Wallace & Tiernan®

an evoqua brand

MICRO/2000® AND DEOX/2000® MEASUREMENT MODULE FOR SFC AND MFC ANALYZER/CONTROLLER

BOOK NO. WT.050.585.003.UA.IM.0714

W3T112426

MICRO/2000® AND DEOX/2000®
MEASUREMENT MODULE
FOR SFC AND MFC
ANALYZER / CONTROLLER

BOOK NO. WT.050.585.003.UA.IM.0714

W3T112426

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 instruction 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 ,must 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 importance 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 part

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, 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

SIEMENS plc
Priory Works, Tonbridge, Kent, TN11 OQL, England, UK, Tel: +44 (0)1732 771777

CE

EC-DECLARATION OF CONFORMITY

Directives covered by this declaration

2004/108/EC Electromagnetic Compatibility Directive (EMCD)

2006/95/EC Low Voltage Directive (LVD)

Products covered by this declaration

Micro 2000: W3T140872, W3T140873, W3T140871, W3T140874, W3T140749, W3T140750

Deox 2000: W3T140747, W3T140748

The products identified above comply with the requirements of the EMC Directive and with the principle elements of the safety objectives of the Low Voltage Directive. The following standards have been applied:

EMCD: BS EN 61326-1: 2006

LVD: BS EN 61010-1: 2001

The CE mark was first applied in 2010

Date of Declaration: 01/09/2010

.....

C.B. Dean
General Manager

SECTION 1

SECTION 1 - TECHNICAL DATA

List of Contents

1.1 Specifications

Micro/2000® and Deox/2000® measuring module for disinfectant (Micro/2000®) and chlorination/dechlorination (Deox/2000®)

Sensor input:	3 electrode cell
Principle of operation:	Potentiostatic amperometry
Temperature drift:	< 0.2 %
Linearity error:	< 0.1 %
Cell voltage:	250 mV
Cell current:	1 to 7 µA/mg/L
Temperature input:	PT 1000
Measuring range (Micro/2000®):	0.100, 0.200, 0.500, 1.00, 2.00, 5.00, 10.0, 20.0, 50.0, 100, 200
Units of measure (Micro/2000®):	µg/L, mg/L
Measuring range (Deox/2000® - defined as dechlorination value (-) to chlorination (+))	-0.50 - +0.50, -1.00 - +1.00, -2.00 - +2.00, -2.50 - +2.50, -5.00 - +5.00, -10.0 - +10.0
Units of measure (Deox/2000®):	mg/L
Measurands (Micro/2000®):	Free chlorine, total chlorine, chlorine dioxide, potassium permanganate, ozone
Measurands (Deox/2000®):	Sulfur dioxide - total chlorine Sodium bisulfite - total chlorine
Sensitivity:	Micro/2000® - 0.001 ppm or 1 % full scale (whichever is greater) Deox/2000® - 0.01 ppm or 5 % full scale (whichever is greater)
Protection Category:	Enclosure - Nema 12 (IP44); CE Version Enclosure - NEMA 4X (IP 66), CE
Power Supply:	230V ± 10%, 50/60 Hz, 15W; Fuse - 200 mA, 5 x 20 mm, Fast acting
Operating Conditions:	Ambient Temperature - 35 to 125 °F (2 to 52 °C) Sample Temperature - 26 to 125 °F (-3 to 52 °C) Storage Temperature - 4 to 158 °F (-16 to 70 °C)

1.1.1 Micro/2000® and Deox/2000® Flow Block Assembly

Housing

Facade Dimensions (W x H x D):	13” x 13” x 10” (330mm x 330mm x 254mm)
Weight:	approx. 20 Lbs (9.1 kg)

Connections

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

Flow control valve (to sample inlet water line accessories)

Flow rate:	Micro/2000® - approx. 1 to 3 gpm (3.8 to 11.31 l/m) Deox/2000® - approx. 2 to 5 gpm (7.6 to 18.9 l/m)
Control range:	3 to 58 psi (0.2 to 4.0 bar)
Back-pressure:	0 psi (0 bar) (free drain)

Sample water

Water quality:	ultra pure, potable, industrial, municipal and industrial waste, dechlorinated waste (Deox/2000®)
Sample water temperature:	max. 122 °F (50 °C)

1.2 Electrodes and Sensors

Micro/2000® and Deox/2000® 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:	Micro/2000: 100 µg/L - 200 mg/L Deox/2000: ±0.50 mg/L - ±10.0 mg/L
Upot:	0 to 1000 mV
Reference electrode:	silver/silver halide/potassium halide solution
Working electrode:	platinum
Storage temperature:	14 to 86 °F (-10 to 30 °C)
Max. pressure:	5 psi (0.4 bar) at pump suction
Water quality:	clean water, potable water quality, municipal & industrial waste, seawater
Flow:	2 g/h (6 l/h), as constant as possible, into sample line
Service Life:	life of the electrodes in operation approx. 3-5 years
Cross-sensitivity:	ozone, bromine, chlorine dioxide, hydrogen peroxide, strong oxidants

1.3 Scope of Supply

1.3.1 Standard

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

Electronic module
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 available with or without Process Control option.

1.4 Description

1.4.1 Versions

The SFC and MFC are available in two different versions (see section 3.1, "Versions), each in two voltage variations:

- 100 to 240 VAC
- 24 VDC

Depending on the application, they 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

A	Cover
B	Cell body with sensor
C	Peristaltic pump
D	Inlet Shut-off Valve
E	Bypass y-strainer with flow control valve
F	Inlet control valve
G	Drain hose

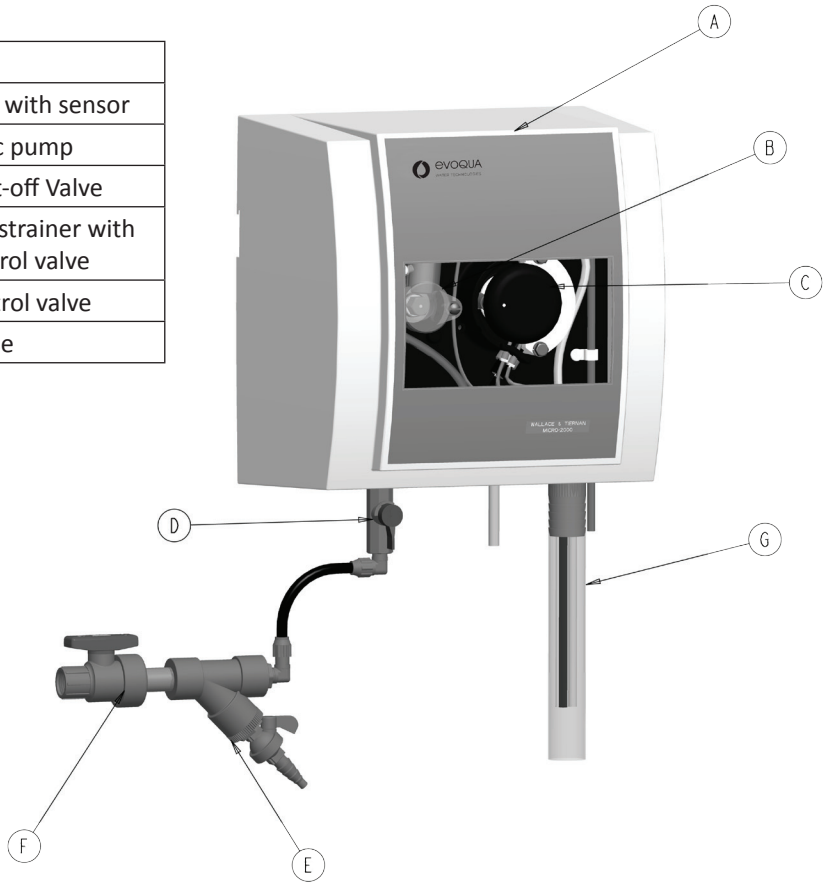


Figure 1.1

1.5 Design

1.5.1 Overall Design

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

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

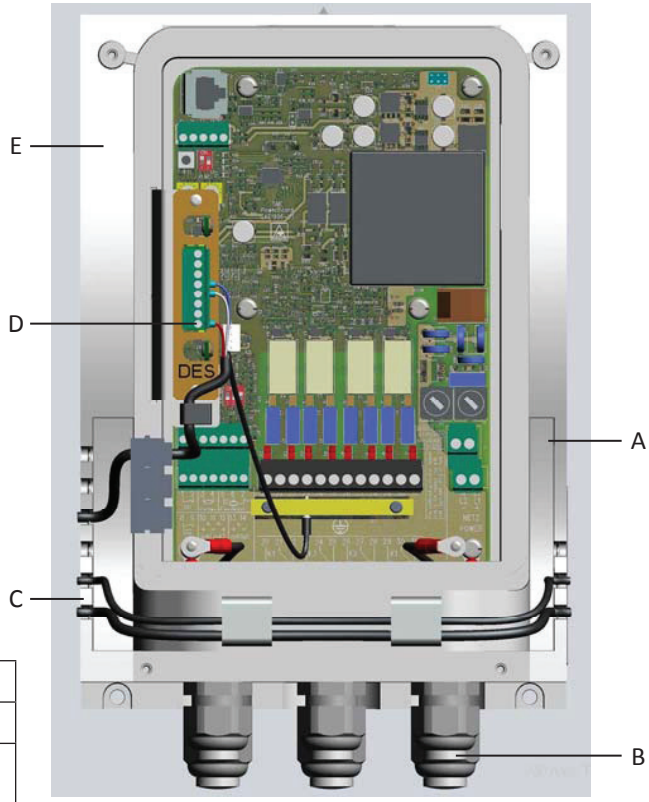
Figure 1.2 - SFC Cl_2 with Depolox® 5 flow block assembly

1.5.2 Electronic Module

The 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 1.3 - SFC basic with card and cable

1.5.3 Micro/2000® and Deox/2000® Flow Block Assembly

The Micro/2000® and Deox/2000® flow block assembly contains the following:

- Cell body with cover
- Flow control valve (mounted externally)
- By-pass strainer (mounted externally)
- Shut-off valve (mounted externally)
- 3 electrode probe for free and total chlorine, chlorine dioxide, ozone, potassium permanganate, sulfur dioxide, sodium bisulfite
- Drain

The cell body can be equipped with one sensor.

A	Cover
B	Cell body with sensor
C	Peristaltic pump
D	Inlet Shut-off Valve
E	Bypass y-strainer with flow control valve
F	Inlet control valve
G	Drain hose

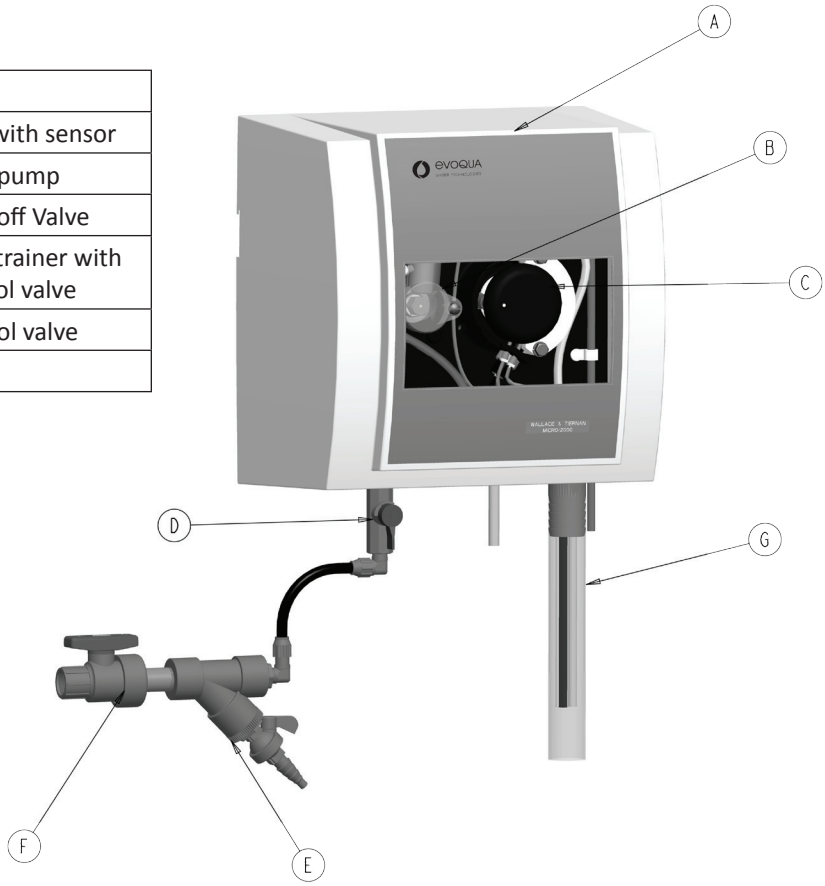


Figure 1.4

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 electronics, see section 3.2, "Measurement Inputs".

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

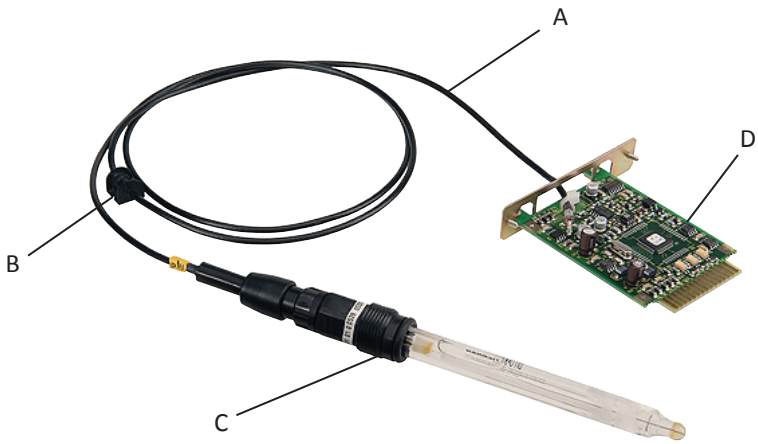


Figure 1.5 - Example sensor measuring module pH

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 and 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 1.1, "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 50 °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 four 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 50.590.100.050)

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 50.590.100.060):

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:

The following table contains the individual commissioning steps in their correct sequence. More detailed information is contained in the chapters listed in the "Chapter Reference" 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	☐
3	Insert the sensors and connect	2.3.3	☐
4	Pour in the cell sand	2.3.2	☐
5	Insert the labeling field in the housing cover	2.3.7	☐
6	Close the housing cover	2.3.8	☐
7	Check measuring range, adjust if necessary	4.3.1	☐
	Input and output settings:		
8	Check flow rate signal settings such as signal, unit, factor, format, measuring range start and end value, adjust if necessary	4.3.1	☐
9	Check flow rate limit values, adjust if necessary	4.3.1	☐
10	Calibrate the fitted sensors after approx. 1 hour running-in time	4.4	☐
11	Repeat calibration after 24 hours running time	4.4	☐

2.3.2 Pour in the Cell Sand (only with Micro/2000® and Deox/2000® units)

Adding grit to Micro/2000® and Deox/2000® flow block.

a. Remove probe from sample cell.
b. Wet finger tip.
c. Insert wet finger into supplied grit tube (see Figure 2.1). Some grit will cling to tip of wet finger (see Figure 2.2).
d. Dip finger into sample cell water, grit will rinse into flow (see Figure 2.3).
e. Replace probe in sample cell.

Figure 2.1

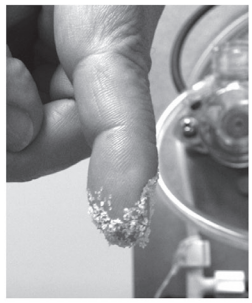


Figure 2.2

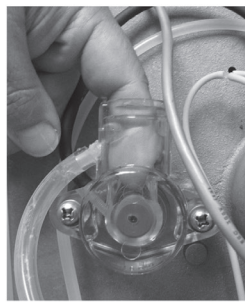


Figure 2.3

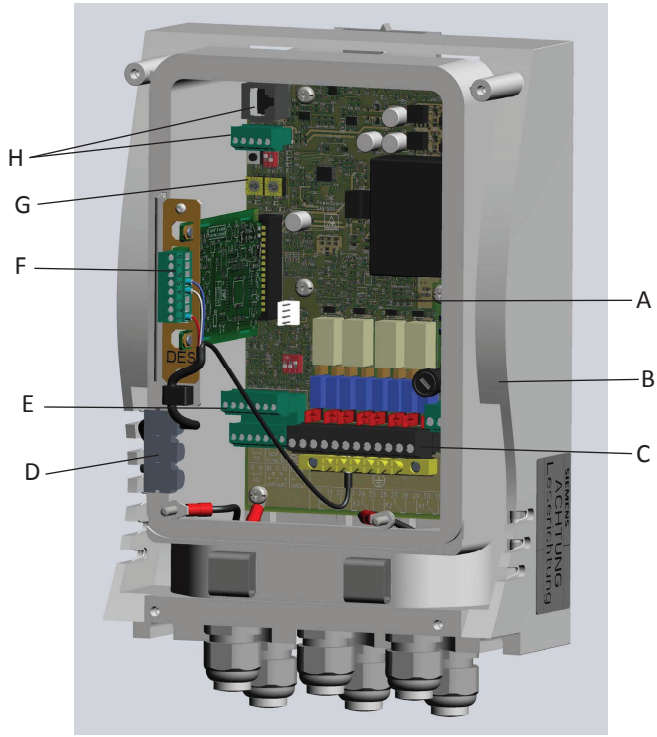
2.3.3 Insert the Sensors and Connect

1. Remove the protection caps from the sensors.

2. Install sensors in the cell body cover.

NOTE: 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 2.4 - 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.

4. It is recommended the cable glands in the bottom of the housing be used for routing the Micro/2000® and Deox/2000® sensor cable.

2.3.4 Installing Reagent Hardware (See Dwg. 50.505.020.010)

WARNING: TO AVOID POSSIBLE SEVERE PERSONAL INJURY OR EQUIPMENT DAMAGE, DO NOT SERVICE THE METERING PUMP WHILE POWER IS APPLIED TO THE PUMP. THE MOTOR HAS ENOUGH TORQUE TO CAUSE SEVERE PAIN AND INJURY IF FINGERS ARE CAUGHT IN THE PUMPING MECHANISM.

WARNING: TO AVOID POSSIBLE SEVERE PERSONAL INJURY OR EQUIPMENT DAMAGE, DO NOT REMOVE THE PUMP OCCLUSION RING WHILE THERE IS ANY WATER PRESSURE AT THE INLET TO THE ANALYZER. IF THE PUMP OCCLUSION RING IS REMOVED WHILE PRESSURE IS APPLIED TO THE PUMP, WATER (POSSIBLY CONTAINING ACID REAGENTS) CAN BE SPRAYED FROM THE DISCHARGE SIDE OF THE PUMP. SPRAYED WATER MAY RESULT IN DAMAGE TO THE EQUIPMENT OR PERSONAL INJURY AS IT MAY CONTAIN SOME REAGENT OR MAY BE CONTAMINATED.

NOTE: It is recommended that water-flow to the wetside should be blocked and the reagent reservoirs are not filled until installation is complete. The metering pump may be operated/tested without reagents or water without damage; however, it is advisable to pour enough water into the cell to cover the impeller (mixer) before powering the unit to prevent damage to the impeller shaft seal from running the unit dry.

Before attaching the reagent bottle mounting brackets to mounting surface, install the retaining strap through the slots in the bracket. The brackets should be located within four feet of the analyzer.

- Install the reagent tubing as follows:

  Uncoil the reagent tubing segment(s) (one per liquid reagent) and remove the rigid tubing segments (1/32-inch O.D., 13-inch long) from the protective packaging. Using two of the three tubing segments, firmly insert one rigid tube into one end of each piece of flexible tubing. Then insert the exposed rigid end into the small hole in the cap of each of the reagent bottles mounted in the bottle brackets. Route the tubing under the facade and connect to the pump reagent tubes.

- For information on installing or replacing reagent tube units, refer to section 5.2.4, "Pump Tubing Units Replacement".

- Tubing Connections:

  Cut the excess reagent tubing and connect to the reagent fittings at the inlet to the reagent tube units.

  Install the “T” fitting provided in the tubing at the inlet to (bottom of) the analyzer metering pump. To do this, cut the tubing about one inch from the entrance to the pump and reconnect the tubing using the “T” fitting. This will leave the middle (small) end of the fitting unused.

- If two reagent tube units (two liquid reagents) are used:

  Install two, one-inch segments of the reagent tubing, cut from the eight-foot segment of reagent tube, on the fittings at the discharge (upper) end of the reagent tube units and join the two segments with the “Y” fitting provided.

  Using approximately seven inches of reagent tubing, connect the reagent discharge fitting to the tee fitting at the pump sample intake.

2.3.5 Connecting the Sample Water

Micro/2000® and Deox/2000® water sample and sample line requirements:

Actual requirements will vary with the equipment application, but the following should be used as general guidelines. Sample plumbing design is the most important part of a reliable monitoring system.

A well-designed sampling system minimizes response time, prevents fouling of the sample line plumbing and the analyzer, and provides a fully developed turbulent flow to the analyzer.

Response time is minimized by locating the analyzer close to the point of sample take-off and by designing for a moderately high flow velocity in the sample line, 5 ft/sec. Flow velocity also helps in reducing sample line deposits.

Plastic pipe or tubing (PVC, ABS, or polyethylene) is preferred for sample line plumbing due to its corrosion resistance, lack of residual demand, and smooth surface finish, which resists deposits. Never use copper pipe or tubing. Avoid the use of metal lines or fittings.

Sample plumbing pipe (or tubing) size is a function of the available pressure at the sample point (or sample pump discharge) along with the sample line length and flow velocity required.

- Potable Water

  Four characteristics typical of potable water are that, generally, it is low in particulates, it is available at reasonably high pressure (>15 psi), its use should be minimized, and the wetside may be mounted within 25 feet of the sample point. In such applications, the sample may be run through 1/4-inch pipe or tubing and the bypass flow on the Y-strainer may be shut. It should be opened only intermittently to flush the strainer element and sample line. Then only (approximately) 500 mL/min of the sample is required, which is the internal analyzer sample requirement.

- Wastewater

  Frequently, wastewater is high in particulates and biological growth potential. The sample is taken from open channel flow, with no pressure available at the sample point. Additionally, the wetside must frequently be mounted a significant distance from the sample point (inside and protected from weather). Here, a sample pump is required and the Y- strainer bypass flow valve should be open to allow continuous flushing of the strainer element. A high flow, low pressure, open impeller-type pump works well in this environment. Typical systems use 1/2-inch pipe or tubing that bypasses

2 gpm through the Y-strainer or 3/4-inch pipe that bypasses 5 gpm. This results in a flow velocity of about four feet per second and a pressure drop of about 4 psi per 100 ft of sample line.

Wastewater will frequently exhibit high biological growth potential; therefore, the sample line may need to be treated with a cleaning (biocidal) agent (typically chlorine) to inhibit growth in the sample line. Biological growth may clog fittings in the sample line or wetside and consume (process) chlorine residual during the sample transit time in the sample line. For sample line dosing, the cleaning agent is periodically injected into the sample line near the sample intake point.

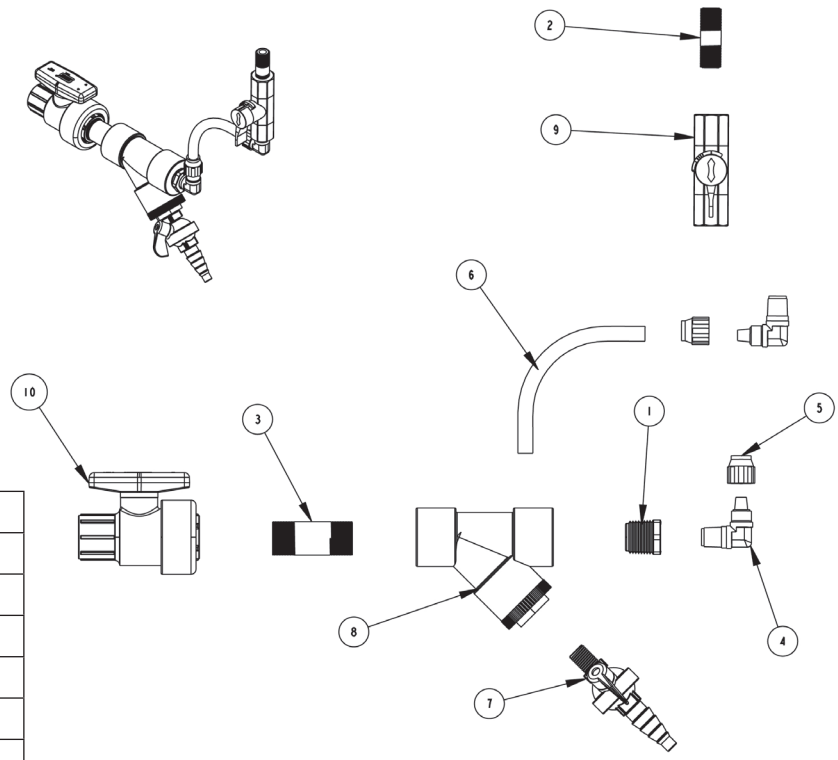
A self-flushing, 1/2-inch Y-strainer is provided and should be located at the analyzer. Valves are provided to be installed on the Y-strainer bypass discharge to control bypass flow and at the filtered discharge from the Y-strainer to the 1/4-inch sample inlet at the base of the flow block.

The analyzer enclosure is equipped with a hose adapter drain connection for 1-1/4-inch hose.

a. Slip 1-1/4 inch drain hose over the end of the drain fitting and run hose to a waste drain.

b. Connect a hose from the Y-strainer bypass valve to the waste drain.

c. Inside the wetside, insert the analyzer bypass tubing and cell discharge tubing (both 1/4-inch OD translucent) into the drain fitting.



1	Reducing Bushing, 1/4" x 1/2" NPT
2	1/4" x 1/4" Nipple
3	1/2" Nipple
4	90° Elbow
5	Nut-Union, 1/2-20 Thread
6	1/4" ID Tubing
7	Valve
8	Y-Strainer
9	1/4" T x T Labcock Valve
10	1/2" Single Entry Ball Valve

Figure 2.5 - Micro/2000® and Deox/2000® sample line

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.

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

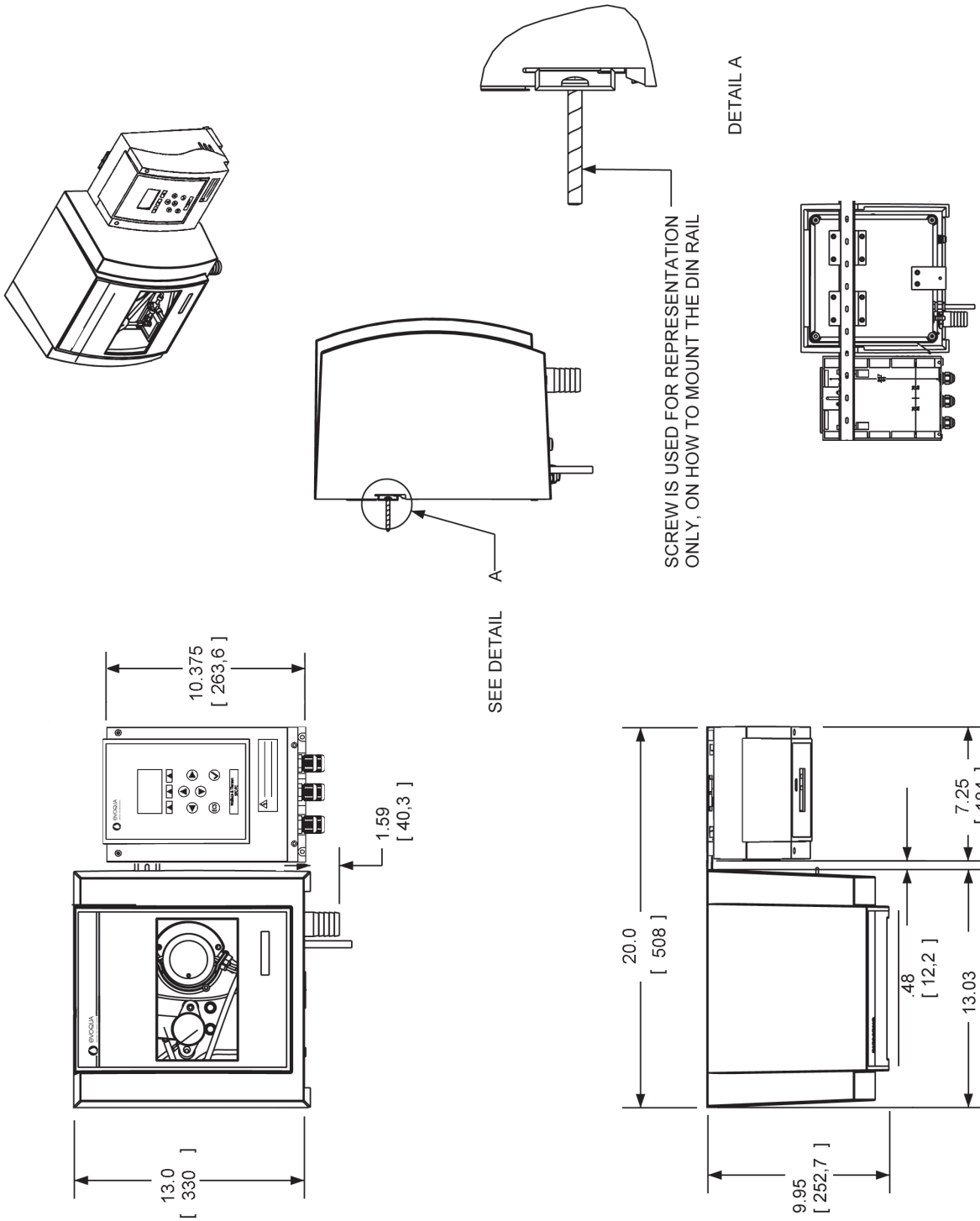
1. Ensure that the cable bushes are fitted correctly.
2. Carefully fit the housing cover of the electronic module and secure with the four housing screws.
3. Carefully place the housing cover onto the flow block assembly and snap into place.

2.4 System Shut Down

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

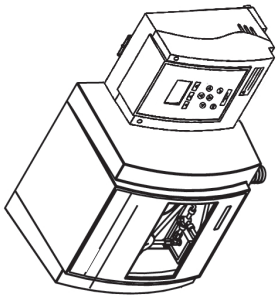
NOTE: If the installation site of the flow block assembly is not frost-free, the system must be shut down prior to any possible frost formation.

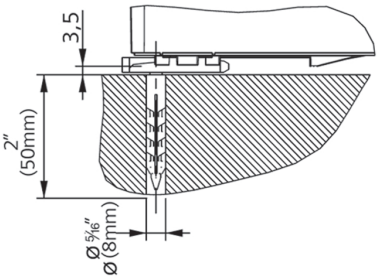
1. Switch off the power supply.
2. Drain the sample water supply line and drainage line (hold container underneath).
3. Empty cell bodies and remove grit.
4. Dismantle the filter housing and/or check valve housing.
5. When the remaining water has drained from the flow control valve, refit the filter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

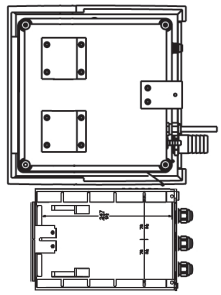


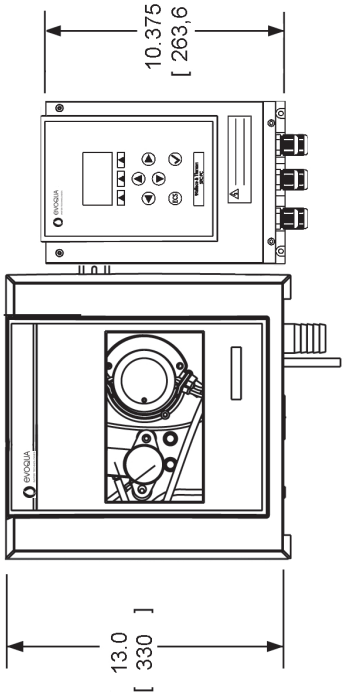
TOP HAT RAIL ASSEMBLY - DIMENSIONS
Micro/2000® and Deox/2000® Flow Block

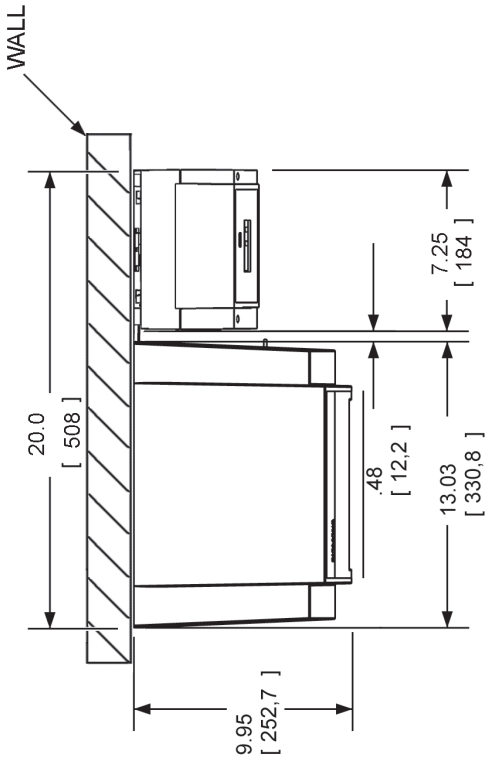
50.590.100.050
ISSUE 1 7-14





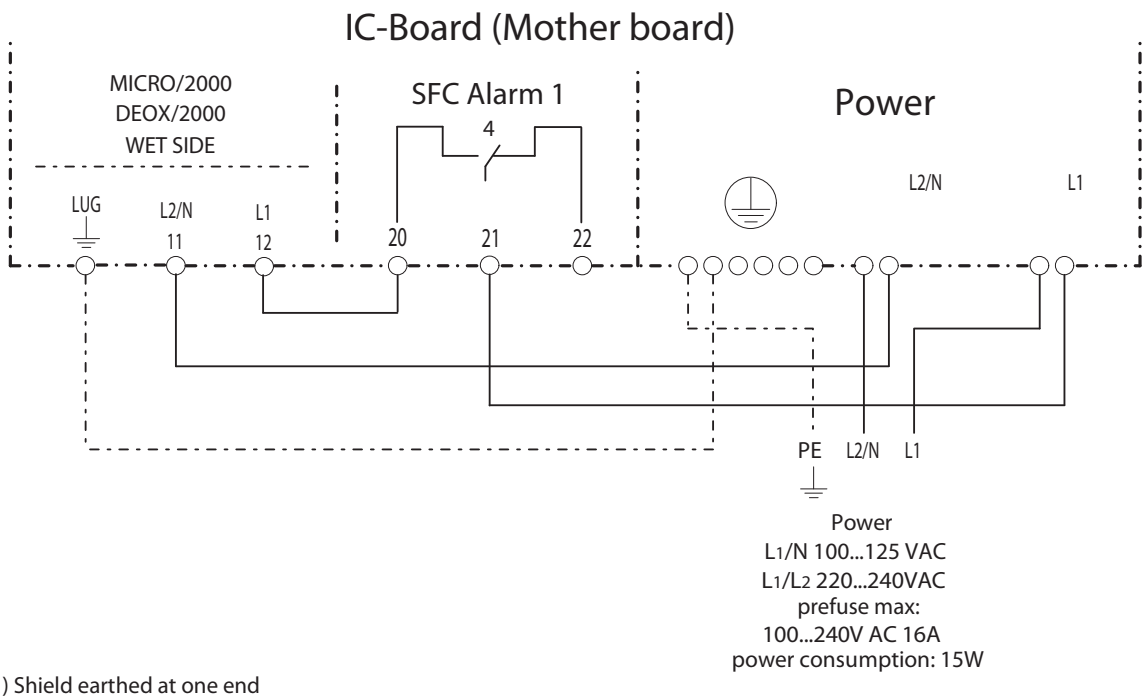


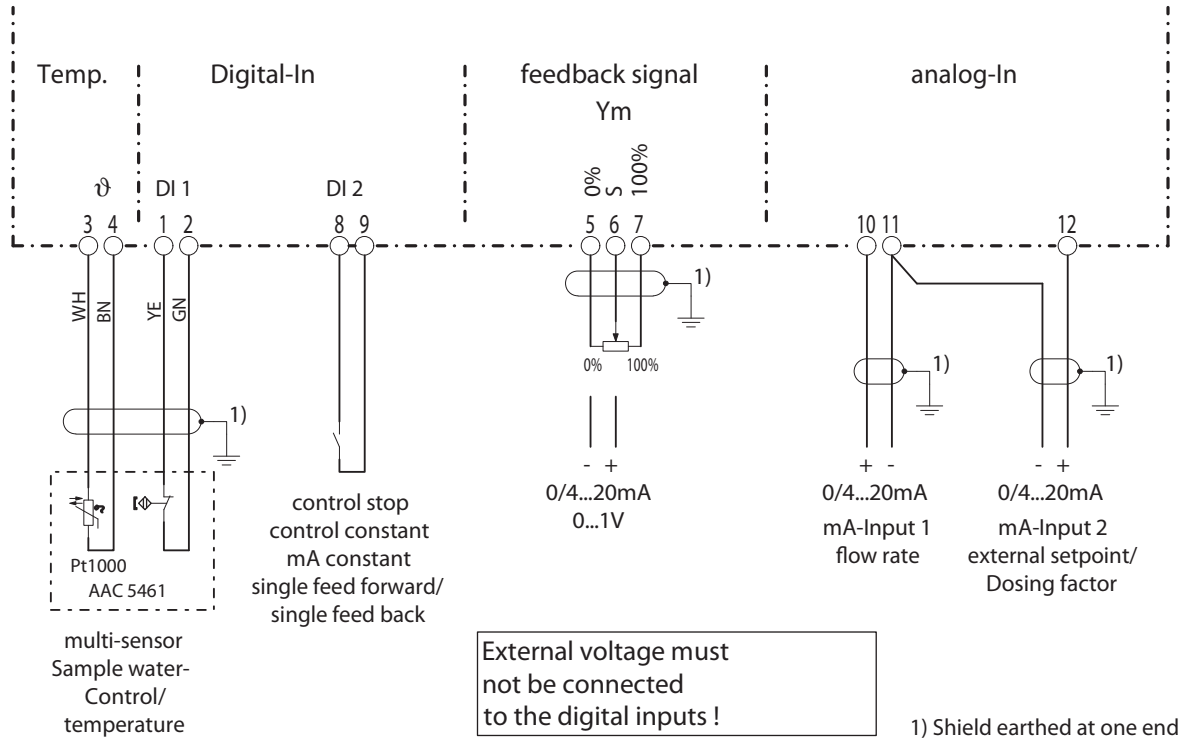




WALLMOUNT ASSEMBLY - DIMENSIONS
Micro/2000® and Deox/2000® Flow Block

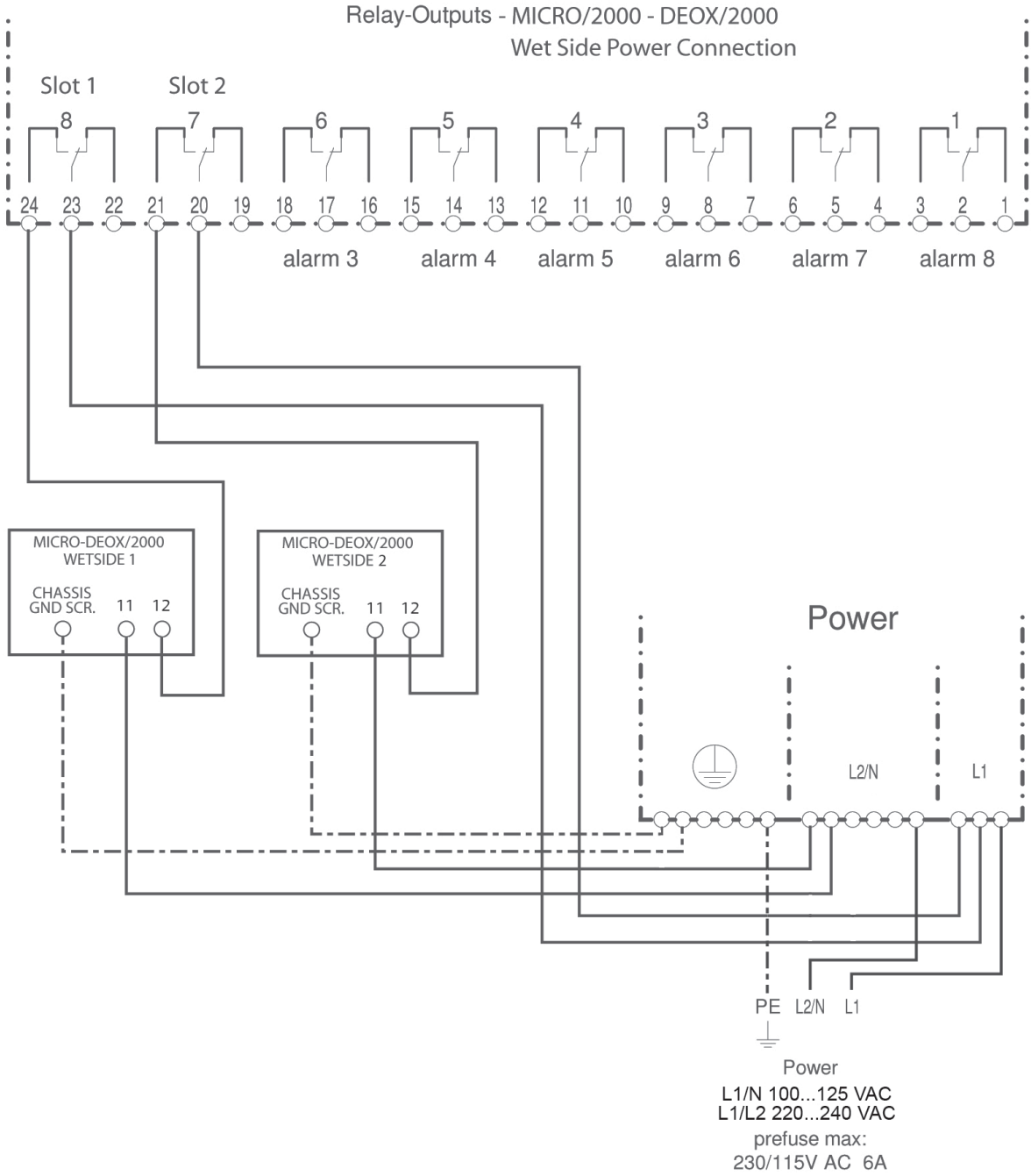
50.590.100.060
ISSUE 1 7-14





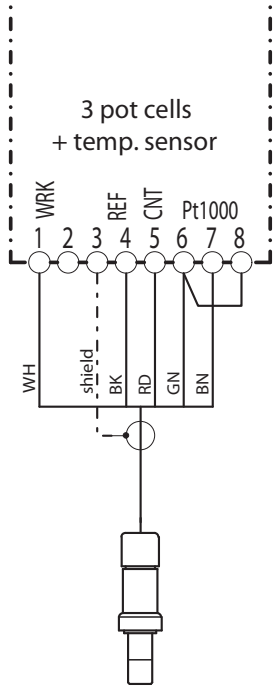
SFC AND MFC - SCHEMATIC WIRING
SFC

50.585.155.050A
ISSUE 1 1-11



SFC AND MFC - SCHEMATIC WIRING
MFC

50.585.155.050B
ISSUE 1 1-11

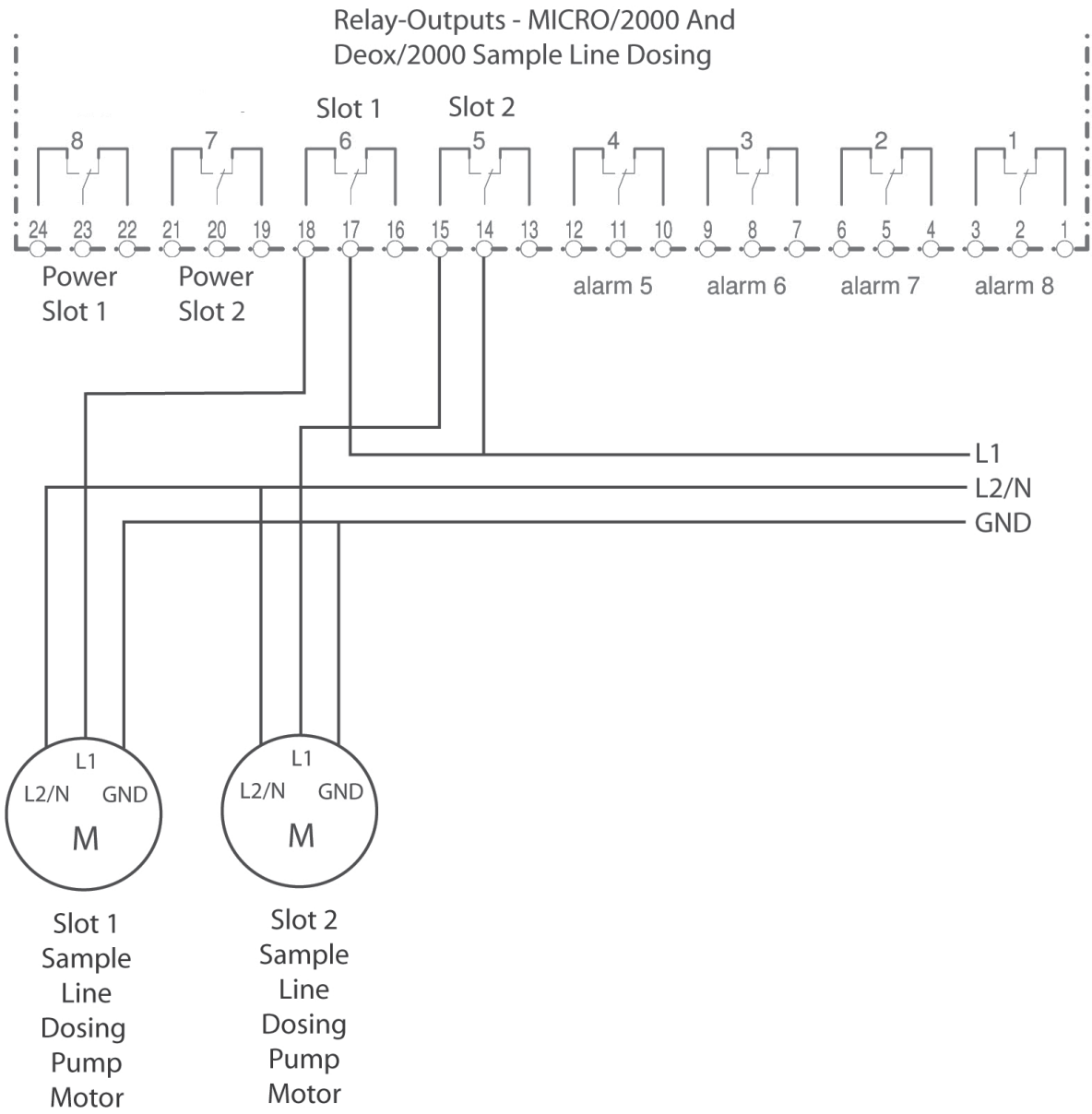


Micro 2000
Dcox 2000

1) Shield earthed at one end

SFC AND MFC - SCHEMATIC WIRING
SFC Sensor/Module Connection for U.S. Version

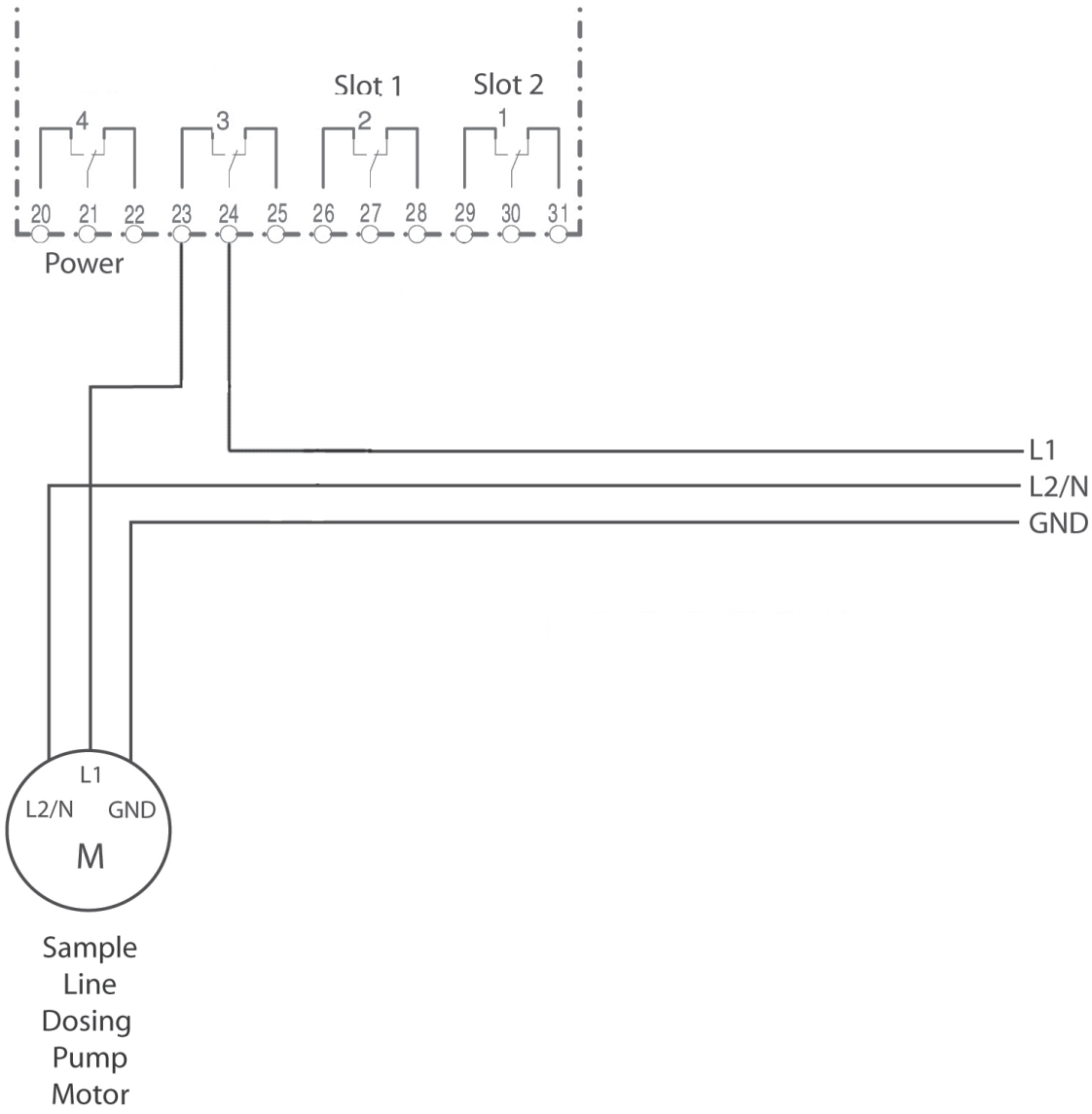
50.585.155.050C
ISSUE 1 9-10



SFC AND MFC - SCHEMATIC WIRING
MFC

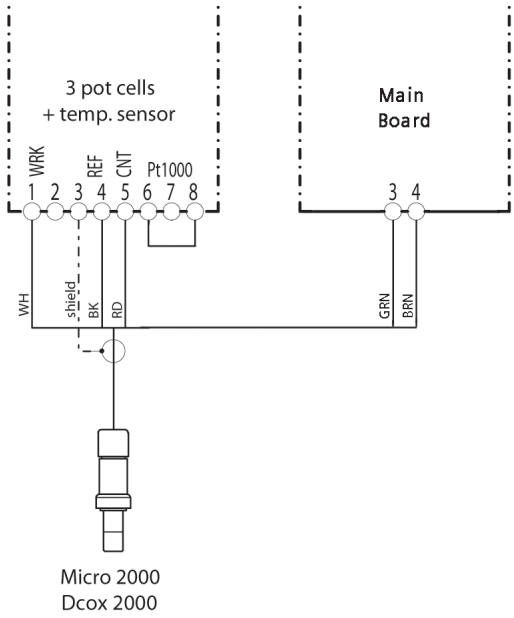
50.585.155.050D
ISSUE 0 7-09

SFC Relay-Outputs - MICRO/2000 And Deox/2000 Sample Line Dosing



SFC AND MFC - SCHEMATIC WIRING
SFC

50.585.155.050E
ISSUE 0 7-09



1) Shield earthed at one end

SFC AND MFC - SCHEMATIC WIRING
SFC Sensor/Module Connection for CE Version

50.585.155.050F
ISSUE 0 9-10

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 (see section 1.1) which differ in terms of their inputs and outputs. Version 1 analyzer or analyzer/controller supports all of the applications described in section 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 fluoride 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
- sodium 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.

The integrated 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 selected using softkeys.

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

3.1.2 Micro/2000® and Deox/2000® Flow Block Assembly

These flow block assemblies guarantee 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, Micro/2000® and Deox/2000® flow block electrodes
- Optimum flow around all sensors

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 chlorine (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

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 when the unit Version 1, 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. No controller output is available for application 1.

3.2.1 Micro/2000® and Deox/2000® Flow Block Assembly

Micro/2000® and Deox/2000® Flow Block Assembly - 3 Electrode Measurement for Total and Free Cl_2, ClO_2, O_3, or $KMnO_4$ (Micro/2000®), Total Cl_2 and SO_2 or $NaHSO_3$ (Deox/2000®)

A sensor module (“DES” for 3 electrode cells) and terminal strips are used to connect the Micro/2000® and Deox/2000® flow block assembly to the SFC. Various controller function are available depending on the application selected.

3.2.1.1 Micro/2000® Flow Block Theory of Operation

The measurement of free chlorine is made directly at a buffered pH of 4 with pH 4 buffer or pH of 5 or 6 with carbon dioxide. The measurement of total chlorine is made by reacting the various chlorine species with potassium iodide at the buffered pH, then measuring the resulting iodine concentration.

The net reaction of chlorine with iodide is:

$Cl_2 + H_2O \rightarrow 2H^+ + OCl^- + Cl^-$ (hydrolysis of chlorine)

$OCl^- + 2I^- + 2H^+ \rightarrow H_2O + 2Cl^- + I_2$

The analyzer measuring process is as follows:

A continuous sample is delivered to the analyzer. A flushing Y-strainer divides the sample into two streams—the larger bypass stream continuously flushes the Y-strainer and the smaller stream, about 500 ml/min, flows into the analyzer. Most of the flow into the analyzer is again bypassed, but a small portion is metered from this flow by a peristaltic metering pump. The reagents, pH 4 buffer or carbon dioxide for the measurement of free chlorine residual and potassium iodide solution with detergent for the measurement of total chlorine residual, are also metered by the same pump. The reagents are then mixed with the sample as the sample is pumped to the analyzer cell. A three-electrode amperometric “probe” is immersed in the sample in the cell. A rotating impeller stirs the sample and maintains a constant sample velocity across the electrode surfaces. It also agitates the grit used to clean deposits from the electrodes, improving the stability of calibration. The amperometric cell produces a signal (electrical current) proportional to the oxidant (e.g., chlorine) concentration in the cell.

3.2.1.2 Deox/2000® Flow Block Theory of Operation

The Deox/2000® Analyzer gives a continuous on-line determination of SO_2 residuals by metering a predetermined amount of Chloramine-T, along with pH4 buffer and potassium iodide, into a metered quantity of process water sample. This constant level addition of iodine is termed the “Iodine Bias”. The Deox/2000® analyzer detects this iodine level as a proportional electric current (mA) in the same manner it does with chlorine. Once in operation, change in current indicates the presence of a chlorine or SO_2 residual in the process water—depending on whether the change is an increase or decrease in iodine concentration, respectively.

Iodine reacts with SO_2 in the same manner that chlorine reacts with SO_2, therefore, the amount of iodine consumed represents the amount of SO_2 residual in the water. Conversely, if there is an increase in the iodine concentration (above the bias concentration), a chlorine residual is indicated and can be accurately determined.

Iodine is used as the "biasing reagent" because it is less likely (and slower) to react with organic oxidant demand, making determination of residuals more reliable than a hypochlorite (chlorine) biased measurement. Because iodine is not stable in solution (i.e., is volatized and reacts readily), Chloramine-T ($CH_3C_6H_4$-4-$SO_2NClNa \bullet 3H_2O$) is reacted with potassium iodide (KI) and releases iodine as used. This conversion reaction takes place in the long length of "reaction" tubing where the mixed reagents react before entering the water sample. The chemistry of this reaction is:

$$CH_3C_6H_4\text{-}4SO_2NClNa+2KI+HAc \rightarrow I_2+KAc+KCl+CH_3C_6H_4\text{-}4SO_2NHNa$$

The net reaction of SO_2 with iodine is:

(consumption of iodine)

$$SO_2 + H_2O \rightarrow H_2SO_3 \text{ (hydrolysis of sulfur dioxide)}$$

$$H_2SO_3 + H_2O + I_2 \rightarrow H_2SO_4 + 2HI$$

The net reaction of chlorine with iodide is:

(formation of iodine)

$$Cl_2 + H_2O \rightarrow 2H+ + OCl- + Cl- \text{ (hydrolysis of chlorine)}$$

$$ClO- + 2I- \rightarrow O2Cl- + I_2$$

The analyzer measuring process is as follows:

A continuous sample is delivered to the analyzer. A flushing Y-strainer divides the sample into two streams—the larger bypass stream continuously flushes the Y-strainer strainer element and the smaller stream, about 500 ml/min, flows into the analyzer. Most of the flow into the analyzer is again bypassed, but a small portion is metered from this flow by a peristaltic metering pump. The reagents, Chloramine-T in pH4 buffer and potassium iodide with detergent in distilled water, are also metered by the same pump. As the reagents are discharged from the pump, they are combined and reacted in a length of tubing referred to as the reaction tubing. The reacted reagents are then mixed with the sample inlet to the metering pump and the "Biased" sample then enters the analyzer cell. A three- electrode "probe" is immersed in the sample in the cell. A rotating impeller stirs the sample and maintains a constant sample velocity across the electrode surfaces. It also agitates the grit used to clean deposits from the electrodes, improving the stability of calibration. The three-electrode amperometric cell produces a signal (electrical current) proportional to the oxidant (iodine) concentration in the cell.

3.2.1.3 Sample Flow Adjustment

Before starting the sample pump or otherwise starting sample flow, check that the bypass control valve on the bypass leg of the Y-strainer, at the analyzer, is open and that the sample flow control valve to the inlet of the analyzer is closed.

CAUTION: To prevent possible equipment damage, apply up to a maximum of 5 psi water pressure to the analyzer sample input. The tubing in the analyzer metering pump cannot withstand more than 5 psi pressure. If pressure in excess of 5 psi is applied to the analyzer input, fluid may be sprayed from the analyzer metering pump inlet.

3.2.1.4 Preparation of Reagents - Micro/2000® and Deox/2000® Flow Block

WARNING: WEAR RECOMMENDED PROTECTIVE EYEWEAR WHEN SERVICING THE WET COMPONENTS OF THE ANALYZER, PARTICULARLY WHEN SERVICING REAGENTS AND REAGENT LINES. THE ANALYZER USES CHEMICALS THAT CAN CAUSE SEVERE PERSONAL INJURY BY CHEMICAL BURNS ON CONTACT WITH EYES. RINSE ANY AREA OF CONTACT IMMEDIATELY. IF CHEMICALS CONTACT EYES, RINSE FROM EYES AND SEEK IMMEDIATE MEDICAL ATTENTION

WARNING: PH4 BUFFER AND ACETIC ACID WILL SEVERELY IRRITATE EYES AND CAUSE CHEMICAL BURNS TO SKIN. ALWAYS WEAR APPROPRIATE PROTECTIVE EQUIPMENT DURING HANDLING. WHEN DILUTING ACID, ALWAYS POUR THE ACID INTO THE WATER, NEVER POUR WATER INTO ACID. USE CAUTION WHEN DISCONNECTING THE REAGENT TUBING AND AVOID CONTACT WITH ANY FLUID THAT DRIPS FROM THE OPEN END. IT IS THE RESPONSIBILITY OF THE USER OF THE EQUIPMENT TO OBTAIN AND FOLLOW THE SAFETY PRECAUTIONS OF THE MANUFACTURER OF THE HAZARDOUS MATERIAL.

CHEMICALS FOR INDUSTRIAL USE: VAPOR MAY BE HARMFUL IF INHALED AND MAY BE FATAL IF SWALLOWED. LIQUID MAY CAUSE SEVERE BURNS TO SKIN AND EYES. AVOID CONTACT WITH EYES, SKIN, OR CLOTHING. WASH THOROUGHLY AFTER HANDLING. IN CASE OF SPILL, SOAK UP WITH SAND OR EARTH.

WHEN SERVICING LIQUID REAGENT LINES, PUMPS, OR REFILLING RESERVOIRS, TURN OFF PUMPS TO AVOID POSSIBLE SQUIRTING OF REAGENT. OBSERVE ALL SAFETY PRECAUTIONS RECOMMENDED BY THE REAGENT MANUFACTURER OR SUPPLIER.

WARNING: HANDLE IN ACCORDANCE WITH MANUFACTURER'S RECOMMENDATIONS. DO NOT MIX WITH OTHER CHEMICALS. DISPOSE OF ANY CHEMICALS IN ACCORDANCE WITH ALL APPLICABLE FEDERAL, STATE AND LOCAL ENVIRONMENTAL REGULATIONS.

The type and number of reagents are determined by the specific application and residual requirements.

Preparation of pH4 Buffer

This reagent is available from Evoqua Water Technologies premixed in one-gallon plastic bottles. It may also be made on-site as follows: dissolve 919 grams of sodium acetate, trihydrate in approximately 1.5 liters of distilled water, then mix with 1.73 liters of glacial acetic acid and dilute with distilled water to obtain one gallon of reagent solution.

WARNING: GLACIAL ACETIC ACID WILL SEVERELY IRRITATE EYES AND CAUSE CHEMICAL BURNS TO SKIN. ALWAYS WEAR APPROPRIATE PROTECTIVE EQUIPMENT DURING HANDLING. WHEN DILUTING ACID, ALWAYS POUR ACID INTO WATER, NEVER POUR WATER INTO ACID. IT IS THE RESPONSIBILITY OF THE USER OF THE EQUIPMENT TO OBTAIN AND FOLLOW THE SAFETY PRECAUTIONS OF THE MANUFACTURER OF THE HAZARDOUS MATERIAL.

Preparation of Potassium Iodide Solution For Micro/2000®

NOTE: Potassium iodide solution is used only in the measurement of total chlorine. Therefore, this section does not apply to analyzers installed to measure free chlorine or potassium permanganate.

Potassium iodide (KI) is added to distilled water and fed into the water sample by the metering pump when measuring total chlorine. The KI reacts with the various forms of chlorine present to release a proportional amount of iodine. The amount of KI required is dependent upon the maximum range of the analyzer.

The quantity of KI required is calculated as follows:

50 + (4 * range) = grams KI

Example: Analyzer range: 5 mg/l

50 + (4 * 5) = 70 grams KI

CAUTION: Never mix potassium iodide (KI) with sulfuric acid, as free iodine will form immediately.

KI Consumption - Grams									
Range	.1	.2	.5	1	2	5	10	20	50
KI grams/gal	50	51	52	54	58	70	90	130	250

KI either in tablets or in granular form may be used. When using auxiliary KI tablets (U11829), one tablet equals 3 grams.

Preparation of Potassium Iodide Solution For Deox/2000®

Dissolve 120 grams of potassium iodide in enough distilled water to make one gallon of solution.

Preparation of Ammonium Sulfate Solution

Ammonium sulfate is used to eliminate free chlorine interference in analyzers monitoring potassium permanganate or chlorine dioxide residuals. It should be purchased in crystal form, technical or reagent grade. The crystal is then mixed with distilled water in the proportion of 36 grams per gallon of solution per maximum mg/l of free chlorine residual expected in the sample water. For example, if a residual of approximately 0.5 mg/l of free chlorine is the highest concentration normally expected then the reagent should be mixed as 18 grams (36 x 0.5) of ammonium sulfate with enough distilled water to make one gallon of solution.

Detergent Additive

Detergent additive (W2T12261 - one gallon, or W2T12260 - six ounce) is used to aid in cleaning and wetting of the system while the analyzer is in operation. Add one ounce of additive to one gallon of KI solution.

To avoid cross contamination of the reagents, always use the same reservoir for the same reagent. The reservoirs should be clearly labeled with the reagent they contain.

Use a funnel when filling reagent reservoirs. Refer to paragraph Refilling Reagent Reservoirs for instructions on re-filling the reservoirs once the analyzer is in operation.

Preparation of Chloramine-T

Dissolve the correct amount of Chloramine-T into one gallon of pH4 buffer solution (see chart).

RANGE	PACKAGE NO.	ADD NO. VIALS
± 0.5 mg/L	W2T8468 - 3 grams	1
± 1.0 mg/L	W2T8468 - 3 grams	2
± 2.5 mg/L	W2T8469 - 15 grams	1
± 5.0 mg/L	W2T8469 - 15 grams	2
± 10.0 mg/L	W2T8469 - 15 grams	4

Refilling Reagent Reservoirs

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

PH4 BUFFER AND ACETIC ACID WILL SEVERELY IRRITATE EYES AND CAUSE CHEMICAL BURNS TO SKIN. ALWAYS WEAR APPROPRIATE PROTECTIVE EQUIPMENT DURING HANDLING. WHEN DILUTING ACID, ALWAYS POUR THE ACID INTO THE WATER, NEVER POUR WATER INTO ACID. USE CAUTION WHEN DISCONNECTING THE REAGENT TUBING AND AVOID CONTACT WITH ANY FLUID THAT DRIPS FROM THE OPEN END. IT IS THE RESPONSIBILITY OF THE USER OF THE EQUIPMENT TO OBTAIN AND FOLLOW THE SAFETY PRECAUTIONS OF THE MANUFACTURER OF THE HAZARDOUS MATERIAL.

CHEMICALS FOR INDUSTRIAL USE: VAPOR MAY BE HARMFUL IF INHALED AND MAY BE FATAL IF SWALLOWED. LIQUID MAY CAUSE SEVERE BURNS OF SKIN AND EYES. AVOID CONTACT WITH EYES, SKIN, OR CLOTHING. WASH THOROUGHLY AFTER HANDLING. IN CASE OF SPILL, SOAK UP WITH SAND OR EARTH.

To avoid cross contamination of the reagents, always use each reservoir for the same reagent. The reservoirs should be clearly labeled with the name of the reagent they contain.

To fill reagent reservoirs, loosen and move or remove the threaded cap on the reservoir. Use a funnel when filling reagent reservoirs. The use of a funnel allows the reservoir to be filled without removing the rigid length of tubing from the reservoir. If the tubing is removed from the reservoir, keep it clean. Dirt can clog the tubing. If the tubing is removed from the reservoir while the metering pump is operating, air is drawn into the tubing. This causes a momentary disruption of service until the tubing is returned to the reservoir and the inducted air is purged from the tubing and pump.

Selection of Reagents

The Micro/2000® Residual Analyzer allows the flexibility to select from several analyzer sample conditioning chemicals (reagents). The choice of conditioning chemical is made to provide the best analyzer performance while considering chemical cost and handling requirements. Some applications require no chemical conditioning of the analyzer sample, while others may require a combination of chemicals. Sample conditioning may be used to provide a stable condition for residual measurement, to eliminate interference from background residuals that are not of interest, and to chemically convert residuals to a form that is conveniently measureable by the analyzer. Also, when required (e.g. with wastewater), detergent may be added to the liquid reagents to prevent the accumulation of grease in the analyzer. More specifically, the choice of chemicals for analyzer sample conditioning in a given application is based on three parameters;

- the residual to be monitored
- other (potentially interfering) residuals present
- water pH and alkalinity

Residual Form

- Chlorine dioxide and potassium permanganate monitoring
  The stability of the sample pH is not as critical when monitoring chlorine dioxide and potassium permanganate residuals as when measuring chlorine residuals. A sample pH change of 0.2 pH units between calibration will cause less than 5% error. Response to chlorine dioxide is somewhat improved at lower pH, however, and for best accuracy (stability) in the monitoring of both residuals, carbon dioxide gas buffering of the analyzer sample is recommended. Carbon dioxide will also help prevent deposits caused by water hardness within the wetted analyzer components.

- Bromine residual monitoring
  Bromine residuals are often encountered in chlorinated water with a significant bromide residual (e.g. in saline waters). Bromine residual behaves very similarly to chlorine residual and so the application recommendations for each are the same.

- Chlorine residual monitoring
  For the purpose of this description, chlorine species can be grouped as follows:
  a. Free chlorine - hypochlorous acid and hypochlorite ion
  b. Chloramines - monochloromine and dichloramine
  c. Organic chlorine - a broad group of compounds with relatively weak disinfecting and oxidizing potential, a byproduct of chlorination
  d. Total chlorine - the sum of the above residuals

- Free chlorine monitoring
  In applications where the pH is less than pH8 an is stable, free chlorine residual can be monitored with no chemical conditioning. Often the stability of the water sample pH is not certain and a buffer is used to regulate the analyzer sample pH of between pH6 and pH4. If it is important that the analyzer function accurately under conditions where the pH of the water sampled may vary, buffering is recommended.

- Total chlorine monitoring
  Potassium iodide liquid reagent must be added to the analyzer sample for the measurement of total chlorine residual. The sample pH should be maintained between 4.0 and 4.7. The iodide solution is made by adding potassium iodide to one gallon of unchlorinated DI water.

- Interfering residuals
  Interfering residuals can cause either positive interference (strong oxidants) or negative interference (e.g. organics that combine with chlorine to form organic forms, some of which can behave as free chlorine or may not be detected at all by the standard method of measurement or by the analyzer). Decreasing the analyzer sample pH (e.g. from pH4 to pH2.5) may, in some applications, cause interference from oxidants but, where acceptable, may also be desirable to improve the response to sluggish organic chlorine compounds. in the measurement of potassium permanganate or chlorine dioxide residuals, ammonium sulfate reagent liquid is used to eliminate the response (interference) to free chlorine when necessary.

3.2.1.5 Probe Installation

The probe should be installed in the analyzer after the rest of the analyzer installation (mounting, plumbing, wiring) is completed and inspected.

<u>CAUTION</u>: Do not fill the probe with electrolyte until immediately before it is installed in the analyzer. Once the probe is filled with electrolyte, the electrode end must be kept wetted, as it is when installed in the analyzer. If the probe is filled and the porous element is allowed to dry, the pores will clog with potassium chloride crystals.

Fill the probe (through the fill hole in the side of the probe body) with electrolyte. Fill only to a level just below the fill hole when the probe is upright. The hole plug is not watertight.

Remove the protective cap from the electrode end of the probe. Check that the electrodes are clean; wipe clean with a paper towel if necessary. Do not touch the electrodes (platinum elements) or the porous element (white element), as finger dirt or oil may impede the probe operation. The platinum material is thin and easily punctured or sheared off. The electrodes are not repairable.

Allow the probe to stand upright (or hang it by its cord) for about ten minutes until electrolyte emerges from the porous element. If the electrolyte does not emerge shortly, it can be forced through the porous element by pressurizing the reservoir with a rubber squeeze bulb - used to force air into the fill hole. Use a sharp blade or a pointed object to cut a small vent hole in filling hole plug, enough to allow air through and equalize to atmospheric pressure on both sides of the plug. Replace the hole plug to prevent evaporation of the electrolyte.

Connect cable to input module.

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.

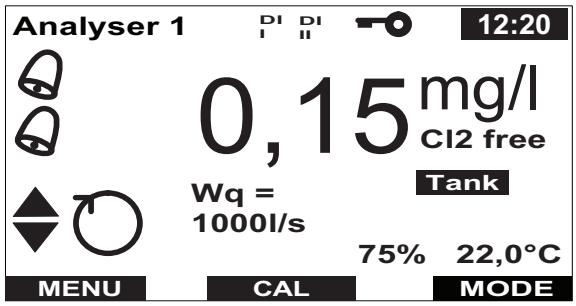


Figure 4.1 - Graphic display

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

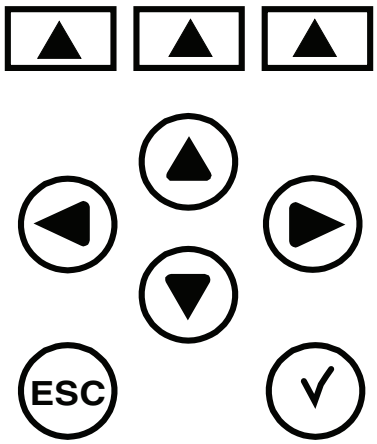


Figure 4.2 - Operating panel

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

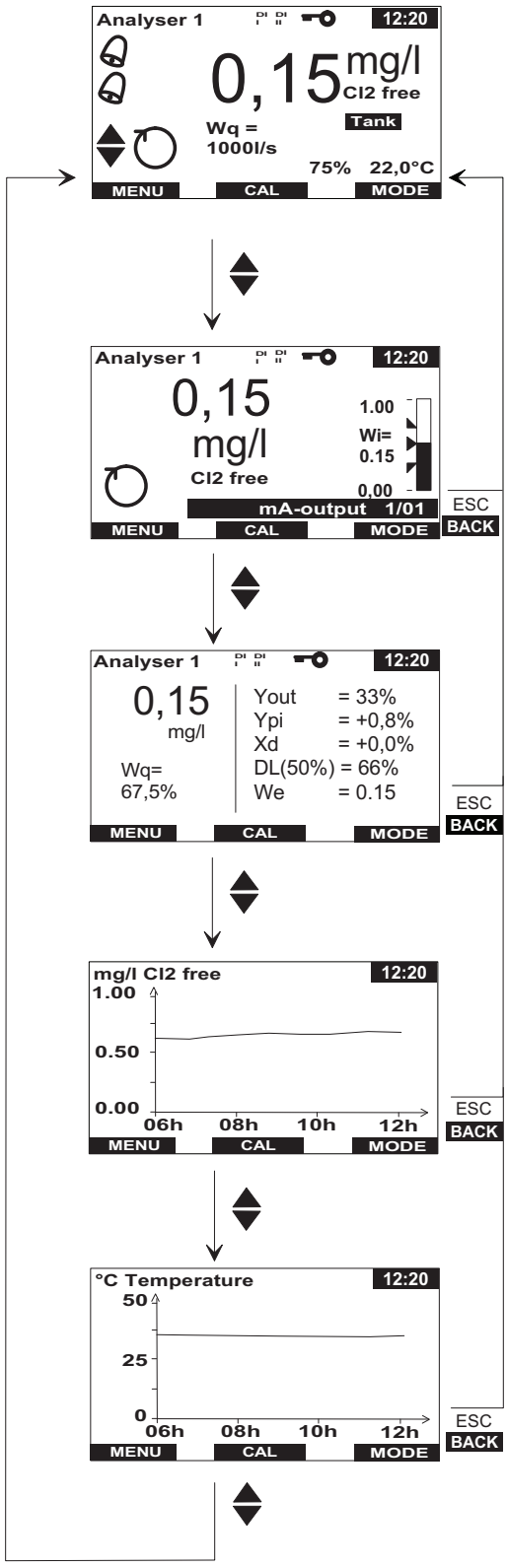
Basic display 1

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
- Feed 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

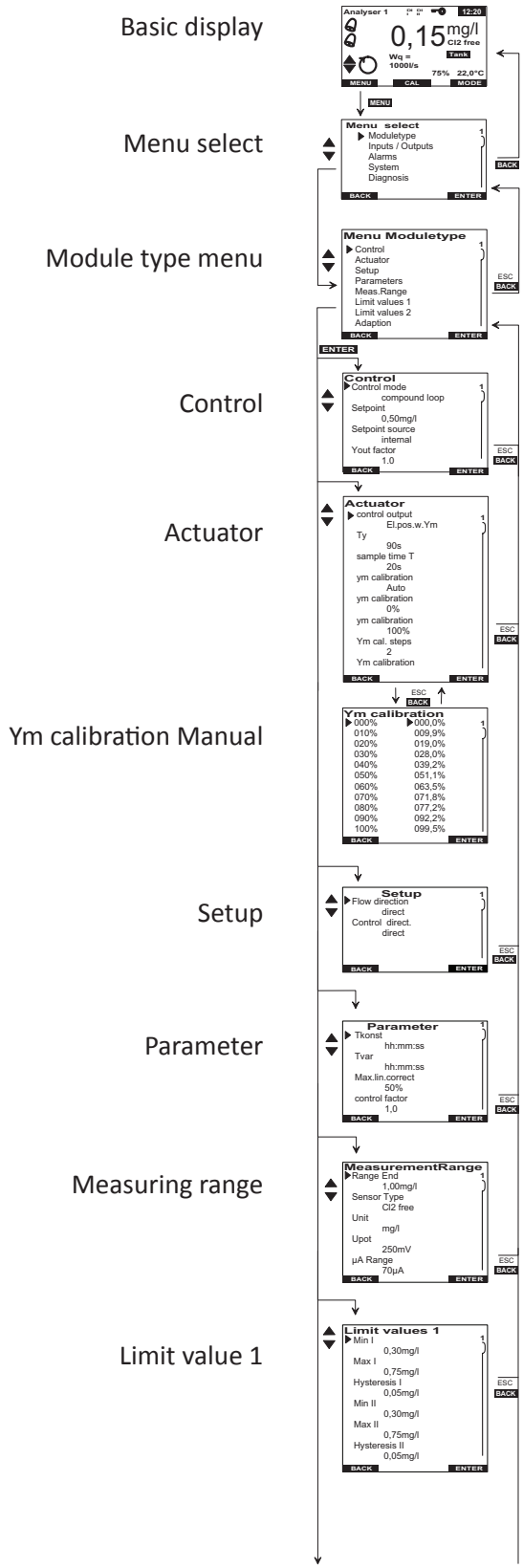
- 6-hour trend graph (can be scrolled back by up to 30 days with option SD card)

Bottom line

- Softkey display

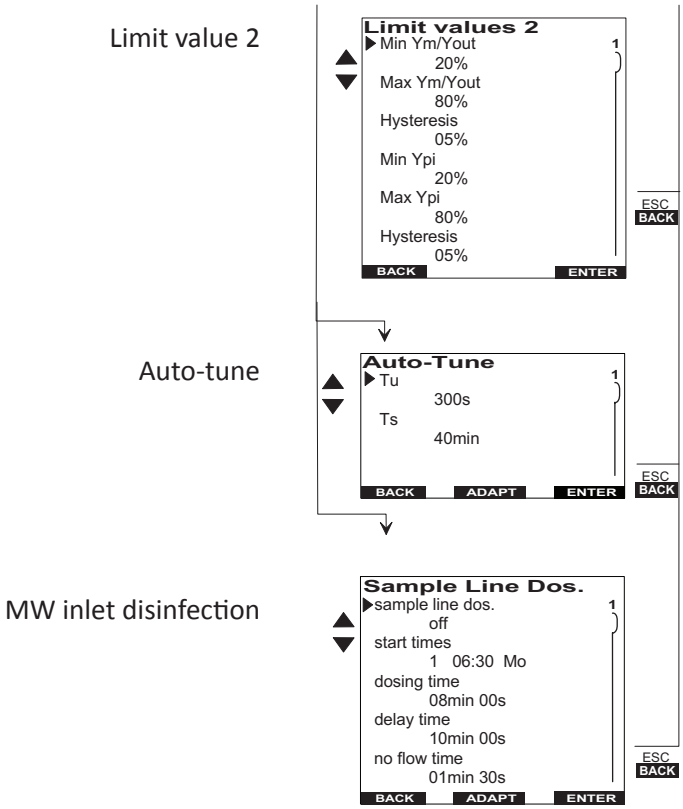
Module Type - Menu

Display using the example of a free chlorine measurement.



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	100 / 200 / 500 µg/l
(Micro/2000®)	1.00 / 2.00 / 5.00 / 10.0 / 20.0 / 50.0 / 100 / 200 mg/l
Deox/2000®	±0.50, ±1.00, ±2.00, ±2.50, ±5.00, ±10.0

Sensor Type

Cl_2						

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

Unit

Cl_2						

Cl_2 mg/l, µg/l, ppb, ppm

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 Micro/2000® and Deox/2000®: 10 µA, 100 µA, 1000 µA

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

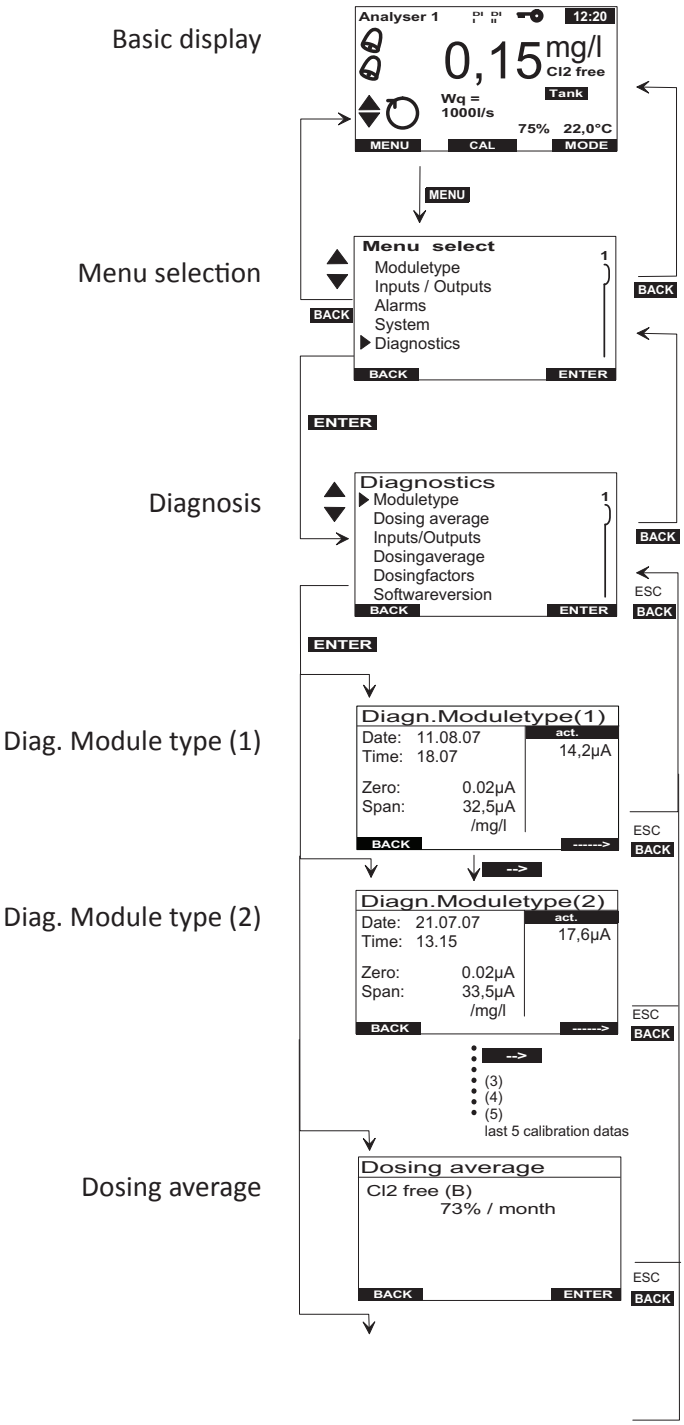
Min Ym/Yout	0–100.0% (not in single feedback closed-loop-control)
Max Ym/Yout	0–100.0% (not in single feedback closed-loop control) Ym is only output if the actuator feedback is present, otherwise the controller output is Yout
Hysteresis	0.1 to 5.0%
Min Ypi	0–100.0% (for combi-controller only)
Max Ypi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

pH Calibration Data

Date and time of the last 5 calibrations

pH7	Signal offset at pH 7 in mV
Span/pH	mV signal of the pH sensor based on 1 pH step
Offs	manual offset in pH (Menu 2.1.2 - Offset pH)
act. (U)	Current mV sensor signal

Redox Calibration Data

Date and time of the last 5 calibrations

Offset	Signal offset of the mV sensor in mV
act. (U)	Current mV sensor signal

Membrane Sensor Calibration Data Cl-tot, O_3 sel, ClO_2 sel, Cl-comb., Cl_2 free

Date and time of the last 5 calibrations

Zero	Membrane sensor zero point signal (only for 2-point calibration mode, not for Cl_2-tot)
DPD mg/l	µA-signal based on 1 mg/l
act. (I)	Current µA sensor signal

F^- Calibration Data

Date and time of the last 5 calibrations

Zero	Established sensor zero point signal
Decade	mV signal of the sensor based on 1 decade (log)
act. (U)	Current mV sensor signal

Conductivity Calibration Data

Date and time of the last 5 calibrations

Span	Conductivity measuring cell calibration factor
Cur	Displays current sensor current in mA
	Displays current sensor voltage in mV
	Displays temperature of the conductivity sensor

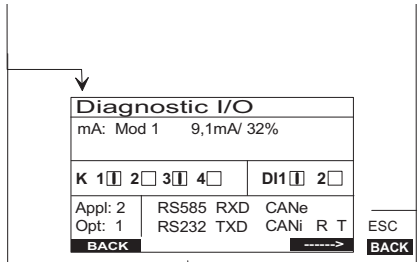
Diagnosis Dosing Average

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

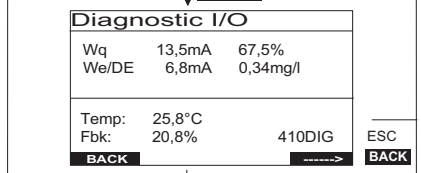
Diagnosis - Menu

"Diagnosis Menu" continued

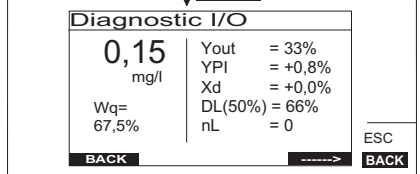
Inputs/Output diagnosis



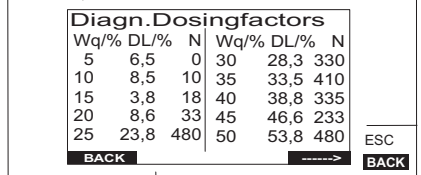
Inputs/Output diagnosis



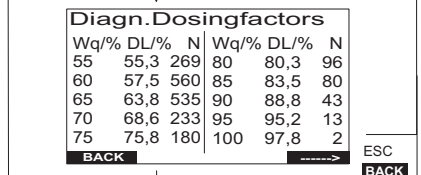
Inputs/Output diagnosis



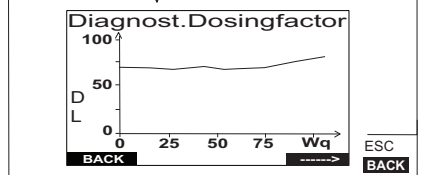
Diagnost.Dosingfactor



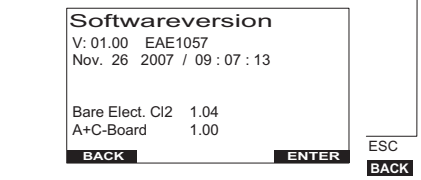
Diagnost.Dosingfactor



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 -> with process 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).

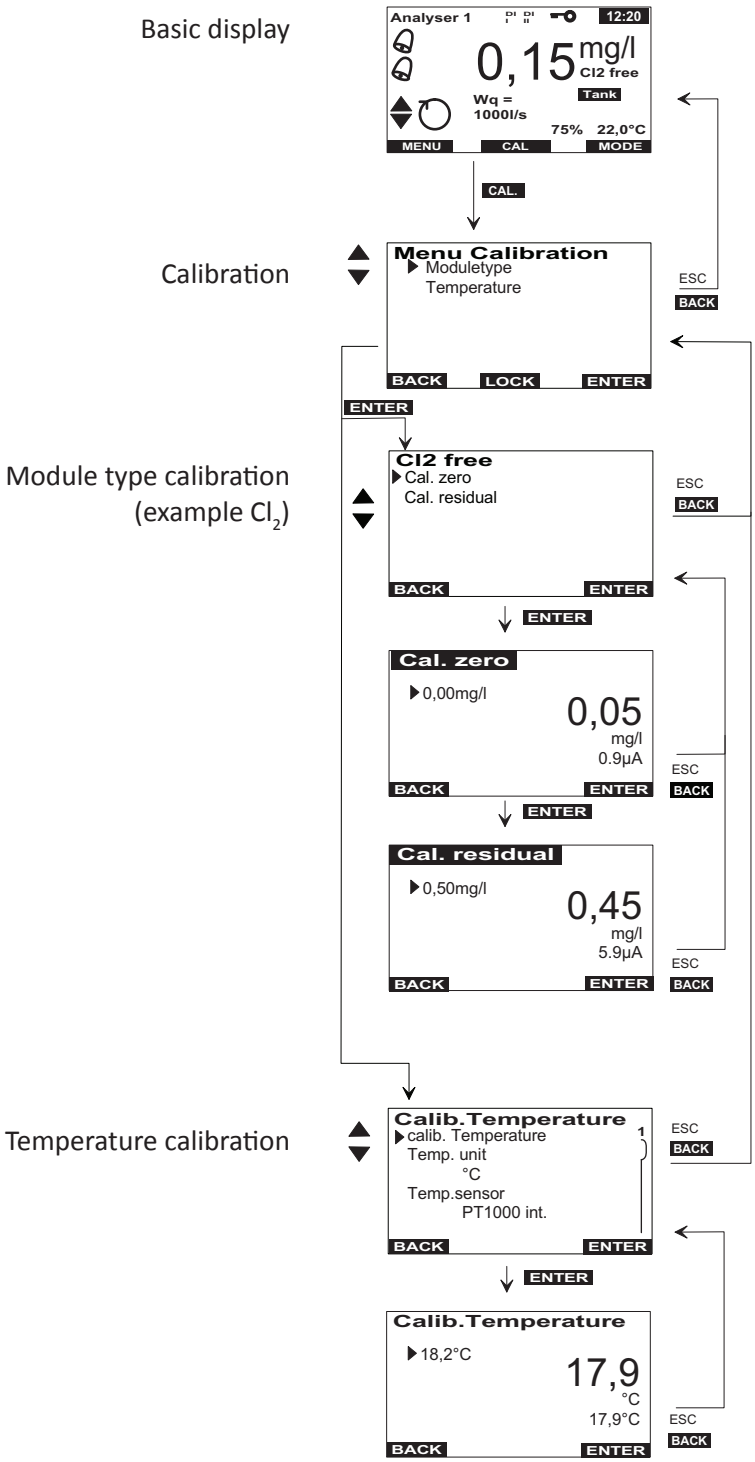
N describes the training meter, how often a dosing factor was learned for this Wq value. This table can be displayed as a diagram (toggle with the ---> key).

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

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.

Micro/2000® and Deox/2000® Sensor Calibration

Zero span	within measuring range
Calib. span	within measuring range
Calibration mode	1-point/2-point

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.

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 Micro/2000® Calibration

Before beginning calibration, choose the method of calibration (1 point or 2 point).

For One Point Calibration:

Grab Sample Method

1. Select the 1 Point calibration method in the calibration menu.

2. Once the reading on the system is stable, collect a sample from the water line.

3. Measure the residual contained in this sample.

4. Enter this value as the “SPAN” value.

Standard Solution Method

1. Select the 1 Point calibration method in the calibration menu.

2. Create a 500 mL sample solution of a desired concentration within the intended operating range.

3. Allow the sample solution to pump through the sample line for a minimum of 10 minutes using the 3-way inlet valve (see Figure 4.3).

4. When the display stabilizes, enter the solution concentration (mg/L) as the “SPAN” value.

For Two Point Calibration:

1. Select the 2 Point method of calibration in the calibration menu.

2. Obtain 500 ml of demand free water.

3. Allow the demand free water to pump through the sample line for a minimum of 10 minutes using the 3-way inlet valve (see Figure 4.3).

4. Once the reading is stable, enter this value as “ZERO”.

5. Complete “Grab Sample Method” above for “SPAN” calibration.

This concludes the Micro/2000® calibration.

4.4.2.1 Calibration Tips

Because the analyzer is on-line, the process should be observed for a few moments before and while taking the sample to ensure that the process does not deviate suddenly during sample taking and before initiating the calibration. A substantial change in the process during calibration results in an inaccurate calibration.

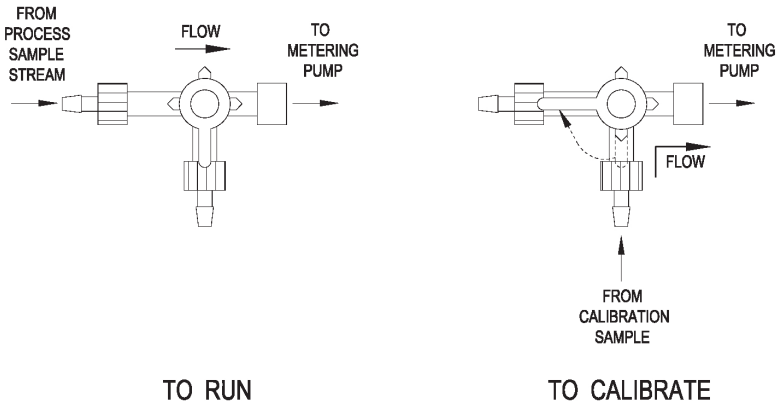


Figure 4.3

4.4.2.2 Deox/2000® BIAS Calibration

In performing the BIAS calibration, the slope is calibrated by directly measuring the residual “bias” resulting from the reagents (iodine) added to the cell. This bias can be directly determined only by operating the analyzer on zero residual, chlorine demand free water (distilled water), so that the iodine bias residual is the only source of residual. The full procedure is discussed below.

A full slope calibration of the analyzer is generally preformed upon start-up and periodically thereafter.

The nominal Bias value is 1½ times the range of the analyzer. Due to variations in feed rate, the actual Bias can vary ± 25%.

a. Place 500 ml of demand free water in a 500 ml flask, and place the flask in the wet side of the analyzer in front of the pump and cell assembly. A 500 ml beaker will not fit.

b. Attach two feet of 1/8-inch ID flexible tubing to the calibration leg (middle leg) of the calibration valve. Put the end of the calibration leg (middle leg) tubing of the calibration valve into the flask.

c. Move to the BIAS calibration function in the calibration menu of the user interface.

d. Move the calibration valve lever to the calibrate position. This closes the valve inlet from the process sample and opens the inlet to the contained sample.

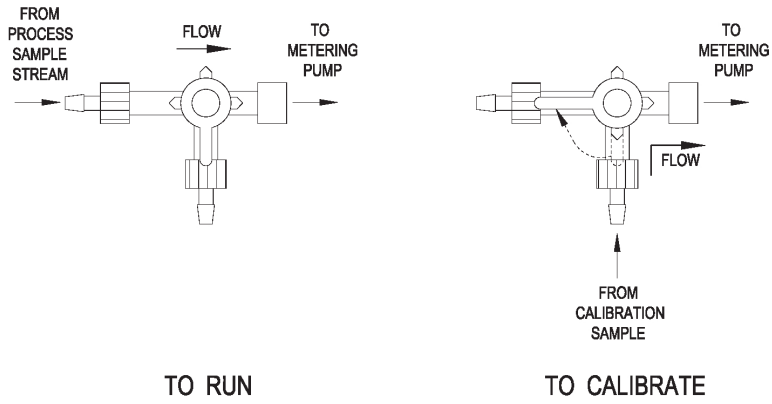


Figure 4.4

e. The pump is now drawing sample from the beaker. Allow the sample to purge the pump and cell for five minutes. Wait for the measured concentration to stabilize. Watch the water level in the flask during this period and refill as required. Do not allow the pump to suck in air, as this disrupts the calibration. If this occurs, get out of the calibration procedure and wait for the analyzer to stablize (10-minute delay) before reattempting calibration.

f. The screen will display the “BIAS” and “Temp Calibration” on the left and the current bias value and microamp (µA) cell signal on the right. Press the down arrow to access the “Temp Calibration” menu. The cell signal value will be replaced by the current temperature value. If necessary, enter the “Temp Calibration” menu and calibrate the temperature as equired.

g. Return to the “BIAS” calibration menu. Monitor the microamp cell signal until it stablilizes. The signal will vary by ± 5%, but will stabilize around a middle point.

<u>NOTE</u>: The microamp cell signal is dependant on the operating range of the unit, with higher range units having a higher signal strength.

Once the signal is stable, enter the desired bias value (1½ x range). Return to main display and allow unit to operate on demand free water. Displayed residual should be zero (± 5%). Adjust bias as required for zero residual.

h. If the calibration is completed before the 10-minute delayed return to operation, the mA is still frozen. The main display continues to function, with a message indicating the delay is in effect.

4.4.2.3 Calibration Tips

The bias calibration method requires that the sample be taken from the cell discharge, where the BIAS produced by the reagents can be directly measured. This sample flow is approximately 8 to 16 ml/min depending on whether a 1 or 2 rpm metering pump is used. The amperometric titration measurement method requires a 200 ml sample, which requires a sample time of from 12 to 30 minutes. Because of the unstable nature of the iodine residual, particularly in a reactive process, it is not good practice to wait this long to take the sample. If direct measurement of the sample cell residual is desired, it can be done as follows:

- Take a sample of exactly 200 ml (e.g., use a volumetric pipette). Dilute it to 200 ml with distilled water in the titration cup. Titrate with 10:1 PAO solution (or, if standard strength PAO is used, multiply the titration value by 10).

4.4.3 pH Calibration

NOTE: During pH calibration the buffer solution and the sample water should have the same temperature. If there is a difference in temperature of > 5 °C, first enter the temperature of the buffer solution in the "Calibration" - "pH" menu under "Cal. at temp.".

pH-7 Calibration

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

2. Select the menu item "pH". The "pH" window appears on the graphic display.

3. Select the "Cal. pH7" parameter.

4. Place one of the supplied beakers into the bottom clip and fill with the buffer solution "pH 7.00" or a bag with buffer solution "pH 7.00" into the bottom clip.

5. Pull or unscrew the pH sensor from the lid of the cell body.

6. Dip the pH sensor through the top clip at least 2 cm deep into the buffer solution and move slightly until the indicated pH value remains constant.

7. Confirm the selection with the "Enter" key and, using the four arrow keys, enter the pH value that corresponds to the buffer temperature, or leave pH 7.00.

8. Save the value by pressing "Enter".

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
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

Table 4.1 - Error Message (Cont'd)

Error message	Cause	Remedy
Calibration ?	In 3 electrode cells 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
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
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
Range?	Min/max limit value is outside the measuring range	Check the min/max limit values and change, if necessary
Sample Line Dos	Automatic sample water inlet disinfection	Time-controlled function is ended automatically, as soon as the process is complete

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 (MFC units only)	Check, fit the housing cover correctly (cable possibly trapped)
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
Micro/2000® and Deox/2000® flow block assembly	
Check for leakages	Weekly
Comparative measurement, calibrate if necessary	Weekly/ acc. to guidelines
Check electrolyte level (Micro/2000® and Deox/2000®)	Weekly
Check cell sand (Micro/2000® and Deox/2000®)	Weekly
Change cell sand (Micro/2000® and Deox/2000®)	Every six months
Change electrolyte (Micro/2000® and Deox/2000®)	Every six months
Change porous element (Micro/2000® and Deox/2000®)	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 (only with Micro/2000® and Deox/2000®)" and "Changing cell sand with 3-electrode cell Micro/2000® and Deox/2000®".)

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 Micro/2000® and Deox/2000® Flow Block Assembly

WARNING: TO AVOID ELECTRICAL SHOCK, TURN OFF POWER BEFORE SERVICING.

TO AVOID ELECTRICAL SHOCK OR DAMAGE TO EQUIPMENT, AVOID CONTACT WITH CIRCUIT BOARD COMPONENTS WHILE MAKING ADJUSTMENTS.

WEAR RECOMMENDED PROTECTIVE EYEWEAR WHEN SERVICING THE WET COMPONENTS OF THE ANALYZER, PARTICULARLY WHEN SERVICING REAGENTS AND REAGENT LINES. THE ANALYZER USES CHEMICALS THAT CAN CAUSE SEVERE PERSONAL INJURY BY CHEMICAL BURNS ON CONTACT WITH EYES. RINSE ANY AREA OF CONTACT IMMEDIATELY. IF CHEMICALS CONTACT EYES, RINSE FROM EYES AND SEEK IMMEDIATE MEDICAL ATTENTION.

5.2.1 Wetside Panel Removal and Replacement

1. Shut off sample flow to the analyzer.
2. Disconnect the probe and motor connectors from the SFC electronics, if those parts will be serviced.
3. Remove the probe and set it carefully aside. Do not rest it on its electrode end. If the probe will be removed for more than an hour, place it, with the electrodes, in a beaker of water.
4. Disconnect the liquid reagent tubing from the inlet and discharge of the metering pump.
5. Disconnect the water sample tube from the panel inlet.
6. Disconnect the drain tubing from drip tray outlet.
7. Remove the clamps holding the probe cable, if probe will be serviced.
8. Remove the four screws holding the panel in the enclosure, and remove the panel from the enclosure. The panel will hang in front of the enclosure on strain relief cables.
9. Hold the panel upright while removing it to avoid spilling water trapped in the cell. Remove mounting screws and set aside before releasing panel. There is water trapped in the various tubing units and chemical trapped in the reagent tube units.

5.2.2 Occlusion Ring Removal and Replacement

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

TURN OFF THE FLOW TO THE ANALYZER BEFORE REMOVING THE OCCLUSION RING FROM THE METERING PUMP. THE OCCLUSION RING STOPS THE FREE FLOW OF LIQUID THROUGH THE ANALYZER SAMPLE LINES. IF IT IS REMOVED WITH FLOW STILL PRESENT AT THE ANALYZER, PROCESS WATER WILL BE SPRAYED FROM THE PUMP DISCHARGE LINE AND FROM THE CELL TOP. SPRAYED PROCESS WATER CAN CREATE AN ELECTRICAL SHOCK HAZARD DUE TO THE PRESENCE OF DANGEROUS VOLTAGE POWERING THE IMPELLER AND PUMP MOTORS.

DO NOT SERVICE THE METERING PUMP WHILE IT IS TURNING, THE METERING PUMP HAS ENOUGH TORQUE TO CAUSE SEVERE PERSONAL INJURY IF HANDS ARE PINCHED IN THE ROTATING PARTS. DISCONNECT THE PUMP MOTOR POWER BEFORE SERVICING THE PUMP.

WEAR RECOMMENDED PROTECTIVE EYEWEAR WHEN SERVICING THE WET COMPONENTS OF THE ANALYZER, PARTICULARLY WHEN SERVICING REAGENTS AND REAGENT LINES. THE ANALYZER USES CHEMICALS THAT CAN CAUSE SEVERE PERSONAL INJURY BY CHEMICAL BURNS ON CONTACT WITH EYES. RINSE ANY AREA OF CONTACT IMMEDIATELY. IF CHEMICALS CONTACT EYES, RINSE FROM EYES AND SEEK IMMEDIATE MEDICAL ATTENTION.

- Removal:

  a. Disconnect power to the wetside of the analyzer by disconnecting the power supply from the SFC electronics.

  b. Turn off the water supply to the analyzer.

  c. Remove the wetside panel (optional). See paragraph 5.2.1, Wetside Panel Removal and Replacement.

  d. Using a 7/16-inch socket wrench, remove the two bolts (with washers) attaching the occlusion ring to the panel. Lift off the occlusion ring. Some residue from the tube units accumulates on the ring during usage. This is normal.

- Replacement:

  The occlusion ring may be difficult to reinstall if the following procedure is not followed. Do not use excessive force. Use care not to pinch the tube units (installed on the pump rollers) when installing the occlusion ring. Before reinstalling the occlusion ring, check that the pump tube units are properly seated in the roller grooves and in the tube retainer grooves. See paragraph 5.2.4, Pump Tubing Units Replacement.

  1. Place the occlusion ring loosely in place over the tube units, but do not attempt to clamp the occlusion ring in place yet.

  2. Hold the ring in place with one hand and slide a bolt, with washer, into the lower mounting hole in the ring until it bottoms against the casting.

  3. Gently squeeze the ring against the tubing while pushing the bolt into place. The bolt will drop (about ¼ inch) into place when the ring is properly located.

  4. Tighten this first bolt a few turns, so that the occlusion ring will pivot on the bolt.

  5. Slide the second bolt (and washer) into its mounting hole in the ring.

  6. Firmly squeeze the ring against the pump rotor (squeeze near the second bolt) to obtain leverage against the pivot bolt until the second bolt drops into place. Finger tighten bolts until occlusion ring is flat against panel.

  7. Tighten bottom bolt 1/4 turn, then tighten top bolt 1/4 turn.

5.2.3 Pump Rotor, Rollers and Thrust Washer Removal and Replacement

The rotor is fastened to the motor shaft by a set screw requiring a 3/32-inch Allen wrench for adjustment.

When the rotor body is removed, check the rollers, roller shafts, thrust washer, the shaft bearing, and shaft bore in the rotor body for signs of excessive wear, damage, or corrosion. Some residue on the roller shafts and inside the rollers is normal. The rotors should function properly for at least one to two years. Do not lubricate the rollers, as some greases may attack the nylon roller material. Lubrication of the rollers is not necessary. If any of the roller shafts show significant wear marks and the corresponding roller is loose, the rollers and rotor body unit must be replaced.

- Removal

    1. Remove the wetside panel from the enclosure.

    2. Remove the occlusion ring from the panel unit.

    3. Remove the sample and reagent tube units from the metering pump.

    4. Locate the set screw in the hub of the rotor body (just behind the back face of the body) and loosen the set screw one or two turns.

NOTE: Hold the panel upright while removing the rotor body to avoid dropping and losing the rollers. To use as a guide for reinstallation, take note of the orientation of the rollers (small groove toward the front of the panel) before removing the rotor.

    5. Slide the rotor body off the motor shaft.

    6. The thrust washer (located against the panel assembly) should be removed and set aside so that it does not drop off the panel and become lost.

- Reinstallation

    1. If the thrust washer was removed, reinstall it over the pump hub, against the panel.

    2. Install the rollers on their shafts in the position noted during the removal of the rotor (small groove toward front).

    3. Look into the shaft bore in the rotor body and adjust the set screw until it just protrudes into the bore (approximately a half turn). The set screw protruding into the bore helps to locate it on the flat of the shaft as the rotor assembly is installed.

    4. Note the position of the flat on the pump shaft and slide the rotor assembly onto the shaft with the set screw over the flat.

    5. The shaft bore has a sliding fit on the shaft, so there may be a slight resistance to the sliding. If the resistance seems excessive, back-off the set screw a quarter turn and twist the rotor body back and forth slightly as it slides back onto the shaft.

    6. Tighten the set screw gently, until it begins to lock in place, on the flat on the shaft. Be sure that the hub of the rotor is flush against the pump hub (but without pressure) when the set screw is tightened. Using the

Allen wrench, tighten the set screw as firmly as is practical. Use pliers to apply additional torque, but not so much as to permanently deform the Allen wrench.

NOTE: If the set screw is not tightened sufficiently, the rotor may wobble on the shaft or may slip on the shaft, damaging the shaft and causing the pump to not operate properly.

5.2.4 Pump Tubing Units Replacement

WARNING: TURN OFF THE FLOW TO THE ANALYZER BEFORE REMOVING THE OCCLUSION RING FROM THE METERING PUMP. THE OCCLUSION RING STOPS THE FREE FLOW OF LIQUID THROUGH THE ANALYZER SAMPLE LINES. IF IT IS REMOVED WITH FLOW STILL PRESENT AT THE ANALYZER, PROCESS WATER WILL BE SPRAYED FROM THE PUMP DISCHARGE LINE AND FROM THE CELL TOP. SPRAYED PROCESS WATER CAN CREATE AN ELECTRICAL SHOCK HAZARD DUE TO THE PRESENCE OF DANGEROUS VOLTAGE POWERING THE IMPELLER AND PUMP MOTORS.

DO NOT SERVICE THE METERING PUMP WHILE IT IS TURNING, THE METERING PUMP HAS SUFFICIENT TORQUE TO CAUSE SEVERE PERSONAL INJURY IF HANDS ARE PINCHED IN THE ROTATING PARTS. DISCONNECT THE PUMP MOTOR CONNECTOR BEFORE SERVICING THE PUMP.

WEAR RECOMMENDED PROTECTIVE EYEWEAR WHEN SERVICING THE WET COMPONENTS OF THE ANALYZER, PARTICULARLY WHEN SERVICING REAGENTS AND REAGENT LINES. THE ANALYZER USES CHEMICALS THAT CAN CAUSE SEVERE PERSONAL INJURY BY CHEMICAL BURNS ON CONTACT WITH EYES. RINSE ANY AREA OF CONTACT IMMEDIATELY. IF CHEMICALS CONTACT EYES, RINSE FROM EYES AND SEEK IMMEDIATE MEDICAL ATTENTION.

The sample and reagent tube units include glued stop rings and adapters and fittings. Replace the entire unit when required.

The tube units should provide approximately six months of service, but should be observed monthly (without disturbing the analyzer) for signs of wear or leakage. If either condition is noticed, replace the suspected tube units immediately.

Remove the tube units only when replacement units are readily available, so there is no confusion about how to reconnect the new tube units.

- Removal of the tube segments is as follows:

    a. Disconnect power to the wetside.

    b. Disconnect the sample and reagent tubing from the fittings at the ends of the tubing segments. The fittings are replaced with the tube units.

c. Remove the occlusion ring mounting bolts (requires a 7/16-inch socket).

d. Remove the tube units.

- Installation of tube units (refer to Figure 5.1):

A	Occlusion ring
B	Sample tube
C	Reagent tube
D	Reagent groove
E	Sample groove
F	Retainer surface
G	Sample segment - roller
H	Reagent segment - roller
I	Roller
J	Tube retaining collar
K	Tubing connector

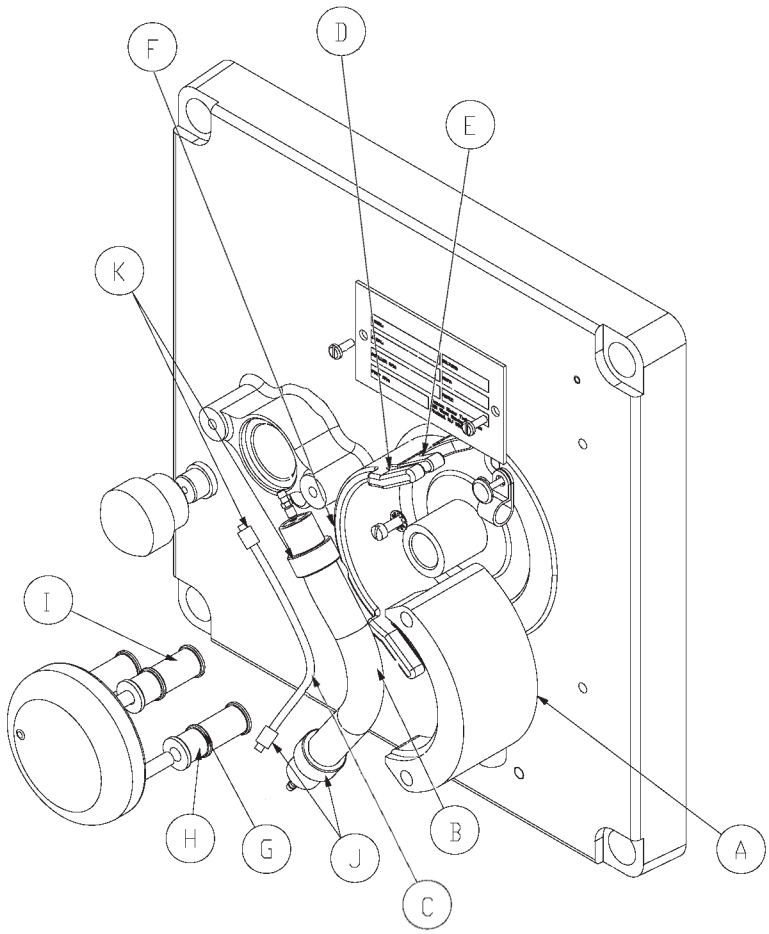


Figure 5.1

1. Remove the occlusion ring (A).

2. Remove the old tube units (B or C) (if replacing).

3. Both reagent tube units (C) fit into the small groove (D) on the tube retainer (F), as well as into the small groove (H) on the rollers (G).

   The sample tube unit (B) fits into the large groove (E) on the tube retainer (F) and the large groove (I) on the rollers (G).

Guide the (new) tube unit through the small (D) or large (E) groove in the lower end of the tube retainer (F) and slide the unit up through the groove until the lower tube stop (J) is against the outer surface of the tube retainer (F).

4. Lay the tube unit (A or B) over the pump rollers (G) in the small (H) or large (I) groove, toward the front of the pump rollers. If two reagent tube units (C) are installed, ensure that the tubes lay side by side and do not cross each other when placed over the rollers (G).

NOTE: If the pump is operated with the reagent tube units crossed, the tube units may be damaged.

5. Stretch the tubing slightly and guide it through the small (D) or large (E) groove in the upper end of the tube retainer (F), with the upper tube stop (K) above the top surface of the upper end of the tube retainer (F). When tension on the tubing is released, the tube stops should be against the outside surfaces of tube retainer.

6. Check that the tube units (B or C) are in their proper small (H) or large (I) groove in the roller (G). Check that the reagent tubes do not cross.

7. Replace the occlusion ring, so that the larger inside radius (in which the sample tubing (B) rides) is facing away from the operator. Locate and start the lower mounting bolt before attempting to squeeze the occlusion ring against the tubing. Then secure the second mounting bolt.

   The tubing exerts side pressure on the retaining bolts, causing some tendency for cross-threading of the bolts as they are reinstalled. Do not force the bolts. If they do not turn smoothly, remove them and install them again.

5.2.5 Pump Bearing Replacement

1. Remove the wetside panel from the mounting enclosure.

2. Remove the pump occlusion ring, tube units, rotor body (with rollers), and thrust washer from the front of the wetside panel.

3. Remove the pump motor from the rear of the wetside panel. The pump mounting screws are on the face of the panel.

4. Drive the bearing out of the front of the casting using the square end of a rod that is approximately ½-inch in diameter by 4 inches long. (A socket wrench socket on an extension will work.) Use care not to scar the bore in which the bearing is pressed.

5. Tap in the new bearing until it is flush with the end of the bearing support. Place the long side of a flat bladed screwdriver over the bearing face and tap with a hammer. Make sure the new bearing is square to the bearing support bore.

5.2.6 Impeller Shaft Seal Replacement

- Removal of the Impeller Shaft Seal:

  1. Disconnect power to the wetside of the analyzer.

  2. Remove the probe from the cell body. Make sure the probe electrodes are not scratched or damaged. Lay the probe on its side so that the electrodes do not contact any surface, but in a position so that the electrolyte does not leak from reservoir fill hole.

  3. Remove the cell body retaining screws and remove the cell body. When removing the cell body take notice of the O-ring that seals the cell body against the seal adapter. This O-ring may cling to the cell body and then fall off.

  4. Use a 3/32-inch Allen wrench to loosen the set screw holding the impeller on the shaft. This set screw leaves a noticeable mark on the shaft. If the shaft is not replaced, reinstall the impeller in the same position.

  5. Slide the grit guard off the shaft.

  6. Slide the seal adapter, with the seal and impeller shaft bearing, off the shaft.

  7. Using a pair of needle nose pliers, grab the center of the seal and remove it from the front of the adapter.

  8. Using a nut driver or small socket and extension, press the impeller shaft bearing out of the seal adapter from the front.

  9. Rinse the grit from the cell body, cell body sealing O-ring, impeller, and seal adapter. Wipe the sealing surfaces and the shaft (gently) with a paper towel to remove all grit and residue.

  10. Check the shaft for signs of unusual wear, which indicates that it needs replacement. Refer to Impeller Shaft Replacement instructions.

- Installation of Shaft Seal:

1. If not already done while removing old shaft seal, rinse grit from the cell body, cell body sealing O-ring, impeller, and seal adapter. Wipe the sealing surfaces and the shaft (gently) with a paper towel to remove all grit and residue.

2. Press new impeller shaft bearing into back of seal adapter. Apply a small quantity of silicone grease to front and back bearing shaft hole.

3. Apply a small quantity of silicone grease to the back side (the front side is the concave side) of the new U-cup before installation into the seal adapter.

4. Install the U-cup into the seal adapter, making sure the edges are fully seated (flush with the inside diameter of the seal adapter).

5. Slide the seal adapter over the impeller shaft until it seats in the panel. Wipe any excess grease from the front of the shaft.

6. Slide the grit guard (small end first) onto the shaft and up against the seal adapter.

7. Slide the impeller onto the shaft, up to the grit guard. Retighten the set screw until just snug.

8. Install the cell body sealing O-ring on the front of the seal adapter.

9. Install the cell body with the retaining screws and washers.

10. Replace the probe.

11. Restart the analyzer.

12. Once the flow is restarted and the cell body is full of sample, replace the grit.

5.2.7 Impeller Motor Removal And Replacement

- Removal

1. Remove the panel assembly from the mounting enclosure. See paragraph 5.2.1, Wetside Panel Removal and Replacement.

2. Remove the cell body, impeller, and shaft seal adapter from the front of the panel assembly. See paragraph 5.2.6, Impeller Shaft Seal Replacement.

3. Turn the panel over and remove the ground lug screw and motor mounting screws.

4. Remove the motor with the impeller shaft.

5. If the motor is being replaced, remove the impeller shaft and coupling from the motor.

- Replacement

  Replacement is basically the reverse sequence of removal.

  Grease the impeller shaft seal, with suitable silicone grease, before reinstalling it on the front of the panel assembly.

WARNING: ALWAYS RECONNECT THE GROUNDING LEADS WHEN REMOVED OR BROKEN. GROUNDING LEADS ARE PROVIDED FOR SAFETY, TO PREVENT INJURY FROM ELECTRICAL SHOCK.

Be sure to reconnect both motor ground leads to the back of the panel before reinstalling the panel.

Motor replacement is the reverse sequence of removal.

5.2.8 Impeller Shaft Replacement

- Impeller Shaft Removal:

1. Disconnect power to the wetside of the analyzer.

2. Stop the flow of sample to the analyzer.

3. Disconnect the sample and reagent tubing from the metering pump inlet.

4. Remove the cell body, impeller, grit guard, cell sealing O-ring, and seal adapter as described in paragraph 5.2.6, Impeller Shaft Seal Replacement.

5. Remove the panel assembly from the mounting enclosure.

6. Disconnect the impeller motor grounding terminal.

7. Remove the impeller motor mounting screws and washers. Remove the impeller motor.

8. Loosen the impeller shaft retaining setscrew using a 3/32-inch Allen wrench.

9. Remove the impeller shaft from the coupling.

- Impeller Shaft Installation:

1. If the impeller shaft coupling is removed from the impeller motor install the coupling on the motor shaft against the front face of the motor. Tighten the retaining setscrew (using a 3/32-inch Allen wrench).

2. Slide the impeller shaft into the coupling until it bottoms against the end of the motor shaft. Tighten the retaining setscrew snugly (using a 3/32-inch Allen wrench), about ¼ turn past the first resistance.

3. Mount the impeller motor on the back of the panel with the retaining screws and washers.

4. Fasten the impeller motor grounding terminal (with pump motor grounding terminal) on the back of the panel with the retaining screw and serrated lockwasher.

5. Remount the panel in the mounting enclosure.

6. Reattach the sample and reagent tubing to the inlet of the metering pump.

7. Apply a small quantity of silicone grease to the O-ring and impeller shaft.

8. Reinstall the seal adapter, grit guard, cell sealing O-ring, impeller, and cell body and cell retaining screws, as described in paragraph 5.2.6, Impeller Shaft Seal Replacement - Installation of Shaft Seal.

5.2.9 Pump Motor Removal and Replacement

1. Remove the panel assembly from the mounting enclosure. Refer to paragraph 5.2.1, Wetside Panel Removal and Replacement.

2. Remove the pump rotor and thrust washer from the panel assembly. Refer to paragraph 5.2.1, Pump Rotor, Rollers, and Thrust Washer Removal and Replacement.

3. Disconnect the motor ground lead from the back of the panel.

4. Remove the two screws that mount the motor from the front of the panel.

5. Gently slide the motor out from the back of the panel. The motor shaft has a sliding fit inside the ball bearing in the pump hub. If it binds while trying to slide it out, check the exposed portion of the shaft for dirt or scratches that may cause binding. Clean off the dirt or carefully remove scratches with a fine file. The shaft can be damaged by excessive filing.

5.2.10 Probe Electrolyte and Electrodes

The analyzer performs best when the probe is left undisturbed as much as possible. Manual cleaning of the probe electrodes should not be done unless necessary, as this will require recalibration of the analyzer.

CAUTION: Do not sand the probe electrodes! The electrodes are made of a thin film of platinum and cannot be replaced or repaired. If sanded, this thin film of platinum will be quickly removed and the probe will no longer function. If cleaning is necessary, a clean paper towel may be used.

Check the electrolyte level occasionally and maintain the level so that it is at least visible through the clear section of the probe with the probe in the installed position. If the electrolyte level drops noticeably in less than a month, the porous element is leaking excessively. The porous element is intended to allow a slight flow of electrolyte and excessive flow will not harm the performance of the analyzer unless the probe is allowed to run out of electrolyte. If excessive use of electrolyte becomes a nuisance (requires constant monitoring of the level), replace the porous element and check the element bore for damage that would hinder the sealing around the element.

Also, check if the electrolyte has become contaminated. This is usually indicated by a color change or by the electrolyte becoming watery. It is not unusual for the electrolyte to become alternately cloudy and then clear, this can be caused by changes in water or ambient temperature.

5.2.11 Probe Cleaning, Refilling and Porous Element Replacement

The probe cannot be disassembled (all joints are cemented). It is not serviceable except for the following maintenance operations.

NOTE: The analyzer will perform best when the probe is left undisturbed as much as possible.

Check the electrolyte level and refill as necessary.

Clean the electrodes by wiping blue abrasive paper or with a clean paper towel. If there is a greasy film on the electrodes, this can be removed by cleaning with a paper towel dipped in alcohol. If there are hard deposits on the electrodes, this can be removed by wiping the electrodes with a clean paper towel dipped

in muriatic acid (10% hydrochloric acid). The analyzer will require recalibrations after 24 hours of operation after the electrodes are cleaned.

WARNING: HYDROCHLORIC ACID AND MURIATIC ACID WILL SEVERELY IRRITATE EYES AND CAUSE CHEMICAL BURNS TO SKIN. ALWAYS WEAR APPROPRIATE PROTECTIVE EQUIPMENT DURING HANDLING. WHEN DILUTING ACID, ALWAYS POUR ACID INTO THE WATER, NEVER POUR WATER INTO ACID. IT IS THE RESPONSIBILITY OF THE USER OF THE EQUIPMENT TO OBTAIN AND FOLLOW THE SAFETY PRECAUTIONS OF THE MANUFACTURER OF THE HAZARDOUS MATERIAL.

If the probe is to be stored for more than a week, the porous element should be removed, the electrolyte drained, and the reservoir should be rinsed with distilled water to eliminate any remaining electrolyte. Otherwise the electrode end must be kept wetted to prevent crystallization of the electrolyte in the pores of the element and clogging of the element.

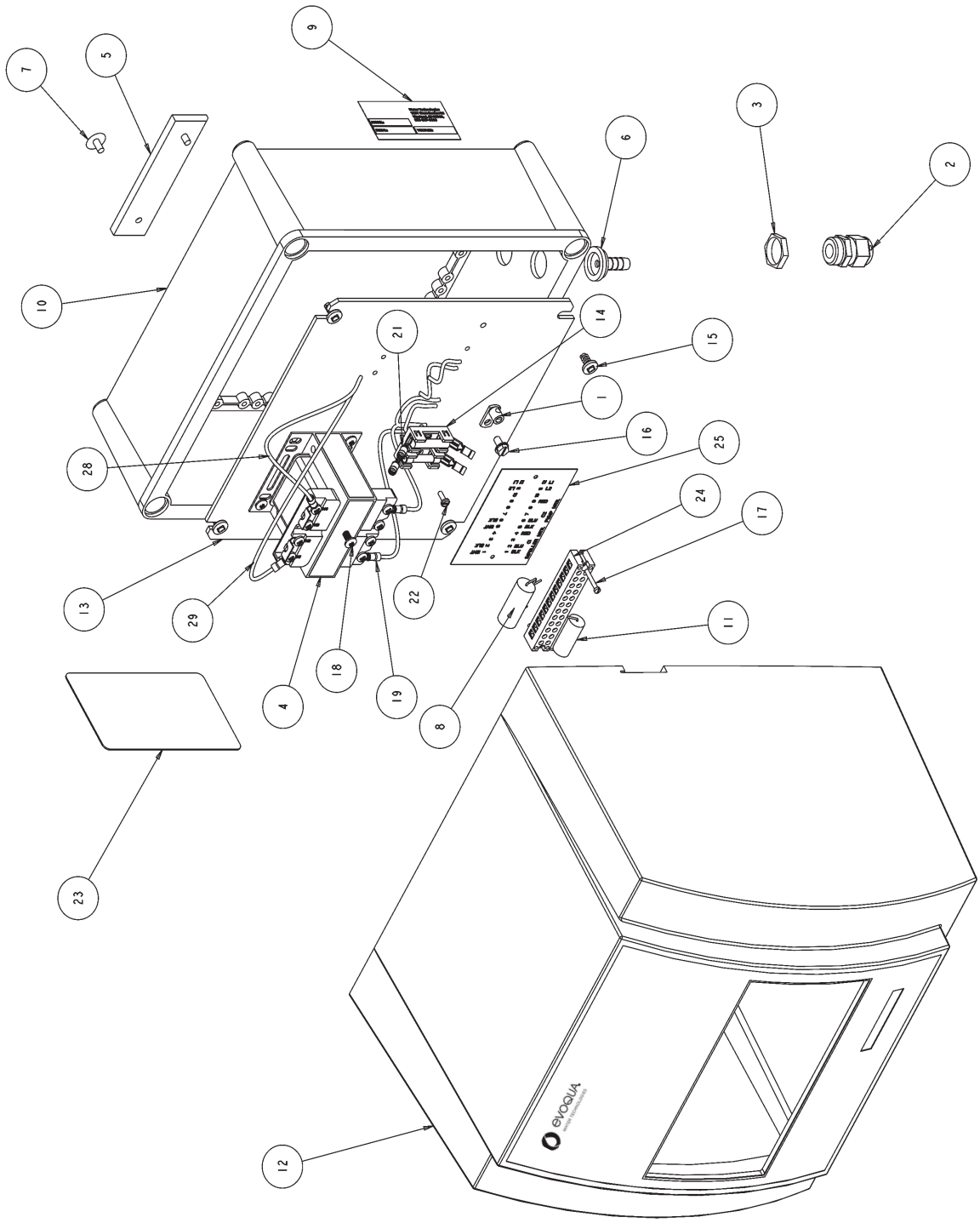
The porous element can be removed and the electrolyte drained as follows: Using a self-tapping screw (a #6 drywall screw is preferred), tap into the porous element, then pull out the element. The element is approximately ¼-inch long. This porous element is no longer usable. The electrolyte will drain out slowly. Rinse the reservoir well with distilled water to remove residual electrolyte. When removing the element in this manner, use care not to scar the sides of the element bore as this might prevent insertion of a new piece of porous material or cause excessive leakage of the electrolyte.

A new porous element can be created and installed as follows: Do not precut the porous material to length. A clean, sharp razor blade is required to make a clean cut in the porous material. First, using a sawing motion, slice off a thin slice of one end of a length of the porous material. Press this fresh cut end into the element bore. The fit should be snug. The material should be embedded to a ¼-inch to 3/8-inch depth. Cut off protruding portion of porous element flush with probe tip, being very careful not to scratch or damage electrodes.

SECTION 6

SECTION 6 - ILLUSTRATIONS

List of Contents



NOTE: FOR PARTS LIST, SEE DWGS. 50.580.000.030B.

MICRO/2000® AND DEOX/2000® U.S. WETSIDE ENCLOSURE ASSEMBLY - PARTS

W3T99806, W3T99807, W3T99805, W3T98057, W3T98058, W3T98056, W3T140746, W3T140876, W3T140872, W3T140873, W3T140749, W3T140971, W3T140874,W3T140750, W3T140747, & W3T140748

50.580.000.030A
ISSUE 3 7-14

KEY NO.	PART NO.	QTY.	DESCRIPTION
1	W2T1535	1	GROUNDING LUG
2	W2T504179	1	M20 CABLE GLAND
3	W3T160551	1	CABLE GLAND NUT
4	W2T416871	1	24VAC TYPE T TRANSFORMER WITH TERMINAL SCREWS AND JUMPERS
5	W2T416873	2	DIN RAIL GUIDE
6	W2T365250	1	1/4" FLAT SEAT HOSE BARB
7	W2T365251	4	RIVET
8	W2T416875	1	CAPACITOR 15µF±20%, 100V
9	W3T108352	1	ID LABEL
10	W2T416879	1	ENCLOSURE MACHINED
11	W2T416880	1	CAPACITOR 10µF±20%, 100V
12	W2T416881	1	FACADE, COMPLETE
13	W2T416882	1	MACHINED MOUNTING PLATE
14	W2T416884	1	FUSE HOLDER
15	W2T365269	4	MOUNTING PLATE SCREW
16	W2T365269	1	10-32 UNCx3/8 GREEN GROUND SCREW
17	W2T19230	2	TERMINAL BLOCK MOUNTING SCREW
18	W2T375927	4	SCREW, MACHINE, TRSHD, 10 DIA., 0.375 SST
19	W2T375930	1	18 AWG STRANDED WIRE, BLACK
20	W2T16189	1	18 AWG STRANDED WIRE, WHITE
21	W2T19801	4	TERMINAL RING (RED)
22	W2T19887	1	SHRINK TUBING .046 ID BS
23	W2T19888	4	FEMALE LUG (RED)
24	W2T19844	2	SCREW 6-32 x 3/8" LG
25	W2T11555	1	WARNING LABEL
26	W2T13305	1	TERMINAL BLOCK, CAPTIVE WIRE
27	W2T421097	1	STRIP, MARKER
28	W2T375930	1.5 FT	18 AWG STRANDED WIRE, BLACK
29	W2T16189	1.67 FT	18 AWG STRANDED WIRE, WHITE

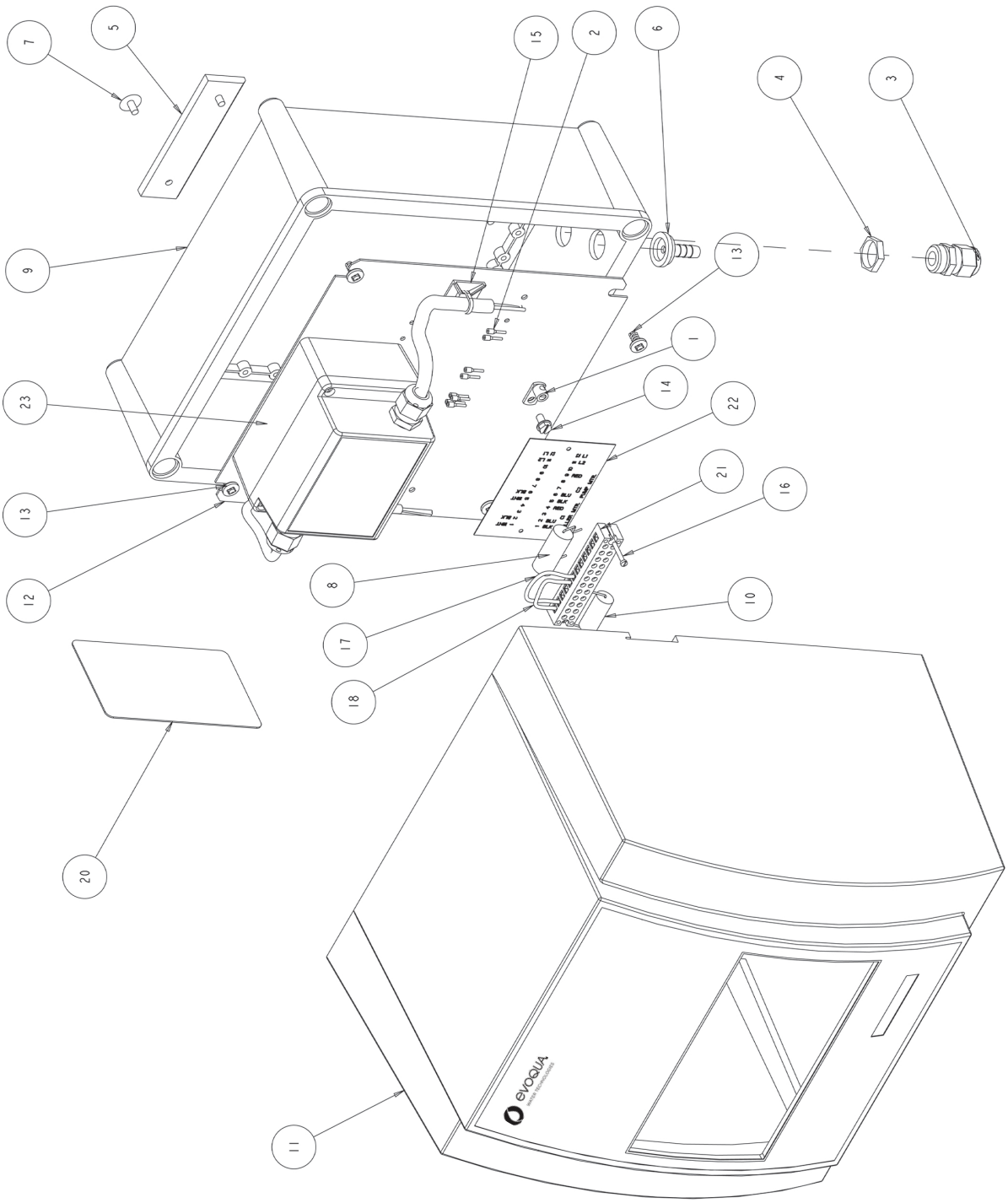
WHEN ORDERING MATERIAL ALWAYS SPECIFY MODEL AND SERIAL NUMBER OF APPARATUS

MICRO/2000® AND DEOX/2000® U.S. WETSIDE ENCLOSURE ASSEMBLY - PARTS LIST

W3T99806, W3T99807, W3T99805, W3T98057, W3T98058, W3T98056, W3T140746, W3T140876, W3T140872, W3T140873, W3T140749, W3T140971, W3T140874,W3T140750, W3T140747, & W3T140748

50.580.000.030B

ISSUE 2 2-11



NOTE: FOR PARTS LIST, SEE DWGS. 50.580.000.030B.

MICRO/2000® AND DEOX/2000® CE WETSIDE ENCLOSURE ASSEMBLY - PARTS

W3T99806, W3T99807, W3T99805, W3T98057, W3T98058, W3T98056, W3T140746, W3T140876, W3T140872, W3T140873, W3T140749, W3T140971, W3T140874,W3T140750, W3T140747, & W3T140748

50.580.000.035A

ISSUE 2 7-14

KEY NO.	PART NO.	QTY.	DESCRIPTION
1	W2T1535	1	GROUNDING LUG
2	W2T504179	8	BOOTLACE FERRULE, INSULATED, 1.5MM
3	W3T160551	1	M20 CABLE GLAND
4	W2T416769	1	CABLE GLAND NUT
5	W2T416873	2	DIN RAIL GUIDE
6	W2T365250	1	1/4" FLAT SEAT HOSE BARB
7	W2T365251	4	RIVET
8	W2T416875	1	CAPACITOR, 15µF±20X, 100V
9	W2T416879	1	ENCLOSURE MACH'D
10	W2T416880	1	CAPACITOR, 10µF±20X, 100V
11	W2T416881	1	FACADE, COMPLETE
12	W2T416882	1	MACH'D MOUNTING PLATE
13	W2T365269	4	MOUNTING PLATE SCREW
14	W2T365269	1	10-32 UNC X 3/8 GREEN GROUND SCREW
15	W2T366020	2	MB3A10C2, CABLE MOUNTS
16	W2T19230	2	TERMINAL BLOCK MOUNTING SCREW
17	W2T375930	1	18 AWG STRANDED WIRE, BLACK
18	W2T16189	1	18 AWG STRANDED WIRE, WHITE
19	W2T19887	1	SHRINK TUBING, 0.46 id bs
20	W2T11555	1	WARNING LABEL
21	W2T13305	1	TERMINAL BLOCK, CAPTIVE WIRE
22	W2T421097	1	STRIP, MARKER
23	W3T139780	1	ENCLOSURE ASSEMBLY, CE TRANSFORMER

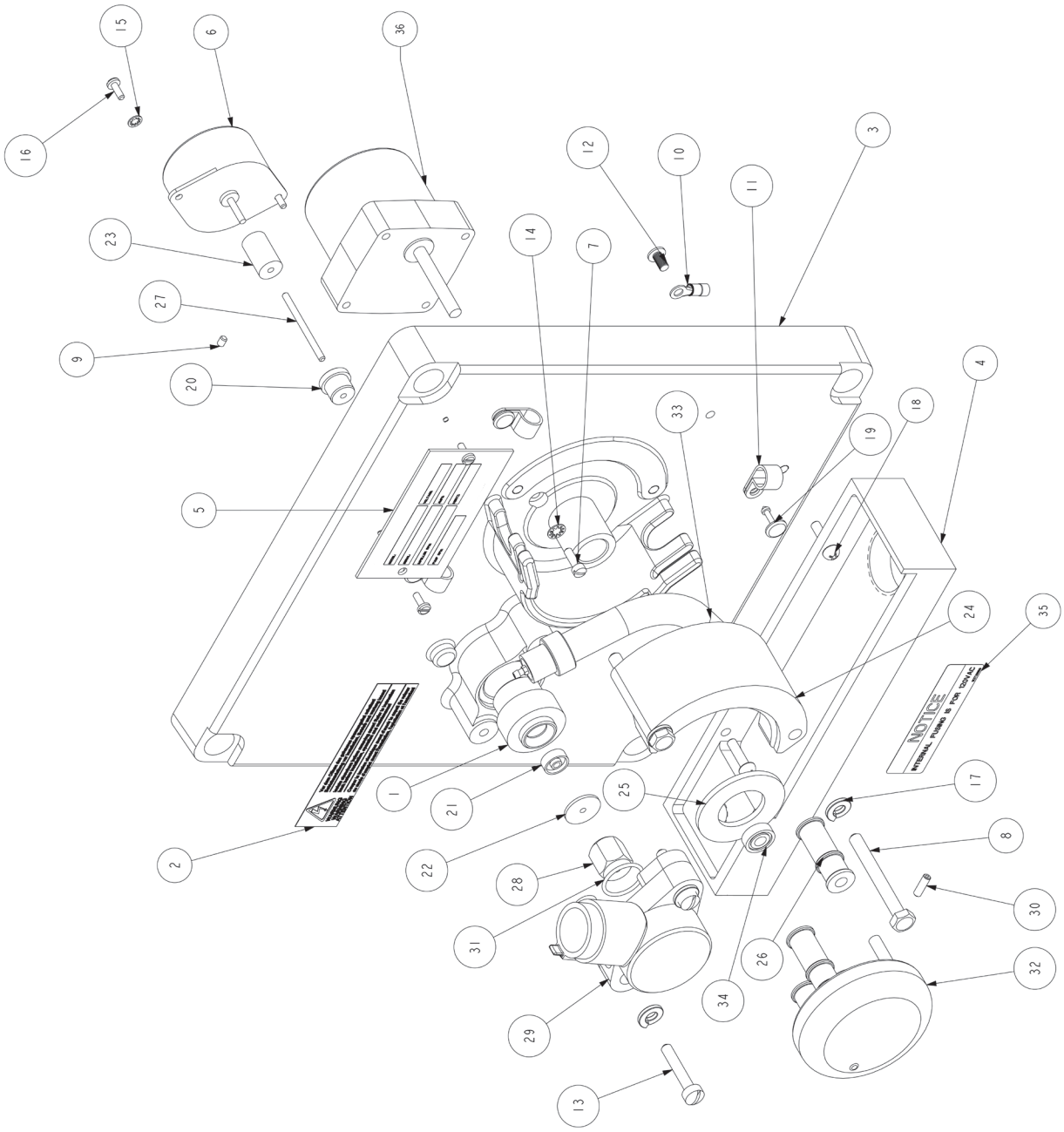
WHEN ORDERING MATERIAL ALWAYS SPECIFY MODEL AND SERIAL NUMBER OF APPARATUS

MICRO/2000® AND DEOX/2000® CE WETSIDE ENCLOSURE ASSEMBLY - PARTS LIST

W3T99806, W3T99807, W3T99805, W3T98057, W3T98058, W3T98056, W3T140746, W3T140876, W3T140872, W3T140873, W3T140749, W3T140971, W3T140874,W3T140750, W3T140747, & W3T140748

50.580.000.035B

ISSUE 1 2-11



NOTE: FOR PARTS LIST, SEE DWGS. 50.580.000.040B.

MICRO/2000® AND DEOX/2000® WETSIDE CASTING ASSEMBLY - PARTS

W3T99806, W3T99807, W3T99805, W3T98057, W3T98058, W3T98056, W3T140746, W3T140876, W3T140872, W3T140873, W3T140749, W3T140971, W3T140874,W3T140750, W3T140747, & W3T140748

50.580.000.040A

ISSUE 3 7-14

KEY NO.	PART NO.	QTY.	DESCRIPTION
1	W2T8855	1	SEAL, ADAPTER, PVC
2	W3T172188	1	LABEL, WARNING
3	W2T416867	1	CASTING, AL6061
4	W2T416872	1	DRIP TROUGH, PVC
5	W3T108352	1	NAME TAG
6	W2T416876	1	MOTOR, REVERSIBLE, 600/500 RPM
7	W2T17575	2	SCREW, #8-32 X 1/2" LG.
8	W2T375790	2	BOLT, 1/4-20 X 2-1/4" LG.
9	W2T19395	3	SET SCREW, #6-32 X 3/16" LG.
10	W2T17709	2	RING TERMINAL, BLUE
11	W2T17365	3	CLAMP, PLASTIC
12	W2T17476	2	SCREW, #10-32 X 1/2" LG.
13	W2T376054	2	SCREW, 1/4-20 X 1-1/4" LG.
14	W2T18721	2	LOCKWASHER, #8 INTERNAL TYPE
15	W2T18998	2	LOCKWASHER, #6 INTERNAL TYPE
16	W2T19844	4	SCREW, #6-32 X 3/8" LG.
17	W2T15636	4	LOCKWASHER, 1/4"
18	W2T14421	2	SCREW, #10-24 X 3/4" LG.
19	W2T13299	3	CLIP, PLASTIC
20	W2T12538	1	BEARING, PVC
21	W2T12112	1	U-CUP, TEFLON
22	W2T418119	1	SEAL, GRIT, TEFLON
23	W2T11682	1	COUPLING, BRASS
24	W2T11674	1	OCCLUSION RING, TEFLON
25	W2T11675	1	THRUST WASHER, TEFLON
26	W2T11676	3	PUMP ROLLER, NYLON
27	W2T11678	1	IMPELLER SHAFT, POLYETHYLENE
28	W2T376256	1	IMPELLER, PVC
29	W2T11680	1	CELL, E 796 TYRIL
30	W2T376260	1	SET SCREW, SS, #10-24 X 1/2" LG.
31	W2T376750	1	O-RING, (018), EPR
32	W3T107925	1	ROTOR BODY UNIT, STEEL
33	W3T107926	1	TUBE UNIT, ASSEMBLED
34	W2T11687	1	BALL BEARING, STEEL, 1/4" ID X 5/8" OD
35	W2T291156	1	LABEL, NOTICE
36	W2T416877	1	MOTOR, 1 RPM
	W2T416878	1	MOTOR, 2 RPM (USED IN W3T980557, W3T98058 AND W3T98057)

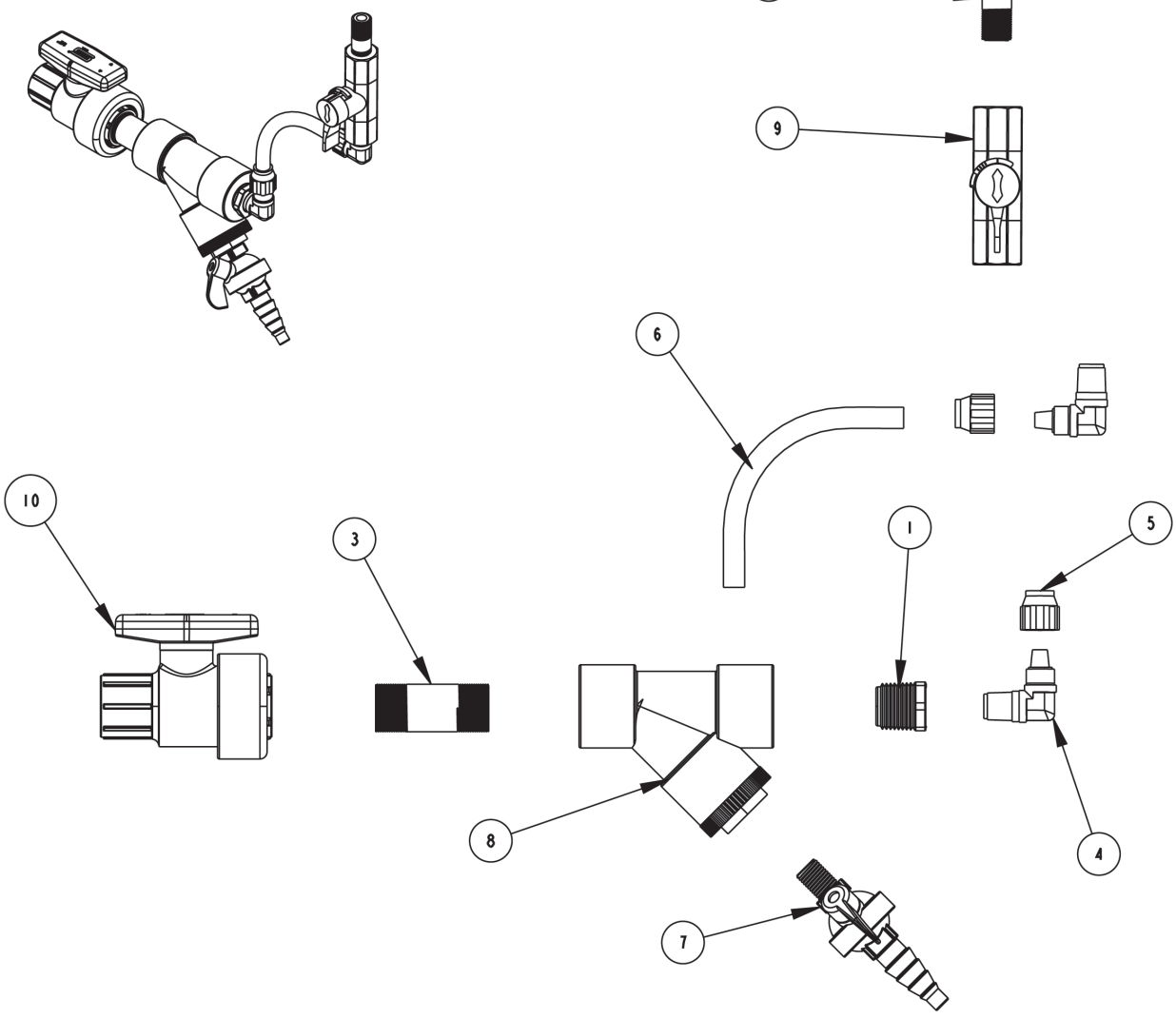
WHEN ORDERING MATERIAL ALWAYS SPECIFY MODEL AND SERIAL NUMBER OF APPARATUS

MICRO/2000® AND DEOX/2000® WETSIDE CASTING ASSEMBLY - PARTS LIST

W3T99806, W3T99807, W3T99805, W3T98057, W3T98058, W3T98056, W3T140746, W3T140876, W3T140872, W3T140873, W3T140749, W3T140971, W3T140874,W3T140750, W3T140747, & W3T140748

50.580.000.040B

ISSUE 2 2-11



NOTE: FOR PARTS LIST, SEE DWGS. 50.580.000.050B.

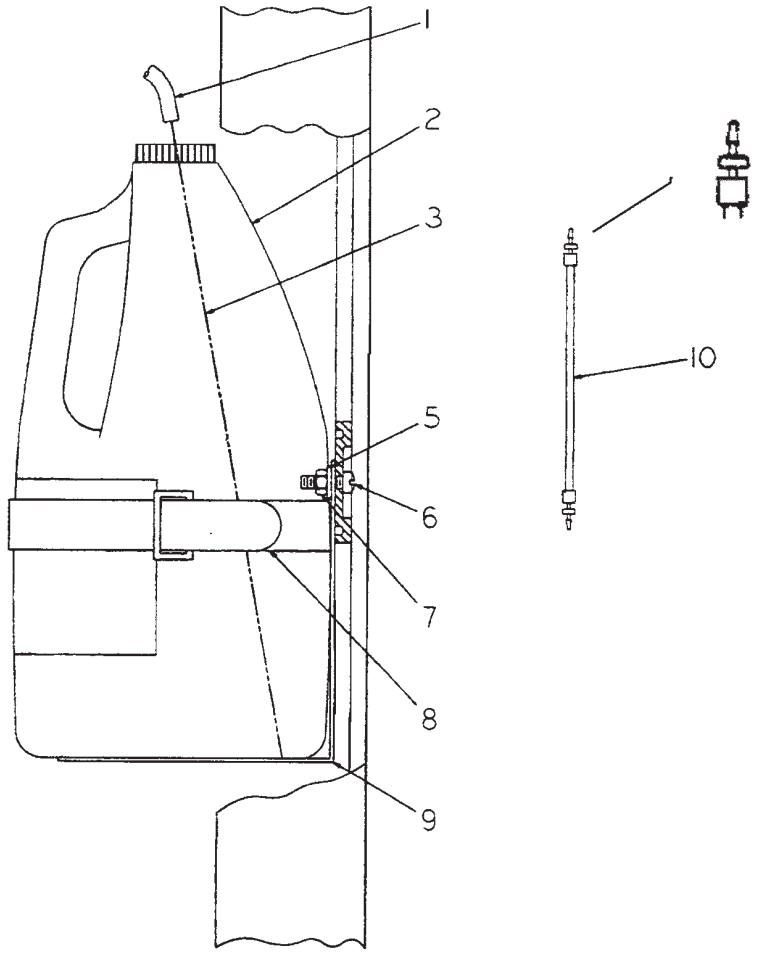
W3T108351 WATERLINE KIT - PARTS

50.580.000.050A
ISSUE 1 9-10

KEY NO.	PART NO.	QTY.	DESCRIPTION
1	W2T19400	1	REDUCING BUSHING, PVC, 1/4" x 1/2" NPT
2	W2T16766	1	NIPPLE, PVC, 1/4" x 1/4"
3	W2T19799	1	NIPPLE, PVC, 1/2"
4	W2T14737	2	ELBOW, PVC, 90°
5	W2T12055	2	UNION NUT, PVC, 1/2-20 THREAD
6	W2T16217	1	TUBING, POLYETHYLENE, 1/4" ID, 3 FT
7	W2T15468	1	VALVE, CCI PVC
8	W2T13310	1	Y STRAINER, PVC
9	W2T12996	1	LABCOCK VALVE, PVC/EPDM, 1/4" T x T
10	W2T378415	1	BALL VALVE, 1/2" SINGLE ENTRY, PVC TYPE

WHEN ORDERING MATERIAL ALWAYS SPECIFY MODEL AND SERIAL NUMBER OF APPARATUS

W3T108351 WATERLINE KIT - PARTS LIST



KEY NO.	PART NO.	QTY.	DESCRIPTION
1	■ W2T11685	8'	TUBING (.020 ID) NORPRENE
2	W3T110057	1	BOTTLE
3	W2T11234	1	RIGID TUBING (.027 ID), 13" LG.
5	W2T16958	2	1/4" LOCKWASHER (SS)
6	W2T18825	2	MACH. SCREW (RD.HD.,SS) 1/4"-20 x 3/4" LG.
7	W2T417965	2	HEX. JAM NUT (SS) 1/4"-20
8	W2T14861	1	STRAP
9	W2T13382	1	BOTTOM BRACKET SHELF
10	W3T107927	1	REAGENT TUBE UNIT

NOTE: ■ NOT PART OF W3T98601.

WHEN ORDERING MATERIAL ALWAYS SPECIFY MODEL AND SERIAL NUMBER OF APPARATUS.

W3T98601 REAGENT - PARTS

50.505.020.010
ISSUE 4 9-03

SECTION 7

SECTION 7 - COMPLETE DEVICES, RETROFIT KITS & SPARE PARTS

List of Contents

PARA. NO.

7.1 Retrofit Sets

3-electrode cell Micro/2000® with PT1000	3-electrode cell Deox/2000® with PT1000
W2T420224 - Plug-in card with terminals AAD8242 - with optional Process Control	W3T158829 - Plug-in card with terminals AAD8245 - with optional Process Control

7.2 Spare Parts and Consumables

Micro/2000® and Deox/2000®					
Electrode cleaning sand W3T100141	Electrolyte W2T13044	Probe porous junction material W2T12276	Probe: Std. range W3T99718 High range W3T99786	Plug-in card no control: Micro/2000® W2T420224 Deox/2000® W3T158829	Plug-in card with control: Micro/2000® AAD8242 Deox/2000® AAD8245

7.3 Micro/2000® and Deox/2000® Spare Parts List

Part No.	Qty.	Description
W3T107488	1	Preventive maintenance kit
W3T107926	▲ 1	Sample tube assembly (Sample metering pump)
W3T107927	▲ 2	Reagent tube assembly (Sample metering pump)
U10242	▲ 1	Tube silicone grease (for impeller shaft seal)
W2T12538	▲ 1	Bearing
W2T12112	▲ 1	Impeller shaft seal
W2T11678	▲ 1	Impeller shaft
W2T12113	▲ 1	Fit guard, Impeller shaft
W2T376750	▲ 1	O-ring (For cell, size #018, EPDM)
W2T11683	16 Ft	Reagent tubing (yellow, 5/32" OD, Norprene)
W2T12617	4 Ft	Sample tubing (black, 1/4" OD, Norprene)
W2T12016	2 Ft	Sample tubing (translucent, 1/4" OD, LDPE)
W3T100141	1 Tube	Tube grit
W2T12276	6 in.	Probe junction material
W2T13044	1 Btl	Probe electrolyte solution, 2 oz.
W2T15779	1 Btl	Potassium iodide, 500 grams
W2T12260	1 Btl	Bottle detergent additive, 6 oz.
W2T12261	1 Btl	Bottle detergent additive, 1 gal.
W2T8468	1 Ctn*	3 gram Chloramine-T reagent, ± .5 and ± 1.0 mg/l range
W2T8469	1 Ctn*	15 gram Chloramine-T reagent, ± 2.5, 5.0 and 10.0 mg/l range
W2T416885	1	Fuse, 3 AG 1/4 Amp, 250 VAC
W2T416886	1	Fuse, 3 AG 1/2 Amp, 250 VAC
W2T16226	1 Ctn	pH 4 Buffer solution
W3T108269	1	Abrasive paper (1" x 2")
W3T122322	1 m	DIN rail (39.37")
W2T492188	2	Fuse, 5 x 20mm, 200 mA, 250VAC

▲ Part of W3T107488 * Eight vials

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.

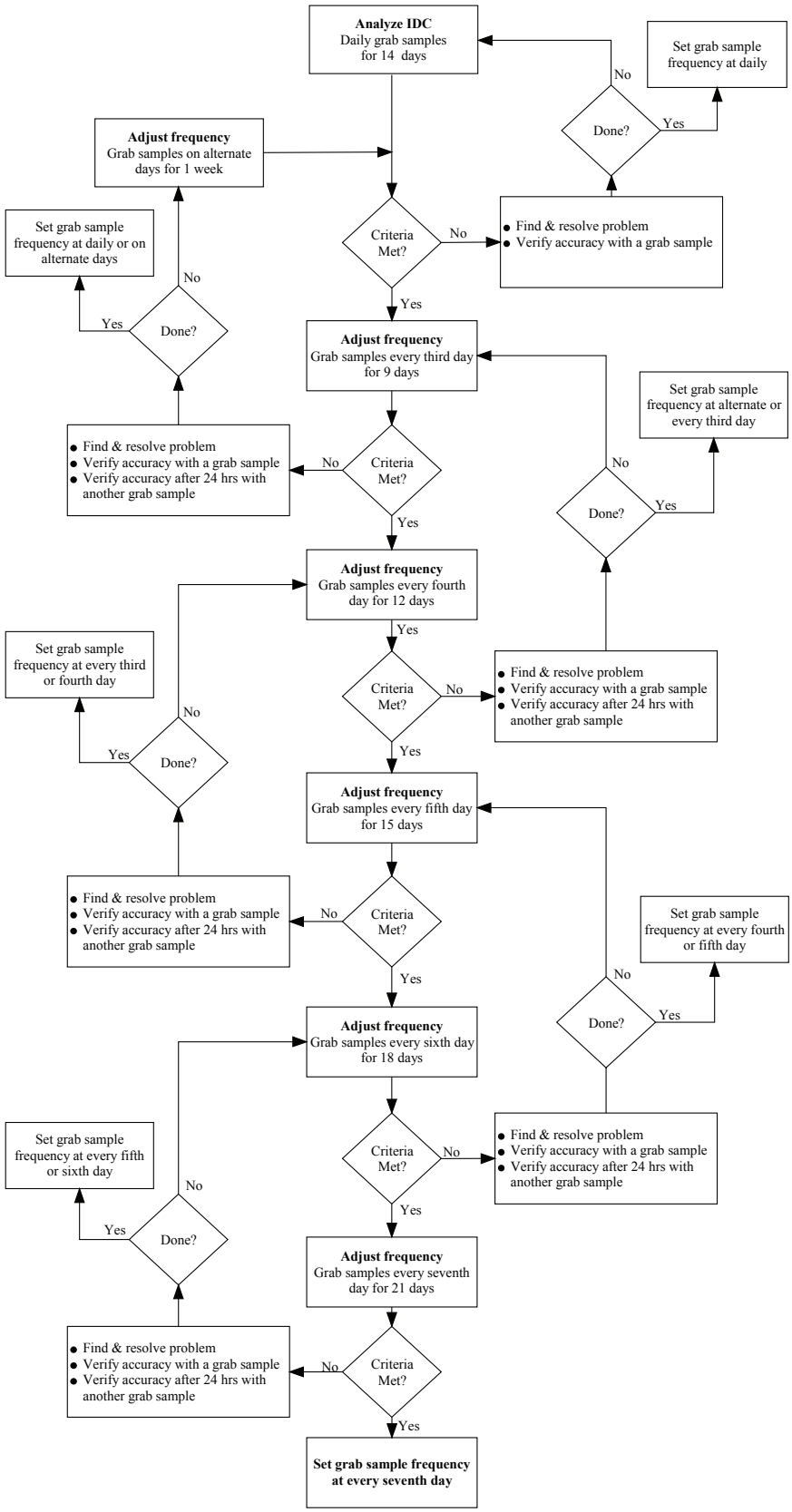
If troubleshooting of the on-line analyzer is required as part of any troubleshooting procedures during this testing period, it is suggested to refer to the troubleshooting guide supplied in the instruction manual of each on-line chlorine analyzer.

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.

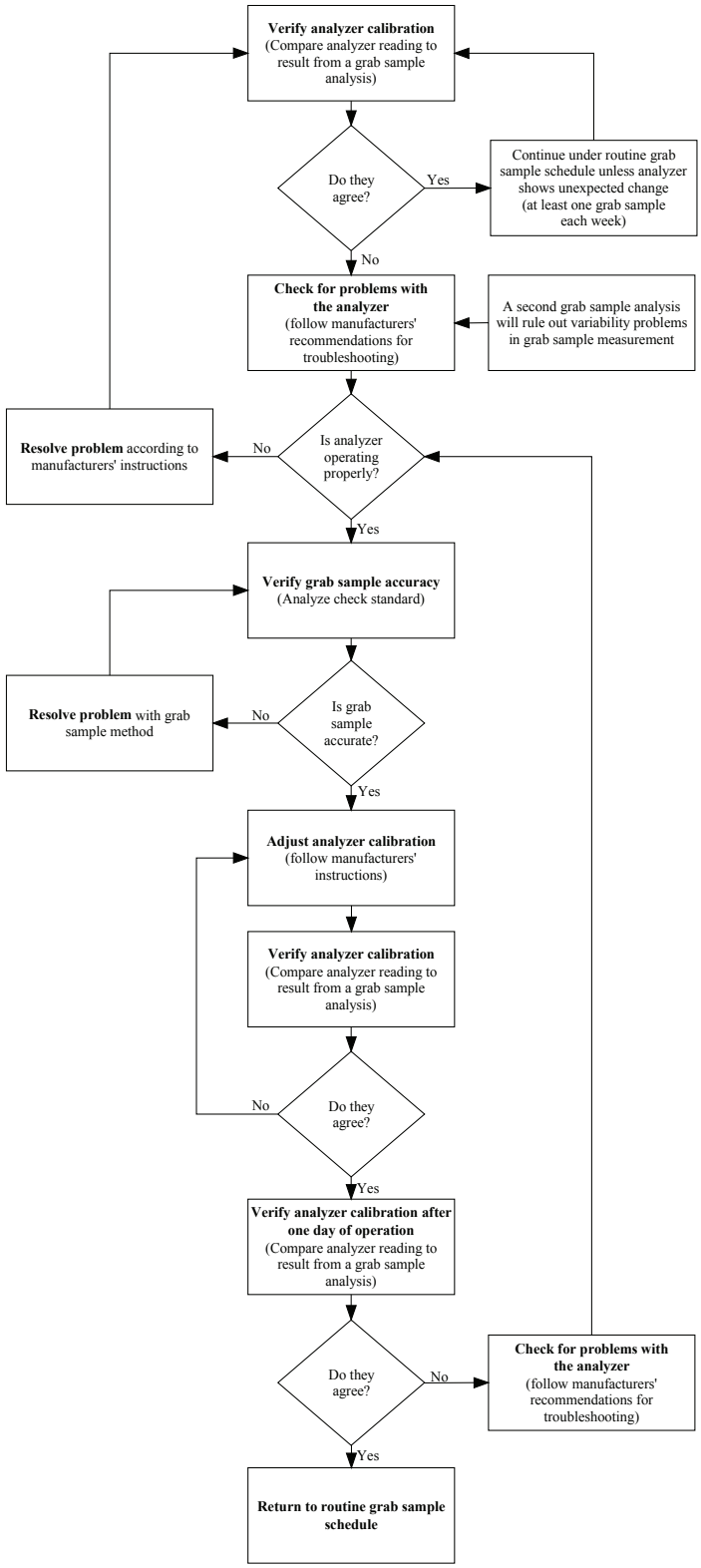
COMPLIANCE FOR EPA METHOD 334.0

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: _____

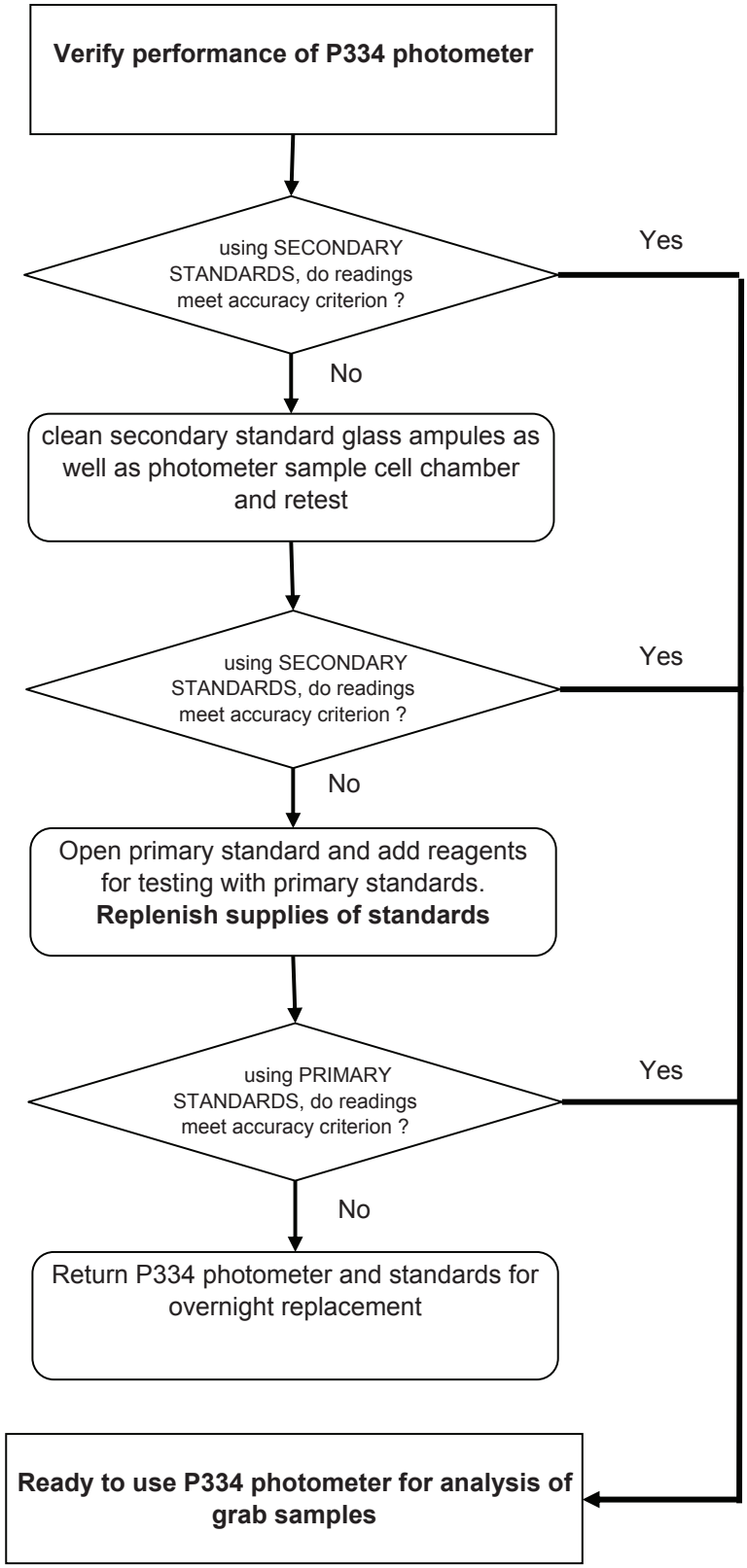
Now take square root of the result (calculator) (S) = _____

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						
	82						
	83						
	84						
	85						
	86						
	87						
	88						
	89						
	90						