SEIKOM ELECTRONIC

Operating instructions **NLSW®45-3 SIL1 Analog**

24 V AC/DC, 230 V AC

SAFETY INTEGRITY LEVEL SIL 1 IEC 61508/61511

TÜVNORD Baumuster geprüft

RoHS compliant

REACH

UK CA

MADE IN GERMANY

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CONTENTS

1. SAFETY INSTRUCTIONS

Please read the operating instructions carefully before using the device. Make sure that the product is fully suitable for your application.

Improper use can lead to malfunctions of the device or to undesirable effects on your application. For this reason, installation, electrical connection, commissioning, operation and maintenance of the device may only be carried out by trained personnel.

2. GENERAL INFORMATION

The NLSW®45-3 SIL1 Analog air flow monitor is a flow monitor consisting of an air flow sensor and an evaluation unit. The device works according to the calorimetric measuring principle. The NLSW®45-3 SIL1 Analog meets the SIL1 standards according to IEC 61508-5:2010.
The NLSW®45-3 SIL1 Analog is an air flow monitor that monitors gaseous flows in the range of approx. 0.1 ... 30 m/s. A relay with changeover contact and a 4 ... 20 mA or a 0 ... 10 V DC output are available as an output signal for the flow. The NLSW®45-3 SIL1 Analog has one channel/sensor. For redundant setups and/or SIL2 requirements, we offer the NLSW®45-3 SIL2 Analog device.
To increase operational safety, the sensor and the evaluation electronics are monitored for function and faults (e.g. sensor breakage) during operation.

2.1 Field of application and practical use

The electronic air flow monitors of the NLSW®45-3 SIL1 Analog series are used in safety-critical environments such as the chemical industry, power plants, clean room technology, pharmaceutical production and in environments containing hydrogen, where reliable measurement of the air flow is essential for the safe operation of processes.

Functionality

Flow monitors of the NLSW®45-3 SIL1 Analog series operate according to the calorimetric principle. The calorimetric measuring principle is based on a heated, temperature-sensitive resistor. Heat is extracted from the precision resistor by the flow of the medium. The temperature of the resistor changes and with it its resistance value. This change is evaluated by the device. However, since not only the flow velocity of the medium has an influence on the amount of heat dissipated, but also its temperature, a correlation between flow and temperature must be established. This is achieved by a single, temperature-dependent precision resistor in addition to the first one. The first precision resistor (temperature compensation) is not heated and is only used to measure the temperature.

2.2 Outputs

The NLSW®45-3 SIL1 analog devices have a relay as well as a 4 ... 20 mA or a 0 ... 10 V analog output. The relay with changeover contact switches off as soon as the air flow falls below the set flow velocity / threshold value (0.1 ... 30 m/s).

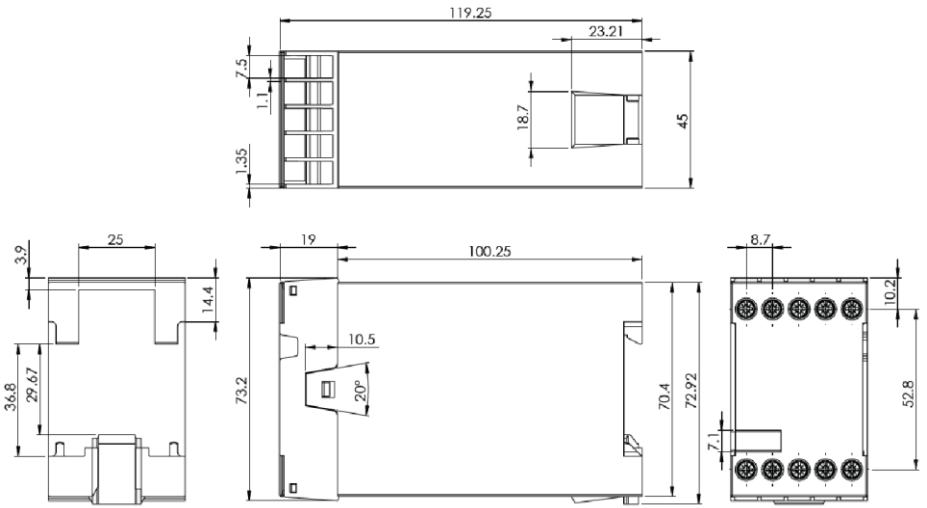
The current output (I_{out}) supplies a value between 4 ... 20 mA. Both the relay output and the current or voltage output are available for further evaluation by a (safety) PLC, for example.

The switching point is independent of the current output. For example, the 4 ... 20 mA output can be set to a measuring range of 0 ... 20 m/s and the relay switching point can be set anywhere between 0.1 m/s and 30 m/s (e.g. at 25 m/s). Depending on the application, this independent functionality offers further application possibilities.

3. TECHNICAL DATA

Type	**NLSW®45-3 SIL1 Analog 24 V AC/DC**		**NLSW®45-3 SIL1 Analog 230 V AC**	
Item number	1134SIL1/A	1134SIL1/V	1135SIL1/A	1135SIL1/V
Operating voltage	24 V AC/DC		230 V AC 50/60 Hz	
Voltage tolerance	± 15%		± 15%	
Overvoltage category	II			
Signal lamp Voltage	Green LEDs			
Power consumption	2.5 VA		< 6.4 VA	
Ambient temperature Device	-20°C ... 50°C			
Signal output flow	1 x relay contact 4 ... 20 mA	1 x relay contact 0 ... 10 V	1 x relay contact 4 ... 20 mA	1 x relay contact 0 ... 10 V
Switching function with flow	Relay activates			
Max. Switching voltage	250 V AC, 30 V DC			
Current and contact load capacity	250 V AC, 4A, 1 kVA / 150W			
Minimum switching load	100 mA / 5 V DC			
Mechanical service life	10^6 switching operations (180 / minute)			
Electrical service life (at 5 A / 230 V AC)	50 × 10^3 (50,000) switching operations			
Electrical service life (at 5 A / 30 V DC)	100 × 10^3 (100,000) switching operations			
Flow signal lamp	Yellow LED			
Start-up bypass	5 s ... 60 s			
Start-up bypass signal lamp	Yellow LED			
Media temperature range	0°C ... 90°C			
Temperature gradient	30 K/min			
Switching point adjustment	Adjustable via potentiometer between 0.1 ... 30 m/s			
Measuring range	0.1 ... 30.0 m/s			
Associated sensor	F3.x SIL1			
Immersion depth sensor	50 mm (F3 SIL1), 130 mm (F3.1 SIL1), 165 mm (F3.2 SIL1), 300 mm (F3.3 SIL1), 400 mm (F3.4 SIL1), 500 mm (F3.5 SIL1)			
Process connection	PG7 thread			
Sensor material	MS58, nickel-plated, optionally available in stainless steel			
Compressive strength	10 bar			
Electrical connection	10 terminal plugs, ≤ 2.5 mm^2			
Enclosure protection class	IP40			
Protection class Terminals	IP20			
Protection class Sensor	IP67			
Pollution class	2			
Housing dimensions (L x W x H)	120 mm x 45 mm x 73 mm			
SIL certification	SIL1 classification IEC 61508 SIL 2: 03.2023, type A			
Further certifications	CE, UKCA			

3.1 Device dimensions



4. INSTALLATION AND COMMISSIONING

Installation and commissioning must be carried out by authorized and qualified personnel.

4.1 Installation conditions of the airflow sensors

The following installation conditions must be observed for the F3.x SIL1 sensor:

- The sensor tip should be located in the center of the pipe if possible and must be fully surrounded by the medium (air/gas).
- Align the mark on the sensors in the direction of the flow.
- For vertical ducts, the flow direction should ideally be from bottom to top.
- Maintain a free inlet section 5 x D upstream of the sensor and an outlet section 3 x D downstream of the sensor.
- Only screw in the sensors via the hexagon of the sensor.
- The sensors are independent of the installation position.
- The sensors must be connected to the airflow monitor in accordance with the connection diagram. Mixing up the connections will lead to malfunctions and possible damage.
- Each sensor is calibrated for its device and should be connected to this device.
- If the sensor cable is laid in a duct together with other live cables (e.g. motors or solenoid valves), we recommend shielding the sensor cable (connect a shield). Sensors with shielded cables are available as accessories from SEIKOM Electronic.

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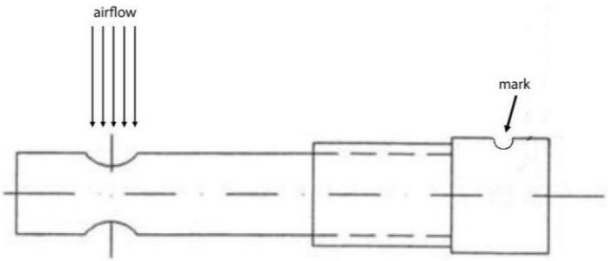
- To avoid malfunctions, the sensor cable must be extended with a cross-section of at least 1.5 mm^2. The maximum cable length should not exceed 50 m.
- Maintenance instructions: Regular cleaning is necessary depending on the application. Maintenance intervals must be determined and specified as required.

4.2 Installation

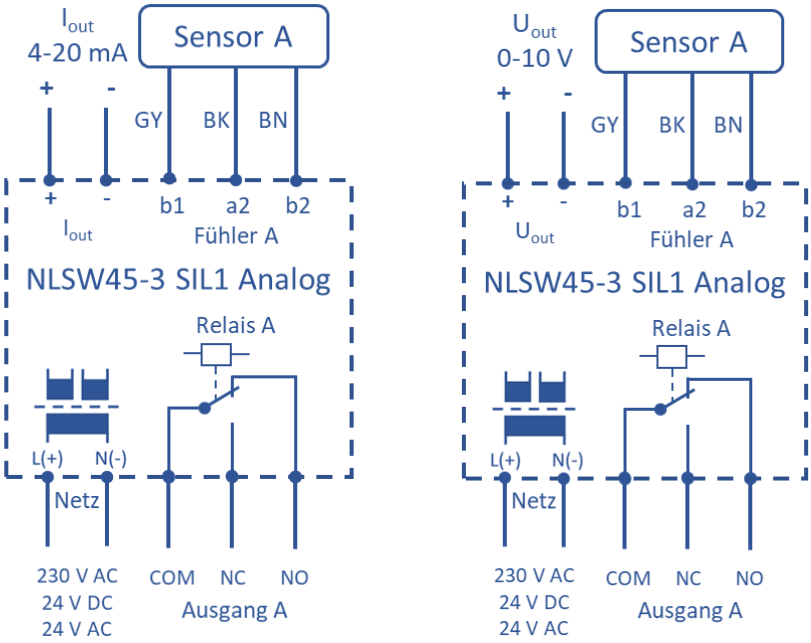
It is mounted using the PG7 thread on the sensor housing. Mounting is also possible using the enclosed PG7 nuts. The marking serves as an alignment aid to align the cross hole with the sensors in the air flow. When commissioning with media temperatures below 0°C and strong air currents, the start-up time of the device may be extended to 60 s until it is ready for operation.



4.3 Electrical connection

The mains connection (L1, N) must be established via a fused isolating switch with the usual fuses. The general VDE regulations must always be observed during electrical installation (VDE0100, VDE0113, VDE0160).

If a safety extra-low voltage is applied to the potential-free contact, ensure that the connecting cables are sufficiently insulated up to the terminal point, as otherwise the double insulation to the mains voltage side will be impaired. The current carrying capacity of the potential-free contact is limited to 4 A.



Color code: GY=grey | BK=black | BN=brown

4.4 Electrical connection of the device

The following sequence must be observed when commissioning and adjusting the devices:

1. Mounting the sensor in the air duct
2. Connect the corresponding sensor (F3.x SIL1) to the device; [gray to b1, black to a2 and brown to b2] (light blue).
3. Connect the PLC/controller to the relay output and, if required, the analog output [I-out] 4 ... 20 mA or [Uout] with 0 ... 10 V (green).
   Please note the contact assignment NC ('normally closed') and NO ('normally open') in the circuit with the PLC.
4. Connecting the electrical connections to the outputs of the NLSW®45-3 SIL1 Analog
5. Checking the electrical connections
6. Connecting the mains voltage
7. Checking the device function in idle state
8. Switching on the air flow
9. Adjusting the settings on the NLSW®45-3 SIL1 Analog *(see section 4.4.2) and* checking the measured values

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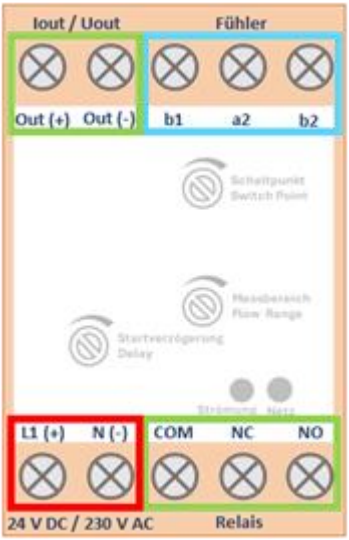


Iout must not be connected to negative supply voltage or earth!

4.4.1. Adjusting the settings on the NLSW®45-3 SIL1 Analog

a) Set the "Switching point" potentiometer (dark blue) to clockwise deflection (high).

b) Set the "Start delay" potentiometer [Delay] (orange) to the desired start-up delay time of approx. 5 ... 60 seconds (left stop approx. 5 seconds/right stop approx. 60 seconds)
c) Apply mains voltage. The green LEDs light up. The device is ready for operation within 2 seconds.
d) The yellow LED lights up (briefly) and switches of again as soon as the set start-up bridging time has elapsed. The relay is energized during this time.
e) Switch on the airflow generator.
f) Before setting the switching point, the appliance should run for at least 2 minutes under operating conditions (with flow).

Switching point adjustment

a) The switching point setting requires an adjustment on the potentiometer and is independent of the current/voltage output.
b) Slowly turn the "switching point" potentiometer (dark blue) to the left until the yellow LED lights up and the output relay is energized. To achieve stable switching conditions, you should turn slightly beyond the switching point.

Setting the current or voltage output

a) Connect current meter or PLC to Iout (or voltage meter to Uout) and measure current value or voltage value.
b) Ex works, the analog signal covers the measuring range 0.1 ... 30 m/s - corresponds to 4 ... 20 mA or 0 ... 10 V. The measuring range or measured value for Iout / Uout can be set using the "Measuring range" potentiometer.
c) Teach/check the flow setting with the PLC by changing or switching off the air flow.
Please note that the analog outputs Iout and Uout are not linear.
If you adjust the measuring range [Flow] of the device, please take into account the adjustment of the current and voltage values stored in the PLC.
d) If the start-up delay is preset, do not adjust the switching points until the start-up delay has expired and the yellow LED has gone out.
e) To check the flow monitoring, reduce or switch off the flow generation. The yellow LED goes out and the output relay drops out.
f) For continuous operation, readjust the settings after 0.5 hours of operation if necessary.

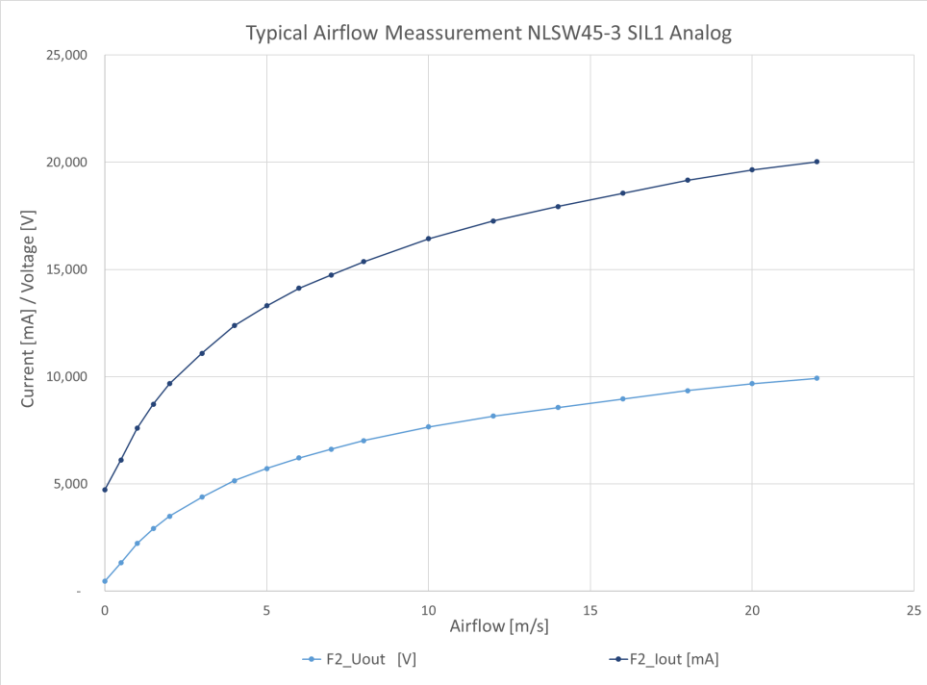
The device is now set to the monitoring function.

Preset values of the NLSW®45-3 SIL1 Analog:

- The switching hysteresis is fixed.
- The switching delay is 0.2 s as standard.
- The start-up delay is adjustable from 5 s to 60 s as standard.

4.5 Typical output values

The NLSW®45-3 SIL1 Analog is factory set so that 0 ... 30 m/s corresponds to 4 ... 20 mA or 0 ... 10 V. The following curves show typical output values of the NLSW®45-3 SIL1 Analog airflow monitor.



If the NLSW®45-3 SIL1 Analog is set to a different measuring range, the curve scales accordingly. For example, Iout at a maximum set air flow of 10 m/s or 25 m/s is approx. 20 mA in each case.

The media temperature has only a negligible influence on the current or voltage output and switching point. Please take this influence into account when commissioning and setting the measuring device by setting the devices in regular operating mode and considering temperature gradients in the event of temperature fluctuations.

4.6 Switching point adjustment

When setting the switching point, it should be noted which change is to be monitored, as different settings have their own advantages and disadvantages. The relationship between air velocity and resistance change is not linear. In the lower range (small flows), the change in resistance is very large. In the upper range, the change in resistance is always smaller for the same flow changes. The following requirements/guidelines should therefore be observed:

Small flow change in the high flow velocity range: The switching point must be selected very close to the measured value of the normal flow, as the measured value change is very small when the flow changes. As the temperature compensation has a certain delay compared to the actual temperature change, such a switching point setting is only possible for applications with slow temperature changes.

Small flow change in the low flow velocity range: The switching point can be selected with a greater distance to the measured value of the normal flow, as the measured value change is large when the flow changes. A change in temperature has no effect on the switching behavior.

Large flow change: A 'yes/no statement' is usually required here (e.g. fan running or fan stopped). Therefore, such a large safety distance can be selected that neither temperature changes nor turbulence have an influence on the switching behavior.

The switching points are set on the evaluation unit of the airflow monitor.

5. SERVICING AND MAINTENANCE

5.1 Maintenance specification Manufacturer

Definition of terms according to IEC 60079-17

Maintenance and repair: A combination of all activities carried out to maintain or restore an item to a condition that meets the requirements of the relevant specification and ensures the performance of the required functions.

Inspection: An activity involving the careful examination of an object with the aim of making a reliable statement about the condition of this object, whereby it is carried out without disassembly or, if necessary, with partial disassembly, supplemented by measures such as measurements.

Type of examination	Definition	Recommended interval
Visual inspection	A visual inspection is an inspection in which visible faults are detected without the use of access equipment or tools, for example damage to the sensor or dust deposits.	Monthly
Close-up inspection	A test in which, in addition to the aspects of the visual inspection, faults are detected that can only be detected by using access equipment, e.g. steps (if necessary) and tools. For close-up tests, an enclosure does not usually need to be opened or the equipment de-energized.	Every 6 months
Detailed check	A test in which, in addition to the aspects of the close-up test, defects such as loose connections, which can only be detected by opening housings and/or, if necessary, using tools and test equipment, are detected.	Every 12 months
Testing the overall system	In the area of responsibility of the operator	

The air flow sensor should be serviced at regular intervals, i.e. when used in heavily polluted areas. contaminated media, the air flow sensor is cleaned. The following procedure is expedient:

- Dismantling the air flow sensor
- Carefully soak the sensor in lukewarm soapy water for approx. 10 minutes (depending on the degree of soiling) and then rinse carefully with lukewarm water
- Refit the sensor as originally (note the installation position)
- Commission the airflow monitor and carry out a new adjustment with the evaluation electronics if necessary

Never use hard or sharp objects (e.g. screwdrivers, wire brushes, etc.) for cleaning!

After cleaning, please check the current setting and switch setting and readjust if necessary.

6. TROUBLESHOOTING

The following instructions are intended to help you if your airflow monitor is not working properly. If you have any further questions, the SEIKOM Electronic team will be happy to help you at any time by phone or e-mail.

Problem	Possible cause	Troubleshooting
Device does not work at all	No or incorrect mains voltage connected	Check mains voltage and connection
Device does not detect flow	Sensor(s) is/are not installed correctly or the sensitivity on the evaluation unit is not set correctly	Check installation conditions and sensitivity settings
	Flow rate is outside the measuring range	Reduce the sensitivity using the [Sense] potentiometer. Adjust the diameter of the pipe to increase or decrease the flow rate.
The yellow LED and the relay switch on and off at short intervals	Sensitivity set too close to the switching point or Air flow fluctuates near switching point.	Increase the sensitivity using the [Sense] potentiometer to make the switching point slightly more sensitive.
	Mains voltage is too low (< 21 V)	Ensure stable and sufficient mains voltage. Do not connect sources of interference (e.g. large loads) to the same supply voltage.
NLSW®45-3 SIL1 Analog has modified response behavior	Sensor is heavily soiled by the medium (deposits on the sensor)	Carefully clean the sensor with water. Never use hard objects for cleaning.
NLSW®45-3 SIL1 Analog switches in the event of a rapid	Temperature gradient is outside the specification	Check the temperature gradient of the system (max. 30 K/min). In the event of a

increase or decrease in media temperature		fault, set the switching point with hot flowing medium.
Current output drops to 0 mA (the relay has also dropped out and the yellow LED has gone out).	Sensor or cable breakage of the heated sensor, or the appliance is switched off.	Check the sensor connections and wiring. Check the sensor for breakage or damage.
Significant current or voltage drop during operation (with air flow present).	Sensor or cable breakage of the unheated sensor	Check the sensor connections and wiring. Check the sensor for breakage or damage.
Current setting does not exactly match the set value.	System has only been in operation for a short time or is being operated at a different temperature.	If necessary, readjust the appliance after 30 minutes of continuous operation.
Current setting no longer matches the set value.	The sensor or filter is dirty or blocked.	Check sensor and air system/duct.
Current output does not output exactly 4 mA when the air flow is switched off.	Not a mistake.	Depending on the flow setting, the current output supplies slightly more than 4 mA.
Voltage output does not output exactly 0 V when the air flow is switched off.	Not a mistake.	Depending on the flow setting, the voltage output supplies slightly more than 0 V.
Current output outputs more than 20 mA.	Maximum occurring flow is above the set end value	Set the current output according to the instructions. [Flow]

7. DISPOSAL

The packaging and used parts must be disposed of in accordance with the regulations of the country in which the product is installed.

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8. EU DECLARATION OF CONFORMITY

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EU-Declaration of Conformity

The EU declaration of conformity applies to the following unit:

NLSW®45-3 SIL1 Analog

This declaration of conformity is issued under the sole responsibility of the manufacturer. We confirm the conformity to the essential requirements of the European directives:

2014/30/EU (EMV-Richtlinie)
2014/35/EU (Niederspannungsrichtlinie)
2011/65/EU (Beschränkung gefährlicher Stoffe)
2015/863/EU (Ergänzung RoHS 3)

The following standards were applied:

DIN EN IEC 63000: 2019-05
DIN EN IEC 61000-6-2: 2019-11
DIN EN 61000-6-3: 2021-03

Mettmann, 14th March 2024

Philipp Hein
Managing Director

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