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1 NAMEN

Ta testna navodila predstavljajo osnovne in funkcionalne preizkuse elektro in I&C vgrajene opreme.

2 REFERENCES

- Interim drawings provided in DMP Section H
- ADP-1.0.131 Organizacija izvedbe modifikacije
- ADP-1.0.500 Program protipožarne zaščite – Požarni red
- ADP-1.1.033 Varnost in zdravje pri delu v nuklearni elektrarni Krško
- ADP-1.1.051 Vstop, izstop in gibanje v tehnološkem delu NEK
- ADP-1.1.122 Izdaja, priprava in planiranje delovnega naloga
- ADP-1.1.125 Izvedba delovnega naloga
- ADP-1.14.221 Varstvena pravila in ukrepi pri delu pred nevarnostjo električnega toka
- ADP-1.15.009 Delovni čas
- ADP-1.2.029 Nadzor in postavljanje EAM-MECL oznak
- ADP-1.3.004 Osamitev opreme
- ADP-1.8.005 Vstop delavcev zunanjih izvajalcev v NEK
- FPP-3.7.002 Postopanje v primeru požara
- GME-4.042 Postopek za montažo kablov in vodnikov
- GME-4.043 Postopek za spajanje kablov in vodnikov

3 ODGOVORNOSTI

Odgovorna podjetja:

- | | |
|--------------------------|-------|
| • Naročnik / Investitor: | NEK |
| • Projektant | SIPRO |
| • Izvajalec | TBD |

Odgovorne osebe:

- | | |
|----------|-------------------|
| • NEK RE | Petan / P. Zakšek |
|----------|-------------------|

- SIPRO RE
- Izvajalec
-

R. Mlakar

TBD

4 SPLOŠNE ZAHTEVE

Odgovorne osebe morajo biti dobro seznanjene z DMP-jem, dejstvom, in da se tu opisani testi izvajajo med normalnim obratovanjem NEK.

Vsi izvajalci del morajo biti seznanjeni z varnostjo pri delu na področju NEK in specifikami glede gibanja po NEK ter podobnimi elementi, ki niso aplikabilni za druga gradbišča. Vodje del morajo biti za to dodatno usposobljeni, kar pomeni poleg izpolnjevanja zahtev GZ tudi NEK predpise.

Za zagotovitev kakovosti del je potrebno dela izvajati v skladu s temi navodili. Za morebitna odstopanja je potrebno obvestiti in pridobiti soglasje od odgovornih oseb.

Podrobnejše podrobnosti izvedbe testnih del, vključno s terminskimi plani, plani osebja, opreme, itd. so predmet instalacijskega paketa.

Zahteve za kakovost

QA in QC osebje mora biti med izvedbo testiranj nenehno prisotno, kajti zadolženo je za hranjenje vseh iz testiranj izhajajočih zapisov in testi morajo biti preverjeni 100%.

Kakovosti del se zagotavlja s tem, da se dela izvedejo po preverjenih in odobrenih testnih navodilih, risbah, delovnih navodilih in navodilih proizvajalcev opreme.

QA in QC osebje je zadolženo, da preverja popolnost vseh izvedenih inštalacij.

Vsi položeni kabli morajo biti preverjeni glede kontinuitete in izolacijske trdnosti po zahtevah postopkov GME-4.042 in GME-4.043.

5 PREDPOGOJI

Pred začetkom del je potrebno upoštevati sledeče:

- DMP je izdan, pregledan in potrjen
- Pripravljeni in potrjeni so vsi delovni nalogi
- Vso izvajalsko osebje je definirano in usposobljeno za nameravana dela
- Vodja izmene NEK je odobril dela
- QA in QC inšpektorji so seznanjeni s planom testiranj
- Instalacijska dela so izvedena oziroma, če gre za preverjanje po fazah, je posamezna faza del izvedena do te točke, da je možno pričeti s preverjanjem posamične faze

Testna skupina mora vključevati naslednje osebe:

- Vodja testiranja
- Tehniki za testiranje
- Odgovorni inženir NEK
- Odgovorna ING.PI in TO.VZIC
- Drugo osebje po potrebi
- Vzpostavljena zahtevana komunikacija med testiranim območjem opreme

6 OPOZORILA IN OMEJITVE

Upošteva naj se postopek ADP-1.1.033 »Varstvo pri delu«, zakonodaja in pravilniki s področja varnosti pri delu ter vsa navodila dobaviteljev opreme ali delovnih sredstev, ki se nanašajo na to področje.

Pri izvedbi testnih del se bo večkrat primerilo, da bodo dela izvajana v bližini/prisotnosti nevarnih električnih napetosti. Ob teh delih je še posebej potrebno preveriti in zagotoviti usposobljenost osebja in izvajanje vseh ukrepov za varno delo.

7 POSEBNA ORODJA IN OPREMA

Predvidena je standardna oprema in orodja, kot opisano v GME-4.042, GME-4.043 in GME-4.305. Posebna orodja ali postopki so lahko predpisani v dokumentih dobaviteljev opreme.

Potrebuje se:

- Portable 4 ½ digit DMM, Fluke 8060A or equivalent;
- transmitter simulator /Variable voltage source, Transmation 1040 or equivalent,
- multifunction Calibrator, Scandura B20 or equivalent,
- Priročno orodje.

Nekateri testi predvidevajo delo oseb v parih ali ekipah, ki testirajo na različnih krajih objekta.

Potrebno je zagotoviti komunikacijo med ekipami – npr. radio zveza.

8 POSTOPEK TESTNIH DEL

8.1 TESTIRANJE OMARE EE106PNLA701

8.1.1.1 Pred instalacijo omare v field-u, omaro je potrebno testirati v delavnici.

8.1.1.2 Pred testiranjem je potrebno na W100PLC-A100 konfigurirati vse vhodno in izhodne zanke. Potrebno je narediti in ostale nastavitve in parametrisiranja kot so: nastavitve merilnih območij za instrumentacijo, nastavitve alarmov, nastavitve izhodnih funkcij, logika krmiljenja in vse ostale potrebne nastavitve za pravilno funkcioniranje PLC-ja in pravilno prikazovane na zaslonu PLC-ja.

8.1.1.3 Na vhodnih sponkah je potrebno simulirati vse vhodne signali in preveriti pravilni odziv meritvi na zaslonu, pravilno aktivacijo alarmov in pravilno aktiviranje izhodnih signala.

8.1.1.4 QC Inšpektor zabeleži rezultate testa in ga hrani kot zapis (zapis QC) za TOP

Izvedel: _____ Preveril: _____

8.2 NASTAVITVE LT9722

8.2.1.1 Pred instalacijo merilnika nivoja v bazen je potrebno narediti nastavitve merilnika v delavnici v skladu s Prilogo 1.

Izvedel: _____ Preveril: _____

Referenčni načrti
Priloga 1

8.3 NASTAVITVE AIT9724

8.3.1.1 Pred instalacijo analizatorja v field-u je potrebno narediti nastavitve analizatorja v delavnici v skladu s Prilogo 2.

Izvedel: _____ Preveril: _____

Referenčni načrti
Priloga 2

8.4 IZOLACIJSKA UPORNOST (MEGGER)

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8.4.1.1 Test izolacijske upornosti se izvede za novo položene kable v skladu z navodilom podanim v GME-4.042 »Postopek za montažo kablov in vodnikov«.

8.4.1.2 QC Inšpektor Zabeleži rezultate testa na kopijo CIRCUIT SCHEDULE vsakega kabla in ga hrani kot zapis (zapis QC) za TOP

8.4.1.3 8.3.1.3 Izolacijska upornost se preskusi med:

- ozemljitev in vsi vodniki,
- ozemljitvena in zaščitna/odtočna žica,
- prevodniki drug drugega,
- vodniki in oklopna/odtočna žica.

8.4.1.4 QC Inšpektor Zabeleži rezultate testa na kopijo CIRCUIT SCHEDULE vsakega kabla in ga hrani kot zapis (zapis QC) za TOP

8.4.1.5 8.3.1.6 Preverjanje izolacijske upornosti se izvede za naslednje kable v skladu z CIRCUIT SCHEDULE.

8.4.1.6 Kabli morajo biti odklopljeni na obeh straneh.

Testirajo se naslednji kabli:

- 1FDK1034X
- 1FDK1035X
- 1FDK1036X
- 1FDK1037X
- 1FDK1038X
- 1FDK1039X
- 1FDK1040X
- 1FDK1041X
- 1FDK1040X
- 1FDK1042X
- 1FDK1043X
- 1FDK1044X
- 1FDK1045X
- 1FDK1046X

Izvedel: _____

Preveril: _____

Referenčni načrti
S-212 serija

8.5 PREVERJANJA NEPREKINJENOSTI KABLA

8.5.1.1 Prekinjenost kablov je treba preveriti z digitalnim multimetrom (DMM) in v skladu s postopkom GME-4.042. Vzpostaviti je treba komunikacijo med poljem in kontrolno

omaro. Preizkušani vodniki so na eni strani kabla premoščeni, na drugi strani pa se za preverjanje neprekinjenosti uporabi digitalni multimetr.

8.5.1.2 Prekinjenost se preveri po namestitvi priključkov ali katerega koli drugega priključnega materiala.

8.5.1.3 Pred preskusom namestite potrebne mostičke. Po preskusu je treba kabel priključiti na obeh straneh (From & To).

Referenčni načrti
S-212 serija

8.6 Test smeri vrtnje motorja »bump test«

8.6.1 Za preverjanje pravilnega vrtenja črpalke je treba izvesti "bump test". Motor je treba začasno zagnati s stikalom za ročni start črpalke v položaju "MANUAL" in varovalko motorja na EE106PNLA701. Vrtenje motorja je treba vizualno preveriti, ali se ujema z oznako na ohišju. Pomembno je, da se tak preizkus izvede ločeno od obremenitve in da je pogostost ponovnih zagonov v skladu z navodili proizvajalca.

8.6.2 Če vrtenje motorja ni pravilno, je treba preizkus ustaviti in ponovno preveriti vse ožičenje ter odpraviti napake/opustitve.

Izvedel: _____

Preveril: _____

Referenčni načrti
B-208-060 sh 22

8.7 Testiranje analognih vhodov v to PLC

8.7.1 Instrumenti so bili kalibrirani v delavnici ali prostorih proizvajalca opreme in dodatna kalibracija v field-u ni potrebna. QC inšpektorji morajo zbrati certificirane kalibracijske liste za kasnejšo uporabo. V skladu s tem navodilom se mora simulirati signal (4–20 mA) iz instrumenta in preveriti pravilna indikacija in alarma na zaslonu PLC-ja v omari.

8.7.2 Analogni vhodni signali iz field-a v PLC se morajo izvesti s simulacijo 0–50–100 % signala in s preverjanjem pravilne indikacije na zaslonu na omari in v skladu s shemo ožičenja analogne vhodne zanke – načrti serije 816-364. Prav tako se v skladu s tem navodilom preizkusi aktivacija alarma LO in/ali HI s simulacijo nastavljenih vrednosti za alarm LO in HI.

LT9722

Izhodni signal: 4-20 mA
Merilno območje: 0-1090 mm

LO-LO alarm (zaščita črpalke): 250 mm, 7,67mA
LO alarm (start črpalke) 330 mm, 8,84 mA
HI alarm (izklop črpalke): 970 mm, 18,24 mA
HI-HI alarm 1080 mm, 19,85 mA
0% 4 mA, 0 mm vode
50% 12 mA, 545 mm vode
100% 20 ma, 1090 mm vode

AIT9724

Izhodni signal: 4-20 mA
Merilno območje: xx to xx mV
0% 4 mA, xx mV
50% 12 mA, xx mV
100% 20 mA, xx mV

FIT9721

Izhodni signal: 4-20 mA
Merilno območje: 0-20 m³/h
0% 4mA, 0 m³/h
50% 12mA, 10 m³/h
100% 20mA, 20 m³/h

TT9723

Izhodni signal: 4-20 mA
Merilno območje: 0-50 °C
0% 4 mA, 0°C
50% 12 mA, 0°C
100% 20 mA, 0°C

Izvedel: _____

Preveril: _____

Referenčni načrti
816-364 serija

8.8 Testiranje digitalnih vhodov (process) switches v PLC

8.8.1 Prosess switches (digitalni vhodni signali) iz field-a v PLC se izvede z nastavitvijo vrednosti 0 in vrednosti 1 ter preverjanjem pravilne aktivacije alarma LO in/ali HI na zaslonu PLC-ja v skladu z shemo ožičenja digitalne vhodne zanke 816-364.

LS9720

Izvedel: _____

Preveril: _____

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816-364 serija

PLANT MODIFICATION

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8.8.2 KONTROLNI SEZNAM TESTNIH DEL

Po izvedbi testnih del je potrebno preveriti, če so bili res izvedeni vsi testi in so vsa referencirana dokumentacija in tukaj navedeni sezname ustrezno verificirani in parafirani.

Točka navodil	Verificiral
8.1	
8.2	
8.3	
8.4	
8.5	
8.6	
8.7	
8.8	

Potrditev zaključka testov:

Z izjemami navedenimi posebej
S »punch listo« odprtih zadev

DA/NE

DA/NE

Preveril: _____
Verificiral: _____
Potrdil: _____

Podpis: _____ Datum: _____
Podpis: _____ Datum: _____
Podpis: _____ Datum: _____

PLANT MODIFICATION

Plant Mod. No. 2024-1061

Rev. No. 0

TESTNA NAVODILA

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9 PRILOGE

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Priloga 2: DULCOMETER Operating Instructions F2.3



Level



Pressure



Flow



Temperature

Liquid
Analysis

Registration

Systems
Components

Services

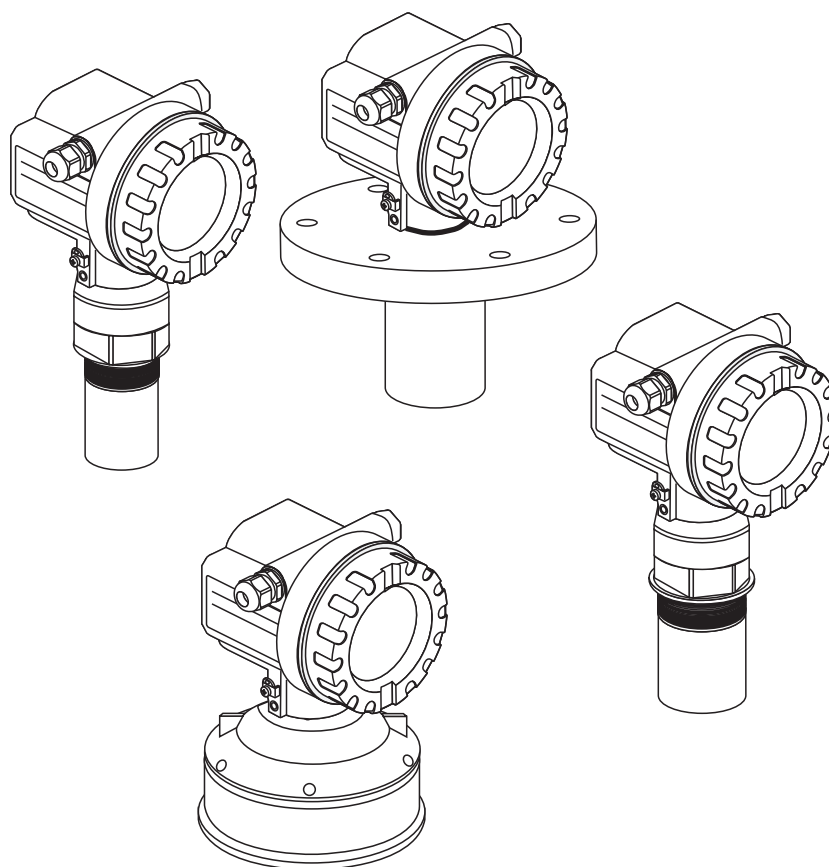


Solutions

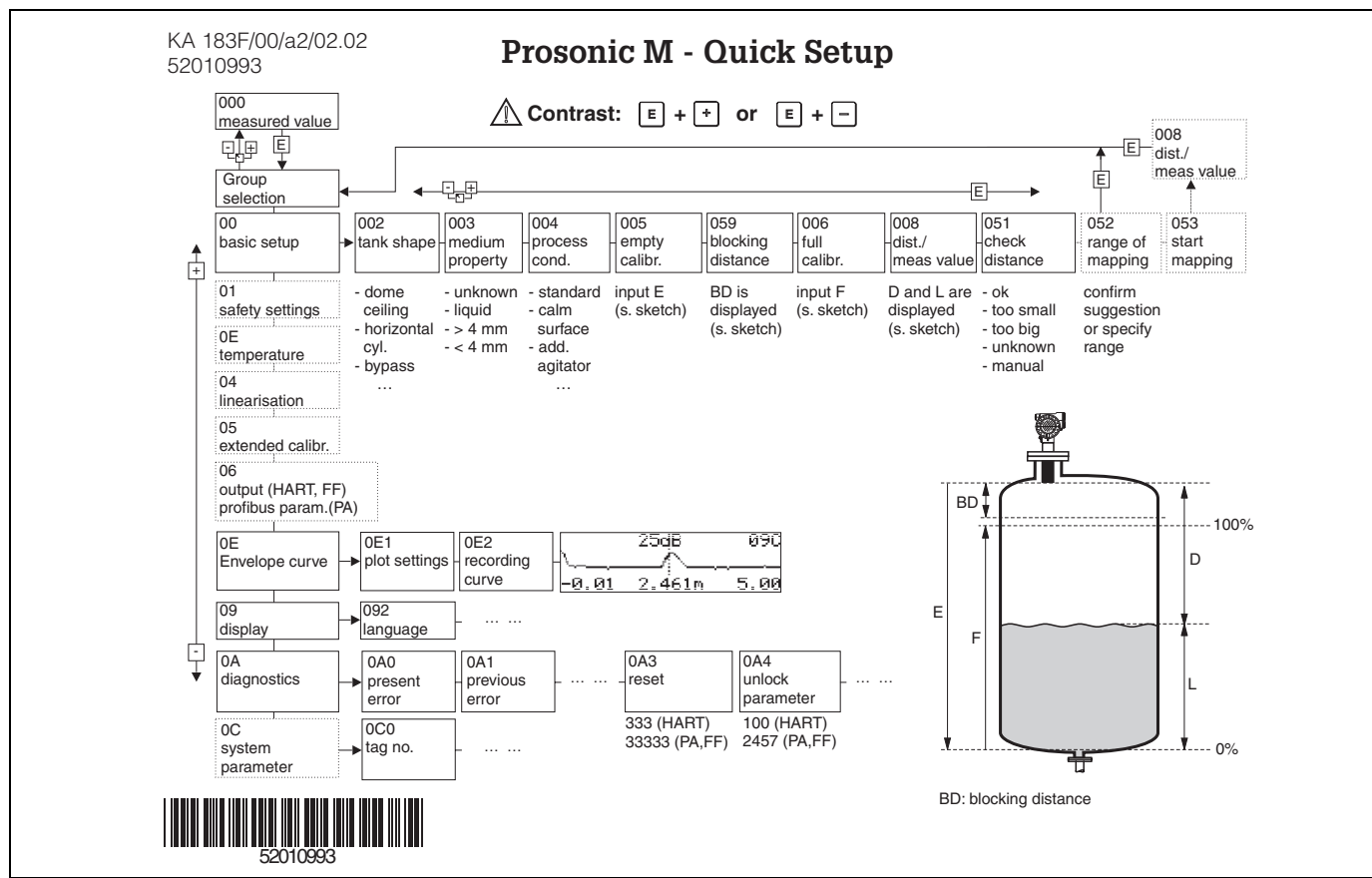
Operating Instructions

Prosonic M FMU40/41/42/43

Ultrasonic Level Measurement



Short instructions



Contents of the operating instructions

This operating instructions describes the installation and commissioning of the Prosonic M ultrasonic level transmitter. It contains all the functions required for a normal measuring operation. Also, the Prosonic M provides additional functions for optimising the measuring point and for converting the measured value. These functions are not included in this operating instructions.

You can find an **overview of all the device functions** in the Appendix.

You can find a **detailed description of all the device functions** in the operating instructions BA 240F/00/en "Prosonic M - Description of Instrument Functions". This is located on the supplied documentation CD-ROM.

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1 Safety instructions

1.1 Designated use

The Prosonic M is a compact measuring device for continuous, non-contact level measurement. Depending on the sensor, the measuring range is up to 15m in fluids and up to 7m in bulk solids. By using the linearisation function, the Prosonic M can also be used for flow measurements in open channels and measuring weirs.

1.2 Installation, commissioning, operation

The Prosonic M is fail-safe and is constructed to the state-of-the-art. It meets the appropriate standards and EC directives. However, if you use it improperly or other than for its designated use, it may pose application-specific hazards, e.g. product overflow due to incorrect installation or configuration. Installation, electrical connection, start-up, operation and maintenance of the measuring device must therefore be carried out exclusively by trained specialists authorised by the system operator. Technical personnel must have read and understood these operating instructions and must adhere to them. You may only undertake modifications or repair work to the device when it is expressly permitted by the operating instructions.

1.3 Hazardous area

Measuring systems for use in hazardous environments are accompanied by separate "Ex documentation", which is an integral part of this Operating Manual. Strict compliance with the installation instructions and ratings as stated in this supplementary documentation is mandatory.

- Ensure that all personnel are suitably qualified.
- Observe the specifications in the certificate as well as national and local standards and regulations.

1.4 Notes on safety conventions and symbols

In order to highlight safety-relevant or alternative operating procedures in the manual, the following conventions have been used, each indicated by a corresponding symbol in the margin.

Safety conventions	
	Warning! A warning highlights actions or procedures which, if not performed correctly, will lead to personal injury, a safety hazard or destruction of the instrument
	Caution! Caution highlights actions or procedures which, if not performed correctly, may lead to personal injury or incorrect functioning of the instrument
	Note! A note highlights actions or procedures which, if not performed correctly, may indirectly affect operation or may lead to an instrument response which is not planned
Explosion protection	
	Device certified for use in explosion hazardous area If the device has this symbol embossed on its name plate it can be installed in an explosion hazardous area
	Explosion hazardous area Symbol used in drawings to indicate explosion hazardous areas. Devices located in and wiring entering areas with the designation "explosion hazardous areas" must conform with the stated type of protection.
	Safe area (non-explosion hazardous area) Symbol used in drawings to indicate, if necessary, non-explosion hazardous areas. Devices located in safe areas still require a certificate if their outputs run into explosion hazardous areas
Electrical symbols	
	Direct voltage A terminal to which or from which a direct current or voltage may be applied or supplied
	Alternating voltage A terminal to which or from which an alternating (sine-wave) current or voltage may be applied or supplied
	Grounded terminal A grounded terminal, which as far as the operator is concerned, is already grounded by means of an earth grounding system
	Protective grounding (earth) terminal A terminal which must be connected to earth ground prior to making any other connection to the equipment
	Equipotential connection (earth bonding) A connection made to the plant grounding system which may be of type e.g. neutral star or equipotential line according to national or company practice
	Temperature resistance of the connection cables States, that the connection cables must be resistant to a temperature of at least 85 °C.

2 Identification

2.1 Nameplate

ENDRESS+HAUSER
PROSONIC-M

Made in Germany
D-79689 Maulburg

Order Code:

Ser.-No.:

IP68 / NEMA 6P

☐ Profibus PA
☐ Foundation Fieldbus
☒ 90 ... 253 V AC 4VA
☐ 10,5 ... 32 V DC 1W
☐ 14 ... 36 V DC 0,8W
☒ 4 ... 20 mA HART

TA > 70°C : ☒ >85°C

CE

☐ 2-wire
☐ 4-wire

☐ X = if modification see sep. label
 Patents →

Dat./Insp.:

D01345-B

100-FM114xxxx-18-00-00-yy-001

1: Order Code; **2:** Serial number; **3:** Designation according to Directive 94/9/EC and designation of the type of protection (only for certified device variants); **4:** Reference to additional safety-relevant documentation (only for certified device variants); **5:** Communication variant and supply voltage (the appropriate option is highlighted)

2.2 Product structure FMU 40

Certificates					
	A				Variant for non-hazardous area
	1				ATEX II 1/2 G or II 2 G; EEX ia IIC T6
	4				ATEX II 1/2 G or II 2 G; EEX d [ia] IIC T6
	G				ATEX II 3G EEx nA II T6
	2				ATEX II 1/2D, Alu blind cover
	5				ATEX II 1/3D
	S				FM IS Cl. I,II,III Div. 1 Gr. A-G / NI Cl. I Div. 2
	T				FM XP Cl. I,II,III Div. 1 Gr. A-G
	U				CSA IS Cl. I,II,III Div. 1 Gr. A-G / NI Cl. I Div. 2
	V				CSA XP Cl. I,II,III Div. 1 Gr. A-G
	N				CSA General Purpose
	K				TIIS Ex ia II C T6
	Y				Special certificate
Process connection					
	R				G 1½" thread ISO 228
	N				NPT 1½" - 11,5 thread
	Y				Special version
Power supply/communication					
	B				2 wire, 4...20mA-loop/HART
	H				4 wire, 10,5...32VDC / 4-20mA HART
	G				4 wire, 90...253VAC / 4-20mA HART
	D				2 wire, PROFIBUS PA
	F				2 wire, Foundation Fieldbus
	Y				Special version
Display / on-site operation					
	1				Without LC display
	2				With LC display VU 331 incl. on-site operation
	3				Prepared for remote display FHX 40
	9				Special version
Housing					
	A				Aluminium F12 housing coated to IP 68
	C				Aluminium T12 housing coated to IP 68; with separate terminal compartment
	D				Aluminium T12 housing coated to IP 68; with separate terminal compartment; with overvoltage protection
	9				Special version
Screw union/entry					
	2				M20x1.5 screw union
	3				G 1/2" entry
	4				NPT 1/2" entry
	5				M12 PROFIBUS-PA plug-in connector
	6				7/8" FF plug
	9				Special version
FMU 40 -					Product designation

2.3 Product structure FMU 41

Certificates					
A	Variant for non-hazardous area				
1	ATEX II 1/2 G or II 2 G; EEX ia IIC T6				
4	ATEX II 1/2 G or II 2 G; EEX d [ia] IIC T6				
G	ATEX II 3G EEx nA II T6				
2	ATEX II 1/2D, Alu blind cover				
5	ATEX II 1/3D				
S	FM IS Cl. I,II,III Div. 1 Gr. A-G / NI Cl. I Div. 2				
T	FM XP Cl. I,II,III Div. 1 Gr. A-G				
U	CSA IS Cl. I,II,III Div. 1 Gr. A-G / NI Cl. I Div. 2				
V	CSA XP Cl. I,II,III Div. 1 Gr. A-G				
N	CSA General Purpose				
K	TIIS Ex ia II C T6				
Y	Special certificate				
Process connection					
R	G 2" thread ISO 228				
N	NPT 2" - 11,5 thread				
Y	Special version				
Power supply/communication					
B	2 wire, 4...20mA-loop/HART				
H	4 wire, 10,5...32VDC / 4-20mA HART				
G	4 wire, 90...253VAC / 4-20mA HART				
D	2 wire, PROFIBUS PA				
F	2 wire, Foundation Fieldbus				
Y	Special version				
Display / on-site operation					
1	Without LC display				
2	With LC display VU 331 incl. on-site operation				
3	Prepared for remote display FHX 40				
9	Special version				
Housing					
A	Aluminium F12 housing coated to IP 68				
C	Aluminium T12 housing coated to IP 68 with separate terminal compartment				
D	Aluminium T12 housing coated to IP 68; with separate terminal compartment; with overvoltage protection				
9	Special version				
Screw union/entry					
2	M20x1.5 screw union				
3	G 1/2" entry				
4	NPT 1/2" entry				
5	M12 PROFIBUS-PA plug-in connector				
6	7/8" FF plug				
9	Special version				
FMU 41 -					Product designation

2.4 Product structure FMU 42

Certificates									
	A	Variant for non-hazardous area							
	1	ATEX II 1/2 G EEX ia IIC T6							
	4	ATEX II 1/2 G EEX d [ia] IIC T6							
	G	ATEX II 3G EEx nA II T6 (in preparation)							
	S	FM IS Cl. I,II,III Div. 1 Gr. A-G / NI Cl. I Div. 2							
	T	FM XP Cl. I,II,III Div. 1 Gr. A-G							
	U	CSA IS Cl. I,II,III Div. 1 Gr. A-G / NI Cl. I Div. 2							
	V	CSA XP Cl. I,II,III Div. 1 Gr. A-G							
	N	CSA General Purpose							
	K	TIIS Ex ia II C T6 (in preparation)							
	Y	Special certificate							
Process connection									
	M	mounting bracket FAU20							
	P	DN80/ANSI 3"/JIS10K80, PP, Universal flange							
	Q	DN80/ANSI 3"/JIS10K80, PVDF, Universal flange							
	S	DN80/ANSI 3"/JIS10K80, 316L, Universal flange							
	T	DN100/ANSI 4"/JIS16K100, PP, Universal flange							
	U	DN100/ANSI 4"/JIS16K100, PVDF, Universal flange							
	V	DN100/ANSI 4"/JIS16K100, 316L, Universal flange							
	Y	Special version							
Power supply/communication									
	B	2 wire, 4...20mA-loop/HART							
	H	4 wire, 10,5...32VDC / 4-20mA HART							
	G	4 wire, 90...253VAC / 4-20mA HART							
	D	2 wire, PROFIBUS PA							
	F	2 wire, Foundation Fieldbus							
	Y	Special version							
Display / on-site operation									
	1	Without LC display							
	2	With LC display VU 331 incl. on-site operation							
	3	Prepared for remote display FHX 40							
	9	Special version							
Housing									
	A	Aluminium F12 housing coated to IP 68							
	C	Aluminium T12 housing coated to IP 68, with separate terminal compartment							
	D	Aluminium T 12 housing coated to IP 68, with separate terminal compartment; with overvoltage protection							
	Y	Special version							
Gland/Entry									
	2	M20x1.5 gland							
	3	G 1/2" entry							
	4	NPT 1/2" entry							
	5	M12 PROFIBUS-PA plug							
	6	7/8" FF plug							
	9	Special version							
Sealing Sensor/Flange									
	2	VITON flat sealing							
	3	EPDM flat sealing							
	9	special version							
Additional options									
	A	Additional options not selected							
FMU 42 -									Product designation

2.5 Product structure FMU 43

Certificates					
	A				Variant for non-hazardous area
	2				ATEX II 1/2 D or II 2 D, Aluminium Deckel
	5				ATEX II 1/3 D or II 3 D, Sichtdeckel
	M				FM DIP Class II, III, Div. 1, Gr. E,F,G NI
	N				CSA General Purpose
	P				CSA DIP, Class II, III, Div. 1, Gr. E,F,G NI
	Y				Special version
Process connection/material					
	P				Flange DN 100/ANSI 4"/JIS 16K100, PP (universal slip-on flange included)
	S				Flange DN 100/ANSI 4"/JIS 16K100, SS 316TI (universal slip-on flange included)
	K				Without slip-on flange/without mounting bracket (customer mounting equipment)
	M				With mounting bracket
	Y				Special version
Power supply/communication					
	H				4 wire, 10,5...32VDC / 4-20mA HART
	G				4 wire, 90...253VAC / 4-20mA HART
	D				2 wire, PROFIBUS PA
	F				2 wire, Foundation Fieldbus
	Y				Special version
Display / on-site operation					
	1				Without LC display
	2				With LC display VU 331 incl. on-site operation
	3				Prepared for remote display FHX 40
	9				Special version
Housing					
	A				Aluminium F12 housing coated to IP 68
	9				Special version
Screw union/entry					
	2				M20x1.5 screw union
	3				G 1/2" entry
	4				NPT 1/2" entry
	5				M12 PROFIBUS-PA plug-in connector
	6				7/8" FF plug
	9				Special version
FMU 43 -					Product designation

2.6 Scope of delivery

2.6.1 Instrument and accessories

- Instrument according to the version ordered
- "ToF Tool - FieldTool Package" (2 CD-ROMs)
- for FMU 40/41 in the versions FMU 40 *R**** and FMU 41 *R****: counter nut (PC)
- for FMU 40/41: sealing ring (EPDM)
- for gland M20x1.5:
 - 1 cable gland for 2-wire instruments
 - 2 cable glands for 4-wire instrumentsThe cable glands are mounted on delivery.

2.6.2 Supplied documentation

Short instructions (KA 183F, in the instrument)

intended as a memory jogger for users who are familiar with the operating concept of Endress+Hauser Time-of-Flight instruments.

Operating instructions (BA 237F, this booklet)

This describes the installation and commissioning of the Prosonic M. The operating menu includes all the functions which are required for standard measurement tasks. Any additional functions are **not** included.

Description of Instrument Functions (BA 240F)

contains a detailed description of all the functions of the Prosonic M. You can find this document as a pdf file on the supplied ToF Tool - FieldTool CD-ROM 1.

Safety instructions

Additional safety instructions (XA, ZE, ZD) are supplied with certified device versions. Refer to the nameplate for the names of the safety instructions that apply to your device version.

2.7 Certificates and approvals

CE mark, declaration of conformity

The 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. The device complies with the applicable standards and regulations as listed in the EC declaration of conformity and thus complies with the statutory requirements of the EG directives. Endress+Hauser confirms the successful testing of the device by affixing to it the CE mark.

2.8 Registered trademarks

HART®

Registered trademark of HART Communication Foundation, Austin, USA

ToF®

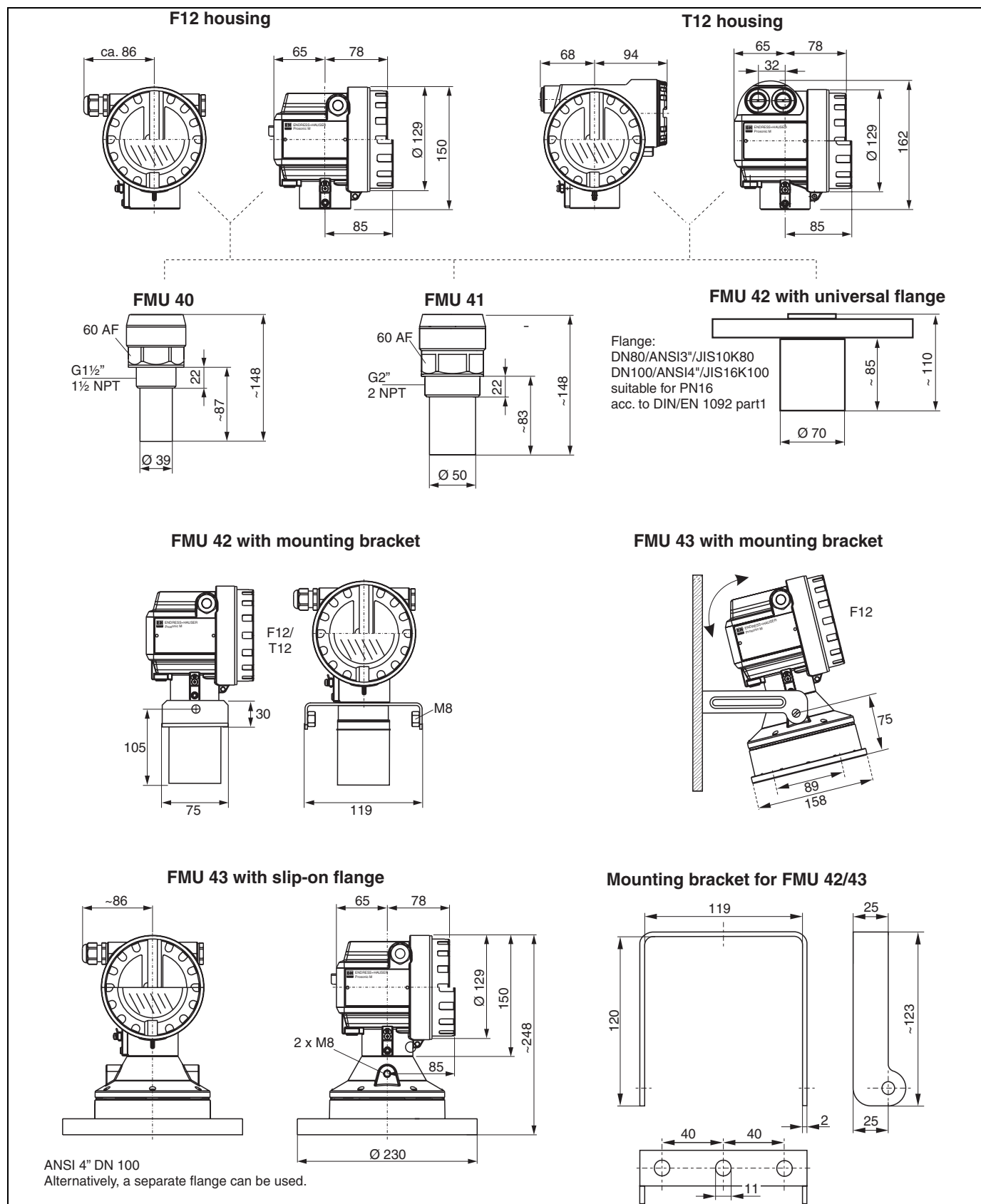
Registered trademark of the company Endress+Hauser GmbH+Co. KG, Maulburg, Germany

PulseMaster®

Registered trademark of the company Endress+Hauser GmbH+Co. KG, Maulburg, Germany

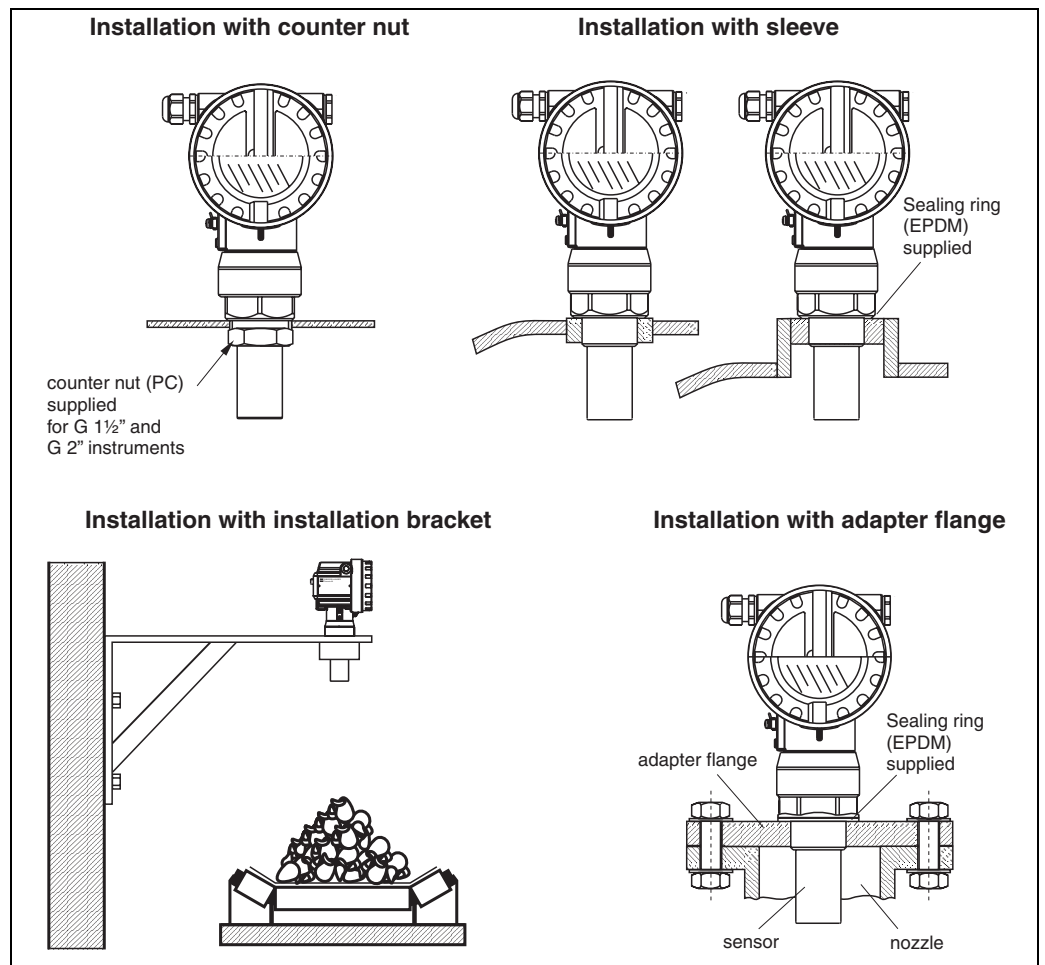
3 Installation

3.1 Dimensions



3.2 Installation variants

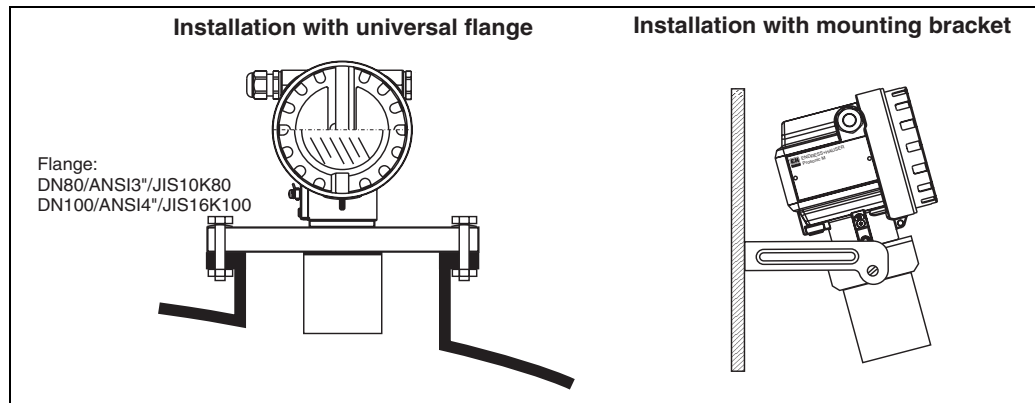
3.2.1 Installation variants FMU 40, FMU 41



L00-FMU4xxxx-17-00-00-en-002

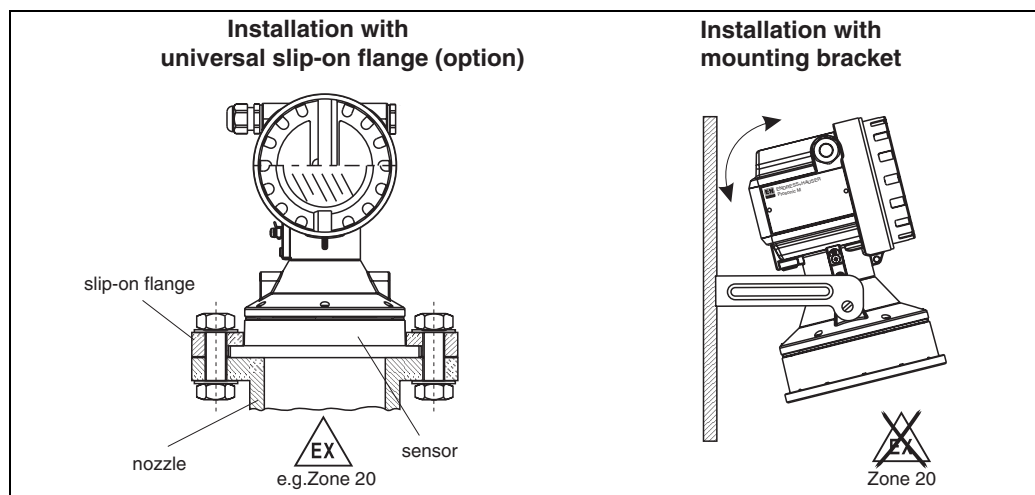
For installation bracket or adapter flange s. chapter "Accessories".

3.2.2 Installation variants FMU 42



L00-FMU42xxxx-17-00-00-en-001

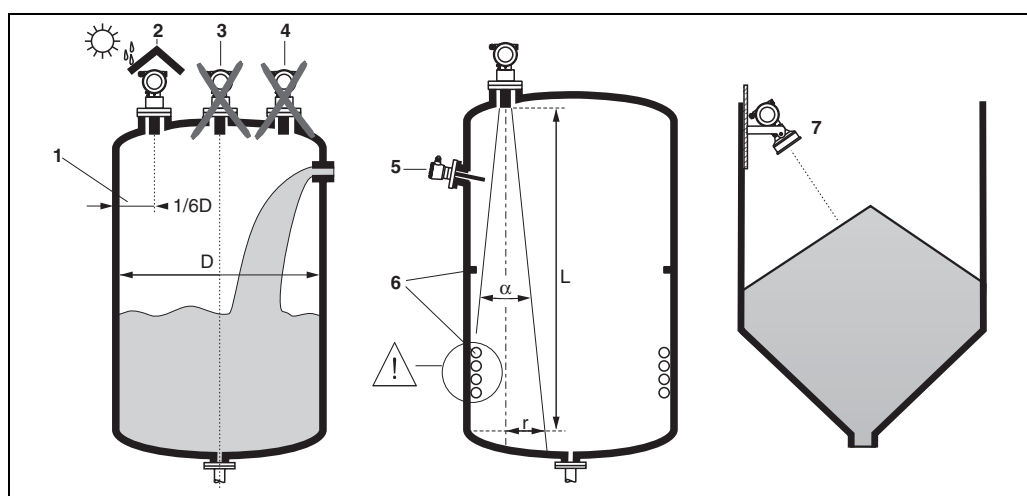
3.2.3 Installation variants FMU 43



L00-FMU43xxxx-17-00-00-en-001

3.3 Installation conditions

3.3.1 Installation conditions for level measurements



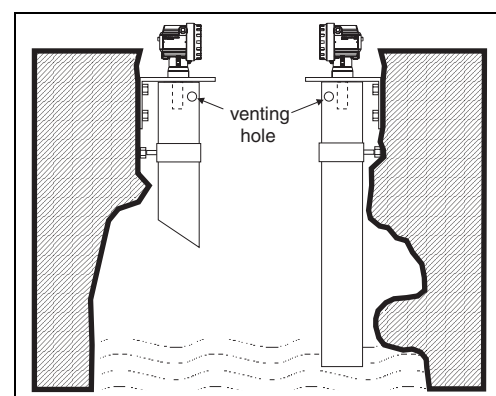
L00-FMU4xxxx-17-00-00-de-005

- Do not install the sensor in the middle of the tank (3). We recommend leaving a distance between the sensor and the tank wall (1) measuring $1/6$ of the tank diameter.
- Use a protective cover, in order to protect the device from direct sun or rain (2).
- Avoid measurements through the filling curtain (4).
- Make sure that equipment (5) such as limit switches, temperature sensors, etc. are not located within the emitting angle α . In particular, symmetrical equipment (6) such as heating coils, baffles etc. can influence measurement.
- Align the sensor so that it is vertical to the product surface (7).
- Never install two ultrasonic measuring devices in a tank, as the two signals may affect each other.
- To estimate the detection range, use the 3 dB emitting angle α .

Sensor	α	$L_{\max}$	$r_{\max}$
FMU 40	11°	5 m	0,48 m
FMU 41	11°	8 m	0,77 m
FMU 42	9°	10 m	0,96 m
FMU 43	6°	15 m	0,79 m

3.3.2 Installation in narrow shafts

In narrow shafts with strong interference echoes, we recommend using an ultrasound guide pipe (e.g. PE or PVC wastewater pipe) with a minimum diameter of 100 mm. Make sure that the pipe is not soiled by accumulated dirt. If necessary, clean the pipe at regular intervals.

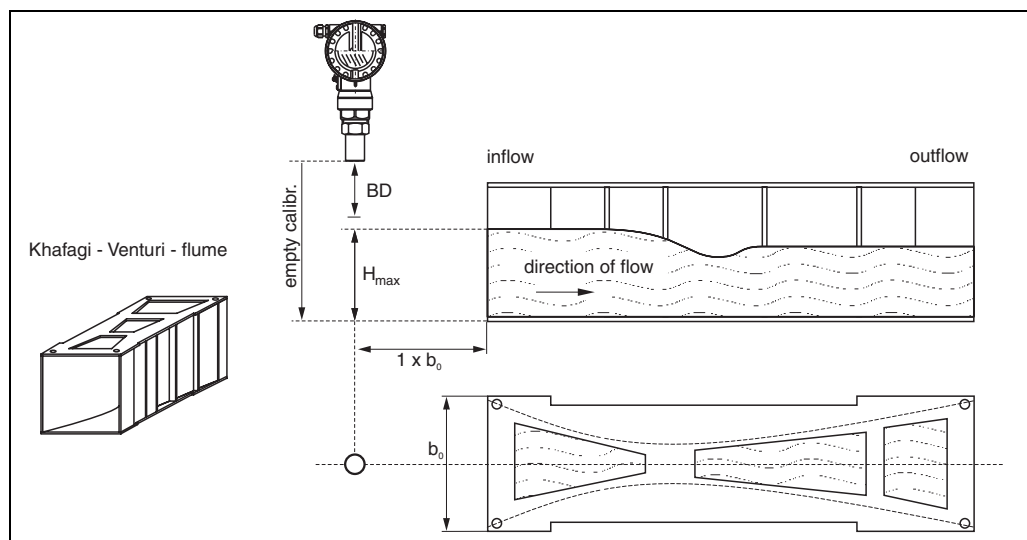


L00-FMU14xxxx-17-00-00-en-010

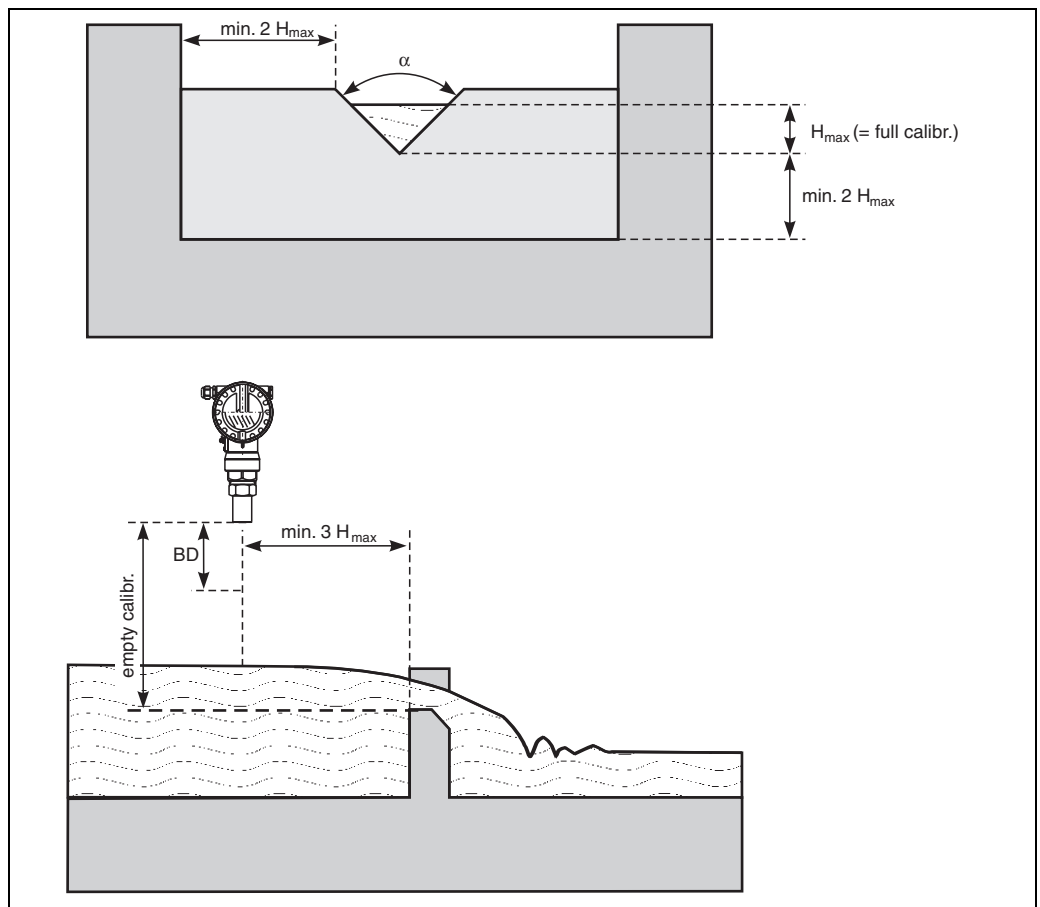
3.3.3 Installation conditions for flow measurements

- Install the Prosonic M at the inflow side, as close above the maximum water level $H_{\max}$ as possible (take into account the blocking distance BD).
- Position the Prosonic M in the middle of the channel or weir.
- Align the sensor membrane parallel to the water surface.
- Keep to the installation distance of the channel or weir.
- You can enter the "Flow to Level" linearisation curve ("Q/h curve") using ToF Tool or manually via the on-site display.

Example: Khafagi-Venturi flume



100-FMU4xxxx-17-00-00-en-003

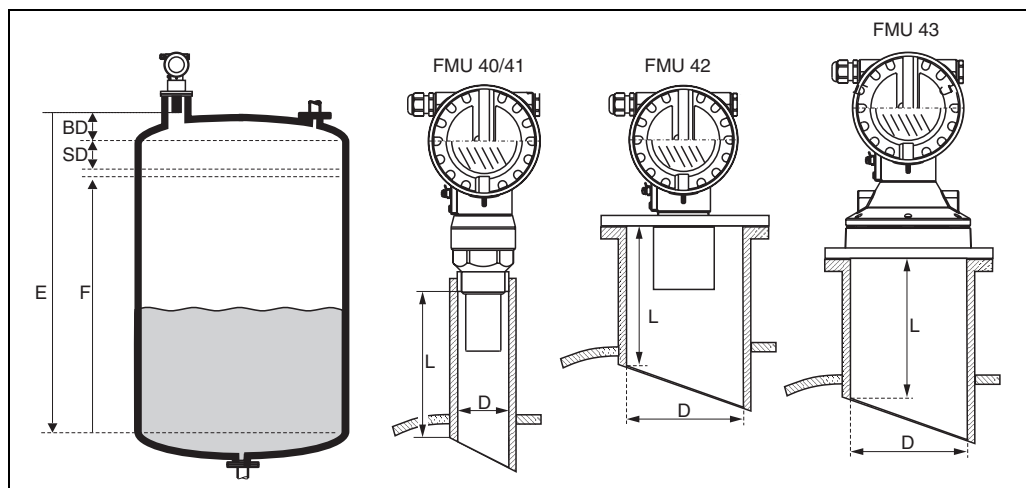
Example: Triangular weir

100-FMU4xxxx-17-00-00-en-012

3.4 Measuring range

3.4.1 Blocking distance, Nozzle mounting

Install the Prosonic M at a height so that the blocking distance BD is not undershot, even at maximum fill level. Use a pipe nozzle if you cannot maintain the blocking distance in any other way. The interior of the nozzle must be smooth and may not contain any edges or welded joints. In particular, there should be no burr on the inside of the tank side nozzle end. Note the specified limits for nozzle diameter and length. To minimise disturbing factors, we recommend an angled socket edge (ideally 45°).



BD: blocking distance; **SD:** safety distance; **E:** empty calibration; **F:** full calibration (span); **D:** nozzle diameter; **L:** nozzle length

Sensor	BD	Max. range liquids	Max. range bulk materials	nozzle diameter	max. nozzle length
FMU 40	0.25 m	5 m	2 m	50 mm	approx. 80 mm
				80 mm	approx. 240 mm
				100 mm	approx. 300 mm
FMU 41	0.35 m	8 m	3.5 m	80 mm	approx. 240 mm
				100 mm	approx. 300 mm
FMU 42	0.4 m	10 m	5 m	80 mm	approx. 250 mm
				100 mm	approx. 300 mm
FMU 43	0.6 m	15 m	7 m	min. 100 mm	approx. 300 mm



Caution!

If the blocking distance is undershot, it may cause device malfunction.

3.4.2 Safety distance

If the level rises to the safety distance SD, the device switches to warning or alarm status. The size of SD can be set freely in the **"Safety distance" (015)** function. The **"in safety distance" (016)** function defines how the device reacts if the level enters the safety distance.

There are three options:

- **Warning:** The device outputs an error message but continues measurement.
- **Alarm:** The device outputs an error message. The output signal assumes the value defined in the **"Output on alarm" (011)** function (MAX, MIN, user-specific value or holds the last value). As soon as the level drops below the safety distance, the device recommences measurement.
- **Self holding:** The device reacts in the same way as for an alarm. However, the alarm condition continues after the level drops below the safety distance. The device only recommences measurement when you cancel the alarm using the **"Ackn. alarm" (017)** function.

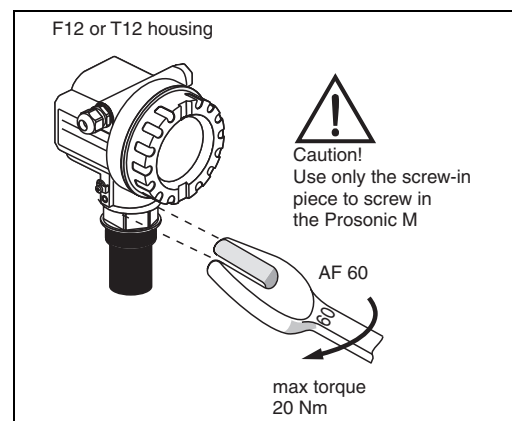
3.4.3 Range

The sensor range is dependent on the measuring conditions. Refer to Technical Information TI 365F/00/en for an estimation. The maximum range is shown in the above diagram (valid for good conditions).

Sensor	maximum range
FMU 40	5 m
FMU 41	8 m
FMU 42	10 m
FMU 43	15 m

3.5 Installation hint for FMU 40/41

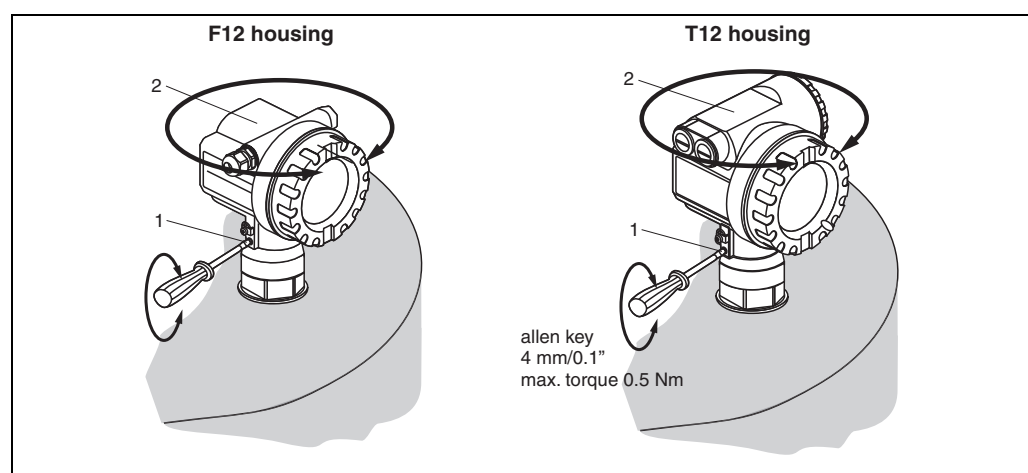
Screw the Prosonic M at the screw-in piece using an AF 60 spanner.
Maximum torque: 20 Nm.



3.6 Turn housing

After mounting, the housing can be turned 350° in order to simplify access to the display and the terminal compartment. Proceed as follows to turn the housing to the required position:

- Undo the fixing screws (1)
- Turn the housing (2) in the required direction
- Tighten up the fixing screws (1). Maximum torque 0.5 Nm.
- Loctite can be used for securing the screw.



3.7 Installation check

After installing the device, carry out the following checks:

- Is the device damaged (visual inspection)?
- Does the device correspond to the measuring point specifications for process temperature, process pressure, ambient temperature, measuring range etc.
- If available: Are the measuring point number and labelling correct (visual inspection)?
- Is the measuring device sufficiently protected against precipitation and direct sunlight?
- Are the cable glands tightened correctly?
- After aligning the housing, check the process seal at the nozzle or flange.

4 Wiring

4.1 Electrical connection



Caution!

Before connection please note the following:

- The power supply must be identical to the data on the nameplate.
- Switch off power supply before connecting up the instrument.
- Connect equipotential bonding to transmitter ground terminal before connecting up the instrument (s. section "Potential matching")



Warning!

When you use the measuring system in hazardous areas, make sure to comply with national standards and the specifications in the safety instructions (XA's). Make sure you use the specified cable gland.

4.1.1 Wiring in the housing F12

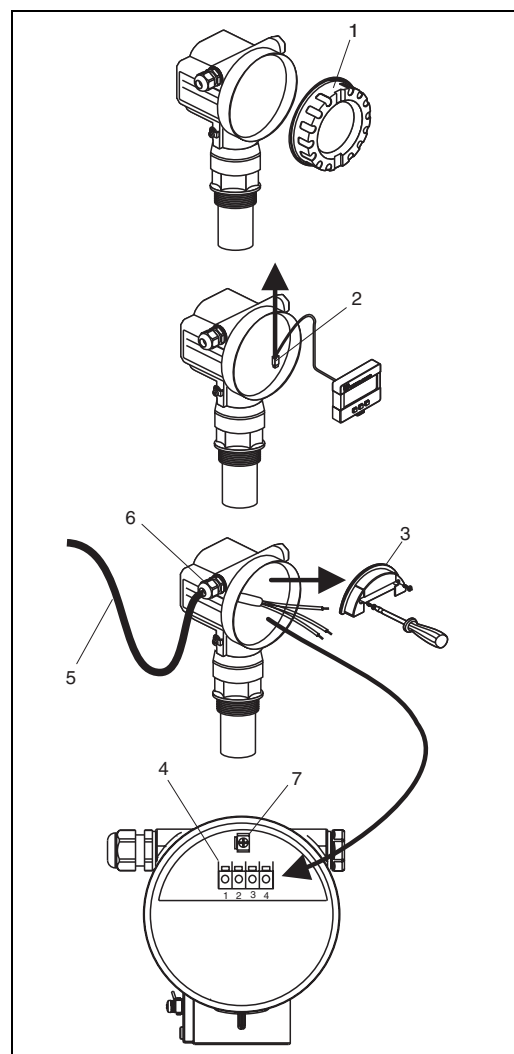
1. Unscrew housing cover (1).
2. Remove display (2) if fitted.
3. Remove cover plate (3) from terminal compartment.
4. Pull out terminal module (4) slightly using pulling loop.
5. Insert cable (5) through gland (6).



Caution!

If possible, insert the cable from above and let a draining loop in order to avoid intrusion of humidity.

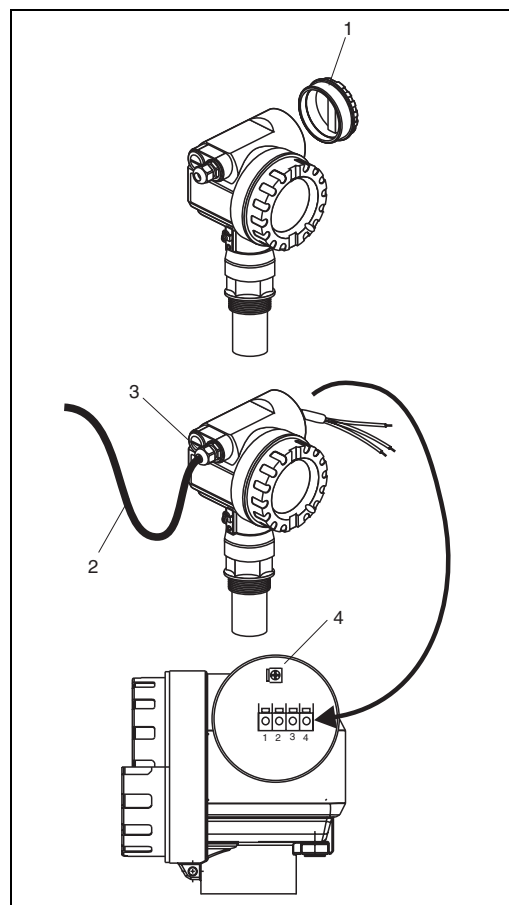
6. Connect cable screen to the grounding terminal (7) within the terminal compartment.
7. Make connection according to terminal assignment (see below).
8. Re-insert terminal module (4).
9. Tighten cable gland (6).
10. Tighten screws on cover plate (3).
11. Insert display (2) if fitted.
12. Screw on housing cover (1).
13. Switch on power supply.



L00-FM14xxxx-04-00-00-yy-008

4.1.2 Wiring in the housing T12

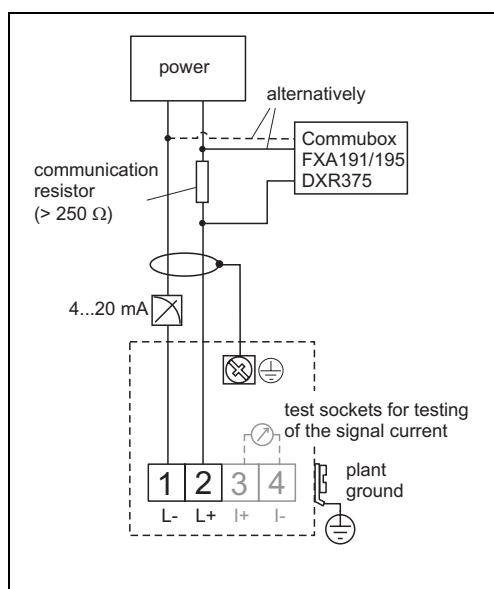
1. Unscrew the cover (1) of the separate connection room.
2. Insert cable (2) through gland (3).
- ⚠ **Caution!**
If possible, insert the cable from above and let a draining loop in order to avoid intrusion of humidity.
3. Connect cable screen to the grounding terminal (4) within the connection room.
4. Make connection according to the terminal assignment (see below).
5. Tighten cable gland (3).
6. Screw on housing cover (1).
7. Switch on power supply.



100-FM14xxxx-04-00-00-yy-009

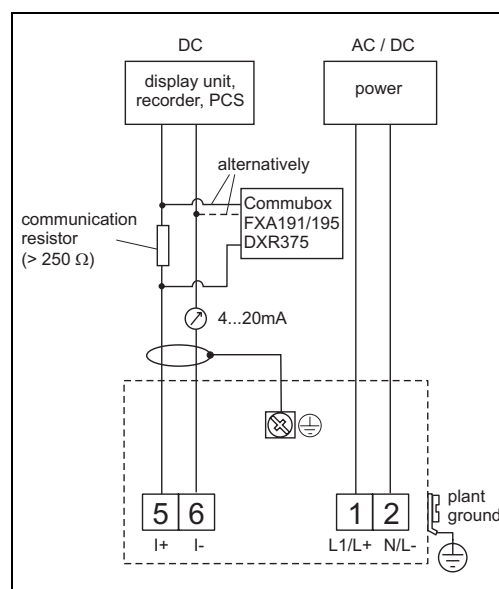
4.2 Terminal assignment

Loop-powered version



100-FMxxxxxx-04-00-00-en-015

4-wire version (active)



100-FMxxxxxx-04-00-00-en-011

4.3 Supply voltage

4.3.1 HART, 2-wire

The following values are the voltages across the terminals directly at the instrument:

Version		Current consumption	Terminal voltage minimum	Terminal voltage maximum
2-wire HART	Standard	4 mA	14 V	36 V
		20 mA	8 V	36 V
	EEx ia	4 mA	14 V	30 V
		20 mA	8 V	30 V
	EEx d	4 mA	14 V	30 V
		20 mA	11 V	30 V
Fixed current, adjustable, e.g. for solar power operation (measured value via HART)	Standard	11 mA	10 V	36 V
	EEx ia	11 mA	10 V	30 V
Fixed current for HART multidrop mode	Standard	4 mA ¹⁾	14 V	36 V
	EEx ia	4 mA ¹⁾	14 V	30 V

1) Start-up current 11 mA

4.3.2 HART, 4-wire, active

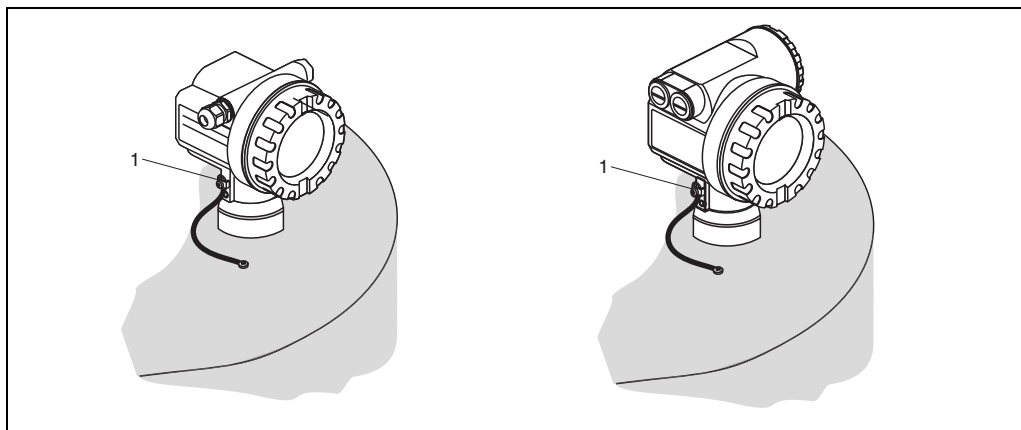
Version	Voltage	max. load
DC	10,5 ... 32 V	600 Ω
AC 50/60 Hz	90 ... 253 V	600 Ω



Caution!

When using the public powers supply, install an easy accessible power switch in the proximity of the instrument. Mark the power switch as a disconnecter for the instrument (IEC/EN 61010).

4.4 Potential matching



L00-FMU4xxxx-17-00-00-yy-014

1: external ground terminal of the transmitter

Connect the equipotential bonding to the external ground terminal of the transmitter.



Caution!

In Ex applications, the instrument must only be grounded on the sensor side. Further safety instructions are given in the separate documentation for applications in explosion hazardous areas.



Note!

Since the housing is isolated from the tank by the plastic sensor, interference signals may occur if the potential matching line is not properly connected.

For optimum electromagnetic compatibility the potential matching line should be as short as possible and at least 2,5 mm² in cross-section.

If increased electromagnetic interference is to be expected due to the installation conditions, we recommend usage of a ground strap.

4.5 Checking the connection

After wiring the device, carry out the following checks:

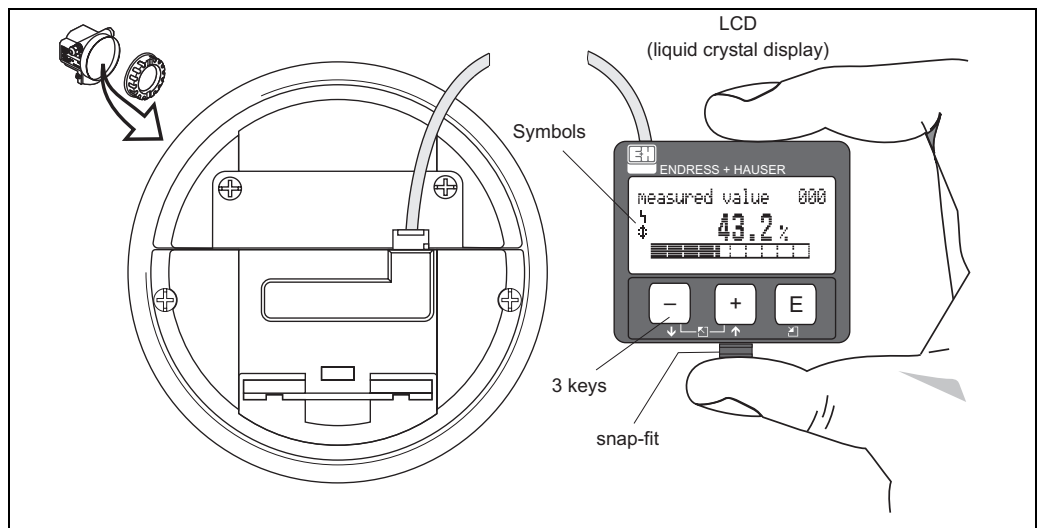
- Are the terminals correctly assigned?
- Is the cable gland tight?
- Is the housing cover fully screwed on?
- If power supply available: Does a display appear on the display module?

5 Operation

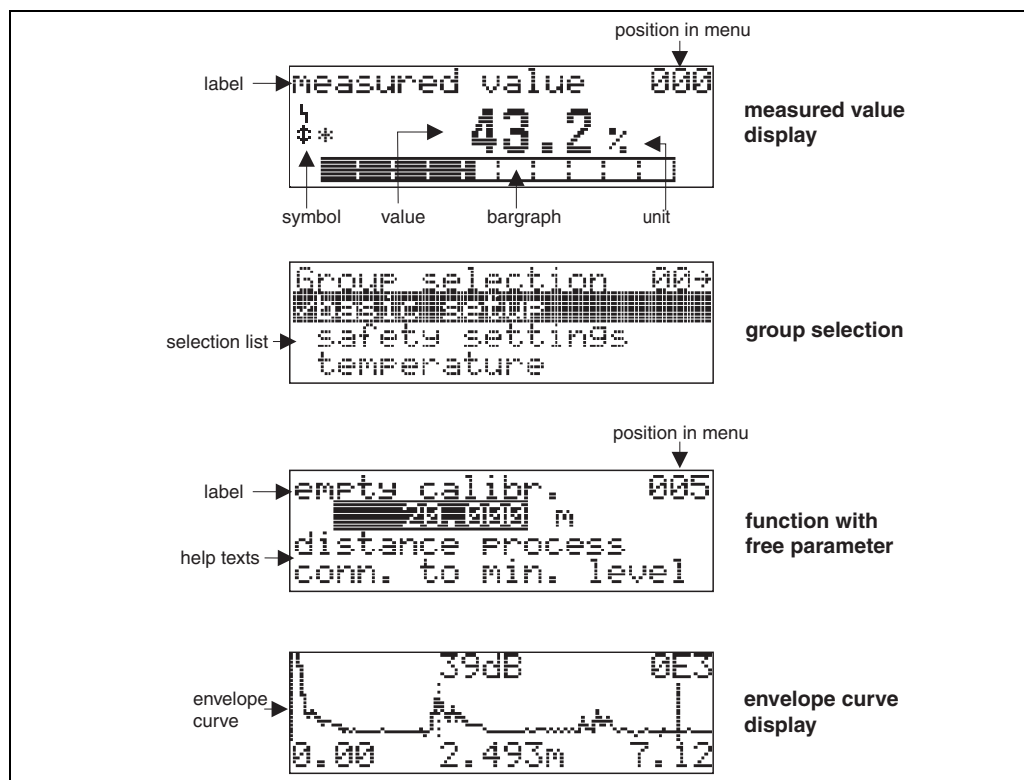
5.1 Display and operating elements

5.1.1 On-site display VU 331

The LCD module VU 331 for display and operation is located beneath the housing cover. The measured value is legible through the glass in the cover. Open the cover to operate the device.



5.1.2 Display appearance



L00-FMxxxxxx-07-00-00-en-002

In the measured value display, the bargraph corresponds to the output.
The bargraph is segmented in 10 bars. Each completely filled bar represents a change of 10% of the adjusted span.

5.1.3 Display symbols

The following table describes the symbols that appear on the liquid crystal display:

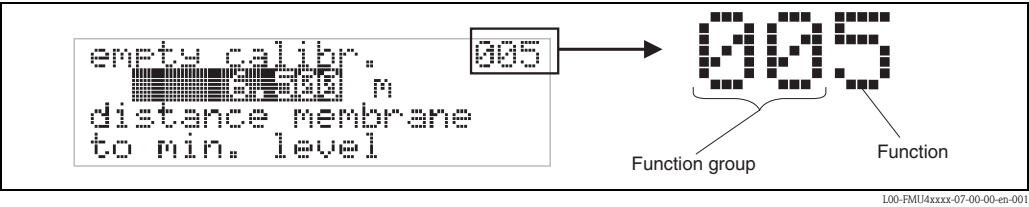
Sybmol	Meaning
	ALARM_SYMBOL This alarm symbol appears when the instrument is in an alarm state. If the symbol flashes, this indicates a warning.
	LOCK_SYMBOL This lock symbol appears when the instrument is locked,i.e. if no input is possible.
	COM_SYMBOL This communication symbol appears when a data transmission via e.g. HART, PROFIBUS PA or FOUNDATION Fieldbus is in progress.

5.1.4 Function of the keys

Key(s)	Meaning
+ or ↑	Navigate upwards in the selection list Edit numeric value within a function
- or ↓	Navigate downwards in the selection list Edit numeric value within a function
← ← ← or ←	Navigate to the left within a function group
E	Navigate to the right within a function group, confirmation.
+ and E or - and E	Contrast settings of the LCD
+ and - and E	Hardware lock / unlock After a hardware lock, an operation of the instrument via display or communication is not possible! The hardware can only be unlocked via the display. An unlock parameter must be entered to do so.

5.2 Function codes

For easy orientation within the function menus, for each function a position is shown on the display.



L00-FM14xxxx-07-00-00-en-001

The first two digits identify the function group:

- basic setup 00
- safety settings 01
- linearisation 04
- ...

The third digit numbers the individual functions within the function group:

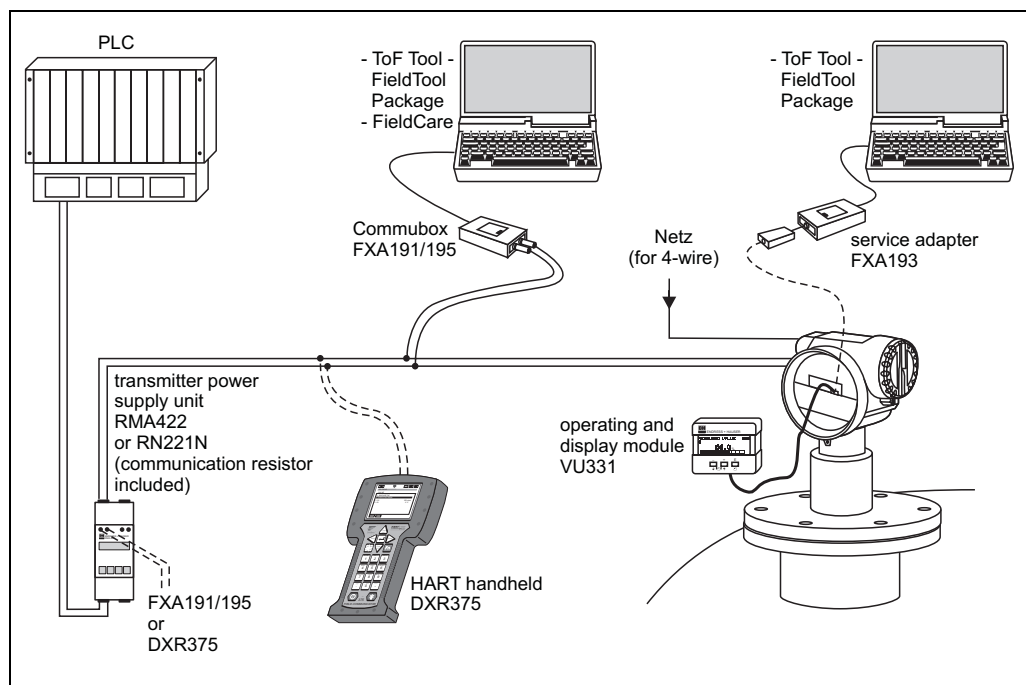
- basic setup 00 → ■ tank shape 002
- medium property 003
- process cond. 004
- ...

Hereafter the position is always given in brackets (e.g. "tank shape" (002)) after the described function.

5.3 Operating options

5.3.1 4...20 mA output with HART protocol

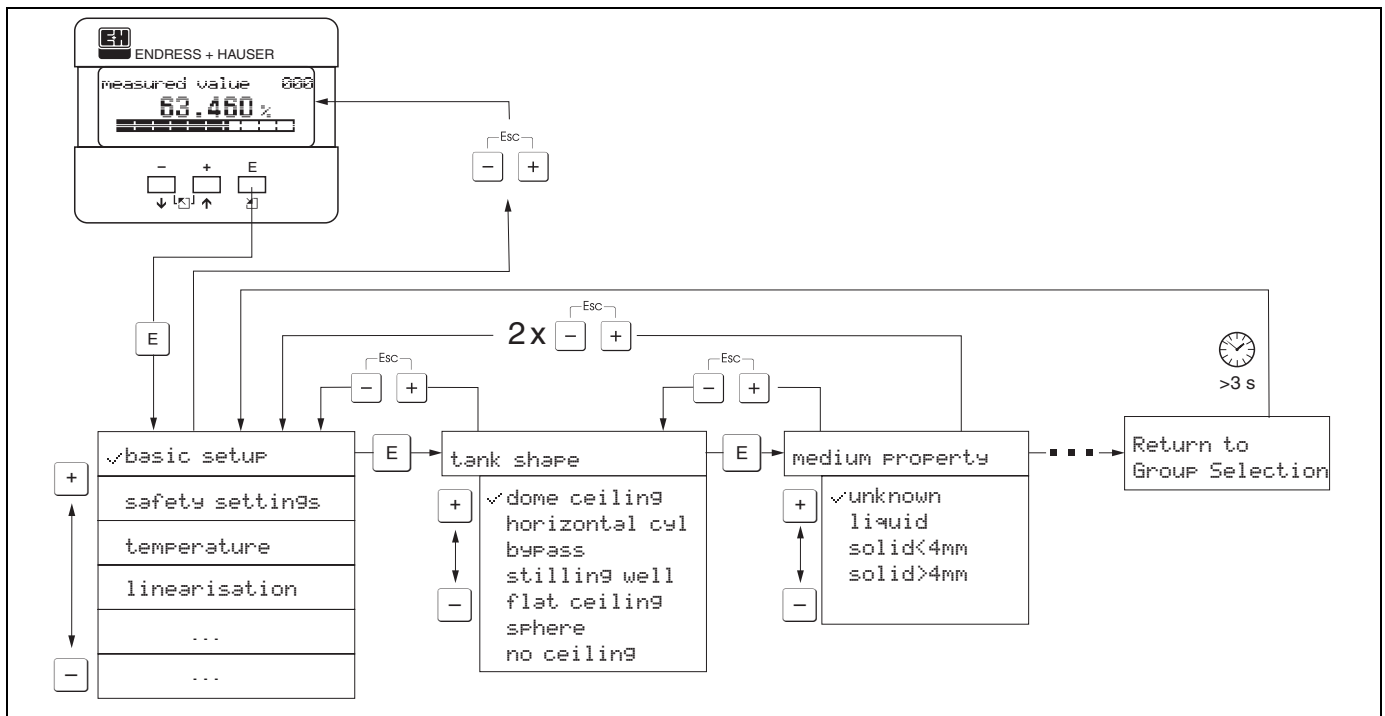
The complete measuring system consists of:



L00-FMxxxxxx-14-00-06-en-007

If the HART communication resistor is not built into the supply unit, it is necessary to insert a communication resistor of 250 Ω into the 2-wire line.

5.4 Operation using the on-site display VU 331



100-FM14xxxx-19-00-00-en-018

1. Change from Measured Value Display to **Group Selection** by pressing $\boxed{E}$.
2. Press $\boxed{-}$ or $\boxed{+}$ to select the required **Function Group** and confirm by pressing $\boxed{E}$. The active selection is marked by a 3 in front of the menu text.
3. Activate Edit mode with $\boxed{+}$ or $\boxed{-}$.

Selection menus

- a. Select the required **Parameter** in selected **function** with $\boxed{-}$ oder $\boxed{+}$.
- b. $\boxed{E}$ confirms selection; 3 appears in front of the selected parameter.
- c. $\boxed{E}$ confirms the edited value; system quits edit mode.
- d. $\boxed{+}$ and $\boxed{-}$ (= $\boxed{\text{F3}}$) interrupts selection; system quits edit mode.

Typing in numerals and text

- a. Press $\boxed{+}$ or $\boxed{-}$ to edit the first character of the **numeral / text**.
 - b. $\boxed{E}$ positions the cursor at the next character; continue with a. until you have completed your input.
 - c. If a $\downarrow$ symbol appears at the cursor, press $\boxed{E}$ to accept the value entered; system quits edit mode.
 - d. If a $\leftarrow$ symbol appears at the cursor, press $\boxed{E}$ to return to the previous character (e.g. for correction of entries).
 - e. $\boxed{+}$ and $\boxed{-}$ (= $\boxed{\text{F3}}$) interrupts selection; system quits edit mode.
4. Press $\boxed{E}$ to select the next **function**.
 5. Press $\boxed{+}$ and $\boxed{-}$ (= $\boxed{\text{F3}}$) once; return to previous **function**. Press $\boxed{+}$ and $\boxed{-}$ (= $\boxed{\text{F3}}$) twice; return to **Group Selection**.
 6. Press $\boxed{+}$ and $\boxed{-}$ (= $\boxed{\text{F3}}$) to return to **Measured value display**.

5.5 Operation using ToF Tool

The ToF Tool is a graphical operation software for instruments from Endress+Hauser. It is used to support commissioning, securing of data, signal analysis and documentation of the instruments. It is compatible with the following operating systems: WinNT4.0, Win2000 and WinXP.

The ToF Tool supports the following functions:

- Online configuration of transmitters
- Signal analysis via envelope curve
- Linearisation table (graphically supported creation, editing, importing and exporting)
- Loading and saving of instrument data (Upload/Download)
- Documentation of measuring point



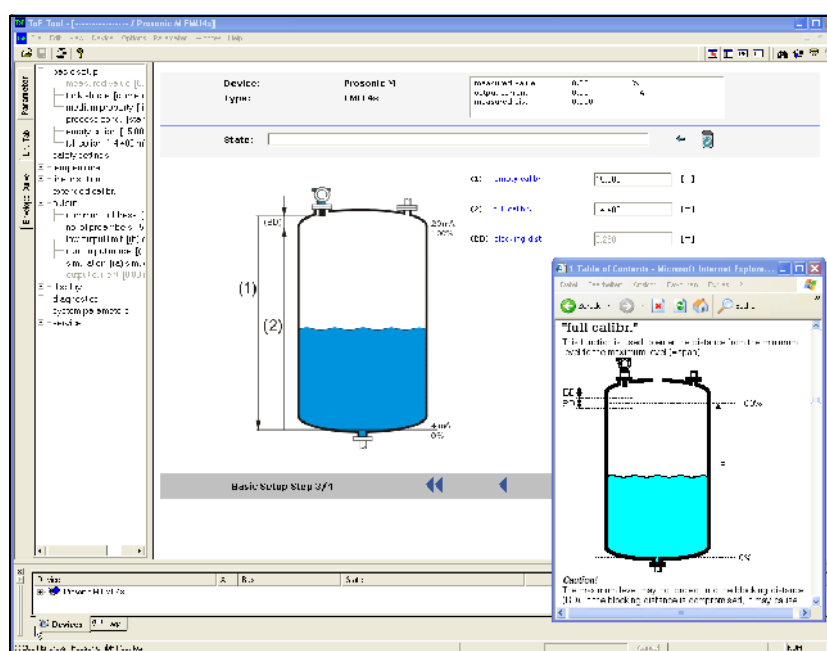
Note!

Further information you may find on the CD-ROM, which is enclosed to the instrument.

5.5.1 Connection options

- HART with Commubox FXA 191
- Service interface with adapter FXA 193

5.5.2 Menu guided commissioning

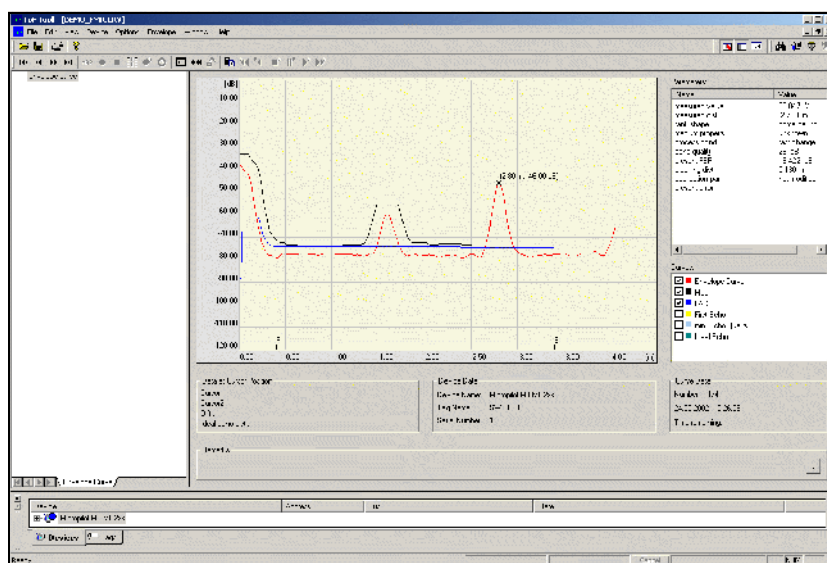


L00-FMU4xxxx-19-00-00-en-003

- You can find the function groups and functions of the device in the **navigation bar**.
- You can find the input fields for the parameters in the **main window**.
- If you click on a parameter name, the **Help pages** open with precise explanations of the required input.

5.5.3 Envelope curve display

The ToF Tool offers easy analysis of the envelope curve via the "Envelope" menu:



L00-FMU4xxxx-19-00-00-en-004

5.6 Operation with Commuwin II

Commuwin II is an operating software with graphical support (MS Windows) for intelligent transmitters with the communication protocols Rackbus, Rackbus RS-485, HART and PROFIBUS-PA.

Commuwin II supports the following functions:

- Online configuration of transmitters
- Loading and saving of instrument data (Upload/Download)
- Orderly visualisation of measured values and limit values
- Display and recording of measured values with a line recorder



Note!

Further information on Commuwin II is given in the following E+H documentation:

- System Information: SI 018F/00/en “Commuwin II”
- Operating Manual: BA 124F/00/en “Commuwin II” operating program

5.6.1 Operation

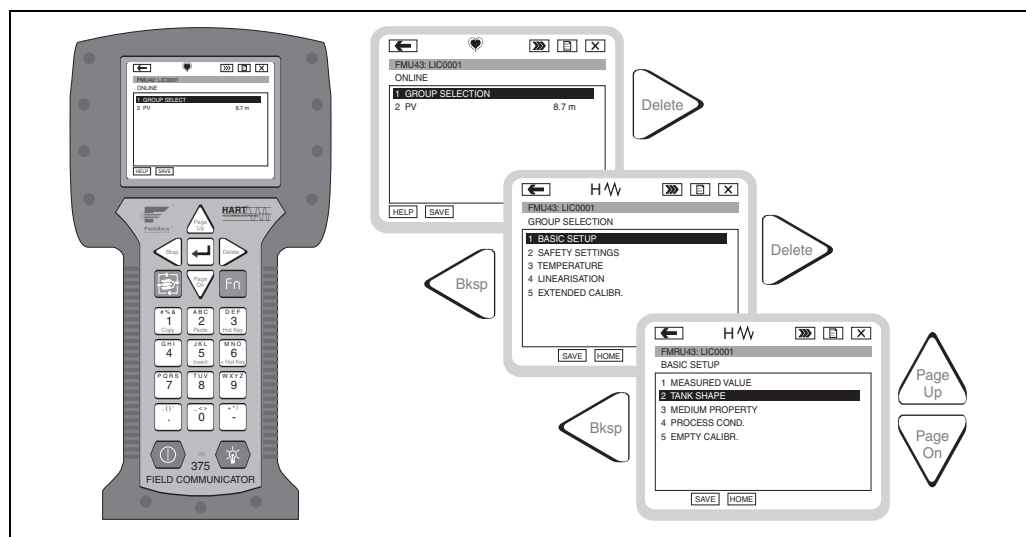
You make the settings using an operating matrix or via a graphic interface. Envelope curves can not be display in Commuwin II.

5.6.2 Connection

The computer ist connected to the HART communicatain line via the Commubox FXA 191.

5.7 Operation using a HART handheld terminal DXR 375

The operating menu of the Prosonic M can be accessed via the HART handheld terminal DXR 375.



L00-FMU43xxxx-07-00-00-de-005

Connect the handheld terminal directly to the HART communication line.

5.8 Lock/unlock configuration

5.8.1 Software security locking

Enter a number $\frac{1}{4}$ 100 in the "**unlock parameter**" (0A4) function in the "**diagnostics**" (0A) function group.

The  symbol appears on the display. Inputs are no longer possible.

If you try to change a parameter, the device jumps to the "**unlock parameter**" (0A4) function.

Enter "100"

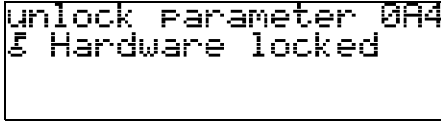
Now change the parameters.

5.8.2 Hardware security locking

Press ,  and  simultaneously.

Inputs are no longer possible.

If you try to change a parameter, the following appears:



L00-fmrz0a4-20-00-00-de-001

Press ,  and  simultaneously. The "**unlock parameter**" (0A4) function appears.

Enter "100"

Now change the parameters.



Note!

A hardware locking can **only** be unlocked again via the display by pressing the ,  and  keys at the same time again. It is **not** possible to unlock the hardware by communication.

5.9 Resetting the customer parameters

It is advisable to reset the customer parameters if you want to use a device with an unknown history.

Effects of resetting:

- All customer parameters are reset to their default values.
- Customer interference echo suppression is **not** deleted.
- Linearisation is switched to "**linear**", but the table values are kept. The table can be switched back on in the "**linearisation**" (04) function group in the "**linearisation**" (041) function.

In order to carry out the reset, enter the number "33333" in the "**reset**" (0A3) function in the "**diagnostics**" (0A) function group.



Caution!

A reset may lead to impairment of the measurement. As a rule, a basic calibration is required after a reset.



Note!

The default values of each parameter are shown in bold in the menu overview in the appendix.

5.10 Resetting an interference echo suppression (tank map)

It is always advisable to reset the interference echo suppression (tank mapping) when:

- a device with an unknown history is used
- an incorrect suppression was input.

Proceed as follows:

1. Switch to the **"extended calibr." (05)** function group and to the **"selection" (050)** function.
2. Select **"extended map."**
3. Then proceed to the **"cust. tank map" (055)** function.
4. Select
 - **"reset"**, to delete (reset) the existing interference echo suppression.
 - **"inactive"** to deactivate an existing interference echo suppression. The suppression remains saved.
 - **"active"** to reactivate an existing interference echo suppression.

6 Commissioning

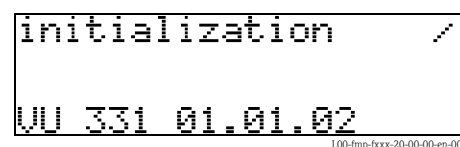
Commission the Prosonic M in the following stages:

- Installation check
- Power-up device
- Basic calibration
- Measuring signal check using the envelope curve

The chapter describes the commissioning process using the on-site display. Commissioning using ToF Tool is identical. Access to the device functions using ToF Tool is described on Page 21. You can find detailed information in the ToF Tool operating instructions (BA 224F/00/en) on the supplied CD-ROM.

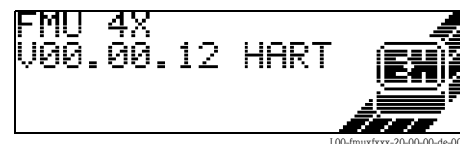
6.1 Power up instrument

After switching on the supply voltage, the instrument is first initialised.



Then the following appear for approximately five seconds:

- Device type
- Software version
- Type of digital communication signal



Press **[E]** to exit this display.

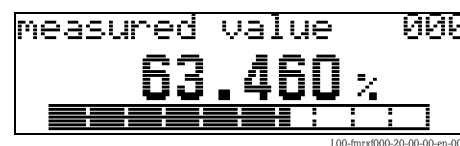
On first power-up, you are requested to select the language for the display texts.



Then you are requested to select the unit of length for your measurements.



A measured value is displayed. This is NOT equivalent to the level in your tank. Firstly carry out a basic calibration.



Press **[E]** to switch to the group selection.
Press **[E]** again to start the basic calibration.



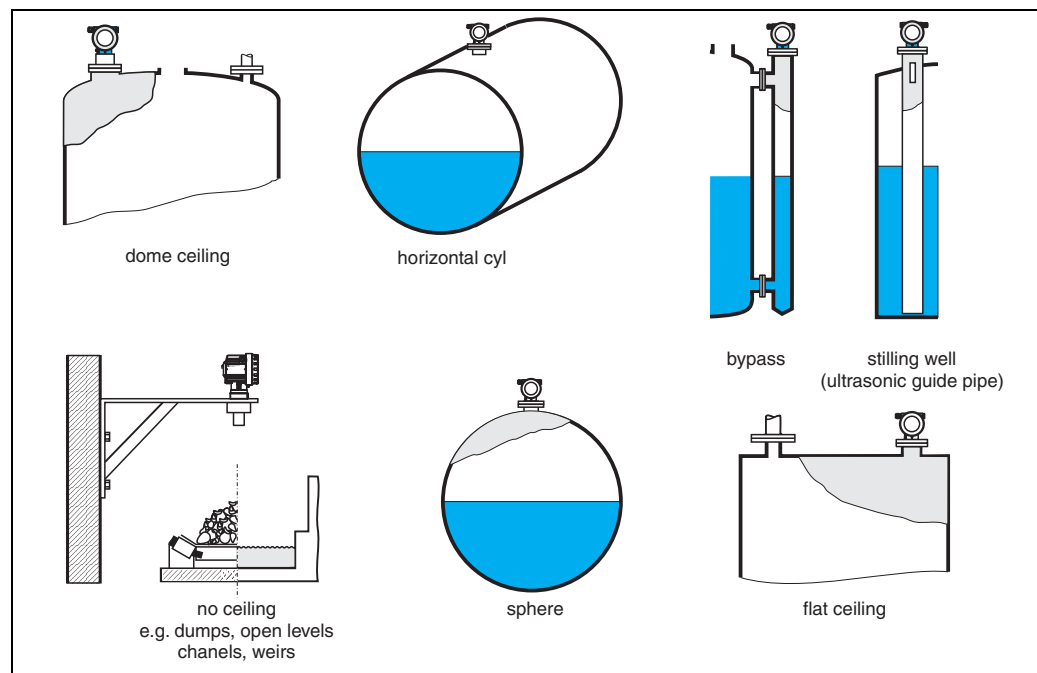
6.2 Basic calibration

The **"Basic setup" (00)** function group lists all the functions which are required for a standard measurement task to commission the Prosonic M. When you have completed your input for a function, the next function appears automatically. In this way, you are guided through the complete calibration.

6.2.1 Measuring point settings

Function "tank shape" (002)

In this function, select one of the following options:



L00-FMU4xxxx-14-00-06-en-001

Function "medium property" (003)

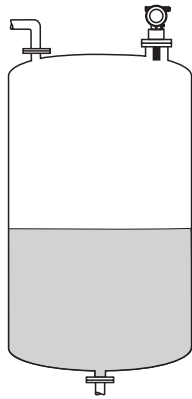
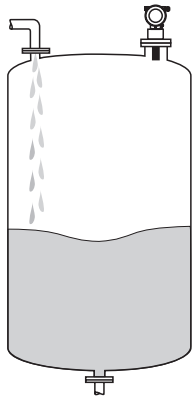
Set the medium type in this function.

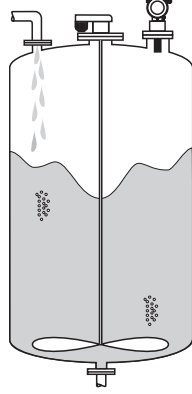
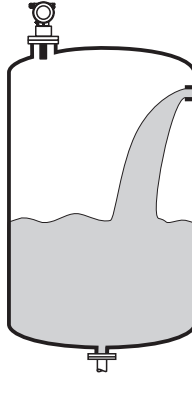
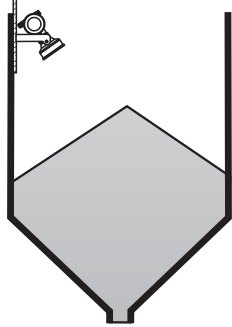
You have the following options:

- unknown (e.g. pasty media such as greases, creams, gels etc.)
- liquid
- solid, grain size < 4 mm (fine)
- solid, grain size > 4 mm (coarse)

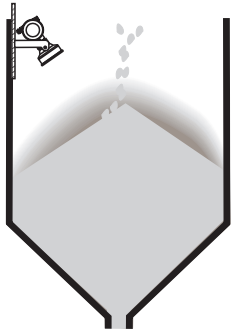
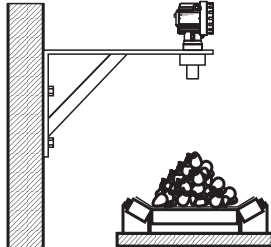
Function "process conditions" (004)

For this function, you have the following options:

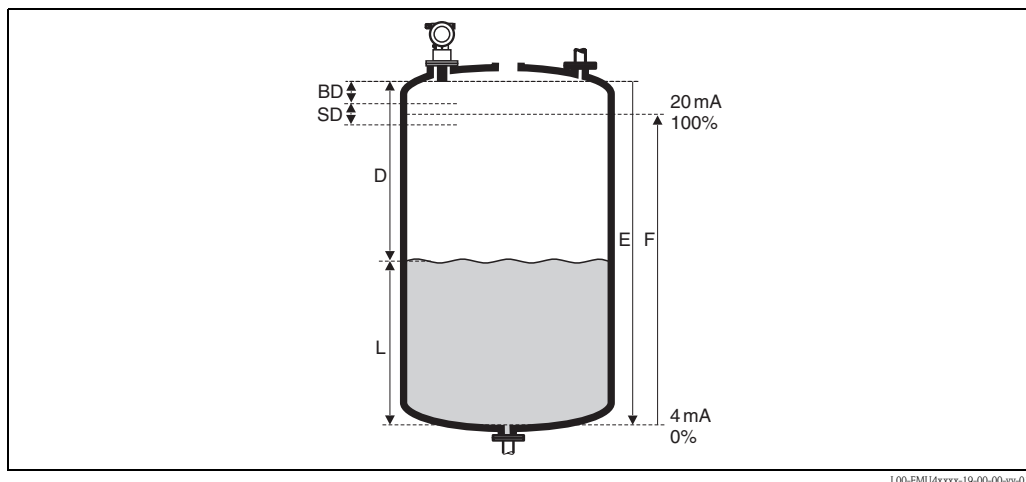
standard liquids	calm surface	turb. surface
For all fluid applications which do not fit in any of the following groups.	Storage tanks with immersion tube or bottom filling	Storage / accumulation tanks with uneven surface due to free filling, mixing nozzles or small bottom stirrers
	 L00-FMU4xxxx-14-00-00-xx-001	 L00-FMU4xxxx-14-00-00-xx-002
The filters and output damping are set to average values.	The averaging filters and output damping are set to large values. -> Stable measured value -> Accurate measurement -> Slow reaction time	Special filters for stabilising the input signal are activated. -> Stable measured value -> Medium reaction time

add. agitator	fast change	standard solid
Moving surfaces (poss. with vortex formation) due to agitators	Rapid level change, particularly in small tanks	For all bulk solids applications which do not fit in any of the following groups.
 L00-FMU4xxxx-14-00-00-xx-003	 L00-FMU4xxxx-14-00-00-xx-004	 L00-FMU4xxxx-14-00-00-xx-006
Special filters for stabilising the input signal are set to large values. -> Stable measured value -> Medium reaction time	The averaging filters are set to small values. -> Rapid reaction time -> Possibly unstable measured value	The filter and output damping are set to average values.

Commissioning

solid dusty	conveyor belt	Test: no filter
Dusty bulk solids	Bulk solids with rapid level change	All the filters can be switched off for purposes of service and diagnosis.
 L00-FMU4xxxx-14-00-00-xx-007	 L00-FMU4xxxx-14-00-00-xx-005	
The filters are set to detect even relatively weak signals.	The averaging filters are set to small values. -> Rapid reaction time Possibly unstable measured value	All filters off

6.2.2 Empty and full calibration



Function "empty calibration" (005)

In this function, enter the distance E from the sensor membrane to the minimum level (zero point).



Caution!

With dished boiler heads or conical outflows, the zero point should not be deeper than the point at which the ultrasonic wave impinges on the tank bottom.

Function "blocking distance" (059)

In this function the blocking distance (BD) of the sensor is displayed.



Caution!

When entering the full calibration (span), please take into account, that the maximum level may not project into the blocking distance (BD)



Note!

After basic calibration, enter a safety distance (SD) in the **"safety distance" (015)** function. If the level is within this safety distance, the Prosonic M signals a warning or an alarm, depending on your selection in the **"in safety distance" (016)** function.

Function "full calibration" (006)

In this function, enter the span F, i.e. the distance from the minimum level to the maximum level.

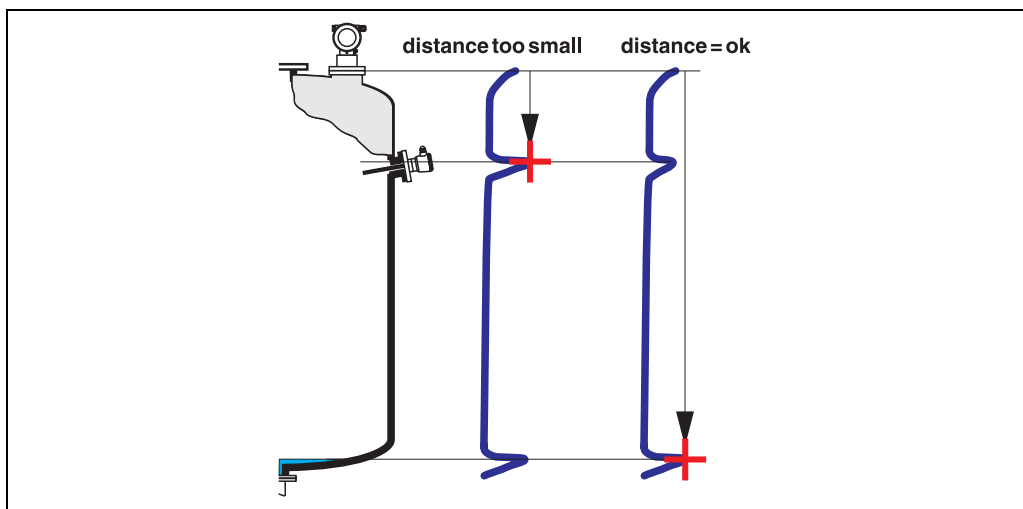
6.2.3 Interference echo suppression (tank mapping)

Function "dist./measured value" (008)

In the **"dist./meas.value" (008)** function, the measured distance D from the sensor membrane to the product surface is displayed together with level L. Check these values.

Function "check distance" (051)

The mapping is initialized by this function.



L00-FMR2xxxx-14-00-06-en-010

Select

- **"distance=ok"** if the correct distance is displayed. Any echoes closer to the sensor will be suppressed by the following interference echo suppression.
- **"dist. too small"** if the displayed distance is too small. In this case, the signal comes from an interference echo which will be suppressed.
- **"dist. too big"** if the displayed distance is too large. This error cannot be cancelled by suppressing the interference echo. This means that the following two functions are skipped. Check the application parameters **"tank shape" (002)**, **"medium property" (003)** and **"process cond." (004)** and the **"empty calibr." (005)** in the **"basic setup" (00)** function group.
- **"dist. unknown"** if you do not know the actual distance. This means that the following two functions are skipped.
- **"manual"** if you want to specify the suppression area yourself in the following function.

Function "range of mapping" (052)

The suggested suppression area is displayed in this function. The reference point is always the sensor membrane. You can still edit the value. With manual suppression, the default value is 0 m.



Caution!

The suppression range must end 0.5 m in front of the echo of the actual level. With an empty tank, do not enter E but E - 0.5 m.

Function "start mapping" (053)

You have the following options for this function:

- **off:** Nothing is suppressed.
- **on:** Starts suppression.



Note!

If a mapping already exists, it will be overwritten up to the distance specified in the "**range of mapping**" (052) function. Beyond this distance the existing mapping remains unchanged.

Function dist./measured value (008)

After suppression, the measured distance D from the sensor membrane to the product surface is displayed together with the level. Check that the values correspond to the actual level and/or the actual distance.

The following cases may occur:

- Distance correct – Level correct -> End of basic calibration
- Distance incorrect – Level incorrect -> An additional interference echo suppression must be carried out. Go back to the "**check distance**" (051) function.
- Distance correct – Level incorrect -> Check the value of the "**empty calibr.**" (005) function.

Rücksprung zur Gruppenauswahl

Nach der Störechoausblendung ist der Grundabgleich beendet und das Gerät springt automatisch in die Gruppenauswahl zurück.

6.3 Envelope curve

After the basic setup, an evaluation of the measurement with the aid of the envelope curve ("envelope curve" (0E) function group) is recommended.

6.3.1 Function "plot settings" (0E1)

In this function, select whether you want to display

- just the envelope curve
- The envelope curve and the echo evaluation line FAC
- The envelope curve and interference echo suppression (map)



Note!

The FAC and the interference echo suppression (map) are explained in BA 240F "Prosonic M - Description of Instrument Functions"

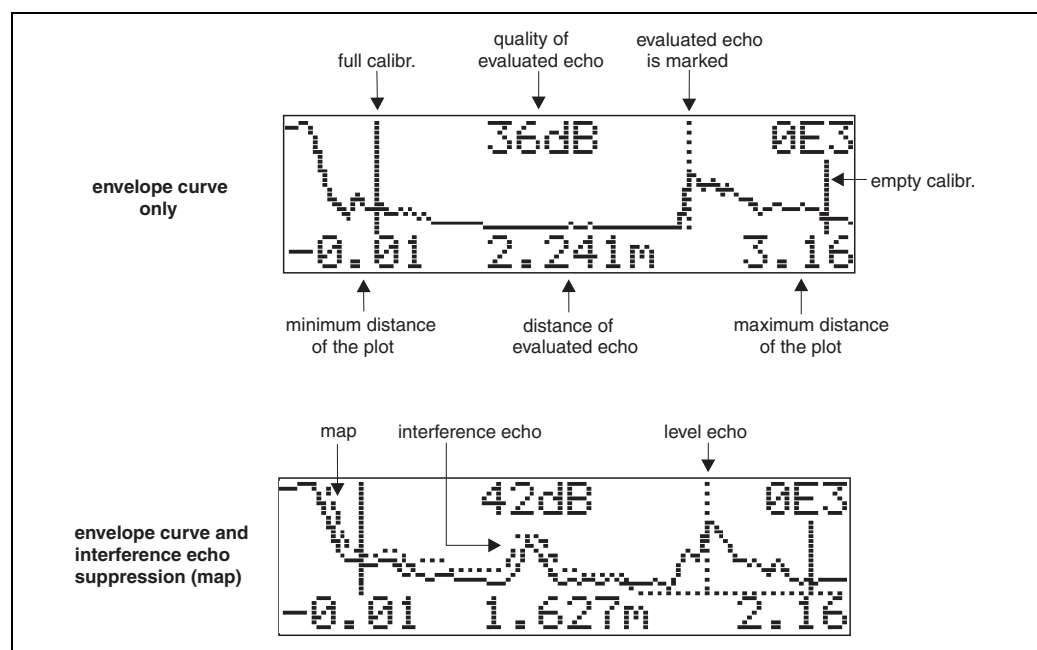
6.3.2 Function "recording curve" (0E2)

In this function, specify whether you want to display

- an individual envelope curve
- The current envelope curve, with cyclical refreshment.

6.3.3 Function "envelope curve display" (0E3)

The envelope curve is displayed in this function. You can use it to obtain the following information:



L00-FMU4xxxx-07-00-00-en-003

Check that the following conditions are fulfilled:

- The echo quality at the end of measuring range should be at least 10dB.
- There should be practically no interference echoes in front of the level signal.
- If interference echoes cannot be avoided, they must be below the suppression curve.

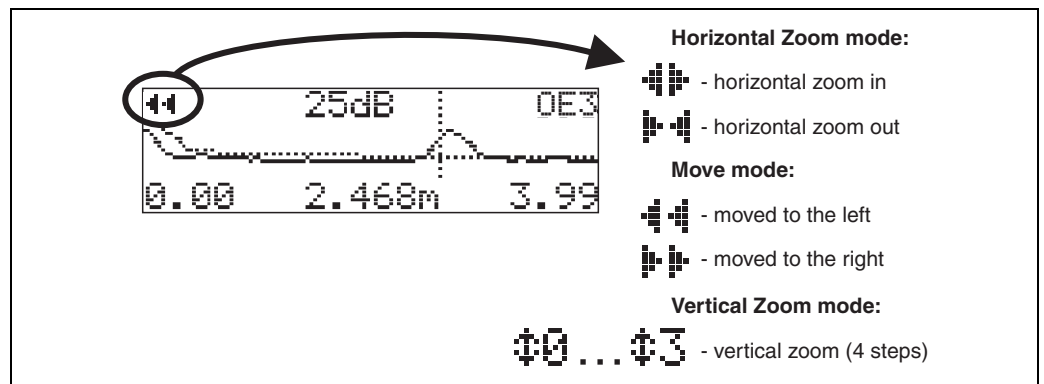


Note!

If the cyclical envelope curve display is still active on the display, the measured value is updated at a slower cycle time. We therefore advise you to exit the envelope curve display after optimising the measuring point. To do this, press [E]. (The instrument does not leave the envelope curve display automatically.)

6.3.4 Navigation in the envelope curve display

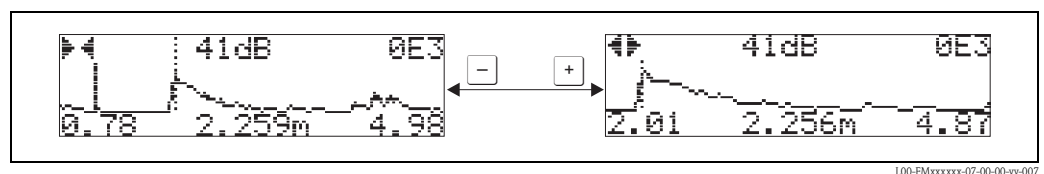
Using navigation, the envelope curve can be scaled horizontally and vertically and shifted to the left or the right. The active navigation mode is indicated by a symbol in the top left hand corner of the display.



Horizontal Zoom mode

Firstly, go into the envelope curve display. Then press or to switch to the envelope curve navigation. You are then in Horizontal Zoom mode. Either or is displayed.

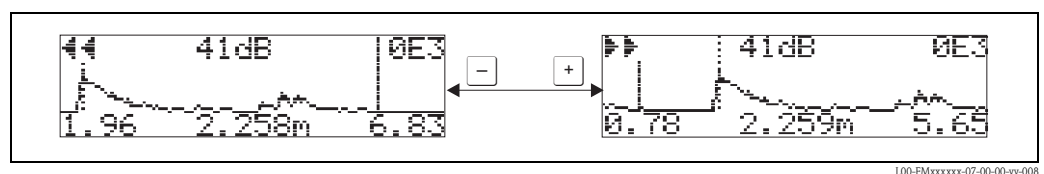
- increases the horizontal scale.
- reduces the horizontal scale.



Move mode

Then press to switch to Move mode. Either or is displayed.

- shifts the curve to the right.
- shifts the curve to the left.

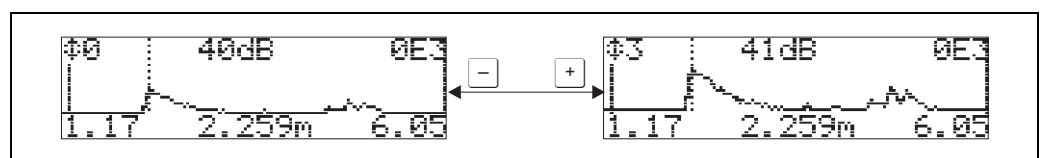


Vertical Zoom mode

Press once more to switch to Vertical Zoom mode. is displayed. You now have the following options.

- increases the vertical scale.
- reduces the vertical scale.

The display icon shows the current zoom factor (to).



Exiting the navigation

- Press again to run through the different modes of the envelope curve navigation.
- Press and to exit the navigation. The set increases and shifts are retained. Only when you reactivate the **"recording curve" (0E2)** function the display settings return to their standard values.

7 Troubleshooting

7.1 System error messages

7.1.1 Current error

Errors which the Prosonic M detects during commissioning or operation are displayed:

- In the **"measured value" (000)** function
- In the **"diagnostics" (0A)** function group in the **"present error" (0A0)** function
Only the highest priority error is displayed; in the case of multiple errors, you can scroll between the different error messages by pressing  or .

7.1.2 Last error

The last error is displayed in the **"diagnostics" (0A)** function group in the **"previous error" (0A1)** function. This display can be deleted in the **"clear last error" (0A2)** function.

7.1.3 Types of error

Type of error	Symbol	Meaning
Alarm (A)	 continuous	The output signal assumes a value which can be set using the "output on alarm" (010) function: ■ MAX: 110%, 22mA ■ MIN: -10%, 3,8mA ■ Hold: last value is on hold ■ User-specific value
Warning (W)	 flashing	The device continues measurement. An error message is displayed.
Alarm/Warning (E)	You can define whether the error should behave as an alarm or as a warning.	

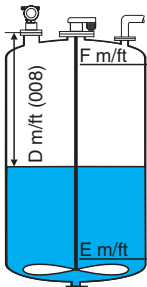
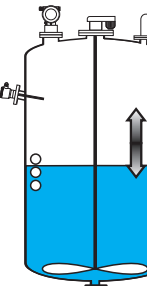
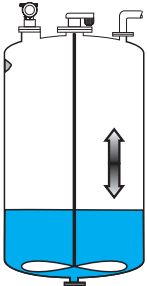
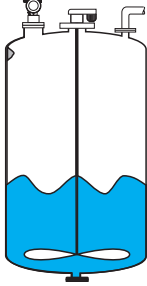
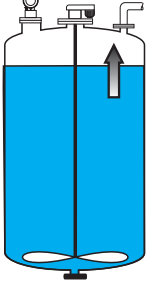
7.1.4 Error codes

Code	Error description	Action
A102 A110 A152 A160	checksum error	Reset; If alarm still present after reset, replace electronics
W103	initialising	If the message does not disappear after several seconds, replace the electronics
A106	downloading	Wait; Message disappears after load sequence
A111 A113 A114 A115 A121 A125 A155 A164 A171	electronics defect	Reset; Check system for EMC, improve as necessary If alarm still present after reset, replace electronics
A116	download error	Check connection; Restart download
W153	initialising	Wait a few seconds; if error is still displayed, switch the power off and on again
A231	sensor defect	Check connection, if necessary replace HF module or electronics

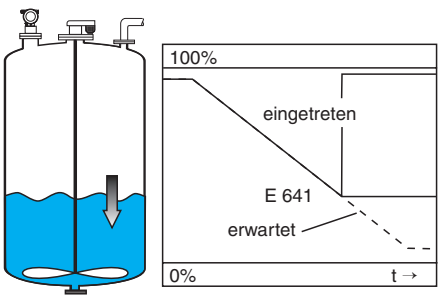
Troubleshooting

Code	Error description	Action
A281	interruption temperature sensor	Exchange sensor
A502	Sensor type not detected	Exchange sensor and/or electronics
A512	recording of mapping	Alarm disappears after a few seconds
A521	new sensor type detected	Reset
W601	linearisation curve not monotone	Correct table (enter monotonously increasing table)
W611	less than 2 linea-risation points	Enter additional value pairs
W621	simulation on	Switch simulation mode off [" output " (06) function group, " simulation " (065) function]]
E641	no usable echo	Check basic calibration
E651	level in safety distance - risk of overspill	Error disappears when the level leaves the safety distance. Possibly reset the lock. [" safety settings " (01) function group, " ackn. alarm " (017) function]]
A661	Sensor overtemperature	
A671	Linearisation incomplete	Activate linearisation table
W681	current out of range	Carry out basic calibration; check linearisation
W691	Filling noise detected, level ramp is active	

7.2 Application errors

Error	Example	Elimination
Measured value (00) is incorrect but measured distance (008) is correct	 100% expected actual 0% t → L00-FMR2xxxx-19-00-00-en-019	1. Check empty calibration (005) and full calibration (006). 2. Check linearisation – level/ullage (040) – max. scale(046) – diameter vessel(047) – linearisation table
Measured value (000) and measured distance (008) are incorrect	 100% expected actual 0% t → L00-FMR2xxxx-19-00-00-en-019	1. For measurements in bypass or stilling well: Select the according option in the "tank shape" (002) function. 2. Carry out interference echo suppression.
No change in measured value on filling/emptying	 100% actual expected 0% t → L00-FMR2xxxx-19-00-00-en-014	1. Carry out interference echo suppression. 2. Clean sensor if necessary 3. If necessary, select better installation position 4. If necessary due to wide interference echoes, set function "detection window" (0A7) to "off".
With an uneven surface (e.g. filling, emptying, running agitator) the measured value may jump sporadically to higher levels	 100% actual expected 0% t → L00-FMR2xxxx-19-00-00-en-015  100% actual expected 0% t → L00-FMR2xxxx-19-00-00-en-016	1. Carry out interference echo suppression 2. Set the process cond. (004) to "calm surface" or "add. agitator" 3. Increase output damping (058). 4. If necessary, select a different installation position and/or a larger sensor
On filling/emptying the measured value drops	 100% expected actual 0% t → L00-FMR2xxxx-19-00-00-en-017	1. Check tank shape (002), e.g. "dome ceiling" or "horizontal cyl." 2. If possible, do not select a central installation position 3. Possible user stilling well/echo guide pipe

Troubleshooting

Error	Example	Elimination
E 641 (echo loss)	 The diagram shows a cross-section of a tank with a liquid level. A sensor is mounted vertically, pointing downwards into the liquid. To the right of the tank is a graph with a vertical axis from 0% to 100% and a horizontal axis labeled 't' with an arrow pointing right. Two curves are shown: a solid line labeled 'eingetreten' (actual) and a dashed line labeled 'erwartet' (expected). The 'erwartet' curve starts at 100% and drops sharply towards 0% as time progresses. The 'eingetreten' curve follows the 'erwartet' curve initially but then levels off at a value significantly below 100%, indicating an echo loss. Below the graph, the text 'E 641' is written. At the bottom right of the diagram area, the code 'L00-FMR2xxxx-19-00-00-en-018' is printed.	1. Check application parameters (002), (003) and (004) 2. If necessary, select a different installation position and/or a larger sensor 3. Align the sensor parallel to the product surface (particularly for bulk solids applications)

8 Maintenance and repairs

8.1 Exterior cleaning

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

8.2 Repairs

The Endress+Hauser repair concept assumes that the measuring devices have a modular design and that customers are able to undertake repairs themselves.

Spare parts are contained in suitable kits. They contain the related replacement instructions.

All the spare parts kits which you can order from Endress+Hauser for repairs are listed with their order numbers in the section "Spare parts".

For more information on service and spare parts, contact the Service Department at Endress+Hauser.

8.3 Repairs to Ex-approved devices

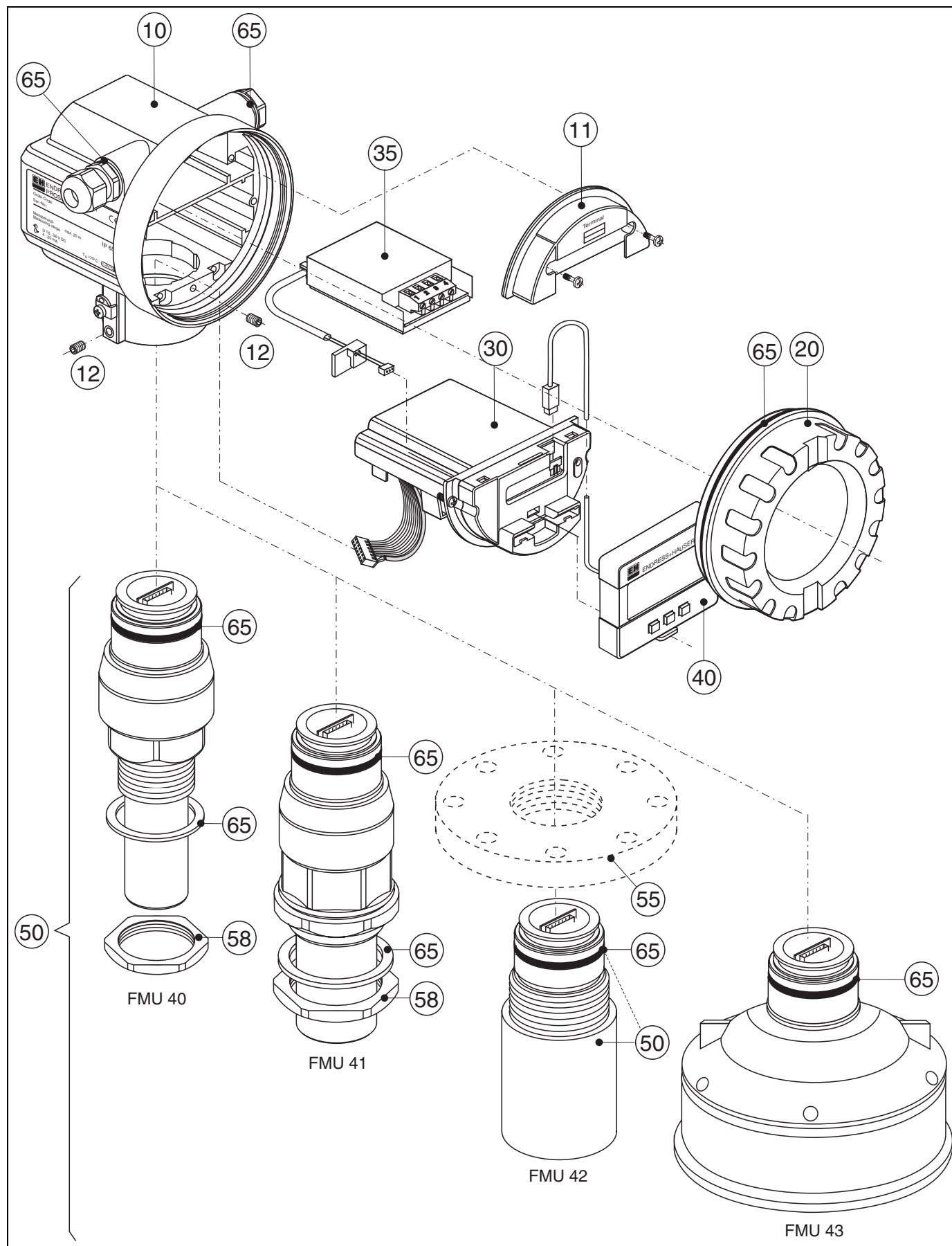
When carrying out repairs to Ex-approved devices, please note the following:

- Repairs to Ex-approved devices may only be carried out by trained personnel or by the Endress+Hauser Service.
- Comply with the prevailing standards, national Ex-area regulations, safety instructions (XA) and certificates.
- Only use original spare parts from Endress+Hauser.
- When ordering a spare part, please note the device designation on the nameplate. Only replace parts with identical parts.
- Carry out repairs according to the instructions. On completion of repairs, carry out the specified routine test on the device.
- Only Endress+Hauser Service may convert a certified device into a different certified variant.
- Document all repair work and conversions.

8.4 Replacement

After a complete instrument or electronic module has been replaced, the parameters can be downloaded into the instrument again via the communication interface. Prerequisite to this is that the data were uploaded to the PC beforehand using the ToF Tool / Commuwin II. Measurement can continue without having to carry out a new setup. Only a linearisation and a tank map (interference echo suppression) have to be recorded again.

8.5 Spare parts (housing type F12)



10 Housing

543120-0022 Housing F12, aluminium, G1/2
543120-0023 Housing F12, aluminium, NPT1/2
543120-0024 Housing F12, aluminium, M20
52001992 Housing F12, aluminium, M20, PA connector
52008556 Housing F12, aluminium, M20, FF connector
52013350 Housing F12, aluminium, coated, M20, 4-wire
52013351 Housing F12, aluminium, coated, M20, metal
52013348 Housing F12, aluminium, coated, G1/2, 4-wire
52013349 Housing F12, aluminium, coated, NPT1/2, 4-wire

11 Hood for terminal compartment

52006026 Cover for the connection compartment F12
52019062 Cover for the connection compartment F12, FHX40

12 Set of screws

535720-9020 Set of screws for housing F12/T12

20 Cover

52005936 Cover F12/T12 aluminium, inspection glass, seal
517391-0011 Cover F12/T12 aluminium, coated, seal

30 Electronics

52023756 Electronics Prosonic M, Ex, 2-wire, HART
52023757 Electronics Prosonic M, Ex, 4-wire, HART
52023758 Electronics Prosonic M, Ex, PA, V2.04
52023759 Electronics Prosonic M, Ex, FF, V2.04

35 Terminal module / power unit

52006197 Terminal module 4-pin, HART, 2-wire with connecting cable
52012156 Terminal module 4-pin, PROFIBUS PA, Foundation Fieldbus
52013304 Power unit, 10.5...32V DC (housing F12) for electronics, 4-wire
52013305 Power unit, 90 ...250V AC (housing F12) for electronics, 4-wire
52015585 Power unit, CSA, 10.5...32V DC (housing F12) for electronics, 4-wire
52015586 Power unit, CSA, 90...250V AC (housing F12) for electronics, 4-wire

40 Display

52005585 Display/operating module VU331

50 Probe with process connection

52010509 Sensor FMU40 G1-1/2
52010507 Sensor FMU40 NPT1-1/2
52010510 Sensor FMU41 G2
52010508 Sensor FMU41 NPT2
52023965 Sensor FMU42
52013543 Sensor FMU43 4", gasket

55 Flanges

52023919 Flange, Uni-DN80/ANSI 3"/JIS 80A, PP

52023920 Flange, Uni-DN80/ANSI 3"/JIS 80A, PVDF

52023921 Flange, Uni-DN80/ANSI 3"/JIS 80A, 316L

52023922 Flange, Uni-DN100/ANSI 4"/JIS 100A, PP

52023923 Flange, Uni-DN100/ANSI 4"/JIS 100A, PVDF

58 Hexagon nut

52000599 Hexagon nut (SW60) G1-1/2, bk, PC

52000598 Hexagon nut (SW70) G2, bk, PC

65 Sealing kit

52010526 Sealing kit FMU4x

Miscellaneous

52010545 Nameplate Prosonic M, modification

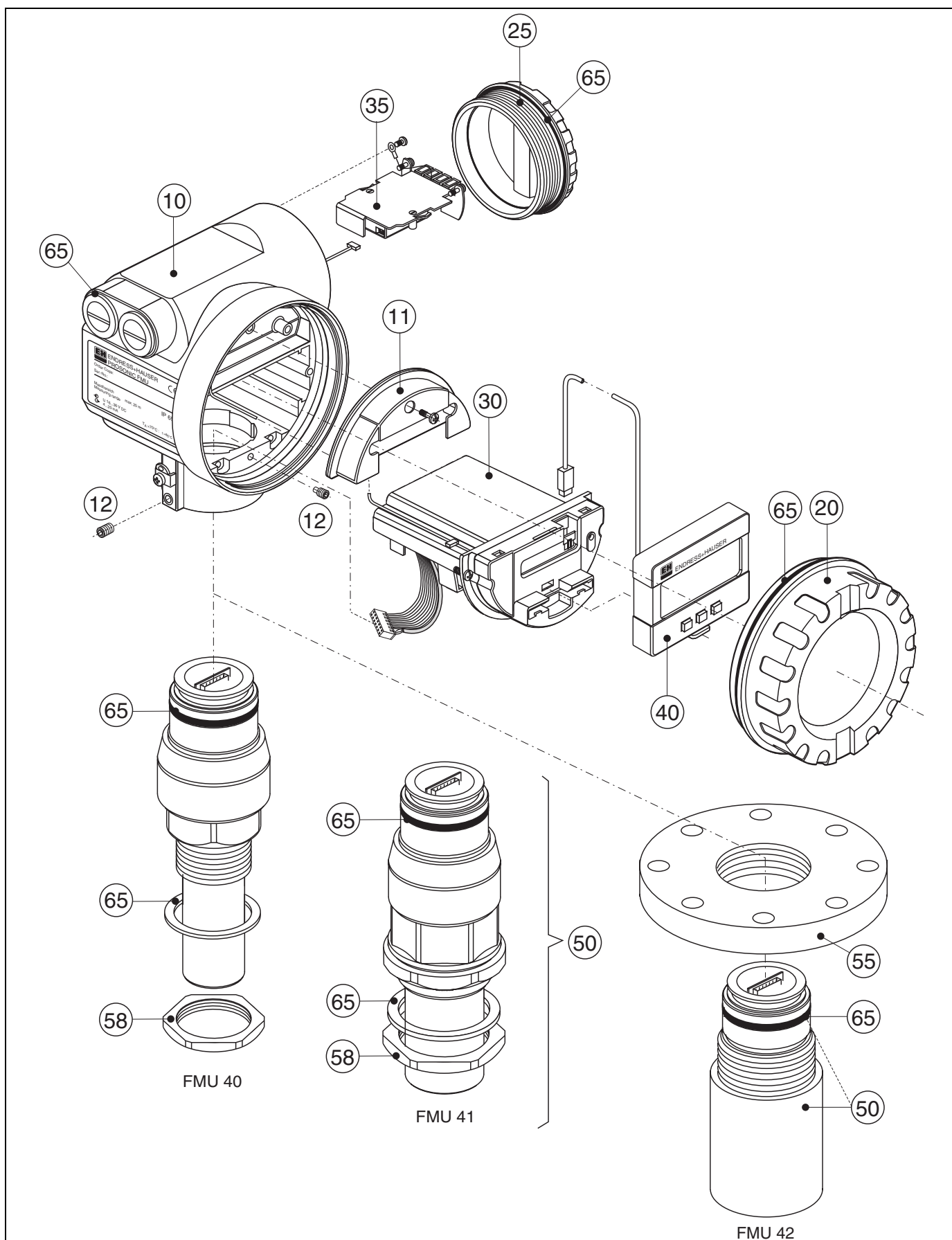
Spare parts for FHX40

52018204 Adaption kit housing F12, 2-wire, FHX40

52018205 Adaption kit housing F12, 4-wire, FHX40

52016334 Cable FHX40, 20m

8.6 Spare parts (housing type T12)



10 Housing

543180-1023 Housing T12, aluminium, NPT1/2, PEL

52006204 Housing T12, aluminium, G1/2, PEL, cover

52006205 Housing T12, aluminium, M20, PEL, cover

11 Hood for terminal compartment

52005643 Hood T12

12 Set of screws

535720-9020 Set of screws for housing F12/T12

20 Cover

52005936 Cover F12/T12 aluminium, inspection glass, seal

517391-0011 Cover F12/T12 aluminium, coated, seal

25 Cover for the connection compartment

518710-0020 Cover T3/T12, aluminium, coated, seal

30 Electronics

52023756 Electronics Prosonic M, Ex, 2-wire, HART

52023758 Electronics Prosonic M, Ex, PA, V2.04

52023759 Electronics Prosonic M, Ex, FF, V2.04

35 Terminal module / power unit

52013302 Terminal module Ex d, 4-pin, 2-wire, HART, T12

52013303 Terminal module Ex d, 2-pin, 2-wire, PROFIBUS PA, Foundation Fieldbus, T12

52018949 Terminal module EEx ia, 4-pin, HART, T12, OVP

52018950 Terminal module EEx ia, 4-pin, PROFIBUS PA, Foundation Fieldbus, T12, OVP

40 Display

52005585 Display/operating module VU331

50 Probe with process connection

52010509 Sensor FMU40 G1-1/2

52010507 Sensor FMU40 NPT1-1/2

52010510 Sensor FMU41 G2

52010508 Sensor FMU41 NPT2

52023965 Sensor FMU42

55 Flanges

52023919 Flange, Uni-DN80/ANSI 3"/JIS 80A, PP

52023920 Flange, Uni-DN80/ANSI 3"/JIS 80A, PVDF

52023921 Flange, Uni-DN80/ANSI 3"/JIS 80A, 316L

52023922 Flange, Uni-DN100/ANSI 4"/JIS 100A, PP

52023923 Flange, Uni-DN100/ANSI 4"/JIS 100A, PVDF

52023924 Flange, Uni-DN100/ANSI 4"/JIS 100A, 316L

58 Hexagon nut

52000599 Hexagon nut (SW60) G1-1/2, bk, PC

52000598 Hexagon nut (SW70) G2, bk, PC

65 Sealing kit

52010526 Sealing kit FMU4x

Miscellaneous

52010545 Nameplate Prosonic M, modification

8.7 Return

The following procedures must be carried out before a transmitter is sent to Endress+Hauser e.g. for repair or calibration:

- Remove all residue which may be present. Pay special attention to the gasket grooves and crevices where fluid may be present. This is especially important if the fluid is dangerous to health, e.g. corrosive, poisonous, carcinogenic, radioactive, etc.
- Always enclose a duly completed "Declaration of contamination" form (a copy of the "Declaration of contamination" is included at the end of this operating manual). 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 EN 91/155/EEC.

Additionally specify:

- An exact description of the application.
- The chemical and physical characteristics of the product.
- A short description of the error that occurred (specify error code if possible)
- Operating time of the device.

8.8 Disposal

In case of disposal please separate the different components according to their material consistence.

In case of disposal please separate the different components according to their material consistence.

8.9 Software history

Software version / date	Changes to software	Changes to documentation
V 01.02.00 / 01.2002 V 01.02.02 / 03.2003	Original software Compatible with: ■ ToF Tool ■ Commuwin II (version 2.05.03 and higher) ■ HART Communicator DXR 275 (from OS 4.6) with Rev. 1, DD 1	
V 01.02.04/02.2004	■ FMU 42 added ■ compatible with HART Communicator DXR 375	FMU 42 added
V 01.04.00/07.2006	■ "detection window" function added can be operated via: ■ ToF Tool from version 4.50 ■ HART Communicator DXR375 with Rev. 1, DD1	"detection window" added Version: 07.06

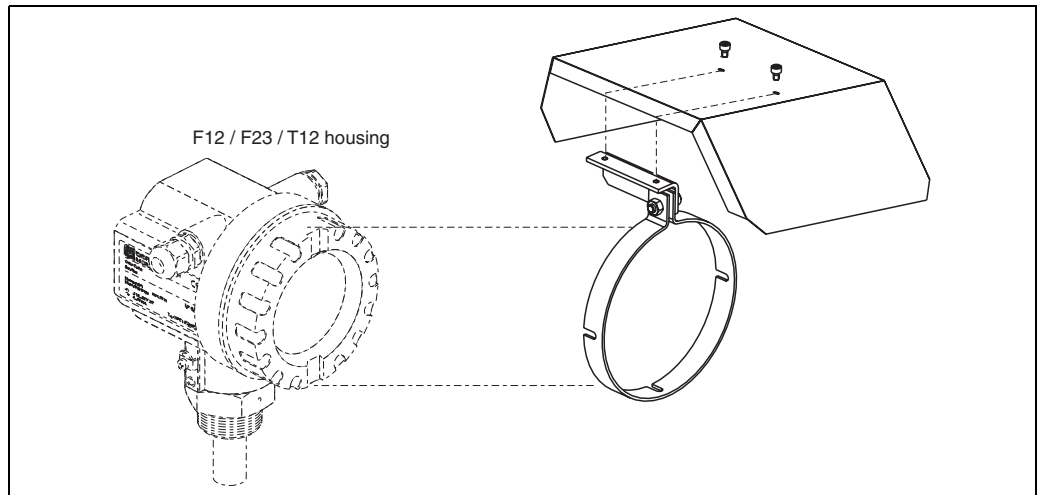
8.10 Contact addresses of Endress+Hauser

Contact addresses can be found on our homepage: www.endress.com/worldwide. If you have any questions, please do not hesitate to contact your Endress+Hauser representative.

9 Accessories

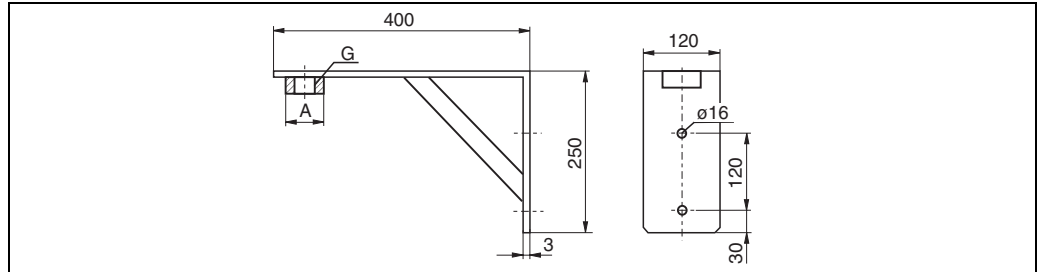
9.1 Weather protection cover

A Weather protection cover made of stainless steel is recommended for outdoor mounting (order code: 543199-0001). The shipment includes the protective cover and tension clamp.



L00-FMR2xxxx-00-00-06-en-001

9.2 Installation bracket for FMU 40/41

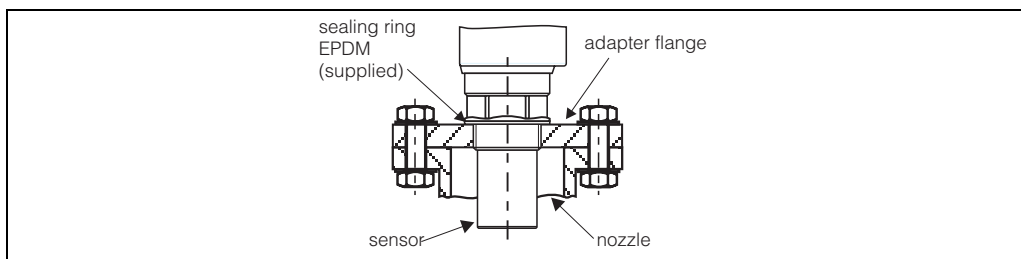


L00-FMU4x-00-00-00-de-001

- for FMU 40, G1½: Order No. 942669-0000
- for FMU 41, G2: Order No. 942669-0001

suited for NPT 1½" and 2" as well

9.3 Adapter flange for FMU 40 / FMU 41



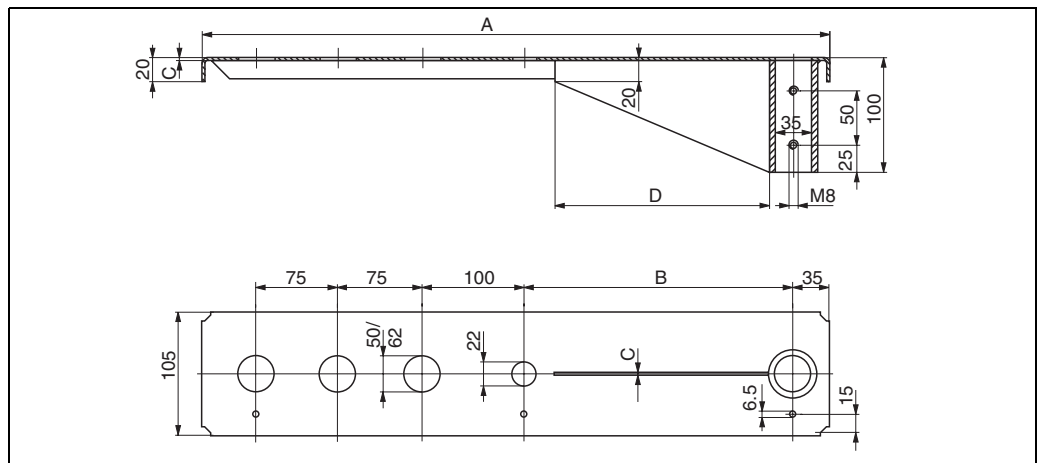
9.3.1 Version with metrical thread (FAU 70 E)

	Version		
	12	DN 50 PN 16	
	14	DN 80 PN 16	
	15	DN 100 PN 16	
		Thread	
	3	G 1½, ISO 228	
	4	G 2, ISO 228	
		Material	
	2	1.4435 (316L)	
	7	PPs (Polypropylene)	
FAU 70 E			Product designation

9.3.2 Version with conical thread (FAU 70 A)

Version			
	22	ANSI 2" 150 psi	
	24	ANSI 3" 150 psi	
	25	ANSI 4" 150 psi	
Thread			
	5	NPT 1½ - 11,5	
	6	NPT 2 - 11,5	
Material			
	2	1.4435 (316L)	
	7	PPs (Polypropylene)	
FAU 70 A			Product designation

9.4 Cantilever

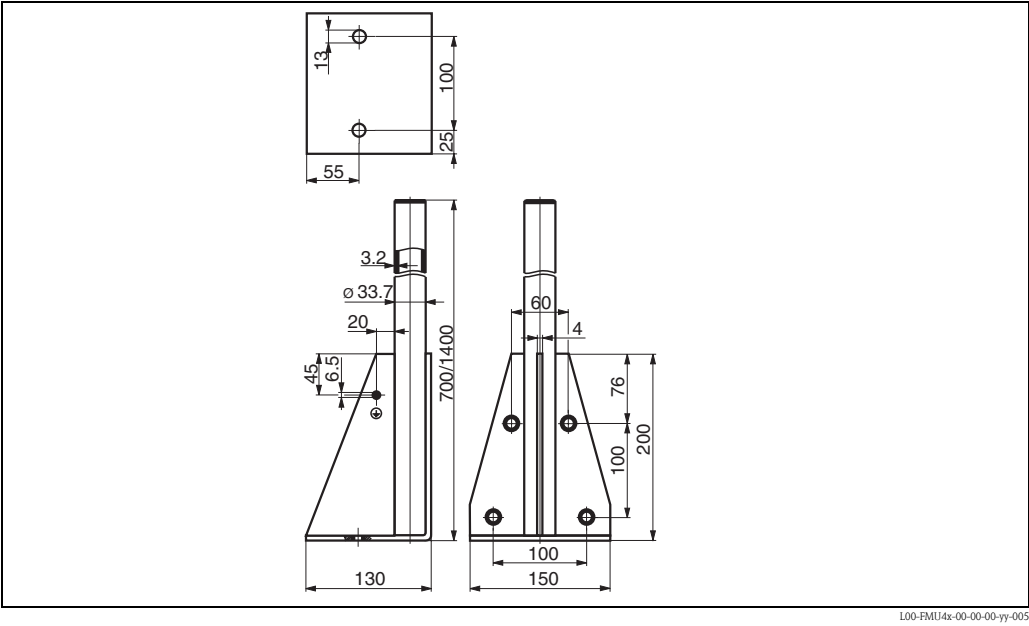


L00-FMU4xxxx-06-00-00-yy-005

A	B	C	D	for Sensor	Material	Order Code
585 mm	250 mm	2 mm	200 mm	FMU 40	1.4301 (AISI 304)	52014132
					galv. steel	52014131
				FMU 41	1.4301 (AISI 304)	52014136
					galv. steel	52014135
1085 mm	750 mm	3 mm	300 mm	FMU 40	1.4301 (AISI 304)	52014134
					galv. steel	52014133
				FMU 41	1.4301 (AISI 304)	52014138
					galv. steel	52014137

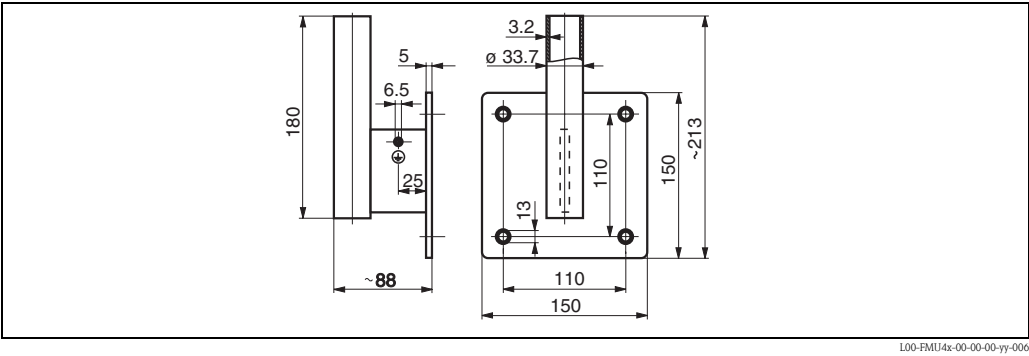
- The 50 mm or 62 mm orifices serve for the mounting of the FMU 40 or FMU 41 sensor, respectively.
- The 22 mm orifice may be used for an additional sensor.

9.5 Mounting Frame



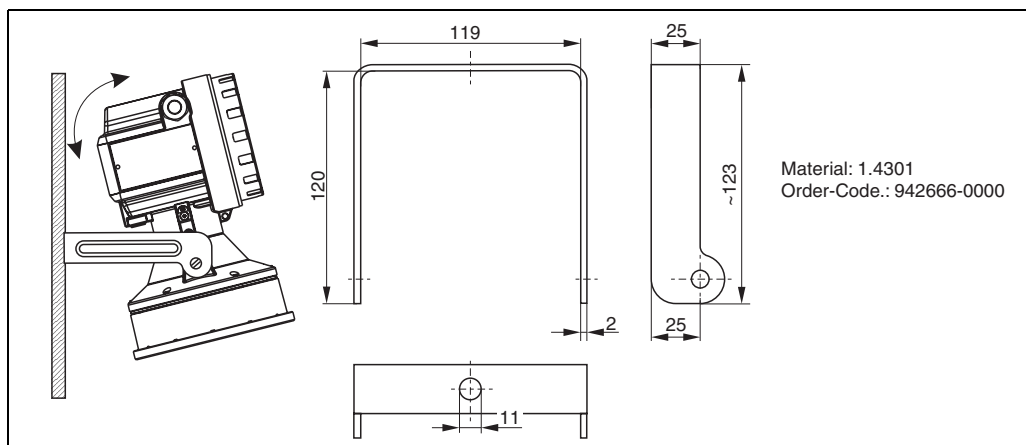
Height	Material	Order Code
700 mm	galv. steel	919791-0000
700 mm	1.4301 (AISI 304)	919791-0001
1400 mm	galv. steel	919791-0002
1400 mm	1.4301 (AISI 304)	919791-0003

9.6 Wall Bracket



Material	Order Code
galv. steel	919792-0000
316Ti/1.4571	919792-0001

9.7 Mounting bracket for FMU 43



9.8 Commubox FXA191 HART

For intrinsically safe communication with ToF Tool/FieldCare via the RS232C interface. For details refer to TI237F/00/en.

9.9 Commubox FXA195 HART

For intrinsically safe communication with ToF Tool/FieldCare via the USB interface. For details refer to TI404F/00/en.

9.10 Commubox FXA291

The Commubox FXA291 connects Endress+Hauser field instruments with CDI interface (= Endress+Hauser Common Data Interface) to the USB interface of a personal computer or a notebook. For details refer to TI405C/07/en.



Note!

For the following Endress+Hauser instruments you need the "ToF Adapter FXA291" as an additional accessory:

- Cerabar S PMC71, PMP7x
- Deltabar S PMD7x, FMD7x
- Deltapilot S FMB70
- Gammapilot M FMG60
- Levelflex M FMP4x
- Micropilot FMR130/FMR131
- Micropilot M FMR2xx
- Micropilot S FMR53x, FMR540
- Prosonic FMU860/861/862
- Prosonic M FMU4x
- Tank Side Monitor NRF590 (with additional adapter cable)

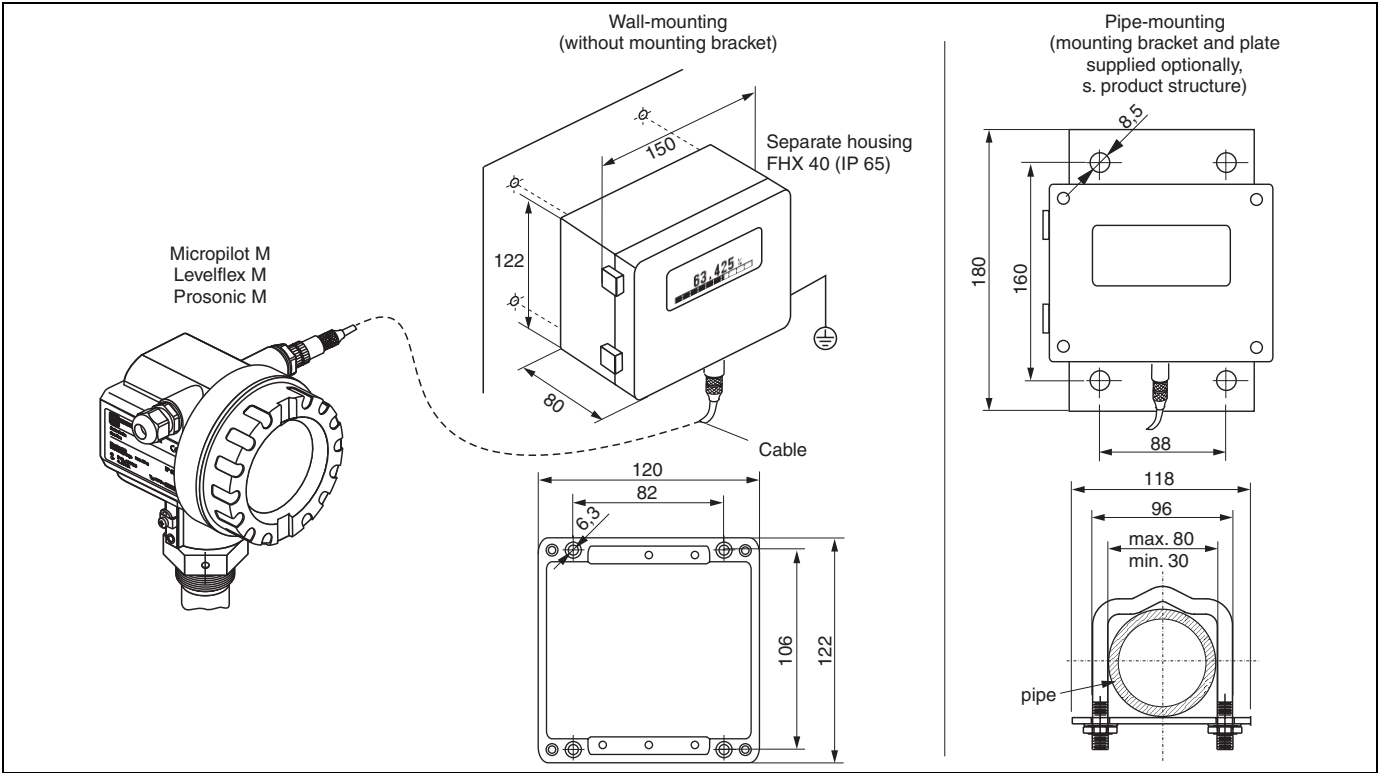
9.11 ToF Adapter FXA291

The ToF Adapter FXA291 connects the Commubox FXA291 via the USB interface of a personal computer or a notebook to the following Endress+Hauser instruments:

- Cerabar S PMC71, PMP7x
- Deltabar S PMD7x, FMD7x
- Deltapilot S FMB70
- Gammapilot M FMG60
- Levelflex M FMP4x
- Micropilot FMR130/FMR131
- Micropilot M FMR2xx
- Micropilot S FMR53x, FMR540
- Prosonic FMU860/861/862
- Prosonic M FMU4x
- Tank Side Monitor NRF590 (with additional adapter cable)

For details refer to KA271F/00/a2.

9.12 Remote display FHX40



L00-FMxxxxxx-00-00-06-en-003

9.12.1 Technical data (cable and housing) and product structure:

Max. cable length	20 m (65 ft)
Temperature range	-30 °C...+70 °C (-22 °F...158 °F)
Degree of protection	IP65 acc. to EN 60529 (NEMA 4)
Materials	Housing: AISi12; cable glands: nickle plated brass
Dimensions [mm] / [inch]	122x150x80 (HxWxD) / 4.8x5.9x3.2

			Approval:
	A		Nn-hazardous area
	1		ATEX II 2 G EEx ia IIC T6, ATEX II 3D
	S		FM IS Cl.I Div.1 Gr.A-D
	U		CSA IS Cl.I Div.1 Gr.A-D
	N		CSA General Purpose
	K		TIIS ia IIC T6 (in preparation)
			Cable:
	1		20m/65ft; for HART
	5		20m/65ft; for PROFIBUS PA/FOUNDATION Fieldbus
			Additional option:
	A		Basic version
	B		Mounting bracket, pipe 1" / 2"
FHX40 -			Complete product designation

For connection of the remote display FHX40 use the cable which fits the communication version of the respective instrument.

10 Technical Data

10.1 Technical data at a glance

10.1.1 Input

Measured variable	The distance D between the sensor membrane and the product surface is measured. Using the linearisation function, the device uses D to calculate: ■ level L in any units ■ volume V in any units ■ flow Q across measuring weirs or open channels in any units
-------------------	--

Maximum range/blocking distance

Sensor	Maximum range in liquids ¹	Maximum range in solids ¹	blocking distance
FMU 40	5 m	2 m	0,25 m
FMU 41	8 m	3,5 m	0,35 m
FMU 42	10 m	5 m	0,4 m
FMU 43	15 m	7 m	0,6 m

¹The actual range is dependent on the measuring conditions. Refer to Technical Information TI 365F/00/en for an estimation.

10.1.2 Output

Output signal	4 ... 20 mA with HART protocol
---------------	--------------------------------

Signal on alarm	■ Error symbol, error code and plain text description on the on-site display ■ Error code via HART communication ■ Current output (configurable)
-----------------	--

10.1.3 Auxiliary energy

Cable entry	■ Cable gland M20x1.5 (recommended cable diameter 6 ... 10 mm) ■ Cable entry G½ or ½ NPT
-------------	---

Supply voltage	■ Loop-powered HART: 14 ... 36 V (depending on output current) ■ Loop-powered fixed current: 10 ... 36 V ■ 4-wire DC: 10.5 ... 32 VDC ■ 4-wire AC: 90 ... 253 VAC
----------------	--

There may be additional restrictions for devices with an explosion protection certificate. Refer to the notes in the appropriate safety instructions (XA).

Power consumption

Version	Power consumption
2-wire	51 mW ... 800 mW
4-wire AC	max. 4VA
4-wire DC; FMU 40/41	330 mW ... 830 mW
4-wire DC; FMU 42/43	600 mW ... 1 W

Load HART	Minimum load for HART communication: 250 Ω
HART ripple	47...125 Hz: V _{pp} = 200 mV (measured at 500 Ω)
Max. noise HART	500 Hz...10 kHz: V _{rms} = 2.2 mV (measured at 500 Ω)
Galvanic isolation	With 4-wire devices, the evaluation electronics and mains voltage are galvanically isolated from each other.

10.1.4 Performance characteristics

Reaction time	The reaction time depends on the parameter settings (min. 0.5s for 4-wire devices, min. 2s for 2-wire devices).
Reference operating conditions	■ Temperature = +20 °C ■ Pressure = 1013 mbar abs. ■ Humidity = 50 % ■ Ideal reflective surface (e.g. calm, smooth fluid surface) ■ No interference reflections within signal beam ■ Set application parameters: – Tank shape = flat ceiling – Medium property = liquid – process conditions = calm surface

Measured value resolution

Sensor	Measured value resolution
FMU 40	1 mm
FMU 41	1 mm
FMU 42	2 mm
FMU 43	2 mm

Measuring error

Typical specifications for reference operating conditions (include linearity, repeatability, and hysteresis):

Sensor	Measuring error
FMU 40	± 2 mm or 0.2% of set measuring distance (empty calibration) ¹
FMU 41	± 2 mm or 0,2% of set measuring distance (empty calibration) ¹
FMU 42	± 4 mm or 0,2% of set measuring distance (empty calibration) ¹
FMU 43	± 4 mm or 0,2% of set measuring distance (empty calibration) ¹

¹whichever is greater

10.1.5 Ambient conditions

Ambient temperature	-40 °C ... +80 °C The functionality of the LC display becomes restricted at $T_u < -20\text{ °C}$ and $T_u > +60\text{ °C}$. If the device is operated outdoors in strong sunlight, you should use a protective cover.
Storage temperature	-40 °C ... +80 °C
Climate class	DIN EN 60068-2-38 (Test Z/AD) DIN/IEC 68 T2-30Db
Ingress protection	■ With closed housing, tested according to – IP 68, NEMA 6P (24h at 1.83m under water surface) – IP 66, NEMA 4x ■ With open housing: IP 20, NEMA 1 (also ingress protection of the display)
Vibration resistance	DIN EN 60068-2-64 / IEC 68-2-64: 20...2000 Hz, 1 (m/s ²) ² /Hz; 3 x 100 min
Electromagnetic compatibility (EMC)	■ Interference emission to EN 61326, Equipment Class B ■ Interference immunity to EN 61326, Appendix A (Industrial) and NAMUR Recommendation NE 21 (EMC). ■ A standard installation cable is sufficient if only the analogue signal is used. Use a screened cable when working with a superimposed communication signal (HART).

10.1.6 Process conditions

Process temperature	-40 °C ... +80 °C A temperature sensor is integrated in the sensor for correction of the temperature-dependent time-of-flight.
---------------------	--

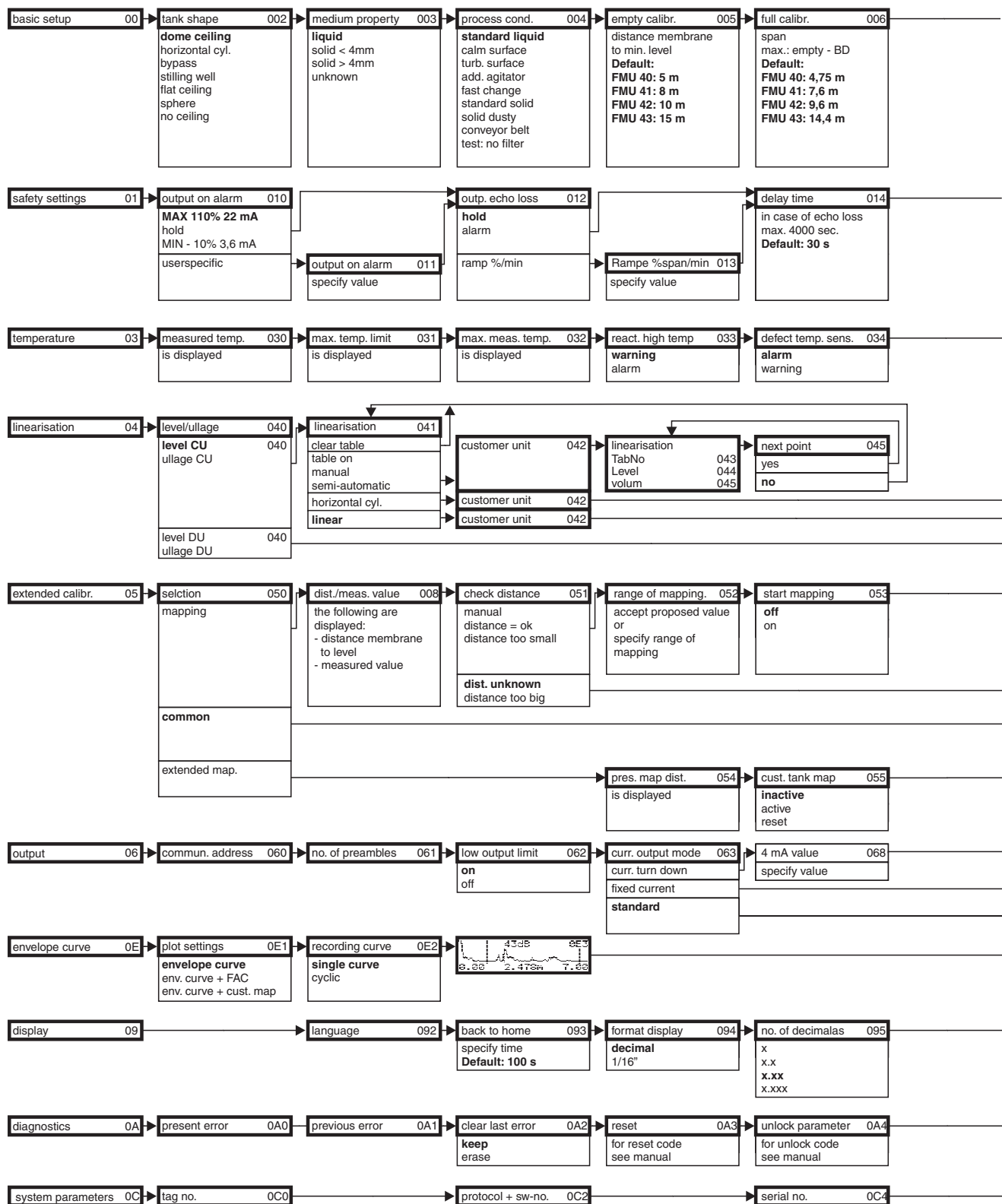
Process pressure	■ FMU 40/41: 0.7 bar ... 3bar abs. ■ FMU 42/43: 0.7 bar ... 2.5bar abs.
------------------	--



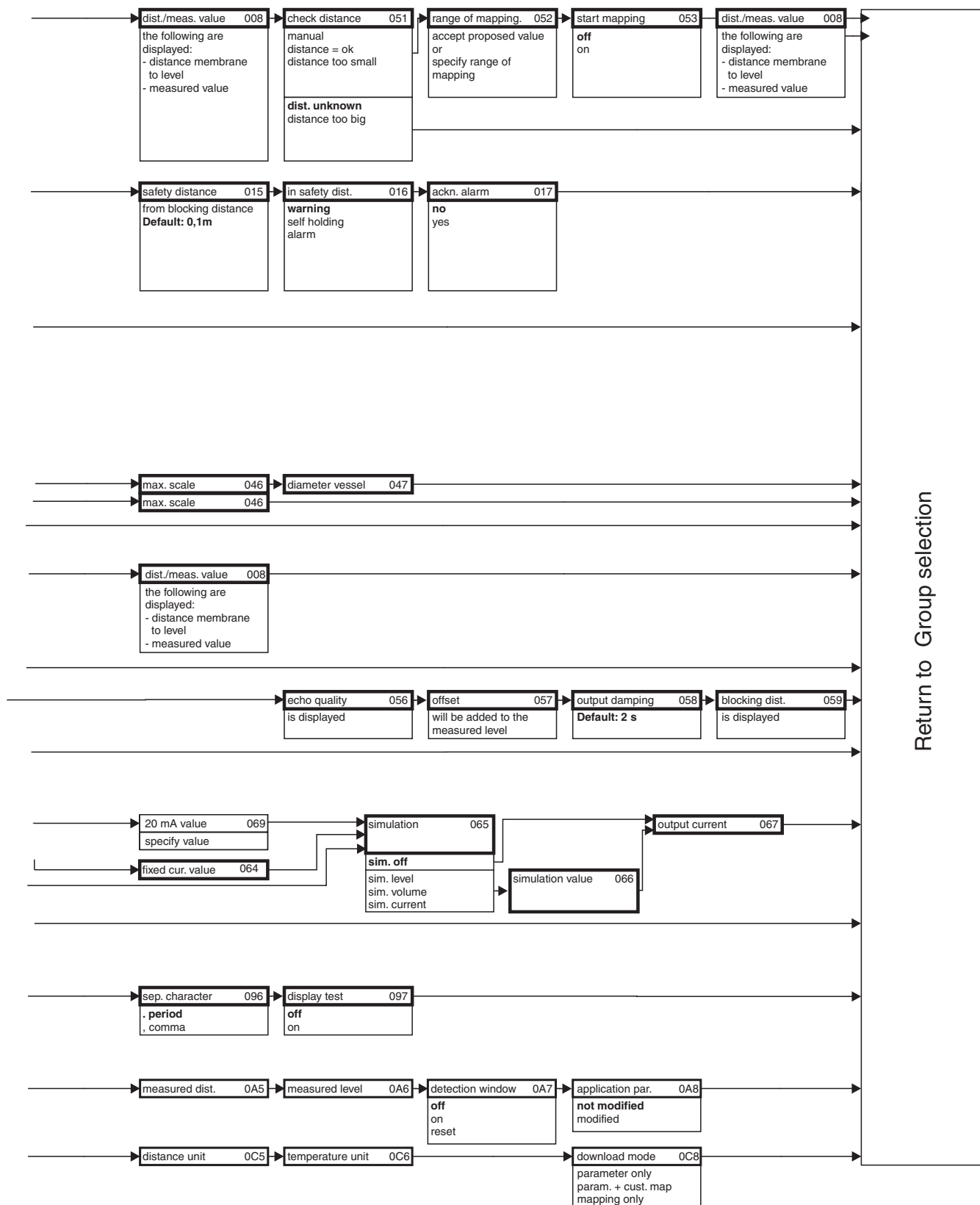
Note!
For pressures less than 0.7 bar please contact Endress+Hauser

11 Appendix

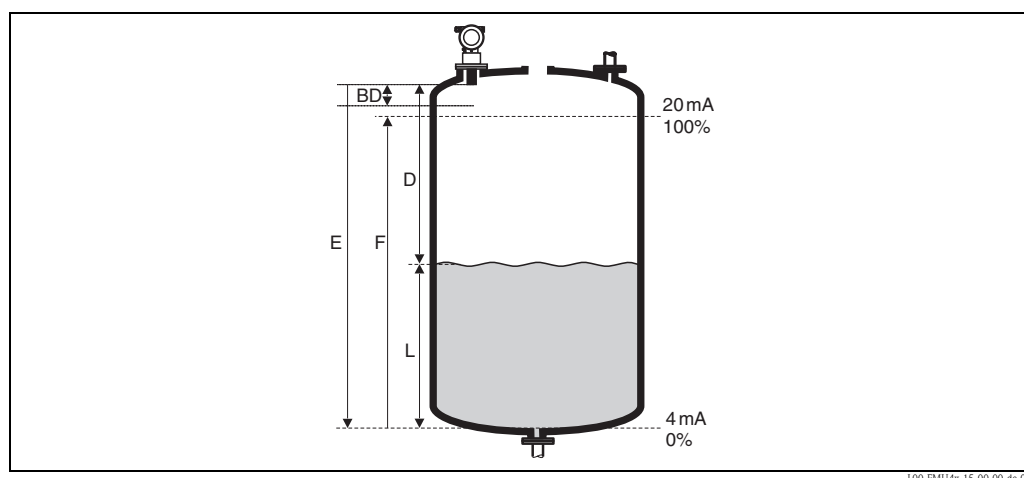
11.1 Operating menu



Note! The Default values of the parameters are typed in bold face.



11.2 Measuring principle



E: Empty distance; **F:** Span (full distance); **D:** Distance from sensor membrane - product surface; **L:** Level; **BD:** Blocking distance

Sensor	BD	Max. range fluids	Max. range bulk materials
FMU 40	0.25 m	5 m	2 m
FMU 41	0.35 m	8 m	3.5 m
FMU 42	0.4 m	10 m	5 m
FMU 43	0.6 m	15 m	7 m

11.2.1 Time-of-flight method

The sensor of the Prosonic M transmits ultrasonic pulses in the direction of the product surface. There, they are reflected back and received by the sensor. The Prosonic M measures the time t between pulse transmission and reception. The instrument uses the time t (and the velocity of sound c) to calculate the distance D between the sensor membrane and the product surface:

$$D = c \cdot t / 2$$

As the device knows the empty distance E from a user entry, it can calculate the level as follows:

$$L = E - D$$

An integrated temperature sensor compensates for changes in the velocity of sound caused by temperature changes.

11.2.2 Interference echo suppression

The interference echo suppression feature on the Prosonic M ensures that interference echos (e.g. from edges, welded joints and installations) are not interpreted as a level echo.

11.2.3 Calibration

Enter the empty distance E and the span F to calibrate the device.

11.2.4 Blocking distance

Span F may not extend into the blocking distance BD . Level echos from the blocking distance cannot be evaluated due to the transient characteristics of the sensor.

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Endress+Hauser

People for Process Automation

Declaration of Hazardous Material and De-Contamination

Erklärung zur Kontamination und Reinigung

RA No.

Please reference the Return Authorization Number (RA#), obtained from Endress+Hauser, on all paperwork and mark the RA# clearly on the outside of the box. If this procedure is not followed, it may result in the refusal of the package at our facility.

Bitte geben Sie die von E+H mitgeteilte Rücklieferungsnummer (RA#) auf allen Lieferpapieren an und vermerken Sie diese auch außen auf der Verpackung. Nichtbeachtung dieser Anweisung führt zur Ablehnung ihrer Lieferung.

Because of legal regulations and for the safety of our employees and operating equipment, we need the "Declaration of Hazardous Material and De-Contamination", with your signature, before your order can be handled. Please make absolutely sure to attach it to the outside of the packaging.

Aufgrund der gesetzlichen Vorschriften und zum Schutz unserer Mitarbeiter und Betriebseinrichtungen, benötigen wir die unterschriebene "Erklärung zur Kontamination und Reinigung", bevor Ihr Auftrag bearbeitet werden kann. Bringen Sie diese unbedingt außen an der Verpackung an.

Type of instrument / sensor

Geräte-/Sensortyp

Serial number

Seriennummer

☐ **Used as SIL device in a Safety Instrumented System / Einsatz als SIL Gerät in Schutzeinrichtungen**
Process data / Prozessdaten

Temperature / Temperatur _____ [°F] _____ [°C]

Pressure / Druck _____ [psi] _____ [Pa]

Conductivity / Leitfähigkeit _____ [µS/cm]

 Viscosity / Viskosität _____ [cp] _____ [mm²/s]

Medium and warnings

Warnhinweise zum Medium



	Medium / concentration Medium / Konzentration	Identification CAS No.	flammable entzündlich	toxic giftig	corrosive ätzend	harmful/ irritant gesundheitsschädlich/ reizend	other * sonstiges*	harmless unbedenklich
Process medium Medium im Prozess								
Medium for process cleaning Medium zur Prozessreinigung								
Returned part cleaned with Medium zur Endreinigung								

* explosive; oxidising; dangerous for the environment; biological risk; radioactive

* explosiv; brandfördernd; umweltgefährlich; biogefährlich; radioaktiv

Please tick should one of the above be applicable, include safety data sheet and, if necessary, special handling instructions.

Zutreffendes ankreuzen; trifft einer der Warnhinweise zu, Sicherheitsdatenblatt und ggf. spezielle Handhabungsvorschriften beilegen.

Description of failure / Fehlerbeschreibung

Company data / Angaben zum Absender

Company / Firma _____	Phone number of contact person / Telefon-Nr. Ansprechpartner: _____
Address / Adresse _____	Fax / E-Mail _____
_____	Your order No. / Ihre Auftragsnr. _____

"We hereby certify that this declaration is filled out truthfully and completely to the best of our knowledge. We further certify that the returned parts have been carefully cleaned. To the best of our knowledge they are free of any residues in dangerous quantities."

"Wir bestätigen, die vorliegende Erklärung nach unserem besten Wissen wahrheitsgetreu und vollständig ausgefüllt zu haben. Wir bestätigen weiter, dass die zurückgesandten Teile sorgfältig gereinigt wurden und nach unserem besten Wissen frei von Rückständen in gefährlicher Menge sind."

(place, date / Ort, Datum)

Name, dept./Abt. (please print / bitte Druckschrift)

Signature / Unterschrift

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People for Process Automation

Assembly and operating instructions**ProMinent®****DULCOMETER, Compact Controller**
Measured variable: pH / ORP**EN**

A0206

Please carefully read these operating instructions before use. · Do not discard.
The operator shall be liable for any damage caused by installation or operating errors.
The latest version of the operating instructions are available on our homepage.

Supplemental directives

General non-discriminatory approach

In order to make it easier to read, this document uses the male form in grammatical structures but with an implied neutral sense. It is aimed equally at both men and women. We kindly ask female readers for their understanding in this simplification of the text.

Supplementary information

Please read the supplementary information in its entirety.

Information



This provides important information relating to the correct operation of the unit or is intended to make your work easier.

Safety Information

The safety information includes detailed descriptions of the hazardous situation, see  *Chapter 2.1 ‘Explanation of the safety information’ on page 8*

The following symbols are used to highlight instructions, links, lists, results and other elements in this document:

Tab. 1: More symbols

Symbol	Description
1. 	Action, step by step
	Outcome of an action
	Links to elements or sections of these instructions or other applicable documents
	List without set order
[Button]	Display element (e.g. indicators) Operating element (e.g. button, switch)
‘Display /GUI’	Screen elements (e.g. buttons, assignment of function keys)
CODE	Presentation of software elements and/or texts

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Identity code

1 Identity code

DCCa	DULCOMETER® Compact,									
	Mounting type									
	E	Spare part units								
	W	Wall/pipe mounting IP 67								
	S	With fitting kit for control panel mounting IP 54								
	Design									
	00	With ProMinent® logo								
	E1	Spare part unit, controller housing lower part (processor/PCB), fully assembled								
	E2	Spare part unit, controller housing top part (processor/PCB), fully assembled								
	Operating voltage									
	6	90 ... 253 V, 48/63 Hz								
	Measured variable									
	C0	Free chlorine								
	NG	pH/ORP (switchable)								
	L3	Conductive conductivity (designation: COND_C)								
	L6	Inductive conductivity (designation: COND_I)								
	Hardware extension									
	0	None								
	Approvals									
	01	CE (Standard)								
	Certificates									
0	None									
Operating instructions language										
EN	German	KR	Korean							

DCCa	DULCOMETER® Compact,									
							EN	English	LT	Lithuanian
							ES	Spanish	LV	Latvian
							IT	Italian	NL	Dutch
							FR	French	PL	Polish
							FI	Finish	PT	Portuguese
							BG	Bulgarian	RO	Romanian
							ZH	Chinese	SV	Swedish
							CZ	Czech	SK	Slovakian
							EL	Greek	SL	Slovenian
							HU	Hungarian	RU	Russian
							YES	Japanese	TH	Thai

Introduction

2 Introduction

Data and functions

These operating instructions describe the technical data and functions of the DULCOMETER® Compact Controller, measured variable pH / ORP.

2.1 Explanation of the safety information

Introduction

These operating instructions provide information on the technical data and functions of the product. These operating instructions provide detailed safety information and are provided as clear step-by-step instructions.

The safety information and notes are categorised according to the following scheme. A number of different symbols are used to denote different situations. The symbols shown here serve only as examples.

DANGER!

Nature and source of the danger

Consequence: Fatal or very serious injuries.

Measure to be taken to avoid this danger

Danger!

- Denotes an immediate threatening danger. If this is disregarded, it will result in fatal or very serious injuries.

WARNING!

Nature and source of the danger

Possible consequence: Fatal or very serious injuries.

Measure to be taken to avoid this danger

Warning!

- Denotes a possibly hazardous situation. If this is disregarded, it could result in fatal or very serious injuries.

CAUTION!

Nature and source of the danger

Possible consequence: Slight or minor injuries, material damage.

Measure to be taken to avoid this danger

Caution!

- Denotes a possibly hazardous situation. If this is disregarded, it could result in slight or minor injuries. May also be used as a warning about material damage.

! NOTICE!**Nature and source of the danger**

Damage to the product or its surroundings

Measure to be taken to avoid this danger

Note!

- Denotes a possibly damaging situation. If this is disregarded, the product or an object in its vicinity could be damaged.

***Type of information***

Hints on use and additional information

Source of the information, additional measures

Information!

- *Denotes hints on use and other useful information. It does not indicate a hazardous or damaging situation.*

Introduction

2.2 Users' qualifications



WARNING!

Danger of injury with inadequately qualified personnel!

The operator of the plant / device is responsible for ensuring that the qualifications are fulfilled.

If inadequately qualified personnel work on the unit or loiter in the hazard zone of the unit, this could result in dangers that could cause serious injuries and material damage.

- All work on the unit should therefore only be conducted by qualified personnel.
- Unqualified personnel should be kept away from the hazard zone

Training	Definition
Instructed personnel	An instructed person is deemed to be a person who has been instructed and, if required, trained in the tasks assigned to him/her and possible dangers that could result from improper behaviour, as well as having been instructed in the required protective equipment and protective measures.
Trained user	A trained user is a person who fulfils the requirements made of an instructed person and who has also received additional training specific to the system from ProMinent or another authorised distribution partner.
Trained qualified personnel	A qualified employee is deemed to be a person who is able to assess the tasks assigned to him and recognize possible hazards based on his/her training, knowledge and experience, as well as knowledge of pertinent regulations. The assessment of a person's technical training can also be based on several years of work in the relevant field.

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Introduction

Training	Definition
Electrician	Electricians are deemed to be people, who are able to complete work on electrical systems and recognize and avoid possible hazards independently based on his/her technical training and experience, as well as knowledge of pertinent standards and regulations. Electricians should be specifically trained for the working environment in which the are employed and know the relevant standards and regulations. Electricians must comply with the provisions of the applicable statutory directives on accident prevention.
Customer Service department	Customer Service department refers to service technicians, who have received proven training and have been authorised by ProMinent to work on the system.

 **Note for the system operator**
The pertinent accident prevention regulations, as well as all other generally acknowledged safety regulations, must be adhered to!

Safety and responsibility

3 Safety and responsibility

3.1 General Safety Information



WARNING!

Live parts!

Possible consequence: Fatal or very serious injuries

- Measure: Disconnect the mains power supply prior to opening the housing
- De-energise damaged, defective or manipulated units by disconnecting the mains plug



WARNING!

Unauthorised access!

Possible consequence: Fatal or very serious injuries

- Measure: Ensure that there can be no unauthorised access to the unit



WARNING!

Operating errors!

Possible consequence: Fatal or very serious injuries

- The unit should only be operated by adequately qualified and technically expert personnel
- Please also observe the operating instructions for controllers and fittings and any other component groups, such as sensors, measuring water pumps ...
- The operator is responsible for ensuring that personnel are qualified



CAUTION!

Electronic malfunctions

Possible consequence: Material damage to destruction of the unit

- The mains connection cable and data cable should not be laid together with cables that are prone to interference
- Measure: Take appropriate interference suppression measures

Safety and responsibility

! NOTICE!**Correct and proper use**

Damage to the product or its surroundings

- The unit is not intended to measure or regulate gaseous or solid media
- The unit may only be used in accordance with the technical details and specifications provided in these operating instructions and in the operating instructions for the individual components

! NOTICE!**Correct sensor operation / Run-in time**

Damage to the product or its surroundings

- Correct measuring and dosing is only possible if the sensor is working perfectly
- It is imperative that the run-in times of the sensors are adhered to
- The run-in times should be allowed for when planning initial operation
- It may take a whole working day to run-in the sensor
- Please read the operating instructions for the sensor

! NOTICE!**Correct sensor operation**

Damage to the product or its surroundings

- Correct measuring and dosing is only possible if the sensor is working perfectly
- Check and calibrate the sensor regularly

! NOTICE!**Compensation of control deviations**

Damage to the product or its surroundings

- This controller cannot be used in control circuits which require rapid compensation (< 30 s)

3.2 Correct and proper use

! NOTICE!**Compensation for control deviations**

Damage to the product or its surroundings

- The controller can be used in processes, which require compensation of > 30 seconds

Safety and responsibility

! NOTICE!

Correct and proper use

The unit is intended to measure and regulate liquid media. The marking of the measured variables is located on the controller and is absolutely binding.

The unit may only be used in accordance with the technical details and specifications provided in this operating manual and in the operating manuals for the individual components (such as, for example, sensors, fittings, calibration devices, metering pumps etc.).

Any other uses or modifications are prohibited.

Functional description

4 Functional description

Brief functional description

The DULCOMETER® Compact Controller for pH and redox measured variables provides basic functions for water treatment applications. It has a fixed configuration with the following features:

- Measured variables pH and redox (can be switched over on the DULCOMETER® Compact Controller)
- Language independent operation (use of abbreviations, such as *[INPUT]*, *[OUTPUT]*, *[CONTROL]*, *[ERROR]*)
- Illuminated display
- 3 LEDs indicate the operating states (*[f-REL]* active, *[P-REL]* active, error)
- Sensor monitoring of pH
- P or PID control characteristics
- Selectable control direction (raise or lower measured value)
- Impulse frequency relay *[f-REL]* for metering pump control
- Power relay *[P-REL]*, configurable as alarm, limit value or pulse width modulated (PWM) control output for metering pumps
- Analogue output 0/4...20 mA, can be configured as a measured value or correction variable
- Suction function for all actuators
- Digital input to switch off the DULCOMETER® Compact Controller or to process a sample water limit contact by remote control
- Temperature sensor input (Pt 1000) for temperature compensation of the pH value
- Protection class IP67 (wall/pipe mounting), protection class IP54 (control panel mounting)

Applications:

- Waste water treatment
- Treatment of drinking water
- Swimming pool water treatment

Functional description

4.1 Flow diagram

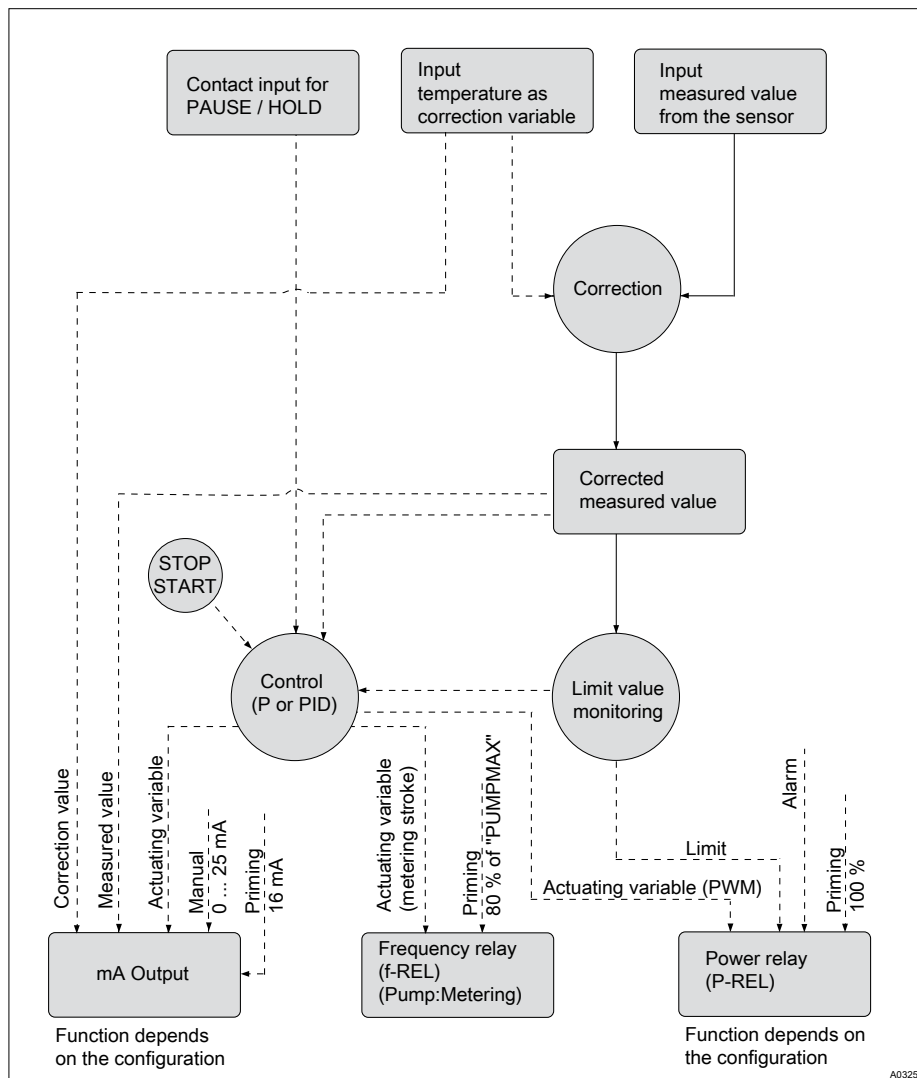


Fig. 1: Flow diagram

4.2 Overview of the first level menu

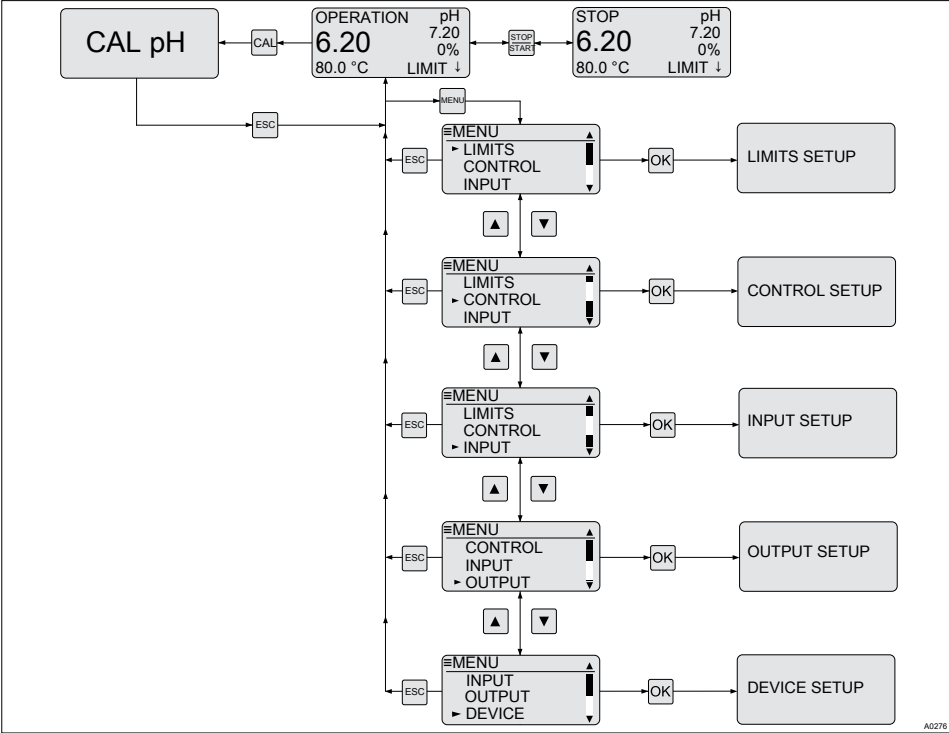
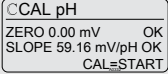
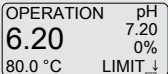
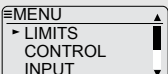
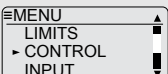


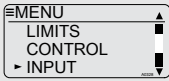
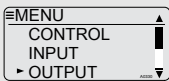
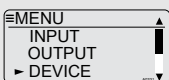
Fig. 2: Overview of the first level menu; shown for pH

Display view	Selection with:	Reference	Function
OPERATION pH 6.20 7.20 80.0 °C 0% LIMIT ↓		⚙ <i>Chapter 7 'Operating diagram' on page 44</i>	
CAL			Changes to the calibration menu.

Functional description

Display view	Selection with:	Reference	Function
		↗ Chapter 8.1 'pH sensor calibration (CAL)' on page 49	The calibration menu enables calibration of controller and sensor.
			
			Stop/Start the control and metering function.
		↗ Chapter 9.2 'STOP/START key' on page 74	By pressing the STOP key, the control is stopped. The STOP key can be pressed independently of the currently displayed menu. However the STOP state is only shown in the continuous display.
		↗ Chapter 7.3 'Continuous display' on page 46	Changes from the continuous display to the setting menu.
		↗ Chapter 8.3 'Setting limit values [LIMITS]' on page 59	Enables the setting of the limit value for limit value monitoring.
			
		↗ Chapter 8.4 'Setting the control [CONTROL]' on page 61	Enables parameter setting for the control.
			

Functional description

Display view	Selection with:	Reference	Function
		<i>Chapter 8.5 'Input setting (INPUT)' on page 64</i>	Enables setting of the measured value input parameter.
			
		<i>Chapter 8.6 ' Output setting (OUTPUT)' on page 67</i>	Enables setting of the mA output parameter.
			
		<i>Chapter 8.7 'DEVICE setting' on page 71</i>	Enables adjustment of the password and the controller [RESTART] function.

Assembly and installation

5 Assembly and installation

- **User qualification, mechanical installation:** trained qualified personnel, see
 ↳ *Chapter 2.2 'Users' qualifications' on page 10*
- **User qualification, electrical installation:** Electrical technician, see
 ↳ *Chapter 2.2 'Users' qualifications' on page 10*



CAUTION!

Possible consequence: Material damage.

The hinge between the front and rear part of the housing cannot absorb high levels of mechanical loading. When working on the DULCOMETER® Compact Controller, firmly hold the top section of the controller housing.



CAUTION!

Check band for strain relief

Possible consequence: Material damage.

The ribbon cable and its socket cannot be mechanically loaded. Hence it is essential that when mounting the controller in the control panel mounting, the check strap (part number 1035918) is fitted for strain relief and mechanical securing. Without the check strap, the ribbon cable or its socket could be damaged if they were to fall out of the controller upper housing.



NOTICE!

Mounting position and conditions

- The controller conforms to IP 67 degree of protection (wall/pipe mounting) or IP 54 (control panel mounting) requirements. This degree of protection is only achieved if all seals and cable glands are correctly fitted.
- The (electrical) installation should only take place after (mechanical) installation
- Ensure that there is unimpeded access for operation
- Ensure safe and low-vibration fastening
- Avoid direct sunlight
- Permissible ambient temperature of the controller at the installation location: -10 ... +60 °C at max. 95% relative air humidity (non-condensing)
- Take into consideration the permissible ambient temperature of the sensors and other components connected
- The controller is only suitable for operation in closed rooms. If operated outside, the controller must be protected against the environment by a suitable protective enclosure

Assembly and installation

***Read-off and operating position***

- *Install the device in a favourable position for reading and operating (preferably at eye level)*

***Mounting position***

- *Leave sufficient free space for the cables*

***Packaging material***

Dispose of packaging material in an environmentally responsible way. All packaging components carry the corresponding recycling code ♻️.

Assembly and installation

5.1 Scope of delivery

The following parts belong to the standard scope of delivery of a DULCOMETER® Compact Controller.

Description	Quantity
Assembled device	1
Cable connection set DMTa/DXMa (metr.)	1
Operating instructions	1

5.2 Mounting (mechanical)

The DULCOMETER® Compact Controller is suitable for mounting on a wall, pipe or control panel.

Tab. 2: Mounting materials (contained in the scope of supply):

Description	Quantity
Wall/tube retaining bracket	1
Round head screws 5x45 mm	2
Washer 5.3	2
Rawlplug Ø 8 mm, plastic	2

5.2.1 Wall mounting Mounting (mechanical)

Assembly and installation

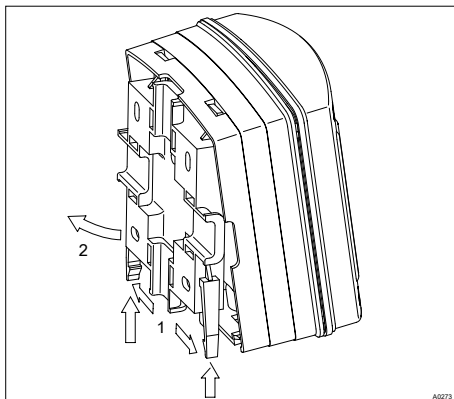


Fig. 3: Removing the wall/pipe bracket

1. ➤ Remove the wall/pipe bracket. Pull the two snap-hooks (1) outwards and push upwards
2. ➤ Fold out the wall/pipe bracket (2) and pull out in a downwards direction
3. ➤ Mark two drill holes diagonal to each other by using the wall/pipe bracket as a drilling template
4. ➤ Drill holes: $\varnothing$ 8 mm, d = 50 mm

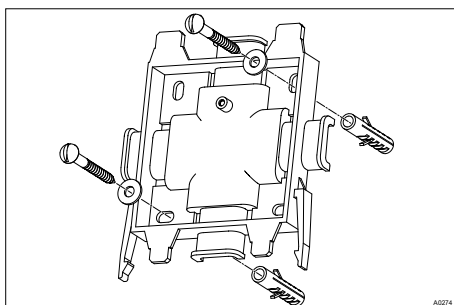


Fig. 4: Screwing on the wall/pipe bracket using washers

5. ➤ Screw on the wall/pipe bracket using the washers
6. ➤ Suspend the DULCOMETER® Compact Controller at the top in the wall/pipe bracket and push using light pressure at the bottom against the wall/pipe bracket. Then press upwards until the DULCOMETER® Compact Controller audibly snaps into position.

Assembly and installation

5.2.2 Pipe mounting

Mounting (mechanical)



Pipe diameter

Pipe diameter: 25 mm to 60 mm.

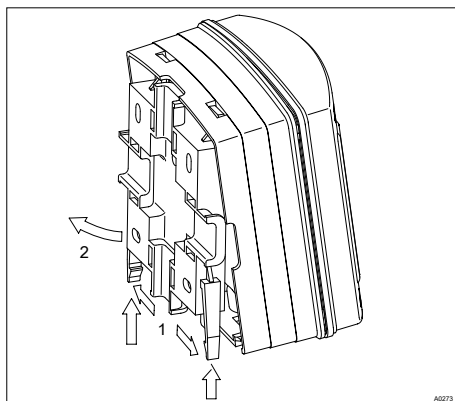


Fig. 5: Removing the wall/pipe bracket

1. ➡ Remove the wall/pipe bracket. Pull the two snap-hooks (1) outwards and push upwards
2. ➡ Fold out the wall/pipe bracket (2) and pull out in a downwards direction
3. ➡ Secure the wall/pipe bracket using cable ties (or pipe clips) to the pipe

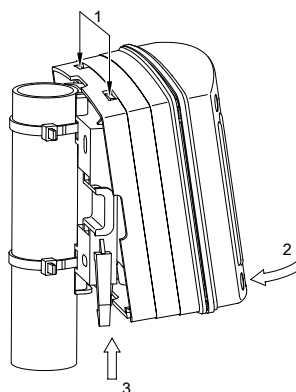


Fig. 6: Suspend and secure the DULCOMETER® Compact Controller

4. ➡ Suspend the DULCOMETER® Compact Controller at the top (1) in the wall/pipe bracket and push using light pressure at the bottom (2) against the wall/pipe bracket. Then press upwards (3) until the DULCOMETER® Compact Controller audibly snaps into position

5.2.3 Control panel mounting

Tab. 3: Mounting kit for control panel installation of the DULCOMETER® Compact Controller: Order number 1037273

Description	Quantity
Drilling template sheet 3872-4	1
PT screw (3.5 x 22)	3
Profile seals	2
Strain relief strip DF3/DF4	1
PT screw (3.5 x 10)	2
Individual parts packed in transparent cover / Mounting kit is not contained in the standard scope of supply	



CAUTION!

Material thickness of control panel

Possible consequence: material damage

- The thickness of the material of the control panel should be at least 2 mm to ensure secure fixing



In the mounted state, the DULCOMETER® Compact Controller extends approx. 30 mm from the control panel.

Assembly and installation

Preparing the control panel

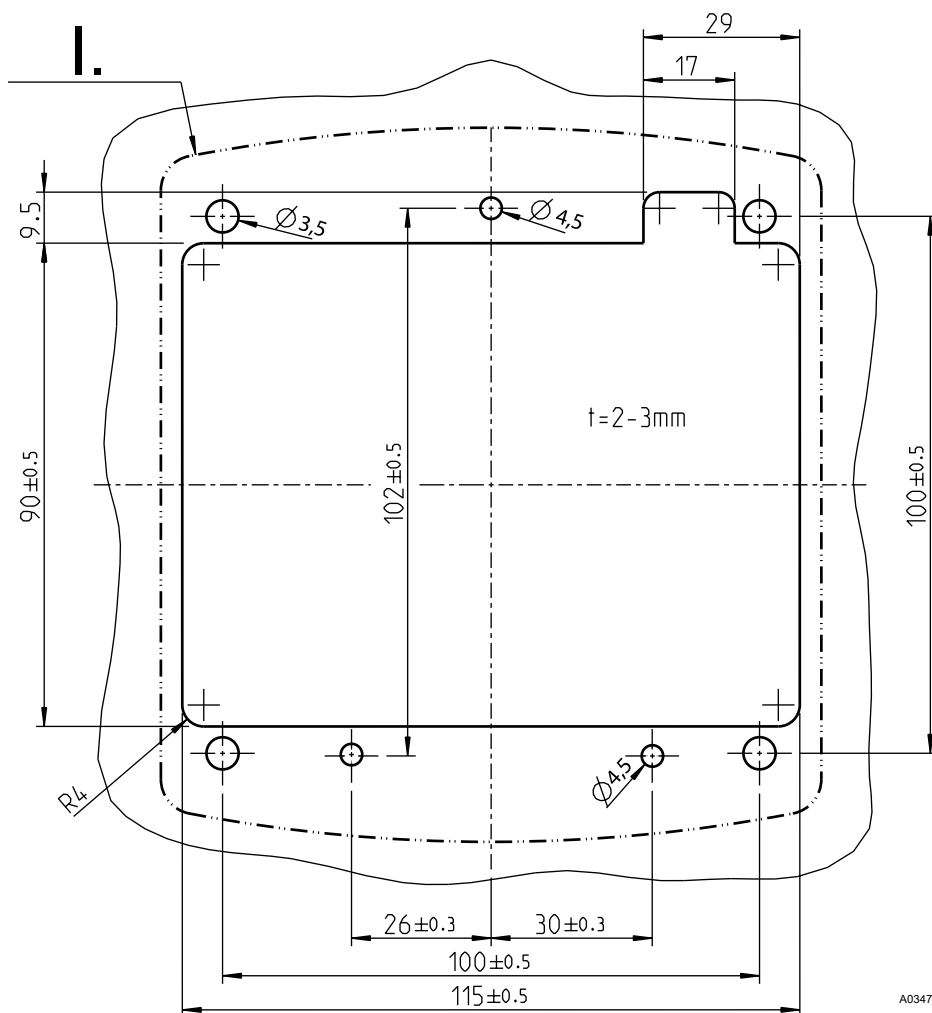


Fig. 7: The drawing is not to scale and is intended for information purposes only.

I. Outline contour of the DULCOMETER® Compact Controller housing

Assembly and installation

1. ➤ Mark the exact position of the DULCOMETER® Compact Controller on the control panel using the drilling template

2. ➤

**Core hole**

Adhere to the 3.5 mm Ø as the core hole diameter for screwing in the fixing bolts.

Drill four holes for the bolts for the top section of the controller housing using a 3.5 mm Ø drill bit

3. ➤ Drill three holes for the bolts for the bottom section of the controller housing using a 4.5 mm Ø drill bit

4. ➤ Drill four holes using an 8 mm Ø drill bit and use a jigsaw to cut the cut-out

⇒ Deburr all the edges.

Assembly and installation

Fitting the DULCOMETER® Compact Controller into the cut-out in the control panel

! NOTICE!

Ribbon cable base

The base for the ribbon cable is firmly soldered onto the PCB. The base cannot be removed. Open the base lock (3) to loosen the ribbon cable, see Fig. 8

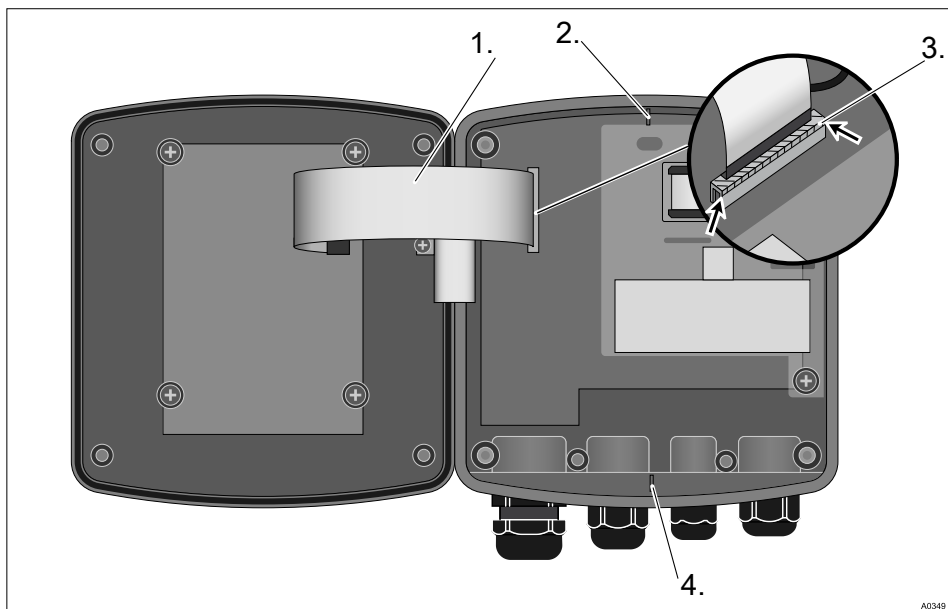
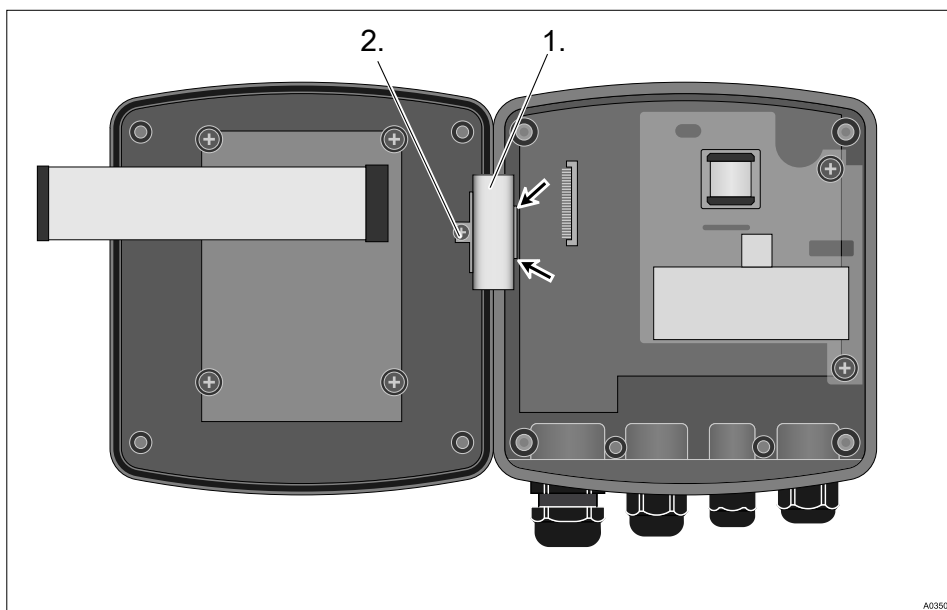


Fig. 8: Loosening the ribbon cable

1. ➤ Undo four screws and open the DULCOMETER® Compact Controller
2. ➤ Open the right and left lock (3) (arrows) on the base and pull the ribbon cable (1) out of the socket
3. ➤ Use pliers to break off the catches (2 and 4). These are not needed for control panel installation

Assembly and installation

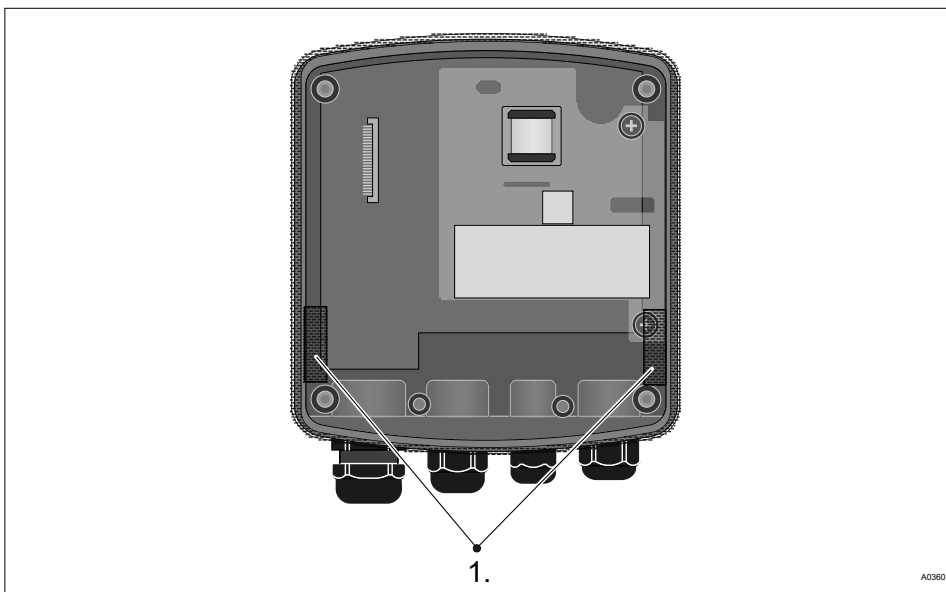


A0350

Fig. 9: Dismantle the hinge

- 4.** ➡ Remove the screw (2), unclip the hinge (1) on the bottom section of the controller housing (arrows) and remove the hinge

Assembly and installation



A0360

Fig. 10: Fitting the profile seal on the bottom section of the controller housing

5. ➤ Position the profile seal evenly around the upper edge of bottom section of the DULCOMETER® Compact Controller housing. Arrange the clips (1) as shown in the figure
⇒ Ensure that the profile seal evenly surrounds the upper edge of the housing.
6. ➤ Insert the bottom section of the DULCOMETER® Compact Controller housing with the profile seal from behind into the cut-out and use three screws to secure it in place

Assembly and installation

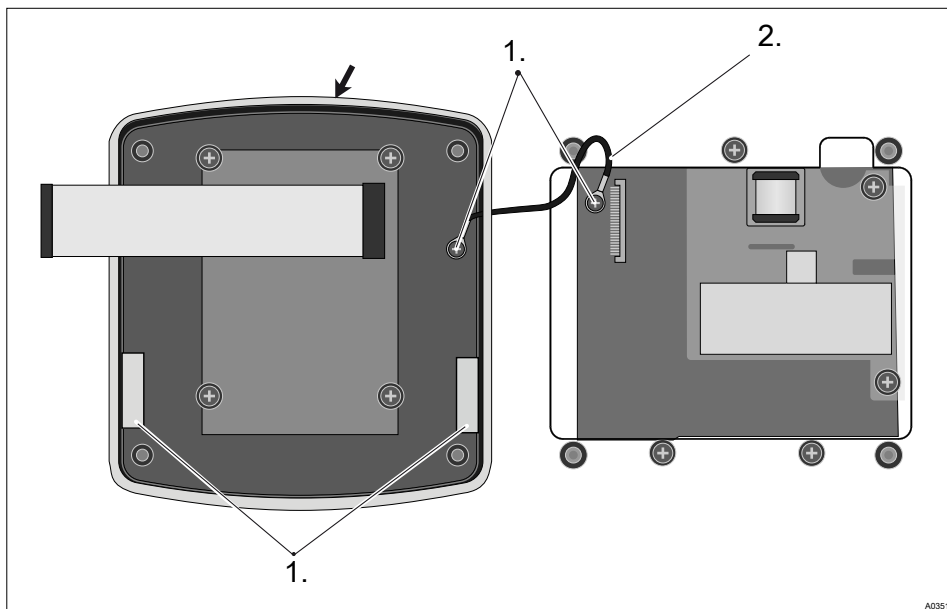


Fig. 11: Fitting the profile seal onto the top section of the controller housing

- 7.** ➤ Position the profile seal (arrow) evenly into the groove in the top section of the DULCOMETER® Compact Controller housing. Arrange the clips (3) as shown in the figure
- 8.** ➤ Secure the strain relief (2) using two screws (1)

Assembly and installation

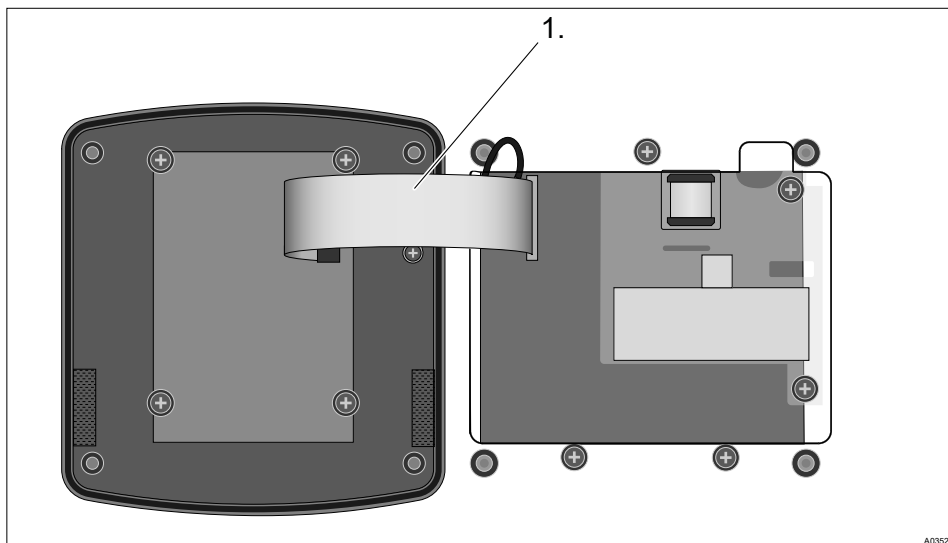


Fig. 12: Push and lock the ribbon cable in its base

- 9.** ➤ Push and lock the ribbon cable (1) in its base
- 10.** ➤ Screw the top section of the controller housing onto the bottom section of the DULCOMETER® Compact Controller housing
- 11.** ➤ Once again check that the profile seals are fitted properly
 - ⇒ IP 54 degree of protection can only be provided if the control panel is mounted correctly

5.3 Installation (electrical)



WARNING!

Live parts!

Possible consequence: Fatal or very serious injuries

- Measure: Disconnect the electrical power supply to the device before opening the housing and secure to prevent unintentional reconnection
- Disconnect damaged or defective devices or devices that have been tampered with and prevent unintended reconnection
- The provision of a suitable isolating device (emergency-off switch, etc.) is the responsibility of the plant operator



The signal leads of the DULCOMETER® Compact Controller must not be routed alongside interference-prone cabling. Faults could lead to malfunctions of the DULCOMETER® Compact Controller.

Assembly and installation

5.3.1 Cable Cross-Sections and Cable End Sleeves

	Minimum cross-section	Maximum cross-section	Stripped insulation length
Without cable end sleeve	0.25 mm ²	1.5 mm ²	
Cable end sleeve without insulation	0.20 mm ²	1.0 mm ²	8 - 9 mm
Cable end sleeve with insulation	0.20 mm ²	1.0 mm ²	10 - 11 mm

5.3.2 Installation of coaxial cable to guard terminal XE1



CAUTION!

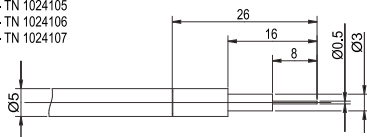
Maximum length of the coaxial cable 10 m

Incorrect measured value due to too long a coaxial cable

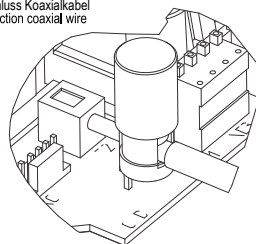
Possible consequence: Slight or minor injuries, material damage.

The maximum length of the coaxial cable may not exceed 10 m when using redox or pH sensors. The measurement signal can otherwise be falsified by the effects of interference.

Manufacturing coaxial cable for the connection at DCC
or prefabricates in the variants
Konfektionierung Koaxialkabel zum Anschluss an DCC
oder vorkonfektioniert in den Varianten
0,8m - TN 1024105
2,0m - TN 1024106
5,0m - TN 1024107



Detail Anschluss Koaxialkabel
Detail connection coaxial wire



A0382

Fig. 13: Installation of Coaxial Cable to Guard Terminal XE1

When installing the coaxial cable for the guard terminal XE 1, the lengths of insulation to be removed from the coaxial cable must be adhered to. The guard terminal *'is tightened'* by hand.

5.3.2.1 Terminal diagram / wiring

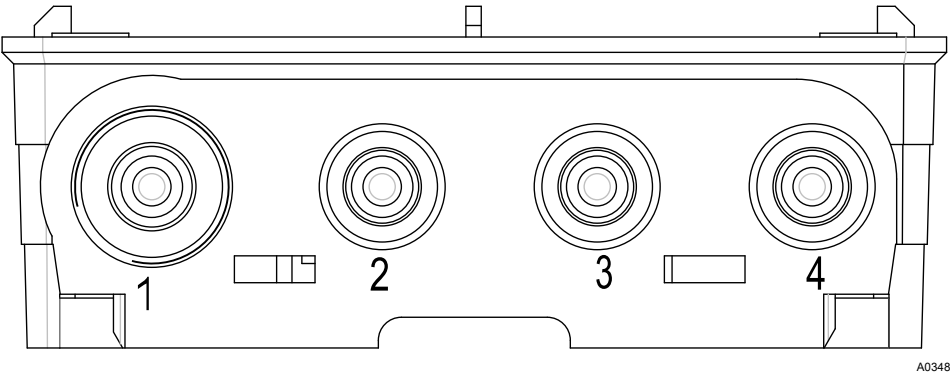


Fig. 14: Threaded connector number

Tab. 4: Wiring

Threaded connector no. Size	Description	Terminal Description	Terminal number	Pol	Function	Recommended cable ø	Remarks
1 / M20	ph/redox Input 1		XE 1	Ref. El.	pH/ redox sensor	ø 5	Guide cable through multiple M20 / 2x 5 mm seal inserts
			XE 2	meas. sig			
	Temp. input Pt 1000	XE 4	1	+	Temp. sensor	ø 5	
			2	-			
2 / M16	Wire jumper or potential equaliser	XE 3			]	ø 4,5 *	Guide 4-core cable through multiple M 16 / 2x 4,5 mm seal inserts
					Short circuit		
		XE 3	1	free	Potential equaliser***		
			2	Ref. volt.			

Assembly and installation

Threaded connector no. Size	Description	Terminal Description	Terminal number	Pol	Function	Recommended cable ø	Remarks
	Standard signal output	XA 1	1	+ 15 V	e.g. recorder / actuator	ø 4,5 *	Guide 4-core cable through multiple M 16 / 2x4,5 mm seal inserts
			2	-			
	Contact input	XK 1	1	+	Pause		
			2	-			
	Relay output (f-relay)	XR 2	1		Frequency controlled metering pump		
			2				

*** To achieve protection class IP 67 please use original Prominent cable, part number 1036759**

***** When using as a potential equaliser, the short circuit bridge] must be removed!**

3 / M16	Relay output	XR1	1	COM	Solenoid valve / metering pump ** raise / lower	ø 5	Guide cable through single M16 seal insert
	or		2	NO			
	Relay output						
	or	XR1	1	COM	Limit relay		
	Relay output		2	NO			
	(P-relay)						
		XR1	1	COM	Alarm relay		
			3	NC			

**** An RC suppressor must be connected (not part of the scope of delivery)**

Threaded connector no. Size	Description	Terminal Description	Terminal number	Pol	Function	Recommended cable ø	Remarks
4 M16	Mains connection	XP 1	1	N	85 ... 253 V eff.	ø 6,5	Guide cable through single M16 seal insert
			2	L			

Tab. 5: Legend to the "Wiring" table

Abbreviation	Meaning
Pol.	Polarity
Ref. El.	Reference electrode
meas sig.	Measurement signal (glass electrode)
Ref. pot.	Internal reference potential
f-relay	Pump frequency relay
P-relay	Power relay
COM	Common relay contact (root)
NO	Contact <i>'normally opened'</i>
NC	Contact <i>'normally closed'</i>

Assembly and installation

Terminal diagram

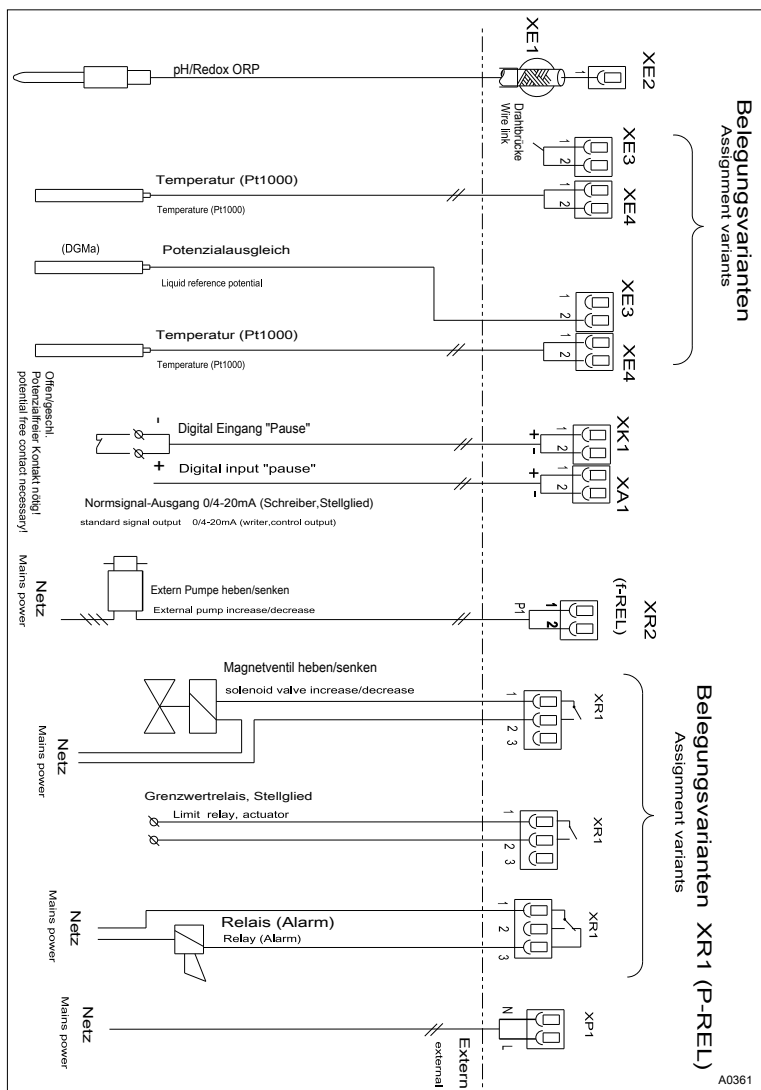


Fig. 15: Terminal diagram

Assembly and installation

5.3.3 Installation (electrical)



The cable must be routed in a site-provided cable duct to ensure strain relief

1. ➤ Undo the four housing screws
2. ➤ Slightly lift the controller housing top section forwards and fold it to the left

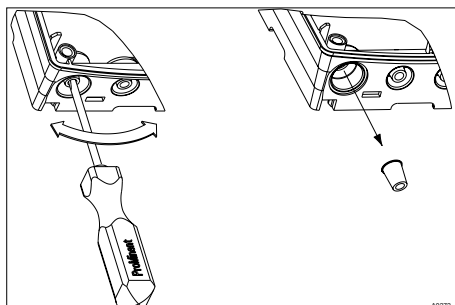


Fig. 16: Punch out threaded holes

3. ➤



*Large threaded connection
(M 20 x 1.5)*

*Small threaded connection
(M 16 x 1.5)*

Punch out as many threaded connections on the bottom side of the controller housing bottom section as required

4. ➤ Guide the cable into the respective reducing inserts.
5. ➤ Insert the reducing inserts into the threaded connectors
6. ➤ Guide the cable into the controller.
7. ➤ Connect the cable as indicated in the terminal diagram
8. ➤ Screw the required threaded connections in and tighten
9. ➤ Tighten the clamping nuts of the threaded connections so that they are properly sealed
10. ➤ Click the controller housing top section on to the controller housing bottom section
11. ➤ Manually tighten the housing screws
12. ➤ Once again check the seating of the seal. Only if the mounting is correct, is protection class IP 67 (wall/pipe mounting) or IP 54 (control panel mounting) achieved

Assembly and installation

5.4 Switching of inductive loads



If you connect an inductive load, i.e. a consumer which uses a coil (e.g. an alpha motorised pump), then you must protect your controller with a protective circuit. If in doubt, consult an electrical technician for advice.

The RC member protective circuit is a simple, but nevertheless very effective, circuit. This circuit is also referred to as a snubber or Boucherot member. It is primarily used to protect switching contacts.

When switching off, the connection in series of a resistor and capacitor means that the current can be dissipated in a damped oscillation.

Also when switching on, the resistor acts as a current limiter for the capacitor charging process. The RC member protective circuit is highly suitable for AC voltage supplies.

$$C = k \cdot I_L$$

$k = 0,1 \dots 2$ (dependent on the application).

Only use capacitors of class X2.

Units: $R = \text{Ohm}$; $U = \text{Volt}$; $I_L = \text{Ampere}$;
 $C = \mu\text{F}$



If consumers are connected which have a high starting current (e.g. plug-in, switched mains power supplies), then a means of limiting the starting current must be provided.

The switching-off process can be investigated and documented using an oscilloscope. The voltage peak at the switch contact depends on the selected RC combination.

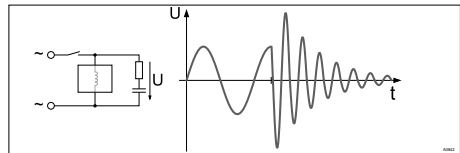


Fig. 17: Switching-off process shown on the oscillogram.

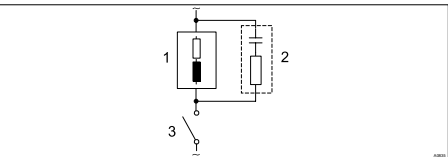


Fig. 18: RC protective circuit for the relay contacts

The magnitude of the resistance R of the RC member is determined according to the following equation:

$$R = U / I_L$$

(Where U = Voltage across the load and I_L = current through the load)

The magnitude of the capacitor is determined using the following equation:

Units: $R = \text{Ohm}$; $U = \text{Volt}$; $I_L = \text{Ampere}$;
 $C = \mu\text{F}$

Assembly and installation

Typical AC current application with an inductive load:

- 1) Load (e.g. alpha motor-driven pump)
- 2) RC-protective circuit
 - Typical RC protective circuit at 230 V AC:
 - Capacitor $[0.22\mu F/X2]$
 - Resistance $[100\ \Omega / 1\ W]$ (metal oxide (pulse resistant))
- 3) Relay contact (XR1, XR2, XR3)

Commissioning

6 Commissioning

- **Users' qualification:** trained user, see
🔗 *Chapter 2.2 'Users' qualifications'*
on page 10



WARNING!

Sensor run-in periods

This can result in hazardous incorrect metering

- Correct measuring and metering is only possible if the sensor is working perfectly
- Please read the operating manual for the sensor
- The sensor must be calibrated after commissioning

Following completion of mechanical and electrical assembly, the DULCOMETER® Compact Controller should be integrated into the measuring point.

6.1 Initial commissioning

When first switching on the DULCOMETER® Compact Controller the DULCOMETER® Compact Controller is in a STOP state.

Selection of the measurement variable, controller setting and setting of the various, process-dependent, parameters takes place next. 🔗 *Chapter 8 'Operating menus for the measured variables pH and ORP'* on page 49.

6.2 Selection of the measured variable

The pH and redox measurement variables are set in the *'INPUT'* menu.



NOTICE!

Reset to factory settings

If you set or switch the measurement variable, all parameters in the controller are reset to the factory settings for the selected measurement variable.

You must then reset all the controller functions.

6.3 Setting the controller during commissioning



NOTICE!

Reset to factory settings

When switching over the metering direction, all actuators in the DULCOMETER® Compact Controller are reset to the factory settings for the selected metering direction.

For safety reasons, all actuators are deactivated. The base load is reset to 0 %. All parameters relating to the actuator, are reset to the factory setting.

Consequently all parameters relating to the actuator, must be reset.

The DULCOMETER® Compact Controller only controls *'one-way'*. Only one position or one negative control variable can be calculated. The direction of the control variable is set in the *'PUMP'* menu. There is no dead zone. In this sense, control cannot be *'switched off'* (except with *'STOP'* or *'PAUSE'*).

The value of the P-proportion of the control (X_p) is specified with the DULCOMETER® Compact Controller in the units of the corresponding measurement variable (e.g. 1.5 pH).

For pure P-control and a separation between the set and actual values, which corresponds to the X_p value, the calculated control variable is +100 % (with the setting *'raise'*) or -100 % (with the setting *'lower'*).

Operating diagram

7 Operating diagram

7.1 Overview of equipment/Control elements

- **User qualification:** instructed user, see  Chapter 2.2 'Users' qualifications' on page 10

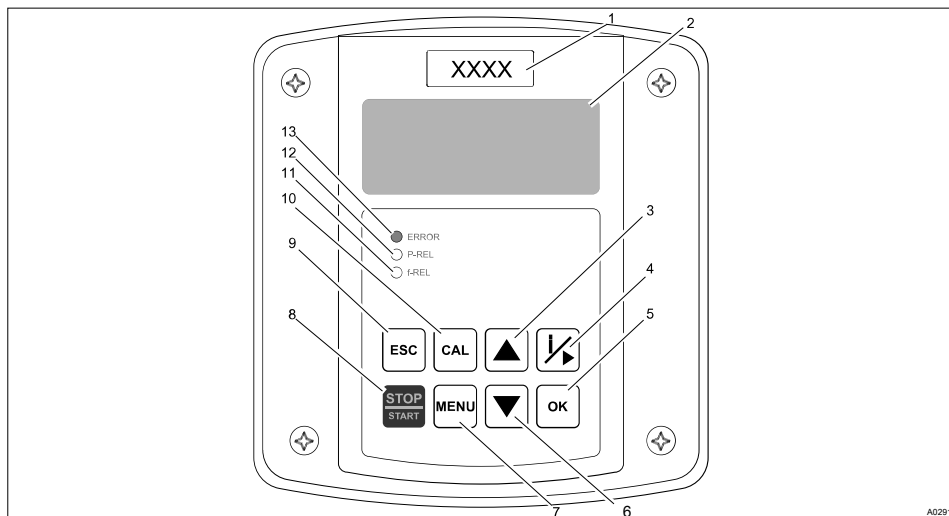


Fig. 19: Overview of equipment/Control elements

Function	Description
1st respective measured variable	Affix the measured variable label here
2. LCD display	
3. UP key	To increase a displayed number value and to jump upwards in the operating menu
4. INFO/RIGHT key	Opens the info menu or moves the cursor one place to the right
5. OK key	To apply, confirm or save a displayed value or status or to acknowledge an alarm

Operating diagram

Function	Description
6. DOWN key	Too decrease a displayed number value and to jump down in the operating menu
7. MENU key	Accesses the controller operating menu
8. STOP/START key	Starts and stops control and metering function
9. ESC key	Jumps a level back in the operating menu, without storage or changing entries or values
10. CAL key	For accessing the calibration menu and navigating within the calibration menu.
11. f-REL LED	Shows the activated state of the f-relay
12. P-REL LED	Shows the activated state of the P-relay
13. ERROR LED	Indicates a controller error state. A text message is displayed simultaneously in the LCD continuous display

7.2 Adjusting display contrast

If the DULCOMETER® Compact Controller is set to *'continuous display'*, you can set the contrast of the LCD-display. By pressing the ▲ key you can adjust the LCD display contrast so it is darker. By pressing the ▼ key you can adjust the LCD display contrast so it is lighter. Here each key press represents a contrast level. I.e. the key must be pressed once for each contrast level.

Operating diagram

7.3 Continuous display

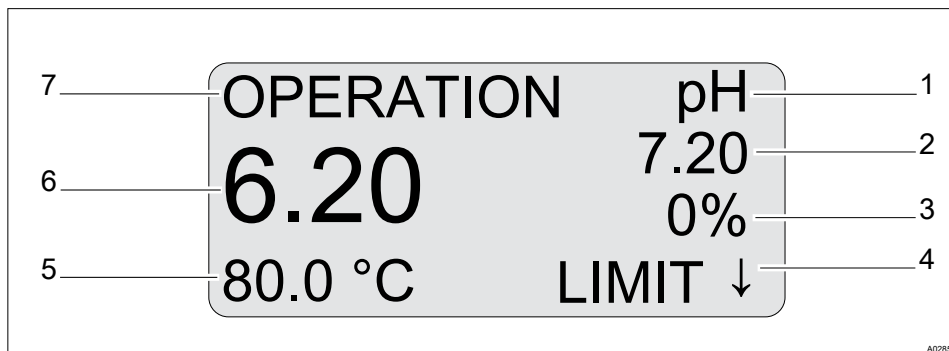


Fig. 20: Continuous display

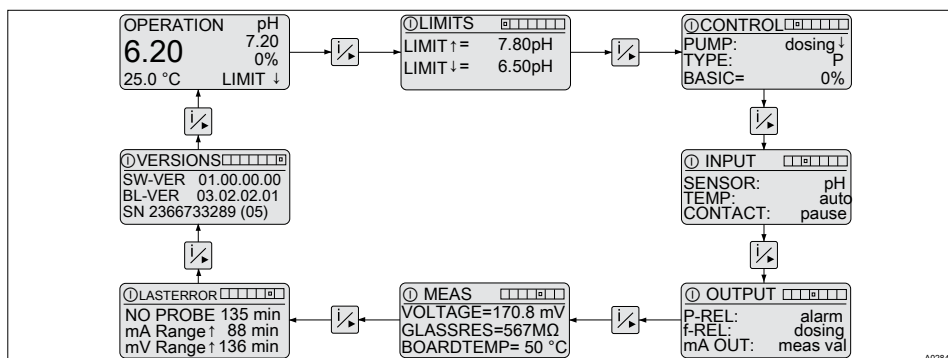
- | | | | |
|---|--|---|-----------------------------------|
| 1 | Measured variable | 5 | Temperature (Correction variable) |
| 2 | Setpoint | 6 | Measured value (actual value) |
| 3 | Control variable | 7 | Mode |
| 4 | Possible error text: e.g. "Limit ↓"
(Direction of the limit value transgression, e.g. here lower limit value transgression) | | |

7.4 Info display

In the info display, the most important parameters for each menu item of the first menu level are displayed.

Access to the info display from the continuous display is by pressing the  key. Pressing the  key again calls the next info display. Pressing the  key recalls the continuous display again.

Operating diagram



A0284

Fig. 21: Info display

Using the **OK** key you can jump from the currently displayed info display directly to the selection menu of this info display.

Using the **ESC** key you can jump back to the info display.

**Info display "MEAS"**

The "MEAS" info display shows the following measured values:

- [VOLTAGE]: currently measured sensor mV value
- [GLASSRES]: measured glass resistance of connected pH sensors for media temperatures of 15 °C to 80 °C. The displayed value is only valid when used with ProMinent pH sensors
- [BOARDTEMP]: Current housing interior temperature

Operating diagram

7.5 Password

Access to the setting menu can be limited using a password. The DULCOMETER® Compact Controller is supplied with the password '5000'. Using the preset password '5000' the DULCOMETER® Compact Controller is setup so that all menus can be accessed without any limitations.

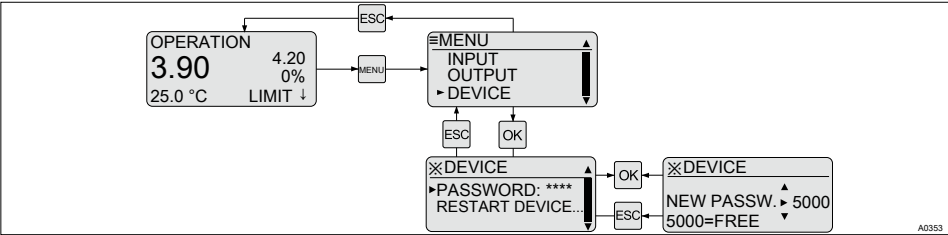


Fig. 22: Password setting

Password	Possible values			
Factory setting	Increment	Lower value	Upper value	Remarks
5000	1	0000	9999	5000 = [FREE]

Operating menus for the measured variables pH and ORP

8 Operating menus for the measured variables pH and ORP

- **User qualification:** instructed user, see  Chapter 2.2 'Users' qualifications' on page 10

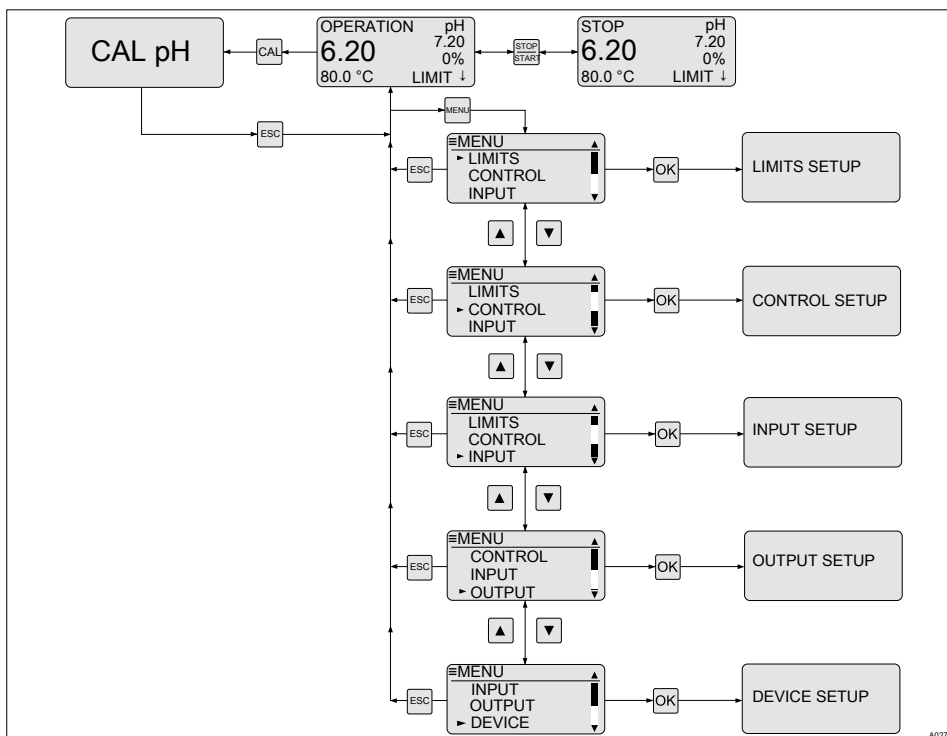


Fig. 23: Operating menu overview

8.1 pH sensor calibration (CAL)



Correct sensor operation

- Correct measuring and metering is only possible if the sensor is working perfectly
- Observe the sensor operating instructions
- The carrying out of a 2-point calibration is strongly recommended and is to be preferred to a single point calibration

Operating menus for the measured variables pH and ORP

During calibration, the DULCOMETER® Compact Controller sets the control outputs to '0'. Exception to this: a basic load or a manual control variable has been set. This remains active. The mA standard signal output is frozen.

When calibration/testing has been completed successfully, all of the error checks relating to the reading are restarted. The DULCOMETER® Compact Controller saves all the determined data for zero point and slope when the calibration is successful.



Used buffer

Dispose of the used buffer solution. Related info: see buffer solution safety data sheet.

Setting		Possible values			
	Starting value	Increment	Lower value	Upper value	Remarks
Buffer temperature	Measured value	0.1 °C	0 °C	120 °C	The temperature can only be adjusted under 'TEMP' 'auto' or 'manual'
Buffer values	Start value = 7.00 pH (ZERO) 4.00 pH (SLOPE)	0.01 pH	0.00 pH	14.00 pH	Limit value ZERO = 6..8 pH Limit value SLOPE = < 6 pH; > 8 pH

Operating menus for the measured variables pH and ORP

2-Point Calibration

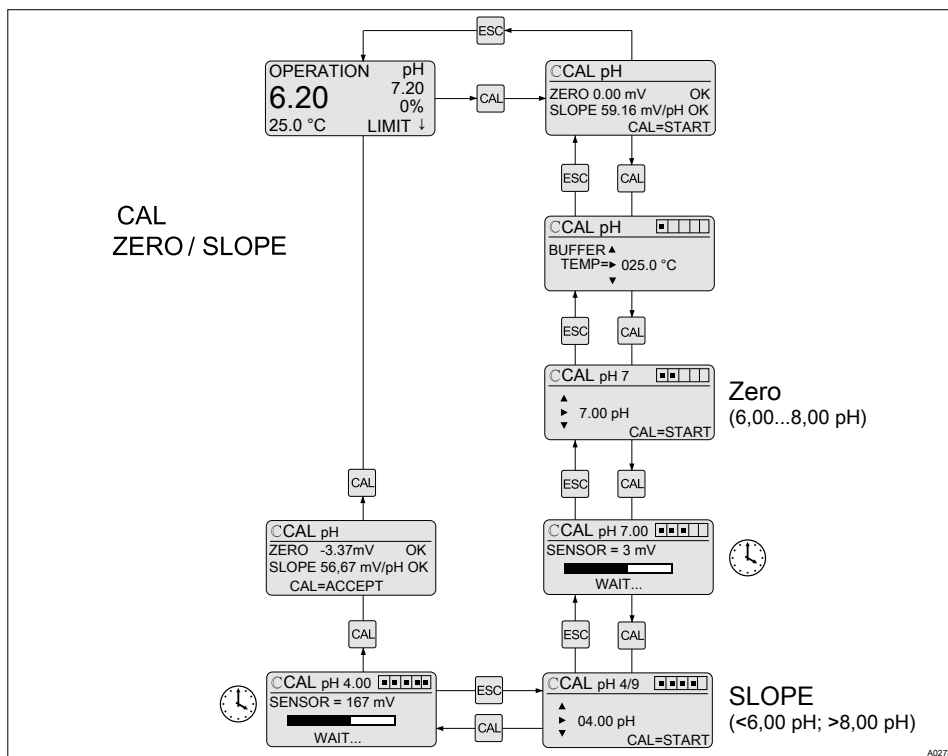


Fig. 24: 2-Point calibration pH sensor

Operating menus for the measured variables pH and ORP



Valid calibration values

Valid calibration:

- Zero point -60 mV...+60 mV
- Slope 40 mV/pH...65 mV/pH

Two test containers with a buffer solution are required for calibration. The pH value of the buffer solutions should be at least 1.5 pH units apart. Thoroughly rinse the sensor with water when changing the buffer solution.

1. Select the calibration menu
2. Start the calibration
3. If temperature has been selected (only if 'TEMP' is set to 'auto' or 'manual'), then set the buffer temperature with the keys , and
4. Confirm the entry by pressing the key
5. Set the pH-value of the buffer 'ZERO' using the keys , and
6. Immerse sensor in the buffer solution containing test container 1 (e.g. pH 7). In so doing, slightly move the sensor
7. Then press
 - ⇒ Calibration is running
8. Then press to accept the value
 - ⇒ if CAL=ACCEPT is shown in the display and the displayed mV value is stable.
9. Remove the sensor from the buffer solution, rinse thoroughly in water and then dry with a cloth (pad dry, don't rub!)
10. Set the pH-value of the buffer 'SLOPE' using the keys , and
11. Immerse sensor in the buffer solution containing test container 2 (e.g. pH 4). In so doing, slightly move the sensor
12. Then press
 - ⇒ Calibration is running
13. Then press to accept the value
 - ⇒ if CAL=ACCEPT is shown in the display and the displayed mV value is stable.
14. The determined values for the zero point and slope are displayed

Operating menus for the measured variables pH and ORP

- ⇒ The calibration is now saved as successful if the values for 'ZERO' and 'SLOPE' are both 'OK'.



Incorrect calibration

Should the result of the calibration lie outside the specified tolerance limits, an error message appears 'ERR'. In this case the current calibration will not be applied.

Check the prerequisites for the calibration and clear the error. Then repeat the calibration

- 15.** ➤ Then press  to confirm the result or to terminate the calibration (if necessary, as unsuccessful)

Operating menus for the measured variables pH and ORP

3. ➤ If temperature has been selected (only if 'TEMP' is set to 'auto' or 'manual'), then set the buffer temperature with the keys ▲, ▼ and ↱.
4. ➤ Confirm the entry by pressing the  key or  key
5. ➤ Do not set the pH-value of the buffer 'ZERO'. Press the  key to confirm and if 'CAL=SKIP ZERO' appears (within no more than 10 s), press the  key again
 - ⇒ You have skipped the zero point calibration and are now in the slope calibration screen
6. ➤ Set the pH-value of the buffer 'SLOPE' using the keys ▲, ▼ and ↱.
7. ➤ Immerse sensor in the buffer solution containing test container (e.g. pH 4). In so doing, slightly move the sensor
8. ➤ Then press 
 - ⇒ Calibration is running .
9. ➤ Then press  to accept the value
10. ➤ The determined values for the zero point and slope are displayed
 - ⇒ The calibration is now saved as successful if the values for 'ZERO' and 'SLOPE' are both 'OK'.



Incorrect calibration

Should the result of the calibration lie outside the specified tolerance limits, an error message appears 'ERR'. In this case the current calibration will not be applied.

Check the prerequisites for the calibration and clear the error. Then repeat the calibration

11. ➤ Then press  to confirm the result or to terminate the calibration (if necessary, as unsuccessful)

Operating menus for the measured variables pH and ORP

Single point zero point calibration

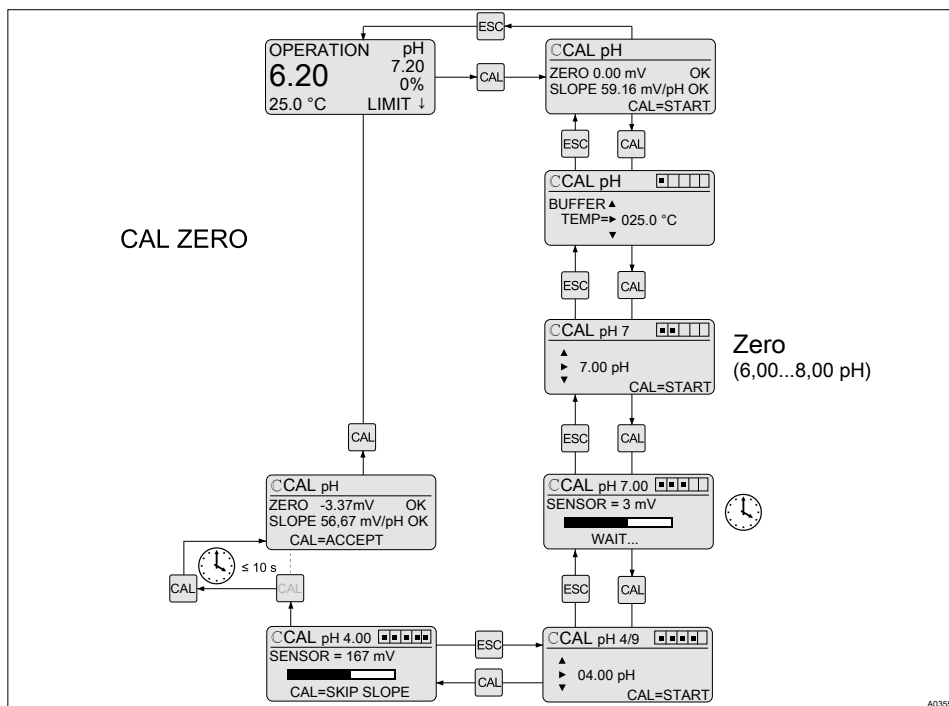


Fig. 26: Single point zero point calibration

Valid calibration values

Valid calibration:

- Zero point $-60\text{ mV} \dots +60\text{ mV}$

One test container with a buffer solution is required for calibration. Again with the single point calibration the buffer values for 'ZERO' and 'SLOPE' must be at least 1.5 pH units apart. If these buffer values are not recognised, then you must carry out a 2-point calibration.

1. ➤ Select the calibration menu 
2. ➤ Start the calibration 
3. ➤ If temperature has been selected (only if 'TEMP' is set to 'auto' or 'manual'), then set the buffer temperature with the keys ,  and 

Operating menus for the measured variables pH and ORP

4. ➤ Confirm the entry by pressing the  key again
5. ➤ Set the pH-value of the buffer 'ZERO' using the keys ,  and 
6. ➤ Immerse sensor in the buffer solution containing test container (e.g. pH 7). In so doing, slightly move the sensor
7. ➤ Then press 
 - ⇒ Calibration is running .
8. ➤ Then press  to accept the value
9. ➤ Do not set the pH-value of the buffer 'SLOPE'. Press the  key to confirm and if 'CAL=SKIP SLOPE' appears (within no more than 10 s), press the  key again
 - ⇒ The calibration is now saved as successful if the values for 'ZERO' and 'SLOPE' are both 'OK'.



Incorrect calibration

Should the result of the calibration lie outside the specified tolerance limits, an error message appears 'ERR'. In this case the current calibration will not be applied.

Check the prerequisites for the calibration and clear the error. Then repeat the calibration

10. ➤ Then press  to confirm the result or to terminate the calibration (if necessary, as unsuccessful)

8.2 Redox sensor calibration (CAL)



Redox sensor calibration

The redox sensor cannot be calibrated. It is only possible to set an 'OFFSET' of the order of ± 40 mV and then make a comparison using this value. Should the redox sensor differ by more than ± 40 mV from the reference value, then it must be checked in accordance with the requirements of the sensor operating instructions.

Operating menus for the measured variables pH and ORP



Correct sensor operation

- Correct measuring and metering is only possible if the sensor is working perfectly
- Observe the sensor operating instructions

During the calibration: the DULCOMETER® Compact Controller sets the control outputs to '0'. Exception to this: a basic load or a manual control variable has been set. This remains active. The mA standard signal output is frozen.



Used buffer

Dispose of the used buffer solution. Related info: see buffer solution safety data sheet.

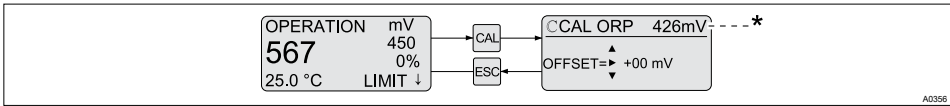


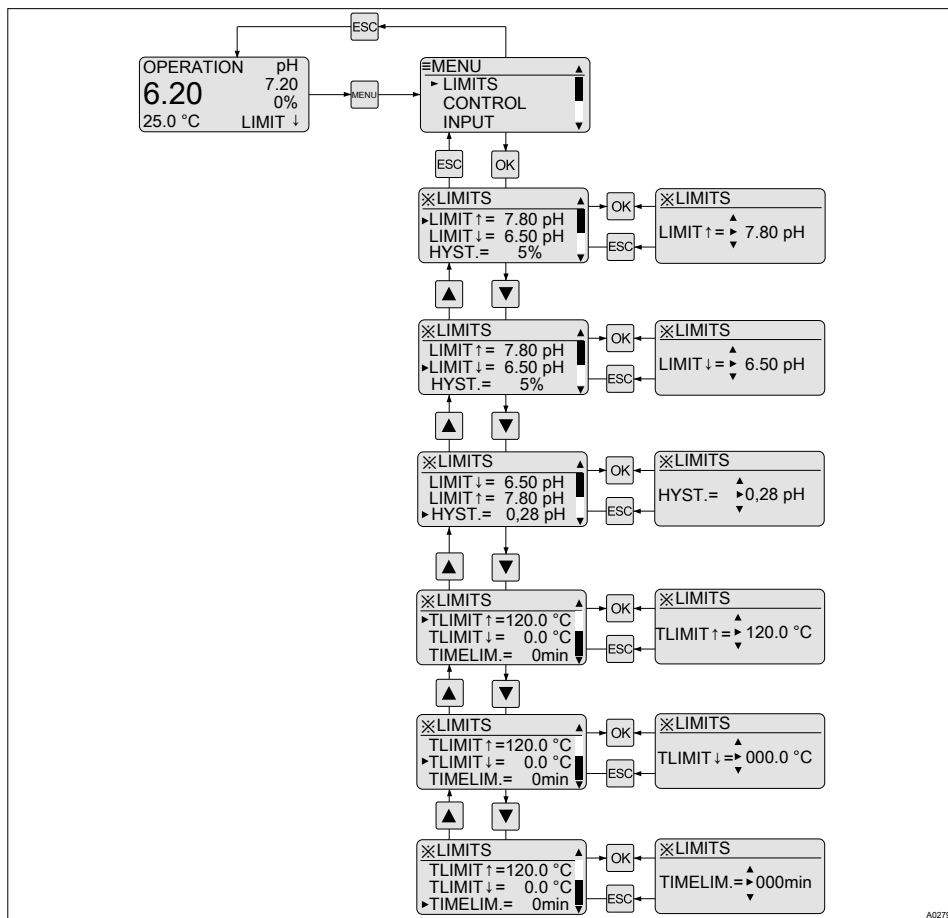
Fig. 27: Redox sensor calibration (CAL) * corrected value

A container with a redox buffer solution (e.g. 465 mV) is needed for testing.

1. Select the Test menu
2. Immerse redox sensor in the redox buffer solution containing test container (e.g. 465 mV)
3. Wait until the mV value has stabilised
4. Adjust the displayed mV values using the keys , and to the mV value of the redox buffer solution in the test container. Confirm the value by pressing . The OFFSET value is transferred into the measuring parameters
 - ⇒ quits the test menu without transferring the OFFSET value into the measuring parameters.
5. If the redox sensor is unclean or defective, it must be cleaned as described in the redox sensor operating instructions, or alternatively replaced

Operating menus for the measured variables pH and ORP

8.3 Setting limit values [LIMITS]



A0279

Fig. 28: Setting limit values [LIMITS]

Operating menus for the measured variables pH and ORP

Setting		Possible values			
Display	Starting value	Increment	Lower value	Upper value	Remark
[LIMIT ↑ pH]	8.50 pH	0.01 pH	0.00	14.00	upper pH limit value
[LIMIT ↓ pH]	6.50 pH	0.01 pH	0.00	14.00	lower pH limit value
[LIMIT ↑ ORP]	800	1 mV	-1000 mV	1000 mV	upper ORP limit value
[LIMIT ↓ ORP]	600	1 mV	-1000 mV	1000 mV	lower ORP limit value
[HYST.]	0.28 pH	0.01 pH	0.00	14.00	hysteresis for pH
	20 mV	1 mV	-1000 mV	1000 mV	hysteresis for ORP
[TLIMIT ↑ °C]	120.0 °C	0.1 °C	0.0 °C	120.0 °C	upper limit correction value °C
[TLIMIT ↓ °C]	0.0 °C	0.1 °C	0.0 °C	120.0 °C	lower limit correction value °C
[TLIMIT ↑ °F]	248.0 °F	0.1 °F	32.0 °F	248.0 °F	upper limit correction value °F
[TLIMIT ↓ °F]	32.0 °F	0.1 °F	32.0 °F	248.0 °F	lower limit correction value °F
[TIMELIM.]	0 min = OFF	1 minute	0	999	Checktime after a limit value has been exceeded or undershot pH / ORP

Hysteresis = [HYST.]

If the value has fallen below a limit value, then the limit value criteria are reset when the measured value has reached the value of the limit value plus hysteresis.

If the value has fallen below a limit value, then the limit value criteria are reset when the measured value has reached the value of the limit value minus hysteresis.

If the limit value criteria no longer exist on expiry of [TIMELIM], then the control is automatically reactivated.

Operating menus for the measured variables pH and ORP

8.4 Setting the control [CONTROL]

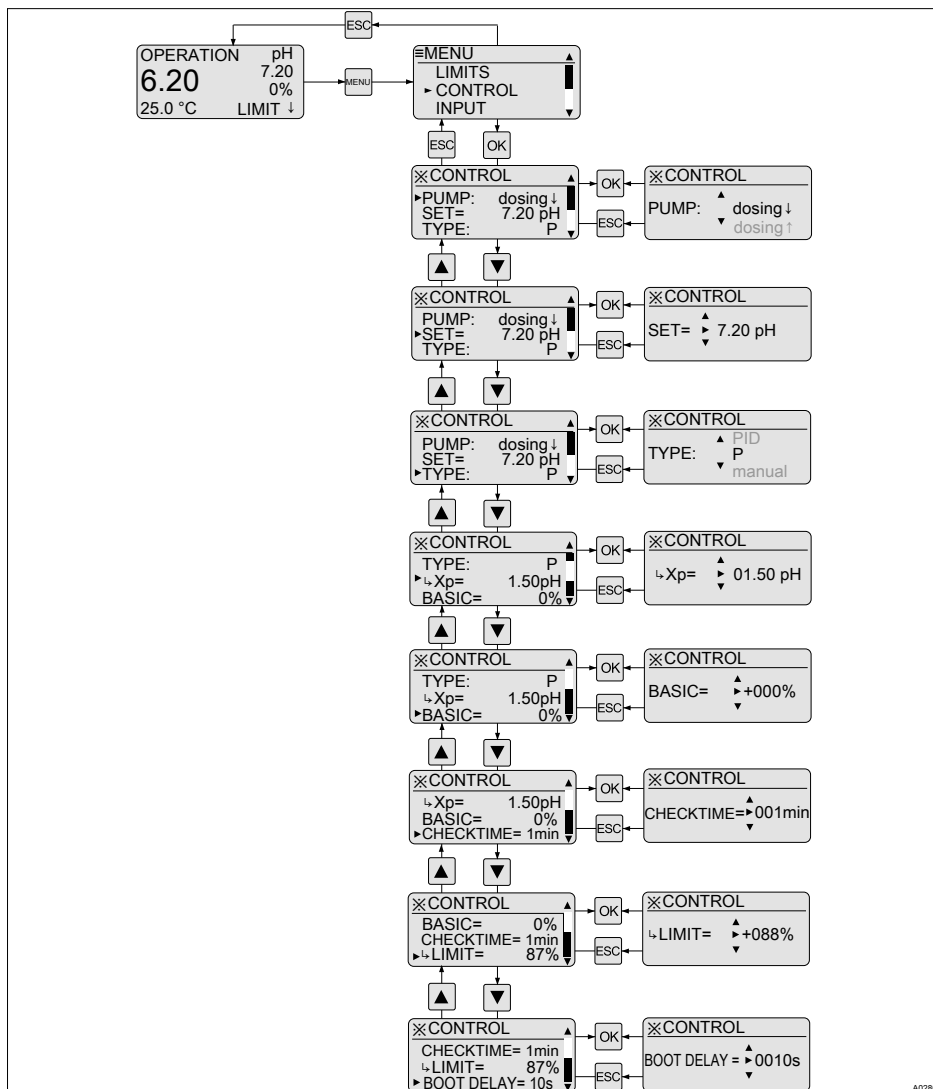


Fig. 29: Setting the control [CONTROL]

Operating menus for the measured variables pH and ORP

Setting		Possible values			
	Starting value	Increment	Lower value	Upper value	Remark
[PUMP]	dosing ↓	dosing ↓ dosing ↑			Mono-directional control direction ²
[SET]	7.20 pH	0.01 pH	0.00 pH	14.00 pH	pH setpoint
[SET]	750 mV	1 mV	-1000 mV	1000 mV	ORP voltage setpoint
[TYPE]	P	P Manual PID			Controller type
[↵Xp]	1.50 pH	0.01 pH	0.01 pH	70.00 pH	P-proportion of the pH control variable
[↵Xp]	100 mV	1 mV	1 mV	3000 mV	P-proportion of the ORP control variable
[↵Ti]	0 s	1 s	0 s	9999 s	PID control integral action time (0 seconds = no I-proportion)
[↵Td]	0 s	1 s	0 s	2500 s	PID control derivative action time (0 seconds = no D-proportion)
[BASIC] ¹	0%	1%	- 100%	100%	Basic load
[↵MANUAL] ¹	0%	1%	- 100%	100%	Manual control value
[CHECK-TIME]	0 min	1 min	0 min	999 min	Control checktime 0 minutes = off

Setting		Possible values			
	Starting value	Increment	Lower value	Upper value	Remark
[↵LIMIT] ¹	0%	1%	- 100%	100%	Checktime limit. No basic load, only PID control value
[BOOT DELAY]	0 s	1 s	0 s	9999 s	Control delay period after the start of the measuring point. After it is switched on, the unit only measures but does not control during this period.

1 = in an upwards direction with mono-directional control: 0 .. +100% (setting with PUMP: dosing ↑), in a downwards direction: -100..0% (setting with PUMP: dosing ↓).

2 = When switching over the metering direction, all actuators in the DULCOMETER® Compact Controller are reset to the factory settings for the selected metering direction.

Operating menus for the measured variables pH and ORP

8.5 Input setting (INPUT)

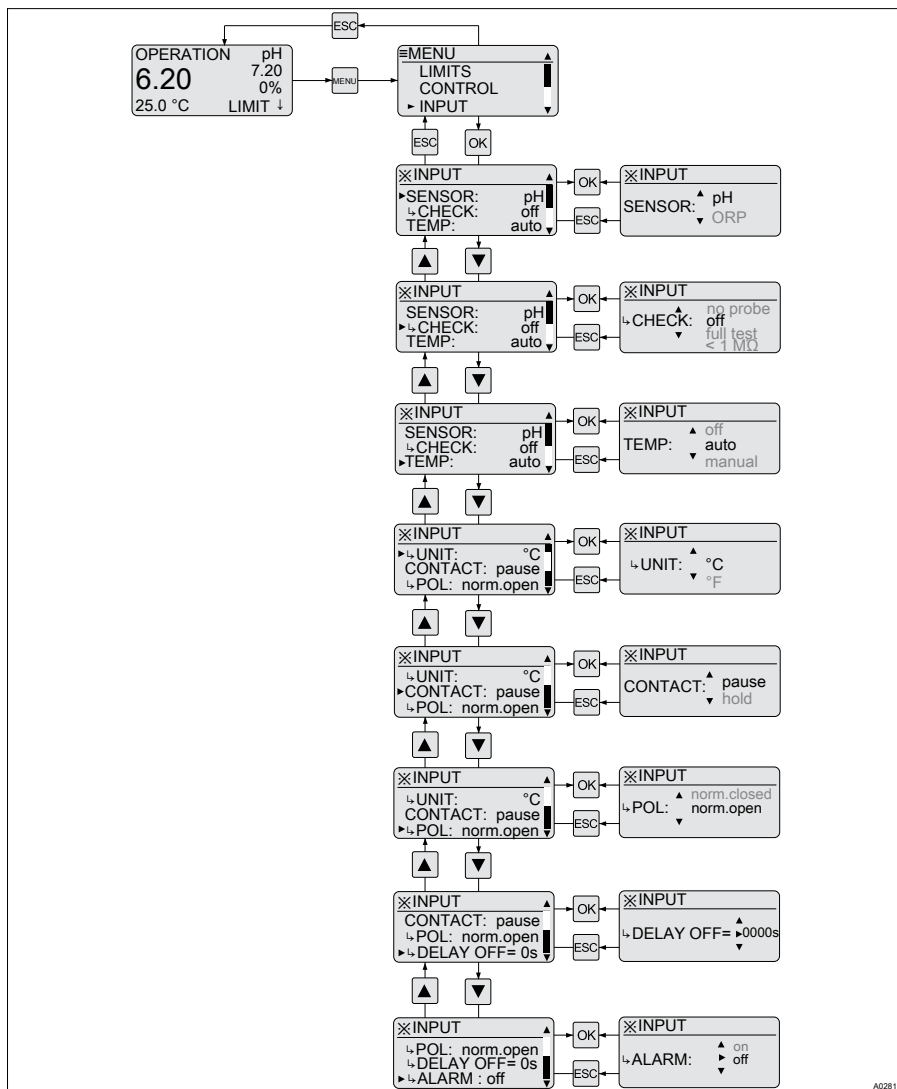


Fig. 30: Input setting (INPUT)

2024-1061		Rev. 0		Priloga 2 F2.3-65	
Operating menus for the measured variables pH and ORP					
Setting		Possible values			
Display	Starting value	Increment	Lower value	Upper value	Remarks
Sensor	pH	pH			Process variables switchover pH <--> redox ^{1.}
		ORP			
↳CHECK	off	off			Sensor monitoring 'off'
		< 1 MΩ			Sensor break check (glass break)
		no probe			Check for presence
		full test			Check for sensor break and presence
TEMP	off	auto			Pt 1000
		manual			manual
		off			Correction off
↳UNIT	°C	°C			Correction variable unit
		°F			
↳VALUE	25.0 °C	0.1 °C	0.0 °C	120.0 °C	Manual correction variable °C
↳VALUE	77.0 °F	0.1 °F	32 °F	248 °F	Manual correction variable °F
CONTACT	pause	pause			Configuration digital contact input
		hold			
↳POL	norm.open	norm.open			Polarity of the contact input
		norm.close d			
1. Attention: If this setting is changed, all parameters are reset to the corresponding factory settings					

Operating menus for the measured variables pH and ORP

Setting		Possible values			
Display	Starting value	Increment	Lower value	Upper value	Remarks
↳ DELAY OFF	0 s	1 s	0 s	1000 s	Contact input switch-off delay. Switching off of the contact input is delayed by this period.
↳ ALARM	OFF	ON			Switch on and off use of the alarm relay 'PAUSE/HOLD'
		OFF			

1. Attention: If this setting is changed, all parameters are reset to the corresponding factory settings

↳ **CHECK** = With configured pH measured variables, it is possible to monitor a sensor connected to the potentiometric input for fault states. This check is disabled as standard.

Monitoring for sensor breakage: The sensor breakage check (glass breakage) identifies a defective sensor due to its low internal resistance. Correctly functioning pH sensors have very high resistances with internal resistances in the high MΩ range. The DULCOMETER® Compact Controller is capable of recognising broken sensors from their internal resistance. This function should be deactivated if very low resistance sensors are used.

Check for presence: The "Presence check" identifies a disconnected sensor or a broken cable. This function should be disabled if pH sensors are used which have a high internal resistance across their entire operating range.

Operating menus for the measured variables pH and ORP

8.6 Output setting (OUTPUT)

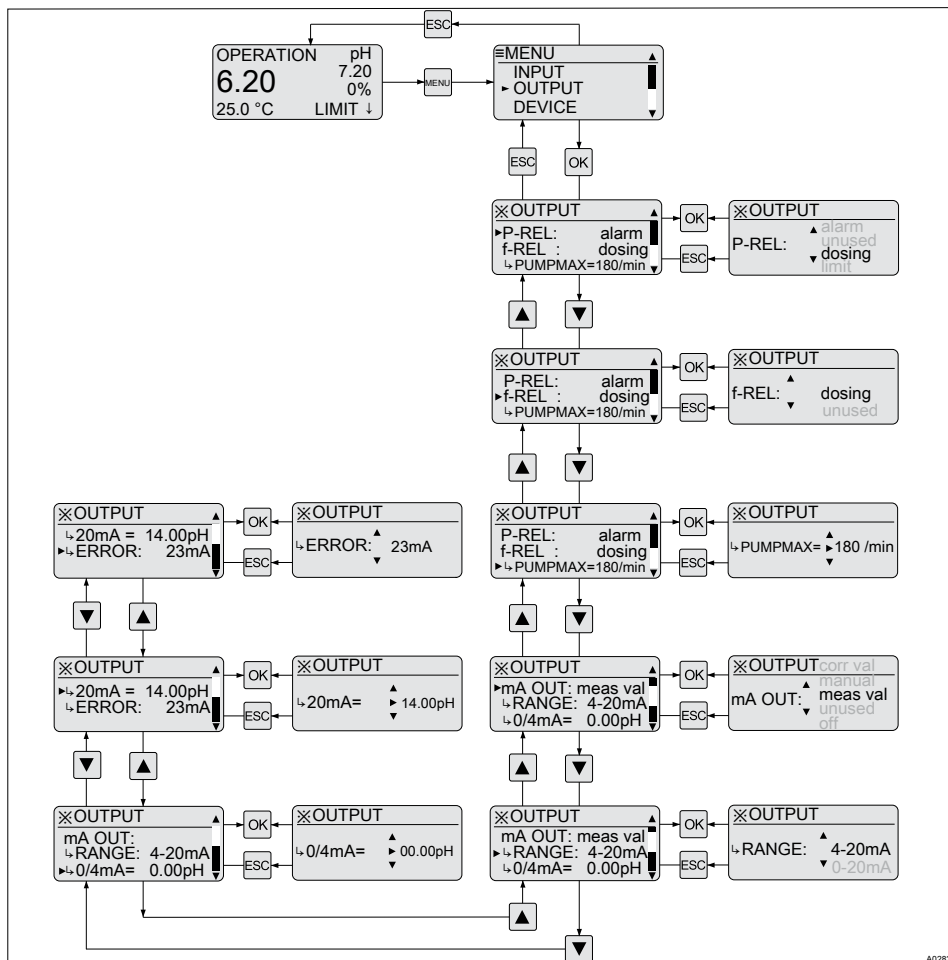


Fig. 31: Output setting (OUTPUT)

Operating menus for the measured variables pH and ORP

Setting		Possible values			
	Starting value	Increment	Lower value	Upper value	Remarks
P-REL (Power relay)	alarm	alarm			Alarm relay
		unused			off
		dosing			PWM relay
		limit			Limit relay
↳PERIOD	60 s	1 s	30 s	6000 s	Cycle time of the PWM control (P-REL = dosing)
↳MIN ON ¹	10 s	1 s	5 s	PERIOD/4 or 999	Minimum switch on period using PWM control (P-REL = dosing)
↳DELAY ON	0 s	1 s	0 s	9999 s	Switch-on delay limit value relay (P-REL = limit)
↳DELAY OFF	0 s	1 s	0 s	9999 s	Switch-off delay limit value relay (P-REL = limit)
f-REL	dosing	dosing			Activation of the low power relay (frequency relay)
		unused			
↳PUMPMA X	1 rpm	1	1	500	Maximum stroke rate of the low power relay (frequency relay)

2024-1061		Rev. 0		Priloga 2 F2.3-69	
Operating menus for the measured variables pH and ORP					
Setting		Possible values			
	Starting value	Increment	Lower value	Upper value	Remarks
mA OUT (Output value of the mA standard signal output)	meas val	off			off
		meas val			meas val
		corr val			corr val
		dosing			dosing = control value
		manual			manual
↳RANGE	4 - 20 mA	0 - 20 mA			Range of the mA standard signal output
		4 - 20 mA			
↳0/4 mA	2.00 pH	0.01 pH	0.00 pH	14.00 pH	pH value assigned 0/4 mA
↳20 mA	12.00 pH	0.01 pH	0.00 pH	14.00 pH	pH value assigned 20 mA
↳0/4 mA	0 mV	1 mV	-1000 mV	1000 mV	Redox value assigned 0/4 mA
↳20 mA	1000 mV	1 mV	-1000 mV	1000 mV	Redox value assigned 20 mA
↳0/4 mA	0.0 °C	0.1 °C	0.0 °C	120.0 °C	Temp. value assigned 0/4 mA
↳20 mA	100.0 °C	0.1 °C	0.0 °C	120.0 °C	Temp value assigned 20 mA
↳0/4 mA	32.0 °F	0.1 °F	32.0 °F	248.0 °F	Temp. value assigned 0/4 mA

Operating menus for the measured variables pH and ORP

Setting		Possible values			
	Starting value	Increment	Lower value	Upper value	Remarks
↳ 20 mA	212.0 °F	0.1 °F	32.0 °F	248.0 °F	Temp value assigned 20 mA
↳ 20 mA ²	- 100 %	1 %	10 % / - 10 %	100 % / - 100 %	Control value assigned 20 mA (0/4 mA is fixed as 0%)
↳ VALUE	4.00 mA	0.01 mA	0.00 mA	25.00 mA	Manual output current value
↳ ERROR	off	23 mA			Output current value upon fault, 23 mA
		0/3.6 mA			Output current value upon fault, 0/3.6 mA
		off			off = no fault current is output

1 = The parameter maximum occurs at PERIOD/4 or 999, whichever is smaller

2 = dependent on metering direction, the limits are either -10% and -100% or +10% and +100%

Operating menus for the measured variables pH and ORP

8.7 DEVICE setting

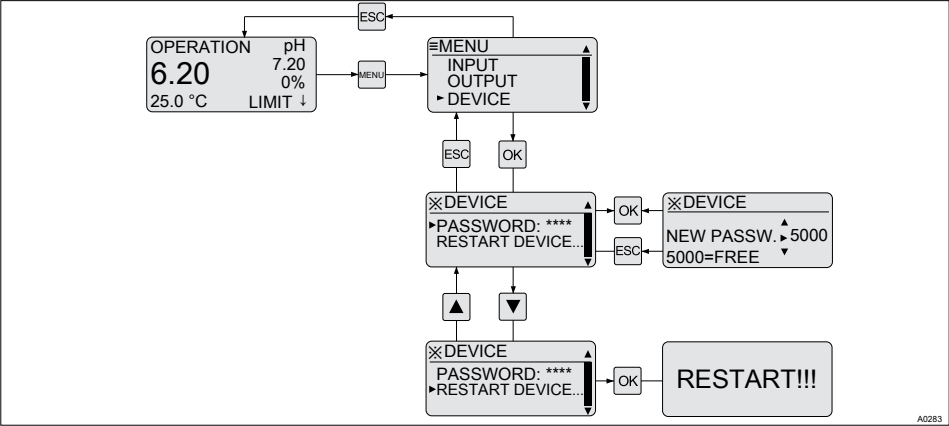


Fig. 32: Device setting

Setting		Possible values			
	Starting value	Increment	Lower value	Upper value	Remarks
Password	5000	1	0000	9999	5000 = no password protection
Restart device					Controller is restarted

Control parameters and functions

9 Control parameters and functions

- **User qualification:** trained user, see *Chapter 2.2 'Users' qualifications' on page 10*

9.1 DULCOMETER® Compact Controller function states

DULCOMETER® Compact Controller function states have the following priority:

- 1. 'STOP'
- 2. 'PAUSE/HOLD'
- 3. 'CAL' (calibration)
- 4. 'OPERATION' (normal mode)

"CAL" (calibration) peculiarities

- Control goes to basic load, mA measurement outputs are frozen
- New faults are detected, however they have no effect on the alarm relay or the mA output
- Detection of measurement variable relevant faults during 'CAL' (calibration process) are suppressed (e.g. LIMIT↑)

"PAUSE" peculiarities

- Control is switched to 0% control variable. The I-proportion is saved
- New faults are detected, however they have no effect on the alarm relay or the mA output
- Special case alarm relay in 'PAUSE': If activated the output relay switches to 'PAUSE' (error message CONTACTIN)

"HOLD" peculiarities

- Control and all other outputs are frozen
- New faults are detected, however they have no effect on the alarm relay or the mA output. However the effect of already existing faults (e.g. fault current) remains
- Special case alarm relay: Activation of the frozen alarm relay is permitted (= no alarm), if all faults have been acknowledged or have disappeared
- Special case alarm relay in 'HOLD': If activated the output relay switches to 'HOLD' (error message CONTACTIN)

"STOP" peculiarities

- Control OFF
- New faults are detected, however they have no effect on the alarm relay or the mA output
- The alarm relay is switched off in 'STOP'

Peculiarities of the "START" event, i.e. switching from "STOP" to "OPERATION" (normal mode)

- Fault detection starts afresh, all existing faults are deleted

Generally applicable information

- If the cause of a fault disappears, then the fault message in the LCD footer disappears.
- A previously existing 'PAUSE/HOLD' state is not influenced by starting a 'CAL' (calibration) process. If during 'CAL' (calibration) the functional state 'PAUSE/HOLD' is released, then all states will remain frozen until the end of the 'CAL' (calibration) process.

Control parameters and functions

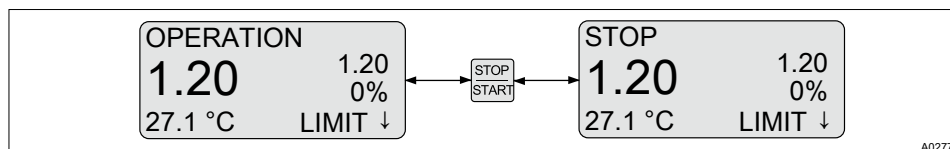
- If 'CAL' (calibration) is started while functional state 'OPERATION' (normal mode) is active, then the functional state 'PAUSE/HOLD' is ignored until 'CAL' (calibration) completes. However STOP/START is possible at any time
- An alarm can be acknowledged or removed as follows: By clearing all faults by pressing the  key and the  key while the continuous display is visible

Control parameters and functions

9.2 STOP/START key



The control function is started / stopped by pressing the key. The key can be pressed independently of the currently displayed menu. However, the *[STOP]* state is only shown in the continuous display.



A0277

Fig. 33: -Key

When the controller is first switched on, the controller is in *[STOP]* status.

Upon certain defined fault conditions, the controller switches to the *[STOP]* status. The control is then off (= 0 % control variable).

To differentiate between the fault-related *[STOP]* and the operating status *[STOP]* by pressing the key, instead of *[STOP]* the identifier *[ERROR STOP]* is displayed.

Pressing the key causes operating status *[ERROR STOP]* to change to operating status *[STOP]*. Pressing once more causes the controller to be started again.

In *[STOP]* state, the controller must be started manually by pressing the key.

[STOP] of the controller causes the following:

- Control is stopped
- The P-relay functioning as a limit value relay and a PWM relay are switched to the de-energised state
- The P-relay acting as an alarm relay activates (no alarm)

Restarting of the controller causes the following:

- If a *[STOP]* state existed, then the controller must be manually started after being switched back on.
- Fault detection starts afresh, all existing faults are deleted

Control parameters and functions

9.3 Priming (PRIME)

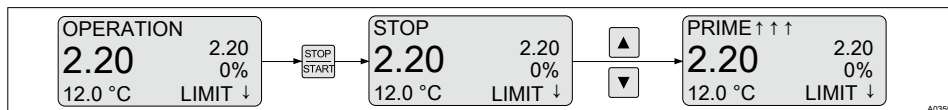


Fig. 34: Priming, e.g. to vent a pump

While the continuous display is visible and the states 'STOP' or 'OPERATION' are active, simultaneously pressing ▲ and ▼ causes the priming function 'PRIME' to be started.

At the same time, dependent on the configuration of the controller, the output relay (P-REL) is actuated at 100 %, the frequency relay (f-REL) is actuated at 80 % of "PUMPMAX" and 16 mA is output at the mA output. However this is only the case if these outputs are set as actuator 'dosing'.

The power relay (P-REL) starts after priming in an activated state.

You can use this function, for example, to transport the feed chemical up to the pump to vent the metering line.

Control parameters and functions

9.4 Hysteresis limit

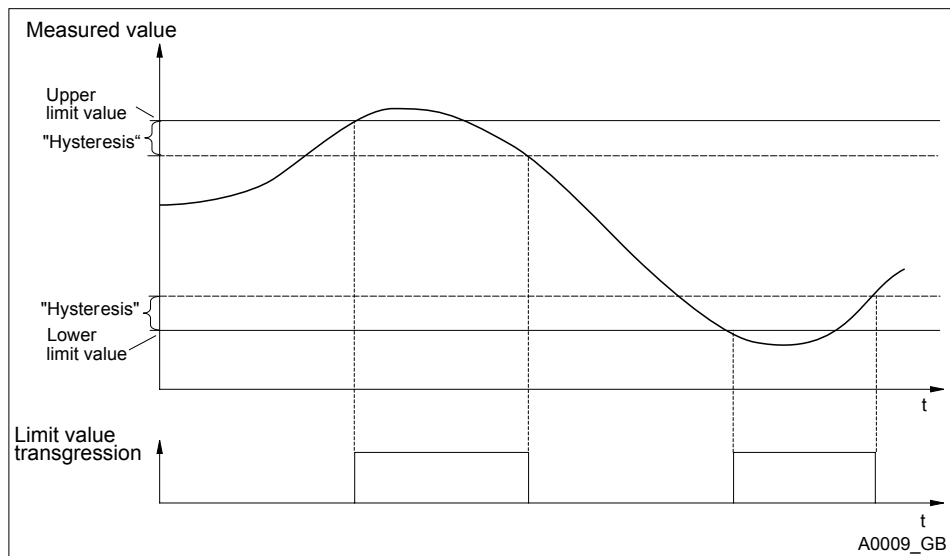


Fig. 35: Hysteresis

Upper limit value = LIMIT ↑

Lower limit value = LIMIT ↓

The range between LIMIT ↑ and LIMIT ↓ is the **valid measuring range**.

The DULCOMETER® Compact Controller has fixed 'hysteresis'.

Measured variable	Hysteresis
pH	0.28 pH
Redox	20 mV

The 'Hysteresis' acts to cause an increase in the limit value transgression, i.e. if the 'Limit ↑' of e.g. pH 7.5 was exceeded, then the criterion for a limit value transgression is only removed again when the value falls below pH 7.22. The hysteresis behaviour for a 'Limit ↓' functions in an analogue way (the hysteresis value is here added to the Limit ↓), for example 'Limit ↓' pH 4.00, hysteresis pH 0.28, then the limit value transgression criterion is only removed again when the pH exceeds 4.28.

Control parameters and functions

9.5 Temperature correction variable for pH

The correction variable compensates for the effect of the temperature of the medium on the measured value. The correction variable is the temperature of the medium to be measured. The temperature of the medium affects the pH value to be measured.

Operating modes

- *[off]*: No temperature compensation takes place
 - For measurements which do not require temperature compensation
- *[auto]*: The DULCOMETER® Compact Controller evaluates the temperature signal of the connected temperature sensor
 - For measurements using a temperature sensor (Pt1000) (0 -120 °C)
- *[manual]*: The temperature of the medium to be measured has to be measured by the user. The measured value is then entered using the keys  and  in the parameter 'VALUE' in the DULCOMETER® Compact Controller and saved using the key 
 - For measurements where the medium to be measured has a constant temperature, which has to be taken into account in the control process

Control parameters and functions

9.6 Checkout time for measured variable and correction variable

Error text	Description
LIMIT ERR	Checkout time of the measured variable
TLIMITERR	Checkout time of the correction variable

If upon the expiry of the checkout time, the valid measuring range is not reached, then the DULCOMETER® Compact Controller exhibits the following behaviour:

- **LIMIT ERR:** The control is switched off. An error current is emitted, provided the output is configured as a measured variable output
- **TLIMITERR:** The control is switched off. An error current is emitted, provided the output is configured as a correction variable output or a measured variable output

Initially the transgression of a limit is only a limit value transgression. This leads to a 'WARNING'. Switching on the control time 'TIMELIM' (> 0 minutes), creates an alarm from the limit value transgression. In the event of a [TLIMITERR] a, the control switches to [STOP].

9.7 Checkout time control



Monitoring of the control path

The checkout time monitors the control path. The checkout time mechanism permits detection of possible defective sensors.



Dead time determination

Each control path has a dead time. The dead time is the time, which the control path requires to detect a change or addition of metered chemicals using its own instrumentation.

You must select the checkout time so that it is greater than the dead time. You can determine the dead time, by operating the metering pump in manual mode and, for example, dosing acid.



NOTICE!

Dead time determination

You should only determine the dead time if the current process cannot be negatively influenced by the manual metering.

You must determine the time, which the control path (i.e. the entirety of controllers, sensors, measurement water, flow gauges, etc.) requires to detect a first change in the measured value starting from the beginning of dosing. This time is the 'dead time'. A safety margin, e.g. 25%, must be added to this dead time. You must allocate an appropriate safety margin for your own particular process.

Control parameters and functions

The parameter *'LIMIT'* can be used to set a limit for the control variable. If the control variable exceeds this limit value, the CHECKTIME fault is triggered (checkout time of the control has elapsed). The control is switched to basic load and a fault current output.

9.8 Power relay "P-REL" as limit value relay

The power relay *'P-REL'* can be configured as a limit value relay. It always act only on the measurement variable, whereby the limits are set in *'LIMITS'*. The relay is activated upon infringement of either the top or lower limit values.

Constant checking is carried out to determine whether a limit has been infringed and if this is interrupted with the power relay configured *'P-REL=limit'* for at least *'DELAY ON'* seconds, then the relay is activated. If the limit value transgression disappears for at least *'DELAY OFF'* seconds, then the limit value relay is again deactivated.

The limit value relay is deactivated immediately upon: *'STOP'*, user calibration, *'PAUSE'* and *'HOLD'*.

Control parameters and functions

9.9 Setting and functional description of "Relay Used as a Solenoid Valve"

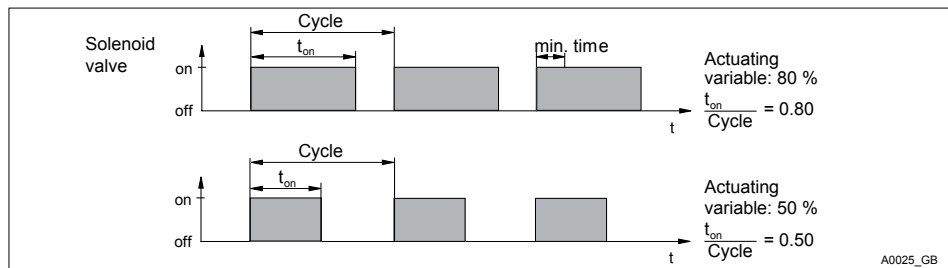


Fig. 36: Solenoid valve (= P-REL: dosing)

min. time [MIN ON]

Cycle = [PERIOD] (in seconds)



Solenoid valve switching times

The switching times of the relay (solenoid valve) depend on the cycle time, the control variable and the 'min. time' (smallest permissible switch-on time for the connected device). The actuating variable determines the ratio t_{on}/cycle and thus also the switching times.

The 'min. time' affects the switching times in two situations:

Control parameters and functions

1. Theoretical switching time < min. time

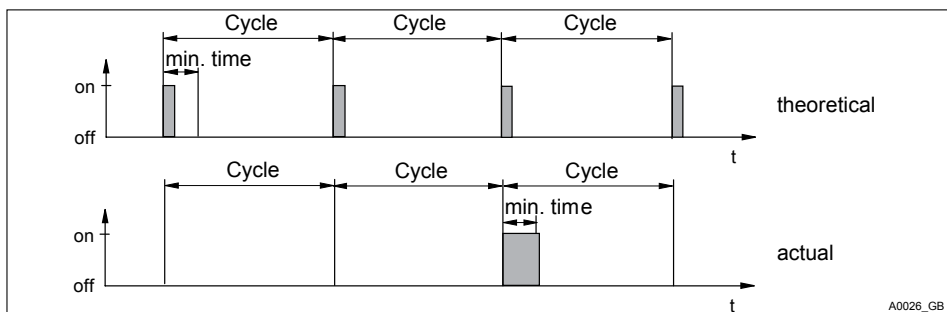


Fig. 37: Theoretical switching time < min. time

min. time [MIN ON]

Cycle = [PERIOD] (in seconds)

The DULCOMETER® Compact Controller does not switch on for a certain number of cycles until the sum of the theoretical switching times exceeds 'min. time'. Then it switches for the duration of this total time.

2. Theoretical switching time > (cycle - min. time)

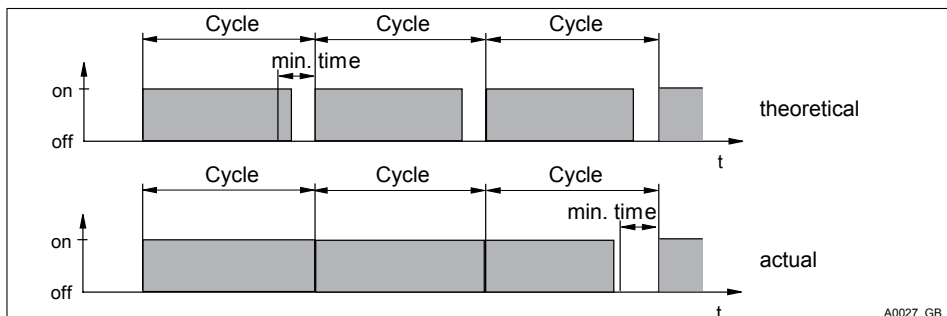


Fig. 38: Theoretical switching time > (cycle - min. time) and calculated switching time < cycle

min. time [MIN ON]

Cycle = [PERIOD] (in seconds)

The DULCOMETER® Compact Controller does not switch off for a certain number of cycles until the differences between the cycle and the theoretical switching time exceed 'min. time'.

Control parameters and functions

9.10 Alarm relay

The alarm relay triggers in *'OPERATION'* (normal mode) if an error occurs which has been defined as *'ERROR'* and not just as *'WARNING'*.

The error message *'ALARM'* in the continuous display is marked with a * (star) and can be acknowledged with the  key. The alarm and the * will then disappear.

9.11 "Error logger" operating mode

The last three errors are displayed. Also displayed is how long ago (in minutes) they occurred. When a new fault occurs, the oldest fault is deleted.

Faults are only shown which occur in operating status *'OPERATION'*, i.e. not in operating status *'STOP'*, *'CAL'* (user calibration), *'HOLD'* or *'PAUSE'*.

Only *'ERRORs'* are shown, not *'WARNINGS'*, e.g. a *'LIMIT ERR'* is shown, but not *'LIMIT↑'*.

A fault, whose display has lasted for 999 minutes is automatically deleted from the *'Error Logger'*. The *'Error Logger'* is neither saved nor backed up in the event of power loss.

10 Maintenance

- **Users' qualification:** trained user, see  *Chapter 2.2 'Users' qualifications' on page 10*

The DULCOMETER® Compact Controller is maintenance free.

10.1 Changing the fuse, DULCOMETER® Compact Controller



WARNING!

Danger from electrical voltage

Possible consequence: Fatal or very serious injuries.

- The DULCOMETER® Compact Controller does not have a mains switch
- When working inside the control unit, disconnect the control unit from the mains power via an external switch or by removing the external fuse



NOTICE!

Use only 5 x 20 mm micro-fuses

Possible consequence: Damage to the product or its surroundings

- 5x20 T 0.315 A
- Part number 732404

Fuse change

The mains fuse is located in a sealed fuse holder in the inside of the device.

- 1.** ➤ Disconnect the controller from the mains power
- 2.** ➤ Open the controller and fold the controller housing top section to the left
- 3.** ➤ Remove the PCB cover
- 4.** ➤ Remove the micro-fuse using a suitable tool
- 5.** ➤ Fit the micro-fuse using a suitable tool
- 6.** ➤ Refit the PCB cover
- 7.** ➤ Replace controller housing top section and close the controller

Maintenance

10.2 Fault reporting and troubleshooting

- **Users' qualification for diagnostics:** trained user, see [Chapter 2.2 'Users' qualifications'](#) on page 10. Further measures depend on the type and scope of possible troubleshooting measures to be carried out.

Tab. 6: Fault reporting and troubleshooting

Display	Description / cause	Status ¹	Mode ²	Measured variable output ³	Correction variable output ⁴
pH/mV RANGE ↓	Input voltage too low	Error	Basic load	Fault current	-
pH/mV RANGE ↑	Input voltage too high	Error	Basic load	Fault current	-
T RANGE ↓	Measured temperature beneath measuring range	Error	Basic load	Fault current	Fault current
T RANGE ↑	Measured temperature above measuring range	Error	Basic load	Fault current	Fault current
CAL ERROR	No valid user calibration exists	Error	-	-	-
NO PROBE	If activated: pH sensor monitoring outputs: no sensor	Error	Basic load	Fault current	-
PROBE ERR	If activated: pH sensor monitoring outputs: sensor break	Error	Basic load	Fault current	-
CHECK-TIME	Control checkout time elapsed	Error	Basic load	Fault current	-
mA RANGE ↑	mA output current has an upper limit	Error	-	-	-

Maintenance

Display	Description / cause	Status ¹	Mode ²	Measured variable output ³	Correction variable output ⁴
mA RANGE ↓	mA output current has a lower limit	Error	-	-	-
LIMIT ↑	Measured variable exceeds upper set limit	Warning	-	-	-
LIMIT ↓	Measured variable falls below lower set limit	Warning	-	-	-
T LIMIT ↑	Correction variable exceeds upper set limit	Warning	-	-	-
T LIMIT ↓	Correction variable falls below lower set limit	Warning	-	-	-
LIMIT ERR	Set checkout time for monitoring the measurement variable limits has elapsed	Error	Stop	Fault current	-
TLIMITERR	Set checkout time for monitoring the correction variable limits has elapsed	Error	Stop	Fault current	Fault current
NO CAL	No valid user calibration exists	Warning	-	-	-
CONTACTIN	If activated: Power relay is activated in 'PAUSE/HOLD'	Error	-	-	-

1 = [Status] Error status after occurrence of the fault (error means: alarm relay deactivates, ******* is displayed before the error message, can be acknowledged with OK)

Maintenance

2 = *[Mode]* Resulting controller mode (relates to control variable and thus, as necessary, mA output)

3 = *[Measured variable output]* Consequence for the current output, if this is set as '*a measured variable output*'

4 = *[Correction variable output]* Consequence for the current output, if this is set as '*a correction variable output*'

Technical data DULCOMETER® Compact Controller

11 Technical data DULCOMETER® Compact Controller

11.1 Permissible ambient conditions



Degree of protection (IP)

The controller fulfils the IP 67 degree of protection requirements (wall/pipe mounting) or IP 54 (control panel mounting). This degree of protection is only achieved if all seals and threaded connectors are correctly fitted.

Tab. 7: Permissible ambient operating conditions

Temperature	-10 °C ... 60 °C
Air humidity	< 95 % relative air humidity (non-condensing)

Tab. 8: Permissible ambient storage conditions

Temperature	-20 °C ... 70 °C
Air humidity	< 95 % relative air humidity (non-condensing)

11.2 Sound Pressure Level

No noise generation measurable

Technical data DULCOMETER® Compact Controller

11.3 Material data

Part	Material
Housing lower and upper section	PC-GF10
Bracket rear side housing bottom section	PPE-GF20
Operating film	Polyester PET membrane
Seal	Expanded PUR
Cover screws	Stainless steel A2
Profile seal (control panel mounting)	Silicone

11.4 Chemical Resistance

The device is resistant to normal atmospheres in plant rooms

11.5 Dimensions and weights

Complete device:	128 x 137 x 76 mm (W x H x D)
Packaging:	220 x 180 x 100 mm (W x H x D)
Weight of device without packaging:	approx. 0.5 kg
Gross weight of device with packaging:	approx. 0.8 kg

Electrical data

12 Electrical data

Mains connection	
Nominal voltage range	100 – 230 VAC ± 10 %
Frequency	50 – 60 Hz
Current consumption	50 – 100 mA

The mains connection is isolated from other switching parts by reinforced insulation. The device has no mains switch; a fuse is fitted.

Power relay (P-relay)	
Loading of switching contacts	5 A; no inductive loads

Outputs galvanically isolated from other switching parts by reinforced insulation.

Digital input	
Open circuit voltage	15 V DC max.
Short circuit current	approx. 6 mA
Max. switching frequency	Static For switching processes such as 'PAUSE', 'HOLD', etc.



NOTICE!

Do not supply with voltage

For the connection of an external semi-conductor or mechanical switch.

mA Output	0 - 20 mA	4 - 20 mA	manual
Current range	0 – 20.5 mA	3.8 – 20.5 mA	0 - 25 mA
In the event of a fault	0 or 23 mA	3.6 or 23 mA	
Max. load	480 Ω at 20.5 mA		

Electrical data

mA Output	0 - 20 mA	4 - 20 mA	manual
Max. output voltage	19 V DC		
Overvoltage-resistant up to:	±30 V		
Output accuracy	0.2 mA		

Galvanically isolated from all other connections (500 V)

mV input	
Measuring range	-1 V ... +1 V 0 pH ... 14 pH
Measurement accuracy	±0.25 % of the measuring range
Sensor monitoring of input (low resistance threshold) (can be switched off)	< 500 kΩ ... 1 MΩ (short circuit)
Sensor monitoring of input (high resistance threshold) (can be switched off)	no pH sensor connected
Display glass sensor resistance of ProMinent pH sensor	0 ... 5000 MΩ
Overvoltage-resistant up to:	±5 V

Pump control (f-relay)	
Max. switching voltage:	50 V (protective low voltage)
Max. switching current:	50 mA
Max. residual current (open):	10 μA
Max. resistance (closed):	60 Ω
Max. switching frequency (HW) at 50% filling factor	100 Hz

Digital output galvanically isolated from all other connections via OptoMos relay.

Electrical data

Temperature input	
Temperature measuring range:	0...120 °C
Measuring flow:	approx. 1.3 mA
Measuring accuracy:	±0.8 % of measuring range
Overvoltage-resistant up to:	±5 V
Short circuit-resistant	Yes

For connection of a Pt1000 temperature sensor using a 2-wire system. Not galvanically isolated from the mV input

Spare parts and accessories

13 Spare parts and accessories

Spare parts	Part number
Fine fuse 5x20 T 0.315 A	732404
Wall/tube retaining bracket	1002502
Guard terminal top part (knurled nut)	733389
Measured variable labels	1002503
DMT fixing strap	1002498
Cable connection set DMTa/DXMa (metric)	1022312
Controller housing lower part (processor/PCB), fully assembled	Identity code DCCA_E_E1 ...
Controller housing top part (display/operating part), fully assembled	Identity code DCCA_E_E2 ...

Accessories	Part number
Mounting kit for control panel installation	1037273
Check strap	1035918

Replacing spare part units

14 Replacing spare part units

- **User qualification, mechanical installation:** trained qualified personnel, see *Chapter 2.2 'Users' qualifications' on page 10*
- **User qualification, electrical installation:** Electrical technician, see *Chapter 2.2 'Users' qualifications' on page 10*



CAUTION!

Check strap for strain relief

Possible consequence: Material damage.

The ribbon cable and its base cannot be mechanically stressed. Hence it is essential when mounting the controller in the control panel, that the check strap (part number 1035918) is fitted for strain relief and mechanical fixing. Without the check strap, the ribbon cable or its base could be damaged if they were to fall out of the top part of the controller housing.

14.1 Replacing the top part of the housing



NOTICE!

Ribbon cable base

The base of the ribbon cable is firmly soldered onto the PCB. The base cannot be removed. Open the base lock (3) to loosen the ribbon cable, see Fig. 39

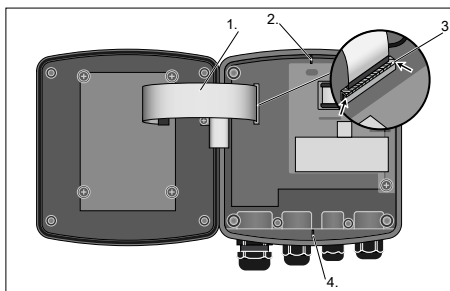


Fig. 39: Loosening the ribbon cable

1. Undo four screws and open the DULCOMETER® Compact Controller
2. Open the right and left lock (3) (arrows) on the base and pull the ribbon cable (1) out of the socket
3. The catches (2 and 4) are not needed with units for control panel installation.

Replacing spare part units

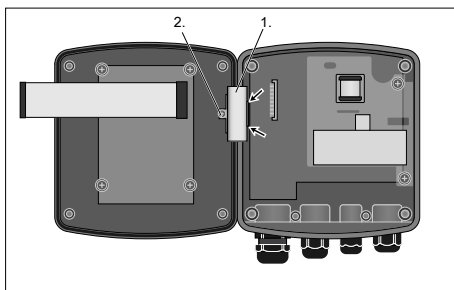


Fig. 40: Dismantling the hinge

4. ➔ Remove the screw (2), unclip the hinge (1) on the lower part of the controller housing (arrows) and remove the hinge
5. ➔ With control panel installation: Remove the two screws and remove the strain relief

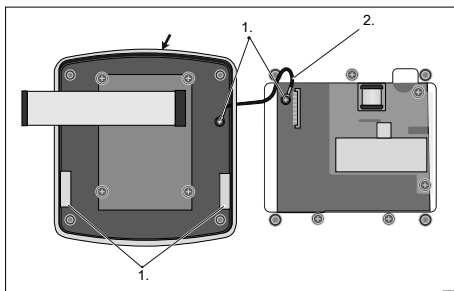


Fig. 41: With control panel installation: Fit the profile seal onto the top part of the controller housing

6. ➔ With control panel installation: Position the profile seal (arrow) evenly into the groove in the top part of the DULCOMETER® Compact Controller housing. Arrange the flaps (3) as shown in the figure
7. ➔ With control panel installation: Secure the strain relief (2) using two screws (1)

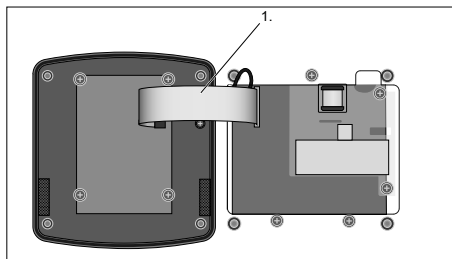


Fig. 42: Pushing and locking the ribbon cable in its base

8. ➔ Push and lock the ribbon cable (1) in its base
9. ➔ Fit the hinge
10. ➔ Screw the top part of the controller housing onto the lower part of the DULCOMETER® Compact Controller housing
11. ➔ With control panel installation: Re-check that the profile seals are fitted properly
 - ⇒ Re-check that the seal is seated properly. Only if the mounting is correct, can IP 67 (wall/pipe mounting) or IP 54 (control panel mounting) degree of protection be achieved

Replacing spare part units

14.2 Replacing the lower part of the housing (wall/tube retaining bracket)



Complete commissioning of the controller

Once the lower part of the housing has been replaced, it is necessary to fully commission the measuring and control point, as the new lower part of the housing does not have specific settings, only factory settings.

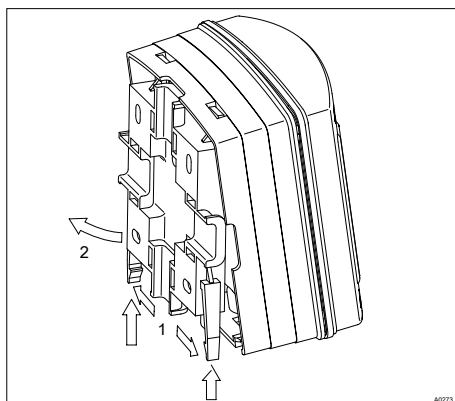


Fig. 43: Removing the wall/tube retaining bracket

1. ➔ Remove the wall/tube retaining bracket. Pull the two snap-hooks (1) outwards and push upwards



NOTICE!

Ribbon cable base

The base of the ribbon cable is firmly soldered onto the PCB. The base cannot be removed. Open the base lock (3) to loosen the ribbon cable, see Fig. 39

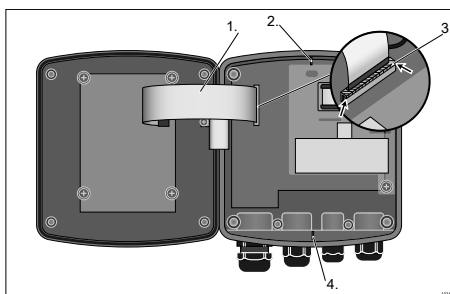


Fig. 44: Loosening the ribbon cable

2. ➔ Undo four screws and open the DULCOMETER® Compact Controller
3. ➔ Open the right and left lock (3) (arrows) on the base and pull the ribbon cable (1) out of the base. The catches (2 and 4) are used to align the two halves of the housing.

Replacing spare part units

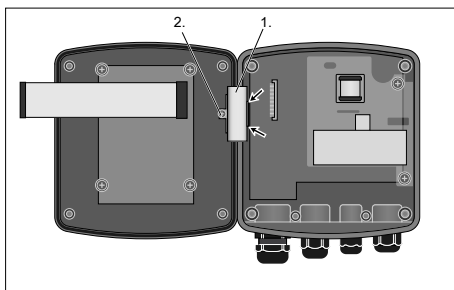


Fig. 45: Dismantling the hinge

4. ➔ Remove the screw (2), unclip the hinge (1) on the lower part of the controller housing (arrows) and remove the hinge
5. ➔ Label the cable connectors fitted to distinguish them and remove the cables from the lower part of the controller

Preparing the new lower part of the controller housing

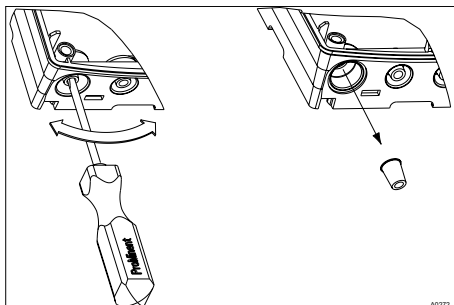


Fig. 46: Punching out the threaded holes

6. ➔



*Large threaded connection
(M 20 x 1.5)*

*Small threaded connection
(M 16 x 1.5)*

Punch out as many threaded holes on the bottom of the lower part of the controller housing as required

Fit the cable and threaded connectors

7. ➔ Guide the cable into the respective reducing inserts
8. ➔ Insert the reducing inserts into the threaded connectors
9. ➔ Guide the cable into the controller
10. ➔ Connect the cable as indicated in the terminal diagram
11. ➔ Screw in the required threaded connectors and tighten
12. ➔ Tighten the threaded connector clamping nuts so that they are properly sealed

Refit the controller

13. ➔ Fit the hinge

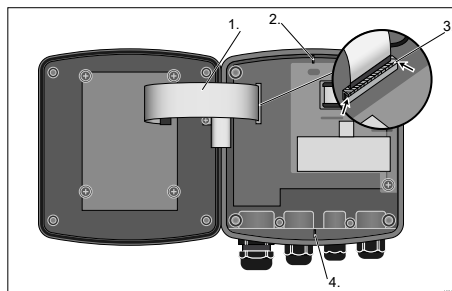


Fig. 47: Fix the ribbon cable

Replacing spare part units

14. ➔ Push and lock the ribbon cable (1) in its base. The catches (2 and 4) are used to align the two halves of the housing.
15. ➔ Screw the top part of the controller housing onto the lower part of the DULCOMETER® Compact Controller housing
16. ➔ Re-check that the seal is seated properly. IP 67 degree of protection (wall/pipe-mounting) can only be provided if the installation is correct

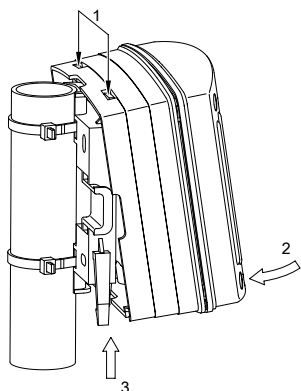


Fig. 48: Suspend and secure the DULCOMETER® Compact Controller

17. ➔ Suspend the DULCOMETER® Compact Controller at the top (1) in the wall/tube retaining bracket and push using light pressure at the bottom (2) against the wall/pipe retaining bracket. Then press upwards (3) until the DULCOMETER® Compact Controller audibly snaps into position

14.3 Replacing the lower part of the housing (control panel installation)



Complete commissioning of the controller

Once the lower part of the housing has been replaced, it is necessary to fully commission the measuring and control point, as the new lower part of the housing does not have specific settings, only factory settings.



NOTICE!

Ribbon cable base

The base of the ribbon cable is firmly soldered onto the PCB. The base cannot be removed. Open the base lock (3) to loosen the ribbon cable, see Fig. 39

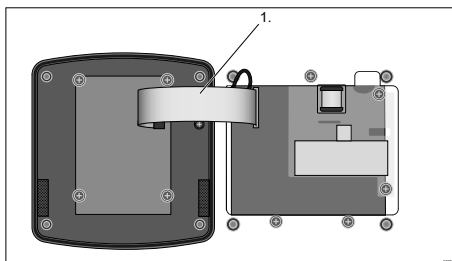


Fig. 49: Loosen the ribbon cable from the base

1. ➔ Undo four screws and open the DULCOMETER® Compact Controller
2. ➔ Open the right and left lock on the base and pull the ribbon cable (1) out of the base.

Replacing spare part units

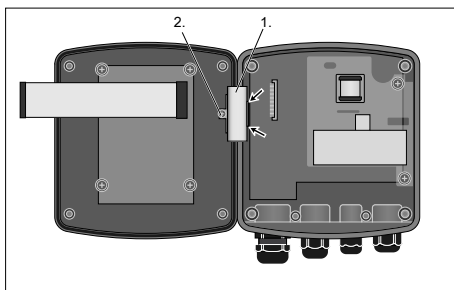


Fig. 50: Dismantling the hinge

3. ➔ Remove the screw (2), unclip the hinge (1) on the lower part of the controller housing (arrows) and remove the hinge

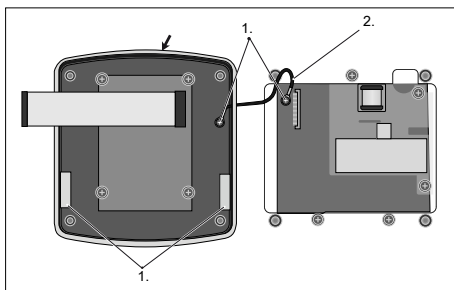


Fig. 51: Removing the strain relief

4. ➔ Remove the strain relief (2). Remove the screws (1) to do so.
5. ➔ Check the profile seal (arrow), then position the profile seal evenly into the groove in the top part of the DULCOMETER® Compact Controller housing. Arrange the flaps (3) as shown in the figure
6. ➔ Remove the top part of the controller housing (3 fixing bolts)
7. ➔ Label the cable connectors fitted to distinguish them and remove the cables from the lower part of the controller

Preparing the new lower part of the controller housing

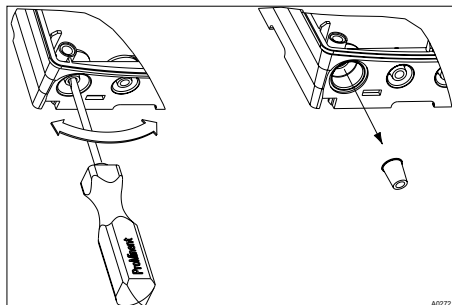


Fig. 52: Punching out the threaded holes

8. ➔



*Large threaded connection
(M 20 x 1.5)*

*Small threaded connection
(M 16 x 1.5)*

Punch out as many threaded holes on the bottom of the lower part of the controller housing as required

Replacing spare part units

Fit the cable and threaded connectors

9. ➤ Guide the cable into the respective reducing inserts
10. ➤ Insert the reducing inserts into the threaded connectors
11. ➤ Guide the cable into the controller
12. ➤ Connect the cable as indicated in the terminal diagram
13. ➤ Screw in the required threaded connectors and tighten
14. ➤ Tighten the threaded connector clamping nuts so that they are properly sealed

Refit the controller

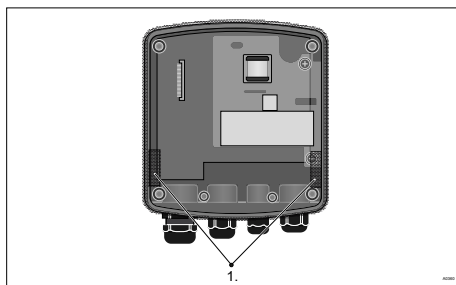


Fig. 53: Fitting the profile seal on the lower part of the controller housing

15. ➤ Use pliers to break off the catches. They are not needed for control panel installation

Position the profile seal evenly around the top edge of the lower part of the DULCOMETER® Compact Controller housing. Arrange the flaps (1) as shown in the figure

- ⇒ Ensure that the profile seal evenly surrounds the top edge of the housing.

16. ➤ Insert the lower part of the DULCOMETER® Compact Controller housing with the profile seal from behind into the cut-out and use three screws to secure it in place

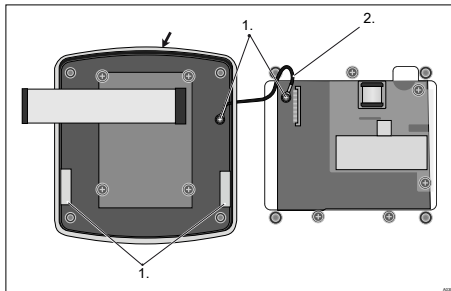


Fig. 54: Fit the profile seal onto the top part of the controller housing

17. ➤ Position the profile seal (arrow) evenly into the groove in the top part of the DULCOMETER® Compact Controller housing. Arrange the flaps (3) as shown in the figure
18. ➤ Secure the strain relief (2) using two screws (1)
19. ➤ Fit the hinge

Replacing spare part units

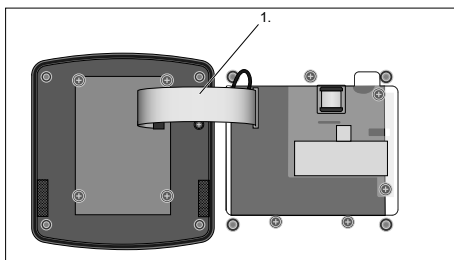


Fig. 55: Pushing and locking the ribbon cable in its base

- 20.** ➤ Push and lock the ribbon cable (1) in its base
- 21.** ➤ Screw the top part of the controller housing onto the lower part of the DULCOMETER® Compact Controller housing
- 22.** ➤ Re-check that the profile seals are fitted properly
 - ⇒ IP 54 degree of protection can only be provided if the control panel is mounted correctly

Standards complied with and Declaration of Conformity

15 Standards complied with and Declaration of Conformity

The EC Declaration of Conformity for the controller is available to download on our homepage.

EN 60529 Specification for degrees of protection provided by housings (IP code)

EN 61000 Electromagnetic Compatibility (EMC)

EN 61010 Safety requirements for electrical equipment for measurement, control and laboratory use - Part 1: General requirements

EN 61326 Electrical equipment for measuring, control and laboratory use - EMC requirements (for class A and B devices)

16 Disposal of Used Parts

- **User qualification:** instructed user, see  *Chapter 2.2 'Users' qualifications' on page 10*

NOTICE!

Regulations governing the disposal of used parts

- Note the current national regulations and legal standards which apply in your country

The manufacturer will take back decontaminated used units providing they are covered by adequate postage.

Decontaminate the unit before returning it for repair. To do so, remove all traces of hazardous substances. Refer to the Material Safety Data Sheet for your feed chemical.

A current Declaration of Decontamination is available to download on the ProMinent website.

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