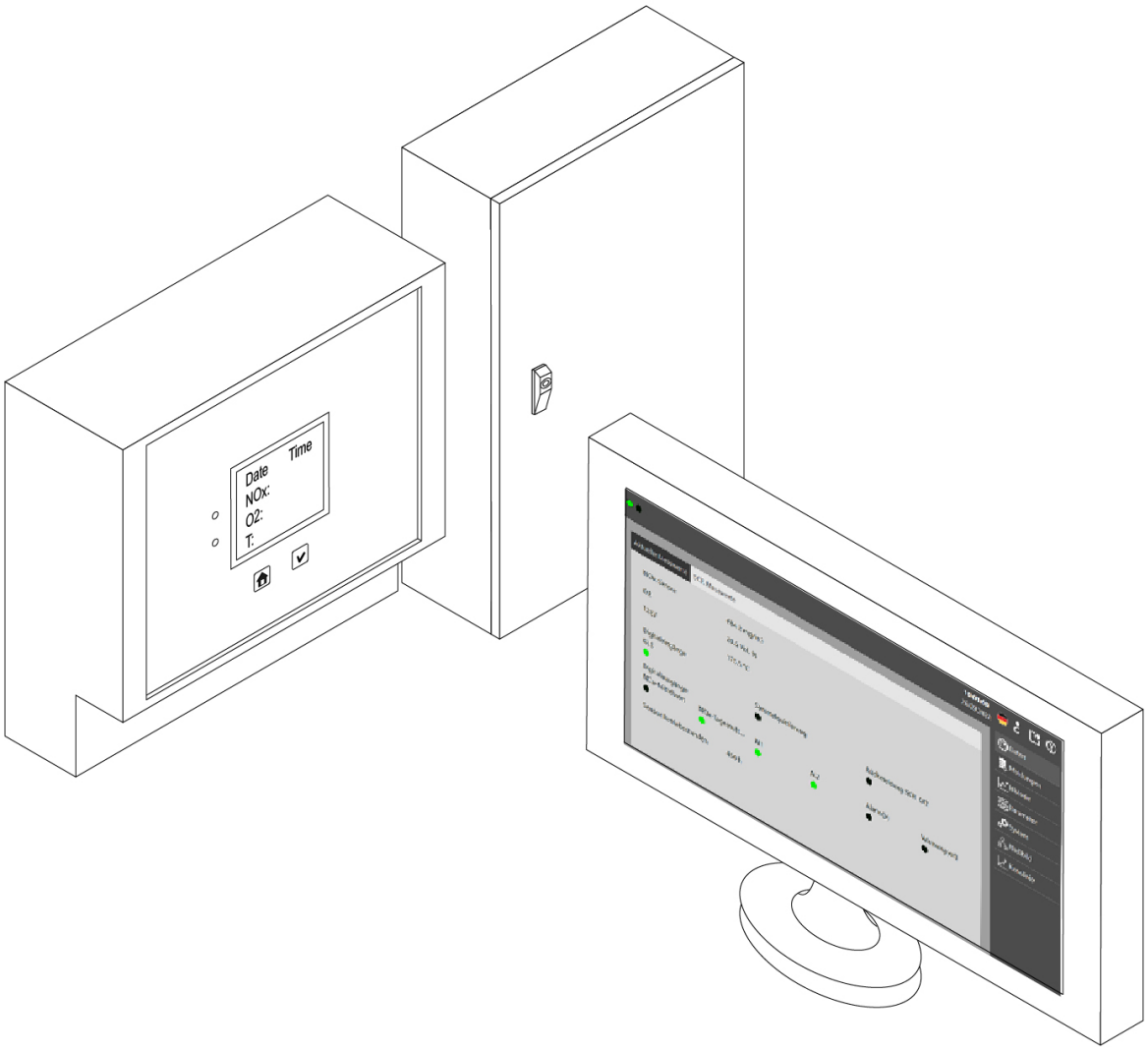
EmiBox

SCR Control Kit and NO_x Sensor Kit
Operating manual
1240 6894 EN 2023-07
Competence level OL/BL or
Competence level CL Q



This document is a part of the operating manual in accordance with Machinery Directive 2006/42/EC.
This is a translation of the German original. All translations are based on the German original.

Technical modifications required to improve our products are reserved with regard to specification data and other technical information contained in the document. No parts of this document may be reproduced in any form or by any means without the written approval of the manufacturer.

The document contains information that is necessary for maintenance and repair work on the product. When carrying out the work listed in the maintenance schedule, only original parts or parts and operating media approved by the manufacturer may be used.

Masthead:
Caterpillar Energy Solutions GmbH
Servicedokumentation
Carl-Benz-Str. 1
68167 Mannheim
Germany
+49 621 384 0
+49 621 384 8800
www.caterpillar-energy-solutions.de

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1 Information about this manual

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1.1 Introduction

1.1.1 Target audience

This document is intended for personnel who fulfil at least the following requirements:

- Working as Operating personnel or qualified specialist personnel
- Possess knowledge and skills corresponding to Operator Level (OL) or BOP Specialist Level (BL)

For further information on the knowledge and skills required of personnel, see

- Operating Manual ⇒ General ⇒ Safety regulations
  - Safety and Product Information Specification ⇒ Tasks, personnel and competencies

1.1.2 Validity

The document is drafted in German. In other languages, the document is a translation of the original manual.

1.1.3 Handling

The notes and descriptions given in the document enable safe and efficient handling of the product. Observe and comply with all warnings, safety notes and instructions for handling in order to work safely on the product.

In the document, illustrations assist in basic understanding and may deviate from the actual design.

1.1.4 Storage

This document is a component of the product. Keep the document in the immediate vicinity of the product. The document must be accessible at any time.

1.1.5 Operator obligations

In order for the product to function properly and to be operated for its intended purpose, the operator must observe and ensure the following:

- Have all activities on the product performed in accordance with the applicable standards and specifications
- Define the responsibilities for operation, maintenance and troubleshooting
- Inform authorized operators and authorized specialists about possible hazards that can arise when working with the product
- Ensure that the authorized operators and authorized specialist personnel have read and understood the operating manual

1.1.6 Symbols used

Symbols are used in this document so that the authorized specialist personnel can quickly recognize issues and clearly categorize them. Warnings are marked with symbols.

1.1.7 Conventions of terminology

CES: Caterpillar Energy Solutions GmbH, the manufacturer of this product.

SCR: Selective Catalytic Reduction (SCR), employed to reduce emission of nitrous oxides (NO_x), carbon monoxide and formaldehyde in the exhaust gas.

SCR application: plant-specific implementation of a technical apparatus featuring SCR technology, but without the EmiBox.

SCR catalytic converter: exhaust catalytic converter, the core component for the technical process of selective catalytic reduction.

EmiBox: the central component for electronic analysis and communication of the instantaneous measured NO_x value; the open- and closed-loop control for running the process technology of an SCR application.

SCR Control Kit: an extension of the EmiBox for open- and closed-loop control of an SCR catalytic converter by means of software and hardware.

SCR Control switchgear cabinet: a component of the SCR Control Kit serving as the electronic and electrical interface to the EmiBox and the SCR application.

SCR Control: umbrella term for the functionality of the SCR Control switchgear cabinet.

TEM system: the Total Electronic Management (TEM) control system for the genset and its systems.

TPEM system: the Total Plant and Energy Management (TPEM) control system for the genset and various systems in the plant.

Cable: the term cable is used for all cable-like electrical connections, regardless of where they are installed (underground or above ground).

For further information on the system layout and the terms, see chapter 4 Structure and function 33.

371-001-EN : 51000010 : BA : VAR, COV, IMP, B, BA, BS, DEM, EIN, IBN, IST, WP, SK, MH, SB, STB, TA, TL

1.2 Legal notes

1.2.1 Limitations of liability

In this document, all information and notes have been compiled taking the relevant standards and specifications for the product and the state of the art technology into account.

The manufacturer assumes no liability for damage resulting from the following causes:

- Non-observance of the operating manual
- Non-intended use
- Deployment of unauthorized specialist personnel
- Unauthorized conversions
- Technical alterations
- Use of unapproved spare parts or attachments
- Use of unapproved operating media

The actual scope of delivery may differ under the following conditions:

- Special versions
- Utilization of additional order options
- Due to the latest technical modifications

The regulations apply in the following order:

1. Obligations agreed in the delivery agreement
2. Terms and conditions of the manufacturer for the sales and delivery of new engines, new plants and original parts in the current version
3. Legal provisions valid when the contract was concluded

The right for the manufacturer to undertake technical alterations to improve the performance characteristics and further development is reserved.

1.2.2 Copyright

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Unless for in-house purposes, the following measures are not permitted:

- Transferring the document to third parties
- Reproducing any parts in any form or by any means
- Utilization or disclosure of the contents

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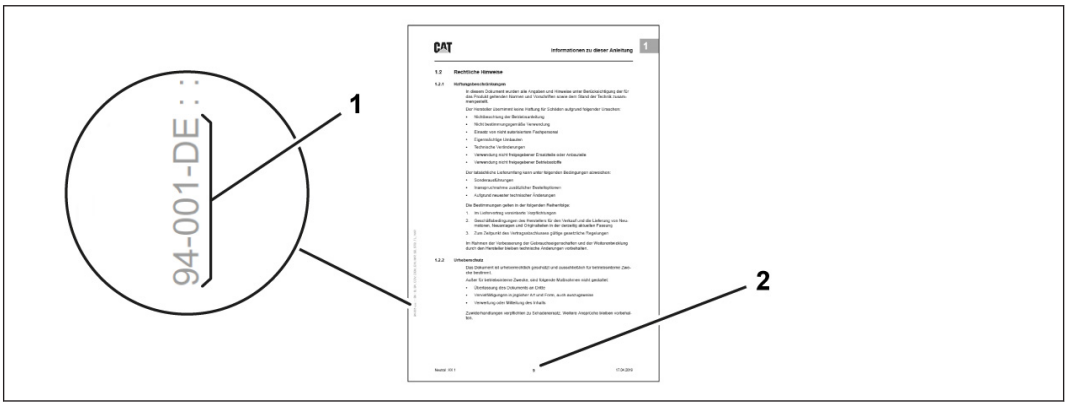

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We look forward to hearing from you!

2 Safety

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2.1 Safety regulations

Observe the applicable safety regulations for operation, maintenance and servicing. Observe and comply with all instructions for handling and safety notes given in this document. Otherwise, substantial hazards may arise.

The product is used in the commercial sector. The operator is subject to the legal obligations for health and safety at work.

The operator must comply with the following for the product's and overall plant's area of application:

- Safety notes in this document
- Safety regulations
- Accident prevention regulations
- Environmental protection specifications
- General rules on health and safety at work
- Risk assessment of the operator
- Directives and ordinances on operational safety

Directives, ordinances and regulations are available from trade associations or specialist dealers.

For necessary information on the safety regulations, see

- Operating Manual ⇒ General ⇒ Safety regulations
  - Safety and Product Information Specification

2.2 Intended use

The EmiBox, its functionalities and available accessories are intended for integration into a genset manufactured by Caterpillar Energy Solutions GmbH together with a catalytic converter approved and marketed by CES. The components of the standard version are suitable exclusively for a TEM system or TPEM system type control with the appropriate hardware and corresponding release version. Older TEM systems and/or TPEM systems must be retrofitted with prepared Retrofit Kits. For further information on the technical requirements, see chapter 3 Technical data and rating plates 25.

The primary task of the EmiBox without its accessories is to measure exhaust gas emissions, save and analyze measurements, and transmit relevant indicators. With the SCR Control Kit extension, the EmiBox can also handle open- and closed-loop control of an SCR application.

Operation of the EmiBox and the functionality of the SCR Control and other accessories is only permitted under the following conditions:

- Fully functional and maintained genset with:
  - operating media and auxiliary media approved by the manufacturer
  - emissions downstream of the exhaust turbocharger complying with the manufacturer's specifications
- Fully functional and maintained SCR application with:
  - operating media and auxiliary media approved by the manufacturer
  - emissions upstream of the SCR application complying with the manufacturer's specifications
- Fully functional EmiBox and current firmware
- Use in accordance with technical specifications and technical data
- Proper electrical and electronic connection
- Proper configuration and parameter assignment for the SCR application and the place of use
- Suitable data exchange network and appropriate IT security measures

Any other use of the EmiBox and its accessories outside of the intended use of the TEM/ TPEM system and beyond the intended use of the EmiBox is not permitted. The operator is liable for any damage resulting from such improper use.

2.3 Residual dangers

Dangers are described in the technical documentation by safety notes and warning messages. Danger areas are marked by symbols on the product.

Nevertheless, residual dangers cannot be ruled out.

The following points are residual dangers inherent in the design:

- Improper handling
- Defective or removed safeguards
- Defective or damaged components
- Improper and unintended use
- Maintenance work not carried out
- Improper maintenance work
- Failure to observe specifications of the technical documentation
- Failure to observe operating media regulations
- Failure to observe the Technical Bulletins
- Unattained personnel qualifications

2.4 Work on the product; Operation

All work done on the product (assembly, commissioning, troubleshooting, maintenance and dismantling) must be carried out by an authorized and qualified specialist (in the area of electrical engineering, additionally trained for SCR systems). Relevant regional safety regulations and environmental regulations must be observed. The product must be integrated into the overall system in accordance with the manufacturer's technical specifications and existing technical rules.

The following general information always applies. These must be supplemented in accordance with the regional specifications, recognized technical rules, job assignment and situation on site.

- If a problem occurs, do not open the product. Instead, contact the responsible dealer or service partner
- If the product has an unusual odor or makes unusual noises, disconnect the product from the mains immediately. Contact the responsible dealer or service partner
- Keep the product away from liquids
- Disconnect the product from the mains before any maintenance work

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2.5 Hazards and measures

2.5.1 Mechanical hazards

Cutting or severing

Cutting cables, lines, pipes and installation material to length

For protection against injury during assembly and maintenance, all work must be carried out by specialist personnel using the suitable tools.

Slipping, tripping and falling

Work on the roof

There may be components of various systems on the roof where maintenance work or measurements are required. If there is no access to the respective workplace on the roof or if there is no railing at the workplace to protect against falling, suitable safety measures are required for work. Depending on the work to be carried out, the safety measures are:

- Use of an elevating work platform (e.g., work on the exhaust muffler or exhaust catalytic converter)
- Use of a mobile climbing aid (e.g., work on the stack)
- Erecting scaffolding or catching frame
- Use of fall protection

The following generally applies for work on the roof:

- Instruction is required. Repeat the instruction corresponding to the regional regulations
- After a person suspended following a fall is rescued, counteract any possible suspension trauma by immediately applying first aid measures. Corresponding information and practical exercises are a component of the instruction
- When working on the roof, a second person must be enlisted who remains in sight and hearing range

Special caution must be exercised when cleaning the recooler base:

- Round loops must be fastened on the feet of the recoolers for fall protection. Do not use the feet on the roof edge when doing so
- Keep safety belts as short as possible. The maximum length must not exceed the distance to the roof edge
- Secure tools and work equipment (e.g., industrial vacuum cleaners) against falling

Cable

Cables must not be a trip hazard. If possible, use existing cable trays, etc. for the cables.

2.5.2 Electrical hazards

Electric shock

Assembly

The electrical connection of the system or its components may only be carried out by authorized specialist personnel in observance of the regional connection requirements and regulations, and in compliance with the circuit diagrams and specifications of the manufacturer.

Improper electrical connection can cause wide-ranging damage to property and injury to personnel.

Cleaning

Product cleaning may only be performed by authorized and qualified personnel.

Before cleaning, have the product disconnected from the mains by electrical specialist personnel and have it put into operation after the work has been completed.

Maintenance

Work on the electrical system may only be carried out by authorized qualified electricians or by persons qualified in electrical engineering under supervision.

Relieving

Working on products that have not been powered off can lead to personal injury.

Assembly, maintenance and repair work may only be carried out on products that have been powered off and relieved of load by qualified specialist personnel beforehand. Before opening any components of the product, the power supply must be switched off.

Fire

Do not extinguish electrical components with water in the event of fire.

2.5.3 Thermal hazards

Burns

Non-insulated surfaces

In the intended approaches to the installation site of the NO_x sensor, surfaces possessing particular risk of of causing burns and which can be touched accidentally while passing them, have been insulated.

Because of the processes involved, the NO_x sensor can become extremely hot.

Observe the following for protection against burns:

- Before beginning work, inform the operator and/or competent plant supervisor about the danger zones
- Pay attention to corresponding warning signs on components
- Allow the exhaust system and/or the surface temperature to cool to 60 °C or lower
- Wear protective equipment, especially working gloves
- When working on the NO_x sensor under operating conditions, or when conducting measurements on the hot exhaust system, observe special safety precautions, in particular: Wear heat-resistant and heat-insulating work gloves

Dehydration

Protective measures

Observe the following for protection against dehydration:

- Avoid performing maintenance work at very high ambient temperatures and in intensive sunlight whenever possible
- Take appropriate breaks and ensure adequate liquid intake and cooling
- Allow the genset and exhaust system to cool down before working on the plant
- If this is not possible, for example for measurements when the genset is operating:
  - Take breaks more frequently
  - Exercise particular caution

If discomfort nevertheless arises, the affected person must stop work. Seek or call a doctor.

2.5.4 Hazards generated by materials and substances

Fire

Naked flames and smoking

Naked flames and smoking are prohibited on and within the plant owing to the risk of fire.

Corresponding signs are attached at all access doors.

Extinguishing agents

Fires can occur as a result of inadequate maintenance. If the lube oil ignites, only the extinguishing agent indicated in the safety data sheet for the lube oil may be used.

Extinguishing with a water jet is unsuitable and dangerous. Water mist, foam, powder or carbon dioxide is generally suitable.

Sensitization

Insulation

Initiate corresponding protective measures for protection against contact with mineral wool fibers when removing insulation.

- Observe safety data sheet for mineral wool
- Wear protective equipment, in particular long clothing, respiratory protection, safety goggles, gloves
- Ventilate room
- Clean body and protective equipment as quickly as possible

Breathing difficulties, suffocation, poisoning

Exhaust gases

The exhaust gas can suppress the atmospheric oxygen. There is a risk of suffocation and poisoning.

Hot exhaust gas can escape when removing components from the exhaust system. There is a risk of suffocation, poisoning and burns. Work on the exhaust system with its components and assemblies during commissioning, operation, maintenance and decommissioning is carried out corresponding to the regional regulations by authorized specialist personnel. Wear corresponding protective equipment. Ensure sufficient ventilation.

Ventilation

A high air exchange through the ventilation system occurs in the genset room during operation. Exhaust leaks or fuel gas leaks are diluted and the health risk is reduced. The ventilation system will continue to run some time after stopping the genset.

Observe the following for protection against breathing difficulties, suffocation or poisoning:

- Stop the genset before carrying out work on the exhaust system or fuel gas system. Exception only for unavoidable work on the genset while operating, for example visual inspection
- Open doors
- If required, switch on the ventilation system manually and purge the interior with fresh air

Chemical burns

Condensate

The condensate is slightly acidic and can cause chemical burns. The eyes are particularly sensitive.

Wear protective equipment, especially safety goggles, for protection during maintenance work. If condensate comes into contact with the eyes, rinse the eyes immediately with an eye wash. Wash off affected areas of the skin.

The following applies for work on the condensate drain:

- Do not open condensate lines when the plant is operating, if possible
- If this is not possible, for work on the siphon or condensate collector, shut off the upstream condensate lines and secure against accidental opening
  - Only shut off for a short time so that no condensate enters the exhaust system due to back pressure

Collect condensate in a suitable container and dispose of in an environmentally-friendly manner.

Urea solution (only for SRC catalytic converters)

The urea solution does not pose any danger if the user behaves prudently. Nevertheless, it can cause chemical burns with prolonged exposure. The eyes are particularly sensitive.

Wear protective equipment, especially safety goggles, for protection during maintenance work. If urea solution comes into contact with the eyes, rinse the eyes immediately with an eye wash. Wash off affected areas of the skin immediately.

The following applies to work on the SRC catalytic converter and its urea components:

- If possible, do not open the urea lines while the plant is running
- Collect leaking urea in a suitable tank or pick it up from the ground or surfaces using suitable means and dispose of it in an environmentally friendly manner
  - Since urea is corrosive, clean affected surfaces immediately.

Explosion

Gas blowout

Depending on the plant version, the fuel gas system may be equipped with a pre-pressure gas train. A gas blowout is located at the end of the outlet line of the pre-pressure gas train. A small amount of fuel gas may escape from the gas blowout, which may form an explosive mixture with the ambient air. There is a risk of explosion in the area of the gas blowout.

The following specifications always apply:

- Before beginning work, inform the operator or competent plant supervisor about possible gas blowouts
- Do not use any possible ignition sources in the explosion zone of the gas blowout (fire, sparks from machines, etc.)
- When working with possible ignition sources in the area of the gas blowout:
  - Shut off and secure the fuel gas supply before starting work
  - Have a specialist render the pre-pressure gas train and outlet line inert (purge)

2.5.5 Hazardous event involving pneumatic and hydraulic equipment

Ejection of liquids or substances under high pressure

Urea and compressed air

Piping of the injection system is pressurized while in operation. Wear personal protective equipment when working in the area of the injection system.

2.5.6 Hazardous event involving electrical equipment

Direct contact

Safety rules

Before work, perform the following points in the order shown:

- Disconnect plant
- Secure against reconnection
- Verify a de-energized state
- Ground and short-circuit
- Cover or cordon off adjacent parts which are electrically live

Switchgear cabinet lock

The door of a switchgear cabinet is provided with a lock for protection against unauthorized access. Only electrical specialist personnel or electrically qualified personnel may open a switchgear cabinet door. The operator keeps the key.

Tests

For protection against direct contact with live cables and contacts, their insulation and/or the contact protection must always be ensured. Assembly and initial inspection may only be conducted by a qualified electrician.

Have the electrical system regularly tested by a qualified electrician corresponding to the regional regulations.

2.5.7 Hazardous event involving the control

Unexpected startup

Safeguarding

In order to protect against an unexpected startup by the genset and parts of the SCR application, stop the plant and safeguard against reactivation before commencing work.

2.5.8 Hazardous event involving materials and substances or physical factors

Noise

Ear protection

For protection against noise, wear suitable ear protection when working within the machine enclosure.

Corresponding signs are attached at all access doors.

2.5.9 Other hazardous events

Radiation

The electrical components of the product comply with the regional specifications for protection against electromagnetic radiation applicable for the manufacturer. Depending on the operating site, further or other specifications must be observed.

For protection against electromagnetic radiation of the entire system, the electrical assembly and commissioning is carried out by an EMC specialist.

For necessary information on regional specifications, see

- Responsible dealer

Medical equipment

For protection against malfunctions or other effects on implants, persons with cardiac pacemakers, for example, may not enter the plant or may only do so after consultation with a doctor.

Corresponding signs are attached at all access doors.

3 Technical data and rating plates

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3.1 EmiBox

3.1.1 Ambient conditions

Description	Value
Installation site	Dry environment, immovable
Height above sea level	max. 2000 m
Air humidity	max. 95 %
Operating temperature	-0 °C to +50 °C
Transport/storage temperature	-20 °C to +70 °C

3.1.2 Safety

Description	Value
Protection class	IP 54 housing IP 65 cable glands and plug-in connections

3.1.3 Power supply and connections

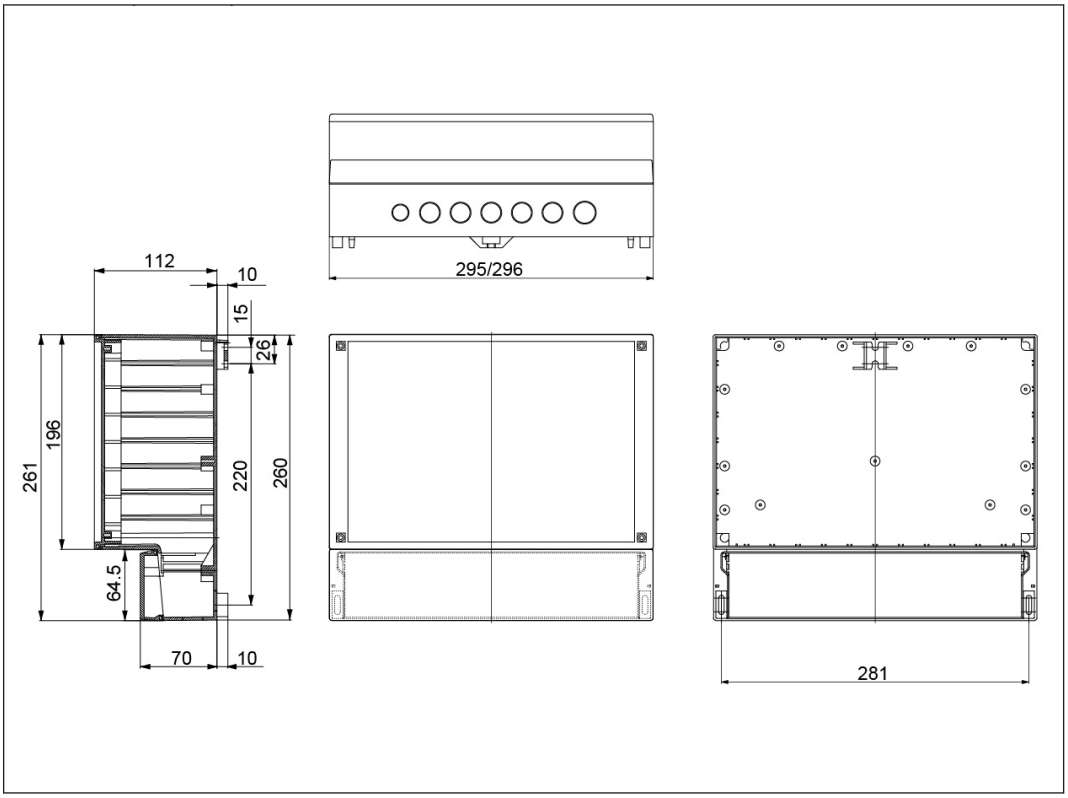
Description	Value
Voltage supply	90 to 240 V_{AC}
Frequency range	47 to 63 Hz
Operating current	2.6 A
Connections	Connections for: • Power supply • Communication systems • Data export • Equipotential bonding

3.1.4 Approvals and guidelines

Description	Value
Certifications[1]	• European Union (CE)

[1] For current information, see labeling on the device or contact the responsible dealer or service partner

3.1.5 Dimensions

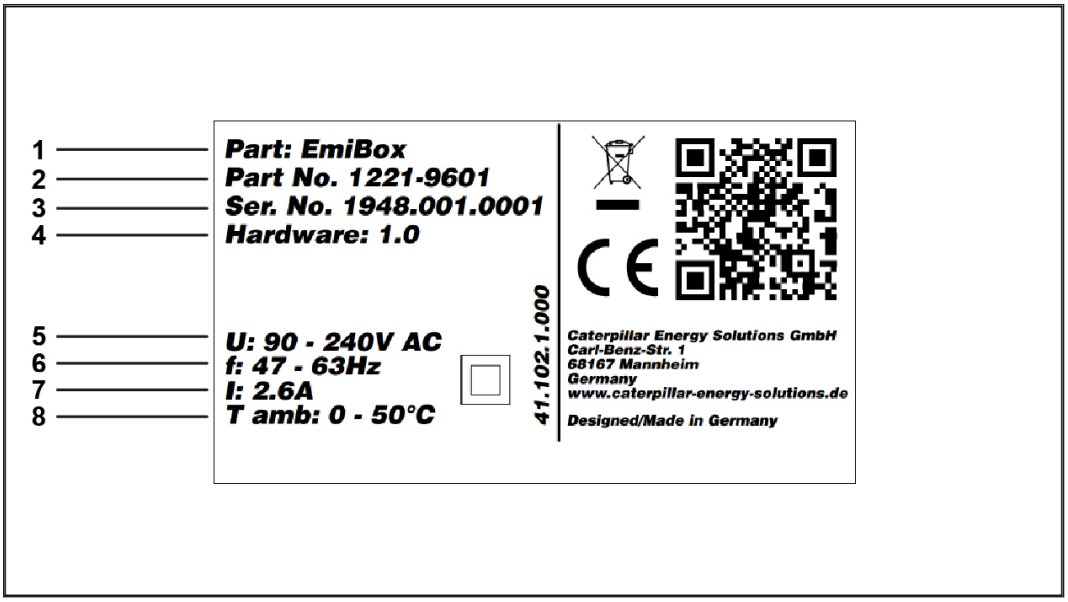


75966-001 EmiBox dimensions

3.1.6 Rating plate

The rating plate is located on the component. The information must be observed.

The information presented is important should you have questions for the manufacturer.



72099-001 EmiBox rating plate

1 Component designation

2 Part number

3 Serial number
4 Hardware version
5 Voltage range in V_{AC}
6 Frequency range in Hz
7 Operating current in A
8 Ambient temperature in °C

3.2 NO_x sensor and terminal box

NO_x sensor

The terminal box as well as the measuring lance and its screw fittings are mounted on the exhaust system. As a result, it is possible that the predominant ambient conditions are those found for an outdoor installation in Germany.

The ambient conditions as a function of the installation site (indoor or outdoor installation, temperature ranges and weather exposure conditions typical of the location) and as a function of the system's use must be considered.

Designation	Ambient condition
NO_x sensor control device	-40 °C to +105 °C
Cable between control device and NO_x sensor	-40 °C to +150 °C
NO_x sensor rear side on cable gland	-40 °C to +150 °C
Sensor tip to hexagonal connection on NO_x sensor	-40 °C to +620 °C

Terminal box

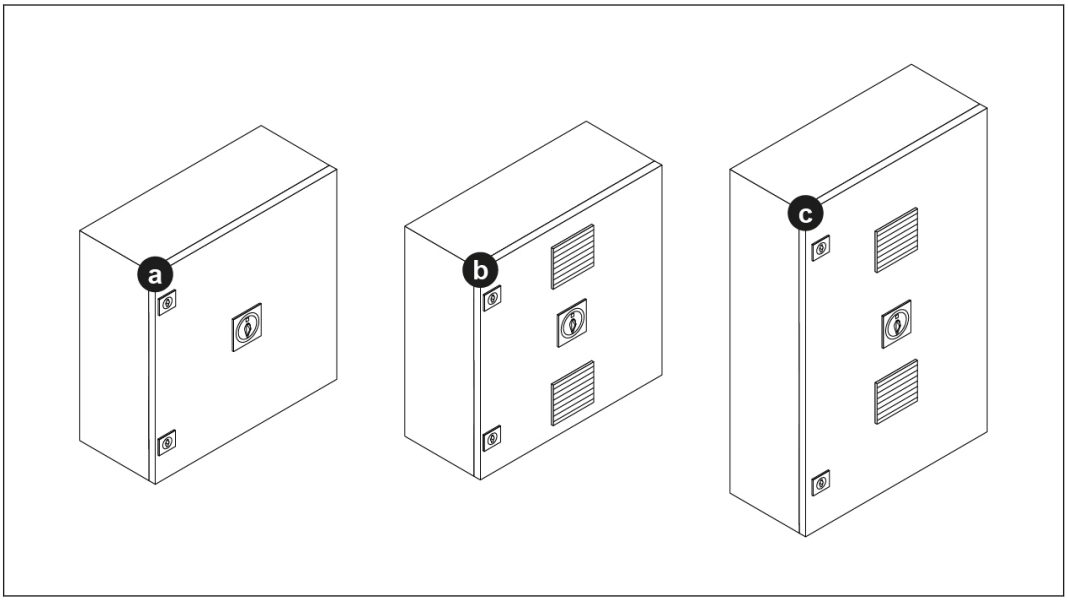
Designation	Ambient condition
Operating temperature	-40 °C to +80 °C

3.3 SCR Control switchgear cabinet

3.3.1 System requirements

Refer to the circuit diagram for system requirements.

3.3.2 Overview of types



75863-001 Example illustration

3.3.3 Ambient conditions

Description	Value		
Type	(a)	(b)	(c)
Installation site	Interior, fixed location		Exterior, fixed location
Elevation above sea level	max. 2000 m, depending on EmiBox		
Operating temperature	0 °C to +40 °C	0 °C to +50 °C	-20 °C to +45 °C
Tested per	DNV-GB A/B IEC 60255-21-1/2/3 IEC 60068-2-27		

3.3.4 Safety

Description	Value		
Type	(a)	(b)	(c)
Protection class	IP 65	IP 54	IP 65

3.3.5 Power supply and connections

Description	Value
Voltage supply	230 V_{AC} 16 A back-up fuse Optional 24 V_{DC} 6 A back-up fuse
Connections	Connections for: • Ethernet • Power supply • Digital signals • Analog signals • Equipotential bonding

3.3.6 Approvals and guidelines

Types (a) and (b)

Description	Value
Certifications[1]	• European Union (CE) • UK Conformity Assessed (UKCA) • Underwriters Laboratories (UL/ULC) • Det Norske Veritas (DNV) und Germanischer Lloyd (GL) • European Conformity (EAC) • Conformity certificate (GOST)

[1] For current information, see labeling on the device or contact the responsible dealer or service partner

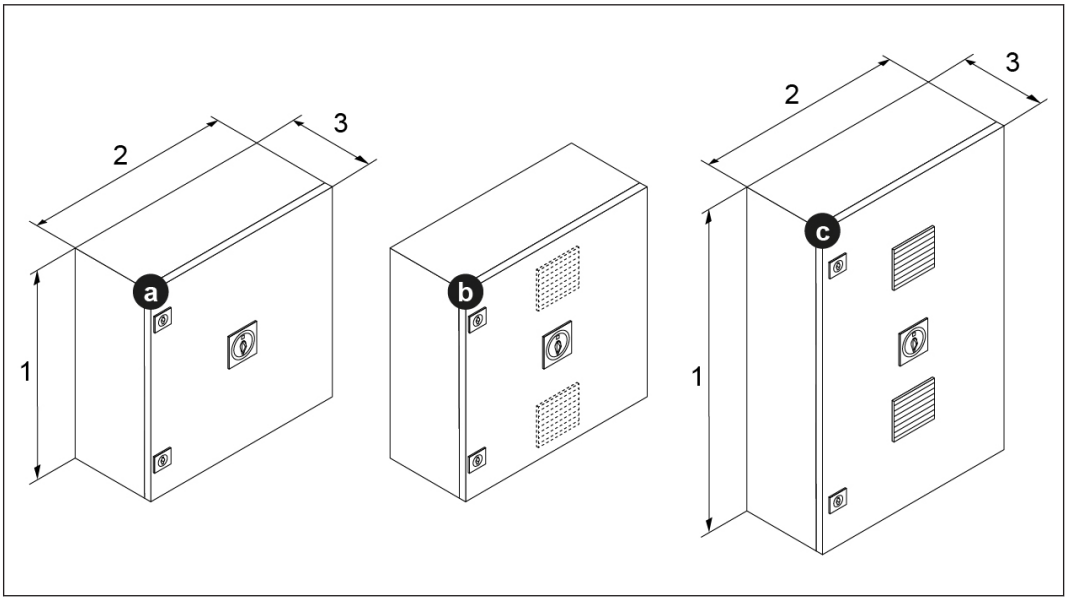
Type (c)

Description	Value
Certifications[1]	• European Union (CE) • UK Conformity Assessed (UKCA) • Underwriters Laboratories (UL/ULC) • Conformity certificate (GOST)

[1] For current information, see labeling on the device or contact the responsible dealer or service partner

3.3.7 Housing

Description	Value		
Type	(a)	(b)	(c)
Material	Sheet steel		Glass-reinforced polyester
Dimensions	1: 600 mm 2: 600 mm 3: 210 mm		1: 735 mm 2: 600 mm 3: 210 mm
Fastening	Wall fixture with screw connection Fastening material depending on the underlying material Through-hole on rear wall: 8.5 mm		
Ventilation	-	Fan	Fan



75851-001 Example illustration

4 Structure and function

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4.1 Introduction to air quality preservation

Exhaust gas composition from combustion engines; emission measurements

A genset (1) uses a gas engine as the motive force to convert energy by burning a mixture of fuel gas and air in the combustion chamber. The resulting exhaust gas is released into the atmosphere. It is composed of various substances (emissions). Since some of these substances are dangerous, regional regulations and/or limits apply for the emission of these substances. Of particular interest in this context is the value of nitrous oxides (NO_x) in the exhaust gas.

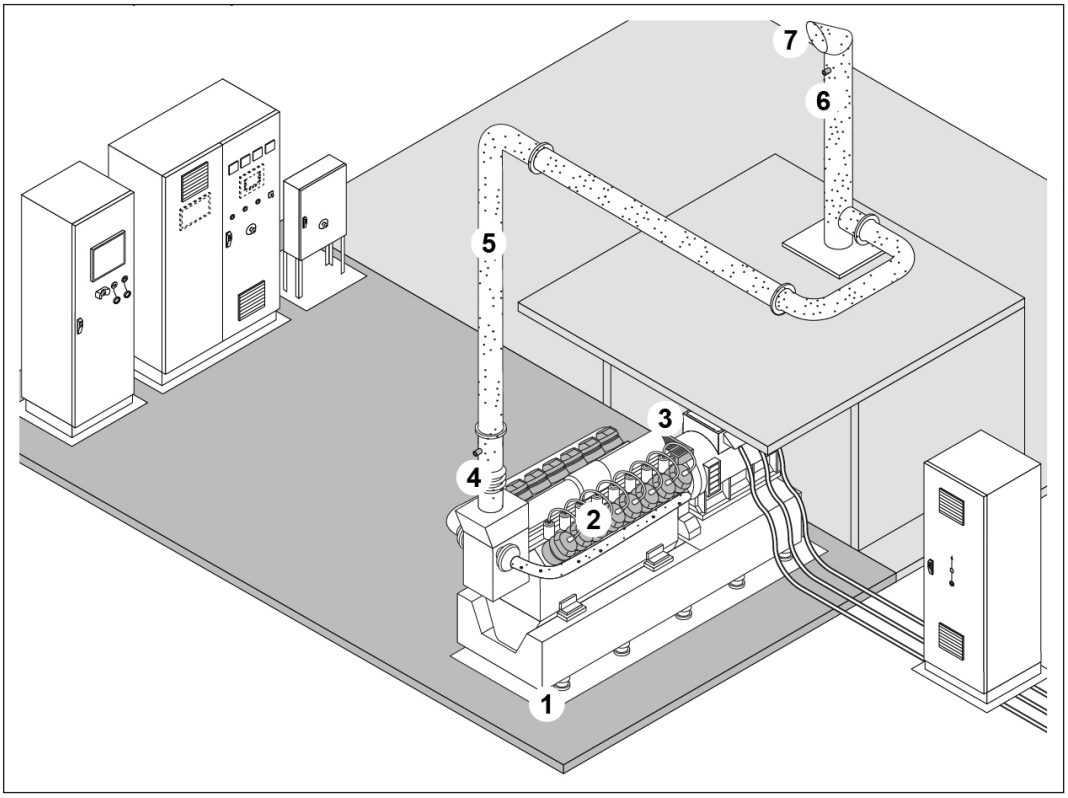
To demonstrably comply with specified limits, take samples or perform adjustment work, exhaust gas measurement connection pieces must be provided:

- Exhaust gas measurement connection pieces for analyzing the combustion exhaust gases from the gas engine
- Exhaust gas measurement connection pieces for analyzing the exhaust gas scrubbing system

Because detailed regulations for documentation and reporting vary by region, it is recommended to install an automated measurement system with a data transfer interface.

Combustion optimization in the gas engine

By optimizing process parameters in the combustion chamber (2) (mixture ration of fuel gas and air, ignition timing, etc.), it is possible to drastically reduce nitrous oxide emissions. Because this optimization must be effective for different operating points under load (genset connected to mains), and because the performance, operational characteristics and stability of the gas engine must remain unimpaired, optimization is handled by the automatic engine control (3) with its sensors, actuators and feedback loops.



75567-001 Example illustration

1 Genset with gas engine and generator

2 Cylinder units with combustion chamber

3 Engine control (using the example of a gas engine)

4 Exhaust gas measurement connection piece downstream of gas engine, e.g. for adjustment tasks

5 Exhaust system

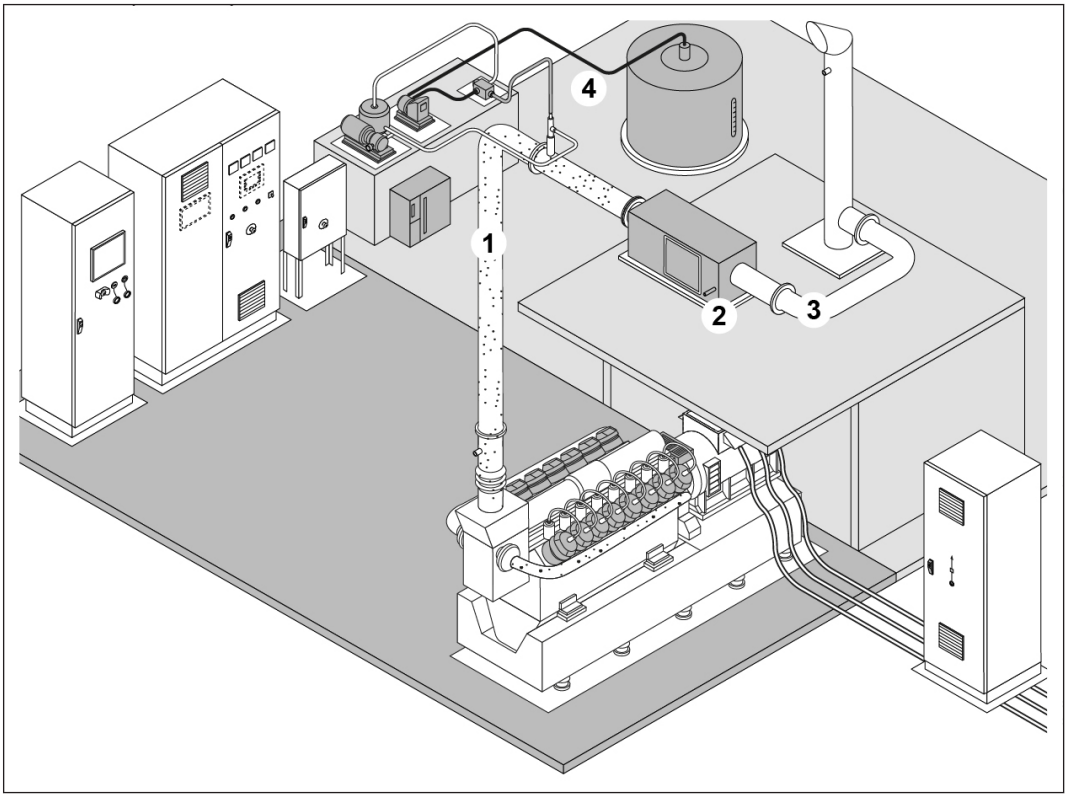
6 Exhaust gas measurement connection piece before flue outlet, e.g. for verification measurements

7 Flue outlet

Exhaust gas post-treatment

If it is not possible to comply with regulations by modifying the engine itself, exhaust gas may be treated, for example with an exhaust catalytic converter. Various technologies may be used depending on the requirements:

- Catalytic converters with oxidation technology
- Catalytic converters with selective catalytic reduction (SCR)
- Combinations of the above



75568-001 Example illustration

1 Exhaust gas with elevated NO_x content

2 Exhaust catalytic converter with SCR technology

3 Exhaust gas with reduced NO_x content

4 Catalytic converter auxiliary systems

For additional information on exhaust emissions and the requirements for exhaust gas measurement connection pieces, see

- Operating Manual ⇒ General ⇒ Application and Installation Guide
  - Power plants layout ⇒ Exhaust system

4.2 Emission monitoring and emission cleaning with the EmiBox

4.2.1 Base system, accessories and applications

Base system and applications

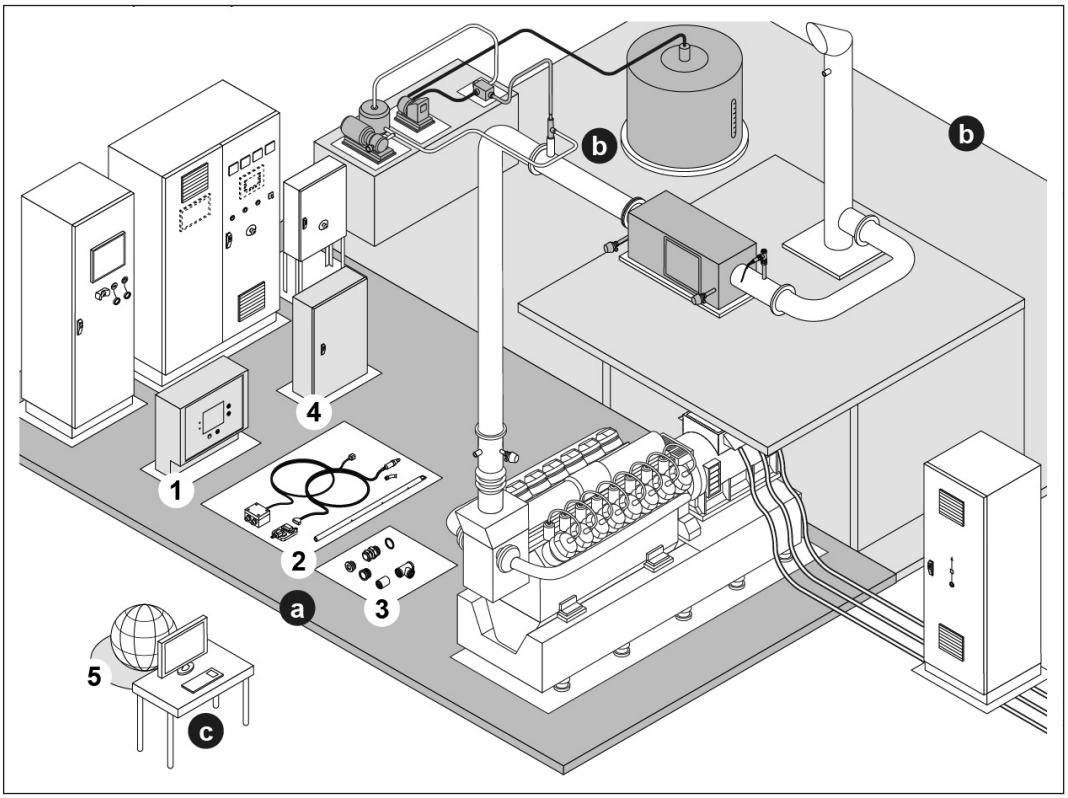
The EmiBox with SCR Control Kit is the base system (a) for monitoring of NO_x emissions and control of SCR applications (b) for exhaust gas treatment with SCR technology. An integrated interface offers the operator (c) to relevant operating data.

The base system comprises the following components:

- Central EmiBox control unit (1)
- SCR Control switchgear cabinet (4), the interface for easy coupling with an SCR application

This operating manual describes the base system. For additional information on the deliverable application, see

- Operating Manual ⇒ Operation ⇒ Exhaust system



75565-001 Example illustration

a Base system for a genset

b Configured SCR application on site, in the example with SCR catalytic converter

c Operator's interface for data transfer

1 EmiBox

2 NO_x sensor kit

3 Connection kit

4 SCR Control switchgear cabinet

5 Remote access

Accessories

The following accessories are available:

- NO_x sensor kit with accessories (2) for connecting to the EmiBox (optional)
- Connection kit (3) in case the application does not have a suitable measurement connection (optional)
- Remote Access (5) for telecontrol of the EmiBox user interface (optional)

Additional accessories forthcoming.

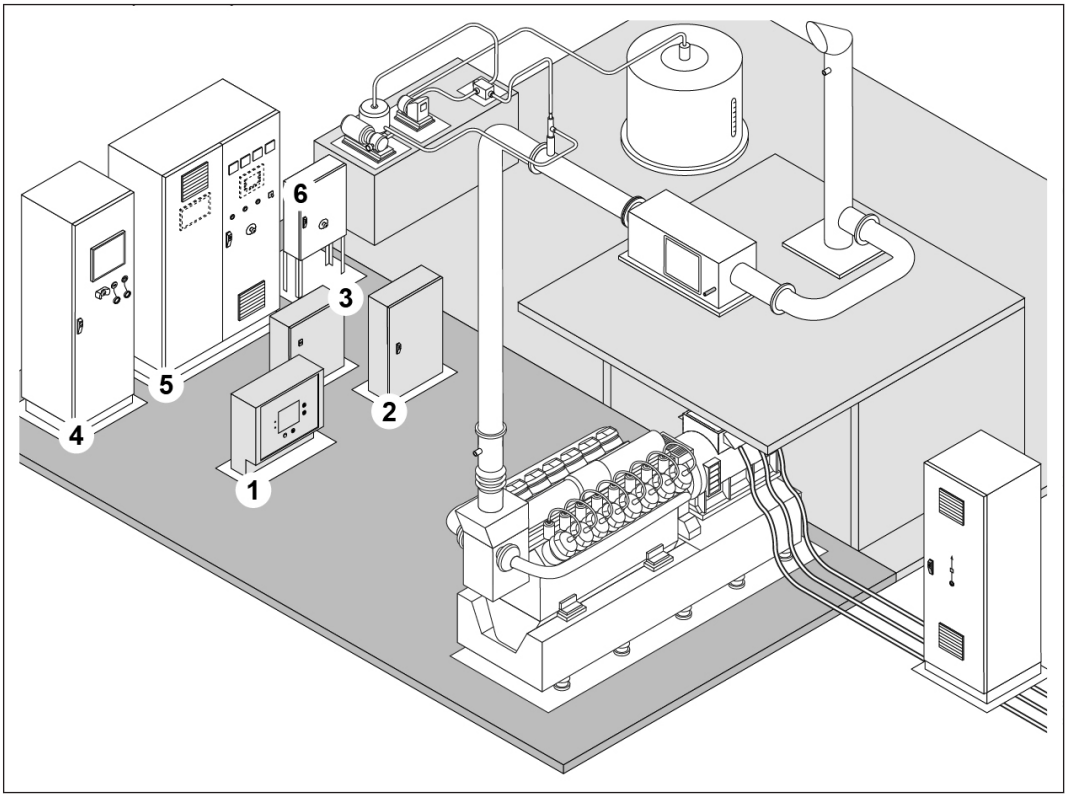
For more information on accessories, see

- Responsible service partner

4.2.2 Special applications and retrofits

The base system has flexible interfaces that can also be used for special applications with the appropriate configuration. Interfaces are assigned and configured by the manufacturer or its agents.

For existing plants with the TEM system (6) or TPEM system (4), the optional connection box (SB HAS) (3) offers ready-made connections to simplify integration.



75570-001 Example illustration

1 EmiBox

2 SCR Control switchgear cabinet

3 Connection box (SB HAS) for auxiliary cabinet (HAS)

4 Switch cabinet TPEM Control Cabinet (TPEM CC) with TPEM system

5 Auxiliary cabinet (HAS)

6 Genset switch cabinet (AGS) with TEM system

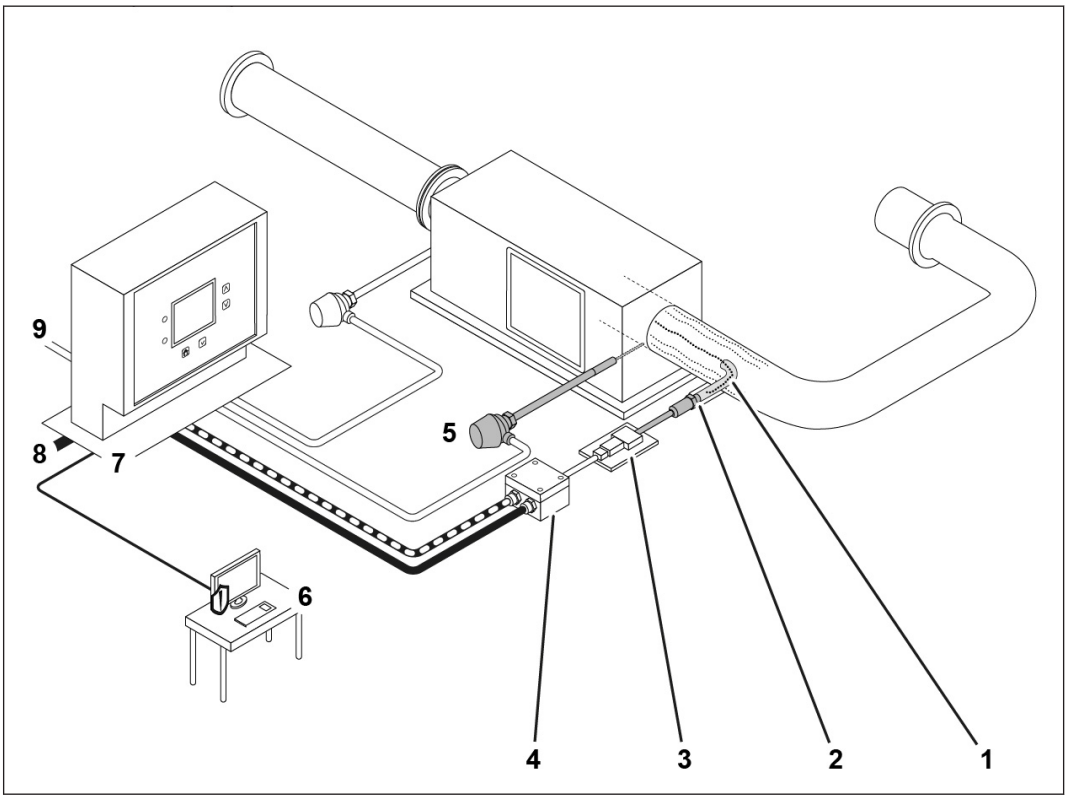
4.3 Monitoring with EmiBox

4.3.1 Emission measurement and catalytic converter protection

Emissions in the exhaust gas are analyzed for NO_x and O_2. Acquisition of all sensor signals is limited to normal genset operation (excludes startup and shutdown procedures).

Measurements are performed with a NO_x sensor (2) downstream of the catalytic converter. The sensor is located in a measuring lance (1), the opening of which is situated in the exhaust flow. The signal from the sensor is converted by a control device (3) to make it compatible for the CAN bus to the EmiBox (7). A terminal box (4) supplies the control device with power and communicated with the EmiBox via a CAN bus.

The SCR catalytic converter requires a minimum temperature to achieve maximum performance. A maximum temperature, which depends on the model, must not be exceeded. A temperature sensor (5) is therefore required right after the catalytic converter. A temperature monitoring system with a corresponding warning or shutoff strategy in the genset control is implemented to protect the catalytic converter.



75571-001 Example image of a possible measurement setup

1 Measuring lance
2 NO_x sensor
3 Control device for NO_x sensor
4 Terminal box
5 Temperature sensor for exhaust gas temperature
6 External computer with user interface
7 EmiBox

8 Voltage supply

9 Connection to the TEM system or TPEM system

The EmiBox is connected with the TEM system or TPEM system (9). However, it does not interfere with the genset control. Depending on the installation and/or configuration, the EmiBox can send messages to the genset/plant control (implemented with dry contacts).

Power supply is provided by a connection (8) to the low-voltage supply system.

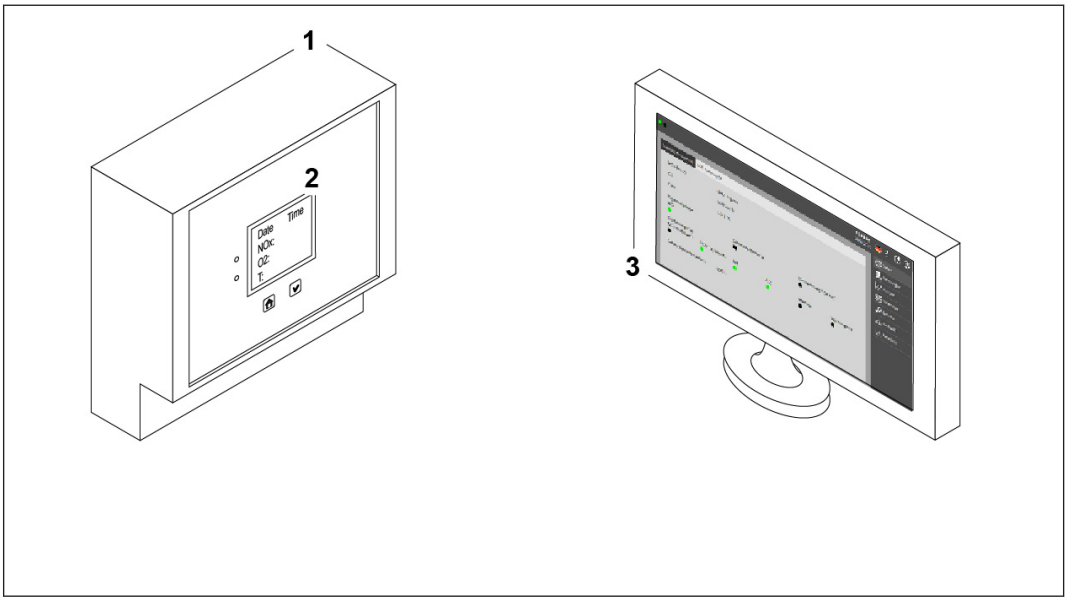
Internally, the EmiBox has a motherboard with:

- Process for analyzing measurement signals and, depending on the product version, for open- and closed-loop control of connected systems
- SD card slot (optional)
- USB connection (optional)

4.3.2 Signal processing and measurement data

Measurement signals are analyzed in the EmiBox (1). In addition, the EmiBox saves the daily mean values of relevant parameters.

Measurement data are displayed on the EmiBox display (2) or through the user interface (3) of an external computer. Measurement data are exported to the external computer with the user interface (3).



75959-001 Example illustration

1 EmiBox

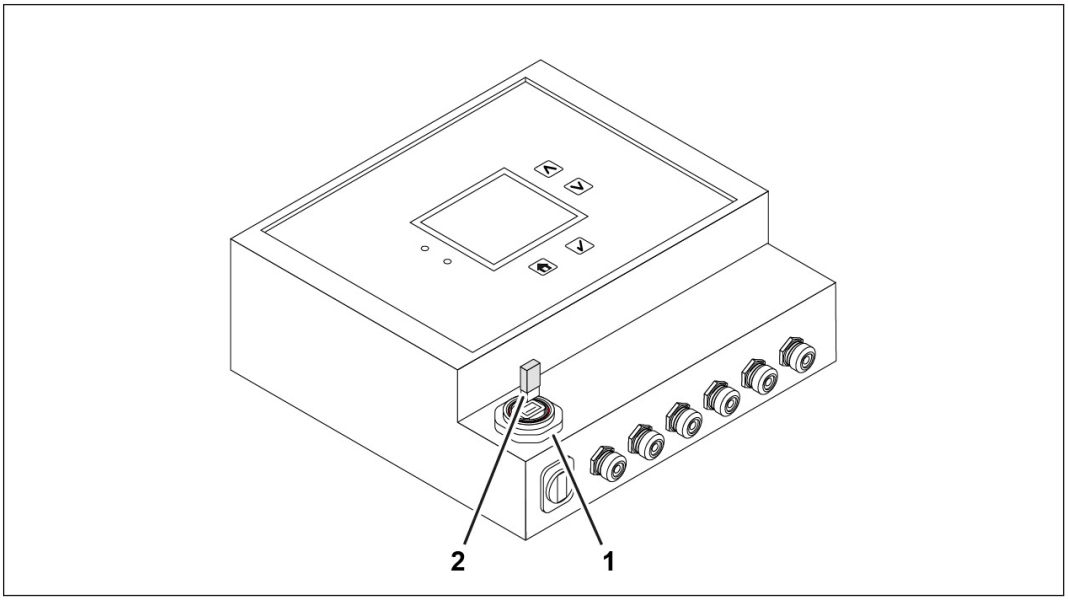
2 Display

3 User interface

Data export accessories

A USB connection (1) is available to simplify data export. Once assembled and commissioned, measurement data are automatically archived on a USB storage device (2).

Commercially available USB data storage devices (2) suitable for Linux™ and Microsoft Windows™ may be used. The FAT32 file system (or better) is therefore recommended when formatting the USB storage device.



75955-001 Example illustration

1 USB connection

2 USB data storage device

Additional information on the USB connection and its availability

- Responsible service partner

4.4 SCR feedback control with SCR Control

4.4.1 EmiBox and SCR Control switchgear cabinet

In conjunction with the SCR Control switchgear cabinet, the EmiBox can also provide open- and closed-loop control for an SCR application. This chapter describes the general functionality, up to and including the interfaces for connecting an SCR application.

For additional information on the SCR application, see

- Operating Manual ⇒ Operation ⇒ Exhaust system

4.4.2 Open- and closed-loop control of NO_x emissions

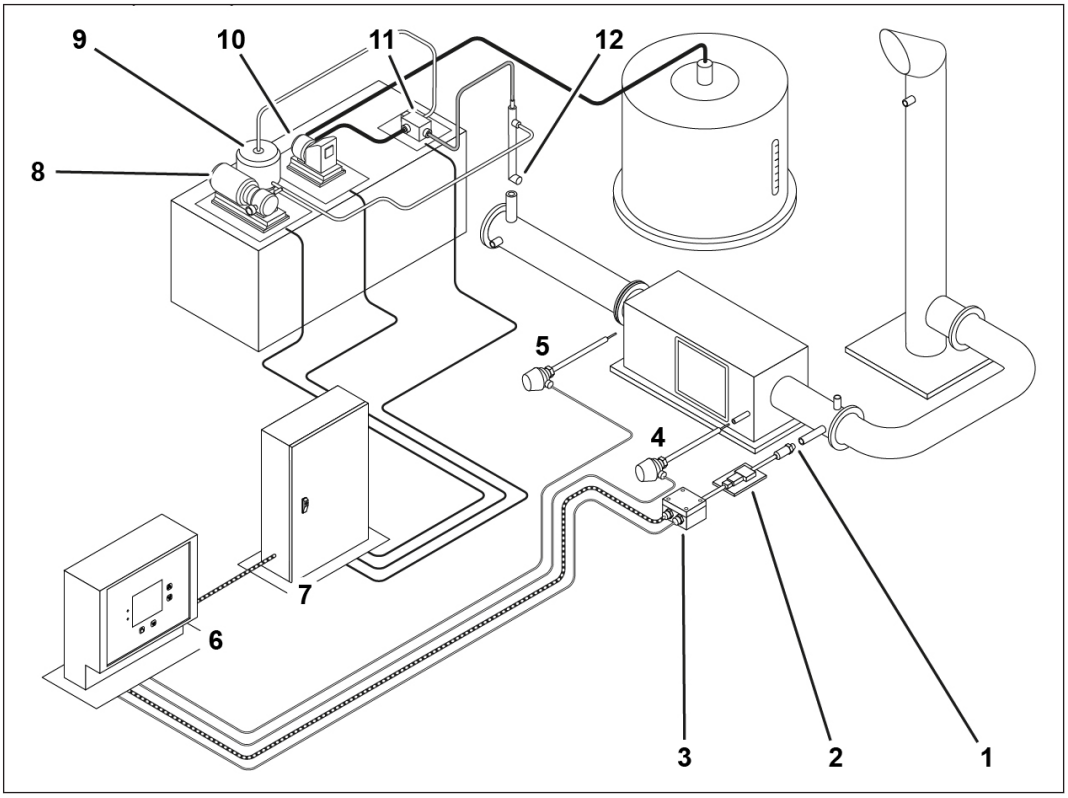
Open- and closed-loop control concept

The exhaust treatment with SCR technology reduces nitrous oxides (NO_x) with a dosed injection (11) of urea-air mixture into the hot exhaust stream. The urea-air mixture is generated by the compressed air unit (8) and the urea dosing unit (10). The quantity of urea injected therefore depends on the measured level of NO_x (1) in the exhaust gas and the current engine load.

To comply with the necessary requirements, urea can be dosed in one of the following ways:

- Controlled by the EmiBox with a characteristic curve that has been calculated for the SCR application
- Controlled by the EmiBox with a PID controller

Control of and signal exchange with the injection unit are implemented by the SCR Control switchgear cabinet. For high-speed communication, the EmiBox (6) is connected with the SCR Control switchgear cabinet (7) via Modbus TCP; it is connected with the terminal box (3) via a CAN bus.



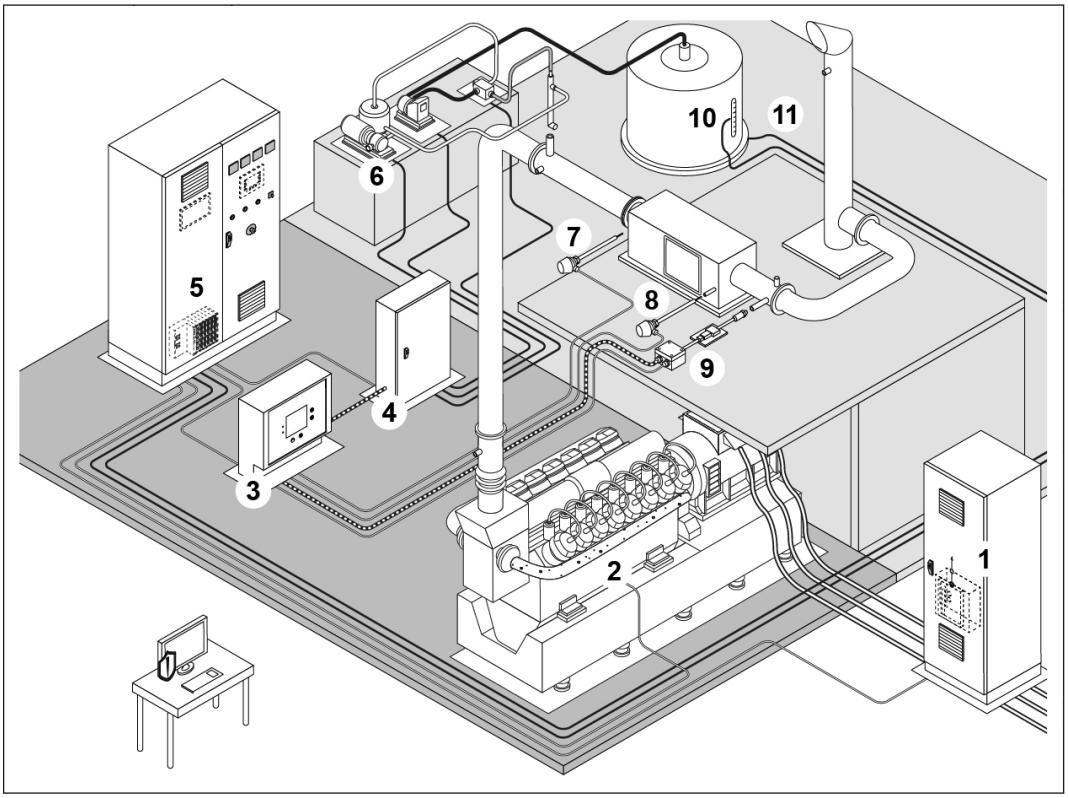
75574-001 Example illustration

1 NO_x sensor
2 Control device for NO_x sensor
3 Terminal box
4 Temperature sensor downstream of catalytic converter
5 Temperature sensor upstream of catalytic converter
6 EmiBox with PID controller
7 SCR Control switchgear cabinet, the interface to the injection unit
8 Compressed air unit
9 Compressed air container
10 Urea dosing unit
11 3-way valve
12 Injection lance

Overview of controller, actuators and sensors

For closed- and open-loop control of the injection system, and for monitoring of the operating data, the EmiBox is connected with the following in typical applications:

- SCR application: NO_x sensor, temperature sensors, pressure sensor on compressed air container, compressed air unit drive, urea dosing unit drive, 3-way valve control, urea tank level sensor and leak sensor
- Auxiliary cabinet (HAS):
  - Signal from the engine control for the actual power of the gas engine.
  - Signal from the generator circuit breaker cabinet (GLF) to set the generator circuit breaker (GLS/GCB).



75573-001

1 Generator circuit breaker cabinet (GLF) with generator circuit breaker (GLS/GCB)

2 Actual genset power

3 EmiBox

4 SCR Control switchgear cabinet

5 Auxiliary cabinet (HAS) with I/O controller for TEM/TPEM system

6 Injection unit with injection lance, compressed air unit, urea dosing unit and 3-way valve

7 Temperature sensor upstream of catalytic converter

8 Temperature sensor downstream of catalytic converter

9 NO_x sensor

10 Urea tank level sensor

11 Urea tank leak sensor

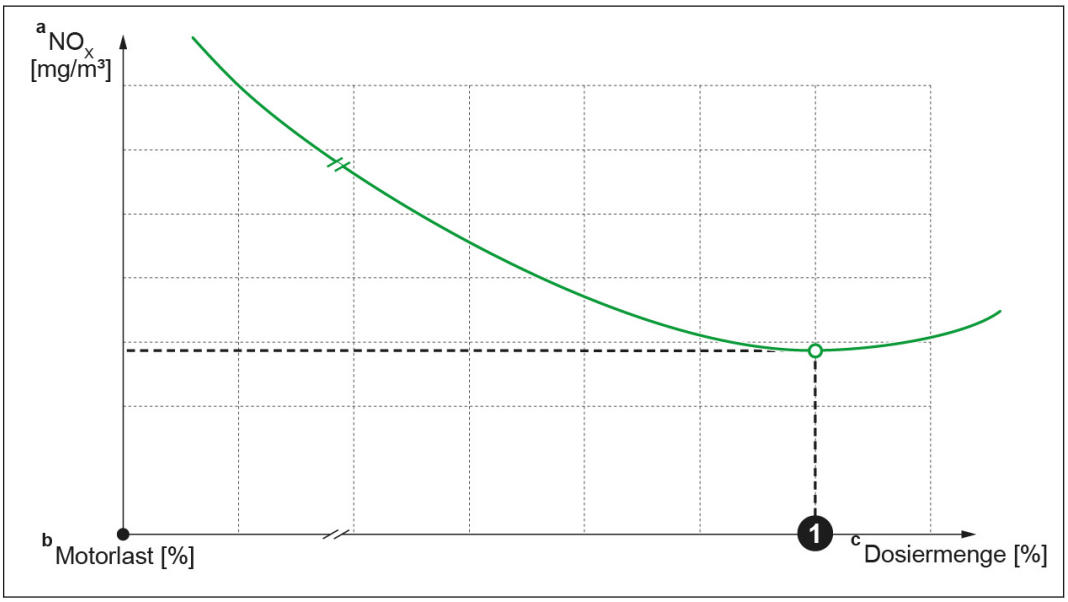
Exhaust temperature

The SCR catalytic converter requires a minimum temperature to achieve maximum performance. The SCR catalytic converter is heated by the temperature of the exhaust gas. Using the measurement signal from the temperature sensor downstream of the SCR catalytic converter (8), the SCR Control integrates the current temperature for open- or closed-loop control of the urea dosing system.

NO_x emission as a function of urea dosing

The NO_x emission can be affected by dosing urea into the SCR catalytic converter. The reduction possible in this way is not a linear function of the quantity of dosed urea. Past a certain dosing quantity, saturation behavior emerges with a minimum (1), beyond which the NO_x value actually begins to rise again.

The following figure is an illustrative representation of saturation behavior; it applies for a defined, constant engine load.



75968-001 Sample illustration of NO_x value and urea dosing quantity (not to scale)

a NO_x [mg/m^3]

b Engine load [%]

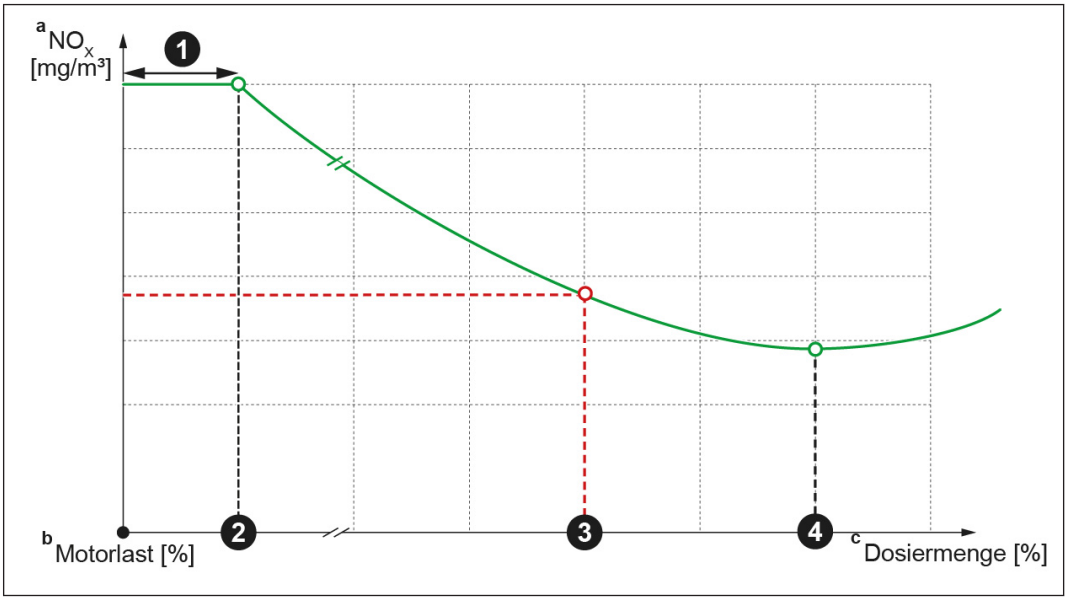
c Dosing quantity [%]

1 Minimum

Specific plant behavior

Besides the chemical reaction behavior, the physical design of the SCR application also affects the NO_x reduction process. Therefore, when commissioning the SCR Control, the plant characteristics are surveyed and the control behavior adjusted on site while the genset is running. Here, the full range of characteristics across the gas engine's power spectrum must be measured for typical applications.

The figure below shows an example of the relationships between SCR application, NO_x emission and urea dosing amount for a fixed engine load level.



75969-001 Example illustration of plant behavior (not to scale)

a NO_x [mg/m³]

b Engine load [%]

c Dosing quantity [%]

1 Filling time

2 System responds

3 Setpoint

4 NO_x minimum

Filling time

Because the urea first has to be pumped to the injection lance when the system starts up, the plant-specific filling time must be found and entered as a parameter for the SCR Control. The filling time is independent of the engine load. It is usually affected by the pumping speed of the dosing pump until the NO_x sensor registers a system response.

System response and `Lower Limit`

As a consequence of the design (specific implementation of the SCR application and inertia of the system overall), the measured value of the NO_x emission only responds beyond a minimum quantity of injected urea.

Knowledge of this plant-specific point is important for the PID control. Because control should only take effect a sufficient distance past this point, a corresponding value must be entered as the `Lower Limit` when parameterizing the PID controller.

For more information on limits, see: chapter 4.4.2.6 Dosing via PID controller 50

Setpoint and actual value

Because the SCR catalytic converter can only reduce the NO_x emissions when it is within its technical specifications, the exhaust gas from the gas engine must be within the permissible emission limits.

When searching for the value, the desired setpoint is approached manually using the measured value from the NO_x sensor and compared with a reference measurement at a suitable measurement connection downstream of the SCR catalytic converter. If there are deviations, the NO_x sensor must be recalibrated.

NO_x minimum and `Upper Limit`

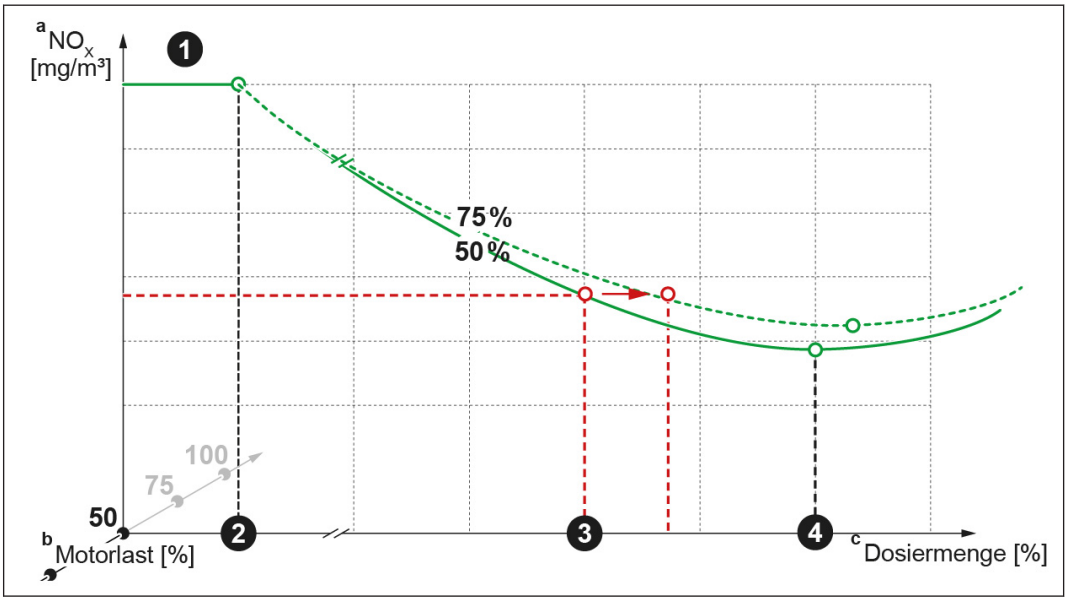
As described above, there is an optimal minimum in the NO_x value for a plant-specific dosing amount. Beyond this dosing amount (NO_x minimum), further increasing the amount will cause an undesired reaction in the SCR catalytic converter, i.e. a rise in the NO_x value.

To avoid wasting urea, a sufficient distance to the NO_x minimum is recommended for the PID control. It should parameterized accordingly as the `Upper Limit`.

For more information on limits, see: chapter 4.4.2.6 Dosing via PID controller 50

Engine load

When the stationary engine load changes, so too do the volumetric flow and temperature of the resulting exhaust gas. The function of NO_x emission also changes accordingly, along with the necessary dosing amount. Therefore, the specific plant behavior should be measured as a characteristic curve across different engine load levels. Ordinarily, 4 reference points (load steps) are sufficient to define the characteristic.



75970-001 Example illustration: Dosing and different engine loads (not to scale)

a NO_x [mg/m³]

b Engine load [%]

c Dosing quantity [%]

1 Filling time

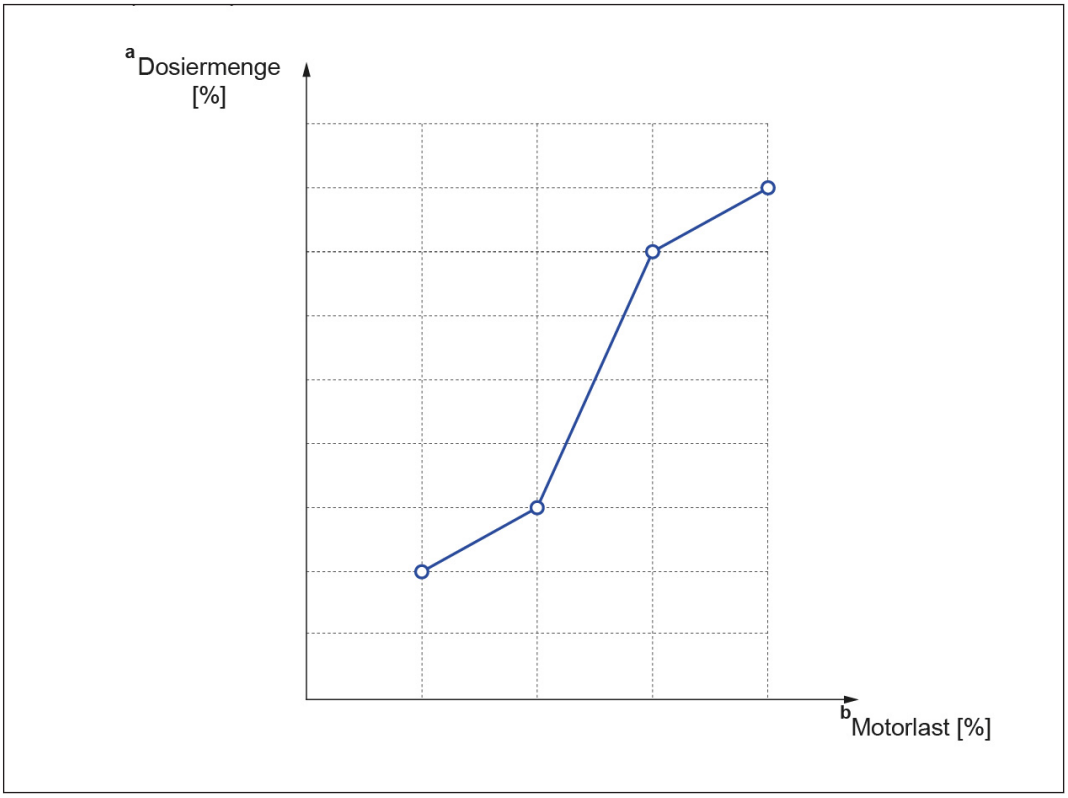
2 System responds

3 Setpoint requires higher dosing

4 NO_x minimum shifts

Plant characteristic (characteristic curve)

Once all load steps have been run, the data acquired permit calculation of a specific characteristic curve as a function of engine load and dosing amount for the desired NO_x setpoint.



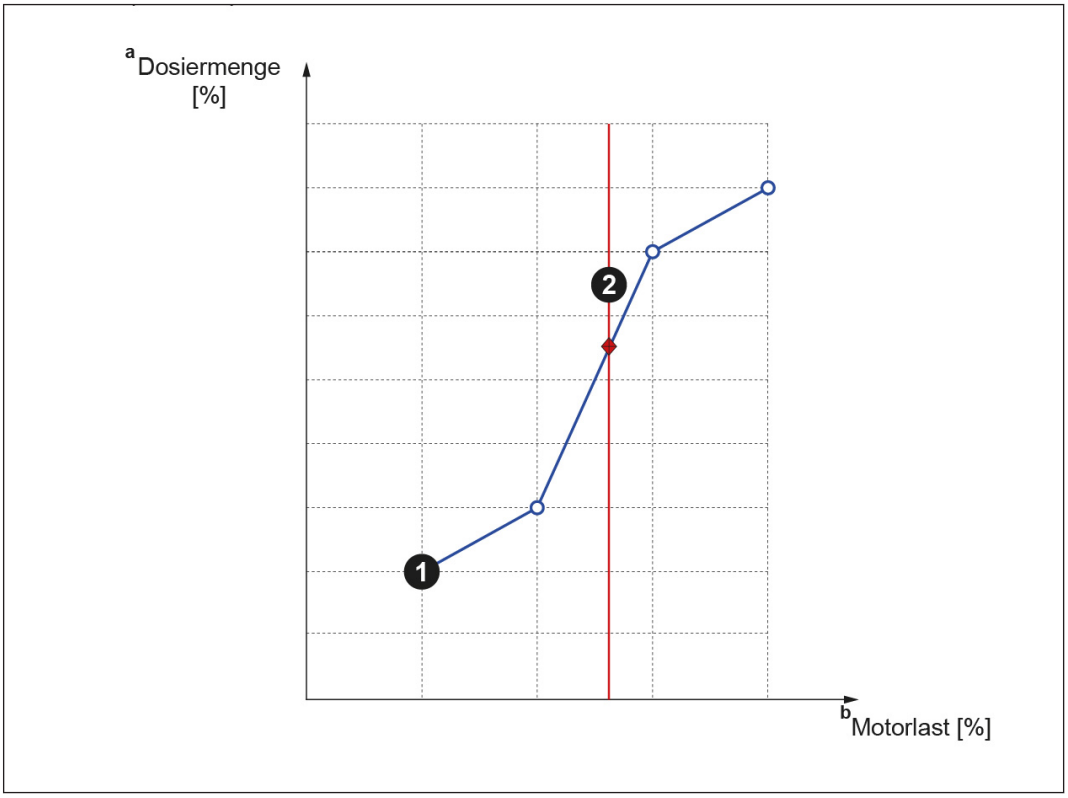
75971-001 Example illustration: NO_x characteristic curve (not to scale)

a Dosing quantity [%]

b Engine load [%]

Dosing via characteristic curve

If the characteristic curve (1) has been recorded accurately is is thus representative for the current state of the genset and the SCR application, it is suitable for automatic control of the NO_x emission during operation. In this case, the measured value (2) from the NO_x sensor will be relatively close to or even on the characteristic curve (1).



75972-001 Example illustration: Dosing via characteristic curve (not to scale)

a Dosing quantity [%]

b Engine load [%]

1 Characteristic curve

2 NO_x measured value (controlled)

Because the chemical reaction capability of the SCR application slowly declines over its service life, the characteristic curve will slowly shift. Therefore, the characteristic curve (1) should be re-acquired at regular intervals.

After maintenance

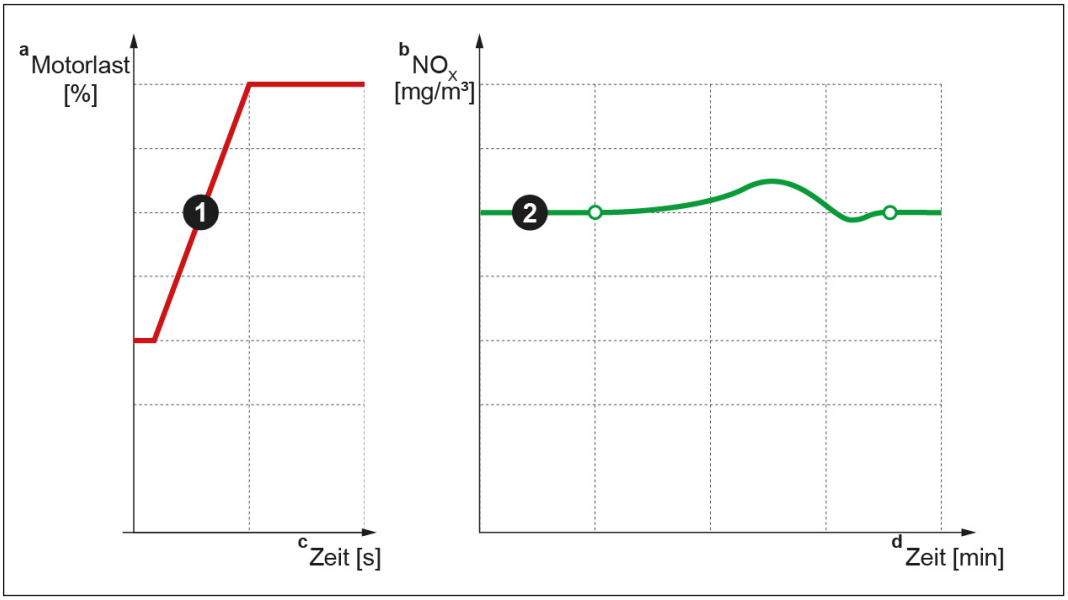
The characteristic curve (1) should also be checked after maintenance on the gas engine if the maintenance could affect the emissions and/or combustion chamber temperatures.

Dosing via PID controller

Open- or closed-loop control

While using the characteristic curve to control the system does not take into account the current NO_x measured value, the PID controller will vary the dosing amount directly on the basis of the signal from the NO_x sensor (actual value). This allows the NO_x setpoint to be attained more accurately and reduce urea consumption.

How fast and how accurately the controller moves to the desired setpoint by modifying the dosing amount (2) following a load change (1) depends on the PID parameter settings.



75974-001 Example illustration: Load change and control response (not to scale)

a Engine load [%]

b NO_x [mg/m³]

c Time [s]

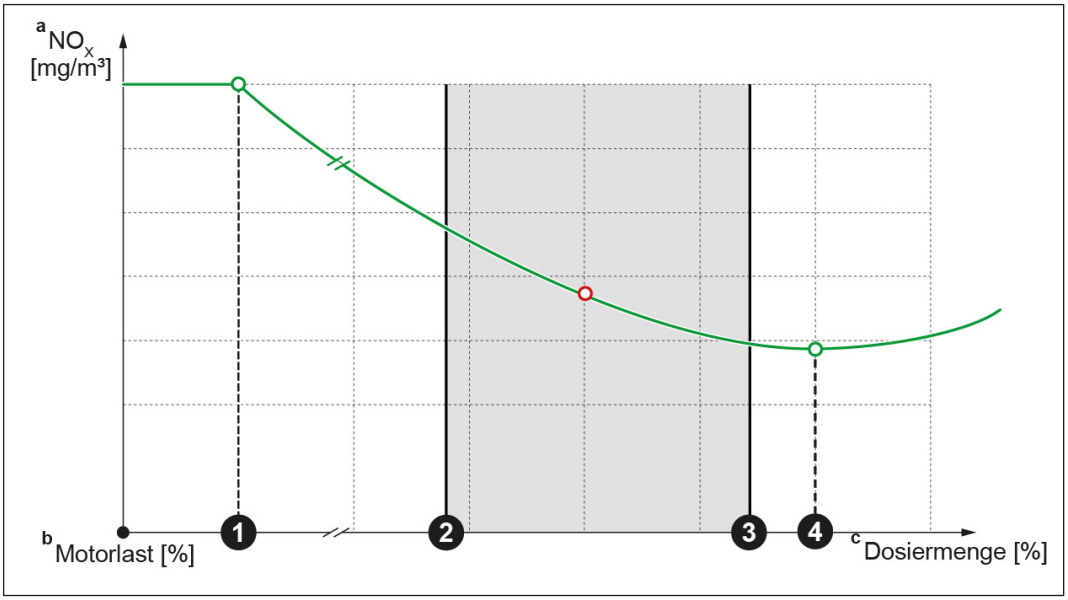
d Time [min]

1 Load change with ramp

2 Controller response

Control range and limits

If the SCR application needs to be run with the PID controller, it is important to specify a lower limit (2) and an upper limit (3). These limits represent a plausible control range over the entire load range. Forming the basis for the limits are the system response (filling time) (1) and the optimum point (NO_x minimum) (4), which should be given a sufficient margin of safety. The values obtained are, again, plant-specific. The must be assigned as parameters as the lower limit (2) and upper limit (3) when defining the characteristic curve.



75975-001 Example minimum-maximum range (not to scale)

a NO_x [mg/m³]

b Engine load [%]

c Dosing quantity [%]

1 System response (filling time)

2 Lower limit

3 Upper limit

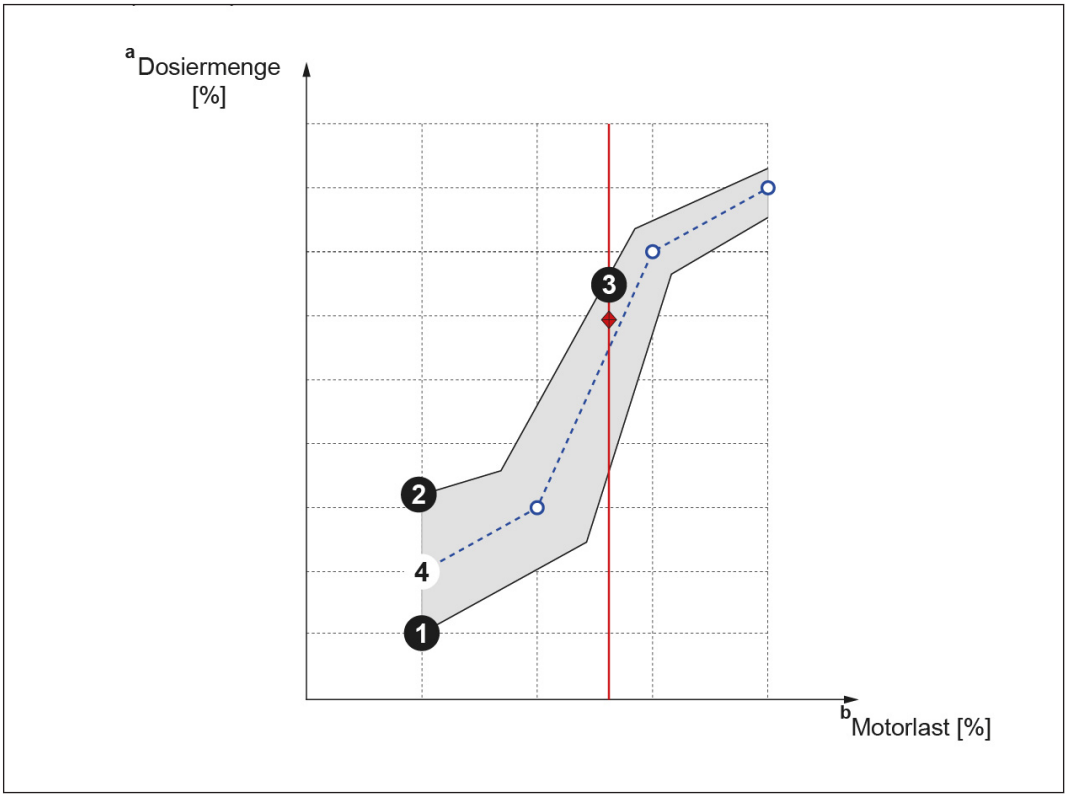
4 Minimum (NO_x minimum)

Control range and downtime

If the SCR Control is working with a PID controller in automatic operation, the PIC controller will calculate the dosing amount whenever the NO_x value deviates and will control the actual value until it reaches the setpoint.

If one of the limits is reached, a downtime will start counting down. No control signals are issued during the downtime The SCR Control waits to see whether there is a temporary fault and whether the NO_x value drifts back into the control range of its own accord. Once the downtime elapses, a fault is presumed to be present. SCR Control issues a message and switches from PID control to characteristic curve control.

Thanks to active characteristic curve control, the NO_x value will move back to the calculated characteristic curve. Then the SCR Control switches back to PID control. If the fault still remains, the change repeats again until the fault is no longer present.



75973-001 Example illustration: Dosing via characteristic curve with control range and working point (not to scale)

a Dosing quantity [%]

b Engine load [%]

1 Lower limit

2 Upper limit

3 NO_x value (controlled)

4 Characteristic curve

4.4.3 Operating states

The SCR Control distinguishes between the following operating states of the SCR application:

- Standby
- Start-up
- Operation
- Shutdown

Standby

The SCR application is not active. The solenoid valve is in the idle position (open on the compressed air side). The dosing pump is not in operation. All components are supplied with power.

Start-up

Once a minimum temperature is detected in the exhaust system, the compressor starts. After a defined time, and provided another exhaust temperature and system minimum power threshold have been exceeded, the 3-way valve changes position, the dosing pump starts and urea starts flowing.

Operation

The urea quantity is controlled by the dosing pump based on the NO_x value.

Shutdown

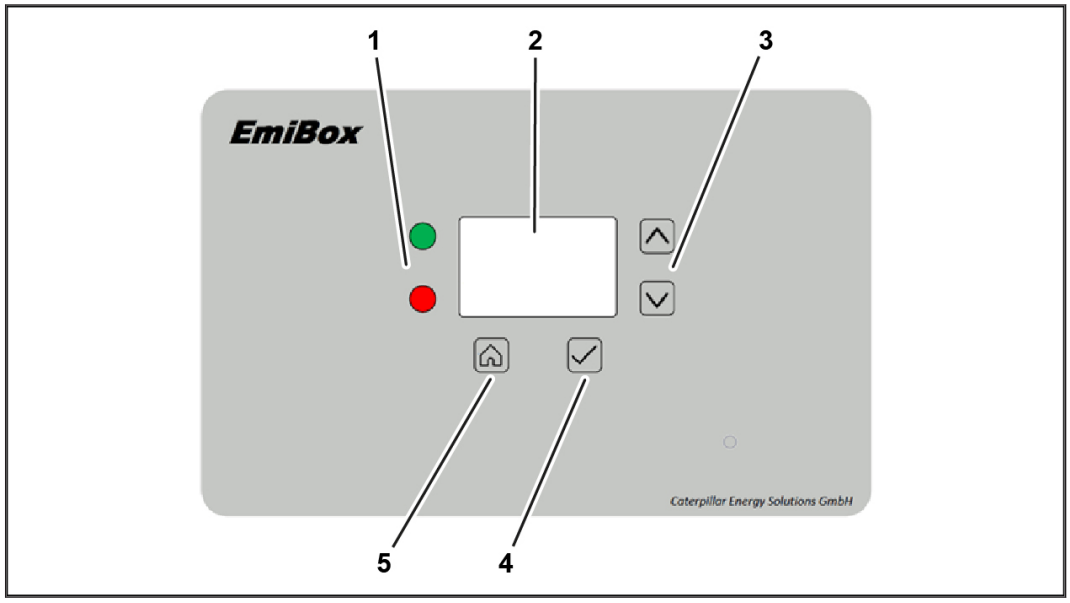
If the genset output falls below a certain minimum value, the dosing quantity is shut off and the 3-way valve moves back to the position corresponding to the compressed air system.

The compressor continues to run for a certain amount of time in order to purge the residual urea from the system and cool the lines.

4.5 EmiBox panel

4.5.1 User interface

The front of the EmiBox contains the panel for communicating with the control.



72135-001 Example illustration

1 LED displays
2 Display
3 Up and Down arrow keys
4 Selection key
5 Home key

LED displays

The two status LEDs (1) represent the current state of the system.

- Green LED: system is enabled
- Red LED: an unacknowledged alarm is present

Display

The display shows the programmed faceplates from the EmiBox's internal control system.

Arrow keys

The arrow keys are used for navigating in the faceplates.

- Up key: shows a previous faceplate
- Down key: shows the next faceplate

Selection key

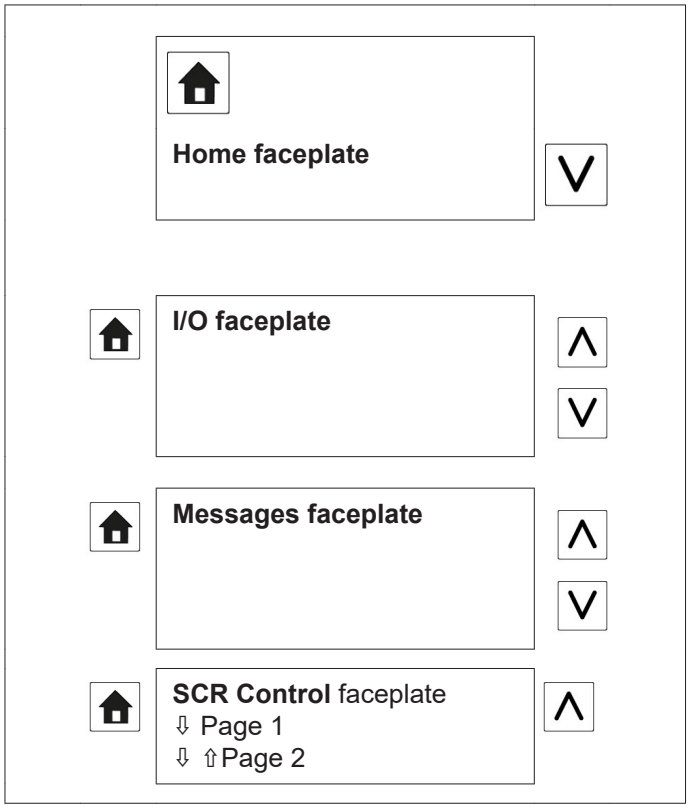
The Selection key (4) acknowledges all alarms shown on the display (2). The arrow keys (3) change to the Information faceplate or the Alarms faceplate.

Home key

The Home key (5) changes back to the Home screen. A long key press activates the display backlight for five minutes.

4.5.2 Displayed screens and navigation

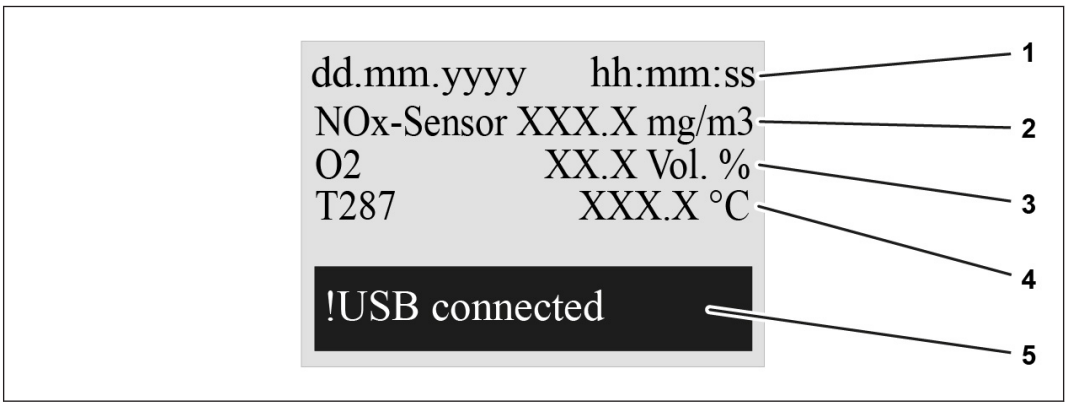
Navigation is performed with the Home key and the Up and Down keys.



Tab. 4-1 Navigation with the Home key and the Up and Down keys

4.5.3 Home faceplate

The Home screen is the start screen and lists, among other things, key emission scrubbing indicators.



75913-001 Example illustration

1 Date and time

2 Measured value from the NO_x sensor

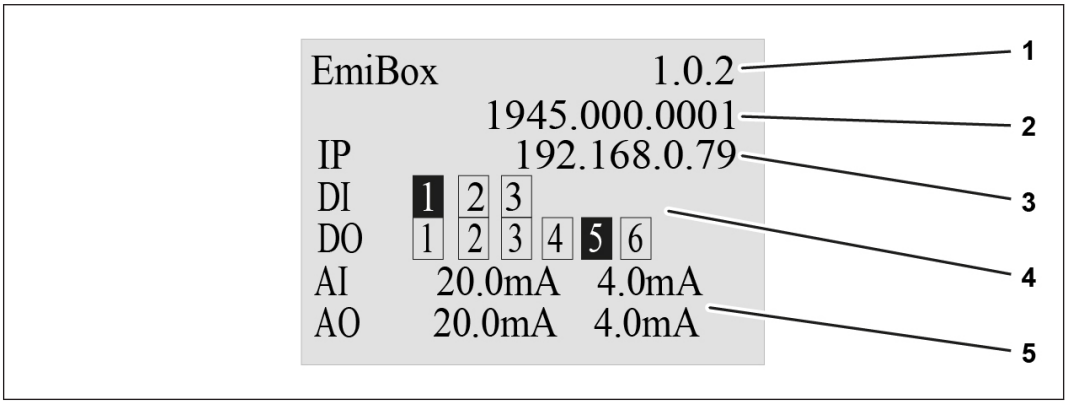
3 O_2 volume fraction

4 Temperature sensor measured value

5 USB storage device connected (optional)

4.5.4 I/O faceplate

The I/O screen lists information about the internal system of the EmiBox. It displays the current state of various inputs and outputs.



72144-003 Example illustration

1 Software version number

2 EmiBox serial number

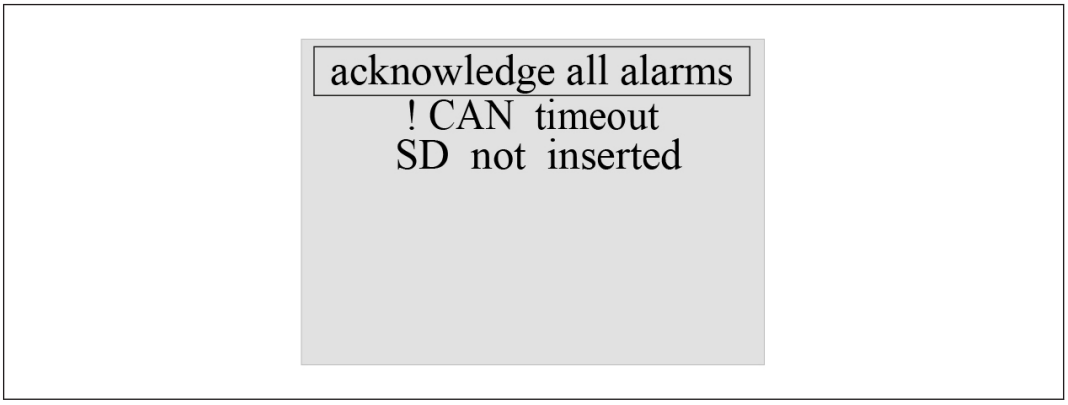
3 Current IP address (if Ethernet was connected).

4 States of the digital inputs and outputs (DI and DO): shaded boxes are physically active, unshaded ones are inactive)

5 For analog inputs and outputs (AI and AO), the current state (current level) is displayed

4.5.5 Messages faceplate

The Messages screen provides a list of various options for handling messages and alarms. The active row in the list is highlighted with a black frame. The arrow keys change the selection.



72145-003 Example illustration

The display distinguishes between pending alarms and the alarm history:

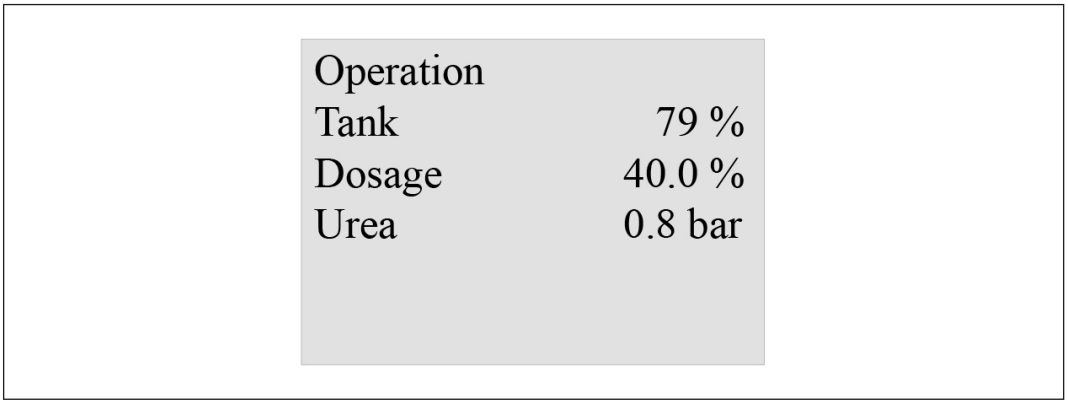
- The exclamation point (!) symbolizes pending (active) alarms. These notify the operator about a current problem. They must be rectified. Only then can they be deleted.
- Alarms without an exclamation point are no longer active. They provide information about the history of the alarm messages and can be deleted at any time.

The control options are:

- Acknowledge all alarms
  - Use the selection keys to navigate to the Acknowledge all alarms list entry.
  - Press the Selection key.
  - All alarms not previously acknowledged are considered to be acknowledged and are no longer in the history.
- Acknowledge individual alarms
  - Use the selection keys to navigate to the desired list entry.
  - Press the Selection key.
  - The alarm is considered acknowledged and is no longer in the history.

SCR Control status faceplates

Additional faceplates show the current state of the SCR Control and/or the connected actuators and sensors of the SCR application.



75612-001 Example illustration

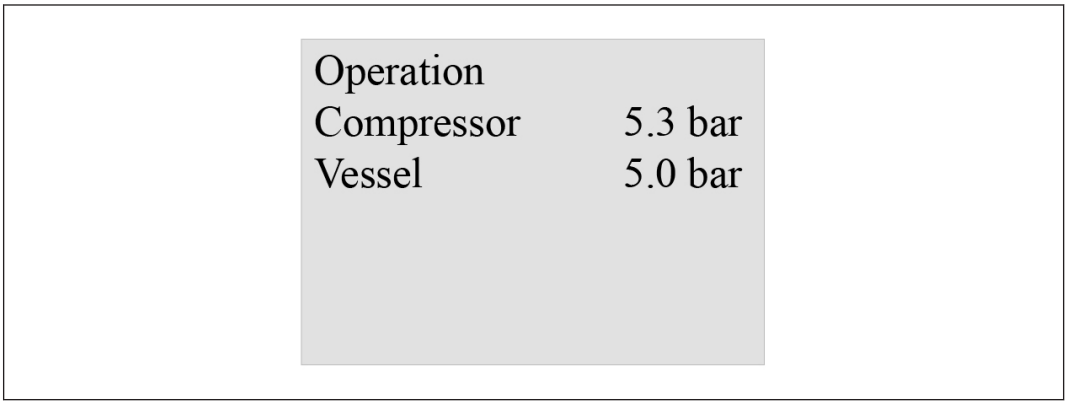
Row 1): Operating states (e.g. Operation)

Row 2): Urea tank fill level

Row 3): Dosing pump pumping rate

Row 4): Pressure in the urea system

Next faceplate



75613-001 Example illustration

Row 1): Operating states (e.g. Operation)

Row 2): Air pressure in compressor

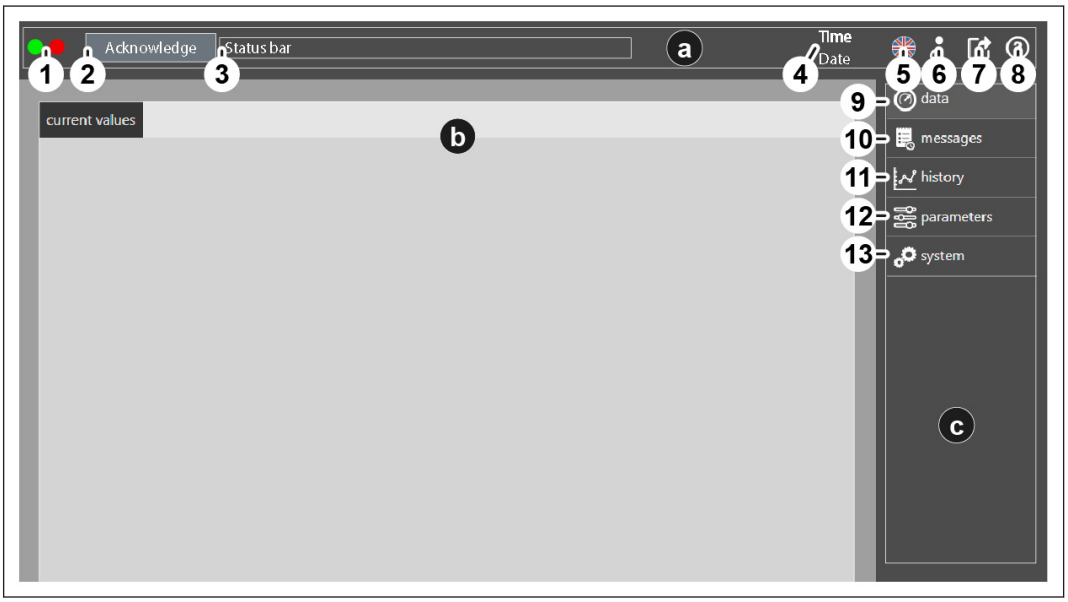
Row 3): Air pressure in buffer tank

4.6 Web server user interface

4.6.1 Monitoring concept

The user interface consists of an icon bar (a), a dialog and display pane (b) and a toolbar (c).

When the user interface starts, the functional group `Data` appears with the `Current values` tab.



72296-003 Example illustration

a Icon bar

b Dialog and display pane

c Toolbar

1 Light-emitting diodes (LEDs)

2 Acknowledge button

3 Status bar

4 Date and time

5 Language

6 User login

7 Data export

8 Help menu

9 Functional group `Data`

10 Functional group `Messages`

11 Functional group `History`

12 Functional group `Parameters`

13 Functional group `System`

Light-emitting diodes (LEDs)

The LEDs visualize the system status with color codes:

- Green: system enabled
- Red: an unacknowledged alarm is pending

Acknowledge button

If the red LED shows a pending alarm, the alarm can be acknowledged as necessary once the operator recognizes it.

Status bar

The status bar displays messages, warnings and alarms.

Date and time

This display area shows the active system data for date and time.

Language

This display area shows the selected language.

Login

This button opens the login dialog window. The button also displays the user level of the currently logged in user.

Data export

This button opens the data export dialog window.

Help menu

This button opens the Help menu.

(currently inactive)

Functional group "Data"

This button displays the tab for the functional group "Data". It displays, for example, current measured values for the exhaust gas emissions.

Functional group "Messages"

This button displays the tab for the functional group "Messages". Displays the logbook.

Functional group "History"

This button displays the tab for the functional group "History". It displays historical measured values, for example.

Functional group "Parameters"

This button displays the tab for the functional group "Parameters". It displays, for example parameters for the exhaust gas measurement which, depending on the user authorization, can be modified.

Functional group "System"

This button displays the tab for the functional group "System". It displays administrative functions.

4.6.2 SCR Control concept

If an SCR Control Kit is also installed in addition to the EmiBox, another tab (1) will be available to display the specific SCR Control data.

The toolbar provides additional functional groups (2) for authorized specialist personnel. These only appear for certain logins.

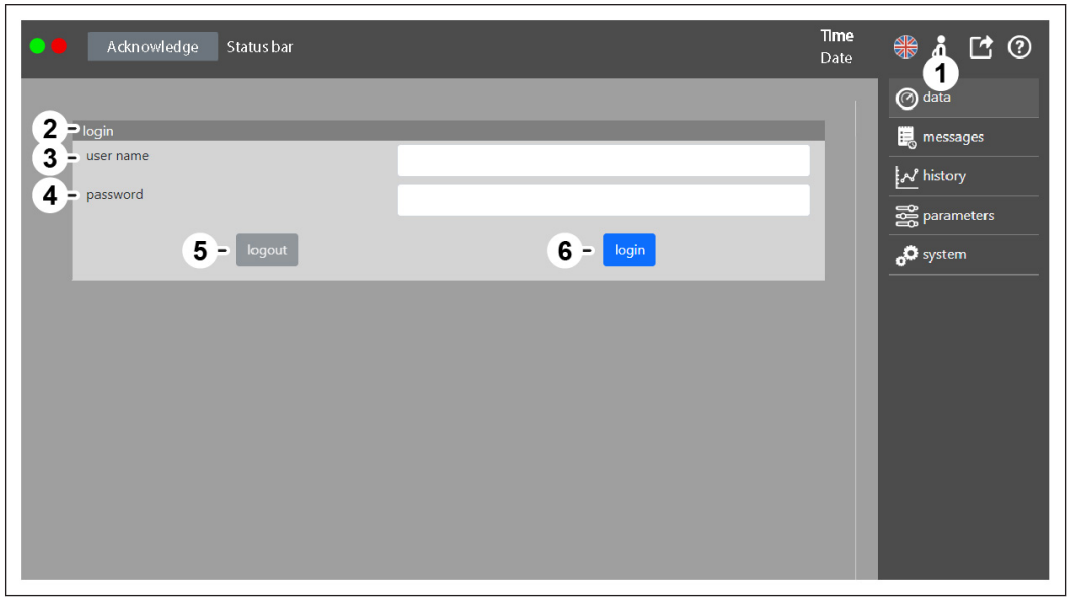
75936-001 Example illustration

1 `SCR Measured values` tab

2 Reserved area for SCR Control functional groups

4.6.3 Login

The `Login` dialog area (2) appears after pressing the `Login` button (1) in the icon bar.



76037-001 Example illustration

1 `Login` button

2 Login dialog area

3 User name field

4 Password field

5 Logout button

6 Login button

The `Login` dialog display (3) is used for logging in or logging out users who are entered in the user management. User name (3) and password (4) are managed by the system administrator.

If the connection to the EmiBox is terminated, or if the user remains inactive for 10 minutes, the system logs the user out.

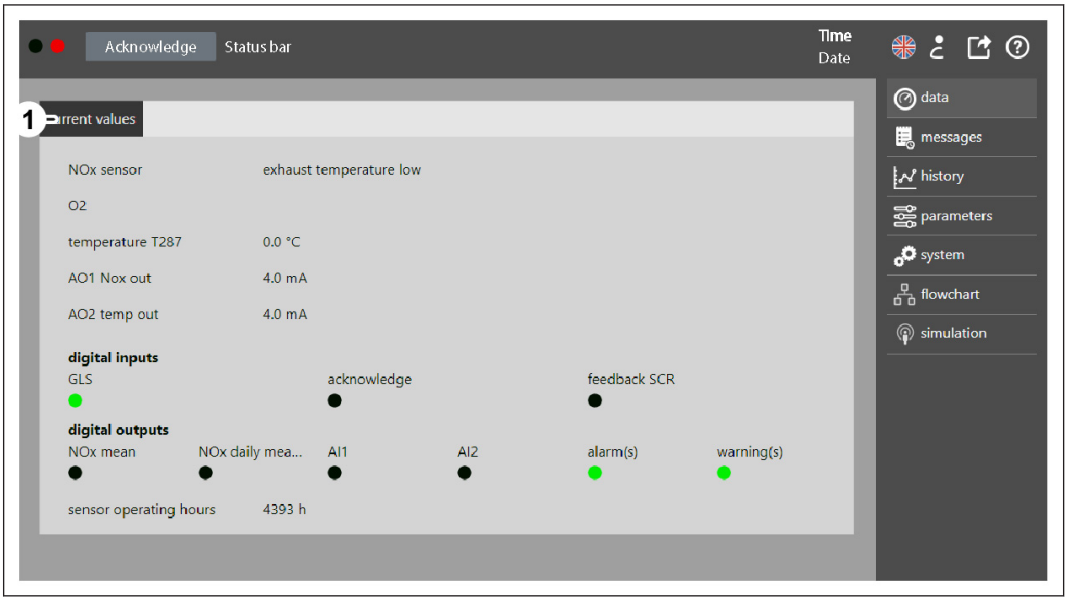
4.6.4 Functional group "Data"

General

The Functional group "Data" appears after the user presses the `Data` button (1) in the sidebar. The tabs displayed depend on the installed functionality of the EmiBox (monitoring or SCR Control).

76039-001 Example illustration

Current values tab



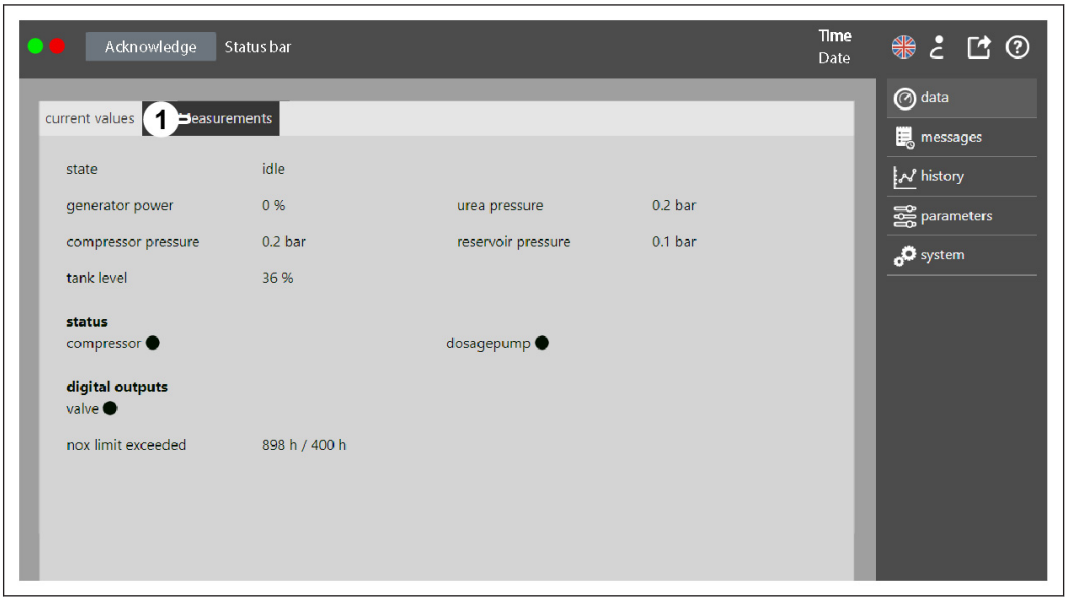
75946-001 Example illustration

The `Current values` tab (1) displays an overview of the current measured values, active digital inputs and digital outputs, and the uptime of the NO_x sensor.

The tab displays the following data:

- NOx sensor: Displays the currently measured NO_x value
- O2: Displays the currently measured O_2 value
- T287 (name can be parameterized): Value of the analog input, if activated. If the analog input is deactivated, it will not appear in the functional group `Data`
- Status of digital inputs
- GLS/GCB: Green LED = GLS/GCB closed
- Collective acknowledgement: Green LED = alarms acknowledged
- SCR CAT feedback: Green LED = SCR catalytic converter in operation. SCR catalytic converter enable signal present for NO_x value recording.
- Status of digital outputs
- Green LED = output active
- Black LED = output inactive
- Sensor operating hours

SCR Measured values tab



75947-001 Example illustration

The `SCR Measured values` tab (1) shows an overview of the current measured values and operating data for SCR Control.

The `SCR Measured values` tab displays the following data:

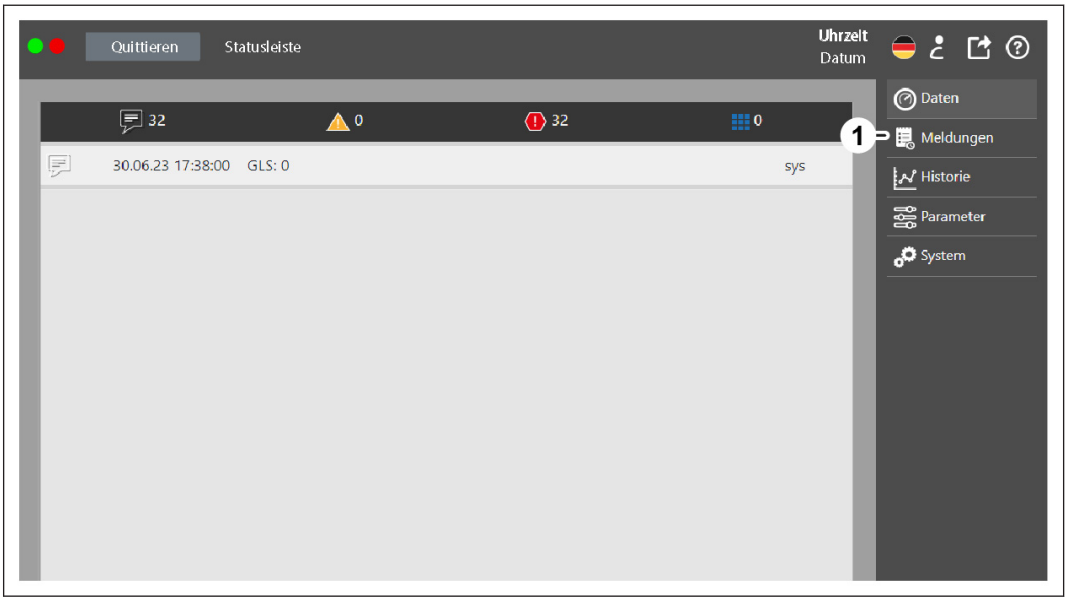
- Operating state of SCR Control (e.g. Operation)
- The current urea dosing quantity and the operation mode (e.g. Characteristic curve) are also displayed
- Engine load
- Current genset power in percent
- Compressed air pressure
- Air pressure at compressor outlet
- Urea fill level
- Urea tank fill level in percent
- Urea pressure
- Urea pressure at dosing medium pump outlet
- Pressure in pressure vessel
- Air pressure in compensation tank
- Compressor status
- Motor circuit breaker feedback
  - LED green = Motor circuit breaker "ON" feedback
  - LED black = No feedback from motor circuit breaker / motor circuit breaker has tripped
- Dosing medium pump status
  - LED green = No fault / Red LED = Dosing medium pump fault
- Digital outputs

- 3-way valve
  - Green LED: Valve is switched, in urea injection position
  - Black LED: Valve is not switched, in compressed air purge position
- NOX exceedance
- A separate uptime counter (fault time counter) accumulates the time in which the emission reduction system is not functional. This means that the 30-minute mean value (can be parameterized) of the NO_x emission has exceeded the programmed daily mean limit.
  - If the fault time counter exceeds the programmed limit (in this example: 400 hours), the "Motor stop" digital output is set, which can be used to shut down the genset.
  - The fault time counter is reset every year at 23:59 on 12/31.

4.6.5 Functional group "Messages"

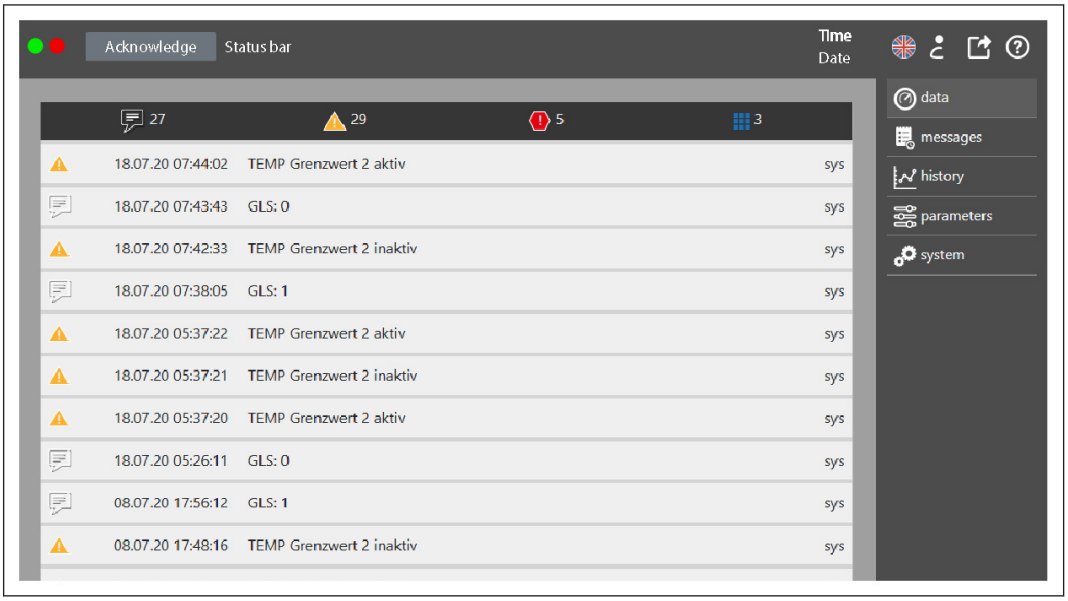
General

The functional group "Messages" appears after the user presses the `Messages` button (1) in the toolbar.



76040-001 Example illustration

Messages tab



76041-001 Example illustration

The `Messages` tab displays the logbook and its entries. Depending on the user's authorizations, additional text entries may also be possible for authorized specialist personnel.

The logbook lists the entries (messages, warnings, alarms and parameter changes) in chronological order.

Icons indicate the type of entry being displayed.

Event message

Alarm message

Warning message

Parameter change message

Examples of what can trigger a message:

- Limit value of an analog input specifically assigned to a message
- Change in a digital input if the `entry in logbook` selection was activated for this
- Normal operation active signal
- The uptime counter is written to the logbook once a week.

Examples of what can trigger parameter changes:

- Any change performed in the functional group "Parameters"
- Automatic change of the time during time changes

Examples of what can trigger warnings:

- A limit value of an analog input which has been individually assigned to a warning
- Default: 30 min NO_x mean value above the limit value

Examples of what can trigger alarms:

- NO_x daily mean value above the limit value
- Sensor defective
- Writing to SD card not possible
- A limit value of an analog input that has been individually assigned to an alarm

Alarms must be acknowledged manually. This can be done either by pressing a button on the EmiBox or via a digital input. When factory default settings are effective, an alarm does not cause the genset to shut down. If necessary, this can be parameterized separately via a digital output.

Faults can be triggered, for example with an SCR Control, by:

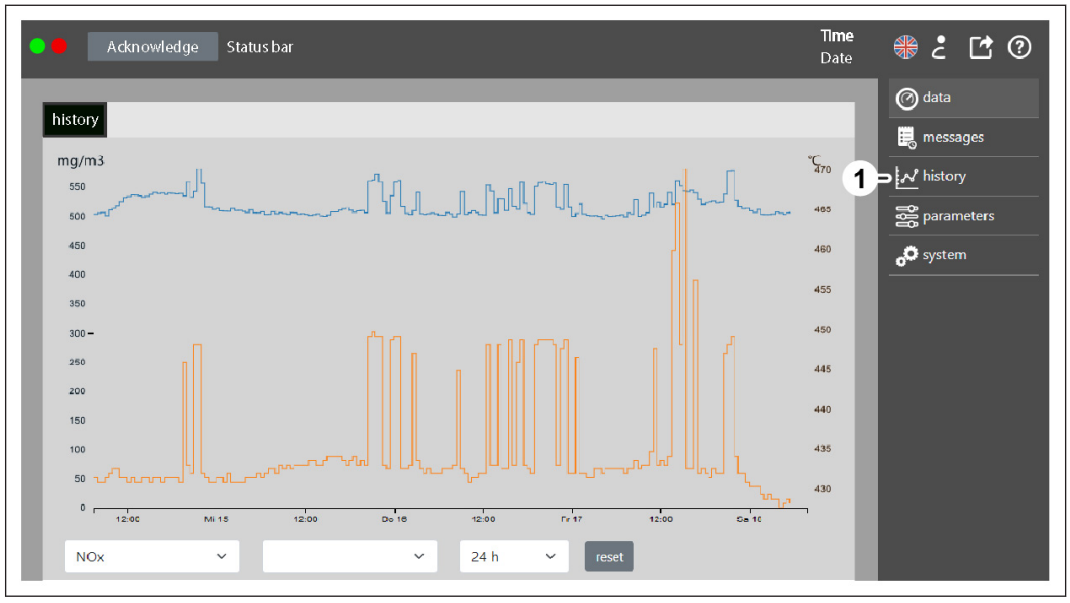
- Low limit violation of the minimum pressure in the urea or compressed air system.

With SCR Control, a fault will cause a shutdown of the urea system. The compressor will continue to be supplied with power to ensure a purge of the injection lines.

4.6.6 Functional group "History"

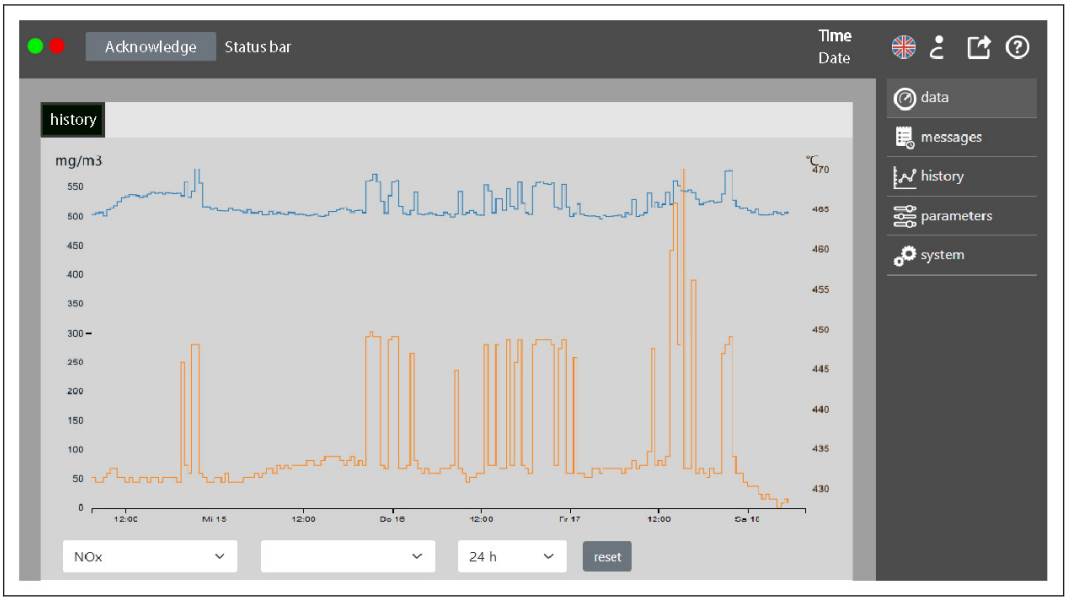
General

The functional group "History" appears after the user presses the `History` button (1) in the toolbar.



76042-001 Example illustration

History tab



76043-001 Example illustration

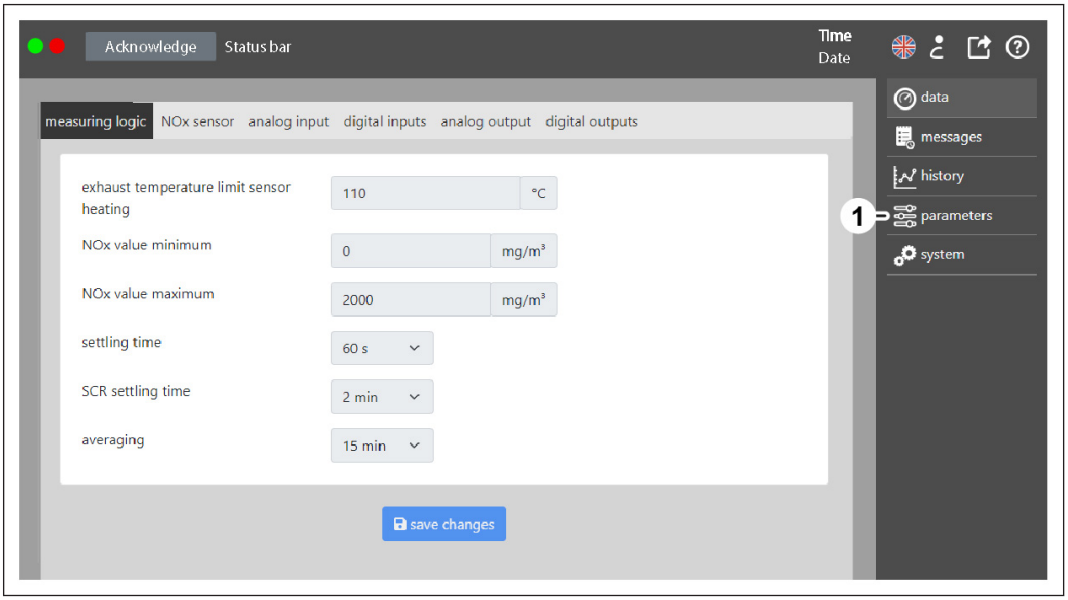
The `History` tab displays the recorded measured values and the system data as a graphic. It is based on the contents of the history file. The history file saves mean values from the sensor signals every 30 minutes (adjustable) and status changes from the binary inputs. It can be used to draw conclusions about the operation in case the NO_x limit value is exceeded. The functional group "Data" also shows the contents of this file.

The buttons in the lower area allow the user to select the desired variables (max. 2) and the time interval to display. The possible display intervals are 24 hours, 7 days, 30 days or 365 days.

4.6.7 Functional group "Parameters"

General

The functional group "Parameters" appears after the user presses the `Parameters` button (1) in the toolbar. Various tabs are displayed.



76044-001 Example illustration

The functional group "Parameters" allows authorized specialist personnel to set parameters for the system control.

The individual parameters are grouped in tabs according to type. Each tab has a display area in which parameters are grouped according to the scope of the function.

The number of tabs that are displayed, and their content, depends on the functional scope of the EmiBox and the user's login.

All parameter changes are documented in the log file.

Tabs

Risk of destruction of components

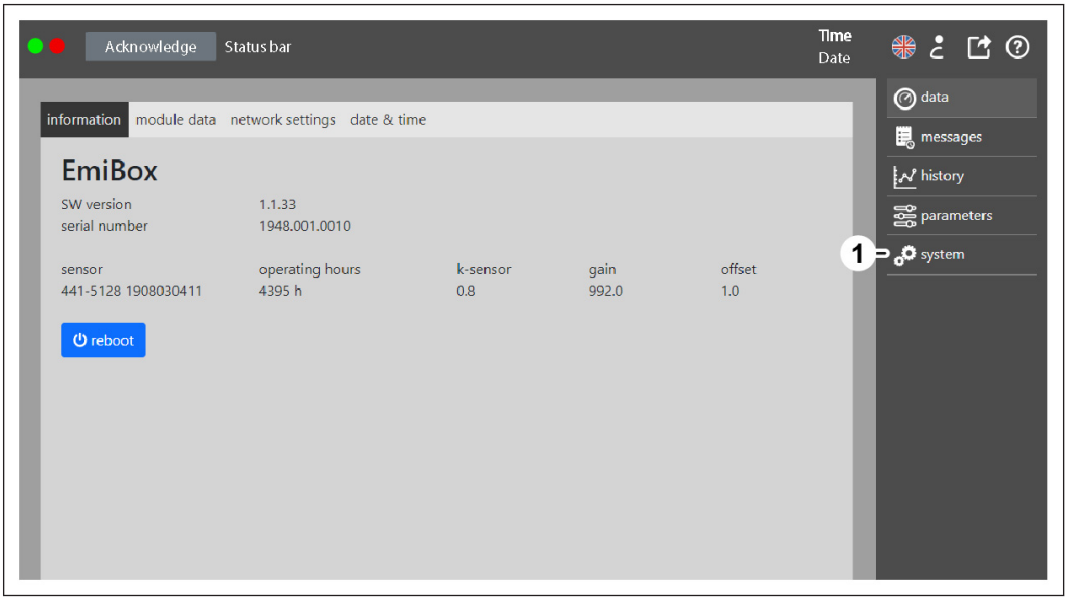
Incorrect parameters can cause malfunction and damage

- This description is intended for operators. It therefore does not describe parameter changes.

4.6.8 Functional group "System"

General

The functional group "System" appears after the user presses the `System` button (1) in the toolbar. Various tabs are displayed.



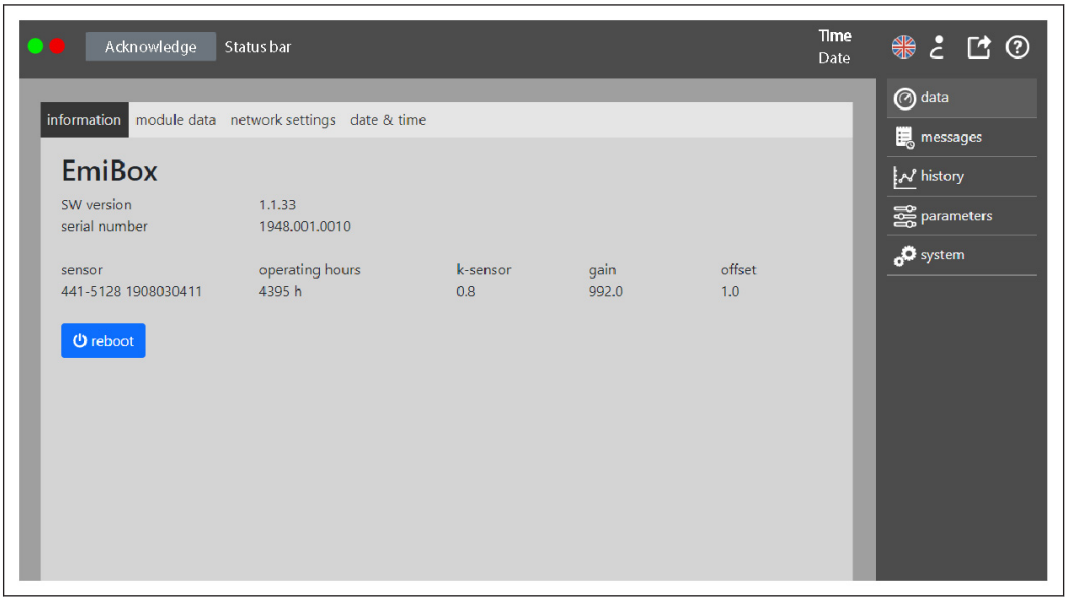
76045-001 Example illustration

The "System" functional group displays information about the EmiBox, manages users and allows for firmware updates.

The individual pieces of system information are grouped in tabs according to type. Each tab has a display area in which pieces of information are grouped according to the scope of the system function.

The number of tabs that are displayed, and their content, depends on the functional scope of the EmiBox and the user's login.

Information tab



75937-001 Example illustration

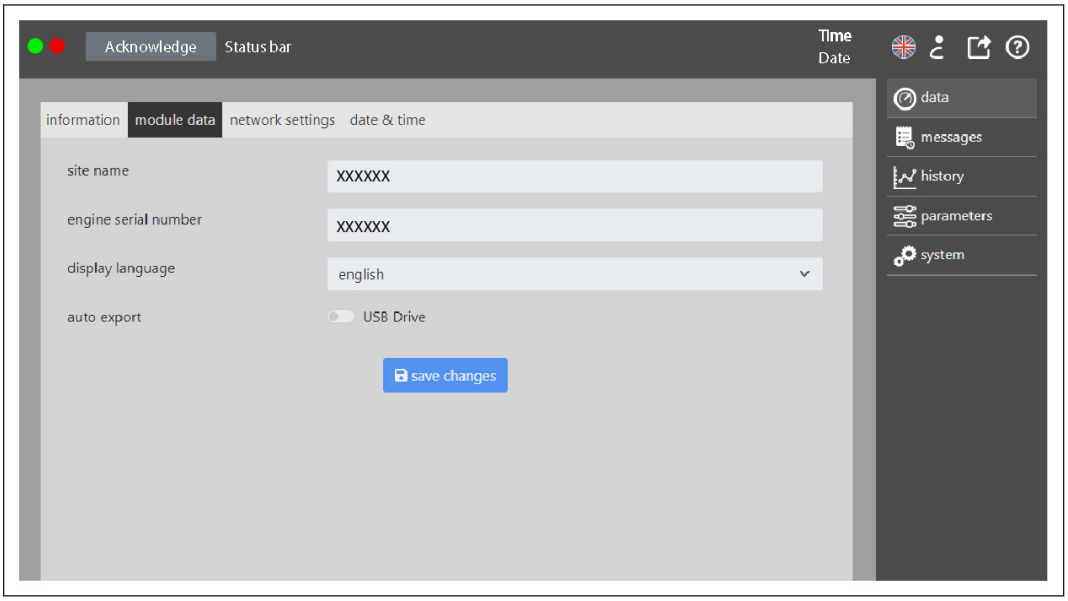
The `Information` tab displays general system information. It allows the user to restart the system.

The display area provides information about:

- SW version: Version of the installed firmware
- Serial number: EmiBox serial number
- Sensor: Type of the installed NO_x sensor
- Operating hours of the NO_x sensor
- K-sensor: NO_2/NO_X ratio
- Gain: current gain
- Offset: current offset

The `Reboot` button causes the EmiBox to reboot. During the reboot, functionalities are temporarily unavailable. Therefore, a reboot should only be performed when the genset is shut down, if possible.

Module data tab



75627-001 Example illustration

The `Module data` tab is used to manage genset data and the SCR application.

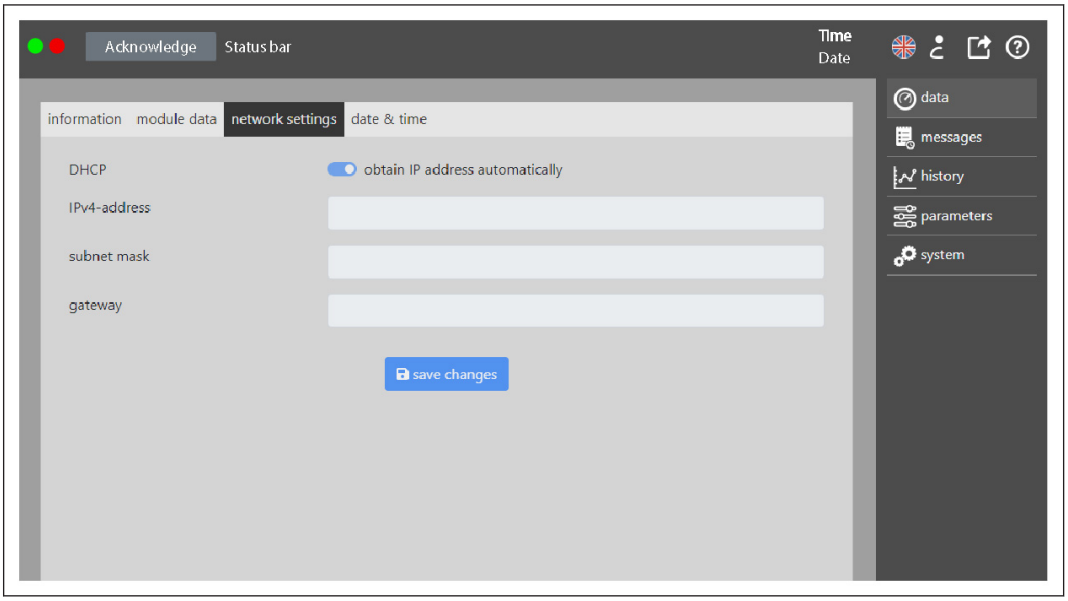
The input area provides:

- Site name: Enter the correct name of the plant. The site name is also used in the History function group and in the logbook
  - With multi-engine plants, also enter the name of the genset.
- Engine serial number: Enter the serial number for unique identification
- Display language: Select the language used on the display
- Automatic export: When the USB connection (accessory) is installed, this switch is enabled. When the switch is activated, the emission data will be exported automatically as soon as a USB data storage device is detected
- Save changes: Make your entries go live

Further information

- For more information on the USB connection, see chapter 4.3.2.1 Data export accessories 41

Network settings tab



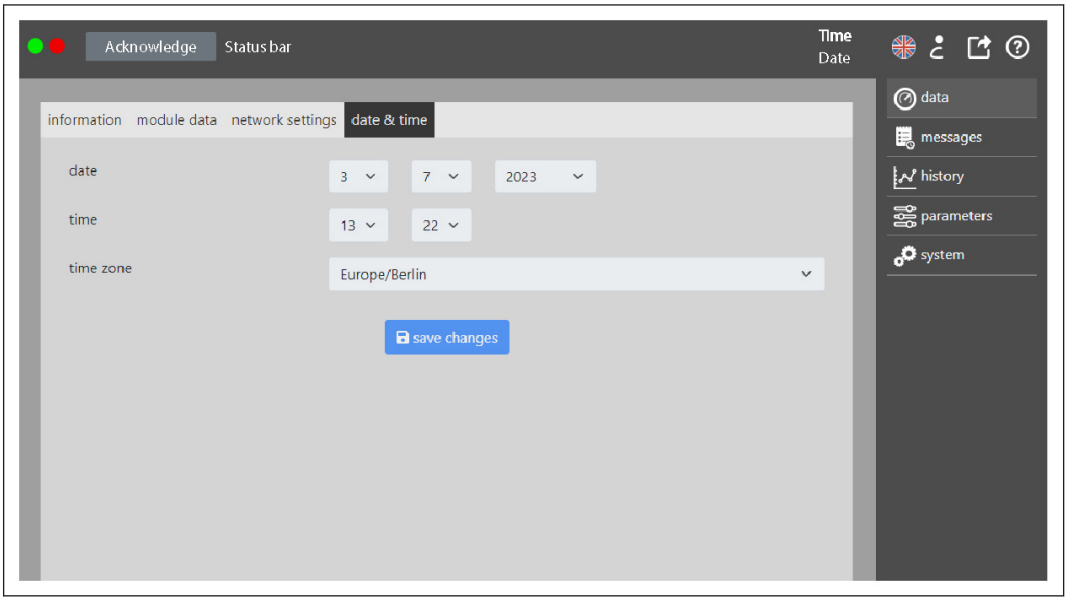
75951-001 Example illustration

The `Network settings` tab is used for managing the network connection.

The input area provides:

- DHCP: Select the mode for Dynamic Host Configuration Protocol
  - In most cases, it is sufficient to obtain the IP address automatically.
- The other input fields are used for manually entering a static IP address. The inputs should be obtained from your system administrator
- Save changes: Make your entries go live

Date & time tab



75952-001 Example illustration

The `Date & time` tab is used for managing the date and time.

The input area provides:

- Date: Enter the desired date
- Time: Enter the desired time
- Time zone: Select the current time zone
- Save changes: Make your entries go live

The time is automatically adjusted for time changes.

4.7 Remote access as an option

4.7.1 Purpose and overview of the function

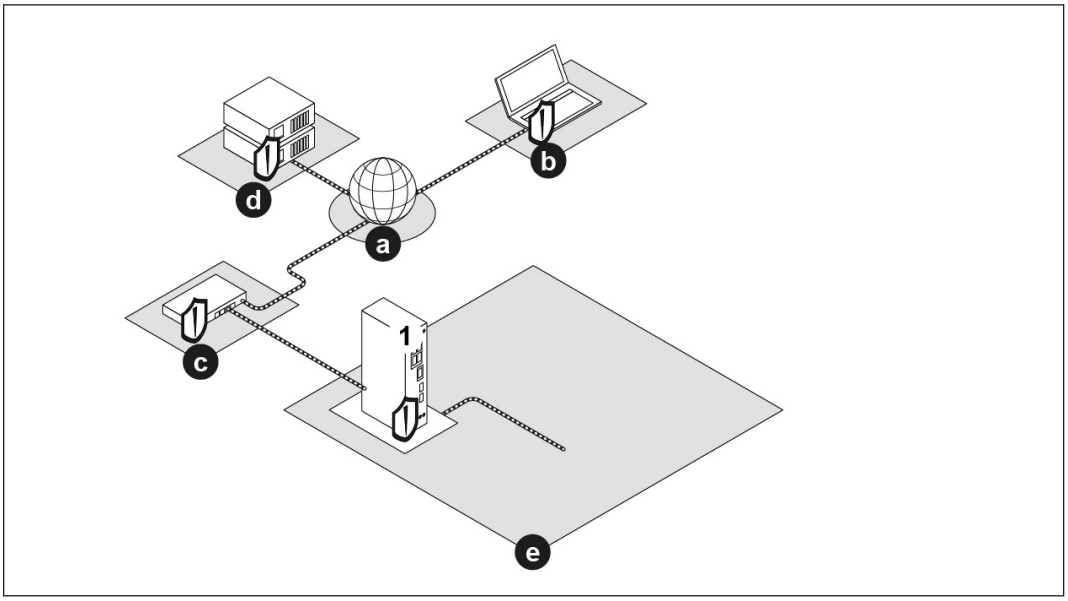
Remote access allows a network-enabled computer (client) to access the web server of the EmiBox from any location via the internet. This lets operators and authorized personnel, depending on their authorizations, view operating data, export system states or exchange data. When explaining the principle of operation, the description below distinguishes between the external network outside of the CES control system and the internal network with the CES components that are relevant for data exchange.

External network

In the external network, the remote client (b) for remote access, the operator's router (c) and the TEM/TPEM Rendezvous Server (d) communicate via the internet (a). The TEM/TPEM Rendezvous Server orchestrates data exchange with the client and only grants access to authorized participants.

The following roles are responsible for IT security: For the router (c), it is the operator; for the computer with the client, it is the computer's user and/or owner.

The TEM/TPEM Remote Plant Gateway (1) serves as the interface between the external and internal network of the CES control system.



75933-001 Example illustration: Networks and interfaces

a Data exchange via the internet or Wide Area Network (WAN)

b Remote client, for example a laptop with client software and a firewall

c Operator's network connection with firewall

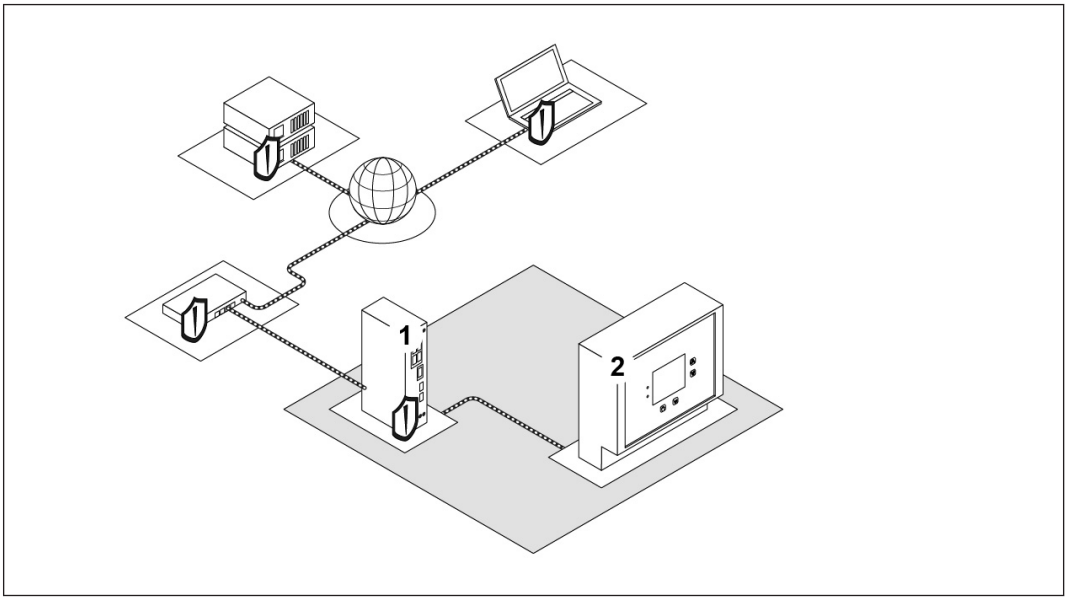
d TEM/TPEM Rendezvous Server of Caterpillar Energy Solutions (CES)

e Internal network of the TEM/TPEM system with access to EmiBox and SCR Control

1 TEM/TPEM Remote Plant Gateway

Internal network with EmiBox

In the TEM/TPEM system, CES components are connected to an internal network. The EmiBox is integrated directly via a connection to the TEM/TPEM Remote Plant Gateway (1).



75932-001 Example illustration: Remote access with EmiBox

1 TEM/TPEM Remote Plant Gateway router with firewall

2 EmiBox with web server

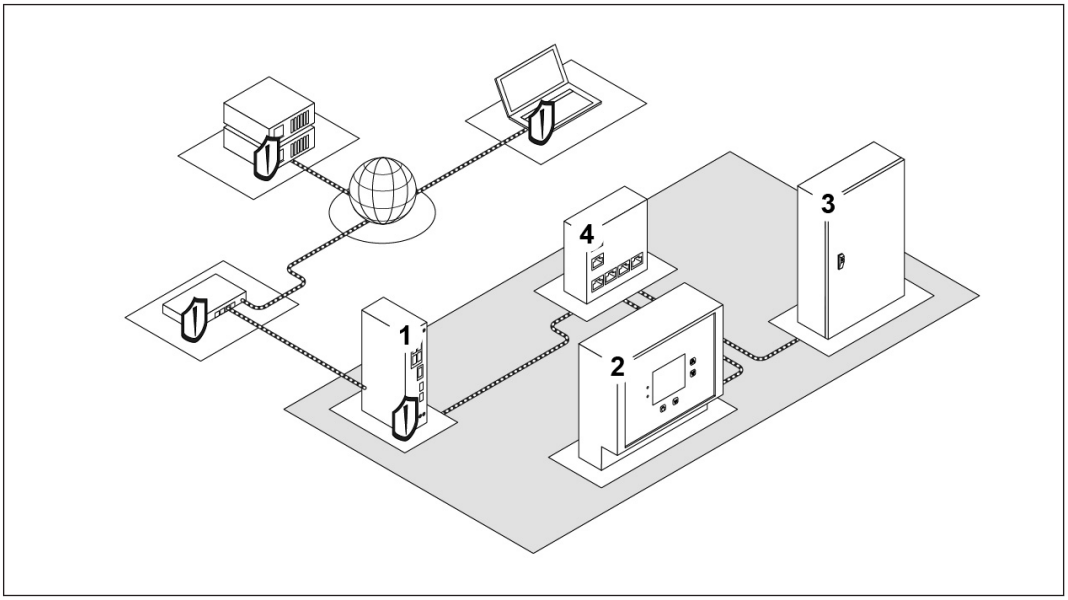
The EmiBox contains an integrated web server that the client can access. The requirements for the client to communicate with the web server of the EmiBox are:

- Network-enabled client computer with client software installed and configured
- Configured and operational TEM/TPEM Remote Plant Gateway
- Registered account with Caterpillar Energy Solutions (CES)
- Configured and operational CES network modules

Internal network with EmiBox and SCR Control Kit

With an installation with the SCR Control Kit, an additional switch (4) is required for remote access. The switch (4) facilitates data exchange with between the EmiBox (2) and SCR Control (3) for process control of the SCR application. The switch (4) also enables connection to the TEM/TPEM Remote Plant Gateway (1).

371-001-EN : 51000010 : BA : VAR, COV, IMP, B, BA, BS, DEM, EIN, IBN, IST, WP, SK, MH, SB, STB, TA, TL



75818-001 Example illustration: Remote access with EmiBox and SCR Control Kit

1 TEM/TPEM Remote Plant Gateway router with firewall

2 EmiBox with web server

3 SCR Control switchgear cabinet with network connection

4 Switch for EmiBox and SCR Control

4.8 IT security

The operator is responsible for security of the network connections. The current standard for industrial network protection applies.

Pay particular attention to:

- Only establish a connection to the EmiBox
- Appropriate and updated firewalls, especially on computers or servers with interfaces to the internet
- Current firmware on all operator-side routers
- Only use secure cloud functions
- All other network components, such as switches and routers, must not be accessible via the internet
- If possible, deactivate USB interfaces and unnecessary network interfaces

For necessary information on IT security, see

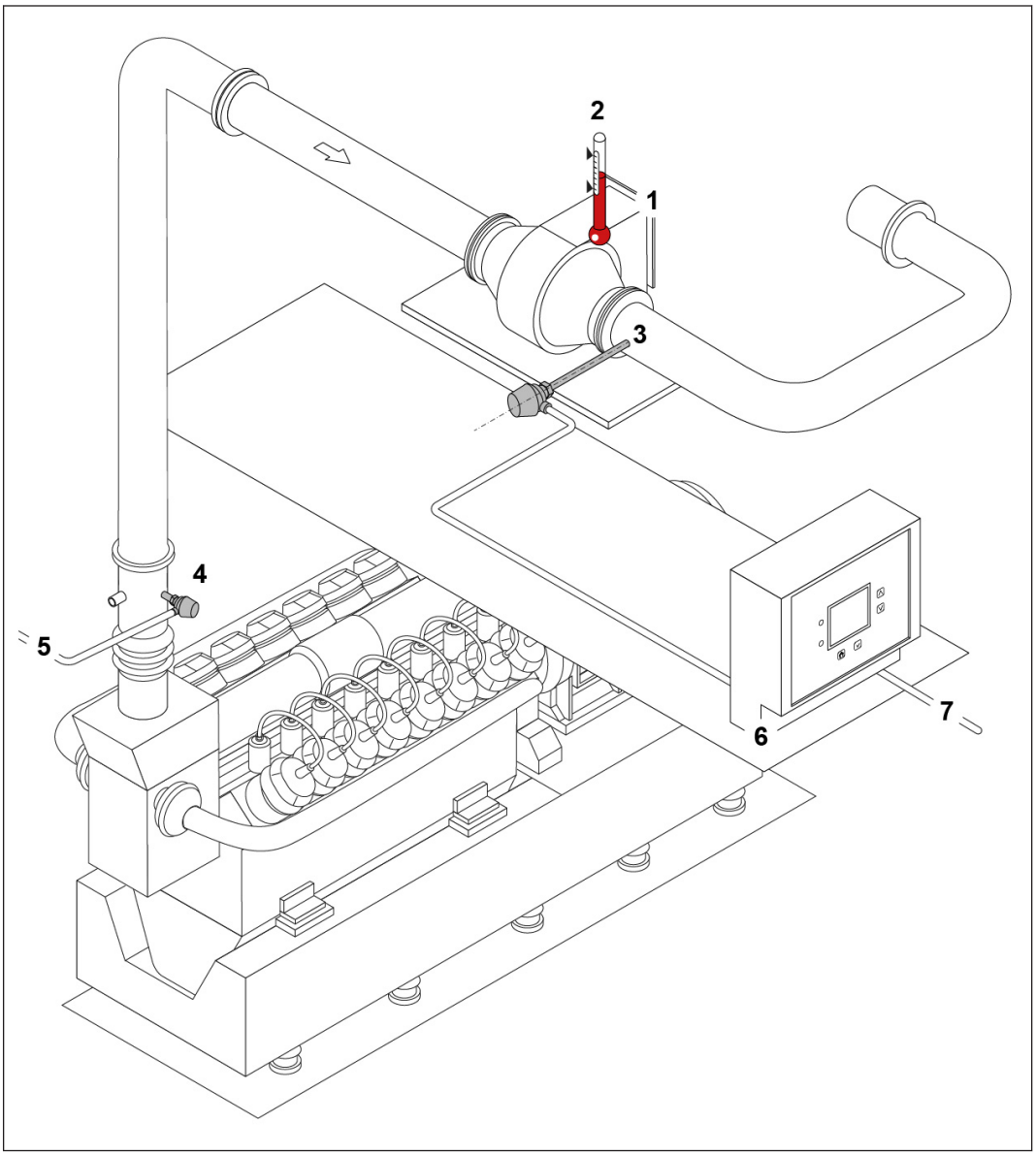
- Operator IT contact person

371-001-EN : 51000010 : BA : VAR, COV, IMP, B, BA, BS, DEM, EIN, IBN, IST, WP, SK, MH, SB, STB, TA, TL

4.9 Catalytic converter protection

4.9.1 Temperature monitoring on the oxidation catalytic converter

A maximum temperature, which depends on the model, must not be exceeded in the oxidation catalytic converter. Catalytic converter protection requires a temperature sensor downstream of the oxidation catalytic converter (3).



76024-001 Example illustration

1 Oxidation catalytic converter
2 Temperature in the catalytic converter
3 Temperature sensor downstream of oxidation catalytic converter
4 Temperature sensor for genset downstream of charging group
5 Signal to TEM/TPEM system
6 EmiBox
7 Signal to TEM/TPEM system

Monitoring strategy

The signals from the temperature sensor (3) are processed in the EmiBox (4) and sent to the TEM/TPEM system (7). Depending on the temperature, the EmiBox will display the corresponding messages.

Temperature monitoring is implemented in the TEM/TPEM system. It considers the signals from the sensor on the oxidation catalytic converter and temperature sensor (5) on the genset downstream of the charging group. In addition to issuing warning messages, an immediate emergency stop of the genset will be enforced if the programmed limit temperature is exceeded.

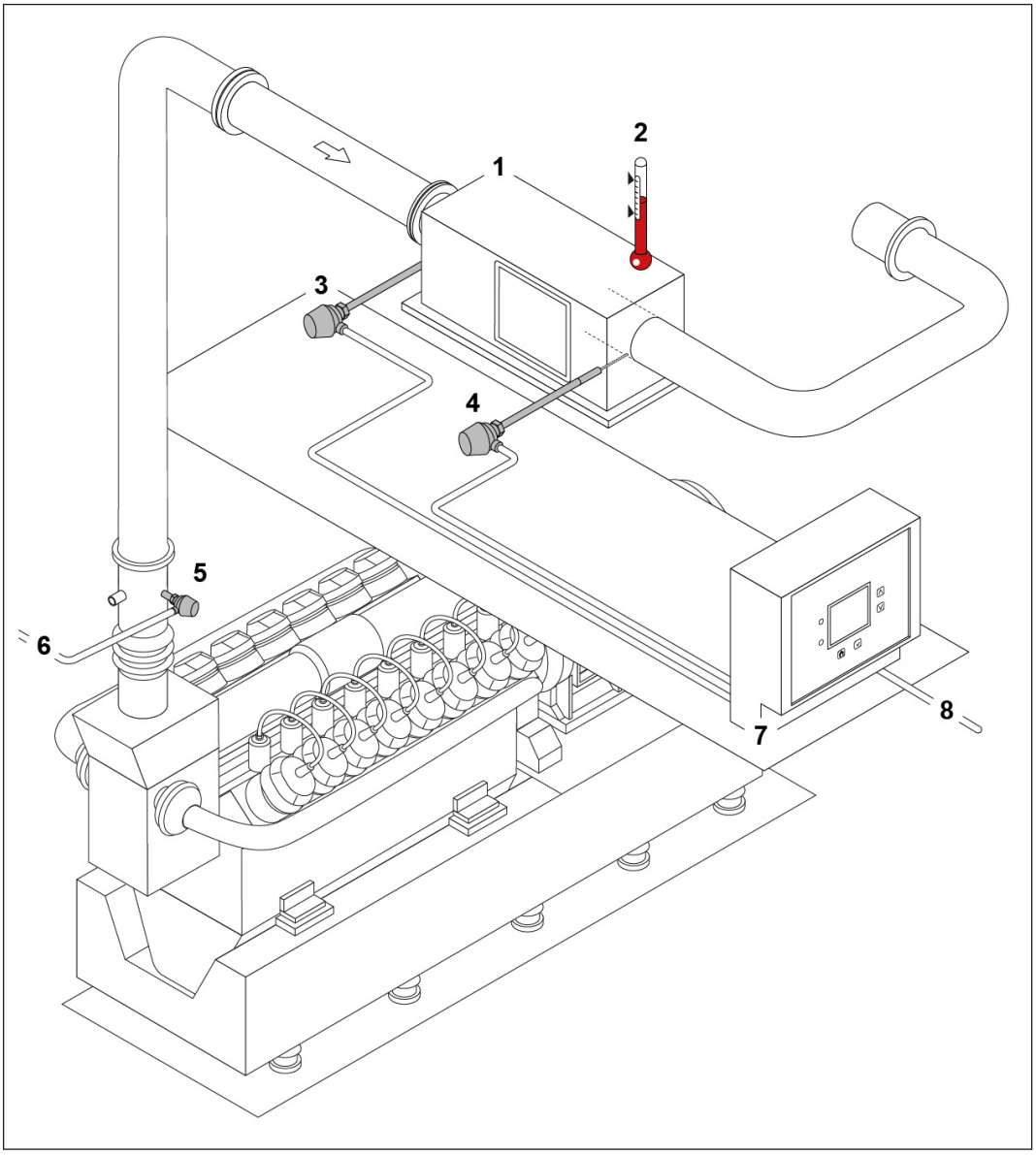
Integrating the temperature sensors into the TEM/TPEM system and assigning correct parameters during commissioning assures sufficient protection of the catalytic converter against excessive process temperatures (2).

The following table lists the generally specified threshold values and/or limit values for the temperature monitoring system. A different limit for the exhaust temperature may be necessary as a function of the genset configuration and the fuel gas supply. Parameters are assigned by trained and authorized specialist personnel, as only these personnel can take into account the prevailing conditions on site when assigning parameters.

Tempera-ture	Position	Temperature monitoring response
At 560 °C	Catalytic converter	**EmiBox** • Entry in logbook • Collective alarm **TEM/TPEM system** • Entry in operation log • Immediate emergency stop with continued pump operation

4.9.2 Temperature monitoring on the SCR catalytic converter with integrated oxidation catalytic converter

A maximum temperature, which depends on the model, must not be exceeded within the SCR catalytic converter. Therefore, to protect the catalytic converter, an additional temperature sensor is required upstream of the SCR catalytic converter (3) in addition to the genset temperature sensor (5) and the temperature sensor (4) for process control by SCR Control.



76023-001 Example illustration

1 SCR catalytic converter

2 Temperature in the catalytic converter

3 Temperature sensor upstream of SCR catalytic converter

4 Temperature sensor downstream of SCR catalytic converter

5 Temperature sensor for genset downstream of charging group

6 Signal to TEM/TPEM system

7 EmiBox

8 Signal to TEM/TPEM system

Monitoring strategy

The signals from the temperature sensors (3) and (4) are processed in the EmiBox (5) and sent onward to the TEM/TPEM system (7). Depending on the temperature, the EmiBox will display the corresponding messages.

Temperature monitoring is implemented in the TEM/TPEM system. It considers the signals from the temperature sensors (3) and (4) as well as the signal from the temperature sensor (5) on the genset downstream of the charging group. Not only can warning messages be issued, process control actions can be taken, up to and including genset shutdown.

Integrating the temperature sensors into the TEM/TPEM system and assigning correct parameters during commissioning assures sufficient protection of the catalytic converter against excessive process temperatures (2).

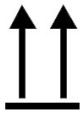
The following table lists the generally specified threshold values and/or limit values for the temperature monitoring system. A different limit for the exhaust temperature may be necessary as a function of the genset configuration and the fuel gas supply. Parameters are assigned by trained and authorized specialist personnel, as only these personnel can take into account the prevailing conditions on site when assigning parameters. Operator specifications are the operator's prerogative, but these must be agreed upon in advance with CES and documented in writing.

Tempera-ture	Position	Temperature monitoring response
At 500 °C	Upstream of CAT	**EmiBox** • Warning message
505 °C and higher	Genset or pre-CAT	**TEM/TPEM system** • Warning message and entry in operation log • If the signal is pending for 5 minutes, a controlled shutdown of the genset will occur
At 525 °C	Genset or pre-CAT	**TEM/TPEM system** • Entry in operation log • Immediate emergency stop with continued pump operation
At 530 °C	Upstream of CAT	**EmiBox** • Entry in logbook • Collective alarm
At 560 °C	Post-CAT	**EmiBox** • Entry in logbook • Collective alarm **TEM/TPEM system** • Entry in operation log • Immediate emergency stop with continued pump operation

5 Preservation, packaging, transport and storage

Table of contents

5.1 Symbols on the packaging

	**Top** Shows the correct upright position of the package. Only transport and store the packages in an upright position.
	**Protect from moisture** Protect packages from moisture and store in a dry place.
	**Fragile** Indicates packages with fragile or damageable contents. Treat packages with care, do not throw and be careful not to knock or bump them.

5.2 Removing from transport

Immediately check the delivery for completeness and transport damage upon receipt.

In the event of visible transport damage on the outside, proceed as follows:

1. Do not accept the delivery or only accept under reserve
2. Note the extent of the damage on the transport documents or on the hauler's delivery note
3. Lodge complaint

Note

Make a claim for each fault as soon as it is detected. Claims for damage may only be made within the legal and contractually agreed claim deadlines.

5.3 Information on packaging

The individual packages are packed according to the transport conditions to be expected.

Note

For required information on packaging, see

- Operating Manual ⇒ General ⇒ Operating media regulations
  - Technical Bulletin (TR) 2169 Specification for preservation, packaging, transport and storage

The packaging should protect the individual components up to assembly. Therefore, do not destroy the packaging and only remove it directly before assembly.

Handling packaging materials

Danger to the environment

Incorrect disposal of packaging materials may cause environmental damage.

- Dispose of packaging material according to the respectively applicable legal regulations and local specifications.
- Pass recyclable packaging material on to be recycled
- Commission a specialist company if necessary

6 Assembly

Table of contents

6.1 Safety notes

WARNING!

Electric shock if live components are touched

This can lead to severe injuries and even death.

- Only authorized specialist personnel may work on the electrical system.
- Turn off electrical power supply and secure against restarting:
  - Disconnect electrical system.
  - Secure against reconnection.
  - Check that equipment is de-energized.
  - Ground and short-circuit the electrical system.
  - Cover or cordon off adjacent components which are electrically live.

The disconnection of the plant also includes the measuring lines. Since individual measuring lines are connected upstream of the generator circuit breaker (GLS/GCB), they can carry mains voltage even when the genset is stopped and the power supply of the TPEM Control Cabinet (TPEM CC) is disconnected.

WARNING!

Injury due to improper installation

This can lead to severe injuries and even death.

- Only authorized specialist personnel may install the product.
- Ensure sufficient installation space.
- Handle sharp-edged components carefully.
- Ensure tidiness and cleanliness in the workplace.
  - Do not leave tools lying around.
  - Components left lying around and on top of one another are accident hazards.
- Assemble components properly.
  - Observe specified tightening torques.
- Secure components from being knocked over or falling down.

Risk of destruction of components

Electrostatic charging of the assembly personnel or their tools can damage sensitive components or restrict their function.

- Observe handling regulations for components subject to electrostatic hazards

Risk of destruction of components

Mechanical stress, for example, impact or shock, can damage the NO_x sensor or limit its function.

- Leave the NO_x sensor in its packaging as long as possible
- Do not use excessive force during assembly

6.2 General

6.2.1 Guidelines

All components must be assembled and connected properly. Depending on the region, additional requirements may apply or acceptance testing may be required.

Tightening

Observe specified tightening torques for electrical operating equipment, housing, etc.

Electrical connections

The cable routing and connections to electrical equipment must comply with the following general guidelines:

- Observe the wiring diagram for the existing switchgear cabinets and any wiring diagram supplements for later retrofit
- Observe the wiring diagrams for the EmiBox and optional components
- Follow the specified cable routing in switchgear cabinets. Route cables in the existing lateral cable ducts to the levels with the equipment such that the cables are free from tension. Comply with permissible bending radii. Secure cables with suitable fastening means
- Protect cables to be laid outside switchgear cabinets from damage and secure with suitable fastening means. Options for protecting cables include rigid or flexible conduits made of metal or plastic, cable ducts, or the use of cut-resistant cables. Comply with permissible bending radii.
- Properly install and close or seal feedthroughs for electrical connections in switchgear cabinets, etc.
- Cover open cable ends with a protective cap as a safeguard before installation
- Establish the connections and cable connections such that they cannot come loose during operation
- Secure the connections and cable connections such that they cannot be loosened easily by persons. The method of securing or loosening should require a tool
- Label the unlabeled cables or wires according to the wiring diagram
- Adapt technical documentation accordingly

6.2.2 Local situation and documents

This document describes the assembly and connection as realistically as possible according to the standard situation. If adjustments are to be made or if there are any queries, contact the responsible service partner.

The wiring diagram supplied always applies.

- Before assembly, compare the local situation with this manual and the wiring diagram

6.2.3 Power supply timing

To the extent possible, do not supply power to the system until all hardware is installed and all electrical connections are established.

6.3 Preparation

6.3.1 Authorization and competence

Service work always requires valid authorization by the operator and the responsible manufacturer or their authorized representative.

The required competence depends on the type of work and the affected interfaces of the overall system.

Additional qualification

Assigning parameters to an input in the TEM/TPEM system requires a corresponding qualification and the associated TEM dongle or TPEM token.

6.3.2 Situation at the site

Before assembly, obtain and consider at least the following information:

- Control system of the genset (TEM/TPEM system)?
- Functions to be implemented (monitoring, SCR Control, extras)?
- Required measuring lance length?
- Is a suitable measuring header present?
- Does the scope of delivery match the situation at the site?

6.4 Overview of installation variants

Variants/system	NO_x sensor	temp. sensor[1]	Relay (GLF)	EmiBox	TPEM CB	Switch
Monitoring with TEM	x	x	x	x	-	-
Monitoring with TPEM	x	x	x	-	x	-
Monitoring and SCR Control with TEM	x	x	x	x	-	-
Monitoring and SCR Control with TPEM	x	x	x	x	-[2]	-
Remote access for EmiBox with TEM/ TPEM	-	-	-	X	-	-
Remote access for EmiBox and SCR Control Kit with TEM/TPEM	-	-	-	X	-	x

[1] Additional temperature sensor on exhaust systems with a catalytic converter (oxidation or SCR)
[2] In case of retrofits in the presence of a TPEM system, the monitoring connections must be reset

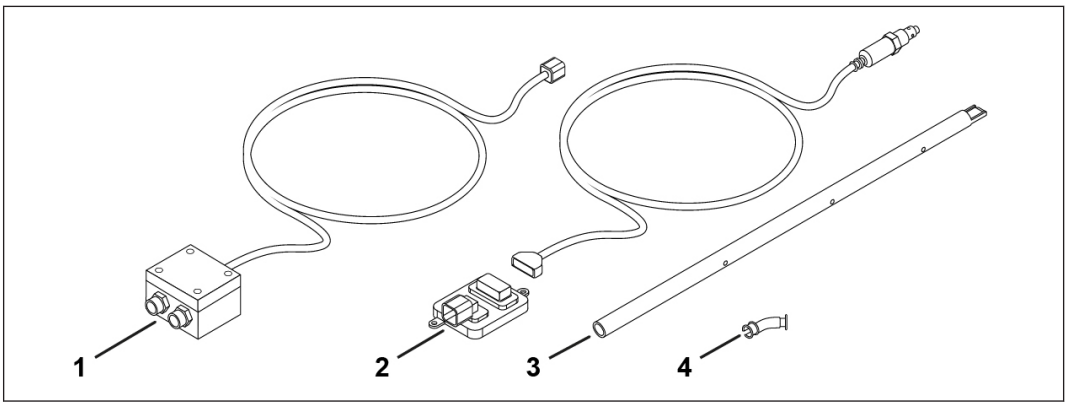
Tab. 6-1 Installation variants

6.5 Actuators, sensors and connection options

6.5.1 NO_x sensor with accessories

Scope of delivery

The measuring lance protrudes into the middle of the exhaust flow within the exhaust system. Depending on the version of the exhaust system, it is possible to choose versions of different lengths when ordering. The measuring lance can then be shortened to the desired length during assembly.



75634-001 Example illustration

1 Terminal box

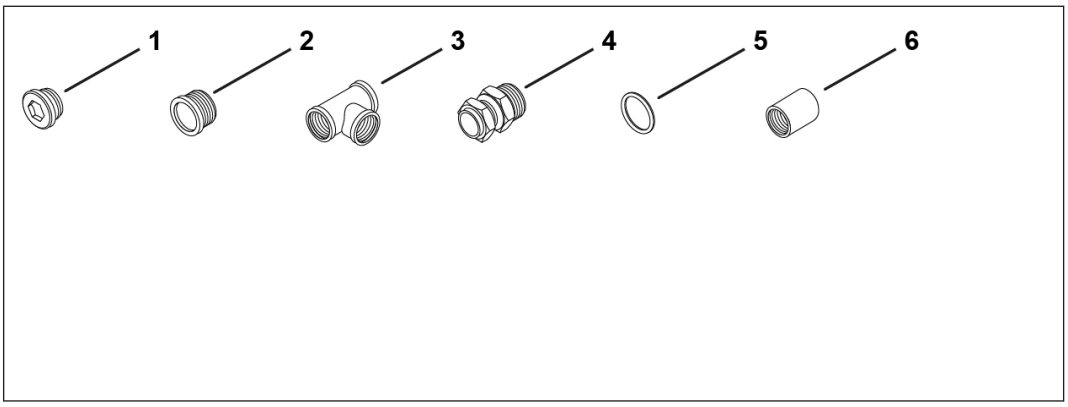
2 NO_x sensor and sensor control device

3 Measuring lance

4 Strain relief for NO_x sensor

Kit for retrofit assembly of a measuring point

If there is no suitable measuring point for installing the measuring lance, a measuring point can be installed as a retrofit.



75852-001 Example illustration

1 Allen-head sealing plug

2 Adapter

3 T piece

4 Straight screw-in fittings (2 pcs.)

5 Copper sealing ring (8 pcs.)

6 Welding coupling sleeve

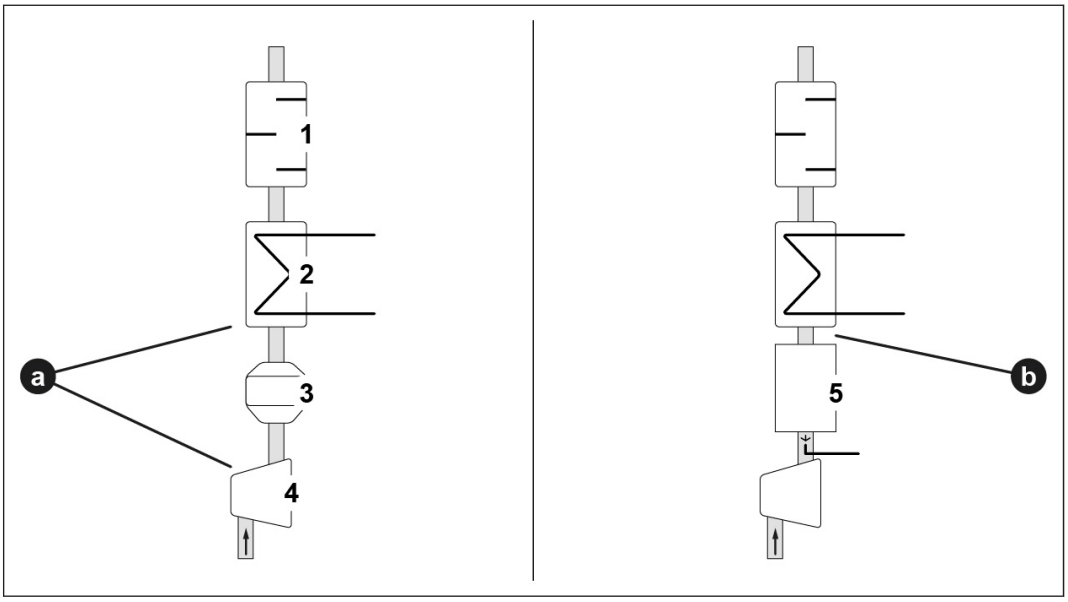
Installation site, installation orientation and temperatures

Installation site for exhaust applications with catalytic converters

The installation site for the NO_x sensor can be selected from the following:

- Oxidation catalytic converter (a): always downstream of the exhaust turbocharger and, if possible, upstream of any exhaust heat exchanger that may be present
- SCR catalytic converter (b): always downstream of the SCR catalytic converter and, if possible, upstream of any exhaust heat exchanger that may be present

If the NO_x sensor has to be installed downstream of the exhaust heat exchanger, the required system temperature must be attained at that location.



75940-001 Example illustration

a Installation area for oxidation catalytic converters

b Installation area for SCR catalytic converters

1 Muffler

2 Exhaust heat exchanger

3 Oxidation catalytic converter

4 Turbocharger

5 SCR catalytic converter

For required information on the distances of NO_x measuring points, see

- Operating Manual ⇒ General ⇒ Application and Installation Guide
  - Power plants layout

For necessary information on the P&I diagram, see

- Operating Manual ⇒ General ⇒ Diagrams

System temperature

For every installation position, a documented temperature measurement taken during commissioning must verify that the exhaust temperature at the tip of the NO_x sensor is above 110 °C during normal operation.

If this temperature is not attained, both the T piece and the protruding piece of the measuring lance where it sticks out of the exhaust pipe can be insulated.

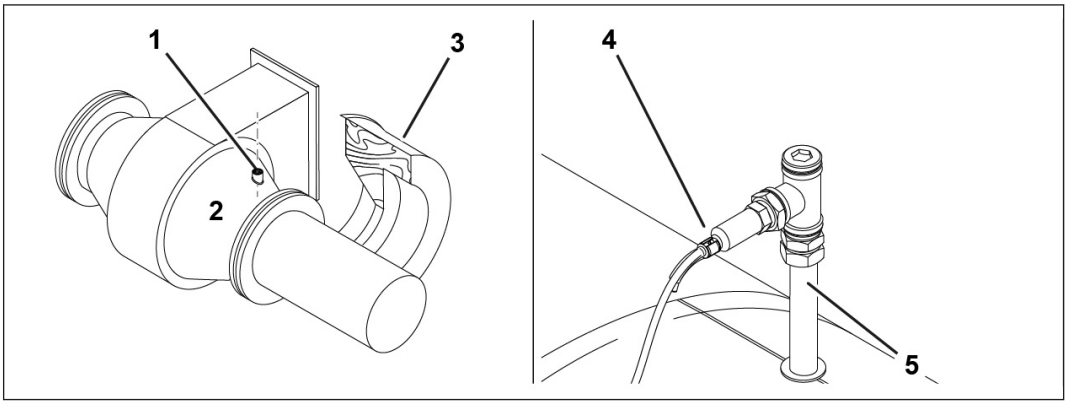
Risk of destruction of components

Overheating of the NO_x sensor can destroy the sensor or cause incorrect measurement results.

- The sensor and its rear side must not must not exceed a temperature of 150 °C.
- Do not insulate the side branch of the T piece for the NO_x sensor or the rear side of the NO_x sensor

Installation position

The NO_x sensor (4) lies in a measuring lance (5) outside the exhaust pipe or catalytic converter (2). The measuring lance (5) is connected via a sleeve (1) and protrudes into the middle of the exhaust stream from the gas engine. It diverts a portion of the exhaust stream to the NO_x sensor (4). In case no suitable connection piece is present, an optional kit may be used to retrofit a weld-on sleeve coupling.



75948-001 Example illustration

1 Sleeve

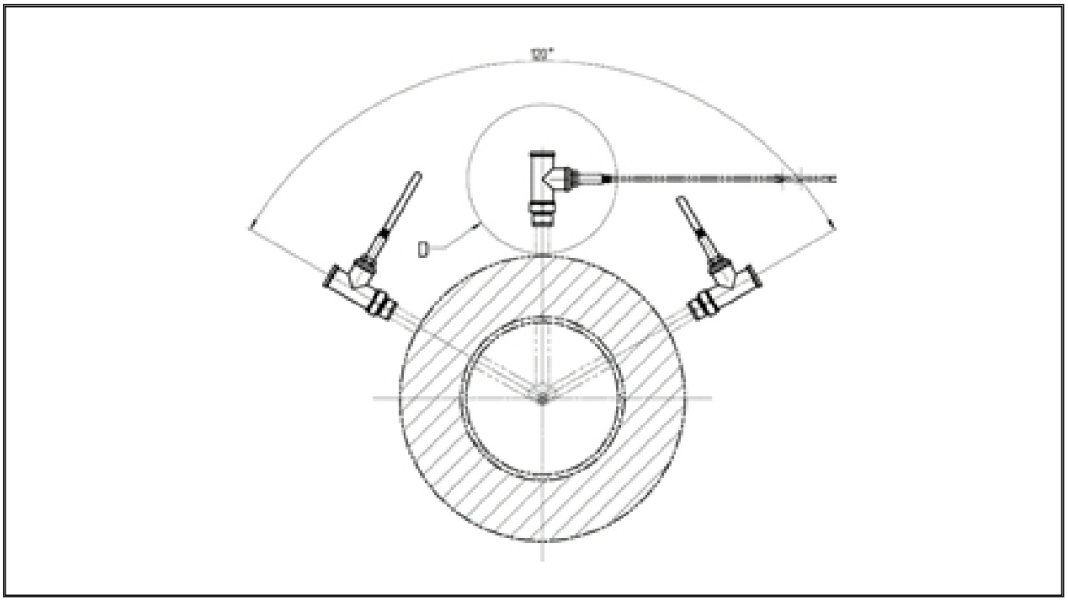
2 Catalytic converter (in the example: an oxidation catalytic converter)

3 Cut-away insulation

4 NO_x sensor

5 Measuring lance

The measuring lance should protrude into the exhaust pipe at as close as possible an angle to 90 degrees. A deviation from the vertical axis by +/- 60° is permissible. In this case, the T piece must be oriented so that any condensate that builds up can run off without collecting in the branch of the T piece.



72311-001 Example illustration

If a vertical installation position is not at all possible, appropriate measures must be taken to ensure that:

- the specified system temperature is maintained under all operating states and weather conditions;
- any condensate that forms can run off.

Installing the measuring lance and NO_x sensor

Notes

With SCR catalytic converters, an NO_x sensor should already be installed. The description below therefore explains using the example of a retrofit installation on an existing oxidation catalytic converter. The description has been kept general can can also apply to exhaust applications without a catalytic converter.

It must be ensured through corresponding measures that no residues in the pipe system (dirt, welding beads, etc.) can damage other components and lead to leakages. The pipes must be connected so that no forces and vibrations can be transmitted.

Installation sequence

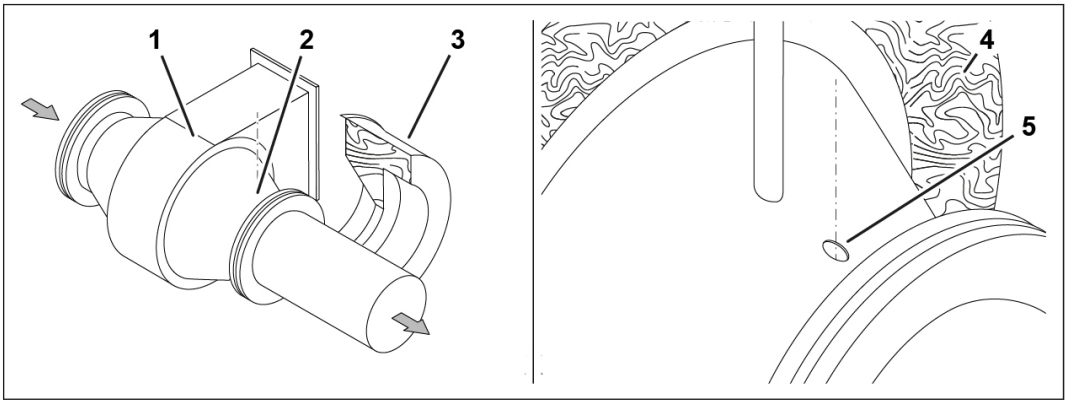
Oftentimes, there is no suitable screw-in connection piece for the measuring lance in the exhaust system. Therefore, in the following description, the included weld-on sleeve is assembled to serve as a screw-in connection piece.

Copper gaskets have been included to seal the screw-in elements. Depending on the sealing surface, more than one copper ring may be necessary per screw connection.

Defining the installation position and creating a hole for the measuring lance

The preferred installation position (2) is downstream of the oxidation catalytic converter (1).

If possible, the sensor should be installed in a pipe section which is decoupled from the vibrations of the gas engine; potentially after the expansion joints.

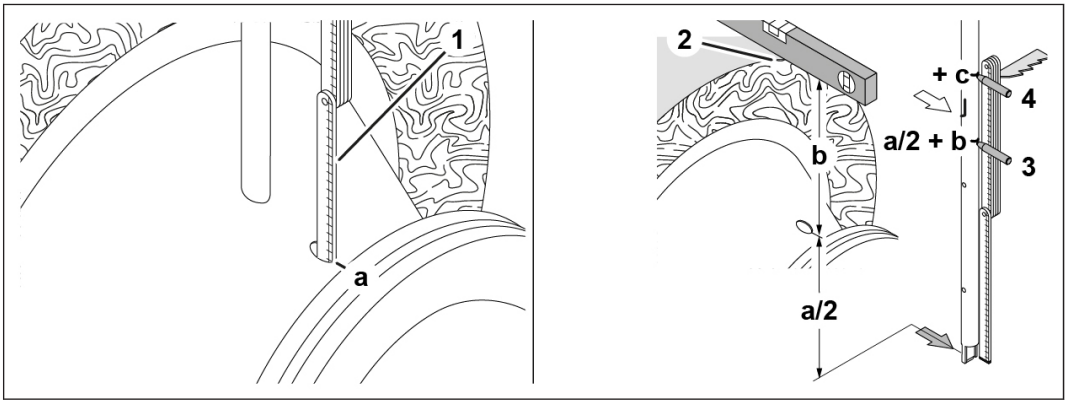


75844-001 Example illustration of a cone-shaped oxidation catalytic converter

- Remove the insulation (3) on the cone behind the slide-in support (1) for the oxidation catalytic converter
  - The insulation on the slide-in support (4) should remain in place if possible.
- Create a hole (5)

Preparing the measuring lance

The opening that captures exhaust gas and diverts it into the measuring lance (the scoop) should be located in the middle of the exhaust pipe.



75845-001 Example illustration

- Determine the scoop position in the exhaust pipe
  - Measure the depth from the upper edge of the hole (a) to the bottom of the exhaust pipe (1).
  - Half that distance = scoop position in the middle of the exhaust stream (a/2).
- Find the measuring lance protrusion distance and prepare the measuring lance
  - Measure the distance to the upper surface of the insulation (b).
  - Mark the insertion depth (a/2 + b) on the measuring lance (3). Later, when the insulation is back in place, this mark will be a guide when lowering the measuring lance into the exhaust pipe.
  - Mark the total length (a/2 + b + c) on the measuring lance (4). The length c (100 mm) accounts for the required distance that the measuring lance must protrude above the insulation

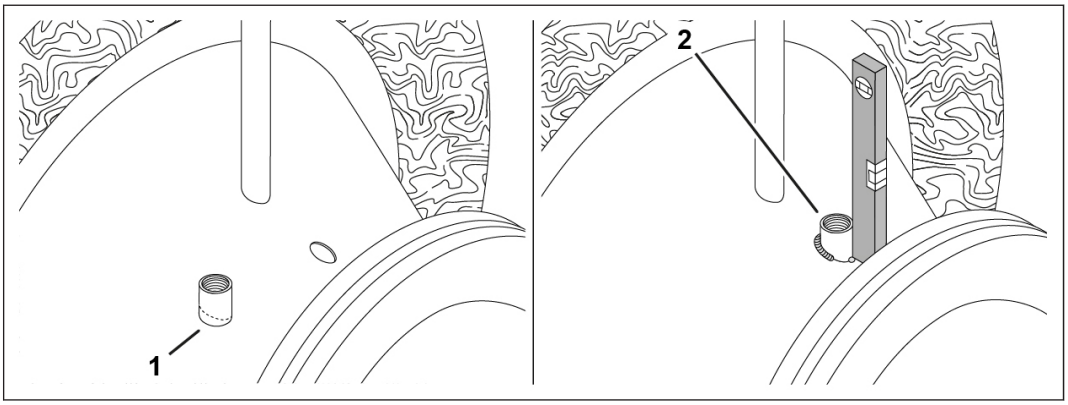
– Rotate the scoop so that its opening is parallel to the exhaust pipe and faces into the flow. This is the alignment angle.
– Above the insertion depth mark on the measuring lance (3), make a clear marking for the alignment angle.
– Truncate the measuring lance at the total length marking (4).

Welding the connection sleeve

Risk of destruction of components

With electric welding techniques, an incorrectly positioned ground cable can destroy electronic components

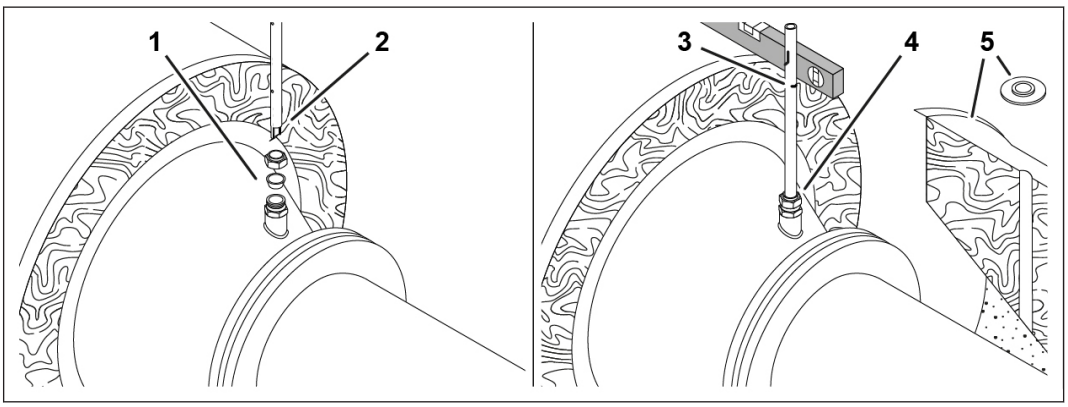
- Always affix the ground cable in the immediate vicinity of the welding electrode.



75846-001 Example illustration

- Modify the bottom of the weld-on sleeve (1) to suit the installation position (slope of the cone)
- Tack the weld-on sleeve in position, ensure alignment (2) and weld it into place
  – The weld-on sleeve must be at a right angle to the direction of the exhaust flow. Only in this position can the scoop perform optimally.
  – The illustration shows the procedure for a horizontal exhaust pipe

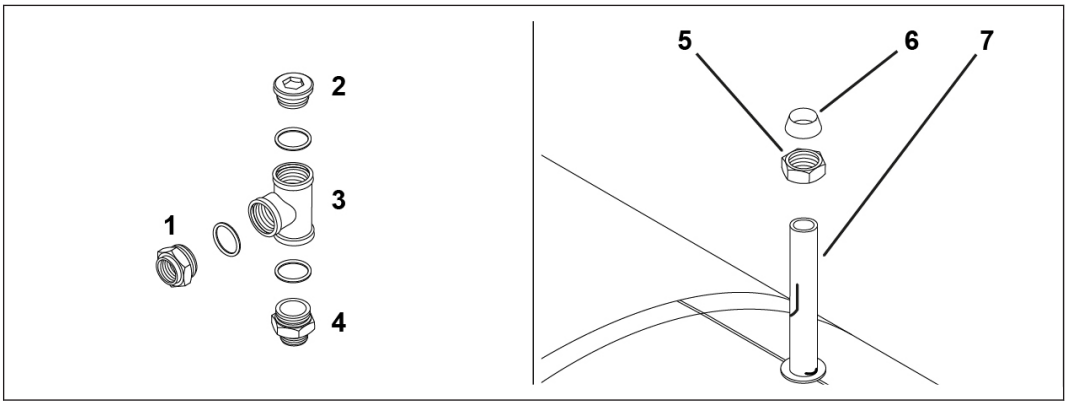
Inserting the measuring lance



75847-001 Example illustration

- Dismantle the screw-in fitting (1) and assemble the screw-in part
- Slide the compression ring and union nut onto the measuring lance
- Lower the measuring lance until the marking (3). Rotate the marking in the direction of the exhaust flow and fix in place (4)
- Put the insulation back in place and affix a suitable cover (5) around the measuring lance
  - The measuring lance should protrude approx. 100 mm out of the insulation.

Preparing the T piece



75848-001 Example illustration

- Assemble the adapter (1) and plug (2) onto the T piece (3)
- Dismantle the screw-in fitting (4) and assemble the screw-in part on the T piece
- Slide the compression ring (6) and union nut (5) onto the measuring lance (7)

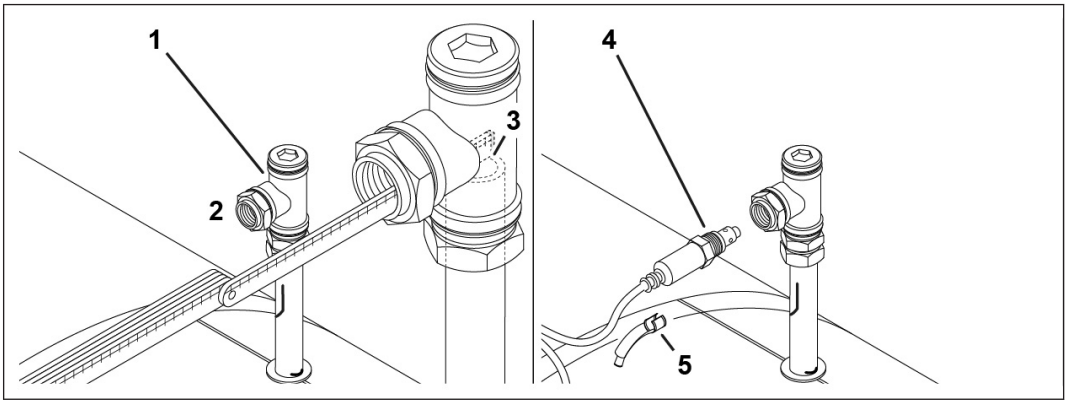
Make sure that the screw fitting is attached so that the measuring lance protrudes to just before (approx. 5 mm) the sensor tip.

Assembling the T piece an NO_x sensor

Risk of destruction of components

Incorrect assembly can destroy the NO_x sensor or cause malfunction

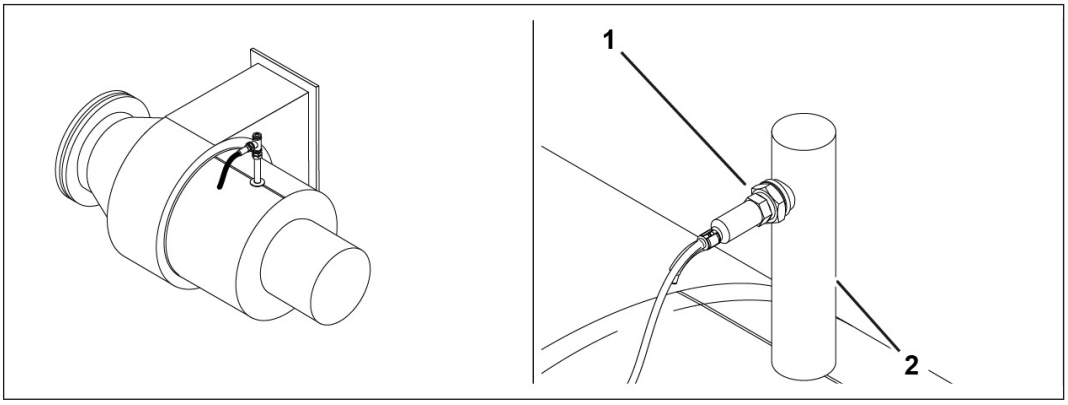
- The sensor tip is highly sensitive. It must not touch any parts of the T piece or the intersecting measuring lance during assembly.
- If the NO_x sensor falls down or is subjected to similar impacts, it must be assumed to be defective. The sensor must be replaced in this case
- Do not kink the sensor cable where it enters the sensor. If possible, attach the strain relief before assembly.



75849-001 Example illustration

- Slide the pre-assembled T piece (1) onto the measuring lance and loosely fix it in place
- Position the T piece, for example with a measuring stick, where the NO_x sensor (2) screws in
  - The end of the measuring lance (3) must not end below the stem of the T piece, and it must not protrude into this space, either.
- Clamp the T piece in place
- Assemble the strain relief (5) on the NO_x sensor
- Assemble NO_x sensor
  - Use the hexagon nut on the sensor to screw it in
  - Tightening torque: 50 Nm +/- 10 Nm
  - Do not use lubricant or similar substance

Insulating the T piece and the end of the measuring lance



76052-001 Example illustration

- Insulate T piece and measuring lance (2)
  - In order for the NO_x sensor not to overheat, do not insulate the stem of the T piece (1) with the NO_x sensor.

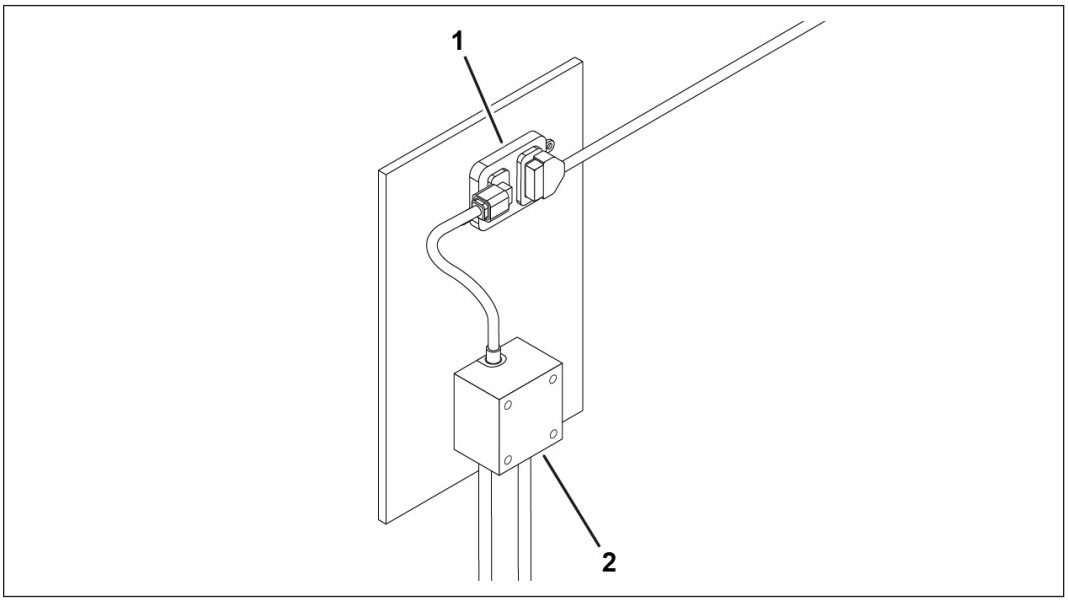
Terminal box and sensor control device

Notes on terminal box assembly

The terminal box is the interface between the NO_x measuring sensor system and other connected systems (EmiBox and/or TPEM system, depending on functionality). Observe the following during assembly:

- The terminal box must be installed at an appropriate distance from hot parts. The ambient temperature may not exceed 80 °C.
- The cables between the EmiBox and terminal connection box must comply with the cable specification (see Chapter `Cable specification`).
- The cable length between the EmiBox and terminal box must not exceed 40 m.
- The cables must be routed in corresponding cable guides so that there is no tensile load on the terminal box or EmiBox.
- Assembly must be performed in accordance with the IP degree of protection of the terminal box. Select assembly materials and assembly procedure accordingly.
- For positioning, make sure enough space is available for maintenance work.

The illustration below shows an example of terminal box assembly and sensor control device assembly inside a building:



75941-001 Example illustration

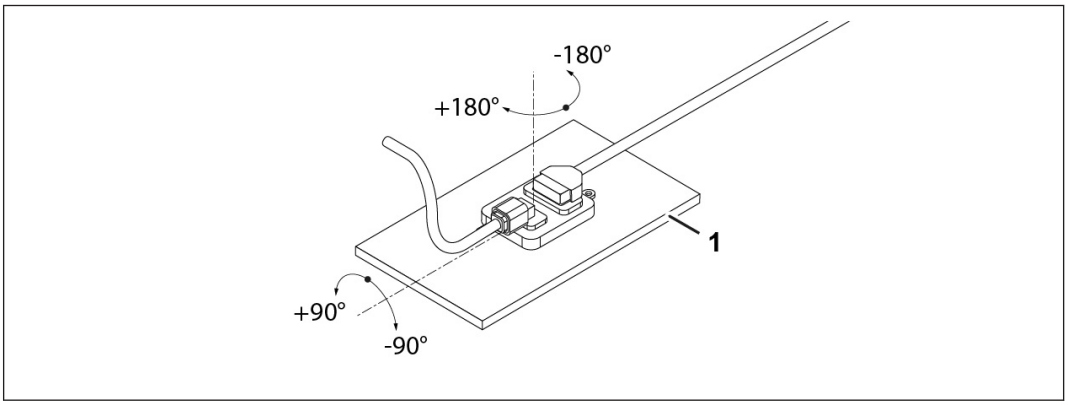
1 Sensor control device

2 Terminal box

Notes on sensor control device assembly

The sensor control device processes the measurement signals from the NO_x sensor. Observe the following during assembly:

- The connection cables of the NO_x sensor and the terminal box must not be kinked, nor should they exceed an angle of 15°.
- The connection cable between the NO_x sensor and the sensor control device should be fixed in place every 15 cm wherever possible. If this is not possible, the connection cable must be routed so that it cannot hang freely or abrade on adjacent components.
- Use the strain relief on the cable output of the NO_x sensor. Strain relief is only not necessary if the cable exits straight out of the NO_x sensor and can be appropriately fixed in place.
- The connection cable between the NO_x sensor and the sensor control device must have a bending radius of no less than 20 mm.
- The orientation of the sensor control device must fall within the following limits:



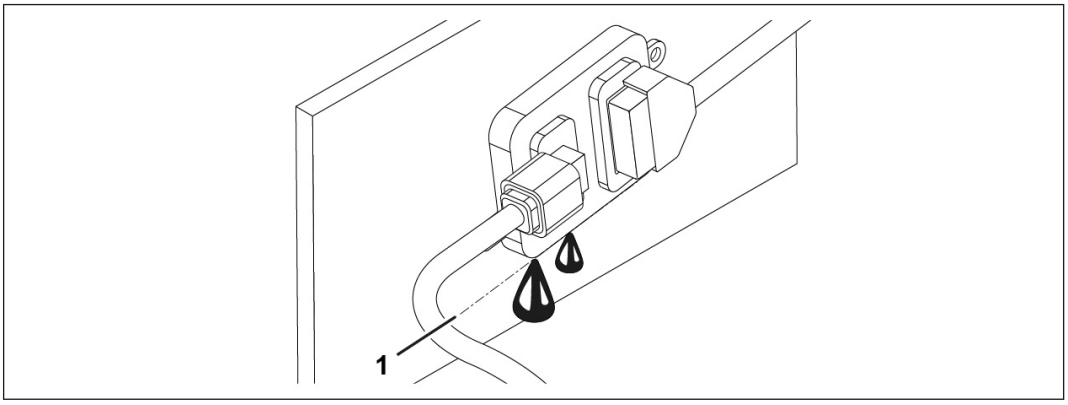
75944-001 Example illustration

1 Horizontal plane as the reference plane for permissible installation angles

Outdoor sensor control device

When assembled outdoors, the sensor control device should match the illustration:

- Sensor control device placed on a vertical plane and with connections positioned horizontally
- Angle the sensor control device slightly so that
  - a runoff angle for rainwater is produced;
  - rainwater can flow over the electrical plug-in connections instead of seeping into them.



75945-001 Example illustration: Sensor control device assembly outdoors

1 Sensor control device tilt

6.5.2 Catalytic converter temperature sensor

Risk of destruction of components

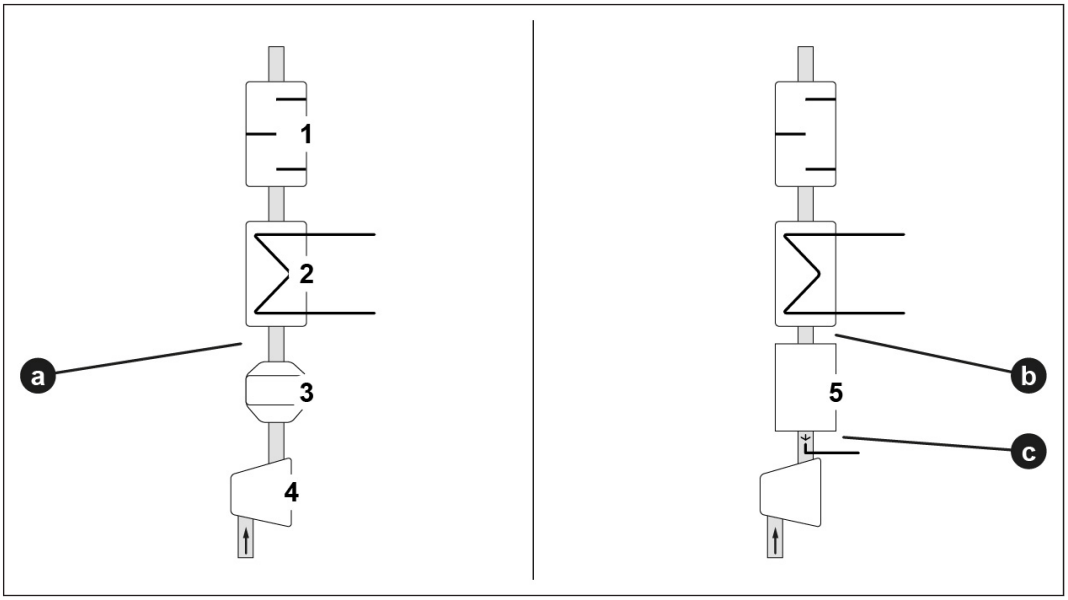
Excessive exhaust temperatures can damage the catalytic converter and the NO_x sensor

- In exhaust systems with an oxidation catalytic converter and/or SCR catalytic converter, temperature monitoring must be in place (or must be retrofitted) to protect the catalytic converter.

As specified by CES, the following applies for temperature monitoring on plants with a catalytic converter:

- SCR catalytic converter: temperature measurement upstream and downstream of the catalytic converter
- Oxidation catalytic converter: temperature measurement downstream of the catalytic converter

In plants without a catalytic converter, retrofitting a temperature sensor is not strictly necessary, but it is recommended for system analysis purposes.



75967-001 Example illustration

a Installation area for a sensor downstream of oxidation catalytic converter

b Installation area for a sensor downstream of SCR catalytic converter

c Installation area for a sensor upstream of SCR catalytic converter

1 Exhaust muffler

2 Exhaust heat exchanger

3 Oxidation catalytic converter

4 Charging group with exhaust turbocharger

5 SCR catalytic converter

For additional information on the necessity and positioning of a temperature sensor, see

- Operating Manual ⇒ General ⇒ Application and Installation Guide
  - Power plants layout

Implementation with the EmiBox

The existing control system can monitor the exhaust temperature. The EmiBox already includes this feature and additionally stores the events in the logbook.

Notes on implementation:

- Input the exhaust temperature measurement as a 4...20 mA signal to the EmiBox
  - If the signal has already been integrated into the existing control system, the EmiBox should be configured so that the signal passes through the EmiBox for use elsewhere.
- Separate isolation amplifiers are recommended to protect the EmiBox or to maintain availability of the plant
  - With TEM systems, a failure of the temperature sensor will cause a genset shutdown. If the EmiBox is connected without an isolation amplifier between the temperature sensor and the IO controller, a failure of the EmiBox will also result in the genset being shut down.

Installing the temperature sensor

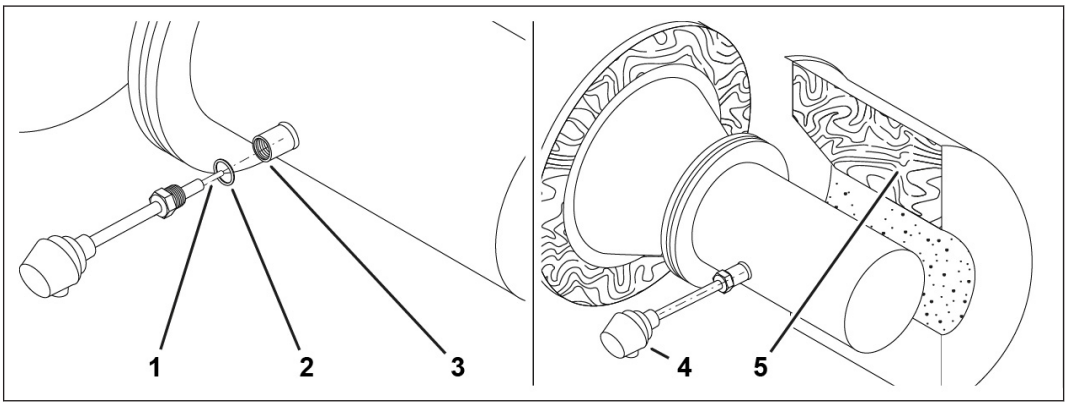
Notes

The description below explains using the example of a retrofit installation on an existing oxidation catalytic converter. The description has been kept general can can also apply to exhaust applications without a catalytic converter.

It must be ensured through corresponding measures that no residues in the pipe system (dirt, welding beads, etc.) can damage other components and lead to leakages. The pipes must be connected so that no forces and vibrations can be transmitted.

Select temperature sensor

The length of the temperature sensor depends on the installation scenario.



76031-001 Example view

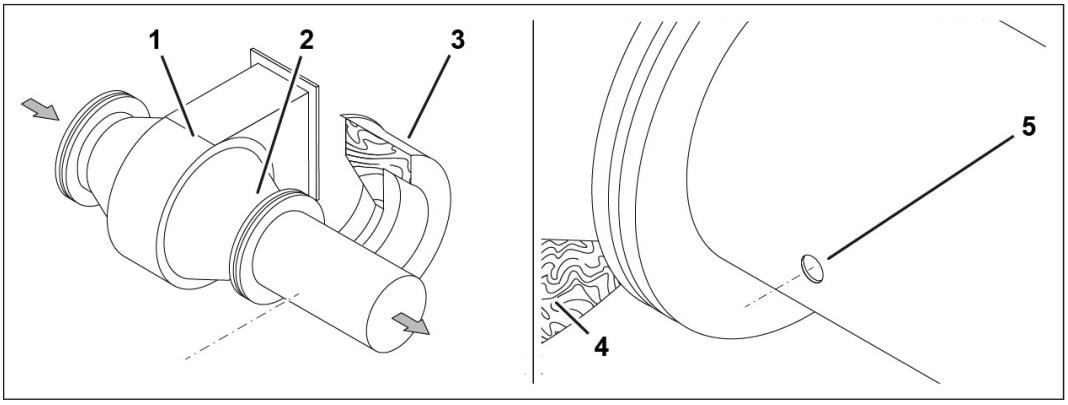
Consider the following in making a selection:

- To achieve short response times, use a temperature sensor without a shield
- Suitable for the temperature range and for installation in a weld-on sleeve (3)
- When installed, the probe tip (1) must protrude into the exhaust stream
- The connection head (4) must stick out a sufficient distance after the insulation (5) is affixed

Define the assembly position and create a hole for the measuring lance

The preferred installation position (2) is downstream of the oxidation catalytic converter (1).

If possible, the sensor should be installed in a pipe section which is decoupled from the vibrations of the gas engine; potentially after the expansion joints.



76025-001 Example illustration for installation downstream of a cone-shaped oxidation catalytic converter

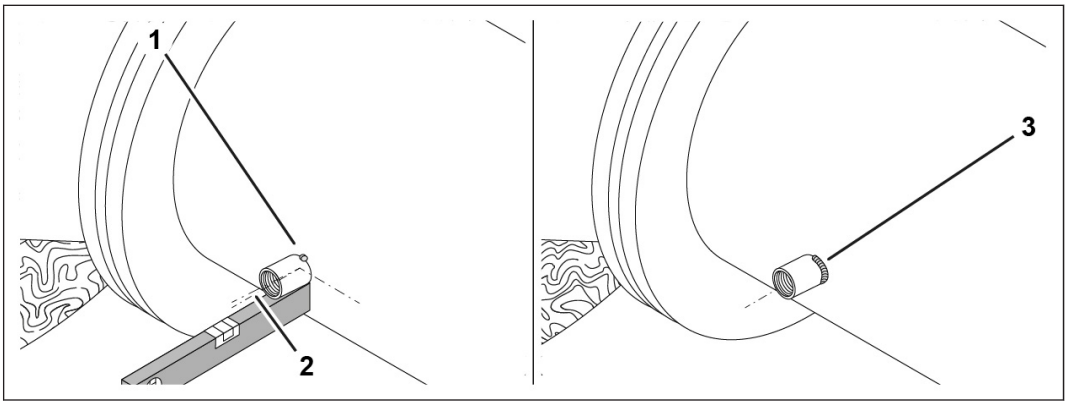
- Remove the insulation (3) after the oxidation catalytic converter (1)
  - The insulation on the oxidation catalytic converter (4) should remain in place if possible.
- Create a hole (5)

Welding the connection sleeve

Risk of destruction of components

With electric welding techniques, an incorrectly positioned ground cable can destroy electronic components

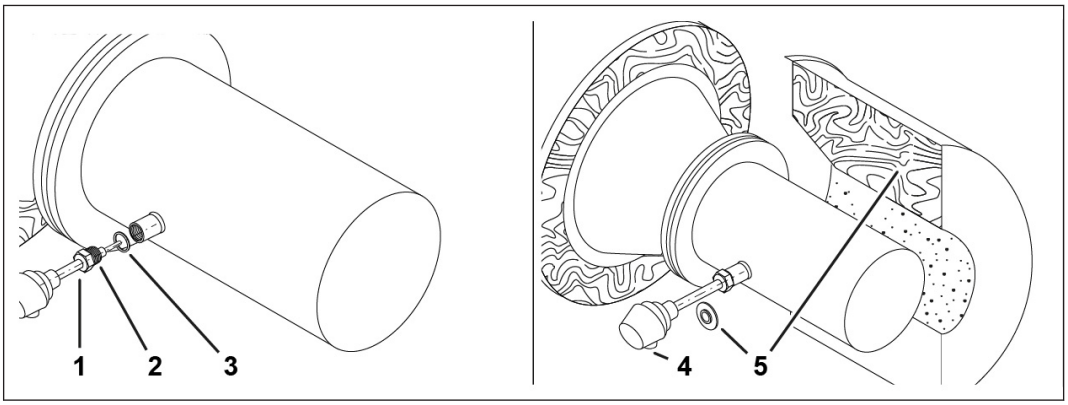
- Always affix the ground cable in the immediate vicinity of the welding electrode.



76026-001 Example illustration

- Prepare weld-on sleeve
  - Depending on the temperature, the screw-in thread might lie on the boundary of the cone. If this is the case, chamfer the weld-on sleeve so that the sleeve does not make contact with the cone when the part is screwed in.
- Tack the weld-on sleeve in position (1), ensure alignment (2) and weld it into place (3)
  - The weld-on sleeve should be at a right angle to the direction of the exhaust flow.
  - The illustration shows the procedure for a horizontal exhaust pipe. In this case, the weld-on sleeve must have a slight gap so that condensate does not collect in the thread.

Installing the temperature sensor



76028-001 Example illustration

- Wet the screw-in thread (2) with heat-resistant assembly paste
- Installing the temperature sensor
  - Install the temperature sensor so that the connection head (4) points downward, if possible.
  - Use the hexagon nut (1) on the thread to turn the part.
  - Tightening torque: see sensor data sheet.
- Put the insulation back in place and affix a suitable cover (5) around the opening for the sensor
- Establish electrical connection to the connection head (4)

6.5.3 Generator circuit breaker (GLS/GCB)

To operate, the EmiBox requires a digital signal with the status of the generator circuit breaker. The signal should be polled with the appropriate free pins on the coupling relay of the generator circuit breaker, then sent to the EmiBox. If there are no free pins available on the coupling relay, it is possible to split the signal and install a second relay.

In that case, during parameter assignment of the digital inputs at the time of commissioning, the digital signals can be assigned to suit the selected installation.

6.5.4 Monitoring and SCR Control via EmiBox (TEM/TPEM system)

Cable specification

CAN – Cable			
Function		Cable cross section	
		Exhaust waste-gate (AWG)	mm^2
	CAN HS +	19	0.75
	CAN LS −	19	0.75
	CAN shield		SH
Cable designation in circuit diagram			
	=A1+ EmiBox – W18.31		
Requirements			
	• CAN – Cable • Twisted pair • Resistant to sunlight (UV resistance, optional) • Oil resistant • Flame retardant		
Technical data			
	• Shielded • Mutual capacitance: approx. 40 nF/km • Operating peak voltage: 250 V • Test voltage: Wire/Wire: 1500 V eff. • Loop resistance: max. 55 Ohm/km • Characteristic impedance: 120 Ohm • Temperature range: −40 °C to +80 °C		

Cable – KAT temperature sensor			
Function		Cable cross section	
		Exhaust waste-gate (AWG)	mm^2
	+ (WH)	19	0.75
	− (BN)	19	0.75
	Shield		SH
Cable designation in circuit diagram			
	=A1+ HAS – W …		

Cable – KAT temperature sensor	
Requirements	
	• Oil resistant • Resistant to sunlight (UV resistance, optional) • Flame retardant • Twisted pair
Technical data	
	• Shielded • Operating peak voltage: 500 V (not for heavy current) • Temperature range: −40 °C to +80 °C

Power supply cable between EmiBox and sensor connection box			
Function		Cable cross section	
		Exhaust waste-gate (AWG)	mm^2
	Power supply +24 V	13	2.5
	Power supply GND 24 VDC	13	2.5
	Protective earth conductor PE	13	2.5
Cable designation in circuit diagram			
	=A1+ EmiBox – W18.1		
Requirements			
	• Oil resistant • Resistant to sunlight (UV resistance, optional) • Flame retardant • Flexible • Fine wire		
Technical data			
	• Nominal voltage: 24 V • VDE U0 /U: 300/500 V • Protective earth conductor: GN/GE • Temperature range: −40 °C to +80 °C		

Cable message GLS closed (GCB closed)			
Function		Cable cross section	
		Exhaust waste-gate (AWG)	mm^2
	Message "GLS closed (GCB closed)"	18	1.0

Cable message GLS closed (GCB closed)			
	Message "GLS open (GCB open)"	18	1.0
Cable designation in circuit diagram			
	=A1+ EmiBox – W6.4		
Requirements			
	• Oil resistant • Resistant to sunlight (UV resistance, optional) • Flame retardant • Flexible • Fine wire		
Technical data			
	• Nominal voltage: 24 V • VDE U0 /U: 300/500 V • Temperature range: −40 °C to +80 °C		

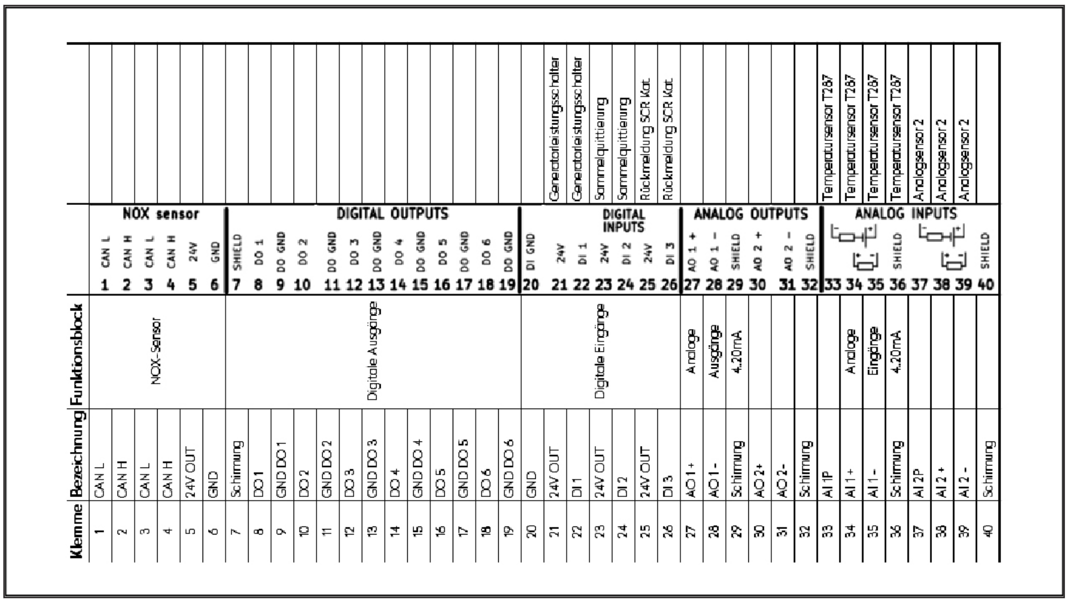
Electrical connection

The electrical connections of the EmiBox and the terminal box must be made according to the plant-specific circuit diagram.

For further information on the circuit diagram, see

- Operating Manual ⇒ General ⇒ Wiring diagrams
- Operating Manual ⇒ Supplier documentation CD ⇒ Circuit diagram

The lower section of the EmiBox can be opened with a screwdriver. The connection cables are fed through the cable bushings on the lower part of the EmiBox and connected to the connection terminals.



72088-001

1. Connect NOx sensor

- Establish bus connection via pins 1&2 or 3&4
- Establish power supply via pins 5&6

2. Connect CAT temperature sensor

- Enabled connection / sensor is supplied with voltage via EmiBox
  - Establish connection via pins 33&35
  - Connect shielding to pin 36
- Passive connection / sensor is supplied with voltage via an external source
  - Establish connection via pins 34&35
  - Connect shielding to pin 36

3. Connect generator circuit breaker signal

- Establish connection via pins 21&22

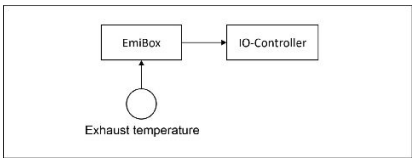
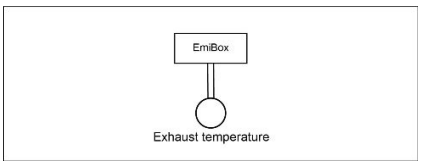
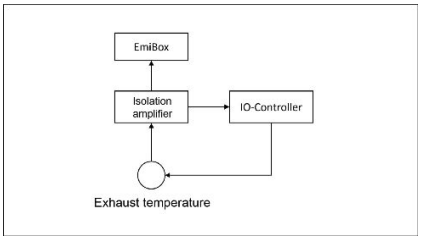
4. Connect SCR CAT signal

- SCR CAT present
  - Establish connection via pins 25&26
- SCR CAT not present
  - Do not connect anything
  - However, digital input 3 must be inverted.

In the standard case, the terminating resistor must be switched on. If a second CAN line is connected and there is a terminating resistor elsewhere, the terminating resistor can be switched off on the EmiBox.

371-001-EN : 51000010 : BA : VAR, COV, IMP, B, BA, BS, DEM, EIN, IBN, IST, WP, SK, MH, SB, STB, TA, TL

72089-001

Description	Sketch	Circuit diagram
The temperature sensor is connected to an analog input of the EmiBox. This signal is then routed back to the control system from an analog output.		Page 6 a
A temperature sensor must be retrofitted, but the signal does not have to be routed to the control system.		Page 6 b
The temperature signal is routed via a 1-channel isolation amplifier to decouple the EmiBox.		Page 6 c

The circuit diagram of the EmiBox includes three variants of how a temperature sensor can be connected. However, the actual number of possible connection variants is greater. The corresponding page can be filled in on the basis of the circuit diagram and then added to the circuit diagram of the cabinet in which the conversion was carried out. Project-specific adjustments to, for example, the terminal or relay designations are necessary.

6.5.5 Monitoring via TPEM Connection Box (TPEM system only)

Cable specification

Power supply cable 24 VDC to terminal box			
Function		Cable cross section	
		Exhaust waste-gate (AWG)	mm^2
	Voltage supply +24 V	13	2.5
	Voltage supply GND 24 VDC	13	2.5
	Protective conductor PE	13	2.5
Cable designation in circuit diagram			
	=A1+TPEM CU – W18.1		
Requirements			
	• Resistant to sunlight (UV resistance, optional) • Oil resistant • Flame retardant • Flexible • Fine wire		
Technical data			
	• Rated voltage: 24 V • VDE U0 /U: 300/500 V • Protective conductor: GN/GE • Temperature range: -40 °C to +80 °C		

CAN cable			
Function		Cable cross section	
		Exhaust waste-gate (AWG)	mm^2
	CAN HS +	19	0.75
	CAN LS -	19	0.75
	CAN shield	-	SH
Cable designation in circuit diagram			
	=A1+TPEM CU – W18.31		
Requirements			

CAN cable	
	• CAN cable • Twisted pair • Resistant to sunlight (UV resistance, optional) • Oil resistant • Flame retardant
Technical data	
	• Shielded • Mutual capacitance: approx. 40 nF/km • Peak operating voltage: 250 V • Core/core test voltage: 1500 V eff. • Conductor resistance: (Loop): max. 55 Ohm/km • Characteristic impedance: 120 Ohm • Temperature range: -40 °C to +80 °C

Converting the TPEM Connection Box

The connection terminals with part number 12523807 (Phoenix PTU 4-TWIN) or 1252 3809 (Phoenix PTU 4-TWIN-PE) are required in the connection box for the power supply to the NOx sensor. These are possibly already installed in the TPEM Connection Box (see figure after conversion). If this is not the case (see figure before conversion), terminals E-XT1 to E-XT6 must be replaced with the terminals from completion 1240 6643 of TPEM CU conversion.

- Disconnect power supply from TPEM engine control (CU) with corresponding fuses in the TPEM CC cabinet
- Secure against restarting
- Check that equipment is de-energized
- Note existing connections at terminals E-XT1 – E-XT6 and disconnect
- Remove jumper from terminals E-XT4 – E-XT6
- Remove terminals E-XT1 – E-XT6 together with end cover and replace by terminals with part number 1252 3807 including end cover 1252 3808
- Add terminal E-XT0 with part number 1252 3809 for the protective earth conductor connection between TPEM CC and TPEM Connection Box
- Insert new jumper (part number 1252 3806) for terminals E-XT4 – E-XT6
- Supplement fuse 1252 3854 (C10A) on the top-hat rail. It may be necessary to slide the remaining terminals on the top-hat rail
- Reconnect the disconnected connections in corresponding assignment
- Also add a connection 2.5 mm² from the fuse to E-XT1

1 Terminals E-XT1 – E-XT6

1 Fuse 12523854

2 E-XT0 (PE) 1252 3809E-XT1 - 6 power supply 1252 3807

Connecting the NO_x sensor and linking it with the TPEM system

The voltage supply is provided by the TPEM Connection Box (cables as per cable specification).

Function	Connection point
24V DC +	F1 (C 10A)
24 VDC -	E-XT4 B
Protective conductor	E-XT0 B

CAN bus connection

The CAN bus connection is connected directly to the engine wiring harness instead of the end resistor. For this, the matching mating plug with part number 1232 4076 must be attached to the CAN cable (as per cable specification) between the engine and NOx sensor.

- Remove cable sheath
- Remove shield (mounted on sensor side)
- Provide transition from cable to individual conductors with heat-shrink tubing
- Strip wires
- Attach crimp contacts (part number 1232 4312), use crimp pliers (part number 1221 8233)
- Plug the contacts into the plug housing:
  - A: CAN HS
  - B: CAN LS
  - C: Close with blind plug 1232 4085, shield mounted on sensor side
- Remove CAN end resistor from wiring harness. This is located close to the TPEM Connection Box, see graphic.

The plug designation in the circuit diagram for the depending on the number of cylinders is as follows:

Number of cylinders	Part no. wiring harness current	Plug designation
16	1232 4678_00	X210
12	1232 4680_00	X210
8	1232 4682_00	X210

Number of cylinders	Part no. wiring harness old 1	Plug designation
16	1232 4486_02 - 1232 4486_00	X17
12	1232 4492_02 - 1232 4492_00	X17
8	1232 4498_01 - 1232 4498_00	X17

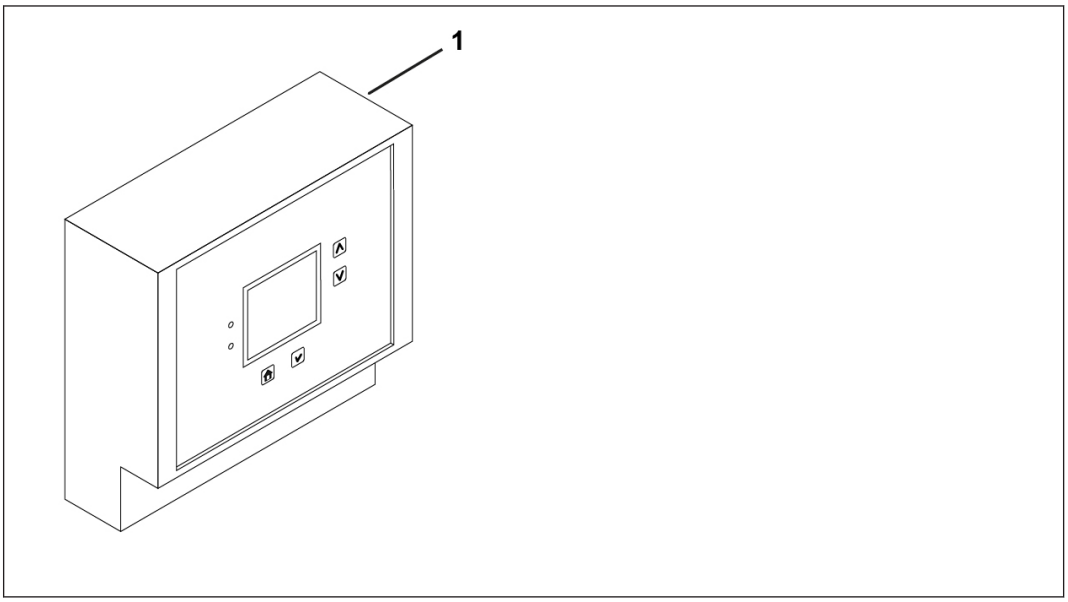
Number of cylinders	Part no. wiring harness old 2	Plug designation
16	1232 4208_01	E-C37
12	1232 4202_00	E-C37
8	1232 4194_00	E-C37

The plug designation in the circuit diagram for the for all cylinder variants is: X217.

- Connect the connecting cable with plug instead of the CAN end resistor to the engine wiring harness
- Connect cables for the voltage supply and CAN bus connection to the terminal box

6.6 EmiBox

6.6.1 EmiBox scope of delivery



75840-001 Example illustration

1 EmiBox

6.6.2 EmiBox

Notes on assembly

The following minimum requirements apply for the assembly:

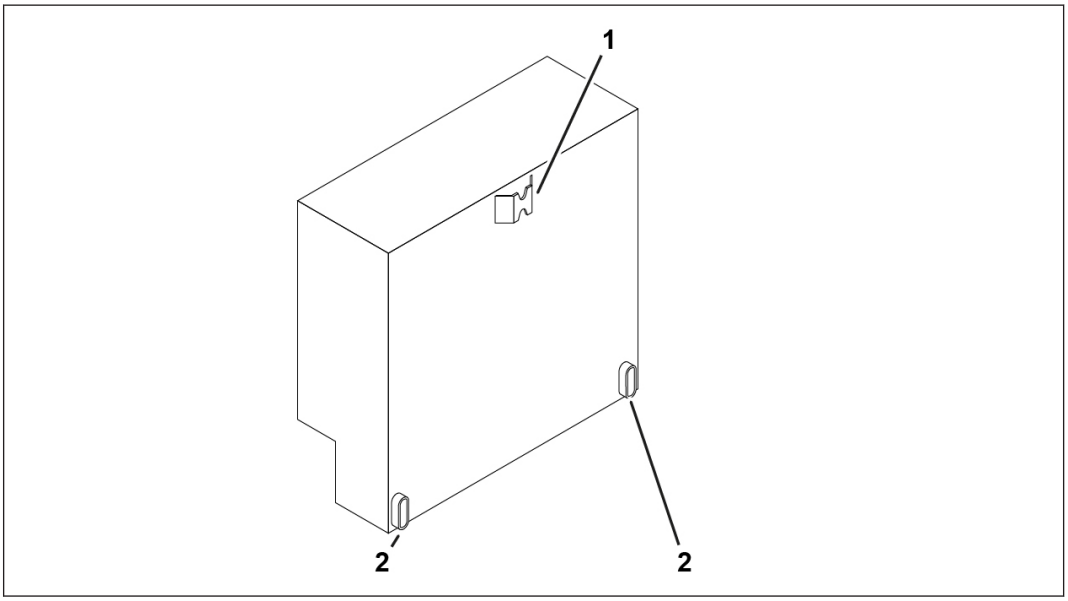
- Installation site is not on the genset and is outside the danger zone of the genset
- Installation site is not within the action radius of other moving parts
- Safety distances according to the regional assembly and accident prevention regulations are possible
- The EmiBox is easily accessible for all tasks (wiring, commissioning, operation, troubleshooting, servicing and maintenance)
- Installation site is protected from dirt, splash water and vibration
- Installation site is at a sufficient distance from heat sources
- Observe tightening torques
- Before drilling the assembly holes, check for existing cables and supply lines as well as other sources of danger such as moving components
- The fasteners of the EmiBox do not correspond to the usual dimensions of a perforated plate. For assembly, it is recommended to use an additional installation plate with appropriate holes when assembling on perforated plates
- The EmiBox should be installed at eye level (approx. 1.65 m) to allow good visibility of the indicators on the display

Installing the EmiBox

Risk of destruction of components

Due to incorrect fastening method

- Check whether the wall and the fastening materials are suitable for the chosen fastening method.



75853-001 EmiBox fastening

- Position the EmiBox at the installation location and align it
- Mark fastener locations and prepare the appropriate fasteners
- Screw the EmiBox into place at its upper attachment point (1) with suitable fasteners and align it
- Screw the EmiBox into place at the lower attachment points (2) using suitable fasteners

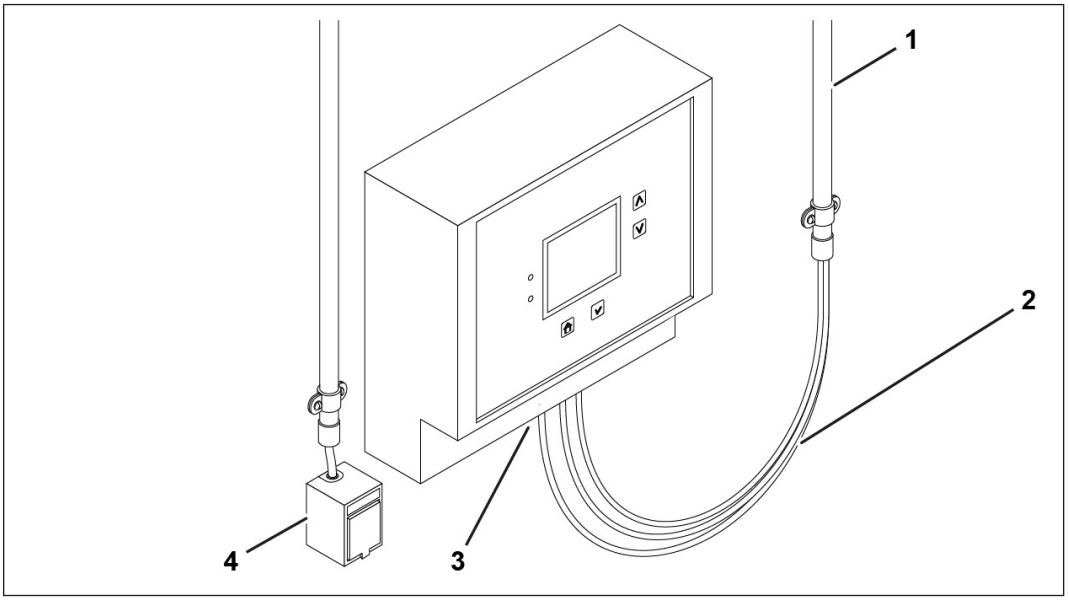
6.6.3 Cable routing and connection, battery buffer

Overview

The EmiBox is connected to an external power source with a plug-in connector. The underside has a connection socket and prepared holes for cables to connect lines for communication, signal exchange and for supplying control voltage.

Connection cables must be routed in suitable installation conduits or in installation ducts. Exposed connection cables leading to and from the EmiBox should be routed so that there is no tension on the cables at the connectors and/or where they enter the EmiBox.

The battery buffer of the EmiBox features a contact interrupter (a plastic tab) when it ships from the factory. This prevents discharge during storage.



75926-001 Example illustration: Connections and cable inlet on the EmiBox

1 Installation conduit

2 Cables routed to prevent tension

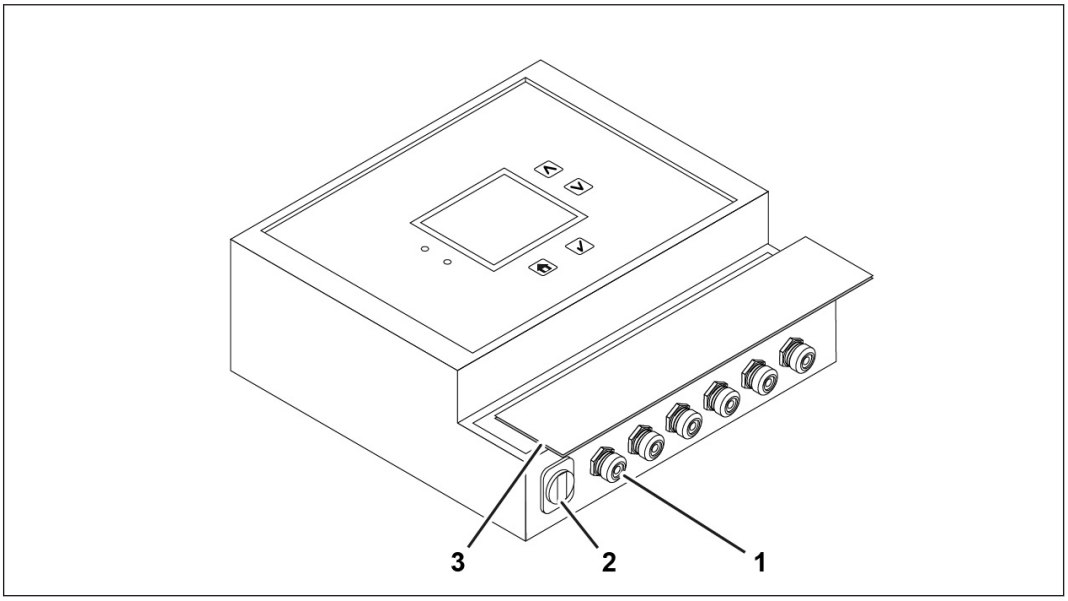
3 Area with connection socket and cable inlets

4 External socket with ground contacts for EmiBox voltage supply

General procedure

The connections for communications, signal exchange and control voltage are behind a cover (3).

The connection socket (2) only has a permanent connection with the SCR Control Kit (see accompanying description). Otherwise, it is used to manually connect a computer where needed.



75927-001 Sample illustration: Installation area

1 Cable inlet

2 Connection socket

3 Cover

- Remove cover (3)
- Remove plastic tab from the contact zone of the buffer battery
- Open cable glands (1)
- Route cables into the EmiBox and connect them as necessary for the application
- Assemble cover
- Follow proper procedure to seal cable glands (1)

6.6.4 EmiBox voltage supply

The EmiBox voltage supply is provided via a suitable socket (not included in the scope of delivery). The following minimum requirements apply:

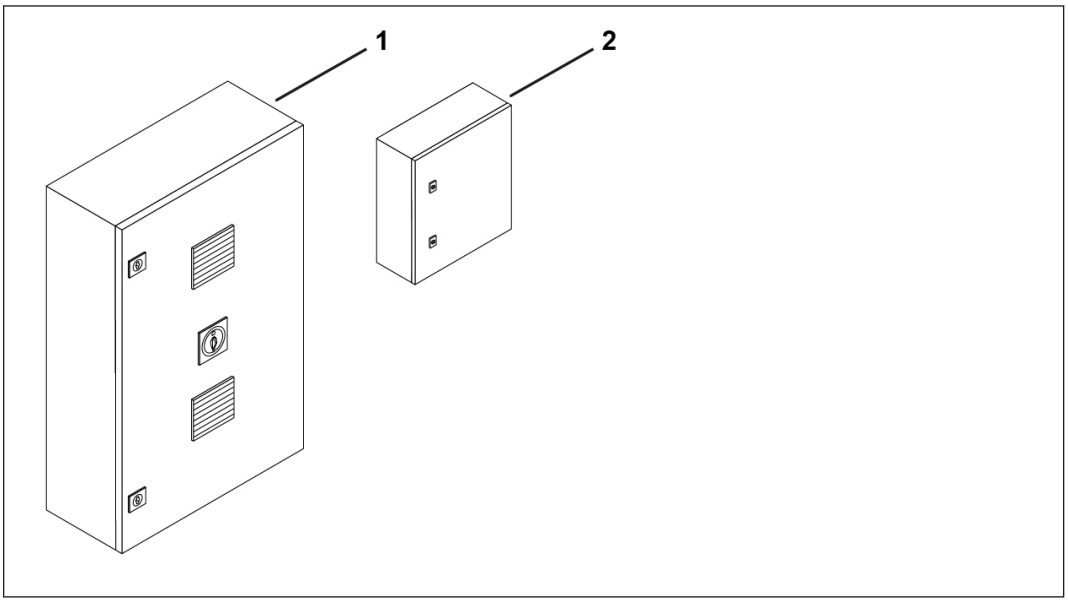
- Suitable for industrial use
- Properties comply with the EmiBox technical data
- Design with protective grounding contacts
- Space for labeling
- Suitable for permanent attachment to the intended installation surface
- Socket secured against overcurrent with a 10 A fuse

Assembly and connection are performed by the customer or the operator. The following installation specifications apply:

- Install socket at a distance of at most 1.5 m from the EmiBox
- Socket must be switched off in the event of a gas alarm and must also be labeled as such
- To prevent the plug from being inadvertently unplugged, put a notice on or around the plug to the effect of "Do not unplug".

6.7 SCR Control Kit

6.7.1 SCR Control Kit scope of delivery



75636-001 Example illustration

1 SCR Control switchgear cabinet

2 Optional connection box for retrofits to connect with the auxiliary cabinet (HAS)

6.7.2 SCR Control switchgear cabinet

Notes on assembly

The following minimum requirements apply for the assembly:

- Installation site is not on the genset and is outside the danger zone of the genset
- Installation site is not within the action radius of other moving parts
- Safety distances according to the regional assembly and accident prevention regulations are possible
- The SCR Control switchgear cabinet is easily accessible for all tasks (wiring, commissioning, operation, troubleshooting, servicing and maintenance)
- Installation site is protected from dirt, splash water and vibration
- Installation site is at a sufficient distance from heat sources
- Observe tightening torques
- Before drilling the assembly holes, check for existing cables and supply lines as well as other sources of danger such as moving components

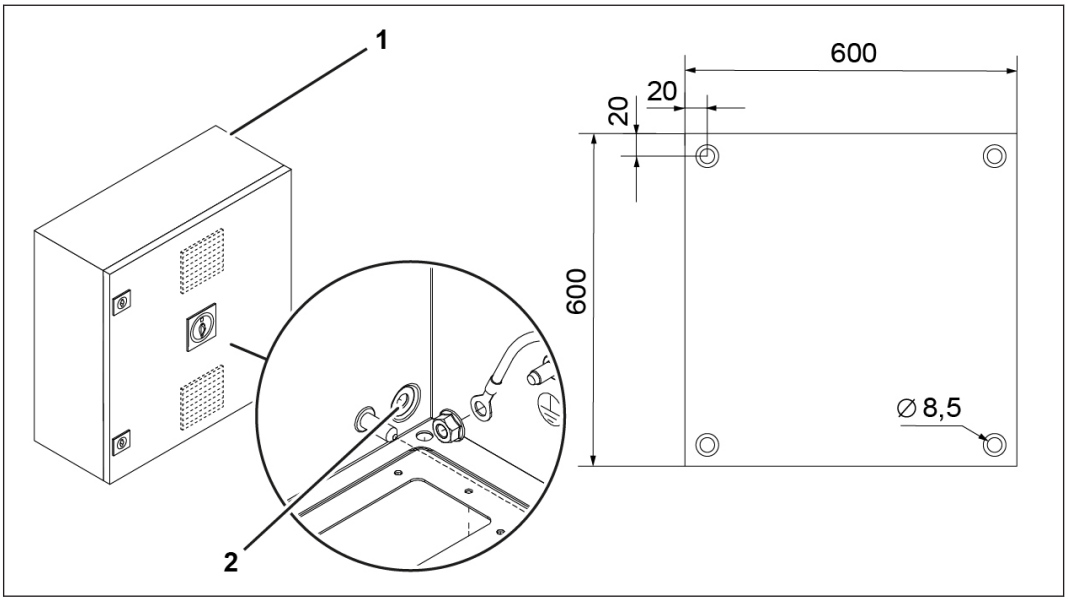
Installing the SCR Control switchgear cabinet

Risk of destruction of components

Due to incorrect fastening method

- Check whether the wall and the fastening materials are suitable for the chosen fastening method.

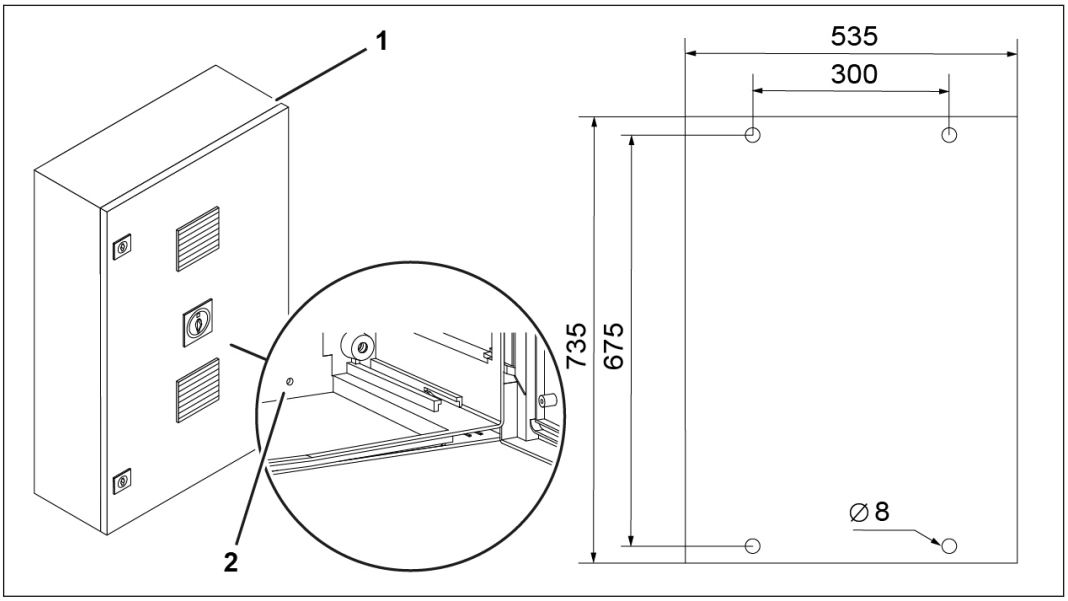
Switchgear cabinet type a and type b



75860-001 Example illustration

- Position the SCR Control switchgear cabinet (1) at the installation site and align it with the attachment points
- Screw the SCR Control switchgear cabinet into place with suitable fasteners in the holes (2)

Switchgear cabinet type c



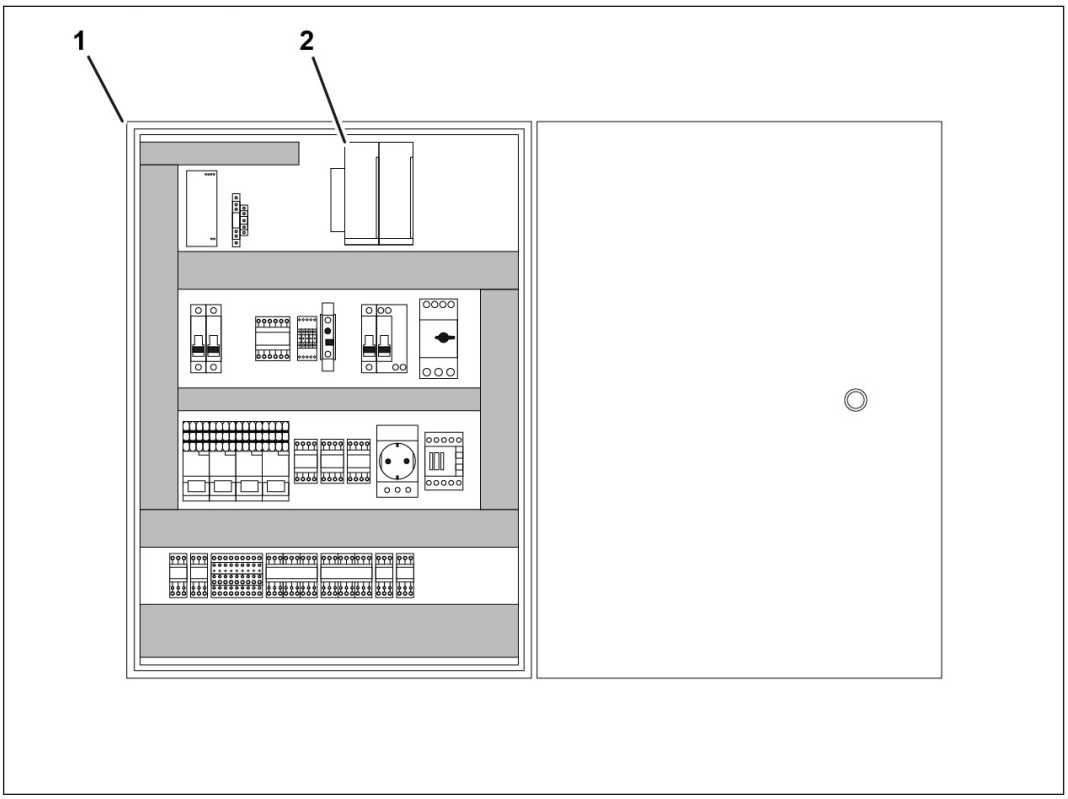
75854-001 Example illustration

- Position the SCR Control switchgear cabinet (1) at the installation site and align it with the attachment points
- Screw the SCR Control switchgear cabinet into place with suitable fasteners in the holes (2)
  - Tightening torque 8 Nm to 10 Nm (housing made of glass-reinforced polyester).

6.7.3 Cable routing and connection

Overview of connections

The cable inlet depends on the local conditions. On the switchgear cabinet, cable inlets are only possible from below.



75855-001 Example illustration: Connections and cable inlet in the switchgear cabinet

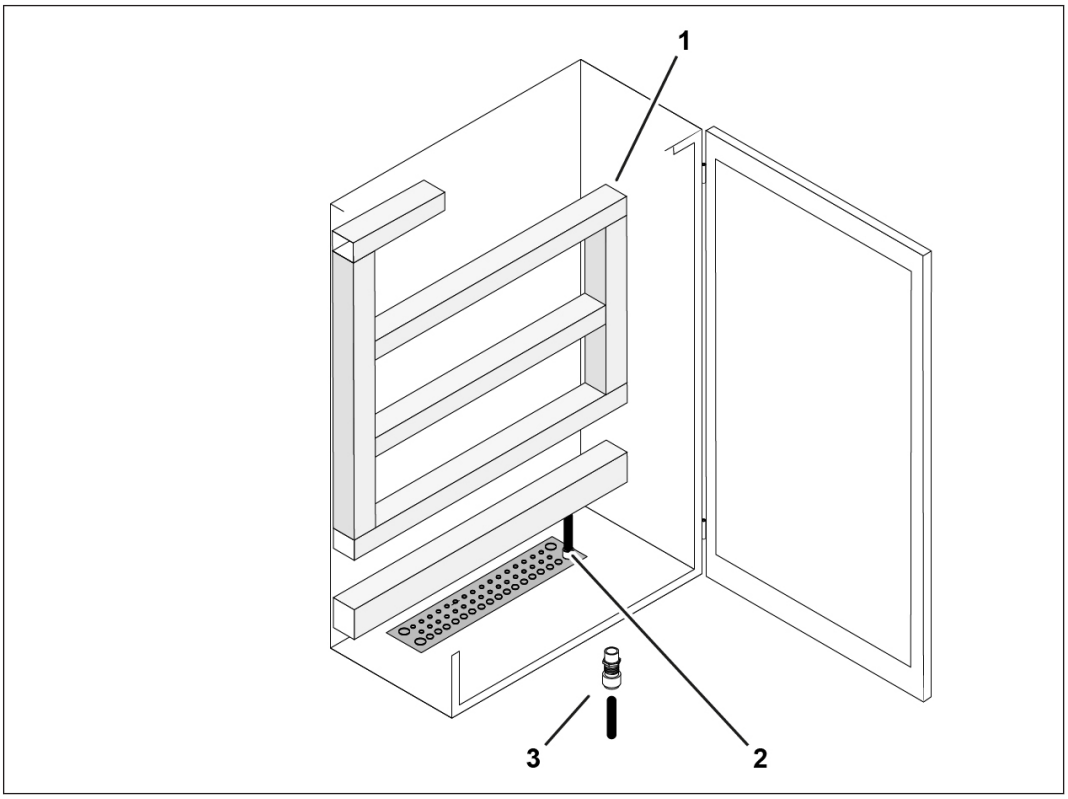
1 SCR Control switchgear cabinet

2 I/O module

Routing cables into the switchgear cabinet

The cable routing and the installation location must be selected on site according to the possible cable inlet and according to which rails are populated with operating elements.

The project-specific circuit diagram has precedence for the connection.



75856-001 Example illustration: Cable ducts and cable inlet

1 Cable ducts (example)

2 Bottom cable inlet

3 Cable gland

- Prepare cable inlet (2) with cable glands
- Route cables from the SCR application control into the switchgear cabinet according to the circuit diagram and connect them
- Route cables from the genset control and/or plant control into the switchgear cabinet according to the circuit diagram and connect them
- Route Modbus TCP cables from the EmiBox and into the switchgear cabinet according to the circuit diagram and connect them to the I/O module
- Route power supply cables into the switchgear cabinet according to the circuit diagram and connect them
- Seal the insertion point properly

Electrical tests

Before commissioning, the electrical installation must be checked for safety and function by an authorized qualified specialist in accordance with the regional regulations by testing and measuring. The results must be documented in a test report.

The scope of testing includes the following general points and is to be determined according to the local conditions and the specific installation.

- Cable routing (cable correctly secured, short-circuit-proof routing, insulation, etc.)
- Installed equipment (fastening, insulation, no damage)
- Continuity of equipotential bonding
- Check continuity of cables
- Insulation resistance
- Voltage supply of the switchgear cabinet and equipment
- Perform electrical safety tests without and with power supply
- Only approve the installation for commissioning after successful testing
- If commissioning will take place at a later time, bring the switchgear cabinet into a safe state, re-establish the power supply and enable the plant for operation

6.8 Remote access as an option

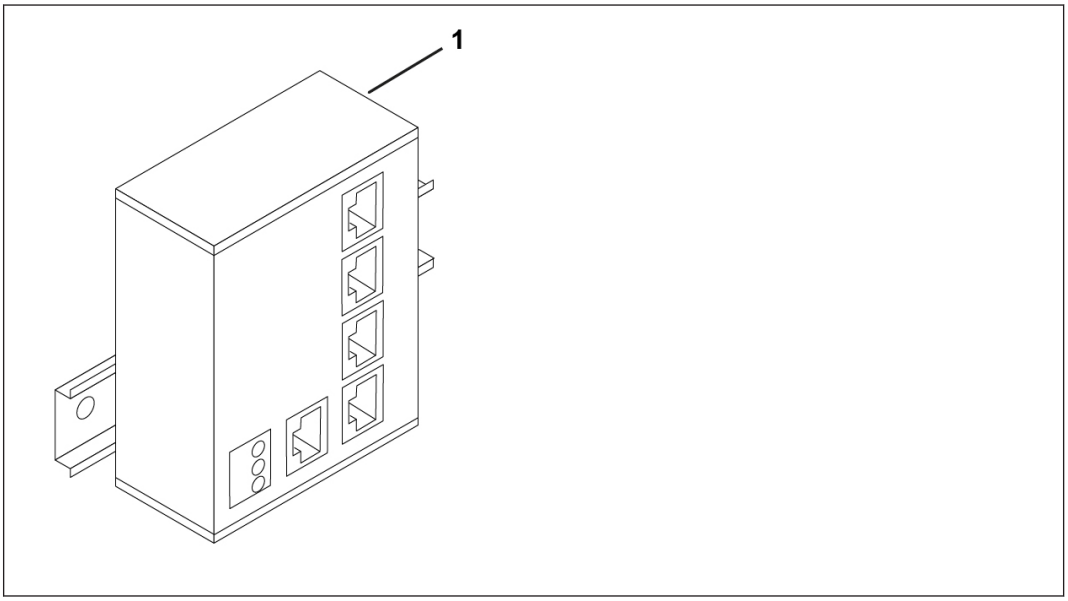
6.8.1 Remote Access scope of delivery

Remote Access for EmiBox

No additional components are required for assembly.

Remote Access for EmiBox with SCR Control Kit

A switch has been provided for integrating the SCR Control switchgear cabinet.



75894-001 Example illustration

1 Switch

6.8.2 Cable routing and connection only for EmiBox

Connecting the TEM/TPEM Remote Plant Gateway (RPG)

Switching off the voltage supply

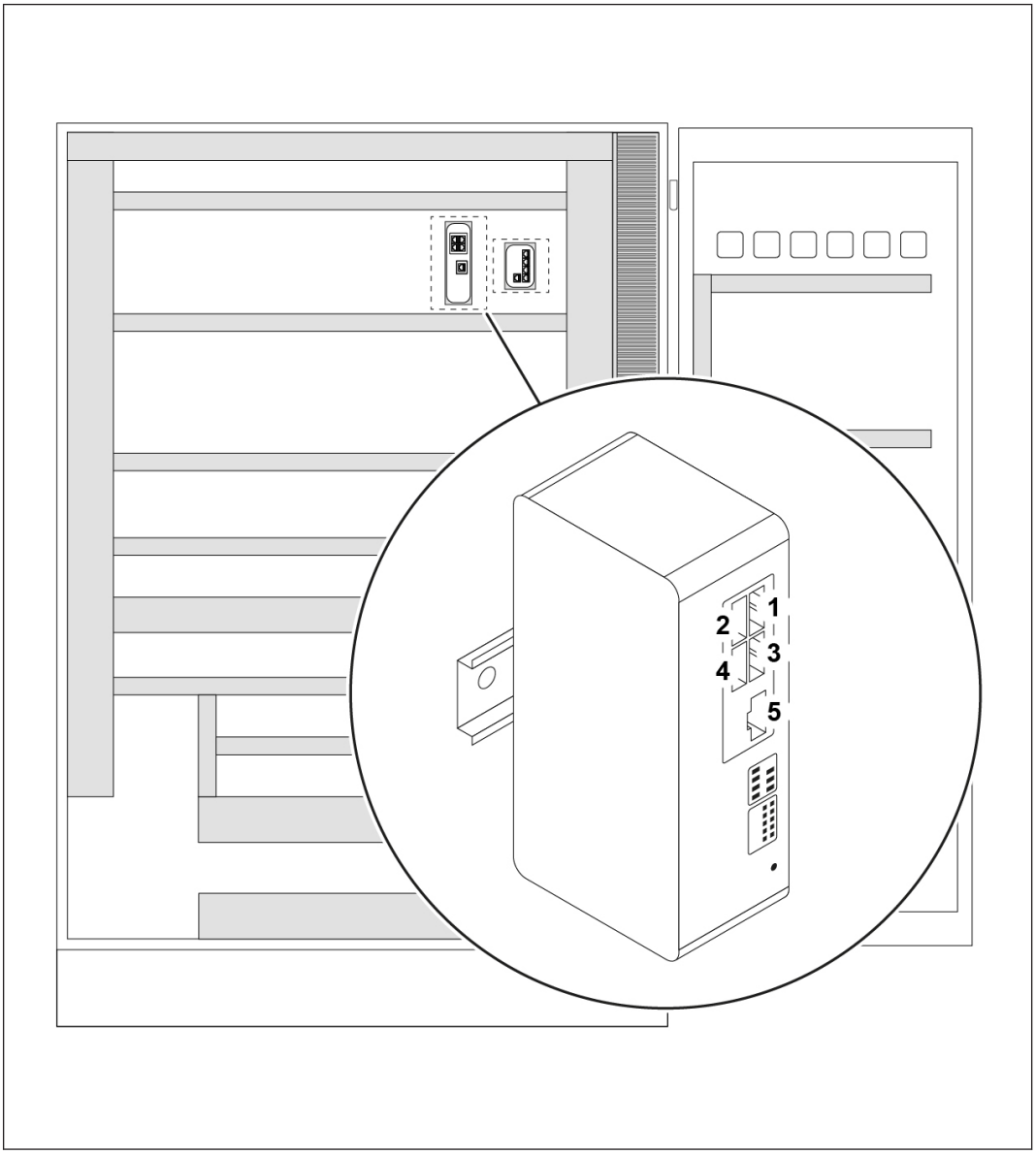
The connection of the power supply for the auxiliary cabinet (HAS) depends on the design of the plant on site.

- Shut down the power station (genset) and secure it
- Disconnect incoming power supply and instrumentation lines, disconnect loads from them, and secure them
- Open the auxiliary cabinet and make sure working conditions are secure. For necessary information on safety, see chapter 6.1 Safety notes 90

In the auxiliary cabinet (HAS), connect the LAN patch cable

On gensets with a TPEM system, the TEM/TPEM Remote Plant Gateway (RPG) is located in the TPEM Control Cabinet (TPEM CC). On gensets with a TEM system, it is usually located in the auxiliary cabinet (HAS).

The EmiBox connection is the same for both systems.



75892-001 Sample illustration (item numbers 1-5 match device labels)

1 Occupied

2 Free for EmiBox connection

3 Occupied

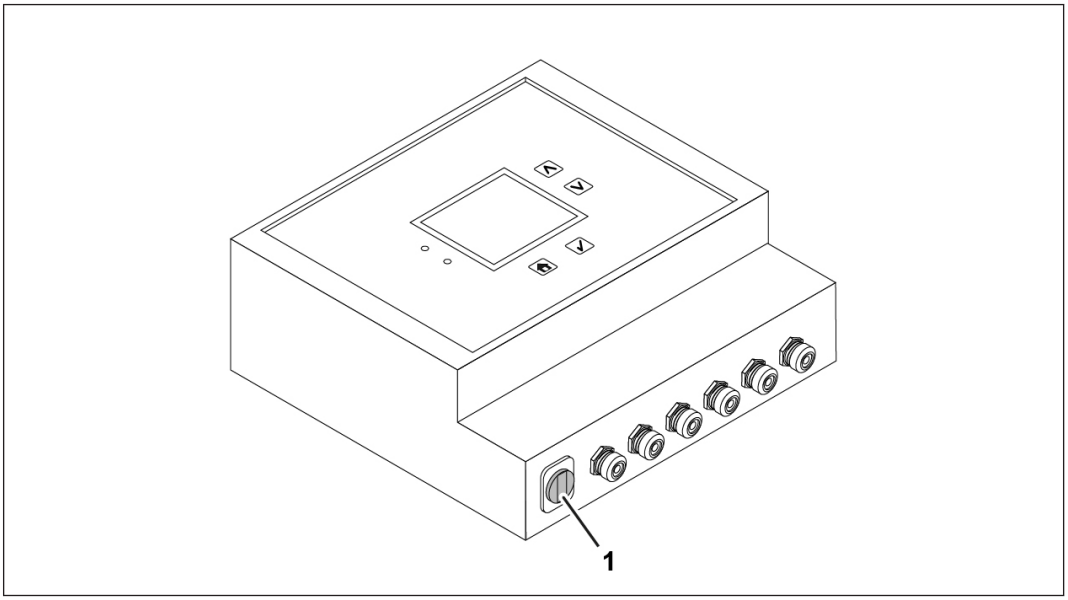
4 Occupied

5 Occupied

- Connect LAN patch cable to connection (2) and route it to the EmiBox

Connecting the LAN patch cable to the EmiBox

The EmiBox is connected to the TEM/TPEM Remote Plant Gateway (RPG) via the bottom of the housing.



75631-001 Example illustration

1 Connection for TEM/TPEM Remote Plant Gateway (RPG)

- Connect LAN patch cable from the TEM/TPEM Remote Plant Gateway (RPG) at connection (1)

Electrical tests

Before commissioning, the electrical installation must be checked for safety and function by an authorized qualified specialist in accordance with the regional regulations by testing and measuring. The results must be documented in a test report.

The scope of testing includes the following general points and is to be determined according to the local conditions and the specific installation.

- Cable routing (cable correctly secured, short-circuit-proof routing, insulation, etc.)
- Installed equipment (fastening, insulation, no damage)
- Contiguous equipotential bonding (depends on installed equipment)
- Check continuity of cables
- Insulation resistance (depends on installed equipment)
- Voltage supply of installed equipment
- Perform electrical safety tests without and with power supply
- Only approve the installation for commissioning after successful testing
- If commissioning will take place at a later time, bring the respective switchgear cabinet into a safe state, re-establish the power supply and enable the plant for operation

6.8.3 Assembly switch for EmiBox with SCR Control Kit

Switching off the voltage supply

The connection of the power supply for the auxiliary cabinet depends on the design of the plant on site.

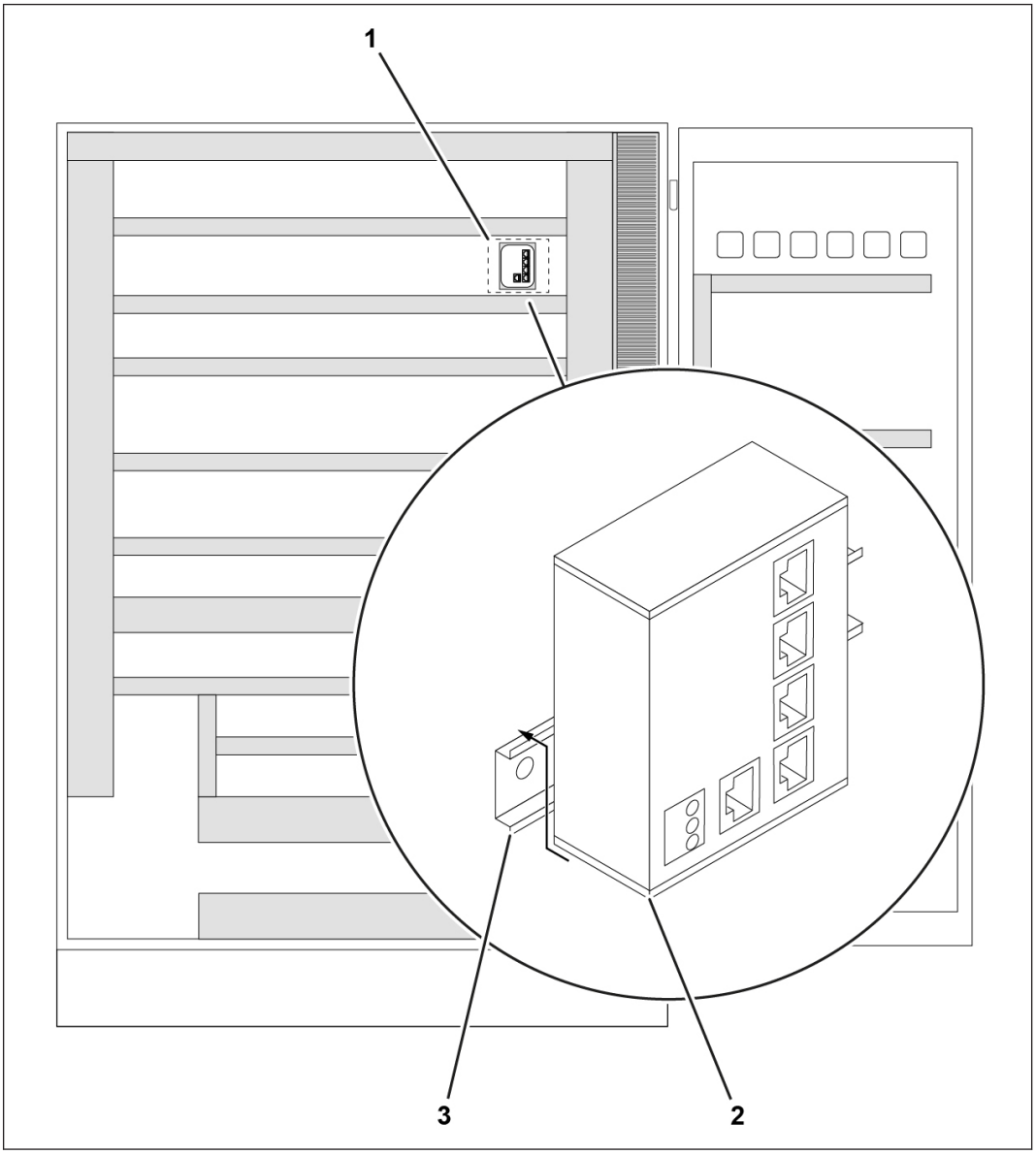
- Shut down the power station (genset) and secure it
- Disconnect incoming power supply and instrumentation lines, disconnect loads from them, and secure them
- Open the auxiliary cabinet and make sure working conditions are secure. For necessary information on safety, see chapter 6.1 Safety notes 90

Install switch and connect equipotential bonding

Install in the auxiliary cabinet (HAS) if possible.

The image below shows an example of an installation location. Alternatively, and depending on which busbars are occupied with equipment, a different installation location should be chosen so that there is enough clearance with the other equipment; it should also allow for the fastening options of the switchgear cabinet to be used and for proper routing of the connection cables.

The switch is fixed in place with a mounting rail that fits with the mounting plate in the switchgear cabinet.



75888-001 Example illustration of switch

- Position the switch (1) in a suitable installation location in the switchgear cabinet and mark the attachment points for the mounting rail (3)
- Install the switch
  - Use suitable attachment hardware to attach the mounting rail (3) to the installation surface.
  - Clip the switch (2) onto the mounting rail (3) from below.
  - Press the switch (2) upward and slightly against the installation surface until the switch (2) audibly snaps into place in the mounting rail (3).

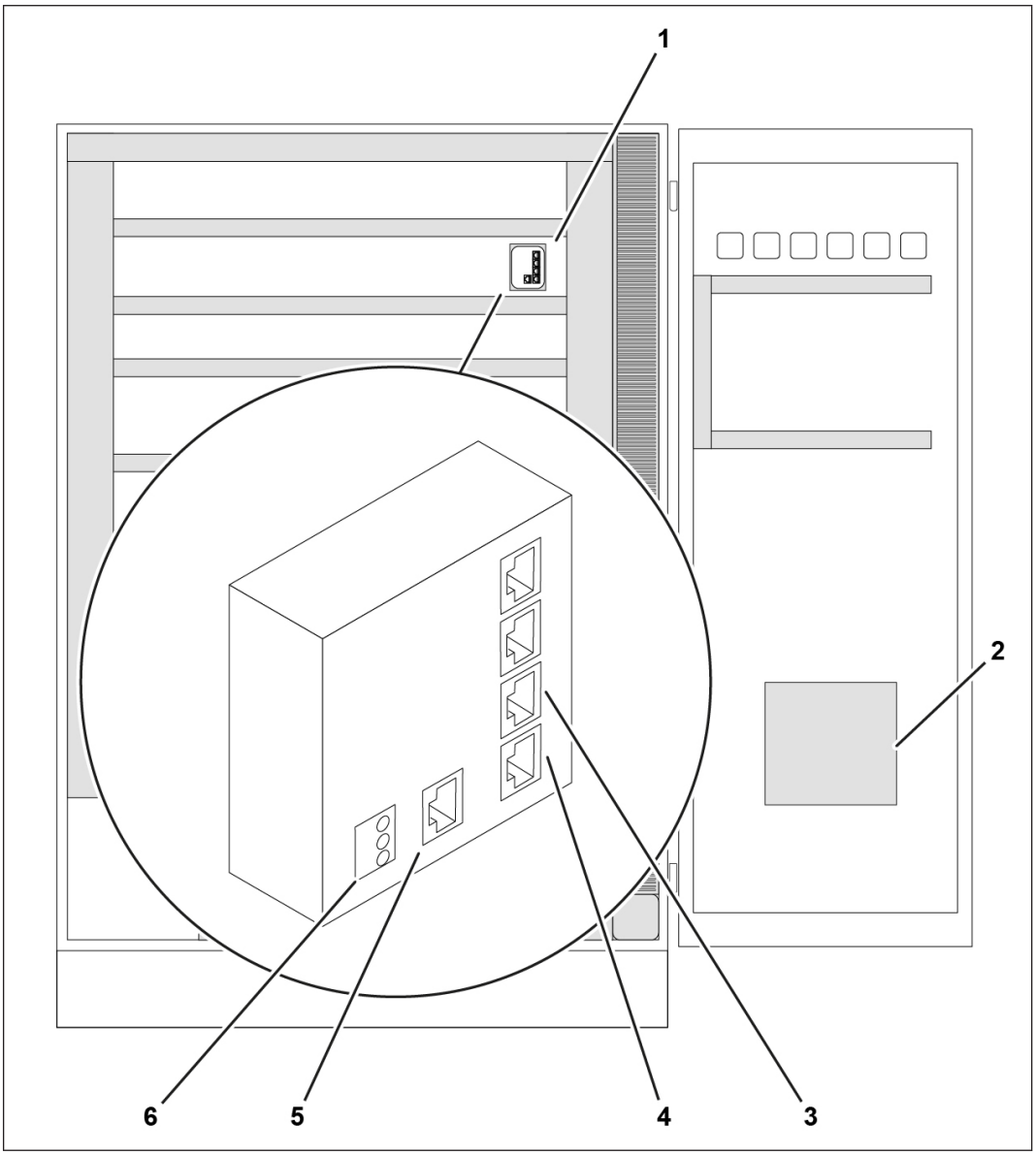
6.8.4 Cable routing and connection for EmiBox and SCR Control Kit

Overview of connections

Auxiliary cabinet (HAS)

The cable inlet depends on the local conditions. With the auxiliary cabinet (HAS), cables can enter the cabinet from above or below.

The pocket (2) contains the wiring diagrams. The latest version of the wiring diagram with the switch connected should be stored there.



75887-001 Example illustration: Connections and cable routing in auxiliary cabinet (HAS)

1 Switch (installation location dependent on local situation)

2 Pocket for wiring diagrams

3 SCR Control connection

4 EmiBox connection

5 TEM/TPEM RPG connection

6 Voltage supply connection

For necessary information on the cabling, see

- Operating Manual ⇒ General ⇒ Application and Installation Guide
  - Power plants layout ⇒ Cabling

Route cables into the auxiliary cabinet (HAS)

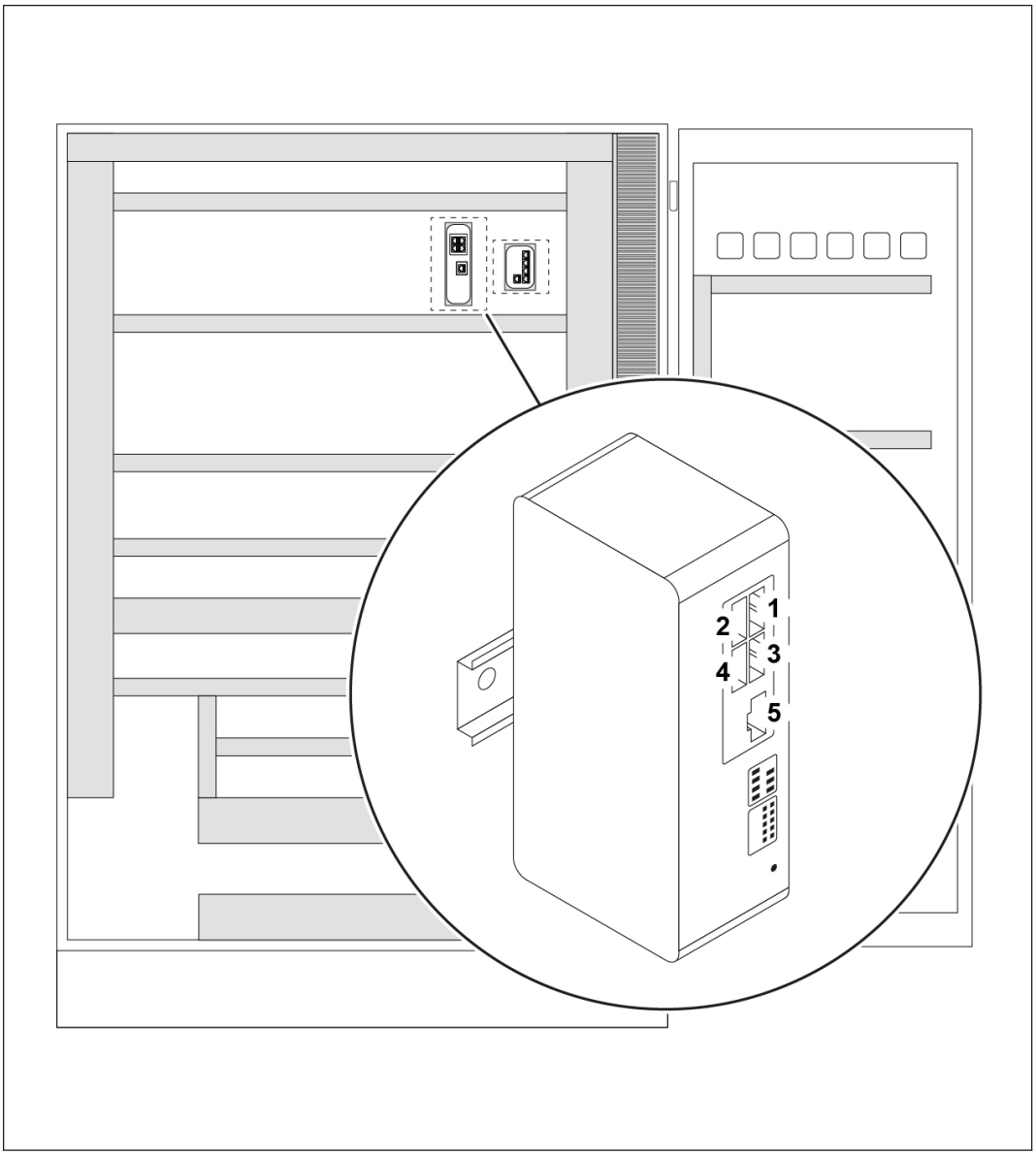
The cable routing and the installation location must be selected on site according to the possible cable inlet and according to which rails are populated with operating elements.

- Depending on the situation, prepare cable inlet (2) or (7), for example with cable glands
- Route cables into the auxiliary cabinet (HAS)
- Seal the insertion point properly

Connecting the TEM/TPEM Remote Plant Gateway (RPG)

On gensets with a TPEM system, the TEM/TPEM Remote Plant Gateway (RPG) is located in the TPEM Control Cabinet (TPEM CC). On gensets with a TEM system, it is usually located in the auxiliary cabinet (HAS).

The switch connection is the same for both systems.



75892-001 Sample illustration (item numbers 1-5 match device labels)

1 Occupied

2 Free switch connection

3 Occupied

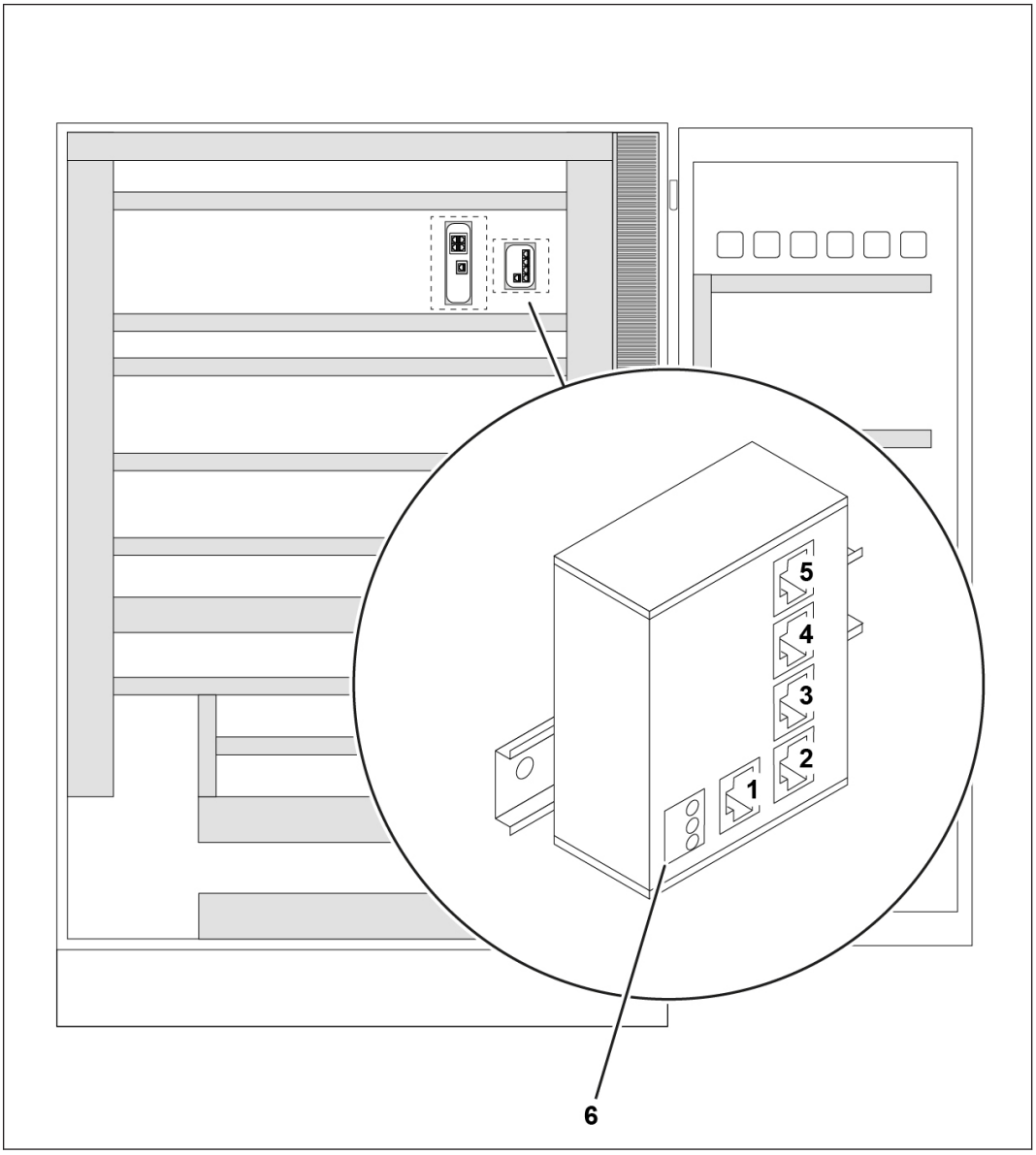
4 Occupied

5 Occupied

- Connect LAN patch cable to connection (2) and route it to the switch

Connect the switch

The switch is powered with a 24 VDC voltage supply. The power supply must meet the requirements of the certificate for the region (for certificate symbols, see rating plate or manufacturer documentation).



75893-001 Sample illustration (item numbers 1-5 match device labels)

1 Connection for TEM/TPEM Remote Plant Gateway (RPG)

2 Free connection

3 Free connection

4 Free connection

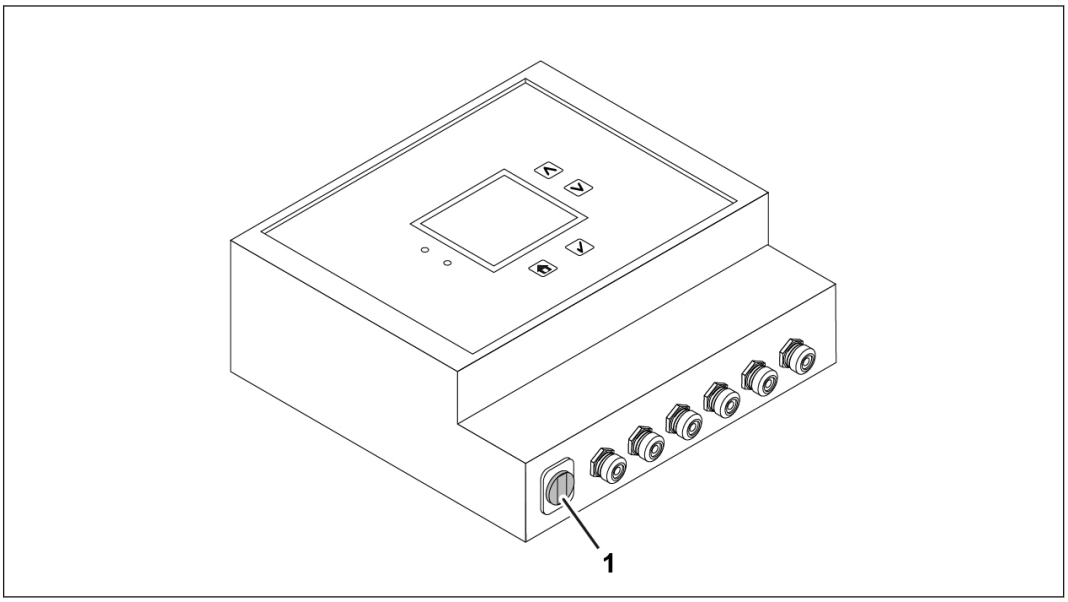
5 Free connection

6 Voltage supply

- Connect LAN patch cable to connection (1) and route it to the TEM/TPEM Remote Plant Gateway (RPG)
- Connect LAN patch cable to connection (2) and route it to the EmiBox
- Connect LAN patch cable to connection (3) and route it to the SCR Control switchgear cabinet
- Connect voltage supply (6)

Connect EmiBox

Depending on the installation, the SCR Control switchgear cabinet may already be connected to the EmiBox. In this case, remove the LAN patch cable.



75631-001 Example illustration

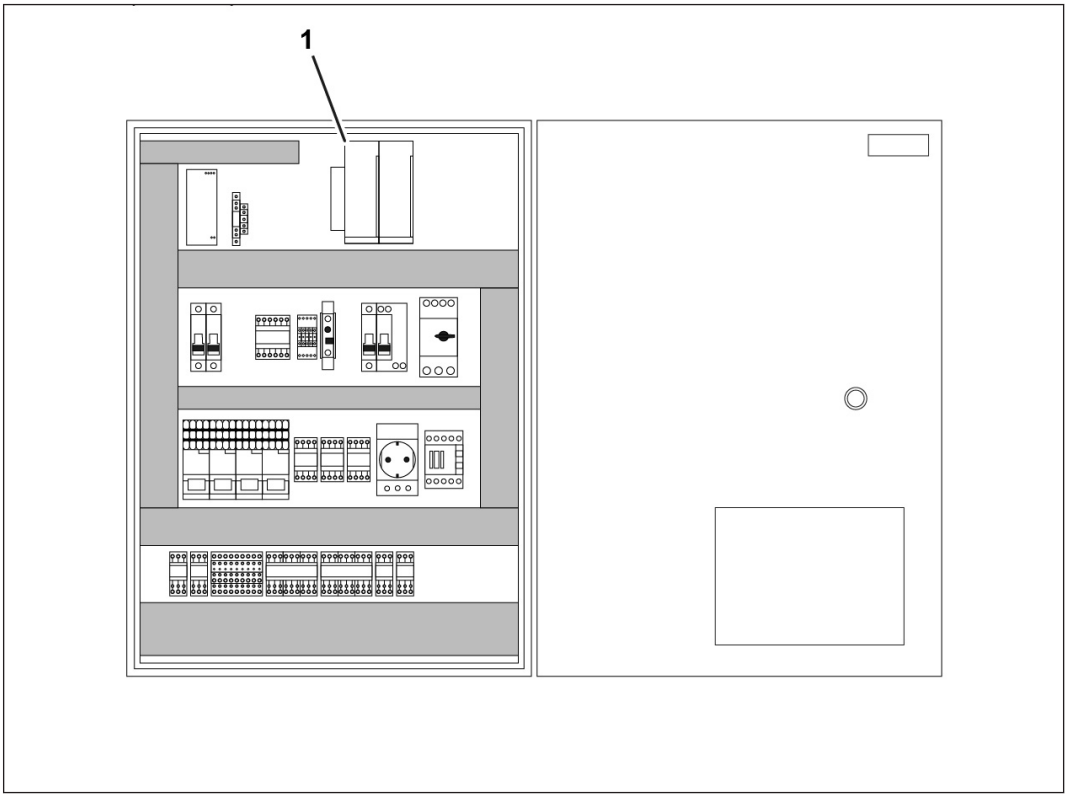
1 Switch connection

- Connect LAN patch cable from switch to connection (1)

Connect SCR Control switchgear cabinet

The SCR Control switchgear cabinet contains the I/O module with network connections.

Depending on the installation, the SCR Control switchgear cabinet may already be connected to the EmiBox. In this case, the LAN cable should be removed and replaced with the LAN patch cable from the switch.



75891-001 Example illustration

1 I/O module

- Connect LAN patch cable from switch to the I/O module (1)

Electrical tests

Before commissioning, the electrical installation must be checked for safety and function by an authorized qualified specialist in accordance with the regional regulations by testing and measuring. The results must be documented in a test report.

The scope of testing includes the following general points and is to be determined according to the local conditions and the specific installation.

- Cable routing (cable correctly secured, short-circuit-proof routing, insulation, etc.)
- Installed equipment (fastening, insulation, no damage)
- Contiguous equipotential bonding (depends on installed equipment)
- Check continuity of cables
- Insulation resistance (depends on installed equipment)
- Voltage supply of installed equipment
- Perform electrical safety tests without and with power supply
- Only approve the installation for commissioning after successful testing
- If commissioning will take place at a later time, bring the respective switchgear cabinet into a safe state, re-establish the power supply and enable the plant for operation

6.9 Seals on catalytic converters

6.9.1 Purpose and handling

The catalytic converter may only be installed, commissioned and maintained by properly trained and authorized specialist personnel. To prevent unauthorized personnel from opening catalytic converters inadvertently, and as an indicator to third parties, a seal must be placed on the catalytic converter by authorized personnel immediately after completing any work steps.

The seal must be given a uniquely identifiable number, which must remain recognizable over the complete life cycle of the seal.

As part of the annual discontinuous emission measurement, the relevant test institute inspects the integrity of the seal together with the owner. In addition, the authorized service technician must document the integrity of the seal and document this in the logbook during relevant maintenance work.

6.9.2 Required entry in the logbook

Any change to the exhaust system must be entered in the logbook. This also includes cleaning or replacing the catalytic converter, as well as sealing the catalytic converter.

The reason for the removal or the reattachment of the seal must be documented in the logbook with the date, an indication of the identifying number of the seal, and personal identification of the authorized service technician along with the values from the inspection measurement for NO_x. It must be readily apparent which person (with complete name and company affiliation) has carried out the conversion measures.

- For more information on the logbook, see chapter 8.5.7 Updating the logbook 163

6.9.3 Affixing and removing seals

Note

A distinction is made between seals for plug-in catalytic converters and seals for cone-style catalytic converters.

Seals are available from a competent service partner.

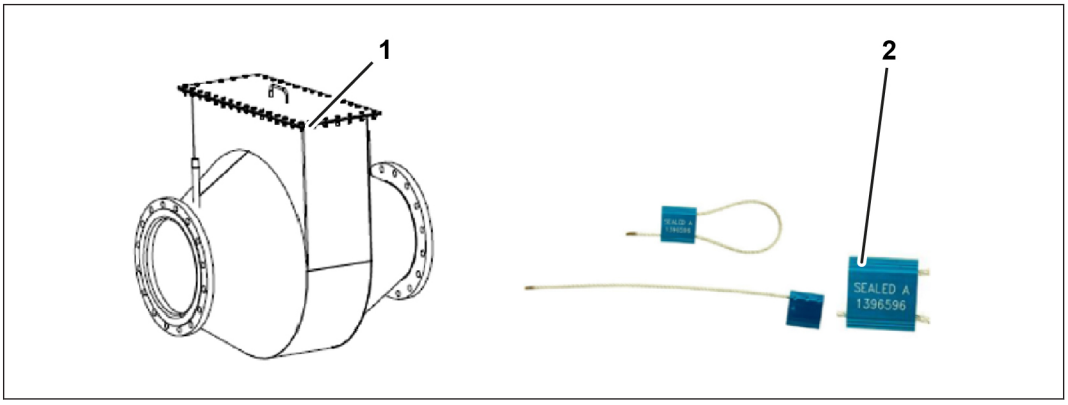
The seal may only be removed and re-affixed by trained CES specialist personnel (authorized service technicians) with an authorization level of 200 or higher, or by an accredited metrological institute. After the above work, the catalytic converter must be sealed immediately by an authorized person and checked with an inspection measurement using a Testo measuring device or similar.

The seal may only be removed for the following purposes:

- Cleaning the catalytic converter
- Maintenance work on the catalytic converter
- Repair of the catalytic converter
- Replacement of the catalytic converter

Plug-in catalytic converters

For sealing plug-in catalytic converters, we recommend drilling a hole in the connecting flange of the catalytic converter with a diameter of 5 mm, as shown in the following figure. The open seal should then be threaded through this hole and sealed. No special tool is needed to attach the seal. To remove the seal, we recommend a standard wire cutter.



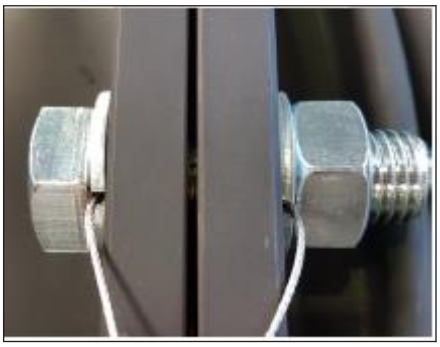
71120-002

1 Drill hole for seal

2 Seal

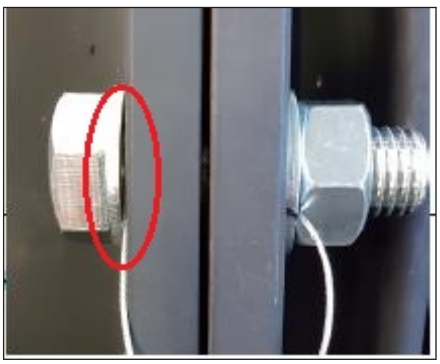
Cone-style catalytic converters

For sealing conical catalytic converters, we recommend guiding the seal through a screw hole on the flange connection with a diameter of 26 mm and fastening it there. We recommend using an M24 screw with a matching slotted washer.



71121-002

If the washer is not slotted, an optimal surface pressure cannot be ensured.



71122-002

No special tool is needed to attach the seal. To remove the seal, we recommend a standard wire cutter.

7 Commissioning

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7.1 Safety notes

WARNING!

Hazardous system conditions or work situations are possible due to lack of expertise and qualifications

This can lead to severe injuries and even death.

- Only authorized and qualified specialist personnel of the manufacturer or their representative may work on the product.

8 Operation

Table of contents

8.1 Safety notes

WARNING!

Injuries due to improper operation

This can lead to severe injuries and even death.

- Only authorized and trained operators are permitted to operate the genset and/or plant with installed EmiBox and SCR Control.
- Operating personnel are prohibited from making any changes to the hardware and its connections, parameters, files, etc.
- Before operation, ensure that all the covers and safety devices have been mounted and are functioning properly.
- Never shut down or remove safety devices during operation.

Danger to the environment

Operator errors can increase the emissions to rise above the permissible range

- Only authorized and trained personnel are permitted to operate the EmiBox and SCR Control.
- Only authorized and trained personnel are permitted to modify the parameters approved by the manufacturer.

Risk of destruction of components

Unusual odors, noises or other problems may indicate critical system conditions or damage to the product

- Never examine or open the product, but switch it off or disconnect it from the mains immediately
- Contact the responsible service personnel

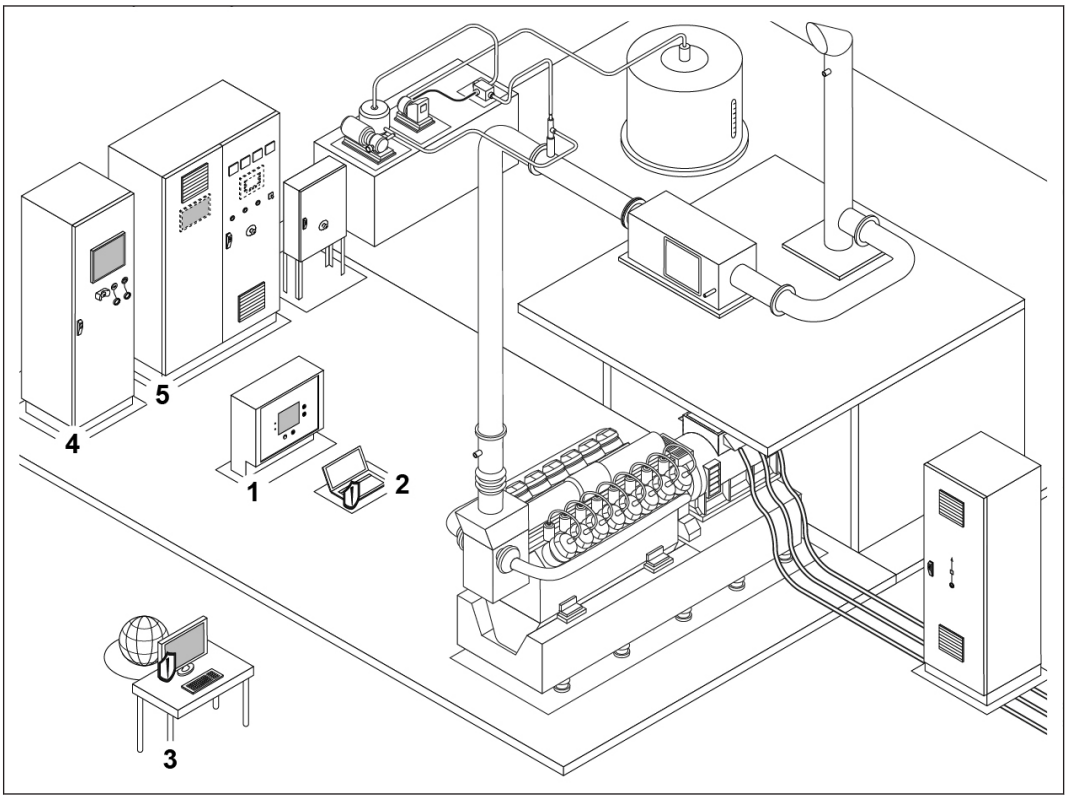
Risk of destruction of components

Liquids penetrating components can lead to damage

- Keep liquids away from the product

8.2 Monitoring with EmiBox

8.2.1 Overview of displays, control elements and markings



75896-001 Example illustration of EmiBox for monitoring

1 EmiBox

2 External computer

3 Remote access

4 TPEM CC switchgear cabinet on TPEM system

5 HAS auxiliary cabinet on TEM system

EmiBox (1)

On its front side, the EmiBox has a panel with input and output options.

An integrated interface also permits communication via remote access (2).

External computer (2)

The integrated web server of the EmiBox, with its user-accessible interface, also allows an external computer to be connected. The user interface offers numerous functions for monitoring and system configuration.

Remote access (3)

Optional remote access allows an operator to access the web server of the EmiBox remotely and interact with its user interface.

TPEM CC switchgear cabinet on TPEM systems (4)

The EmiBox communicates with the TPEM system. Messages relating to this are displayed by the TPEM Touch Panel on the TPEM CC switchgear cabinet.

Auxiliary cabinet HAS on TEM systems (5)

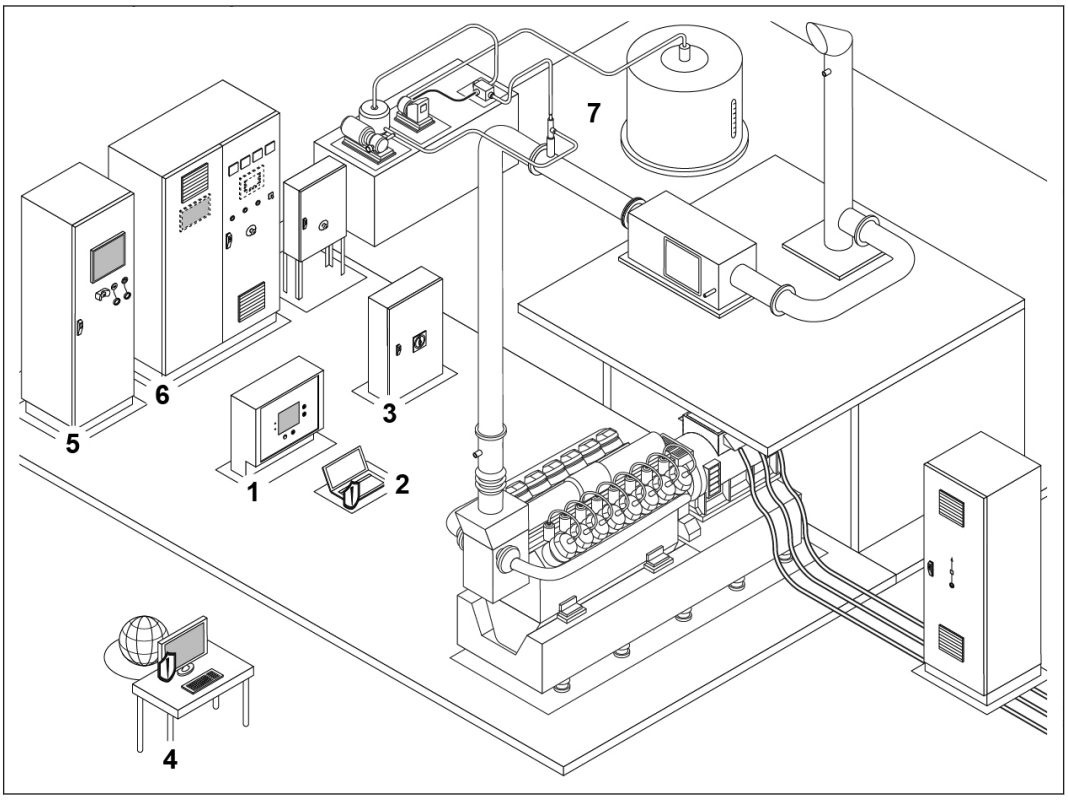
Depending on the configuration, the EmiBox may communicate with the TEM system. Messages relating to this are displayed by the TEM Touch Panel on the HAS switchgear cabinet.

8.2.2 Operation modes

No operation modes are provided for monitoring.

8.3 SCR feedback control with SCR Control

8.3.1 Overview of displays, control elements and markings



75630-001 Example illustration: EmiBox with SCR Control Kit

1 EmiBox
2 External computer
3 SCR Control switchgear cabinet
4 Remote access
5 TPEM CC switchgear cabinet on TPEM system
6 HAS auxiliary cabinet on TEM system
7 SCR application

EmiBox (1)

On its front side, the EmiBox has a panel with input and output options.

An integrated interface also permits communication via remote access (2).

External computer (2)

The integrated web server of the EmiBox, with its user-accessible interface, also allows an external computer to be connected. The user interface offers numerous functions for monitoring and system configuration.

SCR Control switchgear cabinet (3)

The SCR Control switchgear cabinet serves as the interface to the SCR application. The master switch for the electrical system is located on the front.

Remote access (4)

Optional remote access allows an operator to access the web server of the EmiBox remotely and interact with its user interface.

TPEM CC switchgear cabinet on TPEM systems (5)

The EmiBox communicates with the TPEM system. Messages relating to this are displayed by the TPEM Touch Panel on the TPEM CC switchgear cabinet.

Auxiliary cabinet HAS on TEM systems (6)

The EmiBox communicates with the TEM system. Messages relating to this are displayed by the TEM Touch Panel on the HAS switchgear cabinet.

SCR application (7)

Depending on the installed SCR application, it may contain other displays, control elements and markings.

8.3.2 SCR Control operation modes

For open- and closed-loop control of the SCR application, the following operation modes are available:

- Automatic operation
- Manual operation

Automatic operation

In automatic operation, the SCR Control provides open- and closed-loop control to the SCR application in accordance with the loaded configuration. No operator intervention is required

Manual operation

Manual operation is only for authorized service personnel. It can only be enabled with the proper login.

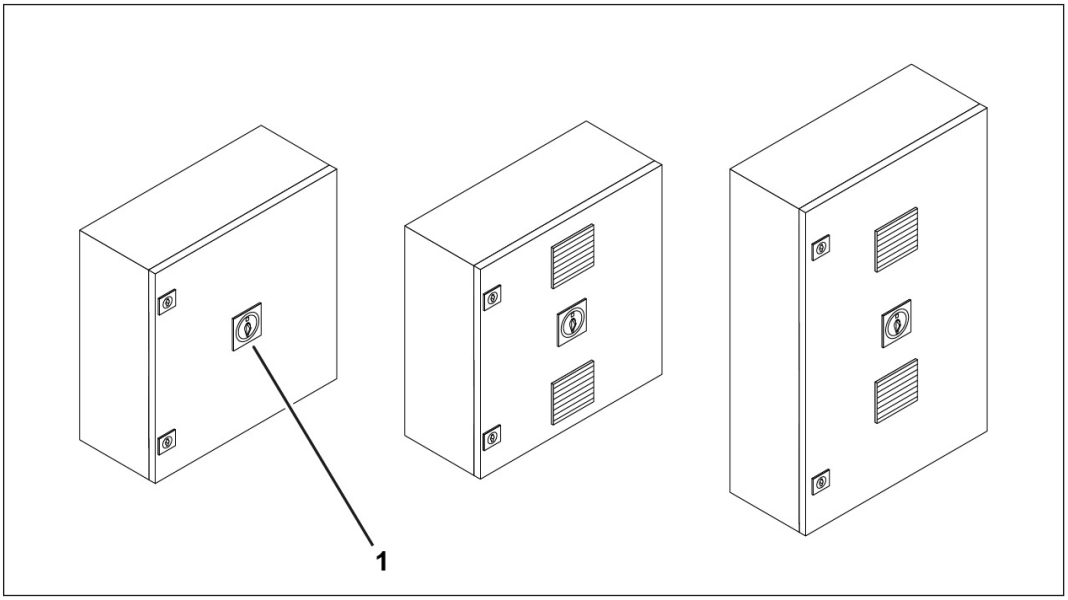
8.3.3 Switching on and operating SCR Control for normal operation

WARNING!

Automatic start of components of the base system and of the SCR application

This can lead to severe injuries and even death.

- Do not work on the EmiBox or connected components when the base system is switched on



75939-001 Example illustration: SCR Control switchgear cabinet

1 Main switch

If the basis system is supplied with power, it is automatically in standby state.

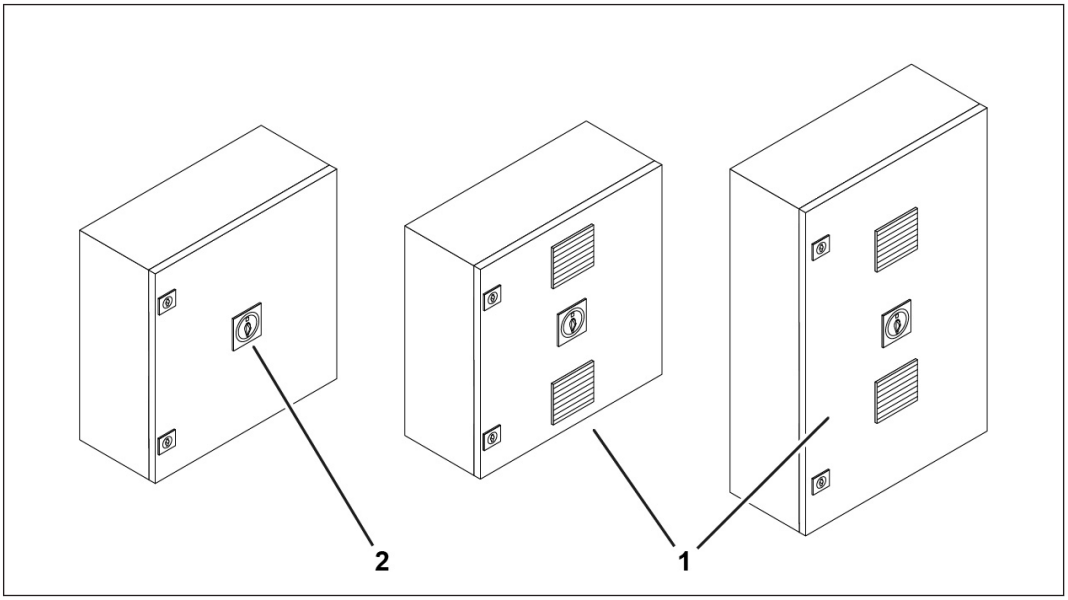
- Switch on the main switch
  - The base system starts up and is in the standby state.
- Start the genset
  - The exhaust system is heated and the SCR Control provides synchronous open- or closed-loop control (depending on the internal configuration) to the components of the SCR application.
  - Normal operation does not require any further switching actions from the operating personnel.

8.3.4 Switching off the SCR Control

Risk of destruction of components

Suddenly switching off the voltage supply can cause malfunction

- The SCR Control should be allowed to run through its internal procedure to shut down the SCR application.



75938-001 Example illustration: SCR Control switchgear cabinet

1 Switchgear cabinet variants with fan

2 Main switch

- Shut down the genset
  - The genset power drops and, because of its internal configuration below a minimum genset power, the SCR Control switches to the shutdown operating state.
  - Wait until the shutdown process is complete.
- Switch off the main switch (2)
  - The power supply for the power section (230 V_{AC}) has been interrupted.
  - The power supply for the control section (24 V_{DC}) has been interrupted.
  - Depending on the connected SCR application and the installation at the site, the control power supply (24 V_{DC}) and various signal lines may remain energized. If necessary, these must be de-energized according to the circuit diagram.
  - The SCR Control functionality has been switched off.
  - Depending on the SCR Control switchgear cabinet variant and the installation on site, cables for control signals may be connected to external power supplies (for example, incoming from the SCR application). If necessary, these must be de-energized according to the circuit diagram.

8.3.5 Tasks during operation

- Monitor urea fill level
- Check displays for messages and alarms; respond accordingly

Note

Depending on regional specifications, time limits may apply for the reporting of an alarm. In extreme cases, the genset may need to be shut down to comply with the requirements for various alarms.

Requisite information should be obtained from the competent authority

8.4 Remote access as an option

8.4.1 Setting up an external computer as a client

Requirements

- The EmiBox or the TEM/TPEM switch (only needed if SCR Control Kit is installed) are connected to the TEM/TPEM Remote Plant Gateway or Port 2 on said gateway
- The TEM/TPEM Remote Plant Gateway is connected to the internet
- The client (computer) is capable of remote access
- There is an account for the remote access client
- The `Remote Access Client` software is available for installation

For necessary information on the requirements, see

- Operating Manual Remote Engine Management

Establish the initial connection between client and web server (TEM system)

- Install the `Remote Access Client` software on the client (computer)
- Launch the `Remote Access Client` software
  - The software starts up and the login dialog window appears.
- Log in with the access credentials that have been provided
  - If the login is correct, the `LOGIN` tab will display the `Connection` dialog with the available profiles.
  - When first starting, only the default profile is available.
- Open Settings
  - Click the `gear wheel` shown next to the profile.
  - The `Connection` tab appears
- Create a custom profile
  - To the left of the `Connection` tab are the profile buttons.
  - Click the button with the `pages` icon to duplicate the default profile.
- Configure your profile
  - Change the profile name.
  - Select the server type `Switchboard`.
  - Enter the server address `rem-portal.caterpillar-energy-solutions.de`.
  - Enter user name.
  - Do NOT fill out the Organisation dialog.
  - Set your password.
  - Enable the `Save password` option.
  - Save the configuration with the `Ok` button.
- Specify server (optional)

  - Click the tab `Advanced` > `Proxy`.
  - Enable `Proxy` and enter the proxy server that routes the connection to the internet (information on the proxy can be obtained from your system administrator).
- Establish connection
  - Click `Sign In` button to establish the connection to the server.
  - The `Dashboard` tab appears showing the available plants/gensets.
- Connect with the EmiBox
  - Select genset with the desired EmiBox; or search for the desired EmiBox with the Filter dialog
  - For the RPG serial number that appears, click the `Arrow` button to open the endpoints and then click the EmiBox endpoint. The designation always begins with `EMI`.
  - Select the custom endpoint `EMI_HTTP`.
  - A browser window with the EmiBox user interface appears.

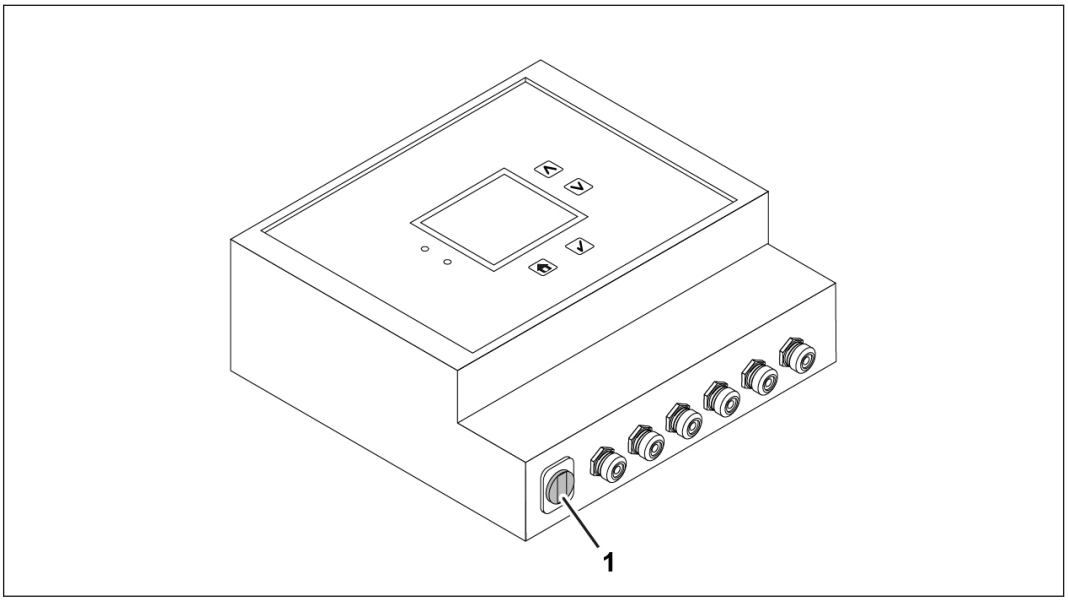
For more information on the user interface

- see chapter 4.6 Web server user interface 60

8.5 Key functions

8.5.1 Connecting an external computer

Connection with an EmiBox without an installed SCR Control Kit



75631-001 Example illustration

1 RJ45 adapter for LAN patch cable

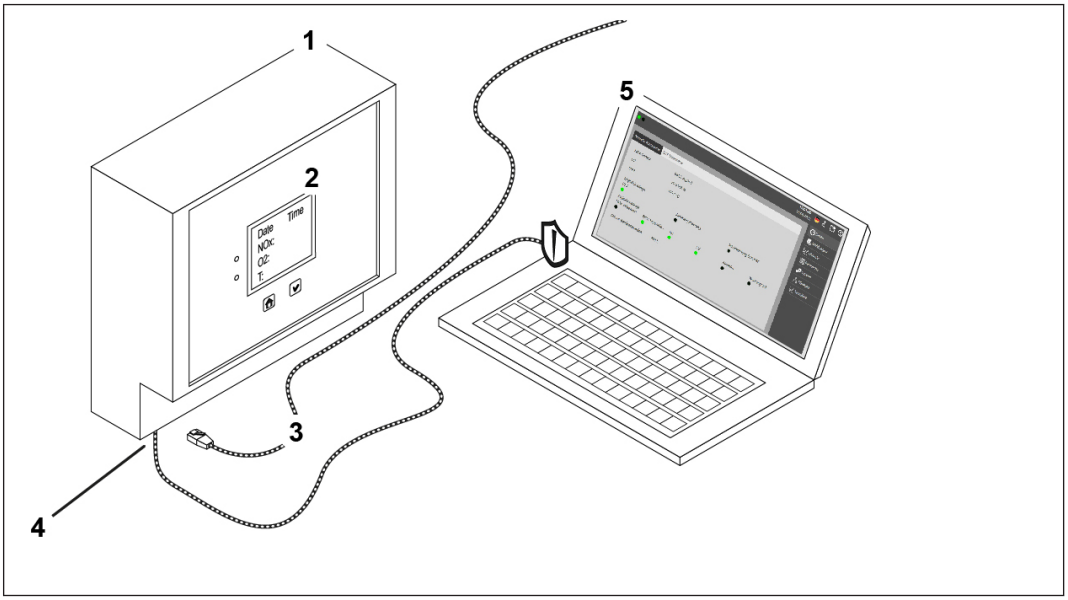
- Use a network cable (patch cable) to connect the computer as a direct connection to the EmiBox
  - It can take up to 5 minutes for the computer and the EmiBox to negotiate their IP addresses.
  - The IP address can be read in the `Information` faceplate on the EmiBox panel if necessary.

Connection with an EmiBox with an installed SCR Control Kit

Note

Currently, for an EmiBox with an installed SCR Control Kit, operator personnel only have access to a direct connection.

Connection of an external computer (e.g. for exporting measured values) should therefore be planned during downtimes.



75900-001 Example illustration

1 EmiBox

2 Display

3 LAN patch cable to the SCR Control switchgear cabinet

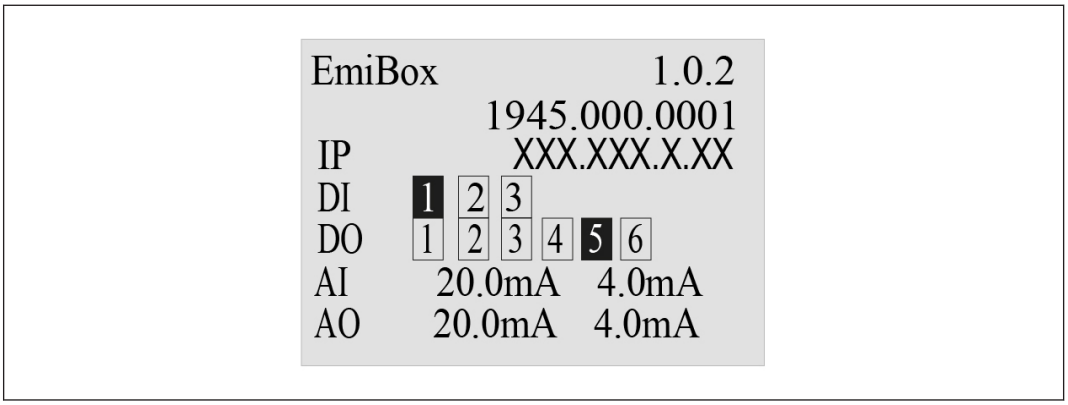
4 RJ45 adapter for LAN patch cable

5 Operator-provided computer with web browser and firewall

- Shut down the genset
- Remove the LAN patch cable to the SCR Control switchgear cabinet (3)
- Use a network cable (patch cable) to connect the computer to the EmiBox (4)
  - It can take up to 5 minutes for the computer and the EmiBox to assign their IP addresses.
  - The IP address can be read in the `Information` faceplate on the EmiBox panel (2) if necessary.
- If the connection is no longer needed, restore the original connection
- Recommission the genset
  - If a connection interruption error appears on the operating computer for the connection to the SCR Control switchgear cabinet, acknowledge it.

8.5.2 Launching the user interface

Find the IP address of the EmiBox



75643-001 Example illustration

- On the EmiBox panel, use the Up arrow key to navigate to the Information faceplate
- Make a note of the current IP address.

Launch the user interface in the web browser

Note

The user interface can only be displayed in a web browser. Microsoft Internet Explorer is not supported.

75642-001 Example illustration

- Connect external computer to the EmiBox
- Open web browser
- In the address bar (1), enter the EmiBox's IP address that you noted down, followed by a colon and the port number 5000: http://XXX.XXX.XXX.XXX:5000
  - The default user interface appears.
  - A login is required to access advanced functions of the user interface.

Note

If the user interface does not appear, you may need to change the IP address of the computer.

8.5.3 Login

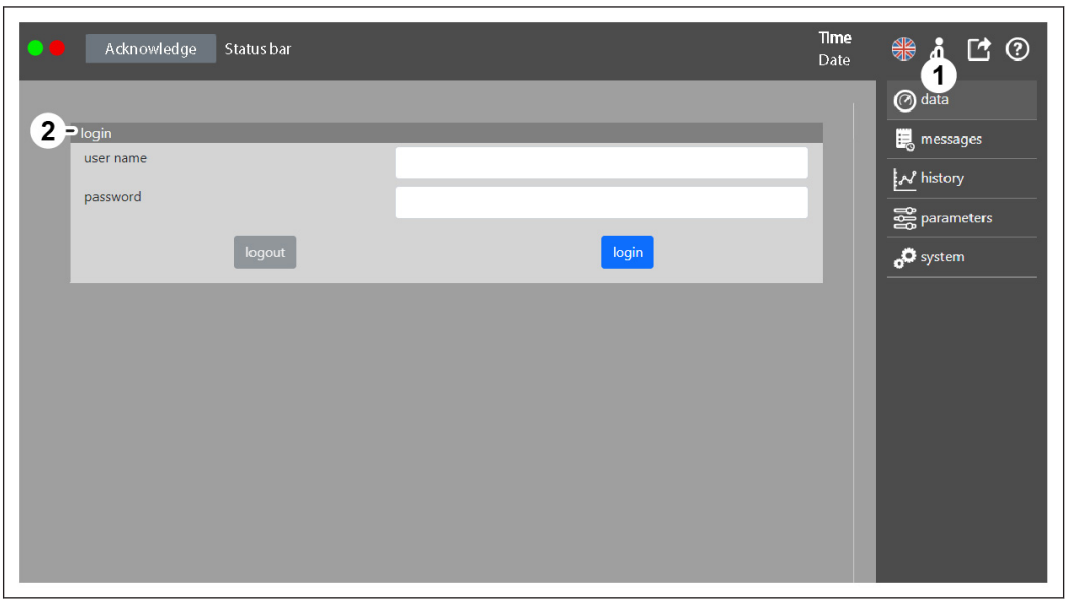
The login is intended to protect the system against unauthorized access. It is only required for system-related actions (such as parameter changes).

Prerequisite

A valid user name and password are required for login. Management is carried out by the system administrator.

User interface navigation

- User interface > icon bar

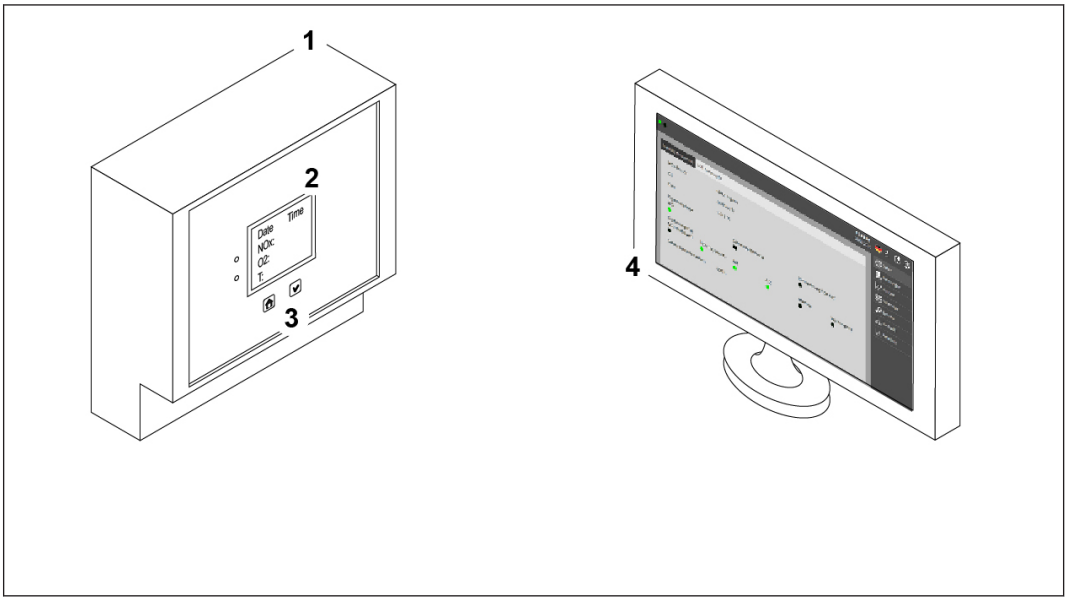


75953-001 Example illustration

- Press the login button (1) in the user interface
  - The `Login` dialog (2) appears.
- Log in
  - The user interface switches to the functionality assigned in the system to the specific user name.

If the connection is lost or the screen is inactive for 10 minutes, the user is automatically logged off.

8.5.4 Displaying measured values and system data



75897-001 Example illustration

1 EmiBox

2 Display

3 Navigation buttons

4 Operator-provided computer with web browser and user interface

Display

The EmiBox display (2) displays relevant data, for instance:

- NO_x value / system status
- O_2 value
- Exhaust temperature
- Value of analog input 2, if parameterized, and other digital inputs and outputs
- Pending alarms as running text
- Various operation parameters of connected systems (e.g. SCR Control)

User interface

An external computer can be used to access the measurement data via the user interface (4). It is also possible to export a CSV file.

For more information

- on the user interface, see chapter "4.6 Web server user interface 60"
- For external access to the EmiBox, see chapter "8.5.2 Launching the user interface 156"

8.5.5 Exporting measured values and system data

Note

Data export is only possible with a web browser. Microsoft Internet Explorer is not supported.

The Data export function uploads various data on the system and/or emission measurements to a computer for operational analysis:

- The logbook, its messages and upper limit violations of permissible NO_x daily mean values
- The history with all mean values across a selectable time interval (e.g. 30 min)
- The user list, if the authorization level is 200 or higher

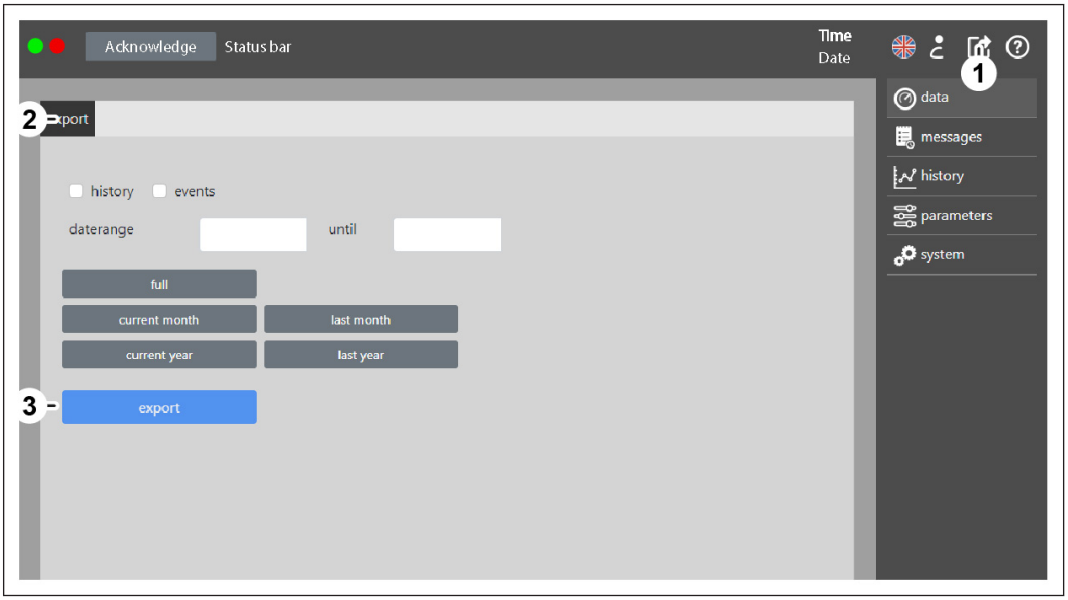
Data export does not require a login with user name and password.

Preparation

- Connect interface and external computer
- Launching the user interface

User interface navigation

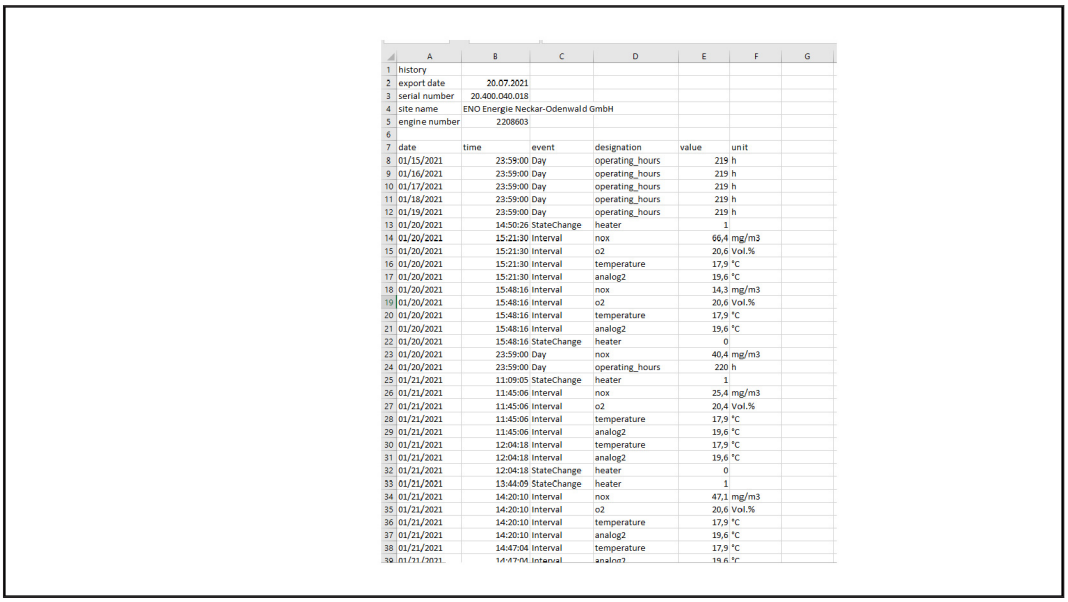
- User interface > icon bar



75954-001 Example illustration

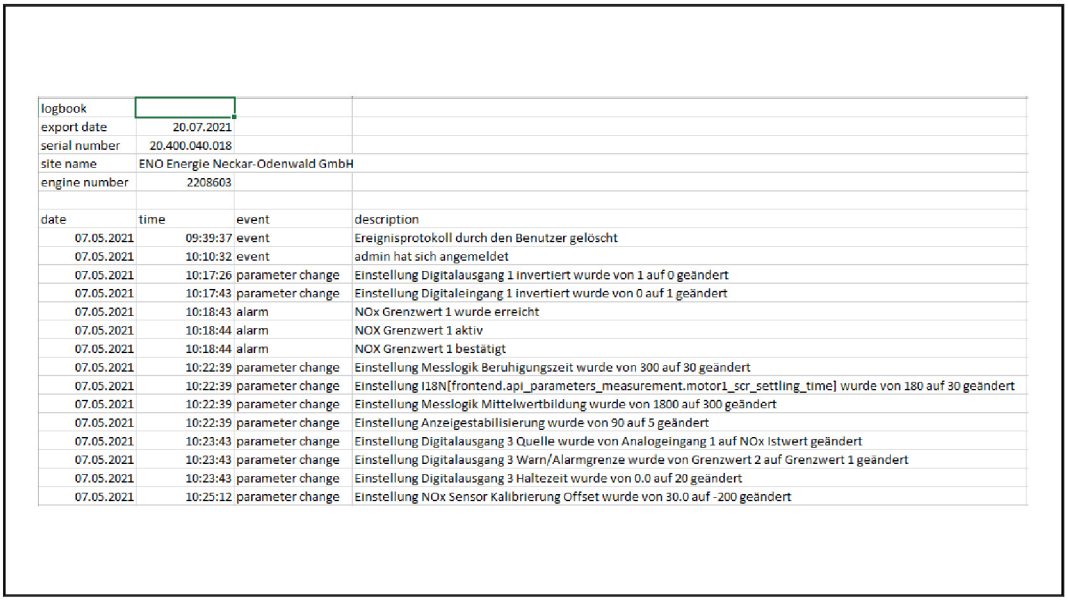
- Press the Data export button (1) on the user interface
- In the `Export data to PC` dialog (2), select the desire export options and sub-options, the commence the export with the `Export` button (3)
  - Depending on the file size, it may take a few minutes for the download to start. The user interface does not change during this time. However, the download will automatically start in the background.
  - The data are exported to the external computer in the operating system folder `Downloads`.

Examples



	A	B	C	D	E	F	G
1	history						
2	export date	20.07.2021					
3	serial number	20.400.040.018					
4	site name	ENO Energie Neckar-Odenwald GmbH					
5	engine number	2208603					
6							
7	date	time	event	designation	value	unit	
8	01/15/2021	23:59:00	Day	operating_hours	219	h	
9	01/16/2021	23:59:00	Day	operating_hours	219	h	
10	01/17/2021	23:59:00	Day	operating_hours	219	h	
11	01/18/2021	23:59:00	Day	operating_hours	219	h	
12	01/19/2021	23:59:00	Day	operating_hours	219	h	
13	01/20/2021	14:50:26	StateChange	heater	1		
14	01/20/2021	15:21:30	Interval	nox	66,4	mg/m3	
15	01/20/2021	15:21:30	Interval	o2	20,6	Vol.%	
16	01/20/2021	15:21:30	Interval	temperature	17,9	°C	
17	01/20/2021	15:21:30	Interval	analog2	19,6	°C	
18	01/20/2021	15:48:16	Interval	nox	14,3	mg/m3	
19	01/20/2021	15:48:16	Interval	o2	20,6	Vol.%	
20	01/20/2021	15:48:16	Interval	temperature	17,9	°C	
21	01/20/2021	15:48:16	Interval	analog2	19,6	°C	
22	01/20/2021	15:48:16	StateChange	heater	0		
23	01/20/2021	23:59:00	Day	nox	40,4	mg/m3	
24	01/20/2021	23:59:00	Day	operating_hours	220	h	
25	01/21/2021	11:09:05	StateChange	heater	1		
26	01/21/2021	11:45:06	Interval	nox	25,4	mg/m3	
27	01/21/2021	11:45:06	Interval	o2	20,4	Vol.%	
28	01/21/2021	11:45:06	Interval	temperature	17,9	°C	
29	01/21/2021	11:45:06	Interval	analog2	19,6	°C	
30	01/21/2021	12:04:18	Interval	temperature	17,9	°C	
31	01/21/2021	12:04:18	Interval	analog2	19,6	°C	
32	01/21/2021	12:04:18	StateChange	heater	0		
33	01/21/2021	13:44:09	StateChange	heater	1		
34	01/21/2021	14:20:10	Interval	nox	47,1	mg/m3	
35	01/21/2021	14:20:10	Interval	o2	20,6	Vol.%	
36	01/21/2021	14:20:10	Interval	temperature	17,9	°C	
37	01/21/2021	14:20:10	Interval	analog2	19,6	°C	
38	01/21/2021	14:47:04	Interval	temperature	17,9	°C	
39	01/21/2021	14:47:04	Interval	analog2	19,6	°C	

72150-002 History example



logbook			
export date	20.07.2021		
serial number	20.400.040.018		
site name	ENO Energie Neckar-Odenwald GmbH		
engine number	2208603		
date	time	event	description
07.05.2021	09:39:37	event	Ereignisprotokoll durch den Benutzer gelöscht
07.05.2021	10:10:32	event	admin hat sich angemeldet
07.05.2021	10:17:26	parameter change	Einstellung Digitalausgang 1 invertiert wurde von 1 auf 0 geändert
07.05.2021	10:17:43	parameter change	Einstellung Digitaleingang 1 invertiert wurde von 0 auf 1 geändert
07.05.2021	10:18:43	alarm	NOx Grenzwert 1 wurde erreicht
07.05.2021	10:18:44	alarm	NOX Grenzwert 1 aktiv
07.05.2021	10:18:44	alarm	NOX Grenzwert 1 bestätigt
07.05.2021	10:22:39	parameter change	Einstellung Messlogik Beruhigungszeit wurde von 300 auf 30 geändert
07.05.2021	10:22:39	parameter change	Einstellung I18N[frontend.api_parameters_measurement.motor1_scr_settling_time] wurde von 180 auf 30 geändert
07.05.2021	10:22:39	parameter change	Einstellung Messlogik Mittelwertbildung wurde von 1800 auf 300 geändert
07.05.2021	10:22:39	parameter change	Einstellung Anzeigestabilisierung wurde von 90 auf 5 geändert
07.05.2021	10:23:43	parameter change	Einstellung Digitalausgang 3 Quelle wurde von Analogeingang 1 auf NOx Istwert geändert
07.05.2021	10:23:43	parameter change	Einstellung Digitalausgang 3 Warn/Alarmgrenze wurde von Grenzwert 2 auf Grenzwert 1 geändert
07.05.2021	10:23:43	parameter change	Einstellung Digitalausgang 3 Haltezeit wurde von 0.0 auf 20 geändert
07.05.2021	10:25:12	parameter change	Einstellung NOx Sensor Kalibrierung Offset wurde von 30.0 auf -200 geändert

72151-002 Logbook example

8.5.6 Automatically exporting measured values to USB storage device

This functionality requires an accessory. The USB data storage device is not part of the scope of delivery.

Further information

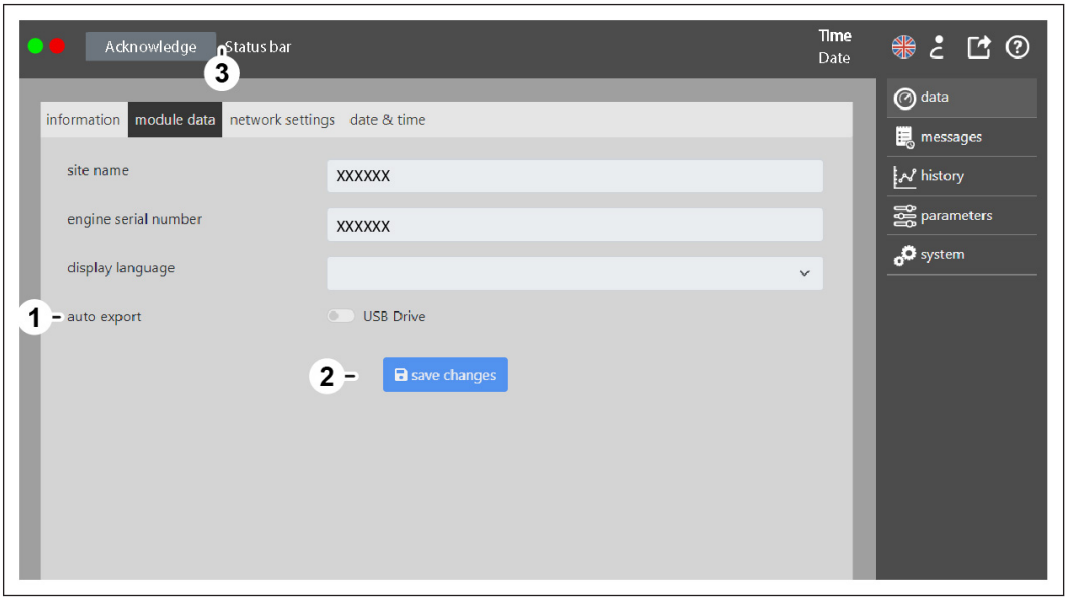
- For more information on the functionality and availability of accessories, and on the USB storage device, see chapter 4.3.2 Signal processing and measurement data 41

Enable auto export (one time only)

The following setting is only required when first commissioning the accessory/ accessories. It is active until it is manually canceled.

User interface navigation

- User interface > toolbar > System > Module data



75962-001 Example illustration

1 Status bar

2 `Auto export` dialog

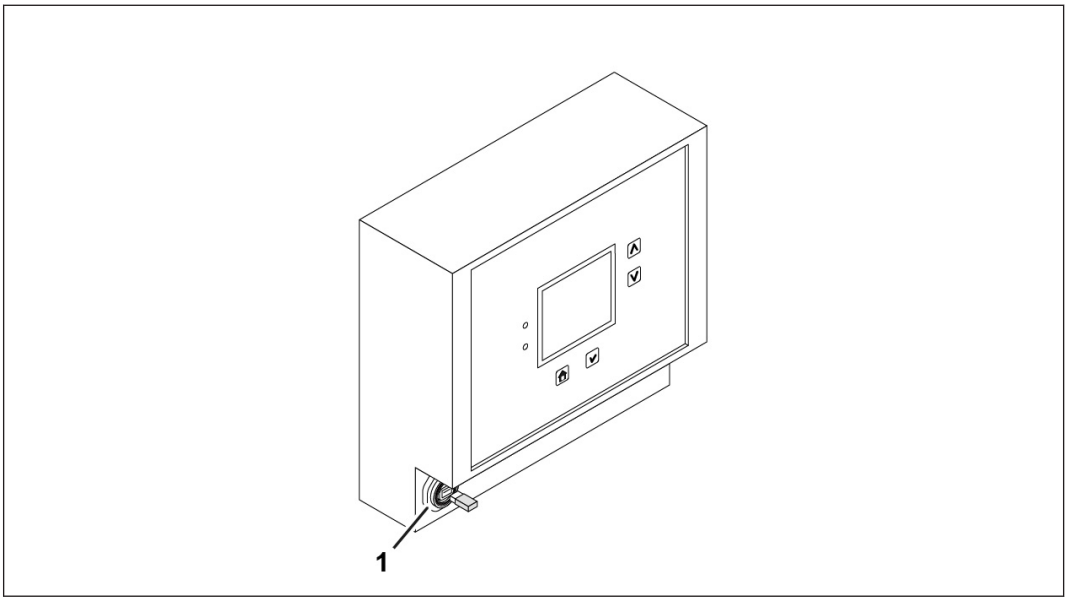
3 `Save changes` button

Procedure

- Click the `Module data` tab
- In the `Auto export` dialog (1), flip the virtual switch to the `USB Drive` position
- Click the `Save changes` button (2)
  - The function is activated.
  - The data will be automatically exported as soon as a USB storage device is detected.
  - The status bar (3) displays relevant messages about the connection and the export process.

Exporting data

Procedure



75965-001 Example illustration

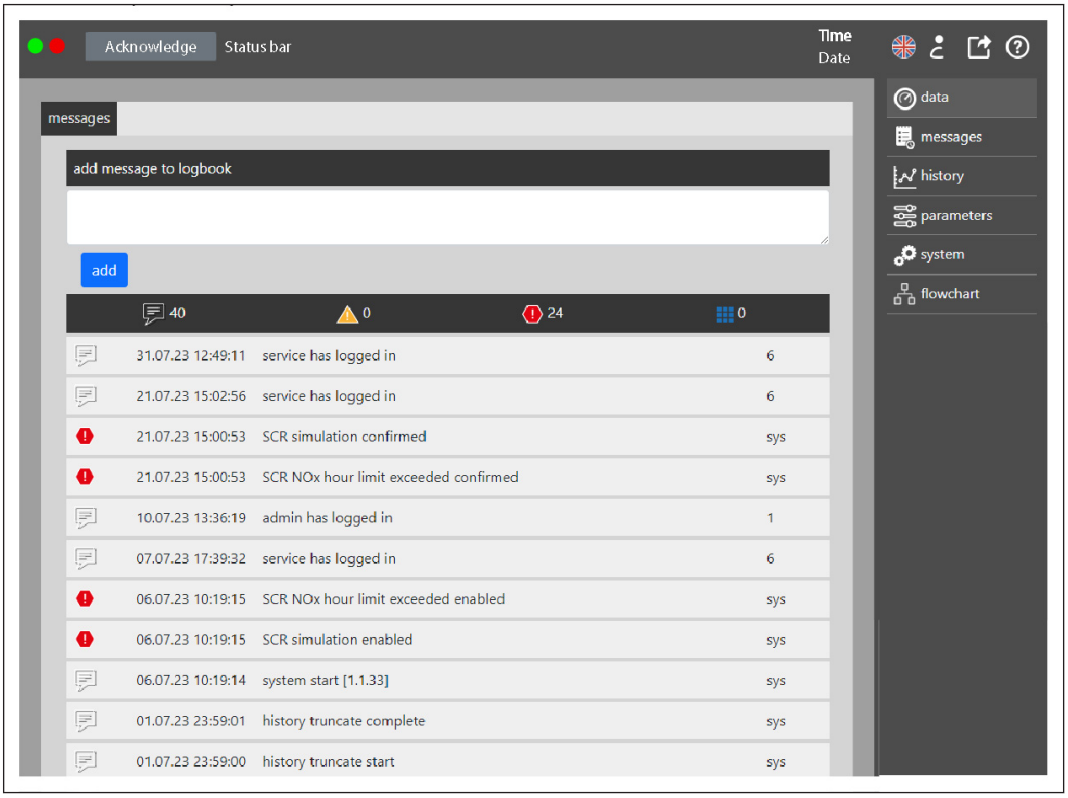
- Insert the USB storage device into the USB port (1) on the EmiBox
- In the display pane (1), check whether the following message appears: `USB Drive connected`
  - Once the USB data storage device is detected, the export begins.
- Wait for the data export to finish
  - The EmiBox display will show the message `USB export complete`.
  - The message `USB export complete` appears in the top status bar of the user interface.
- Unplug the USB data storage device

8.5.7 Updating the logbook

Logged-in users can enter an arbitrary text in the logbook as a message. This message can be used to document maintenance work performed on the catalytic converter.

User interface navigation

- User interface > toolbar > Messages



75976-001 Example illustration

- Login with required authorizations
- Click the `Messages` button in the toolbar
  - The `Messages` tab appears, along with the additional entry field `add message to logbook`.
- Enter user-defined text in the field
- Click the `add` button
  - The text appears in the list.

Further information

- see chapter 4.6.5.1 General 66

8.5.8 Entering a seal number

Authorized personnel can change the seal number in the Messages functional group in the form of a user-defined entry in the logbook.

An appropriate login is required to make the entry.

For more information

- see chapter 4.6.5.1 General 66

8.6 In case of emergency

8.6.1 SCR Control switchgear cabinet

WARNING!

Operator error arising from failure to understand the security concept of the overall plant

This can lead to severe injuries and even death.

- The SCR Control Kit is integrated into an existing plant.
- The main switch on the SCR Control switchgear cabinet is used for self-sufficient supply
  - The power supply for the entire SCR application is plant-specific. Information about this must be obtained from the operator and/or referenced in the circuit diagrams.
  - It is the responsibility of the operator personnel and/or the operator to know the security concept of the overall plant and understand how the SCR Control switchgear cabinet is integrated, and furthermore to conduct themselves accordingly in the event of an emergency.

To switch off the SCR Control switchgear cabinet and/or its control system for the SCR application in an emergency situation:

- Switch off the main switch on the SCR Control switchgear cabinet
  - The SCR Control functionality has been switched off.

Further information

- For more information on the functionality of the main switch, see chapter 8.3.4 Switching off the SCR Control 149

9 Troubleshooting

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9.1 Safety notes

WARNING!

Hazardous system conditions or work situations are possible due to lack of expertise and qualifications

This can lead to severe injuries and even death.

- Only authorized and qualified specialist personnel of the manufacturer or their representative may work on the product.

9.2 Definitions

Message:

A message is an event that serves to provide information and does not require any user action. This can help with troubleshooting, among other things. A possible message can be, for example, the switching on of the generator circuit breaker.

Warning:

Warnings are triggered by, e.g.:

- The limit value of a parametrizable input that has been individually assigned to a warning
- Default, if a 30 min NOx mean value is above the limit value

Alarm:

An alarm alerts the user to an incorrect state of the device. An alarm can indicate, among other things, that

- A daily NOx mean value is above the set limit value
- There is a defective sensor
- A write operation to the SD card is not possible
- The limit value of a parametrizable input has been exceeded.

When factory default settings are on, an alarm does not cause the genset to shut down. If necessary, this can be parametrized separately via a digital output.

Alarms must be acknowledged manually. This can be done either by pressing a button on the EmiBox housing or via a digital input.

9.3 Troubleshooting the EmiBox

9.3.1 Fault messages

Fault message shown on the display	Description	Remedy
SYS setup	Message about system setup/ reset	none
SD not inserted	No SD inserted	Check SD card and insert if necessary
RTC low volt.	Battery low	Renew EmiBox battery buffer
CAN timeout	CAN timeout	Check connection to the NO_x sensor
CAN FMI	CAN sensor error	Check NO_x sensor and renew it if necessary
NOx daily MW exc.	NOx daily mean value exceeded	Contact service partner
NOx LV1	Limit violation on NOX limit 1	Check NO_x values and limit values
NOx LV2	Limit violation on NOX limit 2	Check NO_x values and limit values
TEMP error	Sensor error on temperature sensor	Check temperature sensor and cable
TEMP LV1	Temperature sensor value above/below limit 1	Check limit value and, if necessary, temperature sensor
TEMP LV2	Temperature sensor value above/below limit 2	Check limit value and, if necessary, temperature sensor
AI2 error	Sensor error on analog input 2	Check sensor and cable on analog input
AI2 LV1	Analog input 2 value above/ below limit 1	-
AI2 LV2	Analog input 2 value above/ below limit 2	-
DO1-6 overload	Overload/short circuit at the digital outputs	Check digital outputs for short circuit/excessive load
LOG write error	Error when writing the event log	Contact service partner

Fault message shown on the display	Description	Remedy
HST write error	Error when writing the history	Contact service partner Storage space may be insufficient. If recording of limits is enabled, check the limit. If it is too close to the recorded value, there will be an increased number of entries
AIO read error	Analog input error	* Perform a reboot If error persists, contact service partner.
AIO write error	Analog output error	* Perform a reboot If error persists, contact service partner.
GPIO read error	Error in IO controller	* Perform a reboot If error persists, contact service partner.
GPIO write error	Error in IO controller	* Perform a reboot If error persists, contact service partner.
WD read error	Watchdog error	* Perform a reboot If error persists, contact service partner.
GLS (GCB) timeout	After 20 minutes (warning) or 30 minutes (alarm) have passed since the generator circuit breaker input became active, it is assumed that no plausible NO_x signal is present.	* Perform a reboot If error persists, contact service partner.

* To perform a system reboot, disconnect the voltage supply for at least 60 s to completely discharge the internal voltage stability capacitor.

If the NO_x daily mean value is exceeded, a suitable reference measurement must be performed to check whether the measured values displayed by the EmiBox correspond to the reference measurement. If not, contamination of the NO_x sensor or a sensor error may be the cause of the problem. To ensure the measured values match, it may be necessary to adjust the combustion chamber temperature curve.

Especially within the first 1000 operating hours after an initial commissioning or a fundamental change to the engine (exchange of several cylinder heads, the engine block, etc.), a drift in the emission values is a normal process, which may require a readjustment of the combustion chamber temperature curve.

9.4 SCR Control Kit troubleshooting

Alarm messages on the display and on the user interface support authorized specialist personnel with troubleshooting.

If instructed, it may be necessary in some circumstances to restart the EmiBox. To do this, the EmiBox must be disconnected from the mains for at least 60 seconds.

If the NO_x daily mean value is exceeded, a suitable reference measurement must be performed to check whether the measured values displayed by the EmiBox correspond to the reference measurement. If not, contamination of the NO_x sensor or a sensor error may be the cause of the problem. To ensure the measured values match, it may be necessary to adjust the combustion chamber temperature curve.

Especially within the first 1000 operating hours after an initial commissioning or a fundamental change to the engine (exchange of several cylinder heads, the engine block, etc.), a drift in the emission values is a normal process, which may require a readjustment of the combustion chamber temperature curve.

Dosage implausible

Within a given time (specified internally), the dosing quantity does not match the amount of urea expected for exhaust scrubbing.

This fault can occur due to how the genset is being run at a particular moment in time, or due to the running characteristics of the engine. If the fault occurs after commissioning or after major maintenance, check the dosing limit and the characteristic curve.

Procedure:

- Check how the engine is running
- Check raw emissions
- Have authorized specialist personnel check control parameters, dosing limits and downtime

Type	Text	Description	Remedy
Message	3-way valve: 1	3-way valve position BC	not required
Message	3WV Urea Injection: 0	Urea injection switched off	not required
Message	3WV Urea Injection: 1	Urea injection switched on	not required
Message	"User" has logged off	-	not required
Message	"User" has logged in	-	not required
Alarm	AI2 sensor error enabled	The recorded value is outside the measurement range (4 - 20 mA)	Check current Check cabling Check sensor
Alarm	AI2 sensor error confirmed	-	-
Alarm	AI2 sensor error disabled	-	-
Alarm	CAN timeout enabled	-	-
Alarm	CAN timeout confirmed	-	-
Alarm	DL disk write error enabled	The data logger could not write to the USB drive	Check connection on EmiBox and USB drive Check available storage space on the USB drive Check USB drive format

Type	Text	Description	Remedy
Alarm	DL disk write error confirmed	-	-
Alarm	DL drive write error disabled	-	-
Alarm	DL modbus data error enabled	The requested Modbus address is not available on the target device	Check address setting Check IP address and port setting Check whether the target device is only being queried by the data logger Check whether the adjacent address (registry number +/- 1) is available Reboot EmiBox
Alarm	DL modbus data error confirmed	-	-
Alarm	DL modbus data error disabled	-	-
Alarm	DL modbus connection error confirmed	The Modbus node rejected or did not confirm the connection	Check IP address and port setting Check whether the target device is only being queried by the data logger Reboot EmiBox
Alarm	DL modbus connection error disabled	-	-
Alarm	DO1-6 overload enabled	-	-
Alarm	GLS (GCB) timeout confirmed	-	-
Message	GLS (GCB): 0	-	not required
Message	GLS (GCB): 1	-	not required
Message	Compressor enabled: 0	The compressor was switched off	not required
Message	Compressor enabled: 1	The compressor was switched on	not required
Alarm	History truncate complete	-	-
Alarm	NOx daily mean exceeded confirmed	The daily mean value exceeds the programmed permissible limit.	Check daily mean value limit in the user interface Navigation: Parameter > NOx sensor) Check NO_x setpoint in the user interface Navigation: Characteristic curve > Setpoint NOx
Message	SCR CAT feedback: 1	-	not required

Type	Text	Description	Remedy
Alarm	SCR emergency venting enabled	The urea pressure between the dosing pump and 3-way valve is too high	Check cabin ventilation; the enclosed medium may have expanded too much Modify parameters in the user interface if necessary Navigation: Parameter > SCR System > Dosing pump: Emergency pressure vent or Continuous emergency vent
Alarm	SCR emergency venting confirmed	-	-
Alarm	SCR emergency venting disabled	-	-
Alarm	SCR exhaust temperature high enabled	The temperature in the exhaust train is too high. Damage to the catalytic converter is possible	Check exhaust temperature or sensor Decrease exhaust temperature Check catalytic converter temperature from data sheet.
Alarm	SCR exhaust temperature high confirmed	-	-
Alarm	SCR exhaust temperature high disabled	-	-
Alarm	SCR exhaust temperature low enabled	The temperature in the exhaust train is too low. No SCR function	Check exhaust temperature or sensor
Alarm	SCR exhaust temperature low confirmed	-	-
Alarm	SCR exhaust temperature low disabled	-	-
Message	SCR active: 0	The SCR closed-loop control or open-loop control is not active	not required
Message	SCR active: 1	The SCR closed-loop control or open-loop control is active.	not required
Alarm	SCR dosage implausible enabled	-	-
Alarm	SCR dosage implausible confirmed	-	-
Alarm	SCR dosage implausible disabled	-	-

Type	Text	Description	Remedy
Alarm	SCR dosage pump fault enabled	There is a fault with the dosing pump. For more information, refer to the display for the dosing pump.	If the pump shuts off due to overpressure, the overlap time between the pumps and the valve may be the cause.
Alarm	SCR dosage pump fault confirmed	-	-
Alarm	SCR dosage pump fault disabled	-	-
Alarm	SCR exhaust outlet pressure fault enabled	The recorded value is outside the measurement range (4 - 20 mA)	Check current Check cabling Check sensor
Alarm	SCR exhaust outlet pressure fault confirmed	-	-
Alarm	SCR exhaust outlet pressure fault disabled	-	-
Alarm	SCR exhaust inlet pressure fault enabled	The recorded value is outside the measurement range (4 - 20 mA)	Check current Check cabling Check sensor
Alarm	SCR exhaust inlet pressure fault confirmed	-	-
Alarm	SCR exhaust inlet pressure fault disabled	-	-
Alarm	SCR reservoir pressure low enabled	The value measured in the pressure vessel is below the minimum pressure	Check pressure Check routing of hoses Search for leaks Test non-return valve
Alarm	SCR reservoir pressure low confirmed	-	-
Alarm	SCR reservoir pressure low disabled	-	-
Alarm	SCR reservoir pressure sensor fault enabled	The recorded value is outside the measurement range (4 - 20 mA)	Check current Check cabling Check sensor
Alarm	SCR reservoir pressure sensor fault confirmed	-	-
Alarm	SCR reservoir pressure sensor fault disabled	-	-
Alarm	SCR compressor pressure low enabled	The value measured in the compressed air system is below the minimum pressure	Check pressure Check routing of hoses Search for leaks Test non-return valve
Alarm	SCR compressor pressure low confirmed	-	-

Type	Text	Description	Remedy
Alarm	SCR compressor pressure low disabled	-	-
Alarm	SCR compressor pressure sensor fault enabled	The recorded value is outside the measurement range (4 - 20 mA)	Check current Check cabling Check sensor
Alarm	SCR compressor pressure sensor fault confirmed	-	-
Alarm	SCR compressor pressure sensor fault disabled	-	-
Alarm	SCR urea tank level low enabled	The urea fill level falls below the minimum level stored in the parameters	Check tank level, refill if necessary
Alarm	SCR urea tank level low confirmed	-	-
Alarm	SCR urea tank level low disabled	-	-
Alarm	SCR urea pressure low enabled	The urea system pressure is too low	Check pressure Check routing of hoses Search for leaks Test dosing pump
Alarm	SCR urea pressure low confirmed	-	-
Alarm	SCR urea pressure low disabled	-	-
Alarm	SCR urea pressure sensor fault enabled	The recorded value is outside the measurement range (4 - 20 mA)	Check current Check cabling Check sensor
Alarm	SCR urea pressure sensor fault confirmed	-	-
Alarm	SCR urea pressure sensor fault disabled	-	-
Alarm	SCR compressor motor trip enabled	The motor circuit breaker or its auxiliary contact tripped	Check motor circuit breaker Check auxiliary contact Check cabling When commissioning, invert signal in parameters if necessary
Alarm	SCR compressor motor trip confirmed	-	-
Alarm	SCR compressor motor trip disabled	-	-
Alarm	SCR modbus ai communication error confirmed	The EmiBox cannot reach the distributed IO devices at the specified IP address	Check network topology and cabling. Check IP addresses of card and EmiBox.

Type	Text	Description	Remedy
Alarm	SCR modbus ao communication error confirmed	The EmiBox cannot reach the distributed IO devices at the specified IP address	Check network topology and cabling. Check IP addresses of card and EmiBox.
Alarm	SCR modbus dio communication errorconfirmed	The EmiBox cannot reach the distributed IO devices at the specified IP address	Check network topology and cabling. Check IP addresses of card and EmiBox.
Alarm	SCR modbus communication error confirmed	-	-
Alarm	SCR generator power sensor fault enabled	The recorded value is outside the measurement range (4 - 20 mA)	Check current Check cabling Check sensor
Alarm	SCR generator power sensor fault confirmed	-	-
Alarm	SCR generator power sensor fault disabled	-	-
Alarm	SCR NOx daily average exceeded enabled	The measured NO_x values exceed the permissible limit for the recording day	Can occur during very short operational phases: see log. SCR system, settings and gas engine must be checked by authorized specialist personnel.
Alarm	SCR NOx hour limit exceeded enabled	The specified maximum permissible over-limit hours have been exceeded	SCR system, settings and gas engine must be checked by authorized specialist personnel.
Alarm	SCR NOx hour limit exceeded confirmed	-	-
Alarm	SCR NOx hour limit exceeded disabled	-	-
Alarm	SCR tank sensor fault enabled	The recorded value is outside the measurement range (4 - 20 mA)	Check current Check cabling Check sensor
Alarm	SCR tank sensor fault confirmed	-	-
Alarm	SCR tank sensor fault disabled	-	-
Message	Service has logged off	-	not required
Message	Service has logged in	-	not required
Alarm	History truncate start	-	-
Alarm	SYS system setup enabled	-	-
Alarm	SYS system setup confirmed	-	-

Type	Text	Description	Remedy
Alarm	SYS system setup disabled	-	-
Alarm	System rebooting	A manual system reboot was initiated	not required
Alarm	TEMP sensor error enabled	The recorded value is outside the measurement range (4 - 20 mA)	Check current Check cabling Check sensor
Alarm	TEMP sensor error confirmed	-	-
Alarm	USB drive attached enabled	A USB drive is connected with the EmiBox	not required
Alarm	USB drive attached confirmed	-	-
Alarm	USB drive attached disabled	-	-
Message	USB export complete confirmed	Automatic export to the USB data storage device is complete. User interface navigation: System > Module data	-

10 Maintenance

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10.1 Safety notes

WARNING!

Hazardous system conditions or work situations are possible due to lack of expertise and qualifications

This can lead to severe injuries and even death.

- Only authorized and qualified specialist personnel of the manufacturer or their representative may work on the product.

10.2 EmiBox and sensor kit maintenance and inspection schedule

All the maintenance work that is required for fault-free operation is summarized in the maintenance schedule. The maintenance and inspection schedule applies to both flex operation and continuous operation.

Note

Care must be taken to protect the seal whenever work is performed on the catalytic converter.

Any change to the exhaust system must be entered in the logbook. This also includes cleaning or replacing the catalytic converter, as well as sealing the catalytic converter.

If the seal is damaged, see chapter 6.9 Seals on catalytic converters 138.

Assembly, maintenance, and repair tasks are mandatory.

The work may be carried out by personnel who meet the following minimum requirements:

OL (CL1)	maintenance activities for which the operating personnel must have the minimum requirement Operator Level (OL)
BL (CLQ)	assembly and repair activities for which the service personnel must have the minimum requirement BOP Specialist Level (BL)
SL (CL2)	maintenance and repair activities for which the service personnel must have the minimum requirement Service Level (SL)

For required information on the safety regulations, see

- Operating Manual ⇒ General ⇒ Safety regulations
  - Safety and Product Information Specification

Maintenance work	Interval	CL
Calibrate NO_x sensor	6 mos or 4000 h*	SL
Renew NO_x sensor Gas quality: High Gas quality: Medium and Low	 2 yrs or 8000 h* 1 yr or 4000 h*	SL
Renew EmiBox buffer battery	5 yrs	SL
Renew EmiBox SD card	5 yrs	SL
* whichever occurs first h = hours, mos = months, yrs = years		

10.3 SCR Control Kit maintenance schedule

All the maintenance work that is required for fault-free operation is summarized in the maintenance schedule. The maintenance and inspection schedule applies to both flex operation and continuous operation.

The maintenance schedule only applies for the SCR Control Kit. The maintenance and inspection schedule for the respective SCR application at the site also applies.

Note

Care must be taken to protect the seal whenever work is performed on the catalytic converter.

Any change to the exhaust system must be entered in the logbook. This also includes cleaning or replacing the catalytic converter, as well as sealing the catalytic converter.

If the seal is damaged, see chapter 6.9 Seals on catalytic converters 138.

Assembly, maintenance, and repair tasks are mandatory.

The work may be carried out by personnel who meet the following minimum requirements:

OL (CL1)	maintenance activities for which the operating personnel must have the minimum requirement Operator Level (OL)
BL (CLQ)	assembly and repair activities for which the service personnel must have the minimum requirement BOP Specialist Level (BL)
SL (CL2)	maintenance and repair activities for which the service personnel must have the minimum requirement Service Level (SL)

For required information on the safety regulations, see

- Operating Manual ⇒ General ⇒ Safety regulations
  - Safety and Product Information Specification

Maintenance work	Interval	CL
Visually inspect SCR Control switchgear cabinet and cables leading to the switchgear cabinet for damage.	Monthly	OL
Perform checks in and on the SCR Control switchgear cabinet cable inlets, cabinet door with lock, fittings, ventilation, electrical cables, connections, contacts, etc. Check functionality.	With other switchgear cabinets	BL
Check NO_x minimum (low point) and modify parameters if necessary. If this does not produce the desired value, check SCR system.	3 mos or 2000 h*	SL

Maintenance work	Interval	CL
Check open-loop control and closed-loop control of the NO_x value as a function of characteristic curve and PID settings. Reconfigure if necessary.	Any time the NO_x sensor is serviced or calibrated	SL
* whichever occurs first h = hours, mos = months, yrs = years		

11 Dismantling and disposal

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11.1 Safety notes

WARNING!

Hazardous system conditions or work situations are possible due to lack of expertise and qualifications

This can lead to severe injuries and even death.

- Only authorized and qualified specialist personnel of the manufacturer or their representative may work on the product.