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DEPOLOX® 5 BARE ELECTRODE MEASUREMENT MODULE

FOR SFC AND MFC ANALYZER/CONTROLLER

BOOK NO. WT.050.585.001.UA.IM.0814

W3T112481

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FOR SFC AND MFC
ANALYZER / CONTROLLER

BOOK NO. WT.050.585.001.UA.IM.0814

W3T112481

EQUIPMENT SERIAL NO. _____

DATE OF START-UP _____

START-UP BY _____

Prompt service available from nationwide authorized service contractors.

ORDERING INFORMATION

In order for us to fill your order immediately and correctly, please order material by description and part number, as shown in this book. Also, please specify the serial number of the equipment on which the parts will be installed.

WARRANTY

Seller warrants for a period of one year after shipment that the equipment or material of its manufacture is free from defects in workmanship and materials. Corrosion or other decomposition by chemical action is specifically excluded as a defect covered hereunder, except this exclusion shall not apply to chlorination equipment. Seller does not warrant (a) damage caused by use of the items for purposes other than those for which they were designed, (b) damage caused by unauthorized attachments or modifications, (c) products subject to any abuse, misuse, negligence or accident, (d) products where parts not made, supplied, or approved by Seller are used and in the sole judgment of the Seller such use affects the products' performance, stability or reliability, and (e) products that have been altered or repaired in a manner in which, in the sole judgment of Seller, affects the products' performance, stability or reliability. **SELLER MAKES NO OTHER WARRANTY OF ANY KIND, AND THE FOREGOING WARRANTY IS IN LIEU OF ALL OTHER WARRANTIES, EXPRESS OR IMPLIED, INCLUDING ANY WARRANTY OF MERCHANTABILITY OR OF FITNESS OF THE MATERIAL OR EQUIPMENT FOR ANY PARTICULAR PURPOSE EVEN IF THAT PURPOSE IS KNOWN TO SELLER.** If Buyer discovers a defect in material or workmanship, it must promptly notify Seller in writing; Seller reserves the right to require the return of such defective parts to Seller, transportation charges prepaid, to verify such defect before this warranty is applicable. In no event shall such notification be received by Seller later than 13 months after the date of shipment. No action for breach of warranty shall be brought more than 15 months after the date of shipment of the equipment or material.

LIMITATION OF BUYER'S REMEDIES. The **EXCLUSIVE REMEDY** for any breach of warranty is the replacement f.o.b. shipping point of the defective part or parts of the material or equipment. Any equipment or material repaired or replaced under warranty shall carry the balance of the original warranty period, or a minimum of three months. Seller shall not be liable for any liquidated, special, incidental or consequential damages, including without limitation, loss of profits, loss of savings or revenue, loss of use of the material or equipment or any associated material or equipment, the cost of substitute material or equipment, claims of third parties, damage to property, or goodwill, whether based upon breach of warranty, breach of contract, negligence, strict tort, or any other legal theory; provided, however, that such limitation shall not apply to claims for personal injury.

Statements and instructions set forth herein are based upon the best information and practices known to Evoqua Water Technologies, but it should not be assumed that every acceptable safety procedure is contained herein. Of necessity this company cannot guarantee that actions in accordance with such statements and instructions will result in the complete elimination of hazards and it assumes no liability for accidents that may occur.

725 Wooten Road
Colorado Springs, Co 80915

INTRODUCTION

This instruction manual provides the information for installation, operation and maintenance personnel.

This instruciton manual is intended for the operating personnel. It contains important information for safe, reliable, trouble-free and economical operation of the unit. Observance of this information helps to prevent hazards, lower repair costs, reduces down-times, and increases the reliability and service life of the unit.

The chapters on installation and maintenance are solely provided for trained service personnel. These sections contain important information on the installation, configuration and commissioning of the unit as well as information on its repair.

All persons working with the unit ,ust have read and understood the operating instructions, in particular, the safety instructions it contains.

Intended Use

The SFC and MFC Analyzer/Controller are exclusively designed for measurement and control tasks required for the treatment of waste water, potable water and industrial water.

The operational safety of the unit is only guaranteed if it is used in accordance with its intended application. The unit may only be used for the purpose defined in the order and under the operating conditions indicated in the technical specifications.

Compliance with the intended use also includes reading this operating manual and observing all the instructions it contains. All inspection and maintenance work must be performed at the prescribed intervals by qualified personnel.

The operator bears full responsibility if this unit is put to any use which does not comply strictly and exclusively with the intended use.

Table Of Contents

GENERAL SAFETY INSTRUCTIONS

Evoqua Water Technologies attaches great imporatnce to ensuring work on its system is safe. This is taken into account in the design of the system, by the integration of safety features.

Safety Instructions

The safety instructions in this documentation must always be observed. These do not impact any additional national or company safety instructions.

Safety Instructions on the System

All safety instructions attached to the system itself must be observed.

Technical Standard

The system or unit has been constructed in accordance with state of-the-art technology and the accepted safety regulations. In the event of the system or unit being used by persons who have not been adequately instructed, risks hazard to of such persons or third parties and damage to the system or unit itself or to other property are possible. Work described in this operating manual may only be performed by authorized personnel.

Personnel

The operator of the system must ensure that only authorized and qualified specialized personnel are permitted to work with and on the unit within their defined scope of authority. "Authorized specialists“ are trained technicians employed by the operator, by Evoqua Water Technologies, or, if applicable, the service partner. Only qualified electricians may perform work on electrical components.

Spare Parts/Components

Trouble-free operation of the system is only guaranteed if original spare parts and components are used as described in this operating manual. Failure to observe this instruction may incur the risk of malfunction or damage to the system.

Modifications and Extensions

Never attempt to perform any modifications or conversions to the unit without the written approval of the manufacturer.

Electrical Power

During normal operation, the control unit must remain closed. Before starting any assembly, inspection, maintenance, or repair work, the system must be switched OFF, and the switch must be secured against reactivation. Connect all cables in accordance with the wiring diagram.

Waste Disposal

Ensure safe and environmentally-friendly disposal of reagents and replaced parts.

WARRANTY CONDITIONS

The following must be observed for compliance with warranty conditions:

- Installation, commissioning by trained and authorized personnel.
- Intended use.
- Observation of the operational parameters and settings.
- The unit may only be operated by trained personnel.
- An operating log book must be kept.
- Only approved calibration chemicals may be used.
- The unit must not be exposed to ambient conditions outside those specified.
- Maintenance work must be executed at recommended intervals.
- Use of original Evoqua Water Technologies spare parts.

If any of the above conditions are not met, the warranty could be void.

SPECIFIC OPERATING PHASES

Normal Operation

Never employ procedures which could affect safety.

Only operate the unit when the housing is closed.

Inspect the unit at least once daily for externally visible damage and faults. Inform the responsible person/authority immediately of any detected changes (including any changes in the operating performance).

In the event of malfunctions, switch the unit off immediately. Have malfunctions remedied immediately.

Installation and Maintenance Work

Always perform installation or maintenance work in accordance with this operating manual.

Secure the unit against activation during installation and maintenance work.

Always retighten released screw connections.

Never use corrosive cleaning agents. Use only a damp cloth to clean the unit.

Ensure safe disposal of reagents and replaced parts in accordance with environmental regulations.

VERY IMPORTANT SAFETY PRECAUTIONS

This page provides very important safety information related to safety in installation, operation, and maintenance of this equipment.

WARNING

TO AVOID POSSIBLE SEVERE PERSONAL INJURY OR EQUIPMENT DAMAGE, OBSERVE THE FOLLOWING:

ALL USERS OF THIS EQUIPMENT SHOULD BE MADE AWARE OF THE PROBLEMS ASSOCIATED WITH HANDLING HAZARDOUS MATERIALS IN EITHER LIQUID OR GASEOUS FORM AND OF THE EFFECTS OF EXPOSURE TO THEIR FUMES. REFERENCE SHOULD BE MADE TO THE LITERATURE AVAILABLE FROM THE SUPPLIERS OF THESE CHEMICALS, PARTICULAR ATTENTION BEING PAID TO THE INFORMATION AND ADVICE ON PROTECTIVE CLOTHING.

THIS EQUIPMENT IS CONNECTED TO LINE VOLTAGE. IT IS ESSENTIAL THAT THE UTMOST CARE IS TAKEN WHEN WORK IS CARRIED OUT ON EQUIPMENT WHERE LINE VOLTAGES ARE PRESENT. IT IS RECOMMENDED THAT ALL POWER SUPPLIES ARE SWITCHED OFF WHENEVER POSSIBLE.

WHEN DEALING WITH HAZARDOUS MATERIAL, IT IS THE RESPONSIBILITY OF THE EQUIPMENT USER TO OBTAIN AND FOLLOW ALL SAFETY PRECAUTIONS RECOMMENDED BY THE MATERIAL MANUFACTURER.

DO NOT DISCARD THIS INSTRUCTION BOOK UPON COMPLETION OF INSTALLATION. INFORMATION PROVIDED IS ESSENTIAL TO PROPER AND SAFE OPERATION AND MAINTENANCE.

ADDITIONAL OR REPLACEMENT COPIES OF THIS INSTRUCTION BOOK ARE AVAILABLE FROM:

Evoqua Water Technologies
725 Wooten Road
Colorado Springs, CO 80915
Phone: (800) 524-6324

NOTE

Minor part number changes may be incorporated into Evoqua Water Technologies products from time to time that are not immediately reflected in the instruction book. If such a change apparently has been made in your equipment and does not appear to be reflected in your instruction book, contact your local Evoqua Water Technologies sales office for information.

Please include the equipment serial number in all correspondence. It is essential for effective communication and proper equipment identification.

REGIONAL OFFICES

INSTALLATION, OPERATION, MAINTENANCE, AND SERVICE INFORMATION

Direct any questions concerning this equipment that are not answered in the instruction book to the Reseller from whom the equipment was purchased. If the equipment was purchased directly from Evoqua Water Technologies Corp., Vineland, NJ, contact the office indicated below.

UNITED STATES

1901 West Garden Road
Vineland, NJ 08360
TEL: (856) 507-9000
FAX: (856) 507-4125

CANADA

If the equipment was purchased directly from Evoqua Water Technologies Canada, Inc., contact the nearest office indicated below.

ONTARIO

250 Royal Crest Court
Markham, Ontario
L3R3S1
(905) 944-2800

QUEBEC

243 Blvd. Brien
Bureau 210
Repentigny, Quebec
(450) 582-4266

SECTION 1

SECTION 1 - TECHNICAL DATA

List of Contents

1.1 Depolox® 5 Bare Electrode

Disinfection (DES) measuring module Depolox 5 bare electrode 3-electrode cell

Sensor:	3 electrode cell
Principle of operation:	Potentiostatic amperometry
Temperature drift:	max. 0.2 % / 10 K
Linearity error:	< 0.1 %
Calibration:	Pre-calibrated
Upot cell voltage:	0 to 1000 mV
Upot accuracy:	± 20 mV
Upot temperature drift:	0.5 % / 10 K
Cell current:	-7 to 1000 µA
Temperature input:	PT 1000 (analyzer versions only)
Measuring current ranges:	10, 70, 100, 200, 1000 µA (depending on the type of the DES module)
Measuring ranges:	1.00, 2.00, 5.00, 10.0, 20.0, 50.0, 100, 200
Units of Measure:	µg/L, mg/L, ppb, ppm
Measurands:	Free chlorine, chlorine dioxide, potassium permanganate, ozone

1.2 Depolox® 5 Flow Block Assembly

Dimensions (W x H x D)	8.5” x 14.8” x 6.1” (215mm x 375mm x 155mm)
Weight	approx. 3.3 Lbs (1.5 kg)
Multi sensor (flow and temperature)	
Switching point	21 l/h ± 3 l/h
Switching hysteresis	2 l/h
Temperature sensor	PT 1000
Measured variables	Free chlorine, chlorine dioxide, ozone, potassium permanganate
Measuring current ranges	70, 100, 200, 1000 µA
Typical output signal	approx. 20 µA/mg/l free chlorine
Measuring system	Potentiostatic 3-electrode system
Reference electrode	Silver/Silver chloride/Potassium chloride solution
Working electrode	Platinum
Other materials	PVC, PMMA, ABS, ECTFE, PTFE, stainless steel, EPDM, FKM, NBR
Cable length	650 mm
Electrolyte	Potassium chloride solution, 3 mol
Zero point calibration	by stopping flow rate
Response time T_{90}	< 20 sec.
Temperature compensation	32 to 122 °F (0 to 50 °C)
Storage temperature	14 to 122 °F (-10 to 50 °C) (without electrolyte)
Influence of the pH value	See HOCl curve, operating range pH 6.5 to pH 8.5 (free chlorine)
Cross-sensitivity	other strong oxidation agent: copper-based algaecide
Water quality	Potable, clean industrial and process water
Sample water temperature	max. 122 °F (50 °C)
Conductivity	min. 200 µS/cm

Service life Life of the electrolyte in operation approx. 6 months. Service life of electrodes in operation approx. 5 years (shortened by poor water quality, e.g., sand, dirt).

The HOCI curve describes the influence of the pH value on the Depolox® 5, free chlorine measurement.

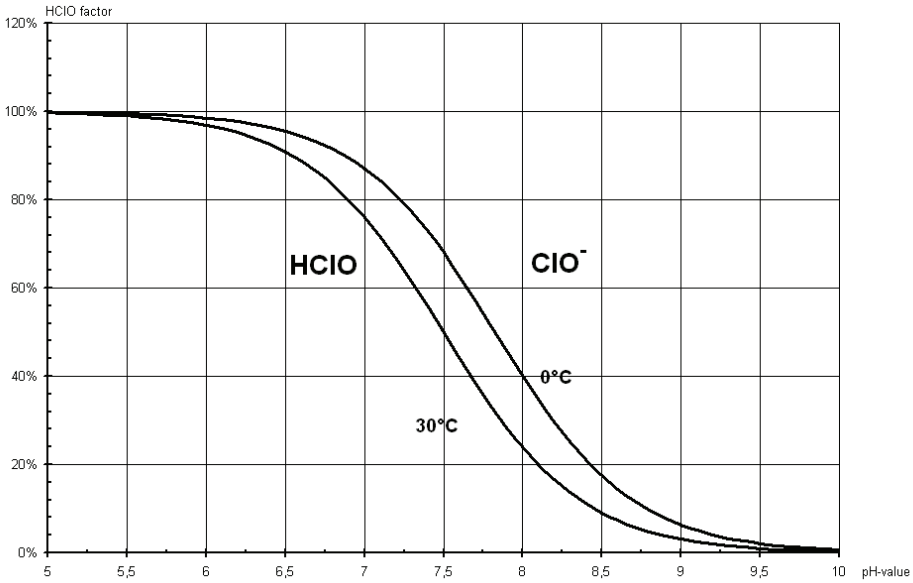


Figure 1.1 - HOCl curve

Volumetric flow control

Flow rate:	approx. 8 g/h (33 l/h) (controlled)
Control range:	3 to 58 psi (0.2 to 4.0 bar)
Back-pressure:	0 psi (0 bar) (free drain)

Connections

Sample water:	1/4" OD (6mm) hose
Thread connection:	1/2" (13mm)

1.2.1 Electrodes and Sensors

Depolox® 5 3-electrode measuring cell

Measuring system:	3-electrode sensor with additional stock of electrolyte salt
Principle of operation:	potentiostatic amperometry
Temperature compensation:	32 to 122 °F (0 to 50 °C)
Temperature drift:	max. 0.2 % / 10 K
Measuring range:	.01 - max. 20 mg/L
Upot:	0 to 1000 mV
Reference electrode:	silver/siver halide/potassium halide solution
Working electrode:	platinum
Storage temperature:	14 to 86 °F (-10 to 30 °C)
Max. pressure:	7 psi (0.5 bar) (only with suitable adapter)
Water quality:	clean water, potable water quality
Conductivity:	>10 µS/cm to max. 2500 µS/cm
Flow:	2 - 9 g/h (6 - 35 l/h), as constant as possible
Service Life:	life of the electrodes in operation approx. 6 mths, membrane cap service life typ. 1 yr (reduced by poor water quality)
Cross-sensitivity:	ozone, bromine, chlorine dioxide, hydrogen peroxide, strong oxidents

1.3 Scope of Supply

1.3.1 Standard

Depending on the individual order, the scope of supply includes the following:

Elctronic module SFC
including accessories set and mounting set, comprising of:

- 4x screws Ø 5mm
- 4x dowels Ø 8mm
- 4x washers
- 3 multiple seal inserts 2x6mm
- 3 multiple seal inserts 4x5mm
- 3 reducing sealing rings Ø 8mm
- 4 bolts for multiple seal inserts 5mm
- 2 bolts for multiple seal inserts 6mm
- DIN rail

1.3.2 Options

Flow block assembly

- Depolox® 5 analyzer
- VariaSens™ sensor
- Y flow-through adapters
- Mirco/200® and Deox/2000® analyzers

Sensor measuring module kit including accessories

- pH
- Redox
- Conductivity
- Fluoride
- Free chlorine (FC1)
- Chlorine dioxide selective (CD7)
- Ozone selective (OZ7)
- Total chlorine (TC1)
- Depolox® 5 3-electrode cell
- Depolox® 3 plus 3-electrode cell with PT 100
- mA/V input card
- Micro/2000® analyzer
- Deox/2000® analyzer

NOTE: All sensor measuring modules are avilable with or without Process Control option.

1.4 Description

1.4.1 Versions

The SFC and MFC are available in two different versions, each in two voltage variations:

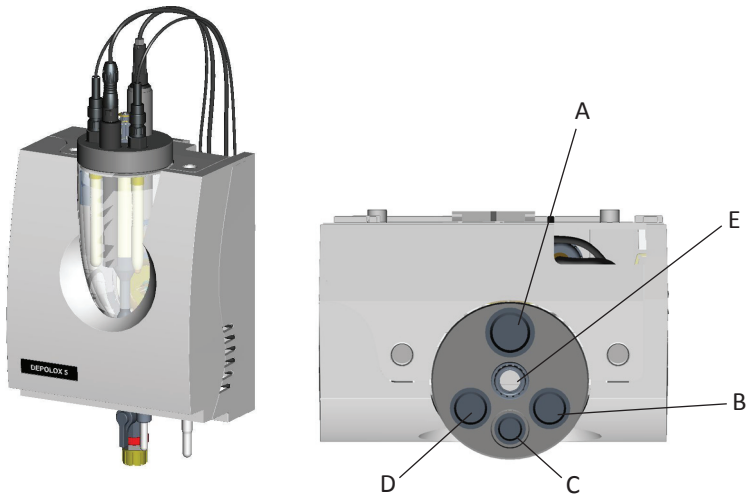
- 100 to 240 VAC
- 24 VDC

Depending on the application, the SFC can be operated either without a flow block assembly (no sensor measuring module) or in connection with a flow block assembly and sensor measuring module.

Flow Block Assembly

The flow block assembly is available in different versions:

- Depolox 5
- VariaSens
- Various Y flow-through adapters
- Micro/2000
- Deox/2000
- Strantrol flow assembly



A	Membrane sensor for free chlorine FC1, total chlorine TC1, chlorine dioxide CD7, ozone OZ7
B	Redox
C	Fluoride or conductivity
D	pH
E	3-electrode sensor (single rod glass electrode)

Figure 1.2 - Depolox 5

1.5 Design

1.5.1 Overall Design

The SFC unit is a modular design and can be equipped with various types of measuring modules. Several SFC modules can be installed next to each other on a DIN rail or using surface moutning brackets.

A	Depolox® 5 flow block assembly
B	Sensors
C	Electronic module SFC

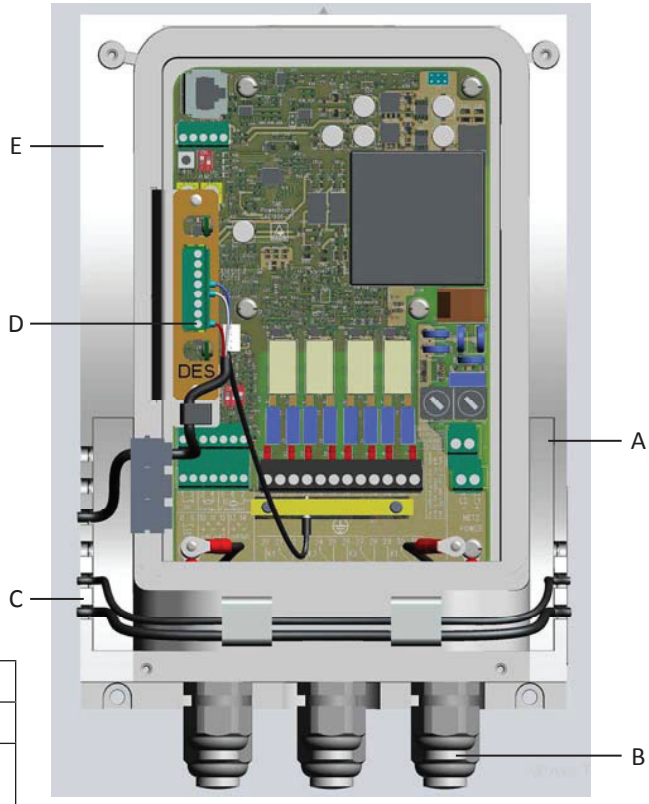
Figure 1.3 - SFC Cl_2 with Depolox® 5 flow block assembly

1.5.2 SFC Electronic Module

The SFC electronic module consists of a plastic housing with a removable cover.

The housing contains:

- IC board
- Housing ducts for the cables of the sensor measuring modules
- the cable glands
- the sensor measuring module (optional)



A	IC board
B	Cable glands
C	Housing ducts for the cables of the sensor measuring modules
D	Slot for sensor measuring module
E	Housing

Figure 1.4 - SFC basic with card and cable

1.5.3 Depolox® 5 Flow Block Assemby

The Depolox® 5 flow block assembly contains the following:

- Cell body with cover
- Flow control valve
- 3 electrode cell for Cl_2, ClO_2, O_3, or $KMnO_4$
- Multi-sensor
- Drain
- Fine filter (For use only when membrane sensors are used.)
- Sample water inlet with check valve and ball valve

Two clips are installed in the housing cover. Insert these clips into the rear panel of the housing. Insert one clip into the upper catch to attach the sensor. Insert the second clip into the center catch in order to measure the buffer or calibration solution using the plastic cups provided.

The cell body can be equipped with up to five sensors.

A	Cell body with cover
B	Plastic housing
C	Flow control valve
D	3 electrode cell for Cl_2, ClO_2, O_3, or $KMnO_4$
E	Drain
F	Ball valve
G	Fine filter
H	Lower clip and cup
I	Multi-sensor
J	Upper clip
K	Sensors

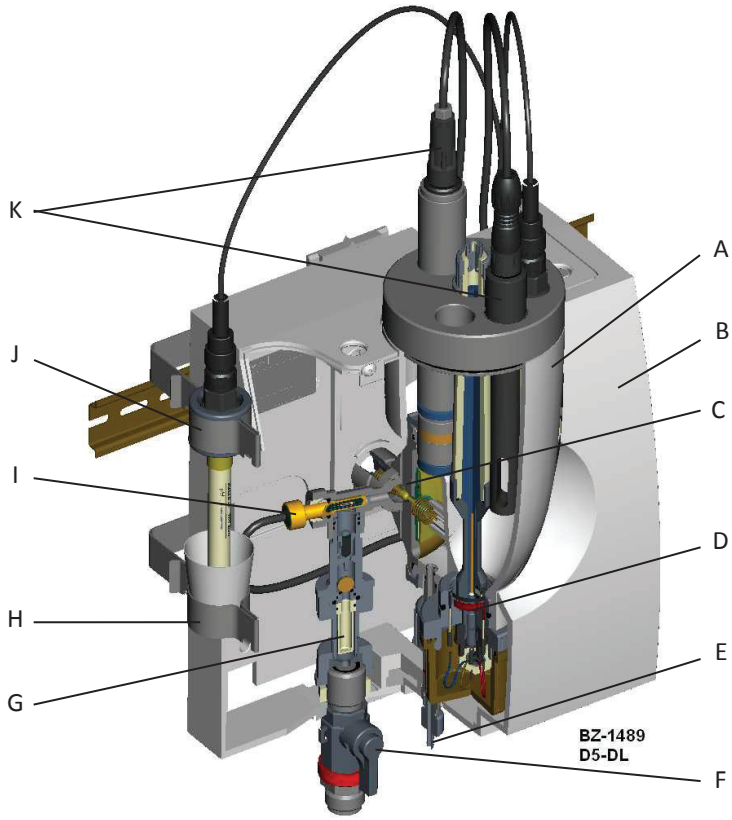


Figure 1.5 - Depolox® 5 flow block assembly cutaway model

1.5.4 Sensor Measuring Module

The sensor measuring module consists of:

- Sensor (Not with 3-electrode cell Depolox® 5 electrode cells, Micro/2000®, Deox/2000® or mA/V input.)
- Sensor cable with watertight housing cable gland (Not with 3-electrode cell Depolox® 5 electrode cells, Micro/2000®, Deox/2000® or mA/V input.)
- Factory-calibrated plug-in card

Due to the modular design, sensor measuring modules can be installed and configured at any time. All sensor measuring modules for Cl_2, pH, mV, F^-, etc. can be plugged into the module slot. This configuration determines the functionality of the SFC, see section 4.2, "Measurement Inputs".

A	Sensor cable
B	Housing cable gland
C	Sensor
D	Plug-in card

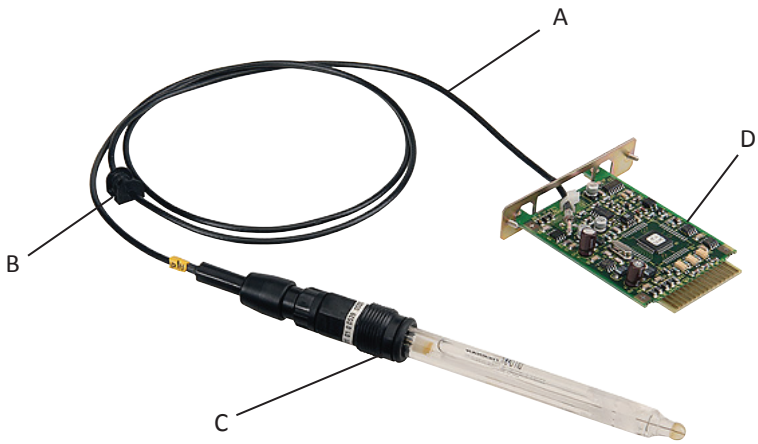


Figure 1.6 - Example sensor measuring module pH

SECTION 2

SECTION 2 - INSTALLATION

List of Contents

2.1 Transport and Storage

2.1.1 Transport

The unit is supplied in standard packaging. During transport the packaged unit must be handled carefully ans should not be exposed to wet weather or moisture.

Check that the transport packaging is undamaged. In the event of damage please inform the transport company immediately.

If the device is damaged, please contact the respective Evoqua Water Technologies agency immediately. Keep the packing until the unit has been correctly installed and put into operation.

2.1.2 Storage

Store the unit and the sensors in a dry condition without any residual water in a dry place. Storage temperature, see section 1.2, "Specifications".

2.2 Installation

The device must be protected against rain, frost and direct sunlight and should not be installed outdoors. It must be mounted horizontally on a flat wall with an ambient temperature of 32 to 122 °F (0 to 122 °C). The air in the room should be non-condensing.

2.2.1 Opening the Housing

1. Remove the housing cover of the flow block assembly, by lightly pressing the two buttons on the top of the housing (optional).

2. Loosen the screws on the cover of the electronic module.

CAUTION: The indication and operator controls on the cover of the SFC electronic module are connected to the housing with strain relief cables.

NOTE: The device switches off automatically when the cover is removed.

3. Carefully remove the cover of the electronic module and leave to hang on the strain relief cables.

2.2.2 Installation with Mounting Rail (see drawing 50.590.100.030)

1. Fasten the mounting rail to the wall with two screws.

2. Hook the electronic module onto the mounting rail so that it is flush to the right and fasten to the wall with two screws.

3. Hook the flow block assembly onto the mounting rail to the left of the electronic module and fasten to the wall with two screws.

NOTE: The flow block assembly does not need to be mounted directly next to the electronics, it can be mounted on separate mounting rail. The exact location limited by available probe cable lengths.

2.2.3 Installation without Mounting Rails (see drawing 50.590.100.040):

If the electronic module and the flow block assembly are to be mounted in different places, the modules can be hooked onto suitable tallow-drop screws by the top holding fixtures instead of onto the mounting rail. Proceed with the installation as described above.

2.3 Commissioning

2.3.1 Installation Guide

Commissioning procedure:

When the unit has been mounted, the sensor measuring module can be installed. The electrical connections can then be setup in accordance with the required application.

The following table contains the individual commissioning steps in their correct sequence. More detailed information is contained in the chapters listed in the "Chapter Referece" column.

NOTE: If this installation sequence cannot be complied with, please contact you Evoqua Water Technologies service department.

Commissioning using the example of application 2:

Sequence	Task	Section	Completed
1	Setup electrical connection in accordance with the application.	2.3.6	☐
2	Install sensor measuring module	1.5.4 & 2.3.3	☐
3	Insert the sensors and connect	2.3.3	☐
4	Pour in the cell sand (Depolox 5® only)	2.3.2	☐
5	Insert fine filter, if membrane sensors are used (Depolox 5® and VariaSens™ only)	2.3.5	☐
6	Insert the labeling field in the housing cover	2.3.7	☐
7	Close the housing cover	2.3.8	☐
8	Check measuring range, adjust if necessary	4.3.1	☐
	Input and output settings:		
9	Check flow rate signal settings such as signal, unit, factor, format, measuring range start and end value, adjust if necessary	4.3.1	☐
10	Check flow rate limit values, adjust if necessary	4.3.1	☐
11	Calibrate the fitted sensors after approx. 1 hour running-in time	4.4	☐
12	Switch to operating mode "Auto"	4.4	☐

2.3.2 Pour in the Cell Sand (only with Depolox® 5 unit)

1. Close the ball valve on the sample water inlet.

2. Remove the protection plugs on the cell body cover of the 3-electrode cells.

3. Fill half a cap from the plastic bottle with grit and pour it into the cell body (approx. 1/2 cm^3 cell sand).

4. Replace the protection plugs on the cell body cover of the 3-electrode cells.

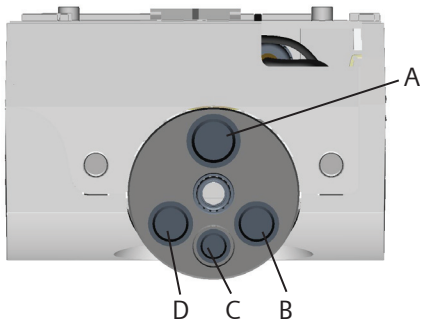
NOTE: Make sure that the opening is clean; rinse off with distilled water, if necessary.

5. Reopen the ball valve on the sample water inlet.

NOTE: The system must be recalibrated approx. 4 hours after each time the grit is replaced. The calibration must be checked after one day.

2.3.3 Insert the Sensors and Connect

Arrangement of the sensors:



Depolox® 5 Sensors

A	Membrane sensor: FC1, CD7, OZ7, TC1
B	Redox
C	Fluoride / pH
D	Conductivity

Figure 2.1

1. Remove the protection caps from the sensors.

2. Install sensors (see figure above) in the cell body cover.

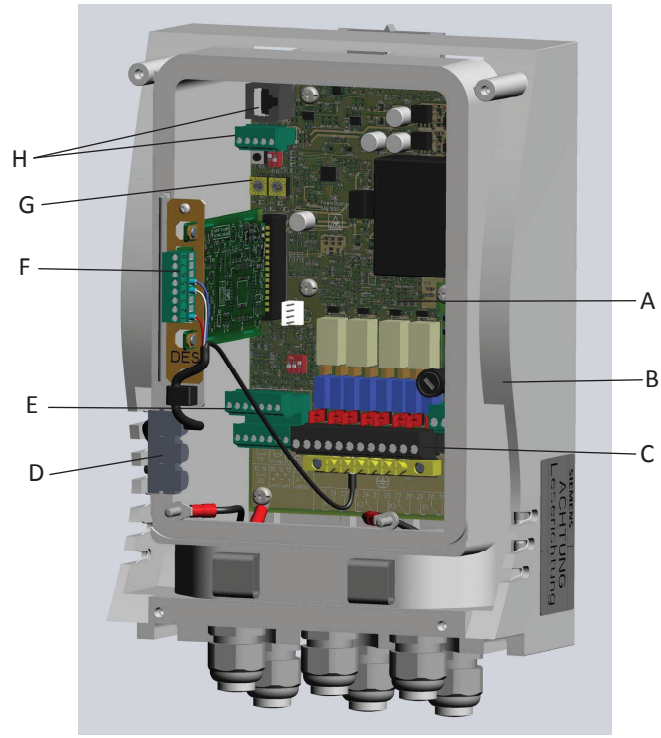
The sensors are marked as follows:

Membrane sensor for free chlorine FC1, chlorine dioxide CD7, ozone and OZ7 and total chlorine TC1 (A) marked "DES"

mV: Sensor for Redox, marked “mV” (B)
pH: Sensor for fluoride or pH value, marked “pH” (D)
µS: Sensor for conductivity, marked “LF325” (C)
Des: Sensor for free chlorine, marked "DES" (E)
F1: Sensor fluoride, marked "F1" (C)

<u>NOTE</u>: Keep the dust protection caps and watering caps of the sensors for subsequent use.

Arrangement of the plug-in cards and cables:



A	IC board
B	Housing
C	Relay terminal
D	Sensor cable duct
E	Terminal signal inputs/outputs
F	Sensor measuring module
G	Coding switch IC board
H	Connecting plug or terminal at the front panel board

Figure 2.2 - Electronic Module Cutaway

Connecting the sensor cables:

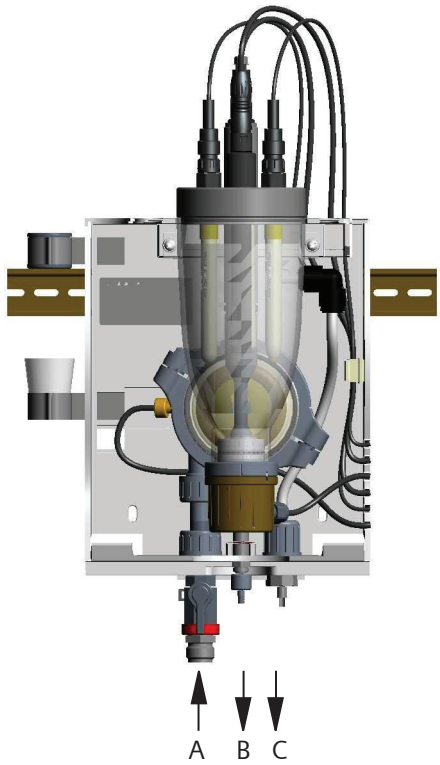
1. Place the sensor cables with the attached glands into the cable ducts of the housing.

2. Depending on the sensor design, either plug or screw the cable in place.

3. Insert the supplied bushes into ducts that are not in use in order to seal housing.

2.3.5 Connecting the Sample Water

Depolox® 5 sample water line:



A	Sample water inlet with ball valve
B	Drain on the drain screw
C	Sample water outlet

Figure 2.3 - Flow block assembly cross-section

Connecting the sample water inlet:

NOTE: Never use copper tubing.

1. The pressure in the sample water inlet must always be within a range of 2 to 60 psi (0.2 to 4 bar).

   - If the inlet pressure is below 2 psi (0.2 bar), a booster pump must be used (see examples for sample water extraction with booster pump).

   - If the inlet pressure exceeds 60 psi (4 bar), a pressure reducing valve must be used.

2. To prevent long loop lag times, ensure that the lines in the sample water inlet are as short as possible.

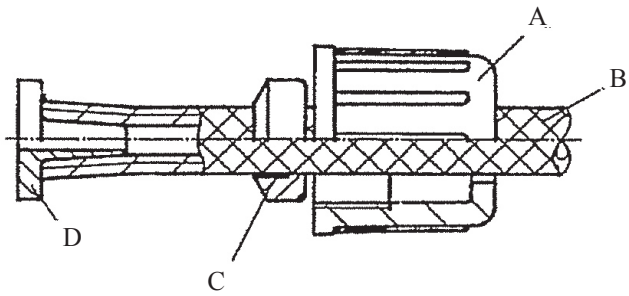
3. An external strainer with a mesh width of 0.5mm is provided for the sample water inlet.

With hose connection:

NOTE: The integrity of the hose screw connection is only guaranteed if the following installation instructions are followed!

1. Release the union nut (A) on the hose screw connection.

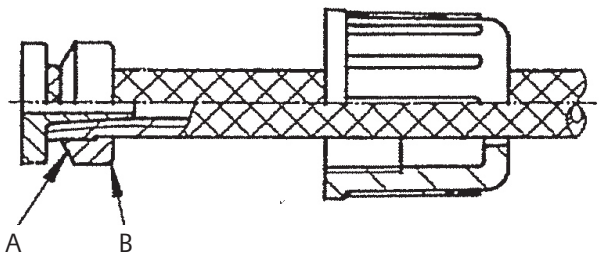
2. Insert the hose (B) until it hits the hose bushing (D).



A	Union nut
B	Hose
C	Locking ring
D	Hose bushing

Figure 2.4 - Hose and housing bushing assmebly

3. Push the locking ring out until the union nut engages the connecting threads.



A	30° pitch on this side
B	Rounding on this side

Figure 2.5 - Locking ring assembly

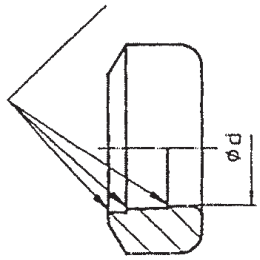


Figure 2.6 - Locking ring for PE hose with 3 clamping points

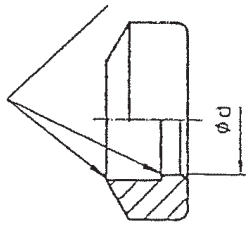


Figure 2.7 - Locking ring for PVC hose with 2 clamping points

With rigid pipework:

1. Connect the sample water pipework to the ball valve connection threads.

2. Ensure that the sample water pipework is installed without mechanical stress.

Connecting the sample water outlet:

NOTE: Never use copper tubing.

1. No back-pressure is permitted in the cell body. The sample water outlet must be open.

2. The sample water outlet must be installed so that no siphon effect can occur.

Recommendation: Position the outlet above the drain line opening.

Connecting the cell drain:

1. Ensure that the cell drain screw is always closed.

2.3.5 Installing the Fine Filter

Insert fine filter with the Depolox® 5 flow through adapters.

NOTE: A fine filter must be installed when membrane sensors are employed. The fine filter is included in the enclosed accessory set.

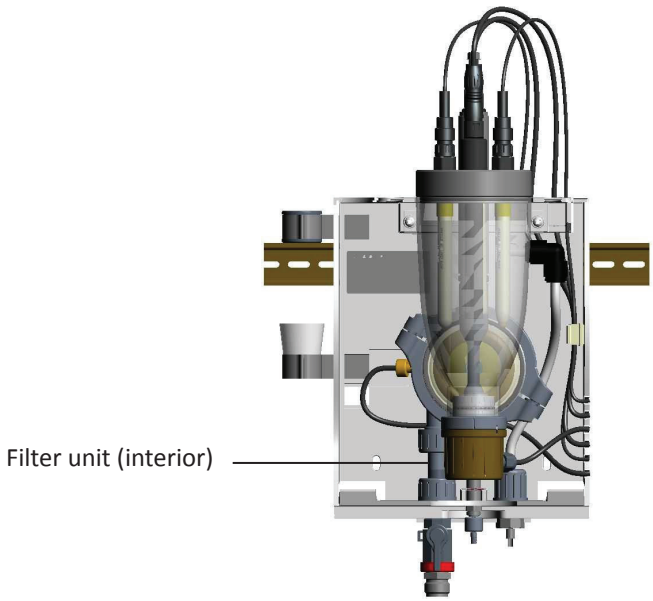


Figure 2.8 - Fine filter

1. Release both knurled nuts.
2. Remove complete filter unit.
3. Place the fine filter into the filter unit. Ensure that the O-ring is seated correctly (insert as far as possible).
4. Fit the filter unit. Ensure that it is seated in the correct position.
5. Retighten both knurled nuts.

2.3.6 Connect the Device to the Power Supply

WARNING: ONLY AUTHORIZED AND QUALIFIED ELECTRICIANS ARE PERMITTED TO INSTALL THE DEVICE AND OPEN THE HOUSING. THE DEVICE MAY ONLY BE TAKEN INTO OPERATION WHEN THE HOUSING IS CLOSED, AND MUST BE CONNECTED TO PROTECTION EARTH. MODIFICATIONS TO THE DEVICE WHICH GO BEYOND THOSE DESCRIBED IN THIS MANUAL ARE NOT PERMISSIBLE.

WARNING: THE DEVICE IS NOT EQUIPPED WITH A MAINS SWITCH AND IS IN OPERATION AS SOON AS THE SUPPLY VOLTAGE IS APPLIED. AN EXTERNAL SWITCH OR CIRCUIT BREAKER IS NECESSARY, (6 A) MIN. THE CONDUCTOR CROSS SECTION OF THE MAINS CABLE MUST BE AT LEAST 0.75 MM (AWG 18). WHEN CONNECTING SYSTEM COMPONENTS (E.G. DEVICES, MOTORS, PUMPS) AS WELL AS WHEN ENTERING OPERATING DATA, THE SYSTEM COMPONENTS MUST BE SWITCHED OFF.

CAUTION: To ensure safe and correct commissioning, knowledge of the operation, connected electrical load, measurement signals, cable assignment and fuse protection of the connected devices and machines and the relevant safety regulations is required. The device may only be commissioned by qualified and authorized electricians. Incorrectly connected devices can be damaged, possibly irreparably, or cause faults in other equipment when they are switched on or in operation. Ensure that the measuring and control cables are not confused or make contact with one another. Never connect or disconnect any cables to which voltage is applied!

NOTE: A line-side fuse (max. 16 A) in the main supply line is necessary when connecting to 230 V or 115 V.

RECOMMENDATION: Provide an on/off facility for the unit at the installation site. 6 A is recommended for the line fuse. Observe local installation regulations.

Connect system components in accrodance with the application relevent wiring diagrams in section 5)

2.3.7 Attaching the Labeling Field

1. Select the required labeling field depending on what module is loaded.
2. Insert labeling field in the housing cover.

2.3.8 Mounting the Housing Covers

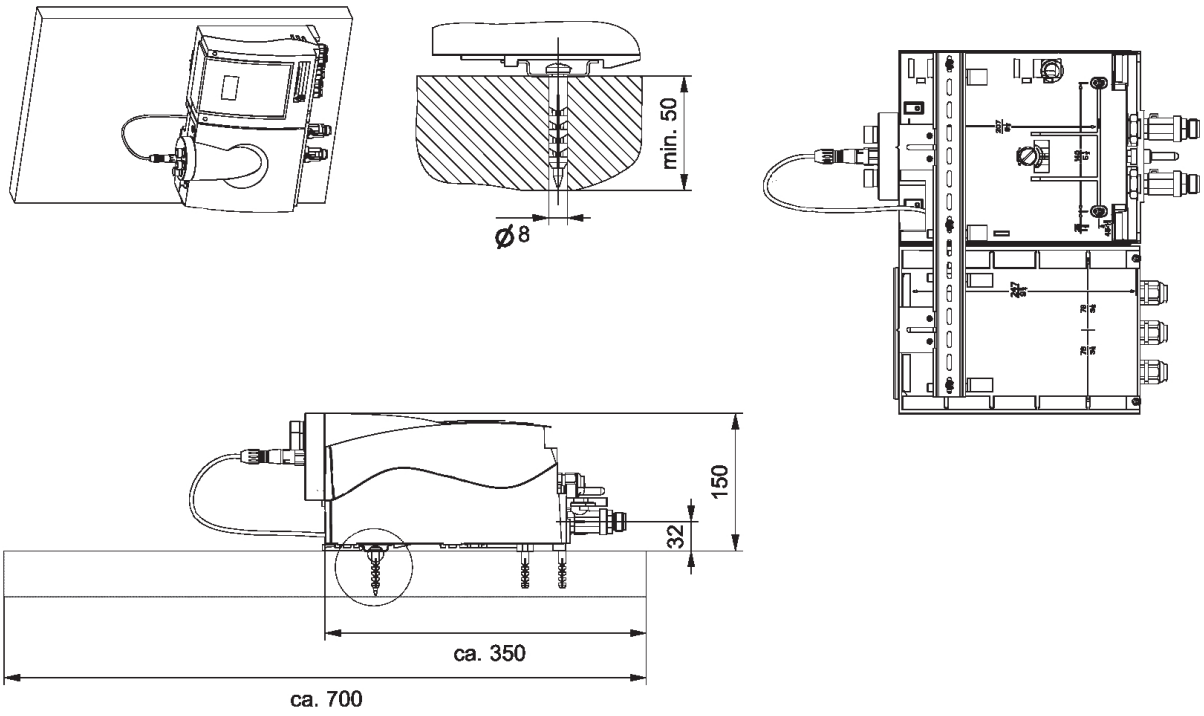
1. Ensure that the cable bushes are fitted correctly.
2. Carefully fit the housing cover of the electronic module and secure with the four housing screws.
3. Carefully place the housing cover onto the flow block assembly and snap into place.

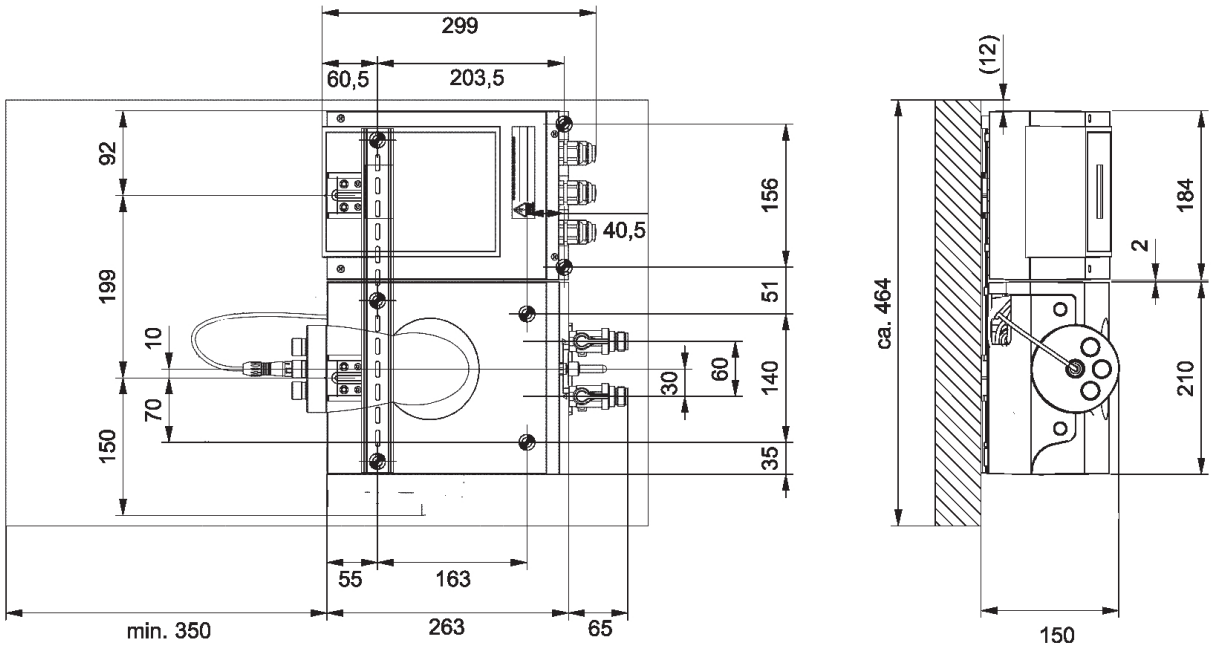
2.4 System Shut Down

CAUTION: Danger of uncontrolled dosing of chlorine or pH correction medium: Shut down dosing system, close positioner!

NOTE: If the installation site of the flow block assembly is not frost-free, the system must be shut down prior to any possible frost formation.

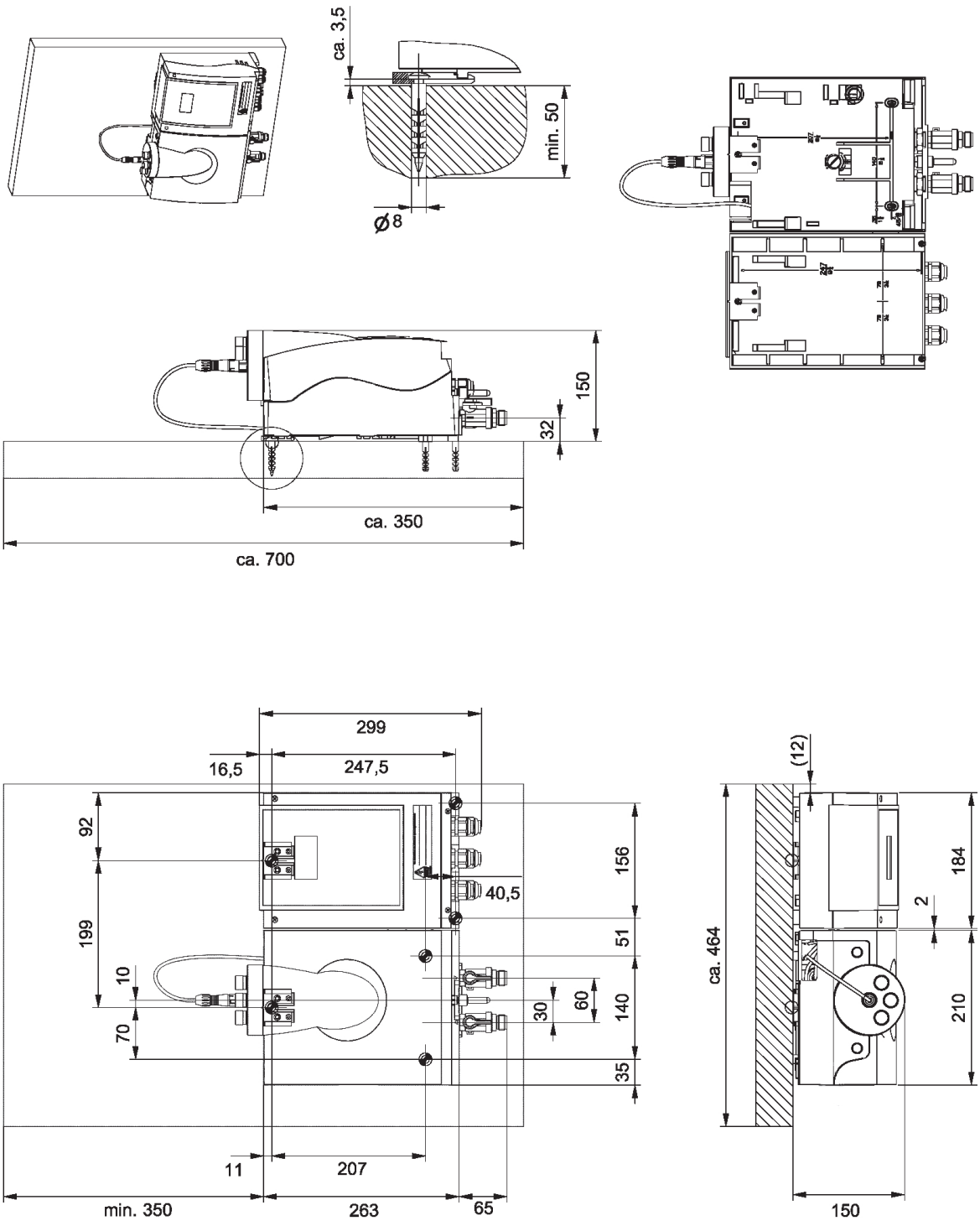
1. Switch off the power supply.
2. Drain the sample water supply line and drainage line (hold container underneath).
3. Empty cell bodies and remove grit.
4. Dismantle the filter housing and/or check valve housing.
5. When the remaining water has drained from the flow control valve, refit the filter housing and the check valve housing.
6. Remove the sensors from the cell body cover and disconnect from the cable.





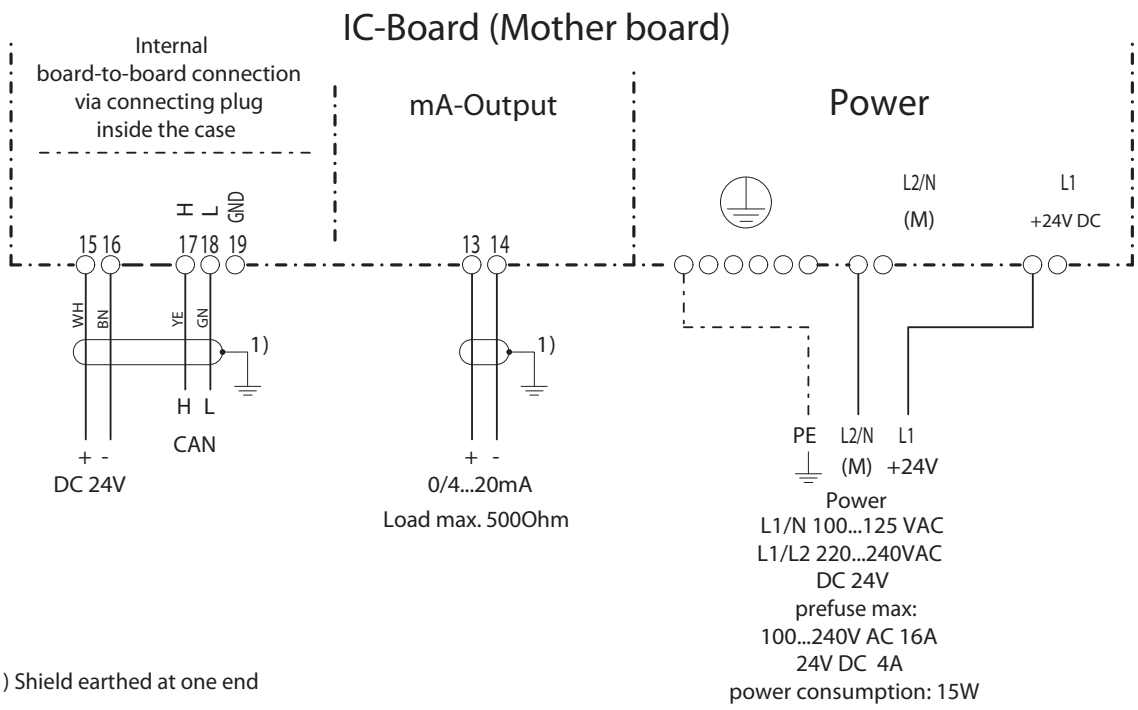
TOP HAT RAIL ASSEMBLY - DIMENSIONS
Single SFC Analyzer/Controller with Single Wet Side

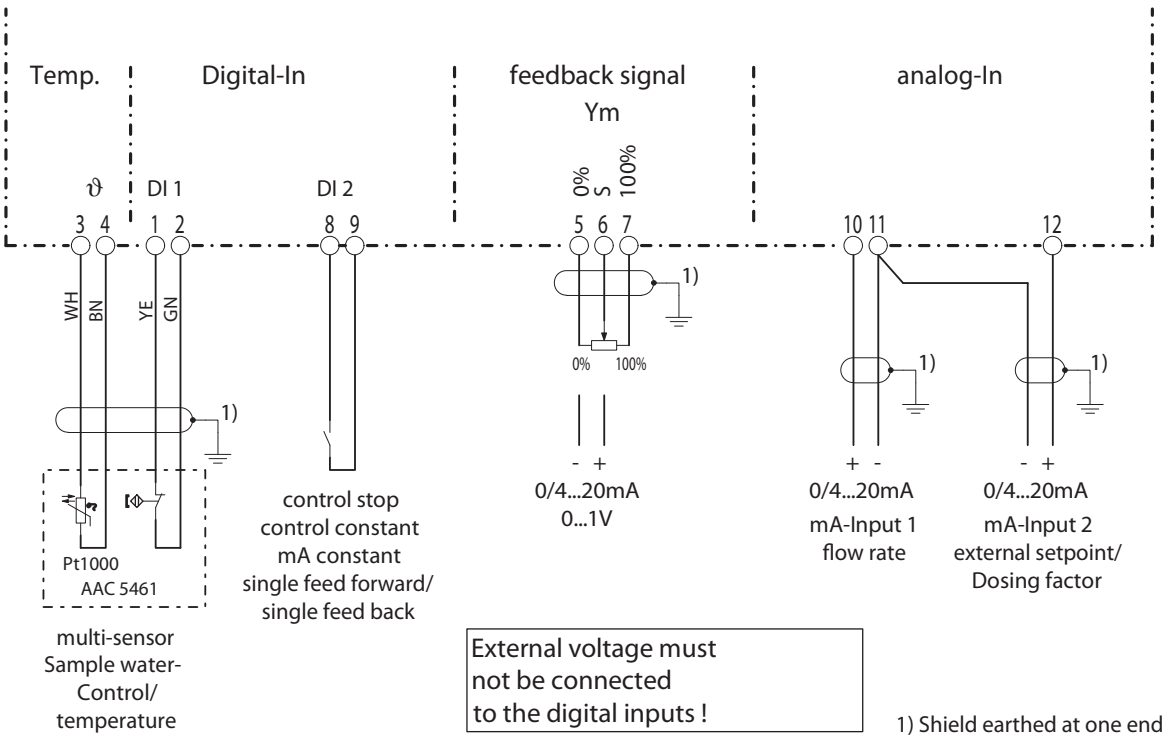
50.590.100.030
ISSUE 1 12-08



WALL MOUNT ASSEMBLY - DIMENSIONS
Single SFC Analyzer/Controller with Single Wet Side

50.590.100.040
ISSUE 1 12-08





SFC - SCHEMATIC WIRING

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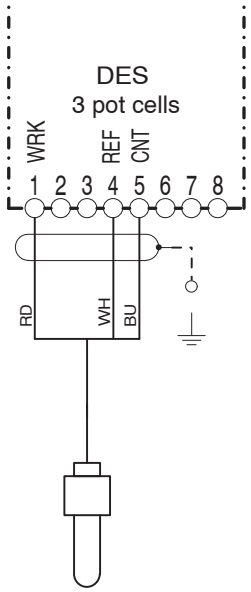
ISSUE 1 1-11

Connection (sensor) - measurement module



Depolox 5

DEPOLOX® 5 MEASUREMENT MODULE - SCHEMATIC WIRING

50.585.155.030

ISSUE 0 7-09

SECTION 3

SECTION 3 - SETUP AND CONTROL FUNCTIONS

List of Contents

3.1 General Information

The SFC and MFC are special measuring and control devices for use on potable water, industrial process water and waste water.

Two different versions of the unit are available which differ in terms of their inputs and outputs. Version 1 analyzer or analyzer/controller supports all of the applications described in secton 1.1. Due to the restricted number of inputs and outputs, version 2 works as a controller only (SFC-SC and SFC-PC).

Typical applications:

- Measurement and monitoring of water parameters
- Flow-controlled potable water chlorination (combi-control)
- Flow-controlled fluroide dosing (combi-control)
- pH single feedback closed-loop control
- Chlorine single feedback closed-loop control
- Quantity-proportional dosing of disinfectants (ratio control)
- Quantity-proportional dosing of disinfectants with linearization of the actuator (with positioner)

Possible process measurements (only with applications 1 and 2) are:

- free chlorine
- combined chlorine
- total chlorine
- chlorine dioxide
- potassium permanganate
- ozone
- pH
- redox
- fluoride
- conductivity
- sulfur dioxide
- soduim bisulfite

As an option, two additional control signal inputs can be installed to log flow rate and external setpoint using combi-control or ratio control.

NOTE: For the simultaneous recornding of process measurements (Cl_2, pH, ...) an flow-controlled dosing of chemicals (ratio control, combi-control), it is necessaary to use sensor measuring modules with the process control option.

The intergrated graphic display shows the following:

- Measured values
- Mode

- Bar graph with limit values
- Setpoint and measuring range
- Description of customized measuring points
- etc.

The menus are easy to use, displayed in plain text and are slected using softkeys.

A mA output and a RS485 bus interface, including Wallace & Tiernan® protocol, are available to connect systems. Three different process applications, which reflect the variety of on-site conditions, are integrated into the electronic module to simplify commissioning.

3.1.1 Overall Function

Possible measured values:

- Free chlorine*/Cl_2^{++}*, potassium permanganate*, chlorine dioxide*, ozone* (3-electrode cells)
- Free chlorine*, total chlorine*, potassium permanganate*, chlorine dioxide*, ozone* (Micro/2000® 3-electrode cell)
- Total chlorine*/Combined chlorine* (membrane sensor)
- Total chlorine*, sulfur dioxide* (Deox/2000® 3-electrode cells)
- pH value
- Redox voltage
- Conductivity*
- Ozone* (membrane sensor)
- Chlorine dioxide* (membrane sensor)
- Free chlorine* (membrane sensor)
- Fluoride
- External mA/V inputs
- Temperature measurement
- Actuator feedback

The value of the combined chlorine is calculated from the difference between the total chlorine and the free chlorine (optional). This requires a free chlorine and total chlorine measurement in the same sample water.

* These measurements are automatically temperature-compensated.

The Cl_2^{++} value is a pH-compensated chlorine measurement (optional). This requires a pH-measurement in the same sample water as the 3-electrode cell (Not applicable to Micro/2000® and Deox/2000®).

The graphic display shows the measured data, limit values and setpoints as numeric values, diagrams or a trend line.

3.1.2 Applications

The control functions available are determined by the type of sensor measuring modules, and the application selected. See the SFC and MFC instruction manuals for application details.

3.1.3 Controller Outputs

Controller outputs for positioners, dosing pumps, pulse pumps, continuous mA output as well as a sample line dosing contact. CAN actuators are also supported.

3.1.4 Depolox® 5 Flow Block Assembly

This flow block assembly guarantees a stable measurement signal with:

- Robust sensors
- Constant flow rate with the aid of the flow control valve
- Hydrodynamic grit cleaning of the Depolox® 5 flow block electrode
- Optimum flow around all sensors

The multi-sensor integrated into the flow block assembly of the Depolox® 5 monitors the constant sample water flow rate, registers the sample water temperature and ensures wide-spread equipotential grounding (sample water grounding).

3.2 Measurement Inputs

In principle, the following sensor measuring module types or retrofit kits can be installed at the module slot. The sensor measuring modules are only supported in applications 1 and 2:

DES	-	for 3-electrode cell (Depolox® 5)
DES	-	for 3-electrode cell with PT100 temperature option (Depolox® 3 plus)
DES	-	for free chloring (FC1), chlorine dioxide (CD7), ozone (OZ7), and total chlorine (TC1) membrane sensors
DES	-	for Micro/2000® analyzer with PT1000
DES	-	for Deox/2000® analyzer with PT1000
pH	-	pH value
mV	-	Redox value
F^-	-	Fluoride value
mS	-	Conductivity
mA/V	-	Input module

NOTE: As a 3-electrode cell, Depolox® 5 or Depolox® 3 plus can be connected. Both of these sensor measuring modules are available with the "Process Control" option (PC).

When the device is switched on, the menus are initialized according to the installed sensor module. If the sensor modules are changed at a later date, the user menus are automatically initialized when the device is switched on. If no sensor measuring module is installed in the unit, the message "No measurement available" appears.

The sensor measuring module should be considered as the main measurement, and control functions such as ratio control, single feedback closed loop, and combi-control are supported depending on the Process Control option.

3.2.1 Depolox® 5 Flow Block Assembly

Depolox® 5 Flow Block Assembly - 3 Electrode Measurement for Free Cl_2, ClO_2, O_3 or $KMnO_4$:

Potable and clean industrial water are disinfected almost exclusively by addinf chlorine, chlorine dioxide, ozone or potassium permanganate. With the flow block assembly Depolox® 5 with the integrated 3-electrode cell, the contents of this disinfectant can be continuously recorded.

A sensor module (“DES” for 3 electrode cells) and terminal strips are used to connect the Depolox® 5 flow block assembly to the electronic module. Various controller functions are available depending on the slot and application selected. The Depolox® 5 flow block assembly is also used to install additional sensors, such as pH, Redox, fluoride, conductivity, or membrane sensors for free chlorine, chlorine dioxide, ozone, total chlorine or combined chlorine.

Mode of operation of the 3-electrode sensor in the flow block assembly Deplox® 5:

The measuring cell in the flow block assembly Depolox® 5 is a 3-electrode cell with external potentiostatic control circuit. Working and counter electrodes are designed as half-ring electrodes and consist of a special platinum alloy. The reference electrode is a silver/silver chloride electrode, which is connected to the sample water via two diaphragms (pourous membranes). The reference electrode with PVC support is immersed into an electrolyte solution. The electrolyte supply can be replenished during operation if necessary.

By connecting the 3-electrode cell to the electronic module (DES sensor module for 3-electrode cell), a variable Upot cell voltage can be output between the working electrode (red) and reference electrode (white) via the potentiostatic

control circuit. A measuring cell current (µA signal), which is evaluated using the electronic module sets itself proportional to the disinfectant concentration in the sample water.

A special cleaning sand is filled into the flow block assembly, which is circulated by the sample water current and continuously cleans the platinum electrodes.

A multi-sensor is integrated into the flow block assembly Depolox® 5 to measure the temperature and monitor the flow rate. This is made of a stainless steel housing and is used simultaneously as the sample water grounding.

3.2.1.1 Depolox® 5 Theory of Operation

The free chlorine that is measured in water for disinfection purposes comes in three forms. Free chlorine consists of elemental chlorine (Cl_2), hypochlorous acid (HClO), and hypochlorite ions (ClO-).

Hypochlorous acid is found in the acidic to neutral pH range undissociated in water. Only when the pH value rises does it break down into H+ and ClO- ions.

To understand the mode of functioning of chlorine as a disinfectant, it is necessary to know the chemical reactions that take place when water is chlorinated. Firstly there is the hydrolysis of the chlorine. This is the reaction of the chlorine with water. When chlorine gas is dissolved in water the formation of hypochlorous acid and hydrochloric acid results. All other disinfectants based on chlorine also react with water and form hypochlorous acid. The hypochlorous acid is the active substance for the disinfection process. Figure 3.1 shows the dependence of the form of chlorine on the pH value of the water. With rising pH value, the share of hypochlorous acid decreases by dissociating to form H3O+ and ClO-. In other words, the hypochlorous acid needed as the active substance in disinfection becomes less with increasing pH value while the share of ClO- ions that are meaningless for disinfection rises.

The Free Chlorine (Bare Electrode) measuring cell consists of a three-electrode system with external potentiostatic closed-loop control. The working electrode and the counter electrode of the half-ring type are made of a platinum alloy. A silver/silver-chloride electrode serves as reference electrode; the contact between reference electrode and sample water is established by two membranes. The reference electrode is mounted in PVC brackets and completely submerged in electrolyte.

The electrolyte container is transparent, thus enabling a visual check to be made of the amount of electrolyte in the reservoir. Replenishment of the electrolyte is possible without shutting down the measuring cell system. A membrane in the plug of the electrolyte reservoir provides the necessary equalization of pressure.

The measuring cell is connected to a digital measuring amplifier which maintains an adjustable constant potential (Upot) between working and reference electrodes by means of potentiostatic closed-loop control.

About 33 l/hr of the water to be analyzed flows past this system of electrodes. The current generated in the measuring cell is directly proportional to the concentration of the oxidizing agent in the sample water. This current is then passed to the microprocessor-based SFC for processing.

The surfaces of the electrodes are continuously cleaned by a special kind of cleaning grit in the electrode cell. The transparent plexiglass body of the cell makes it possible to observe the circulation of the grit in the cell.

If a second SFC or MFC is used, a pH-value measurement can be input to the chlorine analyzer. With the pH valve, used in conjunction with the chlorine measurement, it is possible to correct for variations caused by shifting pH.

The following features ensure accurate, repeatable measured data and reduce the frequency of zero point recalibration:

- potentiostatic control
- continuous hydromechanical electrode cleaning system
- regulated sample water flow.

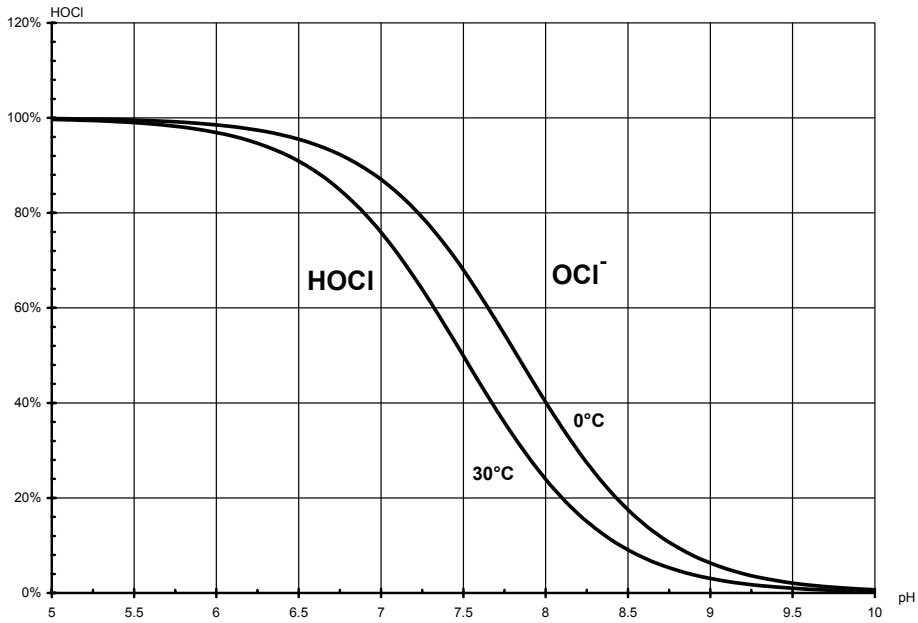


Figure 3.1 - Dissociation characteristics of HOCl and ClO- with pH value and showing effects of temperature

3.2.1.2 Adjusting the Measurement Signal Input

The µA signal input of the Depolox® 5 flow block assembly is adjusted on the sensor module as follows:

The Depolox® 5 flow block assembly measuring cell current (µA current signal) is directly proportional to the disinfectant concentration in the sample water. Depending on how the Depolox® 5 flow block assembly is used, the µA measuring range on the sensor input must be adjusted according to the operating conditions.

NOTE: The µA measuring range setting depends on the cell, disinfectant concentration and the type of disinfectant.

3.2.1.3 Setting Guideline

The difference between the µA cell current at 0% disinfectant (or sample water stop) and the maximum measured value must be within the following µA measuring ranges:

- 0–70 µA
- 0–100 µA (factory setting)
- 0–200 µA
- 0–1000 µA

NOTE: Select a higher µA measuring range for a correspondingly high concentration of disinfectant. With the Depolox® 5, a µA value of approximately 30 µA per 1 mg/l chlorine should be taken as a guide value.

The “µA Meas. Range” parameter can be modified in the “Meas. Range” menu of the respective module.

3.2.1.4 Setting the Upot Potential Voltage

A variable potential voltage is output between the working electrode and the reference electrode. If a disinfectant other than Cl_2 is used, the potential voltage must be adjusted:

• Chlorine	250 mV (factory setting)
• Chlorine dioxide, ozone, potassium permanganate	300 mV

The “Upot” parameter can be set in the “Meas. Range” menu of the respective module.

3.2.1.5 Installation Notes

The following must be taken into account when installing the 3-electrode measurement:

- Select the sample water extraction point that guarantees a proper mixture of disinfectant and a bubble-free sample water flow.
- Keep the sample water extraction line as short as possible.

NOTE: No water carrying lines made of copper piping may be installed. These would distort the measurements.

- The sensor can be calibrated for the first time after approximately two to three hours of run time.

NOTE: The calibration must be checked after one day.

3.2.2 Temperature Measurement

The IC board of SFC has a temperature measurement for connecting a PT 1000 sensor (multi-sensor). This temperature measurement is used for temperature compensation of the "DES" module and pH measurement. The temperature is shown on the main display and can be calibrated if necessary. The measuring range is 0 – 50 °C. The unit may be adjusted to °F.

SECTION 4

SECTION 4 - OPERATION

List of Contents

4.1 Display and Operator Controls

Graphic display and operating panel

All information is shown on the graphic display.

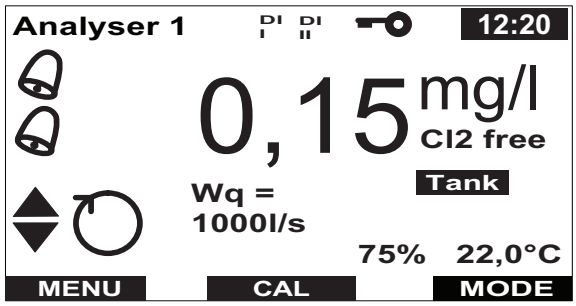


Figure 4.1 - Graphic display

The SFC and MFC are operated with nine keys. The software function is controlled with the top three keys (softkeys).

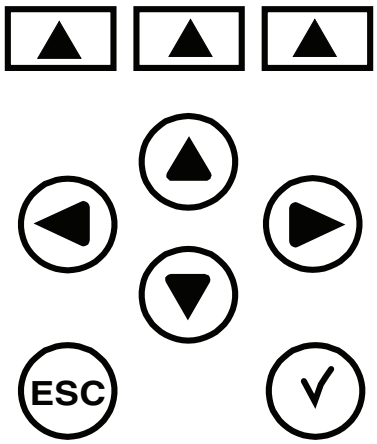


Figure 4.2 - Operating panel

The exact depiction of the individual parameters on the graphic display is described in section 4.3, Menu Structure.

Operator Controls

Softkey

- Activate the function shown on the graphic display with the keys.

Up

- Move up one level.
- Display the previous option.
- Increase the value.

Down

- Move down one level.
- Display the next option.
- Decrease the value.

Left/right

- Change the column in the menu.
- Change the position in the displayed value (cursor menu).
- Move forwards or backwards by six hours in the trend graph.

Escape

- Cancel the entry without saving the new value.
- Move up one menu level.

Enter/Acknowledge

- Acknowledge alarm message.
- Set the running delays to zero.
- Delete adaption error.
- Acknowledge max. dosing time to reactivate dosing.

4.2 Notes On Operation

During operation observe the following points:

- Check your entry and modifications before exiting the menu.
- Only press the keys with your fingers, never with hard or pointed objects such as pencils, etc. This could damage the sealed keypad.

4.2.1 Operation

You have the following options starting from the basic display (the basic display is opened by pressing the "ESC" key in the menu four times):

Switch between the basic displays and trend graphs	• Press the up or down key
Select menu	• Press the “MENU” softkey to select the menu • Press the “CAL” softkey to calibrate • Press the “MODE” softkey to set the operating mode
Select a menu item in the menu display	• Select the menu item with the arrow keys (arrow in front of menu item) • Confirm the selection with “ENTER”
Change/enter displayed parameters	• Select the parameter with the arrow keys (arrow in front of parameter) • Confirm the selection with “ENTER” • Change/enter the display with the up or down arrow keys • Confirm the entry with “ENTER”
Cancel entry	• Press the “ESC” key to exit the menu item. Entries which have not been confirmed are reset to their original settings.
Reactivate password protection	This function is only active when a password has been programmed. • Change/enter displayed parameters • Block the system entry with the “LOCK” softkey in the menu display
Exit the menu item	• Press the “ESC” key or • Press the “BACK” softkey

4.3 Menu Structure

The SFC has various menus:

- Main menu
- Module type, e.g. Cl_2 free 1
- Inputs/Outputs
- Alarms
- System
- Diagnosis
- Calibration
- Mode

Display of these depend on the number of sensor measuring modules installed.

The “Calibration” and “Mode” menus are opened with the corresponding soft keys directly from the basic display. All other menus can be accessed with the “MENU” softkey.

The following pages show the eight individual menus. The displays contain the default settings.

NOTE: The actual displays on your device can vary from those illustrated. The displays and menus depend on the number of sensor measuring modules installed and the selected settings.

4.3.1 Main Menu

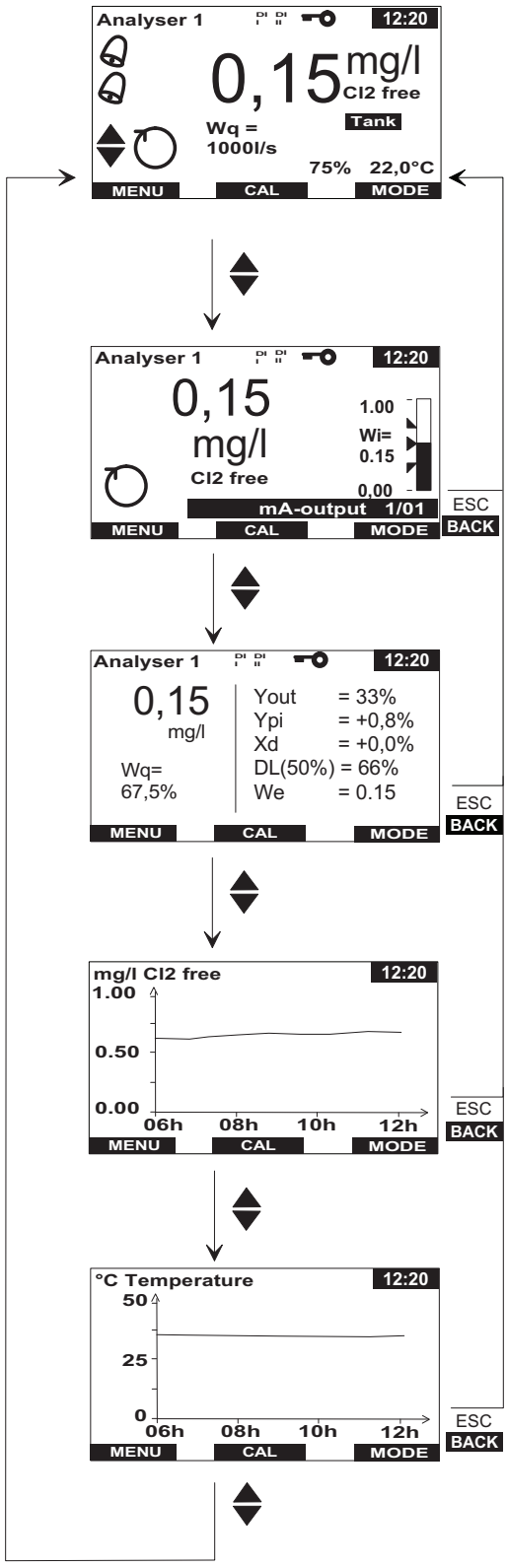
Basic display 1

Basic display 2

Basic display 3

Trend graph 1

Trend graph 2



Basic Display 1

Top status line

- System name
- Digital inputs activated
- Password protection activated
- Time

Center display range

- Mode
- Measured value, e.g. free chlorine (mg/l) as a digital display with module designation (optional)
- Flow rate display Wq
- Alarm relay display
- Control output
- Fedd delay (s), e.g. following sample water stop or change of mode from manual to automatic
- Fault message (instead of positioner feedback, temperature and feed delay) In the case of several fault messages the display alternates.
- Sample water temperature (°C)

Bottom status line

- Softkey display

Basic Display 2

Top status line

- See basic display 1

Center display range

- Mode
- Measured value display with bar graph display

Bottom status line

- See basic display 1

Basic Display 3

Top status line

- See basic display 1

Center display range

- Measured value display
- Flow rate display
- Controller-specific input/output variables, such as Yout, Ypi, Xd, dosing capacity DL depending on Wq, setpoint value Wi/We

Bottom status line

- See basic display 1

Trend Graph (2 max.)

Top status line

- Unit and type of the selected measurement parameter
- Date of the displayed diagram

Center display range

- 6-hour trend graph (can be scrolled back by up to 30 days with option SD card)

Bottom line

- Softkey display

Module Type - Menu

Display using the example of a free chlorine measurement.

Basic display

Menu select

Module type menu

Control

Actuator

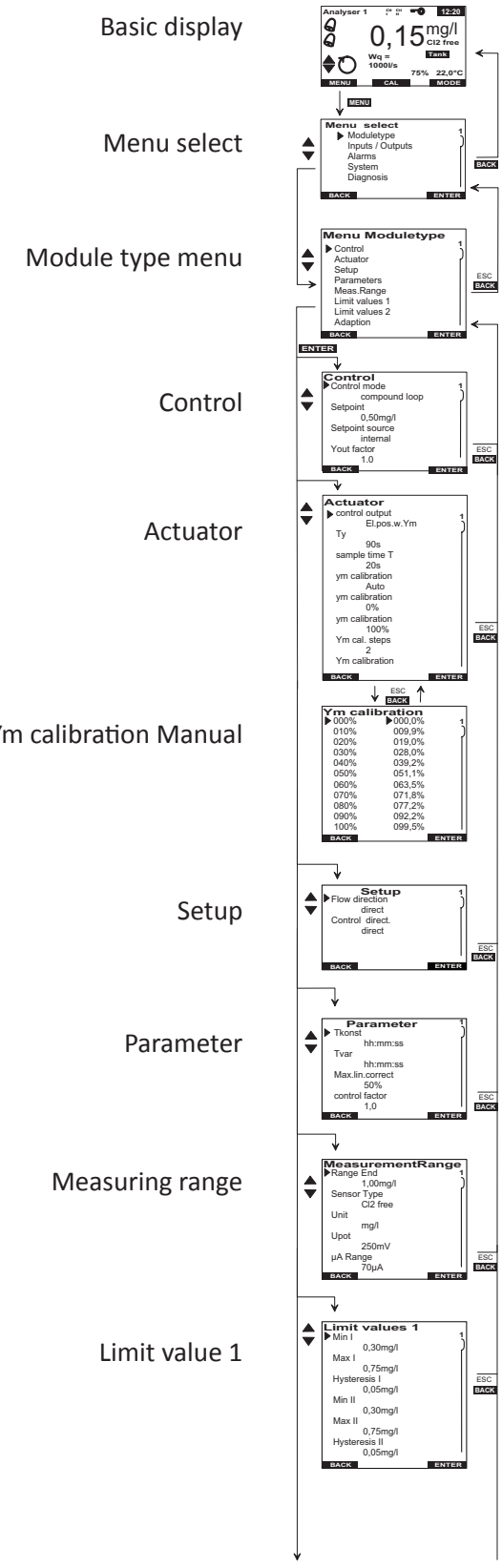
Ym calibration Manual

Setup

Parameter

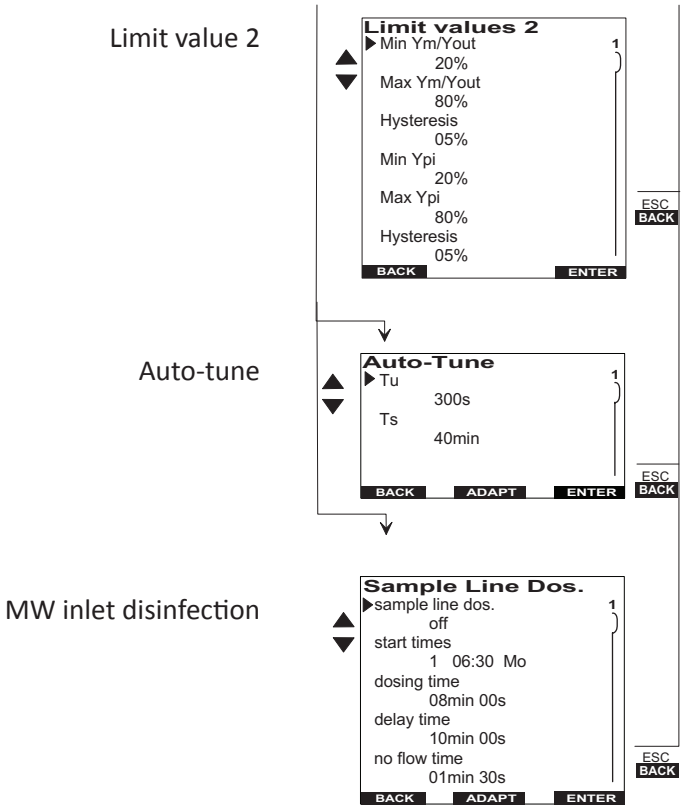
Measuring range

Limit value 1



Module Type - Menu

Display using the example of a free chlorine measurement.



<u>NOTE</u>: The displayed menus and selection parameters depend on the number of sensor measuring modules installed and the selected application. All the parameters illustrated here are not displayed at the same time.

Basic Display

Refer to main menu

Selection Menu

Display of all available menus

Module Type (1) Menu

Display of all available settings for module type 1

Control

Control mode	Combined/ratio/single feedback (combined and ratio only available with modules with PC option)
Setpoint	Measuring range
Setpoint source	internal / external / internal with DI 2/ external with DI 2
Dosing factor	0–100%
Dos. fact source	internal / external / internal with DI 3/external with DI 3
Yout-factor	1.0 - 4.0

Actuator

Control output	Positioner with Ym
	Positioner without Ym
	CAN-Bus actuator
	Dosing pump 2p.
	Dosing pump 3p.
	Solenoid pump 2p.
	Solenoid pump 3p.
	Analog output 2p.
	Analog output 3p.
	Dosing contact
CAN slave addresses	---(off), 00...31
Tp	10 s - 180 s (60 s)
Ty	10 s - 180 s (90 s)
Sample time T	1 - 20 s
Ym calibration	Auto
Ym calibration	Manual
Ym calib. points	2, 3, 6, 11
max. Pulse/min	100/120/140/160/180
Hysteresis	Depending on measuring range 0.01 - 0.50 / 00.1 - 5.0 / 1 - 50
min. ON	1min00s - 59min59s

Setup

Flow source	Off / flow rate measured value
Flow direction	direct / inverse
Control variable 2	Off / measured value X
X direction	direct / inverse
Control direction	direct / inverse
X factor	0.1 to 4.0
Ymin	0–100%
Ymax	0–100%

Parameter

Xsh	0.0 to 5.0 %
Tconst	30 s – 10 min
Tvar	30 s – 10 min
Max. lin. corr.	0–100%
Control factor	0.1 to 10
Xp	1–1000%
Tn	0.0 to 100.0 min

Measuring Range

Measuring Range

Cl_2						

Adjustment of the measuring range:
Cl_2 (Depolox® 5) 100 / 200 / 500 µg/l
1.00 / 2.00 / 5.00 / 10.0 / 20.0 / 50.0 / 100 / 200 mg/l

Sensor Type

Cl_2						

Definition of the sensor at 3 electrode cells:
free Cl_2, Cl_2^{++}, ClO_2, O_3, $KMnO_4$

Cl_2 mg/l, µg/l, ppb, ppm

Sensor modules:
000.0 / 00.00 / 0000

Upot

Cl_2						

Adjustment of the potential voltage at 3 electrode cells:
0–1000 mV

µA Measuring Range

Cl_2						

Selection of the µA signal measurement range for 3 electrode cells and membrane sensors:
70 µA, 100 µA, 200 µA, 1000 µA

CAN Address pH

Cl_2						

only for sensor type Cl_2^{++}:
Assignment of which pH module will be used to compensate for the Cl_2 measurement. The pH value is obtained via the CAN bus.

Limit Value 1

Min I	within measuring range
Max I	within measuring range
Min II	within measuring range
Max II	within measuring range
Hysteresis	Depends on measuring range 0.01 to 0.25 / 00.1 to 05.0 / 1 to 50

Limit Value 2

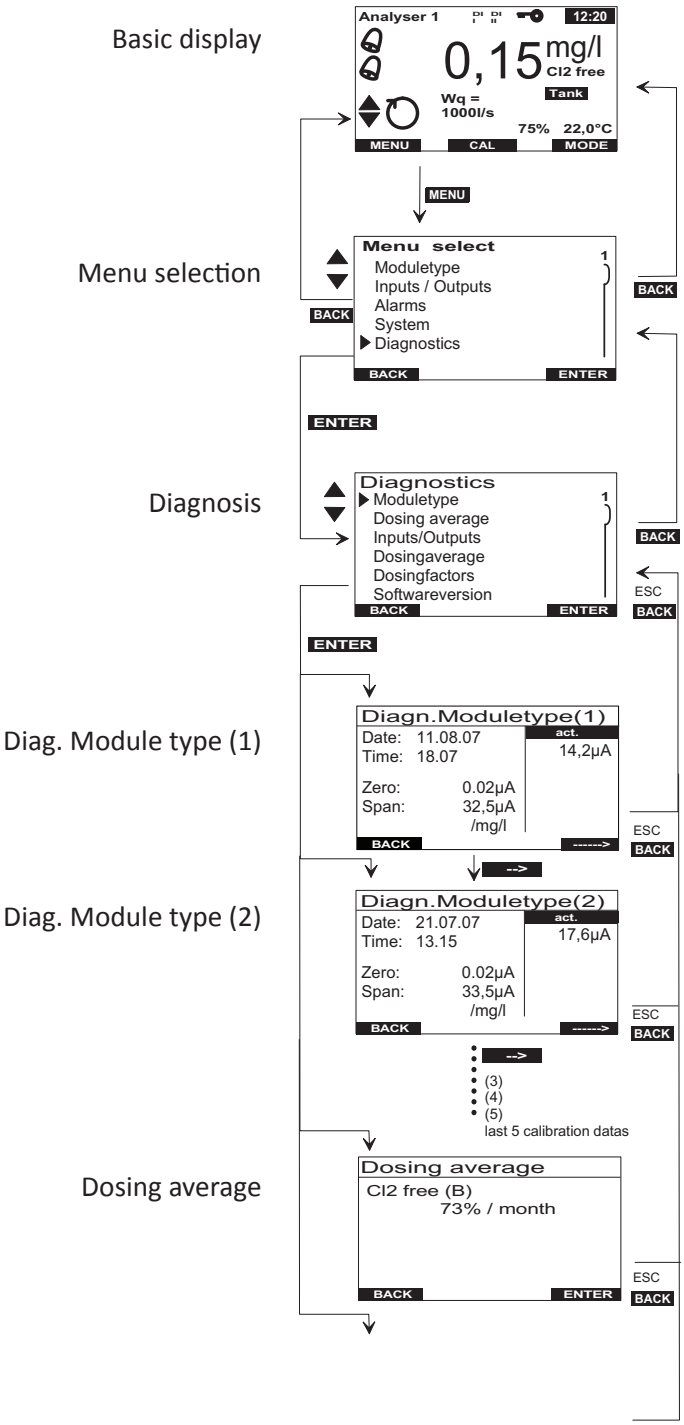
Min Ym/Yout	0–100.0% (not in single feedback closed-loop-control)
Max Ym/Yout	0–100.0% (not in single feedback closed-loop control) Ym is only output if the actuator feedback is present, otherwise the controller output is Yout
Hysteresis	0.1 to 5.0%
Min Ypi	0–100.0% (for combi-controller only)
Max Ypi	0–100.0% (for combi-controller only)
Hysteresis	0.1 to 5.0% (for combi-controller only)

Adaption

Adaption is only available for single feedback closed-loop control with “DES” modules.

Tu	1–3600 s (60 s)
Ts	0.1 to 480.0 min (10 min)

Diagnosis - Menu



Basic Display

Refer to main menu

Menu Select

Display of all available menus

Diagnosis

Display of all available diagnosis displays

Diagnosis (1-4) Using the Example of Cl_2

(Scroll with softkey "-->")

Calibration Data of 3-electrode Sensor for Cl_2, $KMNO_4$, O_3, ClO_2, Cl_2^{++}

Calibration data with the date and time of the last 5 calibrations (1-5)

Zero	Zero point signal of the measuring cell
DPD mg/l	µA-signal based on 1 mg/l
act. (I)	Current µA sensor signal

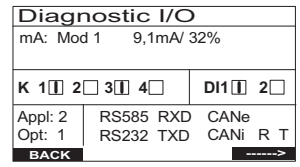
Diagnosis Dosing Average

Displays the dosing average of the previous hour, day, week, month.

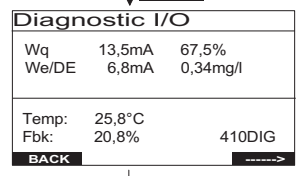
Diagnosis - Menu

"Diagnosis Menu" continued

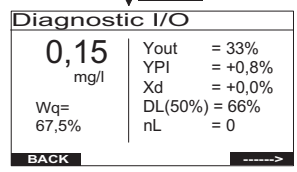
Inputs/Output diagnosis



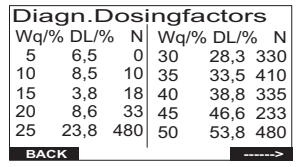
Inputs/Output diagnosis



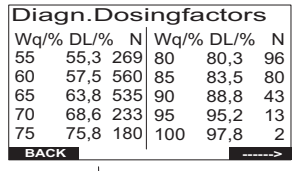
Inputs/Output diagnosis



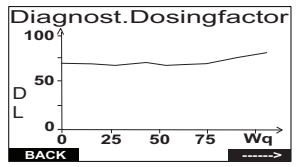
Diagnost.Dosingfactor



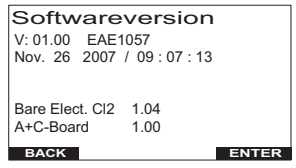
Diagnost.Dosingfactor



Diagnost.Dosingfactor



Software versions



Inputs/Output Diagnosis

Information on

- The assignment of the mA outputs
- The current mA output in mA and %
- The current switching conditions of the relays:
  ☐ Relay off ☐ Relay on
- The selected application
- Display the option (Opt = 1 -> withprocess control, Opt = 0 -> without process control)
- The send/receive condition of both interfaces RS485, RS232, CAN external and CAN internal
- The current switching conditions of the digital inputs 1 and 2

Second Display - Input/Output

Information on

- The current input signal of the flow rate measurement (Wq)
- The current input signal of the external setpoint (We) or external dosing factor (ext. DF) DF
- Temperature display
- Feedback signal display

Third Display - Input/Output

Information on

- Measured value module
- Combi-control Yout in %
- Ypi-share of Yout in %
- Control deviation Xd in %
- Dosing rate (DL) in % acc. to the current flow rate from the dosing factor table
- nL delay until new DL value is accepted in the dosing factor table (entry at 120)

Dosing Factor Diagnosis

Displays the learned DL dosing factors for the combi-control output depending on Wq (display in 5% increments).

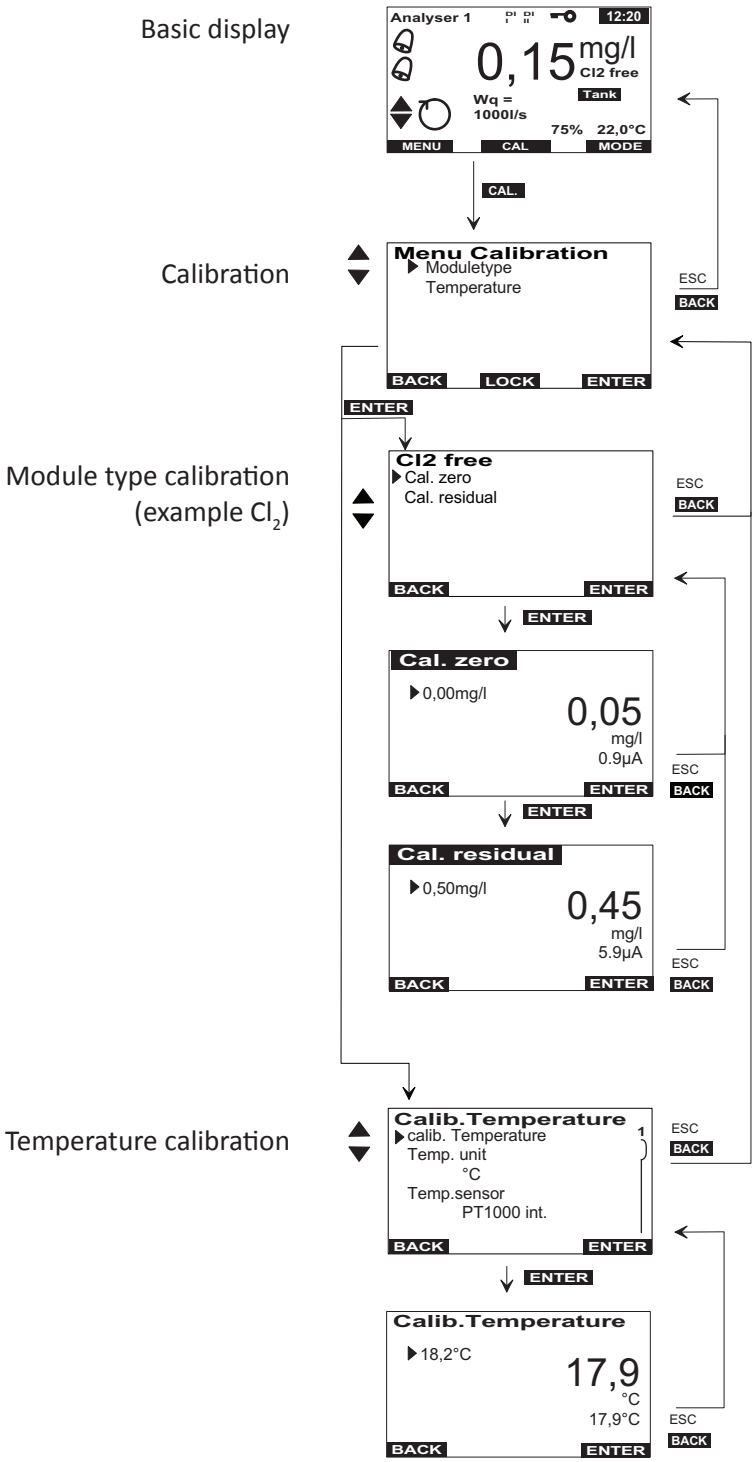
N describes the training meter, how often a dosing factor was learned for this Wq value. This table can be displayed as a diagram (toggle with the ---> key).

Software Version Diagnosis

Displays the software version of the front panel boards of the sensor measuring module and the IC boards.

Calibration - Menu 2.1

Refer to section 4.4, "Calibration".



Basic Display

Refer to main menu

Calibration

Display of all available calibration options

Module Type Calibration Cl_2 free, Cl_2^{++}, ClO_2, O_3, $KMNO_4$

Cal. zero	The "ENTER" softkey sets the display to "0.00 mg/l"
Cal. residual	within measuring range

Temperature Calibration

Calib. temperature	32 to 122 °F (0 to 50 °C)
Unit	°C / °F
Temp. sensor	Switching automatic temperature compensation on or off, selection of the internal temperature sensor (temperature input IC board), or sensor measuring module (temperature input sensor measuring module option). With the PT 1000 switched off, a manual temperature value can be entered in the calibration menu when a pH measurement is taken.

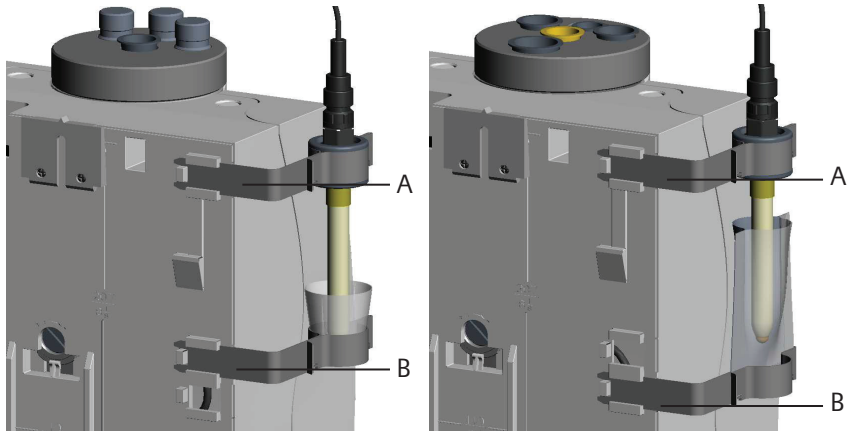
4.4 Calibration

CAUTION: The electrode fingers or membranes on the sensors are extremely sensitive. Do not touch, soil or damage them.

NOTE: To prevent loss of control during calibration, the "Hold function" in the system/common menu should be set to "On" (mA-outputs and controller outputs then remain constant during calibration). To determine how often you must calibrate, refer to section 5.1, Maintenance Schedules.

Calibration Aids Depolox® 5 and VariaSens™

Two clips are installed in the housing cover. These clips can be inserted into the rear panel of the housing. The clip (A) for the sensor will be inserted into the upper catch. When the electrodes are calibrated in the beaker with the calibration solution, the second clip (B) will be inserted into the catch (left figure). The lower clip position is provided for calibrating with the calibration solution bag (right figure).



A	Upper clip
B	Lower clip

Figure 4.3 - Fastening clips

4.4.1 Temperature Calibration

1. Starting from the basic display in the main menu select the "Calibration" menu.

2. Select the "Temperature" menu item

The "Calib. temperature" window appears on the graphic display.

3. Select "Cal. temperature".

4. Perform comparative temperature measurement

5. Open the menu with the “Enter” key and enter the ascertained value with the arrow keys.

6. Save the value by pressing the "Enter" key.

NOTE: °C or °F can be selected in the “Temp. unit” menu. The required temperature input can be selected or switched off in the "Temp. sensor" menu.

4.4.2 3-electrode Cell Depolox® 5 Calibration

Calibration of the 3-electrode cell for Cl_2, $KMnO_4$, O_3, ClO_2 and Cl_2^{++} (pH-compensated). Before Cl_2^{++} calibration, it must be ensured that the pH measurement is calibrated correctly. During calibration of the 3-electrode cell, perform a zero point calibration and a measurement value calibration. The calibration process is nearly the same for chlorine, chlorine dioxide, ozone and potassium permanganate. The difference lies in the fact that some of the reagents are measured with a photometer and others with a color meter.

Zero Point Calibration

1. Starting from the basic display in the main menu select the “Calibration” menu.

2. Select the measurement to be calibrated from the menu, e.g. Cl_2 free.

3. Select the “Cal.zero” parameter.

4. Close the ball valve on the sample water inlet.

   NOTE: When the sample water supply has been stopped, the display first drops rapidly, and after approximately one minute slowly approaches zero. During commissioning it is essential to wait for 5 minutes, even if the display should show “0.00” or flash after a few seconds.

5. Wait until the displayed value or the µA sensor signal no longer changes for at least one minute. It is possible the display may show a negative value.

6. Press the “ENTER” softkey to set the display to zero and press “Enter” again to save the value.

7. Press the softkey "back".

Zero Point Calibration with Disinfectant-Free Water

8. If disinfectant-free water (e.g. by switching off the dosing system) is available, zero point calibration can be performed with it. To do this, switch off the dosing system and perform steps 1, 2, 3, 5 and 6. The delay times for sample water extraction and dosing must be observed here (waiting time).

9. Open the ball valve on the sample water inlet.

Measurement Value Span Calibration

10. After zero point calibration, wait at least 2 minutes.

11. Extract a specimen of the sample water.

12. Determine the free chlorine, ozone, chlorine dioxide or potassium permanganate content.

13. Select the parameter “Cal. residual” and confirm with “Enter”.

14. Open the menu with the "Enter" key and enter the ascertained value withthe arrow keys. Then save with the "Enter " key.

15. Press the softkey "Back" several times until the main display is shown.

This concludes the calibration.

NOTE: In the span calibration of the Cl_2^{++} measurement, the calibration value should be greater than or equal to 25 % of the measurement range.

4.5 Errors and Remedies

Error Messages

The following table shows and explains all possible error messages which can be displayed. If several errors occur at the same time, the corresponding messages appear alternately in succession. When the error has been remedied, the error message is automatically deleted.

If you are unable to remedy the error yourself, please contact your local Evoqua Water Technologies service department.

Table 4.1 - Error Message

Error message	Cause	Remedy
Measured value display flashes	Measured value is outside the measuring range	Check measuring range and change, if necessary. Check dosing or controller settings
DI I flashes	Sample water flow recently insufficient (delay running), signal at the signal input DI I	Check sample water flow rate (approx. 33 l/h)
DI I Permanent display	Sample water flow insufficient for some time (delay elapsed)	Clean or replace the preliminary filter Multi-sensor incorrectly connected or defective
Zero ?	In 3 electrode cells Sensor has zero current > +5 µA or < -5 µA	Electrodes in the 3 electrode cell are soiled; clean and service, if necessary Sample water is turned off or sample line leaks Upot potential voltage set incorrectly; change, if necessary
Calibration ?	In 3 electrode cells and membrane sensors Slope error - the sensor current based on 1 mg/l has fallen below the required minimum In measuring range: 10 µA: in. 0.04 µA/mg/l 70 µA: in. 0.2 µA/mg/l 100 µA:min. 0.4 µA/mg/l 200 µA: min. 2 µA/mg/l 1000 µA: min. 4 µA/mg/l	Check whether there are air bubbles on the membrane sensor and remove, if necessary Service membrane sensors - replace electrolyte/membrane cap Clean 3 electrode cells, replace cell sand

Table 4.1 - Error Message (Cont'd)

Error message	Cause	Remedy
Cl_2^{++}?	pH <6 or pH>8.75 pH measurement via CAN bus is not available	Check pH measurement Check CAN addresses/segment, check setup of CAN bus
Temperature?	Interruption in the temperature sensor or cable	Check multi-sensor and cable
Temp. mod?	Temperature measurement of the sensor measurement module is faulty Interruption in the temperature sensor or cable	Check the temperature sensor and cable
Cl_2 comb?	Cl_2 measurement via CAN bus is not available	Check CAN addresses/check segment, check setup of CAN bus
Cell ?	In 3 electrode cells: Chlorine sensor not connected properly No sand cleaning Sensor, sensor cable or sensor module defective Sensor measuring module µA measuring range exceeded	Connect sensor correctly. Check sand cleaning; add if necessary Check the sensor, sensor cable or sensor module, replace if necessary Select higher µA measuring range
Module?	Sensor module was removed Sensor module defective	Refit or replace the sensor module
Range?	Min/max limit value is outside the measuring range	Check the min/max limit values and change, if necessary

Error

The following table shows and explains possible errors which can occur. If you are unable to remedy the error yourself, please contact the Evoqua Water Technologies service department.

Table 4.2 - Errors

Error	Cause	Remedy
No indication on device	No power supply	External switch or fuse off
	Device fuse defective	Check the power supply and replace fuse
	Housing cover is fitted incorrectly	Check, fit the housing cover correctly (cable possibly trapped)
Displayed/output value incorrect	Change on sensor or in the sample water	Calibrate
Measured value display not available, although the appropriate measuring module is installed	Measuring module defective or fitted incorrectly	Check, refit module correctly, replace measuring module

SECTION 5

SECTION 5 - MAINTENANCE

List of Contents

5.1 Maintenance Schedules

The following maintenance schedules are recommendations only. Adhere to the appropriate standards, regulations and locally applicable guidelines.

Task	Period/Interval
Depolox® 5 flow block assembly	
Check for leakages	Weekly
Comparative measurement, calibrate if necessary	Weekly/ acc. to guidelines
Check electrolyte level	Weekly
Check cell sand	Weekly
Clean fine filter if membrane cells are used	Every two months (depending on water quality)
Change cell sand	Every six months
Change electrolyte	Every six months
Change pourous element	Every six months (depending on water quality)

Checking For Tightness

Check the entire measuring device including all screw connections for leakage. Repair any leakage points immediately.

NOTE: Air bubbles in the sample water influence the measuring accuracy. The cause must be determined and remedied.

Checking the Cell Sand

Check that there is sufficient sand in the cell body. The cell sand must be swirled around in the bottom section of the cell body. The cell sand is necessary for cleaning the chlorine sensor electrodes and must be replenished or replaced when required. (Refer to section 2.3.2 "Pour in the cell sand" and "Changing cell sand with 3-electrode cell."

NOTE: When fresh sand is replenished, the electrode current may increase slightly for approximately 3 hours. Do not calibrate during this time. You must calibrate each time the cell sand is replaced. The calibration must be checked after one day.

5.2 Maintaining Depolox® 5 Flow Block Assembly

Changing Cell Sand in Depolox® 5 3-Electrode Cell

The cell sand required for constant cleaning of the electrodes grinds itself down over time until it is very fine. It must be replaced regularly. Cell sand is delivered in a plastic bottle:

1. Remove Depolox® 5 flow block assembly cover.
2. Close the ball valve on the sample water inlet.
3. Open the drain valve and drain the cell body (hold container underneath).
4. Close the drain valve when the cell body is empty.
5. Remove the sensors. Remove sensor cable from the sensors.
6. Loosen the lower cap on the 3 electrode cell.
7. Remove the signal cable.
8. Unscrew the upper knurled nut on the electrolyte container.
9. Using the electrode mount, push the electrolyte tank downwards out of the cell body.
10. Wash the cell sand out of the electrode mount or flow distributor cap.
11. Using the electrolyte container, insert the electrode mount back into the cell body or screw the flow distributor cap back on.

NOTE: The cell body's dowl pin must be locked into place in the appropriate hole in the electrode mount.

12. Screw the upper knurled nut back onto the electrolyte container.
13. Reconnect the signal cable acc. to color.

CNT	Counter electrode	Blue point	Blue cable
WRK	Working electrode	Red point	Pink cable
Ref	Reference electrode (middle)		White cable

14. Screw the cap back on.
15. Fill half a cap from the plastic bottle with cell sand and pour it into the cell body (approx. 1/2 cm^3 cell sand).
16. Reinsert electrodes.

17. Reopen the check valve on the sample water inlet.

18. Perform the zero-point calibration after approximately three hours running-in time.

NOTE: You must calibrate each time the cell sand is replaced. The calibration must be checked after one day. We recommend checking and, if necessary, replacing the electrodes and diaphragms when replacing the cell sand (see "Replacing electrolyte, reference electrode and diaphragms (Depolox® 5)").

Check Electrolyte Level of the Depolox® 5 3-Electrode Cell

1. Check whether the electrolyte is filled approx. 3 cm over the water level (narrowing of the KCL container) and replenish, if necessary. To do this, remove the plug in the upper part of the electrolyte tank and inject the electrolyte (use the syringe in the accessory set).

2. The diaphragms in the electrolyte tank form the connection between the reference electrolytes and the sample water. If the sample water quality is poor (e.g. high iron content), both diaphragms in the electrolyte housing should be replaced. The diaphragms should be white (any coloration is an indication that the diaphragms are clogged and should be replaced).

3. Calibrate after approximately three hours.

NOTE: The calibration must be checked after one day.

Replacing Electrolyte, Reference Electrode and Diaphragms (Depolox® 5)

1. Remove Depolox® 5 flow block assembly cover.

2. Close the ball valve on the sample water inlet.

3. Open the drain valve and drain the cell body (hold container underneath).

4. Close the drain valve when the cell body is empty.

5. Remove the sensors. Loosen the cable union (hold the cable while doing this as it may not be allowed to rotate).

6. Loosen the lower cap on the 3 electrode cell.

7. Remove the signal cable.

Replace Electrolyte (Depolox® 5)

8. Unscrew the upper knurled nut on the electrolyte container.

9. Remove the electrolyte tank out of the cell body from below using the electrode mount.

NOTE: Wash the cell sand out of the electrode mount "Changing the Cell Sand with the 3-electrode cell Depolox 5®".

10. Remove the electrolyte container from the electrode mount. To do this, unscrew the knurled nut in the electrode mount.

11. Remove the electrolyte container out the electrode mount from the top.

12. Remove the drain plug from the electrolyte container.

13. Turn the electrolyte container upside down and drain the KCl electrolytes by lightly shaking it.

Replacing Reference Electrode (Depolox® 5)

14. If necessary, replace the reference electrode. The reference electrode can be unscrewed from the electrolyte container. Lightly wet the O-ring before installing a new reference electrode.

Replacing Diaphragms (Depolox® 5)

NOTE: The diaphragms, which form the contact between the reference electrodes and sample water, cannot be cleaned. If the water quality is very good, the porous membranes can remain installed for up to three years; they should be replaced thereafter (no exceptions). If the sample water quality is poor, the porous membranes may be soiled. This influences the measuring accuracy.

15. Remove both diaphragms from the electrolyte container using a suitable tool (e.g. tweezers).

16. Push new diaphragms into the electrolyte container. Lightly wet the O-rings.

17. Insert the electrolyte container back into the electrode mount. Lightly wet the O-ring here as well.

18. Fill the container with fresh electrolyte (approx. 3 cm above the water level or narrowing of the KCl container).

19. Insert the drain plug into the electrolyte container.

20. Insert the electrode mount back into the cell body using the electrolyte container.

NOTE: The cell body's dowl pin must be locked into place in the appropriate hole in the electrode mount.

21. Screw the upper knurled nut back onto the electrolyte container.

22. Reconnect the signal cable acc. to color.

CNT	Counter electrode	Blue point	Blue cable
WRK	Working electrode	Red point	Pink cable
Ref	Reference electrode (middle)		White cable

24. Screw the cap back on.

25. Fill half a cap from the plastic bottle with cell sand and pour it into the cell body (approx. 1/2 cm^3 cell sand).

26. Reinsert electrodes.

27. Reopen the check valve on the sample water inlet.

28. Perform the zero-point calibration after approximately three hours running-in time.

NOTE: Perform a zero-point calibration after one hour running-in time and, if required, after 24 hours. You must calibrate each time the cell sand is replaced. The calibration must be checked after one day. Note the electrolyte's expiration date.

Cleaning/Replacing the Fine Filter

A fine filter must only be installed when membrane sensors are employed. The fine filter must be cleaned or replaced in order to protect the membrane sensor's delicate membrane against soiling or damage.

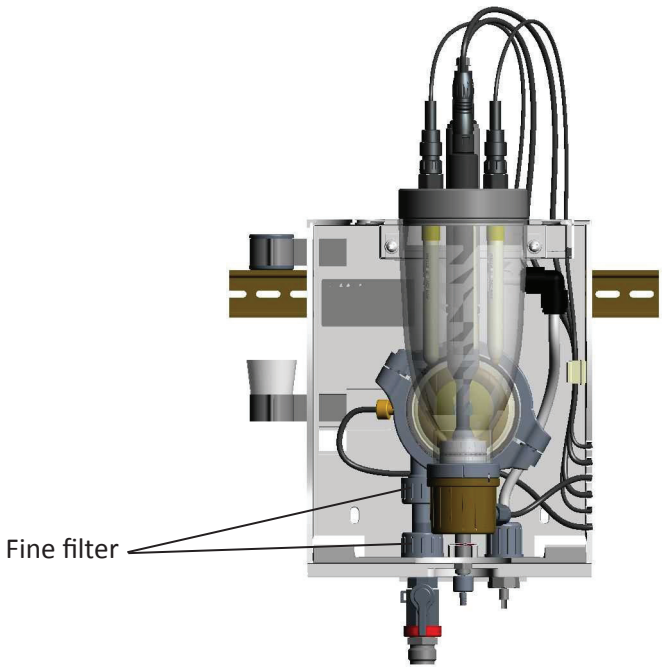


Figure 5.1 - Flow block assembly cutaway model

1. Release both knurled nuts.

2. Remove complete filter unit.

3. Remove the fine filter.

To do this, screw corse thread screw slightly into the fine filter and pull the fine filter out of the filter unit
OR
Pry the fine filter with a suitable tool out of the filter unit.

4. Rinse the fine filter with water, replace if necessary.

5. Place the fine filter into the filter unit. Ensure that the O-ring is fitted correctly (insert as far as possible).

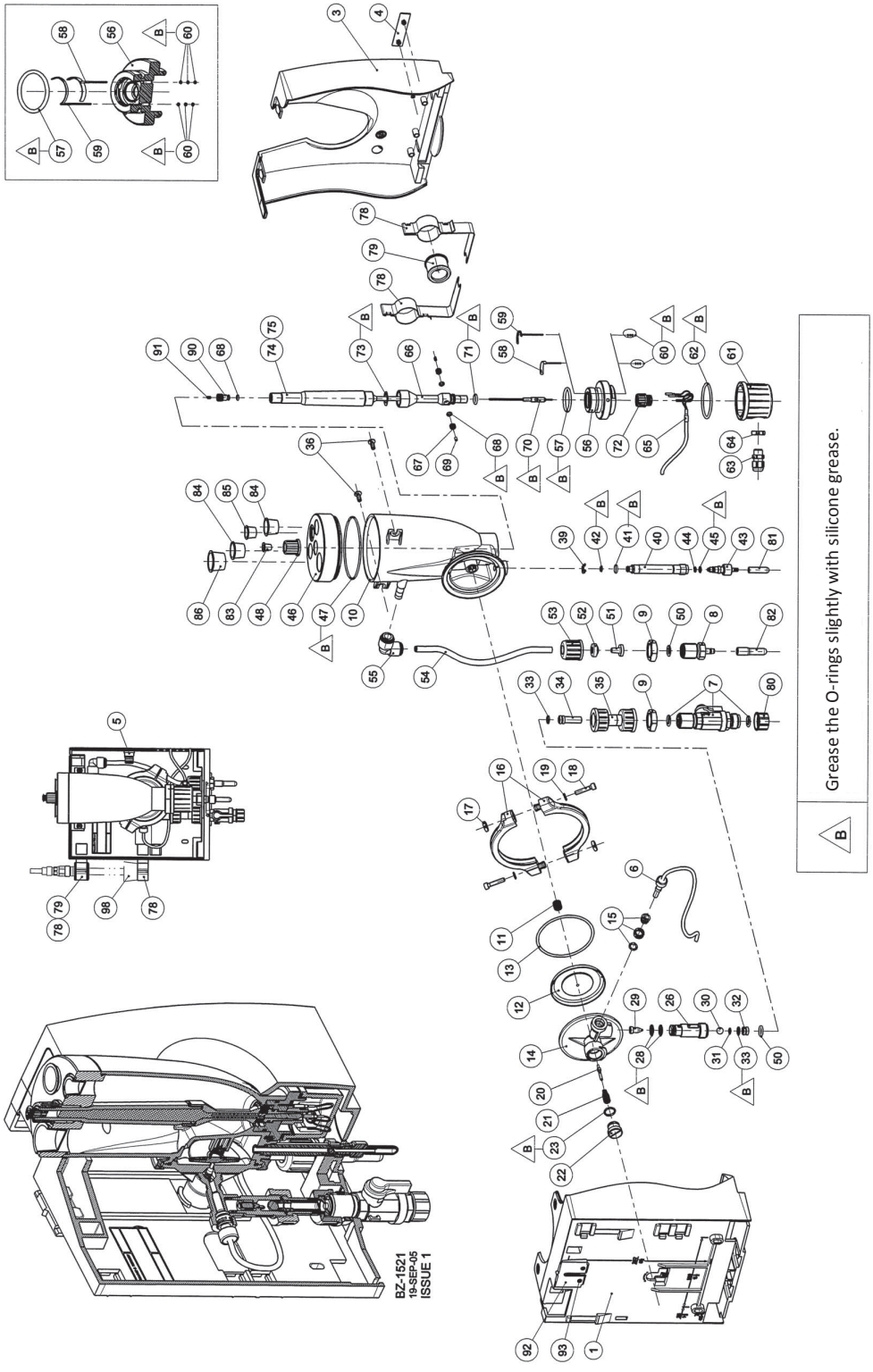
6. Fit the filter unit. Ensure that it is fitted in the correct position.

7. Tighten both knurled nuts.

SECTION 6

SECTION 6 - ILLUSTRATIONS

List of Contents



NOTE: FOR PARTS LIST, SEE DWGS. 50.580.000.010B-D.

W3T170031 DEPOLOX® 5 WETSIDE - PARTS

50.580.000.010A

ISSUE 2 2-11

KEY NO.	PART NO.	DESCRIPTION
1	W3T160628	BASE HOUSING
1,92,93	W3T164571	BASE HOUSING, PRE-ASSEMBLED
3	W3T160629	HOUSING COVER
4	W3T172042	PRODUCT ID
5	W2T499035	CABLE CLIP
6	W3T172029	MULTI SENSOR
7	W3T166170	SHUT-OFF VALVE
8	W3T158593	OUTLET CONNECTION
9	W2T499055	LOW CROWN NUT
10	W3T158561	CELL BODY
11	W3T164226	COMPRESSION RING
12	W3T158569	MEMBRANE UNIT
13	W3T160654	O-RING
14	W3T158595	CONTROL VALVE BODY
15	W2T504209	PLASTIC CARTRIDGE
16	W3T160649	V PROFILE CLAMP
17	W3T158567	SQUARE NUT
18	W2T442619	PAN HEAD SCREW
19	W2T11355	WASHER
20	W3T158572	VALVE NEEDLE
21	W2T376069	COMPRESSION RING
22	W3T158573	ADJUSTING SCREW
23	W3T160357	O-RING
26	W3T160648	CHECK VALVE HOUSING
28	W2T13117	O-RING
29	W3T169827	FLOAT, INCLUDES MAGNET
30	W3T149670	BALL
31	W3T149671	O-RING
32	W3T149672	UNION END
33	W3T149673	O-RING
34	W3T168189	FINE FILTER
33,34	W3T150633	FINE FILTER, COMPLETE
35	W3T158602	FILTER HOUSING
36	AAC5002	PLASTIC SELF-TAPPING SCREW
39	W3T172041	SECURING RING
40	W3T158576	DRAIN TUBE

WHEN ORDERING MATERIAL ALWAYS SPECIFY MODEL AND SERIAL NUMBER OF APPARATUS

W3T170031 DEPOLOX® 5 WETSIDE - PARTS LIST

50.580.000.010B

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KEY NO.	PART NO.	DESCRIPTION
41	PXC95968	O-RING
42	AAC7126	O-RING
43	W3T158575	DRAIN SCREW
44	W3T166261	FLAT GASKET
45	W2T18871	O-RING
46	W3T158565	CELL BODY COVER
47	AAC4906	O-RING
48	W2T9645	KNURLED NUT
50	W2T12552	O-RING
51	W3T149683	HOSE BUSHING
52	W3T169815	LOCKING RING
53	W3T149685	UNION NUT
50-53	W3T149686	HOSE CONNECTION PARTS
54	W3T158601	HOSE
55	W2T505093	REDUCING ELBOW
56	W3T166209	ELECTRODE MOUNT
57	W2T11147	O-RING
58	W3T127848	WORKING ELECTRODE
59	U95614	COUNTER ELECTRODE
60	W2T12058	O-RING
61	W3T158562	SEALING CAP
62	W2T9671	O-RING
63	W2T504177	CABLE UNION
64	W2T499056	HEXAGON NUT
65	W3T160702	CONNECTOR CABLE COMBINATION
66	W3T139776	ELECTRODE CASE
67-69	W2T11582	DIAPHRAGM COMPLETE
70	W2T11581	REFERENCE ELECTRODE
71	W2T9670	O-RING
72	W2T9644	KNURLED NUT
73	W2T438267	FLAT GASKET
74	W2T11564	KCL ELECTRODE SET, 100ml
75	W3T149262	CONTAINER
78	W3T166169	CLIP, COATED
79	W3T172045	ELECTRODE MOUNT
80	W2T499247	SCREW CAP

WHEN ORDERING MATERIAL ALWAYS SPECIFY MODEL AND SERIAL NUMBER OF APPARATUS

W3T17003 DEPOLOX® 5 WETSIDE - PARTS LIST

50.580.000.010C

ISSUE 1 2-11

KEY NO.	PART NO.	DESCRIPTION
81	W2T499046	PROTECTION CAP
82	W2T499047	PROTECTION CAP
83	W2T499254	PROTECTION CAP
84	W2T9673	PROTECTION CAP
85	W2T499050	PROTECTION CAP
86	W2T499051	PROTECTION CAP
68,90,91	W2T9652	PLUG COMPLETE
92	W3T160627	WALL HOOKS
93	W2T499245	SHEET METAL SCREW
98	W2T499052	BREAKER, 1 PC
98	W3T158600	BREAKER, 75 PC
Accessories	W3T149263	FELT WASHER, TRANSPORT LOCK
Accessories	W3T149686	HOSE CONNECTION PARTS, ID 6 x WDG 1
Accessories	W3T149725	HOSE CONNECTION PARTS, ID 6 x WDG 3
Accessories	W3T158743	ELECTRODE CLEANING SAND “QK”
Accessories	W3T149726	MOUNTING SET

WHEN ORDERING MATERIAL ALWAYS SPECIFY MODEL AND SERIAL NUMBER OF APPARATUS

W3T170031 DEPOLOX® 5 WETSIDE - PARTS LIST

50.580.000.010D

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SECTION 7

SECTION 7 - COMPLETE DEVICES, RETROFIT KITS & SPARE PARTS

List of Contents

PARA. NO.

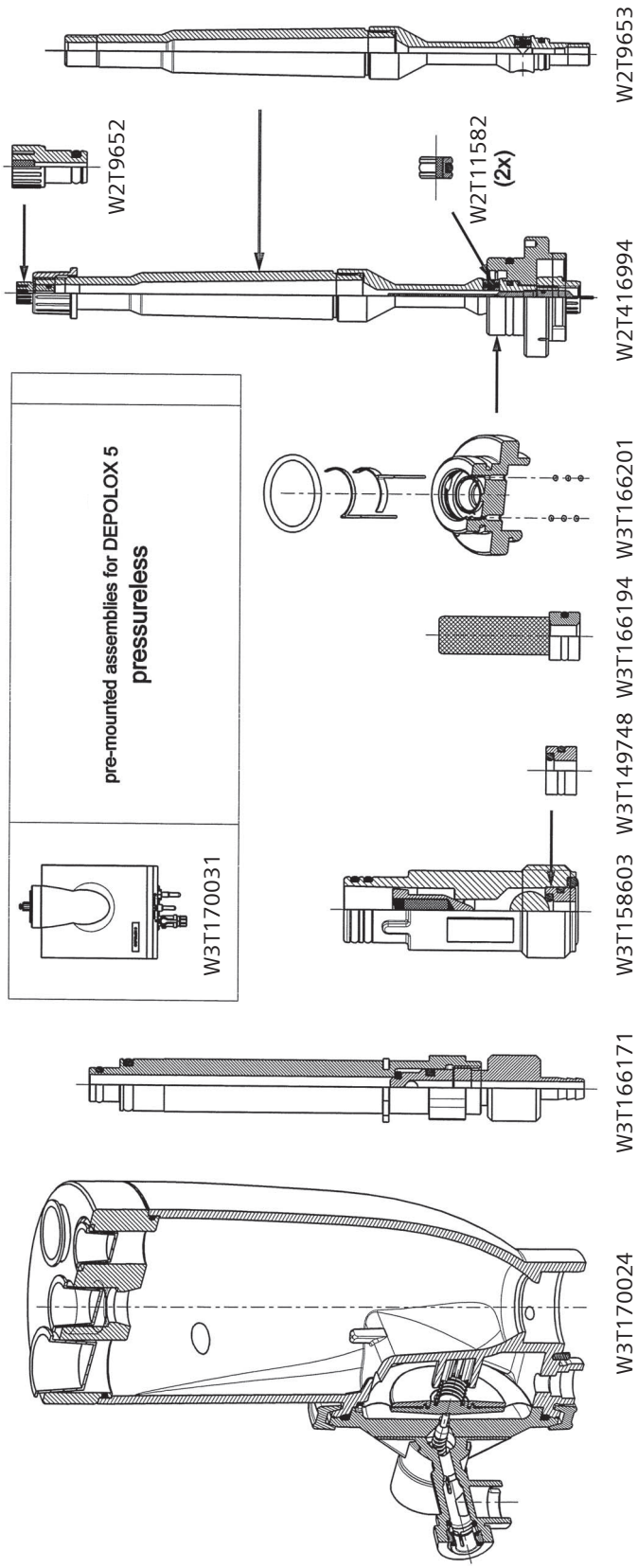
7.1 Retrofit Sets

3-electrode cell DEPOLOX® 5	W3T170334 - Plug-in card with terminals AAD9568 - with optional Process Control

7.2 Spare Parts and Consumables

Depolox® 5					
Electrode cleaning sand W3T158743	Electrolyte W2T11564	Multi sensor W3T172029	Measuring cup 75 pcs W3T158600	Cable W3T160702	Plug-in card without Process Control W3T158824 Plug-in card with Process Control W3T158823

7.3 Depolox® 5 Retrofit Set W3T170031



7.3.1 Depolox® 5 Retrofit Set Parts List W3T170031

Part. No.	Description
W3T170031	Flow block assembly
W3T170024	Cell body D5-DL, complete
W3T166171	Drain unit
W3T158603	Back pressure unit
W3T149748	Ball seat, complete
W3T166194	Fine filter
W3T166210	Electrode support, complete
W2T416994	Electrode cell, complete, electrode not included
W2T9652	Plug complete
W2T11582	Diaphragm complete
W2T9653	Electrode housing
AAC7078	D5-DL accessory set
W2T350531	Spare parts set, BASIS-KIT
AAC7183	Spare parts set, 2 years Operation
W3T129462	Spare parts set, 5 years Operation

SECTION 8

STEP BY STEP COMPLIANCE PROCEDURE FOR U.S. EPA METHOD 334.0

BOOK NO.: WT.050.000.000.UA.IM.0614

W3T130691

Evoqua Water Technolgies

COMPLIANCE FOR ON-LINE ANALYZERS

REGIONAL OFFICES

INSTALLATION, OPERATION, MAINTENANCE, AND SERVICE INFORMATION

Direct any questions concerning this equipment that are not answered in the instruction book to the Reseller from whom the equipment was purchased. If the equipment was purchased directly from Evoqua Water Technologies, Colorado Springs, CO contact the office indicated below.

UNITED STATES

725 Wooten Road
Colorado Springs, CO 80915
TEL: (800) 524-6324

CANADA

If the equipment was purchased directly from Evoqua Water Technologies, Canada, contact the nearest office indicated below.

ONTARIO

Evoqua Water Technologies Ltd.
2045 Drew Road
Mississauga, Ontario
L5S 1S4
(905) 944-2800

QUEBEC

Evoqua Technologies des Eaux Itee
505 Levy Street
St. Laurent, Quebec
H4R 2N9
(450) 582-4266

COMPLIANCE FOR ON-LINE ANALYZERS

INTRODUCTION

In order to comply with the US EPA method 334.0 for the use of on-line chlorine analyzers when used for reporting purposes, this addendum will provide you with a suggested step by step procedure for calibration of the on-line chlorine analyzer after initial installation as well as day to day use thereafter.

Please note that this addendum does not take the place of a thorough review of the US EPA published method, but is strictly an attempt to provide guidance on how to comply with the method if the instrumentation described herein is utilized.

Please note that this addendum does not replace any of the instructions provided in the equipment specific instruction manuals and it is highly recommended that all instruction manuals be reviewed in detail prior to installation and operation.

Table Of Contents

Summary of Required Steps

1. Procedure for the initial verification of the P334 colorimeter calibration or A790 titrator (Section 2)
2. Initial Demonstration of Capability using the P334 photometer or A790 titrator (Section 3 & Appendix A)
3. Initial grab sample comparison testing to put on-line analyzer in use for compliance monitoring (Section 4 & Appendix C)
4. Establishing frequency of routine analyzer checks (Section 5 & Appendix D)
5. Routine quality check for on-line chlorine analyzer (Section 7)

1 Initial Start up of the On-line Analyzer Instrument

After the analyzer electronics and complete flow cell are installed as per the instructions provided in the equipment specific instruction manual, the analyzer system should be leak tested and all electrical connections should be checked for accuracy.

Start sample water flow though the flow cell as per the instruction manual. Again check for leaks and maintain sample flow through the flow cell.

Initialize power to the instrument. As is noted in the instruction manual of your instrument, our analyzers are not provided with their own power switch and therefore power is usually initialized by an external breaker or power switch.

NOTE: Connected devices, such as chemical feed equipment have to be switched off during input of operating data in order to prevent uncontrolled start-up or malfunctions. Only when the operating data input is complete and checked may other devices be switched on.

NOTE: The analyzer should be left in operation with sample water flowing and power on for a period of 24 hours prior to the initial calibration is performed. During this time, the analyzer output should not be used for automatic disinfectant feed.

2 Initial Procedure for the Use of the Evoqua P334 Colorimeter

The initial calibration of the on-line analyzer will require the analysis of a grab sample. For ease of use in drinking water applications, a DPD colorimetric method using our Evoqua P334 colorimeter is suggested.

(Those facilities that are already using amperometric titration with the Evoqua A 790 titrator for calibration purposes should continue to use this calibration procedure)

The following grab sample analysis procedure must be followed during the initial start-up of the on-line analyzer:

To ensure the accuracy of the Evoqua P334 colorimeter is dependent on whether the instrument being used is factory calibration certified or whether field verification is necessary:

- For factory certified P334 instruments, perform an initial P334 colorimeter calibration check utilizing the primary chlorine standard provided. The primary chlorine standard must be analyzed within +/- 15% of its expected concentration.

- For P334 instruments that are not factory certified and require field calibration verification of the instrument. The instrument calibration curve must be verified by performing a calibration check of the P334 instrument with a blank sample and 3 calibration standards that span the concentration range. Each calibration standard must be analyzed within +/- 15% of its expected concentration.

- For the A-790 titrator, the calibration of the instrument should be confirmed with calibration standards that span the concentration range.

The accuracy of the grab sample method should be confirmed quarterly with the use of a primary chlorine standard.

3 Initial Demonstration of Capability with Use for the Grab Sample Analysis

To ensure the operator is well schooled in the use of the colorimeter (or titrator if it is being used) it is required that the operator perform 5 consecutive analysis of samples that have the same chlorine concentration to confirm his initial demonstration of capability (IDC).

The concentration of the 5 consecutive samples used should be near the expected concentration of the water samples under normal water plant operating conditions.

The average concentration of the 5 consecutive analyses must be within +/- 15% of the expected value.

Calculate the relative standard deviation (RSD) of the 5 consecutive analyses using the equation:

$RSD = S / X \times 100\%$

Where 'S' is the standard deviation of the replicate values
And 'X' is the average value of the replicate values

The relative standard deviation (RSD) of the results of the replicate analyses must be less than or equal to 15%.

Utilize the Appendix A to establish the initial demonstration of capability (IDC) and file completed form.

Please see Appendix B for troubleshooting of the Evoqua P334 photometer when the above measurements fail to provide an acceptable result.

4 Initial Calibration of the On-line Analyzer and Placing Into Service for Compliance Monitoring

An initial analyzer calibration should be performed only after the analyzer has been in operation for a 24 hour period in which the sensor reaches its working equilibrium.

Follow the calibration procedure as it pertains to your specific measurement module as described in the instruction manual supplied with your analyzer.

NOTE: The initial demonstration of capability of the use of the Evoqua P334 photometer (or Evoqua A-790 titrator) should be completed before proceeding (see Section 3).

Perform the analyzer calibration and note both the grab sample and on-line analyzer result on a table, a sample of which is supplied in Appendix C.

Continue to perform on-line chlorine analyzer calibration check with a grab sample analysis once per day for a period of fourteen days.

Perform additional checks of the on-line analyzer as needed but re-initiate the fourteen day daily calibration check utilizing the Evoqua P334 photometer (or Evoqua A-790 titrator) if the on-line analyzer requires calibration during this trial period.

Only after the on-line analyzer readings are within the required tolerance of 15% of the grab sample concentration measurement for fourteen consecutive days is the on-line analyzer ready to be put into use for compliance monitoring.

5 Establishing a Frequency of Routine Grab Sample Comparisons to Online Analyzer Readings

To establish the routine grab sample comparison schedule additional testing is required to gain a level of historical confidence in the on-line to grab sample comparison.

The flowchart in Section 6 illustrates the required comparison testing required to set up a grab sample comparison frequency of every 3, 4, 5, 6 or 7 consecutive days.

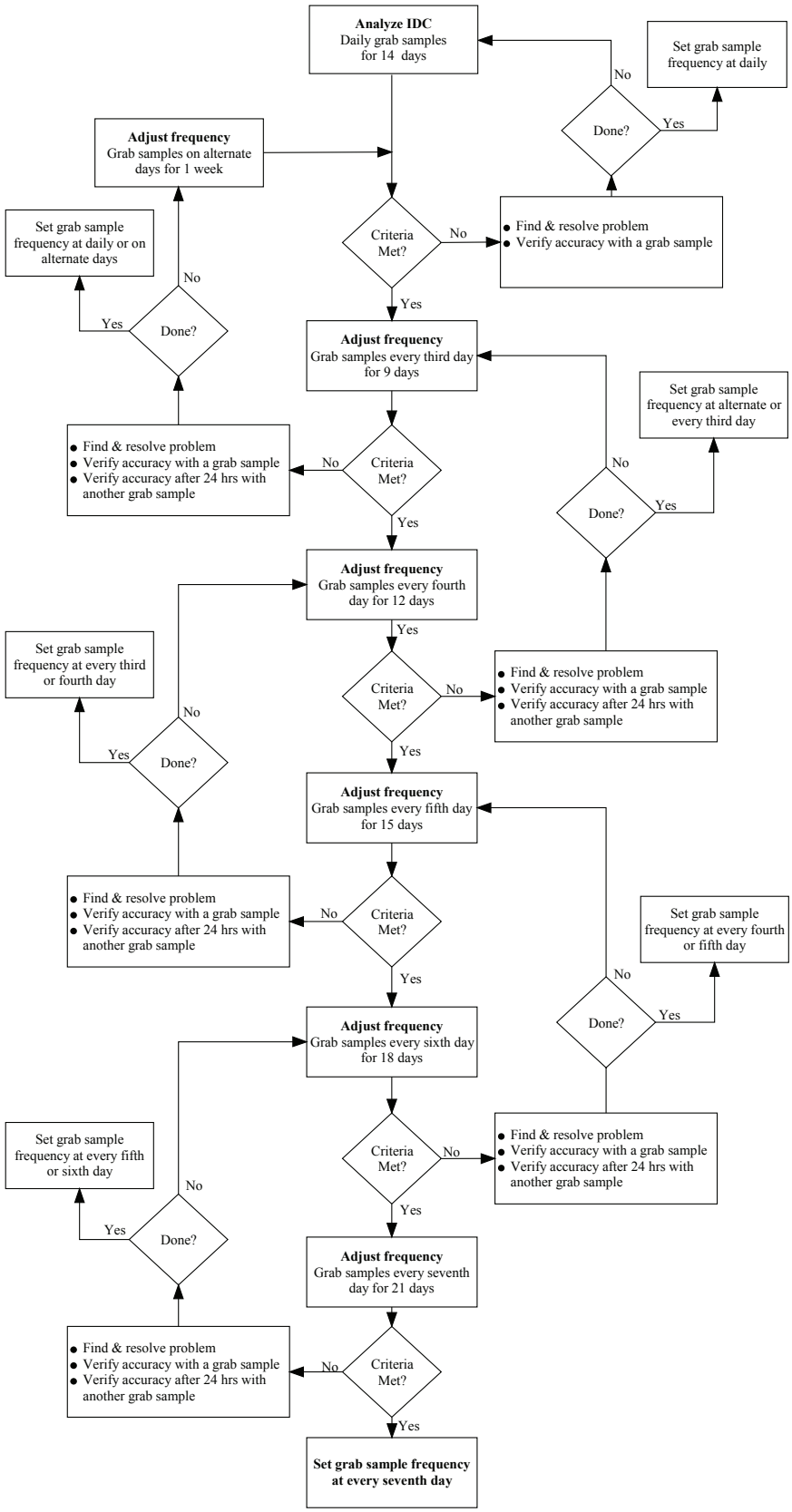
If troubleshooting of the on-line analyzer is required as part of any troubleshooting procedures during this testing period, it is suggested to refer to the troubleshooting guide supplied in the instruction manual of each on-line chlorine analyzer.

A spreadsheet to record the results of the testing is supplied in Appendix D.

NOTE: In order to proceed down the rows of comparison testing in the table provided in Appendix D, the on-line analyzer concentration recorded must be within +/- 0.1 mg/l or +/- 15% (which ever is larger) of the grab sample measurement.

NOTE: For existing online analyzer installations, only the initial demonstration of capability of the online analyzer is required, as described on the previous page. The grab sample comparison test frequency thereafter can be set to every seven days.

6 The flow chart below shows how to establish a grab sample check every 7th day



7 Routine Operation of the On-line Chlorine Analyzer

Let us review the calibration requirements of the on-line analyzer for routine operation:

1. Record the on-line analyzer chlorine reading

2. Immediately thereafter collect a grab sample as close as possible to the on-line analyzer flow cell

3. Perform analysis of the grab sample with either a colorimeter or amperometric titrator.

4. If the on-line analyzer concentration recorded is within +/- 0.1 mg/l or +/- 15% (which ever is larger) of the grab sample measurement no action is required.

5. If the on-line analyzer concentration recorded is not within +/- 0.1 mg/l or +/- 15% (which ever is larger) of the grab sample measurement, calibration of the on-line chlorine analyzer is required. You may wish to collect a second grab sample before proceeding with the calibration procedure to confirm calibration is indeed required. Please refer the instruction manual of your particular on-line chlorine analyzer for calibration instructions.

6. If calibration of the on-line analyzer is required, please note that the P334 colorimeter calibration (or A790 titrator calibration) **must be confirmed by calibration with a primary chlorine standard**.

7. An additional grab sample comparison should be performed after one day of operation to verify that the calibration adjustment was performed properly.

8. Please refer to Appendix B for troubleshooting guidance if you encounter difficulties with the use of the P334 colorimeter. Please note the use of secondary chlorine standards is recommended to help troubleshoot the colorimeter in order to minimize the use of the primary chlorine standard for that purpose.

9. Please refer to the instruction manual of your particular on-line chlorine analyzer if you encounter difficulties with calibration.

NOTE: A grab sample comparison should be performed at least once per week.

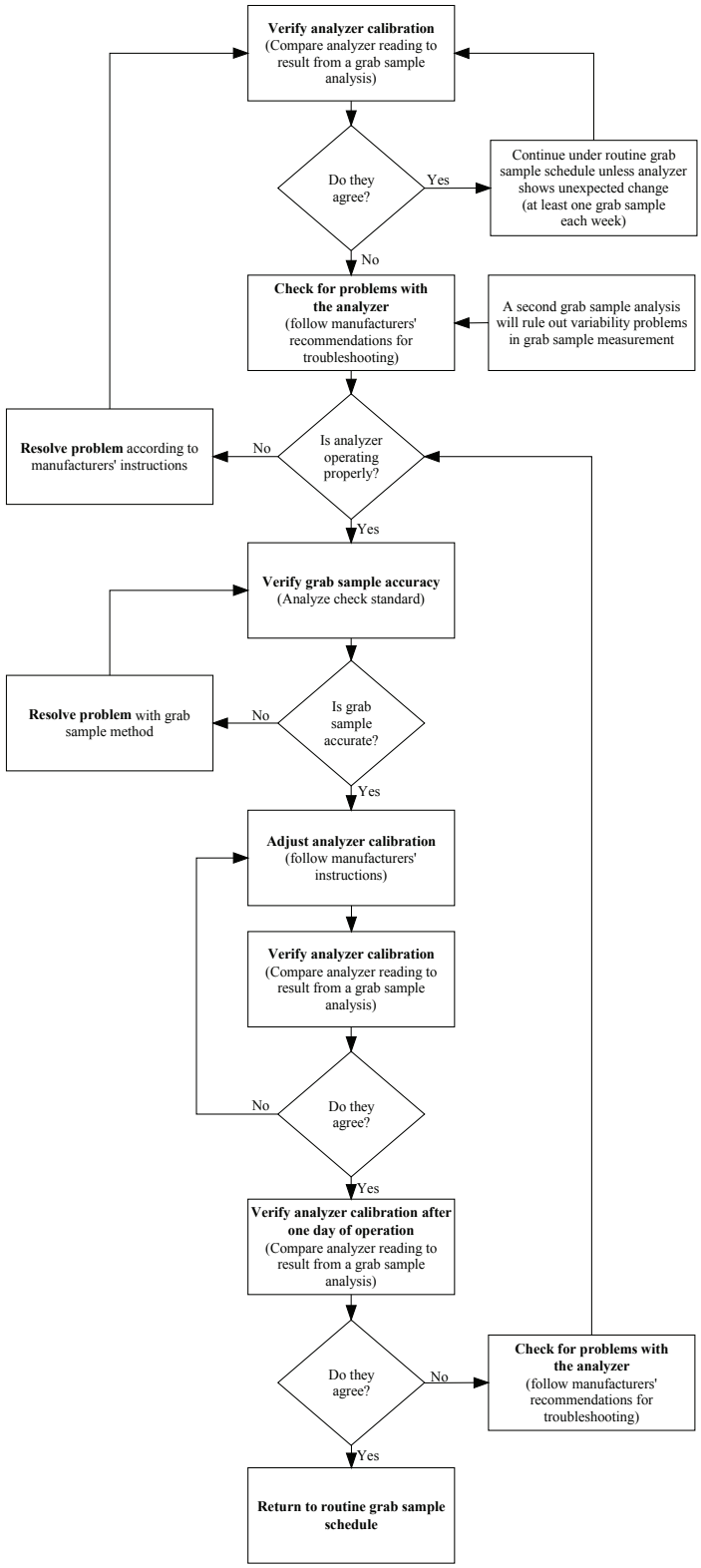
COMPLIANCE FOR EPA METHOD 334.0

Illustration of on-line analyzer readings and grab sample analysis comparison:

On-line analyzer reading	re-calibrate	Acceptable grab sample analysis range			re-calibrate
1.0	< 0.9	0.9	-	1.2	> 1.2
1.1	< 0.9	0.9	-	1.3	> 1.3
1.2	< 1.0	1.0	-	1.4	> 1.4
1.3	< 1.1	1.1	-	1.5	> 1.5
1.4	< 1.2	1.2	-	1.6	> 1.6
1.5	< 1.3	1.3	-	1.7	> 1.7
1.6	< 1.4	1.4	-	1.8	> 1.8
1.7	< 1.4	1.4	-	2.0	> 2.0
1.8	< 1.5	1.5	-	2.1	> 2.1
1.9	< 1.6	1.6	-	2.2	> 2.2
2.0	< 1.7	1.7	-	2.3	> 2.3
2.1	< 1.8	1.8	-	2.4	> 2.4
2.2	< 1.9	1.9	-	2.5	> 2.5
2.3	< 2.0	2.0	-	2.6	> 2.6
2.4	< 2.0	2.0	-	2.8	> 2.8
2.5	< 2.1	2.1	-	2.9	> 2.9
2.6	< 2.2	2.2	-	3.0	> 3.0
2.7	< 2.3	2.3	-	3.1	> 3.1
2.8	< 2.4	2.4	-	3.2	> 3.2
2.9	< 2.5	2.5	-	3.3	> 3.3
3.0	< 2.6	2.6	-	3.5	> 3.5
3.1	< 2.6	2.6	-	3.6	> 3.6
3.2	< 2.7	2.7	-	3.7	> 3.7
3.3	< 2.8	2.8	-	3.8	> 3.8
3.4	< 2.9	2.9	-	3.9	> 3.9
3.5	< 3.0	3.0	-	4.0	> 4.0
3.6	< 3.1	3.1	-	4.1	> 4.1
3.7	< 3.1	3.1	-	4.3	> 4.3
3.8	< 3.2	3.2	-	4.4	> 4.4
3.9	< 3.3	3.3	-	4.5	> 4.5
4.0	< 3.4	3.4	-	4.6	> 4.6
4.1	< 3.5	3.5	-	4.7	> 4.7
4.2	< 3.6	3.6	-	4.8	> 4.8
4.3	< 3.7	3.7	-	4.9	> 4.9
4.4	< 3.7	3.7	-	5.1	> 5.1
4.5	< 3.8	3.8	-	5.2	> 5.2
4.6	< 3.9	3.9	-	5.3	> 5.3
4.7	< 4.0	4.0	-	5.4	> 5.4
4.8	< 4.1	4.1	-	5.5	> 5.5
4.9	< 4.2	4.2	-	5.6	> 5.6
5.0	< 4.3	4.3	-	5.8	> 5.8

Routine quality check for on-line chlorine analyzer

The flowchart illustrates a means of performing the quality check of the on-line analyzer.



APPENDIX A
Initial Demonstration of Capability (IDC) for use with the Evoqua P334 Photometer (or A790 Titrator)

Date:	Operator:	Evoqua Instrument:

Perform five consecutive analysis of a water sample with constant chlorine concentration (the five analyses should be performed within a 20 minute period) & note all five readings below:

	Concentration	Lowest Allowable Concentration	Highest Allowable Concentration
Sample 1			
Sample 2			
Sample 3			
Sample 4			
Sample 5			

Calculate the allowable deviation by multiplying the result in sample 1 by 0.9 to gain the lowest allowable concentration deviation and multiplying the result in sample 1 by 1.1 to gain the highest allowable concentration deviation and note both results in the table above.

If the sample 2 through 5 do not fall within the allowable concentration ranges, repeat the testing procedure of 5 additional consecutive samples.

1. Calculate the mean (average): add all five sample concentration values and divide by 5 – note the result – Mean (X) = _____

2. Calculate the difference of each of the five samples from the mean and square the result and note the result in the table below:

Sample	Mean	Sample – Mean	(Sample - Mean) Squared
1			
2			
3			
4			
5			

Add these 5 squared results _____

Added result divided by 5: _____

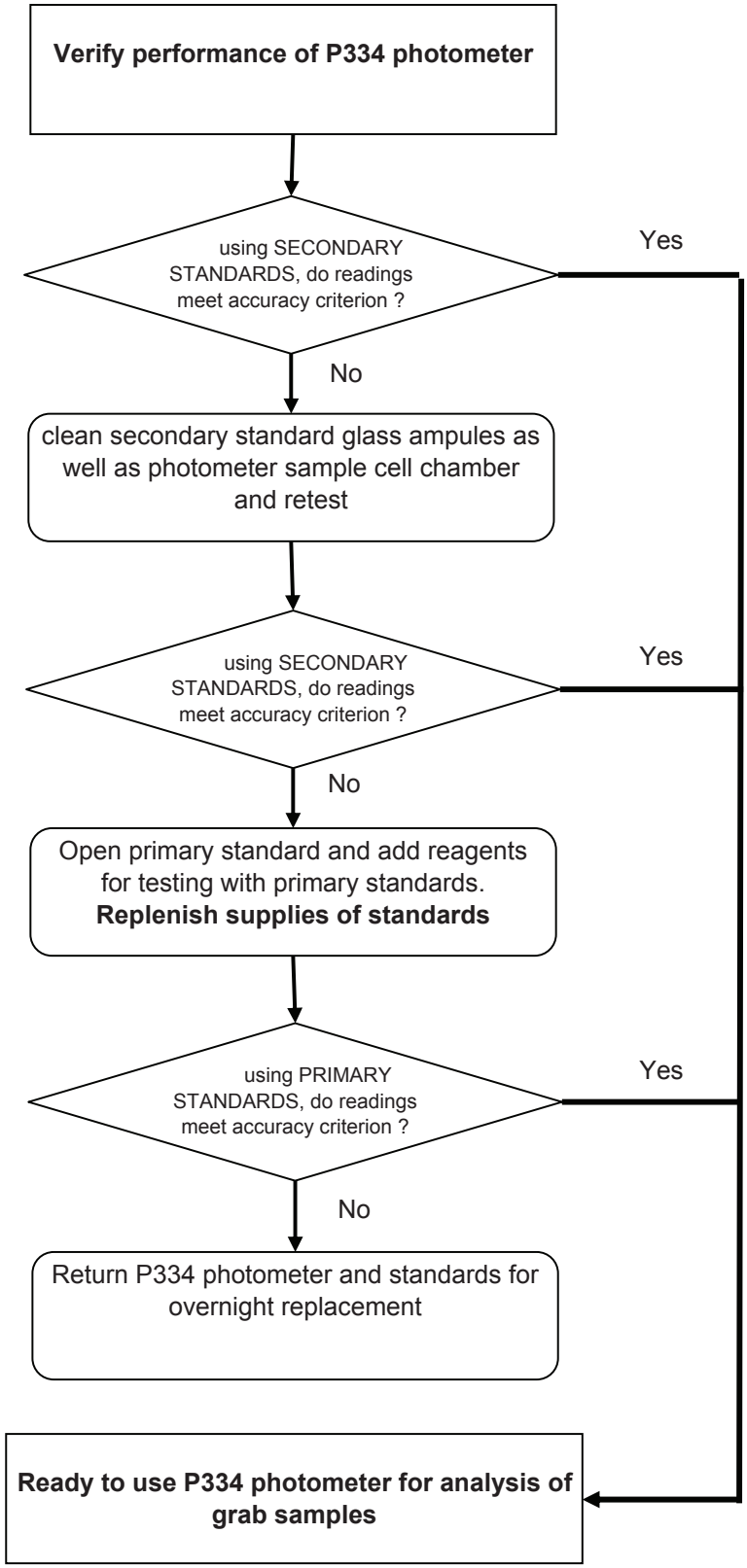
Now take square root of the result (calculator) (S) = _____

Divide the standard deviation (S) result by the mean (X) calculated earlier and multiply by 100 to calculate the required relative standard deviation.

RSD = (S) / X * 100 (result is noted as a %), where (S) is the standard deviation and X is the mean.

The resulting RSD value must not exceed 15 %. _____

APPENDIX B
Troubleshooting the Evoqua P334 Photometer



APPENDIX C
Initial On-line Analyzer Initial Demonstration of Capability (IDC) Period

Date:	Operator:	Evoqua Instrument:

Period	Day	Date	Analyzer Reading	Grab Sample Reading
Initial on-line analyzer trial (IDC) period	1			
	2			
	3			
	4			
	5			
	6			
	7			
	8			
	9			
	10			
	11			
	12			
	13			
	14			

APPENDIX D

Spreadsheet to Set Up Routine On-analyzer Checks to Every 4th Day:

Date:	Operator:	Evoqua Instrument:

Period	Day	Date	Analyzer Reading	Grab Sample Reading	Date	Analyzer Reading	Grab Sample Reading
Initial calibration	1				Use the additional data blocks provided below if one of the calibration steps needs to be repeated.		
	2						
	3						
	4						
	5						
	6						
	7						
	8						
	9						
	10						
	11						
	12						
	13						
	14						
adjust frequency to every 3rd day	15						
	16						
	17						
	18						
	19						
	20						
	21						
	22						
	23						
adjust frequency to every 4th day	25						
	26						
	27						
	28						
	29						
	30						
	31						
	32						
	33						
	34						
	35						
	36						

<u>NOTE</u>: In order to proceed down the rows of comparison testing, the on-line analyzer concentration recorded must be within +/- 0.1 mg/l or +/- 15% (which ever is larger) of the grab sample measurement)

APPENDIX D (cont'd)
Spreadsheet to Set Up Routine On-analyzer Checks to Every 6th Day:

Date:	Operator:	Evoqua Instrument:

Period	Day	Date	Analyzer Reading	Grab Sample Reading	Date	Analyzer Reading	Grab Sample Reading
					Use the additional data blocks provided below if one of the calibration steps needs to be repeated.		
adjust frequency to every 5th day	37						
	38						
	39						
	40						
	41						
	42						
	43						
	44						
	45						
	46						
	47						
	48						
	49						
	50						
	51						
adjust frequency to every 6th day	52						
	53						
	54						
	55						
	56						
	57						
	58						
	59						
	60						
	61						
	62						
	63						
	64						
	65						
	66						
	67						
	68						
	69						

APPENDIX D (cont'd)
Spreadsheet to Set Up Routine On-analyzer Checks to Every 7th Day:

Date:	Operator:	Evoqua Instrument:

Period	Day	Date	Analyzer Reading	Grab Sample Reading	Date	Analyzer Reading	Grab Sample Reading
					Use the additional data blocks provided below if one of the calibration steps needs to be repeated.		
adjust frequency to every7th day	70						
	71						
	72						
	73						
	74						
	75						
	76						
	77						
	78						
	79						
	80						
	81						
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	90						