



850 Series

Electronic Indicating
Temperature Transmitter/Switch



Operating Instructions

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Declarations of conformity can be found online at www.noshok.com.

1. General information

- The temperature transmitter/switch described in these operating instructions has been designed and manufactured using state-of-the-art technology. All components are subject to stringent quality and environmental criteria during production. Our quality management systems are certified to ISO 9001:2015.
- These operating instructions contain important information on handling the instrument. Working safely requires that all safety instructions and work instructions are observed.
- Observe the relevant local accident prevention regulations and general safety regulations for the instrument's range of use.
- The operating instructions are part of the product and must be kept in the immediate vicinity of the instrument and readily accessible to skilled personnel at any time.
- Skilled personnel must have carefully read and understood the operating instructions prior to beginning any work.
- The manufacturer's liability is void in the case of any damage caused by using the product contrary to its intended use, non-compliance with these operating instructions, assignment of insufficiently qualified skilled personnel or unauthorised modifications to the instrument.
- The general terms and conditions contained in the sales documentation shall apply.
- Subject to technical modifications.
- Further information:
www.noshok.com
T: 440.243.0888
F: 440.243.3472
info@noshok.com

1. General information

Explanation of symbols



WARNING!

... indicates a potentially dangerous situation that can result in serious injury or death, if not avoided.



CAUTION!

... indicates a potentially dangerous situation that can result in light injuries or damage to equipment or the environment, if not avoided.



Information

... points out useful tips, recommendations and information for efficient and trouble-free operation.



CAUTION!

... indicates a potentially dangerous situation that can result in burns, caused by hot surfaces or liquids, if not avoided.

Abbreviations

U+	Positive power terminal
U-	Reference potential
S+	Analog output
SP1	1 switch point
SP2	2 switch point
C	Communication with IO-Link
MBA	Start of measuring range
MBE	End of measuring range

2. Safety



WARNING!

Before installation, usage and operation, ensure that the appropriate temperature transmitter/switch has been selected in terms of measuring range, design and specific measuring conditions. Non-observance can result in serious injury and/or damage to the equipment.



WARNING!

Observe the working conditions in accordance with chapter 3 “Specifications”.



Further important safety instructions can be found in the individual chapters of these operating instructions.

2.1 Intended use

The temperature transmitter/switch is used to convert temperature into an electrical signal indoors and outdoors.

The instrument has been designed and built solely for the intended use described here, and may only be used accordingly.

The technical specifications contained in these operating instructions must be observed. Improper handling or operation of the temperature switch outside of its technical specifications requires the instrument to be taken out of service immediately and inspected by an authorized NOSHOK service engineer.

The manufacturer shall not be liable for claims of any type based on operation contrary to the intended use.

2. Safety

2.2 Personnel qualification



WARNING!

Risk of injury should qualification be insufficient!

Improper handling can result in considerable injury and damage to equipment.

The activities described in these operating instructions may only be carried out by skilled personnel who have the qualifications described below.

Skilled personnel

Skilled personnel are understood to be personnel who, based on their technical training, knowledge of measurement and control technology and on their experience and knowledge of country-specific regulations, current standards and directives, are capable of carrying out the work described and independently recognising potential hazards.

Special operating conditions require further appropriate knowledge, e.g. of aggressive media.

2.3 Special hazards



WARNING!

For hazardous media such as oxygen, acetylene, flammable or toxic gases or liquids, and refrigeration plants, compressors, etc., in addition to all standard regulations, the appropriate existing codes or regulations must also be followed.



WARNING!

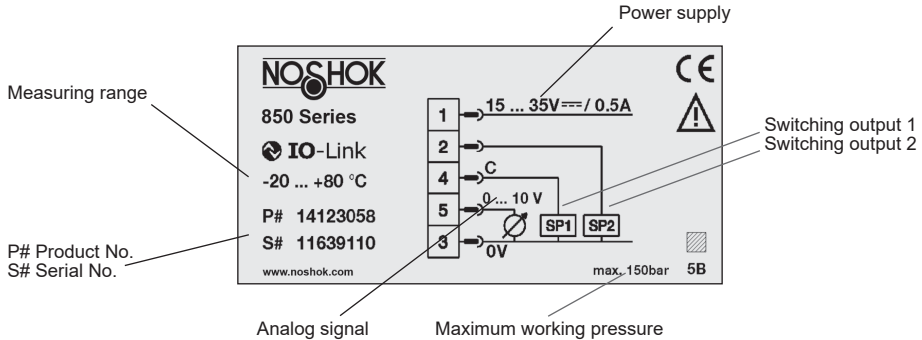
Residual media in the dismantled temperature switch can result in a risk to persons, the environment and equipment.

Take sufficient precautionary measures.

2. Safety

2.4 Labeling, safety marks

Product label



If the serial number becomes illegible (e.g. due to mechanical damage or overpainting), traceability will no longer be possible.

Explanation of symbols



General danger symbol



CE, Communauté Européenne

Instruments bearing this mark comply with the relevant European directives.

3. Specifications

3.1 Measuring ranges

Temperature	°C	°F
Standard	-20 °C to +80 °C	-4 °F to +176 °F
Option ¹⁾²⁾	-20 °C to +120 °C	-4 °F to +248 °F

1) Only for process connections with compression fitting.

2) Installation instructions under "Operating conditions" must be observed.

3.2 Display

14-segment LED, red, 4-digit, 9 mm (0.35 in) character size

Display can be turned electronically through 180°

Update: 200 ms

3.3 Output signal

Switching output		Analog signal
SP1	SP2	
PNP	-	4 ... 20 mA (3-wire)
PNP	-	DC 0 ... 10 V (3-wire)
PNP	PNP	-
PNP	PNP	4 ... 20 mA (3-wire)
PNP	PNP	DC 0 ... 10 V (3-wire)

Optionally also available with an NPN instead of a PNP switching output.

3. Specifications

IO-Link, revision 1.1 (option)

IO-Link is optionally available for all output signals.

With the IO-Link option, switching output SP1 is always PNP

Switching thresholds

Switch point 1 and switch point 2 are individually adjustable

Switching functions

Normally open, normally closed, window, hysteresis freely adjustable

Switching voltage

Power supply - 1 V

Switching current

- without IO-Link: max. 250 mA
- with IO-Link: SP1 max. 100 mA, SP2 max. 250 mA

Adjustment accuracy

≤ 0.5 % of span

Temperature offset adjustment

± 3 % of span

Scaling

Zero point: 0-25 % of span

Full scale: 75-100 % of span

Load

Analogue signal 4 to 20 mA: ≤ 0.5 k Ω

Analogue signal DC 0 ... 10 V: > 10 k Ω

Service life

100 million switching cycles

3. Specifications

3.4 Voltage supply

Power supply U_+

DC 15 ... 35 V

Current consumption

Switching outputs with

- **Analog signal 4 ... 20 mA:** 70 mA
- **Analog signal DC 0 ... 10 V:** 45 mA
- **without analog signal:** 45 mA

IO-Link option causes a deviating current consumption

Total current consumption

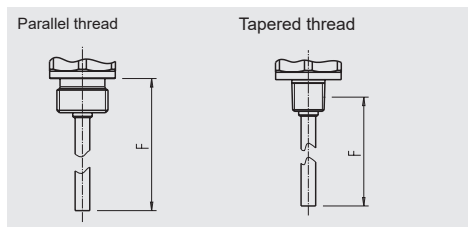
- without IO-Link: max. 600 mA including switching current
- with IO-Link: max. 450 mA including switching current

3.5 Measuring element

Model

Pt1000, 2-wire, DIN EN 60751 / class A

Insertion length (F)



F						
mm	25 ¹⁾	50 ¹⁾²⁾	100 ²⁾	150 ²⁾	250 ²⁾	350 ²⁾
inch	0.98 ¹⁾	1.97 ¹⁾²⁾	3.94 ²⁾	5.91 ²⁾	9.84 ²⁾	13.8 ²⁾

1) Not available with compression fitting or measuring range -4 °F to 248 °F (-20 °C to 120 °C).

2) Not available with G 1/8 A per DIN 3852-E.

3. Specifications

Response time

T05 < 5 s (per DIN EN 60751)

T09 < 10 s (per DIN EN 60751)

Maximum operating pressure

150 bar (2,175 psi)

When using a compression fitting:

max. 50 bar at 120 °C (max. 725 psi at 248 °F)

3.6 Accuracy data

Analog signal

$\leq \pm 0.5$ % of span + temperature sensor error

Switching output

$\leq \pm 0.8$ % of span + temperature sensor error

Display

$\leq \pm (0.8$ % of span + temperature sensor error) ± 1 digit

Temperature sensor

For °C: $\pm(0.15 K + 0.002 | t |)$ per EN 60751

For °F: $\pm[1.8*(0.15 + 0.002 (t - 32) / 1.8)]$

|T| is the value of the temperature without consideration of the sign.

The actually achievable accuracy is significantly determined by the mounting situation (immersion depth, sensor length, operating conditions). This is especially the case for large temperature gradients between the environment and the medium.

3. Specifications

3.7 Operating conditions

Permissible temperature ranges

Medium: See measuring ranges

Ambient: -4 °F to 176 °F (-20 °C to 80 °C) ¹⁾

Storage: -4 °F to 176 °F (-20 °C to 80 °C)

1) The permissible ambient temperature is limited to -4 °F to 176 °F (-20 °C to 80 °C) at the "-20 - 120 °C" measuring range.

At high medium or ambient temperatures, ensure by suitable measures that the instrument case temperature does not exceed 176 °F (80 °C) in continuous operation (the temperature is measured at the hexagon of the process connection).

At medium temperatures above 176 °F (80 °C) the thread must not be immersed into the medium.

Humidity

45 - 75 % r. h.

Vibration resistance

Insertion length $F \leq 150$ mm (5.91 in):

6 g (IEC 60068-2-6, under resonance)

Insertion length $F \geq 250$ mm (9.84 in):

2 g (IEC 60068-2-6, under resonance)

Shock resistance

50 g (IEC 60068-2-27, mechanical)

3. Specifications

Ingress protection

IP 65 and IP 67 (per IEC 60529)

The stated ingress protection only applies when plugged in using mating connectors that have the appropriate ingress protection.

Mounting position

as required

3.8 Reference conditions

Temperature:	59 °F to 77 °F (15 °C to 25 °C)
Atmospheric pressure:	950 - 1,050 mbar (13.78 ... 15.23 °F)
Humidity:	45 - 75 % r. h.
Nominal position:	Process connection lower mount (LM)
Power supply:	DC 24 V
Load:	see "Output signal"

3.9 Materials

Wetted parts

Temperature sensor: Stainless steel 316Ti

Non-wetted parts

Case:	Stainless steel 304
Keyboard:	TPE-E
Display window:	PC
Display head:	PC + ABS-Blend

3. Specifications

3.10 Electrical connections

Connections

- Circular connector M12 x 1 (4-pin)
- Circular connector M12 x 1 (5-pin) ¹⁾

1) Only for version with two switching outputs and additional analog signal

Electrical safety

Short-circuit resistance: S+ / SP1 / SP2 vs. U-

Reverse polarity protection: U+ vs. U-

Insulation voltage: DC 500 V

Overvoltage protection: DC 40 V

3.11 CE conformity

EMC directive

2004/108/EC, EN 61326 emission (Group 1, Class B) and interference immunity (industrial application)

3.12 Manufacturer's declaration

RoHS conformity

2011/65/EU.

4. Design and function

4.1 Description

By means of a measuring element (Pt1000) and by supplying power, the prevailing temperature is converted into a switching signal or an amplified standardized electrical signal via the change in resistance of the measuring element. This electrical signal varies in proportion to the temperature and can be evaluated accordingly.

4.2 Scope of delivery

Cross-check scope of delivery with the delivery note.

5. Transport, packaging and storage

5.1 Transport

Check the temperature transmitter/switch for any damage that may have been caused by transport. Obvious damage must be reported immediately.

5.2 Packaging

Do not remove packaging until just before mounting.

Keep the packaging as it will provide optimum protection during transport (e.g. change in installation site, sending for repair).

5.3 Storage

Permissible conditions at the place of storage:

- Storage temperature: -4 °F to 176 °F (-20 °C to 80 °C)
- Humidity: 45 - 75 % relative humidity



WARNING!

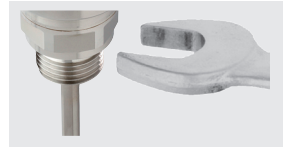
Before storing the instrument (following operation), remove any residual media. This is particularly important if the medium is hazardous to health, e.g. caustic, toxic, carcinogenic, radioactive, etc.

6. Usage, operation

6.1 Mounting

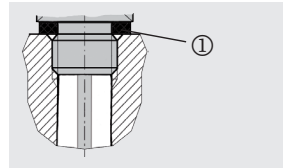
Required tool: Open-ended spanner (spanner width 27)

- The sealing faces at the temperature transmitter/switch and the measuring point must always be clean.
- Only screw in, or unscrew, the instrument via the spanner flats. Never use the case as a working surface.
- The correct torque depends on the dimensions of the process connection and the sealing used (form/material).
- When screwing in, do not cross the threads.
- The instrument must be grounded via the process connection.
- Attach the connector and screw it in hand-tight.



Seal

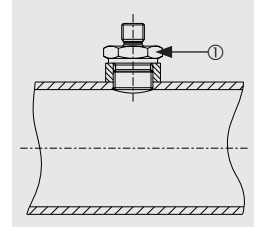
Correct sealing of the process connections with parallel threads at the sealing face must be made using suitable flat gaskets, sealing rings or NOSHOK profile sealings. The sealing of tapered threads (e.g. NPT threads) is made by providing the thread with additional sealing material such as, for example, PTFE tape (EN 837-2).



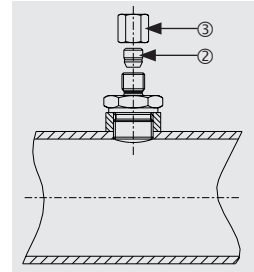
6. Usage, operation

Compression fitting

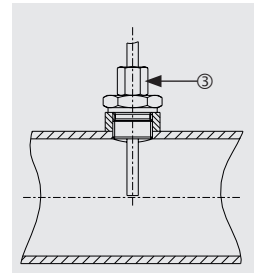
1. Screw the compression fitting (1) into the process connection and tighten.



2. Insert the tapered side of the ferrule (2) into the fitting and screw on the union nut (3) hand-tight.



3. Insert the temperature transmitter/switch into the fitting and maintain it at the required immersion depth. Tighten the union nut (3) with approx. 50 Nm.



4. Optional

Check the assembly: Loosen the union nut. The ferrule is firmly connected to the sensor tube.

6. Usage, operation

Connection diagrams

Circular connector M12 x 1, 4-pin



Assignment

U+	U-	S+	SP1 / C	SP2
1	3	2	4	2

Circular connector M12 x 1, 5-pin



Assignment

U+	U-	S+	SP1 / C	SP2
1	3	5	4	2

6.2 Operating modes

System start

- Display is fully activated for 2 seconds.
- When the temperature transmitter/switch is powered up within the range of the hysteresis, the output switch is set to "not active" by default.

Display mode

Normal operation, display temperature value

Programming mode

Setting the parameters

6. Usage, operation

6.3 Keys and functions

The temperature transmitter/switch has two operating modes: the display mode and the programming mode. The selected operating mode determines the respective function of the key.



Jumping to the programming mode

Keep the "MENU" key pressed for approx. 5 seconds. If the password is set to \neq 0000, a password will be requested first-hand. If authentication is successful, then it enters the programming mode, otherwise it reverts to display mode.



Returning to the display mode

Simultaneous pressing of both keys.

6. Usage, operation



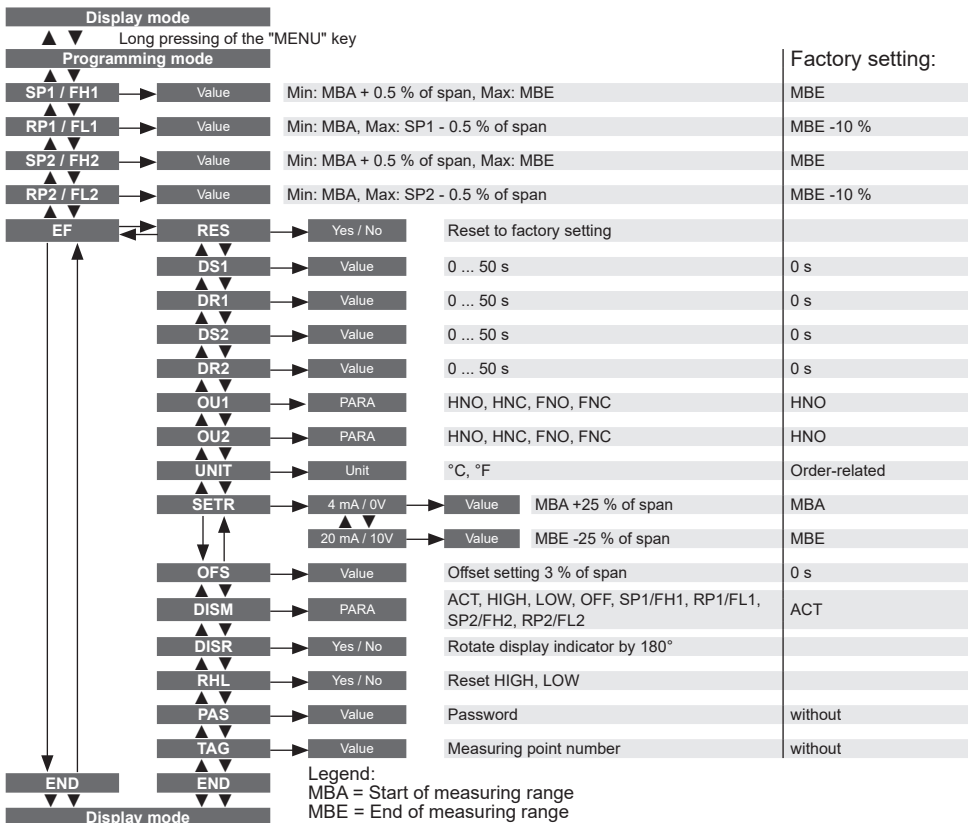
6. Usage, operation

6.4 Parameters

Parameter	Description
SP1/SP2	Hysteresis function: Switch point switching output (1 or 2)
FH1/FH2	Window function: Window high switching output (1 or 2)
RP1/RP2	Hysteresis function: Reset point switching output (1 or 2)
FL1/FL2	Window function: Window low switch output (1 or 2)
EF	Extended programming functions
RES	Return the set parameter to the factory settings
DS1/DS2	Switch delay time, which must occur without interruption before any electrical signal change occurs (SP1 or SP2)
DR1/DR2	Switch delay time, which must occur without interruption before any electrical signal change occurs (RP1 or RP2)
OU1	Switching function switching output (1 or 2)
OU2	HNO = hysteresis function, normally open HNC = hysteresis function, normally closed FNO = window function, normally open FNC = window function, normally closed
UNIT	Changing units
SETR	Measuring range scaling (analogue output) "4 mA" or "0 V" determines at which temperature the output signal is to be 4 mA or 0 V. "20 mA" or "10 V" determines at which temperature the output signal is to be 20 mA or 10 V.
OFS	Offset adjustment (3 % of span)
DISM	Display value in display mode ACT = Actual temperature value; LOW, HIGH = Minimum, Maximum temperature value OFF = display off; SP1/FH1 = function switch point 1, RP1/FL1 = function reset point 1, SP2/FH2 = function switch point 2, RP2/FL2 = function reset point 2
DISR	Rotate display indicator by 180°
RHL	Clear the Min- and Max-value memories
PAS	Password input, 0000 = no password; Password input digit by digit
TAG	Input of a 16-figure alphanumeric measuring point number

6. Usage, operation

Menu (programming and factory setting)



6. Usage, operation

6.4 Switching functions

Hysteresis function

If the temperature fluctuates around the set point, the hysteresis keeps the switching status of the outputs stable. With increasing temperature, the output switches when reaching the switch point (SP).
With temperature falling again, the output will not switch back before the reset point (RP) is reached.

- Contact normally open (HNO): active
- Contact normally closed (HNC): inactive

With temperature falling again, the output will not switch back before the reset point (RP) is reached.

- Contact normally open (HNO): inactive
- Contact normally closed (HNC): active

Window function

The window function allows for the control of a defined range. When the temperature is between window High (FH) and window Low (FL), the output switches on.

- Contact normally open (FNO): active
- Contact normally closed (FNC): inactive

When the temperature is outside window High (FH) and window Low (FL), the output does not switch on.

- Contact normally open (FNO): inactive
- Contact normally closed (FNC): active

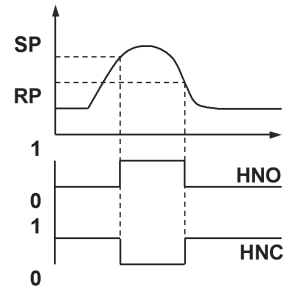


Fig.: Hysteresis function

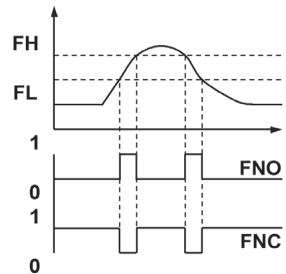


Fig.: Window function

6. Usage, operation

Delay times (0 - 50 s)

This makes it possible to filter out unwanted temperature peaks of a short duration or a high frequency (damping).

The temperature must be present for at least a certain pre-set time for the output to switch on. The output does not immediately change its status when it reaches the switching event (SP), but rather only after the pre-set delay time (DS).

If the switching event is no longer present after the delay time, the switch output does not change.

The output only switches back when the temperature has fallen down to the reset point (RP) and stays at or below the reset point (RP) for at least the pre-set delay time (DR).

If the switching event is no longer present after the delay time, the switch output does not change.

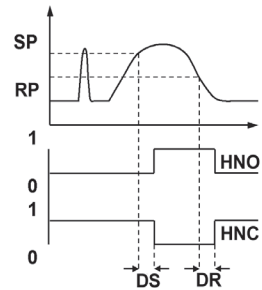


Fig.: Delay times

6.7 Description of the IO-Link functionality (optional)

IO-Link is a point-to-point connection for the communication of the 850 Series with an IO-Link master.

7. Maintenance and cleaning

7.1 Maintenance

The temperature transmitter/switch is maintenance-free.
Repairs must only be carried out by the manufacturer.

7.2 Cleaning



CAUTION!

- Clean the instrument with a moist cloth.
- Electrical connections must not come into contact with moisture.
- Wash or clean the dismantled instrument before returning it in order to protect personnel and the environment from exposure to residual media.
- Residual media in the dismantled temperature switch can result in a risk to persons, the environment and equipment. Take sufficient precautionary measures.



For information on returning the instrument see Chapter 9.2 "Return".

8. Faults

8. Faults

In the event of any faults, first check whether the temperature transmitter/switch is mounted correctly, mechanically and electrically.

Error display

Via the instrument's display internal errors are output.

The following table shows the error codes and their meaning.

Error code	Description
ATT1	On changing the switch point, the system automatically reduces the reset point
ATT3	Password entered for menu access is incorrect
ATT4	TAG cannot be shown in the display (e.g. special characters)
ERR	Internal error
OL	Measuring range exceeded > approx. 5 % (display blinks)
UL	Below measuring range < approx. 5 % (display blinks)

Acknowledgement of an error display by pressing the "Enter" key.

8. Faults

Problem	Possible cause	Measure
No output signal	Cable break	Check the through drilling
No output signal / line break	Mechanical load too high	Replace sensor with a suitable design
No output signal	No/wrong power supply	Rectify the power supply
No/wrong output signal	Wiring error	Observe the pin assignment
Wrong output signal	Process temperature out of range; Sensor drift caused by overtemperature	Check temperature range
Wrong output signal	Sensor burnout/short circuit	Send the instrument to the manufacturer
Wrong output signal	Sensor drift caused by chemical attack	Check media compatibility
Wrong output signal and too long response time	Wrong mounting geometry, for example mounting depth too deep or heat dissipation too high	Move the temperature-sensitive area of the sensor into the medium
Signal span too small	Deposit on the sensor	Remove deposit
Signal span too small	Power supply too high/low	Rectify the power supply
Signal span drops	Humidity has entered	Assemble the cable correctly



CAUTION!

If faults cannot be eliminated by means of the measures listed above, the temperature switch must be shut down immediately, and it must be ensured that signal is no longer present, and it must be prevented from being inadvertently put back into service. In this case, contact the manufacturer. If a return is needed, follow the instructions given in Chapter 9.2 "Return".

9. Dismounting, return and disposal



WARNING!

Residual media in the dismounted temperature transmitter/switch can result in a risk to persons, the environment and equipment.
Take sufficient precautionary measures.

9.1 Dismounting



WARNING!

Risk of burns!
Let the instrument cool down sufficiently before dismounting it!
During dismounting there is a risk of dangerously hot pressure media escaping.

9.2 Return



WARNING!

Strictly observe the following when shipping the instrument:

All instruments delivered to NOSHOK must be free from any kind of hazardous substances (acids, leachate, solutions, etc.).

When returning the instrument, use the original packaging or a suitable transport package.

Enclose the completed RMA Request Form with the instrument.



The RMA Request Form can be found under the heading 'Contact Us' at www.noshok.com.

9.3 Disposal

Incorrect disposal can put the environment at risk.

Dispose of instrument components and packaging materials in an environmentally compatible way and in accordance with the country-specific waste disposal regulations.

Appendix 1: EC Declaration of Conformity

