DEPOLOX® 3 *PLUS*
RESIDUAL ANALYZER
FOR MEASURING CHLORINE, CHLORINE DIOXIDE, OZONE, AND/OR pH OR FLUORIDE

BOOK NO. IM 50.560CA UA ISSUE B

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 judgement 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 judgement 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 U.S. Filter/Wallace & Tiernan, Inc., 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.

USFilter
WALLACE & TIERNAN PRODUCTS
1901 West Garden Road, Vineland, NJ 08360

INTRODUCTION

The Depolox 3 plus Residual Analyzer is a low, cost economical analyzer for potable water that continuously measures either free or total chlorine, chlorine dioxide or ozone residuals using proven amperometric measurement technology. There is also an arrangement available for measuring pH or flouride.

The Depolox 3 plus analyzer consists of two separate components: a "wet side" package containing the sensor/cell and an electronic control package.

The electronic package is available for either 115 or 230 volt operation. A single input arrangement is used when only a disinfectant measurement (free or total chlorine, chlorine dioxide, ozone) is required. A dual input arrangement is available when either pH or fluoride measurement is required in addition to a disinfectant measurement. Note that for pH- or fluoride-only measurement, the dual input electronic package is required and the dual input cannot be used for two disinfectant measurements. The electronic package provides for operator input via plain-text-assisted, self-explanatory menus and a sealed keypad. The large, two-line (16 characters each) display of disinfectant residual alternates every five seconds with the pH or fluoride values when the analyzer is set up for two measurements.

There are two wetside configurations available: Membrane and Bare Electrode. Both consist of a flow-through cell with a transparent plexiglass body that houses one or two measuring sensors. The cell's transparency permits visual checks on the flow of sample water and measuring conditions. The Membrane wetside can be fitted with any one of four membrane-type sensors (free chlorine, total chlorine, chlorine dioxide or ozone) for disinfectant measurement. A second sensor can be added for pH or fluoride measurement. The bare electrode wetside is available for free chlorine measurement only. This arrangement can be used where a quick response time is required or if there is a high hardness in the sample water that could foul a membrane sensor. A second sensor can be added for pH or fluoride measurement. Note that free chlorine measurement by this wetside is affected by changes in pH. An optional CO2 gas reagent kit is available for economical pH adjustment. It is also possible to compensate for pH changes by using a dual input arrangement with the pH sensor option for automatically calculating the residual value.

Refer to Table A for part numbers for the various analyzer combinations.

Table A - Analyzer Type Selection Sheet Using Package Numbers

ELECTRONIC PACKAGE (Select one unless using pH or Fluoride alone)	PART #
Chlorine ONLY (SINGLE SENSOR)	
115V	AAB1525
230V	AAB1540
Chlorine AND/OR pH OR Fluoride (DUAL SENSOR)	
115V	AAB1534
230V	AAB1543
SENSOR 1 - DISINFECTANT (SINGLE OR DUAL) (Select one unless using pH or Fluoride alone)	
Bare Electrode	
Free Chlorine Measurement Package	AAB5383
AND (If pH higher than 9)	
CO_2 Buffer Package	G2358
OR	
Membrane Sensor	
Membrane Flow Block Assembly	AAB4390
AND (SELECT 1)	
Free Cl_2 Probe FC1	AAB4297
Total Cl_2 ProbeTC1	AAB1423
ClO_2 Probe CD7	AAB4300
Ozone Probe OZ7	AAB4303
AND (SELECT 1)	
2m Cable	AAC4681
5m Cable	AAC4687
10m Cable	AAC4690
15m Cable	AAC4693
25m Cable	AAC5812
50m Cable	AAC5815
AND/OR (Options for Bare and Membrane)	
Flow Switch Alarm	AAA7000
Stop Valve	U95687
SENSOR 2 (FOR DUAL INPUT ONLY)	
pH Kit (Compensation available if combined with Bare Electrode)	AAB5386
OR	
Fluoride Kit - Refillable	AAB5389
OR	
Fluoride Kit - Gel Type	AAC5570
AND (If Fluoride or pH ONLY)	
Fluoride/pH Standalone Wetside	U95224

Options:

- Flow switch (to provide alarm for loss of sample water)
- Stop valve (to shut off sample flow)
- Impedance transformer (for pH or Fluoride probe)

NOTE: When ordering material, always specify model and serial number of apparatus.

Electromagnetic Compatibility and Other Requirements

DEPOLOX 3 *plus* devices conform with the following requirements:

- Generic standards EN 50081-1 (emission)
- EN 55022 Class B
- EN 50082-2 (immunity)
- EN 61000 -4- 2, 3, 4, 5, 6, 8, 11

DEPOLOX 3 *plus* devices are designed for use in industry, as well as the domestic, business, and trade sectors.

Declaration of Conformity

DEPOLOX 3 *plus* devices comply with the requirements of the EU directives 89/392/EC "Machinery Directive", 73/23/EC "Low Voltage Directive" and 89/336/EC "Electromagnetic Compatibility" and the harmonized European Standards listed therein.

Intended Use

The DEPOLOX 3 *plus* consists of one or two combined measuring and reference sensors for chlorine, chlorine dioxide, ozone, pH, and fluoride; a measuring water monitoring device; and an electronics module. The system is for measuring the concentration of chlorine, chlorine dioxide, and ozone as well as pH and fluoride, and to display and transmit measurements, in potable water.

Refer to the permissible measurement combinations, for a single unit, as mentioned previously.

WARNING: TO AVOID INJURY TO PERSONS CAUSED BY ELECTRICITY ONLY AUTHORIZED AND QUALIFIED ELECTRICIANS MAY INSTALL THE DEVICE AND OPEN THE HOUSING. THE DEVICE MAY ONLY BE OPERATED WHEN THE HOUSING IS CLOSED AND MUST BE CONNECTED TO THE PROTECTIVE CONDUCTOR. MODIFICATIONS TO THE DEVICE WHICH EXCEED THOSE DESCRIBED IN THIS MANUAL ARE NOT PERMISSIBLE.

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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 PLANT MAY BE CONNECTED TO MAINS VOLTAGE. IT IS ESSENTIAL THAT THE UTMOST CARE IS TAKEN WHEN WORK IS CARRIED OUT ON EQUIPMENT WHERE MAINS VOLTAGES ARE PRESENT. IT IS RECOMMENDED THAT MAINS 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 BOOK ARE AVAILABLE FROM:

USFILTER'S WALLACE & TIERNAN PRODUCTS
1901 WEST GARDEN ROAD
VINELAND, NEW JERSEY 08360
PHONE: (856) 507-9000
FAX: (856) 507-4125

VERY IMPORTANT SAFETY PRECAUTIONS (CONT'D)

NOTE

Minor part number changes may be incorporated into USF/W&T products from time to time that are not immediately reflected in the instruction book. If such a change has apparently been made in your equipment and does not appear to be reflected in your instruction book, contact your local USF/W&T sales representative 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 USFilter's Wallace & Tiernan Products (USF/W&T), contact the office indicated below.

UNITED STATES

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

CANADA

If the equipment was purchased directly from USF/W&T Canada, contact the nearest office indicated below.

ONTARIO

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

QUEBEC

243 Blvd. Brien
Bureau 210
Repentigny, Quebec
(514) 582-4266

MEXICO

If the equipment was purchased directly from USF/W&T de Mexico, contact the office indicated below.

Via Jose López Portillo No. 321
Col. Sta. Ma. Cuautepec, Tultitlan
Edo. México 54900
TEL: +52 55 2159 2976 / +52 55 2159 2989
FAX: +52 55 2159 2985

SECTION 1 - TECHNICAL DATA

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1.1 DEPOLOX 3 *plus* Electronics

Power supply	115 V ± 10%, 50 - 60 Hz, 14 VA F1 Fuse T315 mA, 5 x 20 mm or 230 V ± 10%, 50 - 60 Hz, 14 VA F1 Fuse T160 mA, 5 x 20 mm
Input A: Disinfectant measuring ranges	0.20 / 0.50 / 1.00 / 2.00 / 5.00 / 10.0 / 20.0 mg/l
Input B: pH measuring ranges (optional)	pH 4.00 to pH 10.00, pH 0 to pH 14.00
Input B: Fluoride measuring range (optional)	0.20 to 2.00 mg/l
Measurement inputs	1 x disinfection sensor 1 x pH or fluoride sensor (Dual Input only) electrically isolated for up to 50 V to ground
mA outputs 4 - 20 mA	1x for disinfection 1x for pH or fluoride (with Dual Sensor) max. 1000 ohm load, electrically isolated for up to 50 V to ground
Relay outputs	2 freely configurable alarm contacts for disinfectant signal 2 for ph or fluoride (with Dual Sensor) Electrically isolated up to 500 V to ground
Relay Contact Rating	5A 1/6 HP 125, 250 V AC or 5A 30 V DC 30 W max. Interference suppression via suppressor diodes.
1x Digital input	Dry contact input Electrically non-isolated
Interface	RS485 for connection to programmable controller or central instrumentation and control systems via RS485 USF/W&T protocol.
Ambient temp.	32 to 122°F (0 to 50°C)

1.2 Sensor Feature List

	free C12 (bare electrode)	FC1 (membrane type)	TC1
Principle of operation	Potentiostatic 3-electrode-amperometric, bare electrode	Potentiostatic 3-electrode-amperometric, membrane type	Potentiostatic 3-electrode-amperometric, membrane type
Measurand	free chlorine Cl	free chlorine Cl	total chlorine Cl
Application	Potable water, high hardness and fast response requirements	Potable water, prefered for low conductivity and variable pH	Potable water, prefered for low conductivity and variable pH
Analyzer electronics	Depolox Basic Depolox 3+	Depolox Basic Depolox 3	Depolox Basic Depolox 3+
Pressure capability	Pressureless	Pressureless	Pressureless
Range	0 to 20 ppm	0 to 20 ppm	0 to 20 ppm
Zero cal.	Required	Not required	Not required
Accuracy	0.01 mg/l or 2% F.S. whichever is greater	0.05 mg/l or 6% F.S. whichever is greater	0.05 mg/l or 6% F.S. whichever is greater
Sensitivity	0.01 mg/l or 1% F.S. whichever is greater	0.01 mg/l or 1 % F.S. whichever is greater	0.01 mg/l or 1% F.S. whichever is greater
Repeatability	0.01 mg/l or 2% F.S. whichever is greater	0.02 mg/l or 3% F.S. whichever is greater	0.02 mg/l or 3% F.S. whichever is greater
Stability	2% F.S. under typical conditions for 1 month	5% F.S. under typical conditions for 1 month	5% F.S. under typical conditions for 1 month
Response time (T_{90})	90% change in less than 20 seconds	90% change in less than 5 minutes	90% change in less than 5 minutes
Sample temperature	41 to 122° F (+5 to 50° C)	41 to 113° F (-5 to 45° C)	41 to 113° F (-5 to 45° C)
Storage temperature	14 to 140° F (-10 to 60° C)	14 to 122° F (-10 to +50° C)	14 to 122° F (-10 to +50° C)
pH dependence	pH 4 to pH 9 must have stable pH (max. pH variation 0.l pH) pH comp. Available with dual input units optional CO_2 buffering available	Usable range pH 6 to pH 10 maximum interference 5% per pH-unit	Usable range pH 6 to pH 10 maximum interference 5% per pH-unit
Conductivity	> 250 µS/cm	>10 µS/cm up to 2500 µS/cm	> 10 µS/cm up to 2500 µS/cm
Sample water flow	33 1/h +/- 5 liter, constant	6 1/h to 35 1/h, constant	6 l/h to 35 1/h, constant
Inlet pressure	2 to 60 psi (0.15 to 4 bar)	2 to 60 psi (0.15 to 4 bar)	2 to 60 psi (0.15 to 4 bar)
Outlet pressure	0 psi	0 psi	0 psi
Temperature compensation	Yes, Pt 100 sensor / Depolox 3 plus only	Yes	Yes
Flow switch (optional)	Yes	Yes	Yes
Flow regulator	Yes	Yes	Yes
Reagents	CO_2 buffer available	None	None
Cleaning	Dynamic grit	None	None
Typical life time	membrane: 1 year electrolyte: 6 months	membrane: 1 year electrolyte: 6 months	membrane: 1 year electrolyte: 6 months

1.2 Sensor Feature List (Cont'd)

	CD7	OZ7
Principle of operation	Potentiostatic 2-electrode-amperometric-, membrane type	Potentiostatic 2-electrode-amperometric-, membrane type
Measurand	Chlorine Dioxide (ClO_2)	Ozone (O_3)
Application	All water with suspended solids less than 0.8 mm	All water with suspended solids less than 0.8 mm
Interference	Ozone and periacetic acid	Chlorine Dioxide and periacetic acid
Analyzer electronics	DEPOLOX 3 plus	DEPOLOX 3 plus
Pressure capability	Pressureless	Pressureless
Range	0 to 20 ppm	0 to 10 ppm
Zero cal.	Not required	Not required
Accuracy	0.05 mg/l or 6% F.S. whichever is greater	0.05 mg/l or 6% F.S. whichever is greater
Sensitivity	0.01 mg/l or 1 % F.S. whichever is greater	0.01 mg/l or 1 % F.S. whichever is greater
Repeatability	0.02 mg/l or 3% F.S. whichever is greater	0.02 mg/l or 3% F.S. whichever is greater
Stability	± 5% F.S. under typical conditions for 1 month	± 5% F.S. under typical conditions for 1 month
Response time (T_{90})	90% change in less than 20 seconds	90% change in less than 50 seconds
Sample temperature	41 to 113° F (-5 to 45° C)	41 to 113° F (-5 to 45° C)
Storage temperature	14 to 122° F (-10 to +50° C)	14 to 122° F (-10 to +50° C)
pH dependence	None	None
Conductivity	> 1 μS/cm up to 40 mS/cm	> 1 μS/cm up to 40 mS/cm
Sample water flow	6 l/h to 35 l/h, constant	6 l/h to 35 l/h, constant
Inlet pressure	2 to 60 psi (0.15 to 4 bar)	2 to 60 psi (0.15 to 4 bar)
Outlet pressure	0 psi	0 psi
Temperature compensation	Yes	Yes
Flow switch (optional)	Yes	Yes
Flow regulator	Yes	Yes
Reagents	None	None
Cleaning	Yes (See instruction book)	Yes (See instruction book)
Typical life time	membrane: 1 year electrolyte: 6 month	membrane: 1 year electrolyte: 6 month

1.3 pH Sensor Kit (AAB5386)

Range of pH sensor	0 to pH 14
Temperature range	23 to 122° F (-5 to 50° C) for the sample water
Pressure	max. 60 psig (4 bar)
Conductivity	>300μS/cm

NOTE: When used for pH compensated Free chlorine measurement, the pH range must be between 6 and 9.

NOTE: Where the standard 1.5-meter sensor cable is not long enough (for special installations up to 50-meter cable length), an impedance transformer is used to convert the very high-resistance electrode signal of the pH to a low-resistance signal. The impedance transformer (Part No. U95607) is screwed onto the pH sensor cable. The impedance transformer is powered by an integral battery. Battery lifetime is approximately five years.

1.4 Fluoride Sensor Kit (AAB5389)

Range	saturated solutions up to 10^{-6} M (0.02ppm)
pH Range	pH 5 to pH 7 at 10^{-6} M (0.01 ppm F-) up to pH 11 at 10^{-1} M (1900 ppm F-)
Temperature Range	23 to 122° F (-5 to 50° C)

NOTE: An impedance transformer is used to convert the very high-resistance electrode signal of the fluoride sensor to a low-resistance signal. The impedance transformer (Part No. U95607) is screwed onto the fluoride sensor cable. It is powered by an integral battery. Battery lifetime is approximately five years.

SECTION 2 - INSTALLATION

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2.1 DEPOLOX 3 *plus*

NOTE: For safe and effective installation a knowledge of the connected devices is required with respect to operation, electrical connections, measurement signals, cable assignment, fuses and the safety regulations which have to be observed. The installation of the device therefore is only to be done by qualified and authorized skilled electricians.

CAUTION: Incorrectly connected devices may be damaged or destroyed when switching on or during operation, or may cause malfunctions in other devices. Be careful not to confuse measuring cables and other cables and not to let them come into contact with one another. Do not connect or disconnect live cables.

2.1.1 Unpacking

Check the transport packing for damage. Notify the carrier immediately if there is damage, otherwise your claim for compensation will be nullified.
If the device has suffered damage, get into touch with the responsible USF/W&T representative immediately. Keep the packaging until the system has been properly installed and is in operation.

2.1.2 Check Voltages

The line voltage of the DEPOLOX 3 *plus* is set at the factory in accordance with the instructions given at the time of the order (230 V or 115 V).

Check this setting from the rating plate immediately after unpacking the device, and in any case before it is installed.

If the line voltage setting does not match your supply, the setting will have to be altered (refer to paragraph 2.1.3, Adjust Line Voltage/Change the Fuse).

2.1.3 Adjust Line Voltage/Change Fuse

The rating plate on the top of the device shows the line voltage which was set at the factory. If this does not match the voltage at the site of installation, the device will have to be adjusted.

NOTE: Operating the device with the wrong voltage can lead to the device fuse blowing or other damage or malfunction. Adjustment of the line voltage must take place before installation and before the

connection of cables. The device may be opened and adjusted by an electrician only.

For connection to power with two hot wires (L1, L2), replace the metal pin on the F2 socket by a fuse corresponding to the voltage (see Figure 2.1).

The switch to adjust the voltage is inside the housing. To open up the housing push out the two lateral lugs with a screwdriver or similar tool. Unscrew the two screws on each side of the cover and lift off the cover of the housing. Should the ribbon cable be pulled off when doing this, it must be put back when putting back together. The cables must not be twisted (if the display is not illuminated the two-core ribbon cable has been inserted the wrong way round).

The slide switch to adjust the voltage allows a choice between 230 V and 115 V.

When setting to 230 V or 115 V, the fuse must be changed (fine-wire fuse 5 x 20 mm):
for 230 V: T160mA part no. UXF-92568
F1} for 115 V: T315mA part no. UXJ-92568

Figure 2.1 - Rating Plate

The change in voltage setting must be marked clearly and permanently on the rating plate as follows (example):

Line voltage changed to 230 V!
Date .... Name/firm/department

If the device fuse blows repeatedly due to a fault, the device must be repaired or replaced. Contact USF/W&T Technical Service.

2.1.4 Select Sensor Types

The setting for the measuring signal of the disinfection sensors must correspond to the connected sensor. Select the sensor at the ten-position DIP switch S3 on the board (factory setting is for Bare Electrode).

WARNING: WRONG SETTING CAN CAUSE DAMAGE TO THE SENSOR AND TO THE DEPOLOX 3 *PLUS*.

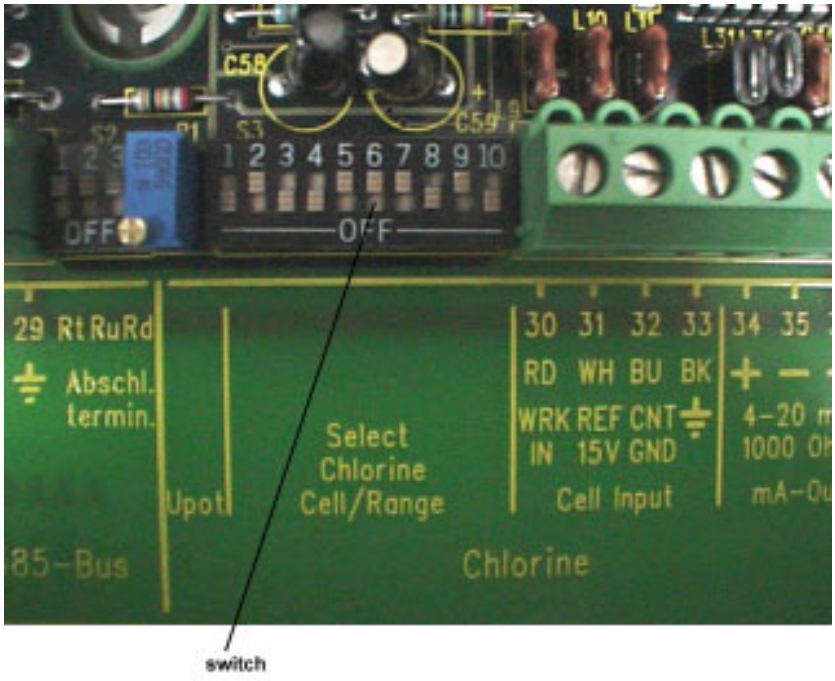
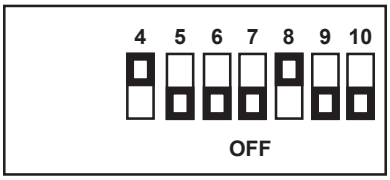
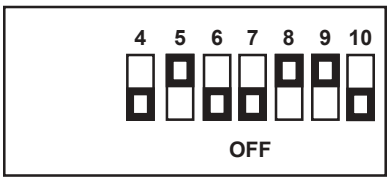


Figure 2.2 - DIP Switch

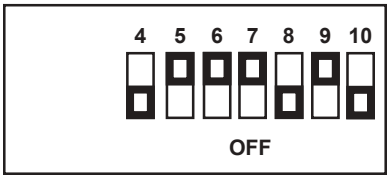
3-Elect. “Depolox 3 plus” (Bare Electrode):



2-Elect. “old Depolox 3”:

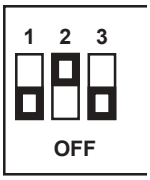


All membrane sensor:

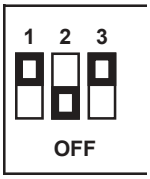


In case the cell current is >200µA (e.g., in waters with high conductivity), change the setting of positions 1 through 3 as follows:

DIP Switch (default 200µA):



DIP Switch
(only if sensor current >200µA to max. 1000 µA):



The other positions remain as before.

2.1.5 Installing the DEPOLOX 3 *plus* Electronics Module

The DEPOLOX 3 *plus* electronics module is built in a wall-mounted housing and should be mounted near the flow-through assembly.

2.1.6 Electrical Connections

Connect the sensor cables, alarm signal lines and the power cable according to the wiring diagrams (see Dwgs. 50.560.155.010, .020, .030, .040, and .050).

Do not switch on the power.

2.1.7 Digital Input

The flow switch (optional) must be connected to the terminals 25 and 26.

The digital input “Digital IN” is set for a potentially isolated external contact, e.g., for the flow switch.

If the flow switch is not used, jumper terminals 25 and 26. Otherwise, “Digital IN” error will occur.

2.1.8 Start-Up

WARNING: THE DEPOLOX 3 *PLUS* MODULE HAS NO POWER SWITCH OF ITS OWN AND IS IN OPERATION AS SOON AS THERE IS A CONNECTION TO THE POWER SUPPLY. CONNECTED DEVICES HAVE TO BE SWITCHED OFF DURING INPUT OF OPERATING DATA IN ORDER TO PREVENT UNCONTROLLED START-UP OR MALFUNCTIONS. ONLY WHEN THE OPERATING DATA IS INPUT AND CHECKED MAY OTHER DEVICES BE SWITCHED ON.

Start-up can only be effected after correct installation of the sample water line, leak test, and electrical connection to the systems.

Start operation of the measuring cell (refer to paragraph 3.3.1, Start-Up of the Measuring Cell, or to paragraph 2.3, Membrane Sensor.

Check that the setting of the 10-position DIP switch, S3, “Chlorine Cell” (refer to paragraph 2.1.4, Select the Chlorine Cell) is correct. Start by switching on the mains power to the control module.

First, the program version is displayed, for example:

AAB1603
FRG 49
V:X_XX/XX
Free Chlorine

Continue as follows (refer to Section 3 - Operation, as necessary):

a. Select the bus address in the SETUP menu (if operated in a bus system)

b. Select measuring range in the SETUP menu.

c. Select disinfectant.

d. Select pH or Fluoride mode (optional, SETUP)

e. Set the alarm values and functions in the ‘alarm’ menu(s).

f. Switch on the external units

g. After about 24 hours of running time, a calibration must be carried out. Until then the measured values are only approximate.

2.2 Bare Electrode (Free Chlorine) Sensor Kit

The flow block assembly with the sensors should be installed in a frost-protected location and, where possible, in a heated room.

The sample water should provide a minimum of approximately 2 psi (0.2 bar) water gauge pressure at the measuring cell inlet.

The sample water line should be as short as possible. In the water line to the measuring cell a strainer (size 0.5 mm) must be installed.

The sample water inlet must be connected to a stop valve (connection 1/4" - 18 NPT). The tapping point for the sample water must be positioned to ensure a bubble-free flow of water and a complete mixing of the disinfectant.

The drain line must be unpressurized.

2.3 Membrane Sensors (See Dwg. 50.560.160.020 in Section 3)

WARNING: DO NOT TOUCH THE REFERENCE ELECTRODE! DO NOT TOUCH THE PRESSURE BALANCE DIAPHRAGM!

Before unscrewing the membrane cap, remove the elastomer seal to allow air into the vent hole. Not doing this will cause a vacuum to occur which will damage the membrane when unscrewing the cap. Do not remove the yellow-grey layer on the reference electrode.

Unscrew the membrane cap from the electrode shaft and fill it to the top with the enclosed electrolyte. Strike the electrode shaft against the membrane cap to remove air bubbles. Clean the gold working electrode with the enclosed lapping paper (special abrasive paper). To do this, place the special abrasive paper on a paper towel. While holding on to a corner of the paper move the tip of the electrode of the vertically held probe one or two times over the rough side of the special abrasive paper. Ensure that the elastomer seal completely covers the vent hole. While holding the electrode shaft in a vertical position, screw on the cap onto the shaft. Surplus electrolyte will escape through the vent hole in the membrane cap below the elastomer seal. Do not hold the vent hole or press on the elastomer seal! If you detect air bubbles in the electrolyte, repeat the filling process. Wash away the escaped electrolyte with water.

NOTE: The membrane cap must be completely screwed to the electrode shaft so that no gap remains between membrane cap and electrode shaft. The sensor requires a one- to two-hour run in time before

a first calibration can be performed. The final calibration should be done after one day.

2.3.1 Insert Membrane Sensor Into Flow Block Assembly

Position the sensor through the flow block cap such that the sensor body touches the bottom of the water inlet assembly. The water flow should point directly to the membrane. It may be necessary to turn the flow block cap to find the correct position for the sensor in the water inlet assembly. Remove any air bubbles from the membrane as they disturb the measurement. Connect the sensor cables to the electronic module.

Under these conditions the sensor should give proper readings for three to six months.

For connection to the DEPOLOX 3 *plus* electronics, refer to Dwgs. 50.560.155.020 and 50.560.155.040.

The sensor requires a one to two hour run in time before a first calibration can be performed. The final calibration should be done after one day.

2.4 pH Sensor Kit

NOTE: This kit is required for pH-compensated Free chlorine measurement when used with the Bare Electrode Cell.

To insert the pH sensor into the flow block assembly, remove the cap from the pH sensor and put the sensor into the smaller hole in the flow block assembly cover.

For connection to the DEPOLOX 3 *plus* electronics, refer to Dwgs. 50.560.155.030 and 50.560.155.040).

2.5 Fluoride Sensor Kit

To insert the fluoride sensor into the flow block assembly, prepare the sensor as described in paragraph 3.6.2, Preparation of the Electrode.

Place the sensor into the hole in the flow block assembly cover.

For connection to the DEPOLOX 3 *plus* electronics, refer to Dwgs. 50.560.155.030 and 50.560.155.040).

2.6 Flow Switch (AAA7000) (Optional)

In general, the flow switch is only connected to the digital input of the DEPOLOX 3 plus. In case of other applications, ensure that the rating of this Reed contact (100 V AC and 0.5 A) is not exceeded even for a short time. In case inductive loads (e.g., relays or contactors) are switched, the contact has to be protected against induction sparks.

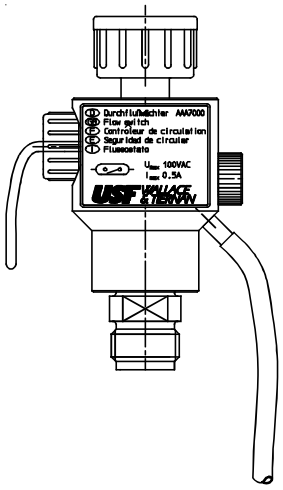


Figure 2.3 - Flow Switch

See Dwgs. 50.560.100.020 and .030 for flow switch location.

2.7 Stop Valve (U95687) (Optional)

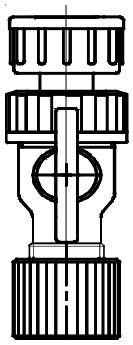
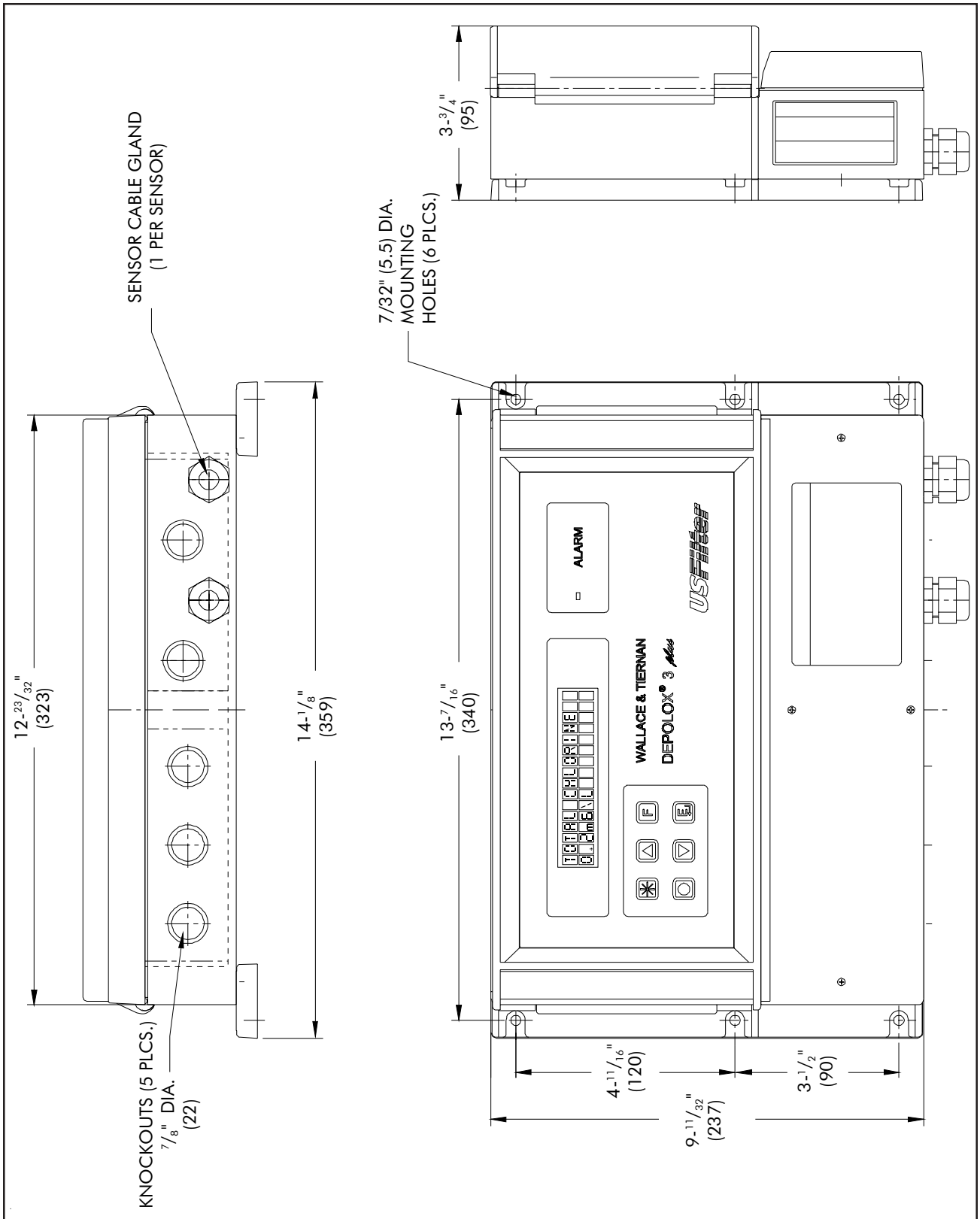


Figure 2.4 - Stop Valve

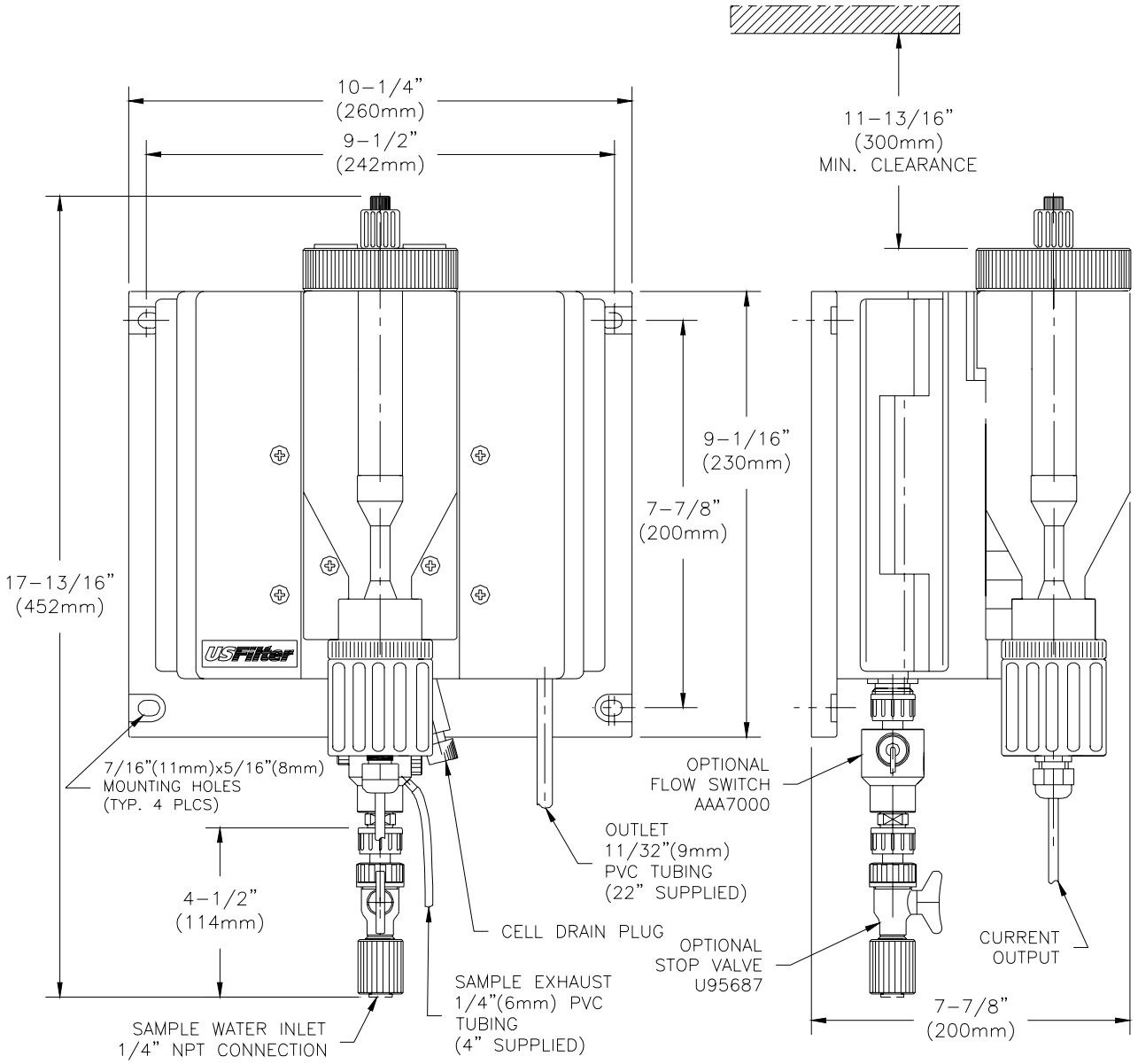
See Dwgs. 50.560.100.020 and .030 for stop valve location.



DEPOLOX 3 *PLUS* ELECTRONIC MODULE - DIMENSIONS

50.560.100.010

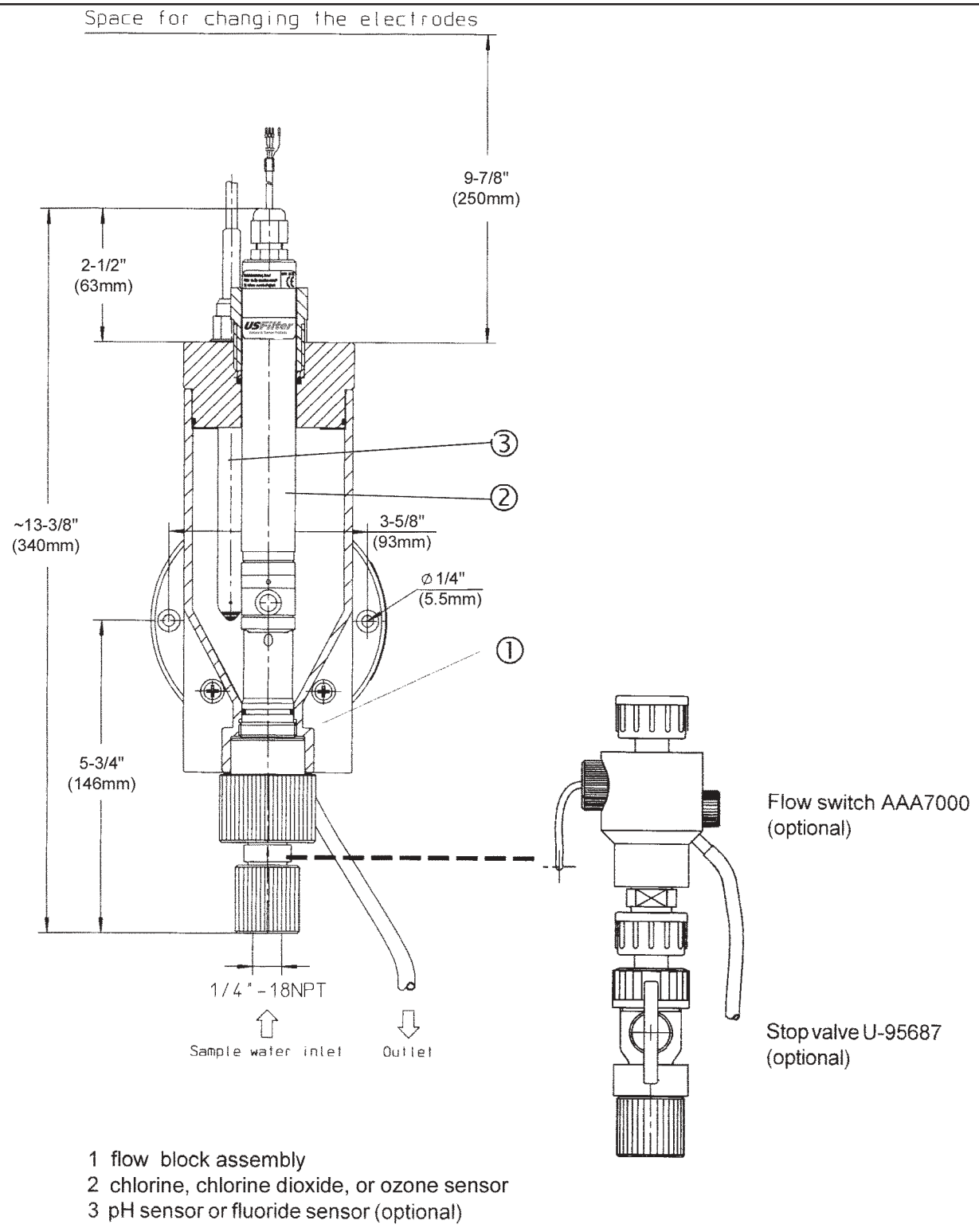
ISSUE 0 4-00



BARE ELECTRODE MEASURING CELL - DIMENSIONS

50.560.100.020

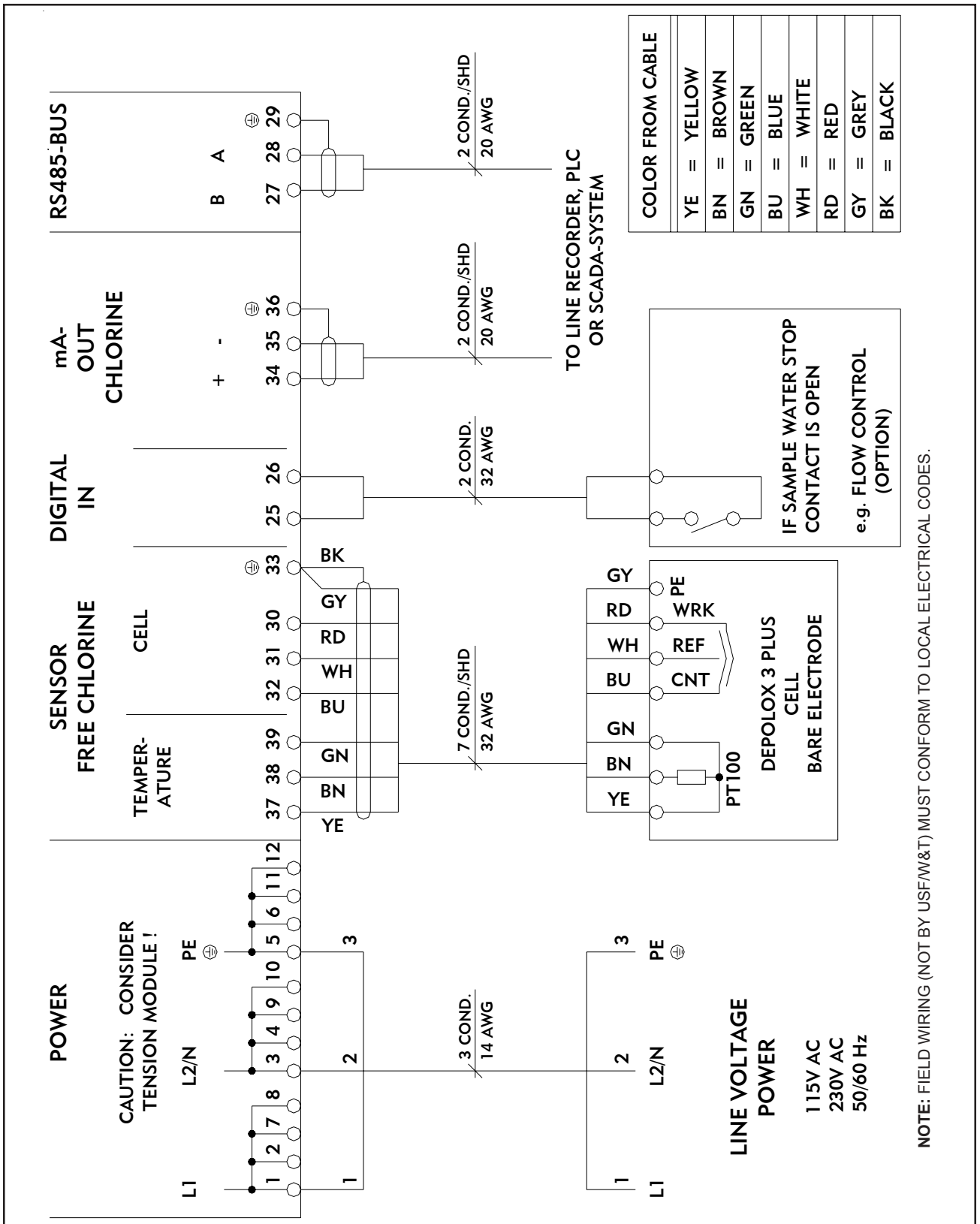
ISSUE 1 1-03



1 flow block assembly
2 chlorine, chlorine dioxide, or ozone sensor
3 pH sensor or fluoride sensor (optional)

MEMBRANE MEASUREMENT PACKAGE - DIMENSIONS
Sensors & Flow Block Assembly

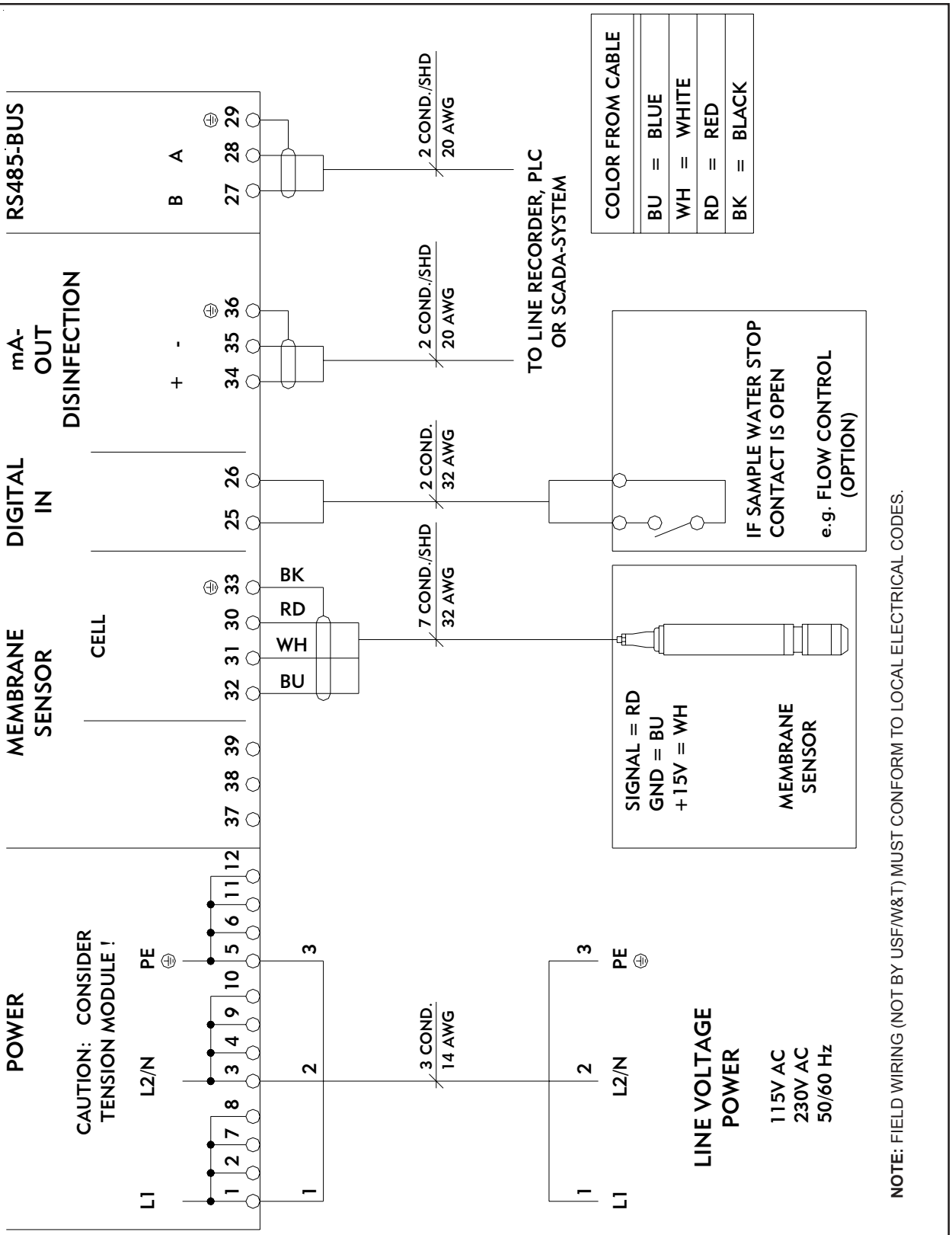
50.560.100.030
ISSUE 1 1-03



DEPOLOX 3 *PLUS* WITH BARE ELECTRODE SENSOR KIT - WIRING

50.560.155.010

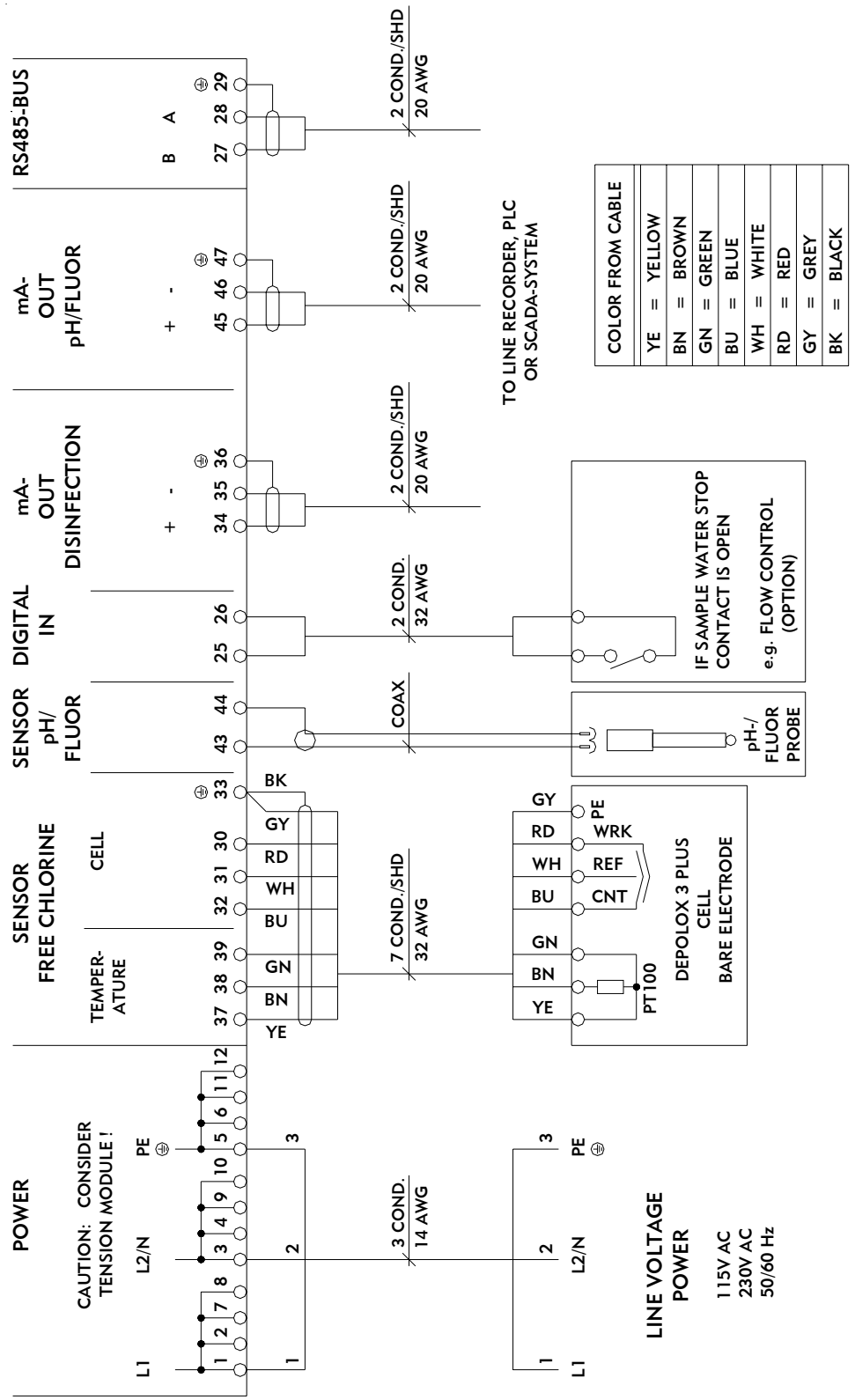
ISSUE 1 1-03



DEPOLOX 3 *PLUS* WITH MEMBRANE SENSOR KIT - WIRING

50.560.155.020

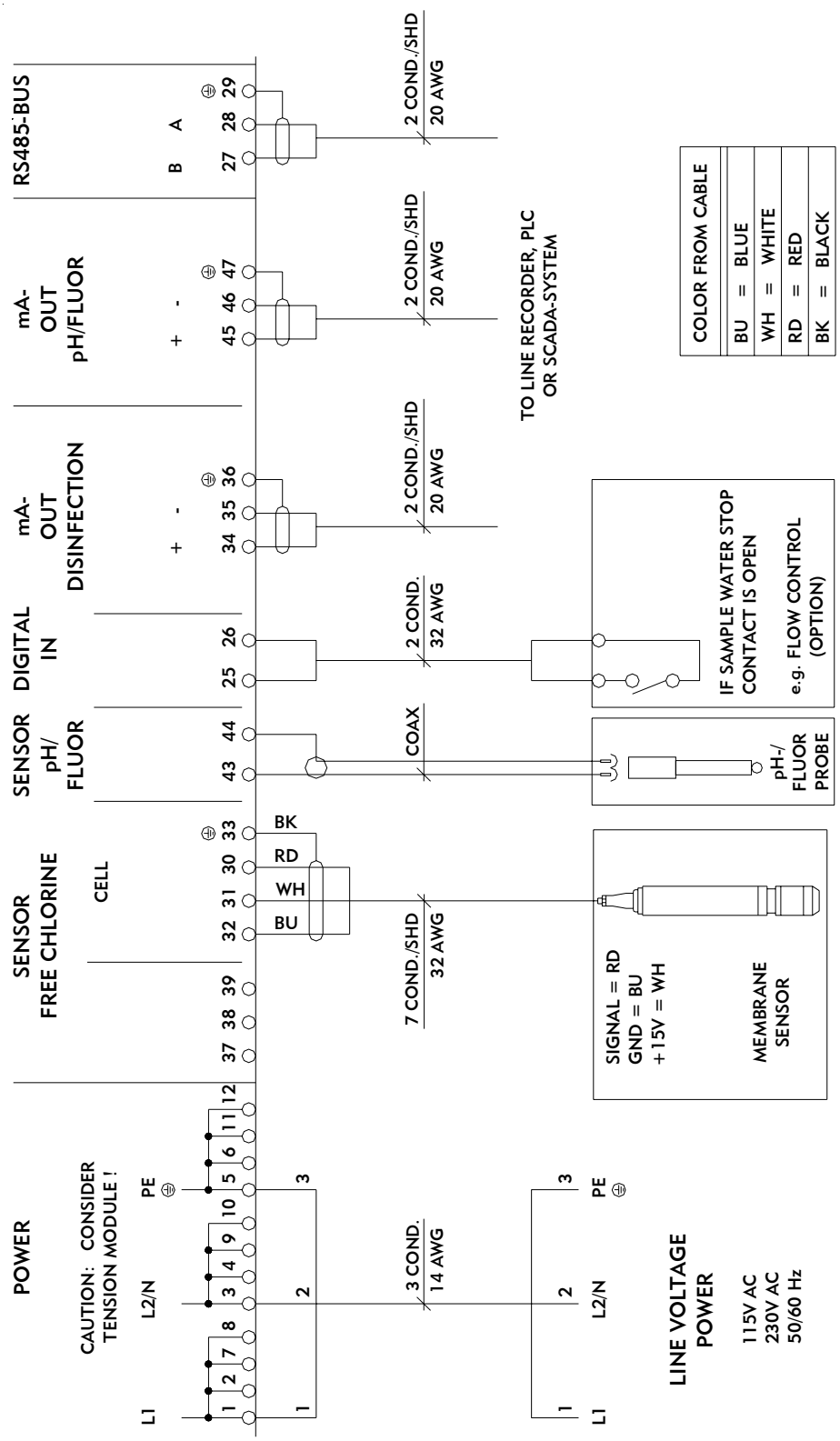
ISSUE 1 1-03



DEPOLOX 3 *PLUS* WITH BARE ELECTRODE SENSOR KIT AND pH OR FLUORIDE SENSOR KIT - WIRING

50.560.155.030

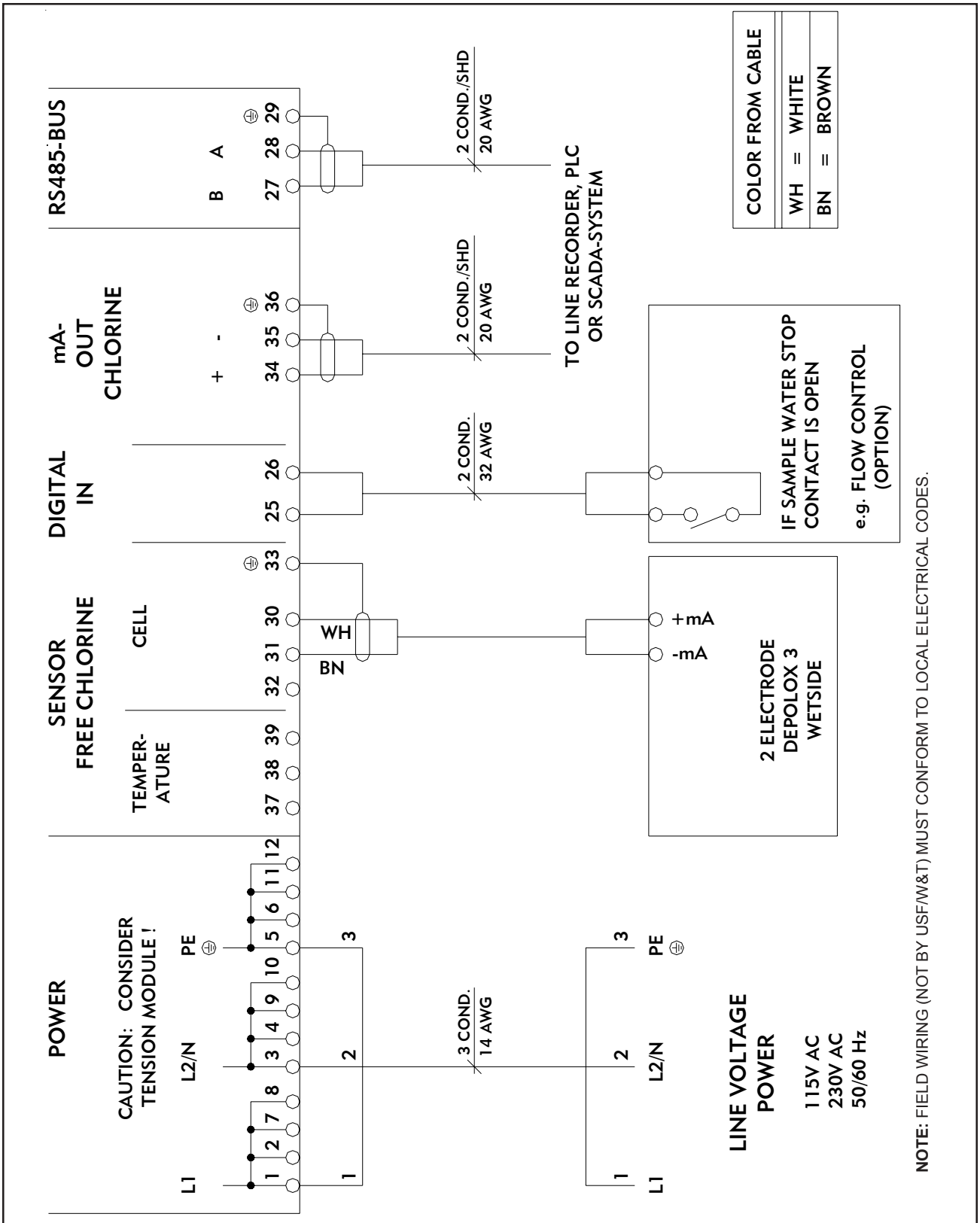
ISSUE 1 1-03



DEPOLOX 3 *PLUS* WITH MEMBRANE SENSOR KIT AND pH OR FLUORIDE SENSOR KIT - WIRING

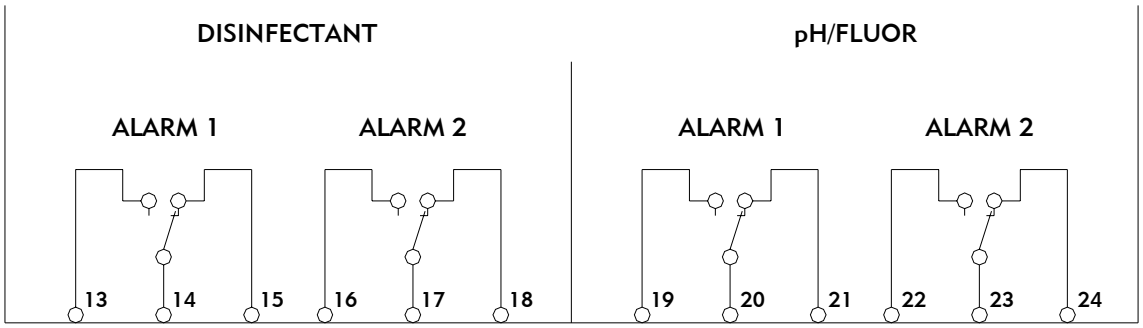
50.560.155.040

ISSUE 1 1-03



DEPOLOX 3 *PLUS* WITH BARE TWO ELECTRODE SENSOR KIT - WIRING
50.560.155.045

ISSUE 0 1-03



DEPOLOX 3 *PLUS* - ALARM RELAYS - CONNECTIONS

50.560.155.050

ISSUE 1 1-03

SECTION 3 - OPERATION

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3.1 DEPOLOX 3 *plus* - Operation

3.1.1 General Description

The DEPOLOX 3 *plus* module is a microprocessor-controlled electronic amplifier for the measurement of Disinfectants, and/or for pH value or fluoride in water.

The built-in RS485 interface can be used to transfer the measured values and operating modes to a PC or SCADA system.

3.1.2 Display and Keypad

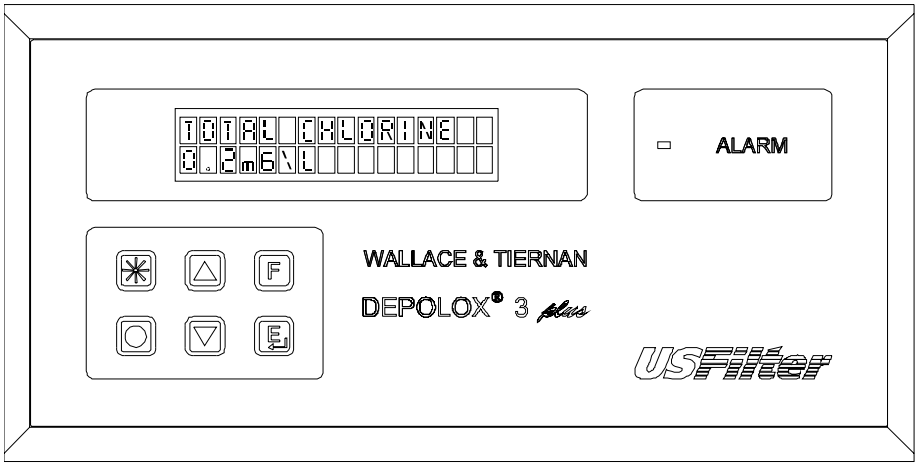


Figure 3.1 - Display and Keypad

3.1.2.1 Keypad Functions

ACKNOWLEDGE ALARM - De-energize the alarm relays (this does not reset the alarm message)

ESCAPE - Terminate input without saving new value. Jump back to the menu title and return to basic display by pressing the key once more.

UP ARROW - Skip one level upwards, increase value or display previous option.

DOWN ARROW - Skip one level downwards, reduce value or display next option.

F — Display next menu (jump from menu title to menu title)

E — ENTER - change into change mode (">" is displayed before the value), - save new setting.

NOTE: Check that any alterations have been ENTERED before exiting the menu. Protect the menus from unauthorized operation with a code number of your choice (1 to 999) (refer to paragraph 3.1.3, Code Number).

Press the keypads only with the fingers, do not use hard or pointed objects like pencils, etc., as these could damage the sealed keypad.

3.1.2.2 Selecting the Menus

- From the basic display, access to the other menu paths is achieved by pressing the **F** key.
- Sub menus are accessed using the keys ▲ and ▼. To exit from a sub menu to a main menu and then to the basic display press the ● key.

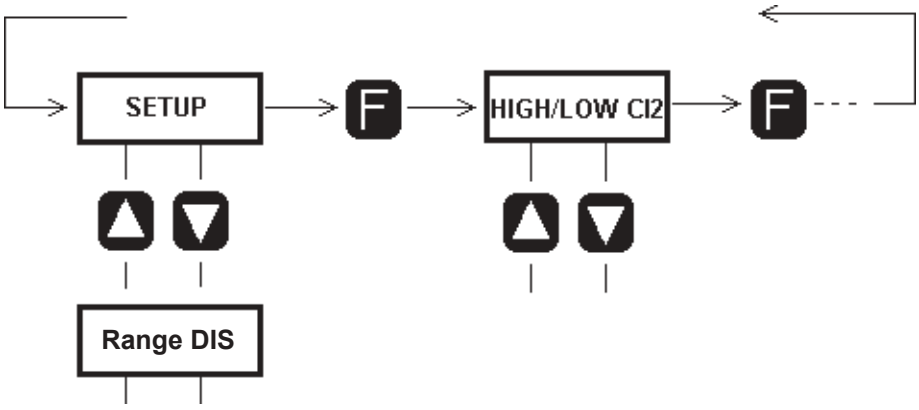


Figure 3.2 - Menu Selection

3.1.2.3 Changing the Settings

a. Select the menu to be changed.

b. Press the **E** key, ">" is displayed.

c. Using the arrow keys increase or decrease the value or skip to the next selection.

d. Store the changed setting by pressing the **E** key.

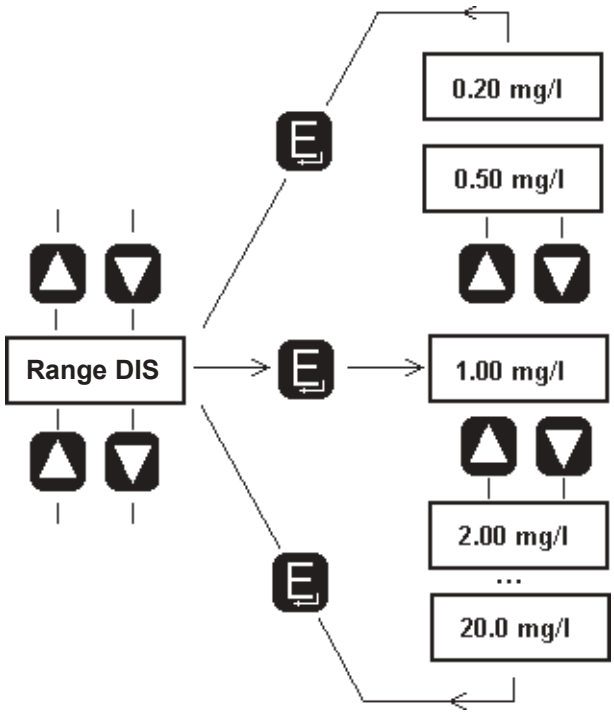


Figure 3.3 - Setting Changes

As long as the new value has not been stored by pressing the **E** key, pressing the ● key will return to the former setting. Select the next menu to be accessed with the arrow keys ▲ and ▼.

3.1.3 Menu Summaries

These summaries contain all menus of the respective versions. Depending on the setting a few menus are not necessary and therefore not displayed.

Table 3.1 - Menu List / Disinfection Only

ROOT	CALIBRATION	SETUP	HIGH/LOW DIS			ALARM RELAY 1/2		SIGNAL DIAG.	SYSTEM DIAG.	OUTPUT CALIBRATION
	DIS zero *	Range DIS	Low value			AR1 Definition		Sensor Current	Keypad Test	Cal. code
	DIS span		High value			AR1 Operation		Temperature *)	Display Test	Cal. DIS 4mA
			Setpoint			AR1 Latch			System Reset	Cal. DIS 20mA
DIS Value		Code	Deadband			AR1 Delay		mA Out DIS (mA)	System Shutdown	
		Lock setting				AR2 Definition		mA Out DIS (%)	RS485	
		Lock code set				AR2 Operation			Software Release	
		RS485 addr. DIS				AR2 Latch				
		Contrast				AR2 Delay				
		Language								
		DIS Sensor						Local Operation		
		Select						Rel.: 1 2 3 4		
								DI: 1		
								VF Conv. 1		
								VF Conv. 2 *)		

* Bare Electrode only.

Table 3.2 - Menu List / Disinfection + pH

ROOT	CALIBRATION	SETUP	HIGH/LOW DIS	HIGH/LOW pH		ALARM RELAY 1/2	ALARM RELAY 3/4	SIGNAL DIAG.	SYSTEM DIAG.	OUTPUT CALIBRATION
DIS	DIS zero*	Range DIS	Low value	Low value		AR1 Definition	AR3 Definition	Sensor current	Keypad Test	Cal. code
pH	DIS span	Range pH	High value	High value		AR1 Operation	AR3 Operation	Temperature	Display Test	Cal. DIS 4mA
	pH offset	Code	Setpoint	Deadband		AR1 Latch	AR3 Latch	pH cell voltage	System Reset	Cal. DIS 20mA
	pH zero	Lock setting	Deadband			AR1 Delay	AR3 Delay	mA Out DIS (mA)	System Shutdown	Cal. pH 4mA
	pH span	Lock code set				AR2 Definition	AR4 Definition	mA Out DIS (%)	RS485	Cal. pH 20mA
		RS485 addr. DIS				AR2 Operation	AR4 Operation	mA Out pH (mA)	Software Release	
		RS485 addr. pH				AR2 Latch	AR4 Latch	mA Out pH (%)		
		Contrast				AR2 Delay	AR4 Delay			
		Language								
		DIS sensor						Local Operation		
		Select						Rel.: 1 2 3 4		
		Mode Cl_2 free						DI: 1		
								VF Conv. 1		
								VF Conv. 2 *		
								VF Conv. 3		

* Three-(Bare) Electrode Chlorine cell only (no Membrane).

Table 3.3 - Menu List / Disinfection + Fluoride

ROOT	CALIBRATION	SETUP	HIGH/LOW DIS		HIGH/LOW FLUOR	ALARM RELAY 1/2	ALARM RELAY 3/4	SIGNAL DIAG.	SYSTEM DIAG.	OUTPUT CALIBRATION
DIS	DIS zero*	Range DIS	Low value		Low value	AR1 Definition	AR3 Definition	DIS cell current	Keypad Test	Cal. code
	DIS span		High value		High value	AR1 Operation	AR3 Operation	Temperature*	Display Test	Cal. DIS 4mA
Fluor		Code	Setpoint		Deadband	AR1 Latch	AR3 Latch	Fluor cell volt.	System Reset	Cal. DIS 20mA
	Fluor offset	Lock setting	Deadband			AR1 Delay	AR3 Delay	mA Out DIS (mA)	System Shutdown	
	Fluor zero	Lock code set				AR2 Definition	AR4 Definition	mA Out DIS (%)	RS485	
	Fluor span	RS485 addr. DIS				AR2 Operation	AR4 Operation		Software Release	Cal. Fluor 4mA
		RS485 addr. Fluor				AR2 Latch	AR4 Latch			Cal. Fluor 20mA
		Contrast				AR2 Delay	AR4 Delay	mA Out Fluor (mA)		
		Language						mA Out Fluor (%)		
		DIS sensor						Local Operation		
		Select						Rel.: 1 2 3 4		
								DI: 1		
								VF Conv. 1		
								VF Conv. 2*		
								VF Conv. 3		

* Three-(Bare) Electrode Chlorine cell only (no Membrane).

3.1.3.1 Root Menu

Display	Description
Total Cl_2 Free Cl_2 Ozone Chlorine Dioxide 1.30 mg/l (+) or pH - value 7.00 pH or Fluor 1.00 mg/l	Sensor Type (available: Input 1 - TC1, FC1, CD7, OZ7, D4; Input 2 - pH, Flour) Measured values, unit of measurement The (+) sign indicates the pH compensated mode, available when Bare Electrode free chlorine and pH measurement packages are used together. The display switches from one value to the next every 5 sec. with dual input operation. If another menu is selected, the display will come back to the root menu 5 minutes after pressing the last key. If you select the display of one of the measured values with the ▲ or ▼ key, this value will be displayed for 5 minutes. Then the display will start again with all values alternating.

3.1.3.2 Calibration Menu

Display	Value Range	Description
CALIBRATION		**Calibration menu** All calibration settings take place via this menu path. The outputs follow the measured values during calibration.
DIS zero	0	**Chlorine zero calibration** (Bare Electrode/Free Chlorine only) By pressing the **E** key the display is calibrated to zero. Outside the range limits it is not possible to calibrate.
DIS span		**Chlorine residual calibration** The measured value is set with ▲ or ▼. By pressing the **E** key, the display is calibrated to this value.
pH offset (only with pH option)		**pH calibration** In this menu, the difference in the displayed residual to the known solution value is set. The displayed value is adjusted to that of the buffer solution with ▲ or ▼. Press the **E** key to calibrate the display to this value. This adjustment is the difference (+ or -) that the displayed value is from the known solution.
pH zero (only with pH option)	pH 7	**pH calibration to 7.00** By pressing the **E** key the display is calibrated to 7.00. Outside the limits of the range it is not possible to calibrate.
pH span (only with pH option)	4.00 pH or 10.00 pH	**pH calibration** In this menu, the rate of rise of the pH curve is set. The value of the buffer solution is set with ▲ or ▼. By pressing the **E** key, the display is calibrated to this value. The value must be greater than pH8 or less than pH6, otherwise error is displayed.
Fluor offset (only with Fluoride option)		**Fluoride calibration** In this menu, the difference in the displayed fluoride residual to the known solution value is set. The displayed value is adjusted to that of the known fluoride concentration solution with ▲ or ▼. Press the **E** key to accept this value. This adjustment is the difference (+ or -) that the displayed value is from the known solution.
Fluor zero (only with Fluoride option)	0.20 mg/l	**Fluoride zero calibration** By pressing the **E** key the display is calibrated to zero. Outside the range limits it is not possible to calibrate.
Fluor span (only with Fluor option)	2.00 mg/l	**Fluoride residual calibration** The value measured is set with ▲ or ▼. By pressing the **E** key, the display is calibrated to this value.

3.1.3.3 Setup Menu

Display	Value Range (factory setting in bold)	Description
SETUP		Setup menu (measuring ranges, general settings).
Range DIS	0.20 mg/l 0.50 mg/l 1.00 mg/l 2.00 mg/l **5.00 mg/l** 10.0 mg/l 20.0 mg/l	Range of measured chlorine residual.
Range pH	**pH4 ... pH10.00** pH0 ... pH14	range of measured pH
Code	0 ... 999	Security code required to unlock the unit.
Lock setting	**unlocked** locked	
Lock code set	000 ... 999 **000**	Lock code. (Back door = 911.)
RS485 addr. DIS	0 - 31 **(0)**	Bus addresses for bus mode. default = 0
RS485 addr. pH / Fluor	0 - 31 **(1)**	Bus addresses for bus mode. default = 1
Contrast	0% - 100% 100% **(30%)**	Setting of display illumination. The illumination of the display can be set within a range of 0% to 100%.
Language	**English** French Spanish German	Language of menus (factory setting: "English" - to change to another language press the **E** key, select the language with ▲ and ▼, store with the **E** key).
DIS sensor	2 electr. system (Membrane select: TC1, FC1, OZ7, CD7) **3 electr. system** off	Free chlorine sensor (two-electrode technology). Free chlorine sensor (three-electrode technology). Switch off.
Select	pH Fluor off	Select second input to pH sensor. Select second input to Fluoride sensor. Swithc second input off.
Mode Cl2 free*	**normal** pH compensated	Non-compensated mode (normal). pH-compensated mode.

* Only with Bare Electrode free chlorine and pH measurement packages together.

3.1.3.4 High/Low Dinfection Alarm Menu

Display	Value Range (Defaults in bold)	Description
HIGH/LOW DIS		
Low value	**0** ... max. range in mg/l	
High value	0 ... **max. range** in mg/l	
Setpoint	0 ... max. range in mg/l **(0.4 mg/l)**	Only for special function of Alarm relay 1 Simple dosing contact without warnings
Deadband	1 ... 25 Digit **(3)**	

3.1.3.5 High/Low pH Alarm Menu (With pH Option Only)

Display	Value Range (Defaults in bold)	Description
HIGH/LOW pH		
Low value	**min** ... max. range in pH	
High value	min ... **max. range** in pH	
Deadband	1 ... 25 Digit **3 Digit**	

3.1.3.6 High/Low Fluoride Alarm Menu (With Fluoride Option Only)

Display	Value Range (Defaults in bold)	Description
HIGH/LOW FLUOR		
Low value	**0.20** ... 2.00 in mg/l	
High value	0.20 ... **2.00** in mg/l	
Deadband	1 ... 25 Digit **3 Digit**	

3.1.3.7 Alarm Relay 1, 2 (Always Assigned to Disinfectant)

Display	Value Range (Defaults in bold)	Description
ALARM RELAY 1/2		
AR 1 Definition	high DIS, low DIS, high/low DIS general fault DI dosing contact **off**	Functions relating to alarm relay 1 all alarm menus apart from this one are no longer displayed, relay contacts NO. off: alarm inactive, all alarm menus apart from this one are no longer displayed, relay contacts NO.
AR 1 Operation	**norm. open** fail safe	
AR 1 Latch	**latching** non-latching	
AR1 Delay	**0 min** 60 min	Setting for delay time of alarm 1 The delay time begins when the switching conditions are fulfilled. If the switching conditions discontinue during the delay time, the delay time is reset.
AR 2 Definition	high DIS, low DIS, high/low DIS general fault DI **off**	Functions relating to alarm relay 2 off: alarm inactive, all alarm menus apart from this one are no longer displayed, relay contacts NO.
AR 2 Operation	**norm. open** fail safe	
AR 2 Latch	**latching** non-latching	
AR2 Delay	**0 min** 60 min	Setting for delay time of alarm 2 The delay time begins when the switching conditions are fulfilled. If the switching conditions discontinue during the delay time, the delay time is reset.

3.1.3.8 Alarm Relay 3, 4 (With pH Option Only)

Display	Value Range (Defaults in bold)	Description
ALARM RELAY 3/4		
AR 3 Definition	high pH, low pH, high/low pH general fault DI **off**	Functions relating to alarm relay 3 off: alarm inactive, all alarm menus apart from this one are no longer displayed, relay contacts NO.
AR 3 Operation	**norm. open** fail safe	
AR 3 Latch	**latching** non-latching	
AR 3 Delay	**0 min** 60 min	Setting for delay time of alarm 3 The delay time begins when the switching conditions are fulfilled. If the switching conditions discontinue during the delay time, the delay time is reset.
AR 4 Definition	high pH, low pH, high/low pH general fault DI **off**	Functions relating to alarm relay 4 off: alarm inactive, all alarm menus apart from this one are no longer displayed, relay contacts NO.
AR 4 Operation	**norm. open** fail safe	
AR 4 Latch	**latching** non-latching	
AR 4 Delay	**0 min** 60 min	Setting for delay time of alarm 4 The delay time begins when the switching conditions are fulfilled. If the switching conditions discontinue during the delay time, the delay time is reset.

3.1.3.9 Alarm Relay 3, 4 (With Fluoride Option Only)

Display	Value Range (Defaults in bold)	Description
ALARM RELAY 3/4		
AR 3 Definition	high Fluor, low Fluor, high/low Fluor general fault DI **off**	Functions relating to alarm relay 3 off: alarm inactive, all alarm menus apart from this one are no longer displayed, relay contacts NO.
AR 3 Operation	**norm. open** fail safe	
AR 3 Latch	**latching** non-latching	
AR 3 Delay	**0 min** 60 min	Setting for delay time of alarm 3 The delay time begins when the switching conditions are fulfilled. If the switching conditions discontinue during the delay time, the delay time is reset.
AR 4 Definition	high Fluor, low Fluor, high/low Fluor general fault DI **off**	Functions relating to alarm relay 4 off: alarm inactive, all alarm menus apart from this one are no longer displayed, relay contacts NO.
AR 4 Operation	**norm. open** fail safe	
AR 4 Latch	**latching** non-latching	
AR 4 Delay	**0 min** 60 min	Setting for delay time of alarm 4 The delay time begins when the switching conditions are fulfilled. If the switching conditions discontinue during the delay time, the delay time is reset.

3.1.3.10 Signal Diagnostics Menu

Display	Values	Description	
SIGNAL DIAG.			
DIS sensor	value in µA	Present cell current in µA	
Temperature	value in °C	Present cell temperature	(Bare Electrode only - no Membrane)
pH sensor	value in mV	Present pH electrode voltage	(pH option only)
Fluor sensor	value in mV	Present fluoride electrode voltage	(Fluoride option only)
mA-Out DIS	value in mA	Present output in mA	
mA-Out DIS	value in % FS	Present output in mA in % full scale	
mA-Out pH	value in mA	Present output in mA	(pH option only)
mA-Out pH	value in % FS	Present output in mA in % full scale	(pH option only)
mA-Out Fluor	value in mA	Present output in mA	(Fluoride option only)
mA-Out Fluor	value in % FS	Present output in mA in % full scale	(Fluoride option only)
Local Operation	**Normal**	Normal operation	
	Service	Relay outputs are frozen in non-alarm states. mA output is frozen. Analyser will not return to main display. Operating mode is automatically set to normal (re-enabling alarms) when leaving the diagnostics menu group or cycling power.	
REL: 1 2 3 4 St: 0 0 0 0		Relay test Press Enter and then the up or down arrow key to cycle through each relay, press Enter to change the state for test. 1 = energized, 0 = de-energized The alarm relays can be exercised in Normal or Service mode. After leaving the menu the relays will come back to their previous states. (relays 3 and 4 only with pH or Fluoride option)	
DI: 1 St: 0		Digital input state 1 = active	
VF Conv 1		Frequency display of the voltage - frequency converter DIS	
VF Conv 2		Frequency display of the voltage - frequency converter for temperature	
VF Conv 3		Frequency display of the voltage frequency converter for pH or Fluoride	

3.1.3.11 System Diagnostics Menu

Display	Values (Defaults in bold)	Description
SIGNAL DIAG.		
Keypad Test		Prompt user to display each key. Follow the display text as long as there is the ">".
Display Test		All LCD dots must be displayed
System Reset	**no** yes	Allows for a "warm" startup of the system. It simulates a system power-up by resetting the CPU. To set defaults, hold "star key" while cycling power.
System Shutdown	**no** yes	Puts unit in "sleep mode". mA output is set to 0 mA. All relays are de-energized. Pressing any key takes it out of "sleep mode". Cycling power takes it out of "sleep mode".
RS485		Communication via RS485 interface
Software Release	e.g., V:A_ 09/02	Information about actual software/firmware code; date; part no.

3.1.3.12 Output Calibration

WARNING: CHANGES IN THIS MENU WILL AFFECT THE ACCURACY OF THE FACTORY CALIBRATION.

Calibration menus for pH or Fluoride only with the corresponding options.

Display	Values	Description
Cal. code		enter the calibration code "911" to open the calibration menu
Cal. DIS 4 mA	0...400 Digit	Adjustment of the DIS mA output to 4 mA
Cal. DIS 20 mA	800...1023 Digit	Adjustment of the DIS mA output to 20 mA
Cal. pH 4 mA	0...400 Digit	Adjustment of the pH mA output to 4 mA
Cal. pH 20 mA	800...1023 Digit	Adjustment of the pH mA output to 20 mA
Cal. Fluor 4 mA	0...400 Digit	Adjustment of the fluoride mA output to 4 mA
Cal. Fluor 20 mA	800...1023 Digit	Adjustment of the fluoride mA output to 20 mA

3.1.4 Code Number

To protect the settings against unauthorized access or an inadvertent change, the settings should be locked using a freely selectable code number. The settings can be displayed, but not changed. If an attempt is made, then "Code???" is displayed before reverting to the former setting.

After switching on, after a RESET or generally after one hour without pressing a key, the code number is set to 0. If the unit is locked, settings can only be changed after entry of the correct code number. Locking can be selected in the "Lock Setting" menu.

To alter the number again, enter the new code number in the SETUP menu under "Lock code set". If you then want to block access to unauthorized operators, immediately change the code in the SETUP menu to another number and set to "Locked" in the "Lock Setting menu".

In order to provide general access, select "Unlocked". This means that changes are possible at any time without having to enter a code. Code is no longer displayed in the main menu. However, another code number can now be entered and access denied to all those operators who do not know the new number.

The unit is delivered with the "Lock code set" = 0, "Lock setting" = Unlocked. If the code number is forgotten enter the back entry code 911. You can only alter the values in the protected menus once you have set the correct code number in the SETUP menu and thus proved that you are an authorized operator.

3.1.5 High - Low Alarms

The DEPOLOX 3 *plus* has independent alarms that can be allocated to the measured values for chlorine (and optionally for pH or fluoride).

Menu Setting	Alarm Condition	Action
High	$X \geq$ alarm value	alarm message on
	$X \leq$ (alarm value - deadband)	alarm message off
Low	$X \leq$ alarm value	alarm message on
	$X \geq$ (alarm value - deadband)	alarm message off

The deadband can be set in the range of one to 25 digits.

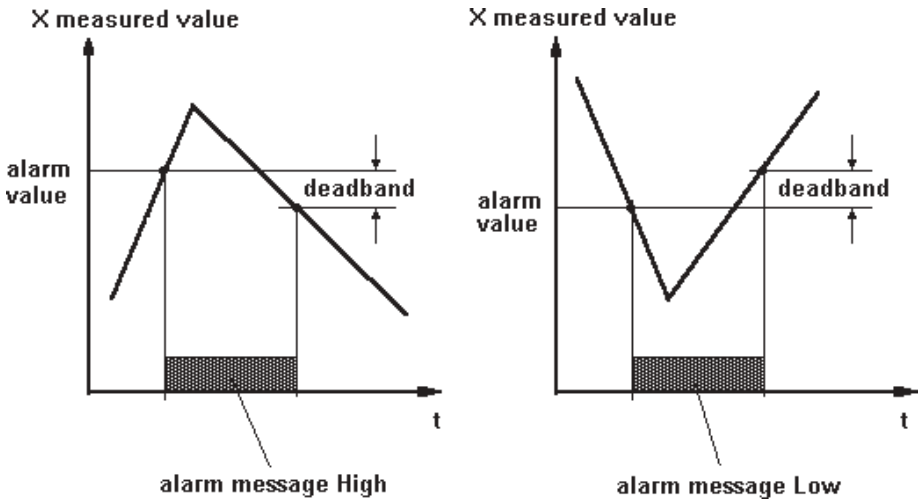


Figure 3.4 - High / Low Alarms

3.1.6 Alarm Relays

DEPOLOX 3 *plus* features the following alarm relays:

- Two relays allocated to chlorine alarms.
- Two relays allocated to pH or fluoride alarms (optional).

Definitions for switching the relays:

high DIS:	relay reacts to the set value
low DIS:	relay reacts to the set value
high/low:	combination of high and low value
general fault:	relay is activated as long as there is an alarm message
DI:	relay is activated as long as there is a signal on the digital input
dosing contact:	relay is energized as long as the actual value is below the setpoint (for disinfectant only)
off:	relay is de-energized

Selections:

normally open (N.O.):	relay is energized in case of an alarm.
fail safe (N.C.):	relay is de-energized in case of an alarm
non latching:	relay is de-energized as soon as the alarm condition has ceased
latching:	relay stays energized after the alarm until the star key "✳" is pressed to acknowledge the alarm

3.1.7 Dosing Contact for Chlorine

The chlorine alarm relay 1 can be used to switch-on a pump or solenoid valve for dosing chlorine.

The relay is energized if "AR 1 Definition" is set to "dosing contact" and the actual value is < setpoint.

3.1.8 mA Outputs

For each sensor there is an mA current signal output (e.g., for connecting an additional display). The range fixed at 4...20mA corresponds to the measuring range. For example, for a Membrane range of 0 to 5 mg/l:

0 mg/l: 4 mA
5 mg/l: 20 mA

The signal that is output corresponds to the measured value. The connected impedance must not be higher than 1000 Ohm. Broken wires or open mA loops will be detected.

3.2 DEPOLOX 3 *plus* - Calibration

3.2.1 Free Chlorine (Bare Electrode) Calibration

When calibrating with the pH compensation option, note that the pH value must be calibrated or verified first so that the subsequent Cl_2 calibration is automatically adjusted by the correct pH value.

To achieve this, the prompt "pH correct, yes/no?" appears in the menu. When confirmed by "Yes," direct access is granted to chlorine calibration "Zero Calibration," below. If answered with "No," pH calibration follows.

NOTE: The relays and mA outputs follow the measured values. If necessary, switch off the alarm relays.

- Zero Calibration

  a. Starting from the basic display press the **F** key until the "CALIBRATION" menu is displayed. Press the ▼ key until the "Cl_2 zero" menu is found.

b. Close the shut-off valve at the flow block assembly, stopping all flow to unit. Wait until the displayed value ceases changing.

c. Press the **E** key twice in order to set the display to "0.00".

d. Go to the root menu. Display will be 0.00 mg/l

In case of calibration error *Cal. Cl_2?*: Ensure that the sample water is completely stopped and repeat calibration. If the error comes again, adjust the cell voltage Upot: Go to SIGNAL DIAG. and menu "Cl_2 cell current".

If he display still does not read 0.00 mg/l after calibration, adjust the potentiometer Upot so far that the displayed cell current is 0 ±5 µA (turning clockwise reduces the current) (see Figure 3.5). The current will change very slowly. Wait one half hour and check again. Perform calibration again.

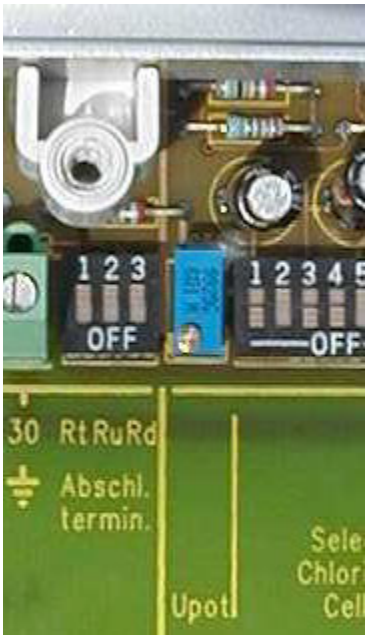


Figure 3.5 - Upot Adjustment

e. Let the sample water flow again.

NOTE: When there is no key pressed for five minutes, the DEPOLOX 3 *plus* returns to the basic display.

- Span calibration

  a. After zero calibration wait at least two minutes. Then take a sample at the measuring cell. Determine the residual value of this sample.

  b. Press the ▼ key until the menu “DIS span” is reached. Press the **E** key to open the menu.

  c. Press keys ▼ or ▲ until the displayed value agrees with the manually measured value.

  d. Store the value using the **E** key. The chlorine measuring cell is now calibrated. In case of an error message, refer to paragraph 4.1.1, Errors.

  e. Return to the basic display by pressing the ● key twice.

3.2.2 Membrane Sensor Calibration (All Membrane Types)

a. Take a sample at the measuring cell. Determine the residual value of this sample.

b. Starting from the basic display, press the **F** key until the “Calibration” menu is displayed.

c. Press the ▼ key until the menu “DIS span” is reached. Press the **E** key to open the menu.

d. Press keys ▼ or ▲ until the displayed value agrees with the manually measured value.

e. Store the value using the **E** key. The disinfectant measuring cell is now calibrated. In case of an error message refer to paragraph 4.1.1, Errors.

f. Return to the basic display by pressing the ● key twice.

3.2.3 pH Calibration

NOTE: pH measurement is optional.

WARNING: DO NOT CONTINUE TO USE BUFFER SOLUTIONS AFTER USE-BY DATE. BUFFER SOLUTIONS THAT HAVE BEEN OPENED CAN ONLY BE KEPT FOR A LIMITED PERIOD. READ THE LABEL ON THE BOTTLE.

NOTE: Sample water and buffer solution should have the same temperature.

In case sample water temperature deviates from the reference temperature of 77° F (25° C), calibrate the resp. value shown in the temperature table (see label on buffer solution).

There are two methods for pH calibration. The first adjusts the zero and the span settings for the pH range. The second calibration is an "offset," in which the pH sensor is exposed to a known pH solution and the displayed value is adjusted, up or down, to match the known value. This calibration can also be performed on the process water with the sensor in the flow cell. Verify that the pH of the process water has been accurately determined.

NOTE: The offset calibration is typically all that is recommended to calibrate pH when first starting the unit or replacing the sensor. The Depolox 3 *plus* zero and span values are factory set in order to properly work with the sensor. Complete the zero and span calibrations, if there is a problem, only after completing the offset calibration.

- pH OFFSET Calibration

  a. With sensor in flow block, test sample pH.

  b. Press the **F** key until the "CALIBRATION" menu is displayed. Press the ▼ key until the "pH offset" menu is found.

  c. Press the **E** key.

  d. Press ▼ or ▲ keys until the offset value is the difference of the displayed pH value compared to the manually measured value. Store this value using the **E** key. (Example: For pH7 solution, the basic display reads 7.15pH. The offset value will be adjusted to -0.15 because the value is to come down from 7.15pH to 7.00pH.)

  e. Return to the basic display by pressing the ● key twice.

- pH Zero Calibration (Isothermal Intersection, pH7):

  a. Starting at the basic display press the **F** key until the "CALIBRATION" menu is displayed. Press the ▼ key until the "pH zero" menu is found.

  b. Withdraw the pH sensor. Fill 10 to 20 ml "pH7.00" buffer solution into a 100 ml beaker. Dip the sensor at least 20mm deep in the buffer solution pH7.00 and agitate lightly until the displayed pH value remains constant.

  c. Press the **E** key.

  d. Press the ▼ or ▲ keys until the displayed value agrees with the value of the pH buffer solution. Store this value using the **E** key.

- pH Span Calibration:

  a. Rinse the sensor in distilled water (in order to avoid spreading the buffer solution).

  b. Press the key ▼ until the "pH span" menu is reached.

  c. Pour 10 to 20ml pH4 or pH10 buffer solution into another beaker. Dip the pH sensor at least 20mm deep in the buffer solution and agitate lightly until the displayed pH value remains constant. (In case another buffer solution is used: the pH value of the buffer solution must be less than pH6 or greater than pH8.)

  d. Press the **E** key to open the "pH Span" menu.

  e. Press keys ▼ or ▲ until the displayed value agrees with the value of the pH buffer solution. Store this value using the **E** key. The measuring cell is now calibrated.

  f. Replace the sensor into the flow block.

  g. Dispose of the buffer solutions, rinse with enough water.

  h. Return to the basic display by pressing the ● key twice or skip to fluoride calibration.

In case of error, both calibration points must be calibrated again.

3.2.4 Fluoride Calibration

NOTE: Fluoride measurement is optional.

WARNING: DO NOT CONTINUE TO USE BUFFER SOLUTIONS AFTER USE-BY DATE. BUFFER SOLUTIONS WHICH HAVE BEEN OPENED CAN ONLY BE KEPT FOR A LIMITED PERIOD. READ THE LABEL ON THE BOTTLE.

NOTE: Sample water and buffer solution should have the same temperature.

In case sample water temperature deviates from the reference temperature of 77° F (25° C), calibrate the resp. value shown in the temperature table (see label on buffer solution).

There are two methods for fluoride calibration. The first adjusts the zero and the span settings for the fluoride range. The second calibration is an "offset," in which the fluoride sensor is exposed to a known fluoride concentration solution and the displayed value is adjusted, up or down, to match the known value. This calibration can also be performed on the process water with the sensor in the flow cell. Verify that the fluoride concentration of the process water has been accurately determined.

NOTE: The offset calibration is typically all that is recommended to calibrate fluoride when first starting the unit or replacing the sensor. The Depolox 3 *plus* zero and span values are factory set in order to properly work with the sensor. Complete the zero and span calibrations, if there is a problem, only after completing the offset calibration.

- Fluoride OFFSET Calibration

  a. With sensor in flow block, test sample Fluoride residual.

  b. Press the **F** key until the "CALIBRATION" menu is displayed. Press the ▼ key until the "Fluoride offset" menu is found.

  c. Press the **E** key.

  d. Press ▼ or ▲ keys until the offset value is the difference of the displayed fluoride value compared to the manually measured fluoride solution value. Store this value using the **E** key. (Example: The flow is measured at 0.20 mg/l fluoride solution. The basic display reads 0.28 mg/l fluoride. The offset value will be ad-

justed to "- 0.08 mg/l fluoride" because the value is to come down from 0.28 mg/l to 0.20 mg/l.)

e. Return to the basic display by pressing the ● key twice.

- Calibration at 0.20 mg/l:

a. Starting at the basic display press the **F** key until the "CALIBRATION" menu is displayed. Press the ▼ key until the "Fluor zero" menu is found.

b. Withdraw the fluoride sensor. Fill 10 to 20 ml "0.20 mg/l" buffer solution into a 100 ml beaker. Dip the sensor at least 20mm deep in the buffer solution 0.20 mg/l and agitate lightly until the displayed value remains constant.

c. Press the **E** key.

d. Press keys ▼ or ▲ until the displayed value agrees with the value of the buffer solution. Store this value using the **E** key.

- Calibration at 2.00 mg/l:

a. Rinse the sensor in distilled water (in order to avoid spreading the buffer solution).

b. Press the key ▼ until the "Fluor span" menu is reached.

c. Fill 10 to 20ml "2.00 mg/l" buffer solution into another beaker. Dip the fluoride sensor at least 20mm deep in the buffer solution and agitate lightly until the displayed value remains constant.

d. Press the **E** key to open the "Fluor Span" menu.

e. Press keys ▼ or ▲ until the displayed value agrees with the value of the buffer solution. Store this value using the **E** key. The measuring cell is now calibrated.

f. Refit the sensor into the flow block.

g. Dispose of the buffer solutions, rinse with enough water.

h. Return to the basic display by pressing the ● key twice.

In case of error both calibration points must be calibrated again.

3.3 Free Chlorine (Bare Electrode) Sensor Kit

3.3.1 Start-Up of the Measuring Cell

a. Unscrew nut (2) and remove cover (3) (see Dwg. 50.560.000.010 in Section 5).

b. Hold electrode assembly together with electrolyte reservoir (4-11) at the cover (10) and pull it out of the cell block (13) without turning.

c. Remove felt ring (transport protection of the membrane, 6)

d. Exchange plug (4) with separately supplied plug fitted with membrane for venting the electrolyte reservoir.

e. Place electrode assembly with electrolyte reservoir back into the cell block. Keying pin in the electrode assembly must snap into position.

f. Fill a half capful of grit (U-95653) into the cell block.

g. Place cover (3) and tighten by nut (2).

h. Allow sample water flow by opening the inlet valve(s).

i. After one hour the measuring signal has stabilized so far that a first calibration should be made as function test.

NOTE: For the first starting-up: After 24 hours of running time a further calibration is necessary. Air bubbles building up at the inner surface of the cell block and preventing somewhat the rotation of the grit will disappear after a running-in period of 24 to 48 hours.

3.3.2 Adjusting the Flow Regulator

The flow regulator is adjusted to a flow of 33 l/h (=0.55 l/min.). If necessary adjust the regulator as follows:

a. Remove the left or right hinge pin at the measuring cell and tilt the housing front to the side.

b. At the inner side of the front is the flow regulator. In the middle of the regulator is the adjusting screw. Turn the screw with a coin or a screwdriver (>10 mm). Turn to the right to reduce flow; turn to the left to increase flow.

c. Check flow and reassemble.

d. Perform calibration.

3.3.3 Bare Electrode Theory of Operation

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

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

To understand the mode of functioning of chlorine as a disinfectant, it is necessary to know the chemical reactions that take place when water is chlorinated. Firstly there is the hydrolysis of the chlorine. This is the reaction of the chlorine with water. When chlorine gas is dissolved in water the formation of hypochlorous acid and hydrochloric acid results. All other disinfectants based on chlorine also react with water and form hypochlorous acid. The hypochlorous acid is the active substance for the disinfection process. Figure 3.6 shows the dependence of the form of chlorine on the pH value of the water. With rising pH value, the share of hypochlorous acid decreases by dissociating to form H3O+ and ClO-. In other words, the hypochlorous acid needed as the active substance in disinfection becomes less with increasing pH value while the share of ClO- ions that are meaningless for disinfection rises.

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

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

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

About 33 l/hr of the water to be analyzed flows past this system of electrodes. The current generated in the measuring cell is directly proportional to the concentration of the oxidizing agent in the sample water. This current is then passed to the microprocessor-based electronic system DEPOLOX 3 *plus* for processing. A flow switch gives a signal to the DEPOLOX 3 *plus* if the flow is reduced (optional).

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

If a double input electronics is used, a pH-value measurement will be inserted into the hole in the removable cover of the measuring cell. With the pH valve, used in conjunction with the chlorine measurement, it is possible to correct for variations caused by shifting pH.

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

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

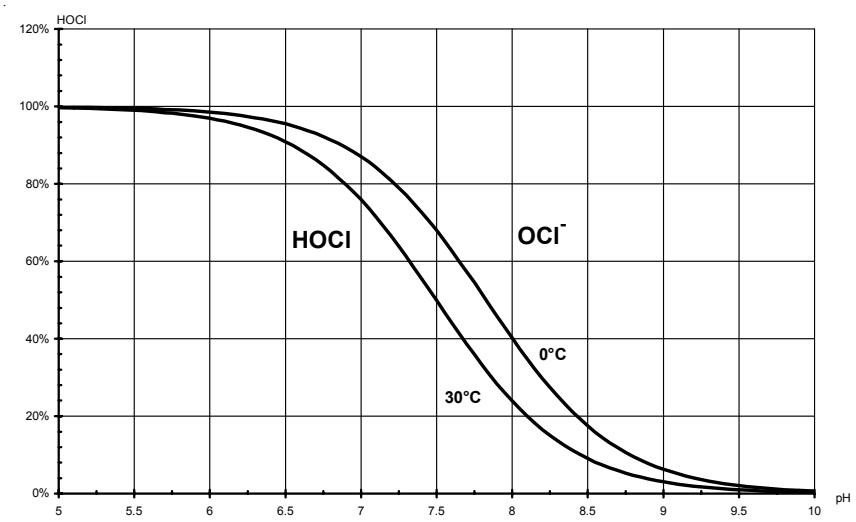


Figure 3.6 - Dissociation characteristics of HOCl and ClO- with pH value and showing effects of temperature

3.4 Membrane Sensor Kits

3.4.1 Start-Up the Flow Block Assembly

On completion of plant installation by trained, qualified personnel and prior to start-up, check that the sample water pipeline is securely connected and tested for leakage and that the sensor(s) are in place.

a. Open the sample water supply.

b. Check that the sample water stream directly points to the membrane of the Membrane sensor, if necessary turn the cover of the flow block assembly. Do not tolerate any air bubbles at the membrane of the sensor.

Start the DEPOLOX 3 *plus* module as described in paragraph 2.1.8, Start-Up.

3.4.2 System Shut-Down

- To switch-off the system for the short term:

  Switch off the electrical supply and close the sample water shut-off valve.

- To switch-off the system for the long term, for repairs, etc.:

  a. Switch off the entire system and isolate from the electrical supply

  b. Close the water shut-off valve on the flow block inlet

  c. Allow water to drain from the flow block.

  d. Remove one sensor after the other from the flow block.

  e. Clean the sensors and store them as described below.

  f. Cover the holes in the cover of the flow block with the protective caps.

  To re-start the system, refer to paragraph 2.3, Membrane Sensor.

- To store the sensors after use:

  Remove the elastomer seal from the vent hole. Unscrew the membrane cap. Rinse the membrane and the reference electrode with distilled water. Carefully dry the reference electrode with a paper towel. Let the cap dry in a dust free place. Screw the dry membrane cap loosely onto the sensor. The membrane must not touch the gold working electrode.

3.4.3 Membrane Sensor Theory of Operation

- **TC1:** The Membrane Sensor Kit consists of a flow through cell with a transparent Plexi-glass body that houses the chlorine sensors (and optionally the pH or the fluoride sensor). The cell's transparency permits visual checks on the flow of sample water and measuring conditions.

  The Membrane Sensor measures the sum of free chlorine and chloramines. The Sensor includes a membrane-covered potentiostatic 3 electrode system. The silver/silver-iodide reference electrode and gold working electrode are positioned inside the membrane cap filled with a potassium iodide electrolyte solution. The stainless steel counter electrode is located outside the membrane cap for added stability. Chlorine, diffusing through the membrane, causes a reaction at the working electrode, creating a current, which is a direct measure of Total Chlorine. An amplifier in the electrode shaft conditions this signal including temperature compensation and passes it to the microprocessor-based electronic system DEPOLOX 3 plus for processing.

  Air bubbles on the membrane may prevent chlorine from passing through the membrane, resulting in a false reading of the probe. A water jet, designed into the flow block assembly, is used to remove any potential air bubbles from the membrane.

  The sensor has a very low dependence on pH-value, so you can use it in water with varying pH-value. The sensor should be used only in potable water applications.

  The sensor is designed such that a zero residual chlorine will yield zero current. Therefore only a single point calibration is needed.

  The flow block assembly, housing the Membrane Sensor, is designed to provide a constant flow of water past the membrane surface. This and the potentiostatic three-electrode system ensure accurate and repeatable measured data.

- **FC1, OZ7, CD7:** The FC1 for Free Chlorine, the OZ7 for Ozone, and the CD7 for Chlorine Dioxide all work similarly, however, they utilize a silver/silver chloride reference electrode, a different electrolyte, and a different membrane to allow for the selectivity required for the different measurands.

WARNING: DO NOT TOUCH THE REFERENCE ELECTRODE! BEFORE UNSCREWING THE MEMBRANE CAP, REMOVE THE ELASTOMER SEAL TO ALLOW AIR INTO THE VENT HOLE. NOT DOING THIS WILL CAUSE A VACUUM TO OCCUR WHICH WILL DAMAGE THE MEMBRANE WHEN UNSCREWING THE CAP. DO NOT REMOVE THE YELLOW-GREY LAYER ON THE REFERENCE ELECTRODE.

NOTE: It is important that the membrane is in the direct sample water flow. Because of this the flow-through assembly has a special form where the sensor fits in.

3.5 pH Sensor Kit

3.5.1 Description

The USF/W&T pH sensor has a ceramic diaphragm and a silver/silver-chloride reference electrode. The 3.0 mol KCl gel electrolyte does not require replenishment.

To protect the sensitive measuring membrane the sensor is shipped with a protection cap over its glass tip. This cap contains 3 mol KCl solution to keep the sensor in a constant state of readiness. Leave the cap in place on the sensor until it is about to be installed. Do not discard the cap but keep it and use it to protect the sensor whenever it is removed from service. Then fill the cap with water (not distilled) and place it over the tip of sensor.

The pH sensor has a threaded plug-in head. Care must be taken to ensure that the O-ring is present when connecting the head. A standard 1.5 m long, shielded coaxial (measuring) cable is supplied with the pH sensor. At one end the cable has a special plug which is screwed on to the threaded plug-in head of the sensor. The other end of the shielded special cable is connected directly to the intended terminal connection in the PCS control module.

3.6 Fluoride Sensor Kit

3.6.1 Description

The fluoride sensor is equipped with a rubber cap over the fluoride sensitive membrane. Lift the cap before placing the electrode into the sample water.

NOTE: Do not touch or scratch the membrane, the electrode could be damaged.

If the sensor is not used for longer, place the cap again on the electrode with some reference electrode filling solution in it.

As a standard, a shielded coax cable, 1.5 m long, is supplied together with the sensor.

3.6.2 Preparation of the Electrode

See instructions included with sensor.

3.7 RS485 Interface

3.7.1 Printer Facility

The DEPOLOX 3 *plus* is not able to send data directly to a printer.

3.7.2 Description of the RS485 Bus Interface

The serial RS485 bus interface of the DEPOLOX 3 *plus*, built-in as a standard, is used for data transmission to a PC, to an external plant control or to the MF485 interface card (e.g., for connection to a printer).

The serial RS485 bus interface of the DEPOLOX 3 *plus* is designed as a symmetrical two-wires bus line to EIA RS 485 (DIN 66259 part 4 resp. ISO 8482), that enables data transfer with high transfer rate (19.2 KBaud) and long distances (up to 1200 m).

Characteristics:

- Data transfer in both directions
- twin wire connection (half duplex)
- Bus structure (addressable interface, up to 32 bus users)

The interface works with differential voltage signals, ensuring high interference susceptibility.

The bus system consists of a maximum of 32 passive users and one active user. Only the active user (computer system) is entitled to start communication. The DEPOLOX 3 *plus* is always a passive user.

3.7.2.1 Cable

A shielded and twisted two-wire cable (twisted pair) is to be used. The shield improves the electromagnetic compatibility. An unshielded cable can be used if acceptable within the surroundings, that means, if no electromagnetic interferences are expected.

The bus cable is connected from one user to the next. Stub cables of a maximum length of 0.3 m are allowed. The surge impedance of the cable should be between 100 and 130 ohm, the cable capacitance preferably <60 pF/m and the cross section 0.22 mm² (e.g., Li2CY(TP) 2x0.22 mm²). If using a shielded cable we recommend to connect the shield on both sides with low resistance (large cross sections and short cables) to protection ground, to have optimum interference compatibility.

3.7.2.2 Interface Connection

The bus cable for the communication with the DEPOLOX 3 *plus* should be connected to the following terminals:

Bus line A: Terminal 28
Bus line B: Terminal 27

<u>NOTE</u>: The RS485 interface of the DEPOLOX 3 *plus* is not galvanically isolated. Each DEPOLOX 3 *plus* occupies two bus addresses of its own (e.g., 0 for chlorine, 1 for pH or for fluoride). This means that in a bus system with DEPOLOX 3 *plus*-modules, each of the modules behaves as two separate bus users.

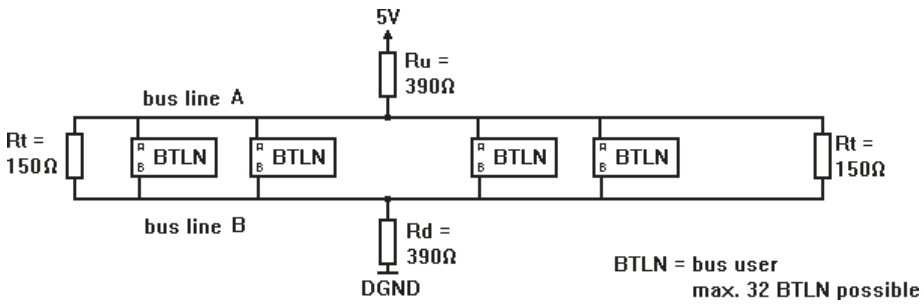


Figure 3.7 - Interface Connection

Both ends of the bus cable must be connected to a moving load Rt (150 Ohm). Symmetry is assured at only one point of the bus. With a voltage supply of 5 V, the resistors Rd and Ru (390 Ohm each) connect to ground and 5 V. These resistor values fit for transmission of up to 19200 Bit/s and a maximum bus length of 1200 m. Symmetry and bus ends should be executed in the same way at potentially isolated and non-isolated bus systems.

Resistors may be switched on via DIP switch in the terminals box. (See Figure 3.8.)

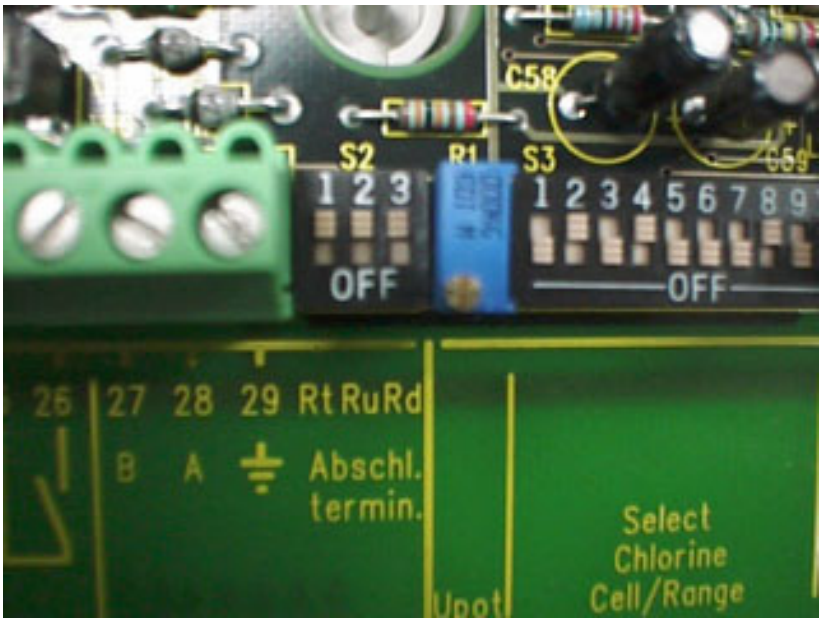


Figure 3.8 - Terminals Box

3.7.2.3 Bus Connection

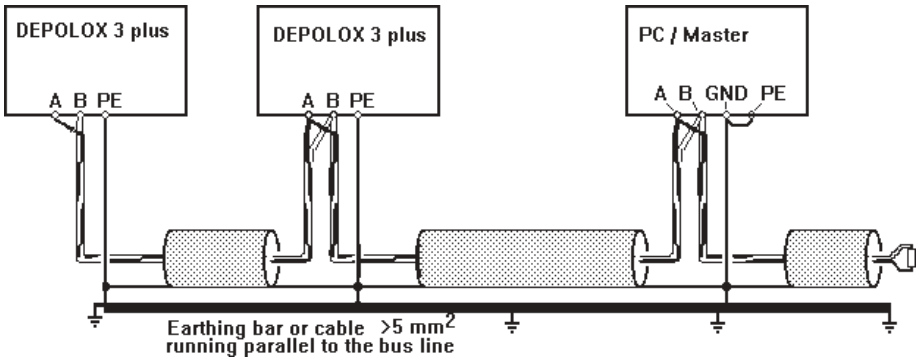


Figure 3.9 - Potentially Not Isolated RS485 Bus System

3.7.3 Specification of Bus Interface

1	Synchronization mode:	Asynchronous	
2	Transmission rate:	19200 Baud	
3	Data format (asynchronous):	- Start bit:	1 Bit
		- Data bit:	8 Bit
		- Parity bit:	even
		- Stop bit:	1 Bit
4	Signal polarity:	Differential voltage interface Logical “1” = (A-B >= 0.2V) Logical “0” = (A-B <= -0.2V)	
5	Handshake:	No handshake because of request control with fixed blocks	
6	Transmission code:	USF/W&T-Protocol (master-slave) multipoint communication, maximum 32 users	
7	Galvanically not isolated		

3.7.4 Transmission Protocol

For the communication between master (active user, e.g., computer) and slave (passive user), two different kinds of frames are used:

- Request - Frame
- Set - Frame

The slave answers to these frames with the following frames:

- Answer frame
- Positive confirmation
- Negative confirmation

The bytes of these frames always have the same formats:

- 1 Start bit (always “0”)
- 8 Data bits
- 1 Parity bit (even)
- 1 Stop bit (always “1”)

3.7.4.1 Description of the Bytes of the Frames

- Synchronization bytes: Used for the synchronization of the user units to the others.

- Start byte (SB): Marks the begin of a frame.

  The value depends on the type of the frame:

Request frame	10H
Set frame	68H
Answer frame	68H
Positive confirmation	A2H
Negative confirmation	DCH

- Slave address: To every module in the RS485 bus a special bus address is allocated (slave address). The address can be a number between 0 and 31 Dec.

NOTE: The DEPOLOX 3 *plus* module uses up to two bus addresses because of the two-fold function of the module (Cl_2 measurement, pH or fluoride measurement).

- Destination address: Determines the transmission variable in the address reference list, that is to be read or written.

- Check byte: Determines the type of information to be read from the slave. Also the data format is defined.

  Data format of the check byte (Bit 0 through 3):

Bit (3210)	Dez.	Format:
0000	0	Default (to address reference list)
0001	1	Default (to address reference list)
0010	2	Boolean
0011	3	Boolean
0100	4	unsigned Character
0101	5	signed Character
0110	6	unsigned Integer
0111	7	signed Integer
1000	8	unsigned long Integer
1001	9	signed long Integer
1010	10	Floating Point
1011	11	Floating Point
1100	12	ASCII

1101	13	ASCII
1110	14	Mixed data format
1111	15	Mixed data format

Additional functions of the check byte (Bit 4 through 7):

Bit (7654)	Function
1000	Minimum value of the variable
0100	Maximum value of the variable
0010	Default value of the variable
0001	additional information of the variable

If no bit is set in bits 5 through 7, the actual value is written or read. Otherwise the corresponding additional information is sent by the slave.

- Special case: With "negative confirmation," the check byte includes an additional information about the error occurred. With "positive confirmation," the check byte is set to 00Hex.

Value:	Function:
01H	End of address table
02H	Wrong data format
04H	Additional information not available
08H	Variable to set not within min. and max. limits
10H	reading access not permitted
20H	reading access permitted but wrong password
40H	writing access not permitted
80H	writing access permitted but wrong password
C0H	writing access not permitted (wrong operation mode)

- Number byte: Defines the number of bytes to read or to write.

- Frame Check: The sum of the control bytes of a frame is stored in the frame check.

  FC = (unsigned char) SB + SA + ZA + KB + AB

- Data unit: Includes data informations be sent by slave or master.

- Data check: The check sum of the data bytes of a frame is stored in the data check.

  CD = (unsigned char) sum of DU

- End byte: Marks the end of a frame. Value is always 16Hex.

3.7.4.2 Request - Frame

This is necessary to read data or additional information from a slave.

Format of the request frame:

Byte:	0-2	3	4	5	6	7	8	9
Name:	SYN	SB	SA	ZA	KB	AB	FC	EB

Byte:	Name:	occupied by:
0-2	SYN	Synchronization bytes
3	SB	Start byte 10H
4	SA	Slave address
5	ZA	destination address
6	KB	check byte
7	AB	number of bytes
8	FC	frame Check
9	EB	end byte 16H

With the request frame, single words, values covering more addresses, or additional information of the destination address can be read. If the contents of a single destination address are requested, the number byte is set to 00Hex. In the answer frame, the data format and the number of bytes are entered from the address reference list to the check byte and the number byte.

If a number byte is set in the request frame (request covering more addresses), the data format in the answer frame is set to 04Hex (unsigned char). The number byte of the answer frame receives the value of the number byte of the request frame. A data format eventually entered in the request frame is ignored.

If the additional information of a destination address is requested, the check byte must include the identification for this additional information. The data format and the number byte are ignored. The check byte and the answer byte are set according to the reference list. Valid request frames are answered with an answer frame. Invalid request frames are answered with “negative confirmation.”

Example: Requesting the contents of destination address 02H from slave 07H:

00H	00H	00H	10H	07H	02H	00H	00H	19H	16H
	SYN		SB	SA	ZA	KB	AB	FC	EB

3.7.4.3 Set - Frame

The set frame is used for writing data to a slave.

Format of the set frame:

Byte:	0-2	3	4	5	6	7	8	9-X	Y	Z
Name:	SYN	SB	SA	ZA	KB	AB	FC	DU	DC	EB

Byte:	Name:	Function:
0-2	SYN	Synchronization bytes
3	SB	Start byte 68H
4	SA	Slave address
5	ZA	Destination address
6	KB	Check byte
7	AB	Number byte
8	FC	Frame Check
9-X	DU	Data bytes
Y	DC	Data Check
Z	EB	End byte 16H

With the set frame, single words, values covering more addresses, or additional information can be written.

If the contents of a single destination address are written, the number byte must correspond to the number byte of the address reference list. The data format must be set to “default” or to the data format from the address reference list.

If more variables are to be set covering more addresses, the data format must be set to “default.” The number byte means the number of bytes to write; only whole variables have to be written. Valid set frames are answered with a “positive confirmation.” Invalid set frames are answered with “negative confirmation.”

Example: Setting the contents of destination address 02H of the slave 07H to 904 (Dec).

0H	00H	00H	68H	07H	02H	06H	02H	79H	03H	88H	8BH	16H
	SYN		SB	SA	ZA	KB	AB	FC	DU		DC	EB

3.7.4.4 Answer - Frame

The answer frame is transmitted by the slave because of a request frame of the master.

Format of the answer frame:

Byte:	0-2	3	4	5	6	7	8	9-X	Y	Z
Name:	SYN	SB	SA	ZA	KB	AB	FC	DU	DC	EB

Byte:	Name:	Function:
0-2	SYN	Synchronization bytes
3	SB	Start byte 68H
4	SA	Slave address
5	ZA	Destination address
6	KB	Check byte
7	AB	Number byte
8	FC	Frame Check
9-X	DU	Data bytes
Y	DC	Data Check
Z	EB	End byte 16H

If no data format and no number of bytes (AB) is set in the request frame in the check byte, the data format and the number of bytes are entered into the answer frame from the address list.

Example: Request frame

00H	00H	00H	10H	07H	02H	00H	00H	19H	16H
	SYN		SB	SA	ZA	KB	AB	FC	EB

Answer to the example Request - Frame:

00H	00H	00H	68H	07H	02H	06H	02H	79H	00H	00H	8BH	16H
	SYN	SB	SA	ZA	KB	AB	FC	DU		DC	EB	

3.7.4.5 Positive and Negative Confirmation

The “positive confirmation” is transmitted by the slave, if a set frame of the master has been executed validly. A “negative confirmation” is transmitted by the slave, if a set frame or a request frame couldn’t be executed validly.

Format of the positive/negative confirmation:

Byte:	0-2	3	4	5	6	7	8	9
Name:	SYN	SB	SA	ZA	KB	AB	FC	EB

Byte:	Name:	Function:	
0-2	SYN	Synchronization bytes	
3	SB	Positive:	Start byte A2H
		Negative:	Start byte DCH
4	SA	Slave address	
5	ZA	Ziel address	
6	KB	Check byte	
7	AB	Number byte	
8	FC	Frame Check	
9	EB	End byte 16H	

The check byte is occupied by 00Hex for positive confirmation and by an error code for negative confirmation.

Example: Positive confirmation

00H	00H	00H	A2H	07H	02H	00H	00H	ABH	16H
	SYN		SB	SA	ZA	KB	AB	FC	EB

Example: Negative confirmation

00H	00H	00H	DCH	07H	02H	02H	00H	A5H	16H
	SYN		SB	SA	ZA	KB	AB	FC	EB

3.7.5 Address Reference List

<u>NOTE</u>: To each DEPOLOX 3 *plus* two addresses are allocated. Each of the two addresses lead to a corresponding address reference list (e.g., Adr00 for Cl_2 measurement, Adr01 for pH or fluoride measurement).

KEY

Abbreviations of the data formats	BOOL-boolean, UCHAR-unsigned char, SCHAR-signed char, USINT-unsigned integer, SINT-signed integer, ULONG-unsigned long, SLONG-signed long, FLOAT- float, ASCII-ASCII-code
Abbreviations of access	L-read, S-write, LP-read with password, SP-write with password, SW-write with USF/W&T-password
Data structure 1	Byte1-2: Measured valuet (signed int), Byte3-4: range-start (signed int), Byte 5-6: range-end (signed int), Byte7-11: unit (ASCII), Byte12: divider (character)

Table 3.4 - Address Reference List - Address 1 - Chlorine

ADDR.	DESCRIPTION	FORMAT	LENGTH	RANGE	UNIT	FACTOR	STATUS	NOTES
0.	date software version	ASCII	12	-	-	-	L	"V: A_08/95"
1.	module name	ASCII	28	-	-	-	L	"COMMON Electronic - Analyzer"
2.	password of interface	USINT	2	0...999	-	1,0	L, S	"904"
3.	module type	ASCII	12	-	-	-	L	"Depolox 3 DES"
4.	operation mode	UCHAR	1	-	-	-	L	0x01 (Automatic - no manual-mode possible)
5.	measured DES	UCHAR	12	-	-	-	L	data structure 1
6.		UCHAR	12	-	-	-	L	0x2D
7.		UCHAR	12	-	-	-	L	data structure 1
8.	Low - Alarm DES	UCHAR	12	-	-	-	L	data structure 1
9.	High - Alarm DES	UCHAR	12	-	-	-	L	data structure 1
10.		UCHAR	12	-	-	-	L	0x2D
11.		UCHAR	12	-	-	-	L	0x2D
12.	setpoint DES	UCHAR	12	-	-	-	L	data structure 1
13.	module option	UCHAR	1	-	-	-	L	0x03 (Regulator + Temperature)
14.	alarm and digital input	UCHAR	1	-	-	-	L	0x01 - alarm 1 (K1) activated 0x02 - alarm 2 (K2) activated 0x04 - alarm 3 (K3) activated 0x08 - alarm 4 (K4) activated 0x10 - digital input activated
15.	error status	UINT	2	-	-	-	L	0x0001 - Sollwert error DES 0x0002 - Low/High DES error 0x0004 - Low/High DES error 0x0020 - mA output error 0x0040 - ADC1 error 0x0080 - ADC2 error 0x0100 - ADC3 error 0x0400 - temperature sensor error 0x0800 - zero error 0x1000 - DPD error 0x4000 - cell error
16.		SINT	2	-	-	-	L	0x2D
17.		FLOAT	4	-	-	-	L	0x2D
18.	module language	UCHAR	1	-	-	-	L, SP	0x01 - german 0x02 - english 0x04 - french 0x08 - spanish
19.		SINT	2	-	-	-	L	0x2D
20.	setpoint DES	SINT	2	depends on range	mg/l	0,1/0,01	L, SP	--
21.		SINT	2	-	-	-	L	0x2D
22.		SINT	2	-	-	-	L	0x2D
23.	Alarm Relay 1 Definition	UCHAR	1	-	-	-	L, SP	0x01 - High 0x02 - Low 0x04 - High/Low 0x08 - General Fault 0x10 - DI 0x20 - Dose contact 0x80 - End
24.	Alarm Relay 1 Operation	UCHAR	1	-	-	-	L, SP	0x01 - norm. open 0x02 - fail safe
25.	Low Alarm Value DES	SINT	2	depends on range	mg/l	0,1/0,01	L, SP	-

Table 3.4 - Address Reference List - Address 1 - Chlorine (Cont'd)

ADDR.	DESCRIPTION	FORMAT	LENGTH	RANGE	UNIT	FACTOR	STATUS	NOTES
26.	Alarm 1 Hysteresis	SINT	2	1...25	digit	1,0	L, SP	-
27.	Alarm Relay 1 Delay	SINT	2	0...60	min	1,0	L, SP	-
28.	Alarm Relay 2 Definition	UCHAR	1	-	-	-	L, SP	0x01 - High 0x02 - Low 0x04 - High/Low 0x08 - General Fault 0x10 - DI 0x80 - End
29.	Alarm Relay 2 Operation	UCHAR	1	-	-	-	L, SP	0x01 - norm. open 0x02 - fail safe
30.	High Alarm Value DES	SINT	2	depends on range	mg/l	0,1/0,01	L, SP	-
31.	Alarm 2 Hysteresis	SINT	2	1...25	digit	1,0	L, SP	-
32.	Alarm Relais 2 Delay	SINT	2	0...60	min	1,0	L, SP	-
33.		UCHAR	1	-	-	-	L	0x2D
34.		UCHAR	1	-	-	-	L	0x2D
35.		SINT	2	-	-	-	L	0x2D
36.		SINT	2	-	-	-	L	0x2D
37.		SINT	2	-	-	-	L	0x2D
38.		UCHAR	1	-	-	-	L	0x2D
39.		UCHAR	1	-	-	-	L	0x2D
40.		SINT	2	-	-	-	L	0x2D
41.		SINT	2	-	-	-	L	0x2D
42.		SINT	2	-	-	-	L	0x2D
43.		UCHAR	6	-	-	-	L	0x2D
44.	Contrast	SINT	2	0 ... 100	%	1	L, SP	--
45.	Eprom - Storage no.	CHAR	7	-	-	-	L	"AAB1603"
46.	Eprom - Version	CHAR	9	-	-	-	L	"V:A_06/01"
47.	SUM		217					

Table 3.5 - Address Reference List - Address 2 - pH

ADDR.	DESCRIPTION	FORMAT	LENGTH	RANGE	UNIT	FACTOR	STATUS	NOTES
0.	date software version	ASCII	12	-	-	-	L	"V:A_08/95"
1.	module name	ASCII	28	-	-	-	L	"COMMON Electronic - Analyzer"
2.	password of interface	USINT	2	0... 999	-	1,0	L, S	"904"
3.	module type	ASCII	12	-	-	-	L	"Depolox3 pH"
4.	operation mode	UCHAR	1	-	-	-	L	0x01 0x01 (Automatic - no manual-mode possible)
5.	measured value pH	UCHAR	12	-	-	-	L	data structure 1
6.		UCHAR	12	-	-	-	L	0x2D
7.	sample water temperature	UCHAR	12	-	-	-	L	data structure 1
8.	Low alarm pH	UCHAR	12	-	-	-	L	data structure 1
9.	High alarm pH	UCHAR	12	-	-	-	L	data structure 1
10.		UCHAR	12	-	-	-	L	0x2D
11.		UCHAR	12	-	-	-	L	0x2D
12.		UCHAR	12	-	-	-	L	0x2D
13.	module option	UCHAR	1	-	-	-	L	0x02 (Temperature)
14.	alarm and digital input	UCHAR	1	-	-	-	L	0x01 - relay 1 (K1) activated 0x02 - relay 2 (K2) activated 0x04 - relay 3 (K3) activated 0x08 - relay 4 (K4) activated 0x10 - digital input activated
15.	Error status	UINT	2	-	-	-	L	0x0002 - Low/High pH error 0x0004 - Low/High pH error 0x0020 - mA output error 0x0040 - ADC1 error 0x0080 - ADC2 error 0x0100 - ADC3 error 0x0200 - Calibration error 0x0400 - temperature sensor error 0x4000 - cell error
16.		SINT	2	-	-	-	L	0x2D
17.		FLOAT	4	-			L	0x2D
18.	module language	UCHAR	1	-	-	-	L, SP	0x01 - german 0x02 - english 0x04 - french 0x08 - spanish
19.		SINT	2	-	-	-	L	0x2D
20.		SINT	2	-	-	-	L	0x2D
21.		SINT	2	-	-	-	L	0x2D
22.		SINT	2	-	-	-	L	0x2D
23.	Alarm relay 1 definition	UCHAR	1	-	-	-	L, SP	0x01 - High 0x02 - Low 0x04 - High/Low 0x08 - General fault 0x10 - DI 0x80 - off
24.	Alarm relay 1 operation	UCHAR	1				L, SP	0x01 - norm. open 0x02 - fail safe
25.	Low alarm value pH	SINT	2	range	pH	0.01	L, SP	-

Table 3.5 - Address Reference List - Address 2 - pH (Cont'd)

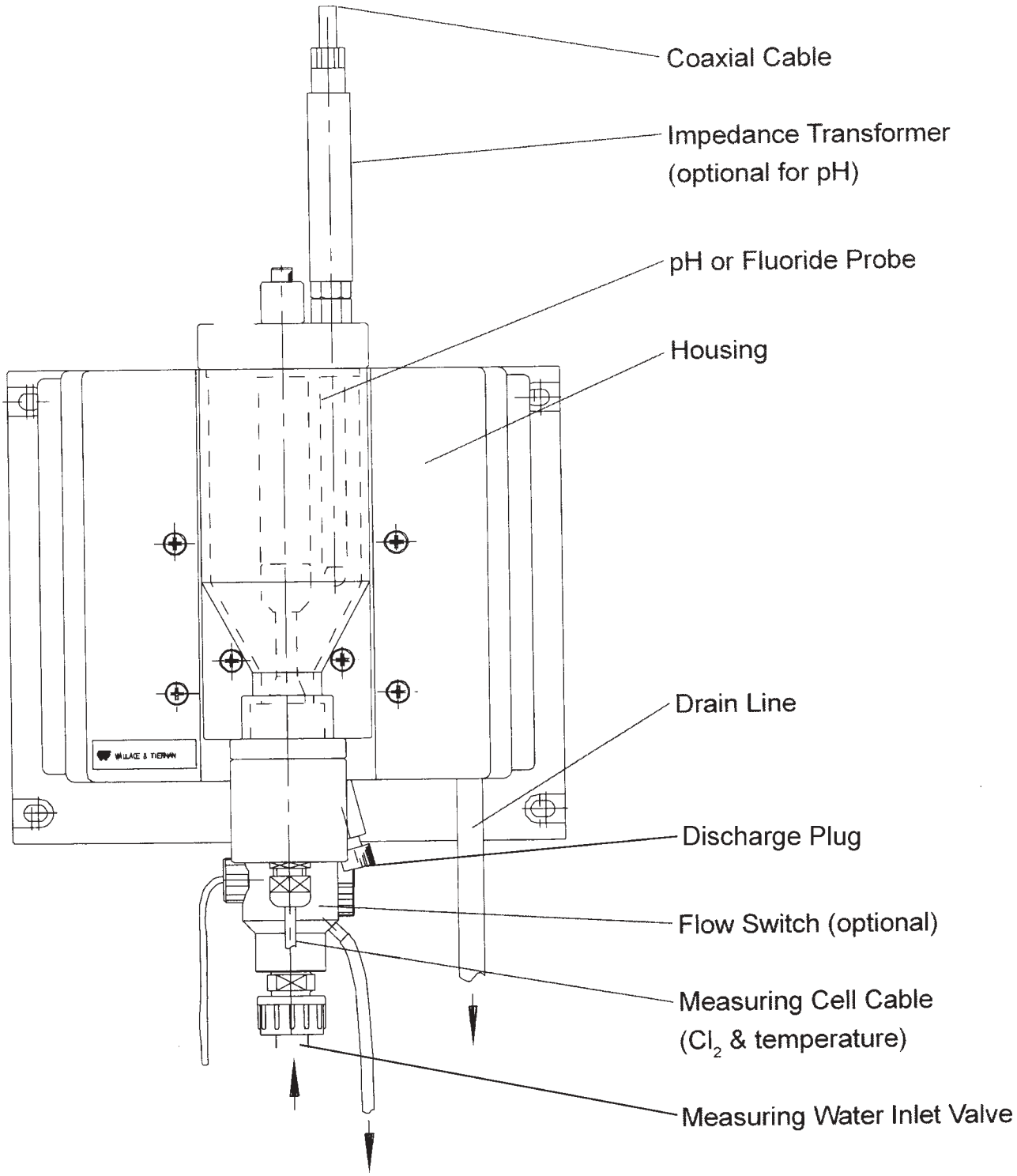
ADDR.	DESCRIPTION	FORMAT	LENGTH	RANGE	UNIT	FACTOR	STATUS	NOTES
26.	Alarm relay 1 hysteresis	SINT	2	1...25	digit	1.0	L, SP	-
27.	Alarm relay 1 delay	SINT	2	1...60	min	1.0	L, SP	-
28.	Alarm relay 2 definition	UCHAR	1	-	-	-	L, SP	0x01 - High 0x02 - Low 0x04 - High/Low 0x08 - General fault 0x10 - DI 0x80 - off
29.	Alarm relay 2 operation	UCHAR	1				L, SP	0x01 - norm. open 0x02 - fail safe
30.	High alarm value pH	SINT	2	range	pH	0.01	L, SP	-
31.	Alarm relay 2 hysteresis	SINT	2	1...25	digit	1.0	L, SP	-
32.	Alarm relay 2 delay	SINT	2	1...60	min	1.0	L, SP	-
33.		UCHAR	1				L	0x2D
34.		UCHAR	1				L	0x2D
35.		SINT	2				L	0x2D
36.		SINT	2				L	0x2D
37.		SINT	2				L	0x2D
38.		UCHAR	1				L	0x2D
39.		UCHAR	1				L	0x2D
40.		SINT	2				L	0x2D
41.		SINT	2				L	0x2D
42.		SINT	2				L	0x2D
43.		UCHAR	6				L	0x2D
44.	contrast	SINT	2	0...100	%	1	L, SP	--
45.	EPROM storage no.	CHAR	7	-	-	-	L	"AAB1603"
46.	EPROM version	CHAR	9	-	-	-	L	"V:A_06/01"
47.	Sum		217					

Table 3.6 - Address Reference List - Address 2 - Fluor

ADDR.	DESCRIPTION	FORMAT	LENGTH	RANGE	UNIT	FACTOR	STATUS	NOTES
0.	date software version	ASCII	12	-	-	-	L	"V: A_08/95"
1.	module name	ASCII	28	-	-	-	L	"COMMON Electronic - Analyzer"
2.	password of interface	USINT	2	0... 999	-	1,0	L, S	"904"
3.	module type	ASCII	12	-	-	-	L	"Depolox3 FI"
4.	operation mode	UCHAR	1	-	-	-	L	0x01 0x01 (Automatic - no manual-mode possible)
5.	measured value pH	UCHAR	12	-	-	-	L	data structure 1
6.		UCHAR	12	-	-	-	L	0x2D
7.	sample water temperature	UCHAR	12	-	-	-	L	data structure 1
8.	Low alarm pH	UCHAR	12	-	-	-	L	data structure 1
9.	High alarm pH	UCHAR	12	-	-	-	L	data structure 1
10.		UCHAR	12	-	-	-	L	0x2D
11.		UCHAR	12	-	-	-	L	0x2D
12.		UCHAR	12	-	-	-	L	0x2D
13.	module option	UCHAR	1	-	-	-	L	0x02 (Temperature)
14.	alarm and digital input	UCHAR	1	-	-	-	L	0x01 - relay 1 (K1) activated 0x02 - relay 2 (K2) activated 0x04 - relay 3 (K3) activated 0x08 - relay 4 (K4) activated 0x10 - digital input activated
15.	Error status	UINT	2	-	-	-	L	0x0002 - Low/High pH error 0x0004 - Low/High pH error 0x0020 - mA output error 0x0040 - ADC1 error 0x0080 - ADC2 error 0x0100 - ADC3 error 0x0200 - Calibration error 0x0400 - temperature sensor error 0x4000 - cell error
16.		SINT	2	-	-	-	L	0x2D
17.		FLOAT	4	-			L	0x2D
18.	module language	UCHAR	1	-	-	-	L, SP	0x01 - german 0x02 - english 0x04 - french 0x08 - spanish
19.		SINT	2	-	-	-	L	0x2D
20.		SINT	2	-	-	-	L,	0x2D
21.		SINT	2	-	-	-	L	0x2D
22.		SINT	2	-	-	-	L	0x2D
23.	Alarm relay 1 definition	UCHAR	1	-	-	-	L, SP	0x01 - High 0x02 - Low 0x04 - High/Low 0x08 - General fault 0x10 - DI 0x80 - off
24.	Alarm relay 1 operation	UCHAR	1				L, SP	0x01 - norm. open 0x02 - fail safe
25.	Low alarm value pH	SINT	2	range	pH	0.01	L, SP	-

Table 3.6 - Address Reference List - Address 2 - Fluor (Cont'd)

ADDR.	DESCRIPTION	FORMAT	LENGTH	RANGE	UNIT	FACTOR	STATUS	NOTES
26.	Alarm relay 1 hysteresis	SINT	2	1...25	digit	1.0	L, SP	-
27.	Alarm relay 1 delay	SINT	2	1...60	min	1.0	L, SP	-
28.	Alarm relay 2 definition	UCHAR	1	-	-	-	L, SP	0x01 - High 0x02 - Low 0x04 - High/Low 0x08 - General fault 0x10 - DI 0x80 - off
29.	Alarm relay 2 operation	UCHAR	1				L, SP	0x01 - norm. open 0x02 - fail safe
30.	High alarm value pH	SINT	2	range	pH	0.01	L, SP	-
31.	Alarm relay 2 hysteresis	SINT	2	1...25	digit	1.0	L, SP	-
32.	Alarm relay 2 delay	SINT	2	1...60	min	1.0	L, SP	-
33.		UCHAR	1				L, SP	0x2D
34.		UCHAR	1				L, SP	0x2D
35.		SINT	2				L, SP	0x2D
36.		SINT	2				L, SP	0x2D
37.		SINT	2				L, SP	0x2D
38.		UCHAR	1				L, SP	0x2D
39.		UCHAR	1				L, SP	0x2D
40.		SINT	2				L, SP	0x2D
41.		SINT	2				L, SP	0x2D
42.		SINT	2				L, SP	0x2D
43.		UCHAR	6				L, SP	0x2D
44.	contrast	SINT	2	0...100	%	1	L, SP	-
45.	EPROM storage no.	CHAR	7	-	-	-	L	"AAB1603"
46.	EPROM version	CHAR	9	-	-	-	L	"V:A_06-01"
47.	Sum		217					



BARE ELECTRODE SENSOR KIT - ASSEMBLY

50.560.160.010

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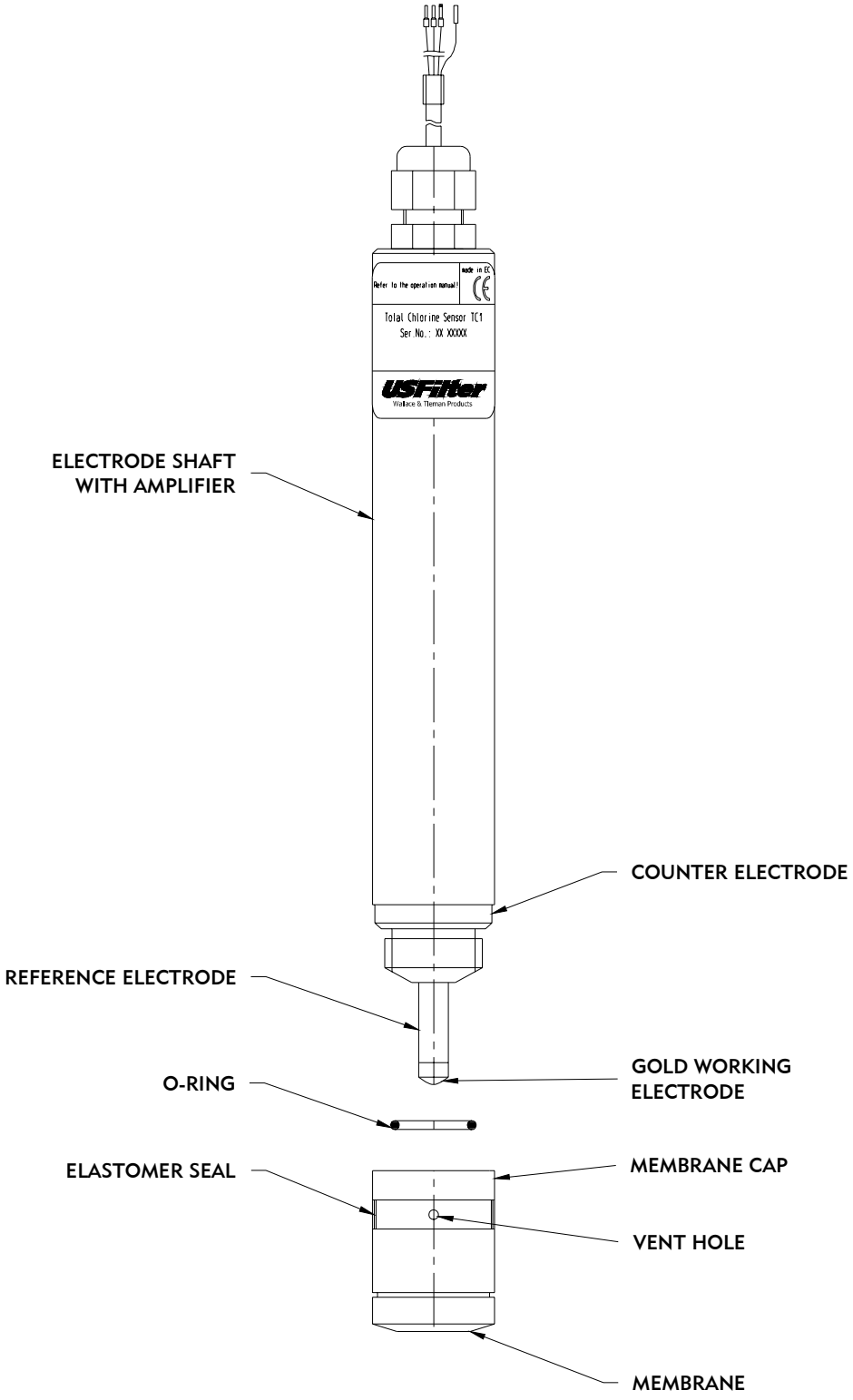
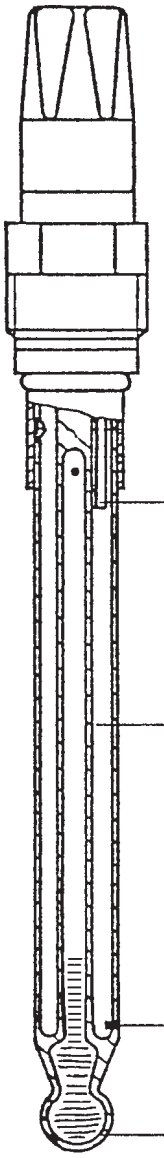


MEMBRANE SENSOR KIT - ASSEMBLY

50.560.160.020

ISSUE 1 1-03



pH SENSOR KIT - ASSEMBLY

50.560.160.030

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SECTION 4 - SERVICE

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4.1 DEPOLOX 3 *plus*

Table 4.1 - Errors

Error Message	Cause	Remedy
High/Low Alarms:		
*High DIS ? *	Alarm value exceeded	check dosing
*Low DIS ? *		check sample water flow
*High pH ? *		
*Low pH ? *		
*High Fluor ? *		
*Low Fluor ? *		
General Faults:		
*mA-loop 1 ? *	mA loop impedance too high	check mA loop <1000 ohm
*mA-loop 2 ? *	loop interrupted	jump if not used
*cell DIS ? *	sensor wrongly connected	check wiring
*cell pH ? *	sensor cables interchanged or (in pH compensated mode) pH is out of range	perform calibration or adjust pH
*cell Fluor ? *	sensor defectif	replace sensor
*Circ.Fail. ? *	internal failure	contact USF/W&T
temp ?	temperature failure	check temp. sensor, wiring
Warnings		
*H/L DIS ? *	Alarm value out of range	adjust range or limit value
*H/L pH ? *	range changed subsequently	
*H/L Fluor ? *		
*Setp. DIS ? *	Setpoint Cl2 out of range	adjust range or setpoint
*ADU 1 ? *	internal failure	call USF/W&T service
*ADU 2 ? *		
*ADU 3 ? *		
*Cal. DIS ? *	Calibration error	perform new calibration
*Cal. pH ? *		check buffer solutions
*Cal. Fluor ? *		replace electrolyte
*OVR DIS ? *	value exceeds range	check range and dosing
*OVR pH ? *	range does not fit	
*OVR Fluor ? *	dosing too high	

Table 4.1 - Errors (Cont'd)

Error Message	Cause	Remedy
Warnings (cont'd)		
* Digital In ?*	Signal at the digital input	check for the origin of the signal, e.g., sample water flow too low jump if not used
Additional Errors		
Device has no display	No mains power Defective fuse or wrong setting of mains voltage	Turn on external mains switch Check voltage setting and replace fuse, see paragraph 2.1.3
Displayed/output value wrong	wrong calibration Old buffer solutions Old electrolyte Wrong wiring or setting	New calibration sensor maintenance check sensor, wiring and setting

In case of an alarm:

- the alarm LED will become illuminated
- the display will detail the specific alarm every five seconds for one second for each alarm.
- if an alarm relay is associated to the alarm condition, the delay time will begin. At the end of the delay time the relay will be triggered.

NOTE: Refer to Table 4.2 - Relay / Display Operation During Alarm Conditions, for details.

Table 4.2 - Relay / Display Operation During Alarm Conditions

Alarm / ErrorType	Assigned to Relay	Alarm Status Sequence	Relay Type Latch / Non-latch	Press Alarm Ack key	Relay	Display	LED
Hi / Lo Alarm	yes	no alarm	Non-latch	NA	non-alarm state	no message	off
		alarm		NA	Alarm State	alarm message	on
		no alarm		NA	non-alarm state	no message	off
Hi / Lo Alarm	yes	no alarm	Latch	no	non-alarm state	no message	off
		alarm		no	alarm state	alarm message	on
		alarm		yes	non-alarm state	alarm message	blink
		no alarm		no	non-alarm state	no message	off
Hi / Lo Alarm	yes	no alarm	Latch	no	non-alarm state	no message	off
		alarm		no	alarm state	alarm message	on
		no alarm		no	alarm state	alarm message	on
		no alarm		yes	non-alarm state	no message	off
Hi / Lo Alarm	no	no alarm	NA	NA	NA	no message	off
		alarm	NA	NA	NA	alarm message	blink
		no alarm	NA	NA	NA	no message	off
General Fault	yes	no alarm	Non-latch	NA	non-alarm state	no message	off
		alarm		NA	Alarm State	alarm message	on
		no alarm		NA	non-alarm state	no message	off
General Fault	yes	no alarm	Latch	no	non-alarm state	no message	off
		alarm		no	alarm state	alarm message	on
		alarm		yes	non-alarm state	alarm message	blink
		no alarm		no	non-alarm state	no message	off
General Fault	yes	no alarm	Latch	no	non-alarm state	no message	off
		alarm		no	alarm state	alarm message	on
		no alarm		no	alarm state	alarm message	on
		no alarm		yes	non-alarm state	no message	off
General Fault	no	no alarm	NA	NA	NA	no message	off
		alarm	NA	NA	NA	alarm message	blink
		no alarm	NA	NA	NA	no message	off
Warning	no	no alarm	NA	NA	NA	no message	off
		alarm		NA	NA	alarm message	on
		no alarm		NA	NA	no message	off
Digital Input	yes	no alarm	Non-latch	NA	non-alarm state	no message	off
		alarm		NA	Alarm State	alarm message	on
		no alarm		NA	non-alarm state	no message	off
Digital Input	yes	no alarm	Latch	no	non-alarm state	no message	off
		alarm		no	alarm state	alarm message	on
		alarm		yes	non-alarm state	message	blink
		no alarm		no	non-alarm state	no message	off
Digital Input	yes	no alarm	Latch	no	non-alarm state	no message	off
		alarm		no	alarm state	alarm message	on
		no alarm		no	alarm state	alarm message	on
		no alarm		yes	non-alarm state	no message	off
Digital Input	no	no alarm	NA	NA	NA	no message	off
		alarm		NA	NA	alarm message	blink
		no alarm		NA	NA	no message	off

4.2 Free Chlorine (Bare Electrode) Sensor Kit

4.2.1 Maintenance

- Daily checks

  Each day check the complete unit for leaks, including all pipe unions and glands, and rectify all leaks immediately.

NOTE: All air leaks must receive immediate attention as they will have a detrimental effect on the operation of the cell unit. Should an air leak occur upstream of the measuring cell assembly, bubbles are seen passing through the cell block. With a leak down stream of the cell assembly, bubbles are seen only in the drain hose from the cell block.

  Measure the actual free chlorine residual by any standard colorimetric or titration method ensuring the equipment manufacturers instructions are strictly observed.

  Draw the sample water from the sample drain nipple (see Dwg. 50.560.160.010 in Section 3).

NOTE: It is very important to obtain consistent results when measuring the residual value of the test sample and it is recommended that precisely the same method is used every time a sample is tested.

  If the indicated residual on the controller or amplifier display varies from the measured residual by more than is acceptable to the user, carry out the calibration procedure referred to in paragraph 3.2.1, Free Chlorine (Bare Electrode) Calibration.

  If the variation still remains after recalibration, refer to "Bimonthly check," below.

- Weekly checks

  With the sample water turned on, check that there is sufficient grit in the measuring cell block to keep the electrodes clean. This will be indicated by the amount of grit being swirled about in the vortex of the cell. Lack of grit will lead to insufficient cleaning and more grit must be added.

NOTE: When fresh grit is added to the cell block a temporary rise in cell output will normally occur which, generally, will last for two to three hours. It is important that no calibration adjustments are made during this period.

- Monthly checks

  Remove and clean, if fitted, the detachable element of the strainer in the sample water supply line. Check the calibration of the cell (refer to paragraph 3.2.1, Free Chlorine (Bare Electrode) Calibration)

- Bimonthly checks (see Dwg. 50.560.000.010)

  a. Check the zero point to ensure no drift has occurred.

  b. Check that the potassium chloride electrolyte is level with the bottom of the electrolyte reservoir neck and top up if necessary. This operation can be carried out by removing the nut (2) in the top of the electrolyte reservoir.

  c. The particles of grit used for continuous electrode cleaning take approximately two months to wear down. After this period of time the grit should be replaced. The procedure for grit replacement is detailed later.

  d. The membranes in the electrode case (6) form an interface between the reference electrolyte and the sample water. If the quality of the water passing through the cell is poor, especially if the water has a high iron content, inspect the two porous membranes (6) located in the electrode case. They should be white in color and any obvious discoloration is a sign that the membranes are becoming clogged up and should be replaced.

- Semi-annual checks

  Every six months the reference electrolyte should be replaced. Electrolyte replacement can be incorporated into a grit replacement operation. Having removed the reservoir (see steps a through f in the procedure on Grit Replacement that follows), the electrolyte should be discarded safely and the reservoir thoroughly washed in distilled water. Check the condition of the porous membranes and replace if needed. Refill the reservoir to the neck with fresh electrolyte and continue from step g in the Grit Replacement procedure.

- Grit Replacement (See Dwg. 50.560.000.010)

  When they become worn, grit particles should be replaced by taking the following steps:

  a. Close the shut-off valve at the cell inlet.

b. Drain the cell by unscrewing the drain plug.

c. When the cell block is empty, install the drain plug.

d. Unscrew the electrolyte reservoir clamping nut (2) and remove the cell cover (3).

e. Withdraw the complete electrode/electrolyte reservoir assembly (4 to 11) from its housing. This can be achieved by exerting a gentle pressure at the top of the electrolyte reservoir. Rinse off the reservoir to remove any remaining grit particles.

f. Being careful of the cable connector, replace the assembly ensuring that the keying pin in the base of the cell block locates into its corresponding hole in the electrode housing (8).

g. Empty a half capful of grit into the cell block and replace the cover. The assembly should then be secured in its housing with the clamping nut.

h. Open the sample water shut-off valve at the inlet to the measuring cell assembly.

i. Leave the cell running for an hour, to allow the system to settle down, and then carry out the zero calibration procedure. This procedure may be repeated after 24 hours if required.

- Electrode and membrane replacement

The membranes, which form the contact point between reference electrode and sample water, cannot be cleaned. With very good water quality, membrane life may extend for up to three years continuous use. After this period of time however, they should be replaced. Where the quality of the sample water is particularly poor, fouling of the membranes may occur with a corresponding loss in cell efficiency (Refer to the note in "Bimonthly check," above, for further details).

With the electrode/electrolyte reservoir assembly withdrawn from the cell block as described above, the electrodes may be removed and replaced as follows (see Dwg. 50.560.000.010):

a. Slacken the cable gland locking nut and unscrew the cable gland (11) taking care to avoid rotating the cable.

b. Unscrew the cover (10) and remove the push-fit connections from each electrode (and the temperature sensor if fitted).

c. Unscrew the nut (9) which clamps the electrolyte reservoir to the electrode housing (8) and separate the two items.

d. If the reference electrode (7) is to be replaced, hold the electrolyte reservoir vertical with the electrode uppermost. The electrode may now be unscrewed, by holding it just below the wire stem, and replaced.

e. To replace the two membranes (6) in the reservoir housing a pair of pointed tweezers (or similar) should be used. Insert the points into the holes in the pvc body of the membrane and gently pull and turn until the membrane is removed.

f. Fit new membrane using the same technique.

NOTE: The two half ring type platinum electrodes are arranged one above the other in the top recess of the electrode housing (22), with the counter electrode uppermost. To replace the working electrode it is necessary to firt remove the counter electrode.

g. Gently push the stem (blue spot) of the counter electrode until the half ring can be grasped and the electrode removed from the housing.

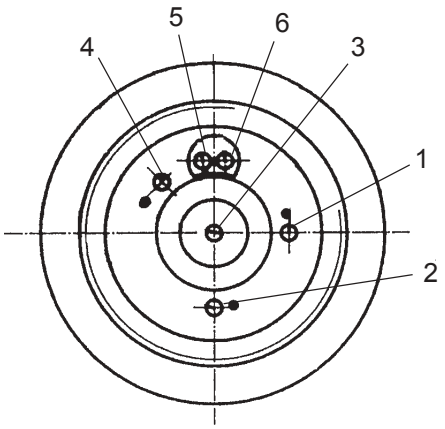
h. If the working electrode (red spot) is to be replaced repeat step (g) with the working electrode.

i. Carefully clean any grit or other deposits from the electrode recess in the upper housing ensuring no moisture enters the electrode stem bore.

j. Fit the replacement working electrode into thetop of the housing and gently (to avoid disturbing the 'O' rings inthe bore) push the electrode down into position.

k. Repeat step (j) with the counter electrode.

l. Reassemble the reservoir to the electrode housing and, ensuring the bottom cover (10) is on the cable, reconnect the signal wires as shown in Figure 4.1:



(1) Counter electrode (blue spot) blue wire (4) Earth grey wire
(2) Working electrode (red spot) pink wire (5) Temperature sensor brown wire
(3) Reference electrode white wire (6) Temperature sensor yellow & green wire

Figure 4.1

m. Reassemble the cover (10) and cable gland (11) to the electrode housing.

n. Refit the electrode/electrolyte reservoir assembly and secure with the clamping nut (2).

o. Reconnect the water inlet line, outlet line and the cell drain line.

p. Leave the cell running for an hour, to allow the system to settle down, and then carry out the zero calibration procedure. This procedure may be repeated after 24 hours if required.

4.2.2 Troubleshooting

The following troubleshooting table is provided for determining and correcting most common troubles.

Table 4.3 - Troubleshooting - Free Chlorine (Bare Electrode) Sensor Kit

FAULT CONDITION	POSSIBLE CAUSE	CORRECTIVE ACTION
Insufficient sample water flow	Drain hose free fall restricted	Ensure 1500mm free fall
	Dirt in cell unit	clean cell
	air bubbles	check lines
	blocked strainer	clean strainer
	shut-off valve closed	open
	regulating valve not working correctly	strip and clean regulator
Air leaks	faulty o-rings	grease or replace
	faulty pipe connections	check and make good where needed
	booster	check and make good where needed
Electrode current too low	dirty electrodes	clean with fine sand paper, add more grit
	worn electrodes	replace
	electrodes touching	adjust
Unsteady output from electrodes	membrane clogged	replace
	air bubbles on inner surface of membrane	adjust
Zero or range not adjustable	zero current too high or too low	replace
		wait until running-in period is completed
		Measure the electrode current in menu "Diagnosis." Zero current must be <±5μA. Check Upot = 250 mV.
		Shut-off valve not closed at zero calibration
	cell current too low or too high	check μA-range
		insufficient sample water flow
Indicated value oscillates considerably at constant chlorine concentration	considerable fluctuations in water pressure	check pressure
	fluctuation in pH value	check pH value
	inlet to cell body or flow regulator clogged	clean inlet or flow regulator
	flow regulator defective	check or replace

4.3 Membrane Sensor Kit

4.3.1 Maintenance

Daily: Check the entire system including all screw fittings for leakage and repair any leaks immediately. Using the cell outlet (see Dwg. 50.560.100.030 in Section 2), carry out a manual measurement every day.

NOTE: The same test method should always be used in order to obtain consistent comparisons between results. Air bubbles at the membrane effect the accuracy of measurement. The cause must be determined and rectified.

When there is an obvious difference between the displayed value and the manually measured value then a calibration must be performed (refer to paragraph 3.2.2, Membrane Calibration). If the deviation remains, even after calibration, then the electrodes should be cleaned in accordance with the manufacturers instructions (see instruction sheet contained in the sensor packaging).

Monthly: Perform a calibration.

4.3.2 Maintenance of the Membrane Probes

Before unscrewing the membrane cap, remove the elastomer seal to allow air into the vent hole. Unscrew the membrane cap, clean the reference electrode with distilled water and then dry with a clean paper towel. Cover the vent hole with the elastomer seal. Refill the cap with new electrolyte (refer to paragraph 2.3, Membrane Sensor). If the signal is still low or unstable, it may be necessary to replace the cap with a new one.

After this procedure the probe requires a run-in time of about one to two hours before recalibration.

4.3.3 Troubleshooting

The following troubleshooting table is provided for determining and correcting most common troubles.

Table 4.4 - Troubleshooting - Membrane Sensor Kit

FAULT CONDITION	POSSIBLE CAUSE	CORRECTIVE ACTION
Insufficient flow of measuring water	Free runoff prevented Back pressure too high	check for free drain or return
	Dirt in cell	Clean measuring cell
	Air bubbles	Check sample water take-off
	Screen in water inlet blocked	Clean
	Inlet valve closed	Open valve
Air bubbles	Leaking O-rings	Replace O-rings
	Incorrect fittings	Check and if necessary tighten or replace
DIS Electrode current too low	Electrolyte used up	perform sensor maintenance
	Membrane defective	Replace membrane cap
DIS Span cannot be adjusted	Measuring cell gives insufficient current	Check μA measuring range.
		The minimum current difference between un-chlorinated and chlorinated water with 1 mg/l residual DIS must be at least >2μA. If the difference is smaller, carry out maintenance
Strong fluctuations in display, though chlorine concentration is constant	Sample water flow too low	Check, if necessary clean inlet
	Electrolyte used up	carry out maintenance

4.4 pH Sensor Kit

WARNING: 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.

4.4.1 Maintenance

Depending on the degree of contamination of the sample water, the pH probe has to be cleaned in regular intervals. The frequency of cleaning has

to be determined empirically, but it is recommended to clean or calibrate it every four weeks. To prevent incorrect measurement, both the glass diaphragm and the ceramic membrane have to be cleaned. Clean the glass diaphragm mechanically with a moistened, clean and soft napkin or cotton swab.

Do not clean the probes with a dry napkin or cotton swab as this method tends to produce a uniform cover of dirt on the probe surface. Do not use abrasive cleaning methods to clean the membrane.

Remove oil or grease with acetone, denatured alcohol or glass cleaning liquid. After cleaning it, rinse the probe thoroughly with water.

To remove calceous deposits from glass diaphragm and membrane, submerge the probe in 0.1mol hydrochloric acid. Rinse thoroughly with distilled water.

Probe ageing is frequently the cause of a sluggish pH-value indication or a declining slope. pH-probes have a service life of one to three years provided that they are serviced regularly.

To store the sensors after use: At delivery the sensor has a protection cap over the pH sensitive membrane glass resp. the diaphragm. The cap contains 3mol KCl solution to keep the sensor ready for use. If the sensor is to be stored for longer time, the cap with the KCl solution should be placed over the sensor again. Protect against frost. Do not store the sensor in distilled water.

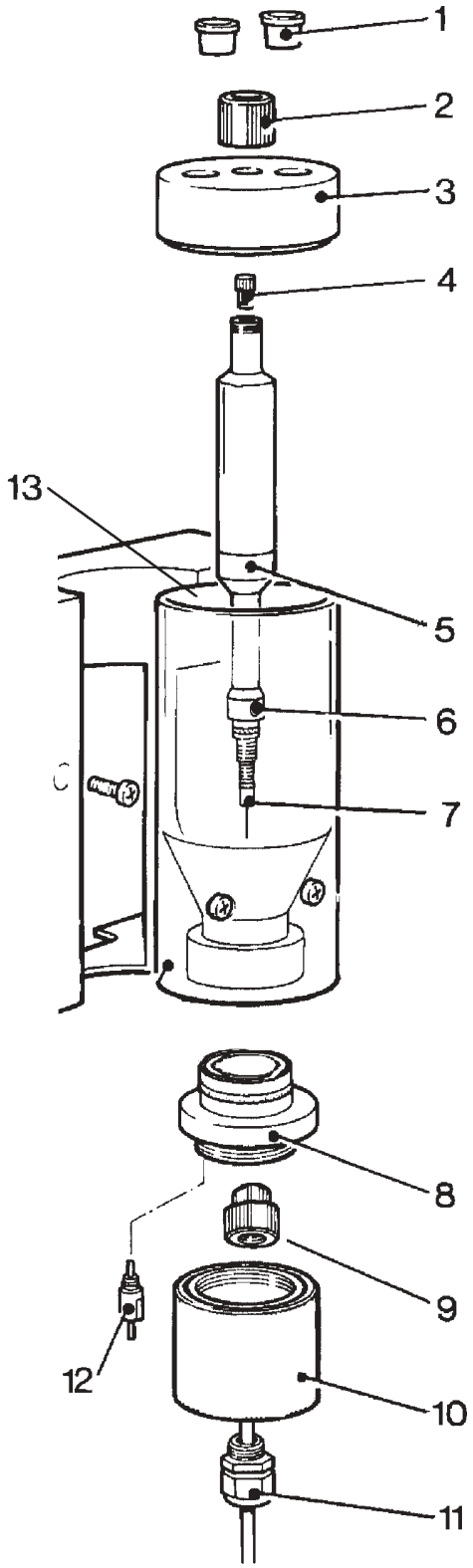
4.5 Fluoride Sensor Kit

See Instruction Sheet provided with probe.

SECTION 5 - ILLUSTRATIONS

List Of Contents

	DWG. NO.
Parts	
Bare Electrode Sensor Kit	50.560.000.010A&B
Bare Electrode Residual Analyzer	50.560.000.020A-E
Membrane Flow Block Assembly	50.560.000.030A&B



NOTE: FOR PARTS LIST, SEE DWG. 50.560.000.010B.

BARE ELECTRODE SENSOR KIT - PARTS

50.560.000.010A

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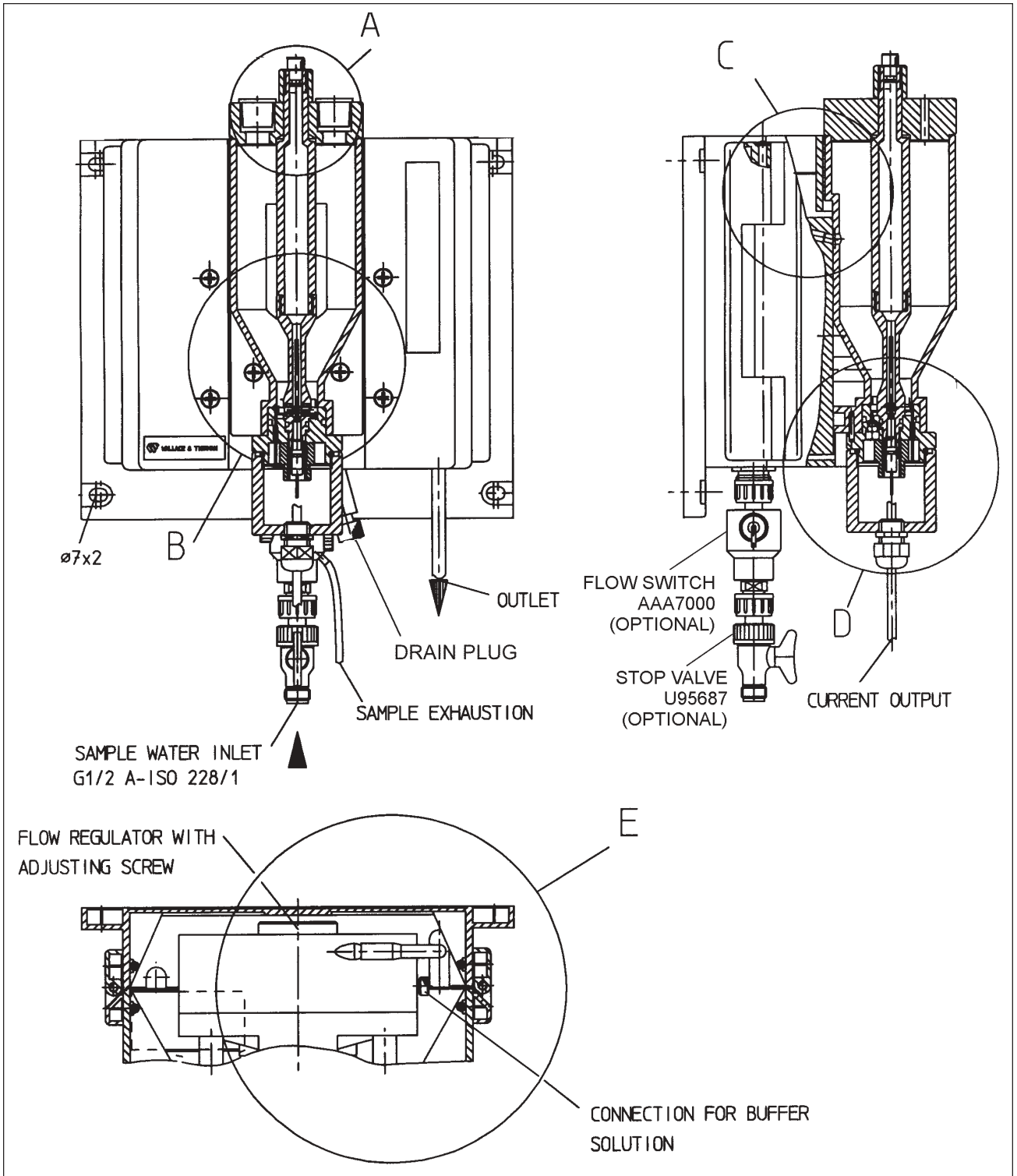
KEY NO.	PART NO.	QTY.	DESCRIPTION
1	P96487	2	CAP
2	P96191	1	NUT
3	P96714	1	COVER
4	UXB95664	1	PLUG
5	U86964	1	ELECTROLYTE RESERVOIR
6	U95641	2	MEMBRANE
7	U95626	1	REFERENCE ELECTRODE
8	U95827	1	ELECTRODE HOUSING (W/ WORKING & COUNTER ELECTRODE)
9	P96208	1	NUT
10	P96207	1	COVER
11	UXB95656	1	CABLE CONNECTOR
12	U95624	1	TEMPERATURE SENSOR
13	P96379	1	CELL BLOCK

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

BARE ELECTRODE SENSOR KIT - PARTS LIST

50.560.000.010B

ISSUE 1 1-03

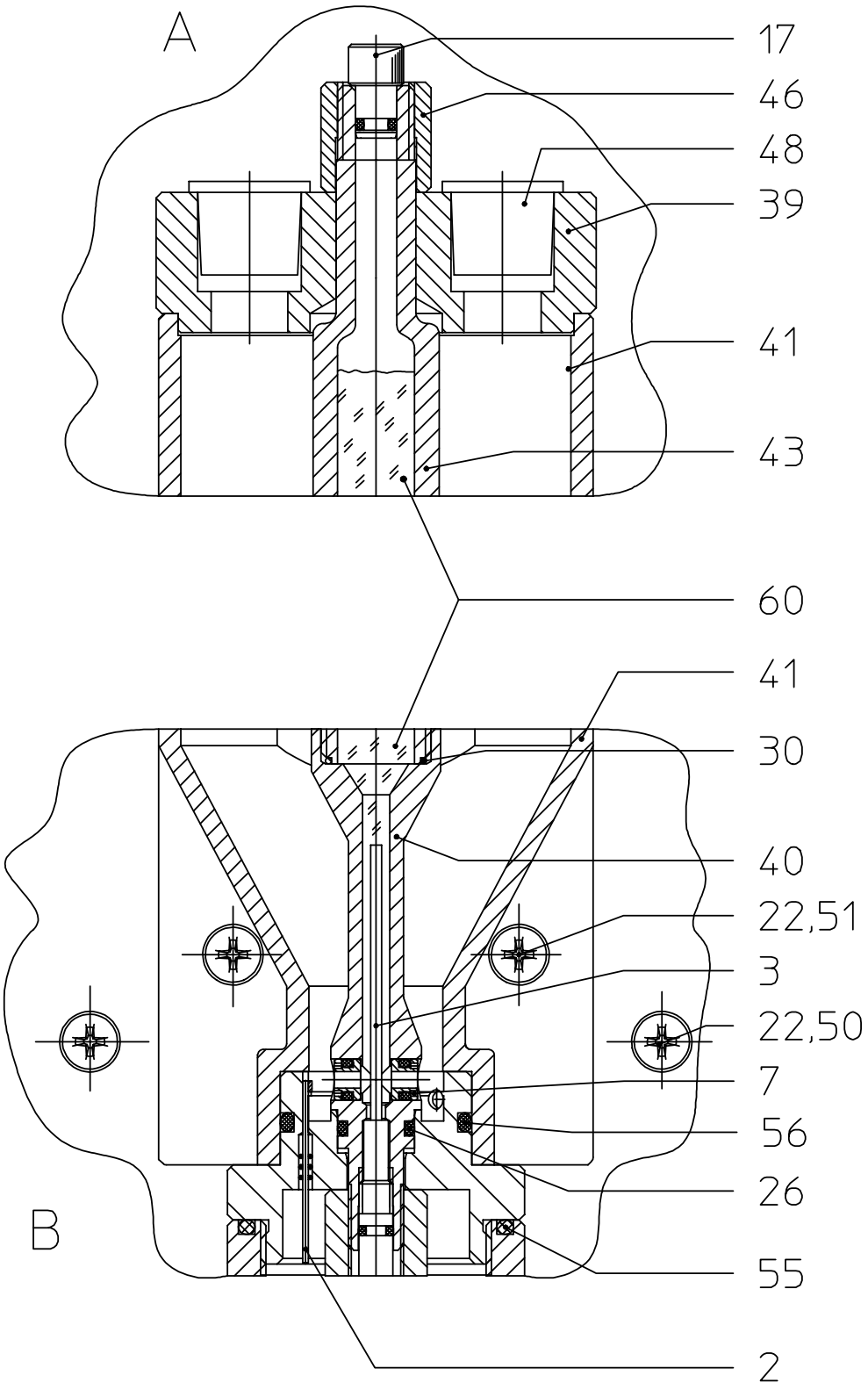


NOTE: FOR PARTS LIST, SEE DWG. 50.560.000.020E.

BARE ELECTRODE RESIDUAL ANALYZER - PARTS

50.560.000.020A

ISSUE 2 1-03

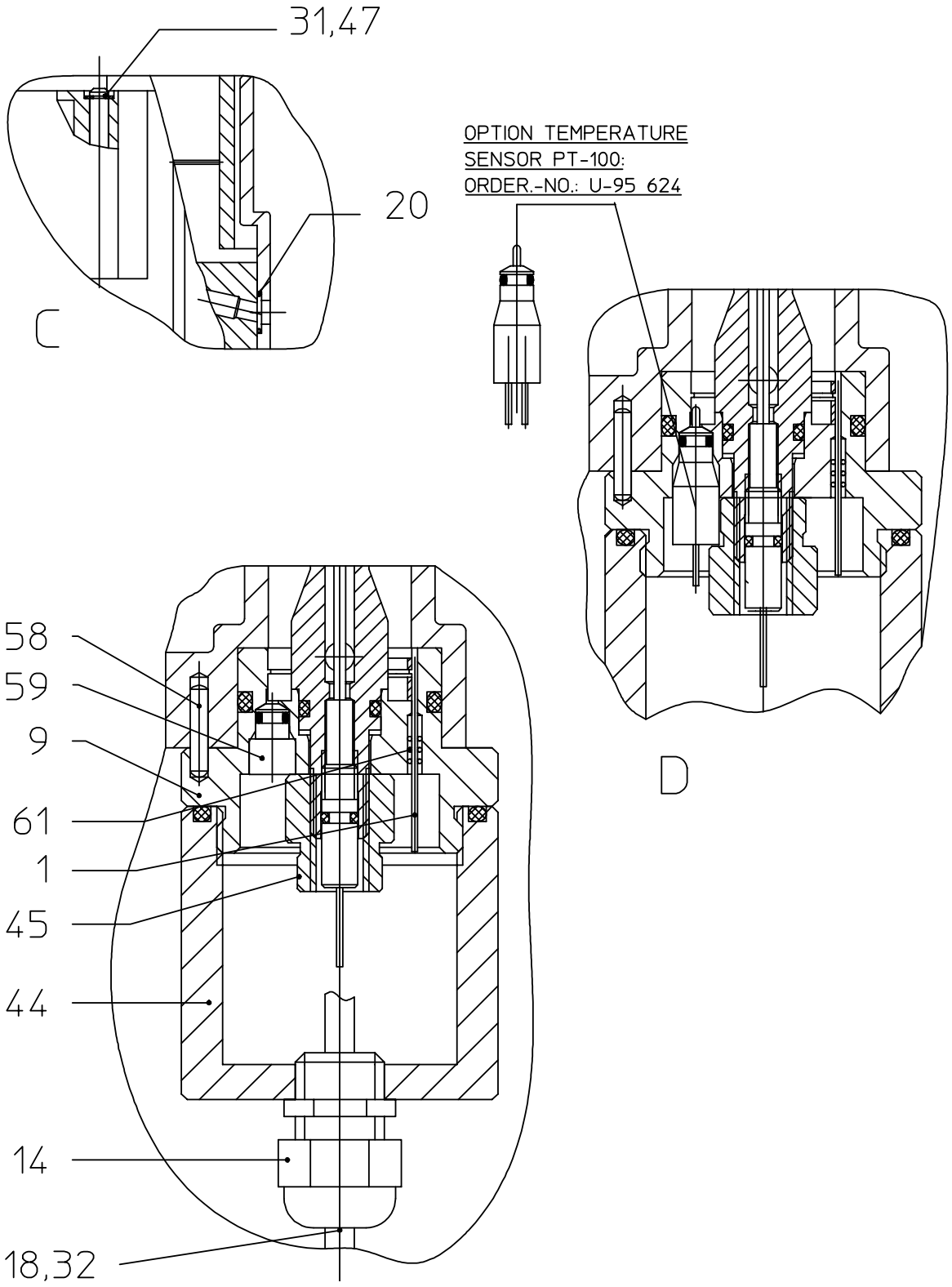


NOTE: FOR PARTS LIST, SEE DWG. 50.560.000.020E.

BARE ELECTRODE RESIDUAL ANALYZER - PARTS

50.560.000.020B

ISSUE 1 1-03



NOTE: FOR PARTS LIST, SEE DWG. 50.560.000.020E.

BARE ELECTRODE RESIDUAL ANALYZER - PARTS

50.560.000.020C

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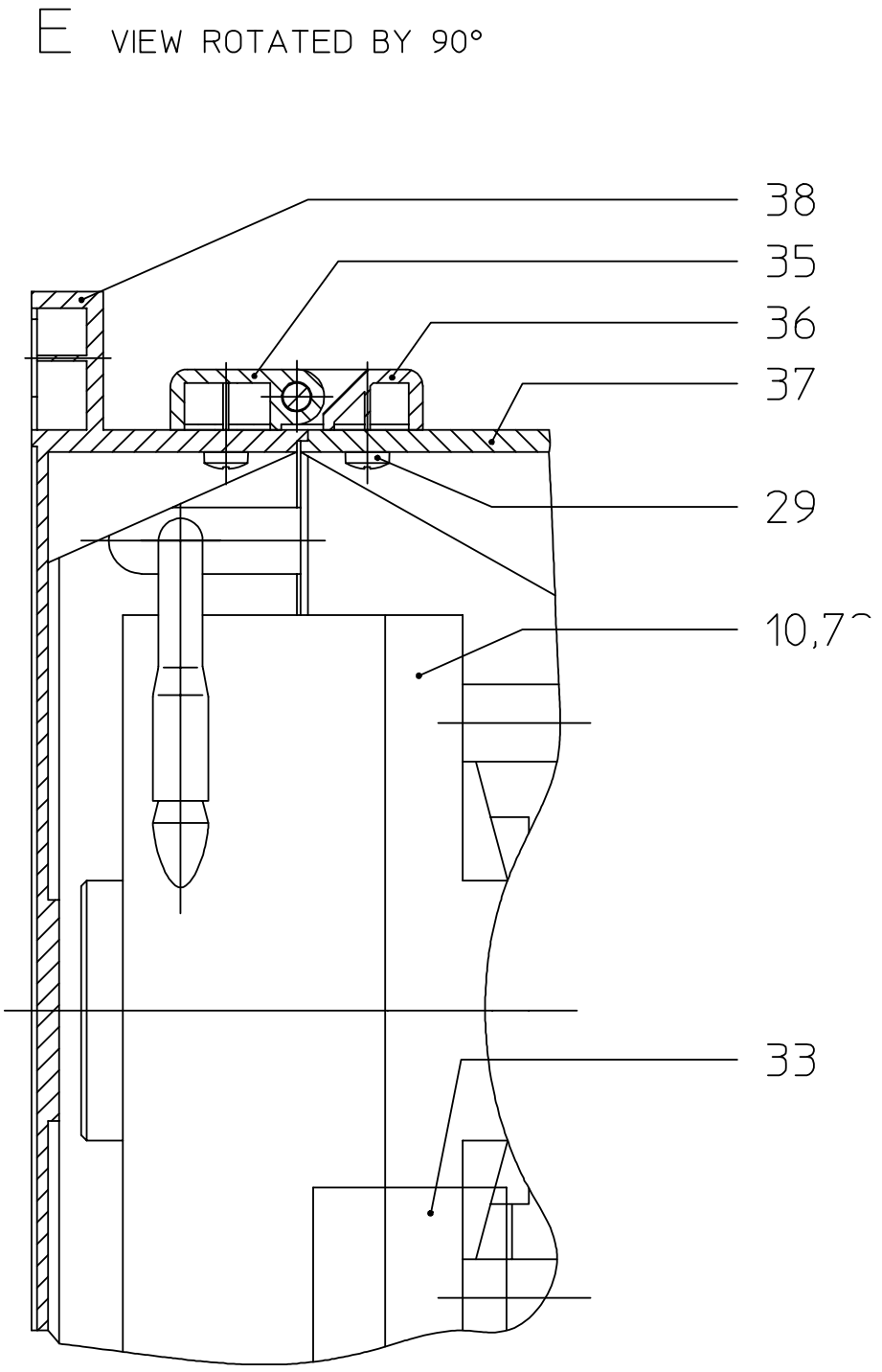


NOTE: FOR PARTS LIST, SEE DWG. 50.560.000.020E.

BARE ELECTRODE RESIDUAL ANALYZER - PARTS

50.560.000.020D

ISSUE 1 1-03

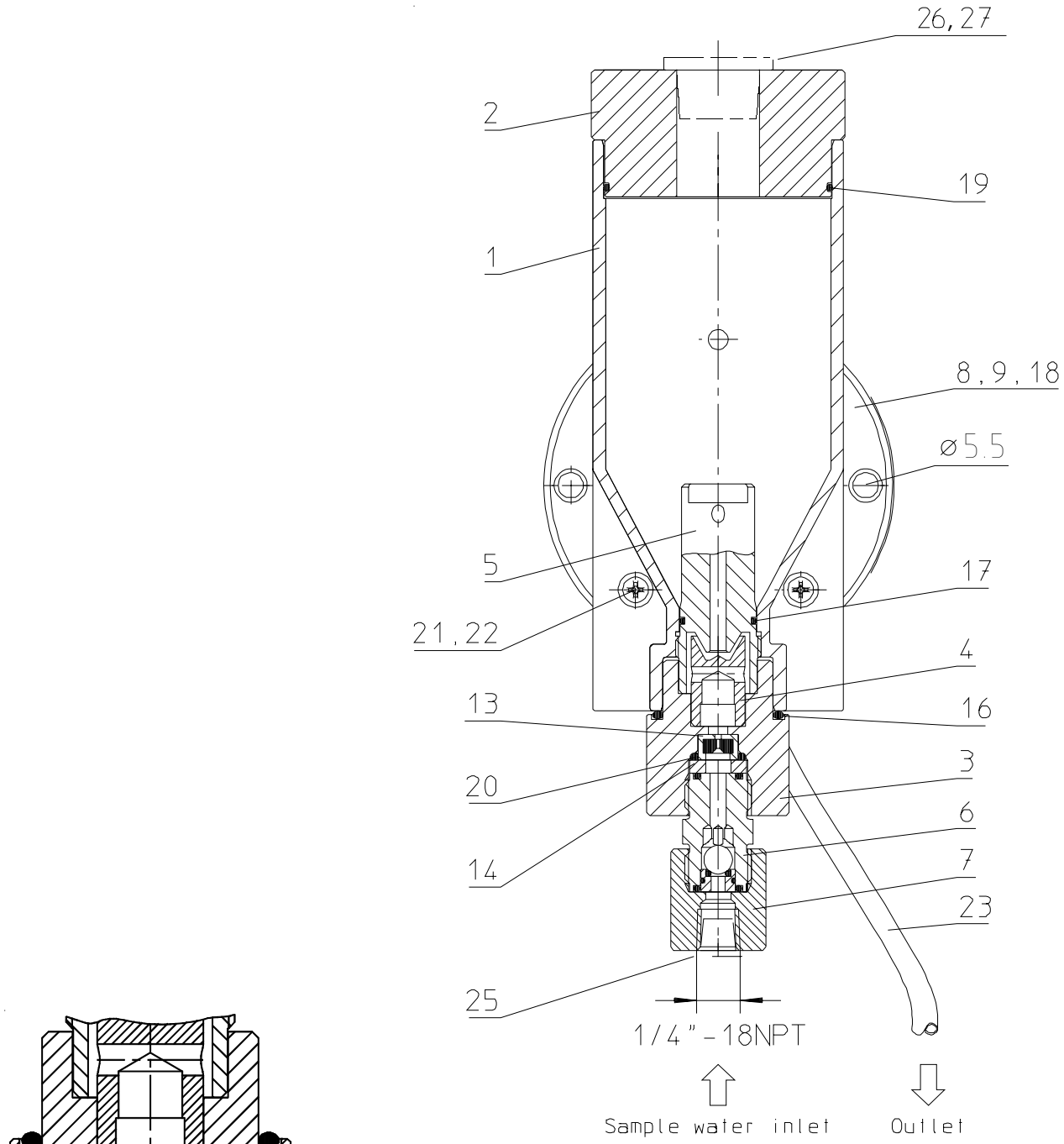
KEY NO.	PART NO.	QTY.	DESCRIPTION
▲ 1	UXB95818	1	ELECTRODE
▲ 2	U95614	1	ELECTRODE
3	U95626	1	ELECTRODE
7	U95641	2	DIAPHRAGM COMPLETE
▲ 9	U95832	1	ELECTRODES PICK UP
10	UXA95648	1	FLOW CONTROL VALVE
14	UXB95656	1	CABLE TERMINAL SCREW
17	UXB95664	1	PLUG UNIT
18	UXA95672	1	CELLULAR CABLE
20	P26234	2	O-RING
22	P92697	6	WASHER
26	P94337	1	O-RING
29	PXA96603	20	EJOT PT-SCREW
30	P96766	1	O-RING
31	PXF94841	2	WASHER
32	PXA95399	1	CABLE CLAMP
33	P95408	1	NAME PLATE
● 34	PXC96112	1	CAP
35	PXA96159	2	HINGE
36	PXB96159	2	HINGE
37	PXA96182	1	HOUSING UPPER PART
38	P96161	1	HOUSING LOWER PART
39	P96714	1	CELLULAR COVER
40	P96931	1	ELECTRODE CASE
41	P96379	1	CELL BLOCK
43	P96206	1	TANK
44	P96207	1	COVER
45	P96208	1	KNURLED NUT
46	P96191	1	NUT
47	P96214	2	CONNECTING PIECE
● 48	P96487	2	CAP
50	PXM96220	4	SCREW
51	PXK96220	2	SCREW
● 53	P96251	1	FELT WASHER
55	P100449	1	O-RING
▲ 56	P100470	1	O-RING
58	PXJ96265	1	CYLINDER PIN
▲ 59	UXA95625	1	PLUG
60	UXA95949	0,031	KCl ELECTROLYTE (PART OF KCl ELECTROLYTE SET)
▲ 61	P39224	6	O-RING

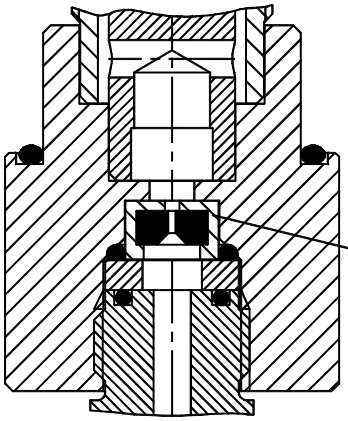
NOTE: ▲ INCLUDED IN ELECTRODE HOUSING.
● ONLY FOR TRANSPORT.

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

BARE ELECTRODE RESIDUAL ANALYZER - PARTS LIST

50.560.000.020E
ISSUE 1 1-03





13
"MARIC" FLOW-VALVE 0.5l/min
Note fitting position!

MEMBRANE FLOW BLOCK ASSEMBLY - PARTS

NOTE: FOR PARTS LIST, SEE DWG. 50.560.000.030B.

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KEY NO.	PART NO.	QTY.	DESCRIPTION
1	AAB2161	1	CELL BLOCK
2	AAB1414	1	CELL COVER
5	AAB2461	1	INLET BLOCK
6	UXA95505	1	CHECK VALVE
7	AAB1420	1	ADAPTOR
8	AAA6979	1	EXHAUSTION
9	AAA6877	1	UNION
13	UXC85386	1	FLOW VALVE
14	AAB2164	1	CLAMPING RING
16	P95961	1	O-RING
17	P97226	1	O-RING
18	P26234	1	O-RING
19	P97425	1	O-RING
20	PXA26345	1	O-RING
21	PXK96220	2	SCREW
22	P92697	2	PLAIN WASHER
23	RP9114451	0.3m	TUBE
25	P31459	1	PLUG
26	P34374	1	PLUG
27	P34854	1	PLUG

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

MEMBRANE FLOW BLOCK ASSEMBLY - PARTS LIST

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SECTION 6 - SPARE PARTS LIST

List Of Contents

PARA. NO.

Free Chlorine (Bare Electrode) Sensor Kit 6.1
Membrane Sensor Kit 6.2
pH Sensor Kit 6.3
Fluoride Sensor Kit 6.4
Electronics 6.5

6.1 Free Chlorine (Bare Electrode) Sensor Kit

DESCRIPTION	PART NO.
Spare part set for two years operation	UXA96819
Spare part set for five years operation	UXB96819
Individual spare parts:	
Electrode housing (with working and counter electrode)	U95827
Membrane (two required)	U95641
Electrolyte for reference electrode (0.11)	UXA95949
Grit (25 g)	U96820
PT100 Temperature Sensor	U95624

6.2 Membrane Sensor Kit

DESCRIPTION	PART NO.
Mem Sen Pack TCl (Total Chlorine) PM Kit (includes membrane cap, elastomer seal, O-ring, electrolyte, abrasive paper, instruction)	AAB1534
Mem Sen Pack FC1 (Free Chlorine) PM Kit	AAC5737
Mem Sen Pack OZ7 (Ozone) PM Kit	AAC5743
Mem Sen Pack CD7 (Chlorine Dioxide) PM Kit	AAC5740
2m Cable	AAC4681
5m Cable	AAC4687
10m Cable	AAC4690

15m Cable	AAC4693
25m Cable	AAC5812
50m Cable	AAC5815

6.3 pH Sensor Kit

DESCRIPTION	PART NO.
Complete pH Sensor Kit	AAB5386
pH sensor	U95690
cable for the pH sensor	U93838
Impedance transformer (optional)	U95607

6.4 Fluoride Sensor Kit

DESCRIPTION	PART NO.
Complete Fluoride Sensor Kit	AAB5389
Refillable Fluoride sensor	U95799
Gel Fluoride sensor	AAC5567
cable for the fluoride sensor	U93838
Impedance transformer	U95607
100 mg/l calibration solution	U22777
Fluoride filling solution	AAC5132
Fluoride/pH Cable - 1.5m	U93838
Fluoride/pH Cable - 5m	UXA93838
Fluoride/pH Cable - 10m	UXB93838
Fluoride/pH Cable - 15m	UXC93838

6.5 Electronics

DESCRIPTION	PART NO.
PCB Assembled - 115V Cl_2	AAB1501
PCB Assembled - 230V Cl_2	AAB1513
PCB Assembled - 115V Cl_2 + pH/Fluor	AAB1504
PCB Assembled - 230V Cl_2 + pH/Fluor	AAB1516
Fuse cover	P96994
160 mA fuse	UXF92568
315 mA fuse	UXJ92568
Metal slug	P97449
Front Membrane (keypad)	AAB1588