

## TECHNICAL MANUAL UV254 (COD\*, TOC\*, BOD\*) analysis

### *Path through cell analyser CT200*

\* Using correlation



*CT200 analyser (standard version)*

## Summary

1	Technical description of the proposal .....	3
1.1	Detailed description of the analyser .....	3
1.2	Summarized characteristics: CT200 standard version .....	6
1.3	Summarized characteristics: CT200 ECO version .....	7
2	Possible options.....	8
2.1	Possible options for both standard and ECO version .....	8
2.2	Possible option for ECO version only .....	8
2.3	Possible option for standard version only .....	8
2.4	Standard / Classeco (ECO) sum-up and comparison .....	11
3	Recommendation for maintenance and routine checking .....	13
3.1	Soft checking recommendation .....	13
3.2	Calibration checking.....	13
3.3	Yearly preventive maintenance .....	14
4	Operational limits.....	14
4.1	Electromagnetic compliance .....	14
4.2	Temperature.....	14
4.3	Interference.....	14

# 1 Technical description of the proposal

## 1.1 Detailed description of the analyser

### 1.1.1 Technology

The CT200 analyser is a UV spectrometer tuned on 254 nm. It performs a selective measurement taking into account the turbidity and the presence of interfering species if necessary by using a second wavelength channel in a range where no organic matter absorbs.

The UV light source is a long life time Xenon lamp. The original powering electronics grants a very low energy consumption as well as a life time that exceeds 10 years. In order to ensure the best reproducibility and accuracy of measurements, several measurements are performed within a very short time (less than 20 sec) for each analysis cycle. Any disturbance in the measurement conditions that could affect the analysis result is detected by the probe itself and leads to a fault alarm activation.

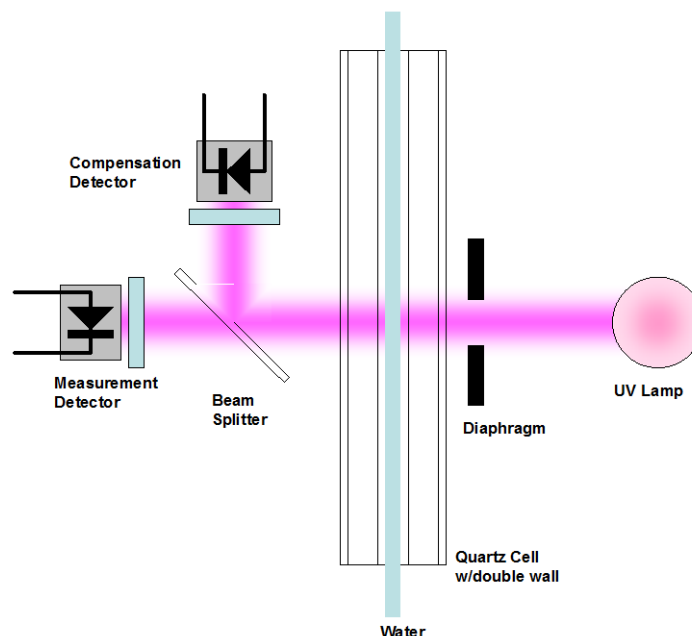
Any electronic disturbance likely to affect the result of the analysis is detected by the analyser and sets a default off.

The measurement result is given in UV absorbance unit or mg/l COD, TOC or BOD depending on the parameters setting.

The measurement results can be remotely transmitted using a 4 - 20 mA output. The range of variation can also be set by the user.

The analyser is factory calibrated, it needs no routine recalibration. The UV spectrometry method makes the measurement long term reliable without drift risk.

#### Measurement principle



## 1.1.2 Range and accuracy

### 1.1.2.1 Low range

The measurement range of the CT200 equipped with the 10 mm path through cell is 0 to 200 m<sup>-1</sup> on clear water (drinking water, river water, ground water).

The resolution is better than 0,1 m<sup>-1</sup>.

The accuracy is about +/-3% of measured value on clear water in the range 0 – 100 m<sup>-1</sup>. Between 100 and 200 m<sup>-1</sup>, the accuracy of the measurement decreases down to +/- 10% at the end of the range.

### 1.1.2.2 High range

The measurement range of the CT200 equipped with the 1 mm path through cell is 0 to 1000 m<sup>-1</sup>.

The accuracy is about +/-3% of measured value on clear water in the range 0 – 100 m<sup>-1</sup>. The resolution is better than 0,6 m<sup>-1</sup>.

## 1.1.3 Measurements and recording

The CT200 can make an analysis every minute. The time interval between measurements can be set minute by minute up to 12 hours.

The measurements performed in the automatic mode are automatically stored in an internal memory (not available in the CLASSECO version). In the manual mode, a special key on the front panel allows the operator to store the value in the memory if desired. So, the CT200 analyser has the advantages of a digital datalogger.

Each stored event contains:

- Date and time of the measurement,
- Measurement result expressed in m<sup>-1</sup> or mg/L of COD (TOC or BOD).

## 1.1.4 Measurement transmission (not available in the CLASSECO version)

The measured concentration results may be transmitted using :

- The built-in 4 – 20 mA output (all version)
- Using the built-in RS232 communication output by connecting a computer (standard version only).

## 1.1.5 Energy

The CT200 is operated using mains 110 – 240 VAC, 50 – 60 Hz.

In the standard version a 12 VDC built-in battery supplies the power in the case of mains failure (optional in the ECO version).

## 1.1.6 Alarm relays

Two alarm relays (dry contacts) for level alarms. The alarms values may be set by the user himself.

One measurement fault alarm relay that is activated in the case of a measurement fault.

### **1.1.7 Reliability**

Depositions that may occur on the walls of the measurement cell are the only obstacles to the light passing through. An automatic cleaning system which allows an acid solution to circulate through the measurement cell and keeps any deposition off is suggested in order to ensure the reliability of the measurements over long periods. An automatic adjustment of the zero can be set after each cleaning cycle.

Any unreliable measurement due to a failure of the measurement cycle produces an error message on the measurement frame and activates the default relay of the analyser.

On standard version only, a journal of events which can be read on the PC records the date and the time of all events (excepting measurements) occurring on the analyser: cleaning cycle, error measurements, potential communications or messages of the operator using the RS232 link or the modem board,....

### **1.1.8 Hydraulic connections**

The hydraulic connections use double ring fittings. The fittings material is SS316L, but could be replaced by PP for applications in sea water (on demand).

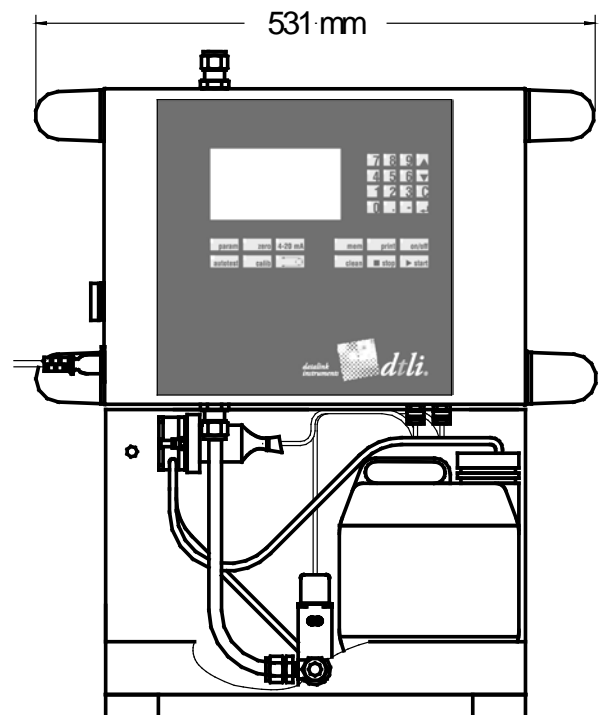
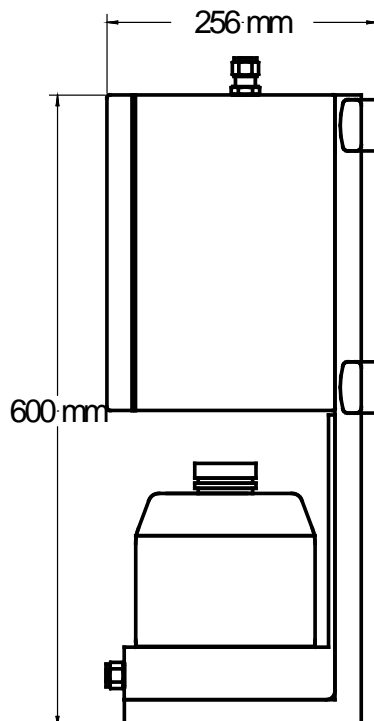
If the optional peristaltic sampling pump is used, the input fitting is a PE nut for smooth tube.

### **1.1.9 Consumables**

No reagent is required. The only consumable liquid is the cleaning solution.

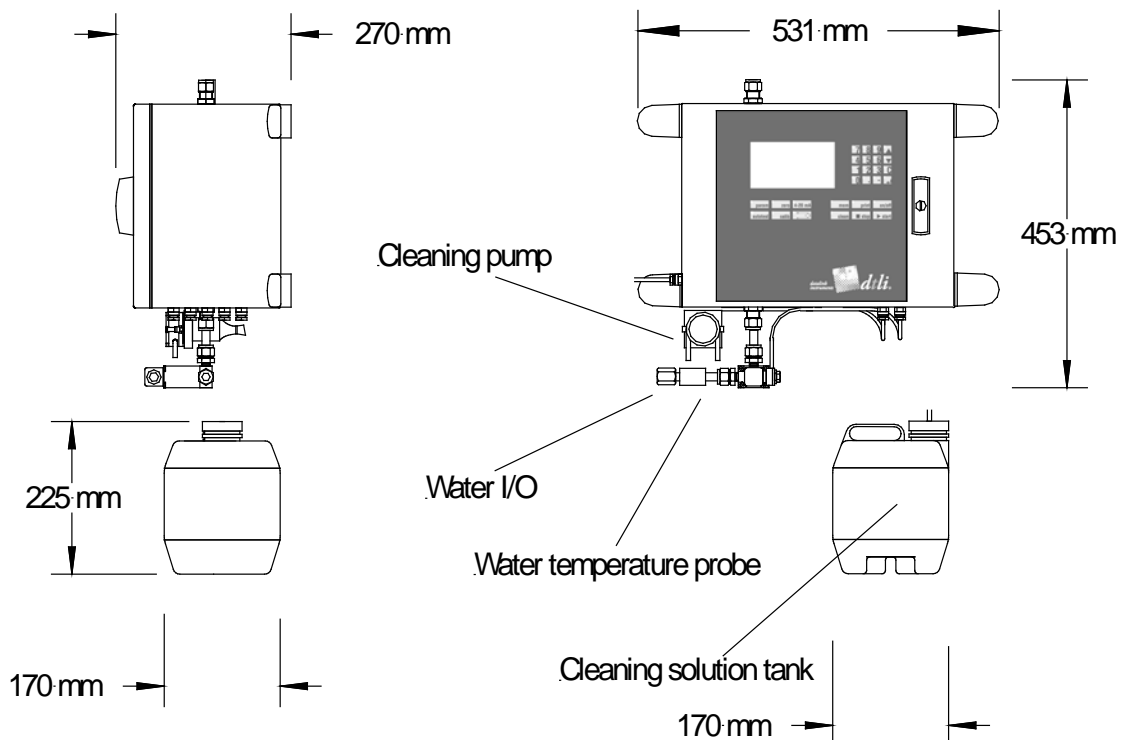
## 1.2 Summarized characteristics: CT200 standard version

Weight :	18 Kg
Range :	0 – 200 m <sup>-1</sup> (Low range) 0 – 1000 m <sup>-1</sup> (High range)
Energy :	100-240V 50/60 Hz 60 W + internal battery 12 V
Outputs :	4-20 mA isolated, 12 bits resolution High threshold/low threshold relay Alarm default relay
Enclosure :	Watertight IP66 Painted steel box
Communication :	RS232 or RS485 (on demand) for PC, or MODBUS
Water flow rate :	typical 0.6 L/mn
Measurement cell volume :	100 ml
Sample temperature	> 1 to 60°C
Sample Pressure	No pressure if sampling pump 0.1 to 5 bar without sampling pump



### 1.3 Summarized characteristics: CT200 ECO version

Weight :	15 Kg
Range :	0 – 200 m <sup>-1</sup> (Low range) 0 – 1000 m <sup>-1</sup> (High range)
Energy :	100-240V 50/60 Hz 60 W + internal battery 12 V
Outputs :	4-20 mA isolated, 12 bits resolution High threshold/low threshold relay Alarm default relay
Enclosure :	Watertight IP66 Painted steel box
Water flow rate :	typical 0.6 L/mn
Measurement cell volume :	100 ml
Sample temperature	> 1 to 60°C
Sample Pressure	No pressure if sampling pump 0.1 to 5 bar without sampling pump

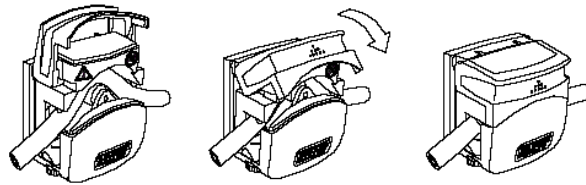


## 2 Possible options

### 2.1 Possible options for both standard and ECO version

#### 2.1.1 Peristaltic sampling pump

If the water is to be pumped from a natural source or a large container, an optional peristaltic pump can be used. It is supplied with power by the battery of the analyser and can be either manually or automatically operated, using the keyboard of the analyser.



The pumping rate is 0.5 L per minute and the pumping is efficient up to five meters high maximum.

#### 2.1.2 Water presence detector

Detect by conductivity the presence or not of water in the analyser.

When the analyser is fed under pressure with permanent circulation, the detector forbids all the automatic measurements if the presence of water is not detected. A device default message is produced.

Also, the auto-calibration of the zero of the analyser will be forbidden if the cleaning solution is not detected. This prevents an adjustment of the zero on an empty measurement cell or which would not have been cleaned for lack of solution.

### 2.2 Possible option for ECO version only

#### 2.2.1 Stainless steel stand-up system

Makes the analyser ready for a lab application without hanging it on a wall.

#### 2.2.2 Built-in battery

Give the analyser a total autonomy that allows mains short breakdown protection or use on the field without external energy power.

### 2.3 Possible option for standard version only

#### 2.3.1 Remote measurement command

This option allows to start a measurement cycle by activating an analog input with a voltage pulse. This is useful when the analyser is integrated in a system monitored by a PLC.

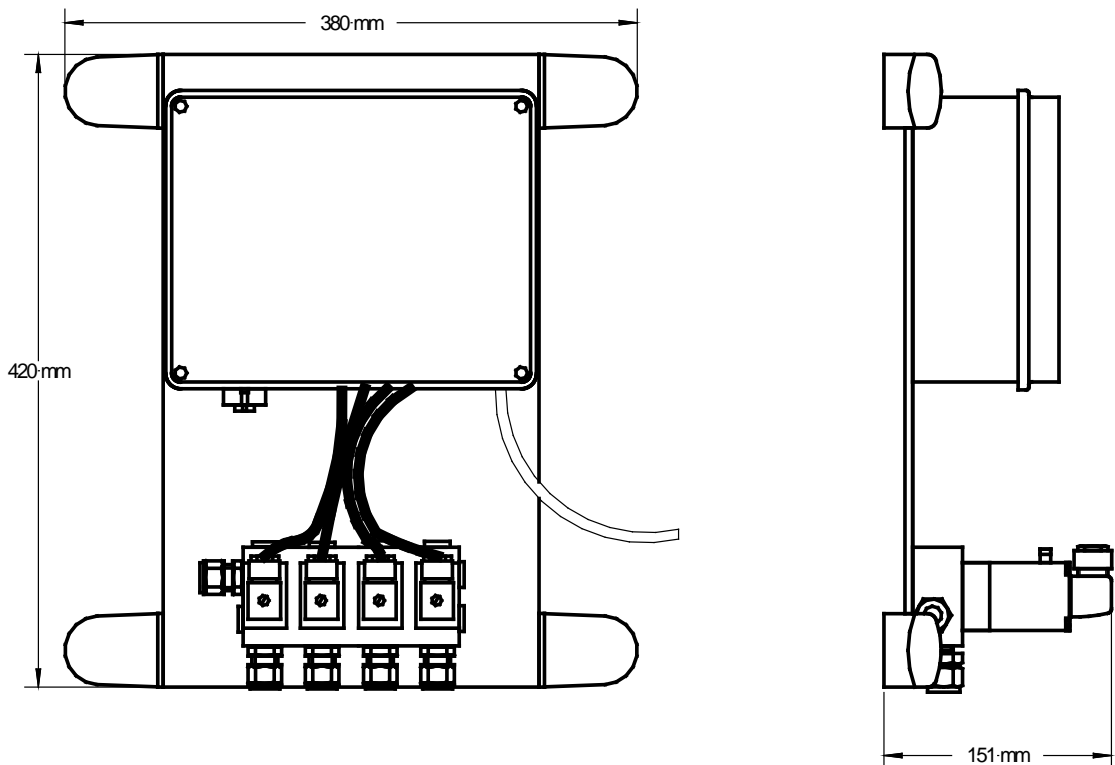
An output contact is activated when the analyser is ready for a measurement command. If the analyser is not ready (cleaning cycle or previous measurement cycle still in process, keyboard being used) the output contact is disabled.



### 2.3.2 Four channel multiplexing system

This option allows the analysis of up to four different water networks with the same analyser.

When a measurement cycle is started, all water channels are successively analysed. The water flowing time must be programmed on each channel. As soon as a channel is started on the analyser, the corresponding pump (or electric valve) is activated during the flowing time which has been previously programmed.



Four 4 – 20 mA outputs are available on the device. Each output is assigned to a water inlet. The four outputs are supplied continuously and maintained at the last measured value for each corresponding channel.

### 2.3.3 Nitrate Measurement

A UV absorption tuned on the wavelength of the nitrates is available as an option on this analyser. The measurement is expressed in mg/L  $\text{NO}_3^-$  or in mg/L of nitrogen. The measurement unit is made by the user himself on the keyboard of the analyser.

The measurement range is 0 to 250 mg/L  $\text{NO}_3^-$ .

The accuracy of all measurements is about +/- 2% of the measured value on clear water in the 0 - 100 mg/L  $\text{NO}_3^-$  range. The resolution is better than 0.1 mg/L  $\text{NO}_3^-$ . Between 100 and 250 mg/L  $\text{NO}_3^-$ , the accuracy of the measurement decreases down to +/- 10% at the end of the range.

#### **2.3.4 Colour measurement**

A UV absorption tuned on the wavelength of the potassium chloroplatinate in a cobalt chloride solution is available as an option on this analyser. The measurement is expressed in Pt-Co unit or Hazen unit. The measurement unit is made by the user himself on the keyboard of the analyser.

The measurement range is 0 to 1000 Pt-Co.

The accuracy of the optical density is about  $\pm 5\%$  of measured value on clear water.

Note: The presence of turbidity, even if compensated by the measurement system, affects the sensitivity of the analyser.

#### **2.3.5 pH measurement**

A pH probe can be connected to the CT200 analyser. In that case, the measurement benefits from assets of the CT200 that constitutes the storage of the measurement in the memory.

The temperature compensation is automatically made by the analyser.

#### **2.3.6 Conductivity measurement**

It is the same for the conductivity measurement in the range of 0 – 2000  $\mu\text{S}/\text{cm}$ .

## 2.4 Standard / Classeco (ECO) sum-up and comparison

✓	Included
■	Optional
✗	Not Available

	STANDARD VERSION	ECO VERSION
<i>Dimensions</i>		
<i>Weight :</i>	18 Kg	15 Kg
<i>Length: (mm)</i>	531	531
<i>Height: (mm)</i>	600	453
<i>Width: (mm)</i>	270	256
<i>Features:</i>		
Watertight IP66 Painted steel box	✓	✓
Automatic chemical Cleaning System	✓	✓
Datalogger Data compatible with standard worksheets, particularly Excel® to obtain graphs easily.	✓	■
Digital and graphic Display	✓	✓
Feet and Cleaning system Tank Holder	✓	■
Peristaltic sampling pump	■	■
Water presence detector	■	■

Additional Parameter (up to 4 parameters per analyser)	-	✗
Multiplexing System (Up to 4 channels)	-	✗
Remote measurement command	-	✗
High Temperature & High Pressure option (up to 100°C, 10 bar)	-	✗
<i>Power:</i>		
100-240V 50/60 Hz 60 W	✓	✓
Internal 12V battery	✓	-
External 12V / 24V Battery Powering mode	✓	✓
DC-DC Converter	-	-
<i>Outputs and Communication:</i>		
4-20 mA isolated output	✓	✓
High / Low Threshold Relay	✓	✓
Default Alarm Relay	✓	✓
RS232 output	✓	-
RS485 output	-	-

## **3 Recommendation for maintenance and routine checking**

### **3.1 Soft checking recommendation**

#### **3.1.1 Description**

Any automatic analysis system requires a minimum checking operation even if it is not necessary to adjust any parameter. The automatic operation ensures the daily and repetitive measurements and cleaning, but a human control still remains necessary.

The CT200 analyser has its own self checking facility which produces the fault relay switching in the case of a measurement problem.

The low level check-up of the analyser just consists in the control of correct measurement conditions:

- Visual control of feeding pipes dirtying, as well as measurement cell dirtying.
- Pumping Autoprene pipe replacement (external pump).
- Manual cleaning cycle in order to check that everything goes well.
- Manual measurement on a zero solution in order to detect any zero drift.
- Manual measurement on process water.
- Cleaning solution tank refilling.

#### **3.1.2 Periodicity**

Once every 1 month.

#### **3.1.3 Duration**

Less than 15 minutes.

#### **3.1.4 Operator**

Local operator.

### **3.2 Calibration checking**

#### **3.2.1 Description**

This operation is to be added to the previous one. It consists in a manual measurement of a known sample or on a standard solution. In the case of difference between the measurement and the expected value, a calibration cycle should be run.

#### **3.2.2 Periodicity**

Once every 6 months.

#### **3.2.3 Duration**

Less than 15 minutes.

#### **3.2.4 Operator**

Local operator.

### **3.3 Yearly preventive maintenance**

#### **3.3.1 Description**

This maintenance is not necessarily required but is strongly recommended. If the check-up operations described above are correctly made, the measurement performance of the analyser will be kept on long term. However, a dirtying of pipes and pumps can be observed. The replacement of these parts could be necessary depending on operation conditions.

From our experience, we observed that the analysers that are yearly controlled give better reliability than others.

#### **3.3.2 Periodicity (*facultative*)**

Once a year.

#### **3.3.3 Duration**

1 day (trip not included).

#### **3.3.4 Operator**

DTLI technician or DTLI representative.

## **4 Operational limits**

### **4.1 Electromagnetic compliance**

The CT200 design was improved and controlled in test bench. The electromagnetic compliance was fully checked in industrial environment. The EU standards are met.

In order to comply with the EU standards, the 4-20mA and relays wiring should be made using shielded cables. The shield should be connected to the housing of the analyser.

### **4.2 Temperature**

The analyser is designed for use on liquid water whose temperature is necessarily maintained in the 0.5 – 60°C range.

Freezing can destroy the measurement cell.

High temperature vapour circulation in the measurement cell can damage the sealing. In that case a DTLI or habilitated intervention would be necessary.

### **4.3 Interference**

Iron chloride and other chemical species that strongly absorb in the UV254 nm range can interfere for the measurement of COD in the 0 – 4000 µg/l range.