

TECHNICAL MANUAL Analysis of Cr⁶⁺ ions in water

Path through cell analyser CR200



CR200 analyser (standard version)

Summary

1	Technical description of the proposal	3
1.1	Detailed description of the analyser	3
1.2	Summarized characteristics: CR200 standard version	6
1.3	Summarized characteristics: CR200 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	10
3	Recommendation for maintenance and routine checking	12
3.1	Soft checking recommendation	12
3.2	Calibration checking.....	12
3.3	Yearly preventive maintenance	13
4	Operational limits.....	13
4.1	Electromagnetic compliance	13
4.2	Temperature.....	13
4.3	Interference.....	13

1 Technical description of the proposal

1.1 Detailed description of the analyser

1.1.1 Technology

The CR200 analyzer is a UV spectrometer tuned on the absorption band of Chromium 6. It performs a selective measurement taking into account the turbidity and the presence of some interfering species organic matter.

The UV light source is a long life time Xe 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.

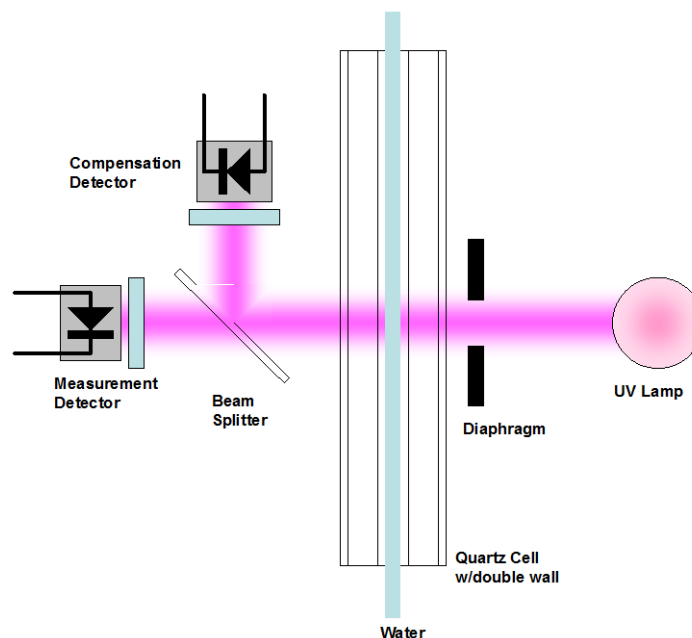
Any electronic disturbance likely to affect the result of the analysis is detected by the analyzer and sets a default off.

The measurement result is given in mg/l of Cr⁶⁺ ions.

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

The measurement results can be transmitted thanks to a 4 – 20 mA output that whose scale can be set by the user himself.

Measurement principle



1.1.2 Range and accuracy

1.1.2.1 Low range

The CR200 measurement range is 0 to 20 mg/l.

The accuracy is about +/-5% of measured value on clear water (turbidity < 3 NTU). The detection limit is better than 0.05 mg/l.

1.1.2.2 High range

The CR200 measurement range is 0 to 200 mg/l.

The accuracy is about +/-5% of measured value on clear water (turbidity < 10 NTU). The detection limit is better than 0.5 mg/l.

Notice : The organic matter, even if compensated, can interfere in the measurement. As an example, the detection of Cr⁶⁺ traces below 2 mg/l in rough urban sewage water is not possible.

1.1.3 Measurements

Measurement cycles can be continuously set or sequentially set depending on the operation mode.

In the sequential mode the CR200 may perform one measurement cycle every minute. The time interval between measurements can be set minute by minute up to 12 hours.

All automatic measurement results are stored in the memory of the analyser.

For each recorded data the following information is stored :

- date and time of measurement,
- measurement result.

1.1.4 Energy

The CR200 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).

1.1.5 Measurement transmission

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).

1.1.6 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.

A journal of events which can be read on the PC records the date and the time of all events (measurements excepted) occurring on the analyzer: cleaning cycle, error measurements, potential communications or messages of the operator using the RS232 link (standard version).

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).

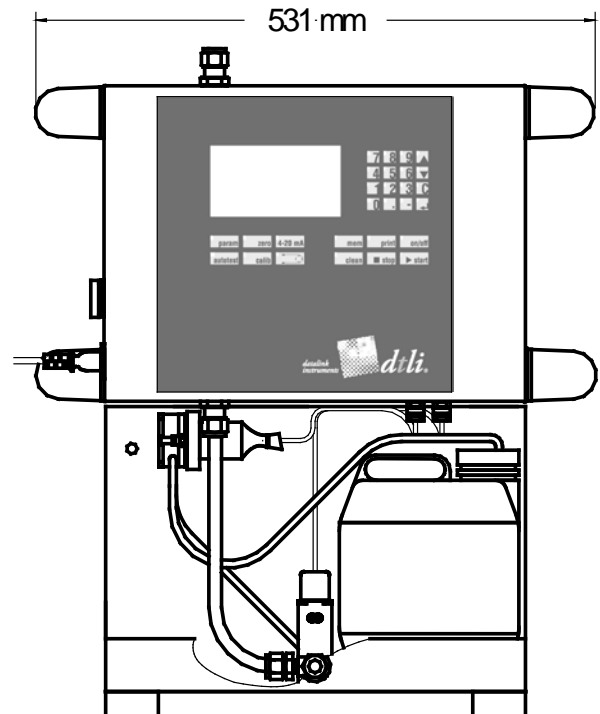
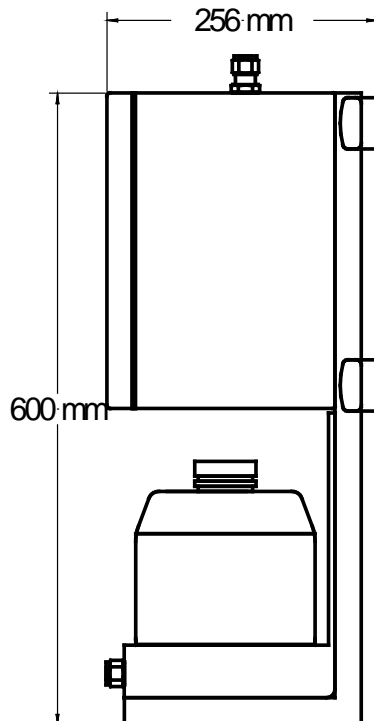
If the optional peristaltic sampling pump is used, the input fitting is a PE nut for smooth tube.

1.1.9 Consumables

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

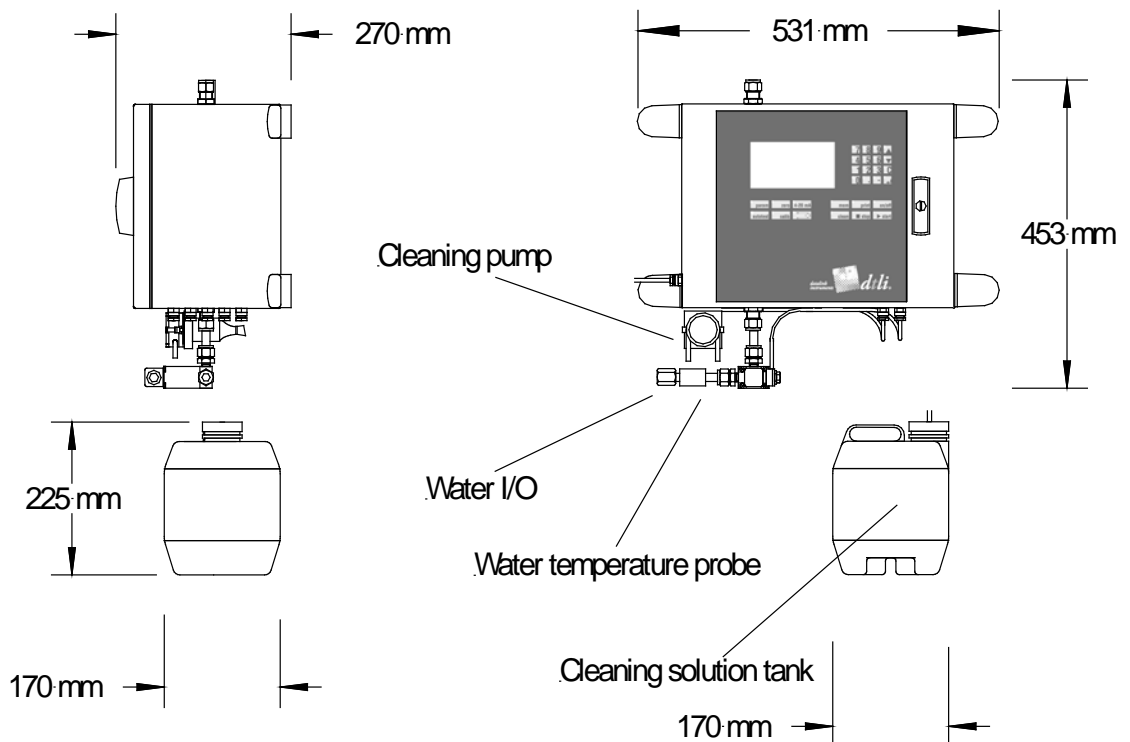
1.2 Summarized characteristics: CR200 standard version

Weight :	18 Kg
Range :	0 – 20 mg/l Cr6+ (Low range) 0 – 200 mg/l Cr6+ (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: CR200 ECO version

Weight :	15 Kg
Range :	0 – 20 mg/l Cr6+ (Low range) 0 – 200 mg/l Cr6+ (High range)
Energy :	100-240V 50/60 Hz 60 W + internal battery 12 V (Option)
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

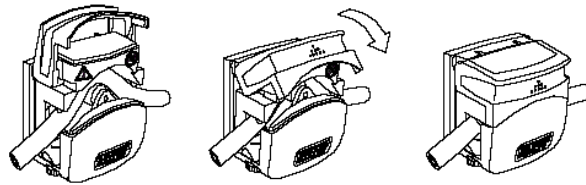


2 Possible options

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 analyzer and can be either manually or automatically operated, using the keyboard of the analyzer.



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 analyzer.

When the analyzer 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 autocalibration of the zero of the analyzer 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

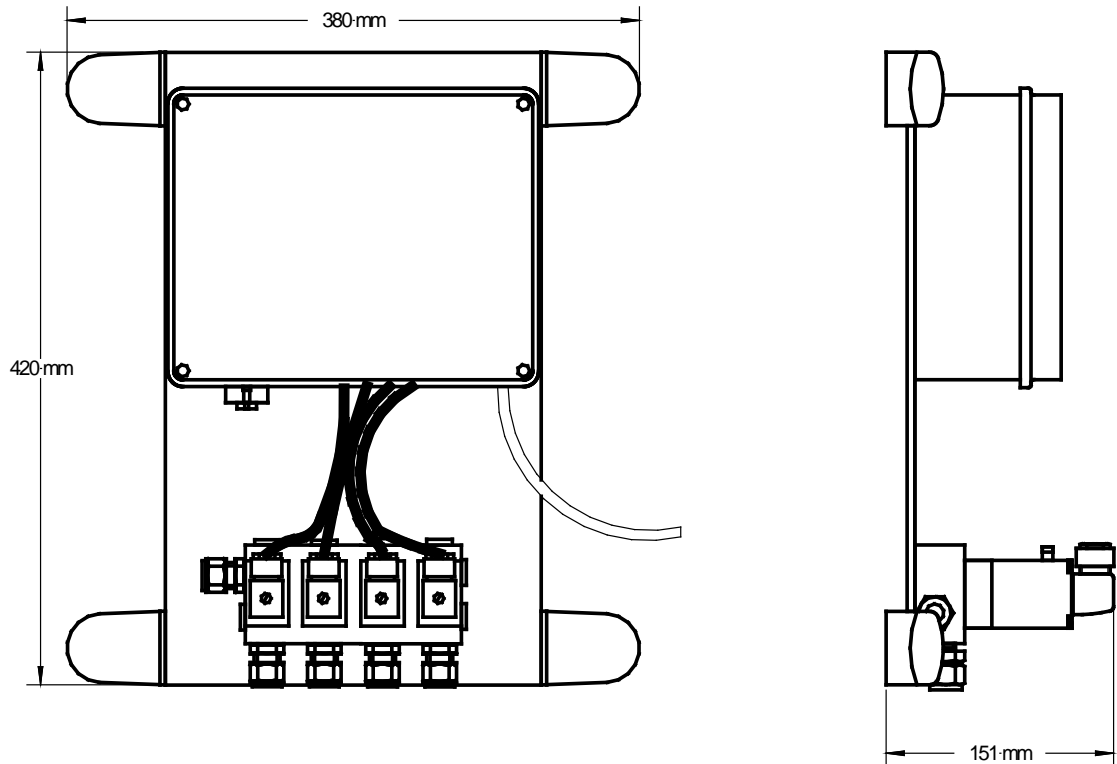
This option allows to start a measurement cycle by activating an analog input with a voltage pulse. This is useful when the analyser is integrated in a system monitored by a PLC.

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 analyzer.

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



2.3.3 pH measurement

A pH probe can be connected to the CR200 analyzer. In that case, the measurement benefits from assets of the CR200 that constitute the automatic cleaning (if the probe is placed on the channelling of exit) and of the storage of the measurement in the memory.

The temperature compensation is automatically made by the analyzer.

2.3.4 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 <i>Data compatible with standard worksheets, particularly Excel® to obtain graphs easily.</i>	✓	■
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 measurement system needs to be routinely checked even if no corrective action is operated. The automatic process ensures the repetitive operations, but an operator check-up as to be done from time to time.

The routine check-up can be summarized as follows:

- Visual control of flow cell
- Flow cell cleaning using the cleaning system
- Zero checking / adjustment on a zero solution
- Measurement cycle test on process water

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 done after the soft check-up. It consists in a measurement using a standard solution. In the case of a difference between the measured value and the standard, an automatic calibration cycle has to be done.

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 operation is recommended. If the previously described check-up are made the analysis performance of the probes will be maintained. However, a detailed cleaning process is sometime required, depending on water environment incidences. The preventive maintenance visit allows a detailed inspection of all optical and hydraulic parts.

From our experience, we observe that analysers which are preventively maintained show a better reliability over several years.

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 system proposed fully complies with EM standards in industrial field. The wirings should be performed with shielded cable and the shield should be connected to the transmitter carcass.

4.2 Temperature

The CR200 analyzer is designed to be operated with liquid water whose temperature must necessarily be kept between 1 and 60°C. Apart from this range of temperature, measurements will be less reliable.

Freezing conditions would lead to strong damage.

4.3 Interference

Organic matter in excess or phenol traces may lead to a measurement drift.