For more information

The Data Sheet is available for free download by scanning this code:

or by clicking the link below:

Data Sheet
Testomat AW101
Water hardness monitor
Electrical safety

This equipment complies with the requirements of CEI/IEC 61010-1:2001-2 ‘Safety Requirements for Electrical Equipment for Measurement, Control and Laboratory Use’. If the equipment is used in a manner NOT specified by the Company, the protection provided by the equipment may be impaired.

Symbols

One or more of the following symbols may appear on the equipment labelling:

- ▼ Warning – refer to the manual for instructions
- ▼ Caution – risk of electric shock
- ▼ Protective earth (ground) terminal
- ▼ Earth (ground) terminal
- --- Direct current supply only
- --- Alternating current supply
- --- Both direct and alternating current supply
- □ The equipment is protected through double insulation

Information in this manual is intended only to assist our customers in the efficient operation of our equipment. Use of this manual for any other purpose is specifically prohibited and its contents are not to be reproduced in full or part without prior approval of the Technical Publications Department.

Health and safety

To ensure that our products are safe and without risk to health, the following points must be noted:

- The relevant sections of these instructions must be read carefully before proceeding.
- Warning labels on containers and packages must be observed.
- Installation, operation, maintenance and servicing must only be carried out by suitably trained personnel and in accordance with the information given.
- Normal safety precautions must be taken to avoid the possibility of an accident occurring when operating in conditions of high pressure and/or temperature.
- Chemicals must be stored away from heat, protected from temperature extremes and powders kept dry. Normal safe handling procedures must be used.
- When disposing of chemicals ensure that no two chemicals are mixed.

Safety advice concerning the use of the equipment described in this manual or any relevant hazard data sheets (where applicable) may be obtained from the Company address on the back cover, together with servicing and spares information.
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1 General

The AW101 has been developed as a simple device to monitor the quality of water from softeners. Applications include laundries, utility boiler plants, soft drinks factories, brewing, food processing and potable water plants. It provides an alarm for high hardness that starts an automatic regeneration of the ion exchange beds used most commonly in these applications.

The AW101 uses one of four reagents that changes from green to red at a predetermined water hardness level. The reagent is added to a known volume of sample via a small pump until a color change takes place. The volume of reagent required to bring about this reaction (monitored photo-electrically) indicates the level of hardness of the water sample. The AW101 also provides an analog signal, with a range determined by the choice of one of the four reagents available.

The digital display on the front of the monitor and the analog output show the value of the last analysis cycle.

Three alarm outputs are provided – two concentration alarms for control purposes and one alarm to drive an audible signal device. There are also inputs for a flow device and suspension of the flow cycle.

1.1 Reagents Available for AW101

The available ranges are determined by the choice of appropriate reagents. A summary of the different possibilities are shown in Table 1.1.

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>^°dH (Resolution)</td>
<td>0.05 … 0.50 (0.01)</td>
<td>0.25 … 2.50 (0.05)</td>
<td>1.0 … 10.0 (0.2)</td>
<td>2.5 … 25.0 (0.2)</td>
</tr>
<tr>
<td>^°F (Resolution)</td>
<td>0.09 … 0.89 (0.02)</td>
<td>0.45 … 4.48 (0.1)</td>
<td>1.79 … 17.9 (0.4)</td>
<td>4.48 … 44.8 (0.4)</td>
</tr>
<tr>
<td>ppm CaCO3 (Resolution)</td>
<td>0.89 … 8.93 (0.2)</td>
<td>4.47 … 44.7 (0.9)</td>
<td>17.9 … 179 (3.8)</td>
<td>44.7 … 447 (3.8)</td>
</tr>
<tr>
<td>mmol/l (Resolution)</td>
<td>0.01 … 0.09 (0.01)</td>
<td>0.04 … 0.45 (0.01)</td>
<td>0.18 … 1.79 (0.04)</td>
<td>0.45 … 4.48 (0.04)</td>
</tr>
</tbody>
</table>

Table 1.1 Reagents Available for AW101

Note.

- A consistently reliable result can only be guaranteed by the AW101 with the use of original ABB reagents. Failure or problems which are caused by the use of different indicators are not covered by the warranty.
- When monitoring hardness, larger quantities of heavy-metal ions in the softened water can affect the color reaction, especially iron above 0.5 mg/l, copper above 0.1 mg/l and aluminium above 0.1 mg/l (brownish-red color indication). Measurement should be made within the range of 4 … 10.5 pH.
- At a concentration of more than 100 mg/l of CO2 in the water, the excess must be removed by installing an appropriate debubbler in the feed water line to the AW101 unit.
2 Installation and Commissioning

2.1 Installation

Note. The unit doors swing to the left when opened. Allow sufficient space for the doors to open when preparing for installation.

1. Fix the unit vertically to the wall and secure using suitable fixings.
2. Avoid tension of the housing.

Fig. 2.1 Dimensions
2.2 Sample Supply
The temperature of the sample water must be between 10 and 40 °C (50 and 105 °F). Higher water temperatures can lead to damage to all parts coming into contact with water (for example, the filter housing or measuring chamber). Lower water temperatures can cause misting on the sight-glass windows.

In the event of higher temperatures, install a cooler in the sample line of the AW101.

Position the sample line (fitted with a hand-operated shut-off valve) as close as possible to the outlet from the water softening plant. Keep the sample line to the AW101 as short as possible and not longer than a maximum of 5 m (16.04 ft.). It is important that the sample 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.

![Diagram showing sample inlet installation](image)

*Fig. 2.2 Sample Inlet Installation*

2.3 Electrical Connection
Check the supply voltage on the rating plate.

2.3.1 Basic Requirements
Keep the external cables (for example, water meter and interface) clear of the power cables and as short as possible.

2.4 Plug Connector
The unit is equipped as a standard with a plug connector for opaque plastic hoses (external diameter 6 [0.24 in.] mm/internal diameter 4 mm [0.16 in.]).

2.5 Sample to Drain
The feed water flows through the measuring chamber then, via the outlet pipe, to the drain (hose connection internal diameter 14 mm [0.44 in.]). Ensure, by using a funnel for example, that the water can run freely to drain and cannot backup into the measuring chamber. Use a hose impervious to light for the drain pipe (to discourage algae formation).
3 Commissioning

To commission the AW101:

1. Connect a full reagent bottle.
2. Attach the vacuum connection onto the reagent bottle using the union nut.
3. 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 selected to prevent an error or alarm message.
4. Bleed the dosing pump and the capillary by repeatedly pressing the Manual key on the dosing pump. Ensure all air is removed from the tubing (if necessary, tighten up the connections).
5. Program the unit as applicable to your requirements, for example:
   - Mode of Operation
   - Type of reagent
   - Displayed unit
   - Limit values
   For a description of programming see page 11.
6. Remove all air from the water supply side of the unit by manual flushing.
   - M SERVICE MANUAL OPERATION FLUSH (ENTER press repeatedly).
   Continue flushing until no bubbles can be seen in either the measuring chamber or the filter housing.
7. Check all connections for tightness.
8. Press the Manual key to carry out the first analysis.

---

Fig. 3.1 Installation Diagram
4 Description of Displays and Operating Features

- **Status of Limit Value Displays**
  Displays the status of the limit values LV1 and LV2.

- **Text Display**
  Displays the current analysis, all important status results and programming data in a 2-line LCD.

- **Alarm**
  Displays a function fault.

- **Power Switch**
  The On/Off switch is located on the right-hand side panel.

- **Unit Fuse (inside the unit)**
  Protects outputs against overload and short circuit.

- **Analysis Message**
  Displays current analysis.

- **Programming Keys (Cursor block with ENTER)**
  These keys are used to enter all values and programming data.

- **'Manual' – manual start of an analysis.**

- **'STANDBY' – manual analysis stop/standby.**

- **'Alarm' – cancels alarm message.**

- **I-Key**
  Access all unit information.

- **M-key**
  Access the programming menu.

4.1 Display Functions

**Status of limit values 1 and 2**

1: The red display lamp is lit if limit value 1 (LV1) is reached or exceeded. It turns green if the measured value falls below the set limit value.

2: The red display lamp is lit if limit value 2 (LV2) is reached or exceeded. It turns green if the measured value falls below the set limit value.

Status and measured value display:

- In continuous operation the current measured value is shown in the upper line.
- When the measured value falls below the measuring range '='< is displayed: for example, <0.05 °dH
- When the measured value exceeds the measuring range '>' is displayed: for example, >10.0 °dH
- When the analysis interval is stopped while in operation (Analysis Stop), STANDBY and measured value are displayed alternately.
- The icon appears if the low-level reagent alarm is active.

4.2 Limit Value Displays

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

4.3 Alarm Message

A fault condition is signalled by a red light.

Error messages are displayed alternately with the normal display text and can only be deleted by cancellation and correction of the fault.
4.4 Description of the Relay Outputs
LV1 and LV2 limit value outputs
To signal that a limit value has been exceeded, two volt-free relay contacts are available. For both contacts the limit values, hysteresis and alarm action can be programmed independently:

<table>
<thead>
<tr>
<th>Function</th>
<th>Type of contact</th>
<th>Action</th>
</tr>
</thead>
<tbody>
<tr>
<td>LV1 active when in excess of limit value 1</td>
<td>Volt-free change-over contact</td>
<td>Programmable:</td>
</tr>
<tr>
<td></td>
<td></td>
<td>■ Continuous contact</td>
</tr>
<tr>
<td></td>
<td></td>
<td>■ Impulse (1 … 99 seconds/minutes)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>■ Interval (1 … 99 seconds/minutes)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>■ Two-step regulator</td>
</tr>
<tr>
<td></td>
<td></td>
<td>■ Hysteresis (1, 2 or 3 limit value in excess)</td>
</tr>
<tr>
<td>LV2 active when in excess of limit value 2</td>
<td>Volt-free change-over contact</td>
<td>Programmable:</td>
</tr>
<tr>
<td></td>
<td></td>
<td>■ Continuous contact</td>
</tr>
<tr>
<td></td>
<td></td>
<td>■ Impulse (1 … 99 seconds/minutes)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>■ Interval (1 … 99 seconds/minutes)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>■ Hysteresis (1, 2 or 3 limit value in excess)</td>
</tr>
</tbody>
</table>

Table 4.1 Relay Outputs

4.5 Diagnostic Alarm Messages
The Alarm output is a volt-free change-over relay contact. During normal operation the contact between terminals 16/17 is closed and the one between terminals 15/16 is open. If the voltage fails or the alarm is activated, the contact between terminals 15/16 is closed and the one between 16/17 is open.

The unit is equipped with a range of alarm notification functions.
- **Activation:**
  The Alarm output remains activated (with terminals 15/16 closed) as long as the fault persists.
- **Alarm Indicators:**
  Text and a red LED Alarm on the display indicate a fault.
- **Alarm cancellation:**
  The Alarm output condition is cancelled using the Horn key.
  An error message can only be deleted after the fault has been corrected.

  **Exception** – reagent low level, this message is confirmed in the M-menu by entering in the new reagent level.

The following conditions activate the Alarm output and are displayed:
- Low-water pressure
- Low reagent level
- Function fault optics
- Measuring fault – dirty chamber
- Measuring fault – analysis
- Measuring fault – turbid sample
- Function fault – dosing pump
- Measuring range exceeded
- Function fault outlet to drain

Error messages are described in Table 6.1, page 14.

For a more detailed description of the programming refer to page 11. For general maintenance refer to page 15.
4.6 Description of the Signal Inputs and Output

Caution. Connect the signal inputs 'Stop' and 'IN' to volt-free contacts only.

<table>
<thead>
<tr>
<th>Function</th>
<th>Type of contact</th>
<th>Action</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stop</td>
<td>Programmable normally closed/normally open volt-free.</td>
<td>No analyses are carried out while the contact at the input is open or closed.</td>
</tr>
<tr>
<td>IN</td>
<td>Normally closed/ normally open volt-free or turbine</td>
<td>Analysis starts after a configured sample quantity is reached.</td>
</tr>
</tbody>
</table>

Table 4.2 Stop External Analysis Stop

<table>
<thead>
<tr>
<th>Function</th>
<th>Terminal</th>
<th>Action</th>
</tr>
</thead>
<tbody>
<tr>
<td>Current 0/4-20mA</td>
<td>max. load 350 Ohm</td>
<td>programmable 0 - 20 mA or 4 - 20 mA</td>
</tr>
</tbody>
</table>

Table 4.3 OUT Interface Output

4.7 Function Characteristics

Mode of operation (Analysis controller)

- **Time Control** – internal triggering by a timer. The shortest interval = 0 minutes between analyses, longest interval = 99 minutes. – see page 9.

  The analysis interval is determined by the duration of the set flush times the programmed (interval) and the duration of the analysis. The analysis duration is a direct function of the value to be measured.

- **Quantity Control** – triggered by the water meter. Minimum interval = 1 liter, maximum interval = 9999 liters. 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).

  The current analysis interval can be interrupted by initiating the 'Stop' relay contact.
4.8 Analysis Cycle

The analysis cycle comprises the following steps:

1. The flow cell is flushed thoroughly to ensure that an uncontaminated sample is analysed. This flush time is programmable to suit the process sample and conditions.
2. The measuring chamber is filled with a known sample volume.
3. The sample is checked optically to ensure it is clean.
4. A quantity of reagent is titrated and the end-point (color change) is reached. The result is evaluated and displayed. If the hardness value is outside the range determined by the reagent used, an alarm state is triggered and 3 and 5 are known as the analysis period.
5. The chamber is drained.
6. There is a pause period (programmable) until the next analysis cycle is started.

4.9 Displayed Unit

Programmed hardness unit is displayed. You have the choice of °dH, °f, ppm CaCO₃ and mmol/l. The unit entered is displayed as programmed.

4.9.1 Type of Reagent

Select the reagent type used in the unit – for example, reagent AW101901 means 0.89 ppm CaCO₃ lower limit of the measuring range and 8.93 ppm CaCO₃ upper.

4.9.2 Setting the Timer

To ensure the analyzed sample represents the current value, the sampling tube must be sufficiently well flushed taking its length into consideration. If the installation has been out of operation for a long period or in the case of long analysis intervals, a flushing time in excess of 60 seconds is recommended. A flush is initiated by simultaneously opening the AW101 inlet and the outlet valves.

The analysis interval depends directly 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.

Example: For 3 bar pressure, a connection longer than 5 m (16.6 ft), an internal tube diameter of 4 mm (0.16 in), a minimum 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 liter.

4.9.3 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. To carry out analyses continuously, set the pause to 0. The longest pause is 99 minutes.

4.10 Monitoring the Limit Value

Two limit values are programmable continuously. The range for the limit value depends on the reagent type used and on the programmed unit. The functions of these outputs can be programmed independently from each other.

When limit value LV1 is exceeded, the Status LED LV1 is lit RED and relay output LV1 reacts as programmed in the switch function. If the limit value is not exceeded, the display light remains GREEN. The unit operates in the same way for limit value LV2.

4.11 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, for example, 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 after the limit value has been exceeded.

The corresponding output is energized only if the limit value of this analysis is exceeded again. If a hysteresis of 3 is set, the corresponding output reacts only after the limit value has been exceeded three times in succession.
4.12 Logic Functions of Limit Value Outputs LV1 and LV2

The logic limits are:

- Logic function 0, Duration
  Output relay LV1 or LV2 energizes 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 de-energizes again.

- Logic function 1, Impulse
  If the measured value rises above limit value LV1 or LV2, the relevant output energizes 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 energizes at intervals of the set time (Impulse/Pause).

- Logic function 3, Two-point
  If the upper limit value LV1 is exceeded, the output relay LV1 energizes. If the lower limit value LV2 falls below the set limit, output relay LV1 de-energizes.
  Output relay LV2 energizes according to the programmed logic function.
  This function is possible only if different values are selected for LV1 and LV2. For example for LV1 = 0.2 °dH and for LV2 = 0.1 °dH.

4.13 Low-level Reagent Alarm (BOB function)

In certain steam boiler installations, the possibility of an unsupervised boiler operating with a depleted supply of reagent has safety implications (because untested sample is allowed to flow through the boiler system). To overcome this problem, the AW101 employs a programmable low-level reagent alarm operation function. This monitors the reagent constantly and an alarm is triggered if the available reagent quantity falls below the quantity required for 72 hours usage.

BOB on: Continuous monitoring of the residual reagent quantity. ALARM message when the available quantity falls below the minimum quantity for the set period – ‘Alarm’ flashes, the Alarm output is energized.

BOB off: Without BOB function – the residual reagent quantity is monitored only for the minimum quantity (10% level).

Example: BOB-Duration = 72 Hours.
  Number of analyses per hour = 10.
  Necessary quantity of reagent for 72 h = 72 h x 10.
  Analysis/h x (3 x 30) µl/Analysis = 64.8 ml.
  (Corresponds to approximately 13% of a full level bottle).

4.14 STOP Function

The active analysis cycle can be interrupted by pressing the STOP/Standby key on the display pad. The cycle can be interrupted remotely/automatically using the STOP relay.

4.15 Water Meter

For quantity-dependent analysis triggering it is necessary to connect a water meter to the IN2 input. Program the corresponding water meter rating under menu item WATER METER or enter the impulse number of the turbine water meter.

4.16 Analog Output

Another possibility for monitoring the analysis is the connection to a process recorder or supervisory system. For this purpose the unit is equipped with a programmable current output.

A maximum working resistance of 350 \( \Omega \) must not be exceeded. In situations where interferences might occur and for very long cables (approximately 20 m [65 ft.]), use a screened cable.

![Fig. 4.4 Reagent AW10903](image-url)
5 Menu Structure

5.1 Selection and Input

5.1.1 Start Menu
Select one of the two menus by pressing the M or the i key.

5.2 Selection
The active line position is displayed in CAPITALS. Using the ENTER key, the line is activated to enter a submenu. Using the \( \downarrow \) key, the next parameter appears below the lowest display line; in this way you scroll through the menu.

5.3 Entry Function (M menu only)
The entry functions are:

- Select a programming step using the \( \uparrow \downarrow \) keys 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. Change a value using the \( \uparrow \downarrow \) keys.
- Use the \( \leftarrow \rightarrow \) keys to confirm an entry and simultaneously change to the next or the preceding digit (the entry to be changed starts flashing).
- Terminate the entry function by pressing ENTER. The following line is activated.
- To go up one level of the menu press the M key.

5.4 End Menu
To go up one level of the menu press the M or i key.

After returning from the highest menu level the unit is again in display mode.

5.5 Information Menu

The information menu calls-up the active settings and status of the unit – see Fig. 5.2

1 Call
Press the i key to open the information menu.

2 Operating values:
- Display of current values
- Reagent level
- Software version.

3 Program values.

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

For example:

- i INFORMATION \( \bullet \) PROGRAM VALUES \( \bullet \) TYPE OF REAGENT

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

**Key:**

1. **Call**
   
   Press the M key to select the program menu.
   
   Except for the basic programming, all functions without password protection can be called-up.

2. **Service**

3. **Input Reagent**

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

4. **Manual Operation**

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

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

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

5. **Flush**

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

6. **Flush chamber**

   By pressing ENTER, the measuring chamber is flushed once.

7. **Drain chamber**

   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.

8. **Fill chamber**

   When ENTER is pressed, the measuring chamber is filled.

9. **Language**

   Choose language of display.

10. **Diagnosis**

    The current status of the signal inputs and outputs from a list can be called-up.

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

    The displayed value of the output OUT corresponds to 1/10 mA (for example, 150 = 15.0 mA).
5.7 Basic Program
After the menu has been accessed with ENTER, carry out the BASIC PROGRAMMING of the unit.

5.8 Program Values
To call up the factory-set basic default setting, hold down the M and i keys briefly while switching the unit ON.

Values and settings are described in the structure of the basic program.

5.8.1 Structure of the Basic Programming
Abbreviations: s = seconds m = minutes, h = hours, d = days, l = liters

Caution. To reset the factory-set basic default setting, hold down the M and i keys briefly while switching the unit ON. The previous configuration is erased.

Fig. 5.4 Basic Programming Structure
### 6 Error Messages and Troubleshooting

<table>
<thead>
<tr>
<th>Displayed Message (flashes at selected display)</th>
<th>Possible Causes</th>
<th>Remedies</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>CANCEL WITH HORN-KEY</strong></td>
<td>Dosing pump defective</td>
<td>Replace dosing pump</td>
</tr>
<tr>
<td></td>
<td>No dosing message from the dosing pump</td>
<td>Check cable to the dosing pump for correct connection</td>
</tr>
<tr>
<td><strong>Mf. TURBID</strong></td>
<td>The water is turbid / dirty</td>
<td></td>
</tr>
<tr>
<td><strong>MEASURING RANGE EXCEEDED</strong></td>
<td>The measuring range is exceeded</td>
<td>Choose another type of reagent (Basic program)</td>
</tr>
<tr>
<td><strong>LOW WATER-PRESSURE</strong></td>
<td>No water input although LED I is lit</td>
<td>Check water inlet</td>
</tr>
<tr>
<td></td>
<td>Inlet pressure too low</td>
<td>Connector of the inlet valve oxidized</td>
</tr>
<tr>
<td></td>
<td>Overflow reagent is not active</td>
<td>Clean filter strainer</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Replace valve block</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Extract pressure regulator valve</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Carry out adjustment</td>
</tr>
<tr>
<td><strong>Ff. OUTLET TO DRAIN</strong></td>
<td>Water remains in the measuring chamber although LED OUT lights up</td>
<td>Check water outlet</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Connector of the outlet valve oxidized</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Replace valve block</td>
</tr>
<tr>
<td><strong>REAGENT LOW</strong></td>
<td>Reagent quantity is below minimum setting without BOB: 50 ml (10%), with BOB: after calculation</td>
<td>Check reagent level, fill up if necessary: enter level: M  SERVICE</td>
</tr>
<tr>
<td><strong>Mf. DIRTINESS</strong></td>
<td>Sight-glass windows dirty</td>
<td>Clean sight-glass windows</td>
</tr>
<tr>
<td><strong>Ff. OPTICS</strong></td>
<td>Plug-in circuit board defective</td>
<td>Replace plug-in circuit board</td>
</tr>
<tr>
<td></td>
<td>Error at the optic component (transmitter or receiver defective)</td>
<td>Replace measuring chamber sealing rings</td>
</tr>
<tr>
<td><strong>Mf. ANALYSIS</strong></td>
<td>Incorrect analysis</td>
<td>Tighten connections of the dosing pump</td>
</tr>
<tr>
<td></td>
<td>For example:</td>
<td>Replace stirring mechanism</td>
</tr>
<tr>
<td></td>
<td>- Air in the dosing capillary</td>
<td>Replace suction insert in the bottle</td>
</tr>
<tr>
<td></td>
<td>- Incomplete blending</td>
<td>Replace reagent (use only ABB reagent)</td>
</tr>
<tr>
<td></td>
<td>- Reagent too old or use of third-party reagent</td>
<td></td>
</tr>
<tr>
<td><strong>Ff. DOSING FAULT</strong></td>
<td>Dosing inaccuracy of the dosing pump</td>
<td>Replace dosing pump or return to the supplier for calibration</td>
</tr>
</tbody>
</table>

---

**Table 6.1 Error Messages and Troubleshooting**

**Key**

- **Ff.** = Function fault
- **Mf.** = Measuring fault
- **BOB** = Low-level reagent alarm – see section 4.13, page 10.
7 Further Information

<table>
<thead>
<tr>
<th>Fault</th>
<th>Possible causes</th>
<th>Remedies</th>
</tr>
</thead>
<tbody>
<tr>
<td>Interface works incorrectly</td>
<td>Incorrect measuring value at the output or no power supply</td>
<td>Max. load exceeded</td>
</tr>
<tr>
<td>Although unit is switched ON, No display</td>
<td>Fuse F9, F5 or F2 (240 V; F1) defective</td>
<td>Replace fuses</td>
</tr>
<tr>
<td></td>
<td>Power switch defective</td>
<td>Replace power switch</td>
</tr>
<tr>
<td></td>
<td>Multi-pin strap cable at display circuit board or base circuit board loose contact</td>
<td>Check and reconnect</td>
</tr>
<tr>
<td></td>
<td>Fault on display circuit board or base circuit board</td>
<td>Replace display or base circuit board</td>
</tr>
</tbody>
</table>

8 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 error messages: MF.DIRTINESS or REAGENT LOW
- the last maintenance was carried out more than 6 months ago.

Observe the safety rules when handling cleaning agents.

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

8.1 Description of Maintenance Work

Cleaning the measuring chamber and the sight-glass windows:

1. Switch the unit 'off' or press the STANDBY key (drain the measuring chamber completely).
2. Close the hand-operated valve on the sample line to the AW101.
3. Unhook the toggle-type fastener, tip the measuring chamber upwards and extract.
4. Slacken both sight-glass window holders, extract and clean the sight-glass windows. Stubborn coatings can be removed easily with alcohol.
5. Clean the measuring chamber with 10% hydrochloric acid and then rinse well.
6. 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).
7. Insert the measuring chamber by tilting it backwards until the slot engages with the rear guide bar and press down.
8. Secure the chamber with the toggle type fastener.

Note. Never use organic solvents to clean the measuring chamber and other plastic parts!
8.2 Cleaning the Filter Housing

To clean the filter housing:

1. Close the hand-operated valve on the sample line to the AW101.
2. Undo the hose connections to the filter housing.
3. Unscrew the inlet connection, remove sealing ring, spring and filter strainer. Clean these items.
4. Extract the retaining pin and withdraw the flow regulator and remove the valve body.
5. Clean the filter housing with water or alcohol and reassemble.
6. Install the hose connections to the filter housing.

**Note.** Insert the filter strainer with pointed end downwards.

**Note.**

- Avoid contact of the housing surface with reagent, oil or grease.
- If the housing is contaminated, clean the surface with isopropanol (never use other solvents).

Check the unit for leaks before carrying out the first analysis:

1. Switch the unit to STANDBY
2. Manually fill the measuring chamber
4. Check the connections and seals for leaks

Care for the unit:

- Water leakage from the seals can result in damage to parts of the unit
## 9 Spare Parts List

### Pressure Regulator

<table>
<thead>
<tr>
<th>Part Number</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>AW101601</td>
<td>Regulator/Filter housing</td>
</tr>
<tr>
<td>AW101602</td>
<td>Regulator plug T2000, kpl</td>
</tr>
<tr>
<td>AW101603</td>
<td>Flow regulator valve</td>
</tr>
<tr>
<td>AW101604</td>
<td>Retaining pin for regulator plug</td>
</tr>
<tr>
<td>AW101605</td>
<td>Inlet filter</td>
</tr>
<tr>
<td>AW101606</td>
<td>Spring for inlet filter</td>
</tr>
<tr>
<td>AW101607</td>
<td>Inlet connector</td>
</tr>
<tr>
<td>AW101608</td>
<td>Plug-in connector</td>
</tr>
</tbody>
</table>

### Measuring Chamber

<table>
<thead>
<tr>
<th>Part Number</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>AW101611</td>
<td>Sight-glass window 30 x 3 with seal</td>
</tr>
<tr>
<td>AW101612</td>
<td>Sight-glass window 30 x 3</td>
</tr>
<tr>
<td>AW101613</td>
<td>Sight-glass retaining disc</td>
</tr>
<tr>
<td>AW101614</td>
<td>Screw spindle M3 x 40</td>
</tr>
<tr>
<td>AW101615</td>
<td>Latch fastener TL 800-7-1</td>
</tr>
<tr>
<td>AW101616</td>
<td>Plastic plug</td>
</tr>
<tr>
<td>AW101617</td>
<td>Measuring chamber T2000</td>
</tr>
</tbody>
</table>

### Holding Block for Measuring Chamber

<table>
<thead>
<tr>
<th>Part Number</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>AW101622</td>
<td>Magnetic stirrer</td>
</tr>
<tr>
<td>AW101624</td>
<td>Solenoid valve 2/2–way</td>
</tr>
<tr>
<td>AW101625</td>
<td>Rear guide bar for measuring chamber</td>
</tr>
</tbody>
</table>

### Dosing Pump DOSI Clip

<table>
<thead>
<tr>
<th>Part Number</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>AW101631</td>
<td>Jet pump complete</td>
</tr>
<tr>
<td>AW101632</td>
<td>Suction capillary</td>
</tr>
<tr>
<td>AW101633</td>
<td>Pressure capillary complete</td>
</tr>
<tr>
<td>AW101634</td>
<td>Base circuit board T1 complete</td>
</tr>
<tr>
<td>AW101635</td>
<td>Magnet (24 V DC)</td>
</tr>
</tbody>
</table>

### Bottle Connections/Suction Tube

<table>
<thead>
<tr>
<th>Part Number</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>AW101641</td>
<td>Screwed cap with bottle insert T2000</td>
</tr>
<tr>
<td>AW101642</td>
<td>Screwed cap GL32 only</td>
</tr>
<tr>
<td>AW101643</td>
<td>Bottle insert for screwed cap with push-fit suction</td>
</tr>
</tbody>
</table>

### Electrical Components

<table>
<thead>
<tr>
<th>Part Number</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>AW101651</td>
<td>Fuse M4A</td>
</tr>
<tr>
<td>AW101656</td>
<td>Cable sleeve 7 – 10</td>
</tr>
<tr>
<td>AW101657</td>
<td>Mains on/off switch</td>
</tr>
<tr>
<td>AW101658</td>
<td>Cover for mains on/off switch</td>
</tr>
<tr>
<td>AW101659</td>
<td>Multi-pin strap cable 10 pole with EMI filter clamp</td>
</tr>
<tr>
<td>AW101660</td>
<td>Multi-pin strap cable 26 pole with EMI filter clamp</td>
</tr>
<tr>
<td>AW101661</td>
<td>Cable loom 2V complete (for valves)</td>
</tr>
<tr>
<td>AW101663</td>
<td>Cable loom for mains on/off switch complete</td>
</tr>
<tr>
<td>AW101664</td>
<td>Fuse T0.16 A</td>
</tr>
<tr>
<td>AW101665</td>
<td>Fuse T1.0 A</td>
</tr>
</tbody>
</table>

### Spare Parts for 2 to 3 Years Operation

<table>
<thead>
<tr>
<th>Part Number</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>AW101611</td>
<td>2 x sight-glass window 30 x 3 with seal</td>
</tr>
<tr>
<td>AW101605</td>
<td>1 x inlet filter (optional)</td>
</tr>
<tr>
<td>AW101701</td>
<td>Gasket set T2000. The quantity required is dependent on the maintenance regime (see section 8.2, page 16)</td>
</tr>
<tr>
<td>AW101664</td>
<td>1 x fuse T0.16 A</td>
</tr>
<tr>
<td>AW101665</td>
<td>1 x fuse T1.0 A</td>
</tr>
<tr>
<td>AW101901</td>
<td>TH2005 Water Hardness 0.89 to 8.93 ppm CaCO3</td>
</tr>
<tr>
<td>AW101902</td>
<td>TH2025 Water Hardness 4.47 to 44.7 ppm CaCO3</td>
</tr>
<tr>
<td>AW101903</td>
<td>TH2100 Water Hardness 17.9 to 179 ppm CaCO3</td>
</tr>
<tr>
<td>AW101904</td>
<td>TH2250 Water Hardness 44.7 to 447 ppm CaCO3</td>
</tr>
</tbody>
</table>
10 AW101 Testomat® Block Diagram

Fig. 10.1 AW101 Testomat® Block Diagram
10.1 Terminal Block Identification

<table>
<thead>
<tr>
<th>No.</th>
<th>Terminal</th>
<th>Type</th>
<th>Function</th>
<th>Note</th>
</tr>
</thead>
<tbody>
<tr>
<td>–</td>
<td>PE</td>
<td>IN</td>
<td>Mains – Protective earth (5x)</td>
<td>Earth/Ground</td>
</tr>
<tr>
<td>1 2</td>
<td>L N</td>
<td>IN</td>
<td>Mains, L = Live \ Mains, N = Neutral</td>
<td>Mains input \ 115 V, 230 V or 24 V AC</td>
</tr>
<tr>
<td>3 to 5</td>
<td>n l</td>
<td>OUT</td>
<td>Neutral, switched (8x) \ Live, switched (8x)</td>
<td>Mains voltage, max. 4 A</td>
</tr>
<tr>
<td>9</td>
<td></td>
<td>OUT</td>
<td>Limit value output 1 – Normally closed \ Limit value output 1 – Common \ Limit value output 1 – Normally open</td>
<td>Volt-free relay output, max. load 240 V AC, 4 A</td>
</tr>
<tr>
<td>10</td>
<td>LV1</td>
<td>OUT</td>
<td>Limit value output 2 – Normally closed \ Limit value output 2 – Common \ Limit value output 2 – Normally open</td>
<td>Volt-free relay output, max. load 240 V AC, 4 A</td>
</tr>
<tr>
<td>11</td>
<td></td>
<td>OUT</td>
<td>Fault message – Normally closed \ Fault message – Common \ Fault message – Normally open</td>
<td>Volt-free relay output, max. load 240 V AC, 4 A</td>
</tr>
<tr>
<td>12</td>
<td>LV2</td>
<td>OUT</td>
<td>Limit value output 1 – Common \ Limit value output 2 – Common \ Limit value output 2 – Normally open</td>
<td>Volt-free relay output, max. load 240 V AC, 4 A</td>
</tr>
<tr>
<td>13</td>
<td></td>
<td>OUT</td>
<td>External analysis stop Common earth for inputs</td>
<td>Only for volt-free normally open/normally closed contact</td>
</tr>
<tr>
<td>14</td>
<td>Alarm</td>
<td>OUT</td>
<td>Fault message – Common \ Fault message – Normally open \ Fault message – Normally open</td>
<td>Volt-free relay output, max. load 240 V AC, 4 A</td>
</tr>
<tr>
<td>15</td>
<td>Stop 2</td>
<td>IN</td>
<td>Water meter input Common earth for inputs</td>
<td>Only for volt-free normally open/normally closed contact</td>
</tr>
<tr>
<td>16</td>
<td></td>
<td>OUT</td>
<td>Note technical data of turbine</td>
<td>Note technical data of turbine</td>
</tr>
<tr>
<td>17</td>
<td></td>
<td>OUT</td>
<td>Only for volt-free normally open/normally closed contact</td>
<td>Note technical data of turbine</td>
</tr>
</tbody>
</table>

Current output 22 + (0/4 to 20 mA) 23 –

Note technical data of turbine. Max. power input of sensor must not exceed 20 mA
11 Specification

Ranges
Determined by reagent – see Table 1.1 on page 2

Alarms
Three relay outputs –
Limit values (LV1, LV2) and one fault alarm
Resistive load 4 A

Alarm displays
The following faults are shown on the display and also activate the Alarm output:
- Low water pressure
- Function fault optics
- Measuring fault analysis
- Function fault dosing pump
- Function fault outlet to drain
- Reagent low level
- Measuring fault dirtiness
- Measuring fault turbine meter
- Measuring range exceeded

Front panel indicators
Programme in operation
Analysis stopped
Lack of reagent
Satisfactory result
Unsatisfactory result
Viewing window

Outputs
Current output
0 to 20 mA or 4 to 20 mA
Max. load 500 \( \Omega \)

EMC
Conformity
EN50081-1, EN5008-2, EN61010-1

Power Supply
Voltage
115 V, 230 V or 24 V AC ±10%\%, 50/60 Hz

Power consumption
30 VA

Unit Protection
115 V, 230 V: T 0.1 A
24 V: T 1.0 A

Environmental Data
Sample pressure
0.1 to 3 bar (1.5 to 45.5 psi)

Sample temperature
10 to 40 °C (41 to 104 °F) max.

Ambient temperature
10 to 45 °C (41 to 124 °F)

Mechanical Data
Ingress protection
IP65

Dimensions
380 x 459 x 280 mm (15 x 18.8 x 11 in.)

Weight
9 kg (19.8 lbs)

Consumables
Reagent consumption
0.07ml (0.000123 pint) per test

DS/AW100-EN Rev. E