FI: EY-vaatimustenmukaisuusvakuutus

Me, Grundfos, vakuutamme omalla vastuullamme, että tuotteet DDA, DDC ja DDE, joita tämä vakuutus koskee, ovat EY:n jäsenvaltioiden lainsäädännön yhdenmukaistamiseen tähtäävien Euroopan neuvoston direktiivien vaatimusten mukaisia seuraavasti:

SE: EG-försäkran om överensstämmelse

Vi, Grundfos, försäkrar under ansvar att produkterna DDA, DDC och DDE, som omfattas av denna försäkran, är i överensstämmelse med rådets direktiv om inbördes närmande till EU-medlemsstaternas lagstiftning, avseende:

TR: EC uygunluk bildirgesi

Grundfos olarak bu beyannameye konu olan DDA, DDC ve DDE ürünlerinin, AB Üyesi Ülkelerin kanunlarını birbirine yaklaştırma üzerine Konsey Direktifleriyle uyumlu olduğunun yalnızca bizim sorumluluğumuz altında olduğunu beyan ederiz:

CN: EC 产品合格声明书

我们格兰富在我们的全权责任下声明，产品 DDA, DDC 和 DDE，即该合格证所指之产品，符合欧共体使其成员国法律趋于一致的以下欧共理事会指令：

JP: EC 適合宣言

Grundfos は、その責任の下に、DDA, DDC 製品および DDE 製品が EC 加盟諸国の法規に関連する、以下の評議会指令に適合していることを宣言します：

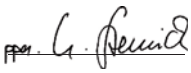
KO: EC 적합성 선언

Grundfos 에서는 자사의 단독 책임에 따라 이 선언과 관련된 DDA, DDC 및 DDE 제품이 EC 회원국 법률에 기반한 다음 이사회 지침을 준수함을 선언합니다 :

– Machinery Directive (2006/42/EC).
  Standards used: EN 809: 1998, DIN EN ISO 12100:2010.
– Low Voltage Directive (2006/95/EC).
  Standard used: EN 61010-1: 2001 (second edition).
– EMC Directive (2004/108/EC).
  Standards used: EN 61326-1: 2006,
  EN 61000-3-2: 2006+A1: 2009+A2: 2009, EN 61000-3-3: 2008.

This EC declaration of conformity is only valid when published as part of the Grundfos installation and operating instructions.

Pfinztal, 1 December 2014



Ulrich Stemick
Technical Director
Grundfos Water Treatment GmbH
Reetzstr. 85, D-76327 Pfinztal, Germany

Person authorised to compile technical file and
empowered to sign the EC declaration of conformity.

This page is intentionally left blank

This page is intentionally left blank

This page is intentionally left blank

Argentina
Bombas GRUNDFOS de Argentina S.A.
Ruta Panamericana km. 37.500 Centro Industrial Garin
1619 - Garin Pcia. de B.A.
Phone: +54-3327 414 444
Telefax: +54-3327 411 111

Australia
GRUNDFOS Pumps Pty. Ltd.
P.O. Box 2040
Regency Park
South Australia 5942
Phone: +61-8-8461-4611
Telefax: +61-8-8340 0155

Austria
GRUNDFOS Pumpen Vertrieb Ges.m.b.H.
Grundfosstraße 2
A-5082 Grödig/Salzburg
Tel.: +43-6246-883-0
Telefax: +43-6246-883-30

Belgium
N.V. GRUNDFOS Bellux S.A.
Boomsesteenweg 81-83
B-2630 Aartselaar
Tél.: +32-3-870 7300
Télécopie: +32-3-870 7301

Belarus
Представительство ГРУНДФОС в Минске
220125, Минск
ул. Шафарнянская, 11, оф. 56
Тел.: +7 (375 17) 286 39 72, 286 39 73
Факс: +7 (375 17) 286 39 71
E-mail: minsk@grundfos.com

Bosnia/Herzegovina
GRUNDFOS Sarajevo
Trg Heroja 16,
BiH-71000 Sarajevo
Phone: +387 33 713 290
Telefax: +387 33 659 079
e-mail: grundfos@bih.net.ba

Brazil
BOMBAS GRUNDFOS DO BRASIL
Av. Humberto de Alencar Castelo Branco, 630
CEP 09850 - 300
São Bernardo do Campo - SP
Phone: +55-11 4393 5533
Telefax: +55-11 4343 5015

Bulgaria
Grundfos Bulgaria EOOD
Slatina District
Iztochna Tangenta street no. 100
BG - 1592 Sofia
Tel. +359 2 49 22 200
Fax. +359 2 49 22 201
email: bulgaria@grundfos.bg

Canada
GRUNDFOS Canada Inc.
2941 Brighton Road
Oakville, Ontario
L6H 6C9
Phone: +1-905 829 9533
Telefax: +1-905 829 9512

China
Grundfos Alldos
Dosing & Disinfection
ALLDOS (Shanghai) Water Technology Co. Ltd.
West Unit, 1 Floor, No. 2 Building (T 4-2)
278 Jinhu Road, Jin Qiao Export Processing Zone
Pudong New Area
Shanghai, 201206
Phone: +86 21 5055 1012
Telefax: +86 21 5032 0596
E-mail: grundfosalldos-CN@grundfos.com

China
GRUNDFOS Pumps (Shanghai) Co. Ltd.
50/F Maxdo Centre No. 8 Xing Yi Rd.
Hongqiao Development Zone
Shanghai 200336
PRC
Phone: +86-21 6122 5222
Telefax: +86-21 6122 5333

Croatia
GRUNDFOS CROATIA d.o.o.
Cebini 37, Buzin
HR-10010 Zagreb
Phone: +385 1 6595 400
Telefax: +385 1 6595 499
www.hr.grundfos.com

Czech Republic
GRUNDFOS s.r.o.
Čapkovského 21
779 00 Olomouc
Phone: +420-585-716 111
Telefax: +420-585-716 299

Denmark
GRUNDFOS DK A/S
Martin Bachs Vej 3
DK-8850 Bjerringbro
Tlf.: +45-87 50 50 50
Telefax: +45-87 50 51 51
E-mail: info_GDK@grundfos.com
www.grundfos.com/DK

Estonia
GRUNDFOS Pumps Eesti OÜ
Peterburi tee 92G
11415 Tallinn
Tel: + 372 606 1690
Fax: + 372 606 1691

Finland
OY GRUNDFOS Pumput AB
Mestarintie 11
FIN-01730 Vantaa
Phone: +358-(0)207 889 900
Telefax: +358-(0)207 889 550

France
Pompes GRUNDFOS Distribution S.A.
Parc d'Activités de Chesnes
57, rue de Malacombe
F-38290 St. Quentin Fallavier (Lyon)
Tél.: +33-4 74 82 15 15
Télécopie: +33-4 74 94 10 51

Germany
GRUNDFOS Water Treatment GmbH
Reetzstraße 85
D-76327 Pfinztal (Söllingen)
Tel.: +49 7240 61-0
Telefax: +49 7240 61-177
E-mail: gwt@grundfos.com

Germany
GRUNDFOS GMBH
Schlüterstr. 33
40699 Erkrath
Tel.: +49-(0) 211 929 69-0
Telefax: +49-(0) 211 929 69-3799
E-mail: infoservice@grundfos.de
Service in Deutschland:
E-mail: kundendienst@grundfos.de

Greece
GRUNDFOS Hellas A.E.B.E.
20th km. Athinon-Markopoulou Av.
P.O. Box 71
GR-19002 Peania
Phone: +0030-210-66 83 400
Telefax: +0030-210-66 46 273

Hong Kong
GRUNDFOS Pumps (Hong Kong) Ltd.
Unit 1, Ground floor
Siu Wai Industrial Centre
29-33 Wing Hong Street &
68 King Lam Street, Cheung Sha Wan
Kowloon
Phone: +852-27861706 / 27861741
Telefax: +852-27858664

Hungary
GRUNDFOS Hungária Kft.
Park u. 8
H-2045 Törökbálint,
Phone: +36-23 511 110
Telefax: +36-23 511 111

India
GRUNDFOS Pumps India Private Limited
118 Old Mahabalipuram Road
Thoraipakkam
Chennai 600 097
Phone: +91-44 4596 6800

Indonesia
PT GRUNDFOS Pompa
Jl. Rawa Sumur III, Blok III / CC-1
Kawasan Industri, Pulogadung
Jakarta 13930
Phone: +62-21-460 6909
Telefax: +62-21-460 6910 / 460 6901

Ireland
GRUNDFOS (Ireland) Ltd.
Unit A, Merrywell Business Park
Ballymount Road Lower
Dublin 12
Phone: +353-1-4089 800
Telefax: +353-1-4089 830

Italy
GRUNDFOS Pompe Italia S.r.l.
Via Gran Sasso 4
I-20060 Truccazzano (Milano)
Tel.: +39-02-95838112
Telefax: +39-02-95309290 / 95838461

Japan
GRUNDFOS Pumps K.K.
Gotanda Metalion Bldg. 5F,
5-21-15, Higashi-gotanda
Shiagawa-ku, Tokyo,
141-0022 Japan
Phone: +81 35 448 1391
Telefax: +81 35 448 9619

Korea
GRUNDFOS Pumps Korea Ltd.
6th Floor, Aju Building 679-5
Yeoksam-dong, Kangnam-ku, 135-916
Seoul, Korea
Phone: +82-2-5317 600
Telefax: +82-2-5633 725

Latvia
SIA GRUNDFOS Pumps Latvia
Deglava biznesa centrs
Augusta Deglava ielā 60, LV-1035, Rīga,
Tālr.: + 371 714 9640, 7 149 641
Fakss: + 371 914 9646

Lithuania
GRUNDFOS Pumps UAB
Smolensko g. 6
LT-03201 Vilnius
Tel: + 370 52 395 430
Fax: + 370 52 395 431

Malaysia
GRUNDFOS Pumps Sdn. Bhd.
7 Jalan Peguam U1/25
Glenmarie Industrial Park
40150 Shah Alam
Selangor
Phone: +60-3-5569 2922
Telefax: +60-3-5569 2866

Mexico
Bombas GRUNDFOS de México S.A. de C.V.
Boulevard TLC No. 15
Parque Industrial Stiva Aeropuerto
Apodaca, N.L. 66600
Phone: +52-81-8144 4000
Telefax: +52-81-8144 4010

Netherlands
GRUNDFOS Netherlands
Veluwezoom 35
1326 AE Almere
Postbus 22015
1302 CA ALMERE
Tel.: +31-88-478 6336
Telefax: +31-88-478 6332
E-mail: info_gnl@grundfos.com

New Zealand
GRUNDFOS Pumps NZ Ltd.
17 Beatrice Tinsley Crescent
North Harbour Industrial Estate
Albany, Auckland
Phone: +64-9-415 3240
Telefax: +64-9-415 3250

Norway
GRUNDFOS Pumper A/S
Strømsveien 344
Postboks 235, Leirdal
N-1011 Oslo
Tlf.: +47-22 90 47 00
Telefax: +47-22 32 21 50

Poland
GRUNDFOS Pompy Sp. z o.o.
ul. Klonowa 23
Baranowo k. Poznania
PL-62-081 Przeźmierowo
Tel: (+48-61) 650 13 00
Fax: (+48-61) 650 13 50

Portugal
Bombas GRUNDFOS Portugal, S.A.
Rua Calvet de Magalhães, 241
Apartado 1079
P-2770-153 Paço de Arcos
Tel.: +351-21-440 76 00
Telefax: +351-21-440 76 90

Romania
GRUNDFOS Pompe România SRL
Bd. Biruintei, nr 103
Pantelimon county Ilfov
Phone: +40 21 200 4100
Telefax: +40 21 200 4101
E-mail: romania@grundfos.ro

Russia
ООО Грундфос
Россия, 109544 Москва, ул. Школьная 39
Тел. (+7) 495 737 30 00, 564 88 00
Факс (+7) 495 737 75 36, 564 88 11
E-mail grundfos.moscow@grundfos.com

Serbia
GRUNDFOS Predstavništvo Beograd
Dr. Milutina Ivkovića 2a/29
YU-11000 Beograd
Phone: +381 11 26 47 877 / 11 26 47 496
Telefax: +381 11 26 48 340

Singapore
GRUNDFOS (Singapore) Pte. Ltd.
25 Jalan Tukang
Singapore 619264
Phone: +65-6681 9688
Telefax: +65-6681 9689

Slovakia
GRUNDFOS s.r.o.
Prievozská 4D
821 09 BRATISLAVA
Phona: +421 2 5020 1426
sk.grundfos.com

Slovenia
GRUNDFOS d.o.o.
Šlandrova 8b, SI-1231 Ljubljana-Črnuče
Phone: +386 1 568 0610
Telefax: +386 1 568 0619
E-mail: slovenia@grundfos.si

South Africa
Grundfos (PTY) Ltd.
Corner Mountjoy and George Allen Roads
Wilbart Ext. 2
Bedfordview 2008
Phone: (+27) 11 579 4800
Fax: (+27) 11 455 6066
E-mail: lsmart@grundfos.com

Spain
Bombas GRUNDFOS España S.A.
Camino de la Fuentecilla, s/n
E-28110 Algete (Madrid)
Tel.: +34-91-848 8800
Telefax: +34-91-628 0465

Sweden
GRUNDFOS AB
(Box 333) Lunnagårdsgatan 6
431 24 Mölndal
Tel.: +46 31 332 23 000
Telefax: +46 31-331 94 60

Switzerland
GRUNDFOS ALLDOS International AG
Schönmattstraße 4
CH-4153 Reinach
Tel.: +41-61-717 5555
Telefax: +41-61-717 5500
E-mail: grundfosalldos-CH@grundfos.com

Switzerland
GRUNDFOS Pumpen AG
Bruggacherstrasse 10
CH-8117 Fällanden/ZH
Tel.: +41-44-806 8111
Telefax: +41-44-806 8115

Taiwan
GRUNDFOS Pumps (Taiwan) Ltd.
7 Floor, 219 Min-Chuan Road
Taichung, Taiwan, R.O.C.
Phone: +886-4-2305 0868
Telefax: +886-4-2305 0878

Thailand
GRUNDFOS (Thailand) Ltd.
92 Chaloem Phrakiat Rama 9 Road,
Dokmai, Pravej, Bangkok 10250
Phone: +66-2-725 8999
Telefax: +66-2-725 8998

Turkey
GRUNDFOS POMPA San. ve Tic. Ltd. Sti.
Gebze Organize Sanayi Bölgesi
Ihsan dede Caddesi,
2. yol 200. Sokak No. 204
41490 Gebze/ Kocaeli
Phone: +90 - 262-679 7979
Telefax: +90 - 262-679 7905
E-mail: satis@grundfos.com

Ukraine
Бізнес Центр Європа
Столичне шосе, 103
м. Київ, 03131, Україна
Телефон: (+38 044) 237 04 00
Факс.: (+38 044) 237 04 01
E-mail: ukraine@grundfos.com

United Arab Emirates
GRUNDFOS Gulf Distribution
P.O. Box 16768
Jebel Ali Free Zone
Dubai
Phone: +971-4- 8815 166
Telefax: +971-4-8815 136

United Kingdom
GRUNDFOS Pumps Ltd.
Grovebury Road
Leighton Buzzard/Beds. LU7 4TL
Phone: +44-1525-850000
Telefax: +44-1525-850011

U.S.A.
GRUNDFOS Pumps Corporation
17100 West 118th Terrace
Olathe, Kansas 66061
Phone: +1-913-227-3400
Telefax: +1-913-227-3500

Uzbekistan
Grundfos Tashkent, Uzbekistan The Representative Office of Grundfos Kazakhstan in Uzbekistan
38a, Oybek street, Tashkent
Телефон: (+998) 71 150 3290 / 71 150 3291
Факс: (+998) 71 150 3292

Addresses revised 21.05.2014

be think innovate

95724708 1114

ECM: 1146320

www.grundfos.com

GRUNDFOS

GRUNDFOS

CRN SERIES, MULTI-STAGE CENTRIFUGAL PUMP

LEFT BLANK

CR, CRI, CRN, CRT

Installation and operating instructions

be
think
innovate

GRUNDFOS

Table of contents

Original installation and operating instructions.

CONTENTS

Warning

Prior to installation, read these installation and operating instructions. Installation and operation must comply with local regulations and accepted codes of good practice.

Warning

Electrical work: All electrical work should be performed by a qualified electrician in accordance with the latest edition of national, state, and local codes and regulations.

Warning

Shock Hazard: A faulty motor or wiring can cause electrical shock that could be fatal, whether touched directly or conducted through standing water. For this reason, proper grounding of the pump to the power supply's grounding terminal is required for safe installation and operation. In all installations, the above-ground metal plumbing should be connected to the power supply ground as described in Article 250-80 of the National Electrical Code.

1. Limited warranty

Products manufactured by GRUNDFOS PUMPS CORPORATION (Grundfos) are warranted to the original user only to be free of defects in material and workmanship for a period of 24 months from date of installation, but not more than 30 months from date of manufacture. Grundfos' liability under this warranty shall be limited to repairing or replacing at Grundfos' option, without charge, F.O.B. Grundfos' factory or authorized service station, any product of Grundfos' manufacture. Grundfos will not be liable for any costs of removal, installation, transportation, or any other charges which may arise in connection with a warranty claim. Products which are sold but not manufactured by Grundfos are subject to the warranty provided by the manufacturer of said products and not by Grundfos' warranty. Grundfos will not be liable for damage or wear to products caused by abnormal operating conditions, accident, abuse, misuse, unauthorized alteration or repair, or if the product was not installed in accordance with Grundfos' printed installation and operating instructions.

To obtain service under this warranty, the defective product must be returned to the distributor or dealer of Grundfos' products from which it was purchased together with proof of purchase and installation date, failure date, and supporting installation data. Unless otherwise provided, the distributor or dealer will contact Grundfos or an authorized service station for instructions.
Any defective product to be returned to Grundfos or a service station must be sent freight prepaid; documentation supporting the warranty claim and/or a Return Material Authorization must be included if so instructed.

GRUNDFOS WILL NOT BE LIABLE FOR ANY INCIDENTAL OR CONSEQUENTIAL DAMAGES, LOSSES, OR EXPENSES ARISING FROM INSTALLATION, USE, OR ANY OTHER CAUSES. THERE ARE NO EXPRESS OR IMPLIED WARRANTIES, INCLUDING MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE, WHICH EXTEND BEYOND THOSE WARRANTIES DESCRIBED OR REFERRED TO ABOVE.

Some jurisdictions do not allow the exclusion or limitation of incidental or consequential damages and some jurisdictions do not allow limit actions on how long implied warranties may last. Therefore, the above limitations or exclusions may not apply to you. This warranty gives you specific legal rights and you may also have other rights which vary from jurisdiction to jurisdiction.

2. Symbols used in this document

Warning

If these safety instructions are not observed, it may result in personal injury.

Warning

If these instructions are not observed, it may lead to electric shock with consequent risk of serious personal injury or death.

Caution ***If these safety instructions are not observed, it may result in malfunction or damage to the equipment.***

Note ***Notes or instructions that make the job easier and ensure safe operation.***

3. Introduction

The CR range is based on the inline multistage centrifugal pump first pioneered by Grundfos. CR is available in four basic materials and over one million configurations. CR is suitable for pumping water and water-like liquids in industry, petrochemical plants, water treatment plants, commercial buildings, and many other applications. Some of the outstanding characteristics of CR are:

- superior efficiency
- reliability
- easy maintenance
- compact size and small footprint
- quiet operation.

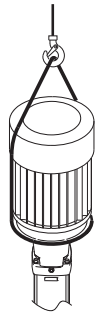
4. Shipment inspection

Examine the components carefully to make sure no damage has occurred to the pump during shipment. Ensure that the pump is NOT dropped or mishandled.

4.1 Lifting instructions

Caution ***Do not use the lifting eyes of the motor for lifting the entire pump and motor assembly.***

Lift pump assembly with lifting straps that pass through the motor stool. Ensure that the load is not applied to the pump shaft.



TM04 0339 0608

Fig. 1 Correct lifting of a CR pump

4.2 Ensure you have the right pump

Check the pump nameplate to make sure that it is the one you ordered.

- **CR:** Centrifugal pump; all parts in contact with the pumped liquid are made of standard cast iron and AISI 304 stainless steel
- **CRI:** Centrifugal pump; all parts in contact with the pumped liquid are made of AISI 304 stainless steel
- **CRN:** Centrifugal pump; all parts in contact with the pumped liquid are made of AISI 316 stainless steel
- **CRT:** Centrifugal pump; all parts in contact with the pumped liquid are made of titanium
- **CRE:** Centrifugal pump with a Grundfos MLE variable frequency drive motor.

4.3 Checking the condition of the pump

The packing in which your pump arrived is specially designed for your pump to prevent damage during shipment. As a precaution, leave the pump in the packing until you are ready to install it. Examine the pump for any damage that may have occurred during shipping. Examine any other parts of the shipment as well for any visible damage.

Note ***If the shipment consists of a complete unit (motor attached to pump end), the position of the coupling connecting the pump shaft to the motor shaft is set to factory specifications.***
No adjustment is required. If the shipment is a pump end without motor, follow the adjustment procedures in section 13. Replacing the motor.

Pump without motor (CR, CRI, CRN 1s, 1, 3, 5, 10, 15, and 20 only):

If you purchased a pump end without motor, the shaft seal has been set from factory. Do not loosen the three set screws on the shaft seal when attaching the motor.

Pump without motor (CR, CRN 32, 45, 64, 90, 120, and 150 only):

If you purchased a pump end without motor, you must install the shaft seal. The shaft seal is protected in its own box inside the pump packing crate. To protect the shaft and bearings during shipment, a transport protector is used. Remove the transport protector prior to installation of the shaft seal. Read the seal installation instructions which are included in the pump packing.

4.4 Electrical requirements

Warning

Electrical work: All electrical work should be performed by a qualified electrician in accordance with the current national, state, and local codes and regulations.

Warning

Shock hazard: A faulty motor or faulty wiring can cause electric shock that could be fatal, whether the motor is touched directly or the current is conducted through standing water. For this reason, safe installation and operation require proper grounding of the pump to the power supply ground (earth) terminal.

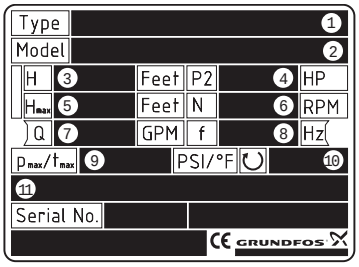
In all installations, connect the above-ground metal plumbing to the power supply ground terminal as described in Article 250-80 of the National Electrical Code.

Verify the power supply to make sure that the voltage, phases and frequency match those of the pump. The proper operating voltage and other electrical information appear on the motor nameplate. These motors are designed to run on - 10 %/+ 10 % of the rated nameplate voltage. For dual-voltage motors, the motor should be internally connected to operate on the voltage closest to the 10 % rating, i.e., a 208 V motor should be wired according to the 208 V wiring diagram. The wiring diagram can be found on either a plate attached to the motor or on a label inside the terminal box cover.

Caution ***Do not operate the pump if voltage variations are greater than - 10 % /+ 10 %.***

5. Identification

5.1 Nameplate data

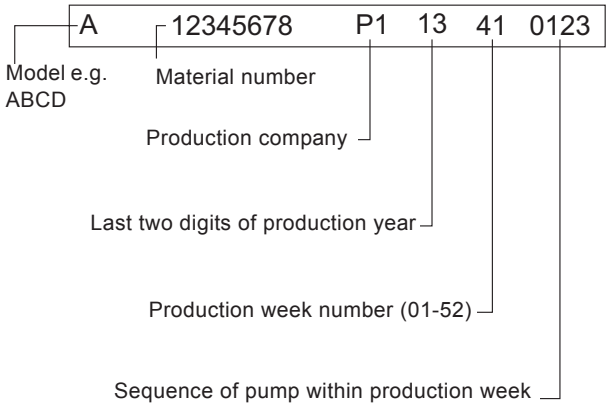


1. Type designation
2. Model, material number, production number
3. Head in feet at rated flow
4. Rated motor hp
5. Head at zero flow
6. Rated rpm
7. Rated flow
8. Rated frequency
9. Maximum pressure and maximum liquid temperature
10. Direction of rotation
11. Production country

TM04 3895 2609

Fig. 1 Example of nameplate CR, CRI, CRN, CRT

Specification of the model line in nameplates:



TM04 3904 3913

Fig. 2 Key to model line in nameplates

5.2 Type keys

5.2.1 CR, CRI, CRN 1s, 1, 3, 5, 10, 15, and 20

Example	CR 3-	10	A	FG	A	E	HQQE
Type range: CR, CRI, CRN							
Rated flow rate in [m^3/h] (x 5 gpm)							
Number of impellers							
Code for pump version							
Code for pipe connection							
Code for materials							
Code for rubber parts							
Code for shaft seal							

5.2.2 CR, CRN 32, 45, 64, 90, 120, and 150

Example	CR 32-	2-	1	A	G	A	E	KUBE
Pump range: CR, CRN								
Rated flow rate in [m^3/h] (x 5 gpm)								
Number of impellers								
Number of reduced-diameter impellers								
Code for pump version								
Code for pipe connection								
Code for materials								
Code for rubber parts								
Code for shaft seal								

5.2.3 CRT 2, 4, 8, and 16

Example	CRT	16-	30	/2	A	G	A	AUUE
Pump range: CRT								
Rated flow rate in [m^3/h] (x 5gpm)								
Number of stages x 10								
Code for impellers (used only if the pump has fewer impellers than stages)								
Code for pump version								
Code for pipe connection								
Code for materials								
Code for shaft seal and rubber parts								

5.2.4 Codes

Example		A	-G	-A	-E	-H	QQ	E
Pump version								
A	Basic version[1)]							
B	Oversize motor							
E	Certificate/approval							
F	CR pump for high temperatures (air-cooled top assembly)							
H	Horizontal version							
HS	High-pressure pump with high-speed MLE motor							
I	Different pressure rating							
J	Pump with different max. speed							
K	Pump with low NPSH							
M	Magnetic drive							
N	Fitted with sensor							
P	Undersize motor							
R	Horizontal version with bearing bracket							
SF	High-pressure pump							
T	Oversize motor (two flange sizes bigger)							
U	NEMA version[1)]							
X	Special version[2)]							
Pipe connection								
A	Oval flange, Rp thread							
B	Oval flange, NPT thread							
CA	FlexiClamp (CRI(E), CRN(E) 1, 3, 5, 10, 15, 20)							
CX	Triclamp (CRI(E), CRN(E) 1, 3, 5, 10, 15, 20)							
F	DIN flange							
G	ANSI flange							
J	JIS flange							
N	Changed diameter of ports							
P	PJE coupling							
X	Special version							
Materials								
A	Basic version							
D	Carbon-graphite filled PTFE (bearings)							
G	Wetted parts, AISI 316							
GI	All parts stainless steel, wetted parts, AISI 316							
I	Wetted parts, AISI 304							
II	All parts stainless steel, wetted parts, AISI 304							
K	Bronze (bearings)							
S	SiC bearings + PTFE neck rings							
X	Special version							
Code for rubber parts								
E	EPDM							
F	FXM							
K	FFKM							
V	FKM							

Example		A	-G	-A	-E	-H	QQ	E
Shaft seal								
A	O-ring seal with fixed driver							
B	Rubber bellows seal							
E	Cartridge seal with O-ring							
H	Balanced cartridge seal with O-ring							
K	Metal bellows cartridge seal							
O	Double seal, back-to-back							
P	Double seal, tandem							
X	Special version							
B	Carbon, synthetic resin-impregnated							
H	Cemented tungsten carbide, embedded (hybrid)							
Q	Silicon carbide							
U	Cemented tungsten carbide							
X	Other ceramics							
E	EPDM							
F	FXM							
K	FFKM							
V	FKM							

1) In August 2003 the NEMA version pump code was discontinued for all material numbers created by Grundfos manufacturing companies in North America. The NEMA version pump code will still remain in effect for existing material numbers. NEMA version pumps built in North America after this change will have either an A or a U as the pump version code depending on the date the material number was created.

2) If a pump incorporates more than two pump versions, the code for the pump version is X. X also indicates special pump versions not listed above.

6. Applications

Compare the pump's nameplate data or its performance curve with the application in which you plan to install it. Make sure the application falls within the following limits.

Type	Application/liquid
CR	Hot and chilled water, boiler feed, condensate return, glycols and solar thermal liquids.
CRI/CRN	Deionized, demineralized and distilled water. Brackish water and other liquids unsuitable for contact with iron or copper alloys. (Consult manufacturer for specific liquid compatibilities.)
CRN-SF	High-pressure washdown, reverse osmosis or other high-pressure applications.
CRT	Salt water, chloride based liquids and liquids approved for titanium.

7. Operating conditions

7.1 Ambient temperature and altitude

If the ambient temperature exceeds the maximum temperature limits of the pump or the pump is installed at an altitude exceeding the altitude values in the chart below, the motor must not be fully loaded due to the risk of overheating.

Overheating may result from excessive ambient temperatures or the low density and consequently low cooling effect of the air at high altitudes. In such cases, it may be necessary to use a motor with a higher rated output (P_2).

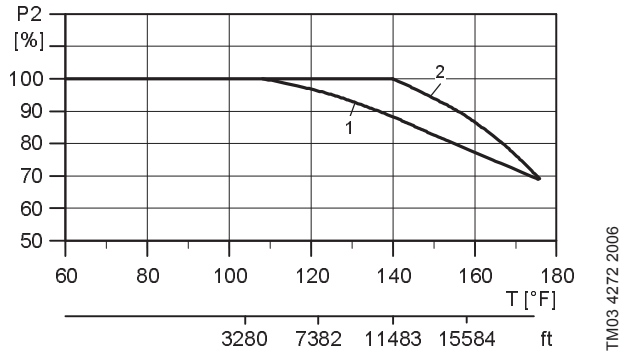


Fig. 3 Relationship between motor output (P_2) and ambient temperature/altitude

Legend

Pos.	Description
1	NEMA standard-efficiency motors
2	NEMA premium-efficiency motors

Example: From fig. 3 it appears that P_2 must be reduced to 88 % when a pump with a NEMA premium-efficiency ML motor is installed 15,584 feet above sea level. At an ambient temperature of 167 °F, P_2 of a standard-efficiency motor must be reduced to 74 % of rated output.

In cases where both the maximum temperature and the maximum altitude are exceeded, the derating factors must be multiplied. Example: 0.89 x 0.89 = 0.79.

7.2 Liquid temperatures

Pump	Liquid temperature
CR, CRI, CRN 1s, 3, 5, 10, 15, and 20	-4 - +248 °F (-20 - +120 °C)
CR, CRN 32, 45, 64, and 90*	-22 - +248 °F (-30 - +120 °C)
CR, CRN 120 and 150* (up to 60 hp)	-22 - +248 °F (-30 - +120 °C)
CR, CRN 120 and 150 (75 and 100 hp)	32-248 °F (0-120 °C)
CRT 2, 4, 8, 16	-4 - +248 °F (-20 - +120 °C)
CRN-SF	-4 - +221 °F (-15 - +105 °C)
Pumps with Cool-Top™	up to 356 °F (180 °C)

All motors are designed for continuous duty in 104 °F (40 °C) ambient air conditions. For higher ambient temperature conditions, consult Grundfos.

* We recommend xUBE shaft seals for temperatures above 200 °F. Pumps with KUHE hybrid shaft seals can only operate up to 200 °F (90 °C). Pumps with xUUE shaft seals can be operated down to -40 °F (-40 °C). ("x" is the seal type).

7.3 Minimum inlet pressures

All CR, CRI, CRN	NPSHR + 2 feet
CRN-SF	29 psi (2 bar)

7.4 Maximum inlet pressures

Pump type	Stages		Max. [psi (bar)]
	60 Hz	50 Hz	
CR, CRI, CRN 1s	2-27	2-36	145 (10)
CR, CRI, CRN 1	2-25	2-36	145 (10)
	27		217 (15)
CR, CRI, CRN 3	2-17	2-29	145 (10)
	19-25	31-36	217 (15)
CR, CRI, CRN 5	2-9	3-16	145 (10)
	10-24	18-36	217 (15)
CR, CRI, CRN 10	1-5	1-6	116 (8)
	6-17	7-22	145 (10)
CR, CRI, CRN 15	1-2	1-3	116 (8)
	3-12	4-17	145 (10)
CR, CRI, CRN 20	1	1-3	116 (8)
	2-10	4-17	145 (10)
CR, CRN 32	1-1 - 2	1-1 - 4	58 (4)
	3-2 - 6	5-2 - 10	145 (10)
	7-2 - 11-2	11-14	217 (15)
CR, CRN 45	1-1 - 1	1-1 - 2	58 (4)
	2-2 - 3	3-2 - 5	145 (10)
	4-2 - 8-1	6-2 - 13-2	217 (15)
CR, CRN 64	1-1	1-1 - 2-2	58 (4)
	1 - 2-1	2-1 - 4-2	145 (10)
	2 - 5-2	4-1 - 8-1	217 (15)
CR, CRN 90		1-1 - 1	58 (4)
	1-1 - 1	2-2 - 3-2	145 (10)
	2-2 - 4-1	3-6	217 (15)
CR, CRN 120	1-1 - 1	1 - 2-1	145 (10)
	2-2 - 3	2 - 5-1	217 (15)
	4-1 - 5-1	6-1 - 7	290 (20)
CR, CRN 150	1-1	1-1 - 1	145 (10)
	1-2	2-1 - 4-1	217 (15)
	3-2 - 4-2	5-2 - 6	290 (20)
CRT 2	2-6	2-11	145 (10)
	7-18	13-26	217 (15)
CRT 4	1-7	1-12	145 (10)
	8-16	14-22	217 (15)
CRT 8	1-16	1-20	145 (10)
CRT 16	2-10	2-16	145 (10)
CRN-SF	all	all	72 (5)*
			362 (25)**

* While pump is off or during start-up.

** During operation.

7.5 Maximum operating pressures

250 °F (194 °F for CRN-SF)

Pump type/ connection	Stages		Max. [psi (bar)]
	60 Hz	50 Hz	
CR, CRI, CRN 1s			
Oval flange	1-17	1-23	232 (16)
FGJ, PJE	1-27	1-36	362 (25)
CR, CRI, CRN 1			
Oval flange	1-17	1-23	232 (16)
FGJ, PJE	1-27	1-36	362 (25)
CR, CRI, CRN 3			
Oval flange	1-17	1-23	232 (16)
FGJ, PJE	1-27	1-36	362 (25)
CR, CRI, CRN 5			
Oval flange	1-16	1-22	232 (16)
FGJ, PJE	1-24	1-36	362 (25)
CR, CRI 10			
Oval flange CR	1-6		145 (10)
Oval flange, CRI	1-10	1-16	232 (16)
FGJ, GJ, PJE	1-10	1-16	232 (16)
FGJ, GJ, PJE	12-17	17-22	362 (25)
CRN 10			
All	1-17	1-22	362 (25)
CR, CRI 15			
Oval flange	1-5	1-7	145 (10)
FGJ, GJ, PJE	1-8	1-10	232 (16)
FGJ, GJ, PJE	9-12	12-17	362 (25)
CRN 15			
All	1-12	1-17	362 (25)
CR, CRI 20			
Oval flange	1-5	1-7	145 (10)
FGJ, GJ, PJE	1-7	1-10	232 (16)
FGJ, GJ, PJE	8-10	12-17	362 (25)
CRN 20			
All	1-10	1-17	362 (25)
CR, CRN 32			
	1-1 - 5	1-1 - 7	232 (16)
	6-2 - 11-2	8-2 - 14	435 (30)
CR, CRN 45			
	1-1 - 4-2	1-1 - 5	232 (16)
	4-2 - 8-1	6-2 - 13-2	435 (30)
CR, CRN 64			
	1-1 - 3	1-1 - 5	232 (16)
	4-2 - 5-2	6-2 - 8-1	435 (30)
CR, CRN 90			
	1-1 - 3	1-1 - 4	232 (16)
	4-2 - 4-1	5-2 - 6	435 (30)
CR, CRN 120			
	1-1 - 3		232 (16)
	4-2 - 5-2	1-1 - 5-2	435 (30)
CR, CRN 150			
	1-1 - 3		232 (16)
	4-1 - 4-2	1-1 - 4-2	435 (30)
CRT 2	2-18	2-26	305 (21)
CRT 4	1-16	1-22	305 (21)
CRT 8	1-8	1-12	232 (16)
	10-16	14-20	362 (25)
CRT 16	1-8	1-8	232 (16)
	10-12	10-16	362 (25)

Consult Grundfos in case of other operating conditions.

8. Installation

Warning

Do not turn on the power supply until the pump is properly installed.

8.1 Pump location

Locate the pump in a dry, well-ventilated, frost-free area which is not subject to extreme variation in temperature.

Make sure the pump is mounted at least 6 inches (150 mm) clear of any obstruction or hot surfaces.

The motor requires an adequate air supply to prevent overheating and adequate vertical space to remove the motor for repair.

In open systems requiring suction lift, locate the pump as close to the liquid source as possible to reduce friction loss in pipes.

8.2 Foundation

Use concrete or similar foundation material to provide a secure, stable mounting base for the pump.

See table below for bolt hole center line dimensions for the various pump types.

Secure the pump to the foundation using all four bolts and shim pump base to assure the pump is vertical and all four pads on the base are properly supported (uneven surfaces can result in pump base breakage when mounting bolts are tightened).

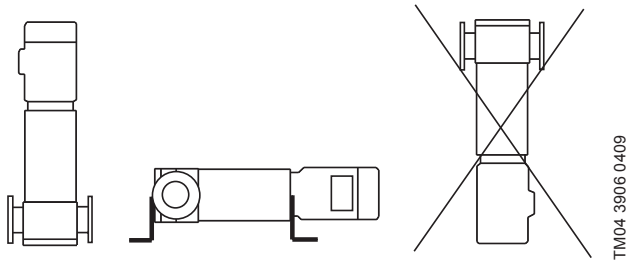


Fig. 4 Pump position

The pump can be installed vertically or horizontally. See fig. 4.

Ensure that an adequate supply of cool air reaches the motor cooling fan. The motor must never fall below the horizontal plane.

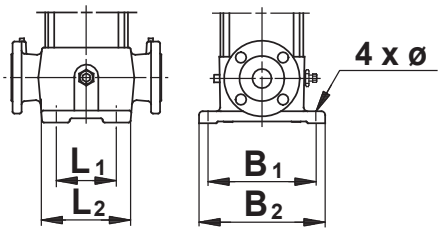
Arrows on the pump base show the direction of flow of liquid through the pump.

To minimize possible noise from the pump, it is advisable to fit expansion joints on either side of the pump and anti-vibration mountings between the foundation and the pump.

Note ***Make sure the vent plug is located in the uppermost position.***

Fit isolating valves on either side of the pump to avoid draining the system if the pump needs to be cleaned, repaired or replaced.

Base and bolt hole center line dimensions



Pump type	L1		L2		B1		B2		ø	
	[inches]	[mm]	[inches]	[mm]	[inches]	[mm]	[inches]	[mm]	[inches]	[mm]
CR 1s, 1, 3, 5	3 15/16	100	5 11/16	145	7 1/16	180	8 11/16	220	1/2	13
CRI, CRN 1s 1, 3, 5 CRT 2, 4	3 15/16	100	5 7/8	150	7 1/16	180	8 11/16	220	1/2	13
CR 10, 15, 20	5 1/8	130	6 15/16	176	8 7/16	215	10 1/16	256	9/16	13.5
CRN 10, 15, 20 CRT 8, 16	5 1/8	130	7 7/8	200	8 7/16	215	9 3/4	248	1/2	13
CR 32	6 11/16	170	8 3/4	223	9 7/16	240	11 3/4	298	9/16	14
CRN 32	6 11/16	170	8 7/8	226	9 7/16	240	11 3/4	298	9/16	14
CR 45, 64	7 1/2	190	9 3/4	248	10 1/2	266	13 1/16	331	9/16	14
CRN 45, 64	7 1/2	190	9 7/8	251	10 1/2	266	13 1/16	331	9/16	14
CR, CRN 90	7 13/16	199	10 1/4	261	11	280	13 11/16	348	9/16	14
CR, CRN 120, 150	10 13/16	275	13 9/16	344	14 15/16	380	18 9/16	472	11/16	18

8.3 Pump mounting

Warning

CR, CRI, CRN pumps are shipped with covered suction and discharge ports. Remove the covers before the pipes are connected to the pump.

8.3.1 Recommended installation torques

Pump type	Recommended foundation torque [ft-lbs]	Recommended flange torque [ft-lbs]
CR, CRI, CRN 1s/1/3/ 5 and CRT 2/4	30	37-44
CR, CRI, CRN 10/15/ 20 and CRT 8/16	37	44-52
CR, CRN 32/45/64/90/ 120/150	52	52-59

8.4 Suction pipe

The suction pipe should be adequately sized and run as straight and short as possible to keep friction losses to a minimum (minimum of four pipe diameters straight run prior to the suction flange). Avoid using unnecessary fittings, valves or accessory items. Use butterfly valves in the suction line only when it is necessary to isolate a pump because of a flooded suction condition. This would occur if the water source is above the pump. See fig. 5 and fig. 6. Flush piping prior to pump installation to remove loose debris.

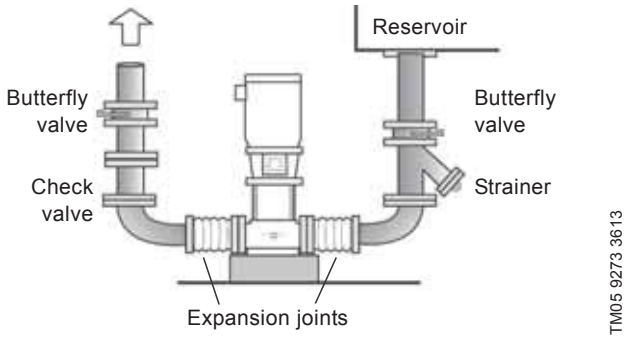


Fig. 5 Flooded suction

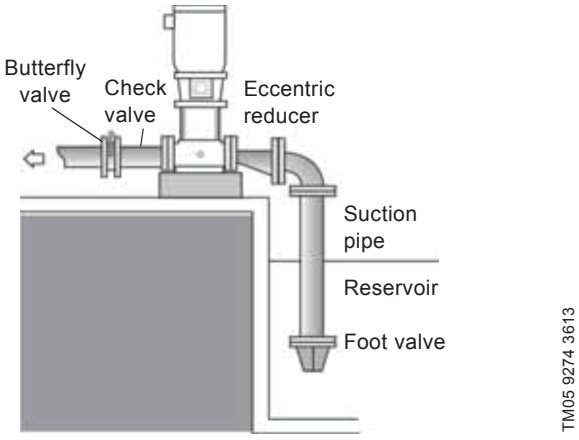


Fig. 6 Suction lift*

* The suction pipe should have a fitting on it for priming. CRN-SF pumps cannot be used for suction lift.

8.4.1 Suction pipe sizes

The following recommended suction pipe sizes are the smallest sizes which should be used with any specific CR pump type.

Verify the suction pipe size in each installation to ensure that good pipe practices are being observed and excess friction losses are not encountered.

High temperatures may require larger diameter pipes to reduce friction and improve NPHSA.

Pump type	Min. suction pipe size	
CR, CRI, CRN 1s, 1, 3; CRT 2	1"	Nominal diameter acc. to ANSI schedule 40
CR, CRI, CRN 5; CRT 4	1 - 1/4"	Nominal diameter acc. to ANSI schedule 40
CR, CRI, CRN 10, 15, 20; CRT 8, 16	2"	Nominal diameter acc. to ANSI schedule 40
CR, CRN 32	2 - 1/2"	Nominal diameter acc. to ANSI schedule 40
CR, CRN 45	3"	Nominal diameter acc. to ANSI schedule 40
CR, CRN64, 90	4"	Nominal diameter acc. to ANSI schedule 40
CR, CRN 120, 150	5"	Nominal diameter acc. to ANSI schedule 40

8.5 Discharge pipe

We suggest to install a check valve and a isolating valve in the discharge pipe.

Pipe, valves and fittings should be at least the same diameter as the discharge pipe or sized in accordance with good piping practices to reduce excessive flow velocities and friction losses in pipes.

Caution ***The pressure rating of pipes, valves and fittings must be equal to or greater than the maximum system pressure.***

Before installing the pump, pressure check the discharge piping to at least the maximum pressure the pump is capable of generating or as required by codes or local regulations.

Whenever possible, avoid high pressure-loss fittings, such as elbows or branch tees directly on either side of the pump. The piping should be adequately supported to reduce thermal and mechanical stresses on the pump.

According to good installation practices, clean the system thoroughly and flush it of all foreign materials and sediment prior to pump installation. Furthermore, never install the pump at the lowest point of the system due to the natural accumulation of dirt and sediment. If there is excessive sediment or suspended particles, we recommend that a strainer or filter is used. Grundfos recommends that pressure gauges are installed on suction and discharge flanges or in pipes to monitor pump and system performance.

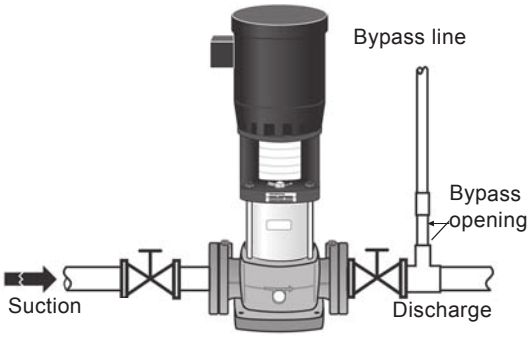
Warning

To avoid problems with water hammer, do not use quick-closing valves in CRN-SF applications.

8.6 Bypass

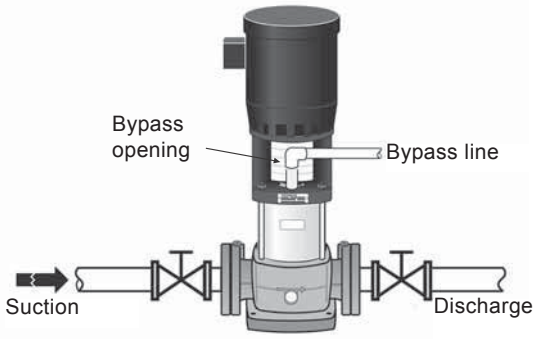
Install a bypass in the discharge pipe if there is any risk that the pump may operate against a closed valve in the discharge line. Flow through the pump is required to ensure that adequate cooling and lubrication of the pump is maintained.
See *7.3 Minimum inlet pressures* for minimum flow rates.

Elbows should be at least 12" from the bypass opening to prevent erosion.



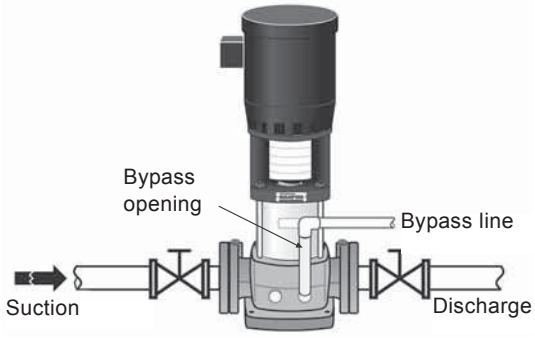
TM04 3926 3613

Fig. 7 Recommended bypass arrangement



TM04 3909 3613

Fig. 8 Optional bypass arrangement

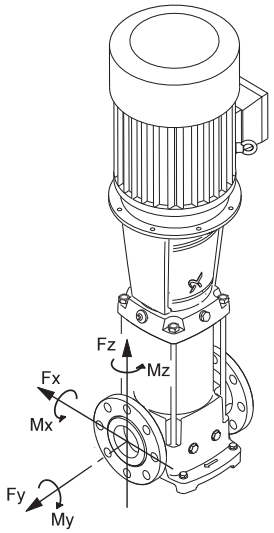


TM04 3924 0409

Fig. 9 Optional bypass arrangement for CR, CRN 32, 45, 64 and CR 90, 120 and 150 only

8.7 Flange forces and torques

If not all loads reach the maximum permissible value stated in the tables after fig. 10, one of these values may exceed the normal limit. Contact Grundfos for further information.



Y-direction: Direction of chamber stack
Z-direction: 90 ° from inlet/outlet
X-direction: Inlet/outlet

TM04 0346 1613

Fig. 10 Flange forces and torques

Flange	CR, CRI, CRN	Force [F]		
		Y-direction [lb]	Z-direction [lb]	X-direction [lb]
1 1/4"	1s to 5	171	263	175
2"	10, 15 and 20	303	371	337
2 1/2"	32	382	466	422
3"	45	461	562	506
4"	64 and 90	607	753	674
5", 6"	120 and 150	607	753	674

Flange	CR, CRI, CRN	Torque [M]		
		Y-direction [ft-lb]	Z-direction [ft-lb]	X-direction [ft-lb]
1 1/4"	1s to 5	605	715	900
2"	10, 15 and 20	738	848	1,033
2 1/2"	32	793	904	1,106
3"	45	848	959	1,180
4"	64 and 90	922	1,069	1,291
5", 6"	120 and 150	922	1,069	1,291

8.8 Minimum continuous duty flow rates [gpm]

Pump type	min. °F to 176 °F (min. °C to 80 °C)	at 210 °F (at 99 °C)	at 248 °F (at 120 °C)	at 356 °F (at 180 °C)
CR, CRI, CRN 1s	0.5	0.7	1.2	1.2*
CR, CRI, CRN 1	0.9	1.3	2.3	2.3*
CR, CRI, CRN 3	1.6	2.4	4.0	4.0*
CR, CRI, CRN 5	3.0	4.5	7.5	7.5*
CR, CRI, CRN 10	5.5	8.3	14	14*
CR, CRI, CRN 15	9.5	14	24	24*
CR, CRI, CRN 20	11	17	28	28*
CR, CRN 32	14	21	35	35*
CR, CRN 45	22	33	55	55*
CR, CRN 64	34	51	85	85*
CR, CRN 90	44	66	110	110*
CR, CRN 120	60	90	N/A	N/A
CR, CRN 150	75	115	N/A	N/A
CRT 2	1.3	2.0	3.3	N/A
CRT 4	3.0	4.5	7.5	N/A
CRT 8	4.0	6.0	10	N/A
CRT 16	8.0	12	20	N/A

* Grundfos Cool-Top® is only available in the following pump types:

Pump type	CR 1s	CR 1	CR 3	CR 5	CR 10	CR 15	CR 20	CR 32	CR 45	CR 64	CR 90
Standard (CR)								●	●	●	●
I version (CRI)	●	●	●	●	●	●	●				
N version (CRN)	●	●	●	●	●	●	●	●	●	●	●

8.9 Check valves

A check valve may be required on the discharge side of the pump to prevent the pump inlet pressure from being exceeded.

When a pump with no check valve is stopped because there is no demand on the system (all valves are closed), the high system pressure on the discharge side of the pump will "find" its way back to the inlet of the pump.

This is especially critical for CRN-SF applications because of the very high discharge pressures involved. As a result, most CRN-SF installations require a check valve on the discharge piping.

8.10 Temperature rise

It may sometimes be necessary to stop the flow through a pump during operation.

When the flow is stopped, the power to the pump is transferred to the pumped liquid as heat, causing a temperature rise in the liquid.

The result is risk of overheating and consequent damage to the pump. The risk depends on the temperature of the pumped liquid and for how long the pump is operating without flow. See the following temperature rise table.

Pump type	Time for temperature rise of 18 °F (10 °C)	
	Seconds	Minutes
CR 1s, 1, 3	210	3.5
CR 5	240	4.0
CR 10	210	3.5
CR 15	150	2.5
CR 20	120	2.0
CR 32, 45, 64, 90, 120, 150	60	1.0

Conditions/reservations

The listed times are subject to the following conditions/ reservations:

- No exchange of heat with the surroundings.
- The pumped liquid is water with a specific heat capacity of 1.0 $^{Btu}/_{lb.}$ °F (4.18 $^{kJ}/_{kg}$ °C).
- Pump parts (chambers, impellers and shaft) have the same heat capacity as water.
- The water in the base and the pump head is not included.

These reservations should give sufficient safety margin against excessive temperature rise.

The maximum temperature must not exceed the pump maximum temperature rating.

8.11 Electrical connection

Warning

The safe operation of this pump requires that it is grounded in accordance with the National Electrical Code and local codes and regulations. Connect the ground conductor to the grounding screw in the terminal box and then to the ACCEPTABLE grounding point. All electrical work must be performed by a qualified electrician in accordance with the latest edition of the National Electrical Code and local codes and regulations.

8.12 Motors

Grundfos CR pumps are supplied with heavy-duty, 2-pole (3600 rpm), ODP (open drip-proof) or TEFC (totally enclosed fan cooled), NEMA C frame motors selected to our rigid specifications.

Motors with other enclosure types and for other voltages and frequencies are available on a special-order basis.

CRN-SF pumps are supplied with an IEC (metric) type motor with a reverse thrust bearing.

If you replace the pump, but keep a motor previously used on another CR pump, be sure to read *12. Maintaining the motor* for proper adjustment of the coupling height.

8.13 Position of terminal box

The motor terminal box can be turned to any of four positions in steps of 90 °.

To rotate the terminal box, remove the four bolts securing the motor to the pump but do not remove the coupling. Turn the motor to the desired position; replace and securely tighten the four bolts. See fig. 11.

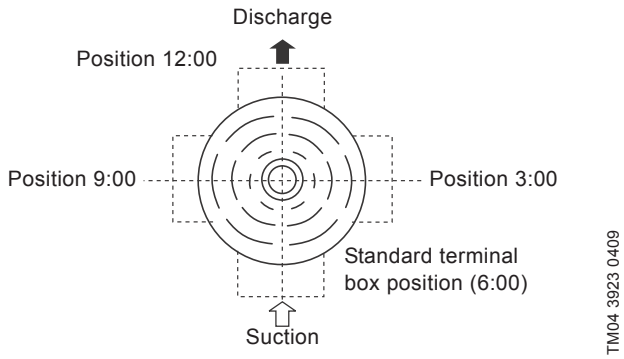


Fig. 11 Motor terminal box positions (top view)

8.14 Field wiring

Lead sizes should be based on the current carrying properties of conductors required by the latest edition of the National Electrical Code or local regulations. Direct-on-line (DOL) starting is approved due to the extremely short run-up time of the motor and the low moment of inertia of the pump and motor. If DOL starting is not acceptable and reduced starting current is required, use an auto transformer, resistance starter or soft starter. We suggest to use a fused disconnect for each pump in case standby pumps are installed.

8.15 Motor protection

8.15.1 Single-phase motors

All CR pumps with single phase motors, except 10 hp, are equipped with multi-voltage, squirrel cage induction motors which include built-in thermal protection.

8.15.2 Three-phase motors

CR pumps with three-phase motors must be used with the proper size and type of motor-protective circuit breaker to ensure the motor is protected against damage from low voltage, phase failure, current unbalance and overloads.

Use a properly sized circuit breaker with manual reset and ambient-temperature compensated extra-quick trip in all three phases. The overload protection should be set and adjusted to the full-load current rating of the motor. Under no circumstances should the overload protection be set to a higher value than the full-load current shown on the motor nameplate. This will void the warranty.

Set overload protection for auto transformers and resistance starters in accordance with the recommendations of the manufacturer.

Three-phase MLE motors (CRE-pumps) require only fuses as circuit breaker. They do not require a motor-protective circuit breaker. Check for phase unbalance (worksheet is provided. See section *18. Worksheet for three-phase motors*).

Caution ***Standard allowable phase unbalance is 5 %.***

8.15.3 CRN-SF

The CRN-SF is typically operated in series with a feed pump. Because the maximum allowable inlet pressure of the CRN-SF increases from 73 psi (when pump is off and during start-up) to 365 psi (during operation), use a control device to start the CRN-SF pump one second before the feed pump starts. Similarly, the CRN-SF must stop one second after the feed pump stops. See CRN-SF start-up timeline below.

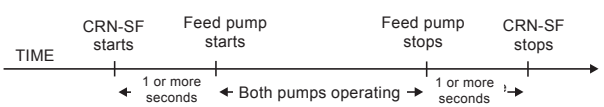


Fig. 12 CRN-SF start-up

9. Commissioning

9.1 Priming

To prime the pump in a closed system or an open system where the water source is above the pump, close the pump isolating valve(s) and open the priming plug on the pump head. See fig. 13, fig. 14, and fig. 15.

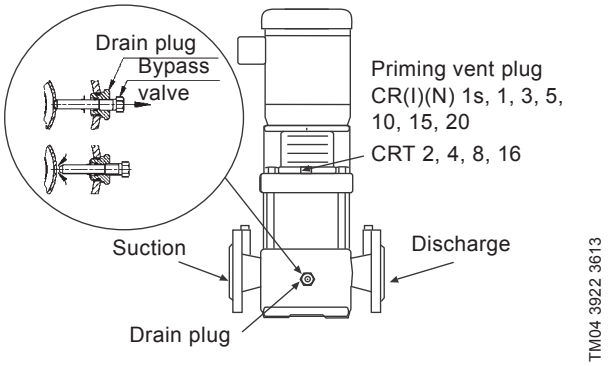


Fig. 13 Position of plugs and bypass valve

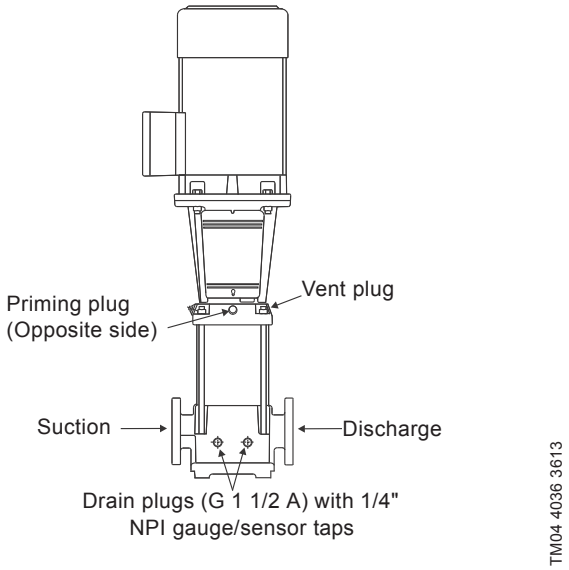


Fig. 14 Position of plugs CR, CRN 32, 45, 64, 90, 120, 150

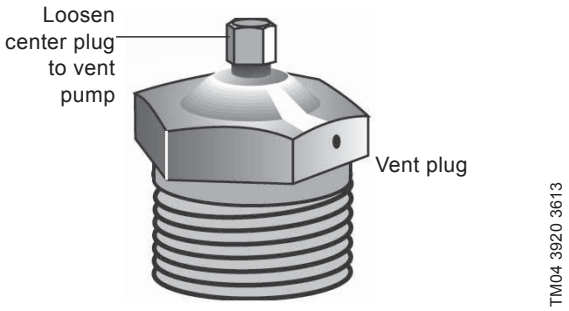


Fig. 15 Vent plug

In open systems where the water level is below the pump inlet, the suction pipe and pump must be filled with liquid and vented before starting the pump.

1. Close the discharge isolating valve and remove the priming plug.
2. Pour water through the priming hole until the suction pipe and pump are completely filled with liquid. If the suction pipe does not slope downwards away from the pump, the air must be purged while priming the pump.
3. Replace the priming plug and tighten securely.

9.2 Startup

1. Gradually open the isolating valve in the suction line until a steady stream of airless water runs out of the priming hole.
2. Close the plug and tighten securely.
3. Completely open the isolating valves.

For pumps with Cool-Top®, see section *16. Startup of pump with air-cooled top (Cool-Top®)*.

Follow these steps:

1. Switch off the power supply.
2. Check to make sure the pump has been filled and vented.
3. Remove the coupling guard and rotate the pump shaft by hand to make sure it turns freely.
4. Verify that the electrical connections are in accordance with the wiring diagram on the motor.
5. Switch on the power and observe the direction of rotation. When viewed from above, the pump should rotate counter-clockwise (clockwise for CRN-SF).
6. To reverse the direction of rotation, first switch off the power supply.
7. On three-phase motors, interchange any two phases of the power supply.
   On single-phase motors, see wiring diagram on the nameplate. Change wiring as required.
8. Switch on the power again and check for proper direction of rotation. Once direction of rotation has been verified, switch off the power again. Do not attempt to reinstall the coupling guards while the motor is on. Replace the coupling guard if the direction of rotation is correct. When the guards are in place, the power can be switched on again.

Note

For CR, CRI, CRN 1s to 5 it is advisable to open the bypass valve during start-up. See fig. 13. The bypass valve connects the suction and discharge sides of the pump, thus making the filling procedure easier. Close the bypass valve when operation is stable.

Caution

Motors should not be run unloaded or uncoupled from the pump at any time; damage to the motor bearings will occur.

Do not start the pump before priming or venting the pump. See fig. 15. Never let the pump run dry.

10. Operation

10.1 Operating parameters

CR multi-stage centrifugal pumps installed in accordance with these instructions and sized for correct performance will operate efficiently and provide years of service. The pumps are water-lubricated and do not require any external lubrication or inspection. The motors may require periodic lubrication as described in section *12. Maintaining the motor*.

Under no circumstances should the pump be operated for any prolonged periods of time without flow through the pump. This can result in motor and pump damage due to overheating. A properly sized relief valve should be installed to allow sufficient liquid to circulate through the pump to provide adequate cooling and lubrication of the pump bearings and seals.

10.2 Pump cycling

Pump cycling should be checked to ensure the pump is not starting more often than the following max. starts per hour:

Grundfos ML motors:

- 200 times per hour on 1/3 to 5 hp models
- 100 times per hour on 7 1/2 to 15 hp models
- 40 times per hour on 20 to 30 hp models.

Baldor motors:

- 20 times per hour on 1/3 to 5 hp models
- 15 times per hour on 7 1/2 to 15 hp models
- 10 times per hour on 20 to 100 hp models.

Rapid cycling is a major cause of premature motor failure due to overheating of the motor. If necessary, adjust controller to reduce the frequency of starts and stops.

10.3 Boiler feed installations

If the pump is used as a boiler feed pump, make sure the pump is capable of supplying sufficient water throughout its entire evaporation and pressure ranges. Where modulating control valves are used, a bypass around the pump must be installed to ensure pump lubrication. See section *7.3 Minimum inlet pressures*.

10.4 Frost protection

If the pump is installed in an area where frost could occur, the pump and system should be drained during freezing temperatures to avoid damage. To drain the pump, close the isolating valves, remove the priming plug and drain plug at the base of the pump. Do not refit the plugs until the pump is to be used again. Always replace the drain plug with the original or an exact replacement. Do not replace with a standard plug. Internal recirculation will occur, reducing the output pressure and flow.

11. Maintaining the pump

Depending on the conditions and operating time, make the following checks at regular intervals:

- Check that the pump meets the required performance and is operating smoothly and quietly.
- Check that there are no leaks, particularly at the shaft seal.
- Check that the motor is not overheating.
- Remove and clean all strainers or filters in the system.
- Check that the tripping function of the motor overload protection works.
- Check the operation of all controls.
- If the pump is not operated for unusually long periods, maintain the pump in accordance with these instructions. In addition, if the pump is not drained, the pump shaft should be manually rotated or run for short periods of time at monthly intervals.
- In severe-duty applications, pump life may be extended by performing one of the following actions:
  - Drain the pump after each use.
  - Flush the pump with water or other liquid that is compatible with the pump materials and process liquid.
  - Disassemble the pump and thoroughly rinse or wash components in contact with the pumped liquid with water or other liquid that is compatible with the pump materials and process liquid.

If the pump fails to operate or there is a loss of performance, see to *section 17. Diagnosing specific problems*.

12. Maintaining the motor

Warning

Before starting work on the motor, make sure that all power supplies to the motor have been switched off and that they cannot be accidentally switched on. Electric shock can cause serious or fatal injury. Only qualified personnel should attempt installation, operation, and maintenance of this equipment.

12.1 Motor inspection

Inspect the motor approximately every 500 hours of operation or every three months, whichever occurs first. Keep the motor clean and the ventilation openings clear.

Go through the following steps during each inspection:

1. Check that the motor is clean. Check that the interior and exterior of the motor are free of dirt, oil, grease, water, etc. Oily residue, paper, pulp, textile lint, etc. can accumulate and block motor ventilation. If the motor is not properly ventilated, overheating can occur and cause early motor failure.
2. Use an ohmmeter periodically to ensure that the winding insulation is OK. Record the ohmmeter readings, and immediately investigate any significant drop in insulation resistance.
3. Check all electrical connections to be sure that they are tightened securely.

12.2 Motor lubrication

Electric motors are pre-lubricated from factory and do not require additional lubrication at start-up. Motors without external grease zerks have sealed bearings that cannot be re-lubricated.
Motors with grease zerks should only be lubricated with approved types of grease. Do not over-grease the bearings. Over-greasing will cause increased bearing heat and can result in bearing or motor failure. Do not mix oil-based grease and silicon grease in motor bearings.

Bearing grease will lose its lubricating ability over time.
The lubricating ability of a grease depends primarily on the type of grease, the size of the bearings, the speed at which the bearings operate and the severity of the operating conditions.

Good results can be obtained if the following recommendations are used in your maintenance program. It should also be noted that multistage pumps, pumps running to the left of the performance curve, and certain pump ranges may have higher thrust loads. Pumps with high thrust loads should be greased according to the next service interval level.

Warning

The grease outlet plug MUST be removed before adding new grease.

12.3 Recommended lubricant

Severity of duty	Ambient temperature (max.)	Environment	Approved types of grease
Standard	104 °F (40 °C)	Clean, little corrosion	Grundfos ML motors are greased for life, or the grease type will be stated on the nameplate. Baldor motors are greased with Polyrex EM (Exxon Mobile).
Severe	122 °F (50 °C)	Moderate dirt, corrosion	
Extreme	> 122 °F (50 °C) or class H insulation	Severe dirt, abrasive dust, corrosion	

12.4 Lubricating chart (for motors with grease zerks)

New motors that have been stored for a year or more should be regreased according to the following table:

NEMA (IEC) frame size	Service intervals [hours]			Weight of grease [oz (grams)]	Volume of grease [in^3 (teaspoons)]
	Standard duty	Severe duty	Extreme duty		
Up to and incl. 210 (132)	5500	2750	550	0.30 (8.4)	0.6 (2)
Over 210 up to and incl. 280 (180)	3600	1800	360	0.61 (17.4)	1.2 (3.9)
Over 280 up to and incl. 360 (225)	2200	1100	220	0.81 (23.1)	1.5 (5.2)
Over 360 (225)	2200	1100	220	2.12 (60.0)	4.1 (13.4)

12.5 Lubricating procedure

Caution

Keep grease free from dirt to avoid damage to motor bearings. If the environment is extremely dirty, contact Grundfos, the motor manufacturer, or an authorized service center for additional information.

Do not mix dissimilar types of grease.

1. Clean all grease zerks. If the motor does not have grease zerks, the bearing is sealed and cannot be greased externally.
2. If the motor is equipped with a grease outlet plug, remove it. This will allow the old grease to be displaced by the new grease. If the motor is stopped, add the recommended amount of grease. If the motor is to be lubricated while running, add a slightly greater quantity of grease.
3. Add grease SLOWLY taking approximately one minute until new grease appears at the shaft hole in the flange or grease outlet plug. Never add more than 1 1/2 times the amount of grease shown in the lubricating chart.

Note

If new grease does not appear at the shaft hole or grease outlet, the outlet passage may be blocked. Contact Grundfos service center or certified motor shop.

4. Let motors equipped with a grease outlet plug run for 20 minutes before replacing the plug.

13. Replacing the motor

Caution

Motors used on CR pumps are specifically selected to our rigid specifications. Replacement motors must be of the same frame size, should be equipped with the same or better bearings and have the same service factor. Failure to follow these recommendations may result in premature motor failure.

If the motor is damaged due to bearing failure, burning or electrical failure, observe the following instructions as to how to remove the motor and how to mount the replacement motor.

Warning

Before starting work on the motor, make sure that the mains switch has been switched off. It must be ensured that the power supply cannot be accidentally switched on.

13.1 Disassembly

Proceed as follows:

1. Disconnect the power supply leads from the motor. Remove the coupling guards.

Note

For CR 1s, 1, 3, 5, 10, 15, and 20: Do not loosen the three hexagon socket head cap screws securing the shaft seal.

2. Use the proper metric hexagon key to loosen the four cap screws in the coupling. Remove coupling halves completely. On CR 1s-CR 20, the shaft pin can be left in the pump shaft. CR, CRN 32, 45, 64, 90, 120, and 150 do not have a shaft pin.
3. Use the correct size spanner to loosen and remove the four mounting bolts joining motor and pump.
4. Lift the motor straight up until the shaft has cleared the motor stool.

13.2 Assembly

Proceed as follows:

1. Remove key from motor shaft, if present, and discard.
2. Thoroughly clean the surfaces of the motor and pump mounting flanges. The motor and shaft must be clean of all oil or grease and other contaminants where the coupling attaches. Place the motor on top of the pump.
3. Turn the terminal box to the desired position by rotating the motor.
4. Insert the four mounting bolts, then tighten diagonally and evenly:
   – for 3/8" bolts (1/2 - 2 hp), torque = 17 ft-lb
   – for 1/2" bolts (3 - 40 hp), torque = 30 ft-lb
   – for 5/8" bolts (50 - 100 hp), torque = 59 ft-lb
   – follow instructions for particular pump model in sections *13.2.2 CR 1s, 1, 3, and 5* to *13.2.5 CR, CRN 32, 45, 64, 90, 120, and 150*.

13.2.1 Torque specifications

Torque specifications for CR, CRI, CRN 1s, 1, 3, 5, 10, 15, and 20 CRT 2, 4, 8, and 16

Coupling screw size	Minimum torque
M6	10 ft-lb
M8	23 ft-lb
M10	46 ft-lb

13.2.2 CR 1s, 1, 3, and 5

1. Insert shaft pin into shaft hole.
2. Mount the coupling halves onto shaft and shaft pin.
3. Fit the coupling screws and leave loose. Check that the gaps on either side of the coupling are even and that the motor shaft keyway is centered in the coupling half as shown in fig. 16.
4. Tighten the screws to the correct torque. See section *13.2.1 Torque specifications*.

13.2.3 CR 10, 15 and 20

1. Insert shaft pin into shaft hole.
2. Insert plastic shaft seal spacer beneath shaft seal collar.
3. Mount the coupling halves onto shaft and shaft pin.
4. Fit the coupling screws and leave loose. Check that the gaps on either side of the coupling are even and that the motor shaft keyway is centered in the coupling half as shown in fig. 16.
5. Tighten the screws to the correct torque. See section *13.2.1 Torque specifications*.
6. Remove plastic shaft seal spacer and hang it on inside of coupling guard.

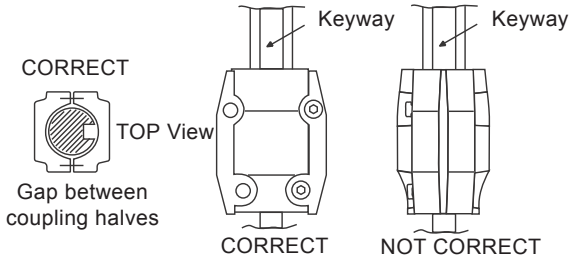


Fig. 16 Coupling adjustment all CR, CRI, CRN, CRT

13.2.4 CRT 2, 4, 8 and 16

1. Mount coupling halves. Make sure the shaft pin is located in the pump shaft.
2. Put the cap screws loosely back into the coupling halves.
3. Using a large screwdriver, raise the pump shaft by placing the tip of the screwdriver under the coupling and carefully raising the coupling to its highest point. See fig. 17.

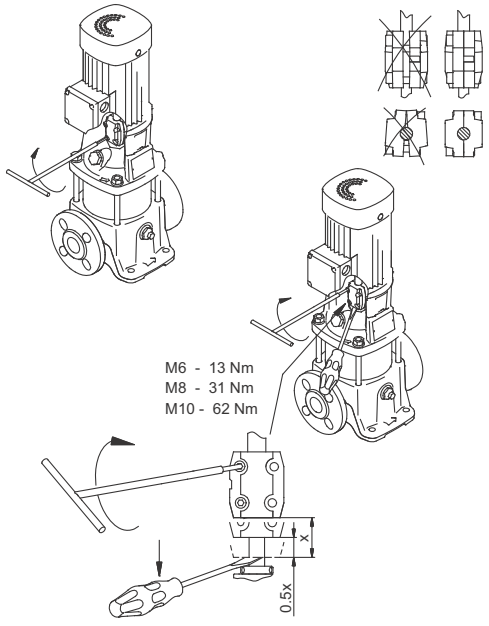


Fig. 17 Coupling adjustment CRT 2, 4, 8, and 16

Note ***The shaft can only be raised approximately 0.20 inches (5 mm).***

4. Now lower the shaft halfway back the distance you just raised it and tighten the coupling screws (finger tight) while keeping the coupling gap equal on both sides. When the screws are tight enough to keep the coupling in place, then cross-tighten the screws.
   - Note the clearance below the coupling.
   - Raise the coupling as far as it will go.
   - Lower it halfway back down (1/2 the distance you just raised it).
   - Tighten screws (see torque specifications).

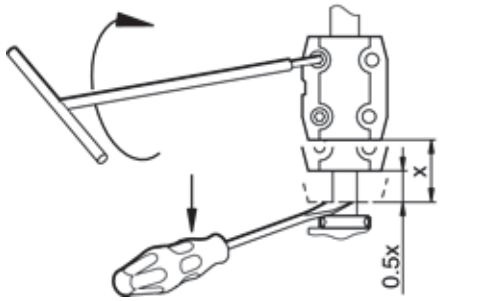


Fig. 18 Coupling adjustment clearance CRT 2, 4, 8, and 16

13.2.5 CR, CRN 32, 45, 64, 90, 120, and 150

1. Make sure pump shaft is all the way down. Tighten the set screws on the mechanical shaft seal.
2. Place the plastic adjusting fork under the cartridge seal collar. See fig. 19.

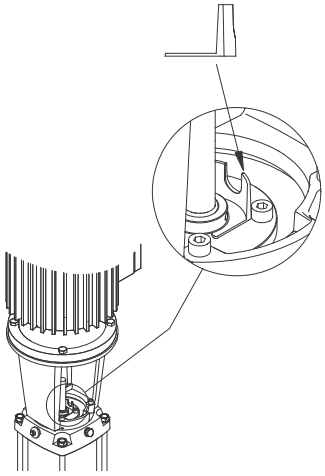


Fig. 19 Coupling adjustment CR, CRN 32, 45, 64, 90, 120, and 150

3. Fit the coupling on the shaft so that the top of the pump shaft is flush with the bottom of the coupling chamber. See fig. 20.

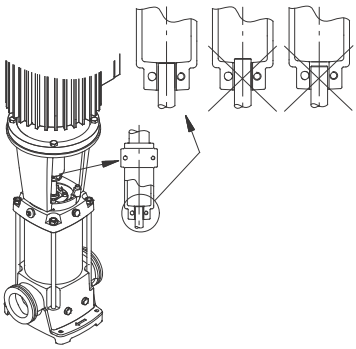


Fig. 20 Coupling adjustment, CR, CRN 32, 45, 64, 90, 120, and 150

Caution ***To avoid damaging the coupling halves, ensure that the motor shaft keyway is centered in the coupling half as shown in fig. 16.***

4. Lubricate the coupling screws with an anti-seize, lubricating compound. Tighten the coupling screws (finger tight) while keeping the coupling gap equal on both sides and the motor shaft keyway centered in the coupling half as shown in fig. 16. When the screws are tight enough to keep the coupling in place, then cross-tighten the screws.
5. Tighten coupling screws to 62 ft-lbs (75 and 100 hp motors to 74 ft-lbs). Remove the adjusting fork from under the cartridge seal collar and replace it to the storage location. See fig. 21.

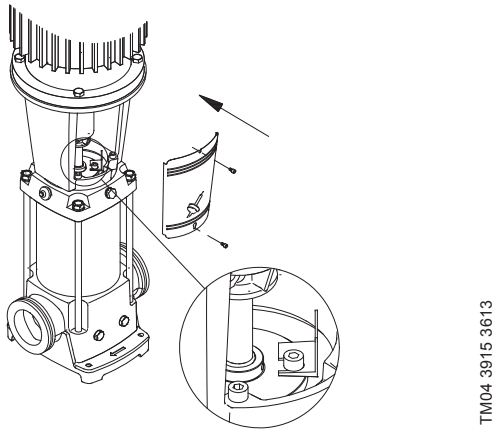


Fig. 21 Adjusting fork storage CR, CRN 32, 45, 64, 90, 120, and 150

6. Check to see that the gaps between the coupling halves are equal. Loosen and readjust, if necessary.
7. Make sure the pump shaft can be rotated by hand. If the shaft cannot be rotated or it jams, disassemble and check for misalignment.
8. Prime the pump.
9. Follow the wiring diagram on the motor label for the correct motor wiring combination which matches your supply voltage. Once this has been confirmed, reconnect the power supply leads to the motor.
10. Check the direction of rotation by bump-starting the motor. Direction of rotation must be left to right (counter-clockwise) when looking directly at the coupling.
11. Switch off the power, then mount the coupling guards. When the coupling guards have been mounted, the power can be switched on again.

14. Parts list

Grundfos offers an extensive parts list for each CR pump model. A parts list typically covers the following items:

- a diagram of pump parts which we recommend to have on hand for future maintenance
- a list of prepacked service kits covering the pump components most likely to be exposed to wear over time
- complete chamber stacks needed to replace the rotating assembly of each model.

These parts lists are available separately from the Grundfos literature warehouse or as a set with extensive service instructions in the Grundfos CR Service Manuals.

TM05 9272 3613

Fig. 22 Prepacked chamber stack kits

TM04 3916 1609

Fig. 23 Prepacked flange kits

14.1 Spare parts

Grundfos offers an extensive list of spare parts for CR pumps. For a current list of these parts, see Grundfos All Product Spare Parts/Service Kits Price List, part number L-SK-SL-002.

15. Preliminary electrical tests

Warning

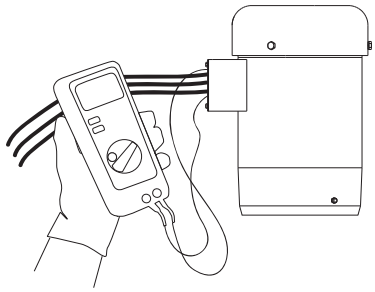
When working with electrical circuits, use caution to avoid electrical shock. It is recommended that rubber gloves and boots be worn, and metal terminal boxes and motors are grounded before any work is done. For your protection, always disconnect the pump from its power source before handling.

15.1 Supply voltage

15.1.1 How to measure the supply voltage

Use a voltmeter (set to the proper scale) to measure the voltage at the pump terminal box or starter. On single-phase units, measure between power leads L1 and L2 (or L1 and N for 115 volt units). On three-phase units, measure between:

– Power leads L1 and L2
– Power leads L2 and L3
– Power leads L3 and L1.



TM04 3911 2609

Fig. 24 Measuring supply voltage

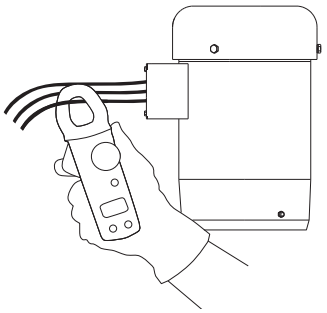
15.1.2 Meaning of supply voltage measurement

When the motor is under load, the voltage should be within + 10 %/- 10 % of the nameplate voltage. Larger voltage variation may cause winding damage. Large variations in the voltage indicate a poor electrical supply and the pump should not be operated until these variations have been corrected. If the voltage constantly remains high or low, the motor should be changed to the correct supply voltage.

15.2 Current

15.2.1 How to measure the current

Use an ammeter (set on the proper scale) to measure the current on each power lead at the terminal box or starter. See the motor nameplate for amp draw information. Current should be measured when the pump is operating at constant discharge pressure.



TM04 3908 2609

Fig. 25 Measuring current

15.2.2 Meaning of current measurement

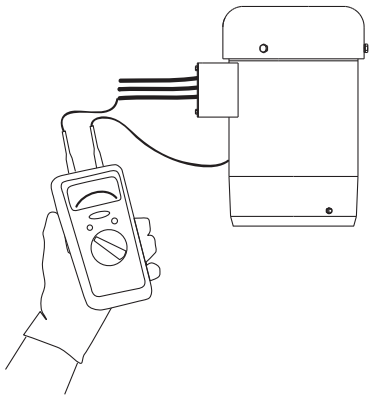
If the amp draw exceeds the listed service factor amps (SFA) or if the current unbalance is greater than 5 % between each leg on three-phase units, check for the following faults:

Fault	Remedy
Burned contacts in the motor-protective circuit breaker.	Replace contacts.
Loose terminals in motor-protective circuit breaker or terminal box or possibly defective lead.	Tighten terminals or replace lead.
Too high or too low supply voltage.	Reestablish correct supply voltage.
Motor windings are short-circuited or grounded. (Check winding and insulation resistances).	Remove cause of short circuit or grounding.
Pump is damaged causing motor overload.	Replace defective pump parts.

15.3 Insulation resistance

15.3.1 How to measure the insulation resistance

Turn off power and disconnect the supply power leads in the pump terminal box. Using an ohmmeter or megohmmeter, set the scale selector to R x 100K and zero-adjust the meter.
Measure and record the resistance between each of the terminals and ground.



TM04 3907 2609

Fig. 26 Measuring insulation resistance

15.3.2 Meaning of insulation resistance measurement

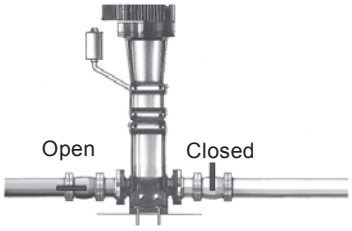
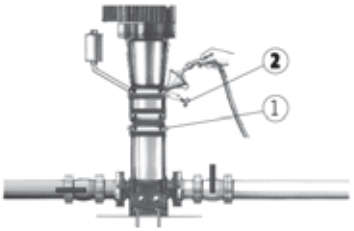
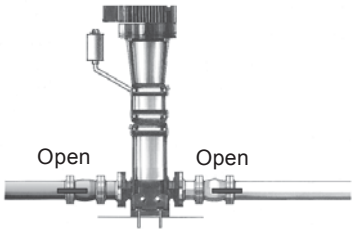
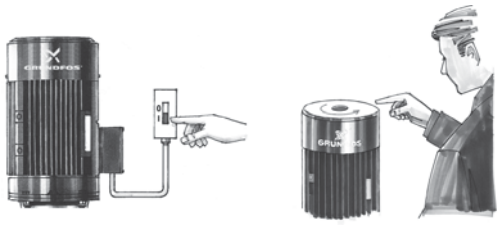
Motors of all hp, voltage, phase and cycle duties have the same value of insulation resistance. Resistance values for new motors must exceed 1,000,000 ohms. If they do not, the motor should be repaired or replaced.

16. Startup of pump with air-cooled top (Cool-Top®)

Caution ***Do not start the pump until it has been filled with liquid and vented.***

Warning

Pay attention to the direction of the vent hole and ensure that the escaping liquid does not cause injury to persons or damage to the motor or other components. In hot-liquid installations, pay special attention to the risk of injury caused by scalding hot liquid. We recommend you to connect a drain pipe to the 1/2" air vent in order to lead the hot water/steam to a safe place.

Step		Action
1	 TM02 4151 5001	The air-cooled top should only be started up with cold liquid. Close the isolating valve on the discharge side and open the isolating valve on the suction side of the pump.
2	 TM02 4153 1503	Remove the priming plug from the air-cooled chamber (pos. 2) and slowly fill the chamber with liquid. When the chamber is completely filled with liquid, replace the priming plug and tighten securely.
3	 TM02 5907 1503	Open the isolating valve on the discharge side of the pump. The valve may have to be partially closed when the pump is started if there is no counter pressure (i.e. boiler not up to pressure).
4	 TM01 1406 3702 - TM01 1405 4497	Start the pump and check the direction of rotation. See the correct direction of rotation of the pump on the motor fan cover. If the direction of rotation is wrong, interchange any two of the incoming power supply leads. After 3 to 5 minutes, the air vent has been filled with liquid. Note ***During start-up of a cold pump with hot liquid, it is normal that a few drops of liquid are leaking from the sleeve.***

17. Diagnosing specific problems

Warning

Before removing the terminal box cover and before removing/dismantling the pump, make sure that the power supply has been switched off and that it cannot be accidentally switched on.

Problem	Possible cause	Remedy
1. The pump does not run.	a) No power to motor.	Check voltage to motor terminal box. If no voltage to motor, check starter panel for tripped circuits and reset circuits.
	b) Fuses blown or circuit breaker tripped.	Turn off power and remove fuses. Check for continuity with ohmmeter. Replace blown fuses or reset circuit breaker. If new fuses blow or circuit breaker trips, the electrical installation, motor and wires must be checked.
	c) Motor starter overload protection burned or tripped out.	Check for voltage on line and load side of starter. Replace or reset burned motor protection. Inspect starter for other damage. If protection trips again, check the supply voltage and starter holding coil.
	d) Starter does not energize.	Energize control circuit and check for voltage to the holding coil. If no voltage, check control circuit fuses. If voltage, check holding coil for short circuits. Replace bad coil.
	e) Defective control devices.	Check that all safety and pressure switches function correctly. Inspect contacts in control devices. Replace worn or defective parts or control devices.
	f) Motor is defective.	Turn off power and disconnect wiring. Measure the lead-to-lead resistances with ohmmeter (RX-1). Measure lead-to-ground values with ohmmeter (RX-100K). Record measured values. If an open or grounded winding is found, remove motor and repair or replace it.
	g) Defective capacitor (single-phase motors).	Turn off power and discharge capacitor. Check with ohmmeter (RX-100K). When the meter is connected to the capacitor, the needle should jump towards 0 ohms and slowly drift back to infinity (h). Replace capacitor if defective.
	h) Pump is blocked or seized.	Turn off power and manually rotate pump shaft. If shaft does not rotate easily, check coupling setting and adjust as necessary. If shaft rotation is still tight, remove pump and inspect. Disassemble and repair the pump.

Problem	Possible cause	Remedy
2. The pump runs but at reduced performance or does not deliver water.	a) Wrong direction of rotation.	Check wiring for proper connections. Correct wiring.
	b) Pump is not primed or is air-bound.	Turn pump off, close isolation valve(s) and remove priming plug. Check liquid level. Refill the pump, replace plug and start the pump. Long suction lines must be filled before starting the pump.
	c) Strainers, check or foot valves are clogged.	Remove strainer, screen or check valve and inspect. Clean and replace. Reprime pump.
	d) Suction lift too large.	Install compound pressure gauge at the suction side of the pump. Start pump and compare reading to performance data. Reduce suction lift by lowering pump, increase suction line size or removing high friction loss devices.
	e) Suction and/or discharge pipes leaking. (Pump spins backwards when turned off)	Air in suction pipe. Suction pipe, valves and fittings must be airtight. Repair any leaks and retighten all loose fittings.
	f) Pump worn.	Install pressure gauge, start pump, gradually close the discharge valve and read pressure at shutoff. Convert measured pressure (in psi) to head (in feet): (Measured psi x 2.31 ft/psi = ___ ft). Refer to the specific pump curve for shutoff head for that pump model. If head is close to curve, pump is probably OK. If not, remove pump and inspect.
	g) Pump impeller or guide vane is clogged.	Disassemble and inspect pump passageways. Remove any foreign materials found.
	h) Incorrect drain plug installed.	If the proper drain plug is replaced with a standard plug, water will recirculate internally. Replace with proper plug.
	i) Improper coupling setting.	Check/reset the coupling. See page 18.
3. Pump cycles too much	a) Pressure switch is not properly adjusted or is defective.	Check that pressure switch is set and functions correctly. Check voltage across closed contacts. Readjust switch or replace if defective.
	b) Level control is not properly adjusted or is defective.	Check that level control is set and functions correctly. Readjust setting (refer to level control manufacturer's data). Replace if defective.
	c) Insufficient air charging or leaking tank or piping.	Pump air into tank or diaphragm chamber. Check diaphragm for leaks. Check tank and piping for leaks with soap and water solution. Check air-to-water volume. Repair as necessary.
	d) Tank is too small.	Check tank size and air volume in tank. Tank volume should be approximately 10 gallons for each gpm of pump performance. The normal air volume is 2/3 of the total tank volume at the pump cut-in pressure. Replace tank with one of correct size.
	e) Pump is oversized.	Install pressure gauges on or near pump suction and discharge ports. Start and run pump under normal conditions, record gauge readings. Convert psi to feet (Measured psi x 2.31 ft/psi = ____ ft) Refer to the specific pump curve for that model, ensure that total head is sufficient to limit pump delivery within its design flow range. Throttle pump discharge flow if necessary.

Problem	Possible cause	Remedy
4. Fuses blow or circuit breakers or overload relays trip	a) Tank is too small.	Check voltage at starter panel and motor. If voltage varies more than - 10 %/+ 10 %, contact power company. Check wire sizing.
	b) Motor overload protection set too low.	Cycle pump and measure amperage. Increase size of overload protection or adjust trip setting to maximum motor nameplate (full load) current.
	c) Three-phased current is imbalanced.	Check current draw on each lead to the motor. Must be within - 5 %/+ 5 %. If not, check motor and wiring. Rotating all leads may eliminate this problem.
	d) Motor short-circuited or grounded.	Turn off power and disconnect wiring. Measure the lead-to-lead resistance with an ohmmeter (RX-1). Measure lead-to-ground values with an ohmmeter (RX-100K) or a megaohmmeter. Record values. If an open or grounded winding is found, remove the motor, repair and/or replace.
	e) Wiring or connections are faulty.	Check proper wiring and loose terminals. Tighten loose terminals. Replace damaged wires.
	f) Pump is blocked or seized.	Turn off power and manually rotate pump shaft. If shaft does not rotate easily, check coupling setting and adjust as necessary. If shaft rotation is still tight, remove pump and inspect. Disassemble and repair the pump.
	g) Defective capacitor (single-phase motors).	Turn off power and discharge capacitor. Check with ohmmeter (RX-100K). When the meter is connected to the capacitor, the needle should jump towards 0 ohms and slowly drift back to infinity (∞). Replace capacitor if defective.
	h) Motor overload protection devices at higher ambient temperature than motor.	Use a thermometer to check the ambient temperature near overload protection devices and motor. Record these values. If ambient temperature at motor is lower than at overload protection devices, especially where temperature at overload protection devices is above 104 °F (40 °C), replace standard protection devices with ambient-compensated protection devices.

18. Worksheet for three-phase motors

Below is a worksheet for calculating current unbalance on a three-phase hookup. Use the calculations below as a guide.

Note

Current unbalance should not exceed 5 % at service factor load or 10 % at rated input load. If the unbalance cannot be corrected by rolling the leads, the source of the unbalance must be located and corrected. If, on the three possible hookups, the leg farthest from the average stays on the same power lead, most of the unbalance is coming from the power source. However, if the reading farthest from the averages moves with the same motor lead, the primary source of unbalance is on the "motor side" of the starter. In this instance, consider if the cause can be a damaged cable, an untight cable splice, a poor connection, or a faulty motor winding.

Explanation and examples	
Here is an example of current readings at maximum pump loads on each leg of a three-wire hookup. You must make calculations for all three hookups. To begin, add up all three readings for hookup numbers 1, 2, and 3.	**Hookup 1** T1 = 51 amps T2 = 46 amps T3 = 53 amps TOTAL = 150
Divide the total by three to obtain the average.	**Hookup 1** 50 amps 3 | 150 amps
Calculate the greatest current difference from the average.	**Hookup 1** 50 amps — 46 amps 4 amps
Divide this difference by the average to obtain the percentage of the unbalance. In this case, the current unbalance for **Hookup 1** is 8 %.	**Hookup 1** .08 or 8 % 50 | 4.00 amps

Blank worksheet

Hookup 1	Hookup 2	Hookup 3
L_1 to T_1 = ___ amps	L_1 to T_3 = ___ amps	L_1 to T_2 = ___ amps
L_2 to T_2 = ___ amps	L_2 to T_1 = ___ amps	L_2 to T_3 = ___ amps
L_3 to T_3 = ___ amps	L_3 to T_2 = ___ amps	L_3 to T_1 = ___ amps
TOTAL = ___ amps	TOTAL = ___ amps	TOTAL = ___ amps

Hookup 1	Hookup 2	Hookup 3
___ amps	___ amps	___ amps
3 | ___ amps	3 | ___ amps	3 | ___ amps

Hookup 1	Hookup 2	Hookup 3
___ amps	___ amps	___ amps
___ amps	___ amps	___ amps
___ amps	___ amps	___ amps

Hookup 1	Hookup 2	Hookup 3
___ or ___ %	___ or ___ %	___ or ___ %
___ | ___ amps	___ | ___ amps	___ | ___ amps

19. Disposal

This product or parts of it must be disposed of in an environmentally sound way:

1. Use the public or private waste collection service.
2. If this is not possible, contact the nearest Grundfos company or service workshop.

Subject to alterations.

Grundfos Kansas City
17100 West 118th Terrace
Olathe, Kansas 66061
Phone: +1-913-227-3400
Fax: +1-913-227-3500

www.grundfos.us

Grundfos Canada
2941 Brighton Road
Oakville, Ontario L6H 6C9 Canada
Phone: +1-905 829 9533
Fax: +1-905 829 9512

www.grundfos.ca

Grundfos México
Boulevard TLC No. 15
Parque Industrial Stiva Aeropuerto
C.P. 66600 Apodaca, N.L. Mexico
Phone: +011-52-81-8144 4000
Fax: +011-52-81-8144 4010

www.grundfos.mx

L-CR-TL-001

98419736 0114
ECM: 1122180

LEFT BLANK

HACH

MODEL SOLITAX SC, TURBIDITY SENSOR

LEFT BLANK

DOC023.54.03232

SOLITAX sc

User Manual

12/2009, Edition 4A

This page is intentionally left blank

Table of Contents

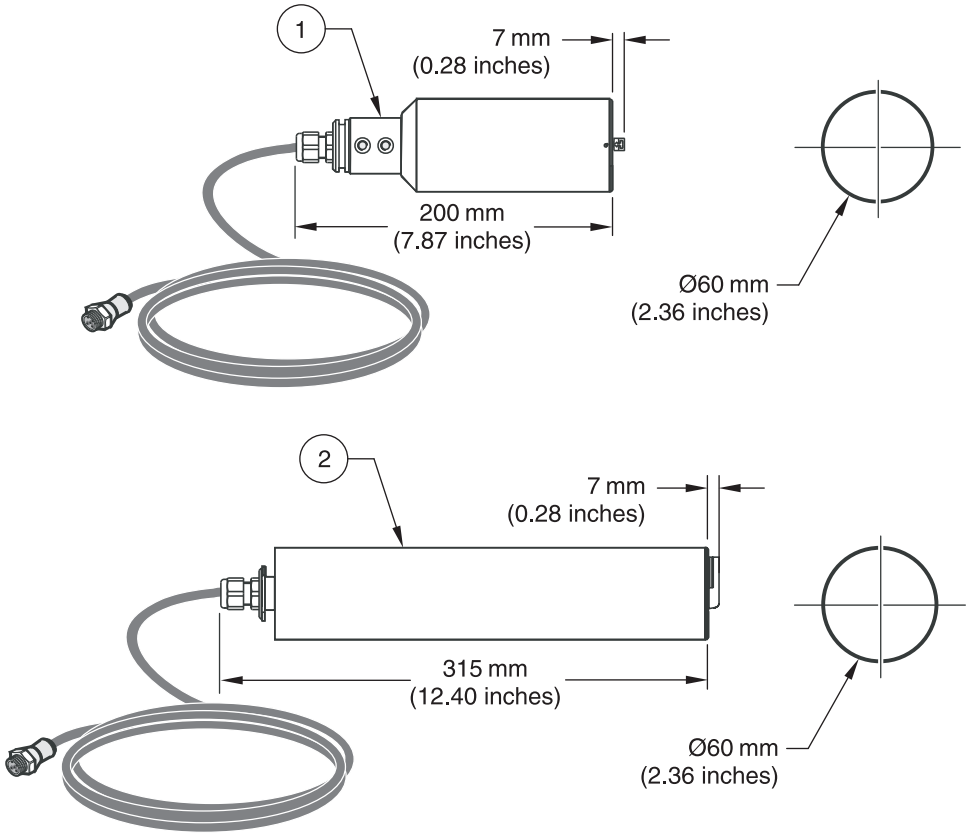
Section 1 Specifications

Specifications are subject to change without notice.

Measuring Technique	Infrared Duo scattered light technique for color-independent turbidity measurement Turbidity in accordance with DIN EN 27027 / TS equivalent DIN 38414
Measuring Range	t-line turbidity: 0.001–4000 FNU/NTU ts-line, inline turbidity: 0.001–4000 FNU/NTU; TSS content: 0.001 mg/L–50 g/L hs-line, highline turbidity: 0.001–4000 FNU/NTU; TSS content: 0.001 mg/L–500 g/L TSS
Reproducibility	Turbidity < 1 %, Total Suspended Solids (TSS) < 3 %
Measuring Accuracy	Turbidity up to 1000 FNU/NTU: without calibration < 5 % of the measured value ± 0.01 FNU/NTU with calibration < 1 % of the measured value ± 0.01 FNU/NTU
Technique variation coefficient	1 % in accordance with DIN 38402
Response Time	1 s ≤ T90 ≤ 300 s (adjustable)
Calibration	Zero point permanently set from the factory, gradient once for the TS content
Cable Length	10 m (33 ft), max. 100 m (328 ft) with extension cable
Ambient Temperature	0 to +40 °C (32 to 104 °F)
Pressure Range	Stainless steel: ≤ 6 bar or ≤ 60 m (87 psi) PVC: ≤ 1 bar or ≤ 10 m (14,5 psi)
Flow Velocity	Max. 3 m/s (the presence of air bubbles affects the measurement)
Materials	Optics carrier and sleeve: stainless steel 1.4571 or PVC black
	Wiper shaft: stainless steel 1.4104
	Wiper arm: stainless steel 1.4581
	Wiper rubber: silicone rubber (standard) Optional: Viton[1] (LZX578)
	Windows and light guide: quartz glass
	O-rings (optics carrier, wiper, windows): NBR (acrylonitrile butadiene rubber)
	Housing seals: NBR 70
	Sensor connecting cable (hard-wired): 1 cable pair AWG 22 / 12 V DC twisted, 1 cable pair AWG 24 / data twisted, common cable screen, Semoflex (PUR)
	Sensor connection plug (hard-wired): type M12 enclosure rating IP 67
	Threaded cable fitting: stainless steel 1.4305
Inspection interval	On request 1/year service contract with guarantee extension to 5 years
Dimensions	Tank probe: D x L 60 mm x 200 mm (2 x 8 in.) Probe for pipe installation: D x L 60 mm x 315 mm (2 x 12.4 in.) (Pipe installation fitting: DN 65 / PN 16 DIN 2633; < 5 bar (73 psi); for pipes from DN 80) Distance sensor - wall (floor): TS > 10 cm (4 in.), turbidity > 50 cm (20 in.)
Weight	Tank probe: approx. 1.8 kg (63 oz) (t-line: approx. 0.6 kg (21 oz)) Probe for pipe installation: approx. 2.4 kg (85 oz) Pipe installation fitting: approx. 2.7 kg (95 oz) (without probe) Pipe installation safety fitting:approx. 18 kg (40 lb) (without probe)
User Maintenance	1 h / month, typical
Certifications	CE

[1] Viton® is a registered trademark of E.I. DuPont de Nemours + Co.

Figure 1 Sensor Dimensions



1.	SOLITAX sc models t-line, ts-line, and hs-line for immersion in open tanks
2.	SOLITAX sc models inline and highline sensors for insertion in pipes

Section 2 General Information

2.1 Safety Information

Please read this entire manual before unpacking, setting up, or operating this equipment. Pay attention to all danger and caution statements. Failure to do so could result in serious injury to the operator or damage to the equipment.

Make sure that the protection provided by this equipment is not impaired, do not use or install this equipment in any manner other than that specified in this manual.

2.1.1 Use of Hazard Information

DANGER
Indicates a potentially or imminently hazardous situation which, if not avoided, will result in death or serious injury.

CAUTION
Indicates a potentially hazardous situation that may result in minor or moderate injury.

Important Note: *Information that requires special emphasis.*

Note: *Information that supplements points in the main text.*

2.1.2 Precautionary Labels

Read all labels and tags attached to the instrument. Personal injury or damage to the instrument could occur if not observed

	This symbol, if noted on the instrument, references the instruction manual for operation and/or safety information.
	This symbol indicates that a risk of electrical shock and/or electrocution exists.
	Electrical equipment marked with this symbol may not be disposed of in European public disposal systems after 12 August of 2005. In conformity with European local and national regulations (EU Directive 2002/96/EC), European electrical equipment users must now return old or end-of life equipment to the Producer for disposal at no charge to the user. ***Note:*** *For return for recycling, please contact the equipment producer or supplier for instructions on how to return end-of-life equipment, producer-supplied electrical accessories, and all auxiliary items for proper disposal.*

2.2 Sensor Overview

Note: *All sensors are also available without wipers for special applications.*

t-line: 0.001–4000 FNU/NTU

High-resolution turbidity probe made of plastic for the outlets of sewage treatment plants and bodies of water.

ts-line: 0.001–4000 FNU/NTU; 0.001 mg/L–50.0 g/L

High-precision turbidity and solids probe made of stainless steel or plastic for color-independent measurement of fine turbidities and sludges.

hs-line: 0.001–4000 FNU/NTU; 0.001 mg/L–500.0 g/L

High-precision turbidity and solids probe made of stainless steel or plastic for color-independent measurement of highly concentrated sludges.

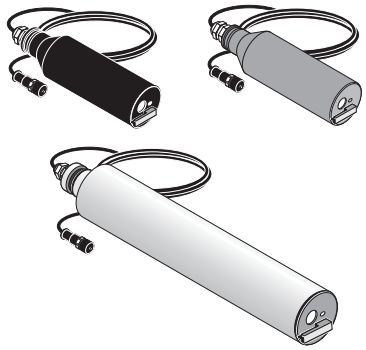
inline: 0.001–4000 FNU/NTU; 0.001 mg/L–50.0 g/L

High-precision pipe installation probe for turbidity and solids made of stainless steel for color-independent measurement of fine turbidities and sludges.

highline: 0.001–4000 FNU/NTU; 0.001 mg/L–500.0 g/L

High-precision pipe installation probe for turbidity and suspended solids made of stainless steel for color-independent measurement of highly concentrated sludges.

Figure 2 Solitax sc Sensors



2.3 Measuring Principle

The measuring principle is based on a combined infrared absorption scattered light technique that measures the lowest turbidity values in accordance with DIN EN 27027 just as precisely and continuously as high sludge content. Using this method, the light scattered sideways by the turbidity particles is measured over an angle of 90°.

2.4 Handling

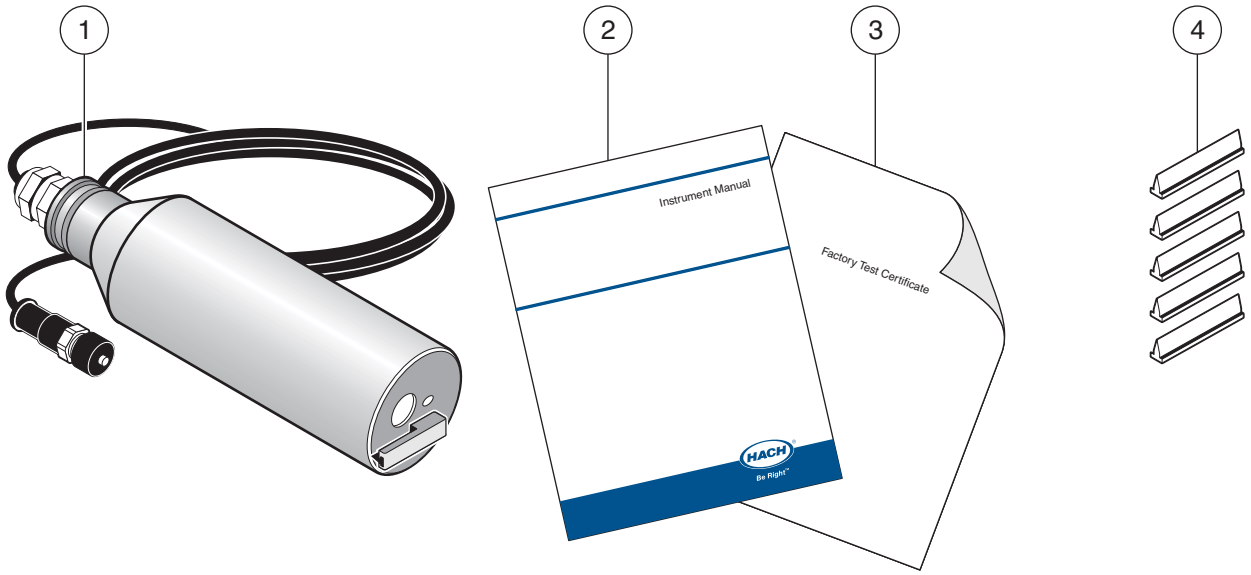
The sensor contains high-quality optical and electronic assemblies. Make sure the sensor is not subjected to any hard mechanical knocks. There are no customer-serviceable items inside the sensor.

Section 3 Installation

DANGER
Only qualified personnel should conduct the tasks described in this section of the manual.

3.1 Unpacking the Instrument

Figure 3 Items Supplied with SensorI



1.	SOLITAX sc Sensor	**3.**	Factory Test Certificate
2.	User Manual	**4.**	Wiper Set (for 5 changes) LZX050

3.1.1 Function Check

After unpacking, both components should be checked for any transport damage and a short function check performed prior to installation.

To perform a function check, connect the sensor to the display unit and power the unit. Shortly after the unit is plugged in, the display is activated and the instrument switches to the measurement display. Measured values taken in air is meaningless.

If no messages appear in the lower part of the display, the function check is then complete.

3.2 Sensor Installation

Figure 4 on page 10 illustrates the installation overview for Solitax sc Models t-line, ts-line, and hs-line for immersion in open tanks.

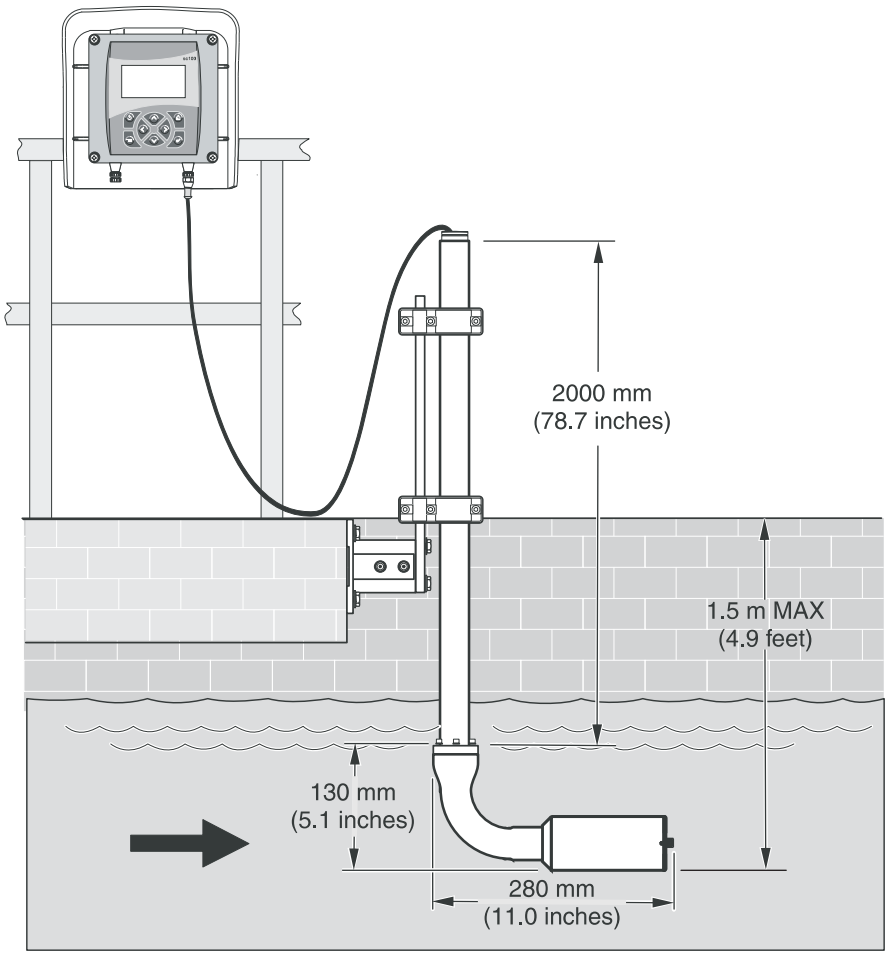
The maximum distance from the mounting surface to the sensor without the use of an extension tube is 1.5 m (4.9 ft). When that distance exceeds 1.5 m (4.9 ft), one of the following extension tubes is required and can be ordered separately:

- 1.0 m (3.28 ft) extension pipe LZY413
- 1.8 m (5.90 ft) extension pipe LZY414

To ensure a suitable measuring position, install the probe to the following conditions:

- The probe optical window must have a ground clearance of at least 30 cm (11.8 in.).
- Install the probe with the optical window facing (downstream) in the direction of the flow to minimize the risk of fouling.
- Avoid installation sites where air bubbles are inconsistent. If this not possible, try moving the probe slightly or adjusting its alignment to minimize the bubble effect.
- Protect the probe against the oncoming flow of large objects, such as branches or ice and against flow surges.
- Avoid installing the probe with the optical window facing into direct light or facing a highly-reflective surface.

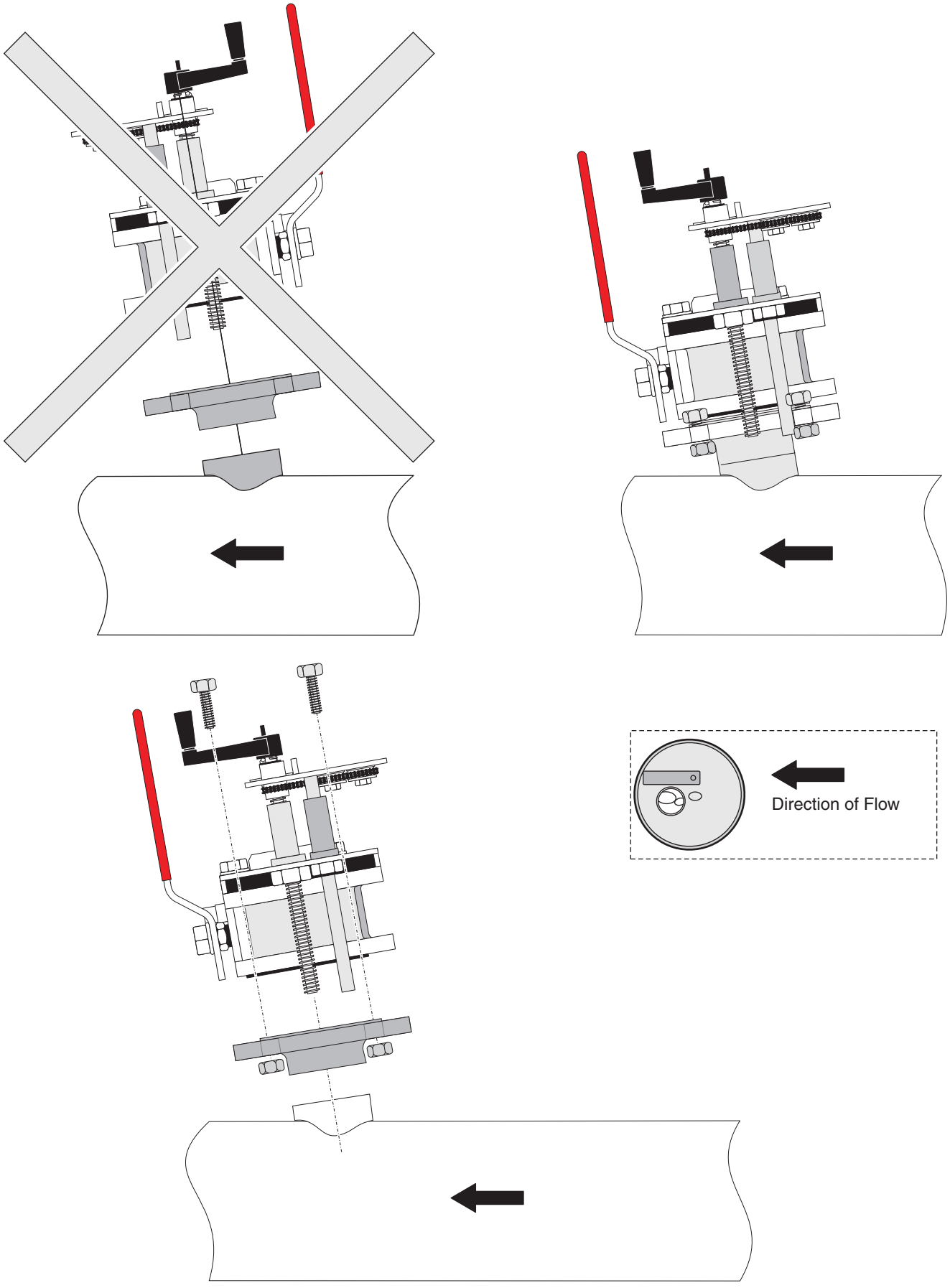
Figure 4 Sensor Installation Overview



3.3 Pipe Installation

- Install the sensor in an up-flow pipe section for best results. Do not mount the sensor in a down-flow pipe section.
- Mounting in a horizontal pipe section is acceptable if the sensor is fully immersed at all times. Usually, mounting 90 degrees from the top of the pipe guarantees full immersion. Do not mount on the top or bottom of a horizontal pipe section.
- Install the sensor in a pipe that is equal to or greater than 4 inches in diameter.
- Install the sensor at least 1.5 m (5 ft.) or three times the pipe diameter (whichever is greater) downstream of pumps, valves, or pipe elbows.
- Install the sensor on the discharge side of a pump, if possible, with a dilution or flush valve installed on the suction side of the pump.
- If the sensor is to be used to measure sludge with significant amounts of debris, install it after a sludge grinding pump or after a pump with a grinding/comminuting unit in front of it.
- Install the sensor within 7.8 m (25 ft.) of the controller with the standard probe cable. Optional cable extensions can be added for a maximum combined distance of 100 meters (330 ft.).
- If the flange cannot be welded to the pipe due to incompatibility of materials between the stud and the pipe, it is recommended that a stainless steel pipe section be fabricated. Weld the flange onto the stainless steel pipe section and attach the stainless steel section as a segment of the process pipe.

Figure 5 Proper Positioning for Insertion into Pipe



3.4 Connecting sensor cable

CAUTION
Always lay cables and hoses so they do not pose a trip hazard and are not bent.

1. Unscrew the protective cap on the controller socket and retain it.
2. Pay attention to the guide in the plug and push the plug into the socket.
3. Tighten the nuts.

Connector cables are available in various lengths (refer to Section 7 Replacement Parts and Accessories on page 23). Maximum overall cable length: 50 m (165 ft).

Figure 6 Connection of the sensor plug to the controller

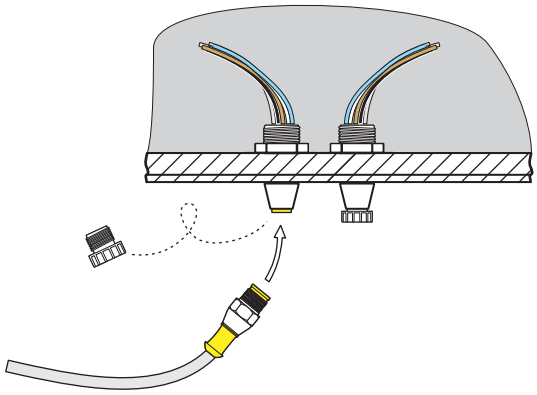
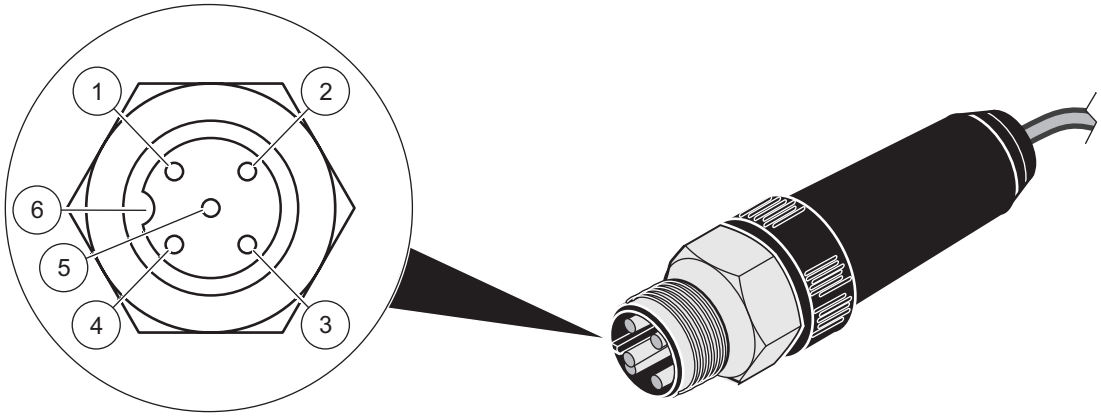


Figure 7 Sensor connector pin assignment



Number	Description	Cable colour (Standard-Cable)
1	+12 VDC	brown
2	Ground	black
3	Data (+)	blue
4	Data (–)	white
5	Screen	Screen (grey)
6	Notch	–

Section 4 Operations

4.1 Use of an sc controller

Before using the sensor in combination with an sc controller, refer to the controller user manual for navigation information.

4.2 Sensor Setup

When a sensor is initially installed, the serial number of the sensor will be displayed as the sensor name. To change the sensor name refer to the following instructions:

1. Select Main Menu.
2. From the Main Menu, select SENSOR SETUP and confirm.
3. Highlight the appropriate sensor if more than one sensor is attached and confirm.
4. Select CONFIGURE and confirm.
5. Select EDIT NAME and edit the name. Confirm or cancel to return to the Sensor Setup menu.

4.3 Sensor Data Logging

A data memory and event memory per sensor are available via the sc controller. While measured data are saved in the data memory at stipulated intervals, the event memory collects numerous events such as configuration changes, alarms and warning conditions. Both the data memory and the event memory can be read out in CSV format. For information on how you can download the data, please see the controller manual.

4.4 Sensor Diagnostics Menu for pH and ORP

SELECT SENSOR (if more than one sensor is attached)

STATUS	
ERROR LIST	See section 6.1 on page 21.
WARNING LIST	See section 6.2 on page 21..

4.5 Sensor Setup Menu

SELECT SENSOR (if more than one sensor is attached)

WIPE	
Initiates a wiping action on the sensor window.	
CALIBRATE	
SET OUTMODE	Select the behavior of the outputs during calibration for zero point setting (Hold, Active, Transfer, Selection). Hold maintains the last reading prior to going into the menu. Active transmits the current level readings, corrected with previous calibration data until new data is entered. Set Transfer transmits the value designated during the system setup
SENSOR MEASURE	Displays the current, uncorrected measured value.
CONFIGURE	Select the calibration type and follow the calibration steps for 2 point, 3 point, 4 point, and 5 point calibration.
FACTOR/2 POINTS/ 3 POINTS/4 POINTS/ 5 POINTS	Display depends on the selection in configuration.
SET CAL DEFAULT	Return the instrument to the default calibration settings.

4.5 Sensor Setup Menu (continued)

CONFIGURE		
	EDIT NAME	Enter up to a 10-digit name in any combination of symbols and alpha or numeric characters.
	SET PARAMETER	This setting configures the Solitax to measure turbidity or suspended solids. The Solitax cannot simultaneously measure both. Choose “TRB” for turbidity measurements, or “TS” for suspended solids measurement. This selection determines which units may be selected in the “Meas Units” menu.
	MEAS UNITS	Choose from the displayed units. TRB (FNU, EBC, TE/F, NTU); TS (mg/L, g/L, ppm, %) Default: FNU If TRB was selected in set parameter, select “NTU” (commonly used in the U.S.), FNU, EBC, or TE/F. If TS was selected, choose mg/L, g/L, ppm, or %. Press enter to choose the selection. If the units selected result in a reading that exceeds 4 digits, the display will only show dashes. For example, if mg/L were selected, and the measurement was 10,500 mg/L, the display will show dashes until the reading drops to 9999 or lower.
	CLEAN INTERVAL	Select the cleaning interval (1, 5, 15 or 30 minutes; 1, 4, or 12 hours; 1, 3, 7 days) Default: 12 hours This is the interval between wiper cleaning of the sensor window. It is recommended to start with a setting of 30 minutes. This time may be adjusted according to the application. If readings continue to be accurate, try a longer interval. If not, shorten the interval.
	RESPONSE TIME	This is a damping function. While the Solitax takes readings continually, it will average them together over the period of the response time. Once the response time has elapsed, the displayed reading, 4-20 outputs, and alarm status are updated. (0 to 300 seconds) Default: 3 seconds
	LOGGER INTERVAL	This is the datalog interval, with options from 1–15 minutes. Values logged are the average of the all readings during the previous logging interval. The controller will hold approximately 360 days of readings for one sensor at 15 minute intervals, or 24 days at 1 minute intervals (and proportional in between). Default:10 minutes
	SET DEFAULTS	Resets all user-editable options to the factory-defaults.
TEST/MAIN		
	PROBE INFO	Displays the sensor type, entered name of the sensor (Default: sensor serial number), the sensor serial number, the software version number, and the sensor driver version number.
	PROFILE	Select Profile Counter to display the number of wipes made (from 20000 backwards). Select Reset Config to manually reset the profile counter.
	COUNTER	Shows the number of hours or cycles left for operating hours, test/maint, gasket, and the motor.
	TEST/MAIN	WIPE—Initiates the wiping action of the wiper.
		SIGNALS—displays the signal outputs for the device.
		OUTPUT MODE—Select the behavior of the instrument outputs (Hold, Active, Transfer, Selection)
		DEFAULT SETUP—Resets all user-editable options to the factory defaults.

4.6 Calibration

There are two calibration techniques; depending on whether turbidity or suspended solid is required (refer to section 4.6.2 or section 4.6.3 on page 18). Before calibration, determine the behavior of the 4–20 outputs and alarm relays while the user is in the CALIBRATE menu (refer to section 4.6.1).

4.6.1 Setting the Outmode

1. From the Main Menu, select SENSOR SETUP and press confirm.
2. Select the appropriate sensor if more than one is attached and confirm.
3. Select CALIBRATE and press confirm.
4. Select SET OUTMODE. Select the available Out Mode (Active, Hold, Transfer) and confirm.

4.6.2 Calibration for Turbidity

Turbidity calibration requires the use of a Turbidity Standard Solution. The manufacturer recommends the 800 NTU Turbidity Standard Solution (part of the calibration kit No. 57330-00). A zero-point calibration using deionized water is also recommended.

1. From the Main Menu, select SENSOR SETUP and press confirm.
2. Select the appropriate sensor if more than one is attached and confirm.
3. Select CALIBRATE and press confirm.
4. Select SENSOR MEASURE and confirm.
5. Place the sensor in the calibration cylinder with deionized water, mounting it with the supplied clamp. The tip of the probe should be approximately 1-inch below the surface of the water. Record the reading from the sensor measure display.
6. Select OFFSET. Multiply the reading obtained in step 5 and enter the value.
7. Select SENSOR MEASURE.
8. Rinse the outside of the StablCal® 800 NTU standard with water to remove any dust or debris adhering to the surface of the bottle. Gently invert both StablCal standard bottles a minimum of 50 times. Remove the lid and seal from each bottle. Slowly (to avoid creating bubbles) pour the contents of the bottles into the calibration cylinder. Immediately place the tip of the probe into the positioning bracket in the calibration cylinder. The tip of the probe should be approximately 1-inch below the surface standard. Allow the reading to become stable on the SENSOR MEASURE screen. Record the value (measured value). Calculate the factor. Refer to section 4.6.2.1.
9. Select FACTOR to display the corrected measurement.

4.6.2.1 Calculating the Factor

$$\text{New Factor} = \frac{\text{800 NTU Standard}}{\text{measured value}}$$

For example, if a sample measures 750 NTU using the sensor and the standard is 800 NTU, the new factor would be calculated as follows:

$$\text{New Factor} = \frac{\text{800 NTU}}{\text{750 NTU}} = 1.07$$

4.6.3 Calibration for Suspended Solids

Suspended solids calibration requires calibration to the actual sample. This optimizes the compensation for the particle size and shape typical at a measuring site. It is best performed by mounting the sensor as usual for normal measurement, and then grab samples collected and evaluated by laboratory methods. While a single point calibration is usually sufficient to provide accuracy, the SOLITAX does offer the ability to calibrate with up to 5 calibration points.

1. From the Main Menu, select SENSOR SETUP and press confirm.
2. Select the appropriate sensor if more than one is attached and confirm.
3. Select CALIBRATE and press confirm.
4. Select CONFIGURE and confirm.
5. Select the number of points desired for calibration (the unit with linearly interpolate values between calibration points). Select Factor for a single point calibration.
6. Mount the sensor as is during normal operation. Alternatively, place the sensor in the calibration cylinder (or a container with dark, non-reflective walls) 2 inches of clearance from the probe face with the probe face submerged by 1 inch or more.
7. Select SENSOR MEASURE and record the reading.
8. Immediately take a grab sample. Determine the total suspended solids using a gravimetric method such as Method 2540 D in *Standards Methods for the Examination of Water and WasteWater.*
9. Calculate the new factor. Refer to section 4.6.3.1 for single point (Factor) calibration. Refer section 4.6.3.2 on page 18 for multiple point calibrations.
10. Select FACTOR and press confirm. The corrected measurement should be displayed.

4.6.3.1 For Single Point (Factor) Calibration

Calculate the new factor:

$$\text{New Factor} = \frac{\text{Determined gravimetric value}}{\text{measured value}}$$

For example, if a sample measures 2.3 g/L using the SS sensor and the gravimetric value was 2.0 g/L, the new factor would be calculated as follows:

$$\text{New Factor} = \frac{2.0\ \text{g/L}}{2.3\ \text{g/L}} = 0.87$$

4.6.3.2 Multi-point Calibration

1. Repeat steps 6–8 in section 4.6.3 on page 18 at different times to obtain different measurements.
2. From the CONFIGURE menu, select the appropriate calibration point menu.
3. Enter the pairs of values for each reading, the target value being the laboratory determined value, and the actual value being the reading that the SOLITAX produced in step 5. The pairs should be entered in order from lowest values to highest.

Section 5 Maintenance

DANGER
Only qualified personnel should conduct the tasks described in this section of the manual.

Proper maintenance of the measuring windows in the sensor is critical for accurate measurements. The measuring windows should be checked monthly for soiling and the wiper checked for wear.

Important Note: *The seals must be replaced every 2 years by the Service Department. If the seals are not changed regularly, water may enter the probe head and seriously damage the instrument.*

5.1 Maintenance Schedule

Maintenance Task	**Duration**
Visual inspection	monthly
Check calibration	monthly *(depending on the ambient conditions)*
Inspection	six months (counter)
Seal change	every 2 years (counter)
Change wiper and reset counter	as per counter (20000 cycles)

5.2 Cleaning the Sensor Measuring Windows

CAUTION
Always were
- ***Safety glasses,***
- ***Gloves and***
- ***Overal***

handling hydrochloric acid and observe safety regulations.

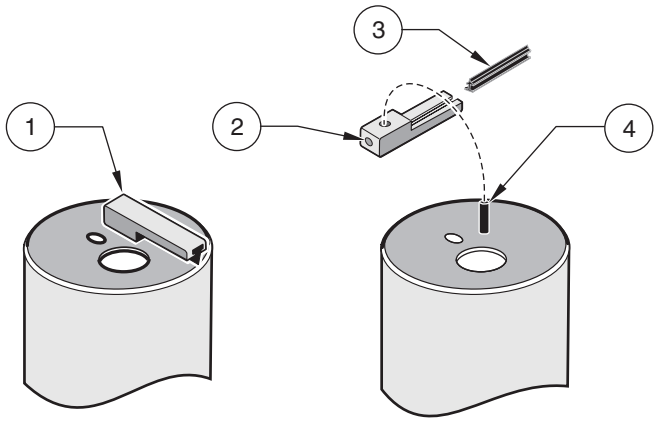
The measuring windows are made of quartz glass. If necessary, they can be cleaned with a cleaning agent and a cloth.

5.3 Replacing the Wiper

The life of the wiper is dependent on the number of cleaning actions performed and the type of deposits to be removed. The life of the wiper varies. The wipers supplied with the instrument should last for approximately one year.

1. From the Main Menu, select SENSOR SETUP and press confirm.
2. Select the appropriate sensor if more than one is attached and confirm.
3. Select TEST/MAINT and press confirm.
4. Select PROFILE and confirm. Change the wiper, see section 5.3 on page 20.
5. Select RESET CONFIG and confirm.
6. Select MAN. RESET ARE YOU SURE? and confirm.

Figure 8 Wiper Replacement



1. Wiper arm	**3.** Wiper
2. M4 hex socket head bolt	**4.** Wiper axle

Section 6 Troubleshooting

6.1 Error Codes

In the case of an error, the indication of the measured value flashes on the display and all the contacts and current outputs allocated to this sensor are placed on hold. The following conditions will result in flashing measured values:

- Data transmission between controller and sensor interrupted

On the Main menu open the SENSOR DIAG menu using **ENTER** and determine the cause of the fault.

Table 1 Error Messages

Error Displayed	Cause	Solution
POS. UNKNOWN	Wiper position unknown	Open the TEST/MAINT menu and trigger the ”WIPE” function, if the problem persists contact the manufacturer's customer service
LED FAULTY	Faulty LED	Contact customer service
MOIST	Moisture value > 10	Remove the sensor immediately and store in a dry place, contact customer service
CAL. DATA	Factory calibration data lost	Contact customer service

6.2 Warnings

A warning results in a flashing warning icon on the right of the display, all menus, contacts and outputs remain unaffected and continue to work normally. On the Main menu open the SENSOR DIAG menu using **ENTER** and determine the cause of the warning.

A warning may be used to trigger a relay and users can set warning levels to define the severity of the warning.

Table 2 Warnings

Warning Displayed	Cause	Solution
WARNING	Cause	Action
REPLACE WIPER	Counter elapsed	Replace wiper, reset counter
TEST/MAINT	Counter elapsed	Contact customer service
GASKET	Counter elapsed	Contact customer service

Section 7 Replacement Parts and Accessories

7.1 Immersion Sensors[1]

Description	Catalog Number
Turbidity, t-line sc, PVC with wiper (0.001 to 4000 NTU)	LXV423.99.10000
Turbidity, t-line sc, PVC without wiper (0.001 to 4000 NTU)	LXV423.99.12000
Turbidity and Suspended Solids, ts-line sc, PVC with wiper (0.001 to 4000 NTU, 0.001 mg/L to 50 g/L)	LXV423.99.10100
Turbidity and Suspended Solids, ts-line sc, PVC without wiper (0.001 to 4000 NTU, 0.001 mg/L to 50 g/L)	LXV423.99.12100
Turbidity and Suspended Solids, ts-line sc, stainless steel with wiper (0.001 to 4000 NTU, 0.001 mg/L to 50 g/L)	LXV423.99.00100
Turbidity and Suspended Solids, ts-line sc, stainless steel without wiper (0.001 to 4000 NTU, 0.001 mg/L to 50 g/L)	LXV423.99.02100
Turbidity and Suspended Solids, hs-line sc, PVC with wiper (0.001 to 4000 NTU, 0.001 mg/L to 500 g/L)	LXV423.99.10200
Turbidity and Suspended Solids, hs-line sc, PVC without wiper (0.001 to 4000 NTU, 0.001 mg/L to 500 g/L)	LXV423.99.12200
Turbidity and Suspended Solids, hs-line sc, stainless steel with wiper (0.001 to 4000 NTU, 0.001 mg/L to 500 g/L)	LXV423.99.00200
Turbidity and Suspended Solids, hs-line sc, stainless steel without wiper (0.001 to 4000 NTU, 0.001 mg/L to 500 g/L)	LXV423.99.02200

[1] All sensors come with the sensor, replacement wipers, and manual.

7.2 Insertion Sensors[1]

Description	Catalog Number
Turbidity and Suspended Solids, inline sc, stainless steel with wiper (0.001 to 4000 NTU, 0.001 mg/L to 50 g/L)	LXV424.99.00100
Turbidity and Suspended Solids, inline sc, stainless steel without wiper (0.001 to 4000 NTU, 0.001 mg/L to 50 g/L)	LXV424.99.02100
Turbidity and Suspended Solids, highline sc, stainless steel with wiper (0.001 to 4000 NTU, 0.001 mg/L to 500 g/L)	LXV424.99.00200
Turbidity and Suspended Solids, highline sc, stainless steel without wiper (0.001 to 4000 NTU, 0.001 mg/L to 500 g/L)	LXV424.99.02200

[1] All sensors come with the sensor, replacement wipers, and manual.

7.3 Replacement Parts

Description	Catalog Number
Set of wipers (for 5 changes) made of silicone for normal applications	LZX050
Set of wipers (for 5 changes) made of Viton for e. g. media containing oil	LZX578
SOLITAX sc User Manual, english	DOC023.54.03232
Extension cable, 5 m (16.4 ft)	LZX848
Extension cable, 10 m (33 ft)	LZX849
Extension cable, 15 m (50 ft)	LZX850
Extension cable, 20 m (65 ft)	LZX851
Extension cable, 30 m (100 ft)	LZX852
Extension cable, 50 m (165 ft)	LZX853

7.3 Replacement Parts (continued)

Description	Catalog Number
Extension pipe, 1,0 m (3.28 ft)	LZY413
Extension pipe, 1,8 m (5.90 ft)	LZY414
Installation kit, fixed-point (for t-line, ts-line, and hs-line immersion sensors)	LZX414.00.10000
Consisting of:	
Base	ATS010
Mounting plate	HPL061
Holding clamp (2×)	LZX200
Assembly pipe 2 m	BRO075
HS small parts set	LZX416
Installation kit with straight adapter	LZX414.00.20000
Kit, screws and seals for sensor adapters	LZX417
Miscellaneous hardware for probe installation kit	LZX416
Second fastening point, includes: bracket, sensor pipe stand, sensor pipe stand bracket, screws, and grommet)	LZX456
Sensor fixed-point mounting kit: Sensor pipe bracket	ATS010
Sensor pipe stand bracket	LZX200
L-bracket	ATS011
Adapter, Sensor 90° elbow	AHA034
Ball valve for insertion probes without adapting flange	LZX337
Welded flange made of C-steel for the pipe installation fitting	LZX703
Welded flange made of stainless steel for pipe installation safety fitting	LZX660

Section 8 Contact Information

HACH Company
World Headquarters
P.O. Box 389
Loveland, Colorado
80539-0389 U.S.A.
Tel (800) 227-HACH
(800) -227-4224
(U.S.A. only)
Fax (970) 669-2932
orders@hach.com
www.hach.com

Repair Service in the United States:
HACH Company
Ames Service
100 Dayton Avenue
Ames, Iowa 50010
Tel (800) 227-4224
(U.S.A. only)
Fax (515) 232-3835

Repair Service in Canada:
Hach Sales & Service
Canada Ltd.
1313 Border Street, Unit 34
Winnipeg, Manitoba
R3H 0X4
Tel (800) 665-7635
(Canada only)
Tel (204) 632-5598
Fax (204) 694-5134
canada@hach.com

Repair Service in Latin America, the Caribbean, the Far East, Indian Subcontinent, Africa, Europe, or the Middle East:
Hach Company World Headquarters,
P.O. Box 389
Loveland, Colorado,
80539-0389 U.S.A.
Tel +001 (970) 669-3050
Fax +001 (970) 669-2932
intl@hach.com

HACH LANGE GMBH
Willstätterstraße 11
D-40549 Düsseldorf
Tel. +49 (0)2 11 52 88-320
Fax +49 (0)2 11 52 88-210
info@hach-lange.de
www.hach-lange.de

HACH LANGE LTD
Pacific Way
Salford
GB-Manchester, M50 1DL
Tel. +44 (0)161 872 14 87
Fax +44 (0)161 848 73 24
info@hach-lange.co.uk
www.hach-lange.co.uk

HACH LANGE LTD
Unit 1, Chestnut Road
Western Industrial Estate
IRL-Dublin 12
Tel. +353(0)1 46 02 5 22
Fax +353(0)1 4 50 93 37
info@hach-lange.ie
www.hach-lange.ie

HACH LANGE GMBH
Hütteldorferstr. 299/Top 6
A-1140 Wien
Tel. +43 (0)1 9 12 16 92
Fax +43 (0)1 9 12 16 92-99
info@hach-lange.at
www.hach-lange.at

HACH LANGE
Rorschacherstrasse 30 a
CH-9424 Rheineck
Tel. +41 (0)71 886 91 11
Fax +41 (0)71 886 91 66
info@hach-lange.ch
www.hach-lange.ch

HACH LANGE FRANCE S.A.S.
8, mail Barthélémy Thimonnier
Lognes
F-77437 Marne-La-Vallée
cedex 2
Tél. +33 (0)8 20 20 14 14
Fax +33 (0)1 69 67 34 99
info@hach-lange.fr
www.hach-lange.fr

HACH LANGE SA
Motstraat 54
B-2800 Mechelen
Tél. +32 (0)15 42 35 00
Fax +32 (0)15 41 61 20
info@hach-lange.be
www.hach-lange.be

DR. LANGE NEDERLAND B.V.
Laan van Westroijen 2a
NL-4003 AZ Tiel
Tel. +31(0)344 63 11 30
Fax +31(0)344 63 11 50
info@hach-lange.nl
www.hach-lange.nl

HACH LANGE APS
Åkandevej 21
DK-2700 Brønshøj
Tel. +45 36 77 29 11
Fax +45 36 77 49 11
info@hach-lange.dk
www.hach-lange.dk

HACH LANGE AB
Vinthundsvägen 159A
SE-128 62 Sköndal
Tel. +46 (0)8 7 98 05 00
Fax +46 (0)8 7 98 05 30
info@hach-lange.se
www.hach-lange.se

HACH LANGE S.R.L.
Via Riccione, 14
I-20156 Milano
Tel. +39 02 39 23 14-1
Fax +39 02 39 23 14-39
info@hach-lange.it
www.hach-lange.it

HACH LANGE S.L.U.
Edif. Arteaga Centrum
C/Larrauri, 1C- 2ª Pl.
E-48160 Derio/Vizcaya
Tel. +34 94 657 33 88
Fax +34 94 657 33 97
info@hach-lange.es
www.hach-lange.es

HACH LANGE LDA
Av. do Forte nº8
Fracção M
P-2790-072 Carnaxide
Tel. +351 214 253 420
Fax +351 214 253 429
info@hach-lange.pt
www.hach-lange.pt

HACH LANGE SP.ZO.O.
ul. Opolska 143 a
PL-52-013 Wrocław
Tel. +48 (0)71 342 10-83
Fax +48 (0)71 342 10-79
info@hach-lange.pl
www.hach-lange.pl

HACH LANGE S.R.O.
Lešanská 2a/1176
CZ-141 00 Praha 4
Tel. +420 272 12 45 45
Fax +420 272 12 45 46
info@hach-lange.cz
www.hach-lange.cz

HACH LANGE S.R.O.
Roľnícka 21
SK-831 07 Bratislava –
Vajnory
Tel. +421 (0)2 4820 9091
Fax +421 (0)2 4820 9093
info@hach-lange.sk
www.hach-lange.sk

HACH LANGE KFT.
Vöröskereszt utca. 8-10.
H-1222 Budapest XXII. ker.
Tel. +36 (06)1 225 7783
Fax +36 (06)1 225 7784
info@hach-lange.hu
www.hach-lange.hu

HACH LANGE S.R.L.
Str. Căminului nr. 3
Sector 2
RO-021741 Bucureşti
Tel. +40 (0) 21 205 30 03
Fax +40 (0) 21 205 30 17
info@hach-lange.ro
www.hach-lange.ro

HACH LANGE
8, Kr. Sarafov str.
BG-1164 Sofia
Tel. +359 (0)2 963 44 54
Fax +359 (0)2 866 15 26
info@hach-lange.bg
www.hach-lange.bg

HACH LANGE SU ANALİZ SİSTEMLERİ LTD.ŞTİ.
Hilal Mah. 75. Sokak
Arman Plaza No: 9/A
TR-06550 Çankaya/ANKARA
Tel. +90 (0)312 440 98 98
Fax +90 (0)312 442 11 01
bilgi@hach-lange.com.tr
www.hach-lange.com.tr

HACH LANGE D.O.O.
Fajfarjeva 15
SI-1230 Domžale
Tel. +386 (0)59 051 000
Fax +386 (0)59 051 010
info@hach-lange.si
www.hach-lange.si

HACH LANGE E.Π.E.
Αυλίδος 27
GR-115 27 Αθήνα
Τηλ. +30 210 7777038
Fax +30 210 7777976
info@hach-lange.gr
www.hach-lange.gr

HACH LANGE E.P.E.
27, Avlidos str
GR-115 27 Athens
Tel. +30 210 7777038
Fax +30 210 7777976
info@hach-lange.gr
www.hach-lange.gr

HACH LANGE D.O.O.
Ivana Severa bb
42 000 Varaždin
Tel. +385 (0) 42 305 086
Fax +385 (0) 42 305 087
info@hach-lange.hr
www.hach-lange.hr

HACH LANGE MAROC SARLAU
Villa 14 – Rue 2 Casa Plaisance
Quartier Racine Extension
MA-Casablanca 20000
Tél. +212 (0)522 97 95 75
Fax +212 (0)522 36 89 34
info-maroc@hach-lange.com
www.hach-lange.ma

Section 9 Limited warranty

Hach Company warrants its products to the original purchaser against any defects that are due to faulty material or workmanship for a period of one year from date of shipment unless otherwise noted in the product manual.

In the event that a defect is discovered during the warranty period, Hach Company agrees that, at its option, it will repair or replace the defective product or refund the purchase price excluding original shipping and handling charges. Any product repaired or replaced under this warranty will be warranted only for the remainder of the original product warranty period.

This warranty does not apply to consumable products such as chemical reagents; or consumable components of a product, such as, but not limited to, lamps and tubing.

Contact Hach Company or your distributor to initiate warranty support. Products may not be returned without authorization from Hach Company.

Limitations

This warranty does not cover:

- Damage caused by acts of God, natural disaster, labor unrest, acts of war (declared or undeclared), terrorism, civil strife or acts of any governmental jurisdiction
- Damage caused by misuse, neglect, accident or improper application or installation
- Damage caused by any repair or attempted repair not authorized by Hach Company
- Any product not used in accordance with the instructions furnished by Hach Company
- Freight charges to return merchandise to Hach Company
- Freight charges on expedited or express shipment of warranted parts or product
- Travel fees associated with on-site warranty repair

This warranty contains the sole express warranty made by Hach Company in connection with its products. All implied warranties, including without limitation, the warranties of merchantability and fitness for a particular purpose, are expressly disclaimed.

Some states within the United States do not allow the disclaimer of implied warranties and if this is true in your state the above limitation may not apply to you. This warranty gives you specific rights, and you may also have other rights that vary from state to state.

This warranty constitutes the final, complete, and exclusive statement of warranty terms and no person is authorized to make any other warranties or representations on behalf of Hach Company.

Limitation of Remedies

The remedies of repair, replacement or refund of purchase price as stated above are the exclusive remedies for the breach of this warranty. On the basis of strict liability or under any other legal theory, in no event shall Hach Company be liable for any incidental or consequential damages of any kind for breach of warranty or negligence.

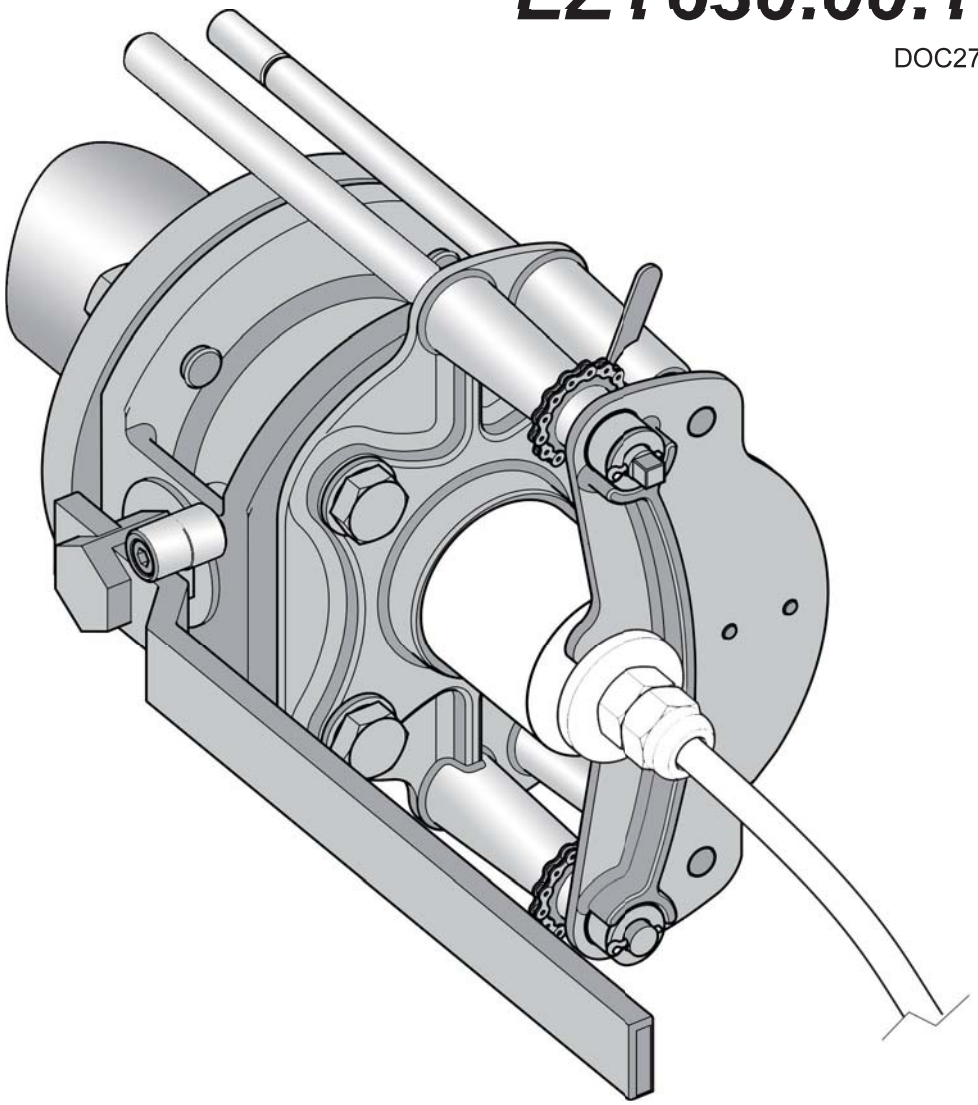
Appendix A Modbus Register Information

Table 3 Sensor Modbus Registers

Group Name	Tag Name	Register	Data Type#	Length	R/W	Description
Measurements	TurbidityFNU	40001	Float	2	R	Turbidity FNU
Measurements	TurbidityEBC	40003	Float	2	R	Turbidity EBC
Measurements	SolidsMGL	40005	Float	2	R	Solids mg/L
Measurements	SolidsGL	40007	Float	2	R	Solids g/L
Measurements	SolidsPR	40009	Float	2	R	Solids %
—	Reserved	40011	Unsigned Integer	1	R	Reserved
Base	Parameter	40012	Unsigned Integer	1	R/W	Parameter
Base	UnitTRB	40013	Unsigned Integer	1	R/W	Unit Turbidity
Base	UnitTS	40014	Unsigned Integer	1	R/W	Units Solids
Calibration	OffsetTRB	40015	Float	2	R/W	Turbdity Offset
Calibration	FactorTRB	40017	Float	2	R/W	Turbidity Factor
Calibration	FactorTS	40019	Float	2	R/W	Solids Factor
Data	Wiperstate	40021	Unsigned Integer	1	R/W	Wiper register
Setup	ResponseInterval	40022	Unsigned Integer	1	R/W	Response time
Setup	CleaningInterval	40023	Unsigned Integer	1	R/W	Wiper interval
Setup	LogInterval	40024	Unsigned Integer	1	R/W	Logger interval
Setup	Outputmodekal	40025	Unsigned Integer	1	R/W	Output when calibrate
Setup	Outputmodesrv	40026	Unsigned Integer	1	R/W	Output when service
Setup	Location	40027	String	8	R/W	Edited name
Setup	ProfilCounter	40035	Unsigned Integer	1	R/W	Profi counter
Data	SerienNummer	40036	String	6	R	Serial number
Calibration	DateUserCal	40042	Date	2	R	Date of manufacturing calibration
Calibration	DateUserCalTURB	40044	Date	2	R	Date of calibration turbidity
Calibration	DateUserCalSOLID	40046	Date	2	R	Date of calibration solid
Data	VersionAppl	40048	Float	2	R	Version application
Data	VersionBoot	40050	Float	2	R	Version Bootlader
Data	VersionStruct	40052	Unsigned Integer	1	R	Version structure probedriver
Data	VersionContent	40053	Unsigned Integer	1	R	Version register probedriver
Data	VersionFirmware	40054	Unsigned Integer	1	R	Version firmware probedriver
Data	FormatMinFNU	40055	Float	2	R	Minimum turbidity FNU
Data	FormatMaxFNU	40057	Float	2	R	Maximum turbidity FNU
Data	FormatMinEBC	40059	Float	2	R	Minimum turbidity EBC
Data	FormatMaxEBC	40061	Float	2	R	Maximum turbidity EBC
Data	FormatMinGL	40063	Float	2	R	Minimum solids g/L
Data	FormatMaxGL	40065	Float	2	R	Maximum solids g/L
Data	FormatMinMGL	40067	Float	2	R	Minimum solids mg/L
Data	FormatMaxMGL	40069	Float	2	R	Maximum mg/L
Data	FormatMinPR	40071	Float	2	R	Minimum solids %
Data	FormatMaxPR	40073	Float	2	R	Maximum solids %
Data	SignalsLED	40075	Unsigned Integer	1	R	Signal LED
Data	SignalsMoist	40076	Unsigned Integer	1	R	Signal moist

LZX337
LZX660
LZX661
LZY630.00.10000
LZY630.00.11000
LZY630.00.12000

DOC273.99.90204/6A



BG Преди инсталацията/монтажа на продукта, прочетете внимателно всички инструкции за инсталация и ги спазвайте по време на инсталирането. Инсталацията трябва да се извършва от квалифициран специалист в съответствие с местните разпоредби за безопасност. Погрижете се избраното място на инсталацията да гарантира безопасна инсталация и експлоатация. Продуктът е предназначен единствено за придържане/прикрепване на измервателните сензори/продукти на HACH/HACH LANGE. Всяко друго приложение може да носи риск за потребителя. Работите по поддръжката и ремонта трябва да се извършват изключително от оторизирания отдел за обслужване на клиенти. Могат да се използват само оригинални резервни части и препоръчани от производителя принадлежности. Всякакви изменения по продукта водят до анулиране на всички отговорности от страна на производителя. Неспазването на инструкциите за употреба или използването на продукта за цели, различни от тези, за които е предназначен, може да доведе до сериозно нараняване на потребителя и/или повреда на оборудването. Работата по заваряване, трябва да бъде извършвана само от квалифицирани заварчици съгласно DIN/EN 287 или от сертифицирани фирми по EN 3834-2.

CS Při instalaci/montáži produktu si pečlivě přečtěte všechny pokyny k instalaci a v průběhu instalace tyto pokyny dodržujte. Instalaci musí provádět kvalifikovaný odborník v souladu s místními bezpečnostními předpisy. Pečlivě vyberte umístění pro instalaci, které zajistí bezpečnou instalaci a provoz. Produkt je určen pouze k upevnění/přichycení měřicích snímačů/produktů HACH/HACH LANGE. Jakékoli jiné použití může znamenat riziko pro uživatele. Údržbu a opravy smí provádět výhradně autorizované oddělení zákaznických služeb. Je dovoleno používat pouze originální náhradní díly a příslušenství doporučené výrobcem. Jakékoli změny provedené na produktu způsobí neplatnost veškerých záruk. Nedodržení těchto pokynů nebo používání produktu pro jiný účel než pro který je určen může způsobit uživateli vážné zranění anebo poškodit zařízení. Potřebné svářečské práce musí být provedeny kvalifikovaným svářečem výhradně podle DIN/EN 287 nebo dodavatelem v souladu s EN 3834-2.

DA Før du installerer/monterer produktet, skal du læse alle installationsinstruktionerne grundigt og følge dem under installeringen. Installationen skal udføres af en kvalificeret ekspert i overensstemmelse med alle lokale sikkerhedsbestemmelser. Vælg sikker og betjeningsvenligt placering til installationen. Produktet er kun beregnet til at holde/fastgøre HACH/HACH LANGE-målesensorer/-produkter. Enhver anden form for brug kan medføre skadesrisiko for brugeren. Vedligeholdelse og reparation bør kun udføres af en autoriseret kundeserviceafdeling. Der må kun anvendes originale reservedele og tilbehør, der er anbefalet af producenten. Alle ændringer af produktet ophæver garantien. Hvis du ikke følger disse instruktioner eller bruger produktet til et andet formål, end det er beregnet til, kan der forekomme alvorlige personskader og/eller skader på udstyret. Svejsearbejde må kun udføres af DIN/EN 287 kvalificerede svejsere, eller EN 3834-2 certificerede firmaer.

DE Die Montageanleitung ist vor der Installation/Montage des Produktes sorgfältig und vollständig zu lesen und zu befolgen. Die Installation muss von einer Fachkraft (qualifiziertes Personal) unter Einhaltung aller lokal gültigen Sicherheitsvorschriften erfolgen. Der Montageort ist so zu wählen, dass eine sichere Installation und der sichere Betrieb gewährleistet ist. Die Verwendung des Produktes ist ausschließlich zum Halten/Befestigen von HACH/HACH LANGE Messsonden/Produkten vorgesehen. Jede andere Benutzung ist mit Risiken für den Benutzer verbunden. Wartungs- und Reparaturarbeiten sollten nur vom autorisierten Kundendienst durchgeführt werden. Es dürfen nur vom Hersteller empfohlene Originalersatz- und Zubehörteile verwendet werden. Änderungen am Produkt haben den Verlust jeglicher Haftungsansprüche zur Folge. Nichtbeachtung dieser Anweisungen oder eine andere Verwendung des Produktes kann schwerwiegende Verletzungen der Anwender oder Beschädigung am Gerät zur Folge haben. Die notwendigen Schweißarbeiten dürfen ausschließlich von entsprechend DIN/EN 287 qualifizierten Schweißern durchgeführt werden, oder von Fachfirmen entsprechend EN 3834-2.

EL Πριν από την εγκατάσταση/τοποθέτηση του προϊόντος, διαβάστε προσεκτικά και ακολουθήστε όλες τις οδηγίες εγκατάστασης κατά την εγκατάσταση. Η εγκατάσταση πρέπει να πραγματοποιηθεί από κατάλληλα εκπαιδευμένο τεχνικό και σύμφωνα με όλους τους τοπικούς κανονισμούς ασφάλειας. Επιλέξτε μια θέση τοποθέτησης που θα διασφαλίσει την ασφαλή εγκατάσταση και λειτουργία. Το προϊόν προορίζεται αποκλειστικά για τη στήριξη/σύνδεση των αισθητήρων μέτρησης/προϊόντων HACH/HACH LANGE. Οποιαδήποτε άλλη χρήση ενδέχεται να ενέχει κινδύνους για τον χρήστη. Οι εργασίες συντήρησης και επισκευής θα πρέπει να εκτελούνται αποκλειστικά από το εξουσιοδοτημένο τμήμα εξυπηρέτησης πελατών. Επιτρέπεται η χρήση μόνον των γνήσιων ανταλλακτικών και των αξεσουάρ που συνιστά ο κατασκευαστής. Οποιεσδήποτε αλλαγές στο προϊόν ακυρώνουν την ευθύνη της εταιρείας. Σε περίπτωση που δεν τηρηθούν αυτές τις οδηγίες ή χρησιμοποιηθεί το προϊόν για διαφορετικό σκοπό από αυτόν που προορίζεται, ενδέχεται να προκληθεί σοβαρός τραυματισμός στον χειριστή και/ή βλάβη στον εξοπλισμό. Οι απαιτούμενες εργασίες συγκόλλησης θα πρέπει να διεξαχθούν από εξειδικευμένο προσωπικό σύμφωνα με DIN / EN287 ή από κατασκευαστικές εταιρείες σύμφωνα με DIN 3834-2.

EN Before installing/mounting the product, read all the installation instructions carefully and follow the instructions during installation. Installation must be carried out by a qualified expert in accordance with all local safety regulations. Take care to choose an installation location that will ensure safe installation and operation. The product is intended solely for holding/attaching HACH/HACH LANGE measuring sensors/products. Any other use may involve risks for the user. Maintenance and repair work should be carried out exclusively by the authorized customer service department. Only original replacement and accessory parts recommended by the manufacturer may be used. Any changes made to the product will nullify all liability. Failure to follow these instructions or use of the product for a purpose other than that for which it was intended may result in serious injury to the user and/or damage to the equipment. The required welding work must be performed exclusively in accordance with DIN / EN 287 qualified welders, or from contractors in accordance with EN 3834-2.

ES Antes de instalar o fijar el producto, lea con atención todas las instrucciones de instalación y sígalas durante el montaje. La instalación debe llevarla a cabo un experto cualificado, de acuerdo con las normas de seguridad locales. Elija una ubicación para la instalación que garantice que ésta y el funcionamiento del producto sean seguros. El producto sólo está diseñado para sujetar o fijar sensores o productos de medición de HACH/HACH LANGE. Cualquier otro uso puede conllevar riesgos para el usuario. El trabajo de mantenimiento y reparación sólo debe llevarse a cabo por el departamento de atención al cliente autorizado. Sólo deben utilizarse las piezas de repuesto recomendadas por el fabricante. Cualquier cambio que se realice en el producto anulará toda responsabilidad. Si no se siguen estas instrucciones o si se utiliza el producto para un uso distinto del uso para el que fue diseñado, el usuario puede sufrir heridas graves y/o se puede dañar el equipo. Los trabajos de soldadura requeridos deben ser realizados exclusivamente por soldadores cualificados según DIN / EN 287, o por contratistas de acuerdo a EN 3834-2.

FI Ennen kuin asennat/kiinnität tuotteen, lue kaikki asennusohjeet huolellisesti ja noudata niitä. Tuotteen saa asentaa vain valtuutettu henkilö, ja asennuksessa on noudatettava kaikkia paikallisia turvallisuusmääräyksiä. Asenna tuote sellaiseen paikkaan, johon asentaminen on turvallista ja jossa tuote toimii oikein. Tuote on tarkoitettu ainoastaan HACH/HACH LANGE -mittausanturien/-tuotteiden ripustamiseen/kiinnittämiseen. Muunlainen käyttö voi aiheuttaa vaaratilanteita käyttäjälle. Huolto- ja korjaustyöt saa tehdä vain valtuutettu asiakaspalveluosasto. Tuotteessa saa käyttää vain valmistajan suosittelemia alkuperäisiä varaja lisäosia. Tuotteeseen tehdyt muutokset mitätöivät kaikki vastuut. Jos näitä ohjeita ei noudateta tai jos tuotetta käytetään johonkin muuhun kuin sen varsinaiseen käyttötarkoitukseen, käyttäjälle voi aiheutua vakavia vammoja ja/tai laite voi vaurioitua. Vain DIN / EN 287 mukaan hyväksytyt hitsaajat tai EN 3834-2 mukaiset urakoitsijat saavat tehdä vaaditut hitsaustyöt.

FR Avant l'installation/le montage du produit, lisez attentivement toutes les instructions d'installation et suivez-les au cours de l'installation. L'installation doit être réalisée par un expert qualifié conformément à toutes les réglementations de sécurité locales. Veillez à choisir un emplacement permettant d'assurer une installation et un fonctionnement en toute sécurité. Ce produit est uniquement destiné à maintenir/fixer des capteurs/équipements de mesure HACH LANGE. Toute autre utilisation entraînerait un risque pour l'utilisateur. Seul le service clientèle agréé est autorisé à effectuer les travaux de maintenance et de réparation. Seuls les pièces de rechange et les accessoires d'origine recommandés par le fabricant doivent être utilisés. La modification du produit annule toute responsabilité. Le non-respect de ces instructions ou l'utilisation de ce produit à des fins autres que celles auxquelles il est destiné risqueraient de gravement blesser l'utilisateur et/ou d'endommager le matériel. Le travail de soudure requis doit être réalisé exclusivement par des soudeurs qualifiés en conformité avec DIN / EN 287, ou par prestataires conformément à EN 3834-2.

HR Prije instalacije/postavljanja uređaja, pažljivo pročitajte sve upute za montažu i pratite ih tijekom postupka instalacije. Instalaciju mora provesti kvalificirani stručnjak u skladu s lokalnim sigurnosnim propisima. Brižljivo odaberite mjesto instalacije na kojem će se postavljanje uređaja i njegovo korištenje odvijati u sigurnim uvjetima. Uređaj je namijenjen isključivo za držanje/pričvršćivanje HACH/HACH LANGE mjernih senzora/uređaja. Upotreba uređaja u druge svrhe može predstavljati rizik za korisnika. Održavanje i popravke smije provoditi isključivo ovlašteni servisni odjel. Mogu se upotrebljavati samo originalni rezervni i dodatni dijelovi koje je preporučio proizvođač. Bilo kakve izmjene izvršene na uređaju poništit će njegovu pouzdanost. Nepoštivanje ovih uputa ili upotreba uređaja za svrhe za koje nije namijenjen mogu dovesti do ozbiljnih ozljeda osoba koje se njime koriste i/ili štete na opremi. Potreban posao za zavarivanje mora biti izveden prema DIN / EN 287 od strane kvalificiranih varioca ili izvođača radova prema EN 3834-2.

HU A termék üzembe helyezése/rögzítése előtt tekintse át a vonatkozó utasításokat, és tartsa is be azokat. Az üzembe helyezést kizárólag szakember végezheti, a hatályos biztonsági előírásoknak megfelelően. A telepítéshez biztonságos üzemet szavatoló helyet válasszon. A termék kizárólag HACH/HACH LANGE mérőberendezések és készülékek rögzítésére szolgál. Az ettől eltérő bármilyen használat kockázattal jár. A karbantartást és egyéb javításokat kizárólag az arra feljogosított ügyfélszolgálati részleg végezheti el. Csak a gyártó által ajánlott cserealkatrészek használhatóak. A terméken végzett bármilyen módosítás a felelősség kizárását vonja maga után. Az utasítások be nem tartása, a termék megadott felhasználási területtől eltérő célra való alkalmazása a kezelő súlyos sérülését és/vagy a berendezés károsodását okozhatja. A szükséges hegesztési munkákat csak DIN/EN 287 bizonyítvánnyal rendelkező hegesztő szakember, vagy EN 3834-2 minősítéssel rendelkező szakcég végezheti.

IT Prima di installare/montare il prodotto, leggere le istruzioni sull'installazione e attenersi scrupolosamente ad esse durante l'installazione. L'installazione deve essere eseguita da personale qualificato in base alle norme di sicurezza locali. Scegliere con cura il punto di installazione per un'installazione corretta e un funzionamento sicuro. Il prodotto è adatto esclusivamente per il sostegno/collegamento di prodotti/sensori di misura HACH/HACH LANGE. Qualsiasi altro utilizzo può provocare lesioni all'utente. La manutenzione e gli interventi di riparazione devono essere eseguiti esclusivamente dal reparto assistenza clienti. Il produttore consiglia di sostituire gli accessori solo con ricambi originali. Qualsiasi modifica apportata al prodotto prevede l'esclusione da qualsiasi responsabilità. La mancata osservanza della procedura di installazione o l'utilizzo inappropriato del prodotto possono provocare serie lesioni all'utente e/o danni all'apparecchiatura. Il lavoro di saldatura richiesto deve essere effettuato esclusivamente in accordo alla direttiva DIN / EN 287 da saldatori qualificati o da costruttori in accordo a EN 3834-2.

JA 製品を取り付ける前にすべての設置手順をよく読み、手順に従って設置してください。 設置は地域の安全基準に従い、資格のある担当者が行ってください。 設置場所は、安全に取り付けて操作できる場所を選んでください。 本製品は、HACH/HACH LANGE 測定センサー/製品の保持および接続専用です。 その他の用途には、ユーザーの責任において使用してください。 メンテナンスおよび修理は、認定されたカスタマー・サービス部門のみが実施できます。 交換部品および付属品には、メーカー推奨の純正品のみを使用してください。 製品を改変した場合、保証は無効になります。 手順に従わなかった場合、または製品を用途外に使用した場合は、重傷を負ったり、装置が破損することがあります。 ウェルディングはDIN/EN287に基づいて認定された作業者あるいはEN3834-2に基づく受託業者が実施する。

KO 본 제품을 설치하거나 장착하기 전에 모든 설치 지침을 충분히 검토하고 설치 시 반드시 해당 지침을 따르십시오. 설치는 숙련된 기술자가 지역의 모든 관련 안전 규정을 준수하여 수행해야 합니다. 설치 및 작동 시 안전한 장소를 신중하게 고르십시오. 본 제품은 HACH/HACH LANGE 측정 센서 또는 측정 제품을 지지하거나 연결하는 용도로만 사용됩니다. 그 외 다른 용도로 사용 시 작업자가 위험할 수 있습니다. 유지 관리 및 보수 작업은 공인된 고객 서비스 부서에서 전적으로 담당해야 합니다. 제조사가 승인한 교체용 부품 및 주변 장치만 사용 가능합니다. 제품 변경으로 인한 책임은 지지 않습니다. 이러한 지침에 어긋나거나 원래 제품의 용도와 다른 목적으로 사용할 경우 작업자에게 심각한 부상이 일어나거나 장비가 손상될 수 있습니다. 용접 작업이 필요한 경우에는 반드시 DIN/EN 287 자격을 가진 용접공이나 EN3834-2에 상응한 사람에 의해서 반드시 수행되어져야 합니다.

NL Lees vóór montage van het product alle montage-instructies grondig door en volg de instructies tijdens de montage op. Montage dient te worden uitgevoerd door een gekwalificeerde persoon en in overeenstemming met alle plaatselijke veiligheidsvoorschriften. Kies een montagelocatie die een veilige montage en werking garandeert. Het product is uitsluitend bedoeld voor opname/bevestiging van meetsensoren/-producten van HACH/HACH LANGE. Elk ander gebruik kan gevaren voor de gebruiker met zich meebrengen. Onderhoud en reparatie mogen uitsluitend worden uitgevoerd door de geautoriseerde afdeling klantenservice. Er mogen alleen originele, door de fabrikant aanbevolen reservedelen en accessoires worden gebruikt. Bij elke aanpassing van het product vervalt de aansprakelijkheid. Als u deze instructies niet opvolgt of als u het product voor een ander doel gebruikt dan waarvoor het is bedoeld, kan dit leiden tot ernstig letsel van de gebruiker en/of beschadiging van de apparatuur. Het benodigde laswerk mag uitsluitend uitgevoerd worden door DIN/EN287 gekwalificeerde lassers, of door EN3834-2 gecertificeerde installateurs.

PL Przed zainstalowaniem/zamontowaniem produktu, uważnie przeczytać wszystkie instrukcje i postępować zgodnie z ich zaleceniami podczas instalacji. Instalacja powinna zostać wykonana przez specjalistę o odpowiednich kwalifikacjach, zgodnie ze wszystkimi obowiązującymi lokalnie przepisami bezpieczeństwa. Wybrać takie miejsce instalacji, które zapewni bezpieczeństwo podczas instalacji i użytkowania. Produkt jest przeznaczony wyłącznie do zamocowania/zawieszenia czujników/mierników firmy HACH/HACH LANGE. Jakiekolwiek inne zastosowanie niesie ze sobą ryzyko dla użytkownika. Konserwacje i naprawy powinny być przeprowadzane wyłącznie przez upoważniony personel działu serwisowego klienta. Wolno używać tylko oryginalnych części zamiennych i części wyposażenia zalecanych przez producenta. Jakiekolwiek modyfikacje w budowie i działaniu produktu oznaczają wygaśnięcie

gwarancji i wykluczają wszelką odpowiedzialność producenta. Nieprzestrzeganie tych instrukcji lub używanie produktu do celów innych niż wynika z opisu jego przeznaczenia, może być przyczyną poważnych wypadków z udziałem użytkownika i/lub uszkodzenia sprzętu. Wymagane prace spawalnicze muszą być wykonane zgodnie z normą DIN / EN 287 przez wykfalifikowany personel lub przez firmy pośredniczące zgodnie z EN3834-2.

PT Antes de instalar/montar o produto, leia atentamente as instruções de instalação e siga-as durante a instalação. A instalação deve ser efectuada por um profissional qualificado em conformidade com todas as regulamentações locais de segurança. Escolha cuidadosamente o local de instalação de modo a assegurar uma operação e instalação com segurança. Este produto foi concebido apenas para segurar/fixar sensores/produtos para medições da HACH/HACH LANGE. Qualquer outro tipo de utilização pode implicar riscos para o utilizador. O trabalho de manutenção e reparação deve ser efectuado única e exclusivamente pelo departamento de assistência ao cliente devidamente autorizado. Apenas podem ser utilizados acessórios e peças de substituição originais recomendados pelo fabricante. Qualquer alteração feita ao produto anula qualquer responsabilidade da nossa parte. O não cumprimento das instruções ou a utilização do produto para outros fins que não aqueles para que o produto foi concebido pode resultar em ferimentos graves e/ou danos no equipamento. O trabalho de soldadura exigido deverá ser executado exclusivamente por soldadores qualificados de acordo com a norma DIN /EN 287, ou por empreiteiros em conformidade com a norma EN 3834-2.

RO Înainte de instalarea/montarea produsului, citiți cu atenție toate instrucțiunile de instalare și urmați instrucțiunile în timpul instalării. Instalarea trebuie realizată de un expert calificat în conformitate cu toate reglementările locale pentru siguranță. Aveți grijă să alegeți o locație de instalare care să asigure instalarea și funcționarea în siguranță. Produsul este destinat exclusiv pentru menținerea/atașarea senzorilor/produselor de măsurare HACH/HACH LANGE. Utilizarea în alte scopuri poate implica riscuri pentru utilizator. Întreținerea și lucrările de reparație trebuie realizate exclusiv de departamentul de service autorizat pentru clienți. Pot fi utilizate numai piesele de schimb și accesoriile originale recomandate de producător. Orice modificare adusă produsului va duce la anularea oricărei răspunderi. Nerespectarea acestor instrucțiuni sau utilizarea produsului în alte scopuri decât în cele destinate pot duce la accidente grave pentru utilizator și/sau defectarea echipamentului. Lucrările de sudură necesare trebuie să fie efectuate exclusiv de sudori calificați în conformitate cu DIN / EN 287 , sau de contractori în conformitate cu EN 3834-2.

RU Перед установкой/монтажом изделия необходимо внимательно прочитать инструкции по установке и строго следовать им во время выполнения работ. Установка должна быть выполнена квалифицированным специалистом с соблюдением действующих правил по технике безопасности. Выбирая место для установки, необходимо учитывать требования по безопасности при монтаже и эксплуатации изделий. Данное изделие предназначено только для крепления измерительных датчиков/приборов компании HACH/HACH LANGE. Любое другое применение может представлять опасность для пользователя. Работы по ремонту и техобслуживанию должны выполняться исключительно специалистами уполномоченной сервисной организации. С изделием могут использоваться только запчасти и принадлежности, рекомендуемые изготовителем. Любые изменения, внесенные в конструкцию изделия, приведут к отмене гарантии поставщика. Несоблюдение требований инструкций или использование изделия не по назначению могут стать причиной серьезных травм для людей и/или повреждения оборудования. Необходимые сварочные работы должны проводиться только сварщиками, квалифицированными в соответствии с DIN / EN 287, или подрядчиками в соответствии с DIN 3834-2.

SK Pred inštaláciou/upevnením produktu si pozorne prečítajte všetky pokyny k inštalácii a počas inštalácie ich dodržujte. Inštaláciu musí vykonať kvalifikovaný expert v súlade so všetkými miestnymi bezpečnostnými nariadeniami. Uistite sa, že si vyberiete miesto inštalácie, ktoré zaručí bezpečnú inštaláciu a prevádzku. Produkt je určený výlučne pre uchytenie/upevnenie meracích snímačov/produktov HACH/HACH LANGE. Akékoľvek iné použitie môže zahŕňať riziká pre používateľa. Údržbu a opravy by malo vykonávať výlučne autorizované oddelenie služieb pre zákazníkov. Môžu sa použiť len originálne náhradné diely a príslušenstvo, ktoré odporúča výrobca. Akékoľvek zmeny vykonané na produkte spôsobia neplatnosť všetkej zodpovednosti. Nedodržanie týchto pokynov alebo používanie produktu na iný než určený účel môže spôsobiť vážne zranenie používateľa alebo poškodenie zariadenia. Požadované zváračské práce musia byť vykonané výhradene v súlade s DIN/EN 287 kvalifikovanými zváračmi, alebo dodávateľmi v súlade s EN 3834-2.

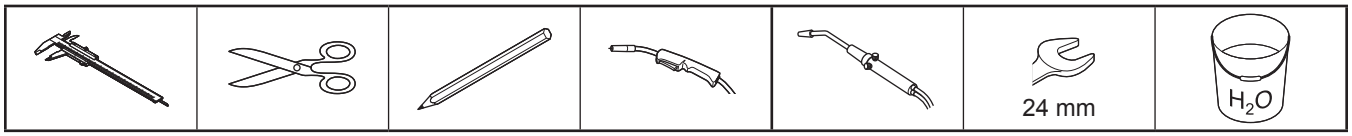
SL Pred namestitvijo/postavitvijo izdelka natančno preberite vsa navodila za namestitev in jih med nameščanjem upoštevajte. Namestitev mora izvesti usposobljen strokovnjak v skladu z vsemi lokalnimi varnostnimi predpisi. Za namestitev izberite mesto, ki zagotavlja varno namestitev in uporabo. Izdelek je namenjen izključno za namestitev/pritrditev merilnih senzorjev/izdelkov HACH/HACH LANGE. Vsakršna drugačna uporaba lahko predstavlja nevarnost za uporabnika. Vzdrževanje in popravilo lahko izvaja izključno osebje pooblaščenega servisnega oddelka. Uporabljate lahko samo originalne nadomestne dele in dodatno opremo, ki jih priporoča proizvajalec. Spremembe izdelka razveljavijo vsakršno odgovornost. Če teh navodil ne upoštevate ali izdelek uporabljate v neprimeren namen, lahko pride do hudih poškodb uporabnika in/ali poškodovanja opreme. Zahtevana dela varenja lahko izvajajo izključno usposobljeni varilci v skladu z DIN/EN 287 ali izvajalci v skladu z EN 3834-2.

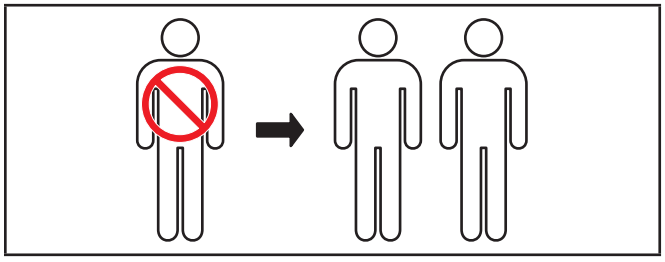
SR Pre instalacije/montaže uređaja pažljivo pročitajte sva uputstva za montažu i pratite ih tokom postupka montaže. Instalaciju mora provesti kvalifikovani stručnjak u skladu sa lokalnim propisima o bezbednosti. Brižljivo odaberite mesto instalacije na kom će se montaža uređaja i korišćenje odvijati u bezbednim uslovima. Uređaj je namenjen isključivo za držanje/pričvršćivanje HACH/HACH LANGE mernih senzora/uređaja. Upotreba uređaja u druge svrhe može da predstavlja rizik po korisnika. Održavanje i opravke sme da provodi isključivo ovlašćeni serviser. Kod zamene i opravaka smeju da se koriste samo originalni rezervni i dodatni delovi koje je preporučio proizvođač. Bilo kakve izmene izvršene na uređaju poništiće njegovu pouzdanost. Nepridržavanje uputstava ili upotreba uređaja u svrhe za koje nije namenjen mogu dovesti do ozbiljnih povreda ljudi koji ga koriste i/ili štete na opremi. Neophodni radovi zavarivanja treba da budu izvršeni od strane zavarivača u skladu sa DIN / EN 287 ili od ugovorenog izvođača radova u skladu sa EN 3834-2.

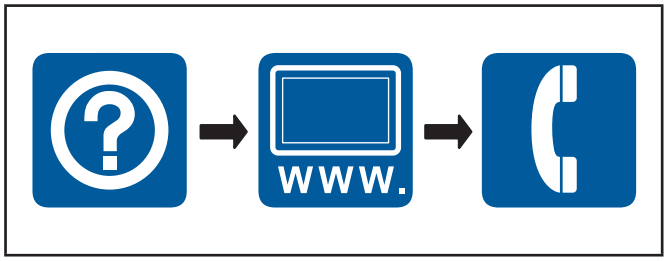
SV Läs alla installationsanvisningar noggrant innan du installerar/monterar produkten och följ anvisningarna under installationen. Installationen måste utföras av en kvalificerad expert i enlighet med alla lokala säkerhetsföreskrifter. Se till att välja en installationsplats som garanterar säker installation och drift. Produkten är endast ämnad för att hålla/fästa mätsensorer/-produkter från HACH/HACH LANGE. Annan användning kan medföra risker för användaren. Underhålls- och reparationsarbeten ska uteslutande utföras av den auktoriserade kundserviceavdelningen. Endast originalreservdelar och -tillbehör som rekommenderas av tillverkaren ska användas. Om någon ändring görs på produkten upphävs tillverkarens ansvar. Det kan det medföra allvarliga skador för användaren eller skador på utrustningen om du inte följer anvisningarna eller om du använder produkten i installationer den inte är avsedd för. Svetsarbeten skall uteslutande utföras av svetsare kvalificerade enligt DIN/EN 287, eller av entreprenör enligt EN3834-2.

TR Ürünün montajını yapmadan önce, tüm montaj talimatlarını dikkatlice okuyun ve kurulum sırasında talimatları mutlaka takip edin. Montaj, kalifiye bir uzman tarafından tüm yerel güvenlik düzenlemelerine uygun şekilde yapılmalıdır. Ürünü, montaj ve kullanımın güvenli olacağı bir yere monte edin. Ürün sadece HACH/HACH LANGE ölçüm sensörlerini/ ürünlerini, tutmak/takmak için tasarlanmıştır. Başka amaçlarla kullanılması, kullanıcı için tehlikeler doğurabilir. Bakım ve onarım sadece yetkili müşteri hizmetleridepartmanı tarafından gerçekleştirilmelidir. Sadece üretici tarafından önerilen orijinal yedek parça ve aksesuarlar kullanılmalıdır. Ürüne yapılan her türlü değişiklik, tüm sorumluluğu ortadan kaldırır. Bu talimatlara uyulmaması veya ürünün üretim amacından başka bir amaçla kullanılması sonucunda kullanıcı ciddi şekilde yaralanabilir ve/veya ürün zarar görebilir. Gerekli kaynak işi yalnızca kalifiye kaynakçılar tarafından DIN / EN 287'ye göre yapılmalıdır, veya müteahhitler tarafından EN 3834-2'ye göre yapılmalıdır.

ZH 在安装/固定产品之前，请仔细阅读所有安装说明，并在安装过程中遵守这些说明。 必须由合格的专家完成安装，并遵守当地的所有安全法规。仔细选择安装地点，确保安全地安装和操作。 本产品只能用于固定/连接 HACH/HACH LANGE 测量传感器/产品。 用于其他用途可能会给用户带来危险。 维护和修理工作应由经授权的客户服务部门完成。 只能使用正宗替换件和制造商推荐的附件。 对本产品进行任何更改均可能导致所有担保失效。不遵守这些说明，或者将本产品用于其它用途，可能会对用户造成严重伤害和/或设备损坏。所需的焊接工作必须要根据DIN/EN 287，由合格的焊接工人单独执行，或者根据EN 3834-2由承包人执行。







LZX337	SOLITAX inline sc SOLITAX highline sc	**A1**		**A2**	LZY441	**A3**	M16x45mm A4 ISO4017	**A4**	LZY462	**A5**	DOC273.99.03911	**A6**	LZV678	
		1x		1x		4x		1x		1x		1x		

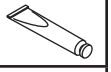
LZX660	SS 316Ti/ 1.4571 DN65/PN16 DIN 2633	**B1**	DN65	**B2**	DOC273.99.03911	**B3**	DN65	
		1x		1x		1x		

LZX661	C-steel / 1.0037 DN65/PN16 DIN 2633	**B1**	DN65	**B2**	DOC273.99.03911	**B3**	DN65	
		1x		1x		1x		

LZY630.00.12000	TSS inline sc	**A1**		**A2**	LZY441	**A3**	M16x45mm A4 ISO4017	**A4**	LZY462	**A5**	DOC273.99.03911	**A6**	LZV678	
		1x		1x		4x		1x		1x		1x		

TSS
inline sc

LZY630.00.10000

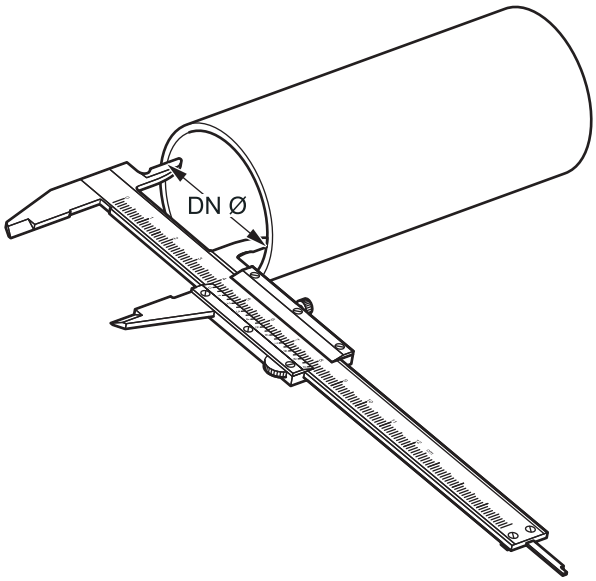
LZY630.00.12000		**A1**		**A2**	LZY441	**A3**	M16x45mm A4 ISO4017	**A4**	LZY462	**A5**	DOC273.99.03911	**A6**	LZV678	
		1x		1x		4x		1x		1x		1x		
LZX660	SS 316Ti/ 1.4571 DN65/PN16 DIN 2633	**B1**	DN65	**B2**	DOC273.99.03911	**B3**	DN65							
		1x		1x		1x								

TSS
inline sc

LZY630.00.11000

LZY630.00.12000		**A1**		**A2**	LZY441	**A3**	M16x45mm A4 ISO4017	**A4**	LZY462	**A5**	DOC273.99.03911	**A6**	LZV678	
		1x		1x		4x		1x		1x		1x		
LZX661	C-steel / 1.0037 DN65/PN16 DIN 2633	**B1**	DN65	**B2**	DOC273.99.03911	**B3**	DN65							
		1x		1x		1x								

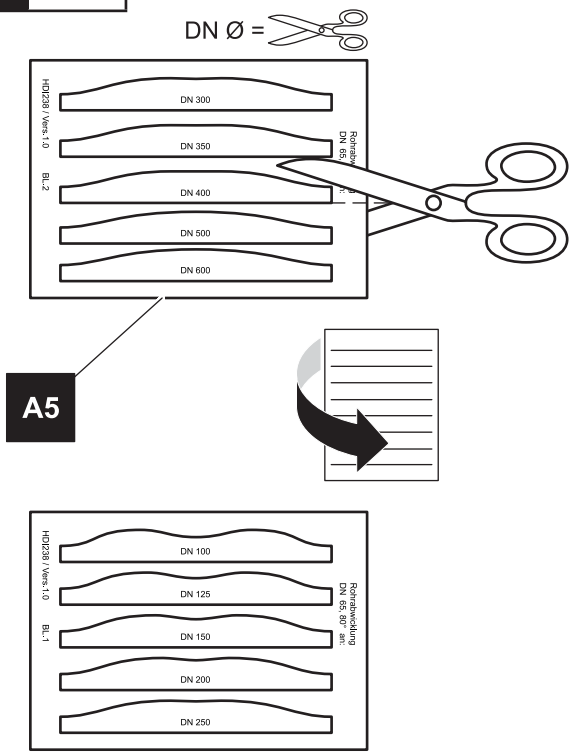
1



2

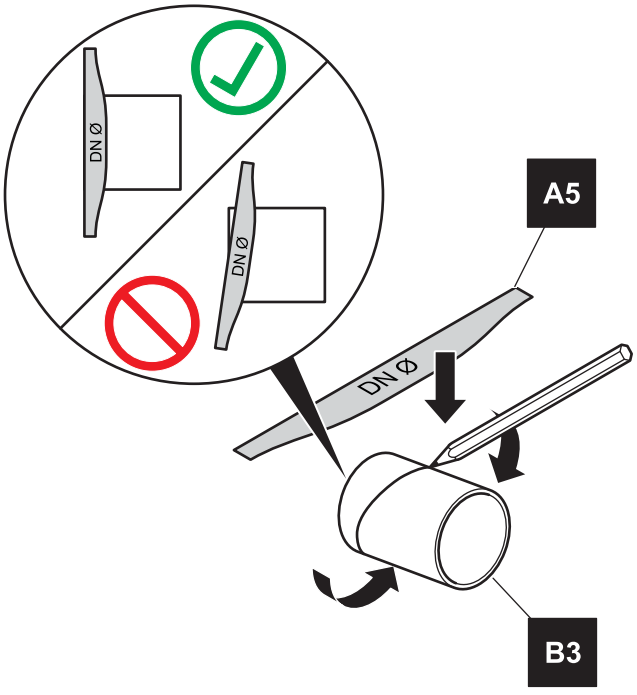
A5

DN Ø =

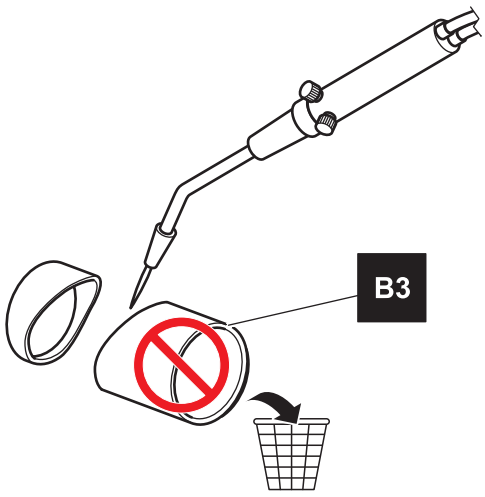


3

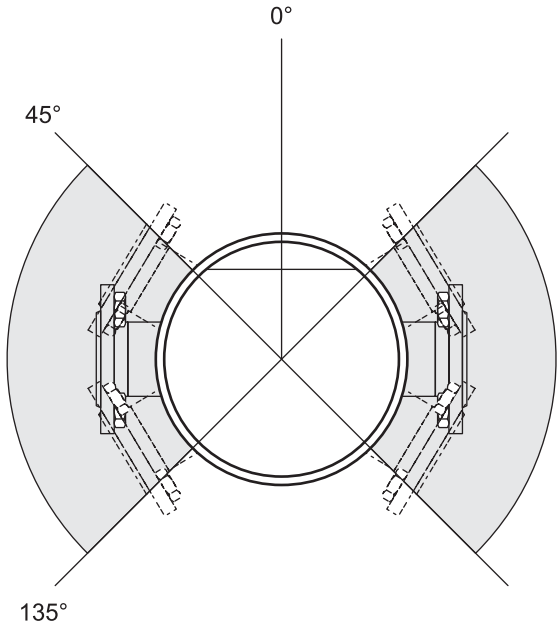
B3

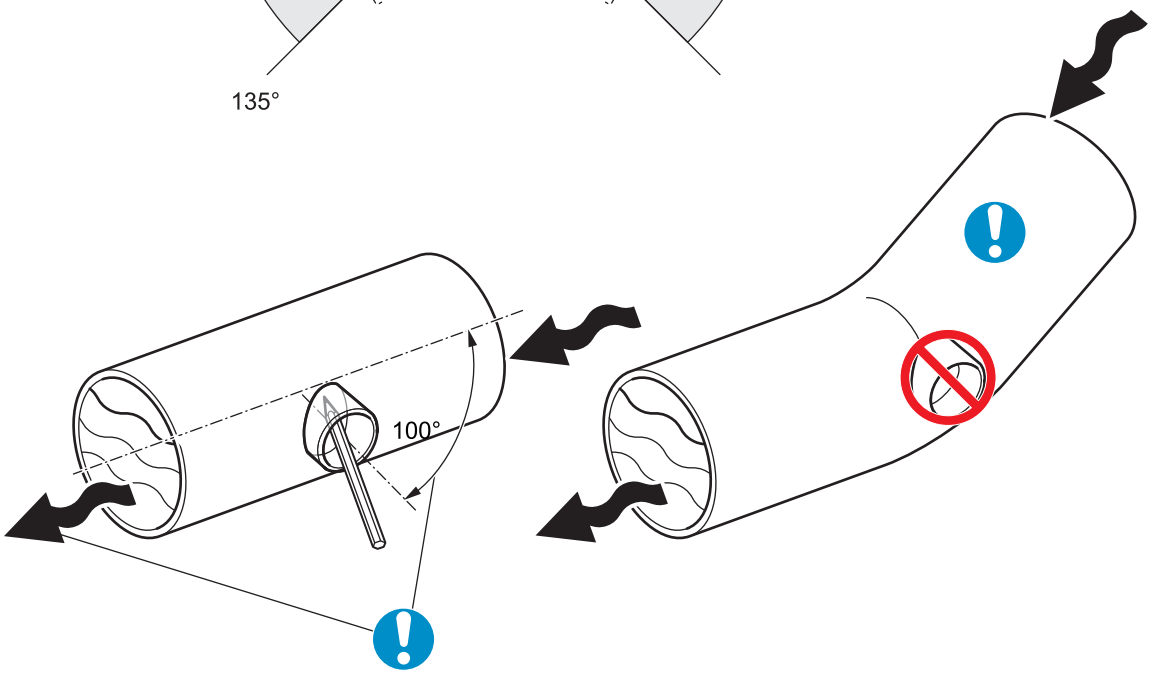


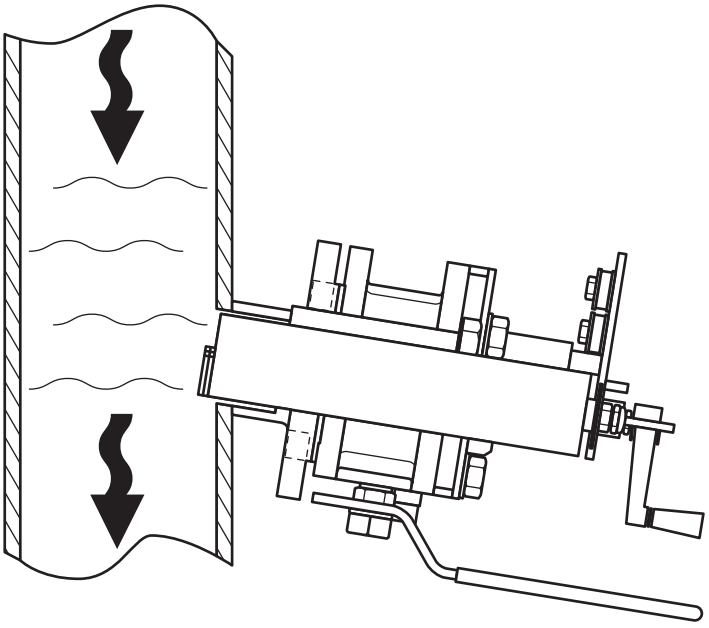
4

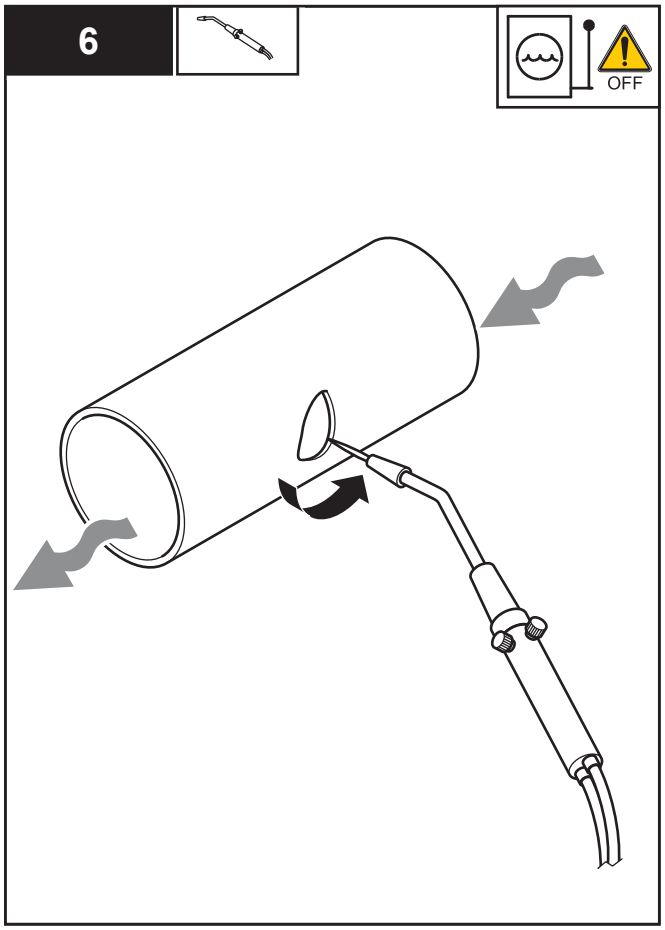


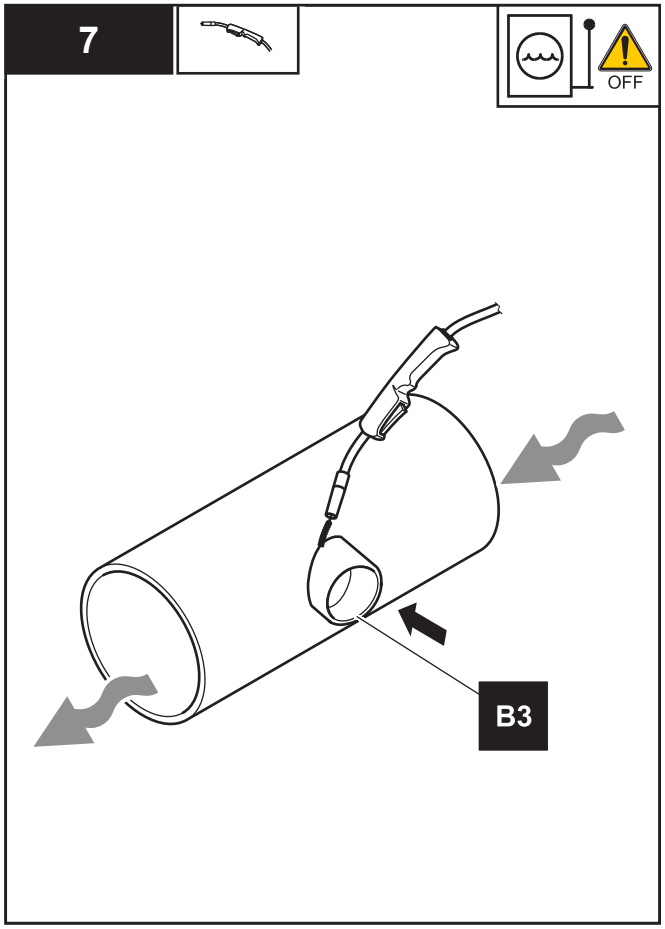
5

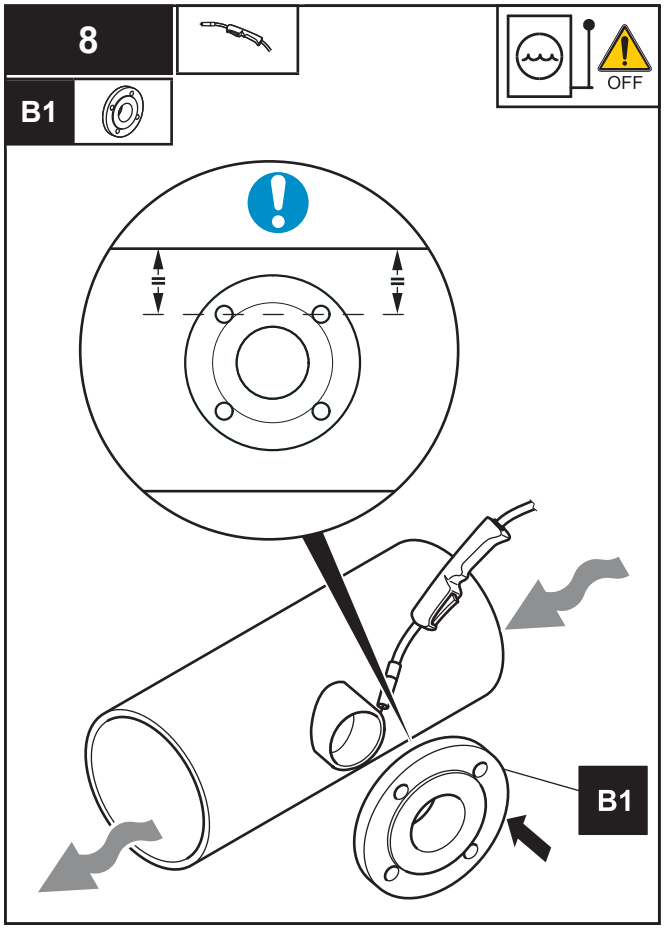


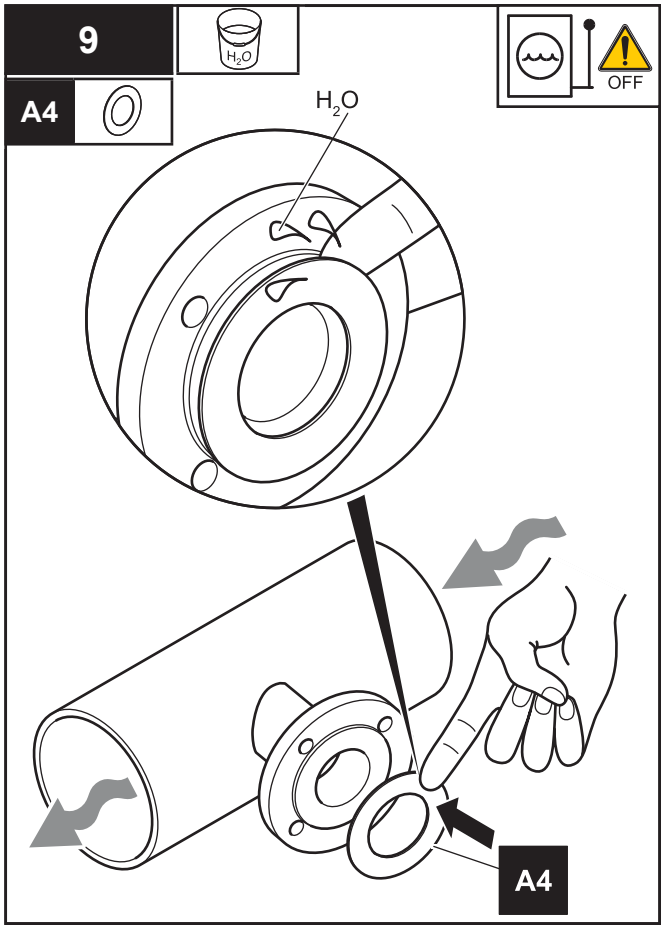


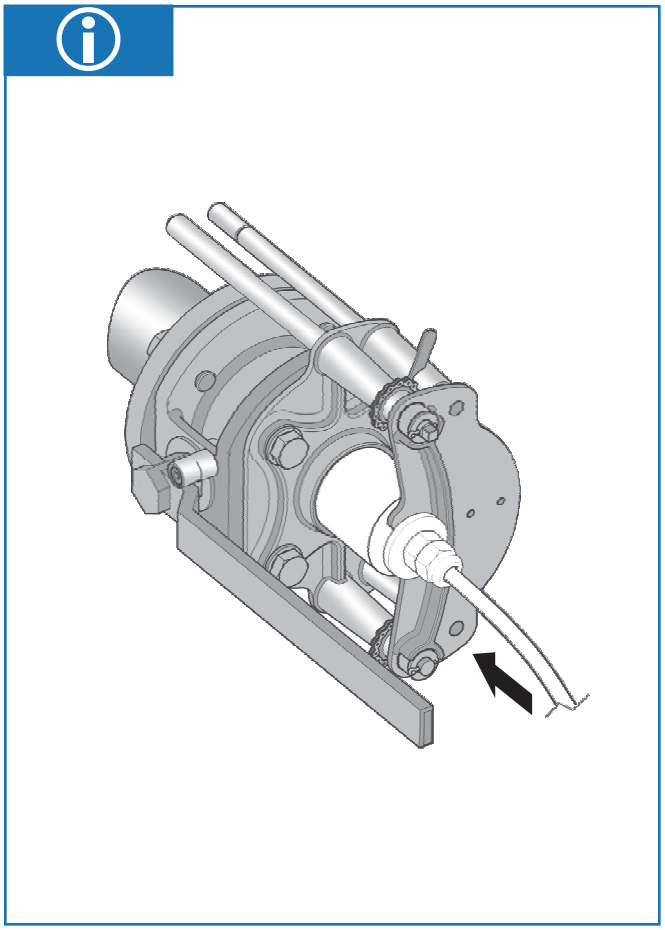


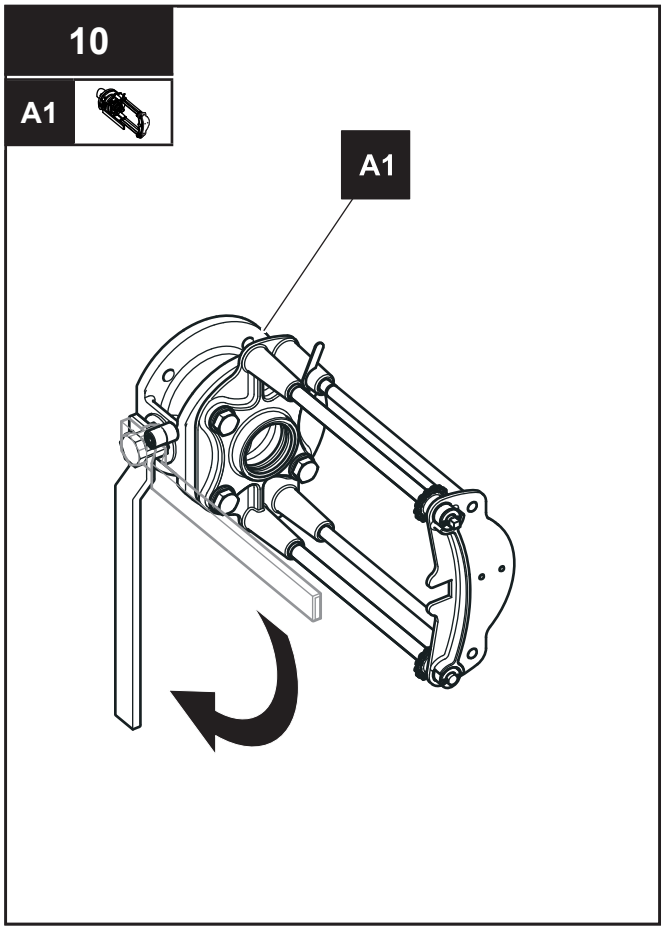

6
OFF

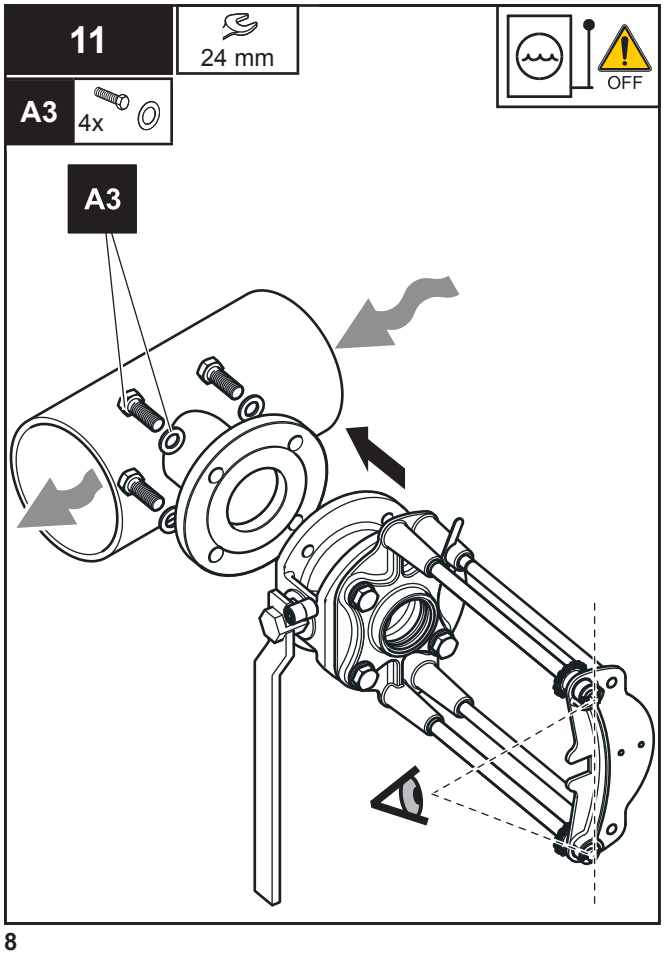

7
OFF
B3

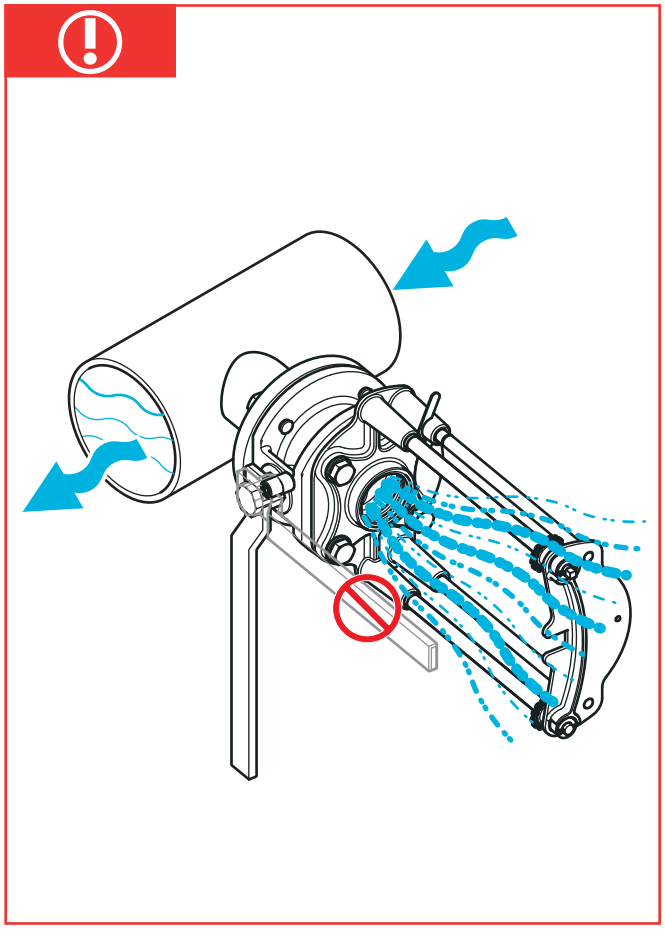

8
B1
OFF
B1

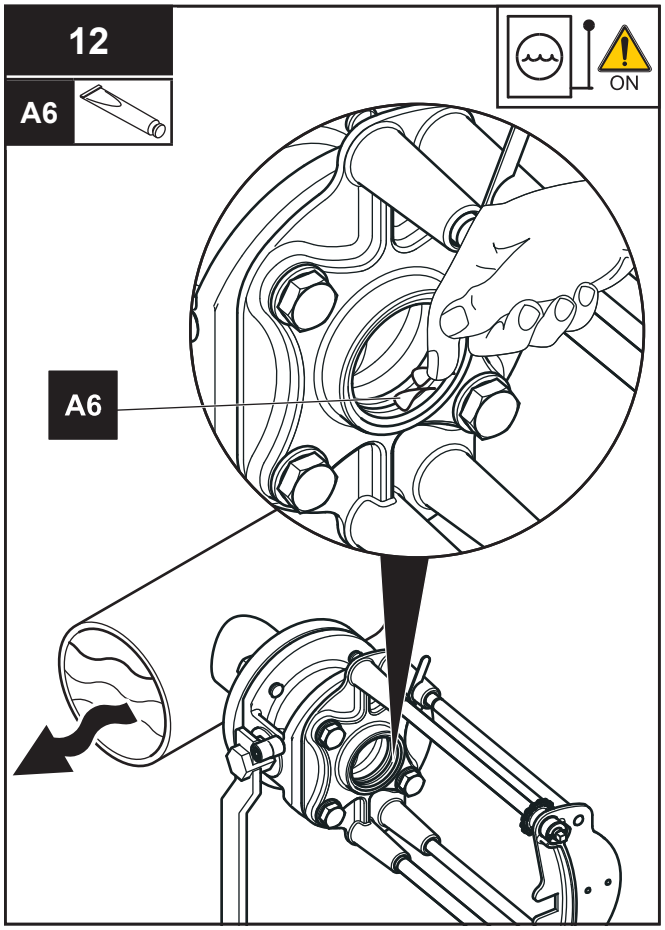

9
A4
H_2O
OFF
A4

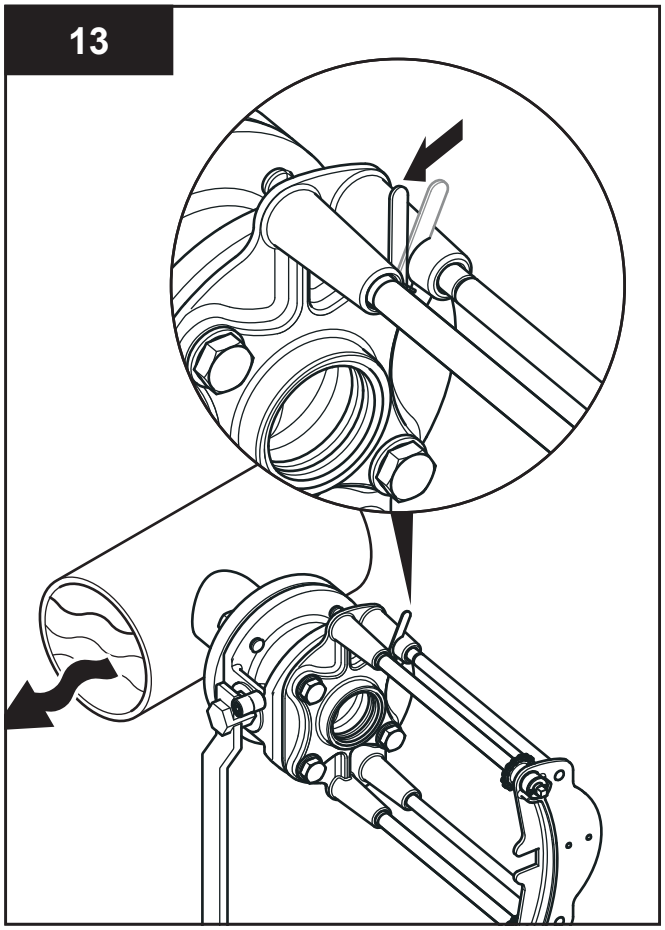


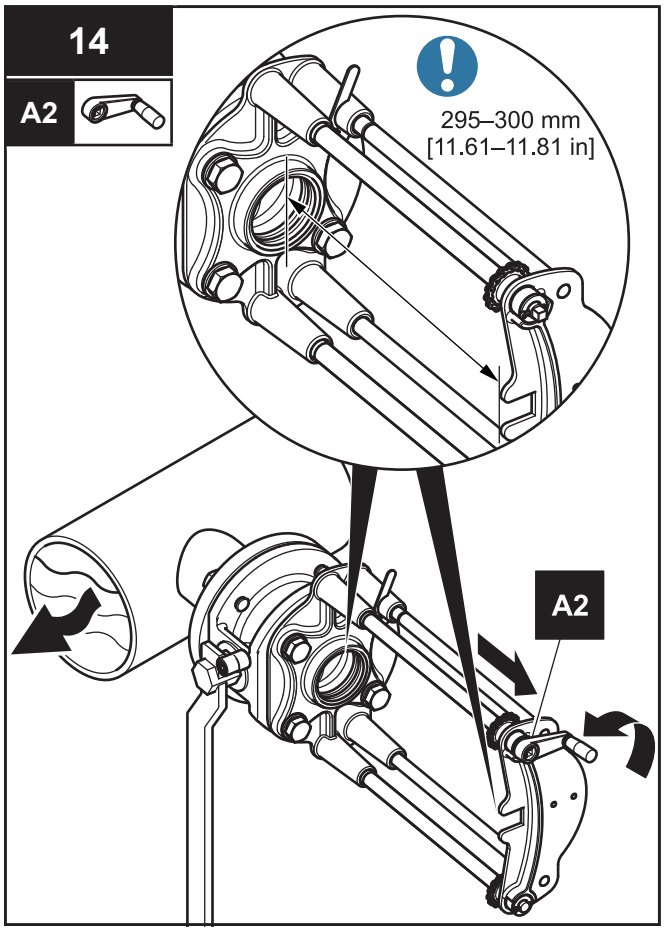

10
A1
A1

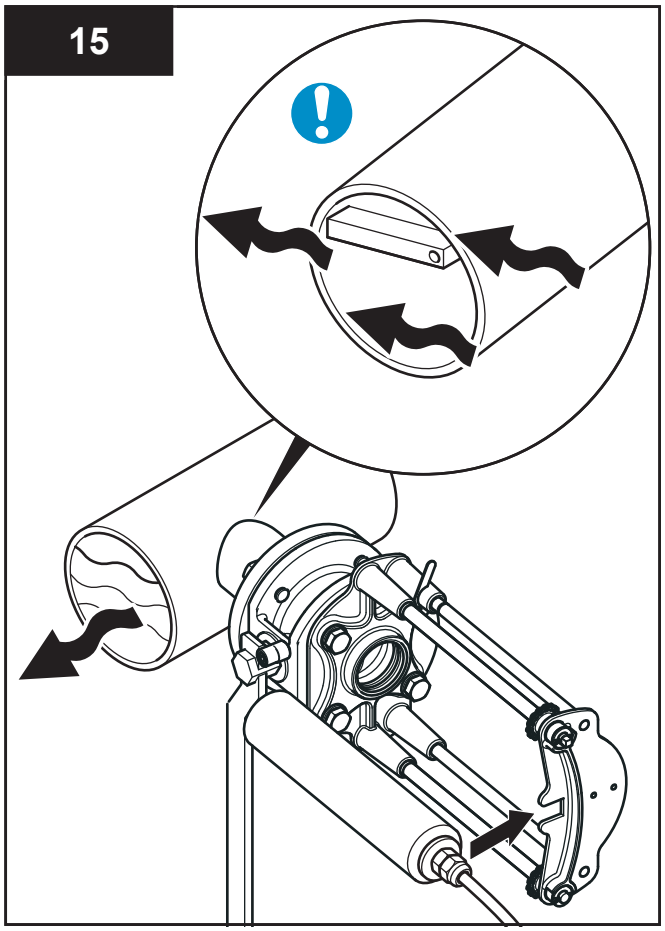

11
24 mm
OFF
A3
4x
A3

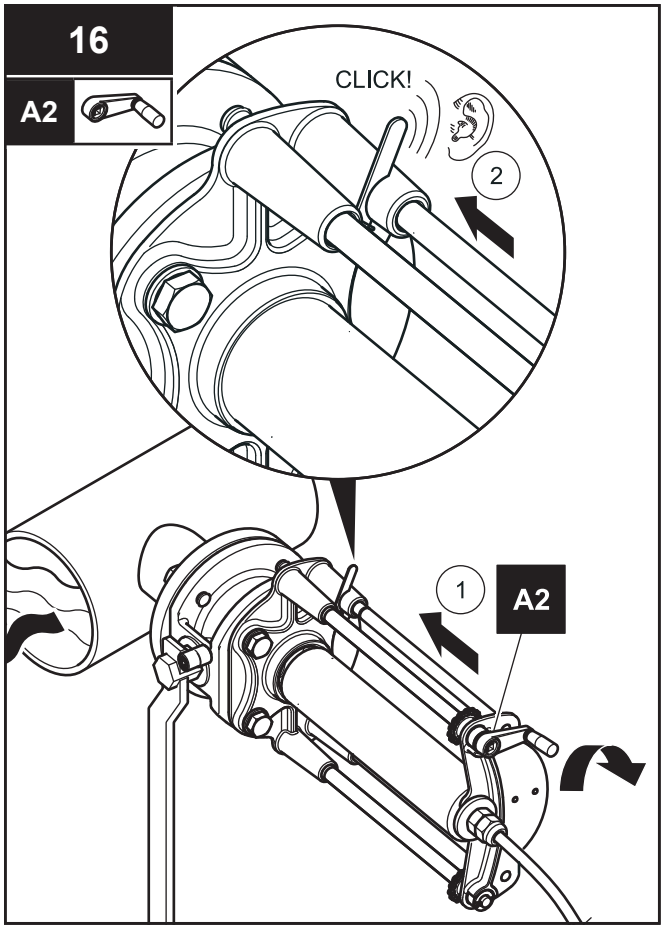


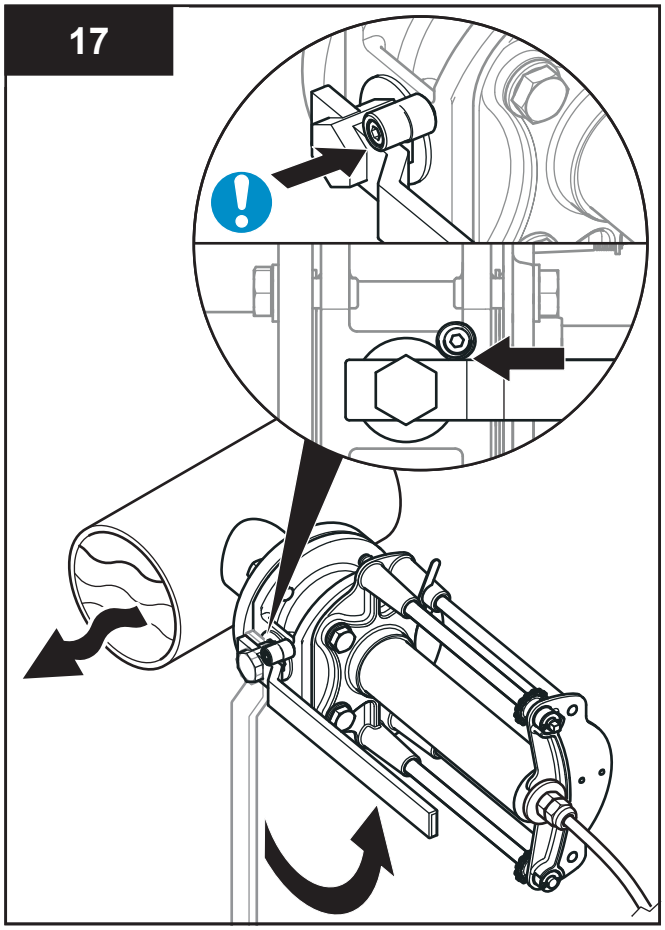

12
A6
ON
A6

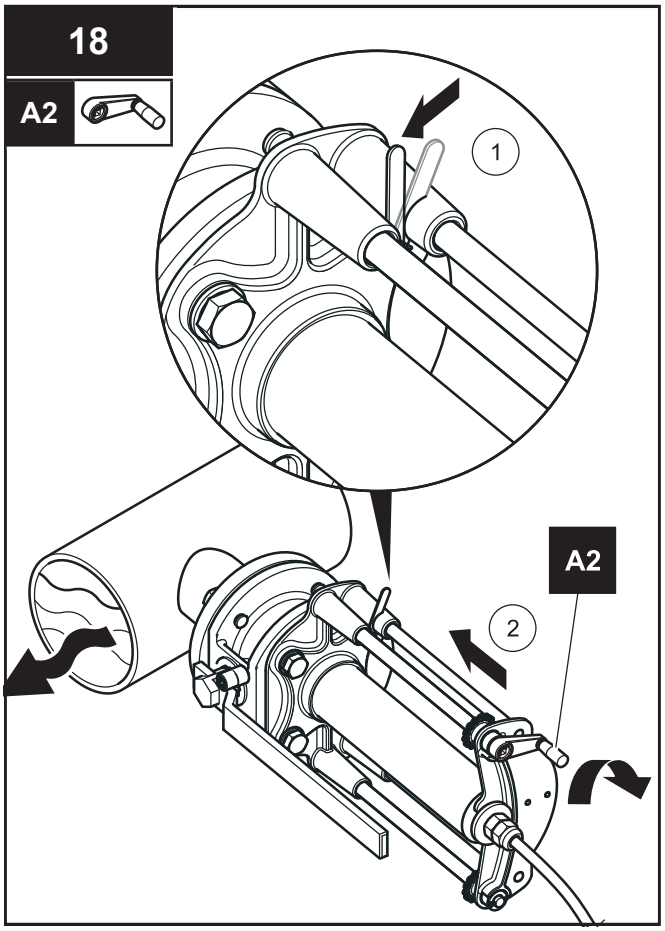

13

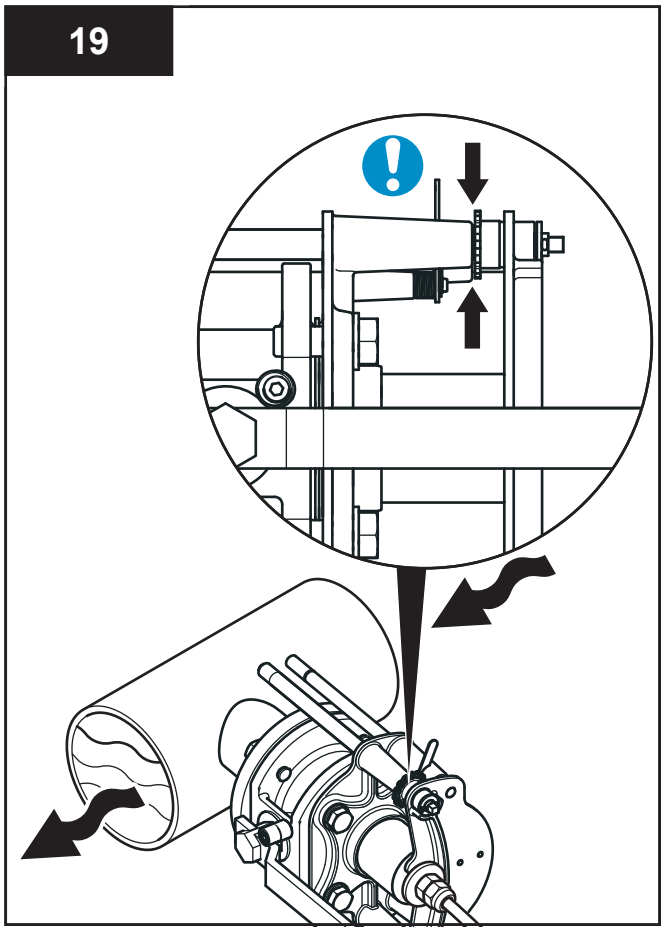

14
A2
295–300 mm
[11.61–11.81 in]
A2

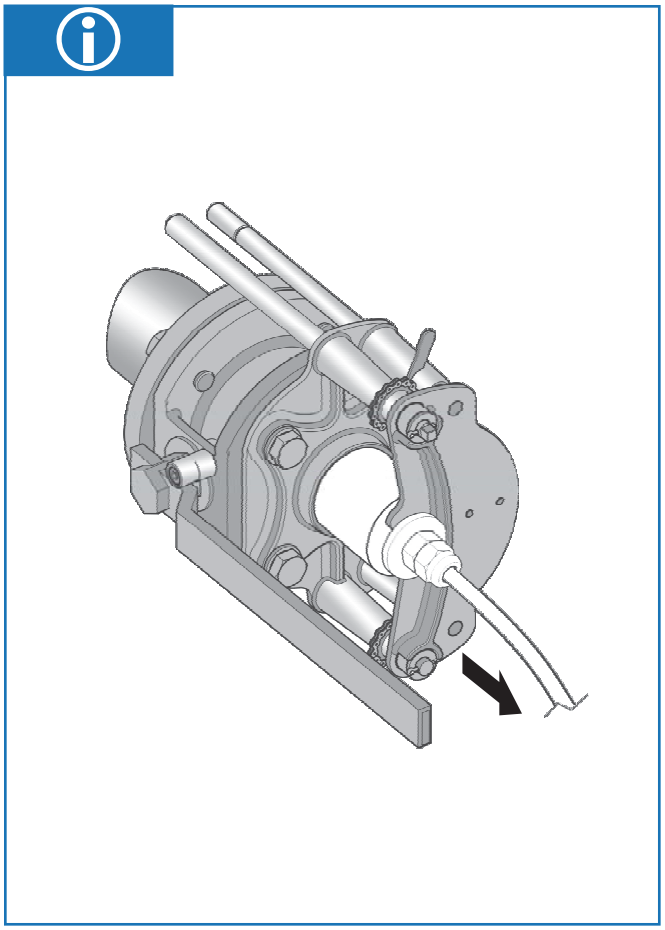

15

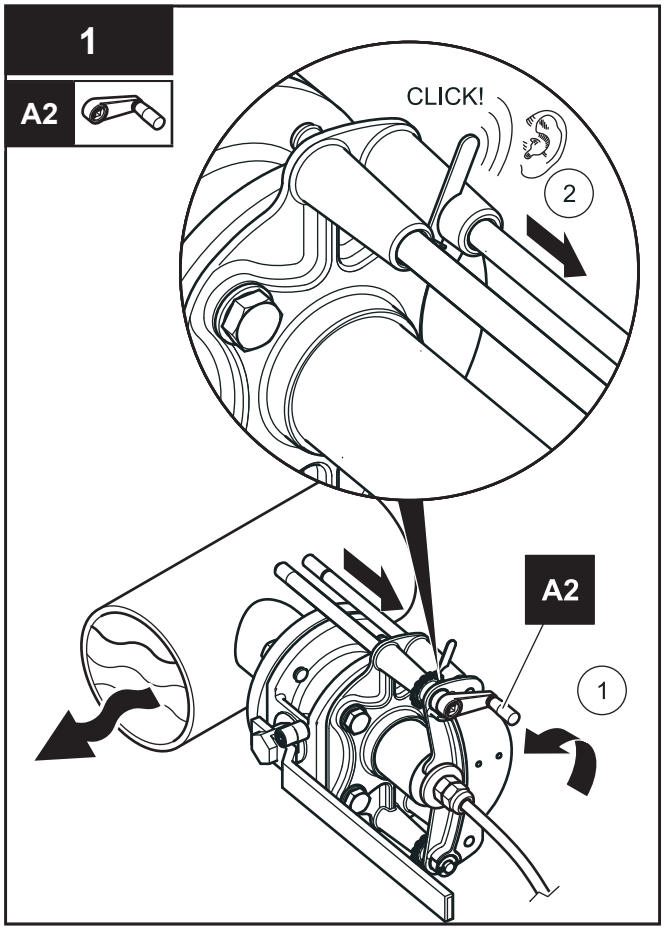

16
A2
CLICK!
2
1
A2

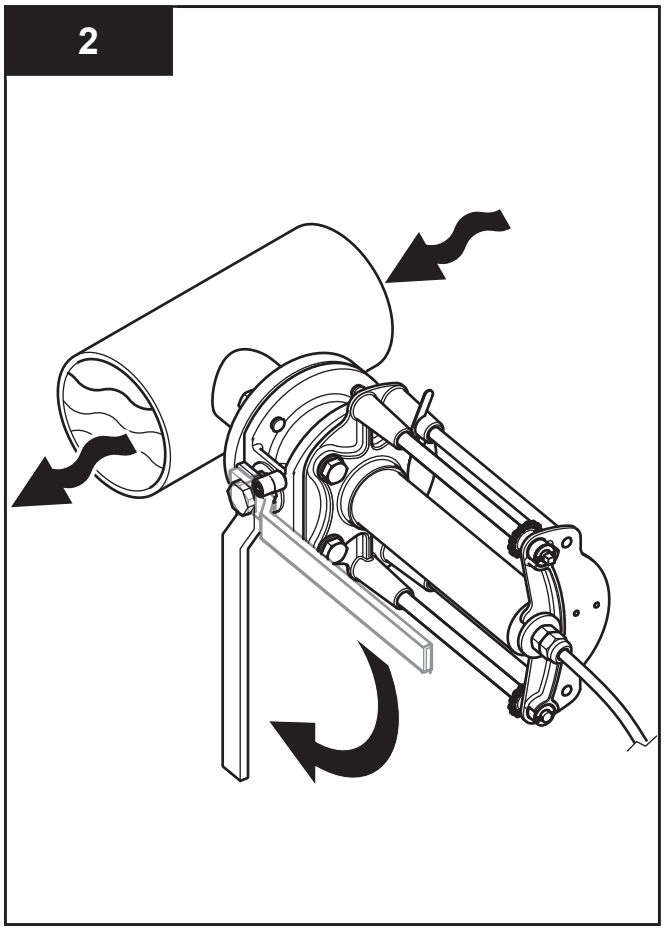

17

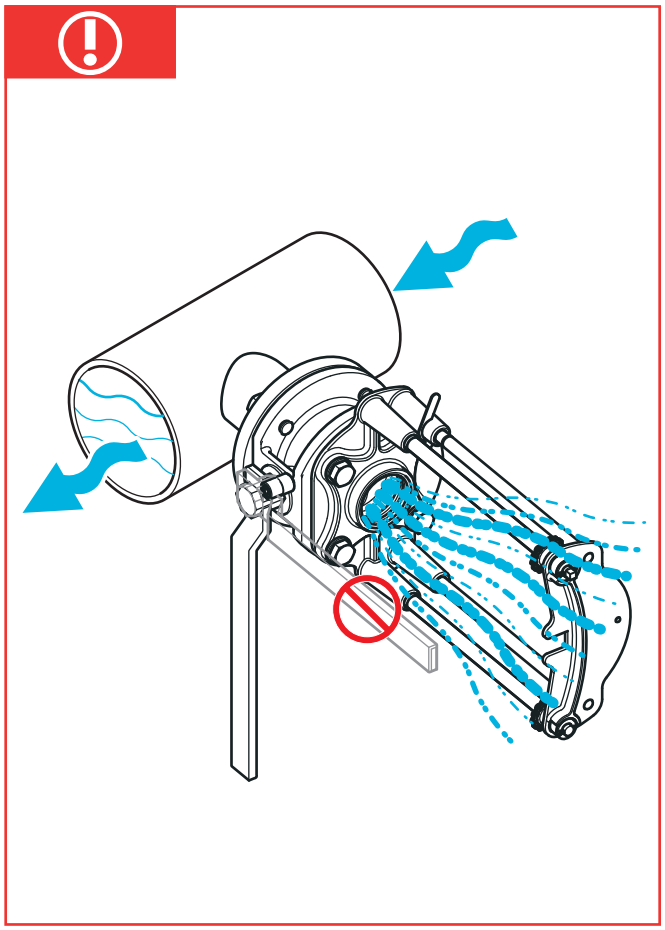

18
A2
1
A2
2

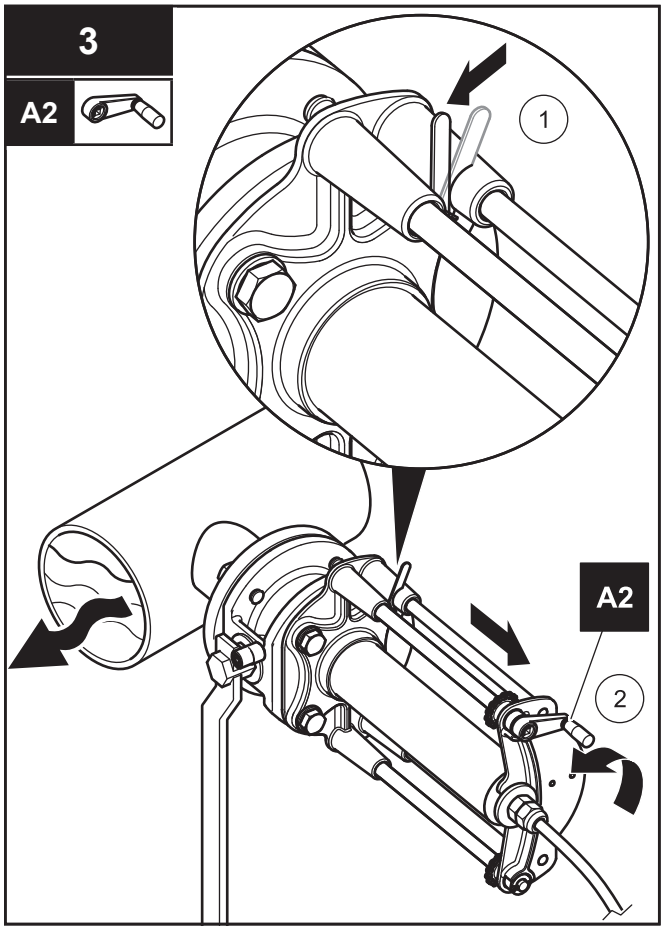

19

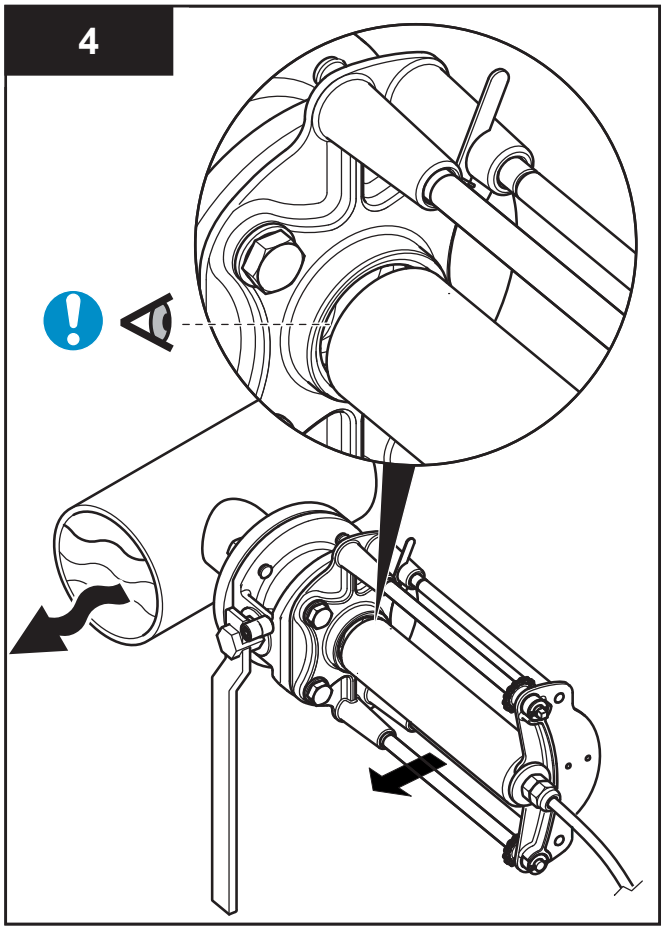


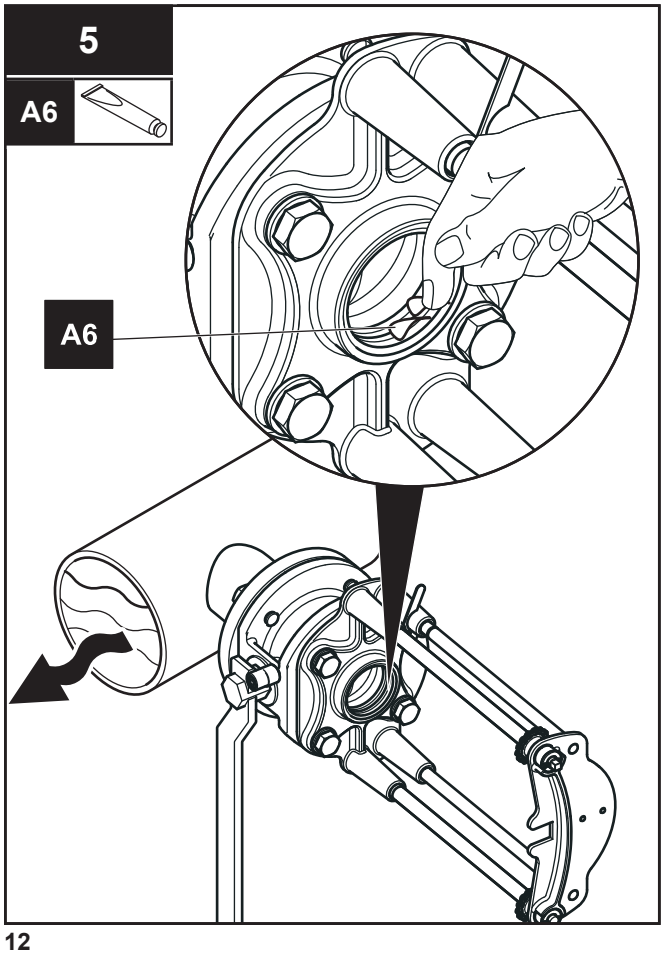

1
A2
CLICK!
2
A2
1


2




3
A2
1
A2
2


4


5
A6
A6

HACH Company
World Headquarters
P.O. Box 389
Loveland, Colorado
80539-0389 U.S.A.
Tel (800) 227-HACH
(800) -227-4224
(U.S.A. only)
Fax (970) 669-2932
orders@hach.com
www.hach.com

Repair Service in the United States:
HACH Company
Ames Service
100 Dayton Avenue
Ames, Iowa 50010
Tel (800) 227-4224
(U.S.A. only)
Fax (515) 232-3835

Repair Service in Canada:
Hach Sales & Service
Canada Ltd.
1313 Border Street, Unit 34
Winnipeg, Manitoba
R3H 0X4
Tel (800) 665-7635
(Canada only)
Tel (204) 632-5598
Fax (204) 694-5134
canada@hach.com

Repair Service in Latin America, the Caribbean, the Far East, Indian Subcontinent, Africa, Europe, or the Middle East:
Hach Company World Headquarters,
P.O. Box 389
Loveland, Colorado,
80539-0389 U.S.A.
Tel +001 (970) 669-3050
Fax +001 (970) 669-2932
intl@hach.com

HACH LANGE GMBH
Willstätterstraße 11
D-40549 Düsseldorf
Tel. +49 (0)2 11 52 88-320
Fax +49 (0)2 11 52 88-210
info@hach-lange.de
www.hach-lange.de

HACH LANGE LTD
Pacific Way
Salford
GB-Manchester, M50 1DL
Tel. +44 (0)161 872 14 87
Fax +44 (0)161 848 73 24
info@hach-lange.co.uk
www.hach-lange.co.uk

HACH LANGE LTD
Unit 1, Chestnut Road
Western Industrial Estate
IRL-Dublin 12
Tel. +353(0)1 46 02 5 22
Fax +353(0)1 4 50 93 37
info@hach-lange.ie
www.hach-lange.ie

HACH LANGE GMBH
Hütteldorferstr. 299/Top 6
A-1140 Wien
Tel. +43 (0)1 9 12 16 92
Fax +43 (0)1 9 12 16 92-99
info@hach-lange.at
www.hach-lange.at

HACH LANGE GMBH
Rorschacherstrasse 30 a
CH-9424 Rheineck
Tel. +41 (0)848 55 66 99
Fax +41 (0)71 886 91 66
info@hach-lange.ch
www.hach-lange.ch

HACH LANGE FRANCE S.A.S.
8, mail Barthélémy Thimonnier
Lognes
F-77437 Marne-La-Vallée
cedex 2
Tél. +33 (0)8 20 20 14 14
Fax +33 (0)1 69 67 34 99
info@hach-lange.fr
www.hach-lange.fr

HACH LANGE NV/SA
Motstraat 54
B-2800 Mechelen
Tél. +32 (0)15 42 35 00
Fax +32 (0)15 41 61 20
info@hach-lange.be
www.hach-lange.be

DR. LANGE NEDERLAND B.V.
Laan van Westroijen 2a
NL-4003 AZ Tiel
Tel. +31(0)344 63 11 30
Fax +31(0)344 63 11 50
info@hach-lange.nl
www.hach-lange.nl

HACH LANGE APS
Åkandevej 21
DK-2700 Brønshøj
Tel. +45 36 77 29 11
Fax +45 36 77 49 11
info@hach-lange.dk
www.hach-lange.dk

HACH LANGE AB
Vinthundsvägen 159A
SE-128 62 Sköndal
Tel. +46 (0)8 7 98 05 00
Fax +46 (0)8 7 98 05 30
info@hach-lange.se
www.hach-lange.se

HACH LANGE S.R.L.
Via Rossini, 1/A
I-20020 Lainate (MI)
Tel. +39 02 93 575 400
Fax +39 02 93 575 401
info@hach-lange.it
www.hach-lange.it

HACH LANGE S.L.U.
Edificio Seminario
C/Larrauri, 1C- 2ª Pl.
E-48160 Derio/Vizcaya
Tel. +34 94 657 33 88
Fax +34 94 657 33 97
info@hach-lange.es
www.hach-lange.es

HACH LANGE LDA
Av. do Forte nº8
Fracção M
P-2790-072 Carnaxide
Tel. +351 214 253 420
Fax +351 214 253 429
info@hach-lange.pt
www.hach-lange.pt

HACH LANGE SP.ZO.O.
ul. Krakowska 119
PL-50-428 Wrocław
Tel. +48 801 022 442
Zamówienia: +48 717 177 707
Doradztwo: +48 717 177 777
Fax +48 717 177 778
info@hach-lange.pl
www.hach-lange.pl

HACH LANGE S.R.O.
Zastrčená 1278/8
CZ-141 00 Praha 4 - Chodov
Tel. +420 272 12 45 45
Fax +420 272 12 45 46
info@hach-lange.cz
www.hach-lange.cz

HACH LANGE S.R.O.
Roľnícka 21
SK-831 07 Bratislava – Vajnory
Tel. +421 (0)2 4820 9091
Fax +421 (0)2 4820 9093
info@hach-lange.sk
www.hach-lange.sk

HACH LANGE KFT.
Vöröskereszt utca. 8-10.
H-1222 Budapest XXII. ker.
Tel. +36 (06)1 225 7783
Fax +36 (06)1 225 7784
info@hach-lange.hu
www.hach-lange.hu

HACH LANGE S.R.L.
Str. Căminului nr. 3
et. 1, ap. 1, Sector 2
RO-021741 Bucureşti
Tel. +40 (0) 21 205 30 03
Fax +40 (0) 21 205 30 17
info@hach-lange.ro
www.hach-lange.ro

HACH LANGE
8, Kr. Sarafov str.
BG-1164 Sofia
Tel. +359 (0)2 963 44 54
Fax +359 (0)2 866 15 26
info@hach-lange.bg
www.hach-lange.bg

HACH LANGE SU ANALİZ SİSTEMLERİ LTD.ŞTİ.
Ilkbahar mah. Galip Erdem
Cad. 616 Sok. No:9
TR-Oran-Çankaya/ANKARA
Tel. +90312 490 83 00
Fax +90312 491 99 03
bilgi@hach-lange.com.tr
www.hach-lange.com.tr

HACH LANGE D.O.O.
Fajfarjeva 15
SI-1230 Domžale
Tel. +386 (0)59 051 000
Fax +386 (0)59 051 010
info@hach-lange.si
www.hach-lange.si

HACH LANGE E.Π.E.
Αυλίδος 27
GR-115 27 Αθήνα
Τηλ. +30 210 7777038
Fax +30 210 7777976
info@hach-lange.gr
www.hach-lange.gr

HACH LANGE D.O.O.
Ivana Severa bb
HR-42 000 Varaždin
Tel. +385 (0) 42 305 086
Fax +385 (0) 42 305 087
info@hach-lange.hr
www.hach-lange.hr

HACH LANGE MAROC SARLAU
Villa 14 – Rue 2 Casa Plaisance
Quartier Racine Extension
MA-Casablanca 20000
Tél. +212 (0)522 97 95 75
Fax +212 (0)522 36 89 34
info-maroc@hach-lange.com
www.hach-lange.ma

HACH LANGE OOO
Finlyandsky prospekt, 4A
B. Zentrum “Petrovsky fort”, R.803
RU-194044, Sankt-Petersburg
Tel. +7 (812) 458 56 00
Fax. +7 (812) 458 56 00
info.russia@hach-lange.com
www.hach-lange.com

Edition 08/2012 6A sk

HACH

MODEL SC200, UNIVERSAL CONTROLLER

LEFT BLANK

DOC023.53.80040

sc200 Controller

07/2016, Edition 8

User Manual

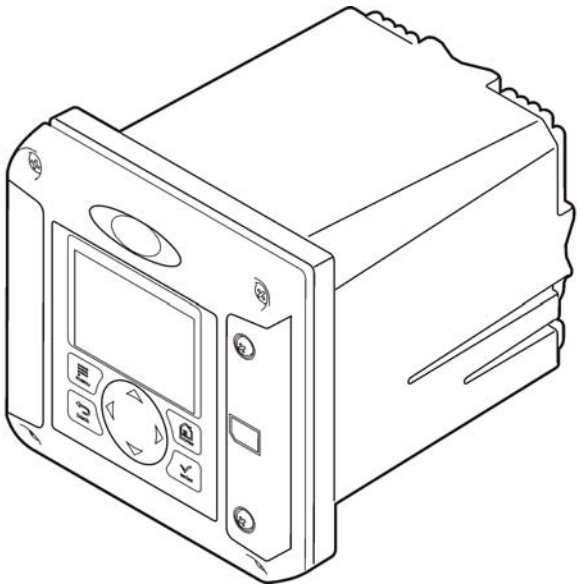


Table of Contents

Table of Contents

Specifications

Specifications are subject to change without notice.

Specification	Details
Component description	Microprocessor-controlled and menu-driven controller that operates the sensor and displays measured values.
Operating temperature	-20 to 60 ºC (-4 to 140 ºF); 95% relative humidity, non-condensing with sensor load <7 W; -20 to 50 ºC (-4 to 104 ºF) with sensor load <28 W
Storage temperature	-20 to 70 ºC (-4 to 158 ºF); 95% relative humidity, non-condensing
Enclosure[1]	NEMA 4X/IP66 metal enclosure with a corrosion-resistant finish
Power requirements	**AC powered controller:** 100-240 VAC ±10%, 50/60 Hz; Power 50 VA with 7 W sensor/network module load, 100 VA with 28 W sensor/network module load (optional Modbus, RS232/RS485, Profibus DPV1 or HART network connection).
	24 VDC powered controller: 24 VDC—15%, + 20%; Power 15 W with 7 W sensor/network module load, 40 W with 28 W sensor/network module load (optional Modbus, RS232/RS485, Profibus DPV1 or HART network connection).
Altitude requirements	Standard 2000 m (6562 ft) ASL (Above Sea Level)
Pollution degree/Installation category	Polution Degree 2; Installation Category II
Outputs	Two analog (0-20 mA or 4-20 mA) outputs. Each analog output can be assigned to represent a measured parameter such as pH, temperature, flow or calculated values. Optional module supplies three additional analog outputs (5 total).
Relays	Four SPDT, user-configured contacts, rated 250 VAC, 5 Amp resistive maximum for the AC powered controller and 24 VDC, 5A resistive maximum for the DC powered controller. Relays are designed for connection to AC Mains circuits (i.e., whenever the controller is operated with 115 - 240 VAC power) or DC circuits (i.e., whenever the controller is operated with 24 VDC power).
Dimensions	½ DIN—144 x 144 x 180.9 mm (5.7 x 5.7 x 7.12 in.)
Weight	1.7 kg (3.75 lb)
Compliance information[2]	CE approved (with all sensor types). Listed for use in general locations to UL and CSA safety standards by ETL (with all sensor types). Certain AC mains powered models are listed for use in general safety locations to UL and CSA safety standards by Underwriters Laboratories (with all sensor types).
Digital communication	Optional Modbus, RS232/RS485, Profibus DPV1 or HART network connection for data transmission
Data logging	Secure Digital Card (32 GB maximum) or special RS232 cable connector for data logging and performing software updates. The controller will keep approximately 20,000 data points per sensor.
Warranty	2 years

General information

In no event will the manufacturer be liable for direct, indirect, special, incidental or consequential damages resulting from any defect or omission in this manual. The manufacturer reserves the right to

[1] Units that have the Underwriters Laboratories (UL) certification are intended for indoor use only and do not have a NEMA 4X/IP66 rating.

[2] DC powered units are not listed by UL.

make changes in this manual and the products it describes at any time, without notice or obligation. Revised editions are found on the manufacturer's website.

Safety information

NOTICE

The manufacturer is not responsible for any damages due to misapplication or misuse of this product including, without limitation, direct, incidental and consequential damages, and disclaims such damages to the full extent permitted under applicable law. The user is solely responsible to identify critical application risks and install appropriate mechanisms to protect processes during a possible equipment malfunction.

Please read this entire manual before unpacking, setting up or operating this equipment. Pay attention to all danger and caution statements. Failure to do so could result in serious injury to the operator or damage to the equipment.

Make sure that the protection provided by this equipment is not impaired. Do not use or install this equipment in any manner other than that specified in this manual.

Use of hazard information

⚠ DANGER

Indicates a potentially or imminently hazardous situation which, if not avoided, will result in death or serious injury.

⚠ WARNING

Indicates a potentially or imminently hazardous situation which, if not avoided, could result in death or serious injury.

⚠ CAUTION

Indicates a potentially hazardous situation that may result in minor or moderate injury.

NOTICE

Indicates a situation which, if not avoided, may cause damage to the instrument. Information that requires special emphasis.

Precautionary labels

Read all labels and tags attached to the instrument. Personal injury or damage to the instrument could occur if not observed. A symbol on the instrument is referenced in the manual with a precautionary statement.

	This symbol, if noted on the instrument, references the instruction manual for operation and/or safety information.
	This symbol indicates that a risk of electrical shock and/or electrocution exists.
	This symbol indicates the presence of devices sensitive to Electro-static Discharge (ESD) and indicates that care must be taken to prevent damage with the equipment.
	Electrical equipment marked with this symbol may not be disposed of in European domestic or public disposal systems. Return old or end-of-life equipment to the manufacturer for disposal at no charge to the user.

Certification

Canadian Radio Interference-Causing Equipment Regulation, IECS-003, Class A:

Supporting test records reside with the manufacturer.

This Class A digital apparatus meets all requirements of the Canadian Interference-Causing Equipment Regulations.

Cet appareil numérique de classe A répond à toutes les exigences de la réglementation canadienne sur les équipements provoquant des interférences.

FCC Part 15, Class "A" Limits

Supporting test records reside with the manufacturer. The device complies with Part 15 of the FCC Rules. Operation is subject to the following conditions:

1. The equipment may not cause harmful interference.
2. The equipment must accept any interference received, including interference that may cause undesired operation.

Changes or modifications to this equipment not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment. This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to Part 15 of the FCC rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference, in which case the user will be required to correct the interference at their expense. The following techniques can be used to reduce interference problems:

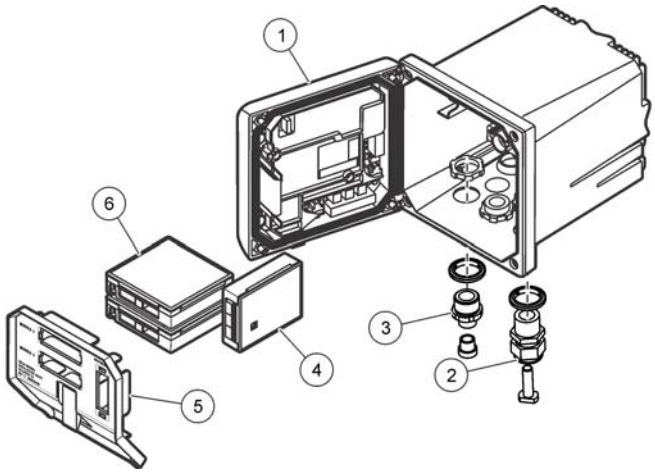
1. Disconnect the equipment from its power source to verify that it is or is not the source of the interference.
2. If the equipment is connected to the same outlet as the device experiencing interference, connect the equipment to a different outlet.
3. Move the equipment away from the device receiving the interference.
4. Reposition the receiving antenna for the device receiving the interference.
5. Try combinations of the above.

Product overview

The controller displays sensor measurements and other data, can transmit analog and digital signals, and can interact with and control other devices through outputs and relays. Outputs, relays, sensors and sensor modules are configured and calibrated through the user interface on the front of the controller.

Figure 1 shows the product components. Components may vary according to controller configuration. Contact the manufacturer if parts are damaged or missing.

Figure 1 System components



1 Controller	**4** Network module (optional)
2 Strain relief assembly (optional depending on controller version)	**5** High-voltage barrier
3 Digital connection fitting (optional depending on controller version)	**6** Sensor modules (optional)

Sensors and sensor modules

The controller accepts up to a maximum of two sensor modules or two digital sensors (depending on the controller configuration), along with one communication module. A single digital sensor and a single sensor module can be installed in combination. A variety of sensors can be wired to the sensor modules. Sensor wiring information is given in the specific sensor manuals and in the user instructions for specific modules.

Relays outputs and signals

The controller has four configurable relay switches and two analog outputs. An optional analog output module can increase the number of analog outputs to five.

Device scans

With two exceptions, the controller automatically scans for connected devices without user input when it is powered on. The first exception is when the controller is powered on for the first time before initial use. The second exception is after the controller configuration settings have been set to their default values and the controller is powered on. In both cases, the controller first displays the language, date and time edit screens. After the language, date and time entries are accepted, the controller performs a device scan. Refer to Connect a digital sc sensor on page 20 for instructions about how to scan for devices when the controller is already powered on.

Controller enclosure

The controller enclosure is NEMA 4X/IP66-rated and has a corrosion-resistant finish designed to withstand corrosive environmental constituents such as salt spray and hydrogen sulfide. Protection against environmental damage is strongly recommended for outdoor use.
Note: *Units that have the Underwriters Laboratories (UL) certification are intended for indoor use only and do not have a NEMA 4X/IP66 rating.*

Controller mounting options

The controller can be mounted to a panel, to a wall or to a vertical or horizontal pipe. A neoprene sealing gasket is included and can be used to reduce vibration. The gasket can be used as a template for panel mounting before the inner gasket component is separated.

Installation

Mounting components and dimensions

⚠ CAUTION

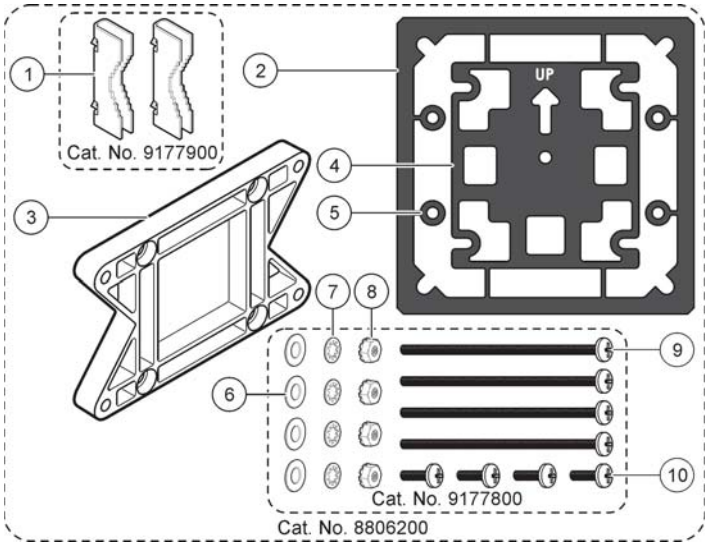
Personal injury hazard. Only qualified personnel should conduct the tasks described in this section of the manual.

The controller can be installed on a surface, panel or pipe (horizontal or vertical). For mounting options and instructions, refer to Figure 2, Figure 3 on page 8, Figure 4 on page 9, Figure 5 on page 10 and Figure 6 on page 11.

For horizontal pipe mounts, the mounting feet (Figure 2) must be attached to the mounting bracket in a vertical position.

For both horizontal and vertical pipe mounts, attach the mounting bracket to the controller as shown in Figure 5 on page 10.

Figure 2 Mounting components



1	Mounting foot (2x)	**6**	Flat washer, ¼-inch ID (4x)
2	Sealing gasket for panel mount, Neoprene	**7**	Lock washer, ¼-inch ID (4x)
3	Bracket for wall and pipe mounting	**8**	M5 x 0.8 Keps hexnut (4x)
4	Vibration isolation gasket for pipe mount	**9**	Pan head screws, M5 x 0.8 x 100mm (4x) (Used for variable diameter pipe mount installations)
5	Vibration isolation washer for pipe mount (4x)	**10**	Pan head screws, M5 x 0.8 x 15 mm (4x)

Note: *A bracket for panel mounting is available as an optional accessory.*

Controller mounting

Figure 3 Surface mounting dimensions

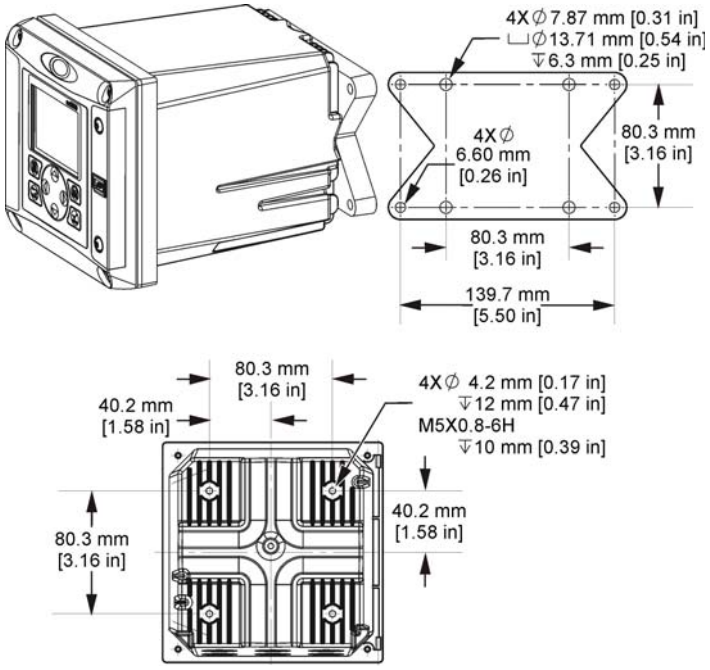
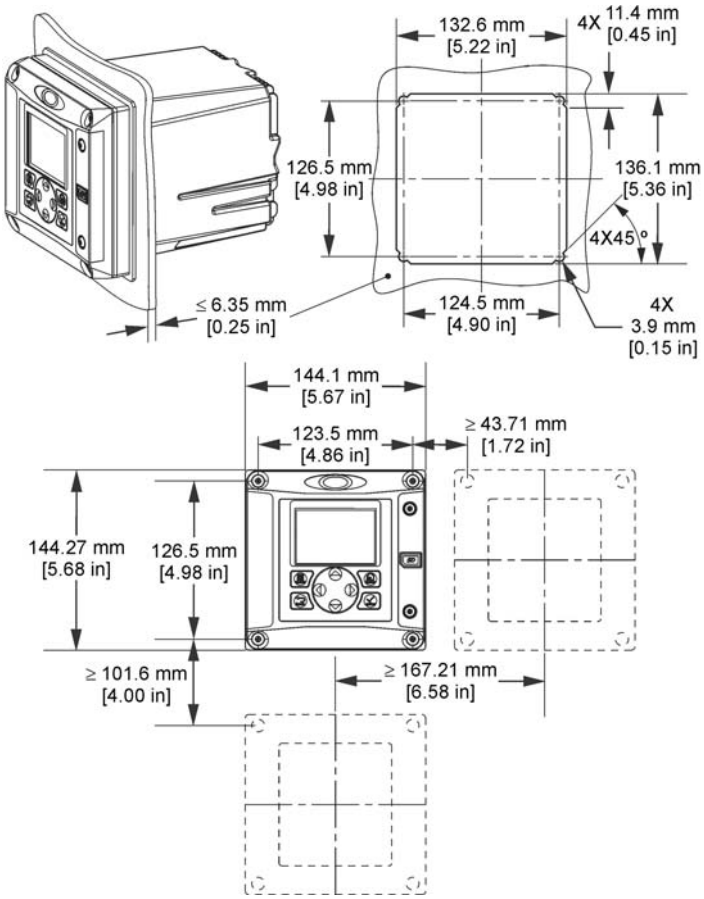


Figure 4 Panel mounting dimensions



Note: *If using the bracket (optional) for panel mounting, push the controller through the hole in the panel and then slide the bracket over the controller on the back side of the panel. Use the four 15 mm pan head screws (supplied) to attach the bracket to the controller and secure the controller to the panel.*

Figure 5 Pipe mounting (vertical pipe)

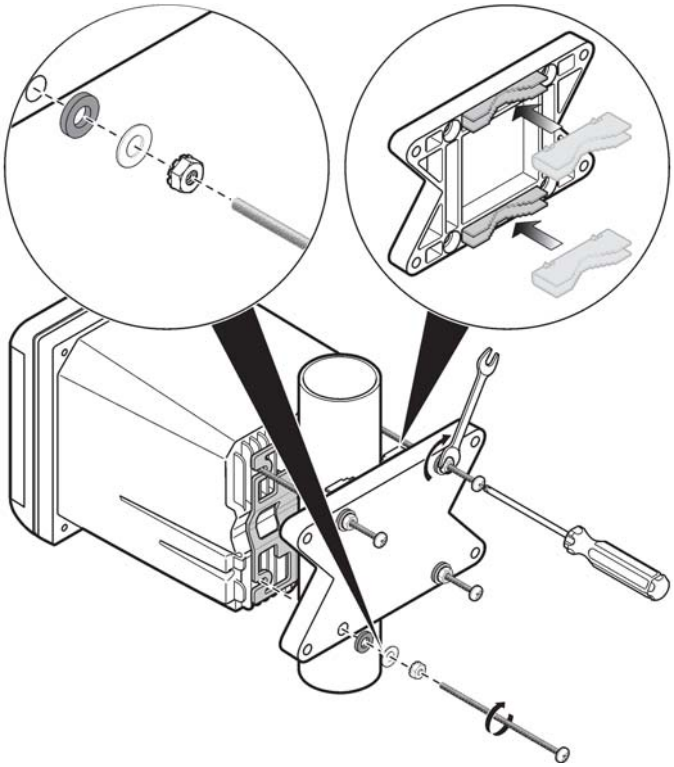
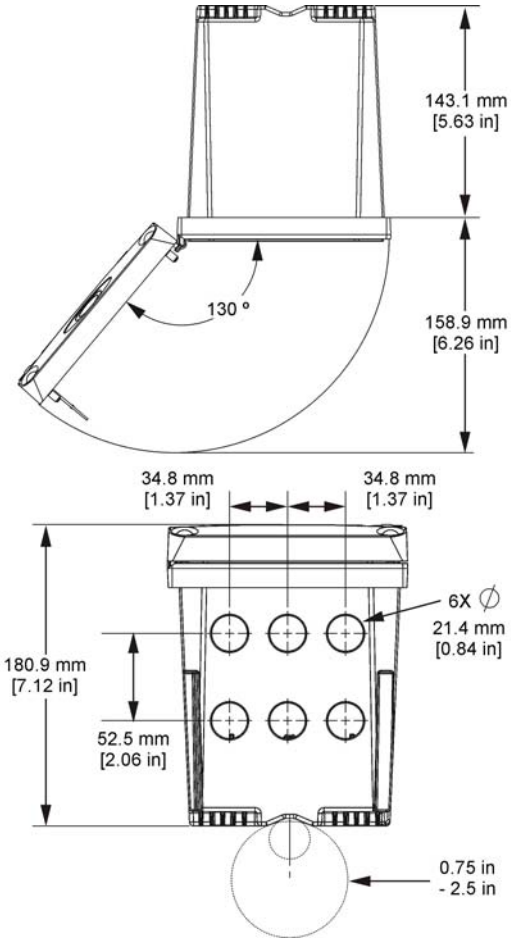


Figure 6 Top and bottom views



High-voltage barrier

High-voltage wiring for the controller is located behind the high-voltage barrier in the controller enclosure. The barrier must remain in place except when installing modules or when a qualified installation technician is wiring for power, alarms, outputs or relays. Do not remove the barrier while power is applied to the controller.

Electrostatic discharge (ESD) considerations

NOTICE	
	Potential Instrument Damage. Delicate internal electronic components can be damaged by static electricity, resulting in degraded performance or eventual failure.

Refer to the steps in this procedure to prevent ESD damage to the instrument:

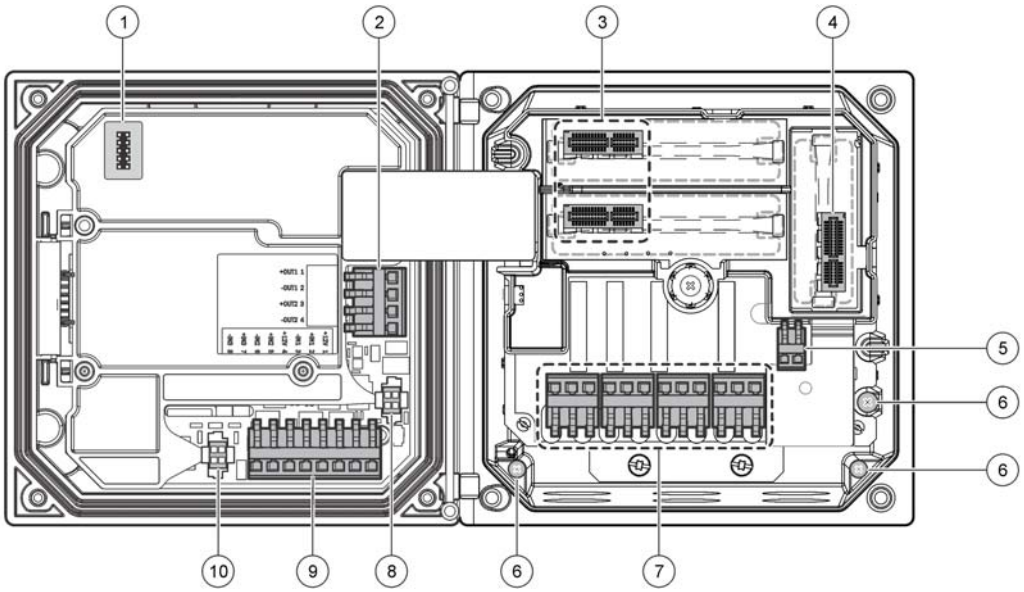
- Touch an earth-grounded metal surface such as the chassis of an instrument, a metal conduit or pipe to discharge static electricity from the body.

- Avoid excessive movement. Transport static-sensitive components in anti-static containers or packages.
- Wear a wrist strap connected by a wire to earth ground.
- Work in a static-safe area with anti-static floor pads and work bench pads.

Wiring overview

Figure 7 shows an overview of the wiring connections inside the controller with the high voltage barrier removed. The left side of the figure shows the back side of the controller cover.
Note: *Remove connector caps from the connectors before module installation.*

Figure 7 Wiring connections overview



1 Service cable connection	**5** AC and DC power connector[3]	**9** Discrete input wiring connector[3]
2 4-20 mA output[3]	**6** Ground terminals	**10** Digital sensor connector[3]
3 Sensor module connector	**7** Relay connections[3]	
4 Communication module connector (e.g., Modbus, Profibus, HART, optional 4-20 mA module, etc.)	**8** Digital sensor connector[3]	

Wiring for power

⚠ WARNING

Potential Electrocution Hazard. Always disconnect power to the instrument when making electrical connections.

[3] Terminals can be removed for improved access.

⚠WARNING

Potential Electrocution Hazard. If this equipment is used outdoors or in potentially wet locations, a **Ground Fault Interrupt** device must be used for connecting the equipment to its mains power source.

⚠DANGER

Electrocution Hazard. Do not connect AC power to a 24 VDC powered model.

⚠WARNING

Potential Electrocution Hazard. A protective earth (PE) ground connection is required for both 100-240 VAC and 24 VDC wiring applications. Failure to connect a good PE ground connection can result in shock hazards and poor performance due to electromagnetic interferences. ALWAYS connect a good PE ground to the controller terminal.

NOTICE

Install the device in a location and position that gives easy access to the disconnect device and its operation.

The controller can be purchased as either a 100-240 VAC powered model or a 24 VDC powered model. Follow the appropriate wiring instructions for the purchased model.

The controller can be wired for line power by hard-wiring in conduit or wiring to a power cord. Regardless of the wire used, the connections are made at the same terminals. A local disconnect designed to meet local electrical code is required and must be identified for all types of installation. In hard-wired applications, the power and safety ground service drops for the instrument must be 18 to 12 AWG.

Notes:

- The voltage barrier must be removed before making any electrical connections. After making all connections, replace the voltage barrier before closing the controller cover.
- A sealing type strain relief and a power cord less than 3 meters (10 feet) in length with three 18-gauge conductors (including a safety ground wire) can be used to maintain the NEMA 4X/IP66 environmental rating.
- Controllers can be ordered with AC power cords pre-installed. Additional power cords may also be ordered.
- The DC power source that supplies power to the 24 VDC powered controller must maintain voltage regulation within the specified 24 VDC-15% +20% voltage limits. The DC power source must also provide adequate protection against surges and line transients.

Wiring procedure

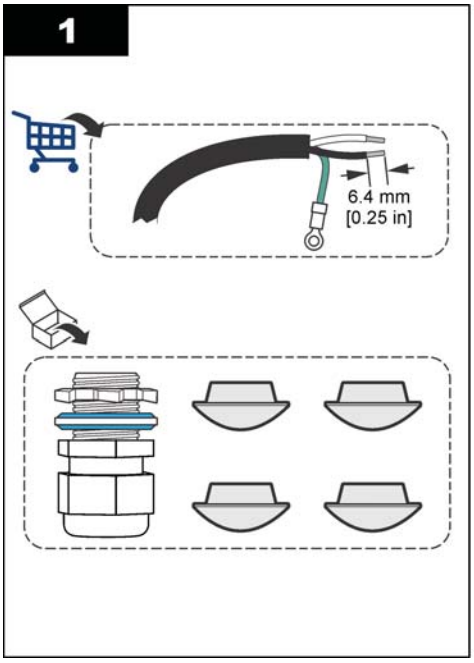
Refer to the illustrated steps that follow and Table 1 or Table 2 to wire the controller for power. Insert each wire into the appropriate terminal until the insulation is seated against the connector with no bare wire exposed. Tug gently after insertion to make sure that there is a secure connection. Seal any unused openings in the controller box with conduit opening sealing plugs.

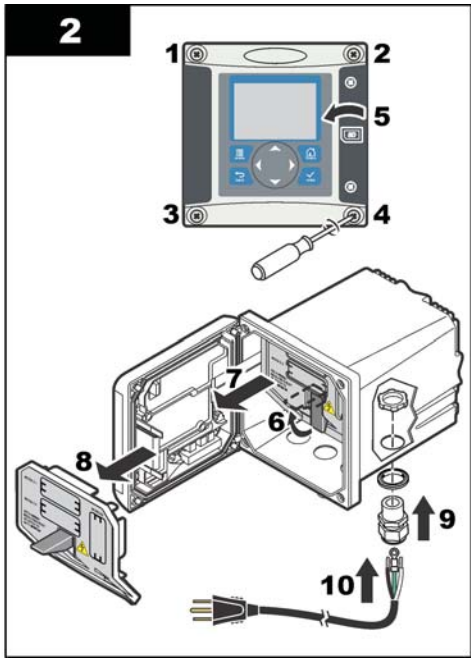
Table 1 AC power wiring information (AC powered models only)

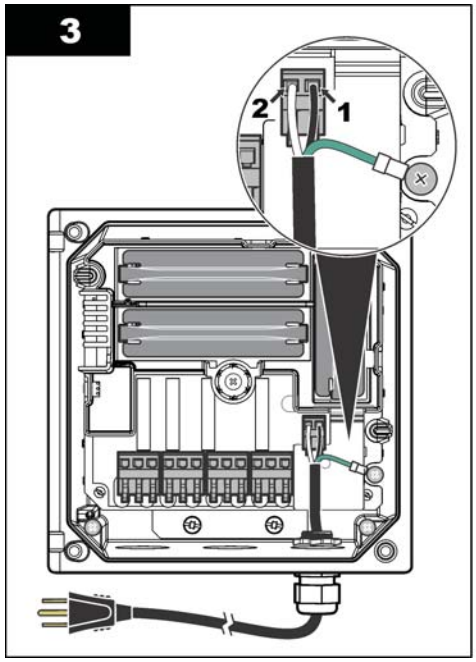
Terminal	Description	Color—North America	Color—EU
1	Hot (L1)	Black	Brown
2	Neutral (N)	White	Blue
—	Protective Earth (PE) Ground lug	Green	Green with yellow stripe

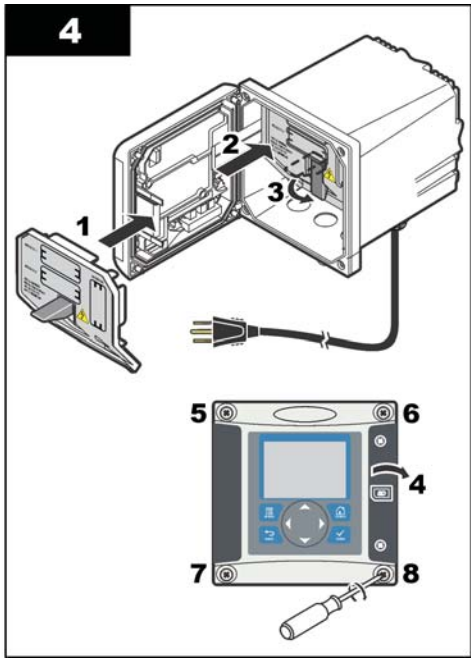
Table 2 DC power wiring information (DC powered models only)

Terminal	Description	Color—North America	Color—EU
1	+24 VDC	Red	Red
2	24 VDC return	Black	Black
—	Protective Earth (PE) Ground lug	Green	Green with yellow stripe









Alarms and relays

The controller is equipped with four unpowered, single pole relays rated 100-250 VAC, 50/60 Hz, 5 amp resistive maximum. Contacts are rated 250 VAC, 5 amp resistive maximum for the AC powered controller and 24 VDC, 5A resistive maximum for the DC powered controller. The relays are not rated for inductive loads.

Wiring relays

⚠ WARNING
Potential Electrocution Hazard. Always disconnect power to the instrument when making electrical connections.

⚠ WARNING
Potential fire hazard. The relay contacts are rated 5A and are not fused. External loads connected to the relays must have current limiting devices provided to limit current to < 5 A.

⚠ WARNING
Potential fire hazard. Do not daisy-chain the common relay connections or jumper wire from the mains power connection inside the instrument.

⚠ WARNING
Potential electrocution hazard. In order to maintain the NEMA/IP environmental ratings of the enclosure, use only conduit fittings and cable glands rated for at least NEMA 4X/IP66 to route cables in to the instrument.

AC line (100—250 V) powered controllers

The wiring compartment is not designed for voltage connections in excess of 250 VAC.

24 VDC powered controllers

⚠ WARNING

Potential electrocution hazard. AC mains powered controllers (115 V–230 V) are designed for relay connections to AC mains circuits (i.e., voltages greater than 16 V-RMS, 22.6 V-PEAK or 35 VDC).

⚠ WARNING

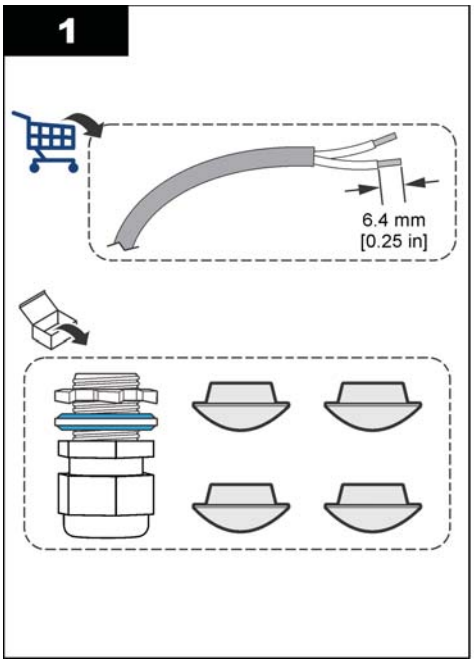
Potential electrocution hazard. 24 V powered controllers are designed for relay connections to low voltage circuits (i.e., voltages less than 16 V-RMS, 22.6 V-PEAK or 35 VDC).

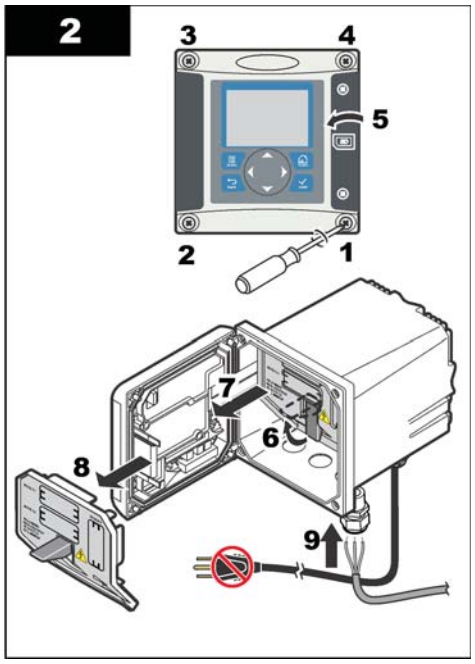
The 24 VDC controller relays are designed for the connection to low voltage circuits (i.e., voltages less than 30 V-RMS, 42.2 V-PEAK or 60 VDC). The wiring compartment is not designed for voltage connections above these levels.

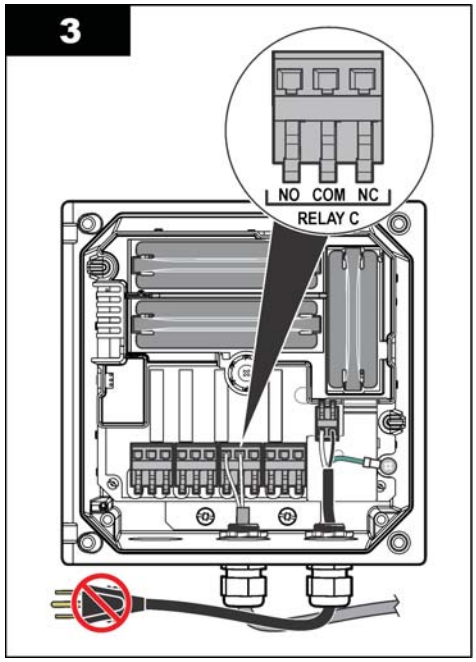
The relay connector accepts 18–12 AWG wire (as determined by load application). Wire gauge less than 18 AWG is not recommended.

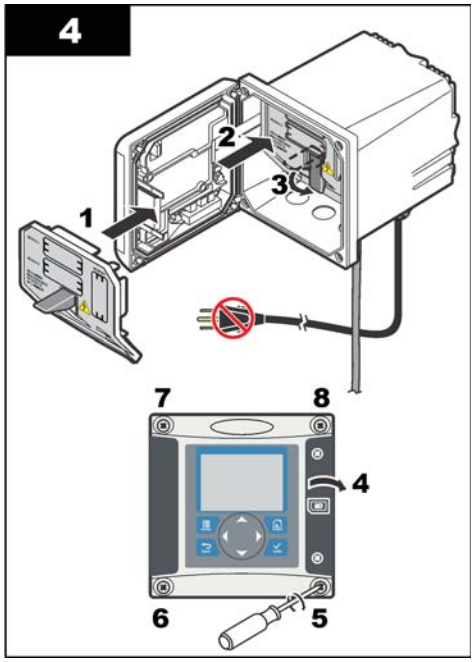
The Normally Open (NO) and Common (COM) relay contacts will be connected when an alarm or other condition is active. The Normally Closed (NC) and Common relay contacts will be connected when an alarm or other condition is inactive (unless the Fail Safe is set to Yes) or when power is removed from the controller.

Most relay connections use either the NO and COM terminals or the NC and COM terminals. The numbered installation steps show connection to the NO and COM terminals.









Analog output connections

⚠WARNING

Potential Electrocution Hazard. Always disconnect power to the instrument when making electrical connections.

⚠WARNING

Potential electrocution hazard. In order to maintain the NEMA/IP environmental ratings of the enclosure, use only conduit fittings and cable glands rated for at least NEMA 4X/IP66 to route cables in to the instrument.

Two isolated analog outputs (1 and 2) are provided (Figure 8). Such outputs are commonly used for analog signaling or to control other external devices.

Make wiring connections to the controller as shown in Figure 8 and Table 3.
Note: *Figure 8 shows the back of the controller cover and not the inside of the main controller compartment.*

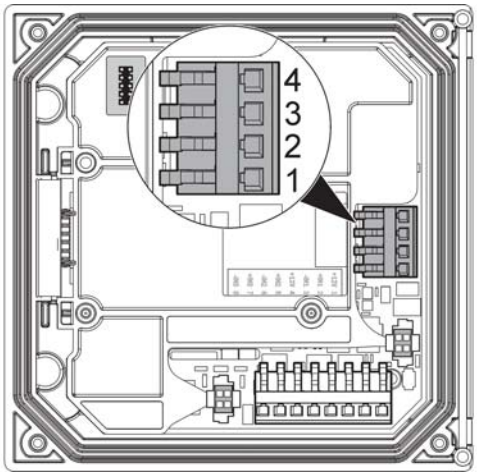
Table 3 Output connections

Recorder wires	Circuit board position
Output 2–	4
Output 2+	3
Output 1–	2
Output 1+	1

1. Open the controller cover.
2. Feed the wires through the strain relief.
3. Adjust the wire as necessary and tighten the strain relief.

4. Make connections with twisted-pair shielded wire and connect the shield at the controlled component end or at the control loop end.
   - Do not connect the shield at both ends of the cable.
   - Use of non-shielded cable may result in radio frequency emission or susceptibility levels higher than allowed.
   - Maximum loop resistance is 500 ohm.
5. Close the controller cover and tighten the cover screws.
6. Configure outputs in the controller.

Figure 8 Analog output connections



Discrete input wiring connections

⚠ WARNING
Potential Electrocution Hazard. Always disconnect power to the instrument when making electrical connections.

⚠ WARNING
Potential electrocution hazard. In order to maintain the NEMA/IP environmental ratings of the enclosure, use only conduit fittings and cable glands rated for at least NEMA 4X/IP66 to route cables in to the instrument.

Three discrete inputs are provided for switch closure inputs or logic level voltage inputs. Make wiring connections and configure jumper settings to the controller as shown in Figure 9, Table 4 and Figure 10.

Note: Figure 9 *shows the back of the controller cover and not the inside of the main controller compartment.*

Figure 9 Discrete input wiring connections

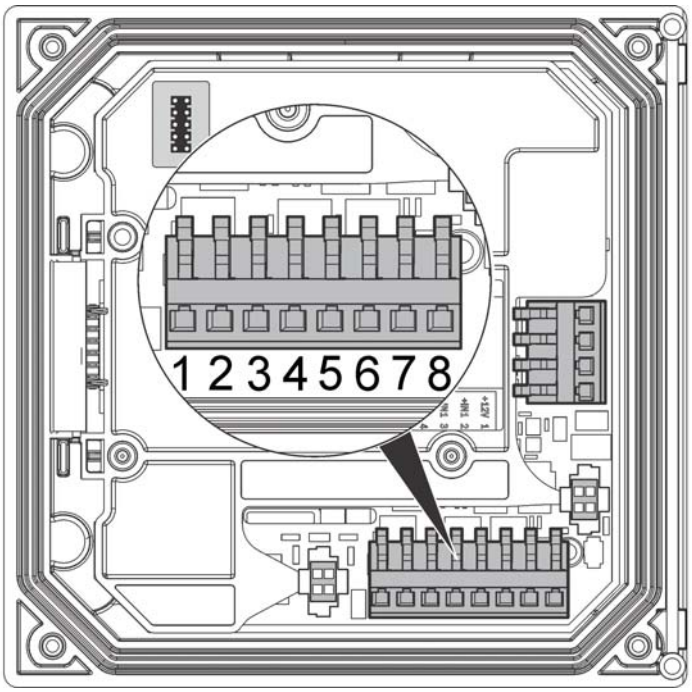
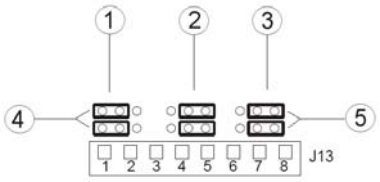


Table 4 Input connections

Discrete inputs	Connector position - Switch input	Connector position - Voltage input
Input 1+	3	2
Input 1-	2	3
Input 2+	6	5
Input 2-	5	6
Input 3+	8	7
Input 3-	7	8

Figure 10 Jumper settings



1 Input 1 configuration jumpers	**4** Jumpers positioned to the left for switch inputs
2 Input 2 configuration jumpers	**5** Jumpers positioned to the right for voltage inputs
3 Input 3 configuration jumpers	

1. Open the controller cover.
2. Feed the wires through the cable gland.
3. Adjust the wire as necessary and tighten the cable gland.
4. The jumpers are positioned immediately behind the connector. Remove the connector for improved access to the jumpers and configure the jumper settings according to the type of input as shown in Figure 10.
5. Close the controller cover and tighten the cover screws.
6. Configure inputs in the controller.

Note: *In* ***switch input*** *mode the controller supplies 12 volts to the switch and is not isolated from the controller. In* ***voltage input*** *mode the inputs are isolated from the controller (user input voltage from 0 to 30 volts).*

Connect a digital sc sensor

Note: *To connect an analog sensor, refer to the instructions supplied in the module or sensor manual.*

A digital sc sensor can be connected to the controller using the keyed quick-connect fitting (Figure 11). A digital sensor can be connected with the controller powered on or off.

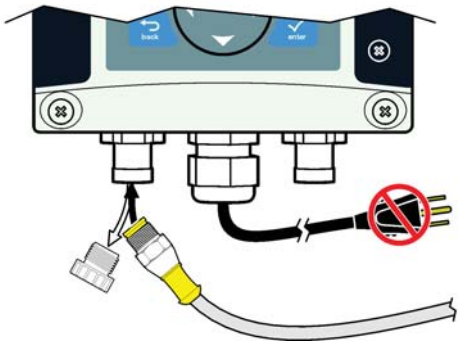
When a sensor is connected with the controller powered on, the controller does not automatically perform a device scan. To make the controller perform a device scan, navigate to the Test/Maintenance menu and select Scan Devices. If a new device is found, the controller performs the installation process without further user action.

When a sensor is connected with the controller powered off, the controller will perform a device scan when it is powered on again. If a new device is found, the controller performs the installation process without further user action.

Retain the connector cap to seal the connector opening in case the sensor must be removed.

Figure 11 Digital sensor quick connect

1.



Connect the optional digital communication output

The manufacturer supports Modbus RS485, Modbus RS232, Profibus DPV1 and HART communication protocols. The optional digital output module is installed in the location indicated by item 4 in Figure 7 on page 12. Refer to the instructions supplied with the network module for more details.

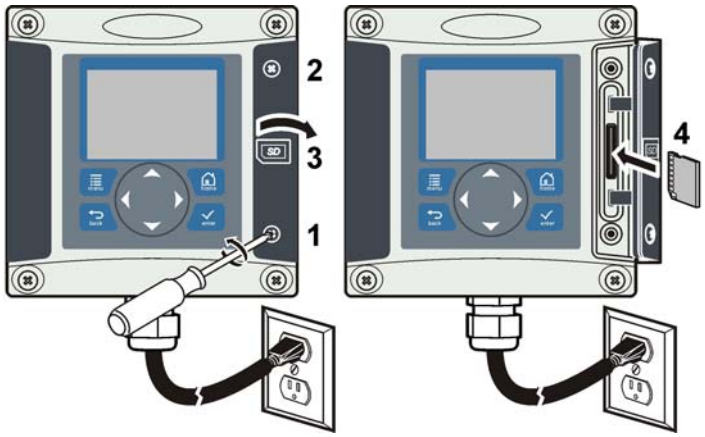
For information about Modbus registers, go to http://www.de.hach.com or http://www.hach.com and search *Modbus registers* or go to any sc200 product page.

Install a Secure Digital (SD) memory card

For instructions on how to install an SD card in the controller, refer to Figure 12. Information on how to use the SD memory card can be found in Using the secure digital memory (SD) card on page 42.

To remove an SD card, push down on the edge of the card and release, then pull the card up and out of the slot. After the card is removed, close the slot cover and tighten the cover screws.

Figure 12 SD card installation

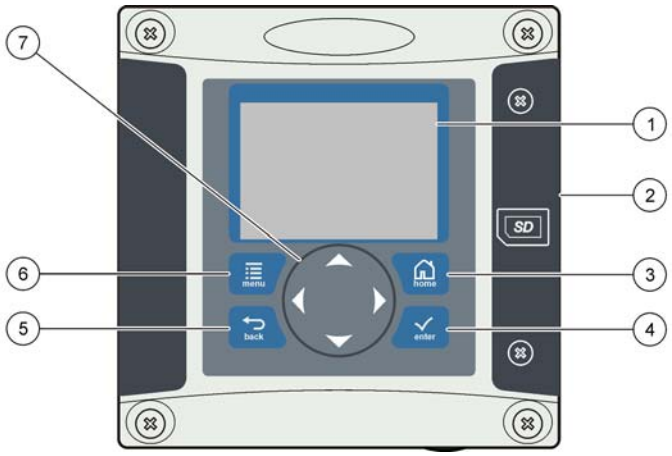


User interface and navigation

User interface

The keypad has four menu keys and four directional keys as shown in Figure 13.

Figure 13 Keypad and front panel overview



1 Instrument display	**5** **BACK** key. Moves back one level in the menu structure.
2 Cover for secure digital memory card slot	**6** **MENU** key. Moves to the Settings Menu from other screens and submenus.
3 **HOME** key. Moves to the Main Measurement screen from other screens and submenus.	**7** Directional keys. Used to navigate through the menus, change settings, and increment or decrement digits.
4 **ENTER** key. Accepts input values, updates, or displayed menu options.	

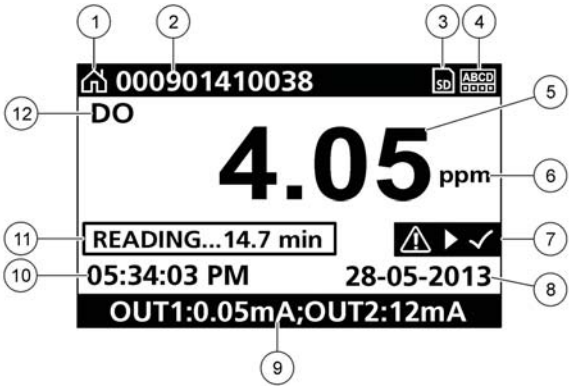
Inputs and outputs are set up and configured through the front panel using the keypad and display screen. This user interface is used to set up and configure inputs and outputs, create log information and calculated values, and calibrate sensors. The SD interface can be used to save logs and update software.

Display

Figure 14 shows an example of the main measurement screen with a DO sensor connected to the controller.

The front panel display screen shows sensor measurement data, calibration and configuration settings, errors, warnings and other information.

Figure 14 Example of Main Measurement screen



1 Home screen icon	**7** Warning status bar
2 Sensor name	**8** Date
3 SD Memory card icon	**9** Analog output values
4 Relay status indicator	**10** Time
5 Measurement value	**11** Progress bar
6 Measurement unit	**12** Measurement parameter

Table 5 Icon descriptions

Icon	Description
Home screen	The icon may vary depending on the screen or menu being displayed. For example, if an SD card is installed, an SD card icon appears here when the user is in the SD Card Setup menu.
SD memory card	This icon appears only if an SD card is in the reader slot. When a user is in the SD Card Setup menu, this icon appears in the upper left corner.
Warning	A warning icon consists of an exclamation point within a triangle. Warning icons appear on the right of the main display below the measurement value. Push the **ENTER** key then select the device to view any problems associated with that device. The warning icon will no longer be displayed once all problems have been corrected or acknowledged.
Error	An error icon consists of an exclamation point within a circle. When an error occurs, the error icon and the measurement screen flash alternately in the main display. To view errors, push the **MENU** key and select **Diagnostics**. Then select the device to view any problems associated with that device.

Additional display formats

- From the Main Measurement screen push the **UP** and **DOWN** arrow keys to switch between measurement parameters
- From the Main Measurement screen push the **RIGHT** arrow key to switch to a split display of up to 4 measurement parameters. Push the **RIGHT** arrow key to include additional measurements. Push the **LEFT** arrow key as needed to return to the Main Measurement screen
- From the Main Measurement screen push the **LEFT** arrow key to switch to the graphical display (see Graphical display on page 23 to define the parameters). Push the **UP** and **DOWN** arrow keys to switch measurement graphs

Graphical display

The graph shows concentration and temperature measurements for each channel in use. The graph supplies easy monitoring of trends and shows changes in the process.

1. From the graphical display screen use the up and down arrow keys to select a graph and push the **HOME** key.
2. Select an option:

Option	Description
MEASUREMENT VALUE	Set the measurement value for the selected channel. Select between Auto Scale and Manually Scale. For manual scaling enter the minimum and maximum measurement values
DATE & TIME RANGE	Select the date and time range from the available options

System startup

When initially powered up, the Language, Date Format and Date/Time screens appear in order. After these options are set, the controller performs a device scan and displays the message **Scanning for devices. Please wait...** If a new device is found, the controller performs an installation process before displaying a main measurement screen.

If the scan finds previously installed devices without configuration changes, the main measurement screen of the device in the number one position appears immediately after the scan is complete.

If a device has been removed from the controller or is not found during the next power-cycled or menu-driven scan, the controller displays a **Device missing** message and prompts to delete the missing device.

If no sensor is connected to an installed analog module, the controller will indicate an error. If devices are connected but not found by the controller, refer to Troubleshooting on page 46.

Set the language, date and time for the first time

The controller displays the language, date and time edit screens when the controller is powered on for the first time, and when it is powered on after the configuration settings have been set to their default values.
After the language, date and time options are set for the first time, update the options as necessary through the sc200 setup menu.

1. In the Language screen, highlight a language in the options list and push the **ENTER** key. English is the default language for the controller.
   The selected language is saved. The Date Format screen appears.
2. In the Date Format screen, highlight a format and push the **ENTER** key.
   The date and time format is saved. Next, the Date /Time screen appears.
3. In the Date/Time screen, push the **RIGHT** or **LEFT** arrow keys to highlight a field, then push the **UP** and **DOWN** arrow keys to update the value in the field. Update the other fields as necessary.
4. Push the **ENTER** key.
   The changes are saved and the controller performs a start-up scan for devices. If connected devices are found, the controller displays the main measurement screen for the device in the number one position. If the controller fails to find connected devices, refer to Troubleshooting on page 46.

Controller configuration information

General information about configuration options is listed in the table.

1. To navigate to the menu options, from the Settings Menu, select sc200 Setup.

Option	Description
Security setup	Sets the passcode preferences (refer to Security setup on page 25)
Output setup	Configures the controller analog outputs (refer to Configure the controller analog outputs on page 27)

Option	Description
Relay setup	Configures the controller relays (refer to Configure relays on page 30)
Display setup	Configures the controller display (refer to Display setup on page 39)
Set Date/Time	Sets the controller time and date (refer to Update the date and time on page 40)
Datalog setup	Configures data logging options. Available only if Calculation has been setup. At least one sensor must be attached to enter a calculation (refer to Set the datalog mode and interval on page 40)
Manage Data	Select the device from the list of installed components to view the data or event log
Error Hold Mode	**Hold Outputs**—Holds outputs at last known value when controller loses communication with the sensor. **Transfer Outputs**—Switches to transfer mode when controller loses communication with the sensor. Outputs transfer to a pre-defined value.
Calculation	Configures the controller math function (refer to Set up a calculation on page 40)
sc200 Information	**S/W VER:**—Displays the current version of controller software **Bootloader VER:**—Displays the current Bootloader version. The Bootloader is a file that loads the main operating system for the controller **S/N:**—Displays the controller serial number **Version:**—Displays the current version of controller hardware
Discrete Input Setup	Configures three discrete input channels (refer to Set up the discrete inputs on page 41)
Language	Assigns the language used in the controller (refer to Update the display language on page 42)

2. Select an option and push **ENTER** to activate the menu item.

Advanced operation

Security setup

Enable or disable the passcode

By default the passcode option is disabled and all configuration settings and calibrations can be changed. When the passcode function is enabled, access to Sensor calibration and Test/Maint menus requires a passcode.
To enable the passcode:

1. From the Settings Menu, select sc200 Setup and push the **ENTER** key.
2. Select Security Setup and push the **ENTER** key.
3. Select Set Passcode and push the **ENTER** key.
4. Select Disabled or Enabled and push the **ENTER** key.
   The passcode is enabled.
5. Push the **BACK** key to return to the sc200 Setup Menu, or push the **MENU** key to return to the Settings Menu.

Edit the passcode

The passcode is factory set to SC200. The Edit Passcode menu option appears in the Security Setup menu only after the passcode feature is enabled and a valid passcode has been entered.
A passcode consists of up to six upper or lower-case alpha, numeric and special characters. Passcodes are case-sensitive.

To edit the passcode:

1. Make sure the passcode is enabled. Refer to Enable or disable the passcode on page 25 for information on how to enable the passcode.
2. From the Settings menu, select Security Setup and push **ENTER**.
3. Use the arrow keys to enter the current valid passcode and push **ENTER**.
   The Edit Passcode option appears in the Security Setup menu.
4. Select Edit Pass Code and push **ENTER**.
   The Edit Pass Code screen appears.
5. Use the arrow keys to edit the passcode and push **ENTER**.
   The new passcode is saved and the Security Setup menu appears.
   Note: *All menus stay accessible until the* ***HOME*** *key is pushed or the controller is restarted.*
6. Push the **HOME** key or perform a controller restart.
   The new passcode settings are saved, and the new passcode is required to enter the Security Setup, Datalog Setup and Test/Maint menus.

Protect features

This option is only displayed if an analyzer or sensor that supports this feature is connected to the controller. Security categories are displayed that are defined by the connected analyzer or sensor. The user can then enable or disable password protection against individual menu options within these categories.

Configure a 4-20 mA input module

An analog module must be installed in the controller.

1. Determine what output the connected device is using (0-20 mA or 4-20 mA). This information will be used to set the scale.
2. Determine what the 20 mA value is equal to (e.g, 100 psi).
3. Determine what the low end (0 or 4 mA) value is equal to (e.g., 10 psi). This information will be used to set the display range.
4. From the Settings Menu, select Sensor Setup.
5. Select Configure.
6. Update the options.
   a. Highlight an option and push **ENTER**.
   b. Make a selection or update the entries.
   c. Push **ENTER** to save the changes.

Option	Description
Edit name	Edits the module name
Edit units	Edits the measurement units
Edit parameter	Edits the parameter name
Display range **For the 0-20 mA scale:** • **Set the 20 mA value** • **Set the 0 mA value** **For the 4-20 mA scale:** • **Set the 20 mA value** • **Set the 4 mA value**	Sets the values used for the selected scale (0-20 mA or 4-20 mA)

Option	Description
Signal average	Sets how often signals are averaged. Higher values produce a smoother signal but increase the time it takes for a signal to respond to a change in the process value.
Set resolution— **X.XXX, XX.XX, XXX.X, XXXX**	Sets the number of decimal places used in the display.
Select scale— **4-20 mA or 0-20 mA**	Sets scale used for the 4-20 mA input
Data log interval—5 sec, 30 sec, 1 min, 2 min, 5 min, 10 min, 15 min, 30 min, 60 min	Sets how often data is logged to the internal controller memory.
Reset defaults—Push ENTER to reset configuration settings or push the BACK key to cancel.	Resets configuration settings to the default values.

For additional information, refer to the *sc200 4–20 Analog Input Module User Manual*.

Configure a 4-20 mA output module

The Network Setup option appears in the Settings Menu only if an analog output module or other network module such as Modbus or Profibus is installed in the controller.

Outputs for analog output modules are set at 4-20 mA. Outputs can be assigned to represent a measured parameter such as pH, temperature, flow or calculated values.

1. From the Settings menu, select Network Setup.
2. Select Edit Name and enter a name for the module. Push **ENTER** to save the name.
3. Select an output (A, B, C, D) and push **ENTER**.
   a. Highlight an option and push **ENTER**.
   b. Make a selection from the list or update the entries.
   c. Push **ENTER** to save the changes.

Option	Description
Select Source	Selects the output to configure—None, sensor 1 name, sensor 2 name, calculation (if set up). For sensor output, Select Parameter sets the measurement options. When the measurement is autorange, Set Range sets the range.
Set Low Value	Sets the 4 mA value (default: 0.000). (Range and units depend on sensor)
Set High Value	Sets the 20 mA value (default: 1.000). (Range and units depend on sensor)
Set Transfer	Sets the transfer value. Range 3.0 to 25.0 mA (default 4.000).
Set Filter	Sets a time-average filter value of 0 (default) to 120 seconds.

For additional information, refer to the *sc200 4-20 Output Module User Manual*.

Configure the controller analog outputs

The controller analog outputs can be assigned to represent the measured parameter or secondary measurements such as temperature and calculations. To configure the options, highlight a menu option, push **ENTER** and select an option or update the entries. Push **ENTER** after an option is selected or the entries are updated.

1. From the Settings menu, select sc200 Setup.
2. Select Output Setup.
3. Select Output 1 or Output 2.

4. Choose Select Source and select a source from the list. Typically the source is one of the sensors attached to the system. If an analog input card is installed, the analog input may be used as a source.
5. From the Output Setup menu, choose Select Parameter and choose an option from the list. Parameters will vary depending on the type of sensors installed.
6. From the Output Setup menu, select Set Function and choose a function. Further setup options will vary depending on which function is chosen.

Option	Description
Linear	Signal is linearly dependent on the process value
PID	Signal works as a PID (Proportional, Integral, Derivative) controller
Logarithmic	Signal is represented logarithmically within the process variable range
Bilinear	Signal is represented as two linear segments within the process variable range

7. From the Output Setup menu, select Activation. Use the information in the table below the chosen function to configure the options.
8. If Transfer is or will be selected as the Error Hold Mode, or if the Transfer will be used during calibration or other functions within the sensor menu, select Set Transfer from the Output Setup menu and enter the transfer value.
9. From the Output Setup menu, select Set Filter and enter the filter value.
10. From the Output Setup menu, select Scale and choose the scale (0-20 mA or 4-20 mA).

- **Linear**

Option	Description
Set low value	Sets the low endpoint of the process variable range
Set high value	Sets the high endpoint of the process variable range

- **PID**

Option	Description
Set mode (Auto or Manual)	Auto—the signal is automatically controlled by the algorithm within the analyzer using proportional, integral, and derivative inputs. Manual—the signal is controlled by the user through manual adjustment of the % change value. This option is shown as Manual Output after the manual set mode is selected.
Phase (Direct or Reverse)	The direction in which the signal responds to process change. Direct—signal increases as the process increases. Reverse—signal increases as process decreases.
Set setpoint	Creates a desired control point of process
Prop band	A function of the difference between the measured signal and the desired setpoint.
Integral	The period of time from the injection point of a reagent to contact with the measuring device.
Derivative	Used to compensate for the 2nd order effects of the process. The majority of applications can be controlled without the use of the derivative setting.
Transit time	Stops all PID control for a selected period of time as the sample travels from the control pump to the measurement sensor.

- **Logarithmic**

Option	Description
Set 50% value	Sets the value corresponding to 50% of the process variable range.
Set high value	Sets the upper value of the process variable range.

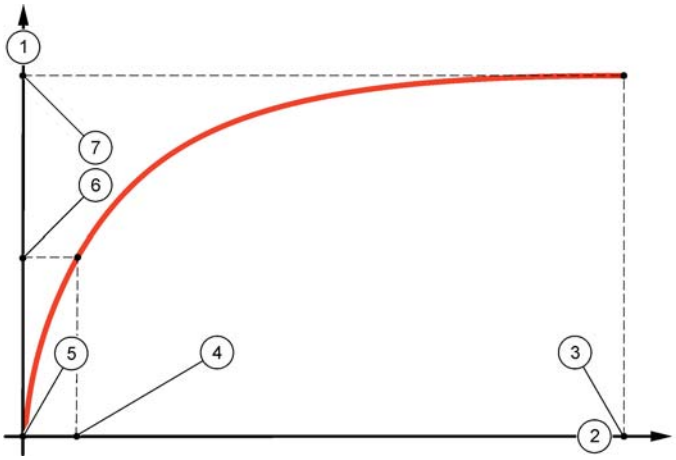
- **Bilinear**

Option	Description
Set low value	Sets the low endpoint value of the process variable range.
Set high value	Sets the high endpoint value of the process variable range.
Set knee point value	Sets the value at which the process variable range divides into another linear segment.
Set knee point current	Sets the value of the current at the knee point value.

Logarithmic output mode

Figure 15 shows in graph form the operation of the logarithmic output mode.

Figure 15 Logarithmic output

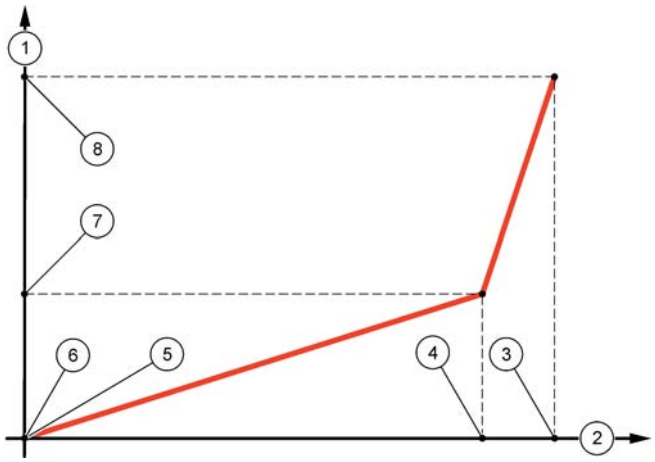


1 Output current axis	**5** Minimum output current (0-4 mA)
2 Source value axis	**6** 50% output current
3 High value	**7** Maximum output current (20 mA)
4 50% value	

Bilinear output mode

Figure 16 shows in graph form the operation of the bilinear output mode.

Figure 16 Bilinear output



1	Output current axis	**5**	Low value
2	Source value axis	**6**	Minimum output current (0-4 mA)
3	High value	**7**	Knee point current
4	Knee point value	**8**	Maximum output current (20 mA)

Configure relays

The Normally Open (NO) and Common (COM) relay contacts will be connected when an alarm or other condition is active. The Normally Closed (NC) and Common relay contacts will be connected when an alarm or other condition is inactive (unless the Fail Safe is set to Yes), or when power is removed from the controller. To select a menu option, highlight the option and push **ENTER**.

1. From the sc200 Setup menu, select Relay Setup.
2. Select a relay from the list.
3. From the Relay Setup menu, choose Select Source and push **ENTER**. Normally, a source is one of the sensors attached to the system, but the controller can also function as a source. If an analog input module is installed, the source may be the analog input.
4. From the Relay Setup menu, select Set Parameter and choose from the list of parameters. The list of parameter options will vary with the type of attached sensor.
5. From the Relay Setup menu, select Set Function and choose from the list. Further setup will depend on the function chosen.

Option	Description
Scheduler Function (available if the controller is selected as the relay source)	Relay switches at certain times independently of any process value
Alarm Function	Relay activates when upper or lower alarm value is exceeded
Feeder Control Function	Relay indicates if a process value exceeds or falls below a setpoint
Event Control Function	Relay toggles if a process value reaches an upper or lower limit
Pulse Width Modulation (PWM) Control Function	Relay uses a Pulse Width Modulation control depending on a process value

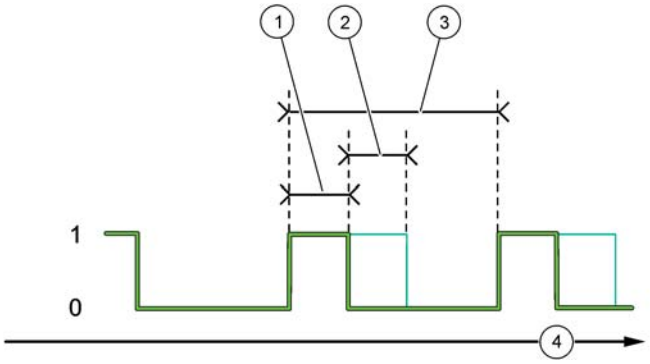
Option	Description
Frequency control	Relay switches with a frequency depending on a process value
Warning	Relay indicates warning and error conditions in probes

6. From the Relay Setup menu, select Set Transfer and choose Active or Inactive.
7. From the Relay Setup menu, select Fail Safe and choose Yes or No.
8. From the Relay Setup menu, select Activation.
   The activation options for the selected function appear. Use the information in the table below each function to update the options.
9. Test the relay function to make sure it is properly energizing the connected device. To do relay testing, go to the Setting menu, then select **Test/Maint>Test Relay**.

- **Scheduler Function (refer to Figure 17)**

Option	Description
Hold outputs	Holds outputs in the present ON or OFF state
Run days	Sets the weekday(s) that the relay operates. Options: Sunday, Monday, Tuesday., Wednesday, Thursday, Friday, Saturday
Start time	Sets the start time.
Interval	Sets the time between activation cycles (Default value: 5 min).
Duration	Sets the period of time the relay is energized (Default value: 30 sec).
Off delay	Sets the time for additional hold/output time after the relay has been turned off.

Figure 17 Scheduler function



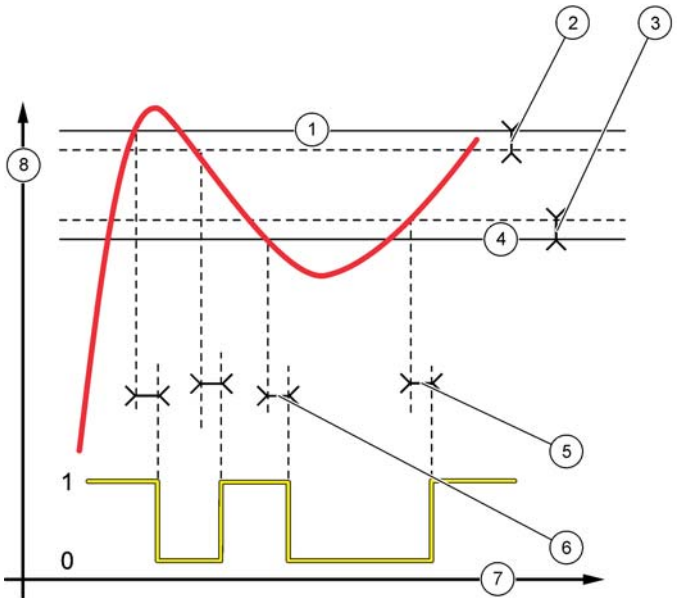
1 Duration	**3** Interval
2 OFF delay	**4** Time (x-axis)

- **Alarm Function (refer to Figure 18)**

Option	Description
Low alarm	Sets the value where the relay will turn on in response to decreasing measured value. For example, if the low alarm is set for 1.0 and the measured value drops to 0.9, the relay activates.
High alarm	Sets the value where the relay will turn on in response to increasing measured value. For example, if the high alarm is set for 1.0 and the measured value increases to 1.1, the relay activates.

Option	Description
Low deadband	Sets the range where the relay remains on after the measured value increases above the low alarm value. For example, if the low alarm is set for 1.0 and the low deadband is set for 0.5, the relay remains on between 1.0 and 1.5. Default is 5% of the range.
High deadband	Sets the range where the relay remains on after the measured value decreases below the high alarm value. For example, if the high alarm is set for 4.0 and the high deadband is set for 0.5, the relay remains on between 3.5 and 4.0. Default is 5% of the range.
Off delay	Sets a time (0-300 seconds) to delay the relay from normally turning off (Default: 0 seconds).
On delay	Sets a delay time for the relay to turn on (Default: 0 seconds).

Figure 18 Alarm function



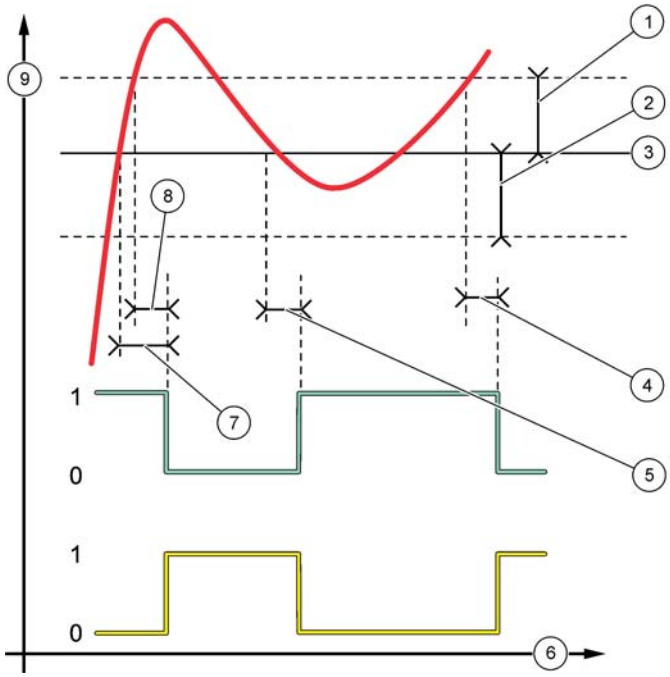
1 High alarm	**5** ON delay
2 High deadband	**6** OFF delay
3 Low deadband	**7** Time (x-axis)
4 Low alarm	**8** Source (y-axis)

- **Feeder Control Function (refer to Figure 19 and Figure 20)**

Option	Description
Phase	Defines the relay status if the process value exceeds the setpoint. High (default)—turns the relay on when the process value exceeds the setpoint. Low—turns the relay on when the process value falls below the setpoint.
Set setpoint	Sets the process value at which the relay toggles. The default value is different for each sensor.
Deadband	Sets the area for an amount of change necessary after the relay setpoint is reached in order to satisfy a condition.

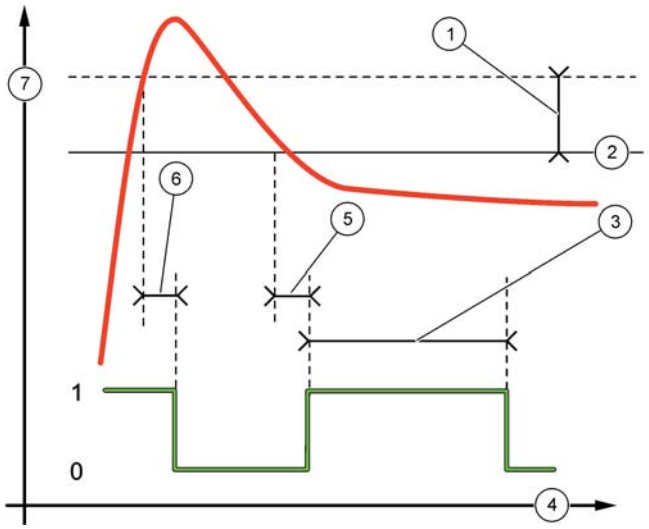
Option	Description
Overfeed timer	Sets a time period for de-activating an active relay if the process setpoint cannot be reached. Once an overfeed alarm is present, it must be manually reset.
Off delay	Sets a delay time for the relay to turn off (default: 0 seconds).
On delay	Sets a delay time for the relay to turn on (default: 0 seconds).

Figure 19 Feeder control function



1 Deadband (Phase = Low)	**6** Time (x-axis)
2 Deadband (Phase = High)	**7** ON delay (phase set high)
3 Setpoint	**8** OFF delay (phase set low)
4 OFF delay (phase set high)	**9** Source (y-axis)
5 ON delay (phase set low)	

Figure 20 Feeder control function (Phase low, Overfeed timer)

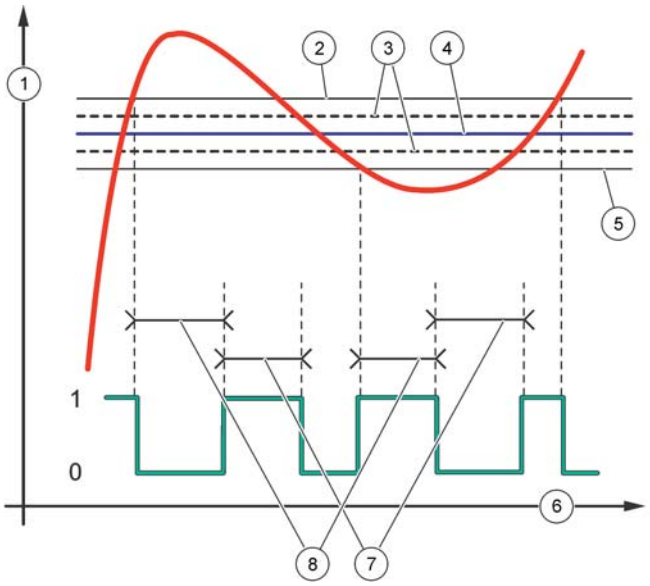


1 Deadband	**5** ON delay
2 Setpoint	**6** OFF delay
3 Overfeed timer	**7** Source (y-axis)
4 Time (x-axis)	

- **Event Control Function (refer to Figure 21, Figure 22 and Figure 23)**

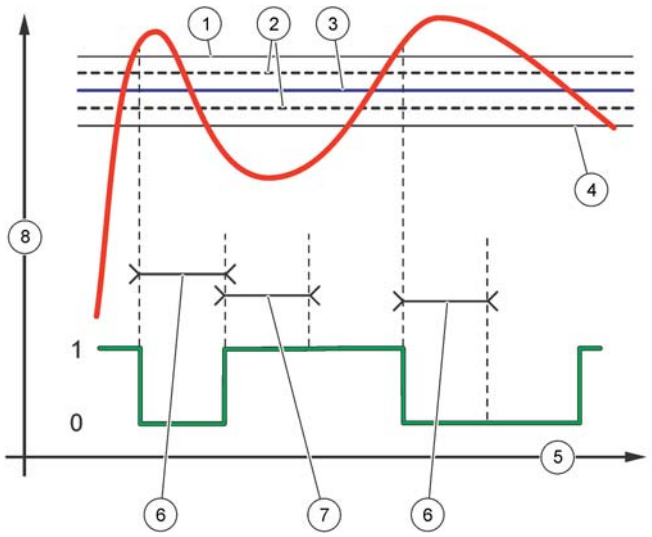
Option	Description
Set setpoint	Sets the value where the relay will turn on.
Deadband	Sets a hysteresis so the relay will not swing unregulated when the process value converges to the setpoint.
OnMax timer	Sets the maximum time the relay can stay on independent from the measured value (default: + 0 min).
OffMax timer	Sets the maximum time the relay can stay off independent from the measured value (default: + 0 min).
OnMin timer	Sets the minimum time the relay can stay on independent from the measured value (default: + 0 min).
OffMin timer	Sets the minimum time the relay can stay off independent from the measured value (default: + 0 min).

Figure 21 Event control function (no delay)



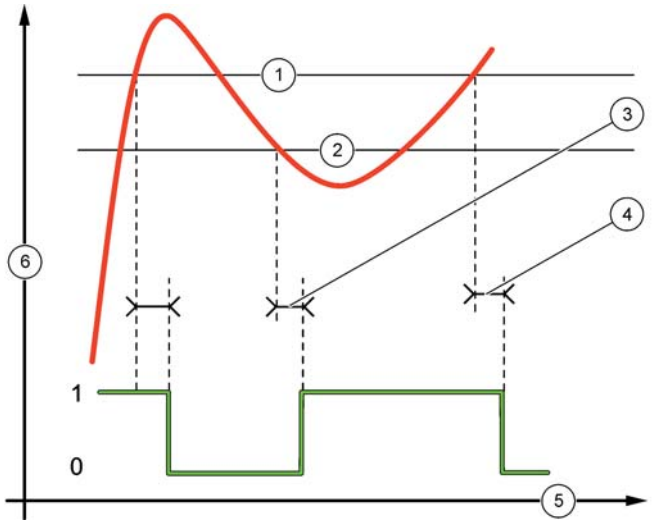
1 Source (y-axis)	**5** Low alarm
2 High alarm	**6** Time (x-axis)
3 Deadband	**7** OnMax-time
4 Setpoint	**8** OffMax-time

Figure 22 Event control function (OnMin timer, OffMin timer)



1 High alarm	**5** Time (x-axis)
2 Deadband	**6** OffMin timer
3 Setpoint	**7** OnMin timer
4 Low alarm	**8** Source (y-axis)

Figure 23 Event control function (ON/OFF delay)

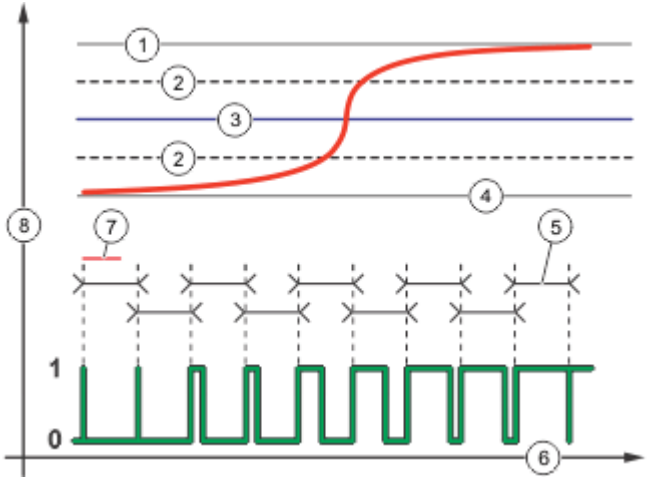


1 High alarm	**4** OFF delay
2 Low alarm	**5** Time (x-axis)
3 ON delay	**6** Source (y-axis)

- **Pulse Width Modulation Control Function (refer to Figure 24)**

Option	Description
Set mode	Auto—the relay output works as a PID controller. Manual—the signal is controlled by the user through manual adjustment of the % change value. This option is shown as Manual Output after the manual set mode is selected.
Phase	Reverses the leading sign of the control deviation for the PID controller (default: Reverse). The phase selects whether the relay will operate at the first part of a cycle (direct phase) or the second part (reverse phase).
Set setpoint	Creates a setpoint value.
Dead zone	The range above and below the setpoint. In this set range, the PID controller does not take action to change the Pulse Width Modulation On/Off Ratio output signal until the limits of the dead zone are reached.
Period	Sets the cycle duration of the PWM output signal (default: 5 seconds).
Min width	Sets the minimum PWM ratio (default: 1.0 second).
Max width	Sets the maximum PWM ratio (default: 4.0 seconds).
Prop band	Sets the proportional part of the PID controller. The proportional part of the controller supplies an output signal which is linearly dependent to the control deviation. The proportional part reacts on any changes at the input but starts to oscillate easily if the value is set high. The proportional part cannot completely compensate for disturbances.
Integral	Sets the integral part of the PID controller (default: 000 minutes). The integration part of the controller supplies an output signal. The output signal increases linearly if the control deviation is constant. The integration part responds slower than the proportional part and can completely compensate disturbances. The higher the integration part, the slower it responds. If the integration part is set too low, it starts to oscillate.

Figure 24 Pulse Width Modulation function (linear mode)

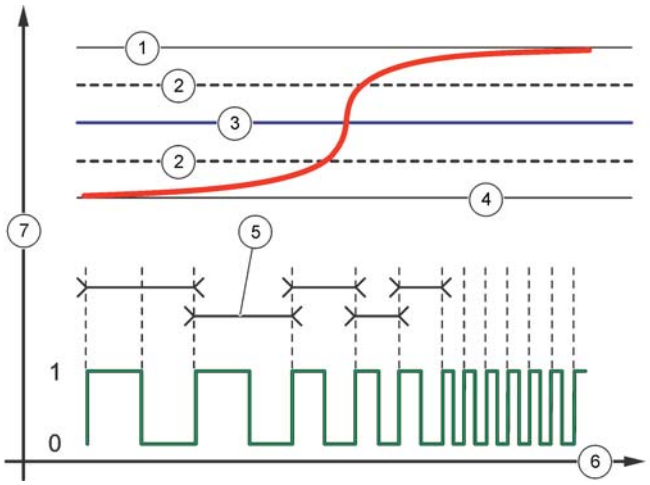


1 High alarm	**5** Period
2 Deadband	**6** Time (x-axis)
3 Setpoint	**7** Phase
4 Low alarm	**8** Selected source (y-axis)

- **Frequency Control Function (refer to Figure 25)**

Option	Description
Set mode	Auto—The relay works as a PID controller. Manual—the signal is controlled by the user through manual adjustment of the % change value. This option is shown as Manual Output after the manual set mode is selected.
Phase	Reverses the leading sign of the control deviation for the PID controller (default: Reverse). The phase selects whether the relay will operate at the first part of a cycle (direct phase) or the second part (reverse phase).
Set setpoint	Sets the process value which is controlled by the PID controller.
Dead zone	In this set range, the PID controller does not take action to change the output frequency until within the limits of the dead zone.
Pulse width	Sets the cycle duration (0-600 seconds) of the PWM output signal. (default: 0.5 seconds) The cycle duration is equal to the duty cycle of the output signal.
Minimum pulses	Sets the minimum number of pulses per minute at which the relay can operate. Range: 0.001–4.000 (default: 1.000)
Maximum pulses	Sets the maximum number of pulses per minute at which the relay can operate. Range: 0.001–60.000 (default: 04.000). This value cannot be set lower than Minimum Pulses value.
Prop band	Sets the proportional part of the PID controller. The proportional part of the controller supplies an output signal which is linearly dependent to the control deviation. The proportional part reacts on any changes at the input but starts to oscillate easily if the value is set high. The proportional part cannot fully compensate for disturbances.
Integral	Sets the derivative part of the PID controller (default: 000 minutes). The integration part of the controller generates an output signal. The output signal increases linearly if the control deviation is constant. The integration part responds slower than the proportional part and can fully compensate disturbances. The higher the integration part, the slower it responds. If the integration part is set too low, it starts to oscillate.

Figure 25 Frequency control function



1	High limit	**5**	Cycle duration
2	Deadband	**6**	Time (x-axis)
3	Setpoint	**7**	Selected source (y-axis)
4	Low limit		

- **Warning Function**

Option	Description
Warning	Sets the level for warning activation. Refer to the sensor manual for the numbers for individual warning messages.

Display setup

Configures the controller display.

1. From the Settings menu, select sc200 Setup and push **ENTER**.
2. Select Display Setup and push **ENTER**.

Option	Description
Adjust Order	View and modify the measurement display order. • **See Current Order**—View the current display order • **Add Measurements**—Add selected measurements to the display • **Remove Measurements**—Remove selected measurements from the display • **Reorder List**—Select one or more measurements and change their order in the display • **See Default Order**—View the default display order • **Set to Default**—Set the display order to the default configuration ***Note:*** *Some of the above will not be available if no adjustment is possible for that option (e.g.* ***Reorder List*** *and* ***Remove Measurements*** *will not be available if only one measurement is selected for display).*
Display Contrast	Adjust the contrast to a value between the minimum of +1 and the maximum of +9
Edit Name	Assigns a name to the controller

Update the date and time

1. From the Settings menu, select sc200 Setup and push **ENTER**.
2. Select Set Date/Time and push **ENTER**.
3. Select Date Format from the Set Date/Time screen and push **ENTER**.
4. Select a format and push **ENTER**.
5. Select Date/Time from the Set Date/Time screen and push **ENTER**.
6. Update the entries.
   a. Use the right and left arrow keys to highlight a field.
   b. Use the up and down arrow keys to change the values in the field and push **ENTER**.
   c. At the end of the date field, push the right arrow to wrap down to the time fields.
   d. Use the up and down and arrow keys to update the time fields.
7. Push **ENTER** to save the changes.
   The controller returns to the Set Date/Time menu.

Set the datalog mode and interval

Datalog Setup is available if a calculation has been set up.

1. From the Settings menu, select sc200 Setup and push **ENTER**.
2. Select Datalog Setup and push **ENTER**.
3. Select Set Mode and push **ENTER**.
4. Select an option (Snap Shot, Average, Maximum, Minimum) and push **ENTER**.
5. From the Datalog Setup menu, select Set Interval and push **ENTER**.
6. Select an interval from the list and push **ENTER**.

Set up a calculation

1. From the Settings menu, select sc200 Setup and push **ENTER**.
2. Select Calculation and push **ENTER**. Select a menu option and choose from the displayed list or update the entry. Refer to the table below for more information about each option.

Option	Description
Set variable X	Selects the sensor for the x variable
Set parameter X	Selects the sensor measurement for the x variable
Set variable Y	Selects the sensor for the y variable
Set parameter Y	Selects the sensor measurement for the y variable
Set formula	Select the math function to implement: • **None**—Disables the math function • **X-Y**—Subtraction function • **X+Y**—Addition function • **X/Y**—Division function • **[X/Y]%**—Percentage function • **[X+Y]/2**—Average function • **[X*Y]**—Multiplication function • **[X-Y]%/X**—Difference function
Display format	Selects the number of digits and decimal points

Option	Description
Set units	Selects the units for the calculated reading
Set parameter	Selects the parameter for the calculated reading

3. Push **ENTER** to save the selection or setting and return to the Calculation menu.

Set up the discrete inputs

Use these inputs to switch closure inputs or logic level voltage inputs.

1. Press the **MENU** key.
2. Select sc200 Setup and push **ENTER**.
3. Select Discrete Input Setup and push **ENTER**.
4. Select the desired channel (Input 1, Input 2 or Input 3) and push **ENTER**.
5. Select a control logic option and push **ENTER**.

Option	Description
Disable	This channel is disabled and not used.
On/High	This channel is active when either the switch input is On (or closed), or the logic level voltage input is at a High level.
Off/Low	This channel is active when either the switch input is Off (or opened), or the logic level voltage input is at a Low level.

6. Select a warning option and push **ENTER**.

Option	Description
Off	An active discrete input does not trigger a device warning.
On	An active discrete input triggers a device warning.

7. Select an output mode option and push **ENTER**.

Option	Description
Active	Output level continues to represent operating conditions.
Hold	Output level is held static.
Transfer	Output level moves to a pre-configured value.

8. Select the sensors that will have their outputs (analog and relay) affected when one of the discrete inputs becomes active. Push **ENTER**.
9. Use the arrows to select the On Delay value (the duration time delay between the discrete input activation and the configured response of the controller). Push **ENTER**.
10. Use the arrows to select the Off Delay value (the duration time delay between the discrete input de-activation and the configured response of the controller). Push **ENTER**.
11. Repeat steps 4–10 for each desired channel.
12. If a discrete input needs to be changed after initially set up:
    a. Repeat steps 1–4 and an Input Settings menu appears with the following options:
       - Control Logic
       - Set Warning
       - Output Mode
       - On Delay
       - Off Delay
    b. Select the desired option and push **ENTER**.

c. Make the desired changes and push **ENTER** to save the changes and return to the Inputs Setting menu.

Update the display language

The display language can be changed through the Setup menu.

1. From the Settings Menu, select sc200 Setup and push **ENTER**.
2. Select Language and push **ENTER**.
   The list of language options appears. English is the default language for the controller.
3. Highlight the language to be used for the controller and push **ENTER**.
   The selected language is saved and is used for the controller display. The display returns to the sc200 Setup menu.

Using the secure digital memory (SD) card

An SD card must be installed in the controller.

- The SD card can be used to update software and firmware and to download event and data logs. If the SD card is installed while the controller is in the Settings Menu, push the **HOME** key and then the **MENU** key to verify the option is visible. The SD icon will also be visible in the upper status bar of the main measurement screen when a card is installed.
- Data log files on the SD card are available in XML and binary formats.
- DataCom is used to convert files from binary to CSV format. Refer to the DataCom manual for more information on how to use the application. For a copy of the DataCom manual, software updates or other downloadable resources, go to http://www.de.hach.com or http://www.hach.com. Search *DataCom* or go to any sc200 product page.

Updating software

Notes:

- The controller does not automatically transfer information to or from an SD card.
- When the SD card is put in multiple controllers, each controller has a separate set of folders in the SD card memory. To make sure software updates are in the correct folder for the controller in use, it is best to use a separate dedicated SD card for each controller.

1. From the Settings Menu, select SD Card Setup and push the **ENTER** key.
2. Select Upgrade Software and push the **ENTER** key.

   Note: *If the Upgrade Software option does not appear, do the steps in* Firmware updates with SD cards on page 44.
3. Select a device from the list and push the **ENTER** key. The list of options includes the controller and all connected devices that have software placed in the appropriate folder on the SD card.
4. If more than one version of the upgrade software is available, select the version with the highest number and push the **ENTER** key.
5. Push the **ENTER** key to begin the software transfer.
   The display will show "Transferring files. Please wait..." The percentage of completion appears in the bottom left corner of the display. The upgrade cannot be halted once it has begun.

   - When the transfer is successful, the display will show "Transfer complete" along with a prompt to push **ENTER** to restart the controller or to push the **BACK** key and exit to the SD Card Setup menu. Controller updates take effect when the controller is restarted. A restart is not necessary for sensor updates.
   - If the transfer is unsuccessful, the display will show "Transfer failed" and an error message. Press the **ENTER** key to acknowledge the warning and exit out of the menu. Error messages are different for each sensor. Refer to the applicable sensor manual.

Saving data and event logs with SD cards

Notes:

- Data and event logs can be downloaded to an SD card and viewed with any device capable of reading an SD card.
- Data logs store the measurement data at selected intervals in a packed binary format (.flg file).
- Event logs store a variety of events that occur on the devices such as configuration changes, alarms and warning conditions. Event logs are set up during the sensor or module configuration process. Event logs are stored in a CSV format.

1. From the Settings Menu, select SD Card Setup and push the **ENTER** key.
2. Select Save Logs and push the **ENTER** key.
3. If more than one device appears on the screen, all devices are selected by default. To deselect an item, highlight the selection and push the left arrow key. Select the devices from which logs will be saved and push the **ENTER** key.
4. Select the time period from which logs are to be saved.

Option	Description
Last Day	All logs from the last full 24 hours, starting from 12:00 a.m., and any additional time remaining on the current day
Last Week	All logs from the last full week (7 days) starting from 12:00 a.m., and any additional time remaining on the current day
Last Month	All logs from the last full month (30 days) starting from 12:00 a.m., and any additional time remaining on the current day
All	Save all logs in memory
New	All logs that are new since the last time logs were saved to the SD card

5. Push the **ENTER** key to confirm the choice, and push the **ENTER** key again to begin the file transfers.
6. Allow time for the files to transfer. The display will show Transferring files. Please wait... and the percentage of files transferred.
   If the transfer is successful, the display will show "Transfer complete." If the transfer is not successful, the display will show "Transfer failed."
7. Do one of the following:
   a. Push the **ENTER** key to exit back to the SD Card Setup menu.
   b. Push the **HOME** key to return to the measurement screen.
   c. Push the **BACK** keys to return to the Settings Menu.

Access data and event log files on the SD card

A PC with an SD Card reader device or USB adapter is necessary to view the event and data logs kept on the SD Card. Excel 2003 or higher (for XML files) or the Data Com application (for binary flg files) is necessary to open the event and data logs.
Data logs have the following structure: Device Name, Device Serial Number, Device Identification, Data Log, Time Stamp.

Event logs have the following structure: Device Name, Device Serial Number, Device Identification, Event Log, Time Stamp.

To view data or event log files stored on the SD card:

1. Attach the card reader device to the PC (if necessary) and install the SD card that contains the files in the reader device.
2. In the SD card directory, open the HACH folder.
3. Select the Logs folder.
4. Select a device folder.

The event and data log files in the folder are shown.

5. To view XML data log files:
   a. Make sure the HachDatalog.xsl style sheet exists in the device folder.
   b. Open the Excel application.
   c. Go to File, Open.
   d. Select the data log file.
   e. In the Import XML dialog box, select **Open the file with the following style sheet applied** and select **HachDatalog.xml**.
   f. Click OK to view the data.
6. To view binary data log (.flg) files:
   a. Make sure the device driver (.flg.drv) file exists in the device folder.
   b. Open Data Com.
   c. In the File Viewer section, click Open.
   d. Select the data log file.
   The data log file is shown in the box and a comma separated values (csv) file with the same file name is created. This csv file can be opened in Excel.

Firmware updates with SD cards

The latest firmware updates can be placed on an SD card. The SD card can then be used to update the controller or device firmware.

A PC and a USB card reader or other device capable of reading an SD card are necessary.

1. Find the zip file at http://www.hach-lange.com or http://www.hach.com and copy it to the PC.
2. Extract file(s) from the zip folder and save them to the SD card.
3. Remove the SD card and update the controller and device firmware. Refer to Updating software on page 42.

Backup settings to an SD card

Saves the configuration of a device to the SD card.

1. Push the **MENU** key.
2. Select SD Card Setup and push **ENTER**.
3. Select Manage Configuration and push **ENTER**.
4. Select Backup Settings and push **ENTER**.
5. Select the devices to be backed up. All devices are selected by default. To deselect an item, highlight the selection and push the left arrow key. Push **ENTER** to begin the file transfers. If backup files already exist on the SD card, a confirmation window appears. Select the devices again and push **ENTER**. Wait for the "Transfer complete" message.
6. Push **ENTER** again to return to the Manage Configuration menu.

Restore settings to the controller

This menu selection only appears if a (serial number-specific) backup file for the controller or one of the sensors connected to it exists on the SD Card. This menu selection loads the configuration of a specific device from the SD card to the same device (serial number-controlled function).

1. Push the **MENU** key.
2. Select SD Card Setup and push **ENTER**.
3. Select Manage Configuration and push **ENTER**.
4. Select Restore Settings and push **ENTER**.
5. Select the device that will be restored. All devices are selected by default. To deselect an item, highlight the selection and push the left arrow key. Push **ENTER** to begin the file transfers.

6. When the transfer is complete, push **ENTER**.
7. To have the settings take effect immediately, restart the controller. Push the **BACK** key to exit the Manage Configuration menu.

Transfer settings to another device

All device settings including calibration, sensor name, selected temperature and measurement units and data logging settings are transferred.

1. Push the **MENU** key.
2. Select SD Card Setup and push **ENTER**.
3. Select Manage Configuration and push **ENTER**.
4. Select Transfer Settings and push **ENTER**. Two options appear:
   - Retrieve Settings
   - Copy Settings
5. To retrieve settings from the controller (or a device connected to it) and put the settings on the SD card:
   a. Select Retrieve Settings and push **ENTER**.
   b. Select the devices that contain the information to be transferred. All devices are selected by default. To deselect an item, highlight the selection and push the left arrow key. Push **ENTER** to begin the file transfers. Wait for the "Transfer complete" message.
   c. If files already exist on the SD card, a confirmation window appears. Select the devices again and push **ENTER**. Wait for the "Transfer complete" message.
   d. Push **ENTER** to return to the Manage Configuration menu.
6. To copy settings from the SD card to a controller (or a device connected to it):
   a. Select Transfer Settings and push **ENTER**.
   b. Select Copy Settings and push **ENTER**.
   c. Select the devices on the SD card. All devices are selected by default. To deselect an item, highlight the selection and push the left arrow key. Push **ENTER** to begin the file transfers.
7. When the transfer is complete, push **ENTER** to restart the connected devices.
8. Push **ENTER** to restart the controller or push **BACK** to return to the Manage Configuration menu.

Using the service port

The service port is used to download data files from the controller and install new versions of controller and sensor firmware. To download data and update software, use the service port in combination with DataCom and a service cable (LZX887).

Using DataCom

When using the service port, it is necessary to use DataCom. DataCom is a PC Application Utility that downloads data log and event log files from the controller and installed sensors. Files are downloaded from the controller through the controller service port or they can be placed on a Secure Digital Memory (SD) card installed in the controller. In addition, DataCom is used to upload software for the controller and sensors. The DataCom application must be installed on a PC to read the files.

Refer to the DataCom manual for more information on how to use the application. The DataCom manual, software updates and other downloadable resources are available at http://www.de.hach.com or http://www.hach.com on any sc200 product page.

Maintenance

⚠ DANGER

Multiple hazards. Only qualified personnel must conduct the tasks described in this section of the document.

Cleaning the controller

⚠ DANGER

Always remove power from the controller before performing maintenance activities.

Note: *Never use flammable or corrosive solvents to clean any part of the controller. Use of these solvents may degrade the environmental protection of the unit and may void the warranty.*

1. Make sure the controller cover is securely closed.
2. Wipe the controller exterior with a cloth dampened with water, or with a mixture of water and mild detergent.

Fuse replacement

Fuses are not user-serviceable items. The need for fuse replacement in controllers indicates severe technical failure and is therefore considered to be a service activity. If a blown fuse is suspected, contact Technical Support.

Battery replacement

The lithium ion backup battery is not user replaceable. Contact technical support for replacement.

Troubleshooting

Problem	Resolution
No current output	Verify current output configuration.
	Test current output signal using the Test/Maintenance submenu. Input a current value and verify the output signal at the controller connections.
	Contact Technical Support.
Incorrect current output	Verify current output configuration.
	Test current output signal using the Test/Maintenance submenu. Input a current value and verify the output signal at the controller connections. If the output is incorrect, perform an output calibration.

Problem	Resolution
No relay activation	Make sure relay connections are secure.
	If using an external power source, make sure the relay wiring is correct.
	Make sure the relay configuration is correct.
	Test the relay activation through the Test/Maintenance menu. The relay should energize and de-energize as selected.
	Make sure the controller is not in calibration mode and that the relay is not being held.
	Reset the Overfeed Timer to make sure the timer has not expired.
Secure Digital Memory (SD) card not recognized by the controller	Make sure the SD card is properly oriented. The copper traces should face toward the controller display.
	Make sure the SD card is fully seated in the slot and the spring lock is engaged.
	Make sure the SD card is properly formatted with a Fat 32 format. The MMC format is not supported. Follow the instructions of the card manufacturer to format the SD card on a PC.
	Make sure the card is not larger than 32 GB.
	Make sure an SD card is being used. Other types of cards (such as xSD, micro SD, mini SD) will not work properly.
Information not saving, or not saving properly to the SD card.	Make sure the SD card is properly formatted with the FAT 32 format. The MMC format is not supported. Follow the instructions of the card manufacturer to format the SD card on a PC.
	If the SD card has previously been in use, format the card with the Fat 32 format, install the card in the controller, and try downloading files.
	Try a different SD card.
SD card full	Read the SD card with a PC or other card reader device. Save important files and then delete some or all of the files on the SD card.
Controller cannot find software updates on the SD card.	Make sure an appropriate folder is created by installing the SD card in the controller. An update folder will automatically be created.
	Install the SD card on a PC and make sure the software files are located in the appropriate update folder.
	If the same SD card is used with multiple controllers, each controller will have a separate folder on the system. Make sure the software updates are in the folder dedicated to the controller in use.
Display is lit but shows no characters or characters are faint or blurry.	Adjust the display contrast
	Make sure protective film has been removed from display.
	Clean the outside of the controller, including the display screen.

Problem	Resolution
Controller will not power up, or powers up intermittently	Make sure the AC power connections are properly terminated in the controller.
	Make sure the power strip, line power, wall plug are all properly plugged in.
	Contact Technical Support
Network or sensor module not recognized	Make sure the module is properly installed.
	Make sure the module selector switch is set to the proper number.
	Remove sensor module and install the module into the second analog slot. Apply power to the controller and allow the controller to perform a device scan.
	Contact Technical Support.
Sensor not recognized ***Note:*** *Example of possible display message: *****	If the sensor is an analog sensor and a corresponding module is installed in the controller, refer to the instructions supplied with the Network or Sensor Module.
	Make sure the digital connector wiring harness is seated on the inside of the door assembly and that the wiring harness is not damaged.
	If the digital sensor is connected to the controller with a digital termination box, user supplied junction box, digital extension cables, or a user-supplied extension cable, connect the sensor directly to the controller and perform a device scan. If the controller recognizes the sensor, check that all the wiring in the junction boxes or extension cables is correct.
	Make sure that only two sensors are installed in the controller. Although two analog module ports are available, if a digital sensor and two analog modules are installed, only two of the three devices will be seen by the controller.
	Contact Technical Support
Device Missing error message appears	Perform a Device Scan from the Test/Maintenance menu.
	Power cycle the controller

Test and Maintenance menu

1. From the Settings Menu, select Test/Maint and push **ENTER**.

Option	Description
Scan devices	Performs a scan for active and missing devices.
Output cal • **Output 1** • **Output 2**	Lets the user calibrate the 4–20 mA outputs with a 250 ohm resistor in series to the mA output terminals. The settings for each output are adjusted until the correct value (4 mA or 20 mA) is supplied. Calibrate 4 mA output (Min: 0 Max: 25000) Calibrate 20 mA output (Min: 35000 Max: 65533)
Hold outputs	Sets the value the controller sends to an external system for a defined period of time. After the time period, the instrument goes back to reporting real time values. Set activation—Launch or release Set Outmode—Hold Outputs (default) or Transfer Outputs Set Channels—All (default) or select from hardware list

Option	Description
Test output • **Output 1** • **Output 2**	Lets the user select a mA value that is sent by the controller for verification. Min: 0 mA (default +04.00) Max: 25.00 mA
Status	View status of all modules, sensors and relays.
Test relay—A, B, C, D	Energize or De-energize the selected relay
Overfeed reset	Resets the Overfeed Timer.
Reset default config	Resets the controller configuration settings to the default values (language, date and time, relay function and data output function).
Restart sc200	Performs a controller restart
Simulation (only displays if sensors or modules are connected)	After the sim value is entered, the controller outputs this value as if it was the value sent from the sensor. The simulation stops after the user exits the screen. Source- • <Module 1> • <Module 2> (Footer displays current source selection) Parameter—Source measurement type (footer displays current source selection) Sim value—Use arrow keys to change value (footer displays current source selection)
Modbus stats	Displays Error and Good count stats for selected port. • Sensor port 1, 2, 3 or 4 • Network port • Service port • Clear stats
System data	Displays the current system current, temperature and voltage data.

Warning and error conditions

Follow the steps below to acknowledge controller warnings.

1. From the Settings menu, select Diagnostics and push **ENTER**.
2. Select the device (controller, sensor, network card) with the warning or error and push **ENTER**.
3. Select the warning, error or event list and push **ENTER**.
4. Select Yes and push **ENTER** to acknowledge the warning.
   Note: *Errors cannot be acknowledged.*
5. For more information on a specific warning, error or event, refer to the device manual.

Device scan information

Display message	Action
Installing device...please wait	The controller has found a new device. No action is necessary. The controller automatically performs an installation process for the new device and displays the main measurement screen of the device installed in the number one position.
Device missing <device id>	A previously installed device has been removed from the controller or is not detected. • Push the **Enter** key to continue. • Push the left arrow key to select or de-select a missing device. • Push the **Enter** key to delete the missing device. The controller will display the main measurement screen for the device in the number one position. ***Note:*** *This message also displays when a device is missing and a new device has been installed. After the missing device is deleted, the controller automatically installs the new device and displays Installing device...please wait. The controller then displays the main measurement screen for the device installed in the number one position.*

Replacement parts and accessories

Note: *Product and Article numbers may vary for some selling regions. Contact the appropriate distributor or refer to the company website for contact information.*

Description	Item number
4 GB Secure Digital Memory (SD) card	9218100
Connector kit for digital sensor	9201000
Controller installation kit	8806200
DataCom cable	LZX887
Mounting bracket inserts	9177900
Plug, conduit opening (set of 3)	5868700
Power cord kit, with strain relief, 125 VAC, U.S.-style plug	9202900
Power cord kit, with strain relief, 230 VAC, European-style plug	9203000
Screw driver	6134300
SD card reader	9218200
SD card cover kit for sc200 controller	9200900
Screws for controller installation kit	9177800
Cord grip kit (1)	9178000
Sealing washer for cord grip assembly	1033814
UV protection screen	8809200
Weather and sun shield w/ UV protection screen	9220600
Sensor and communication modules	
Conductivity module	9013000

Description	Item number
Flow module	9012700
4-20 mA input module	9012800
pH and DO module	9012900
4-20 mA output module	9334600
HART network module kit	9328100
Modbus network module	9013200
Profibus network module	9173900
Profibus M12 connector kit	9178500
Profibus M12 socket (hard wire to quick connector adapter)	9178200
Profibus M12 T-splitter	9178400

HACH COMPANY World Headquarters
P.O. Box 389, Loveland, CO 80539-0389 U.S.A.
Tel. (970) 669-3050
(800) 227-4224 (U.S.A. only)
Fax (970) 669-2932
orders@hach.com
www.hach.com

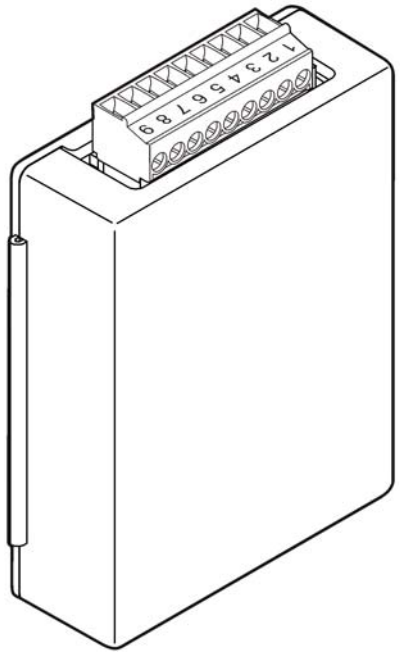
HACH LANGE GMBH
Willstätterstraße 11
D-40549 Düsseldorf, Germany
Tel. +49 (0) 2 11 52 88-320
Fax +49 (0) 2 11 52 88-210
info-de@hach.com
www.de.hach.com

HACH LANGE Sàrl
6, route de Compois
1222 Vésenaz
SWITZERLAND
Tel. +41 22 594 6400
Fax +41 22 594 6499

DOC023.97.80194

HART® Module

11/2013, Edition 4



User Manual

Specifications

Specifications are subject to change without notice.

Specification	Details
Minimum current	3 mA
Maximum current	23 mA
Linearity	± 0.05% of span
HART receive impedance	Rx ≥ 200 KΩ; Cx = 4 pF
Internal module loop power	15 VDC
Lift-off voltage	13.3 VDC
External loop power over temperature	30 VDC maximum
Loop resistance (HART communications)	Internal module loop power: 250–350 Ω; 18–24 VDC power supply: 250–500 Ω; 24–30 VDC power supply: 250–976 Ω
Loop resistance (non-HART communications)	Internal module loop power: 0–350 Ω; 12–24 VDC power supply: 0–250 Ω; 24–30 VDC power supply: 250–976 Ω
HART burst mode	Not supported
HART protocol revision	7.2
Certification	Class I, Division 2 Groups A, B, C, D and Class I, Zone 2 Group IIC, T4 Hazardous and Ordinary Locations

General information

In no event will the manufacturer be liable for direct, indirect, special, incidental or consequential damages resulting from any defect or omission in this manual. The manufacturer reserves the right to make changes in this manual and the products it describes at any time, without notice or obligation. Revised editions are found on the manufacturer's website.

Safety information

NOTICE

The manufacturer is not responsible for any damages due to misapplication or misuse of this product including, without limitation, direct, incidental and consequential damages, and disclaims such damages to the full extent permitted under applicable law. The user is solely responsible to identify critical application risks and install appropriate mechanisms to protect processes during a possible equipment malfunction.

Please read this entire manual before unpacking, setting up or operating this equipment. Pay attention to all danger and caution statements. Failure to do so could result in serious injury to the operator or damage to the equipment.

Make sure that the protection provided by this equipment is not impaired. Do not use or install this equipment in any manner other than that specified in this manual.

Use of hazard information

⚠ DANGER

Indicates a potentially or imminently hazardous situation which, if not avoided, will result in death or serious injury.

⚠ WARNING

Indicates a potentially or imminently hazardous situation which, if not avoided, could result in death or serious injury.

⚠ CAUTION

Indicates a potentially hazardous situation that may result in minor or moderate injury.

NOTICE

Indicates a situation which, if not avoided, may cause damage to the instrument. Information that requires special emphasis.

Precautionary labels

Read all labels and tags attached to the instrument. Personal injury or damage to the instrument could occur if not observed. A symbol on the instrument is referenced in the manual with a precautionary statement.

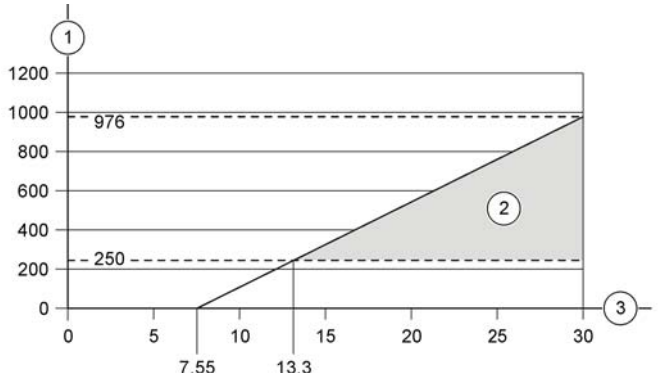
	This symbol, if noted on the instrument, references the instruction manual for operation and/or safety information.
	This symbol indicates that a risk of electrical shock and/or electrocution exists.
	This symbol indicates the presence of devices sensitive to Electro-static Discharge (ESD) and indicates that care must be taken to prevent damage with the equipment.
	Electrical equipment marked with this symbol may not be disposed of in European public disposal systems after 12 August of 2005. In conformity with European local and national regulations (EU Directive 2002/96/EC), European electrical equipment users must now return old or end-of-life equipment to the Producer for disposal at no charge to the user.

Product overview

The HART module enables HART digital communication and gives two HART connections to the controller. HART communication is an industrial standard bidirectional digital communication over 4-20 mA analog current loops. The module connects to the network card connector inside the controller.

Three isolated analog outputs (output A – output C) are provided. Such outputs are commonly used for analog signaling or to control other external devices. Each output can be active through the use of internal module power or external/loop power (requires an external VDC power supply). When configured for HART communication, an external power supply is recommended. For maximum loop resistance versus voltage information, refer to Figure 1.

Figure 1 Loop load limitations

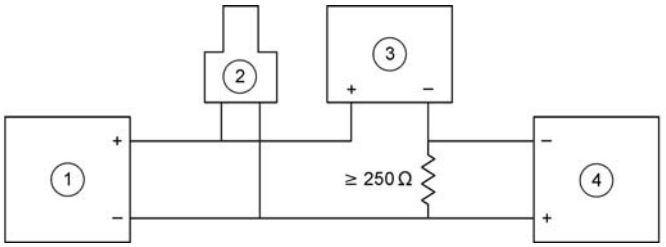


1 Loop load resistance (ohms)	**3** Supply voltage (DC)
2 HART operating region	

Circuit diagrams for HART communication

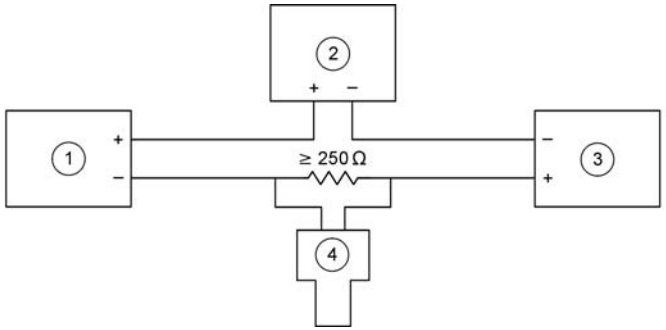
For HART communication, refer to Figure 2, Figure 3, Table 1, Figure 4, Figure 5 and Table 2.

Figure 2 HART voltage circuit - externally/loop powered



1 HART module	**3** External power supply
2 Hand-held terminal (Secondary communication device)	**4** External device (Recorder/data acquisition system)

Figure 3 HART current circuit - externally/loop powered

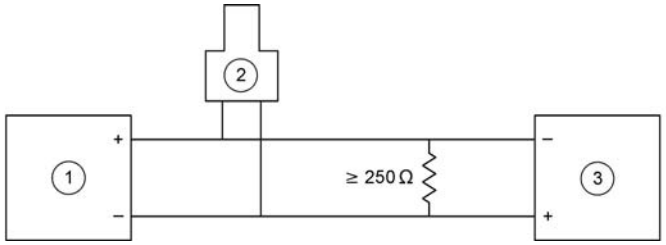


1 HART module	**3** External device (Recorder/data acquisition system)
2 External power supply	**4** Hand-held terminal (Secondary communication device)

Table 1 Recommended resistance values for externally/loop powered HART circuits

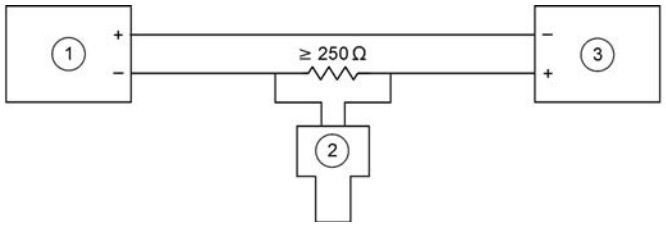
Power supply voltage	Loop resistance
18–24 VDC	250–500 Ω
24–30 VDC	250–976 Ω

Figure 4 HART voltage circuit - active module powered



1 HART module	**3** External device (Recorder/data acquisition system)
2 Hand-held terminal (Secondary communication device)	

Figure 5 HART current circuit - active module powered



1 HART module	**3** External device (Recorder/data acquisition system)
2 Hand-held terminal (Secondary communication device)	

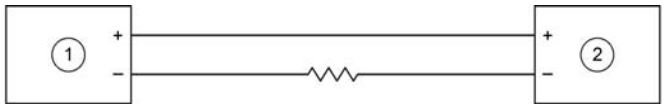
Table 2 Resistance values for active module powered HART circuits

Loop resistance
250–350 Ω

Circuit diagrams for non-HART communication

Figure 6, Table 3, Figure 7 and Table 4 are not recommended for HART communication.

Figure 6 4-20 mA circuit - active module powered

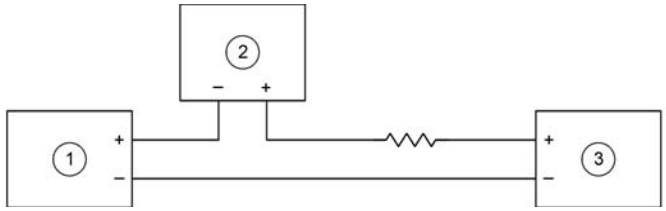


1 HART module	**2** External device (Recorder/data acquisition system)

Table 3 Resistance values for active module powered 4-20 mA circuit

Power supply voltage	Loop resistance
15 VDC	0–350 Ω

Figure 7 4-20 mA circuit - externally/loop powered



1 HART module	**3** External power supply
2 External device (Recorder/data acquisition system)	

Table 4 Recommended resistance values for externally/loop powered 4-20 mA circuit

Power supply voltage	Loop resistance
12–24 VDC	0–250 Ω
24–30 VDC	250–976 Ω

Wiring tables

Table 5 is recommended for HART communication.

Table 5 Wiring information for externally/loop powered outputs

Output	Connection	Connector pin number
Output C	(–) IN	1
Output C	(+) IN	2
—	—	3
Output B	(–) IN	4
Output B	(+) IN	5
—	—	6
Output A	(–) IN	7
Output A	(+) IN	8
—	—	9

Table 6 is not recommended for HART communication.

Table 6 Wiring information for module powered active outputs

Output	Connection	Connector pin number
Output C	(+) OUT	1
—	—	2
Output C	(–) OUT	3

Table 6 Wiring information for module powered active outputs (continued)

Output	Connection	Connector pin number
Output B[1]	(+) OUT	4
—	—	5
Output B[1]	(–) OUT	6
Output A[1]	(+) OUT	7
—	—	8
Output A[1]	(–) OUT	9

[1] This connection method is not recommended for HART communication.

Installation

⚠ DANGER

Explosion Hazard. For the module installation in classified hazardous locations, refer to the controller user manual for safety instructions.

⚠ DANGER

Electrocution Hazard. Always remove power from the instrument before making any electrical connections.

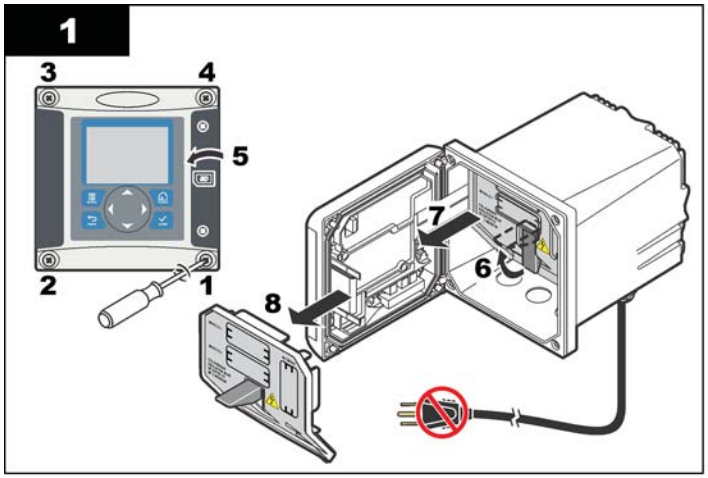
⚠ WARNING

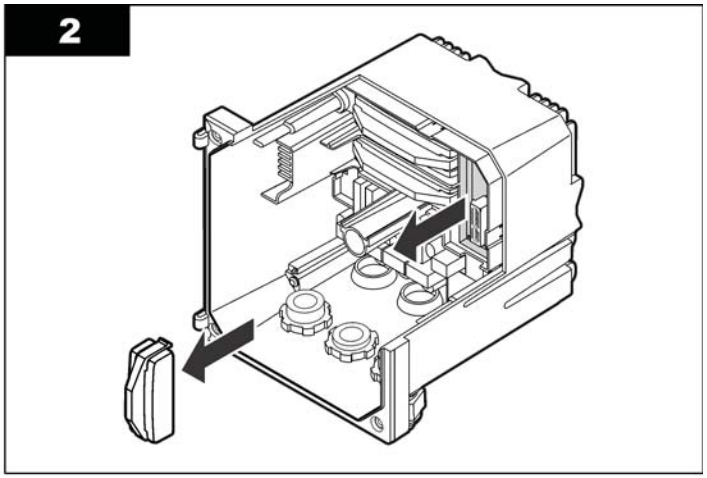
Potential Electrocution Hazard. Only qualified personnel should conduct the tasks described in this section of the manual.

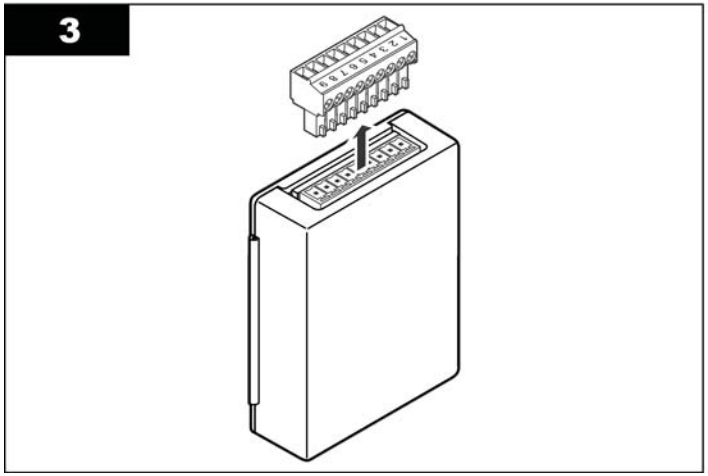
NOTICE

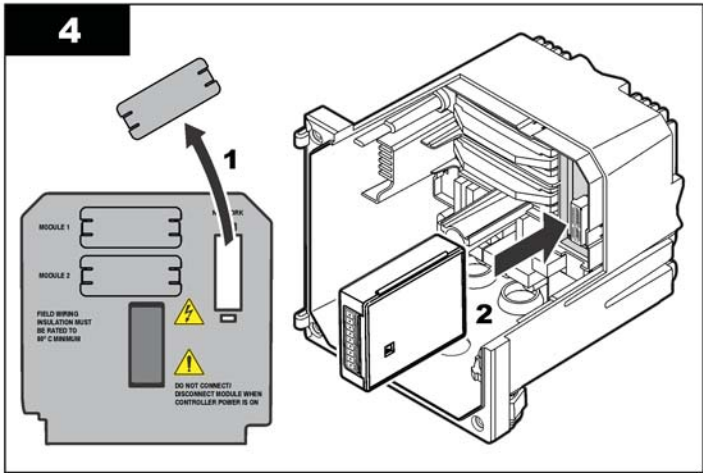
Potential Instrument Damage. Delicate internal electronic components can be damaged by static electricity, resulting in degraded performance or eventual failure.

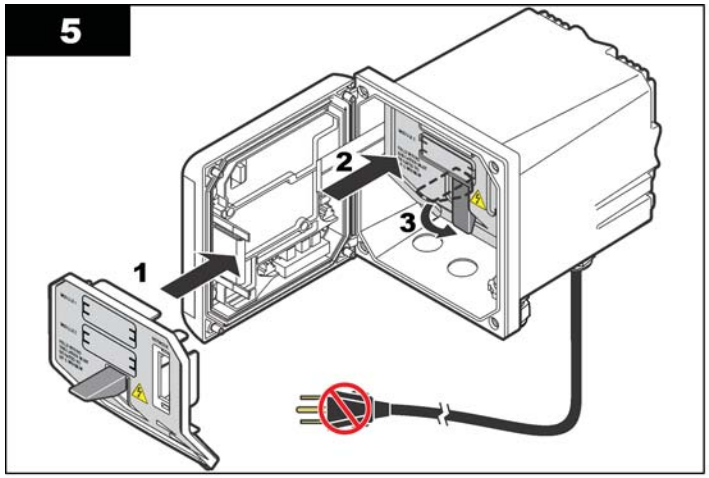
To install the module and connect the outputs, refer to Wiring tables on page 7 and the illustrated steps that follow.

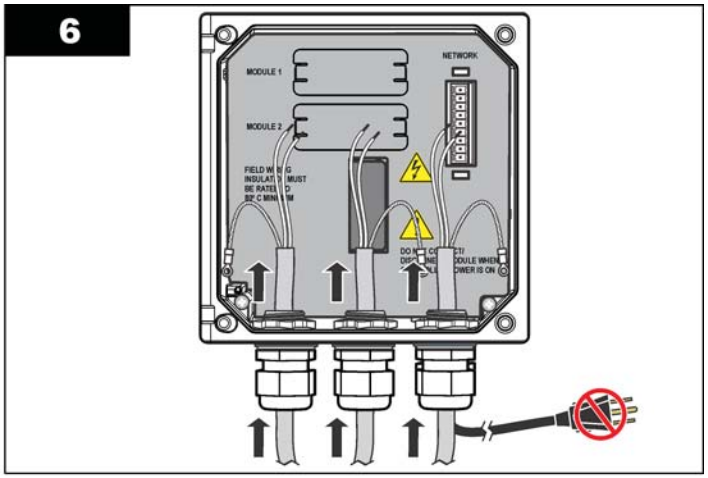

1
3
4
5
2
1
7
6
8

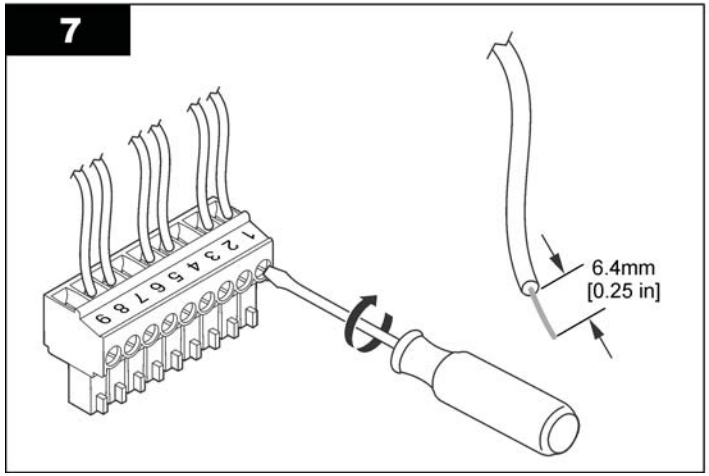

2

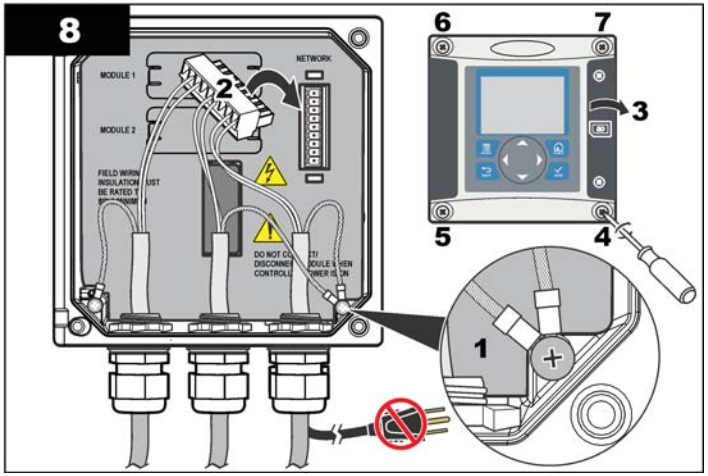

3


4
1
MODULE 1
MODULE 2
FIELD WIRING
INSULATION MUST
BE RATED TO
DO NOT CONNECT/
DISCONNECT MODULE WHEN
CONTROLLER POWER IS ON
2


5
1
2
3


6
NETWORK
MODULE 1
MODULE 2


7
1 2 3 4 5 6 7 8 9
6.4mm
[0.25 in]


8
NETWORK
MODULE 1
MODULE 2
2
6
7
3
5
4
1

Operation

Configure a HART module

The Network Setup option appears in the Settings Menu only if a HART module or other network module such as Modbus, Profibus or 4-20 mA is installed in the controller.

The range on the HART module is set at 4-20 mA. Each of the outputs can be assigned to represent a measured parameter from a sensor that is connected to the controller such as pH, temperature, flow or calculated values.

1. From the Settings menu, select Network Setup.
2. Select Edit Name and enter a name for the module. Push **ENTER** to save the name.
3. Select an output (A, B, C) and push **ENTER**.

   Note: *Only outputs A and B can be configured for HART communications.*

   a. Highlight an option and push **ENTER**.
   b. Make a selection from the list or update the entries.
   c. Push **ENTER** to save the changes.

Option	Description
Select Source	Selects the sensor to be represented on the selected output —None, sensor 1 name, sensor 2 name, calculation (if set up). For sensor output, Select Parameter sets the measurement options. When the measurement is autorange, Set Range sets the range.
Set Low Value	Sets the measured value from the sensor to be represented by a 4 mA signal (default: 0.000). (Range and units depend on sensor)
Set High Value	Sets the measured value from the sensor to be represented by a 20 mA signal (default: 1.000). (Range and units depend on sensor)
Set Transfer	Sets the transfer value. Range 3.0 to 23.0 mA (default 4.000). If a device malfunction is detected, the output goes to the user-selected transfer value. ***Note:*** *In addition, the transfer value can be set during a sensor calibration or maintenance (Diag/Test>Hold Outputs).*
Set Filter	Sets a time-average filter value of 0 (default) to 120 seconds.
Set HART Address	Sets the HART address for the selected output channel. Range 0 to 63.

Diagnostics and tests menu

1. From the Settings menu, select **Network Setup>Diag/Test**.
2. Select an option and push **ENTER** to perform the function or view the data.

Option	Description
Output Cal	Calibrates the low (4 mA) and high (20 mA) values for each of the three 4-20 mA outputs (A, B, C). Adjust the DAC counts until a connected multimeter reads the applicable output value. The default DAC counts are: • Output A—2807 for 4 mA, 14046 for 20 mA • Output B—2797 for 4 mA, 14109 for 20 mA • Output C—2641 for 4 mA, 13294 for 20 mA
Hold output	Sets the hold output options to Hold, Transfer or Release for each of the three 4-20 mA outputs (A, B, C).
Test output	Drives selected output to a simulated value.
Status	Displays the output value.
Error hold mode	Selects the behavior of the output in an error condition.

Option	Description
Module information	Displays information about the installed module. • Software version • Bootloader version • Serial Number
Default Setup	Sets the configuration to factory defaults.

Troubleshooting

For general problems with HART module communications, try the corrective actions listed below. If the problem continues or other problems occur, contact technical support.

- Make sure the connections between the module and the HART host are correct.
- Make sure the loop supply is live.
- Make sure the HART host is set to the correct device address.
- Check the module network setup for the selected channel. Make sure that the installed device is mapped to the selected channel. Make sure the SET LOW VALUE and the SET HIGH VALUE are within the range of the selected source.
- If the HART output from the HART host cannot be trimmed or fixed, make sure the sensor does not have an error that makes the controller hold or transfer the output at a fixed value.

HACH COMPANY World Headquarters
P.O. Box 389, Loveland, CO 80539-0389 U.S.A.
Tel. (970) 669-3050
(800) 227-4224 (U.S.A. only)
Fax (970) 669-2932
orders@hach.com
www.hach.com

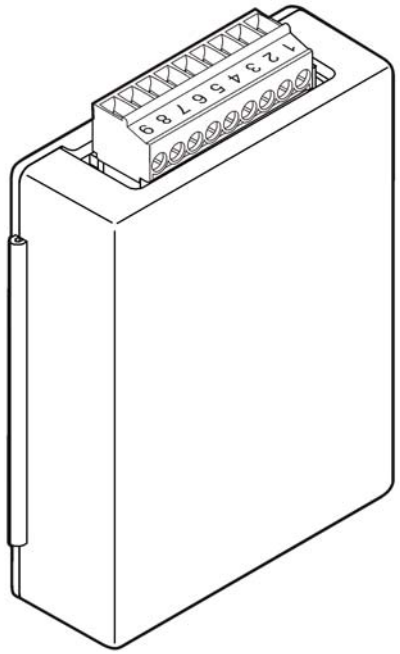
HACH LANGE GMBH
Willstätterstraße 11
D-40549 Düsseldorf, Germany
Tel. +49 (0) 2 11 52 88-320
Fax +49 (0) 2 11 52 88-210
info@hach-lange.de
www.hach-lange.de

HACH LANGE Sàrl
6, route de Compois
1222 Vésenaz
SWITZERLAND
Tel. +41 22 594 6400
Fax +41 22 594 6499

DOC023.97.80192

Active 4-20 mA Output Module

05/2013, Edition 2



User Manual

General Information

In no event will the manufacturer be liable for direct, indirect, special, incidental or consequential damages resulting from any defect or omission in this manual. The manufacturer reserves the right to make changes in this manual and the products it describes at any time, without notice or obligation. Revised editions are found on the manufacturer's website.

Safety information

Please read this entire manual before unpacking, setting up or operating this equipment. Pay attention to all danger and caution statements. Failure to do so could result in serious injury to the operator or damage to the equipment.

Make sure that the protection provided by this equipment is not impaired, do not use or install this equipment in any manner other than that specified in this manual.

Use of hazard information

⚠ DANGER

Indicates a potentially or imminently hazardous situation which, if not avoided, will result in death or serious injury.

⚠ WARNING

Indicates a potentially or imminently hazardous situation which, if not avoided, could result in death or serious injury.

⚠ CAUTION

Indicates a potentially hazardous situation that may result in minor or moderate injury.

NOTICE

Indicates a situation which, if not avoided, may cause damage to the instrument. Information that requires special emphasis.

Precautionary labels

Read all labels and tags attached to the instrument. Personal injury or damage to the instrument could occur if not observed. A symbol on the instrument is referenced in the manual with a precautionary statement.

	This symbol, if noted on the instrument, references the instruction manual for operation and/or safety information.
	This symbol, when noted on a product enclosure or barrier, indicates that a risk of electrical shock and/or electrocution exists.
	Delicate internal electronic components can be damaged by static electricity, resulting in degraded performance or eventual failure.
	Electrical equipment marked with this symbol may not be disposed of in European public disposal systems after 12 August of 2005. In conformity with European local and national regulations (EU Directive 2002/98/EC), European electrical equipment users must now return old or end-of-life equipment to the Producer for disposal at no charge to the user. ***Note:*** *For return for recycling, please contact the equipment producer or supplier for instructions on how to return end-of-life equipment, producer-supplied electrical accessories, and all auxillary items for proper disposal.*

Overview of the 4-20 mA output module

The 4-20 mA output module gives three additional 4-20 mA output connections to a controller. The module connects to the network card connector inside the controller.

Installation

⚠WARNING

Potential Electrocution Hazard. Always disconnect power to the instrument when making electrical connections.

⚠WARNING

Potential Electrocution Hazard. Only qualified personnel should conduct the tasks described in this section of the manual.

NOTICE

Potential Instrument Damage. Delicate internal electronic components can be damaged by static electricity, resulting in degraded performance or eventual failure.

Three isolated analog outputs (output 1–output 3) are provided. Such outputs are commonly used for analog signaling or to control other external devices. Each output is loop powered and requires a customer supplied 12 to 24 VDC power supply or the use of internal module power. To install the module and connect the outputs, refer to the Illustrated steps and either Table 1 or Table 2.

Table 1 Wiring information for module powered

Output	Connection	Connector pin number
Output C	(+) IN	1
—	—	2
Output C	(–) IN	3
Output B	(+) IN	4
—	—	5
Output B	(–) IN	6
Output A	(+) IN	7
—	—	8
Output A	(–) IN	9

Table 2 Wiring information for external customer powered

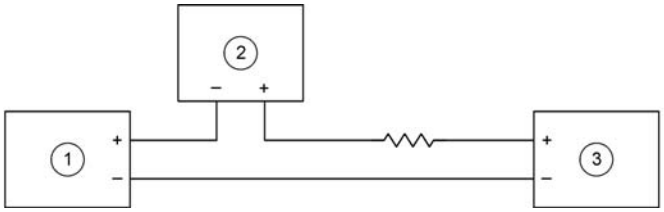
Output	Connection	Connector pin number
Output C	(–) IN	1
Output C	(+) IN	2
—	—	3
Output B	(–) IN	4
Output B	(+) IN	5
—	—	6
Output A	(–) IN	7
Output A	(+) IN	8

Table 2 Wiring information for external customer powered (continued)

Output	Connection	Connector pin number
—	—	9

1. Disconnect controller power.
2. Open the controller cover.
3. Feed the twisted-pair shielded wire through the strain relief.
4. Adjust the wire as necessary and tighten the strain relief.
5. Connect the shield at the power supply side. The power supply positive polarity connects to the (+) terminal, and the negative polarity connects to the (-) terminal (Figure 1 or Figure 2).
   - Do not connect the shield at both ends of the cable.
   - Use only shielded cable to minimize radio frequency emissions and susceptibility.
   - External loop resistance may be required (Table 3 or Table 4).
6. Close the controller cover and tighten the cover screws.
7. Connect controller power.
8. Configure outputs in the controller.

Figure 1 Wiring diagram for external customer powered

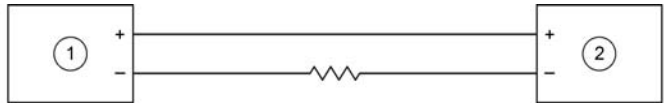


1 4–20 mA output module	**3** Customer power supply
2 External device (Recorder/data acquisition system)	

Table 3 Resistance values for external customer powered

Power supply voltage	Loop minimal resistance	Loop maximal resistance
12–18 VDC	0 Ω	250 Ω typical
18–24 VDC	250 Ω	500 Ω typical

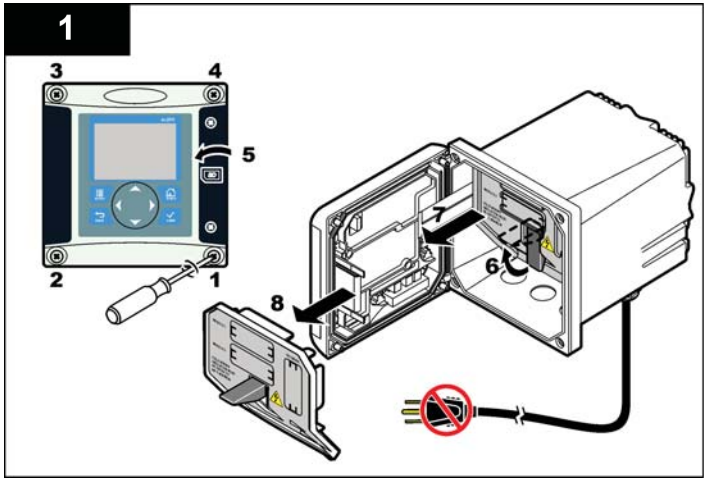
Figure 2 Wiring diagram for module powered

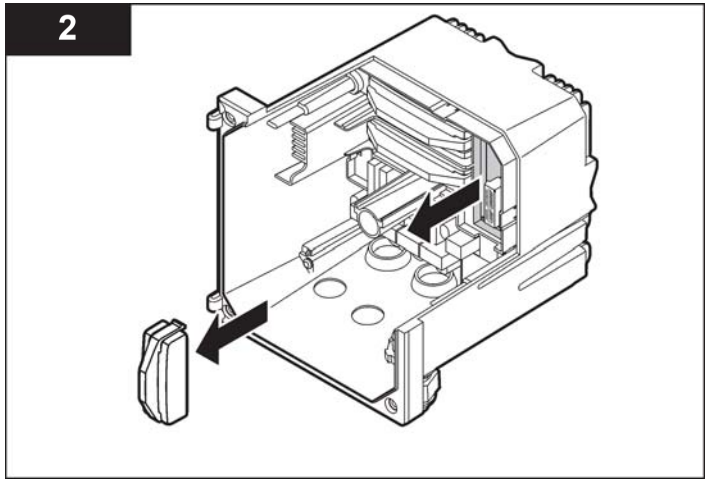


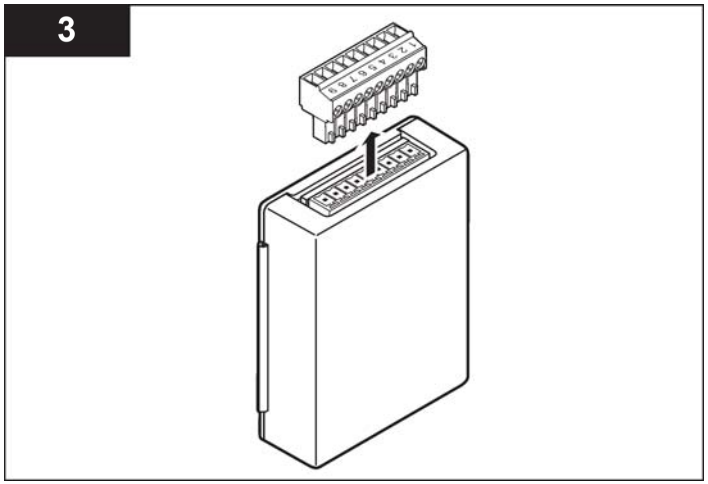
1 4–20 mA output module	**2** External device (HART master)

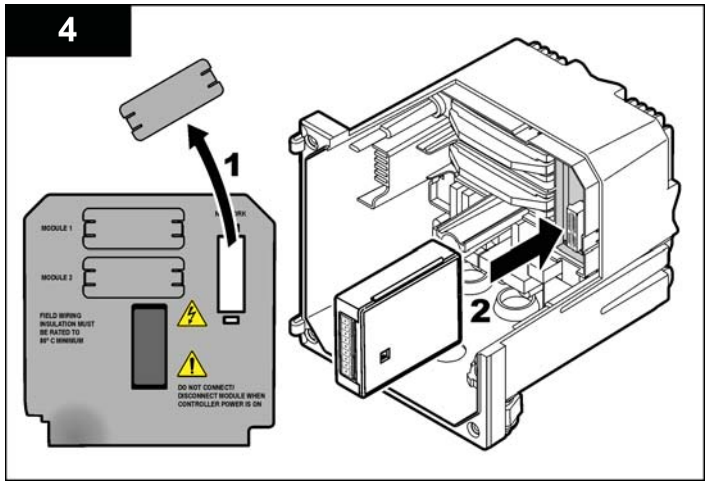
Table 4 Resistance values for module powered

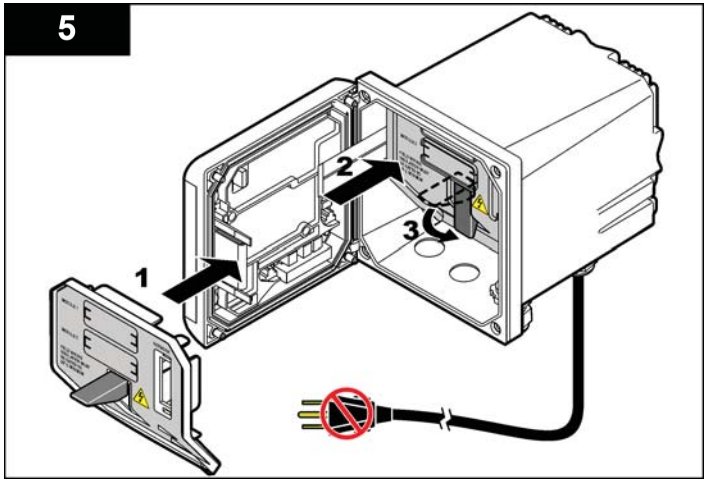
Power supply voltage	Loop minimal resistance	Loop maximal resistance
15 VDC	0 Ω	350 Ω typical

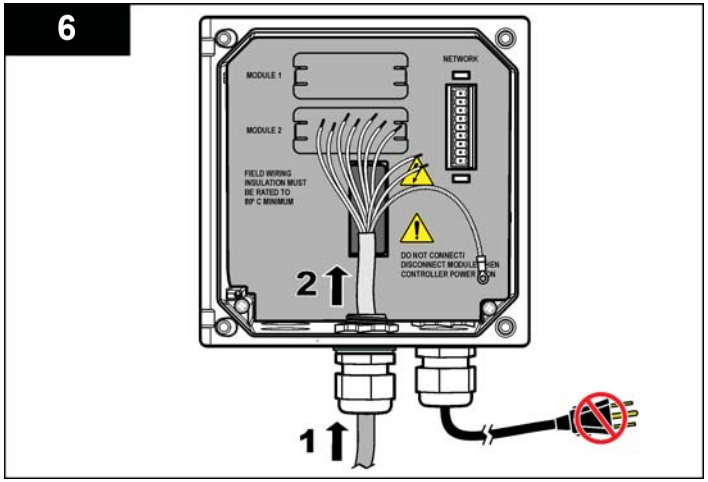

1
3
4
5
2
1
8
7
6

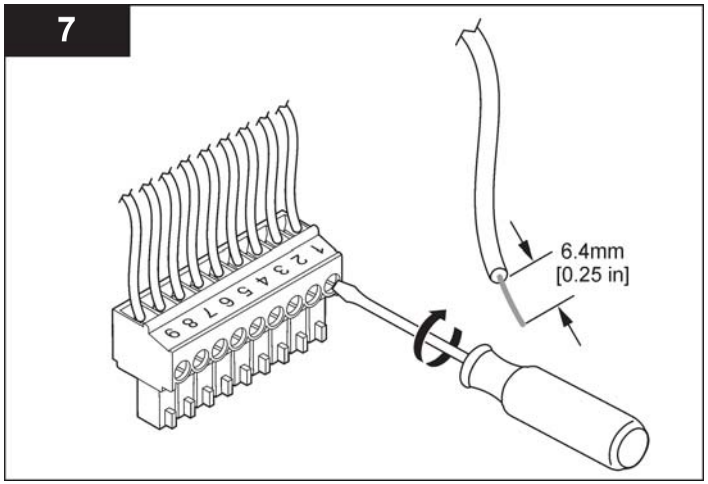

2

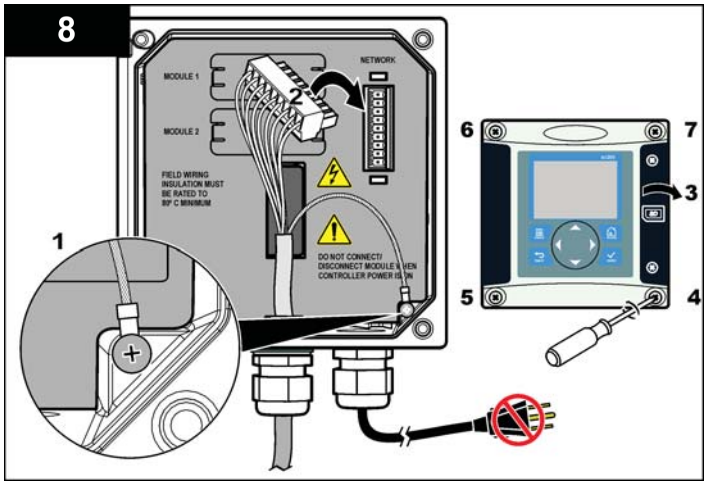

3


4
1
2
MODULE 1
MODULE 2
FIELD WIRING INSULATION MUST BE RATED TO 90° C MINIMUM
DO NOT CONNECT/ DISCONNECT MODULE WHEN CONTROLLER POWER IS ON


5
1
2
3


6
MODULE 1
MODULE 2
NETWORK
FIELD WIRING
INSULATION MUST
BE RATED TO
80° C MINIMUM
DO NOT CONNECT/
DISCONNECT MODULE WHEN
CONTROLLER POWER IS ON
2
1


7
1 2 3 4 5 6 7 8 9
6.4mm
[0.25 in]


8
MODULE 1
MODULE 2
NETWORK
FIELD WIRING
INSULATION MUST
BE RATED TO
80° C MINIMUM
DO NOT CONNECT/
DISCONNECT MODULE WHEN
CONTROLLER POWER IS ON
1
2
3
4
5
6
7

Operation

Configure a 4-20 mA output module

The Network Setup option appears in the Settings Menu only if an analog output module or other network module such as Modbus or Profibus is installed in the controller.

Outputs for analog output modules are set at 4-20 mA. Outputs can be assigned to represent a measured parameter such as pH, temperature, flow or calculated values.

1. From the Settings menu, select Network Setup.
2. Select Edit Name and enter a name for the module. Push **ENTER** to save the name.
3. Select an output (A, B, C) and push **ENTER**.
   a. Highlight an option and push **ENTER**.
   b. Make a selection from the list or update the entries.
   c. Push **ENTER** to save the changes.

Option	Description
Select Source	Selects the output to configure—None, sensor 1 name, sensor 2 name, calculation (if set up). For sensor output, Select Parameter sets the measurement options. When the measurement is autorange, Set Range sets the range.
Set Low Value	Sets the 4 mA value (default: 0.000). (Range and units depend on sensor)
Set High Value	Sets the 20 mA value (default: 1.000). (Range and units depend on sensor)
Set Transfer	Sets the transfer value. Range 3.0 to 23.0 mA (default 4.000).
Set Filter	Sets a time-average filter value of 0 (default) to 120 seconds.

Diagnostics and tests menu

1. From the Settings menu, select Diagnostics and Tests.
2. Select an option and push **ENTER** to perform the function or view the data.

Option	Description
Output Cal	Calibrates the low (4 mA) and high (20 mA) values for each of the three 4-20 mA outputs (A, B, C).
Hold output	Sets the hold output options to Hold, Transfer or Release for each of the three 4-20 mA outputs (A, B, C).
Test output	Drives selected output to a known value.
Status	Displays the output value.
Error hold mode	Selects what to do on error condition.
Module information	Displays information about the installed module. • Software version • Bootloader version • Serial Number
Default Setup	Sets the configuration to factory defaults.

Modbus registers

A list of Modbus registers is available for network communication. Refer to www.hach.com or www.hach-lange.com for more information.

HACH COMPANY World Headquarters
P.O. Box 389, Loveland, CO 80539-0389 U.S.A.
Tel. (970) 669-3050
(800) 227-4224 (U.S.A. only)
Fax (970) 669-2932
orders@hach.com
www.hach.com

HACH LANGE GMBH
Willstätterstraße 11
D-40549 Düsseldorf, Germany
Tel. +49 (0) 2 11 52 88-320
Fax +49 (0) 2 11 52 88-210
info@hach-lange.de
www.hach-lange.de

HACH LANGE Sàrl
6, route de Compois
1222 Vésenaz
SWITZERLAND
Tel. +41 22 594 6400
Fax +41 22 594 6499

LEFT BLANK

HACH

MODEL DPD1R1, pH SENSOR
MODEL DRD1R5, ORP SENSOR

LEFT BLANK

Catalog Number 6120218

pHD sc Digital Differential pH/ORP Sensors

USER MANUAL

April 2009, Edition 5

eac/te/dp

Table of Contents

Section 1 Specifications

Specifications are subject to change without notice.

Table 1 Differential pH and ORP Sensor Specifications

Specification Category	pH Sensors[1]	Stainless Steel pH Sensor	ORP Sensors[2]
Wetted Materials	PEEK®[3] or Ryton®[4] (PVDF) body, salt bridge of matching material with Kynar®[5] junction, glass process electrode, titanium ground electrode, and Viton®[6] O-ring seals (pH sensor with optional HF-resistant glass process electrode has 316 stainless steel ground electrode, and perfluoroelastomer wetted O-rings; for other wetted O-ring materials consult the manufacturer)	Immersion mounting only, 316 SS Stainless Steel body with Ryton® (PVDF) ends and salt bridge.	PEEK® or Ryton® (PVDF) body, salt bridge of matching material with Kynar® junction, glass and platinum (or glass and gold) process electrode, titanium ground electrode, and Viton® O-ring seals
Operating Temperature Range	–5 to 70 °C (23 to 158 °F) for sensor with integral digital electronics –5 to 105 °C (23 to 221 °F) for analog sensor with digital gateway	0 to 50 °C (32 to 122 °F) for sensor with integral digital electronics	–5 to 70 °C (23 to 158 °F) for sensor with integral digital electronics –5 to 105 °C (23 to 221 °F) for analog sensor with digital gateway
Pressure/Temperature Limits (without mounting hardware)	6.9 bar at 105 °C (100 psi at 221 °F) for analog with gateway 6.9 bar at 70 °C (100 psi at 158 °F)	N/A (immersion only)	6.9 bar at 70 °C (100 psi at 158 °F) 6.9 bar at 105 °C (100 psi at 221 °F) for analog with gateway
Maximum Flow Rate	3 m (10 ft) per second	3 m (10 ft) per second	3 m (10 ft) per second
Built-in Temperature Element	NTC 300 ohm thermistor for automatic temperature compensation and analyzer temperature readout	NTC 300 ohm thermistor for automatic temperature compensation and analyzer temperature readout	NTC 300 ohm thermistor for analyzer temperature readout only — not for automatic temperature compensation
Stability	0.03 pH per 24 hours, non-cumulative	0.03 pH per 24 hours, non-cumulative	2 mV per 24 hours, non-cumulative
Maximum Transmission Distance	1000 m (3280 ft) with termination box	1000 m (3280 ft) with termination box	1000 m (3280 ft) with termination box
Sensor Cable (integral)	Digital: PUR (polyurethane) 4-conductor with one shield, rated to 105 °C (221 °F), 10 m (33 ft) standard length Analog: Five-conductor (plus two isolated shields) cable with XLPE (cross-linked polyethylene) jacket; rated to 150 °C (302 °F); 6 m (20 ft) standard length	Digital: PUR (polyurethane) 4-conductor with one shield, rated to 105 °C (221 °F), 10 m (33 ft) standard length	Digital: PUR (polyurethane) 4-conductor with one shield, rated to 105 °C (221 °F), 10 m (33 ft) standard length Analog: Five-conductor (plus two isolated shields) cable with XLPE (cross-linked polyethylene) jacket; rated to 150 °C (302 °F); 6 m (20 ft) standard length
Components	Corrosion-resistant materials, fully-immersible probe with 10 m (30 ft) cable	Corrosion-resistant materials, fully-immersible probe with 10 m (30 ft) cable	Corrosion-resistant materials, fully-immersible probe with 10 m (30 ft) cable
Measuring Range	–2.0 to 14.0 pH or –2.00 to 14.00 pH	–2.0 to 14.0 pH or –2.00 to 14.00 pH	–1500 to +1500 mV
Probe Storage Temperature	4 to 70 °C (40 to 158 °F); 0 to 95% relative humidity, non-condensing	4 to 70 °C (40 to 158 °F); 0 to 95% relative humidity, non-condensing	4 to 70 °C (40 to 158 °F); 0 to 95% relative humidity, non-condensing

Table 1 Differential pH and ORP Sensor Specifications (continued)

Specification Category	pH Sensors[1]	Stainless Steel pH Sensor	ORP Sensors[2]
Temperature Compensation	Automatic from –10 to 105 °C (14.0 to 221 °F) with selection for NTC 300 ohm thermistor, Pt 1000 ohm RTD, or Pt 100 ohm RTD temperature element, or manually fixed at a user-entered temperature; additional selectable temperature correction factors (ammonia, morpholine, or user-defined pH/°C linear slope) available for pure water automatic compensation from 0.0 to 50 °C (32 to 122 °F)	Automatic from –10 to 105 °C (14.0 to 221 °F) with selection for NTC 300 ohm thermistor, Pt 1000 ohm RTD, or Pt 100 ohm RTD temperature element, or manually fixed at a user-entered temperature; additional selectable temperature correction factors (ammonia, morpholine, or user-defined pH/°C linear slope) available for pure water automatic compensation from 0.0 to 50 °C (32 to 122 °F)	N/A
Measurement Accuracy	±0.02 pH	±0.02 pH	±5 mV
Temperature Accuracy	±0.5 °C (0.9 °F)	±0.5 °C (0.9 °F)	±0.5 °C (0.9 °F)
Repeatability	±0.05 pH	±0.05 pH	±2mV
Sensitivity	±0.01 pH	±0.01 pH	±0.5 mV
Calibration Methods	Two point automatic, one point automatic, two point manual, one point manual.	Two point automatic, one point automatic, two point manual, one point manual.	one point manual
Maximum Probe Immersion Depth/ Pressure	Submersible to 107 m (350 ft)/1050 kPa (150 psi)	Immersion only	Submersible to 107 m (350 ft)/1050 kPa (150 psi)
Sensor Interface	Modbus	Modbus	Modbus
Probe Cable Length	6 m (20 ft) + 7.7 m (25 ft) interconnect cable extension for analog sensor with digital gateway 10 m (31 ft) for sensor with integral digital electronics	6 m (20 ft) + 7.7 m (25 ft) interconnect cable extension for analog sensor with digital gateway 10 m (31 ft) for sensor with integral digital electronics	6 m (20 ft) + 7.7 m (25 ft) interconnect cable extension for analog sensor with digital gateway 10 m (31 ft) for sensor with integral digital electronics
Probe Weight	316 g (11 oz)	870 g (31 oz)	316 g (11 oz)
Probe Dimensions	See Figure 2 on page 9 through Figure 3 on page 9.	See Figure 4 on page 9.	See Figure 2 on page 9 through Figure 3 on page 9.

[1] Most pH applications are in the 2.5 to 12.5 pH range. The pHD™ Differential pH sensor with the wide-range glass process electrode performs exceptionally well in this range. Some industrial applications require accurate measurement and control below 2 or above 12 pH. In these special cases, please contact the manufacturer for further details.

[2] For best ORP measuring results in solutions containing zinc, cyanide, cadmium or nickel, the manufacturer recommends using the pHD™ ORP sensor equipped with a gold electrode.

[3] PEEK® is a registered trademark of ICI Americas, Inc.

[4] Ryton® is a registered trademark of Phillips 66 Co.

[5] Kynar® is a registered trademark of Pennwalt Corp.

[6] Viton® is a registered trademark of E.I. DuPont de Nemours + Co.

Table 2 Digital Gateway Specifications

Weight	145 g (5 oz)
Dimensions	17.5 x 3.4 cm (7 x 1 3/8 in.)
Operating Temperature	–20 to 60 °C (–4 to 140°F)

Section 2 General Information

2.1 Safety Information

Please read this entire manual before unpacking, setting up, or operating this equipment. Pay attention to all danger and caution statements. Failure to do so could result in serious injury to the operator or damage to the equipment.

To ensure that the protection provided by this equipment is not impaired, do not use or install this equipment in any manner other than that specified in this manual.

This product is acceptable for use in a Hazardous Location when used with an sc100 Controller and installed per Control Drawing 58600-78 as described in the sc100 Controller Manual, Cat. No. 5860018.

2.1.1 Use of Hazard Information

DANGER
Indicates a potentially or imminently hazardous situation which, if not avoided, could result in death or serious injury.

CAUTION
Indicates a potentially hazardous situation that may result in minor or moderate injury.

Important Note: *Information that requires special emphasis.*

Note: *Information that supplements points in the main text.*

2.1.2 Precautionary Labels

Read all labels and tags attached to the instrument. Personal injury or damage to the instrument could occur if not observed.

	This symbol, if noted on the instrument, references the instruction manual for operation and/or safety information.
	This symbol, when noted on a product enclosure or barrier, indicates that a risk of electrical shock and/or electrocution exists.
	This symbol, if noted on the product, indicates the need for protective eye wear.
	This symbol, when noted on the product, identifies the location of the connection for Protective Earth (ground).
	This symbol, when noted on the product, identifies the location of a fuse or current limiting device.

2.2 General Sensor Information

Optional equipment, such as mounting hardware for the probe, is supplied with instructions for all user installation tasks. Several mounting options are available, allowing the probe to be adapted for use in many different applications.

The electronics of the sensor are encapsulated in a PEEK® or Ryton® body. The pH sensor has an integral NTC 300 ohm thermistor to automatically compensate pH readings for temperature changes. ORP sensors have a fixed temperature value of 25 °C/300 ohm (the ORP measurement is not temperature dependent).

2.2.1 Sensor Body Styles

pHD™ Differential pH and ORP sensors are available in three body styles:

- **Convertible Body Style** — has 1-inch NPT threads at both ends of the body for mounting in any of the following configurations:
  - into a standard 1-inch NPT pipe tee
  - into a pipe adapter for union mounting with a standard 1-½ inch pipe tee
  - onto the end of a pipe for immersion into a vessel

Note: *The convertible style sensor can also be retrofitted into existing installations for 1-½ inch LCP, Ryton, and epoxy sensors.*

- **Insertion Body Style** — similar to the convertible sensor except that its 1-inch NPT threads are only on the cable end for mounting into a flow cell or the pipe adapter of a ball valve hardware assembly. This hardware enables the sensor to be inserted into or retracted from the process without stopping the process flow.
- **Sanitary Body Style** — features a built-in 2-inch flange for mounting into a 2-inch sanitary tee. Included with the sanitary-style sensor is a special cap and EDPM compound gasket for use with the sanitary hardware.

In addition, all probes are available with or without integral digital electronics. For applications with extreme temperatures, the sensor without integral digital electronics can be combined with the digital gateway.

Figure 1 Convertible Style Sensor Dimensions

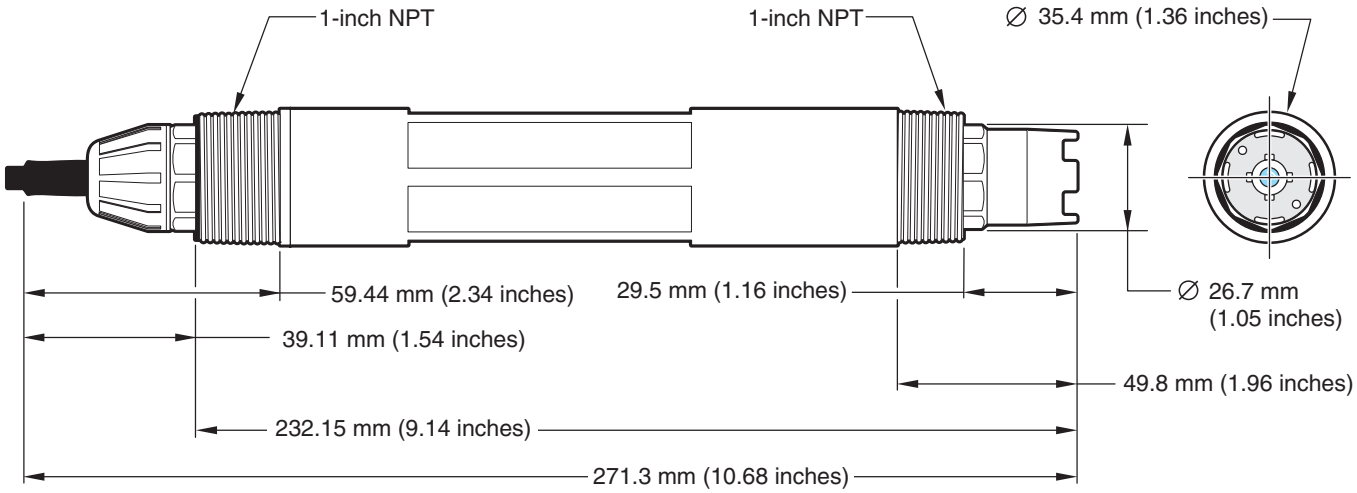


Figure 2 Insertion Style Sensor Dimensions

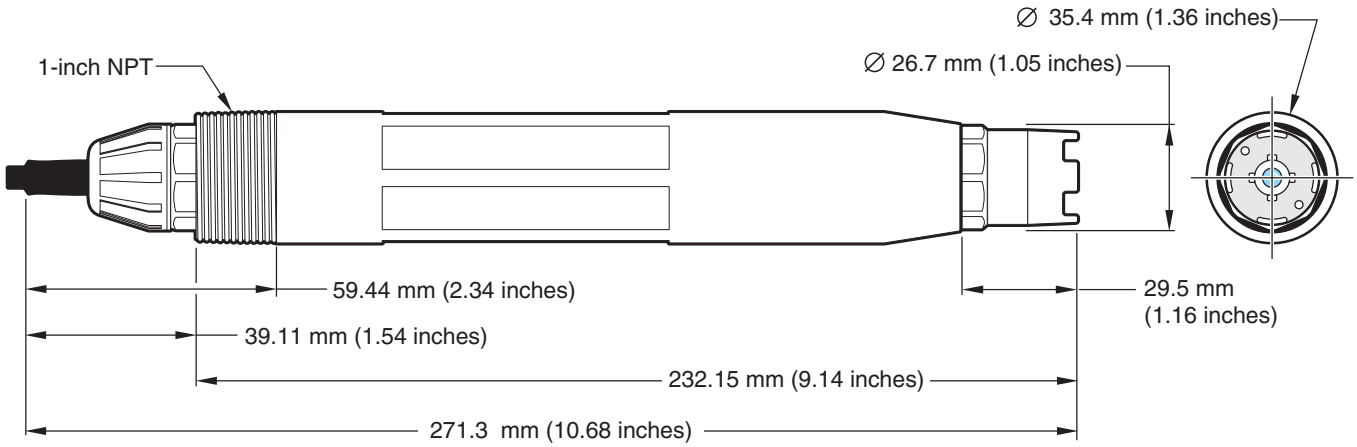


Figure 3 Sanitary Style Sensor Dimensions

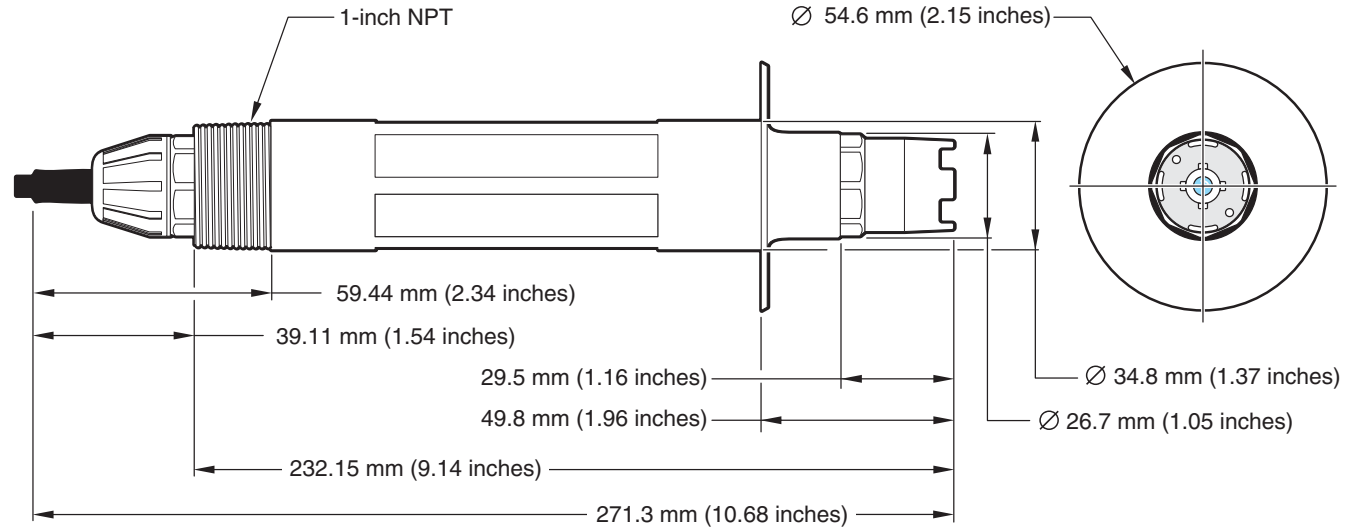
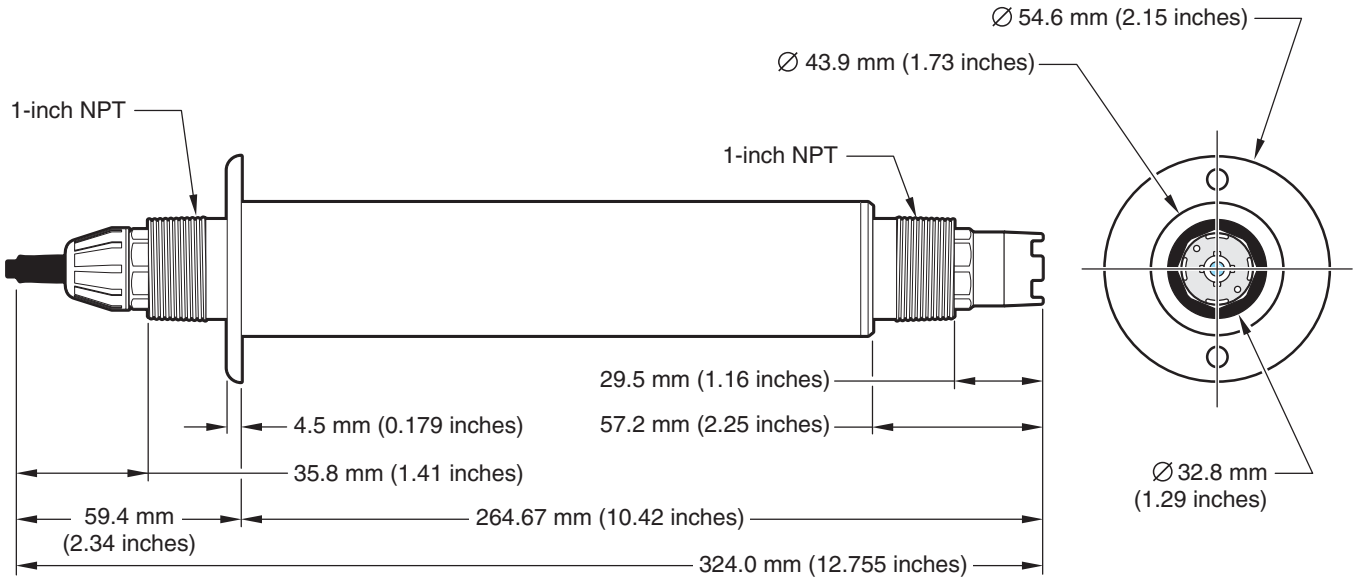


Figure 4 Stainless Steel Style Sensor (DPS1 and DRS5) Dimensions



2.3 The Digital Gateway

The digital gateway was developed to provide a means to use existing analog sensors with the new digital controllers. The gateway contains all the necessary software to interface with the controller and output a digital signal. Extension cables are required for connection from the digital gateway to the digital controller. See Replacement Parts and Accessories on page 41.

2.4 Operating Precaution

CAUTION
If the pH process electrode breaks, handle the sensor very carefully to prevent injury.

Before placing the pH or ORP sensor into operation, remove the protective cap to expose the process electrode and salt bridge. Save the protective cap for future use.

For short-term storage (when sensor is out of the process for more than one hour) fill the protective cap with pH 4 buffer or DI water and place the cap back on the sensor. Keeping the process electrode and salt bridge moist will avoid slow response when the sensor is placed back in operation.

For extended storage, repeat the short-term storage procedure every 2 to 4 weeks, depending on the surrounding environmental conditions. See Specifications on page 5 for temperature storage limits.

The process electrode at the tip of the pH sensor has a glass bulb, which can be broken. Do not subject it to abrupt impact or other mechanical abuse.

The gold or platinum process electrode at the ORP sensor tip has a glass shank (hidden by the salt bridge) which can break. Do not subject this electrode to impact or other mechanical abuse.

DANGER
Only qualified personnel should conduct the tasks described in this section of the manual.

DANGER
Seul un technicien qualifié peut effectuer les tâches d'installation décrites dans cette section du manuel.

3.1 Connecting/Wiring the Sensor to the sc100 Controller

DANGER
The sc100 and certain versions of the sensor are suitable for use in Class 1, Division 2, Groups A, B, C, D Hazardous Locations . See Control Drawing 58600-78 in the sc100 Controller Manual, Cat. No. 58600-18 for acceptable sensor versions and installation requirements.

DANGER
Le sc100 et certaines versions du capteur peuvent être utilisés dans des endroits dangereux de la Classe 1, Division 2, Groupes A, B, C, D. Reportez-vous au schéma de contrôle 58600-78 du Manuel du contrôleur sc100, Réf. 58600-18 pour connaître les versions des capteurs admises et les conditions d'installation.

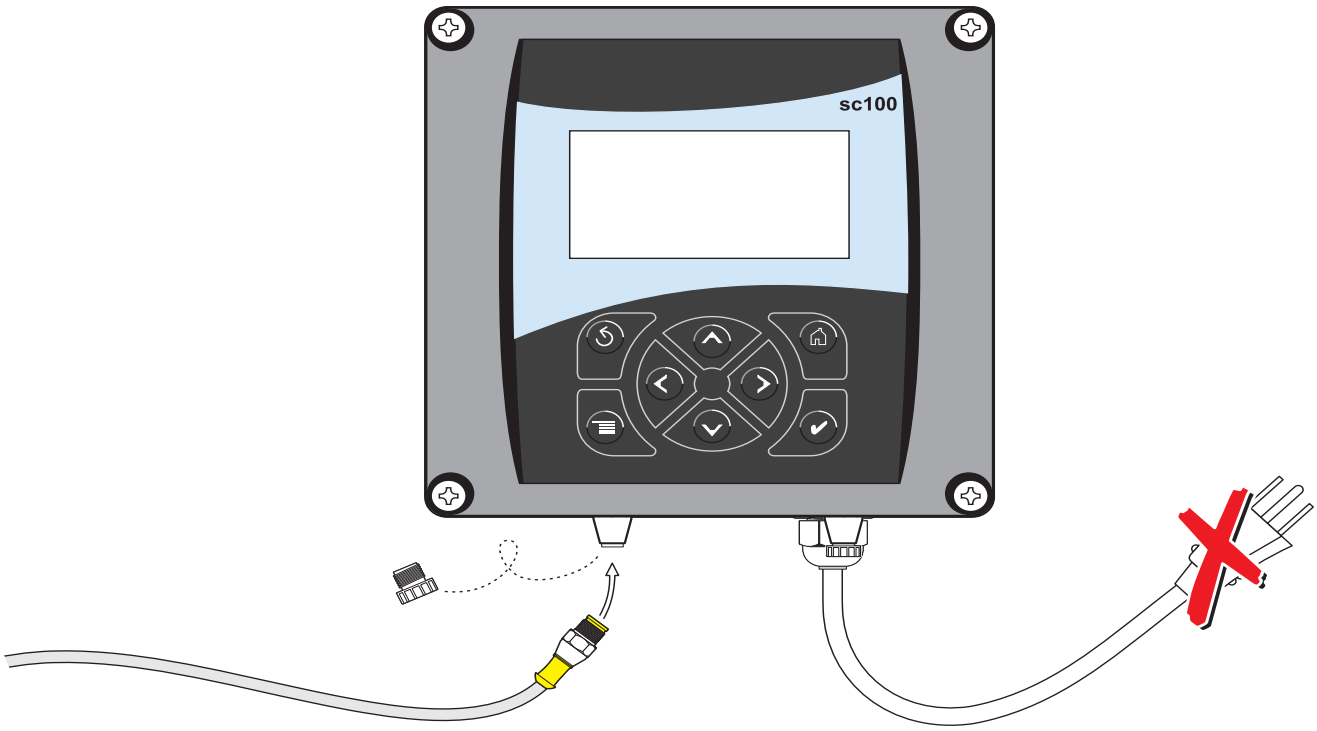
3.1.1 Connecting the sc Sensor to a sc100 Controller in a Non-hazardous Location

3.1.1.1 Attaching a sc Sensor with a Quick-connect Fitting

Important Note: *The standard quick-connect fitting is NOT suitable for Class 1, Division 2 Hazardous Location installations without the connector lock installed, see section 3.1.2 on page 13 for more information.*

The sensor has a keyed quick-connect fitting for easy attachment to the controller (Figure 5). Retain the connector cap to seal the connector opening when the sensor is removed. Extension cables may be purchased to extend the sensor cable length. If the total cable length exceeds 100 m (300 ft), a termination box must be installed. See Replacement Parts and Accessories on page 41.

Figure 5 Attaching the Sensor using the Quick-connect Fitting



3.1.1.2 Hard-wiring a sc Sensor to the Controller

Important Note: *Hard-wiring the sensor to the sc100 is not an approved method for Class I, Division 2 Hazardous Locations.*

1. Disconnect power to the controller if powered.
2. Open the controller cover.
3. Disconnect and remove the existing wires between the quick-connect and terminal strip J5, see Figure 5 on page 12.
4. Remove the quick-connect fitting and wires and install the threaded plug on the opening to maintain the environmental rating.
5. Cut the connector from the sensor cable.
6. Strip the insulation on the cable back 1-inch. Strip ¼-inch of each individual wire end.
7. Pass the cable through conduit and a conduit hub or a strain relief fitting (Cat.No.16664) and an available access hole in the controller enclosure. Tighten the fitting.

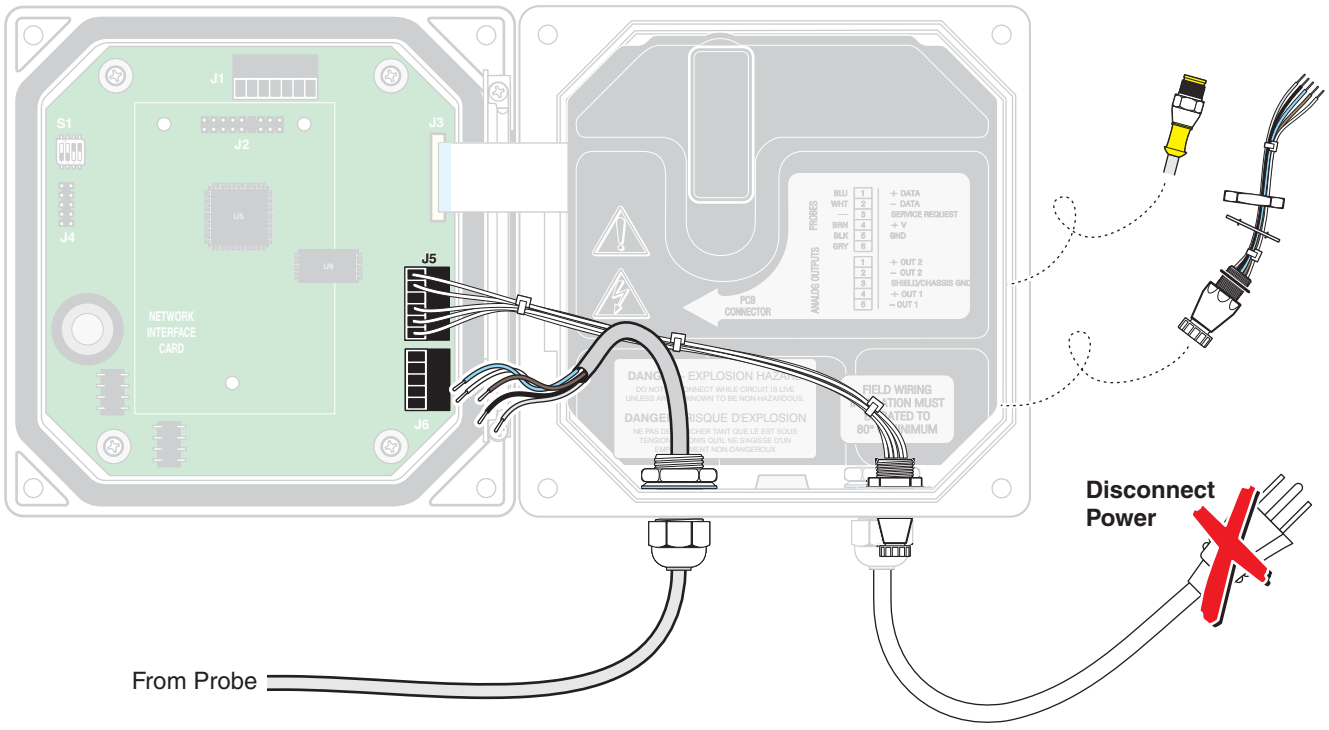
Note: *Use of strain relief fitting other than Cat. No. 16664 may result in a hazard. Use only the recommended strain relief fitting.*

8. Reinstall the plug on the sensor access opening to maintain the environmental rating.
9. Wire as shown in Table 3 and Figure 6.
10. Close and secure the cover.

Table 3 Wiring the Sensor at Terminal Block J5

Terminal Number	Terminal Designation	Wire Color
1	Data (+)	Blue
2	Data (–)	White
3	Service Request	No Connection
4	+12 V dc	Brown
5	Circuit Common	Black
6	Shield	Shield (grey wire in existing quick disconnect fitting)

Figure 6 Hard-wiring the sensor



3.1.2 Connecting the sc Sensor to a sc100 Controller in a Hazardous Location

DANGER
The sc100 and certain versions of the sensor are suitable for use in Class 1, Division 2, Groups A, B, C, D Hazardous Locations. See Control Drawing 58600-78 in the sc100 Controller Manual, Cat. No. 58600-18 for acceptable sensor versions and installation requirements.

DANGER
Le sc100 et certaines versions du capteur peuvent être utilisés dans des endroits dangereux de la Classe 1, Division 2, Groupes A, B, C, D. Reportez-vous au schéma de contrôle 58600-78 du Manuel du contrôleur sc100, Réf. 58600-18 pour connaître les versions des capteurs admises et les conditions d'installation.

DANGER
Explosion hazard. Do not connect or disconnect equipment unless power has been switched off or the area is known to be non-hazardous.

DANGER
Risque d'explosion. Couper le courant ou s'assurer que l'emplacement est designe non dangereux avant de replacer le aucon composant.

3.1.2.1 Attaching a sc Sensor with a Quick-connect Fitting in a Hazardous Location

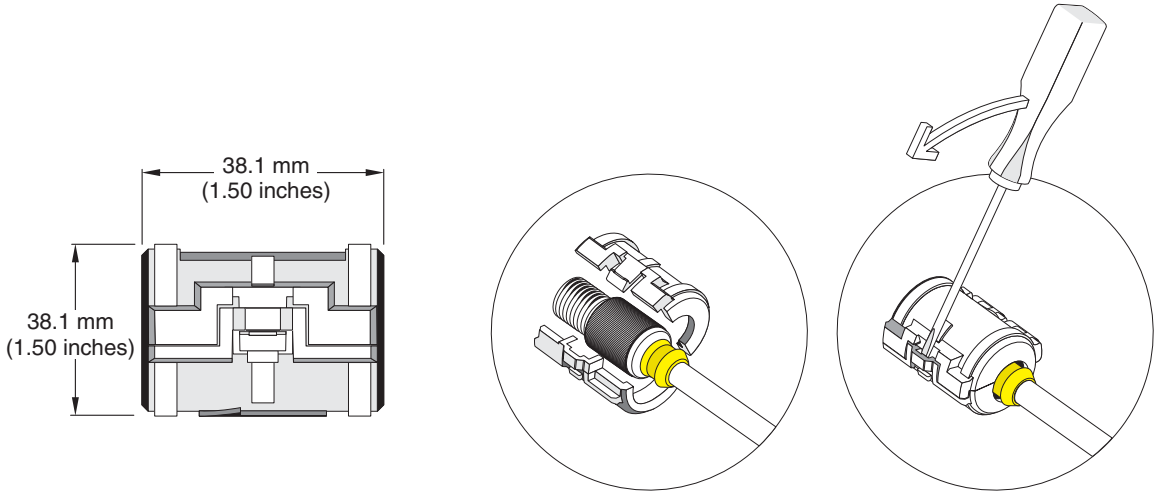
The sensor cable is supplied with a keyed quick-connect fitting for easy attachment to the controller, see Figure 5. For hazardous locations, a connector safety lock (Cat. No. 6139900) **must** be installed. Retain the connector cap to seal the connector opening in case the sensor must be removed.

1. Remove the connector cap from sc100 controller. Retain the connector cap to seal the connector opening in case the sensor must be removed.

2. Connect the sensor connector to the plug on the sc100.

3. Install a connector safety lock (Figure 7). Align the lock over the connector and squeeze the two halves together to lock. To remove the connector safety lock by inserting a small flat-bladed screwdriver into the locking groove. Pivot the screwdriver away from the groove and separate the two halves (Figure 7).

Figure 7 Installing the Connector Safety Lock



3.2 Connecting the Sensor to the sc1000

3.2.1 Connecting the Sensor using the Quick-connect Fittings

1. Unscrew the connector cap from the controller. Retain the connector cap to seal the connector opening in case the sensor must be removed.

2. Push the connector into the socket.

3. Hand-tighten the union nut.

Note: *Do not use the middle connection for the sensors as this is reserved for the display module.*

3.3 Using the Digital Gateway

The digital gateway is designed to provide a digital interface to the controller. The non-sensor end is wired to the sc100 or sc1000 controller in a non-hazardous location as

shown in section 3.1.1 on page 11. The non-sensor end is wired to the sc100 controller in a hazardous location as shown in section 3.1.2 on page 13.

3.3.1 Wiring the Digital Gateway

DANGER
The sc100 and certain versions of the sensor are suitable for use in Class 1, Division 2, Groups A, B, C, D Hazardous Locations . See Control Drawing 58600-78 in the sc100 Controller Manual, Cat. No. 58600-18 for acceptable sensor versions and installation requirements.

DANGER
Le sc100 et certaines versions du capteur peuvent être utilisés dans des endroits dangereux de la Classe 1, Division 2, Groupes A, B, C, D. Reportez-vous au schéma de contrôle 58600-78 du Manuel du contrôleur sc100, Réf. 58600-18 pour connaître les versions des capteurs admises et les conditions d'installation.

DANGER
Explosion hazard. Do not connect or disconnect equipment unless power has been switched off or the area is known to be non-hazardous.

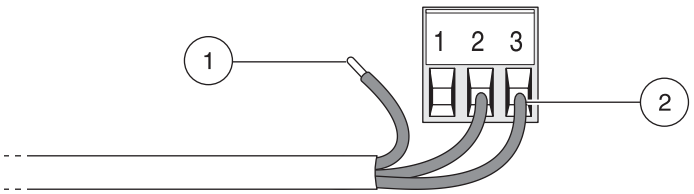
DANGER
Risque d'explosion. Couper le courant ou s'assurer que l'emplacement est designe non dangereux avant de replacer le aucon composant.

1. Route the cable from the sensor through the strain relief in the digital gateway then properly terminate the wire ends (see Figure 8).

Note: *Do not tighten the strain relief until the digital gateway is wired and the two halves are threaded securely together.*

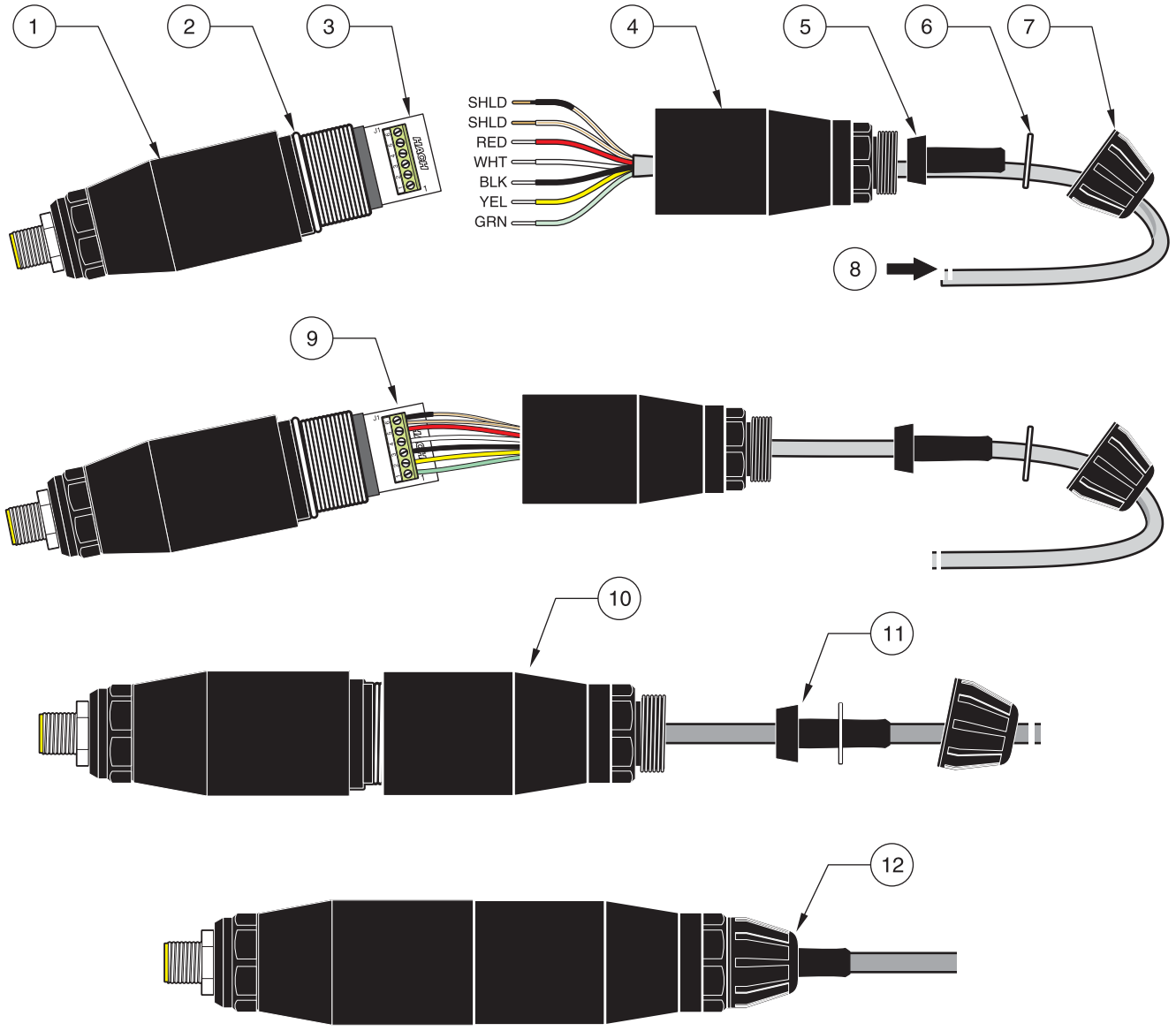
2. Insert the wires as shown in Table 4 and Figure 9.
3. Make sure the O-ring is properly installed between the two halves of the digital gateway and thread the two halves together. Hand tighten.
4. Tighten the strain relief to secure the sensor cable.
5. Connect the digital gateway to the controller.
   - sc100 Non-Hazardous Location Instructions—section 3.1.1 on page 11.
   - sc100 Hazardous Location Instructions—section 3.1.2 on page 13g
   - sc1000 Connection Instructions—Refer to section 3.2 on page 14.

Figure 8 Proper Wire Preparation and Insertion



1. Strip ¼-inch of insulation.	**1.** Seat insulation against connector with no bare wire exposed.

Figure 9 Wiring and Assembling the Digital Gateway



1.	Digital gateway front	**7.**	Cord grip
2.	O-ring	**8.**	From sensor
3.	Sensor wire connector	**9.**	Insert wires into connector according to Table 4. Use the included 2 mm screwdriver (Cat. No. 6134300) to secure connections.
4.	Digital gateway back	**10.**	Screw back of digital gateway onto front.
5.	Cable bushing	**11.**	Push cable bushing and anti-rotation washer into back.
6.	Anti-rotation washer	**12.**	Fasten cord grip securely. Assembly is complete.

Table 4 Wiring the Digital Gateway (Cat. No. 6120500)

Sensor (wire color)	Sensor Signal	Digital Gateway J1
Green	Ref	J1-1
Yellow	Temp +	J1-2
Black	Temp –	J1-3
White	VI	J1-4
Red	Active	J1-5
Clear	Shield	J1-6
Clear w/shrink wrap	Shield	J1-6

3.3.2 Mounting the Digital Gateway

The digital gateway is supplied with a mounting clip for mounting to a wall or other flat surface. See Figure 10 for dimensions. Use an appropriate fastener to secure it to the wall, see Figure 11. After the sensor is wired to the digital gateway and the two halves are threaded together, place the mounting clip over the center of the digital gateway and squeeze the clip together to secure.

Figure 10 Digital Gateway Dimensions

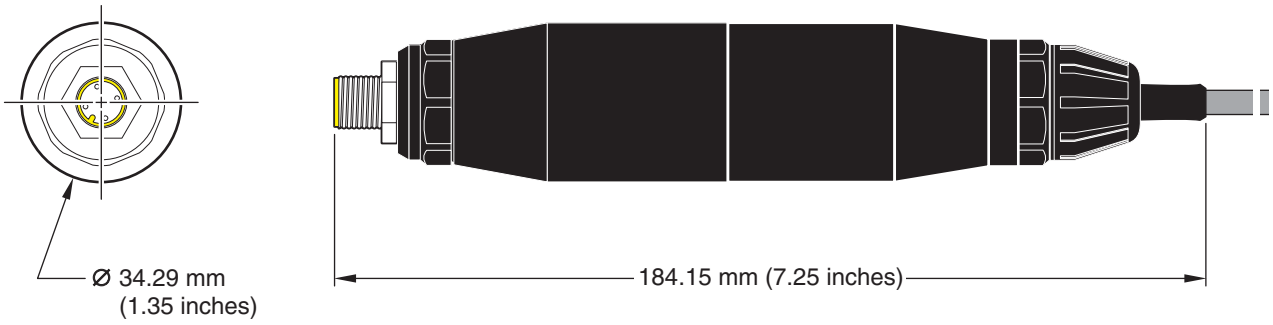
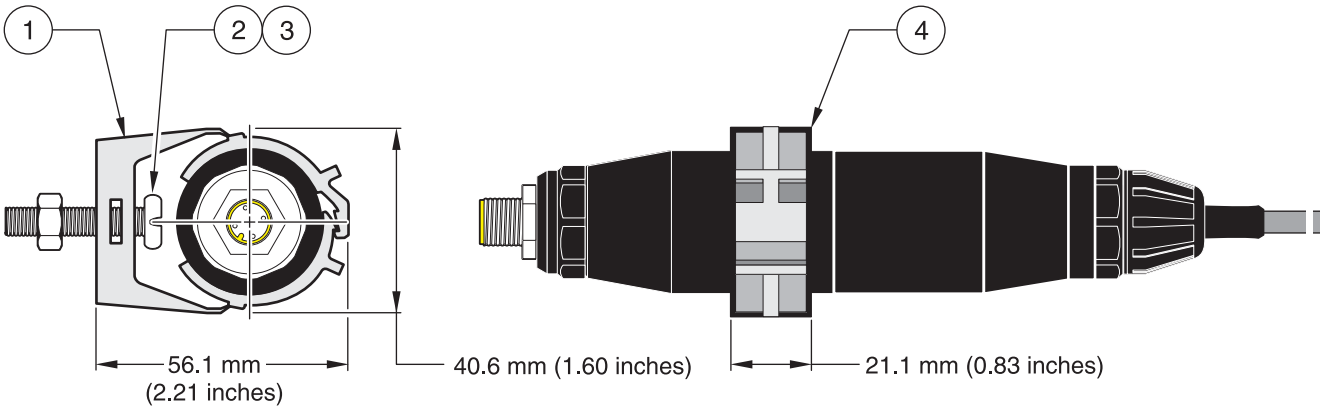


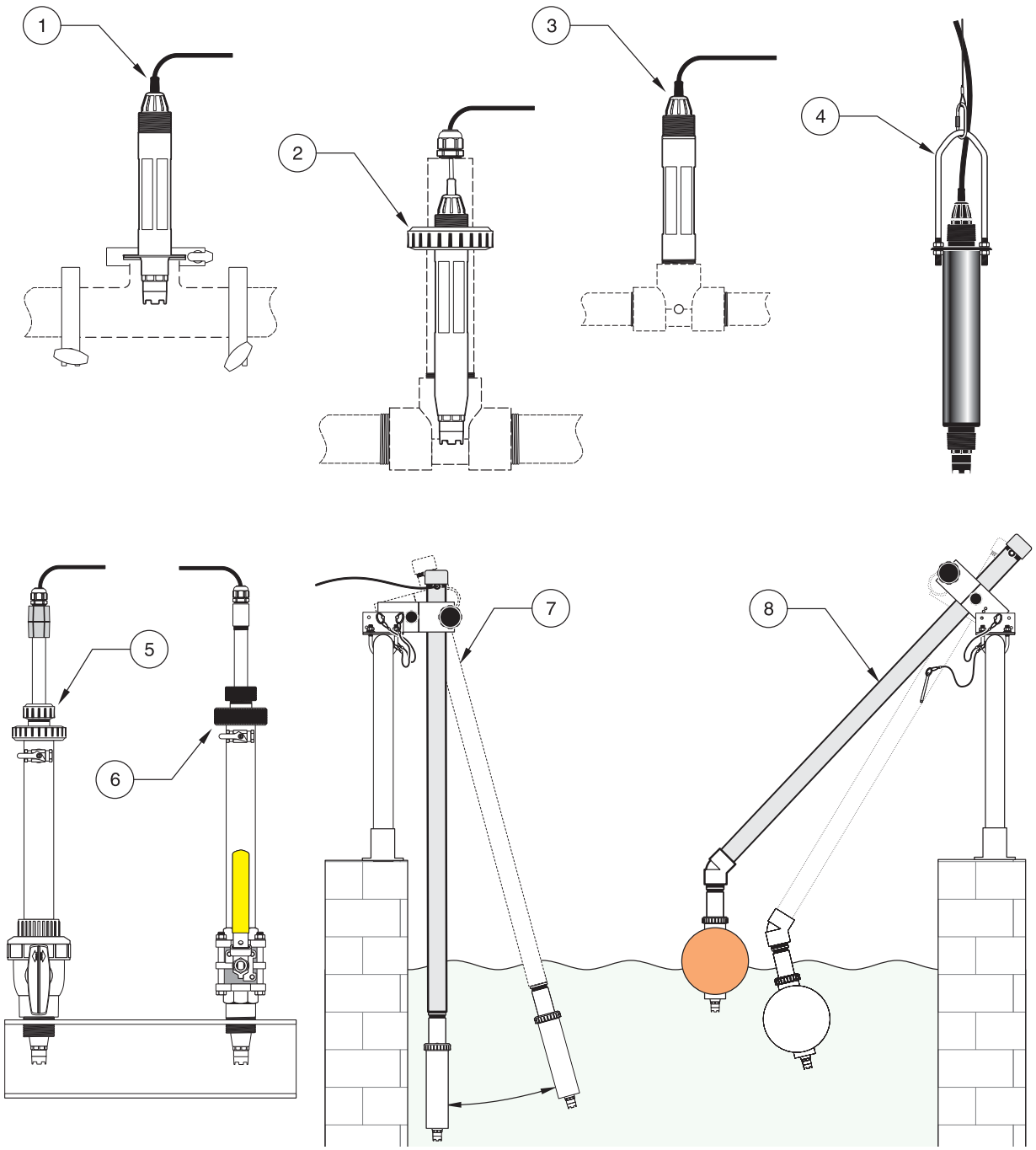
Figure 11 Mounting the Digital Gateway



1. Mounting Clip	**14.** Hex Nut, ¼-28
13. Screw, pan head, ¼-28 x 1.25-in.	**15.** Mount clip, insert digital gateway, squeeze clip closed.

3.4 Installing the Sensor in the Sample Stream

Figure 12 Sensor Installation Examples

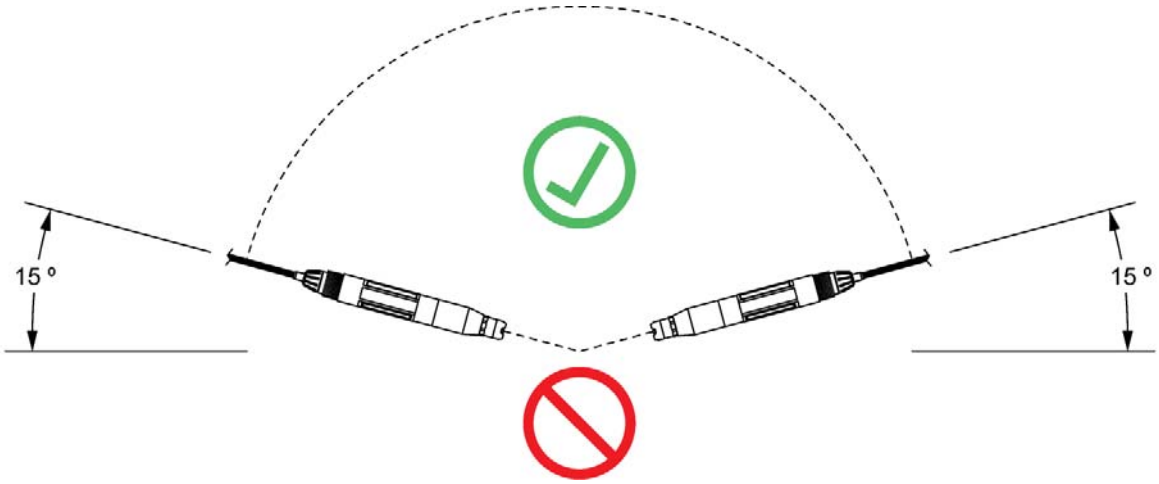


1. Sanitary mount	**19.** PVC Insertion mount
16. Union mount	**20.** Stainless steel insertion mount
17. Flow-through mount	**21.** Immersion mount
18. Hanging stainless steel sensor with the bale	**22.** Immersion mount, ball float

- Install the sensor so the sample contacts is representative of the entire process.
- Mount the sensor at least 508 mm (20 in) from the aeration basin wall, and immerse it at least 508 mm (20 in) into the process.

- Install the sensor using the instructions supplied with the installation apparatus. See Figure 12 for suggested mounting configurations.
- Sensor must be mounted at least 15º above horizontal. See Figure 13.

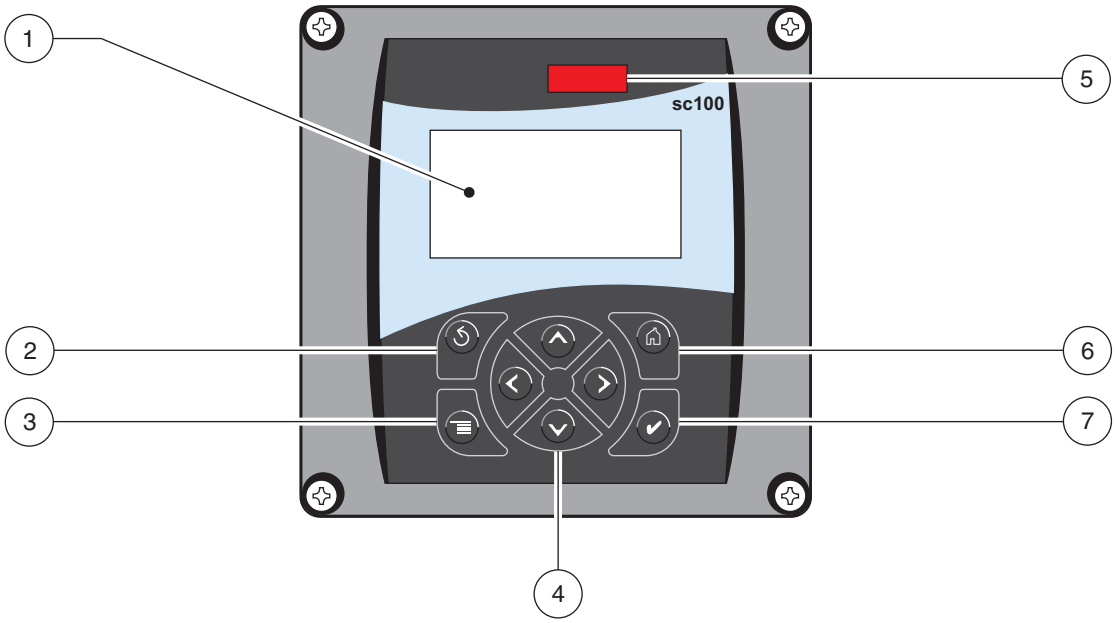
Figure 13 Sensor Mounting Angle



4.1 Using the sc100 Controller

The front of the controller is shown in Figure 14. The keypad consists of the eight keys described in Table 5.

Figure 14 Front of the Controller



1. Instrument display	**26.** IrDA window
23. BACK key	**27. HOME** key
24. MENU key	**28. ENTER** key
25. RIGHT, **LEFT**, **UP**, and **DOWN** keys	

Table 5 Controller Key Functions/Features

Number	Key	Function
2	back	Moves back one level in the menu structure.
3	menu	Moves to the main menu from other menus. This key is not active in menus where a selection or other input must be made.
4		Navigates through the menus, changes settings, and increments and decrements digits.
5	home	Moves to the Main Measurement screen from any other screen. This key is not active in menus where a selection or other input must be made.
6	enter	Accepts an input value, updates, or accepts displayed menu options.

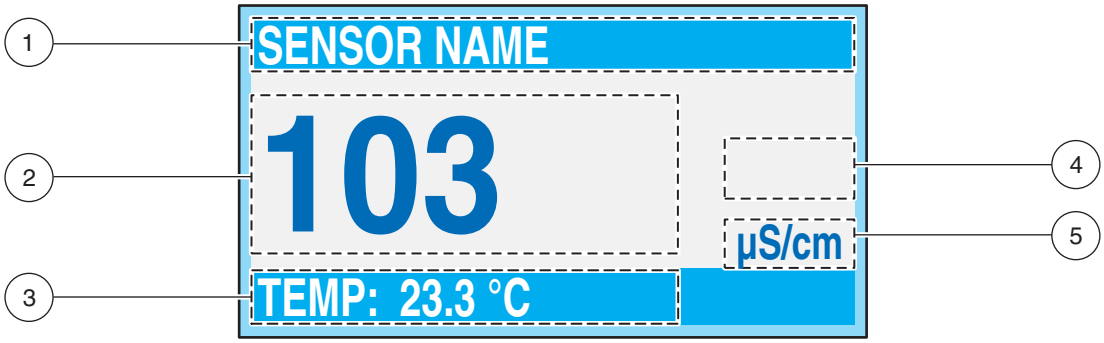
4.1.1 Controller Display Features

When a sensor is connected and the controller is in measurement mode, the controller display will show the current conductivity reading plus the sample temperature.

The display will flash on startup, when a sensor error has occurred, when the hold outputs function has been activated, and when a sensor is being calibrated.

An active system warning will cause the warning icon (a triangle with an exclamation point inside) to be displayed on the right side of the display.

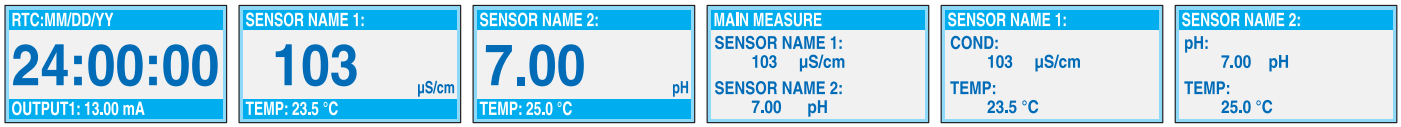
Figure 15 Display



1. Status bar. Indicates the sensor name and status of relays. The relay letter is displayed when the relay is energized.	**30.** Secondary measurement
	31. Warning icon area
29. Main measurement	**32.** Measurement units (µS, mS, S, mohm, TDS)

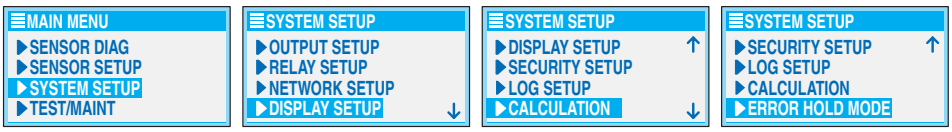
4.1.2 Important Key Presses

- Press the **HOME** key then the **RIGHT** or **LEFT** key to display two readings when two sensors are connected. Continue to press the **RIGHT** or **LEFT** key to toggle through the available display options as shown below.



- Press the **UP** and **DOWN** keys to toggle the status bar at the bottom of the measurement display to display the secondary measurement (temperature) and output information.

- When in Menu mode, an arrow may appear on the right side of the display to indicate that more menus are available. Press the **UP** or **DOWN** key (corresponding to the arrow direction) to display additional menus.



4.2 Using the sc1000 Controller

The sc1000 is a touch screen application. Use your finger to touch keys and menu commands. In normal operation the touch screen displays the measured values for the sensors selected.

4.2.1 Display Features

4.2.1.1 Using the Pop-up Toolbar

The pop-up toolbar provides access to the controller and sensor settings. The toolbar is normally hidden from view. To view the toolbar, touch the bottom-left of the screen.

Figure 16 Pop-up Toolbar Functions

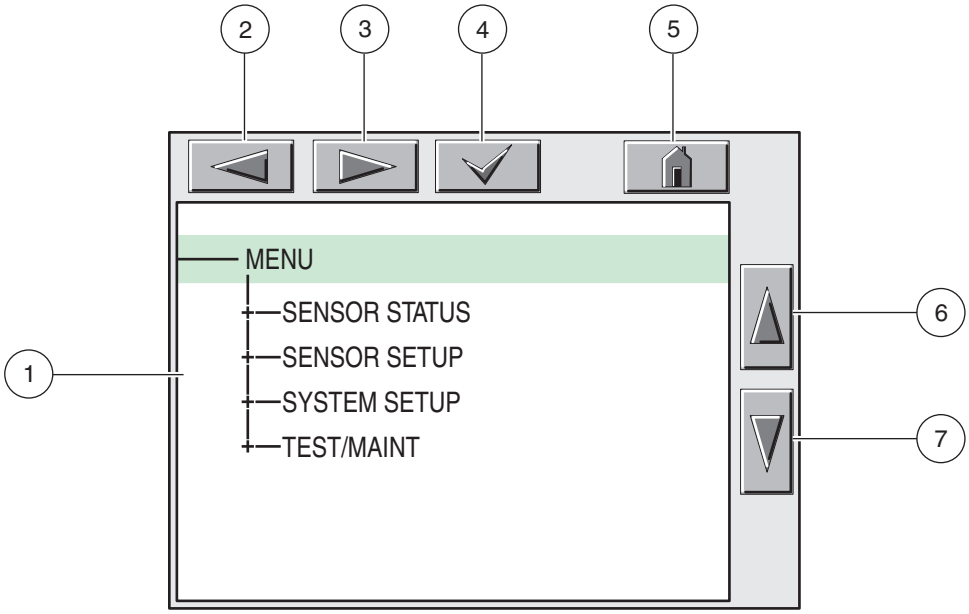
	**MAIN MENU**–displays the Main Menu Structure
	**UP** Arrow–scrolls up to the previous displayed value.
	Displays one value.
	Displays two values at the same time.
	Displays four values at the same time.
	**LIST**–displays the list of connected devices and sensors.
	**DOWN** Arrow–scrolls down to the next displayed value.

4.2.1.2 Using the Menu Windows

If the Menu button (from the pop-up toolbar) is selected, the Main Menu screen is opened. The Main Menu screen allows the user to view the sensor status, configure the sensor setup, system setup, and perform diagnostics.

The menu structure may vary depending on the configuration of the system.

Figure 17 Main Menu



1.	Display Area
33.	**BACK**
34.	**FORWARD**
35.	**ENTER**–confirms the entry or selection.
36.	**HOME**–changes to the display of measured values. The pop-up toolbar cannot open from the menu window. To view the Main Menu from this display, touch the Home button and then the bottom of the screen.
37.	**UP**–scrolls up
38.	**DOWN**–scrolls down

4.2.1.3 Navigating the Menu Windows

To view a menu item, touch the menu item or use the **UP** and **DOWN** keys to highlight the item. The menu item remains highlighted for approximately 4 seconds after it is selected. To view the highlighted command, select the area to the left of the menu item or select the **ENTER** button.

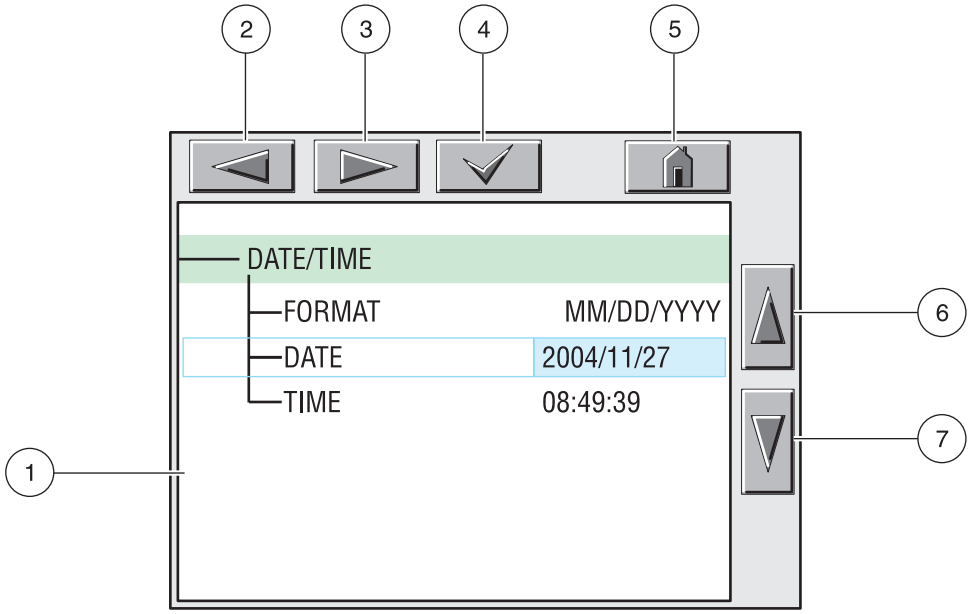
A "**+**" next to a menu command indicates there is a submenu. Touch the "+" to view the submenu. An "**i**" next to a menu command indicates it is information only.

If a menu item is editable, highlight the item and touch the far-left part of the menu item until it is highlighted and press **ENTER** or double-tap the highlighted item. A keypad will be displayed to change an entry (Figure 19 on page 25) or a list box will be displayed (Figure 20 on page 26).

Messages are displayed in the message window (Figure 21 on page 26).

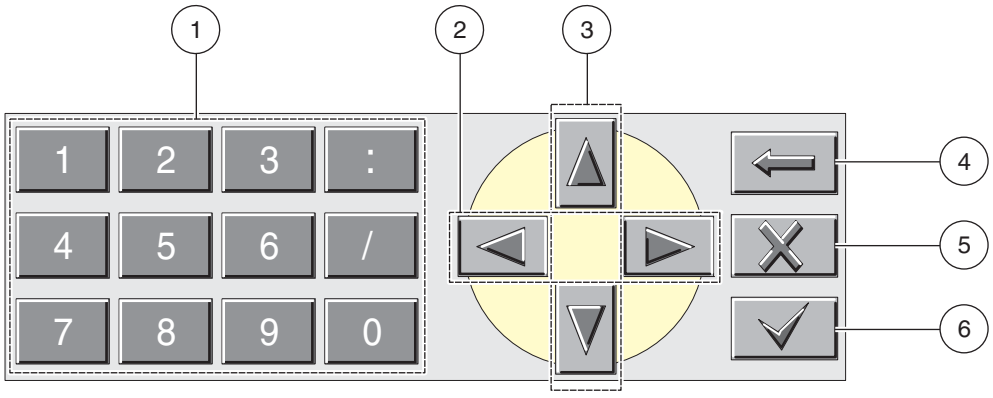
If an entry is incorrect, repeat the entry with the correct values. If the entry is outside the working range, a correction to the entry is made automatically.

Figure 18 Changing a Menu Item



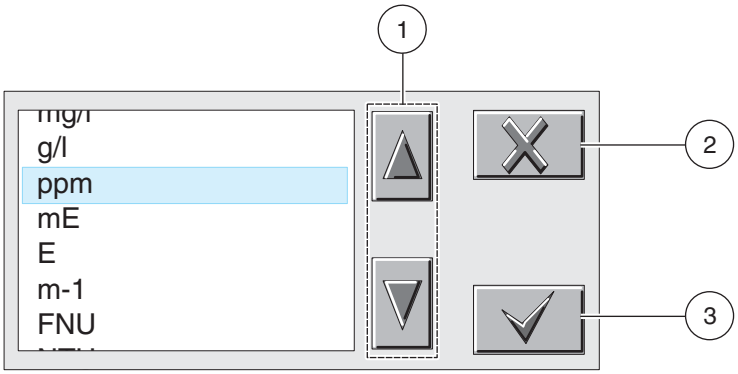
1. Display Area	**42.** **HOME**–changes to the display of measured values.
39. **BACK**	**43.** **UP**–scrolls up
40. **FORWARD**	**44.** **DOWN**–scrolls down
41. **ENTER**–confirms the entry or selection.	

Figure 19 Keypad



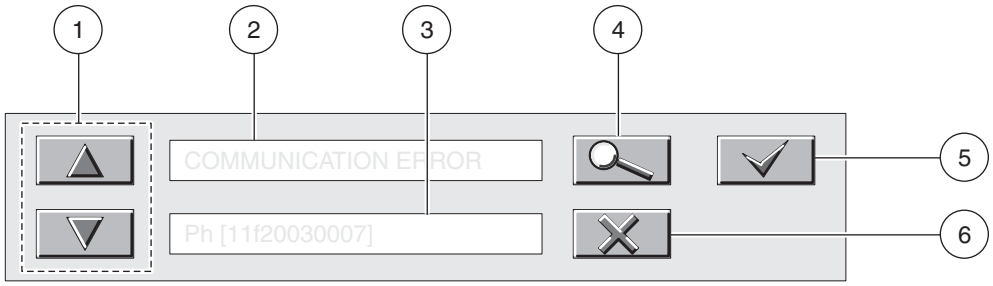
1. Enters numbers or the character as shown on the button.	
45. Moves the cursor one position to the left or to the right.	
46. Increase/Decrease a number or letter at the cursor position. Keep the button pressed to change the numbers/characters continuously.	
47. Deletes the character to the left of the cursor.	
48. **CANCEL**–cancels the entry.	
49. **ENTER**–confirms the entry or selection.	

Figure 20 List Box



1.	Scrolls up or down
50.	**CANCEL**–cancels and entry.
51.	**ENTER**–confirms a selection.

Figure 21 Message window



1.	Scrolls up or down.
52.	Displays the messages or warnings.
53.	Displays details on the selected entry.
54.	This button changes back to the previous display.
55.	**ENTER**–confirms an entry.
56.	**CANCEL**–cancels an entry.

Section 5 Operation

5.1 Sensor Setup

When a sensor is initially installed, the serial number of the sensor will be displayed as the sensor name. To change the sensor name refer to the following instructions:

1. Select Main Menu.
2. From the Main Menu, select SENSOR SETUP and confirm.
3. Highlight the appropriate sensor if more than one sensor is attached and confirm.
4. Select CONFIGURE and confirm.
5. Select EDIT NAME and edit the name. Confirm or cancel to return to the Sensor Setup menu.

5.2 Sensor Data Logging

The sc controller provides one data log and one event log for each sensor. The data log stores the measurement data at selected intervals. The event log stores a variety of events that occur on the devices such as configuration changes, alarms, warning conditions, etc. The data log and the event log can be read out in a CSV format. For downloading the logs please refer to the controller user manual.

5.3 Sensor Diagnostics Menu for pH and ORP Menu

SELECT SENSOR (if more than one sensor is attached)

STATUS	
ERROR LIST	See section 7.1 on page 37.
WARNING LIST	See section 7.2 on page 37.

5.4 pH Sensor Setup Menu

SELECT SENSOR (if more than one sensor is attached)

CALIBRATE	
1-POINT AUTO	Calibration with a single buffer — normally pH 7.
2-POINT AUTO	Calibration with two buffers — normally pH 7 and pH 4 or 10.
1-POINT MANUAL	Calibration against a single known sample.
2-POINT MANUAL	Calibration against two samples, both with a known pH.
TEMP ADJUST	Adjust the displayed temperature by up to ± 15 °C.
DEFAULT SETUP	Restores the system to the original factory calibration.

5.4 pH Sensor Setup Menu (continued)

CONFIGURE	
EDIT NAME	Enter a 10-digit name in any combination of symbols and alpha or numeric characters.
SELECT MEASURE	Select the appropriate measurement units to display.
DISPLAY FORMAT	Select the measurement resolution (xx.xx pH or xx.x pH).
TEMP UNITS	Choose from the displayed options (°C or °F).
LOG SETUP	Choose SENSOR INTERVAL to set the sensor log interval or select TEMP INTERVAL to set the temperature log interval.
REJECT FREQUENCY	Choose 50 or 60 Hz depending on the power line frequency for optimal noise rejection. Default is 60 Hz.
FILTER	Select 0–60 second signal averaging time.
TEMP ELEMENT	Select type of temperature element from the displayed choices.
SELECT BUFFER	Select the buffer type (standard 4, 7, 10 or DIN 19267) from the displayed choices.
PURE H20 COMP	Allows the user to specify that ammonia, morpholine, or other user-defined electrolyte is being used in the application, allowing a temperature-dependent linear slope factor to be applied to the measured pH.
CAL DAYS	Number of days since the last calibration. Default notification at 60 days.
SENSOR DAYS	Number of days the sensor has been in operation. Default notification at 365 days.
DEFAULT SETUP	Resets all user-editable options to their factory-defaults.
DIAG/TEST	
PROBE INFO	Display the sensor type, entered name of the sensor (Default: sensor serial number.), the sensor serial number, the software version number, and the sensor driver version number.
CAL DATA	Displays the pH slope and the date of the last calibration
SIGNAL	SENSOR SIGNAL: Displays the sensor output in mV SENSOR ADC COUNTS: Displays the sensor ADC counts TEMP ADC COUNTS: Displays raw data for temperature ADC counts. ADC counts are comparable to A/D counts and are for sensor electronic diagnostic purposes only. ELECTRODE STATE: Identifies the state of the electrode (good or bad) depending on whether the impedance is within preset limits. ACTIVE ELECT: Displays the impedance (Mohms) of the active electrode if Imped Status is set to Enabled. REF. ELECTRODE: Displays the impedance (Mohms) of the reference electrode if Imped Status is set to Enabled. IMPED STATUS: Sensor diagnostic. Choose Enabled or Disabled.
COUNTERS	SENSOR DAYS: displays the cumulative days the sensor has been in use. RESET SENSOR: Allows the sensor counter to be reset to zero. ELECTRODE DAYS: Cumulative days the electrode has been in use.

5.5 ORP Sensor Setup Menu

SELECT SENSOR (if more than one sensor is attached)

CALIBRATE	
1-POINT MANUAL	Calibration against a single known sample.
TEMP ADJUST	Adjust the displayed temperature by up to ± 15 °C.
DEFAULT SETUP	Restores the system to the original factory calibration.
CONFIGURE	
EDIT NAME	Enter up to a 10-digit name in any combination of symbols and alpha or numeric characters. Press **ENTER** when the entry is complete. The name will be displayed on the status line with the measurement value.
SELECT SENSOR	Choose from the displayed sensor type (pH or ORP).
TEMP UNITS	Choose from the displayed options (°C or °F).
LOG SETUP	Choose SENSOR INTERVAL to set the sensor log interval or select TEMP INTERVAL to set the temperature log interval.
AC FREQUENCY	Choose 50 or 60 Hz depending on the power line frequency for optimal noise rejection. Default is 60 Hz.
FILTER	Select 0–60 second signal averaging time.
TEMP ELEMENT	Select type of temperature element from the displayed choices.
SELECT BUFFER	Select the buffer type (standard 4, 7, 10 or DIN 19267) from the displayed choices.
PURE H20 COMP	Allows the user to specify that ammonia, morpholine, or other user-defined electrolyte is being used in the application, allowing a temperature-dependent linear slope factor to be applied to the measured pH.
CAL DAYS	Number of days since the last calibration. Default notification at 60 days.
SENSOR DAYS	Number of days the sensor has been in operation. Default notification at 365 days.
IMPED LIMITS	Set min/max electrode sensor impedance limits.
DEFAULT SETUP	Resets all user-editable options to their factory-defaults.
DIAG/TEST	
PROBE INFO	Display the sensor type, entered name of the sensor (Default: sensor serial number.), the sensor serial number, the software version number, and the sensor driver version number.
CAL DATA	Displays the pH slope and the date of the last calibration
SIGNAL	SENSOR SIGNAL: displays the sensor output in mV SENSOR ADC COUNTS: displays the sensor ADC counts TEMP ADC COUNTS: shows raw data for temperature ADC counts. ADC counts are comparable to A/D counts and are for sensor electronic diagnostic purposes only. ELECTRODE STATE: Identifies the state of the electrode (good or bad) depending on whether the impedance is within preset limits. ACTIVE ELECT: Shows the impedance (Mohms) of the active electrode if Imped Status is set to Enabled. REF. ELECTRODE: Shows the impedance (Mohms) of the reference electrode if Imped Status is set to Enabled. IMPED STATUS: Sensor diagnostic. Choose Enabled or Disabled.
COUNTERS	SENSOR DAYS: displays the cumulative days the sensor has been in use. RESET SENSOR: allows the sensor counter to be reset to zero. ELECTRODE DAYS: Cumulative days the electrode has been in use.

5.6 pH Calibration

The manufacturer offers one and two point automatic and manual calibrations for pH. An automatic calibration identifies the buffer table corresponding to the chosen buffer and automatically calibrates the probe after it stabilizes. A manual calibration is performed by placing the pH sensor in any buffer or sample with a known value and then entering that known value into the controller.

The value of the sample used in the manual calibration may be determined by laboratory analysis or comparison reading.

1. From the Main Menu, select SENSOR SETUP and confirm.
2. Select the appropriate sensor if more than one is attached and confirm.
3. Select CALIBRATE and confirm.
4. Select 1 POINT AUTO. Select the available Output Mode (Active, Hold, or Transfer) and confirm.
5. Move the clean probe to buffer and confirm to continue.
6. Confirm when stable. A screen will display 1 Point Auto Complete and the slope (XX.X mV/pH).
7. Return the probe to process.

5.6.1 Two Point Automatic Calibration

1. From the Main Menu, select SENSOR SETUP and confirm.
2. Select the appropriate sensor if more than one is attached and confirm.
3. Select CALIBRATE and confirm.
4. Select 2 POINT AUTO. Select the available Output Mode (Active, Hold, or Transfer) and confirm.
5. Move the clean probe to Buffer 1 and confirm.
6. Confirm when stable.
7. Move the clean probe to Buffer 2 and confirm.
8. Confirm when stable. A screen will display 2 Point Calibration Complete and the slope (XX.X mV/pH).
9. Return the probe to process.

5.6.2 One Point Manual Calibration

1. From the Main Menu, select SENSOR SETUP and confirm.
2. Select the appropriate sensor if more than one is attached and confirm.
3. Select CALIBRATE and confirm.

4. Select 1 POINT MANUAL. Select the available Output Mode (Active, Hold, or Transfer) and confirm.

5. Move the clean probe to solution and confirm to continue.

6. Confirm when stable. Edit the solution value and confirm.

7. Confirm when stable. A screen will display 1 Point Manual Complete and the slope (XX.X mV/pH).

8. Return the probe to process.

5.6.3 Two Point Manual Calibration

1. From the Main Menu, select SENSOR SETUP and confirm.

2. Select the appropriate sensor if more than one is attached and confirm.

3. Select CALIBRATE and confirm.

4. Select 2 POINT MANUAL CAL. Select the available Output Mode (Active, Hold, or Transfer) and confirm.

5. Move the clean probe to Solution 1 and confirm.

6. Confirm when stable. Edit the solution value and confirm.

7. Move probe to solution 1 and confirm.

8. Confirm when stable. Edit the solution value and confirm.

9. A screen will display 2 Point Manual Cal Complete and the slope (XX.X mV/pH).

10. Return the probe to process.

5.7 ORP Calibration

The manufacturer offers a one point manual calibration for ORP. The value of the sample used in the manual calibration may be determined by laboratory analysis or comparison reading.

1. From the Main Menu, select SENSOR SETUP and confirm.

2. Select the appropriate sensor if more than one is attached and confirm.

3. Select CALIBRATE and confirm.

4. Select 1 POINT MANUAL CAL. Select the available Output Mode (Active, Hold, or Transfer) and confirm.

5. Move the clean probe to Solution and confirm.

6. Confirm when stable. Edit the solution value and confirm.

7. A screen will display 1 Point Manual Complete and the slope (XX.X mV).

8. Return the probe to process.

5.8 Concurrent Calibration of Two Sensors for pH and ORP

1. Begin a calibration on the first sensor and continue until “Wait to Stabilize” is displayed.

2. Select LEAVE and confirm. The display will return to the main measurement screen. The reading for the sensor currently being calibrated will flash.

3. Begin the calibration for the second sensor and continue until “Wait to Stabilize” is displayed.

4. Select LEAVE and confirm. The display will return to the main measurement screen and the reading for both sensors will flash. The calibration for both sensors are now running in the background.

5. To return to the calibration of either sensor select SENSOR SETUP from the Main Menu and confirm. Select the appropriate sensor and confirm.

6. The calibration in progress will be displayed. Continue with the calibration.

5.9 Adjusting the Temperature

View or change the temperature using the steps below.

1. From the Main Menu, select SENSOR SETUP and confirm.

2. Select the appropriate sensor if more than one is attached and confirm.

3. Select CALIBRATE and confirm.

4. Select TEMP ADJUST and confirm.

5. Select MEASURED TEMP and confirm.

6. The temperature will be displayed. Edit the temperature and confirm.

DANGER
Only qualified personnel should conduct the tasks described in this section of the manual.

DANGER
Seul un technicien qualifié peut effectuer les tâches d'installation décrites dans cette section du manuel.

DANGER
Explosion hazard. Do not connect or disconnect equipment unless power has been switched off or the area is known to be non-hazardous.

DANGER
Risque d'explosion. Couper le courant ou s'assurer que l'emplacement est designe non dangereux avant de replacer le aucon composant.

DANGER
Explosion hazard. Substitution of components may impair suitability for Class 1, Division 2.

DANGER
Risque d'explosion. La substitution de composants peut rendre ce materiel inacceptable pour les emplacements de Classe 1, Division 2..

6.1 Maintenance Schedule

Maintenance Task	90 days	Annually
Clean the sensor[1]	x	
Inspect sensor for damage	x	
Replace Salt Bridge and fill solution[2]		x
Calibrate Sensor (as required by regulatory agency)	**Per the schedule mandated by your regulatory agency.**	

[1] Cleaning frequency is application dependent. More or less frequent cleaning will be appropriate in some applications.
[2] Salt bridge replacement frequency is application dependent. More or less frequent replacement will be appropriate in some applications

6.2 Cleaning the Sensor

CAUTION
Before cleaning with acid, determine if the chemical reaction between the acid and the sample will create a hazardous chemical reaction. (For example, do not put a sensor that is used in a cyanide bath directly into a strong acid for cleaning because this chemical combination may produce poisonous cyanide gas.)

1. Clean the exterior of the sensor with a stream of water. If debris remains remove loose contaminate buildup by carefully wiping the entire measuring end of the sensor (process electrode, concentric metal ground electrode, and salt bridge) with a soft clean cloth. Rinse the sensor with clean, warm water.

2. Prepare a mild soap solution of warm water and dish detergent or other non-abrasive soap that does not contain lanolin such as laboratory glass cleaner.

Note: *Lanolin will coat the glass process electrode and can adversely affect sensor performance.*

3. Soak the sensor for 2 to 3 minutes in the soap solution.

4. Use a small soft bristle brush (such as a toothbrush) and scrub the entire measuring end of the sensor, thoroughly cleaning the electrode and salt bridge surfaces. If surface deposits cannot be removed by detergent solution cleaning, use muriatic acid (or other dilute acid) to dissolve them. The acid should be as dilute as possible. Experience will determine which acid to use and the appropriate dilution ratio. Some stubborn coatings may require a different cleaning agent. For assistance, contact Technical and Customer Service (U.S.A. only) on page 43.

DANGER
Acids are hazardous. Always wear appropriate eye protection and clothing in accordance with material safety data sheet recommendations.

5. Soak the entire measuring end of the sensor in dilute acid for no more than 5 minutes. Rinse the sensor with clean, warm water then place the sensor back into the mild soap solution for 2 to 3 minutes to neutralize any remaining acid.

6. Remove the sensor from the soap solution, and rinse the sensor again in clean, warm water.

7. After cleaning, always calibrate the measurement system.

6.2.1 Replacing the Standard Cell Solution and Salt Bridge

If calibration cannot be attained, rejuvenate the sensor by replacing its standard cell solution and salt bridge as shown in Figure 22. If calibration is still not possible, refer to Section 7 on page 37.

1. To remove the salt bridge, hold the sensor upright (electrode at top), and use pliers or a similar tool to turn it counterclockwise. Take care not to damage the protruding process electrode. Properly discard the old salt bridge.

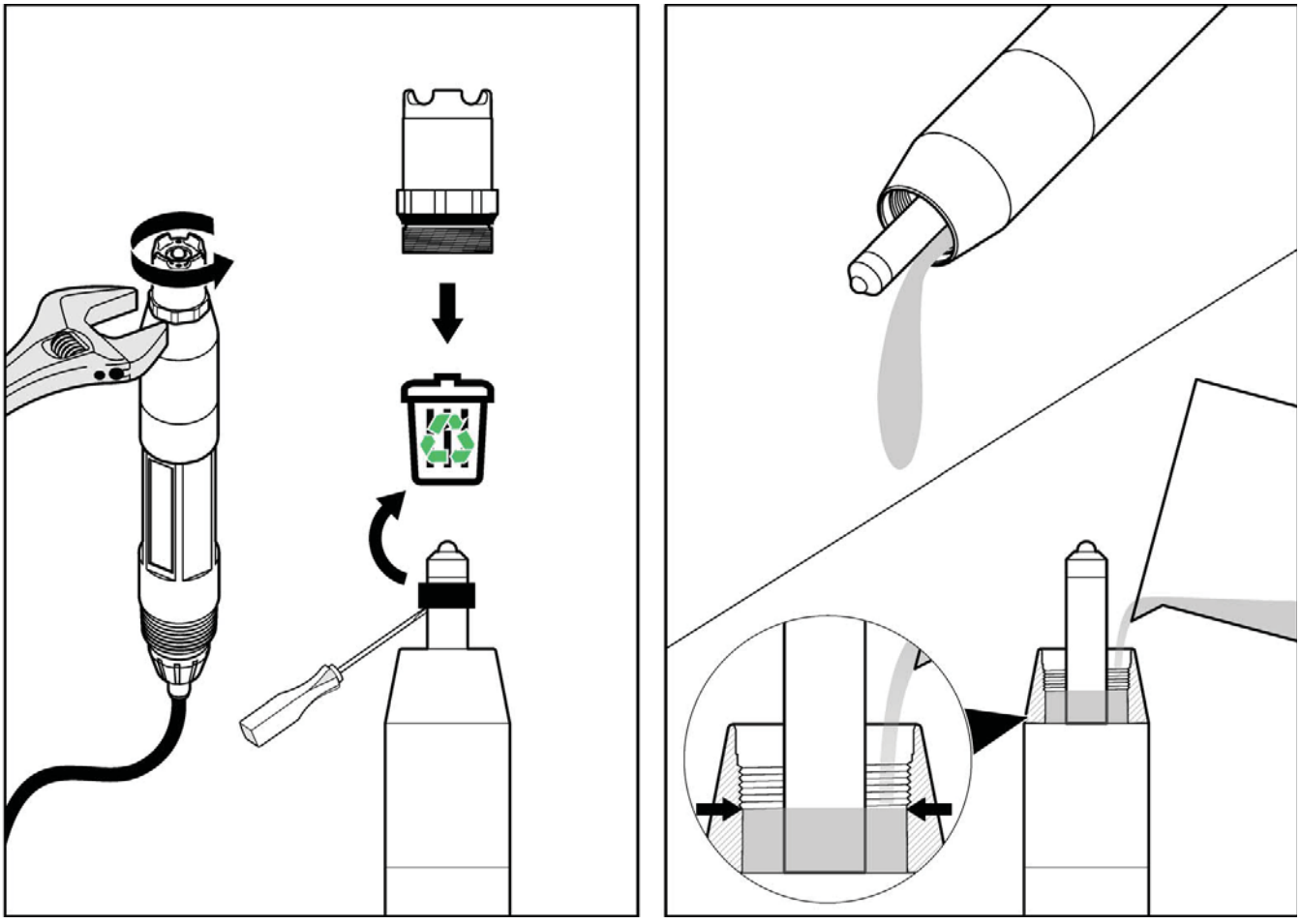
2. Replace the standard cell solution in the sensor reservoir.

   a. Pour out the aged solution, and thoroughly flush the reservoir with standard cell solution.

   b. Fill the reservoir to the bottom of the salt bridge mating threads with fresh standard cell solution (Cat. No. 25M1A1025-115).

3. Carefully thread the new salt bridge clockwise until it is finger-tight and the bottom surface of the salt bridge is in full contact with the top surface of the sensor body. Tighten the salt bridge another ½ turn with the wrench or tool.

Figure 22 Replacing Standard Cell Solution and Salt Bridge



Section 7 Troubleshooting

7.1 Error Codes

When a sensor is experiencing an error condition, the sensor reading on the measurement screen will flash and all relays and analog outputs associated with the sensor will be held. The following conditions will cause the sensor reading to flash:

- Sensor calibration
- Relay timer washing cycle
- Loss of communication

Highlight the Sensor Diag menu and press **ENTER**. Highlight Errors and press **ENTER** to determine the cause of the error.

Errors are defined in Table 6.

Table 6 Error Codes

Displayed Error	Definition	Resolution
ADC FAILURE	System measurement fails	Contact Technical Consulting Services.

7.2 Warnings

A sensor warning will leave all menus, relays, and outputs functioning normally, but will cause a warning icon to flash on the right side of the display. Highlight the Sensor Diag menu and press **ENTER** to determine the cause of the warning.

A warning may be used to trigger a relay and users can set warning levels to define the severity of the warning. Errors are defined in Table 7.

Table 7 Warning Codes

Displayed Warning	Definition	Resolution
PROBE OUT RANGE	Measured pH/ORP exceeds the expected value range.	Contact Technical Consulting Services.
TEMP OUT RANGE	Measured temperature exceeds the expected value range.	Contact Technical Consulting Services.
FLASH FAILURE	System flash memory write has failed.	Contact Technical Consulting Services.
ACTIVE. ELEC	Standard electrode is not performing within the required specifications.	Contact Technical Consulting Services.
REF. ELECTRODE	Reference electrode is not performing within the required specifications.	Contact Technical Consulting Services.
CAL REQUIRED	60 days has elapsed since the last calibration	Perform a calibration.
REPLACE SENSOR	One year has elapsed since the sensor has been installed.	Clean the sensor and replace the salt bridge and standard cell solution (see section 6.2 on page 34 and section 6.2.1 on page 35). Reset the counter in the SENSOR SETUP>CONFIGURE> SENSOR DAYS menu. If necessary, replace the sensor.

7.3 Troubleshooting the pH Sensor

Clean the sensor using the procedure described in section 6.2 on page 34. If the measuring system cannot be calibrated after cleaning, replace the standard cell solution and salt bridge (see section 6.2.1 on page 35) and try calibrating again. If the measuring system still cannot be calibrated, check the sensor operation.

Some simple tests using the sc100 or a multimeter and two pH buffers will determine if the pH sensor is operating properly. The use of pH 7 and pH 4 buffers is preferred but pH 10 can be used in place of pH 4 if it more closely covers the measurement range of interest.

Determine if the sensor has integral digital electronics or uses an external digital gateway. If the sensor uses a digital gateway, it will be hard-wired to the gateway through terminal connections inside the digital gateway enclosure. If the sensor uses the digital gateway and therefore does not have integral digital electronics, proceed with section 7.3.1. If the sensor has integral digital electronics, move to section 7.3.2 on page 39.

7.3.1 Troubleshooting a pH Sensor without Integral Digital Electronics

1. Disconnect the red, green, yellow, and black sensor wires from the digital gateway.

2. Place the sensor in a pH 7 buffer. Before continuing, allow the temperatures of the sensor and buffer to equalize to approximately 25 °C (70 °F).

3. Verify that the sensor temperature element (300 ohm thermistor) is operating properly by measuring the resistance between the yellow and black wires. The reading should be between 250 and 350 ohms at approximately 25 °C (70 °F).

4. Reconnect the yellow and black wires.

5. Connect the multimeter (+) lead to the red wire and (–) lead to the green wire. With the sensor in the pH 7 buffer, measure the dc millivolts. The sensor offset reading should be within the factory-specified limits of –50 and +50 mV. If it is, record the millivolt value reading and continue with step 6. If the reading is outside these limits, discontinue this test and contact Technical Support.

6. With the multimeter still connected, rinse the sensor with water and place it in either pH 4 or pH 10 buffer. Allow the temperatures of the sensor and buffer to equalize to approximately 25 °C (70 °F) then measure the sensor span reading as shown in Table 8 and Table 9 on page 39.

Span Reading in pH 4 Buffer
With the sensor in pH 4 buffer, the sensor span reading should be at least +160 mV more than the offset reading taken in step 5.

Table 8 Typical Span Reading Examples (pH 4 buffer)

Offset Reading (in pH 7 buffer)	Span Reading (in pH 4 buffer)
–50 mV	+110 mV
–25 mV	+135 mV
0 mV	+160 mV
+25 mV	+185 mV
+50 mV	+210 mV

Span Reading in pH 10 Buffer
With the sensor in pH 10 buffer, the sensor span reading should be at least –160 mV less than the noted offset reading taken in step 5.

Table 9 Typical Span Reading Examples (pH 10 buffer)

Offset Reading (in pH 7 buffer)	Span Reading (in pH 10 buffer)
–50 mV	–210 mV
–25 mV	–185 mV
0 mV	–160 mV
+25 mV	–135 mV
+50 mV	–110 mV

If the span reading is at least +160 mV more than or –160 mV less than the offset reading in pH 4 or pH 10, respectively, the sensor is within factory-specified limits. If not, contact Technical Support.

7.3.2 Troubleshooting the pH Sensor with Integral Digital Electronics

1. Place the sensor in pH 7 buffer and allow the buffer and sensor to reach temperature equilibrium. This can be verified by monitoring the sensor temperature value for a stable temperature measurement. This value is shown on the sc100 display when it is in measurement mode.

2. From the Sensor Setup Menu on the sc100, highlight “Diag/Test” and press **ENTER**.

3. Highlight “Sensor Signal” and press **ENTER**. This sensor offset reading should be within factory-specified limits of –50 and +50 mV. If it is, write down this millivolt value reading and perform step 4. If the reading is outside these limits, discontinue this test and contact Technical Support.

4. Rinse the sensor and place it in pH 4 or 10 buffer and allow the buffer and sensor to reach temperature equilibrium. This can be verified by monitoring the sensor temperature value for a stable temperature measurement. This value is located on the sc100 display when it is in measurement mode.

5. From the Sensor Setup Menu on the sc100, highlight “Diag/Test” and press **ENTER**.

6. Highlight “Sensor Signal” and press **ENTER**. Then measure the sensor span value.

Span Reading in pH 4 Buffer
With the sensor in pH 4 buffer, the sensor span reading should be at least +160 mV more than the offset reading as shown in Table 10 and Table 11.

Table 10 Typical Span Reading Examples (pH 4 buffer)

Offset Reading (in pH 7 buffer)	Span Reading (in pH 4 buffer)
–50 mV	+110 mV
–25 mV	+135 mV
0 mV	+160 mV
+25 mV	+185 mV
+50 mV	+210 mV

Span Reading in pH 10 Buffer
With the sensor in pH 10 buffer, the sensor span reading should be at least –160 mV less than the noted offset reading taken in step 6. Examples of typical readings:

Table 11 Typical Span Reading Examples (pH 10 buffer)

Offset Reading (in pH 7 buffer)	Span Reading (in pH 10 buffer)
–50 mV	–210 mV
–25 mV	–185 mV
0 mV	–160 mV
+25 mV	–135 mV
+50 mV	–110 mV

7. If the span reading is at least +160 mV more than or –160 mV less than the offset reading in pH 4 or pH 10, respectively, the sensor is within factory-specified limits. If not, contact Technical Support.

7.4 Checking ORP Sensor Operation

Simple tests using the sc100 or a multimeter and a 200 mV reference solution can determine if the ORP sensor is operating properly. Determine if the sensor has integral digital electronics or uses an external digital gateway. If the sensor uses a digital gateway, it will be hard-wired to the digital gateway through terminal connections within the digital gateway enclosure. If the sensor uses a digital gateway proceed with section 7.4.1. If the sensor has integral digital electronics, move to section 7.4.2 on page 40.

7.4.1 Troubleshooting the ORP Sensor without Integral Digital Electronics

1. Disconnect the red, green, yellow, and black sensor wires from the digital gateway.

2. Place the sensor in a 200 mV reference solution and allow the temperature of the sensor and reference solution to equalize to approximately 25 °C (70 °F).

3. Verify that the sensor temperature element (300 ohm thermistor) is operating by measuring the resistance between the yellow and black wires. The reading should be between 250 and 350 ohms at approximately 25 °C (70 °F).

4. Reconnect the yellow and black wires.

5. Connect the multimeter (+) lead to the red wire and (–) lead to the green wire. With the sensor in the 200 mV reference solution, measure the dc millivolts. The reading should be between 160 and 240 mV. If the reading is outside these limits, contact Technical Support.

7.4.2 Troubleshooting the ORP Sensor with Integral Digital Electronics

1. Place the sensor in 200 mV reference solution and allow the buffer and sensor to reach temperature equilibrium. This can be verified by monitoring the sensor temperature value for a stable temperature measurement. This value is located on the sc100 display when it is in measurement mode.

2. From the Sensor Setup Menu on the sc100, highlight “Diag/Test” and press **ENTER**. Highlight “Sensor Signal” and press **ENTER**. The reading should be between 160 and 240 mV. If the reading is outside these limits, contact Customer Service.

Section 8 Replacement Parts and Accessories

8.1 Replacement Items, Accessories, and Reagent and Standards

Item Description	QTY	Catalog Number
Air blast cleaning system, 115 V, includes Kynar® (PVDF) washer head with 7.6 m (25 ft) tubing and quick connect fitting, and a compressor in a NEMA 4X enclosure	each	1000A3335-005
Air blast cleaning system, 230 V, includes Kynar® (PVDF) washer head with 7.6 m (25 ft) tubing and quick connect fitting, and a compressor in a NEMA 4X enclosure	each	1000A3335-006
Air/Water blast cleaning head	each	1000A3335-004
Buffer, pH 7	500 mL (1 pint)	2283549
Buffer, pH 4	500 mL (1 pint)	2283449
Buffer, pH 10	500 mL (1 pint)	2283649
Buffer, pH 7	1 gallon	2283556
Buffer, pH 4	1 gallon	2283456
Buffer, pH 10	1 gallon	2283656
Buffer, pH 7	500 mL (1 pint)	2283549
Cable, interconnect, unterminated ends, specify length in whole feet	each	1W1100
Cable, sensor extension, 1 m (3 ft)	each	6122400
Cable, sensor extension, 7.7 m (25 ft)	each	5796000
Cable, sensor extension, 15 m (50 ft)	each	5796100
Cable, sensor extension, 31 m (100 ft)	each	5796200
Connector Cable	each	6139900
Instruction manual, Differential pH System, English	each	6120218
Plug, sealing, conduit opening	each	5868700
O-ring, Viton	each	5H1304
O-ring, EPDM	each	5H1306
O-ring, Perflouro	each	5H1096-019
ORP Standard Solution, 200 mV	500 mL (1 pint)	25M2A1001-115
ORP Standard Solution, 600 mV	500 mL (1 pint)	25M2A1002-115
ORP Standard Solution, 200 mV	1 gallon	25M2A1001-123
ORP Standard Solution, 600 mV	1 gallon	25M2A1002-123
Salt Bridge, PEEK® Body, PVDF outer junction	each	SB-P1SV
Salt Bridge Ryton® Body, PVDF outer junction	each	SB-R1SV
Standard Cell Solution	each	25M1A1025-115
Strain relief, Heyco	each	16664

Section 9 How to Order

U.S.A. Customers

By Telephone:
6:30 a.m. to 5:00 p.m. MST
Monday through Friday
(800) 227-HACH (800-227-4224)

By Fax:
(970) 669-2932

By Mail:
Hach Company
P.O. Box 389
Loveland, Colorado 80539-0389 U.S.A.
Ordering information by e-mail: orders@hach.com

Information Required

- Hach account number (if available)
- Your name and phone number
- Purchase order number
- Brief description or model number
- Billing address
- Shipping address
- Catalog number
- Quantity

International Customers

Hach maintains a worldwide network of dealers and distributors. To locate the representative nearest you, send an e-mail to: intl@hach.com or contact:

Hach Company World Headquarters; Loveland, Colorado, U.S.A.
Telephone: (970) 669-3050; Fax: (970) 669-2932

Technical and Customer Service (U.S.A. only)

Hach Technical and Customer Service Department personnel are eager to answer questions about our products and their use. Specialists in analytical methods, they are happy to put their talents to work for you.

Call 1-800-227-4224 or e-mail techhelp@hach.com

Section 10 Repair Service

Authorization must be obtained from Hach Company before sending any items for repair. Please contact the Hach Service Center serving your location.

In the United States:
Hach Company
Ames Service
100 Dayton Avenue
Ames, Iowa 50010
(800) 227-4224 (U.S.A. only)
FAX: (515) 232-3835

In Canada:
Hach Sales & Service Canada Ltd.
1313 Border Street, Unit 34
Winnipeg, Manitoba
R3H 0X4
(800) 665-7635 (Canada only)
Telephone: (204) 632-5598
FAX: (204) 694-5134
E-mail: canada@hach.com

**In Latin America, the Caribbean, the Far East,
Indian Subcontinent, Africa, Europe, or the Middle East:**
Hach Company World Headquarters,
P.O. Box 389
Loveland, Colorado, 80539-0389 U.S.A.
Telephone: (970) 669-3050
FAX: (970) 669-2932
E-mail: intl@hach.com

Section 11 Limited Warranty

Hach Company warrants its products to the original purchaser against any defects that are due to faulty material or workmanship for a period of one year from date of shipment unless otherwise noted in the product manual.

In the event that a defect is discovered during the warranty period, Hach Company agrees that, at its option, it will repair or replace the defective product or refund the purchase price excluding original shipping and handling charges. Any product repaired or replaced under this warranty will be warranted only for the remainder of the original product warranty period.

This warranty does not apply to consumable products such as chemical reagents; or consumable components of a product, such as, but not limited to, lamps and tubing.

Contact Hach Company or your distributor to initiate warranty support. Products may not be returned without authorization from Hach Company.

Limitations

This warranty does not cover:

- Damage caused by acts of God, natural disaster, labor unrest, acts of war (declared or undeclared), terrorism, civil strife or acts of any governmental jurisdiction
- Damage caused by misuse, neglect, accident or improper application or installation
- Damage caused by any repair or attempted repair not authorized by Hach Company
- Any product not used in accordance with the instructions furnished by Hach Company
- Freight charges to return merchandise to Hach Company
- Freight charges on expedited or express shipment of warranted parts or product
- Travel fees associated with on-site warranty repair

This warranty contains the sole express warranty made by Hach Company in connection with its products. All implied warranties, including without limitation, the warranties of merchantability and fitness for a particular purpose, are expressly disclaimed.

Some states within the United States do not allow the disclaimer of implied warranties and if this is true in your state the above limitation may not apply to you. This warranty gives you specific rights, and you may also have other rights that vary from state to state.

This warranty constitutes the final, complete, and exclusive statement of warranty terms and no person is authorized to make any other warranties or representations on behalf of Hach Company.

Limitation of Remedies

The remedies of repair, replacement or refund of purchase price as stated above are the exclusive remedies for the breach of this warranty. On the basis of strict liability or under any other legal theory, in no event shall Hach Company be liable for any incidental or consequential damages of any kind for breach of warranty or negligence.

Section 12 Compliance Information

Hach Co. certifies this instrument was tested thoroughly, inspected and found to meet its published specifications when it was shipped from the factory.

The Model sc100/sc1000 Controller with Differential pH/ORP sensor has been tested and is certified as indicated to the following instrumentation standards:

Product Safety

UL 61010A-1 (ETL Listing # 65454)
CSA C22.2 No. 1010.1 (ETLc Certification # 65454)
Certified by Hach Co. to EN 61010-1 Amds. 1 & 2 (IEC1010-1) per 73/23/EEC, supporting test records by Intertek Testing Services.

Immunity

This equipment was tested for industrial level EMC per:

EN 61326 (EMC Requirements for Electrical Equipment for Measurement, Control and Laboratory Use) **per 89/336/EEC EMC:** Supporting test records by Hach Company, certified compliance by Hach Company.

Standards include:

IEC 1000-4-2:1995 (EN 61000-4-2:1995) Electrostatic Discharge Immunity (Criteria B)
IEC 1000-4-3:1995 (EN 61000-4-3:1996) Radiated RF Electromagnetic Field Immunity (Criteria A)
IEC 1000-4-4:1995 (EN 61000-4-4:1995) Electrical Fast Transients/Burst (Criteria B)
IEC 1000-4-5:1995 (EN 61000-4-5:1995) Surge (Criteria B)
IEC 1000-4-6:1996 (EN 61000-4-6:1996) Conducted Disturbances Induced by RF Fields (Criteria A)
IEC 1000-4-11:1994 (EN 61000-4-11:1994) Voltage Dip/Short Interruptions (Criteria B)

Additional Immunity Standard/s include:

ENV 50204:1996 Radiated Electromagnetic Field from Digital Telephones (Criteria A)

Emissions

This equipment was tested for Radio Frequency Emissions as follows:

Per **89/336/EEC** EMC: **EN 61326:1998** (Electrical Equipment for measurement, control and laboratory use—EMC requirements) Class “A” emission limits. Supporting test records by Hewlett Packard, Fort Collins, Colorado Hardware Test Center (A2LA # 0905-01) and certified compliance by Hach Company.

Standards include:

EN 61000-3-2 Harmonic Disturbances Caused by Electrical Equipment
EN 61000-3-3 Voltage Fluctuation (Flicker) Disturbances Caused by Electrical Equipment

Additional Emissions Standard/s include:

EN 55011 (CISPR 11), Class “A” emission limits

Canadian Interference-causing Equipment Regulation, IECS-003, Class A

Supporting test records by Hewlett Packard, Fort Collins, Colorado Hardware Test Center (A2LA # 0905-01) and certified compliance by Hach Company.

This Class A digital apparatus meets all requirements of the Canadian Interference-causing Equipment Regulations.
Cet appareil numèrique de la classe A respecte toutes les exigences du Rëglement sur le matÈriel brouilleur du Canada.

FCC PART 15, Class “A” Limits

Supporting test records by Hewlett Packard, Fort Collins, Colorado Hardware Test Center (A2LA # 0905-01) and certified compliance by Hach Company.

This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions:

(1) this device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

Changes or modifications to this unit not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference, in which case the user will be required to correct the interference at his own expense. The following techniques of reducing the interference problems are applied easily.

1. Disconnect the Controller from its power source to verify that it is or is not the source of the interference.

2. If the Controller is connected into the same outlet as the device with which it is interfering, try another outlet.

3. Move the Controller away from the device receiving the interference.

4. Reposition the receiving antenna for the device receiving the interference.

5. Try combinations of the above.

Appendix A General pH Information

A.1 pH Measurement Theory

pH is the negative logarithm of the hydrogen ion activity and a measure of the acidity or alkalinity of a solution.

$$pH = -\log A[H+]$$

pH is normally measured using a glass electrode and a reference electrode.

The glass electrode acts as a transducer, converting chemical energy (the hydrogen ion activity) into an electrical energy (measured in millivolts). The reaction is balanced and the electrical circuit is completed by the flow of ions from the reference solution to the solution under test.

The electrode and reference solution together develop a voltage (emf) whose magnitude depends on the type of reference electrode, the internal construction of the glass electrode, the pH of the solution and the temperature of the solution. This voltage is expressed by the Nernst Equation:

$$E = E_o - (2.3\ RT/F) \times \log A[H+]$$
$$E = E_o - (\text{slope}) \times \log A[H+]$$

where:

E = the emf of the cell

E_o = the zero potential (isopotential) of the system. It depends on the internal construction of the glass and reference electrodes.

R = gas constant

T = temperature in Kelvin

A[H+] = activity of the hydrogen ion (assumed to be equivalent to the concentration of hydrogen ions)

F = Faraday constant

For every unit change in pH (or decade change in ion concentration) the emf of the electrode pair changes by 59.16 mV at 25 °C. This value is known as the Nernstian Slope of the electrode.

The pH electrode pair is calibrated using solutions of known and constant hydrogen ion concentration, called buffer solutions. The buffer solutions are used to calibrate both the electrode isopotential and slope.

A.2 PID Controller Basics

A pH control loop operates as follows: The pH meter measures the value of the pH in the effluent, and, if the pH is different from the setpoint, the controller actuates the reagent pump (or valve) that adds reagent to a mixing tank. The added reagent adjusts the pH value of the process.

The physical layout of the loop, the sizing of the pump (valve), type of mixing tank, and location of the pH electrodes all have a major impact on the ultimate performance of the loop, after the controller is tuned for optimal performance. The largest single performance factor is the delay time around the loop. This includes the response time of the

electrode/meter, time required to deliver the reagent to the process water, time required for the reagent to mix with and react with the process water, and the time required to deliver the completely mixed water to the electrode. If the delay times are too long or the mixing is not complete, the control will be poor regardless of how well the controller is tuned.

The Process pH Meter uses a PID (proportional, integral (reset), derivative (rate) control) control algorithm. Each of the instrument settings along with their effects on the control loop, are described below.

Mode
Manual: The manual output is specified in percent of full-scale PID output (4–20 mA) and is commonly used for testing the output device.

Auto: Allows the process to be controlled automatically using information specified in the Phase, Setpoint, Proportional Band, Integral, and Derivative menus as follows:

Phase
Direct: The control output action will cause the process value to increase.

Reverse: The control output action will cause the process value to decrease.

Setpoint
The setpoint is defined as the desired process value in pH

Proportional Band
The proportional band is the range in pH from the setpoint value where the controller provides proportional control. For example, the desired setpoint for the process is pH 7.0 and the process requires that a reagent must be added to the process water to bring it up to pH 7.0. If the proportional band is set to pH 1.0, the controller will provide proportional output control over the range of pH 6.0 to 8.0. When the process is at pH 6.0, the controller will provide a 100% control output level (assuming that Phase is set to Direct). When the process is at pH 7.0, the proportional control will provide a 0% control output level. When the process is at pH 6.5 the proportional control will provide a 50% output. The output action is equal to the difference between the setpoint and the process value, divided by the proportional band value.

Integral
The integral value is used to reduce the steady state error, between the process value and the setpoint, to zero. For example, assume a process can be manually controlled at a level of pH 8.0 by sending a 35% control output level to a reagent pump. Now, say that the system is set up for the controller to provide proportional only control, with the controller setpoint set to pH 8.0 and the proportional band set to pH 1.0. Note that the nearer the process gets to the pH 8.0 setpoint, the lower the control output level is. In fact, when the process is at pH 8.0, the output level will be 0%. Since the process requires that the pump be operated at 35% for the process to reach pH 8.0, its apparent that proportional-only control will never quite reach the desired setpoint of pH 8.0. This is where the integral control comes in.

Integral control can be thought of as adding up the output action from the proportional control over time. For example, the proportional control output reaches a steady state level of 5%. If the integral time is set to five minutes, the integral action of the controller will add an additional 5% to the controller output level over a 5-minute interval. The integral action is additive, so for every 5-minute interval an additional 5% is added to the controller's output level. This will allow the controller to bring the process to the desired setpoint level. Note that the longer the integral time setting, the longer it takes for the

integral action to affect the process. The integral control action is disabled by setting it to zero. Note that the integral time is in minutes.

Derivative
Derivative control is used to adjust the control output level based upon the rate at which the process value is approaching or passing the setpoint. Derivative control action would be used in cases where the process value can rapidly ramp up and overshoot the setpoint. The derivative setting is in minutes. The output action of the derivative control is equal to the rate of change of the process (in pH units per minute) times the derivative time, divided by the proportional band, times negative one. For example, if the process pH is changing at a rate of pH 0.20 per minute, the derivative time is set to 3.0 minutes, the proportional band is set to pH 0.80, and the action is “direct” the derivative control output action will be approximately equal to: (–0.20 pH/minute X 3.0 minute) /0.80 pH = –75%.

During calibration, the analog outputs can remain active, be held, or be transferred to a preset mA value.

Appendix B Modbus Register Information

Table 12 Sensor Modbus Registers

Group Name	Tag Name	Register #	Data Type	Length	R/W	Description
Tags	SensorMeasTag	40001	Integer	1	R	Sensor measurement tag
Measurements	pHMeas	40002	Float	2	R	pH /ORP measurement
Tags	TempMeasTag	40004	Integer	1	R	Temperature measurement tag
Measurements	TempDegCMeas	40005	Float	2	R	Temperature measurement
Configuration	SensorName	40007	String	6	R/W	Sensor name
Tags	FuncCode	40013	Integer	1	R/W	Function code tag
Tags	NextState	40014	Integer	1	R/W	Next state tag
Configuration	MeasType	40015	Integer	1	R/W	Measurement type-pH or ORP
Configuration	TempUnits	40016	Integer	1	R/W	Temperature units-C or F
Configuration	pHFormat	40017	Integer	1	R/W	pH display format
Configuration	TaggedPhFormat	40018	Long	2	R	pH display tagged format
Configuration	Filter	40020	Integer	1	R/W	Sensor filter
Configuration	TempElementType	40021	Integer	1	R/W	Temperature element type
Tags	TempUserValueTag	40022	Integer	1	R	Temperature user value tag
Configuration	TempUserDegCValue	40023	Float	2	R/W	Temperature user value
Configuration	pHBuffer	40025	Integer	1	R/W	pH buffer type
Configuration	PureWaterCompType	40026	Integer	1	R/W	Pure H_2O compensation type
Configuration	PureWaterCompUser	40027	Float	2	R/W	Pure H_2O compensation user val
Calibration	OutputMode	40029	Integer	1	R/W	Output mode
Calibration	CalLeave	40030	Integer	1	R/W	Cal leave mode
Calibration	CalAbort	40031	Integer	1	R/W	Cal abort mode
Tags	CalEditValueTag	40032	Integer	1	R	Cal edit value tag
Calibration	CalEditPhValue	40033	Float	2	R/W	Cal edit value
Diagnostics	pHSlope	40035	Float	2	R	pH slope
Diagnostics	SoftwareVersion	40037	String	6	R	Software version
Diagnostics	SerialNumber	40043	String	6	R	Serial number
Diagnostics	pHOffset	40049	Float	2	R	pH offset
Diagnostics	OrpOffset	40051	Float	2	R	Orp offset
Calibration	CalCode	40053	Integer	1	R	Cal code
Configuration	SensorLogInterval	40054	Integer	1	R/W	Sensor data log interval
Configuration	TempLogInterval	40055	Integer	1	R/W	Temperature data log interval
Diagnostics	pHmV	40056	Float	2	R	pH mV
Diagnostics	ProdDate	40058	Date	2	R/W	Production date
Diagnostics	StdElectrode	40060	Float	2	R	Standard electrode impedance
Diagnostics	RefElectrode	40062	Float	2	R	Reference electrode impedance
Diagnostics	LastCalDate	40064	Date	2	R	Last calibration date
Diagnostics	SensorDays	40066	Integer	1	R	Sensor running days
Diagnostics	ElectrodeDays	40067	Integer	1	R	Electrode running days
Diagnostics	ElectrodeStatus	40068	Integer	1	R	Electrode status
Diagnostics	SensorType	40069	Integer	1	R	Sensor type
Configuration	RejectFrequency	40070	Integer	1	R/W	Reject frequency
Diagnostics	DeviceDriver	40071	String	5	R	Device driver
Configuration	CalWarningDays	40076	Integer	1	R/W	Calibration warning days
Configuration	SensorWarningDays	40077	Integer	1	R/W	Sensor warning days

Index

HAPMAN

VACUUM CONVEYOR SYSTEM

LEFT BLANK

HAPMAN
Ideas that move.
Gen
a MGlobal company

VEOLIA WATER TECHNOLOGIES CANADA INC.

JOB# H17116

PO# 18000905 HD 05000

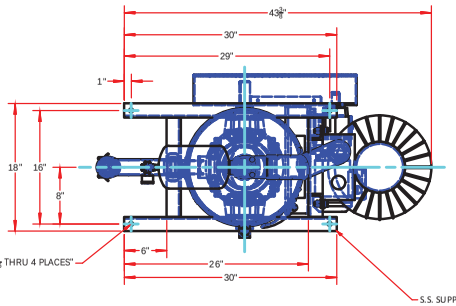
Installation, Operation and Maintenance Manual

Performantee
Designed for results – guaranteed.

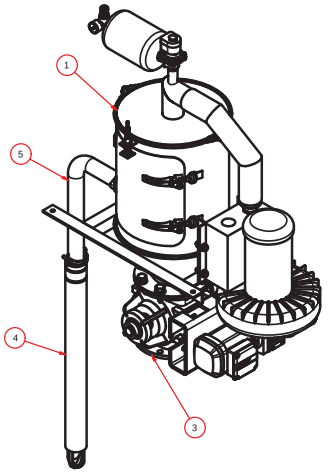
Global Headquarters
6002 East N Avenue
Kalamazoo, MI 49048, USA
(800) 427-6260
sales@hapman.com
www.hapman.com

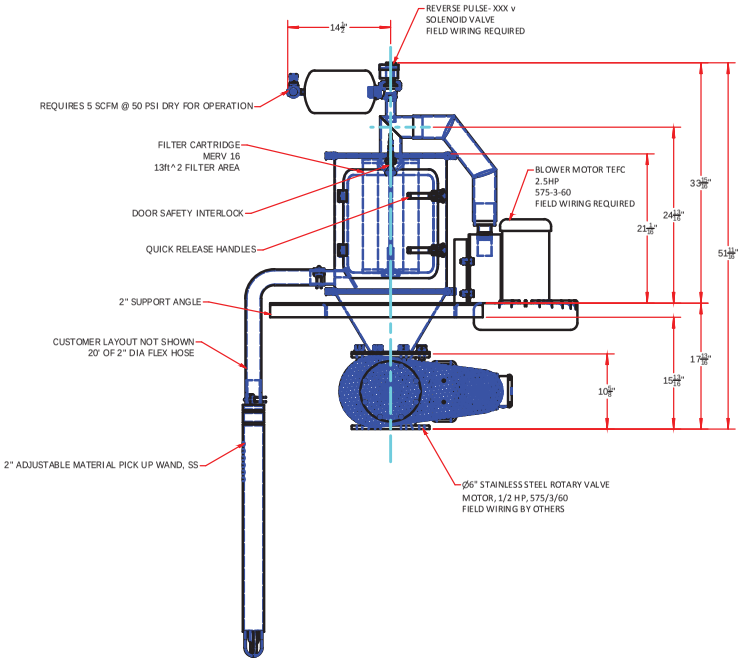
This page is intentionally left blank

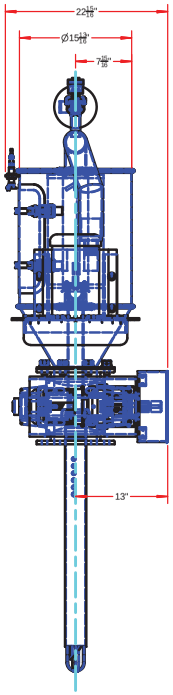
REV.	REVISION DESCRIPTION	DATE	BY
A	REMOVED 2" COLLAR ON CONE	5/17/18	JD



NOTES:
(1) PURCHASE ORDER NUMBER: 18000905 HD 05000
(2) MATERIAL CONVEYED: POTASSIUM PERMANGANATE
PARTICLE SIZE: POWDER
BULK DENSITY: 94 LBS/ CU FT
MOISTURE CONTENT: DRY
TEMPERATURE: AMBIENT
FLOWABILITY: FREE
ABRASIVENESS: MILDLY
MATERIAL CHARACTERISTICS: X
CAPACITY REQUIREMENTS: 77 Kgs/DAY
(3) MATERIAL CONTACT SURFACES: STAINLESS STEEL
(4) HAPMAN STANDARD GRADE FINISH SPECIFICATION #40-108, REV "C"
(5) SUPPORT AND INSTALLATION LABOR FURNISHED BY OTHER.
(6) MOTOR 575v/ 3PH/60HZ







CONTROLS, FILTER PULSE TIMER & MOTOR STARTER BY OTHERS

APPROVAL DRAWING

☐ APPROVED WITH NO CHANGES
☐ APPROVED AS NOTED
☐ RESUBMIT WITH CHANGES NOTED

BY _____ DATE _____

TITLE _____

THE EQUIPMENT SHOWN ON THIS DRAWING WILL BE RELEASED FOR FABRICATION UPON RECEIPT OF THIS SIGNED APPROVAL DRAWING AT HAPMAN. PLEASE VERIFY THE ACCURACY OF THE DIMENSIONAL AND APPLICATION INFORMATION PRIOR TO SIGNING. CHANGES TO THE DESIGN AFTER APPROVAL WILL RESULT IN SCHEDULE DELAYS AND REQUIRE A PURCHASE ORDER PRICE CHANGE.

REV.	SUF.	ITEM NO.	DRAWING / PART NO.	DESCRIPTION	ITEM QTY
	AA	1	H1711 6AA-D00	16" FILTER/RECEIVER HOUSING, SS	1
	AB	3	H1711 6AB-L00	6" DIA. DISCHARGE ROTARY VALVE, SS	1
	AC	4	H1711 6AC-D00	INLET WAND ASS'Y, 2", SS	1
	AD	5	H1171 6AD-D00	FLEXIBLE CONVEY LINE AND SS HOSE CLAMPS, 2" DIA. X 240" LG.	1

UNLESS OTHERWISE SPECIFIED
DIMENSIONS ARE ENGLISH (FEET AND/OR INCHES)
TOLERANCES

DECIMALS	INCHES	FEET	ANGLES
.X ± .030" .XX ± .015" .XXX ± .005"	X/X" = ± 1/16"	.X'-X" = ± 1/4" UP TO 20 FEET .X'-X" = 1/2" OVER 20 FEET	- ± .1°

DO NOT SCALE DRAWING | **REMOVE ALL SHARP EDGES**

HAPMAN
Ideas that move
5944 E. N AVE. KALAMAZOO, MICHIGAN 49048
PHONE (269) 343-1675 FAX (269) 349-2477

DATE: 5/14/2018	JOB NO.:	DRAWN: jbouchard
SCALE:	H1711600	WEIGHT: N/A

S:\U:\H-PARK\CW\H1711600 glowing Filter\H1711600 (REV A).iam

VACUUM CONVEYING SYSTEM

CUSTOMER: VEOLIA WATER TECHNOLOGIES CANADA INC.

SHEET 1 OF 1	DRAWING NO.: H1711600-D00	A

This page is intentionally left blank