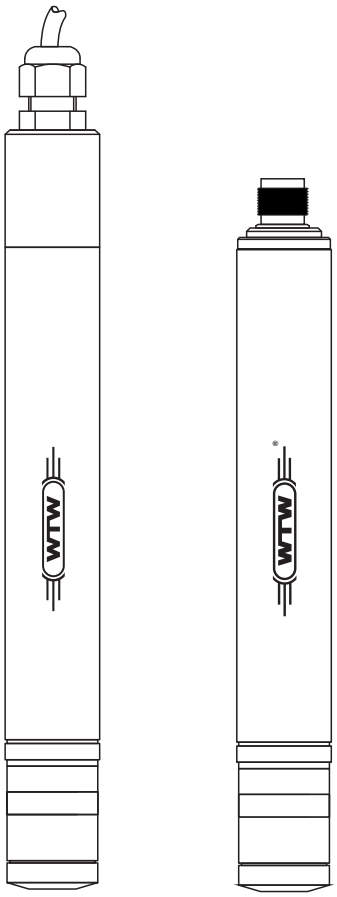


TCML 412 N TCML 412 M12

OPERATING MANUAL

ba77208e02 01/2025

TCML 412 N
TCML 412 M12-2

SENSOR FOR TOTAL CHLORINE

WTW
a xylem brand

Contents

1 Overview

The sensor is a membrane-covered, amperometric sensor for the determination of total chlorine.

Structure

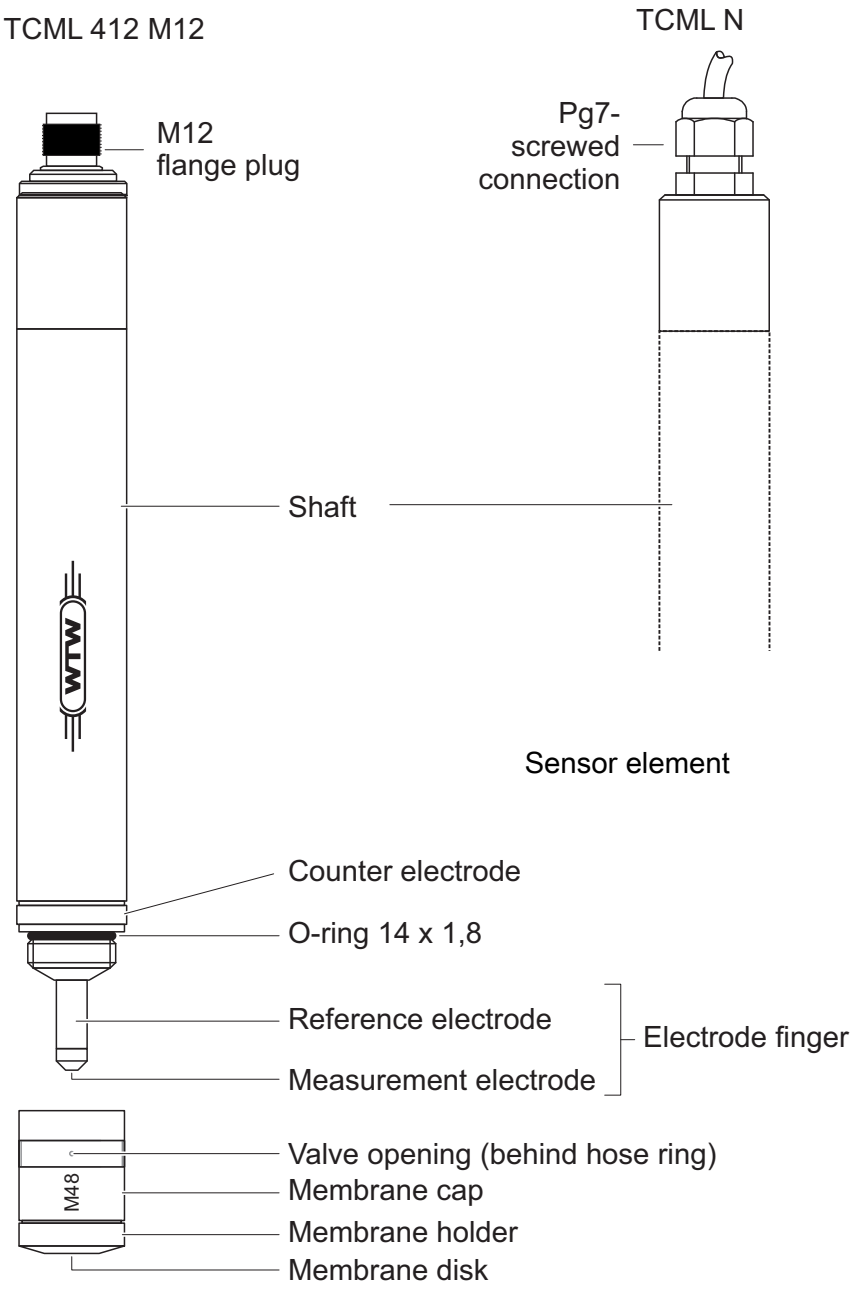


figure 1-1 Structure

Due to its special design (potentiostatic three electrode system), the sensor measures all the free chlorine present (sum of gaseous dissolved chlorine, hypochloric acid and hypochlorite) and the chlorine that is bonded organically and inorganically. The sensor works nearly independent of the pH value.

The sensor has integrated measuring electronics and delivers a measuring

signal that is already temperature compensated. A zero point adjustment is not required. Routine calibration is done by comparison with the photometric DPD method according to DIN 38408.

Electrical connection TCML 412 N

The TCML 412 N sensor is connected with the monitor (e.g. MULTILINE 1000) via a two line connection. The wires are used for the power supply of the monitor and for the transmission of measurement signals (4 - 20 mA current signal).

Electrical connection TCML 412 M12-2

The TCML 412 M12-2 sensor has a four-pin socket for connecting with the monitor (e.g. CL 7010) via the ADA CI/IDS cable (not included in the scope of delivery). The power supply and the transmission of the measured signal (0 to -1500 mV voltage signal) are carried out separately over two lines.

2 Safety instructions

2.1 Safety information

2.1.1 Safety information in the operating manual

This operating manual provides important information on the safe operation of the product. Read this operating manual thoroughly and make yourself familiar with the product before putting it into operation or working with it. The operating manual must be kept in the vicinity of the sensor so you can always find the information you need.

Important safety instructions are highlighted in this operating manual. They are indicated by the warning symbol (triangle) in the left column. The signal word (e.g. "CAUTION") indicates the level of danger:

WARNING
indicates a possibly dangerous situation that can lead to serious (irreversible) injury or death if the safety instruction is not followed.

CAUTION
indicates a possibly dangerous situation that can lead to slight (reversible) injury if the safety instruction is not followed.

NOTE
indicates a situation where goods might be damaged if the actions mentioned are not taken.

2.1.2 Safety signs on the product

Note all labels, information signs and safety symbols on the product. A warning symbol (triangle) without text refers to safety information in this operating manual.

2.1.3 Further documents providing safety information

The following documents provide additional information, which you should observe for your safety when working with the measuring system:

- Operating manuals of other components (power packs, controller, accessories)
- Safety datasheets of calibration and maintenance equipment (e.g. cleaning solutions).

2.2 Safe operation

2.2.1 Authorized use

The authorized use of the sensor is the stationary measurement of chlorine in drinking water, swimming pool water and process water.. Only the operation and running of the sensor according to the instructions and technical specifications given in this operating manual is authorized (see chapter 7 TECHNICAL DATA). Any other use is considered unauthorized.

2.2.2 Requirements for safe operation

Note the following points for safe operation:

- The product may only be operated according to the authorized use specified above.
- The product may only be supplied with power by the energy sources mentioned in this operating manual.
- The product may only be operated under the environmental conditions mentioned in this operating manual.
- The product may not be opened.

2.2.3 Unauthorized use

The product must not be put into operation if:

- it is visibly damaged (e.g. after being transported)
- it was stored under adverse conditions for a lengthy period of time (storing conditions, see chapter 7 TECHNICAL DATA).

3 Commissioning

3.1 Scope of delivery

- Sensor TCML 412 with membrane cap M48
  - Sensor TCML 412 N
    or
  - Sensor TCML 412 M12-2
- Dropping bottle with 100 ml electrolyte solution ELY-TCML 412 N
- Polishing strip
- Operating manual

3.2 Filling the membrane cap with electrolyte solution

NOTE
Risk of damage for the sensor in the case of improper handling.
Do not touch the electrode finger with your fingers.
Do not apply pressure to the membrane disk.
Do not unscrew the membrane holder.

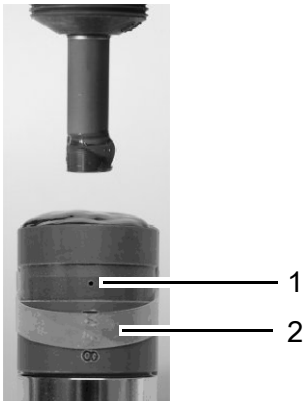
When it is delivered, the membrane cap is not filled with electrolyte and is loosely screwed onto the shaft. In order to put the sensor into operation, fill the membrane head as follows:

Filling the membrane cap

1. Unscrew the membrane cap from the electrode shaft. Place the membrane cap on a clean (non-absorbent) surface.

2. Cut off the tip of the dropping bottle until the opening in the tip is visible, then fill the membrane cap completely with electrolyte solution making sure it is bubble free.

3. Lift off the hose ring of the membrane cap, which closes the valve opening, from the side so that the valve opening is exposed (see picture below).
Hold the sensor shaft in an upright position and place it on the filled membrane cap. Some of the electrolyte solution will leak over the upper edge of the membrane cap while doing this. Then screw the electrode shaft into the membrane cap. For this, first turn the electrode shaft anti-clockwise until the thread catches; then slowly screw in the electrode shaft as far as it will go until no gap can be seen between the sensor shaft and membrane cap.



1 Valve opening
2 Hose ring

NOTE
Overpressure in the membrane cap can destroy the membrane disk. Therefore, make sure the valve opening is not inadvertently closed by your fingers. Excess electrolyte solution must be able to escape freely at any time. Screw slowly so that no back pressure can develop.

4. Using a blunt object, slide the hose ring over the valve opening and insert it evenly in the groove.

5. Rinse off any electrolyte solution adhering on the outside.

3.3 Electrical connection

How to connect the TCML 412 N sensor to the measuring transmitter or the MIQ/IDS module is described in the operating manual of the measuring transmitter.

How to connect the sensor TCML 412 M12-2 to the MIQ/IDS module is explained in the operating manual of the module MIQ/IDS.

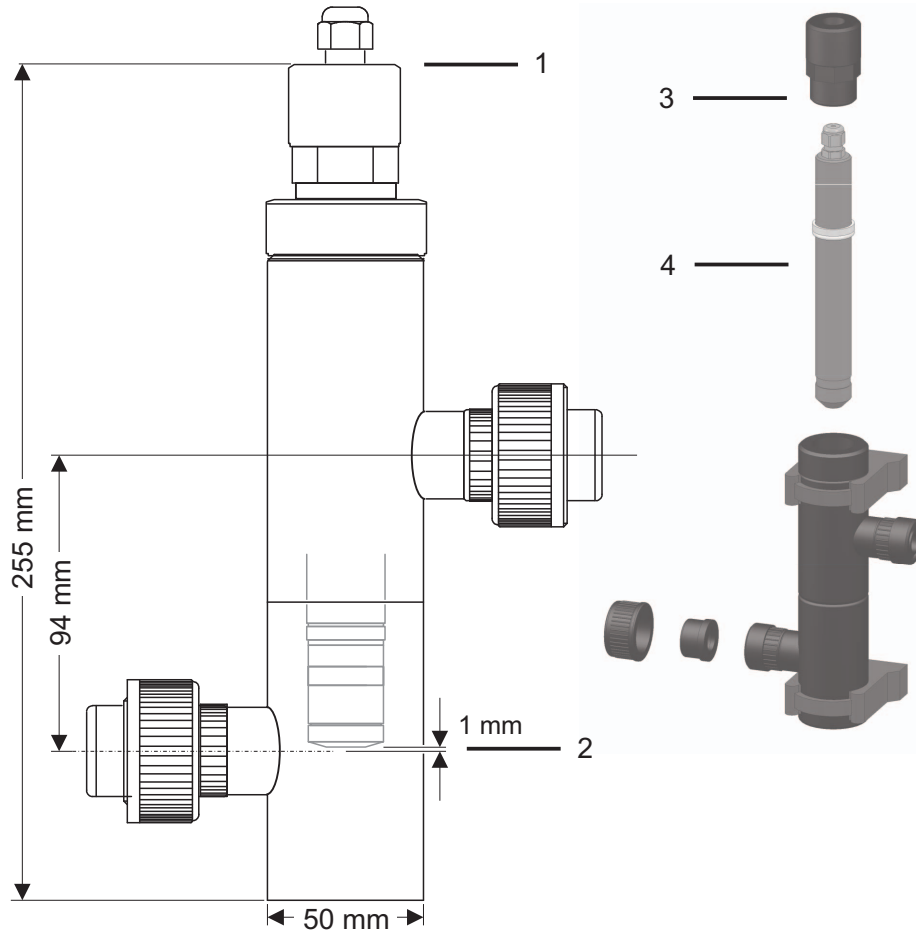
3.4 Installation in the flow through vessel D-CL

The flow-through vessel D-CL is optimized for the TCML 412 N chlorine sensors.

The position in the flow through vessel has a considerable effect on the approach flow and, hence, the measuring function of the sensor. Therefore carefully position the sensor as described below.

Proceed as follows to install the sensor:

1. Slide the black O-ring and then the PVC sliding ring over the sensor.
2. Unscrew the screw connection of the flow-through vessel.
3. Insert the sensor into the flow-through vessel without the cable connected.
4. Slide the screw connection of the flow-through vessel over the sensor.
5. Screw the screw connection of the flow-through vessel onto the flow-through vessel.



1 Top edge of the screw connection
2 Sensor 1 mm above the middle of the inlet opening
3 Screw connection
4 O-ring and PVC slide ring

6. Reconnect the sensor connection cable to the sensor.

NOTE
When commissioning, always open the feed slowly. A strong shock pressure can destroy the membrane.

3.5 Installation in the flow through vessel D 19

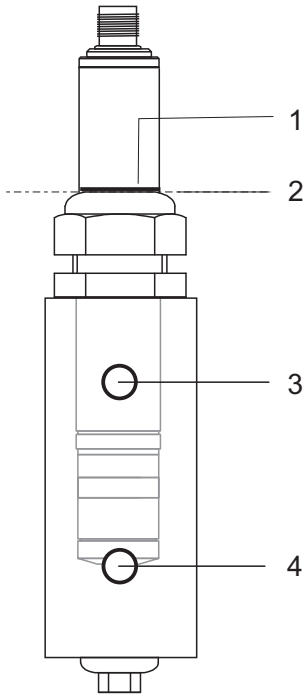
The flow-through vessel D 19 is optimized for the TCML 412 M12-2 chlorine sensor.

The TCML 412 M12-2 has a marking on its shaft for optimum installation in the flow-through vessel D 19.

The position in the flow through vessel has a considerable effect on the approach flow and, hence, the measuring function of the sensor. Therefore carefully position the sensor as described below.

Proceed as follows to install the sensor:

1. Insert the black O-ring, then the PVC slide ring in the 1" installation opening of the flow through vessel.
2. Push the coupling ring of the flow-through vessel loosely onto the sensor.
3. Insert the sensor with the coupling ring in the flow-through vessel.



1 Marking on the TCML 412 M12-2
2 Top edge of the coupling ring
3 Drain opening
4 Inlet opening

4. Align the marking (1) on the sensor with the top edge (2) of the coupling ring.
5. Tighten the coupling ring by hand.

6. Tighten the coupling ring approx. a quarter turn further with the M32 assembly wrench.
   Make sure the sensor is firmly attached. Otherwise, it can be pressed out of the flow through vessel by pressure.

NOTE
When commissioning, always open the feed slowly. A strong shock pressure can destroy the membrane.

The assembly wrench, size M32, is available as an accessory (see section 5.4 MAINTENANCE EQUIPMENT AND REPLACEMENT PARTS)..

4 Measuring / Operation

4.1 Run-in period

Polarization

Each time the sensor is refilled it must be polarized. To do this, immerse the connected and voltage-supplied sensor in a well-stirred chlorine solution with at least 5 mg/l chlorine for an hour. Then put the sensor into use (measuring position). The sensor can be calibrated after a stabilizing time of approx. 20 minutes. After approx. one day a post-calibration should be performed.

The sensor filled with electrolyte must not become dry and has to be permanently supplied with electrical voltage. Otherwise the characteristics of the membrane cap, electrode finger and electrolyte will be changed (sometimes irreparably). The sensor may only be stored if it is not filled (see also section 5.3 STORAGE).

4.2 Check of the sensor / analysis

Calibration with the DPD method

The chlorine sensor has a linear characteristic curve. Calibration of the chlorine sensor is carried out as a single-point calibration. The calibration value (nominal value) is usually determined photometrically. A common procedure for this is the DPD method for total chlorine. The photometer and test sets for this are described in the WTW catalog or on the Internet.

How to carry out the calibration is described in detail in the operating manual of the monitor.

4.3 Chlorine measurement

The chlorine sensor measures the dissolved chlorine present (sum of gaseous dissolved chlorine, hypochloric acid and hypochlorite) and the chlorine that is bonded organically and inorganically. The values determined with the photometer according to the DPD-3 method (total chlorine) are directly comparable to the values determined by the sensor.

Interfering factors

- Chlorine dioxide
- Ozone
- Hydrogen peroxide

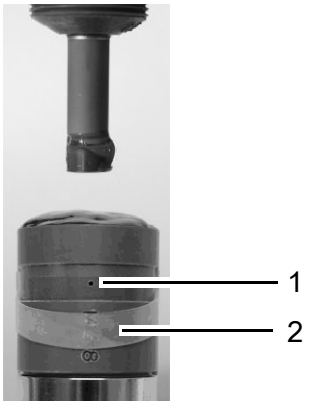
5 Maintenance, cleaning, storage

5.1 Cleaning the measurement electrode / exchanging the membrane cap and electrolyte

We recommend to disconnect the sensor from the measuring transmitter before starting any maintenance work.

If calibration is not possible due to readings that are too low, the measurement electrode has to be cleaned with the enclosed polishing strip. Proceed as follows:

1. Using a blunt object, lift the hose ring out of the guiding groove and push it to the side so that the valve opening is uncovered.



1 Valve opening
2 Hose ring

NOTE
Negative pressure in the membrane cap can destroy the membrane disk. Therefore, make sure the valve opening is not inadvertently closed by your fingers while unscrewing the membrane cap.

2. Unscrew the membrane cap from the sensor shaft and pour away the electrolyte solution.
3. Rinse the electrode finger and membrane cap with clean water and dab them dry with a clean paper towel.
4. Clean the measurement electrode with the polishing strip.
   To do so, place the polishing strip on a paper towel and hold it by a corner. Then hold the electrode finger vertically with the tip down and run the tip over the polishing strip two or three times.

NOTE
The brown coating on the shell (reference electrode) of the electrode finger must not be polished off. This would destroy the sensor!

5. Fill the membrane cap with fresh electrolyte solution as described in section 3.2, screw it on the sensor shaft and make the sensor ready for measurement.

After exchanging the electrolyte solution and/or membrane cap the sensor has to be repolarized (see section 4.1 RUN-IN PERIOD). If calibration is still not possible after cleaning the measurement electrode, change the membrane cap.

5.2 Cleaning

Removing lime deposits on the membrane cap

Remove lime deposits on the membrane cap as follows:

1. Unscrew the membrane cap from the sensor shaft and pour away the electrolyte solution (see section 5.1).
2. Put the membrane cap into 10 % acetic acid for several hours.
3. Then thoroughly rinse the membrane cap with clean water.
4. Fill the membrane cap with fresh electrolyte solution as described in section 3.2, screw it on the sensor shaft and make the sensor ready for measurement.

5.3 Storage

NOTE
The sensor may only be stored in an unfilled condition.

Proceed as follows to store the sensor:

1. Unscrew the membrane cap from the sensor shaft and pour away the electrolyte solution (see section 5.1).
2. Thoroughly rinse the membrane cap and electrode finger with clean water and dry them dust free.
3. Loosely screw the dry membrane cap on the sensor shaft. The membrane disk must not touch the electrode finger.

Recommissioning

For recommissioning, clean the electrode tip with the polishing strip and use a new membrane cap (see section 5.1). The membrane cap can be put into 10 % acetic acid for some hours to remove any lime deposits (see section 5.2).

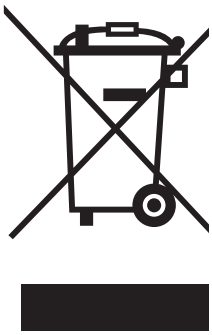
5.4 Maintenance equipment and replacement parts

Description	Model	Order no.
Accessory kit for chlorine sensor TCML 412 N, including: – 1x membrane cap M48 – 100 ml electrolyte solution ELY-TCML 412 N – Polishing strip	ZBK-TCML 412	205249
Adapter for connecting the sensor TCML 412 M12-2 to an IDS interface	ADA Cl/IDS	108155
Flow-through vessel D 19 for chlorine sensor TCML 412 M12-2	D 19	401991
Flow-through vessel D-CL for chlorine sensor TCML 412 N	D-CL	
Accessory for the flow-through vessel D 19 – 1x assembly wrench M32	FS DWP	904030

6 Disposal

Handle and dispose of all waste in compliance with local laws and regulations.

EU only: Correct disposal of this product — WEEE Directive on waste electrical and electronic equipment



This marking on the product, accessories or literature indicates that the product should not be disposed of with other waste at the end of its working life.

To prevent possible harm to the environment or human health from uncontrolled waste disposal, please separate these items from other types of waste and recycle them responsibly to promote the sustainable reuse of material resources.

Waste from electrical and electronic equipment can be returned to the producer or distributor.

7 Technical data

7.1 Measurement characteristics

Measuring principle

Membrane-covered, amperometric sensor with potentiostatic three- electrode system and integrated measuring electronics

Measuring range

TCML 412 N	0.01 ... 2.00 mg/l total chlorine
TCML 412 M12-2	0.01 ... 2.00 mg/l total chlorine (upper limit depends on the slope)

Response time

t_{90} (90 % of the final value display after) approx. 120 s

pH dependency

approx. 10 % slope loss per pH unit

Temperature compensation

Internal, automatic, by means of integrated temperature sensor

Polarization time

approx. 1 hour on commissioning or after exchanging the electrolyte

Calibration procedure

Single-point calibration, e.g. with photometric measurement according to the DPD method as a reference

7.2 Application characteristics

Temperature range

0... 45 °C (32 ... 113 °F) with automatic temperature compensation

pH application range

pH 4 ... 12

Max. allowed overpressure

D-CL	$3 \cdot 10^5$ Pa (3.0 bar),
D 19	$3 \cdot 10^5$ Pa (3.0 bar), Pressureless operation in the flow through vessel recommended

Working life of the membrane cap

typically 1 year (depending on measuring medium)

Approach flow

Recommended minimum flow rate in the flow through vessel:

D-CL	> 30 l/h
D 19	> 15 l/h

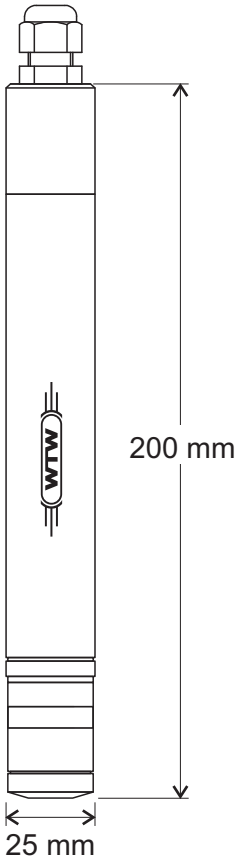
Typical application range

Drinking water, swimming pool water and mains water in the flow through vessel

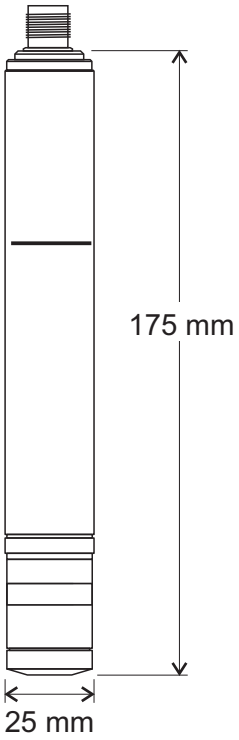
7.3 General data

Dimensions

TCML N:



TCML 412-M12:



Membrane cap M48

Membrane type Microporous, hydrophilic membrane

Electrolyte ELY-TCML 412 N (from ZBK-TCML 412 N)

Material

Shaft	PVC
Membrane cap	PVC
Membrane holder, counter electrode	Stainless steel
Working electrode	Gold
Reference electrode	Ag/AgCl
Hose ring	Silicone
Cable gland	Polyamide

7.4 Electrical data

TCML 412 N

- 2-wire connection via cable (AK-Cl 298)
- 12 ... 30 V DC power supply by the monitor
- Output signal 4 ... 20 mA

TCML 412 M12-2

- 5-pin M12 flange connector: for the ADA Cl/IDS adapter by means of screw/plug connection
- Power supply: +/- 5 ... 15 V DC through the MIQ/IDS module
- Nominal slope: -1000 mV/ppm

Xylem |ˈzīləm|

1) The tissue in plants that brings water upward from the roots;
2) a leading global water technology company.

We're a global team unified in a common purpose: creating advanced technology solutions to the world's water challenges. Developing new technologies that will improve the way water is used, conserved, and re-used in the future is central to our work. Our products and services move, treat, analyze, monitor and return water to the environment, in public utility, industrial, residential and commercial building services settings. Xylem also provides a leading portfolio of smart metering, network technologies and advanced analytics solutions for water, electric and gas utilities. In more than 150 countries, we have strong, long-standing relationships with customers who know us for our powerful combination of leading product brands and applications expertise with a strong focus on developing comprehensive, sustainable solutions.

For more information on how Xylem can help you, go to www.xylem.com.

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