



EasyNO_x – NO_x Monitoring

Operating Manual



Original instructions

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1 General Information

Read through this operating manual carefully before use and become familiar with the product. Installation and start-up should not be carried out before reading and understanding this document. Keep this manual readily available so that you can reference it as needed.

1.1 What Is the Purpose of this Operating Manual?

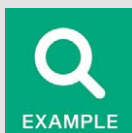
This manual serves as an aid for the installation and operation of the product and supports the technical staff with all operating and maintenance tasks to be performed. Furthermore, this manual is aimed at preventing dangers to life and health of the user and third parties.

1.2 Who Is this Operating Manual Targeted To?

The operating manual provides a code of conduct for personnel tasked with the setup, operation, maintenance, and repair of gas engines. A certain level of technical knowledge with respect to the operation of gas engines and basic knowledge of electronic ignition systems are necessary. Persons who are only authorized to operate the gas engine shall be trained by the operating company and shall be expressly instructed concerning potential hazards.

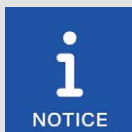
1.3 Which Symbols Are Used in the Operating Manual?

The following symbols are used in this manual and must be observed:



Example

This symbol indicates examples, which point out necessary handling steps and techniques. In addition, you receive additional information from the examples, which will increase your knowledge.



Notice

This symbol indicates important notices for the user. Follow these. In addition, this symbol is used for overviews that give you a summary of the necessary work steps.



Warning

This symbol indicates warnings for possible risks of property damage or risks to health. Read these warning notices carefully and take the mentioned precautionary measures.



Danger

This symbol indicates warnings for danger to life, especially due to high voltage. Read these warning notices carefully and take the mentioned precautionary measures.

1.4 Which Abbreviations/Acronyms Are Used in the Operating Manual?

In the operating manual or the user interface, the following abbreviations/acronyms are used.

Abb.	Term	Description	Explanation
AC	Alternating Current		
ADC	Analog-to-Digital Converter		Component that converts analog input signals into digital signals.
ATDC	After Top Dead Center		
BTDC	Before Top Dead Center		
CAN bus	Controller Area Network bus	Bus for control devices/networks	Asynchronous serial connection system for linking control units
CE	Conformité Européenne	Conformity with EU directives	Mark based on EU legislation for certain products in conjunction with product safety
CiA®	CAN in Automation		Users' and manufacturers' group standardizing CAN protocols
°crank	Degree crankshaft		Unit for the rotation angle of the crankshaft
CSV	Comma-separated Values	Data separated by comma	Text file for storage or exchange of structured data
DC	Direct Current		
DetCon	Detonation Controller		Serves to prevent major engine damage that can be caused by knocking combustion.
DIP	Dual In-Line Package		Housing form for electronic components with two rows of connections for push-fit assembly
DIS	Draft International Standard		Draft ISO standard
ECU	Electronic Control Unit		Electronic module for control and regulation

1 General Information

Abb.	Term	Description	Explanation
EEPROM	Electrically Erasable Programmable Read-Only Memory		Non-volatile electronic memory module whose stored information can be deleted electrically.
ESD	Electrostatic Discharge		
HMI	Human-Machine Interface		Interface between a human and a machine or a computer
IEC	International Electrotechnical Commission		International organization for standardization in the field of electrical engineering and electronics
I/O	Input/Output		Communication of an information system with the outside world
ISO	International Organization for Standardization		
LED	Light Emitting Diode		Light emitting electronic semiconductor
LSS	Layer Setting Services		Service for configuration of node ID and bit rate in a CAN-open® network
MAP	Manifold Absolute Pressure		
MIC	MOTORTECH Ignition Controller		
MICT	MOTORTECH Integrated Configuration Tool		Software for configuring MOTORTECH devices
MMC	Multimedia Card		Digital storage medium
NMT	Network Management		
PRAK	PIN Reset Authorization Key	Key for resetting all PINs	Key that resets all PINs of the EasyNO _x .
PRRK	PIN Reset Request Key	Key for applying for a PIN reset key	Key with which the key for resetting all EasyNO _x PINs can be requested.
SAE	Society of Automotive Engineers		International organization for standardization in the field of mobility technology
SD card	Secure Digital card	Secure digital data memory card	Digital storage medium
SDHC card	Secure Digital High-Capacity card	Secure, high-capacity digital memory card	Digital storage medium

Abb.	Term	Description	Explanation
Temp-Scan	Temperature Scanner		Serves for monitoring temperatures of thermocouples
USB	Universal Serial Bus		Serial connection system to link a computer to external devices
UTC	Coordinated Universal Time		

2 Safety Instructions

2.1 General Safety Instructions

The following safety instructions must be followed in the area in which the device is operated:



High voltage! Danger to life!

While the engine is running, there is danger to life through high voltage particularly in the area of the ignition system. The following parts should therefore not be touched or removed unless explicitly stated otherwise:

- Ignition coils and caps
- Wires of the high voltage circuit
- In- and output wiring of the ignition controller
- Pickups and their wiring



Danger to persons with implanted cardiac devices!

Electromagnetic impulses in the wiring of the ignition system may exceed the permissible limits of active implanted cardiac devices such as pace-makers or defibrillators. Persons with cardiac devices must therefore not be present in the vicinity of the ignition system being operated. Mark the operating location of the ignition system with the corresponding standardized warning symbol.

MOTORTECH equipment is manufactured as state of the art and therefore safe and reliable to operate. Nevertheless, the equipment can cause risks or damage can occur if the following instructions are not complied with:

- The gas engine must only be operated by trained and authorized personnel.
- Observe all safety instructions of the system and all safety instructions of the system operator.
- Operate the equipment only within the parameters specified in the technical data.
- Use the equipment correctly and for its intended use only.
- Never apply force.
- For all work such as installation, conversion, adaptation, maintenance, and repair, all equipment must be disconnected from the mains and secured against unintentional reactivation.
- Perform only such maintenance and repair work as is described in the operating manual, and follow the instructions given while working.
- Only use spare parts supplied by MOTORTECH for the maintenance of the device.
- Further work must only be performed by personnel authorized by MOTORTECH. Non-compliance with the instructions will void any guarantee for the proper function of the equipment as well as the responsibility for the validity of the certifications.
- Safety devices must not be dismantled or disabled.
- Avoid all activities that can impair the function of the equipment.
- Operate the equipment only while it is in proper condition.

- Investigate all changes detected while operating the gas engine or ignition system.
- Ensure compliance with all laws, directives, and regulations applicable to the operation of your system, including such not expressly stated herein.
- If the system is not entirely tight and sealed, gas may escape and result in explosion hazard. The inhalation of gas can also lead to death or severe health damages. Therefore, upon completion of all assembly works, always check the system's tightness.
- Always ensure adequate ventilation of the engine compartment.
- Ensure a safe position at the gas engine.
- There is a risk of burning on hot surfaces. Allow the gas engine to cool down before starting any work.
- Personal protective equipment (PPE), e.g. safety shoes and gloves, must be worn during all work on the gas engine.
- Noise from the system can cause permanent or temporary damage to your hearing. Wear suitable hearing protection at the system.
- Your behavior can reduce possible residual risks to a minimum. Observe responsible handling of the gas engine and the gas-carrying system.

2.2 Electrostatic Discharge Hazards

Electronic equipment is sensitive to static electricity. To protect these components from damage caused by static electricity, special precautions must be taken to minimize or prevent electrostatic discharge.

Observe these safety precautions while you work with the equipment or in its vicinity.

- Before performing maintenance or repair work, ensure that the static electricity inherent to your body is discharged.
- Do not wear clothing made from synthetic materials to prevent static electricity from building up. Your clothing should therefore be made of cotton or cotton mix materials.
- Keep plastics such as vinyl and Styrofoam materials as far away from the equipment and the work environment as possible.
- Do not remove the circuit boards from the housing of the device.

2 Safety Instructions

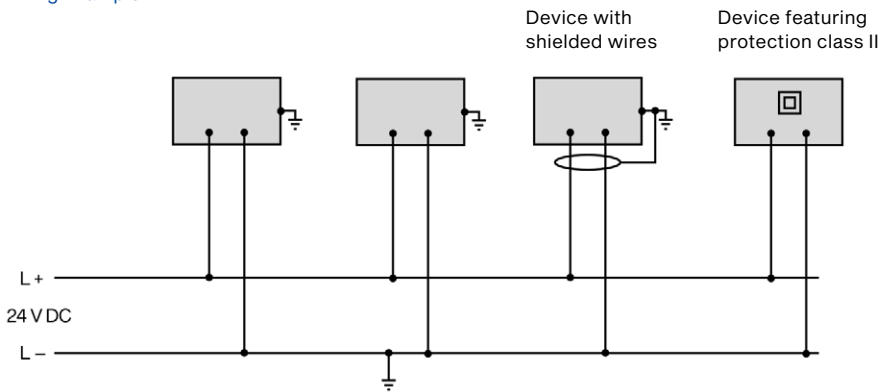
2.3 Information on Electric Isolation

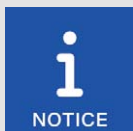
If ground and earth potential are not properly isolated, the following problems as well as others can occur:

- Electromagnetic interferences (e.g. ground loops)
- Signal corruption (e.g. of the analog voltage signal)
- Unwanted leakage currents

Therefore, earth potential and the negative pole of the power supply of all devices in the electric assembly that provide the option, should be connected separately. If possible, the negative pole of the power supply should only be connected to earth potential at one point in the entire system.

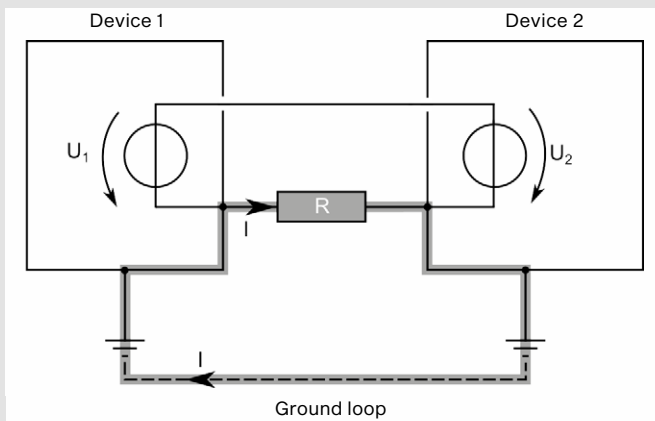
Wiring Example



**Occurrence of ground loops**

The devices shown in the following image do not feature the possibility to connect the earth potential and the negative pole of the power supply separated from each other. This results in a ground loop.

A ground loop is a ground connection of an electric wiring assembly that is closed as a loop. Due to impedance (resistance $R > 0$) of the loop, low-frequency interference currents can lead to an unwanted voltage drop in the signal path.



2 Safety Instructions

2.4 Special Safety Instructions for the EasyNO_x



Explosion hazard!

The following operations may only be executed providing the environment is classified as non-explosive:

- Establishing and terminating communications via EasyNO_x interfaces and connections.
- Inserting and removing memory cards.



Risk of destruction and injury!

The EasyNO_x is an electrically operated device, and there is the risk of electrostatic discharges. Therefore, never operate the device without the appropriate grounding, to prevent injuries and damage.



Risk of injury!

The EasyNO_x is designed for operation in circuits with **protected extra-low voltage (PELV)**. The voltages in these circuits must not exceed 50 V AC or 75 V DC.

The EasyNO_x must not be electrically connected to circuits which carry dangerously high voltages or which could do so if a single fault occurs.

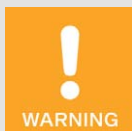
Therefore, the following conditions, among others, must be fulfilled:

- The power supply may only be provided from power supply units with safe electrical isolation or from batteries.
- Relays with safe isolation must be used for coupling to circuits that carry or in the event of a failure could carry dangerous voltage.
- All currently applicable standards and regulations must be taken into account.



Operational safety!

The EasyNO_x and the software are not designed for safety-critical applications. The analog and binary inputs and outputs of the EasyNO_x system must not be used for safety-critical purposes.

**Risk of destruction!**

It is possible to damage the ignition kit and engine through EasyNO_x settings. Consequently, protect your device against unauthorized access.

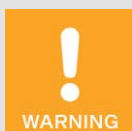
- Enable access control.
- Log out after using the access level employed.

**Risk of destruction!**

When using the EasyNO_x, observe the following points:

- Do not let the device fall.
- The device must not come into contact with water and other liquids.
- Do not operate the device in direct sunlight, near heat sources or in humid environments.
- Only operate the device in accordance with the technical specifications.

Disregard of these guidelines can lead to the destruction of the device.

**Risk of damage and malfunctions!**

Safe operation is no longer guaranteed in the following cases:

- The EasyNO_x shows visible damage.
- The display remains dark or shows unusual patterns for a longer period of time.
- The screen saver does not turn off when touching the display.
- The EasyNO_x does not react after a restart.

The EasyNO_x must then be turned off and must not be used any longer.

**Risk of destruction!**

The surface of the touchscreen is sensitive to pointed and sharp-edged objects. Therefore handle the touchscreen carefully. Pixel errors due to improper handling are excluded from the guarantee.

2 Safety Instructions

2.5 Special Safety Instructions for Use as NO_x Monitor



Explosion hazard!

In the event of a malfunction, ignitable sparks may be generated in the EasyNO_x system. Comply with all locally applicable explosion protection regulations and ensure that no explosive gases form in the system area.



Risk of suffocation! Risk of poisoning!

Leaks in the exhaust pipe can cause exhaust gases to escape and people in the system room can suffocate or be poisoned. After mounting the sensors, check the tightness of the exhaust pipe.



Risk of burning!

There is a risk of burns when touching the sensing elements of the NO_x sensor and the thermocouples because the sensing elements become hot during operation. Therefore, observe the following:

- Install the sensing elements on the exhaust pipe at suitable locations so that people at the plant cannot be burned by them, or install an appropriate protection around the sensing elements that prevents contact with them.
- The sensing elements must have cooled down sufficiently after switching off or disconnecting the power supply before you can touch the sensing elements again.



Risk of destruction and injury!

The CAN bus/NO_x sensor module is an electrically operated device, and there is the risk of electrostatic discharges. Therefore, never operate the device without the appropriate grounding, to prevent injuries and damage.

**Operational safety!**

The NO_x monitoring devices, including the EasyNO_x, must be operated with closed housings. Otherwise, proper functioning of the devices and compliance with the protection classes cannot be guaranteed.

When the system is powered off, the housings may only be opened for wiring and configuration. When the housing is open, make sure that no moisture forms in the housing.

**Operational safety!**

To prevent sparking and short circuits that can cause electric shock and serious damage to the connected equipment, always switch off the power supply to the EasyNO_x system before disconnecting the electrical connections in the EasyNO_x system.

**Danger of interference with radio reception!**

The CAN bus/NO_x sensor-module is not intended for use in residential areas and cannot ensure adequate protection of radio reception in such environments.

2 Safety Instructions

2.6 Special Safety Instructions on NO_x Sensor P/N 56.03.003



Explosion hazard!

Only use the NO_x sensor for measurement in non-explosive gas mixtures, as explosive gas mixtures can ignite at the hot sensing element. Especially in the event of an engine malfunction, make sure that no unburned gas mixture enters the exhaust pipe. Also comply with all locally applicable explosion protection regulations.



Operational safety!

Proper functioning of the NO_x sensor is only guaranteed if the sensing element does not overheat at the mounting location. Avoid accumulated heat at the sensing element and ensure sufficient ventilation of the sensing element by ambient air.



Operational safety!

To ensure proper functioning of the NO_x sensor throughout its service life, be sure to observe the following:

- The probe must not come into contact with condensation water, other liquid components such as oil and grease, or sealants.
- Contamination in the exhaust gas, e.g. due to corrosion or material escaping from the catalytic converter, must be avoided.
- The sensor and its electronics must not be painted or otherwise coated.
- Do not open the cover of the evaluation unit's connector.



Operational safety!

The NO_x sensor must not be used any further under any circumstances if it is damaged or the sensing element of the NO_x sensor has been mechanically shocked (e.g. by dropping it on the floor or impacts on the sensing element). In these cases, contact MOTORTECH for sensor replacement (see *Customer Service Information* on page 200).

**Operational safety!**

The sensing element may be mounted a maximum of one time. The electrical connection to the NO_x sensor's evaluation unit may be established and disconnected a maximum of 20 times. After that, proper functioning of the sensor can no longer be guaranteed.

2.7 Proper Storage

CAN Bus/NO_x Sensor Module

Keep the storage period of the CAN bus/NO_x sensor module as short as possible and unpack the CAN bus/NO_x sensor module no earlier than directly before mounting (see section *Proper Transport* on page 21). For storage, observe the mechanical specifications of the CAN bus/NO_x sensor module (see section *Mechanical Data* on page 35). In the vicinity of the NO_x sensor, no easily evaporating organic materials or silicone-organic materials may be stored.

2.8 Proper Transport

EasyNO_x

Let the EasyNO_x remain in its original packaging until it reaches its place of use. After unpacking, secure the EasyNO_x housing against falling over, dropping, and slipping.

CAN Bus/NO_x Sensor Module

Let the CAN bus/NO_x sensor module and in particular the sensing element of the NO_x sensor remain in their original packaging until they reach their place of use.

After unpacking, take care not to twist the wires in the connection cable between the sensing element and the evaluation unit of the NO_x sensor P/N 56.03.003 when carrying the CAN bus/NO_x sensor module. Do not wrap the connection cable of the NO_x sensor around the CAN bus/NO_x sensor module under any circumstances. Wrap the connection cable separately from the module, and maintain the minimum bending radius of 20 mm (0.79") as well as the minimum distance of the first bend of 30 mm (1.18") on both ends of the connection cable.

The protective cap of the NO_x sensor's sensing element is designed to prevent dirt and dust from entering the sensing element. Do not remove the protective cap from the sensing element until you are instructed to do so in the EasyNO_x operating manual (see section *Mounting the Sensing Element of NO_x Sensor P/N 56.03.003* on page 59).

2.9 Proper Disposal

For the proper disposal of MOTORTECH equipment, observe the information provided at www.motortech.de.

3 Intended Use

3.1 Functional Description

The EasyNO_x HMI module is equipped with a NO_x monitor which, in conjunction with a CAN bus/NO_x sensor module from MOTORECH, monitors the exhaust gases of up to two stationary gas-powered lean-burn engines in industrial environments.

The EasyNO_x HMI module also visualizes and records engine operating data provided by MOTORTECH control units and is used for monitoring and error analysis of these control units in the field.

For further evaluation, recorded engine operating data and reports can be exported to a USB flash drive.

The EasyNO_x HMI module has two CAN bus interfaces via which it can be connected to the supported devices.

Using the I/O communication module BPlus specially available from MOTORTECH and I/O modules supporting device profile CiA® 401 or CiA® 404, the EasyNO_x can be expanded with physical analog and binary inputs and outputs in order to communicate with other devices, e.g. a master control.

Depending on your purchased device activation, the EasyNO_x can integrate the following devices:

- NO_x monitor
 - Support of up to two CAN bus/NO_x sensor modules from MOTORTECH via CAN2
 - Monitoring of the exhaust gases of a stationary gas-powered lean-burn engine via each CAN bus/NO_x sensor module
 - Connection of up to two thermocouples to the CAN bus/NO_x sensor module to measure the exhaust gas temperature near the catalytic converter and to detect the dew point for the module's NO_x sensor
 - Visualization and recording of provided engine operating data
 - Export of recorded engine operating data and reports
 - Switching of binary outputs via CAN1 for warnings and errors
 - Complete configuration of the NO_x monitor
- Ignition controller
 - Support of one MOTORTECH ignition controller MIC100, MIC3, MIC3+, MIC4, MIC5, or MIC6 via CAN1
 - Visualization and optionally recording of provided engine operating data
 - Export of recorded engine operating data
 - Runtime adjustment of selected ignition controller settings
- Detonation controller
 - Support of one MOTORTECH detonation controller DetCon2, DetCon16, or DetCon20 via CAN1
 - Visualization and optionally recording of provided engine operating data
 - Export of recorded engine operating data
 - Switching of binary outputs via CAN1 for warnings and errors

- Temperature module
 - Support of up to three temperature modules TempScan20 from MOTORTECH via CAN1
 - Visualization and optionally recording of provided engine operating data
 - Export of recorded engine operating data
 - Complete configuration of temperature module
 - Switching of binary outputs via CAN1 for warnings and errors
- I/O communication module, I/O module (device profile CiA® 401/404)
 - Support of up to three I/O modules supporting device profile CiA® 401 or 404 via CAN1 including a maximum of two I/O communication modules from the manufacturer BPlus, which are specially available from MOTORTECH
 - Use of analog and binary inputs and outputs via CANopen® for communication e.g. with a master control
 - Analog and binary inputs and outputs assignable depending on application
 - No activation required
- Generic device
 - Integration of up to three generic devices not supported by the EasyNO_x via CAN1
 - Automatic start of generic device when EasyNO_x is started up
 - Connection status monitoring
 - No activation required

3 Intended Use

3.2 Applications



Danger of interference with radio reception!

The CAN bus/NO_x sensor-module is not intended for use in residential areas and cannot ensure adequate protection of radio reception in such environments.

The EasyNO_x is designed for use in a non-hazardous area and may only be operated with the devices specified for this purpose. The EasyNO_x does not support safety-critical applications.

In conjunction with NO_x sensor P/N 56.03.003, the NO_x monitor of the EasyNO_x is designed for use with stationary gas-powered lean-burn engines in industrial environments, which are equipped with exhaust gas cleaning and whose exhaust gases have an oxygen content ≥ 1 vol%.

The NO_x sensor P/N 56.03.003 of the CAN bus/NO_x sensor module is suited for exhaust gases that are free of ammonia. The NO_x sensor may only be used mounted in an exhaust pipe for measurements in non-explosive gas mixtures.

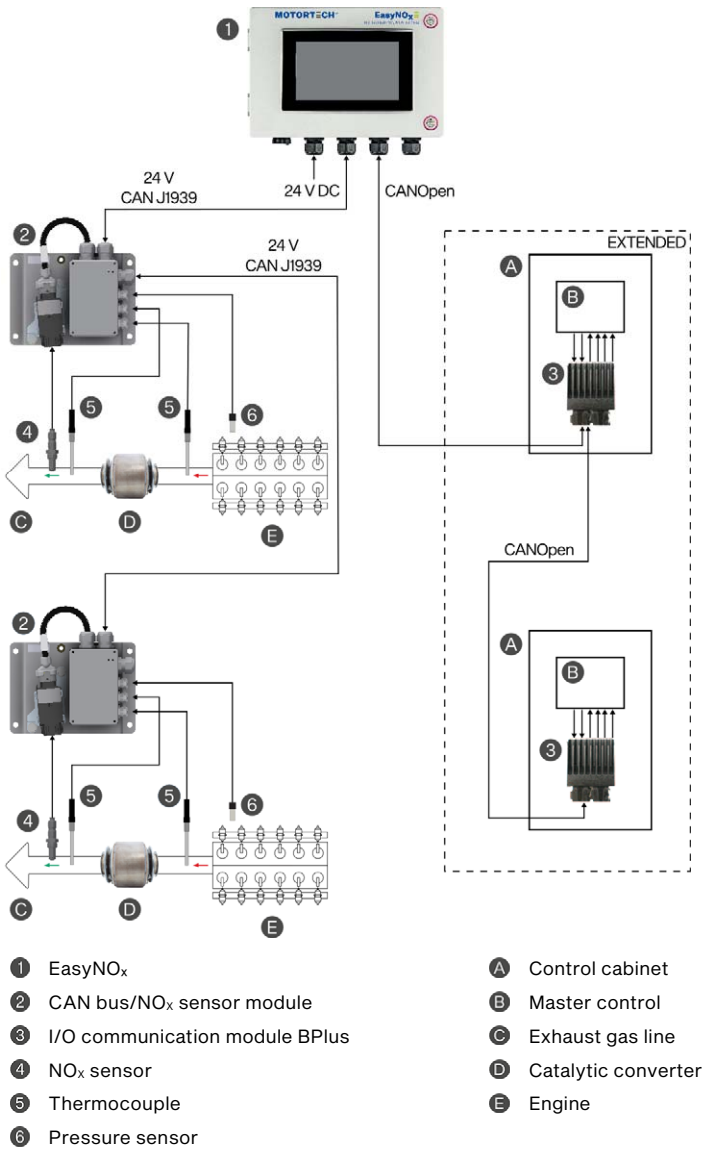
In exhaust gas lines equipped with an oxidizing catalytic converter, the NO_x monitor of the EasyNO_x can be used for qualitative monitoring and documentation of nitrogen oxide emissions in accordance with the 44th Ordinance Implementing the Federal Immission Control Act (BImSchV) and the standard sheet VDMA 6299:2019-09.

The NO_x monitor of the EasyNO_x can be used with two CAN bus/NO_x sensor modules to monitor two engines that are located in the same room in close proximity.

As per EN 55011, the EasyNO_x HMI module in housing is equipment of Group 1 and Class B. As per EN 55011, the CAN bus/NO_x sensor module is equipment of Group 1 and Class A.

Any use other than the one described in the operating manual shall be considered improper use and will result in the voiding of any guarantee.

System Overview NO_x Monitoring (Example)



4 Product Description

4.1 Technical Data

4.1.1 EasyNO_x

4.1.1.1 Certifications

The EasyNO_x HMI module in housing is certified as follows: CE

The EU Declaration of Conformity can be obtained on request from your MOTORTECH contact person (see section *Customer Service Information* on page 200).

4.1.1.2 Mechanical Data



Compliance with protection class

The specified protection class is only guaranteed if all external cables are wired according to their specifications, all cable glands and screw openings are tightly closed, and the door is closed as specified.

The EasyNO_x has the following mechanical characteristics.

Feature	Value
Dimensions	305.6 mm x 230 mm x 86 mm (12.04" x 9.06" x 3.39") (length x width x height)
Weight	3.5 kg (7.8 lbs)
Shape of device	See section <i>Overview Drawings</i> on page 31
Mechanical environmental conditions	Protection: IP 66
Climatic environmental conditions	Operation: 0 °C to +50 °C (+32 °F to +122 °F) Housing closed: 5 % to 90 % humidity without condensation Condensation must be prevented by suitable measures Housing open: 5 % to 50 % humidity without condensation at +40 °C (+104 °F) 5 % to 90 % humidity without condensation at +20 °C (+68 °F) Storage: –20 °C to +70 °C (–4 °F to +158 °F) 30 % to 70 % humidity without condensation Up to 3,000 m (9,842') above sea level

4.1.1.3 Warning Notices on the Device

Information Text on Memory Card Slot of EasyNO_x
To preserve data integrity, do not remove memory card!

Warning Symbol on Memory Card Slot of EasyNO_x
Warning



4.1.1.4 Product Identification – Labeling on the Device

EasyNO_x
On the outside of the housing

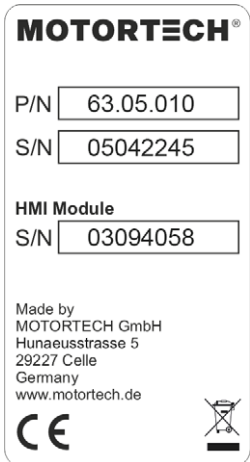


Illustration example

Abb.	Meaning
P/N	Part number of the EasyNO _x
S/N	Serial number of the EasyNO _x and under <i>HMI Module</i> the serial number of the EasyNO _x HMI module installed in the housing

4 Product Description

EasyNO_x HMI Module
Rear side

MOTORTECH[®]
HMI Module

P/N

PV4.00.0000-200-AA-C

A/N

03094058

S/N

R0501000002-01.00.02

Illustration example

Abb.	Meaning
P/N	Part number of the EasyNO _x HMI module
A/N	Arrangement number of the EasyNO _x HMI module
S/N	Serial number of the EasyNO _x HMI module
R/N	Revision number of the EasyNO _x HMI module indicating its precise construction status (R/N)

4.1.1.5 Electrical Data

The EasyNO_x has the following electrical characteristics:

Feature	Value
Power consumption	<p>Without CAN bus/NO_x sensor module:</p> <ul style="list-style-type: none"> – 5.3 W typical, max. 22.8 W <p>With up to two CAN bus/NO_x sensor modules with NO_x sensor P/N 56.03.003:</p> <ul style="list-style-type: none"> – Max. 100 W in measuring operation – During heating up to 176 W for a short period
Power supply	<p>Nominal voltage: 24 V DC</p> <p>Operating voltage:</p> <ul style="list-style-type: none"> – Without CAN bus/NO_x sensor module: 9 V DC to 32 V DC – With CAN bus/NO_x sensor module: 16 V DC to 32 V DC
Required current	<p>Without CAN bus/NO_x sensor module:</p> <ul style="list-style-type: none"> – Max. 1.5 A <p>With up to two CAN bus/NO_x sensor modules with NO_x sensor P/N 56.03.003:</p> <ul style="list-style-type: none"> – Max. 4.7 A in measuring operation – During heating up to 7.9 A for a short period
Real-time clock accuracy	± 30 ppm at 25 °C (77 °F)
Internal backup battery	<p>Non-rechargeable lithium manganese dioxide portable battery CR1220, 3 V, 35 mAh</p> <p>Service life: approx. 8 years (depending on application)</p>

4.1.1.6 Display

The EasyNO_x display has the following features:

Feature	Value
Screen diagonal	178 mm (7")
Resolution	800 x 480 pixels
Color depth	18 bit (262,144 colors)
Brightness	400 cd/m² typical
Viewing angle	50°, 70°, 70°, 70° (UDRL)
Touch technology	Projected capacitive multi touch
Backlight service life	50,000 hours typical

4 Product Description

4.1.1.7 Interfaces

The EasyNO_x has the following interfaces:

USB Interface

- Compatible with USB 2.0
- Data rate: 480 Mbit/s (Host)
- Suitable for USB flash drives formatted with FAT (FAT12, FAT16, FAT32)

CAN Bus Interfaces

- Quantity: 2
- Galvanically separated
- Network protocol: CANopen® (CAN1), SAE J1939 (CAN2)
- As per ISO/DIS 11898
- Transmission rate: 250 kbit/s
- Max. cable length 250 m (820')
- The CAN bus interfaces of the EasyNO_x are exclusively intended for communication with devices that are supported by the EasyNO_x.



Operational safety!

The EasyNO_x is delivered with an SDHC card, which is inserted in the HMI module and is required for recording data. To ensure the integrity of the data recorded on it, the SDHC card under any circumstances must not be removed or replaced. Similarly, the recorded data from the NO_x monitor must not be used with another HMI module.

To process recordings of the EasyNO_x on a PC, export the desired recordings to a USB flash drive (for the NO_x monitor see section *Export* on page 122 and for all other devices see section *Recordings* on page 101).

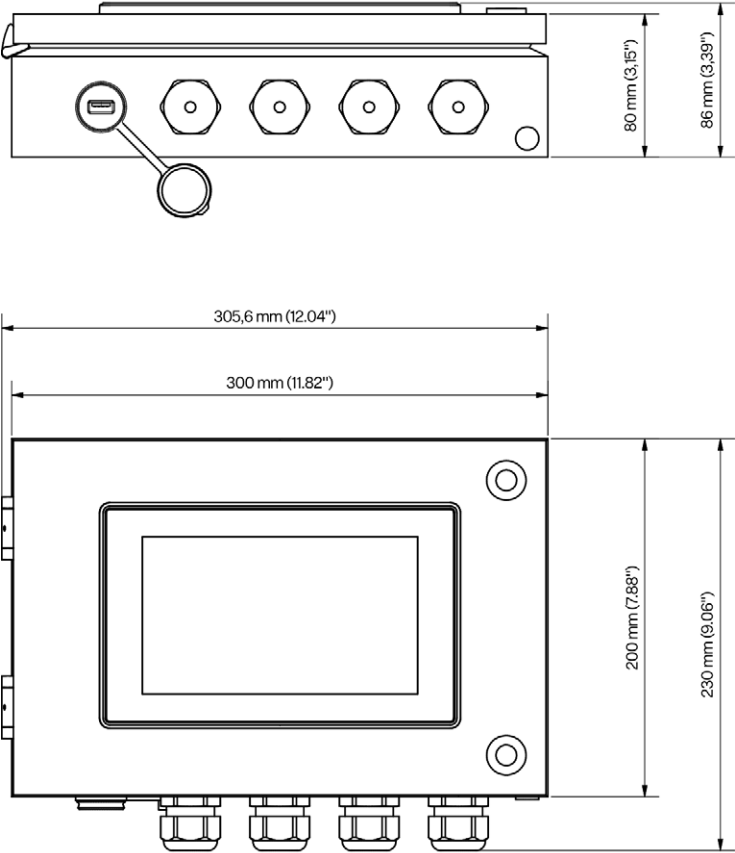
If the SDHC card requires mandatory replacement (e.g. due to a defect), contact your MOTORTECH contact person (see section *Customer Service Information* on page 200).

Memory Card Slot

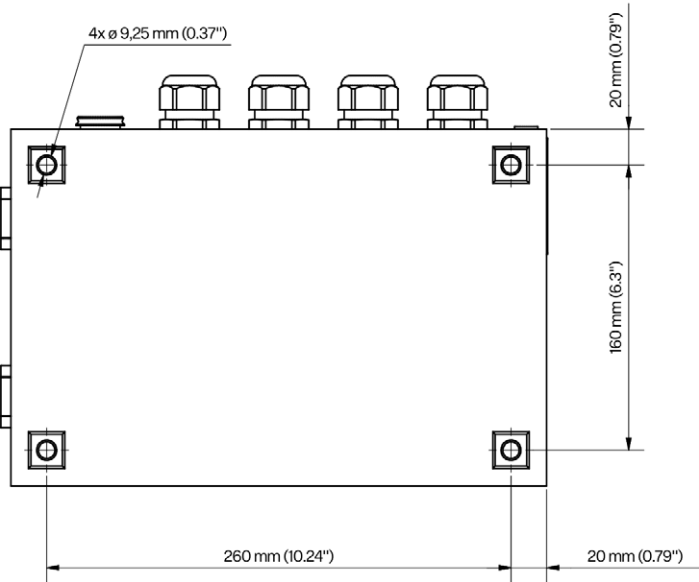
- Supported memory card types: SDHC, SD, MMC
- Formatting: FAT (FAT12, FAT16, FAT32)

4.1.1.8 Overview Drawings

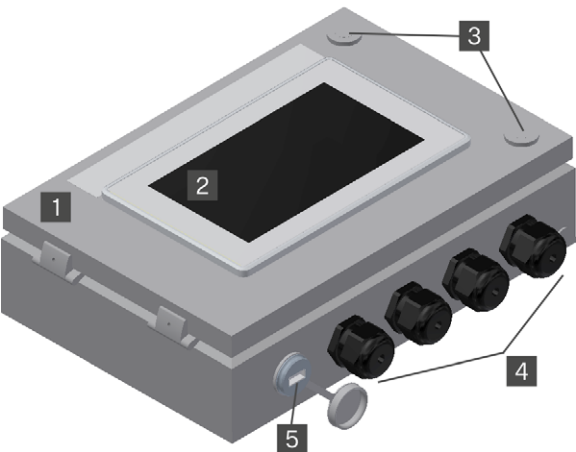
Dimensions



4 Product Description



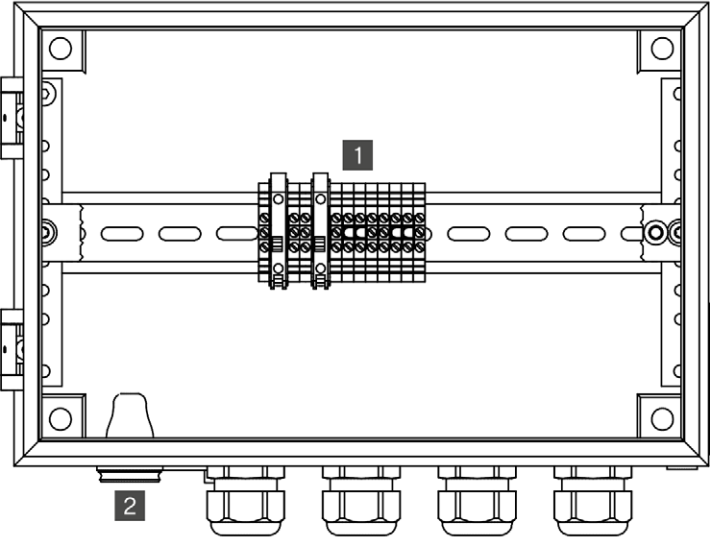
Components



Pos.	Description
1	Housing door
2	Touchscreen
3	Housing door lock
4	Cable glands
5	USB port with protective cap

4 Product Description

4.1.1.9 Connections



Pos.	Description
1	Terminal blocks (see section <i>Wiring</i> on page 68)
2	USB port

4.1.2 CAN Bus/NO_x Sensor Module

4.1.2.1 Certifications

The CAN bus/NO_x sensor module is certified as follows: CE

The EU Declaration of Conformity can be obtained on request from your MOTORTECH contact person (see section *Customer Service Information* on page 200).

4.1.2.2 Mechanical Data



Compliance with protection class

The specified protection class is only guaranteed if all external cables are wired according to their specifications, all cable glands and screw openings are tightly closed, and the cover is closed as specified.

The CAN bus/NO_x sensor module with NO_x sensor P/N 56.03.003 has the following mechanical characteristics:

Feature	Value
Dimensions	Length x width mounting plate: 206.5 mm x 150 mm (8.13" x 5.91") Height mounting plate with CAN bus module: 82 mm (3.23")
Weight	1.52 kg (3.4 lbs)
Shape of device	See section <i>Overview Drawings</i> on page 40
Mechanical environmental conditions	Protection: IP 66 with mating plug connected to evaluation unit of NO _x sensor P/N 56.03.003 and sensing element mounted in suitable welding boss from MOTORTECH
Climatic environmental conditions	Operation: –40 °C to +85 °C (–40 °F to +185 °F) 5 % to 90 % humidity without condensation with closed housing Storage: –40 °C to +75 °C (–40 °F to +167 °F) 30 % to 60 % humidity without condensation with closed housing Max. 18 months Up to 2,000 m (6,561') above sea level

4 Product Description

The sensing element of the NO_x sensor P/N 56.03.003 has the following mechanical characteristics:

Feature	Value
Dimensions	Length of probe: 24 mm (0.95") Length of sensing element: 83.3 mm (3.28") Length of connection cable: 980 mm (38.58")
Shape of device	See section <i>Overview Drawings</i> on page 40
Mechanical environmental conditions	Protection: IP 6K9K with mating plug connected to evaluation unit and sensing element mounted in suitable welding boss from MOTORTECH
Climatic environmental conditions	Exhaust gas temperature range: –40 °C to +850 °C (–40 °F to +1,562 °F) Operating temperature hexagon nut: –40 °C to +500 °C (–40 °F to +932 °F) Operating temperature sensing element grommet and connection cable: –40 °C to +170 °C (–40 °F to +338 °F) Operating pressure range: 600 mbar abs to 1,500 mbar abs
Mounting cycles	Max. 1
Service life	8,000 operating hours with ambient temperature max. +90 °C (+194 °F) at evaluation unit

4.1.2.3 Product Identification – Labeling on the Device

CAN Bus/NO_x Sensor Module

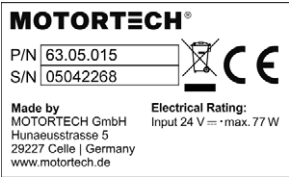


Illustration example

Abb.	Meaning
P/N	Part number of the CAN bus/NO _x sensor module
S/N	Serial number of the CAN bus/NO _x sensor module

CAN Bus Module

On the outside of the housing



Illustration example

Abb.	Meaning
P/N	Part number of the CAN bus module

NO_x Sensor P/N 56.03.003

The numbers required for unique product identification are on the top side of the evaluation unit:

- Part number of the NO_x sensor (P/N)
- Serial number of the NO_x sensor (S/N)

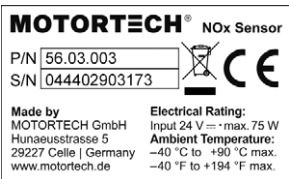


Illustration example

4 Product Description

4.1.2.4 Electrical Data

The measuring inputs of the CAN bus module have the following electrical data:

Feature	Value
Resolution	16 bit
Thermocouple inputs	Quantity: 2 Suitable for thermocouples of type K, class 1 as per IEC 584 With cold junction compensation Measuring range: -200 °C to +1,200 °C (-328 °F to +2,192 °F) Measurement resolution: 0.1 K Measuring accuracy: ± 0.1 K Sampling rate: 100 Hz per input The measuring point of the thermocouple must be insulated from the housing.
Analog current inputs	Quantity: 2 Permissible current: max. 22 mA Current range for measured values: 4 mA to 20 mA Measurement resolution: 0.001 mA Measuring accuracy: 0.01 % FS Sampling rate: 200 Hz per input
Period CAN message	200 ms

The measuring probe of the NO_x sensor P/N 56.03.003 has the following characteristics:

Feature	Value
Measuring range nitrogen oxide (NO _x)	0 ppm to 3,012 ppm
Measuring accuracy nitric oxide (NO)	See table 1, valid measured values from O ₂ ≥ 1 vol%
Response time nitric oxide (NO)	t ₁₀₋₉₀ : max. 1,800 ms at exhaust gas velocity 10 m/s
Light-off time nitric oxide (NO)	Max. 80 s after dew point release
Cross sensitivity NO _x measurement	Ammonia (NH ₃) typ. 110 %
Sensitivity NO _x measurement	Nitrogen dioxide (NO ₂) typ. 85 %
Measuring range oxygen (O ₂)	0 % to 20.95 %
Measuring accuracy oxygen (O ₂)	See table 2
Response time oxygen (O ₂)	t ₁₀₋₉₀ : max. 800 ms at exhaust gas velocity 11 m/s
Light-off time oxygen (O ₂)	Max. 45 s after dew point release
Exhaust gas velocity	10 m/s to 100 m/s

Table 1: Measuring accuracy nitric oxide (NO)

Measurement	Measuring accuracy new at O ₂ ≥ 1 vol%	Measuring accuracy aged at O ₂ ≥ 1 vol%
0 ppm	± 8 ppm abs	± 10 ppm abs
90 ppm	± 10 ppm abs	± 12 ppm abs
1,500 ppm	± 8 % rel	± 10 % rel

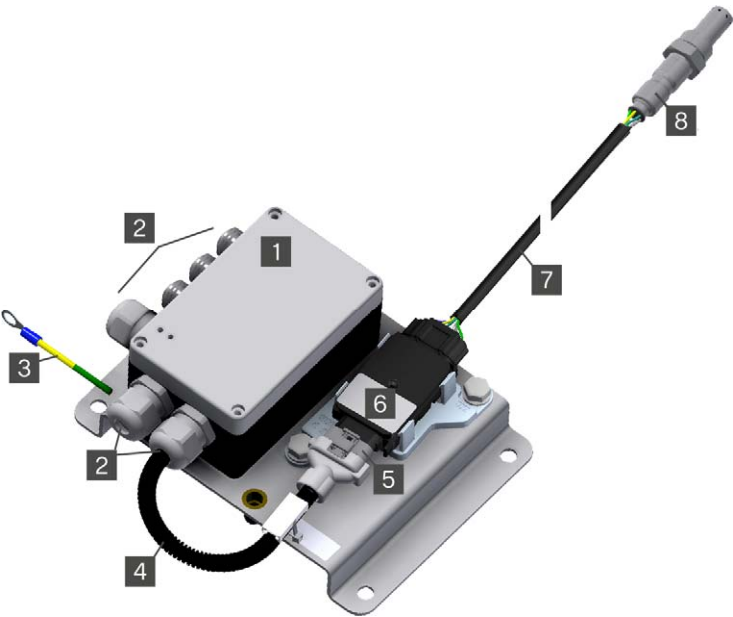
Table 2: Measuring accuracy oxygen (O₂)

Measurem ent	Gas composition	Measuring accuracy new	Measurement accuracy aged
0 %	N ₂ with 1 % H ₂ O	± 0.2 % abs	± 0.3 % abs
8.29 %	8.29 % O ₂ in N ₂ ; 0 % H ₂ O	± 6 % rel	± 8 % rel
12 %	12 % O ₂ in N ₂ ; 0 % H ₂ O	± 6 % rel	± 8 % rel
20.95 %	20.95 % O ₂ in N ₂ ; 0 % H ₂ O	± 6 % rel	± 8 % rel

4.1.2.5 Overview Drawings

[illegible]

Components

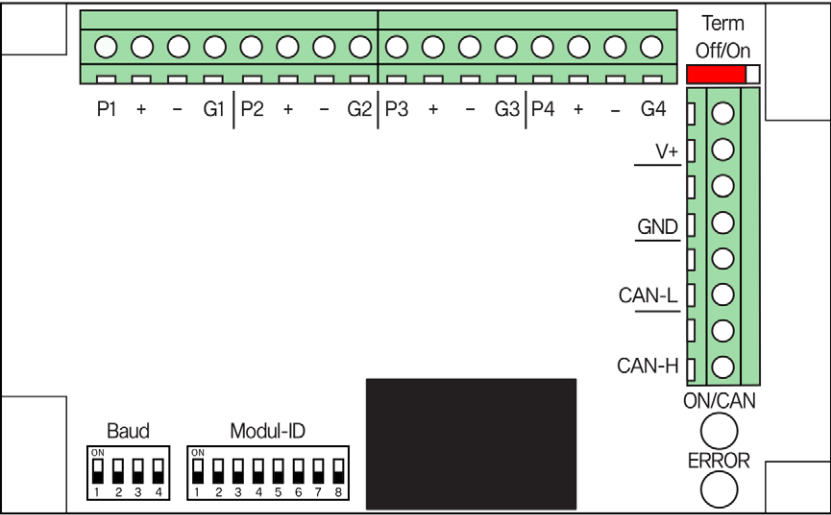


Pos.	Description
1	CAN bus module
2	Cable glands
3	Grounding cable
4	Connection cable CAN bus module to evaluation unit
5	Evaluation unit connector
6	Evaluation unit of NO _x sensor P/N 56.03.003
7	Connection cable evaluation unit to sensing element
8	Sensing element of NO _x sensor P/N 56.03.003

4 Product Description

4.1.2.6 Connections and LEDs

CAN Bus Module



Designation	Function
P1, +, -, G1 P2, +, -, G2	Measurement connections for the thermocouples
P3, +, -, G3	Analog input for a manifold pressure or load signal
P4, +, -, G4	Optional analog current input, whose input current can be displayed in the NO _x monitor of the EasyNO _x (see section <i>Overview</i> on page 114).
Term Off/On	Slide switch for CAN bus termination
V+, GND	Connection for the supply voltage and for looping through the supply voltage
CAN-L, CAN-H	Port for communication via the CAN bus
ON/CAN	<p>The LED indicates the J1939 status of the CAN bus module:</p> <ul style="list-style-type: none"> Green: The CAN bus module is in "Error Active" state. Glowing green, 4 times flashing red: The CAN bus module is in "Error Passive" state. Red: The CAN bus module is either in "Bus Off" state or there is an error regarding the set bit rate or node ID.

Designation	Function
ERROR	<p>The LED indicates the device status of the CAN bus module:</p> <ul style="list-style-type: none"> – Green: The CAN bus module works flawlessly. – Flashes red repeatedly 1 time long and 1 time short: The bit rate is set incorrectly. – Flashes red repeatedly 1 time long and 2 times short: The node ID is set incorrectly. – Flashing steadily red: an unsuitable sensor or no sensor connected
Modul-ID	DIP switches for setting the node ID of the CAN bus module (see section <i>Node ID CAN Bus Module</i> on page 75)
Baud	DIP switches for setting the bit rate of the CAN bus module (see section <i>Bit Rate CAN Bus Module</i> on page 76)

The wiring and configuration of the CAN bus module is described in section *CAN Bus/NO_x Sensor Module* on page 71.

4.1.3 I/O Communication Module BPlus (Optional)

4.1.3.1 Certifications

The I/O communication module BPlus is certified as follows: CE

The EU Declaration of Conformity can be requested from your MOTORTECH contact person (see section *Customer Service Information* on page 200) if required.

4.1.3.2 Mechanical Data

The I/O communication module BPlus has the following mechanical characteristics:

Feature	Value
Dimensions	Without wiring: 100 mm x 97 mm x 48 mm (3.94" x 3.82" x 1.89") (length x width x height)
Weight	Without harnesses: 320 g (0.71 lbs)
Shape of device	See section <i>Overview Drawings</i> on page 45
Mechanical environmental conditions	Protection: IP20
Climatic environmental conditions	<p>–40 °C to +85 °C (–40 °F to +185 °F)</p> <p>Max. 85 % humidity without condensation</p> <p>Up to 2,000 m (6,561') above sea level</p>

4 Product Description

4.1.3.3 Product Identification – Labeling on the Device

The numbers required for unique product identification are on the bottom side of the top hat rail spring clip:



Illustration example

Abb.	Meaning
P/N	Part number of the I/O communication module
S/N	Serial number of I/O communication module

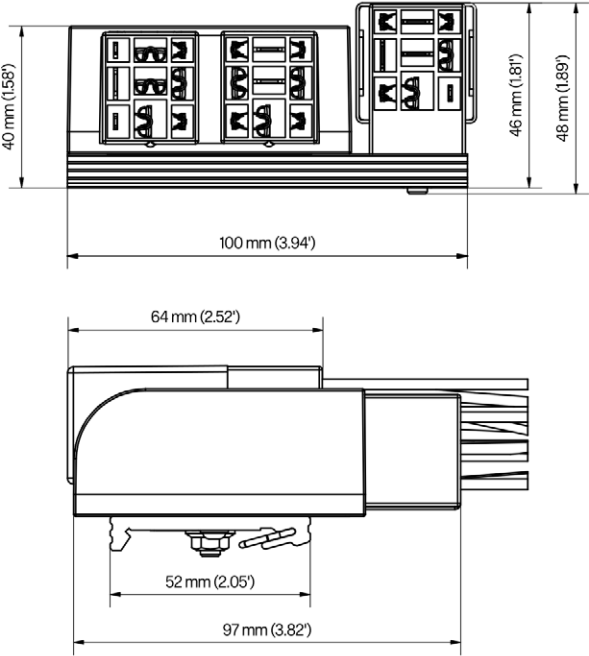
4.1.3.4 Electrical Data

The I/O communication module BPlus has the following electrical characteristics:

Feature	Value
Power consumption	0.72 W with unloaded outputs
Power supply	Nominal voltage: 24 V DC Operating voltage: 8 V DC to 32 V DC
Required current	30 mA at 24 V and with unloaded outputs
Binary input	Low level: 0 V High level: corresponds to supply voltage Safe low level at 24 V: 0 V to 12 V Safe high level at 24 V: 14 V to 24 V
Binary outputs	Quantity: 3 Plus/ground switching Low level: 0 V High level: corresponds to supply voltage
Analog input	Current range for measured values: 4 mA to 20 mA
Analog output	Output current: 4 mA to 20 mA

4.1.3.5 Overview Drawings

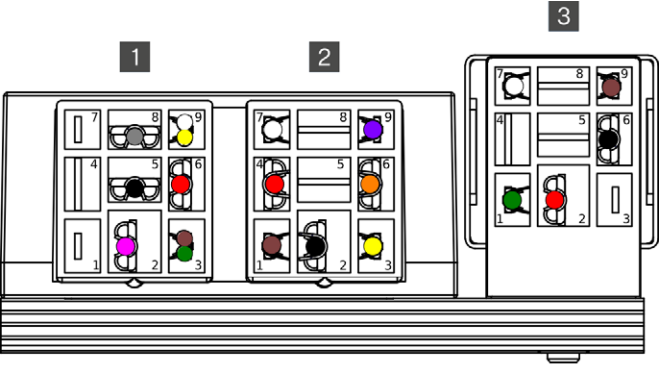
Dimensions



4 Product Description

4.1.3.6 Assignment

The I/O communication module BPlus is designed for wiring via a terminal strip in the control cabinet. The contacts and wires of the module are assigned as follows:



Relay connector left 1

Contact	Wire color	Assignment	Function
1	–	–	Not used
2	Pink	Binary input	Function configurable (see <i>Binary Inputs</i> on page 190)
3	Brown	CAN Lo	CAN connection to the previous device in the CANopen® network
	Green	CAN Lo	CAN connection to the following device in the CANopen® network or connection of the terminating resistor
4	–	–	Not used
5	Black	L –	Supply voltage for I/O communication module BPlus (8 V DC to 32 V DC, nominal voltage 24 V DC)
6	Red	L +	
7	–	–	Not used
8	Gray	Analog input	Function configurable (see <i>Analog Inputs</i> on page 192)
9	White	CAN Hi	CAN connection to the previous device in the CANopen® network
	Yellow	CAN Hi	CAN connection to the following device in the CANopen® network or connection of the terminating resistor

Relay connector center **2**

Contact	Wire color	Assignment	Function
1	Brown	CAN Lo	Internal CAN connection to the right I/O module
2	Black	L –	Pass-through of the supply voltage to the right I/O module
3	Yellow	Binary output 3	Function configurable (see <i>Binary Outputs</i> on page 191)
4	Red	L +	Pass-through of the supply voltage to the right I/O module
5	–	–	Not used
6	Orange	Binary output 2	Function configurable (see <i>Binary Outputs</i> on page 191)
7	White	CAN Hi	Internal CAN connection to the right I/O module
8	–	–	Not used
9	Purple	Binary output 1	Function configurable (see <i>Binary Outputs</i> on page 191)

Relay connector right **3**

Contact	Wire color	Assignment	Function
1	Green	Analog output	Function configurable (see <i>Analog Outputs</i> on page 193)
2	Red	L +	Supply voltage for right I/O module
3	–	–	Not used
4	–	–	Not used
5	–	–	Not used
6	Black	L –	Supply voltage for right I/O module
7	White	CAN Hi	Internal CAN connection to left I/O module
8	–	–	Not used
9	Brown	CAN Lo	Internal CAN connection to left I/O module

5 Functions

5.1 NO_x Monitoring

In the following sections, the NO_x monitoring functions of the EasyNO_x are described. To use the NO_x monitoring in the EasyNO_x, the EasyNO_x must be connected to a suitable CAN bus/NO_x sensor module from MOTORTECH.

5.1.1 Measured Value Display and Measured Value Output

The NO_x monitoring of the EasyNO_x displays the following measured values for up to two engines:

- The current nitrogen oxide concentration reading from the connected NO_x sensor in ppm
- The current oxygen concentration reading from the connected NO_x sensor in vol. %
- The current nitrogen oxide reading converted according to VDMA 6299:2019-09 in mg/Nm³ (for further details see section *Conversion of Nitrogen Oxide Readings* on page 48)
- The provisional daily average of nitrogen oxide readings determined in normal operation in mg/Nm³

The NO_x monitoring calculates the nitrogen oxide daily average from valid readings of the NO_x sensor in normal operation, provided that the dew point of the NO_x sensor has been reached at the catalyst outlet for at least 5 minutes. If the conditions for normal operation are met before the dew point of the NO_x sensor has been reached, the averaging time is correspondingly shorter than the time of the detected normal operation. Both times are identified in the NO_x monitoring report (see section *NO_x Monitoring Report* on page 54).

In conjunction with the optionally available I/O communication module BPlus or a suitable I/O module supporting device profile CiA® 401 or CiA® 404, the current nitrogen oxide reading converted according to VDMA 6299:2019-09 or the provisional daily average can additionally be output to a master control via an analog output.

5.1.2 Conversion of Nitrogen Oxide Readings

The readings from the connected NO_x sensor are converted according to VDMA 6299:2019-09 in the NO_x monitor of the EasyNO_x.

At first, the oxygen content measured in wet exhaust gas is converted to dry exhaust gas:

$$O_{2,dr} = \frac{O_{2,w}}{1 - \left(0.1966 - 0.8953 \cdot \frac{O_{2,w}}{100}\right)}$$

In this context, the NO_x monitor of the EasyNO_x does not regard oxygen readings for wet exhaust gas, which lead to oxygen contents in the dry exhaust gas of over 20 %.

In the next step, the measured nitrogen oxide value is corrected by sensor- and plant-specific NO₂ correction factors:

$$NO_{x,w-c} = NO_{x,w} \cdot (1 - K) + NO_{x,w} \cdot \left(\frac{K}{K_{NO2}}\right)$$

Following that, this NO₂-corrected nitrogen oxide value measured in wet exhaust gas is converted to dry exhaust gas:

$$NO_{x,dr} = \frac{NO_{x,w-c}}{1 - \left(0.1966 - 0.8953 \cdot \frac{O_{2,w}}{100}\right)}$$

Then the volume-based nitrogen oxide measured value is converted to a mass-based value in mg/Nm³:

$$\text{NO}_{\text{X,dr-mg}} = 2.053 \cdot \text{NO}_{\text{X,dr}}$$

In the last step, the mass-based nitrogen oxide measured value is converted to a reference oxygen content of O_r = 5 %:

$$\text{NO}_{\text{X,r}} = \frac{21 - \text{O}_r}{21 - \text{O}_{2,\text{dr}}} \cdot \text{NO}_{\text{X,dr-mg}}$$

Variable	Meaning
K	NO ₂ /NO _x ratio of the exhaust gas as a constant (see section <i>Determining the NO₂/NO_x Ratio</i> on page 64)
K _{NO2}	Sensor-specific NO ₂ correction factor as a constant (see section <i>Sensor</i> on page 129)
NO _{X,r}	Nitrogen oxide measured value converted to reference oxygen content and based on mass and dry exhaust gas in mg/Nm ³
NO _{X,w}	Nitrogen oxide value of the NO _x sensor measured wet in ppm
NO _{X,w-c}	NO ₂ -corrected nitrogen oxide measured value related to wet exhaust gas in ppm
NO _{X,dr}	Nitrogen oxide measured value related to dry exhaust gas in ppm
NO _{X,dr-mg}	Mass-based nitrogen oxide measured value related to dry exhaust gas in mg/Nm ³
O _r	Reference oxygen
O _{2,dr}	Oxygen measured value of the NO _x sensor calculated on dry exhaust gas in vol. %
O _{2,w}	Oxygen value of the NO _x sensor measured wet in vol. %

5.1.3 Limit Monitoring

For the nitrogen oxide daily average, you define a level limit that must not be exceeded and a warning threshold that indicates that the daily average is approaching the level limit. To use the NO_x monitoring in accordance with standard sheet VDMA 6299:2019-09, the daily average at which an alarm should be triggered must be specified as level limit. If the final nitrogen oxide daily average exceeds the specified level limit, the detected normal operation hours of the day are added to the failure hour counter of the ongoing calendar year to the second.

The limit monitoring can be configured in the NO_x *Setup* view (see section *Preferences* on page 124).

5 Functions

5.1.4 Failure Hour Counter

The failure hour counter of the NO_x monitoring registers the time to the second that the nitrogen oxide daily average has been above the configured level limit so far in a running calendar year. The detected normal operation hours of a day are added to this failure hour counter to the second if the final nitrogen oxide daily average exceeds the configured level limit (also see section *Limit Monitoring* on page 49).

For this failure hour counter, you specify a time limit in the NO_x monitoring that must not be exceeded and a warning threshold that indicates that the failure hour counter is approaching the time limit.

You can configure the normal operation detection in the *NO_x Setup* view (see section *Preferences* on page 124).

The change of day is firmly preset to 00:00:00 hrs Central European Time (CET) or UTC+1. At the beginning of a new calendar year, the failure hour counter is automatically reset to 0 hours.

5.1.5 Exhaust Gas Temperature Monitoring

The exhaust gas temperature monitoring of the NO_x monitor is used for monitoring catalytic converter operation and also as dew point detection for the NO_x sensor (see section *Dew Point Detection* on page 50), and it is designed for thermocouples of type K. For up to two measuring points, you define a temperature threshold respectively, that must not be exceeded. If the exhaust gas temperature is to be monitored both before and after the catalytic converter, you can also define the permissible temperature difference range of the exhaust gas between the catalyst inlet and catalyst outlet.

You can configure the exhaust gas temperature monitoring in the *NO_x Setup* view (see section *Preferences* on page 124).

5.1.6 Dew Point Detection

For the dew point detection of the NO_x sensor, the temperature in the exhaust pipe at the catalyst outlet is used, which is measured by the NO_x monitor to monitor the exhaust gas temperature (see section *Exhaust Gas Temperature Monitoring* on page 50). The dew point detection threshold is firmly predefined in the NO_x monitor.

For engines with two catalytic converters in split exhaust gas lines, the exhaust gas temperature at the catalyst outlet must be measured in both exhaust gas lines for NO_x sensor dew point detection.

The status of the dew point detection is displayed in the *NO_x Monitoring* view of the EasyNO_x (see section *Overview* on page 114).

5.1.7 Normal Operation Detection

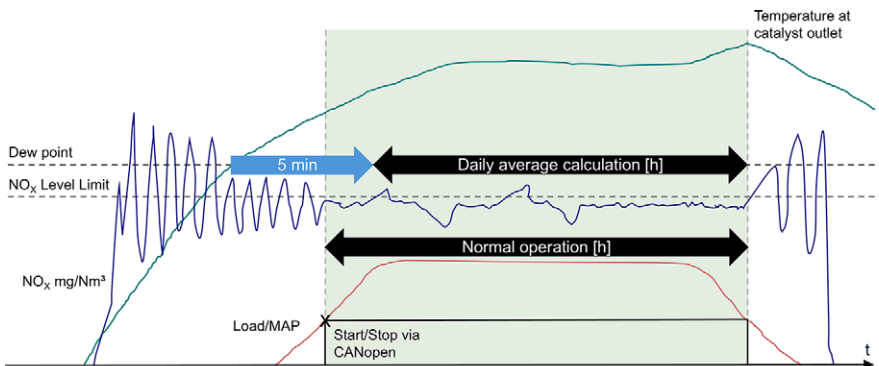
The NO_x monitoring of the EasyNO_x provides two modes for normal operation detection:

- **Load**

In this mode, the NO_x monitor detects normal operation when the engine to be monitored reaches a specific load that can be set in the NO_x monitor. For this purpose, the NO_x monitor can evaluate the analog load signal of a master control that is connected to the CAN bus module of the EasyNO_x system, to the optional I/O communication module BPlus or to a suitable I/O module supporting device profile CiA® 401 or CiA® 404.

Alternatively, the NO_x monitor can use the manifold pressure as an indicator for the engine load. For this purpose, a pressure sensor can be connected directly to the CAN bus module of the EasyNO_x system or alternatively the signal of a pressure sensor can be forwarded to the CAN bus module via the control cabinet. The manifold pressure threshold for normal operation detection can be configured.

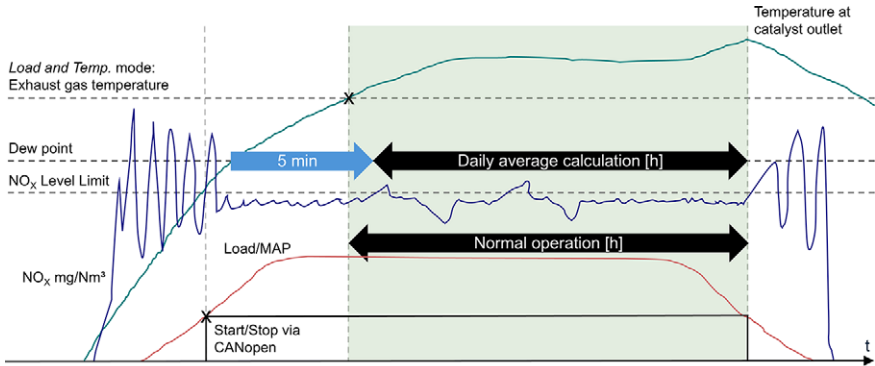
In conjunction with the optional I/O communication module BPlus or a suitable I/O module supporting device profile CiA® 401 or CiA® 404, there is also the option of a master control releasing normal operation via the binary input of the I/O module (see section *Binary Inputs* on page 190).



5 Functions

– Load and Temperature

As an additional condition, you can configure that a specific exhaust gas temperature must be reached at the catalyst outlet in order for normal operation to be detected on the engine to be monitored. For engines with two catalytic converters in split exhaust gas lines, this condition must be met in both exhaust gas lines. If the exhaust gas temperature falls 20 °C (68 °F) below the configured value, the NO_x monitor interprets this as an exit from normal operation.



The status of the normal operation detection is displayed in the *NO_x Monitoring* view of the Easy-NO_x (see section *Overview* on page 114). You can configure the normal operation detection in the *NO_x Setup* view (see section *Preferences* on page 124).

5.1.8 Daily Log

Every 10 seconds, the NO_x monitor of the EasyNO_x saves a complete record of all relevant measured values, timers, and status values to a daily log on the memory card inserted in the EasyNO_x. Selected measured values of the daily logs can be visualized in the NO_x *History* view of the NO_x monitor (see section *History* on page 118). Via the USB interface of the EasyNO_x, each daily log can be exported as a CSV file to a USB flash drive (see section *Export* on page 122).

5.1.9 Annual Log

For each calendar year, the NO_x monitor of the EasyNO_x summarizes the relevant measured values and timers of all measurement days in an annual log. This annual log is stored on the memory card inserted in the EasyNO_x and contains the following information:

- Measured values: average, minimum value, maximum value, and standard deviation related to the measurement day
- Timers: daily value related to the measurement day and total value related to the calendar year

Note that in the annual log, the daily averages for nitrogen oxide (NO_x [ppm]) and oxygen (O₂ [%]) include all valid readings from the day, including those outside of normal operation.

Via the USB interface of the EasyNO_x, each annual log can be exported as a CSV file to a USB flash drive (see section *Export* on page 122).

5.1.10 Logbook

In a logbook, the NO_x monitor of the EasyNO_x logs emission-related events. Additionally, custom entries can be made in this logbook (see section *Logbook* on page 120). The logbook can be exported to a USB flash drive as part of the NO_x monitoring report (see section *NO_x Monitoring Report* on page 54). You can maintain the logbook in accordance with standard sheet VDMA 6299: 2019-09.

5 Functions

5.1.11 NO_x Monitoring Report

For each calendar year for which the NO_x monitor has values, the EasyNO_x can generate a NO_x monitoring report as a PDF file if needed and export it to a USB flash drive (see section *Export on* page 122). This NO_x monitoring report contains the following information:

[illegible]

Illustration example

Pos.	Description
1	Name of the monitored engine
2	Operator information
3	Annual summary
4	Time limit for twelve consecutive months as per 44th BImSchV § 20 (4)
5	Configuration of the respective NO _x monitor
6	Logbook of the respective NO _x monitor
7	Daily values of the respective NO _x monitor
8	Miscellaneous data on the EasyNO _x

Note that in the *Summary* [2](#) section, the entries *NO_x Average* and *O₂ Average* each represent the last recorded daily average from the section *Daily Values* [7](#).

Exceedances of the time limit within twelve consecutive months are highlighted in red in the *Sum* column of the time limit overview ⁴

5.2 Ignition Controller

The EasyNO_x can visualize and record specific engine operating data from supported MOTORTECH ignition controllers (see section *Functional Description* on page 22). You can make runtime adjustments to selected ignition controller settings via the EasyNO_x. One supported ignition controller can be connected to the EasyNO_x via the CAN bus interface CAN1.

A description of the functions and views of an added ignition controller can be found in the section *Ignition Controller* on page 131.

5.3 Detonation Controller

The EasyNO_x can visualize and record specific engine operating data from supported MOTORTECH detonation controllers (see section *Functional Description* on page 22). If warnings and errors occur in the detonation controller, the EasyNO_x can switch two binary outputs via the CAN bus interface CAN1. One supported detonation controller can be connected to the EasyNO_x via the CAN bus interface CAN1.

A description of the functions and views of an added detonation controller can be found in the section *Detonation Controller* on page 159.

5.4 Temperature Module

The EasyNO_x can visualize and record engine operating data from supported MOTORTECH temperature modules (see section *Functional Description* on page 22). If warnings and errors occur in the temperature module, the EasyNO_x can switch binary outputs correspondingly via the CAN bus interface CAN1. Supported temperature modules are fully configurable via the EasyNO_x. Up to three supported temperature modules can be connected to the EasyNO_x via the CAN bus interface CAN1.

A description of the functions and views of an added temperature module can be found in the section *Temperature Module* on page 167.

5.5 I/O Communication Module BPlus

The optional I/O communication module BPlus available from MOTORTECH provides the EasyNO_x with the following inputs and outputs:

- One analog input
- One analog output
- One binary input
- Three binary outputs

Depending on the application, these inputs and outputs can be linked to different functions, for example for the input and output of measured values or for signalling warnings, errors, or certain operating states from or to a master control. Up to two I/O communication modules BPlus can be connected to the EasyNO_x via the CAN bus interface CAN1.

A description of the functions and views of an added I/O communication module BPlus can be found in the section *I/O Communication Module BPlus, I/O Module (CiA401, CiA404)* on page 184.

5 Functions

5.6 I/O Module (Device Profile CiA® 401/404)

The EasyNO_x can use analog and binary inputs and outputs from I/O modules that support the device profile CiA® 401 or 404 and that are connected to the EasyNO_x via the CAN interface CAN1. The number of available analog and binary inputs and outputs depends on the I/O module to which the EasyNO_x is connected.

Depending on the application, the inputs and outputs can be linked to different functions, for example for the input and output of measured values or for signalling warnings and errors or certain operating states from or to a master control.

Up to three supported I/O modules can be connected to the EasyNO_x via the CAN bus interface CAN1. Of these, a maximum of two modules can be the I/O communication modules from BPlus (see section *I/O Communication Module BPlus* on page 55), which are specially available from MOTORTECH.

For more information on the functions and views of an added I/O module, read the section *I/O Communication Module BPlus, I/O Module (CiA401, CiA404)* on page 184 .

5.7 Generic Device

The EasyNO_x can integrate up to three devices that it does not support directly, but to which it is connected via the CAN bus interface CAN1 (for example a protocol converter), as a so-called generic device each. Generic devices are started along with the EasyNO_x, and their connection status is monitored by the EasyNO_x. Generic devices are not displayed in the start menu, but their connection status is visualized in the menu bar of the EasyNO_x and logged in the *Event Log* view. For more information on the generic devices, see section *Generic Device* on page 194.

6.1 Unpacking

Before unpacking, observe the instructions in section *Proper Transport* on page 21.

To prevent condensation from forming in the sensing element of the supplied NO_x sensor P/N 56.03.003, you should avoid any temperature shocks when opening the packaging. Before opening, allow the shipping unit to adjust to the mounting temperature, and after having opened it, avoid temperature changes. The supplied NO_x sensor must not be taken out of its packaging in polluted air and under bad weather conditions (e.g. oil, water, snow, dust, sand, smoke).

Unpack the components of the EasyNO_x system without damaging them and ensure that the operating manual is always within reach of the device and easily accessible. Do not remove the protective cap from the sensing element until you are instructed to do so within this operating manual (see section *Mounting the Sensing Element of NO_x Sensor P/N 56.03.003* on page 59). Check the contents for completeness and verify that the equipment meets your application requirements.

Scope of Supply

The scope of supply of the EasyNO_x includes:

- EasyNO_x incl. housing and inserted SDHC card 16 GB
- Sealing plugs for EasyNO_x housing (4x)
- Sealing insert for cable gland M25 of EasyNO_x housing, 3x ø7 mm (2x)
- Sealing insert pin for sealing insert opening ø7 mm (6x)
- Wire end ferrules
- Up to two CAN bus/NO_x sensor modules pre-mounted on a mounting plate, each including
 - Sealing insert pin for cable gland M16, ø9 mm
 - Sealing insert pin for cable gland M12, ø7 mm (2x)
 - Welding boss for NO_x sensor
 - Locking screw for welding boss
- Storage device including
 - EasyNO_x operating manual
 - Handling guidelines for MOTORTECH NO_x sensors
 - MOTORTECH Trend Viewer software for visualizing EasyNO_x recordings of specific devices
- Safety instructions for the EasyNO_x
- EXTENDED package: up to two I/O communication modules BPlus

Optional accessories:

- CAN bus hybrid cable for connecting the CAN bus modules to the EasyNO_x and to the power supply
- Sheath thermocouples with suitable compression fitting
- Pressure sensor

6 Installation Instruction

6.2 Installation of the EasyNO_x

The EasyNO_x is typically mounted on the wall in the control room at a suitable accessible location. If there is no control room, the EasyNO_x can also be mounted in the engine room, but not in the immediate vicinity of the engine in order to protect it from high temperatures and vibrations. The installation location must be selected in such a way that there is sufficient space for maintenance and repair work and that the EasyNO_x can be operated without problems. The mechanical specifications of the EasyNO_x must always be complied with (see section *Mechanical Data* on page 26). The EasyNO_x is not suited for outdoor installation.

For wall mounting, always use the four screw openings on the back of the EasyNO_x housing (see section *Overview Drawings* on page 31). Ensure that the wall has sufficient load-bearing capacity and use fasteners that are suitable for wall mounting. In order to ensure the IP protection class of the EasyNO_x, carry out the fastening in such a way that the screw openings are sufficiently sealed.



Sealing plugs for screw openings

To ensure that the IP protection class of the EasyNO_x is also guaranteed during storage or transport, you can close the four screw openings with the supplied sealing plugs if required.

6.3 Mounting of CAN Bus/NO_x Sensor Module

The CAN bus/NO_x sensor modules are to be installed at a suitable location in direct proximity to the engine, but not on the engine. When selecting the mounting locations, pay attention to the maximum available cable lengths and specifications of the individual connection cables. Also comply with the specifications for laying the connection cable between the sensing element and the evaluation unit of the NO_x sensor P/N 56.03.003 from the section *Laying the Connection Cable* on page 62.

Also observe the mechanical specifications of the CAN bus/NO_x sensor module (see section *Mechanical Data* on page 35). Also ensure that the J1939 network, to which the EasyNO_x and the CAN bus/NO_x sensor modules are connected, complies with the maximum cable length of 250 m (820').

The CAN bus/NO_x sensor module is mounted via the screw openings on the mounting plate (see section *Overview Drawings* on page 40). Use suitable fasteners and make sure that the load-bearing capacity is sufficient at the mounting location.

6.4 Mounting the Sensing Element of NO_x Sensor P/N 56.03.003

**Risk of suffocation! Risk of poisoning!**

Leaks in the exhaust pipe can cause exhaust gases to escape and people in the system room can suffocate or be poisoned. After mounting the sensors, check the tightness of the exhaust pipe.

**Operational safety!**

To safely mount the NO_x sensor, be sure to observe the following:

- To protect the NO_x sensor and yourself, wear ESD-compliant work gloves. To protect the NO_x sensor against electrostatic discharge, also comply with IEC 61340-5-1 and IEC TR 61340-5-2 in their respective valid versions.
- Under no circumstances touch the probe of the sensing element while mounting.

**Operational safety!**

The NO_x sensor must not be used any further under any circumstances if it is damaged or the sensing element of the NO_x sensor has been mechanically shocked (e.g. by dropping it on the floor or impacts on the sensing element). In these cases, contact MOTORTECH for sensor replacement (see *Customer Service Information* on page 200).

**Operational safety!**

Proper functioning of the NO_x sensor is only guaranteed if the sensing element does not overheat at the mounting location. Avoid accumulated heat at the sensing element and ensure sufficient ventilation of the sensing element by ambient air.

**Operational safety!**

The sensing element may be mounted a maximum of one time. The electrical connection to the NO_x sensor's evaluation unit may be established and disconnected a maximum of 20 times. After that, proper functioning of the sensor can no longer be guaranteed.

6 Installation Instruction



SCR catalytic converter: no monitoring in accordance with VDMA 6299:2019-09

The NO_x monitor of the EasyNO_x does not evaluate the dosing release of the urea solution in an SCR catalytic converter. Thus, the NO_x monitor of the EasyNO_x is not suited for monitoring SCR catalytic converters in accordance with the standard sheet VDMA 6299:2019-09.

The following sections describe the mounting of the sensing element of the NO_x sensor from the CAN bus/NO_x sensor module.

6.4.1 Mounting Position of Sensing Element

The possible mounting positions of the sensing element depend on the catalytic converter type used:

- Oxidizing catalytic converter: Select a suitable position between the exhaust gas turbocharger and the exhaust gas heat exchanger before or after the catalytic converter. For engines with two catalytic converters in split exhaust gas lines, select a suitable position before or after the split exhaust gas lines.
- SCR catalytic converter: Select a suitable position after the catalytic converter.

Ensure that there is a sufficient distance between the sensing element and the exhaust gas turbocharger. Normally this distance should be at least 1 meter (3.3').

The NO_x sensor is only suited for measurement when mounted in an exhaust pipe.

The mounting position of the sensing element must be defined in such a way that no condensation water is able to collect in the protective tube of the sensing element.

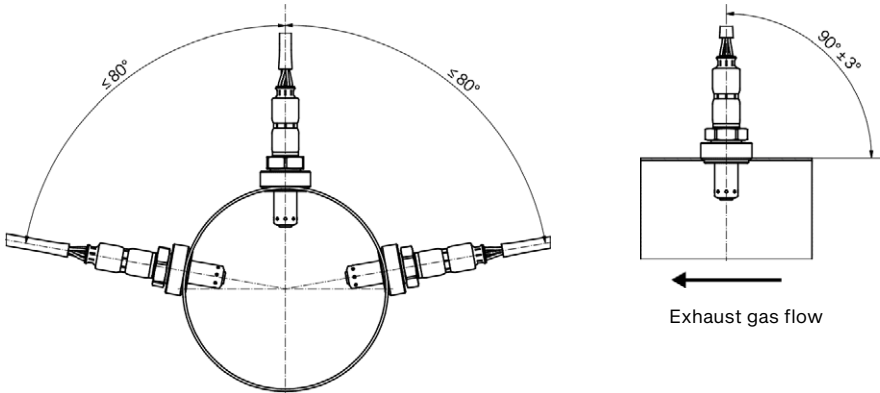
A pipe connected to the exhaust system (e.g. for changing the gas mass flow or gas pressure) must not be located in the environment of the sensing element.

If the intake pipe is located near the sensing element, the distance between the sensing element and the intake pipe must be chosen in a way that condensed liquid droplets will not stream back to the sensing element due to gas pulsation.

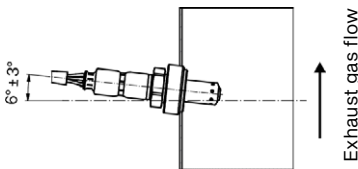
When mounting the sensing element after the catalytic converter, make sure that no material escapes from the catalytic converter.

The possible tilt angles of the sensing element depend on the course of the exhaust pipe. Mounting in a vertical exhaust pipe is not recommended by MOTORTECH.

Tilt angles horizontal exhaust pipe



Tilt angles vertical exhaust pipe



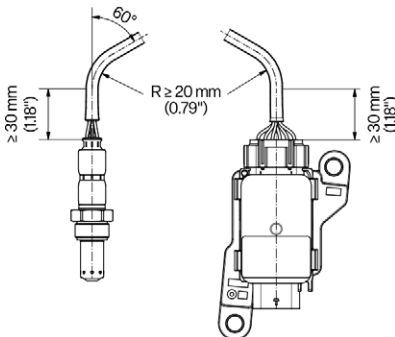
The sensing element heats up as soon as the NO_x sensor is powered. Therefore, the sensing element must be installed on the exhaust pipe at a suitable location at which people at the plant cannot be burned by it, or an appropriate protection must be installed around the sensing element that prevents contact with it.

Make sure that the sensing element of the NO_x sensor does not overheat at the mounting location. Avoid accumulated heat at the sensing element and ensure sufficient ventilation of the sensing element by ambient air. Also comply with the specified temperature limits (see section *Mechanical Data* on page 26).

6 Installation Instruction

6.4.2 Laying the Connection Cable

To ensure proper functioning of the connection cable between the sensing element and the evaluation unit, the minimum bending radius of the connection cable of 20 mm (0.79") must be adhered to at the mounting position and the first bend of the connection cable must maintain a minimum distance of 30 mm (1.18") on each end. In addition, the angle of the cable outlet at the sensing element grommet must not exceed 60° and there must be no pull on the connection cable.



Also, it must be possible to lay the connection cable in such a way that it is not affected by heat-conducting or heat-radiating components.

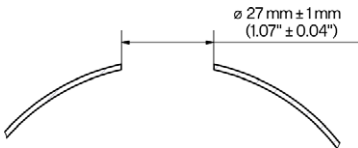
6.4.3 Mounting the Sensing Element

Make sure that the engine is switched off while mounting and that the EasyNO_x system is not live. Also make sure that the exhaust pipe has cooled down sufficiently and that there are no exhaust gases in the exhaust pipe.

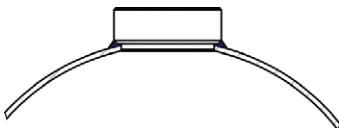
The sensing element of the NO_x sensor is screwed into the exhaust pipe via the supplied stainless steel welding boss (material number 1.4301) from MOTORTECH. The supplied locking screw is used for closing the welding boss if you no longer want to use the opening or close it temporarily, and as a welding aid for the welding boss.

Proceed as follows:

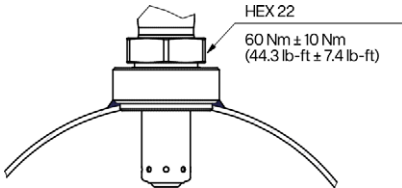
1. At the selected mounting position in the exhaust pipe, drill a hole with a diameter of 27 mm ± 1 mm (1.07" ± 0.04") into the exhaust pipe.



2. Screw the supplied locking screw into the supplied welding boss and weld the stainless steel welding boss (material number 1.4301) into this hole with a suitable welding filler.



3. At the mounting position of the sensing element, determine the NO_2/NO_x ratio (correction factor K) in the exhaust gas with a suitable calibrated exhaust gas analyzer. More information on this is available in the section *Determining the NO_2/NO_x Ratio* on page 64.
4. Remove the protective cap from the probe of the sensing element. Do not pull on the connection cable, but hold the sensing element only by its metal body.
5. Check whether the thread of the sensing element is sufficiently greased. If necessary, re-grease only the thread of the sensing element with a small amount of high temperature grease (Optimol Paste MF from Castrol® or Never Seez Regular Grade from Bostik®, recommendation $40 \text{ mg} \pm 10 \text{ mg}$). Also make sure that no dirt, dust, or grease gets deposited in or on the probe while mounting.
6. Insert the sensing element into the welding boss and screw the sensing element into the welding boss via its hexagon nut by hand first. The outgoing wires must not twist in the process. Therefore counter the sensing element with your hand.
7. Then tighten the sensing element over its hexagon nut using a calibrated torque tool with a torque of $60 \text{ Nm} \pm 10 \text{ Nm}$ ($44.3 \text{ lb-ft} \pm 7.4 \text{ lb-ft}$).



8. Then lay the connection cable between the sensing element and the evaluation unit of the NO_x sensor. When doing so, comply with the specifications in the section *Laying the Connection Cable* on page 62.
 - The sensing element of the NO_x sensor is mounted.
9. Later, when configuring the Easy NO_x , enter the NO_2/NO_x ratio determined above in the *NO_x Setup* view of the respective NO_x monitor (see section *Preferences* on page 124).
10. Also, when configuring the Easy NO_x , enter the sensor-specific factor $K\text{NO}_2$ for the corrective calculation of the NO_2 sensitivity in the *NO_x Setup* view of the respective NO_x monitor (see section *Preferences* on page 124). For the correction factor, refer to the entry *NO_2 Gain* in the *NO_x Sensor* view of the respective NO_x monitor (see section *Sensor* on page 129).

6 Installation Instruction

6.5 Determining the NO₂/NO_x Ratio

When the NO_x sensor is mounted for the first time at the installation location and each time the NO_x sensor is replaced, the NO₂/NO_x ratio (correction factor K) in the exhaust gas must be determined at the mounting position of the sensing element. Use a suitable calibrated exhaust gas analyzer and determine the concentration of nitrogen dioxide (NO₂) and nitrogen oxide (NO_x) at the sensing element's mounting position. The correction factor K results from the following equation:

$$K = \frac{NO_2}{NO_x}$$

When configuring the EasyNO_x, enter this value in the NO_x Setup view of the respective NO_x monitor (see section *Preferences* on page 124).

Always determine the NO₂/NO_x ratio before screwing the sensing element in for the first time and avoid repeatedly screwing the sensing element in and out. Also follow the instructions in the section *Mounting the Sensing Element of NO_x Sensor P/N 56.03.003* on page 59 when mounting the NO_x sensor for the first time and the instructions in the section *Replacing the NO_x Sensor* on page 202 when replacing the NO_x sensor.

6.6 Installation Locations of Thermocouples



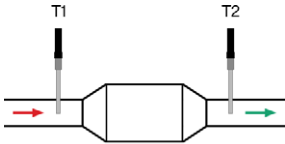
Risk of suffocation! Risk of poisoning!

Leaks in the exhaust pipe can cause exhaust gases to escape and people in the system room can suffocate or be poisoned. After mounting the sensors, check the tightness of the exhaust pipe.

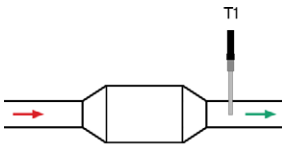
To monitor catalyst operation, to detect the dew point for the NO_x sensor, and optionally to detect normal operation, it is necessary to install a thermocouple in the exhaust pipe at the catalyst outlet at a suitable location. Only use type K thermocouples with the measuring point insulated from the housing. When installing the thermocouples, follow the manufacturer's instructions and ensure that the thermocouples are positioned centrally in the exhaust pipe.

The following layouts are supported by the EasyNO_x:

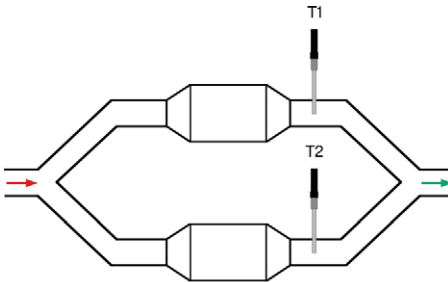
- Before and after catalytic converter (*Before & After Cat*)
In this arrangement, mount the thermocouples at equal distances before and after the catalytic converter.



- After catalytic converter (*One After Cat*)



- In two exhaust gas lines after catalytic converter (*Two After Cat*)
The measured values of both thermocouples are used to detect the dew point for the NO_x sensor and, optionally, to detect normal operation.



6.7 Installation Location of Pressure Sensor



Risk of suffocation! Risk of poisoning!

Leaks in the exhaust pipe can cause exhaust gases to escape and people in the system room can suffocate or be poisoned. After mounting the sensors, check the tightness of the exhaust pipe.

If you want to use the manifold pressure as engine load indicator for normal operation detection and use for this purpose the NO_x monitoring mode *MAP Naturally Aspirated* or *MAP Turbo* in the EasyNO_x (see section *Preferences* on page 124), a pressure sensor 4–20 mA is required.

Install the pressure sensor on the intake side of the engine after the throttle. The installation location must have adequate mechanical strength and must not exceed the specified temperature ranges. Observe the tightening torques as specified by the manufacturer. Comply with the pertinent regulations for wiring. Upon completion of the assembly works, check the system's tightness.

The pressure sensor can be connected directly to the CAN bus module. Alternatively, its signal can be routed to the CAN bus module via the control cabinet. For more information, read the section *Wiring of Pressure Sensor, Pressure Signal, Load Signal* on page 73.

6 Installation Instruction

6.8 Determining Manifold Pressure for Normal Operation Detection

This step is mandatory if you want to use the manifold pressure as engine load indicator for normal operation detection and use for this purpose the NO_x monitoring mode *MAP Naturally Aspirated* or *MAP Turbo* in the EasyNO_x (see section *Preferences* on page 124). In that case, you need to determine the manifold pressure that indicates the start of normal operation on the intake side of your engine (for example 30 % nominal load as per VDMA 6299:2019-09 or nominal load as per the engine manufacturer's specifications). In the case of a naturally aspirated engine, this manifold pressure must then be undercut, in the case of a turbocharged engine it must be exceeded.

6.9 Mounting of I/O Communication Module BPlus



Assignment of the modules to the engines

Set up your EasyNO_x system in such a way that the first NO_x monitor of the EasyNO_x monitors the first engine and the second NO_x monitor of the EasyNO_x monitors the second engine. Ensure the correct configuration of the EasyNO_x components (CAN bus module, NO_x sensor, I/O communication module BPlus).

In the optional I/O communication modules BPlus, the node IDs are unchangeably pre-configured. The MOTORTECH part number (P/N) tells you which node ID is configured in the respective I/O communication module.

Part number	Node ID
P/N 63.05.014-01	10 (0x0A)
P/N 63.05.014-02	11 (0x0B)

MOTORTECH recommends that you wire and configure the I/O communication module BPlus with node ID 10 for use with the first NO_x monitor of the EasyNO_x and the I/O communication module BPlus with node ID 11 for use with the second NO_x monitor of the EasyNO_x.

Accordingly, mount the I/O communication module with the appropriate part number onto a horizontal top hat rail in the control cabinet of the respective engine. In doing so, observe that the CANopen® network to which the EasyNO_x and the I/O communication modules BPlus are connected must comply with the maximum cable length of 250 m (820').

6.10 Mounting of I/O Module (Device Profile CiA® 401/404)

For mounting the I/O modules supporting device profile CiA® 401 or CiA® 404, read the manufacturer's documentation accompanying the product.

7.1 EasyNO_x

The following sections describe the wiring of the EasyNO_x. The EasyNO_x must be wired without voltage.

7.1.1 Opening and Closing of Housing



Operational safety!

The NO_x monitoring devices, including the EasyNO_x, must be operated with closed housings. Otherwise, proper functioning of the devices and compliance with the protection classes cannot be guaranteed.

When the system is powered off, the housings may only be opened for wiring and configuration. When the housing is open, make sure that no moisture forms in the housing.

To wire the EasyNO_x, you must open the door of the EasyNO_x housing. In order to be able to open the door, use a suitable slotted screwdriver or a screwdriver T25 to turn both locks on the right side of the housing door (see position **3** in the subsection *Components* of the section *Overview Drawings* on page 31) to the open position. Having finished the work in the housing, close the door of the EasyNO_x housing and turn the locks on the right side of the housing door to the closed position.

Closed position
(long slot on top)



Open position
(long slot to the left)



7 Wiring and Configuration

7.1.2 Wiring



Risk of injury!

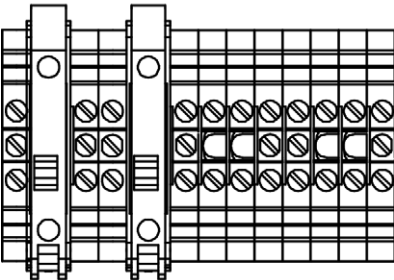
The EasyNO_x is designed for operation in circuits with **protected extra-low voltage (PELV)**. The voltages in these circuits must not exceed 50 V AC or 75 V DC.

The EasyNO_x must not be electrically connected to circuits which carry dangerously high voltages or which could do so if a single fault occurs.

Therefore, the following conditions, among others, must be fulfilled:

- The power supply may only be provided from power supply units with safe electrical isolation or from batteries.
- Relays with safe isolation must be used for coupling to circuits that carry or in the event of a failure could carry dangerous voltage.
- All currently applicable standards and regulations must be taken into account.

Do the wiring as follows:



Earth	L +	L -	L -	L +	Shield	Lo	Hi	Com	Com	Hi	Lo	Shield
Power in 24 V _~ max. 10 A		Power out max. 8 A		CAN1 CANopen				CAN2 J1939				

Designation		Function
Power in 24 V _~	Earth, L +, L -	Terminals for the power supply of the EasyNO _x system (16 V DC to 32 V DC, nominal voltage 24 V DC)
Power out	L -, L +	Terminals for passing through the supply voltage to the first CAN bus/NO _x sensor module (e.g. via the CAN bus hybrid cable from MOTORTECH)
CAN1 CANopen	Shield, Lo, Hi, Com	Terminals of the CAN bus interface CAN1 (protocol CAN- open®) for connection to the devices in the CANopen® network the including I/O communication modules BPlus and the I/O modules supporting device profile CiA® 401 or CiA® 404 (see <i>Wiring CANopen® Network (CAN1)</i> on page 76)
CAN2 J1939	Com, Hi, Lo, Shield	Terminals of the CAN bus interface CAN2 (protocol J1939) for connection to the first CAN bus/NO _x sensor module (e.g. via the CAN bus hybrid cable from MOTOR- TECH)

Use suitable wire end ferrules for each wire that you place on a terminal.

Use a three-core round cable with a minimum wire cross section of 1.5 mm² to connect the Easy-NO_x system to the power supply. The earth of the EasyNO_x system must be connected to the earth of the system.

7 Wiring and Configuration

For CAN bus wiring, only use shielded CAN cables in compliance with the standards ISO 11898-2 and CiA® 303-1. The *Shield* terminals at the CAN bus interfaces CAN1 and CAN2 are intended to connect the shields of the CAN buses to earth potential. Connect the shield from the CAN bus at CAN2 to the *Shield* terminal in the *CAN2 J1939* area. If needed, also connect the shield from the CAN bus at CAN1 to the *Shield* terminal in the *CAN1 CANopen* area. For further details on the wiring of the CAN bus at CAN1, read the section *Wiring CANopen® Network (CAN1)* on page 76.

Unless you use the CAN bus hybrid cable from MOTORTECH, the CAN and power supply cables to the CAN bus/NO_x sensor modules must be routed in parallel.

The power supply cables to the CAN bus/NO_x sensor modules should have a minimum wire cross-section of 1.5 mm². Depending on the total cable length of both power supply cables and the number of CAN bus/NO_x sensor modules connected, provide sufficient supply voltage to the EasyNO_x. Possible wire cross-sections and total cable lengths depending on the supply voltage can be found in the following tables.

Wire cross-section 1.5 mm²

Total cable length	Minimum supply voltage	
	1 module	2 modules
25 m (82')	18 V DC	20 V DC
50 m (164')	20 V DC	24 V DC

Wire cross-section 2.5 mm²

Total cable length	Minimum supply voltage	
	1 module	2 modules
25 m (82')	17.3 V DC	18.5 V DC
50 m (164')	18.5 V DC	21 V DC

Insert the supplied sealing inserts and sealing insert pins into the cable glands through which you do not feed any cables. Close all cable glands with a tightening torque of 8 Nm (5.9 lb-ft).

Close the door of the EasyNO_x housing after wiring the EasyNO_x and turn the locks of the door to the closed position (see section *Opening and Closing of Housing* on page 67).

7.2 CAN Bus/NO_x Sensor Module

The following sections describe the wiring and configuration of the CAN bus/NO_x sensor module. The CAN bus/NO_x sensor module must be wired without voltage.

7.2.1 Opening and Closing of Module



Operational safety!

The NO_x monitoring devices, including the EasyNO_x, must be operated with closed housings. Otherwise, proper functioning of the devices and compliance with the protection classes cannot be guaranteed.

When the system is powered off, the housings may only be opened for wiring and configuration. When the housing is open, make sure that no moisture forms in the housing.

To wire and configure the CAN bus module and the NO_x sensor, you have to open the housing cover of the CAN bus module. To do so, loosen the four cover screws on the top with a suitable screwdriver and then remove the housing cover. Regard that the cover screws are captively connected to the housing cover.

After wiring and configuration, put the housing cover back onto the CAN bus module and firmly tighten the four cover screws with a suitable screwdriver until stop so that the CAN bus module is securely closed again.

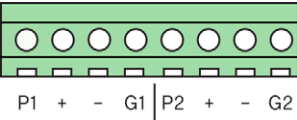
7.2.2 Grounding

The grounding cable (see position **3** in subsection *Components* of the section *Overview Drawings* on page 40) of the CAN bus/NO_x sensor module must be connected to the earth of the system.

7 Wiring and Configuration

7.2.3 Wiring of Thermocouples

All cables must be fed through a cable gland at a suitable position of the CAN bus module. Use suitable wire end ferrules for each wire that you place on a terminal.



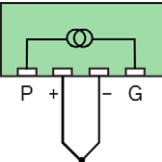
Connect the first thermocouple to input 1. Optionally, connect the second thermocouple to input 2 (see section *Installation Locations of Thermocouples* on page 64). Depending on the layout, connect the thermocouples as follows:

Layout	Input 1 (T1)	Input 2 (T2)
Before and after catalytic converter (<i>Before & After Cat</i>)	Before catalytic converter	After catalytic converter
After catalytic converter (<i>One After Cat</i>)	After catalytic converter	–
In two exhaust gas lines after catalytic converter (<i>Two After Cat</i>)	First exhaust gas line: after catalytic converter	Second exhaust gas line: after catalytic converter

If you do not use input 2, bridge this input with a jumper between the terminals + and –. This prevents the measuring circuit from being disturbed by interfering radiation.

Only use thermocouples with shielded leads. When connecting, make sure that the terminal designation corresponds to the polarity of the thermocouples.

Connect the thermocouples as follows:



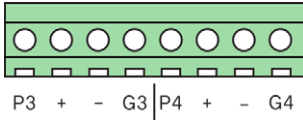
The type K sheathed thermocouples from MOTORTECH, which are available as optional accessory for the EasyNO_x, are marked in accordance with IEC 60584-3 and are assigned as follows:

Color	Assignment
Green	+
White	–

Connect the shields of the thermocouple leads with the cable glands. Do not lay the shields inside the CAN bus module.

7.2.4 Wiring of Pressure Sensor, Pressure Signal, Load Signal

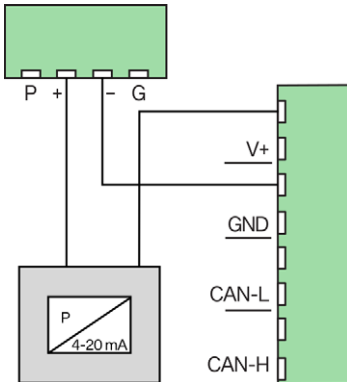
All cables must be fed through a cable gland at a suitable position of the CAN bus module. Use suitable wire end ferrules for each wire that you place on a terminal.



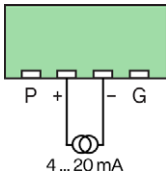
Depending on the intended NO_x monitoring mode (see *Preferences* on page 124), connect a pressure sensor 4–20 mA, a pressure signal 4–20 mA, or a load signal 4–20 mA to input 3. You can optionally connect another 4–20 mA signal to input 4, whose current value is displayed in the EasyNO_x in the *NO_x Monitoring* view. Note that the large cable gland at the long side of the CAN bus module (see section *Wiring of Power Supply and CAN Bus* on page 74).

Connect the shields of the wires with the cable glands. Do not lay the shields inside the CAN bus module. No bridges may be set between the measurement inputs.

Connect a pressure sensor as shown in the following illustration. The wire cross-section of the power supply cable from the pressure sensor should be at least 0.5 mm². For smaller wire cross-sections, ensure that the cable is appropriately fused.



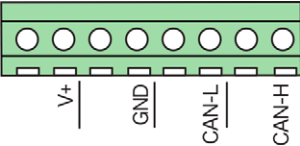
Connect active signal sources 4–20 mA (pressure signal, load signal) as shown in the following illustration. Use shielded wires for connecting active signals 4–20 mA.



7 Wiring and Configuration

7.2.5 Wiring of Power Supply and CAN Bus

All cables must be fed through a cable gland at a suitable position of the CAN bus module. Use suitable wire end ferrules for each wire that you place on a terminal.



Designation	Function
V+, GND	Terminals for the supply voltage coming from the Easy-NO _x or from the first CAN bus module and for passing through the supply voltage to the NO _x sensor and optionally to a second CAN bus module
CAN-L, CAN-H	Terminals for the CAN cable coming from the EasyNO _x or from the first CAN bus module and for passing through the CAN signal to the NO _x sensor and optionally to a second CAN bus module

Note that each terminal is available twofold. If more than one wire has to be connected to a terminal, use suitable double wire end ferrules for a safe connection (not included in scope of supply). Use these terminals to connect the CAN bus module to the supply voltage and the CAN cable from the EasyNO_x or the first CAN bus module. Use a shielded CAN cable in compliance with the standards ISO 11898-2 and CiA® 303-1. Connect the shield of the CAN cable with the cable glands. Do not lay the shield inside the CAN bus module.

To pass through the supply voltage and the CAN signal, connect the NO_x sensor and, if needed, a second CAN bus module to these terminals. The CAN cable to the second CAN bus module must be shielded and comply with the standards ISO 11898-2 and CiA® 303-1. Unless you use the CAN bus hybrid cable from MOTORTECH, the CAN and power supply cable to the second CAN bus module must be routed in parallel.

The connection cable from the CAN bus module to the evaluation unit of the NO_x sensor is assigned as follows:

Color	Assignment
White	L +
Brown	L –
Green	CAN Lo
Yellow	CAN Hi
Gray	Node ID of the NO _x sensor (see section <i>Node ID NO_x Sensor</i> on page 75)

To avoid coupling of interference signals, make sure that the CAN lines are not laid over the signal lines when wiring.

If you connect a second CAN bus module to the first CAN bus module, pass the power supply and CAN cable to the second CAN bus module through the large cable gland at the long side of the CAN bus module on the right.

7.2.6 Closing of Cable Glands

Insert the supplied sealing inserts and sealing insert pins into the cable glands through which you do not feed any cables. Close the large M16 cable glands with a tightening torque of 3 Nm (2.2 lb-ft) and the small M12 cable glands with a tightening torque of 1.2 Nm (0.9 lb-ft).


7.2.7 CAN Bus Termination

The CAN bus module is the last device in the J1939 network and must be terminated. If you use two CAN bus modules, terminate only the last CAN bus module in the J1939 network. To do so, set the *Term* switch to the desired position using a fine screwdriver.

Termination off

Term


Off/On



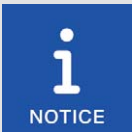
Termination on

Term

Off/On



7.2.8 Node ID NO_x Sensor



Assignment of the modules to the engines

Set up your EasyNO_x system in such a way that the first NO_x monitor of the EasyNO_x monitors the first engine and the second NO_x monitor of the EasyNO_x monitors the second engine. Ensure the correct configuration of the EasyNO_x components (CAN bus module, NO_x sensor, I/O communication module BPlus).

For communication with the EasyNO_x via the CAN bus, the correct node ID must be set for the NO_x sensor. Set the node ID of the NO_x sensor using the grey wire of the harness to the NO_x sensor as follows.

- First NO_x monitor (NO_x:1): Put the grey wire on the GND terminal.
- Second NO_x monitor (NO_x:2): Do not connect the grey wire.

7.2.9 Node ID CAN Bus Module

For communication with the EasyNO_x via the CAN bus, the correct node ID be set on the CAN bus module. Set the node ID of the CAN bus module via the DIP switches *Modul-ID* as follows:

CAN bus module	1	2	3	4	5	6	7	8
First NO _x monitor (NO _x :1)	0	0	0	0	0	0	1	0
Second NO _x monitor (NO _x :2)	1	0	0	0	0	0	1	0

7 Wiring and Configuration

7.2.10 Bit Rate CAN Bus Module

Set the bit rate of the CAN bus module to 250 kbit/s via the DIP switches *Baud*:

1	2	3	4
0	1	1	1

7.2.11 Device Setup EasyNO_x

For each CAN bus/NO_x sensor module you use, add a NO_x monitor (display name *NO_x*) in the *Device Setup* view of the EasyNO_x (see section *Adding a Device* on page 91). Set up your EasyNO_x system in such a way that the first NO_x monitor (*NO_x:1*) monitors the first engine and the second NO_x monitor (*NO_x:2*) monitors the second engine.

7.3 Wiring CANopen® Network (CAN1)

The CAN bus interface CAN1 of the EasyNO_x connects the EasyNO_x to a CANopen® network. Via this CANopen® network, you connect the EasyNO_x to the following devices:

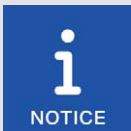
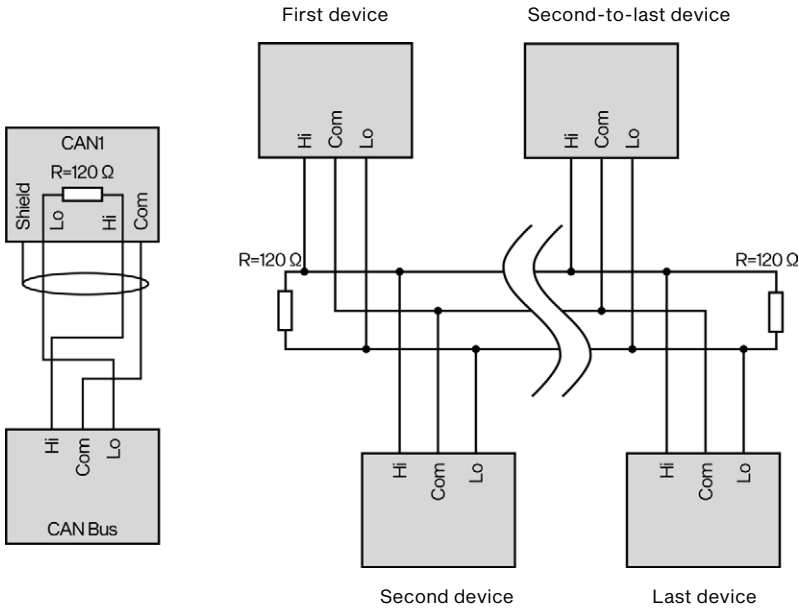
- Ignition controller
- Detonation controller
- Temperature module
- I/O communication module BPlus
- I/O module (device profile CiA® 401 or CiA® 404)
- Generic device

Observe the device restrictions in the section *Adding a Device* on page 91.

The EasyNO_x functions as NMT manager in the CANopen® network.

The wiring of the CAN bus requires three conductors (CAN Hi, CAN Lo, and CAN Com). The conductors for CAN Hi and CAN Lo must be twisted wires. At a bit rate of 250 kbit/s, the bus may only have a maximum cable length of 250 m (820') and must be terminated at both ends by a terminating resistor of 120 Ω between the CAN Hi and CAN Lo conductors to prevent reflections. The EasyNO_x has a built-in 120 Ω terminating resistor and must therefore be the first or last device in the CANopen® network.

Only use shielded CAN cables in compliance with the standards ISO 11898-2 and CiA® 303-1. The shield must be connected across the entire bus cable. To avoid ground loops, the shield is to be grounded at only one point, e.g. via the *Shield* terminal of the CAN bus interface CAN 1 at the EasyNO_x (see section *Wiring* on page 68). If only bus segments are shielded, every bus segment must be grounded at one point each.



Common mode voltage in CAN bus

If the CAN bus contains devices with CAN bus interfaces that are not isolated from the power supply (i.e. the I/O communication module BPlus available from MOTORTECH or the NO_x sensor from the CAN bus/NO_x sensor module), error-free communication of the devices in the CAN bus is only guaranteed if the voltage levels of the signal lines CAN Hi and CAN Lo are within the range of -2 V to +7 V. If this common mode voltage range is not maintained, use a CAN bus insulator (available from MOTORTECH as accessory) for potential isolation between the interfaces.

7 Wiring and Configuration



CAN bus wiring

Note the following when connecting the CAN bus:

- Each bus end must be fitted with a terminating resistor of 120 Ω (see drawing).
- The maximum cable length depends on the bit rate:

Bit rate	Maximum cable length	Maximum length of a stub	Maximum length of all stubs
1 Mbit/s	25 m (82')	1.5 m (5')	7.5 m (25')
800 kbit/s	50 m (164')	2.5 m (8')	12.5 m (41')
500 kbit/s	100 m (328')	5.5 m (18')	27.5 m (90')
250 kbit/s	250 m (820')	11 m (36')	55 m (180')
125 kbit/s	500 m (1,640')	22 m (72')	110 m (360')
50 kbit/s	1,000 m (3,280')	55 m (180')	275 m (902')

- Only use cables that are specified by the manufacturer for use in the CAN bus.
- Comply with the standards ISO 11898-1 and CiA® 303-1.

The EasyNO_x is delivered with a bit rate set to 250 kbit/s.

Settings on the Devices

All connected devices are designated as nodes on the CAN bus. Each node is identified by a CANopen®-node ID. These node numbers must be indicated both in the connected devices as well as in the configuration of the EasyNO_x. Refer to the operating manuals of the respective devices for instructions on how to set the node ID for each device and to determine if further settings must be made to communicate via the CAN bus.

A node ID can only be assigned once within a CAN bus and must be a number between 1 and 127. Note that some devices use several node numbers. The node numbers must be assigned in the configuration after start-up of the EasyNO_x. Observe that the node IDs of the I/O communication modules BPlus are firmly preset (see section *Device Setup EasyNO_x* on page 80).



Overview of the CAN bus

Setting up the CAN bus in the CANopen® network requires the following settings:

- Activate CAN interface on the devices if applicable.
- Assign unique CANopen®-node IDs to the devices.
- Set bit rate of all devices to 250 kbit/s.



CANopen® protocol

If you require information on the CANopen® protocol of your EasyNO_x, contact your MOTORTECH contact person (see section *Customer Service Information* on page 200).

7.4 I/O Communication Module BPlus

The following sections describe the wiring and configuration of the optional I/O communication module BPlus.

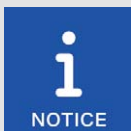
The I/O communication module BPlus is designed for wiring via a terminal strip in the control cabinet. The I/O communication module must be wired without voltage.

7.4.1 Wiring of Power Supply

The I/O communication module BPlus must be supplied with power via the control cabinet of the respective engine. Connect the black wire L – and the red wire L + of the left relay connector (see position **1** in the section *Assignment* on page 46) to the power supply via a terminal strip in the control cabinet.

To ensure error-free device communication in the CAN bus, make sure that the potential difference between the voltage supply grounds of the I/O communication modules BPlus and the Easy-NO_x is as small as possible.

7.4.2 CAN Bus Wiring, CAN Bus Termination



Common mode voltage in CAN bus

If the CAN bus contains devices with CAN bus interfaces that are not isolated from the power supply (i.e. the I/O communication module BPlus available from MOTORTECH or the NO_x sensor from the CAN bus/NO_x sensor module), error-free communication of the devices in the CAN bus is only guaranteed if the voltage levels of the signal lines CAN Hi and CAN Lo are within the range of –2 V to +7 V. If this common mode voltage range is not maintained, use a CAN bus insulator (available from MOTORTECH as accessory) for potential isolation between the interfaces.

For wiring, use a terminal strip in the control cabinet. On the left relay connector of the I/O communication module BPlus (see position **1** in section *Assignment* on page 46), the white wire CAN Hi and the brown wire CAN Lo are used for the CAN connection to the previous device in the CANopen® network. Use the yellow wire CAN Hi and the green wire CAN Lo of the left relay connector to connect the I/O communication module to the following device in the CANopen® network. If the I/O communication module is the last device in the CANopen® network, connect the supplied 120 Ω terminating resistor to these wires.

Reference ground of the CAN bus interface of the I/O communication module BPlus is the supply voltage ground.

7 Wiring and Configuration

7.4.3 Wiring of Inputs and Outputs



Operational safety!
The EasyNO_x and the software are not designed for safety-critical applications. The analog and binary inputs and outputs of the EasyNO_x system must not be used for safety-critical purposes.

Wire the binary and analog inputs and outputs of the I/O communication module BPlus via a terminal strip in the control cabinet as needed. For further details on the assignment of the relay connectors, refer to the section *Assignment* on page 46.

Relay connector	Wire color	Assignment
Left	Pink	Binary input
	Gray	Analog input
Center	Yellow	Binary output 3
	Orange	Binary output 2
	Purple	Binary output 1
Right	Green	Analog output

Note that, in the EasyNO_x, you must assign the desired function to the wired inputs and outputs of the I/O communication module BPlus before you can use them (see section *Preferences* on page 189). To do so, the respective BPlus module must have been added as a device in the EasyNO_x (see following section *Device Setup EasyNO_x* on page 80).

Reference ground of the analog and binary inputs and outputs of the I/O communication module BPlus is the supply voltage ground.

7.4.4 Device Setup EasyNO_x

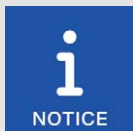
For each I/O communication module BPlus you use, add a *BPlus* device in the *Device Setup* view of the EasyNO_x (see section *Adding a Device* on page 91).

When using the EasyNO_x as NO_x monitor, MOTORTECH recommends that you wire and configure the I/O communication module with node ID 10 (MOTORTECH part number P/N 63.05.014-01) for use with the first NO_x monitor of the EasyNO_x and the I/O communication module with node ID 11 (MOTORTECH part number P/N 63.05.014-02) for use with the second NO_x monitor of the EasyNO_x.

7.5 I/O Module (Device Profile CiA® 401/404)

For the wiring and configuration of the I/O modules supporting device profile CiA® 401 or CiA® 404, read the manufacturer's documentation accompanying the product.

General functions and setting options for the EasyNO_x are described in this chapter. You can find information on the menus of added devices in chapter *Devices* on page 112.

**Notice**

In this manual, the screenshots and buttons are displayed in day mode. You can find out how to toggle between day and night mode in the section *Start Menu* on page 85.

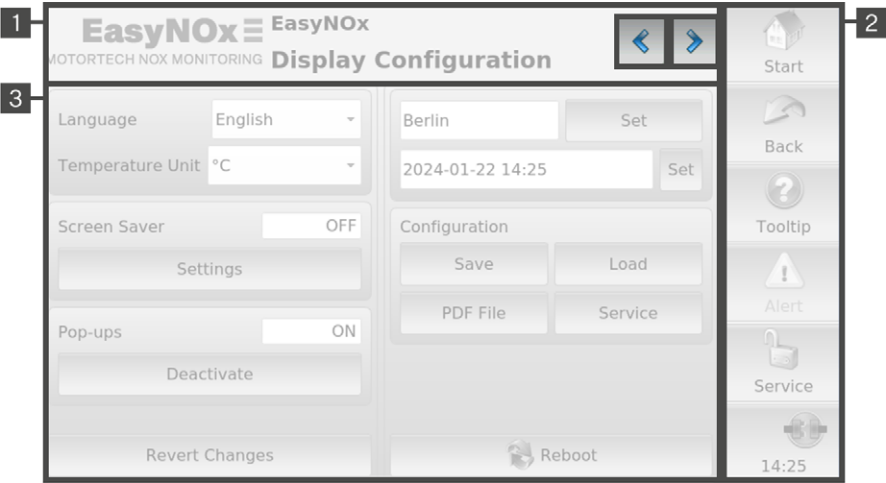
8.1 Switching on and off the Device

The device is switched on by connection to the power supply and switched off by interrupting the power supply.

8 General Operation

8.2 Navigation



The EasyNO_x has a touchscreen, which can be operated directly with the finger or a stylus pen suitable for capacitive touchscreens (not included in scope of supply). The screen comprises the following areas:



Title Area ¹

The name of the current view is displayed in the title area of the EasyNO_x. If you are in a device menu, the device and its node ID set in the EasyNO_x are additionally displayed for certain devices. In the NO_x monitor views, a custom name is additionally displayed instead of the device and the node ID (see section *Preferences* on page 124).

By tapping on the logo in the upper left corner, you can display detailed information about the EasyNO_x in an information window, regardless of the selected view. If a USB flash drive with the folder *temp* created in its root directory is inserted in the EasyNO_x, tapping on the logo also creates a screenshot of the current view. An information text in the title bar of the information window informs you about the successfully created screenshot.

In certain views you can access additional views via the buttons  and .

Menu Bar ²






The menu bar on the right-hand side of the screen is always displayed. There is more information in the section *Menu Bar* on page 83.

Main Window ³








In the main window, the EasyNO_x is configured, and the device menus of added devices are shown.

8.3 Menu Bar

The menu bar is always displayed and offers the following options and information:

Symbol	Function
 Start	With the <i>Start</i> button you reach the <i>Start Menu</i> . There is more information in the section <i>Start Menu</i> on page 85.
 Back	With the <i>Back</i> button you reach the next higher operating level of the EasyNOx.
 Tooltip	<p>Information on the buttons and functions can be displayed in pop-up windows. Proceed as follows:</p> <ol style="list-style-type: none"> In the menu bar, tap the <i>Tooltip</i> button. <ul style="list-style-type: none"> The <i>Tooltip</i> button is now activated and framed light blue. Tap a button or an area of the display. <ul style="list-style-type: none"> A pop-up window with information opens. The <i>Tooltip</i> button is deactivated. Tap the screen at any location to close the pop-up window. <p>To get information about other buttons and areas, the <i>Tooltip</i> button must be reactivated.</p>
 Alert	<p>The <i>Alert</i> button in the menu bar can display two states:</p> <ul style="list-style-type: none"> If the button is grayed, there are no new messages. The button is activated when messages are present. <p>By tapping the activated button, you acknowledge messages and open the <i>Event Log</i> view.</p> <ul style="list-style-type: none"> The filter of the <i>Event Log</i> view is automatically set so that only messages of devices that have reported alarms, warnings, or errors are displayed. The <i>Alert</i> button is grayed out. In the <i>Start Menu</i>, devices which had a yellow frame now get a turquoise frame again.
 Service	<p>This button informs about the status of the access control:</p> <ul style="list-style-type: none"> <i>Operator, Service, Master</i>: The corresponding access level is set. <i>Locked</i>: The <i>Read Only</i> access level is set. <i>Disabled</i>: The access control is disabled. <p>By tapping this button, you can access the <i>Access Control</i> view. There is more information in the section <i>Access Control</i> on page 104.</p>

8 General Operation

Symbol	Function
	<p>The bottom field of the menu bar displays status information from devices that are connected to the EasyNO_x via the CAN bus interface CAN1 (CANopen®).</p> <p>If, for supported devices (ignition controller, detonation controller, temperature module), the recording of trend data is activated (see section <i>Devices</i> on page 87), the database symbol provides information on the following states:</p> <ul style="list-style-type: none"> Trend data is being recorded onto the memory card inserted in the EasyNO_x. An error has occurred while recording the trend data (e.g. insufficient memory space on memory card, memory card not readable). <p>The connection status symbol provides information on the following states:</p> <ul style="list-style-type: none"> There is a connection to all added devices. The connection is not established to all added devices. There is no connection to any added device. No device is added. <p>The system time is displayed at the very bottom.</p> <p>If you tap the button, the <i>Event Log</i> view opens. There is more information in the section <i>Event Log</i> on page 110.</p>

8.4 Start Menu

The *Start Menu* will be displayed after the EasyNO_x has started. You can access the *Start Menu* any time via the *Start* button in the menu bar.



You have the following options in the *Start Menu*:

Devices

With this button you open the *Device Setup* view, in which you can add new devices and edit device settings. There is more information in the section *Devices* on page 87.

Display

With this button, you open the *Display Configuration* view. Among other things, you can set the language and system time of the EasyNO_x and activate a screen saver. There is more information in the section *Display* on page 95.

Connection

With this button, you open the *Communication Setup* view. You can change the node ID and the bit rate of the EasyNO_x and of all LSS-capable devices to which the EasyNO_x is connected via the CAN bus interface CAN1. There is more information in the section *Connection* on page 99.

8 General Operation

Night Mode / Day Mode

With this button, you can change the display colors to ensure legibility under various lighting conditions.



Recordings

With this button, you open the *Recorded Files* view. You can display and administer recorded trend data of certain devices (ignition controller, detonation controller, temperature module) from the inserted memory card. There is more information in the section *Recordings* on page 101.

Help

This button opens the operating manual of the EasyNOx. There is more information in the section *Help* on page 111.

Added Devices

The buttons of added devices each contain a device icon, the device name, and for some devices the node ID configured in the EasyNOx or a sequential number. The frames of the buttons can take different colors.



The frames of the device buttons have the following meaning:

- Turquoise: There are no errors.
- Yellow: There are one or more messages for the device. Acknowledge the messages via the *Alert* button (see section *Menu Bar* on page 83).
- Purple: The device is not activated (see section *Device Activation* on page 90).
- Red: The device is not connected. Check the connection and connection settings.

Tapping on a device opens the *Main Menu* of the particular device. For information on how to configure devices, see section *Devices* on page 112.

8.4.1 Devices



The *Devices* button in the *Start Menu* opens the *Device Setup* view.



The *Device Setup* view provides the following options:

- **List of Added Devices**
In this field, all added devices are listed. If you tap a device, the class, the node ID or sequence number (depending on the device), and the device logging status are displayed below.
- **Edit**
With the button you can edit the settings of certain devices. You can find more information in the section *Editing a Device* on page 93.
- **Logging**
With the button, you can select for certain devices (ignition controller, detonation controller, temperature module) whether trend data of the device should be recorded on the memory card inserted in the EasyNOx. There is more information in the section *Logging Device Data* on page 94. For an added NO_x monitor, the recording of data on the memory card inserted in the EasyNO_x is firmly preset and cannot be deactivated.

8 General Operation

- **Add**
With the button you open the dialog *Add Device*. You can find more information in the section *Adding a Device* on page 91.
 - **Delete**
Tap this button to delete an added device. You can find more information in the section *Deleting a Device* on page 94.
 - **Device Activation**
The EasyNO_x HMI modules are activated differently ex works. In certain cases, you can activate additional devices in the EasyNO_x with software dongles from MOTORTECH. There is more information in the section *Device Activation* on page 90. With the *Back up* button, you can save all device activations to a USB flash drive (e.g. before software updates). A device-specific software dongle is stored on the USB flash drive for each activated device, including those activated ex works. If necessary, you can re-activate the devices with these software dongles.
 - **Binary Outputs**
The EasyNO_x provides the binary outputs *Warning* and *Error* virtually via the CAN bus interface CAN1. In order to use them in the CAN bus, they must be activated in the EasyNO_x. Additionally, they can each be connected to a physical binary output of an optional I/O module (see section *Binary Outputs* on page 191). Observing the following safety instructions, you can use the *Unlock* button to activate the binary outputs *Warning* and *Error* and the *Lock* button to deactivate them. The status displays *Warning* and *Error* indicate the switching status of these binary outputs.
- 
- Operational safety!**
- The EasyNO_x and the software are not designed for safety-critical applications. The analog and binary inputs and outputs of the EasyNO_x system must not be used for safety-critical purposes.
- **Test**
For test purposes, you can switch the binary outputs *Warning* and *Error*, which the EasyNO_x provides virtually via the CAN bus interface CAN1, on and off. To do so, use the *Test* button to open the *Binary Output Test* window. In this window, you can switch the binary outputs while observing the following safety instructions and thereby test the behavior of the devices that are connected to these binary outputs.
- 
- Operational safety!**
- Testing the outputs affects the connected devices. Before performing tests, make sure that switching the outputs will not result in hazards or damage.

- **Demo**

To access the device-specific pages for demonstration or pre-configuration without the device being connected, you can activate and deactivate the demo mode by tapping the button while observing the following safety instructions. The demo mode is indicated in the information bar in the logo by the text *DEMO MODE*.



Operational safety!

The demo mode is not a normal operating state of the EasyNO_x. In combination with other devices the EasyNO_x must not be operated in demo mode.

8 General Operation

8.4.1.1 Device Activation



Device activations of the NO_x monitor packages

In an NO_x monitor package of the EasyNO_x for two engines, both NO_x monitors have been activated in the EasyNO_x ex works.

If you purchase a second engine extension package for a package of the EasyNO_x supporting one engine, a software dongle is included with this extension package. This software dongle activates the second NO_x monitor in the EasyNO_x.

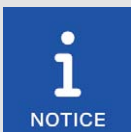
For certain devices, activation is required in order to add and use them in the EasyNO_x (see section *Adding a Device* on page 91).

If your EasyNO_x HMI module is not activated for a specific device ex works (e.g. for the second NO_x monitor), you may retrofit the device in certain cases by purchasing a software dongle from your MOTORTECH contact person (see section *Customer Service Information* on page 200). With this software dongle, you then activate the respective device in your EasyNO_x. After activation, you can add the device to the device configuration of your EasyNO_x.

Software dongles are tied to the respective EasyNO_x via the serial number. For retrofitting your EasyNO_x with a software dongle, you need to specify its serial number. You can find the serial number on the device label of your EasyNO_x (see section *Product Identification – Labeling on the Device* on page 27) or display it in the EasyNO_x in the *Display Information* view (see section *Display* on page 95).

If you have received a software dongle from MOTORTECH, proceed as follows to activate the respective device in the EasyNO_x:

1. The EasyNO_x reads software dongles from a USB flash drive inserted in the EasyNO_x. Therefore, ensure that the desired software dongle from MOTORTECH is on a USB flash drive.
2. Insert the USB flash drive with the desired software dongle into your EasyNO_x.
3. In the *Device Setup* view in the area *Device Activation*, tap *Activate*.
 - ▶ The storage locations available are displayed in a window.
4. Navigate to the desired software dongle with the file extension *.usd* and select it.
5. Tap *Enter*.
 - ▶ The device is activated.
 - ▶ You can add the device in the EasyNO_x (see section *Adding a Device* on page 91) and use it.



Activating multiple devices

If you have multiple software dongles for device activation, you can alternatively copy the software dongles into one folder on the USB flash drive. Then mark this folder in the device activation selection window so that the EasyNO_x reads all the software dongles that are in this folder.

8.4.1.2 Adding a Device



Maximum number of added devices

You can add a maximum of ten devices in the EasyNO_x. In addition, you can add a maximum of three devices of the type *Generic*.

The following restrictions apply to the following devices: You can add a maximum of two NO_x monitors, one ignition controller, one detonation controller, three temperature modules, and three I/O modules including a maximum of two I/O communication modules BPlus.





To add a device, proceed as follows:


1. In the *Device Setup* view, tap the *Add* button.
 - ▶ The dialog *Add Device* opens.

8 General Operation

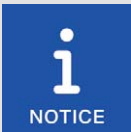
- 2. Select the device. For information on the *Generic* device, read the section *Generic Device* on page 194.

 This symbol next to a device indicates this device has been activated at least once. You can add the device multiple times until the maximum number of activated devices of this type is reached. In certain cases, you can retrofit additional devices (see section *Device Activation* on page 90).

 This symbol next to a device indicates that no activation is required for the device. The device can be added to the device configuration if its maximum number has not been exceeded.

 This symbol next to a device indicates that the device has not been activated and cannot be added to the device configuration. In certain cases, you can retrofit additional devices (see section *Device Activation* on page 90).

- 3. Where available, use the arrow keys to set the node ID of the device to be added.



Node ID

The node ID entered must correspond to the node ID of the device to be added. To learn about the node ID, refer to the operating manual of the respective device. For the I/O communication module BPlus, you can find this information in the section *Device Setup EasyNOx* on page 80.

- 4. Confirm your entry via the *Save* button.
 - ▶ The dialog is closed, and you are returned to the *Device Setup* view. The device is displayed in the list of added devices with device class and node ID or sequential number.



- 5. To add more devices, repeat steps 1 to 4.

- When you tap *Start* in the menu bar, the added devices are displayed in the *Start Menu* with node ID or sequential number (NO_x monitor only).



8.4.1.3 Editing a Device

You can edit the settings of certain devices. Proceed as follows:

- In the *Device Setup* view, select the device whose settings you want to change from the list of added devices.
- Tap the *Edit* button.
 - The dialog for editing devices opens.
- Set the device and, where applicable, the node ID.
- Tap *Save*.
 - The dialog is closed.
 - The device is displayed with changed settings in the *Device Setup* view and in the *Start Menu*.

8 General Operation

8.4.1.4 Deleting a Device



Deleting the NO_x monitor

An added NO_x monitor can only be deleted if the mode of the respective NO_x monitor is set to *Off* and thus NO_x monitoring is deactivated (see section *Preferences* on page 124).

Further, the first NO_x monitor (display name *NO_x:1*) cannot be deleted prior to the second NO_x monitor (display name *NO_x:2*).

If you want to delete both NO_x monitors, you must first delete the second NO_x monitor.

If you only want to use the second NO_x monitor, set the mode of the first NO_x monitor to *Off*.

To delete an added device, proceed as follows:

1. In the *Device Setup* view, select the device you want to delete from the list of added devices.
2. Tap *Delete*.
 - ▶ The device is no longer displayed in the *Device Setup* view and in the *Start Menu*.

8.4.1.5 Logging Device Data

The EasyNO_x enables you to record trend data (e.g. speed, knocking intensity, and temperature) from certain added devices (ignition controller, detonation controller, temperature module) onto the memory card inserted in the EasyNO_x. You can then display and administer the recordings with the EasyNO_x (see section *Recordings* on page 101) or the MOTORTECH Trend Viewer (see section *Processing Data on the PC* on page 103). For each supported device, you can start and stop the recording of trend data in the *Device Setup* view (see section *Devices* on page 87).




Recording data


If the power supply to the EasyNO_x is interrupted during recording or the inserted memory card is removed, data will be lost.

Each time you restart the EasyNO_x and each time you insert a memory card, a new recording file is created.

Starting a Recording

1. In the *Device Setup* view, mark the device whose data you want to record in the list of added devices. If the device has the recording status *Off* under *Logging*, no data is recorded from the device.
2. Tap the *Logging* button.
 - ▶ The recording status of the device in the list of added devices changes to *On*.
 - ▶ If the device is connected to the EasyNO_x and switched on, a database symbol  in the menu bar indicates that data is being recorded.
 - ▶ You can start or end more recordings and use other functions of the EasyNO_x without an active recording ending.
 - ▶ The recording is not interrupted by the screen saver.

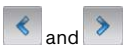
Ending a Recording



1. From the list of added devices in the *Device Setup* view, select the device from which you no longer wish to record data. If the device has the recording status *On* under *Logging*, data is recorded from the device.
2. Tap the *Logging* button.
 - ▶ The recording status of the device in the list of added devices changes to *Off*.
 - ▶ The recording is ended. The database symbol  in the menu bar disappears if no more data is being recorded from other devices.
 - ▶ You can administer and display the recorded data (see section *Recordings* on page 101).

8.4.2 Display

The *Display* button in the *Start Menu* opens the following views:

- *Display Configuration*
- *Display Information*



The  and  buttons allow you to switch between the views.

The views are described as follows.

8 General Operation

Display Configuration

EasyNOx

MOTORTECH NOx MONITORING

EasyNOx

Display Configuration

←

→

LanguageEnglish

Temperature Unit°C

Screen SaverOFF

Settings

Pop-upsON

Deactivate

Revert Changes

BerlinSet

2024-01-22 14:25Set

Configuration

SaveLoad

PDF FileService

Reboot

Start

Back

Tooltip

Alert

Service

14:25

You have the following options:

- [Language](#)
Select the desired system language.
- [Temperature Unit](#)
Select, whether temperatures in the EasyNO_x are to be displayed in °C or in °F. Recordings are also created in the units selected. This setting has no effect on the NO_x monitor. In the NO_x monitor, all temperatures are displayed and recorded in °C.
- [Screen Saver](#)
Tap *Settings* to configure the screen saver. When the screen saver has been activated, the display is darkened and switched off after a specified time (*Power Save* option) or a slide show starts. In addition, the EasyNO_x is placed on the access level *Read Only* (displayed status *Locked* in the menu bar). By touching the display, a running screen saver is stopped.
- [Pop-ups](#)
Activate or deactivate pop-ups with information for the user. Important pop-ups, e.g. with information on errors, are always displayed. Pop-ups which e.g. provide information on successful actions can be deactivated.
- [Revert Changes](#)
Tap *Revert Changes* to restore the last saved configuration state. Date and time are not reset.
- [Time Zone](#)
Tap *Set* to set the time zone.
- [Date, Time](#)
Tap *Set* to set the system time and date. Your configuration options depend on the access level you are logged in to (see section *Access Control* on page 104).

– Configuration

You have the following options:

– Save

Save the configuration of your EasyNO_x to a USB flash drive inserted in the EasyNO_x. One file is created each for the configuration of the EasyNO_x, for all added NO_x monitors, and for each configured temperature module and I/O module. This enables you to easily re-store the configuration of your EasyNO_x or transfer it to another EasyNO_x using a USB flash drive. With the I/O module, the configuration of deleted devices is also saved so that it is also available on another EasyNO_x if you add the device with an identical node ID to the device configuration. The following configuration files are saved:

File	Content
Configuration.xml	General configuration of the EasyNO _x including the list of added devices from the <i>Device Configuration</i> view
nox_config.json	Configuration of all added NO _x monitors in the EasyNO _x
TempScanxxx.xml	Configuration of a temperature module with node ID xxx
Dev401_xxx.json	Configuration of an I/O communication module BPlus or an I/O module supporting device profile CiA® 401 with node ID xxx
Dev404_xxx.json	Configuration of an I/O module supporting device profile CiA® 404 with node ID xxx

– Load

Load a configuration of your EasyNO_x stored on a USB flash drive. For this, select the desired configuration files via the displayed context menu.

– PDF File

Save a PDF document with information on the configuration of your EasyNO_x to a USB flash drive.

– Service

Creates a service report in English as a PDF document on a USB flash drive. In addition to the configuration information, this service report also contains information on memory usage and a list of events. To receive the best possible support, send the service report to your MOTORTECH contact person (see *Customer Service Information* on page 200) for service requests.

– Reboot


With the *Reboot* button, you carry out a reboot of your EasyNO_x. Unsaved settings will get lost, and databases will be closed!

8 General Operation



Display Information


In the *Display Information* view, you can find the following information:


- Display ID
- MOTORTECH serial number
- Arrangement number
- Board support package version
- Software version of your EasyNO_x


EasyNO_x  **EasyNO_x**


MOTORTECH NO_x MONITORING **Display Information**





Start

Back

Tooltip

Alert

Service

10:49

Display ID	02509571
MOTORTECH S/N	01234567
Arrangement Number	PV4.00.0000-200-AA-C
Board Support Package	rocko-7.0-0
Software	2.2.0

In demo mode (see section *Devices* on page 87), data on the Ethernet connection of the EasyNO_x is additionally displayed for service purposes. The Ethernet interface of the EasyNO_x is intended exclusively to be used by MOTORTECH service.

8.4.3 Connection

The *Connection* button in the *Start Menu* opens the *Communication Setup* view.



Bit rate settings in the CAN bus

For communication via the CAN bus, it is mandatory that all connected devices use the same bit rate. MOTORTECH devices are usually delivered with a bit rate set to 250 kbit/s.

If the EasyNO_x is connected to a CANopen® network via the CAN bus interface CAN1, you can make the following settings for this network in the *Communication Setup* view:

EasyNO_x

Changing Node ID

The factory setting for the node ID on your EasyNO_x is 66. Change the node ID as follows:

1. You can set a node ID for your EasyNO_x in the *EasyNO_x* area using the arrow keys.
2. Tap *Save* to confirm the setting of the node-ID.
 - ▶ The node ID of the EasyNO_x is changed.

The changed node ID will be discarded if you tap *Reset* before saving or leave the *Communication Setup* view without saving.

8 General Operation

Changing Bit Rate

Change the bit rate of the EasyNO_x as follows:

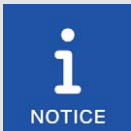
1. Select the desired bit rate in the *EasyNO_x* area.
2. Tap *Save*.
 - ▶ The bit rate of the EasyNO_x is changed.

The changed bit rate will be discarded if you tap *Reset* before saving or leave the *Communication Setup* view without saving.

Other Devices

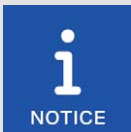
If supported by the respective device, you can use LSS commands to change the node ID and the bit rate of devices in the CAN bus on CAN1. The following MOTORTECH device supports changing the node ID and bit rate via LSS commands:

- Temperature module TempScan20



LSS commands: Disconnect all other devices from the CAN bus!

When sending LSS commands, all devices connected to the CAN bus via CAN1 are addressed. In order to change the bit rate or the node ID of the desired device only, no other devices may be connected to the EasyNO_x via CAN1.



LSS commands: Use identical bit rates!

LSS commands can only be received from another device in the CAN bus if the LSS manager (here: EasyNO_x) is set to the bit rate of the other device. If necessary, set the corresponding bit rate in the EasyNO_x before sending the LSS command.

Changing Node ID

You can change the node ID of another device in the CANopen® network as follows:

1. Make sure that the current bit rate of the other device is set in the EasyNO_x.
2. Make sure that there is only the other device connected to the EasyNO_x via CAN1.
3. Set the node ID that the other device is to be given in the *LSS Commands* area.
4. Tap *Send Command*.
 - ▶ The node ID of the other device is changed.
5. If you have changed the bit rate of the EasyNO_x in step 1, set the EasyNO_x back to the previous bit rate in the *EasyNO_x* area, if required.

Changing Bit Rate

You can change the bit rate of another device in the CANopen® network as follows:

1. Make sure that the current bit rate of the other device is set in the EasyNOx.
2. Make sure that there is only the other device connected to the EasyNOx via CAN1.
3. Make sure that the current node ID of the other device is set in the *LSS Commands* area. Otherwise, it will be changed accordingly when the LSS command is sent.
4. Select the bit rate that the other device is to be given.
5. Tap *Send Command*.
 - The bit rate and the node ID of the other device are changed.
6. If you have changed the bit rate of the EasyNOx in step 1, set the EasyNOx back to the previous bit rate in the *EasyNOx* area, if required.

8.4.4 Recordings

The EasyNOx allows you to record trend data from certain added devices (ignition controller, detonation controller, temperature module) on the memory card inserted in the EasyNOx. The *Recordings* button in the *Start Menu* opens the *Recorded Files* view, which allows you to display and administer these recordings.

EasyNOx
MOTORTECH NOX MONITORING

Recorded Files

Device	Node ID	Date	Time	Size	Logging
All Types	All Nodes	All Dates	All Sizes		
Device	ID	Date	Time	Size	Logging
MIC4	30	2023-05-10	14:05:23	1.72K	x
MIC4	30	2023-05-10	13:57:06	212	
MIC4	30	2023-05-10	13:55:06	0	
MIC4	30	2023-05-10	13:25:28	2.30K	
MIC4	30	2023-05-10	13:19:01	1.51K	
MIC4	30	2023-05-10	10:21:07	2.65K	
MIC4	30	2023-05-10	10:16:12	0	
TempScan20	21	2014-01-06	13:46:53	50.4K	
MIC4	30	2013-04-30	12:31:21	4.59K	
DetCon2/20	40	2013-04-29	18:04:53	324K	
DetCon2/20	40	2013-04-29	18:04:53	324K	

Buttons: Start, Back, Tooltip, Alert, Service, Plot, Delete, Delete All, Back up, Plot

Time: 15:47

At first all recorded files are displayed. You have the option of filtering the recordings according to device type, node ID, alteration date and file size. In the *Date* and *Size* drop-down lists, the double arrows indicate the sorting order.

8 General Operation

You have the following options for navigating in the list:

- Tap in the list and drag the displayed list section in the desired direction.
- Double-tap in the upper or lower border area of the list to jump to the end of that border area.
- Tap and hold the upper or lower border area of the list to scroll in the desired direction.
- Move the scroll bar to scroll in the desired direction.

The view has the following buttons:

- **Delete**
Deletes the currently selected file.
- **Delete All**
Deletes all currently listed files based on the filter settings.
- **Back up**
With this button you can back up the currently selected file to a USB flash drive inserted in the EasyNO_x.
- **Plot**
Displays the currently selected file in the EasyNO_x (see *Displaying Recordings* on page 102).

Files of running recordings are marked with an X in the *Logging* column. These files can neither be saved nor deleted.

To start or end a recording, read the section *Logging Device Data* on page 94.

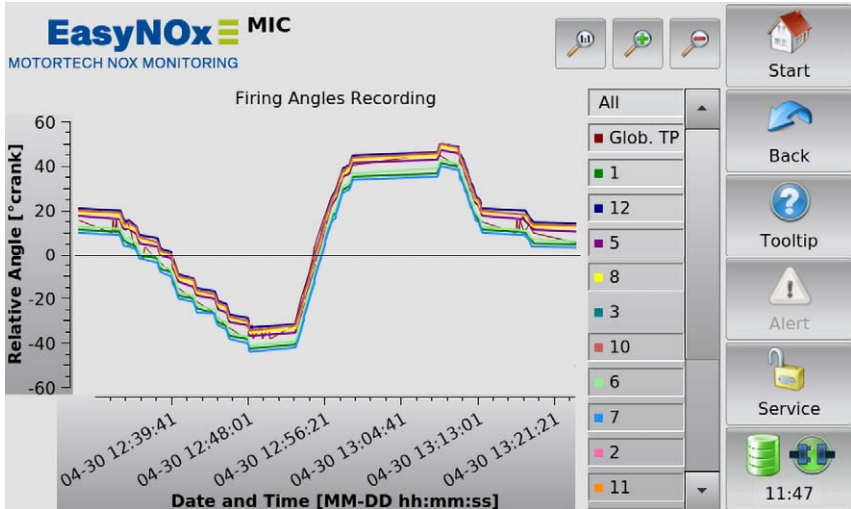
8.4.4.1 Displaying Recordings

You have the option to display recorded data from the memory card inserted in the EasyNO_x:

1. Select the desired file in the *Recorded Files* view.
2. Tap the *Plot* button.
 - ▶ The selected file is opened.



3. Select a button in the view (for example *Firing Angles*) to display the recorded data.
 - ▶ The selected data is displayed.



You can customize the recording views to suit your requirements:

- Use the legend on the right of the graph to display and hide trend lines individually.
- Adjust the enlargement factor:



Overall view
Larger
Smaller

- Move the trend lines by tapping and dragging them directly in the display.

8.4.4.2 Processing Data on the PC

You can use the MOTORTECH Trend Viewer software to process recordings of the EasyNO_x, which you have saved on a USB flash drive using the *Recorded Files* view (see section *Recordings* on page 101), on a PC. The software provides the following options:

- Visualization of data
- Export of data as CSV file
- Export of data as graphic file

Further information can be found in the MOTORTECH Trend Viewer manual.

8 General Operation

8.5 Access Control

The access control can be accessed in the menu bar via the highlighted button. Depending on the current setting, the button is labeled *Disabled*, *Locked*, *Operator*, *Service*, or *Master*.



The access control of the EasyNO_x serves to protect sensitive data and functions. When access control is disabled, there are no restrictions with the exception of the NO_x monitor views. With enabled access control (see section *Enabling/Disabling Access Control* on page 106), four access levels with different rights are available (see table below). Note that the NO_x monitor views can only be opened when access control is enabled, and you need at least the rights of the access level Operator to open these views.

Access level	Rights
Read Only (displayed status in the menu bar: <i>Locked</i>)	<ul style="list-style-type: none">– Read access to all data provided by an ignition controller, a detonation controller, and a temperature module– Switching between day and night mode– Activating and deactivating pop-ups– Changing detonation controller preferences

Access level	Rights
Operator	<ul style="list-style-type: none"> – Read Only rights – Access to NO_x monitor – Exporting daily log, annual log, and NO_x monitoring report to a USB flash drive – Display configuration – Recording of trend data from an ignition controller, a detonation controller, or a temperature module – Ignition controller: <ul style="list-style-type: none"> – Acknowledging runtime errors – Acknowledging alarms – Resetting misfire rate
Service	<ul style="list-style-type: none"> – Operator rights – Changing preferences of the following devices: <ul style="list-style-type: none"> – NO_x monitor – Temperature module – I/O communication module BPlus – I/O module (device profile CiA® 401/404) – Device setup – Activating devices – Changing the node ID and the bit rate of the EasyNO_x – Ignition controller: <ul style="list-style-type: none"> – Adjusting ignition timing (globally, cylinder individually), energy, voltage calibration, and reset position – Setting of spark plug operating hours and engine operating hours – Self test
Master	<ul style="list-style-type: none"> – Service rights – Setting system time and system date – Enabling/disabling access control – Resetting all PINs – Sending LSS commands



Access to locked functions

If you would like to access a function with enabled access control, which exceeds your currently set rights, you will be prompted to enter the PIN for the access level required in a dialog window. The required access level is displayed in the header of the dialog window respectively (e.g. *Enter Operator PIN*).

8 General Operation

8.5.1 Enabling/Disabling Access Control



Access control in as-delivered state

In as-delivered state, the access control is not enabled, and all PINs are set to 0000. After enabling the access control, assign an individual PIN for each access level including *Master* (see *Changing the PIN* on page 108).

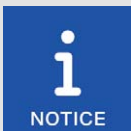
Enabling Access Control

Enable the access control for all access levels as follows:

1. Tap the *Enable Control* button.
 - ▶ You are prompted to enter the PIN for the access level *Master*.
2. Enter the PIN for the access level *Master* and tap *OK*.
 - ▶ Access control for all access levels is enabled.
 - ▶ You are logged in as *Master*.
 - ▶ The *Logout* button is activated.
 - ▶ The *Disable Control* button is activated.

If necessary, you can log in to a different access level. Refer to the section *Logging in and Logging Out* on page 107.

Disabling Access Control



Disabling access control

If the access control is not to be used for a longer period of time, we recommend that you write down the Master PIN or reset all PINs to 0000 before disabling the access control. A renewed enabling of the access control is only permitted with the Master PIN. If you have forgotten the Master PIN, you must contact MOTORTECH for a reset of all PINs (see *Resetting the PINs* on page 108).

Disable the access control for all access levels as follows:

1. Tap the *Disable Control* button.
 - ▶ You are prompted to enter the PIN for the access level *Master*.
2. Enter the PIN for the access level *Master* and tap *OK*.
 - ▶ The *Disabling Access Control* dialog window appears.

3. Observe the note in the *Disabling Access Control* dialog window. If you are certain that you want to disable the access control, answer the displayed question by tapping **Yes**.
 - ▶ Access control for all access levels is disabled.
 - ▶ In the menu bar the condition *Disabled* is displayed.
 - ▶ The buttons *Login* and *Logout* are deactivated.
 - ▶ The *Enable Control* button is activated.

8.5.2 Logging in and Logging Out

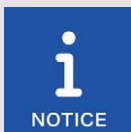
With enabled access control, you can log in to the access levels *Operator*, *Service* and *Master*.

Logging In

Log in to the desired access level as follows:

1. From the drop-down list under *Access Level*, select the desired access level (*Operator*, *Service*, or *Master*).
2. Tap the *Login* button.
 - ▶ You will be prompted to enter the corresponding PIN.
3. Enter the PIN and tap **OK**.
 - ▶ You have now logged in to the desired access level and can use the associated functions.
 - ▶ The access level set is displayed in the menu bar.

Logging Out



Automatic logout

You are automatically logged out of the access levels *Operator*, *Service*, or *Master*,

- if you have not entered anything for six minutes.
- if for six minutes only functions of lower access levels are used.
- if the screen saver is switched on.

The EasyNO_x is then placed on the access level *Read Only* with the displayed status *Locked*.

There are two options for logging out manually from the access levels *Operator*, *Service*, or *Master*:

Option 1:

Leave the currently set access level with the *Logout* button in the *Access Control* view.

- ▶ In the menu bar, the condition *Locked* is displayed.
- ▶ The set access level is *Read Only*.
- ▶ The *Logout* button is deactivated.
- ▶ The *Login* button is activated.

8 General Operation

Option 2:

1. From the drop-down list under *Access Level* in the *Access Control* view, select a different access level (*Operator*, *Service*, or *Master*).
2. Tap the *Login* button.
 - ▶ You will be prompted to enter the corresponding PIN.
3. Enter the PIN and tap *OK*.
 - ▶ You have now logged in to the desired access level and can use the associated functions.
 - ▶ The access level set is displayed in the menu bar.

8.5.3 Changing the PIN

Change the PIN of the access levels *Operator*, *Service*, or *Master* as follows:

1. Log in to the access level (*Operator*, *Service*, or *Master*) whose PIN you want to change (see section *Logging in and Logging Out* on page 107).
2. Tap the *Change PIN* button.
 - ▶ You are prompted to enter a new PIN for the active access level.
3. Enter the new four-digit PIN and tap *OK*.
4. In the *Confirm new PIN* field, re-enter the new four-digit PIN and tap *OK*.
 - ▶ The PIN of the active access level was changed.

8.5.4 Resetting the PINs

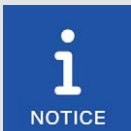
Forgotten Operator PIN / Service PIN

If you have forgotten the PIN of the access levels *Operator* or *Service*, contact the Master. The latter can reset all PINs to the value 0000 as described in the following. Afterwards, new PINs must be assigned to all access levels.

Resetting All PINs

The authorization for the access level *Master* allows you to reset the PINs of all access levels:

1. Log in to the access level *Master* (see section *Logging in and Logging Out* on page 107).
2. In the area *Master Only*, tap on *Reset All PINs*.
 - ▶ All PINs are reset to the value 0000.



Assign new PINs!

After resetting the PINs, new PINs must be assigned to all access levels to guarantee maximum security.

Master PIN Forgotten

If you have forgotten the Master PIN, you must apply for a PIN Reset Authorization Key from MOTORTECH. With this key, you can reset all PINs without authorization for the access level *Master*.

Requesting Key

Request the key from MOTORTECH as follows:

1. Tap the *Request Key* button.
 - ▶ A dialog window with the new and actual PIN Reset Request Key opens.
 - ▶ Write down the new PIN Reset Request Key (*New PRRK*) and send it to your MOTORTECH contact person.
2. Tap the *Confirm* button.
 - ▶ MOTORTECH sends you a PIN Reset Authorization Key based on *New PRRK*. Note that the PIN Reset Authorization Key is only valid for a limited period of time.

Entering Key

Enter the key from MOTORTECH in your EasyNO_x as follows:

1. Insert a USB flash drive on which the MOTORTECH key is stored into your EasyNO_x.
2. In the area *PIN Reset with Key*, tap the button *Reset All PINs*.
 - ▶ The storage locations available are displayed in a window.
3. Navigate to the desired PIN Reset Authorization Key (file extension *.prak*) and select it.
4. Tap the *Enter* button.
 - ▶ All PINs are reset to the value 0000.

8 General Operation

8.6 Event Log

If you tap on the status information field in the menu bar (see marking), the *Event Log* view opens. In this view you get messages concerning the EasyNOx.

EasyNOx

MOTORTECH NOX MONITORING

EasyNOx

Event Log

Start

Back

Tooltip

Alert

Service

11:23

Date	Time	ID	Device	Message
2024-01-10	18:37:26	66	HMI	Access level set to Service.
2024-01-10	16:59:35	66	HMI	Access level set to Service.
2024-01-10	16:49:04	66	HMI	Access level set to Service.
2024-01-10	16:37:03	1	NOx	18 - Delta temperature under
2024-01-10	16:36:03	1	NOx	17 - Delta temperature excee
2024-01-10	16:37:38	1	NOx	Service set Mode from MAP Tur
2024-01-10	16:34:43	66	HMI	Access level set to Service.
2024-01-10	16:30:47	502	NOx	SD-Card removed. No NOx recor
2024-01-10	16:17:55	66	HMI	Access level set to Service.
2024-01-10	16:02:03	1	NOx	Delta temperature exceeded
2024-01-10	16:01:03	1	NOx	Delta temperature undercut
2024-01-10	16:00:30	66	HMI	Demo mode switched on
2024-01-10	16:00:30	66	HMI	Access level set to Service.
2024-01-10	15:47:33	66	HMI	Access level set to Service.
2024-01-10	15:25:41	66	HMI	Access control enabled.

The following data is displayed: date (YYYY-MM-DD) and time (hh:mm:ss) of the entry, node ID or internal sequential number of the device, device name, and the accompanying message. The abbreviation *HMI* represents the EasyNOx. A maximum of 1,000 messages are displayed and stored. Older messages are deleted.

In the title area, two buttons are displayed. The symbols on the buttons change depending on their setting and are described in the following.

Filter Button

The button's appearance has the following meaning:



No filters are active. All entries are displayed.



Filters are active. Only certain entries are displayed.

To set or change filters, tap the *Filter* button. The *Filter Settings* dialog window appears. Select time and node IDs of the entries you want to display. If you select none of the listed node IDs, the entries of all listed node IDs are displayed. Confirm your selection with *OK*. Tap *Clear* to reset the filters.

Automatic Scrolling Button

The button's appearance has the following meaning:



Automatic scrolling is inactive.



Automatic scrolling is active.

To activate and deactivate automatic scrolling, tap the *Automatic Scrolling* button. When the function is activated, the EasyNO_x scrolls automatically to newly registered entries.

You have the following options for navigating in the list:

- Tap in the list and drag the displayed list section in the desired direction.
- Double-tap in a border area of the list (top, bottom, left, right) to jump to the end of that border area.
- Tap and hold in a border area of the list (top, bottom, left, right) to scroll in the desired direction.
- Move one of the scroll bars to scroll in the desired direction.

8.7 Help

You can access the operating manual of the EasyNO_x as follows:

- *Help* button in *Start Menu*
- *Help* button in the *NO_x Main Menu* view of an added NO_x monitor
- *Help* button in the *Main Menu* of an added I/O communication module BPlus or I/O module

You can access the operating manual of an added device (ignition controller, detonation controller, temperature module) as follows:

- *Help* button in the main menu of the added device

In the browser, tap on the appropriate links, and then use the bars on the right side of the screen to scroll and the buttons for navigation:

- [Start](#)
Use this button to go to the first page of the operating manual.
- [Back](#)
Use this button to go to the previously displayed page of the operating manual.
- [Close](#)
Use this button to exit the Help menu.

9 Devices

This chapter describes the device menus of the devices that can be added in the EasyNO_x. Information about adding devices can be found in the section *Devices* on page 87. You can access the device menus of added devices via the corresponding buttons in the *Start Menu*.

9.1 NO_x Monitor



NO_x monitor: enable access control

The views of the NO_x monitor can only be opened when access control is enabled. In order to open these views, you need at least the rights of the access level *Operator*. For more information, read the section *Access Control* on page 104.



Automatic exit from NO_x monitor

If you do not make any entries for 6 minutes or the screen saver switches on, the views of the NO_x monitor are automatically exited, and the access level is set to *Read Only* (displayed state in the menu bar *Locked*).

This section describes the functions and views of an added NO_x monitor.

9.1.1 Main Menu

The main menu of an added NO_x monitor can be opened in the start menu via the NO_x button.



The main menu has the following buttons:

- [Overview](#)
The button provides information about the current status of the NO_x monitor and provides access to the current trend of measured values. There is more information in the section *Overview* on page 114.
- [History](#)
The button can be used to display the trends of selected measured values for each day from the daily logs. There is more information in the section *History* on page 118.
- [Logbook](#)
The button provides access to the logbook of the NO_x monitor. There is more information in the section *Logbook* on page 120.
- [Export](#)
The button provides access to the export function of the NO_x monitor, which allows you to export the daily and annual logs logged by the NO_x monitor as well as the NO_x monitoring report including the logbook to a USB flash drive. There is more information in the section *Export* on page 122.
- [Preferences](#)
The button provides access to the settings of the NO_x monitor. Access is only possible after you have specified the serial number of the engine to be monitored in the view *Information on Operator* (see section *Operator* on page 128). For more information on the NO_x monitor settings, see section *Preferences* on page 124.



9 Devices

- [Operator](#)
Use the button to specify information about the engine and the operator. The information entered here appears in the NO_x monitoring report of the respective NO_x monitor. There is more information in the section *Operator* on page 128.
- [Sensor](#)
The button gives you access to the status information from the NO_x sensor of the connected CAN bus/NO_x sensor module. There is more information in the section *Sensor* on page 129.
- [Help](#)
This button opens the operating manual of the EasyNO_x. There is more information in the section *Help* on page 111.

9.1.2 Overview

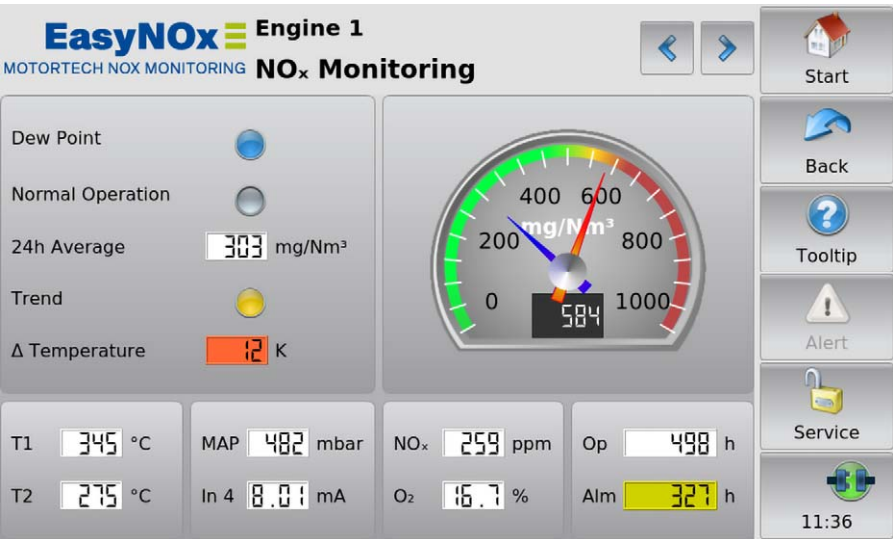
The *Overview* button in the main menu of an added NO_x monitor opens the following views:

- *NO_x Monitoring*
- *NO_x Trends*

The  and  buttons allow you to switch between the views.

The views are described as follows.

NO_x monitor



This view displays the current status of the NO_x monitor. The view varies depending on the set NO_x monitoring mode. The various parameters of the NO_x monitor can be set in the *NO_x Setup* view (see section *Preferences* on page 124). If one of the entries shows the value A, the value is outside of the specified range.

The following information is provided:

- **Dew Point**

The blue status display shows that the temperature in the exhaust pipe at the catalyst outlet is above the dew point of the NO_x sensor. For thermocouple layout *Two After Cat* (see *Preferences* on page 124), this condition must be met in both exhaust gas lines.

- **Normal Operation**

The status display shows the status of the normal operation detection.

- Gray: Normal operation is not being detected.
- Green: Normal operation is being detected.
- Yellow: This status is possible in normal operation detection mode *Load and Temp.* and indicates that the exhaust gas temperature configured for normal operation has been reached at the catalyst outlet. However, depending on the NO_x monitoring mode set, the configured load or the configured manifold pressure for normal operation has not been reached or the load has not been released via CANopen®.
- Orange: This status is possible in normal operation detection mode *Load and Temp.* and indicates that, depending on the NO_x monitoring mode set, the configured load or the configured manifold pressure for normal operation has been reached or the load has been released via CANopen®. However, the exhaust gas temperature configured for normal operation has not been reached at the catalyst outlet.

- **24h Average**

This entry shows the provisional daily average of the nitrogen oxide readings since 00:00:00 hrs CET (UTC+1) of the current day converted according to VDMA 6299:2019-09. If the entry is grayed, the conditions for averaging are not met.

- **Trend**

The status display indicates that the provisional daily average of the nitrogen oxide concentration exceeds certain thresholds. In parallel, the NO_x monitor signals the threshold exceedance correspondingly via the binary outputs *Warning* and *Error* of the EasyNO_x (see section *Devices* on page 87).

- Red: The provisional daily average currently exceeds the configured level limit. The NO_x monitor has switched the binary output *Error* of the EasyNO_x.
- Yellow: The provisional daily average currently exceeds the configured warning threshold. The NO_x monitor has switched the binary output *Warning* of the EasyNO_x.
- Gray: The provisional daily average currently does not exceed any of the configured thresholds. The binary outputs *Warning* and *Error* of the EasyNO_x are not switched by the NO_x monitor.

- **Δ Temperature**

This entry shows the current temperature difference of the exhaust gas between the catalyst inlet and outlet. The entry is available if the layout *Before & After Cat* is set for exhaust gas temperature monitoring in the EasyNO_x (see section *Preferences* on page 124). The temperature at the catalyst inlet is subtracted from the temperature at the catalyst outlet. The background colors of the entry have the following meaning:

- Red: The configured temperature difference maximum is exceeded.
- Blue: The configured temperature difference minimum is undercut.
- White (day mode) or black (night mode): The current temperature difference is within the configured permissible range.

9 Devices

– Nitrogen Oxide Reading Display (Analog)

- Red pointer
During normal operation display of the current nitrogen oxide reading converted according to VDMA 6299:2019-09 (see section *Conversion of Nitrogen Oxide Readings* on page 48)
- Blue pointer
Display of the provisional daily average of the nitrogen oxide readings since 00:00:00 hrs CET (UTC+1) of the current day converted according to VDMA 6299:2019-09 as soon as valid nitrogen oxide readings are available in normal operation.

– Nitrogen Oxide Reading Display (Digital)

In normal operation display of the current nitrogen oxide reading converted according to VDMA 6299:2019-09

– T1, T2

Display of the currently measured exhaust gas temperature at the designated measuring points (see section *Installation Locations of Thermocouples* on page 64). T2 is not available if the layout *One After Cat* is set for exhaust gas temperature monitoring in the EasyNO_x (see section *Preferences* on page 124). The background colors of the entry have the following meaning:

- Red: The configured overtemperature has been exceeded at the respective measuring point.
- White (day mode) or black (night mode): The currently measured exhaust gas temperature is below the configured overtemperature at the respective measuring point.
- Purple: The measured value is not transmitted via the CAN bus.

– MAP / Load / In 3

The displayed entry depends on the selected monitoring mode. If the background of the respective entry is purple, the measured value is not transmitted via the CAN bus.

– MAP

This entry is displayed in the NO_x monitoring modes *MAP Naturally Aspirated* and *MAP Turbo* and shows the current manifold pressure measured via input 3 of the respective CAN bus module.

– Load

This entry is displayed in the NO_x monitoring modes *Load on CAN Module* and *Load via CANopen* and shows the current load signalled via the respective analog input.

– In 3

This entry is displayed in the NO_x monitoring modes *Off*, *Recording Only*, and *Start/Stop via CANopen* and shows the current input current at input 3 of the respective CAN bus module.

– In 4

This entry shows the current input current at input 4 of the respective CAN bus module. If the background of the entry is purple, the measured value is not transmitted via the CAN bus.

– NO_x

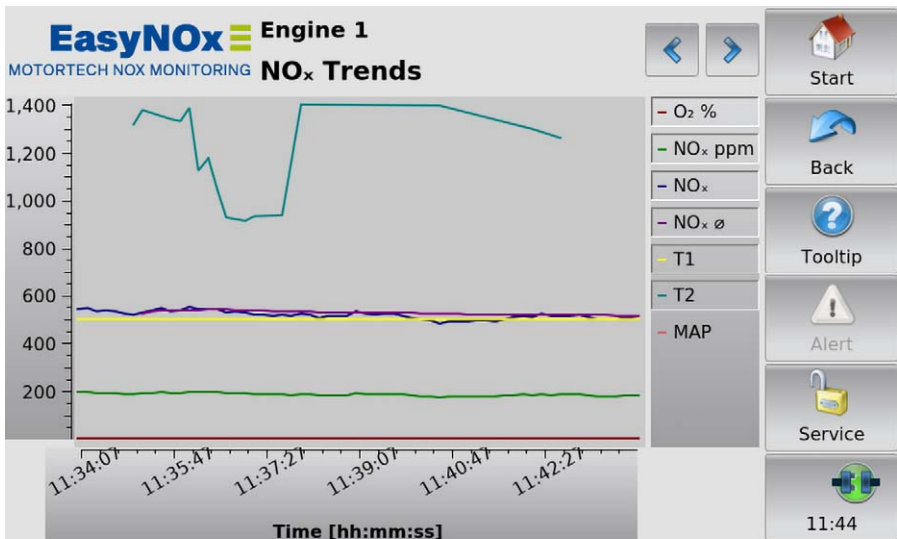
Display of the current nitrogen oxide reading from the connected NO_x sensor. If the background of the entry is purple, the measured value is not transmitted via the CAN bus.

– O₂

Displays the current oxygen reading from the connected NO_x sensor. If the background of the entry is purple, the measured value is not transmitted via the CAN bus.

- **Op**
Displays the normal operation hours registered so far by the NO_x monitor for the current calendar year. The normal operation hours are registered to the second and rounded down to the hour in the display.
- **Alm (Alarm)**
Failure hour counter, which shows the number of hours that the daily average of the NO_x concentration has been above the configured level limit in the current calendar year so far (see section *Failure Hour Counter* on page 50). The failure hours are registered to the second and rounded down to the hour in the display. The background colors of the entry have the following meaning:
 - Red: The configured time limit of the failure hour counter is exceeded.
 - Yellow: The configured warning threshold of the failure hour counter is exceeded.
 - White (day mode) or black (night mode): None of the configured thresholds is exceeded.

NO_x Trends



In the *NO_x Trends* view, you get information about the current trend of the measured values and the provisional nitrogen oxide daily average for the last 10 minutes. You can hide or show individual trends by using the legend.

The following trends are displayed:

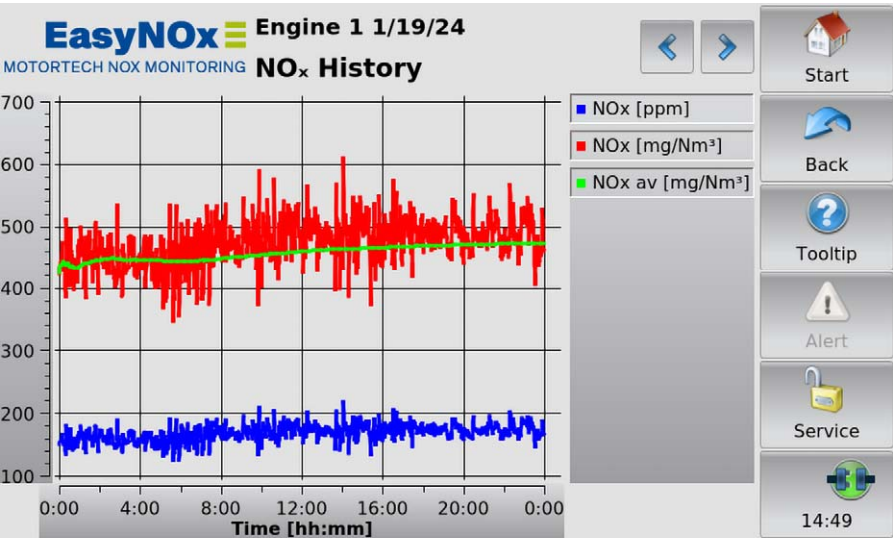
- **O₂ %**
Trend of the oxygen reading from the connected NO_x sensor
- **NO_x ppm**
Trend of the nitrogen oxide reading from the connected NO_x sensor

9 Devices



- **NO_x**
Trend of the nitrogen oxide reading converted according to VDMA 6299:2019-09 (see section *Conversion of Nitrogen Oxide Readings* on page 48) in mg/Nm³
- **NO_x Ø**
Trend of the provisional daily average of the nitrogen oxide readings since 00:00:00 hrs CET (UTC+1) of the current day converted according to VDMA 6299:2019-09 in mg/Nm³
- **T1, T2**
Trend of the measured exhaust gas temperatures at the designated measuring points (see section *Installation Locations of Thermocouples* on page 64)
- **MAP / Load / ---**
The displayed trend depends on the selected monitoring mode. *MAP* displays the trend of the measured manifold pressure in the NO_x monitoring modes *MAP Naturally Aspirated* and *MAP Turbo*, *Load* the trend of the signalled load in the NO_x monitoring modes *Load on CAN Module* and *Load via CANopen*. Three dashes (---) appear in the NO_x monitoring modes *Off*, *Recording Only*, and *Start/Stop via CANopen*, and no trend is displayed.

9.1.3 History

The *History* button in the main menu of an added NO_x monitor opens the *NO_x History* view.



In this view, you can display the trends of selected measured values for each day from the daily logs.

The  and  buttons allow you to switch between the days.

You can hide or show individual trends in the view by using the legend.

Three parameter groups are available. Tap into the trend graph to select the desired group.


Depending on the selected parameter group, the following trends are displayed:

Parameter group	Parameters	Description
NOx	NOx [ppm]	Daily trend of the nitrogen oxide reading from the connected NO _x sensor
	NOx [mg/Nm ³]	Daily trend of the nitrogen oxide reading converted according to VDMA 6299:2019-09 (see <i>Conversion of Nitrogen Oxide Readings</i> on page 48)
	NOx av [mg/Nm ³]	Daily trend of the provisional daily average of the nitrogen oxide readings converted according to VDMA 6299:2019-09
Temperature	T1 [°C]	Daily trend of the measured exhaust gas temperature at measuring point T1 (see <i>Installation Locations of Thermocouples</i> on page 64)
	T2 [°C]	Daily trend of the measured exhaust gas temperature at measuring point T2
Current	In3 [mA]	Daily trend of the measured input current at input 3 of the respective CAN bus module
	In4 [mA]	Daily trend of the measured input current at input 4 of the respective CAN bus module
Signals	Normal	Daily trend of the detected normal operation
	Load	Daily trend of the detected sufficient load for normal operation
	Temp.	Daily trend of the detected exhaust gas temperature sufficient for normal operation
	NOx av	Daily averaging trend
	Dew Point	Daily trend of the dew point detection

9 Devices

9.1.4 Logbook




The *Logbook* button in the main menu of an added NO_x monitor opens the *Logbook* view. In the logbook, the EasyNO_x logs events from the respective NO_x monitor. You can also create custom entries in the logbook. The logbook can be maintained in accordance with standard sheet VDMA 6299:2019-09.


EasyNO_x 

MOTORTECH NOX MONITORING


Engine 1

Logbook







Start




Back




Tooltip



Alert



Service



11:56

Date	Time	Category	Message
2024-01-26	11:54:17	ALARM	Delta temperature exceeded
2024-01-26	11:54:17	ALARM	Temperature 2 exceeded
2024-01-26	11:54:11	ALARM	Delta temperature undercut
2024-01-26	11:54:07	ALARM	Delta temperature exceeded
2024-01-26	11:54:07	ALARM	Temperature 2 exceeded
2024-01-26	11:54:05	ALARM	Temperature 2 undercut
2024-01-26	11:53:35	ALARM	Delta temperature undercut
2024-01-26	11:53:31	ALARM	Delta temperature exceeded
2024-01-26	11:53:31	ALARM	Temperature 2 exceeded
2024-01-26	11:52:17	CONFIGURATI	Service set NOx Warning from 500 t
2024-01-26	11:30:56	CONFIGURATI	Service set Sensor Layout from Bef
2024-01-26	11:30:54	CONFIGURATI	Service set Mode Limit from 800 to
2024-01-26	11:30:52	CONFIGURATI	Service set Mode from MAP Naturall
2024-01-26	11:30:52	CONFIGURATI	Service set Scaling Max. from 3007
2024-01-26	11:30:42	CONFIGURATI	Service set Mode Limit from 1400 t

For each entry the date (YYYY-MM-DD), time (hh:mm:ss), category, and the related message are displayed. Note that this view is continuously updated and displays at most the last 1,000 entries, although the logbook may contain more entries. To display older entries, you can filter the period to be displayed (see section *Filter Button* below).

In the title area, three buttons are displayed. The symbols on the middle and right button change depending on their settings. The buttons are described as follows.

Custom Entry Button

To add custom entries to the logbook, tap the following button:




The dialog window *Add Entry to Logbook* appears.

First, specify the creator of the logbook entry under *Name/Organization*. Then under *Measure*, use the drop-down list to select the type of measure (e.g. Service, Faults, Maintenance) the logbook entry is. The selection made here determines the available entries under *Event*. Then under *Event*, select the relevant event from the drop-down list (e.g. Regular engine maintenance performed, Engine/generator/cooling defective). If necessary, you can enter additional information about the logbook entry under *Description*. To save your logbook entry, tap on *OK*. To discard the logbook entry, tap on *Cancel*.



Events with lock icon

Events marked with a lock icon  cannot be entered in the logbook with the rights of your access level. If you select such an event, you will be prompted to log in to the required access level.

Filter Button

The button's appearance has the following meaning:



No filters are active. Continuously updated, the last 1,000 entries are displayed.



Filters are active. Up to 1,000 entries are displayed according to the set filters.

To filter the logbook entries, tap the *Filter* button. The dialog window *Logbook Filter* appears. Select the period and the categories of the entries to be displayed. Regard any dialog messages that you may get when setting the filters. Confirm your selection with *OK*.

9 Devices

Automatic Scrolling Button

The button's appearance has the following meaning:



Automatic scrolling is inactive.



Automatic scrolling is active.


To activate and deactivate automatic scrolling, tap the *Automatic Scrolling* button. When the function is activated, the EasyNO_x scrolls automatically to newly registered entries.

You have the following options for navigating in the list:

- Tap in the list and drag the displayed list section in the desired direction.
- Double-tap in a border area of the list (top, bottom, left, right) to jump to the end of that border area.
- Tap and hold in a border area of the list (top, bottom, left, right) to scroll in the desired direction.
- Move one of the scroll bars to scroll in the desired direction.

9.1.5 Export

The *Export* button in the main menu of an added NO_x monitor opens the *NO_x Export* view.

EasyNO_x  **Engine 1**
MOTORTECH NO_x MONITORING **NO_x Export**

2/21/23	6/13/23	6/14/23	6/15/23	6/28/23	7/5/23	7/10/23
7/12/23	7/26/23	7/27/23	8/1/23	8/3/23	8/4/23	8/14/23
8/22/23	9/8/23	9/25/23	9/26/23	10/4/23	10/5/23	10/6/23
10/9/23	10/11/23	10/12/23	10/15/23	10/18/23	10/22/23	
10/23/23	10/24/23	10/25/23	10/26/23	10/27/23	11/6/23	
11/10/23	11/16/23	11/17/23	11/22/23	11/23/23	11/27/23	
11/28/23	11/30/23	12/1/23	12/4/23	12/6/23	12/7/23	12/8/23
12/12/23	12/21/23	2023				

Copy


CSV Export


Report


Up


Abort


0%



Start


Back


Tooltip


Alert


Service


12:15

From this view, you can copy daily and annual logs of the NO_x monitor (see section *Daily Log* on page 53 and section *Annual Log* on page 53) and the NO_x monitoring report including the logbook (see section *NO_x Monitoring Report* on page 54) to a USB flash drive inserted in the EasyNO_x.

The file overview shows you the logs available on the device. Move the scroll bar to scroll up or down when necessary. Select the desired calendar year via the respective year number in blue letters. Select the desired daily log via the respective date in black letters. Select the annual log via the year number in green letters.

When copying to the USB flash drive, the progress bar below the buttons shows the copying progress and other information about the copying process.

You have the following options:

- **Copy**
This function is available for service purposes and creates a 1:1 copy of the desired log on the USB flash drive. This 1:1 copy cannot be read or processed by other devices.
- **CSV Export**
Mark the desired log (daily or annual) and use the button to create a copy of the log as a CSV file on the USB flash drive. On a PC, the CSV file can be opened with an editor, for example, or further processed with a spreadsheet. The CSV file is saved in the following format depending on the system language set in the EasyNO_x:

System language	Character set	Separator	Decimal separator
German	Windows-1252	Semicolon	Comma
English		Comma	Dot

- **Report**
Use this button to create a NO_x monitoring report for the selected calendar year as a PDF file on the USB flash drive. This monitoring report also includes the logbook along with other summarizing information. The operator information contained in the NO_x monitoring report can be specified in the *Information on Operator* view (see section *Operator* on page 128).
- **Up**
Use this button to return to the calendar year selection in the file overview.
- **Abort**
Use this button to cancel an ongoing copying process to the USB flash drive.

With the rights of the access level *Master*, the EasyNO_x additionally displays the following button in this view:



Loss of your NO_x monitor's data integrity!


The functions available via the *More* button are designed exclusively for service purposes and may only be triggered by MOTORTECH service or upon instruction from MOTORTECH. If you do not observe this notice, you risk the data integrity of your NO_x monitor. In such a case, contact your MOTORTECH contact person (see *Customer Service Information* on page 200).

The functions available via this button may only be triggered by MOTORTECH service or upon instruction from MOTORTECH. In addition, observe the preceding notice.

9 Devices

9.1.6 Preferences

The *Preferences* button in the main menu of an added NO_x monitor opens the NO_x Setup view.

EasyNOx  **Engine 1**

MOTORTECH NOx MONITORING **NO_x Setup**

Mode MAP Naturally A

Scaling Min. 0 mbar

Scaling Max. 3000 mbar

MAP < 800 mbar

Normal Operation Load and Temp.

Temperature 350 °C

Level Limit 600 mg/Nm³

Level Warning 500 mg/Nm³

Time Limit 400 h

Time Warning 350 h

K 0.2

KNO₂ 0.8

Layout Before & After

Overtemperature 1 580 °C

Undertemperature 1 250 °C

Overtemperature 2 590 °C


Undertemperature 2 250 °C


Min. Δ Temperature -20 K


Max. Δ Temperature 20 K


Output NO_x Min. 100 mg/Nm³


Output NO_x Max. 1005 mg/Nm³


 Start

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 10:46

Note that changes in this view are not saved and applied by the NO_x monitor until you exit the view. To be able to open this view via the *Preferences* button, you must have specified the serial number of the engine to be monitored in the view *Information on Operator* (see section *Operator* on page 128).

You can make the following settings:

- **Mode**
Use the drop-down list to set the NO_x monitoring mode:
 - **Off**
NO_x monitoring is disabled. The nitrogen oxide and oxygen readings from the NO_x sensor are not recorded. This mode must be set in the respective NO_x monitor if you want to delete it from the device configuration (see section *Deleting a Device* on page 94).
 - **Recording Only**
The nitrogen oxide and oxygen readings from the NO_x sensor are recorded, but NO_x monitoring is deactivated.
 - **MAP Naturally Aspirated**
For normal operation detection of the NO_x monitor, the manifold pressure of a naturally aspirated engine serves as an indicator for the engine load. For this purpose, a pressure sensor must be connected to input 3 of the respective CAN bus module (see *Wiring of Pressure Sensor, Pressure Signal, Load Signal* on page 73).
 - **MAP Turbo**
For normal operation detection of the NO_x monitor, the manifold pressure of a turbo engine serves as an indicator for the engine load. For this purpose, a pressure sensor must be connected to input 3 of the respective CAN bus module (see *Wiring of Pressure Sensor, Pressure Signal, Load Signal* on page 73).

- [Load on CAN Module](#)
The NO_x monitor detects normal operation by means of the load signal connected to input 3 of the respective CAN bus module (see *Wiring of Pressure Sensor, Pressure Signal, Load Signal* on page 73).
- [Load via CANopen](#)
The NO_x monitor detects normal operation by means of the load signal connected to the analog input of the I/O communication module BPlus or an I/O module. For this purpose, the function *Load Input for NOx* must be assigned to the analog input of the respective I/O module (see *Analog Inputs* on page 192).
- [Start/Stop via CANopen](#)
The NO_x monitor receives the normal operation release from the master control via a binary signal connected to the binary input of the I/O communication module BPlus or an I/O module. For this purpose, the function *Normal Operation Release for NOx* must be assigned to the binary input of the respective I/O communication module (see *Binary Inputs* on page 190).
- [Scaling Min., Scaling Max.](#)
Via these entries you can specify the measuring value range of the pressure sensor in the NO_x monitoring modes *MAP Naturally Aspirated* and *MAP Turbo*. Under *Scaling Min.*, enter the measured value of the sensor at 4 mA and under *Scaling Max.* at 20 mA. The values in-between are interpolated linearly.
- [MAP < / MAP > / Load / ---](#)
The entry displayed at this point depends on the set NO_x monitoring mode:
 - [MAP <](#)
In the NO_x monitoring mode *MAP Naturally Aspirated* you set the manifold pressure which must be undercut for normal operation detection (see *Determining Manifold Pressure for Normal Operation Detection* on page 66).
 - [MAP >](#)
In the NO_x monitoring mode *MAP Turbo*, you set the manifold pressure which must be exceeded for normal operation detection (see *Determining Manifold Pressure for Normal Operation Detection* on page 66).
 - [Load](#)
In the NO_x monitoring modes *Load on CAN Module* and *Load via CANopen*, you specify the load that indicates the beginning of normal operation of your engine (for example 30 % nominal load as per VDMA 6299:2019-09 or as per the engine manufacturer's specifications).
 - [---](#)
In NO_x monitoring modes *Off* and *Recording Only*, normal operation detection is disabled. In the NO_x monitoring mode *Start/Stop via CANopen*, the NO_x monitor receives the normal operation release from the master control.

9 Devices

– Normal Operation

In this area, you set the mode for normal operation detection:

– Load

The NO_x monitor detects normal operation solely via the analog load signal, the manifold pressure, or the binary signal *Normal Operation Release for NO_x*, depending on the set NO_x monitoring mode.

– Load and Temp.

In order for the NO_x monitor to detect normal operation, a specific exhaust gas temperature, which you set via the entry *Temperature*, must be reached at the catalyst outlet of the engine to be monitored in addition to the release via the analog load signal, the manifold pressure, or the binary signal *Normal Operation Release for NO_x*.

– Temperature

Specify the exhaust gas temperature at the catalyst outlet that must be reached in *Load and Temp.* mode for normal operation detection. For thermocouple layout *Two After Cat*, this condition must be met in both exhaust gas lines.

– K

Enter the NO₂/NO_x ratio of the exhaust gas from your system. The NO₂/NO_x ratio must be determined at the mounting position of the NO_x sensor's sensing element before start-up of NO_x monitoring and each time the NO_x sensor is replaced. More information on this is available in the section *Determining the NO₂/NO_x Ratio* on page 64.

– KNO₂

Enter the factor for the corrective calculation of the NO_x sensor's NO₂ sensitivity. For the correction factor, refer to the entry *NO₂ Gain* in the *NO_x Sensor* view (see section *Sensor* on page 129).

– Level Limit

Enter the daily average of the NO_x concentration, which must not be exceeded under any circumstances. To use the NO_x monitoring of the EasyNO_x in accordance with standard sheet VDMA 6299:2019-09, enter here the daily average at which an alarm should be triggered. If the daily average exceeds the level limit at the end of a day, the detected normal operation hours are added to the failure hour counter of the ongoing calendar year to the second. The change of day is firmly preset to 00:00:00 hrs Central European Time (CET) or UTC+1.

– Level Warning

Below the configured *Level Limit*, specify a daily average of the NO_x concentration above which the EasyNO_x will issue a warning. The *Level Warning* daily average serves to indicate that the daily average is approaching the configured level limit. As a warning threshold, you can specify your currently valid plant-specific limit value.

– Time Limit

For the failure hour counter of the NO_x monitor, specify the number of hours that the NO_x concentration may exceed the configured level limit as a maximum within one calendar year. If this number of hours is exceeded, the EasyNO_x indicates this in the *NO_x Monitoring* view via a red status display in the failure hour counter *Alm*.

– Time Warning

For the failure hour counter of the NO_x monitor, specify a warning threshold to indicate that the failure hour counter is approaching the configured *Time Limit*. If this warning threshold is exceeded, the EasyNO_x indicates this in the *NO_x Monitoring* view via a yellow status display in the failure hour counter *Alm*.

- **Layout**
Use the drop-down list to set the layout of the thermocouples (see *Installation Locations of Thermocouples* on page 64):
 - **Before & After Cat**
One thermocouple respectively measures the exhaust gas temperature before and after the catalytic converter.
 - **One After Cat**
One thermocouple measures the exhaust gas temperature after the catalytic converter.
 - **Two After Cat**
In engines with two exhaust gas lines, one thermocouple after each catalytic converter measures the exhaust gas temperature.
- **Overtemperature 1/2**
Specify respectively the exhaust gas temperature which must not be exceeded in the exhaust pipe at the corresponding measuring point ($1 = T_1$, $2 = T_2$).
- **Undertemperature 1/2**
Specify respectively the exhaust gas temperature which must not be undercut in the exhaust pipe at the corresponding measuring point ($1 = T_1$, $2 = T_2$).
- **Min. Δ Temperature, Max. Δ Temperature**
If you have selected the layout *Before & After Cat* for exhaust gas temperature monitoring, you must also specify the permissible temperature difference range of the exhaust gas between the catalyst inlet and outlet. A positive temperature difference stands for a correspondingly higher temperature at the outlet compared to the inlet. A negative temperature difference stands for a correspondingly lower temperature at the outlet compared to the inlet.
- **Output NO_x Min., Output NO_x Max.**
Specify the value range that is output by the EasyNO_x at an analog output for the currently measured nitrogen oxide reading (assigned function *Actual NO_x from NOx1/NOx2*) and for the provisional daily average (assigned function *Average NO_x from NOx1/NOx2*).

With the rights of the access level *Master*, the EasyNO_x additionally displays the following drop-down list in the title area of this view:

Simulation Off ▾



Risk of burning! Risk of destruction!

The simulation function of the NO_x monitor must always be set to *Simulation Off*, otherwise there is a risk of people getting burned on components of the plant or components of your system being destroyed.

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Loss of your NO_x monitor's data integrity!

The simulation function of the NO_x monitor must always be set to *Simulation Off*. In case of a deviating setting, the NO_x monitor loses its data integrity! In such a case, contact your MOTORTECH contact person (see *Customer Service Information* on page 200) immediately.

This list field is protected by a special PIN, allows a simulation of the NO_x monitor, and may only be changed by MOTORTECH service. In addition, observe the preceding notices.


9.1.7 Operator


The *Operator* button in the main menu of an added NO_x monitor opens the view *Information on Operator*.


EasyNO_x  **Engine 1**


MOTORTECH NO_x MONITORING **Information on Operator**


Engine Name	Engine 1
Serial Number	140253
Owner/Operator	Company
Contact	Jane Doe
Street	5 Main Street
Postal Code	E1 7DP
City	London
Site	CHP



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10:24

In this view, you can specify the following information about the engine and the operator:

- **Engine Name**
Enter a custom name for the engine to be monitored. This name is displayed in the title area in all views of the respective NO_x monitor.
- **Serial Number**
Enter the serial number of the engine to be monitored. This field is mandatory. Only after entering a serial number can you use the *Preferences* button in the respective NO_x monitor to open the *NO_x Setup* view, in which you can configure the respective NO_x monitor (see section *Preferences* on page 124).

- [Owner/Operator, Contact, Street, Postal Code, City, Site](#)

In this section, enter information about the operator of the NO_x monitor. The operator information specified here applies to both NO_x monitors of the EasyNO_x.

All information you provide on this page is included correspondingly in the NO_x monitoring report, which can be exported to a USB flash drive using the export function of the respective NO_x monitor (see section *Export* on page 122).

9.1.8 Sensor

The *Sensor* button in the main menu of an added NO_x monitor opens the *NO_x Sensor* view.

EasyNO _x Engine 1		MOTORTECH NO _x MONITORING NO _x Sensor	
NO _x [ppm]	185	Heater Ratio	0
OK	OK	NO _x Gain [%]	0
O ₂ [%]	5.47	NO _x Offset [ppm]	0
OK	OK	Operating Hours	252:10
Heater	Auto	O ₂ p Gain [%/bar]	0.51
OK	OK	NO _x p Gain [%/bar]	0.1
Power	OK	NO ₂ Gain	0.85
Diagnosis	Not Activ	NH ₃ Gain	1.1
Software	Z597 99 01	Self-Diagnosis	255
ECU ID	2267220397 0000002135 24V		

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In this view, status information from the NO_x sensor of the connected CAN bus/NO_x sensor module is displayed. The status information displayed may vary depending on the NO_x sensor connected. If one of the entries shows the value A, the value is outside of the specified range.

The following information is provided:

- [NO_x \[ppm\]](#)

In the field to the right of the entry, the current nitrogen oxide reading is displayed. The left field below the entry displays whether the current reading is valid, there is an error, there is no connection to the NO_x sensor, or the NO_x sensor has not yet determined a measured value (for example, if the dew point has not yet been reached). In case of an error, an error message or an error code is displayed in the right field below the entry.

- [O₂ \[%\]](#)

In the field to the right of the entry, the current oxygen reading is displayed. The left field below the entry displays whether the current reading is valid, there is an error, there is no connection to the NO_x sensor, or the NO_x sensor has not yet determined a measured value (for example, if the dew point has not yet been reached). In case of an error, an error message or an error code is displayed in the right field below the entry.

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- **Heater**
In the field to the right of the entry, the current mode of the sensing element heater of the NO_x sensor is displayed. The left field below the entry displays whether the sensing element is at operating temperature, there is an error, there is no connection to the NO_x sensor, or the status is not available. In case of an error, an error message or an error code is displayed in the right field below the entry.
- **Power**
Display of the current status of the supply voltage applied to the NO_x sensor.
- **Diagnosis**
Display of the current status of the NO_x sensor's self-diagnosis
- **Software**
Display of the software identification data of the NO_x sensor
- **ECU ID**
Display of the ECU identification data of the NO_x sensor consisting of ECU part number, ECU serial number, and ECU voltage type
- **Heater Ratio**
With certain NO_x sensors, this entry displays the current heater ratio of the resistance heater that is embedded in the sensing element of the NO_x sensor.
- **NO_x Gain [%]**
Display of the current NO_x gain of the new part deviation
- **NO_x Offset [ppm]**
Display of the current NO_x offset of the new part deviation
- **Operating Hours**
Display of the total operating hours of the NO_x sensor, counted from dew point release. Observe that the NO_x sensor must be replaced when its service life has been reached. For more information on this, refer to the section *Replacing the NO_x Sensor* on page 202.
- **O₂ p Gain [%/bar] / $\alpha\{\lambda\}$ [bar]**
The displayed entry depends on the connected NO_x sensor.
 - **O₂ p Gain [%/bar]**
Display of O₂ correction factor
 - **$\alpha\{\lambda\}$ [bar]**
Display of the pressure correction constant of the linear lambda signal
- **NO_x p Gain [%/bar] / $\alpha\{\text{NO}_x\}$ [bar]**
The displayed entry depends on the connected NO_x sensor.
 - **NO_x p Gain [%/bar]**
Display of NO_x correction factor
 - **$\alpha\{\text{NO}_x\}$ [bar]**
Display of the pressure correction constant of the NO_x signal
- **NO₂ Gain**
Display of the factor for the corrective calculation of the NO₂ sensitivity. Enter the value displayed here in the NO_x Setup view as NO₂ correction factor in the entry KNO₂ (see section *Preferences* on page 124).
- **NH₃ Gain**
Display of the factor for the corrective calculation of the NH₃ sensitivity

- [Self-Diagnosis](#)

Final result of the NO_x sensor's self-diagnosis displayed as a ratio to the reference value defined by the manufacturer

9.2 Ignition Controller

Unless otherwise indicated, the functions and views of an added ignition controller are described in this section based on the example of an MIC4 ignition controller.

9.2.1 Main Menu

The main menu of an added ignition controller can be opened in the *Start Menu* via the button with the corresponding device name (e.g. *MIC4*, *MIC100*).



Depending on the device type of the ignition controller, the main menu has the following buttons:

- [Overview](#)

The button provides you with information on the most important operating data. There is more information in the section *Overview* on page 132.

- [Timing](#)

The button provides you with information on ignition timing. There is more information in the section *Timing* on page 136.

- [Ignition](#)

With the exception of the MIC100, the button provides you with information on estimated secondary voltages and misfires. There is more information in the section *Ignition* on page 137. With an MIC100, the button provides you with information on the absolute firing angles, the energy output, and the spark duration. There is more information in the section *MIC100* on page 140.


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- [Energy](#)
The button provides you with information on energy output and spark duration. There is more information in the section *Energy* on page 140. With the MIC100, this button is not available.
- [Firing Angles](#)
The button provides you with information on the absolute and relative firing angles. There is more information in the section *Firing Angles* on page 141. With the MIC100, this button is not available.
- [Adjustments](#)
The button gives you access to further views in which you can make runtime adjustments for the ignition controller. In addition, you can carry out a self test. There is more information in the section *Adjustments* on page 143.
- [Trends](#)
The button gives you access to the firing angles trend and additionally, with the exception of the MIC100, to the estimated secondary voltages trend. There is more information in the section *Trends* on page 151.
- [Message Log](#)
The button gives you access to status messages as well as information, alarms, warnings, and error messages from the ignition controller. There is more information in the section *Message Log* on page 153. With the MIC100, this button is not available.
- [Diagnosis](#)
The button provides you with information on the operating data of the ignition controller. There is more information in the section *Diagnosis* on page 156.
- [Information](#)
The button provides you with data on the hardware and software of the connected ignition controller. There is more information in the section *Information* on page 157.
- [Help](#)
This button opens the operating manual of the ignition controller. There is more information in the section *Help* on page 111.

9.2.2 Overview

The *Overview* button in the *Main Menu* of the added ignition controller opens the following views:

- *Overview*
- *Ignition Data*

The  and  buttons allow you to switch between the views.

The views are described as follows.

Overview



The following operating data of the ignition controller are summarized in the view:

- **Pickup**
The status display shows whether pickup signals are being detected.
 - Gray: No signals are detected.
 - Yellow: The ignition controller is being synchronized to the pickup signals.
 - Green: Signals are detected.
- **Ignition Outputs**
The status display shows the status of the ignition outputs of the ignition controller.
 - Gray: There are no firings.
 - Green: The outputs are firing without any errors.
 - Yellow: There were previous misfires, but there are no misfires at present.
 - Red: There are misfires.

Detailed information on ignition outputs can be found in the *Ignition* view (see section *Ignition* on page 137, for the MIC100 see section *MIC100* on page 140).

- **Ignition Enabled**
The status display shows whether the ignition controller has received an ignition enabled command.
 - Gray: Ignition is not enabled.
 - Green: Ignition is enabled.
 - Yellow: Ignition is enabled but the ignition controller is waiting for the engine to stop.

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– System

The status display shows the system status.

- Gray: No signal is received.
- Green: The system works flawlessly.
- Yellow: There are warnings or alarms, which do not lead to an engine stop.
- Red: There are errors, which have led to an engine stop. If errors occur, the ignition controller is put into error state.

– GPO

The status display shows the status of the general purpose output. The functions of the general purpose output are set in the MICT. Further information can be found in the operating manual of your ignition controller.

- Green: The general purpose output is switched.
- Gray: The general purpose output is not switched.

– Engine Speed

In the analog display the current engine speed is presented with a pointer and also numerically.

- Green area: The engine speed is below nominal speed.
- Yellow area: The engine speed is between nominal speed and overspeed.
- Red area: Overspeed

With the exception of the MIC100, the following operating data is displayed additionally:

– Schedule

The status display shows the active schedule of the ignition controller. If schedules have been named in the MICT, the names are displayed (for example *Biogas* and *Natural Gas*). If no names have been assigned, the schedules are called *A* and *B* in the EasyNO_x.

- Gray: The schedule is not active.
- Blue: The schedule is active.

– Ignition Timing

Shows the current global ignition timing in °crankshaft.

– Spark Plugs

Displays the present operating hours of the spark plugs.

Only with the MIC6, the following operating data is displayed additionally:

– Pickup Redundancy

The status display shows the status of the pickup redundancy.

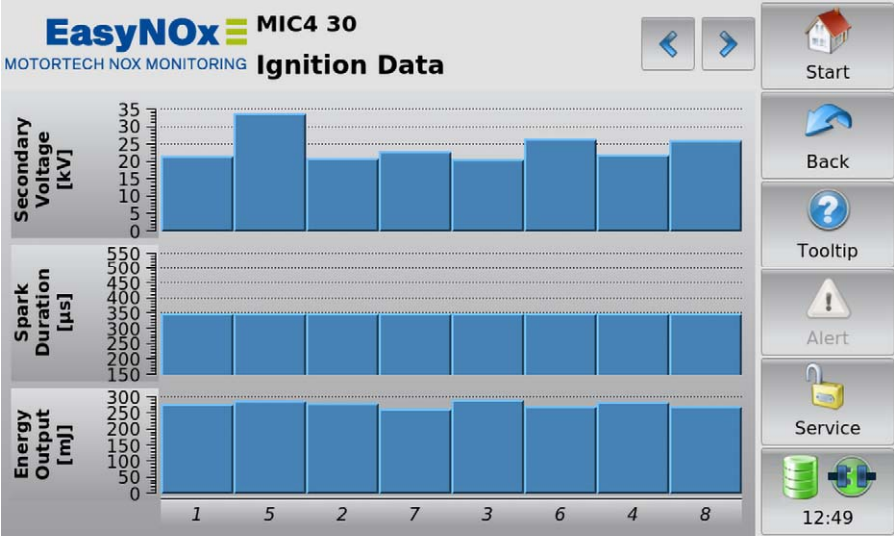
- Gray: Pickup redundancy is deactivated.
- Yellow: Pickup redundancy is activated.
- Green: Both pickup sets are synchronized and working error-free.

– Set 1, Set 2

The status display respectively signals the following states:

- Gray: No signals are received from the pickup set.
- Yellow: The pickup set is being synchronized.
- Green: The pickup set works without errors.

Ignition Data



For each ignition output of the ignition controller, this view displays the energy output, the spark duration, and, with the exception of the MIC100, the estimated secondary voltage as bars. If cylinder names have been assigned in the configuration of the ignition controller (not available with the MIC100), they are displayed on the X-axis. If no cylinder names have been assigned in the configuration of the ignition controller, the corresponding ignition output number (A1, A2, ...) is displayed instead.


With all supported ignition controllers except the MIC100, numerical values for the estimated secondary voltage are displayed in the *Ignition* view (see section *Ignition* on page 137) and for the energy output and spark duration in the *Energy* view (see section *Energy* on page 140).

With the MIC100, numerical values for the energy output and spark duration are displayed in the *Ignition* view (see section *MIC100* on page 140).

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9.2.3 Timing

The *Timing* button in the *Main Menu* of the added ignition controller opens the *Timing* view.


**MIC4 30**
MOTORTECH NOX MONITORING **Timing**


Global Timing Calculation


Base Timing	20.0	BTDC	
Potentiometer Timing	0.1	RET	48.9 %
Analog Current Input Timing	4.9	RET	19.8 mA
Analog Voltage Input Timing	0.0	RET	0.0 V
Speed Curve Correction	1.3	RET	
Timing Correction	0.0	RET	
Global Timing Point	13.7	BTDC	


Individual Timing


Minimum	15.7	ATDC
Maximum	10.7	ATDC
Average	13.8	ATDC



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14:06

Depending on the device type of the ignition controller, the following information is provided:

Global Timing Calculation

Overview of the values from which the global ignition timing is calculated.

- **Base Timing**
Shows the base timing in °crankshaft.
- **Potentiometer Timing** (not available with the MIC100)
Displays the adjustment of the ignition timing via the potentiometer in °crankshaft in the direction advanced or retarded and right next to it the adjustment on the potentiometer in percent.
- **Analog Current Input Timing**
Displays the adjustment of the ignition timing via the analog current signal in °crankshaft in direction advanced or retarded. On the right next to it, the current measurement value of the analog current input is displayed in mA.
- **Analog Voltage Input Timing** (not available with the MIC100)
Displays the adjustment of the ignition timing via the analog voltage signal in °crankshaft in direction advanced or retarded. On the right next to it the current measurement value of the analog voltage input is displayed in V.
- **Speed Curve Correction**
Displays the adjustment via the speed curve in °crankshaft in direction advanced or retarded.
- **Timing Correction**
Displays the adjustment via the ignition timing correction in °crankshaft in direction advanced or retarded.

- **Global Timing Point**

Displays the current ignition timing in °crankshaft, which was calculated for the engine from the previously named settings.

With the exception of the MIC100, the following information on the adjustment of the cylinder-specific ignition timing is additionally provided:

Individual Timing

Overview of the adjustment of the cylinder-specific ignition timing:

- **Minimum**

Displays the minimum ignition timing in °crankshaft resulting from the cylinder-specific adjustment.

- **Maximum**

Displays the maximum ignition timing in °crankshaft resulting from the cylinder-specific adjustment.



- **Average**

Displays the average value of the cylinder-specific ignition timing adjustment in °crankshaft for all cylinders.

9.2.4 Ignition

With the exception of the MIC100, the *Ignition* button in the *Main Menu* of the added ignition controller opens the following views:

- *Ignition*
- *Misfires*

The  and  buttons allow you to switch between the views.

The views are described as follows.

For the MIC100, read the section *MIC100* on page 140.

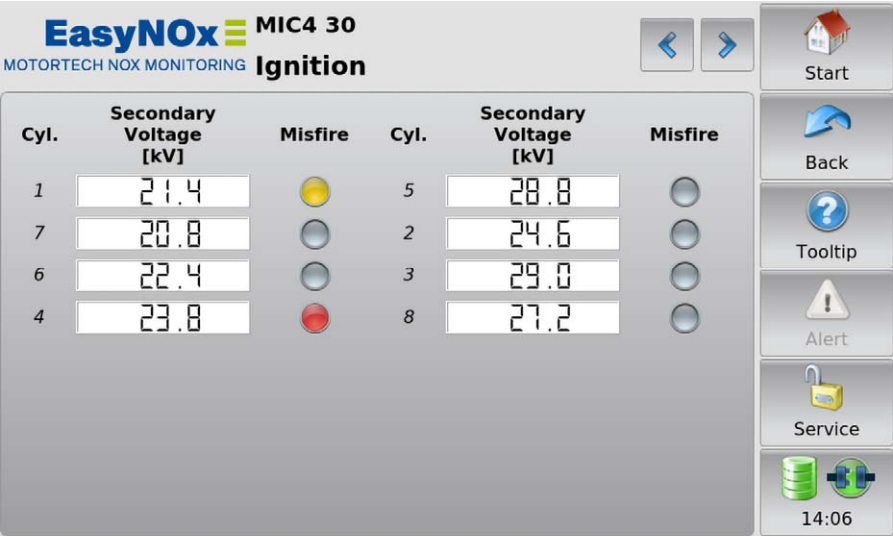
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Cyl. / Output column

If cylinder names have been assigned in the configuration of the ignition controller, they are displayed in the *Cyl.* column. If no cylinder names have been assigned in the configuration of the ignition controller, the *Output* column with the corresponding ignition output numbers (A1, A2, ...) is displayed instead.

Ignition



The following information is provided:

- The estimated secondary voltage is displayed individually for every ignition output of the ignition controller.
- The status display provides information about misfires for each cylinder:
 - Gray: No misfires have been registered.
 - Yellow: There were previous misfires, but there are no misfires at present.
 - Red: Misfires occurred, and there is no warning or error status.

You can view the estimated secondary voltages as a bar chart in the *Ignition Data* view, which can be accessed via the *Overview* (see section *Overview* on page 132).

Misfires

EasyNOx MIC4 30

MOTORTECH NOX MONITORING **Misfires**

Cyl.	Primary Open	Primary Short	Secondary Open	Secondary Short	Cyl.	Primary Open	Primary Short	Secondary Open	Secondary Short
1	Yellow	Gray	Gray	Gray	5	Gray	Gray	Gray	Gray
7	Gray	Gray	Gray	Gray	2	Gray	Gray	Gray	Gray
6	Gray	Gray	Gray	Gray	3	Gray	Gray	Gray	Gray
4	Gray	Gray	Gray	Gray	8	Red	Gray	Gray	Gray

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Tooltip

Alert

Service

14:07

You receive information on where an error has occurred in the ignition circuit:

- *Primary*: The information relates to the primary side of the ignition circuit.
- *Secondary*: The information relates to the secondary side of the ignition circuit.

You receive information on which error has occurred in the wiring of the ignition coils:

- *Open*: The ignition circuit is not closed.
- *Short*: short circuit

The status displays can show different colors:

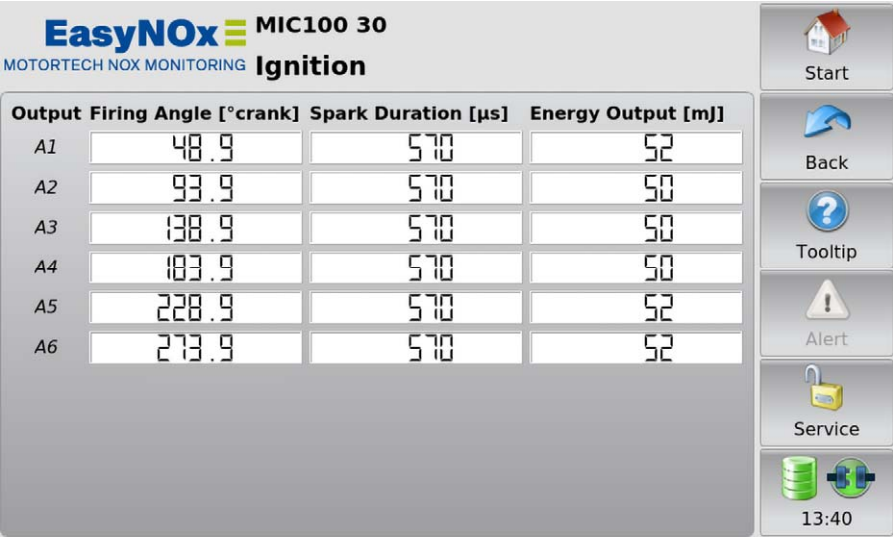
- Gray: There are no errors.
- Red: Misfires occurring at the moment.
- Yellow: At least one misfire has occurred.
- White: The wrong ignition coils were set via the MICT, or the misfire detection is unavailable for the coils selected.

With the button you can reset the misfire counters of the ignition controller.

9 Devices

9.2.4.1 MIC100

The *Ignition* button in the *Main Menu* of an added MIC100 ignition controller opens the *Ignition* view.



For each output of the ignition controller, the absolute firing angles of the cylinders in °crankshaft, the spark duration in µs, and the energy output in mJ are displayed. The values for spark duration and energy output can be used to detect possible wear of the spark plugs.

Alternatively, you can view the spark duration and energy output as a bar chart in the *Ignition Data* view, which can be accessed via the *Overview* (see section *Overview* on page 132).

9.2.5 Energy

The *Energy* button in the *Main Menu* of certain added ignition controllers opens the *Energy* view.

With the MIC100, the *Energy* view is not available. Instead, the information of this view can be found in the *Ignition* view (see section *MIC100* on page 140).



Cyl. / Output column

If cylinder names have been assigned in the configuration of the ignition controller, they are displayed in the *Cyl.* column. If no cylinder names have been assigned in the configuration of the ignition controller, the *Output* column with the corresponding ignition output numbers (A1, A2, ...) is displayed instead.


EasyNOx


MIC4 30


MOTORTECH NOX MONITORING


Energy


Cyl.	Spark Duration [μs]	Energy Output [mJ]	Cyl.	Spark Duration [μs]	Energy Output [mJ]
1	300	270	5	300	296
7	300	280	2	300	266
6	300	282	3	300	270
4	300	280	8	300	274


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Tooltip

Alert

Service

14:06



This view displays the *Spark Duration* in μs and the *Energy Output* in mJ. The values can be used to detect possible wear of the spark plugs.

You can view the spark duration and the energy output as a bar chart in the *Ignition Data* view, which can be accessed via the *Overview* (see section *Overview* on page 132).

9.2.6 Firing Angles

The *Firing Angles* button in the *Main Menu* of certain added ignition controllers opens the following views:

- *Firing Angles*
- *Firing Angles Drift*

The  and  buttons allow you to switch between the views.

The views are described as follows.

With the MIC100, the views *Firing Angles* and *Firing Angles Drift* are not available. Instead, information on the firing angles can be found in the *Ignition* view (see section *MIC100* on page 140).

9 Devices



Cyl. / Output column

If cylinder names have been assigned in the configuration of the ignition controller, they are displayed in the *Cyl.* column. If no cylinder names have been assigned in the configuration of the ignition controller, the *Output* column with the corresponding ignition output numbers (A1, A2, ...) is displayed instead.

Firing Angles

EasyNOx

MIC4 30

MOTORTECH NOX MONITORING

Firing Angles

Cyl.

Firing Angle [°crank]

1

17.8

BTDC

Cyl.

Firing Angle [°crank]

5

17.8

BTDC

Cyl.

Firing Angle [°crank]

7

17.8

BTDC

Cyl.

Firing Angle [°crank]

2

17.8

BTDC

Cyl.

Firing Angle [°crank]

6

17.8

BTDC

Cyl.

Firing Angle [°crank]

3

17.8

BTDC

Cyl.

Firing Angle [°crank]

4

17.8

BTDC

Cyl.

Firing Angle [°crank]

8

17.8

BTDC

Start

Back

Tooltip

Alert

Service

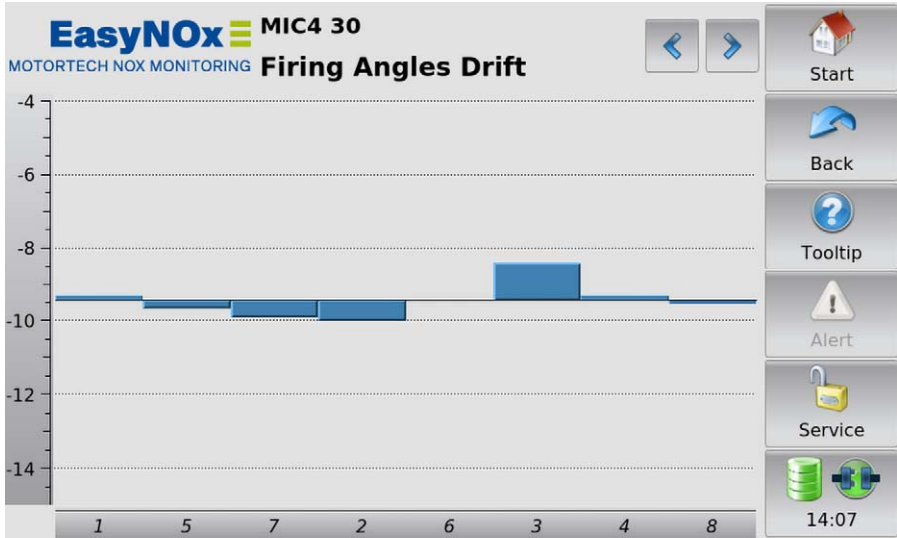
14:07

The firing angles of the cylinders are displayed in °crankshaft for each output of the ignition controller.

With the  button you can switch the display of the firing angles:

- *Absolute*: Firing angle in °crankshaft related to the top dead center of the first cylinder in firing order
- *Relative*: Firing angle in °crankshaft related to its own top dead center

Firing Angles Drift





The deviations from the global ignition timing in °crankshaft are displayed in a bar chart.

9.2.7 Adjustments

The *Adjustments* button in the *Main Menu* of the added ignition controller opens the following views:

- *Self Test*
- *Timing Adjustment*
- *Operating Hours*
- *Energy Adjustments*
- *Voltage Calibration* (not available with the MIC100)
- *Reset Position*
- *Cylinder Individual Offset* (not available with the MIC100)

The  and  buttons allow you to switch between the views.

The views are described as follows.

9 Devices



Risk of destruction!

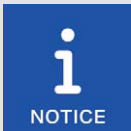
Incorrect settings for energy, firing angles and the reset position can lead to damage to the engine and the ignition system. Therefore make sure that engine and ignition kit are designed for the corresponding settings.



Risk of destruction!

Changes to the settings for energy, firing angles, voltage and reset position take effect *immediately and without further confirmation*. Therefore always comply with the operating manuals of the engine and all components of the ignition kit.

Self Test



Entry Cylinder / Output

If cylinder names have been assigned in the configuration of the ignition controller (not available with the MIC100), this view displays the entry *Cylinder* with the assigned cylinder names. If no cylinder names have been assigned in the configuration of the ignition controller, this view displays the entry *Output* and the corresponding ignition output numbers (A1, A2, ...) instead.

**Operational safety!**

If you carry out a self test, it is essential for the gas supply to be switched off and no more residual gas is left in the combustion chamber. Non-compliance can result in damage to equipment or injury to persons.

You can run a self test to check the order of the wiring and the connection between the ignition controller outputs down to the spark plugs.

The status display indicates whether the ignition controller is ready for the self test.

- Red: The ignition controller is in a state in which no self test can be done. For example, there is an error or a configuration is currently being downloaded into the device.
- Yellow: The self test is running.
- Green: The ignition controller is ready and the self test can be started.

Carry out the self test as follows:

1. Stop the gas supply to the engine.
2. Purge the engine.
 - The engine is ready for the self test.
3. Set the *Cycle Time* (the interval between the two ignitions).
4. Define via the *Number of Cycles* whether the self test is to run *Unlimited* or whether it should be ended after a defined number of cycles.

9 Devices

- 5. Define whether *All* configured outputs or only a defined output should be fired during the self test.
- 6. Start the self test via the *Start* button.
 - ▶ The self test runs until it is stopped. In the meantime you can inspect the data received in other views.
- 7. End the self test via the *Stop* button.
 - ▶ The self test is concluded.

Timing Adjustment

 **MIC4 30**

MOTORTECH NOX MONITORING **Timing Adjustment**

Timing Correction [°crank]

0.1

RET

Global Timing Point [°crank]

17.8

BTDC

-0.5

-0.1

+0.1

+0.5

 Start

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 14:07

Via the corresponding buttons, the global ignition timing can be corrected in 0.1° or 0.5° increments to advance or retard.

Operating Hours



Set the operating hours of the spark plugs or the engine via the arrow keys to the desired value. You can reset the operating hours value of the spark plugs and the engine to 0 with the *Reset* buttons.

9 Devices

Energy Adjustments

EasyNOx

MIC4 30

MOTORTECH NOX MONITORING

Energy Adjustments

←

→

Schedule A - Biogas

Spark Duration

350

μs

⏪ ⏩ ⏴ ⏵

Spark Intensity

55

mA

⏪ ⏩ ⏴ ⏵

Schedule B - Natural Gas

Spark Duration

200

μs

⏪ ⏩ ⏴ ⏵

Spark Intensity

60

mA

⏪ ⏩ ⏴ ⏵

🏠

Start

↩

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?

Tooltip

⚠

Alert

🔓

Service

🗄️ ⌚

14:08

With an added MIC100, *Schedule A* is available only.

In this view, you have the following options:

- The *Spark Duration* for the schedules can be lowered or increased via the corresponding buttons by 1 μs or 5 μs.
- The *Spark Intensity* for the schedules can be lowered or increased via the corresponding buttons by 1 mA or 5 mA.

Voltage Calibration

EasyNOx MIC4 30
MOTORTECH NOX MONITORING **Voltage Calibration**

A1	1.5	A2	0.4	B1	1.8	B2	1.0
A3	1.5	A4	-0.5	B3	1.4	B4	0.5
A5	1.0	A6	0.0	B5	1.5	B6	-0.3
A7	1.2	A8	1.4	B7	2.1	B8	0.4

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With the MIC100, the *Voltage Calibration* view is not available.

In this view, you can set a unitless correction value for the secondary voltage estimation for each output. Observe that in this view the EasyNO_x does not display any cylinder names, but only ignition output numbers, even if cylinder names are assigned in the configuration of the ignition controller.

Changes are made to selected outputs. You have the following options for selecting outputs:

- Tap the desired output directly to select it. To remove the output from the selection, tap the output again.
- Tap a group symbol (e.g.) to invert the selection for the respective group.
 - ▶ Selected outputs have a blue frame.

- Tap to clear all selections.

For the selected outputs, set the correction value using the arrow keys:

- With and in steps of 0.1
- With and in steps of 0.5

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Reset Position

EasyNOx  **MIC4 30**

MOTORTECH NOX MONITORING **Reset Position**

Reset [°crank]

34.0

ADV

 0.5 ADV

 0.1 ADV

 0.1 RET

 0.5 RET

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Using the arrow keys, correct the index/reset position (*Reset*) in steps of 0.1 °crankshaft or 0.5 °crankshaft to advance or retard. If the correction range is not sufficient, the reset/index position must be adjusted in the configuration in the MICT.

Cylinder Individual Offset

EasyNOx  **MIC4 30**

MOTORTECH NOX MONITORING **Cylinder Individual Offset**

A1

1.0

A2

0.0

B1

0.5

B2

0.0

A3

0.3

A4

-0.5

B3

0.0

B4

0.0

A5

0.1

A6

0.2

B5

0.2

B6

0.2

A7

0.9

A8




0.0

B7





0.0


B8


0.3


  


[°]


   


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 14:08

With the MIC100, the *Cylinder Individual Offset* view is not available.

In this view, you can adjust the ignition timing position for each cylinder individually. Observe that in this view the EasyNO_x does not display any cylinder names, but only ignition output numbers, even if cylinder names are assigned in the configuration of the ignition controller.

Changes are made to selected outputs. You have the following options for selecting outputs:

- Tap the desired output directly to select it. To remove the output from the selection, tap the output again.
- Tap a group symbol (e.g. ) to invert the selection for the respective group.
 - ▶ Selected outputs have a blue frame.

- Tap  to clear all selections.

For the selected outputs, set the correction value using the arrow keys:

- With  and  in steps of 0.1°
- With  and  in steps of 0.5°

9.2.8 Trends

The *Trends* button in the *Main Menu* of the added ignition controller opens the *Trends* view.

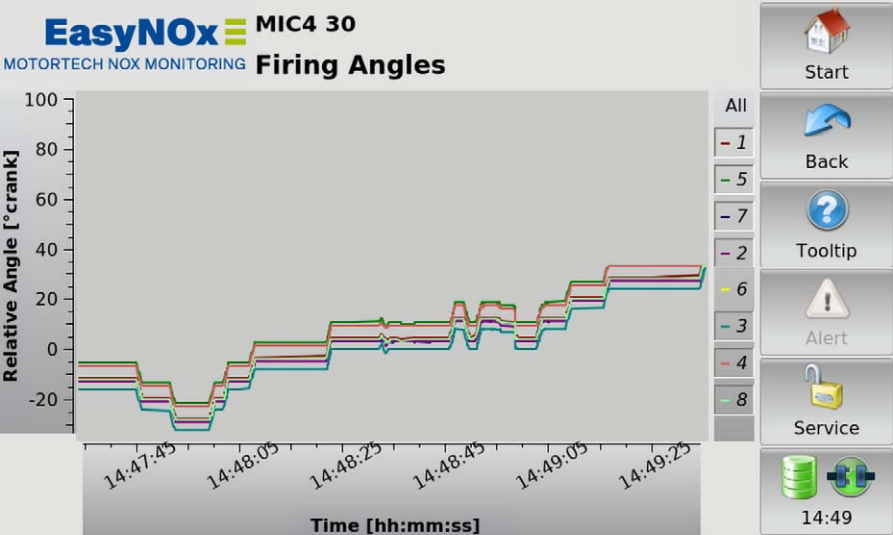


To view the current trend of the firing angles or (not available with the MIC100) the estimated secondary voltages (*High Voltages*), tap the desired button.

9 Devices

Firing Angles

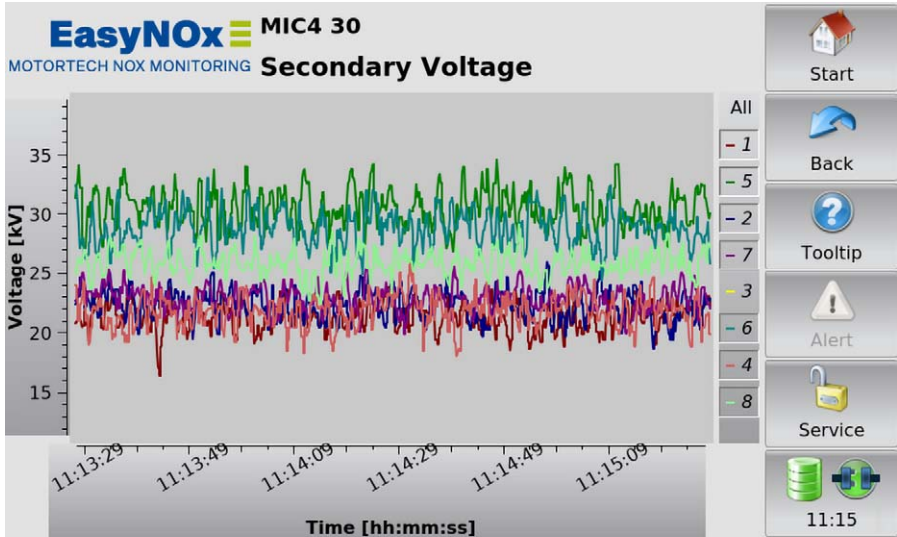
The *Firing Angles* button in the *Trends* view of the added ignition controller opens the *Firing Angles* view.



You receive information on the current trend of the firing angles. The cylinders can be hidden and shown individually using the legend.

Secondary Voltage

The *High Voltages* button in the *Trends* view of certain added ignition controllers opens the *Secondary Voltage* view. With the MIC100, the *High Voltages* button and the *Secondary Voltage* view are not available.





You receive information on the current trend of the estimated secondary voltages. The cylinders can be hidden and shown individually using the legend.

9.2.9 Message Log

The *Message Log* button in the *Main Menu* of certain added ignition controllers opens the following views:

- *States*
- *Message Log*

The  and  buttons allow you to switch between the views.

The views are described as follows.

With the MIC100, the *States* and *Message Log* views are not available.

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States

EasyNOx

MOTORTECH NOX MONITORING


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States

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Operating Hours	Time	Status Message
68:09:56.283	2024-02-05 17:27:40	Analog current input failure (current: 1,0
67:46:29.930	2024-02-05 17:04:14	Cylinder individual timing limited.
68:09:49.885	2024-02-05 17:27:34	PU1: Missing Signal. Signal timeout occ

Status messages are listed in the States view.

The following information is provided:

- *Operating Hours*: total operating hours of the ignition controller at the time of the message
- *Time*: date and time of the message
- *Status Message*: message text

Status messages are displayed in black if they are current. If a status is reset, the status message is displayed gray for 10 seconds before it is deleted from the list.

Message Log

EasyNOx MIC4 30
MOTORTECH NOX MONITORING **Message Log**


Operating Hours	Time	Category	Message
44,561:26:43.121	2024-01-24 09:03:28	Info	CANopen on interface CA
44,561:26:43.122	2024-01-24 09:03:28	Info	CANopen on interface CA
44,561:26:43.122	2024-01-24 09:03:28	Info	CANopen on interface CA
44,561:26:43.370	2024-01-24 09:03:28	Info	J1939 on interface CAN1
44,561:28:04.176	2024-01-24 09:04:49	Info	CANopen on interface CA
44,561:28:04.176	2024-01-24 09:04:49	Info	CANopen on interface CA
44,561:28:19.498	2024-01-24 09:05:04	Info	CANopen on interface CA
44,561:28:57.670	2024-01-24 09:05:43	Info	Device switched off.
44,561:28:58.936	2024-01-24 09:09:25	Info	Device (firmware 0.0.1.3
44,561:28:58.936	2024-01-24 09:09:25	Info	J1939 on interface CAN1
44,561:28:58.938	2024-01-24 09:09:25	Info	CANopen on interface CA
44,561:28:58.944	2024-01-24 09:09:25	Info	CANopen on interface CA
44,561:28:58.945	2024-01-24 09:09:25	Info	CANopen on interface CA
44,561:28:58.945	2024-01-24 09:09:25	Info	CANopen on interface CA
44,561:28:59.192	2024-01-24 09:09:25	Info	J1939 on interface CAN1
44,561:29:10.122	2024-01-24 09:09:36	Info	CANopen on interface CA
44,561:29:10.122	2024-01-24 09:09:36	Info	CANopen on interface CA
44,561:29:25.313	2024-01-24 09:09:51	Info	CANopen on interface CA

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The *Message Log* view lists information, alarms, warnings, and errors (with ignition controller MIC4 working from version 0.16).

The following information is provided:

- *Operating Hours*: total operating hours of the ignition controller at the time of the message
- *Time*: date and time of the message
- *Category*: type of message (information, warning, error, alarm)
- *Message*: message text


With the  button you open the menu *Actions*. You have the following options:

- Acknowledge alarms
- Acknowledge runtime errors
- Switch automatic scrolling on and off

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9.2.10 Diagnosis

The *Diagnosis* button in the *Main Menu* of the added ignition controller opens the *Diagnosis* view.

EasyNOx  **MIC4 30**

MOTORTECH NOX MONITORING **Diagnosis**

Temperatures

Controller Board 54.8 °C Output Board 51.3 °C


Voltages


Supply Voltage 24.3 V


Operating Hours


Device 55926:39 Engine 44586


Spark Plugs 4584 Engine Total 55462



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Depending on the device type of the ignition controller, information on the operating values of the ignition controller is displayed in the *Diagnosis* view:

Temperatures

Overview of the temperatures of the ignition controller

- [Controller Board](#)
Temperature of the controller board
- [Output Board](#)
Temperature of the output board. For the MIC100, this information is omitted.



Switching between °C and °F

In the *Display Configuration* view, you can specify whether the temperatures are displayed in °C or in °F (see section *Display* on page 95).

Voltages

Information on the supply voltage of the ignition controller

Operating Hours

The operating time of the ignition controller is displayed in hours and minutes. The operating time of the engine and the spark plugs is displayed in hours.

- [Controller](#)
Total operating time of the ignition controller
- [Spark Plugs](#)
Current operating hours of the spark plugs
- [Engine](#)
Current operating hours of the engine
- [Engine Total](#)
Total engine operating hours registered by the ignition controller disregarding changes caused by runtime adjustments (see section *Adjustments* on page 143) or the MICT

9.2.11 Information

The *Information* button in the *Main Menu* of the added ignition controller opens the *Information* view.


EasyNOx
MOTORTECH NOX MONITORING


MIC4 30
Information


Hardware			
Device ID	1.5.1	Revision	1.4.0.19856
Serial Number	01011134	Arrangement	421.08.C000-000-AA-4


Software Version			
Bootloader	0.26.2.20138	Firmware	1.12.0.40630


Coil Data			
Name	06.50.104	Version	1



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In the *Information* view, hard- and software data of the ignition controller are displayed.

Hardware

Overview of the hardware of the connected ignition controller

- [Device ID](#)
The identification number of the device provides information on type and subtype of the MOTORTECH device.
- [Revision](#)
Hardware revision number of the device

9 Devices

- [Serial Number](#)
The unique serial number is assigned once to each device.
- [Arrangement](#)
The arrangement number comprises the type and subtype of the ignition controller.

Software Version

Information on the software of the connected ignition controller

- [Bootloader](#)
Version number of the bootloader
- [Firmware](#)
Version number of the firmware of the device

Coil Data

Information on the ignition coil type set in the connected ignition controller

- [Name](#)
Ignition coil type
- [Version](#)
Version of the ignition coil data set stored in the device

9.3 Detonation Controller

This section describes the functions and views of an added detonation controller.

9.3.1 Main Menu

The main menu of an added detonation controller can be opened in the *Start Menu* via the button with the corresponding device name (e.g. *DetCon2/20*).



The main menu has the following buttons:

- [Overview](#)
The button provides you with information on the most important operating data. There is more information in the section *Overview* on page 160.
- [Intensity](#)
The button provides you with information on the knocking intensity of each cylinder. There is more information in the section *Intensity* on page 162.
- [Trends](#)
The button gives you access to the knocking intensity and analog output signal trend. There is more information in the section *Trends* on page 163.
- [Preferences](#)
This button gives you access to the settings for processing the detonation controller signals. There is more information in the section *Preferences* on page 166.
- [Help](#)
This button opens the operating manual of the detonation controller. There is more information in the section *Help* on page 111.

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9.3.2 Overview

The *Overview* button in the *Main Menu* of the added detonation controller opens the *Overview*.



The most important operating data of the detonation controller are summarized in the view.

- [Analog Output](#)
The current analog output signal strength is presented in percent with a pointer and also numerically in the display.
- [Knocking Intensity](#)
The maximum knocking intensity measured is presented in percent with a pointer and also numerically in the display.
 - Green area: The knock level does not exceed any limits of the detonation controller.
 - Yellow area: The knock level is above the *Ignition reduction limit* configured in the detonation controller.
 - Red area: The knock level is above the *Immediate stop limit* configured in the detonation controller.

In the field *Status*, the operating condition of the detonation controller is presented via status displays:

- [Engine Knocking](#)
A yellow status display indicates that the knock level is above the *Ignition reduction limit* configured in the detonation controller.
- [Trip](#)
If the output TRIP of the detonation controller is configured as "normally open", a red status display indicates that the knock level is above the configured *Immediate stop limit* in the detonation controller. If the output TRIP is configured as "normally closed", a red status display indicates that the knock level does not exceed the configured *Immediate stop limit*. If needed, the status display *Trip* in the EasyNO_x can be inverted (see section *Preferences* on page 166).

- **Reduction**

A yellow status display indicates that the reduction of the knock level via the analog output signal has exceeded the maximum value. The load reduction is activated.

In the field *Errors*, errors of detonation controller are indicated via status displays:

- **Low RPM**

A yellow status display indicates that the detonation control is ineffective on account of insufficient speed.

- **No Sync Pulse**

A red status display indicates that no pulses are being detected at the ignition pulse input of the detonation controller.

- **Spurious Pulse**

A red status display indicates that the signals at the ignition pulse input are faulty.

- **EEPROM Fault**

A red status display indicates that configuration data is defective.

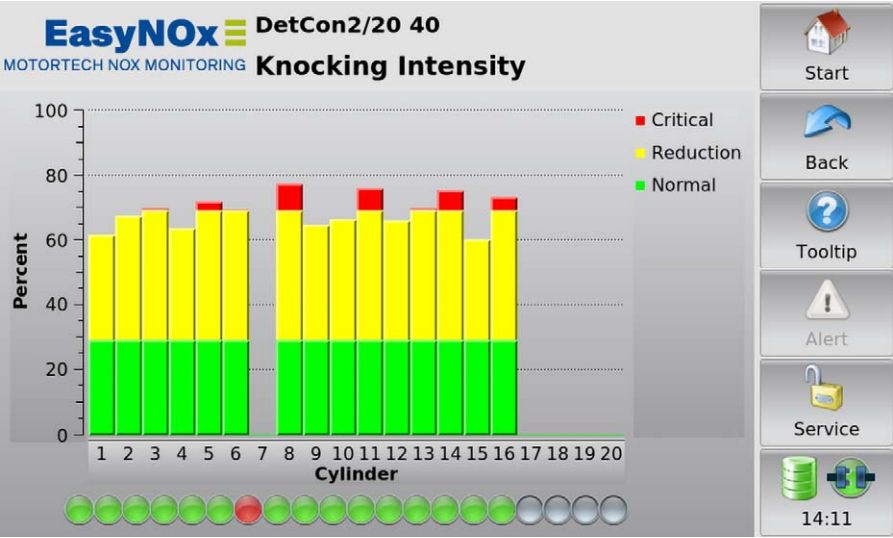
- **Bad Sensors**

A red status display indicates that at least one faulty detonation sensor signal has been detected.

9 Devices

9.3.3 Intensity

The *Intensity* button in the *Main Menu* of the added detonation controller opens the *Knocking Intensity* view.



In the *Knocking Intensity* view the current knocking intensity is shown as a bar for each cylinder monitored. For the measured values to be displayed in cylinder sequence, the firing order of the cylinders must be specified in the *Preferences* view. For more information, refer to the section *Preferences* on page 166. If you have specified a firing order, only as many cylinders are displayed as are used in the firing order.

The colors of the bars have the following meanings:

Color	Meaning	Explanation
Green	Normal	The knock level does not exceed any limits of the detonation controller.
Yellow	Reduction	The knock level is above the <i>Ignition reduction limit</i> configured in the detonation controller.
Red	Critical	The knock level is above the <i>Immediate stop limit</i> configured in the detonation controller.

The status displays show the detonation sensor status for each cylinder. The colors of the status displays have the following meaning:

- Gray: The detonation sensor is not in use.
- Green: The detonation sensor is active.
- Red: The detonation sensor is providing faulty signals or has failed entirely.

9.3.4 Trends

The *Trends* button in the *Main Menu* of the added detonation controller opens the *Trends* view.

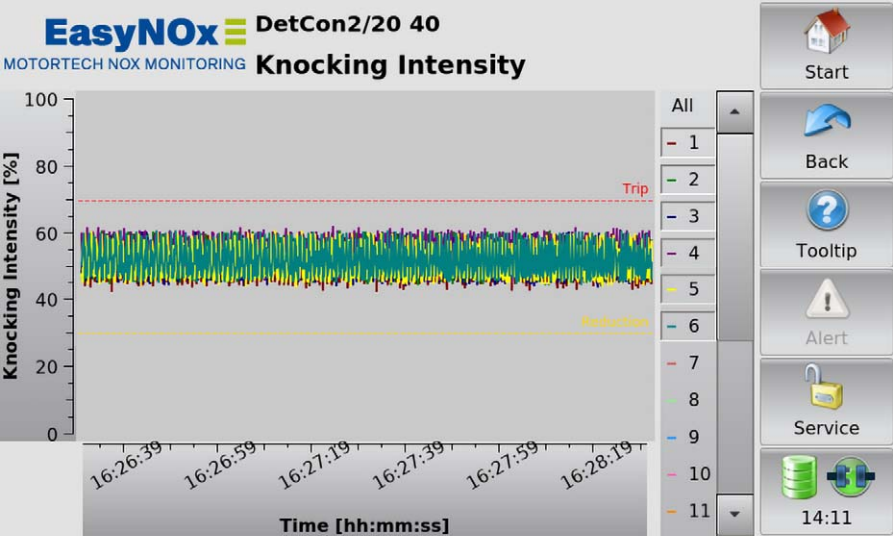


To view the current knocking intensity or the analog output signal trend, tap the desired button.

9 Devices

Knocking Intensity

The *Knocking* button in the *Trends* view of the added detonation controller opens the *Knocking Intensity* view.



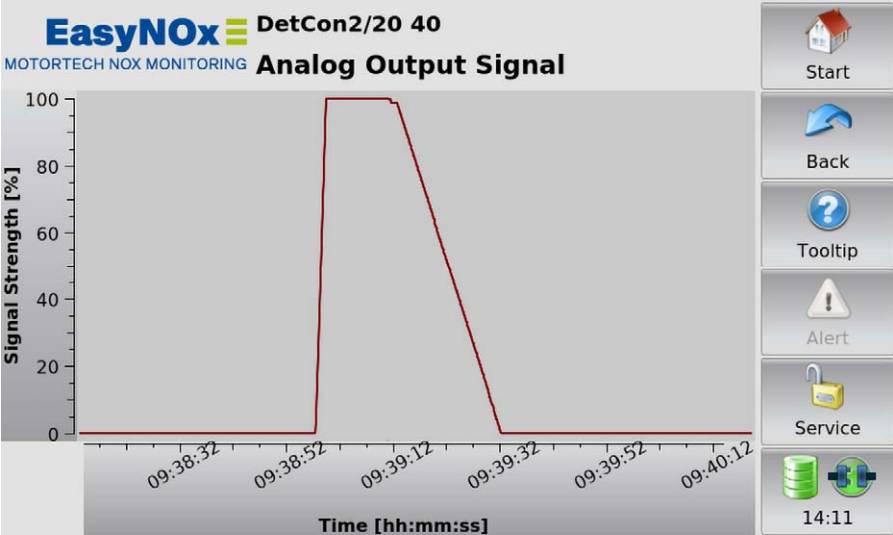
In this view the current knocking intensity trend of all cylinders is presented. The cylinders are presented in different colors and can be hidden and shown individually using the buttons to the right of the display window. For the trend to be displayed in cylinder sequence, the firing order of the cylinders must be specified in the *Preferences* view. For more information, refer to the section *Preferences* on page 166.

The areas have the following meaning:

Area	Meaning
From 0 to the yellow line <i>Reduction</i>	The knock level does not exceed any limits of the detonation controller.
From the yellow line <i>Reduction</i> to the red line <i>Trip</i>	The knock level is above the <i>Ignition reduction limit</i> configured in the detonation controller.
From the red line <i>Trip</i> to 100	The knock level is above the <i>Immediate stop limit</i> configured in the detonation controller.

Analog Output Signal

The *Analog Output* button in the *Trends* view of the added detonation controller opens the *Analog Output Signal* view.



The diagram indicates the current trend of the analog output signal in percent.

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9.3.5 Preferences

The *Preferences* button in the *Main Menu* of the added detonation controller opens the *Preferences* view.

EasyNOx

MOTORTECH NOX MONITORING

DetCon2/20 40

Preferences

Firing Order

1-3-5-7-9-11-13-15-2-4-6-8-10-12-14-16

Set


Trip Handling


☐ Invert Trip Signal


Binary Outputs


☒ Warning on Knocking


☒ Error on Trip


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In this view you change the settings for processing the signals that the EasyNO_x receives from the detonation controller and can activate messages via the binary outputs of the EasyNO_x (see section *Devices* on page 87).

Firing Order

The detonation sensors are usually connected to the detonation controller in firing order. To ensure that the EasyNO_x displays the measured values of the detonation sensors in cylinder sequence, tap the *Change* button and enter the firing order in the input window that appears. If the knocking intensity of certain cylinders is not to be displayed, omit the relevant cylinders.

Trip Handling

Activate the checkbox to invert the status display *Trip* in the *Overview* of the detonation controller (see section *Overview* on page 160). This setting does not change the setting of the *Trip contact inactive* entry in the detonation controller.

Binary Outputs

You can activate the following messages:

- **Warning on Knocking**
If the detonation controller registers engine knocking, the EasyNO_x's binary output *Warning* (see section *Devices* on page 87) is switched via CAN1.
- **Error on Trip**
If the *Trip* output is activated on the detonation controller, the EasyNO_x's binary output *Error* (see section *Devices* on page 87) is switched via CAN1.

9.4 Temperature Module

This section describes the functions and views of an added temperature module.



Switching between °C and °F

In the *Display Configuration* view, you can specify whether the temperatures are displayed in °C or in °F (see section *Display* on page 95).

9.4.1 Main Menu

The main menu of an added temperature module can be opened in the *Start Menu* via the *TempScan20* button.






The main menu has the following buttons:

- [Overview](#)
This button opens the *Overview* in which all currently measured temperatures are listed. There is more information in the section *Overview* on page 169.
- [Preferences](#)
This button opens the *Preferences* view from which you can access all of the configuration pages for your temperature module. There is more information in the section *Preferences* on page 170.

9 Devices

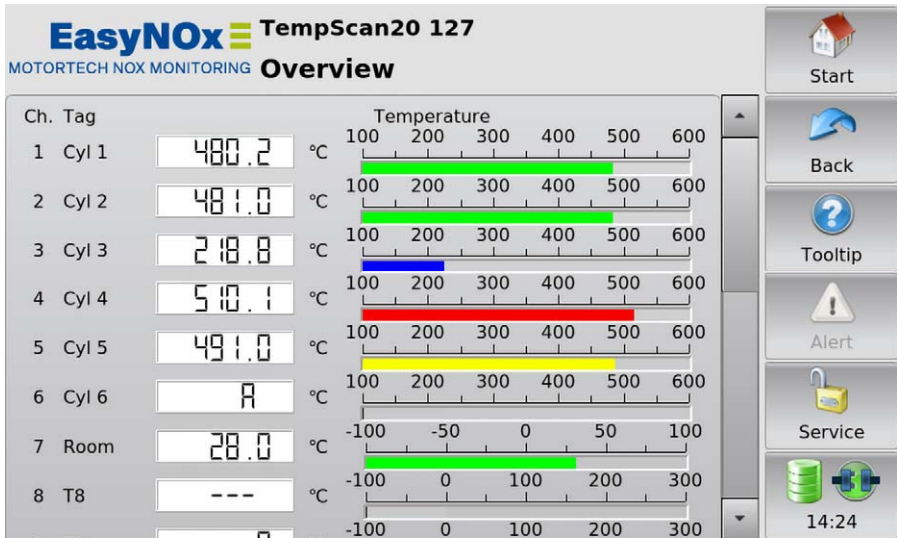
- [Help](#)
This button opens the operating manual of the temperature module. There is more information in the section *Help* on page 111.

Groups can be assigned to the channels of the temperature module (see section *Groups* on page 172). For each group with at least one assigned channel, additional buttons for opening group-specific views are displayed in the *Main Menu*. The buttons are labeled with the name of the group (here: *Bank A*).

Button	Function
	With this button you can open an overview with the measured temperatures of all channels in a group (see <i>Overview</i> on page 182).
	With this button you can open a view with the temperature trends of all channels in a group (see <i>Temperatures</i> on page 183).
	This button is only displayed if the checkbox <i>Average</i> in the <i>Group Names</i> view is activated (see <i>Groups</i> on page 172). The deviation of each channel from the average temperature of all group channels is displayed (see <i>Average Deviation</i> on page 183).

9.4.2 Overview

The **Overview** button in the *Main Menu* of the added temperature module opens the *Overview*.



This view lists the currently measured temperatures of all temperature module channels.

The following information is provided:

- *Ch.*: channel number
- *Tag*: user-specified abbreviation
- *Temperature*: currently measured temperature (A = thermocouple failed; --- = channel not activated)

The colors of the temperature displays have the following meaning:

- Green: The temperature is within the permitted range.
- Blue: The temperature has dropped below the lower warning threshold.
- Yellow: The upper warning threshold has been exceeded.
- Red: The upper shutdown threshold has been exceeded.

Information about setting thresholds can be found in section *Thresholds* on page 178.

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9.4.3 Preferences

The *Preferences* button in the *Main Menu* of the added temperature module opens the *Preferences* view.



The *Preferences* view contains the following buttons:

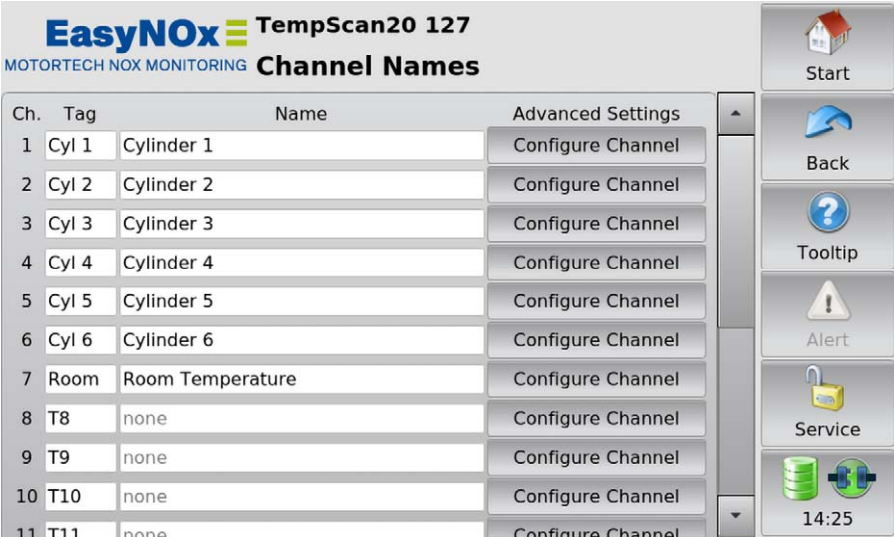
- **Names**
This button opens the *Channel Names* view, in which you can assign names to the available channels. There is more information in the section *Names* on page 171.
- **Groups**
This button opens the *Group Names* view, in which you can assign names to the available groups. There is more information in the section *Groups* on page 172.
- **Channels**
This button opens the views for configuring the individual channels. There is more information in the section *Channels* on page 174.
- **Type**
This button opens the *Thermocouples* view, which allows you to set the thermocouple type for each channel. There is more information in the section *Type* on page 176.
- **Activation**
This button opens the *Channel Activation* view, in which you can activate and deactivate individual channels for the display of measured values and assign them to groups. There is more information in the section *Activation* on page 177.
- **Thresholds**
This button opens the views for configuring the warning and shutdown thresholds. There is more information in the section *Thresholds* on page 178.

- [Internal Status](#)
This button opens views, in which you can access internal parameters of the temperature module. There is more information in the section *Internal Status* on page 179.
- [Store Setup](#)
Tap this button to permanently save the following information in the temperature module:
 - Warning and shutdown thresholds
 - Thermocouple types
 - The information whether a channel is activated or deactivated.

Otherwise, this information will be lost in the temperature module if the temperature module is switched off temporarily and is not connected to the EasyNO_x after switching on.

9.4.3.1 Names

The *Names* button in the *Preferences* view of the added temperature module opens the *Channel Names* view.



This view lists all the channels of the temperature module. You have the following options:

[Tag](#)

To enter an abbreviation, proceed as follows:

1. Tap the desired field in the *Tag* column.
2. Enter an abbreviation (maximum five characters) via the on-screen keyboard and confirm with *OK*.
 - ▶ The abbreviation is displayed and then always used in the user interface of the EasyNO_x if there is insufficient space for the full name.

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Name

Name the channel as follows:

- 1. Tap the desired field in the *Name* column.
- 2. Enter a channel name (maximum 20 characters) via the on-screen keyboard and confirm with *OK*.
 - ▶ The name is displayed.

Advanced Settings

The *Configure Channel* button opens the channel settings. There you can edit all the settings of the respective channel (see section *Channels* on page 174).

9.4.3.2 Groups

The *Groups* button in the *Preferences* view of the added temperature module opens the *Group Names* view.

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Group Names

Label	Group Name	Average
A	Bank A	<input checked="" type="checkbox"/> Enabled
B	Bank B	<input checked="" type="checkbox"/> Enabled
C	Room	<input checked="" type="checkbox"/> Enabled
D	none	<input type="checkbox"/> Enabled

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Up to four groups (labels A to D) can be assigned to the channels of the temperature module. For each group with at least one assigned channel, additional group-specific views are available, which can be accessed via the *Main Menu* of the temperature module (see section *Group-Specific Views* on page 182).

In this view, you can assign group names and activate the display of average temperature deviations for each group:

Group Name

Name the groups A to D as follows:

1. Tap the desired field in the *Group Name* column.
2. Enter a group name (maximum eleven characters) via the on-screen keyboard and confirm with *OK*.
 - ▶ The group name is displayed.

Average

The deviation of each individual channel in the group from the average group temperature can be displayed via the EasyNO_x. For this, activate the desired checkbox in the *Average* column. If the checkbox is activated for a group, the following additional button with the corresponding group name is available in the *Main Menu* of the temperature module:





This button opens the view in which the average temperature deviations within the group are displayed. Read the section *Average Deviation* on page 183 for more information.


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9.4.3.3 Channels

The *Channels* button in the *Preferences* view of the added temperature module opens views for individual configuration of the single channels. In each view, you make all the settings for one channel.

The  and  buttons allow you to switch between the channels.

The configured channel is always the one shown in the title area.

EasyNOx  **TempScan20 127**

MOTORTECH NOX MONITORING **Settings Channel 1**

Tag
Cyl 1

Name
Cylinder 1

Thermocouple
Type K

Status
☒ Channel Enabled
☒ Warning Output ☒ Error Output

Group
☒ Bank A ☐ Room
☐ Bank B ☐ D

Limits
Shutdown High 510 °C
Warning High 490 °C
Warning Low 220 °C

⏏

⏏

⏏

⏏

⏏

⏏

⏏

⏏

⏏

⏏

⏏


⏏


⏏


⏏


⏏


⏏


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You have the following options:

Tag

To enter an abbreviation, proceed as follows:

1. Tap in the field below *Tag*.
2. Enter an abbreviation (maximum five characters) via the on-screen keyboard and confirm with *OK*.
 - ▶ The abbreviation is displayed and then always used in the user interface of the EasyNO_x if there is insufficient space for the full name.

Name

Name the channel as follows:

1. Tap in the field below *Name*.
2. Enter a channel name (maximum 20 characters) via the on-screen keyboard and confirm with *OK*.
 - ▶ The name is displayed.

Thermocouple

Set the thermocouple type that is connected to the channel of the temperature module accordingly.

Status

In the *Status* area you have the following options:

- Activate the checkbox *Channel Enabled* to activate the displayed channel for displaying measured values in the EasyNO_x.
- Activate the checkbox *Warning Output*, so that for the displayed channel the EasyNO_x's binary output *Warning* (see section *Devices* on page 87) is switched via CAN1 if the warning thresholds are not met.
- Activate the checkbox *Error Output*, so that for the displayed channel the EasyNO_x's binary output *Error* (see section *Devices* on page 87) is switched via CAN1 if the shutdown threshold is not met.

Group

Assign a channel to one or several groups. Activate the checkbox for the desired groups.

Limits

The colors of the temperature displays in the *Overview* and in the group-specific views are dependent on the threshold settings (see sections *Overview* on page 169 and *Group-Specific Views* on page 182).

You can set the following threshold values:

- *Shutdown High* defines the upper shutdown threshold value.
- *Warning High* defines the upper warning threshold value.
- *Warning Low* defines the lower warning threshold value.

Adjust the threshold values as follows:

- With  and  in steps of 1 °C or 1 °F
- With  and  in steps of 20 °C or 20 °F

To save the set warning and shutdown thresholds, thermocouple types and channel activations permanently in the temperature module, use the *Back* button to go back to the *Preferences* view and tap the *Store Setup* button.



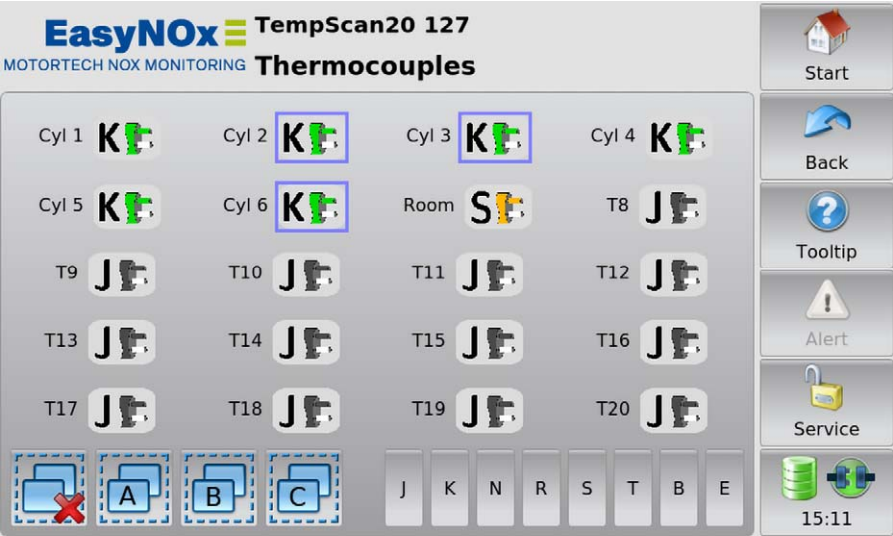
Minimum separation of threshold values

The threshold values *Shutdown High*, *Warning High* and *Warning Low* must each be separated by at least 10 °C (18 °F).

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9.4.3.4 Type

The *Type* button in the *Preferences* view of the added temperature module opens the *Thermocouples* view.



In this view, you can set the thermocouple type connected to the temperature module for each channel. The colors of the thermocouple types shown correspond to the standard IEC 60584-3: 2007.

Changes are made to selected channels. You have the following options for selecting channels:

- Tap the desired channel directly to select it. To remove the channel from the selection, tap the channel again.
- Tap a group symbol (e.g. ) to invert the selection for the respective group.
 - ▶ Selected channels have a blue frame.
- Tap  to clear all selections.



For the selection, set the desired thermocouple type by pressing the corresponding button (for example K or J).

To save the set thermocouple types permanently in the temperature module, use the *Back* button to go back to the *Preferences* view and tap the *Store Setup* button.

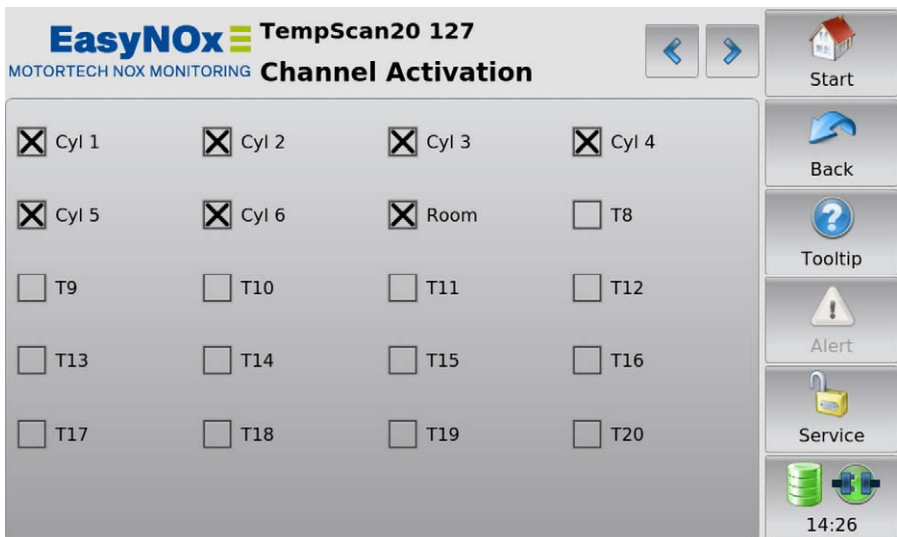
9.4.3.5 Activation

The *Activation* button in the *Preferences* view of the added temperature module opens the following views:

- *Channel Activation*
- *Warning Output*
- *Error Output*
- *to Group x* (A, B, C, D or configured group name)

The  and  buttons allow you to switch between the views.

The views are described as follows.



All channels are displayed with their numbers or an abbreviation (if available).

Channel Activation

Activate the checkbox of the desired channels to activate them for the display of measured values in the EasyNOx.

To save the set channel activation permanently in the temperature module, use the *Back* button to go back to the *Preferences* view and tap the *Store Setup* button.

Warning Output

Activate the checkbox of the desired channels if the EasyNOx's binary output *Warning* (see section *Devices* on page 87) is to be switched via CAN1 when warning thresholds are not met.

Error Output

Activate the checkbox of the desired channels if the EasyNOx's binary output *Error* (see section *Devices* on page 87) is to be switched via CAN1 when shutdown thresholds are not met.

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to Group x

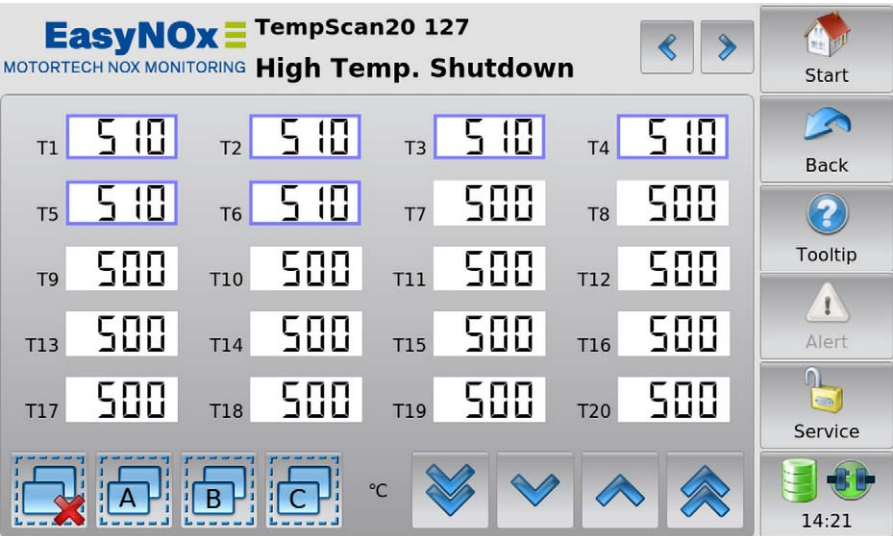
Activate the checkbox of the channels that you want to assign to the displayed group (A, B, C, D, or configured group name).

9.4.3.6 Thresholds

The *Thresholds* button in the *Preferences* view of the added temperature module opens the following views:



- *High Temp. Shutdown*: Defines the upper shutdown thresholds (*Shutdown High* in *Settings Channel x* view).
- *High Temp. Warning*: Defines the upper warning thresholds (*Warning High* in *Settings Channel x* view).
- *Low Temp. Warning*: Defines the lower warning thresholds (*Warning Low* in *Settings Channel x* view).

The  and  buttons allow you to switch between the views.



The colors of the temperature displays in the *Overview* and in the group-specific views are dependent on the threshold settings (see sections *Overview* on page 169 and *Group-Specific Views* on page 182).

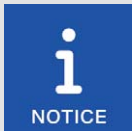
Changes are made to selected channels. You have the following options for selecting channels:

- Tap the desired channel directly to select it. To remove the channel from the selection, tap the channel again.
- Tap a group symbol (e.g. ) to invert the selection for the respective group.
 - Selected channels have a blue frame.
- Tap  to clear all selections.

For the selected channels, set the thresholds using the arrow keys:

- With  and  in steps of 1 °C or 1 °F
- With  and  in steps of 20 °C or 20 °F

To save the set warning and shutdown thresholds permanently in the temperature module, use the *Back* button to go back to the *Preferences* view and tap the *Store Setup* button.





Minimum separation of threshold values

The threshold values *High Temp. Shutdown*, *High Temp. Warning* and *Low Temp. Warning* must each be separated by at least 10 °C (18 °F).

9.4.3.7 Internal Status

The *Internal Status* button in the *Preferences* view of the added temperature module opens the following views:


- *Status*
- *Reference Junction*

The  and  buttons allow you to switch between the views.



These views support service personnel when troubleshooting and are described in the following.


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Status


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MOTORTECH NOX MONITORING **Status**


 


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 **Alert**

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Error React Delay [ms]

5000

Power Supply Measured [V]

8.20

ADC Filter Frequency [Hz]

50

Start in Operational Mode

0

The following information is provided:

- [Error React Delay \[ms\]](#)
Time span after which the temperature module sends an error message if a warning or shut-down threshold is not met.
- [Power Supply Measured \[V\]](#)
The internal supply voltage varies depending on the external supply voltage of the temperature module.
- [ADC Filter Frequency \[Hz\]](#)
Information on the filter frequency of the temperature module's inputs.
- [Start in Operational Mode](#)
This entry must show the value 0 so that the temperature module does not start in operational mode and can be configured at any time via the EasyNOx. If any other value occurs, please contact your MOTORTECH contact person (see section *Customer Service Information* on page 200).

Reference Junction

	Channels 1-10	Channels 11-20
Input Field Value [°C]	26.75	27.25
Auto Correct on [bits]	3FF	3FF

The following information is provided:

- **Input Field Value [°C]**
In order to determine a temperature with thermocouples, you need a reference junction temperature. This entry provides information on the current temperature measured at the reference junctions.
- **Auto Correct on [bits]**
The hexadecimal number *3FF* indicates that the temperature measured at the reference junction is used for determining the temperature with the thermocouples. If any other value occurs, please contact your MOTORTECH contact person (see section *Customer Service Information* on page 200).

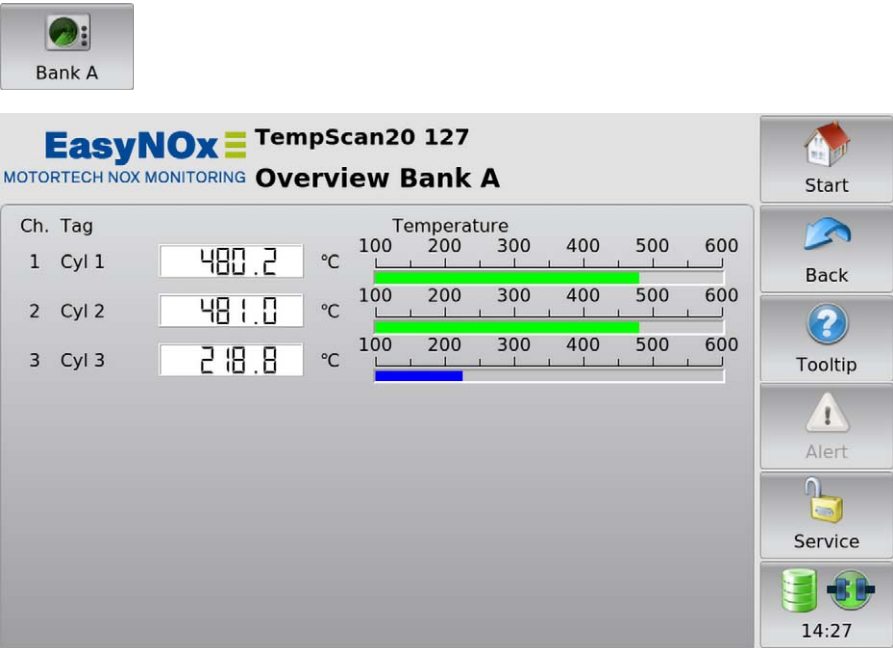
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9.4.4 Group-Specific Views

If at least one activated channel is assigned to a group, you can open the following views via additional buttons in the *Main Menu* of the added temperature module.

9.4.4.1 Overview

The *Overview* of a group (here: *Bank A*) can be opened in the *Main Menu* of the added temperature module via the following button with the corresponding group name:



This view displays the currently measured temperatures of all channels in a group.

- *Ch.*: channel number
- *Tag*: user-specified abbreviation
- *Temperature*: currently measured temperature (A = thermocouple failed; --- = channel not activated)

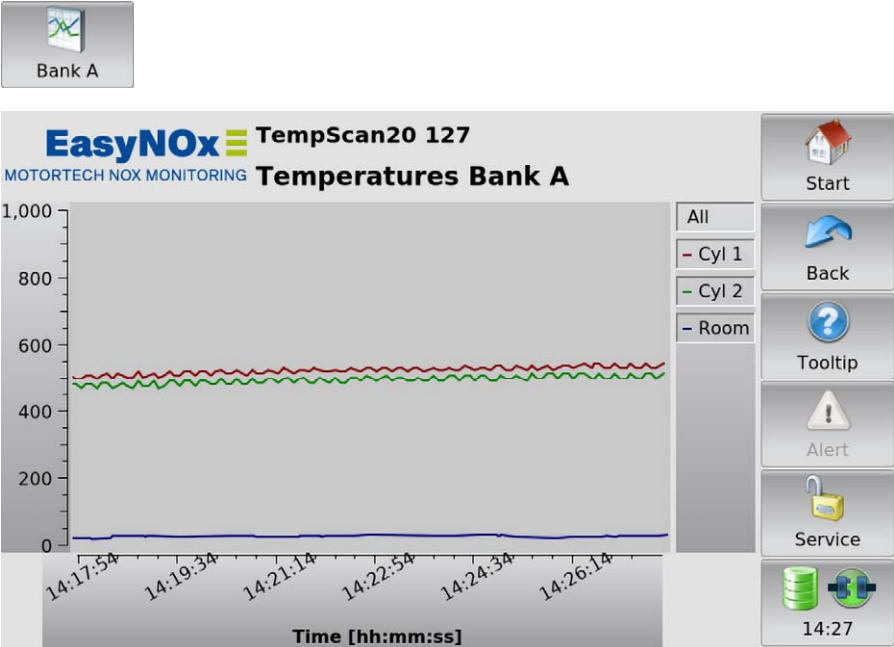
The colors of the temperature displays have the following meaning:

- Green: The temperature is within the permitted range.
- Blue: The temperature has dropped below the lower warning threshold.
- Yellow: The upper warning threshold has been exceeded.
- Red: The upper shutdown threshold has been exceeded.

Information about setting thresholds can be found in section *Thresholds* on page 178.

9.4.4.2 Temperatures

The group-specific view *Temperatures* is opened in the *Main Menu* of the added temperature module using the following button with the corresponding group name (here: *Bank A*):



This view displays the current temperature trends of all channels in a group. The available channels can be displayed or hidden via the legend.

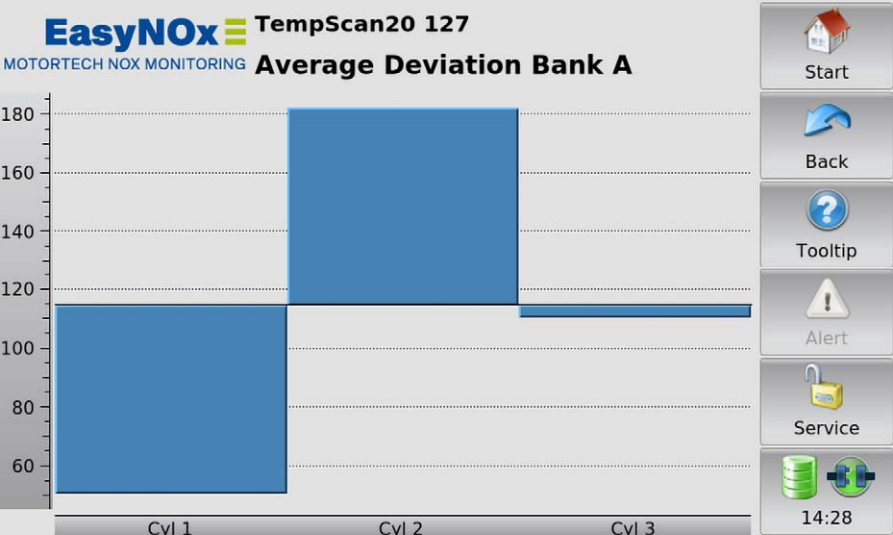
9.4.4.3 Average Deviation

The group-specific view *Average Deviation* is opened in the *Main Menu* of the added temperature module using the following button with the corresponding group name (here: *Bank A*):



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This button is only displayed if for the relevant group the checkbox *Average* is activated in the *Group Names* view (see section *Groups* on page 172).



The deviation of each channel from the average temperature of all channels in the group is displayed.

9.5 I/O Communication Module BPlus, I/O Module (CiA401, CiA404)

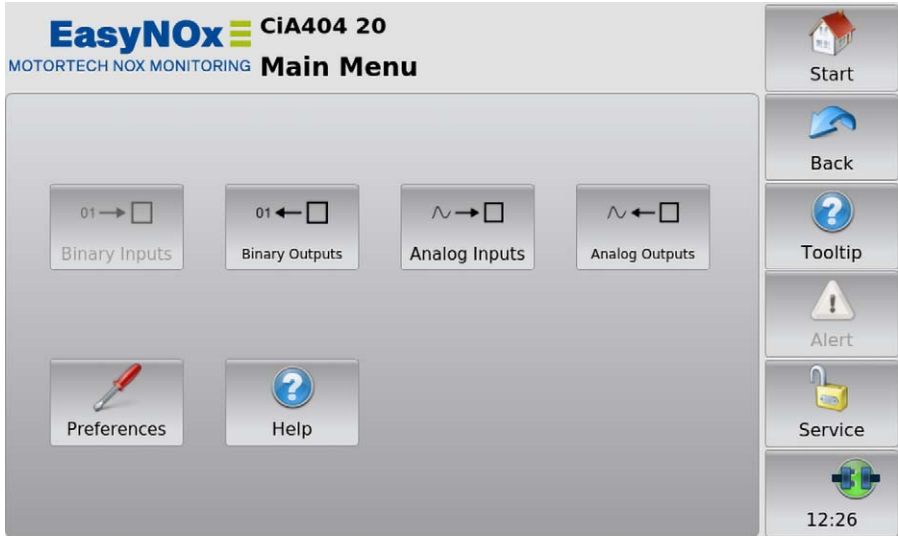
This section uses the example of an I/O module supporting device profile CiA® 404 to describe the functions and views of the I/O communication module BPlus specially available from MOTORTECH and of an I/O module supporting device profile CiA® 401.

The number of available analog and binary inputs and outputs depends on the respective I/O module to which the EasyNO_x is connected via the CAN bus interface CAN1. For the I/O communication module BPlus, you can find this information in the section *I/O Communication Module BPlus* on page 55.

Also observe the node ID that is set for the module in the EasyNO_x and displayed behind the device name in the module's views. It must match the node ID of the respective module.

9.5.1 Main Menu

The main menu of an added I/O communication module BPlus or I/O module supporting device profile CiA® 401 or CiA® 404 can be opened in the *Start Menu* via the respective button (*BPlus*, *CiA401*, or *CiA404*).



If a specific input or output type is not available with the I/O module, the respective button is grayed out.

The main menu has the following buttons:




- **Binary Inputs**
The button opens the *Binary Inputs* view. In this view, a green status display in the *Status* column shows that the corresponding binary input in the *Channel* column is closed (see illustration example binary outputs below). In the *Function* column, the view displays the function that you have assigned to the channel. For an explanation of the function and for assigning the channel a function, read the section *Binary Inputs* on page 190.

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- **Binary Outputs**

The button opens the *Binary Outputs* view. In this view, a green status display in the *Status* column shows that the corresponding binary output in the *Channel* column is switched. In the *Function* column, the view displays the function that you have assigned to the channel. For an explanation of the function and for assigning the channel a function, read the section *Binary Outputs* on page 191. You can switch binary outputs that are not linked to any function (displayed as ---) for test purposes (see section *Testing of Outputs* on page 187).

Illustration example binary outputs

Channel	Status	Linked to Function	Test
1		Cat. Temperature Error NOx1	
2		NOx Exceedance NOx1	
3		---	<input type="checkbox"/>

- **Analog Inputs**

The button opens the *Analog Inputs* view. In this view, the incoming signal that is present at the corresponding analog input in the *Channel* column is displayed in the *Value* column (see illustration example analog outputs below). In the *Function* column, the view displays the function that you have assigned to the channel. For an explanation of the function and for assigning the channel a function, read the section *Analog Inputs* on page 192. If an I/O module supporting device profile CiA® 404 is configured and connected to the EasyNOx, the EasyNOx displays the respective value in the *Value* column with unit. With the I/O communication module BPlus and with an I/O module supporting device profile CiA® 401, the EasyNOx displays the respective raw value.

- **Analog Outputs**

The button opens the *Analog Outputs* view. In this view, the outgoing signal that is output by the I/O module at the corresponding analog output in the *Channel* column is displayed in the *Value* column. In the *Function* column, the view displays the function that you have assigned to the channel. For an explanation of the function and for assigning the channel a function, read the section *Analog Outputs* on page 193. If an I/O module supporting device profile CiA® 404 is configured and connected to the EasyNOx, the EasyNOx displays the respective value in the *Value* column with unit. With the I/O communication module BPlus and with an I/O module supporting device profile CiA® 401, the EasyNOx displays the respective raw value. You can assign values to analog outputs that are not linked to any function (displayed as ---) for test purposes (see section *Testing of Outputs* on page 187).

Illustration example analog outputs

Channel	Value	Function	Test
1	<input type="text" value="4.800"/>	V Actual NOx from NOx1	
2	<input type="text" value="0.000"/>	V ---	<input type="checkbox"/>

- **Preferences**

This button provides access to the settings of the added I/O module. There is more information in the section *Preferences* on page 189.

– [Help](#)

This button opens the operating manual of the EasyNO_x. There is more information in the section *Help* on page 111.

9.5.1.1 Testing of Outputs



Operational safety!

The EasyNO_x and the software are not designed for safety-critical applications. The analog and binary inputs and outputs of the EasyNO_x system must not be used for safety-critical purposes.



Operational safety!

Testing the outputs affects the connected devices. Before performing tests, make sure that switching the outputs will not result in hazards or damage.

Analog outputs to which no function is assigned can be used to output values for test purposes. Binary outputs to which no function is assigned can be switched for test purposes. This allows you to test the behavior of devices connected to these outputs.

Start Testing

If you want to test an output, proceed as follows:

1. For the respective output, tap on the empty rectangle in the *Test* column.
 - ▶ A black dot appears in the rectangle.



- ▶ The field *Test Off* at the bottom left of the respective view is empty.
- ▶ If another output has been tested before, this test is ended, the value of the respective output is reset, and the black dot in the respective rectangle is deleted.

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- 2. Test the output.
 - Binary output: Tap the *Toggle* button to switch the output on and off. A turquoise frame around the *Toggle* button indicates that the output to be tested is switched.

Toggle

- Analog output: Use the slider to set the desired analog test value.



End Testing

You have two options to end the test of an output.

Option 1:

Tap on the field *Test Off*.

- ▶ A black dot appears in the *Test Off* field.



- ▶ The test of the respective output is ended, its value is reset and the black dot in the *Test* column is deleted for the respective output.

Option 2:

Exit the view using the *Back* button in the menu bar.

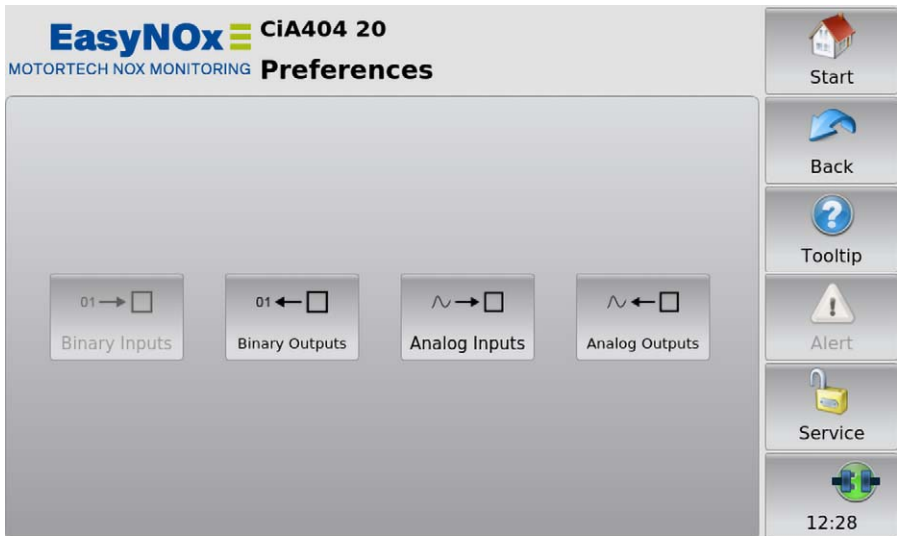
- ▶ The test of the respective output is ended and its value reset.

9.5.2 Preferences

**Operational safety!**

The EasyNO_x and the software are not designed for safety-critical applications. The analog and binary inputs and outputs of the EasyNO_x system must not be used for safety-critical purposes.

The *Preferences* button in the *Main Menu* of an added I/O communication module BPlus or I/O module supporting device profile CiA® 401 or CiA® 404 opens the *Preferences* view.



If a specific input or output type is not available with the I/O module, the respective button is grayed out.

The *Preferences* view contains the following buttons:

- **Binary Inputs**
Use the button to open a view in which you can link the binary inputs of the respective I/O module to a function of the EasyNO_x. There is more information in the section *Binary Inputs* on page 190.
- **Binary Outputs**
Use the button to open a view in which you can link the binary outputs of the respective I/O module with a function of the EasyNO_x. There is more information in the section *Binary Outputs* on page 191.

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- [Analog Inputs](#)

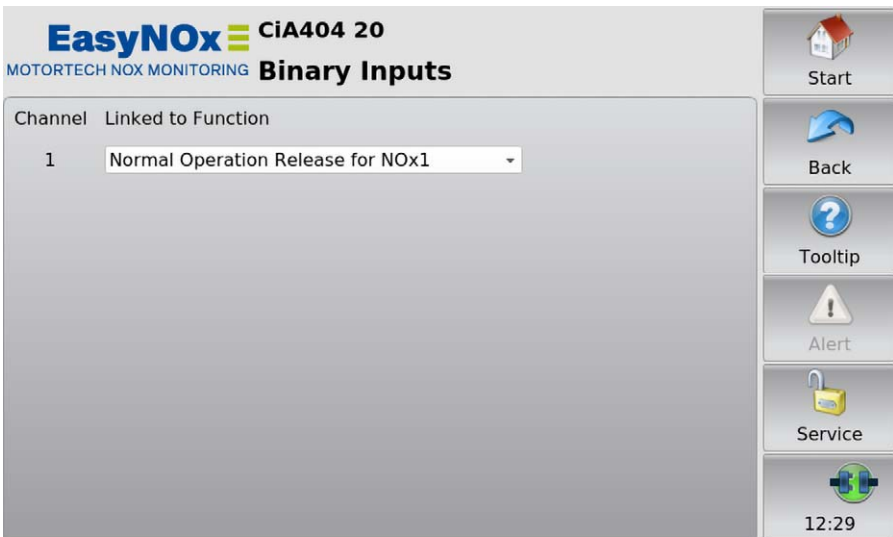
Use the button to open a view in which you can link the analog inputs of the respective I/O module to a function of the EasyNO_x. There is more information in the section *Analog Inputs* on page 192.

- [Analog Outputs](#)

Use the button to open a view in which you can link the analog outputs of the respective I/O module with a function of the EasyNO_x. There is more information in the section *Analog Outputs* on page 193.

9.5.2.1 Binary Inputs

The *Binary Inputs* button in the *Preferences* view of an added I/O communication module BPlus or I/O module supporting device profile CiA® 401 or CiA® 404 opens the *Binary Inputs* view.



Note that changes in this view are not saved and applied by the I/O module until you exit the view. Use the drop-down list to link the I/O module's binary inputs displayed in the *Channel* column to the desired function:

- [Not Used](#)

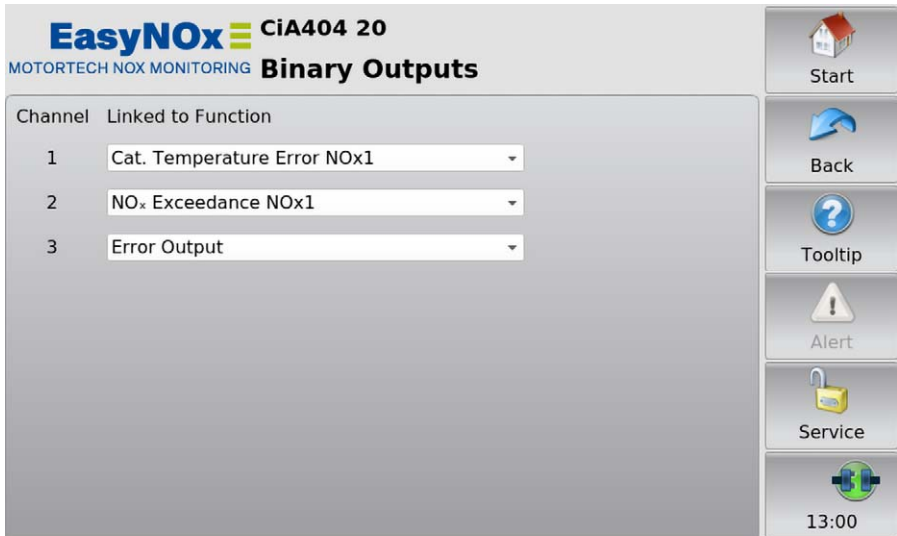
The binary input is not linked to any function.

- [Normal Operation Release for NOx1/NOx2](#)

A master control can signal to the respective NO_x monitor of the EasyNO_x via a closed binary input that the conditions for normal operation are met by the engine. In NO_x monitoring mode *Start/Stop via CANopen*, the binary input must be linked to this function.

9.5.2.2 Binary Outputs

The *Binary Outputs* button in the *Preferences* view of an added I/O communication module BPlus or I/O module supporting device profile CiA® 401 or CiA® 404 opens the *Binary Outputs* view.



Note that changes in this view are not saved and applied by the I/O module until you exit the view. Use the drop-down list to link the I/O module's binary outputs displayed in the *Channel* column to the desired function:

- **Not Used**
The binary output is not linked to any function.
- **Error Output, Warning Output**
The binary output of the respective I/O module is assigned to the binary output *Error* or *Warning* of the EasyNO_x. If the binary outputs of the EasyNO_x are activated (see section *Devices* on page 87), the EasyNO_x switches the assigned binary output of the I/O module if a corresponding monitoring function of an added device requires it.
- **Cat. Temperature Error NOx1/NOx2**
If the respective NO_x monitor of the EasyNO_x has detected a temperature error on the respective engine at at least one of the configured exhaust gas temperature measuring points near the catalytic converter, the EasyNO_x switches the assigned binary output of the I/O module.
- **NO_x Exceedance NOx1/NOx2**
If the provisional daily average of the nitrogen oxide concentration currently exceeds the configured level limit of the engine monitored by the respective NO_x monitor, the EasyNO_x switches the assigned binary output of the I/O module.
- **Normal Operation NOx1/NOx2**
If, for the respective engine, normal operation has been detected by or signalled to the respective NO_x monitor of the EasyNO_x, the EasyNO_x switches the assigned binary output of the I/O module.

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9.5.2.3 Analog Inputs

The *Analog Inputs* button in the *Preferences* view of an added I/O communication module BPlus or I/O module supporting device profile CiA® 401 or CiA® 404 opens the *Analog Inputs* view.

EasyNOx

MOTORTECH NOx MONITORING

CiA404 20

Analog Inputs

Channel	Type	Linked to Function
1	±10 V	Load Input for NOx1
2	±10 V	Load Input for NOx2
3	±10 V	Not Used

Start

Back

Tooltip

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13:00

Note that changes in this view are not saved and applied by the I/O module until you exit the view. If an I/O module supporting device profile CiA® 404 is set and connected to the EasyNO_x, the EasyNO_x displays the analog input type (e.g. ±10 V) in the *Type* column.

Use the drop-down list to link the I/O module's analog inputs displayed in the *Channel* column to the desired function:

- [Not Used](#)
The analog input is not linked to any function.
- [Load Input for NOx1/NOx2](#)
The analog input is used by the respective NO_x monitor as input for the load signal from the respective engine. In NO_x monitoring mode *Load via CANopen*, the analog input must be linked to this function.

9.5.2.4 Analog Outputs

The *Analog Outputs* button in the *Preferences* view of an added I/O communication module BPlus or I/O module supporting device profile CiA® 401 or CiA® 404 opens the *Analog Outputs* view.

Channel	Type	Linked to Function
1	±10 V	Average NO _x from NO _x 1
2	±10 V	Not Used

Note that changes in this view are not saved and applied by the I/O module until you exit the view. If an I/O module supporting device profile CiA® 404 is set and connected to the EasyNO_x, the EasyNO_x displays the analog output type (e.g. ± 10 V) in the *Type* column.

Use the drop-down list to link the I/O module's analog outputs displayed in the *Channel* column to the desired function:

- **Not Used**
The analog output input is not linked to any function.
- **Average NO_x from NO_x1/NO_x2**
Output of the provisional daily average of nitrogen oxide readings converted according to VDMA 6299:2019-09 (see section *Conversion of Nitrogen Oxide Readings* on page 48) as determined by the respective NO_x monitor. For each NO_x monitor, you define the scaling of the output via the entries *Output NO_x Min.* and *Output NO_x Max.* in the *NO_x Setup* view (see section *Preferences* on page 124).
- **Actual NO_x from NO_x1/NO_x2**
Output of the nitrogen oxide reading currently measured by the respective NO_x monitor converted according to VDMA 6299:2019-09. For each NO_x monitor, you define the scaling of the output via the entries *Output NO_x Min.* and *Output NO_x Max.* in the *NO_x Setup* view (see section *Preferences* on page 124).

9 Devices

9.6 Generic Device

You have the option of adding up to three devices that are connected to the EasyNO_x via the CAN bus interface CAN1 but not directly supported by it as a generic device (display name *Generic*). The generic device is started along with the EasyNO_x, and its connection status is monitored by the EasyNO_x.



Generic devices are not displayed in the Start Menu

Generic devices appear in the *Device Setup* view in the list of added devices (display name *Generic*). They are not displayed in the *Start Menu*.

Functions

- When a generic device is added to the device configuration, it is started if this has not already been done.
- The connection status is monitored by the EasyNO_x and is visualized in the menu bar (see section *Menu Bar* on page 83).
- Changes to the connection status are listed in the *Event Log* view (see section *Event Log* on page 110).

10.1 Start-up

Take note of the following before putting the EasyNO_x into operation:

- For all devices to be monitored, make sure that they are correctly connected to the EasyNO_x and that the node IDs are set correctly.
- If wired, make sure that the CAN bus at the CAN bus interface CAN1 is correctly terminated (see section *Wiring CANopen® Network (CAN1)* on page 76 and section *CAN Bus Wiring, CAN Bus Termination* on page 79).
- Make sure that you have assigned PINs to all access levels of the EasyNO_x (see section *Access Control* on page 104).
- Make sure that the time zone as well as date and time are set correctly in the EasyNO_x (see section *Display* on page 95).
- Save your configuration as files and as a PDF on a USB flash drive before start-up and after each modification (see section *Display* on page 95).

Take note of the following before putting the NO_x monitoring of your EasyNO_x system into operation:

- Make sure that the CAN bus modules, the NO_x sensors, the I/O communication modules BPlus, and the I/O modules supporting device profile CiA® 401 or CiA® 404 are mounted in line with the engines to be monitored and that they are connected to the EasyNO_x. Pay particular attention to the node IDs of the individual components. Make sure that the DIP switches of the CAN bus modules are set correctly (see section *Node ID CAN Bus Module* on page 75 and section *Bit Rate CAN Bus Module* on page 76).
- Make sure that the CAN bus at the CAN bus interface CAN2 is correctly terminated (see section *CAN Bus Termination* on page 75).
- Make sure that the layout of the thermocouples corresponds respectively to the configuration of the NO_x monitor in the EasyNO_x (see section *Installation Locations of Thermocouples* on page 64).
- Make sure that the NO₂ correction factor (KNO₂) of the NO_x sensor is set correctly in the configuration of the respective NO_x monitor in the EasyNO_x (see section *Preferences* on page 124).
- Make sure that the NO₂/NO_x ratio determined with an exhaust gas analyzer upon mounting of the NO_x sensor is correctly set in the configuration of the respective NO_x monitor in the EasyNO_x (see section *Determining the NO₂/NO_x Ratio* on page 64).
- Make sure that the respective NO_x monitor is wired and configured to match the set NO_x monitoring mode (see section *Normal Operation Detection* on page 51).
- Ensure that you have specified the operator data in the NO_x monitor (see section *Operator* on page 128).
- Before using the respective NO_x monitor, perform a test run for at least one hour.

10.2 Shutdown

The EasyNO_x including the CAN bus/NO_x sensor modules connected to it and the optional I/O communication modules BPlus are shut down by disconnecting them from the power supply.

10 Operation

10.3 Software Update



Risk of software damage!

The power supply must not be interrupted under any circumstances during the software update. Otherwise, this can lead to serious errors and the EasyNO_x will no longer work.

Also deactivate the screen saver when updating from software version 1.8.0 or older. Otherwise, this may result in the EasyNO_x no longer displaying the operating manuals properly via the *Help* button.



Back up data from the device and the NO_x monitor

Before updating the software, back up the activated devices (see section *Devices* on page 87) and the EasyNO_x configuration (see section *Display* on page 95).

To back up the logs and the logbook of the NO_x monitor, remove the memory card from the EasyNO_x when the power is switched off.

The folders and files on the memory card must remain unchanged.

For each year the NO_x monitor has logs for, a folder with the corresponding year number exists on the memory card. Back up the desired year folders to a PC.

To back up logbooks, back up the desired *Logbook_x* folder (0 = first NO_x monitor, 1 = second NO_x monitor) to a PC.

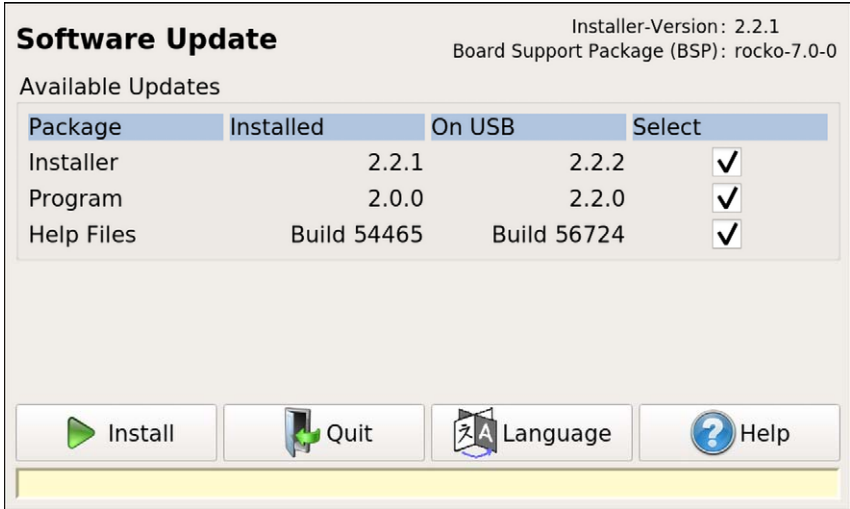
After backing up the data, first insert the memory card into the EasyNO_x before supplying the device with power. When inserting the memory card, make sure that it is not write-protected by an accidentally flipped write-protect switch.

You receive software updates for the EasyNO_x from MOTORTECH. A software update consists of several update files with signature files for verification of the update files. You need a USB flash drive to install updates. The current software version of your EasyNO_x is displayed in the *Display Information* view (see section *Display* on page 95).

Perform updates as follows:

1. Read and observe all information provided with the update (e.g. release notes, README file).
2. Make sure that the update files correspond to the board support package of your EasyNO_x. The *Display Information* view (see section *Display* on page 95) displays the installed board support package of your EasyNO_x. In the file name of the update files, you can identify the board support package by the version number after *BSP* (e.g. *rocko-7.0-0*).
3. Save the update files with the extension *.tar.bz2* and the corresponding signature files with the extension *.sha1* in the root directory of a USB flash drive.


4. Insert the USB flash drive into your running EasyNO_x.
 - ▶ After a few seconds, the standard EasyNO_x interface closes, and the installer interface opens.



5. Available update packages are displayed in the *Package* column. If necessary, tap on the *Language* button to change the language. Under *Installed* the version of the respective package installed on the EasyNO_x is displayed, under *On USB* the version to which the respective package in the EasyNO_x will be updated. As a rule, the suitable update packages are preselected. To change the selection if needed, activate or deactivate the checkbox under *Select* for the respective packages. To install the selected packages, tap *Install*.
 - ▶ The selected update packages are installed. After an installer update, the installation of the remaining packages must be restarted by tapping the *Install* button.
 - ▶ Certain update packages may require a restart of the EasyNO_x.
6. After installing the desired update packages, exit the installer by tapping the *Quit* button and remove the USB flash drive.
 - ▶ You can now use the EasyNO_x with the new software.

11 Errors

11.1 Possible Faults

Fault	Possible cause	Solution
 <p>The connection status symbol in the menu bar is yellow.</p>	<p>There is no connection to at least one added device in the CAN1 bus (CANopen®).</p> <p>The node ID of at least one added device in the CAN1 bus (CANopen®) is incorrect.</p>	<p>Establish the connection to the relevant devices.</p> <p>Set the correct node ID on the relevant devices (see section <i>Devices</i> on page 87).</p>
 <p>The connection status symbol in the menu bar is red.</p>	<p>There is no connection to any added device in the CAN1 bus (CANopen®).</p>	<p>Check the CAN bus wiring in the CAN1 bus.</p>
 <p>The databank symbol in the menu bar is red.</p>	<p>The disk space on the memory card is insufficient.</p> <p>The write-protect switch of the memory card is in write-protect position.</p> <p>The memory card is defective.</p>	<p>Via the EasyNOx, delete recordings that are no longer needed (see section <i>Recordings</i> on page 101).</p> <p>Move the write-protect switch to the position write protection deactivated.</p> <p>Contact your MOTORTECH contact person (see section <i>Customer Service Information</i> on page 200).</p>
<p>The display does not register touches at the desired position.</p>	<p>The display is dirty.</p>	<p>Clean the display (see section <i>Cleaning the Touchscreen</i> on page 201).</p>
<p>The displays on the screen are difficult to recognize.</p>	<p>The lighting conditions are unfavorable.</p>	<p>Adjust the display to the lighting conditions using the <i>Night Mode / Day Mode</i> button in the <i>Start Menu</i>.</p>
<p>The system time is repeatedly incorrect.</p>	<p>The internal battery is dead.</p>	<p>The battery must be replaced (see section <i>Battery Change</i> on page 202).</p>
<p>An added device is indicating erroneous operating data.</p>	<p>Node IDs in the CAN bus are incorrectly assigned.</p> <p>The device is incorrectly wired.</p> <p>The device is configured incorrectly.</p>	<p>Check the set node IDs of all devices connected to the CAN bus.</p> <p>Check the wiring of the device.</p> <p>Check the configuration of the device.</p>

Fault	Possible cause	Solution
Signals do not arrive at an added I/O module (BPlus, CiA401/404) or are not received by the EasyNO _x .	The input or output is not linked to a function in the EasyNO _x .	Link the respective input or output to the desired function (see section <i>Preferences</i> on page 189).
	The input or output is linked to the wrong function in the EasyNO _x .	Link the respective input or output to the correct function (see section <i>Preferences</i> on page 189).
	The wiring is faulty.	Check the wiring including the CAN bus wiring. For outputs, also use the test function of the EasyNO _x (see section <i>Testing of Outputs</i> on page 187).
Data is not getting updated.	The wiring of the CAN bus is defective.	Check the CAN bus wiring and correct any defects found.
	The device is not sending any data (for example if it is defective).	Check the device and fix the problems.
 The device cannot be added, although the above symbol appears next to the device in the <i>Add Device</i> dialog.	The number of available activations for this device has been exceeded.	In certain cases, you can activate additional devices with software dongles (see section <i>Device Activation</i> on page 90).
 The symbol appears in the <i>Add Device</i> dialog next to devices.	This device has not been activated.	Activate the device with a software dongle (see section <i>Device Activation</i> on page 90).
When tapping on a device in the <i>Start Menu</i> , you get the error message "No connection to this device has been established!"	The wiring of the CAN bus is defective.	Check the CAN bus wiring and correct any defects found.
	The bit rate of the device does not correspond to the bit rate of the EasyNO _x .	Set the correct bit rate for the device.
	The node ID of at least one added device is incorrect.	Set the correct node ID for the device in the EasyNO _x (see section <i>Devices</i> on page 87).
The EasyNO _x does not recognize an inserted USB flash drive and cannot read data from or write data to it.	The formatting of the USB flash drive is not compatible with the EasyNO _x .	Format the USB flash drive to a compatible format (see section <i>Interfaces</i> on page 30).
	The USB flash drive is not inserted correctly in the EasyNO _x .	Ensure that the USB flash drive is properly inserted into the device.
	The USB flash drive is defective.	Use a properly working USB flash drive.

11 Errors

11.2 Customer Service Information

You can reach us during our business hours by:

Phone: +49 5141 93 99 0
Email: service@motortech.de (technical support)
sales@motortech.de (all other matters)

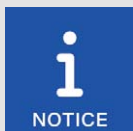
11.3 Returning Equipment for Repair/Inspection

To return the device for repair and inspection, first consult your MOTORTECH contact person (see *Customer Service Information* on page 200). From him you will receive all the information you need to process your order quickly and smoothly. For return shipment, also observe the instructions in the section *Instructions for Packaging the Equipment* on page 200.

11.4 Instructions for Packaging the Equipment

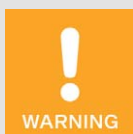
For return shipment, equipment should be packaged as follows:

- Use packaging material that does not damage the equipment surfaces.
- Wrap the equipment with sturdy materials and stabilize it inside the packaging.
- Use sturdy adhesive film to seal the packaging.

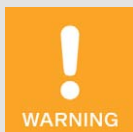
**Document maintenance work in logbook**

Note that all maintenance work on the EasyNO_x that affects its NO_x monitoring must be documented in the logbook of the respective NO_x monitor, provided that you use the logbook as defined in standard sheet VDMA 6299:2019-09.

12.1 Cleaning the Touchscreen

**Risk of destruction!**

Organic solvents as well as acids and alkaline solutions could damage the touchscreen. Therefore only clean the device with a soft cotton cloth and alcohol.

**Risk of destruction!**

Dirt affects the function of the touchscreen. Water, fingerprints, and other dirt should be removed immediately from the touchscreen and the frame to avoid spots.

To avoid spots and input problems, always remove dirt immediately. Clean the touchscreen if it reacts incorrectly when entering information.

Use a soft cotton cloth and alcohol to clean the EasyNO_x touchscreen. Do not use organic solvents. Do not use acidic or alkaline solutions.

12.2 Cleaning the NO_x Sensor

The NO_x sensor must not be cleaned with mechanical means or cleaning agents, as this may destroy the sensor or mechanically damage the labels. The NO_x sensor including its electrical connection must not come into contact with liquids.

If necessary, clean the NO_x sensor with a soft, dry cloth. If you clean the NO_x sensor when it is not mounted, make sure that the probe remains free of dirt.

12 Maintenance

12.3 Maintenance of Housing

Service the housing of the EasyNO_x at least once a year. Carry out the following work:

- Check the hinges and the cam locks of the housing door for ease of movement. Spray the hinges of the housing door with a suitable, water-free lubricant.
- Check the seal in the contact edge area for damage. If the seal in the contact edge area is damaged, contact your MOTORTECH contact person (see *Customer Service Information* on page 200).
- Check all components and surfaces for external damage. To prevent seals from being damaged by temperature-induced freezing, you can treat them with common agents such as talcum, Vaseline, or wax.
- Check the housing for traces of corrosion. Repair damage to the housing as follows:
 - Damage to small areas affecting only a part of the surface (e.g. scratches): Lightly sand off the surface at the damaged place and remove all traces of corrosion and contamination. Depending on the degree of damage, apply 2K-PUR acrylic paint with a paint stick, a brush, or a spray can.
 - Large area damage: Smooth the surface uniformly and clean it with white spirit. Then paint over the entire surface with 2K-PUR acrylic paint.

12.4 Battery Change

The internal board of the EasyNO_x has a backup battery of the type CR1220, whose service life is approximately eight years, depending on use. The backup battery is needed to ensure the integrity of the recorded monitoring data after a power supply failure. To have the battery changed, contact your MOTORTECH contact person (see *Customer Service Information* on page 200).

12.5 Replacing the NO_x Sensor

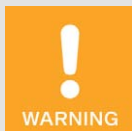
The service life of the NO_x sensor on the CAN bus/NO_x sensor module depends on the type installed:

NO _x sensor	Service life
P/N 56.03.003	8,000 operating hours with ambient temperature max. +90 °C (+194 °F) at evaluation unit
P/N 56.03.002	6,000 operating hours with average temperature of evaluation unit at +90 °C (+194 °F)

After this time the NO_x sensor must be replaced. The total operating hours of the NO_x sensor are displayed in the *Sensor* view of the respective NO_x monitor (see section *Sensor* on page 129). You obtain a replacement sensor from MOTORTECH.

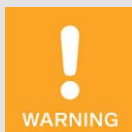
The replacement of the NO_x sensor is detected by the EasyNO_x and logged in the logbook of the respective NO_x monitor.

Proceed as follows to replace the NO_x sensor:

**Operational safety!**

To safely dismount the NO_x sensor, be sure to observe the following:

- To protect the NO_x sensor and yourself, wear ESD-compliant work gloves. To protect the NO_x sensor against electrostatic discharge, also comply with IEC 61340-5-1 and IEC TR 61340-5-2 in their respective valid versions.
- Under no circumstances touch the probe of the sensing element while dismounting.
- The NO_x sensor must not be live during dismounting and must have cooled down for at least 15 minutes after the voltage has been switched off. Otherwise, touching the sensing element may cause burns, the sensing element may burn, and serious damage to the connected equipment due to sparking or a short circuit may occur.

**Operational safety!**

The NO_x sensor must not be used any further under any circumstances if it is damaged or the sensing element of the NO_x sensor has been mechanically shocked (e.g. by dropping it on the floor or impacts on the sensing element). In these cases, contact MOTORTECH for sensor replacement (see *Customer Service Information* on page 200).

**Operational safety!**

Proper functioning of the NO_x sensor is only guaranteed if the sensing element does not overheat at the mounting location. Avoid accumulated heat at the sensing element and ensure sufficient ventilation of the sensing element by ambient air.

**Operational safety!**

The sensing element of the NO_x sensor P/N 56.03.003 may be mounted a maximum of one time, the sensing element of the NO_x sensor P/N 56.03.002 a maximum of two times. The electrical connection to the evaluation unit of the NO_x sensors may be established and disconnected a maximum of 20 times. After that, proper functioning of the sensor can no longer be guaranteed.

12 Maintenance

1. First ensure the following:
 - The engine must be switched off during replacement.
 - The exhaust pipe must have cooled down sufficiently and there must be no exhaust gases in the exhaust pipe.
 - The EasyNO_x system must not be live.
2. Then disconnect the connection cable to the CAN bus module from the connector of the NO_x sensor's evaluation unit.
3. Make sure that the sensing element has not been live for at least 15 minutes. Then unscrew the sensing element from the welding boss using a flare nut wrench 22 mm (0.87") with a spared corner wave profile. The outgoing wires must not twist in the process. Therefore counter the sensing element with your hand. Do not use a hammer or a flat spanner to loosen the sensing element.



Hole spacing on mounting plate unsuitable for replacement sensor

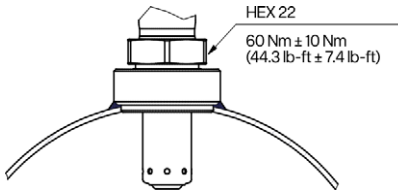
Earlier batches of the mounting plate supplied with the CAN bus/NO_x sensor module are not prepared for the diagonal hole spacing of 102.4 mm (4.03") of newer NO_x sensors from MOTORTECH.

In such cases, leave the previous bracket of the NO_x sensor on the mounting plate. Instead of dismantling it, remove the evaluation unit of the previous NO_x sensor from the bracket in the following instructions and insert the evaluation unit of the replacement NO_x sensor into this bracket.

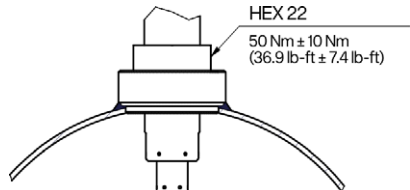
4. Dismount the evaluation unit from the mounting plate of the CAN bus/NO_x sensor module by loosening the two M8x20 hexagon screws.
5. Remove the NO_x sensor.
6. At the mounting position of the sensing element, first check the NO₂/NO_x ratio (correction factor K) in the exhaust gas with a suitable calibrated exhaust gas analyzer. More information on this is available in the section *Determining the NO₂/NO_x Ratio* on page 64.
7. Then mount the evaluation unit of the replacement NO_x sensor onto the mounting plate of the CAN bus/NO_x sensor module using the two hexagon screws M8x20 and a tightening torque of 10 Nm (7.4 lb-ft).
8. Remove the protective cap from the probe of the new NO_x sensor's sensing element. Do not pull on the connection cable, but hold the sensing element only by its metal body.
9. Check whether the thread of the sensing element is sufficiently greased. If necessary, re-grease only the thread of the sensing element with a small amount of high temperature grease. For NO_x Sensor P/N 56.03.003, use only Optimol Paste MF from Castrol® or Never Seez Regular Grade from Bostik® with a recommended amount of 40 mg ± 10 mg.
10. Also make sure that no dirt, dust, or grease gets deposited in or on the probe during replacement.
11. Insert the sensing element into the welding boss and screw the sensing element into the welding boss via its hexagon nut by hand first. The outgoing wires must not twist in the process. Therefore counter the sensing element with your hand.

12. Then, tighten the sensing element over its hexagon nut using a calibrated torque tool with the specified torque as shown in the drawing.

P/N 56.03.003:



P/N 56.03.002:



13. Then lay the connection cable between the sensing element and the evaluation unit. In doing so, observe the following.

P/N 56.03.003:

Comply with the specifications in the section *Laying the Connection Cable* on page 62.

P/N 56.03.002:

Make sure that the minimum bending radius of the connection cable of 20 mm (0.79") is observed and that the angle of the cable outlet at the sensing element grommet is less than 15°.

14. Make sure that the five-pole connector of the NO_x sensor's evaluation unit is dry and that there are no particles or deposited grease in the connector.
15. Connect the connection cable to the CAN bus module to the five-pin connector of the evaluation unit.
 - ▶ The NO_x sensor has been replaced.
16. After you have put the EasyNO_x system back into operation, correct the NO₂/NO_x ratio determined above in the *NO_x Setup* view of the respective NO_x monitor in the entry *K* (see section *Preferences* on page 124), if necessary.
17. Also, if necessary, correct the NO₂ correction factor of the NO_x sensor in the *NO_x Setup* view of the respective NO_x monitor in the entry *KNO₂* (see section *Preferences* on page 124).
 - ▶ You can resume using the NO_x monitoring of the EasyNO_x.

12.6 Spare Parts and Accessories

For spare parts and accessories, please refer to our current Product Guide, which is available for you to download on the internet at www.motortech.de.

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MOTORTECH®

MOTORTECH GmbH

Hunaeusstrasse 5
29227 Celle
Germany

☎ +49 5141 93 99 0
✉ sales@motortech.de
🌐 www.motortech.de

MOTORTECH Americas, LLC

1400 Dealers Avenue, Suite A
New Orleans, LA 70123
USA

☎ +1 504 355 4212
✉ info@motortechamericas.com
🌐 www.motortechamericas.com



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