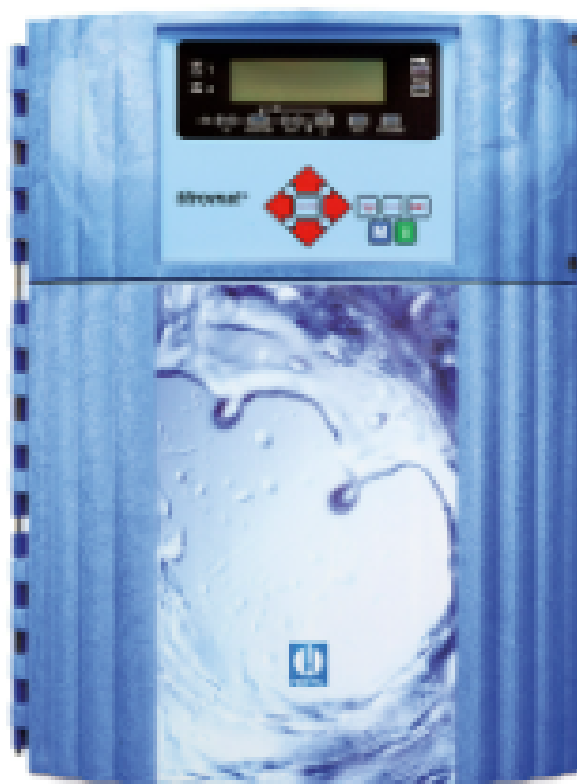


Titromat[®] M1

**Microprocessor controlled titration monitor
for carbonate hardness 0.05 - 1.0°dH**



Operating instructions

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Introduction

This operating instruction describes installation, operation and programming of the analysis unit Titromat® M1. We recommend that, whilst familiarising yourself with the operation of the unit aided by this manual, you have immediate access to the unit in order to perform the functions and combinations as described. As certain functions are interrelated, it is advisable to follow the instructions in the given order.

Should problems or questions arise which are not described in this manual 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 conditions under which it has occurred. This will enable us to offer you swift effective assistance.

Symbols and abbreviations used in these instructions:

L Note for the user "STANDBY" = STANDBY lamp is "ON"

 Important to observe / warning note "M" = Press menu key M **T** Tip: Helpful hint

◦ SERVICE ◦ MANUAL OPERATION ◦ FLUSH = Sequence in a menu selection

Short description

The Titromat® M1 is used for the automatic measuring and monitoring of the carbonate hardness in the range of 0.05-1.0°dH (0.018-0.36mmol/l) with a resolution of 0.025°dH (0.009mmol/l) and accuracy of +/-0.1°dH (+/-0.04mmol/l) with the reagents TC2010A and TC2010B.

	Unit			
	°dH	°f	ppmCaCO ₃	mmol/l
Range/Display (Resolution)	0.05 - 1.0 (0.025)	0.09 - 1.8 (0.045)	0.89 - 17.8 (0.44)	0.02 - 0.36 (0.01)

L A consistently reliable result can be guaranteed by the Titromat® M1 only with the use of original HEYL Titromat® M1 reagents ! Failure or problems which are caused by the use of different indicators are not covered by the warranty or refund services.

 A fine preliminary filter should be installed if the medium to be measured has a strong intrinsic colouring or is turbid.

For pH values below pH4.3 it is not possible to measure the carbonate hardness (of the m value. This is displayed as the measurement result "<0.05°dH".

At a concentration of more than 100 mg/l of CO₂ (carbon dioxide) in the water, the excess carbon dioxide must be removed by installing a Type R aerator in the feed water line to the Titromat® M1 unit.

Notes for the user

- **Repeated switching 'on' and 'off':**

Wait at least for 5 seconds before you switch the unit repeatedly 'on' or 'off' at the main switch.

- **Observation of the environmental conditions:**

In order to guarantee a reliable operation, the unit must only be used under the environmental conditions described in the technical data. Protect the controller against excessive humidity, condensation and water-splash.

- **Safety seal:**

The original seals attached during manufacture (e.g. EPROM labels) must not be broken, otherwise all warranty rights are lost.

- **Malfunction / repair of defective units:**

The repair of a defective unit is only possible when the unit is dismantled and returned to us with a description of the fault. This in no way affects the guarantee rights. In addition, please inform your supplier of the reagent type used and of the quality of treated water measured.

Before you return the unit for repair, remove the reagent bottle and ensure that the measuring chamber is flushed out and empty.

- **Electrical load capacity**

The maximum electrical load capacity of the relay outputs and the total power rating must not be exceeded.

- **Operate the Titromat® M1 strictly in accordance with the manufacturer's instructions.**

- **Environmental protection regulations**

Please observe the environmental protection regulations and collect any unused reagent for safe disposal in accordance with local statutory requirements.

Operational Checks

Careful handling of the unit increases both the operational reliability and the service life!

Therefore the following visual inspection should be carried out at regular intervals.

- Are the hose connections with the dosing pumps 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 properly closed? (Check door seals !)
- Is the unit unduly contaminated with dirt?

Maintenance and servicing notes

(see chapter maintenance)

Safety notes

- The unit must be installed and operated in compliance with the relevant standards (e. g. DIN, VDE, UVV) or in accordance with the regulations laid down by the individual country.
- Some functions (e. g. the manual analysis) allow the direct manipulation of the installation without locking or monitoring. These functions may only be used by trained staff and for this reason they are only accessible after a pass word has been entered.
- If you observe the unit malfunctioning, switch it off immediately. Then shut off the water supply and contact your supplier.
- Do not attempt to repair the unit yourself (loss of warranty rights); instead always get in touch with the authorised service staff. This is the only way a reliable and safe operation of the unit can be ensured.
- After a protective circuit (fuse) has tripped, first of all, attempt to correct the cause of the malfunctioning (e. g. replace the solenoid valve) before reactivating the protective circuit. Frequent tripping is always due to a fault which, in certain circumstances, may also cause damage to the unit.
- Observe the safety notes about working with reagents, chemicals and cleaning agents.



Ignoring these notes can result in damage to the unit as well as the installation and may result in a loss of warranty rights.

Installation and commissioning

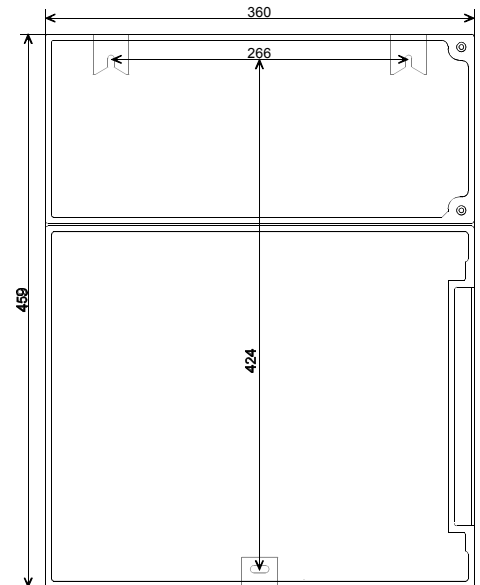
Installation and commissioning must be undertaken only by authorised technicians!

Installation

The unit should be fixed vertically!

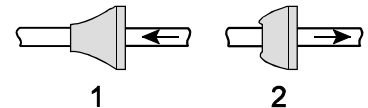
Avoid tension of the housing.

The unit doors swing to the left when they are opened. Please ensure that there is sufficient space for opening them. In this way, you facilitate the electrical installation and later maintenance and service work.



Dimensioned sketch

 Check supply voltage on the rating plate!



Basic requirement

The 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). Then 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 after the installation is completed using the two fastening screws.

Mains water supply

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

L In the event of higher temperatures, the Type KCN cooler must be installed in the branch line of the Titromat®.

 Hot water can lead to scalding!

L Heavy pressure oscillation should be avoided!

The branch line should be positioned as close as possible to the outlet from the water softening plant. The branch line to the Titromat® with a hand-operated shut-off valve must be kept as short as possible and not longer than a maximum of 5 metres. It is important that the branch line connection is taken vertically from the top of the main soft water line in order to prevent dirt particles from entering into the measuring chamber.

When operating the Titromat® M1 with the pressure range of 0.1 to 1 bar remove the valve body out of the regulator/ filter housing.

Plug connector

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

Quick-acting coupling (accessory: Optional adapter for water inlet, Order no. 40123)

When 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-acting coupling (not included with the delivery).

Preliminary filter

The installation of a preliminary filter is recommended if the measuring water of the Titomat® contains turbid substances. Please contact us in order to carry out an adjustment of the instrument if the medium to be measured displays strong intrinsic colouring which cannot even be eliminated by filtration.

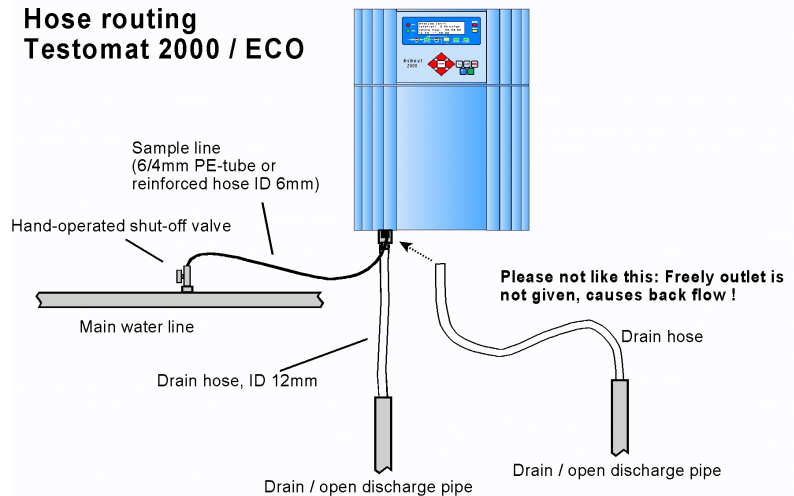
Water to drain

The feed water flows through the measuring chamber then, via the outlet pipe, to the drain (hose connection internal diameter 12 mm).

Make sure, by using a funnel for example, that the water can run freely to drain and cannot back-up into the measuring chamber.

A hose impervious to light should also be used for the drain pipe (to discourage algae formation).

Hose routing Testomat 2000 / ECO



Commissioning

1. Full reagent bottles must be connected before commissioning and switching on. Attach the suction connection onto the reagent bottles using the union nuts.
2. Switch the unit 'on' and press the "STANDBY" key. In this mode, an analysis is prevented from being carried out before a correct program has been entered which could possibly result in an error or alarm message.
3. Then bleed the dosing pumps and the capillary by repeatedly pressing the "Manual" key on the dosing pump. Ensure all air is removed from the tubings ! (If necessary tighten up the connections.)
4. Program the unit as applicable to your requirements, e. g.:
 - Mode of Operation
 - Limit values
 - Flush time/interval

For a description of programming see from page 18.

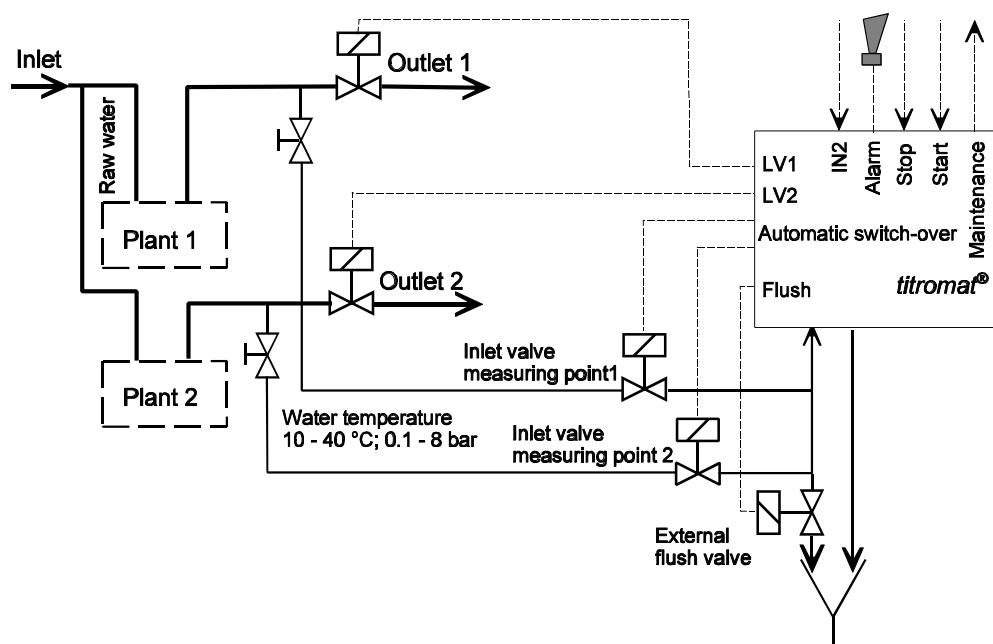
5. Then remove all air from the water supply side of the unit by manual flushing.

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

You should continue flushing until no bubbles can be seen in either the measuring chamber or the filter housing.

6. Check all connections for tightness.
7. By pressing the "Manual" key you carry out the first analysis.

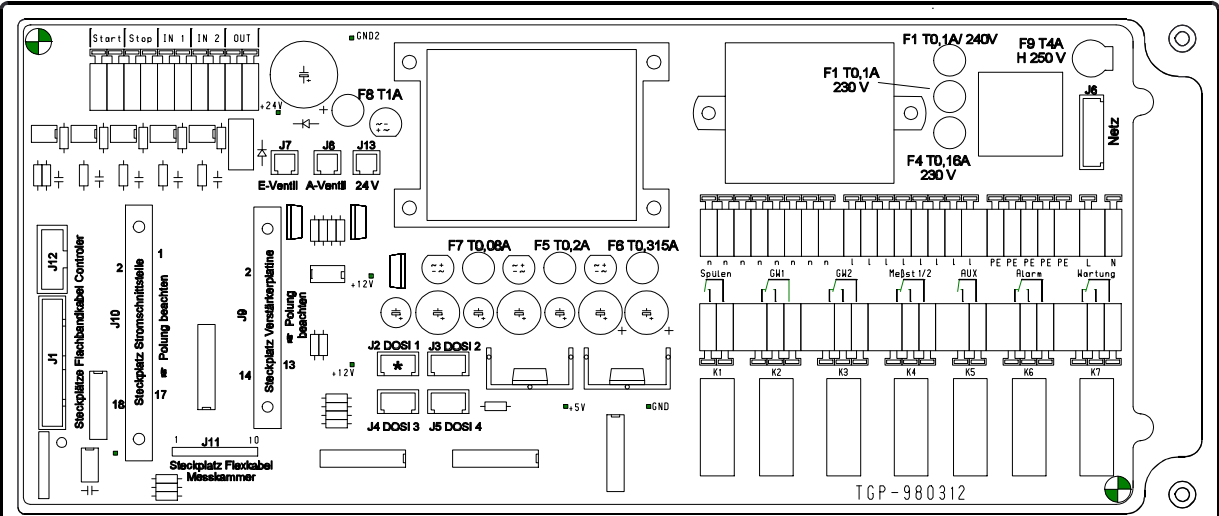
Installation diagram (Example):



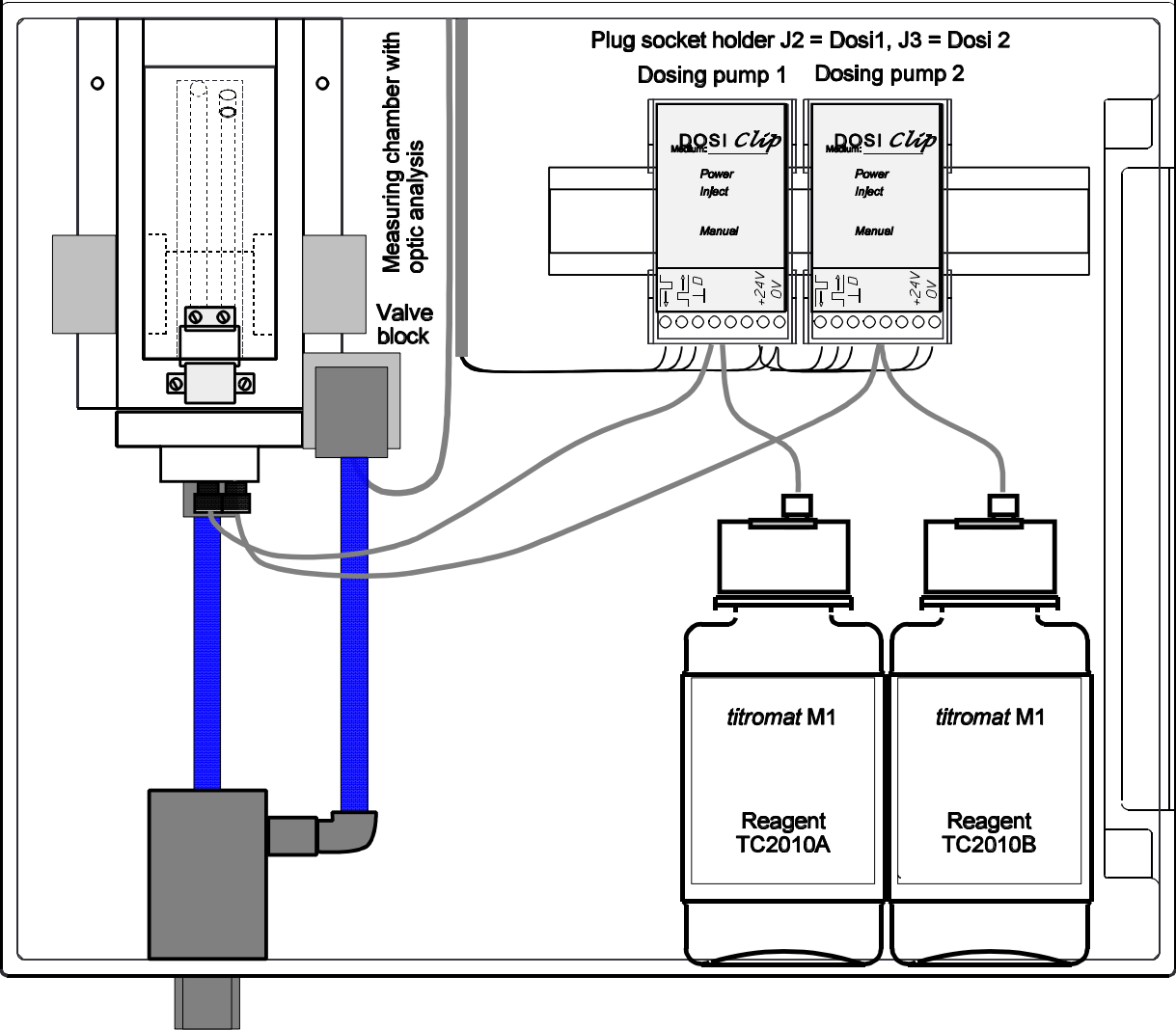
General description

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

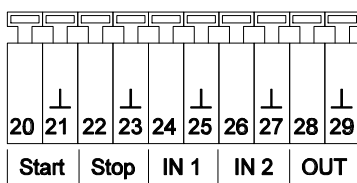
Terminal block identification

Functions

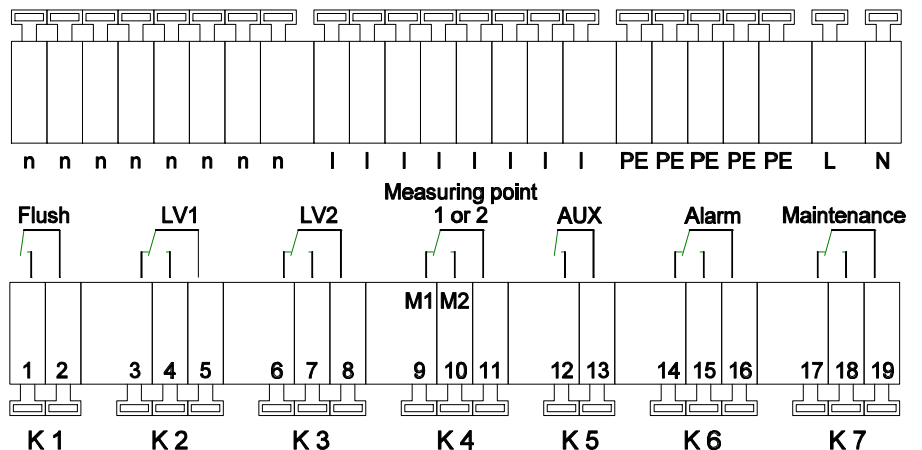
IN = Input, OUT = Output

No.	Terminal	Type	Function	Note
-	PE	IN	Mains - Protective earth (5 x)	Only at mains 115 / 230 V !
-	N (U)	IN	Mains, N = Neutral (U = 24 V)	Mains - input
-	L (V)	IN	Mains, L = Live (V = 24 V)	24 V / 115 V / 230 - 240 V AC
-	l	OUT	Live, switched (8 x)	Mains voltage, max. 4 A
-	n	OUT	Neutral, 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 point 1/2	OUT	Measuring point 1 - Normally closed Measuring point 2 - 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 - Normally closed Fault message - Normally open Fault message - 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 2	IN	External analysis start Common earth for inputs	Only for volt-free normally open contact!
22 23	Stop 2	IN	External analysis stop Common earth for inputs	Only for volt-free normally open/ normally closed contact !
24 25	IN1 2	IN	Universal input 1 Common earth for inputs	Only for volt-free normally open/ normally closed contact!
26 27	IN2 2	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	Potential output ! 28 = 0/4 - 20 mA, 29 = 2

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



Terminal block for mains connection and relay outputs



Description of displays and operating features

(1) Power switch

The 'ON'/'OFF' switch is located on the right-hand side panel.

(2) Unit fuse (inside the unit)

Protects outputs against overload and short circuit.

3 Status of limit value displays

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

4 Text display

Displays the current analysis, all important status results and programming data in a 4-line LC-Display.

5 Alarm

Displays a function fault.

6 Maintenance message

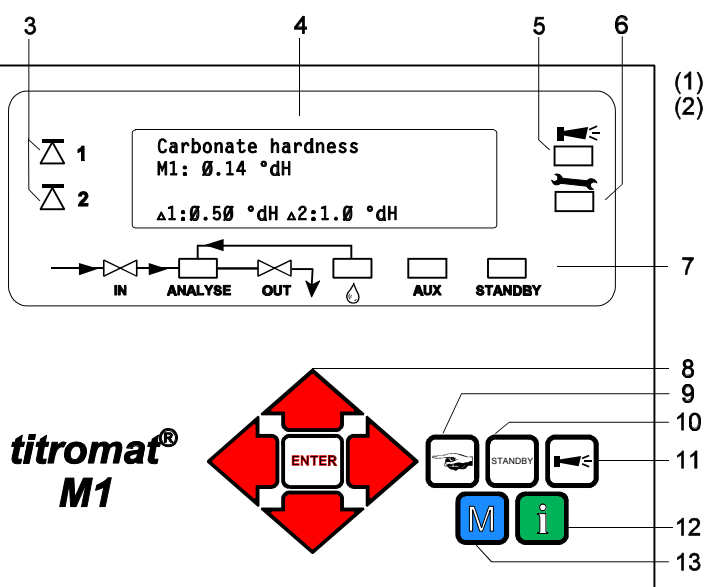
Displays a maintenance request.

7 Status display

6 LEDs signal the current status (analysis and unit status) of the Titromat® M1.

8 Programming keys (Cursorblock with ENTER)

These keys are used to enter all values and programming data.



Function keys:

9 "Manual" = manual start of an analysis

10 STANDBY = manual analysis stop/standby

11 "Alarm" = cancels alarm message

12 i-key

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

13 M-key

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

Display functions

Status of limit value displays 1 and 2

The display signals the status of the limit values.

1: The red display lamp lights up if the limit value 1 is reached or exceeded.

Lights up green if the measured value falls below the set limit value.

2: The red display lamp lights up if the limit value 2 is reached or exceeded.

Lights up green if the measured value falls below the set limit value.

Measured value display

In line 2 and 3 the current measured value for measuring point 1 (M1:) and 2 (M1:) are shown.

When the measured value falls below the measuring range "<" is displayed: e. g. M1: < 0.89 ppm CaCO₃

When the measured value exceeds the measuring range ">" is displayed: e. g. M1: > 35.7 ppm CaCO₃

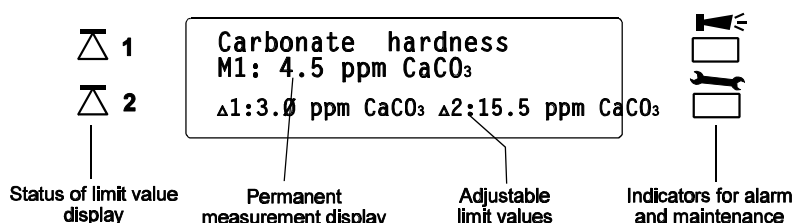
Limit value displays

The adjustable limit values are shown in the bottom display line.

Alarm and maintenance message

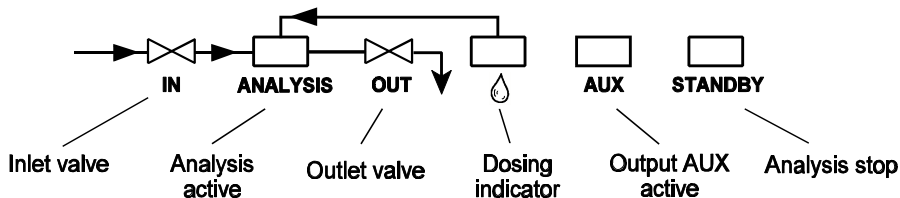
Display of present error messages (red) and of present maintenance request (yellow).

L Error messages are displayed alternately with the normal display text and can only be deleted by cancellation and correction of the fault.



Status display

The flow diagram displays the current operational status.



Description of relay outputs

(Flush) External flush valve

In the event that when installing the unit, the use of a long sampling tube is unavoidable, we recommend the fitting of a programmed flush valve upstream of the unit.

Also, in cases where the unit is used for monitoring two measuring points, an external flush valve should be installed in order to prevent faulty measurements caused by mixing of the samples.

Immediately before each analysis the external flush valve is opened for a programmed period, thereby allowing the tube up to the Titromat® M1 to fill with water to be measured. Please ensure that the programmed flush time is sufficiently long to avoid any air-lock. You set the flush time with menu item

"M" ° BASIC PROGRAM ° PROGRAM VALUES ° FLUSH TIMES/INTERVAL ° EXTERNAL FLUSH TIME .

LV1 and LV2 Limit value outputs

For reporting that a limit value has been exceeded, two volt-free relay contacts are available. For both contacts the limit values, the hysteresis and the function can be independently programmed:

Function	Type of contact	Action
LV1 – active at limit value in excess of limit value 1 or measuring point 1	volt-free change-over contact	programmable: – Continuous contact – Impulse (1 - 99 seconds/minutes) – Interval (1 - 99 seconds/minutes) – Two -step regulator (one measuring point only) – Hysteresis (1, 2 or 3 limit value in excess)
LV2 – active at limit value in excess of limit value 2 or measuring point 2	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 in excess)

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 you use the unit for monitoring two measuring points, the solenoid valves (individual valves or one 3/2-way distributing valve) must be connected to the corresponding sampling tubes. It is important that the terminals are strictly allocated to the appropriate measuring points.

Terminal 9 = Measuring point 1

Terminal 10 = Measuring point 2

"M" ° BASIC PROGRAM ° PROGRAM VALUES ° MEASURING POINTS

AUX Programmable function output

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

1. Message of an current analysis

"M" ◦ BASIC PROGRAM ◦ PROGRAM VALUES ◦ FUNCTION AUX ◦ CONTACT DURING ANALYSIS

and/or

2. Contact before an analysis, e. g. control of a cooler

"M" ◦ BASIC PROGRAM ◦ PROGRAM VALUES ◦ FUNCTION AUX ◦ CONTACT BEFORE ANALYSIS

or

3. Contact after an analysis

"M" ◦ BASIC PROGRAM ◦ PROGRAM VALUES ◦ FUNCTION AUX ◦ CONTACT AFTER ANALYSIS

An active output AUX is indicated with the LED "AUX"

Alarm Fault message

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. When the voltage fails, the contact between terminals 14 – 16 is closed and the one between 15 – 16 is open.

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

- With a continuous contact, the "Alarm" output remains activated (with terminals 15 – 16 closed) as long as the fault persists.
- For a message impulse, the output is alternately switched 'on' for 2 seconds and then switched 'off' for 5 seconds.
- If several faults with different programmed messages are reported simultaneously, the output is switched to continuous contact.
- The red LED "Alarm (5)" and the text on the display indicate a fault.
- The error signal at the "Alarm" output is deleted by cancelling the fault with the "Horn" key.
- An error message can only be deleted after the fault has been corrected.
- **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 fault history (also see i-menu, page 16).

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

The following conditions **always** trigger an error message:

Power failure
Low-water pressure
Function fault optics
Measuring fault analysis
Function fault dosing pump
Function fault outlet to drain
Function fault failure 24V

Conditions which can be **programmed** as faults:

Reagent low level
Function fault dosing error
Measuring fault dirtiness
Measuring fault turbid
Measuring range exceeded
Maintenance interval exceeded

Error messages are described on page 20.

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 terminals 17 – 19 is closed and the one between 18 – 19 is open.

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

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

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

"M" ◦ SERVICE ◦ CONFIRM MAINTENANCE

The following conditions activate the "Maintenance" output:

Reagent low level
Measuring chamber dirty (Measuring fault dirtiness)
Maintenance date reached

For a more detailed description of the programming refer to pages 10-19. For general maintenance refer to page 21.

Description of the signal inputs and output

L Connect the signal inputs "Start", "Stop", "IN1" and "IN2" with **volt-free** contacts only!

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	– Mode of operation EXTERNAL starts an analysis by triggering a contact at the input
Stop – external analysis stop (e. g. via flow controller or from the process controller)	programmable normally closed/ normally open volt-free!	none	– So 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 change-over of measuring point (for selection of the active measuring point)	programmable normally closed/ normally open volt-free!	none	– So long as the contact at the input is 'open' or 'closed', no analyses are carried out from measuring point 2.
IN2 – Water meter input	normally open volt-free!	none	– Quantity recording to start an analysis and plant control

"M" ° BASIC PROGRAM ° PROGRAM VALUES ° INPUT IN1

OUT Interface output (optional)

Function	Terminal	Action
programmable interface – 0 - 20 mA – 4 - 20 mA	max. load 500 Ohm	programmable – Measured value measuring point 1 or 2
serial interface RS232	serial bus (2-cable-line)	– see description of the plug in circuit card RS910

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

"M" ° BASIC PROGRAM ° PROGRAM VALUES ° INTERFACES

Function characteristics

Mode of operation (analysis controller)

1. **Time control:** Internal triggering by a timer. The shortest interval = 0 minutes between analyses, longest interval = 99 minutes.
(see Flush times/interval)

L 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 is a **direct** function of the value to be measured.

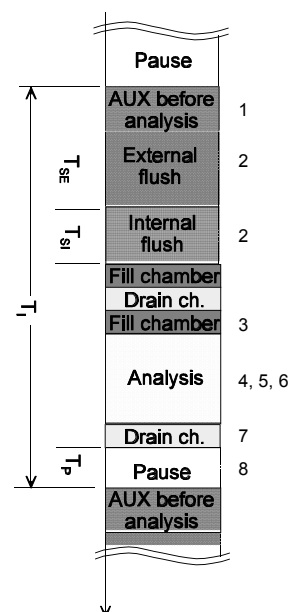
2. **Quantity control:** Triggered by the water meter.
Minimum interval = 1 litre, maximum interval = 9999 litres.
After the programmed water quantity is measured, the analysis is carried out. Prior to the analysis, the capillary and the measuring chamber are flushed (observe the programmed flush times).

3. **External analysis start** via contact "Start" input

L The current analysis interval can be interrupted by making contact at the "Stop" input.

Analysis cycle (Example with schematic cycle diagram)

- 1 Supplementary program AUX before analysis
- 2 Flush branch line and measuring chamber (note flush time of the sampling line), T_{SE} and T_{SI}
- 3 Fill measuring chamber
- 4, 5 Check the sample for dirtiness, dosing reagent A (5 steps) and titration with reagent B (stirring mechanism is "ON")
- 6 Evaluate and display reaction
- 7 Drain measuring chamber
- 8 Pause period up to the next analysis (time or quantity analysis interval), T_p .
 T_i = total analysis interval, ch = measuring chamber



Displayed unit

Programmed hardness unit is displayed. You have the choice of °dH, °f, ppm CaCO_3 and mmol/l. The unit entered will now be displayed as programmed.

Setting the timer

Internal flush

In order to ensure the analysed sample represents the current value, the sampling tube must be sufficiently well flushed taking its length into consideration. After the installation has been out of operation for a longer period, or in the case of long analysis intervals, it is sensible to select a flushing time in excess of 60 seconds. Flush is initiated by simultaneously opening the Titromat[®] M1's inlet and the outlet valves.

- L** The analysis interval directly depends on the programmed flush time. If a flush time of, for example, 90 seconds is set, the analysis interval itself cannot be shorter than 90 seconds.

MODE OF OPERATION	▲▼ M E
TIME-CONTROLLED	*
Volume interval	
Dynamics	
External (START)	

DISPLAYED UNIT	▲▼ M E
DISPLAY IN °dH	*
Display in °f	
Display in ppmCaCO ₃	
Display in mmol/l	

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

External flush

In cases where a very short analysis interval is required, a very long (several meters) sampling tube must be used or a tube with a large diameter is used, an external flush valve should be installed upstream of the Titromat® M1. This is connected to the "Flush" outlet. The external flush time for the valve depends, like the flush time for flush by the unit, on length and diameter of the connection to the Titromat® M1.

Example: For connections longer than 3 m and an internal tube diameter of 4 mm, a minimal internal flushing time of 10 seconds is required to ensure a valid sample is taken from the sampling tube. The quantity of flush water for an internal flush of 1 minute is 0.5 litre.

Interval pause

In the case of timed triggering of the analysis, the interval between two analyses (plus flush time) is determined by the interval pause. The shortest interval can be 0 minute. In this case, the analyses are carried out continuously. The longest interval is 99 minutes.

Monitoring of limit value

You can program the limit value on a continuous scale. The range for the limit value depends on the reagent type used and on the programmed unit.

LIMIT VALUES	▲▼ M E
LIMIT VAL. 1: 4.47 ppm CaCO ₃	
Limit val. 2: 2.68 ppm CaCO ₃	

Example :

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

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

Two limit values:  1 LV1 = Limit value 1

 2 LV2 = Limit value 2

When the unit is used for monitoring two limit values, the outputs for the limit values are strictly allocated to those limit values!

Two measuring points:  1 LV1 = Measuring point 1

 2 LV2 = Measuring point 2

When the unit is used for monitoring two measuring points the outputs for the limit values are strictly allocated to those measuring points!

When the limit value **LV1** is exceeded, limit value control display lights up **LV1 RED** and the relay output **LV1** reacts as programmed in the switch function. As long as this limit value is not exceeded, the display lights up **GREEN**. The unit operates in the same way for the limit value **LV2**.

Hysteresis

Each limit value output reacts only after the 1st, 2nd or 3rd bad analysis result has been detected (suppression of the first or the second measured value).

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

Operation: With a hysteresis of 2 a further analysis is carried out immediately the limit value has been exceeded. Only if the limit value of this analysis is exceeded again, is the corresponding output energised. If you have set a hysteresis of 3, the corresponding output reacts only after the limit value has been exceeded for the 3rd time in succession.

HYSTERESIS GW1	▲▼ M E
Analysis (1,2,3)	1

Logic functions of the limit value outputs LV1 and LV2

- L Logic functions 0 and 2:** If Lock out is programmed, output relay LV1 pulls up according to the programme until a **manual** release is effected (press "STANDBY" key).

FUNCTION LV1 ▲▼ M E	
DURATION	*
Impulse	
Interval	
Two point	
Time:	00m:10s
Two-point only with 2 limit values and 1 measuring point	

Logic function 0, Duration

Output relay LV1 or LV2 pulls up when the measured value rises above limit value LV1 or LV2. If the measured value falls below the limit value LV1 or LV2, the relevant relay drops out again.

Logic function 1, Impulse

If the measured value rises above limit value LV1 or LV2, the relevant output pulls up for a set time t.

Independent of the time taken for the limit value to rise above the set limit, the relevant output always remains in the "ON" position for the set time.

Logic function 2, Interval

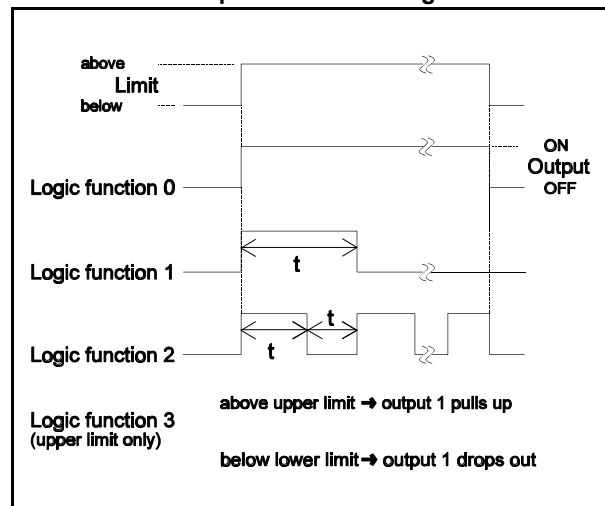
If the measured value rises above one limit value, the relevant output pulls up at intervals with the time set. (Impulse/Pause)

Logic function 3, Two-point

If the upper limit value LV1 is exceeded, the output relay LV1 pulls up. If the lower limit value LV2 falls below the set limit, output relay LV1 drops out.

The output relay LV2 pulls up according to the programmed logic function.

Schematic representation of logic function



- L** This function is possible if different values are selected for LV1 and LV2 with one measuring point only. For example for LV1 = 3.5 ppm CaCO₃ and for LV2 = 12.5 ppm CaCO₃.

Function IN1

When measuring from two measuring points, the automatic measuring point switch over can be suppressed by activating IN1. If IN1 is active, it is only measured from measuring point 2. If IN1 is inactive, it is only measured from measuring point 1. A respective control (e.g. timer) has to be connected to IN1 (voltage-free contact required!). The active status of IN1 has to be programmed correspondingly. Please select function "2 external measuring points" in the menu under **Measuring points**.

Water meter

For quantity dependent analysis triggering with dynamic analysis control and operational monitoring of the water treatment plant (see Plant Control) it is necessary to connect a water meter to the IN2 input.

Program the corresponding water meter rating under menu item "WATER METER".

TYPE OF WATER METER ▲▼ M E	
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 reporting errors. The events which could 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). For certain faults of the unit it is already pre-determined whether they trigger an alarm or a message!

The faults are entered into the fault history and stored if the event is programmed as an alarm or message. Should e. g. reagent low not be programmed as ALARM or MESSAGE, it is not registered in the fault history. Up to 20 error messages are stored. This list can be called up via the information menu. The information stored per event are the time (day, month, year and hour) and the type of the fault.

L After a power failure, the error messages are lost.

ALARM/MESSAGE	▲▼ M E	
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/-
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

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

- It can be programmed as a functional output for providing a contact of a programmable duration before, or/and during or after an analysis.

FUNCTION AUX	▲▼ M E
CONTACT BEFORE ANALYSIS	*
Contact during analysis	
Contact after analysis	
Time:	99m 99s

You can e. g. control the cooling water flow in an upstream cooler by means of a solenoid valve. Then cooling water flows only when necessary, i. e. while an analysis is being carried out.

Service II

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

L The functions in the service II menu have a direct influence with the operation and the monitoring functions of the unit!

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

Calibration

A calibration could be necessary to correct an inaccurate reading. For that you need a standard solution or you have to know the right value of the measured water (ask a laboratory).

CALIBRATION	▲▼ M E
CALIBRATION VALUE	0.35°dH
Calibration	start
Cal. factor	1.0

Calibration value: Please set the calibration value from the standard or the known value of the measured water.

Starting the calibration: Start the calibration with the menu line "Calibration Start" by pressing the ENTER button. Now an analysis will be done and after that the calibration factor will be calculated. The calibration with a standard solution is described on page 23.

Calibration factor (Cal. factor): The alternative to calibrate with a calibration value is to correct the reading directly with a calculated factor. After a done calibration the factor is displayed here.

Reset Operating time

After replacing the metering pump or the holder for the measuring chamber, you can reset the current operating time to 0 hours:

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

OPERATING TIME	▲▼ M E
	000023h
	Reset

You can call up the current operating time in the information menu:

"i" ° INFORMATION ° OPERATING VALUES

Maintenance interval

The observance of the maintenance interval is monitored and displayed by the Titromat® M1. Here you program the desired maintenance interval in days.

MAINTENANCE INTERV.	▲▼ M E
	001d

Water quantity RESET

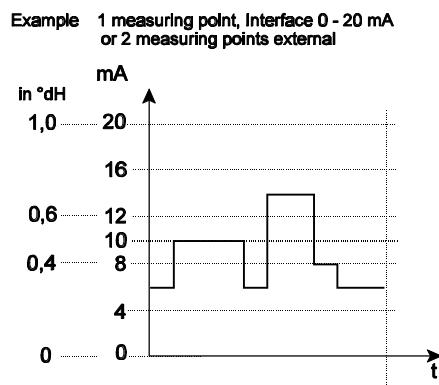
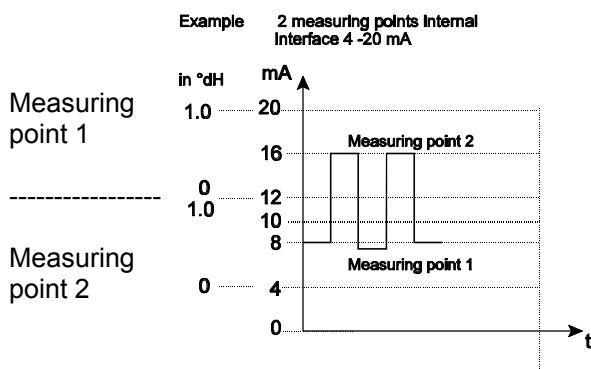
This effects in a reset of processed water quantity currently stored. This is of direct influence on the plant monitoring and the dynamic analysis control.

Interfaces (optional)

Interface 0/4 - 20 mA

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

INTERFACES	▲▼ M E
Type 0-20 mA	
Type 4-20 mA	*
Type RS232	



- L** A maximum working resistance of 500 Ohms must not be exceeded!
In situations where interferences might occur and where very long cables are used (approx. 20 m) a screened cable should be used if possible.

Serial interface RS232

The connection of the Titromat® M1 to a protocol printer via the serial interface RS232 enables the print out of measuring results and error messages. This means the analyses can be continuously recorded. This option is only possible in conjunction with the plug in circuit card RS910 (Item No. 270310).

Structure of the menu



Selection and input

Start menu

Select one of the two menus by pressing the "M" or the "i" key.

Selection

The active line position is displayed in CAPITALS. Using the "ENTER" key, the line is activated to enter a submenu. Using the arrow key "w", the next parameter appears below the lowest display line: in this way you scroll the menu.

Entry function (only possible in the "M" menu)

- You select a programming step by means of the arrow keys "w" and "v" and activate the entry function by pressing the "ENTER" key.
- In the case of digits to be entered, the first digit to be modified flashes.
- You can change the value using the arrow keys "w" and "v".
- By pressing the arrow keys ">" and "<", you confirm the entry and simultaneously change to the next or the preceding digit (which then starts flashing).
- You terminate the entry function by pressing "ENTER".
- The following line is activated.
- By pressing the "M" key you change to the menu one level up.

End menu

By pressing the "M" or the "i" key you return to the menu one level up. After returning from the highest menu level the unit is again in the display mode.

Information Menu "i"

Structure of the "i" menu

You can use the information menu to call up the active settings and status of the unit, the error registration, the date for the next maintenance and the customer service address.

Call (1)

You call up the information menu "i" by pressing the "i" key.

Customer Service (2)

Display of the customer service address or e.g. of a service telephone number. These three lines can be independently programmed in the basic program (**protected by pass word**):

"M" ◦ BASIC PROGRAM ◦
CUSTOMER SERVICE

Operating values (3)

Display of the current values.

Program values (4)

By pressing the arrow keys you can call up the menu item "Program values". By pressing "ENTER" you open the list with the set values. The active setting of a parameter can be queried by pressing "ENTER":

For example:

"i" ◦ INFORMATION ◦ PROGRAM
VALUES ◦ LIMIT VALUES

The selected function is marked by a star (in this context there are no active lines).

Error registration (5)

Open the error registration by pressing the "i" key and then "ENTER". The error registration is a list of the errors or status, that you have programmed as faults. This list is lost during a power failure and the recording is started afresh.

Provided no faults have accumulated since the start-up, the display will show the last time the unit was switched on, e.g.:

```
POWER FAILURE
from 16.06.99 06:56
to   16.06.99 07:09
```

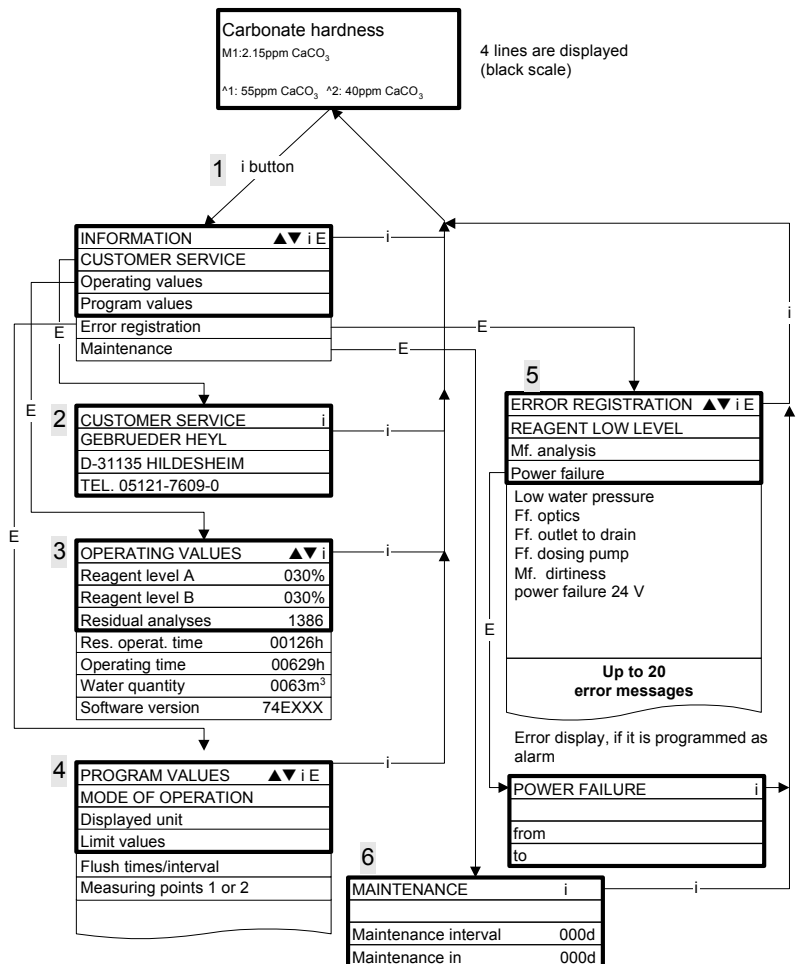
Maintenance (6)

Display of the date of the next maintenance and of the programmed maintenance interval.

You can set the maintenance interval in the basic program (**protected by pass word**):

"M" ◦ BASIC PROGRAM ◦ SERVICE II

For further maintenance information refer to page 21 - onward.



Program Menu "M"

Call (1)

By pressing the "M" key the program menu "M" is selected.

Except for the basic programming, you can call up all functions without pass word protection.

Service I (2)

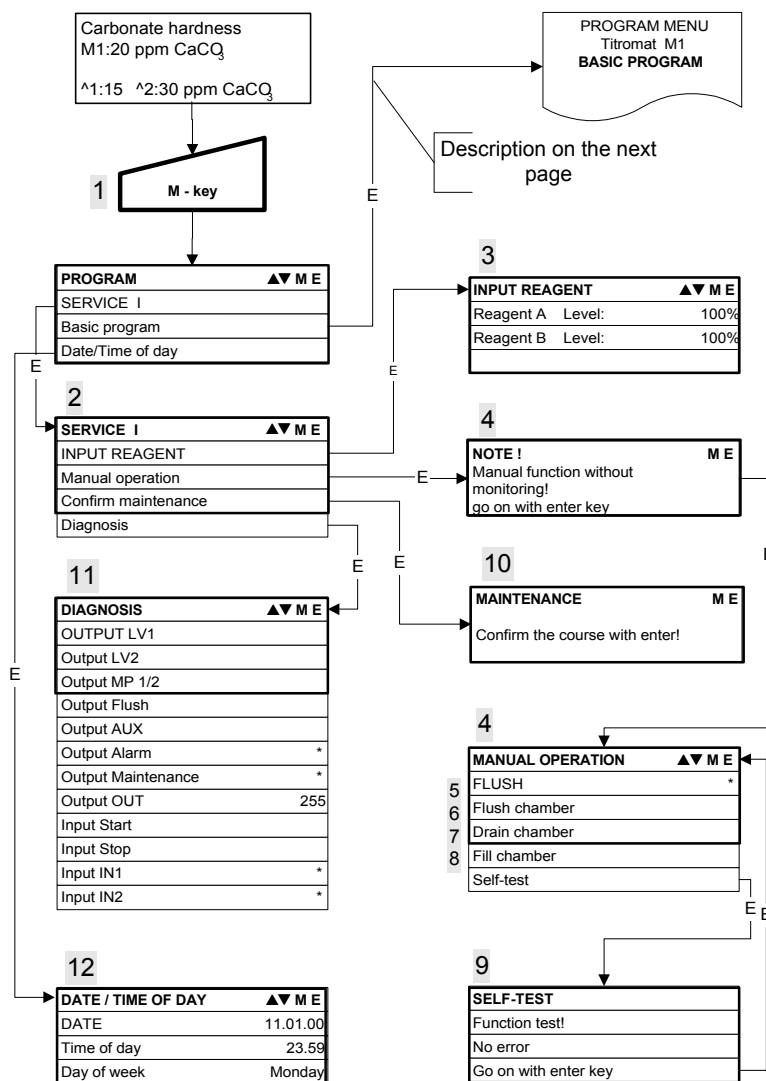
Input Reagent (3)

After **every** refill or replacement of the reagent bottles, you have to enter the new level. As soon as the menu item for the filling levels "INPUT REAGENT A (0 - 100%)" or "INPUT REAGENT B (0 - 100%)" has been selected by pressing "ENTER", the value is preset to 100%. When you have connected a full bottle, confirm this value by pressing "ENTER". If only a partially filled bottle is connected, enter the corresponding % value and confirm this value by pressing "ENTER".

Manual operation (4)

After you have confirmed the information message (4) by pressing ENTER, you can select the desired function using the arrow keys and then activate them by pressing "ENTER".

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



- L** All manual functions can only be selected during an interval between two analyses. During manual operation, no analysis is carried out.
All signal inputs and outputs are locked.

Flush (5)

Start the flushing of the sampling tube through the internal valve by pressing "ENTER". When "ENTER" is pressed again, this function is terminated.

Flush chamber (6)

By pressing "ENTER", the measuring chamber is flushed once.

Drain chamber (7)

By pressing "ENTER" you open the outlet valve to drain the water from the measuring chamber.

By pressing the "ENTER" key again, this function is terminated.

Fill chamber (8)

When "ENTER" is pressed, the measuring chamber is filled.

Self-test (9)

By pressing "ENTER", you start a program for self-testing the Titromat® M1. The program checks all relevant functions of the unit and carries out one analysis. If the check does not reveal any error, this message is displayed (9, see diagram).

Terminate this function by pressing "ENTER" again and you return to the "MANUAL OPERATION" menu.

Should any faults have been detected, a corresponding message is displayed!

Confirm maintenance (10)

After you have carried out the maintenance, confirm this by pressing "ENTER" and leave this item by pressing "M". The maintenance interval is started afresh.

- L** A maintenance request at the end of the maintenance interval, must be confirmed in the M-menu. The message on the display is deleted and the maintenance output is reset.

Refer to page 22 for general maintenance.

Diagnosis (11)

You can call up the current status of the signal inputs and outputs from a list.

An active status is marked with a * (see menu structure).

To change the status of an output press the "ENTER" key.

Date/Time of day (12)

You enter time of day and date by selecting the desired function using the arrow keys and activating them by pressing "ENTER". Then press the "M" key again to store the setting and to return to the display mode.

Basic program

This menu item is only reached after entering the password!

Example for a password entry:



After you have entered the password and confirmed it by pressing "ENTER", you can carry out the basic programming of the unit and select a number of service functions (e.g. calibration).

PROGRAM VALUES

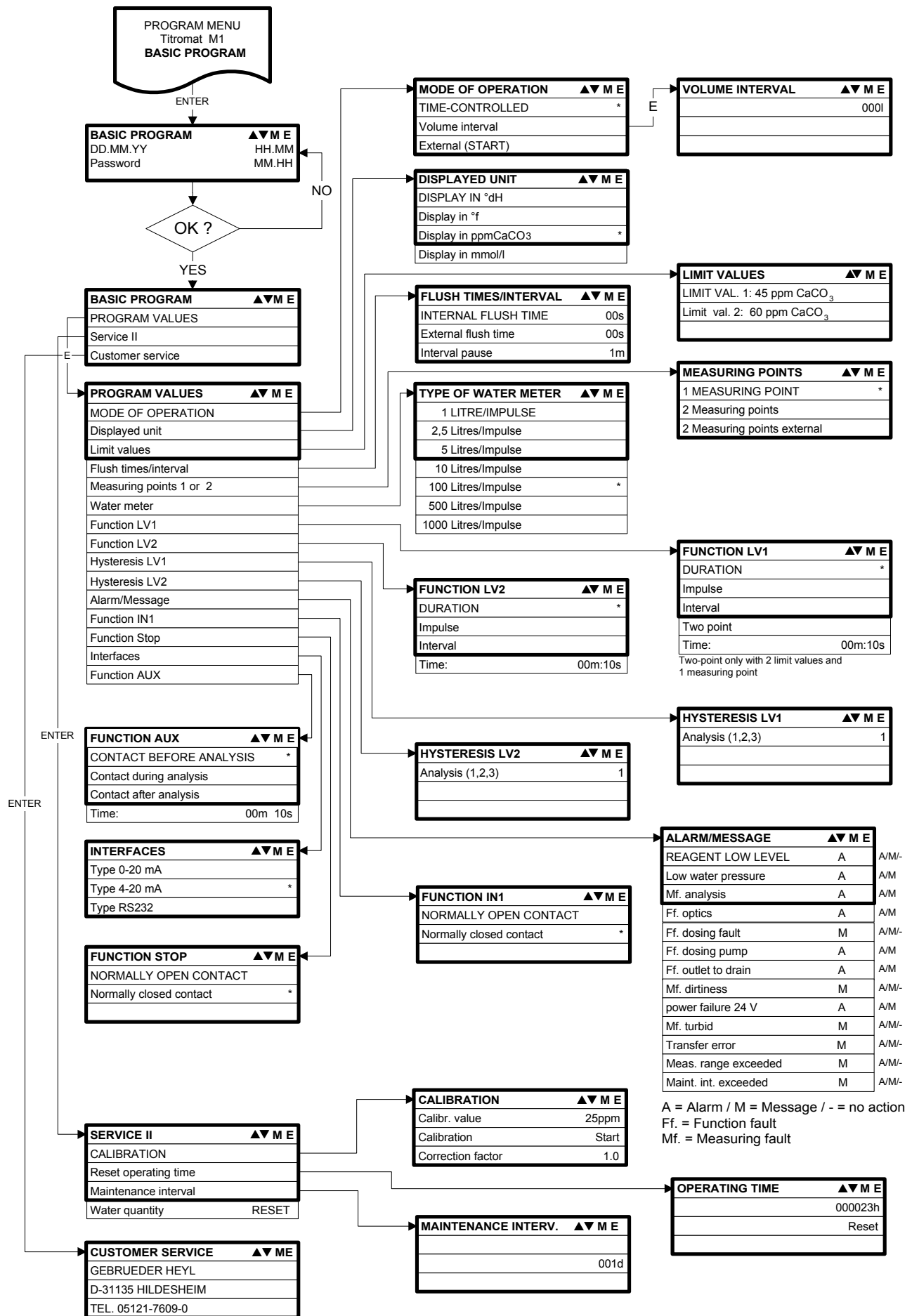
To call up the factory-set basic default setting, briefly hold down the "M" and "I" keys while switching the unit "ON". Values and settings are described in the structure of the basic program on page 19.

The following program values can be entered and stored in the basic program:

Abbreviations:

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

Structure of the basic program



To call up the factory-set basic default setting, briefly hold down the "M" and "I" keys while switching the unit "ON".
CAUTION, the last set of programming will be erased!

Error Messages / Trouble Shooting

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	Filter-out turbidity or dirt from the water supply
MEASURING RANGE EXCEEDED CANCEL WITH HORN-KEY	– After programming: Continuous alarm or message impulses or no message – Continue measurements	• The measuring range is exceeded	
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 (10 %),	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® M1 reagent
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

Fault	Possible causes	Remedies
Interface works incorrectly	incorrect measuring value at the output or no power supply	– Replace fuse F7 – Replace the plug-in circuit board
Although unit is switched "ON" No display	- Fuse F9, F5 or F2 (240 V: F1) defective - Power switch defective - Multi-pin strap cable at display circuit board or base circuit board loose contact - Fault on display circuit board or base circuit board	– Replace fuses – Replace power switch – Check and reconnect – Replace display or base circuit board

Maintenance

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

Please carry out the maintenance work described in the following section when

- the programmed maintenance date has been reached (display "maintenance date exceeded")
- the unit displays the following error messages: "Mf.dirtiness" or "Reagent low level"
- the last maintenance was carried out more than 6 months ago.

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

L If the measuring range has been exceeded over an extended period, a coloured coating can form on the sight-glass windows. This stubborn coating can be easily removed with alcohol.

Description of maintenance work

Cleaning the measuring chamber and the sight-glass windows

1. Switch the unit 'off' or press the "STANDBY" key (drain measuring chamber completely !).
2. Close the hand-operated valve on the sample line to the Titromat® M1.
3. Unhook toggle type fastener, tip the measuring chamber upwards and extract.
4. Slacken both sight-glass window holders, extract and clean the sight-glass windows.
5. This stubborn coating can be easily removed with alcohol.
6. Clean the measuring chamber with 10% hydrochloric acid and then rinse well.
7. After cleaning, replace the sight-glass windows and secure these with the sight-glass windows holder (do not forget the O-ring seals and check for correct seating in the recess).
8. Insert the measuring chamber by tilting it backwards until the slot engages with the rear guide bar and press down. Finally secure the chamber with the toggle type fastener.

Cleaning the filter housing

1. Close the hand-operated valve on the sample line to the Titromat® M1.
2. Undo the hose connections to the filter housing.
3. Unscrew inlet connection remove sealing ring, spring and filter strainer and clean.
4. Extract the retaining pin and withdraw the flow regulator and finally remove the valve body.
5. Clean filter housing with water or alcohol and reassemble.
Insert filter strainer point downwards!
6. Install the hose connections to the filter housing.



⚠ Water leakage of the seals can result in damage to parts of the unit

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

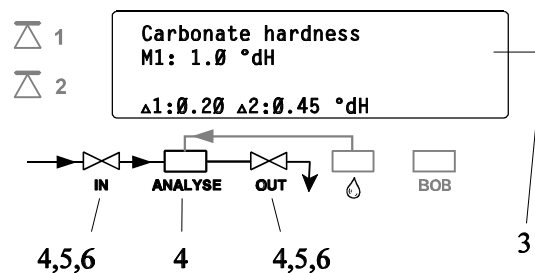
- switch the unit to STANDBY
- manually fill the measuring chamber
- manual reagent dosing (key "Manual")
- check the connections and seals for leaks

Note on care for the unit

The surface of the unit has not been treated. Therefore, a contamination with reagent, oil or grease should be avoided. Should the housing, however, be contaminated, please clean the surface with isopropanol (never use other solvents).

Check and manual calibration of the instrument with standard solution

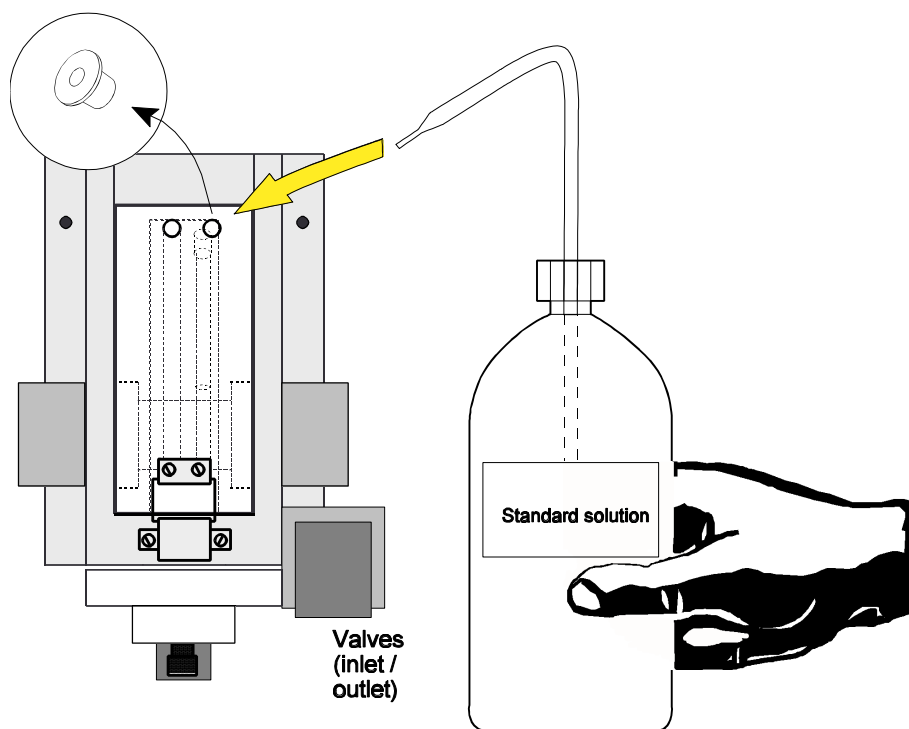
Display and LEDs:



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.
- L** To start the check, activate the measuring by pressing the “Hand” button.
3. 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 Titromat M1.



SPARE PARTS LIST Titromat® M1

Item No.	Pressure regulator
40125	Regulator / filter housing complete
40120	Regulator / filter housing
40129	Regulator plug T2000, complete
11225	Flow regulator valve (1 - 8 bar)
11230	Retaining pin for regulator plug
11217	Inlet filter
11218	Spring for inlet filter
40121	Inlet connector
40153	Plug in connector - G 1/4" -6
Measuring chamber	
40173	Sight-glass window 30 x 3 with seal
40170	Sight-glass window 30 x 3
40176	Sight-glass retaining disc
33253	Screw spindle M3 x 40
40032	Latch fastener TL 800-7-1
11203	Plastic plug
40022	Measuring chamber complete T2000
Holding block for measuring chamber	
40029	Holding block complete (without valves)
40050	Magnetic stirrer
40186	Plug connector
40018	Solenoid valve, 2/2-Way
40181	Rear guide bar for measuring chamber 5 x 60
Dosing pump DOSIClip®	
40201	Jet pump complete (for exchange)
40001	Jet pump complete
40011	Suction capillary complete
40016	Pressure capillary complete
37232	Base circuit board TI, complete
34668	Magnet 24 VDC
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	
37236	Base circuit board T2000 complete 230V	
40092	Control circuit board T2000 complete	
40091	Plug-in circuit board Transmitter / Receiver T2000	
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*Accurate operation of the Titromat M1 can be assured only with regular maintenance and replacements of seals / gaskets (see text on maintenance).

Accessories:

Order no.

040123	Optional adapter for water inlet (Quick-acting plug and -coupling)
270305	Interface (plug-in card) SK 910
270310	Serial interface (RS232 card) RS 910

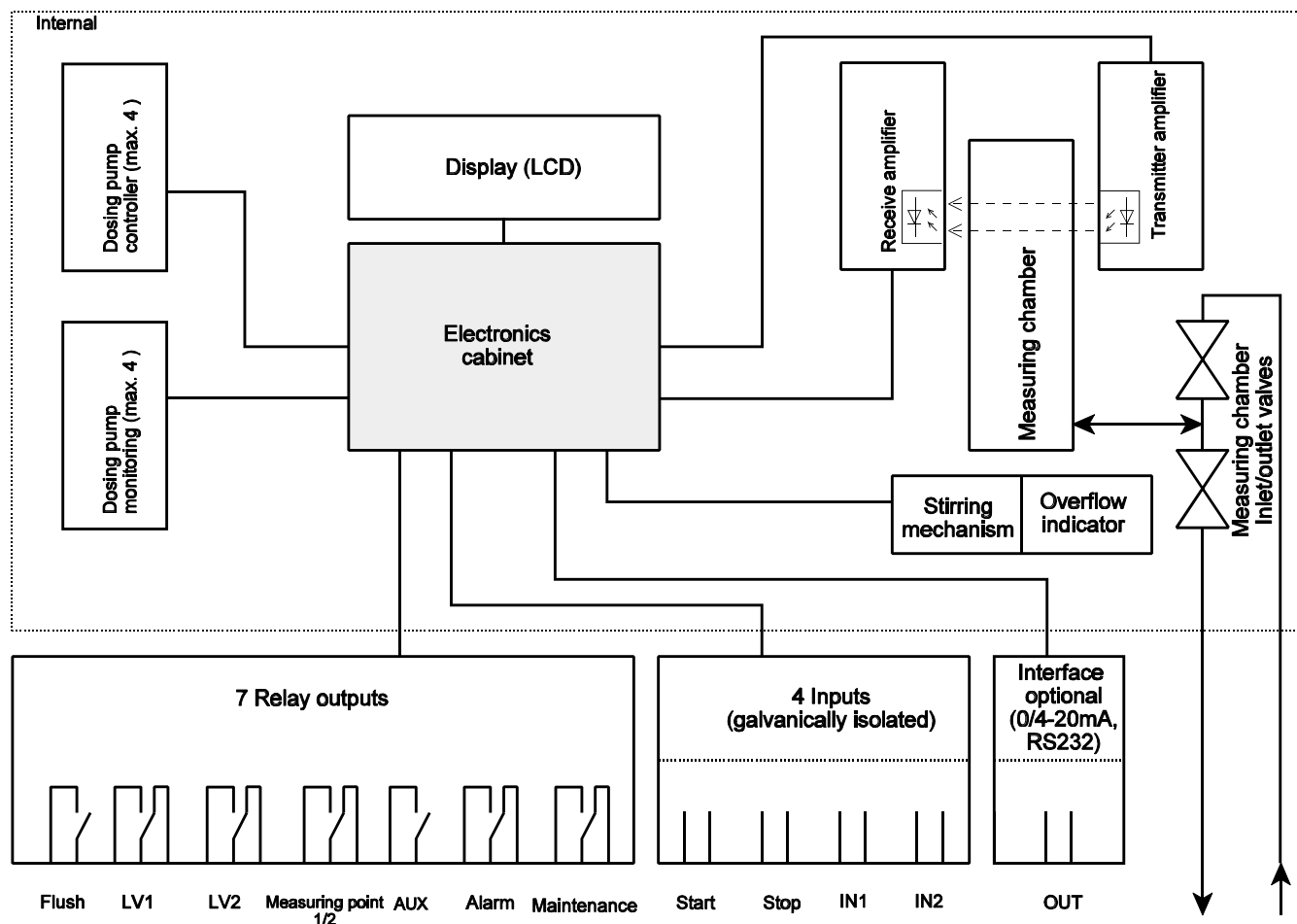
Reagents:

Order no.

155172	TC2010A	Carbonate hardness 0.05 - 1.0 °dH, reagent type A
155173	TC2010B	Carbonate hardness 0.05 - 1.0 °dH, reagent type B

Technical appendix

Block diagram Titromat® M1



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
Interface: 0/4 - 20 mA, max. load 500 Ohms (optional)
Water supply: 0.1 - 1 or 1 - 8 bar (1 bar = 1×10^5 Pa)
Water temperature: max. 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!

