



# NO<sub>x</sub> Sensor

P/N 56.03.003

Installation Instruction



Original installation instruction

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Prior to use, read this installation instruction carefully and familiarize yourself with the product. Installation and start-up should not be carried out before reading and understanding this document. Keep this installation instruction readily available so that you can reference it as needed.

## 1.1 What Is the Purpose of this Installation Instruction?

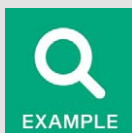
This installation instruction serves as an aid for the installation of the product and supports the technical staff with all maintenance tasks to be performed. Furthermore, this instruction is aimed at preventing dangers to life and health of the user and third parties.

## 1.2 Who Is this Installation Instruction Targeted to?

This installation instruction 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 the electronic components used 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.

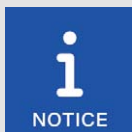
## 1.3 What Symbols Are Used in the Installation Instruction?

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



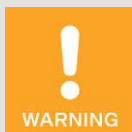
### Example

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.

# 1 General Information



## **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 Installation Instruction?

The following abbreviations/acronyms are used in the installation instruction.

<b>Abb.</b>	<b>Term</b>	<b>Description</b>	<b>Explanation</b>
CAN bus	Controller Area Network bus	Bus for control devices/networks	Asynchronous serial connection system for linking control units
DC	Direct Current		
ESD	Electrostatic Discharge		
HB	Horizontal Burning		Flammability class as per UL 94

### 2.1 General Safety Instructions

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 installation instruction, and follow the instructions given while working.
- Further work must only be performed by personnel authorized by MOTORTECH. Non-compliance with the instructions will void any warranties 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.
- 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 Safety Instructions

### 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.

### 2.3 Special Safety Instructions for the Device



#### Explosion hazard!

Only use the NO<sub>x</sub> 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.



#### Risk of burning!

There is a risk of burns when touching the sensing element of the NO<sub>x</sub> sensor because the sensing element heats up as soon as the NO<sub>x</sub> sensor is live. Therefore, observe the following:

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



#### Risk of injury!

The NO<sub>x</sub> sensor 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. To protect the circuit against overload and short circuits, the supply voltage cable must be secured with a suitable fuse.





**Operational safety!**

To prevent short circuits that can cause electric shock and serious damage to the connected equipment, always switch off the power supply to the NO<sub>x</sub> sensor before disconnecting its electrical connections.



**Operational safety!**

Proper functioning of the NO<sub>x</sub> 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<sub>x</sub> 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<sub>x</sub> sensor must not be used any further under any circumstances if it is damaged or the sensing element of the NO<sub>x</sub> 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 25).

## 2 Safety Instructions



### **Operational safety!**

The sensing element may be mounted a maximum of one time. The electrical connection to the NO<sub>x</sub> 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.

### 2.4 Proper Storage

Keep the storage period of the delivered NO<sub>x</sub> sensor as short as possible and unpack the NO<sub>x</sub> sensor no earlier than directly before mounting (see section *Proper Transport* on page 10). For storage, observe the mechanical specifications of the NO<sub>x</sub> sensor (see section *Mechanical Data* on page 12). In the vicinity of the NO<sub>x</sub> sensor, no easily evaporating organic materials or silicone-organic materials may be stored.

### 2.5 Proper Transport

Let the NO<sub>x</sub> sensor remain in its original packaging until it reaches its place of use and unpack the NO<sub>x</sub> sensor no earlier than directly before mounting.

When carrying the unpacked NO<sub>x</sub> sensor, make sure that you do not twist the wires in the connection cable between the sensing element and the evaluation unit. Under any circumstances, do not wrap the connection cable around the evaluation unit. Wrap the connection cable separately from the evaluation unit, and maintain the connection cable's minimum bending radius of 20 mm (0.79") and on both ends of the connection cable the minimum distance of the first bend of 30 mm (1.18").

The protective cap of the 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 within this installation instruction (see section *Mounting* on page 20).

### 2.6 Proper Disposal

For the proper disposal of MOTORTECH equipment, observe the information provided at [www.motortech.de](http://www.motortech.de).

### 3.1 Functional Description

The NO<sub>x</sub> sensor measures the nitrogen oxide and oxygen concentration in the exhaust gas of stationary gas-powered lean-burn engines in industrial environments and transmits the measured values via the CAN bus to a master control.

For operating the NO<sub>x</sub> sensor, a master control is required, which signals the dew point release to the NO<sub>x</sub> sensor via the CAN bus.

### 3.2 Applications

The NO<sub>x</sub> sensor is designed for use with stationary gas-powered lean-burn engines in industrial environments whose exhaust gases have an oxygen content  $\geq 1$  vol%.

The NO<sub>x</sub> sensor is suitable for exhaust gases and that are free of ammonia and may only be used for measurements in non-explosive gas mixtures.

The NO<sub>x</sub> sensor is designed for use in a non-hazardous area.

The NO<sub>x</sub> sensor is only suited for measurement when mounted in an exhaust pipe.

As per EN 55011, the NO<sub>x</sub> sensor is equipment of Group 1 and Class B.

Any use other than the one described in the installation instruction shall be considered improper use and will result in the voiding of all warranties.

## 4 Product Description

### 4.1 Technical Data

#### 4.1.1 Certifications

The NO<sub>x</sub> sensor 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 25).

#### 4.1.2 Mechanical Data

The NO<sub>x</sub> sensor has the following mechanical characteristics:

Feature	Value
Dimensions	Length of probe: 24 mm (0.95") Length of sensing element: 83.3 mm (3.28") Evaluation unit (length x width x height): 104.4 mm x 72.8 mm x 24.3 mm (4.11" x 2.87" x 0.96") Length of connection cable: 980 mm (38.58")
Weight	210 g (0.47 lbs)
Shape of device	See section <i>Overview Drawings</i> on page 15
IP protection rating as per ISO 20653:2013	IP 6K9K with mating plug of same protection rating connected to evaluation unit and sensing element mounted in suitable welding boss from MOTORTECH
Climatic environmental conditions	Operating temperature evaluation unit: –40 °C to +90 °C (–40 °F to +194 °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) Storage temperature: –40 °C to +75 °C (–40 °F to +167 °F) 0 % to 60 % humidity without condensation Max. 18 months Exhaust gas temperature range: –40 °C to +850 °C (–40 °F to +1,562 °F) Operating pressure range: 600 mbar abs to 1,500 mbar abs
Flammability class as per UL 94	HB
Mounting cycles	Max. 1
Mating cycles evaluation unit	Max. 20
Service life	8,000 operating hours with ambient temperature max. +90 °C (+194 °F) at evaluation unit

### 4.1.3 Product Identification – Labeling on the Device

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

- Part number of the NO<sub>x</sub> sensor (P/N)
- Serial number of the NO<sub>x</sub> sensor (S/N)

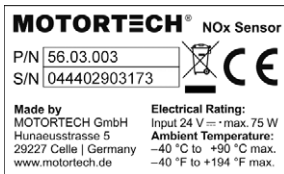


Illustration example

### 4.1.4 Electrical Data

The NO<sub>x</sub> sensor has the following electrical characteristics:

Feature	Value
Power supply	24 V DC (16 V DC to 32 V DC)
Maximum power consumption	75 W
Required current	In measuring operation max. 1.7 A <sub>rms</sub> , 6.3 A <sub>peak</sub>
Connector evaluation unit	5-pole, connector, Hirschmann, MLK, variant 1, code A

The measuring probe of the NO<sub>x</sub> sensor has the following characteristics:

Feature	Value
Measuring range nitrogen oxide (NO <sub>x</sub> )	0 ppm to 3,012 ppm
Measuring accuracy nitric oxide (NO)	See table 1, valid measured values from O <sub>2</sub> ≥ 1 vol%
Response time nitric oxide (NO)	t <sub>10-90</sub> : 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 <sub>x</sub> measurement	Ammonia (NH <sub>3</sub> ) typ. 110 %
Sensitivity NO <sub>x</sub> measurement	Nitrogen dioxide (NO <sub>2</sub> ) typ. 85 %
Measuring range oxygen (O <sub>2</sub> )	0 % to 20.95 %
Measuring accuracy oxygen (O <sub>2</sub> )	See table 2
Response time oxygen (O <sub>2</sub> )	t <sub>10-90</sub> : max. 800 ms at exhaust gas velocity 11 m/s
Light-off time oxygen (O <sub>2</sub> )	Max. 45 s after dew point release
Exhaust gas velocity	10 m/s to 100 m/s
NO <sub>2</sub> correction factor (K <sub>NO2</sub> )	0.85 (set ex works)

## 4 Product Description

Table 1: Measuring accuracy nitric oxide (NO)

Measurement	Measuring accuracy new at O <sub>2</sub> ≥ 1 vol%	Measuring accuracy aged at O <sub>2</sub> ≥ 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 (O<sub>2</sub>)

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

### 4.1.5 Interfaces

#### CAN Bus Interface

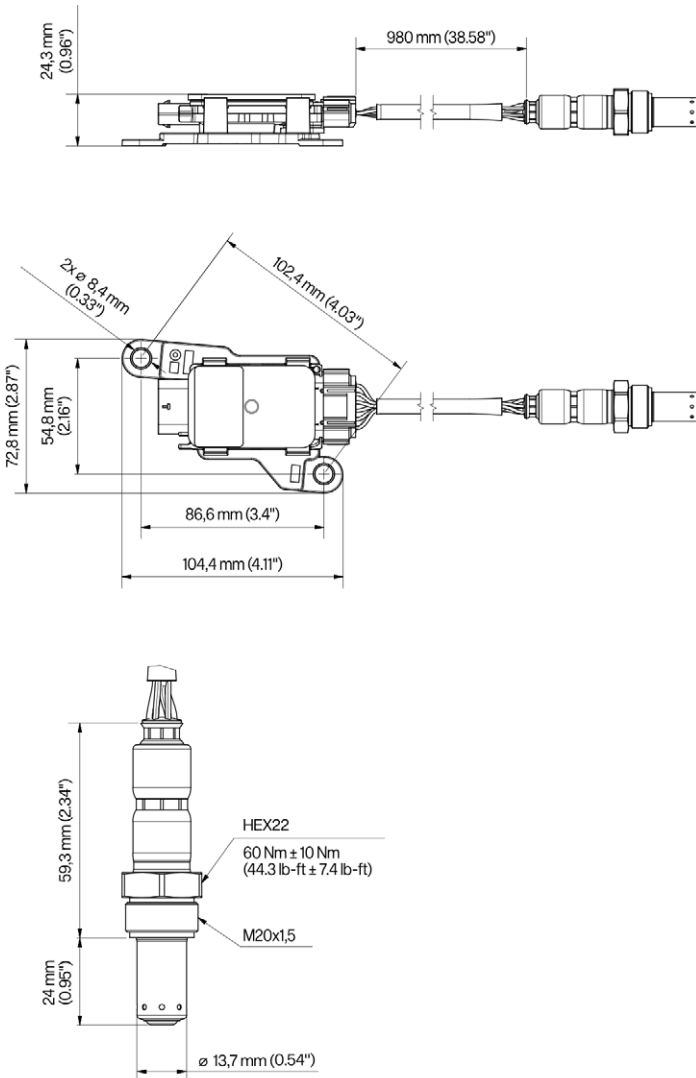
- Classical Extended Frame Format (CAN 2.0B)
- Network protocol: SAE J1939
- Transmission rate: 250 kbit/s

## 4 Product Description

MOTORTECH®

### 4.1.6 Overview Drawings

#### Dimensions



# 5 Functions

## 5.1 Output of Measured Values

The NO<sub>x</sub> sensor only outputs valid measured values when the sensing element is at working temperature (see section *Heating Modes* on page 16). Via the CAN bus, the NO<sub>x</sub> sensor indicates for each measured value whether the measured value is valid or invalid. Further information on the output of measured values via the CAN bus can be found in the CAN bus documentation of the NO<sub>x</sub> sensor P/N 56.03.003, which is available on request from your MOTORTECH contact person (see *Customer Service Information* on page 25).

## 5.2 Heating Modes

The NO<sub>x</sub> sensor operates in the following three heating modes:

- **Protective Heating**  
As soon as the NO<sub>x</sub> sensor is supplied with power, the NO<sub>x</sub> sensor is operated with a low heating power to prevent the formation of condensation water in the sensing element. In this mode, the CAN interface of the NO<sub>x</sub> sensor is already accessible, but the NO<sub>x</sub> sensor does not yet output valid measured values.
- **Heat-up**  
After the NO<sub>x</sub> sensor has received the dew point release from the master control via the CAN bus, the NO<sub>x</sub> sensor heats up the sensing element until its working temperature is reached. The evaluation unit of the NO<sub>x</sub> sensor transmits the status of whether the sensing element is at working temperature as well as the heating status to the master control via a CAN message.
- **Measurement**  
As soon as the sensing element is stably at working temperature, the NO<sub>x</sub> sensor outputs valid measured values via the CAN bus.

## 5.3 Readable Correction Factors

For corrective calculations of the transmitted nitrogen oxide and oxygen concentration measured values in the master control, the NO<sub>x</sub> sensor provides the following correction factors:

- O<sub>2</sub> pressure correction
- NO<sub>x</sub> pressure correction
- NO<sub>2</sub> correction ( $K_{\text{NO}_2}$ )
- NH<sub>3</sub> correction ( $K_{\text{NH}_3}$ )
- NO<sub>x</sub> new part deviation gain
- NO<sub>x</sub> new part deviation offset

The evaluation unit of the NO<sub>x</sub> sensor transmits these correction factors on request to the master control via the CAN bus. Further information on reading out the correction factors can be found in the CAN bus documentation of the NO<sub>x</sub> sensor P/N 56.03.003, which is available on request from your MOTORTECH contact person (see *Customer Service Information* on page 25).





### Replacement of NO<sub>x</sub> sensor in EasyNO<sub>x</sub> system

If you want to replace a NO<sub>x</sub> sensor from MOTORTECH in the exhaust pipe, read the relevant sections in the EasyNO<sub>x</sub> operating manual on replacing a NO<sub>x</sub> sensor P/N 56.03.003.

## 6.1 Preparation

Make sure that your application meets the following requirements.

### 6.1.1 Mounting Position of Sensing Element

The NO<sub>x</sub> 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.

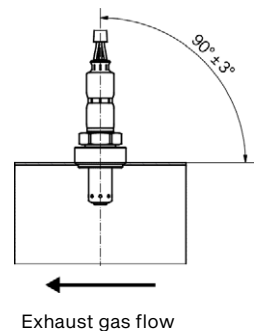
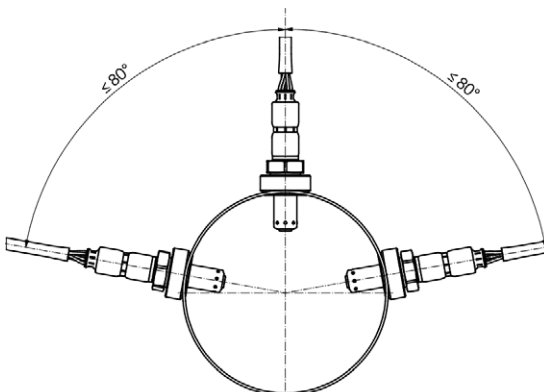
If the intake pipe is located near the sensing element, the distance between the sensing element and the intake pipe must be chosen in a way that condensed liquid droplets will not stream back to the sensing element due to gas pulsation.

In systems with urea injection, if the sensing element is to be mounted near the injection point, the sensing element should be mounted prior to the injection point, and it should be ensured that no urea flows back to the sensing element.

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

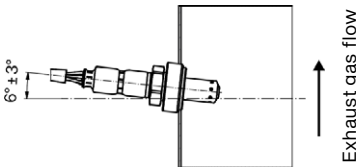
The possible tilt angles of the sensing element depend on the course of the exhaust pipe. Mounting in a vertical exhaust pipe is not recommended by MOTORTECH.

Tilt angles horizontal exhaust pipe



## 6 Installation Instructions

Tilt angles vertical exhaust pipe



The sensing element heats up as soon as the NO<sub>x</sub> 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.

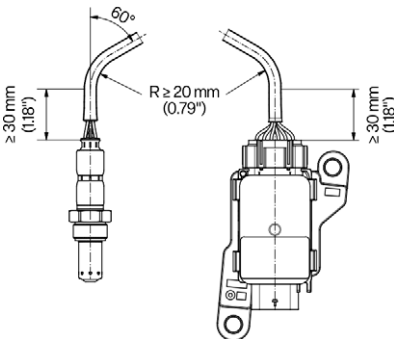
Make sure that the sensing element of the NO<sub>x</sub> sensor does not overheat at the mounting location. Avoid accumulated heat at the sensing element and ensure sufficient ventilation of the sensing element by ambient air. Also comply with the specified temperature limits (see section *Mechanical Data* on page 12).

### 6.1.2 Mounting Position of Evaluation Unit

To prevent the formation of discharge sparks or electric shock when touching the housing, the evaluation unit of the NO<sub>x</sub> sensor must be mounted on a grounded mounting plate. The mounting position of the mounting plate should be free from vibrations.

### 6.1.3 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.

### 6.1.4 External Power Supply



#### **Risk of injury!**

The NO<sub>x</sub> sensor 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. To protect the circuit against overload and short circuits, the supply voltage cable must be secured with a suitable fuse.

## 6.2 Unpacking

Before unpacking, please observe the instructions in section *Proper Transport* on page 10.

To prevent condensation from forming in the sensing element of the NO<sub>x</sub> sensor, 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 NO<sub>x</sub> 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).

Do not remove the protective cap from the sensing element until you are instructed to do so within this installation instruction (see section *Mounting* on page 20).

## 6.3 Material Needed

For mounting the NO<sub>x</sub> sensor, you need the following material:

- Suitable welding boss from MOTORTECH
- Locking screw for welding boss from MOTORTECH
- Suitable harness for connecting the NO<sub>x</sub> sensor to the master control (optionally available from MOTORTECH)

If you have any questions about the needed material, contact your MOTORTECH contact person (see *Customer Service Information* on page 25).

# 6 Installation Instructions

## 6.4 Mounting



### Operational safety!

To safely mount the NO<sub>x</sub> sensor, be sure to observe the following:

- To protect the NO<sub>x</sub> sensor and yourself, wear ESD-compliant work gloves. To protect the NO<sub>x</sub> 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<sub>x</sub> sensor must not be used any further under any circumstances if it is damaged or the sensing element of the NO<sub>x</sub> 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 25).



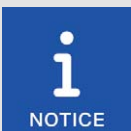
### Operational safety!

Proper functioning of the NO<sub>x</sub> 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<sub>x</sub> 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.



### Replacement of NO<sub>x</sub> sensor in EasyNO<sub>x</sub> system

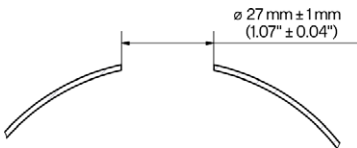
If you want to replace a NO<sub>x</sub> sensor from MOTORTECH in the exhaust pipe, read the relevant sections in the EasyNO<sub>x</sub> operating manual on replacing a NO<sub>x</sub> sensor P/N 56.03.003.

Before mounting, it is essential to observe the instructions in the section *Preparation* on page 17. Make sure that the engine is switched off when mounting. Also make sure that the exhaust pipe has cooled down sufficiently and that there are no exhaust gases in the exhaust pipe.

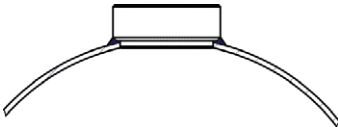
The sensing element of the NO<sub>x</sub> sensor is screwed into the exhaust pipe via a suitable welding boss made of stainless steel (material number 1.4301) from MOTORTECH. For welding in the welding boss, the locking screw of the welding boss can be used as welding aid.

Proceed as follows:

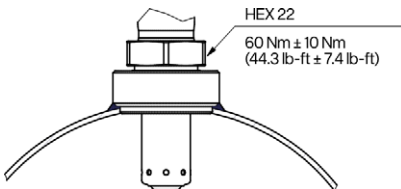
1. First mount the evaluation unit of the NO<sub>x</sub> sensor with two suitable screws onto a grounded mounting plate at the mounting position specified by you. The diameter of the mounting holes is 8.4 mm (0.33").
2. Then, at the selected mounting position in the exhaust pipe, drill a hole with a diameter of 27 mm ± 1 mm (1.07" ± 0.04") into the exhaust pipe for the sensing element.



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



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 mg ± 10 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 Nm ± 10 Nm (44.3 lb-ft ± 7.4 lb-ft).



## 6 Installation Instructions

8. Then lay the connection cable between the sensing element and the evaluation unit. When doing so, comply with the specifications in the section *Laying the Connection Cable* on page 18.
  - ▶ The NO<sub>x</sub> sensor is mounted.

### 6.5 Wiring

For connecting the NO<sub>x</sub> sensor to the master control and the power supply and for selecting the CAN identifier of the NO<sub>x</sub> sensor (see *Setting CAN Identifier* on page 22), suitable harnesses are available from MOTORTECH.

If you want to apply your own solution, use a suitable mating plug to the five-pole connector of the NO<sub>x</sub> sensor's evaluation unit (see *Electrical Data* on page 13) and make sure that your wiring complies with the following specifications:

Pin evaluation unit	Assignment	Cable type	Cross section	Wire length
1	L+	Unshielded	≥ 1 mm <sup>2</sup>	< 15 m (49')
2	L-			
3	CAN Lo	Shielded CAN cable	0.2 mm <sup>2</sup>	250 m (820')
4	CAN Hi			
5	CAN identifier of NO <sub>x</sub> sensor	Shielded	0.2 mm <sup>2</sup>	< 30 m (98')
		Unshielded		< 3 m (9')

When making the plug connection, make sure that the five-pole connector of the NO<sub>x</sub> sensor's evaluation unit is dry and that there are no particles or deposited grease in the connector. In addition, do not apply any lubricants to make the plug connection. The harness and cables should be routed in such a way that there is no pull on them or the evaluation unit. If you use cable fasteners, they should not exert any force on the harness or cables.

### 6.6 Setting CAN Identifier

Two CAN identifiers are predefined in the NO<sub>x</sub> sensor so that a maximum of two NO<sub>x</sub> sensors can be operated on one CAN bus. The CAN identifier is selected externally via pin 5 of the NO<sub>x</sub> sensor's connector.

- 0x18F00E51 = Parameter group number 61454, source address 81:  
Pin 5 is connected to ground.
- 0x18F00F52 = Parameter group number 61455, source address 82:  
Pin 5 is open.

### 6.7 Setting up Master Control

Before you can perform measurements with the NO<sub>x</sub> sensor, the master control must be configured in certain cases.

If you use a master control from MOTORTECH that is designed for use with the NO<sub>x</sub> sensor (e.g. EasyNO<sub>x</sub>), please refer to the operating manual of the master control for more information.

If you use some other master control, it must usually be adapted for communication with the NO<sub>x</sub> sensor via the CAN bus. Further information on this can be found in the CAN bus documentation of the NO<sub>x</sub> sensor P/N 56.03.003, which is available on request from your MOTORTECH contact person (see *Customer Service Information* on page 25). Likewise, in certain cases, the measured values sent by the NO<sub>x</sub> sensor must also be subjected to corrective calculations in the master control.

### 6.8 Dismounting



#### Operational safety!

To safely dismount the NO<sub>x</sub> sensor, be sure to observe the following:

- To protect the NO<sub>x</sub> sensor and yourself, wear ESD-compliant work gloves. To protect the NO<sub>x</sub> 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<sub>x</sub> 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<sub>x</sub> sensor must not be used any further under any circumstances if it is damaged or the sensing element of the NO<sub>x</sub> 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 25).



#### Operational safety!

The sensing element may be mounted a maximum of one time. The electrical connection to the NO<sub>x</sub> 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.

Make sure that the engine is switched off while dismounting. Also make sure that the exhaust pipe has cooled down sufficiently and that there are no exhaust gases in the exhaust pipe.

To dismount the NO<sub>x</sub> sensor, proceed as follows:

1. Make sure that the NO<sub>x</sub> sensor is not live. Then disconnect the mating plug of the MOTORTECH harness or your wiring from the connector of the evaluation unit.

## 6 Installation Instructions

2. 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.
3. Dismount the evaluation unit from the mounting plate.
  - ▶ The NO<sub>x</sub> sensor has been dismantled.

If you do not screw a suitable sensing element into the welding boss after having removed the NO<sub>x</sub> sensor, you may only restart the engine after having sealed the opening in the exhaust pipe gas-tight. For this purpose, use the locking screw of the welding boss. Grease the locking screw sufficiently with high temperature grease before inserting it into the welding boss, and screw the locking screw into the welding boss with a torque of 25 Nm (18.5 lb-ft).



## 7.1 Error Detection

The evaluation unit of the NO<sub>x</sub> sensor detects electrical faults (short-circuits and open wires) in the lines between the sensing element and the evaluation unit and signals these to the master control via the CAN bus. If an electrical fault has been detected, the NO<sub>x</sub> sensor operates in diagnostic mode and remains in this mode even after elimination of the electrical fault, until the dew point release is set or reset, or the NO<sub>x</sub> sensor is reset by an intermediate disconnection from the power supply.

Further information on errors reported via the CAN bus can be found in the CAN bus documentation of the NO<sub>x</sub> sensor P/N 56.03.003, which is available on request from your MOTORTECH contact person (see *Customer Service Information* on page 25).

## 7.2 Self-Diagnosis

The NO<sub>x</sub> sensor has a self-diagnosis function that can be triggered by the master control via a CAN message. Further information on the self-diagnosis can be found in the CAN bus documentation of the NO<sub>x</sub> sensor P/N 56.03.003, which is available on request from your MOTORTECH contact person (see *Customer Service Information* on page 25).

## 7.3 Customer Service Information

You can reach us during our business hours by:

Phone: +49 514193 99 0  
Email: service@motortech.de (technical support)  
sales@motortech.de (all other matters)

## 7.4 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 25). 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 25.

## 7.5 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.

## 8 Maintenance

### 8.1 Cleaning the NO<sub>x</sub> Sensor

The NO<sub>x</sub> sensor must not be cleaned with mechanical means or cleaning agents, as this may destroy the sensor or mechanically damage the labels. The NO<sub>x</sub> sensor including its electrical connection must not come into contact with liquids.

If necessary, clean the NO<sub>x</sub> sensor with a soft, dry cloth. If you clean the NO<sub>x</sub> sensor when it is not mounted, make sure that the probe remains free of dirt.

### 8.2 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](http://www.motortech.de).



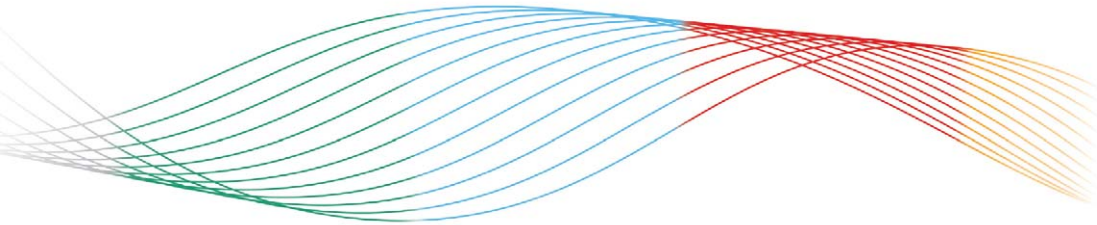


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## GAS ENGINE TECHNOLOGY

