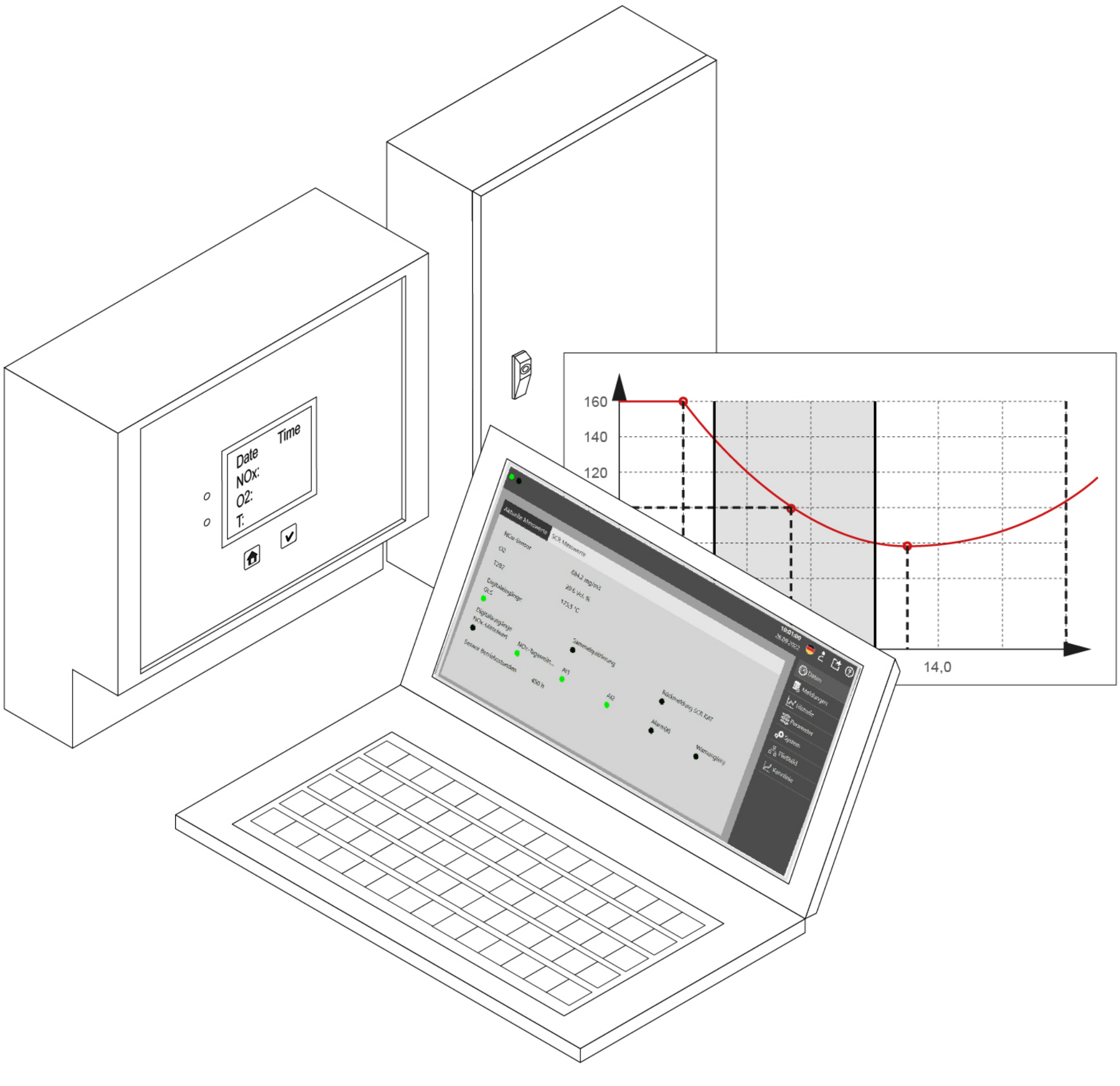
EmiBox

SCR Control Kit and NO_x Sensor Kit
Operating manual
1240 6894 EN 2023-12
Competence level SL or
Competence level CL 2



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

Table of contents

1 Information about this manual

Table of contents

353-003-EN : 51000010 : BA : VAR, COV, IMP, B, BA, BS, DEM, EIN, IBN, IST, WP, SK, MH, SB, STB, TA, TL

1.1 Introduction

1.1.1 Target audience

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

- Working as Qualified specialist personnel
- Possess knowledge and skills corresponding to Service Level (SL)

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 Target audience

This document is intended for authorized specialist personnel with the qualification competence level CL 2. Only authorized specialist personnel may perform the described activities.

For further information on the requirements and qualifications of the authorized specialist personnel, see

- Operating Manual ⇒ General ⇒ Safety regulations
  – Personnel – Qualifications and Duties

1.1.3 Validity

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

1.1.4 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.

1.1.5 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.

1.1.6 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

1.1.7 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.

1.1.8 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.

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

The document is protected by copyright and exclusively designed for in-house purposes.

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

Contraventions necessitate compensation. Rights to other claims remain reserved.

353-003-EN : 51000010 : BA : VAR, COV, IMP, B, BA, BS, DEM, EIN, IBN, IST, WP, SK, MH, SB, STB, TA, TL

1.3 Feedback on documentation

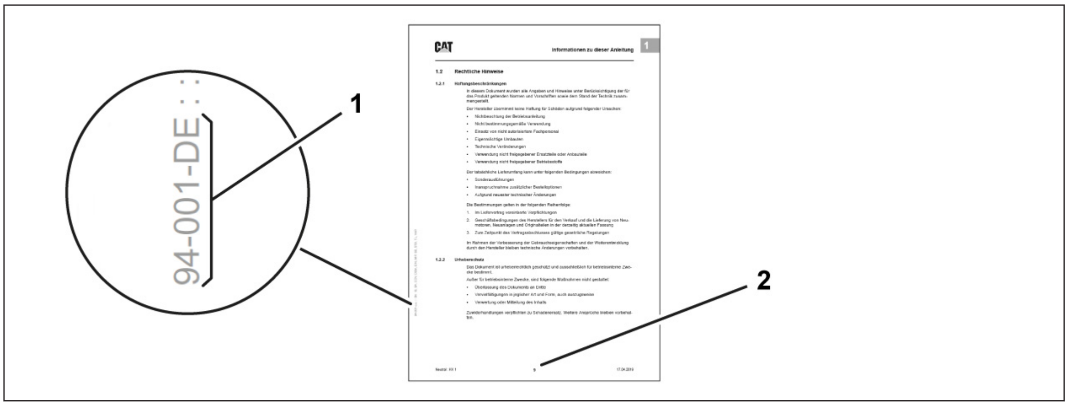
Do you have any praise, criticism or suggestions for improvement for this document?

Send an e-mail to techred@mwm.net.

Describe your request as precisely as possible.

So that we can allocate your feedback, please also provide the following information:

- Document number (1)
- Page number (2)
- Contact data (name, email) for potential further enquiries



71842-002

Thank you for your support. We read all feedback carefully.

We look forward to hearing from you!

353-003-EN : 51000010 : BA : VAR, COV, IMP, B, BA, BS, DEM, EIN, IBN, IST, WP, SK, MH, SB, STB, TA, TL

2 Safety

Table of contents

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

353-003-EN : 51000010 : BA : VAR, COV, IMP, B, BA, BS, DEM, EIN, IBN, IST, WP, SK, MH, SB, STB, TA, TL

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

353-003-EN : 51000010 : BA : VAR, COV, IMP, B, BA, BS, DEM, EIN, IBN, IST, WP, SK, MH, SB, STB, TA, TL

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

Particular care must be taken when working near the edge of the roof:

- Attach fall protection harnesses at suitable points
- 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 product may only be carried out by the service personnel of the manufacturer or their representative, taking into account the regional connection conditions and regulations.

An improperly connected product can result in property damage and personal injury of all kinds.

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

353-003-EN : 51000010 : BA : VAR, COV, IMP, B, BA, BS, DEM, EIN, IBN, IST, WP, SK, MH, SB, STB, TA, TL

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.

353-003-EN : 51000010 : BA : VAR, COV, IMP, B, BA, BS, DEM, EIN, IBN, IST, WP, SB, SK, MH, SB, STB, TA, TL

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 the condensate in a suitable container and dispose of it in an environmentally friendly manner or feed it into a neutralization vessel, if available.

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 the eyes come into contact with urea solution, rinse eyes at an eye wash station. Wash off affected areas of the skin.

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.

353-003-EN : 51000010 : BA : VAR, COV, IMP, B, BA, BS, DEM, EIN, IBN, IST, WP, SK, MH, SB, STB, TA, TL

Explosion

Gas blowout

When installing the product, work may be carried out in the vicinity of the fuel gas system. Depending on the plant design, the fuel gas system may be equipped with an outlet line that terminates in a gas blowout. 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 outlet line and gas blowout inert (purge it).

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.

353-003-EN : 51000010 : BA : VAR, COV, IMP, B, BA, BS, DEM, EIN, IBN, IST, WP, SK, MH, SB, STB, TA, TL

3 Technical data and rating plates

Table of contents

353-003-EN : 51000010 : BA : VAR, COV, IMP, B, BA, BS, DEM, EIN, IBN, IST, WP, SK, MH, SB, STB, TA, TL

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 connec-tions

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

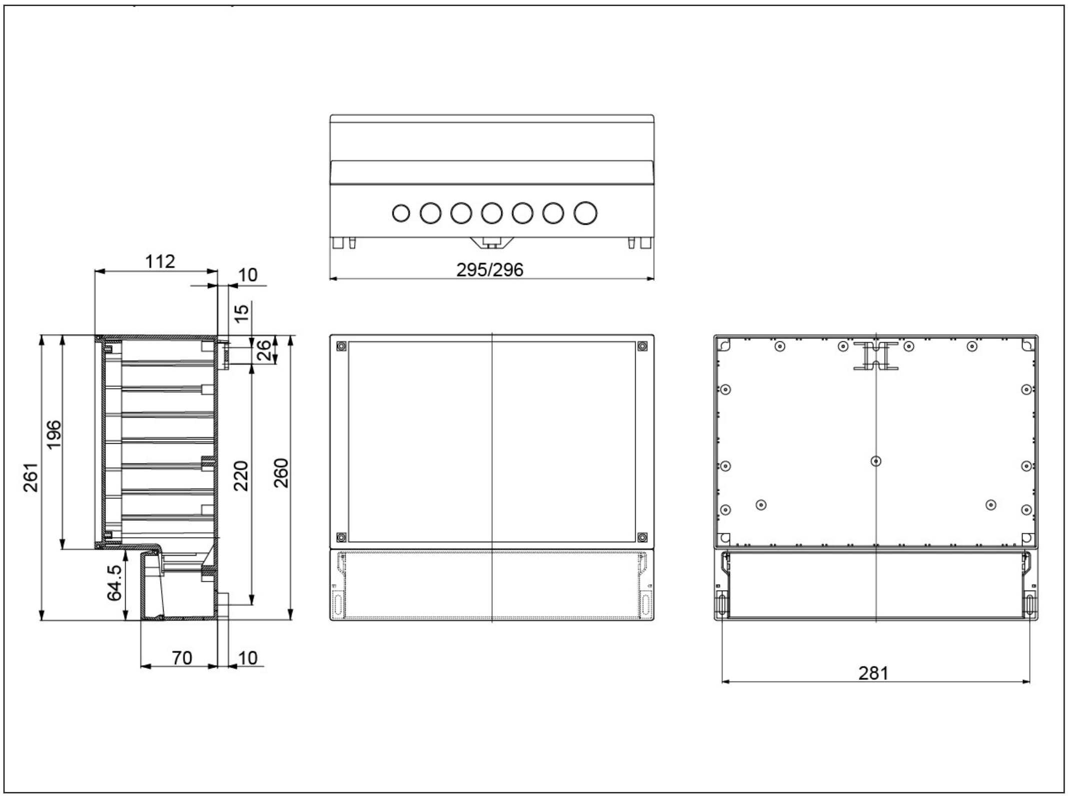
3.1.4 Approvals and guidelines

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

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

353-003-EN : 51000010 : BA : VAR, COV, IMP, B, BA, BS, DEM, EIN, IBN, IST, WP, SK, MH, SB, STB, TA, TL

3.1.5 Dimensions

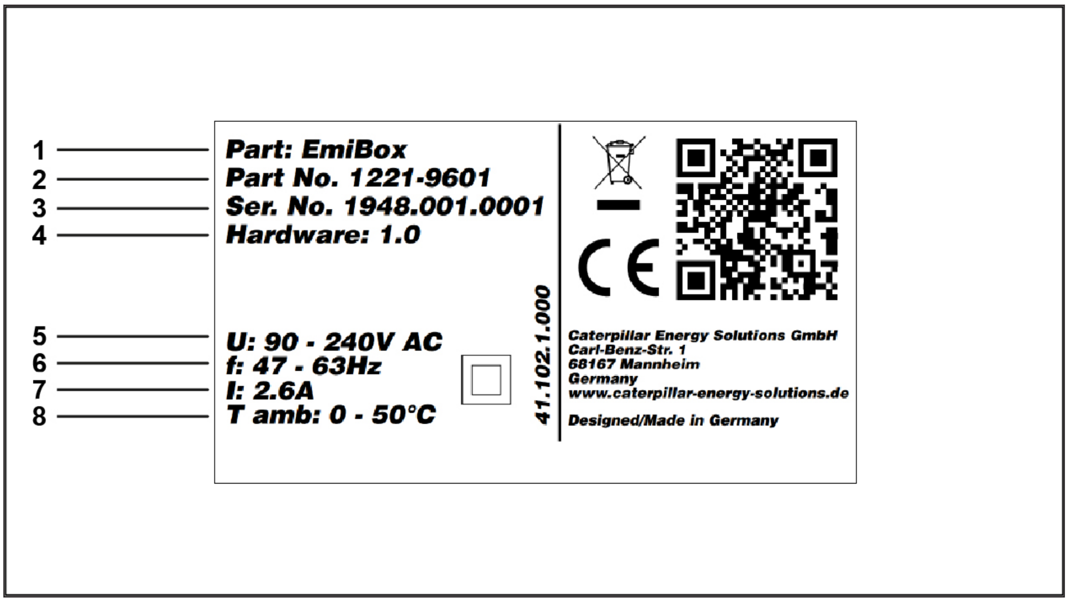


75966-001 EmiBox dimensions

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

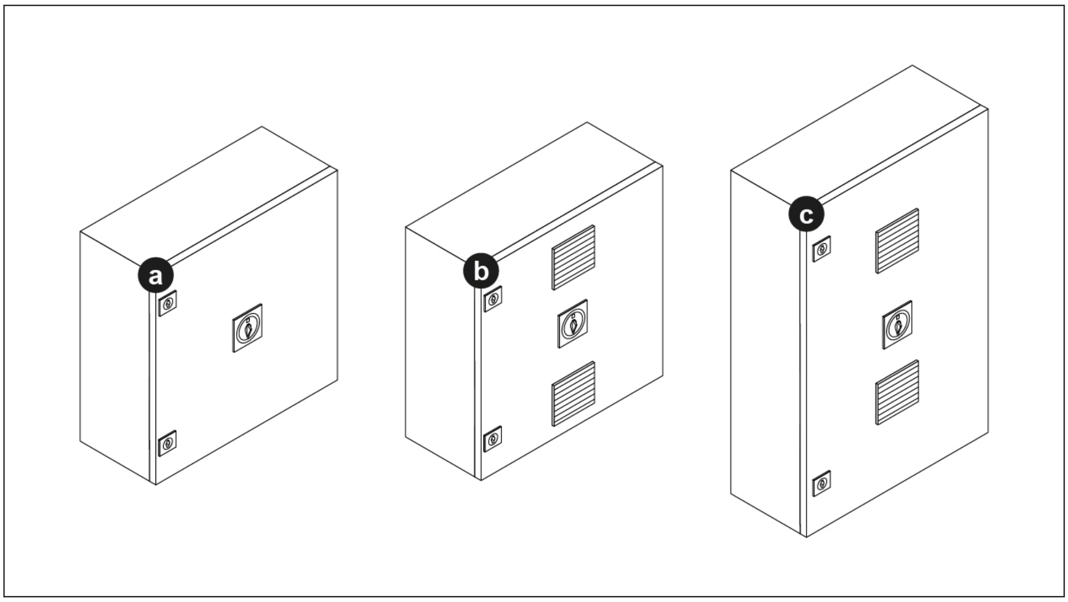
Designation	Ambient condition
Operating temperature	-40 °C to +80 °C

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

353-003-EN : 51000010 : BA : VAR, COV, IMP, B, BA, BS, DEM, EIN, IBN, IST, WP, SK, MH, SB, STB, TA, TL

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

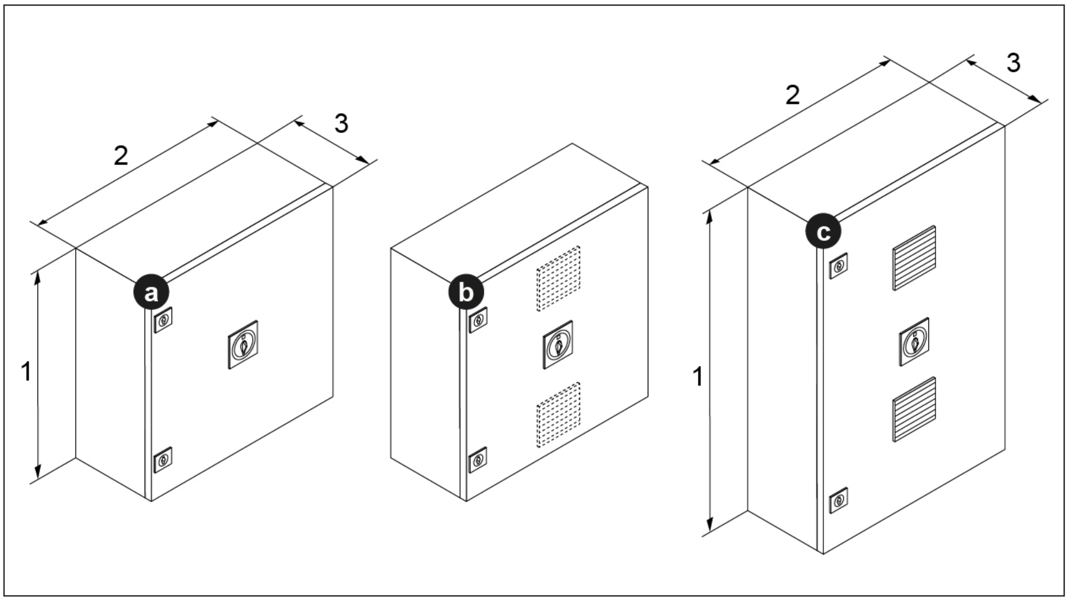
Type (c)

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

Table of contents

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:

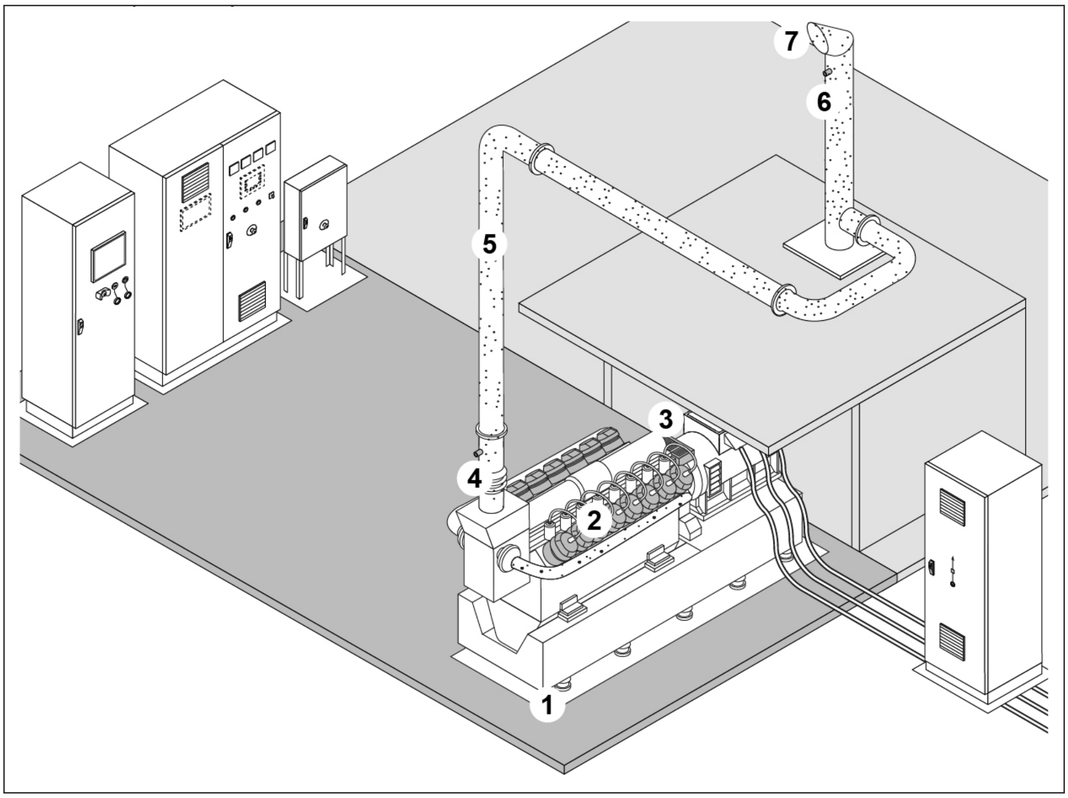
- Exhaust gas measurement connection pieces for analyzing the combustion exhaust gases from the gas engine
- Exhaust gas measurement connection pieces for analyzing the exhaust gas scrubbing system

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.

353-003-EN : 51000010 : BA : VAR, COV, IMP, B, BA, BS, DEM, EIN, IBN, IST, WP, SK, MH, SB, STB, TA, TL



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

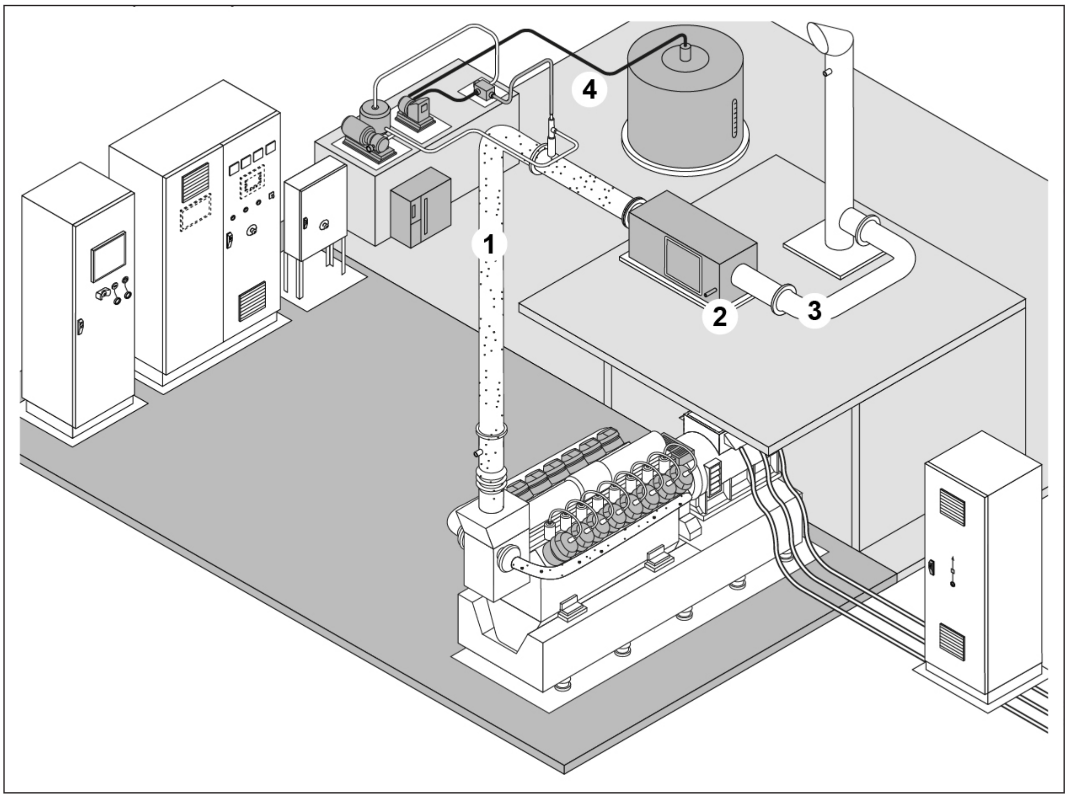
6 Exhaust gas measurement connection piece before flue outlet, e.g. for verification measurements

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

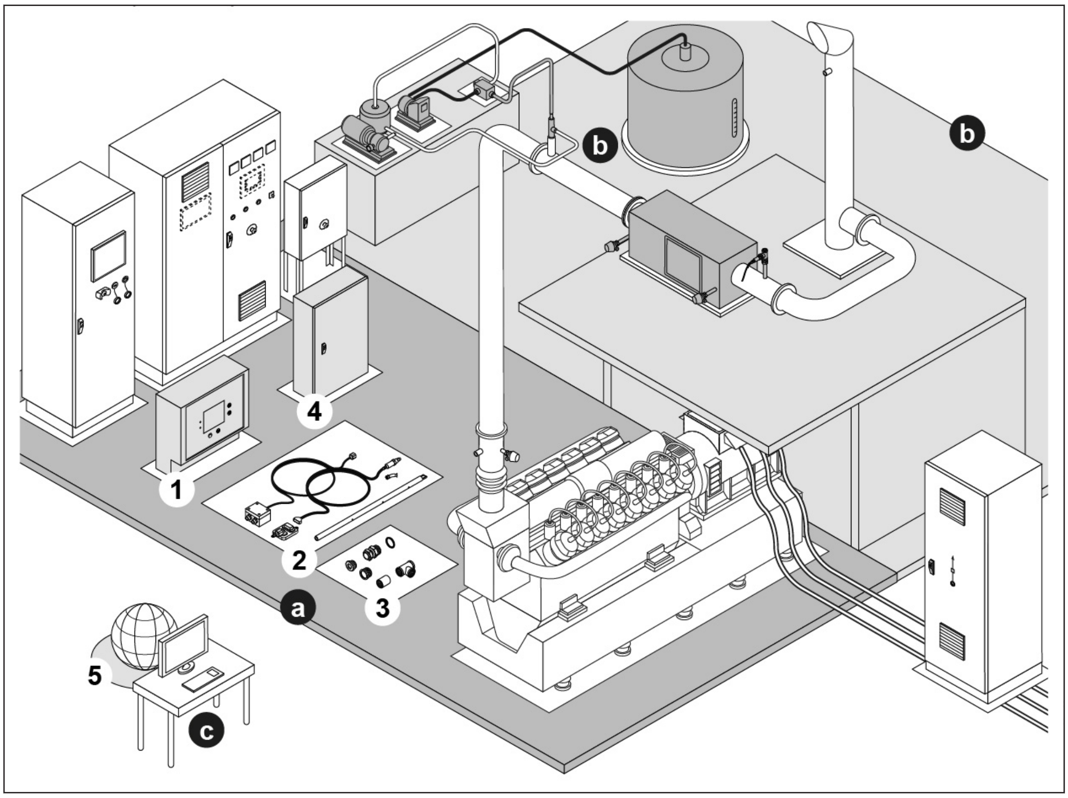
The EmiBox with SCR Control Kit is the base system (a) for monitoring of NO_x emissions and control of SCR applications (b) for exhaust gas treatment with SCR technology. An integrated interface offers the operator (c) to relevant operating data.

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

353-003-EN : 51000010 : BA : VAR, COV, IMP, B, BA, BS, DEM, EIN, IBN, IST, WP, SK, MH, SB, STB, TA, TL

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

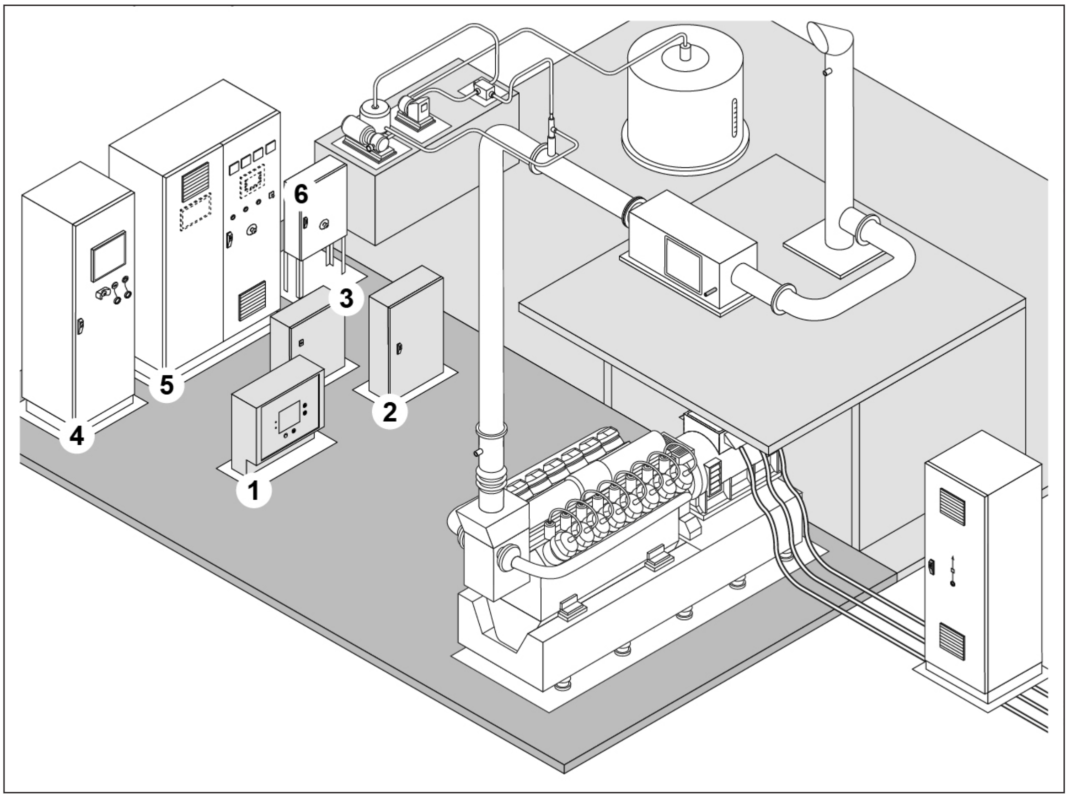
- Responsible service partner

353-003-EN : 51000010 : BA : VAR, COV, IMP, B, BA, BS, DEM, EIN, IBN, IST, WP, SK, MH, SB, STB, TA, TL

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

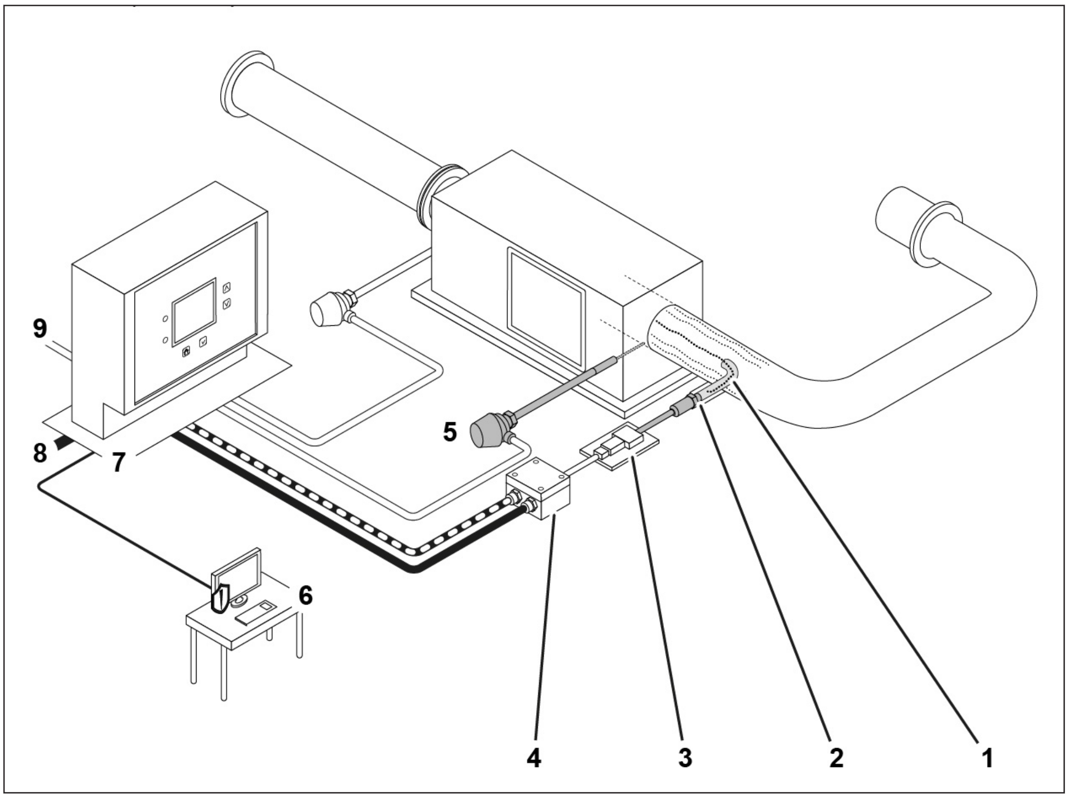
4.3 Monitoring with EmiBox

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.

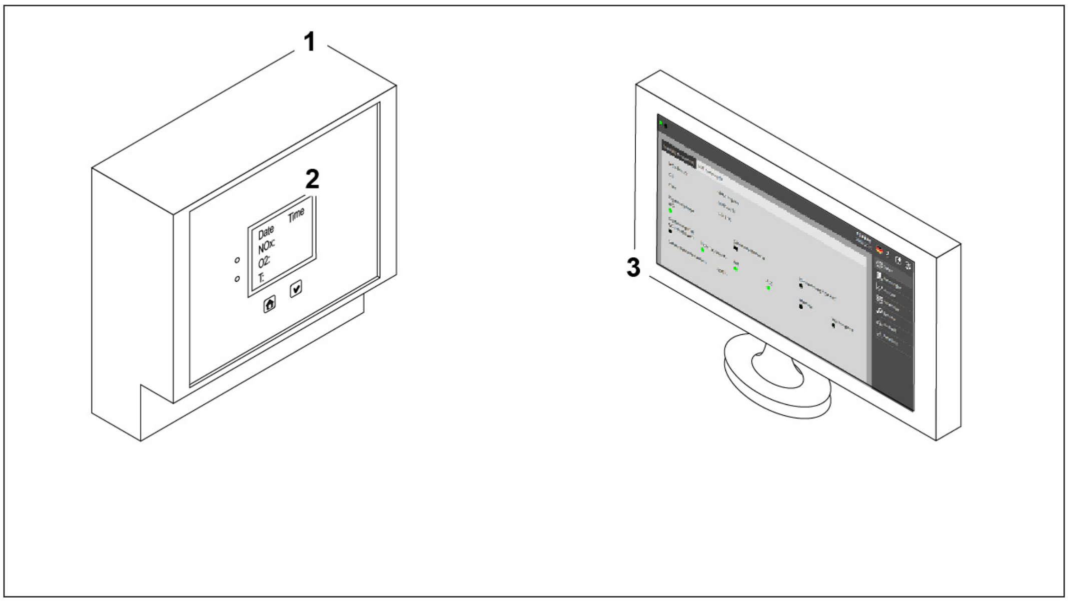
Internally, the EmiBox has a motherboard with:

- 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

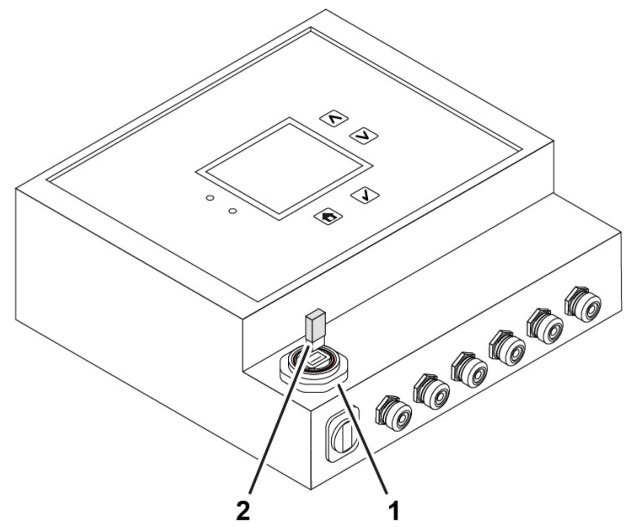
2 Display

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

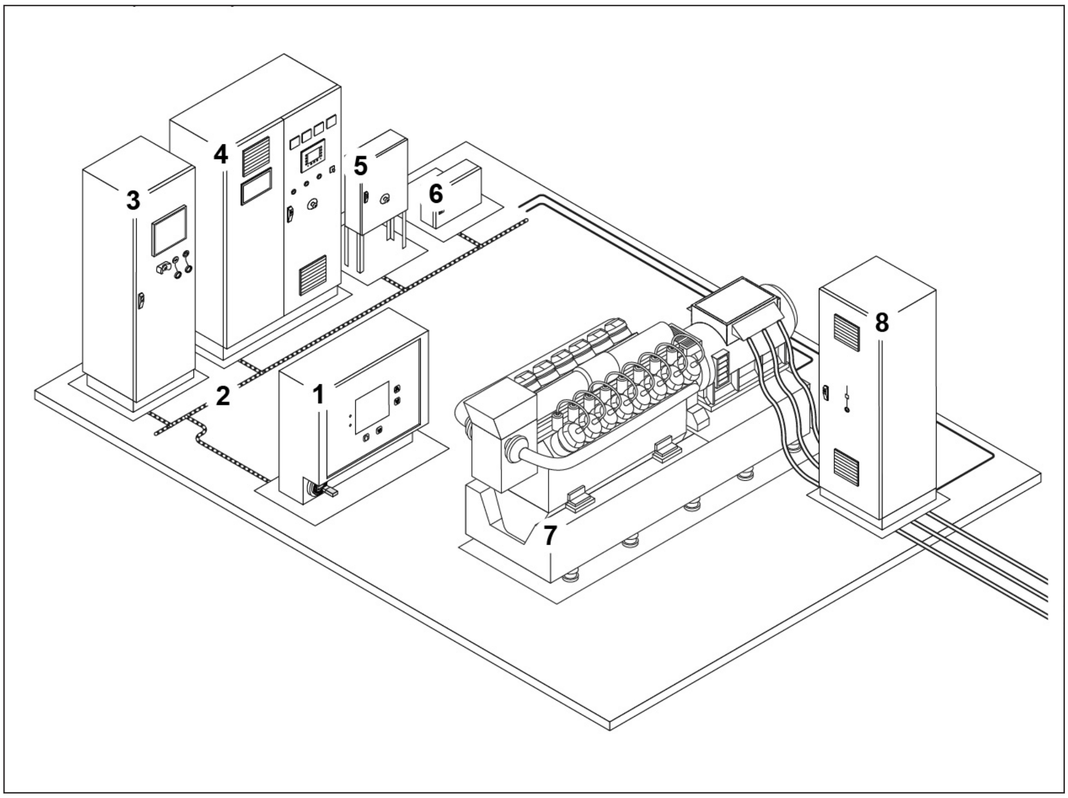
Additional information on the USB connection and its availability

- Responsible service partner

4.3.3 Monitoring with the datalogger

EmiBox as Modbus node

The EmiBox is integrated into the control system of the genset via its Modbus TCP connection. The datalogger function enables targeted data exchange between the EmiBox and the various nodes in the network.



76144-001 Example illustration of datalogger

1 EmiBox with USB connection

2 Modbus TCP

3 TPEM Control Cabinet (TPEM CC) with TPEM system

4 Auxiliary cabinet (HAS)

5 Genset control cabinet (AGS) on TEM system with signal converter if necessary

6 External component with Modbus TCP

7 Genset with signal exchange TEM/TPEM system

8 Generator circuit breaker cabinet (GLF) with signal exchange TEM/TPEM system

The datalogger as a monitoring tool

In addition to data exchange, the EmiBox can also archive data to a USB storage device at predefined intervals if a USB port is installed. This opens up many possibilities for signal monitoring, for example:

- Signals from the exhaust system
- Recording combustion chamber temperatures
- Measured values on the generator circuit breaker
- ...

353-003-EN : 51000010 : BA : VAR, COV, IMP, B, BA, BS, DEM, EIN, IBN, IST, WP, SK, MH, SB, STB, TA, TL

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

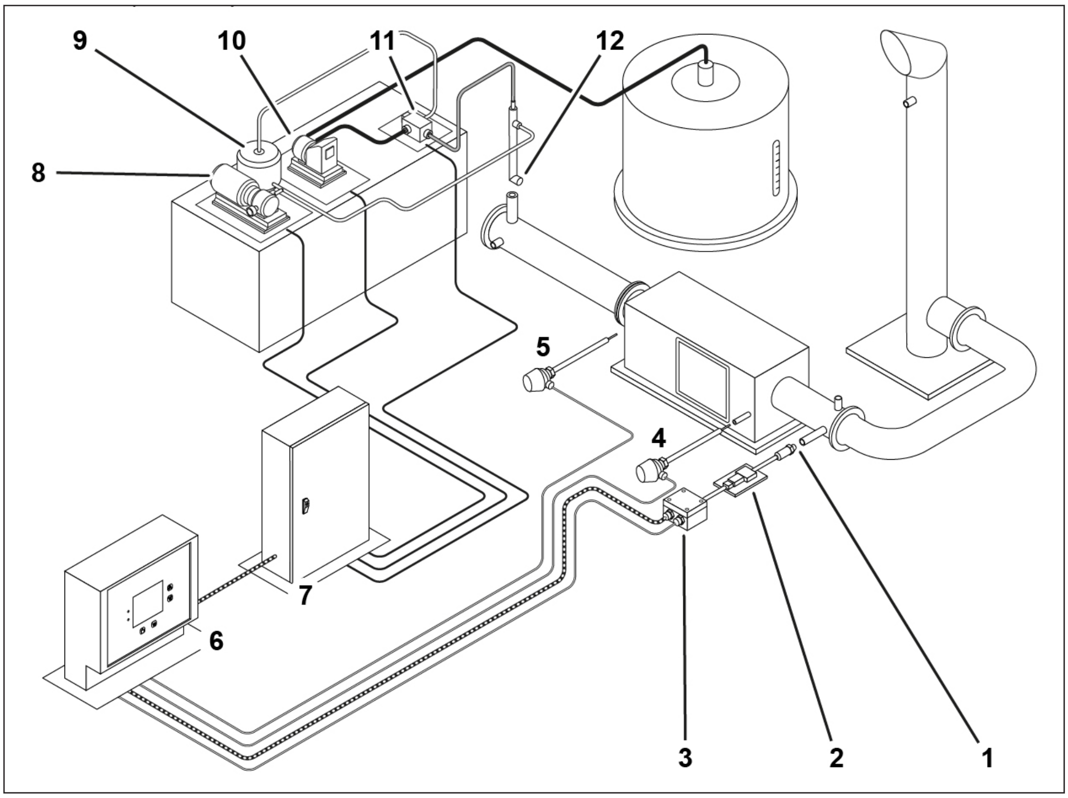
The exhaust treatment with SCR technology reduces nitrous oxides (NO_x) with a dosed injection (11) of urea-air mixture into the hot exhaust stream. The urea-air mixture is generated by the compressed air unit (8) and the urea dosing unit (10). The quantity of urea injected therefore depends on the measured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

353-003-EN : 51000010 : BA : VAR, COV, IMP, B, BA, BS, DEM, EIN, IBN, IST, WP, SK, MH, SB, STB, TA, TL



75574-001 Example illustration

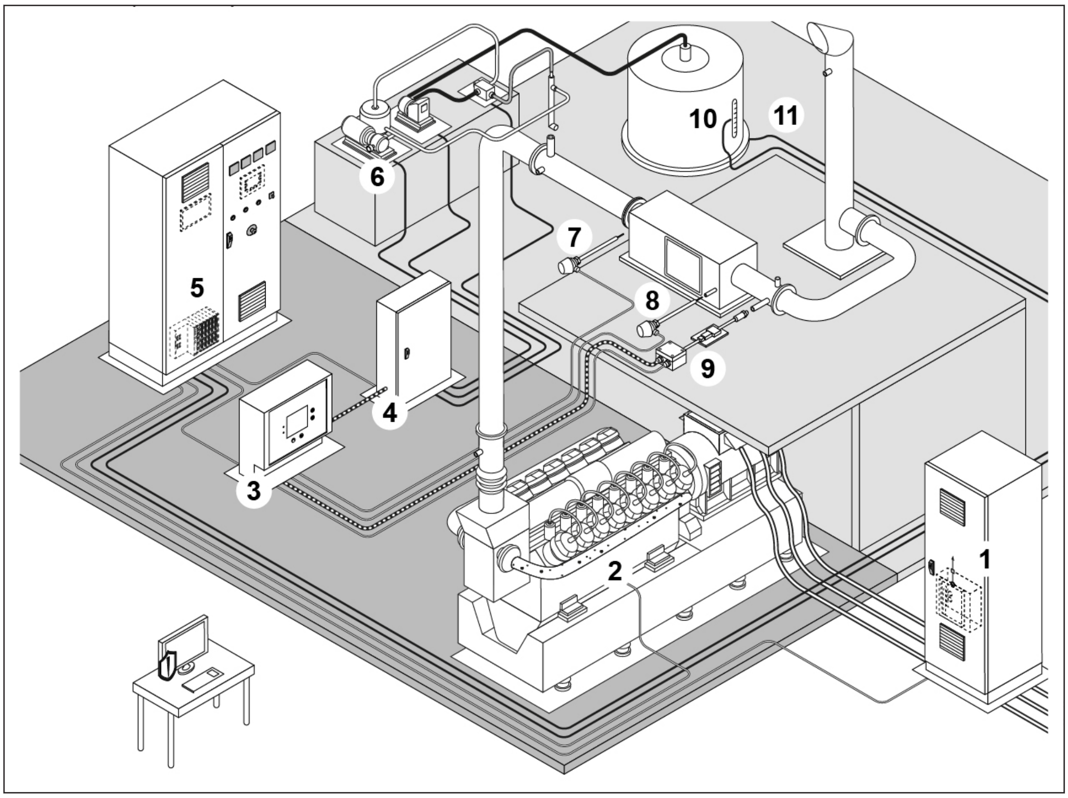
1	NO_x sensor
2	Control device for NO_x sensor
3	Terminal box
4	Temperature sensor downstream of catalytic converter
5	Temperature sensor upstream of catalytic converter
6	EmiBox with PID controller
7	SCR Control switchgear cabinet, the interface to the injection unit
8	Compressed air unit
9	Compressed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

353-003-EN : 51000010 : BA : VAR, COV, IMP, B, BA, BS, DEM, EIN, IBN, IST, WP, SK, MH, SB, STB, TA, TL

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

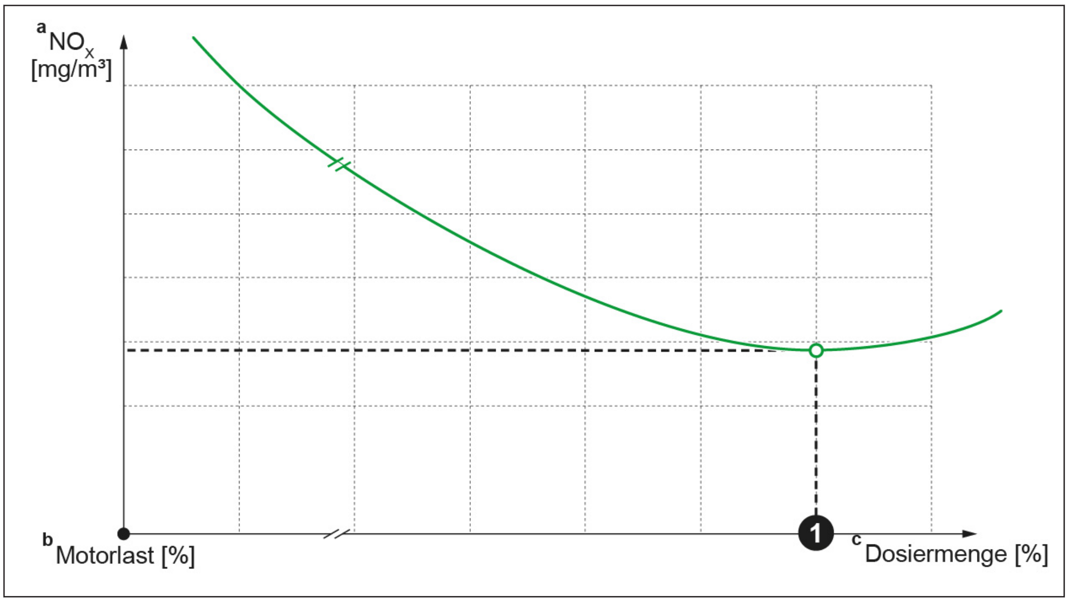
Exhaust temperature

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 NOx [mg/m^3]

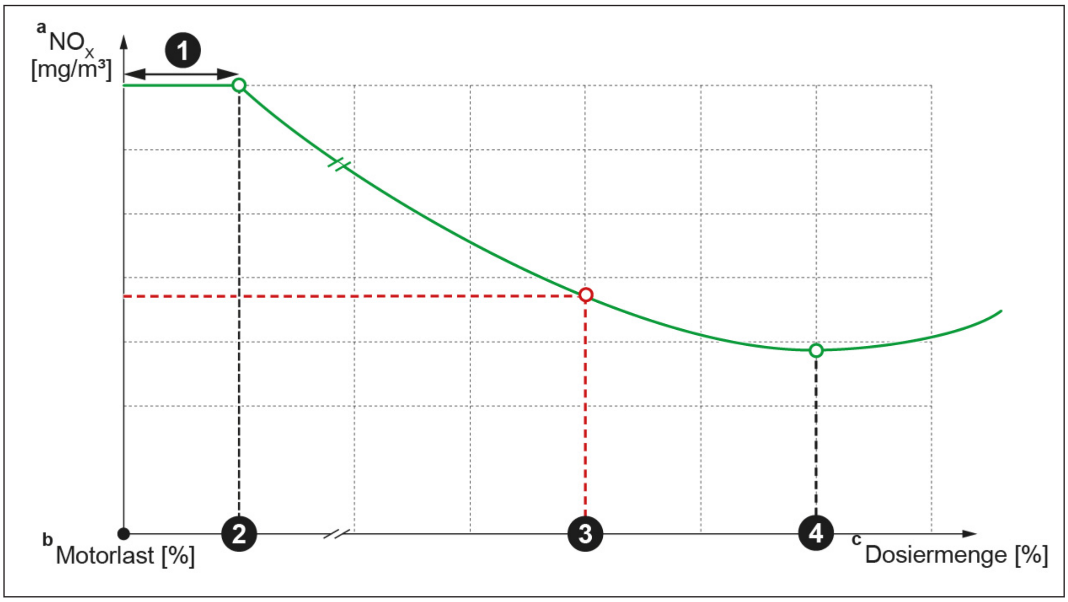
a	NO_x [mg/m^3]
b	Engine load [%]
c	Dosing quantity [%]
1	Minimum

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.

353-003-EN : 51000010 : BA : VAR, COV, IMP, B, BA, BS, DEM, EIN, IBN, IST, WP, SK, MH, SB, STB, TA, TL



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

a NO$_x$ [mg/m^3]

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 52

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`

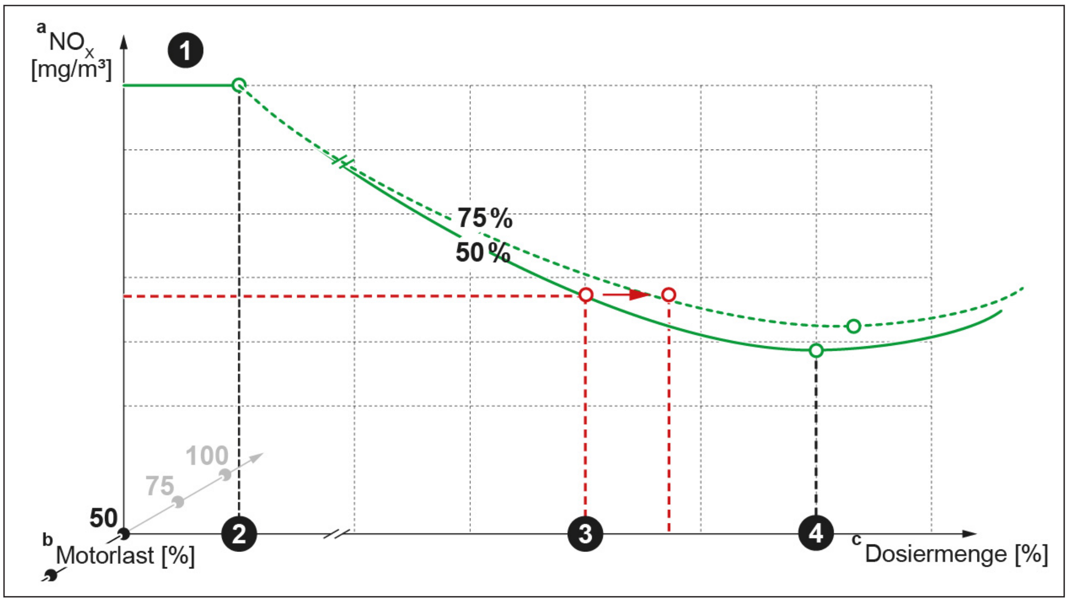
As described above, there is an optimal minimum in the NO_x value for a plant-specific dosing amount. Beyond this dosing amount (NO_x minimum), further increasing the amount will cause an undesired reaction in the SCR catalytic converter, i.e. a rise in the NO_x value.

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 52

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.

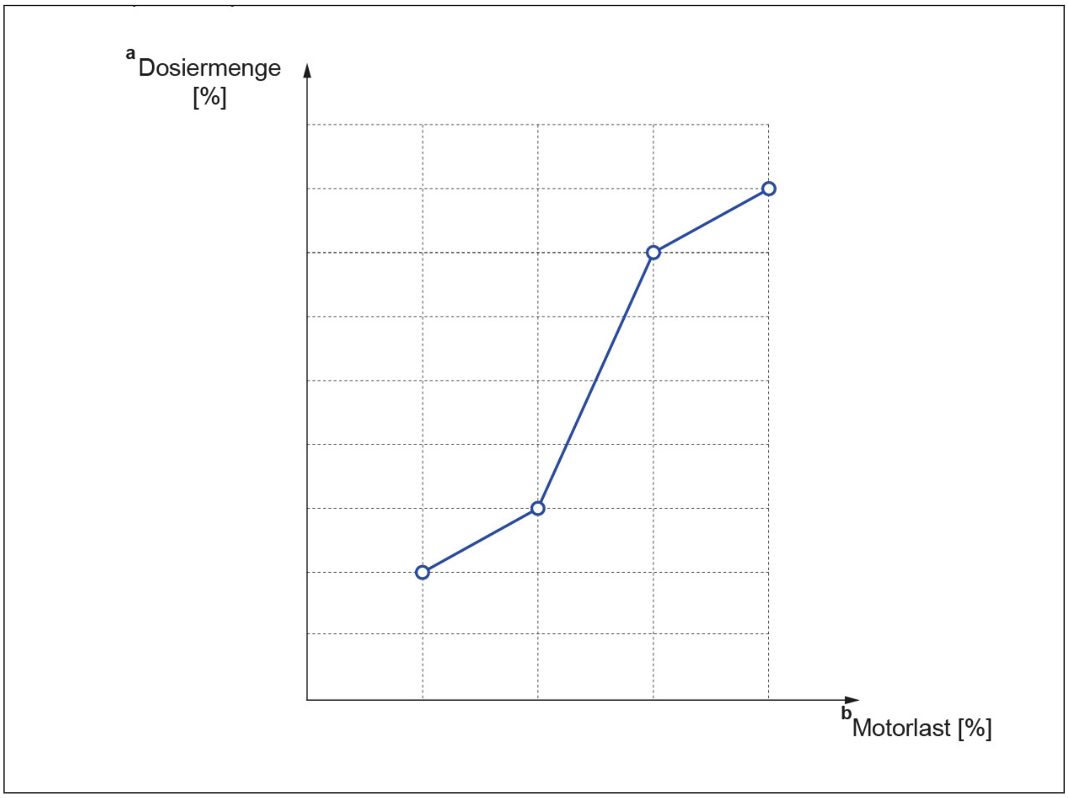


75970-001 Example illustration: Dosing and different engine loads (not to scale)

a	NO_x [mg/m^3]
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.



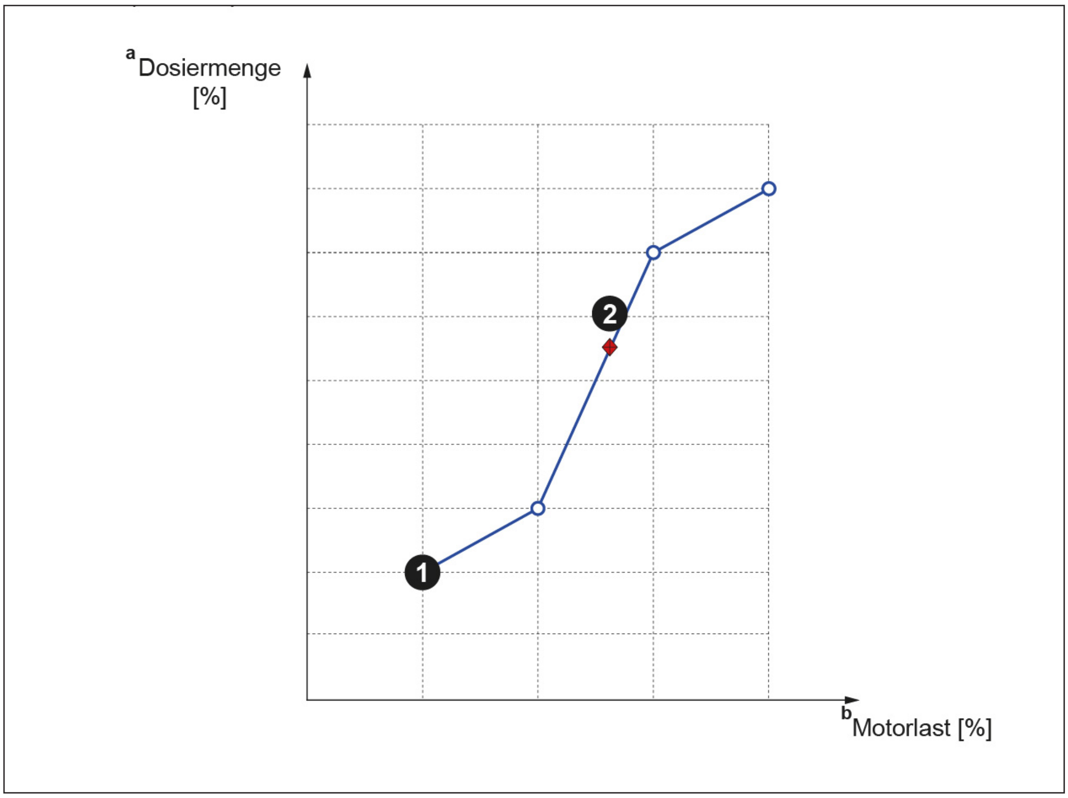
75971-001 Example illustration: NO_x characteristic curve (not to scale)

a Dosing quantity [%]

b Engine load [%]

Dosing via profile

If the profile (1) has been recorded accurately and is thus representative for the state of the genset and the SCR application, it is suitable for automatic control of the NO_x emission during operation. The operating point (2) statically follows the profile (1). If nothing has changed in the behavior and state of the SCR application since the profile was recorded, the resulting NO_x value is within the desired range.



75972-002 Example illustration: Dosing via profile (not to scale)

a Dosing capacity [%]

b Engine load [%]

1 Profile

2 Operating point (dosing at current engine load)

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

After maintenance work

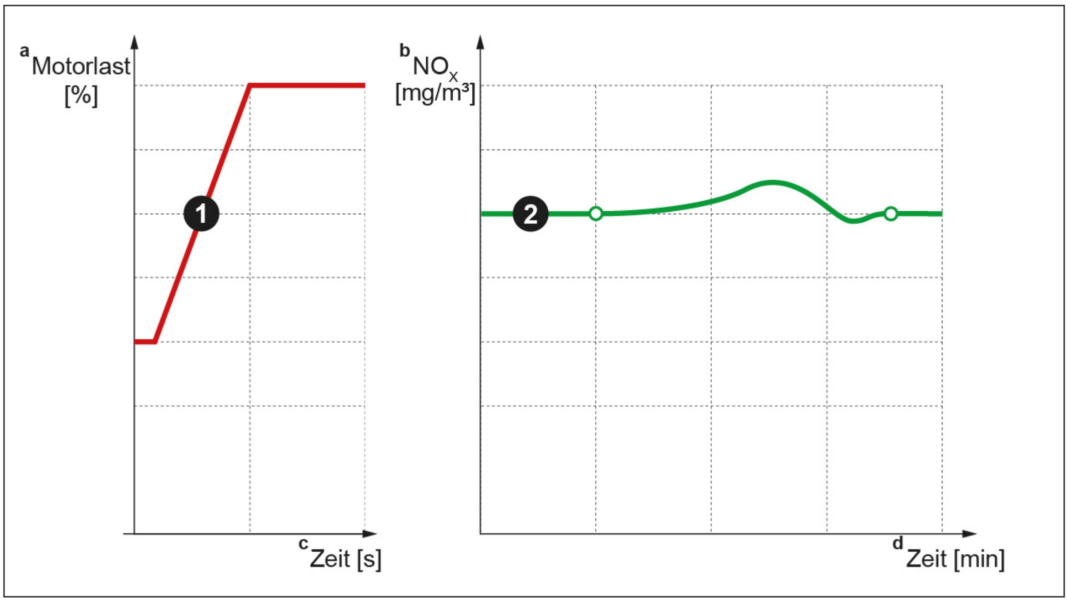
The profile (1) should also be checked after maintenance work on the gas engine if the maintenance work could affect the emissions and/or combustion chamber temperatures.

Dosing via PID controller

Open- or closed-loop control

While the current NO_x value is not taken into account when controlling via the profile, the PID controller does vary the dosing according to 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 capacity (2) following a load change (1) depends on the PID parameter settings.



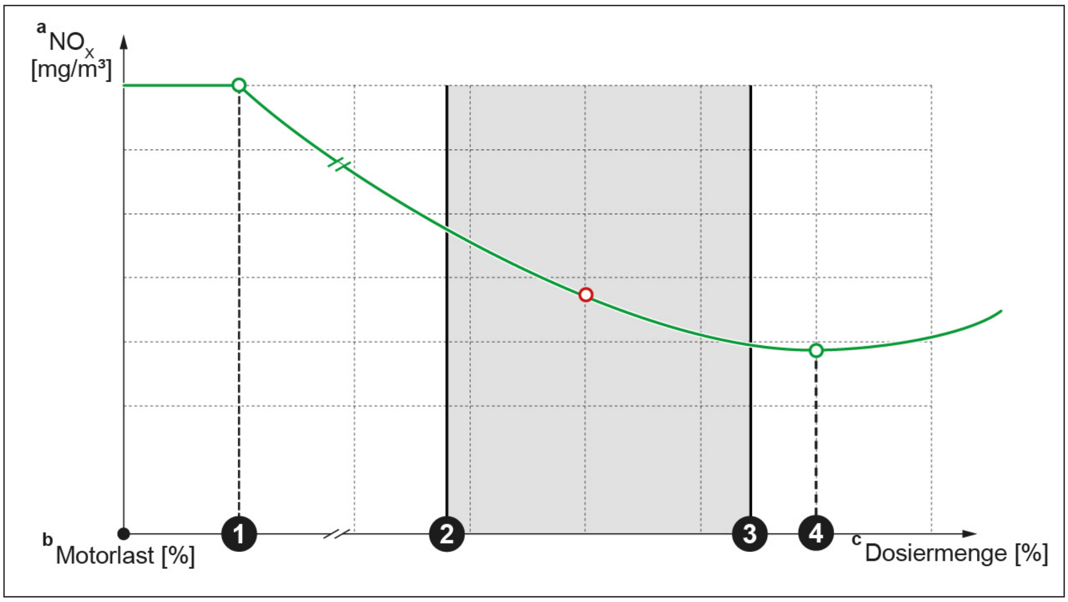
75974-001 Example illustration: Load change and control response (not to scale)

a	Engine load [%]
b	NO_x [mg/m^3]
c	Time [s]
d	Time [min]
1	Load change with ramp
2	Controller response

Control range and limits

Normally, the SCR application runs via the PID controller. In this scenario, it is important to specify a lower limit (2) and an upper limit (3) for monitoring the current operating point.

The limits represent a plausible dosing at the current engine load and form a tolerance band within which the current operating point of the dosing system must remain. Forming the basis for the configuration 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 and must be assigned as parameters as the lower limit (2) and upper limit (3) when defining the profile.



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

a NO$_x$ [mg/m^3]

b Engine load [%]

c Dosing capacity [%]

1 System response (filling time)

2 Lower limit

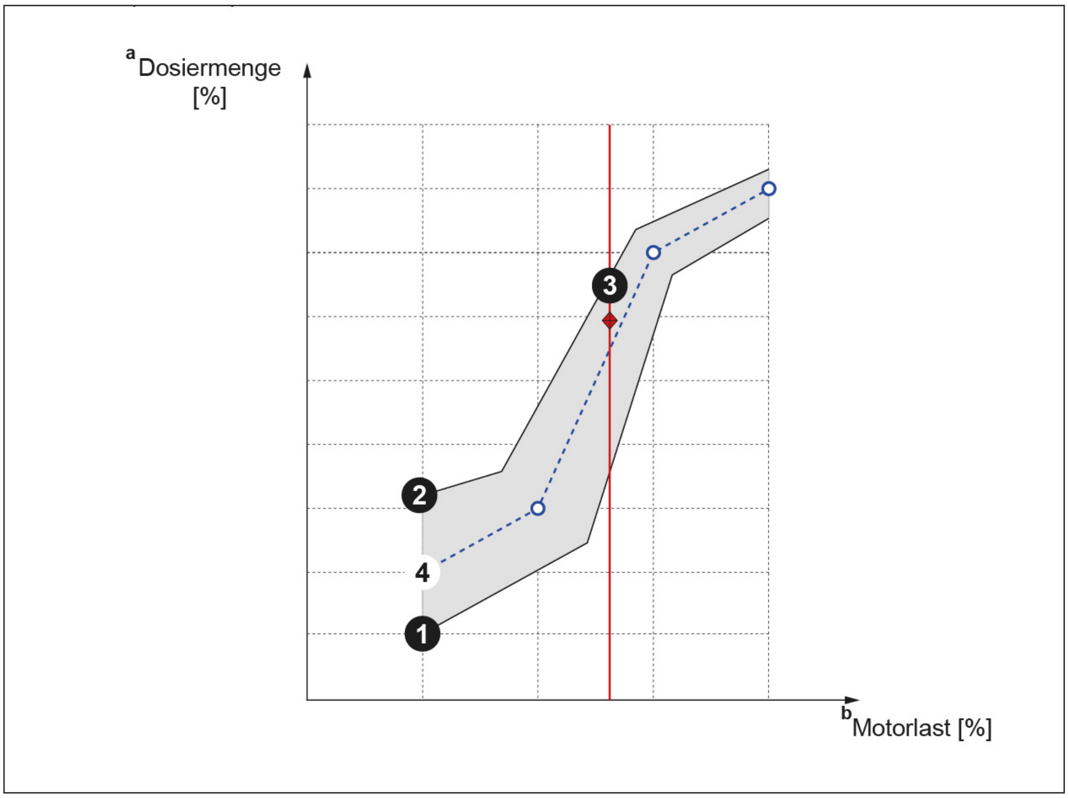
3 Upper limit

4 Minimum (NO$_x$ minimum)

Control range and monitoring

If the SCR Control is running with PID control in automatic automatic operation, the PID controller adjusts the dosing when the NO$_x$ value deviates, thereby adjusting the actual NO$_x$ value to the setpoint. The operating point of the dosing process is monitored to prevent the PID controller from dosing more and more or the NO$_x$ value from rising unacceptably in the event of a system fault.

353-003-EN : 51000010 : BA : VAR, COV, IMP, B, BA, BS, DEM, EIN, IBN, IST, WP, SK, MH, SB, STB, TA, TL



75973-001 Example illustration: Dosing via profile with control range and operating point (not to scale)

a	Dosing capacity [%]
b	Engine load [%]
1	Lower limit
2	Upper limit
3	Operating point (dosing at current engine load)
4	Profile

During operation, the operating point moves along the red vertical line within the gray control range. If one of the limits is reached, a downtime will start counting down. During the downtime, the SCR Control waits to see whether there is a temporary fault and whether the operating point drifts back again on its own.

If this is not the case, there is probably a fault, as the dosing capacity is no longer plausible for normal operation. The SCR control issues a message and switches from PID control to profile control.

With profile control now activated, the NO_x value moves back to the profile that was determined previously. 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.

4.4.3 Operating states

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

- Standby
- Startup
- Operation

- Shutdown
- Engine stop

Standby

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

- Exhaust temperature < 50 °C
- Solenoid valve is in the idle position (open on the compressed air side)
- Dosage pump not in operation
- Dosage pump and sensors are supplied with voltage

Startup

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

- As soon as the temperature in the exhaust system reaches 50 °C, the compressor starts
- As soon as the exhaust gas temperature has been above 280 °C for at least 5 minutes, the dosage pump begins injecting urea solution into the exhaust gas flow. The following conditions must also be met:
  - The compressor has been running continuously for at least 15 minutes (adjustable) to cool the injection lance sufficiently.
  - The urea tank is sufficiently filled.
  - The engine load signal is present.

Operation

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

- Compressor is still active
- The 3-way valve changes position after the dosage pump is switched on and a minimum pressure is reached downstream of the dosage pump
- In this operating phase, the dosage pump pumps urea solution into the exhaust gas flow
- The quantity injected depends on the difference between the measured NO_x value and the setpoint
- If the NO_x signal fails or is not plausible, the system controls the amount of injected urea solution using a profile
- The profile specifies the required amount of urea solution depending on the engine performance. The profile is determined when the exhaust catalytic converter is commissioned and is stored in the control
- The SCR Control also uses the profile for internal plausibility checks and during start-up to reach the required dosing more quickly

Shutdown

If the genset output falls below a certain minimum value, the dosing 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.

- As soon as the engine power is equal to zero, the shutdown begins. (Depending on where the lower sampling point of the injection profile is located, the shutdown may start earlier, e.g. load < 30 %)
- The dosing is reduced to zero and the 3-way valve switches to compressed air in order to purge the hose line after the 3/2-way valve up to the injection lance and blow out urea residues
- The compressor continues to run for 60 minutes when this happens. This keeps a continued cooling effect on the injection lance
- If the engine is restarted within the 60 minutes after shutdown, this shortens the start-up process of the SCR application, as sufficient cooling is already provided. As soon as the system has been at 280 °C for 5 minutes, the injection starts again

Engine stop

- The SCR application is not functional for more than 400 hours per year. The genset must be shut down (to comply with the 44th BImSchV [German Federal Immission Protection Decrees]) (DO2 is set). Individual components of the SCR application (the urea pump) remain operational
- A separate uptime counter (fault time counter) accumulates the time in which the SCR application is not functional. This means that the 30-minute mean value of the NO_x emissions has exceeded the set daily mean limit value
- The operator can acknowledge the fault and thus reset the digital output (entry in the logbook). The accumulation of the fault hour counter resumes
- The fault hour counter resets annually on 12/31 at 23:59.

4.4.4 Special applications

Dual gas operation with switchover at standstill (option)

For special applications, the gas gensets can be equipped to run with two gas types. If, for example, natural gas and sewage gas are available as fuel gas, it is possible to switch over to natural gas if sewage gas is lacking. To switch over between the two gas types, the genset must be at a standstill.

Normally, each type of gas requires its own gas train with filtering, shut-off valves and precise pressure maintenance. After passing through the gas trains, the two gas types are fed to the gas engine via separate or shared piping.

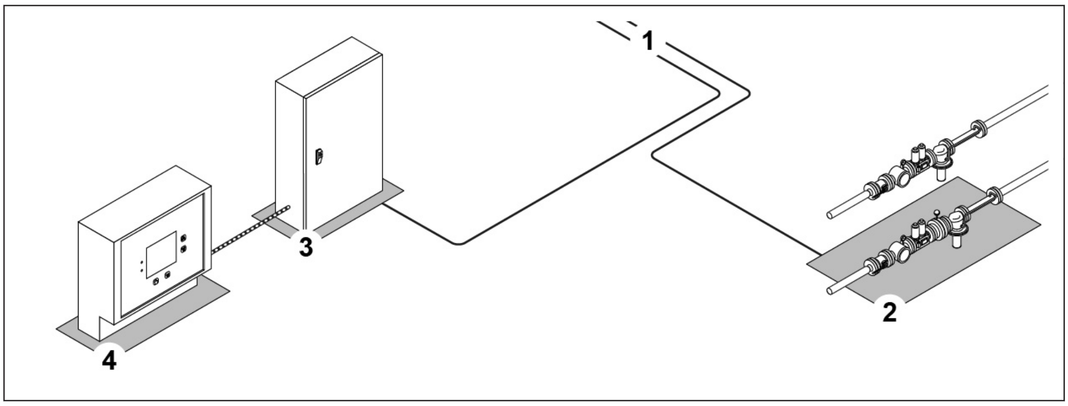
Due to the different net calorific values or pre-pressures of the two gases, the fuel gas system must be designed according to the conditions on site.

For required information on dual gas operation, see

- Operating Manual ⇒ General ⇒ Application and Installation Guide
  – Layout of power plants

Control

The demand for a gas changeover is usually made via a signal from the operator's gas supply to the plant control with the TEM/TPEM system. The TEM/TPEM system then switches the connected gas trains.



76175-001 Example illustration (simplified) for controlling the EmiBox in dual gas operation

1 Control signals for switching the gas type

2 Gas trains

3 SCR Control switchgear cabinet

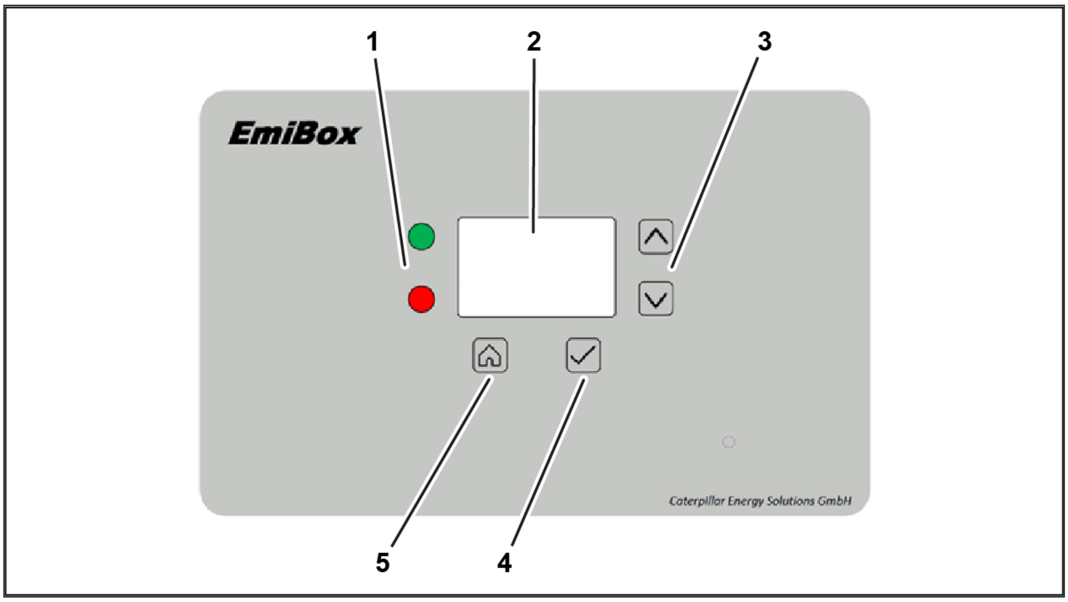
4 EmiBox

To ensure that the EmiBox also recognizes a gas changeover, an additional digital signal is sent to the I/O module in the SCR Control switchgear cabinet. Depending on the status of the signal (Low/High), the connected EmiBox recognizes the current gas type and activates the PID control profile configured for the current gas type.

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

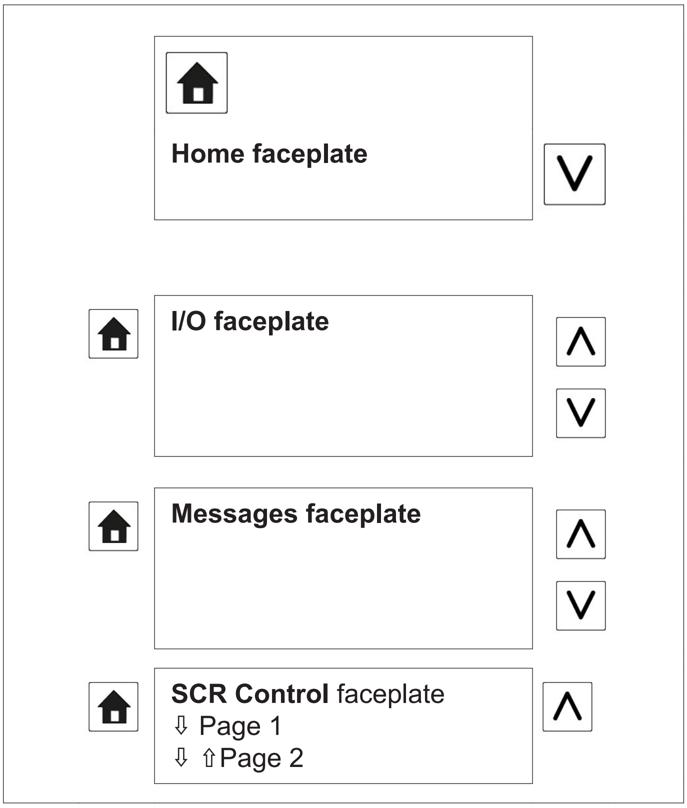
The Selection key (4) acknowledges all alarms shown on the display (2). The arrow keys (3) change to the Information faceplate or the Alarms faceplate.

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

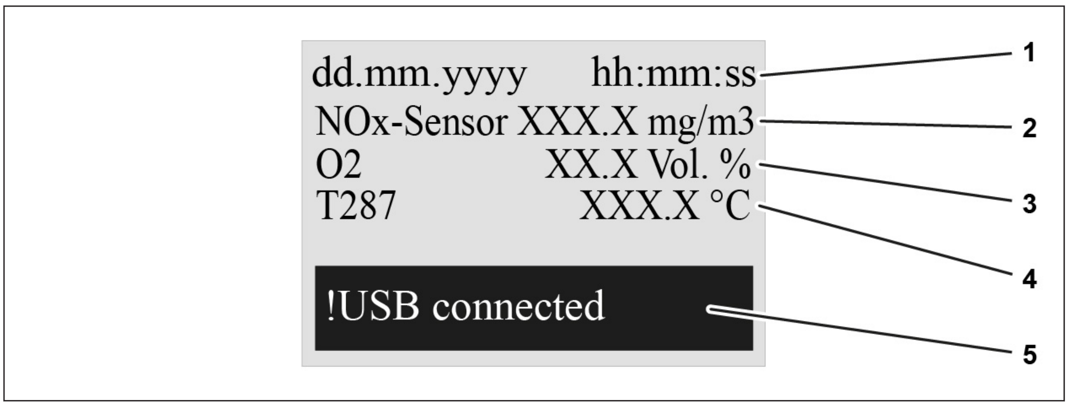
Navigation is performed with the Home key and the Up and Down keys.



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

353-003-EN : 51000010 : BA : VAR, COV, IMP, B, BA, BS, DEM, EIN, IBN, IST, WP, SK, MH, SB, STB, TA, TL

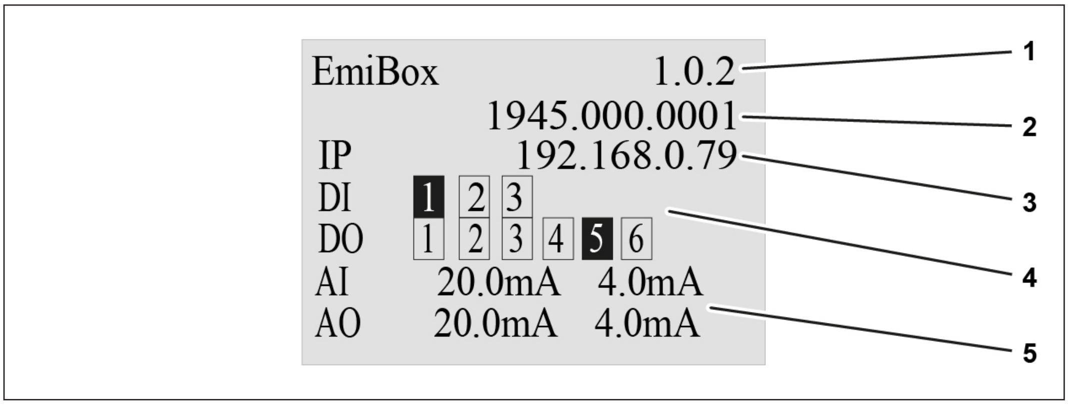
3 O_2 volume fraction

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

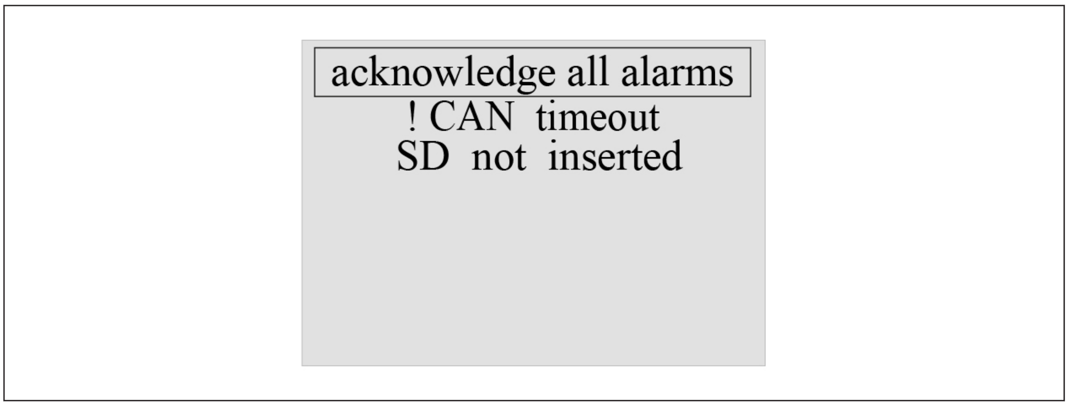
3 Current IP address (if Ethernet was connected).

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.

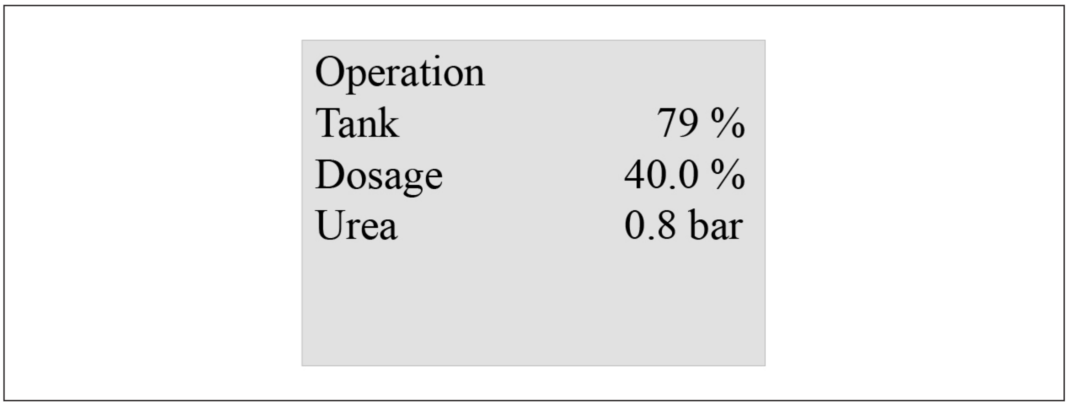
The control options are:

- 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.

353-003-EN : 51000010 : BA : VAR, COV, IMP, B, BA, BS, DEM, EIN, IBN, IST, WP, SK, MH, SB, STB, TA, TL



75612-001 Example illustration

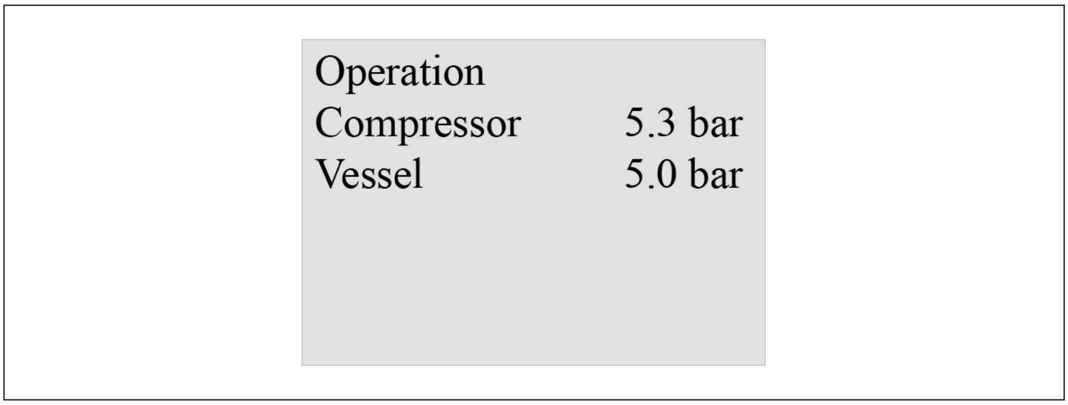
Row 1): Operating states (e.g. Operation)

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

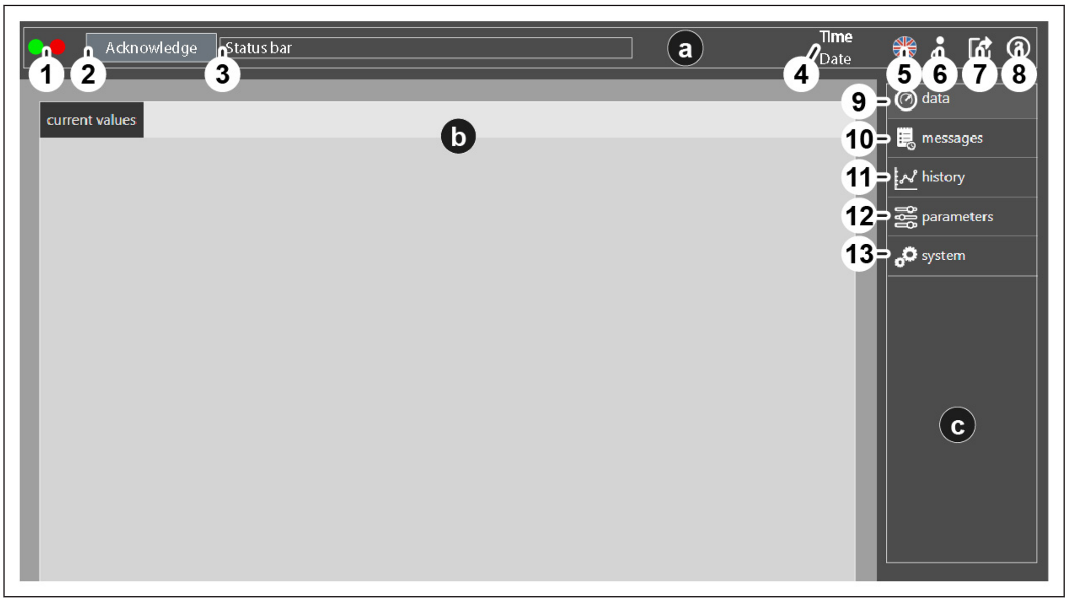
Row 3): Air pressure in buffer tank

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 current language of the user interface.

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 installed in addition to the EmiBox, further displays are available.

75979-002 Example illustration

1 Flowchart

2 Profile

3 Diagnostics

Functional group "Flowchart"

This button shows the tab for the functional group "Flowchart". The system displays a flowchart visualizing the SCR application and its operating state.

Functional group "Profile" (SL only)

This button displays the tab for the functional group "Profile". It displays the current genset output and the dosed urea quantity in relation to the configured profile.

Functional group "Diagnostics" (SL only)

This button displays the tab for the functional group "Diagnostics". It displays system injection data. It is also possible to change the operation mode to manually switch injection for servicing purposes.

4.6.3 Language

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

76179-001 Example illustration

1 `Language` button

2 Language selection dialog area

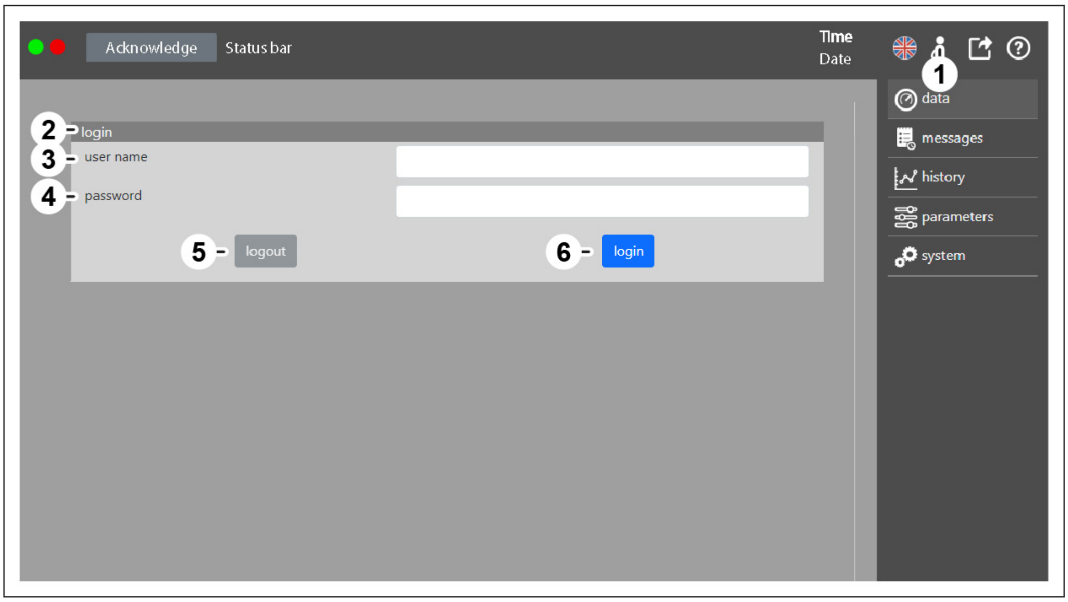
The language can be changed temporarily. The preset system language and the possible alternative languages depend on the configuration by authorized service personnel. At startup, the user interface reverts to the default system language.

Depending on the firmware version, there may be a selection below the language selection (2) for temporarily converting units between metric and imperial units. This setting, too, is only valid for the current web session and has no influence on the display.

4.6.4 Login

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

353-003-EN : 51000010 : BA : VAR, COV, IMP, B, BA, BS, DEM, EIN, IBN, IST, WP, SK, MH, SB, STB, TA, TL



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.

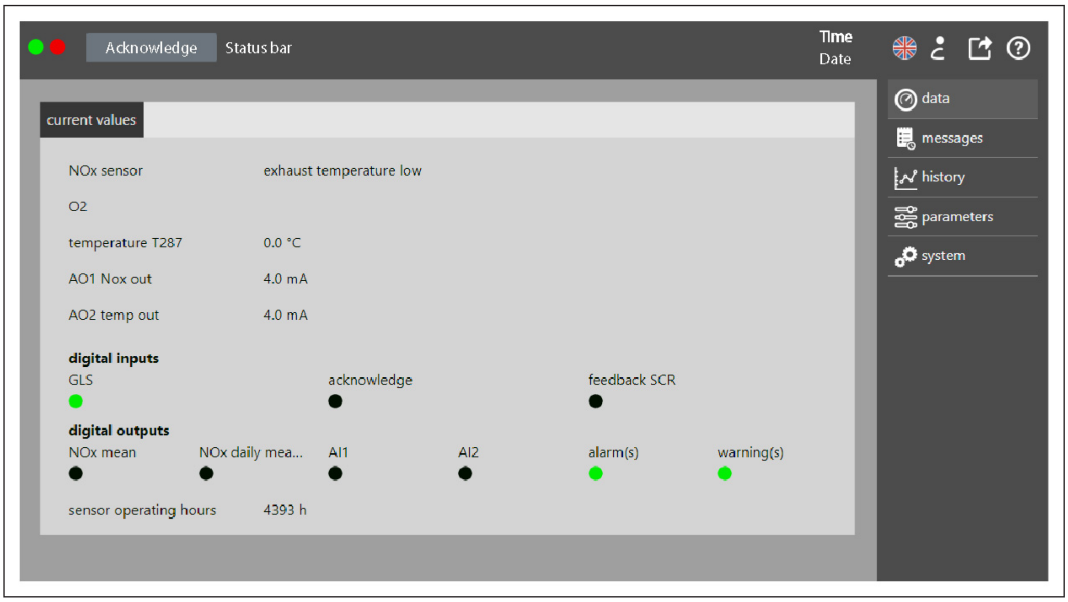
4.6.5 Functional group "Data"

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).

76039-002 Example illustration

Current values tab



75946-002 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.

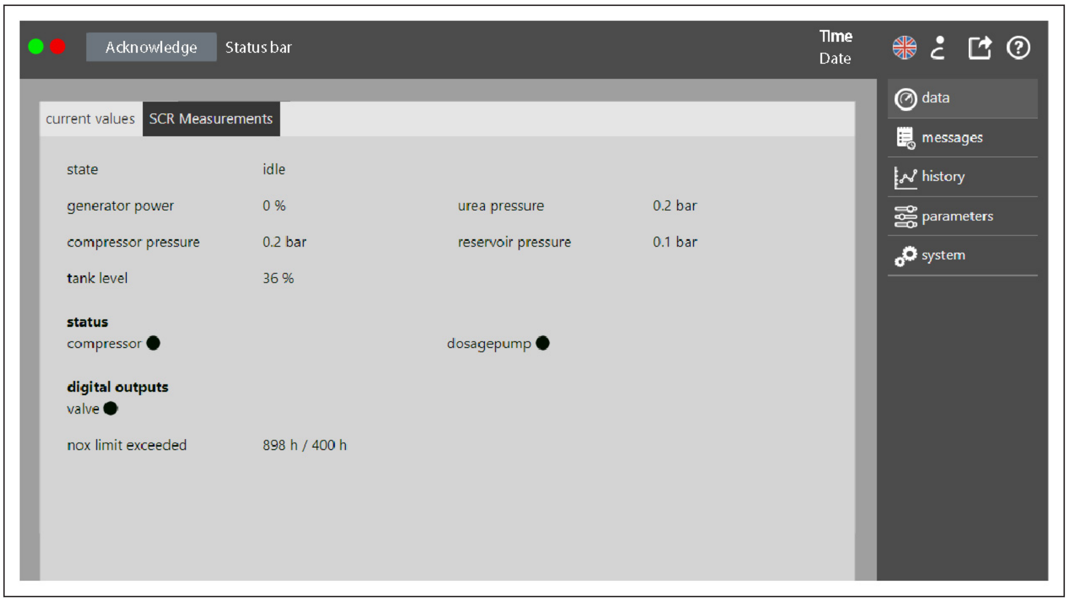
The tab displays the following data:

- 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

353-003-EN : 51000010 : BA : VAR, COV, IMP, B, BA, BS, DEM, EIN, IBN, IST, WP, SK, MH, SB, STB, TA, TL

- 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 Measurements tab



75947-002 Example illustration

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

The `SCR Measurements` tab displays the following data:

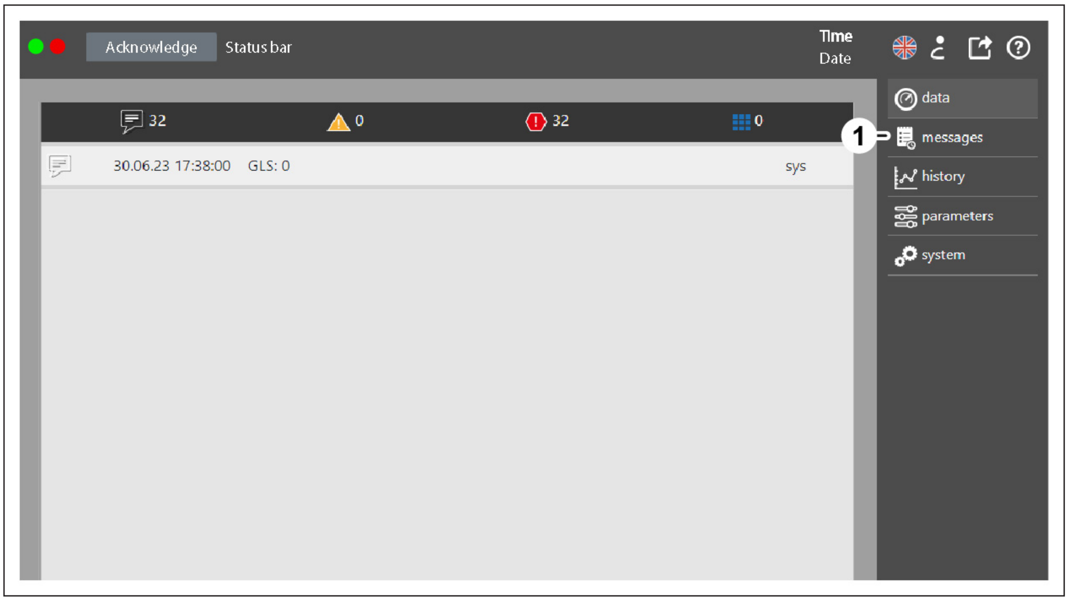
- Operating state of SCR Control (e.g. Running)
- The current urea dosing and the operation mode (e.g. profile) are also displayed
- Engine load
- Current genset power in percent
- Compressed air pressure
- Air pressure at compressor outlet
- Urea fill level
- Urea tank fill level in percent
- Urea pressure
- 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 "Generator 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.

4.6.6 Functional group "Messages"

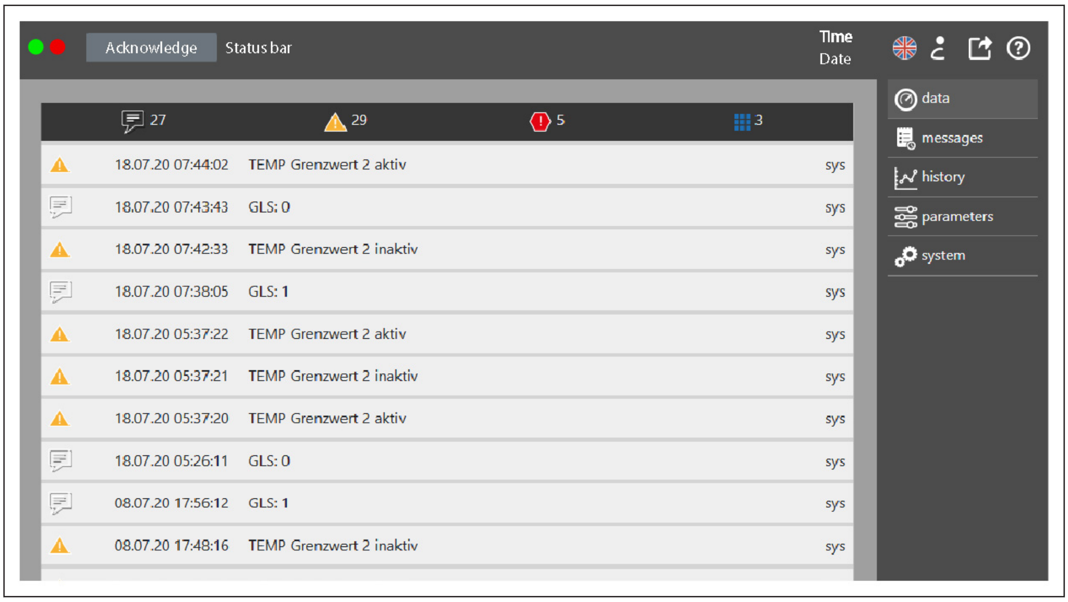
General

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



76040-002 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.

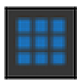
The logbook lists the entries (messages, warnings, alarms and parameter changes) in chronological order.

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:

- Undercut of the minimum pressure in the urea or compressed air system.

The control response depends on the type of fault or the system state. In the case of the SCR Control, for example, a pending fault will in most cases cause the urea system to be switched off. In this case, however, the compressor continues to be supplied with voltage to ensure the injection line is purged.

Messages with SCR Control

Configuring the displayed limits (example)

If an SCR Control Kit is installed and active, the logbook displays information on the SCR application according to the following overview.

Parameters	Value	Min	Max	Category	Logbook
Nitrogen oxide emissions (Alarm already included in EmiBox, new: Warning)	Daily mean: 130 mg/m³		x	Warning	optional
	Daily mean 150 mg/m³		x	Alarm	yes
	Measurement defective, sensor does not provide NOx values			Alarm	yes
Exhaust temperature (already included in Emi-Box)	280 °C	x		Warning	optional
	500 °C		x	Alarm	yes
Urea system pressure	0.6 bar	x		Warning	optional
	0.2 bar	x		Fault	yes
	Measurement defective			Alarm	yes
Pressure on compressor	1.0 bar	x		Warning	optional
	0.5 bar	x		Fault	yes
	Measurement defective			Fault	yes
Pressure of compressed air system on pressure vessel	1.0 bar	x		Warning	optional
	0.5 bar	x		Alarm	yes
	Measurement defective			Alarm	yes

353-003-EN : 51000010 : BA : VAR, COV, IMP, B, BA, BS, DEM, EIN, IBN, IST, WP, SK, MH, SB, STB, TA, TL

Parameters	Value	Min	Max	Category	Logbook
Tank level	95 %		x	Warning	optional
	25 %	x		Warning	optional
	10 %	x		Alarm	yes
	Measurement defective			Alarm	yes

Tab. 4-2

The values shown above are limits in the as-delivered state. These are set by the commissioning engineer for the specific system in question.

In addition to the parameters, faults must be defined for the various components of the system and in the communication system. Some signals must be assigned the "message" category. The following signals and situations must be covered:

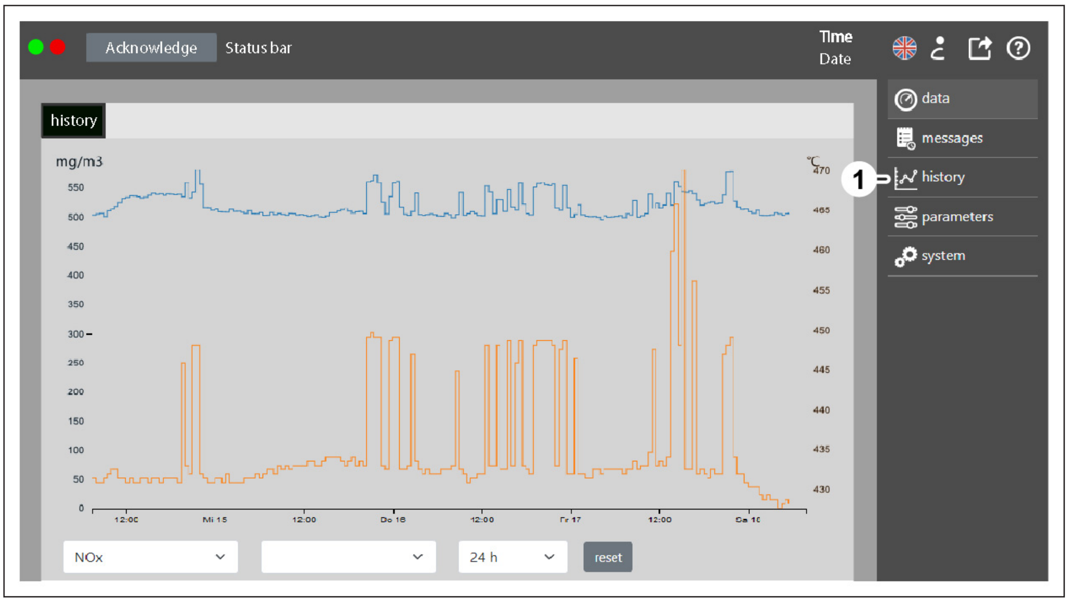
Equipment	Situation	Category	Logbook
Dosing pump	Start	Message	optional
	Fault	Alarm	yes
Compressor	Start	Message	optional
	Supply fault	Alarm	yes
3-way valve	Position BC	Message	optional
Overall system	Operation mode	Message	optional
	Startup: Time limit for reaching exhaust temperature exceeded	Warning	optional
	Startup: Too many undercuts of the critical exhaust gas temper-ature	Fault	yes
	Control switches to profile	Alarm	yes

Tab. 4-3

4.6.7 Functional group "History"

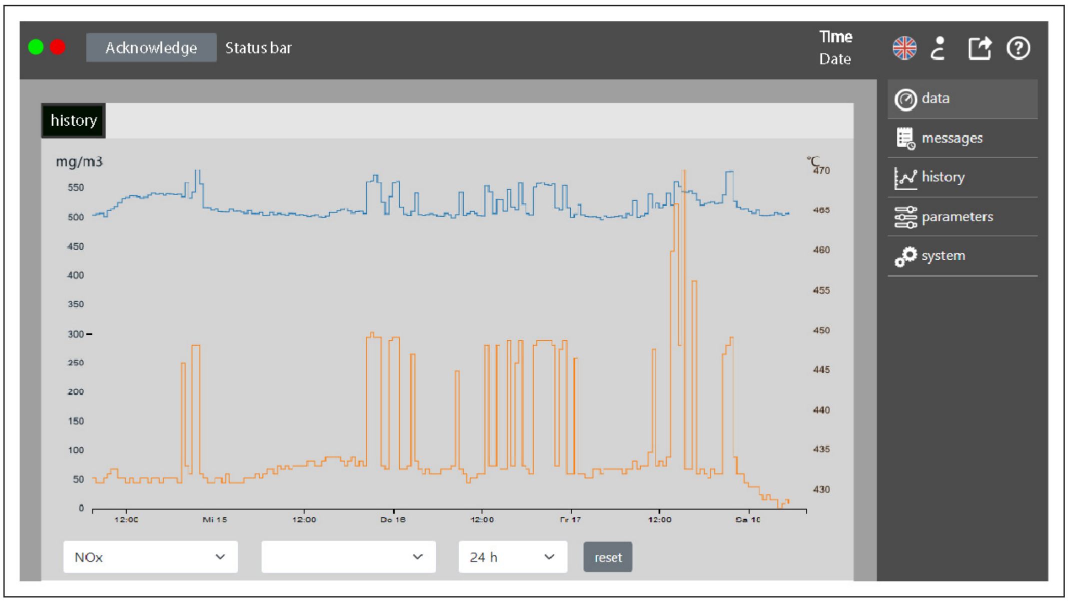
General

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

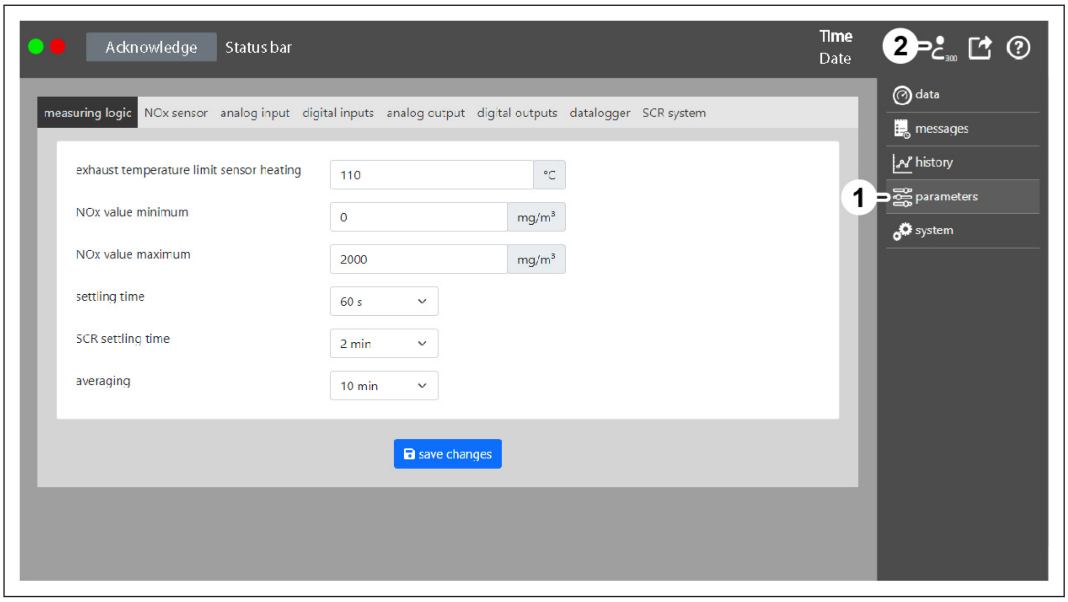
The `History` tab displays the recorded measured values and the system data as a graphic. It is based on the contents of the history file. The history file saves mean values from the sensor signals every 30 minutes (adjustable) and status changes from the binary inputs. It can be used to draw conclusions 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.

4.6.8 Functional group "Parameters"

General

The functional group "Parameters" appears after the user presses the `Parameters` button (1) in the toolbar. Various tabs are displayed. The number of tabs that are displayed, and their content, depends on the functional scope of the EmiBox and the user's login (2).



76219-001 Example illustration

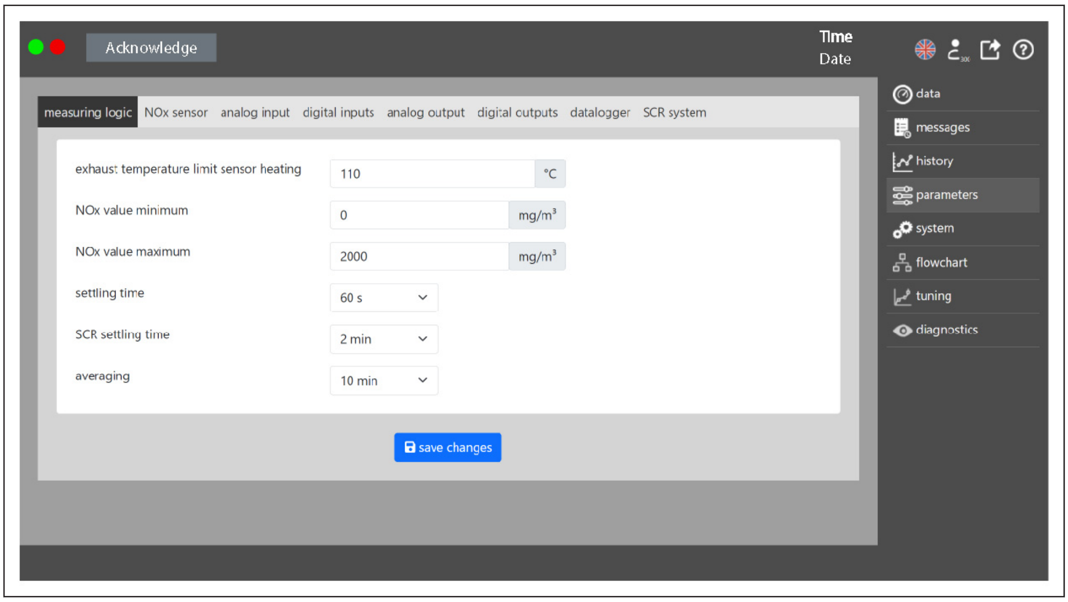
The functional group "Parameters" allows authorized specialist personnel to set parameters for the system control.

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.

All parameter changes are documented in the log file.

353-003-EN : 51000010 : BA : VAR, COV, IMP, B, BA, BS, DEM, EIN, IBN, IST, WP, SK, MH, SB, STB, TA, TL

Measuring logic tab



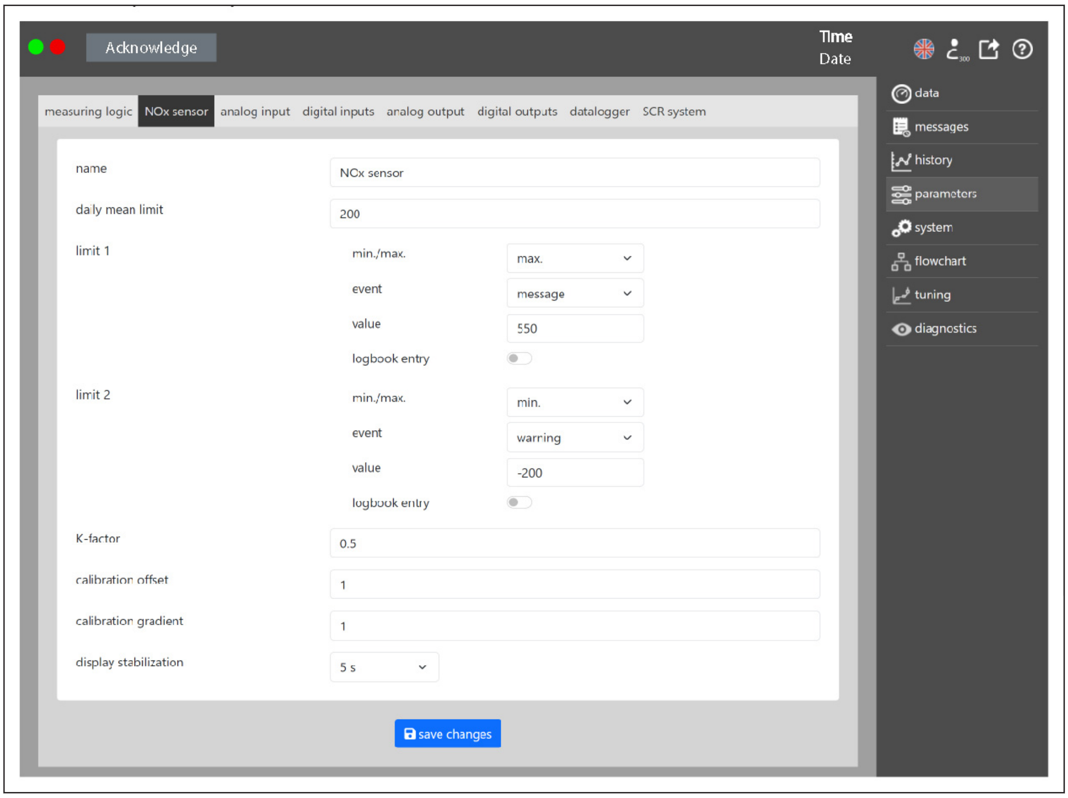
75617-002 Example illustration

The `Measuring logic` tab lets you do the following:

- Setting limits:
  - A: Exhaust gas temperature limit after which the sensor heating is switched on (if GLS/GCB closed)
  - D: Minimum NO_x value below which no recording takes place
  - C: Maximum NO_x value above which no recording takes place
- Specifying time periods:
  - Settling time: The settling time describes the time that elapses after the temperature limit is reached and the generator circuit breaker is closed before NO_x measurement and recording starts. A selection between 30 seconds and 5 minutes is possible. The default value is set to 5 minutes.
  - SCR settling time: After activation of digital input 3 (SCR catalytic converter feedback), the SCR settling time elapses. Only then does the system start recording NO_x values. The SCR settling time is used to give the SCR application a waiting time until the setpoint value is reached during start-up. If only monitoring is provided, or if there is no external SCR Control, digital input 3 must be inverted.
  - Averaging: This drop-down lets the user set the time used to define the mean of the NO_x value. This mean value is saved in the history; it is used to calculate the daily mean value. A selection between 5 minutes and 60 minutes is possible. The default value is set to 30 minutes.

353-003-EN : 51000010 : BA : VAR, COV, IMP, B, BA, BS, DEM, EIN, IBN, IST, WP, SK, MH, SB, STB, TA, TL

NO$_x$ sensor tab



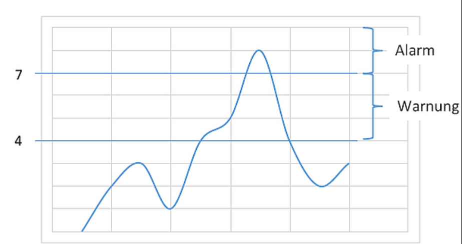
76247-001 Example illustration

The NOx sensor tab allows:

- Naming of the NOx sensor
- Changes for the parameters Daily mean, Limit 1, Limit 2, K factor, Offset and Gradient
  - Important: leave the default value for the "Gradient" calibration at "1".
- Specification for Limit 1 or Limit 2 as to whether this is the minimum or maximum value and which event is to be output if it is exceeded or not reached
- Specifies whether the event (exceeding or falling below the set limit) is entered in the logbook or not. Alarms are always entered in the logbook

Example 1:

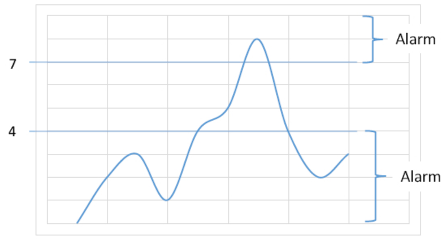
Parameters		
Limit 1	Min./Max.:	Max.
	Alarm/warning:	Warning
	Value:	4
Limit 2	Min./Max.:	Max.
	Alarm/warning:	Alarm
	Value:	4



353-003-EN : 51000010 : BA : VAR, COV, IMP, B, BA, BS, DEM, EIN, IBN, IST, WP, SK, MH, SB, STB, TA, TL

Example 2:

Parameters		
Limit 1	Min./Max.:	Min.
	Alarm/warning:	Alarm
	Value:	4
Limit 2	Min./Max.:	Max.
	Alarm/warning:	Alarm
	Value:	4

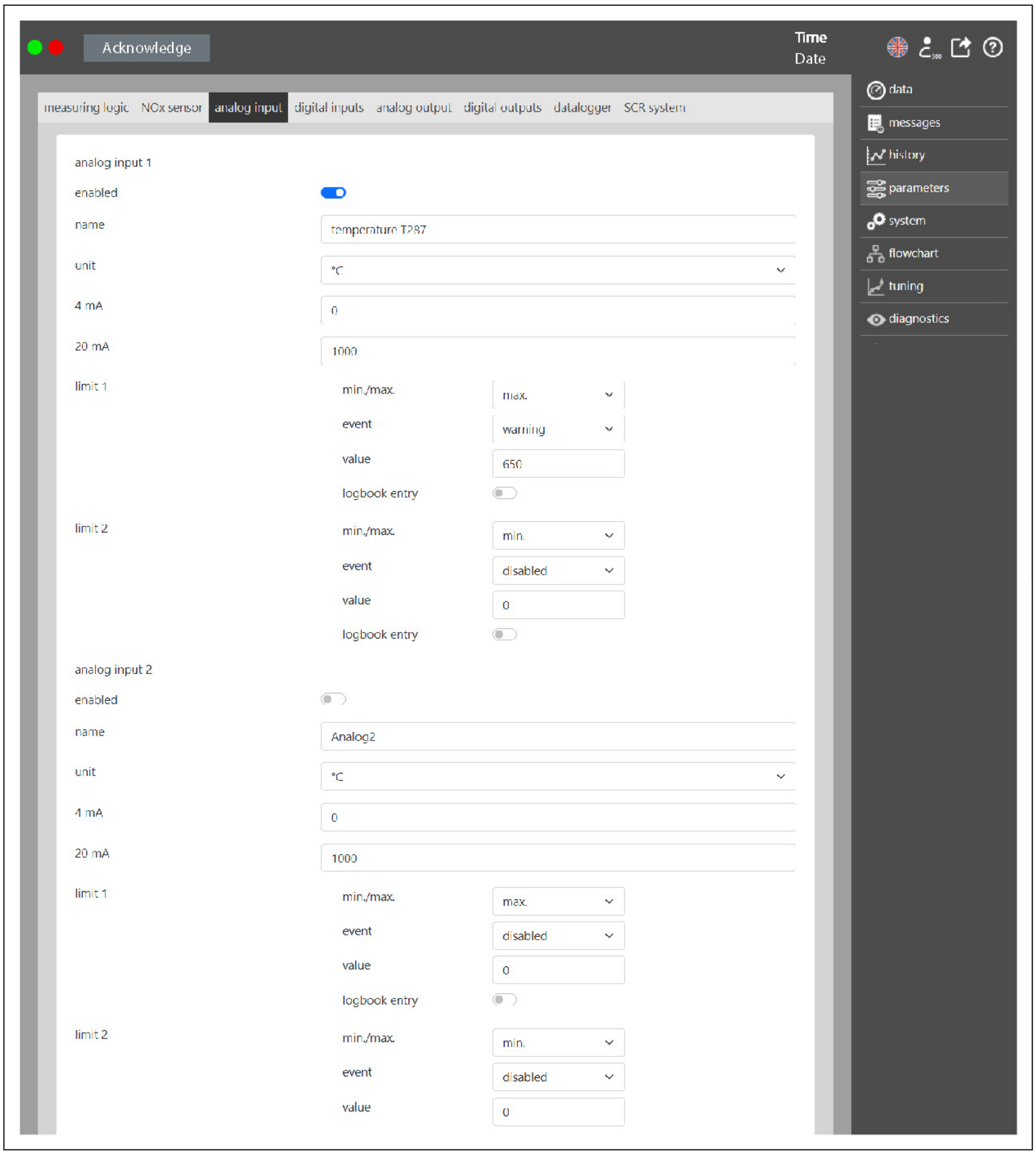


Display stabilisation

Display stabilization dampens the dynamic changes of values or parameters so that they can be read better on the display or on the user interface. Stabilization is achieved through temporary averaging, which has no effect on effective processing and documentation of the results.

The default value is set to 5 seconds.

Analog input tab



75618-002 Example illustration

The Analog input tab allows user input for the analog inputs when the SCR Control Kit is installed. Every analog input is labeled with a heading in the input area:

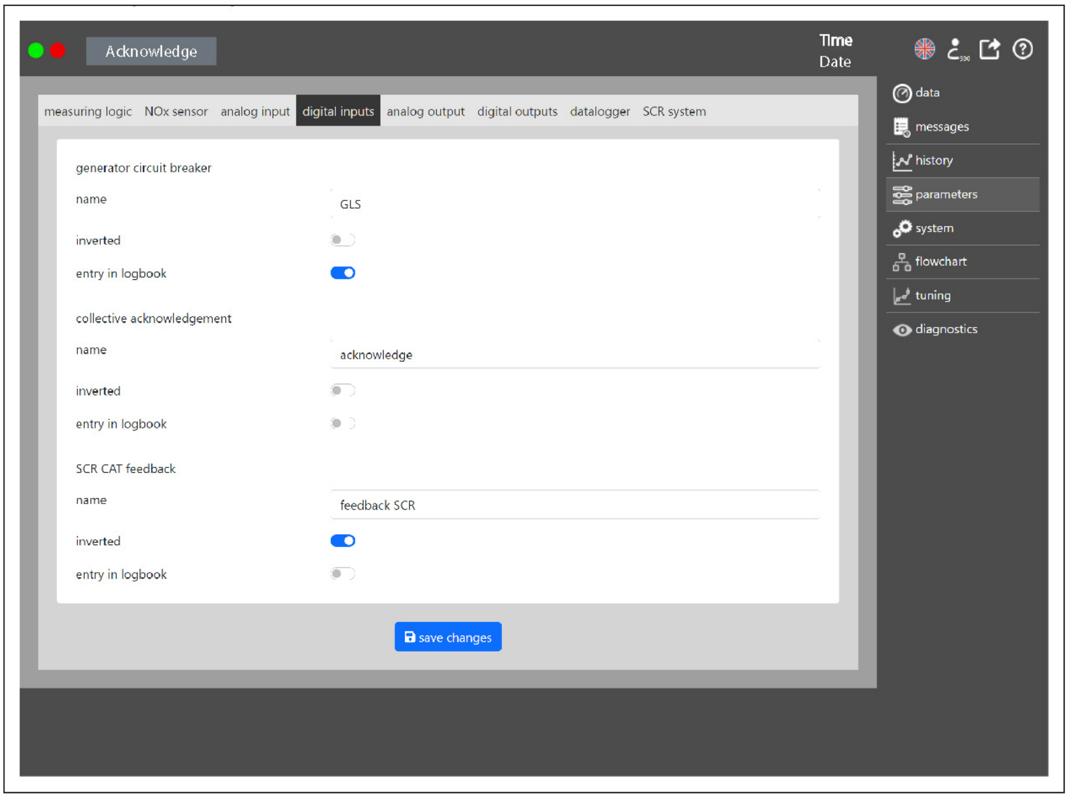
- Analog input 1 for the temperature upstream of the catalytic converter
- Analog input 2 for the temperature downstream of the catalytic converter

Parameters are assigned in accordance with the permissible operating temperatures of the SCR catalytic converter.

Possible inputs for the analog outputs are:

- Active: to activate the input
- Name: to name the input. This name serves as a unique designation for this sensor. This name is used for the entries in the logbook and history, as well as for the "Data" screen.
- Unit: to select the unit of the sensor signal
- 4 mA: for calibrating the sensor signal in order to link the 4 mA input signal to a value
- 20 mA: for calibrating the sensor signal in order to link the 20 mA input signal to a value. The interpolation between 4 mA and 20 mA is linear
- Limit 1: Define the limit as a minimum or maximum; select the event that happens when an upper or lower limit is exceeded or undercut
- Limit 2: Define the limit as a minimum or maximum; select the event that happens when an upper or lower limit is exceeded or undercut
- Selects whether the event (exceeding or falling below the set limit) is entered in the logbook or not. Alarms are always entered in the logbook

Digital inputs tab



75619-002 Example illustration

The `Digital inputs` tab allows user input for the digital inputs when the SCR Control Kit is installed. Every digital input is labeled with a heading in the input area:

- `Generator circuit breaker`
- `Group acknowledgement`
- `SCR CAT feedback`

353-003-EN : 51000010 : BA : VAR, COV, IMP, B, BA, BS, DEM, EIN, IBN, IST, WP, SK, MH, SB, STB, TA, TL

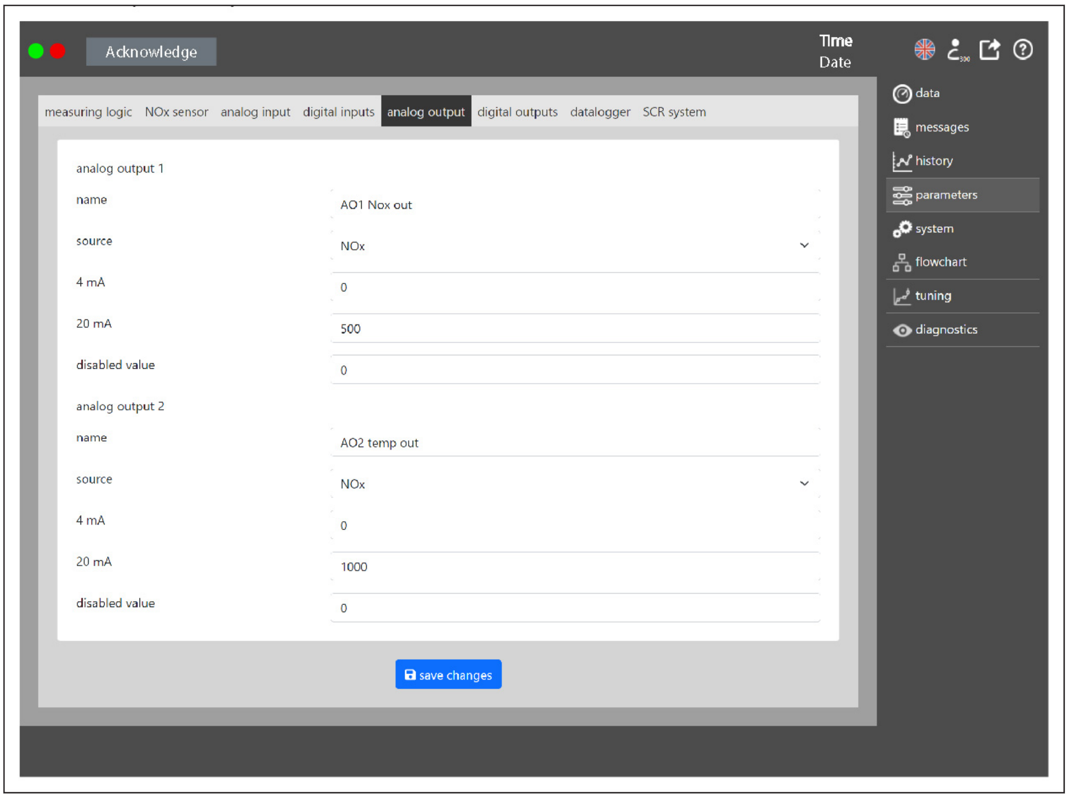
Possible entries for the digital inputs are:

- `Name`: Input name. This name is a unique designation for the input. This name is used for the entries in the logbook and history, as well as for the functional group "Data"
- `Inverted`: if the switch pictured is activated, this will negate the signal
- `Logbook entry`: Select whether the event (state change of the digital input) is entered in the logbook

The setting of the switch pictured in the `SCR Cat feedback` input area depends on the type of SCR Control system provided:

- If the SCR Control is controlling the SCR catalytic converter, the signal remains set to `Inverted` (default setting)
- If a different (external) SCR Control is used, the switch must be deactivated

Analog output tab



75620-002 Example illustration

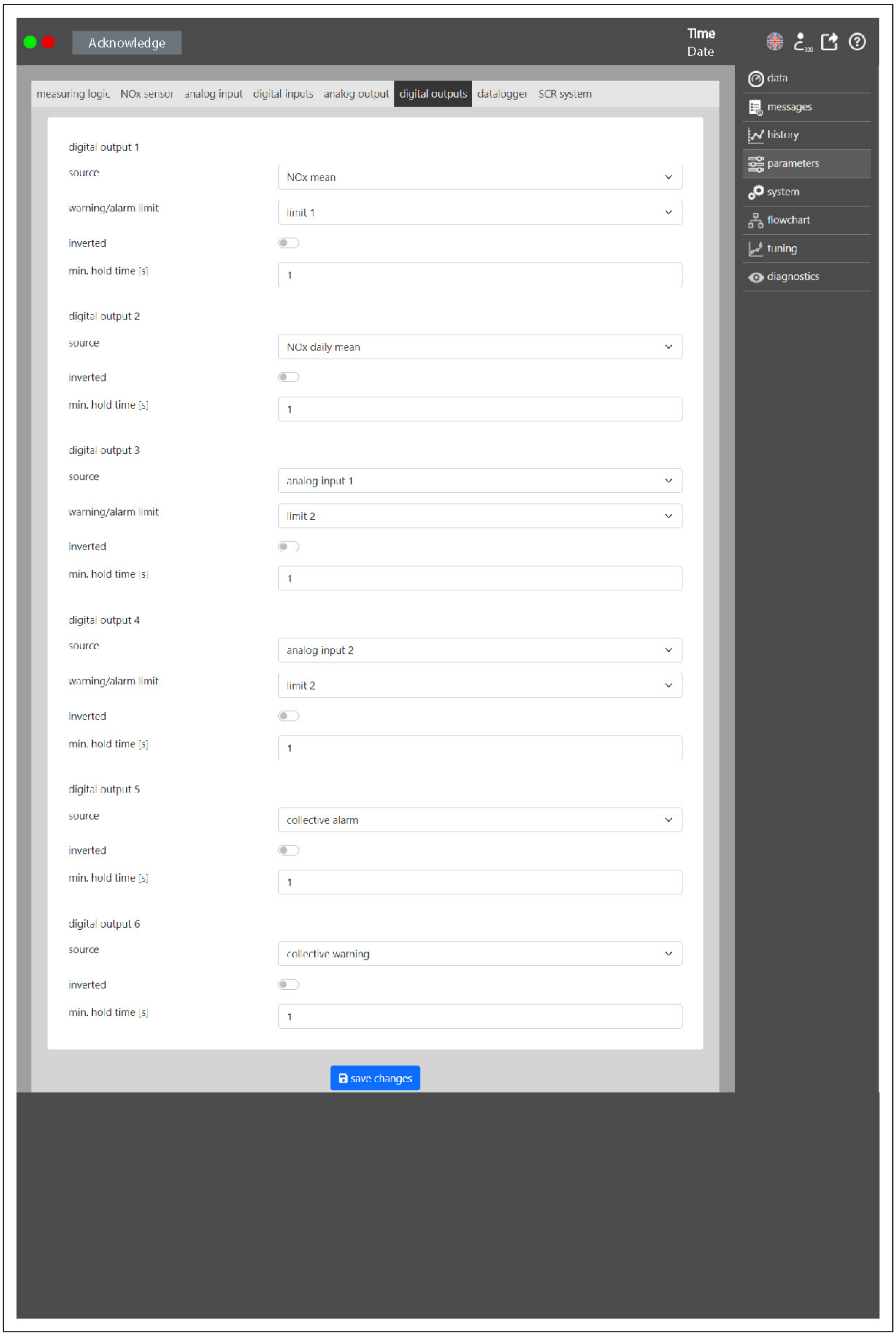
The Analog output tab allows user input for the analog outputs when the SCR Control Kit is installed. Every analog output is labeled with a heading in the input area.

Possible user inputs for the analog outputs are:

- Name: Output name. This name is a unique designation for the output. This name is used for the entries in the logbook and history, as well as for the functional group "Data"
- Source: Selection of the source for the respective output. Possible values are: NOx, Analog input 1, Analog input 2.
  - The actual value of the source is output at the analog output.

- 4 mA: for calibrating the sensor signal in order to link the 4 mA output signal to a value
- 20 mA: for calibrating the sensor signal in order to link the 20 mA output signal to a value. The interpolation between 4 mA and 20 mA is linear

Digital outputs tab



75621-002 Example illustration

The Digital outputs tab allows user input for the digital outputs when the SCR Control Kit is installed. Every digital output is labeled with a heading in the input area.

The input area provides:

- Specify the respective source and the warning or alarm limit for a digital output. It is also possible to invert the signal
- Configuration of a digital output for actions, for example to shut down the plant in a controlled manner in the superior control system in the event of a critical situation

Possible entries for digital outputs are:

- Source: Specifies the value to which the digital output should react
- Warning/alarm limit: Selects the limit value at which the digital status changes when activated
- Inverted: Selects whether the digital output signal is inverted
- Min. hold time: Specifies the minimum period for which the digital output signal is active.
  - This is also important in case a superior control does not recognize an event due to the signal being active for too short a time.

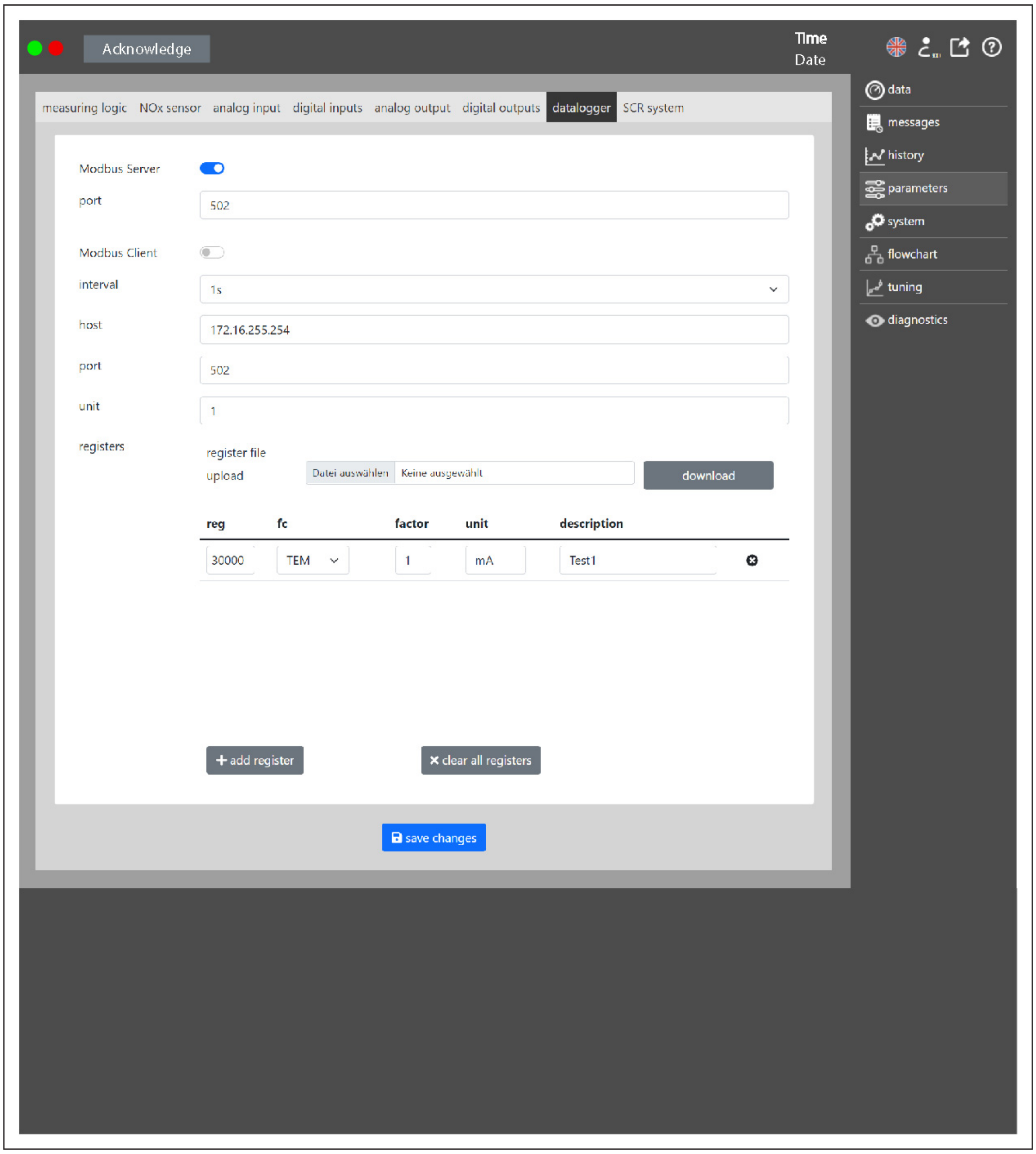
Datalogger tab

Prerequisite

To be able to save the control data on a USB storage device, the EmiBox must be equipped with the accessory for a USB connection.

The desired systems can be accessed via Modbus TCP.

Purpose



75956-002 Example illustration

The datalogger is an optional functionality that enables transfer and archiving of control data between the EmiBox and a suitable control component. The transfer is possible in multiple directions:

- A superior control system acts as a server and supplies the EmiBox with data
- The EmiBox acts as a server and supplies a connected system with data
- The connected system and the EmiBox have a two-way interaction

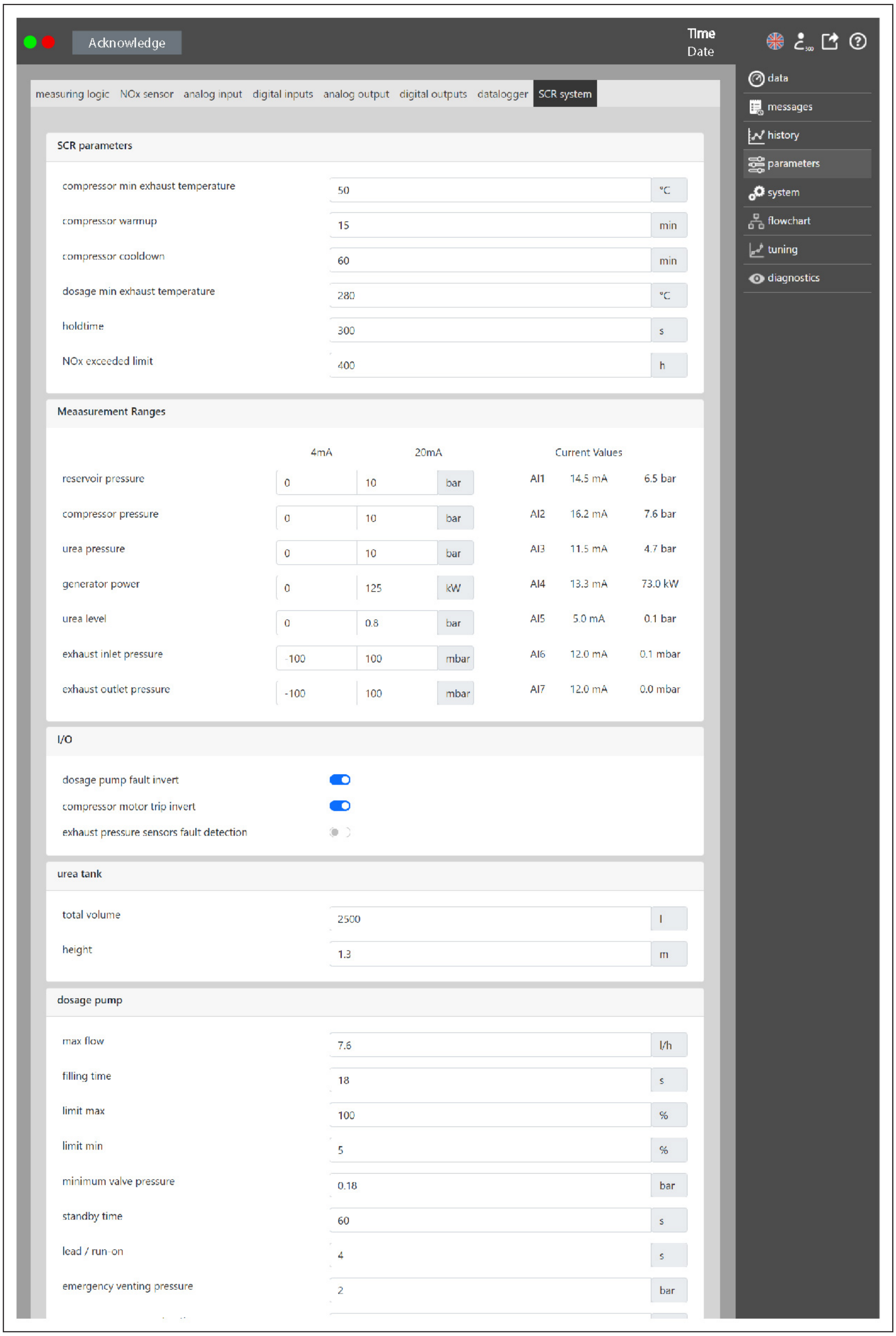
The `Registers` dialog area lets the user manage the data files.

Further information

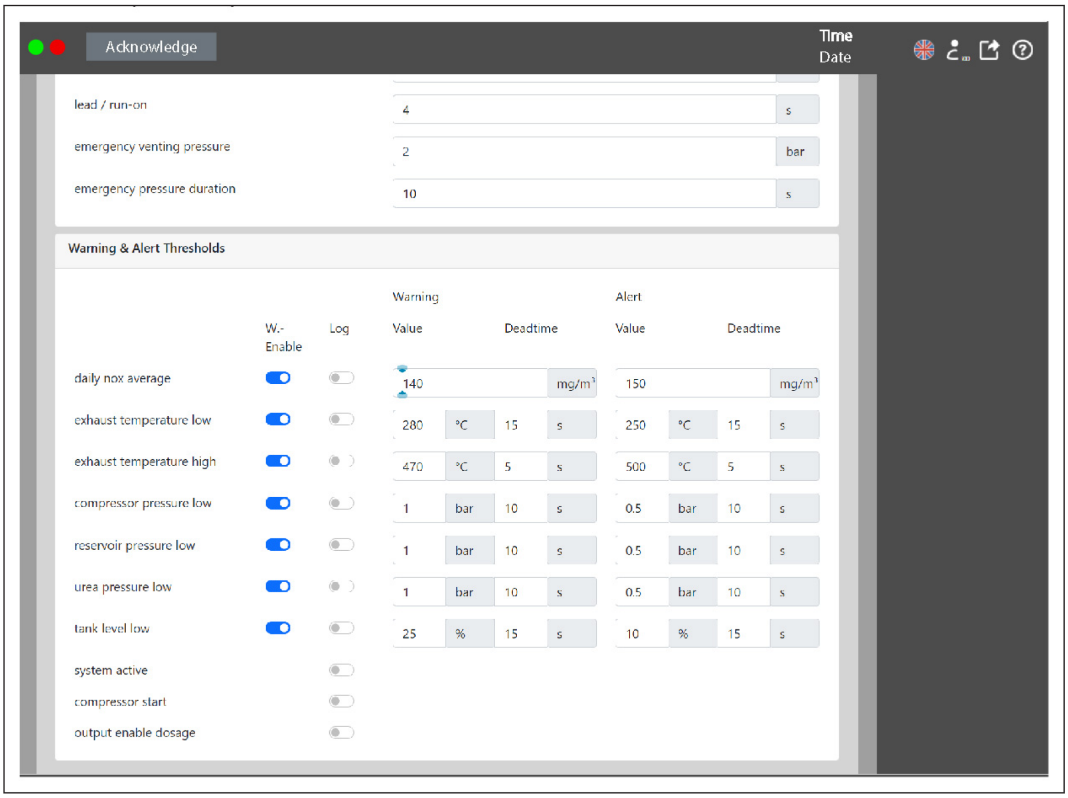
- See chapter 8.5.10 Monitoring with the datalogger 238

353-003-EN : 51000010 : BA : VAR, COV, IMP, B, BA, BS, DEM, EIN, IBN, IST, WP, SK, MH, SB, STB, TA, TL

SCR System tab



76057-002 Example illustration



76249-001 Example illustration

The `SCR System` tab enables full configuration and parameter assignment of the connected SCR system.

The display is divided into several input areas depending on the functionality of the SCR system. Possible input areas are:

- SCR System parameters
- Measurement range settings
- I/O
- Urea tank
- Dosage pump
- Warning and alert thresholds

Due to the plethora of settings options, the input areas will be described in the Commissioning chapter.

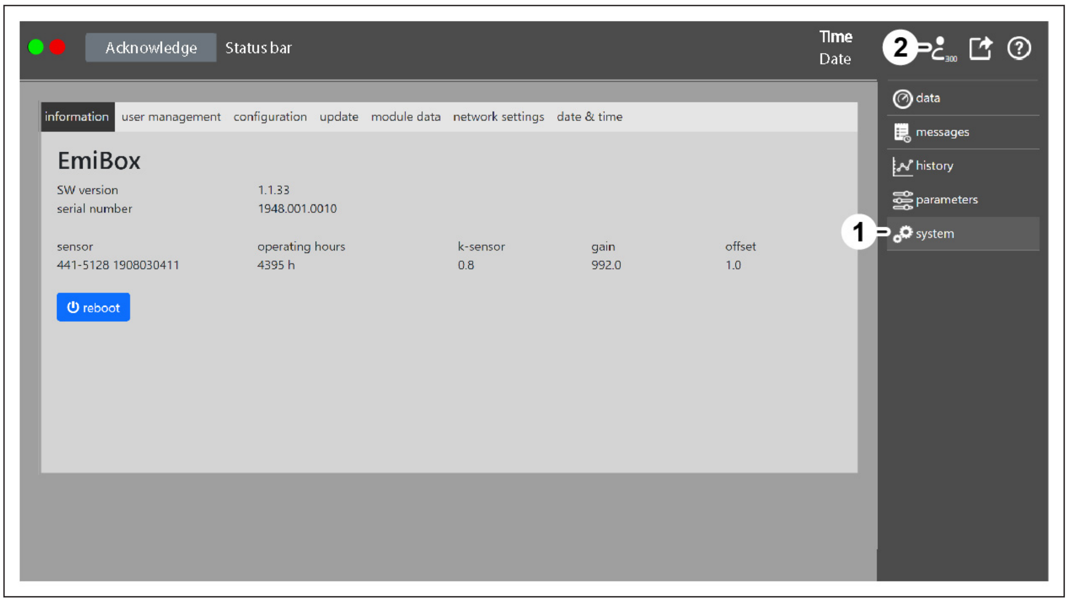
Further information

- For more information on the input areas, see chapter 7.3.11 Configuring the SCR system 190

4.6.9 Functional group "System"

General

The functional group "System" appears after the user presses the `System` button (1) in the toolbar. Various tabs are displayed. The number of tabs that are displayed, and their content, depends on the functional scope of the EmiBox and the user's login (2).



76220-001 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.

Information tab

76251-001 Example illustration

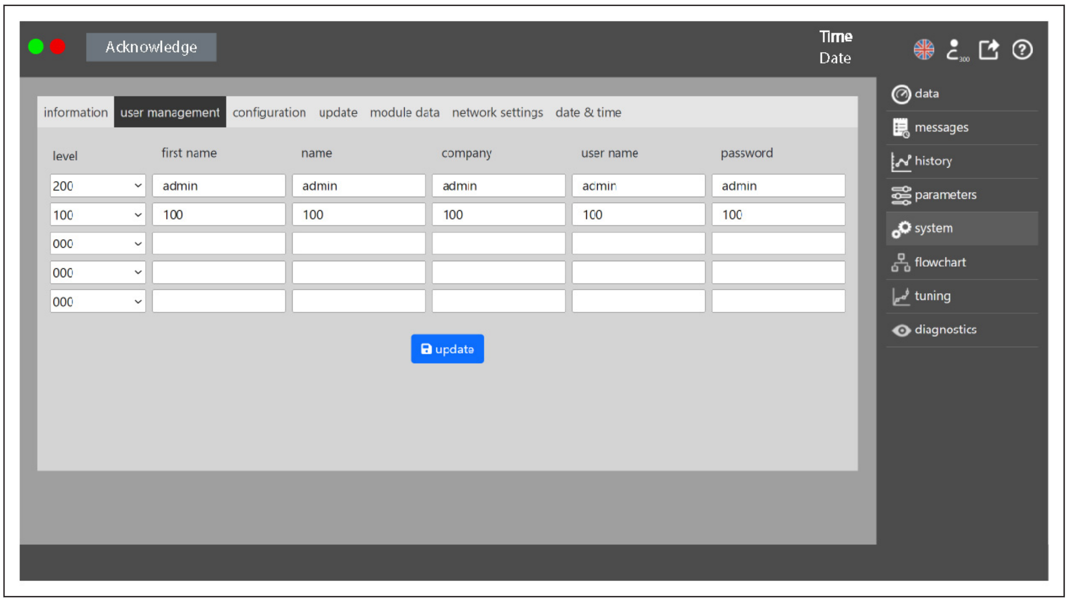
The `Information` tab displays general system information. It allows the user to restart the system.

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.

User management tab



75949-002 Example illustration

The `User management` tab is used by the system administrator to manage users and their authorizations. It is only visible at level 200 or above.

The input area provides:

- Change or delete data of the displayed users
- Create new users

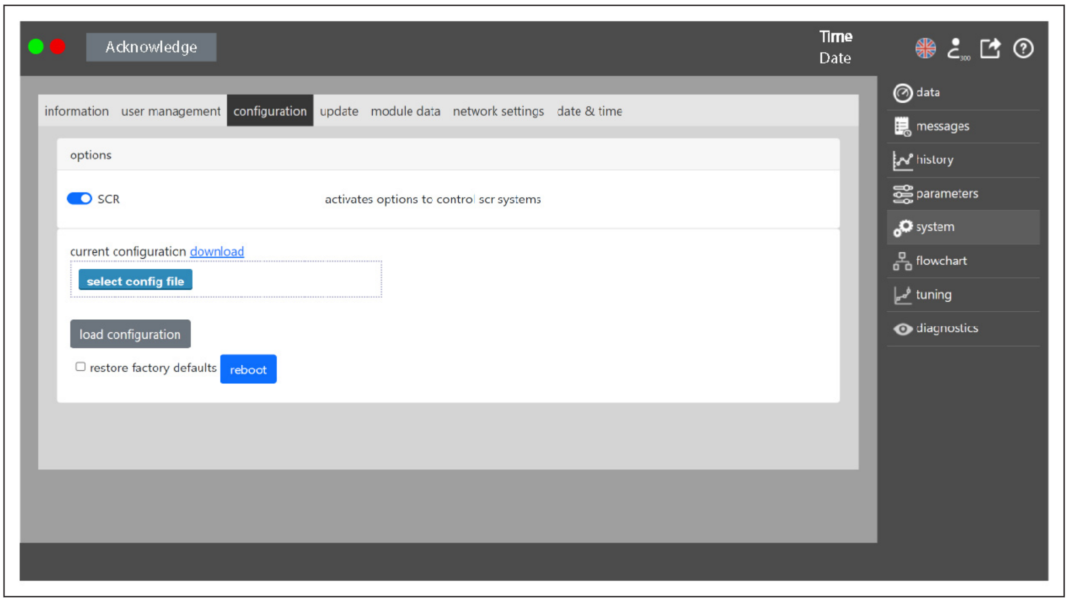
Assignable authorizations are hierarchically divided into levels; they also differentiate between functional groups and individual functions.

Authorization	Level 0	Level 100	Level 200
Functional group "Data":	Read	Read	Read
Functional group "History":	Read	Read	Read
Functional group "Parameters":	Read	Write	Write
Functional group "System":	-	-	Write
Export function:	Yes	Yes	Yes

Tab. 4-4 Structure of authorizations

Update: The button must be pressed to propagate the changes.

Configuration tab



75625-002 Example illustration

The `Configuration` tab is used to manage the configuration of the system.

The input area provides:

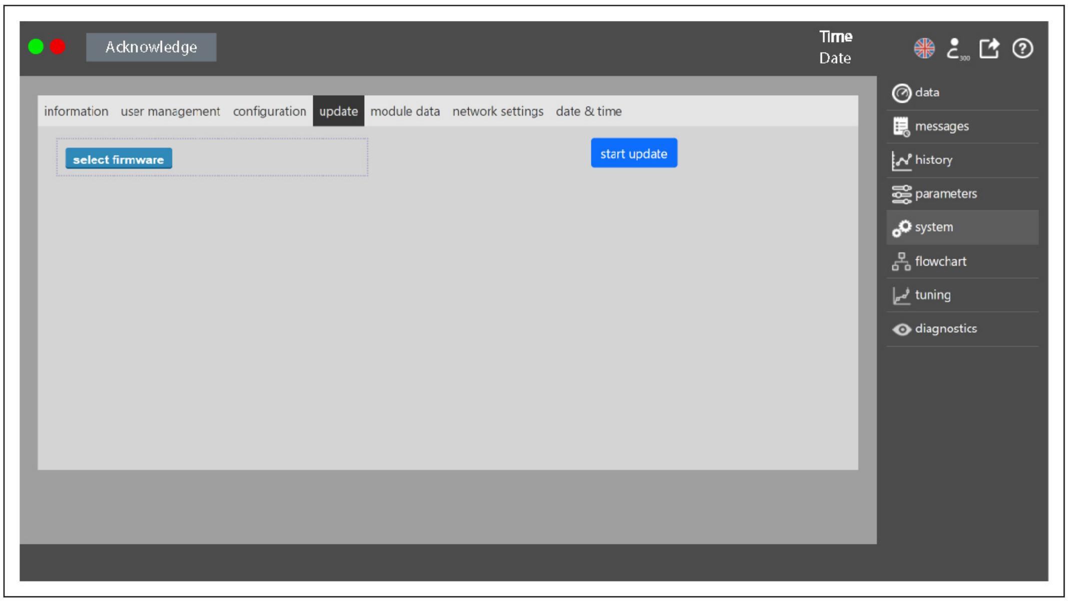
- SCR: Select SCR Control as an extension to the EmiBox functionality
- Current configuration download: export and save current EmiBox parameters and settings
- Select config file: select a saved configuration on the local computer
- Load configuration: load the selected configuration to the EmiBox
- Restore factory defaults: resets the EmiBox to the as-delivered state
- Reboot: restart the EmiBox to activate the settings

Update tab

Risk of destruction of components

Incompatible firmware can lead to malfunctions

- The firmware may only be updated or modified by authorized specialist personnel



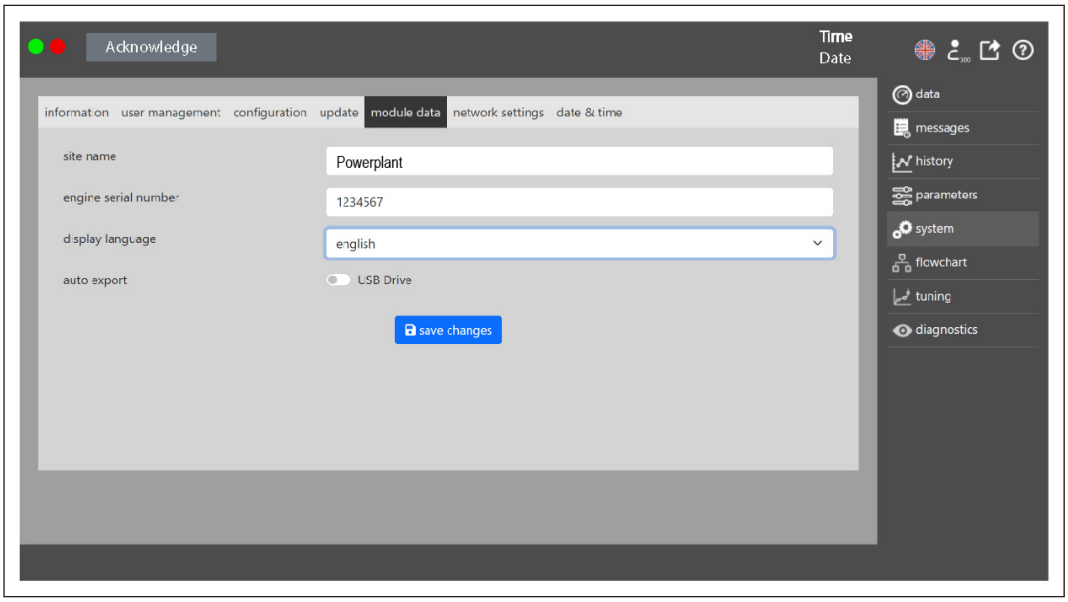
76253-001 Example illustration

The `Update` tab is used to manage the EmiBox's internal firmware.

The input area provides:

- Select firmware: Select the desired firmware from the connected computer
- Start update: the active firmware will be replaced by the selected firmware
  - Only select a newer firmware version than the one already installed.
  - A downgrade to an old firmware version is not possible and may cause the EmiBox to stop working.

Module data tab



76254-001 Example illustration

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

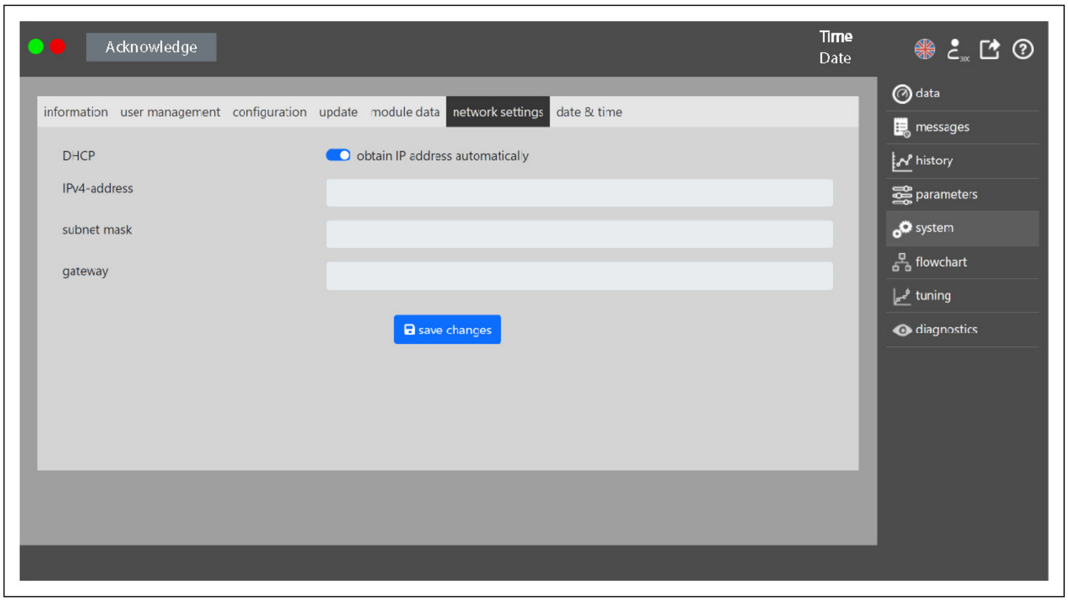
The input area provides:

- 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: Selection of the language used in the user interface displays and on the panel; also affects the language-dependent units (metric/imperial)
- Auto 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 Signal processing and measurement data 42

Network settings tab



76255-001 Example illustration

The `Network settings` tab is used to manage the network connection.

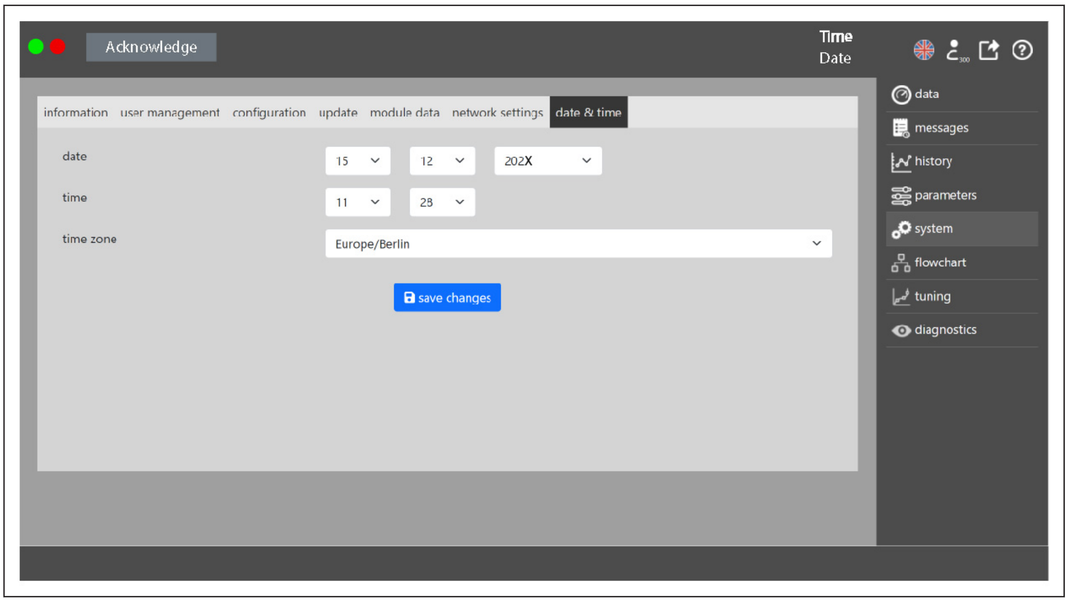
The input area provides:

- `DHCP`: Select the mode for Dynamic Host Configuration Protocol
  – Deactivated (default setting): the IP address is static.
  – Activated: the EmiBox obtains its IP address automatically.
- `IPv4 address`: 10.0.0.98 (default, suitable for TEM/TPEM RPG)
- `Subnet mask`:
- `Gateway`:
- `Save changes`: make your entries go live

Note

In case of special requests, user inputs should be authorized by the competent network administrator.

Date & time tab



76256-001 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.

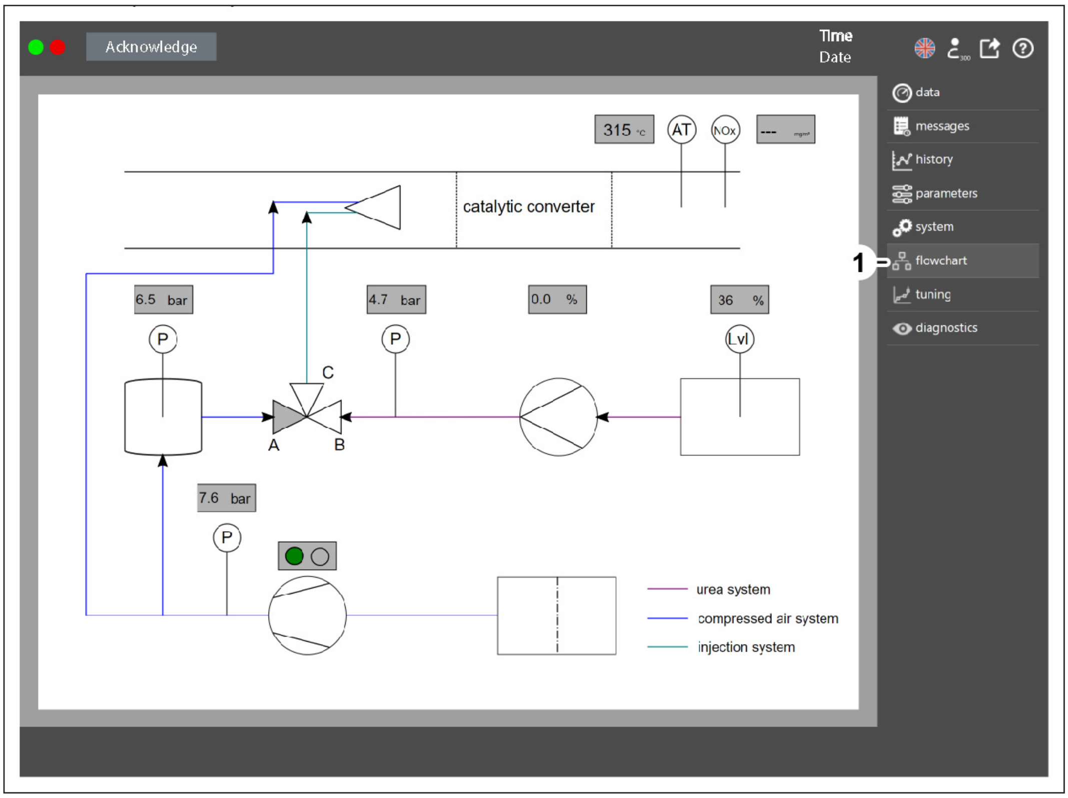
4.6.10 Functional group "Flowchart"

Functional group "Flowchart"

Note

This functionality is only available if the SCR Control Kit is installed!

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



76221-001 Example illustration

The functional group "Flowchart" provides a graphic overview of the system status.

This display area visualizes:

- Measured values from the sensors (NO_x, pressure, temperature, urea level)
- Status of the compressor (green/red LED)
- Status of the urea pump (flow rate)
- Status of the 3-way valve

4.6.11 Functional group "Profiles"

Profile

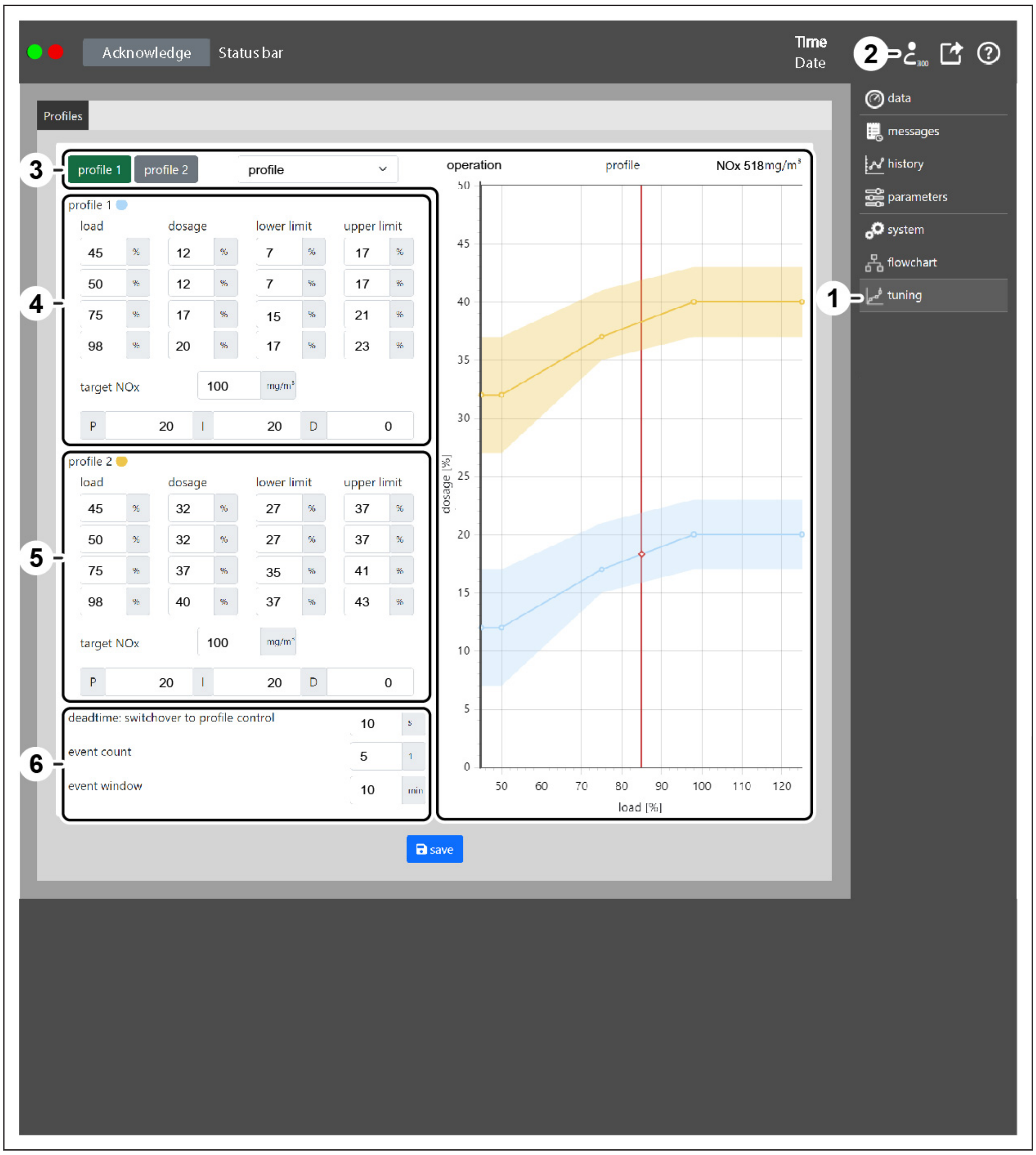
Note

This functionality is only available if the SCR Control Kit is installed.

A login with an authorization level of at least 300 (2) is required to display this!

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

The functional group "Profiles" is used to configure profiles for the open- and closed-loop behavior of the system. It displays the effect of the current setting on the operating behavior in a graph.



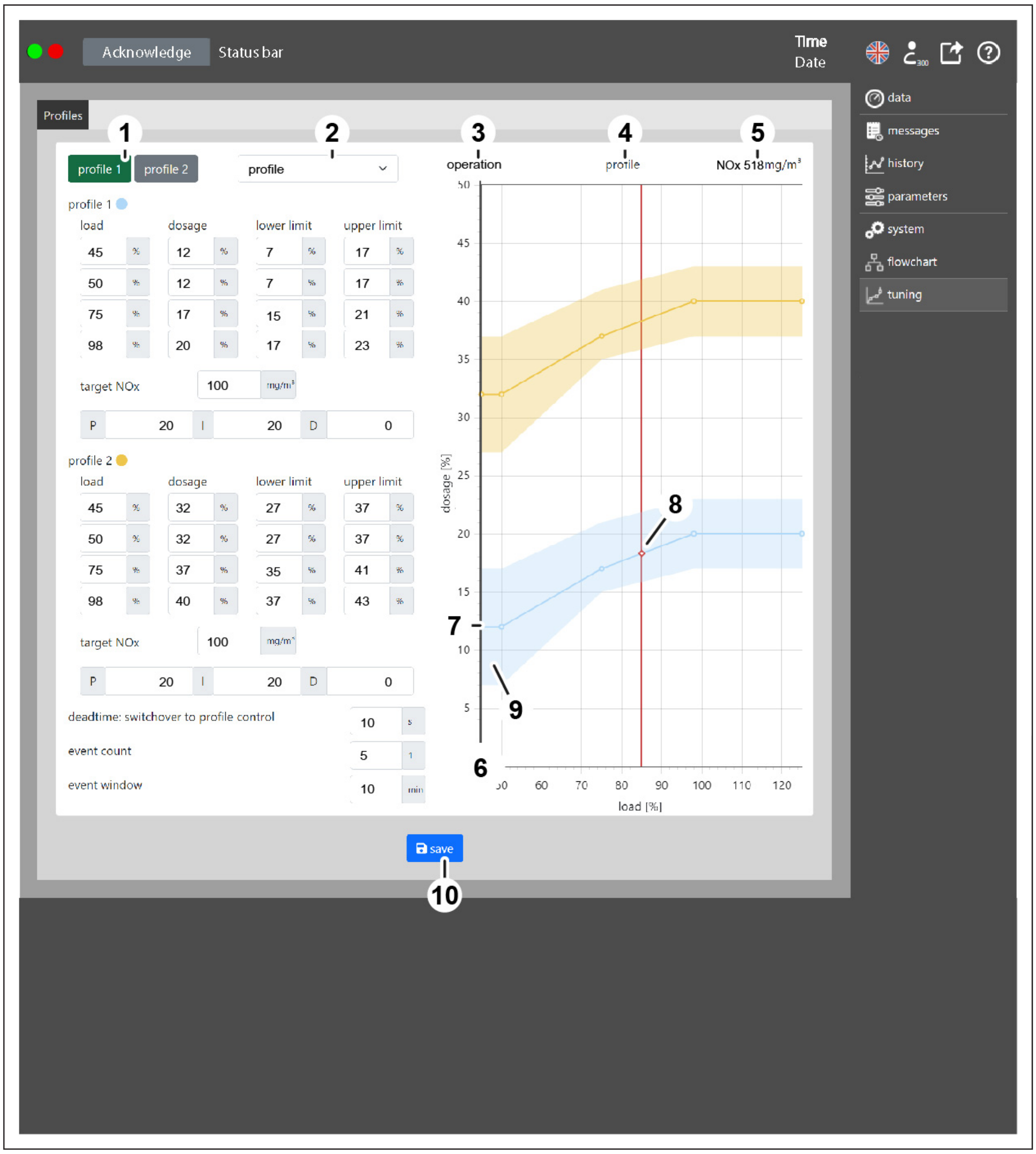
76239-001 Example illustration

The display can be divided into the following areas:

- Mode and operation overview (3)
- Profile (4) or (5)
- Monitoring (6)

353-003-EN : 51000010 : BA : VAR, COV, IMP, B, BA, BS, DEM, EIN, IBN, IST, WP, SK, MH, SB, STB, TA, TL

Mode and operation overview



76240-001 Example illustration

This display area provides information on the control mode, the operating status and a visualization (graph):

- The display (1) shows which profile is currently active. If 2 profiles are required, an automatic switchover must take place via an external signal.
- The multi-function field (2) lets the user specify the mode according to the desired closed- or open-loop control type:
  - `PID` as the basis for **Closed-loop control** mode in standard operation
  - `Profile` as the basis for the **Open-loop control** mode if PID control is not possible
  - Once the selection has been made, the `Save` button (10) activates the new mode for the SCR system

353-003-EN : 51000010 : BA : VAR, COV, IMP, B, BA, BS, DEM, EIN, IBN, IST, WP, SK, MH, SB, STB, TA, TL

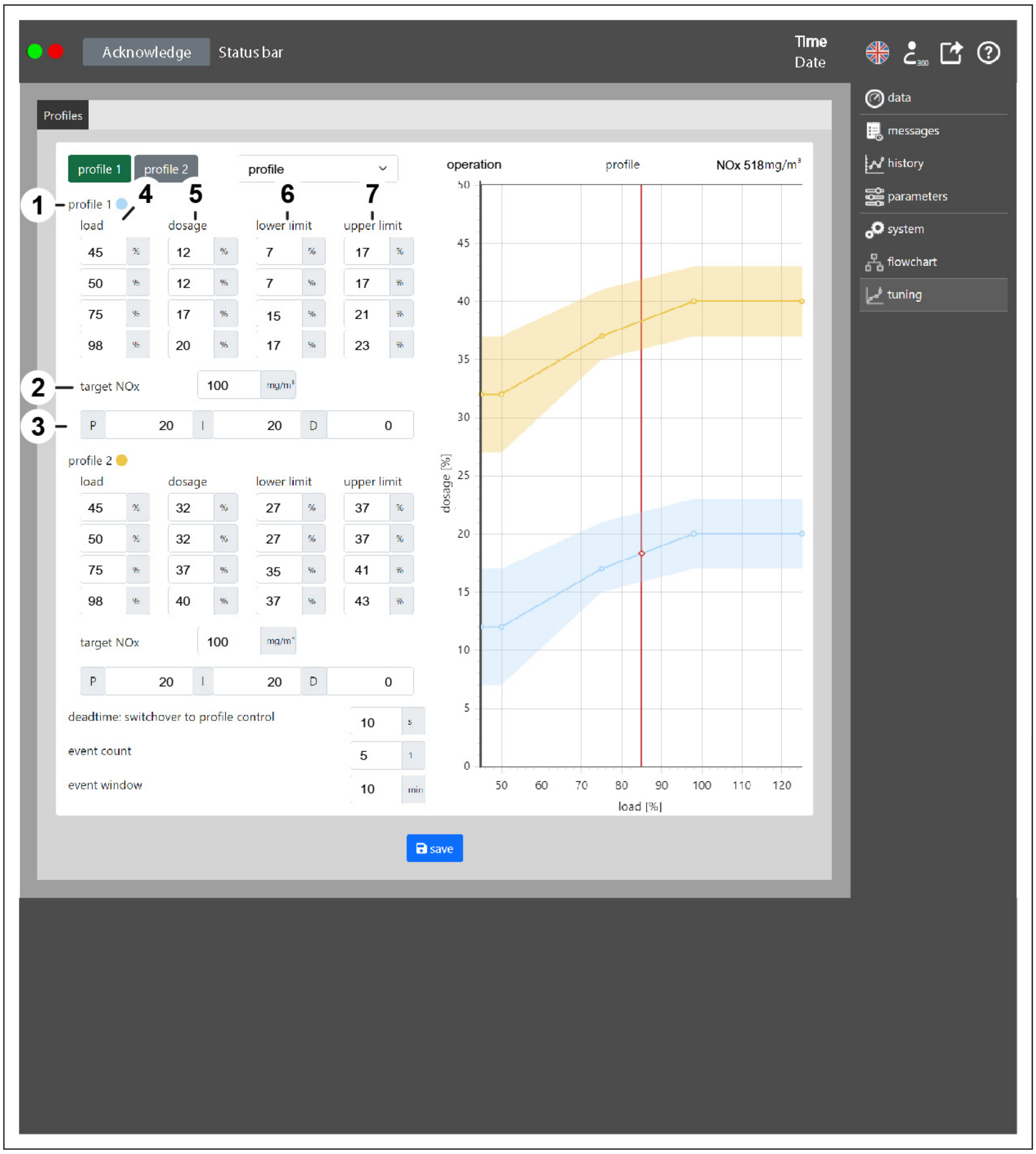
- Display area (3) shows the current operating state (for more information, see chapter 4.4.3 Operating states 55).
- Display area (4) shows the mode currently in use.
- Display area (5) shows the current NO_x value. The display update depends on which display smoothing parameters were assigned (for more information, see chapter 4.6.8.3 NOx sensor tab 78).

The following applies for the graph (8):

- Display of the profiles (7) with limits (9):
  - Display of the static profile (7) with its turning points resulting from the parameterized engine load and dosing.
  - Display of a static tolerance band (9) resulting from the parameterized limits. The current dosing capacity should move within this band
  - Each characteristic appears in the color of its profile
- The current operating point (dosing capacity according to the engine load) is indicated by the red diamond (8):
  - Depending on the active profile, the diamond will appear in the blue or yellow area.
  - In profile mode, the diamond is on the profile.
  - In PID control mode, it moves vertically on the red line within the tolerance band (defined by the limits) in accordance with the dynamic control behavior. Monitoring ensures that it does not leave the tolerance band.

353-003-EN : 51000010 : BA : VAR, COV, IMP, B, BA, BS, DEM, EIN, IBN, IST, WP, SK, MH, SB, STB, TA, TL

Profile



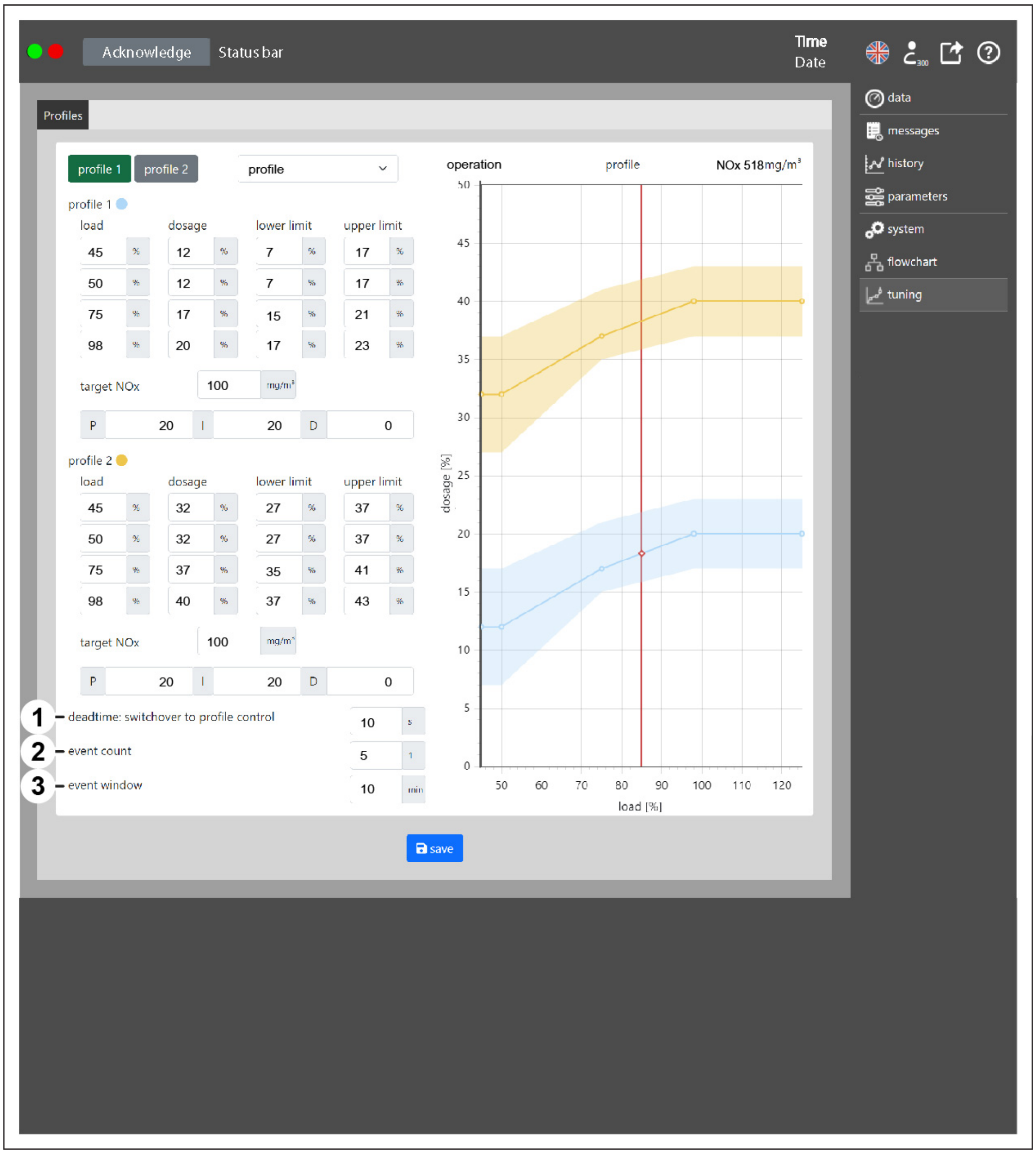
76241-001 Example illustration

The `Profile` input area (1) is used to parameterize the specific profile and the dynamics of the PID controller:

- Two profiles can be configured to suit the various applications of the genset and its SCR system
  - `Profile 1` (blue) is the default profile for the usual combustion processes. The parameters are determined manually for the specific SCR application while the genset is running and then entered
  - `Profile 2` (yellow) is a supplement for different NO_x specifications or for special applications, such as dual-gas operation

- The table lets the user enter 4 characteristic operating states
  - `Load` (4) and `Dosis` (5) define the turning points of the static profile.
  - `Lower limit` (6) and `Upper limit` (7) define the static tolerance band.
  - `Target NOx` defines the NO_x value that must be observed.
- The `PID` input area (6) is used for parameterizing the PID control behavior.

Monitoring



76242-001 Example illustration

This input area configures the system behavior in the event of implausible system states. The following applies to normal operation:

- SCR Control runs with PID control and automatically doses the required amount of urea
- The diamond (current operating point of the dosing system) is within the tolerance band (dosing capacity is plausible)
- If the diamond moves to a limit of the tolerance band, or the current dosing deviates significantly from the determined behavior of the SCR system:

353-003-EN : 51000010 : BA : VAR, COV, IMP, B, BA, BS, DEM, EIN, IBN, IST, WP, SK, MH, SB, STB, TA, TL

  - The ratio of dosing capacity to NO_x value is no longer plausible
  - SCR Control switches to the taught-in static profile after an adjustable `Deadtime` (1).
  - As the diamond then moves back into the plausible range, the SCR Control switches back to PID control.
- To differentiate whether the switchover is only a temporary event or whether it is the result of operational factors, the following applies:
  - The `Event count` (2) defines how often the event is tolerated in the defined time range, called the `Event window` (3).
- If the mode continues to switch over, the `Dosing capacity implausible` alarm is triggered.

Further information

- For further information on the profile, see chapter 7.3.15 Defining the profile 203
- For more information on PID control, see chapter 7.3.16 Setting the PID controller 205

4.6.12 Functional group "Diagnostics"

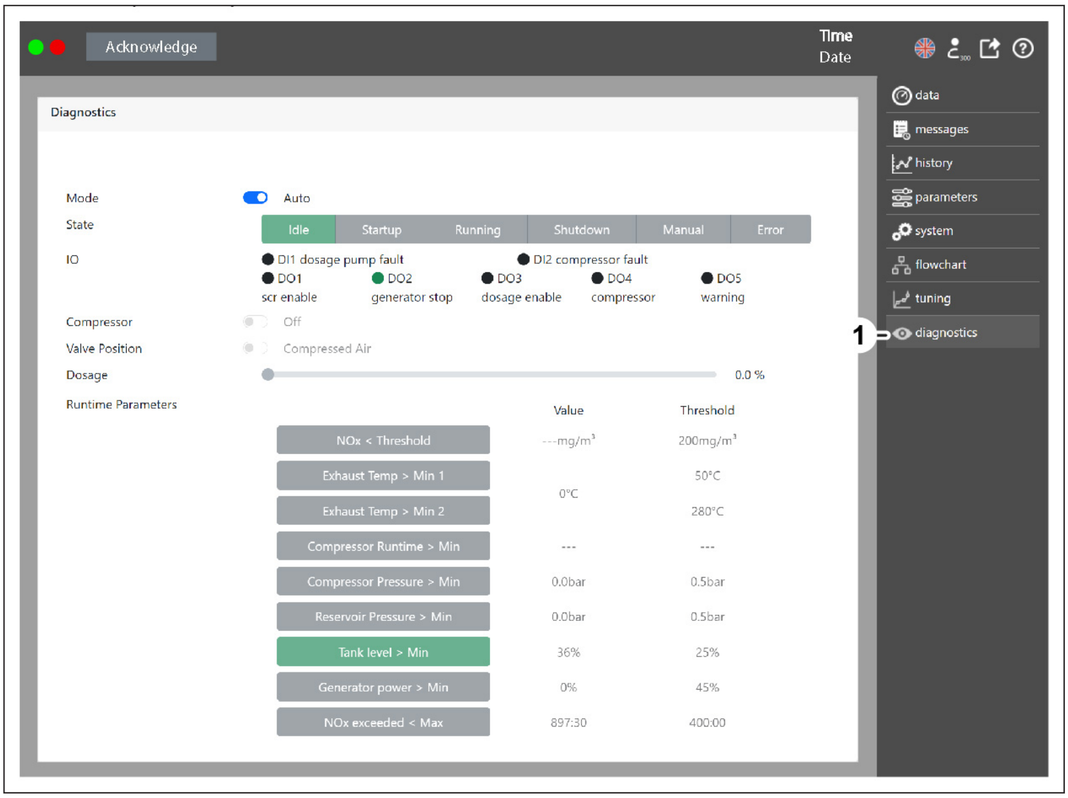
Diagnostics

Note

This functionality is only available if the SCR Control Kit is installed.

A login with an authorization level of at least 300 (2) is required to display this!

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



76224-001 Example illustration

The functional group `Diagnostics` shows system data related to injection. Authorized specialist personnel also have the option of changing the operation mode in order to manually actuate the injection system for making adjustments.

4.7 Remote access as an option

4.7.1 Purpose and overview of the function

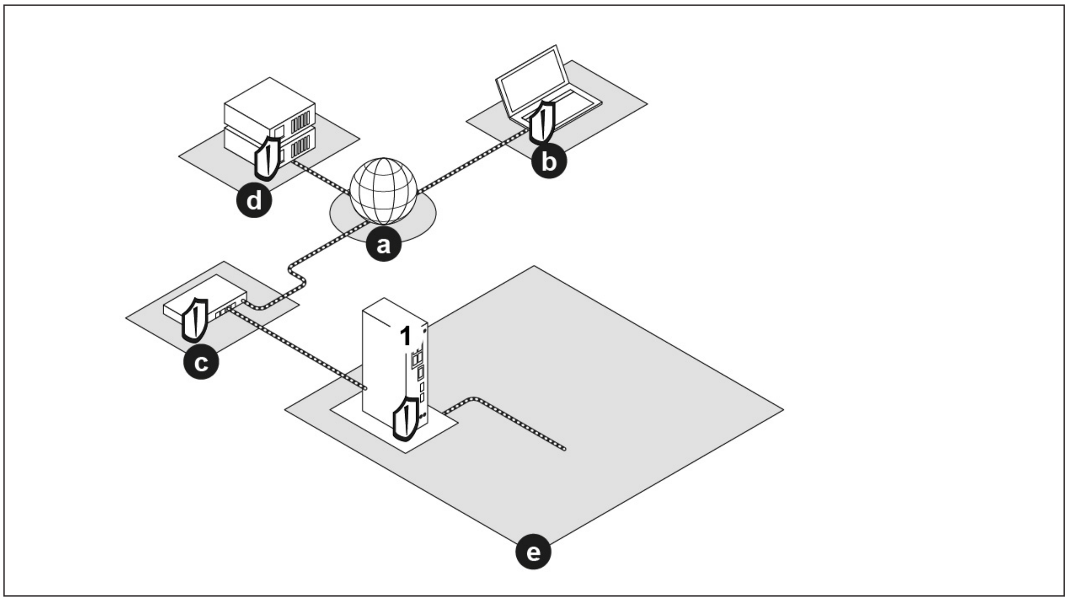
Remote access allows a network-enabled computer (client) to access the web server of the EmiBox from any location via the internet. This lets operators and authorized personnel, depending on their authorizations, view operating data, export system states or exchange data. When explaining the principle 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.



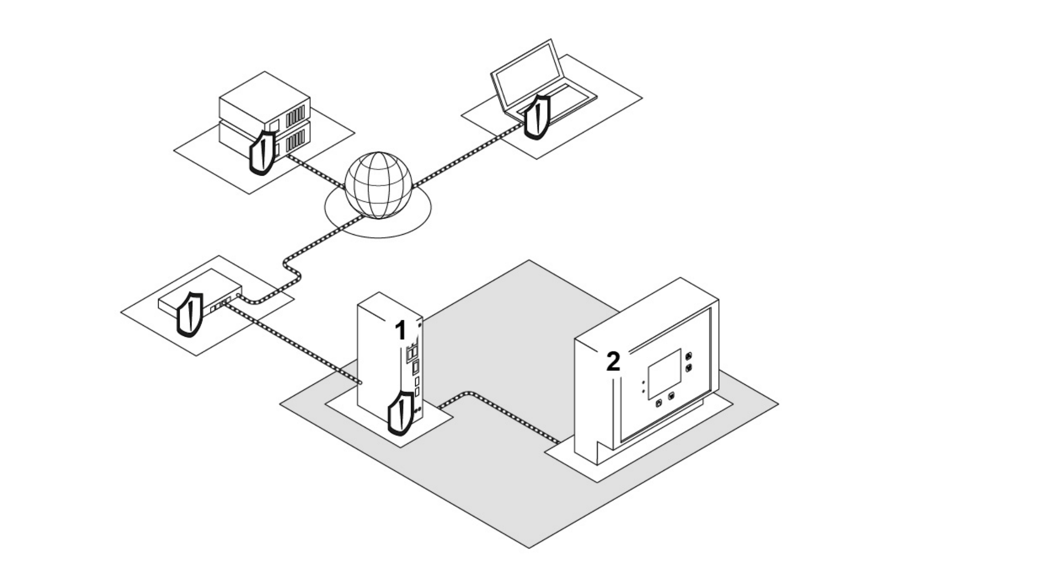
75933-001 Example illustration: Networks and interfaces

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).

353-003-EN : 51000010 : BA : VAR, COV, IMP, B, BA, BS, DEM, EIN, IBN, IST, WP, SK, MH, SB, STB, TA, TL



75932-001 Example illustration: Remote access with EmiBox

1 TEM/TPEM Remote Plant Gateway router with firewall

2 EmiBox with web server

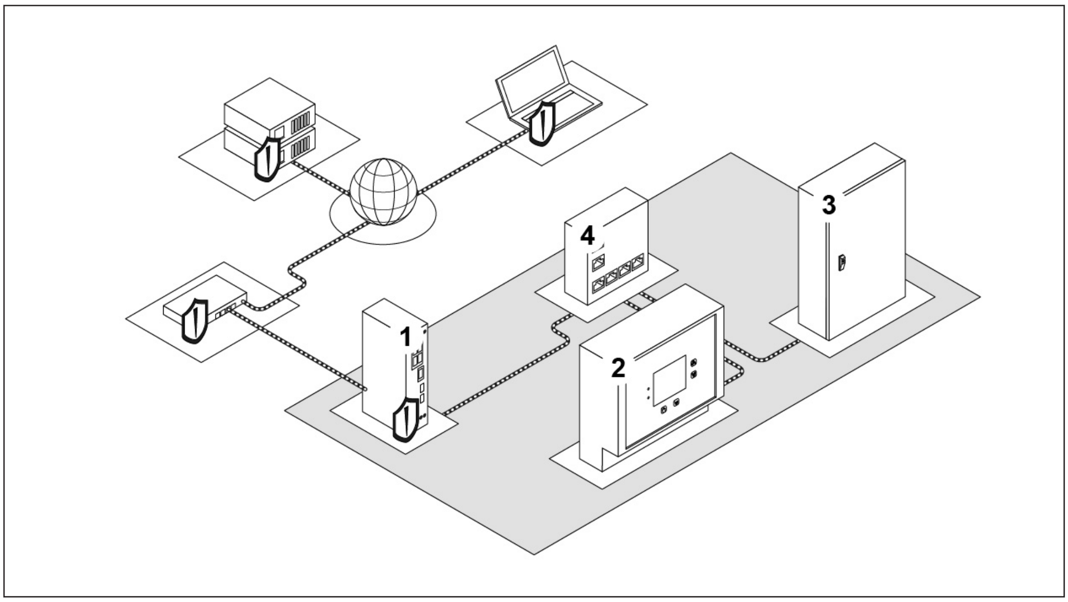
The EmiBox contains an integrated web server that the client can access. The requirements for the client to communicate with the web server of the EmiBox are:

- 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).

353-003-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

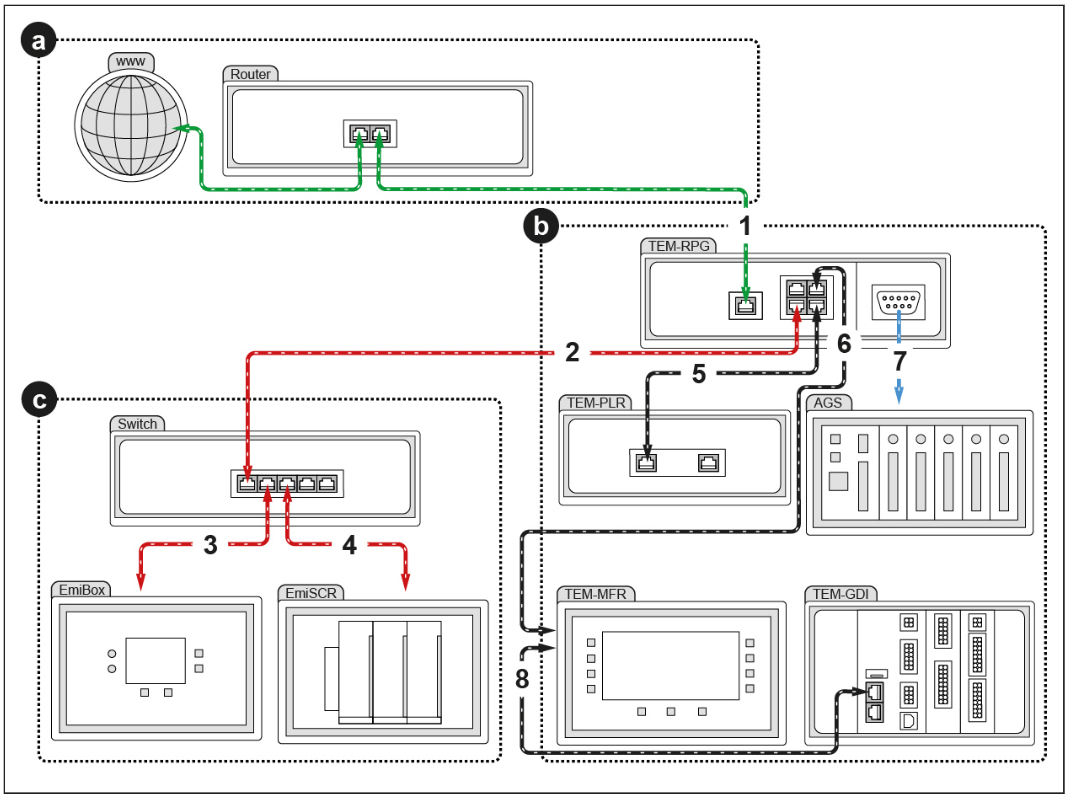
2 EmiBox with web server

3 SCR Control switchgear cabinet with network connection

4 Switch for EmiBox and SCR Control

4.7.2 Communication concept (TEM system)

The following diagram shows schematically the communication concept for remote access in the TEM system. Access to the EmiBox components is shown in red.



75820-001 Communication concept

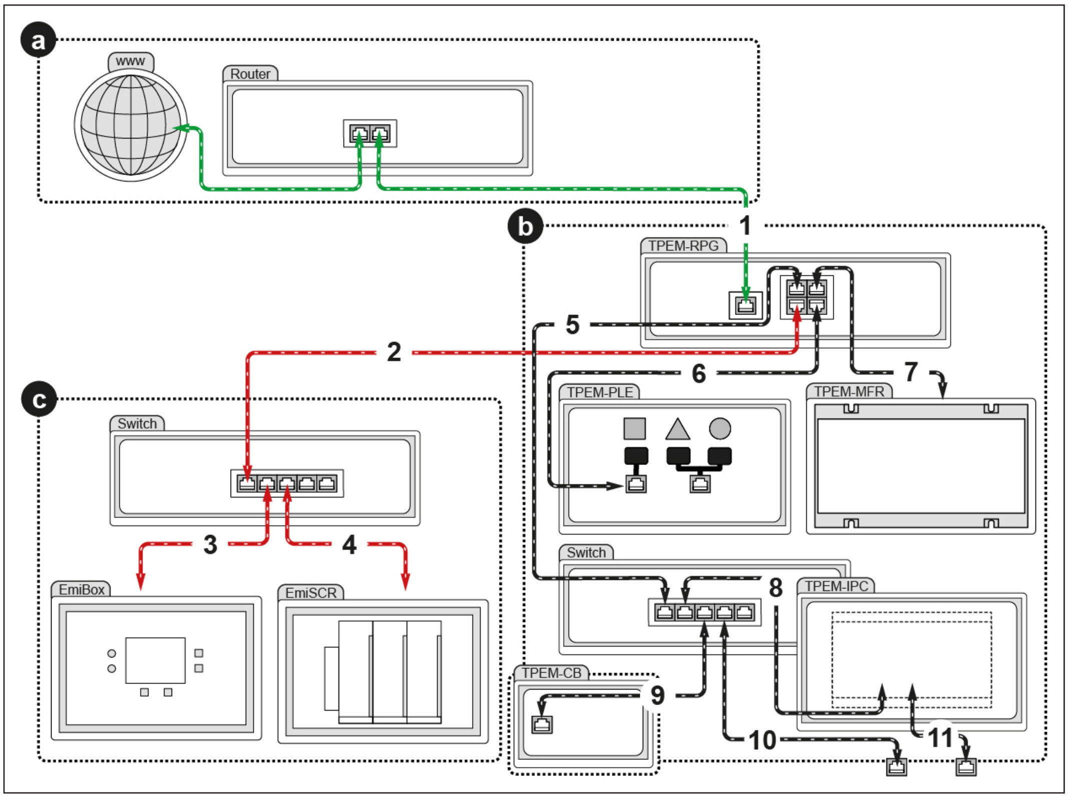
Item	Area	Remark
a	Plant operator	Internet connection and network with standard IT security.
b	Genset control system	Electronic components in the genset control cabinet (AGS) and in the auxiliary cabinet (HAS) or an operator-side switchgear cabinet.
c	Emission measurement and SCR Control	Switch, installed in a suitable switchgear cabinet, e.g. auxiliary cabinet (HAS). EmiBox with internal logic for monitoring and SCR Control. EmiSCR (SCR Control switchgear cabinet) as an interface for control of and communication with the connected SCR application.

Item	Connection	Remark
1	Operator <-> TEM RPG	
2	TEM RPG <-> Switch	
3	Switch <-> EmiBox	
4	Switch <-> EmiSCR	
5	TEM RPG <-> TEM PLR or PLE	
6	TEM RPG <-> TEM MFR	

Item	Connection	Remark
7	TEM RPG <-> AGS	
8	TEM MFR <-> TEM GDI	

4.7.3 Communication concept (TPEM system)

The following diagram shows schematically the communication concept for remote access in the TPEM system. Access to the EmiBox components is shown in red.



75885-001 Communication concept

Item	Area	Remark
a	Plant operator	Internet connection and network with standard IT security.
b	Genset control system	Electronic components in the TPEM Control Cabi-net (TPEM CC) except for the TPEM Connection Box (TPEM CB) located on the genset
c	Emission measurement and SCR Control	Switch, installed in a suitable switchgear cabinet, e.g. auxiliary cabinet (HAS). EmiBox with internal logic for monitoring and SCR Control. EmiSCR (SCR Control switchgear cabinet) as an interface for control of and communication with the connected SCR application.

Item	Connection	Remark
1	Operator <-> TEM RPG	
2	TPEM RPG <-> Switch	
3	Switch <-> EmiBox	
4	Switch <-> EmiSCR	
5	TPEM RPG <-> Switch	
6	TPEM RPG <-> TPEM PLE	
7	TPEM RPG <-> TPEM MFR	
8	Switch <-> TPEM IPC	
9	Switch <-> TPEM CB	Interface on the genset for service work
10	Switch <-> TPEM CC	Interface on the switchgear cabinet front for service work
11	TPEM IPC <-> Modbus	Interface for external Modbus connection

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

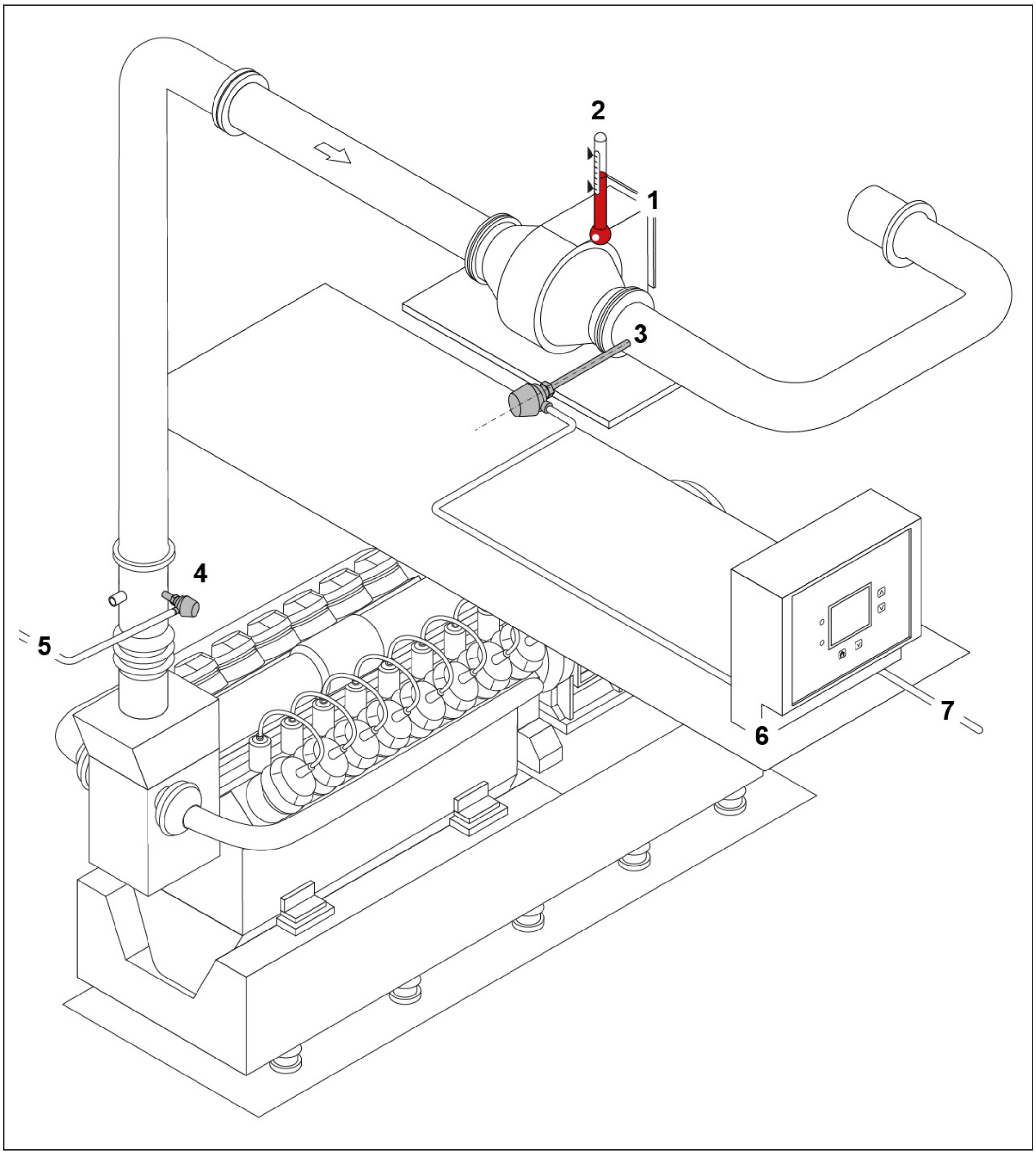
For necessary information on IT security, see

- Operator IT contact person

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.

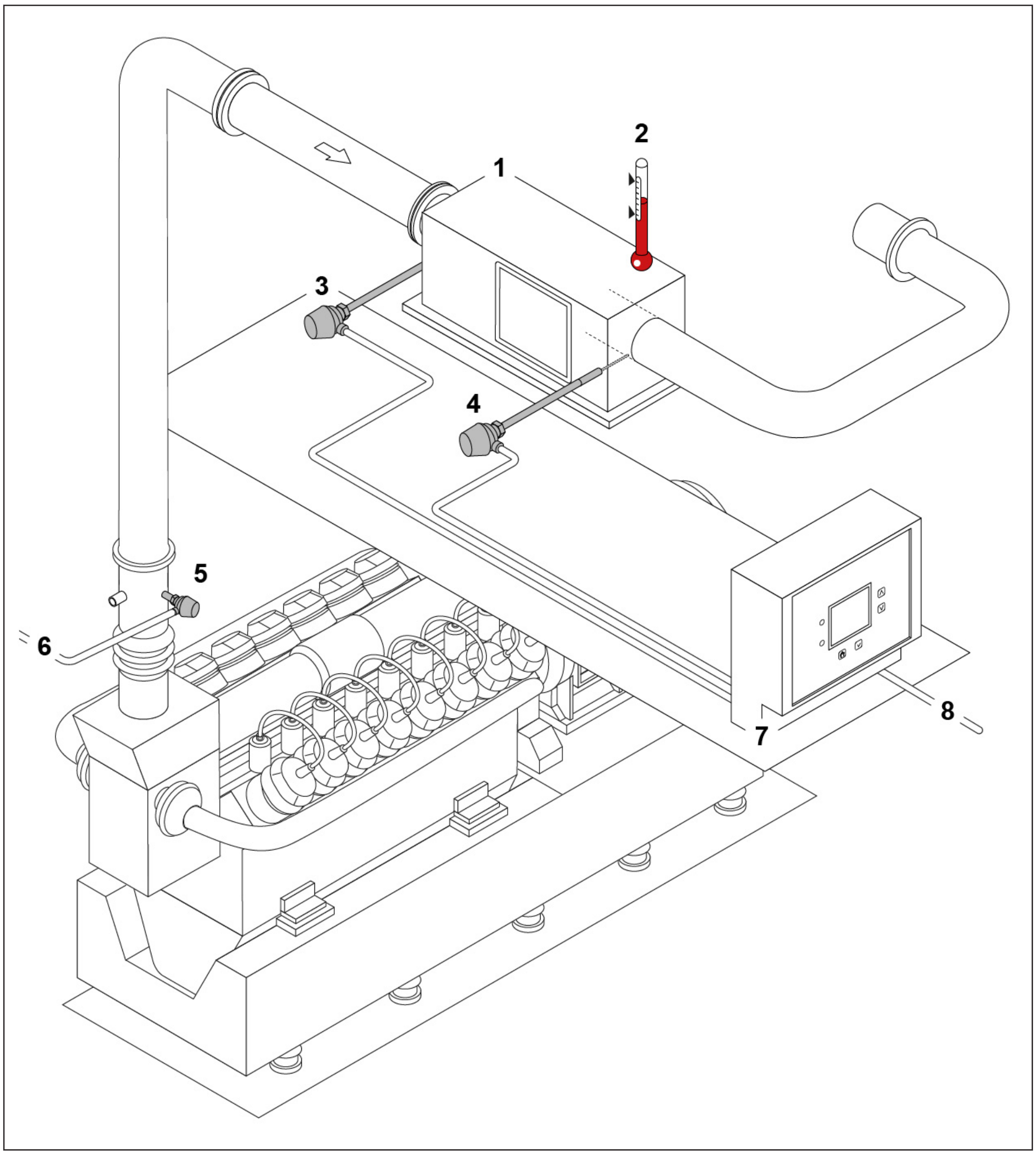
Integrating the temperature sensors into the TEM/TPEM system and assigning correct parameters during commissioning assures sufficient protection of the catalytic converter against excessive process temperatures (2).

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 (7) 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.

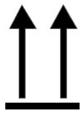
Tempera-ture	Position	Temperature monitoring response
At 500 °C	Upstream of CAT	**EmiBox** • Warning message
505 °C and higher	Genset or pre-CAT	**TEM/TPEM system** • Warning message and entry in operation log • If the signal is pending for 5 minutes, a controlled shutdown of the genset will occur
At 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

353-003-EN : 51000010 : BA : VAR, COV, IMP, B, BA, BS, DEM, EIN, IBN, IST, WP, SK, MH, SB, STB, TA, TL

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

353-003-EN : 51000010 : BA : VAR, COV, IMP, B, BA, BS, DEM, EIN, IBN, IST, WP, SK, MH, SB, STB, TA, TL

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.

353-003-EN : 51000010 : BA : VAR, COV, IMP, B, BA, BS, DEM, EIN, IBN, IST, WP, SK, MH, SB, STB, TA, TL

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	×	×	×	×	–	–
Monitoring with TPEM	×	×	×	–	×	–
Monitoring and SCR Control with TEM	×	×	×	×	–	–
Monitoring and SCR Control with TPEM	×	×	×	×	–[2]	–
Remote access for EmiBox with TEM/ TPEM	–	–	–	×	–	–
Remote access for EmiBox and SCR Control Kit with TEM/TPEM	–	–	–	×	–	×

[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

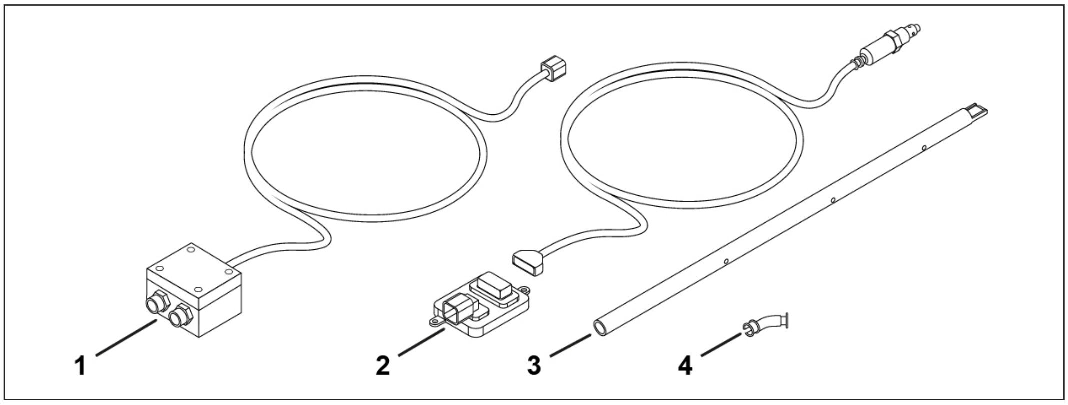
Tab. 6-1 Installation variants

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

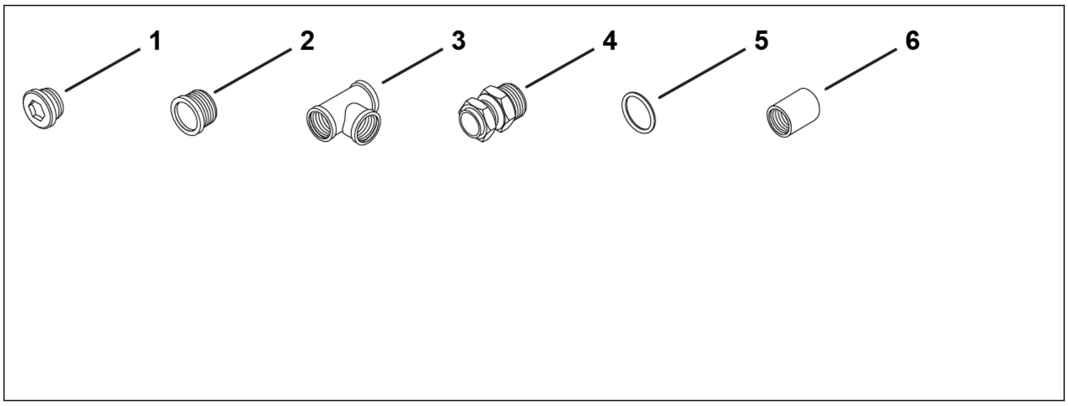
2 NO_x sensor and sensor control device

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.)

353-003-EN : 51000010 : BA : VAR, COV, IMP, B, BA, BS, DEM, EIN, IBN, IST, WP, SK, MH, SB, STB, TA, TL

5	Copper sealing ring (8 pcs.)
6	Welding coupling sleeve

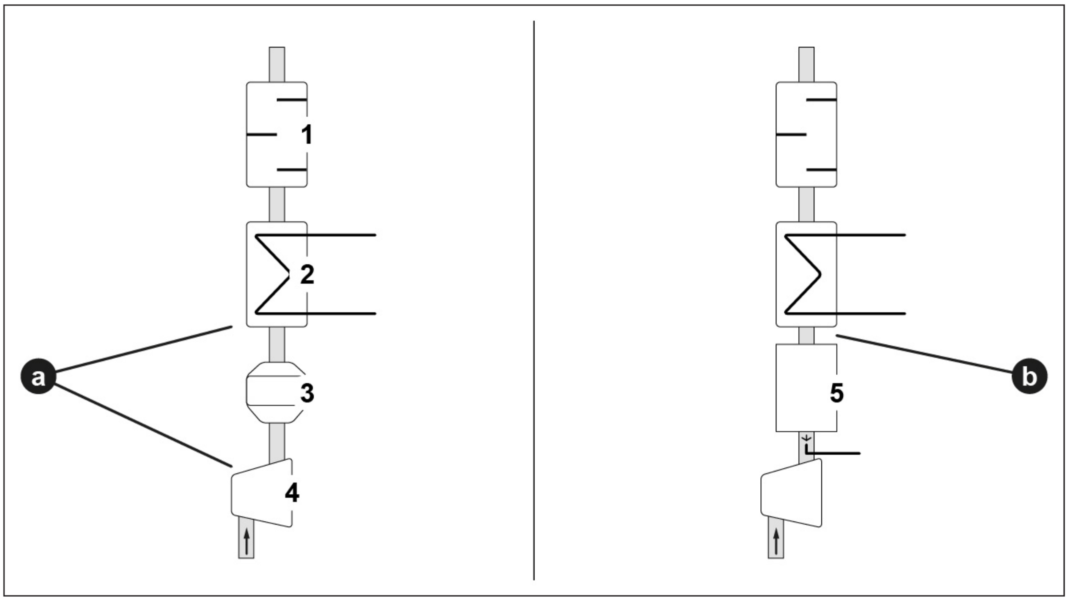
Installation site, installation orientation and temperatures

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.

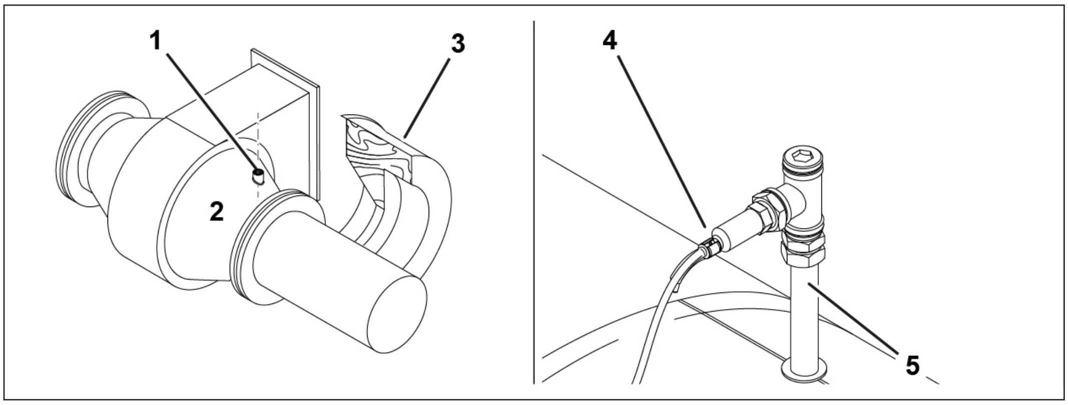
Risk of destruction of components

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

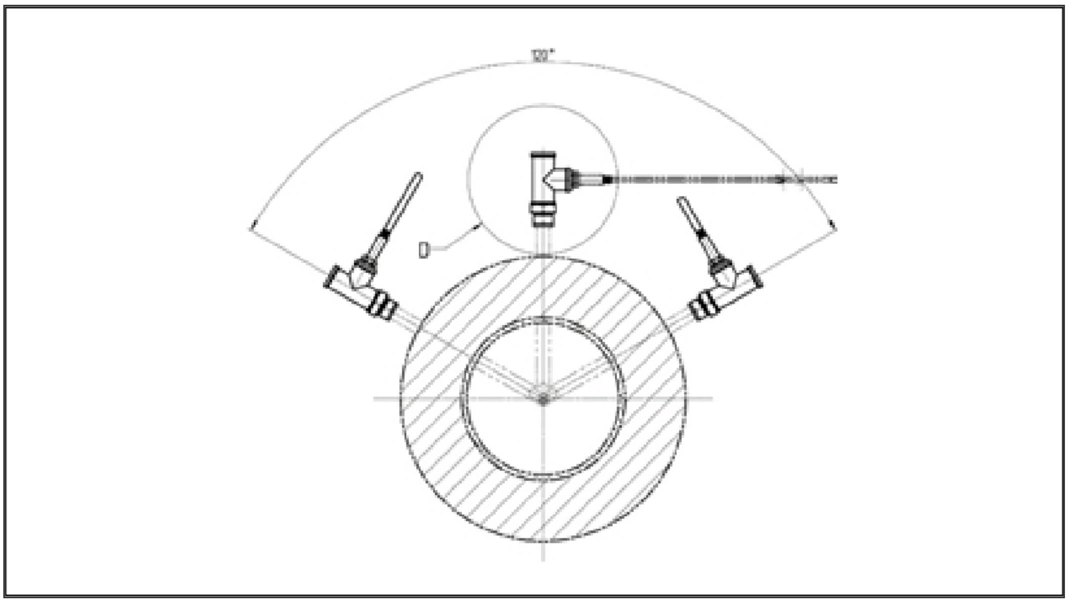
2 Catalytic converter (in the example: an oxidation catalytic converter)

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

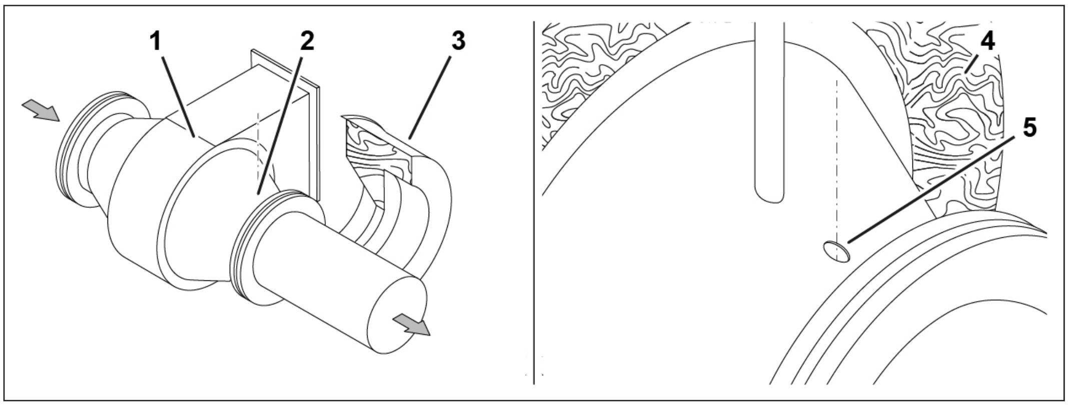
Oftentimes, there is no suitable screw-in connection piece for the measuring lance in the exhaust system. Therefore, in the following description, the included weld-on sleeve is assembled to serve as a screw-in connection piece.

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.

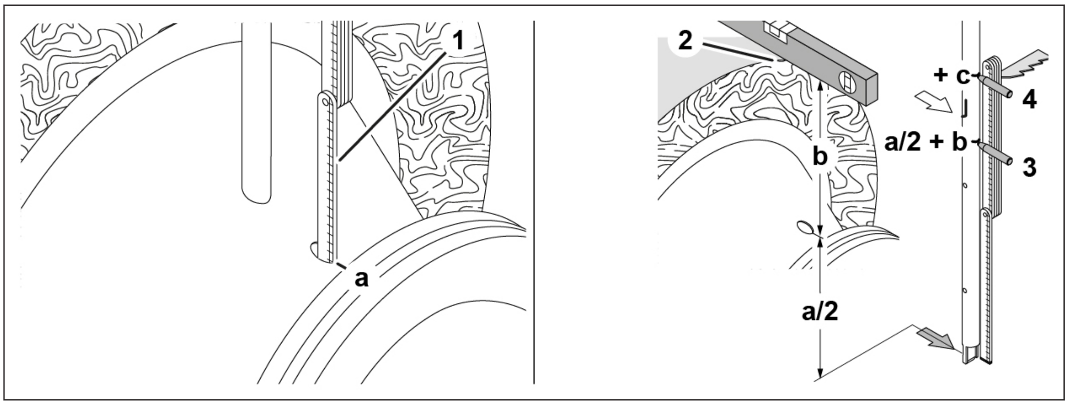


75844-001 Example illustration of a cone-shaped oxidation catalytic converter

- 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

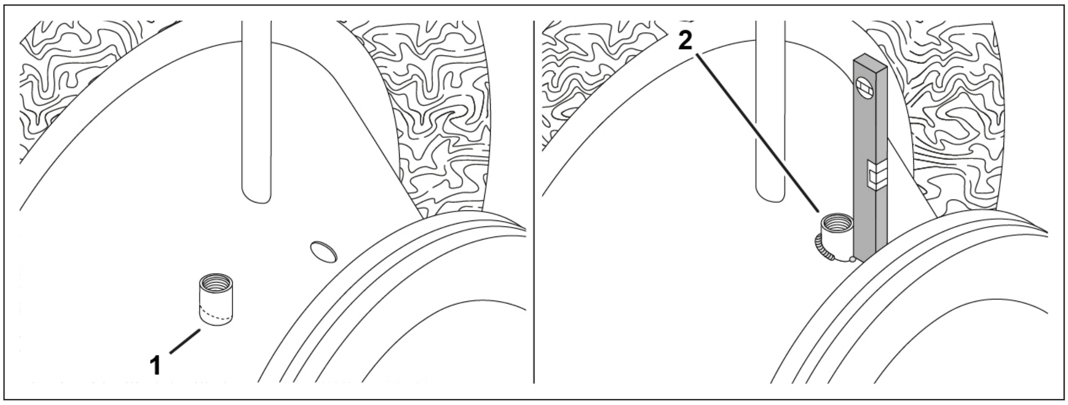
– Rotate the scoop so that its opening is parallel to the exhaust pipe and faces into the flow. This is the alignment angle.
– Above the insertion depth mark on the measuring lance (3), make a clear marking for the alignment angle.
– Truncate the measuring lance at the total length marking (4).

Welding the connection sleeve

Risk of destruction of components

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

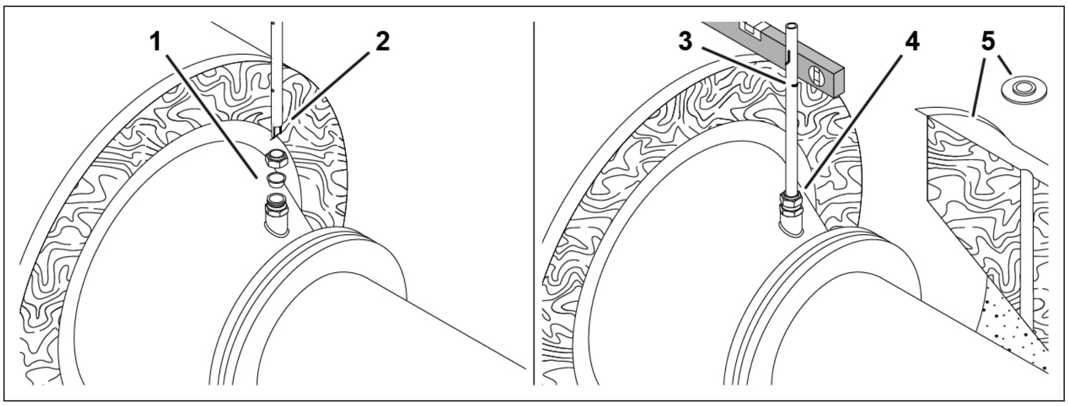
- Always affix the ground cable in the immediate vicinity of the welding electrode.



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

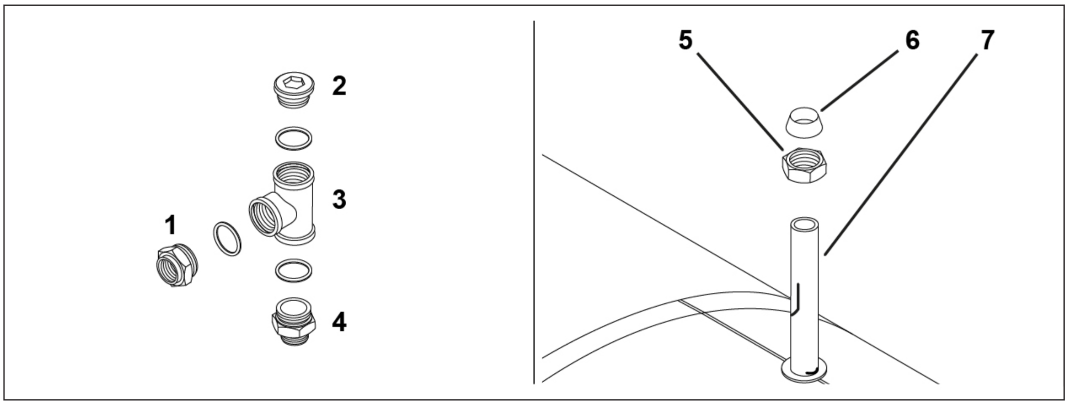


75847-001 Example illustration

353-003-EN : 51000010 : BA : VAR, COV, IMP, B, BA, BS, DEM, EIN, IBN, IST, WP, SK, MH, SB, STB, TA, TL

- 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.

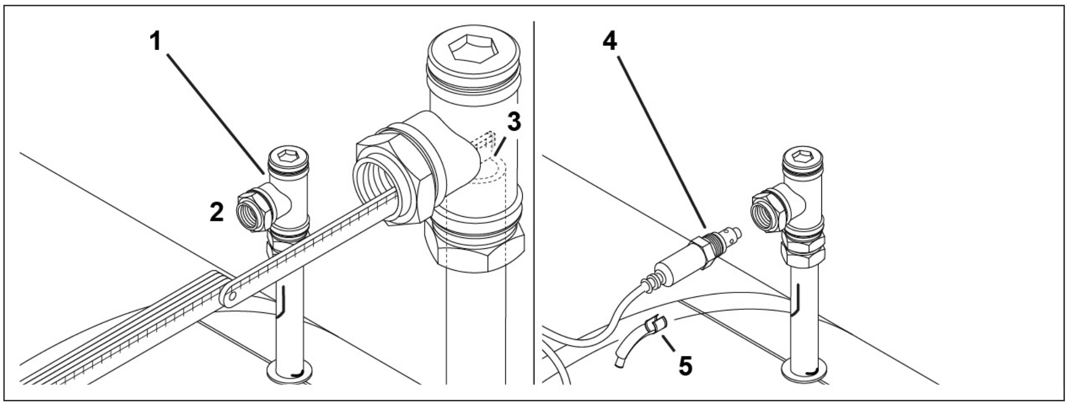
Assembling the T piece an NO_x sensor

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.

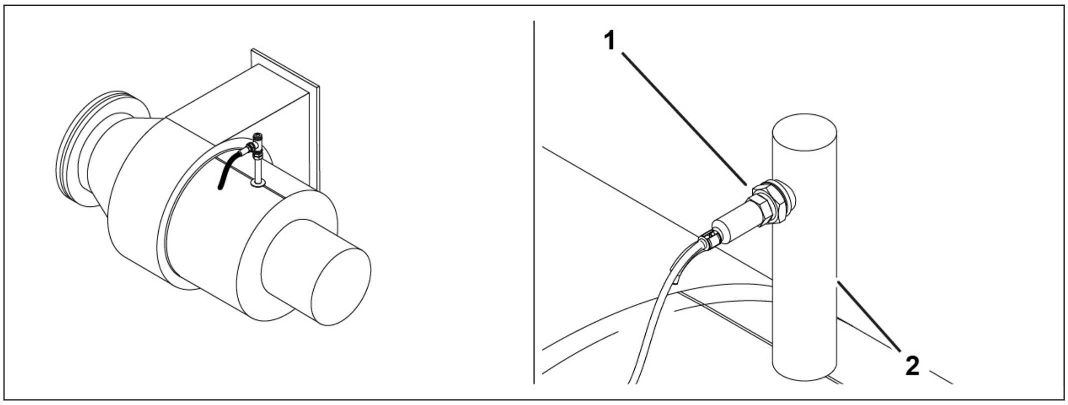
353-003-EN : 51000010 : BA : VAR, COV, IMP, B, BA, BS, DEM, EIN, IBN, IST, WP, SK, MH, SB, STB, TA, TL



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.

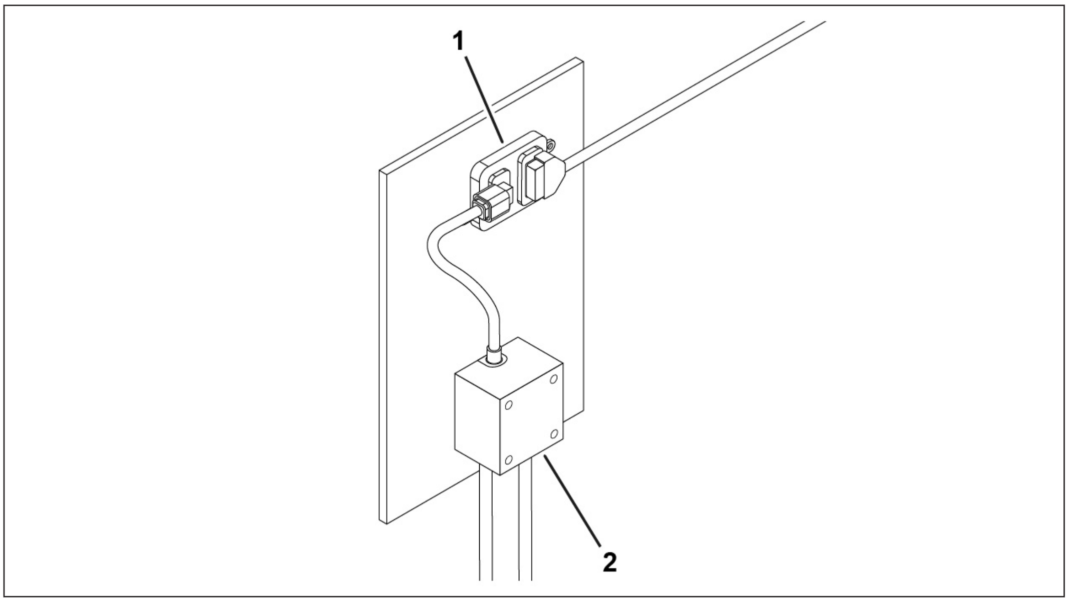
Terminal box and sensor control device

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

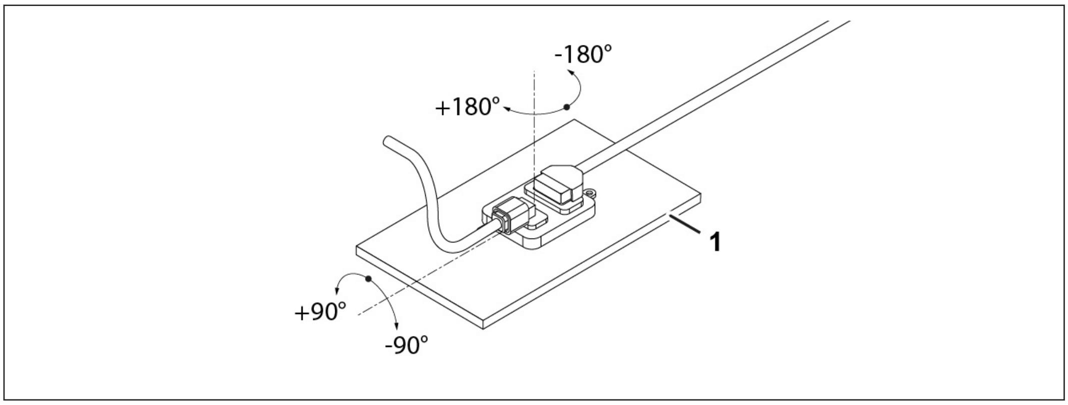
2 Terminal box

353-003-EN : 51000010 : BA : VAR, COV, IMP, B, BA, BS, DEM, EIN, IBN, IST, WP, SK, MH, SB, STB, TA, TL

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:



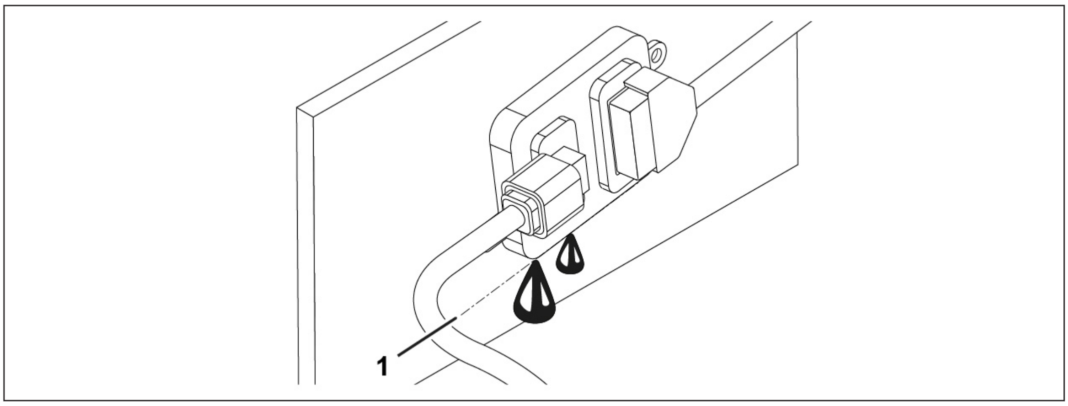
75944-001 Example illustration

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

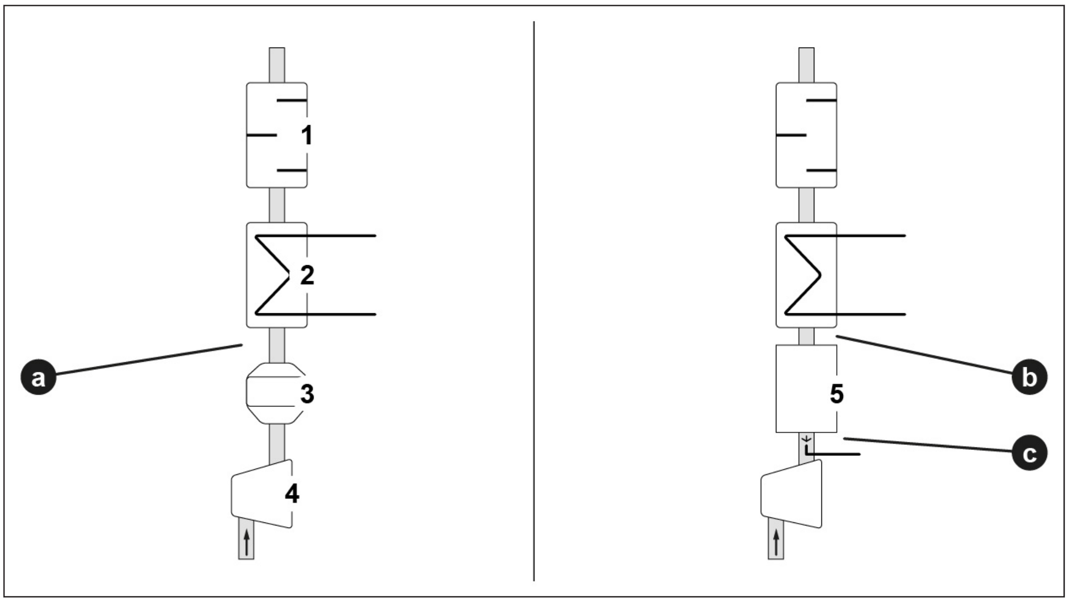
Excessive exhaust temperatures can damage the catalytic converter and the NO_x sensor

- 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

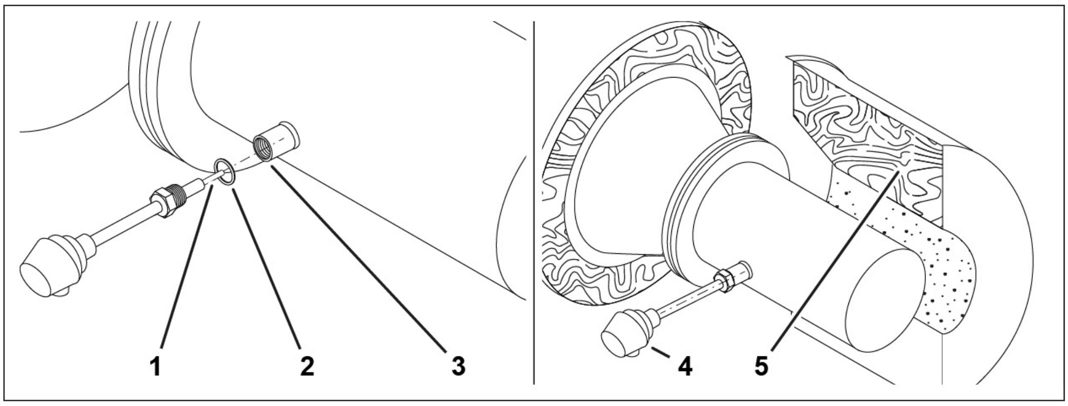
Notes

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

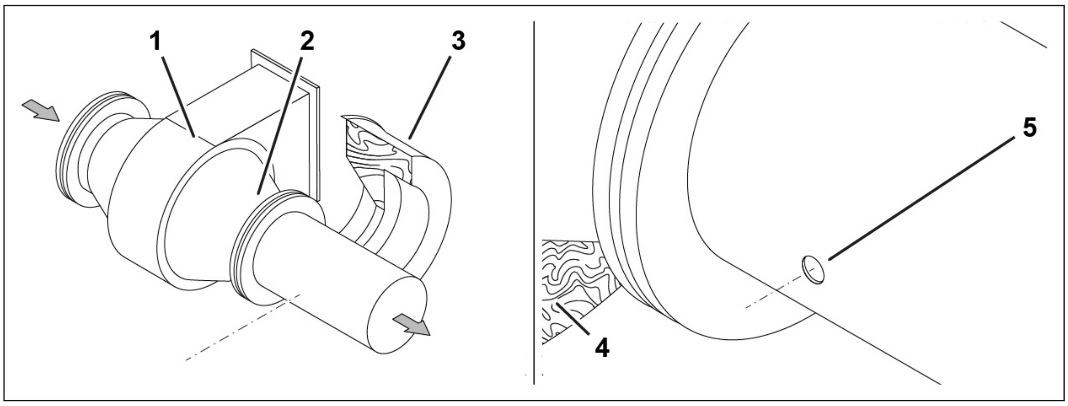
Consider the following in making a selection:

- 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

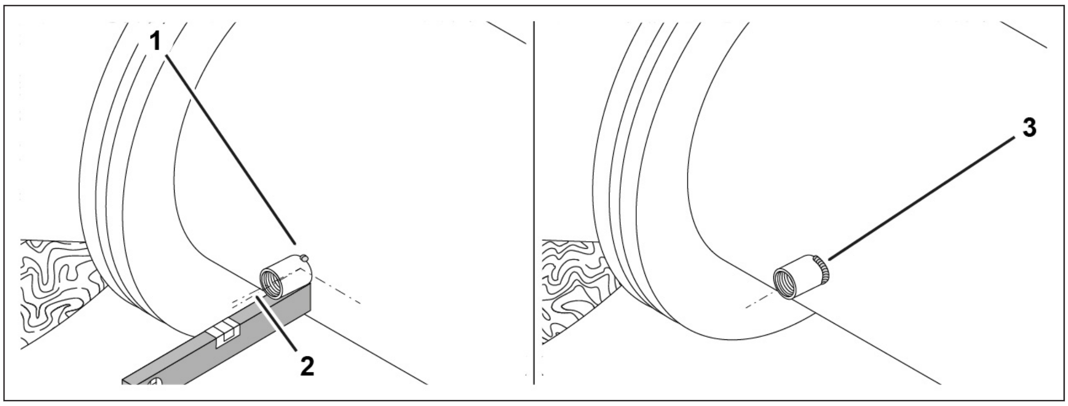
- Remove the insulation (3) after the oxidation catalytic converter (1)
  – The insulation on the oxidation catalytic converter (4) should remain in place if possible.
- Create a hole (5)

Welding the connection sleeve

Risk of destruction of components

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

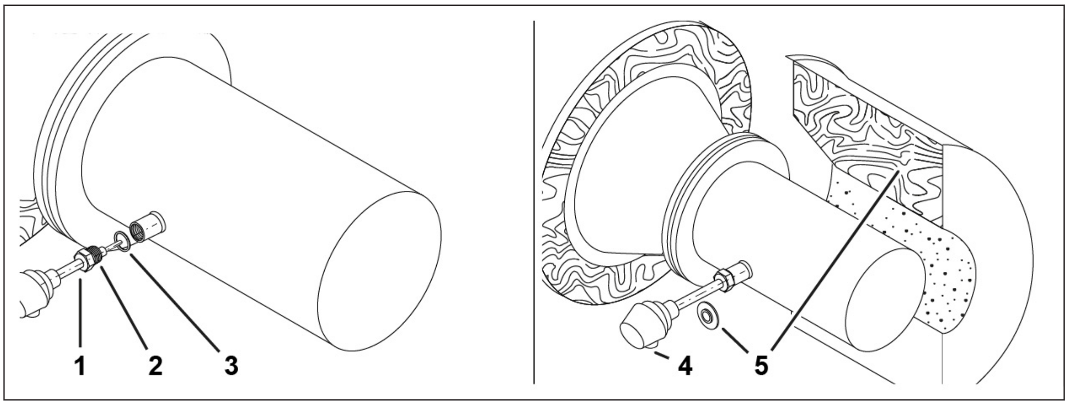
- Always affix the ground cable in the immediate vicinity of the welding electrode.



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.

353-003-EN : 51000010 : BA : VAR, COV, IMP, B, BA, BS, DEM, EIN, IBN, IST, WP, SK, MH, SB, STB, TA, TL

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

353-003-EN : 51000010 : BA : VAR, COV, IMP, B, BA, BS, DEM, EIN, IBN, IST, WP, SK, MH, SB, STB, TA, TL

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		

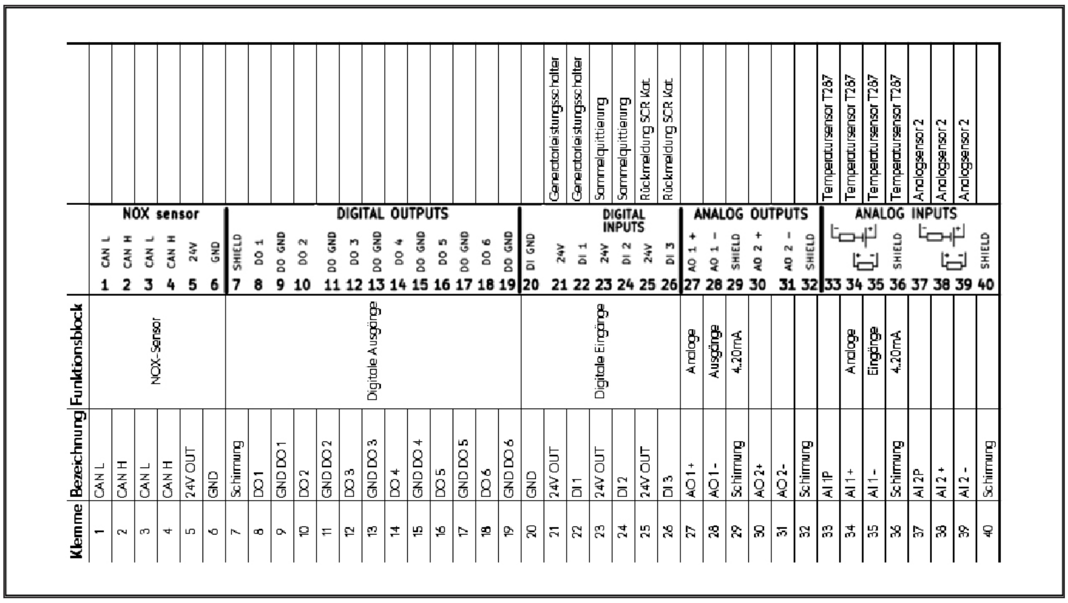
Electrical connection

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

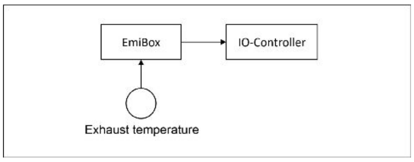
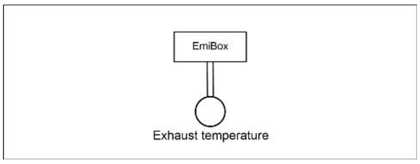
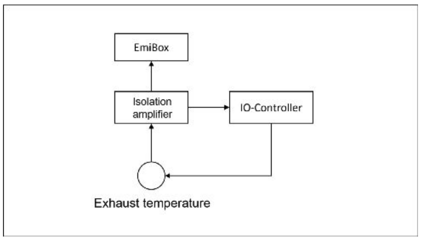
- Establish connection via pins 21&22

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.

72089-001

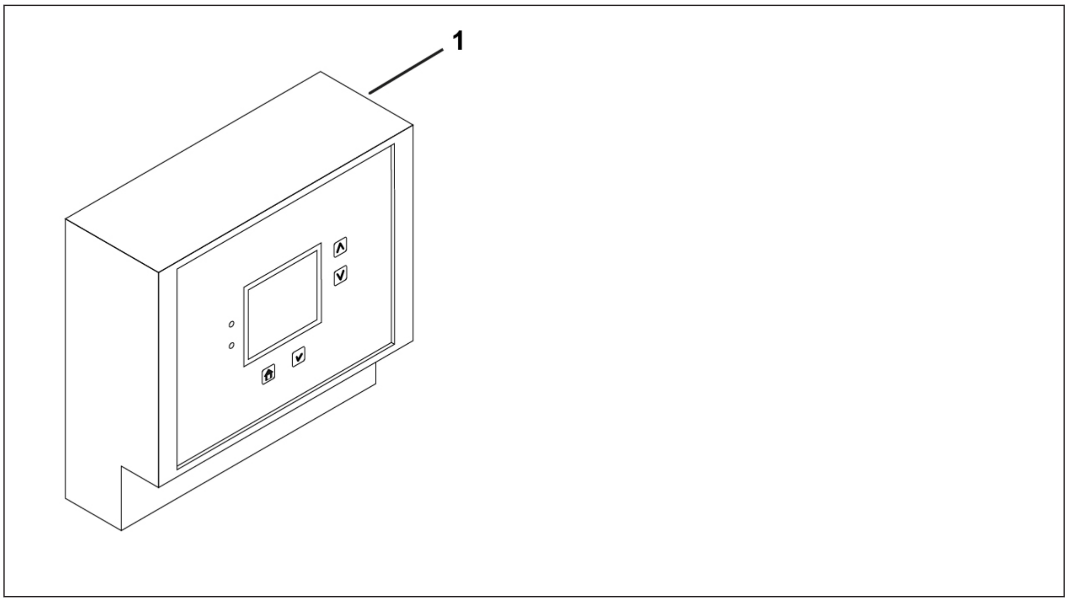
Description	Sketch	Circuit diagram
The temperature sensor is connected to an analog input of the EmiBox. This signal is then routed back to the control system from an analog output.		Page 6 a
A temperature sensor must be retrofitted, but the signal does not have to be routed to the control system.		Page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

353-003-EN : 51000010 : BA : VAR, COV, IMP, B, BA, BS, DEM, EIN, IBN, IST, WP, SK, MH, SB, STB, TA, TL

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:

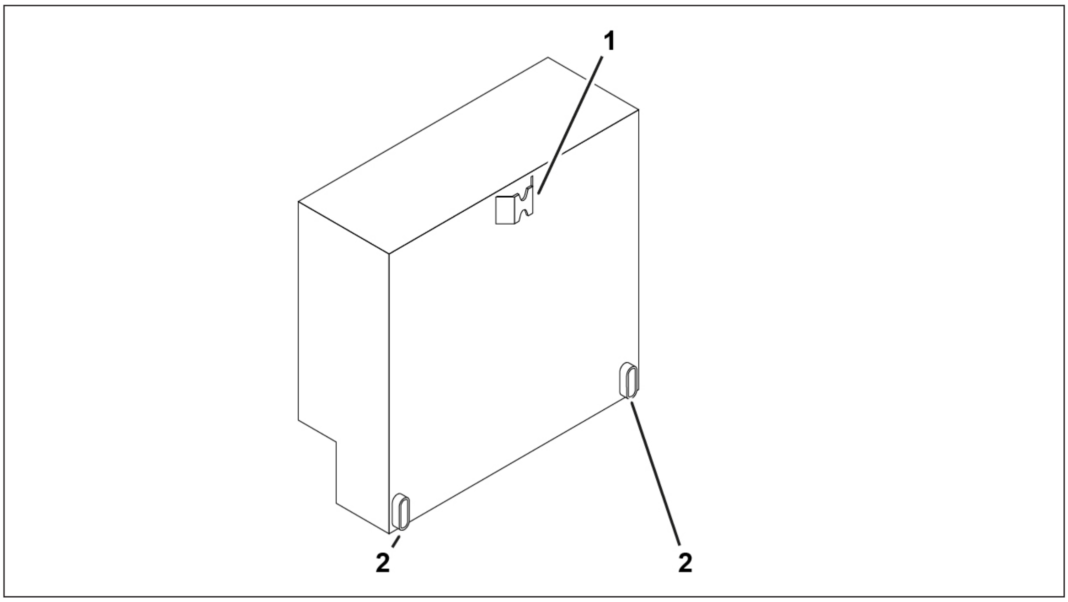
- Installation site is not on the genset and is outside the danger zone of the genset
- Installation site is not within the action radius of other moving parts
- Safety distances according to the regional assembly and accident prevention regulations are possible
- The EmiBox is easily accessible for 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

Note

The external power supply provided by the operator must comply with the regional specifications, be sufficiently dimensioned and be provided with a fuse.

For the power supply, the EmiBox is supplied with a CEE 7/4 plug on delivery (**C**ommission on the Rules for the Approval of the **E**lectrical **E**quipment) for fitting plug-in connections. Plugs of this type have an earthing contact, which is why they are also known as Schuko© plugs [German: "protective contact"]; they are widely used in the European Economic Area.

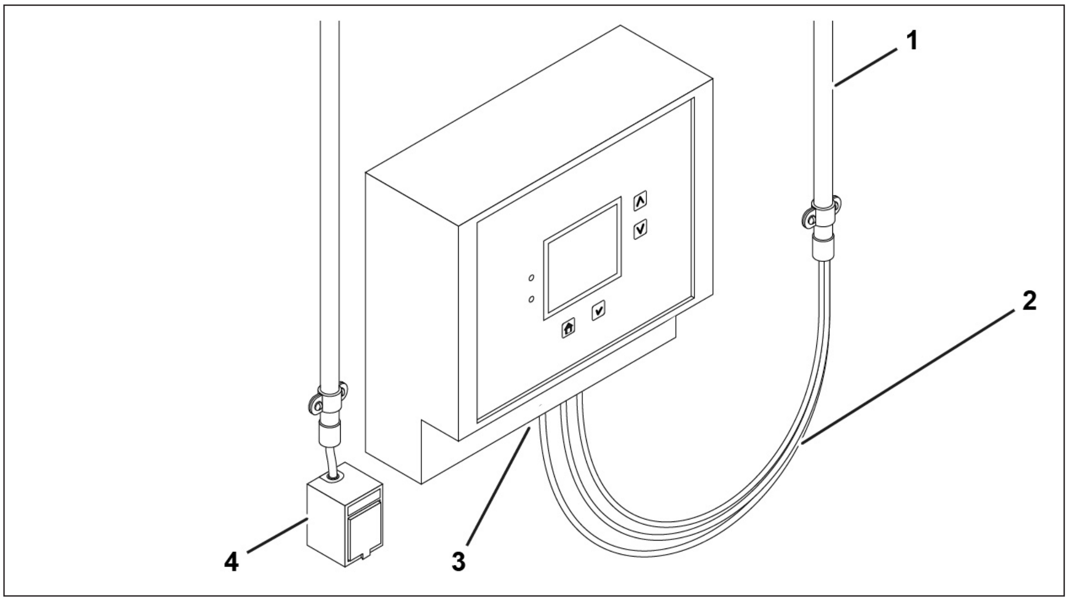
If other plug-in connections are required, the CEE 7/4 (Schuko©) plug can be replaced by a functionally comparable and regionally approved plug (current load, safety, etc.).

It is also possible to connect the EmiBox directly to the voltage supply. In this case, a switch must be provided so that the EmiBox can be disconnected from the voltage supply if necessary.

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

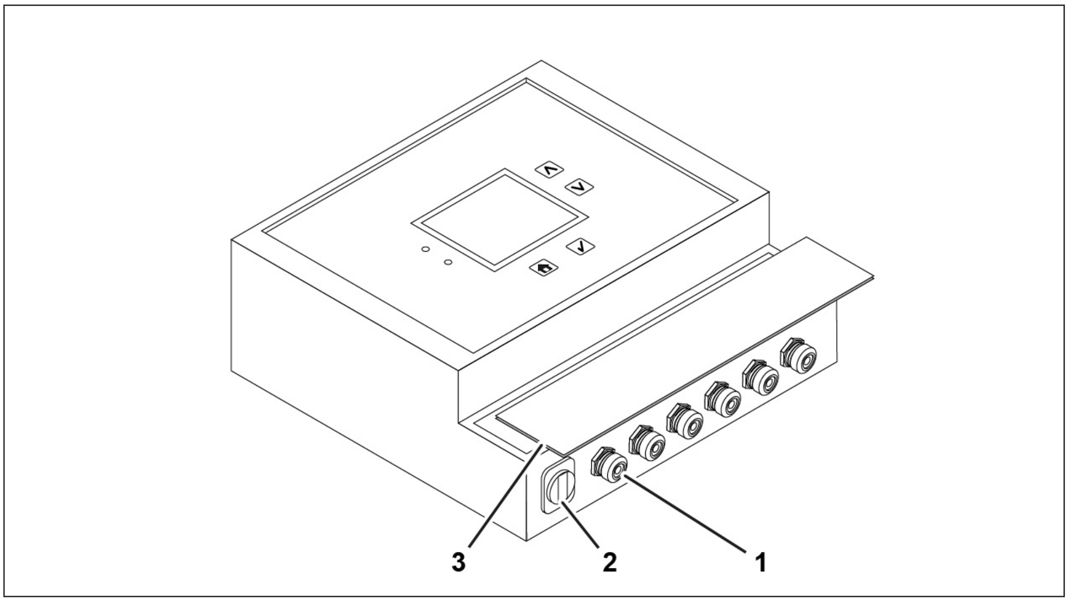
3 Area with connection socket and cable inlets

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

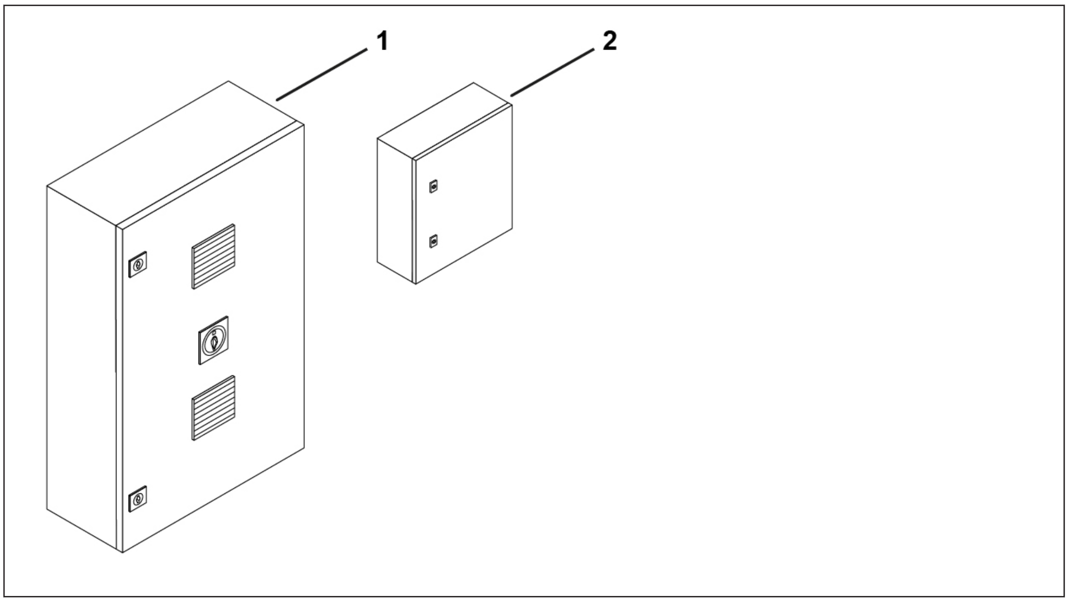
Assembly and connection are performed by the customer or the operator. The following installation specifications apply:

- 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".

353-003-EN : 51000010 : BA : VAR, COV, IMP, B, BA, BS, DEM, EIN, IBN, IST, WP, SK, MH, SB, STB, TA, TL

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

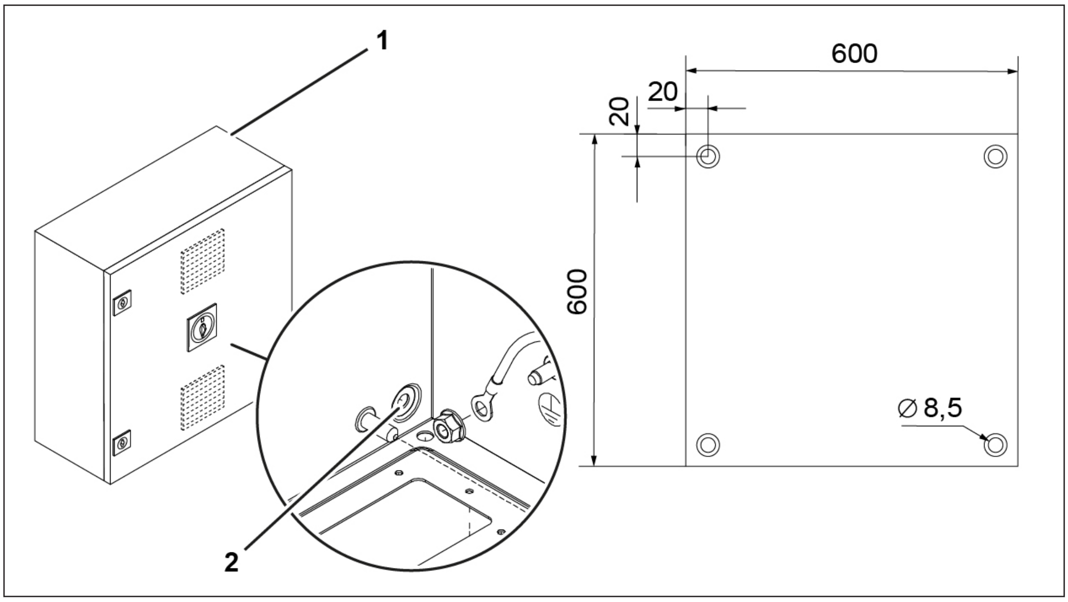
Installing the SCR Control switchgear cabinet

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.

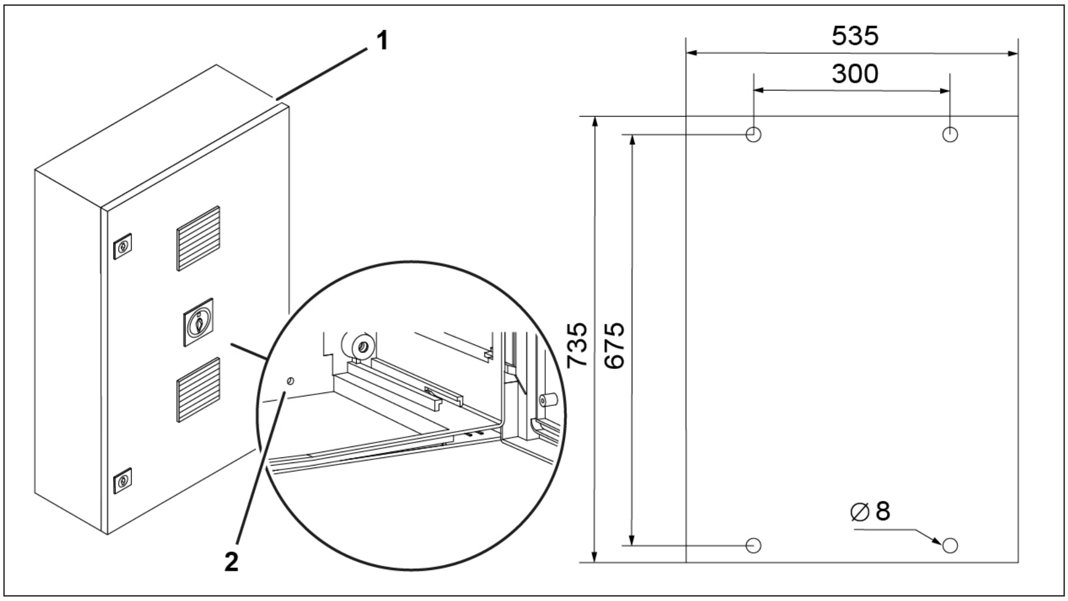
Switchgear cabinet type a and type b



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



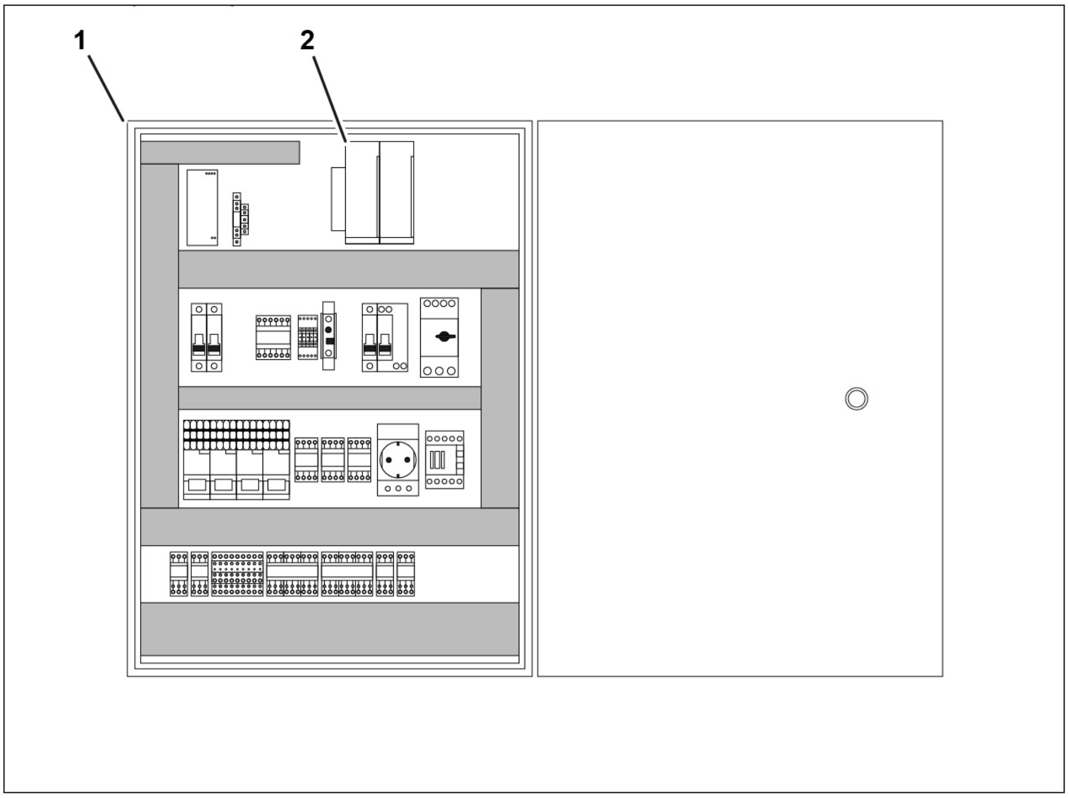
75854-001 Example illustration

- 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

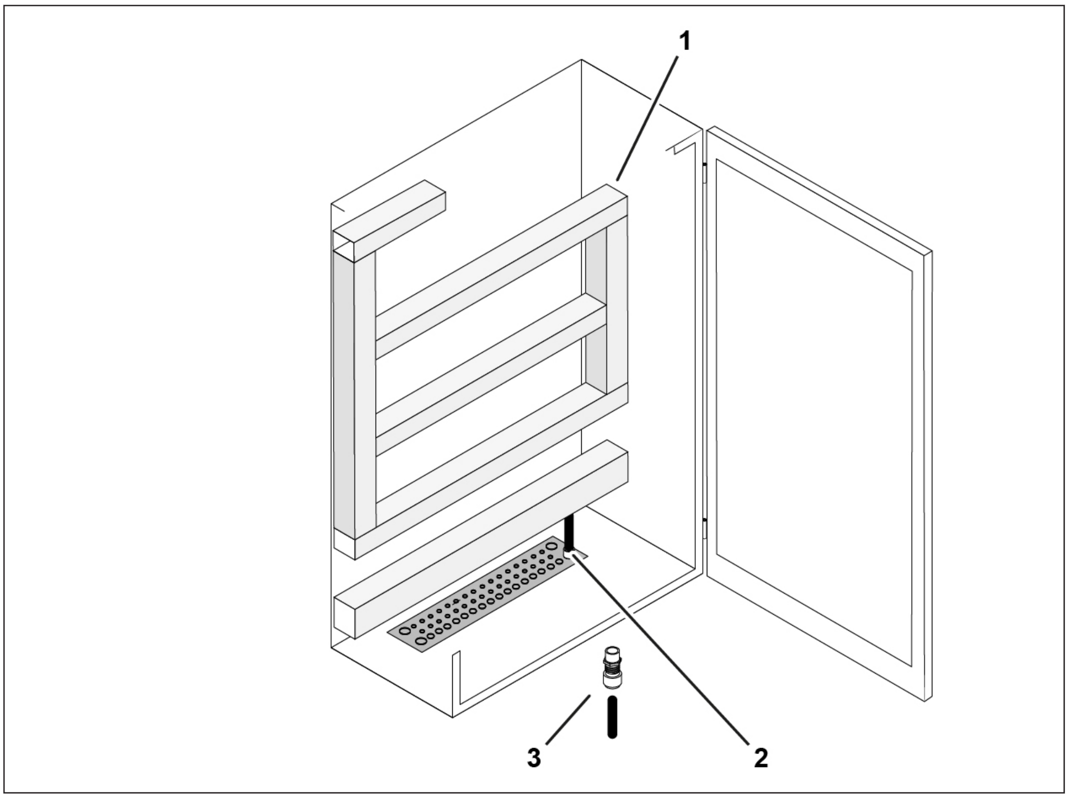
1 SCR Control switchgear cabinet

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

6.7.4 Connection for dual gas operation (option)

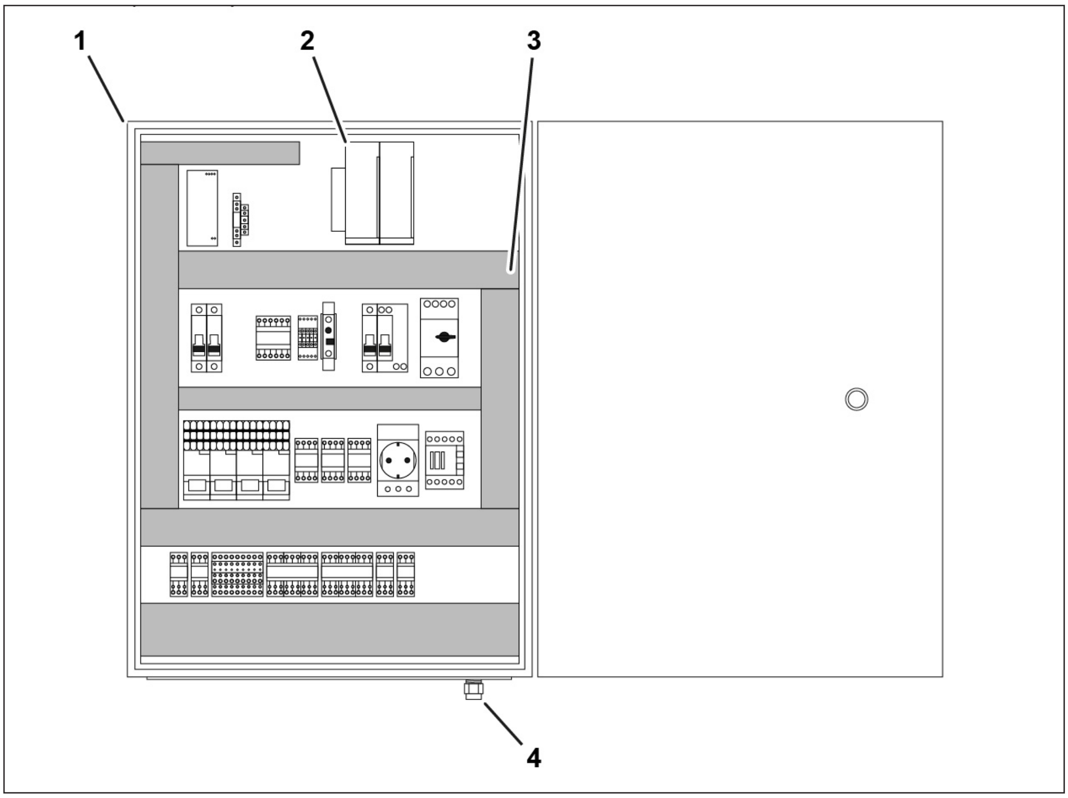
A digital signal about the status of the gas supply is required for the connection. Depending on the control conditions on site, the operator's fuel gas supply system or the TEM/TPEM system may provide a floating contact via a relay, for example, to which the I/O module in the SCR Control switchgear cabinet is connected.

The signal that will be switched is subject to the following assignment:

- Signal Low: signals to the EmiBox that profile 1 should be activated
- Signal High: signals to the EmiBox that profile 2 should be activated

It is recommended to provide the signal in such a way that profile 1 corresponds to the main gas type used for operation.

353-003-EN : 51000010 : BA : VAR, COV, IMP, B, BA, BS, DEM, EIN, IBN, IST, WP, SK, MH, SB, STB, TA, TL



76176-001 Example illustration: Connections and cable inlets in the switchgear cabinet

1 SCR Control switchgear cabinet

2 I/O module

3 Cable ducts (example)

4 Cable inlet

Cables can only enter the cabinet from below. The project-specific circuit diagram has precedence for wiring.

- Prepare cable inlet (4) with cable glands
- Route the cables from the genset control into the switchgear cabinet according to the circuit diagram and connect them to the I/O module (2)
  - Connection: DI/DO card to DI3.
- Seal the insertion point properly

6.8 Remote access as an option

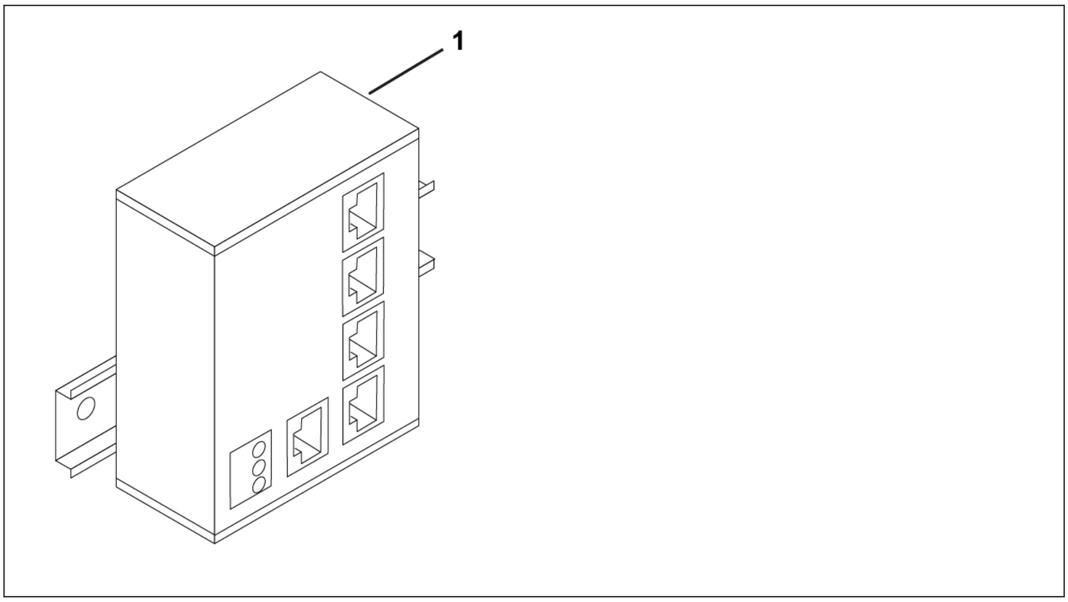
6.8.1 Remote Access scope of delivery

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

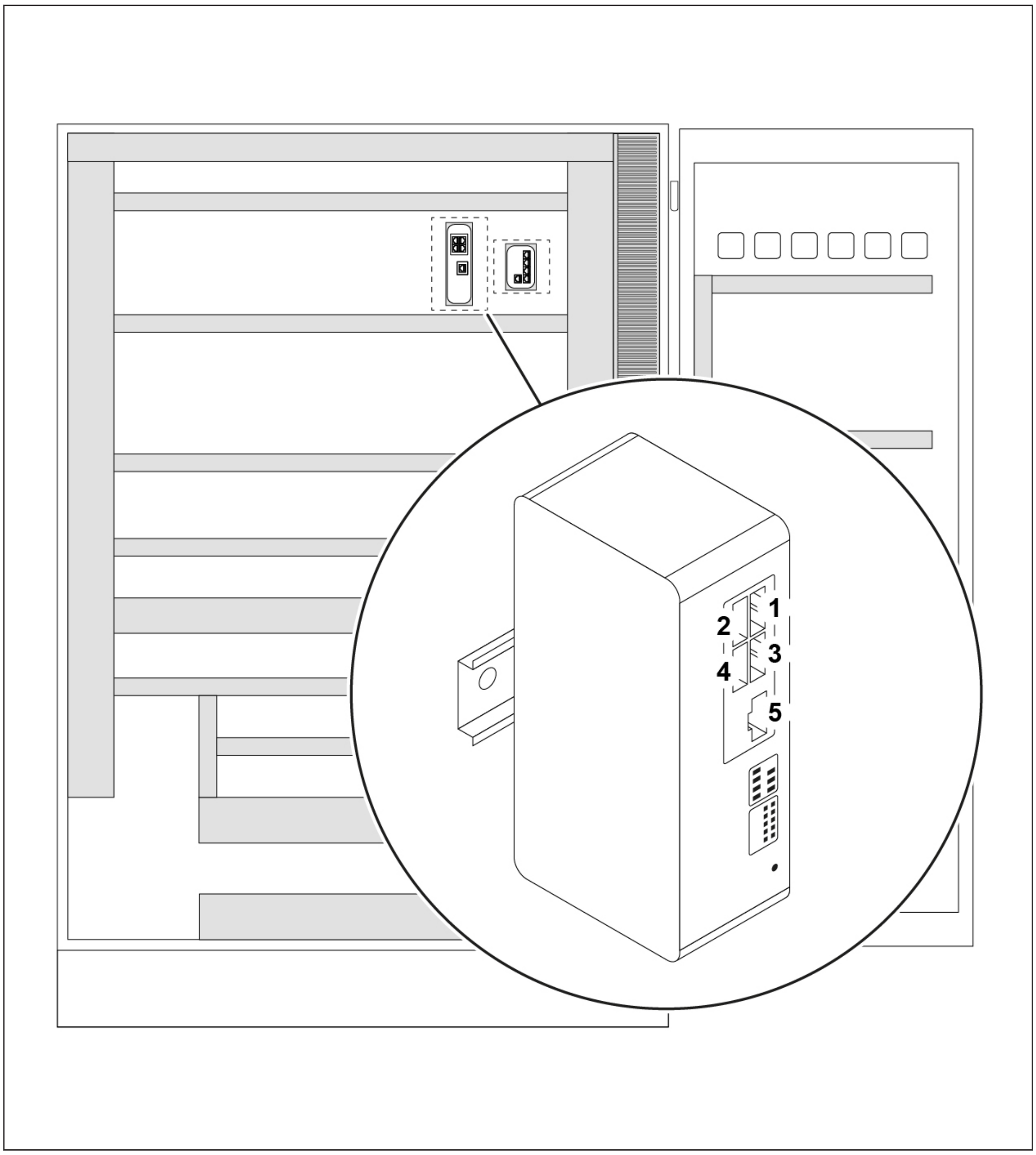
The connection of the power supply for the auxiliary cabinet (HAS) depends on the design of the plant on site.

- 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 122

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

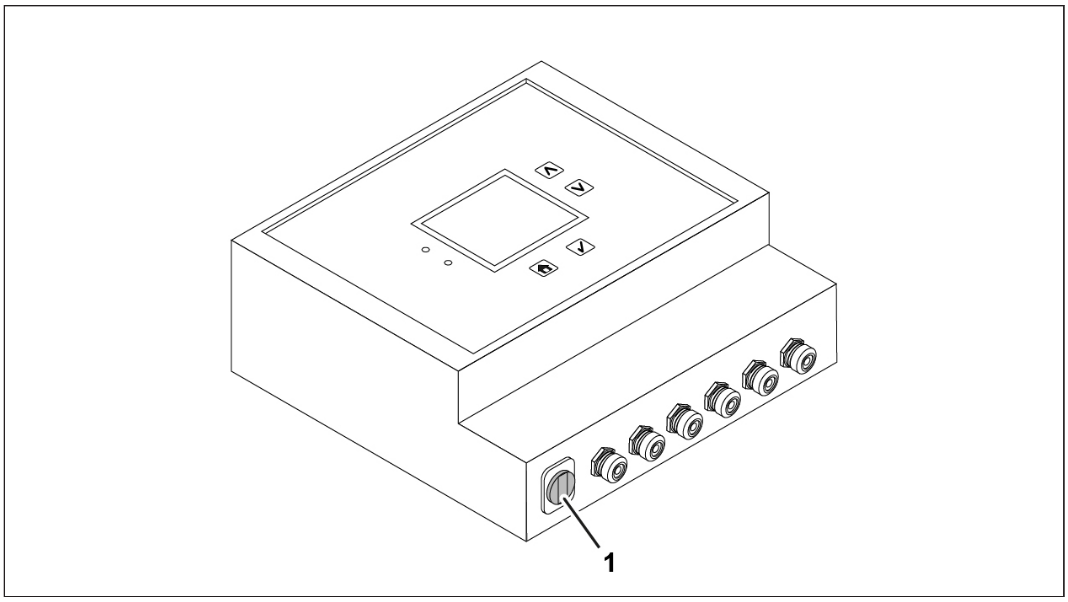
4 Occupied

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

353-003-EN : 51000010 : BA : VAR, COV, IMP, B, BA, BS, DEM, EIN, IBN, IST, WP, SK, MH, SB, STB, TA, TL

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 122

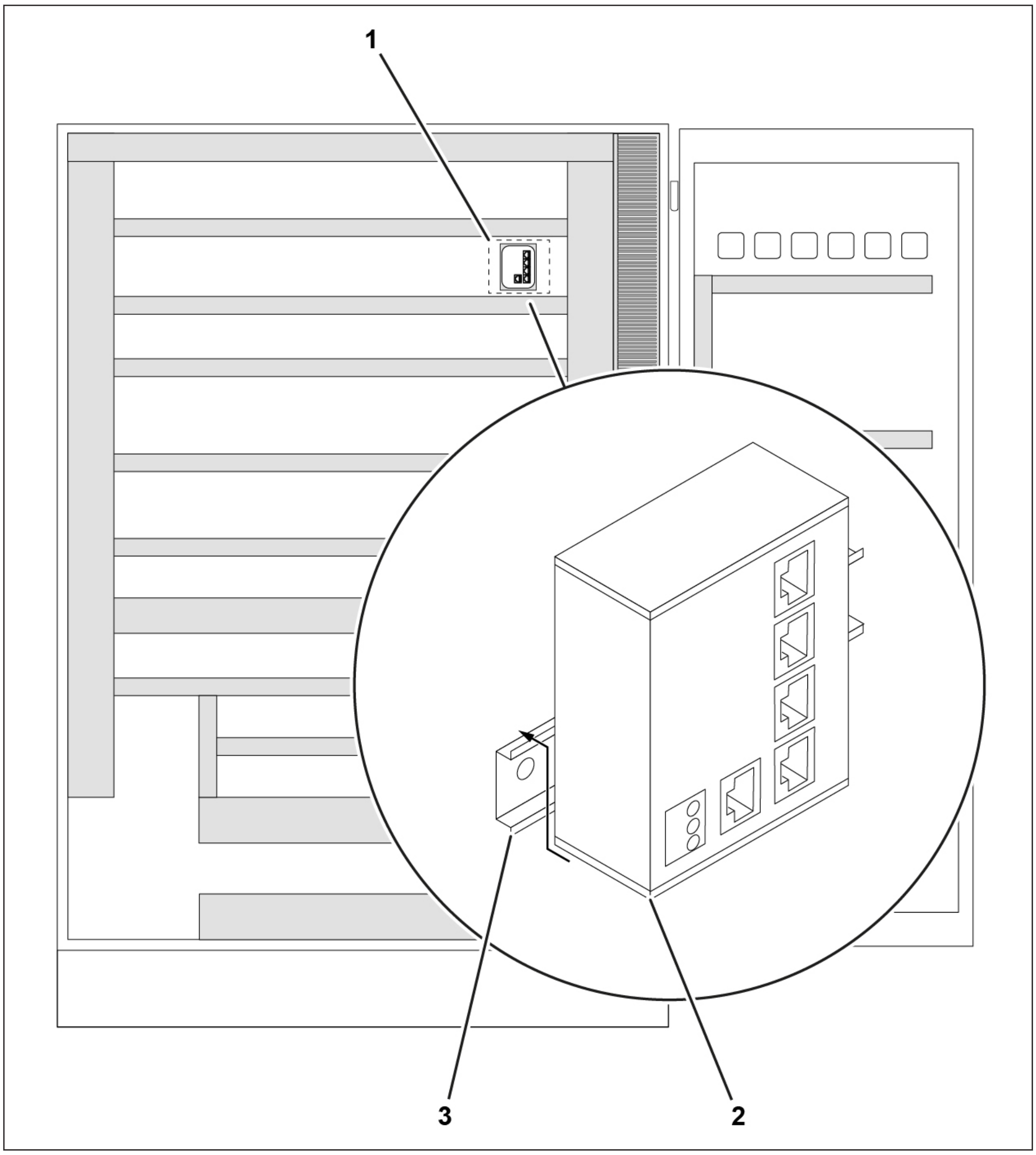
Install switch and connect equipotential bonding

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.

353-003-EN : 51000010 : BA : VAR, COV, IMP, B, BA, BS, DEM, EIN, IBN, IST, WP, SK, MH, SB, STB, TA, TL



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).

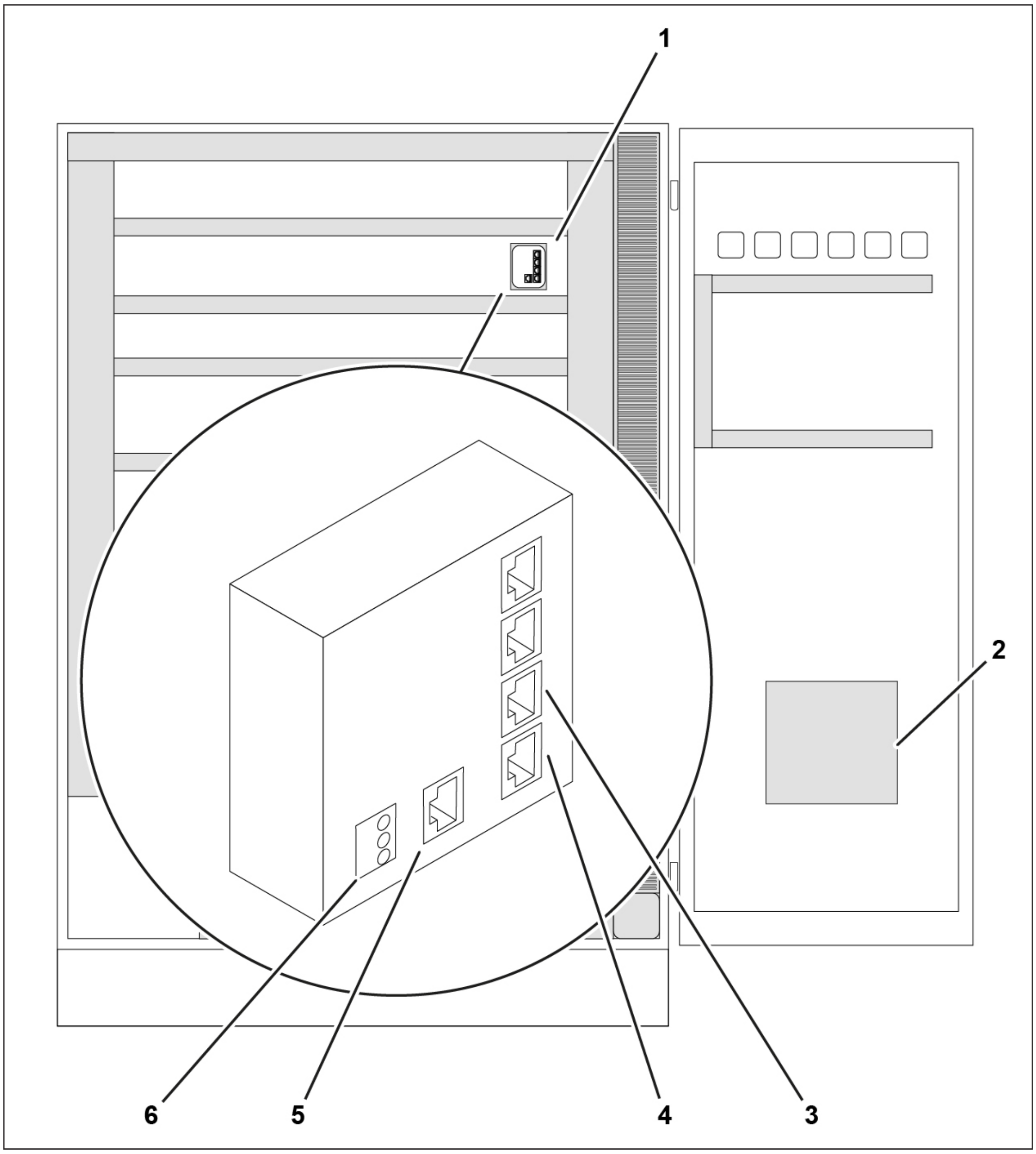
6.8.4 Cable routing and connection for EmiBox and SCR Control Kit

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.

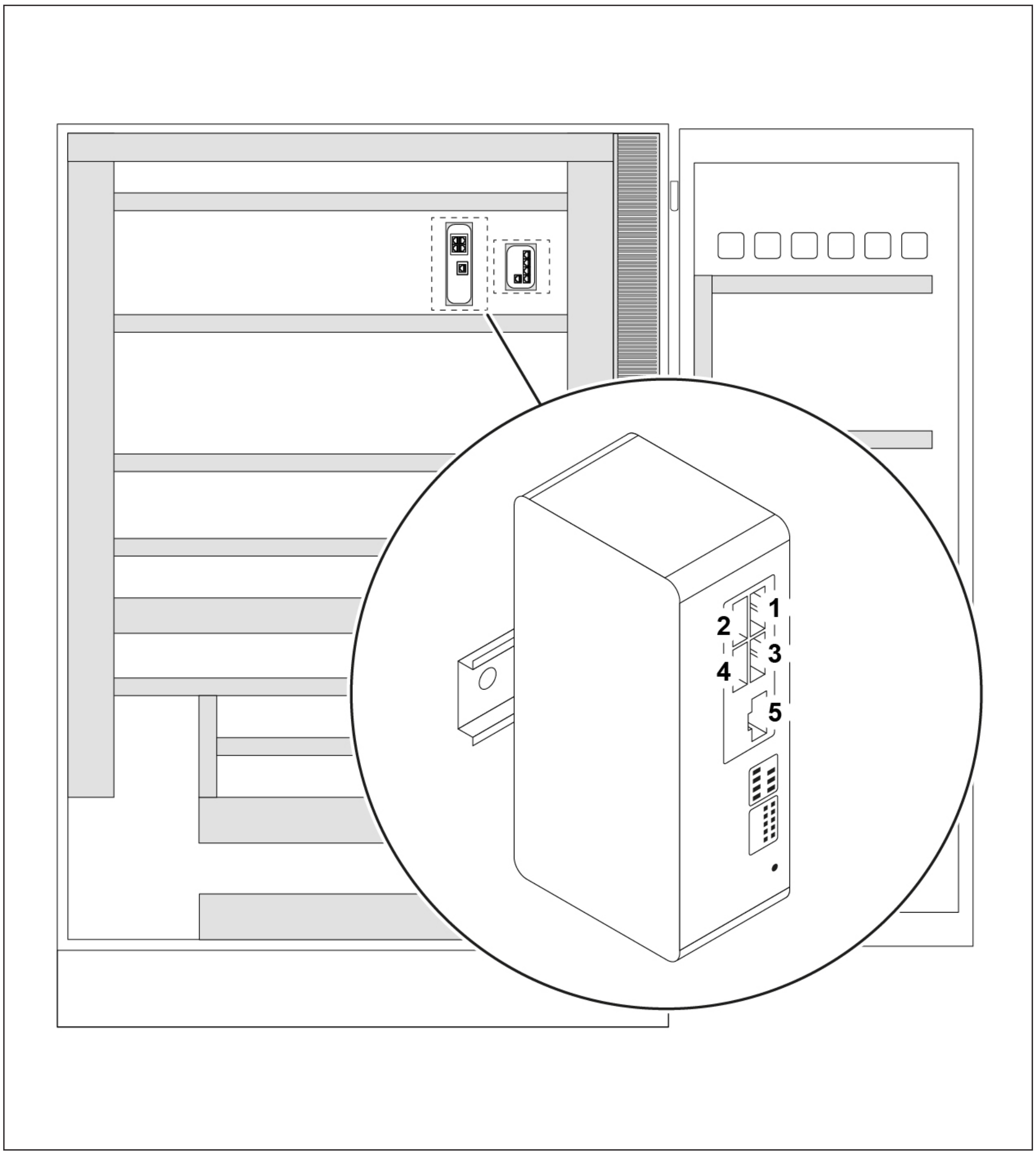
- Depending on the situation, prepare cable inlet (2) or (7), for example with cable glands
- Route cables into the auxiliary cabinet (HAS)
- Seal the insertion point properly

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).

353-003-EN : 51000010 : BA : VAR, COV, IMP, B, BA, BS, DEM, EIN, IBN, IST, WP, SK, MH, SB, STB, TA, TL

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

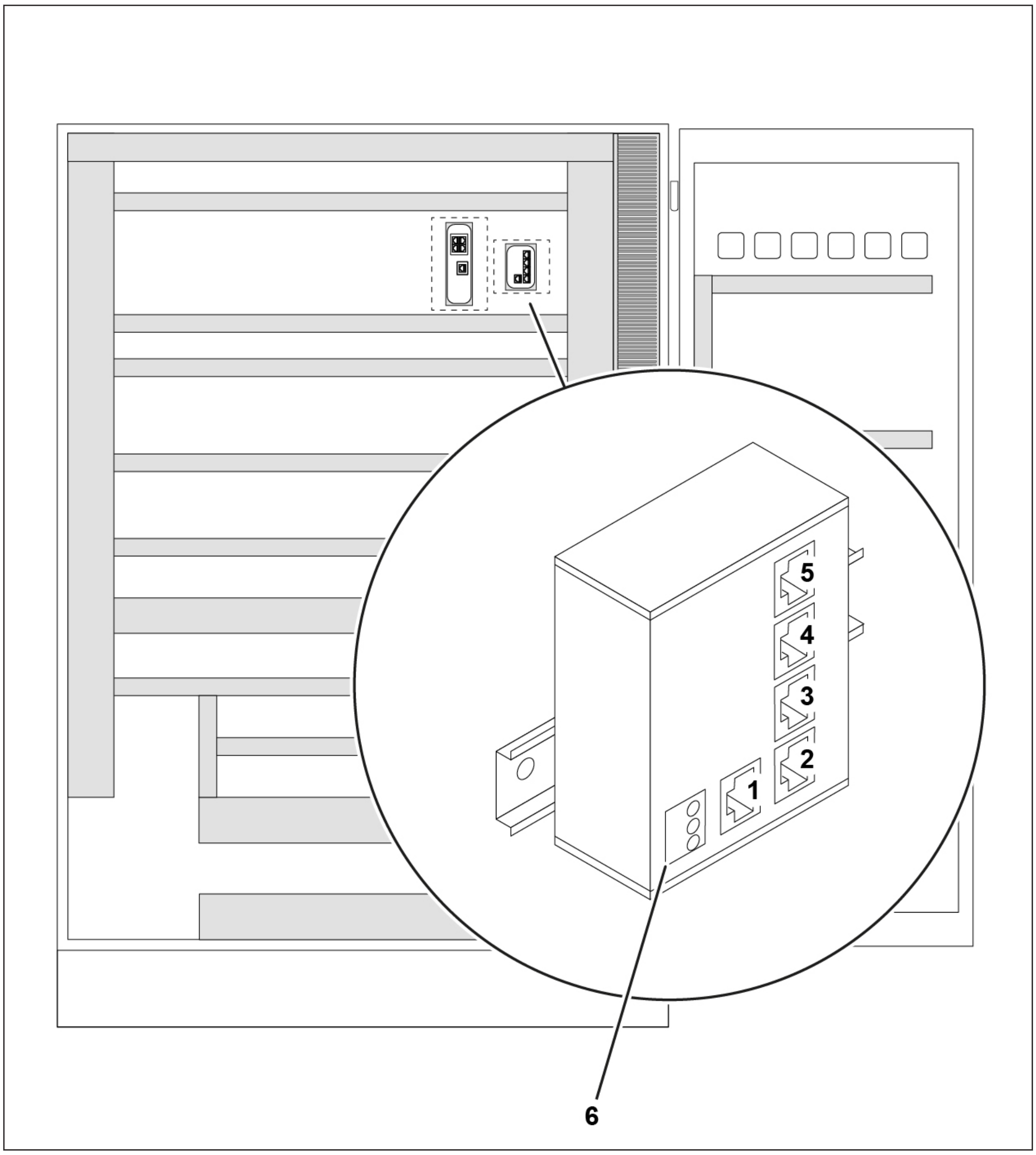
4 Occupied

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).



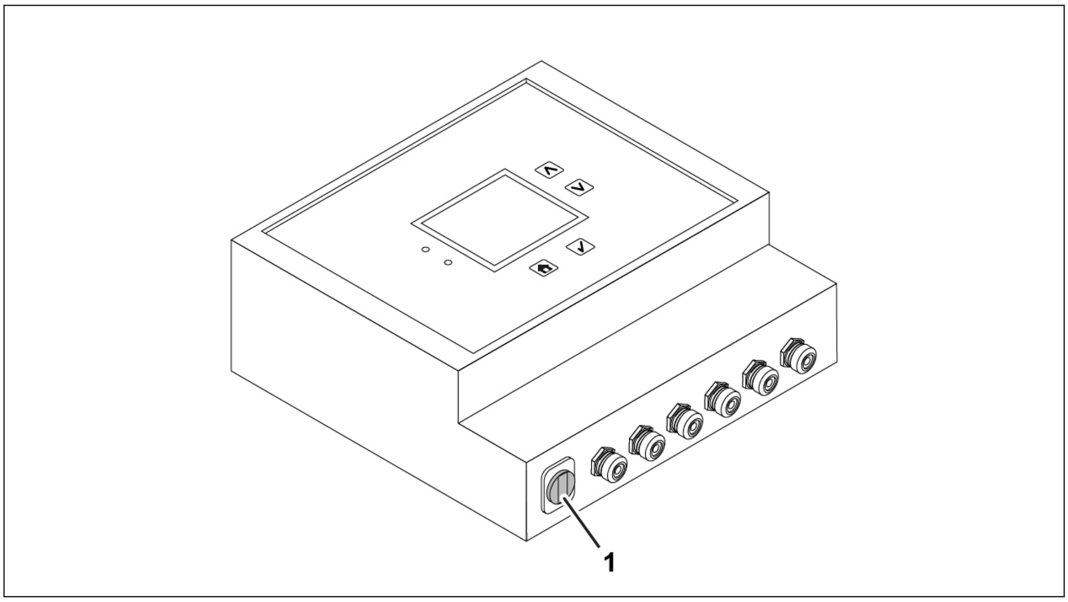
75893-001 Sample illustration (item numbers 1-5 match device labels)

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

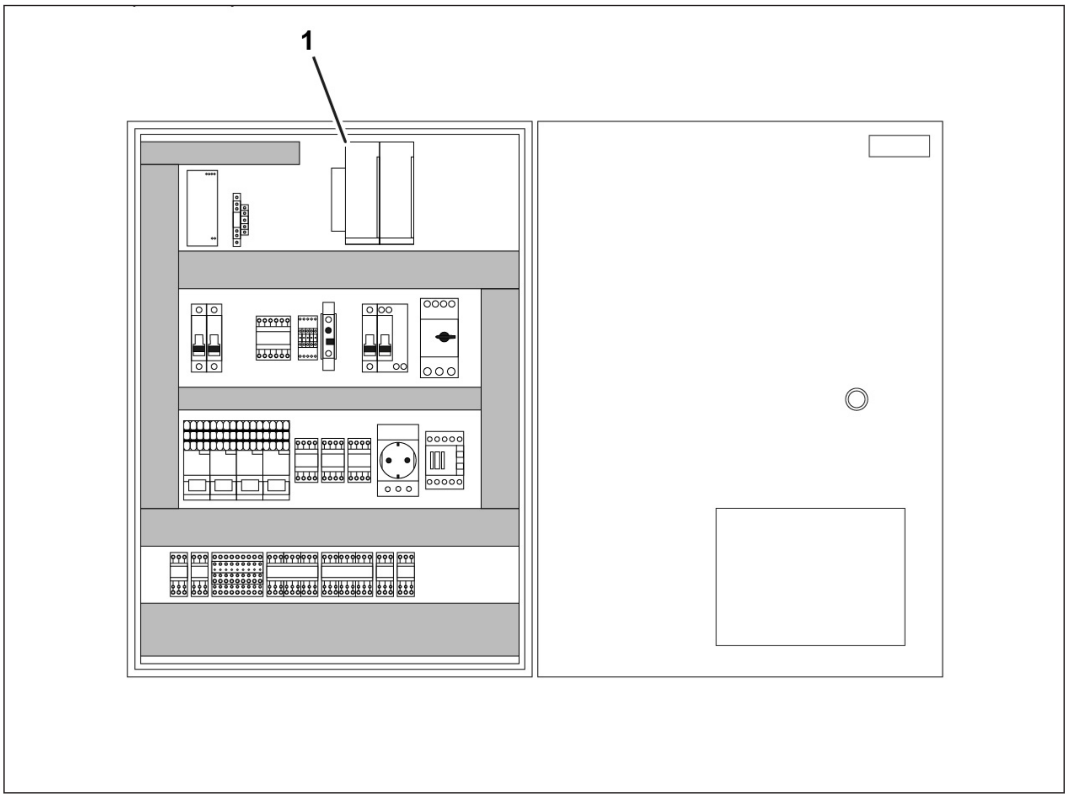
1 Switch connection

- 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 8.5.8 Updating the logbook 237

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.

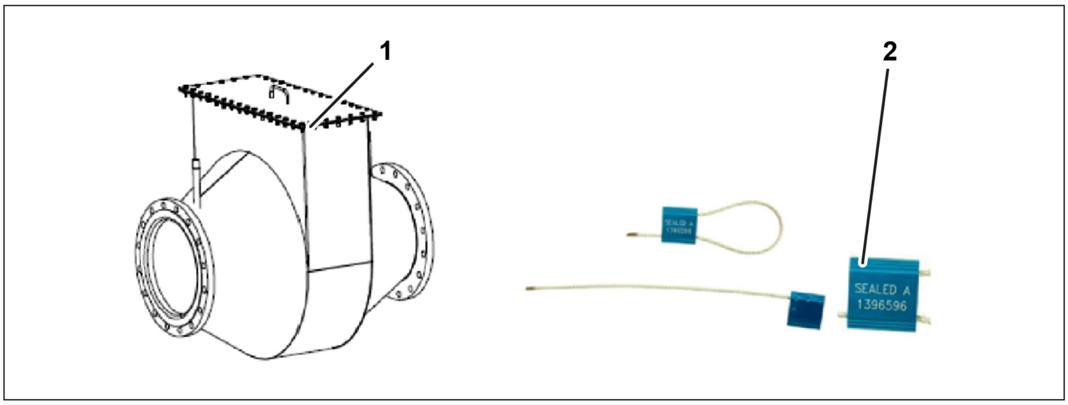
The seal may only be removed and re-affixed by trained CES specialist personnel (authorized service technicians) with an authorization level of 200 or higher, or by an accredited metrological institute. After the above work, the catalytic converter must be sealed immediately by an authorized person and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

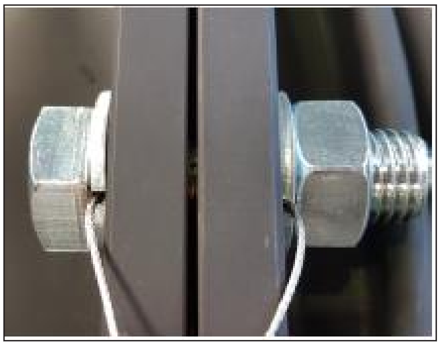


71120-002

1	Drill hole for seal	2	Seal

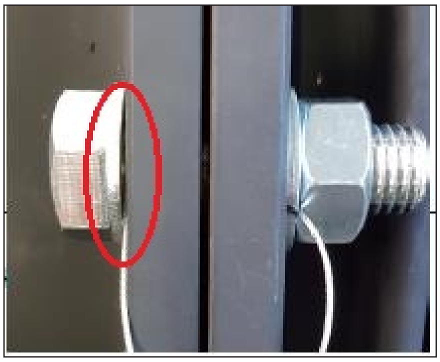
Cone-style catalytic converters

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.

353-003-EN : 51000010 : BA : VAR, COV, IMP, B, BA, BS, DEM, EIN, IBN, IST, WP, SK, MH, SB, STB, TA, TL

7 Commissioning

Table of contents

7.1 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 activation also includes the measuring lines. Depending on the electrical wiring, individual measuring lines or signal lines may be live even when the genset is switched off and the voltage supply to the switchgear cabinet is disconnected.

- Consult the current circuit diagram of the SCR Control switchgear cabinet

WARNING!

Injury due to improper commissioning

This can lead to severe injuries and even death.

- Only authorized specialist personnel may operate the product

Risk of destruction of components

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

- Observe handling regulations for components subject to electrostatic hazards

7.2 Monitoring

7.2.1 Commissioning

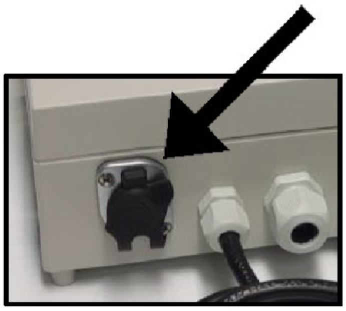
The commissioning may only be performed by qualified specialist personnel.

The following requirements must be fulfilled before commissioning:

- The EmiBox and the sensor connection box must be properly installed
- All sensors and actuators must be connected

7.2.2 PC connection to the EmiBox

After the voltage supply to the EmiBox has been established, the latter will boot within 30 to 60 seconds. To restart the system, interrupt the power supply for at least 60 s to completely discharge the internal voltage stability capacitor.



72132-001

There are three ways of establishing a connection between the PC and the EmiBox. A direct connection is recommended for commissioning the EmiBox.

1. Direct connection

With a direct connection, the PC is connected directly to the EmiBox with a network cable (Cat6). The PC and the EmiBox negotiate an IP address. The IP address of the EmiBox is then shown in the settings window of the display.

2. In a network environment with dynamic IP address

To establish a connection with the EmiBox, the PC must be in the same network. This can be done using a physical LAN connection or a WLAN connection. The EmiBox then automatically obtains an IP address and displays it in the settings window. This type of connection requires a DHCP server to be available in the network.

In cases 1 and 2, the user must set the Internet Protocol, Version 4 (TCP/IPv4) properties setting in their network settings (Control Panel ⇒ Network Connections ⇒ LAN Connection) to "Obtain IP address automatically" and "Obtain DNS server address automatically".

3. In a network environment with a static IP address

353-003-EN : 51000010 : BA : VAR, COV, IMP, B, BA, BS, DEM, EIN, IBN, IST, WP, SK, MH, SB, STB, TA, TL

The EmiBox can be assigned a static IP address. This is done by changing the network settings of the EmiBox. In this case, the PC must be set with a different but similar IP address.

Example: The EmiBox has been set to the IP address `10.0.0.98` in the subnet mask `255.255.255.240`. This allows the PC to be assigned the IP address `10.0.0.99` with the same subnet mask as the EmiBox, for example. Only then is it possible to connect to the EmiBox.

Regardless of the chosen connection method, once a connection has been established, an internet browser can then be opened and the address `http://emibox:5000` or `http://<ip-address>:5000` can be replaced by the IP address displayed on the EmiBox information screen (`<ip-address>`), then the user is taken to the web interface.

If no connection is possible with the displayed IP address, the EmiBox can be accessed via a fallback IP. For this purpose, the static IP address `172.16.255.254`, subnet mask `255.255.255.252` is set on the PC. The box can then be reached at `http://172.16.255.253:5000`.

The EmiBox is optimized for Chrome and Firefox. Microsoft Internet Explorer is not supported.

7.2.3 Updating the operating system (only if required)

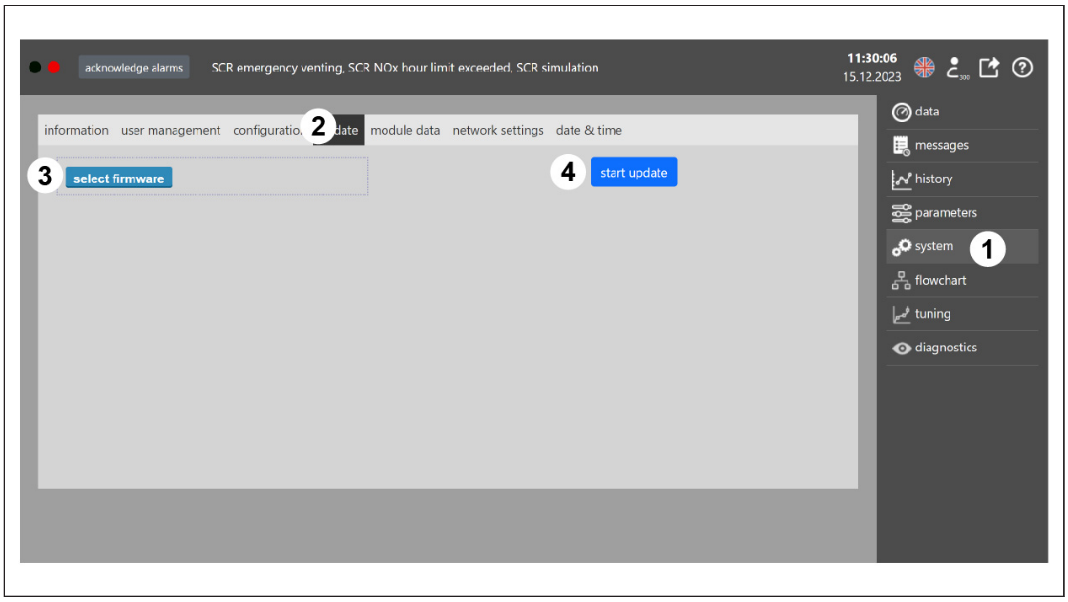
Requirements

Note

All EmiBoxes with a software version lower than 1.1.4 must first be updated to this version. Only then can the current software be installed. If this instruction is not followed, the EmiBox will no longer function.

- The operating system to be installed is available on the service computer

Procedure



75880-001 Example illustration of `Update` dialog window

- Click on functional group `System` (1)
- Click on the `Update` tab (2)
- Click on the `Select firmware` button (3)
  - Select the firmware as described above.
- Click on the `Start update` button (4)
  - The update starts.

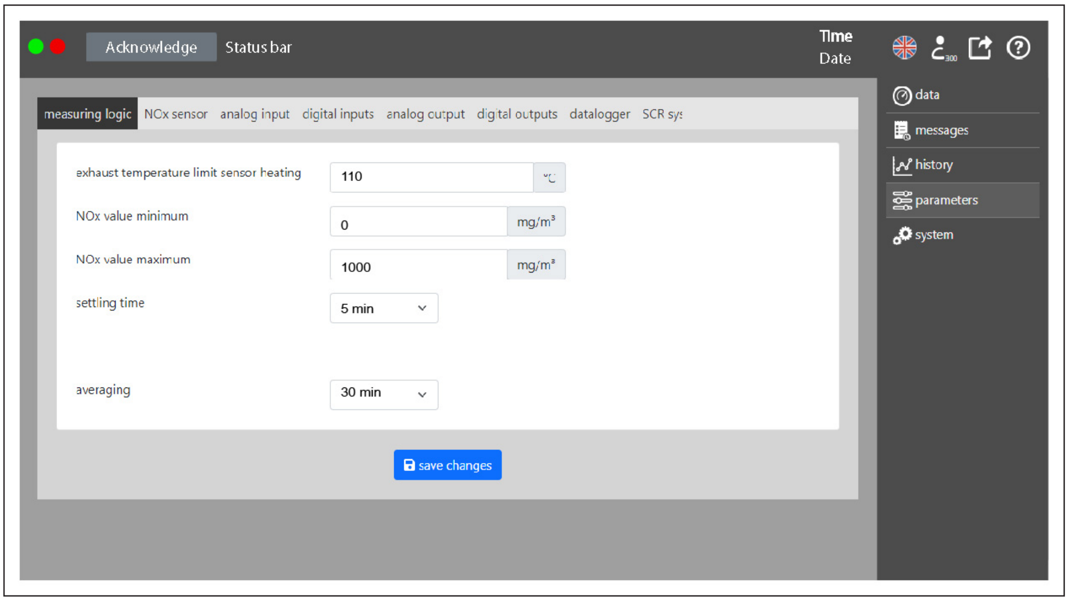
7.2.4 EmiBox parameter input

The EmiBox is already preconfigured on delivery. However, plant-specific changes must still be made.

- Connect to the user interface and log in with the user credentials.
- Before setting the parameters, check whether a firmware update is available. The firmware update must be installed before any parameters can be set.
- Open the functional group `Parameters` on the toolbar.

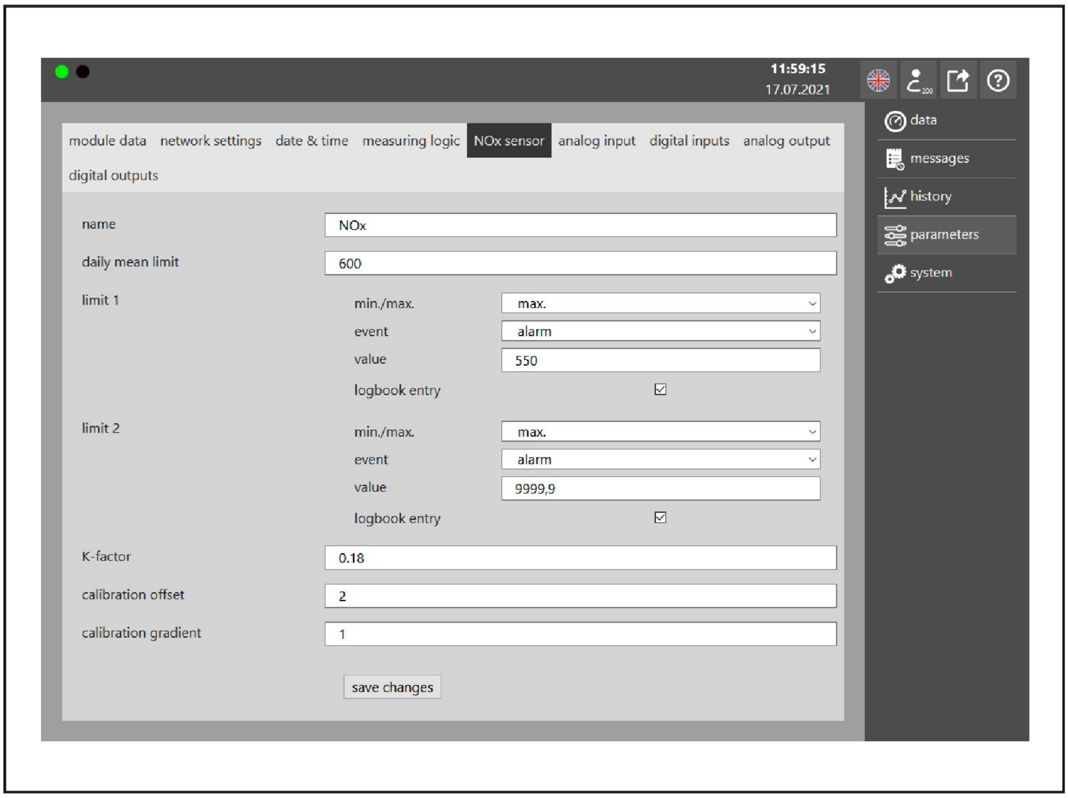
Storage

- By default, enter the following values:



76257-001 Example illustration

NOx sensor



72184-002 Example illustration

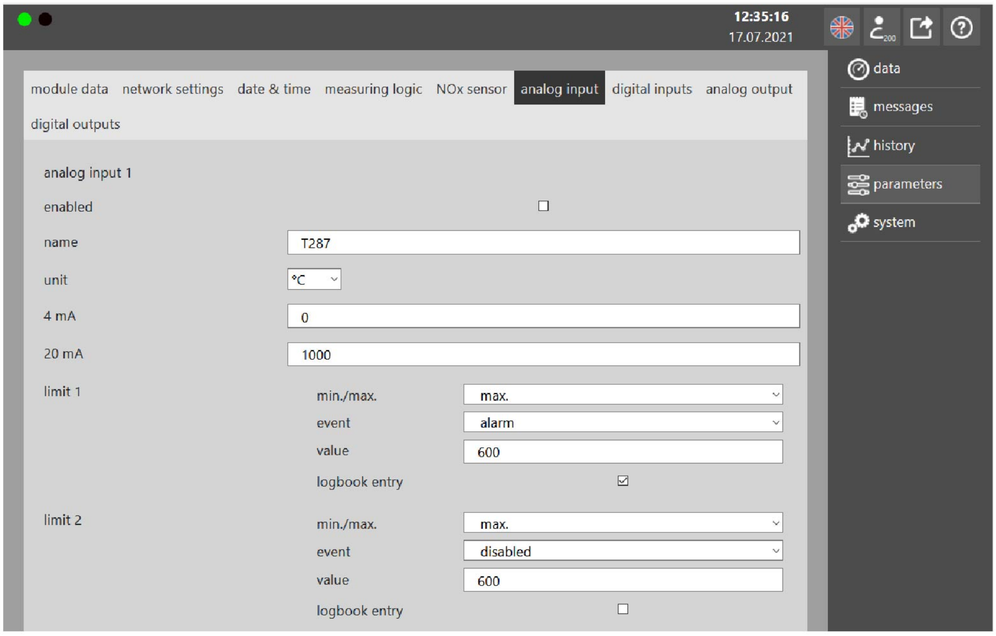
- Enter daily mean limit as defined in the 44th BImSchV [German Federal Immission Protection Decrees].
- For example, a warning can be set at 550 mg/m³.
- Set alarm values as per the 44th BImSchV (see table)

Limit according to the 44th BImSchV	Daily mean value at which alarm is triggered
100 mg/m³	≥ 150 mg/m³
250 mg/m³	≥ 350 mg/m³
500 mg/m³	≥ 600 mg/m³

K-sensor	Fixed value, no input required
K-factor	To determine, see section `Calibrating the NOx sensor`
Calibration offset	To determine, see section `Calibrating the NOx sensor`
Calibration gradient	This parameter is not to be used and remains at the value 1.

353-003-EN : 51000010 : BA : BA : VAR, COV, IMP, B, BA, BS, DEM, EIN, IBN, IST, WP, SK, MH, SB, STB, TA, TL

Analog inputs 1-2



72187-002 Example illustration

If an oxidation catalytic converter is present, the temperature limits of the catalytic converter must be entered for analog input 1. These ensure that an alarm is issued as soon as the temperature exceeds or falls below the permissible catalytic converter temperature. In accordance with the VDMA Standard Sheet 6299, it is useful to issue an alarm if the permissible operating temperature of the catalytic converter is above the permissible value, and a warning if the temperature falls below it.

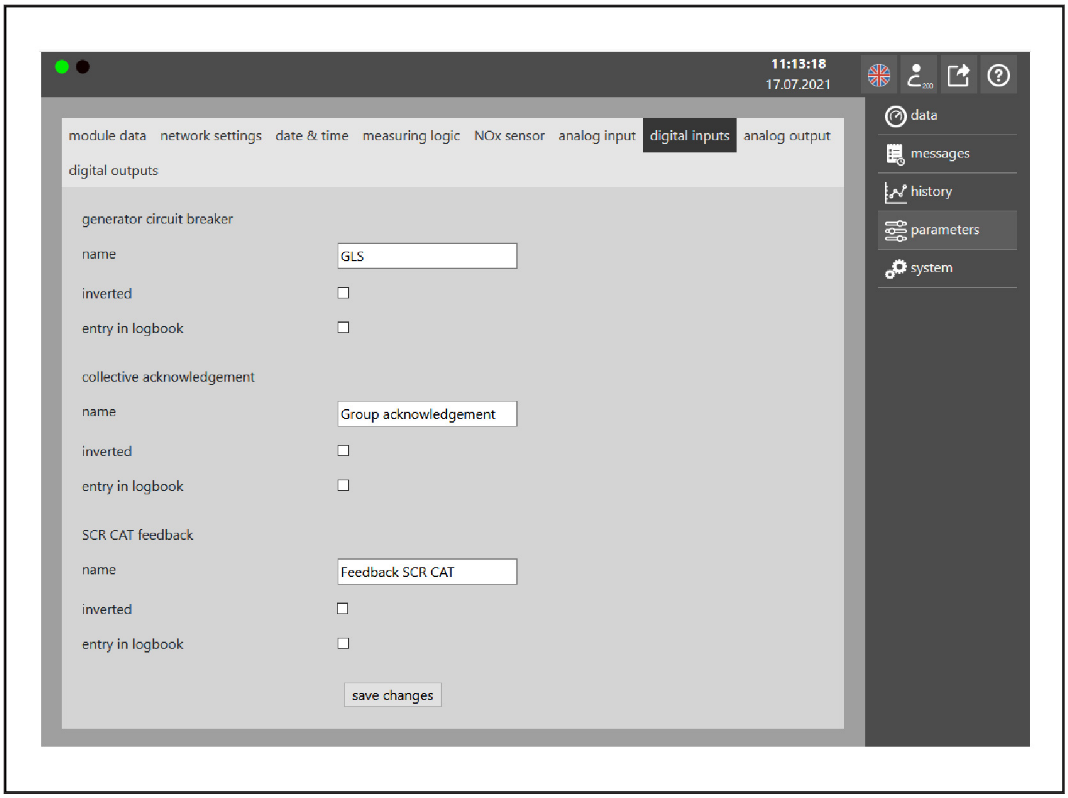
The temperature operating range of the catalytic converter can be found in the corresponding data sheet and should be requested from the system operator.

The values for 4 mA and 20 mA must be adjusted in such a way that the temperature changes that are displayed are reproduced as accurately as possible.

Digital inputs

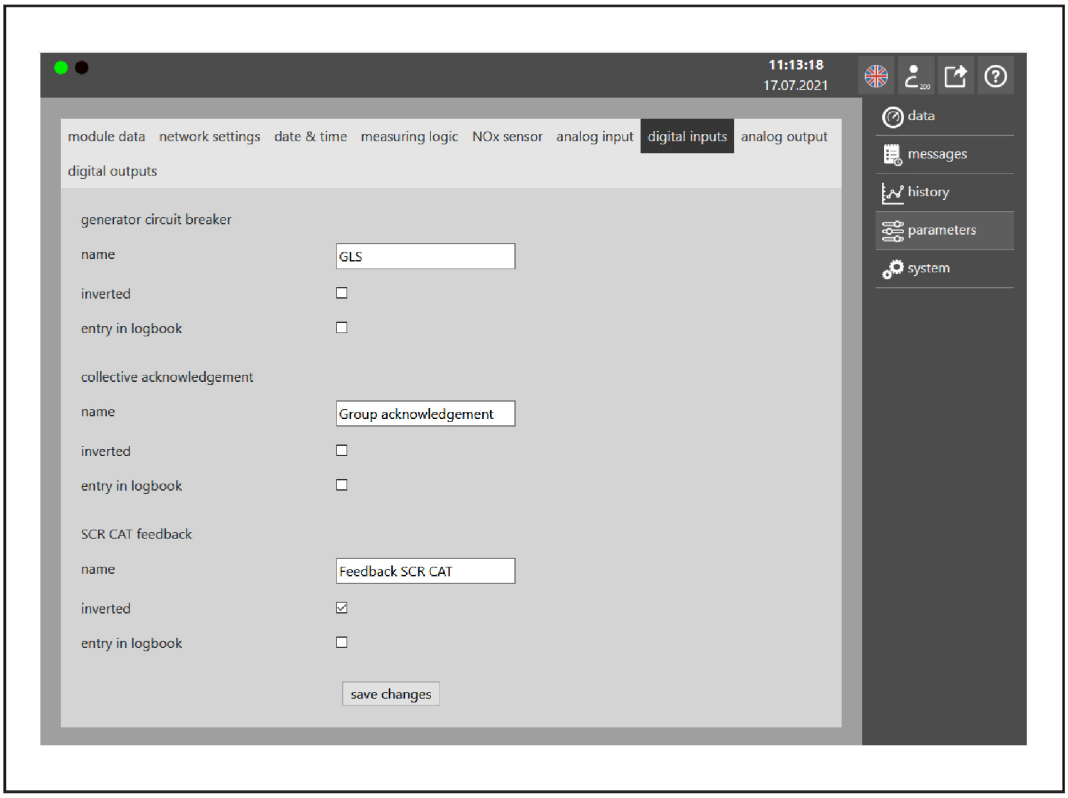
Depending on the connection of digital input 1 (generator circuit breaker), the input may have to be inverted. If the relay is a normally closed contact, the input must be inverted. If the relay is a normally open contact, it does not have to be.

- Plant is equipped with an SCR application:



72188-002 Example illustration

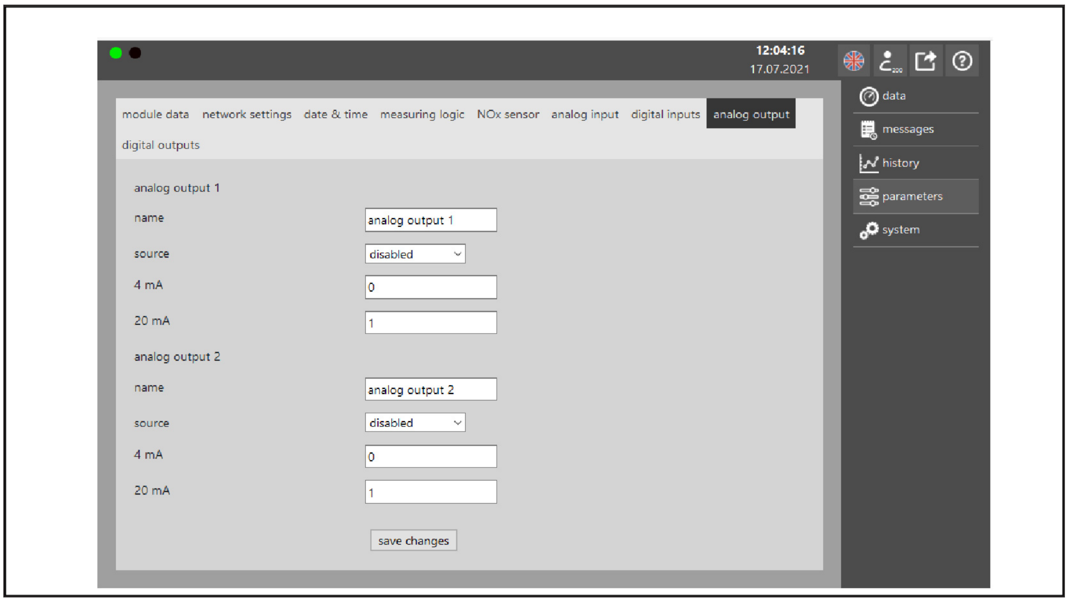
- Plant is not equipped with an SCR application:



72248-002 Example illustration

353-003-EN : 51000010 : BA : VAR, COV, IMP, B, BA, BS, DEM, EIN, IBN, IST, WP, SK, MH, SB, STB, TA, TL

Analog outputs

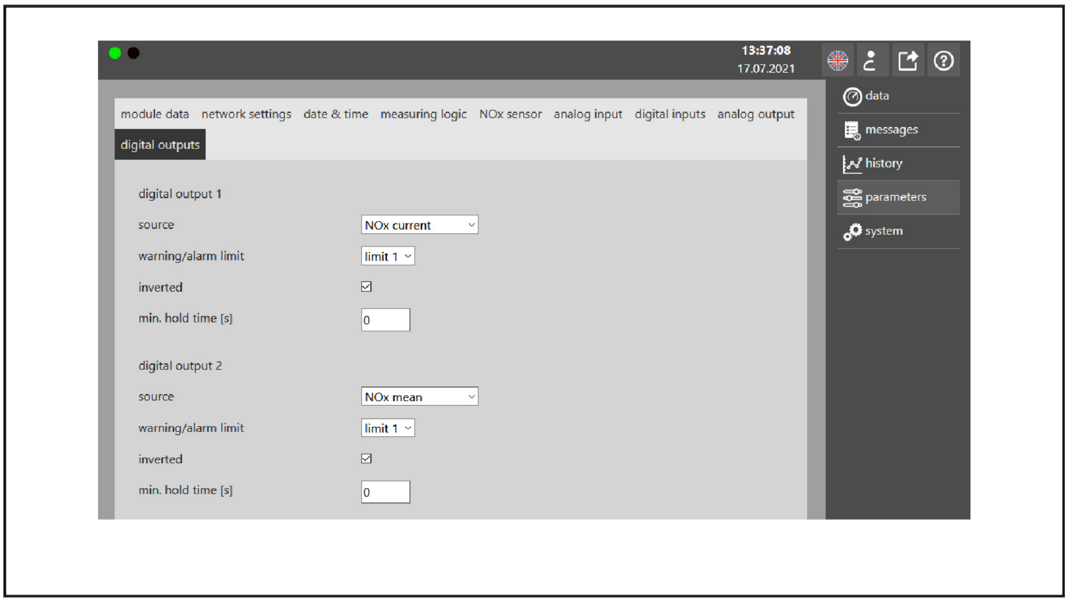


72189-002 Example illustration

If a temperature signal is connected to analog input 1, it can be output again at analog output 1. The limits for 4 mA and 20 mA must be set according to the plant configuration.

Digital outputs

Default settings are to be adopted as follows. Plant-specific adjustments may be necessary here.



72190-002 Example illustration

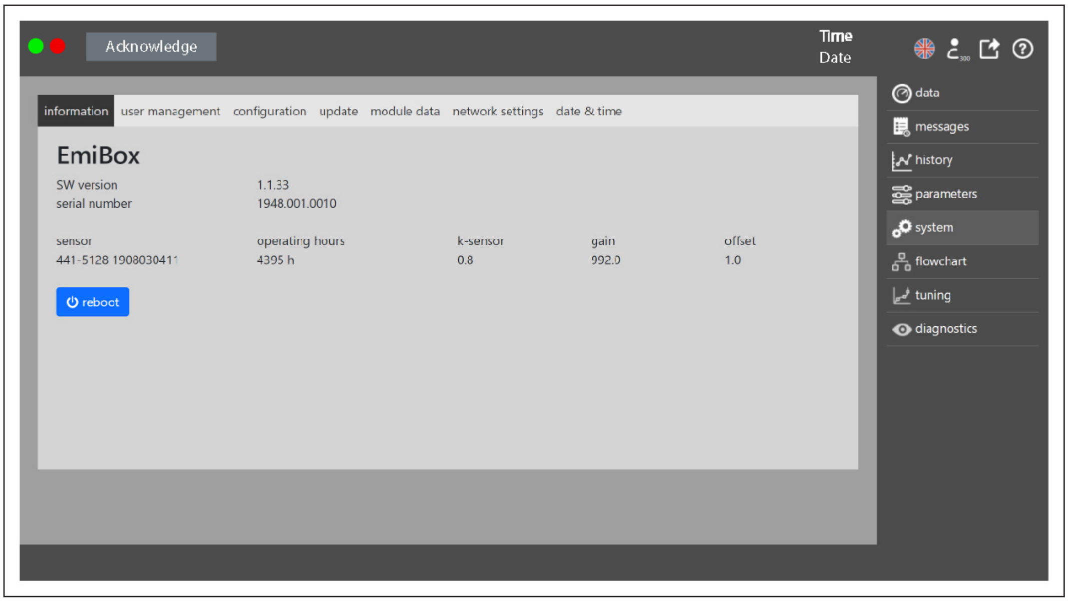
353-003-EN : 51000010 : BA : VAR, COV, IMP, B, BA, BS, DEM, EIN, IBN, IST, WP, SK, MH, SB, STB, TA, TL

7.2.5 EmiBox parameter input

Storage

The EmiBox is already preconfigured on delivery. However, plant-specific changes must still be made.

- Connect to the user interface and log in with the user credentials.
- Open the functional group `System` on the toolbar.



76251-001 Example illustration

- **Module data:** To avoid confusion, the plant name and the engine number must be entered.
- **Network settings:** Select the `Obtain IP address automatically` checkbox.
- **Date & time:** These settings must be set in order to receive the correct export files. Daylight savings time is adjusted automatically on the basis of the set time zone.

7.2.6 Calibrating the NOx sensor

During the commissioning of the plant, the plant-specific K-factor and the need for a potential calibration offset must be determined and set. A calibration protocol can be found in the appendices of this document. The protocol can be found in the appendices of this document as an editable Excel file.

K-sensor

The sensor-specific K-factor (k-sensor) is stored in the EmiBox and cannot be parametrized.

K-factor

The plant-specific K-factor must be determined as follows:

K-factor = NO_2 [ppm] / NO_x [ppm]

The reference measurement must be performed in the same section of the exhaust tract in which the NOx sensor is located. The measuring device and reference measurement must be set to the mean value and measured for at least 2 minutes. If the device does not support a mean value measurement, a measurement can alternatively be taken at three different points in time in order to calculate an average K-factor.

Example:

The NO2 and NOx values must be measured at a minimum of three different points in time.

	Point in time 1	Point in time 2	Point in time 3
NO2 [ppm]	22	25	23
NOx [ppm]	100	101	101
K-factor	0.22	0.25	0.23

The mean value of the K-factors in this example corresponds to 0.23. This figure must then be entered under the "NOx sensor" tab as the plant-specific K-factor.

Calibration offset

After determining and entering the K-factor, it is necessary to check whether the measured NOx value (in mg/m³) corresponds to the value of the reference measurement. The reference oxygen content of the reference measurement must be set 5 %.

If the NOx value of the reference measurement deviates from the NOx value of the EmiBox by +/−15 mg/m³, a corresponding offset must be entered in the EmiBox. The offset value must be repeatedly checked and adjusted until the measured values fall within the tolerance range. An offset can have positive or negative values and is defined as follows:

Offset = $NOx_{\text{Measuring instrument}}$ [mg/m³] – NOx_{EmiBox} [mg/m³]

To calibrate the offset, the mean value of the EmiBox should be set to 5 minutes in order to compare it with a 5-minute averaging of the measurements with the measuring device. The values must be documented in the calibration protocol.

An offset may also need to be calibrated due to ageing or contamination of the sensor.

Calibration gradient

The parameter `calibration gradient` is not to be used and remains at the value 1.

7.2.7 EC conformity of the complete plant

The installation of the emission monitoring device constitutes a change to the complete plant. The emission monitoring device is, however, no more than a measuring device and bears no influence on the operation of the plant.

The assembly and operation of the measuring device does not represent a new hazard or increase any existing risks. To ensure this is the case, the assembly must be performed properly by an authorized specialist.

The installation of the emission monitoring device is not classified as a significant change and therefore does not require a new CE conformity assessment.

353-003-EN : 51000010 : BA : VAR, COV, IMP, B, BA, BS, DEM, EIN, IBN, IST, WP, SK, MH, SB, STB, TA, TL

7.3 SCR Control Kit

7.3.1 Preparation

Required for initial commissioning:

- Authorization by the manufacturer for the work described
- Qualifying theoretical knowledge and practical experience in the function and commissioning of SCR catalytic converters
- Personal login data for the user interface
- The CES commissioning checklist for commissioning SCR catalytic converters
- This Operating Manual and the operating manual for the SCR application
- Knowledge of the regional air pollution control regulations applicable to this product, in particular the required emission values

7.3.2 Configuration specifications and setting values

This Operating Manual

This Operating Manual contains general specifications for the EmiBox with SCR Control Kit.

Operating manual for the SCR application

The project-specific operating manual for the SCR application contains additional or special information that must be taken into account when commissioning the functions of the SCR Control.

Exhaust gas monitoring limits

Temperature	Signal	Effect	Implementation
500 °C	T286	Warning	EmiBox
505 °C	T286 or T495	SC fault (5 min)	TEM/TPEM system "Parameterizable measured values" (is automatically entered in the Operation log, e.g. for warranty purposes)
525 °C	T286 or T495	Emergency stop	TEM/TPEM system "Parameterizable measured values" (is automatically entered in the Operation log, e.g. for warranty purposes)
530 °C	T286	Alarm	EmiBox: Collective alarm, entry in the logbook
560 °C	T287	Emergency stop	TEM parameters 15111 – 15113 TPEM parameters 20750112 and 20750120 (automatically entered in operation log, e.g. for warranty) EmiBox: Collective alarm, entry in logbook

353-003-EN : 51000010 : BA : VAR, COV, IMP, B, BA, BS, DEM, EIN, IBN, IST, WP, SK, MH, SB, STB, TA, TL

7.3.3 On-site checks

Before commissioning, the following product-specific checks must be carried out by specialist personnel for commissioning, in addition to the general checks:

- The conditions and assumptions that apply during project planning match the conditions on site:
  - The installed SCR application (exhaust system with SCR catalytic converter and supply components) matches the project data.
  - The genset is set according to the specifications.
  - The genset's operating media and the urea supply are approved for SCR operation.
- The SCR catalytic converter is fitted and ready for operation
- The NO_x sensor is connected to the EmiBox and calibrated
- The required operating system is installed on the EmiBox
- The EmiBox and the SCR Control switchgear cabinet are securely assembled
- All operator interfaces are easily accessible and outside the danger zone
- All components are mounted or connected properly and according to specifications
- All supply lines and connection cables are professionally routed and connected
- There is no visible damage, soiling or corrosion
- Any dismantled protective and monitoring devices are fully installed and functional

7.3.4 Overview of initial commissioning

Login

- Log in with the username `service` and your personal login credentials

Activating SCR Control mode

- User interface > click on `System` toolbar > `Configuration` tab
- Flip the switches that appear to the `SCR` position

Enter SCR system parameters

- User interface > `System` toolbar > Click on the `SCR System` tab
- Enter parameters in `SCR parameters` dialog area
- Enter parameters in `Measurement ranges` dialog area
- Enter parameters in `I/O` dialog area
- Enter parameters in `Urea tank` dialog area
- Enter parameters in `Dosage pump` dialog area
- Enter parameters in `Warning & alert thresholds` dialog area

Measuring the filling time

- User interface > click the `Diagnostics` toolbar
- Manually measure the filling time and enter it in the dialog area

Approach the NO_x minimum

- User interface > click the `Diagnostics` toolbar
- Move to NO_x minimum manually and enter it in the dialog area

Define control behavior

- User interface > click the `Tuning` toolbar
- Run through the profile manually and enter it in the dialog area
- Manually set PID control

Optimize SCR system

- Perform fine-tuning
- Add messages to the genset's control system as required

User administration

- User interface >click on `System` toolbar > `User management` tab
- Add users

Final steps

- Enter the start and end of commissioning in the logbook
- Create commissioning log

7.3.5 Connecting the service computer

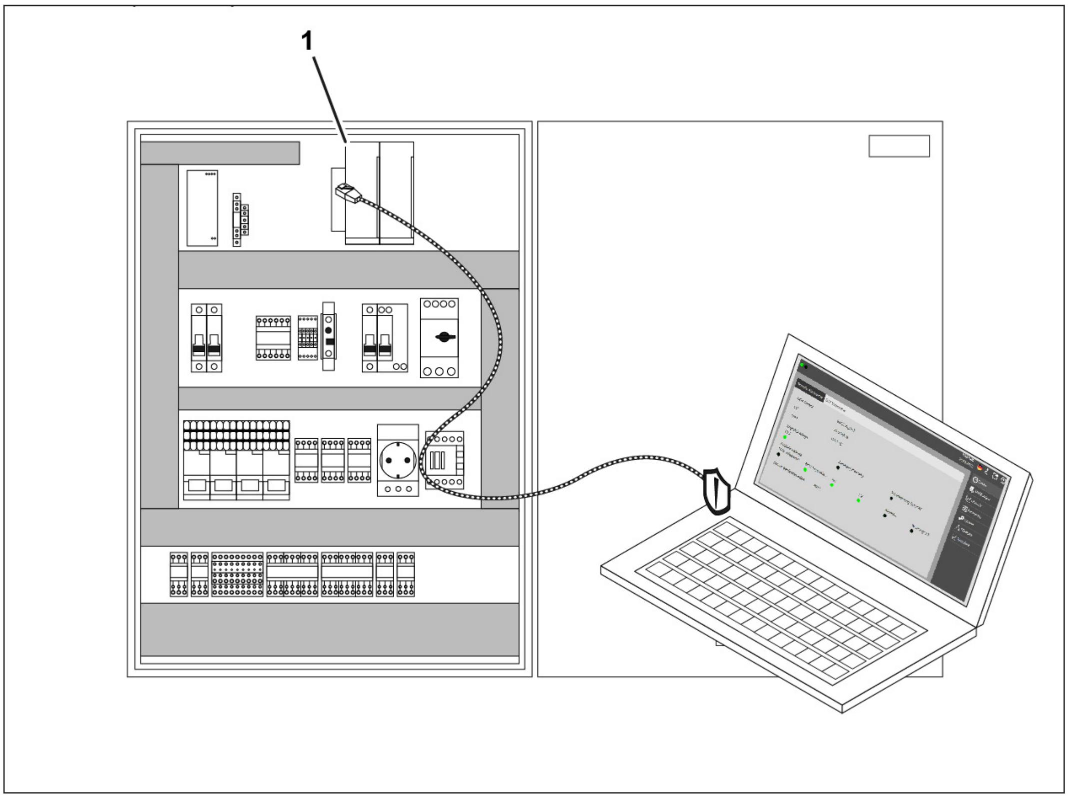
Switching off the voltage supply

The connection of the voltage supply for the SCR Control switchgear cabinet depends on the design of the plant on site.

- Shut down and secure the genset
- Disconnect, relieve and secure the voltage supply and measuring lines to the SCR Control switchgear cabinet
- Open the SCR Control switchgear cabinet and ensure safe working conditions
- For necessary information on safety, see chapter 7.1 Safety notes 172

Connecting the I/O module and service computer

The SCR Control switchgear cabinet contains the I/O module (1) with network connections.



75907-001 Example illustration

- Connect the service computer to the I/O module
  - Place the service computer outside the switchgear cabinet.
  - Open switchgear cabinet door.
  - Connect the service computer to a free network connection on the I/O module (1) using a suitable cable.
  - Leave switch cabinet door slightly open and secure it.

Switch on the power supply

- Establish voltage supply for the SCR Control switchgear cabinet
- Make the genset operationally ready again

7.3.6 Configuring the service computer for accessing the web server

The following address details apply for accessing the user interface via a web browser.

Internet Protocol (TCP/IP) properties	
General	
○ Obtain IP address automatically	
⦿ Use the following IP address	
IP address:	172.16.255.254

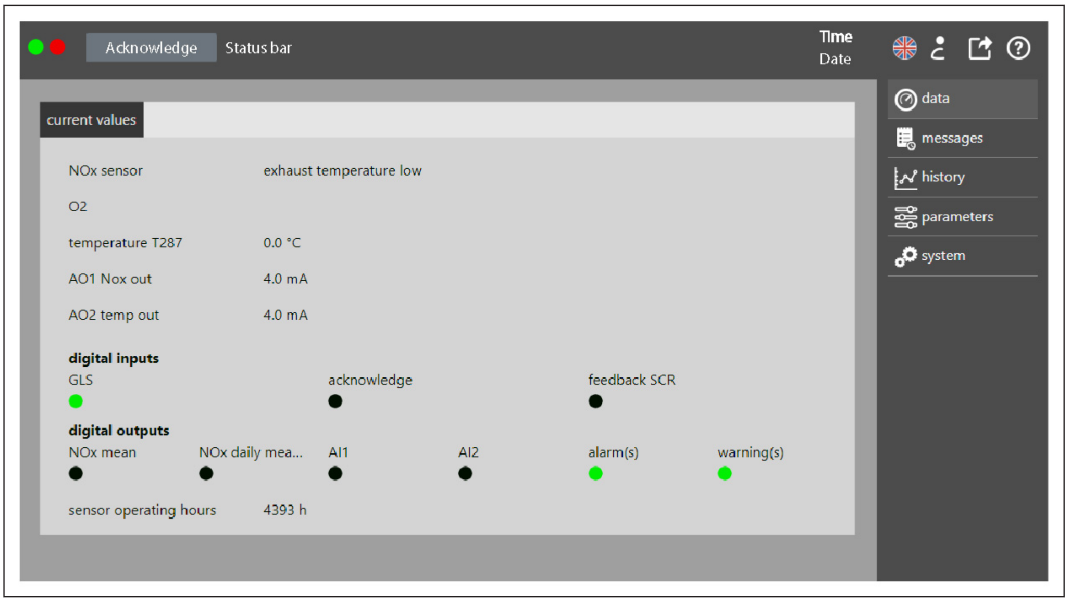
353-003-EN : 51000010 : BA : VAR, COV, IMP, B, BA, BS, DEM, EIN, IBN, IST, WP, SK, MH, SB, STB, TA, TL

Internet Protocol (TCP/IP) properties	
Subnet mask:	255.255.255.252
Default gateway	
○ Obtain DNS server address automatically	
⦿ Use the following DNS server addresses:	
Preferred DNS server:	
Alternative DNS server:	

- Adapt the IP configuration of the service computer

7.3.7 Launch the user interface

- Launch a browser on the service computer
- Enter the IP address for the user interface in the address line: `http://172.16.255.253:5000`.
  - The front end of the web server with the user interface appears.



75946-002 Example illustration: user interface

7.3.8 Login notes

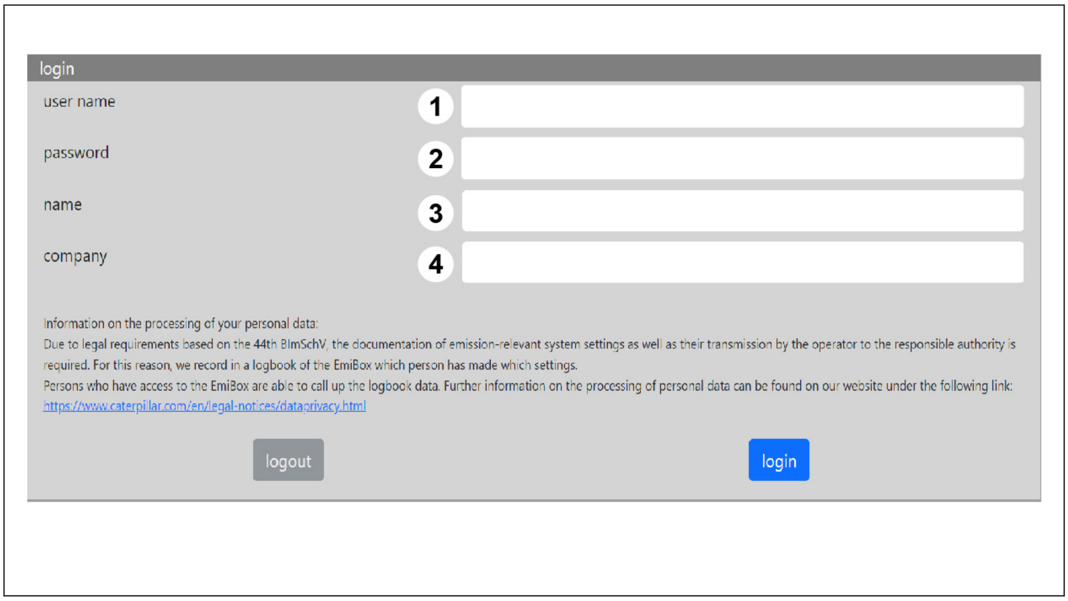
Login

Note

The displays and dialog areas required for commissioning only appear in the user interface after logging in as authorized and registered specialist personnel.

User interface navigation

- User interface > Icon bar > Login icon > `Login` dialog window



75864-001 Example illustration of Login dialog window

1 `User name`

2 `Password`

3 `Name`

4 `Company`

Notes on entering the information

(1) User name: enter `service` as the username

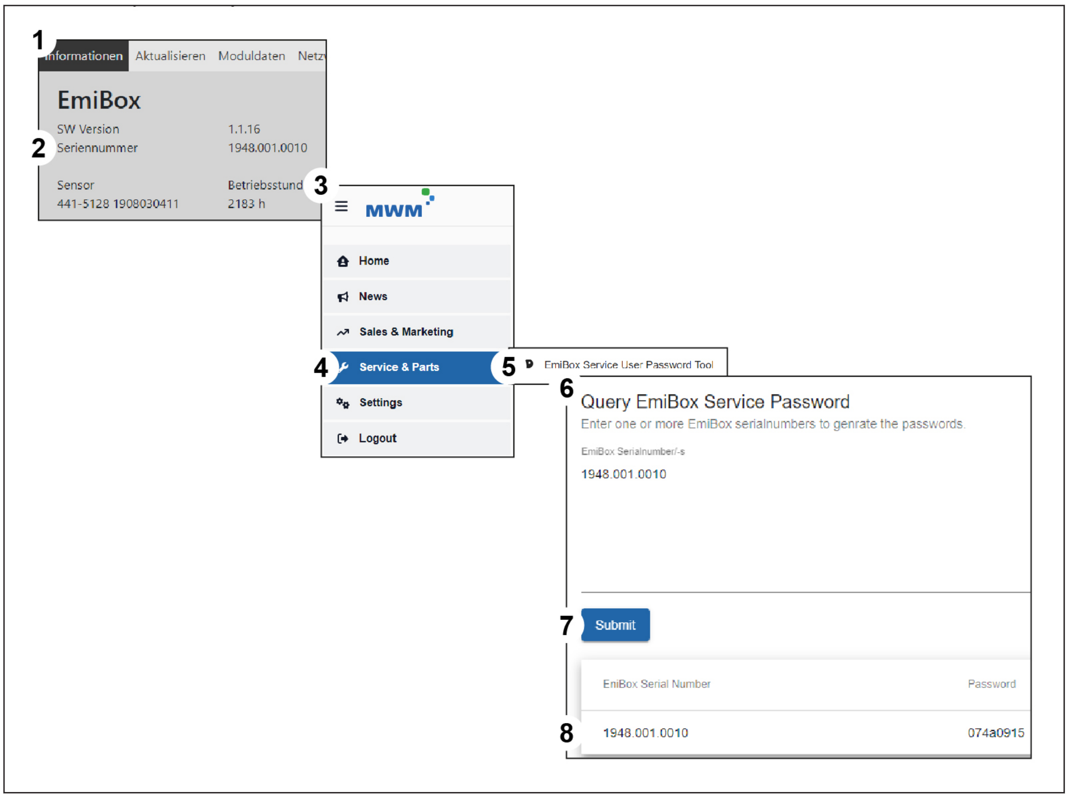
(2) Password: the password (service password) of the EmiBox from the TCG Portal

(3) Name: Name of the authorized specialist

(4) Company: Organization of the authorized specialist (e.g. MWM Service Center South)

Obtaining the password

The login password is available to authorized specialist personnel via the TCG Portal.



75865-001 Example illustration of the Information tab

Find the EmiBox serial number

- User interface > `System` functional group > `Information` tab (1) > `Serial number`
- Copy the serial number of the EmiBox (2)

Procedure in the TCG Portal

- Open TCG Portal (3) in a browser
  - Enter the following address: `https://tcg-portal.mwm.net/`
- Click on the `Service & Parts` category (4) in the menu bar
- Click on the `EmiBox Service User Password Tool` button (5)
  - The `Query EmiBox Service Password` dialog window (6) appears.
- Click on the `Submit` button
  - The `Service Password` appears (8).

Note

It is also possible to enter a whole list of serial numbers (one serial number per line) in one query.

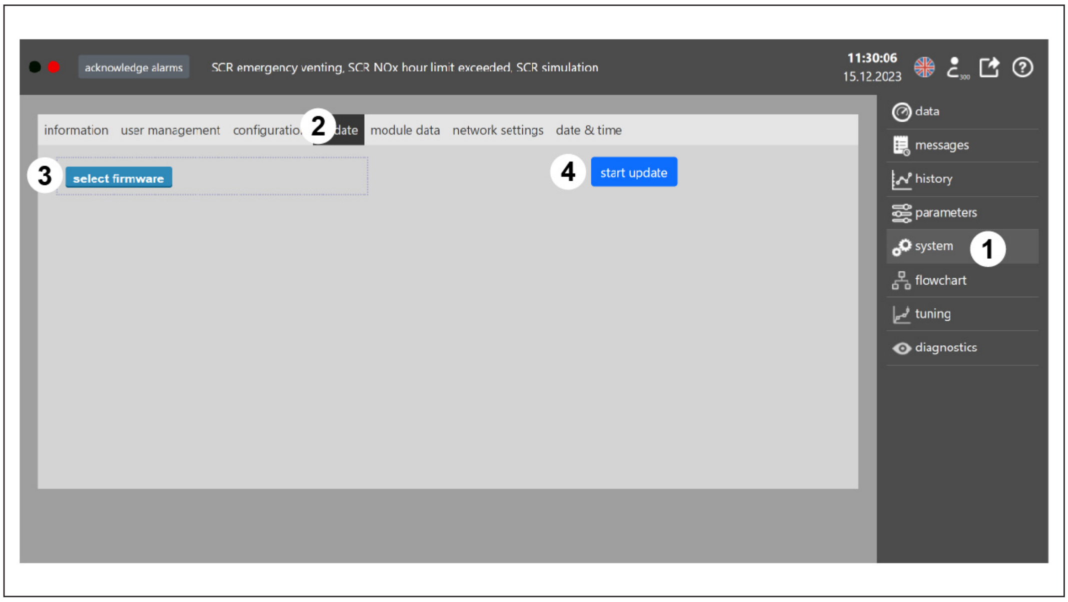
7.3.9 Updating the operating system (only if required)

Requirements

Note
All EmiBoxes with a software version lower than 1.1.4 must first be updated to this version. Only then can the current software be installed. If this instruction is not followed, the EmiBox will no longer function.

- The operating system to be installed is available on the service computer

Procedure



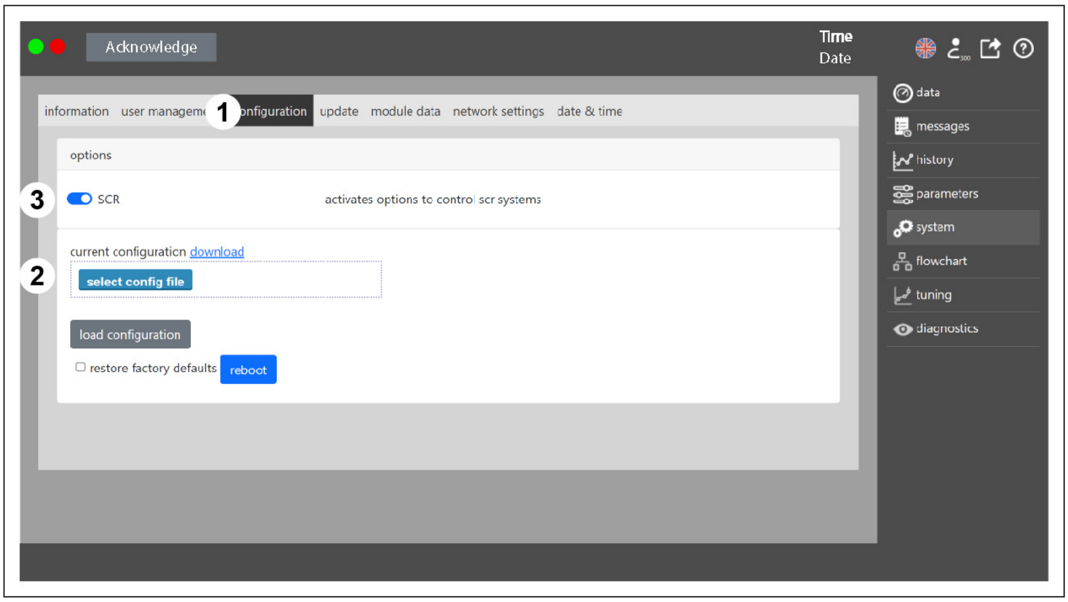
75880-001 Example illustration of `Update` dialog window

- Click on functional group `System` (1)
- Click on the `Update` tab (2)
- Click on the `Select firmware` button (3)
  - Select the firmware as described above.
- Click on the `Start update` button (4)
  - The update starts.

7.3.10 Activating SCR Control mode

User interface navigation

- User interface > `System` toolbar > `Configuration` tab



75866-002 Example illustration

1 `Configuration` tab

2 `Current configuration` dialog area

3 `SCR` switch

Procedure

Note

There is usually no saved configuration present when the device is commissioned for the first time. The following is recommended:

- always save the history, the logbook and the current configuration each time before switching to the SCR system
- during initial commissioning, save the configuration of the system as delivered, and that of the system after commissioning is complete.

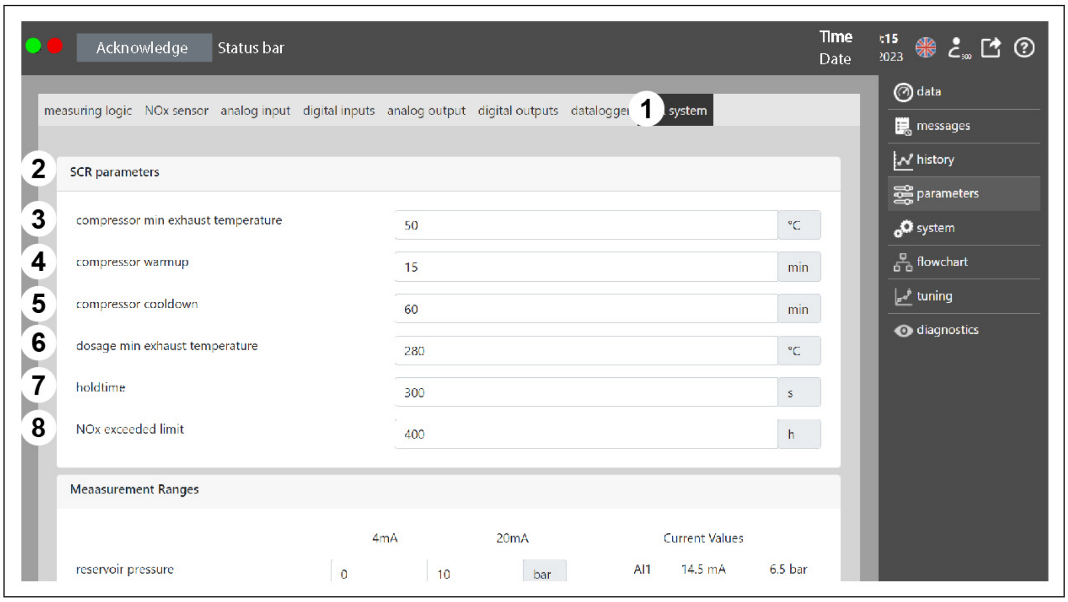
- Click on the `Configuration` tab (1)
- Download the history, logbook and current configuration before changing to the SCR system (2)
- Flip the switch that appears (3) to the `SCR` position
  – After activating `SCR`, additional menus and parameter displays appear in the user interface.

7.3.11 Configuring the SCR system

Enter SCR system parameters

User interface navigation

- User interface > `System` toolbar > `SCR System` tab > `SCR parameters` dialog area



75867-002 Example illustration

1 `SCR system` tab

2 `SCR parameters` dialog area

3 `Compressor min exhaust temperature`

4 `Compressor warmup`

5 `Compressor cooldown`

6 `Dosage min exhaust temperature`

7 `Holdtime`

8 `NOx exceeded limit`

Notes on the user interface and entering parameters

Enter the parameters according to the following instructions and the information in the CES commissioning checklist:

- (3) Compressor min exhaust temperature: Above the configured temperature, the system will switch to the start-up process
- (4) Compressor warmup: Minimum running time of the compressor in order to switch to "Operation" mode
- (5) Compressor cooldown: Time the compressor keeps running after the change from "Operation" mode to "Shutdown" mode. The run time determines the duration of the "Shutdown" mode
- (6) Dosage min exhaust temperature: Minimum temperature to switch to "Operation" mode
- (7) Holdtime: Minimum time for which the temperature set in (4) must be present in order to switch to "Operation" mode
- (8) NO_x exceeded limit: Parameter according to 44th BImSchV [German Federal Immission Protection Decrees]: If injection is defective, fault hours will be counted. If the limit is exceeded, digital output 2 of the I/O module in the SCR Control switchgear cabinet is set to *Generator Stop*

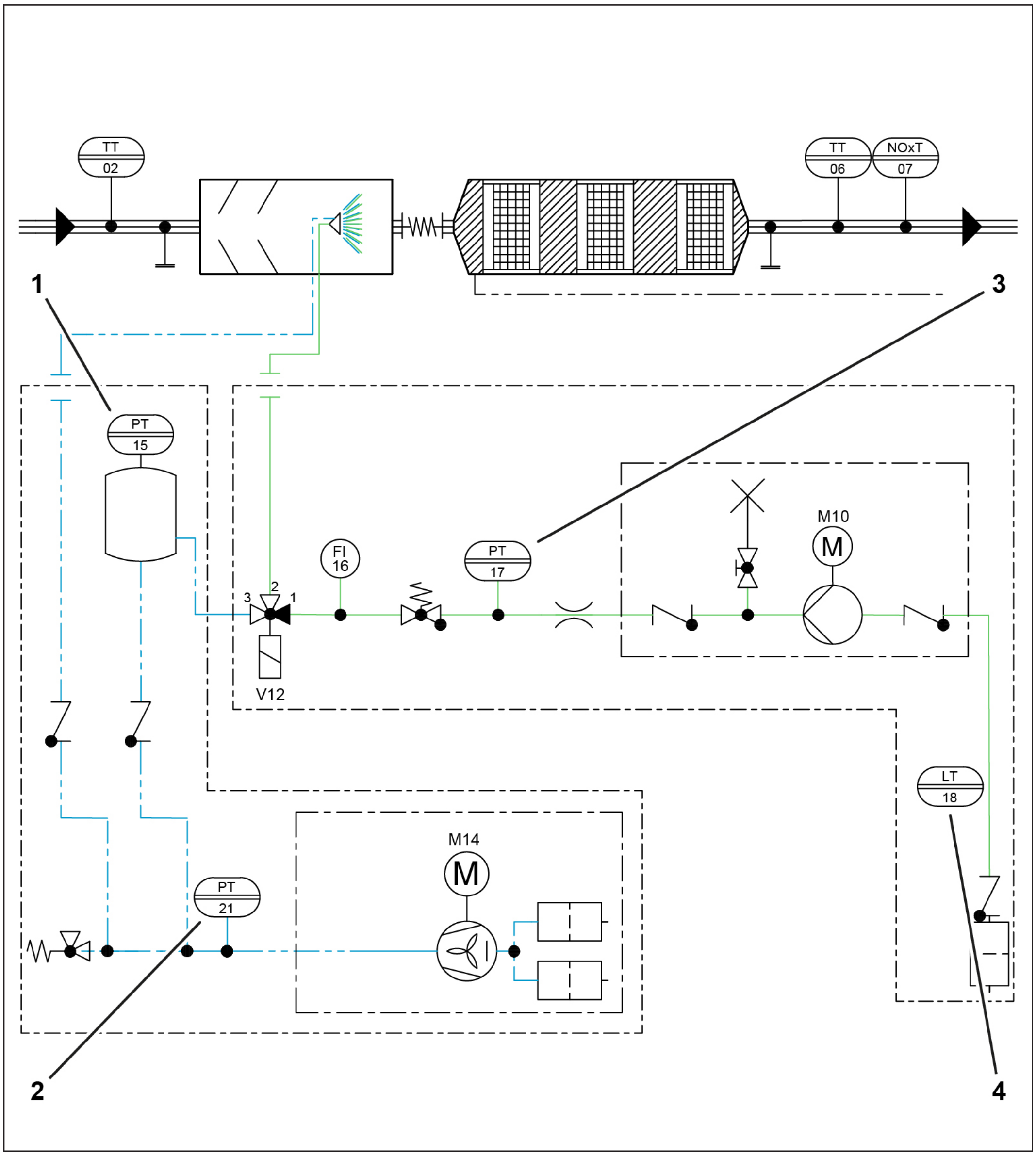
Setting measuring ranges

Note

You can accept the default parameters, but only after checking them first.

Overview of signals

The following P&I diagram provides an exemplary overview of the signals in a standard installation.



75879-001 Example illustration

1 Compressed air container pressure sensor

2 Compressed air compressor pressure sensor

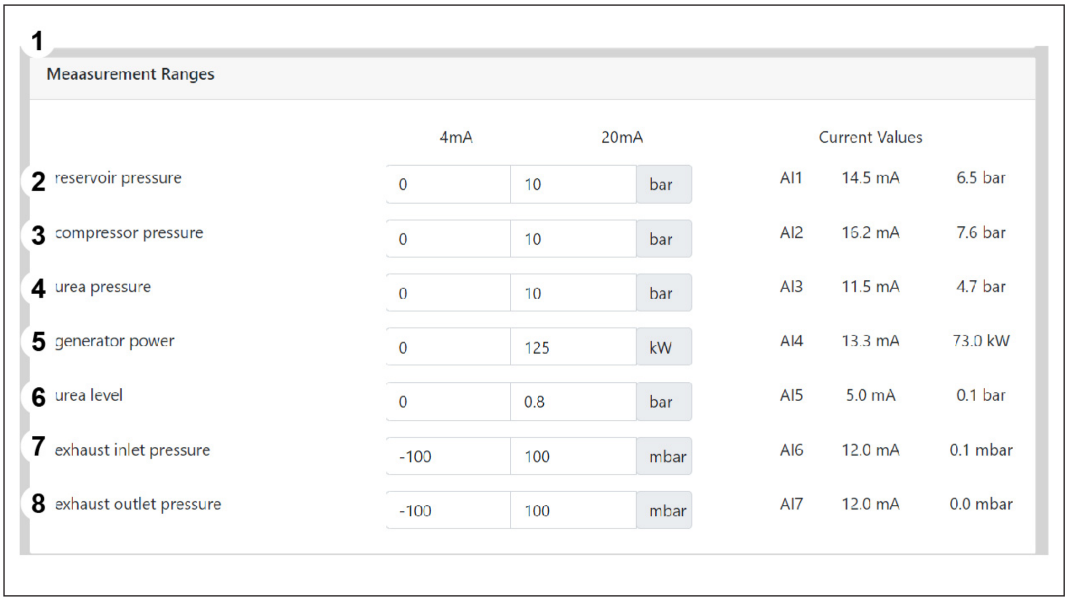
3 Urea solution pressure

4 Analog signal from engine control

353-003-EN : 51000010 : BA : VAR, COV, IMP, B, BA, BS, DEM, EIN, IBN, IST, WP, SK, MH, SB, STB, TA, TL

User interface navigation

- User interface > `System` toolbar > `SCR system` tab > scroll to the `Measurement ranges` dialog area



75868-001 Example illustration

1 `Measurement Ranges` dialog area

2 `Reservoir pressure`

3 `Compressor pressure`

4 `Urea pressure`

5 `Generator power`

6 `Urea level`

7 `Exhaust inlet pressure`

8 `Exhaust outlet pressure`

Notes on the user interface and entering parameters

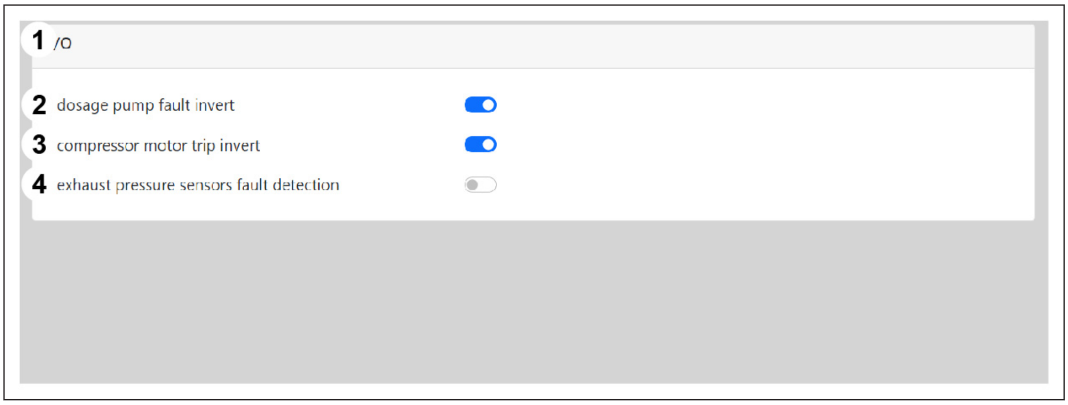
Enter the parameters according to the following instructions and the information in the CES commissioning checklist:

- (2) Reservoir pressure: Pressure in compressed air container
- (3) Compressor pressure: Pressure in the compressed air compressor
- (4) Urea pressure: Urea solution pressure
- (5) Generator power: Analog signal from the engine control
- (6) Urea level: Level sensor in the urea tank.
- (7) Exhaust inlet pressure: Only for diagnostic purposes, usually not present
- (8) Exhaust outlet pressure: Only for diagnostic purposes, usually not present

Set digital inputs and outputs (I/O)

User interface navigation

- User interface > `System` toolbar > `SCR system` tab > scroll to `I/O` dialog area



75869-002 Example illustration

1 `I/O` dialog area

2 `Dosage pump fault invert`

3 `Compressor motor trip invert`

4 `Exhaust pressure sensors fault detection`

Notes on the user interface and entering parameters

Set the digital inputs and outputs (I/O) according to the following instructions and the information in the CES commissioning checklist:

- (2) Dosage pump fault invert: DI1 (dosage pump fault) can be inverted if it is an NC (Normally closed) signal
- (3) Compressor motor trip invert: DI2 (compressor motor circuit breaker) can be inverted if it is an NC (Normally closed) signal
- (4) Exhaust pressure sensors fault detection:
  - Activated: monitors the signal from the exhaust pressure sensors.
  - Deactivated: if the pressure of exhaust gas inlet and pressure of exhaust gas outlet sensors are not connected, the monitoring ignores the missing signal of 4 mA at the AI inputs 6 and 7 of the A/I module in the SCR Control switchgear cabinet.

Parameterizing the urea tank

User interface navigation

- User interface > `System` toolbar > `SCR System` tab > scroll to `Urea tank` dialog area

353-003-EN : 51000010 : BA : VAR, COV, IMP, B, BA, BS, DEM, EIN, IBN, IST, WP, SK, MH, SB, STB, TA, TL

75870-002 Example illustration

1 `Urea tank` dialog area

2 `Total volume`

3 `Height`

Notes on the user interface and entering parameters

Enter the parameters according to the following instructions and the information in the CES commissioning checklist:

- (2) Total volume: Total volume of the urea tank in liters. Is required for calculating the estimated range of the tank contents.
- (3) Height: Maximum height of the liquid in the urea tank. For conversion to filling quantity and range.

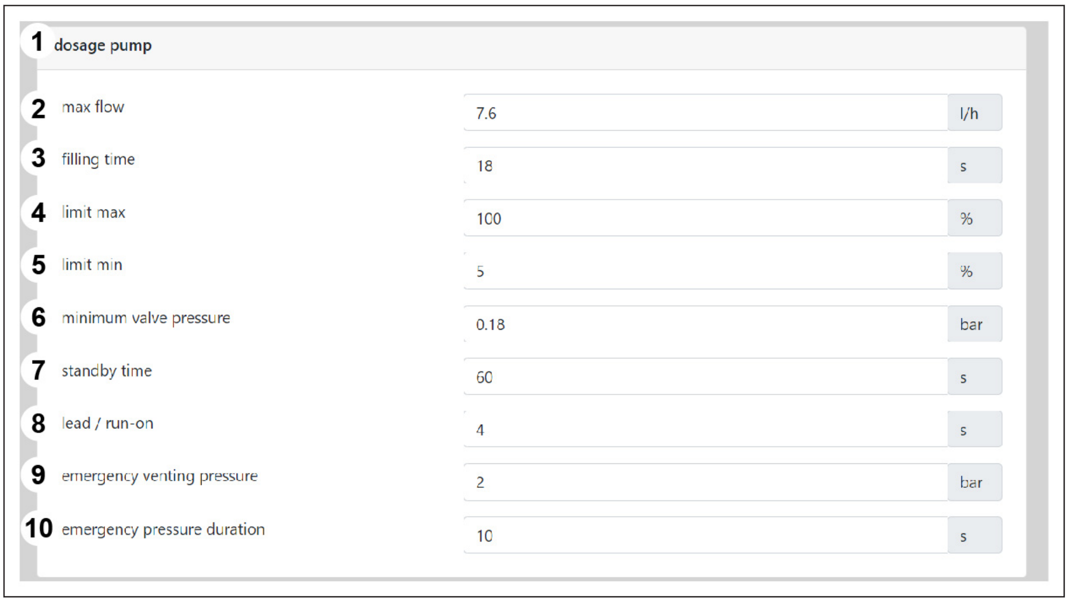
Parameterizing the dosage pump

Note

The dosage pump is parameterized according to the CES commissioning checklist. Any changes or deviating settings must be agreed with CES in advance.

User interface navigation

- User interface > `System` toolbar > `SCR System` tab > scroll to `Dosage pump` dialog area



75871-002 Example illustration

1 `Dosage pump` dialog area

2 `Max flow`

3 `Filling time`

4 `Limit max`

5 `Limit min`

6 `Minimum valve pressure`

7 `Standby time`

8 `Lead/ run-on`

9 `Emergency venting pressure`

10 `Emergency pressure duration`

Notes on the user interface and entering parameters

Enter the parameters according to the following instructions and the information in the CES commissioning checklist:

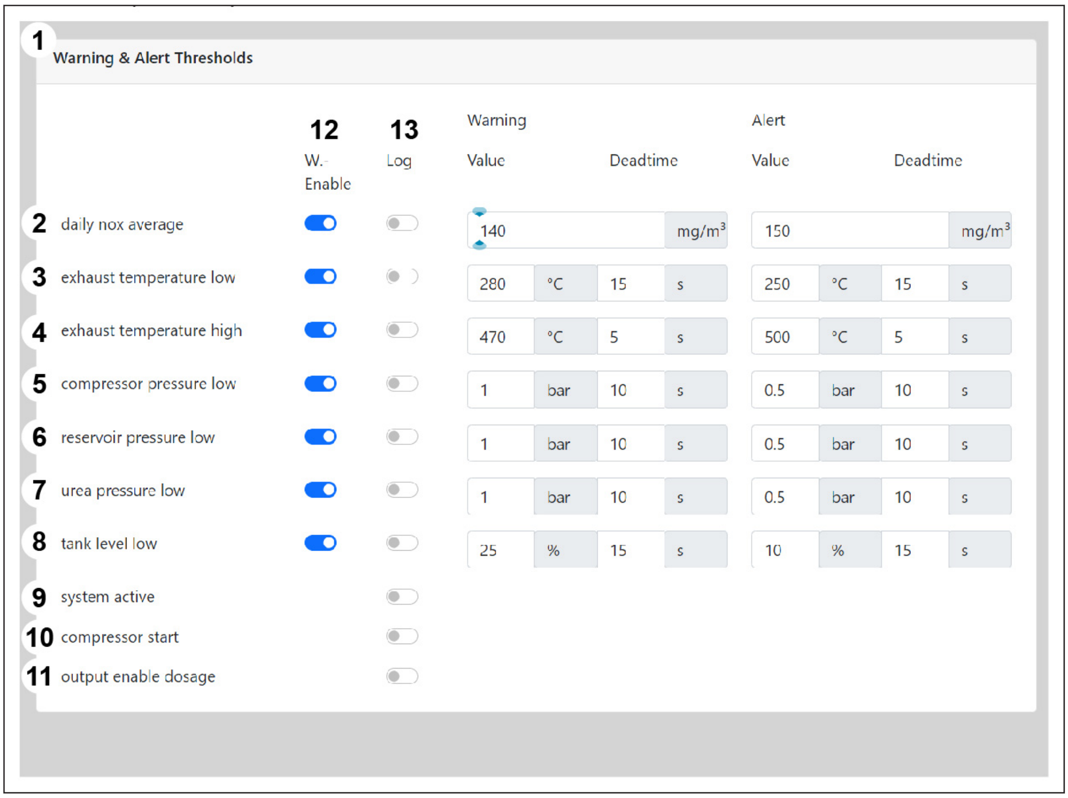
- (2) Max flow: Maximum delivery rate of the dosage pump (see rating plate) = 100 % delivery rate
- (3) Filling time: Filling time of the system (from start of dosage pump to injection into dosing lance)
- (4) Limit max: upper limit of the delivery rate
- (5) Limit min: lower limit of the flow rate (unstable pump behavior)
- (6) Minimum valve pressure: Option to apply a minimum pressure to the 3-way valve for opening
- (7) Standby time: Time for which the min. pressure must be present for a warning to be triggered
- (8) Lead/ run-on: any alarms that occur during the set pre- and post-run time are suppressed to allow for a start-up process

- (9) Emergency venting pressure: when the urea pump is switched off and the 3-way valve is closed, the pressure in the pressure line can increase. If the pressure exceeds the entered limit, the 3-way valve opens briefly to relieve the pressure line
- (10) Emergency pressure duration: Duration of pressure relief

Setting warnings and alarms

User interface navigation

- User interface > `System` toolbar > `SCR system` tab > scroll to `Warning & Alert thresholds` dialog area



75872-002 Example illustration

1 `Warning & alert thresholds` dialog area

2 `Daily NOx average`

3 `Exhaust temperature low`

4 `Exhaust temperature high`

5 `Compressor pressure low`

6 `Reservoir pressure low`

7 `Urea pressure low`

8 `Tank level low`

9 `System acrive`

10 `Compressor start`

11 `Output enable dosage`

12 `W.-Enable` (warning enabled)

353-003-EN : 51000010 : BA : VAR, COV, IMP, B, BA, BS, DEM, EIN, IBN, IST, WP, SK, MH, SB, STB, TA, TL

13 `Log` (logging)

- Set warnings and alarms according to the following instructions

Notes on the user interface and entering parameters

Enter the parameters according to the following instructions and the information in the CES commissioning checklist:

- An alarm threshold can be set for each measured value and activated or deactivated separately
- The flowchart that can be called up provides orientation and shows the current state of the SCR system
  - Navigate to the diagram: User interface > `Flowchart` functional group.

7.3.12 Dosing in manual operation

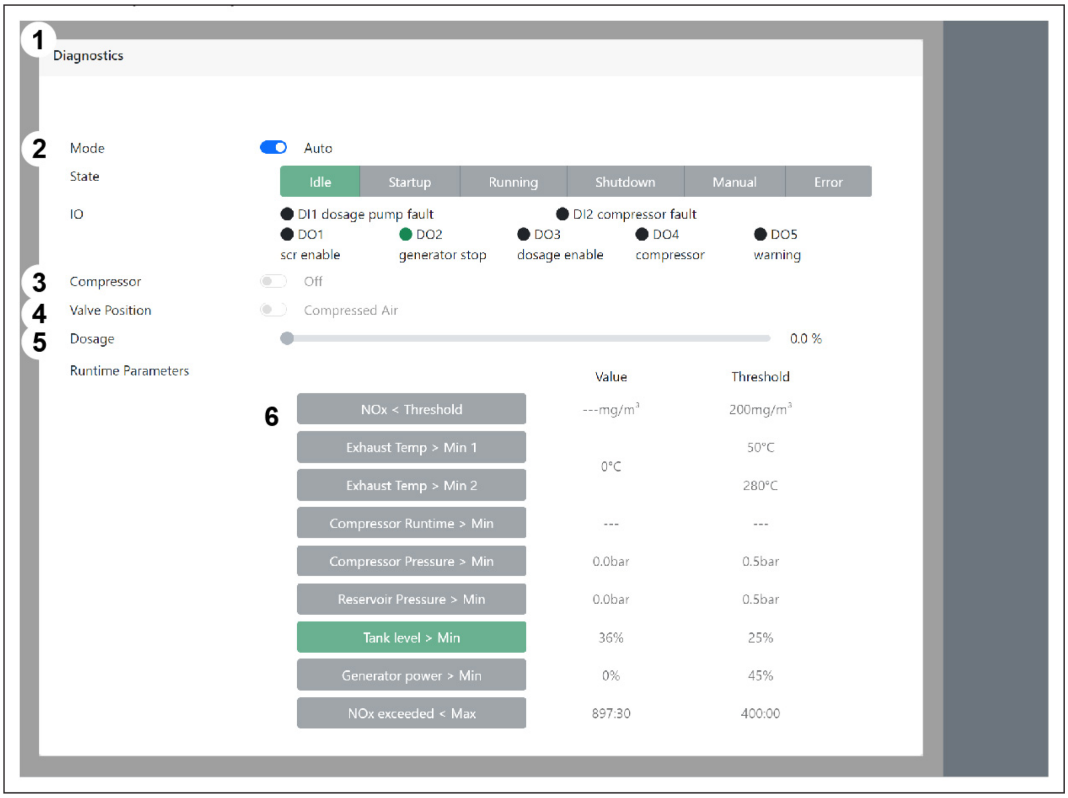
Purpose

The Diagnostics tab can be used to manually set and approach operating points for dosing. This is necessary, for example, when defining the filling time, the NO_x minimum, the profile and the control range.

The tab also shows various injection system statuses.

User interface navigation

- User interface > `Diagnostics` toolbar



75883-002 Example illustration

1 `Diagnostics` tab

2 Mode dialog area

3 Compressor dialog area

4 Valve position dialog area

5 Dosage dialog area

6 Runtime parameters dialog area

Procedure

Note

If the measured value of the NO_x sensor and, if possible, the measured value for the dosing capacity are added to the TEM/TPEM system, the history chart can be clearly viewed.

- Start the genset and approach the desired engine output via the genset control
- Activate the Manual operation mode (2)
- Switch on the Compressor (5)
- Allow the compressor to run for at least 15 minutes
- Switch solenoid valve to the Compressed air position (4)
- Set the desired Dosage (5)

7.3.13 Measure the filling time

The filling time determines the duration for which the dosage pump runs at maximum output (100 %) during *Startup*. This shortens the response time of the SCR catalytic converter by an equal amount. The filling time depends on the design of the SCR system and must therefore be determined manually on site.

Note

If the dosing rate is also available as a measured value on the TEM/TPEM system, the NO_x trend can be clearly displayed.

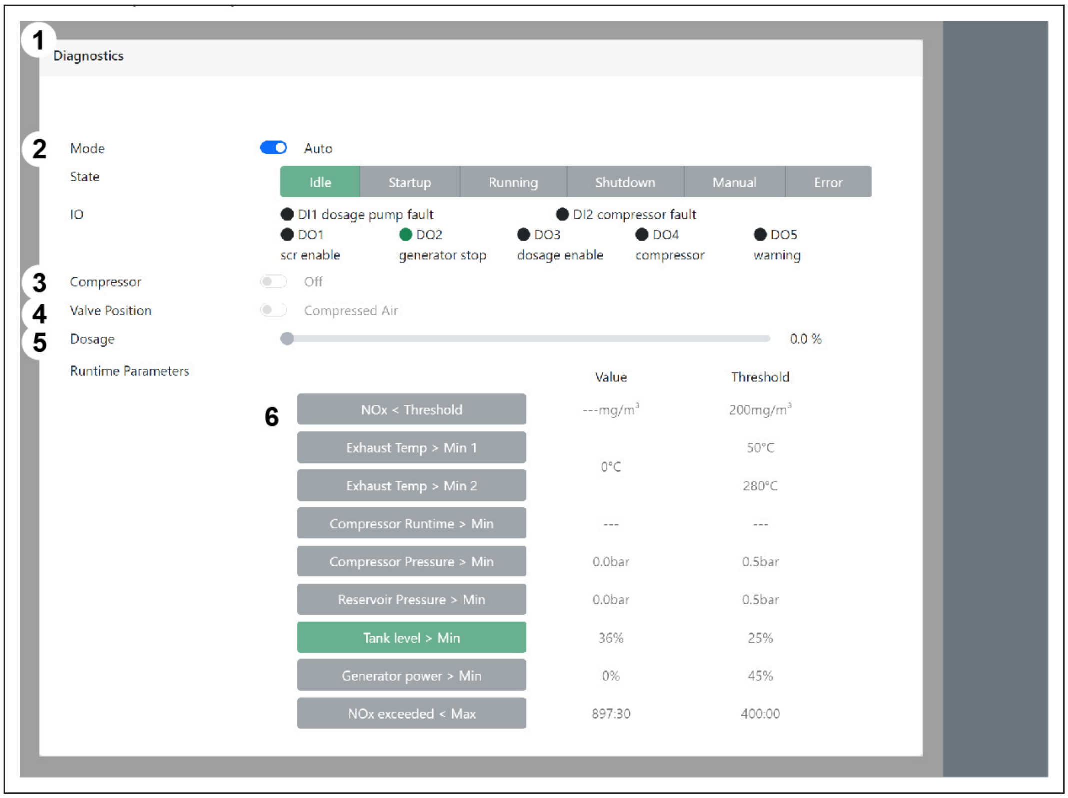
Requirements

The system enable signal for injection is required to determine the filling time:

- System has no errors
- Signal for the NO_x value is displayed
- Genset running at rated load (if possible)
- Exhaust temperature downstream of catalytic converter > 280 °C

User interface navigation

- User interface > Diagnostics toolbar



75883-002 Example illustration

1 `Diagnostics` tab

2 `Mode` dialog area

3 `Compressor` dialog area

4 `Valve position` dialog area

5 `Dosage` dialog area

6 `Runtime parameters` dialog area

Procedure

To determine the filling time, the dosing rate is continuously increased until the NO_x value reacts.

- Activate the `Manual` operation mode (2)
- Switch on the `Compressor` (3)
- Allow the compressor to run for at least 15 minutes
- Switch solenoid valve to the `Compressed air` position (4)
- Set the `Dosage` (5) to 100 %
- Monitor the signal for the NO_x value and stop timing as soon as the NO_x value falls (6)
  – This is the `Filling time`.

- Reduce the `Dosage` to approx. 20 % (5)
- Enter the `Filling time` in the corresponding dialog box
  - Navigation: User interface > `System` toolbar > `SCR System` tab > `Dosage pump` dialog area

7.3.14 Determine NO_x minimum

The NO_x minimum determines the lowest NO_x value during *operation* that can be achieved by varying the dosage. The NO_x minimum depends on the design of the SCR system and must therefore be determined manually on site.

The NO_x minimum is an important parameter for setting the PID control and for assessing the current state of the SCR system.

Note

If the dosing rate is also available as a measured value on the TEM/TPEM system, the NO_x trend curve and the minimum NO_x value can be clearly displayed.

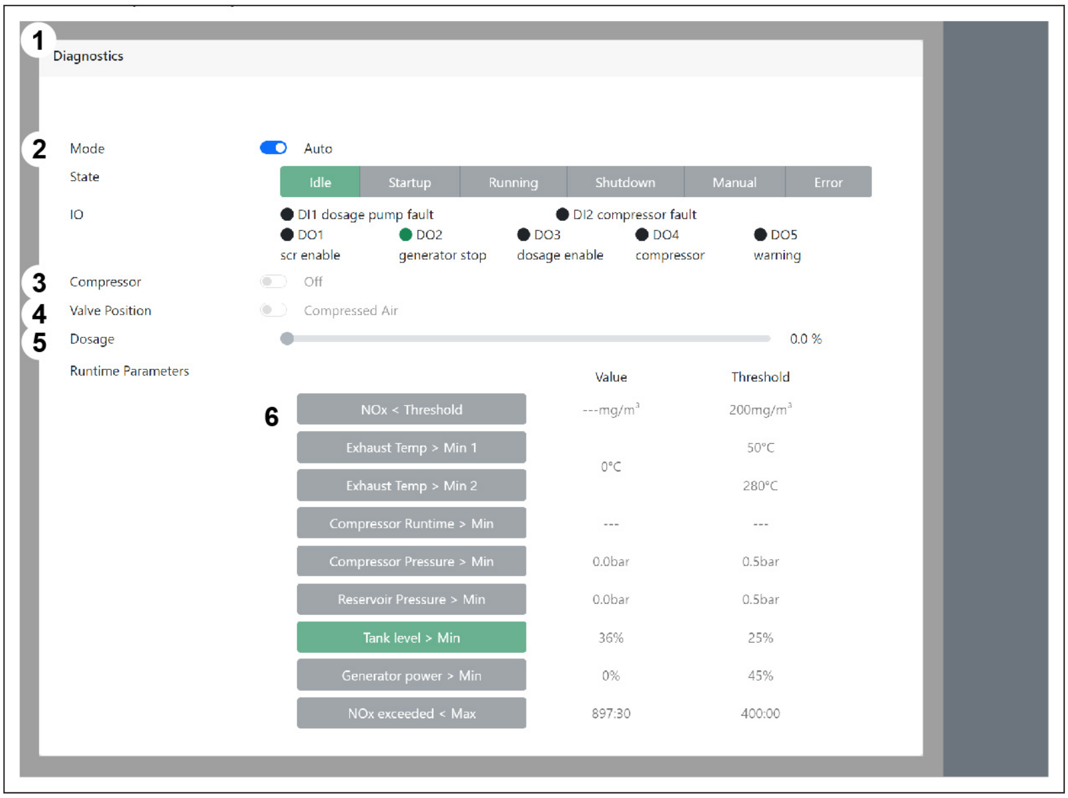
Requirements

The system enable signal for injection is required to determine the filling time:

- System has no errors
- Signal for the NO_x value is displayed
- Genset running at rated load (if possible)
- Exhaust temperature downstream of catalytic converter > 280 °C

User interface navigation

- User interface > `Diagnostics` toolbar



75883-002 Example illustration

1 `Diagnostics` tab

2 `Mode` dialog area

3 `Compressor` dialog area

4 `Valve position` dialog area

5 `Dosage` dialog area

6 `Runtime parameters` dialog area

Procedure

To determine the NO_x minimum, the dosing rate is continuously increased until the falling NO_x value rises again.

- Activate the `Manual operation` operation mode (2)
- Switch on the `Compressor` (3)
- Allow the compressor to run for at least 15 minutes
- Switch solenoid valve to the `Compressed air` position (4)
- Set the `Dosage` (5) to 0 % and increase it slowly
- Monitor NO_x value until the NO_x value rises (6)
  – The NO_x value falls initially.
  – If the NO_x value increases, this dosage is the setting for the NO_x `minimum`.
- Make a note of the NO_x `minimum`

7.3.15 Defining the profile

Purpose

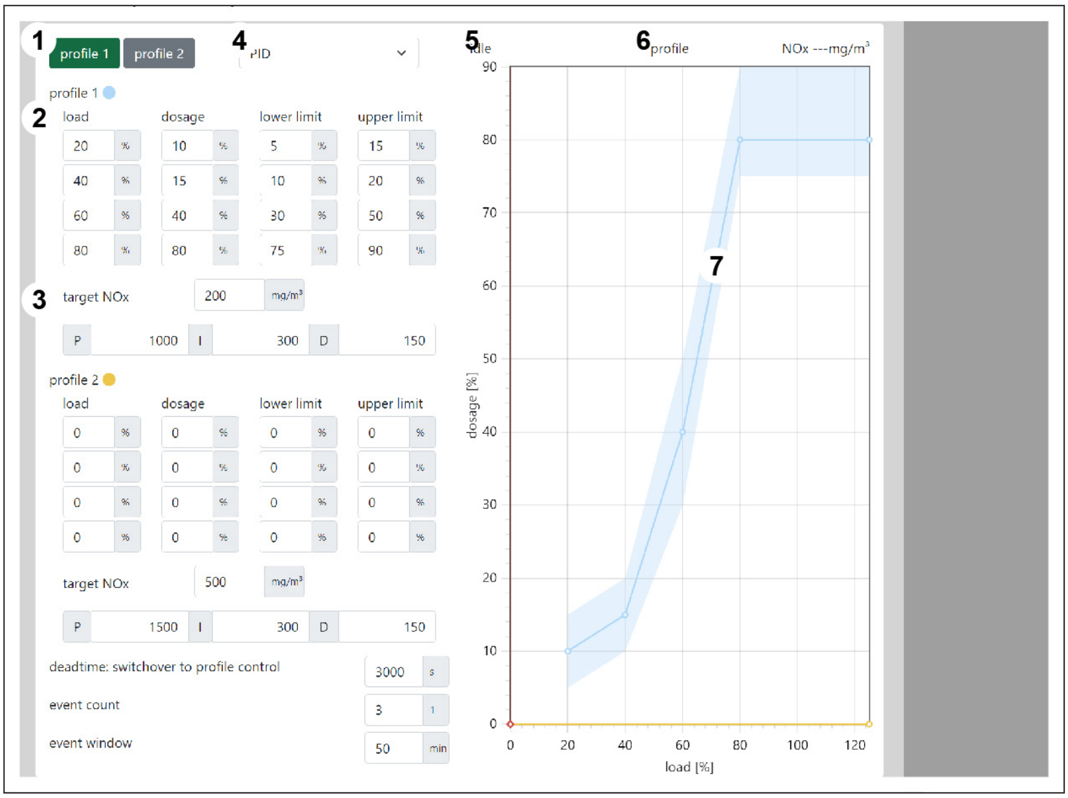
The SCR Control uses the profile to control the dosage in relation to the current load on the gas engine. The profile enables operation of the SCR application if PID control of the dosage is not possible. As the injection quantity is not subject to closed-loop control, the actual NO_x emission is only an approximation of the profile.

The profile is determined manually for several load points while the genset's gas engine is running; it is saved as a profile via the user interface. If the SCR Control switches from PID control to profile, the SCR Control calculates the dosage for the current engine load according to this stored profile.

User interface navigation

The profile is defined via the `Profiles` tab.

- User interface > `System` toolbar > `Profiles` tab > `Control mode` dialog area > select `Profile`



75909-002 Example illustration with graph when selecting Profile (7)

1 Selection: `Profile`

2 Dosing dialog area

3 `Target NOx`

4 Selection: Control mode

5 Displays the current operating state

6 Displays the selected control mode

7 NO_x profile graph

Notes on the user interface

- (1) Profile selection: at least one profile must be created. If required, a further profile with a different NO_x setpoint can be specified and selected by clicking on it.
- (2) Dosing dialog area: During commissioning, the respective dosage and the control limits must be entered for different engine outputs.
- (3) Target NOx: NO_x setpoint for which the profile applies
- (4) Control mode selection: the desired control mode is "Profile".
- (5) Idle: Display of the current operation mode of the SCR system (in the example: Standby).
- (6) Selected control mode: The graph is displayed according to the selection made.
- (7) Graph: Displays the NO_x profile as a function of engine load and injection.

Manually finding and storing the profile

When determining the profile, the system-specific control behavior is found and entered for lines 1 to 4 (increasing, corresponding to the loads on the gas engine):

- Line 1 specifies the engine power up to which the NO_x control should intervene (usually < 30 % power) for the genset shutdown process. Manual measurement is not required. The dosing rate must be lower than in line 2.
- The engine power in lines 2 to 4 can be freely selected (usually 50-75-100 %).

It is advisable to create a table to note down the settings. Example for engine power levels 30-50-75-100:

Engine power levels	30*	50	75	100
Dosing minimum	-			
NO_x dosing setpoint				
NO_x dosing minimum				
Lower limit				
Upper limit				
* The first point does not have to be determined. Its value only has to be below the 2nd profile point				

Tab. 7-1 Profile setting table

For further information, see chapter 4.4.2.4 Specific plant behavior 48

Requirements

System approval for injection is required to approach the load points:

- The measured value of the NO_x sensor and, if possible, the measured value for the dosing capacity are added to the TEM/TPEM system and the history graph can be viewed
- System has no errors
- The genset is idling and can be supplied with a load
- Exhaust temperature downstream of catalytic converter > 280 °C

Procedure

The general procedure is as follows:

- Create table
- Approach the desired engine power for the second profile point via the genset control (e.g. 50 %)
- User interface > `Diagnostics` toolbar
- Activate the `Manual` operation mode
- Turn on the compressor
- Allow the compressor to run for at least 15 minutes
- Change the solenoid valve position
- Set the dosing rate of the dosage pump to 100 % and wait until the displayed NO_x value drops: **this is the filling time!**
- Set the dosing capacity of the dosage pump to 0 % and increase it slowly until the displayed NO_x value drops: **this is the minimum dosing level!**
- Increase the dosing rate until you reach the target NO_x value: **this is the dosing setpoint for this profile point!**
  - Enter the dosing setpoint in the table.
  - Check the NO_x value displayed in the user interface with a suitable measuring device at the provided NO_x measuring point of the SCR application.
  - If the readings differ, calibrate the NO_x sensor.
- Continue to increase the dosing rate until the NO_x value rises: **this is the NOx minimum!**
  - Enter the NO_x minimum you found into the table.
- Find and document the other profile points in the same way
- Take the safety margin into account for each one and enter it in the table
  - `Lower limit`: approx. 85 % of the dosing setpoint.
  - `Upper limit`: approx. 95 % of the NO_x minimum.
- User interface > `System` toolbar > `Profiles` tab
- Enter the table values in the `Dosing` dialog area

7.3.16 Setting the PID controller

Purpose

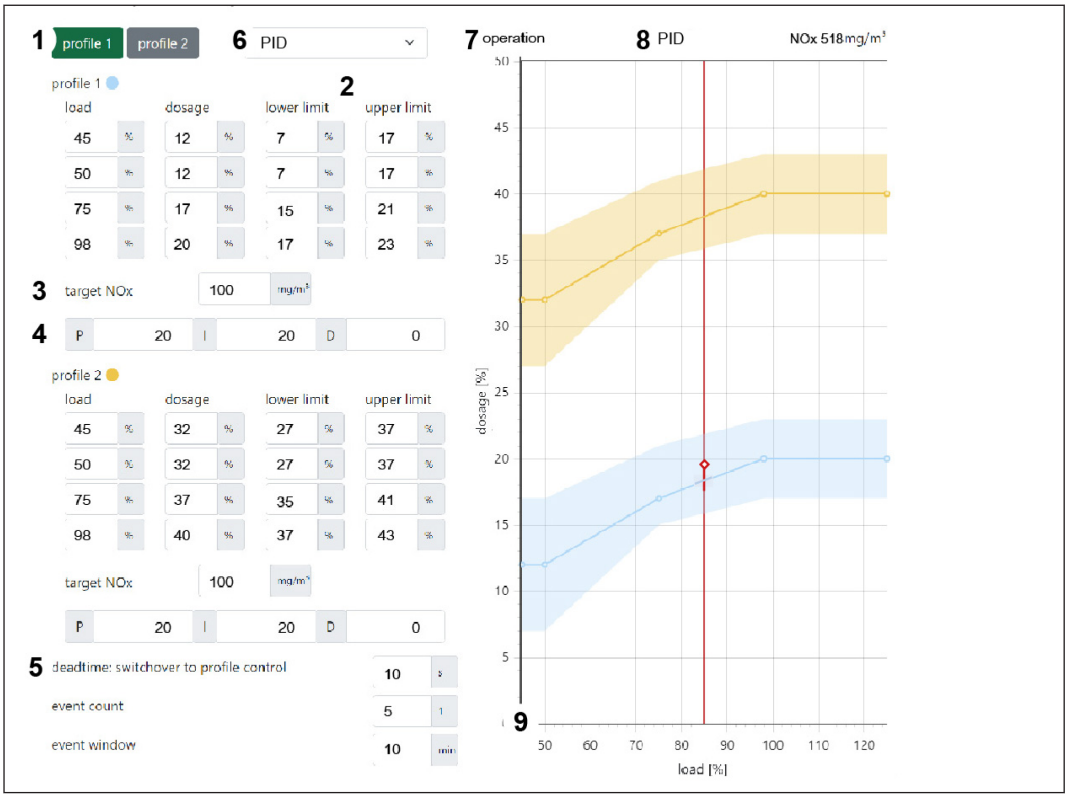
The SCR Control uses the PID controller to regulate the dosage in proportion to the current load on the gas engine and the emissions measured by the NO_x sensor. Injection with the PID controller is the preferred application, as it regulates a measured, deviating NO_x emission to the setpoint within a specified control range.

If the SCR Control cannot drive the setpoint to within the specified control range, a specified time (deadtime) will start counting down. If the controller does not succeed in adjusting the setpoint during this time, there is probably a technical reason. The SCR control then switches from PID control to profile control.

User interface navigation

The parameters for PID control are defined via the `Profiles` tab.

- User interface > `System` toolbar > `Profiles` dialog area > `Control mode` > select `PID`



75910-002 Example illustration with graph with PID (6) selected

1 Current `Profile`

2 Dosing dialog area

3 `Target NOx`

4 `PID` controller dialog area

5 Monitoring

6 Control mode selection

7 Displays the current operating state

8 Current control mode

9 Graph

Notes on the user interface

- (1) Current profile: a maximum of two different profiles with different NO_x setpoints can be configured.
- (2) Dosing dialog area: In PID control, only the parameters for the limits are taken into account.
- (3) Target NOx: NO_x setpoint for which the profile applies
- (4) PID controller dialog area: the control behavior is set by adjusting the PID parameters

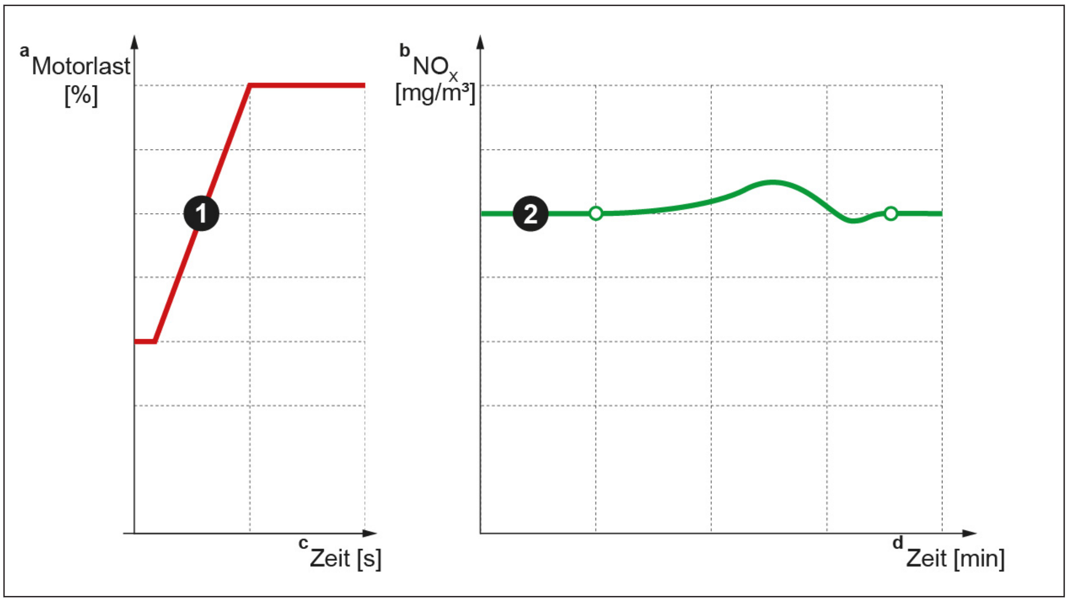
- (5) Monitoring: allows you to specify a downtime during which no monitoring takes place. If the dosage remains at a dosing minimum or maximum for the set time, the PID control switches to profile mode and an alarm is triggered. The cause must be eliminated as quickly as possible
- (6) Control mode selection: Specifies the desired control mode. In normal operation, it is PID control. Only applied when the user's selection is saved.
- (7) Operation: Displays the current operation mode of the SCR system, in the example: Operation.
- (8) Current control mode: Control mode the SCR system is in now.
- (9) Graph: visualizes the settings and the PID control behavior; enables manual switching from PID control to profile control and vice versa.

For a detailed description of the user interface, see chapter 4.6.11.1 Profile 97.

Manually finding and saving PID parameters

The parameters of the PID controller are determined manually for the desired NO_x setpoint while the genset is running, then saved as a profile via the user interface. When finding the values, static control behavior is first set for a typical load of the gas engine. This is followed by discontinuous load changes in order to adjust the dynamic control behavior to a favorable transient response.

Since an SCR application reacts relatively slowly, the D value of the controller is irrelevant. The decisive factor is varying the P value for a sufficiently fast reaction and the I value for a small deviation between the actual value and the setpoint. The following figure shows an example of favorable control behavior when the engine load changes via a ramp.



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

a	Engine load [%]
b	NO_x [mg/m^3]
c	Time [s]
d	Time [min]
1	Load change with ramp
2	Controller response

Requirements

The system enable signal for injection is required in order to determine the PID parameters:

- The measured value of the NO_x sensor and, if possible, the measured value for the dosing capacity are added to the TEM/TPEM system and the history graph can be viewed
- System has no errors
- The compressor has been running for at least 15 minutes
- Exhaust temperature downstream of catalytic converter > 280 °C
- The genset is idling and can be supplied with a load

Procedure

The general procedure is as follows:

- User interface > `Diagnostics` toolbar
- Activate `Auto` operation mode
- Set P value
  - Approach the desired engine power for the static setting of the PID parameters via the genset control (e.g. 50 %).
  - Slowly increase the P value until the desired setpoint is almost reached.
  - Make a major load change in the genset and check the response of the PID controller. A lingering deviation in the measured NO_x value is normal, but the value should nevertheless approach its slowly.
  - Change the P value with another load change until acceptable transient response behavior has been achieved.
- Set the I value
  - Approach the desired engine power for the static setting of the PID parameters via the genset control (e.g. 50 %).
  - Slowly increase the I value until the desired setpoint is reached.
  - Make a major load change in the genset and check the response of the PID controller. There should be a rapid transient response without any significant deviation of the measured NO_x value from the setpoint.
  - If this is not the case, vary the P value and I value.
- Set the D value
  - As the system reacts slowly, a D value is not necessary.
- Perform several load changes and optimize the controller
- User interface > `System` toolbar > `Profiles` tab
- Enter the values determined in the PID controller dialog area
- Set monitoring for the operating point:
  - Enter the deadtime: for example, 1500 s (25 min). The long time span is necessary because it takes a very long time for the exhaust system and the NO_x sensor to heat up. During this time, the NO_x signal drifts as a function of the temperature.
  - Set the event count and event window to suit the situation on site (an event is present if the operating point of the dosing is not plausible).

353-003-EN : 51000010 : BA : VAR, COV, IMP, B, BA, BS, DEM, EIN, IBN, IST, WP, SK, MH, SB, STB, TA, TL

Note

When adjusting the monitoring system, the control behavior of the PID controller must be observed. If, for example, the PID controller is set to respond very slowly and the event window is too short, monitoring may not respond.

7.3.17 Setting the PID controller for dual gas operation (option)

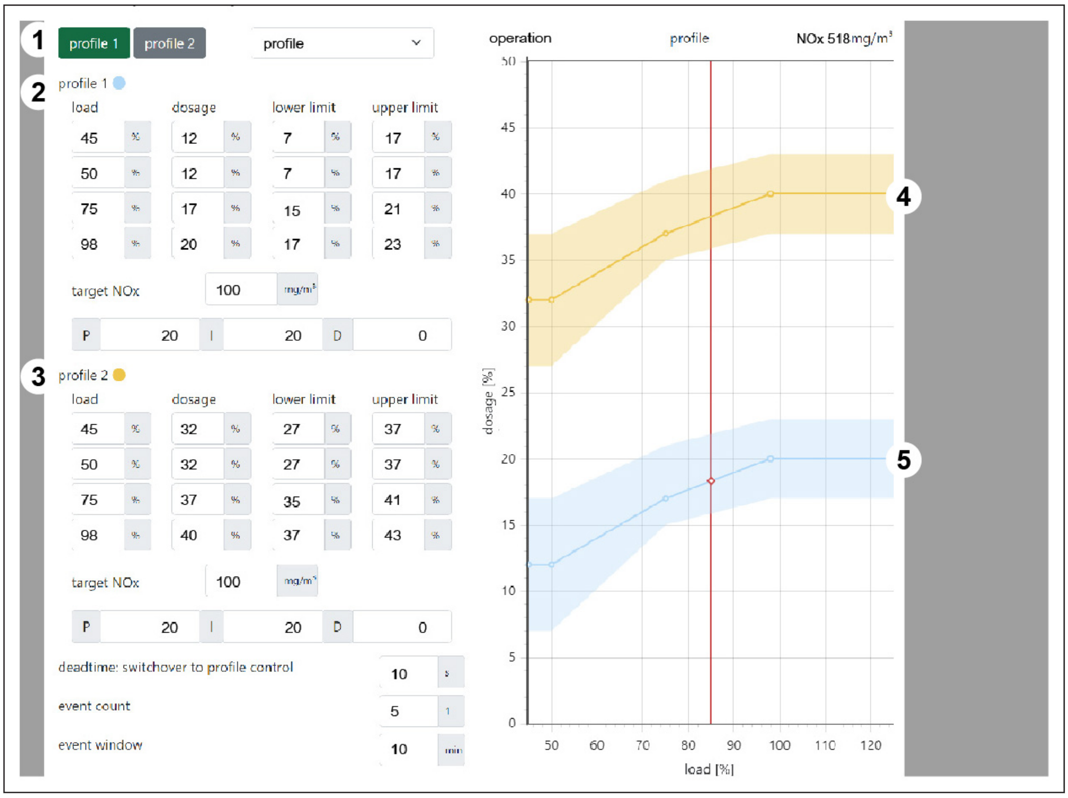
Purpose

A characteristic profile must be determined for each gas type. The EmiBox automatically accesses the respective profile during operation.

User interface navigation

The parameters for PID control are defined via the `Profiles` tab.

- User interface > `System` toolbar > `Profiles` dialog area > `Control mode` > select `PID`



76177-001 Example illustration with graph with PID (7) selected

1	Selection and status of the `Profile`: green = Activated; gray = Not activated
2	`Profile 1` input area
3	`Profile 2` input area
4	Graph with profile and limits for `Profile 1`
5	Graph with profile, limits and current operating point for `Profile 2`

Notes on the user interface

- (1) Profile selection: two different profiles with different NO_x setpoints can be specified and selected by clicking on them during parameterization
- During automatic operation, the status then changes automatically depending on the gas type

Manually finding and saving PID parameters

Switching to a different gas type is only possible when the genset is at a standstill. The genset is then placed under load as described above to determine the parameters for the PID controller for this type of gas and save those parameters as a profile.

Further information

- See chapter 7.3.16 Setting the PID controller 205

7.3.18 User management

The User management tab is used by the system administrator to manage users and their authorizations in order to protect the system from unauthorized access.

The authorizations vary depending on the operating personnel and authorized specialist personnel:

- Plan and define them accordingly
- Document them
- Assign them in the user interface

Persons must be instructed according to their authorizations and made aware of their personal responsibility for protecting their passwords.

The following table can serve as an example for planning:

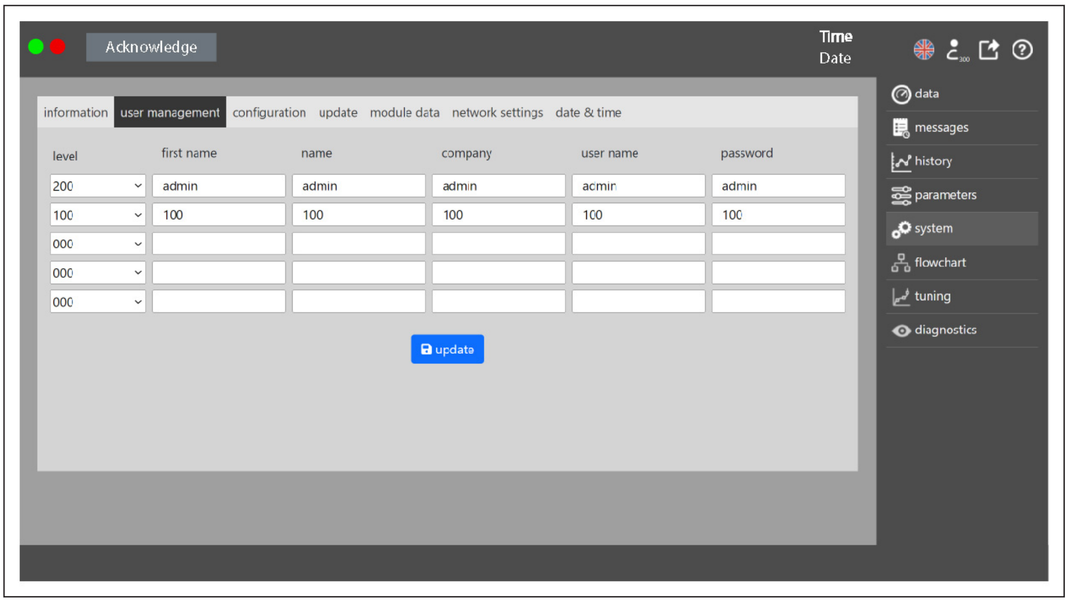
Authorizations in the user interface	Authorization level 0	Authorization level 100	Authorization level 200	Authorization level 300 "Service"
Data	Read	Read	Read	Read
History	Read	Read	Read	Read
Parameters	Read	Write	Write	Write
Export	Yes	Yes	Yes	Yes
System - User manage-ment	Not displayed	Not displayed	Write	Write
System - Configuration	Not displayed	Not displayed	Not displayed	Displayed
System - Update	Not displayed	Not displayed	Not displayed	Displayed
System - Module data	Read	Read	Write	Write
System - Network settings	Read	Read	Write	Write
System - Date & Time	Read	Read	Write	Write

353-003-EN : 51000010 : BA : VAR, COV, IMP, B, BA, BS, DEM, EIN, IBN, IST, WP, SK, MH, SB, STB, TA, TL

Authorizations in the user interface	Authorization level 0	Authorization level 100	Authorization level 200	Authorization level 300 "Service"
Parameters - NOx sensor	Read	Read	Write	Write
Parameters - Datalogger	Not displayed	Not displayed	Not displayed	Write
Parameters - SCR system	Not displayed	Not displayed	Not displayed	Write
Flowchart	Read	Read	Read	Read
Profile	Not displayed	Not displayed	Not displayed	Write
Diagnostics	Not displayed	Not displayed	Not displayed	Write

User interface navigation

- User interface > `System` functional group > `User management`



75949-002 Example illustration

Procedure

- Create a person in a table row
- Press the `Update` button

7.3.19 Optimizing the system

Shut down automatic operation

When shutting down, there will be a steep rise in the NO_x value after the dosage pump is switched off. In this case, the dosing was switched off (line 1 of the profile) at 45 % power. The dosing should be switched off as late as possible (< 30 % power) so that the peak no longer produces a fault message.

353-003-EN : 51000010 : BA : VAR, COV, IMP, B, BA, BS, DEM, EIN, IBN, IST, WP, SK, MH, SB, STB, TA, TL

Integrate SCR system in plant control

For better control of the operating states, it is useful if the dosing rate and urea pressure are also available as analog signals at the engine control.

7.3.20 Final steps

Note

Any change to the exhaust system must be entered in the logbook. This also includes cleaning or replacing the catalytic converter or sensors, placing a tamper-evident seal on the catalytic converter, and changing parameters.

The reason for the removal or the reattachment of the seal must be documented in the logbook with date and 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 NOx. This must uniquely reveal which person (with complete name and company affiliation) has carried out the conversion measures.

- Enter the start and end of commissioning in the logbook
- Create commissioning log

353-003-EN : 51000010 : BA : VAR, COV, IMP, B, BA, BS, DEM, EIN, IBN, IST, WP, SK, MH, SB, STB, TA, TL

7.4 Remote access as an option

7.4.1 Configuring the EmiBox network settings

The Remote Plant Gateway (RPG) is preconfigured. To technically enable remote access to the Emibox, the Emibox simply needs to be connected to the Remote Plant Gateway (RPG) and configured for the network.

The network settings are:

IP address (IPv4): 10.0.0.98

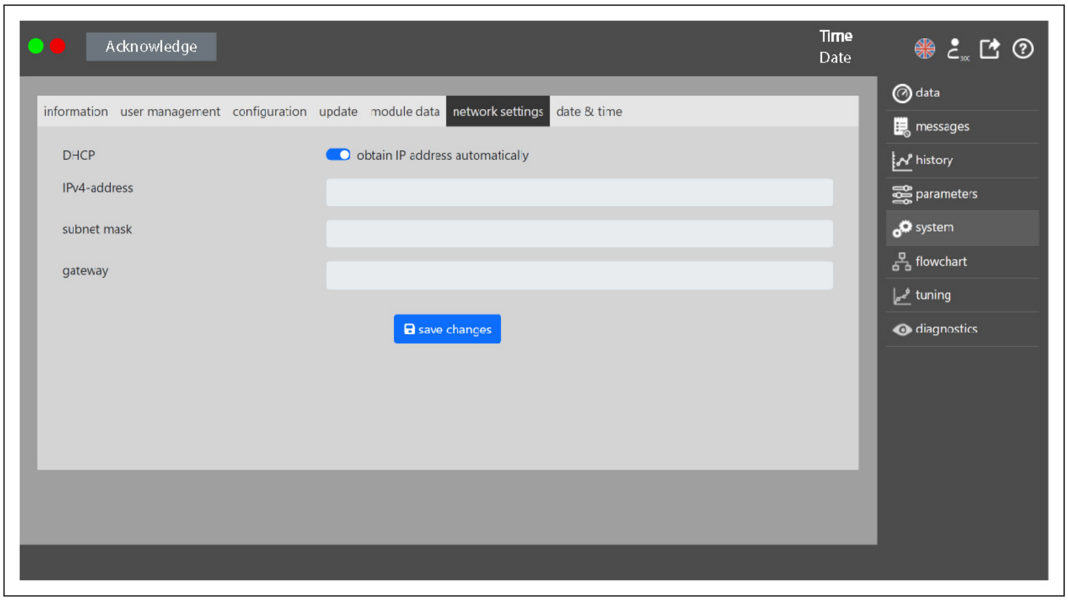
Subnet mask: 255.255.255.240

Gateway: 10.0.0.97

Prerequisite

- Check whether the EmiBox is connected to port 2 of the Remote Plant Gateway (RPG)

Procedure



76255-001 Example illustration

- Launch the user interface
- Login
  - Click on the User icon at the top right.
  - Log in as an admin with the assigned password.
- Click on functional group `System`
- Click on the `Network settings` tab
- Configure the network
- Click on the `Update` button to save the changes
- Be sure to log out as admin

353-003-EN : 51000010 : BA : VAR, COV, IMP, B, BA, BS, DEM, EIN, IBN, IST, WP, SK, MH, SB, STB, TA, TL

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

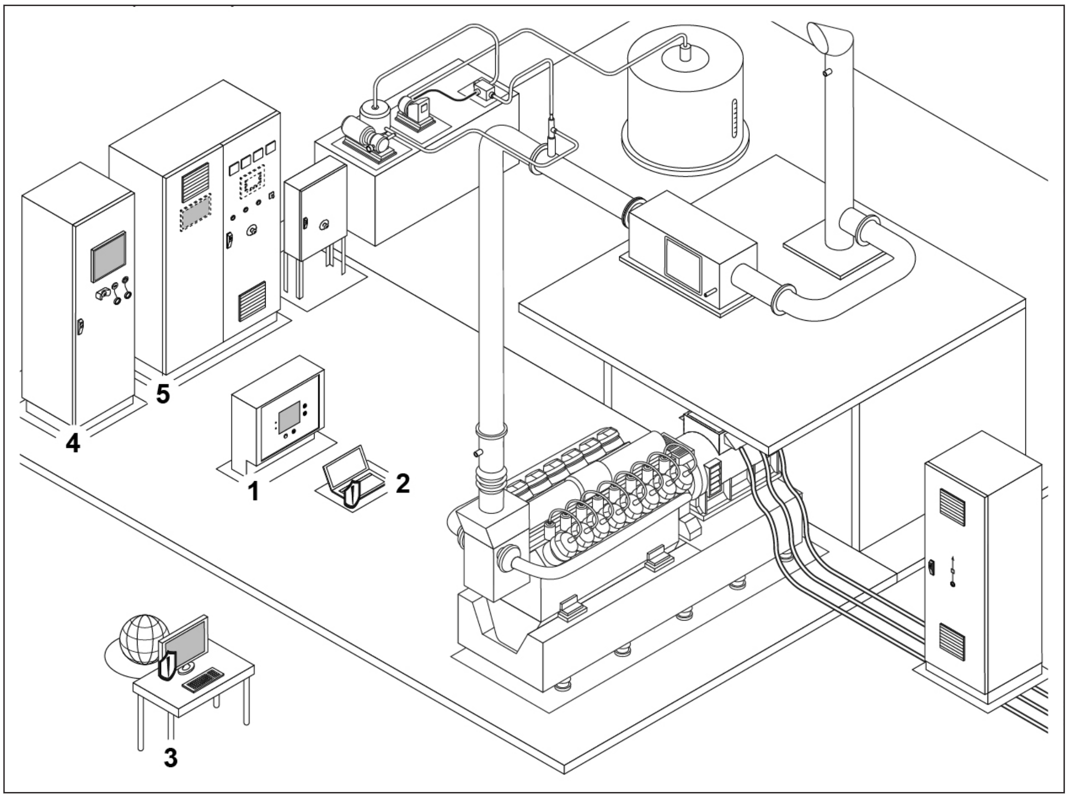
Risk of destruction of components

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)

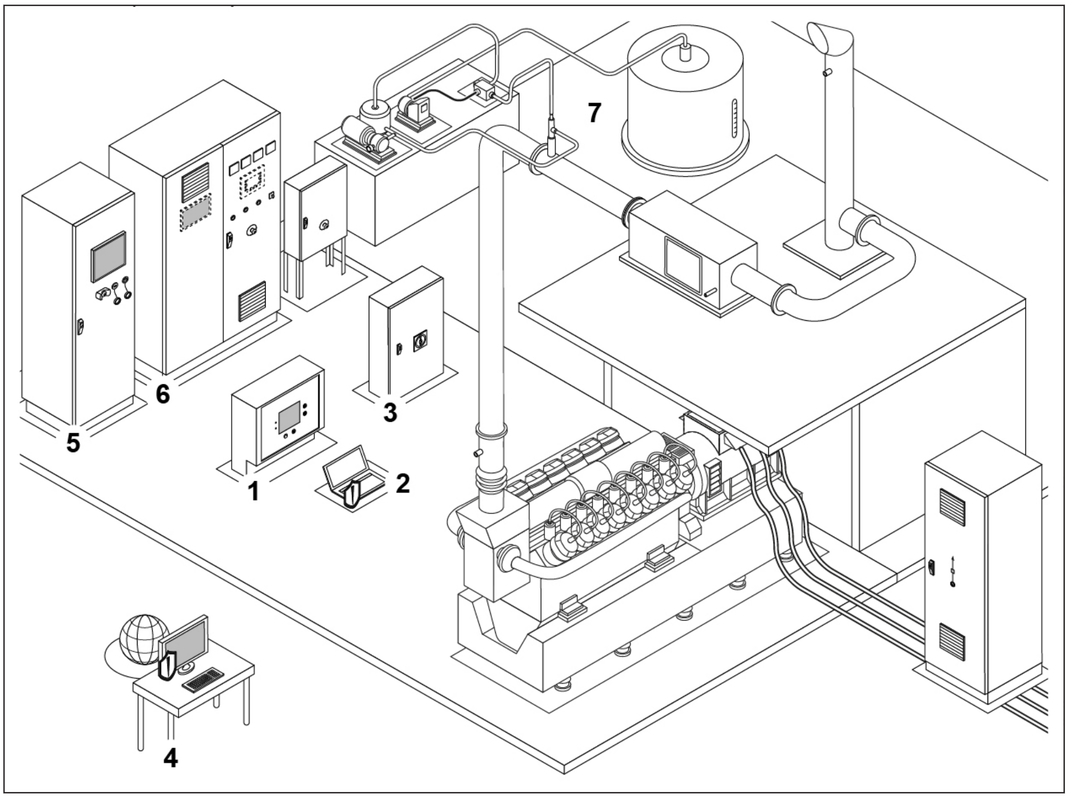
Depending on the configuration, the EmiBox may communicate with the TEM system. Messages relating to this are displayed by the TEM Touch Panel on the HAS switchgear cabinet.

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

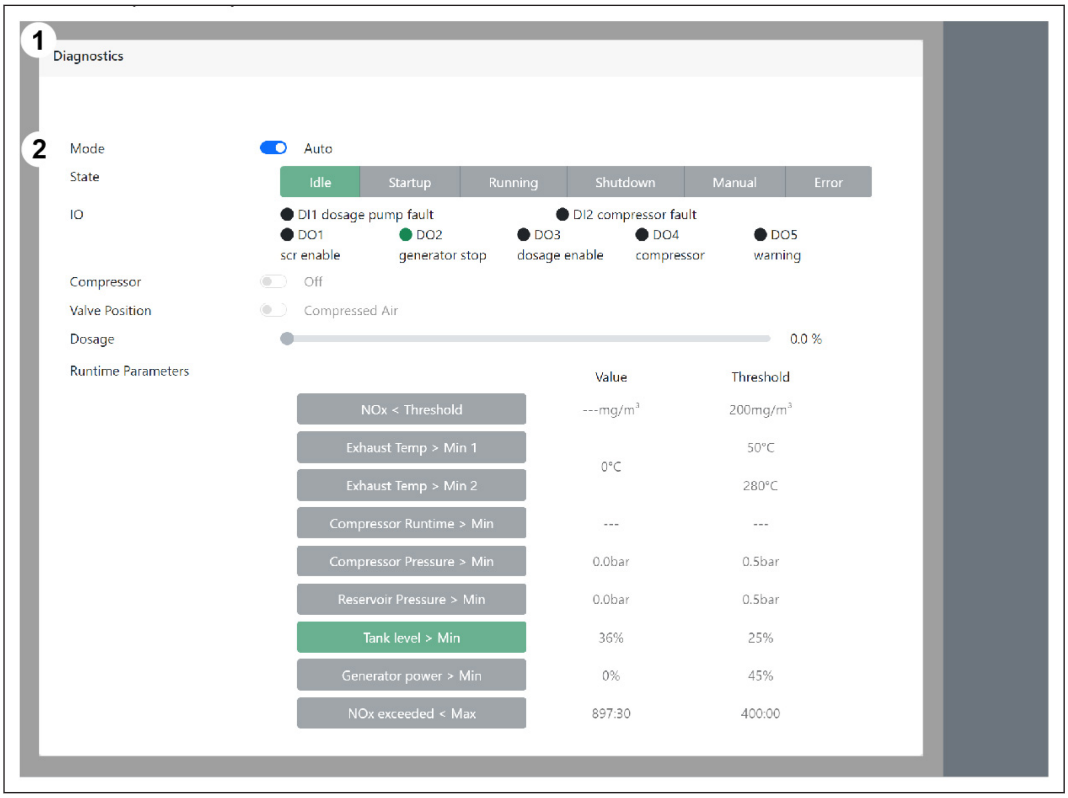
Manual operation

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

In manual operation, the SCR application can be activated manually during commissioning or for maintenance work. The user interface also displays various system states for diagnostics purposes.

353-003-EN : 51000010 : BA : VAR, COV, IMP, B, BA, BS, DEM, EIN, IBN, IST, WP, SK, MH, SB, STB, TA, TL

Manual operation



75895-002 Example illustration

1 Diagnostics tab

2 Operation mode dialog area

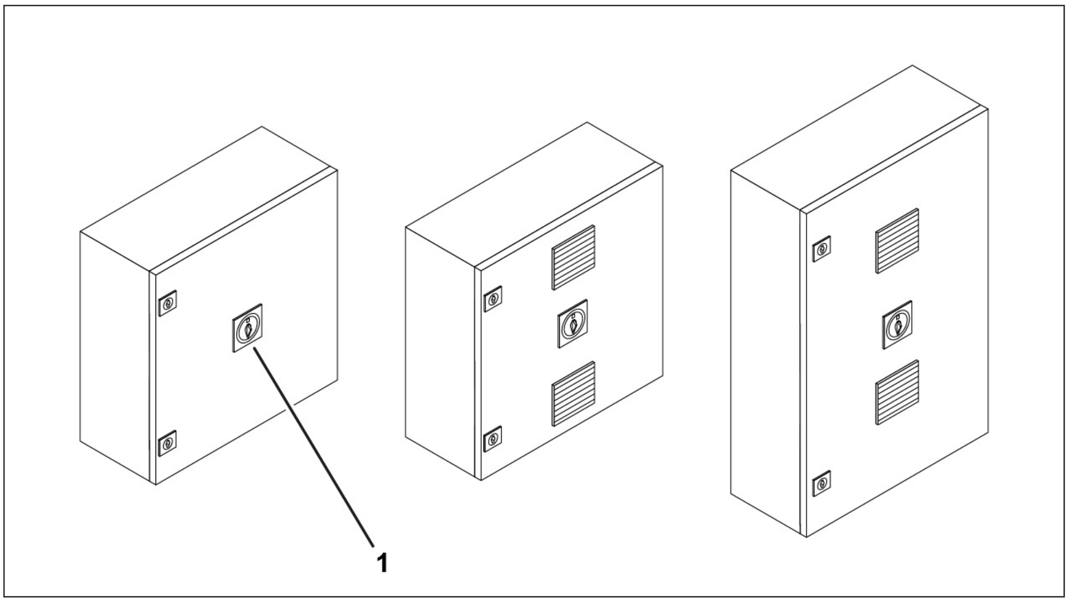
8.3.3 Switching on and operating SCR Control for normal operation

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.

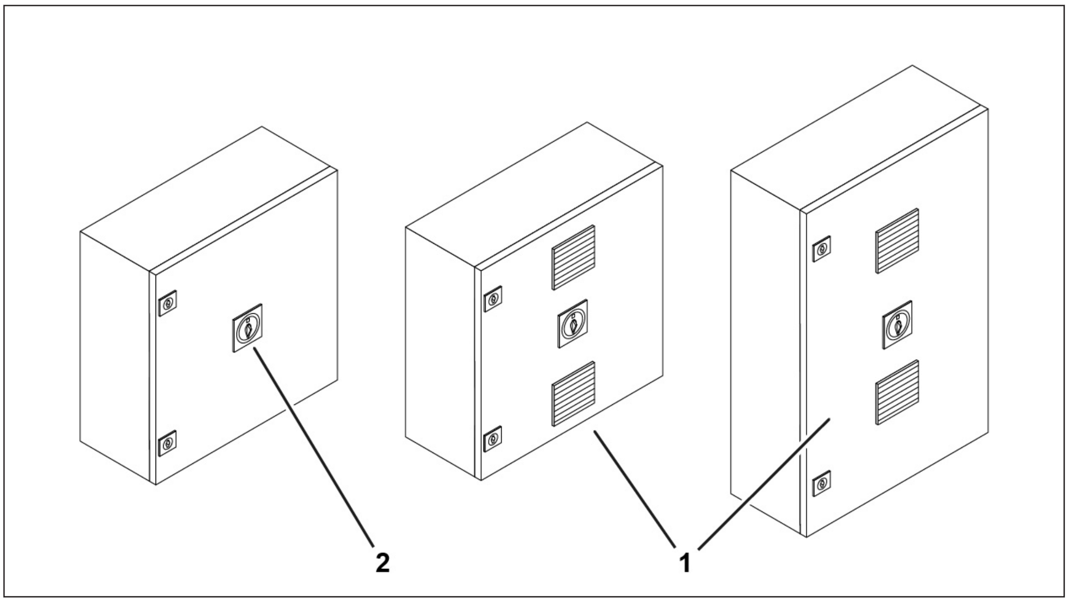
- Switch on the main switch
  - The base system starts up and is in the standby state.
- Start the genset
  - The exhaust system is heated and the SCR Control provides synchronous open- or closed-loop control (depending on the internal configuration) to the components of the SCR application.
  - Normal 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

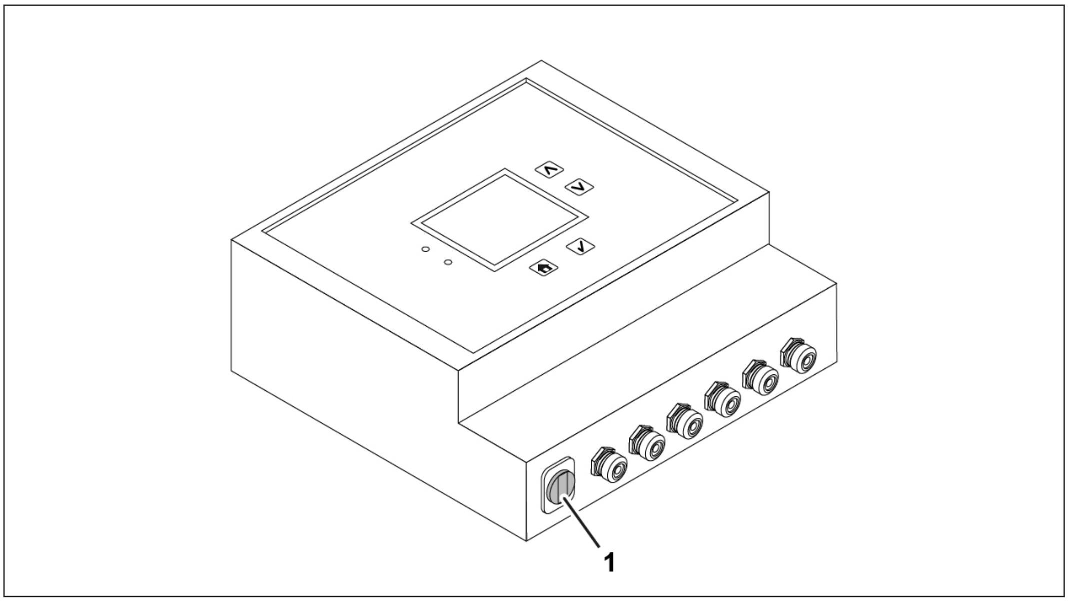
- see chapter 4.6 Web server user interface 64

353-003-EN : 51000010 : BA : VAR, COV, IMP, B, BA, BS, DEM, EIN, IBN, IST, WP, SK, MH, SB, STB, TA, TL

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

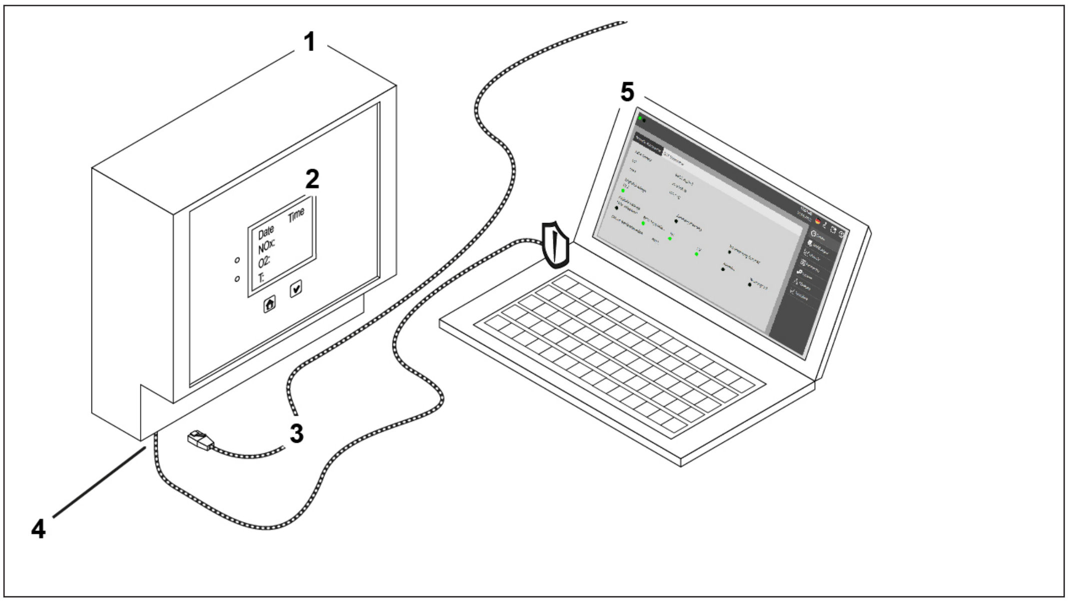
- Use a network cable (patch cable) to connect the computer as a direct connection to the EmiBox
  - It can take up to 5 minutes for the computer and the EmiBox to negotiate their IP addresses.
  - The IP address can be read in the `Information` faceplate on the EmiBox panel if necessary.

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

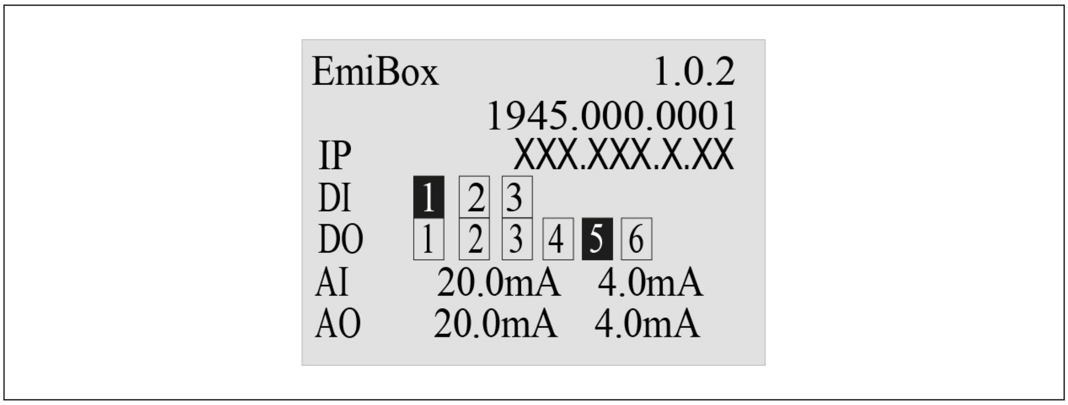
5 Operator-provided computer with web browser and firewall

- 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.

353-003-EN : 51000010 : BA : VAR, COV, IMP, B, BA, BS, DEM, EIN, IBN, IST, WP, SK, MH, SB, STB, TA, TL

8.5.2 Launch 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

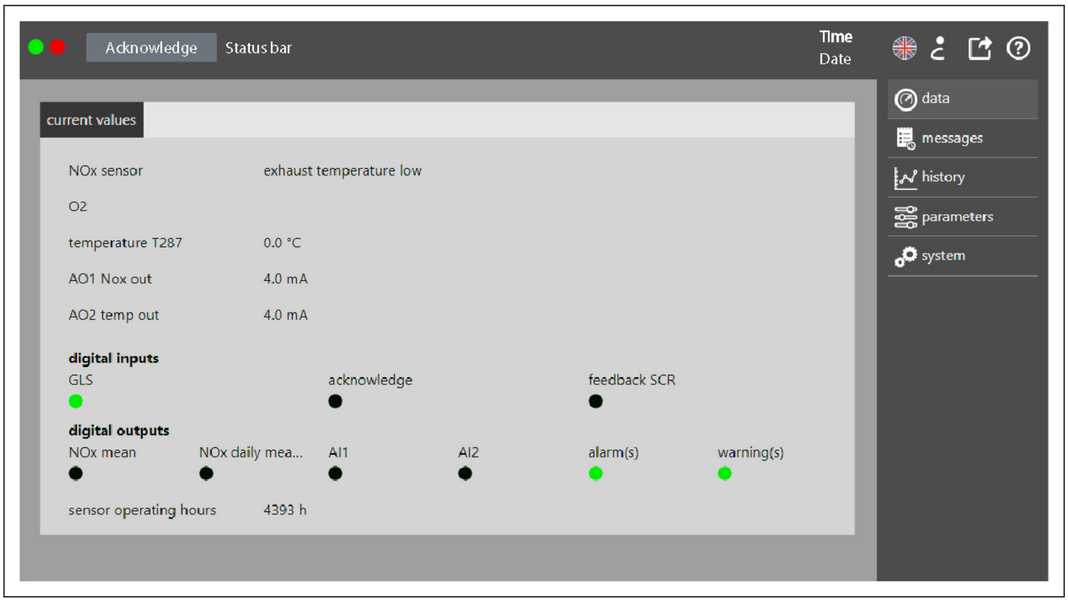
Note

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.

353-003-EN : 51000010 : BA : VAR, COV, IMP, B, BA, BS, DEM, EIN, IBN, IST, WP, SK, MH, SB, STB, TA, TL



75946-002 Example illustration

Note

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

8.5.3 Changing the language

Temporarily

The language for the user interface can be changed temporarily (for the current session) via the icon bar.

Further information

- For more information on temporary changes to the language, see chapter 4.6.3 Language 66.

Changing the system language

You can make a language change permanent by selecting the system language. The selection of the system language applies to the user interface and the panel.

Further information

- For more information on selecting the system language, see chapter 4.6.9.6 Module data tab 94

8.5.4 Login

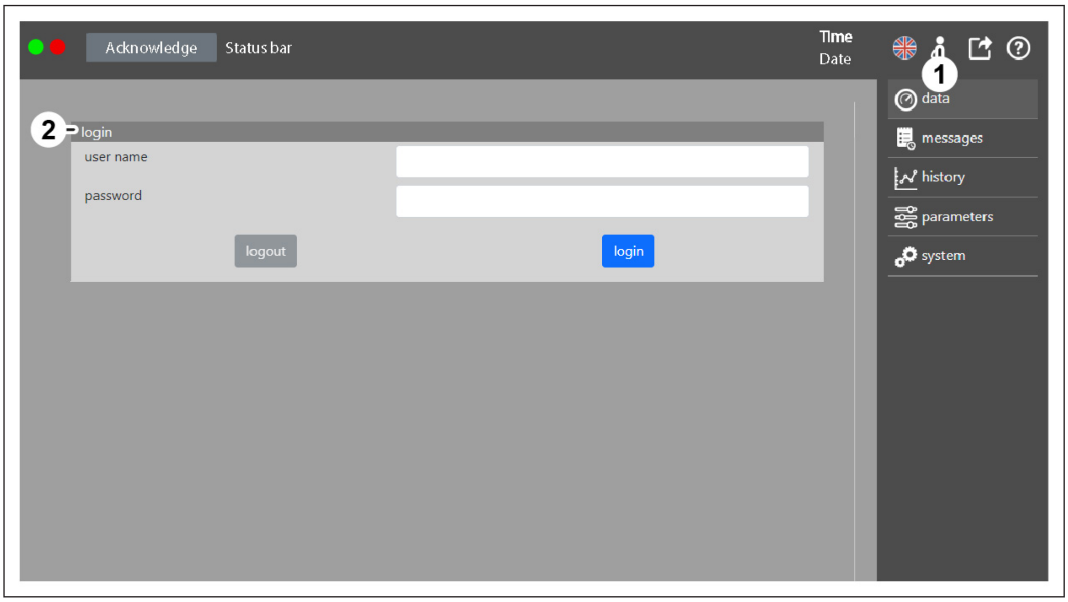
The login is intended to protect the system against unauthorized access. It is only required for system-related actions (such as parameter changes).

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

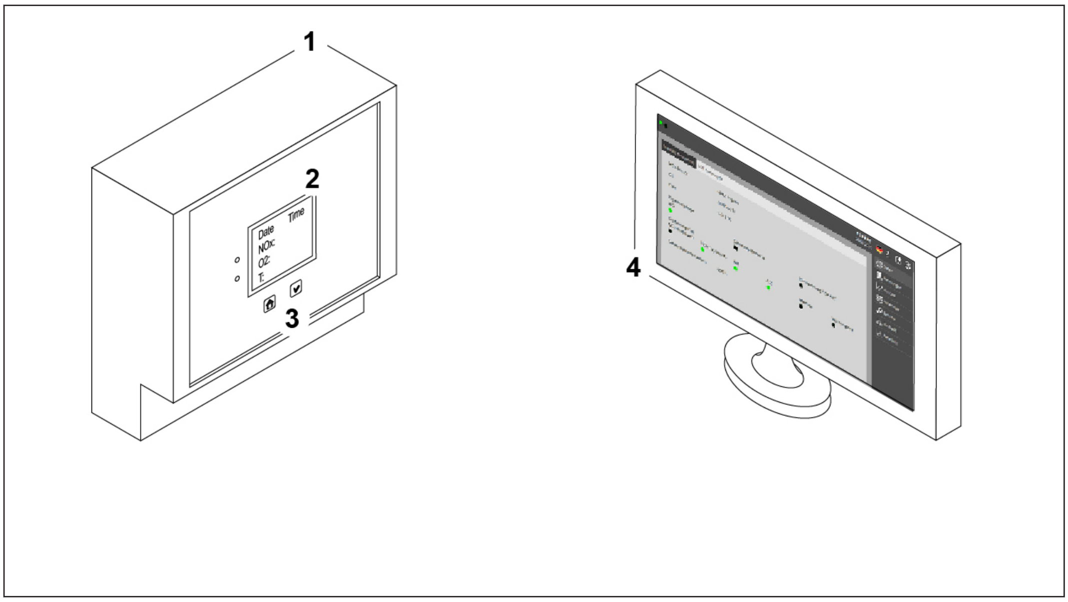


75953-001 Example illustration

- 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.

8.5.5 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 64"
- For external access to the EmiBox, see chapter "8.5.2 Launch the user interface 229"

353-003-EN : 51000010 : BA : VAR, COV, IMP, B, BA, BS, DEM, EIN, IBN, IST, WP, SK, MH, SB, STB, TA, TL

8.5.6 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.

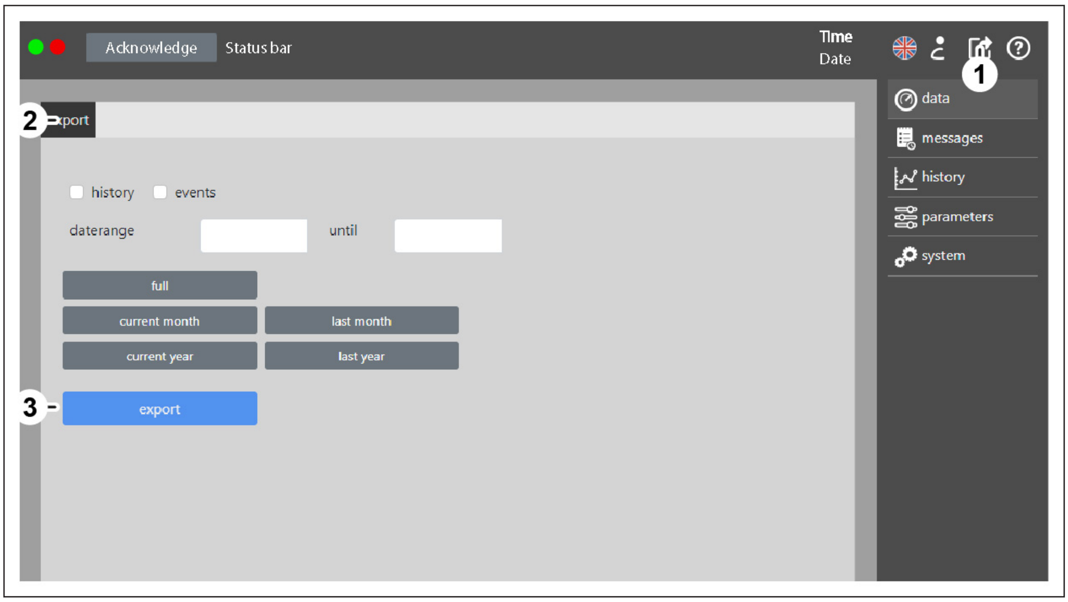
Preparation

- Connect interface and external computer
- Launching the user interface

User interface navigation

- User interface > icon bar

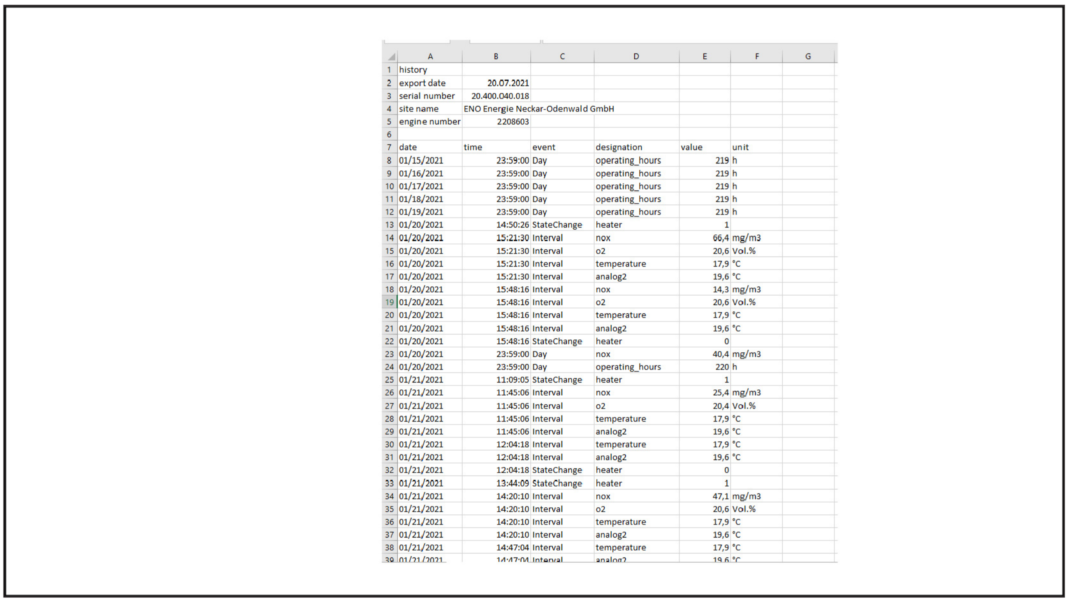
353-003-EN : 51000010 : BA : VAR, COV, IMP, B, BA, BS, DEM, EIN, IBN, IST, WP, SK, MH, SB, STB, TA, TL



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

353-003-EN : 51000010 : BA : VAR, COV, IMP, B, BA, BS, DEM, EIN, IBN, IST, WP, SK, MH, SB, STB, TA, TL

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

8.5.7 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 42

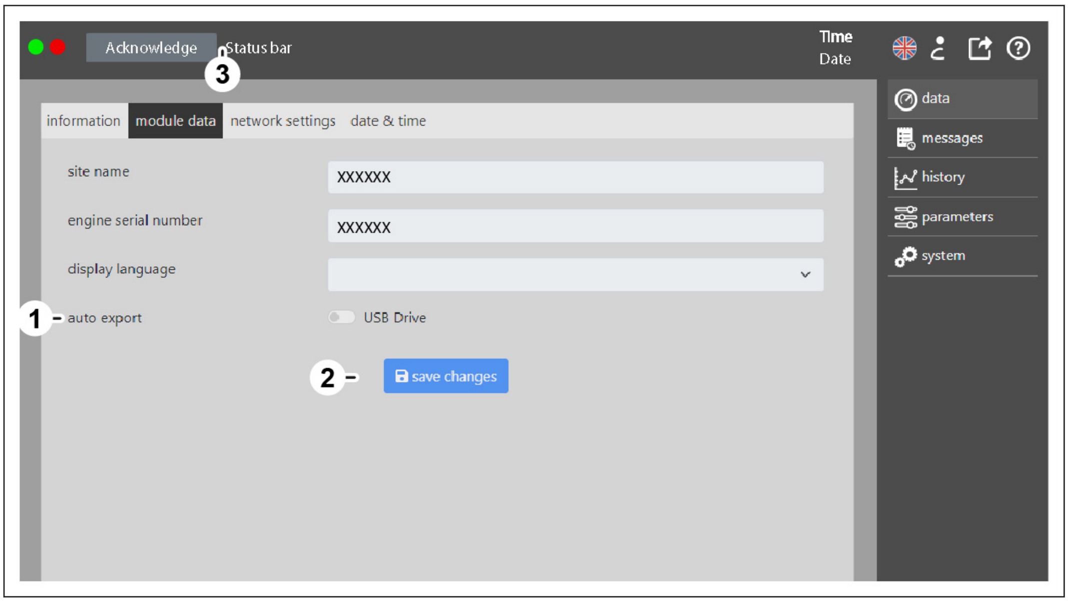
Enable auto export (one time only)

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

353-003-EN : 51000010 : BA : VAR, COV, IMP, B, BA, BS, DEM, EIN, IBN, IST, WP, SK, MH, SB, STB, TA, TL



75962-001 Example illustration

1	Status bar
2	`Auto export` dialog
3	`Save changes` button

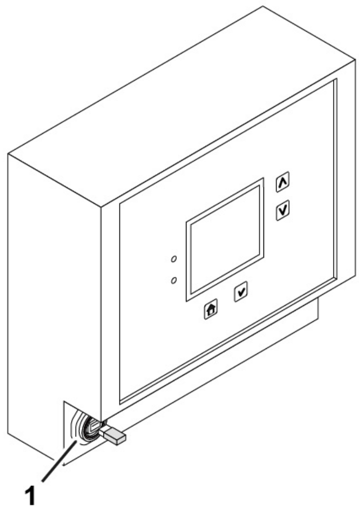
Procedure

- 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.

353-003-EN : 51000010 : BA : VAR, COV, IMP, B, BA, BS, DEM, EIN, IBN, IST, WP, SK, MH, SB, STB, TA, TL

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

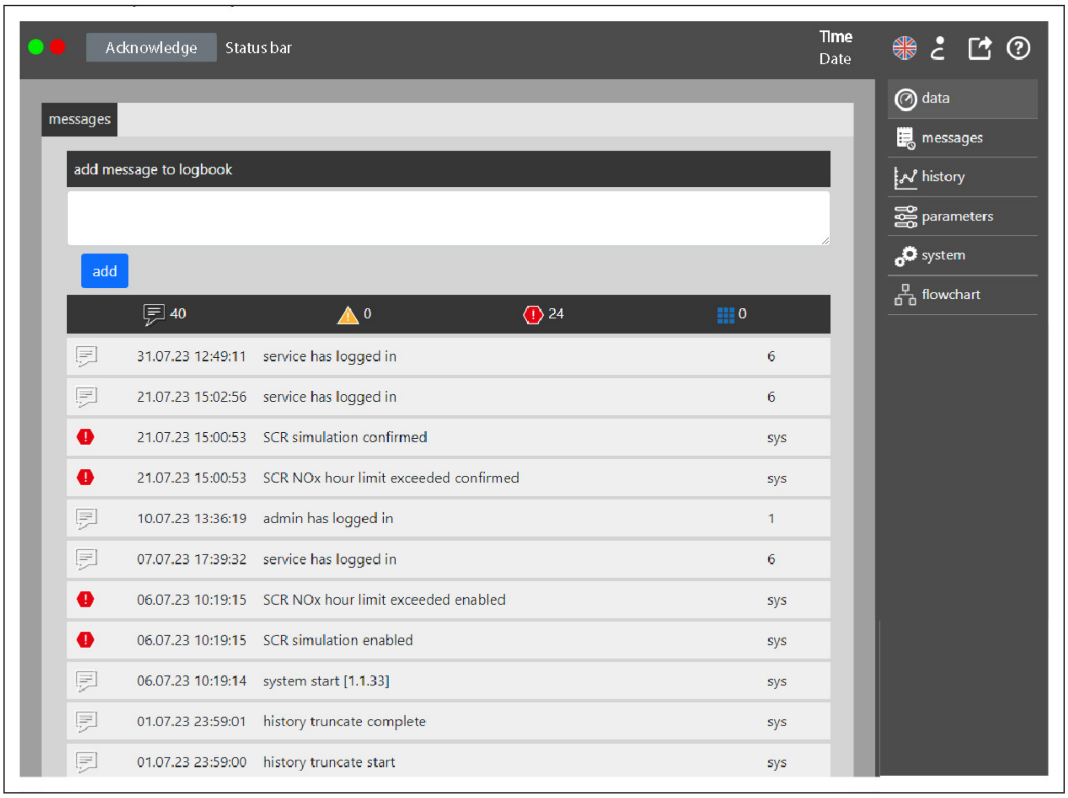
8.5.8 Updating the logbook

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

353-003-EN : 51000010 : BA : VAR, COV, IMP, B, BA, BS, DEM, EIN, IBN, IST, WP, SK, MH, SB, STB, TA, TL



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 4.6.6 Functional group "Messages" 71

8.5.9 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 4.6.6 Functional group "Messages" 71

8.5.10 Monitoring with the datalogger

The datalogger offers extensive options for exchanging and archiving data from various electronic components. Control-related data, such as control commands and measured values that can be sent via Modbus, are suitable.

Requirements

- The desired electronic components are connected via Modbus TCP
- The EmiBox is equipped with the optional USB port for archiving data on a USB storage device

Further information

- For functions, see the chapter entitled "4.3.3 Monitoring with the datalogger 43"
- For information on the USB connection, see the chapter entitled "4.3.2 Signal processing and measurement data 42"

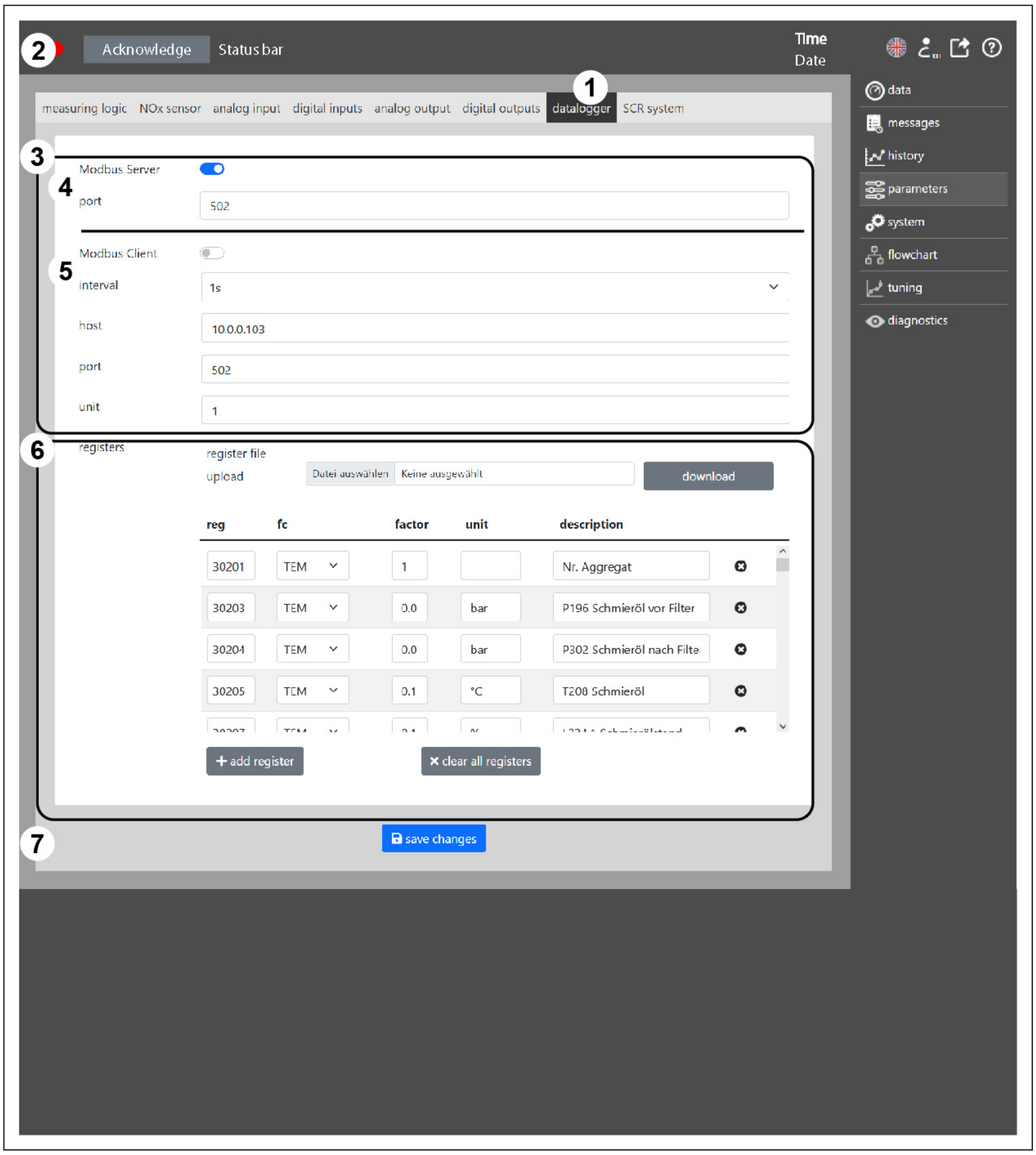
Configuring the datalogger

The `Datalogger` tab is used to control and parameterize data exchange. Knowledge of networks with server/client architecture and Modbus protocol is required.

User interface navigation

- User interface > `Parameters` toolbar > `Datalogger` tab

353-003-EN : 51000010 : BA : VAR, COV, IMP, B, BA, BS, DEM, EIN, IBN, IST, WP, SK, MH, SB, STB, TA, TL



75961-002 Example illustration

1 `Datalogger` tab

2 USB connection display pane

3 Data transfer display pane

4 `Modbus Server` display pane

5 `Modbus Client` display pane

6 `Registers` display pane

7 `Save changes` display pane

Notes on server/client architecture

For data transfer, the role of the connected nodes must be defined from the perspective of the EmiBox.

353-003-EN : 51000010 : BA : VAR, COV, IMP, B, BA, BS, DEM, EIN, IBN, IST, WP, SK, MH, SB, STB, TA, TL

The following settings are possible:

Modbus Server	Modbus Client	Function
off	off	No function
on	off	The EmiBox takes on the role of a server. It serves data, and a connected subscriber can request the data.
off	on	The EmiBox takes on the role of a client. It requests data from another node, who assumes the role of a server. If the node provides data, the EmiBox retrieves the data and saves it on the USB storage device.
on	on	The EmiBox takes on both roles. a The Emibox provides data, and it also retrieves data from a node and saves it. b The Emibox retrieves data from its internal memory and saves it on the USB storage device.

Tab. 8-1 Connection options

Notes on configuring the connection in the Data transfer display area

Configuration of the Modbus server connection with the EmiBox as a server:

- `Port`: 502 is the default specification for the EmiBox

Configuration of the Modbus Client connection:

- `Interval`: Interval at which the Emibox wants to retrieve the data (depending on the amount of data)
- `Host`: IP address of the desired node from which data is requested
- `Port`: Port of the node that offers data as a server
- `Unit`: ID of the node that assumes the role of the server (relevant for Modbus RTU)

Notes on configuring the exchanged data in the Registers display area

The data is stored in a registry file, where it is also assigned to the entries contained within (mapping) for display and analytic purposes.

- Register file: Mapping
  - Upload: upload a registry file to the EmiBox memory.
  - Download: download a registry file from the EmiBox memory.
- Reg.: Modbus registry number
- FC: Modbus function code
- Factor: Scaling factor (conversion factor)
- Unit: refers to the type of entry
- Description: explanatory text for the entry
- x: delete single entry

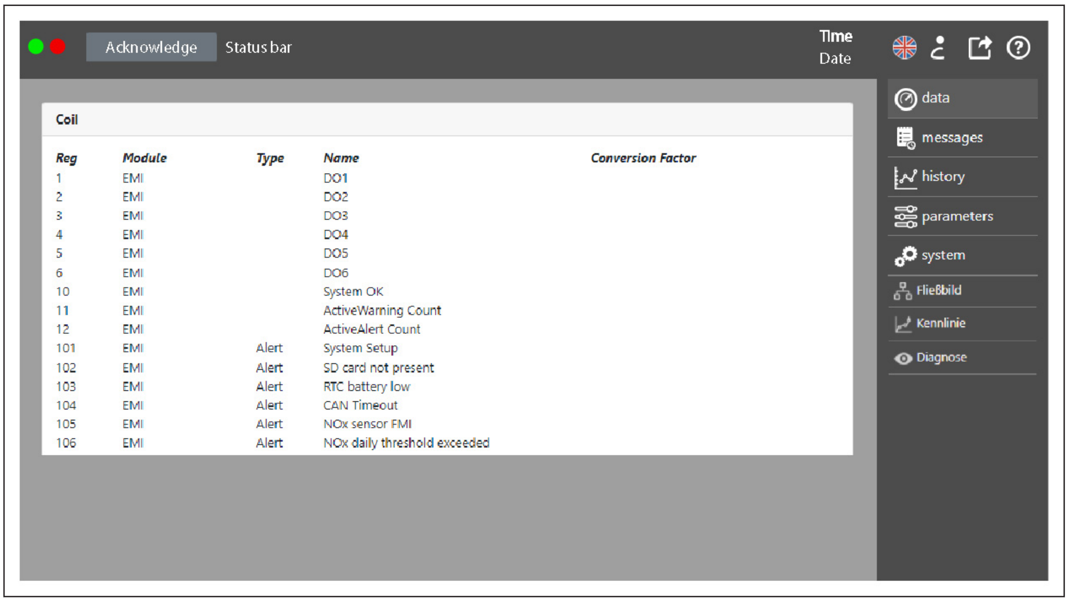
- Add register: add new entry
- Clear all registers: delete all entries

Notes on configuration when setting the EmiBox as server and client

The user interface provides a table to help you select and retrieve the required data.

Open the table as follows:

- Log in with authorization level
- Enter the following in the address line of the browser: `IP address of the EmiBox/Modbus/registry`



76148-001 Example illustration

Register files on the USB storage device

- The EmiBox saves the register files in the format: `datalogger-YYMMDD.csv`
  - The EmiBox creates one file per day.
  - The file contains entries (rows) with a timestamp. The time stamp shows the actual, technically possible intervals.
- The register file can be opened and viewed with Microsoft® Excel, for example
- You can search for specific entries using the registry number
- Empty cells mean that the previous value has not changed

8.5.11 Changing the operation mode of the SCR Control

The SCR Control can be switched from automatic operation to manual operation for commissioning or maintenance work.

Further information

- For more information on changing the operation mode, see 8.3.2 SCR Control operation modes 220.
- For more information on the operating states in the operation modes, see 4.4.3 Operating states 55.

8.5.12 Changing dosing control in the SCR Control

For commissioning or maintenance work, the type of dosing can be manually changed from PID control to profile in the SCR Control.

Further information

- For more information on changing the dosing mode, see 4.6.11.1 Profile 97.

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 222

353-003-EN : 51000010 : BA : VAR, COV, IMP, B, BA, BS, DEM, EIN, IBN, IST, WP, SK, MH, SB, STB, TA, TL

9 Troubleshooting

Table of contents

353-003-EN : 51000010 : BA : VAR, COV, IMP, B, BA, BS, DEM, EIN, IBN, IST, WP, SK, MH, SB, STB, TA, TL

9.1 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.

9.2 Troubleshooting the EmiBox

9.2.1 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	Replace EmiBox battery buffer
CAN timeout	CAN timeout	Check connection to the NO_x sensor
CAN FMI	CAN sensor error	Check NO_x sensor and replace it if necessary
NOx daily MW exc.	NOx daily mean value exceeded	Contact CES Service | Headquarters
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 CES Service | Headquarters

Fault message shown on the display	Description	Remedy
HST write error	Error when writing the history	Contact CES Service | Headquarters There may not be enough storage space. If limit value recording is activated, 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 the error persists, contact CES Service | Headquarters.
AIO write error	Analog output error	* Perform a reboot If the error persists, contact CES Service | Headquarters.
GPIO read error	Error in IO controller	* Perform a reboot If the error persists, contact CES Service | Headquarters.
GPIO write error	Error in IO controller	* Perform a restart. If this is unsuccessful, check the cable routing and plug-in connections of the EmiBox and the NO_x sensor in a de-energized state If the error persists, contact CES Service | Headquarters.

353-003-EN : 51000010 : BA : VAR, COV, IMP, B, BA, BS, DEM, EIN, IBN, IST, WP, SK, MH, SB, STB, TA, TL

Fault message shown on the display	Description	Remedy
WD read error	Watchdog error	* Perform a reboot If the error persists, contact CES Service | Headquarters.
GLS/GCB timeout	If the genset is synchronized to the connected mains, the generator circuit breaker (GLS/GCB) closes and the genset is ramped up to the desired power. At the same time, the EmiBox monitors the elapsed time until the signals from the NO_x sensor are within the usual range. If this is not the case after 20 minutes, a warning message is issued, and after 30 minutes an alarm message is issued.	* Perform a reboot If the error persists, contact CES Service | Headquarters.

* 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 multiple 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.

353-003-EN : 51000010 : BA : VAR, COV, IMP, B, BA, BS, DEM, EIN, IBN, IST, WP, SK, MH, SB, STB, TA, TL

9.3 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 out-side 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 Emi-Box 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	-	-

353-003-EN : 51000010 : BA : VAR, COV, IMP, B, BA, BS, DEM, EIN, IBN, IST, WP, SK, MH, SB, STB, TA, TL

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	-

353-003-EN : 51000010 : BA : VAR, COV, IMP, B, BA, BS, DEM, EIN, IBN, IST, WP, SK, MH, SB, STB, TA, TL

10 Maintenance

Table of contents

10.1 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 (GCB), they can carry mains voltage even when the genset is stopped and the power supply of the switch cabinet TPEM Control Cabinet (TPEM CC) is disconnected.

WARNING!

Risk of injury from improper maintenance

This can lead to severe injuries and even death.

- Only authorized specialist personnel may perform maintenance on the product
- Only qualified specialist personnel may work on the electrical system
- Only qualified specialist personnel may work on the fuel gas system
- Only use original parts

CAUTION!

Risk of burns from touching hot operating media or hot components.

This can lead to minor and severe injuries.

- Wear personal protective equipment.
- Allow the operating media or components to cool down to the ambient temperature.

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

10.2 EmiBox and Sensor Kit maintenance schedule

All the maintenance work that is required for fault-free operation is summarized in the maintenance schedule. The maintenance 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 168.

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 months or 4000 h1*	SL
Replace NO_x sensor		SL
Fuel gas quality: High	2 yrs or 8000 h*	
Fuel gas quality: Medium and low	1 yr or 4000 h*	
Replace EmiBox buffer battery	5 yrs**	SL
Replace EmiBox SD card	5 yrs**	SL
* whichever occurs first h = hours, mos = months, yrs = years **The elapsed time can be calculated using the serial number of the EmiBox, as the first digits represent the year of manufacture. Example: 21XX.XXX.XXXX = year of manufacture 2021		

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 168.

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

353-003-EN : 51000010 : BA : VAR, COV, IMP, B, BA, BS, DEM, EIN, IBN, IST, WP, SK, MH, SB, STB, TA, TL

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		

10.4 EmiBox and Sensor Kit work instructions

Tools

- Standard tools

Spare parts

- NOx sensor
- SD card
- Buffer battery

Auxiliary media

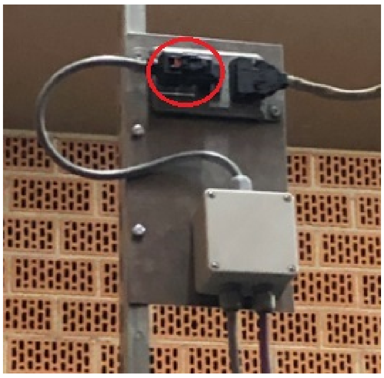
- If necessary, computer or laptop and network cable (Cat6 patch cable)

References

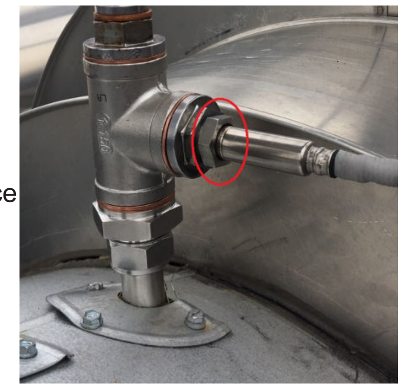
- Operating Manual ⇒ General ⇒ Safety regulations

10.4.1 Replacing the NOx sensor

1. Disconnect the mains plug of the EmiBox
2. Disconnect the plug-in connection between the terminal box and the sensor control device and unscrew the sensor control device



3. Unscrew sensor from the T-piece



4. Screw in new sensor, torque: 50 Nm +/- 10 Nm
5. Screw on sensor control device, cable twist: Max 180 °
6. Connect sensor control device to the EmiBox

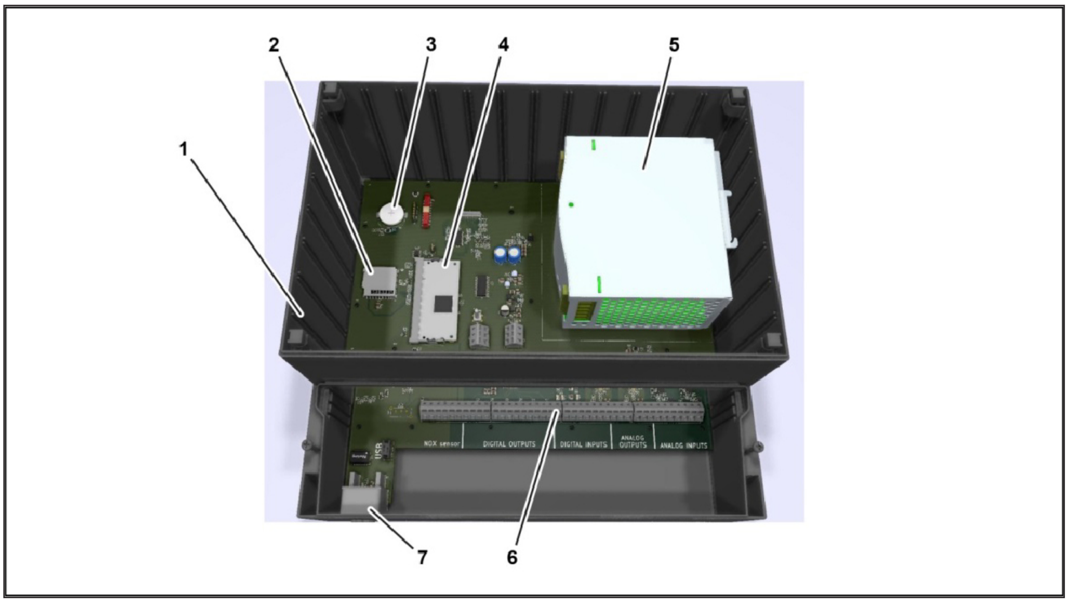
353-003-EN : 51000010 : BA : VAR, COV, IMP, B, BA, BS, DEM, EIN, IBN, IST, WP, SK, MH, SB, STB, TA, TL

7. Plug in the EmiBox mains plug
8. To calibrate the NOx sensor, see section `Calibrating the NOx sensor`

10.4.2 Calibrating the NOx sensor

see section `Calibrating the NOx sensor`

10.4.3 Replacing the EmiBox SD card



72263-001

1	Housing
2	SD card holder
3	Buffer battery for the real-time clock
4	CPU module
5	Power supply unit
6	Terminal strips
7	Ethernet connection (RJ 45)

1. Data backup

Data export via network access

The measurement data can be copied and also saved via download. Existing log entries are not overwritten. Entries made more than 455 days ago will be archived and compressed at the end of the month. This frees up memory (but only after 455 days at the earliest).

To back up data, see section `7.1.4 Data export`.

Data export via SD card

The data is stored on the SD card in a proprietary format and can be converted into an Excel file for further processing.

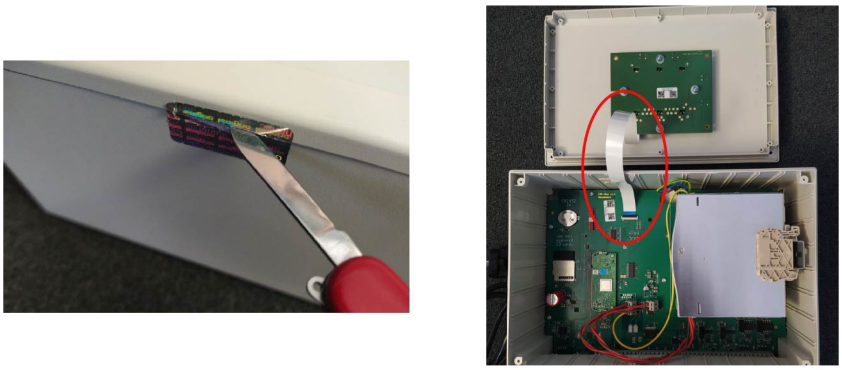
To perform the data backup, remove and read the SD card as described below.

2. Preparatory work:

- De-energizing the EmiBox: either pull the existing CEE 7/4 plug out of the socket or, in the case of a permanent installation, blow the fuse or disconnect it from the power supply box.
- Check that equipment is de-energized

74060-001 Figure 1 (left), Figure 2 (right)

- Open the housing cover of the EmiBox
  - Lift out the screw covers in the corners of the cover with a narrow slotted screwdriver (Figure 1).
  - Unscrew the crosshead screws underneath with a suitable screwdriver (Figure 2).



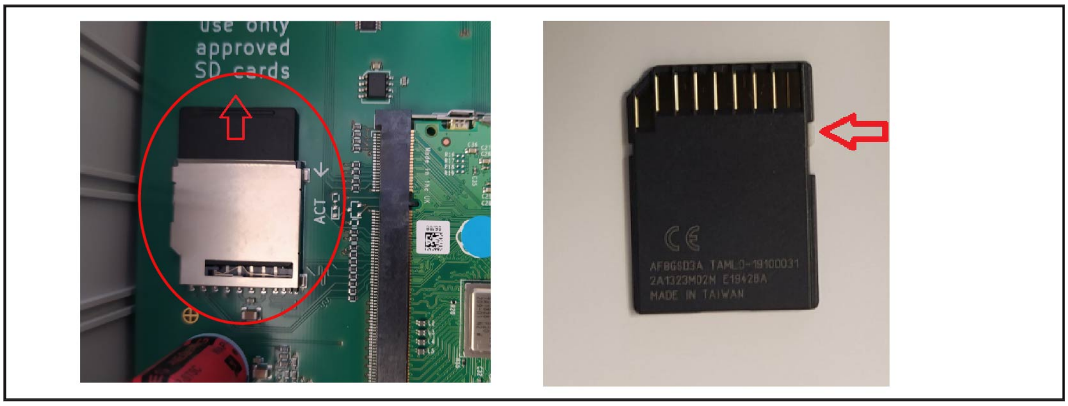
74061-001 Figure 3 (left), Figure 4 (right)

  - Cut open the seal at the joint between the cover and the housing (Figure 3).
- Carefully lift off the cover and swing it open (Figure 4). Handle the flat cable connector with care and keep the cover in a safe place. If the cover has to be removed completely, the flat cable connected to the display should be disconnected. To do so, open the connection bracket of the flat cable on the circuit board and carefully remove the flat cable (note the installation position).

353-003-EN : 51000010 : BA : VAR, COV, IMP, B, BA, BS, DEM, EIN, IBN, IST, WP, SK, MH, SB, STB, TA, TL

3. Replace the SD card

When replacing the SD card, wear an ESD wrist strap to protect the electronic components.



74075-001 Figure 5 (left), Figure 6 (right)

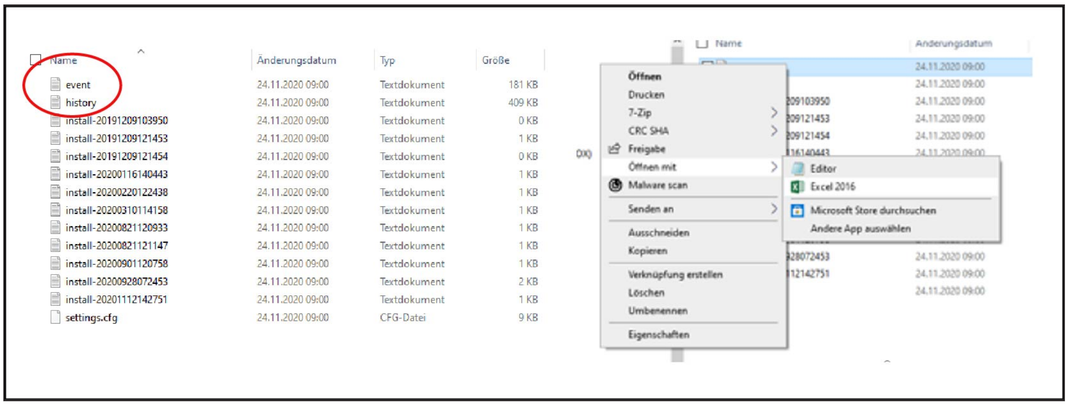
- Remove the SD card from the card slot by pushing it in the direction of the arrow (Figure 5).
- Switch off the write protection switch on the new SD card by sliding it up towards the contacts so that it is in the "OFF" position (Figure 6).
- Insert a new, empty SD card into the card slot. The contacts of the SD card must face the circuit board.

or

- Copy the data from the removed SD card to a new, empty SD card and then insert it.

4. Read and save the data from the SD card

- Read the SD card with a card reader or directly in a laptop.
- Convert data so that they can be edited further.



74076-002 Figure 7 (left), Figure 8 (right)

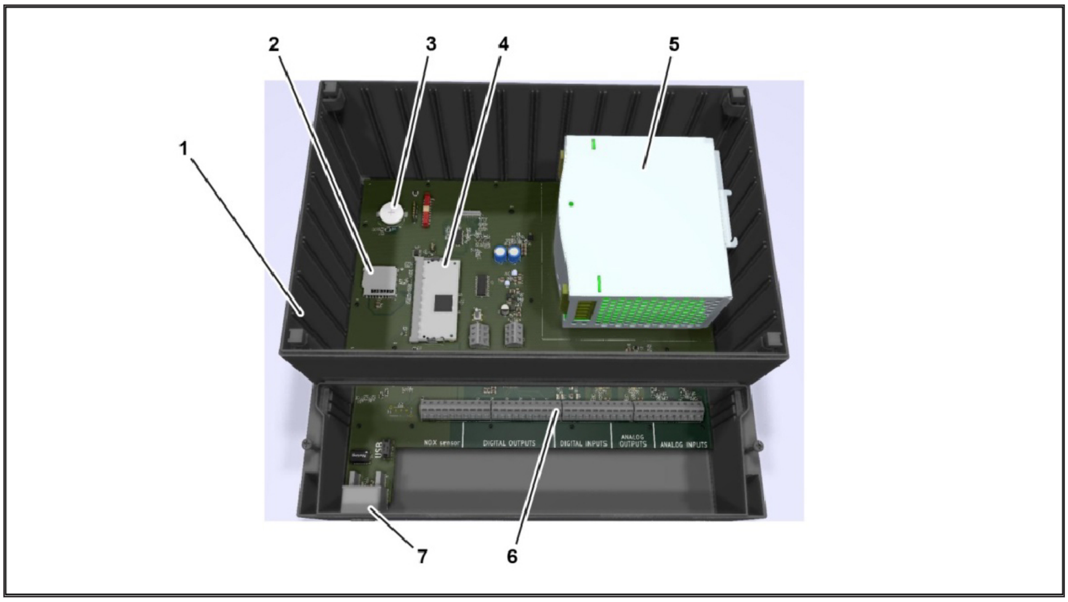
353-003-EN : 51000010 : BA : VAR, COV, IMP, B, BA, BS, DEM, EIN, IBN, IST, WP, SK, MH, SB, STB, TA, TL

The data set from Figure 7, for example, can be opened with Excel. The content must be converted into a tabular format using the function "Text in columns". The easiest way to access and edit stored data is via the network variant. For this see 1. Data backup / data export via network. Another method to backup data is to save data using the SD card; it is easy to do even without PC access and possible at any time. The disadvantage, however, is that preparatory work is required to ensure the data can be read.

5. Start EmiBox and check functionality

- Close the housing cover of the Emibox again, making sure not to pinch the flat cable connection. If the flat cable connection has been disconnected, place the flat cable in the guide of the connection area and close the clip to lock it in place, checking for correct contact.
- Screw on the housing cover and insert the screw covers.
- Re-establish the voltage supply. It takes the device approx. 30 to 60 s to boot.
- Perform a function test and compare data.
- Replace the seal.

10.4.4 Replacing the EmiBox buffer battery



72263-001

1	Housing
2	SD card holder
3	Buffer battery for the real-time clock
4	CPU module
5	Power supply unit
6	Terminal strips
7	Ethernet connection (RJ 45)

1. Data backup

Data export via network access

The measurement data can be copied and also saved via download. Existing log entries are not overwritten. Entries made more than 455 days ago will be archived and compressed at the end of the month. This frees up memory (but only after 455 days at the earliest).

To back up data, see section `7.1.4 Data export`.

Data export via SD card

The data is stored on the SD card in a proprietary format and can be converted into an Excel file for further processing.

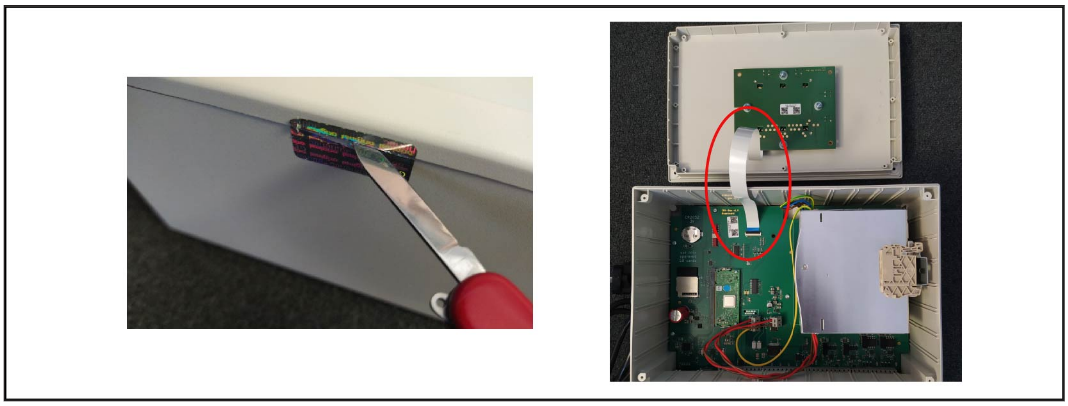
To back up data, remove and read the SD card. See section `10.4.3 Replacing the EmiBox SD card`.

2. Preparatory work:

- De-energizing the EmiBox: either pull the existing CEE 7/4 plug out of the socket or, in the case of a permanent installation, blow the fuse or disconnect it from the power supply box.
- Check that equipment is de-energized

74060-001 Figure 1 (left), Figure 2 (right)

- Open the housing cover of the EmiBox
  - Lift out the screw covers in the corners of the cover with a narrow slotted screwdriver (Figure 1).
  - Unscrew the crosshead screws underneath with a suitable screwdriver (Figure 2).



74061-001 Figure 3 (left), Figure 4 (right)

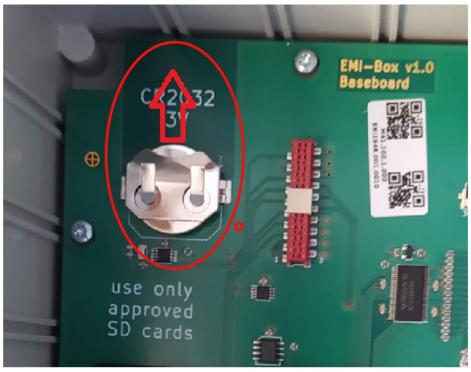
– Cut open the seal at the joint between the cover and the housing (Figure 3).

- Carefully lift off the cover and swing it open (Figure 4). Handle the flat cable connector with care and keep the cover in a safe place. If the cover has to be removed completely, the flat cable connected to the display should be disconnected. To do so, open the connection bracket of the flat cable on the circuit board and carefully remove the flat cable (note the installation position).

3. Replacing buffer battery

Use a new buffer battery of the same model.

Battery designation: CR2032 3V



74062-001 Figure 5

- Remove the buffer battery from the holder by sliding it in the direction of the arrow (Figure 5).
- Push the new buffer battery into the holder, pressing in the retention clips slightly. Note the polarity of the buffer battery: Positive pole (+) smooth surface on top; negative pole (−) curved surface (matte coating) on bottom.

4. Start EmiBox and check functionality

- Close the housing cover of the Emibox again, making sure not to pinch the flat cable connection. If the flat cable connection has been disconnected, place the flat cable in the guide of the connection area and close the clip to lock it in place, checking for correct contact.
- Screw on the housing cover and insert the screw covers.
- Re-establish the voltage supply. It takes the device approx. 30 to 60 s to boot.
- Perform a function test and compare data.
- Replace the seal.

10.4.5 Calibrating the analog input

If the values of the analog inputs are not plausible and there is probably a fault, the accuracy and function of the analog inputs can be restored with an auto-calibration.

1. Back up the EmiBox data

- Perform a data export via the user interface (history, logbook, user list and current configuration)

2. Update firmware

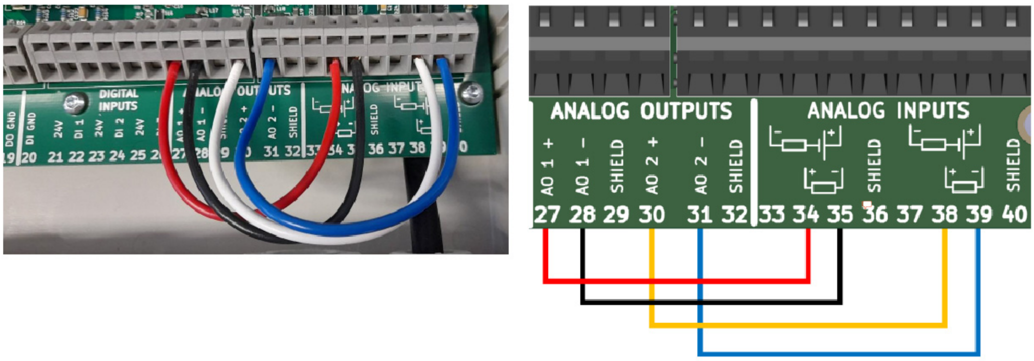
- Install firmware version 1.1.7 or higher on the EmiBox

3. Switch off the EmiBox

- After a successful update, switch off the EmiBox (disconnect the voltage supply)

4. Insert jumper wires

Place the jumper wires as shown in the Figure below:



76243-001 Example illustration

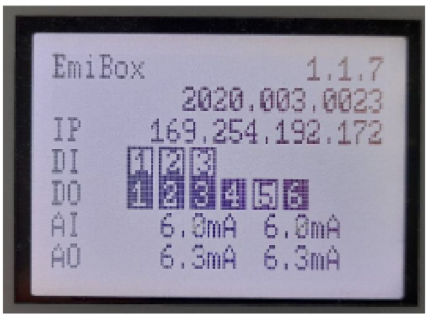
5. Start the EmiBox

- Switch on the EmiBox (restore voltage supply)

6. Log in as an admin

- Open the user interface and log in as admin

7. Display analog values



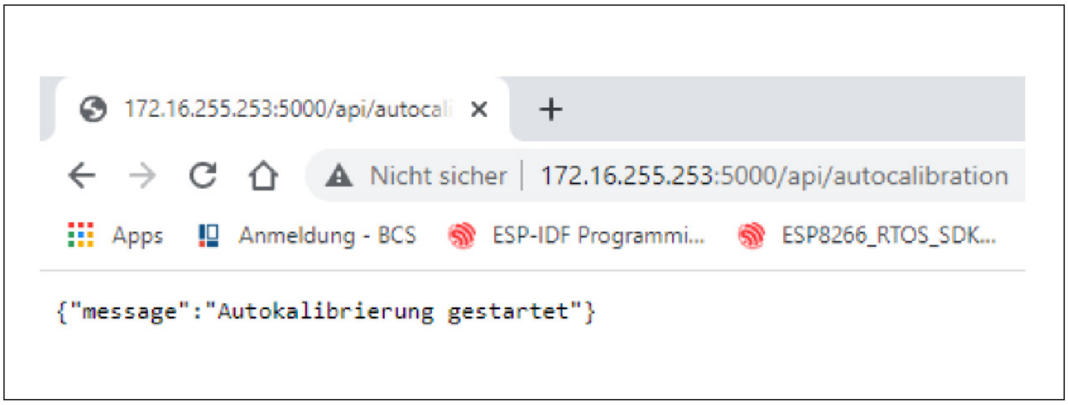
76244-001 Example illustration

- Press the "Up" button on the EmiBox panel to switch to the display mode for the analog input or analog output

353-003-EN : 51000010 : BA : VAR, COV, IMP, B, BA, BS, DEM, EIN, IBN, IST, WP, SK, MH, SB, STB, TA, TL

8. Start auto calibration

- Enter the following character string in the browser navigation bar:
  - <IP address of the EmiBox>:`5000/api/autocalibration`
- The page then gives a brief response. The following image shows an example IP address:



76245-001 Example illustration

- The EmiBox restarts automatically after the calibration has been completed

9. Finalize calibration

- Switch off the EmiBox again and remove the jumpers
- Calibration is complete
- Start the EmiBox again

353-003-EN : 51000010 : BA : VAR, COV, IMP, B, BA, BS, DEM, EIN, IBN, IST, WP, SK, MH, SB, STB, TA, TL

10.5 SCR Control Kit work instructions

Tools

- Standard tools

Auxiliary media

- If necessary, computer or laptop and network cable (Cat6 patch cable)

References

- Operating Manual ⇒ General ⇒ Safety regulations

10.5.1 Checking the NO_x minimum

1. Start up the genset and SCR system
2. The power demand should be equal to the rated power, if possible
3. Set up NO_x value display
4. Set the dosage to 0 % if possible
5. Slowly increase the dosage and monitor the NO_x value
6. The NO_x value will fall at first. If it rises again, the NO_x minimum has been reached

If the current NO_x minimum deviates significantly from the previous measurements, re-acquire the profile and redefine the PID settings.

Further information

- For more information on the NO_x minimum, see chapter 7.3.14 Determine NOx minimum 201

10.5.2 Check profile and PID settings and define them if necessary

1. Start up the genset and SCR system
2. The power demand should be equal to the rated power, if possible
3. Set up NO_x value display
4. User interface > `Tuning` toolbar > `Profile` control mode
5. Evaluate the currently displayed NO_x value in relation to the profile
6. If the value deviates too much from the profile, redefine the profile

Further information

- For more information on defining the profile, see chapter 7.3.15 Defining the profile 203

353-003-EN : 51000010 : BA : VAR, COV, IMP, B, BA, BS, DEM, EIN, IBN, IST, WP, SK, MH, SB, STB, TA, TL

10.5.3 Checking PID settings and adjusting them if necessary

1. Start up the genset and SCR system
2. The power demand should be equal to the rated power, if possible
3. Set up NO_x value display
4. User interface > `Profile` toolbar
5. Evaluate the currently displayed NO_x value with respect to the limits
6. If the value is too close to a limit, redefine the limit
7. Change power demand and assess control behavior
8. If the NO_x value does not stabilize or stabilizes too slowly, adjust the PID settings

Further information

- For more information on the NO_x minimum, see chapter 7.3.16 Setting the PID controller 205

353-003-EN : 51000010 : BA : VAR, COV, IMP, B, BA, BS, DEM, EIN, IBN, IST, WP, SK, MH, SB, STB, TA, TL

11 Dismantling and disposal

Table of contents

11.1 Safety notes

CAUTION!

Injuries due to improper dismantling

This can lead to minor and severe injuries.

- Only service personnel may disassemble the product.
- Properly release the saved residual energies or allow them to escape.
- Handle open sharp-edged components carefully.
- Dismantle the components properly. Observe the partially high dead weight of the components. Secure components from being knocked over or falling down. If necessary, use lifting equipment.
- In case of doubt, contact the responsible dealer.

Danger to the environment

Auxiliary and operating media and materials can cause environmental damage

- When dismantling, adhere to all the valid national and regional environmental protection regulations
- Ensure that the auxiliary and operating media do not leak
- Drain off, collect and dispose of the auxiliary and operating media properly
- Sort the reusable materials (e.g. plastics, metals) and recycle them
- If necessary, commission a designated and certified specialist company to do this
- Improper dismantling may cause environmental damage

11.2 Disposing of components

Dismantling components

- Dismantle components and cabling

Notes on recycling

Unless a return agreement or disposal agreement was concluded, recycle the dismantled components.

The local authority or specialist companies for disposal shall provide information on environmentally sound disposal.

Warnings

Danger to the environment

Incorrect disposal of components and operating media may cause environmental damage.

- Electronic scrap, electronic components, lubricants and other auxiliary media are subject to the treatment of special refuse
- Electronic scrap, electronic components, lubricants and other auxiliary media may be disposed of only by designated and certified specialist companies

Proceed as follows:

- Scrap metals
- Disconnect and recycle electronic components and cables
- Recycle plastic elements
- Sort the remaining components as per the material properties and dispose of them properly

12 Appendix

Table of contents

12.1 Project planning / plant inspection checklist

No.	Checkpoint	Comment
1	Check whether the KAT is installed in the exhaust line or in the front of the muffler or exhaust heat exchanger (AWT).	
2	Check whether the KAT can be sealed with MWM seals.	
3	Check the screw sizes on the KAT (preparation for sealing).	
4	Check whether scaffolding / platform or other safeguards are necessary to work on the roof.	
5	Determine the position for the NOx sensor (temperature at the sensor must be >110 °C, meaning the NOx sensor can be before or after the KAT, but must be before the AWT). • Check whether sheet metal or insulation work is necessary and who is responsible for carrying out the work. • Check whether welding work is necessary and who is responsible for carrying out the work.	
6	Check whether KAT temperature is available and is ready for operation (after exhaust turbocharger (ATL) or after KAT, but before AWT). • If not available: Define position. Estimate the required sensor length. • Check whether a measuring point 1/2" is available for the exhaust measurement in the area of the NOx probe (mandatory, retrofit if necessary). • If no KAT: Check whether temperature of exhaust temperature sensor is available and ready for operation (after ATL or after KAT (useful, but not mandatory), but before AWT). • Check whether sheet metal and insulation work is necessary for retrofitting the temperature sensor.	
7	Select a favorable position for sensor connection box. • Check whether a mounting plate is necessary.	

353-003-EN : 51000010 : BA : VAR, COV, IMP, B, BA, BS, DEM, EIN, IBN, IST, WP, SK, MH, SB, STB, TA, TL

No.	Checkpoint	Comment
8	Select a favorable position for the EmiBox (good accessibility and readability (eye level), installation in the electrical room / control room is preferable due to the ambient conditions. • Check whether a mounting plate is necessary.	
9	Estimate the installation material requirements and the cable lengths to the EmiBox (NOx sensor, exhaust temperature sensor as well as auxiliary drive cabinet (HAS) and, if applicable, control system).	
10	Check the current design of the installation (aluminium or plastic cable conduits).	
11	Clarify who will carry out the cable work (incl. earthed socket for EmiBox).	
12	Clarify who will carry out the metal / welding work (attention: it may be necessary to dismantle piping in order to protect ATL, vagrant welding currents, etc.).	
13	Clarify who will carry out the insulation of the exhaust line.	
14	Clarify which requirements exist on the part of the operator (or the authorities) (max. permissible temperature at the KAT, max. permissible NOx daily mean value, etc.).	
15	Clarify which additional options (connection to the TEM, fault message, NOx value, exhaust temperature, connection to the central control technology (ZLT) via LAN connection) are available.	
16	Clarify (if necessary) who will connect the EmiBox to the ZLT (cable work, request IP address for EmiBox).	
17	Clarify whether changes to the circuit diagram and P&I diagram are necessary or whether handwritten changes are accepted.	
18	Check whether a digital input (parametrizable message) is free on the old I/O controller on 11K10 / 11K11 or on the new I/O controller on 13K02 -13K04 (EmiBox collective warning).	
19	Check whether an analog input (parametrizable message) is free on the old I/O controller on 15K10 / 15K11 or on the new I/O controller on 21K01 / 21K02 (EmiBox collective warning).	

No.	Checkpoint	Comment
20	Check whether the I/O controller 14K03 or I/O controller 19K03 is available (T286 exhaust to engine / T287 exhaust to KAT).	
21	Check whether a free contact is available at the relay for the feedback GLS ON (generator circuit breaker) or whether an additional relay must be installed.	
22	Check whether there is space in the HAS for approx. 10 terminal blocks on the top hat rails (bottom or top, depending on the cable entry). Ideally, there should be 140 mm of contiguous space for terminal blocks, relays and isolation amplifiers.	
23	Check whether cable entry into the HAS is available/possible.	
24	If no I/O controllers 11K10/11K11, 15K10/15K11 or 14K03 are installed, check whether there is enough space to extend the existing I/O controller.	
25	Is there a circuit diagram of the HAS available? If necessary, request a digital copy.	
26	Is there a TEM I/O circuit diagram available? (designation and circuit diagram number)	
27	Is there a P&I diagram available? If necessary, request a digital copy.	
28	Is there a technical data sheet for the catalytic converter available? (max. operating tempera-ture)	
29	Provide the customer documentation incl. cir-cuit diagram and P&I diagram changes as well as instruction protocol.	

353-003-EN : 51000010 : BA : VAR, COV, IMP, B, BA, BS, DEM, EIN, IBN, IST, WP, SK, MH, SB, STB, TA, TL

12.2 Instructing customer personel

After successful commissioning, the operator must be instructed in the use of the EmiBox.

- operating the EmiBox on site: meaning of the LEDs, menu navigation on the display, displaying and acknowledging alarms
- connecting the EmiBox to the PC / in the network environment: access via IP address, history & messages, electronic logbook
- exporting logbook and history
- setting parameters of the EmiBox: critical parameters (K-factor, offset, gradient), user management
- maintenance
- conduct in the case of warnings / alarms

The operator was advised that all services or maintenance which are carried out must be documented in the logbook. This includes all maintenance that may influence emissions. The sealing of the catalytic converter and any changes made to it must also be documented in the logbook. In addition, the verification measurements carried out by the service personnel as well as the official emissions verification measurements must also be documented. It is left to the discretion of the operator whether a purely electronically logbook or a mixed-form logbook (paper & electronic) is kept. The operator is responsible for parameter changes or, if applicable, manipulations of the emission-relevant parameters (e.g. K-factor, offset, gradient) as well as entries into the electronic logbook which they themselves carried out.

"The history is only complete if [...], in the case of manual interventions, the ID (name and company) of the person making the entry has been provided".

In the course of instruction in the operation of the EmiBox, the operator was informed of their obligations arising from the 44th BImSchV and VDMA Standard Sheet 6299. However, this information is subject to change, as it is subject to interpretation by local authorities. This instruction does not release the operator from the obligation to inform themselves about the interpretation of the 44th BImSchV as well as the resulting obligations (e.g. submission obligations of the measured emissions).

With the following signatures, both parties confirm the introduction of the operator to the use of the EmiBox by the service personnel.

Service personnel | Plant operator

353-003-EN : 51000010 : BA : VAR, COV, IMP, B, BA, BS, DEM, EIN, IBN, IST, WP, SK, MH, SB, STB, TA, TL