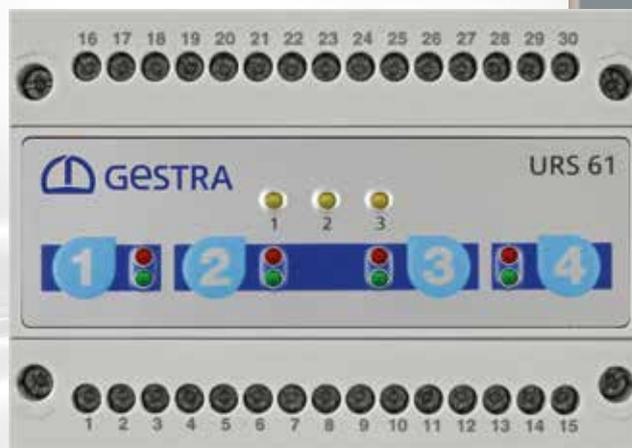




## SPECTORconnect

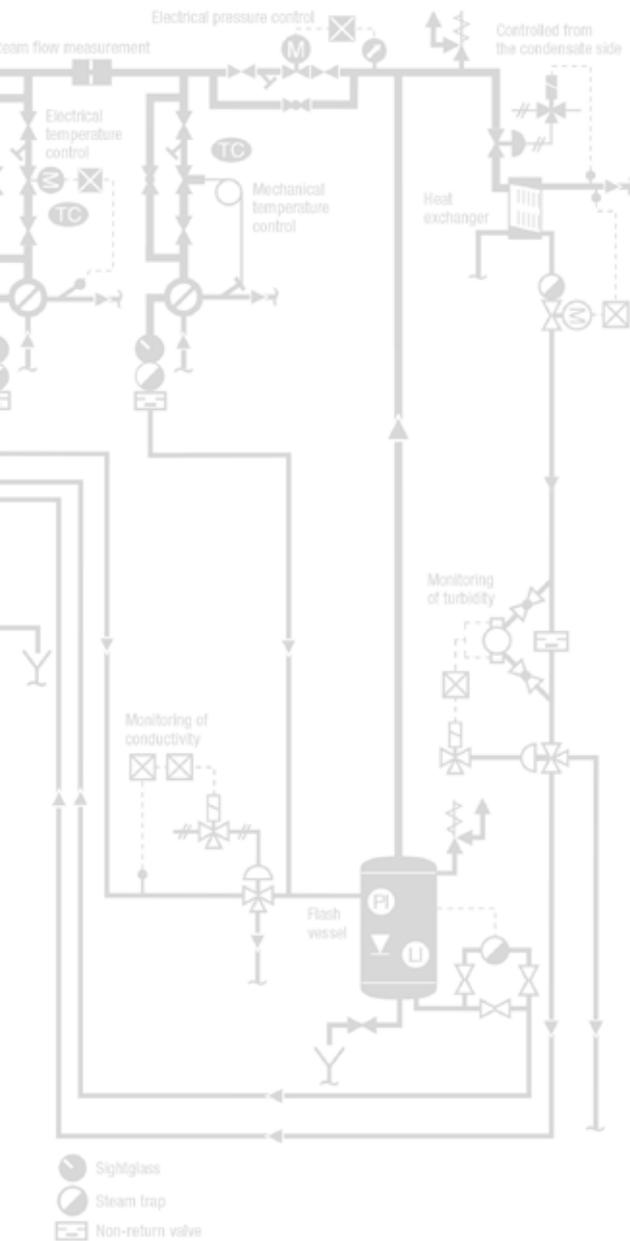
*Safer, more efficient steam production*



Engineering steam performance



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# Welcome to the World of SPECTOR

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For the operator of a pressurized steam or hot-water plant, safety, reliability, availability and cost efficiency are the top priority. To an increasing extent, plant automation and visualisation are also growing in importance. In order to meet these stringent requirements, GESTRA AG has been making exclusive use of low-maintenance, non-wearing electrode systems for more than five decades now. These systems function entirely without moving parts, which mean long service lives and very low failure rates.

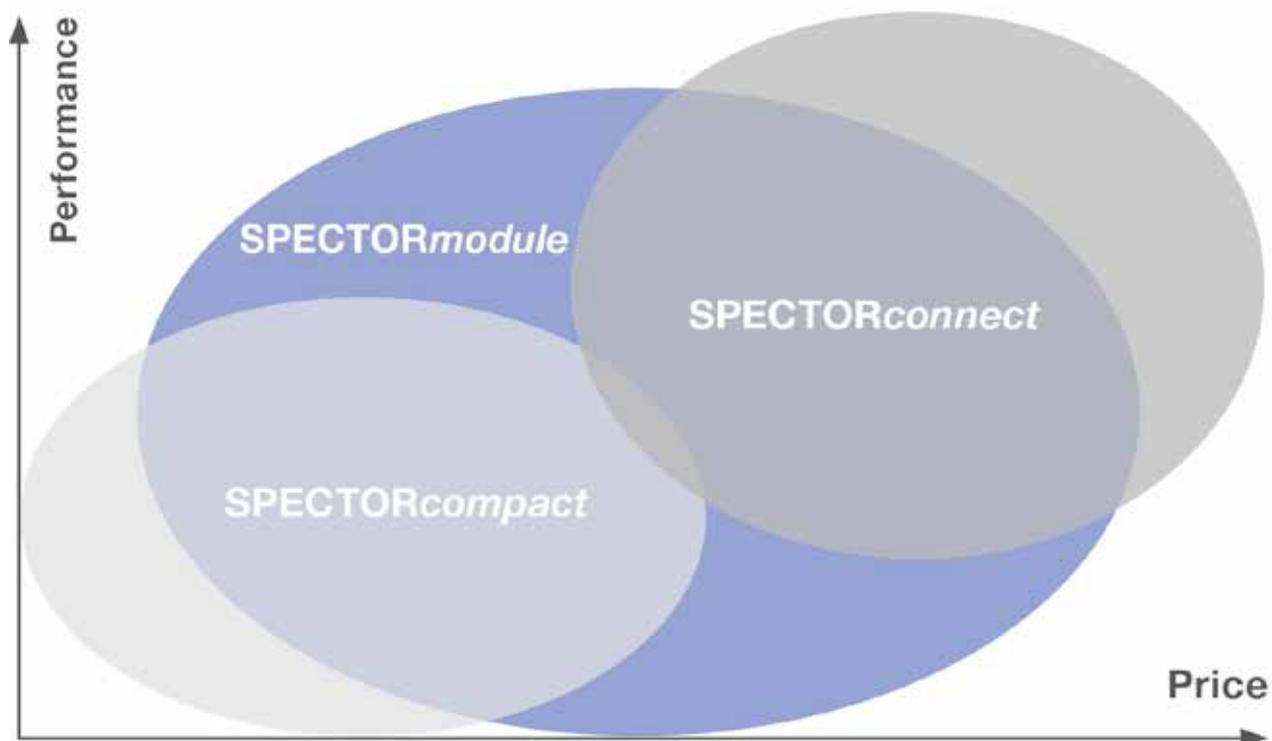
GESTRA electrode systems are now used in many different areas of the energy supply centre. In addition to the boiler equipment itself, these units are also used in condensate tanks, pump-driven return installations, steam regenerators, etc. With a low response sensitivity of  $> 0.5 \mu\text{S}/\text{cm}$ , even operation with full demineralisation plants does not pose a problem. In general, the entire energy supply centre is only as effective as its weakest element. Many plant operators, designers and manufacturers are therefore no longer prepared to accept any compromise in this matter.

## **Nothing is more cost-intensive than a production outage.**

Over and above these aspects, the requirements for the equipment of an energy supply centre tend to differ greatly. The requirements can no longer be met with one and the same system, as was perhaps the case just 10 to 15 years ago. The customers' wishes and requirements have always been the driving force behind GESTRA's innovative developments, and this is still the case today.

The SPECTOR family is able to satisfy these diverse requirements. The family consists of the new SPECTOR*connect*, SPECTOR*compact* and SPECTOR*module*.





### **SPECTORcompact**

The SPECTORcompact has given rise to systems that enable existing self-acting systems to be replaced with ease. Measured values are transferred as standard 4–20 mA signals or can be incorporated in existing controllers by means of integrated volt-free relay contacts, without any need for additional electronic control units. If necessary, controllers are of course also available for implementing entire controlled systems.

### **SPECTORmodule**

The SPECTORmodule system embodies the systematic further development of proven GESTRA technology. The main focus here was on ease of handling, reduced installation costs and cost-effective solutions. New units were developed as demand-based solutions for boiler automation, with parameterization limited to the most essential functions to ensure intuitive controller operation. The customer can choose between the SPECTORmodule and the SPECTORmodule Touch versions of the system, depending on the task at hand. The SPECTORmodule concentrates on key functions, and the parameters are set via a rotary push-button.

### **SPECTORmodule Touch**

The SPECTORmodule Touch version also focuses on the essentials: demand-based main functions and a clear, intuitive user interface. In this series, the controller was separated from the operating unit, which means that the laborious wiring for sensors, feedback, limit values, valve actuation, etc. in the control cabinet door is no longer required. Universal controllers generally entail a large number of parameter settings, making operation and parameterization of equipment more difficult. In the development of the SPECTORmodule Touch series, however, clear and easily understandable operation was top priority. Thanks to the intuitive user interface, the operator can enter parameters rapidly and reliably. The colour touchscreen leads directly to the parameterization level. Values are changed and functions quickly selected on a virtual numeric keypad. Care was taken to ensure that the various controllers always have the same clear, uniform operating structure.

**We design our systems with a focus on optimised system interfaces and minimised maintenance.**

# SPECTORconnect

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The communication abilities of conventional automation systems are limited due to mostly analogue, one-sided data transmission. GESTRA has therefore developed a digital system that can send data in both directions. In addition to the measured values themselves, the SPECTORconnect also transmits other information such as voltage, temperature, limit values and error messages. These data can be displayed and processed in higher-level control systems. This type of information processing is required by various European Directives with the aim of improving energy efficiency and, more recently, reducing CO<sub>2</sub> emissions. With the SPECTORconnect system, GESTRA is fully up-to-date with these requirements.

## **Intelligent, global monitoring**

An extensive and adjustable data connection enables worldwide system monitoring. Clear graphics, historic data and alarms provide clear information about the steam generation process.

## **Always state of the art**

The SPECTORconnect satisfies the requirements of the latest standards for safe steam boiler operation.

## **One unit, several functions**

All the important functions necessary for efficient plant operation have been integrated in a single unit, saving installation time and cutting costs.

## **Reliable service interval monitoring**

The plant operator is informed when components require a service or the system is going outside its normal operating range.

## **Constantly low energy consumption, reduced process costs**

Temperature-compensated measurement and control of conductivity in the steam drum itself reduces the blowdown volume to an absolute minimum.

## **Data communication**

The plant operator's principal requirements concern data communication and storage. Increasingly, plant data are required to monitor and ensure efficiency and reliability. GESTRA designed the SPECTORconnect series with these requirements in mind. The successor to our SPECTORbus units, which have now proven their worth in the field for two decades, are extremely flexible in the matter of data communication. The units are designed to support various data protocols. This way, all boiler-relevant data such as water levels, conductivity, temperature and limit values can be transferred to higher-level control systems simply and reliably. They also offer the easy option of reading out data via an Ethernet interface using a browser. The URB 60 visual display and operating unit acts as the central interface between the sensors, controllers and control centre.

## **Error memory**

All modules now contain extensive error memories to permit the in-depth analysis of any equipment malfunctions. These error memories can be read out on site using the URB 60 visual display and operating unit. Since these error memories are non-volatile, the data can be read out at the factory or by a service engineer, so that possible causes can be tracked down safely and reliably.

## **Market and usage**

The SPECTORconnect system is used for pressurized steam and hot-water plants in accordance with TRD 604, EN 12952 and EN 12953. Development has consistently focused on safety, enabling a SIL 2/3 rating to be achieved for conductivity limiting as well. The URB 60 display unit functions as a data interface and supports various data protocols. The pressure and temperature ratings are up to 183 bar at 357°C.



## Safety

Like its predecessors, the SPECTOR*connect* system encompasses the entire range of boiler equipment. As well as safety-oriented components for monitoring water levels, the system also comes with a thermal cutoff.

The conductivity limiting feature is a world first. In the universal switching unit (URS 60), the continuous signal from the conductivity sensor (LRG 16-60) is converted into a safe switching signal and used to reliably stop the boiler heating system.

The SPECTOR*connect* system comprehensively covers the safety components required by European standards. As well as German and European certifications such as VdTÜV and EC Type Approval, the components

also have SIL certification. A rating of SIL 2 or SIL 3 is achieved, depending on the combination.

The system's life expectancy has been extended to 20 years by using high-quality mechanical and electronic components. GESTRA has been able to ensure a high level of compatibility with predecessor units.



URS 60

## Operation

Based on our decades of experience with boiler automation systems and many suggestions from users of our equipment, we were able to make system operation and handling extremely clear and simple. All functions are controlled and displayed on a central operating unit, the URB 60. The navigation manages almost without language, using simple pictures instead.

In this new system, all sensors have their own display, showing current measured values and system

messages in the probe head. System settings are entered and status messages opened using an integrated, recessed button. There is therefore no need to open the sensor housing.



URB 60

# At a Glance

## Limiter systems with type approval and SIL certification

	URS 60 Universal limiter	URS 61 Universal limiter
Supply voltage	24 VDC	24 VDC
Sensitivity	> 0.5 $\mu\text{S}/\text{cm}$	> 0.5 $\mu\text{S}/\text{cm}$
Connectible sensors	4	4
Low water	(SIL 3)	(SIL 3)
High water	(SIL 3)	(SIL 3)
Temperature	(SIL 3)	(SIL 3)
Conductivity	(SIL 2)	(SIL 2)
Monitoring unit	2x (HW/LW)	2x (HW/LW)

## Capacitance level control and limit level signalling

	NRR 2-60	NRR 2-61
Control function	3-position stepping controller	Continuous controller
Level electrode	NRG 26-60	NRG 26-60
Supply voltage	24 VDC	24 VDC
Limit values	min/max	2x min/max
Pump control unit	-	2 alternating
Control valve	Electric	Pneumatic
3-component input	Optional 2x 4-20mA	Optional 2x 4-20mA
Actual value 4-20mA	Yes	Yes

## Conductivity control and limit level signalling

	LRR 1-60
Control function	3-position stepping controller
Level electrode	LRG 16-60, 16-61, 17-60
Supply voltage	24 VDC
Limit values	(min)/max
Blowdown control	Timer
Control valve	Electric
Standby input	Yes
Actual value 4-20mA	X

### Visual display and operating unit

	<b>URB 60</b>
	Touch panel
Supply voltage	24 VDC
Version	Resistive
IP rating	IP 65 (front)
Error memory	Yes
Communication	Modbus TCP
Ethernet	Yes

### Temperature limiter

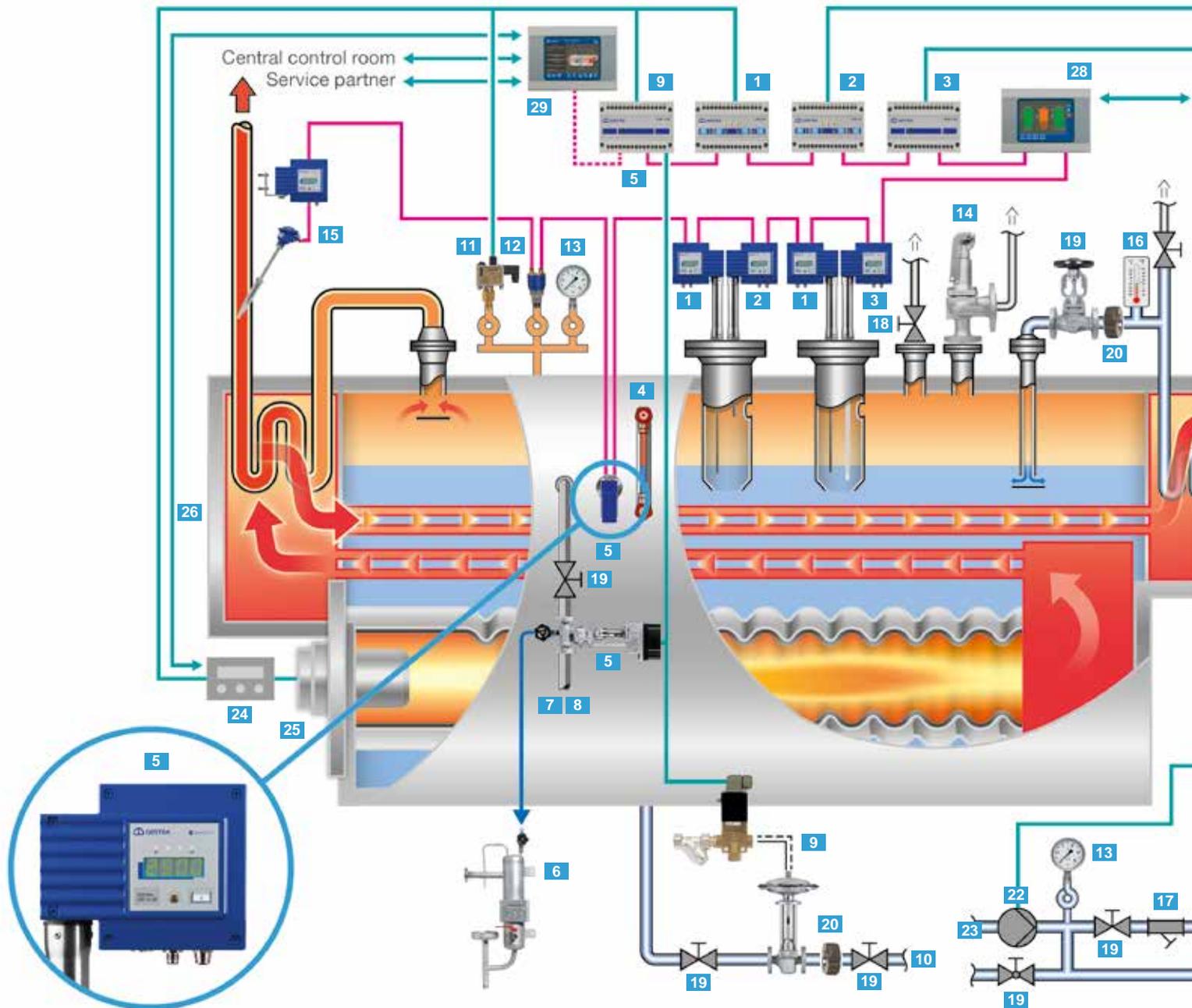
	<b>TRV 5-60</b>
Input	Pt100 sensor
Supply voltage	24 VDC
Local display	Yes

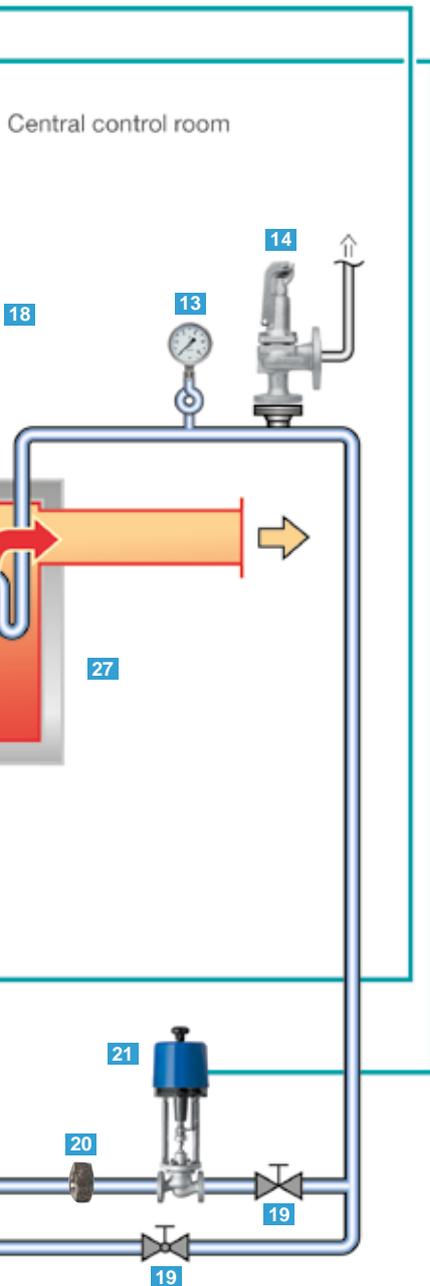
### Signal converter

	<b>URW 60</b>
	Gateway
Input	4-20mA level signal
Supply voltage	24 VDC

# GESTRA Steam Boiler Equipment - SPECTORconnect -

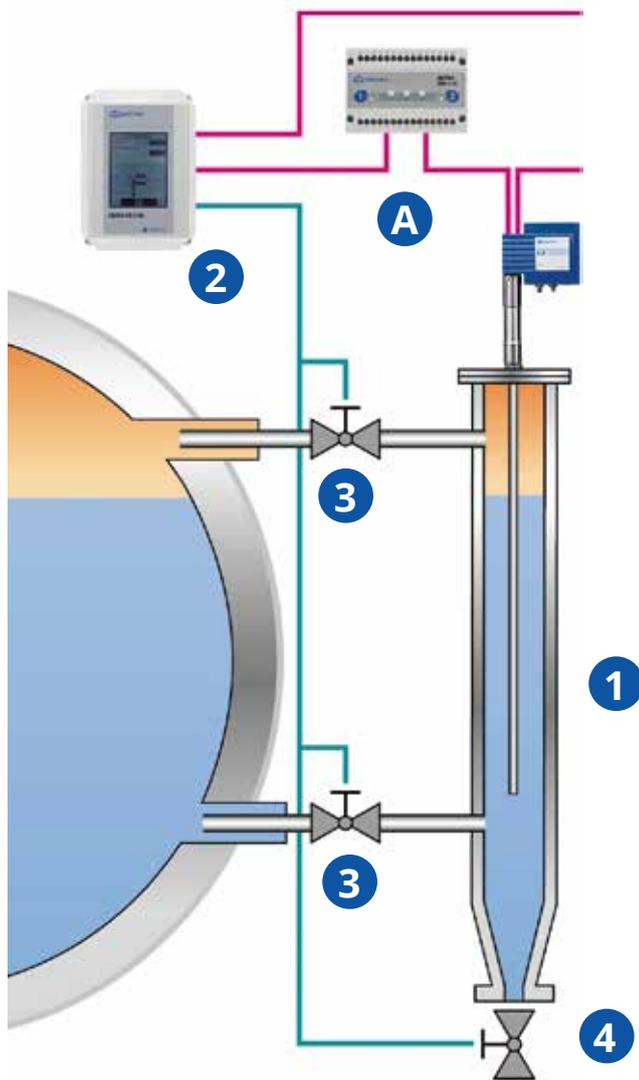
For operation without continuous supervision as per EN 12953 (72h)





1. "SMART" water level limiting system with self-monitoring and routine testing: level electrode NRG 16-60, level switch URS 60
2. "SMART" high-level limiting system with self-monitoring and routine testing: level electrode NRG 16-61, level switch URS 61
3. Continuous water level control system: level electrode NRG 26-60, level controller NRR 2-60
4. Direct water level indicator
5. Conductivity limiting system (TDS control)/continuous and intermittent boiler blowdown: conductivity electrode LRG 16-61, continuous blowdown controller LRR 1-60, continuous blowdown valve BAE 46
6. Sample cooler PK for safe and precise manual sampling (VRM)
7. Flash vessel for heat recovery
8. Residual blowdown cooler for heat recovery
9. Intermittent blowdown valve MPA, three-way pilot valve, strainer GSF
10. Blowdown receiver
11. Pressure limiter
12. Pressure controller/transmitter
13. Pressure gauge
14. Safety valve
15. Safety temperature limiter for superheater, resistance thermometer TRG 5-65, temperature transmitter TRV 5-60
16. Thermometer
17. Strainer GSF
18. Vent valve
19. Shut-off and bypass valve GAV
20. DISCO non-return valve RK 86
21. Electrically/pneumatically operated control valve V 725
22. Feedwater pump
23. Make-up water monitoring:
  - full demineralisation with conductivity monitoring electrode LRG 16-9/LRS 1-7
  - partial demineralisation with residual hardness monitoring
24. Burner control with Modbus RTU interface
25. Burner
26. Superheater
27. Economiser
28. Operating unit URB 60
29. Control, operation and acquisition of operating data with interfaces such as CAN, Modbus, Ethernet, OPC, modem, Profibus (optional), SPECTORcontrol incl. control functions B, D, E and operation T

# Externally Mounted Level Limiter



## Safe flushing and drainage

If a level electrode (low or high-level limiter) is installed in a lockable measuring pot outside the boiler, the connecting pipes must be flushed and the pot drained regularly.

For this to take place, the connecting pipes are shut off and opened at regular intervals, and the drainage valve opens and closes to clean the pipes and measuring pot.

In combination with the level switch URS 60 (low-level limiter) or level switch URS 61 (high-level limiter), the monitoring unit SRL 6-60 monitors compliance with intervals and the sequence of valve operations.

During flushing, the level switch bypasses the level electrode and prevents the safety or control circuit from opening. The level switch is controlled by the monitoring unit, and also monitors the flushing and bypass times.

A. "SMART" water level limiting system, SIL 3 certification: level electrode NRG 16-60, level switch URS 60

1. Measuring pot
2. Monitoring unit SRL 6-60 24 h/72 h
3. Shut-off valve with two limit switches
4. Drain valve with one limit switch



# GESTRA water level limiters

## - Reducing boiler damage to a minimum

### Safety low-level limiter NRG 16-60 (SIL 3) and safety high-level limiter NRG 16-61 (SIL 3)

The safety high-level limiter is self-monitoring, performs routine self-tests and has two channels.

Status signals can be retrieved and equipment settings entered on the integrated display, so there is no need to open the housing. Connection is via a pre-assembled cable with M12 connectors.

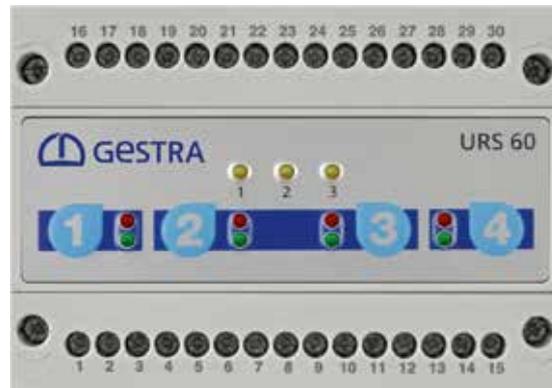


### Universal safety switch URS 60/61 (SIL 2/3)

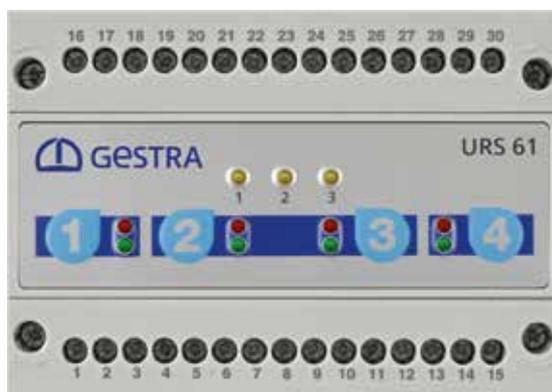
The new universal safety switch has SIL 3 certification in accordance with EN 12952/53. The switch is self-monitoring, performs routine self-tests and has two channels. Data can be processed from up to four safety-oriented sensors:

- (2x) low-level electrode NRG 16-60
- High-level electrode NRG 16-61
- Temperature transmitter TRV 5-60
- Conductivity sensor LRG 16-60/61 or LRG 17-60

The adjustable conductivity limit value is set on the display or on the sensor.



URS 60



URS 61

### Capacitance level electrode NRG 26-60

The capacitance level electrode NRG 26-60 continually measures the water level in pressurized steam or hot-water plants. The principle of capacitance measurement also means the electrode can be used in very clean water, such as in condensate tanks or deaerators. Status signals can be retrieved and equipment settings entered on the integrated display, so there is no need to open the housing. Connection is via a pre-assembled cable with M12 connectors.



### Capacitance level controllers NRR 2-60 / 2-61

The controllers of this series work in conjunction with the NRG 26-60 capacitance electrode. The series also offers a continuous control output for pneumatic valves or speed-controlled pumps (NRR 2-61). The unit is optionally available as a three-component controller.

Simple, menu-guided operation is via a separate touch panel (URB 60). In addition to set points and actual values, trend values, error messages and limit values are also displayed.

100% measuring range adjustment is possible from a water level of just 25%.



The system already incorporates an actual value current output for remotely displaying the level.

### Visual display and operating unit URB 60

- › Soft touch panel
- › Multi-colour display
- › Compatible with predecessor versions, replaces URB 1/URB 2
- › Gateway to higher-level DSC systems
- › Graphic display of historic data
- › Alarm and error memory



# Conductivity Control and Limitation - the Key to Reliable Production and Cost Efficiency

Calcium phosphates, silicates and carbonates are undesirable constituents of boiler water. Due to the evaporation process, they remain in the boiler water and cause it to thicken. They are also deposited on heat transfer surfaces, forming an insulating layer there. As a result, considerably more energy is needed to produce the same amount of steam. What's more, this leads to overheating, resulting in thermal stress cracks. Furthermore, deposits can influence all the valves and instruments and cause them to fail. Measuring the conductivity enables the concentration of these constituents to be established. If conductivity in the boiler is too high, it should be switched off to prevent damage.

To make sure this does not happen, it makes sense to remove water from the boiler continuously and supply fresh feedwater that is low in minerals. This requires less energy, because less cold water is needed than for intermittent blowdown.

## Advantages:

- › Reduction of boiler scale, which can lead to problems with steam production.
- › Boiler water containing calcium phosphate, silicate and carbonate is continuously removed, ensuring energy-efficient operation of the pressurized steam plant.

## Safety conductivity sensor LRG 16-60 (SIL 2)

The conductivity sensor can be used for control and for safely cutting off the heating. When combined with the safety switch URS 60/61, the sensor also becomes a limiter.

The actual value is continuously shown on the integrated display. Status messages can be retrieved and equipment settings entered, so there is no need to open the housing. Connection is via a pre-assembled cable with M12 connectors.

## Universal safety switch URS 60/61 (SIL 2/3)

The new universal safety switch has SIL 3 certification in accordance with EN 12952/53. The switch is self-monitoring, performs routine self-tests and has two channels. Data can be processed from up to four safety-oriented sensors:

- › (2x) low-level electrode NRG 16-60
- › High-level electrode NRG 16-61
- › Temperature transmitter TRV 5-60
- › Conductivity sensor LRG 16-60/61 or LRG 17-60

The adjustable conductivity limit value is set on the display or on the sensor.



URS 60



BAE 46

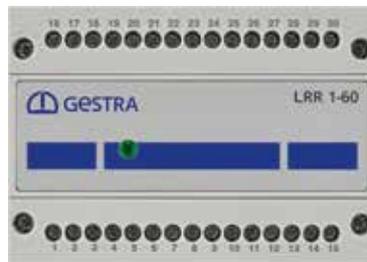


MPA 46

### Conductivity controller LRR 1-60

The controller LRR 1-60 works in conjunction with a conductivity electrode LRG 16-60, LRG 17-60 or LRG 16-61, depending on the measuring range. The controller has been optimised for operation with continuous blowdown valves from the BAE 46/47 or 210 series.

All units feature an actual value current output as standard, and come with a blowdown timer and standby input. As with the level controller, operation is via a separate, recessed touch panel (URB 60).



LRR 1-60



URB 60

In addition to set points and actual values, trend values, error messages and limit values are also displayed. What's more, the URB 60 offers various data transfer protocols for communication with higher-level systems.

### Safety temperature transmitter TRV 5-60 (SIL 3)

The new safety temperature transmitter has SIL 3 certification in accordance with EN 12952/53.

The system is self-monitoring, performs routine self-tests and has two channels.

The equipment works in conjunction with a Pt100 temperature sensor.

The actual temperature is displayed continuously, the target temperature is displayed at the touch of a button.



TRV 5-60

# Technical Information

## - GESTRA water level limiters

Limiters consist of a combination of level electrode and level switch. The areas of application of these units are defined in European (EN 12953 /EN 12953) and German regulations (Water Level 100) and are largely based on the risk potential of a plant. With the SPECTORconnect NRG 16-6.../NRG 17-6.../NRG 19-6... and NRG 111-6.../URS 60/61 system, we offer equipment with state-of-the-art safety technology. Based on the applicable EN standards, the units have been developed and manufactured in accordance with IEC 61508 (Functional safety) and certified to SIL. Of course, the limiters comply with the PED (Pressure Equipment Directive) and have TÜV and EU type approval.

### High-level alarm

A reliable system is also available for the high-level alarm. However, its use is not determined primarily by the technical literature, but by the downstream steam consumers. Based on these requirements, the potential hazard of overflowing and the carry-over of boiler water into downstream sections of the plant must be considered as part of the risk assessment. This covers the risk to downstream steam lines, heating surfaces, apparatus, etc. Self-monitoring high-level limiting systems are used wherever a high risk potential can be expected.

### Externally mounted level limiters

When level limiters are mounted externally, there must be reliable monitoring to ensure regular, controlled flushing of the measuring pot. The

monitoring unit SRL 6-60 monitors the flushing procedure and makes sure the shut-off valve is open. A timeout or incorrect valve position causes the burner to be safely switched off.

### Functional safety

Functional safety refers to an element of system safety, where risk reduction depends on the correct function of safety systems and external equipment. In other words, 'functional safety' covers only one aspect of overall safety, and not electrical safety, fire and radiation protection, etc.

In modern systems, safety functions are increasingly performed by electronic and, in particular, programmable systems. Consequently, the fundamental challenge facing functional safety is to ensure the correct functioning of complex, programmable systems. Therefore, it is essential to use suitable methods for preventing systemic faults (usually due to human error committed during the specification and implementation phase), and for controlling failures and malfunctions (usually resulting from the operating environment).

In this context, we refer to the 'safety integrity' of the protective or safety function. The relevant aspects of functional safety for electrical or electronic (programmable) systems are described in European standard IEC 61508, "Functional safety of electrical/electronic/programmable electronic safety-related systems".

### SPECTORconnect – with SIL 3(2) certification

- Up to four sensors on one safety switch
- Four separate, undelayed signal contacts per sensor
- Various autonomous function tests
- Two forcibly guided safety relays for the safety chain
- Three LEDs for backup error diagnosis
- Two indications per sensor:
  - Flashing (red) = cutoff point reached
  - Steady light (red) = cutoff point reached and time delay elapsed > switch-off
  - Steady light (green) = ready indication of each electrode
- Supply voltage 18–36 VDC, i.e. direct supply also possible via secure networks
- Input for monitoring unit SRL 6-60 (for monitoring the flushing process if installed in an external measuring pot)

## Safety limiter system

	URS 60	URS 61
		
	Universal limiter	Universal limiter
Supply voltage	24 VDC	24 VDC
Sensitivity	> 0.5 µS/cm	> 0.5 µS/cm
Sensor inputs	4	4
<b>Possible functions:</b>		
- Low-level NRG	(SIL 3)	(SIL 3)
- High-level NRG	(SIL 3)	(SIL 3)
- Temperature TRV	(SIL 3)	(SIL 3)
- Conductivity LRG	(SIL 2)	(SIL 2)
- Monitoring unit SRL	2x (HW/LW)	2x (HW/LW)
<b>Outputs:</b>		
- Safety-oriented relays	2	2
- Signal outputs	4 (1x per sensor)	4 (1x per sensor)
<b>Display:</b>		
- Power supply (green)	1-4 (1x per sensor)	1-4 (1x per sensor)
- Alarm (red)	1-4 (1x per sensor)	1-4 (1x per sensor)
- Malfunction (yellow)	3 (depending on fault)	3 (depending on fault)
<b>Operation:</b>		
- Test	Push-button per sensor	Push-button per sensor
- Number of sensors	DIP switch	DIP switch
- Configuration	DIP switch	DIP switch
- Limit value settings	URB/sensor	URB/sensor

	NRG 16-60	NRG 16-61	LRG 16-60	TRV 5-60	SRL 6-60
					
	Low-level electrode	High-level electrode	Conductivity electrode	Temperature transmitter	Monitoring unit

Supply voltage	24 VDC	24 VDC	24 VDC	24 VDC	24 VDC
Sensitivity	> 0.5 µS/cm	> 0.5 µS/cm	> 0.5 µS/cm	0°C	
Inputs				1x Pt100	5x limit switch
<b>Pressure ratings:</b>					
- PN 40	X	X	X	X	
- PN 63	X	X	X		
- PN 160	X	X	X	X	
- PN 320	X	X	X		
- SIL rating	(SIL 3)	(SIL 3)	(SIL 3)	(SIL 3)	
- Connection	CAN bus M12 socket	CAN bus M12 socket			
<b>Display:</b>					
- Sensor	7-segment	7-segment	7-segment	7-segment	7-segment
- Alarm LED (red)	Yes	Yes	Yes	Yes	Yes
- Malfunction LED (yellow)	Yes	Yes	Yes	Yes	Yes
<b>Operation on sensor:</b>					
- Test	Push-button	Push-button	Push-button	Push-button	Touchscreen
- System configuration	Rotary/push-button DIP switch	Rotary/push-button DIP switch	Rotary/push-button DIP switch	Rotary/push-button DIP switch	Touchscreen
- Equipment configuration	Rotary/push-button	Rotary/push-button	Rotary/push-button	Rotary/push-button	Touchscreen/DIP switch
- Limit value settings	Rod length	Rod length	URB/sensor	URB/sensor	

# Technical Information

## - GESTRA level control systems

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### **Continuous level control system - capacitance measurement -**

#### **SPECTOR*connect***

The SPECTOR*connect* series is the embodiment of three decades of experience. The level controllers NRR 2-60/NRR 2-61 offer a range of options that enable the planner or plant operator to employ the best possible system for his/her application. For example, it is now possible to switch between two frequency-controlled feedwater pumps.

Parameters of the SPECTOR*connect* are set intuitively and quickly using a colour touchscreen with direct access to the relevant parameter values.

Touching an input field opens a digital keypad, then the unit returns to the original window when your entry is complete.

You can configure and control up to five separate control circuits with one display unit

### **No programming required - just set the parameters**

100% calibration of the level electrode can take place at a water level of just 25% or more, to save time and costs during installation and start-up.

The separation of power components and operating units in the controller has proven its worth, and this feature has been retained. Thanks to the bus technology used, now only a two-core cable is required for connection.

The actual level indication on the display means that the controller can also be used as a second level indicator in accordance with EN 12952/EN 12963. All that is needed for this is a local sight glass.

For the controllers, three-position stepping controllers and continuous controllers are available, and three-element control can be added to both. In this way, even problematic load conditions can be managed.

### **Level electrode with integrated display**

The level electrode NRG 26-60 has a display integrated in its head, which shows the current water level during normal operation. Electrode-specific values, such as calibration or a change of address, can be set via a rotary push-button. The error memory can also be read out directly on the unit.

## Continuous level control system

	NRR 2-60	NRR 2-61
		
Control function	3-position stepping controller	Continuous controller
Supply voltage	24 VDC	24 VDC
Limit values	min/max	2x min/max
Control valve	Electric	Pneumatic
Continuous pump control	No	2 alternating
3-component input	Optional: 2x 4-20mA	Optional: 2x 4-20mA
Actual value 4-20mA	Yes	Yes
Operation	URB 60	URB 60
Indication	Status LED	Status LED
Connection	Screw terminal	Screw terminal

	NRG 26-60	NRG 26-61
		
	Capacitance level electrode	Capacitance level electrode
Supply voltage	24 VDC	24 VDC
Pressure rating PN 40	X	X
SIL rating		(SIL 2)
Output	CAN bus	CAN bus
Connection	M 12 socket	M 12 socket
<b>Display:</b>		
- Status & actual value	7-segment	7-segment
- Alarm LED (red)	X	X
- Malfunction LED (yellow)	X	X
<b>Operation on sensor:</b>		
- Test	Push-button	Push-button
- System configuration	Rotary/push-button & DIP switch	Rotary/push-button & DIP switch
- Equipment configuration	Rotary/push-button	Rotary/push-button
- Limit value settings		Rotary/push-button

# Technical Information

## - Boiler monitoring

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### **Boiler water monitoring**

A certain amount of minerals passes into the water circuit all the time. Some of these minerals (mainly calcium and magnesium), together with other impurities, remain in the water as hardness constituents. As a result of the evaporation process, the mineral content in the boiler water tends to rise. To prevent deposits in downstream plant components due to "foaming and priming" (the result of an excessive mineral concentration), the TDS (total dissolved solids) level must be kept within the admissible limits. Some hardness constituents can contain sediments which settle at the bottom of the boiler. Together with other foreign matter, these produce a layer of sludge, which must be periodically discharged in order to prevent corrosion, poor heat transfer, etc. Continuous (top) and intermittent (bottom) blowdown complement one another. Therefore, both processes are generally needed for correct boiler maintenance. This also applies to boilers with full demineralisation systems.

### **Conductivity limiting with SPECTORconnect**

The use of a reliable conductivity sensor is required by EN 12952/EN 12953. A type-approved limit switch ensures safe, reliable boiler operation.

The numerical and bar graph presentation of the actual value on the display unit URB 60 means that the controller satisfies the requirements of the WÜ 100 bulletin on water monitoring facilities for the continuous, temperature-compensated indication of conductivity.

### **Boiler water maintenance**

With optimised continuous blowdown control or the right water treatment, the boiler can operate as close as possible to the conductivity limit, reducing the rate of continuous blowdown. A Pt100 sensor integrated in the sensor delivers a temperature-compensated output signal that is proportional to the conductivity. All systems are type-approved on the basis of the VdTÜV 100 bulletin on water monitoring facilities (WÜ 100).

The conductivity controller from the SPECTORconnect series features a large number of options and can therefore be adapted to numerous operating conditions. Actuation of the intermittent blowdown valves is integrated in these controllers, as are the blowdown repeat intervals, standby mode and the flushing pulse for the continuous blowdown valves.

## Conductivity control and limitation

	<b>LRR 2-60</b>
	
Control function	3-position stepping controller
Supply voltage	24 VDC
Limit values	min/max
Control valve	Electric
Continuous pump control	No
3-component input	Optional: 2x 4-20mA
Actual value 4-20mA	Yes
Operation	URB 60
Indication	Status LED
Connection	Screw terminal

	<b>LRG 16-60</b>	<b>LRG 16-61</b>	<b>LRG 17-60</b>
			
	Conductivity sensor	Conductivity sensor	Conductivity sensor
Supply voltage	24 VDC	24 VDC	24 VDC
Pressure rating PN 40	X	X	
Pressure rating PN 63			X
SIL rating	SIL 2	SIL 2	SIL 2
Output	CAN bus	CAN bus	CAN bus
Connection	M 12 socket	M 12 socket	M 12 socket
<b>Display:</b>			
Status & actual value	7-segment	7-segment	7-segment
Alarm LED (red)	X	X	X
Malfunction LED (yellow)	X	X	X
<b>Operation on sensor:</b>			
Test	Push-button	Push-button	Push-button
System configuration	Rotary/push-button & DIP switch	Rotary/push-button & DIP switch	Rotary/push-button & DIP switch
Equipment configuration	Rotary/push-button	Rotary/push-button	Rotary/push-button
Limit value settings	Rotary/push-button	Rotary/push-button	Rotary/push-button

# Technical Information

## - Universal visual display and operating unit

### Universal visual display and operating unit URB 60

### Multicolour touchscreen and gateway

The URB 60 touchscreen is the main control element of the SPECTORconnect system. It displays all the information relevant to the system, such as actual values, historic data, alarms and error messages.

A second sight glass with direct display generally replaces the on-screen presentation of actual level or conductivity values.

The URB 60 can also be used to adjust and set the parameters of the connected sensors and controllers. This unit was designed on a WYSIWYG basis - what you see is what you get. Most values can be entered directly in the fields provided. Once you have entered your password, the on-screen keypad opens containing information on possible setting limits, the unit and the current and new set values.

The touchscreen also ensures the conductivity limit is entered correctly.

The unit features a Modbus TCP interface to satisfy the more stringent requirements for digital data communication. In addition, the screen content can be retrieved and displayed easily using a browser.

The extended error messages stored in the sensors and switching devices can be retrieved via an integrated USB port, and used for further processing.

If the unit is to be connected to an open, external Ethernet network, external measures must be taken to ensure internet and cyber security.



Homepage



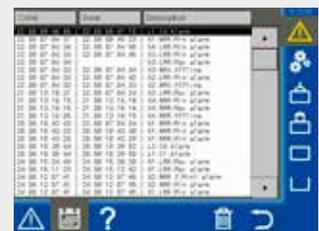
Reliable input of limit values



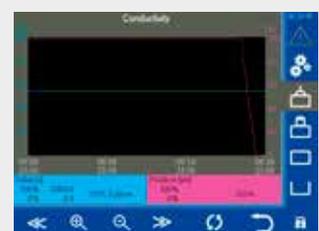
Controller parameterization



List of participants



Alarm list



Historic data

## Visual display and operating unit

URB 60	
	
Touch panel	
Supply voltage	24 VDC
Size	5.7"
Type	Capacitance method
Resolution	640x480
IP rating	IP 65 (front)
Error memory	Yes
Communication	Modbus TCP
Ethernet	10/100 Mbit
USB	Yes
Backup battery	10 years

# Technical Information

## Sample cooler PK

In addition to continuous blowdown, sampling is also especially important for the smooth operation of steam generating units.

Each GESTRA continuous blowdown valve is fitted with a sample valve, which removes boiler water samples for analysis.

However, accurate and uncorrupted analysis requires correct sampling and correctly functioning analysing instruments.

Direct sampling of hot boiler water from pressurized lines always involves a risk of scalding; moreover, these samples do not represent the true TDS (mineral) content. Flash losses in the sampling line or sample container cause the density of the boiler water sample to increase, making corruption of the analysis result inevitable.

The GESTRA sample cooler PK offers the perfect solution. The boiler water sample is cooled to the reference temperature of 25 °C, therefore satisfying the prerequisites for precise water analysis.

The GESTRA sample cooler PK can be fitted downstream from the sample valve, enhancing the technical standard of your energy supply centre.

## Portable digital meter VRM-2/VRM-3

As well as the chemical reagents needed for analysing the boiler water and condensate, electronic analysis units are indispensable tools for modern steam and hot-water generating plants.

GESTRA's solution is the conductivity testing case VRM-2, which contains the conductivity meter and electrode.

The VRM-3 testing case - like the VRM-2 - also contains the conductivity meter and electrode, but also a device for measuring the pH value and temperature, plus accessories such as a pH probe, Pt100, 5 capsules for each of the calibration solutions pH 4.01, 7.01 and 10.01; 1 bottle of 3 mol/L KCl solution, and 1 bottle of Pepsin cleaning solution. The measuring devices operate independently from the mains supply, using a 9 V battery.



VRM-3



VRM-2

Conductivity	0 – 200 $\mu$ S/cm
	0 – 2,000 $\mu$ S/cm
	0 – 20 mS/cm
	0 – 200 mS/cm
pH value	0 – 14.0
Temperature	-50 – +250 °C



# Energy recovery

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## **Energy recovery after continuous blowdown**

Whether continuous blowdown is controlled automatically or set manually, it is easy to make use of the dissipated heat afterwards. In a GESTRA blowdown flash vessel, for example, the energy generated by continuous blowdown is recuperated to a large degree by flashing. What's more, in a residual blowdown cooler located downstream, the heat remaining in the flash vessel can be used to preheat the feedwater. Flash steam coolers are another method of

recovering heat. They can be used for preheating the make-up water using flash steam from the feedwater deaerator, for example. GESTRA's experienced engineers in systems engineering and process technology are at hand to provide you with individual advice.

**In Germany and many other countries, heat recovery systems from GESTRA are eligible for investment subsidies.**



# Technical Information - Condensate Monitoring

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## **GESTRA Condensate Monitoring**

Condensate is produced in all heat exchangers operated with steam.

Since the condensate contains an appreciable quantity of heat, it would be economically unwise to discharge this condensate from the boiler water circuit unused.

Nonetheless, the condensate is often dumped because of fears that it might be contaminated by product ingress. Indeed, the possibility of hydrocarbons, acids, blowdown, dye baths or other substances traversing leaky heat-exchanger surfaces into the condensate, endangering boiler operation, cannot be excluded. As a rule, however, the condensate is not constantly contaminated, i.e. it is generally feasible to make use of the returning condensate in the boiler water circuit.

If the plants are operated according to TRD 604 or EN 12952/12953, however, and there is any risk of ingress by the products mentioned above, the standard requires constant monitoring of the condensate quality. This monitoring makes a distinction between substances that influence the electrical conductivity of the condensate, and those that cause turbidity or refraction. The former is detected by conductivity electrodes and evaluated by the relevant electronic control unit, while oil and turbidity detectors are used to detect oil, grease and similar substances.

TRD 604 stipulates that the boiler plant must be shut down if foreign matter ingress is detected and the contaminated condensate can get into the boiler water circuit. Since boiler plant availability is of the utmost priority, measures must be taken to prevent such an ingress in the boiler water circuit.

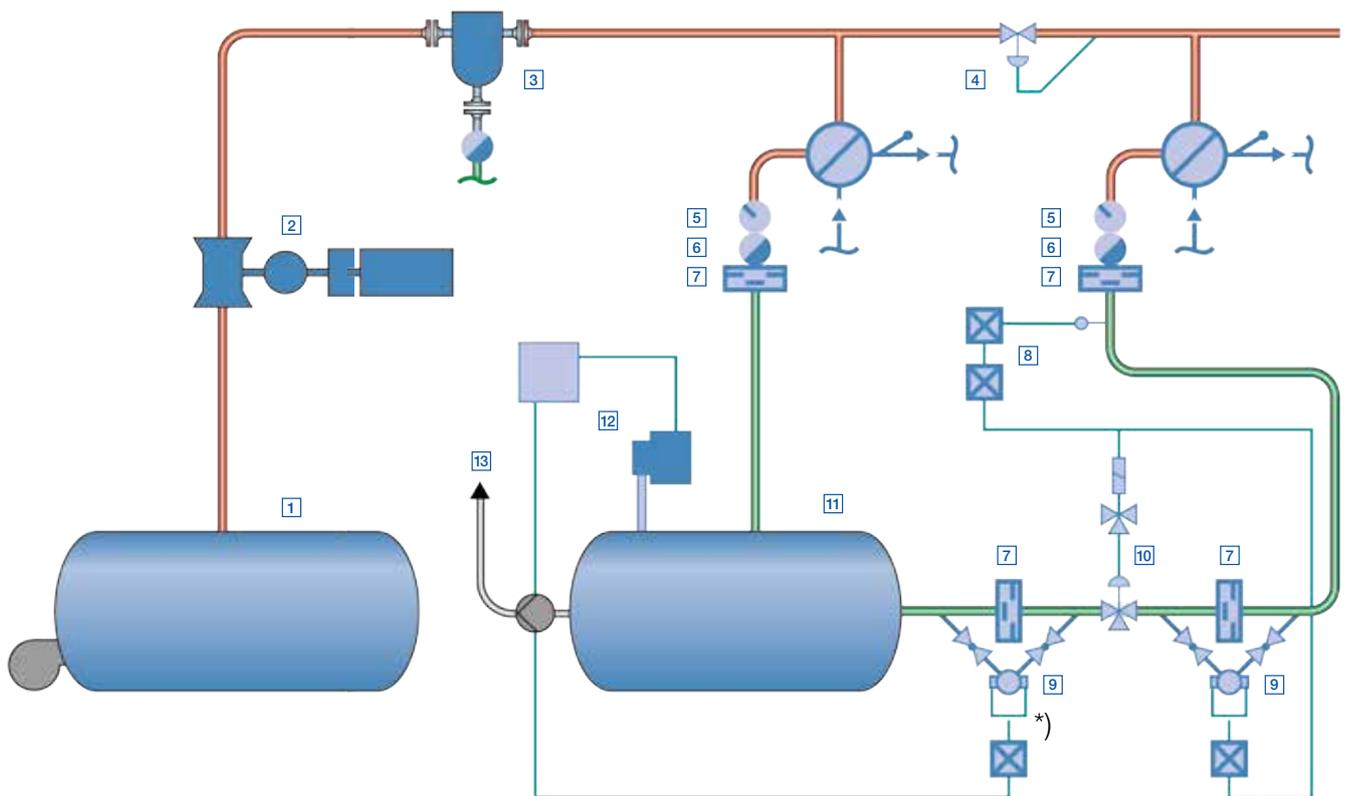
In practice, fitting a pneumatic three-way control valve downstream has proven to be effective, i.e. the contaminated condensate is discharged and then disposed of. This disposal takes place via oil separation systems, for instance, since the contaminated condensate is not allowed to enter the sewage system.

When planning boiler plants according to TRD 604 – 72 h unmanned operation – it is important to note that two oil and turbidity detectors are required.

Experience has shown that it is advisable in these cases to install the second monitoring unit downstream from the three-way control valve, because this is the only way to monitor correct valve function.

# GESTRA Condensate Monitoring

based on TRD 604 (72 h) or EN 12953 Part 6 – Steam and condensate system



1. Steam generating unit
2. Steam flowrate measurement
3. Steam drier
4. Pressure-reducing valve
5. Sight glass
6. Steam trap
7. DISCO non-return valve RK 86, 20 mbar

8. Monitoring for ingress of foreign substances, such as acids and blowdown: conductivity electrode LRG 16-9, conductivity switch LRS 1-7
9. Monitoring for ingress of foreign substances, such as oil and grease: oil and turbidity detector OR 52-5
10. Pneumatic three-way control valve for discharging the contaminated condensate

11. Main condensate tank
12. Condensate discharge control: compact level electrode NRGS 11-1, pump control unit NRSP
13. Feedwater tank

**\*) only one required by EN**

# Technical Information - Condensate Monitoring

## GESTRA Condensate monitoring

If the downstream oil and turbidity detector senses contamination, there is the option of shutting down the condensate pumps to ensure plant availability. This step prevents contaminated condensate getting into the boiler water circuit.

In this case, the shutdown should be linked to an alarm, so that operating personnel can take appropriate action.

As to the question of when monitoring of the return condensate is necessary, TRD 604 and EN 12952/12953 provide a clear rule:

**Whenever there is a risk of ingress by foreign substances, but only then!**

In most installed boiler plants, the condensate is collected in condensate tanks. This is frequently done via a decentralised process in different production zones, and then the condensate is conveyed to the main condensate tank in the energy supply centre by recirculation units working with or without pumps.

For extended systems like this, it is of course important to carefully consider the most suitable location for the condensate monitoring equipment.

Due to increasing cost pressure during plant planning and construction, the principle of less equipment, lower costs is frequently applied. This often means that the monitoring equipment is installed downstream from the condensate tank.

Unfortunately, this approach also means that if there is any ingress of foreign matter, the entire condensate system is contaminated and all condensate must be dumped, resulting in high cleaning and disposal costs.

The following rule should be applied:

**Install monitoring equipment as close as possible to the potential source of trouble.**

If there are several potential trouble-spots in a facility, you may need to group several condensate lines together before the monitoring point.

But even with this solution, the scope of grouped lines should be kept within clear limits, so that the source of a fault can be localised quickly.

## Conductivity monitoring

The ingress of conductive foreign matter such as blowdown, acids, raw water, dye baths, etc. is detected and reported quickly and reliably by the systems LRG 16-9/LRS 1-7 or compact system LRGT/URS 2, and any necessary measures are initiated automatically. Like the boiler water monitoring unit explained earlier, these systems work with automatic temperature compensation, i.e. fluctuations in temperature do not lead to a fault indication or automatic discharge.

## Oil and turbidity detection

As explained above, this monitoring system is used when there is a risk of ingress of hydrocarbons, whey products, etc. Because condensate

varies so much from one system to another, after zero point calibration the system must be able to distinguish between contamination and impurities resulting from the condensate system itself, and contamination by hydrocarbons, for instance. With the oil and turbidity detector OR, GESTRA has developed a system that can make this distinction through a combination of transmitted and scattered light. False alarms are reduced to a minimum, and system malfunctions are detected automatically.

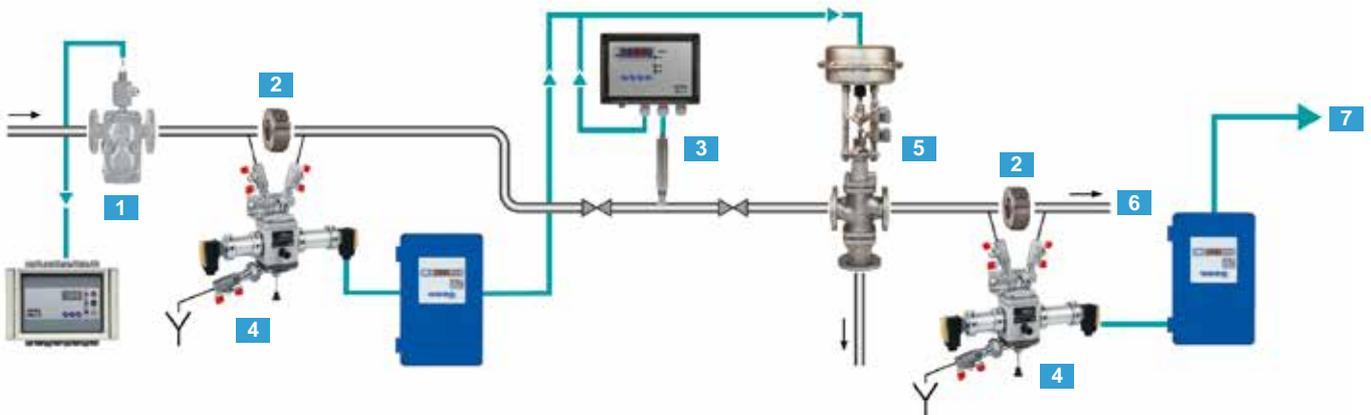
The requirements described above for the condensate system must be applied equally to the return flow in pressurized hot-water plants. An essential difference lies in the signal processing, as in hot-water systems discharge is not possible or not admissible.

# GESTRA Condensate Monitoring

## Please do not disturb!

Since the availability of your boiler plant is the highest priority, nothing must be allowed to penetrate the boiler water circuit. With GESTRA oil and turbidity detectors, disturbances such as:

- › discolouration,
- › bulb ageing,
- › and soiling of sight glasses are automatically compensated.



## Steam and condensate system

1. Steam trap with trap test set: test chamber VKE, electrode NRG 16-19 and test station NRA 1-3 for max. 16 traps
2. Non-return valve RK 86, 20 mbar
3. Quality control for ingress of foreign matter, using type-approved systems as per the VdTÜV 100 bulletin on water monitoring facilities (WÜ 100)
4. Monitoring for ingress of acids, blowdown, raw water, etc.: conductivity electrode with integrated resistance thermometer LRG 16-9, conductivity limit switch LRS 1-7
5. Monitoring for ingress of oil, grease etc.: oil and turbidity detector OR
6. Electric/pneumatic three-way valve for discharging the contaminated condensate
7. Main condensate tank
8. Shutdown of the condensate return system or interruption of the safety chain



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