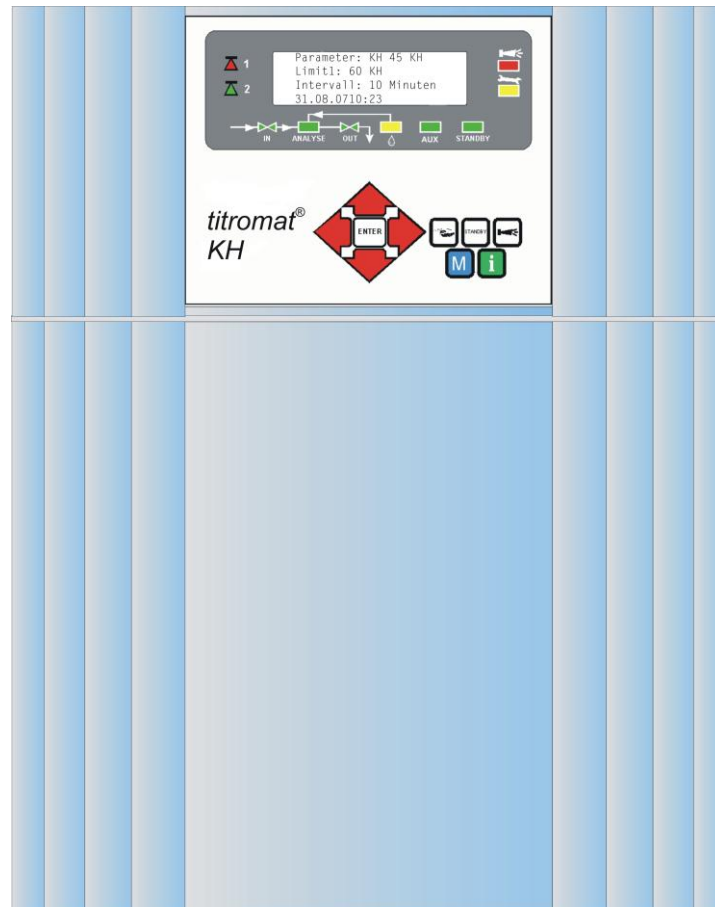


TITROMAT[®] KH

**Microprocessor controlled titration monitor
for carbonate hardness**



Operating Instructions

Table of Contents

Introduction	3	Alarm/Message	16
Short description.....	3	Function AUX	16
Handling instructions	4	Service II	16
Operational reliability instructions.....	4	Calibration.....	16
Safety instructions.....	4	Reset operating time	16
Installation and commissioning	5	Maintenance interval	16
Installation.....	5	Water quantity RESET	16
Electrical connection.....	5	Interfaces.....	17
Mains water supply	5	Menu structure.....	17
Commissioning	6	Selection and input.....	17
General description.....	7	Menu start.....	17
Internal construction	7	Selection	17
Description of the electrical connections	8	Input.....	17
Terminal block identification.....	8	Menu end.....	17
Description of display and operating features	9	Information menu "i"	18
Display functions.....	9	Structure of the "i" -menu	18
Limit value status display	9	Call	18
Measured value display	9	Customer service	18
Limit value displays	9	Operating values	18
Alarm and maintenance message	9	Program values	18
Status displays.....	10	Error history.....	18
Description of the relay outputs	10	Maintenance.....	18
Flush external flush valve	10	Program menu "M"	19
LV1 and LV2 limit value outputs	10	Call	19
Measuring points 1 or 2 Measuring points switch- over	10	Service I	19
AUX programmable function output.....	11	Input reagents.....	19
Alarm fault message output	11	Manuel operation	19
Maintenance Maintenance message	11	Confirm maintenance	20
Description of the signal inputs and outputs.....	12	Diagnosis	20
Start external analysis start.....	12	Time/Date.....	20
Stop external analysis stop	12	Basic program.....	20
IN1 and IN2 universal inputs.....	12	Program values	20
OUT interface output (optional).....	12	Structure of the basic program.....	21
Function characteristics.....	13	Error messages / Troubleshooting	22
Operating modes	13	Further information	23
Analysis cycle	13	Maintenance	23
Display unit	13	Description of maintenance work.....	23
Reagent type	13	Cleaning the measuring chamber and sight-glass windows	23
Time setting	13	Cleaning the filter housing	23
Internal flushing.....	13	Service instructions	23
External flushing.....	13	Spare parts list Titromat®	24
Interval pause.....	14	Technical Appendix.....	25
Limit value monitoring.....	14	Conformity declaration	25
Hysteresis	14	Block diagram Titromat®	26
Switch functions.....	15	Technical data	26
Function IN1	15		
Water meter	15		

Introduction

These operating instructions describe the installation; operation and programming of the titration monitor Titromat® KH. We recommend that, while familiarizing yourself with the operation of the instrument aided by these operating instructions, you have immediate access to the instrument in order to perform the described functions and combinations. As certain areas are interrelated, it is advisable to follow the instructions in the given order. Should problems or questions arise while operating the instrument 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:



Operating instructions



Always observe / warning

"M" = Press the menu key "M"



Tip: Helpful hints



SERVICE → MANUEL OPERATION → FLUSH = Sequence of the menu

"STANDBY" = STANDBY lamp is "ON"

Short description

The Titromat® KH is used for the automatic determination and monitoring of the carbonate hardness in aqueous media. The various measuring parameters and ranges are determined by the choice of the reagents.

		Reagent type/Measuring range	
		TC 2060	TC 2150
Unit	°KH (Resolution)	2 -60 (2)	5 -150 (5)
	°f KH (Resolution)	4 -107 (4)	9 -269 (9)
	mmol/l (Resolution)	0.7 -21.4 (0.7)	1,8 -53,6 (1.8)



Trouble-free operation of the Titromat® units is only guaranteed when using HEYL Titromat® reagents. Faults or problems resulting from the use of other reagents will not be accepted as a warranty or fair dealing claim!



A fine preliminary filter should be installed if the media to be measured is heavily coloured or turbid.



When the Titromat® KH instrument is used to measure the carbonate hardness, the pH value of the aqueous solution must be greater than 4.3. "Measuring Fault Analysis" is displayed for pH values of less than 4.3.

Handling instructions

- **Repeated switching on/off:**
Wait at least 5 seconds before switching the unit '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. If they are broken, it will negatively affect any warranty claims that you make thereafter.
- **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 last used reagent type and the measured medium. Do not carry out any actions at the unit which are not described in these operating instructions; failure to adhere to the instructions will negatively affect any warranty claims that you make thereafter. Before you return the unit for repair work, remove the reagent bottle and ensure that the measuring chamber has been flushed out and is empty. Prior to dismantling, always write down a description of the error (failure effect). The repair of a defective controller (irrespective of the warranty period) is only possible when the controller is dismantled and returned to us with a description of the error.
- **Electrical load capacity**
The maximum electrical load capacity of the relay outputs and the total power rating should never be exceeded.
- **The Titromat[®] KH should only be used for its specified intended purpose.**
- **Environmental protection regulations**
Please observe environmental protection regulations. Collect any unused reagents and send them to us for safe disposal.

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?

Maintenance and servicing instructions
(see "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. manual analysis) 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 the 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 triggered, attempt to eliminate the cause of malfunctioning (e.g. replace a defective valve) before reactivating the protective circuit. Frequent triggering is always due to an error which, in certain circumstances, may also damage the unit.
- 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.heyhl.de>.



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

Installation and commissioning should only be carried out by authorised technicians!

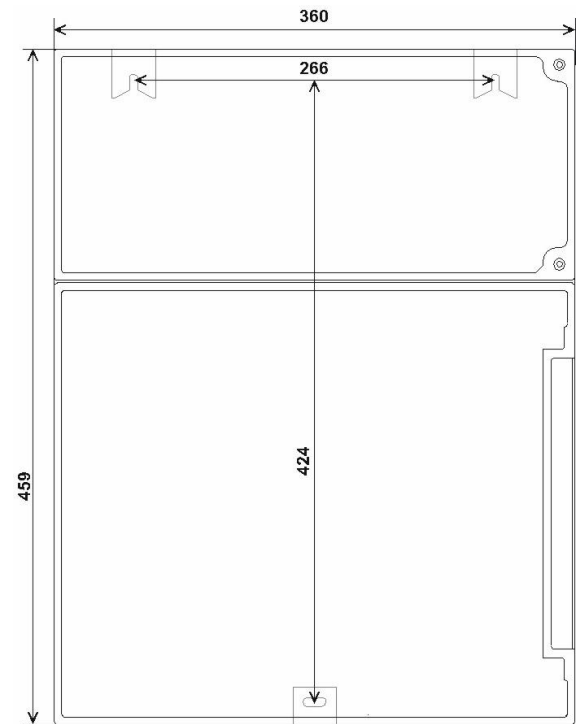
Installation

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.

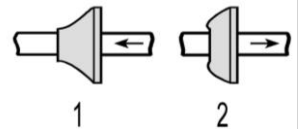
Electrical connection



Dimensioned sketch (mm)



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 wetted parts (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 Titromat®.



Hot water can scald!



Avoid strong pressure fluctuations!

The power branch line to the Titromat® 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 Titromat® within the pressure range 0.3 to 1 bar or when it is supplied via a booster pump (Art. No. 270410), 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 as standard (external diameter 6 mm/ internal diameter 4 mm).

Quick-release coupling (accessory: Adapter for water inlet T2000, 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).

Preliminary filter

If the measuring water of the Titromat[®] contains agents which cause turbidity, it is recommended to install a preliminary filter. If the colouration of the media to be measured cannot be eliminated via filtration, please contact us to adjust the unit accordingly.

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.
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
 - Limit values
 - Flushing times
 - Interval
 - Hysteresis

Refer to "Basic Programming" for a description of the programming.

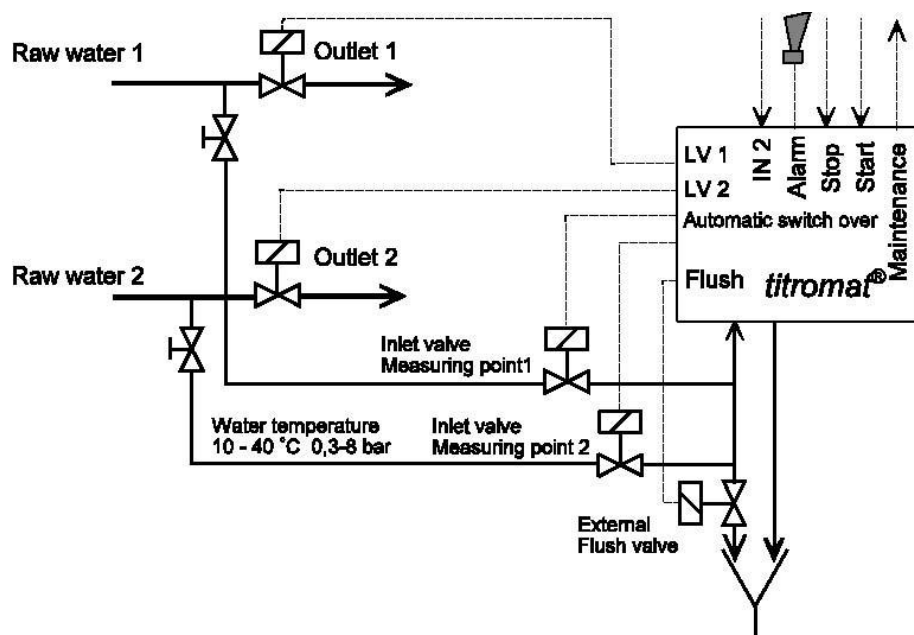
5. Subsequently bleed the unit's water supply via manual flushing.

"M" → SERVICE → MANUAL OPERATION → FLUSH (press "ENTER" repeatedly).

Flush until there are no bubbles visible in the measuring chamber and the filter housing.

6. Check all connections for tightness.
7. Carry out the first analysis by pressing the "Manual" key.

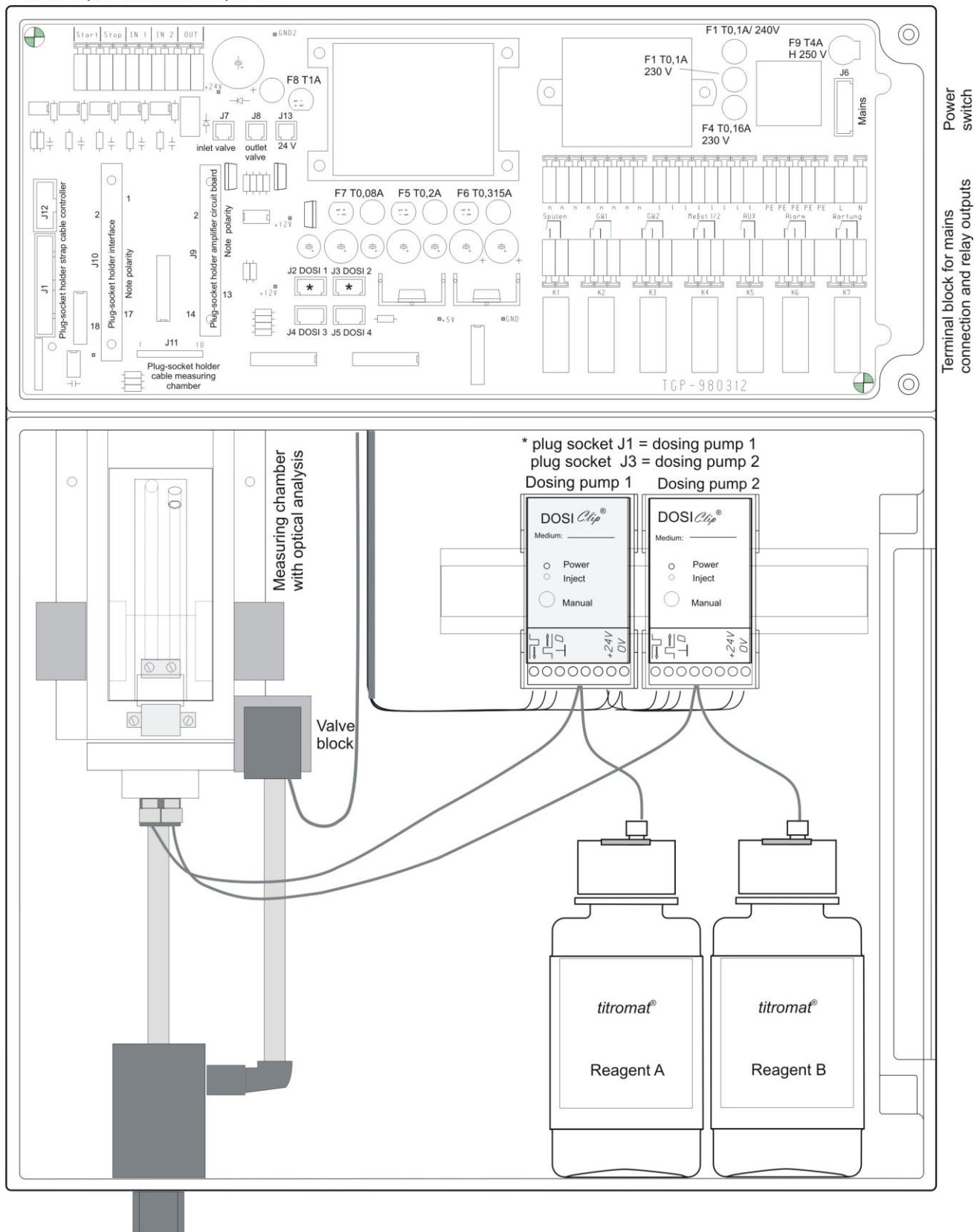
Installation diagram (Example):



General description

Internal construction

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



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

⚠ Ensure that the reagent bottles are connected as shown in the figure above. Reagent A must be connected to dosing pump 1 and reagent B to dosing pump 2. If the reagents are wrongly connected the measuring results will be wrong.

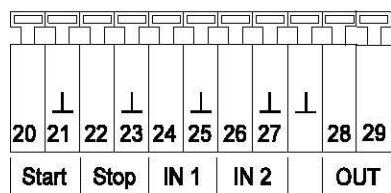
Description of the electrical connections

Terminal block identification

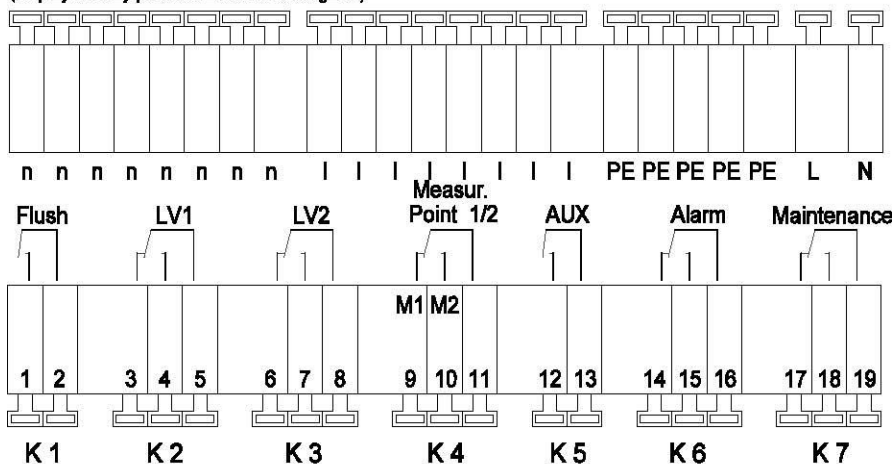
IN = input, OUT = output

No.	Terminal	Type	Function	Comment
-	PE	IN	Mains-Protective earth (5 x)	Only with mains 115 / 230 V !
--	N (U) L (V)	IN	Mains, N = Neutral (U = 24 V) Mains, L = Live (V = 24 V)	Mains input 24V / 115V / 230 -240 V AC
--	n l	OUT	Neutral, switched (8 x) Live, switched (8 x)	Mains for consumers max. 4 A
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 -Norm. closed. Limit value output 1 -Norm. 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 -Norm. closed. Limit value output 2 -Norm. 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 points 1 -Norm. closed Measuring points 1 -Norm. open Measur. points 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 -Norm. closed Fault message output -Norm. open Fault message output -Common	Volt-free relay output max. load 240 V AC, 4 A
17 18 19	Maintenance	OUT	Maintenance message -Norm. closed Maintenance message -Norm. 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 connect for volt-free normally open/closed
22 23	Stop ┴	IN	External analysis stop Common earth for inputs	Only connect for volt-free normally open/closed
24 25	IN1 ┴	IN	Universal input 1 Common earth for inputs	Only connect for volt-free normally open/closed
26 27	IN2 ┴	IN	Universal input 2 (Water meter) Common earth for inputs	Only connect for volt-free normally open/closed
28 29	OUT	OUT	0/4 -20 mA galvanic isolated or serial interface	28 = (+), 29 = (-) 28 = TxD, 29 = RxD

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



Terminal blocks for mains supply and relay outputs
(displayed relay position: Device deenergized)



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

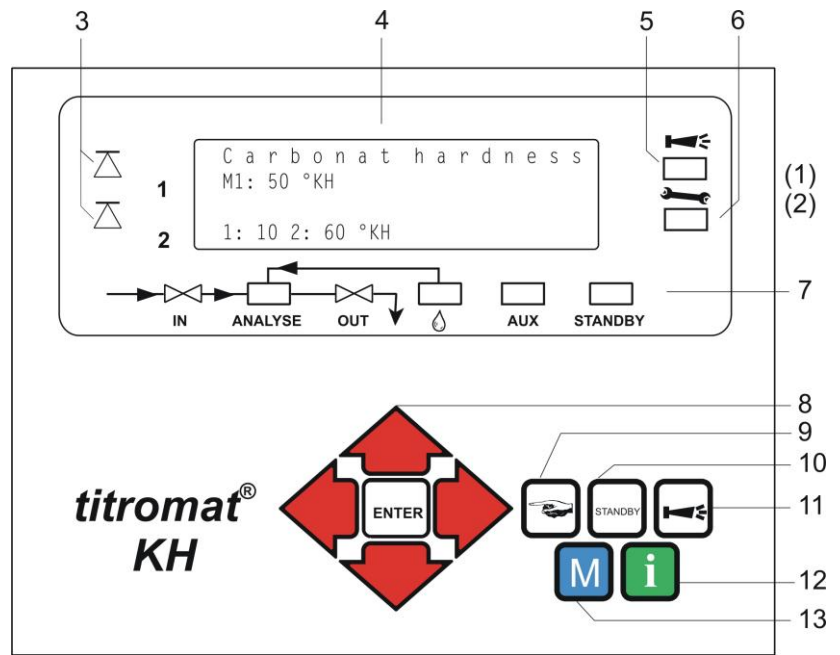
Displays a maintenance request.

7 Status display

Six LEDs signal the current status[®] (analysis and unit status) of the Titromat KH.

8 Programming keys (cursorblock with ENTER)

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



Function keys:

9 "Manuel" = manual start of an analysis

10 STANDBY = manual analysis stop/standby

11 "Hupe" = 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 display 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:) is displayed in line 2 and 3.
If the measured value has fallen below the measuring range start, "<" is displayed: M1: < 5 °KH
If the measured value has exceeded the measuring range start, ">" is displayed: M1: > 150 °KH

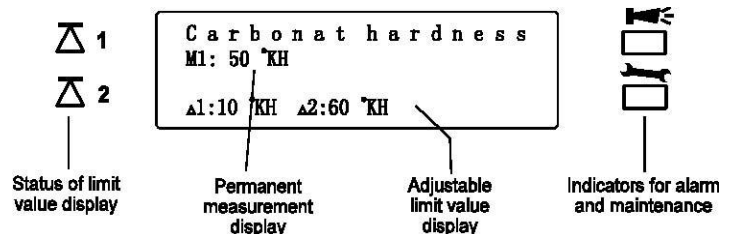
Limit value displays

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

Alarm and maintenance message

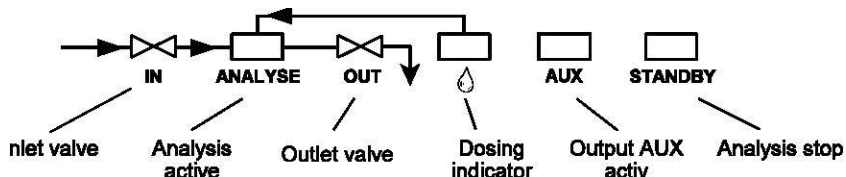
Display of present error messages (red) and maintenance requests (yellow).

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 Titromat® to fill with measuring water. Please ensure that the programmed flush time is sufficient. Set the flush time under menu item

"M" → BASIC PROGRAMM → 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 has 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 value exceeded)
LV2 – active when limit value 2 or measuring point 2 has 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 value exceeded)

Menu values:

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

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

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

"M" → BASIC PROGRAMM → PROGRAM VALUES → HYSTERESIS LV1

"M" → BASIC PROGRAMM → PROGRAM VALUES → HYSTERESIS 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 terminals are strictly allocated to the measuring points.

Terminal 9 = Measuring point 1

Terminal 10 = Measuring point 2

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

AUX programmable function output

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

1. For reporting a current analysis

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

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

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

3. Contact after analysis

"M" → BASIC PROGRAMM → PROGRAM VALUES → FUNCTION AUX → CONTACT AFTER ANALYSIS

–An active relay output AUX is displayed via the LED "AUX".

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 signaled simultaneously, the output is switched to continuous contact.
- The red LED "Alarm" 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 chapter 'information menu "i" ').

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
Measuring fault analysis
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
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":

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" to volt-free contacts!

Start external analysis start

Stop external analysis stop

Function	Type of contact	Test time	Action
Start External analysis start (e. g. via flow controller or process controller)	Normally open volt-free!	None	In operating mode EXTERNAL, the contact starts an analysis at the input
Stop External analysis stop (e. g. via flow controller or process controller)	Programmable norm. closed/ norm. open Volt-free!	None	As long as the contact at the input is 'open' or 'closed', no analysis 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 (for stopping the 2nd measuring point)	programmable norm. closed/ norm. open volt-free!	Period of 10 seconds	As long as the contact at the input is 'open' or 'closed', analysis are carried out from measuring point 1.
IN2 Water meter input	Norm. open volt-free!	None	Quantity recording for starting an analysis

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

OUT interface output (optional)

Function	Type of contact	Test time	Action
Programmable interface 0 -20 mA 4 -20 mA	Max. load 500 Ohm	-	programmable Measured value measuring point 1 or 2
Serial interface RS 232	Serial bus (2-wire-cabel)	-	See interface RS910 description

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

Current interface 0/4-20 mA: interface card SK 910

For the serial interface RS 232: Interface RS910

"M" → BASIC PROGRAMM → PROGRAM VALUES → INTERFACES

Function characteristics

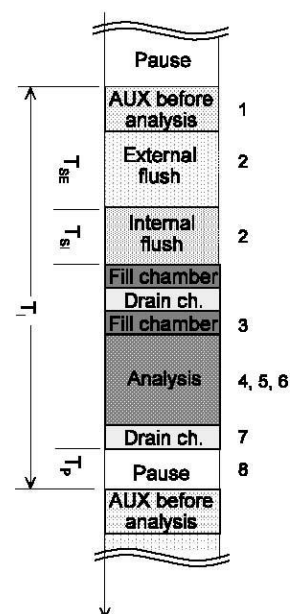
Operating modes (analysis controller)

1. **Time control:** Internal triggering via a timer. Shortest interval = 0 minutes between analyses, longest interval = 99 minutes.
(also see "Interval pause" below)
2. **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).
3. **External analysis start** by triggering a contact at the **start** input

☞ 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.

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

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



Analysis cycle (example with schematic cycle diagram)

- 1 Supplementary program AUX prior to analysis
- 2 Flush the line and measuring chamber (observe the flush time of the sampling line), T_{SE} und T_{SI}
- 3 Fill measuring chamber
- 4, 5 Check the sample for soiling, dose reagent 5 to 12 x reagent A, then titration with reagent B (stirring mechanism is switched on)
- 6 Evaluate and display reaction
- 7 Drain the measuring chamber
- 8 Waiting period until the next analysis (time or quantity analysis interval),
 T_p T_i = total analysis interval, MC = measuring chamber

Display unit

It is possible to program the unit of the displayed value. °KH, °f KH as well as mmol/l can be selected. All the following inputs and displays will be displayed in the programmed unit.

DISPLAYED UNIT ▲▼ ME	
DISPLAY IN °KH	*
Display in °f KH	
Display in mmol/l	

Reagent type

Select the reagent type you are utilising in the unit, e. g. reagent TC 2150 means 150 °KH upper limit of the measuring range and 5 °KH lower limit of the measuring range. The measuring range with its units is listed on the reagent labels.

REAGENT TYPE ▲▼ ME	
TC 2060 Carbonat hardness	*
TC 2150 Carbonat hardness	

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 Titromat®.

FLUSH TIMES/INTERVAL ▲▼ ME	
INTERNAL FLUSH TIME	00s
External flush time	00s
Interval pause	10m

☞ The analysis interval depends directly on the programmed flushing time. If, e.g., a flushing time of 90 seconds has been set, the actual analysis interval cannot be less than 90 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 Titromat®. 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 Titromat®.

Example: For connections longer than 3 m and with an internal hose diameter of 6 mm a minimum internal flushing quantity of flush water for 1-minute internal flushing is 0.5 litres.

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

Variable programming of the limit values is possible. The limit value range is the measuring range

LIMIT VALUES	▲▼ME
LIMIT VAL. 1:	10 °KH
Limit val. 2:	60 °KH

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 limit values, the limit value outputs are permanently allocated to these limit values!

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

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.

HYSTERESIS LV 1	▲▼ME
Analysis (1, 2, 3)	1

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)

Switch functions (limit value outputs LV1 and LV2)



Switch functions 0 and 2: If locking has been programmed, the output relay LV1 switches as programmed until the release occurs manually (press the "STANDBY" key).

FUNCTION LV 1	▲▼ ME
DURATION	*
Duration/inverse	
Impulse	
Interval	
Two point	
Range LV1-LV2	
Time:	00m:10s

(Two-point only with 2 limit values and 1 measuring point.)

Switch function 0, *duration*

If the limit value LV1 or LV2 has been exceeded, the output relay LV1 or LV2. 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 $[t]$.

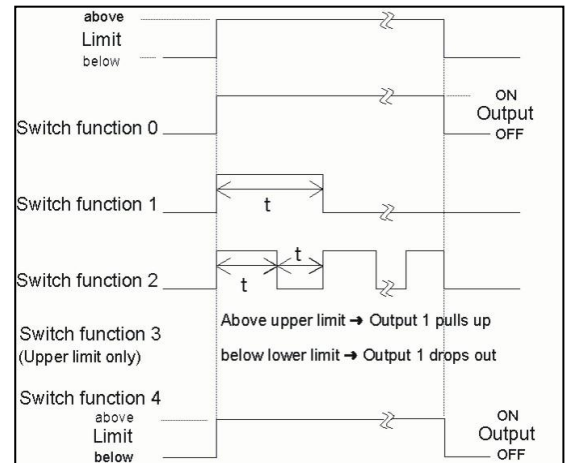
Switch function 3, *two point*

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 LV2 drops out again. The output relay LV2 switches according to the programmed switched 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 = 20 /KH and LV2 = 30 /KH.

Schematic representation of logic function



Switch function 4, *duration/invers*

If the measured value falls below the limit value LV1 or LV2, the output relay LV1 or LV2 reacts. If the limit value LV1 or LV2 has been exceeded, the relevant relay drops out again.

Switch function 5, *range LV1-LV2*

Monitoring the range between limit values LV1 and LV2. If limit value LV1 is exceeded, relay LV1 switches and LED "LV1" illuminates red.

If limit value LV2 is not achieved, relay LV2 switches and LED "LV2" lights up red. If the measured value is within the range, both relays are deactivated and both LEDs illuminate green.

If this function has been selected, no other function can be selected for limit value LV2 in the menu item "FUNCTION LV2".

Function IN1

If it is measured from two measuring points, it is possible to suppress the measuring point switch-over by activating IN1. To achieve this, please program 2 measuring points with an external switch-over ("2 external measuring points"). If IN1 is active, it is only measured from measuring point 1. 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 Internal measuring points	
2 External measuring points	

Water meter

It is necessary to connect a water meter to input IN2 for quantity-dependent analysis triggering, dynamic analysis control and operational monitoring of water treatment plants (see plant control). Program the corresponding water meter rating under the menu item "TYPE OF WATER METER".

TYPE OF WATER METER	▲▼ ME
1 LITRE/IMPULSE	
2,5 Litre/Impulse	
5 Litre/Impulse	
10 Litre/Impulse	*
100 Litre/Impulse	
500 Litre/Impulse	
1000 Litre/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 / 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.

Function AUX

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

- As a functional output for providing a contact with a programmable duration before and/or during the analysis, or after an analysis.

It is e.g. 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!

Calibration

Calibration can, e.g., be carried out to adapt the Titromat® to predominant raw water turbidity. A reference measurement is carried out for this. If it is not possible to compensate the predominant turbidity, install a preliminary filter in the supply line. If this is also insufficient, e.g. due to heavy colouration of the medium, please contact us as regards unit adjustment.

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

Maintenance interval

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

Water quantity RESET

Causes a reset of the currently stored water quantity.

ALARM/MESSAGE	▲▼ ME	
REAGENT LOW LEVEL	A	A/M/-
Low water pressure	A	A/M
Mf. Analysis	A	A/M
Ff. optics	A	A/M
Ff. dosing fault	M	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/-
Mf. Turbid	M	A/M
Plant control	M	A/M/-
Transfer error	M	A/M/-
Meas. range exceeded	M	A/M/-
Maint. Int. exceeded	M	A/M/-

A = Alarm / M = Message / - = no action)

Ff. = Function fault

Mf. = Measuring fault

FUNCTION AUX	▲▼ ME
CONTACT BEFORE ANALYSIS *	
Contact during analysis	
Contact after analysis	
Time	00m 00s

SERVICE II	▲▼ ME
CALIBRATION	
Reset operating time	
Maintenance interval	
Water quantity	RESET

CALIBRATION	▲▼ ME
Calibr. Value	50 °KH
Calibration	Start
Adjust factor	1.0

OPERATING TIME	▲▼ ME
	000023h
	Reset

MAINTENANCE INTERV.	▲▼ ME
	001d

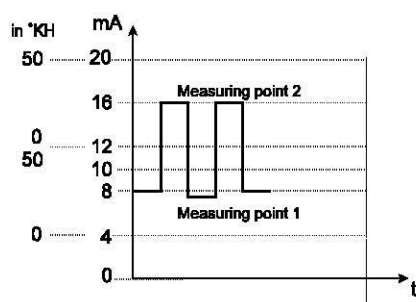
Interfaces (optional)

Current interface 0/4-20 mA (interface SK910)

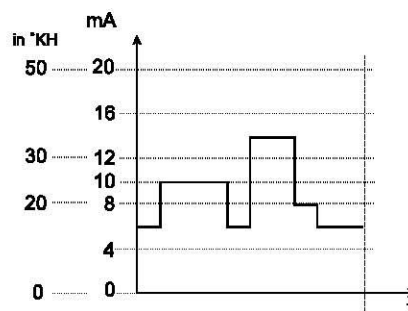
Another possibility for monitoring the analysis is the connection of a recorder. The unit is equipped with a programmable current output for this purpose. Standard values of 0 - 20 mA or 4 - 20 mA can be selected.

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

Example 2 Measuring points, Interface 4 - 20 mA



Example 1 Measuring point, Interface 0 - 20 mA

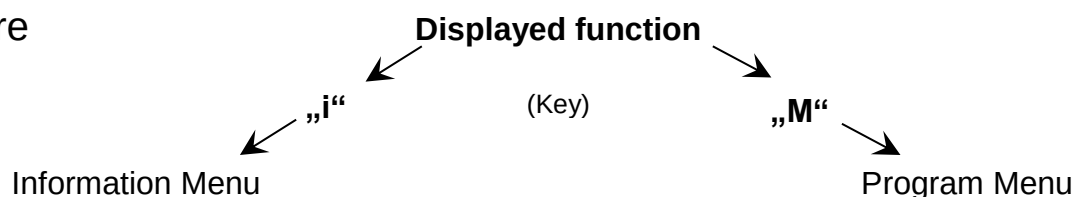


The maximum load of 500 Ohm should not be exceeded! For faults and when using very long cables (approx. 20 m) a screened cable should be used if possible.

Serial interface RS232 (interface RS910)

Connection of the unit, e.g. to a central control room or the printout of measuring results and error messages, can also occur via the serial interface RS232.

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

Input (In the program menu "M" only)

- Select a programming step via the arrow keys "^" and "v" 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 "v" 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" and "i" key to jump 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 the current settings and statuses of the unit, the error history, the date of the next maintenance and the customer service address.

Call (1)

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

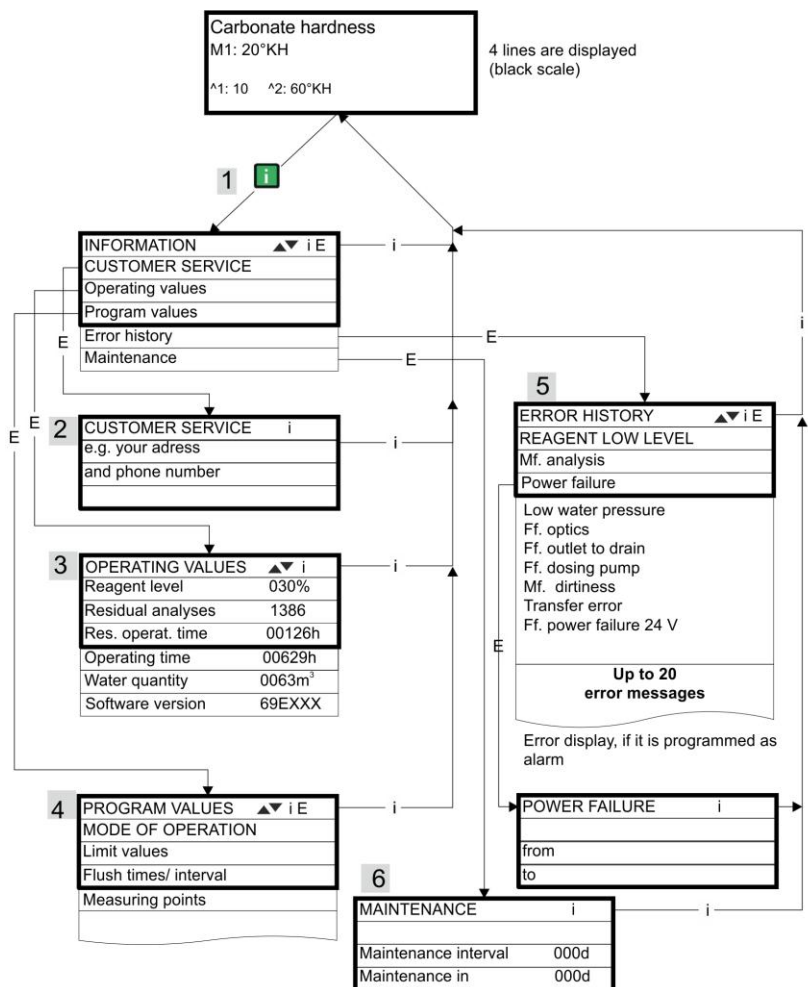
Customer service (2)

Display of the customer service address or, e.g., a service phone 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.
Note: Calculation of the residual analyses occurs with the lowest filling level of the two reagents and with a mean measuring value.



Information menu

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: "i" → INFORMATION → PROGRAM VALUES → LIMIT VALUES

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 16.06.99 06:56
to 16.06.99 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

See "Maintenance" for further information.

Program menu "M"

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

Call: (1)

Use the "M" key to open the menu.

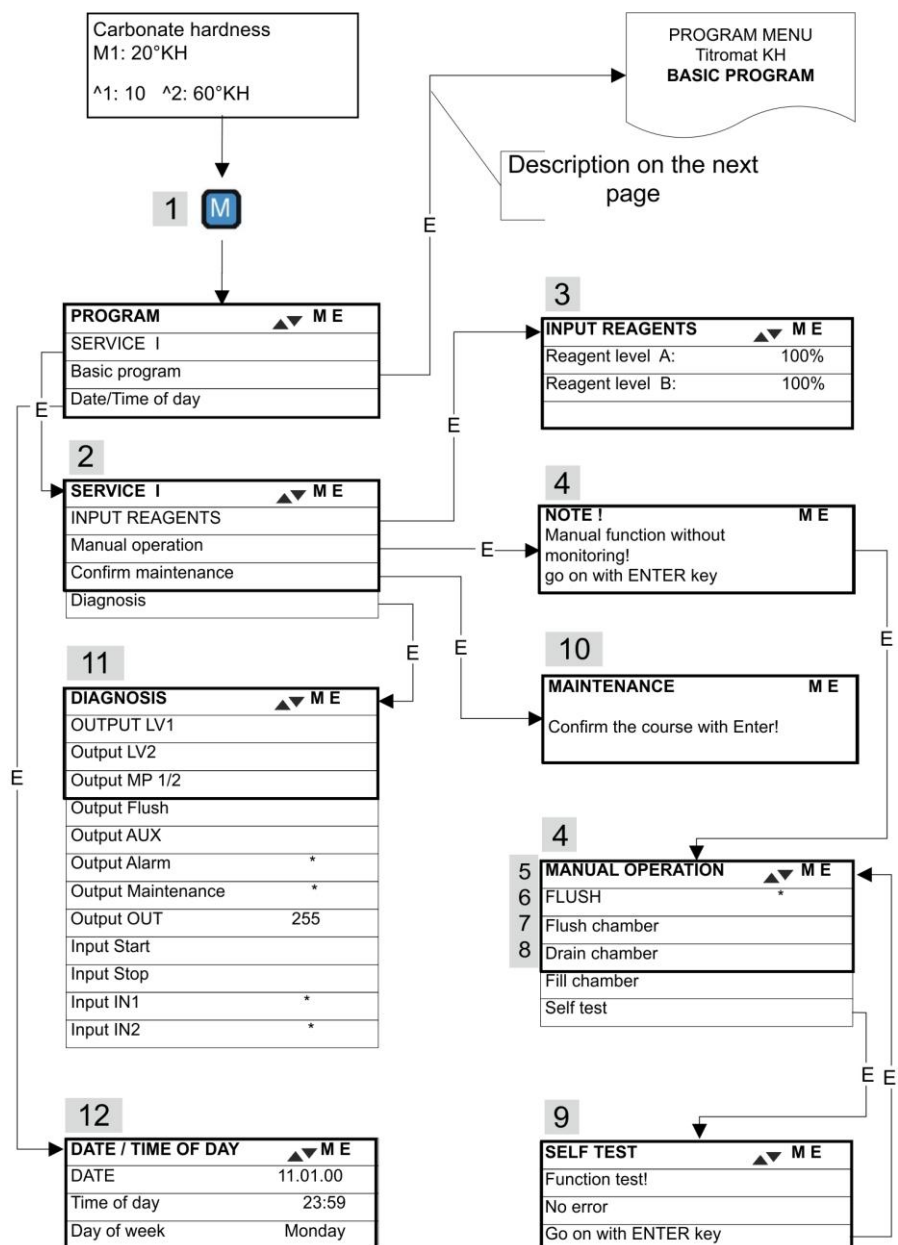
Service I (2)

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 A Filling (0 -100%)" or "Reagent B 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 and confirm it via "ENTER".

Manuel 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 checking 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.

Self-test (9)

Press the "ENTER" key to start the self-test program of the Titromat[®]. The program checks all the relevant functions of the unit and carries out an analysis. If the check is fault free, the message (9, see illustration) will be displayed. Press the "ENTER" key again to cancel this function and to return to the "MANUAL OPERATION" menu.

If errors have occurred, a respective message is displayed!

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)

The relay outputs can be switched on and off via the "Enter" key.

Time/Date (12)

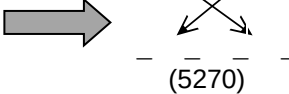
Set the time and date by selecting and activating the desired function via the arrow keys and the "ENTER" key. Subsequently press the "ENTER" key again to save the setting and to return to the display function.

Basic program

This menu item can only be accessed after entering the password!

Example for password entry:

```
> BASIC PROGRAM
21.04.00      07:25
Password:    _____
```



After entering the password and confirming it via the "ENTER" key, it is possible to carry out basic programming of the unit and to select various service functions (e.g. calibration).

Program values

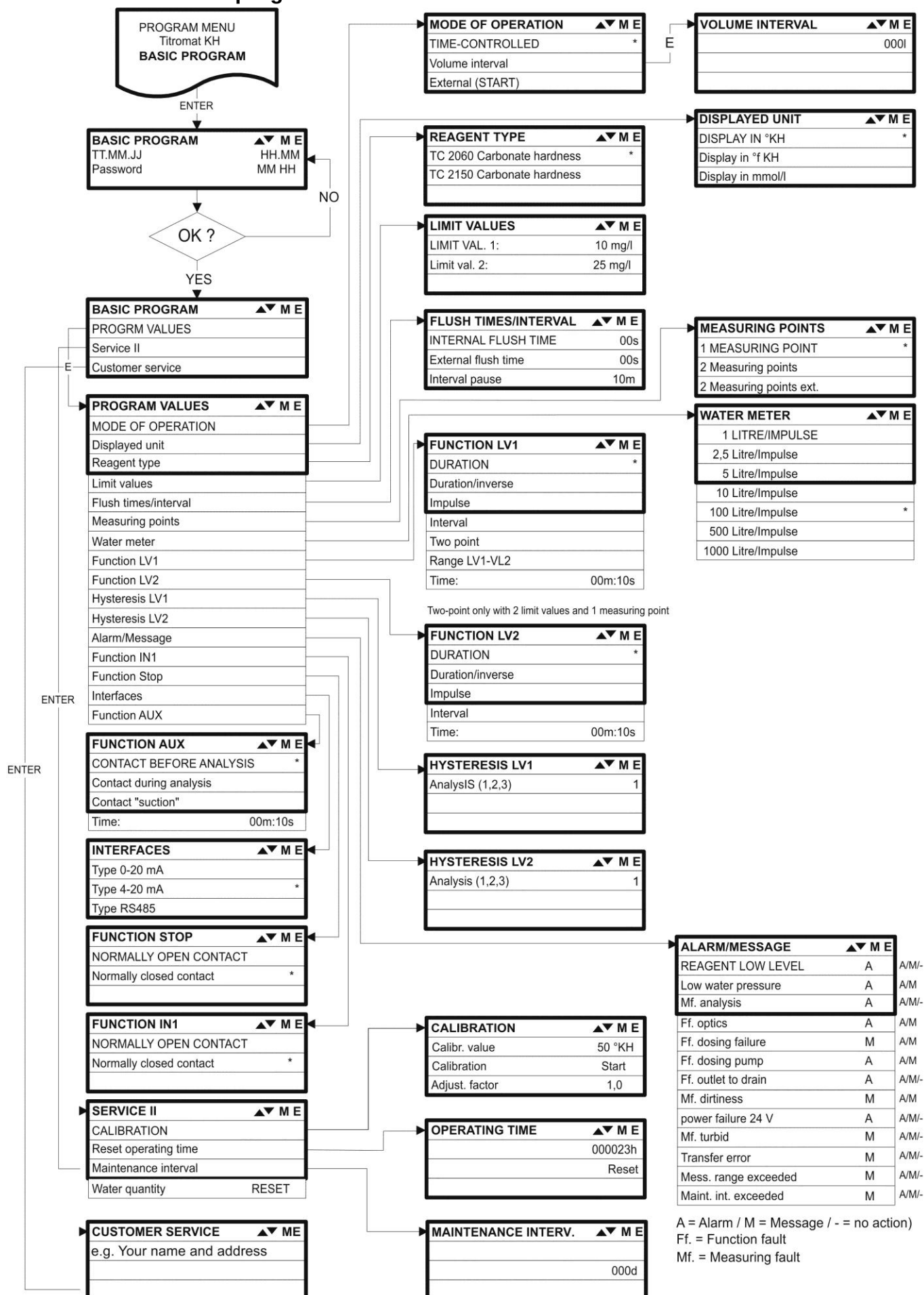
Press the "M" and "I" key to call the basic factory default setting and switch on the unit. The values and settings of the basic default setting are described in the structure of the basic program (see chapter Basic program -Structur of basic program).

The following program values can be entered and stored in the basic program via the respective menu items:

Abbreviations:

- s = seconds
- m = minutes
- h = hours
- T = days
- l = litres

Structure of the basic program



Call the basic factory default setting by simultaneously pressing and holding down the "M" and "i" keys while switching on the unit. CAUTION, the most recent programming will be lost!

Error messages / Troubleshooting

Displayed Message (flashes at selected display)	Unit result functions	Possible causes	Remedies
POWER FAILURE 24 V CANCEL WITH HORN-KEY	- After programming: Continuous alarm or message impulses - Standby	Internal power failure of the 24 V supply	Replace fuse F4 or F8 (The control-lamp "Power" of the dosing pump must light up)
Ff. DOSING PUMP CANCEL WITH HORN-KEY	- After programming: Continuous alarm or message impulses - Standby	- Dosing pump 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	The water is turbid / dirty	
MEASURING RANGE EXCEEDED CANCEL WITH HORN-KEY	- After programming: Continuous alarm or message impulses or no message - Continue measurements	The measuring range is exceeded	Choose another type of reagent (Basic program)
LOW WATER-PRESSURE CANCEL WITH HORN-KEY	- After programming: Continuous alarm or message impulses - Standby	- No water input although LED "IN" lights up - Inlet pressure too low - Overflow reagent is not active	- Check water inlet - Connector of the inlet valve oxidised - Clean filter strainer - Replace valve block - Extract pressure regulator valve - Replace fuse F6
Ff. OUTLET TO DRAIN CANCEL WITH HORN-KEY	- After programming: Continuous alarm or message impulses - Standby	Water remains in the measuring chamber although LED "OUT" lights up	- Check water outlet - Connector of 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	Reagent quantity is below minimum setting without BOB: 50 ml (10 %), with BOB: after calculation	Check reagent level, fill up if necessary (enter level: "M" →SERVICE)
Mf. DIRTINESS CANCEL WITH HORN-KEY	- After programming: Continuous alarm or message impulses or no message - LED and output "maintenance" on - Continue measurements	Sight-glass windows dirty	Clean sight-glass windows
Ff. OPTICS CANCEL WITH HORN-KEY	- After programming: Continuous alarm or message impulses - Standby	Plug-in circuit board defective Error at the optic component (Transmitter or Receiver defective)	- Replace plug-in circuit board - Replace measuring chamber sealing rings
Mf. ANALYSIS CANCEL WITH HORN-KEY	- After programming: Continuous alarm or message impulses - Standby	- Incorrect analysis, e.g. - Air in the dosing capillary - incomplete blending - Reagent too old or use of third-party reagent	- Tighten connections of the dosing pump - Replace stirring mechanism - Replace suction insert in the bottle - Replace reagent, only use HEYL Titromat® reagent
Ff. DOSING FAULT CANCEL WITH HORN-KEY	- After programming: Continuous alarm or message impulses or no message - LED and output "maintenance" on - Continue measurements	Dosing inaccuracy of the dosing pump	Replace dosing pump or return to the supplier for calibration
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	Programmed maintenance date reached or exceeded	Carry out maintenance and finally cancel or confirm

Ff. = Function fault
Mf. = Measuring fault

Further information

Error	Possible causes	Remedies
Current interface functions incorrectly	-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	-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 if

- the programmed maintenance date has been reached (display "maintenance date exceeded")
- the unit displays the following error messages: "Mf. soiling" 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!

 If the measuring range of the unit is exceeded over a longer period, a coloured film may form on the sight-glass windows. This adhesive film can be removed quite easily with alcohol.

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. Loosen the hose connections at the filter housing.
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. The film on the sight-glass windows can be easily removed with alcohol.
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 Titromat®
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.

- Switch the unit to STANDBY
- Manually fill the measuring chamber
- Manually dose the reagents ("Manual" key)
- 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).

Spare parts list Titromat®

Item No.	Pressure regulator
40125	Regulator / filter housing complete
40120	Regulator / filter housing
40129	Regulator plug T2000, complete
11225	Flow regulator valve complete
11230	Retaining pin 3x38, 90 Degrees
11217	Inlet filter 19,5dx25
11218	Spring for inlet filter
40121	Inlet connector
40153	Plug in connector G 1/4" -6
Measuring chamber	
40173	Sight-glass window with seal, T2000
40170	Sight-glass window 30 x 3
40176	Sight-glass retaining disc
33253	Screw spindle M3 x 40
40032	Latch fastener TL-17-201-52
11210	Plug for measuring chamber
40022	Measuring chamber complete T2000
Holding block for measuring chamber	
40370	Holding block DUO
40050	Magnetic stirrer
40186	Plug connector
40018	Solenoid valve, 2/2-way
40181	Rear guide bar for measuring chamber 5 x 60
Dosing pump DOSI Clip®	
40001	Jet pump complete
40011	Suction capillary complete
40016	Pressure capillary complete
37232	Base circuit board TI, complete
40040	Valve set
32046	Plastic cover CNH 45 N
Bottle connection / Suction tube	
40131	Screwed cap with bottle insert T2000
40130	Screwed cap GL32 -only
40135	Bottle insert for screwed cap with push-fit suction tube

Item No.	Electrical components	
31582	Fuse M4A	
40294	Base circuit board T2000 complete 230V	
40092	Control circuit board T2000 complete	
40091	Plug-in circuit board Transmitter / Receiver T2000 complete	
40190	Cable sleeve 5 - 7	
40191	Cable sleeve 7 - 10	
40197	Mains on / off switch T2000	
40198	Cover for Mains on / off switch	
31713	Multi-pin strap cable 10 pol. with EMI filter clamp	
40096	Multi-pin strap cable 26 pol. with EMI filter clamp	
40060	Cable loom 2V complete (For Valves)	
40062	Cable loom 2P complete (For max.2 Dosing pumps)	
40200	Cable loom for Mains on/off switch complete	
31596	Fuse T0.08A	
31585	Fuse T0.315A	
31595	Fuse T0.1A	
31622	Fuse T0.16A	
31592	Fuse T1.0A	
Spare parts requirement for 2 - 3 years of operation		
40173	Sight-glass window 30 x 3 with seal	2
11217	Inlet filter	1 x
40124	Gasket set T2000 (after maintenance)	X*
31585	Fuse T0.315A	1
31592	Fuse T1.0A	1

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

Accessories:

Item-No.	
040123	Optional adapter for water inlet T2000
270305	Interface 0/4-20mA (interface card SK 910)
270310	Serial interface (Interface card RS 910)
270315	Interface 0/2-10V (Interface card UK 910)

Reagents:

Order-no.

155176	TC2060A	Titromat TC 2060, reagent A
155177	TC2060B	Titromat TC 2060, reagent B
155178	TC2150A	Titromat TC 2150, reagent A
155179	TC2150B	Titromat TC 2150, reagent B

Technical Appendix

Conformity declaration

EC Conformity Declaration



for the following product

Titromat KH

Microprocessor controlled titration monitor for carbonate hardness

We hereby confirm that the above product conforms to the principal health and safety regulations laid down in the EC Directives 2004/108/EG and 2006/95/EG. This declaration applies to all units produced in accordance with the attached manufacturing documents which are a constituent part of this declaration.

The product was assessed with reference to the following standards:

EN 61000-6-4: Electromagnetic compatibility, Generic emission standard

EN 61000-6-2: Electromagnetic compatibility, Generic immunity standard

EN 61010-1: Safety requirements for electrical equipment for measurement, control and laboratory use

This declaration is made on behalf of

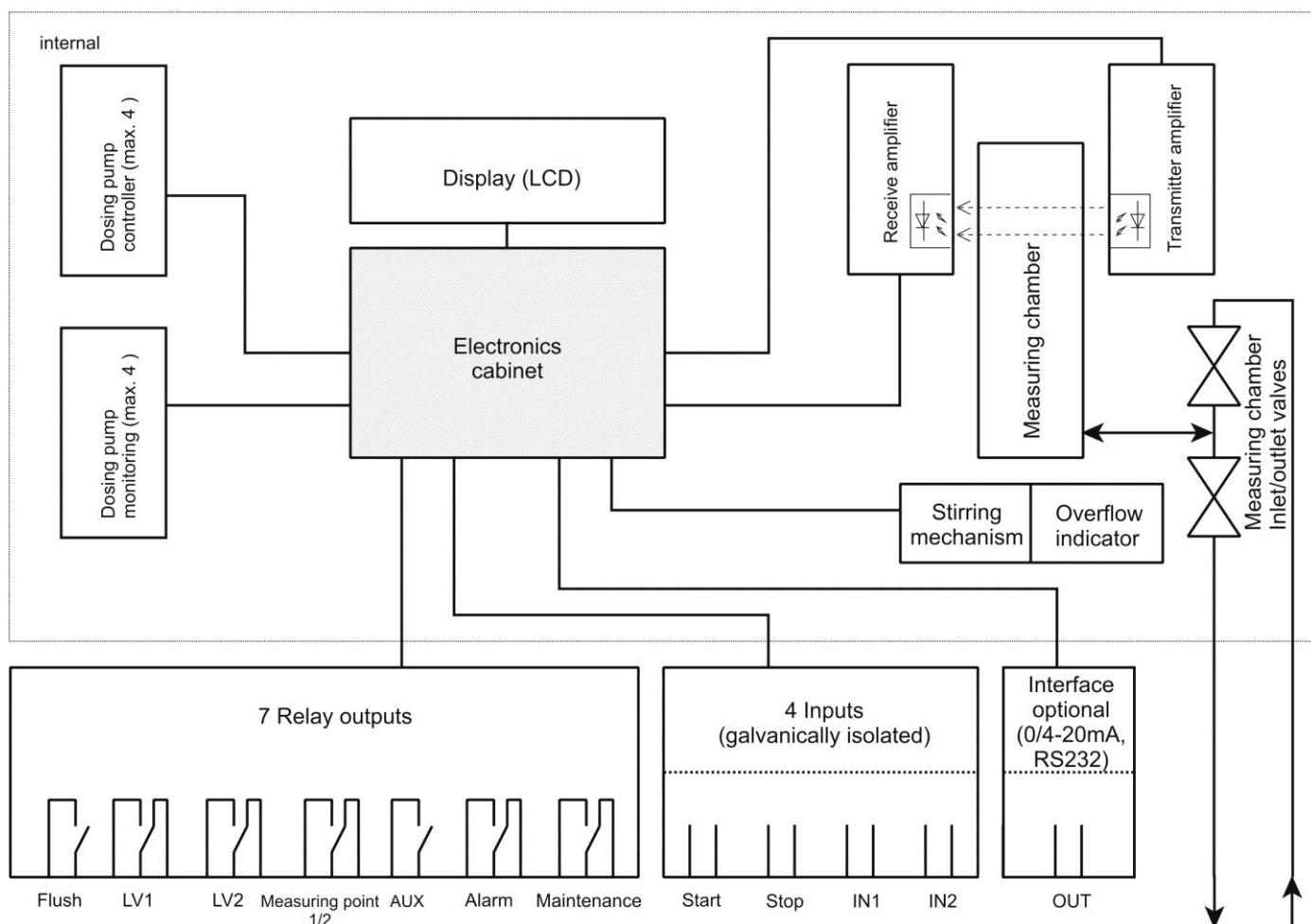
GEBRÜDER HEYL
Analysentechnik GmbH & Co. KG
Orleansstraße 75b
31135 Hildesheim

by


Jörg-Tilman Heyl
General Manager

Hildesheim, 14/11/2013

Block diagram Titromat®



Technical data

Power supply: 230 V or 24 V $\pm$ 10%, 50-60Hz, fuse M4A

Unit protection: 230 V: T0,1 A

24 V: T1,0 A

The unit is non-volatile

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 M 4 A

Measuring range: see "Short description"

Current interface: 0/4 -20 mA, max. load 500 Ω (optional), galv. Isolated

Serial interface: RS 232 for log printer (optional)

Water supply: 0.3 -8 bar

Water temperature: max. 40 °C

Dimensions (B x H x T): 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!

Titromat_KH_GB_131212.docx

LENNTECH
WATER TREATMENT SOLUTIONS

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