)
- Via HART handheld terminal DXR 375
- Via PC (remote operation) using service and configuration software (e.g. "FieldCare")

The tools mentioned can also be used to retrieve information on the software and hardware revision of the device. Further instructions on the settings can be found in the corresponding Operating Instructions  $\rightarrow$  see "Supplementary device documentation" ( $\rightarrow \stackrel{\triangle}{=} 7$ ).

# Monitoring options

The measuring device can be used in protective systems to monitor (Min., Max. and range) the following:

■ Volume flow



### Note!

The device must be correctly installed to guarantee safe operation.



Monitoring options in protective systems

Min. alarm

В Max. alarm

Range monitoring

= Safety function activated

= Permitted operating status

The following table shows the settings which are necessary to use the measuring device in a safety-related application. The settings refer to the 4 to 20 mA output value of the current output which corresponds to the flow value.

Group	Name of function in the group	Allowed setting when Promass is used for a safety function	
CURRENT OUTPUT	ASSIGN CURRENT OUTPUT (only Prowirl 73)	Volume flow	
CURRENT OUTPUT	CURRENT SPAN	- 4-20 mA HART NAMUR - 0-20 mA HART US	
		All configuration options 4 to 20 mA with HART communication are only permitted if HART write protection is activated ( $\rightarrow \stackrel{\square}{=} 8$ , "Locking" section)	
CURRENT OUTPUT	FAILSAFE MODE	Min. current value     Max. current value	
CURRENT OUTPUT	SIMULATION CURRENT	Off	
SYSTEM PARAMETER	POSITIVE ZERO RETURN	Off	
SUPERVISION	ASSIGN SYSTEM ERROR	Off (the assignment of notice and error messages may not be changed)	
SUPERVISION	ALARM DELAY	020 s	
SIMULATION SYSTEM	SIMULATION FAILSAFE MODE	Off	
SIMULATION SYSTEM	SIMULATION MEASURAND	Off	

A detailed description of the functions of the device can be found in the appropriate "Description of Device Functions"  $\rightarrow$  see "Supplementary device documentation" ( $\rightarrow \stackrel{\triangle}{=} 7$ ).

# Security locking

The software must be locked in order to protect the process–related parameters from being changed. This is done using a code which may be selected by the user.

Software locking for local operation		
Function DEFINE PRIVATE CODE	Selectable code number (except 0)	

When using HART communication, the HART write protection must be activated. This can be done with the aid of a jumper on the I/O board. Please refer to the appropriate Operating Instructions for the correct procedure to activate the HART write protection  $\rightarrow$  see "Supplementary device documentation" ( $\rightarrow$   $\stackrel{\triangle}{=}$  7).

# Setting instructions for evaluation unit

The calculated limit value (mA value corresponding to the desired maximum and/or minimum flow rate) must be entered at the following limit contactor (automation system). For all adjustment and setting procedures, please refer to the relevant Operating Instructions  $\rightarrow$  see "Supplementary device documentation" ( $\rightarrow \ge 7$ ).

#### Response to errors

The response in operation and failures is described in the Operating Instructions of the device  $\rightarrow$  see "Supplementary device documentation" ( $\rightarrow \stackrel{\triangle}{} 7$ ).



#### Notel

- Repair: The repair of the devices must principally be performed by Endress+Hauser.
   Is the repair carried out by other people, the safety related functions can no longer be assured.
   Exception: The replacement of modular components by original spare parts is permitted by qualified personnel of the customer, if trained by Endress+Hauser for this purpose.
- A failure of a SIL marked Endress+Hauser product, which was operated in a safety instrumented system, shall be reported to sil@endress.com including product type, serial number and description of the failure. Device failures must be reported to the manufacturer. The user provides a detailed statement to the manufacturer describing the failure and any possible effects. There is also information flow as to whether this is a dangerous failure or a failure which cannot be detected directly.
- In the event of failure of a SIL-labeled Endress+Hauser device, which has been operated in a safety function, the "Declaration of Contamination and Cleaning" with the corresponding note "Used as SIL device in protection system" must be enclosed when the defective device is returned.

# Information on the useful lifetime of electric components

The established failure rates of electrical components apply within the useful lifetime as per IEC/EN 61508-2, section 7.4.7.4, note 3.



#### Note!

The manufacturer and plant owner/operator must take appropriate measures to achieve a longer service life as per DIN EN 61508-2, note NA4.

### **Proof test**

## Proof testing the measuring system

Check the operativeness of safety functions at appropriate intervals. The operator must determine the checking interval and take this into account when determining the probability of failure  $PFD_{avg}$  of the sensor system.



#### Note

In a single-channel architecture, the  $PFD_{avg}$  value to be used depends on the diagnostic coverage of the proof test (PTC = Proof Test Coverage) and the intended lifetime (LT = Lifetime) in accordance with the following formula:

$$PFD_{avg} \approx \lambda_{du} \cdot [PTC/2 \cdot T_i + (1 - PTC)/2 \cdot LT]$$

A0015275

The functional test must be carried out in such a way that it verifies correct operation of the safety device in conjunction with all of the other components. Each test must be fully documented.

The accuracy of the measured value must first be checked in order to test the safety function (Min., Max., range). This involves approaching the configured limit values upon which the safety function (including actuator) should be activated. Checking the accuracy of the measured values is sufficient in order to test the "Range" safety function.

During the proof test, alternative monitoring measures must be taken to ensure process safety.

A proof test of the device can be performed in the following steps:

#### 1. Checking the digital measured value

One of the following tests must be carried out depending on the measured variable to be monitored and the available equipment:

 Test sequence A – Checking the digital measured value with a calibration rig Volume flow

The measuring device is recalibrated using a calibration rig that is certified in accordance with ISO 17025. This can be done on an installed device using a mobile calibration rig or using factory calibration if the device has been disassembled. The amount of deviation between the measured flow rate and the set point must not exceed the maximum measured error specified in the Operating Instructions.



Note!

Please contact your Endress+Hauser sales office for further information on standard methods for on-site calibration of flowmeters.

b. Test sequence B- Checking the digital measured value using the installed totalizer  $\ensuremath{\textit{Volume flow}}$ 

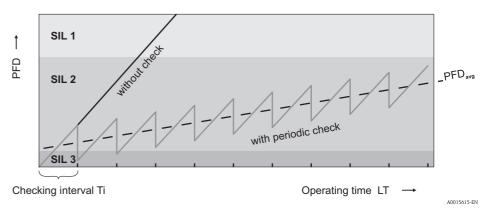
A calibrated measuring vessel is filled with the medium at a flow rate which approximately corresponds to the limit value to be monitored. The change in the volume in the measuring vessel is read off before and after filling and compared with the totalizer installed in the measuring device. The amount of deviation must not exceed the maximum measured error specified in the Operating Instructions. For range monitoring, this test must be carried out separately for the upper and lower limit value.

 Test sequence C – Checking the digital measured value using Fieldcheck Volume flow

Verification of the measuring device in an installed state with Fieldcheck as described in Operating Instructions BA00067D/06. Fieldcheck displays the test results (passed/failed) automatically. This test can be carried out without removal of the flowmeter and makes periodic inspection easier. The high diagnostic coverage means that > 90 % of undetected failures are detected whereby the level of increase in the average probability of failure PFD<sub>AVG</sub> is lower than without the check ( $\rightarrow$  graphic below). The average probability of failure PFD<sub>AVG</sub> can be estimated using the formula for this ( $\rightarrow$   $\stackrel{\square}{=}$  10) and taking into account the intended lifetime t.

When used in conjunction with the "FieldCare" software package, test results can be imported into a database, printed and used as verification for the relevant certification body.

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Single-channel system architecture 1001

#### 2. Checking the temperature measurement (only Prowirl 73)

The medium temperature is required by the device for compensation of measured values and for diagnostic purposes. The medium temperature determined digitally by the device is compared with the measured value of a calibrated thermometer. The amount of deviation must not exceed  $2 \, ^{\circ}$ C ( $4 \, ^{\circ}$ F).

#### 3. Checking the 4–20 mA current output

Using the current simulation (fixed current value) option available in the operating menu, set the current output of the device to the values  $3.6 \, \text{mA}$ ,  $4.0 \, \text{mA}$ ,  $20.0 \, \text{mA}$  and  $22.0 \, \text{mA}$  one after another and compare with the measured values of a calibrated, external current measuring device.

#### 4. Checking the safety function

Correct activation of the safety function – including actuator – must be checked by outputting suitable current values on the 4–20 mA interface per current simulation (just below and above the switch point). For range monitoring, this test must be carried out separately for the upper and lower limit value.

#### 5. Completing the proof test

Switch the 4–20 mA current output to measured value output (if necessary).



#### Note!

The proof test is only completed when steps 1 to 5 are accomplished.

98 % of dangerous, undetected failures are detected using test sequences 1a to 1b, whereas 90 % of dangerous, undetected failures are detected using test sequence 1c. If one of the test criteria from the test sequences described above is not fulfilled, the device may no longer be used as part of a protective system.

The influence of systematic faults on the safety function are not covered by the test and must be examined separately. Systematic faults can be caused, for example, by medium properties, operating conditions, build-up or corrosion.

## Exida management summary

#### Prowirl 72



## **Assessment Results**

Type of Assessment: FMEDA and Proven-in-use assessment – Option 2
Device Name: Vortex Flow Measuring System PROWIRL 72

Software Version: V1.02.01

#### Table 1: Version overview of the types belonging to the considered devices

V1	PROWIRL 72 Remote Version with COMMODUL HART EEX-D
V2	PROWIRL 72 Remote Version with COMMODUL HART EEX-I
V3	PROWIRL 72 with COMMODUL HART EEX-D
V4	PROWIRL 72 with COMMODUL HART EEX-I

Failure rate Database: Basic failure rates from the Siemens standard SN 29500

Component Type: Type B<sup>1</sup>
Hardware Fault Tolerance (HFT): 0
Sensor and mechanical Analysis: Yes
Useful Lifetime: 10 years
SIL capability: SIL 2

#### Version V1: Fail-safe state = "fail high" - IEC 61508 failure rates

Failure (	Category	$\lambda_{\sf sd}$	λ <sub>su</sub> <sup>2</sup>	$\lambda_{dd}$	$\lambda_{du}$	SFF	DCs	DCD
$\lambda_{low} = \lambda_{sd}$	$\lambda_{high} = \lambda_{dd}$	17 FIT	402 FIT	441 FIT	175 FIT	83,0%	4,0%	71,5%
$\lambda_{low} = \lambda_{dd}$	$\lambda_{high} = \lambda_{sd}$	441 FIT	402 FIT	17 FIT	175 FIT	83,0%	52,3%	8,8%

## Version V1: - PFD<sub>AVG</sub> values

T[Proof] = 1 year	T[Proof] = 5 years	T[Proof] = 10 years		
PFD <sub>AVG</sub> = 7,66E-04	PFD <sub>AVG</sub> = 3,82E-03	PFD <sub>AVG</sub> = 7,62E-03		

### Version V2: Fail-safe state = "fail high" - IEC 61508 failure rates

Failure	Category	$\lambda_{\sf sd}$	λ <sub>su</sub> ²	$\lambda_{dd}$	$\lambda_{du}$	SFF	DCs	DCD
$\lambda_{low} = \lambda_{sd}$	$\lambda_{high} = \lambda_{dd}$	11 FIT	341 FIT	446 FIT	175 FIT	82,0%	3,1%	71,8%
$\lambda_{low} = \lambda_{dd}$	$\lambda_{high} = \lambda_{sd}$	446 FIT	341 FIT	11 FIT	175 FIT	82,0%	56,6%	5,9%

#### Version V2: - PFD<sub>AVG</sub> values

T[Proof] = 1 year	T[Proof] = 5 years	T[Proof] = 10 years		
PFD <sub>AVG</sub> = 7,66E-04	PFD <sub>AVG</sub> = 3,82E-03	PFD <sub>AVG</sub> = 7,62E-03		

<sup>&</sup>lt;sup>1</sup> Type B component: "Complex" component (using micro controllers or programmable logic); for details see 7.4.3.1.3 of IEC 61508-2.

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 $<sup>^2</sup>$  "no effect" and "annunciation" failures are included in the " $\lambda_{su}$ " failure category according to IEC 61508. These failures will not affect system reliability and should not be included in spurious trip calculations.



### Version V3: Fail-safe state = "fail high" – IEC 61508 failure rates

Failure 0	Category	$\lambda_{\sf sd}$	λ <sub>su</sub> ²	$\lambda_{dd}$	$\lambda_{du}$	SFF	DCs	DCD
$\lambda_{\text{low}} = \lambda_{\text{sd}}$	$\lambda_{high} = \lambda_{dd}$	17 FIT	366 FIT	345 FIT	165 FIT	81,5%	4,4%	67,6%
$\lambda_{low} = \lambda_{dd}$	$\lambda_{high} = \lambda_{sd}$	345 FIT	366 FIT	17 FIT	165 FIT	81,5%	48,5%	9,3%

## Version V3: - PFD<sub>AVG</sub> values

T[Proof] = 1 year	T[Proof] = 5 years	T[Proof] = 10 years		
PFD <sub>AVG</sub> = 7,23E-04	PFD <sub>AVG</sub> = 3,61E-03	PFD <sub>AVG</sub> = 7,20E-03		

## Version V4: Fail-safe state = "fail high" – IEC 61508 failure rates

Failure (	Category	$\lambda_{\sf sd}$	λ <sub>su</sub> ²	$\lambda_{dd}$	$\lambda_{du}$	SFF	DCs	DCD
$\lambda_{\text{low}} = \lambda_{\text{sd}}$	$\lambda_{\text{high}} = \lambda_{\text{dd}}$	11 FIT	306 FIT	350 FIT	165 FIT	80,1%	3,4%	67,9%
$\lambda_{low} = \lambda_{dd}$	$\lambda_{high} = \lambda_{sd}$	350 FIT	306 FIT	11 FIT	165 FIT	80,1%	53,3%	6,2%

## Version V4: - PFD<sub>AVG</sub> values

T[Proof] = 1 year	T[Proof] = 5 years	T[Proof] = 10 years		
PFD <sub>AVG</sub> = 7,23E-04	PFD <sub>AVG</sub> = 3,61E-03	PFD <sub>AVG</sub> = 7,20E-03		

72\_2.pdf

#### Prowirl 73



## **Assessment Results**

Type of Assessment: Hardware assessment (FMEDA) - Option 1 Device Name: Vortex Flow Measuring System PROWIRL 73

V1.01.00 (PROWIRL 73) Software Version:

#### Table 1: Version overview of the types belonging to the considered devices

V1	PROWIRL 73 Remote Version with COMMODUL HART EEX-D
V2	PROWIRL 73 Remote Version with COMMODUL HART EEX-I
V3	PROWIRL 73 with COMMODUL HART EEX-D
V4	PROWIRL 73 with COMMODUL HART EEX-I

Failure rate Database: Basic failure rates from the Siemens standard SN 29500

Type B<sup>1</sup> Component Type: Hardware Fault Tolerance (HFT): Sensor and mechanical Analysis: Yes

Useful Lifetime: 10 years SIL capability: SIL 1

#### Version V1: Fail-safe state = "fail high" - IEC 61508 failure rates

Failure (	Category	$\lambda_{\sf sd}$	λ <sub>su</sub> ²	$\lambda_{dd}$	$\lambda_{du}$	SFF	DCs	DCD
$\lambda_{low} = \lambda_{sd}$	$\lambda_{high} = \lambda_{dd}$	17 FIT	431 FIT	457 FIT	181 FIT	83,3%	3,7%	71,6%
$\lambda_{low} = \lambda_{dd}$	$\lambda_{high} = \lambda_{sd}$	457 FIT	431 FIT	17 FIT	181 FIT	83,3%	51,4%	8,5%

#### Version V1: - PFD<sub>AVG</sub> values

T[Proof] = 1 year	T[Proof] = 5 years	T[Proof] = 10 years		
PFD <sub>AVG</sub> = 7,94E-04	PFD <sub>AVG</sub> = 3,96E-03	PFD <sub>AVG</sub> = 7,90E-03		

#### Version V2: Fail-safe state = "fail high" - IEC 61508 failure rates

Failure Category		$\lambda_{\sf sd}$	λ <sub>su</sub> ²	$\lambda_{dd}$	$\lambda_{du}$	SFF	DCs	DC <sub>D</sub>
$\lambda_{\text{low}} = \lambda_{\text{sd}}$	$\lambda_{high} = \lambda_{dd}$	11 FIT	370 FIT	462 FIT	181 FIT	82,3%	2,8%	71,8%
$\lambda_{low} = \lambda_{dd}$	$\lambda_{\text{high}} = \lambda_{\text{sd}}$	462 FIT	370 FIT	11 FIT	181 FIT	82,3%	55,5%	5,7%

#### Version V2: - PFD<sub>AVG</sub> values

T[Proof] = 1 year	T[Proof] = 5 years	T[Proof] = 10 years
PFD <sub>AVG</sub> = 7,93E-04	PFD <sub>AVG</sub> = 3,96E-03	PFD <sub>AVG</sub> = 7,89E-03

<sup>&</sup>quot;Complex" component (using micro controllers or programmable logic); for details see 7.4.3.1.3 of IEC 61508-2. <sup>1</sup> Type B component:

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## Version V3: Fail-safe state = "fail high" – IEC 61508 failure rates

Failure Category		$\lambda_{\sf sd}$	λ <sub>su</sub> ²	$\lambda_{dd}$	$\lambda_{du}$	SFF	DCs	DCD
$\lambda_{low} = \lambda_{sd}$	$\lambda_{high} = \lambda_{dd}$	17 FIT	395 FIT	361 FIT	171 FIT	81,8%	4,1%	67,8%
$\lambda_{low} = \lambda_{dd}$	$\lambda_{high} = \lambda_{sd}$	361 FIT	395 FIT	17 FIT	171 FIT	81,8%	47,7%	9,0%

## Version V3: - PFD<sub>AVG</sub> values

T[Proof] = 1 year	T[Proof] = 5 years	T[Proof] = 10 years
PFD <sub>AVG</sub> = 7,51E-04	PFD <sub>AVG</sub> = 3,75E-03	PFD <sub>AVG</sub> = 7,48E-03

### Version V4: Fail-safe state = "fail high" – IEC 61508 failure rates

Failure Category		$\lambda_{\sf sd}$	λ <sub>su</sub> ²	$\lambda_{dd}$	$\lambda_{du}$	SFF	DCs	DCD
$\lambda_{low} = \lambda_{sd}$	$\lambda_{low} = \lambda_{sd}$ $\lambda_{high} = \lambda_{dd}$		335 FIT	366 FIT	171 FIT	80,6%	3,1%	68,1%
$\lambda_{low} = \lambda_{dd}$	$\lambda_{high} = \lambda_{sd}$	366 FIT	335 FIT	11 FIT	171 FIT	80,6%	52,2%	6,0%

## $\mbox{Version V4:} - \mbox{PFD}_{\mbox{\tiny AVG}} \mbox{ values}$

T[Proof] = 1 year	T[Proof] = 5 years	T[Proof] = 10 years
PFD <sub>AVG</sub> = 7,51E-04	PFD <sub>AVG</sub> = 3,75E-03	PFD <sub>AVG</sub> = 7,47E-03

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## Appendix (safety-related characteristic values)

#### **Introductory comments**

Depending on the order code, Prowirl flow measuring systems are supplied with different signal inputs and outputs. For the purposes of clarity, similar types of electronics modules are grouped into categories.



#### Note!

- The safety-related characteristic values are described separately for each of these categories → see sections "Category 1-n". The tables provided in these category sections contain all the important characteristic values. The values apply to all possible applications:
- The failure rates indicated refer to the failure rates of Siemens Standard SN29500 at an ambient temperature of +40 °C (+104 °F).

#### Comments on the term "dangerous undetected failures"

Situations in which the process does not respond to a demand (i.e. the measuring device does not demonstrate the predefined failsafe mode) or in which the output signal deviates more than the total measured error as specified. Please refer to the "Performance characteristics" section of the Operating Instructions for more detailed information on the total measured error.

The following presumptions are made:

- The failure rates are constant, wear out mechanisms are not included.
- Failure propagation is not relevant.
- The HART protocol is only used to read out data during normal operation.
- The recovery time after a safe failure is 8 hours.
- The test time of the automation system to react to a detected failure is one hour.
- All modules are operated in the "low demand mode".
- Only current output 1 is used for safety-related applications.
- Failure rates of the external power supply are not included.
- The stress levels are average values for an industrial environment and are comparable with the Ground Fixed classification of MIL-HDBK-217F. Alternatively, the assumed environment is similar to IEC 60654-1, Class C (sheltered location) with temperature limits within the manufacturer's rating and an average transmitter temperature of 40°C (104 °F) over a longer time period. The humidity level is assumed to be within the manufacturer's rating.
- Only the versions described are used for safety applications.
- As the optional display does not constitute a part of the safety function, the failure rate of the display is not taken into account in the calculations.
- The application program in the safety automation system is designed in such a way that "fail high" and "fail low" failures are detected by the safety function regardless of the effect (safe or dangerous).

## Prowirl 72 Specific values

Prowirl 72	
SIL	SIL 2
HFT	0
SFF	> 76.6 %
PFD <sub>avg</sub> (based on a service interval of 4 years)	< 3.06 · 10 <sup>-3</sup>
Complete functional test e.g. by approaching the flow limit values	every 4 years (for additional values see the following diagram)
Product life span	10 years

### Detailed data on error rates:

Sensor Prowirl 72								
$\lambda_{\text{safe}}$	$\lambda_{dd}$	$\lambda_{du}$	SFF					
0 FIT	0 FIT 138 FIT		97.2 %					

	Electronics Prowirl 72										
Version	Error category		λ <sub>sd</sub> [FIT]	λ <sub>su</sub> <sup>2</sup> [FIT]	λ <sub>dd</sub> [FIT]	λ <sub>du</sub> [FIT]	SFF	DC <sub>S</sub>	$DC_D$		
Non-Ex +	$\lambda_{low} = \lambda_{sd}$	$\lambda_{high} = \lambda_{dd}$	11	168	350	161	76.6 %	6.1 %	68.4 %		
Ex-i/IS; compact	$\lambda_{low} = \lambda_{dd}$	$\lambda_{high} = \lambda_{sd}$	350	168	11	161	76.6 %	67.5 %	6.4 %		
Non-Ex +	$\lambda_{low} = \lambda_{sd}$	$\lambda_{high} = \lambda_{dd}$	11	203	446	171	79.4 %	5.1 %	72.2 %		
Ex-i/IS; remote	$\lambda_{low} = \lambda_{dd}$	$\lambda_{high} = \lambda_{sd}$	446	203	11	171	79.4 %	68.7 %	6.0 %		
Ex-d/XP	$\lambda_{low} = \lambda_{sd}$	$\lambda_{high} \!\! = \lambda_{dd}$	17	228	345	161	78.5 %	6.9 %	68.1 %		
compact	$\lambda_{low} = \lambda_{dd}$	$\lambda_{high} = \lambda_{sd}$	345	228	17	161	78.5 %	60.2 %	9.5 %		
Ex-d/XP	$\lambda_{low} = \lambda_{sd}$	$\lambda_{high} = \lambda_{dd}$	17	264	441	171	80.8 %	6.0 %	39.3 %		
remote	$\lambda_{low} = \lambda_{dd}$	$\lambda_{high} = \lambda_{sd}$	441	264	17	171	80.8 %	29.6 %	9.0 %		

## Prowirl 73 Specific values

Prowirl 73	
SIL	SIL 1
HFT	0
SFF	> 76.8 %
PFD <sub>avg</sub> (based on a service interval of 4 years)	$< 7.90 \cdot 10^{-3}$
Complete functional test e.g. by approaching the flow limit values	every 10 years (for additional values see the following diagram)
Product life span	10 years

### Detailed data on error rates:

Sensor Prowirl 73								
$\lambda_{safe}$	$\lambda_{dd}$	$\lambda_{du}$	SFF					
16 FIT	16 FIT 138 FIT		97.5 %					

Electronics Prowirl 73									
Version	Error category		λ <sub>sd</sub> [FIT]	λ <sub>su</sub> <sup>2</sup> [FIT]	λ <sub>dd</sub> [FIT]	λ <sub>du</sub> [FIT]	SFF	DCs	$DC_D$
Non-Ex +	$\lambda_{low} = \lambda_{sd}$	$\lambda_{high} = \lambda_{dd}$	11	181	366	167	76.8 %	5.7 %	68.6 %
Ex-i/IS; compact	$\lambda_{low} = \lambda_{dd}$	$\lambda_{high} = \lambda_{sd}$	366	181	11	167	76.8 %	66.9 %	6.1 %
Non-Ex +	$\lambda_{low} = \lambda_{sd}$	$\lambda_{high} = \lambda_{dd}$	11	216	462	177	79.5 %	4.8 %	72.3 %
Ex-i/IS; remote	$\lambda_{low} = \lambda_{dd}$	$\lambda_{high}\!\!=\lambda_{sd}$	462	216	11	177	79.5 %	68.1 %	5.8 %
Ex-d/XP	$\lambda_{low} = \lambda_{sd}$	$\lambda_{high} = \lambda_{dd}$	17	241	361	167	78.7 %	6.5 %	68.3 %
compact	$\lambda_{low} = \lambda_{dd}$	$\lambda_{high} = \lambda_{sd}$	361	241	17	167	78.7 %	59.9 %	9.2 %
Ex-d/XP	$\lambda_{low} = \lambda_{sd}$	$\lambda_{high} = \lambda_{dd}$	17	277	457	177	80.9 %	5.7 %	72.0 %
remote	$\lambda_{low} = \lambda_{dd}$	$\lambda_{high} = \lambda_{sd}$	457	277	17	177	80.9 %	62.2 %	8.7 %

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People for Process Automation



















## Safety Instructions

## Proline Prowirl 72, 73

XP (Ex-d version)

Division 1

Documentation for hazardous location Cl.I Div.1



Safety instructions for electrical apparatus for explosion–hazardous areas according to FACTORY MUTUAL standards  $\longrightarrow$   $\Longrightarrow$  3



Safety instructions for electrical apparatus for explosion–hazardous areas according to CANADIAN STANDARDS ASSOCIATION  $\to\to$   $\stackrel{\text{\tiny }}{=}$  13



## Examples for markings according to FM and CSA:

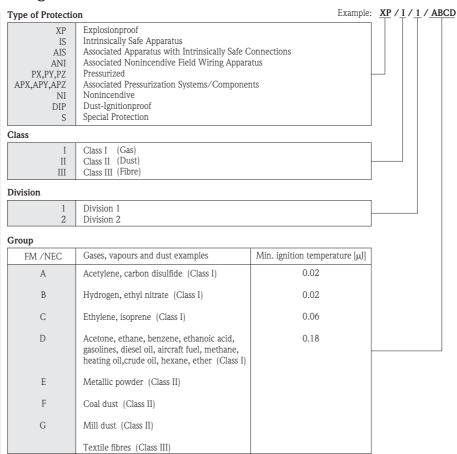
FM APPROVALS

CSA (Canadian Standards Association)



#### **Temperature Class**

Maximum surface temperature							
T1	-						
T2	572 °F	300 °C					
T2A	536 °F	280 °C					
T2B	500 °F	260 °C					
T2C	446 °F	230 °C					
T2D	419 °F	215 °C					
Т3	392 °F	200 °C					
T3A	356 °F	180 °C					
ТЗВ	329 °F	165 °C					
T3C	320 °F	160 °C					
T4	275 °F	135 °C					
T4A	248 °F	120 °C					
T5	212 °F	100 °C					
T6	185 °F	85 °C					





#### **Temperature Class**

Maximum surface temperature							
T1	•						
T2	300 °C	572 °F					
T2A	280 °C	536 °F					
T2B	260 °C	500 °F					
T2C	230 °C	446 °F					
T2D	215 °C	419 °F					
Т3	200 °C	392 °F					
T3A	180 °C	356 °F					
ТЗВ	165 °C	329 °F					
T3C	160 °C	320 °F					
T4	135 °C	275 °F					
T4A	120 °C	248 °F					
T5	100 °C	212 °F					
T6	85 °C	185 °F					

Class		Example: C	Class I, Division 1, Group ABO
I II III	Class I (Gas) Class II (Dust) Class III (Fibre)		
Division			
1 2	Division 1 Division 2		
Group			
CSA / CSC	Gases, vapours and dust examples	Min. ignition temperature [μJ]	
A	Acetylene, carbon disulfide (Class I)	0.02	
В	Hydrogen, ethyl nitrate (Class I)	0.02	
С	Ethylene, isoprene (Class I)	0.06	
D	Acetone, ethane, benzene (Class I)	0.18	
Е	Metallic powder (Class II)		
F	Coal dust (Class II)		
G	Mill dust (Class II)		
	Textile fibres (Class III)		
Type of Protection	on		-
Explosionproof Intrinsically Safe Associated Appar Associated Nonin Pressurized	Apparatus ratus with Intrinsically Safe Connections ncendive Field Wiring Apparatus urization Systems/Components of		

A0005630

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## Safety Instructions

## Proline Prowirl 72, 73

## XP (Ex-d version)

## Division 1



## This document is an integral part of the following Operating Instructions:

- BA084D, Proline Prowirl 72 HART
- BA085D, Proline Prowirl 72 PROFIBUS PA
- BA095D, Proline Prowirl 72 FOUNDATION Fieldbus
- BA094D, Proline Prowirl 73 HART
- BA093D, Proline Prowirl 73 PROFIBUS PA
- BA096D, Proline Prowirl 73 FOUNDATION Fieldbus

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#### General warnings

- Any national regulations pertaining to the installation of devices in hazardous areas must be observed.
- Mounting, electrical installation, commissioning and maintenance of the devices may only be performed by technical staff trained in the area of explosion protection.
- Compliance with all of the technical data of the device (see nameplate) is mandatory.

#### Special conditions

■ The device must be integrated into the potential equalization system. Potential must be equalized along the intrinsically safe sensor circuits. Further information can be found in the "Potential equalization" chapter on → ■ 9.

#### Installation instructions

- The cable entries and openings not used must be sealed tight with suitable components.
- The manufacturer's specifications for all devices connected to the intrinsically safe circuits must be taken into consideration.
- To rotate the transmitter housing, please follow the same procedure as for non-Ex versions. The transmitter housing may also be rotated during operation.
- The continuous service temperature of the cable must correspond at least to the temperature range of -40 °F and up to +50 °F above the ambient temperature present (-40 °F ... (T<sub>a</sub> +50 °F)).
- All equipment of the measuring system must be included in potential matching ( $\rightarrow \stackrel{\triangle}{=} 10$ ).
- The devices may only be used for fluids against which the wetted materials are sufficiently resistant.
- The service connector may not be connected in a potentially explosive atmosphere.
- Install per National Electrical Code. Install intrinsically safe circuits per NEC ANSI/NFPA 70 and ISA RP 12.6 respecting the explosion proof integrity of the enclosure.

#### **Approvals**

#### General

The system meets the basic safety and health requirements for the design and construction of devices and protection systems designated for use in hazardous areas in accordance with the National Electrical Code.

#### Certification number

I.D. 3015769

#### Inspection authority

FM: Factory Mutual Research

#### Identification

The system identification must contain the following information:

Compact version and remote version (transmitter and sensor)				
Prowirl 72***_*********************************	Cl. I, Div. 1 Groups ABCD Cl. II, Div. 1 Groups EFG Cl. III Cl. I, Zone 1 Group IIC			



The installation instructions for the safe use and application of the system must be observed  $\rightarrow \stackrel{\triangle}{=} 4$ .



## Description of the measuring system

The measuring system consists of a transmitter and a sensor. Two versions are available:

- Compact version:
  - The transmitter and sensor form a mechanical unit.
- Remote version:

The transmitter and sensor are mounted separate from one another and interconnected by means of a connecting cable (see also "Electrical connections" ( $\rightarrow \blacksquare 10$ ) and "Cable specifications for connecting cable" ( $\rightarrow \blacksquare 9$ ).

#### Device identification

The nameplates, which are provided on the transmitter and sensor in a manner in which they are clearly visible, contain all the relevant information on the measuring system.

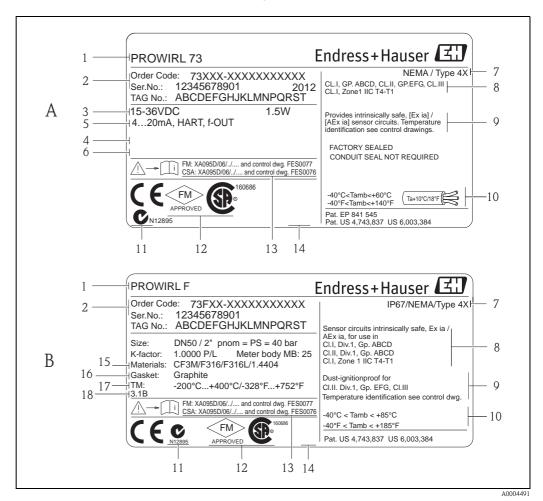


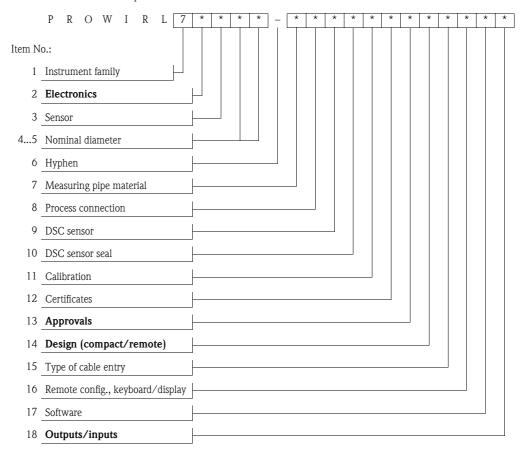
Fig. 1: Example for nameplates of a transmitter and a sensor

- A Transmitter nameplate
- B Sensor nameplate
- 1 Transmitter or sensor type
- 2 Order code and serial number
- 3 Power supply, frequency and power consumption
- 4 Additional specifications (only if present)
- 5 Available inputs/outputs
- 6 Space for additional information on special products
- 7 Identification of the type of protection, explosion group, temperature class, Ingress protection
- 8 Type of housing protection
- 9 Space for notes, e.g. delays, etc. (only if necessary)
- 10 Ambient temperature range
- 11 C-Tick symbol
- 12 Label of notified body: FACTORY MUTUAL standard
- 13 Associated Ex documentation for explosion protected devices
- 14 Space for other approval specifications and certificates, e.g. PROFIBUS, etc. (only if present)
- 15 Material tube/sensor
- 16 Seal material
- 17 Fluid temperature range
- 18 Additional information, e.g. 3.1 = 3.1 certificate for wetted materials



### Type code

The type code describes the exact design and equipment level of the measuring system. It can be read off the nameplate of the transmitter and sensor and is structured as follows:



#### Electronics (Item No. 2 in type code $\rightarrow \stackrel{\triangle}{=} 6$ )

*	Transmitter	Electronics/housing
2	Prowirl 72	■ Intrinsically safe transmitter electronics
3	Prowirl 73	<ul> <li>Transmitter housing of connection compartment with XP explosion protection</li> </ul>

### Approvals (Item No. 13 in type code)

*	ŧ .	Approval	Sensor	Compact	Remote
F		Cl. I, Div. 1 Groups ABCD Cl. II, Div. 1 Groups EFG Cl. III Cl. I, Zone 1 Group IIC	-	DN 1/2"12" DN 1/2"6"	DN 1/2"12" DN 1/2"6"



#### Type (compact/remote; Item No. 14 in type code $\rightarrow \stackrel{\triangleright}{=} 6$ )

*	Туре	Application/zone			
A, J	Compact	Cl. I, Div. 1 Groups ABCD Cl. II, Div. 1 Groups EFG Cl. III Cl. I, Zone 1 Group IIC	Outputs/inputs A/W <sup>1)</sup> : T1-T6 Outputs/inputs H/K <sup>1)</sup> : T1-T4		
		Transmitter			
	Donata	Cl. I, Div. 1 Groups ABCD Cl. II, Div. 1 Groups EFG Cl. III Cl. I, Zone 1 Group IIC	Outputs/inputs A/W <sup>1)</sup> : T1-T6 Outputs/inputs H/K <sup>1)</sup> : T1-T4		
EEVI		Sensor			
E, F, K, L	Remote	Prowirl F DN 1/2"12" Prowirl W DN 1/2"6"	Cl. I, Div. 1 Groups ABCD Cl. II, Div. 1 Groups EFG Cl. III Cl. I, Zone 1 Group IIC  Outputs/inputs A/W 1): T1-T6 Outputs/inputs H/K 1): T1-T4		
<sup>1)</sup> Item No. 18 in type code $\rightarrow \stackrel{\triangle}{=} 6$					

### Outputs/inputs (Item No. 18 in type code $\rightarrow \stackrel{\triangleright}{=} 6$ )

*	Approval	
A, W	Cl. I, Div. 1 Groups ABCD Cl. II, Div. 1 Groups EFG Cl. III Cl. I, Zone 1 Group IIC	Temperature Class: T1-T6
Н, К	Cl. I, Div. 1 Groups ABCD Cl. II, Div. 1 Groups EFG Cl. III Cl. I, Zone 1 Group IIC	Temperature Class: T1-T4

#### Note!

## Compact version temperature table

Maximum fluid temperature [°F] depending on the ambient temperature  $T_a$  and the DSC sensor used (Item No. 9 in the type code  $\rightarrow \stackrel{\cong}{=} 6$ ).

	T <sub>a</sub>	T6 (185 °F)	T5 (212 °F)	T4 (275 °F)	T3 (392 °F)	T2 (572 °F)	T1 (842 °F)
Prowirl 72***-**0******	−40 °F +104 °F	176	203	266	374	536	536
110WII172 - 0	−40 °F +140 °F	-	203	266	374	536	536
Prowirl 72***_**1******** Prowirl 72***_*2******* Prowirl 72***_*3******* Prowirl 72***_*6******* Prowirl 73***_*4****** Prowirl 73***_*7*******	-40 °F +104 °F	176	203	266	374	554	824
	-40 °F +140 °F	-	203	266	374	554	824

Dependency of the minimum fluid temperature  $T_{\mbox{\footnotesize{med}}}$  on the DSC sensor:

T <sub>med</sub> -328 °F	T <sub>med</sub> -58 °F	T <sub>med</sub> -40 °F
Prowirl 72***-**1*******	Prowirl 72F***-**6*******	Prowirl 72***-**0*******
Prowirl 72***-**2*******		
Prowirl 72***-**3*******		
Prowirl 73***-**4******		
Prowirl 73***-**7******		ļ

#### ⚠ Warning!

For devices with outputs Prowirl 72\*\*\*-\*\*\*\*\*\*\*\*H/K and 73\*\*\*-\*\*\*\*\*\*\*\*\*\*\*\*H/K, temperature classes T5 and T6 are not permitted.



## Remote version temperature table

#### Sensor

Maximum fluid temperature [°F] depending on the ambient temperature  $T_a$  and the DSC sensor used (Item No. 9 in the type code  $\rightarrow \stackrel{\cong}{=} 6$ ).

	T <sub>a</sub>	T6 (185 °F)	T5 (212 °F)	T4 (275 °F)	T3 (392 °F)	T2 (572 °F)	T1 (842 °F)
	−40 °F +104 °F	176	203	266	383	536	536
Prowirl 72***_**0*******	−40 °F +140 °F	-	203	266	383	536	536
	−40 °F +185 °F	1	_	266	383	536	536
Prowirl 72***-**1******** Prowirl 72***-**2*******	−40 °F +104 °F	176	203	266	383	554	824
Prowirl 72***-**3******** Prowirl 72***-**6*******	−40 °F +140 °F	1	203	266	383	554	824
Prowirl 73***-**4******** Prowirl 73****-*7********	−40 °F +185 °F	_	_	266	383	554	824

Dependency of the minimum fluid temperature  $T_{\mbox{\footnotesize{med}}}$  on the DSC sensor:

T <sub>med</sub> –328 °F	T <sub>med</sub> -58 °F	T <sub>med</sub> -40 °F
Prowirl 72***_**1 ******** Prowirl 72***_**2******* Prowirl 72***_**3******* Prowirl 73***_**4****** Prowirl 73***_**7******	Prowirl 72F***_**6*******	Prowirl 72***_**0*******

#### $\triangle$ Warning!

#### Transmitter

The minimum ambient temperature is -40 °F.

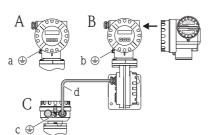
The maximum ambient temperature [°F] depending on the device used is:

	T6 (185 °F)	T5 (212 °F)	T4 (275 °F)	T3 (392 °F)	T2 (572 °F)	T1 (842 °F)
Prowirl 72***-***********A Prowirl 72***-*********W Prowirl 73***-***********A Prowirl 73***-*********************************	104	140	140	140	140	140
Prowirl 72***_************H Prowirl 72***_************ Prowirl 73***_************ Prowirl 73***_*********************************	_	_	140	140	140	140



## Design of the measuring system

#### Compact/remote version design



- A Transmitter housing (compact/remote version)
- B Transmitter housing (remote version)
- C Sensor connection housing (remote version)
- D Transmitter housing side view (compact version)
- a Screw terminal for connecting to potential matching system
- b Remote version connecting cable ( $\rightarrow \stackrel{\triangleright}{=} 9$ )
- c Terminal/electronics compartment cover (see below)
- d Remote version connecting cable ( $\rightarrow \square$  9)

Fig. 2 A0004031

Terminal assignment and connection data  $\rightarrow 10$ 

### Potential matching

## Caution!

- There must be potential matching along the circuits (inside and outside the hazardous area).
- The transmitter must be safely included in the potential matching system by means of the screw terminal (c) on the outside of the transmitter housing or by means of the corresponding ground terminal in the connection compartment (f).
- Alternatively, the sensor and the transmitter (compact version) or the connection housing of the sensor can
  be included in the potential matching system by means of the pipeline if a ground connection, performed
  as per the specifications, is ensured.

#### Cable entries

Cable entries for the connection compartment (XP version): Thread for cable entry  $\frac{1}{2}$ "-NPT

## Connecting cable cable specifications

The sensor cable connection between the sensor and the transmitter has intrinsically safe explosion protection.

The maximum capacitance per unit length of the cable connection is  $300\mu F/\text{ft}$  (1  $\mu F/\text{km}$  ).

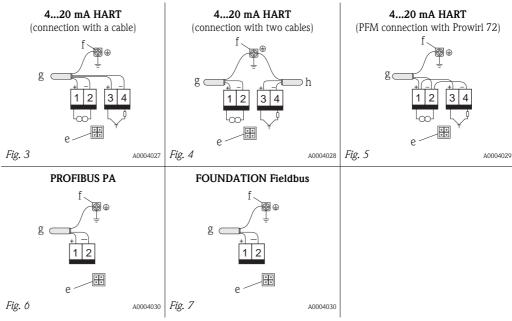
The maximum inductance of the cable is 0.3 mH/ft (1 mH/km).

The cable supplied by Endress+Hauser (max. 98 ft (30 m)) complies with these values.



#### **Electrical connections**

#### Connection compartment (terminal assignment, see tables on $\rightarrow \stackrel{\triangle}{=} 10$ )



- e Service connector (→ 🖹 11)
- f HART ground terminal: if the potential matching is routed via the cable and if two cables are used, both cables must be connected to the potential matching system if a connection is not already established externally. PROFIBUS and FOUNDATION Fieldbus: between the stripped fieldbus cable and the ground terminal, the cable shielding must not exceed 2" in length
- g HART (one cable): cable for supply voltage and/or pulse output HART (two cables): cable for supply voltage PROFIBUS: cable of input and output circuits) FOUNDATION Fieldbus: cable of input and output circuits
- h Optional pulse/frequency output, can also be operated as a status output (not for PROFIBUS PA and FOUNDATION Fieldbus)

#### Note!

PFM output (pulse/frequency modulation) for Prowirl 73: connection as illustrated in  $\rightarrow \bigcirc$  3 or  $\rightarrow \bigcirc$  4; only together with flow computer RMC or RMS 621

## Connecting the supply voltage or signal cable

The terminal assignment and the connection data for the supply voltage are identical for all devices, regardless of the device version (type code).

#### Note!

A graphic illustration of the electrical connections is provided on  $\rightarrow \stackrel{\text{\tiny le}}{=} 10$ .

#### Terminal assignment /connection data

	Terminals	1 (+)	2 (–)	3 (+)	4 (-)
Prowirl 72***-*********A Prowirl 72***-*********W	Terminal designation	Transmitter po	11 )		onal tus output
Prowirl 73****_*********A Prowirl 73****_*********W	Safety-related values	$\leq$ 36 V ( $U_{\rm m}$	ax = 250 V)	≤ 36 V (U <sub>m</sub>	<sub>ax</sub> = 250 V)

	Terminals	1 (+)	2 (-)
Prowirl 72****_***********	Terminal designation	FOUNDATI	ON Fieldbus
Prowirl 73****_********************************	Safety-related values	U = 36 V (U <sub>max</sub> = 250 V)	

	Terminals	1 (+)	2 (-)
Prowirl 72****_*******	Terminal designation	PROFII	BUS PA
Prowirl 73****_*******K	Safety-related values	$U = (U_{max} =$	



#### Service connector

The service connector (for connection, see  $\rightarrow \bigcirc 3... \rightarrow \bigcirc 7$ , e) is only used to connect service interfaces approved by Endress+Hauser.

Only the "PROLINE EX TWO-WIRE CABLE" connecting cable can be used to connect a Prowirl 72 or 73 with the service interface FXA 193.

⚠ Warning!

The service connector may not be connected in a potentially explosive atmosphere.

#### Technical data

#### **Dimensions**

The dimensions of the Ex transmitter housing and the sensor correspond to the standard versions. Please refer to the Technical Information for these dimensions.

Note!

Associated "Technical Information": Prowirl 72F, 72W, 73F, 73W  $\rightarrow$  TI070D

#### Control drawings

Endress+Hauser Reinach hereby declares that the product is in conformity with the requirements of the FACTORY MUTUAL standards.

Note:

The "Documentation/Important Information" folder provided with the measuring device contains a CD-ROM with all the Control Drawings.





















## Safety Instructions

## Proline Prowirl 72, 73

## XP (Ex-d version)

## Division 1



#### This document is an integral part of the following Operating Instructions:

- BA084D, Proline Prowirl 72 HART
- BA085D, Proline Prowirl 72 PROFIBUS PA
- BA095D, Proline Prowirl 72 FOUNDATION Fieldbus
- BA094D, Proline Prowirl 73 HART
- BA093D, Proline Prowirl 73 PROFIBUS PA
- BA096D, Proline Prowirl 73 FOUNDATION Fieldbus

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#### General warnings

- Any national regulations pertaining to the installation of devices in hazardous areas must be observed.
- Mounting, electrical installation, commissioning and maintenance of the devices may only be performed by technical staff trained in the area of explosion protection.
- Compliance with all of the technical data of the device (see nameplate) is mandatory.

#### Special conditions

■ The device must be integrated into the potential equalization system. Potential must be equalized along the intrinsically safe sensor circuits. Further information can be found in the "Potential equalization" chapter on → 19.

#### Installation instructions

- The cable entries and openings not used must be sealed tight with suitable components.
- The measuring device must only be used in the permitted temperature class.
  The values of the individual temperature classes can be found in the temperature tables on → 17.
- The manufacturer's specifications for all devices connected to the intrinsically safe circuits must be taken into consideration.
- To rotate the transmitter housing, please follow the same procedure as for non-Ex versions. The transmitter housing may also be rotated during operation.
- The continuous service temperature of the cable must correspond at least to the temperature range of -40 °C to +10 °C above the ambient temperature present (-40 °C ... ( $T_a + 10$  °C)).
- All equipment of the measuring system must be included in potential matching (see  $\rightarrow \triangleq 20$ ).
- The devices may only be used for fluids against which the wetted materials are sufficiently resistant.
- The service connector may not be connected in a potentially explosive atmosphere.
- Install per National Electrical Code. Install intrinsically safe circuits per CEC and ISA RP 12.6 respecting the
  explosionproof integrity of the enclosure.

#### **Approvals**

#### General

The system meets the basic safety and health requirements for the design and construction of devices and protection systems designated for use in hazardous areas in accordance with the Canadian Electrical Code.

#### Certification number

160686-135901

#### Inspection authority

CSA: Canadian Standards Association

#### Identification

The system identification must contain the following information:

Compact version and remote version (transmitter and sensor)					
Prowirl 72***_*****P****A Prowirl 72***_****P****W Prowirl 72***_*****P*****H Prowirl 72***_************************* Prowirl 73***_*********************************	Cl. I, Div. 1 Groups ABCD Cl. II, Div. 1 Groups EFG Cl. III Cl. I, Zone 1 Group IIC				



The installation instructions for the safe use and application of the system must be observed  $\rightarrow \stackrel{\triangle}{=} 14$ .



## Description of the measuring system

The measuring system consists of a transmitter and a sensor. Two versions are available:

- Compact version:
- The transmitter and sensor form a mechanical unit.
- Remote version:

The transmitter and sensor are mounted separate from one another and interconnected by means of a connecting cable (see also Operating Instructions, "Electrical connections" (Page 11) and "Cable specifications for connecting cable" (Page 13).

#### Device identification

The nameplates, which are provided on the transmitter and sensor in a manner in which they are clearly visible, contain all the relevant information on the measuring system.

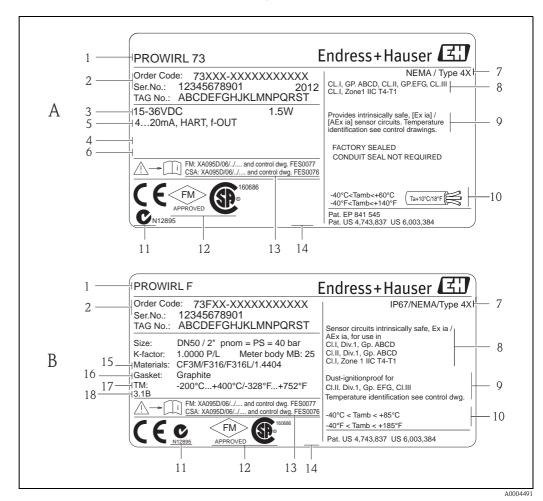


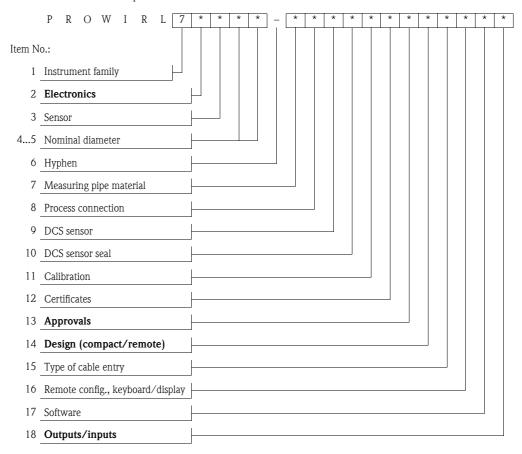
Fig. 8: Example for nameplates of a transmitter and a sensor

- A Transmitter nameplate
- B Sensor nameplate
- 1 Transmitter or sensor type
- 2 Order code and serial number
- 3 Power supply, frequency and power consumption
- 4 Additional specifications (only if present)
- 5 Available inputs/outputs
- 6 Space for additional information on special products
- 7 Identification of the type of protection, explosion group, temperature class, Ingress protection
- 8 Type of housing protection
- 9 Space for notes, e.g. delays, etc. (only if necessary)
- 10 Ambient temperature range
- 11 C-Tick symbol
- 12 Label of notified body: FACTORY MUTUAL standard
- 13 Associated Ex documentation for explosion protected devices
- 14 Space for other approval specifications and certificates, e.g. PROFIBUS, etc. (only if present)
- 15 Material tube/sensor
- 16 Seal material
- 17 Fluid temperature range
- 18 Additional information, e.g. 3.1 = 3.1 certificate for wetted materials



### Type code

The type code describes the exact design and equipment level of the measuring system. It can be read off the nameplate of the transmitter and sensor and is structured as follows:



#### Electronics (Item No. 2 in type code $\rightarrow \stackrel{\triangleright}{=} 16$ )

*	Transmitter	Electronics/housing
2	Prowirl 72	■ Intrinsically safe transmitter electronics
3	Prowirl 73	<ul> <li>Transmitter housing of connection compartment with XP explosion protection</li> </ul>

### Approvals (Item No. 13 in type code)

*	Approval	Sensor	Compact	Remote
P	Cl. I, Div. 1 Groups ABCD Cl. II, Div. 1 Groups EFG Cl. III Cl. I, Zone 1 Group IIC	Prowirl F Prowirl W	DN 15300 DN 15150	DN 15300 DN 15150



#### Type (compact/remote; Item No. 14 in type code $\rightarrow \stackrel{\triangle}{=} 16$ )

C.I. I, Div. 1 Groups ABCD C.I. II, Div. 1 Groups EFG C.I. III C.I. III C.I. I, Zone 1 Group IIC  Transmitter  C.I. II, Div. 1 Groups ABCD C.I. II, Div. 1 Groups ABCD C.I. II, Div. 1 Groups ABCD C.I. II, Div. 1 Groups EFG C.I. III C.I. I, Div. 1 Groups EFG C.I. III C.I. I, Zone 1 Group IIC  Sensor  C.I. I, Div. 1 Groups ABCD C.I. II, Div. 1 Groups EFG C.I. III C.I. I, Zone 1 Group IIC  Sensor  C.I. I, Div. 1 Groups ABCD C.I. II, Div. 1 Groups EFG C.I. III C.I. I, Zone 1 Group IIC Outputs/inputs A/W 1): T1-T6  Outputs/inputs A/W 1): T1-T6	*	Туре	Application/zone			
Cl. I, Div. 1 Groups ABCD Cl. II, Div. 1 Groups EFG Cl. III Cl. I, Zone 1 Group IIC  Sensor  Cl. I, Div. 1 Groups EFG Outputs/inputs A/W 1): T1-T6 Cl. I, Zone 1 Group IIC  Sensor  Cl. I, Div. 1 Groups ABCD Cl. II, Div. 1 Groups ABCD Cl. II, Div. 1 Groups EFG Cl. III, Div. 1 Groups EFG Cl. III Cl. I, Zone 1 Group IIC Outputs/inputs A/W 1): T1-T6	А, Ј	Compact	Cl. II, Div. 1 Groups EFG Cl. III	Outputs/inputs A/W <sup>1)</sup> : T1-T6 Outputs/inputs H/K <sup>1)</sup> : T1-T4		
E, F, K, L  Remote  CI. II, Div. 1 Groups EFG CI. III CI. I, Zone 1 Group IIC  Sensor  CI. I, Div. 1 Groups ABCD CI. II, Div. 1 Groups ABCD CI. II, Div. 1 Groups EFG CI. III, Div. 1 Groups EFG CI. III CI. I, Zone 1 Group IIC Outputs/inputs A/W 1): T1-T6			Transmitter			
E, F, K, L  Remote  Prowirl F Prowirl W  DN 15300 (1/2"12") Prowirl W  DN 15150 (1/2"6")  CI. I, Div. 1 Groups ABCD CI. II, Div. 1 Groups EFG CI. III CI. I, Zone 1 Group IIC Outputs/inputs A/W 1): T1-T6		F, K, L Remote  CI. II, Div. 1 Groups EFG CI. III CI. I, Zone 1 Group IIC  Sensor  Prowirl F DN 15300 (	Cl. II, Div. 1 Groups EFG Cl. III	Outputs/inputs A/W <sup>1)</sup> : T1-T6 Outputs/inputs H/K <sup>1)</sup> : T1-T4		
Prowirl F DN 15300 (1/2"12") Prowirl W DN 15150 (1/2"6")  Cl. I, Div. 1 Groups ABCD Cl. II, Div. 1 Groups EFG Cl. III Cl. I, Zone 1 Group IIC Outputs/inputs A/W <sup>1)</sup> : T1-T6			Sensor			
	E, F, K, L			Cl. II, Div. 1 Groups EFG Cl. III Cl. I, Zone 1 Group IIC		

#### Outputs/inputs (Item No. 18 in type code $\rightarrow \stackrel{\triangle}{=} 16$ )

*	Approval	
A, W	Cl. I, Div. 1 Groups ABCD Cl. II, Div. 1 Groups EFG Cl. III Cl. I, Zone 1 Group IIC	Temperature Class: T1-T6
Н, К	Cl. I, Div. 1 Groups ABCD Cl. II, Div. 1 Groups EFG Cl. III Cl. I, Zone 1 Group IIC	Temperature Class: T1-T4

#### Note!

A detailed explanation of these values with regard to the inputs and outputs available, as well as a description of the associated terminal assignments and connection data is provided on  $\rightarrow 19$  onwards.

## Compact version temperature table

Maximum fluid temperature [°C] depending on the ambient temperature  $T_a$  and the DSC sensor used (Item No. 9 in the type code  $\rightarrow \stackrel{\cong}{=} 16$ ).

	T <sub>a</sub>	T6 (85 °C)	T5 (100 °C)	T4 (135 °C)	T3 (200 °C)	T2 (300 °C)	T1 (450 °C)
Prowirl 72***-**0******	−40 °C +40 °C	80	95	130	195	280	280
Prowin 72""-"0"""	−40 °C +60 °C	_	95	130	195	280	280
Prowirl 72***-**1******** Prowirl 72***-**2******* Prowirl 72***-**3********	−40 °C +40 °C	80	95	130	195	290	440
Prowirl 72***-**6******** Prowirl 73***-**4****** Prowirl 73***-*7*******	−40 °C +60 °C	_	95	130	195	290	440

Dependency of the minimum fluid temperature  $T_{\mbox{\scriptsize med}}$  on the DSC sensor:

T <sub>med</sub> -200 °C	T <sub>med</sub> -50 °C	T <sub>med</sub> –40 °C
Prowirl 72***-**1*******	Prowirl 72F***-**6*******	Prowirl 72***-**0*******
Prowirl 72***-**2*******		
Prowirl 72***-**3*******		
Prowirl 73***-**4*******		
Prowirl 73***-**7*******		

#### ⚠ Warning!



## Remote version temperature table

#### Sensor

Maximum fluid temperature [°C] depending on the ambient temperature  $T_a$  and the DSC sensor used (Item No. 9 in the type code  $\rightarrow \stackrel{\cong}{=} 16$ ):

	T <sub>a</sub>	T6 (85 °C)	T5 (100 °C)	T4 (135 °C)	T3 (200 °C)	T2 (300 °C)	T1 (450 °C)
Prowirl 72***-**0*******	−40 °C +40 °C	80	95	130	195	280	280
	−40 °C +60 °C	_	95	130	195	280	280
	−40 °C +85 °C	_	_	130	195	280	280
Prowirl 72***-**1******** Prowirl 72***-**2*******	−40 °C +40 °C	80	95	130	195	290	440
Prowirl 72***-**3******** Prowirl 72***-**6*******	−40 °C +60 °C	1	95	130	195	290	440
Prowirl 73***-**4******** Prowirl 73***-*7*******	−40 °C +85 °C	_	_	130	195	290	440

Dependency of the minimum fluid temperature  $T_{\mbox{\footnotesize{med}}}$  on the DSC sensor:

T <sub>med</sub> -200 °C	T <sub>med</sub> -50 °C	T <sub>med</sub> -40 °C
Prowirl 72***-**1******** Prowirl 72***-**2******* Prowirl 72**-**3******* Prowirl 73***-**4****** Prowirl 73***-**7******	Prowirl 72F***-**6*******	Prowirl 72***-**0*******

#### $\triangle$ Warning!

#### Transmitter

The minimum ambient temperature is -40 °C.

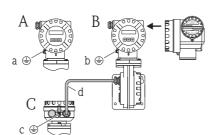
The maximum ambient temperature [°C] depending on the device used is:

	T6 (85 °C)	T5 (100 °C)	T4 (135 °C)	T3 (200 °C)	T2 (300 °C)	T1 (450 °C)
Prowirl 72***_***********A Prowirl 72***_***********W Prowirl 73***_*************A Prowirl 73***_*********************************	40	60	60	60	60	60
Prowirl 72***-*********************************	_	-	60	60	60	60



#### Design of the measuring system

#### Compact/remote version design



- Transmitter housing (compact/remote version)
- Transmitter housing (remote version)
- CSensor connection housing (remote version)
- Transmitter housing side view (compact version)
- Screw terminal for connecting to potential matching system
- Remote version connecting cable (see also  $\rightarrow 19$ ) b
- Terminal/electronics compartment cover (see below)
- Remote version connecting cable (see also  $\rightarrow 19$ )

Fig. 9 A0004031

Terminal assignment and connection data  $\rightarrow \stackrel{\triangle}{=} 20$ 

### Potential matching



## Caution!

- There must be potential matching along the circuits (inside and outside the hazardous area).
- The transmitter must be safely included in the potential matching system by means of the screw terminal (c) on the outside of the transmitter housing or by means of the corresponding ground terminal in the connection compartment (f).
- Alternatively, the sensor and the transmitter (compact version) or the connection housing of the sensor can be included in the potential matching system by means of the pipeline if a ground connection, performed as per the specifications, is ensured.

#### Cable entries

Cable entries for the connection compartment (XP version): Thread for cable entry 1/2"-NPT

#### Connecting cable cable specifications

The sensor cable connection between the sensor and the transmitter has intrinsically safe explosion protection.

The maximum capacitance per unit length of the cable connection is  $1\mu F/km$ .

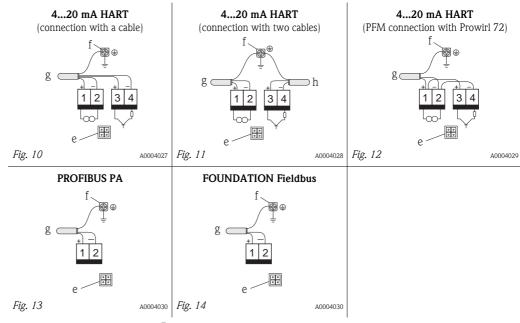
The maximum inductance of the cable is 1 mH/km.

The cable supplied by Endress+Hauser (max. 30 m) complies with these values.



#### **Electrical connections**

#### Connection compartment (terminal assignment, see tables on $\rightarrow \stackrel{\triangle}{=} 20$ )



- $e \quad \textit{Service connector (see also} \rightarrow \ \stackrel{\triangle}{=}\ 21)$
- f HART ground terminal: if the potential matching is routed via the cable and if two cables are used, both cables must be connected to the potential matching system if a connection is not already established externally. PROFIBUS and FOUNDATION Fieldbus: between the stripped fieldbus cable and the ground terminal, the cable shielding must not exceed 5 mm (2") in length
- g HART (one cable): cable for supply voltage and/or pulse output HART (two cables): cable for supply voltage PROFIBUS: cable of input and output circuits) FOUNDATION Fieldbus: cable of input and output circuits
- h Optional pulse/frequency output, can also be operated as a status output (not for PROFIBUS PA and FOUNDATION Fieldbus)

#### Note!

PFM output (pulse/frequency modulation) for Prowirl 73: connection as illustrated in  $\rightarrow \bigcirc 10$  or  $\rightarrow \bigcirc 11$ ; only together with flow computer RMC or RMS 621

## Connecting the supply voltage or signal cable

The terminal assignment and the connection data for the supply voltage are identical for all devices, regardless of the device version (type code).

#### Note!

A graphic illustration of the electrical connections is provided on  $\rightarrow \stackrel{\text{\tiny $\square$}}{=} 20$ .

#### Terminal assignment /connection data

	Terminals	1 (+)	2 (-)	3 (+)	4 (-)
Prowirl 72****_*********A Prowirl 72****_********************************	Terminal designation	Transmitter power supply / 420 mA HART		Optional pulse/status output	
Prowirl 73****_********************************	Safety-related values	≤ 36 V (U <sub>m</sub>	<sub>ax</sub> = 250 V)	≤ 36 V (U <sub>m</sub>	<sub>ax</sub> = 250 V)

	Terminals	1 (+)	2 (-)	
Prowirl 72****_********************************	Terminal designation	FOUNDATION Fieldbus		
	Safety-related values	U = 36 V (U <sub>max</sub> = 250 V)		

	Terminals	1 (+)	2 (-)
Prowirl 72****_***********K Prowirl 73****_*********K	Terminal designation	PROFIBUS PA	
	Safety-related values	U = 36  V $(U_{\text{max}} = 250 \text{ V})$	



#### Service connector

The service connector (for connection, see  $\rightarrow \square 10... \rightarrow \square 14$ , e) is only used to connect service interfaces approved by Endress+Hauser.

Only the "PROLINE EX TWO-WIRE CABLE" connecting cable can be used to connect a Prowirl 72 or 73 with the service interface FXA 193.

⚠ Warning!

The service connector may not be connected in a potentially explosive atmosphere.

#### Technical data

#### **Dimensions**

The dimensions of the Ex transmitter housing and the sensor correspond to the standard versions. Please refer to the Technical Information for these dimensions.

Note!

Associated "Technical Information": Prowirl 72F, 72W, 73F, 73W  $\rightarrow$  TI070D

#### Control drawings

Endress+Hauser Reinach hereby declares that the product is in conformity with the requirements of the CANADIAN STANDARDS ASSOCIATION.

Note!

The "Documentation/Important Information" folder provided with the measuring device contains a CD-ROM with all the Control Drawings.





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