CORREX®

TUCO ADVANCED

Operating manual

Impressed-current anode system
for enamelled hot water tanks

MAGONTEC

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1 General information

1.1 About this operating manual

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Application and purpose

This operating manual applies to the impressed-current anode system CORREX® TUCO ADVANCED.

The operating manual provides the information necessary for safe, proper use in all phases of life:

- Installation
- Commissioning
- Operation
- Troubleshooting
- Dismantling and disposal

Subject to change without notice

MAGONTEC reserves the right to make changes and additions to the impressed-current anode system CORREX® TUCO ADVANCED. Deviations from the information in this operating manual are possible.

Target groups

- Qualified specialist personnel, for example sanitary, heating and air conditioning system technicians.
- *chapter 5.3, Maintaining and monitoring functionality* is aimed at the owner/operator of the storage water heater.

Use of the operating manual

- **You must read and understand the safety chapter and the chapters for the relevant activity in full.**
- Keep the operating manual available for reference at all times.
- Pass on the operating manual when the product changes ownership.

How warning notes are displayed

Danger level	Consequences of disregard	Probability
⚠ DANGER	Fatality or serious injury (irreversible)	Imminently
⚠ WARNING	Fatality or serious injury (irreversible)	Potentially
⚠ CAUTION	Minor injury (reversible)	Potentially
NOTE	Property damage	Potentially

1.2 Copyright protection

CORREX® and CorroScout® are registered trademarks of Magontec (effective 01-12-2019).

2 Description

2.1 Intended use

The CORREX® TUCO ADVANCED is used for permanent cathodic corrosion protection of enamelled storage water heaters for drinking water in closed, dry rooms. The CORREX® TUCO ADVANCED must only be used for this purpose and in compliance with this installation and operating manual.

2.2 Principle of operation

Causes of corrosion

In an enamelled storage water heater, defective spots in the enamel in the interior can lead to corrosion of the metal. Corrosion is caused by an electrochemical reaction between oxygen dissolved in the water and the metallic material of the storage tank.

Function and effect of the titanium anode

The titanium anodes have the following functions:

- Protective current supply
- Potential measurement

The impressed-current electronics generate a protective current opposite to the corrosion current. This cathodic internal protection, as it is known, stops the progress of the corrosion reaction. The titanium anode acts as the positive pole and the metal of the storage water heater as the negative pole (cathode).

The supply of voltage with the potentiostat causes the titanium anode to work as an impressed-current anode. The anode material is not consumed.

How the electronics work

The potentiostatic electronics automatically vary the driving voltage at the titanium anode until it matches the preset target potential. When the preset target potential has been achieved, the corrosion rate becomes negligible. The interrupter principle ensures that neither under- nor overprotection is applied.

Effects of limescale deposits

At higher water hardness, white limescale deposits can form as spots or even massive deposits at defective spots in the enamel. The lime does not interfere with the function of the CORREX® TUCO ADVANCED. The lime can instead act as an additional protection against corrosion.

2.3 Technical data

System

Impressed-current anode system with 1 or 2 titanium anodes for enamelled hot water tanks

2.3.1 Potentiostat TUCO ADVANCED

How it works

Interrupter potentiostat with potential-controlled protective current regulation

Mains supply

The potentiostat requires the following electrical supply:

Voltage	100 V – 230 V ±10 %
Frequency	50/60 Hz

Power consumption at:

Idling	< 0.1 W
5 % power consumption	< 0.14 W
50 % power consumption	< 0.46 W
100 % power consumption	< 0.75 W

Characteristic values

The impressed current of the potentiostat for the titanium anode has the following characteristic values:

Target potential	2,3 V

Rated current (secondary), max.	200 mA
Drive potential (secondary), max.	5 V at 200 mA

Operation

The following requirements apply to the operation of the potentiostat:

Temperature range	0 °C - 60 °C
relative humidity	max. 85 %
Appliance classes	II (operation in closed rooms)
Storage water heater volume	up to 2 × 1000 L

Transport and storage

The following requirements apply to the transport and storage of the potentiostat:

Temperature range	-40 °C – 60 °C, condensation not permissible

Device information

The housing of the potentiostat has the following features:

Dimensions, L × W × H with mounting plate	102 mm × 52 mm × 50.5 mm 102 mm × 52 mm × 55.5 mm
Weight	102 g
Construction type	With C8 connection
Connections	C8 for mains cable Five-pin for anode connection cable Four-pin for RS485 bus
Display	Display, 1 LED (green/red) Acoustic signal in case of malfunction

2.3.2 SmartConnect titanium anode

Properties

The titanium anodes have the following properties:

Electrode diameter	2 mm or 3 mm
Electrode length	200 mm - 1200 mm
Coating material	Noble metal mixed oxide (MMO)
Coating length	Variable, according to individual design for the respective storage water heater

Threaded bolt	M8 × approx. 30 mm Bore at the head end for SmartConnect plugs
Features	with/without touch guard made of water-hygienically approved, special polymer material

2.4 Conformity with directives

EU Declaration of Conformity

By affixing the CE conformity marking to the product CORREX® TUCO ADVANCED, the manufacturer declares that the product complies with the following European Council directives with regard to design, construction, testing and operation:

- 2014/35/EU (Low Voltage Directive)
- 2014/30/EU (EMC Directive)
- 2011/65/EU (RoHS / Restriction of Hazardous Substances)

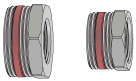
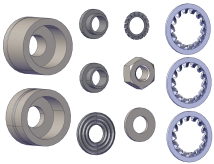
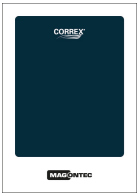
Conformity has been verified and the corresponding documentation as well as the EU Declaration of Conformity are on file with the manufacturer.

2.5 Scope of delivery

The scope of delivery depends on the variants ordered (anode, connection cable, screw plug), and what is shown here is an example. For the exact scope of delivery, see the accompanying documents (e.g. delivery note, order confirmation).

Scope of delivery for version with 1 titanium anode, exemplary:

Qty.	Description	Figure
1	Potentiostat with display, button control, indicator lamp and mounting plate	
1	Mains cable	

Qty.	Description	Figure
1	Titanium anode with SmartConnect connector and insulated mounted screw plug G ¾″ for socket mounting	
1	Connection cable with SmartConnect plug	
1	Bag with 2 reducers for socket mounting G 1¼″, G 1″	
1	Bag with mounting accessories for hole mounting: • Mounting pots 20 mm high/ 15 mm high • Insulation sleeves • Gasket • M8 nut • Washer • Tooth lock washer Ø8 • Tooth lock washers Ø15	
1	Operating manual	

3 ⚠ Safety

3.1 Basic safety instructions

Importance of the safety regulations

To ensure safe handling of the CORREX® TUCO ADVANCED, all persons who work with the CORREX® TUCO ADVANCED must read, understand and follow the safety regulations.

Safety regulations for handling the CORREX® TUCO ADVANCED

CORREX® TUCO ADVANCED are only to be applied for the intended use. See → *chapter 2.1, Intended use, page 5*.

Only qualified specialists, for example technicians for sanitary, heating and air conditioning, may carry out the work described here, with the following exceptions → *chapter 5, Operating and operation, page 19*.

Follow the instructions and warnings in this manual for all work.

4 Installation and commissioning

4.1 Installation requirements

Proper function of the storage water heater

The storage water heater must function properly.

For storage water heaters with electric heating elements:

⚠ WARNING

Risk of electric shock due to defective electrical heating elements
Defective electrical heating elements can apply mains voltage to metal parts of the storage water heater as well as the connections of the titanium anode after it has been installed and cause electric shock with serious injuries or even death.
⇨ Ensure proper functioning of the electrical heating elements.

For storage water heaters with more than one potentiostat in operation at the same time, or for storage water heaters with a volume of greater than 1500 l:

NOTE

Damage to the storage water heater due to gas accumulation
Gas can accumulate in the storage water heater when an impressed-current anode is operated

⇨ Install a degassing valve in accordance with DIN EN 12499 at the highest point of the storage water heater if the storage water heater is operated with more than one potentiostat or has a volume of more than 1500 l.

Sizing of the titanium anodes

NOTE

Damage to the storage water heater due to insufficient corrosion protection.
Incorrectly sized titanium anodes can lead to insufficient corrosion protection.

⇨ Size titanium anodes to be suitable for the storage water heater, if necessary after consulting the customer service department of the storage water heater manufacturer. The following factors can influence the size of the titanium anodes:
  – Total inner surface of the storage water heater in contact with water,
  – Accessories installed in the storage water heater, or their design,
  – Conductivity of the drinking water.

⇨ Size and install titanium anodes so that they do not touch the inner wall surface or accessories installed in the storage water heater.

Suitable mains connection

- A mains connection must be available.
- The mains connection must comply with the applicable national regulations.
- The mains connection must be protected with a residual current device (RCD).
- The voltage at the mains connection must correspond to the voltage for the mains supply of the potentiostat. See → *chapter 2.3, Technical data, page 6*.

- The position of the mains connection must allow safe routing of the cables:
  - Connection cable between the potentiostat and the connections for the titanium anode on the storage water heater (note the length of the connection cable).

NOTE

Extending the connection cable without malfunction

⇨ Extend the connection cable exclusively with accessories (connection cable extension) from Magontec.

A different extension type may cause malfunctioning.

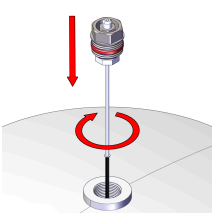
4.2 Socket mounting

Mounting type	Assembly in the threaded socket on the storage water heater
Additional material required	Mounting accessories for the mounting plate of the potentiostat

Requirements

- The storage water heater must be switched off and disconnected from the mains voltage.
- The storage water heater is depressurised and emptied as required.
- All magnesium anodes must have been removed.
- There must be a G ¾″, G 1″ or G 1¼″ threaded socket on the storage water heater for each anode to be installed.

Installing and connecting the anode

1. 

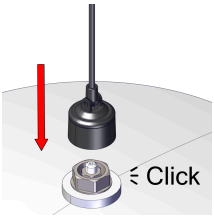
   Screw the titanium anode with the screw plug into the threaded socket on the storage water heater so it is pressure-sealed.

   Use exclusively screw plugs with intact PTFE gaskets. If the gasket is damaged, use a new screw plug.

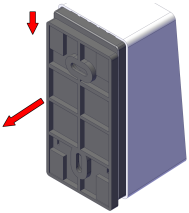
   For threaded socket G 1″ or G 1¼″, use the respective reduction socket provided.

Important:

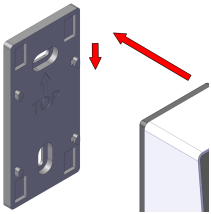
- Do not use any additional sealing material (PTFE sealing tape, hemp). The sealing material interrupts the electrical grounding connection to the storage water heater and causes malfunctions.
- Screw plug with PTFE sealing is optimized for installation in threaded sockets with inlet chamfer having opening angle of 60°.
- Installation of screw plug with PTFE sealing in threaded socket with a different opening angle is possible, but the PTFE sealing could be damaged. If so, use a new screw plug.

2. 

Attach the SmartConnect anode plug for the connection cable so that the anode plug clicks into place audibly.
If required, adapt the connection cable angle on the anode plug.

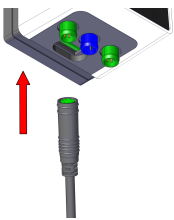
3. 

Moving and removing the mounting plate on the potentiostat.

4. 

Attach the mounting plate at a suitable location next to the storage water heater. Observe the direction: "TOP" arrow points upwards.

Hang the potentiostat on the mounting plate.

5. 

Insert the five-pole connection cable plug into one of the green connectors on the potentiostat.

After installation, put the CORREX® TUCO ADVANCED into operation and test, see → *chapter 4.4, Commissioning with functional test, page 18*.

4.3 Hole mounting

Mounting type	Mounting in the mounting hole in the storage water heater flange plate
Additional material required	Mounting accessories for the mounting plate of the potentiostat

Requirements

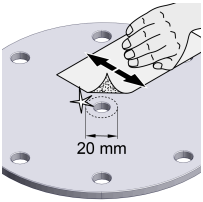
- The storage water heater must be switched off and disconnected from the mains voltage.
- The storage water heater is depressurised and emptied as required.
- All magnesium anodes must have been removed.
- There must be a suitable installation site in a flange plate on the storage water heater for each anode to be installed. The installation site must be on a flat, i.e. not curved, surface.

4.3.1 Assembling anode with flange plate

Assemble the titanium anode with the flange plate of the storage water heater:

1. Drill a mounting hole, Ø 10.5 mm, in the storage water heater flange plate.

   Important:
   - The enamel on the side of the flange plate in contact with water around the mounting hole must not flake off, not even partially.
   - The inner surface of the plate must remain flat (smooth enamel) where the seal (3; see figure step *5.*) makes contact.
   - Small fracture lines in the enamel can lead to leaks and, for example, to the thermal insulation of the storage water heater becoming soaked.

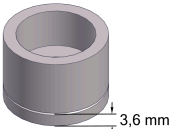
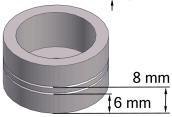
2. 

   Sand the outer surface of the flange plate around the mounting hole down to bare metal.

   Important:
   Without sanding, a permanent grounding connection to the storage water heater cannot be ensured. An improper grounding connection will result in malfunction.

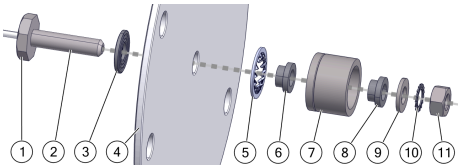
3. Loosen the screw plug nut on the pre-mounted titanium anode and remove all parts from the titanium anode thread bolt.
4. Select the mounting pot according to the flange plate material thickness:

   Place the flange plate and mounting pots next to each other on an even surface and determine with the marked rings on the assembly pots whether a flange plate with material thickness 3,6 mm, 6 mm or 8 mm.

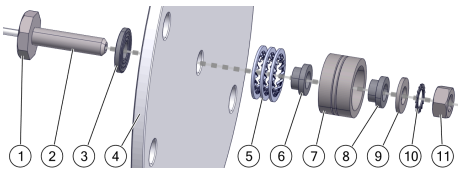
Flange plate 3.6 mm	Assembly pot 20 mm high Marking: 1 ring	
Flange plate 6 - 8 mm	Assembly pot 15 mm high Marking: 2 rings	

5. Assemble parts (3) - (10) on the threaded bolt (2) of the titanium anode.

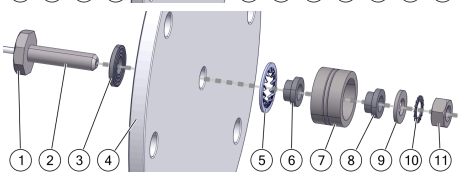
Flange plate 3.6 mm



Flange plate 6 mm



Flange plate 8 mm



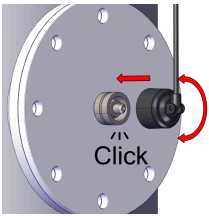
Important:
- Only use an original gasket (3).
- The narrow end of the insulation sleeve (6) must be inside the tooth lock washers Ø15 (5) and in the mounting hole of the flange plate (4).
- The narrow end of the insulation sleeve (8) lies in the bore of the assembly pot (7).
- For 6 mm flange plate 3 tooth lock washers Øuse 15 (5), otherwise 1 tooth lock washer Ø15.

6. Tighten the M8 nut (11) with a torque spanner as follows:

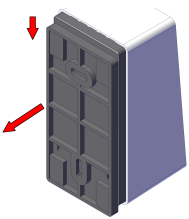
a) Lock the octagonal disk (1) on the titanium anode for steps b - c.
b) Initially, tighten M8 (11) nut hand-tight.
c) Tighten M8 nut (11) by another 1.5 times turn (540°).
Important: Torque must remain **less than** 15 Nm.
If torque of 15 Nm is already reached at less than 1.5 times turn, check the assembly and eliminate the problem, e.g.:
– Thread dirty,
– Thread damaged,
– Gasket not present.

4.3.2 Installing and connecting the anode

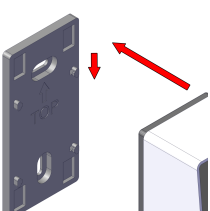
1. Fit the flange plate on the storage water heater.

2. 

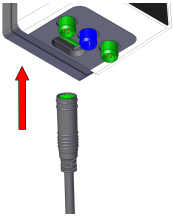
   Attach the SmartConnect anode plug for the connection cable so that the anode plug clicks into place audibly.
   If required, adapt the connection cable angle on the anode plug.

3. 

   Moving and removing the mounting plate on the potentiostat.

4. 

   Attach the mounting plate at a suitable location next to the storage water heater. Observe the direction: "TOP" arrow points upwards.
   Hang the potentiostat on the mounting plate.

5. 

Insert the five-pole connection cable plug into one of the green connectors on the potentiostat.

After installation, put the CORREX® TUCO ADVANCED into operation and test, see → *chapter 4.4, Commissioning with functional test, page 18*.

4.4 Commissioning with functional test

Always complete commissioning with a functional test. Corrosion protection cannot be ensured without successful testing.

Requirements

For electrically operated storage water heaters:

- The storage water heater must be disconnected from the mains voltage.

Commissioning and testing

1. Fill the storage water heater and check for leak tightness.
2. Connect the potentiostat to the mains voltage.

✓ Mains voltage present: Indicator lamp is lit green. After 2 minutes' warm-up time, the device reacts to any faults.

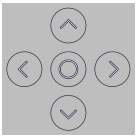
3. Check the indicator lamp or signal tone on the potentiostat:
   - Indicator lamp is not lit or lit red or signal tone is on: See → *chapter 6, Troubleshooting, page 24*.
   - Indicator lamp is lit green, no signal tone: Potentiostat is ready for operation.
4. Set the time, date and language on the display via button control. See → *chapter 5.1, Button control, page 19*, → *chapter 5.2, Display screen and settings, page 19*.
5. Show the anode voltage on the display via button control. See → *chapter 5.1, Button control, page 19*.

✓ The potentiostat functions correctly if the anode voltage is greater than +1.7 V and less than +2.5 V.

If the anode voltage does not fulfil this requirement, there is a malfunction. See → *chapter 6, Troubleshooting, page 24*.

5 Operating and operation

5.1 Button control

Figure	Buttons	Function
	Top, Left, Right, Bottom	Navigation to a menu item: • Menu item is framed. • Name of the menu item is displayed.
	Left, Right	• Measurement value display: Moving between anode 1 (left-hand side connection on the potentiostat) and anode 2 (right-hand side connection) • Settings: Moving to the previous/next setting value; setting value flashes.
	Top, Bottom	Change setting
	O (centre)	• Open main menu/menu item • Confirm legionella warning • Confirm setting • Quit measurement value display

5.2 Display screen and settings

Initial commissioning

1. Display MAGONTEC logo, CORREX® logo
2. Language setting *
3. Date setting *
4. Time setting *
5. Start screen display

* Language, date and time can then be adapted in the settings.

Start screen

Symbol	Designation	Description
	Protected	Corrosion protection is active, no malfunction. Potentiostat is feeding current to the titanium anode.

Symbol	Designation	Description
	No potential	No corrosion protection, fault elimination by a qualified expert necessary. See → *chapter 6, Troubleshooting, page 24*.
	Separated	No SmartConnect connection cable inserted in the potentiostat. Potentiostat anode disconnected.
	Legionellawarning	Warning: Legionella possible Confirm warning with centre button. See → *chapter 5.4, Legionella warning function, page 24*
	Protected, Legionellawarning	Corrosion protection is active. Legionella warning is confirmed. Legionella still possible.
	No potential, Legionellawarning	No corrosion protection. Legionella warning is confirmed. Legionella still possible.

Main menu

Symbol	Designation	Description
	Anode status	Anode 1 or 2 on the left-hand side or right-hand side connection of the potentiostat Status: protected, no potential, disconnected
	Anode power consumption	Measurement value display for anode 1 or 2: Protective current in mA and as a percentage of maximum protective current • Measurement value green: Corrosion protection is active • Measurement value red: no corrosion protection, malfunction
	Anode voltage	Measurement value display for anode 1 or 2: Potential between anode and storage water heater metal • Measurement value green: Corrosion protection is active • Measurement value red: no potential, no corrosion protection, malfunction

Symbol	Designation	Description

	Incidents	Display of past incidents for anode 1 or 2 with time and date:
		• Protected: Corrosion protection is active
		• No potential: Anode voltage zero, no corrosion protection
		• Assembly error: Anode assembled incorrectly, e. g. Short circuit due to titanium anode contact with installations or wall in the storage water heater.
		• Disconnected: Potentiostat anode disconnected
		• Legionella warning
		  • Risk: Legionella possible
		  • All-clear: Heating-up recognised
		See → *chapter 5.4, Legionella warning function, page 24*
		A maximum of 40 incidents are saved. After this, the oldest incident is deleted when a new incident is added.

	Operating time	Measurement value display for anode 1 or 2: • Operating time: The total time for which a SmartConnect connection cable was connected to the potentiostat. The time is not reset when anodes are renewed. • No potential: Time during which a SmartConnect connection cable was connected and the protection potential was not reached. Time in days/hours/minutes, after 1 year in years/days/hours.
	Temperature	Measurement value display for anode 1 or 2: Water temperature
	Settings	To the submenu settings
	Back	Back to the homepage

Settings

Symbol	Designation	Description
	Time *	Setting the time format (24h/12h) and the time
	Date *	Date setting
	Language	Language setting: • German • English • Spanish • French
	Temperature-unit	Temperature unit setting: • °C: Degrees Celsius (factory setting) • °F: Degrees Fahrenheit
	Legionellawarning function	Switch legionella warning function on / off: • Off: deactivated (factory setting) • On: activated If switched on, set the warning function: • Period: 1–29 days • Minimum temperature: 50–99 °C • Number of tanks: 1–2 storage water heaters • Factory setting: 15 days, 60 °C, 1 tank The legionella warning appears if the temperature in a storage water heater always remains below the minimum temperature during the set period.
	Instructions	QR code with Internet link to the operating instructions for CORREX® TUCO ADVANCED
	Device information	Separate display for 2 boards: • KKS: Control of the cathodic corrosion protection • DP: Display control Display of the respective following device information: • SW: Software version • HW: Hardware version • SN: Serial number

Symbol	Designation	Description
	Back	Back to the main menu

* The time and date settings remain for at least 24 hours after the device has been disconnected from the mains connection.

5.3 Maintaining and monitoring functionality

Maintaining functionality

To maintain the corrosion protection:

- When the storage water heater is filled (continuous operation): Ensure permanent supply of the potentiostat with mains voltage.
- Disconnect the potentiostat from the mains voltage briefly (for a few hours) for maintenance work.
- When the storage water heater has been drained: Potentiostat can be disconnected from mains voltage.

Avoiding property damage

NOTE

Damage to the storage water heater due to gas accumulation
Gas can accumulate in the storage water heater when the impressed-current anode is operated.

⇨ Renew water in the storage water heater regularly, at least every 2 months.

⇨ If the storage water heater is operated with more than one potentiostat or has a volume of more than 1500 l, install a degassing valve in accordance with DIN EN 12499 at the highest point of the storage water heater.

Regular monitoring

Check the indicator lamp and display on the potentiostat at least once a month:

- Indicator lamp is lit green, no signal tone, display screen *protected*: Potentiostat is connected to mains voltage and ready for operation.
- Indicator lamp is not lit or lit red or signal tone is on or display screen *no potential*: Fault elimination by qualified specialist.
- Indicator lamp is lit red, no signal tone, display screen *legionella warning*: Legionella possible.
  Ensure that the temperature in the storage water heater remains above the set minimum temperature for 30 minutes in order to clear the warning.
  See → *chapter 5.4, Legionella warning function, page 24*.

5.4 Legionella warning function

Warning function settings

If required, adapt the following in the settings for the legionella warning function:
- Switching the warning function on / off
- Period, minimum temperature, number of storage water heater tanks

See → *Settings, page 22*.

Legionella warning

The display shows a *legionella warning* and the LED is lit red under the following condition:
- During the period set (e.g. 15 days), the temperature always remains above the minimum temperature set (e.g. 60 °C).

In case of operation with 2 tanks, the *legionella warning* appears when the condition is met for one of the two tanks.

The legionella warning is shown in the events history.

No legionella warning

No legionella warning appears under the following conditions:
- Within the period set, the temperature is above the minimum temperature at least for a brief period.

In case of operation with 2 tanks, the legionella warning appears when the condition is met simultaneously for one of the two tanks.

Legionella all-clear

The legionella warning is cleared under the following condition:
- The temperature remains above the minimum temperature set for 30 minutes.

If 2 anodes are operated in one tank, the condition must be met on one anode.

In case of operation with 2 tanks, the condition must be met for both tanks simultaneously for 30 minutes.

6 Troubleshooting

⚠ WARNING

Risk of electric shock due to defective electrical heating elements
Defective electrical heating elements can apply mains voltage to metal parts of the storage water heater and the connections of the titanium anode and cause electric shock with serious injuries or even death.
⇨ If electric heating elements are installed, disconnect them from the power supply before troubleshooting.

6.1 Recognizing and eliminating simple faults

Faults are indicated by the indicator lamp, a signal tone or the display on the potentiostat.

Display	Meaning	Action
Indicator lamp green, no signal tone	Protected, potentiostat is feeding current to titanium anode.	–
Indicator lamp red, signal tone	No potential	Check whether the following causes of malfunction are present: 1 Potentiostat malfunction → *Reset potentiostat, page 25*. 2 *Storage water heater not completely filled, page 26*. 3 *Connection between potentiostat and anode or storage water heater defective, page 26*. 4 *Magnesium anode present/not removed, page 26*.
Off	Mains voltage missing	• Connect the potentiostat to the mains voltage. • Check the fuse of the socket circuit.

Reset potentiostat

1. Disconnect the potentiostat from the mains voltage for approx. 30 seconds.
2. Reconnect the potentiostat to the mains voltage.

✓ The potentiostat has been reset. Function display after 2 minutes' warm-up time.

✓ If the indicator lamp lights up green again, the signal tone is off and the display shows *Protected*, the potentiostat is once again ready for operation. Afterwards carry out a functional test, see → *chapter 4.4, Commissioning with functional test, page 18*.

✓ If the indicator lamp is lit red, the signal tone is on or the display shows *No potential*, continue with the next test.

Storage water heater not completely filled

1. Fill the storage water heater completely with water.

✓ If the indicator lamp lights up green again, the signal tone is off and the display shows *Protected*, the fault has been eliminated. Afterwards carry out a functional test, see → *chapter 4.4, Commissioning with functional test, page 18*.

✓ If the indicator lamp is lit red, the signal tone is on or the display shows *No potential*, continue with the next test.

Connection between potentiostat and anode or storage water heater defective

Operation with 2 anodes for more than 12 hours: Display of a fault already when the connection to an anode is disconnected.

1. Check the connecting cable and plug connections for visible breaks.
2. If there is no electrical continuity: Establish an electrical connection, if necessary by replacing the connecting cable.

   Use exclusively original connecting cable.

✓ If the indicator lamp lights up green again, the signal tone is off and the display shows *Protected*, the fault has been eliminated. Afterwards carry out a functional test, see → *chapter 4.4, Commissioning with functional test, page 18*.

✓ If the indicator lamp is lit red, the signal tone is on or the display shows *No potential*, continue with the next test.

Magnesium anode present/not removed

1. Switch off the storage water heater and disconnect it from the mains voltage.
2. If necessary, empty the storage water heater.
3. Remove the existing magnesium anode(s).

   Afterwards carry out a functional test, see → *chapter 4.4, Commissioning with functional test, page 18*.

✓ If the indicator lamp is lit red, the signal tone is on or the display shows *No potential*, continue with the next test.

6.2 Troubleshooting with measurement values

If the malfunction could not be eliminated by the preceding simple troubleshooting steps, a more detailed analysis using the measurement values shown on the display and, if applicable additional measurements is required.

6.2.1 Assess anode voltage

Prerequisite

- Storage water heater must be completely filled.

Procedure

1. Show the anode voltage on the display via button control. See → *chapter 5.1, Button control, page 19*.
2. Evaluate measurement value for anode voltage:
   - 2,3 V (Set value), 1.7 V to 2.5 V, indicator lamp is lit green, signal tone off: Potentiostat is working.
   - Higher than 2.5 V: Indicator lamp is lit red, signal tone is on.
     Possible cause: Devices with metallic installations in the tank can feed in electricity.
   - Less than 1.7 V, indicator lamp is lit red, signal tone is on: no corrosion protection. There may be uninsulated, metallic heat exchangers in the storage water heater. See → *chapter 6.3.3, Mounted heating element not sufficiently insulated, page 30*.
   - Close to 0 V: Indicator lamp is lit red, signal tone is on.
     Possible cause: Short circuit between titanium anode and ground of the storage water heater. See
     → *chapter 6.3.1, Titanium anode is in contact with installed accessories or wall in the storage water heater, page 29*,
     → *chapter 6.3.2, Titanium anode not sufficiently insulated, page 29*,

6.2.2 Evaluate anode power consumption (protective current)

Prerequisite

- Storage water heater must be completely filled.

Procedure

1. Show the anode power consumption (protective current) on the display via button control. See → *chapter 5.1, Button control, page 19*.
2. Evaluate measured value of protective current:
   - 1 mA - 10 mA: Typical readings; potentiostat is working.
   - Higher than 10 mA: Electricity demand for enamelled hot water tank is unusually high.
     For possible causes and fault elimination, see
     → *chapter 6.3.4, Large defective enamel spots, page 31*,
     → *chapter 6.3.3, Mounted heating element not sufficiently insulated, page 30*.

- 0 mA: Potentiostat is not working, no corrosion protection.
  For possible cause and fault elimination, see
  → *Connection between potentiostat and anode or storage water heater defective, page 26*.

6.2.3 Measuring the insulation of the titanium anode

Requirements

- Storage water heater must be disconnected from the mains voltage.
- Storage water heater must be empty.
- Titanium anode and installation point of the titanium anode must be dry.

Measurement

1. Measure the resistance between the titanium anode and ground of the storage water heater with a digital multimeter or CorroScout® anode tester. To do so, make the following connections:
   - Minus connection "COM" to ground of the storage water heater,
   - Positive connection "V" to the titanium anode.
2. Evaluate the measured value for resistance.
   - 100 kΩ or higher: Insulation sufficient
   - Less than 100 kΩ: Insulation not sufficient.
     For possible cause and fault elimination, see
     → *chapter 6.3.1, Titanium anode is in contact with installed accessories or wall in the storage water heater, page 29*.
     → *chapter 6.3.2, Titanium anode not sufficiently insulated, page 29*,

6.2.4 Measuring the insulation of non-enamelled, electrical heating elements

Requirements

- Storage water heater must be disconnected from the mains voltage.
- Storage water heater must be empty.

Measurement

1. Measure the resistance between the heating element and ground of the storage water heater with a digital multimeter or CorroScout® anode tester.
2. Evaluate the measured value for resistance.

   For evaluation, observe the manufacturer's data for the storage water heater:
   – Heating element installation with/without potential balance resistance,
   – value of the potential balance resistance, if applicable.

Evaluation:

- Without potential balance resistance:
  100 kΩ or higher: Heating element is fully insulated and thus supports the corrosion protection of the storage water heater. In the long term, however, corrosion of the heating element is possible.
- With potential balance resistance (preferred installation method):
  Insulation is sufficient if the result corresponds to the manufacturer's specifications for the potential balance resistance in the storage water heater. (Typical values for potential balance resistance: 550 Ω - 800 Ω.)
- Lower values: Insulation not sufficient. Corrosion of the enamelled hot water tank is possible in the medium to long term.
  For possible causes and fault elimination, see
  → *chapter 6.3.3, Mounted heating element not sufficiently insulated, page 30*.

6.3 Fault elimination after measurement

6.3.1 Titanium anode is in contact with installed accessories or wall in the storage water heater

Elimination

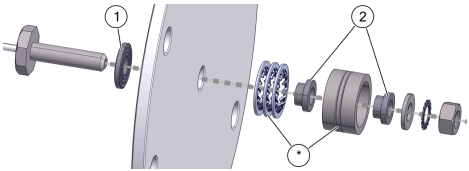
1. Switch off the storage water heater and disconnect it from the mains voltage.
2. Drain the storage water heater.
3. Correct the position of the installed accessories and titanium anode as needed.
   Note: Neither modify nor shorten the titanium anode. Such changes to the titanium anode result in malfunction.
4. For checking, see → *chapter 6.2.3, Measuring the insulation of the titanium anode, page 28*.
5. Functional test, see → *chapter 4.4, Commissioning with functional test, page 18*.

6.3.2 Titanium anode not sufficiently insulated

Elimination

1. Switch off the storage water heater and disconnect it from the mains voltage.
2. Drain the storage water heater.
3. Disconnect the potentiostat from the mains.
4. Remove the connecting cable from the titanium anode.
5. Dismount the titanium anode from the storage water heater, then dismantle the anode. See → *chapter 4.2, Socket mounting, page 12* or → *chapter 4.3, Hole mounting, page 14*.

6. Check the gaskets and insulation sleeves on the titanium anode and replace if necessary. Only use original gaskets and insulation sleeves.
   - Socket mounting: Use new, pre-assembled titanium anodes.
   - Hole mounting: Use assembly accessories with new gaskets (1) and insulation sleeves (2).



* Figure: Tooth lock washers, assembly pot, possible variance

7. Install titanium anode.
   - Socket mounting, see → *chapter 4.2, Socket mounting, page 12*.
   - Hole mounting, see → *chapter 4.3, Hole mounting, page 14*.
8. For checking, see → *chapter 6.2.3, Measuring the insulation of the titanium anode, page 28*.
9. Functional test, see → *chapter 4.4, Commissioning with functional test, page 18*.

6.3.3 Mounted heating element not sufficiently insulated

NOTE

Damage to the storage water heater due to incorrect troubleshooting procedure

⇨ When troubleshooting, follow the manufacturer's instructions for the storage water heater:
- Heating element installation insulated/not insulated,
- Heating element installation with/without potential balance resistance,
- if the insulation is insufficient, replace the heating element.

NOTE

Damage to the storage water heater due to incorrect operation of the titanium anode.

⇨ If the fault due to insufficient insulation of the heating elements cannot be eliminated, observe the further information provided by the manufacturer for operating the storage water heater with a titanium anode.

NOTE

Insufficient insulation of the heating elements can lead to high protective current, overload and malfunction of the potentiostat.

⇨ Observe the manufacturer's instructions for operating the storage water heater with a titanium anode.

Elimination

1. Check the insulation of the heating elements and replace if necessary. Observe the operating instructions for the storage water heater.

   Insufficient insulation may be present, for example, with the following heating elements made of copper, stainless steel or superalloys containing nickel:
   - Finned tube heating elements,
   - Smooth tube heating elements,
   - Smooth tube bundle heating elements.
2. For checking, see

   → *chapter 6.2.4, Measuring the insulation of non-enamelled, electrical heating elements, page 28*,

   → *chapter 6.2.2, Evaluate anode power consumption (protective current), page 27*.
3. Carry out a functional test when putting the unit back into operation, see → *chapter 4.4, Commissioning with functional test, page 18*.

6.3.4 Large defective enamel spots

NOTE

Defective enamel spots with a large surface area can lead to high protective current, overload and malfunction of the potentiostat.

⇨ Observe the manufacturer's instructions for operating the storage water heater with a titanium anode.

Elimination

1. Observe and follow the operating instructions for the storage water heater.
2. Carry out a functional test when putting the unit back into operation, see → *chapter 4.4, Commissioning with functional test, page 18*.

7 Dismantling and disposal

7.1 Dismantling

1. Switch off the storage water heater and disconnect it from the mains voltage.
2. Drain the storage water heater.
3. Disconnect the potentiostat from the mains.
4. Remove the connecting cable from the titanium anode.
5. Dismount the titanium anode from the storage water heater and the anode. See → *chapter 4.2, Socket mounting, page 12* or → *chapter 4.3, Hole mounting, page 14*.

7.2 Disposal

Disposal via collection point

Do not dispose of this product in household waste, but at collection points for waste electrical and electronic equipment or for light metals (titanium anode). Information on collection points is provided by municipalities, waste disposal companies or the seller of the product.

Accordingly, the type plate on the potentiostat housing contains the crossed-out dustbin, in accordance with Directive 2012/19/EU (Waste Electrical and Electronic Equipment).

Comply with legal regulations on disposal and contribute to environmentally friendly disposal.

WEEE register number

MAGONTEC is registered in accordance with Directive 2012/19/EU in the Waste Electrical and Electronic Equipment Register (WEEE Reg. No. 21203187).

For further information:
www.magontec.de/downloads

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