evoqua
WATER TECHNOLOGIES

WALLACE & TIERNAN® MULTI-FUNCTION-CONTROLLER MFC
from version V:2.00

INSTRUCTION MANUAL

Please note

Original manual!

Contents

1. Introduction

1.1 Documentation

1.1.1 Target Groups

This operating manual provides the information for installation, operating and maintenance personnel. It is required for operation and maintenance of the device.

The operating manual is provided for the operating personnel. It contains important information for safe and reliable, trouble-free and economical operation of the device. Observance of this information helps to prevent danger, lowers repair outlay, reduces down-times, and also increases the reliability and service life of the device.

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

2. General Safety Instructions

2.1 Intended Use

The MFC (Multi-Function-Controller) is exclusively designed for measurement and control purposes for the treatment of waste water, potable water and industrial water.

The MFC may only be used in buildings and under the operating conditions described in the technical data.

The device is not designed for any application other than that described in this manual – this is contrary to its intended use!

Compliance with the intended use of this device also includes reading this operating manual and observance of all instructions which it contains, particularly the safety instructions. Furthermore, all inspection and maintenance work must be performed at the prescribed intervals.

If the device is not employed in accordance with its intended use, safe and reliable operation cannot be guaranteed.

The operator is solely responsible for any personal injury or damage to property resulting from employment of the device which is contrary to its intended use! The operator is obliged to keep the device in proper working order.

2.2 Conventions

Note

The following descriptions and symbols are used in this operating manual to indicate hazards, mandatory instructions and notes:

Picto-gram	Note	Meaning
	*Danger!*	Immediate danger to life and limb! If the situation is not handled properly, death or serious injury may be the result.
	*Warning!*	Danger to life and limb! If the situation is not handled properly, death or serious injury may be the result.
	*Caution!*	If this warning is not observed, medium or slight injury or damage to the equipment may the result.
	*Warning!*	Electrical hazard. Switch the unit / system off with the emergency OFF / main switch...
	*Please note*	These notes facilitate work with the unit / system.

2.3 General Principles

General Principles

This device corresponds to the state of the art and recognised technical safety regulations!

This device contains inherent hazards for personnel and equipment! These hazards are related to live components or incorrect dosing of chemicals.

Always observe the safety instructions and hazard notes!

Only use this device in accordance with its intended purpose!

Faults which can negatively affect safety must be remedied immediately!

2.4 Notes for Operator and Operating Personnel

Notes for the operator

This operating manual and the technical documentation of the installed device components must always be available at the installation site!

Always observe any supplementary, generally valid legal regulations or other binding rules and ensure their compliance! These rules and regulations concern, for example:

- Work safety
- Accident prevention
- Environmental protection
- Hygiene
- First aid

All personnel charged with installation, commissioning, operation, maintenance and repair of the device must read and understand this operating manual, in particular the safety instructions!

Never attempt to perform any modifications, extensions or conversions on the device which could have an adverse affect on safety without the written approval of the manufacturer!

Only use spare parts which have been approved by the manufacturer. This is always guaranteed when original spare parts are purchased.

Always observe the intervals for regular maintenance or inspection work which are either prescribed or stated in the operating manual.

The system must not be used with flammable liquids or dangerous or toxic gases.

Notes for operating personnel

Always read the operating manual, in particular the safety instructions, before you operate the device for the first time!

Never employ any working methods which could endanger safety!

Always comply with the prescribed values for sample water admission pressure, connection voltage and ambient and operating conditions!

Never deactivate any safety features!

During operation of the device there is the risk of unexpected incorrect functions resulting from failure or errors of the control system.
In the event of such safety-relevant changes in the operating performance of the device, switch it off immediately and remedy the fault or have it remedied immediately!

When the device is switched off, external voltage may still be applied.

Always eliminate or have eliminated any leakage on the flow block assembly immediately!

In the event of a fire always switch the device off with the external main switch or the external main circuit breaker or fuse!

2.5 Guarantee Conditions

The following must be observed for compliance with guarantee conditions:

- Installation, commissioning by Evoqua technicians or trained and authorised specialised personnel, e.g. of contracted companies
- Intended Use
- The operation parameters and settings must be met.
- The system may only be operated by trained personnel.
- A works journal must be kept.
- Use of approved calibration solutions
- The system should always be protected against frost.
- Execution of maintenance work by operating personnel
- Use of original spare parts

If any of the above conditions are not met, the guarantee is revoked.

2.6 Personnel Selection and Qualification

Only authorised personnel may operate or perform any work on the device!

Only employ reliable, trained and instructed personnel!

Always clearly define competence of personnel for installation, operation, maintenance and repair!

Assign responsibility. The operating personnel must be able to refuse to act upon instructions of third parties which are contrary to the safety regulations!

2.7 Specific Operating Phases

Normal operation

Never employ any working methods which could affect safety!

Only run the device when the housing is closed!

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

In the event of malfunctions, always switch the device off immediately! Have malfunctions remedied immediately!

Installation and maintenance work

Always perform installation or maintenance work in accordance with this operating manual or the technical documentation for installed device components!

Secure the device against activation during installation and maintenance work!

Always retighten released screw connections!

Never use corrosive cleaning agents!
For cleaning only use a damp cloth.

Ensure safe disposal of agents and replaced parts in accordance with environmental regulations!

2.8 Notes on Special Dangers

Electrical power

Only use original fuses with the prescribed current rating! In the event of a fault in the electrical power supply, switch the device off immediately!

Only qualified electricians or trained personnel supervised by a qualified electrician are permitted to perform any work on electrical components in accordance with valid electrotechnical regulations.

If stipulated, disconnect all parts of the device from the power supply before performing any inspection, maintenance or repair work. Then first test the disconnected components to ensure they do not carry any voltage.

Inspect/check the electrical system of the device regularly. Remedy any faults immediately!

Connect disconnected cables in accordance with the wiring diagram!

Agents and chemical substances

When handling agents and chemical substances always observe the safety regulations valid for each product!

Always remove leaked agents immediately with a suitable binder or wipe up with a cloth. Danger of slipping!

Always collect and dispose of agents or used cleaning material separately and in accordance with valid national regulations!

3. Description

3.1 Technical Data

3.1.1 MFC electronic module

Housing

Dimensions (W x H x D): 320 x 270 x 175 mm

Weight: approx. 5 kg

Protection category: IP 66

Electronics

Mains connection

- 200–240 V AC ± 10 %, 50–60 Hz, 30 VA, Fuse 1A (T) Type: TR5
- 100–120 V AC ± 10 %, 50–60 Hz, 30 VA, Fuse 1A (T) Type: TR5
- 24 V DC ± 20 %, 30 W, Fuse 2.5 A (T) Type: TR5

Insulation

- Overvoltage category 2
- Contamination level 2

Operating conditions

- Ambient temperature 0–50 °C
- Humidity < 80 %, non-condensing
- Environment No direct sunlight
- Atmospheric pressure 75–106 kPa
- max. altitude 2000 m
- Storage temperature -20 to +70 °C
- Noise emission <45 dB

Digital inputs

3 x for floating contact (< 100 Ohm)
Power supply though MFC

- D1: Sample water monitoring (freely selectable)
- D2: Freely selectable in menu
- D3: Freely selectable in menu

Measurement inputs

1x Temperature input PT 1000 (0–50 °C) with sensor error display (pre-calibrated)

1x Feedback input
Positioner position feedback
Potentiometer 1 kOhm or 5 kOhm

5x Measured value input (electrically isolated up to 50 V to ground) for sensor measuring module plug-in cards

- 3 electrode cells for chlorine, chlorine dioxide or potassium permanganate
- Membrane sensors for total chlorine (TC1), free chlorine (FC1), chlorine dioxide (CD7, ozone (OZ7)
- pH value
- Redox potential
- Fluoride
- Conductivity
- mA/V input

Interfaces

1x RS232 for direct printer control or firmware update (not electrically isolated)

1x RS485 for connection to:

- ChemWeb server
- OPC Server Data Access V2.0
- CMS Software 3.0
- SECO-S7

The RS485 interface is electrically isolated up to 50 V to ground

1x IRDA for remote calibration with the photometer P42 *i-cal* (isolated)

Display and operating unit

1x Operating panel with 9 keys

8x Red LEDs for indication of operating conditions

1x Green LED for indication of the power supply

1x Graphic display

- Resolution 240 x 64 pixels
- Green background illumination

Relay plug-in card

8x Relay outputs (two-way switch)

- Switching values
  5 A, 250 V AC, 1250 VA max
  5 A, 220 V DC, 150 W max
- UL/CSA-rating
  5 A, 1/6 HP 125, 250 V AC
  5 A, 30 V DC, 30 W max
  1 A, 30 V DC – 0.24 A, 125 V DC

Storage temperature:	-20 to +70 °C

Analog outputs plug-in card

4x Outputs (freely configurable)

- Output 0/4–20 mA
- Accuracy < 0.5 % FS
- Load max. can be switched over 1000 Ohm / 400 Ohm
- Temperature drift max. 0.2 % / 10 °C
- Load monitoring
- Electrically isolated up to 50 V to ground

Storage temperature:	-20 to +70 °C
Calibration:	pre-calibrated

Please note

All sensor measuring modules are electrically isolated to 50 V to ground.

DES measuring module 3 electrode cell

Sensor:	3 electrode cell
Principle of operation:	Potentiostatic amperometry
Temperature drift	max. 0.2 % / 10 K
Linearity error:	< 0.1 %
Calibration:	pre-calibrated
Upot cell voltage:	0 to +1000 mV
Upot accuracy:	± 20 mV
Upot temperature drift	0.5 % / 10 K
Cell current:	-7 to 1000 µA

DES module Membrane sensors	Sensor:	3 electrode sensor membrane-covered
	Principle of operation:	Potentiostatic amperometry
	Temperature drift	max. 0.2 % / 10 K
	Linearity error:	< 0.1 %
	Calibration:	pre-calibrated
	Input signal (plug-in card):	-7 to 1000 µA cell current
pH measuring module for pH value	Sensor input:	pH single-rod electrode
	Temperature drift	max. 0.2 % / 10 K
	Linearity error:	< 0.1 %
	Calibration:	pre-calibrated
	Input signal	-1000 to +1000 mV
	Input impedance:	10^{13} Ohm
mV measuring module for Redox	Sensor input:	Redox single-rod electrode
	Temperature drift	max. 0.2 % / 10 K
	Linearity error:	< 0,1 %
	Calibration:	pre-calibrated
	Input signal	-1000 to +1000 mV
	Input impedance:	10^{13} Ohm
mS measuring module for conductivity	Sensor input:	LF325
	Temperature measuring range:	0 to +50 °C
	Temperature drift:	< 0.2 %
	Calibration:	pre-calibrated
	Linearity error:	< 0.5 %
	Measuring ranges:	2500 µS/cm, 10, 20, 50, 100, 200 mS/cm

mA/V measuring module for analog input	Sensor input:	mA signal or V signal
	Temperature drift:	max. 0.2 % / 10 K
	Linearity error:	< 0.1 %
	Calibration:	pre-calibrated
	Measuring ranges:	0/4–20 mA (scalable) or 0–10 V (scalable)
F⁻ measuring module for fluoride	Sensor input:	Fluoride single-rod electrode
	Calibration:	pre-calibrated
	Measuring ranges:	0.2 to 2.0 mg/l 0.5 to 5.0 mg/l 2.0 to 20.0 mg/l
	Temperature drift:	max. 0.2 % / 10 k
	Linearity error:	< 0.1 %

3.1.2 Flow block assembly DEPOLOX® 5

Housing	Dimensions (W x H x D):	215 x 375 x 155 mm
	Weight:	approx. 1.5 kg
Multi sensor	Switching point:	21 l/h ± 3 l/h
	Switching hysteresis:	2 l/h
	Temperature sensor:	Pt 1000
Measured variables	Free chlorine, chlorine dioxide, ozone, potassium permanganate	
Typical output signal	approx. 20 µA/mg/l free chlorine	
Measuring system	Potentiostatic 3 electrode system	
Max. measuring ranges	0 to 50 mg/l	
Reference electrode	Silver/Silver chloride/Potassium chloride solution	
Working electrode	PCBs	
Other materials	PVC, PMMA, ABS, ECTFE, PTFE, stainless steel, EPDM, FKM, NBR	
Cable length	650 mm	
Electrolyte	Potassium chloride solution, 3 mol	

Chemical analysis	Photometric measuring process	
Zero point calibration	By stopping flow rate or dechlorinated sample water typ. zero current approx. 1 µA	
Response time T_{90}:	< 20 sec.	
Influence of the pH value	HOCl curve	
Temperature compensation	0–50 °C	
Storage temperature	-10 °C to +50 °C (without electrolyte)	
Volumetric flow control	Flow rate:	approx. 33 l/h (controlled)
	Control range:	0.2 to 4.0 bar
	Back-pressure:	- non-pressurised version (open drain) - pressurised version 1.5 bar
Water quality	swimming pool, potable, industrial and process water	
Sample water	Sample water temperature:	max +50 °C
Conductivity	min. 200 µS/cm	
Service life	Life of the electrolytes in operation approx. 6 months Electrode service life in operation approx. 5 years (reduced by poor water quality, e.g. sand, filth)	
Connections	Sample water:	PVC hose 6 x 3 mm or PE-hose 6 x 1 mm
	Thread connection:	G1/2" or NPT-1/4“

3.1.3 Flow block assembly VariaSens

Housing	Dimensions (W x H x D):	215 x 375 x 155 mm
	Weight:	approx. 1.5 kg
Connections	Sample water:	PVC hose 6 x 3 mm or PE hose 6 x 1 mm
	Thread connection:	G1/2" or NPT-1/4“
Flow control valve	Flow rate:	approx. 33 l/h (controlled)
	Control range:	0.2 to 4.0 bar
	Back-pressure:	- non-pressurised version (open drain) - pressurised version 1.5 bar
Sample water temperature	max. +50 °C	
Multi sensor	Switching point:	21 l/h ± 3 l/h
	Switching hysteresis:	2 l/h
	Temperature sensor:	Pt 1000

3.1.4 Y flow-through adapter

Y flow-through adapter pH/mV	Back-pressure:	non-pressurised/pressurised Version (max. 6 bar)
	Sample water temperature:	max +50 °C
Y flow-through adapter fluoride	Back-pressure:	non-pressurised version
	Sample water temperature:	max +50 °C
Y flow-through adapter conductivity	Back-pressure	pressurised version up to 6 bar
	Sample water temperature:	max +50 °C

3.1.5 Electrodes and sensors

pH electrode	Max. measuring range:	pH 0–12
	Operating temperature range:	-5 to +80 °C
	Storage temperature range:	-5 to +30 °C
	Sample water conductivity:	200 µS/cm – 200 mS/cm
	Max. operating pressure:	6 bar
Redox electrode	Max. measuring range:	-1000 to +1000 mV
	Operating temperature range:	-10 to +80 °C
	Storage temperature range:	-5 to +30 °C
	Sample water conductivity:	200 µS/cm – 200 mS/cm
	Max. operating pressure:	6 bar
Fluoride electrode	Max. measuring range:	0.2 to 20 mg/l
	Operating temperature range:	0 to +80 °C
	Storage temperature range:	-5 to +30 °C
	Sample water conductivity:	200 µS/cm – 200 mS/cm
	Max. operating pressure:	non-pressurised
Conductivity electrode	Measuring system:	4 electrode system LF325
	Principle of operation:	4 conductor measurement
	Operating temperature range:	-5 to +100 °C
	Storage temperature range:	-5 to +50 °C
	Cell constant:	0.48 cm^{-1} ± 1.5 %
	Max. operating pressure:	10 bar
	Measuring ranges:	0.100 mS/cm to 200 mS/cm

Membrane sensor for free chlorine FC1

Measured variables:	Free chlorine
Power supply:	unipolar +12 to 15 VDC, 11 mA
Typical output signal:	approx. 10 µA pro 1 mg/l (ppm) Cl_2
Measuring system:	Membrane-covered potentio-static 3 electrode system
Reference electrode:	Silver/Silver halide/Potassium halide solution
Working electrode:	Gold
Counter electrode:	Stainless steel
Other materials:	PVC, silicone rubber
External dimensions:	Ø 25 mm (1“), length 175 mm (6.9“)
Connector cable combination	1.2 m cable length
Measuring ranges:	0.05 to 20 mg/l (ppm) chlorine
Electrolyte:	diluted potassium halide Solution, 100 ml bottle, at 15 °C – 25 °C, store in a dark place, useable up to 1 year, as long as it is still uniformly clear
Zero point calibration:	unnecessary (zero point signal at 0 mg/l chlorine = 0 µA)
Response time T_{90}:	< 5 min
Influence of the pH value	pH 4 to pH 8: -2.5% pro pH pH 8 to pH 9: -10% pro pH pH 9 to pH10: -20% pro pH
Temperature compensation:	internal +5 to +45°C
Storage temperature:	-10 °C to +45 °C (without electrolyte)
Operating pressure:	0.5 bar (only with suitable adapter)

Water quality:	Clean water, potable water quality (limestone deposits may block the membranes)
Conductivity:	>10 µS/cm to max 2500 µS/cm
Flow:	6–35 l/h, as constant as possible
Service life:	Life of the electrolytes in operation approx. 6 months, Membrane cap service life typically 1 year (reduced by poor water quality, e.g. sand, filth)

Membrane sensor for chlorine dioxide CD7

Measured variables:	Chlorine dioxide
Power supply:	unipolar +12 to 15 V DC, 11 mA
Typical output signal:	approx. 10 µA pro 1 mg/l (ppm) ClO_2
Measuring system:	membrane-covered 2 electrode system
Reference electrode:	Silver/Silver halide/Potassium halide solution
Working electrode:	Gold
Other materials:	PVC, silicone rubber, stainless steel
External dimensions:	Ø 25 mm (1“), length 175 mm (6,9“)
Connector cable combination	1.2 m cable length
Electrolyte:	diluted potassium halide Solution, 100 ml bottle, at 15 °C – 25 °C, store in a dark place, useable up to 1 year, as long as it is still uniformly clear
Measuring ranges:	0.05 to 20 mg/l (ppm) ClO_2
Zero point calibration:	unnecessary (zero point signal at 0 mg/l ClO_2 = 0 µA)
Response time T_{90}:	< 20 sec.
Influence of the pH value	No signal influence until ClO_2 stability limit
Temperature compensation:	Internal temperature compensation +5 to +45°C
Storage temperature:	-10 °C to +45 °C (without electrolyte)
Max. pressure:	1.5 bar (only with suitable adapter)

Water quality:	All types of water, swimming pool, potable, industrial- and processing water (limestone deposits may block the membranes)
Conductivity:	> 1 µS/cm up to max. 40 mS/cm
Flow:	6–35 l/h, as constant as possible
Service life:	Life of the electrolytes in operation approx. 6 months, Membrane cap service life typically 1 year (reduced by poor water quality, e.g. sand, filth)
Cross-sensitivity:	ozone, peracetic acid
Selectivity:	compared to chlorine, bromine, hydrogen peroxide

Membrane sensor for ozone OZ7	Measured variable:	ozone, selective compared to Cl_2, Br_2, H_2O_2, cross-sensitivity compared to ClO_2, peracetic acid
	Power supply:	unipolar +12 to 15 VDC, 11 mA
	Typical output signal:	approx. 10 µA pro 1 mg/l (ppm) O_3
	Measuring system:	membrane-covered 2 electrode system
	Reference electrode:	Silver/Silver halide/Potassium halide solution
	Working electrode:	Gold
	Other materials:	PVC, silicone rubber, stainless steel
	External dimensions:	Ø 25 mm (1“), length 175 mm (6,9“)
	Connector cable combination	1.2 m cable length
	Electrolyte:	diluted potassium halide Solution, 100 ml bottle, at 15 °C – 25 °C, store in a dark place, useable up to 1 year, as long as it is still uniformly clear
	Measuring ranges:	0.02 to 10 mg/l (ppm) O_3
	Zero point calibration:	unnecessary (zero point signal at 0 mg/l O_3 = 0 µA)
	Response time T_{90}:	< 50 sec.
	Influence of the pH value	No signal influence until O_3 stability limit
	Temperature compensation:	Internal temperature compensation +5 to + 45°C
	Storage temperature:	-10 °C to +45 °C (without electrolyte)
	Max. pressure:	1.5 bar (only with suitable adapter)

Water quality:	All types of water, swimming pool, potable, industrial- and processing water (incl. tenside-laden) (limestone deposits may block the membranes)
Conductivity:	> 1 µS/cm up to max. 40 mS/cm
Flow:	6–35 l/h, as constant as possible
Service life:	Life of the electrolytes in operation approx. 6 months, Membrane cap service life typically 1 year (reduced by poor water quality, e.g. sand, filth)
Cross-sensitivity:	Chlorine dioxide, peracetic acid

Total chlorine measuring cell TC1	Measured variables:	Total chlorine
	Power supply:	unipolar +12 to 15 V DC, 1 mA
	Typical output signal:	10 µA pro 1 mg/l (ppm) Cl_2
	Measuring system:	Membrane-covered potentio-static 3 electrode system
	Reference electrode:	Silver/Silver iodide/Potassium iodide solution
	Working electrode:	Gold
	Counter electrode:	Stainless steel
	Other materials:	PVC, silicone rubber
	External dimensions:	Ø 25 mm (1“), length 175 mm (6,9“)
	Connector cable combination	1.2 m cable length
	Electrolyte:	diluted potassium iodide solution, 100 ml bottle, at 15 °C – 25 °C, store in a dark place, useable up to 1 year, as long as it is still uniformly clear
	Measuring ranges:	0.05 to 20 mg/l (ppm) chlorine or Chloramines
	Zero point calibration:	unnecessary (zero point signal at 0 mg/l chlorine = 0 µA
	Response time T_{90}:	< 5 min
	Influence of the pH value	Linear signal deviation of approx. 20 % signal in the range of pH 6 to pH 10 (equals - 5 % per pH unit)
	Temperature compensation:	Internal temperature comp-ensation +5 to +45 °C
	Storage temperature:	-10 °C to +45 °C (without electrolyte)
	Max. pressure:	0.5 bar (only with suitable adapter)

Water quality:	Clean water, potable water quality (limestone deposits may block the membranes) a membrane sensor for total chlorine TC1-S is available for brine
Conductivity:	with standard electrolyte W3T171793 <2500 µS/cm with brine electrolyte W3T164805 2,5 à 60 mS/cm
Flow:	6–35 l/h, as constant as possible
Service life:	Life of the electrolytes in operation approx. 6 months, service life of membrane cap typically 1 year (reduced by poor water quality, e.g. sand, filth)
Cross-sensitivity:	Ozone, bromine, chlorine dioxide, hydrogen peroxide

3.2 Scope of supply

Please note

The order numbers for the complete units are found in 8. “Complete Devices, Retrofit Kits and Spare Parts" on page 215.

3.2.1 Standard

The scope of supply includes the following, depending on the individual order:

- MFC electronic module
- Flow block assembly
- Mounting set, comprising:
  8 screws (5 mm diameter)
  8 dowels (8 mm diameter)
  8 washers
- Mounting rail
- Strips for LED marking (Application 1 – 5)
- Accessory set, comprising:
  2 cable unions with hexagon nut
  1 multiple fixings for cable union
  1 reducing wire coil
  2 cable bushes (2.8 mm diameter)
  2 cable bushes (4.2 mm diameter)
  2 spare safety fuses
- Sensor measuring module, including accessories (depending on version)
- Operating manual
- Concise instructions
- Retrofitting manual

3.2.2 Options

Please note

The order numbers for the flow block assembly are found in 8. “Complete Devices, Retrofit Kits and Spare Parts" on page 215.

Flow block assembly:

- DEPOLOX® 5 (non-pressurised or pressurised version)
- VariaSens (non-pressurised or pressurised version)
- Y flow-through adapters (non-pressurised or pressurised version)

Please note

The order numbers for the sensor measuring modules are found in 8. “Complete Devices, Retrofit Kits and Spare Parts" on page 215.

The sensor measuring modules can be individually retrofitted (see 8. “Complete Devices, Retrofit Kits and Spare Parts" on page 215).

Sensor measuring module including accessories:

- pH
- Redox
- Conductivity
- Fluoride

Sensor measuring module for membrane sensors including accessories:

- Free chlorine (FC1)
- Chlorine dioxide selective (CD7)
- Ozone selective (OZ7)
- Total chlorine (TC1)

Sensor measuring module retrofit kit including accessories:

- 3 electrode cell DEPOLOX® 5
- 3 electrode cell DEPOLOX®4 including PT100
- mA/V input card
- 4 mA outputs
- Relay module (8 two-way switches)
- Infrared interface

3.3 Description

3.3.1 Versions

MFC (Multi Function Controller)

The MFC is available in three voltage variations:

- 200–240 V AC
- 100–120 V AC
- 24 V DC

Using a variety of sensor measuring modules, the MFC can record and control various measured variables.

Please note

Each unit is assembled according to customer specifications.

Flow block assembly (DEPOLOX® 5 - VariaSens)

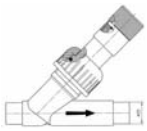
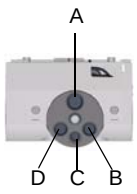
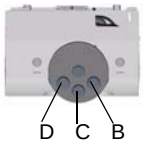
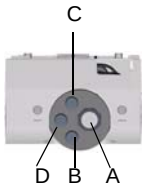
The flow block assembly is available in different versions:

- DEPOLOX® 5 non-pressurised version
  (Sample water drains freely)
- DEPOLOX® 5 pressurised version
  (Sample water is recycled through the system cycle)
- VariaSens - non-pressurised version see “Overview" on page 32
- VariaSens - pressurised version see “Overview" on page 32
- Various Y flow-through adapters

Please note

The selection is customised according to the type measured values to be recorded.

Overview Possible sensor configurations

		Non-pressurised version DEPOLOX® 5	Pressurised version DEPOLOX®5	Non-pressurised version VariaSens	Pressurised version VariaSens	Y flow-through adapter
						Example: 
						[1]W3T171332 [2]W3T159950 [3]W3T158503 [4]W3T163663
		A Membrane sensor for free chlorine (FC1), total chlorine (TC1), total chlorine (TC1-S), chlorine dioxide (CD7), ozone (OZ7) *B Redox* *C Fluoride or conductivity* *D pH*				
Free chlorine, ClO_2, $KMnO_4$, O_3	3 electrode measuring cell	X	X	--		--
Membrane sensor FC1, TC1, CD7 or OZ7	Membrane-covered electrode	1 x	--	2 x	1 x (only OZ7 or CD7)	--
pH	pH 0 to 12	X	X	X	X	X [1) 2)]
Redox value	- 1000 to +1000 mV	X	X	X	X	X [1) 2)]
Fluoride	0.20 to 20.00	X	--	X	--	X [4)]
Conductivity	0.1 to 200 mS/cm	X	X	X	X	X [3)]
"Multi sensor"	Temperature (PT1000) 0 to 50 °C	X	X	X	X	--
	Flow rate monitor (reed-switch)	X	X	X	X	--
	Earthing	X	X	X	X	--

		Non-pressurised version DEPOLOX® 5	Pressurised version DEPOLOX®5	Non-pressurised version VariaSens	Pressurised version VariaSens	Y flow-through adapter
Ball valve Sample water (inlet)	G 1/2“ connection	X	X	X	X	--
Ball valve Sample water (outlet)	G 1/2“ connection	--	X	--	X	--
Preliminary filter	Recommended when using membrane-covered electrodes	X	--	X	X	--
Check valve	Glass ball	X	X	X	X	--
Flow control valve	Free drain	X	--	X	--	--
Factory setting: 33 l/h Admission pressure: 0.2 to 4.0 bar	Max. back-pressure: 1.5 bar	--	X	--	X	--
Drain/extract specimen		X	X	X	X	X [4)]
Calibration support	Calibration aid	X	X	X	X	--

3.3.2 Structure

Overall design

The MFC unit is modularly designed and can be equipped with up to four different or identical sensor measuring modules. This component arrangement determines the version and number of flow block assemblies. It is also possible
to install several different versions of flow block assemblies.

A Flow block assembly DEPOLOX® 5
B Sensors
C MFC electronic module

MFC electronic module

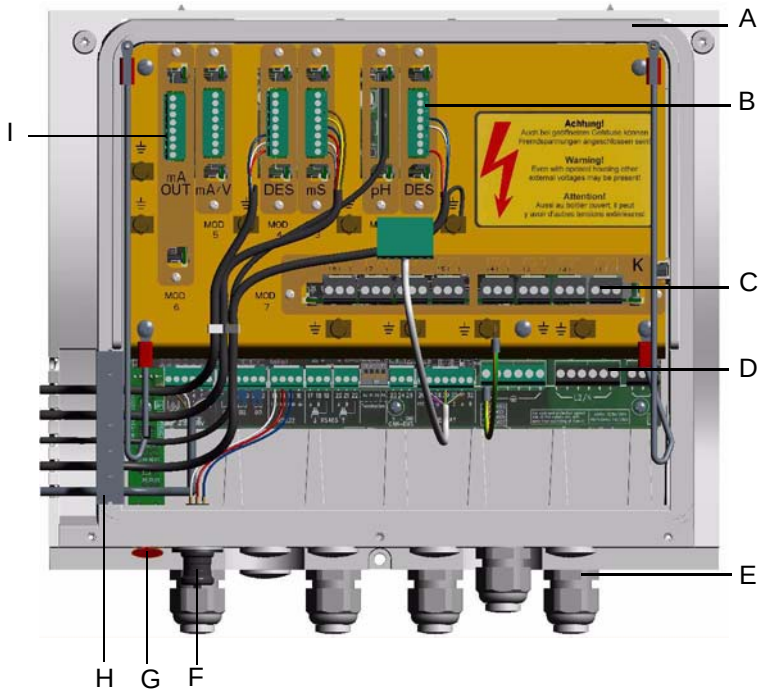
The MFC electronic module consists of a plastic housing (A) with a removable cover.

The housing contains:

- Motherboard with power unit and five slots (B) for the cards of the sensor measuring modules and retrofit kits
- Relay card (C)
- Plug-in card with analog outputs (I)
- Terminal strip (D)
- Housing ducts for the cables of the sensor measuring modules (H)

The following are incorporated into the base of the housing:

- Infrared interface (optional) (G)
- RS232 interface (F)
- Cable terminal screws (E)



A Plastic housing
B Slots
C Relay card
D Terminal strip
E Cable union
F RS232 interface
G Infrared interface
H Sensor measuring module housing duct
I Analog outputs

The following are integrated into the cover (A):

- Graphic display (E)
- Operating elements (D)
- A green LED (B) to indicate the power supply
- Eight red LEDs (C) to indicate the operating conditions

A Cover
B Green LED (Power)
C Red LED (operating and control indicator)
D Operator controls (keys)
E Graphic display

Flow block assembly DEPOLOX® 5 / VariaSens - non-pressurised or pressurised version -

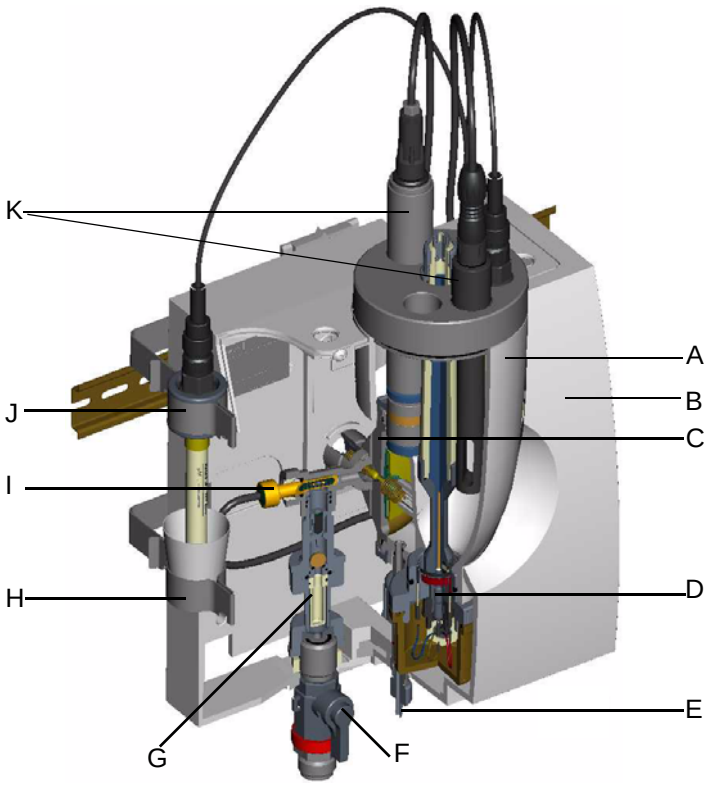
The flow block assembly DEPOLOX® 5/VariaSens consists of a plastic housing (B) with a removable cover.

The Flow block assembly contains the following:

- Cell body with cover (A)
- Flow control valve (C)
- Multi sensor (I)
- Drain (E)
- Fine filter (G) (only when membrane sensors are used)
- The sample water inlet with check valve and ball valve (F)

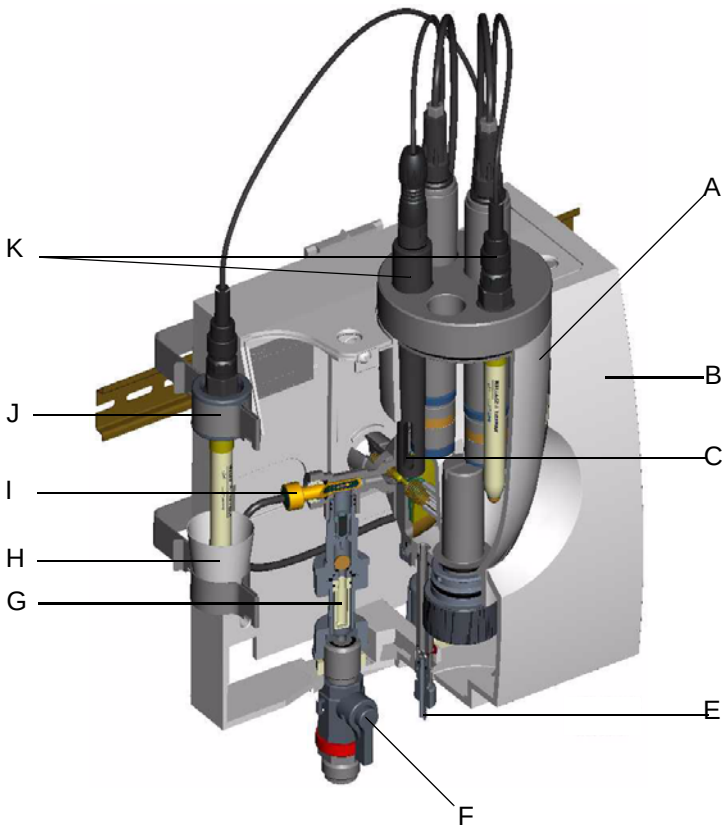
The DEPOLOX® 5 flow block assembly contains the 3 electrode cell for Cl_2, ClO_2, O_3 or $KMnO_4$ (D) .

Flow block assembly DEPOLOX®5 non-pressurised version



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

Flow block assembly VariaSens non-pressurised version



A Cell body with cover
B Plastic housing
C Flow control valve
E Drain/extract specimen
F Ball valve
G Fine filter
H Lower clip
I Multi sensor
J Upper clip (coated)
K sensors

Two clips (H/J) are installed in the housing cover. These clips can be inserted into the rear panel of the housing.

The cell body can be equipped with up to five sensors (K) on the non-pressurised version or four sensors on the pressurised version.

Sensor measuring module

The sensor measuring module consists of:

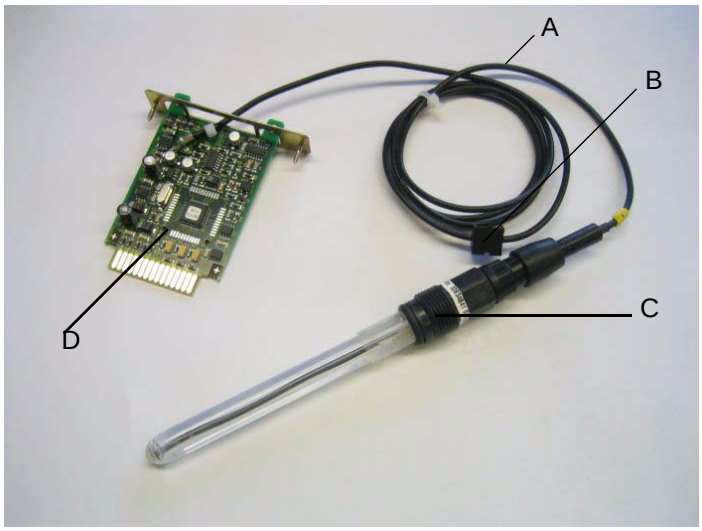
- Sensor (not in 3 electrode cells, mA/V input)
- Sensor cable with watertight housing cable duct (not in 3 electrode cells, mA/V input)
- Pre-calibrated plug-in card

Due to the modular design, simple retrofitting and configuration of sensor measuring modules in accordance with the plug-and-play principle is possible at any time.

All sensor measuring modules and retrofit kits for Cl_2, pH, mV, F^-, etc. can be plugged into module slots 1 to 4.
This configuration determines the MFC's functionality (see 4.2 “Measurement inputs" on page 46).

Please note

Module slot 5 is a control signal input with a MA/V sensor measuring modules and is therefore not freely selectable.



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

4. Functions

4.1 General Information

The MFC is a special measuring and control device for use in potable water and industrial process water treatment.

Typical applications:

- Measurement and registration of water parameters
- Flow-controlled potable water chlorination (compound-loop-control)
- Flow-controlled fluroide dosing (compound-loop-control)
- pH single feed back control
- Chlorine single feed back control
- Quantity-proportional dosing of disinfectants (single feed forward control)
- etc.

The device processes up to four process parameters simultaneously, which are recorded with special sensor measuring modules and sensors.

Possible process measurements:

Free chlorine, combined chlorine, total chlorine, chlorine dioxide, potassium permanganate, ozone, pH, Redox, fluoride, conductivity

As an option, two additional control signal inputs can be installed to log flow rate and external setpoint using a combicontrol.

The integrated graphic display displays the following:

- Measured value
- Mode
- Bar graph with limit values
- Setpoint and measuring range
- Description of customised measuring points
- etc.

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

A 7-day trend display enables you to view past measured values for up to four selectable process variables.

Four mA outputs and an RS 485 bus interface including Wallace & Tiernan protocol are available to connect visualisation systems. Five different process applications, which reflect the variety of on-site conditions, are integrated into the MFC to simplify commissioning.

Overall Function

Up to eight measured values can be indicated by specific process components. Possible measured values:

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

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

The Cl_2^{++}value is a pH-compensated chlorine measurement (optional). This requires a pH-measurement in the same sample water as the 3 electrode cell.

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

All measured values can be displayed at the same time.

* These measurements are automatically temperature-compensated.

The possible control functions are determined on the MFC by assigning the sensor measuring module to the module slot. This means that the type of sensor measuring module installed on slot 1 to determines which measured variables will be controlled (i.e. only alarms or limit switches are available).

Sensor measuring module 1	single feed forward control, single feedback closed-loop control or compound-loop-control Additional alarms and limit switches
Sensor measuring module 2	Single feedback closed-loop control or single feed forward control Additional alarms and limit switches Measured variables for setpoint trim for Control module 1 2x timer contact
Sensor measuring module 3	Alarms and limit switches
Sensor measuring module 4	Alarms and limit switches
Sensor measuring module 5	two control variables for: - Current flow rate measurement for thecompound-loop-control/ single feed forward control of module 1 as well as for the single feed forward control of module 2 - Signal input for external setpoint/ dosing factor for the module 1 controller

Please note

Not all the same controller functions are available in all applications (see chapter 4.4 “Applications" on page 71).

Controller outputs Controller outputs for positioners, dosing pumps, pulse pumps, continuous mA output as well as a dosing contact.

Adaption programme The adaption programme automatically determines the control parameters for measuring module 1 and 2 when commissioning the single feedback closed loop control (chlorine, chlorine dioxide, ozone and potassium permanganate modules only).

Safety functions

The following safety functions are integrated into the control if configured accordingly:

- Safety cut-off if dosing tank signals empty and also if the sample water supply fails
- Dosing time delay
- Alarms
- External stop for all controllers with digital input
- "Positioner closed" function in the event of a power failure (only if positioner has external power supply)
- Password protection on two levels

Infrared calibration

Infrared calibration is performed in conjunction with the photometer P42 *i-cal*. The measured calibration value is automatically transmitted at the correct time with infrared light. Potentially faulty calibrations are prevented by a time-stamp function (e.g. if the chlorine content changes on the MFC during the DPD calibration). The MFC operates internally with past values from up to 15 minutes of recorded memory.

Applications 1 to 5

The MFC provides the option to customise the system to the desired on-site controller functions and systems using up to 5 integrated applications (see chapter 4.4 “Applications" on page 71).

Links

The MFC supports the following links:

- CMS 3.0
  Visualisation software for archiving and display of measured values on PCs with Windows operating systems
- SECO-S7:
  PLC driver for data links to Siemens PLC,
  Type S7-300
- OPC-Server Data Access V2.0:
  Server software for Windows operating systems for data links to visualisation system with OPC client capability
- ChemWeb server:
  Measured value archiving and display, remote diagnosis, remote access with standard browser with Internet and e-mail capability
- Process control systems of different manufacturers
  (refer to the manual "RS-485 Bus Interface" for description, specification and protocol)

DEPOLOX® 5/VariaSens flow block assembly

These flow block assemblies guarantee a stable measurement signal with

- Robust sensors
- Constant flow rate with the aid of the flow control valve
- Hydrodynamic sand cleaning of the 3 electrode sensor measuring electrodes (DEPOLOX®5 flow rate assembly only)
- Optimum flow around all sensors

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

Please note

As an option, sensors may also be installed via the Yflow-through adapter,or the DEPOLOX® 4 sensor may also be combined with the MFC.

4.2 Measurement inputs

In principle, the following sensor measuring module types or retrofit kits can be installed at module slots 1 to 4:

DES - for DEPOLOX® 5 flow block assembly

DES - for DEPOLOX® 4 flow block assembly with PT100 temperature option

DES - for the DEPOLOX® 5 flow block assembly with optional PT1000 thermocouple

DES - for membrane sensors: free chlorine FCI, chlorine dioxide (CD7), ozone (OZ7), total chlorine TC1

pH - pH value

mV - Redox value

R^- - Fluoride value

mS - Conductivity

mA/V - Input module

When the device is switched on, the menus are initialised according to the installed sensor modules. Even if the sensor modules are changed at a later date, the user menus are automatically initialised when the device is switched on.

Sensor measuring module 1 (MOD 1)

Sensor measuring module 1 is regarded as the main measurement and therefore has the most controller functions (ratiocontrol, single feedback close-loop control or compound-loop-control). No controller output is available for application 1.

Sensor measuring module 2 (MOD 2)

The sensor measuring module 2 has various functions depending on the application. Single feed forward control or single feedback closed loop control (application 3), two time switch contacts (application 4) or it is used to optimise the controller setpoint in sensor measuring module 1 (application 5).

Module slot 5 (MOD 5)

Module slot 5 can only be equipped with a mA/V sensor measuring module, which is used to record further process parameters such as flow rate or external setpoint/dosing factor.

Module slot 6 (MOD 6)

As an option, module slot 6 can be equipped with a four-way mA output card. Each mA output can be optionally assigned with a measured value or also with a controller control signal (Ym feedback / Yout).

4.2.1 DEPOLOX®5 flow block assembly

DEPOLOX® 5 flow block assembly - 3 electrode measurement for free Cl_2, ClO_2, O_3 or $KMnO_4$

Potable, industrial and swimming pool water are disinfected almost exclusively by adding chlorine, chlorine dioxide, ozone or potassium permanganate.

Using the DEPOLOX® 5 flow block assembly with integrated 3 electrode cell, the contents of this disinfectant can be continuously recorded.

A sensor module ("DES" for 3 electrode cells) and terminal strips are used to connect the DEPOLOX® 5 flow block assembly to the MFC. The module can be installed to slots 1 to 4 on the MFC. Various controller functions are available depending on the slot and application selected. The DEPOLOX® 5 flow block assembly is also used to install additional sensors, such as pH, Redox, fluoride, conductivity, or membrane sensors for free chlorine, chlorine dioxide, ozone, total chlorine or combined chlorine.

A pressurised and non-pressurised version with flow rate control is available as a flow block assembly with integrated 3 electrode cells (see “Possible sensor configurations" on page 32).

How the 3 electrode sensor in the DEPOLOX® 5 flow block assembly works

The measuring cell in the DEPOLOX® 5 flow block assembly is a 3 electrode cell with external potentiostatic control circuit. Working and counter electrodes are designed as half-ring electrodes and consist of a special platinum alloy.
The reference electrode is a silver silver chloride electrode, which is connected to the sample water via two diaphragms (membranes). The reference electrode with PVC support is immersed into an electrolyte solution.
The electrolyte supply can be replenished during operation if necessary (see 7.2 “Maintaining DEPOLOX® 5 flow block assembly" on page 205).

By connecting the 3 electrode cell to the MFC (DES sensor module for 3 electrode cell), a variable Upot cell voltage can be output between the working electrode (red) and reference electrode (white) via the potentiostatic control circuit. A measuring cell current (µA signal), which is evaluated using the MFC, sets itself proportional to the disinfectant concentration in the sample water.

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

A multi-sensor is integrated into the DEPOLOX® 5 flow block assembly to measure the temperature and monitor the flow rate. This is made of a stainless steel housing and is used simultaneously as the sample water grounding (for connection to MFC, see 9. “Wiring Diagrams" on page 245).

Adjusting the measurement signal input

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

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

Please note

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

Setting guideline

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

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

Please note

Select a higher µA- measuring range for a correspondingly high concentration of disinfectant.

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

Setting the Upot potential voltage

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

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

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

Installation notes

Ambient conditions

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

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

Please note

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

- If using several DEPOLOX® 5 flow block assemblies, only one multi sensor, which records temperature and flow rate, may be connected to the MFC. Additional multisensors must be connected to the sample water grounding with PE.
- If the DEPOLOX® 5 flow block assembly is not installed right next to the MFC, the measuring cell cable can be lengthened up to no more than 50 m with a three-core, shielded cable. Ready-made extension cables are available for this (see 8. “Complete Devices, Retrofit Kits and Spare Parts" on page 215).
- Because the multi sensor is also integrated to measure the temperature and monitor the flow rate in the DEPOLOX® 5 flow block assembly, it must also be installed with an equal extension. Graded, ready-made cable lengths up to 50 m are also available (see “Complete Devices, Retrofit Kits and Spare Parts" on page 215).
- Use terminal strips with right or left side connection routes depending on the module slot in use. Find information on connecting the sensor to the sensor module under 9. “Wiring Diagrams" on page 245.
- The sensor can be calibrated for the first time after approx. two to three hours running-in time.

Please note

The calibration must be checked after one day.

4.2.2 pH Measurement

The pH value is a measured variable in the field of water treatment.

The pH measuring system consists of:

- pH module with a solidlysoldered connecting cable
- pH glass electrode

The pH module can be installed to slots 1 to 4 on the MFC. Various controller functions are available depending on the slot and application selected.

The electrodes can be installed in the DEPOLOX® 5/ VariaSens flow block assembly or in separate Y flow-through adapters.

Installation notes

Ambient conditions

The following must be taken into account when installing the pH measurement:

- Select the sample water extraction point that guarantees a proper mixture of correction medium and a bubble-free sample water flow.
- This does not require a certain flow rate.
- The electrode must be immersed at least 2 cm deep into the sample water.
- If the pH electrode is not installed right next to the MFC, extension cables with plug connectors are available (see 8. “Complete Devices, Retrofit Kits and Spare Parts" on page 215).
- If an extension cable is used (max. 50 m), a impedance converter (see 8. “Complete Devices, Retrofit Kits and Spare Parts" on page 215) must be used on the electrode in order to guarantee a stable measuring signal.

Installing the pH sensor in the flow block assembly

1 Install the pH sensor in the corresponding opening on the flow block assembly in the Y flow-through adapter.

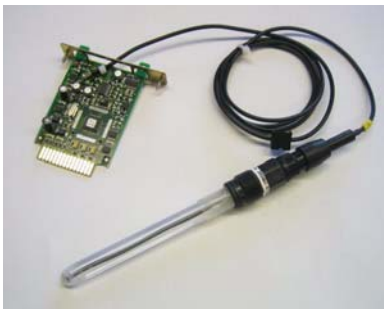
2 Screw the sensor cable marked "pH" into place.

3 The pH sensor can be calibrated for the first time after approx. two to three hours running-in time.

Please note

The calibration must be checked after one day.

4.2.3 Redox Measurement



The Redox measurement is a measured variable in the field of water treatment. The electrical potential present during the Redox reaction is described as Redox potential and represents the oxidation strength of a system. The Redox electrode is a single-rod electrode including silver/silver chloride reference system, which is very robust and low-maintenance.

The Redox measuring system consists of:

- mV module with a solidly soldered connecting cable
- Redox electrode

The mV module can be installed to slots 1 to 4 on the MFC. Various controller functions are available depending on the slot and application selected.

The electrodes can be installed on the DEPOLOX® 5/ VariaSens flow block assembly or in separate Y flow-through adapters.

Installation notes

Ambient conditions

The following must be taken into account when installing the Redox measurement:

- Select the sample water extraction point that guarantees a proper mixture of disinfectant and a bubble-free sample water flow.
- This does not require a certain flow rate.
- The electrode must be immersed at least 2 cm deep into the sample water.

Please note

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

- If the Redox electrode is not installed right next to the MFC, extension cables with plug connectors are available (see 8. “Complete Devices, Retrofit Kits and Spare Parts" on page 215).
- If an extension cable is used (max. 50 m), a impedance converter (see 8. “Complete Devices, Retrofit Kits and Spare Parts" on page 215) must be used on the electrode in order to guarantee a stable measuring signal.

Installing the mV sensor in the flow block assembly

1 Install the mV sensor in the corresponding opening on the flow block assembly in theY flow-through adapter.

2 Screw the sensor cable marked "mV" into place.

3 The mV sensor can be calibrated for the first time after approx. two to three hours running-in time.

Please note

The calibration must be checked after one day.

4.2.4 Fluoride Measurement

The fluoride measurement with fluoride ionic-sensitive electrodes is used to continuously determine the fluorides in solutions. The measurement medium's pH value must be between pH 4 and pH 8.5, in order to obtain a correct result.

Caution!

Quick and repetitive changes in temperature cause the potential to change continuously, which can lead to electrode malfunction.

Please note

The reference system is filled with electrolyte. The integrated storage tank must be replenished routinely with the solution.

The fluoride measuring system consists of:

- Fluoride module with a solidly soldered connecting cable
- Fluoride single-rod electrode

The fluoride module can be installed to slots 1 to 4 on the MFC. Various controller functions are available depending on the slot and application selected.

The electrodes can be installed on the DEPOLOX® 5/ VariaSens flow block assembly or in separate Y flow-through adapters.

Installation notes

Ambient conditions

The following must be taken into account when installing the fluoride measurement:

- Select the sample water extraction point that guarantees a proper mixture of disinfectant and a bubble-free sample water flow.
- This does not require a certain flow rate.
- The electrode must be immersed at least 2 cm deep into the sample water.

Please note

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

- If the fluoride electrode is not installed right next to the MFC, extension cables with plug connectors are available (see 8. “Complete Devices, Retrofit Kits and Spare Parts" on page 215).
- If an extension cable is used (max. 50 m), a impedance converter (see 8. “Complete Devices, Retrofit Kits and Spare Parts" on page 215) must be used on the electrode in order to guarantee a stable measuring signal.
- Because the fluoride electrode has a connecting cable, the impedance converter must be installed between the electrode extension cable and the connecting cable.

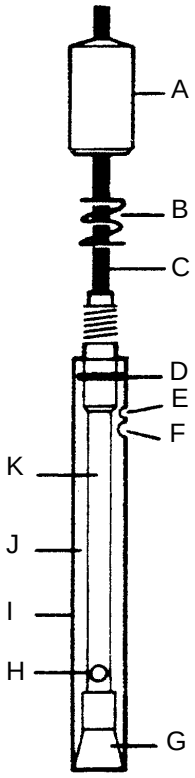
Commissioning

Please note

The fluoride-sensitive membrane of the electrode is protected by a rubber cap. The rubber cap must be removed before the electrode is immersed in the sample water.

To prevent damages, do not touch the membrane.

Preparing the electrodes



A Cap
B Spring
C Cable
D O-ring
E Vent
F Filling hole
G Cone
H Reference element
I Protective cover
J Filling solution chamber
K Electrode body

1 Screw the injection cap on the bottle with the fill solution.

2 Pour a little fill solution into the filling hole. Then rinse the electrode to wet the electrode body O-ring.

3 Press on the electrode cap until the electrode body is loosened slightly from the epoxy cover so that the cone is also wet.

4 Release the cap.
If the protective cover does not immediately return to its original position, check whether the O-ring is wet enough and repeat steps 2 and 3 until the protective cover returns.

5 The electrode must be filled with electrolyte up to the filling hole.

6 Before use, the electrode should be paced in a 100 mg/l fluoride solution at pH 7 for approx. 24 hours (e.g. calibration solution).

Please note

The filling hole or vent must remain open. The solution in the electrode may not be contaminated by other liquids.

Installing the fluoride sensor in the flow block assembly

1 Install the fluoride sensor in the corresponding opening on the flow block assembly in the Y flow-through adapter.

2 Connect the sensor to the sensor cable marked "F¯".

3 The fluoride sensor can be calibrated for the first time after approx. two to three hours running-in time.

Please note

The calibration must be checked after one day.

4.2.5 Conductivity Measurement

The conductivity measurement represents a composite parameter for the total mineralisation of water. This measurement depends heavily on the temperature, therefore a temperature sensor is integrated directly into the conductivity sensor. The measured value is always indicated in relation to a certain temperature value. The international reference temperatures are 20°C or 25°C.

The conductivity measuring system consists of:

- Conductivity module with terminal strip
- Conductivity sensor
- Electrode support for pressurised/non-pressurised assembly

The LF325 conductivity measuring cell consists of a 4-electrode system with integrated temperature sensor. The electrodes are made of graphite and are therefore very robust and abrasion-resistant. The cell constant is 0.48 cm^{-1}.

The conductivity module can be installed to slots 1 to 4 on the MFC. Various controller functions are available depending on the slot and application selected. The electrodes can be installed in the DEPOLOX® 5/DEPOLOX® 4 flow block assemblies or in a separate Y flow-through adapter. The electrode support must also be used if installing the pressurised version on the DEPOLOX® 5 flow block assembly.

Installation notes

Ambient conditions

The following must be taken into account when installing the conductivity measurement:

- Select the sample water extraction point that guarantees bubble-free sample water flow.
- This does not require a certain flow rate.
- The electrode must be immersed at least 4 cm deep into the sample water.
- If the conductivity electrode is not installed right next to the MFC, the measuring cell cable can be lengthened up to no more than 50 m using a connecting box and a six-core, shielded cable (see 8. “Complete Devices, Retrofit Kits and Spare Parts" on page 215).
- Use terminal strips with right or left side connection routes depending on the module slot in use. Find information on connecting the sensor to the conductivity module in the wiring diagrams under 9. “Wiring Diagrams" on page 245.

Installing the conductivity sensor in the flow block assembly

1. Install the conductivity sensor in the corresponding opening on the flow block assembly in the Y flow-through adapter.
2. Use the appropriate accessories if installing the pressurised version.
3. Plug in the corresponding sensor cable.
4. Then calibrate immediately.

4.2.6 Membrane sensors

Membrane sensors

The following alarm messages are configurable:

- Free chlorine - FC1
- Chlorine dioxide - CD7
- Ozone - OZ7
- Total chlorine - TC1

The membrane measuring system consists of the sensor module ("DES" for membrane sensors) including terminal strips and the sensors. The module can be installed to slots 1 to 4 on the MFC. Various controller functions are available depending on the slot and application selected.

All membrane systems are equipped with an integrated temperature sensor and therefore deliver a temperature-compensated output signal.

Please note

For a better overview, the commissioning, maintenance, trouble-shooting, de-bugging and storage is listed here for each sensor.

Installation notes

Ambient conditions

The following must be taken into account when installing the membrane sensors:

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

Please note

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

- The membrane sensors can only be used in the DEPOLOX® 5 or VariaSens flow block assembly, which maintains the constant sample water flow.
  Because not all membrane sensors are designed for pressurised operation, the operating conditions and the sensor technical data must be reviewed and coordinated before the sensors are installed in pressurised flow block assemblies!
- If the membrane sensor is not installed right next to the MFC, the measuring cell cable can be lengthened up to no more than 50 m with a three-core, shielded cable. Ready- made extension cables up to 15 m are available for this (see 8. “Complete Devices, Retrofit Kits and Spare Parts" on page 215).

Use terminal strips with right or left side connection routes depending on the module slot in use. Find information on connecting the sensor to the sensor module in the wiring diagrams under 9. “Wiring Diagrams" on page 245.

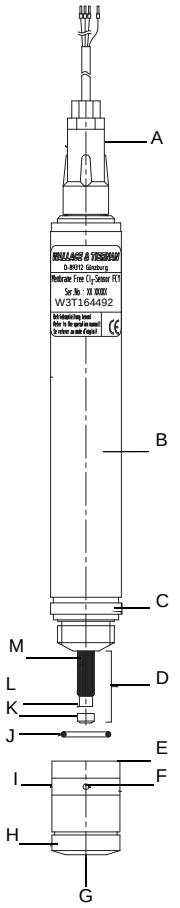
Membrane sensor for free chlorine FC1

The FC1 membrane sensor is a special sensor for measuring the concentration of chlorine in water. The sensor demonstrates a slight pH value dependency (see "Technical data“) and is therefore very suitable for water with various pH values. The sensor may only be used in clear water of potable water quality.

Commissioning

Caution!

The electrode fingers (D) and membranes (G) are extremely sensitive! Do not touch, soil or damage! Before unscrewing the filled membrane cap (E), push the elastomer seal (I) to one side to permit the inflow of air through the vent (F) underneath it (at the cap label)! Otherwise, the membrane (G) may be damaged due to the development of underpressure. Do not remove the light yellowish-gray deposit of the reference electrode (M) or wipe it in the direction of the gold working electrode (L)! Flush eyes and skin immediately with water after contact. Rinse away spilled electrolyte with water.



1 Screw membrane cap (E) off the electrode shaft (B).

2 Place the membrane cap (E) and the G-holder* (K) on a clean, non-absorbent pad and fill both with the included electrolyte bubble-free up to the upper rim.

*) The G-holder (K) will only be used in sensors that were delivered as of November 2004. The G-holder (K) is not required for sensors that were delivered up to October 2004.

3 Rub gold working electrode (L) with the included lapping paper (special emery). To do this, lay the lapping paper on a paper towel, take hold of a corner, and using the tip of the vertically-held electrode shaft (B) (without G-holder), slide it once or twice over the rough side of the lapping paper.

4 Check whether the elastomer seal (I) completely closes the valve opening (F).

5 Hold the electrode shaft (B) vertically and carefully push the electrode finger (D) into the filled G-holder (K).

6 Then screw the filled membrane cap (E) slowly (by hand) back onto the electrode shaft (B).

Please note

As the excess electrolyte escapes through the valve opening (F) under the elastomer seal (I), do not clamp it shut and do not press it onto the elastomer seal (I).

7 Rinse off the escaped electrolyte with water.

Please note

The membrane cap (E) must be completely screwed (hand-tight) onto the electrode shaft (B), so that no gap remains between the two! After a run-in period of about one hour, the membrane sensor is sufficiently run-in for an initial calibration to take place. Calibration should be repeated after one day.

Inserting into the flow-through adapter

1 Insert the membrane sensor through the cover into the flow-through adapter until it is resting mechanically on the inflow mating connector and therefore receives a good flow. It may be necessary to turn the flow-through adapter cover to set it in the right position relative to the inflow mating connector.

Please note

Remove air bubbles from the membrane by lifting the membrane sensor. They interfere with the measurement!

2 Connect the measuring signal cable to the measuring device.

Please note

If the measuring sensor is installed this way, it will function reliably for approx. three to six months.

Storing the membrane sensor

1 Lift elastomer seal (I) and only then screw off the membrane cap (E).

2 Remove G-holder (K) (with tweezers) and rinse together with the membrane cap (E) and electrode finger (D) with clean (distilled) water.

3 Carefully dry the electrode finger (D) with absorbent paper.

4 Leave the membrane cap (E) to dry in a dust-free place.

5 Screw the dry membrane cap (E) loosely onto the electrode shaft (B).

6 Place G-holder (K) loosely into the membrane cap, do not fit onto the electrode finger (D).

Please note

The membrane (G) may not touch the gold working electrode (L).

Restarting

See "Commissioning“.

Trouble-shooting and debugging when the measuring signal is too low or irregular

1 Remove air bubbles on the membrane (G) by lifting the membrane sensor; air bubbles prevent the chlorine from diffusing through the membrane (G) and distort the measurement!

Please note

Air bubbles on the electrode shaft (B) and the membrane cap (E) are normal following the initial startup and subsequent startups and they disappear by themselves after one or two days.

2 Replenish electrolyte. Open membrane sensor. To do this, push the elastomer seal (I) to the side so that air can flow in through the valve opening (F), and only then screw off the membrane cap (E).

Please note

Do not unscrew the membrane holder (H) from the membrane cap (E) under any circumstances!

3 The G-holder (K) remains in the membrane cap (E).

4 Pour out the electrolyte. Wash the electrode finger (D) and the membrane cap (E) with clean (distilled) water and dry with a clean paper towel.

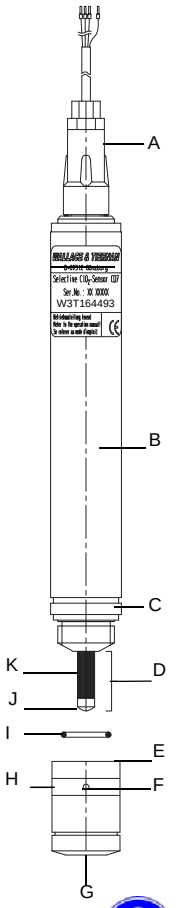
Please note

For further procedures, see “Commissioning“. If the membrane sensor's measuring signal is still too low or irregular, a new membrane cap (E) must be used. The membrane sensor then requires a run-in time of approx. one hour, before a calibration can be carried out.

Membrane sensor for chlorine dioxide CD7

The CD7 membrane sensor enables the chlorine dioxide content in all types of water to be determined selectively, also in high-purity water (LF > 1µS/cm), without cross-sensitivity to chlorine, bromine and hydrogen peroxide, but with cross-sensitivity to ozone and peracetic acid. The sensor demonstrates no pH value dependency (see "Technical data“) and is therefore very suitable for water with various pH values.

Commissioning



Caution!

The electrode fingers (D) and membranes (G) are extremely sensitive! Do not touch, soil or damage! Before unscrewing the filled membrane cap (E), push the elastomer seal (H) to one side to permit the inflow of air through the vent (F) underneath it (at the cap label)! Otherwise, the membrane (G) may be damaged due to the development of underpressure. Do not remove the light yellowish-gray deposit of the reference electrode (K) or wipe it in the direction of the gold working electrode (J)!
Flush eyes and skin immediately with water after contact. Rinse away spilled electrolyte with water.

1 Screw off the membrane cap (E) from the electrode shaft (B) and fill with the included gel electrolyte up to the top brim.

2 Rub gold working electrode (J) with the included lapping paper (special emery). To do this, lay the lapping paper on a paper towel, take hold of a corner, and using the tip of the vertically-held electrode shaft (B), slide it once or twice over the rough side of the lapping paper.

3 Check whether the elastomer seal (H) completely closes the valve opening (F).

4 Then screw the filled membrane cap (E) slowly (by hand) back onto the the electrode shaft (B).

Please note

As the excess electrolyte escapes through the valve opening (F) under the elastomer seal (H), do not clamp it shut and do not press it onto the elastomer seal (H).

5 Rinse off the escaped electrolyte with water.

Please note

The membrane cap (E) must be completely screwed (hand-tight) onto the electrode shaft (B), so that no gap remains between the two! After a run-in period of about one hour, the membrane sensor is sufficiently run-in for an initial calibration to take place. Calibration should be repeated after one day.

Inserting into the flow-through adapter

1 Insert the membrane sensor through the cover into the flow-through adapter until it is resting mechanically on the inflow mating connector and therefore receives a good flow. It may be necessary to turn the flow-through adapter cover to set it in the right position relative to the inflow mating connector.

Please note

Remove air bubbles from the membrane by lifting the membrane sensor. They interfere with the measurement!

2 Connect the measuring signal cable to the measuring device.

Please note

If the measuring sensor is installed this way, it will function reliably for approx. three to six months.

Storing the membrane sensor

1 Lift elastomer seal (H) and only then screw off the membrane cap (E).

2 Wash the membrane cap (E) and electrode finger (D) with clean (distilled) water.

3 Carefully dry the electrode finger (D) with absorbent paper.

4 Leave the membrane cap (E) to dry in a dust-free place.

5 Screw the dry membrane cap (E) loosely onto the electrode shaft (B).

Please note

The membrane (G) may not touch the gold working electrode (J).

Restarting

See "Commissioning“.

Trouble-shooting and debugging when the measuring signal is too low or irregular

1 Remove air bubbles on the membrane (G) by lifting the membrane sensor; air bubbles prevent the chlorine dioxide from diffusing through the membrane (G) and distort the measurement!

Please note

Air bubbles on the electrode shaft (B) and the membrane cap (E) are normal following the initial startup and subsequent startups and they disappear by themselves after one or two days.

2 Replenish electrolyte. Open membrane sensor. To do this, push the elastomer seal (H) to the side so that air can flow in through the valve opening (F), and only then screw off the membrane cap (E). Pour out the electrolyte. Wash the electrode finger (D) and the membrane cap (E) with clean (distilled) water and dry with a clean paper towel.

Please note

For further procedures, see “Commissioning“. If the membrane sensor's measuring signal is still too low or irregular, a new membrane cap (E) must be used. The membrane sensor then requires a run-in time of approx. one hour, before a calibration can be carried out.

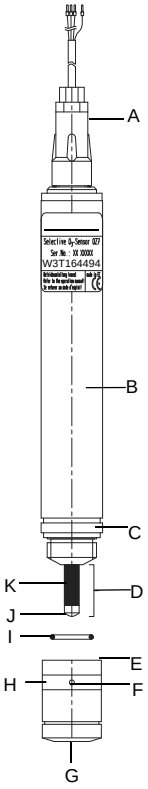
Membrane sensor for ozone OZ7

The OZ7 membrane sensor enables the ozone content in all types of water to be determined selectively, also in high-purity water (LF > 1µS/cm), without cross-sensitivity to chlorine, bromine and hydrogen peroxide, but with cross-sensitivity to chlorine dioxide and peracetic acid. The sensor demonstrates no pH value dependency (see "Technical data“) and is therefore very suitable for water with various pH values.

Commissioning

Caution!

The electrode fingers (D) and membranes (G) are extremely sensitive! Do not touch, soil or damage! Before unscrewing the filled membrane cap (E), push the elastomer seal (H) to one side to permit the inflow of air through the vent (F) underneath it (at the cap label)! Otherwise, the membrane (G) may be damaged due to the development of underpressure. Do not remove the light yellowish-gray deposit of the reference electrode (K) or wipe it in the direction of the gold working electrode (J)!
Flush eyes and skin immediately with water after contact. Rinse away spilled electrolyte with water.



1. Screw off the membrane cap (E) from the electrode shaft (B) and fill with the included gel electrolyte up to the top brim.
2. Rub gold working electrode (J) with the included lapping paper (special emery). To do this, lay the lapping paper on a paper towel, take hold of a corner, and using the tip of the vertically-held electrode shaft (B), slide it once or twice over the rough side of the lapping paper.
3. Check whether the elastomer seal (H) completely closes the valve opening (F).
4. Then screw the filled membrane cap (E) slowly (by hand) back onto the electrode shaft (B).

Please note

As the excess electrolyte escapes through the valve opening (F) under the elastomer seal (H), do not clamp it shut and do not press it onto the elastomer seal (H).

5. Rinse off the escaped electrolyte with water.

Please note

The membrane cap (E) must be completely screwed (hand-tight) onto the electrode shaft (B), so that no gap remains between the two! When the sensors are first commissioned, it is necessary to operate the sensors for two or three hours in water with an ozone content of >0.2 mg/l. The sensor needs this time to activate itself. Following a run-in time of approx. three hours, a first calibration can take place. Calibration should be repeated after one day.

Inserting into the flow-through adapter

1 Insert the membrane sensor through the cover into the flow-through adapter until it is resting mechanically on the inflow mating connector and therefore receives a good flow. It may be necessary to turn the flow-through adapter cover to set it in the right position relative to the inflow mating connector.

Please note

Remove air bubbles from the membrane by lifting the membrane sensor. They interfere with the measurement!

2 Connect the measuring signal cable to the measuring device.

Please note

If the measuring sensor is installed this way, it will function reliably for approx. three to six months.

Storing the membrane sensor

1 Lift elastomer seal (H) and only then screw off the membrane cap (E).

2 Wash the membrane cap (E) and electrode finger (D) with clean (distilled) water.

3 Carefully dry the electrode finger (D) with absorbent paper.

4 Leave the membrane cap (E) to dry in a dust-free place.

5 Screw the dry membrane cap (E) loosely onto the electrode shaft (B).

Please note

The membrane (G) may not touch the gold working electrode (J).

Restarting

See chapter "Commissioning“.

Trouble-shooting and debugging when the measuring signal is too low or irregular

1 Remove air bubbles on the membrane (G) by lifting the membrane sensor; air bubbles prevent the ozone from diffusing through the membrane (G) and distort the measurement!

Please note

Air bubbles on the electrode shaft (B) and the membrane cap (E) are normal following the initial startup and subsequent startups and they disappear by themselves after one or two days.

2 Replenish electrolyte. Open membrane sensor. To do this, push the elastomer seal (H) to the side so that air can flow in through the valve opening (F), and only then screw off the membrane cap (E). Pour out the electrolyte. Wash the electrode finger (D) and the membrane cap (E) with clean (distilled) water and dry with a clean paper towel.

Please note

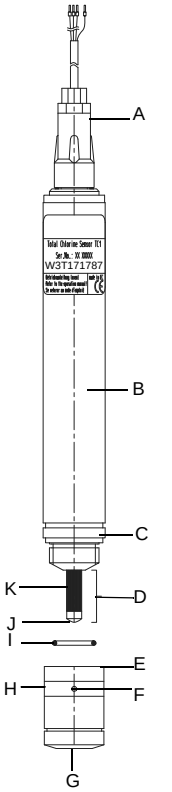
For further procedures, see “Commissioning“. If the membrane sensor's measuring signal is still too low or irregular, a new membrane cap (E) must be used. The membrane sensor then requires a run-in time of approx. one hour, before a calibration can be carried out.

Membrane sensor for total chlorine TC1 and TC1-S

The membrane sensor measures the total amount of free and combined chlorine (chloramine). The sensor demonstrates a slight pH value dependency (see "Technical data“) and is therefore very suitable for water with various pH values. The sensor may only be used in clear water of potable water quality.

For applications in brine with a conductivity of 2.5–60 mS/cm (approx. 4 % NaCl), an identically constructed sensor TC1-S must be used with special electrolyte.

Commissioning



Caution!

The electrode fingers (D) and membranes (G) are extremely sensitive! Do not touch, soil or damage! Before unscrewing the filled membrane cap (E), push the elastomer seal (H) to one side to permit the inflow of air through the vent (F) underneath it (at the cap label)! Otherwise, the membrane (G) may be damaged due to the development of underpressure. Do not remove the light yellowish-gray deposit of the reference electrode (K) or wipe it in the direction of the gold working electrode (J)!
Flush eyes and skin immediately with water after contact. Rinse away spilled electrolyte with water.

1. Screw off the membrane cap (E) from the electrode shaft (B) and fill with the included gel electrolyte up to the top brim. With TC1-S a special brine electrolyte is used instead of the standard electrolyte contained in the shipment.
2. Rub gold working electrode (J) with the included lapping paper (special emery). To do this, lay the lapping paper on a paper towel, take hold of a corner, and using the tip of the vertically-held electrode shaft (B), slide it once or twice over the rough side of the lapping paper.
3. Check whether the elastomer seal (H) completely closes the valve opening (F).
4. Then screw the filled membrane cap (E) slowly (by hand) back onto the electrode shaft (B).

Please note

As the excess electrolyte escapes through the valve opening (F) under the elastomer seal (H), do not clamp it shut and do not press it onto the elastomer seal (H).

5. Rinse off the escaped electrolyte with water.

Please note

The membrane cap (E) must be completely screwed (hand-tight) onto the electrode shaft (B), so that no gap remains between the two! After a run-in period of about one hour, the membrane sensor is sufficiently run-in for an initial calibration to take place. Calibration should be repeated after one day.

Inserting into the flow-through adapter

1 Insert the membrane sensor through the cover into the flow-through adapter until it is resting mechanically on the inflow mating connector and therefore receives a good flow. It may be necessary to turn the flow-through adapter cover to set it in the right position relative to the inflow mating connector.

Please note

Remove air bubbles from the membrane by lifting the membrane sensor. They interfere with the measurement!

2 Connect the measuring signal cable to the measuring device.

Please note

If the measuring sensor is installed this way, it will function reliably for approx. three to six months.

Storing the membrane sensor

1 Lift elastomer seal (H) and only then screw off the membrane cap (E).

2 Wash the membrane cap (E) and electrode finger (D) with clean (distilled) water.

3 Carefully dry the electrode finger (D) with absorbent paper.

4 Leave the membrane cap (E) to dry in a dust-free place.

5 Screw the dry membrane cap (E) loosely onto the electrode shaft (B).

Please note

The membrane (G) may not touch the gold working electrode (J).

Restarting

See "Commissioning“.

Trouble-shooting and debugging when the measuring signal is too low or irregular

1 Remove air bubbles on the membrane (G) by lifting the membrane sensor; air bubbles prevent the chlorine from diffusing through the membrane (G) and distort the measurement!

Please note

Air bubbles on the electrode shaft (B) and the membrane cap (E) are normal following the initial startup and subsequent startups and they disappear by themselves after one or two days.

2 Replenish electrolyte. Open membrane sensor. To do this, push the elastomer seal (H) to the side so that air can flow in through the valve opening (F), and only then screw off the membrane cap (E). Pour out the electrolyte. Wash the electrode finger (D) and the membrane cap (E) with clean (distilled) water and dry with a clean paper towel.

Please note

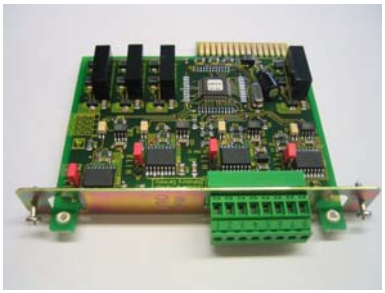
For further procedures, see “Commissioning“. If the membrane sensor's measuring signal is still too low or irregular, a new membrane cap (E) must be used. The membrane sensor then requires a run-in time of approx. one hour, before a calibration can be carried out.

4.2.7 mA/V input module

The mA/V input module is used for connecting sensors or external measurements with mA or voltage output signal.
0/4 – 20 mA signal or 0 – 10 V input voltage are possible.
The mA/V input module can be installed in slots 1 to 4. Various controller functions are available depending on the slot and application selected. An installed mA/V input module in slot 5 serves to record the flow and external setpoint/dosing factor.

4.3 Output Modules

4.3.1 mA output module (four-way)



The mA output module has four potential-separated mA outputs. Each output can be configured in the menu to 0–5 mA, 0–10 mA, 0–20 mA or 4–20 mA. Any measured value, actuator output Y_{out} or temperature can be assigned to the mA outputs.

Please note

The maximum load of each mA output can be switched over for thermal reasons. If less than 400 Ohm load is connected, the corresponding mA output's bridge should be attached to L (load < 400 Ohm). At higher loads, (max. 1000 Ohm), the bridge must be attached to H (load up to 1000 Ohm).

4.3.2 Relay Module (eight-way)

The relay module has over eight relays, each with a two-way switch. These switches are assigned various switching tasks depending on the selected application (see 4.4 “Applications" on page 71). The corresponding diagrams for the five applications are in the appendix under 9. “Wiring Diagrams" on page 245. The switches are wired with suppressor diodes to protect from spikes. In order to switch larger inductive load, we recommend installing an additional contact such as a contactor or load relay, in order to guarantee the contacts have a longer service life.

4.4 Applications

The configuration of the system is determined by:

- The required measurement and control parameters
- The installed components
- The selection of the suitable application

The MFC provides the option to customise the system to the various on-site systems using five integrated applications. Factory setting = application 3.

The connections are determined by selecting the applications 1, 2, 3, 4 or 5. Factory settings are always set for the respective application. However, these can be customised to the respective system.

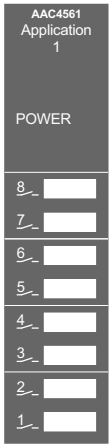
Caution!

The defined application 1, 2, 3, 4 or 5 must be entered the first time the device is switched on (see 6.3.9 “Switching the device on" on page 198).

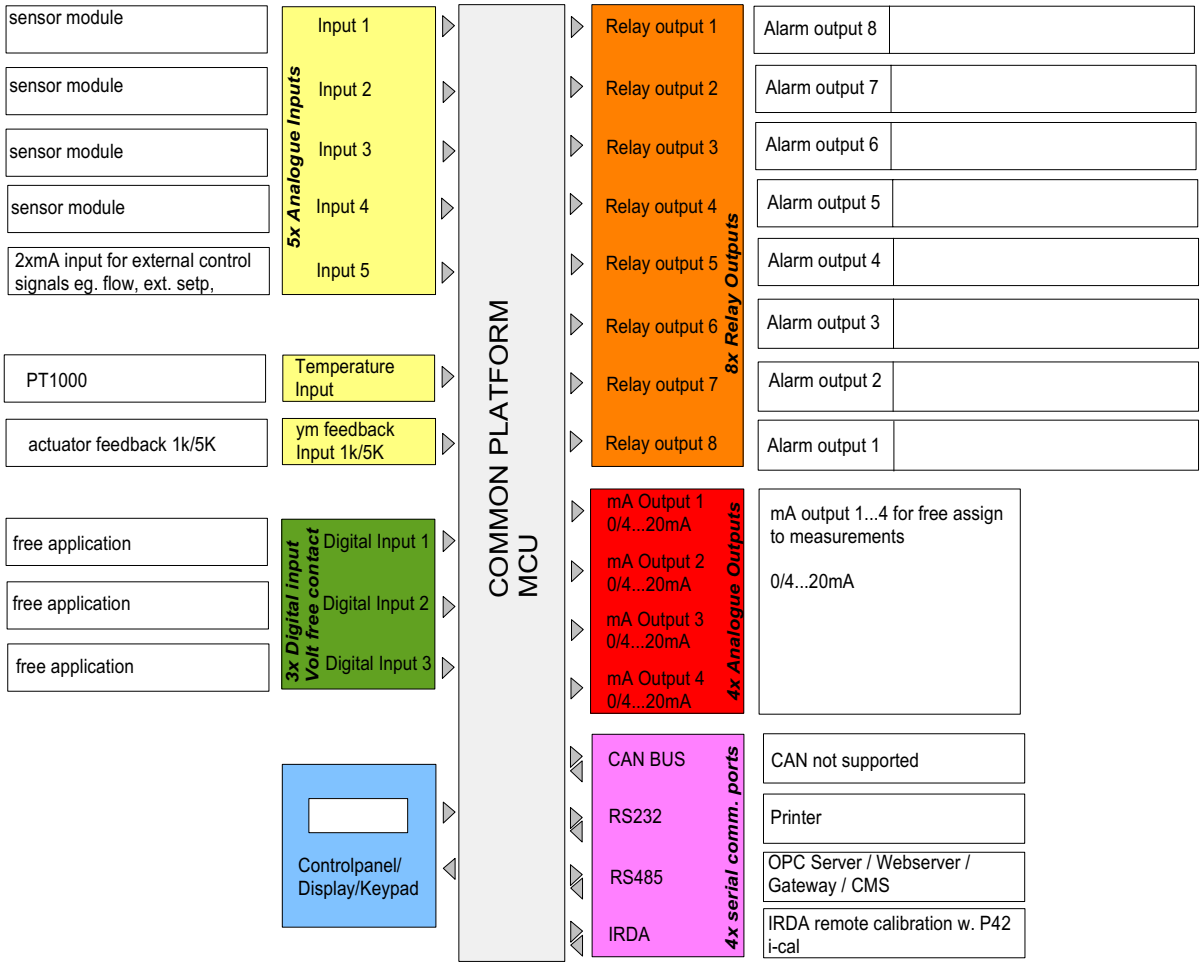
It is then not possible to change this for the defined configuration, otherwise the incorrect controller outputs are activated.

The five applications 1, 2, 3, 4 and 5 are shown below. The illustrations show the options for wiring the inputs and outputs. The respective strips are also shown.

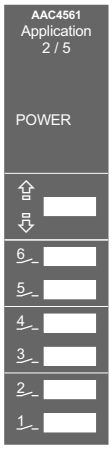
Application 1



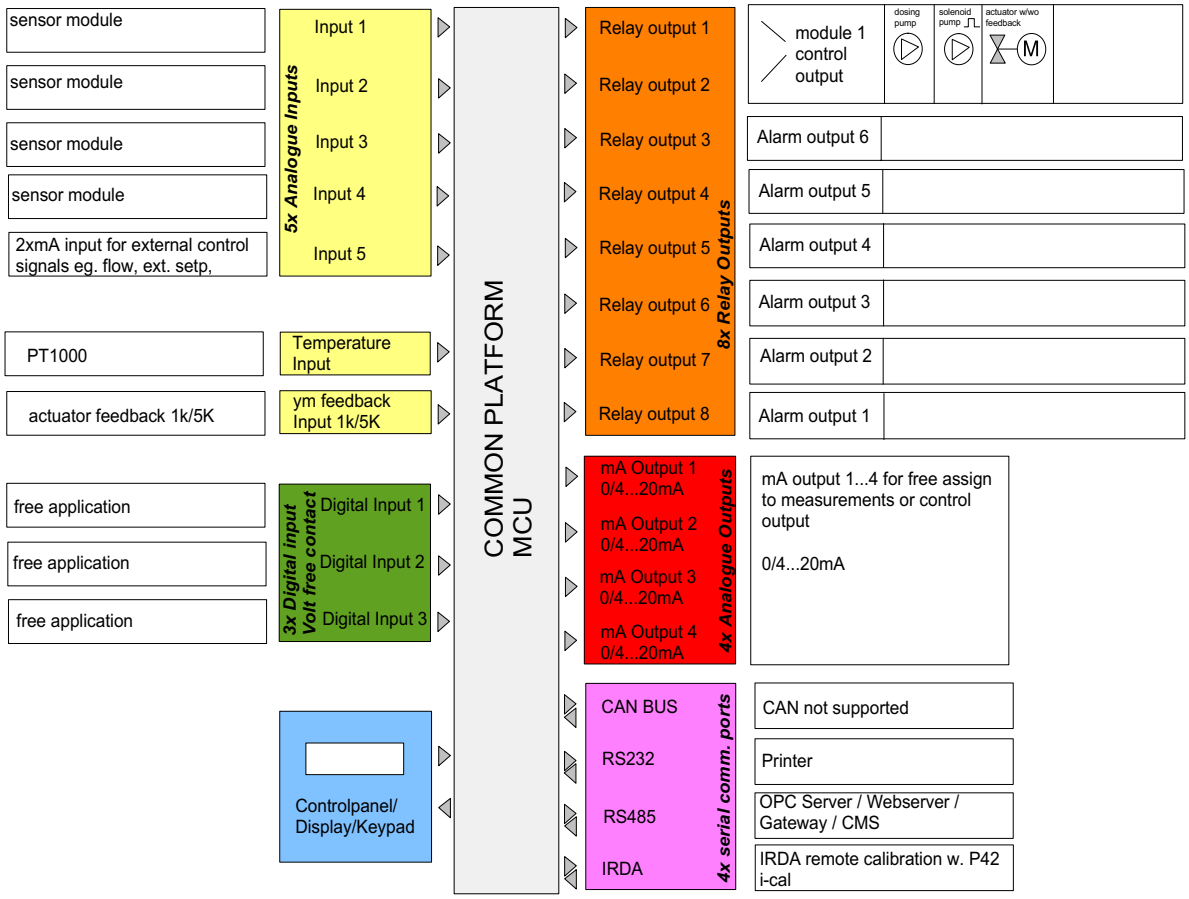
- Up to four equal or varying sensor modules
- No controller functions
- mA output can be assigned
- 8 alarm contacts
- Switching functions freely configurable on digital inputs and limit values



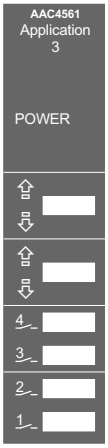
Application 2



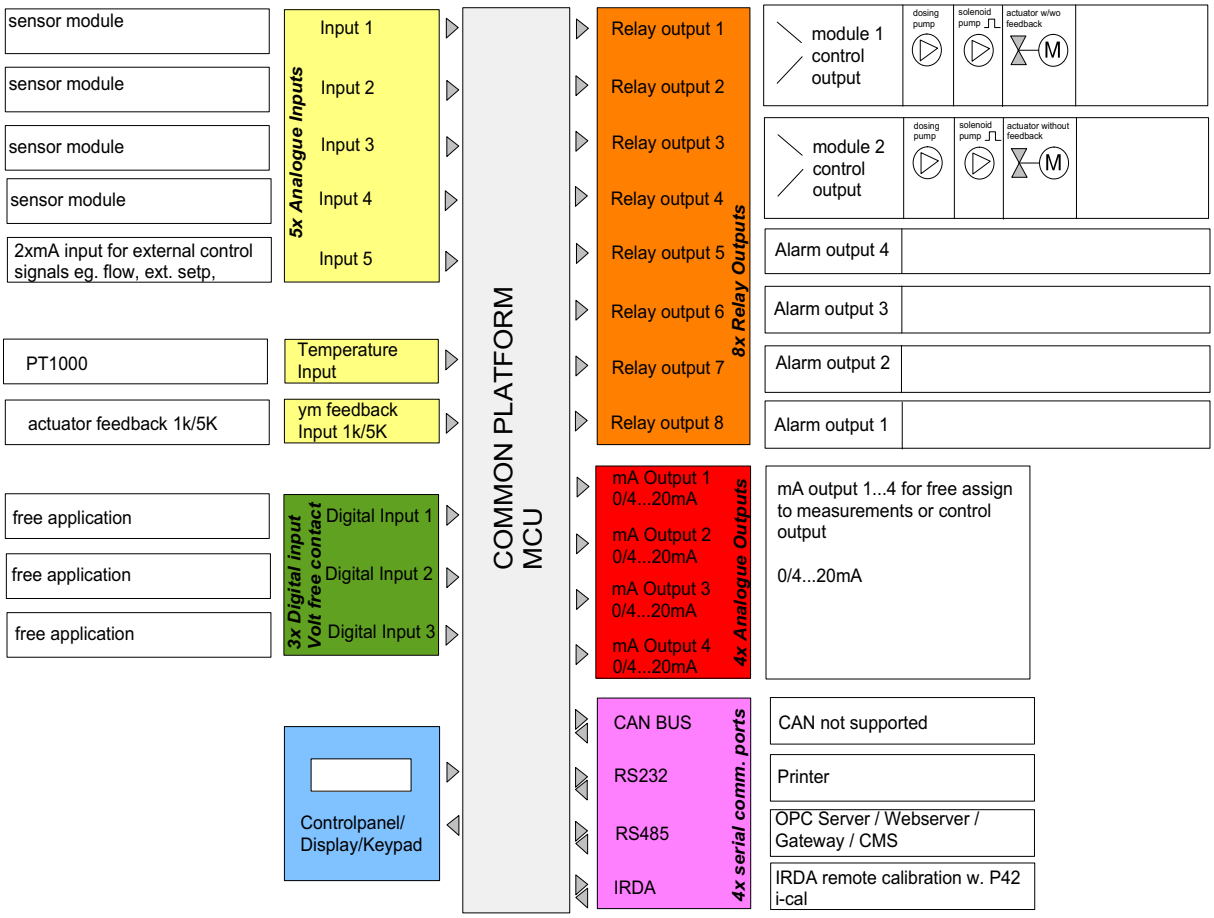
- Up to four equal or varying sensor modules
- Sensor measuring module 1 has controller outputs for single feed forward control, single feed back control or compound-loop-control
- mA output can be assigned
- 6 alarm contacts
- Switching functions freely configurable on digital inputs and limit values



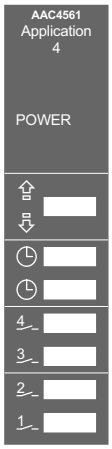
Application 3



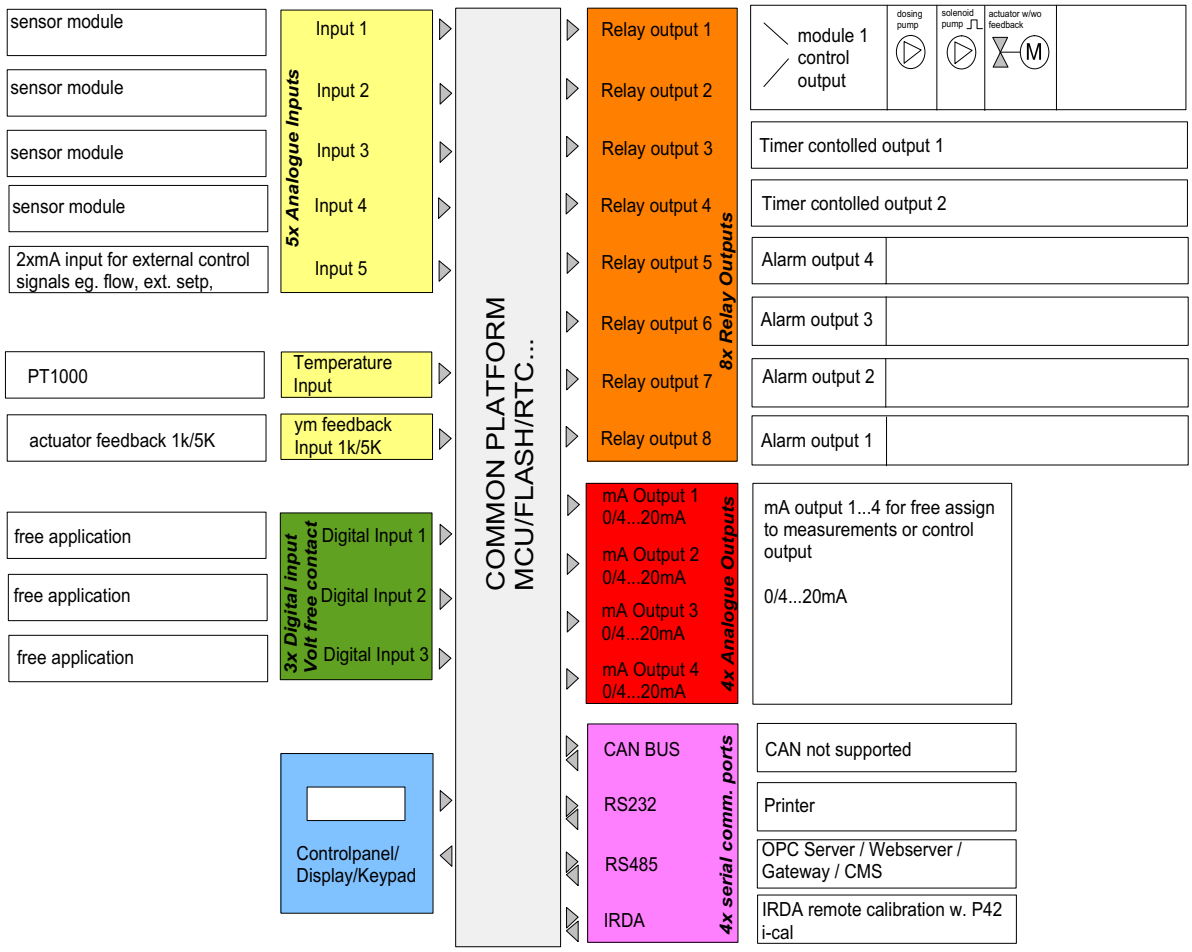
- Factory setting
- Up to four equal or varying sensor modules
- Sensor measuring module 1 has controller outputs for single feed forward control, single feed back control or compound-loop-control
- Sensor measuring module 2 has controller outputs as single feedback closed loop control or single feed forward control (same flowrate signal as MOD 1)
- mA output can be assigned
- 4 alarm contacts
- Switching functions freely configurable on digital inputs and limit values



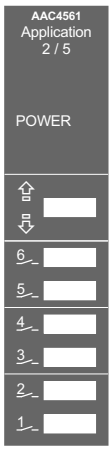
Application 4



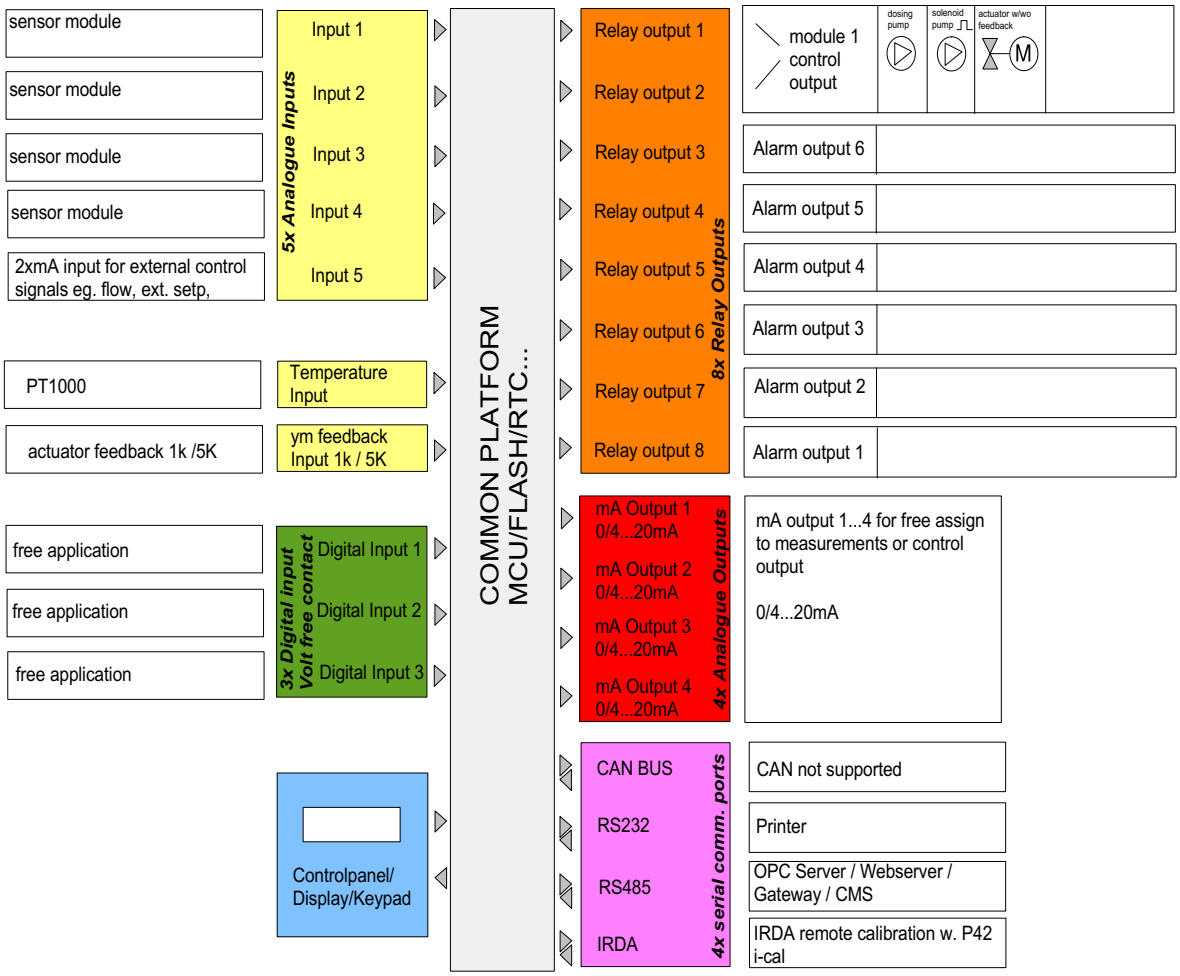
- Up to four equal or varying sensor modules
- Sensor measuring module 1 has controller outputs for single feed forward control, single feed back control or compound-loop-control
- Sensor measuring module 2 has two separately configurable switch contacts
- mA output can be assigned
- 4 alarm contacts
- Switching functions freely configurable on digital inputs and limit values



Application 5



- Up to four equal or varying sensor modules
- Sensor measuring module 1 has a controller output for compound-loop-control
- In conjunction with sensor measuring module 1, sensor measuring module 2 has automatic setpoint optimisation
- Instead of the sensor measurement module 2, this measurement can also be transmitted by a CAN bus from a measuring and control device (e.g. SFC, MFC).
- mA output can be assigned
- 6 alarm contacts
- Switching functions freely configurable on digital inputs and limit values



4.5 Controller Function

The MFC measuring and control device for the treatment of potable and industrial water.

The following integrated control modes are available for selection:

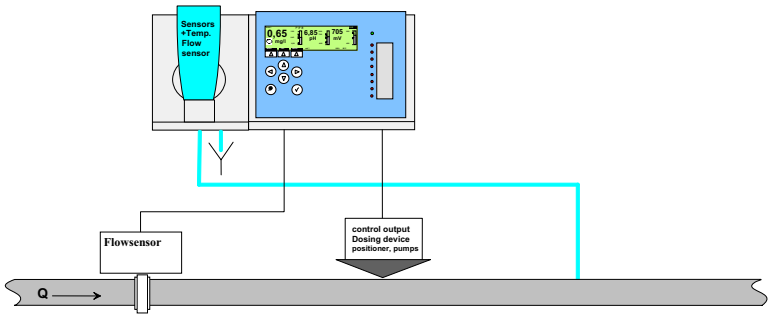
- Single Feed Forward Control
- Single Feed Back Control
- Compound-Loop-Control
- Setpoint trim

Online measurement can be transmitted directly from the MFC and external measuring system via mA input signal. External control signals such as flow rate and external setpoint are recorded using the mA/V input module. The MFC system can record up to four main measurements and two external control signals. In addition, measuring inputs for temperature, actuator feedback and three digital inputs are available.

4.5.1 Single Feed Forward Control

This operating mode controls the quantity-proportional dosing of disinfectants.

A typical application is simple flow-controlled potable water chlorination.



Please note

This control operating mode is also available for sensor measuring module 2 if application 3 is selected, however, only with internal dosing factor and flow measurement from MOD 5 as control variables. Dosing pumps, solenoid pumps or analog output actuators with mA input for MOD2 are supported for dosing.

Required module configuration:

- MOD1 - To record the measured value
- MOD5 - mA/V input module to record flow rates as well as the external dosing factor

Input signals:

- Module 1 measured value recording
- Flow measurement (0/4–20mA, 0–10V) scalable (module 5)
- Second control variable possible via sensor measuring module 1
- Internal or external dosing factor (0/4–20 mA module 5)

The following controller outputs are possible:

- Dosing pumps
- Solenoid pump
- Positioner with feedback 1kOhm/5kOhm
- mA analog output

How the single feed forward control works

The flow rate is recorded and the dosing rate adjusted proportionally to the flow rate using the flow rate sensor with linear mA/V output signal.

For the flow signal settings, see menu "Input/Output" – “Flow Wq“.

The ratio between control variables and dosing output is determined by the internal dosing factor (control "Dos.Fact.Source" = internal), or it can also be set by an external mA/V input signal (Dos.Fact.Source = external).

You can switch between internal and external dosing factor (DF) via the digital input ("Dos.Fact.Source" = "external with DI3" or "internal with DI3").

It is possible that a second control variable "Measured Value X" (measured value from module 1) will proportionally or reverse proportionally influence the single feed forward control ("X-direction" = direct / inverse variable).

The second control variable X is activate if the parameter "Control Variable X" "Measured Value X" (second control variable deactivated by "Off" setting (factory setting).

The amplification factor for this parameter is defined by the X-factor input parameter.

The controller output is calculated in this operating mode as follows:

Yout = Wq x DF x (X-measured value x X-factor) x Yout-factor

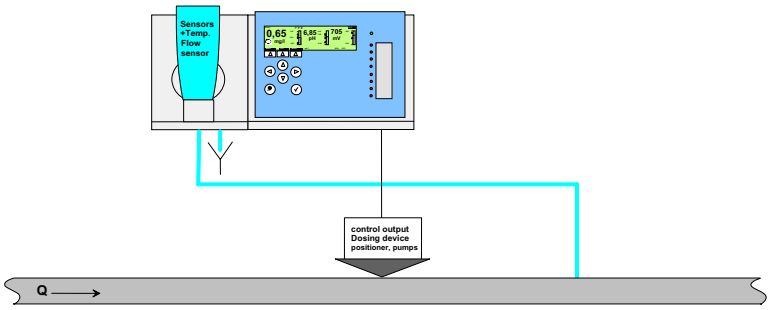
Wq	*Control variable 1 flow in %*
DF	*Set dosing factor in %*
X-measured value	*Control variable 2 measured value sensor measuring module 1 in %*
X factor	*Amplification factor for X measured value*
Yout	*Determined controller output value %*
Yout factor	*This factor offers the option to increase the dosing output if the setpoint is not reached with a dosing factor DF of 100 %.* *Setting range: 1.0– 4.0* *Factory setting: 1.0*

Note*:*
If this factor is increased, there is a danger that the setpoint value will also not be reached with a higher flow rate value, because the Yout value takes the value 100 % prematurely.

4.5.2 Single Feed Back Control

This operating mode controls the desired measured variable according to the the provided setpoint.

A typical application example is chlorine control for tanks that are circulated in cycles.



Please note

This control operating mode is also available for sensor measuring module 2 if application 3 is selected, however, only with internal setpoint input.

Required module configuration:

- MOD 1 - To record measured value
- MOD 5 - mA/V input module to record the external setpoint (optional)

Input signals:

- Module 1 measured value recording
- Internal or external setpoint (module 5) (optional)

The following controller outputs are possible:

- Dosing pumps
- Solenoid pump
- Positioner with/without feedback (1kOhm/5kOhm)
- Continuous

How the single feed back control works

A PI controller is used to control the measured variables of sensor module 1 continuously and without control deviation from the desired setpoint. It continuously determines the required dosing output.

The setpoint can be set within the measuring range of module 1 (at "Setpoint Source" = internal).

Xp and Tn are control parameters to be set. They can also be automatically determined via the integrated adaption during a chlorine control.

An external setpoint from 0–100 % can be provided via the mA/V input signal ("Setpoint Source" = external) You can switch between internal and external setpoint via the digital input ("Setpoint Source" = "external with DI3" or "internal with DI3").

The control direction can be selected with the parameter "Control Direction" = direct or inverse (e.g. direct = chlorination, inverse = dechlorination).

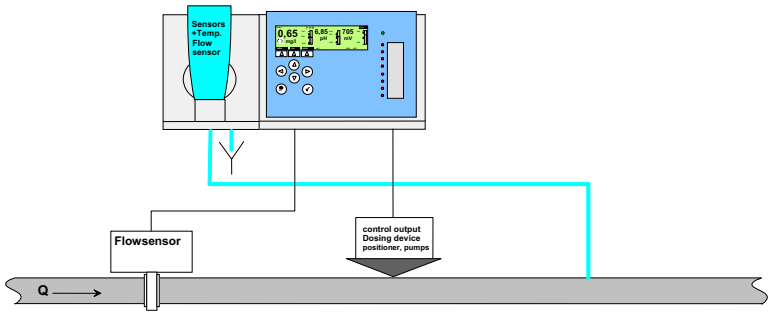
The controller output is calculated in this operating mode as follows:

Yout = Ypi = ek x Kp x (1 + t/tn)

t	*Controller cycle time*
tn	*Integral action time*
Kp	*Control amplification 100 / Xp*
ek	*Setpoint-actual value control deviation*
Ypi	*PI controller output variable*
Yout	*Determined controller output value %*

4.5.3 Compound-Loop-Control

The compound-loop-control is a combination of the single feed forward control with additional single feed back control to correct control deviations.



Required module configuration:

- MOD 1 - To record measured value
- MOD 5 - mA/V input module to record the flow as well as the external setpoint

A typical application is for a flow-controlled chlorine dosing with chlorine surplus correction for potable water treatment.

Input signals:

- Flow rate measurement (0/4–20mA, 0–10V) scalable (module 5)
- Module 1 measured value recording
- Internal or external setpoint (module 5)

Output parameter:

- Dosing pumps
- Solenoid pump
- Positioner with feedback (1kOhm/5kOhm)
- Continuous

How the compound-loop-control works

The compound-loop-controller outputs a dosing rate proportional to the flow rate, which does not have a fixed dosing factor proportional to the flow rate as in the single feed forward control, but varies depending on demand.

To detect control deviations, the sensor module 1 records the control variable and a setpoint is specified, which are compared with the integrated single feed back control.

The internal setpoint can be set within the measuring range of sensor module 1. "Setpoint Source" must be set to "internal". An external setpoint from 0–100 % can be provided via the mA/V input signal. "Setpoint Source" must be set to "external". You can switch between internal and external setpoint via the digital input. The "Setpoint Source" must be set to "external with DI3" or "internal with DI3".

The Xp and Tn control parameters of this higher-level single feed back control are automatically determined by the integrated fuzzy logic Tconst and Tvar process times to be entered at 100 % flow rate. Because the Tvar process time changes, Tvar, Xp and Tn are continuously updated by the integrated fuzzy logic.

The MFC operates internally with a dosing factor table for 0–105 % flow. In 5 % intervals, the device determines the required dosing factors automatically during operation based on the corresponding flow rate.. The single feed back control corrections are transferred into the dosing factor table during this process. Non-linearities in the control loop are learned this way. This quickly activates the setpoint if flow rate changes occur.

The control operating mode can be switched between single feed forward control and single feed back control via digital input.

The control direction can be selected with the parameter "Control Direction" = direct or inverse (e.g. direct = chlorination, inverse = dechlorination)

Behavior in operation

Operation after a flow rate change:

The single feed back control remains switched off (Ypi stop function) during the disturbance variables (flow rate change, positioner running time, dead time from line lengths). This maintains a stable control, which means the control operates with the dosing factor from the dosing factor table applicable for the new flow rate.
The time the single feed back control is switched off is determined by the fuzzy module and is therefore variable ("PI" display in seconds).

A larger change in the setpoint deletes all learning meters, in order to reinitialise the dosing rate curve when the setpoint is reached. However, the learned dosing factors remain initially unchanged. Inactivated flow rate values are automatically preassigned a dosing factor.
The single feed back control is always active.

Control deviations that occur are quickly offset by the PI single feed back control during continuous flow.

A positive jump in the flow rate causes a brief drop below the setpoint due to the running time of the positioner and the dosing delay. Therefore, the PI controller freezes for a brief period ("PI" display in seconds).

A negative jump in the flow rate causes the setpoint to be briefly exceeded due to the running time of the positioner and the dosing delay. Therefore, the PI controller freezes for a brief period ("PI" display in seconds).

The PI controller is not deactivated if the flow rate is continuously rising or falling if the dosing rate can quickly adjust to these changes. This is true of fast positioner running times and loops without dosing delay.

Special Functions

- The control direction can be switched.
- Automatic determination of the control parameter using the integrated fuzzy module. The fuzzy module determines the control parameter from the embedded Tconst and Tvar process times.
- The setpoint can be switched between internal and external
- Ypi stop function during a change in control variable
- Control variable Wq available optionally as proportional or indirect proportional as well as factor adjustment
- Smooth switch from compound-loop-control to single feed forward control or single feed back control via digital input 1, 2 or 3 available

$$\mathbf{Yout = Wq \times (DF_{Wq} + ek \times Kp \times (1 + t/tn)) \times Yout\text{-}factor}$$

Ratio — **Feedback control**

t	*Internal controller cycle time*
tn	*Integral action time*
Kp	*Control amplification 100 / Xp*
ek	*Setpoint-actual value control deviation*
DF_{Wq}	*Learned dosing factor for the current flow rate*
Wq	*Flow rate signal in %*
Yout	*Determined controller output value %*
Yout factor	*This factor offers the option to increase the dosing output if the setpoint is not reached with a dosing factor DF of 100 %.* *Setting range: 1.0– 4.0* *Factory setting: 1.0*

Note*:*
If this factor is increased, there is a danger that the setpoint value will also not be reached with a higher flow rate value, because the Yout value takes the value 100 % prematurely.

Determining combi-control process times

To adjust the control for compound-loop-control, the Tconst and Tvar process times must bet entered in the parameter menu path. These times refer to control loop dead times,which on the one hand are independent of the control variables, and on the other hand depend proportionally on the control variables.

The constant dead time< Tconst > (independent of control variable) consists of the control variable measurement dead time (measuring dead time) and possible dosing delays.

The variable dead time< Tvar > depends on the current control variable and is entered in the menu at a control variable of 100%.

The following calculation examples apply for the use of the MFC for flow-controlled chlorine dosing with chlorine overfeed correction (potable water control loop).

Determining the controlvariable independent dead time Tconst

The control variable independent dead time Tconst consists of the measuring dead time and the dosing dead time.

Calculating the measuring dead time

Calculation 1:

The sample water is extracted right after the mixture loop and fed to the measuring cell.

The sample water dead time depends on the nominal diameter and length of the sample water line and the flow rate to the measuring cell. A flow rate of 36 l/h is assumed for the DEPOLOX® 5 measuring cell.

The following equation applies to the DEPOLOX® 5:

$t_{mw(DEPOLOX® 5)} = (d_{mw} \times d_{mw} \times l_{mw}) : 7.65$ (result in min)

In general, this equation applies:

$t_{mw} = (4.71 \times d_{mw} \times d_{mw} \times l_{mw}) : Q_{mw}$ (result in min)

d_{mw} = Internal diameter of the sample water line in cm
l_{mw} = Length of the sample water line in meter
Q_{mw} = Flow rate to the measuring cell in l/h

Example

As a DN6 the sample water line is 10 m long and connected to a DEPOLOX® 5 chlorine measuring cell.

$t_{mW} = (0.6 \times 0.6 \times 10) : 7.65$ min = 0.47 min, (i.e. approx. 28 sec.)

Calculation 2:

The sample water is extracted using an additional sample water pump (bypass line).

Sample water dead time depends on the flow rate of the sample water pump, nominal diameter of the bypass line and its length up to the sample water branch pipe to the measuring cell.

$T_{by} = (4.71 \times d_{by} \times d_{by} \times l_{by}) : Q_{by}$

d_{by} = Internal diameter of the bypass line in cm
l_{by} = Length of the bypass line from the sample water extraction point to the sample water branch pipe to the cell in m
Q_{by} = Flow rate to the bypass pump in l/h (result in min)

Check whether the length of the sample water line to the measuring cell can be neglected. If so, establish the sum from calculation 1 and 2.

Calculation 3:

The sample water distraction is carried out as in calculation 1 and/ or 2. To increase the exposure time, the sample water is also sent through a delay tank.

The exposure time in the delay tank must be added to the calculated time.

Determining the dosing dead time (dosing delay)

Dosing dead times arise from long dosing lines and positioner running times.

Calculation 1:

Determining the dead time based on dosing line length

The dosing dead time can be determined as follows:

t_{dos} = (4.71 x d_{dos} x d_{dos} x l_{dos}) : Q_{dos} (result in min)

d_{dos} = Internal diameter of the dosing line in cm
l_{dos} = Length of the dosing line in m
Q_{dos} = Dosing line flow rate in l/h

Calculation 2:

If rapid control variable changes are expected in the system, which the dosing equipment cannot adjust to (e.g. positioner running times, dosing pump cycle times), the dosing delay time should be assumed under all circumstances to be half of the positioner running time ty or the cycle time tp.

At a positioner running time of 80 seconds, a value of approx. 40 s should be assumed as the constant dosing delay.

The sum of the measured dead time and the dosing delay is displayed in the< Tconst > menu in minutes.

Determining the control variable dependent Tvar dead time

The control variable dependent Tvar dead time depends on the nominal flow rate, the internal diameter of the line and the distance between where the chlorine is added and the sample water extracted.

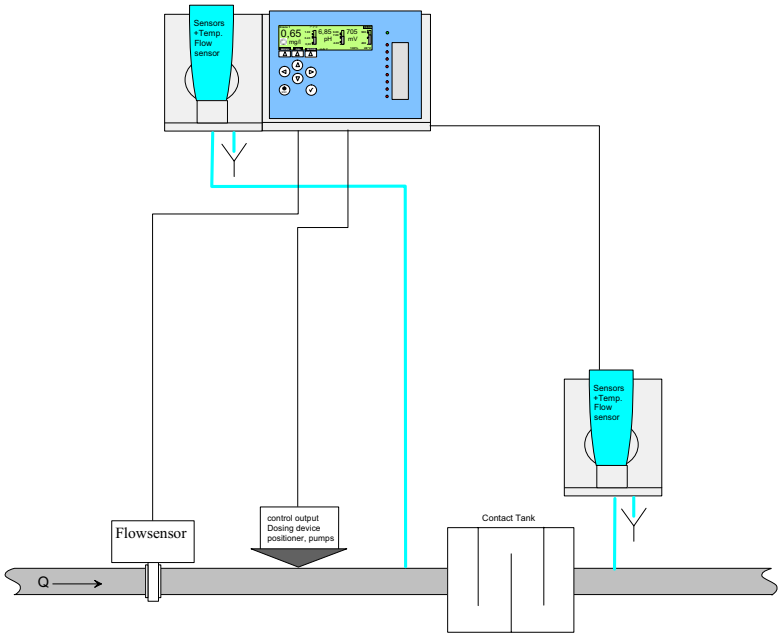
t_{var} = (d_{pipe} x d_{pipe} x l_{pipe}) : (212.3 x Q_{nom}) (result in min)

d_{pipe} = Internal diameter of the pipeline in cm
l_{pipe} = Distance between where chlorine is added and sample water extracted in m
Q_{nom} = Nominal flow rate in m^3/h (reflects the flow rate, which is preset for the controller as 100% flow signal

If there are special reaction tanks in the system, they must be treated separately.

4.5.4 Setpoint Trim

This controller type consists of a compound-loop-control with adaptive setpoint. A second measurement controls possible controldeviations, which, for example, arise as a result of attrition in the delay tank. The compound-loop-control's adaptive setpoint adjustment automatically equalises control deviations developing in the system.



Input signals:

- Flow measurement (0/4–20mA, 0–10V) scalable
- Measured variable 1 compound-loop-control (Sensor module 1 - Cl_2, pH, mA, –)
- Measured variable 2 control measurement (Sensor module 2 - Cl_2, pH, mA, –)

The following requirements must be met:

Measured variables 1 and 2 must be equal measurements with the same unit. The format (e.g. 00.00, 0000, 000.0) must be identical as well.

The measuring range may differ (e.g. mod. 1 = 10.00 mg/l, mod. 2 = 5.00 mg/l).

When using different sensor measuring modules (e.g. Cl_2 = Mod1, mA/V = Mod2), the measuring ranges must be adjusted accordingly.

The measuring ranges must be adjusted as well when transmitting the second measurement using a CAN interface instead of module 2.

Example: Module 1 = Cl_2 free with 1.00 mg/l measuring range
Module 2 = Cl_2 free with 1.00 mg/l measuring range

Only internal setpoint possible.

Output parameter:

- Dosing pump
- Solenoid pump
- Positioner with feedback 1kOhm/5kOhm
- Continuous

How it works

The control circuit 1 operates as the compound-loop-control (see 4.5.3 “Compound-Loop-Control" on page 81). All settings for module 1 must also be made as described under compound-loop-control.

The actuator output is based on the same calculation as the compound-loop-control.

In addition, the compound-loop-control setpoint may be optimised depending on the need.

Yout = Wq x (DF + ek x Kp x (1 + t/tn)) x Yout-Factor
Ratio Feedback control

t	*Internal controller cycle time*
tn	*Integral action time*
Kp	*Control amplification 100 / Xp*
ek	*Setpoint-actual value control deviation*
DF	*Learned dosing factor*
Wq	*Flow rate signal in %*
Yout	*Determined controller output value %*
Yout factor	*This factor offers the option to increase the dosing output if the setpoint is not reached with a dosing factor DF of 100 %.* *Setting range: 1.0– 4.0* *Factory setting: 1.0*

Note*:*
If this factor is increased, there is a danger that the setpoint value will also not be reached with a higher flow rate value, because the Yout value takes the value 100 % prematurely.

A second measurement (sensor measuring module 2 or measured value obtained with CAN interface) is used to optimise the control and it detects possible control deviations, which, for example, arise as a result of attrition in a delay tank. The compound-loop-control's adaptive setpoint adjustment then optimises the setpoint, in order to eliminate existing control deviations.

The setpoint adjustment operates with a delay time that determines the setpoint trim function Tconst and Tvar as well as the flow rate using the process times. The flow must be constant during this delay, otherwise the time restarts.

Behavior in operation

Setpoint 1 = Compound-loop-control setpoint from module slot 1
Actual value 1 = Measured value from module slot 1
Setpoint 2 = Setpoint trim function setpoint from module slot 2
Actual value 2 = Measured value from module slot 2

The compound-loop-control of the measurement from module 1 controls the set setpoint 1 depending on the flow rate (see 4.5.3 “Compound-Loop-Control" on page 81). The setpoint has been reached if the actual value 1 is less that 5 % away from the measuring range of setpoint 1.

For example:

Setpoint 1 = 0.50 mg/l	Measuring range 1.00 mg/l
5 % of measuring range = 0,05 mg/l	=>"good range" = 0.45–0.55 mg/l

A delay time begins when the setpoint 1 is reached, after which the setpoint trim function is activated. This delay time depends on the Tconst. and Tvar delay times and the current flow rate. The smaller the flow rate, the longer the delay time.

Example:
Flow rate = 50 %
Tvar (at 100 % flow rate) = 2h:30min
Tconst = 2 min
=> Delay = 100 % / 50 % x Tvar + Tconst = 5h:02min

The setpoint trim compares setpoint2 with actual value2 once the time has expired and changes the compound-loop-control setpoint1 according to the following equation, if necessary:

New setpoint1 = setpoint1 + (setpoint2 - actual value2) x trim factor

If the flow rate changes, the delay time is reset.

The delay time is also restarted if the actual value1 is more than 5 % of the setpoint 1. The time starts again only after the 5 % range has been reached.

The delay time is always reset after an automatic setpoint change and only restarted once the setpoint range has been reached.

The following parameters must be set for this operating mode in menu (2):

- Band
- Change
- Xsh
- Tconst
- Tvar

Band This parameter describes the range within which the compound-loop-control setpoint 1 can be adjusted by the setpoint trim.

The Band corresponds to the measuring range in percent. The compound-loop-control setpoint may, therefore, move within the range of setpoint2 + Band or setpoint2 - Band.

Example:
Measuring range = 2.0 mg/l free chlorine
Setpoint 2 = 1.00 mg/l
Setpoint range = 20 %

The setpoint range of 20 % defined here corresponds to the measuring range, (i.e. 20 % of 2.00 mg/l = 0.40 mg/l). Therefore, the setpoint may move in the range of 0.60 to 1.40 mg/l.

If the setpoint trim function records a value outside this Band, the maximum or minimum value of the Band is entered (in this example: 0.60 mg/l and 1.40 mg/l).

Change This parameter describes the modification factor, by which the compound-loop-control setpoint 1 should change in the event of a control deviation. The value corresponds to the control deviation in percent.

Example:
Measured value = 0.60 mg/l free chlorine
Setpoint = 1.00 mg/l
Change = 50 %
Error = 0.40 mg/l

The setpoint is increased by 0.20 mg/l, which reflect 50 % of the error.

Xsh This parameter describes a neutral range for the measured value of module2 and is indicated in percent on the measuring range end value. If the measured value in module2 is within this range around the setpoint, the setpoint trim function is inactive. If the measured value of module2 is outside this neutral range, the setpoint trim function is active and optimises the setpoint of module1.

Determining the setpoint trim function

To adjust the control for the setpoint trim function, the Tconst and Tvar process times must bet entered in the setpoint trim menu. These times refer to control loop dead times, which on the one hand are independent of the control variables, and on the other hand depend proportionally on the control variables.

Tconst Menu 2

The constant dead time "Tconst" for the setpoint trim is the sum of the module 2 measurement dead time and possible dosing delays during the compound-loop-control.

For the calculation, see “Determining combi- control process times" on page 84.

Tvar Menu 2

The variable dead time "Tvar" depends on the current flow rate control variable, the internal diameter of the line and the distance between where the chlorine is added and the sample water extracted.
Tvar is entered in the menu for a control variable at 100 % (flow rate = 100 %).

Tvar determination procedure

Enter flow rate Wq between 50 % and 100 %.

Set manual dosing rate and start the dead time measurement at the same time.

Wait until the actual value2 adjusts to the dosing rate and remains constant.

Stop elapsed measuring time.

Calculate as follows:

Tvar = (measuring time - Tkonst) x 100 % / flow rate Wq %

4.6 Controller Outputs

Controller types

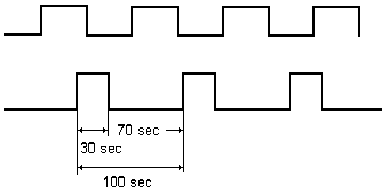
Controller for	Type	Parameter description	Action
Positioner with feedback	3-point	Positioner with Ym	Dosing ↑ or ↓
Positioner without feedback	3-point	Positioner without Ym	Dosing ↑ or ↓
Motor dosing pump (pulse duration controller)	2-point	Dosing pump 2p	Dosing ↑ or ↓
2 Motor dosing pumps (pulse duration controller)	3-point	Dosing pump 3p	Dosing ↑ and ↓
Pulse pump (pulse frequency controller)	2-point	Pulse pump 2p	Dosing ↑ or ↓
2 pulse pumps (pulse frequency controller)	3-point	Pulse pump 3p	Dosing ↑ and ↓
Dosing pump with mA-input	2-point	Analog output 2p	Dosing ↑ or ↓
2 dosing pumps with mA-input	3-point	analog output 3p	Dosing ↑ and ↓
Dosing contact	2-point	Enable contact	Dosing ↑

Positioner (with and without feedback)

With the selection of the integrated controller for "positioner", for example, it is possible to use chlorineoverfeed control in connection with a positioner as dosing equipment in a chlorinator.

2-point pulse duration controller for dosing pumps

The dosing pump is switched on for the calculated time within an adjustable cycle period TP (relay contact). The cycle period is mainly determined by the reaction time of the connected system and entered as the cycle period TP.



Example:

Cycle period TP =	100 s
Output value Yout =	30 %
Duty cycle	30 s
Off duty cycle	70 s

2-point pulse frequency controller for pulse pumps

Pulse pumps are controlled with 0 to 100 or 0 to 120 pulses per minute, depending on the specification of the connected pump.

The duty cycle during each dosing is 0.3 s. The break time is calculated between 0.2 and 60 s depending on the dosing rate.

Example for a solenoid pump with 120 pulses/min.:

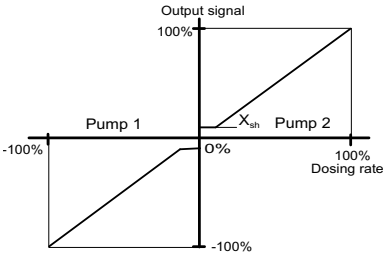
Yout in %	100...	84...	72...	56	50...	33...	25...	10...	5...	10
Pulses/min	120...	96...	85...	75	60...	40...	30...	12...	6...	10

3-point pulse duration controller for dosing pumps and 3-point pulse frequency controller for solenoid pump

Pump 1 decreases the control value.
Pump 2 increases the control value.

The control range is between -100 % (pump 1) and +100 % (pump 2); this range can also be set in manual mode.

If the setpoint = actual value, no pump is activated (neutral zone Xsh).



Output signals as for 2-point pulse-duration controller and 2-point pulse-frequency controller.

Dosing contact for OSEC-A

A special controller is required for controlling electrolyte devices, which prevents excessive activation/deactivation (caused by electrolyte device response times).

This controller output, therefore, uses a minimum duty cycle as well as a switching hysteresis to minimise the switching cycles.

If the value falls below the specified Cl_2setpoint minus hysteresis (e.g. setpoint 0.50mg/l - hysteresis 0.05 = 0.45mg/l), the controller output switches on.
The controller output remains active for at least the set minimum duty cycle. If the setpoint is exceeded and the minimum duty cycle has expired, the contact switches off.

The minimum duty cycle is ignored in manual mode.

Controller with mA output

The MFC has up to four analog mA outputs. These can be assigned individually as registration or controller outputs.

If module 1 dosing "analog output 2p" or "analog output 3p" is selected, the mA output 1 is permanently assigned.

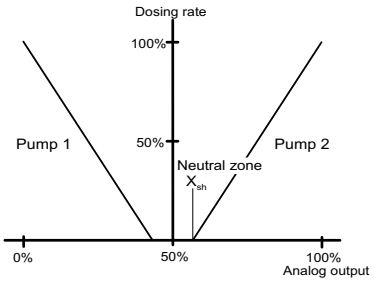
If module 2 dosing "analog output 2p" or "analog output 3p" is selected, the output 2 is permanently assigned.

Analog output controller 2-point

With a controller output of 0 %, the output current is 0 or 4 mA; with a higher controller output, the output current reaches up to 20 mA. Pumps with current input, thyristor controllers with DC or 3-phase pumps or analog control valves can be used as dosing equipment.

Analog output controller 3-point

Pump 1 decreases the control value.
Pump 2 increases the control value.



Output behaviour similar is similar to "analog output controller (2-point)", but with 50 % offset. This means that with a control deviation of 0 % (setpoint = actual value) a current of 10 or 12 mA is output (pump is idle).

Setting	Signal	Pump	Signal	Pump
0–20 mA	0–20 mA	Pump 1	10–20 mA	Pump 2
4–20 mA	4–20 mA	Pump 1	12–20 mA	Pump 2

Therefore, 2 suitable pumps can be controlled with one mA current loop.

4.7 Control Parameters

Control parameters and setting values for determining the control functions of a controller. Different parameters apply for each controller type.

Please note

The control parameters are listed alphabetically.

Pulses max./min

Meaning:
Maximum number of pulses

Explanation:
The pulses max./min parameter only applies to solenoid pumps.

This parameter is used to set the maximum number of pulses per minute in accordance with the employed pump.

Setting range:
The pulses max./min parameter can be set at either 100 or 120 pulses.

Setpoint

Specified value at which the control variable can be maintained by the controller. The setting range corresponds to the respective measuring range.

Tn

Meaning:
Integral action time (I-element)

Display:
Minutes (min)

Explanation:
On the basis of the integral action time Tn, the dosing rate changes constantly until the setpoint is reached. The higher the value of Tn, the longer it takes until the controller increases the dosing rate.

Tn higher: Control response is slower
Tn lower: Control response is faster

Setting range:
The parameter Tn can be set from 0–100 min (Tn = 0 means that the "I-element" is deactivated, i.e. a pure P-control response applies). It may not be possible to reach the setpoint value.

T

Sampling time T is the time after which a change controlvariable or setpoint is responded to. This value must be adjusted in the case of delayed feedback signals.

Tp Meaning:
Cycle period

Display:
Seconds (s)

Explanation:
The parameter Tp only applies to dosing pumps.

The cycle period Tp defines a switching period, which must be coordinated with the respective pump type.

Setting range:
The parameter Tp can be set from 10–180 s.

Example:
Fast dosing pumps correspond to a low Tp; slow dosing pumps correspond to a high Tp.

The control parameter Tp must always be adjusted to suit the pump employed:

Dosing pump strokes/min	**up to 20**	**20-40**	**40-80**	**80-125**	**125-200**
Tp value	120	100	60	30	15

Ts Meaning:
Loop rise time

Display:
Minutes (min)

Explanation:
Time required to reach the measuring range end value with 100% dosing chemical supply (see 4.9 “Adaption" on page 104)

Setting range:
The parameter Ts can be set from 1 s – 8 h.

Please note

If the values Tu and Ts are manually modified, the control parameters Xp and Tn are re-calculated.

Tu

Meaning:
Loop dead time

Display:
Seconds (s)

Explanation:
Time required between dosing start and clear recognition of the rise in the control variable

Setting range:
The parameter Tu can be set from 1 s – 59 min 59s.

Please note

If the values Tu and Ts are manually modified, the control parameters Xp and Tn are re-calculated.

Ty

Meaning:
Running time of the positioner

Display:
Seconds (s)

Explanation:
The parameter Ty only applies to positioners.

Ty is the time which the positioner requires to adjust from 0 % to 100 %.

Setting range:
The parameter Ty can be set from 10–180 s.

Control direction

Meaning:
Direction of the control

Display:
Direct/inverse (e.g. for pH)

Explanation:
Defines which medium is used to perform the correction.

Example:

pH:	Control direction "inverse": Lowering pH-value by adding acid
pH:	Control direction "direct": Adding alkaline to raise the pH value

Xp

Meaning:
Proportional factor

Display:
Percentage (%) with factor

Explanation:
The control amplification is determined with the proportional factor.

The lower the proportional factor Xp is selected in % , the greater the deviation from the setpoint is amplified, and the more quickly the controller attempts to control the deviation from the setpoint.

The control amplification factors is calculated using the following formula:

Factor = (1/Xp) x 100 %

Setting range:
The parameter XP can be set from 1 % (factor 100) – 1000 % (factor 0.1).

Xsh

Meaning:
Neutral zone

Display:
Percentage (%)

Explanation:
The parameter Xsh only applies to 3-point controllers.

No controller output occurs in the neutral zone.

Setting range:
The parameter Xsh can be set from 1–5 % (depending on the measuring range).
The neutral zone is the defined range of setpoint + X_{sh} to setpoint X_{sh}.

Yout-factor

Meaning:
Multiplication factor for dosing output

Setting range:
The parameter Yout factor can be set from 1.0 – 4.0.

Explanation:
If the dosing factor 100 % is not sufficient, the parameter Yout factor is used to increase the dosing output. The parameter is available with compound-loop-control and single feed forward control.

Ymax

Meaning:
Dosing rate limitation
(single feedback control-loop control only)

Display:
Percentage (%)

Explanation:
The parameter Ymax only applies to:

- Positioner with feedback
- Dosing pumps
- Solenoid pump
- Controller with mA output

Ymax defines the maximum control output to the actuator

The control parameter corresponds to electronic dosing limitation of the actuator.

Setting range:
The parameter Ymax can be set from 0–100 %.

Ymin

Meaning:
Dosing rate basic load
(single feedback control-loop control only)

Display:
Percentage (%)

Explanation:
The parameter Yminonly applies to:

- Positioner with feedback
- Dosing pumps 2p
- Solenoid pumps 2p
- Controllers with mA output 2p

A basic dosing rate is output to the actuators with Ymin.

Setting range:
The parameter Ymincan be set from 0–100 %.

Please note

Ymin and Ymax is only available for the single feed back control.
The control range is limited by the parameters Ymax and Ymin.
Do not select a Ymax value lower than Ymin.
At Ymin > 0 overdosing can occur.

Ym calibration

This parameter is only possible for dosing output positioner with feedback.

Adjust the positioner feedback signal to 0 % and 100 % dosing rate. When automatic Ym calibration is started, the positioner moves to positions 0 % and 100 % and calibrates both positions with the MFC.

For manual calibration of the 0 % and 100 % positions, both positions must be shifted to manually and saved in the menu using the enter key (Ym calibration 0 %, Ym calibration 100 %).

Flow rate source

This parameter is only available during single feed forward control of module 1.

This parameter switches off the flow input (off) and activates the flow rate signal for the single feed forward control (factory setting = flow measurement) as control variable.

The parameter must be set to "Flow Measurement" for quantity-proportional dosing.

Flow direction

This parameter determines the direction of the flow rate signal directly proportional to the actuator output:

Direct = flow rate input signal directly proportional to actuator output (factory setting)

inverse = 1 flow rate input signal

Example: 0–100 % flow rate = 0–20 mA (direct)
0–100 % flow rate = 20–0 mA (inverse)

Control variable 2

This parameter activates and deactivates a second control variable during the single feed forward control.
If "Control Variable 2" = measured value X is selected, this influences the actuator output. The setting "Off“ indicates this control variable is inactive (factory setting) (see 4.5.1 “Single Feed Forward Control" on page 77).

X direction

Determines the direction of the second control variable during the single feed forward control.

Direct = measured value directly proportional to the actuator output

inverse = actuator output indirectly proportional to measured value(factory setting = direct)

X factor

This parameter is only available during single feed forward control, control variable 2 = measured value X.

Determines an adjustment factor, how strongly the measured value influences the actuator output (factory setting 1.0).

Tconst Defines the constant dead time in the compound-loop-controller loop. Consists of the sample water line dead time and the dosing delay time (for the calculation, see 4.5.3 “Compound-Loop-Control" on page 81).

Tvar Defines the variable dead time in the compound-loop-controller loop. The time to be entered is based on 100 % flow rate (for the calculation, see 4.5.3 “Compound-Loop-Control" on page 81).

Max.lin.Corr This parameter monitors changes to already learned dosing factors.
If new dosing factor changes are learned, which are larger than the max. linearity correction, this dosing factor is used for all values in the dosing curve = > initialisation of the curve.

Max.lin.Corr. = 0: No curve function; only one dosing factor for all flow rates.

Example:
Max.lin.Corr. = 50 % (based on dosing factor):

Previous dosing factor:	30 %
Newly learned dosing factor:	48 %
max. permissible correction range:	30 ± (50 % from 30 %) = 30 % ± 15 %
Change in this case:	48 % - 30 % = +18 %

=> The new dosing factor is assumed for the entire curve because the new dosing factor (+ 48 %) is greater than the max.lin.Correction (+18 %).

Control factor Setting the ratio of control range and measuring range, in order to adjust the control amplification Xp to the process.

Control factor=
(End of measuring range - start of measuring range): Control range

Example:

Start of measuring range:	pH 4
End of measuring range:	pH 9
Max. process control range:	± 1 pH (=> 2 pH increments) => Control factor = (9 - 4) : 2 = 2.5

4.8 Alarms

The alarms are output via relay contacts and the red LED. The number of up to eight alarms is stipulated in the application.

Each alarm can be assigned the following functions:

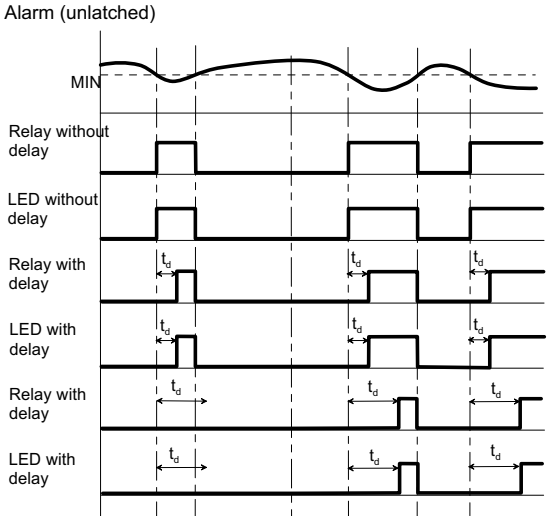
- Limit value = Min — All measured values individually selectable Cl_2, pH, mV, Cl-N, conductivity, etc.
- Limit value = Max — All measured values individually selectable Cl_2, pH, mV, Cl-N, conductivity, etc.
- Digital inputs — 1 to 3 can be selected individually
- Error

The type of alarm can be selected in the "Alarms" menu in the displays "Alarm ... Functions" (display 1.6.1 and 1.6.2“Alarm - Menu 1.6" on page 139) There are three types of alarm.

In all alarm types the response can be influenced by entering a delay (td) (refer to the diagrams in this chapter).

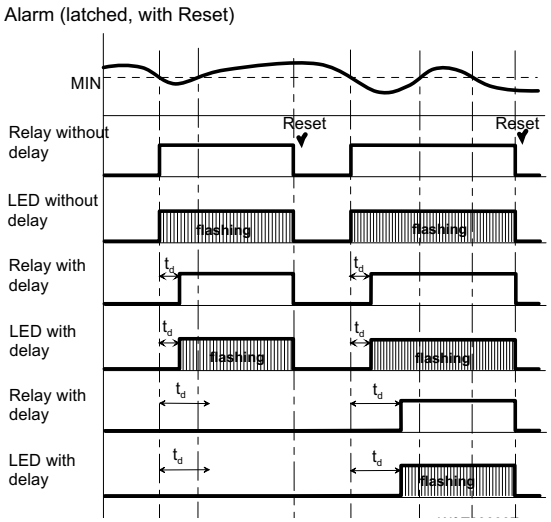
Unlatched alarm without acknowledgement option (N.O. unlatched N.C. unlatched)

The LED lights up in the event of an alarm and goes out automatically when the alarm conditions are eliminated. The same applies for the contact.



Latched alarm with reset acknowledgement option (N.O.latched N.C.latched)

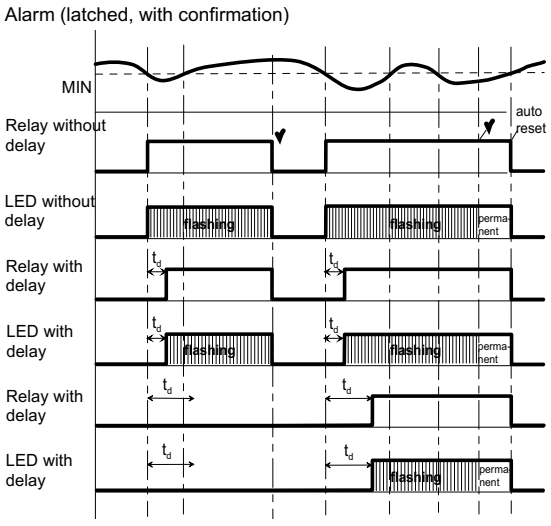
The LED flashes in the event of an alarm until the alarm is acknowledged. The LED goes out, also if the set alarm conditions still apply when the alarm is acknowledged.



Latched alarm with confirmation (acknowledgment option) (N.O. latched ack) N.C. latched ack)

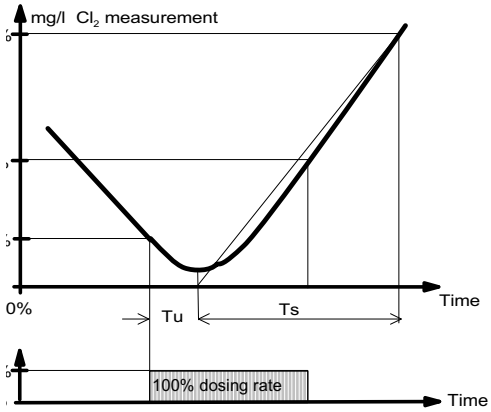
The LED flashes in the event of an alarm until the alarm is acknowledged.

- If the alarm condition no longer applies when the alarm is acknowledged, the LED goes out.
- If the alarm condition still applies when the alarm is acknowledged, the LED resets from flashing to permanent illumination. The LED lights up until the alarm condition is eliminated (auto-reset).



4.9 Adaption

This only applies to Cl_2 single feed back control module 1 and 2.



Use

Adaption is used for automatic determination of the reaction times of the control loop (loop dead time Tu and loop rise time Ts) or the resulting control parameters Xp and Tn.

Please note

The control parameters Xp and Tn determined by adaption must be regarded as a recommendation for commissioning! The control parameters Xp and Tn can be manually optimised for maximum control quality.

Requirements

- Positioner set to automatic (manual wheel engaged) Dosing pump to automatic
- Calibrated Cl_2 measurement (zero point and DPD value)
- Loop dead time < 60 min
- Loop rise time < 480 min (8 h) for 0–100 % measuring range
- Decomposition time < 480 min (8 h) of the current value to 20 % of the measuring range
- Correct menu setting of the end value, control direction (direct or inverse), actuator (e.g. positioner), positioner running time (Ty)

Adaption may not be started:

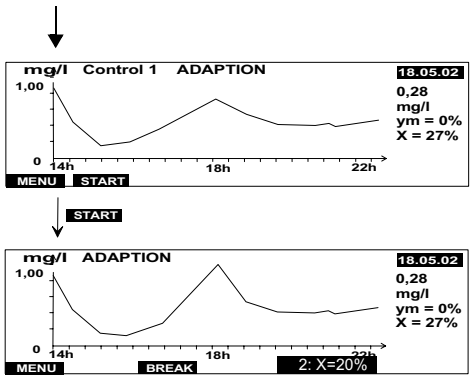
- If a large volume of fresh water is added
- If the chlorine sensor has not been run in
- During cleaning work
- During filter backwashing
- When the circulation changes
- If there are flow rate fluctuations

Starting Adaption

1 Starting from the basic display, select "Adaption" from the "Cl_2free ( )" menu.
The Tu and Ts loop parameters are displayed.

2 In the "Cl_2 Adaption" menu, select the "ADAPT softkey.
This displays the diagram of the previous adaption.

3 Press "START" to start the adaption.
Adaption starts.



Displays

The diagram shows the chlorine value curve during the adaption phases.
The current phase of adaption (total of 13) is shown in the bottom line.

Successful adaption is confirmed by the "ADAPTION OK" message.

Press the "BACK" softkey to return to the basic display.

If adaption is not successful, the error message "ADAPTION?" is displayed.

Adaption sequence

Each adaption phase is then displayed with a status message:

Display text	Explanation
"0: Init“	Start
"1: Ym = 0 %“	Chlorinator to 0 % or dosing pump off
"2: X = 20 %“	Delay until actual value < 0.2 x end value
"3: Ym = 100 %“	Chlorinator to 100 % or dosing pump on
"4: Ym = 100 %“	Wait until the chlorinator reaches 100 %
"5: Tu! "	Start dead time measurement
"6: Tu! "	Measurement of the loop dead time Tu
"7: Tu Check“	Plausibility enquiry dead time
"8: Init Ts“	Start of rise time measurement
"9: Ts "	Measurement of the loop rise time Ts
"10: TS "	Calculate control parameters
"11: Y = 0 %“	Chlorinator to 0 % or dosing pump off
"12: Y = 0 %“	Wait until the chlorinator reaches 0 %
"13: Adaption OK“	End

Various status messages can be output, depending on the selection of the actuator. Different status messages also have different execution times. It is possible that several status messages are only displayed briefly or not at all if the execution time is very short.

Caution!

Adaption can take up to 13 hours, depending on the control loop. During this time no errors should occur on the control loop (e.g. filter backwashing, changes in the circulation or widely fluctuating number of visitors).

Please note

The adaption procedure can be terminated at any time with "STOP". The previously set parameters remain unchanged.

Completing adaption without errors

When the loop times (dead time Tu and rise time Ts) has been completed without errors, calculation of the control parameters Xp and Tn commences. This is indicated by the message "Adaption OK". The calculated parameters are entered into the menus. When adaption has been concluded, the measuring amplifier adjusts with the newly calculated control parameters and continues in the selected operating mode (e.g. automatic).

These are entered into the "Tu" and "Ts" menus to monitor the determined loop times.

If errors occur in the control loop during adaption, incorrect loop times and therefore incorrect control parameters can be determined.

Caution!

The remaining control parameters Ymin, Ymax and Tp are not influenced when adaption is performed. The control parameters Xp and Tn are determined for Ymin = 0 % (no basic load) and Ymax = 100 % (no dosing rate limitation). If a basic load Ymin or dosing rate limitation Ymax be required for specific system requirements, it must be taken into account that the control loop is restricted as a result. There is then the risk of excessive chlorination (Ymin too high) or inadequate chlorination (Ymax limits excessively).

Completing adaption with error

If errors occur in the control loop during adaption (e.g. filter backwashing, changes in the circulation or widely fluctuating number of visitors to the pool) or if the reaction times of the control loop are too long, adaption is interrupted.

Possible error conditions:

Initial value not reached (Display: "T = > 8h")
When adaption has started and the dosing system has closed or the dosing pump has switched off, the measuring amplifier waits until the actual value has dropped below the initial value (0.2 x the measurement range value). This delay is indicated by the message "2: X = 20 %" and the maximum permissible time is 8 hours.

Loop dead time too high (Display: "Tu = > 1h")
The value determined by the time measurement between starting up the dosing, switching on the dosing pumps and the rise of the actual value may only take a maximum of 1 hour. This measured time is displayed by "6: Tu!"

Loop rise time too high (Display: "Ts = > 8h")
The time is determined by a measurement, which the control loop requires at a 100 % dosing rate of the dosing system or the dosing pump, to increase the actual value to 50 % of the measuring range. This measurement is indicated by the message "9: Ts!" and may take up to 4 hours.

If any of the error conditions described above occur, adaption is interrupted. The measuring amplifier indicates an error message. The "old" parameters Xp and Tn are not changed.

Determination of the control parameters with known Tu and Ts times

If the loop times Tu and Ts are already known or if these cannot be determined automatically due to specific system conditions, the loop times can be entered into the "Tu" and "Ts" menus. When Tu or Ts are saved, the control parameters Xp and Tn are also calculated and entered into the menus.

4.10 Interfaces

Various interfaces are available to externally link the MFC.

RS232

The RS232 interface serves to connect:

- A laptop or PC for a Firmware update
  (Download the latest firmware version with an update program and update instruction from the homepage (www.evoqua.com Matching RS232 connecting cable: Ref. W3T164565).
- A printer

Specification of the RS232 interface for printer operation:

- Data transfer 9600 baud
- Parity even
- Word length 8 bit

A log is printed for eachday (see “Log printout" on page 109).

Daily log

Each daily log consists of:

- Log header
- Line diagrams
- Release of daily min. and max. values

Log header

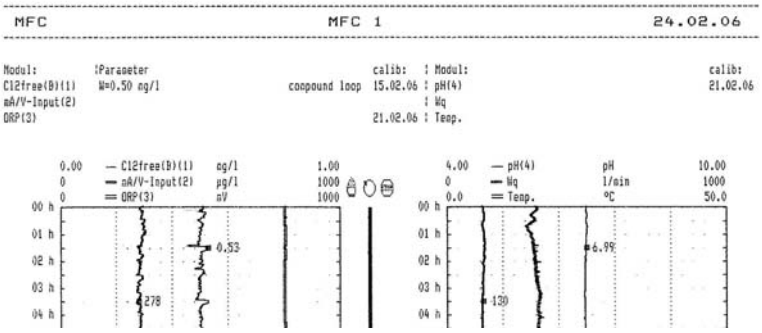
The supplied measurements and the corresponding parameters are printed in the log header. The date of the last calibration is also documented.

Trend Graphs

This prints the trend graphs including the measuring ranges and the current operating mode as a bar graph. Trend graphs are recorded in one-minute intervals.

The daily min. and max. values per measurement are printed at the end of the log.

Log printout



Please note

The maximum cable length between the interface and the printer may not exceed 15 m.

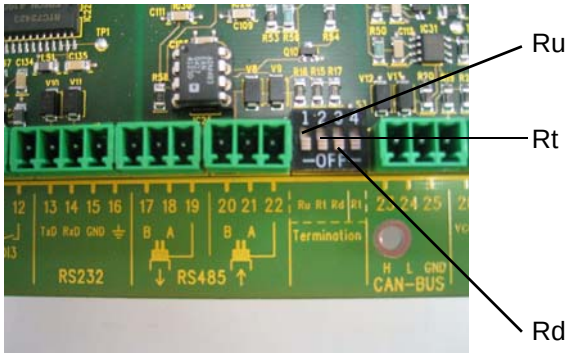
To print logs, we offers the RS232 log printer as an accessory as well as the 3 m and 15 m printer connecting cable. The printer includes setup instructions.
Refer to 8. “Complete Devices, Retrofit Kits and Spare Parts" on page 215.

RS485

The RS485 interface provides connectivity to:

- Web technology via Wallace & Tiernan ChemWeb server
- Higher level visualisation systems through OPC Server Data Access V2.0
- Visualisation systems under Windows TM via Wallace & Tiernan CMS software 3.0
- SECO S7

The MFC RS485 interface is electrically isolated. To integrate into a Wallace & Tiernan bus system, four terminal strips, a terminating resistor Rt and
balancing resistor R_u and R_d are integrated into the MFC.



Please note

Information on the RS485 interface can be requested separately.

Remote calibration with the P42 i-cal via infrared interface

The IRDA infrared interfaces is used for remote calibration of chlorine and pH measurement with Wallace & Tiernan infrared photometer P42 *i-cal* (see instruction manual Photometer P42 *i-cal* l).

The P42 *i-cal* device can only transmit data to the MFC if the chlorine measuring unit is selected as mg/l or ppm. If the unit is selected as µg/l or ppb, remote calibration is not supported.

4.11 CAN interface

The CAN interface of the MFC serves to control CAN actuators such as V10K with CAN interface or dosing pumps with CAN interface, for example.

Individual measured values can also be transmitted to other measuring and control systems using the CAN bus, e.g. SFC measuring system for Cl_2 tot./Cl_2 free for displaying the combined chlorine or SFC-Cl_2++ with pH value input via CAN bus.

The second control measurement can also be imported with the CAN interface and the setpoint trim application.

The CAN interface of the MFC is electrically isolated. For connection to a Wallace & Tiernan CAN bus system, three terminals and a terminating resistor Rt are integrated in the MFC.

The CAN bus is wired from station to station as a two-wire bus. The cable of type 1x 2x0.75 mm^2 (part. no. W3T168568) is used as the installation cable. Stub cables are not permitted.

Do not exceed the maximum line length of 1000 m. The CAN bus is divided into max. 31 segments. In every segment, there can only be one CAN master. All devices communicating with one another must be operated in the same segment.

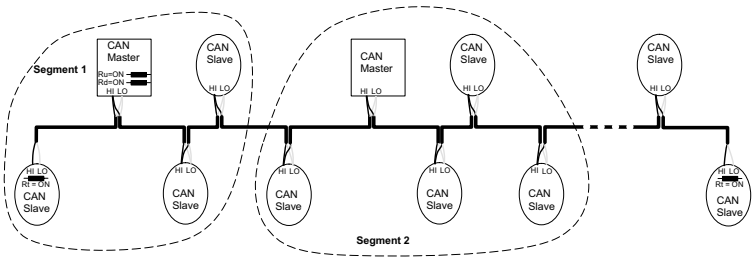
Setting parameters: Segment address 1...31

CAN address for actuator 0...31

The bus master in the segment is responsible for controlling the actuators. The bus master is, for example, MFC, SFC.

CAN slaves include, e.g., dosing pumps with CAN interface, V10K with CAN interface.

CAN bus structure



Picture1CAN-Bus

Please note

This CAN interface is not compatible with CAN Open or other CAN systems.
Only CAN nodes with a Wallace &Tiernan compatible software protocol may be integrated in this CAN system.

To illustrate the CAN functionality, two examples for CAN applications are listed below:

Example 1:
An MFC (master) is operated with a CAN actuator dosing pump in a CAN installation.

Both units must be operated in the same segment. In the following example, segment 1 is used, it could, however, be any segment from 1 - 31.
The following device settings are required:

MFC:	
Menu - Input/Output - Interface - "CAN segment":	1
Menu - Cl_2 free - Actuator - "Dosing output":	CAN-Bus actuator
Menu - Cl_2 free - Actuator - "CAN address":	2

CAN dosing pump:	
Menu - Configuration - CAN Bus	√
Menu - Configuration - Segment address	1
Menu - Configuration - Slave address	2
Menu - Configuration - Bus termination	- (only with the last and first units of the bus installation √)

Example 2:

An MFC-Cl_2++ (master or slave) is installed with an MFC pH in order to compensate the chlorine measurement with the pH value. In this application, both units need not be operated in the same segment. In the following example, segment 1 is used and the following settings must be carried out.

SFC-Cl_2++:	
Menu - Input/Output - Interface - "CAN segment"	1
Menu - Cl_2++ - Measuring range - "CAN address pH""	2

MFC-pH:	
Menu - pH - Meas.range ⇨ "CAN seg. MV->“	1
Menu - pH - Meas.range ⇨ "CAN addr. MV->"	2

Example 3:

An SFC-Cl_2 is installed with an MFC setpoint trim. The Cl_2 measurement is transmitted from the SFC to the MFC via CAN. The following table lists possible settings for the MFC and SFC. The measurements are transmitted in segment 1 to address 2.

MFC-Cl_2:	
Menu - Input/Output - Interface - "CAN segment":	1
Menu - Mod 2 - Meas.range - "CAN addr.MV"	2

SFC-Cl_2:	
Menu - Input/Output - Interface - "CAN seg. MV->“	1
Menu - Input/Output - Interface - "CAN addr. MV->"	2

A bus end (bus termination Rt) must be installed at the first and last units in the bus. The MFC is equipped with a RT dip switch. Other units (dip switch number 4 on switch block between terminals 22 and 23) require a menu setting that activates the bus termination. Balancing of the CAN bus must take place once in the CAN bus. However, the MFC does not offer this option.

4.12 Special Features

Temperature measurement

If a temperature measurement is not integrated into the sensor measuring module (DES), the PT 1000 temperature measurement is automatically used from the mother board for temperature compensation. This can also be switched off in the "Temperature" calibration menu. This generally switches off the PT 1000 temperature compensation for all sensor measuring modules.

If a temperature measurement is integrated into a sensor measuring module for chlorine, it is automatically used for compensation.

You can select between options for manual, permanently set temperature value or temperature measurement with PT 1000 on the motherboard for compensation in the calibration menu for pH. If the PT 1000 measurement of the mother board is switched off, only a manual value may be set for compensation.

Calculated measured value displays

Cl_2++ measurement

The pH dependency of the chlorine measurement is compensated if the pH value fluctuates within the range of pH 6.00 to pH 8.75. This function is only guaranteed to a max. 10 mg/l free chlorine.

If free chlorine measurement is equipped with a DEPOLOX® 5-measuring cell as well as a pH measurement, it is possible to select this measured value display as Cl_2^{++}-measurement in the "Meas Range" - "Sensor Type" menu. The corresponding pH measurement can be selected for pH compensation of this Cl_2.

This function is not available for mA/V sensor measuring modules.

Combined chlorine display

If a total chlorine measurement as well as free chlorine measurement installed, it is possible to display the combined chlorine value. To do this, set the display to "CI-comb" in the total chlorine measurement "Meas Range" - "Sensor Type" menu. The corresponding free chlorine measurement is then assigned in the "CI2 Free Ref" menu, in order to be able to determine the difference (CI-combined) between the total chlorine and the free chlorine.

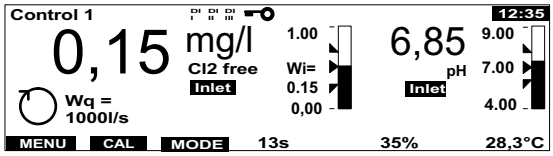
This function is not available for mA/V sensor measuring modules!

5. Operation

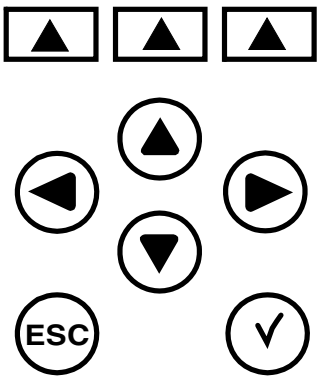
5.1 Display and Operator Controls

Graphic display and operating panel

All information is shown on the graphic display.



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



The exact depiction of the individual parameters on the graphic display is described in chapter 5.3 “Menu structure" on page 122.

Indicators

CONTROL 1 System name (Entered under "System" - "Common" - "System name")

DI I DI II DI III Digital inputs 1, 2, and 3 active
The symbols indicate that a function has been selected for the digital signal and that a signal is applied.

Password active
The defined password must be entered to permit modification of parameters and for calibrating the device.

Time

"AUTO" operating mode active
The control unit is running in automatic mode.
Dosing is performed automatically.

"MANUAL" operating mode active
Dosing can be set manually.

"System stopped" operating mode
Dosing is switched off.

"Adaption" operating mode is active during "Automatic" operation
Automatic determination of the control parameters for single feedback closed loop control is active.

"Adaption" operating mode is active during "Manual" operation
Automatic determination of the control parameters for single feedback closed loop control is active.

Bar graph
This indicates a measured value, the measuring range (column height), limit values (◣ and ◤) as well as the setpoint, Wi (internal setpoint), We (external setpoint), Di (internal setpoint), De (external setpoint) (▶).

Softkeys	Current softkey assignments.
BREAK	Stop the adaption procedure.
SELECT	Select one or more options from the list provided.
CHANGE	Change the operating mode.
ENTER	Confirm your selection.
CAL	Select the "Calibration" menu.
LOCK	Activate password protection.
MENU	Select a menu.
MODE	Select the "Mode" menu.
UNLOCK	Start deactivation of password protection.
BACK	Move up one level.
--->	Open next display.

	13s	Feed delay The time until dosing resumes after interruption.
	100%	Positioner feedback (Ym) If the display blinks, the positioner is in manual mode and cannot be activated.
	28.4°C	Sample water temperature
mA?	**1/5**	Error indication active (display bottom right) The system has detected an error. The error can be specified with the table in chapter 5.5 “Errors" on page 162. The number combination states the series number of the error message and the total number of error messages (in this case the first error of a total of five). Display number (display bottom right) This number enables allocation to a menu and stipulates the sequence within the menu.
	PI 85 s	YPI stop time display. The time it takes after a spike in the flow rate for the single feedback closed loop control in the compound-loop-control to reactivate.

INLET

MFC provides the option to assign a customer-specific name or designation to each measurement. In the menu "Module designat" of the "System" menu, you can name each measurement as desired up to six characters, such as "Inlet", "Main", "Tank", etc. This name is displayed in the main display under the associated measurement. If blanks (default setting) are entered as a module name, it is deactivated and does not appear in the main displays.

Dosing and alarm indications

LED

The nine LEDs are another indicating element. The significance of the eight red LEDs depends on the selected application. This determines whether control output or alarm is selected. The significance is marked on the labelling strip to the right of the LED. The green LED lights up when the device is switched on (POWER).

General messages

Adaption is running!
This message appears if an attempt is made during adaption to automatically calibrate the positioner.

This function is possible in the MANUAL mode only!
This message appears, for example, if an attempt is made to calibrate the positioner during automatic operation. Acknowledge by pressing ENTER or the ESC key.

A module was removed!
Do you wish to accept this configuration?
This message appears when the device is switched on after removal of a module. Confirm with the yes/no key.

New hardware component found!
This message appears when the device is switched on after addition of a module.

Please note

Information on the plug-in cards which are contained in the device are displayed in "Analog scan" when it is switched on or can be viewed statically in the "Diagnosis" menu under "Software Versions"
(Display 1.8.5 “Diagnosis - Menu 1.8" on page 144).

Operator Controls

Softkey

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

Up

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

Down

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

Left/right

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

Escape

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

Acknowledge

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

5.2 Notes on Operation

During operation observe the following points:

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

Password

The system runs with up to two passwords to ensure protection against unauthorised or inadvertent incorrect operation:

- The system password permits full access to all setting options.
- The calibration password only permits access to the calibration menu and the display of the menus.

Each password comprises a four-digit number combination.

Please note

The password is not set at the works (four zeros).

A calibration password can only be set if a system password has been set.

If the password protection was not activated with the "LOCK" softkey after entry/calibration, the system is automatically locked one hour later.

The password can be changed after correct entry of the existing password.

Operation You have the following options starting from the basic display:

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

5.3 Menu structure

The MFC has 11 different menus:

- Main menu
- Module type 1, e.g. Cl_2 free 1
- Module type 2, e.g. Cl-tot 2
- Module type 3, e.g. pH 3
- Module type 4, e.g. mA/V input 4
- Inputs/Outputs
- Alarms
- System
- Diagnosis
- Calibration
- Mode

These depend on the number of sensor measuring modules installed.

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

The following pages show the 11 individual menus.
The displays contain the settings made at the works. If options are available for individual parameter values, these are listed to the right of the illustration of the display information.

Please note

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

The display numbers are featured on the bottom right of the display. These numbers are frequently referred to in the following chapter.

Main menu

Basic display 1

Basic display 2

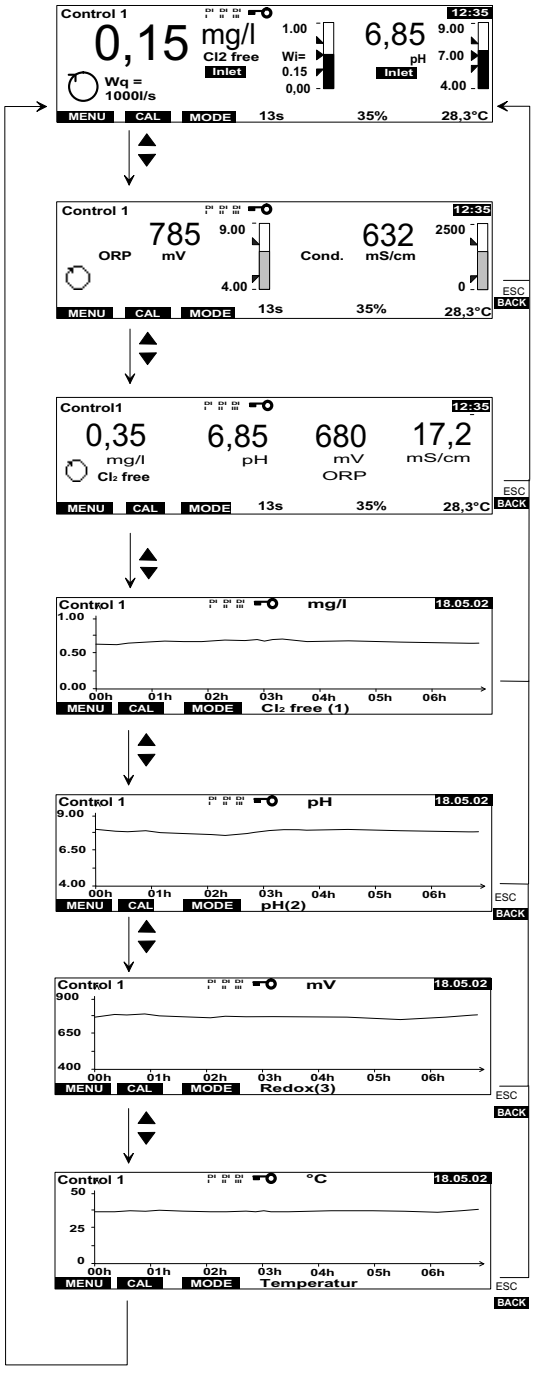
Basic display 3

Trend Graph 1

Trend Graph 2

Trend Graph 3

Trend Graph 4



Main menu

Basic display 1

Top status line

- System name (define in display 1.7.1)
- Digital inputs activated (select function in display 1.5.7)
- Password protection activated (set in display 1.7.2)
- Time (set in display 1.7.1)

Centre display range

- Mode
- Measured value from module 1, e.g. free chlorine (mg/l) as a digital display and bar graph with module designation (optional)
- Measured value from module 2, e.g. pH value (pH) as a digital display and bar graph with module designation (optional)
- Flow rate display Wq

Bottom status line

- Softkey display
- Feed delay(s) (set in display 1.7.2)
  e.g. after sample water stop or change of mode from manual to automatic.
- Error message (instead of positioner feedback, temperature and feed delay)
  The display alternates if there are several error messages.
- Sample water temperature (°C)

Basic display 2

Top status line

See basic display 1

Centre display range

- Mode
- Measured value from module 3, e.g. Redox potential (mV) as a digital display and bar graph with module designation (optional)
- Measured value from module 4, e.g. conductivity (µS/cm) as digital display and bar graph with module designation (optional)

Bottom status line

See basic display 1

Basic display 3

Top status line

See basic display 1

Centre display range

- Mode
- Free chlorine (mg/l) - module 1 measured value display
- pH value (pH) - module 2 measured value display
- Redox potential (mV) - module 3 measured value display
- Conductivity (mS/cm) - module 4 measured value display

Bottom status line

See basic display 1

Trend Graph (4 max.)

Top status line

- System name
- Digital inputs activated
- Password protection activated
- Selected measured parameter unit
- Date of the displayed diagram (set in display 1.7.1)
- Error message

Centre display range

- 7-hour trend graph (can be scrolled back by up to seven days)

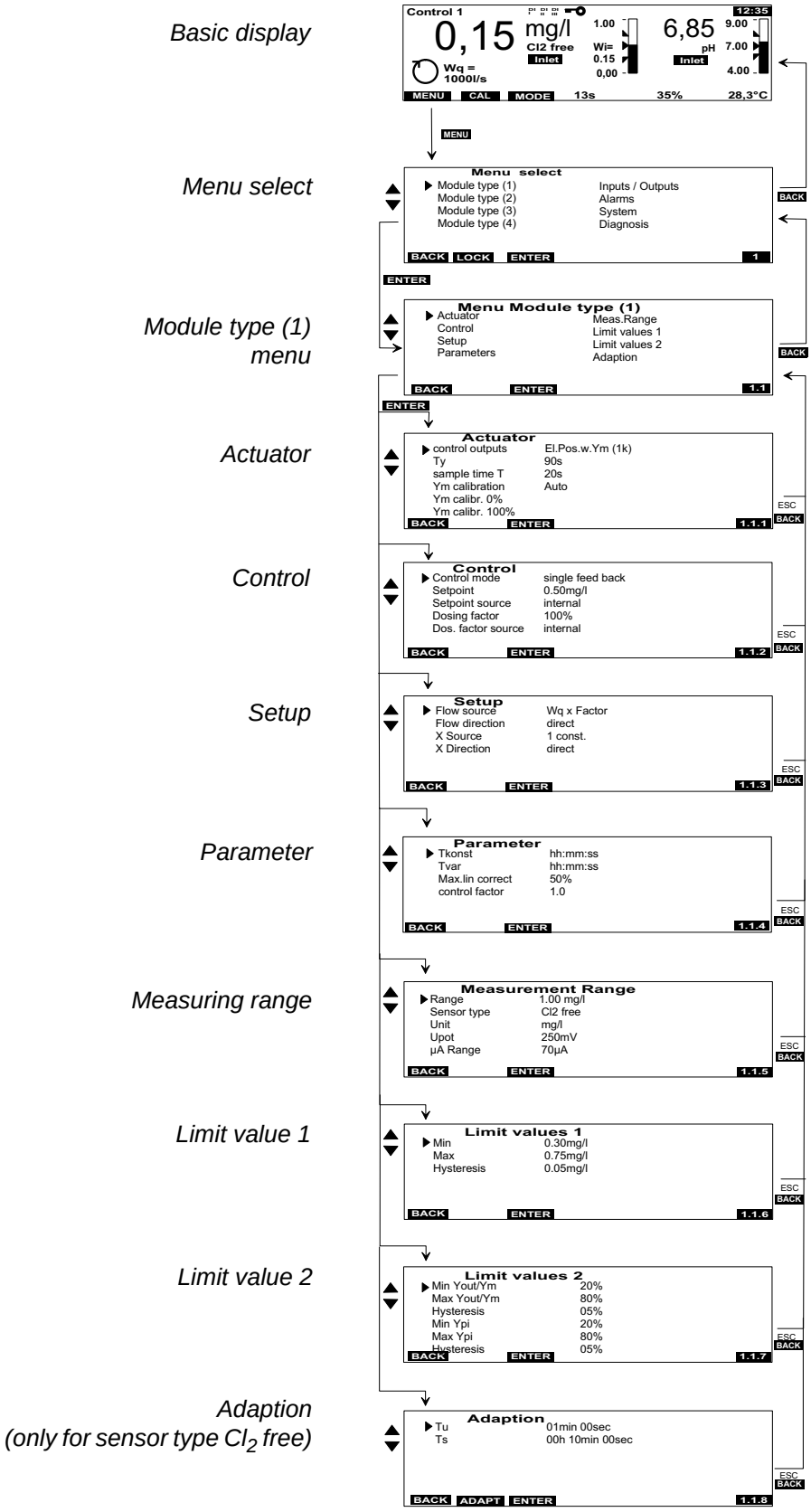
Bottom line

- Softkey display
- Measurement parameters (can be selected in display 1.7.3)

Please note

When the trend graph is moved, the programmed values of the displayed period of time are also displayed when moving up or down one level in the displays.
Return to the current display period by pressing "ESC".

Module type 1 - Menu 1.1 Display using the example of a free chlorine measurement



Module type 1 - Menu 1.1 Display using the example of a free chlorine measurement

Please note

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

Basic display Refer to main menu

Selection menu Display of all available menus

Module type (1) menu Display of all available settings for module type 1

Actuator	Control output	El.Pos.w.Ym (1k) El.Pos.w.Ym (5k) Electr.Pos.wo.Ym Dosing pump 2P. Dosing pump 3P. Solenoid pump 2P. Solenoid pump 3P. Analog output 2P. Analog output 3P. Dosing contact CAN-BUS actuator
	Tp	10 s – 180 s (60 s)
	Ty	10 s – 180 s (90 s)
	Sample time T	1–20 s
	Ym Calibration	Auto
	Ym Calibr. 0%	0 %
	Ym Calibr. 100%	100 %
	Pulses max./min	100/120
	Hysteresis	Depends on measuring range 0.01 to 0.50 / 00.1 to 5.0 / 1 to 50
	min. ON	1min00s – 59 min59s
	CAN address	-- (off), 00...31
Control	Control mode	Single feed back/single feed forward/ compound-loop
	Setpoint	Measuring range
	Setpoint source	internal / external / internal if DI 3 / external if DI 3
	Dosing factor	0–100 %
	Dos. fact. source	internal / external / internal if DI 3 / external if DI 3
	Yout-factor	1.0 to 4.0 (1.0)

Setup	Flow source	out / flow rate measured value
	Flow direction	direct / inverse
	Control input 2	out / measured value X
	Input direction	direct / inverse
	Control direct.	direct / inverse
	X factor	0.1 to 4.0
	Ymin	0–100 %
	Ymax	0–100 %
Parameter	Xsh	0.0 to 5.0 %
	Tkonst	30 s – 10 min
	Tvar	30 s – 5 min
	Max. lin. corr.	0–100 %
	Control factor	0.1 to 10
	Xp	1–1000 %
	Tn	0.0 to 100.0 min

Measuring range

Measuring range

		pH	mV			mA/V

Adjustment of measuring range initial value:

pH	0.00 to 5.00
mV	-1000 to +700 (min 300 mV to end value)
mA/V	Any combination

Range start

		pH	mV			mA/V

Adjustment of the measuring range end value:

pH	9.00 to 14.00
mV	-700 to +1000
mA/V	Any combination

Range end

Cl2	Mem			F^-	LF	

Adjustment of the measuring range:

Cl_2	100 / 200 / 500 µg/l
	1.00 / 2.00 / 5.00 / 10.0 / 20.0 / 50.0 / 100 / 200 mg/l
Mem	100 / 200 / 500 µg/l
	1.00 / 2.00 / 5.00 / 10.0 / 20.0 / 50.0 / 100 / 200 mg/l
F^-	2.00 / 5.00 / 20.00 mg/l
LF	2500 µS/cm / 10.00 mS/cm / 20.0 mS/cm / 50.0 mS/cm
	100.0 mS/cm / 200 mS/cm

Sensor type

Cl2	Mem					

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

Definition of the sensor at membrane cells:
Cl-N total, Cl-N combined, ClO_2 sel., O_3 sel.

Unit

Cl2	Mem					mA/V

Cl_2 mg/l, µg/l, ppb, ppm
Mem mg/l, µg/l, ppb, ppm
mA/V 5 characters max. (any combination)

Format

						mA/V

Selection of the displayed number format for mA/V
Sensor modules:
000.0 / 00.00 / 0000

Upot

Cl2						

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

µA measuring range

Cl2	Mem					

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

Signal

						mA/V

Setting the connected measurement signal:
0–20 mA, 4–20 mA, 0–10 V
Complete electrical connection according to this setting (see 9. “Wiring Diagrams" on page 245)

Factor

						mA/V

Factor to adapt an external input signal:
0.1 to 4.0

pH Compensation

Cl2						

only for sensor type Cl_2^{++}:
Assignment of which pH module will be used to compensate for the $_2$measurement

pH (1) – pH (4) (equipped pH sensor modules only)

Cl_2 free ref.

	Mem					

For sensor type Cl-N combined only:
Assignment of which free Cl_2 module will be used to compensate for the combined Cl_2

Cl_2 free (1) – Cl_2 free (4) (only equipped sensor modules

selectable for 3 electrode cells)

Reference temp. | | | | | | LF | |

Adjustment of the reference temperature for the conductivity measurement:
20°C / 25°C

Quant. salinity => NaCl in g/l / NaCl in % / TDS in g/l / off

TDS factor => 0.4 ... 1.0 (with active TDS display)

TDS:
Total Dissolved Solids = filtrate dried solid matter content in g/l. The TDS factor depends on the composition of the sample water and must determined for each water type.

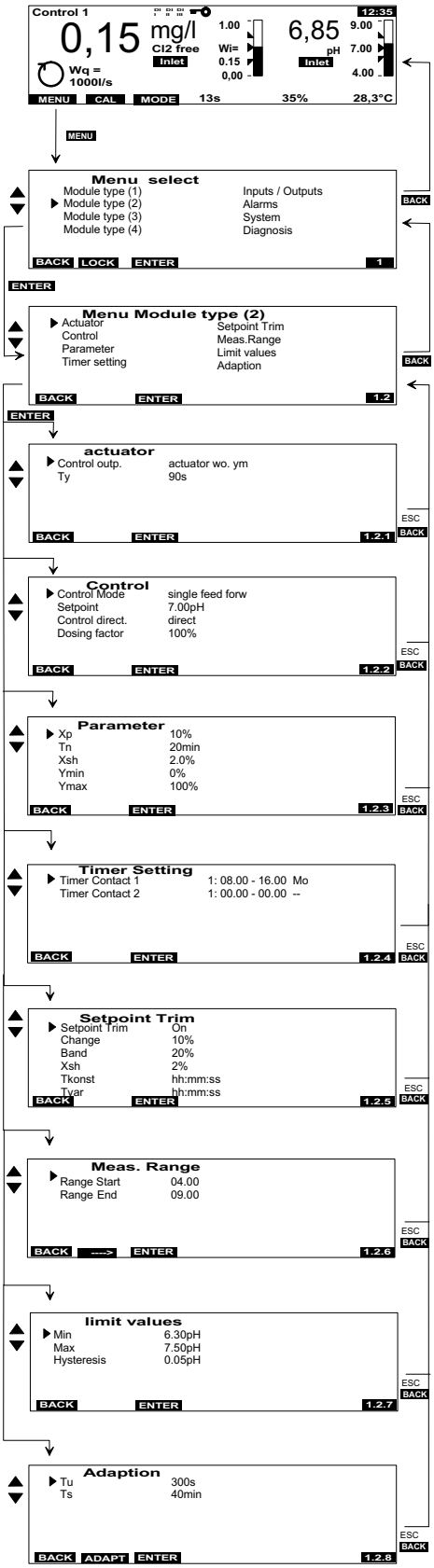
Press the softkey ⟹ to show additional setting menus in the measuring range menu.

CAN segment MW -> 01 (01...31) (--off)
Setting the CAN segment in which the measured value is to be transmitted.

CAN addr. MW -> -- (00...31) (--off)
Setting the CAN address to which the measured value is to be transmitted.

Limit value 1	Min	within measuring range
	Max	within measuring range
	Hysteresis	Depends on measuring range 0.01 to 0.25 / 00.1 to 05.0 / 1 to 50
Limit value 2	Min Yout/Ym	0–100.0 % (not in single feedback closed-loop control)
	Max Yout/Ym	0–100.0 % (not in single feedback closed-loop control) Ym is only output if the actuator feedback is present, otherwise the controller output is Yout
	Hysteresis	0.1 to 5.0 %
	Min Ypi	0–100.0 % (for compound-loop-controller only)
	Max Ypi	0–100.0 % (for compound-loop controller only)
	Hysteresis	0.1 to 5.0 % (for compound-loop-controller only)
Adaption	Adaption is only available for single feed back control with "DES" modules.	
	Tu	1–3600 s (60 s)
	Ts	0.1 to 480.0 min (10 min)

Module type 2 - Menu 1.2 Display using the example of a pH measurement



Module type 2 - Menu 1.2

Please note

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

Basic display	Refer to main menu	
Menu select	Display of all available menus	
Module type (2) menu	Display of all available settings for module type 2	
Actuator	Control output	Electr.Pos.wo.Ym Dosing pump 2P, Dosing pump 3P, Solenoid pump 2P, Solenoid pump 3P, Analog output 2P, Analog output 3P, Dosing contact, CAN-Bus actuator
	Ty	10–180 s (90 s)
	Tp	10–180 s (90 s)
	Pulses max./min	100/120
	Hysteresis	Measuring range
	min. ON	1 min 00s – 59 min 59 s
Control	CAN-address	--, 00...31
	Setpoint	Measuring range
	Control direct.	direct / inverse
Parameter	Xp	1–1000 %
	Tn	0.0 to 100.0 min
	Xsh	0.0 to 5.0 %
	Ymin	0.0 to 100.0 %
	Ymax	0.0 to 100.0 %

Please note

The Ymin and Ymax parameters are not displayed if "Positioner without Ym" is selected and during single feed forward control.

Timer setting

Timer Contact 1		Selection of 9 on-duty and and off-duty cycles max.
Timer Contact 2		Selection of 9 on-duty and and off-duty cycles max.

1	:	00:00	-	00:00		--
Switching cycle 1-9		Duty cycle hh:mm		Off-duty cycle hh:mm		Day Mo-Su (If "--" is displayed, the switching cycle is inactive)

Setpoint trim

Trim setpoint	Switch on/off
Trim factor	0–100 %
Setpoint range	5–50 %
Xsh	1–10 %
Tconst	30 s – 10 h
Tvar	30 s – 10 h

Measuring range

See module type 1 under ““Measuring range" on page 126:

CAN address	00...31 (-- off) Defines the CAN bus address of the external measurement in application 5 (setpoint trim)

Limit values

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

Adaption

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

Tu	1–3600 s
Ts	0.1 to 480.0 min

Module type 3 - Menu 1.3 Display using the example of a ORP measurement

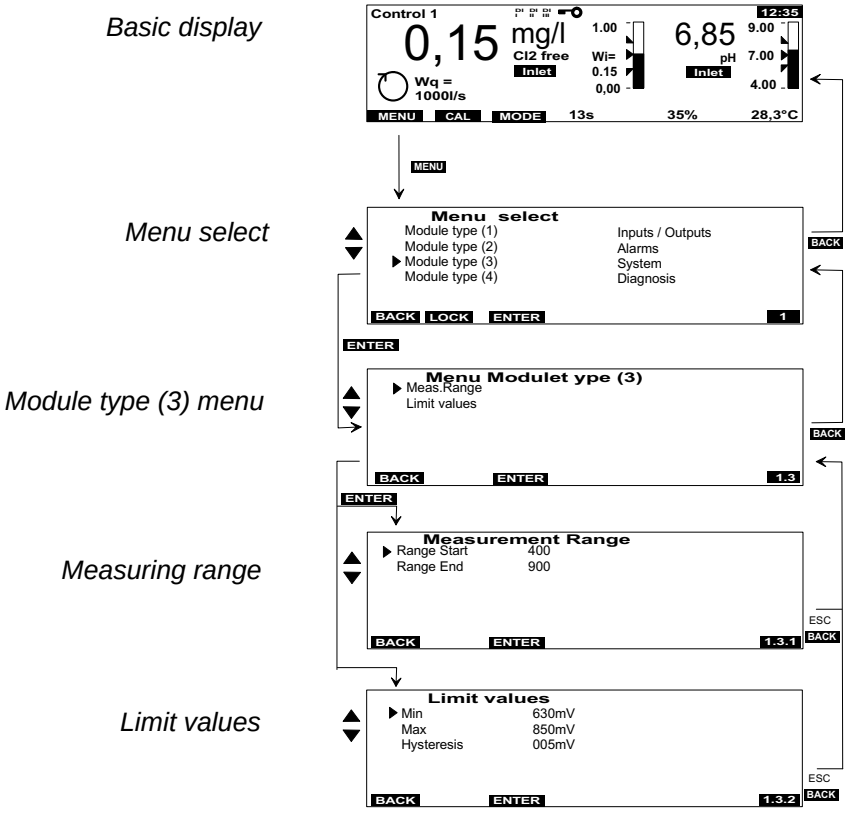
Basic display

Menu select

Module type (3) menu

Measuring range

Limit values



Module type 3 - Menu 1.3

Basic display Refer to main menu

Menu select Display of all available menus

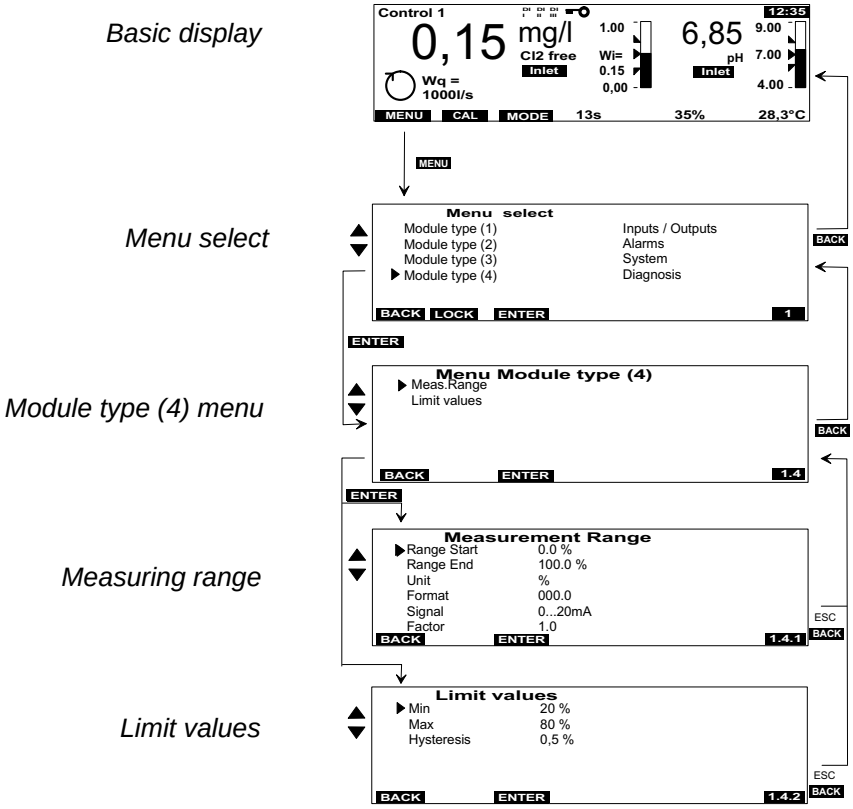
Module type (3) menu Display of all available settings for module type 3

Measuring range See module type 1 under“Measuring range" on page 128

Limit values

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

Module type 4 - Menu 1.4 Display using the example of a mA/V input module



Module type 4 - Menu 1.4

Basic display Refer to main menu

Menu select Display of all available menus

Module type (4) menu Display of all available settings for module type 4

Measuring range See module type 1 under“Measuring range" on page 128

Limit values

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

Inputs/Outputs - Menu 1.5

Basic display

Menu select

Menu Inputs / Outputs

Flow Wq

Flow rate limit value

ext. Setpoint/DF

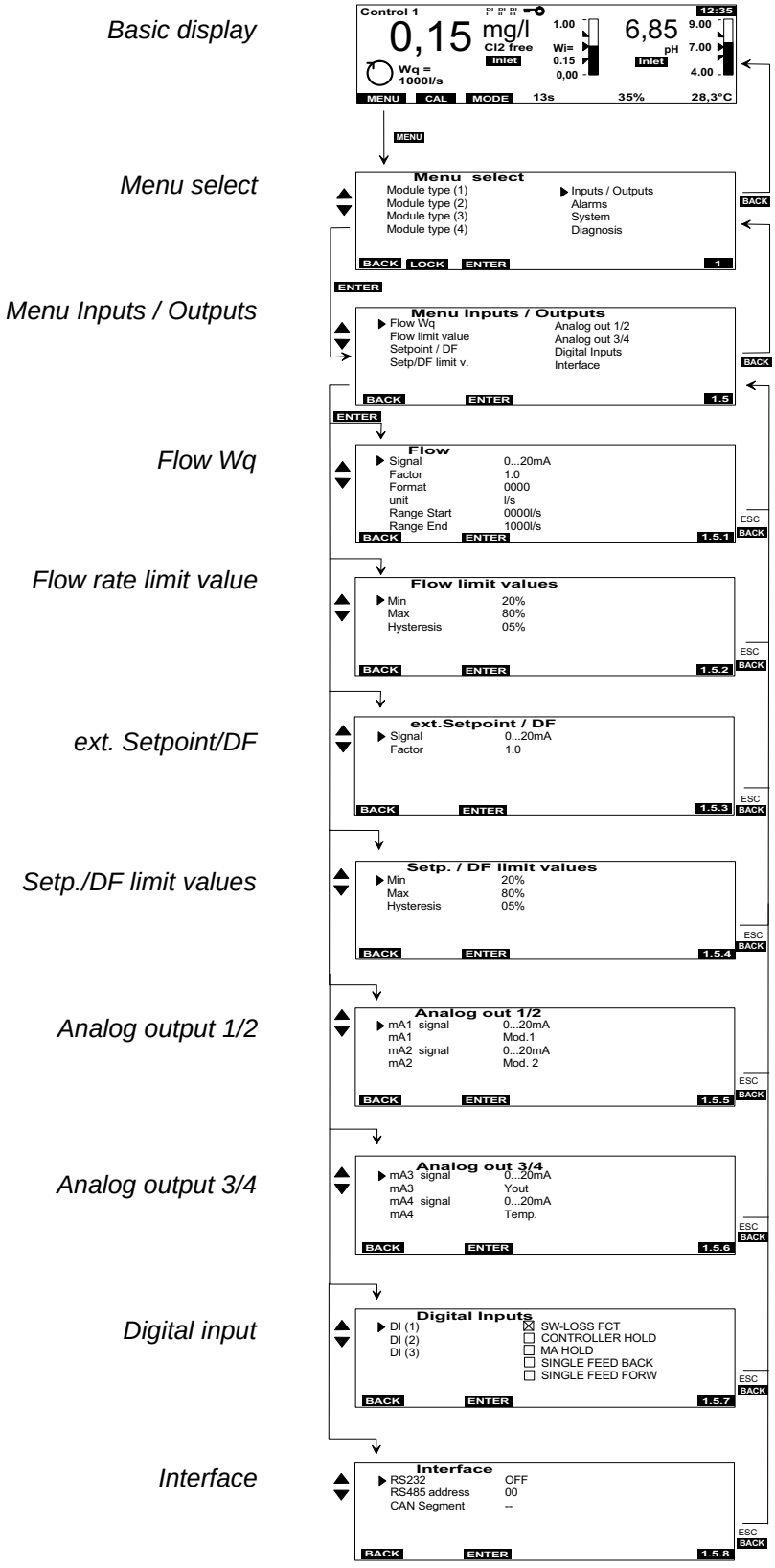
Setp./DF limit values

Analog output 1/2

Analog output 3/4

Digital input

Interface



Inputs/Outputs - Menu 1.5

Basic display	Refer to main menu	
Menu select	Display of all available menus	
Menu Inputs/Outputs	Display of all available input/output settings	
Flow Wq	Signal	0–20 mA, 4–20 mA, 0–10 V
	Factor	0.1 to 4.0
	Format	Measurement display 000.0 / 00.00 / 0000
	Unit	Max. 5 digits (any combination)
	Range-start	Unlimited
	Range-end	Unlimited
Flow rate limit value	Min	Min limit value within measuring range
	Max	Max. limit value within measuring range
	Hysteresis	0.1 to 5.0 %
ext. Setpoint/DF	Signal	0–20 mA, 4–20 mA
	Factor	0.1 to 4.0
Setp./DF limit values	Min	Min. limit value of the external signal input 0–100.0 %
	Max	Max. limit value of the external signal input 0–100.0 %
	Hysteresis	0–25 %
Analog output 1/2	mA 1 signal	0–20 mA, 4–20 mA, 0–10 mA, 0–5 mA, off
	mA 1	Sensor module 1-4, flow, temperature, ext. Setpoint/DF, Yout/Ym (1), Ypi (1)
	mA 2 signal	0–20 mA, 4–20 mA, 0–10 mA, 0–5 mA, off
	mA 2	Sensor module 1-4, flow, temperature, ext. Setpoint/DF Yout/Ym (1), Ypi (1)
Analog output 3/4	mA 3 signal	0–20 mA, 4–20 mA, 0–10 mA, 0–5 mA, off
	mA 3	Sensor module 1-4, flow, temperature, ext. Setpoint/DF, Yout/Ym (1), Ypi (1)
	mA 4 signal	0–20 mA, 4–20 mA, 0–10 mA, 0–5 mA, off
	mA 4	Sensor module 1-4, flow, temperature, ext. Setpoint/DF Yout/Ym (1), Ypi (1)

Digital input	DI (1), DI (2), DI (3)	A function can be assigned to each digital input.
	SW-LOSS FCT	Yout = 0 %, dosing, mA analog output = 0 %
	CONTROLLER HOLD	Yout remains constant (i.e., the control signals are kept constant).
	MA HOLD	All mA outputs remain unchanged, while DI is active.
	SINGLE FEED FORW	If the DI is active, the control mode switches from MOD 1 to single feed forward control. Only if the control mode changeover is set to compound-loop-control via DI3.
	SINGLE FEED BACK	If the DI is active, the control mode switches from MOD 1 to single feed back control. Only if the control mode changeover is set to compound-loop-control via DI3.
Interface	RS232	Off, printer, IAP download, parameter
	RS485 address	Bus addresses 00 to 31 (0)
	CAN segment	01...31 (-- = off)

Alarm - Menu 1.6

Basic display

Menu select

Menu Alarms

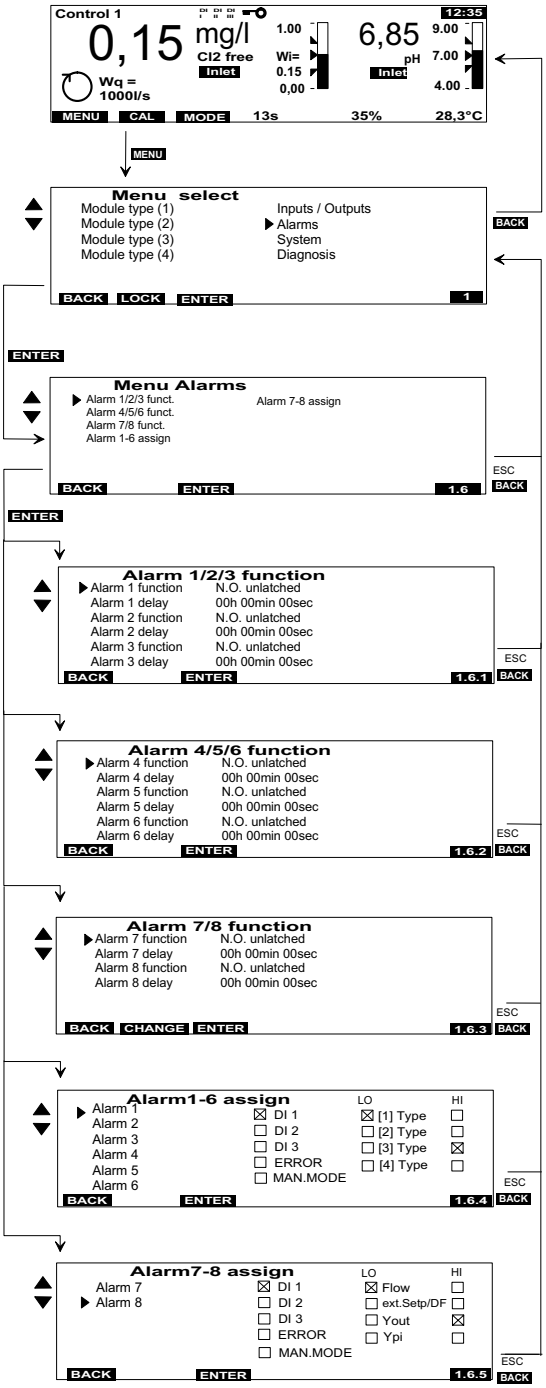
Alarm 1/2/3 fonct.

Alarm 4/5/6 fonct.

Alarm 7/8 fonct.

Alarm assignment 1•6

Alarm assignment 7•8



Alarm - Menu 1.6

Basic display	Refer to main menu	
Menu select	Display of all available menus	
Menu alarms	Display of all available settings	
Alarm 1/2/3 function	Alarm 1 function	Defines the alarm relay contact conditions, if the alarm is inactive. N.O. unlatched N.C. unlatched N.O. latched res. N.C. latched res. N.O. latched ack. N.C. latched ack.
	Alarm 1 delay	00:00 – 10:00 h ON delay
	Alarm 2 function	See description of alarm 1
	Alarm 2 delay	See description of alarm 1
	Alarm 3 function	See description of alarm 1
	Alarm 3 delay	See description of alarm 1
Alarm 4/5/6 function	Alarm 4 function	See description of alarm 1
	Alarm 4 delay	See description of alarm 1
	Alarm 5 function	See description of alarm 1
	Alarm 5 delay	See description of alarm 1
	Alarm 6 function	See description of alarm 1
	Alarm 6 delay	See description of alarm 1

Please note

Assigning alarms 1, 3, 5 and 7 allows you to enter the min/max limit values for module 1 to 4, digital input 1 – 3, error and manual mode.
Assigning alarms 2, 4, 6 and 8 allows you to enter the min/max limit values for the flow rate, ext. setpoint/dosing factor, Yout and Ypi control signals, digital input 1 to 3, error and manual mode.
Alarm 5 and 6 appear only when application 1, 2 or 5 is selected.
Alarm 7 and 8 appear only when application 1 is selected.
For application 1 the Min. and Max. limit values for modules 1 to 4, digital inputs 1 to 3 and error messages are freely selectable.

Alarm 7/8 function	Alarm 7 function	See description of alarm 1
	Alarm 7 delay	See description of alarm 1
	Alarm 8 function	See description of alarm 1
	Alarm 8 delay	See description of alarm 1
Alarm assignment 1-6	Display of all available alarm assignments.	
Alarm assignment 7-8	Display of all available alarm assignments.	

System - Menu 1.7

Basic display

Menu select

Menu system

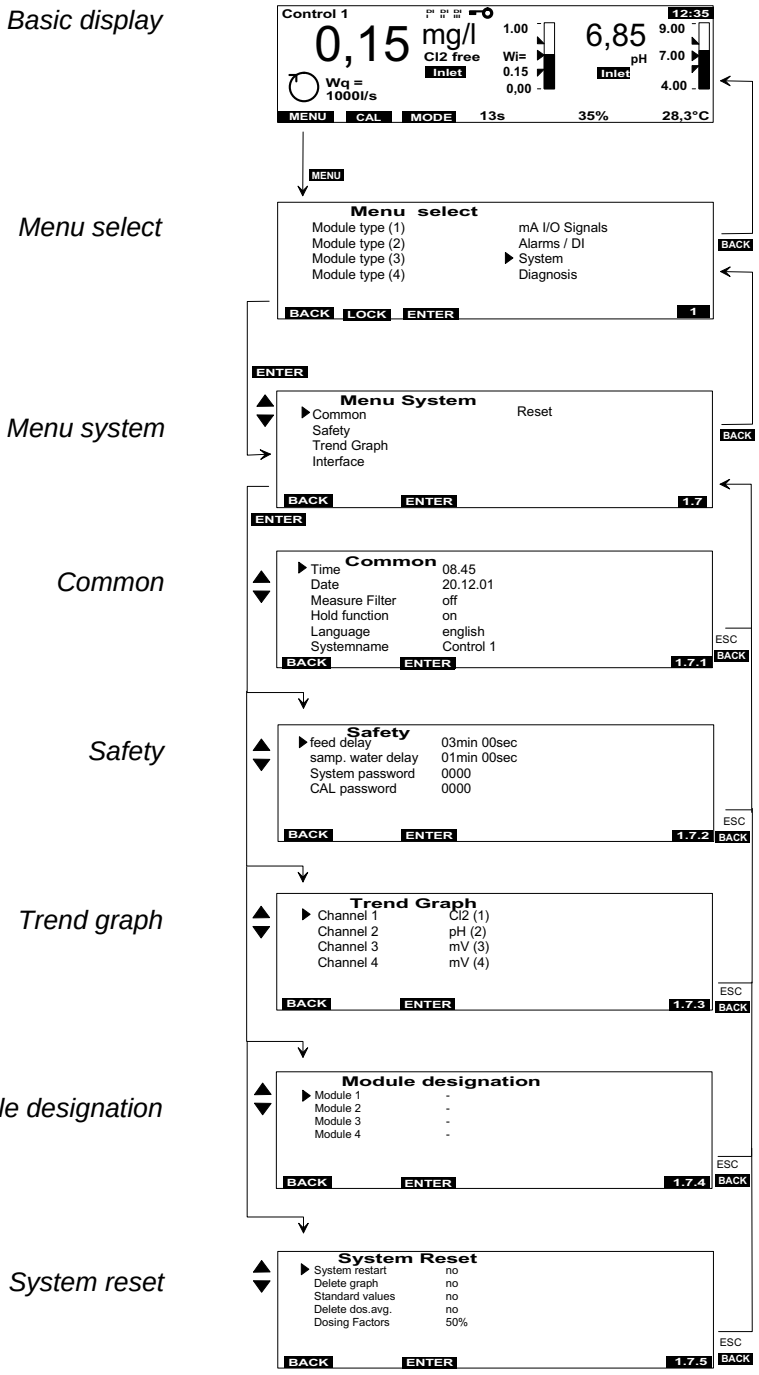
Common

Safety

Trend graph

Module designation

System reset



System - Menu 1.7

Basic display	Refer to main menu	
Menu select	Display of all available menus	
Menu system	Display of all available system settings	
Common	Time (hh:mm)	Current time
	Date (dd.mm.yy)	Current date
	Measure Filter[1)]	off / low / high
	Hold function (see chapter 5.4 “Calibration" on page 151)	Off / On
	Language	German, English, French, Dutch
	System name	12 characters, each with character set A-Z and digits 1-9 including special characters
Safety	Feed delay[2)]	00:00 – 10:00 (03min : 00s)
	Samp. water delay[3)]	00:00 – 10:00 (01min : 00s) (sample water delay)
	System password	four-digit numeric code (activate with Softkey "LOCK" in the "Menu Select" window)
	Calibration password*	four-digit numeric code (activate with Softkey "LOCK" in the "Menu Select" window)
	* only if system password is set	
Trend Graph	Channel 1 to 4	Assignment of a measured value to the line diagram. The selected measured value is plotted in the trend graph (can be traced back up to 7 days). All the following measured values are possible: module 1 - 4, flow rate Wq, external setpoint/dosing factor, temperature, control signals Yout from module 1, Ypi from module 1 or Yout from module 2. If "Off" is selected, that channel is not recorded.

Please note

If Ym is available, the Yout value for module 1 is displayed in Ym.

Module designation	Module 1 to 4	Max. 6 digits, customised entry If blanks are entered, the module description is switched off.
System reset	System restart[4)]	yes / no
	Delete graph[5)]	yes / no
	Standard value[6)]	yes / no
	Delete dos. avg[7)]	yes / no
	Dosing Factors[8)]	0–100 %

Please note

The system settings marked with 1) to 8) are explained below.

Explanation of system settings

1) Measure Filter	The dampening serves to compensate measurement value fluctuations in the event of irregular measurement value signals.
2) Feed delay	The feed delay delays dosing start when the device is switched on and when the operating mode has been changed. Running of the selected time can be cancelled with the "Acknowledge" key.
3) Samp.water delay	The sample water delay (DI 1) determines the time after which dosing is deactivated, e.g. in the event of sample water stop. DI 1 flashes while the delay time is running.
4) System restart	When the applications are changed, the device must be restarted with System Restart.
5) Delete graph	Deletes the values saved in the past 7 days.
6) Standard values	Deletes customer settings (except for the selected application), resets system to factory settings. The sensors must be recalibrated.
7) Delete dos.avg	Resets the average dosing values from display 1.8.3 to zero.
8) Dosing Factors	Resets the dosing factor table to the set value and all training meters to zero.

Diagnosis - Menu 1.8

Basic display

Menu select

Diagnosis

Diagnosis (1) Cl2

Diagnosis (2) pH

Diagnosis (3) mV

Diagnosis (4) Cl-N

Dosing average

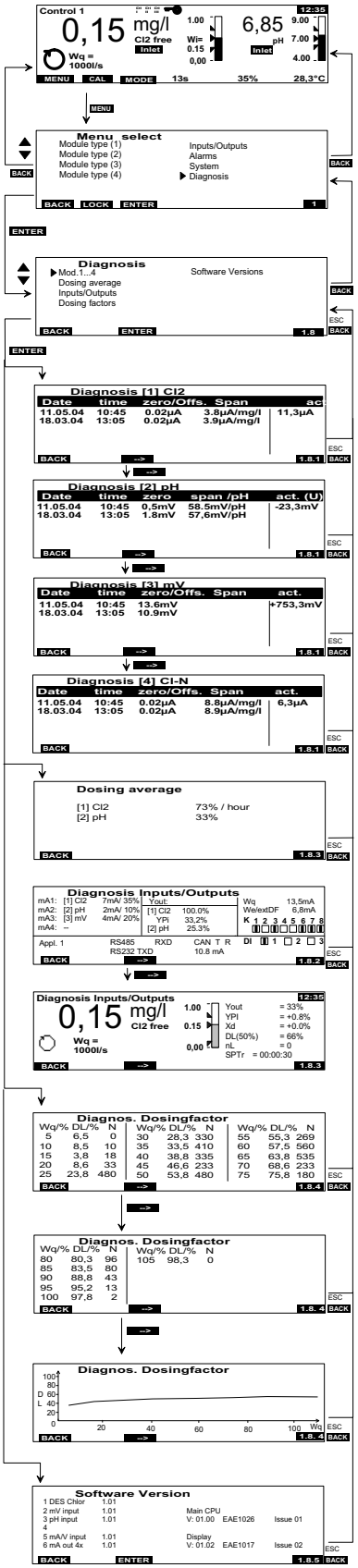
Inputs/Output diagnosis

Diagnos. Dosingfactor

Diagnos. Dosingfactor

Diagnos. Dosingfactor

Software version diagnosis



Diagnosis - Menu 1.8

Basic display	Refer to main menu	
Menu select	Display of all available menus	
Diagnosis	Display of all available diagnosis displays	
Diagnosis (1-4) using the example of Cl_2, pH, mV, Cl-N	Information about the available measuring inputs (Scroll with softkey "-->")	
3pot cell diagnosis for Cl_2, $KMNO_4$, O_3, $Cl0_2$, Cl_2++	Date and time of the last 5 calibrations	
	Zero	Measuring cell zero point signal
	DPD-mg/l	µA-signal based on 1 mg/l
	act. (I)	Current µA sensor signal
pH diagnosis	Date and time of the last 5 calibrations	
	pH7	Signal offset at pH 7 in mV
	Span/pH	mV signal of the pH sensor based on pH1 step
	Offs	manual offset in pH (Menu 2.1.2 - Offset pH)
	act. (U)	Current mV sensor signal
Redox diagnosis	Date and time of the last 5 calibrations	
	Offset	Signal offset of the mV sensor in mV
	act. (U)	Current mV sensor signal
Membrane sensor diagnosis Cl-sat, O_3 sel, ClO_2 sel, (Cl-comb. Cl_2 free)	Date and time of the last 5 calibrations	
	DPD-mg/l	µA-signal based on 1 mg/l
	act. (I)	Current µA sensor signal
F^- diagnosis	Date and time of the last 5 calibrations	
	Zero point	Established sensor zero point signal
	Decade	mV signal of the sensor based on 1 decade (log)
	act.. (U)	Current mV sensor signal
Conductivity diagnosis	Date and time of the last 5 calibrations	
	Spread	Conductivity measuring cell calibration factor
	act.	Displays current sensor current in mA Displays current sensor voltage in mV Displays temperature of the conductivity sensor

Diagnosis - Menu 1.8

Inputs/Output diagnosis

Information on

- The assignment of the mA outputs
- The current mA output in mA and %
- The current dosing output Yout for module 1 as well as Ypi
- The current dosing output for module 2
- The current switching conditions of the relays
  ☐ Relay off ▮ Relay on
- The selected application
- The send/receive condition of both interfaces RS485, RS232 and CAN
- The current switching conditions of the digital inputs 1, 2 and 3
- The current flow measurement (Wq) input signal
- The current input signal of the external setpoint (We) or external dosing factor (ext. DF)

Second display - input/output (compound-loop-control only)

Information on

- Module 1 measured valued
- Compound-loop-control Yout in %
- Ypi-share of Yout in %
- Deviation Xd in %
- Dosing rate (DL) in % acc. to the current flow rate from the dosing factor table
- nL delay until new DL value is accepted in the dosing factor table (entry at 120)
- SPtr running delay until trim setpoint is reactivated

Dosing average diagnosis

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

Dosing factor diagnosis

Displays the learned DL dosing factors for the control output depending on Wq (display in 5 % increments).
N describes the training meter, how often a dosing factor was learned for this Wq value. This table can be displayed as a diagram (toggle with the ---> key).

Software version diagnosis

Displays the software version of the sensor measuring module, the display and the main CPU

Calibration - Menu 2.1

Basic display

Calibration

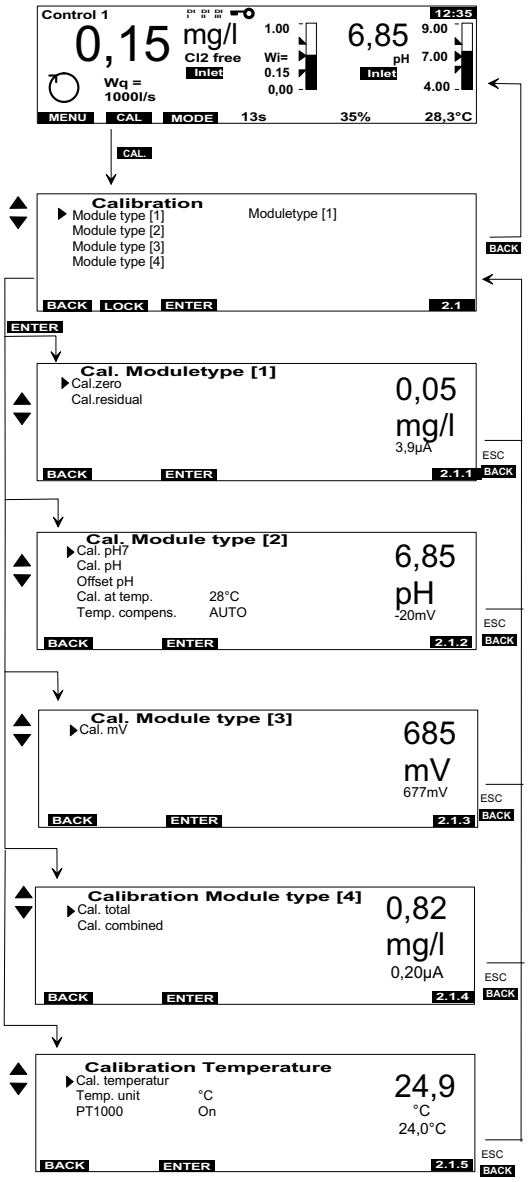
Module type (1) calibration (Example Cl_2)

Module type (2) calibration (Example pH)

Module type (3) calibration (Example ORP)

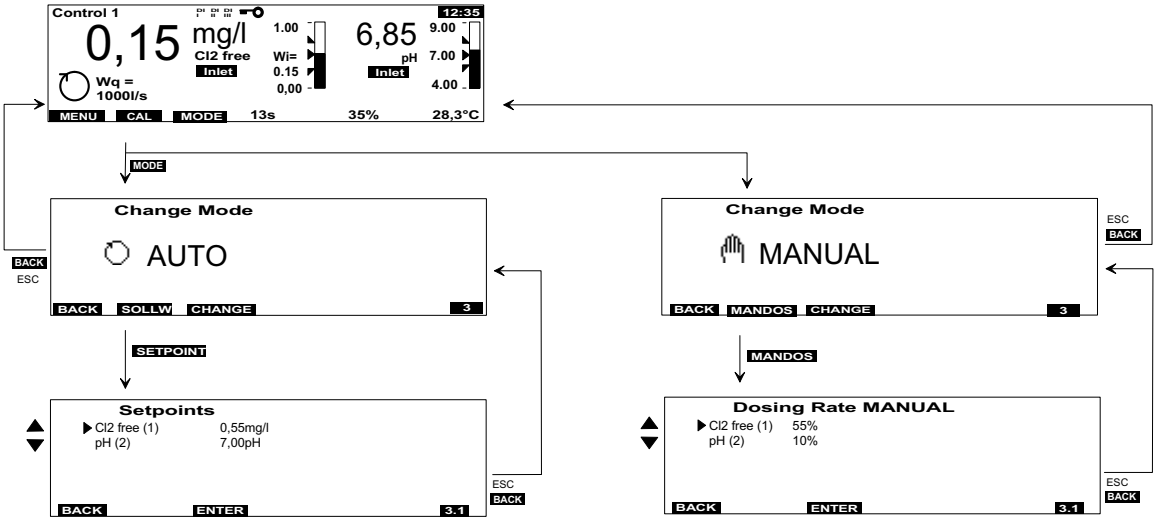
Module type (4) calibration (Example Cl-sat)

Temperature calibration



Calibration - Menu 2.1	Refer to 5.4 “Calibration" on page 151	
Basic display	Refer to main menu	
Calibration	Display of all available calibration options	
Module type calibration Cl_2 free, Cl_2++, ClO_2, O_3, $KMNO_4$	Cal. zero	The "ENTER" softkey sets the display to "0.00 mg/l"
	Cal. Span	within measuring range
	Temp.sensor	off, PT1000 internal, sensor module In case of DES modules with integrated temperature input, it is possible to select the temperature to be used for the compensation.
	Cal. temperature	0 to 50 °C
Module type pH calibration	Cal. pH 7.00	6.85 to 7.15 pH
	Cal. pH	within measuring range
	Offset pH	-1.00 to + 1.00 pH (0pH)
	Cal. at temp.	0–50°C
	Temp. compens.	Auto or manual
Module type mV calibration	Cal. mV	within measuring range
F^- calibration	Cal. lower value	within measuring range
	Cal. upper value	within measuring range
	Offset	-1.00 to +1.00 F^- / 0 mg/l
Module type calibration conductivity	Calib	0 to 200 mS/cm
	Cal. temperature	0 to 50 °C
Module type calibration Membrane sensors ClO_2, O_3 sel, Cl_2 free	Zero point/DPD	within measuring range
	Cal. Span	within measuring range
	Calibration mode	1-point/2-point
Membrane sensor calibration Cl-sat	Cal. total	within measuring range
Membrane sensor calibration Cl-comb.	Cal. total	within measuring range
	Cal. combined	within measuring range
Temperature calibration	Cal. temperature	0–50°C
	Temp. Unit	°C/°F
	PT1000	Switch automatic temperature compensation on or off If the PT1000 is switched off a manual temperature value can be entered into the calibration menu during a pH measurement.
Calibration mA/V input	Cal. zero point	(within measuring range)
	Cal. end value	(within measuring range)

Mode - Menu 3 Display using an example (module 1 = Cl_2 free and module 2 = pH)



Basic display	Refer to main menu	
Manual / Automatic	AUTO / MANUAL	toggle using the "CHANGE" softkey
Setpoints	Cl_2 free(1)	within measuring range
	pH (2)	within measuring range
Dosing rate MANUAL	Cl_2 free (1)	%
	pH (2)	%

Description of the operating modes

MANUAL

In MANUAL mode dosing is not automatically controlled. The values must be continuously monitored.

MANUAL mode is used:

- In the event of any possible system faults
- During maintenance/cleaning work or while checking the system

Please note

When MANUAL mode is set:

The pumps are off, the positioner remains in its current position, if necessary unlock the positioner and close either by hand or with the Man.dos. menu.

AUTOMATIC

Automatically controls the measured variables acc. to the selected application

STOP

STOP mode is automatically activated:

- When the sample water flow is faulty
- When a stop signal is received via the digital inputs

After activation:

- Pumps off, positioner closed, mA analog output = 0 %
  If the stop conditions are no longer active, the system automatically switches to automatic mode.

ADAPTION

ADAPTION mode is activated, if the adaption for the single feed back control module 1 or module 2 is started.

For adaption refer to 4.9 “Adaption" on page 104

5.4 Calibration

Sensor measuring module calibration

Caution!

When calibrating the following sensor measuring modules in the pressurised version:

pH value
ORP potential
Conductivity
Fluoride
Membrane sensors for free chlorine, chlorine dioxide, ozone and Total chlorine

You must also perform the following:

Before calibration:
Close the ball valves on the inlet and outlet.
Depressurise the unit. To this purpose, briefly open and close the knurled nut on the drain.

After calibration:
Open the inlet and outlet.

Caution!

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

Caution!

Note the safety data sheets for buffer solutions.

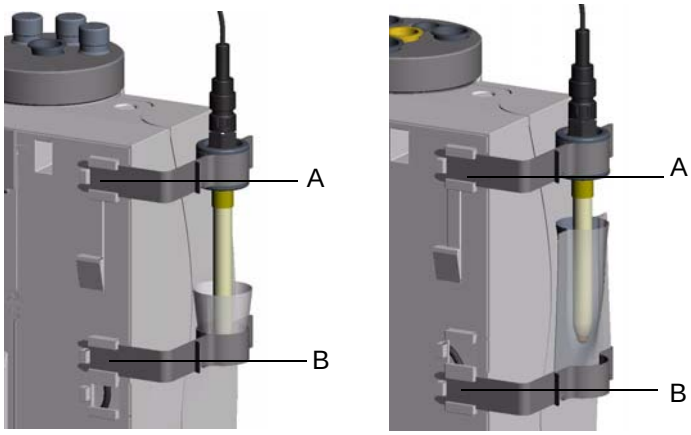
Please note

To prevent the output of non-permissible control signals during calibration, the "Hold function" in the system menu (display 1.7.1 “System - Menu 1.7" on page 141) should be set to "On" (mA-outputs and controller outputs then remain constant during calibration). 2.1.5 “Calibration - Menu 2.1" on page 147).

To determine how often you must calibrate, refer to 7.1 “Maintenance Schedules" on page 203.

Calibration aids

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



A Upper clip
B Lower clip

Calibration configuration for the sensors that are calibrated outside the cell body: pH, Redox, fluoride and conductivity

A Top clip with electrode mount
B Sensor
C Beaker
D Lower clip
E Ball valve on sample water inlet
(also on the sample water drain in the pressurised version)

5.4.1 Temperature calibration

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

2 Select the "Temperature" menu item

The "Calibr. temperature" window (Display 2.1.5 “Calibration - Menu 2.1" on page 147) appears on the graphic display.

3 Select the "Cal. temperature" parameter.

4 Perform comparative temperature measurement.

5 Use the arrow keys to enter the determined value.

6 Confirm the entry.

This concludes the temperature calibration.

Please note

°C or °F can be selected in the "Temp. unit" menu. In the "PT1000“ menu, the automatic temperature compensation with the multi-sensor can be switched on or off.

5.4.2 Calibration of the 3 electrode cell

Calibration of the 3 electrode cell for Cl_2, $KMnO_4$, O_3, ClO_2 and Cl_2++ (pH-compensated)

During calibration of the 3 electrode cell, perform a zero point calibration and a measurement value calibration (DPD).
The calibration process is nearly the same for chlorine, chlorine dioxide, ozone and potassium permanganate.
The difference lies in the fact that some of the reagents are measured with a photometer and others with a colour meter.

Zero point calibration

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

2 Select the measurement to be calibrated from the menu, e.g. Cl_2 free (1).

3 Select the "Cal.zero" parameter.

4 Close the ball valve on the sample water inlet.

Please note

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

5 Wait until the displayed value or the µA sensor signal no longer changes for at least one minute..

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

Zero point calibration with disinfectant-free water

7 If disinfectant-free water (e.g. by switching off the dosing system) is available, zero point calibration can be performed with it. To do this, switch off the dosing system and perform steps 1, 2, 3, 5 and 6. It is necessary to observe the sample water take-off and dosing delay time here!

8 Open the ball valve on the sample water inlet.

Measurement value calibration (DPD)

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

10 Open the knurled nut on the drain by approximately one turn and extract a specimen of the sample water.

11 Determine the free chlorine, ozone, chlorine dioxide or potassium permanganate content, for example, with a photometer.

12 Select the parameter "Cal. Span" and confirm with "Enter".

13 Enter the determined value with the arrow keys and then press the "Enter" key to save.

This concludes the calibration.

Please note

In the DPD calibration of the Cl2++ measurement, the calibration value should be greater than or equal to 25% of the measurement range.

5.4.3 Membrane sensor calibration

Calibration is nearly identical for all membrane sensors. The difference lies in the fact that some of the chemicals are measured manually with a photometer and others with a colour meter.
A 1-point calibration is available to calibrate the total chlorine measurement and the combined chlorine measurement.
Either the total chlorine or the combined chlorine must be calibrated.

For the selective ozone, chlorine dioxide and free chlorine measurements, 1-point or 2-point can be selected in the "Calibration mode" calibration menu. 2-point calibration provides the option to compensate for possible measuring cell zero point offsets.

Total chlorine

1 Open the knurled nut on the drain by approximately two turns and extract a specimen of the sample water.

2 Determine the total chlorine content with a comparative device (e.g. photometer).

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

4 Select the menu item "Cl-sat" for the measurement you wish to perform.
Select the parameter "Cal. total" and confirm with "Enter".

5 Use the arrow keys to enter the determined value.

6 Save the value by pressing "Enter".

This concludes the total chlorine calibration.

Combined chlorine (optional)

1 Determine the values for free chlorine and total chlorine as described under "Total chlorine".

2 Determine the value for combined chlorine:
Total chlorine minus free chlorine.

3 Enter the determined value as described under "Total chlorine" with the arrow keys under the parameter "Cal. combined".

4 Confirm the entry.

This concludes the combined chlorine calibration.

Zero point calibration for ozone, chloride oxide, Cl_2 free (M)

Zero point calibration using 2-point calibration

1 Starting from the basic display, select the "Calibration" menu.

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

3 Select the "zero span" parameter.

4 Run disinfectant-free or reduced water through the flow-through adapter (e.g. by switching off or reducing the dosing system).

5 Allow for the process delay by waiting until the measured value on the display no longer changes.
In disinfectant-reduced water, extract a specimen of the sample water and run a comparative measurement.

6 Press "Enter" to set the display to zero.

7 A determined DPD value can be entered using the arrow keys instead of the zero point (e.g. reduced dosing system).

8 Save the value by pressing "Enter".

DPD calibration using 1-point and 2-point calibration for O_3, ClO_2 and Cl_2

1 Extract specimen of sample water.

2 Determine the disinfectant content with a comparative device (e.g. photometer).

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

4 Select the measurement you wish to calibrate from the menu.

5 Select the "Cal. Span" parameter.

6 Use the arrow keys to enter the determined value.

7 Save the value by pressing "Enter".

This concludes the calibration for O_3, ClO_2 or Cl_2 free.

5.4.4 pH calibration

Please note

During pH calibration the buffer solution and the sample water should have the same temperature. If there is a difference in temperature of > 5 °C, first enter the temperature of the buffer solution in the "Calibration" - “pH (1) ... pH (4)“ menu for the measurement you wish to perform (Display 2.1.2 “Calibration - Menu 2.1" on page 147) under "Cal. at temp.".
For buffer solutions, refer to “Automatic calibration" on page 200.

pH-7 alignment

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

2 Select the menu item “pH (1) ... pH (4)“ for the measurement you wish to perform.
The "Calibr. pH" window (Display 2.1.2) appears on the graphic display.

3 Select the "Cal. pH7" parameter.

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

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

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

7 Enter the pH value associated with the buffer temperature using the arrow keys or or leave pH 7.00.

8 Save the value by pressing "Enter".

Slope alignment

9 Remove the buffer solution "pH 7.00" from the bottom clip.

10 Wash the sensor in distilled water to prevent carry-over of the buffer solution.

11 Select the parameter "Cal. pH" and confirm the selection.

12 Place a second beaker into the bottom clip and fill with the buffer solution "pH 4.65" or clamp a bag with buffer solution "pH 4.65" into the bottom clip.

Please note

If buffer solutions other than those stated are used, the pH value of the buffer solution must be lower than pH 6 or higher than pH 8 .

13 Dip the pH sensor at least 2 cm deep into the buffer solution until the indicated pH value remains constant.

14 Use the four arrow keys to enter the determined value.

15 Save the value by pressing "Enter".

16 Remove the pH sensor from the top clip.

17 Insert or screw the pH sensor into the lid of the cell body.

The pH measurement is then calibrated.

pH calibration

If external influences result in a constant difference between the displayed pH value and a pH value measured manually, this difference can be compensated:

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

2 Select the menu item "pH" for the measurement you wish to perform.

3 Select the "Offset pH" parameter.

4 With the four arrow keys enter the difference between the comparative value and the displayed value (comparative value minus the displayed value).

5 Save the value by pressing "Enter".

This concludes the pH offset.

Please note

The offset is deleted each time a new pH-7 alignment or slope alignment is performed.

5.4.5 ORP calibration (mV)

Please note

ORP sensors have long running-in times. After calibration with a buffer solution, it can therefore take several hours until the value has stabilised.

1. Starting from the basic display in the main menu select the "Calibration" menu.
2. Select the menu item “mV (1) ... mV (4)“ for the measurement you wish to perform.

   The "Cal. mV" parameter is selected.
3. Place one of the supplied beakers into the bottom clip and fill with the buffer solution or clamp a bag with buffer solution into the bottom clip.
4. Pull or unscrew the ORP sensor from the lid of the cell body.
5. Dip the ORP sensor through the top clip at least 2 cm deep into the buffer solution until the indicated pH value remains constant.
6. Use the arrow keys to enter the determined value.
7. Save the value by pressing "Enter".
8. Remove the ORP sensor from the top clip.
9. Insert or screw the ORP sensor into the lid of the cell body.

ORP calibration is then concluded.

5.4.6 Conductivity calibration

Please note

The conductivity sensor has an integrated temperature sensor and therefore an automatic temperature compensation feature.

In the conductivity calibration menu, the temperature of the temperature sensor in the conductivity sensor can be adapted with the parameter "Cal. temperature" to a comparative measurement.

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

2 Select the "Conductivity (1) ... (4)" menu item.

3 Select the "Calibration" parameter.

4 Place one of the supplied beakers into the bottom clip and fill with the buffer solution "60.0mS/cm"* or clamp a bag with buffer solution "60.0 mS/cm"* into the bottom clip.

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

6 Dip the conductivity sensor through the top clip into the calibration solution to the bottom of the beaker.

7 Pull out the conductivity sensor and rinse off with distilled water.

8 Repeat the dipping and rinsing procedure several times.

9 Replace the calibration solution in the bottom beaker with a new solution.

10 Repeat measurement. Move the conductivity sensor slightly until the displayed value remains constant.

11 Use the arrow keys to enter the determined value.

12 Save the value by pressing "Enter".

13 Insert or screw the conductivity sensor into the lid of the cell body.

14 Conductivity calibration is then concluded.

* Depends on measuring range:
600 µS/cm calibration solution for 2500 µS/cm measuring range
60 mS/cm calibration solution for all mS/cm measuring ranges

5.4.7 Fluoride calibration

The fluoride measurement is calibrated at 2 points, which should be as far from each other as possible, but within the measurement range. The lower value must be calibrated with a lower fluoride concentration than the upper value, e.g. lower value 0.20 mg/l and upper value 2.00 mg/l.
Calibration solutions for 0.20 mg/l, 2.00 mg/l and 100 mg/l are available.

Please note

Before use, the electrode must be placed in a 100 mg/l fluoride solution at pH 7 for approx. 24 hours. This is necessary to guarantee that the electrode functions properly.

1. Starting from the basic display in the main menu, select the "Calibration" menu.
2. Select the menu item “Fluoride (1) ... (4)“ for the measurement you wish to perform.
3. Fill 10–20 ml of the lower concentrated standard solution in one of the supplied beakers and place in the bottom clip. Dip the electrode at least 2 cm.
4. Select "Cal. lower value" in the menu and press "Enter".
5. Enter the calibration solution value using the arrow keys and wait until the measured value on the display remains constant.
6. Save the value by pressing "Enter".
7. Select "Cal. upper value" in the menu and press "Enter".
8. Wash electrode with distilled water and fill 10–20 ml of the higher concentrated standard solution into one of the supplied beakers. Dip electrode.
9. Enter the calibration solution value using the arrow keys and wait until the measured value on the display remains constant.
10. Save the value by pressing "Enter".
11. Place the sensor in the flow-through adapter again.

This concludes the fluoride calibration.

5.5 Errors

Error messages

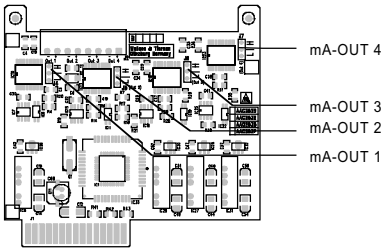
The following table shows and explains all possible error messages which can be displayed. If several errors occur at the same time, the corresponding messages appear alternately in succession. When the error has been remedied, the error message is automatically deleted.

If you are unable to remedy the error yourself, please contact your contractual partner.

Error message	Cause	Remedy
Measured value display flashes	Measured value is outside the measuring range	Check measuring range and change, if necessary. Check dosing or controller settings
Positioner feedback flashes	Positioner in manual mode	Press the adjusting nob on the positioner
DI I flashes	Sample water flow recently insufficient (delay running)	Check sample water flow rate (approx. 33 l/h)
DI I Permanent display	Sample water flow insufficient for some time (delay elapsed)	Clean or replace the preliminary filter Multi-sensor incorrectly connected or defective
DI II and DI III	Signal on signal input DI II or DI III	Check connection and setting
Zero Mod1 Zero Mod2 Zero Mod3 Zero Mod4	In 3 electrode cells Sensor has zero current > +5 µA or < -5 µA	Upot potential voltage set incorrectly; change, if necessary Electrodes in the 3 electrode cell are soiled; clean and service, if necessary Sample water is not turned off or check valve leaks; turn off sample water, if necessary
	In membrane sensors Sensor has zero current > +5 µA or < -5 µA	Disinfectant in water; calibrate with disinfectant-free water, if necessary Check sensors and replace or service, if necessary

Error message	Cause	Remedy
Calib Mod1 Calib Mod2 Calib Mod3 Calib Mod4	In 3 electrode cells and membrane sensors Slope error - the sensor current based on 1 mg/l has fallen below the required minimum In measuring range: 70 µA: min. 0.2 µA/mg/l 100 µA: min. 0.4 µA/mg/l 200 µA: min. 2 µA/mg/l 1000 µA: min. 4 µA/mg/l	Check whether there are air bubbles on the membrane sensor and remove, if necessary Service membrane sensors - replace electrolyte/membrane cap Clean 3 electrode cells, replace cell sand
	In pH In pH 7 calibration, the sensor signal is outside -100 to +100 mV or the sensor sends a signal outside 46–70 mV pre pH increment The calibration point distance is smaller than 1 pH increment	Check electrodes, Check buffer solutions, Replace, if necessary
	In mV The mV electrode correction offset is outside -50 to +50 mV	Check electrodes, Check calibration solution, Replace, if necessary
	Conductivity Conductivity measurement spread is smaller than 0.8 or larger than 1.2	Clean sensor, Inspect, Replace sensor, if necessary
	Fluoride The rate of change of the sensor curve is too small or the calibration limits have been exceeded 0.2 mg/l: 40 to 160 mV 2.0 mg/l: -10 to 100 mV 20 mg/l: -60 to 40mV The lower cal. value sensor voltage must be 20 mV higher than the upper cal. value	Check electrode, cable and standard solution, use fresh standard solution, replace electrodes
Cl_2++	pH value smaller than pH 6.00 or larger than 8.75	Check pH measurement or pH correction, calibrate pH sensor, if necessary

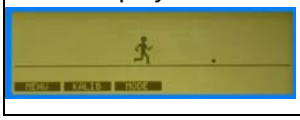
Error message	Cause	Remedy
Calib Mod1 Calib Mod2 Calib Mod3 Calib Mod4	In 3 electrode cells and membrane sensors Slope error - the sensor current based on 1 mg/l has fallen below the required minimum In measuring range: 70 µA: min. 0.2 µA/mg/l 100 µA: min. 0.4 µA/mg/l 200 µA: min. 2 µA/mg/l 1000 µA: min. 4 µA/mg/l	Check whether there are air bubbles on the membrane sensor and remove, if necessary Service membrane sensors - replace electrolyte/membrane cap Clean 3 electrode cells, replace cell sand
	In pH In pH 7 calibration, the sensor signal is outside -100 to +100 mV or the sensor sends a signal outside 46–70 mV pre pH increment The calibration point distance is smaller than 1 pH increment	Check electrodes, Check buffer solutions, Replace, if necessary
	In mV The mV electrode correction offset is outside -50 to +50 mV	Check electrodes, Check calibration solution, Replace, if necessary
	Conductivity Conductivity measurement spread is smaller than 0.8 or larger than 1.2	Clean sensor, Inspect, Replace sensor, if necessary
	Fluoride The rate of change of the sensor curve is too small or the calibration limits have been exceeded 0.2 mg/l: 40 to 160 mV 2.0 mg/l: -10 to 100 mV 20 mg/l: -60 to 40mV The lower cal. value sensor voltage must be 20 mV higher than the upper cal. value	Check electrode, cable and standard solution, use fresh standard solution, replace electrodes
Cl_2++	pH value smaller than pH 6.00 or larger than 8.75	Check pH measurement or pH correction, calibrate pH sensor, if necessary

Error message	Cause	Remedy
mA output 1? mA output 2? mA output 3? mA output 4?	Load error The mA output cannot drive its mA output current through the connected current loop (400 Ohm at 20 mA max.).	Check whether the mA signal is required at all (e.g. for plotter). If not, switch off the output signal in the "INPUTS/OUTPUTS" menu (analog output). Check mA signal cable for interruption
	Resistance in the current loop > 400 Ohm	Reset the respective bridge on the plug-in module "mA outputs": L:< 400 Ohm, H:< 1000 Ohm 
Temperature?	Interruption in the temperaturesensor or cable	Check multi-sensor and cable
Setpoint mod1 Setpoint mod2	Setpoint error in module 1 or 2 Due to modification of the measuring range, the controller setpoint is outside the measuring range.	Reset the controller setpoint or adjust the measuring range
Cell Mod1? Cell Mod2? Cell Mod3? Cell Mod4?	In 3 electrode cells Chlorine sensor not screwed in. No sand cleaning. Sensor, sensor cable or sensor module defective Sensor measuring module µA measuring range exceeded In pH, F^- and mV modules Sensor, sensor cable or sensor module defective In membrane sensors Sensor, sensor cable or sensor module defective Sensor measuring module µA measuring range exceeded In conductivity modules Sensor, sensor cable or sensor module defective	Screw in sensor correctly. Check sand cleaning. Check the sensor, sensor cable or sensor module, replace if necessary Select higher µA measuring range Check the sensor, sensor cable and sensor module, replace if necessary Check the sensor, sensor cable and sensor module, replace if necessary Check the sensor, sensor cable or sensor module, replace if necessary; clean sensor

Error message	Cause	Remedy
Position.Ym?	Ym range too narrow Position 0 % or 100 % incorrectly calibrated	Set gap between 0 % and 100 % to at least 60 % of the entire path
	Positioner selected, but not connected	Check setting: Positioner with Ym
	Feedback signal incorrect	Check feedback signal (1kOhm)
	Positioner feedback incorrectly connected or defective	Check (refer to 9. “Wiring Diagrams" on page 245)
Module?	Sensor module was removed Sensor module defective	Refit or replace the sensor module
Adaption?	Adaption terminated with error	Refer to 4.9 “Adaption" on page 104
Measuring range 1? Measuring range 2? Measuring range 3? Measuring range 4?	Min. or max. limit value is outside the measuring range	Check the min/max limit values and change, if necessary
Setpoint trim?	Measuring range and unit for Mod 1 and Mod two not identical	Set measuring range and unit for Mod 1 the same, e.g. Mod 1 = 1.00 mg/l Mod 2 = 1.00 mg/l

Error The following table shows and explains possible errors which can occur. If you are unable to remedy the error yourself, please contact your contractual partner.

Error	Cause	Remedy
No indication on device	No power supply	External switch or fuse on
	Device fuse defective	Check the power supply and replace fuse (Electrician)
	Housing cover is fitted incorrectly	Check, fit the housing cover correctly (cable possibly trapped)
Displayed/output value incorrect	Change on sensor or in the sample water	Calibrate
Low controller quality (controller swings, setpoint not reached)	Incorrect control parameters	Check, adjust controller parameters; perform automatic adaption on single feed back control
	Dosing chemical tank empty	Fill, replace
	Incorrect actuator selected	Check, correct actuator
	Positioner or pump defective	Check, replace positioner/pump
Measured value display not available, although the appropriate measuring module is installed	Measuring module defective or fitted incorrectly	Check, replace measuring module (Electrician)
Positioner/pump does not work	Positioner in manual mode	Engage manual knob
	Dosing device selected incorrectly	Select correct dosing device
	Positioner/pump incorrectly connected	Connect the positioner/pump correctly (Electrician)
	Relay card defective or fitted incorrectly	Check, replace relay card (Electrician)
	Incorrect application	Check (refer to 4.4 “Applications" on page 71 and 9. “Wiring Diagrams" on page 245)
Positioner runs in wrong direction	Positioner incorrectly connected	Correct connections (Electrician)
Positioner closes	Positioner feedback interrupted	Correct connections (Electrician)
Digital outputs without function	Digital inputs not activated	Activate digital inputs

Error	Cause	Remedy
Main display 	The system hasn't detected a sensor card.	Please check wheather the sensor cards are correctly plugged. Sensor cards defective.

6. Installation

6.1 Transport and storage

Transport

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

Check that the transport packaging is undamaged.
In the event of damage please inform the transport company immediately, as your rights to compensation will otherwise be lost.

If the device is damaged, please contact the respective contractual partner immediately.

Keep the packaging until the unit has been correctly installed and taken into operation.

Storage

Store the device and the sensors in a dry condition without any residual water in a dry place which is not exposed to the weather. Storage temperature 3.1 “Technical Data" on page 13.

6.2 Installation

Installation site

The device must be protected against rain, frost and direct sunlight and may therefore not be installed outdoors.

It must be mounted horizontally on a flat wall in a frost-free room with an ambient temperature of 0 to 50 °C.

The air in the room should be non-condensing.

Opening the housing

1 Remove the housing cover of the MFC flow block assembly. To this purpose, lightly press the two buttons on the top of the housing.

2 Release the five screws on the cover of the MFC electronic module.

Caution!

The indication and operator controls on the cover of the MFC electronic module are connected to the housing with wires.

Please note

The device switches off automatically when the cover is removed.

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

Installation with mounting rail

1. Fasten the mounting rail to the wall with two screws (diameter 5 mm) and two dowels (diameter 8 mm).
2. Hook the electronic module onto the mounting rail so that it is flush at the right and fasten to the wall with a screw (diameter 5 mm) and a dowel (diameter 8 mm).
3. Hook the DEPOLOX ® 5 flow block assembly onto the mounting rail on the left next to the MFC electronic module and fasten to the wall with two screws (diameter 5 mm) and two dowels (diameter 8 mm) .

Refer to “Wall Mount Assembly" on page 171.

Please note

If the flow block assembly is not mounted directly next to the MFC, it can also be mounted without the mounting rail (see next page).

Installation without mounting rails

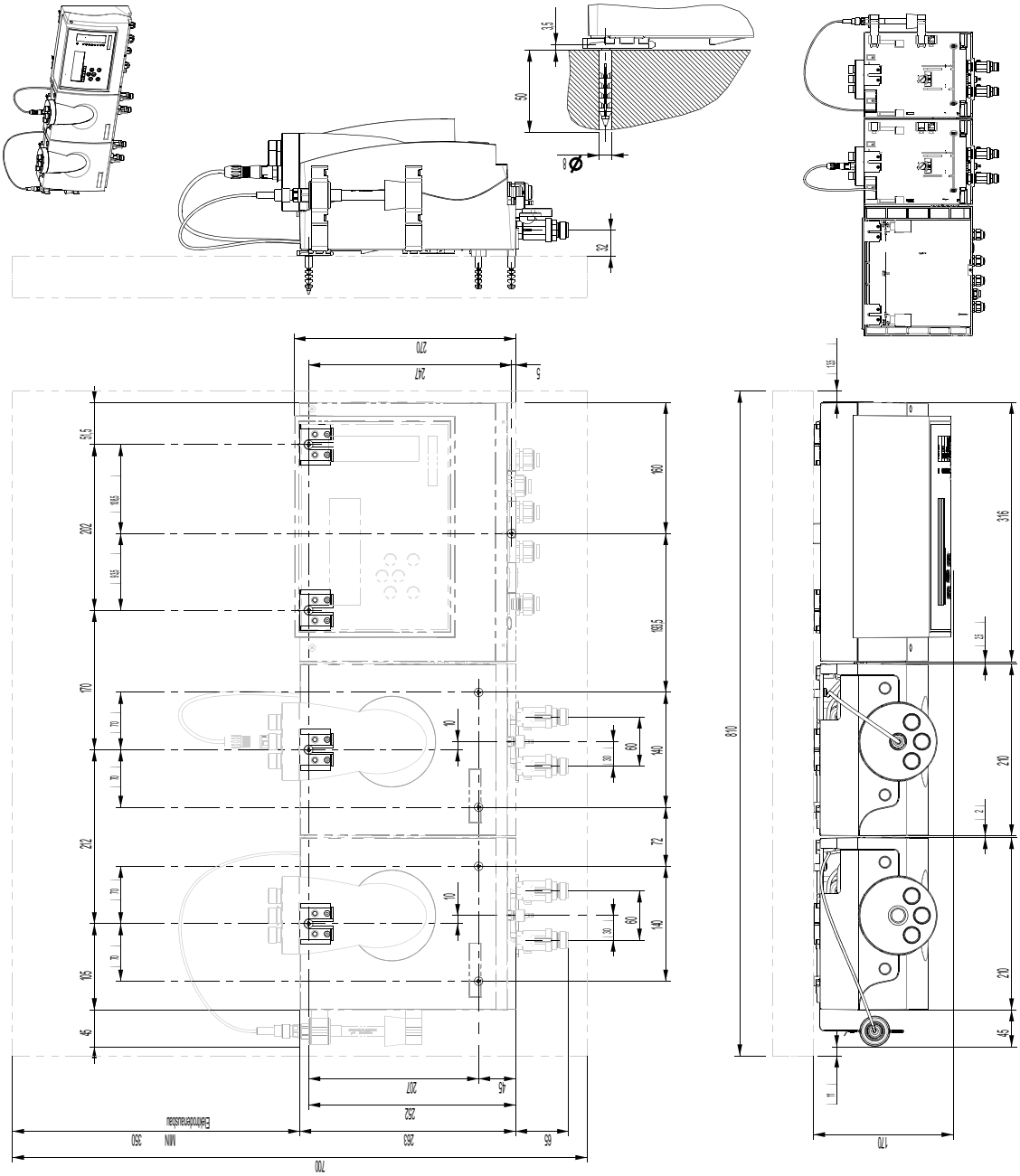
If the electronic module and the DEPOLOX ® 5 flow block assembly are to be mounted in different places, the modules can be hooked onto suitable tallow-drop screws by the top holding fixtures instead of onto the mounting rail. Proceed with the installation as described above.

Please note

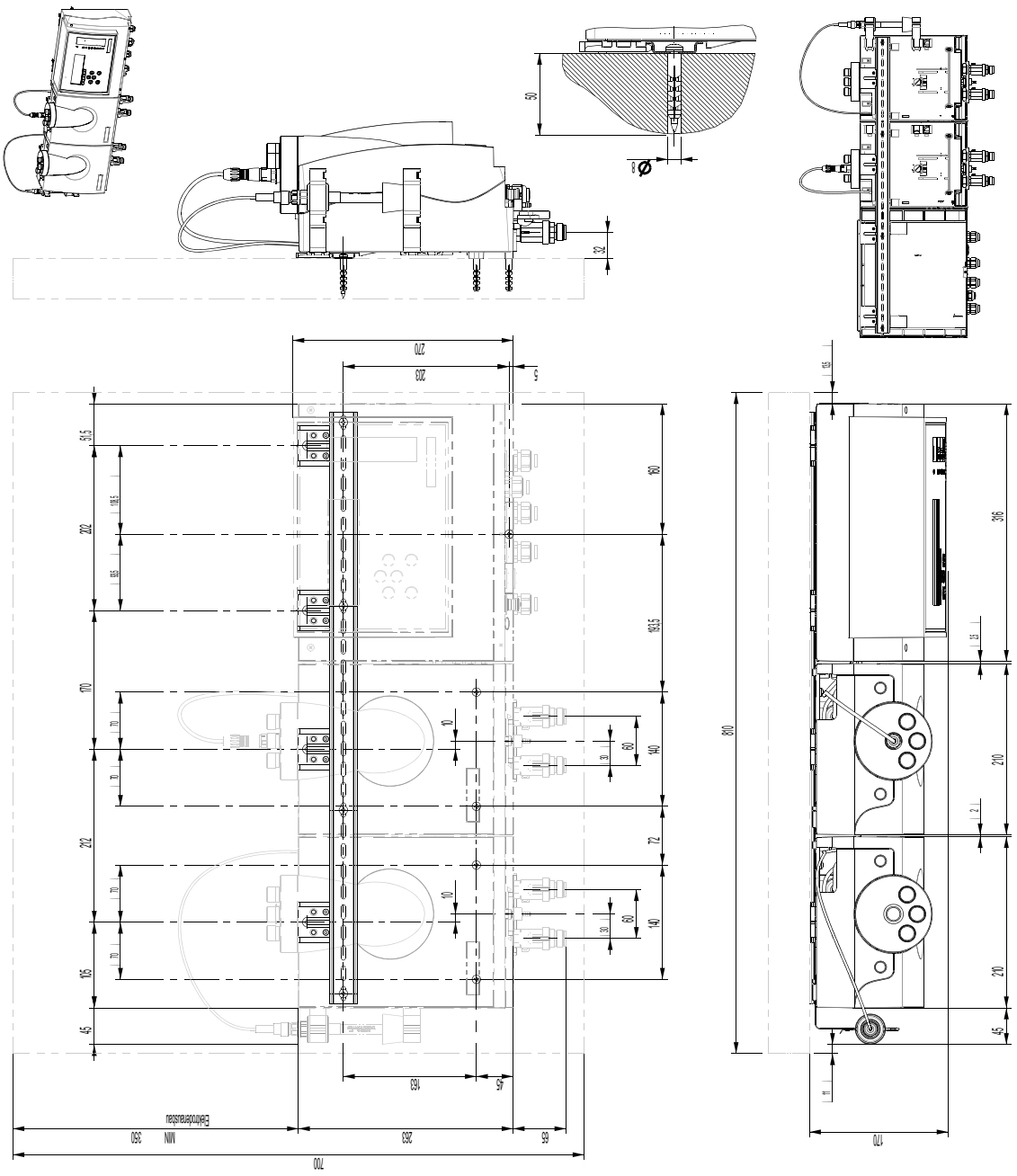
If the electronic module and the flow block assembly are mounted at separate locations, the sensor cable extensions with a maximum length of 50 m must be used. An impedance converter for the Redox, fluoride and pH sensors is also required (see 8. “Complete Devices, Retrofit Kits and Spare Parts" on page 215).

Refer to “Top Hat Rail Assembly" on page 173.

Wall Mount Assembly



Top Hat Rail Assembly



6.3 Commissioning

6.3.1 Commissioning Guide

Commissioning procedure

Once the device is mounted, connect the current.
Then, the sensor measuring modules must be equipped and the application selected.

Depending on the selected controller function and application, the sensor measuring modules must be installed at the appropriate slots (see 4.4 “Applications" on page 71 and 4.5 “Controller Function" on page 77).

The cable descriptions with the numbers 1–4 must be attached to the sensor cables according to the selected slot. The cable descriptions are included with the sensor measuring modules and ensure that cables will not be confused while calibrating multiple similar measurements (e.g. 2 pH measurements).

To set applications, refer to 6.3.10 “Setting the applications" on page 199.

The following table contains the individual commissioning steps in their correct sequence.

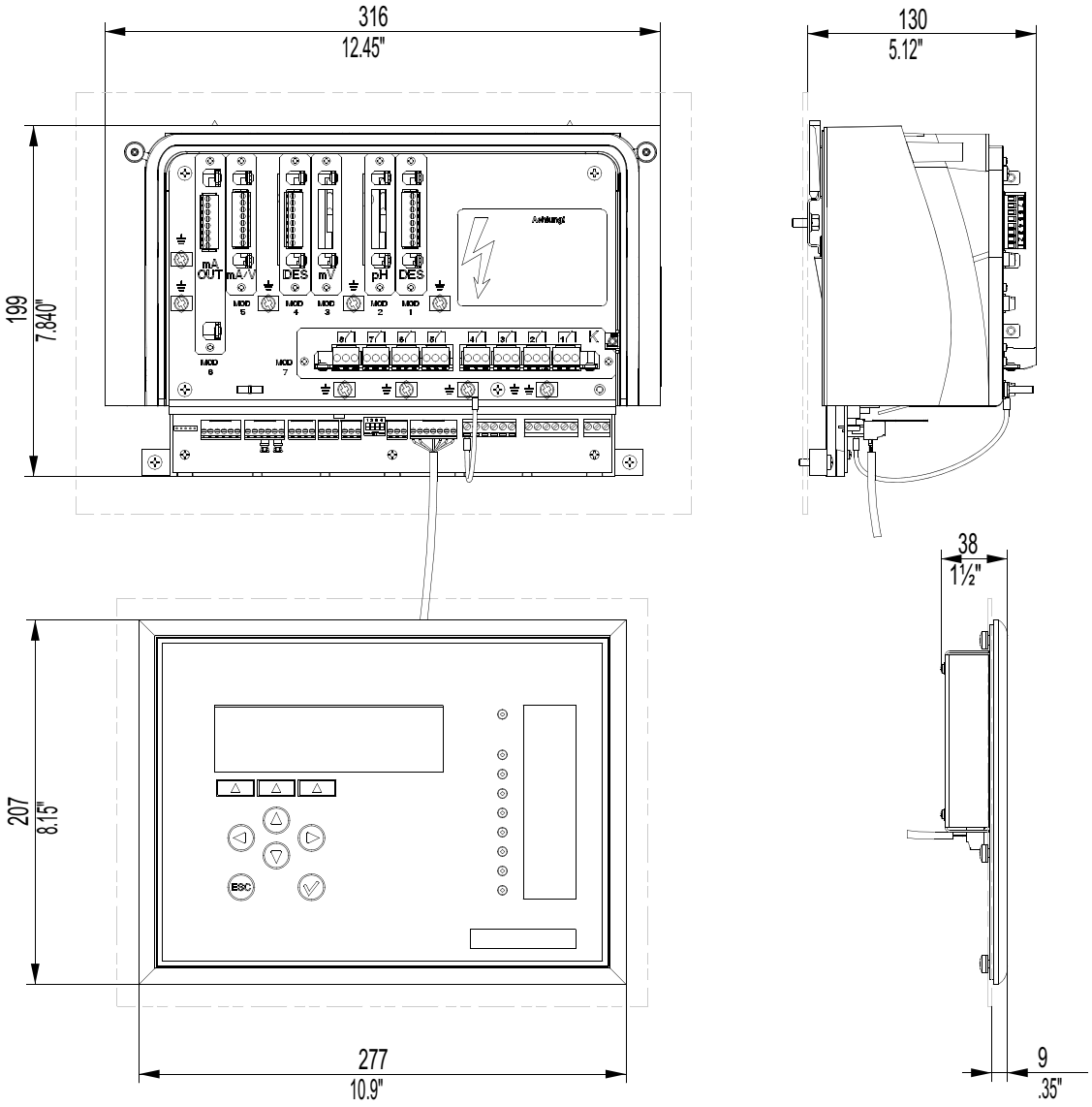
More detailed information is contained in the chapters listed in the "Chapter and page reference" column.

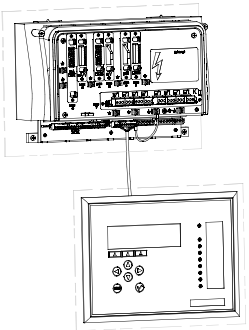
Completion of each step can be confirmed in the "Compl." column.

Please note

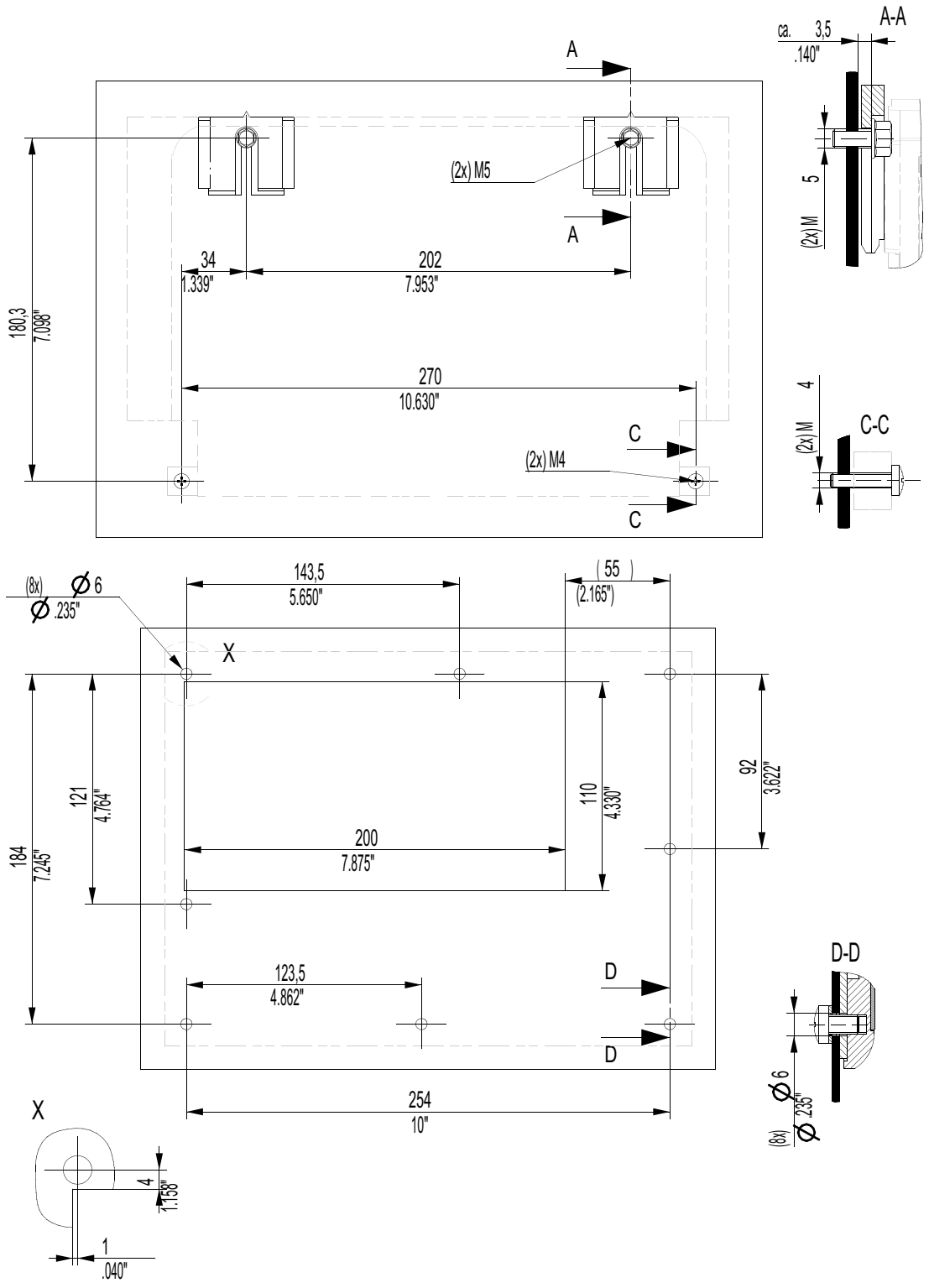
If this installation sequence cannot be complied with, please contact your contractual partner.

Control cabinet installation

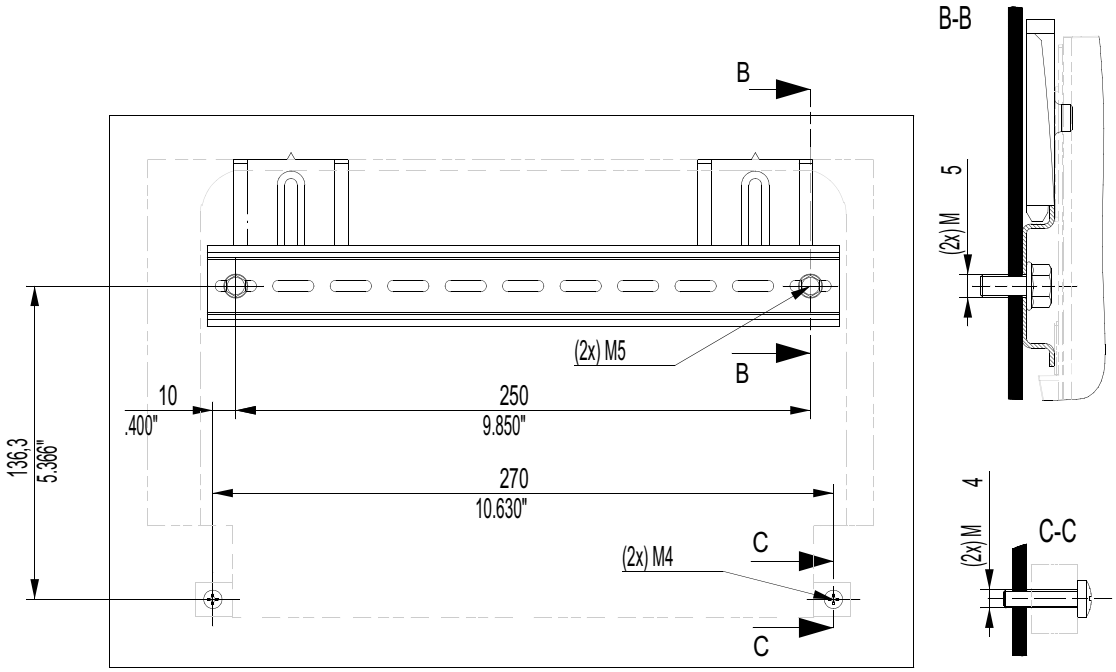




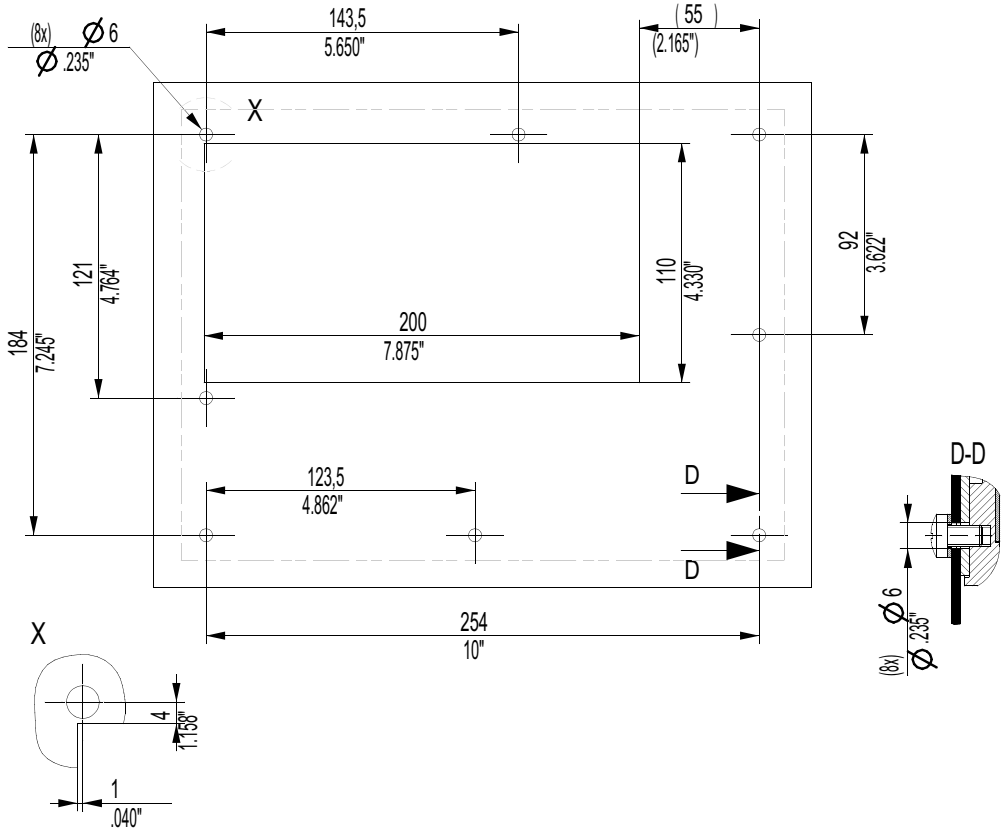
Control cabinet housing installation with wall hooks



Control cabinet housing installation with top-hat rail



Mounting front control panel



Commissioning using the example of application 3

Seq.	Task	Chapter and page reference	Comp.
1	Connect electrical connection Check the set mains voltage and adjust if necessary	6.3.6 Page 195 6.3.9 Page 198	☐
2	Connecting the Sample Water Connect inlet and outlet	6.3.4 Page 186	☐
3	Insert the sensors and connect	6.3.3 Page 183	☐
4	Fill the cell sand (DEPOLOX® 5 only)	6.3.2 Page 182	☐
5	If membrane sensors are used, fit the fine filter	6.3.5 Page 194	☐
6	Wire the device acc. to the application	Ch. 4.4 Page 71	☐
7	Insert the labelling field into the housing cover acc. to the application	6.3.7 Page 197	☐
8	Close the housing cover	6.3.8 Page 197	☐
9	Set the application	4.3.10 Page 199	☐
10	If another operating mode is activated, switch to "MANUAL"	Display 3, Page 149	☐
11	Select the language	Display 1.7.1, Page 141	☐
12	Set the time	Display 1.7.1, Page 141	☐
13	Set the date	Display 1.7.1 Page 141	☐
14	Enter system name (e.g. Control 1)	Display 1.7.1 Page 141	☐
15	Set the trend graphs assignment	Display 1.7.3, Page 141	☐
16	Set module descriptions	Display 1.7.4, Page 141	☐

Seq.	Task	Chapter and page reference	Comp.
	If module 1 is available:		
1	Set dosing output, and adjust positioner running time, Tp, and max. pulses if necessary	Display 1.1.1 Page 126	☐
2	Calibrate "Ym" on positioner with feedback	Display 1.1.1 Page 126	☐
3	Select control mode	Display 1.1.2 Page 126 6.3.11 Page 200	☐
4	Check setpoint and dosing factor, adjust if necessary	Display 1.1.2 Page 126	☐
5	Check setpoint and dosing source, adjust if necessary	Display 1.1.2 Page 126	☐
6	Check flow rate source, adjust if necessary	Display 1.1.3 Page 126	☐
7	Check flow rate direction, adjust if necessary	Display 1.1.3 Page 126	☐
8	Check control variable 2, adjust if necessary (single feed forward control only)	Display 1.1.3 Page 126	☐
9	Check X direction, adjust if necessary (single feed forward control only)	Display 1.1.3 Page 126	☐
10	Check X factor, adjust if necessary (single feed forward control only)	Display 1.1.3 Page 126	☐
11	Adjust values for Xp and Tn on control loop (single feed back control only)	Display 1.1.4 Page 126	☐

Please note

These values may be optimised later by adaption or manually.

Seq.	Task	Chapter and page reference	Comp.
12	Adjust values for Tconst and Tvar on control (compound-loop-control only)	Display 1.1.4, Page 126	☐
13	Check max. Lin. corr., adjust if necessary (compound-loop-control only)	Display 1.1.4 Page 126	☐

Seq.	Task	Chapter and page reference	Comp.
14	Check control factor, adjust if necessary (compound-loop-control only)	Display 1.1.4 Page 126	☐
15	Check measuring range, adjust if necessary	Display 1.1.5 Page 126	☐
16	Check limit values, adjust if necessary	Display 1.1.5 Page 126	☐
	If module 2 is available:		
1	Set dosing output, and adjust positioner running time, Tp, and max. pulses if necessary	Display 1.2.1 Page 131	☐
2	Select control mode	Display 1.2.2 Page 131	☐
3	Check setpoint and dosing factor, adjust if necessary	Display 1.2.2 Page 131	☐
4	Adjust values for Xp and Tn on control loop	Display 1.2.3 Page 131	☐

Please note

These values may be optimised later by adaption or manually.

Seq.	Task	Chapter and page reference	Comp.
5	Check measuring range, adjust if necessary	Display 1.2.6 Page 131	☐
6	Check limit values, adjust if necessary	Display 1.2.6 Page 131	☐
	If module 3 and 4 are available:		
1	Check measuring range, adjust if necessary	Display 1.3.1 Page 134 and Display 1.4.1 Page 135	☐
2	Check limit values, adjust if necessary	Display 1.3.2. Page 134 and Display 1.4.2 Page 135	☐

Seq.	Task	Chapter and page reference	Comp.
	Input and output settings:		
1	Check flow rate signal settings such as signal, unit, factor, format, measuring range start and end value, adjust if necessary	Display 1.5.1 Page 136	☐
2	Check flow rate limit values, adjust if necessary	Display 1.5.2 Page 136	☐
3	Check external set point/dosing factor setting such as signal and factor, adjust if necessary (only if using an external setpoint/dosing factor)	Display 1.5.3 Page 136	☐
4	Check limit values for external set point/dosing factor, adjust if necessary (only if using an external setpoint/dosing factor)	Display 1.5.4 Page 136	☐
5	Check mA signal 1–4, adjust if necessary (only if using the mA outputs)	Display 1.5.6/ 1.5.7 Page 136	☐
6	Check mA 1–4 assignment, adjust if necessary (only if using the mA outputs)	Display 1.5.6/ 1.5.7 Page 136	☐
7	Check settings for digital inputs 1 - 3, adjust if necessary	Display 1.5.7 Page 136	☐
8	Configure RS232 interfaces as required	Display 1.5.8 Page 136	☐
9	Configure RS485 interfaces as required	Display 1.5.8 Page 136	☐
10	Check function of alarms 1–8, adjust if necessary	Display 1.6.1/ 1.6.2 Page 139	☐
11	Configure alarm 1–8 assignment as required	Display 1.6.3/ 1.6.4 Page 139	☐
12	Via MODE - MAN.DOS, check all connected actuators and dosing pumps for proper function	Display 3.1 Page 149	☐
13	Calibrate the fitted sensors after approximately one hour running-in time	Display 2.1.1 - 2.1.5 Page 147	☐

Seq.	Task	Chapter and page reference	Comp.
14	Set to the "AUTO" operating mode	Display 3 Page 149	☐
15	Repeat calibration after 24 hours running time	Display 3 Page 149	☐

6.3.2 Filling the cell sand (DEPOLOX® 5 only)

Caution!

Before opening the cover on the pressurised version always first release the pressure in the cell body with the drain screw.

1. Close the ball valve on the sample water inlet and outlet (pressurised version).
2. On the non-pressurised version, remove the protection plugs on the cell body cover of the 3 electrode cells.

   On the pressurised version, unscrew the protection plugs on the cell body cover of the 3 electrode cells.
3. Fill half a cap from the plastic bottle with cell sand and pour it into the cell body (approx. 1/2 cm³ cell sand).
4. On the non-pressurised version, replace the protection plugs on the cell body cover of the 3 electrode cells.

   On the pressurised version, screw the protection plugs on the cell body cover of the 3 electrode cells.

Please note

Make sure that the opening (especially the threads in the pressurised version) is clean; rinse off with distilled water, if necessary.

5. Reopen the ball valve on the sample water inlet and outlet (pressurised version).

Please note

The system must be recalibrated approx. 4 hours after each time the cell sand is replaced.

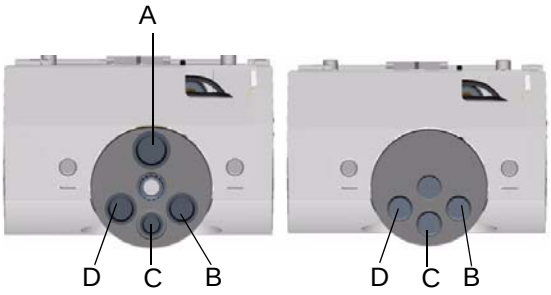
The calibration must be checked after one day.

6.3.3 Insert the sensors and connect

Please note

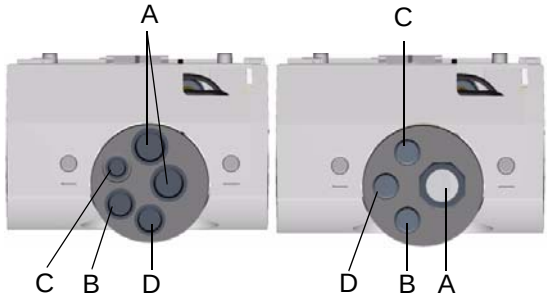
Observe the max. back pressure (pressurised version).
Please consult the membrane sensor data sheet for this figure.
which can be requested from your contractual partner.

Arrangement of the sensors



DEPOLOX® 5 non-pressurised version

DEPOLOX® 5 pressurised version



VariaSens non-pressurised version

VariaSens pressurised version

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

1 Remove the protection caps from the sensors.

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

The sensors are marked as follows:

Membrane sensor for free chlorine, chlorine dioxide, ozone and total chlorine (A)
mV: Sensor for Redox, marked "mV" (B)
pH: Sensor for pH value, marked "pH" (D)
µS: Sensor for conductivity, marked "LF325" (C)

Please note

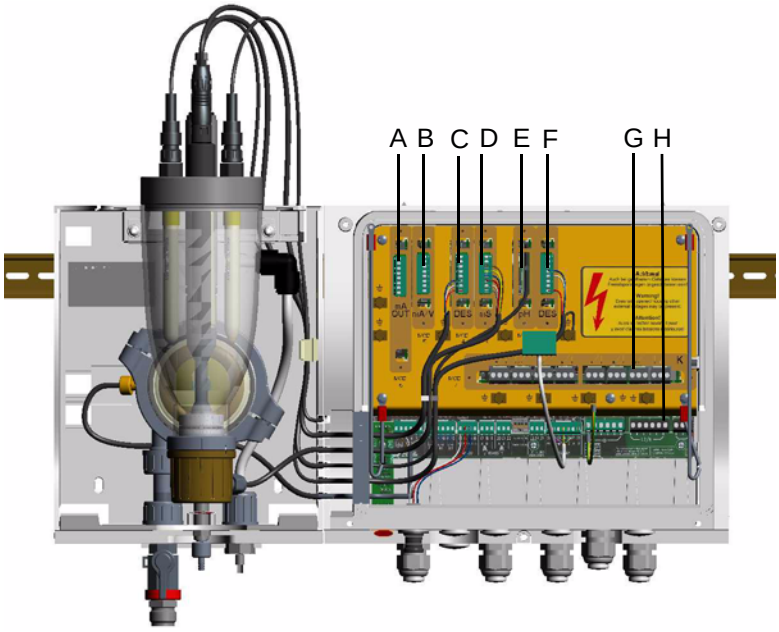
Keep the dust protection caps and watering caps of the sensors for subsequent use.

Please note

Cable extension:
The sensor cable for chlorine, conductivity and total chlorine may be extended to a max. of 50 m.

If the pH, Redox or fluoride sensor cables must be extended (max. 50 m), an impedance converter must be attached to the sensor. The impedance converter converts the very high-resistance sensor signal into a low-resistance signal. The impedance converter is supplied by an installed battery. The life of the battery is approx. 5 years; the impedance converter should be sent to Evoqua Water Technologies GmbH Günzburg for battery replacement.

Arrangement of the plug-in cards and cables



A mA-out plug-in card
B mA/V input - module 5 plug-in card
C Module 4 plug-in card
D Module 3 plug-in card
E Module 2 plug-in card
F Module 1 plug-in card
G Relay card
H Terminal strip

Please note

Should you wish to retrofit additional sensor measuring modules, information is provided in the packaging of the additionally ordered sensor measuring modules and in the included retrofitting manual.

Depending on the application, various controller functions are available for slot 1 and 2 (module 1 and module 2) (see 4.4

“Applications" on page 71).

Connecting the sensor cables

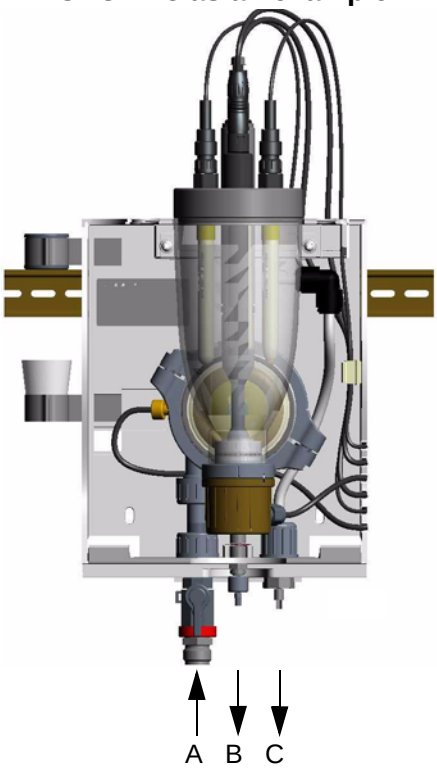
1. Place the sensor cables with the attached bushes into the cable ducts of the housing.
2. Depending on the sensor design, either plug or screw the cable in place.
3. Mount the multi-sensor with the temperature measuring cable to the flow control valve.
   Place the temperature measuring cable into a duct and connect in the electronic module, see 9. “Wiring Diagrams" on page 245.

Please note

Note that the shield of the four-core temperature measuring cable must also be connected.

4. Fit the supplied bushes to ducts which are not in use in order to seal the housing.

6.3.4 Connecting the Sample Water and starting up, taking DEPOLOX® 5 as an example



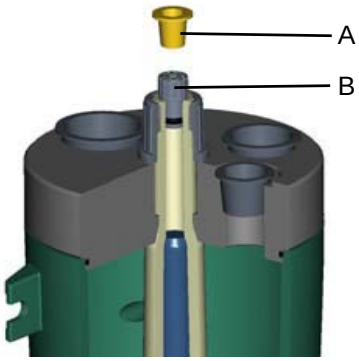
A Sample water inlet with ball valve
B Drain on the drain screw
C Sample water outlet (on pressurised version with ball valve only)

Please note

Before starting the DEPOLOX® 5 perform following steps.

Non-pressurized version

1 Remove the transport plug (yellow) from the electrolyte storage tank and replace with the stopper.

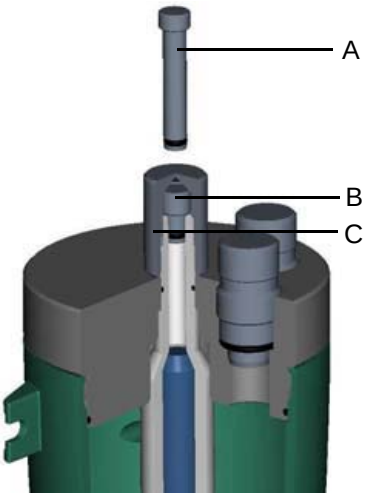


A Transport plug (yellow)
B Stopper (with white venting rod)

Pressurized version

Caution!

The cap must always be in place when the unit is running.



1 Remove the transport plugs (long) from the electrolyte storage tank and replace with the short stopper.
Then put the cap in place.

A Transport plug (long)
B Stopper (short)
C Cap

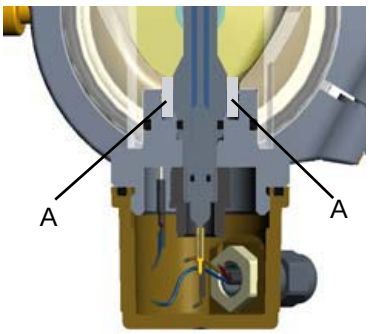
Remove felt ring

Please note

To keep the diaphragm moist and prevent crystallization in the filled electrodes there is a damp felt ring in the gap between the membrane and the electrodes when the unit is in storage.

Caution!

The felt ring must be removed before initial startup.



2 Remove the felt ring between the electrodes and the diaphragm.

A Felt ring

Connecting the sample water inlet

Please note

Never use copper tubing.

1 The pressure in the sample water inlet must always be within a range of min. 0.2 to max. 4 bar. At the same time, the pressure in the sample water inlet must generally be 0.2 bar higher than in the sample water outlet.

- If the preliminary pressure is below 0.2 bar, a pressure booster pump must be used (see "examples for sample water extraction with booster pump“ Page 191 and Page 192).
- If the pressure exceeds 4 bar, a pressure reducing valve must be used.

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

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

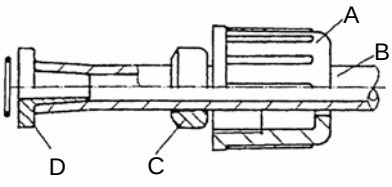
With hose connection

Please note

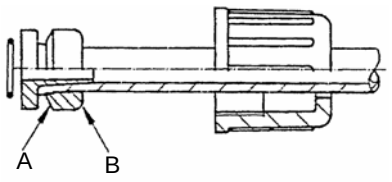
The water-tightness of the hose screw connection is only guaranteed if the following installation instructions are followed!

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

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



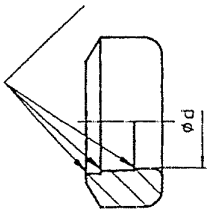
A Union nut
B Hose
C Locking ring
D Hose bushing



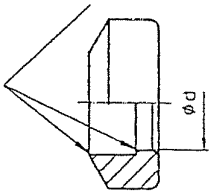
3 Push the locking ring out until the union nut engages the connecting threads.

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

Locking ring for PE hose with 3 clamping points



Locking ring for PVC hose with 2 clamping points



With rigid pipework

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

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

Connecting the sample water outlet

Please note

Never use copper tubing.

1 On the non-pressurised version, no back-pressure is permitted in the cell body. The sample water outlet must be open.

2 On the non-pressurised version, the sample water outlet must be installed so that no siphon effect can occur.

Please note

Recommendation: Position the outlet above the hopper.

3 On the pressurised version, a maximum back pressure of 1.5 bar is permitted on the sample water outlet.

With hose connection

See installation instructions Page 188.

With rigid pipework

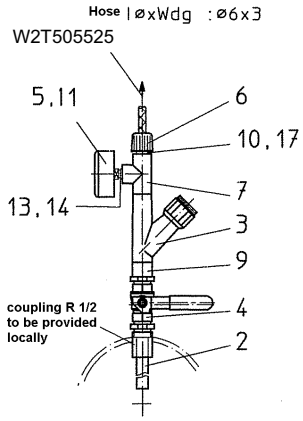
1 Connect the sample water pipework to the connection nozzle.

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

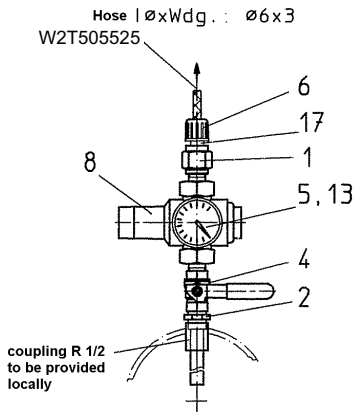
Connecting the drain

3 Ensure that the drain screw is always closed.

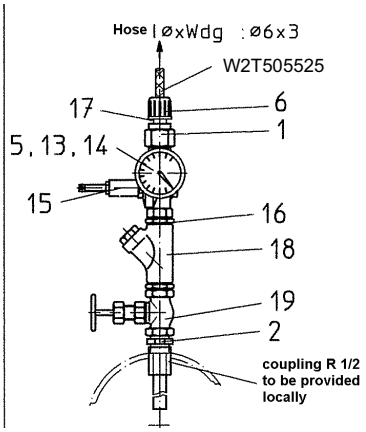
Examples of sample water extraction systems



W3T167656: 0.1 – 1 bar
W3T167628: 0.15 – 4 bar



W3T167645: 4 – 16 bar

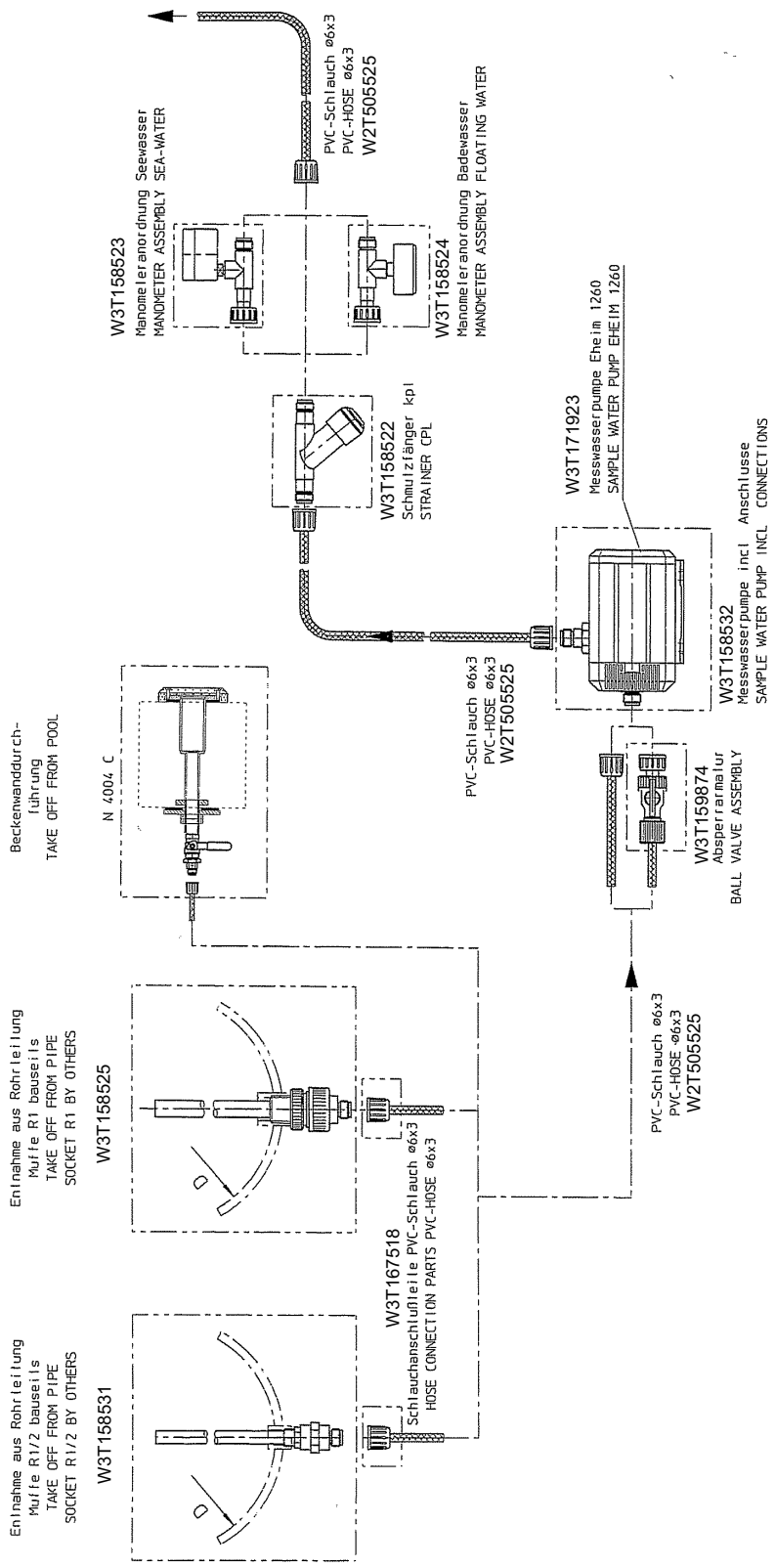


W3T167421 : 16 – 40 bar

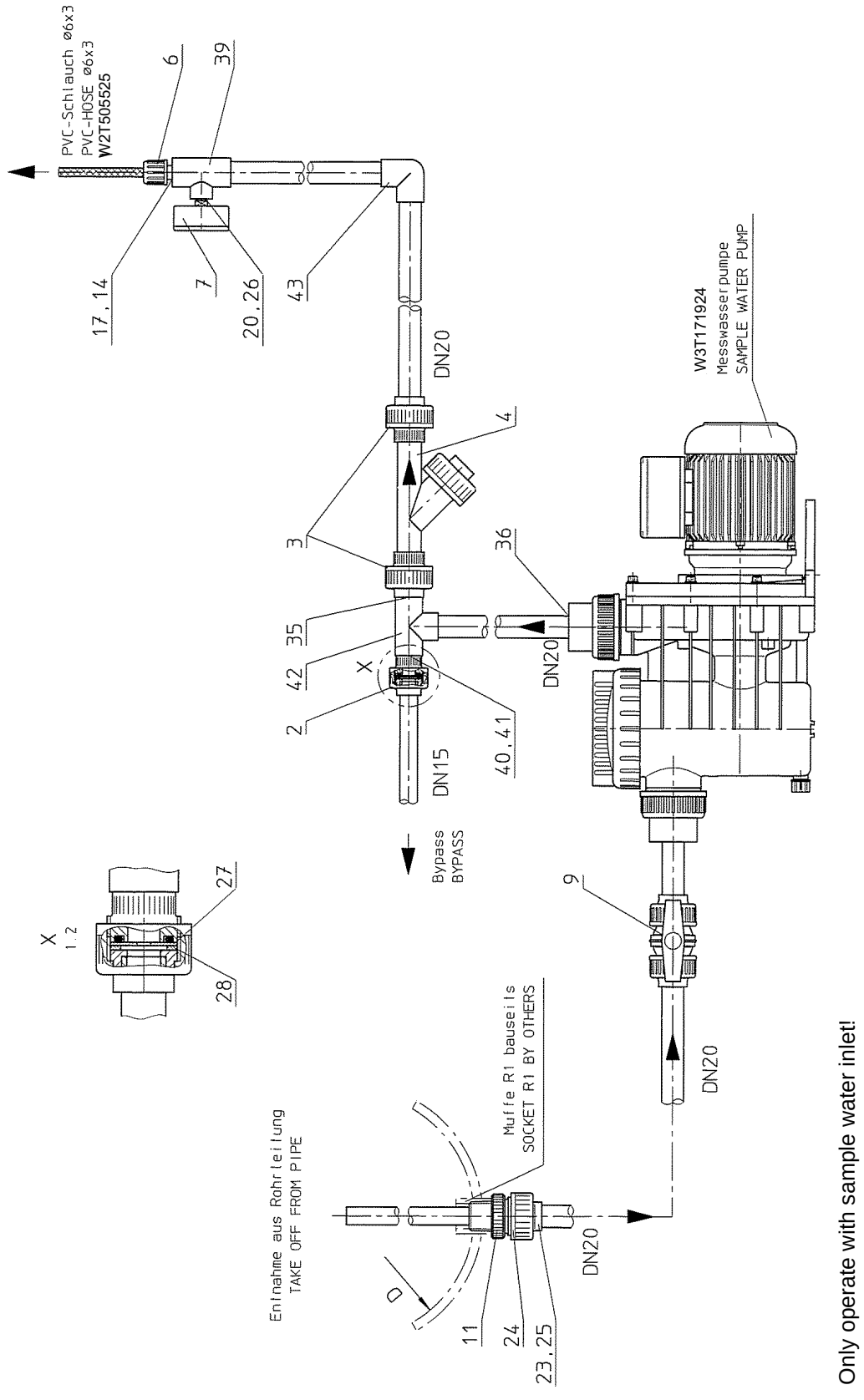
Item	Part No.	Description
1	W2T506486	Pressure gauge bushing
2	W3T167416	Sample pipe
3	W3T171391	Strainer DN15
4	W3T161902	Ball valve R 1/2
5	W3T173160	Pressure gauge 0 – 4 bar
6	W3T167518	Hose connection
7	W2T507524	T junction DN15
8	W3T165583	Pressure reducing valve R 1/2“
9	W2T505339	Male/female union
10	W2T506780	Reduction
11	W3T173138	Pressure gauge 0 – 1 bar
13	W3T161254	Flat gasket
14	W3T163500	Reduction nipple
15	W3T169418	Pressure reducing valve
16	W3T163535	Dual nipple R 1/2
17	W3T172948	Threaded part
18	W3T173148	Strainer
19	W3T165546	Needle valve

Examples for sample water extraction with booster pump

Example 1



Example 2



Only operate with sample water inlet!

parts list Sample water extraction for fresh water part no. W3T158528
Sample water extraction for salt water part no. W3T158529

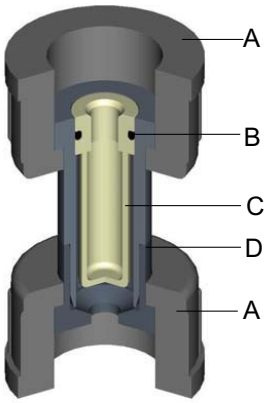
Seq. no.	Quantity	Part No.	Description
2	1	W2T505181	Screw connection
3	2	W2T505182	Screw connection
4	1	W3T171416	Strainer complete
6	1	W3T167518	Hose connection parts
7	1	W3T173160 W3T173198	Pressure gauge (fresh water) Pressure gauge (salt water)
9	1	W2T505945	Ball valve
11	1	W3T163670	Sample pipe
14	1	W3T172948	Threaded part
17	1	W2T505600	Reduction
20	1	W3T163500	Reduction nipple
23	1	W2T507288	Insert
24	1	W2T506934	Union nut
25	1	W3T172720	O-ring
26	1	W3T161254	Flat gasket
27	1	W3T171146	Nozzle washer
28	1	W3T172727	Flat gasket
35	1	W3T166090	Pipe segment
36	2	W2T506782	Reducing bush, short
39	1	W2T506527	T-piece
40	1	W3T166089	Pipe segment
41	1	W2T506778	Reducing bush, short
42	1	W2T507525	T-piece
43	1	W2T507535	Elbow ben

6.3.5 Fitting the fine filter

Please note

A fine filter must only be installed when membrane sensors are employed.

The fine filter (C) is contained in the enclosed accessory set.



A Knurled nut
B O-ring
C Fine filter
D Filter unit

1 Release both knurled nuts (A).

2 Remove complete filter unit (D).

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

4 Fit the filter unit (D). Ensure that it is fitted in the correct position.

5 Retighten both knurled nuts (A).

6.3.6 Connect the device to the power supply

Warning!

Only authorised and qualified electricians are permitted to install the device and open the housing. The device may only be taken into operation when the housing is closed, and must be connected to protection earth. Modifications to the device which go beyond those described in this manual are not permissible.

Warning!

The device is not equipped with a mains switch and is in operation as soon as the supply voltage is applied. An external switch or circuit breaker is necessary.
Provide a mains fuse locally (6 A). The conductor cross section of the mains cable must be at least 0.75 mm (AWG 18).
When connecting system components (e.g. devices, motors, pumps) as well as when entering operating data, the system components must be switched off in order to prevent uncontrolled activation or any incorrect function.

Caution!

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

Please note

A 6 A fuse in the main supply line is necessary when connecting to 230 V or 115 V.

Recommendation: Provide an on/off facility for the device at the installation site.

Connect the system components in accordance with the application-related 9. “Wiring Diagrams" on page 245wiring diagrams.

Checking the mains voltage

The device is available in three voltage variations:

- 24 V DC
- 200–240 V AC, 50–60 Hz (switchable)
- 100–120 V AC, 50–60 Hz

Switching the mains voltage

The mains voltage is switched over from 230 V AC to 115 V AC as follows:

1 Disconnect the device from the power supply.

2 Remove the cover of the MFC electronic module.

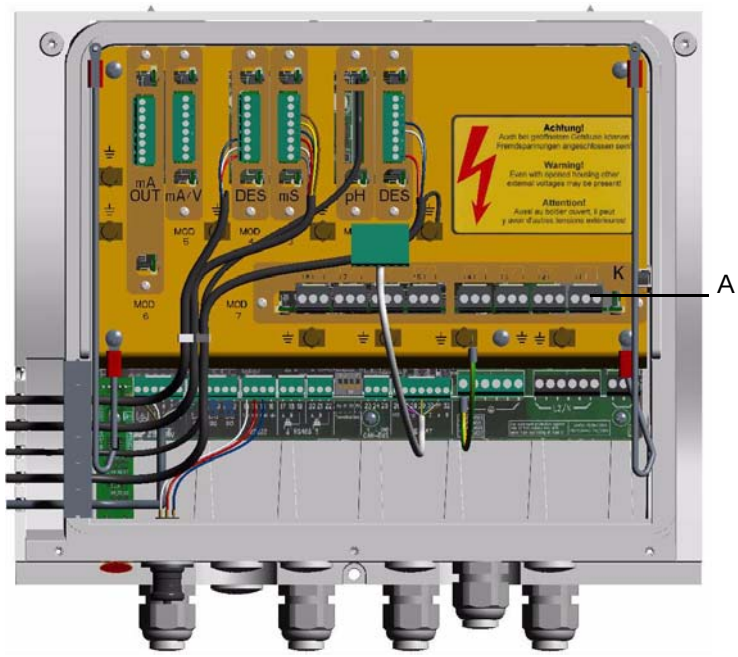
3 Remove the relay card (A).

4 Through the empty slot of the relay card (A), switch the mains switch on the motherboard (e.g. with a screwdriver).

Please note

It is not necessary to replace the fuses.

5 Reassemble the device.



A Relay card

6.3.7 Mounting the Labelling Field

1 Select the supplied labelling field in accordance with the specified application.

2 Supplement the labelling field, if necessary

3 Insert the labelling field for the LEDs on the inside of the housing cover of the MFC electronic module in accordance with the selected application.

6.3.8 Mounting the housing covers

1 Ensure that the cable bushes are fitted correctly.

2 Carefully fit the housing cover of the MFC electronic module and secure with the five housing screws.

3 Carefully place the housing cover onto the flow block assembly and snap into place.

Please note

Tighten the housing screws to a maximum torque of 0.7 Nm (± 0.15 Nm).

6.3.9 Switching the device on

Warning!

The device is not equipped with a mains switch and is in operation as soon as the supply voltage is applied. When entering operating data it must be taken into account that these could directly influence the connected system components.

Activate the power supply to the device.

The green "POWER" indicator lights up.

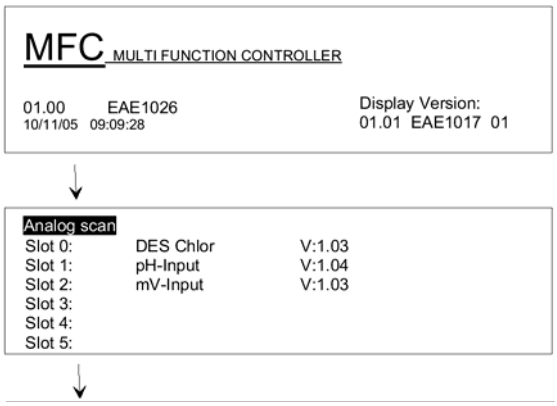
The following appear in succession on the graphic display:

Version

MFC

Analog scan

Basic display in main menu



Please note

When initially switching on the system, the MFC depicts a second display with a menu to set the local language.
Please select your language!
▶ Language ... English
Press "Enter" plus arrow UP or arrow DOWN to change language. German, English, French and Dutch are available. The device does not continue booting until the selection is confirmed with the "Enter" key.

6.3.10 Setting the applications

1 Starting from the basic display, restart the system by selecting "Reset" under the "Select" and "System" menus, and then selecting "System Restart" ... "Yes".
"RESET CPU" and then "MFC" appears.

In the following display "Analog Scan", press both the "left" and the "right" arrow at the same time for at least two seconds. Then appears.

Select the "APPLIC" function.
The "Application Select" menu appears.

Select the set application with the "ENTER" function.

Another application can now be set with the "Up" or "Down" keys (application type: xxxx). (See 4.4 “Applications" on page 71).

Select "ENTER" to program the set application. Select "BACK" to return to the basic display.

2 Make the desired settings in the menu.

3 Calibrate the sensors. Re-calibrate the next day, as new sensors can change within the first 24 hours.

6.3.11 Ym Calibration

Only with selection of "Electr.Pos. w. Ym".

Automatic calibration

1. Starting with the basic display in the main menu, open the "Dosing" window from the "Module Type (1)" menu.
2. Select "Ym Calibration" and confirm the selection.
3. Select the "Auto" function and confirm the selection.

   Feedback signal alignment starts automatically.

   The motor moves to the end positions Ym = 100 % and Ym = 0 %. The message "End" indicates the end of the alignment. If an error occurs during automatic setting, "pos.-error" appears and the setting is terminated.
4. Determine the running time of the positioner from 0 % to 100 %.
5. Enter the determined running time in the "Dosing" window under Ty.

Please note

If automatic alignment is not successful, perform alignment manually. For this purpose, manually move to YmCal. 0 % and YmCal 100 % and save.

Manual calibration

Please note

The feedback signal can be adjusted by no more than 30 %.

1. Switch device to manual (Keys "Mode" ... "Change").
2. Manually close the positioner via the MAN.DOS ... Module Type (1) key until the limit switch turns off.
3. Starting with the basic display in the main menu, open the "Dosing" window from the "Module Type (1)" menu.
4. Select "Ym Cal. 0 %" and confirm the selection.
5. Manually open the positioner via the MODE - MAN.DOS – Module Type (1) key until the limit switch turns off.
6. Starting with the basic display in the main menu, open the "Dosing" window from the "Module Type (1)" menu.
7. Select "YmCal 100 %" and confirm the selection.

Please note

There must be a distance of at least 60 % of the total path between

the set 0 % position and the 100 % position.

8 Check the position in a second operation:

Select the "MANUAL" operating mode.

Move to various positions via the MAN.DOS key and check dosing rate.

Repeat calibration at 0 % and 100 %, if necessary.

9 Determine the running time of the positioner from 0 % to 100 %.

10 Enter the determined running time in the "Cl_2 Dosing" window under Ty.

6.4 Decommissioning

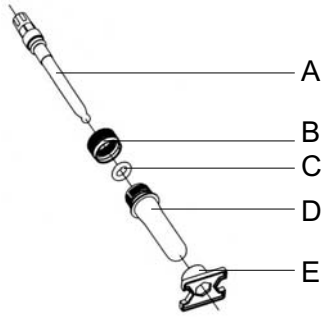
Caution!

Danger of uncontrolled dosing of chlorine or pH correction medium: Shut down dosing system, close positioner! If the installation site of the flow block assembly is not frost-free, the system must be shut down in due time!

1. Switch off the power supply.
2. Drain the sample water supply line and drainage line (hold container underneath)
3. Empty cell bodies and remove cleaning sand (see “Replacing cell sand in DEPOLOX® 5 three-electrode cell" on page 205).
4. Dismantle the filter housing and the check valve housing.
5. When the remaining water has drained from the flow control valve, refit the filter housing and the check valve housing.
6. Remove the sensors from the cell body cover and disconnect from the cable (see 4.2.6 “Membrane sensors" on page 56).
7. Apply a KCl solution to the protection caps of the pH and Redox electrodes and fit onto the electrodes.

Please note

A "KCl tank to store the sensors" may be used instead of the protection cap for pH and Redox electrodes (see 8. “Complete Devices, Retrofit Kits and Spare Parts" on page 215).



A Sensor
B Sealing cap
C O-ring
D Tank
E Stand

The fluoride electrodes can be stored wet in the short term in a 100 mg/l fluoride solution at pH 7. Fill the electrodes in the tank with 100 mg/l fluoride solution and mount on the electrodes. However, the electrodes should be stored in a dry condition if to be warehoused for several months. In this case, drain the fill solution from the electrode chamber and wash the membrane and chamber with distilled water.

8. Store the sensors in a frost-free place.

Please note

The water must be drained if frost occurs. Insert electrode in a beaker with water and store in a frost-free place.

9. Procedure for membrane sensors, see 4.2.6 “Membrane sensors" on page 56.

7. Maintenance

7.1 Maintenance Schedules

Please note

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

Task	Period/ Interval	page
DEPOLOX® 5 flow block assembly		
Check for tightness	daily	Page 204
Comparative measurement, calibrate if necessary	daily/acc. to guidelines	Page 200
Check electrolyte level	weekly	Page 206
Check cell sand	weekly	Page 204
Clean fine filter if membrane cells are used	every 2 months (depending on how dirty it is)	Page 209
Replace cell sand	Every six months	Page 205
Replace electrolyte	Every six months	Page 207
Diaphragms	Every six months (depending on how dirty it is)	Page 207
Membrane sensors FC1, TC1, OZ7, CD7		
Comparative measurement, calibrate if necessary	daily	Page 210
Replace electrolyte	Every six months	Page 210
Replace membrane cap	annually	Page 210
pH measurement		
Comparative pH measurement, calibrate if necessary	weekly/ acc. to guidelines	Page 211

Task	Period/ Interval	page
mV measurement		
Check Redox in buffer solution	every 4 to 6 weeks	Page 210
Conductivity		
Check conductivity	every 4 to 6 weeks	Page 212

Checking for tightness (daily)

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

Please note

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

Checking the cell sand (weekly)

Check that there is sufficient sand in the cell body.
The cell sand must be swirled around in the bottom section of the cell body.
The cell sand is necessary for cleaning the chlorine sensor electrodes and must be replenished or replaced when required. (Refer to 6.3.2 “Filling the cell sand (DEPOLOX® 5 only)" on page 182 and “Replacing cell sand in DEPOLOX® 5 three-electrode cell" on page 205).

Please note

When fresh sand is replenished, the electrode current may increase slightly for approximately 3 hours. Do not calibrate during this time.

You must calibrate each time the cell sand is replaced.

The calibration must be checked after one day.

7.2 Maintaining DEPOLOX® 5 flow block assembly

Replacing cell sand in DEPOLOX® 5 three-electrode cell

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

1 Remove DEPOLOX® 5 flow block assembly cover.

2 Close the ball valve on the sample water inlet and on the outlet (pressurised version).

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

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

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

6 Loosen the lower cap on the 3 electrode cell.

7 Remove the signal cable.

8 Unscrew the upper knurled nut on the electrolyte container.

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

10 Wash the cell sand out of the electrode mount.

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

Please note

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

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

13 Reconnect the signal cable acc. to colour.

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

14 Screw the cap back on.

15 Fill half a cap from the plastic bottle with cell sand and pour it into the cell body (approx. 1/2 cm³ cell sand) (see 6.3.2 “Filling the cell sand (DEPOLOX® 5 only)" on page 182).

16 Reinsert electrodes.

17 Reopen the check valve on the sample water inlet and outlet (pressurised version).

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

Please note

You must calibrate each time the cell sand is replaced.

The calibration must be checked after one day.

Please note

We recommend checking and, if necessary, replacing the electrodes and diaphragms when replacing the cell sand (see “Replacing electrolyte, electrodes and diaphragms" on page 207).

DEPOLOX® 5 three-electrode cell
Check electrolyte level

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

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

3 Calibrate after approximately three hours.

Please note

The calibration must be checked after one day.

Replacing electrolyte, electrodes and diaphragms

1 Remove DEPOLOX® 5 flow block assembly cover.

2 Close the ball valve on the sample water inlet and on the outlet (pressurised version).

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

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

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

6 Loosen the lower cap on the 3 electrode cell.

7 Remove the signal cable.

Replace electrolyte

8 Unscrew the upper knurled nut on the electrolyte container.

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

Please note

Wash the cell sand out of the electrode mount “Replacing cell sand in DEPOLOX® 5 three-electrode cell" on page 205 “.

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

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

12 Remove the drain plug from the electrolyte container.

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

Replacing reference electrode

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

Replacing diaphragms

Please note

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

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

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

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

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

19 Insert the drain plug into the electrolyte container.

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

Please note

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

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

22 Reconnect the signal cable acc. to colour.

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

23 Screw the cap back on.

24 Fill half a cap from the plastic bottle with cell sanc and pour it into the cell body (approx. 1/2 cm^3 cell sand) (see 6.3.2 “Filling the cell sand (DEPOLOX® 5 only)" on page 182).

25 Reinsert electrodes.

26 Reopen the check valve on the sample water inlet and outlet (pressurised version).

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

Please note

Perform a zero-point calibration after one hour running-in time and, if required, after 24 hours.

You must calibrate each time the cell sand is replaced.

The calibration must be checked after one day.

Please note

Note the electrolyte's expiration date.

Please note

We recommend replacing the cell sand when replacing the electrodes and diaphragms (see “Replacing cell sand in DEPOLOX® 5 three-electrode cell" on page 205).

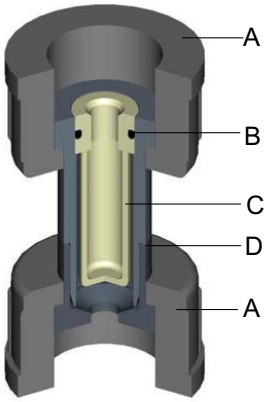
Cleaning/replacing the fine filter

Please note

A fine filter must only be installed when membrane sensors are employed.

Please note

The fine filter must be cleaned or replaced in order to protect the membrane sensor's delicate membrane against soiling or damage.



A Knurled nut
B O-ring
C Fine filter
D Filter unit

1 Release both knurled nuts (A).

2 Remove complete filter unit (D).

3 Remove the fine filter (C).

To do this, screw the M6 screw slightly into the fine filter and pull the fine filter out of the filter unit
or
Press the fine filter (C) with a suitable tool (not pointed) out of the filter unit.

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

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

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

7 Tighten both knurled nuts (A).

7.3 Maintaining membrane sensors

For the membrane sensor maintenance procedure, see 4.2.6 “Membrane sensors" on page 56.

“mA/V input module" on page 69

“Membrane sensor for chlorine dioxide CD7" on page 61

“Membrane sensor for ozone OZ7" on page 64

“Membrane sensor for total chlorine TC1 and TC1-S" on page 67

7.4 Maintaining ORP electrode

Depending on how dirty the sample water is, theORP electrode must be cleaned at certain intervals. Unclean water causes the measurement to be very slow. At the same time, the ORP voltage is frequently indicated as too low. The surface of the platinum disc is usually soiled. This may be to some extent in the form of an invisible coating. In particular, the ceramic electrode diaphragm may also be soiled or coated with lime deposits.

To clean the soiled metal disc, theORPelectrode is removed from the flow-through adapter and cleaned with a paper towel; use diluted hydrochloric acid (up to 10 %), if necessary. Scouring cleaner may not be used because it may clog the diaphragm. Then rinse well with water. Do not touch the platinum electrode after rinsing in order to keep oil from fingers off them. To remove lime deposits, immerse the electrodes just past the diaphragms into hydrochloric acid (10 %); allow several minutes for this to react and rinse with clear water.

Please note

Do not use any other chemicals than those described here. These could damage the electrode.

7.5 Maintaining pH electrode

Clean and calibrate if there are fluctuations in the measured values. A routine schedule cannot be given here because the cleaning schedule depends heavily on the general condition of the sample water. In general, calibrate approx. every 4 weeks. Remove dirt on the glass membrane and diaphragm to prevent measuring errors.

In particular, the ceramic electrode diaphragm may also be soiled or coated with lime deposits.

Remove contaminants deposited on the surface of the membrane glass; use diluted hydrochloric acid (up to 10 %), if necessary.

The electrodes should not be cleaned in a dry state because this is more likely to smear the layer of dirt over the surface rather than removing it. Under no circumstances may the membrane be treated with abrasive cleaning agents.

The electrode must be rinsed subsequently with nothing other than water.

Remove lime deposits on the glass membrane and the diaphragm by immersing the electrode into hydrochloric acid (up to 10 %). Rinse thoroughly with water or distilled water here as well; pH electrodes age. This is often the cause for a slow display of the pH value or a drop in the slope. pH electrodes typically last 1 to 2 years. However, routine maintenance of the electrodes recommended.

7.6 Maintaining fluoride electrode

Routinely check the electrolyte level in the electrode (at least once per week). The fill level should always be just under the filling hole, approx. 25 mm above the sample water. Replenish the electrolyte, if necessary.

Routinely calibrate the measuring system to guarantee safe operation and accuracy.

Do not touch the glass surfaces with the cloth.

7.7 Maintaining conductivity electrode

The electrode does not contain any maintenance parts. However, depending on how dirty the sample water is, the electrode can be cleaned at certain intervals. A routine schedule cannot be given here because the cleaning schedule depends heavily on the general condition of the sample water. In general, calibrate approx. every 4 weeks.

If wiping with a soft, damp paper towel is insufficient, use one of the following chemical cleaning methods depending on how the electrode is soiled:

Soiling	Cleaning agent	Time needed at room temperature
Water soluble substances	Distilled water	Any
Grease and oil	Warm water and household washing liquid	Any
Lime and hydroxide deposits	Hydrochloric acid (0.1 n)	Any

7.8 Replacing a fuse

Warning!

Only authorised and qualified electricians are permitted to open the housing.

The device is not equipped with a mains switch.

1 Disconnect the device from the power supply.

2 Remove the cover of the MFC electronic module.

3 Remove all sensor measuring module plug-in cards (B)
Remove the mA-out plug-in card (C).

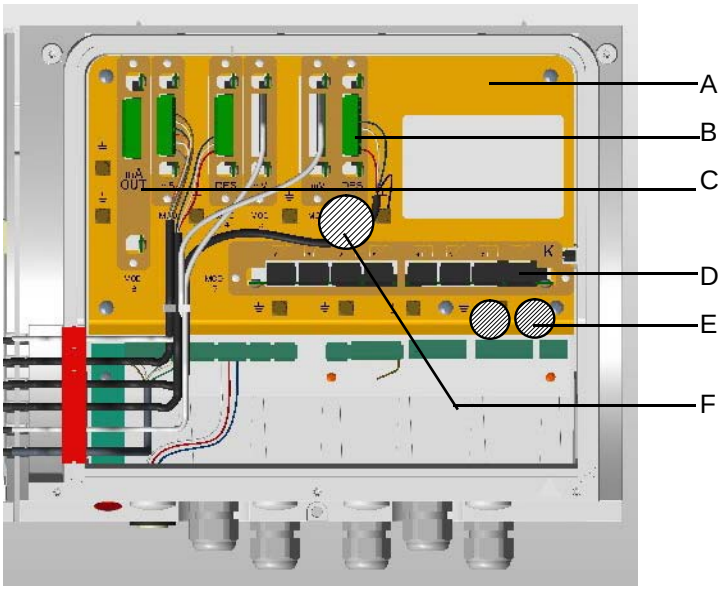
4 Remove the relay card (D).

5 Remove the 4 outer screws on the metal cover (A).

6 Remove the metal cover.

7 Replace the plug-in fuses (E).
TR5 fuse part-no. W3T172031 for 230/115V.
For 24V: part-no. W3T164532.

8 Reassemble the device.



A Metal cover
B Sensor measuring module plug-in card
C plug-in card with mA-out
D Relay card
E Plug-in fuse
F Battery

7.9 Replacing the battery

Warning!

Only authorised and qualified electricians are permitted to open the housing.

The device is not equipped with a mains switch.

The battery is necessary for the supply of the data storage (e.g. for the trend graphs) and of the real time clock in the case of a power failure. Replace the battery if these functions are not working properly.

1 Disconnect the device from the power supply.

2 Remove the cover of the MFC electronic module.

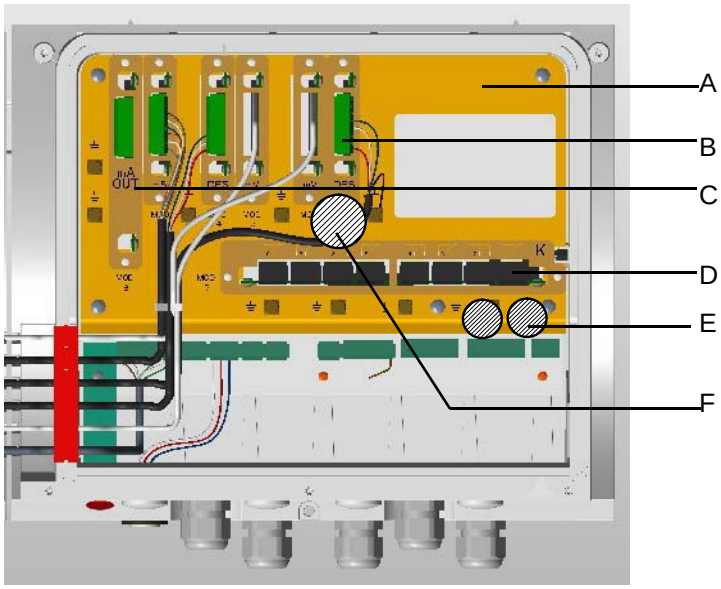
3 Remove all sensor measuring module plug-in cards (B).

4 Remove the mA-OUT plug-in card (C).

5 Remove the relay card (D).

6 Remove the 4 outer screws on the metal cover (A).

Remove the metal cover.Reassemble the device.



A Metal cover
B Sensor measuring module plug-in card
C plug-in card with mA-out
D Relay card
E Battery
F Battery

8. Complete Devices, Retrofit Kits and Spare Parts

Warning!

For reasons of safety, only use original spare parts.
Please contact our customer service department if you need any spare parts.

Complete devices		Part-No.
Electronic module MFC Basic	MFC electronic module 230V, 4x mA Out, 8x Rel.	W3T166345
	MFC electronic module 115V, 4x mA Out, 8x Rel.	W3T166346
	MFC electronic module 24V, 4x mA Out, 8x Rel.	W3T166347
Electronic module MFC Basic for control cabinet installation	Electronic module MFC 115/230V, without mA-Out, without rel.	W3T162593
	Electronic module MFC 24V, without mA-Out, without rel.	W3T162594
	Front control panel for control cabinet installation	W3T162590
MFC/ DEPOLOX® 5 System and MFC/ VariaSens	MFC-DEPOLOX® 5 non-pressurised Cl_2 230V, mA, 8x Rel.	W3T166348
	MFC-DEPOLOX® 5 non-pressurised Cl_2 115V, mA, 8x Rel.	W3T166349
	MFC-DEPOLOX® 5 non-pressurised Cl_2 24V, mA, 8x Rel.	W3T166350
	MFC-DEPOLOX® 5 pressurised Cl_2 230V, mA, 8x Rel.	W3T166351
	MFC-DEPOLOX® 5 pressurised Cl_2 115V, mA, 8x Rel.	W3T166352
	MFC-DEPOLOX® 5 pressurised Cl_2 24V, mA, 8x Rel.	W3T166353
	MFC-VariaSens non-pressurised TC1 230 V, mA, 8x Rel.	W3T166354
	MFC-VariaSens non-pressurised TC1 115 V, mA, 8x Rel.	W3T166355
	MFC-VariaSens non-pressurised TC1 24 V, mA, 8x Rel.	W3T166356
	MFC-VariaSens non-pressurised FC1 230 V, mA, 8x Rel.	W3T166357
	MFC-VariaSens non-pressurised FC1 115 V, mA, 8x Rel.	W3T166358
	MFC-VariaSens non-pressurised FC1 24 V, mA, 8x Rel.	W3T166359

Complete devices		Part-No.
	MFC-VariaSens pressurised CD7 230 V, mA, 8x Rel.	W3T166360
	MFC-VariaSens pressurised CD7 115 V, mA, 8x Rel.	W3T166361
	MFC-VariaSens pressurised CD7 24 V, mA, 8x Rel.	W3T166362
	MFC-VariaSens pressurised OZ7 230 V, mA, 8x Rel.	W3T166363
	MFC-VariaSens pressurised OZ7 115 V, mA, 8x Rel.	W3T166364
	MFC-VariaSens pressurised OZ7 24 V, mA, 8 Rel.	W3T166365
MFC operating manual		W3T159207
Installation manual for retrofit kit		W3T170787
MFC RS485 bus interface operating manual		W3T170789
MFC quick operating instructions		W3T158765

Sensor measuring modules

pH	ORP	Conductivity	Fluoride
W3T166292 incl. calibration solution, sensor, cable, plug-in card	W3T166165 incl. calibration solution, sensor, cable, plug-in card	W3T158763 incl. 600 µS calibration solution, sensor, cable, plug-in card	W3T166293 incl. sensor, cable, plug-in card and calibration solution

Sensor measuring module for membrane sensors

Free chlorine (FC1)	Chlorine dioxide selective (CD7)	Ozone selective (OZ7)	Total chlorine (TC1)	Total chlorine (TC1-S)
W3T170343 incl. sensor, cable, plug-in card, electrolyte	W3T170345 incl. sensor, cable, plug-in card, electrolyte	W3T170347 incl. sensor, cable, plug-in card, electrolyte	W3T170339 incl. sensor, cable, plug-in card, electrolyte	W3T170342 incl. sensor, cable, plug-in card, electrolyte

Seal set for membrane electrodes	Seal kit W3T158755 for pressure-tight installation of the membrane sensors

Retrofit kits

DEPOLOX® 5	DEPOLOX® 5 incl. PT1000	DEPOLOX® 4 incl. PT100	mA/V input card	4 mA output	Relay module (8 two-way switches)	Infrared interface
W3T170334 plug-in cards with terminals only	W3T170336 plug-in cards with terminals only	W3T170337 plug-in cards with terminals only	W3T166161	W3T166162	W3T170020	W3T166240

Spare parts and consumables

DEPOLOX® 5	pH	ORP	Conductivity	Fluoride	DEPOLOX® 4
Electrode cleaning sand W3T158743	Sensor W3T169297	Sensor W3T169298	Sensor W3T172052	Sensor W3T169303	Plug-in card W3T158832
Electrolyte W3T165565	Calibration solution pH 7.00 250 ml W3T165076	Calibration solution 478 mV 250 ml W3T165048	Cable W3T172050	Calibration solution 0.20mg/l W3T161789 500 ml	
Multi sensor W3T172029	Calibration solution pH 4.65 250 ml W3T165084	Calibration solution 478 mV 12 ml Bag W3T161182	Calibration solution 60 mS/cm 1000 ml W3T161187	Calibration solution 2.00 mg/l 500 ml W3T161845	
Measuring cup 5 pcs W3T158600	Calibration solution pH 7.00 12 ml Bag W3T161181	Plug-in card W3T170232	Calibration solution 600 µS/cm 1000 ml W3T161179	Calibration solution 100 mg/l 500 ml W3T161884	
Cable W3T160702	Calibration solution pH 4.65 12 ml Bag W3T161189	Impedance converter W3T165563	Plug-in card W3T170235	Electrolyte set 5x 60 ml W3T161173	
Plug-in card W3T158823 with PT1000 input W3T158827	Plug-in card W3T170233			Plug-in card W3T170234	
	Impedance converter W3T165563			Impedance converter W3T165563	
	KCL tank to store the sensors 5 ml KCL-3 mol. W3T164482				

Membrane sensors

Membrane sensors	Free chlorine FC1	ClO_2, selective CD7	Ozone, selective (OZ7)	Total chlorine TC1	Total chlorine TC1-S
Compl. sensor	W3T164492	W3T164493	W3T164494	W3T171787	W3T164804
Membrane cap incl. lapping paper	W3T164653	W3T168103	W3T168106	W3T171792	W3T171792
Electrolyte	W3T168101	W3T168102	W3T168105	W3T171793	W3T164805
Spare part set Consists of lapping paper, elastomer seal and O-ring	W3T164339	W3T168104	W3T168107	W3T164339	W3T164339
Maintenance set Consists of electrolyte, membrane cap and spare part set	W3T168241	W3T168242	W3T168243	W3T160401	W3T164806
Plug-in card	W3T158825	W3T158825	W3T158825	W3T158825	W3T158825
Connector cable combination 1.2 m	W3T172017				

Cable extensions for sensors

Extension cable/connector cable combination	DEPOLOX® 5	pH ORP Fluoride (with 2 connectors)	Conductivity (with 1 connector)	Multi sensor with cable	Membrane sensors (with 1 connector)
5 m 10 m 15 m 25 m 50 m	W3T160703 W3T160704 W3T160705 W3T160706 W3T160707	W3T164517 W3T164518 W3T164544 W3T164545 W3T164546	W3T164529 W3T164553 W3T164554 W3T164555 W3T164556	W3T164557 W3T164558 W3T164559 W3T164560 W3T164561	W3T164519 W3T164520 W3T164538 W3T164539 W3T164540
Impedance converter	--	W3T165563	--	--	--

MFC spare parts

Part-No.	Description	
W3T160619	Set of strips	for MFC cover application 1 to 5
W3T172031 W3T164532	Fuse	for 200–240 V / 100–120 V for 24 V
W3T172625	Varta battery CR2032	
W3T158715 W3T158716	Basic mode without cover	for 200–240 V / 100–120 V for 24 V
W3T170120	Cover with display	
W3T166185 W3T166186	Accessory set	2 cable unions, 4 cable bushings, 2 fuses for 200–240V / 100–120 V for 24 V
W3T170228 W3T170229	MFC motherboard	test for 24 V, with software test for 115/230 V, with software

Accessories

Part-No.	Description	
W3T164578	Report printer 230 V, type Tally T2024/9	via RS232 interface
W3T168317	Photometer P42 i-cal	via IR interface
W3T164565	Update cable 1.8 m	for RS232 interface
W2T505559	RS485 bus cable	

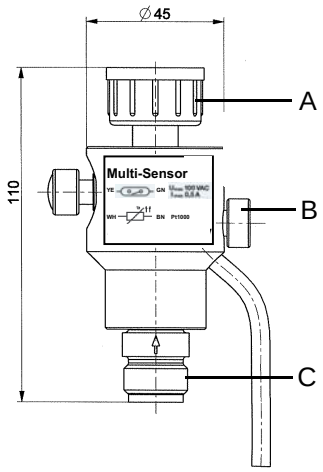
Part-No.	Description
	Spare parts for report printer, type Tally T2024/9
W3T164578	Spare ink ribbon
W3T166182	Printer cable 3 m
W3T166183	Printer cable 15 m

Flow monitoring with temperature sensor PT1000

Part-No.: W3T166494 pressurized version up to 4 bar

Caution!

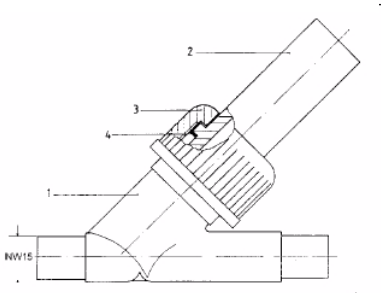
Vertical installation!



A Drain: G1/2“ union nut
B Sample tap
C Inlet: G1/2“ outside thread

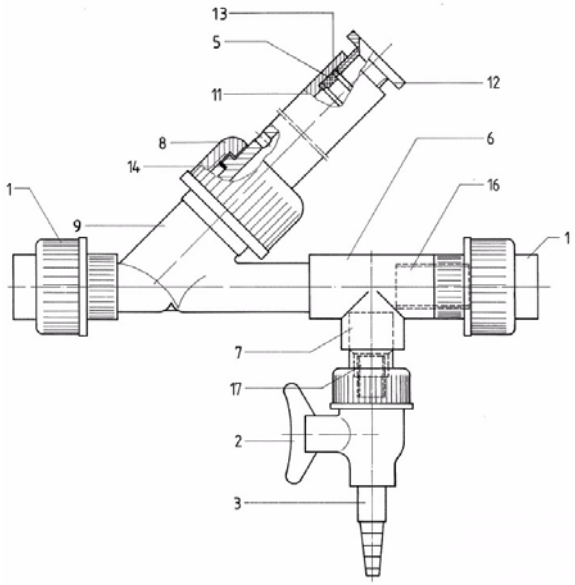
Flow-through adapter pH/mV

Part-No.: W3T171332 non-pressurised version
W3T159950 pressurised version



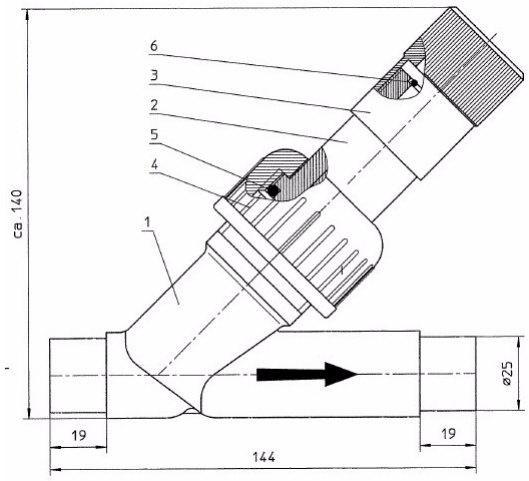
Item	Part No.	Description
1	W3T172856	Housing
2	W3T170970 (non-pressurised) W3T159595 (pressurised)	Electrode mount
3	W3T170971	Hexagon cap nut
4	W3T168861	O-ring

Flow-through adapter fluoride Part-No.: W3T163663 non-pressurised version



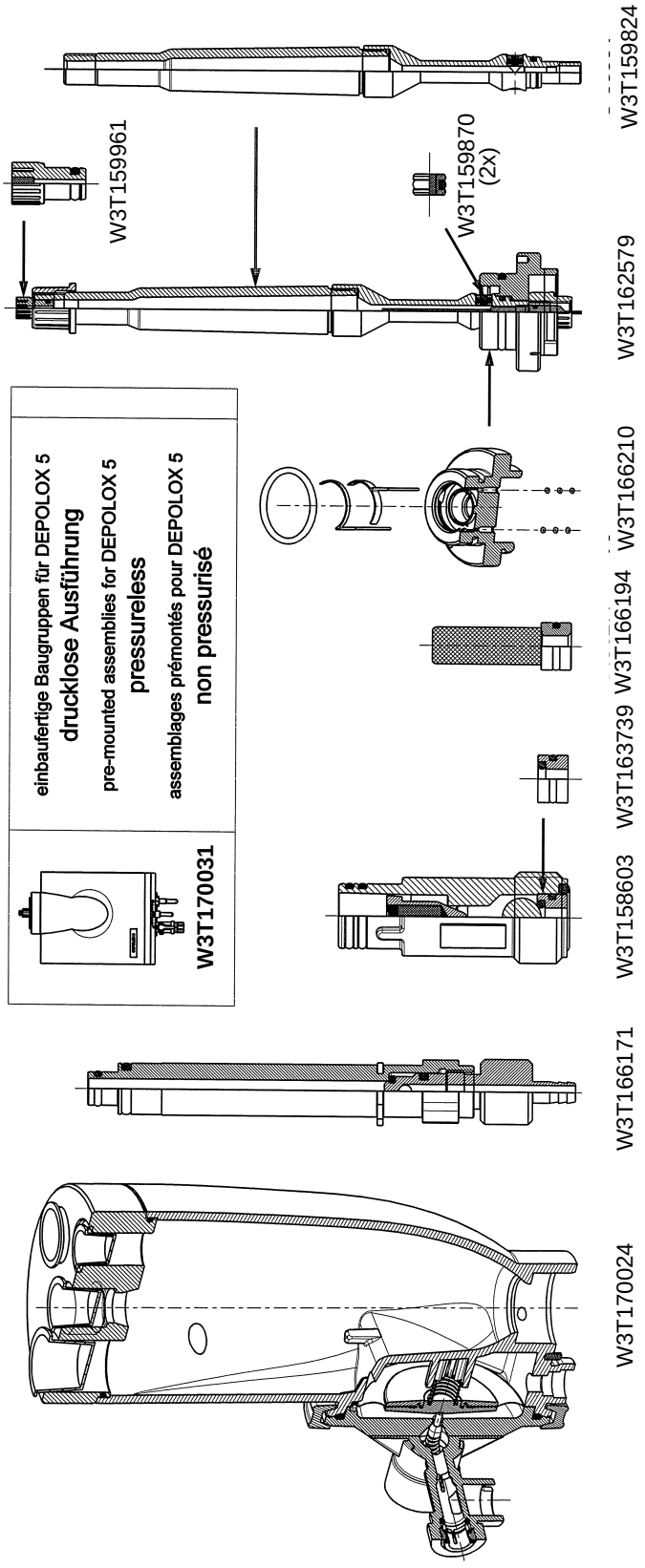
Item	Quant.	Part No.	Description
1	2	W2T505181	PVC screw connection, DN15/d20, with O-ring
2	1	W2T507048	Ball valve
3		W2T506240	Hose bushing
5	1	W3T168889	Seal
6	1	W2T507524	T fitting:
7	1	W2T505438	Reduction
8	1	W3T170971	Hexagon cap nut
9	1	W3T172856	Housing
11	1	W3T159710	Electrode mount
12	1	W3T167218	Tightening nut
13	2	W3T167237	Washer
14	1	W3T168861	O-ring
16	37 mm	W2T506051	Pipe
17	29 mm	W2T506626	Pipe

Flow-through adapter conductivity Part-No.: W3T158503 pressurised version up to 6 bar



Item	Quant.	Part No.	Description
1	1	W3T161463	Strainer housing
2	1	W3T158502	Electrode mount
3	1	W3T158501	Electrode tightening nut
4	1	W3T163440	Hexagon cap nut
5	1	W3T172720	O-ring
6	1	W3T172556	O-ring

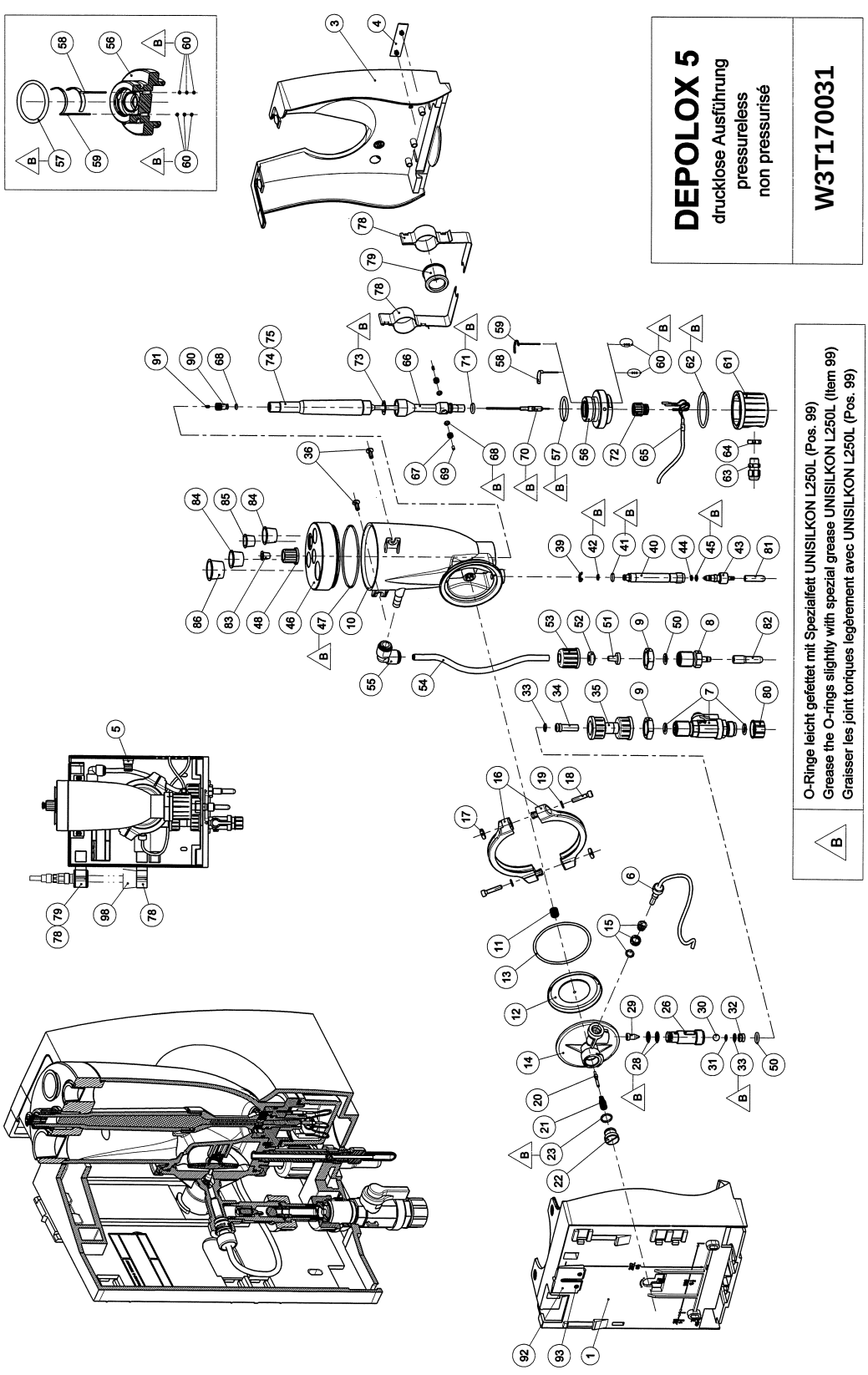
DEPOLOX® 5 retrofit set (non-pressurised version) W3T170031



DEPOLOX® 5 parts list (non-pressurised version) W3T170031

Part No.	Description
W3T170031	Flow block assembly, non-pressurised
W3T170024	Cell body D5-DL, complete
W3T166171	Drain unit
W3T158603	Back pressure unit
W3T163739	Ball seat complete
W3T166194	Fine filter
W3T166210	Electrode support, complete
W3T162579	Electrode cell, complete, electrode not include
W3T159961	Plug complete, non-pressurised
W3T159870	Diaphragm complete
W3T159824	Electrode housing, non-pressurised
W3T170063	D5-DL accessory set
W3T170065	Maintenance part set, annually
W3T170071	Maintenance part set, every 4 years
W3T158882	Set of spare parts for volumetric flow control

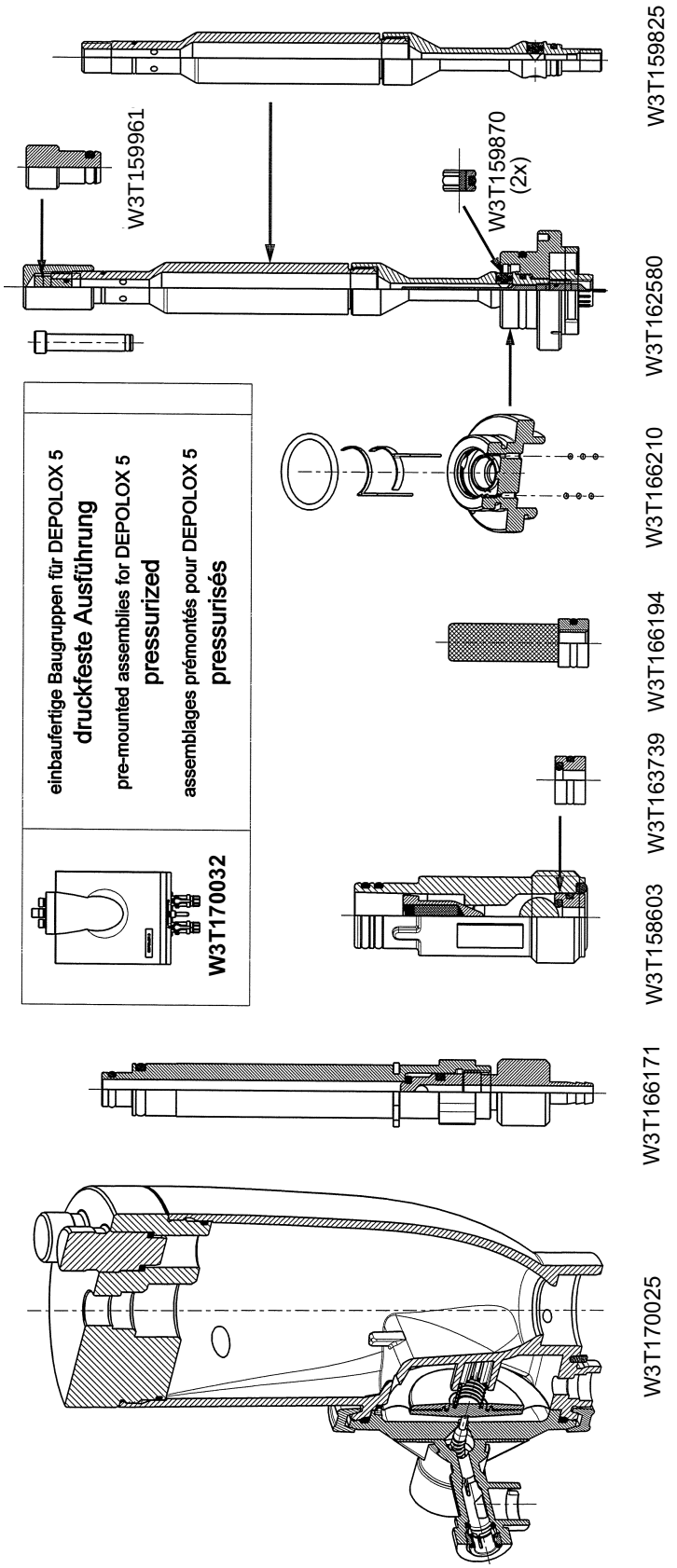
DEPOLOX® 5 drawing (non-pressurised version) W3T170031



DEPOLOX® 5 parts list (non-pressurised version) W3T170031

Item	Part No.	Designation
1	W3T160628	Basic housing
1,92,93	W3T164571	Basic housing, pre-assembled
3	W3T160629	Housing cover
4	W3T172042	Product label
5	W2T506143	Cable clamp
6	W3T172029	Multi sensor
7	W3T166170	Shut-off valve
8	W3T158593	Discharge nozzle
9	W2T507615	Flat nut
10	W3T158561	Cell body
11	W3T164226	Compression spring
12	W3T158569	Membrane unit
13	W3T160654	O-ring
14	W3T158595	Control valve body
15	W2T504209	Plastic cartridge
16	W3T160649	V profile clamp
17	W3T158567	Square nut
18	W2T504659	Cylinder screw
19	W2T506019	Washer
20	W3T158572	Valve pin
21	W3T172795	Compression spring
22	W3T158573	Adjusting screw
23	W3T160357	O-ring
26	W3T160648	Check valve housing
28	W3T161396	O-ring
29	W3T169827	Float with magnet
30	W3T172946	Ball
31	W3T172949	O-ring
32	W3T159707	Insert
33	W3T172975	O-ring
34	W3T168189	Fine filter
33,34	W3T166194	Fine filter, complete
35	W3T158602	Filter housing
36	W2T505463	Plastic self-tapping screw
39	W3T172041	Securing ring
40	W3T158576	Outlet drain pipe
41	W3T172997	O-ring
42	W3T164597	O-ring
43	W3T158575	Drain screw
44	W3T166160	EPDM Flat gasket
45	W3T172556	O-ring
46	W3T158565	Cell body cover
47	W3T160657	O-ring
48	W3T165266	Knurled nut
50	W3T172861	O-ring
51	W3T161501	Hose bushing
52	W3T169815	Locking ring
53	W3T161502	Union nut
50-53	W3T171453	Hose connection parts
54	W3T158601	Hose
55	W2T505093	Angle-reducing connector
56	W3T166209	Electrode mount
57	W3T168875	O-ring
58	W3T163795	Working electrode
59	W3T167461	Counter electrode
60	W3T168904	O-ring
61	W3T158562	Hinged cover
62	W3T168868	O-ring
63	W2T504177	Cable union
64	W3T160549	Hexagonal nut
65	W3T160702	Connector cable combination
66	W3T159653	Electrode housing
67-69	W3T159870	Diaphragm complete
70	W3T169295	Reference electrode
71	W3T161424	O-ring
72	W3T165267	Knurled nut
73	W3T161464	Flat gasket
74	W3T165565	KCL electrolyte set, 100ml
75	W3T172885	Container, non-pressurized version
76	W3T161396	O-ring
78	W3T166169	Fastening clip, coated
79	W3T172045	Electrode mount
80	W3T161561	Screw cap
81	W3T168162	Protective cap
82	W3T164588	Protective cap
83	W3T161537	Protection plug
84	W3T169029	Protection plug
85	W3T169044	Protection plug
86	W3T164573	Protection plug
68,90,91	W3T159961	Plug complete
92	W3T160627	Wall brackets
93	W2T504752	Sheet metal screw
98	W3T158600	Measuring beaker, 5 items
Accessories	W3T161452	Felt ring, transit support
Accessories	W3T171453	Hose connection parts ID6xWdg1
Accessories	W3T167518	Hose connection parts ID6xWdg3
Accessories	W3T158743	Electrode cleaning grit "QK"
Accessories	W3T173182	Fastening kit

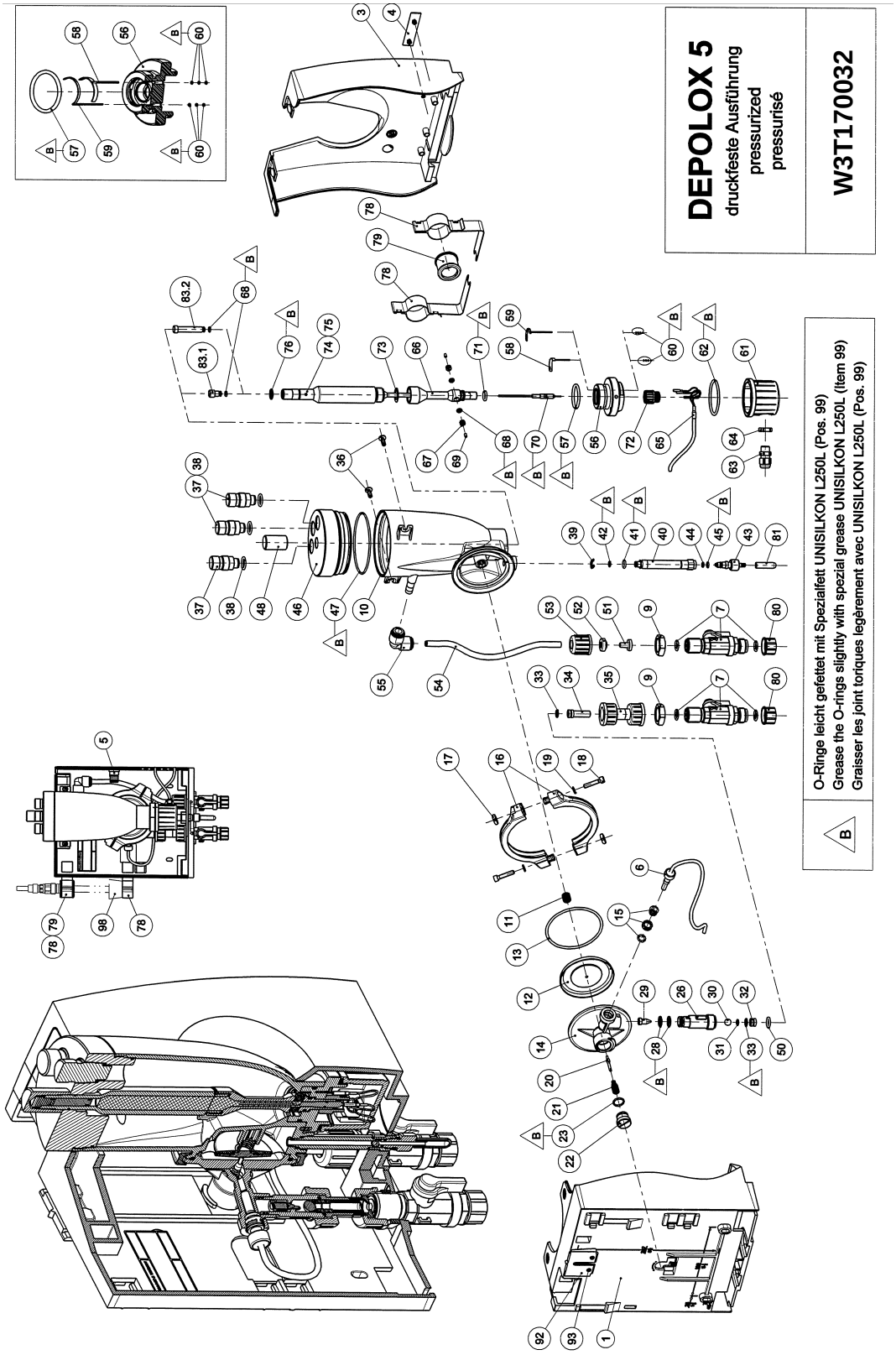
DEPOLOX® 5 retrofit set (pressurised version) W3T170032



DEPOLOX® 5 parts list (pressurised version) W3T170032

Part No.	Description
W3T170032	Flow block assembly, pressurised
W3T170025	Cell body D5-DFL, complete
W3T166171	Drain unit
W3T158603	Back pressure unit
W3T163739	Ball seat complete
W3T166194	Fine filter
W3T166210	Electrode support, complete
W3T162580	Electrode cell, complete, electrode not include
W3T163746	Plug complete, non-pressurised
W3T159870	Diaphragm complete
W3T159825	Electrode housing, non-pressurised
W3T170064	D5-DF accessory set
W3T158875	Maintenance part set, annually
W3T170072	Maintenance part set, every 4 years
W3T158882	Set of spare parts for volumetric flow control

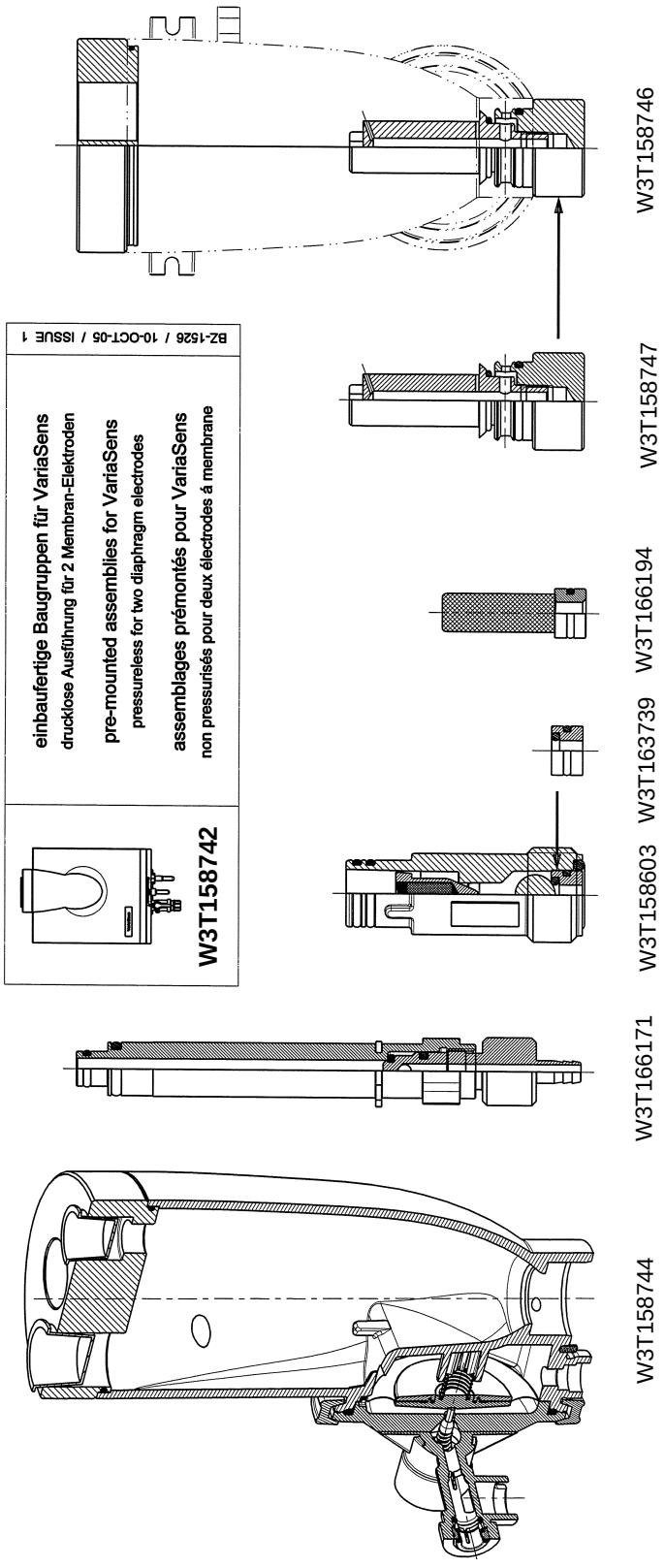
DEPOLOX® 5 drawing (pressurised version) W3T170032



DEPOLOX® 5 parts list (pressurised version) W3T170032

Item	Part No.	Designation
1	W3T160628	Basic housing
1,92,93	W3T164571	Basic housing, pre-assembled
3	W3T160629	Housing cover
4	W3T172042	Product label
5	W2T506143	Cable clamp
6	W3T172029	Multi sensor
7	W3T166170	Shut-off valve
9	W2T507615	Flat nut
10	W3T158560	Cell body
11	W3T164226	Compression spring
12	W3T158569	Membrane unit
13	W3T160654	O-ring
14	W3T158595	Control valve body
15	W2T504209	Plastic cartridge
16	W3T160649	V profile clamp
17	W3T158567	Square nut
18	W2T504659	Cylinder screw
19	W2T506019	Washer
20	W3T158572	Valve pin
21	W3T172795	Compression spring
22	W3T158573	Adjusting screw
23	W3T160357	O-ring
26	W3T160648	Check valve housing
28	W3T161396	O-ring
29	W3T169827	Float with magnet
30	W3T172946	Ball
31	W3T172949	O-ring
32	W3T159707	Insert
33	W3T172975	O-ring
34	W3T168189	Fine filter
33,34	W3T166194	Fine filter, complete
35	W3T158602	Filter housing
36	W2T505463	Plastic self-tapping screw
37	W3T161450	Plug
38	W3T168859	O-ring
39	W3T172041	Securing ring
40	W3T158576	Outlet drain pipe
41	W3T172997	O-ring
42	W3T164597	O-ring
43	W3T158575	Drain screw
44	W3T166160	EPDM Flat gasket
45	W3T172556	O-ring
46	W3T158564	Cell body cover
47	W3T160657	O-ring
48	W3T171088	Knurled nut
50	W3T172861	O-ring
51	W3T161501	Hose bushing
52	W3T169815	Locking ring
53	W3T161502	Union nut
50-53	W3T171453	Hose connection parts
54	W3T158601	Hose
55	W2T505093	Angle-reducing connector
56	W3T166209	Electrode mount
57	W3T168875	O-ring
58	W3T163795	Working electrode
59	W3T167461	Counter electrode
60	W3T168904	O-ring
61	W3T158562	Hinged cover
62	W3T168868	O-ring
63	W2T504177	Cable union
64	W3T160549	Hexagonal nut
65	W3T160702	Connector cable combination
66	W3T159653	Electrode housing
67-69	W3T159870	Diaphragm complete
70	W3T169295	Reference electrode
71	W3T161424	O-ring
72	W3T165267	Knurled nut
73	W3T161464	Flat gasket
74	W3T165565	KCL electrolyte set, 100ml
75	W3T171171	Container, pressurized version
76	W3T161396	O-ring
78	W3T166169	Fastening clip, coated
79	W3T172045	Electrode mount
80	W3T161561	Screw cap
81	W3T168162	Protective cap
83.1, 68	W3T163746	Plug, complete, for operation
83.1	W3T159726	Plug, for operation
83.2, 68	W3T159992	Plug, complete, transit support
83.2	W3T159757	Plug, transit support
92	W3T160627	Wall brackets
93	W2T504752	Sheet metal screw
98	W3T158600	Measuring beaker, 5 items
Accessories	W3T161452	Felt ring, transit support
Accessories	W3T171453	Hose connection parts ID6xWdg1
Accessories	W3T167518	Hose connection parts ID6xWdg3
Accessories	W3T158743	Electrode cleaning grit "QK"
Accessories	W3T173182	Fastening kit

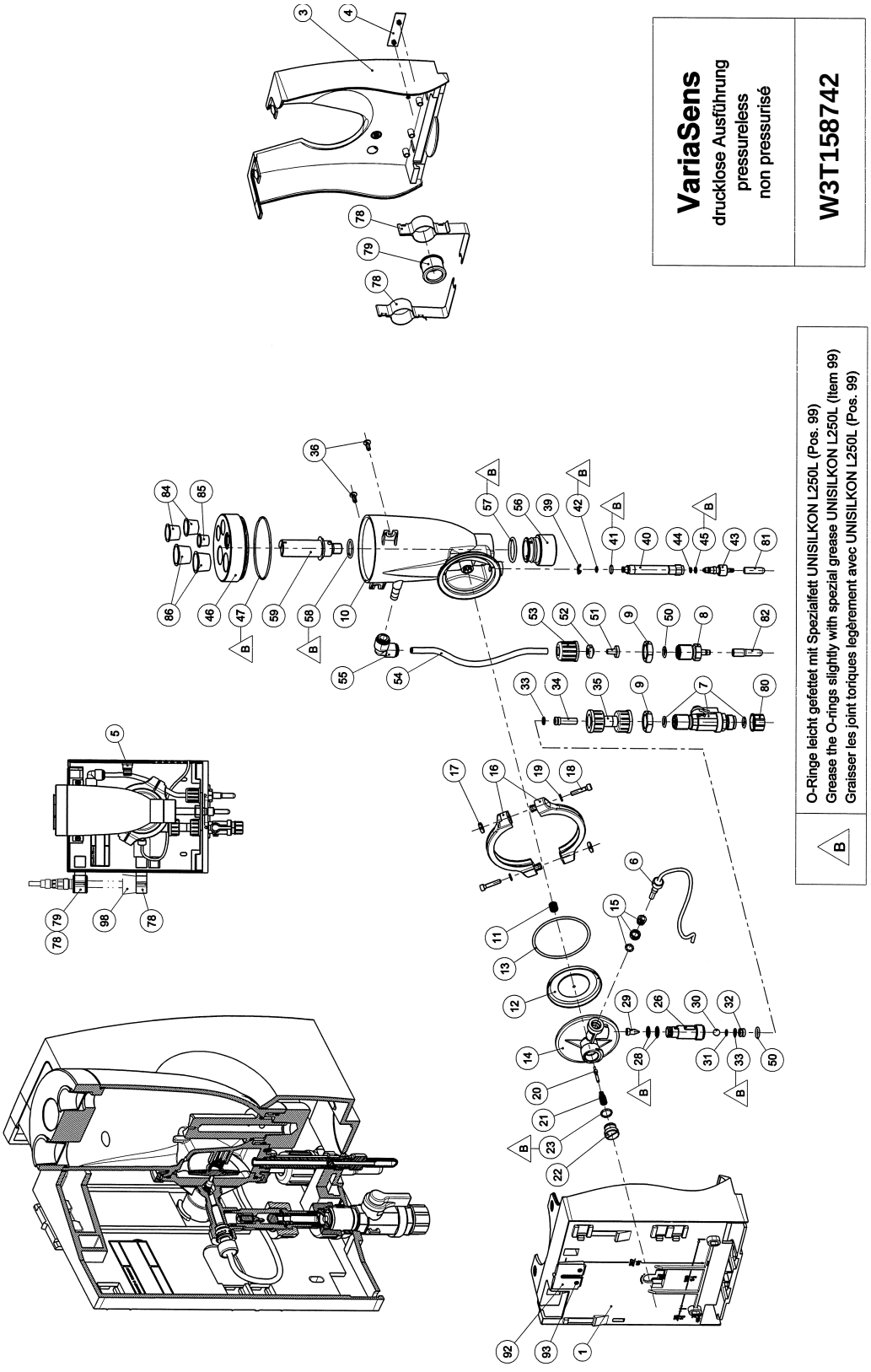
VariaSens retrofit set (non-pressurised version) W3T158742



VariaSens parts list (non-pressurised version) W3T158742

Part No.	Description
W3T158742	Flow block assembly, non-pressurised
W3T158744	Cell body VS-DL, complete
W3T166171	Drain unit
W3T158603	Back pressure unit
W3T163739	Ball seat compl.
W3T166194	Fine filter
W3T158747	Flow body complete
W3T158746	Retrofit kit D5-DL/VS-DL
W3T158745	VS-DL accessory set
W3T158876	Maintenance part set, annually
W3T158750	Maintenance part set, every 4 years
W3T158882	Set of spare parts for volumetric flow control

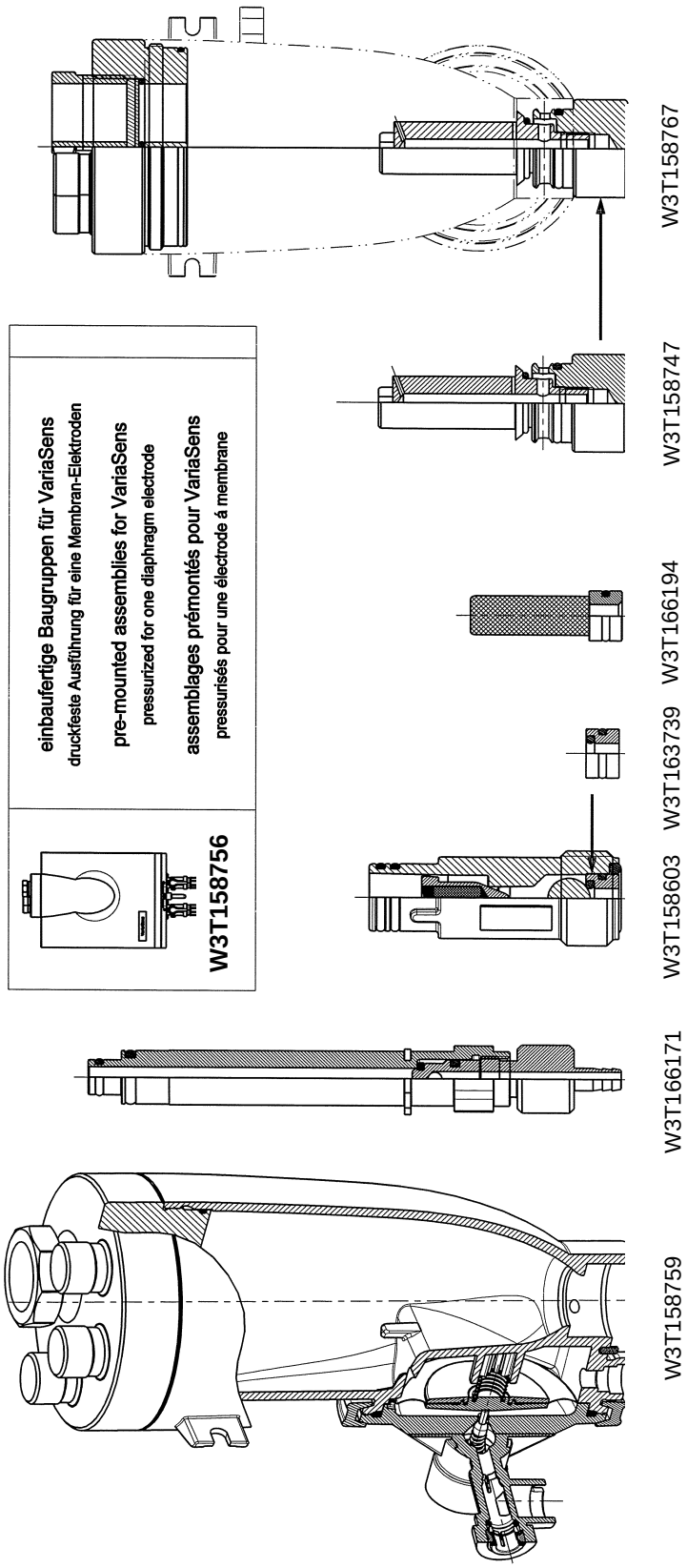
VariaSens drawing (non-pressurised version) W3T158742



VariaSens parts list (non-pressurised version) W3T158742

Item	Part No.	Designation
1	W3T160628	Basic housing
1,92,93	W3T164571	Basic housing, pre-assembled
3	W3T160629	Housing cover
4	W3T160908	Product label
5	W2T506143	Cable clamp
6	W3T172029	Multi sensor
7	W3T166170	Shut-off valve
8	W3T158593	Discharge nozzle
9	W2T507615	Flat nut
10	W3T158561	Cell body
11	W3T164226	Compression spring
12	W3T158569	Membrane unit
13	W3T160654	O-ring
14	W3T158595	Control valve body
15	W2T504209	Plastic cartridge
16	W3T160649	V profile clamp
17	W3T158567	Square nut
18	W2T504659	Cylinder screw
19	W2T506019	Washer
20	W3T158572	Valve pin
21	W3T172795	Compression spring
22	W3T158573	Adjusting screw
23	W3T160357	O-ring
26	W3T160648	Check valve housing
28	W3T161396	O-ring
29	W3T169827	Float with magnet
30	W3T172946	Ball
31	W3T172949	O-ring
32	W3T159707	Insert
33	W3T172975	O-ring
34	W3T168189	Fine filter
33,34	W3T166194	Fine filter, complete
35	W3T158602	Filter housing
36	W2T505463	Plastic self-tapping screw
39	W3T172041	Securing ring
40	W3T158576	Outlet drain pipe
41	W3T172997	O-ring
42	W3T164597	O-ring
43	W3T158575	Drain screw
44	W3T166160	EPDM Flat gasket
45	W3T172556	O-ring
46	W3T158738	Cell body cover
47	W3T160657	O-ring
50	W3T172861	O-ring
51	W3T161501	Hose bushing
52	W3T169815	Locking ring
53	W3T161502	Union nut
50-53	W3T171453	Hose connection parts
54	W3T158601	Hose
55	W2T505093	Angle-reducing connector
56	W3T158740	Drain plug
57	W3T168875	O-ring
58	W3T167941	O-ring
59	W3T158739	Flow body
78	W3T166169	Fastening clip, coated
79	W3T172045	Electrode mount
80	W3T161561	Screw cap
81	W3T168162	Protective cap
82	W3T164588	Protective cap
84	W3T169029	Protection plug
85	W3T169044	Protection plug
86	W3T164574	Protection plug
92	W3T160627	Wall brackets
93	W2T504752	Sheet metal screw
98	W3T158600	Measuring beaker, 5 items
Accessories	W3T1714531	Hose connection parts ID6xWdg1
Accessories	W3T167518	Hose connection parts ID6xWdg3
Accessories	W3T173182	Fastening kit

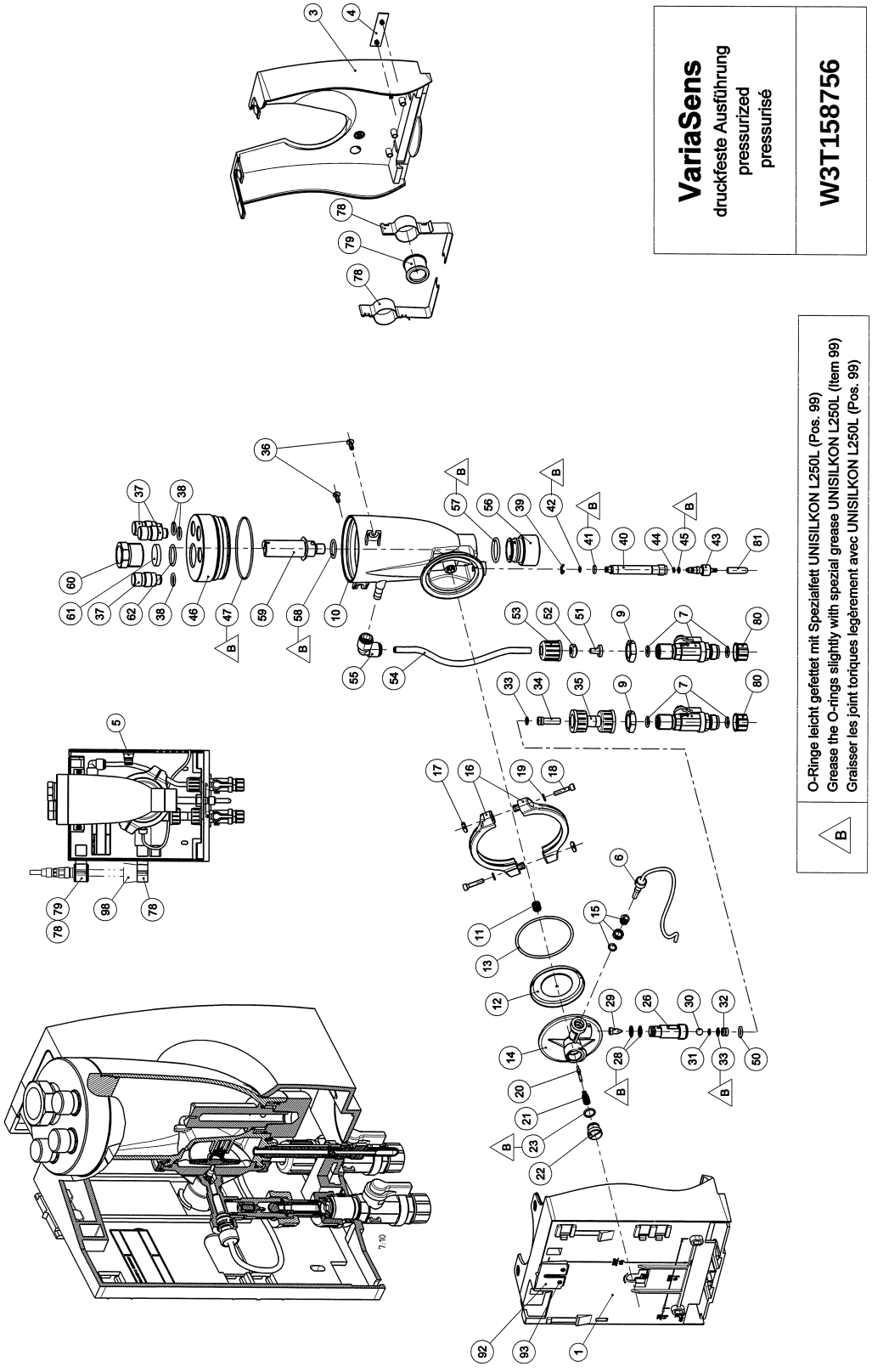
VariaSens retrofit set (pressurised version) W3T158756



VariaSens parts list (pressurised version) W3T158756

Part No.	Description
W3T158756	Flow block assembly, pressurised
W3T158759	Cell body VS-DF, complete
W3T166171	Drain unit
W3T158603	Back pressure unit
W3T163739	Ball seat compl.
W3T166194	Fine filter
W3T158747	Flow body complete
W3T158767	Retrofit kit D5-DF/VS-DF
W3T158758	VS-DF accessory set
W3T158877	Maintenance part set, annually
W3T158879	Maintenance part set, every 4 years
W3T158882	Set of spare parts for volumetric flow control

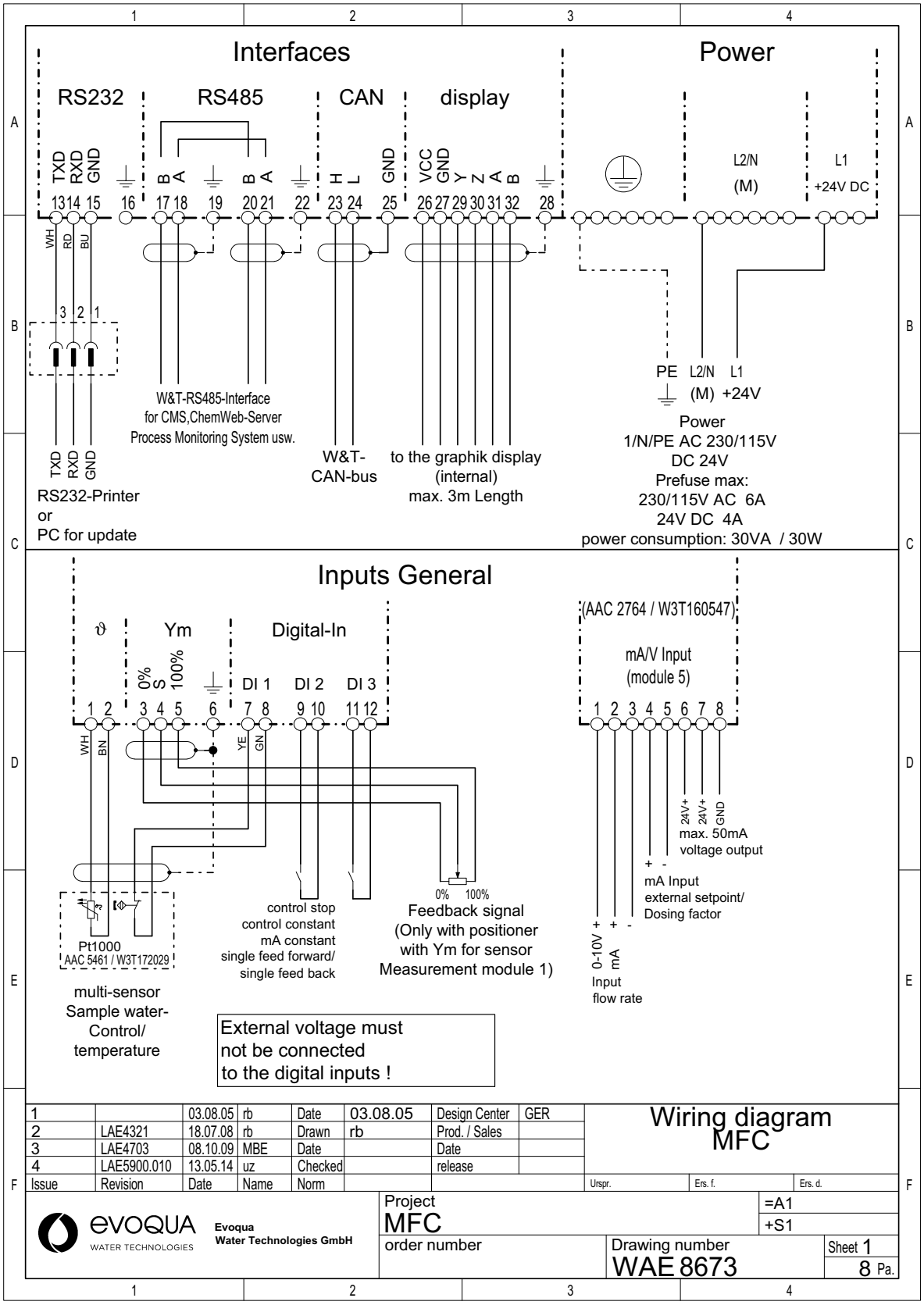
VariaSens drawing (pressurised version) W3T158756

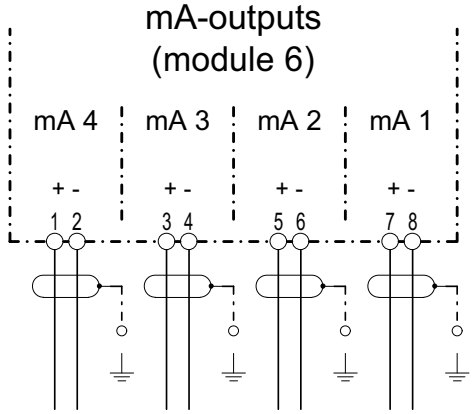


VariaSens parts list (pressurised version) W3T158756

Item	Part No.	Designation
1	W3T160628	Basic housing
1,92,93	W3T164571	Basic housing, pre-assembled
3	W3T160629	Housing cover
4	W3T160908	Product label
5	W2T506143	Cable clamp
6	W3T172029	Multi sensor
7	W3T166170	Shut-off valve
9	W2T507615	Flat nut
10	W3T158560	Cell body
11	W3T164226	Compression spring
12	W3T158569	Membrane unit
13	W3T160654	O-ring
14	W3T158595	Control valve body
15	W2T504209	Plastic cartridge
16	W3T160649	V profile clamp
17	W3T158567	Square nut
18	W2T504659	Cylinder screw
19	W2T506019	Washer
20	W3T158572	Valve pin
21	W3T172795	Compression spring
22	W3T158573	Adjusting screw
23	W3T160357	O-ring
26	W3T160648	Check valve housing
28	W3T161396	O-ring
29	W3T169827	Float with magnet
30	W3T172946	Ball
31	W3T172949	O-ring
32	W3T159707	Insert
33	W3T172975	O-ring
34	W3T168189	Fine filter
33,34	W3T166194	Fine filter, complete
35	W3T158602	Filter housing
36	W2T505463	Plastic self-tapping screw
37	W3T161450	Plug
38	W3T168859	O-ring
39	W3T172041	Securing ring
40	W3T158576	Outlet drain pipe
41	W3T172997	O-ring
42	W3T164597	O-ring
43	W3T158575	Drain screw
44	W3T166160	EPDM Flat gasket
45	W3T172556	O-ring
46	W3T158754	Cell body cover
47	W3T160657	O-ring
50	W3T172861	O-ring
51	W3T161501	Hose bushing
52	W3T169815	Locking ring
53	W3T161502	Union nut
50-53	W3T171453	Hose connection parts
54	W3T158601	Hose
55	W2T505093	Angle-reducing connector
56	W3T158740	Drain plug
57	W3T168875	O-ring
58	W3T167941	O-ring
59	W3T158739	Flow body
60	W3T171788	Screw-in part G1"
61	W3T163376	Washer
62	W3T168861	O-ring
78	W3T166169	Fastening clip, coated
79	W3T172045	Electrode mount
80	W3T161561	Screw cap
81	W3T168162	Protective cap
82	W3T164588	Protective cap
92	W3T160627	Wall brackets
93	W2T504752	Sheet metal screw
98	W3T158600	Measuring beaker, 5 items
Accessories	W3T171453	Hose connection parts ID6xWdg1
Accessories	W3T167518	Hose connection parts ID6xWdg3
Accessories	W3T173182	Fastening kit

9. Wiring Diagrams





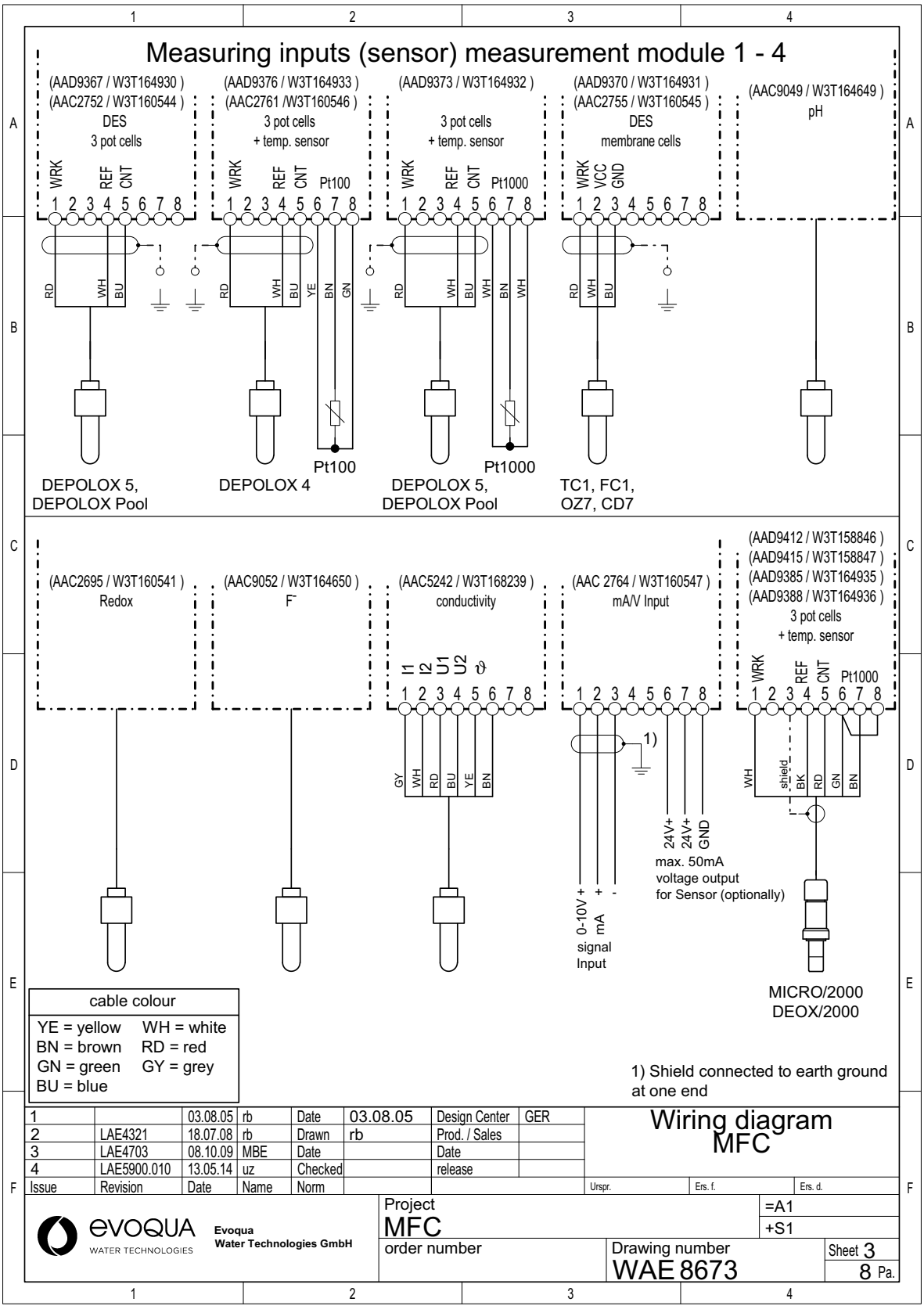
0/4...20mA
Load: 400/1000 Ohm selectable

All mA-outputs are freely selectable:
-to sensor measuring modules 1-4
-temperature
-Ym/Yout
-Ypi
-flow rate
-ext. Setpoint/Dosing factor

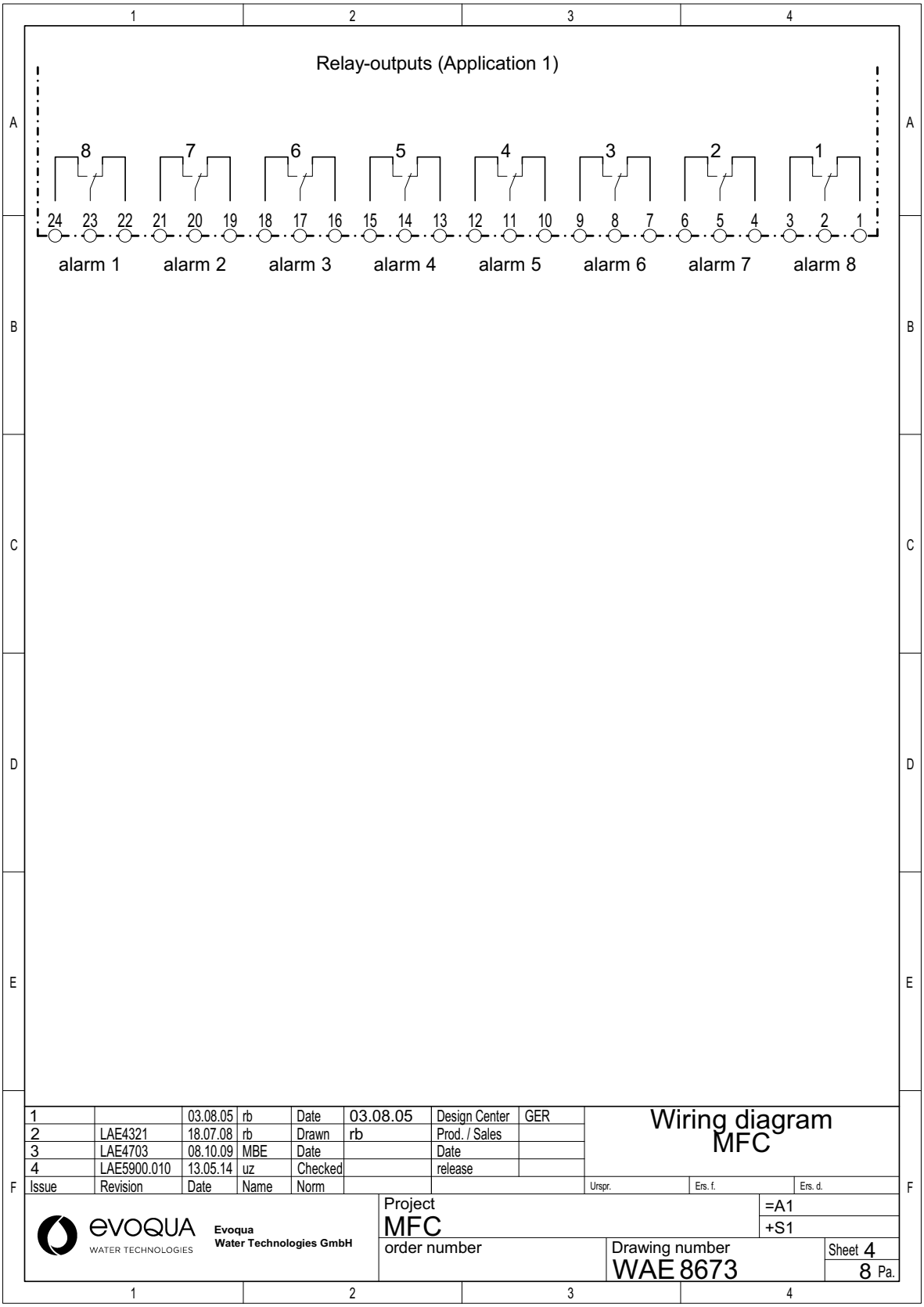
1		03.08.05	rb	Date	03.08.05	Design Center	GER	Wiring diagram MFC
2	LAE4321	18.07.08	rb	Drawn	rb	Prod. / Sales		
3	LAE4703	08.10.09	MBE	Date		Date		
4	LAE5900.010	13.05.14	uz	Checked		release		
Issue	Revision	Date	Name	Norm			Urspr. / Ers. f. / Ers. d.	

Evoqua Water Technologies GmbH

Project: MFC =A1 +S1
order number
Drawing number: WAE 8673
Sheet 2 / 8 Pa.



Issue	Revision	Date	Name	Norm				Urspr.	Ers. f.	Ers. d.
1		03.08.05	rb	Date	03.08.05	Design Center	GER			
2	LAE4321	18.07.08	rb	Drawn	rb	Prod. / Sales				
3	LAE4703	08.10.09	MBE	Date		Date				
4	LAE5900.010	13.05.14	uz	Checked		release				



1		03.08.05	rb	Date	03.08.05	Design Center	GER
2	LAE4321	18.07.08	rb	Drawn	rb	Prod. / Sales	
3	LAE4703	08.10.09	MBE	Date		Date	
4	LAE5900.010	13.05.14	uz	Checked		release	
Issue	Revision	Date	Name	Norm			

Wiring diagram MFC

Urspr. | Ers. f. | Ers. d.

Evoqua Water Technologies GmbH

Project: MFC

=A1

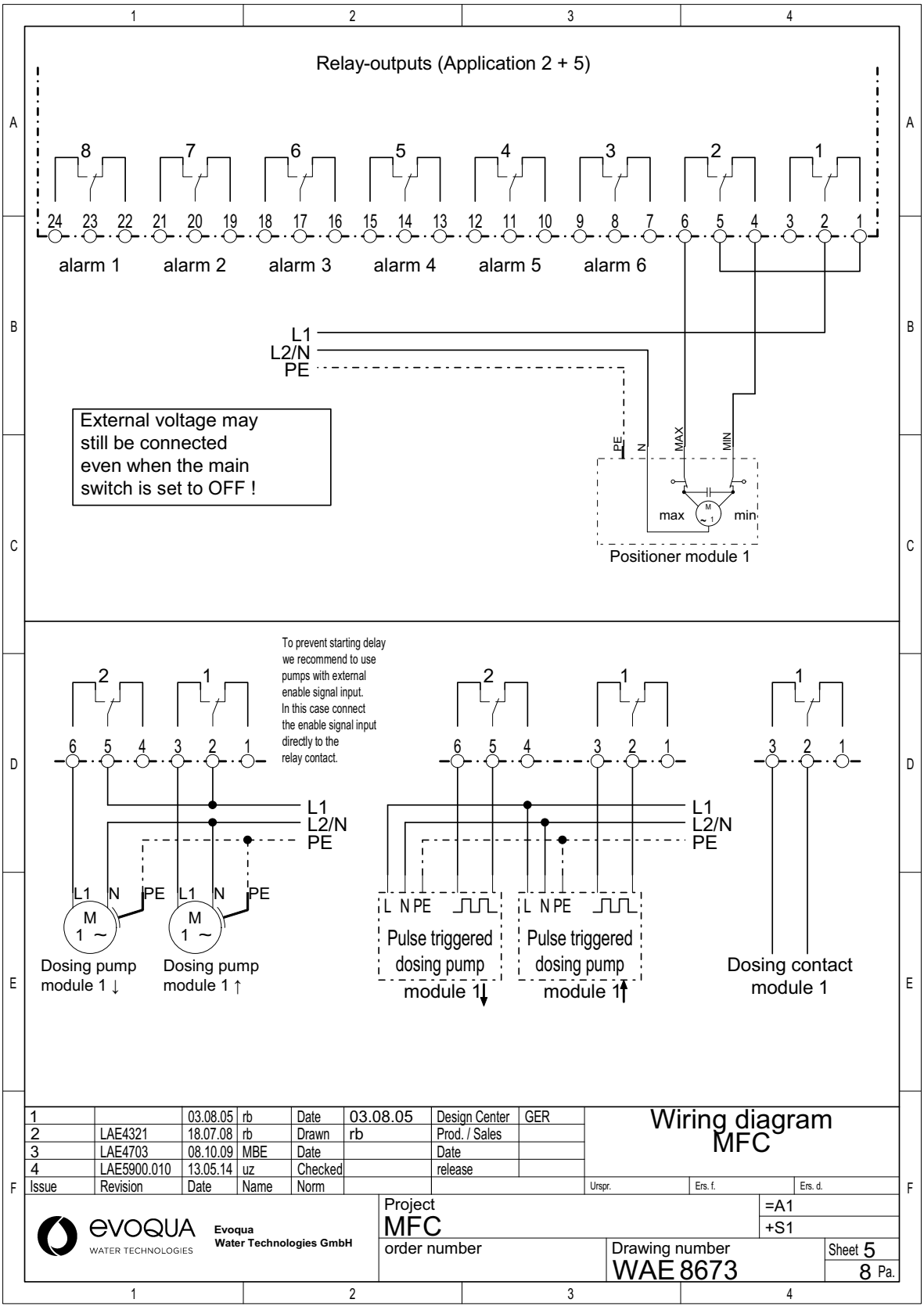
+S1

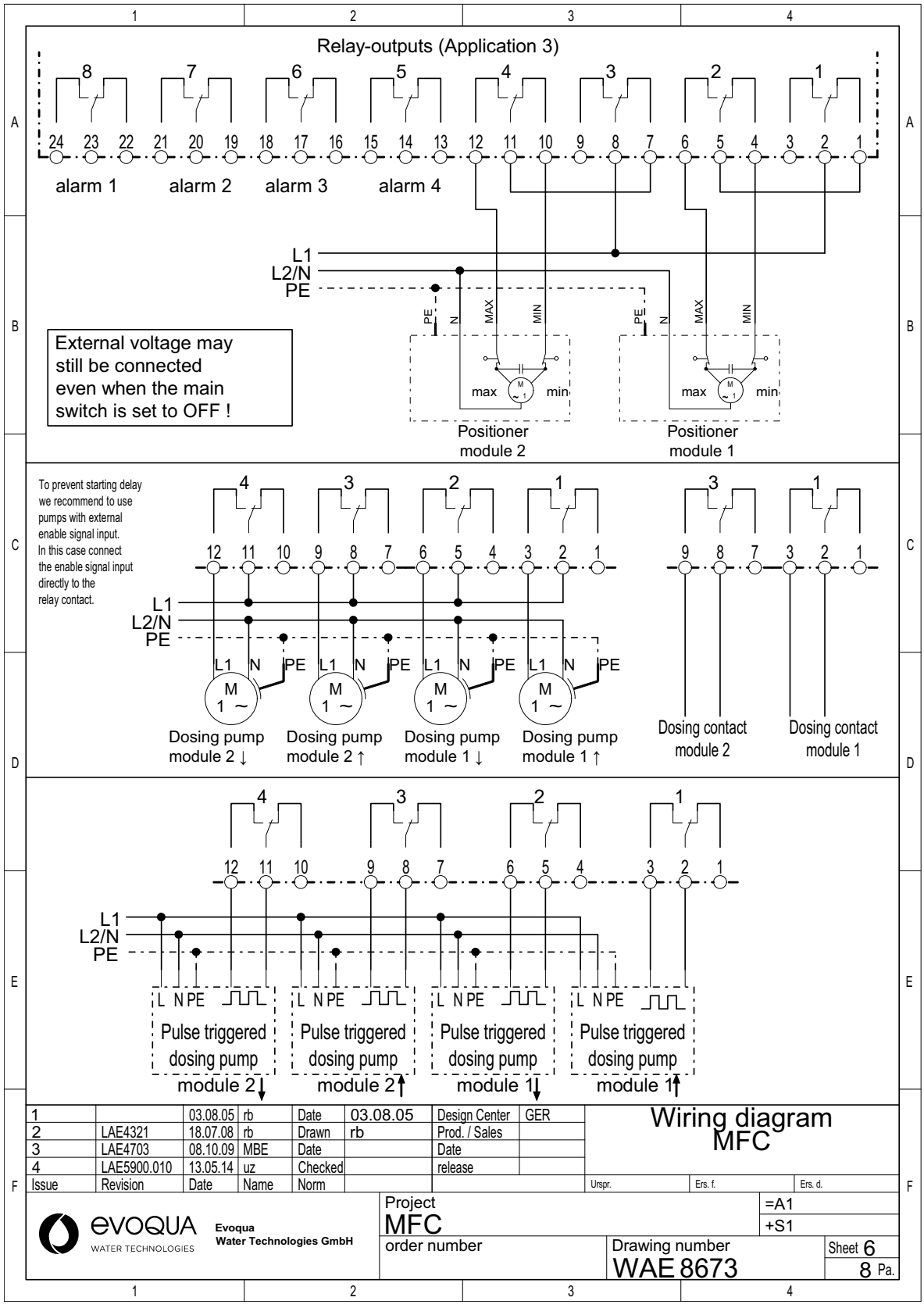
order number

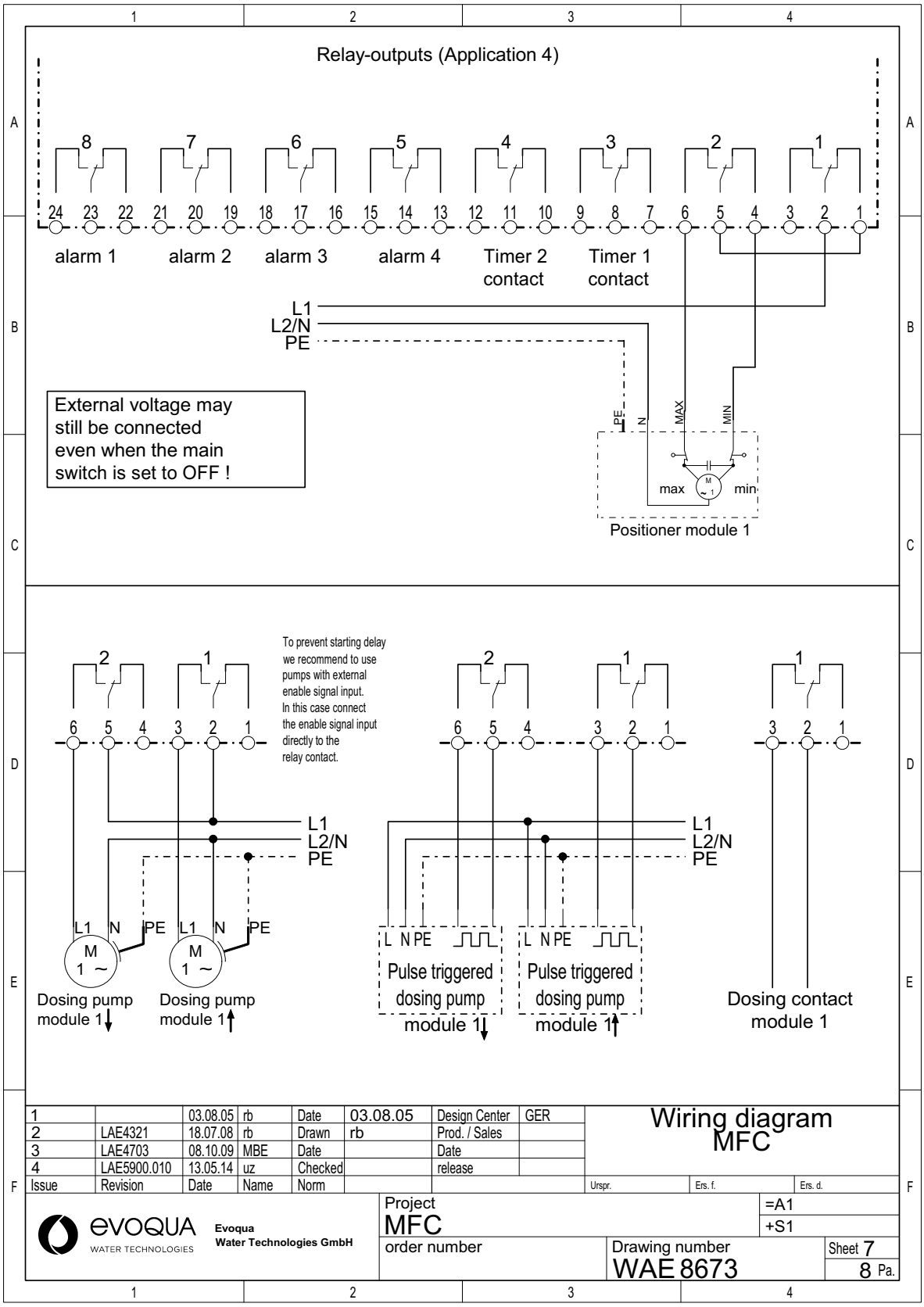
Drawing number: WAE 8673

Sheet 4

8 Pa.


Relay-outputs (Application 2 + 5)
8 7 6 5 4 3 2 1
24 23 22 21 20 19 18 17 16 15 14 13 12 11 10 9 8 7 6 5 4 3 2 1
alarm 1
alarm 2
alarm 3
alarm 4
alarm 5
alarm 6
L1
L2/N
PE
External voltage may still be connected even when the main switch is set to OFF !
PE
N
MAX
MIN
max
min
Positioner module 1
To prevent starting delay we recommend to use pumps with external enable signal input. In this case connect the enable signal input directly to the relay contact.
2 1
6 5 4 3 2 1
L1
L2/N
PE
L1 N PE L1 N PE
M 1 ~
Dosing pump module 1 ↓
Dosing pump module 1 ↑
L N PE
Pulse triggered dosing pump module 1
Dosing contact module 1
1 03.08.05 rb Date 03.08.05 Design Center GER
2 LAE4321 18.07.08 rb Drawn rb Prod. / Sales
3 LAE4703 08.10.09 MBE Date Date
4 LAE5900.010 13.05.14 uz Checked release
Issue Revision Date Name Norm
Urspr. Ers. f. Ers. d.
Wiring diagram MFC
Evoqua Water Technologies GmbH
Project MFC
=A1
+S1
order number
Drawing number WAE 8673
Sheet 5
8 Pa.


Relay-outputs (Application 3)
alarm 1
alarm 2
alarm 3
alarm 4
L1
L2/N
PE
External voltage may still be connected even when the main switch is set to OFF !
Positioner module 2
Positioner module 1
To prevent starting delay we recommend to use pumps with external enable signal input. In this case connect the enable signal input directly to the relay contact.
Dosing pump module 2 ↓
Dosing pump module 2 ↑
Dosing pump module 1 ↓
Dosing pump module 1 ↑
Dosing contact module 2
Dosing contact module 1
Pulse triggered dosing pump
module 2↓
module 2↑
module 1↓
module 1↑
Wiring diagram MFC
Evoqua Water Technologies GmbH
Project MFC
order number
Drawing number WAE 8673
Sheet 6
8 Pa.
=A1
+S1



Issue	Revision	Date	Name	Norm
1		03.08.05	rb	Date
2	LAE4321	18.07.08	rb	Drawn
3	LAE4703	08.10.09	MBE	Date
4	LAE5900.010	13.05.14	uz	Checked

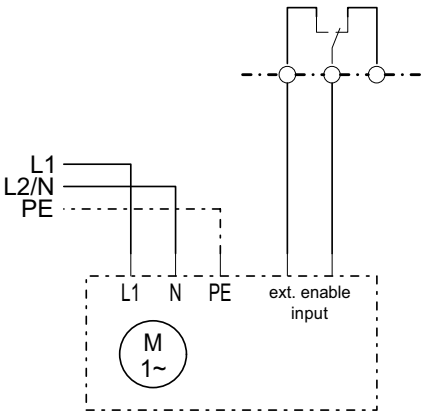
03.08.05	Design Center	GER
rb	Prod. / Sales	
	Date	
	release	

Urspr.	Ers. f.	Ers. d.

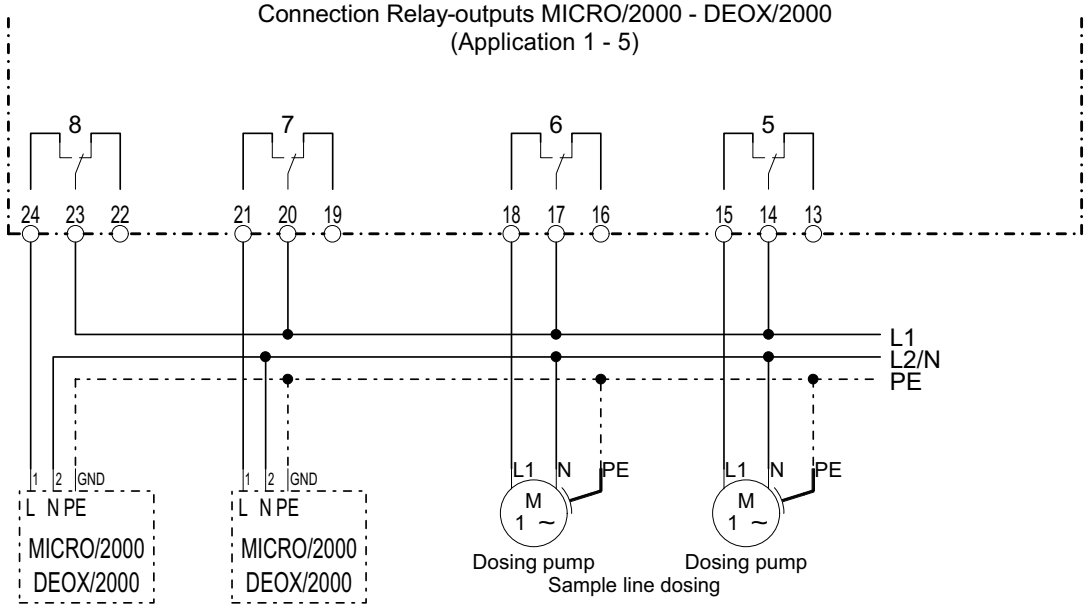
Connection of a dosing pump with external enable signal input contact

Note:

To prevent starting delay we recommend to use pumps with external enable signal input. In this case connect the enable signal input directly to the relay contact.



Connection Relay-outputs MICRO/2000 - DEOX/2000
(Application 1 - 5)



wiring diagramm DE:WAE8672
wiring diagramm EN:WAE8673
wiring diagramm FR:WAE8674

Issue	Revision	Date	Name	Norm			
1		03.08.05	rb	Date	03.08.05	Design Center	GER
2	LAE4321	18.07.08	rb	Drawn	rb	Prod. / Sales	
3	LAE4703	08.10.09	MBE	Date		Date	
4	LAE5900.010	13.05.14	uz	Checked		release	

Wiring diagram MFC

Urspr. | Ers. f. | Ers. d.

Evoqua Water Technologies GmbH

Project: MFC
order number
=A1
+S1
Drawing number: WAE 8673
Sheet 8
8 Pa.

10.Certificates

EVOQUA
WATER TECHNOLOGIES

EG-Konformitätserklärung
EC Declaration of Conformity
Déclaration CE de conformité

No. MAE1140
Ausgabe/*issue*/**édition** 07

Hersteller/*Manufacturer*/**Constructeur:**	Evoqua Water Technologies GmbH
Anschrift/*Address*/**Adresse:**	Auf der Weide 10, D-89312 Günzburg
Produktbezeichnung: *Product description:* **Description du produit:**	Serie DEPOLOX Pool / Strantrol Pool / MFC / V600 / Chem Trim *Series DEPOLOX Pool / Strantrol Pool / MFC / V600 / Chem Trim* **Séries DEPOLOX Pool / Strantrol Pool / MFC / V600 / Chem Trim**

Das bezeichnete Produkt stimmt in der von uns in Verkehr gebrachten Ausführung mit den Vorschriften folgender europäischer Richtlinien überein:
The product described above in the form as delivered is in conformity with the provisions of the following European Directives:
Le produit désigné est conforme, dans la version que nous avons mise en circulation, avec les prescriptions des directives européennes suivantes :

2004/108/EG — Richtlinie des Europäischen Parlaments und des Rates vom 15. Dezember 2004 zur Angleichung der Rechtsvorschriften der Mitgliedstaaten über die elektromagnetische Verträglichkeit.
Directive of the European Parliament and of the Council of 15 December 2004 on the approximation of the laws of the Member States relating to electromagnetic compatibility.
Directive du Parlement européen et du Conseil du 15 décembre 2004 relative au rapprochement des législations des Etats membres concernant la compatibilité électromagnétique.

2006/95/EG — Richtlinie des Europäischen Parlaments und des Rates vom 12. Dezember 2006 zur Angleichung der Rechtsvorschriften der Mitgliedstaaten betreffend elektrische Betriebsmittel zur Verwendung innerhalb bestimmter Spannungsgrenzen.
Directive of the European Parliament and of the Council of 12 December 2006 on the harmonisation of the laws of Member States relating to electrical equipment designed for use within certain voltage limits.
Directive du Parlement européen et du Conseil du 12 décembre 2006 concernant le rapprochement des législations des Etats membres relatives au matériel électrique destiné à être employé dans certaines limites de tension.

CE-Kennzeichnung / *CE marking* / **Marquage CE**: 2014

Ersteller : SR
Ausgabe : 24.02.2014
Dokument: VD130-1_CE_Konformitätserklärung.doc

Evoqua Water Technologies GmbH
Auf der Weide 10
89312 Günzburg
Deutschland

Tel.: +49 (8221) 904-0
Fax: +49 (8221) 904-203
www.evoqua.com

Seite 1 von 2

Die Konformität mit den Richtlinien wird nachgewiesen durch die Einhaltung der in der Nachweisdokumentation aufgelisteten Normen.
Evidence of conformity to the Directives is assured through the application of the standards listed in the relevant documentation.
La conformité avec les directives est assurée par le respect des normes listés dans la documentation téchnique correspondante.

Benannte Person für technische Unterlagen:
Authorized person for the technical file:
Personne désignée pour la documentation technique:

Name / *name* / **nom:** Evoqua Water Technologies GmbH

Adresse / *address* / **adresse:** Auf der Weide 10, D-89312 Günzburg

Günzburg, den / *the* 2014-MAY-07

Evoqua Water Technologies GmbH

i.V. Klaus Andre — Unterschrift *signature* / **signature**

Klaus Andre
Technischer Leiter / *Director Engineering*

i.V. Helmut Fischer — Unterschrift *signature* / **signature**

Helmut Fischer
Leiter QM / *Quality Manager*

Diese Erklärung bescheinigt die Übereinstimmung mit den genannten Richtlinien, ist jedoch keine Beschaffenheits- oder Haltbarkeitsgarantie nach §443 BGB. Die Sicherheitshinweise der mitgelieferten Produktdokumentation sind zu beachten.
This declaration certifies the conformity to the specified directives but does not imply any warranty for properties. The safety documentation accompanying the product shall be considered in detail..
La présente déclaration atteste de la concordance avec les directives citées, elle n'offre cependant pas de garantie quant à la nature ou la durabilité selon l'article 443 du code civil allemand. Les consignes de sécurité de la documentation du produit fournie sont à respecter.

CSA Group

Certificate of Compliance

Certificate: 1581820 **Master Contract:** 226676

Project: 70006008 **Date Issued:** May 29, 2014

Issued to: **Evoqua Water Technologies GmbH**

Auf der Weide 10
Gunzburg, 89312
Germany
Attention: Wolfgang Kleiber

The products listed below are eligible to bear the CSA Mark shown with adjacent indicators 'C' and 'US' for Canada and US or with adjacent indicator 'US' for US only or without either indicator for Canada only.

C US

Anne Drouin

Issued by: Anne Drouin

PRODUCTS

CLASS 3631 05 - ELECTRICAL MEASUREMENT AND TEST EQUIPMENT
CLASS 3631 85 - ELECTRICAL EQUIPMENT FOR MEASUREMENT USE - Certified to US Standards

Water analyzer**, models*:Strantrol MG/L5/ Strantrol Pool / Depolox Pool / MFC / System MFC - Depolox 5 / System MFC - VariaSens XXX, wall mounted, cord connected, Rated: 100-120 / 200-240Vac, 50/60 Hz, 30W, IP66/Nema4X.

Notes:

Notes

*: Only model name is different units.

**: Can be used with the following flow block modules:

DP-XX Flow block module "Depolox Pool" for application in the pool market (together with Electronic-Module Depolox Pool or Strantrol MG/L 5)

SP-DF Flow block module "Strantrol plus" for application in the pool market (together with Electronic-Module Strantrol Pool)

DQD 507 Rev. 2012-05-22 Page: 1

CSA Group

Certificate: 1581820 **Master Contract:** 226676

Project: 70006008 **Date Issued:** May 29, 2014

D5-XX Flow block module "Depolox 5" for application in the potable water market (together with Electronic-Module MFC and chlorine sensor)

VS-XX Flow block module "VariaSens" for application in the potable water market (together with Electronic-Module MFC and different membrane sensors)

These Flow blocks are available in two versions for pressure less or pressurized application. XX stands for DL (*Drucklos*: Pressure less) or DF (*Druckfest*: pressurized)

XXX: stands for the type of sensor used in the unit: TC1 (total chlorine), FC1 (free chlorine), CD7 (chlorine dioxide) or OZ7 (ozone)

APPLICABLE REQUIREMENTS

CAN/CSA-C22.2 No. 61010-1-04: Safety Requirements for Electrical Equipment for Measurement, Control, and Laboratory Use, Part 1: General Requirements

UL Std. No. 61010-1 (2nd Edition): Safety Requirements for Electrical Equipment for Measurement,

CONDITIONS OF ACCEPTABILITY

The user is responsible for providing an approved power supply cord set or power supply cord with attachment plug that is acceptable to the authorities in the country where the equipment is to be used. Units sold without a power supply cord are considered as components.

DQD 507 Rev. 2012-05-22 Page: 2

11.Settings table

Please note

This settings table shows all of the settings available in MFC. Depending on the application selected and the sensor measuring modules fitted, various menu items, menu parameters and setting parameters may be hidden. Cross out any that are not applicable.

Make a note of your settings here.

Please refer to the settings table inside the control cabinet too (optional).

Menu	Menu parameters	Setting parameters (factory setting)	Commissioning
Module type 1			
Actuator (not in appl. 1)	Control outputs	Positioner with Ym 1 k	
	Tp	60 s	
	Ty	90 s	
	Sample time T	5 s	
	Pulses max./min	100	
	Hysteresis		
	min ON		
	CAN adress	-- (Off)	
Control (not in appl. 1)	Control mode		
	Setpoint		
	Setpoint source	Internal	
	Dosing factor	100 %	
	Dos.fact source	Internal	
	Yout-Factor	1.0	

Menu	Menu parameters	Setting parameters (factory setting)	Commissioning
Setup (not in appl. 1)	Flow source	Flow measurement	
	Flow direction	direct	
	Control Input 2	Off	
	Input direction	inverse	
	Control direct.	direct	
	X-Factor	1.0	
	Ymin	0 %	
	Ymax	100 %	
Parameters (not in appl. 1)	Xsh	1.0 %	
	Tkonst	1 min	
	Tvar	30 s	
	Max. lin. corr.	50 %	
	Control factor	1.0	
	Xp	100 %	
	Tn	20.0 min	
Meas. Range	Range-Start		
	pH	4.00	
	mV	400	
	mA/V	0,0	
	Range-End		
	pH	9,00	
	mV	900	
	mA/V	100,0	
	Measuring Range		
	Cl_2	1.00 mg/l	
	Mem	1.00 mg/l	
	F^-	2.00 mg/l	
	LF	10,00 mS/cm	
	Sensor Type	Cl_2 free	
	Unit	%	
	Format	000,0	
	Upot	250 mV	
	µA measuring range	100 µA	
	Signal	0 – 20 mA	
	Factor	1,0	
	Disp. Salt conten	Off	

Menu	Menu parameters	Setting parameters (factory setting)	Commissioning
	TDS Factor	0.7	
	pH compensation		
	Cl_2 free ref		
	Refer.Temp	25 °C	
	CAN-Seg.MV->	01	
	CAN-Addr.MV->	--	
Limit values 1	Min		
	Max		
	Hysteresis		
Limit values 2 (not in appl. 1)	Min Ym/Yout	20 %	
	Max Ym/Yout	80 %	
	Hysteresis	5 %	
	Min Ypi	20 %	
	Max Ypi	80 %	
	Hysteresis	5 %	
Adaption (not in appl. 1)	Tu	60 s	
	Ts	10 min	

Menu	Menu parameters	Setting parameters (factor setting)	Commissioning
Module type 2			
Actuator (not in appl. 1)	Control output	Positioner without Ym	
	Ty	90 s	
	Tp	90 s	
	Pulses max/min	100	
	Hysteresis		
	min. ON	10 min	
	CAN adress	-- (Off)	
Control (not in appl. 1, 2)	Control mode	single feed back	
	Setpoint		
	Control direction	direct	
	Dosing factor	100 %	
Parameters (not in appl. 1, 2)	Xp	10 %	
	Tn	20 min	
	Xsh	1 %	
	Ymin	0 %	
	Ymax	100 %	
Time setting (not in appl. 4)	Time contact 1	Selection of up to 9 switch-on and switch-off times	

	ON	OFF	DAY
1			
2			
3			
4			
5			
6			
7			
8			
9			

<table>
<tr><th>Menu</th><th>Menu parameters</th><th colspan="2">Setting parameters (factor setting)</th><th>Commissioning</th></tr>
<tr><td></td><td>Time contact 2</td><td colspan="3">Selection of up to 9 switch-on and switch-off times
<table>
<tr><th></th><th>ON</th><th>OFF</th><th>DAY</th></tr>
<tr><td>1</td><td></td><td></td><td></td></tr>
<tr><td>2</td><td></td><td></td><td></td></tr>
<tr><td>3</td><td></td><td></td><td></td></tr>
<tr><td>4</td><td></td><td></td><td></td></tr>
<tr><td>5</td><td></td><td></td><td></td></tr>
<tr><td>6</td><td></td><td></td><td></td></tr>
<tr><td>7</td><td></td><td></td><td></td></tr>
<tr><td>8</td><td></td><td></td><td></td></tr>
<tr><td>9</td><td></td><td></td><td></td></tr>
</table></td></tr>
<tr><td rowspan="5">Setpoint Trim
(only appl. 5)</td><td>Setpoint Trim</td><td colspan="2">Off</td><td></td></tr>
<tr><td>Change</td><td colspan="2">10 %</td><td></td></tr>
<tr><td>Band</td><td colspan="2">20 %</td><td></td></tr>
<tr><td>Xsh</td><td colspan="2">2 %</td><td></td></tr>
<tr><td>Tkonst</td><td colspan="2">1 min</td><td></td></tr>
<tr><td rowspan="20">Meas.Range</td><td>Tvar</td><td colspan="2">30 s</td><td></td></tr>
<tr><td>Range-Start</td><td colspan="2"></td><td></td></tr>
<tr><td>pH</td><td colspan="2">4,00</td><td></td></tr>
<tr><td>mV</td><td colspan="2">400</td><td></td></tr>
<tr><td>mA/V</td><td colspan="2">0,0</td><td></td></tr>
<tr><td>Range-End</td><td colspan="2"></td><td></td></tr>
<tr><td>pH</td><td colspan="2">9,00</td><td></td></tr>
<tr><td>mV</td><td colspan="2">900</td><td></td></tr>
<tr><td>mA/V</td><td colspan="2">100,0</td><td></td></tr>
<tr><td>Meas.Range</td><td colspan="2"></td><td></td></tr>
<tr><td>Cl_2</td><td colspan="2">1.00 mg/l</td><td></td></tr>
<tr><td>Mem</td><td colspan="2">1.00 mg/l</td><td></td></tr>
<tr><td>F^-</td><td colspan="2">2.00 mg/l</td><td></td></tr>
<tr><td>LF</td><td colspan="2">10,00 mS/cm</td><td></td></tr>
<tr><td>Sensor Type</td><td colspan="2"></td><td></td></tr>
<tr><td>Unit</td><td colspan="2"></td><td></td></tr>
<tr><td>Format</td><td colspan="2">000,0</td><td></td></tr>
<tr><td>Upot</td><td colspan="2">250 mV</td><td></td></tr>
<tr><td>µA Range</td><td colspan="2">100 µA</td><td></td></tr>
</table>

Menu	Menu parameters	Setting parameters (factor setting)	Commissioning
	Signal	0 – 20 mA	
	Factor	1,0	
	Disp. Salt conten	Off	
	TDS-Factor	0.7	
	pH compensation		
	Cl_2 free ref		
	Refer. Tem.	25 °C	
	CAN-Seg.MV->	01	
	CAN-Addr.MV->	--	
Limit Values 1	Min		
	Max		
	Hysteresis		
Limit Values 2 (not in appl. 1)	Min Ym/Yout	20 %	
	Max Ym/Yout	80 %	
	Hysteresis	5 %	
	Min Ypi	20 %	
	Max Ypi	80 %	
	Hysteresis	5 %	
Adaption (not in appl. 1)	Tu	60 s	
	Ts	10 min	

Menu	Menu parameters	Setting parameters (factor setting)	Commissioning
Module type 3			
Meas.Range	Range-Start		
	pH	4,00	
	mV	400	
	mA/V	0,0	
	Range-End		
	pH	9,00	
	mV	900	
	mA/V	100,0	
	Meas.Range		
	Cl_2	1.00 mg/l	
	Mem	1.00 mg/l	
	F^-	2.00 mg/l	
	LF	10,00 mS/cm	
	Sensor Type		
	Unit		
	Format	000,0	
	Upot	250 mV	
	µA Range	100 µA	
	Signal	0 – 20 mA	
	Factor	1,0	
	pH compensation		
	Disp. Salt conten	Off	
	TDS-Factor	0.7	
	Cl2 free ref		
	Refer. Tem.	25 °C	
	CAN-Seg.MV->	01	
	CAN-Addr.MV->	--	
Limit Values 1	Min		
	Max		
	Hysteresis		

Menu	Menu parameters	Setting parameters (factor setting)	Commissioning
Module type 4			
Meas.Range	Range-Start		
	pH	4,00	
	mV	400	
	mA/V	0,0	
	Range-End		
	pH	9,00	
	mV	900	
	mA/V	100,0	
	Meas.Range		
	Cl_2	1.00 mg/l	
	Mem	1.00 mg/l	
	F^-	2.00 mg/l	
	LF	10,00 mS/cm	
	Sensor Type		
	Unit		
	Format	000,0	
	Upot	250 mV	
	µA Range	100 µA	
	Signal	0 – 20 mA	
	Factor	1,0	
	pH compensation		
	Disp. Salt conten	Off	
	TDS-Factor	0.7	
	Cl2 free ref		
	Refer. Tem.	25 °C	
	CAN-Seg.MV->	01	
	CAN-Addr.MV->	--	
Limit Values 1	Min	within measuring range	
	Max	within measuring range	
	Hysteresis		

Menu	Menu parameters	Setting parameters (factor setting)	Commissioning
Inputs/Outputs			
Flow rate	Signal	0 – 20 mA	
	Factor	1,0	
	Unit	%	
	Format	000,0 %	
	Range-Start	000,0 %	
	Range-End	100,0 %	
Flow rate limit value	Min	20,0 %	
	Max	80,0 %	
	Hysteresis	5,0 %	
ext. setpoint/DF	Signal	0 – 20 mA	
	Factor	1,0	
Setpoint/DF Limit Values	Min	20,0 %	
	Max	80,0 %	
	Hysteresis	5,0 %	
Analog output 1/2	mA 1 Signal	Off	
	mA 1		
	mA 2 Signal	Off	
	mA 2		
Analog output 3/4	mA 3 Signal	Off	
	mA 3		
	mA 4 Signal	Off	
	mA 4		
Digital input	DI 1	SW-LOSS FCT	
	DI 2		
	DI 3		
Interface	RS232	Off	
	RS485 Adress	00	

Menu	Menu parameters	Setting parameters (factor setting)	Commissioning
Alarm			
	Alarm 1 function	N.O. unlatched	
	Alarm 1 delay	0	
	Alarm 2 function	N.O. unlatched	
	Alarm 2 delay	0	
	Alarm 3 function	N.O. unlatched	
	Alarm 3 delay	0	
	Alarm 4 function	N.O. unlatched	
	Alarm 4 delay	0	
	Alarm 5 function	N.O. unlatched	
	Alarm 5 delay	0	
	Alarm 6 function	N.O. unlatched	
	Alarm 6 delay	0	
	Alarm 7 function	N.O. unlatched	
	Alarm 7 delay	0	
	Alarm 8 function	N.O. unlatched	
	Alarm 8 delay	0	
Assigning alarm 1			
Assigning alarm 2			
Assigning alarm 3			
Assigning alarm 4			
Assigning alarm 5 (not in appl. 1, 2, 5)			

Menu	Menu parameters	Setting parameters (factor setting)	Commissioning
Assigning alarm 6 (not in appl. 1, 2, 5)			
Assigning alarm 7 (not in appl. 1)			
Assigning alarm 8 (not in appl. 1)			

Menu	Menu parameters	Setting parameters (factor settings)	Commissioning
System			
General	Dampening	Off	
	Hold Function	Off	
	Language	German	
	System name	MFC 1	
Safety	feed delay	03min : 00s	
	samp.water delay	01min : 00s	
	System Password	0000	
	Calibr.password	0000	
Line diagram	Channel 1	Off	
	Channel 2	Off	
	Channel 3	Off	
	Channel 4	Off	
Module designation	Module 1		
	Module 2		
	Module 3		
	Module 4		

Settings changed from: _____

Settings changed on: _____

12.Index

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