

TESTOMAT[®] 2000 Cr VI

Process Photometer for Chromate 0 - 2mg/l / Cr VI 0 - 1mg/l



Operating Instructions

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Introduction

These operating instructions describe the installation, operation and programming of the process photometer Testomat® 2000 Cr VI.

We recommend that, while familiarising yourself with the operation of the unit aided by these operating instructions, you have immediate access to the unit in order to perform the described functions and combinations. As certain functions are interrelated, it is advisable to follow the instructions in the given order.

Should problems or questions arise while operating the unit which are not described in these operating instructions and/or cannot be solved, our customer service is always at your disposal.

Try to identify the problem as accurately as possible and record the actions and conditions under which it occurred. This will enable us to offer you swift effective assistance.

Symbols and abbreviations used in these operating instructions:

-  Operator instructions "STANDBY" = STANDBY lamp is "ON"
-  Always observe / warning "M" = Press the menu key M ✓ Tip: Helpful hint
- SERVICE → MANUAL OPERATION → FLUSH = Sequence of the menu selection

Short description

The process photometer Testomat® 2000 Cr VI is a robust wet-chemical online monitor for monitoring the chromate (CrO_4) content from 0 to 2.0 mg/l or chromium VI (Cr VI) from 0 to 1.0 mg/l. The unit functions with a photometric analysis principle displayed by DIN 38405.

Analysis is carried out by adding three reagents, the analysis result is displayed after a reaction time of approx. 2 minutes (absolute measuring time without flushing times). Applications include, e.g., the monitoring and controlling of effluent-treatment plants of galvanic.

Two independently programmable limit value contacts are available for various monitoring and control tasks. The analysis result can be recorded using the optional printer board (interface SK910, Art. No. 270305) with a dotted or continuous line printer (0/4-20mA).

 **Trouble-free operation of the Testomat® 2000 CrVI units is only guaranteed when using the HEYL Testomat® 2000 reagents CrVI 2100 A and CrVI 2100 B !**

 Interferences:

The concentration of influencing contents can be safely and easily determined by using our colourimetric TESTOVAL® test kits.

Handling instructions

- **Repeated switching on/off:**
- Wait at least 5 seconds before switching the unit repeatedly either on or off at the main switch.
- **Observance of the ambient conditions:**
- In order to guarantee reliable operation, only operate the unit under the ambient conditions described in the technical data section. Always protect the unit against moisture and humidity. It should never come into contact with condensation or splash water.
- **Safety seal:**
- The original seals attached during manufacture (e.g. EPROM labels) must not be broken, otherwise all warranty rights are void.
- **Malfunctioning / Repairing a defective unit:**
- The repair of a defective unit – irrespective of the warranty period - is only possible when the unit is dismantled and returned to us with a description of the error. Please also inform us of the measured medium.
- Before you return the unit for repair work, remove the reagent bottles and ensure that the measuring chamber has been flushed out and is empty.
- **Electrical load capacity**
- The maximum electrical load capacity of the relay outputs and the total power rating should never be exceeded.
- **Only use the Testomat® 2000 Cr VI for its intended purpose.**
- **Environmental protection regulations**
- Please observe environmental protection regulations and collect any unused reagents and send them to us for safe disposal in accordance with local statutory requirements.

Operational reliability instructions

Careful handling of the unit increases both its operational reliability and service life!
Therefore, carry out a visual inspection at regular intervals as described below.

- Are the hose connections of the dosing pump free of leaks?
- Is there any air inside the dosing hoses?
- Are all the water connections free of leaks?
- Are the doors of the unit closed properly?
- Is the unit unduly soiled?

Always adhere to hazard warnings and safety tips when using reagents, chemicals and cleaning agents. Please adhere to the respective safety data sheet!

Download the safety data sheets for the supplied reagents at <http://www.heyl.de>.

Maintenance and servicing instructions

(see chapter entitled **Maintenance**)

Safety instructions

- The unit must be installed and operated in compliance with relevant standards (e.g. DIN, VDE, UVV) or in accordance with regulations laid down by the respective country.
- Some functions (e.g. diagnosis, manual operation) allow direct manipulation of the plant to be monitored without locking or monitoring. Only trained staff should use these functions, which can only be accessed after entering a password.
- If you notice that the device is malfunctioning, switch it off immediately. Subsequently shut off the water supply and contact our service staff.
- Do not try to repair the unit (loss of warranty rights); always contact authorised service staff. This is the only way to ensure reliable and safe operation of the plant.
- After a protective circuit (fuse) has been tripped, attempt to eliminate the cause of malfunctioning (e.g. replace a defective valve) before reactivating the protective circuit. Frequent tripping is always due to an error which, in certain circumstances, may also cause damage to the unit.
- Always observe the safety instructions about working with reagents, chemicals and cleaning agents.



Non-compliance with these instructions can damage the unit as well as the plant and may result in a loss of warranty rights.

Installation and commissioning

Only authorised technicians should carry out installation and commissioning!

Installation

Install the unit vertically!

Avoid twisting the housing!

The unit doors swing to the left when they are opened. Please ensure that there is sufficient space to open them. This facilitates electrical installation as well as future maintenance and service work.

Electrical connection



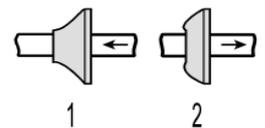
Please observe the supply voltage specified on the rating plate!

Basic requirements

External cables (e.g. water meter, interface) should be kept as short as possible and clear of power cables.

Connection

Loosen both fastening screws and open the upper door. Pierce the required rubber cable glands with a screwdriver and insert the cable (1). Subsequently pull back the cable until the bush (2) has been turned over. Ensure that the leads are held securely in the terminals, then close the upper door once installation has been completed using the two fastening screws.



Mains water supply



The temperature of the sample water should be between 10 °C and 40 °C. Higher water temperatures can damage the parts which come into contact with the water (e.g. filter housing, measuring chamber)! Lower water temperatures can cause mist to form on the sight-glass windows.



For temperatures above 40 °C the KCN type cooler should be installed in the branch line of the Testomat® 2000 Cr VI.



Hot water can scald you!

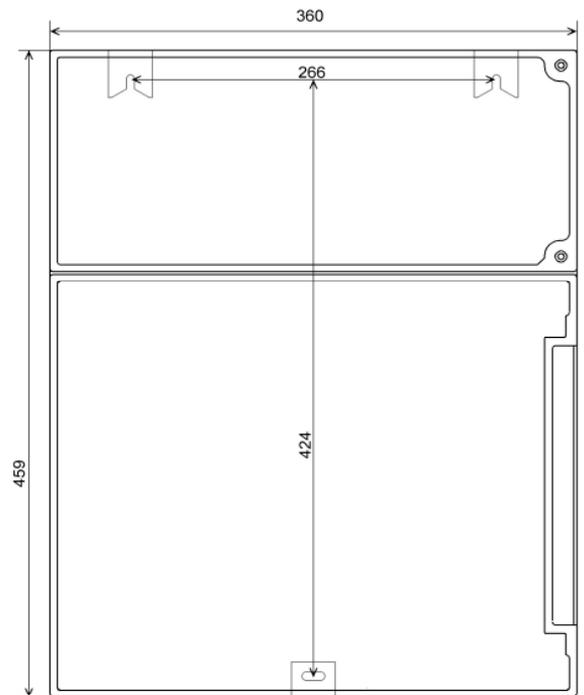
The sampling line to the Testomat® 2000 Cr VI should be equipped with a manually operated shut-off valve and kept as short as possible (the max. length of 5 metres should not be exceeded). It is important that the branch line connection is taken vertically from the top of the main water line in order to prevent dirt particles from entering the unit. When operating the Testomat® 2000 Cr VI within the **pressure range of 0.1 to 1 bar** or when it is supplied via a **feed pump**, please remove the valve body from the controller/filter housing. The feed pump should have a feeding capacity of between 25 and 35 litres/hour and be resistant to the medium being measured.

Plug connector

The unit is equipped with a plug connector for opaque plastic hoses 6/4 x 1 (external diameter 6 mm/ internal diameter 4 mm) as standard.

Quick-release coupling (accessory: Adapter for water inlet, Art. no. 40123)

If fabric-reinforced pressure hoses (e.g. for existing installations) are used, please replace the plug connector at the controller and filter housing with a plug for the quick-release coupling (not included).



Maßbild
Dimensioned sketch
(mm)

Water outlet

The feed water flows through the measuring chamber to the drain via the outlet pipe (hose connection internal diameter 14 mm). Make sure, e.g. by using an open funnel, that the water drains off freely and backwater to the measuring chamber does not develop. An opaque hose should also be used for the drain pipe (to prevent algae formation).

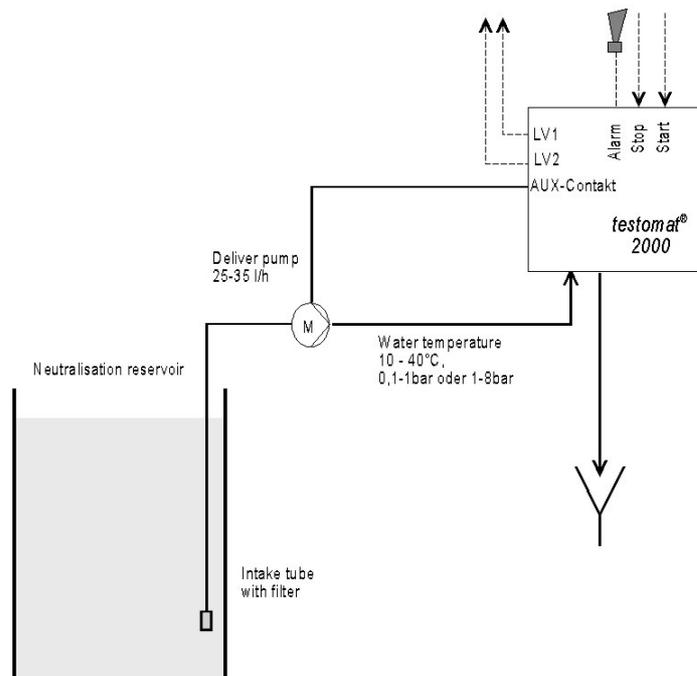
Commissioning

1. Always connect full reagent bottles prior to commissioning and switching on. Use the union nut to attach the vacuum connection to the reagent. Observe correct allocation of the reagents A and B to the dosing pumps: **A = left, B = right**.
2. Switch the unit 'on' and press the "STANDBY" key. This prevents an analysis from being carried out without correct programming and thus an error or alarm message.
3. Subsequently bleed the dosing pumps and pipes by pressing the "Manual" key on the dosing pump. Ensure that there is no air in the pipes! (If necessary, retighten the connections.)
4. Program the unit according to your requirements, e.g.:

- Operating mode	- Display unit
- Limit values	- Flush times / interval

Refer to **program menu "M"** for a description of programming.
5. Enter the correct fill levels of the reagent bottles.
"M" → SERVICE I → INPUT REAGENTS → REAGENT A FILLING (100%)
"M" → SERVICE I → INPUT REAGENTS → REAGENT B FILLING (100%)
6. Subsequently bleed the unit's water supply via manual flushing.
"M" → SERVICE → MANUAL OPERATION → FLUSH (press "ENTER" repeatedly).
7. Flush until there are no bubbles visible in the measuring chamber.
8. Check all connections for tightness.
9. Carry out the first analysis by pressing the "Manual" key.

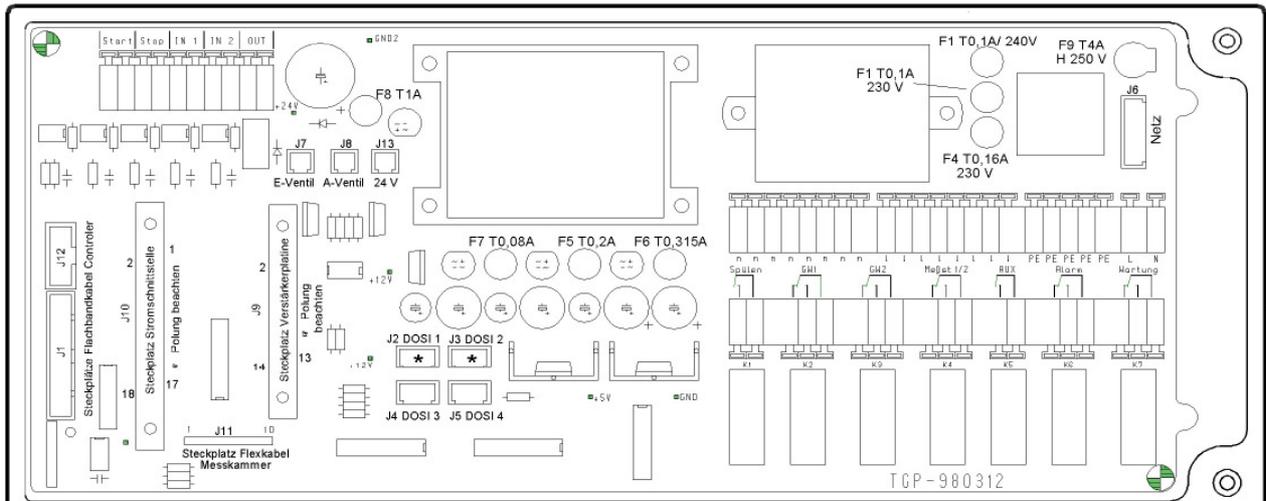
Installation diagram (example):



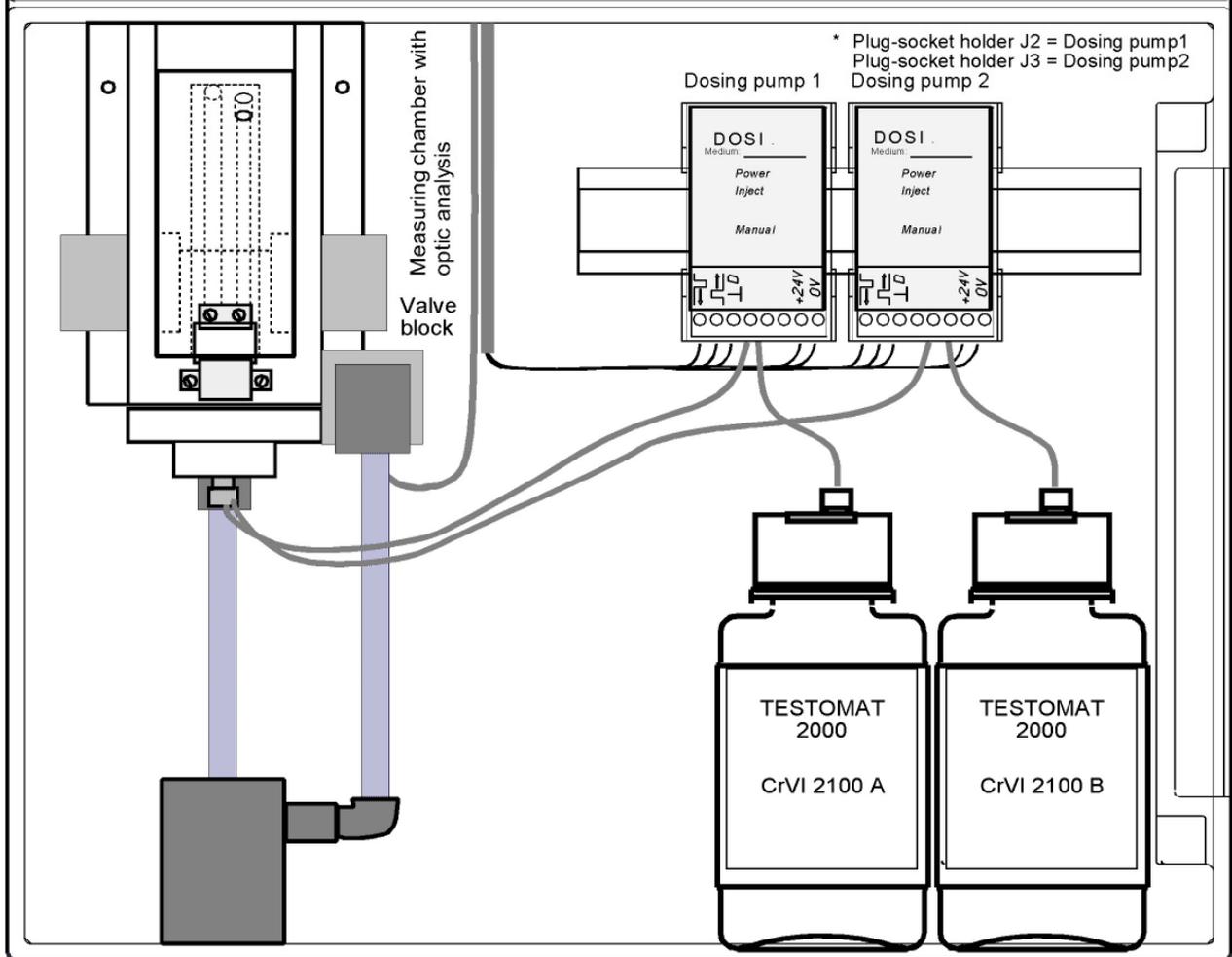
General description

Internal construction

Terminal block for inputs
Start, Stop, IN1, IN2 and output OUT



Power switch
Terminal block for mains
connection and relay outputs



Mains water supply:
Inlet with primary filter and pressure regulator,
outlet

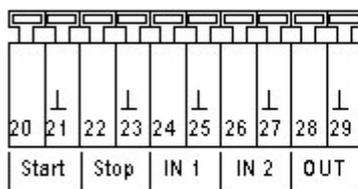
Description of the electrical connections

Terminal block identification

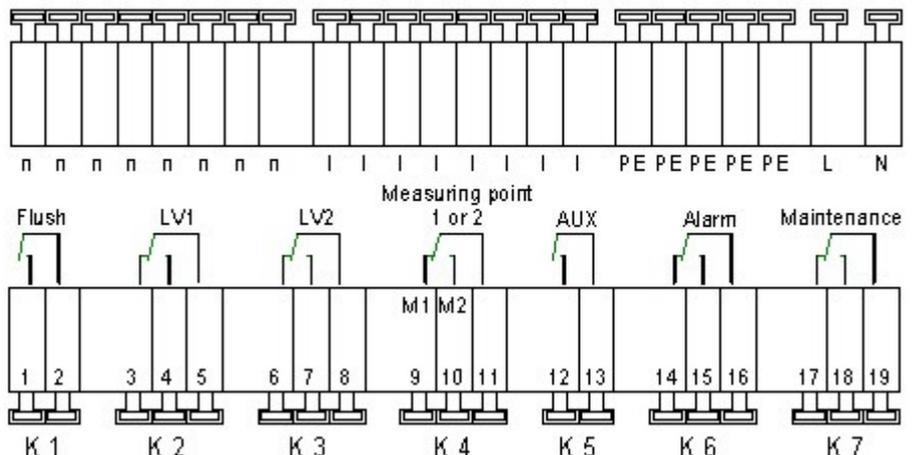
IN = input, OUT = output

No.	Terminal	Type	Function	Comment
-	PE	IN	Mains – Protective earth (5 x)	
-	N	IN	Mains, N = Neutral	Mains input
-	L	IN	Mains, L = Live	230 - 240 V AC
-	n	OUT	Neutral, switched (8 x)	Mains voltage, max. 4 A
-	l	OUT	Live, switched (8 x)	
1 2	Flush	OUT	External flush valve	Volt-free relay output max. load 240 V AC, 4 A
3 4 5	LV1	OUT	Limit value output 1 – Normally closed Limit value output 1 – Normally open Limit value output 1 – Common	Volt-free relay output max. load 240 V AC, 4 A
6 7 8	LV2	OUT	Limit value output 2 – Normally closed Limit value output 2 – Normally open Limit value output 2 – Common	Volt-free relay output max. load 240 V AC, 4 A
9 10 11	Measuring points 1/2	OUT	Measuring point 1 – Normally closed Measuring point 1 – Normally open Measuring point switch-over - Common	Volt-free relay output max. load 240 V AC, 4 A
12 13	AUX	OUT	Universal output	Volt-free relay output max. load 240 V AC, 4 A
14 15 16	Alarm	OUT	Fault message output – Normally closed Fault message output – Normally open Fault message output – Common	Volt-free relay output max. load 240 V AC, 4 A
17 18 19	Maintenance	OUT	Maintenance message – Normally closed Maintenance message – Normally open Maintenance message – Common	Volt-free relay output max. load 240 V AC, 4 A
20 21	Start ⊥	IN	External analysis start Common earth for inputs	Only for volt-free normally open contact!
22 23	Stop ⊥	IN	External analysis stop Common earth for inputs	Only for volt-free normally open/normally closed contact!
24 25	IN1 ⊥	IN	External measuring point switch-over Common earth for inputs	Only for volt-free normally open/normally closed contact!
26 27	IN2 ⊥	IN	Universal input 2 (water meter) Common earth for inputs	Only for volt-free normally open contact!
28 29	OUT ⊥	OUT	0/4 - 20 mA or serial interface	Non floating output! 28 = 0/4 - 20 mA, 29 = ⊥

Terminal block for inputs
Start, Stop, IN1, IN2 and output OUT



Terminal block for mains connection and relay outputs



Description of display and operating features

(1) ON/OFF switch

The ON/OFF switch is located on the right-hand side panel of the unit. Use this switch to switch the unit on or off.

(2) Unit fuse (inside the unit)

The fuse protects the outputs against overloads and short circuits.

3 Limit value status displays

Displays the status of the limit values LV1 (1) and LV2 (2).

4 Text display

Displays the current analysis result as well as all important status results and programming data via a 4-line LCD.

5 Alarm

Indicates malfunctioning.

6 Maintenance message

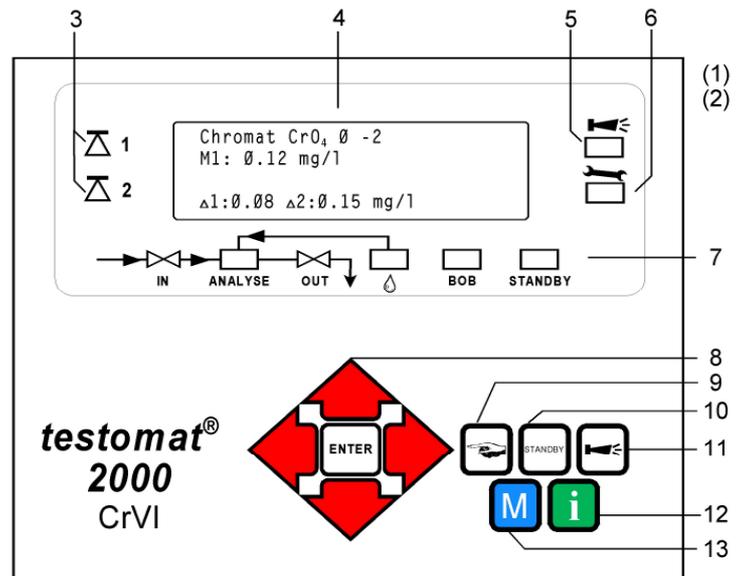
Displays a maintenance request.

7 Status display

Six LEDs signal the current status (analysis and unit status) of the Testomat® 2000 Cr VI.

8 Programming keys (cursor block with ENTER)

Use these keys to enter all the values and programming data.



Function keys:

- 9 "Manual" = manual start of an analysis
- 10 STANDBY = manual analysis stop/standby
- 11 "Alarm" = confirms an alarm message

12 i-key

Call-up all unit information (also see **i menu**).

13 M-key

Call-up the programming menu for user and unit-specific settings (also see **M menu**).

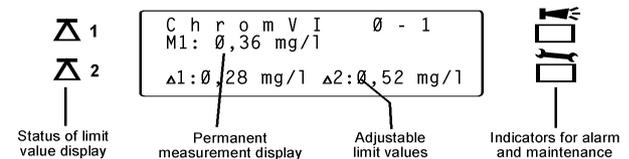
Display functions

Limit value status displays 1 and 2

The displays signal the status of the limit values.

1: The display is red if limit value 1 has been reached or exceeded. The display is green if the measured value has fallen below the set limit value.

2: The display is red if limit value 2 has been reached or exceeded. The display is green if the measured value has fallen below the set limit value.



Measured value display

The current measured value for measuring point 1 (M1:) and 2 (M2:) are displayed in lines 2 and 3, e.g. M1: 0.16 mg/l. If the measured value has exceeded the measuring range, ">" is displayed: e.g. M1: > 2.0 mg/l

Limit value displays

The set limit values are displayed in the bottom display line.

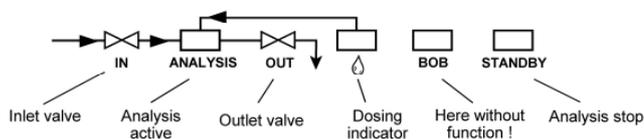
Alarm and maintenance message

Display of present error messages (red) and maintenance requests (yellow).

Error messages are displayed alternately with the normal display and can only be deleted via confirmation and elimination of the fault.

Status displays

The displays signal active unit components.



Description of the relay outputs

Flush external flush valve:

If a long sampling line is unavoidable for installation, we recommend the installation of a flush valve upstream of the unit.

If the unit is used for monitoring two measuring points, also install an external flush valve to prevent incorrect measurements caused by sample mixing.

Immediately before each analysis the external flush valve is opened for the programmed period allowing the line up to the Testomat® 2000 Cr VI to fill with measuring water. Please ensure that the programmed flush time is sufficient.

Set the flush time under menu item

"M" → BASIC PROGRAM → PROGRAM VALUES → FLUSH TIMES/INTERVAL → EXTERNAL FLUSH TIME

LV1 and LV2 limit value outputs

Two volt-free relay contacts are available to signal that a limit value has been exceeded. The limit values, the hysteresis and the function can be freely programmed for both contacts.

Function	Type of contact	Action
LV1 - active when limit value 1 or measuring point 1 have been exceeded	volt-free change-over contact	programmable: Continuous contact Impulse (1 - 99 seconds/minutes) Interval (1 - 99 seconds/minutes) Two-step controller (only for one measuring point) Hysteresis (1, 2 or 3 limit values exceeded)
LV2 - active when limit value 2 or measuring point 2 have been exceeded	volt-free change-over contact	programmable: Continuous contact Impulse (1 - 99 seconds/minutes) Interval (1 - 99 seconds/minutes) Hysteresis (1, 2 or 3 limit values exceeded)

Menu values:

"M" → BASIC PROGRAM → PROGRAM VALUES → LIMIT VALUES

"M" → BASIC PROGRAM → PROGRAM VALUES → FUNCTION LV1

"M" → BASIC PROGRAM → PROGRAM VALUES → FUNCTION LV2

"M" → BASIC PROGRAM → PROGRAM VALUES → HYSTERISIS LV1

"M" → BASIC PROGRAM → PROGRAM VALUES → HYSTERISIS LV2

Measuring points 1 or 2 Measuring points switch-over

If the unit is used for monitoring two measuring points, the solenoid valves (individual valves or one 3/2-way control valve) of the corresponding sampling line have to be connected to this input. The switch-over can occur automatically:

The analyses are carried out alternately from measuring point 1 or 2.

Or via an external request: **Input IN1 active = analysis of measuring point 2**

The terminals are strictly allocated to the measuring points.

Terminal 9 = Measuring point 1

Terminal 10 = Measuring point 2

"M" → BASIC PROGRAM → PROGRAM VALUES → MEASURING POINTS 1/2

AUX programmable function output

The functioning of this volt-free relay output is programmable:

1. For contact prior to an analysis, e.g. to switch on a cooler

"M" → BASIC PROGRAM → PROGRAM VALUES → FUNCTION AUX → CONTACT PRIOR TO ANALYSIS
and/or

2. For reporting a current analysis

"M" → BASIC PROGRAM → PROGRAM VALUES → FUNCTION AUX → CONTACT FOR ANALYSIS
or

3. For contact when the input valve is open

"M" → BASIC PROGRAM → PROGRAM VALUES → FUNCTION AUX → CONTACT SUCTION

Alarm fault message output

The "Alarm" output is a volt-free change-over relay contact. During trouble-free operation the contact between the terminals 15 – 16 is closed and the one between terminals 14– 16 is open. In case of a voltage breakdown, the contact between the terminals 14 – 16 is closed and the one between terminals 15– 16 is open.

The unit is equipped with a range of monitoring functions. You can define the individual statuses as a fault and program the corresponding message either as a continuous contact (A) or as a message impulse (M).

- With a continuous contact, the "Alarm" output remains activated (terminals 15 – 16 closed) as long as the fault persists.
- With a message impulse, the output is switched 'on' for 2 seconds and then switched 'off' for 5 seconds.
- If several faults with differently programmed messages are signalled simultaneously, the output is switched to continuous contact.
- The red LED "Alarm (5)" and the text on the display indicate a fault.
- The fault message signal at the "Alarm" output is deleted by confirming the fault via the "Horn" key.
- The error message can only be deleted if the fault has been eliminated.
- **Exception:** The maintenance date has been exceeded. This message is confirmed in the M menu, see below (maintenance).
- Each new fault is entered into the error history (also see i menu, page 16).

The following faults activate the "Alarm" output and are displayed:

The following statuses **always** trigger a fault message:

Power failure
Low water level
Function fault optics
Function fault dosing pump
Function fault drain outlet
Function fault failure 24V

Statuses which can be **programmed** as a fault:

Low reagent level
Measuring fault soiling
Measuring fault turbidity
Transfer error
Measuring range exceeded
Maintenance interval exceeded

Descriptions of the error messages can be found under "Error messages / Troubleshooting"

Maintenance maintenance message

The "Maintenance" output is a volt-free change-over relay contact. During trouble-free operation without a programmed maintenance interval the contact between the terminals 17 – 19 is closed and the one between terminals 18– 19 is open.

The unit is equipped with a range of monitoring functions and a programmable maintenance interval. The respective maintenance message is always a continuous contact.

A maintenance request is displayed via the yellow "Maintenance" LED.

The maintenance display can only be deleted once the status has been corrected or after the maintenance request has been confirmed.

"M" → SERVICE → CONFIRM MAINTENANCE

The following statuses activate the "Maintenance" output:

Low reagent level
Measuring chamber soiled (Measuring fault soiling)
Maintenance date reached

Further program and maintenance descriptions can be found under "Program menu 'M'" and "Maintenance" respectively.

Description of the signal inputs and outputs

 Only connect the signal inputs "Start", "Stop", "IN1" and "IN2" with **volt-free contacts!**

Start external analysis start

Stop external analysis stop

Function	Type of contact	Test time	Action
Start external analysis start (e.g. from the process controller)	normally open volt-free!	none	In EXTERNAL operating mode an analysis is started by triggering a contact at the input
Stop external analysis stop (e.g. via flow controller or process controller)	programmable normally closed/ normally open volt-free!	none	As long as the contact at the input is 'open' or 'closed', no analyses are carried out.

"M" → BASIC PROGRAM → PROGRAM VALUES → INPUT STOP

IN1 and **IN2** universal inputs

Function	Type of contact	Test time	Action
IN1 external measuring point switch-over (2 measuring points externally programmed)	programmable normally closed/ normally open volt-free!	none	As long as the contact at the input is 'open' or 'closed', analyses are carried out from measuring point 2.
IN2 Water meter input	normally open volt-free!	none	Quantity recording for starting an analysis

"M" → BASIC PROGRAM → PROGRAM VALUES → INPUT IN1

OUT interface output (optional)

Function	Connection	Test time	Action
Programmable interface 0 - 20 mA 4 - 20 mA	max. load 500 Ohms	-	programmable Measured value measuring point 1 or 2
Serial interface RS 232	serial bus (2-wire cable)	-	See description of the interface card RS910

Change the function of the output by exchanging the plug-in circuit board.

"M" → BASIC PROGRAM → PROGRAM VALUES → INTERFACES

Function characteristics

MODE OF OPERATION	▲▼ ME
TIME-CONTROLLED	*
Volume interval	
External (Start)	

Operating modes (analysis controller)

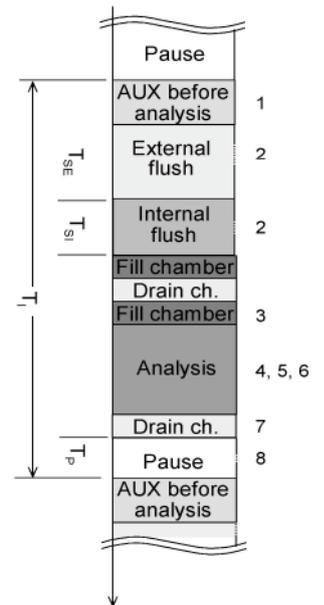
- Time control:** Internal triggering via a timer. Shortest interval = 0 minutes between analyses, longest interval = 99 minutes.
(Also see "Function characteristics / Time setting")

☞ The analysis interval is determined by the duration of the supplementary program AUX, the set flush times (internal and external), the programmed interval and the duration of the analysis. The analysis duration depends **directly** on the measured value.

- Quantity control:** Triggered by the water meter.
Minimum interval = 1 litre, maximum interval = 9999 litres.
The analysis is carried out once the programmed water quantity has been measured. The line and the measuring chamber are flushed prior to the analysis (observe the programmed flush times).

- External analysis start** by triggering a contact at the **start** input

☞ The current analysis interval can be interrupted by triggering a contact at the **stop** input.



Analysis cycle (example with schematic cycle diagram)

- Supplementary program AUX prior to analysis
- Flush the line and measuring chamber (observe the flush time of the sampling line), T_{SE} und T_{SI}
- Fill measuring chamber
Dose the reagents: 8 x reagent A and 8 x reagent B
Subsequent 2-minute reaction time
- Evaluate and display reaction
- Drain the measuring chamber
- Waiting period until the next analysis (time or quantity analysis interval), T_p
 T_I = total analysis interval

Display unit

It is possible to program the unit of the displayed value. mg/l as well as ppm can be selected. All the following inputs and displays will be displayed in the programmed unit.

DISPLAYED UNIT	▲▼ ME
DISPLAY in mg/l	*
Display in ppm	

Measuring points

The Testomat 2000 Cr VI can be used for monitoring 2 measuring points. Measuring point switch-over can occur either automatically or by triggering a contact (or normally closed) at input IN2. If the external measuring point switch-over has been programmed ("2 MEASURING POINTS EXTERNAL"), a respective controller (e.g. timer) has to be connected to IN1 (voltage-free contact required!). The active status of IN1 has to be programmed accordingly.

MEASURING POINTS	▲▼ ME
1 MEASURING POINT	*
2 Measuring points	
2 Measuring points ext.	

Parameter

With the Testomat[®] 2000 Cr VI it is possible to measure **chromate CrO₄** or **chromium Cr VI**. Select the parameter to be displayed ("m" menu). The measuring ranges 0-2mg/l and 0-1mg/l are available for displaying chromate and chromium Cr VI respectively.

PARAMETER	▲▼ ME
CHROMAT CrO ₄	*
Chrom Cr VI	

Time setting

Internal flushing

To ensure that the analysed sample represents the current value, the sampling line must be sufficiently flushed. If the plant has been out of operation for a longer period or in the case of long analysis intervals, we recommend you to select a flushing time greater than 60 seconds. Flushing starts by simultaneously opening the inlet and the outlet valve of the Testomat® 2000 Cr VI.

Example: For connections longer than 3 m and with an internal hose diameter of 6 mm a minimum internal flushing time of 10 seconds is required to ensure that a valid sample is taken from the sampling line. The required quantity of flush water for 1-minute internal flushing is 0.5 litres.

 The analysis interval depends directly on the programmed flushing time. If, e.g., a flushing time of 60 seconds has been set, the actual analysis interval cannot be less than 60 seconds.

External flushing

If very short analysis intervals are required, or if a very long (several metres) sampling line or a line with a large diameter are used, an external flush valve should be installed upstream of the Testomat® 2000 Cr VI. The external flush valve has to be connected to the "Flush" outlet. The external flushing time for the valve depends, just as the flushing time for unit flushing does, on the length and diameter of the supply line to the Testomat® 2000 Cr VI.

Interval pause

If the analysis is triggered via a timer, the interval between two analyses (plus flushing time) is determined by the interval pause. The shortest interval can be 0 minutes. In this case, analyses are carried out continuously. The longest interval is 99 minutes.

Limit value monitoring

It is possible to program the limit values on a continuous scale. The limit value range depends on the used reagent type and the programmed unit.

LIMIT VALUES		▲▼ M E
LIMIT VAL. 1:		0.20 mg/l
Limit val. 2:		0.50 mg/l

Example:

	Number of measuring points			
	1		2	
Function LV1	1, 2 or 3 exceeds upper limit value	upper LV	Measuring point 1	1., 2. or 3 exceeds upper limit value
Function LV2	1., 2. or 3 exceeds upper limit value	lower LV	Measuring point 2	1., 2. or 3 exceeds upper limit value

Two limit value outputs are available for monitoring. The functions of these outputs can be programmed independently of each other.

Two limit values:

 1 LV1 = Limit value 1

 2 LV2 = Limit value 2

If the unit is used for monitoring two limit values, the limit value outputs are permanently allocated to these limit values!

Two measuring points:

 1 LV1 = Measuring point 1

 2 LV2 = Measuring point 2

If the unit is used for monitoring two measuring points, the limit value outputs are permanently allocated to these measuring points!

If the limit value **LV1** has been exceeded, the limit value control display **LV1** lights up **RED** and the relay output **LV1** reacts as programmed in the switch function. If this limit value has not been exceeded, the display lights up **GREEN**. The same applies for the limit value **LV2**.

Hysteresis

HYSTERESIS LV1 ▲▼ M E	
Analysis (1,2,3)	1

The respective limit value output only switches after the 1st, 2nd or 3rd limit value has been exceeded (suppression of the first or the second measured value).

This increases the reliability of the analysis evaluation, e.g. after the measuring point has been switched over or if the sampling line has not been flushed sufficiently. The hystereses of the two outputs LV1 and LV2 can be set independently of each other.

Function: A further analysis is carried out immediately after the limit value has been exceeded for a hysteresis of 2.

The respective output only reacts if the limit value of this analysis is exceeded again. If a hysteresis of 3 has been set, the respective output only reacts after the limit value has been exceeded for the 3rd time in succession.

(The basic setting for LV1 and LV2 is 1)

Logic functions of the limit value outputs LV1 and LV2

Schematic representation of the logic functions

Switch function 0, *duration*

If the limit value LV1 or LV2 has been exceeded, the output relay LV1 or LV2 reacts. If the measured value falls below the limit value LV1 or LV2 without lock out, the relevant relay drops out again.

Switch function 1, *impulse*

If the measured value exceeds the limit value LV1 or LV2, the relevant output reacts for a settable time t .

The respective output **always** remains switched for the **set** time, irrespective of how long the limit value has been exceeded.

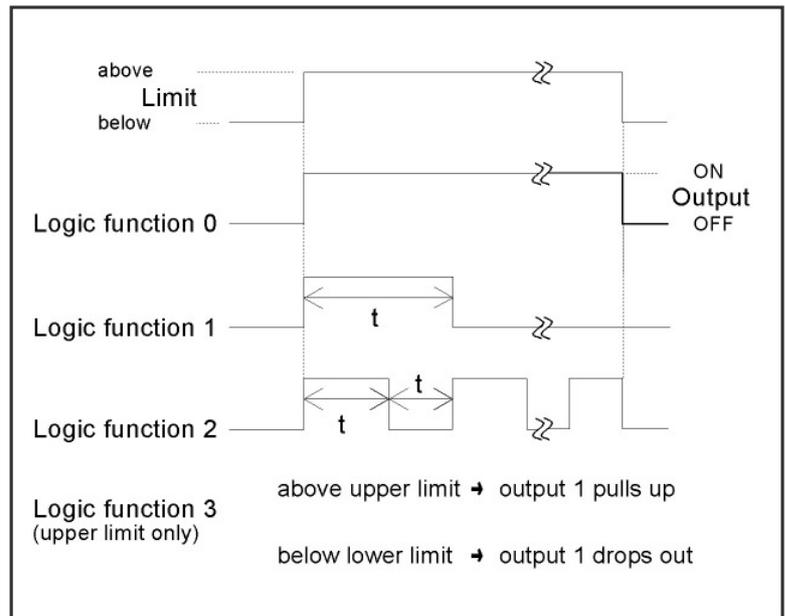
Switch function 2, *interval*

If the limit value has been exceeded, the respective output switches at intervals with the settable impulse/pause time t .

Switch function 3, *two-point*

If the upper limit value LV1 has been exceeded, the output relay LV1 switches. If the lower limit value LV2 falls below the set limit, the output relay LV1 drops out again.

The output relay LV2 switches according to the programmed switch function.



☞ This function is only possible if different values are used for the limit values LV1 and LV2 with just **one** measuring point. For example, LV1 = 0.2 mg/l and LV2 = 0.3 mg/l.

Function IN1

External measuring point switch-over when monitoring 2 measuring points without automatic measuring point switch-over. If the external measuring point switch-over has been programmed, a respective controller (e.g. timer) has to be connected to IN1 (voltage-free contact required!). The active status of IN1 has to be programmed accordingly.

Water meter

It is necessary to connect a water meter to input IN2 for quantity-dependent analysis triggering. Program the corresponding water meter rating under the menu item "WATER METER".

WATER METER ▲▼	
1 LITRE/IMPULSE	
2,5 Litres/Impulse	
5 Litres/Impulse	
10 Litres/Impulse	
100 Litres/Impulse	
500 Litres/Impulse	
1000 Litres/Impulse	

Alarm / Message

The unit is equipped with an alarm relay output for signalling faults. The events which mean a fault at the unit or are intended to trigger a message, can either trigger an alarm (continuous contact) or a message (2-second impulse).

Certain unit faults always trigger an alarm or a message!

The faults are recorded and stored in the error history if the event has been programmed as an alarm or message. For example, if a low reagent level has not been programmed as an ALARM or a MESSAGE, it is not registered in the error history. Up to 20 error messages can be stored. A list of these errors can be opened in the information menu. The information stored per event is the time (day, month, year and hour) and the type of the error.

 The error messages are lost after a power failure.

ALARM/MESSAGE		▲▼ M E
REAGENT LOW LEVEL	A	A/M/-
Low water pressure	A	A/M
Mf. turbid	M	A/M/-
Ff. optics	A	A/M
Ff. dosing pump	A	A/M
Ff. outlet to drain	A	A/M
Mf. dirtiness	M	A/M/-
power failure 24 V	A	A/M
Meas. range exceeded	M	A/M/-
Plant control	M	A/M/-
Transfer error	M	A/M/-
Maint. int. exceeded	M	A/M/-

A = Alarm / M = Message / - = no action
Ff. = Function fault
Mf. = Measuring fault

Function AUX

The AUX relay output can be programmed for the following control functions:

- As a function output for the contact with programmable duration prior to or during the analysis or during the open period of the inlet valve.
(Also see Function characteristics, Operating modes, Analysis cycle)

FUNCTION AUX		▲▼
CONTACT BEFORE ANALYSIS	*	
Contact during analysis		
Contact "suction"		
Time:	00m:10s	

This contact can be used, e.g., to control a feed pump for sampling. It is also possible to control the cooling water inlet of an upstream cooler via a solenoid valve. This way the cooling water only flows when required, i.e. when an analysis is being carried out.

Service II

The service II menu contains various functions for monitoring the operation of the unit.

 The functions in the service II menu directly influence the operation and monitoring functions of the unit!

SERVICE II		▲▼ M
CALIBRATION		
Reset operating time		
Maintenance interval		

Calibration

Calibration can, e.g., be carried out to compensate for negative influences caused by foreign ions. A standard solution or the value of the sample water determined via a laboratory analysis is required for this.

CALIBRATION		▲▼
CALIBRATION VALUE	0.35mg/l	
Calibration	start	
Cal. factor	1.0	

Calibration value: Enter the known value of the standard solution or the determined value of the sample water.

Start calibration: Select menu item "Calibrate Start" and press the "ENTER" key: A reference measurement is carried out and the correction factor is determined. The calibration procedure with a standard solution can be found under "Maintenance / Monitoring/Calibration with standard".

Correction factor: It is also possible to enter a calculatively determined factor for the correction of the display. The current factor is displayed after calibration.

Reset operating time

After replacing the dosing pump or the measuring chamber holder, it is possible to reset the current operating time to 0 hours.

"M" → BASIC PROGRAM → SERVICE II → RESET OPERATING TIME

The current operating time can be requested in the information menu:

"i" → INFORMATION → OPERATING VALUES

OPERATING TIME		▲▼
	000023h	
	Reset	

Maintenance interval

Observance of the maintenance intervals is monitored and displayed by the Testomat® 2000 Cr VI. Program the desired maintenance interval in days here. (0 days equals no maintenance interval.)

MAINTENANCE INTERV.		▲▼ M E
	001d	

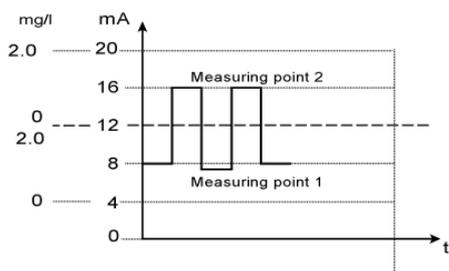
Interfaces (optional)

INTERFACES		▲▼ME
Type 0-20 mA		
Type 4-20 mA		*
Type RS232		

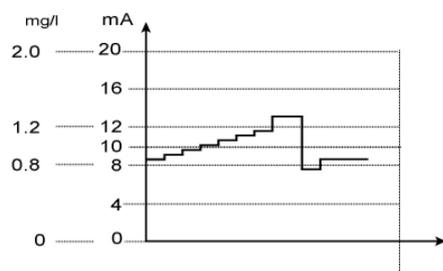
Current interface 0/4-20 mA

Another possibility for monitoring the analysis is the connection of a recorder. The unit is equipped with a programmable current output for this purpose. Standard values of 0 - 20 mA or 4 - 20 mA can be selected.

Example 2 measuring points, Interface 4 -20 mA



Example 1 measuring point, Interface 0 -20 mA

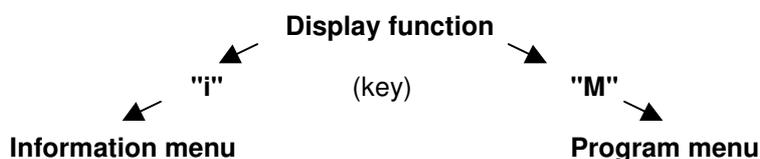


☞ The maximum load of 500 Ohms should not be exceeded!
For faults and when using very long cables (approx. 20 m) a screened cable should be used if possible.

Serial interface RS232

The Testomat[®] 2000 CrVI can also be connected to a log printer via the serial interface RS232 to enable the printout of measuring results and error messages. Analyses can then be continuously logged. This option is only possible in connection with the plug-in card RS910 (Art. no. 270310).

Menu structure



Selection and input

Menu start

Use either the "M" or "i" key to open one of the menus.

Selection

The current line position is displayed in CAPITAL LETTERS. Use the "ENTER" key to activate a line, i.e. a submenu is opened. Use arrow key "" to display the next parameter below the lowest display line. You can "scroll" the menu.

Input (only possible in the "M" menu)

Select a programming step via the arrow keys "" and "" and activate the input function by pressing the "ENTER" key. The first digit to be changed flashes when entering digits.

Use the arrow keys "▼" and "▲" to change the value.

Use the arrow keys "▶" and "◀" to confirm the input and simultaneously change to the next or previous digit (now flashing).

Exit the input function via the "ENTER" key.

The following line is activated.

Use the "M" key to go to the superordinate menu.

Menu end

Use the "M" or "i" key to return to the superordinate menu. After returning from the highest menu level, the unit is in display mode again.

Information menu "i"

Structure of the "i" menu

In the information menu it is possible to request active settings and statuses of the unit, the error history, the date for the next maintenance and the customer service address.

Call (1)

Use the "i" key to open the information menu "i".

Customer service (2)

Display of the customer service address or, e.g., a service telephone number.

These three lines can be freely programmed in the basic program (**password protected**):

"M" → BASIC PROGRAM → CUSTOMER SERVICE

Operating values (3)

Display of the current values.

Program values (4)

Use the arrow keys to open the menu item "Program values". Open the list of the set values by pressing "ENTER". The current setting of a parameter can be requested by pressing "ENTER":

For example (4a): "i" → INFORMATION → PROGRAM VALUES → PARAMETER

An asterisk indicates the selected function. (In this context there are no active lines)

Error history (5)

Open the error history by pressing the "i" and "ENTER" key. The error history is a list of the errors or statuses which have occurred during current operation. This list is lost after a power failure and the recording is restarted.

If no errors have occurred since start-up, the last switch-on time of the unit is displayed, e.g.: POWER FAILURE
 from 16.06.03 06:56
 to 16.06.03 07:09

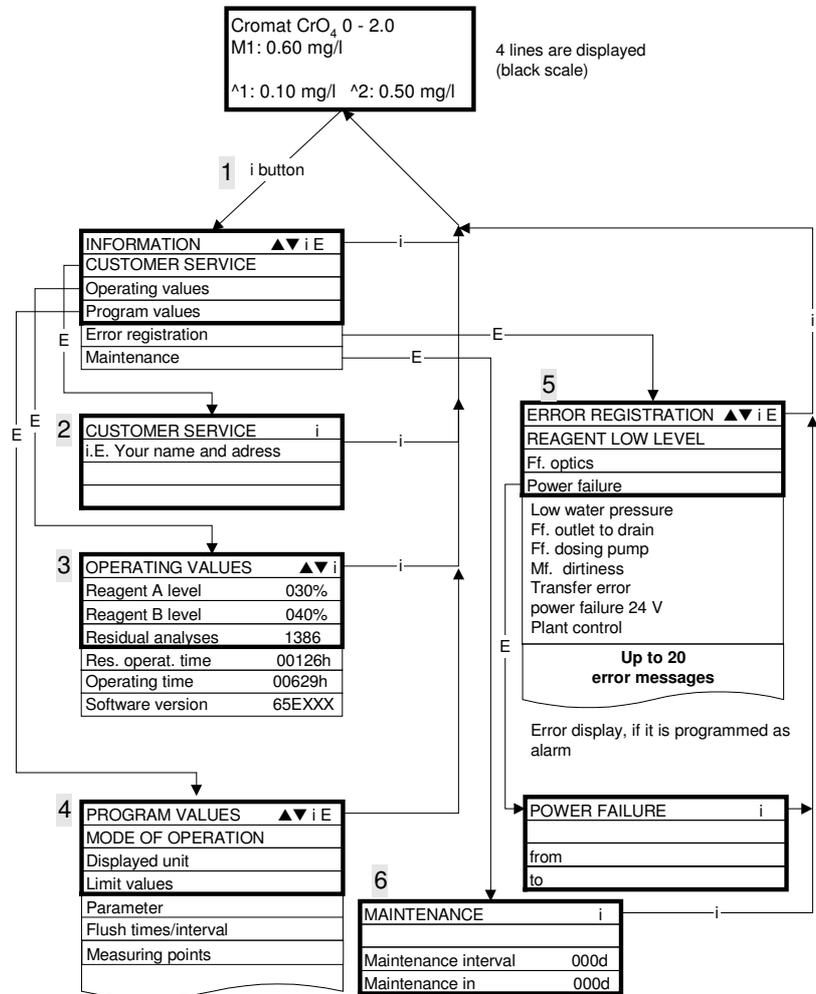
Maintenance (6)

Display of the next maintenance date and programmed maintenance interval.

It is possible to set the maintenance interval in the basic program (**password protected**):

"M" → BASIC PROGRAM → SERVICE II

Refer to the chapter entitled **Maintenance** for further maintenance information.



Program menu "M"

Call: (1)

Use the "M" key to open the program menu "M".

It is possible to call up all the functions without password protection except for the basic program.

Service I (2)

Input reagents (3)

Enter the new filling levels after **each** refill or reagent bottle change. Once you have selected the menu item for entering the filling level "Reagent X Filling (0 - 100%)" via the "ENTER" key, the value is preset to 100%. If a full bottle has been connected, confirm this value via the "ENTER" key. If the filling of the bottle differs, enter the corresponding value.

Manual operation (4)

After confirming the information message (4) via the "ENTER" key, it is possible to select and activate the desired function by using the arrow keys and pressing the "ENTER" key.

These functions are used for monitoring the functions and for commissioning.

- ☞ All manual functions can only be selected during an analysis pause. Analyses are not carried out during manual operation. All signal inputs and outputs are locked.

Flush (5)

Press the "ENTER" key to start the flushing of the sampling line via the internal valves. Press the "ENTER" key again to cancel this function.

Flush chamber (6)

Press the "ENTER" key to flush the measuring chamber once.

Drain chamber (7)

Press the "ENTER" key to open the outlet valve in order to drain the water from the measuring chamber. Press the "ENTER" key again to cancel this function.

Fill chamber (8)

Press the "ENTER" key to fill the measuring chamber.

Confirm maintenance (10)

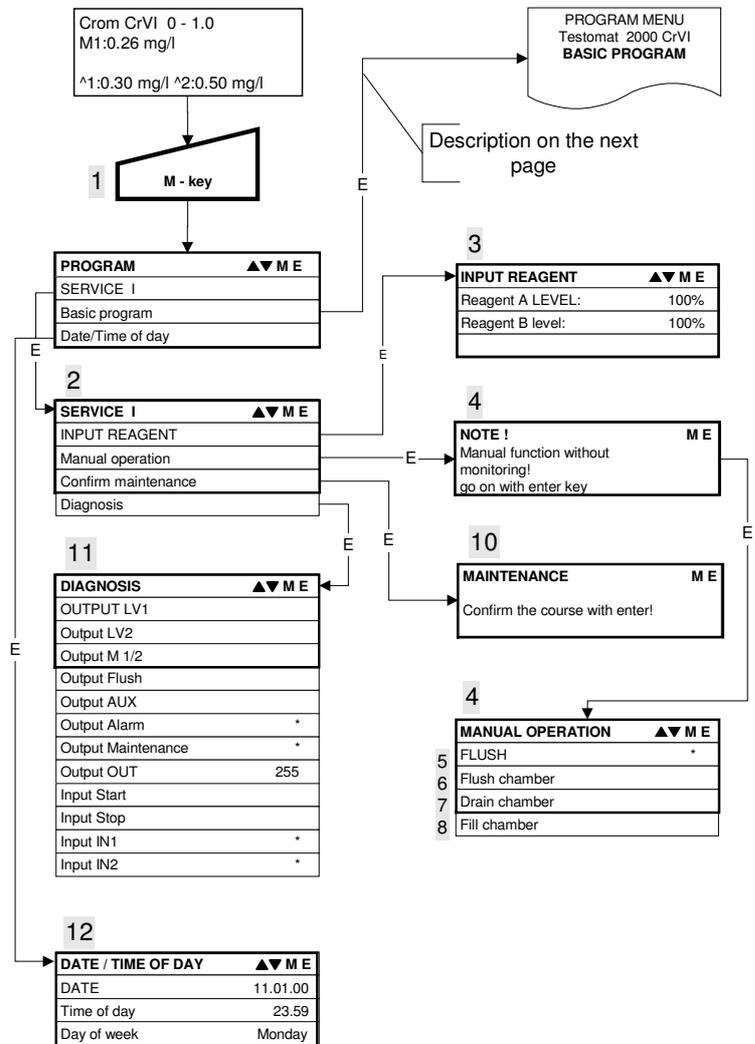
After maintenance has been carried out, confirm it by pressing the "ENTER" key and exit this item via the "M" key. The maintenance interval is restarted.

- ☞ Confirm a maintenance request once the maintenance interval has expired in the M menu. The displayed message is deleted and the "maintenance" output reset.

Refer to the chapter entitled **Maintenance** for further details on maintenance intervals.

Diagnosis (11)

It is possible to request the current statuses of the signal inputs and outputs in a list. Active statuses are marked with an *. (See menu structure)



Error messages / Troubleshooting

Displayed message (flashes at selected display)	Unit result functions	Possible causes	Remedies
Ff. POWER FAILURE 24 V CANCEL WITH HORN KEY	After programming: Continuous alarm or message impulses Standby	<ul style="list-style-type: none"> Internal power failure of the 24 V supply 	Replace fuse F4 or F8 (The control lamp "Power" of the dosing pump should light up)
Ff. DOSING PUMP CANCEL WITH HORN KEY	After programming: Continuous alarm or message impulses Standby	<ul style="list-style-type: none"> Dosing pump is defective No dosing message from the dosing pump 	Replace dosing pump Check cable to the dosing pump for correct connection
Mf. TURBID CANCEL WITH HORN KEY	After programming: Continuous alarm or message impulses or no message Continue measurements	<ul style="list-style-type: none"> The water is turbid / soiled 	
MEASURING RANGE EXCEEDED CANCEL WITH HORN KEY	After programming: Continuous alarm or message impulses or no message Continue measurements	<ul style="list-style-type: none"> The measuring range has been exceeded 	
LOW WATER PRESSURE CANCEL WITH HORN KEY	After programming: Continuous alarm or message impulses Standby	<ul style="list-style-type: none"> No water input although LED "IN" lights up Inlet pressure too low Overflow detection does not react 	Check water inlet Connector at the inlet valve oxidised Clean filter strainer Replace valve block Extract pressure controller valve body Replace fuse F6
Ff. OUTLET TO DRAIN CANCEL WITH HORN KEY	After programming: Continuous alarm or message impulses Standby	<ul style="list-style-type: none"> Water remains in the measuring chamber although LED "OUT" lights up 	Check water outlet Connector at the outlet valve oxidised Replace valve block
REAGENT LOW CANCEL WITH HORN KEY	After programming: Continuous alarm or message impulses or no message LED and output "maintenance" on Continue measurements	<ul style="list-style-type: none"> Reagent quantity is below minimum setting 50 ml (10 %) 	Check reagent level and refill, if necessary (enter the filling quantity: "M" → SERVICE I)
Mf. SOILING CANCEL WITH HORN KEY	After programming: Continuous alarm or message impulses or no message LED and output "maintenance" on Continue measurements	<ul style="list-style-type: none"> Sight-glass windows are soiled 	Clean sight-glass windows
FSt. OPTICS CANCEL WITH HORN KEY	After programming: Continuous alarm or message impulses Standby	<ul style="list-style-type: none"> Plug-in circuit board defective Error at the optical component (transmitter or receiver defective) 	Replace plug-in circuit board Replace measuring chamber holder
MAINTENANCE INTERVAL EXCEEDED XXX DAYS CANCEL WITH HORN KEY	After programming: Continuous alarm or message impulses or no message LED and output "maintenance" on Continue measurements	<ul style="list-style-type: none"> Programmed maintenance date reached or exceeded 	Carry out maintenance and subsequently cancel or confirm

Ff. = Function fault
Mf. = Measuring fault

Further information

Error	Possible causes	Remedies
Current interface functions incorrectly	<ul style="list-style-type: none"> • Incorrect measuring value at the output or no power supplied 	Replace fuse F7 Replace the interface circuit board
Unit is not functioning, even though it is switched on No display	<ul style="list-style-type: none"> • Fuse F9, F5 or F2 (240 V: F1) defective • Power switch defective • Ribbon cable at display circuit board or base circuit board is loose • Error at display circuit board or base circuit board 	Replace fuses Replace power switch Reconnect ribbon cable Replace display or base circuit board

Maintenance

Regular maintenance is necessary to ensure trouble-free operation of the unit!

Please carry out the maintenance work described in the following section the programmed maintenance date has been reached (display "maintenance date exceeded")
 the unit displays the following error messages: "Mf.soiled" or "Reagent low level"
 the last maintenance was carried out max. 6 months ago



Never use organic solvents to clean the measuring chamber or other plastic parts!
 Please observe the safety regulations when handling cleaning agents!

Description of maintenance work

Cleaning the measuring chamber and sight-glass windows

1. Switch off the unit or press the "STANDBY" key (measuring chamber completely drained?).
2. Close the manually-operated valve of the branch line to the Testomat® 2000 Cr VI.
3. Unhook the toggle type fastener, tip the measuring chamber upwards and remove it.
4. Release both sight-glass window holders, remove and clean the sight-glass windows.
5. Remove the film from the sight-glass windows.
6. Clean the measuring chamber with 10% hydrochloric acid and then rinse well.
7. After cleaning, re-insert the sight-glass windows and secure them with the sight-glass window holders.
 (Do not forget the O-ring seals and ensure correct fitting in the groove).
8. Insert the measuring chamber by tilting it backwards and secure it using the toggle type fastener.

Cleaning the filter housing

1. Close the manually-operated valve of the branch line to the Testomat® 2000 Cr VI.
2. Loosen the hose connections at the filter housing.
3. Unscrew the inlet connection, remove the sealing ring, the spring and the filter strainer and clean them.
4. Extract the retaining pin and withdraw the flow controller and finally remove the flow controller valve body.
5. Clean the filter housing with water or alcohol and reassemble the unit.
 Insert the filter with the cone facing downwards!
6. Reattach the hose connections at the filter housing.



Water leakage at sealed points can damage parts of the unit.

Tip: Please check the unit for leaks before carrying out the first analysis.

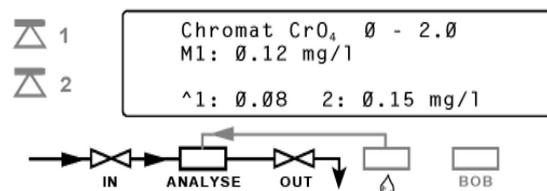
1. Switch the unit to STANDBY
2. Manually fill the measuring chamber
3. Manually dose the reagents ("Manual" key)
4. Check the connections and seals for leaks

Service instructions

The surface of the unit has not been treated. Therefore, soiling caused by reagents, oil or grease should be avoided. However, if the housing is soiled, please clean the surface with isopropanol (never use other solvents).

Check and manual calibration of the instrument with standard solution

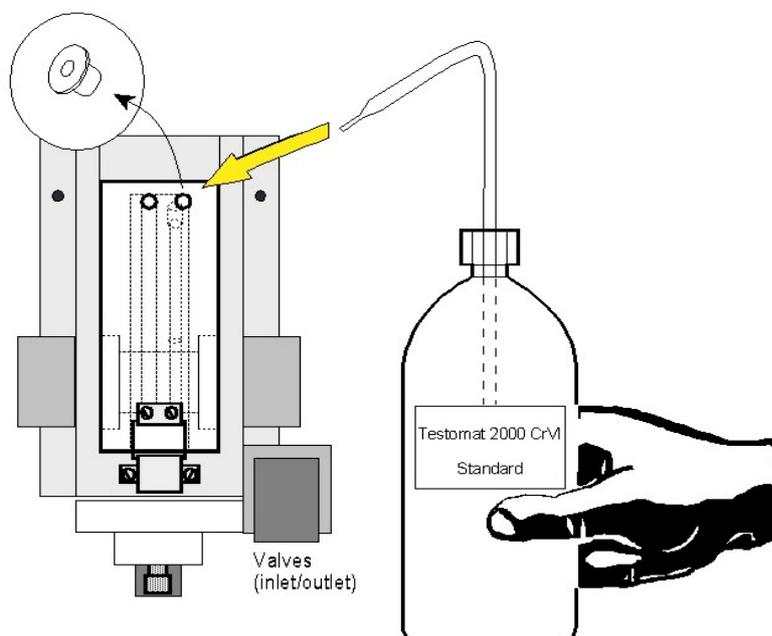
Display and LEDs:



Description

Filling of the measuring chamber with the standard solution by hand

1. Shut-off the sample line to the water inlet.
2. Remove the right closure pin out of the chamber.
(Filling hole for the solution or test water after starting the calibration)
For that you can use regular laboratory wash bottles.
3. To start the check, activate the measuring by pressing the "Hand" button.
Start the calibration by pressing the "ENTER" button at menu "Calibration Start" (LED "ANALYSE" lights up).
4. The analysis cycle begins.
Please wait if necessary until flushing is finished and outlet valve is closed. (LED "OUT" is now OFF).
5. Now fill the chamber complete until overflowing. The inlet valve now closes (LED "IN" is OFF).
This first filling is for flushing and chamber will be drained off.
6. After the outlet valve is closed (LED "OUT" is OFF), fill the chamber again (LED "IN" lights up).
The water level inside the chamber sinks to the sample volume level.
7. Analysis is running and at least the calibration factor will be calculated by the Testomat 2000®.



Spare parts list Testomat® 2000 Cr VI

Art. no.	Pressure controller
040120	Controller / filter receiver
040129	Controller plug T2000, complete
011225	Flow controller valve body (1 - 8 bar)
011230	Retaining pin for controller plug
011217	Inlet filter
011218	Spring for inlet filter
040121	Inlet connector
040153	Plug in connector - G 1/4" -6
Measuring chamber	
040173	Sight-glass window 30 x 3 with seal
040170	Sight-glass window 30 x 3
040176	Sight-glass holder
033253	Screw M3 x 40
040032	Latch fastener TL 800-7-1
011203	Plastic plug
Measuring chamber holder	
040108	Measuring chamber holder DUO rt/ge (without 40022)
040050	Magnetic stirrer
040018	Solenoid valve, 2/2-way
040181	Rear guide bar for measuring chamber 5 x 60
Dosing pump DOSIClip®	
040001	Jet pump, complete
040011	Suction hose, complete
040016	Pressure hose, complete
037232	Base circuit board TI, complete
034668	Magnet 24 VDC
032046	Plastic cover CNH 45 N
Bottle connection / Suction device	
040131	Screw cap with bottle insert T2000
040130	Screw cap GL32 - hole
040135	Bottle insert for screw cap with push-fit suction tube

Art. No.	Unit spare parts list	
031582	Fuse M4A	
037236	Base circuit board T2000, complete 230V	
040092	Control circuit board T2000, complete	
040091	Plug-in circuit board SE-T2000, complete	
	Cable sleeve 5-7	
040191	Cable sleeve 7-10	
040197	Mains on / off switch T2000	
040198	Cover for mains on / off switch	
031713	Ribbon cable 10 pole with EMI filter clamp	
040096	Ribbon cable 26 pole with EMI filter clamp	
040060	Cable loom 2V complete (for valves)	
040063	Cable loom 4P complete (for 4 dosing pumps)	
040200	Cable loom for mains on/off switch complete	
031596	Fuse T0.08A	
031585	Fuse T0.315A	
031595	Fuse T0.1A	
031622	Fuse T0.16A	
031592	Fuse T1.0A	
Spare parts requirement for 2 - 3 years of operation		
040173	Sight-glass window 30 x 3 with seal	2 x
011217	Inlet filter	1 x
040124	Gasket set T2000 (after maintenance requirement)	X*
031585	Fuse T0.315A	1 x
031592	Fuse T1.0A	1 x

X*Trouble-free operation of the TESTOMAT® 2000 Cr VI can only be guaranteed if the unit is maintained and the seals are replaced on a regular basis (see chapter entitled "Maintenance").

Accessories:

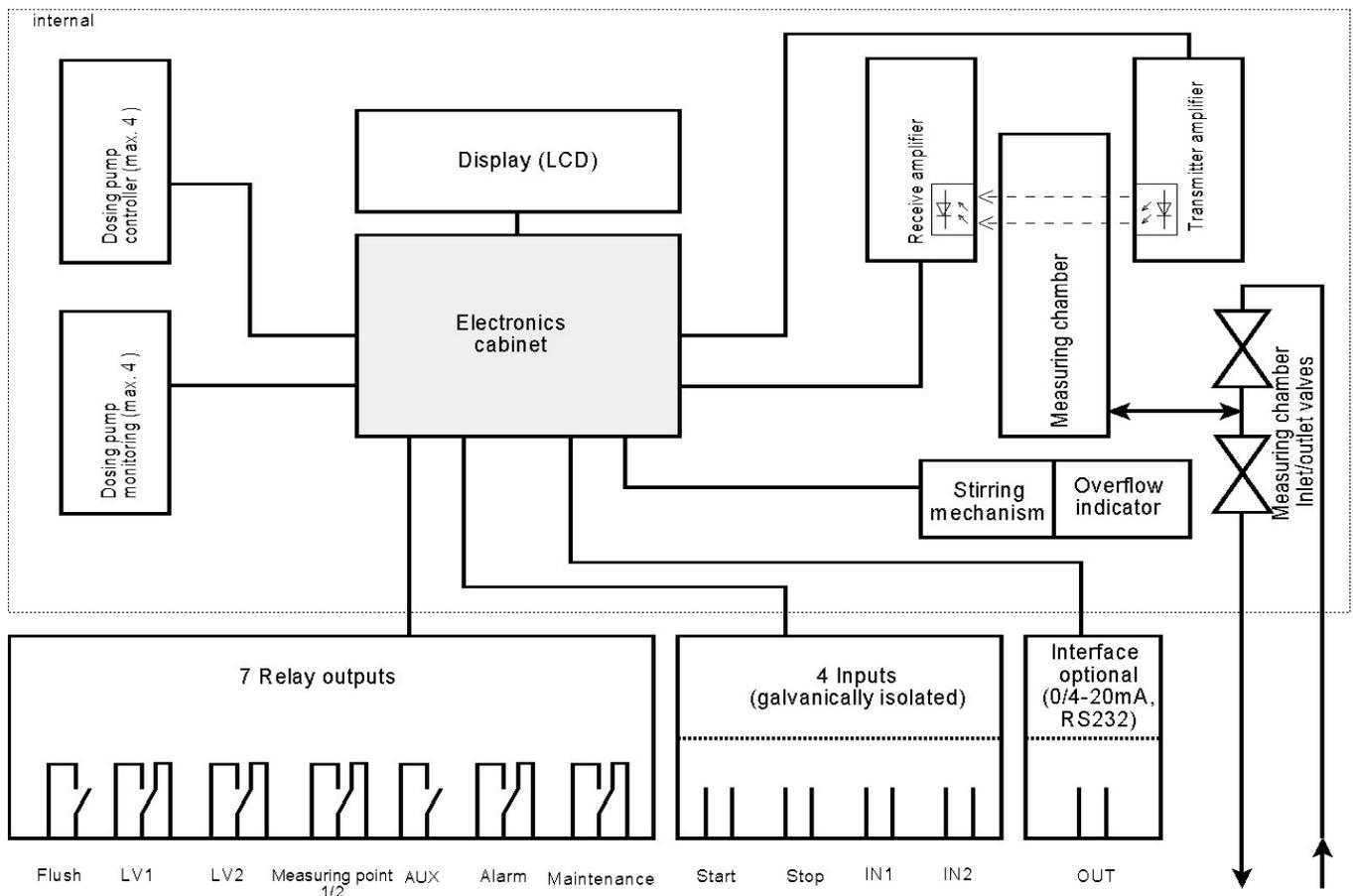
Art. no.	
040123	Optional adapter for water inlet T2000
270305	Interface (interface card SK 910)
270310	Plug-in card RS910 (interface RS232)
270335	Maintenance kit T2000

Reagents:

Art. no.		
156220	CrVI 2100 A	Reagent A, 500ml
156221	CrVI 2100 B	Reagent B, 500ml

Technical appendix

Block diagram Testomat® 2000 Cr VI



Technical data

Power supply: 230 V or 24 V \pm 10 %, 50 - 60 Hz, fuse M4A
Unit protection: 230 V: T0.1A
 24 V: T1.0A

Power consumption: max. 30VA
Degree of protection: IP 65
Protection class: I
Conformity: EN50081-1, EN50082-2, EN 61010-1
Ambient temperature: 10 - 45 °C
Contact rating of the relay outputs: 4 A resistive load, fuse M4A
Measuring range: see page 1
Current interface: 0/4 - 20 mA, max. load 500 Ohm (optional)
Water supply: 0.1 - 8 bar
Water temperature: 10 - 40 °C



Dimensions (W x H x D): 380 x 480 x 280 mm
Weight: Approx. 10.5 kg

We reserve the right to make technical changes without notice in the interest of constantly improving our products!

Art. no.xxxxx

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