



Expert Report

Dipl.-Wirtschaftsing. (FH), Dipl.-Informationswirt (FH)
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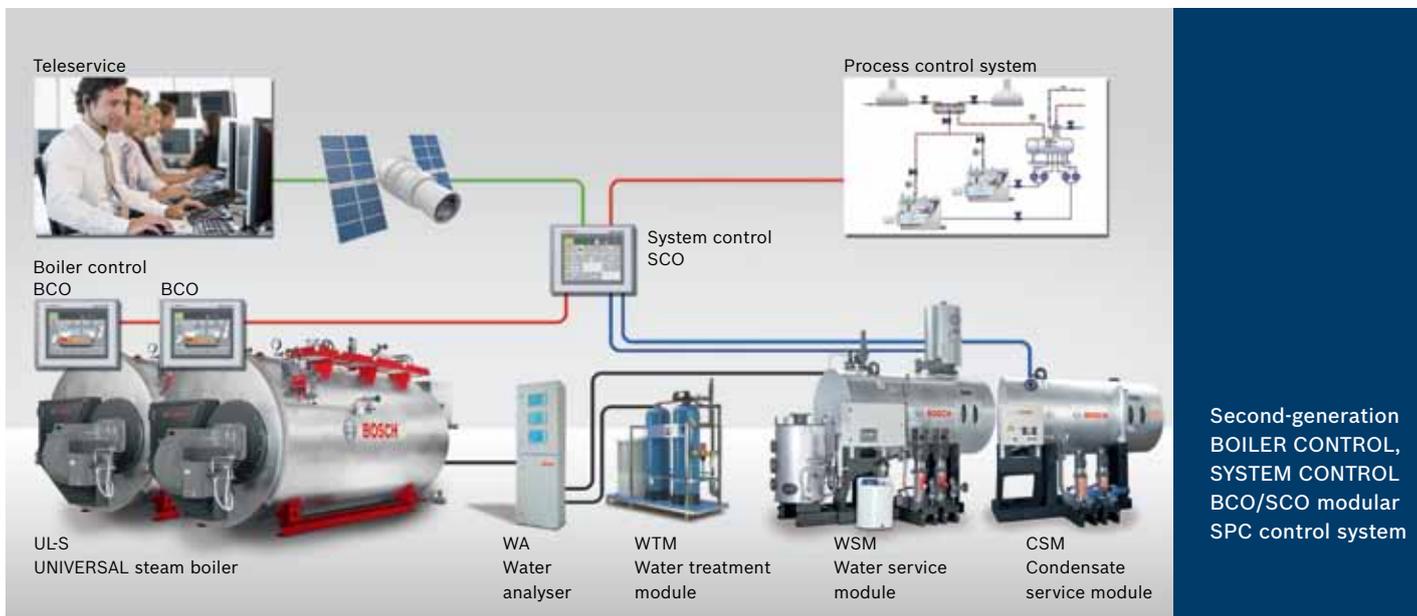


BOSCH
 Invented for life

Future-proof regulating and control technology boiler systems

Bosch Industriekessel GmbH was the first boiler manufacturer to use SPC-based controls as standard for shell boilers in 2001. The concept was a sweeping success in the market and has since become standard equipment.

The control systems have now been further developed and the 2nd generation is now available. All regulating and control functions of stored-program controls will continue to be equipped with the latest bus technology. New elements that have been introduced include graphically led, intuitively operated touch-screen displays, even greater operating data transparency and connectivity.





Touch-screen display on the BOILER CONTROL BCO on a steam boiler with Economiser

Development history

The Bosch Industriekessel GmbH has been operating its own switchgear construction unit since the beginning of the 1960s. The development and manufacture of its own electronically based boiler control and safety systems has led to major safety improvements in the operation of steam and hot water boilers.

- 1965 Fault alarm and display device with memory (German Patent)
- 1966 Electronically based furnace monitoring device (German Patent)
- 1977 Self-monitoring electrode control and monitoring (German Patent)
- 1994 Device for monitoring the water level of a boiler (German Patent)
- 2000 Method for regulating the performance of a steam boiler (German Patent)
- 2001 SPC-based boiler and system control system BOILER CONTROL BCO/SCO
- 2004 Fully automatic water analysis device WATER ANALYSER WA
- 2007 Second generation boiler and system control system BOILER CONTROL BCO/SCO with touch-screen display

The hardware

Industry-proven hardware in the area of stored-program controllers is used in the innovative boiler management systems. The devices take over all the control and regulating functions of the boiler or boiler system and can communicate via bus systems or networks with other controls (e.g. burner management systems, separate controls for boiler house modules, higher-level control systems). The safety chain is carried out using conventional contactor and relay technology.

All control software is saved on a Micro Memory Card. There is thus no need for contactor batteries or Eeproms to protect against power losses. The devices are space-saving, modular and are screwed together on a profile bar to create a robust structure with appropriate EMC. Depending on requirements, optional devices such as additional inputs and outputs or a Profibus DP communication processor for connection to the central management system can be added. An Industrial Ethernet network for connecting several control modules or as preparation for the Teleservice system are further options. A secure connection to the network is created via an analogue or ISDN connection if the Teleservice is used. Analysing and optimising regulating parameters, producing remote diagnoses and removing sources of errors were already possible with the first-generation equipment. What is new is that the Teleservice operator can, through remote access, mirror the boiler system's complete operating interface. This means that every operating step taken locally by the operator can be followed exactly, or the system can be remote-controlled by the service operator under the supervision of the user. This means that first-class support services or training measures are now possible.

A graphic TFT display with touch-sensitive interface is used for display and operation. Its extremely long working life plus its intensive light and contrasts mean that it is ideal for the toughest industrial use. The customer can choose between two sizes.

The entry-level class, at 8", provides plenty of space for boiler system display and operation.

A 10" version is also available as an option. Both panels have a resolution of 640 x 480 pixels and 65 536 colours, allowing even the most complex situations to be displayed in clear detail.

With both display and operating units, both the graphic menu structures and operating messages and the process value archive are saved on an MMC Multi-Media-Card.

If the feed water connector piece is touched, the pump settings and regulating parameters can be changed in the next operating pictures



The software

Software function modules that are specially tailored to the relevant boiler and boiler system regulating requirements and tested at the factory meet the complex, demanding requirements of safe boiler operation. Customers benefit from a wide range of systems in which the individual software modules have already been used and tested many times over in practice. Special individual programs, as is normal with other manufacturers, are only required in rare exceptional cases.

Graphic user guidance with maximum operating data transparency

For easy operation, the symbols, graphics and user menus on the touch-screen displays have been designed in accordance with the latest developments in ergonomics and usability. All the available control and regulating functions can be called up intuitively, and actual and setpoint values can be shown or changed in the colour display.

With BCO, contrast to traditional systems, far more operating states, operating data and measured values for the boiler system can be shown in the graphic display even in the basic version. These always include, for example, the operating hours for the boiler, the burner (in the case of two burners per boiler, separately for both burners) and the number of burner starts. All the set switching points, switching differences and limit contacts can be shown.

Important process data are saved within a specified interval on the memory card of the boiler or system control. Depending on the size of the memory card and the intervals, the data can be called up for days or weeks in this process value archive. The archive is structured on a rolling basis – once the memory capacity has been reached, the oldest process data are deleted and the newest are archived. These can then be called up on the displays in the form of graphic curve diagrams.

It is also possible for the Customer Service to read out the process value archive. The data can be further processed as required within word-processing or table editing systems.

Analyses of fuel consumption, steam production or temperatures are easier than ever before. The outstanding operating data transparency means that it is easy to optimise the regulating parameters, thus lowering energy consumption, pollutant emissions and wear and tear to the boiler.

Integrated protective functions help prevent incorrect operation

Protective functions are integrated into all the control and regulating mechanisms in the boiler or system. BCO, for example, makes sure that speed-regulating pumps can only be operated in their permitted ranges, i.e. that the flow quantities do not go above or below the minimum or maximum levels. Programmed delay times prevent the pulsing operation of burners and the negative effect this has in terms of increased wear and fuel consumption. If an integrated water analysis device detects a change in hardness, the make-up water valve is closed and the system is protected against the negative consequences. The position is similar if contaminated condensate flows are detected – the condensate is discharged immediately without any damage to the system.

But the systems are also protected against incorrect operation. The operator can only change settings within ranges that are unproblematic in terms of operating technology and safety. All other parameters which could cause severe damage or safety risks are integrated in a deeper, access-protected administrative level of the control devices. Only Customer Service engineers can make interventions at this level.

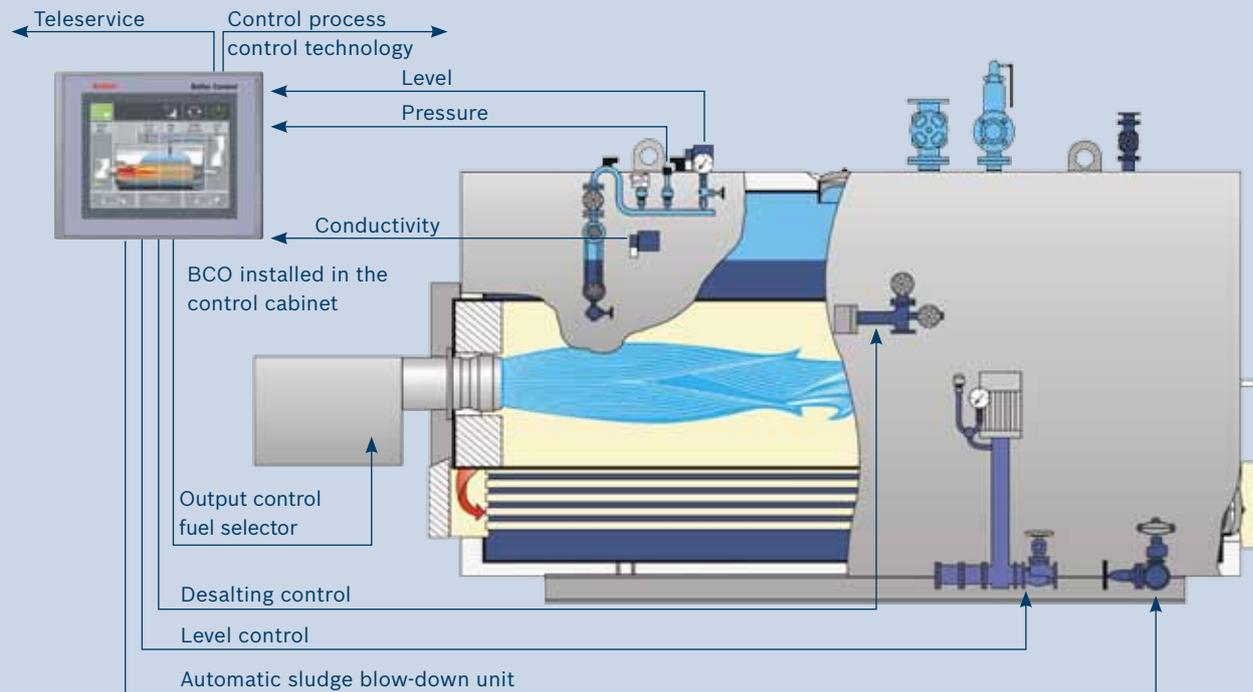
06:03:04 21.02.2007 KQG CODE 068: No signal from feed water flow measurement
03:45:00 21.02.2007 KQ CODE 068: No signal from feed water flow measurement
03:40:24 21.02.2007 K CODE 068: No signal from feed water flow measurement
10:53:09 15.01.2007 KQG CODE 011: Fault in feed pump 1
10:51:12 15.01.2007 KQ CODE 011: Fault in feed pump 1
10:50:04 15.01.2007 K CODE 011: Fault in feed pump 1
9:24:03 28.12.2006 G CODE 0B1: Advance warning, low water L=30%

Traffic light model in the operating and fault alarm memory, in the language spoken in the country

Helpful operating and fault signal management with integrated early warning system

BOILER CONTROL BCO and SYSTEM CONTROL SCO log and register all important operating messages. On the basis of the date and time, the operating message memory registers even early warning messages if levels are above or below various set limits as “coming” or “going”. The boiler attendant will detect an accumulation of poorly set regulating parameters and carry out modifications within a permitted range. This reduces or prevents shut-down on faults through safety limiting devices and thus avoids high costs from loss of production. Operating messages with or without failure of the boiler control are localised and displayed differently visually and acoustically so that a distinction can be made. The traffic light model is used in the display. Messages with a high priority have a red background, those with a medium priority are shown amber and less important messages have a green background on the colour display. This operating message log, which is saved in full on the memory card, can be called up at any time and provides an informative status report of the steam boiler system over longer periods of time.

Basic function of BCO boiler control for steam boilers



Functions in detail

Functions in steam boiler systems

BOILER CONTROL BCO for steam boiler systems

Regulation of the boiler output is suitable for gas, oil or dual burners with electronic or mechanical network. BCO can be used with boiler systems with stage-controlled or modulating burners.

Level regulation can be made as two-step or continuous regulation. A continuous regulation can be realised using speed-regulated feed pumps with integrated pump protection functions or using a continuous regulating module with overflow return flow.

Desalting regulation and automatic blowdown are further BCO functions.

Above and beyond these 4 basic functions, with which almost every modern steam boiler is equipped, BCO can be expanded using additional options and functions, e.g.:

- ▶ Measurement and regulation of flue gas temperatures for boilers with Economisers.
- ▶ Measurement and regulation of superheated steam temperatures for boilers with superheaters.
- ▶ Measurement of volume flows of steam, feed water and fuel.
- ▶ Automatic feed pump switchover using pressure, time or fault detection
- ▶ Time-controlled heat maintenance with lowering of pressure
- ▶ Connection to higher-level control systems
- ▶ Teleservice on request or with Teleservice contract

Servo drives, e.g. for the steam removal valve or the flue gas valve, can be controlled automatically or by manual intervention. BCO is also prepared for unsupervised operation for 72 hours (based on EN 12953).

SYSTEM CONTROL SCO for steam boiler systems

SYSTEM CONTROL SCO brings the controls of steam boilers and any individual module controls together into an overall management system, opening up a wide range of possibilities.

SCO takes over the sequence control of multiboiler systems. Depending on customer requirements and needs, it is possible to choose from various control and regulating options. The quantity of steam or the network pressure can be taken as the regulating parameter. The follow-on boilers are then switched on by the opening of a steam volume regulating valve or by increasing the boiler pressure, which has been lowered for the stand-by time, to the network pressure.

The innovative WATER ANALYSER WA can also be integrated. The system is thus completely automated and protected from the water side too. Through exact dosage of chemicals and control of the vapour steam valve it is possible to save water, energy, chemicals and operating costs and also to protect the environment.

There is no need for separate control units for deaeration systems, condensate systems, foreign body monitoring system and oil supply devices. All functions can be integrated into the SCO.

Functions in hot water boiler systems

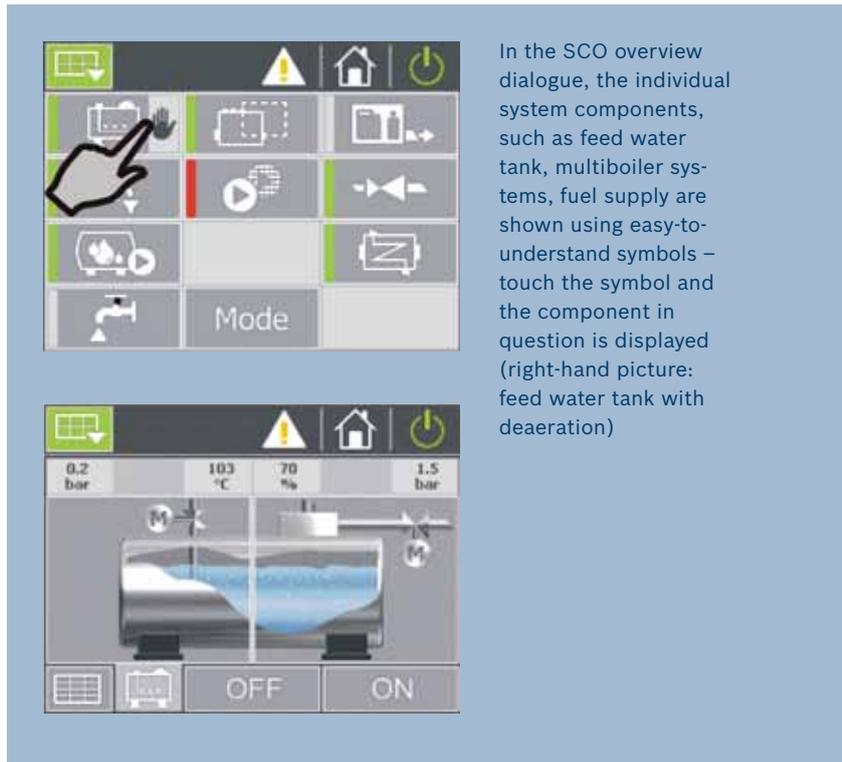
BOILER CONTROL BCO for hot water boiler systems

The basic functions of the BCO for hot water boilers correspond to the boiler control for steam boiler systems. Beside these basic functions, there are also other possible measuring and control functions specially for hot water boiler systems:

- ▶ Measurement and regulation of heat exchanger entry temperature for boiler with Economisers or flue gas condensators
- ▶ Measurement and regulation of supply flow temperature
- ▶ Return flow temperature safeguarding using an admixing pump
- ▶ Time-controlled heat maintenance
- ▶ Connection to higher-level control systems
- ▶ Teleservice on request or with Teleservice contract

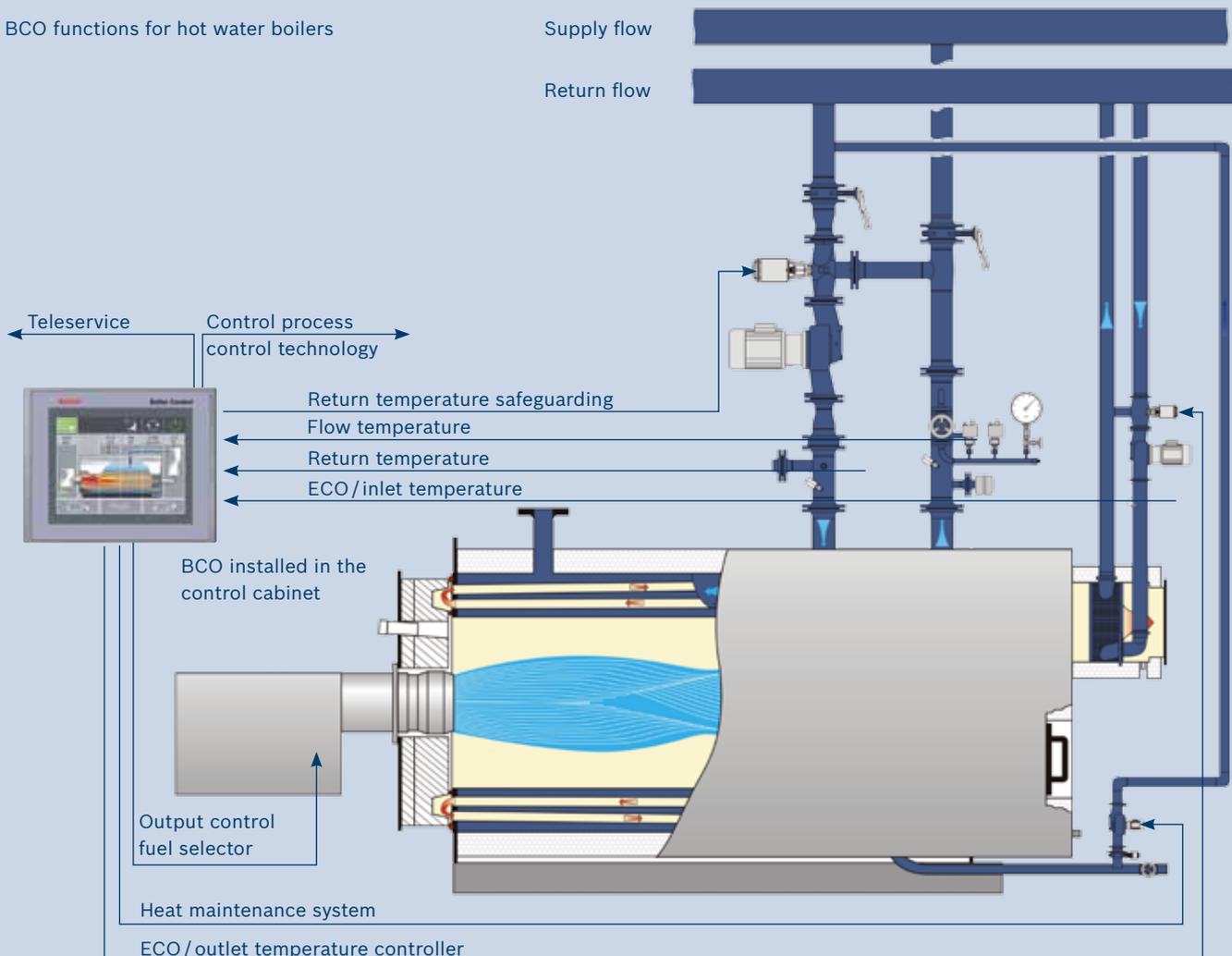
SYSTEM CONTROL SCO for hot water boiler systems

As with steam boiler systems, SYSTEM CONTROL brings together the individual hot water boiler control systems into a higher-level management system. SCO is used for the sequence control of multiboiler systems, the integration of deaeration systems, water analysis devices, foreign body monitoring systems, fuel supply devices, all sorts of pressure and temperature regulation systems, return flow temperature maintenance or weather-based boiler regulation.



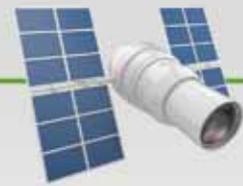
In the SCO overview dialogue, the individual system components, such as feed water tank, multiboiler systems, fuel supply are shown using easy-to-understand symbols – touch the symbol and the component in question is displayed (right-hand picture: feed water tank with deaeration)

BCO functions for hot water boilers



BCO/SCO boiler and plant management system with a complex hot water boiler system

Teleservice



UT
UNIMAT Hot water boiler

WA
Water analyser

WTM
Water treatment module

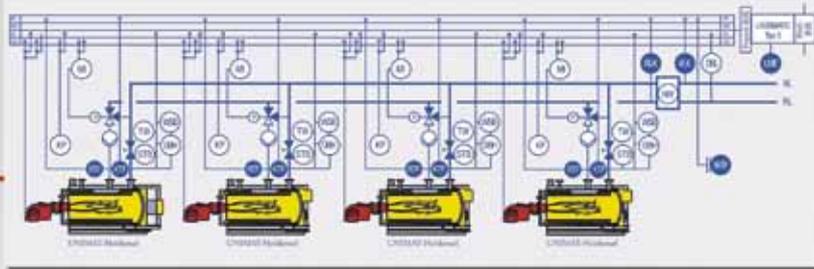
Advantages for planners and plant contractors

Conventional relay logic with electromechanical operating elements, switches, individual digital regulators, time switches and operating and control signals has been almost completely replaced.

Maximum planning and functional reliability is achieved through the use of tried and tested industrial standards and factory-tested software modules used in series.

Higher-level display and control systems can be connected using an optional Profibus DP interface. The reduction in the number of appliances reduces coordination and arrangement requirements. Assembly and commissioning times are simplified and shortened through the use of plug-in connections and presettings at the factory.

Process control system



SCO



WSM
Water service
module



UT
UNIMAT Hot water boiler

Benefits to the customer

The central BCO/SCO automation device contains all the operating and functional logistics required in a steam boiler or hot water boiler system.

- ▶ BCO/SCO allows all measuring and regulating functions to be easily optimised. Energy consumption, pollutant emissions and wear and tear are minimised.
- ▶ BCO/SCO guarantees maximum supply and operating reliability. An extensive operating message memory with integrated early warning system means that badly set regulating parameters can be detected and corrected before any shut-down due to faults.
- ▶ BCO/SCO gives maximum operating data transparency. A wide range of operating states, operating data and measured data can be shown in the graphic touch-screen display.

- ▶ BCO/SCO meets all the special requirements of modern boiler control and is suitable for later expansion, modification and updating.
- ▶ BCO/SCO provides intuitive operation through the use of graphic symbols and displays on modern touch-screen colour monitors.
- ▶ BCO/SCO prevents incorrect operation through its integrated protective functions.
- ▶ BCO/SCO is prepared for data exchange with higher-level control systems and the Teleservice facility
- ▶ The Teleservice option allows the operating interface to be mirrored and provides rapid assistance in the event of operating problems and the search for faults.

The second-generation BOILER CONTROL BCO and SYSTEM CONTROL SCO control modules continues the success story of modern boiler system controls.

Production facilities:

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