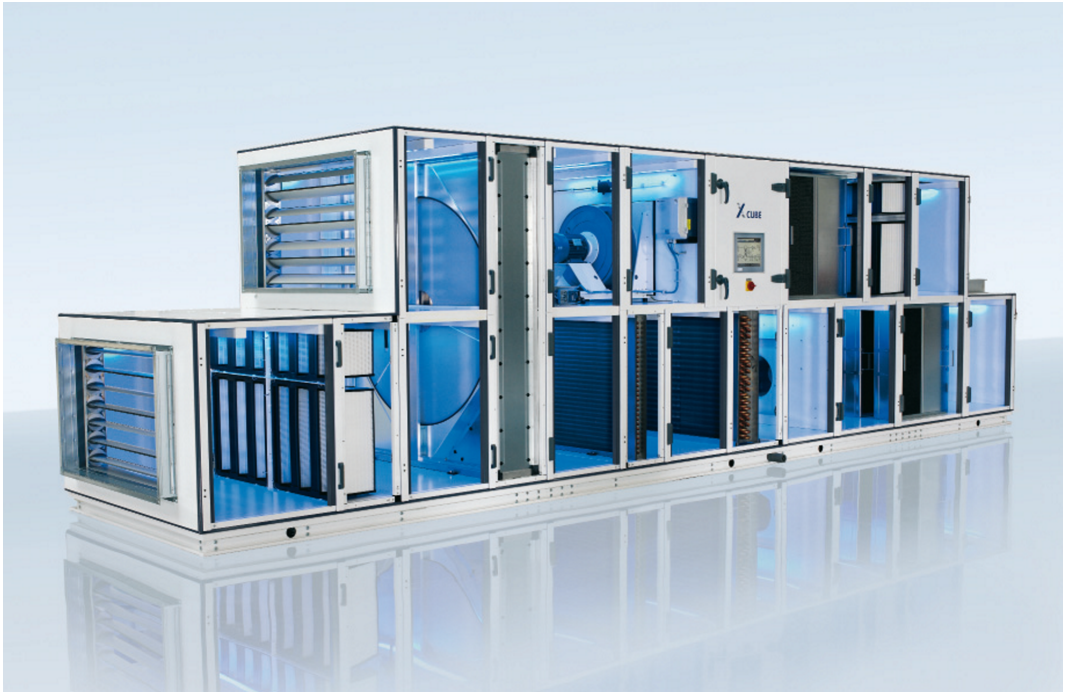
Operating instructions GB/en

RLT-Gerät

X-CUBE



Read the instructions prior to performing any task!

TROX® TECHNIK

The art of handling air

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About this operating manual

This operating manual ensures safe and efficient working with the X-CUBE air handling unit (AHU).

The operating manual is part of the air handling unit and must be kept in the immediate vicinity of the unit to be accessed by personnel at all times.

The operating manual is addressed at properly trained persons.

The properly trained person, ↳ *Chapter 1.9.1 'Personnel requirement' on page 15*, must read and fully understand this manual before starting any work. The basic prerequisite for safe working is to comply with the safety notes and all instructions in this operating manual.

The local regulations for health and safety at work and the general safety regulations for the area of application of the air handling unit also apply.

Illustrations in this operating manual are mainly for information and may differ from the actual design of the air handling unit.

Copyright

TROX Technical Service

To ensure that a fault is processed as quickly as possible, please keep the following information ready:

- Delivery date of the TROX components and systems
- TROX order number
- Product name
- Brief description of the fault

Contact in case of a fault

Online	www.troxtechnik.com
Phone	+49 2845 202-400

Limitation of liability

The information in this manual has been compiled with reference to the applicable standards and guidelines, the state of the art, and our expertise and experience of many years.

The manufacturer does not accept any liability for damages resulting from:

- Non-compliance with this manual
- Incorrect use
- Operation or handling by untrained individuals
- Unauthorised modifications
- Technical changes
- Use of non-approved replacement parts

The actual scope of delivery may differ from the information in this manual for bespoke constructions, additional order options or as a result of recent technical changes.

The obligations agreed in the order, the general terms and conditions, the manufacturer's terms of delivery, and the legal regulations in effect at the time the contract is signed shall apply.

We reserve the right to make technical changes.

Defects liability

For details regarding defects liability please refer to Section VI, Warranty Claims, of the Delivery and Payment Terms of TROX GmbH.

The Delivery and Payment Terms of TROX GmbH are available at www.troxtechnik.com.

Other applicable documentation

In addition to these instructions, the following documents apply:

- Transportation and installation manual
- Order-specific approval drawing
- Data sheets for the supplier components, ↳ *Appendix 'Zulieferdokumente' on page 57*
- Safety data sheets, ↳ *Appendix 'Safety data sheets' on page 133*

Table of contents

1 Sicherheit

1.1 Symbols used in this manual

Safety notes

Symbols are used in this manual to alert readers to areas of potential hazard. Signal words express the degree of the hazard.

DANGER!
Imminently hazardous situation which, if not avoided, will result in death or serious injury.

WARNING!
Potentially hazardous situation which, if not avoided, could result in death or serious injury.

CAUTION!
Potentially hazardous situation which, if not avoided, may result in minor or moderate injury.

NOTICE!
Potentially hazardous situation which, if not avoided, may result in property damage.

ENVIRONMENT!
Environmental pollution hazard.

Safety notes as part of instructions

Safety notes may refer to individual instructions. In this case, safety notes will be included in the instructions and hence facilitate following the instructions. The above listed signal words will be used.

Example:

1. ▸ Untighten the screw.
2. ▸

   CAUTION!
   Danger of finger entrapment when closing the lid.

   Be careful when closing the lid.
3. ▸ Tighten the screw.

Specific safety notes

The following symbols are used in safety notes to alert you to specific hazards:

Warning signs	Type of danger
	Warning – hand injuries.
	Warning – high-voltage.
	Warning - danger of falling.
	Warning – danger zone.

Tips and recommendations

Useful tips and recommendations as well as information for efficient and fault-free operation.

Additional markers

In order to highlight instructions, results, lists, references and other elements, the following markers are used in this manual:

Marker	Explanation
1., 2., 3. ...	Step-by-step instructions
⇨	Results of actions
	References to sections in this manual and to other applicable documents
■	Lists without a defined sequence
[Toggle switch]	Operating elements (e.g. push buttons, switches), display elements (e.g. indicators)
'Display'	Screen elements (e.g. buttons, assignment of function buttons)

1.2 Bestimmungsgemäße Verwendung

The TROX X-CUBE air handling unit is designed exclusively for the treatment of air, i.e. transporting, filtering, heating, cooling, humidifying and dehumidifying air.

Correct use also involves complying with all the information provided in this manual.

Any use that goes beyond the correct use or different use of the unit is regarded as incorrect use.

Incorrect use

⚠ WARNING!

Danger due to incorrect use!

Incorrect use of the air handling unit can lead to dangerous situations.

Never use the air handling unit:

- in rooms with explosive gases or gas mixtures
- in rooms with conductive dust
- in rooms with strong electromagnetic fields
- in rooms with aggressive room air components, e.g. sand
- outside of the design specifications, see TROX air handling unit data sheet
- for structural purposes or as the building roof
- as a smoke extract system in the event of a fire.

1.3 Sicherheitskennzeichnungen

The following symbols and signs are present in the work area. They refer to the immediate surroundings where they are attached.

⚠ WARNING!

Danger due to illegible signage!

Over time, stickers and signs on the exterior of the air handling unit can become illegible, meaning that hazards cannot be identified and necessary operating instructions cannot be followed. This results in the risk of injury.

- Ensure that all of the safety, warning and operating information is clearly legible.
- Damaged signs or stickers must be replaced immediately.

Earthing

These stickers are located in the switch cabinet and at all equipotential bonding connection points, see ↳ *'Equipotential bonding' on page 8*, on the air handling unit.

Electrical voltage

Only skilled qualified electricians are permitted to carry out work in rooms and on components of the air handling unit that have been identified as having electrical voltage.

Unauthorised persons must not enter areas, open cabinets or carry out work on components that have been identified as such.

Fan run-on

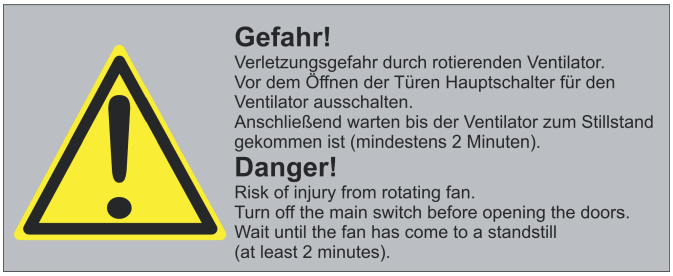

Fig. 1: Inspection access door signage

These stickers are located on the inspection access doors that permit access to the centrifugal fans and rotary heat exchangers.

1.4 Sicherheitseinrichtungen

Non-functioning safety equipment

⚠ WARNING!

Danger due to non-functioning safety equipment!

The cable to the main switch is always under hazardous electrical voltage. If the safety equipment is not functioning or has been disabled, there is the risk of severe injuries or even death.

- Never disable the safety equipment or bypass it.

Air handling unit casing

The panels for the casing of the air handling unit are made from duplex-coated, fully powder-coated steel. This design prevents defective and/or foreign parts from being projected from the air handling unit. In additional, the interior components of the air handling unit are protected against environmental influences by the casing.

The internal walls of the air handling unit can optionally be designed using stainless steel.

Rotary isolator switch

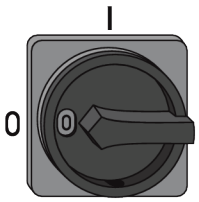

Fig. 2: Rotary isolator switch

When the air handling unit is switched on (main switch in "I" position), voltage is present at the cable to the rotary isolator switch.

On the rotary isolator switch, the equipment sign will specify which component is disconnected with the switch.

The rotary isolator switches can be secured in position "0" using padlocks to prevent them from being switched back on, allowing work on the corresponding equipment (e.g. fan) to be carried out safely.

Equipotential bonding

The air handling unit was connected to the equipotential bonding rail on site by a skilled qualified electrician. Equipotential bonding prevents ignition hazards from electrostatic charging.

Safety lock on inspection access doors to hazardous areas

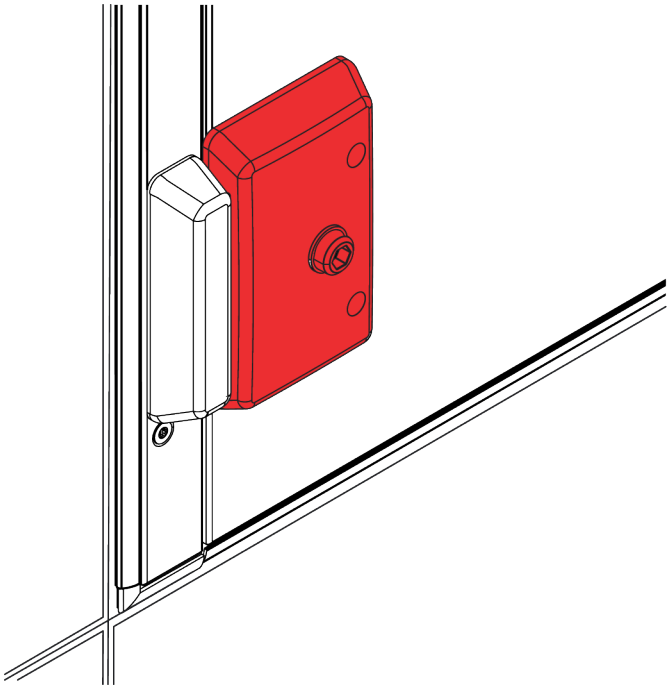

Fig. 3: Inspection access lock

Inspection access doors to hazardous areas can only be opened with a special key.

Safety catch for inspection access doors on the pressure side

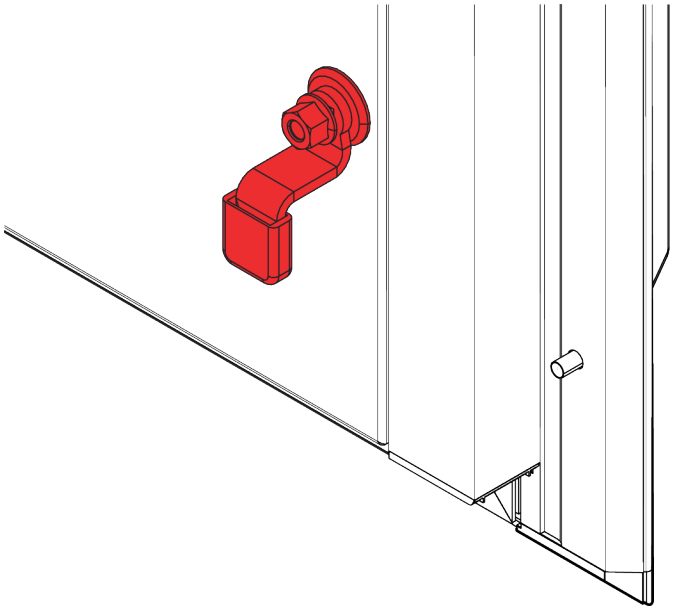

Fig. 4: Safety catch

The inspection access doors on the pressure side are each fitted with a safety catch (Fig. 4). The safety catch prevents inspection access doors on the pressure side from swinging open and injuring people.

Internal handle

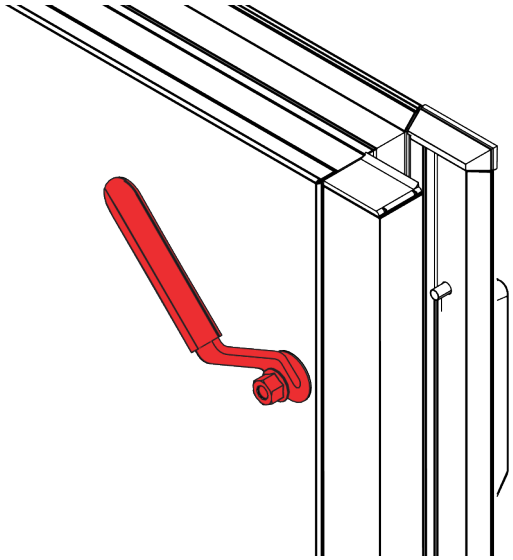

Fig. 5: Internal handle on inspection access door

If the AHU component is higher than 1836 mm, the inspection access doors are fitted with an internal handle. The internal handle prevents people from becoming locked inside the unit.

Internal handle with safety catch

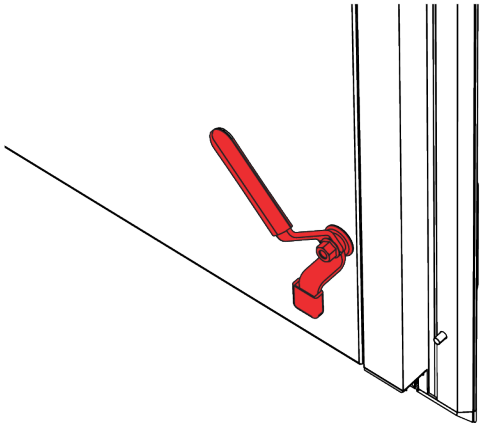

Fig. 6: Internal handle with safety catch

If the AHU component is higher than 1836 mm, the inspection access doors on the pressure side are fitted with a combined internal handle with a safety catch. This safety device prevents:

- inspection access doors on the pressure side from swinging open and injuring people
- people from becoming locked inside the unit.

Quadrant stay

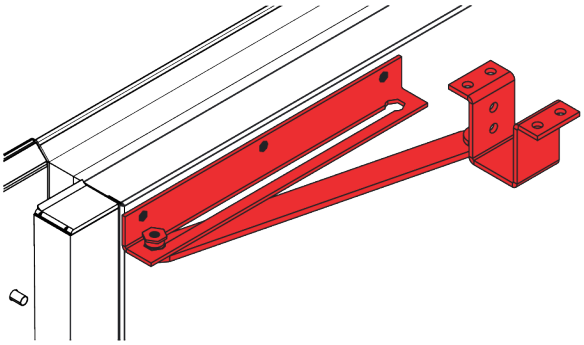

Fig. 7: Quadrant stay

Each inspection access door is fitted with a quadrant stay (Fig. 7). The quadrant stay prevents the inspection access doors from being slammed by wind.

Motor protection switch

Motor protection switches are safety devices for switching, protecting and isolating electric circuits with motorised loads. Motor protection switches protect motors against destruction from locked start-up, overload, short circuit and the failure of a live wire in three-phase networks. In addition, they have a thermal release and an electromagnetic release (short circuit protection). The motor protection switches are located in the switch cabinet of the air handling unit.

1.5 Securing against restarting

Securing the air handling unit against restarting

⚠ WARNING!

Danger of death due to unauthorised or uncontrolled restart!

Unauthorised or uncontrolled restarting of the air handling unit may cause serious injury or even death.

Before activation, check that:

– there are no persons in the air handling unit
– all inspection access doors have been closed
– no tools or other materials are inside in the air handling unit.

1. ▸ Switch off the air handling unit at the main switch (provided by others).

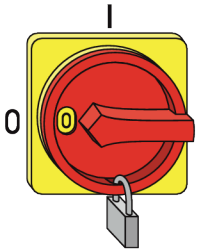

Fig. 8: Securing the main switch

2. ▸

⚠ WARNING!

Danger due to electric current!

The power supply cable from the building connection to the air handling unit remains energised after the unit has been switched off.

Switch the power supply to the air handling unit off by turning the main switch to "0".

3. ▸ Secure the main switch with a padlock (Fig. 8).
4. ▸ Keep the key for the lock in a safe place.
5. ▸ Cover the main switch with a sign indicating that work is in progress.

1.6 Arbeits- und Gefahrenbereiche

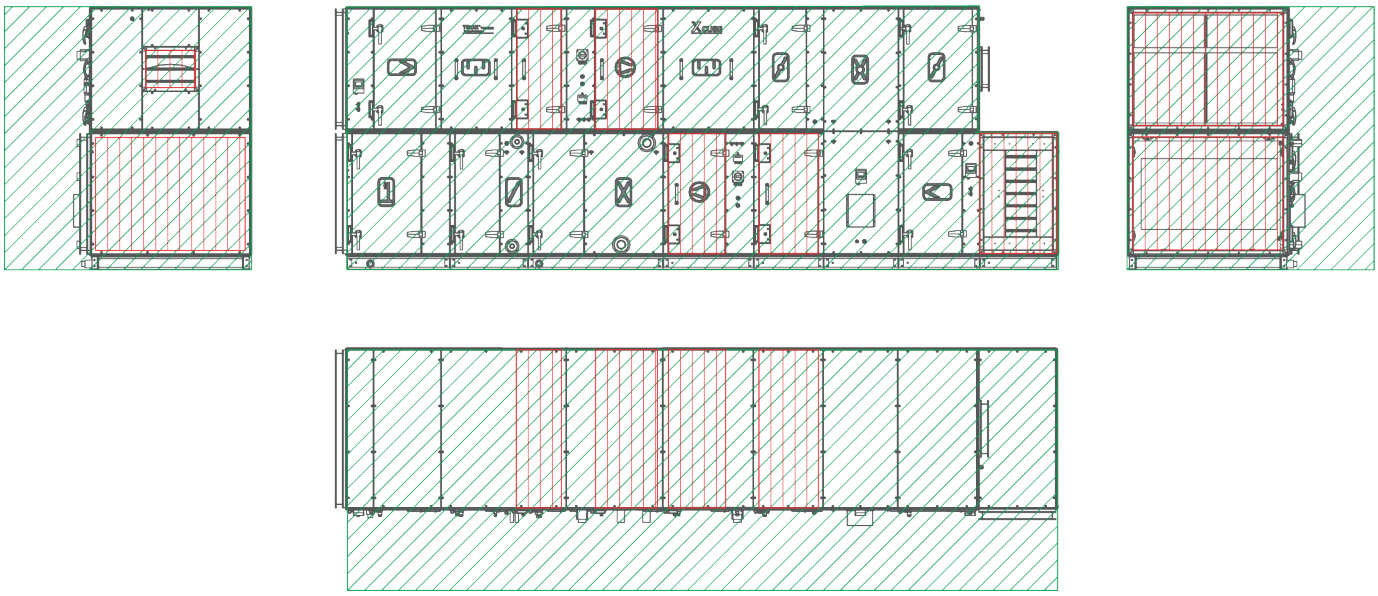

Fig. 9: Hazardous areas

Work areas
Hazardous area

Areas with access to

- fans,
- electric heating coils and
- internal switch cabinets

are hazardous areas. The hazardous areas are only accessible when inspection access doors for the air handling unit are open.

Before installation is complete, the openings for air inlets and outlets are also regarded as hazardous areas.

1.7 Restrisiken

The air handling unit is designed according to the state of the art and current safety requirements. However, residual risks remain present, which require caution to be taken. In this section, any residual risks that were determined as part of a risk assessment are specified.

The safety notes provided in the following chapters of this manual must be observed to reduce health hazards and prevent any hazardous situations.

1.7.1 Allgemeine Gefahren am Arbeitsplatz

Working at great heights

WARNING!

Danger of falling when carrying out work at great heights.

Working at great heights can cause people, tools or materials to fall. This can result in serious injuries or even death.

– Wear a safety harness.
– Only access rooftop installations if ladders, railings and safety harnesses are available and are in working order.
– Only perform work on the air handling unit if the AHU components in question are easily accessible.
– Secure tools and materials against falling.
– Always wear safety shoes, protective work clothing, and a safety helmet.

Leaks

CAUTION!

Risk of injury due to slipping on liquid that accumulates!

Leaks can result in liquid accumulating on the ground. This can cause people to slip and injure themselves.

- Clear away any liquid that is spilt immediately using suitable means.
- Wear non-slip safety shoes.
- Observe the safety data sheets provided by the liquid manufacturers.
- Attach warning notices and mandatory action signs on or in the vicinity of any area where liquid may accumulate on the ground.

1.7.2 Gefahren durch Elektrizität

Electric current

DANGER!

Danger of death due to electric current!

Immediate danger of death due to electric shock in case of contact with live components. Damage to the insulation or individual components can be life threatening.

- Only have work on the electrical system completed by skilled qualified electricians.
- Only have work on the electrical system completed by skilled qualified electricians.
- If the insulation is damaged, disconnect the power supply immediately and have it repaired.
- Before starting work on active components of electrical systems and equipment, disconnect the power supply and ensure this for the duration of the work. Observe the following safety regulations:
  - Switch off the air handling unit at the main switch.
  - Secure it against restarting.
  - Disconnect the air handling unit from the power supply of the building connection.
  - Establish voltage-free state.
  - Earth and short circuit.
  - Cover or fence off neighbouring live parts.
- Never bypass or disable any fuses. Ensure you maintain the correct current rating when replacing fuses.
- Ensure that live parts do not come into contact with moisture. This can cause a short circuit.

Stored charges

DANGER!

Danger of death due to stored charges in capacitors!

The capacitors in the individual components store electrical charges that are also retained once the power supply has been switched off and disconnected. Contact with these components can result in serious or fatal injuries.

- Before starting work on components with capacitors, disconnect these completely from the power supply. Wait 10 minutes to ensure that the internal capacity have fully discharged their energy.

1.7.3 Gefahren durch Maschinenbewegung

Rotating parts on the fan

WARNING!

Risk of injury due to rotating parts!

Rotating parts in the fan can cause severe injuries.

- Never reach into the moving fan wheel or tamper with the fan wheel.
- Never open covers or maintenance ports during operation.
- Make sure that the fan wheel is inaccessible during operation.
- Observe the stopping time: look through the inspection window to ensure that none of the parts are moving before opening the inspection access doors.
- Switch off the system before working on moving fan parts and secure the system against restarting. Wait until all parts have come to a stop.

  Switch off the air handling unit before working on moving fan parts and secure the unit against restarting, ↪ *Chapter 1.5 'Securing against restarting' on page 9*. Wait until all parts have come to a stop.

Moving parts of the multileaf dampers

WARNING!

Danger of crushing due to moving parts!

The closing multileaf damper blades can cause injury to the upper limbs.

- Never reach between the multileaf damper blades
- Only operate multileaf dampers with ducts or safety guards
- Before opening the inspection access doors, switch off the air handling unit and secure against restarting

Rotating parts on the rotary heat exchanger

WARNING!

Risk of injury due to rotating parts!

Rotating parts in the rotary heat exchanger can cause severe injuries.

- Never reach into the moving storage medium or tamper with the storage medium.
- Never open covers or maintenance ports during operation.
- Make sure that the storage medium is inaccessible during operation.
- Switch off the system before working on moving fan parts and secure the system against restarting. Wait until all parts have come to a stop.
  Switch off the system before working on moving rotary heat exchanger parts and secure the system against restarting, *Chapter 1.5 'Securing against restarting' on page 9*. Wait until all parts have come to a stop.

Zufallende Revisionstüren

WARNING!

Quetschgefahr durch zufallende Revisionstüren!

Revisionstüren können durch unbeabsichtigtes Anstoßen oder Wind zufallen und zu schweren Verletzungen am Kopf und an den Händen führen.

- Revisionstüren mit Feststellvorrichtung sichern.
- Niemals die Hände zwischen Tür und Türrahmen halten.
- Beim Öffnen der Revisionstüren Schutzhandschuhe und Schutzhelm tragen.

1.7.4 Gefahren durch Hydraulik

Jet of liquid due to defective hydraulic systems

DANGER!

Danger of death due to jet of liquid escaping under high pressure!

If lines or AHU components are defective, heat transfer media (cooling medium), freezing agent or compressor oil may escape under high pressure. The jet of liquid can result in severe injuries, frostbite and burns.

- Never stand or place objects in the path of a jet of liquid. Prevent people from entering the hazardous area.
- Immediately initiate an emergency stop. If necessary, initiate further measures to reduce the pressure and stop the jet of liquid.
- Correctly clear away and dispose of any liquids that escape.
- Have any defective components repaired immediately.

Refrigeration system

WARNING!

Risk of injury due to refrigeration system!

The components and equipment as well as incorrect handling of the refrigeration system can cause severe injuries.

- Only have work on the refrigeration system completed by skilled qualified refrigeration technicians or the *TROX Technical Service*.
- Always observe the safety data sheet provided by the freezing agent manufacturer, *Appendix 'Freezing agent' on page 143*.

1.7.5 Gefahren durch hohe oder niedrige Temperaturen

Hot surfaces

WARNING!

Risk of injury caused by hot surfaces!

The surfaces of the heater can get very hot during operation. Skin contact with hot surfaces causes severe skin burns.

- Wear heat-resistant protective work clothing and protective gloves when carrying out all work in the vicinity of hot surfaces.
- Before all work, make sure that all surfaces have cooled down to the ambient temperature.

Cold surfaces

WARNING!

Risk of injury due to cold surfaces!

During operation, the surfaces of the integrated refrigeration system and evaporator can cool down to -20 °C. Skin contact with cold surfaces causes frostbite.

- Wear cold-resistant protective work clothing and protective gloves when carrying out all work in the vicinity of cold surfaces.
- Before all work, make sure that all surfaces have warmed up to the ambient temperature.

1.7.6 Gefahren durch Gefahrenstoffe und Betriebsstoffe

Media containing glycol

WARNING!

Media that contain glycol pose a health risk.

The media in the heater, cooler, and run around coil system contain glycol, which can lead to serious health problems if it comes into contact with the body, if it is swallowed, or if aerosols are inhaled.

- Avoid contact with media that contain glycol
- Only have work completed by systems mechanics for sanitary engineering, heating engineering and air conditioning systems.
- Do not eat, drink, or smoke when handling media containing glycol
- Wash hands before breaks and when finishing work
- If you come into contact with media containing glycol, follow the first aid measures on the medium manufacturer's safety data sheet
- When handling media containing glycol, personnel must wear the personal protective equipment specified in the medium manufacturer's safety data sheet

R-410A freezing agent

WARNING!

Health risk due to freezing agent!

If inhaled, the freezing agent used in the refrigeration system can result in severe shortness of breath, unconsciousness, cardiac arrhythmia and asphyxiation. Contact with the body can result in frostbite.

- Avoid contact with freezing agent.
- Only have work on the refrigeration system completed by skilled qualified refrigeration technicians or the *TROX Technical Service*.
- Do not eat, drink or smoke when handling freezing agent.
- Wash hands before breaks and when finishing work
- Following contact with the freezing agent, observe the first aid measures listed on the safety data sheet provided by the manufacturer, *Appendix 'Freezing agent' on page 143*.
- Ensure adequate ventilation when it is released.
- Wear heat-insulating gloves and protective glasses when handling the agent.

Compressor oil

WARNING!

Health risk due to compressor oil!

In the event of bodily contact, swallowing or inhalation, the compressor oil used can cause irritation to the skin, eyes, the gastro-intestinal tract and the upper respiratory tract.

- Avoid contact with compressor oil.
- Only have work on the refrigeration system completed by skilled qualified refrigeration technicians.
- Do not eat or drink when handling freezing agent.
- Following contact with the compressor oil, observe the first aid measures listed on the safety data sheet provided by the manufacturer, *Appendix 'Compressor oil' on page 133*.

Lubricants

WARNING!

Health risk due to lubricants!

Contact with lubricants can induce allergies and skin irritation.

- Wear protective gloves when handling lubricants.
- Do not swallow, do not inhale vapours.
- Following contact with the eyes, rinse the lubricant out thoroughly with plenty of water and seek medical attention if necessary.
- Following contact with the skin, wash off thoroughly with plenty of soap and water.
- Observe the safety data sheets provided by the lubricant manufacturer.

1.7.7 Gefahren durch Brand

Fire protection

WARNING!

Risk of injury due to limited or improper fire-fighting measures!

If in the event of a fire, the fire extinguisher is not in working order or is unsuitable for the class of fire in question, this can result in serious injuries, death and considerable property damage.

- Make sure that only fire extinguishers suitable for the class of fire are available.
- Check that fire extinguishers are in good working order every 2 years.
- Refill the fire extinguishers after every use.
- Only use extinguisher agents and replacement parts that comply with approved information specified on the fire extinguisher.
- In case of use, observe the safety and operating information provided on the fire extinguisher.

Damaged fan parts

WARNING!

Using damaged fan parts can cause fires!

Grinding rotors or overheating bearings can cause a fire and lead to injury or even death.

- Never operate damaged fans
- The power consumption must never exceed the specified nominal current
- Never exceed the maximum motor speed

1.7.8 Einschluss im Gerät

Entrapment in the air handling unit

WARNING!

Risk of injury due to entrapment in the air handling unit!

Entrapment in the air handling unit can result in serious injuries or even death for the persons concerned.

- Secure the air handling unit against restarting when carrying out all work in the AHU.
- Before switching it on, check that no persons are in the air handling unit.

1.8 Verantwortung des Betreibers

Operator

The operator is the person who actually operates the air handling unit for commercial or business purposes or who allows third parties to use/operate the unit, and who bears legal product stewardship for the protection of the user, personnel, or third parties during operation.

Operator's obligations

The unit is intended for commercial use. The operator of the device is therefore subject to the legal obligations of occupational health and safety regulations.

In addition to the safety notes in this manual, the applicable safety, accident prevention, and environmental regulations for the area of application of the unit must be observed.

In particular:

- The operator must be aware of the applicable occupational health and safety regulations and run a risk assessment to determine additional dangers resulting from the special working conditions at the installation location of the air handling unit. The risk assessment must be implemented in the form of an operating manual for the operation of the air handling unit.
- The operator must check that the operating manuals conform to the current version of the regulations throughout the entire operating period of the air handling unit and must revise the manuals as required.
- The operator must secure the air handling unit to prevent access by unauthorised persons.
- The operator must clearly define and regulate the responsibilities for operation, maintenance, cleaning, troubleshooting and removal.
- The operator must ensure that all employees who work with the air handling unit have read and understood this manual.

- The operator must provide all employees with regular training sessions and inform them of the dangers.
- The operator must provide the employees with the required personal protective equipment.
- The operator must ensure that the maintenance intervals specified in this manual are observed.
- The operator must have all safety equipment tested regularly to ensure that it is functional and complete.
- The operator must observe the local fire regulations.
- The operator must document and permanently store the control matrix on which commissioning is based. This original version of the control matrix must be retained in both digital and paper form.
- The operator must document and store any change made to the control matrix.

For air handling units with a refrigeration system/direct evaporator, the following also applies:

- The operator must maintain the supplied refrigeration log sheet to demonstrate compliance with the operator testing obligations.
- Every year, the operator must provide training to employees:
  - on safety requirements in relation to refrigeration systems,
  - on the dangers associated with handling refrigeration systems and
  - on conduct in the event of accidents or faults in relation to refrigeration systems

  unterweisen. This training must be recorded.
- The operator must ensure that work on the refrigeration system is only completed by qualified skilled refrigeration technicians.
- The operator must ensure regular maintenance and care in accordance with local regulations.
- The operator must comply with technical, safety-related, country-specific standards and guidelines.

Any maintenance work undertaken by TROX Technical Service and which requires evidence of its completion is recorded in the refrigeration log sheet.

Hygiene requirements

The operator must observe the local regulations and harmonised standards with respect to hygiene requirements. These include compliance with

- the respective maintenance and inspection intervals for air handling units and
- the specifications for connected air ducts and air diffusers.

1.9 Personalanforderungen

1.9.1 Personnel requirement

Qualification

In this manual, the people considered to be qualified to carry out the various tasks are named as specified below:

HVAC technician
HVAC technicians are individuals who have sufficient professional or technical training in the field they are working in to enable them to carry out their assigned duties at the level of responsibility allocated to them and in compliance with the relevant guidelines, safety regulations and instructions. HVAC technicians are individuals who have in-depth knowledge and skills related to HVAC systems; they are also responsible for the professional completion of the work under consideration.

HVAC technicians are individuals who have sufficient professional or technical training, knowledge and actual experience to enable them to work on HVAC systems, understand any potential hazards related to the work under consideration, and recognise and avoid any risks involved.

Properly trained person
The properly trained person has been provided with training on the assigned duties and informed about possible dangers resulting from improper use. The training was provided by a person trained and qualified in the field in question.

Following the training, the trained person may carry out the following duties on the air handling unit:

- Carry out visual inspections
- Replace filter elements
- Clean filter chambers
- Clean heat exchangers
- Clean fans

Skilled qualified electrician
Skilled qualified electricians are individuals who have sufficient professional or technical training, knowledge and actual experience to enable them to work on electrical systems, understand any potential hazards related to the work under consideration, and recognise and avoid any risks involved.

Skilled qualified personnel for hygiene inspection
Skilled qualified personnel for hygiene inspection are trained individuals who have specialist knowledge and experience and who know the relevant standards and guidelines to be able to work on air handling units. What's more, the skilled qualified personnel for hygiene inspection has an additional qualification in air hygiene and room quality.

The skilled qualified personnel for hygiene inspection is specifically trained in the work environment in which he/she is employed and is familiar with the relevant standards and guidelines.

Skilled qualified refrigeration technicians
Skilled qualified refrigeration technicians are trained in and certified for the specific sector in which they are employed and are aware of the applicable standards and conditions. Due to their specialist training and experience, skilled qualified refrigeration technicians are able to carry out work on refrigeration systems and recognise and avoid possible dangers.

In the European Community, a certificate in accordance with EC 842/2006 and EC 303/2008 must be available. The certificate implies the expertise required to prevent emissions, recover fluorinated greenhouse gases and safely handle refrigeration equipment of the relevant type and size.

For all work, only persons who can be expected to perform the work reliably are acceptable as personnel. Persons whose reactions are impaired, e.g. by drugs, alcohol or other medications, are not acceptable.

Passwords

The menu item for web server setup is password protected to prevent entries or changes being made by unauthorised persons (see software documentation for the air handling unit).

Training

Personnel must be regularly trained by the operator. For improved monitoring, any training that is performed must be recorded.

The record must include at least the following information:

- Date of training
- Name of trainees
- Type of training
- Name of trainer
- Signature of trainee

1.9.2 Unauthorised persons

⚠ WARNING!

Danger of death for unauthorised persons due to dangers in the hazardous and work area!

Unauthorised persons who do not fulfil the requirements specified above are not aware of the dangers in the work area of the air handling unit. There is therefore the risk of serious injuries and even death for unauthorised persons.

– Keep unauthorised persons away from the hazardous and work area.
– If in doubt, confront persons and direct them away from the hazardous and work area.
– Stop work while unauthorised persons are in the hazardous and work area.

1.10 Persönliche Schutzausrüstungen

Personal protective equipment is used to protect people from safety and health risks while they are at work.

During various types of work at and with the unit, personnel must wear personal protective equipment. This is referred to separately in the individual sections of this manual.

Description of the personal protective equipment

Hearing protection

Hearing protection protects against hearing damage resulting from noise exposure.

Industrial safety helmet

Industrial safety helmets protect the head against falling objects, swinging loads, and impacts with stationary objects.

Protective clothing

Protective clothing is close fitting, with low tear resistance, close fitting sleeves, and no projecting parts. It prevents entanglement in moving machinery.

Do not wear jewellery.

Protective gloves

Protective gloves are used to protect hands from friction, abrasions, punctures, or deeper injuries.

Safety harness

The safety harness protects personnel from falling when there is an increased risk of falling. The risk of falling is increased when certain height differences are exceeded and the workspace is not secured by a railing.

The safety harness must be worn in such a way that the safety rope is connected to the safety harness and to a secure attachment point; provide shock absorbers if necessary.

Safety harnesses must only be used by personnel who have been specifically trained to use them.

Safety shoes

Safety shoes protect the feet against crushing, falling parts, and slipping on slippery ground.

Schutzbrille

Die Schutzbrille dient zum Schutz der Augen vor umherfliegenden Teilen und Flüssigkeitsspritzern.

1.11 Umweltschutz

NOTICE!

Risk to the environment due to incorrect handling of substances that are hazardous to the environment!

If substances that are hazardous to the environment are handled incorrectly, and particularly if they are disposed of incorrectly, this can have a considerable impact on the environment.

- The instructions listed below regarding handling and disposing of substances that are hazardous to the environment must always be observed.
- If substances that are hazardous to the environment are released inadvertently into the environment, suitable measures must be taken immediately. In case of doubt, inform the relevant local authorities about the damage and enquire about the suitable measures to be taken.
- If substances that are hazardous to the environment are released inadvertently into the environment, suitable measures must be taken immediately. In case of doubt, inform the relevant authorities about the damage and enquire about the suitable measures to be taken.

The following substances that are hazardous to the environment are used:

Coolant, glycol

Coolants may contain substances that are toxic and hazardous to the environment. They must not be released into the environment. They must be disposed of by a specialist disposal company.

Only use the following glycols for the air handling unit:

- Propylene glycol
- Ethylene glycol

R-410A freezing agent

The freezing agent may contain substances that are toxic and hazardous to the environment or which produce decomposition products that are hazardous to the environment. These must not be released into the environment. They must be disposed of by a specialist disposal company.

Compressor oil

Compressor oil must not enter sewer systems or bodies of water. It must be disposed of by a specialist disposal company.

Lubricants

Lubricants such as greases and oils contain toxic substances. Lubricants must not be released into the environment. They must be disposed of by a specialist disposal company.

1.12 Conduct in the event that harmful substances are released

R-410A freezing agent

Personal protection:

- Bring people to safety.
- Ensure good ventilation and/or extraction in the work areas.
- Wear heat-insulating gloves and protective glasses.

Environmental protection:

- Do not allow the substances to be released into the environment. Use collection pans.

Also observe the safety data sheet provided by the manufacturer, ↳ *Appendix 'Freezing agent' on page 143*.

Compressor oil

Personal protection:

- Wear protective gloves and protective glasses.

Environmental protection:

- Do not allow the substances to enter sewer systems or bodies of water. Use collection pans.
- Absorb the substance with sand, soil or a similar absorbent material and place it in containers for disposal.
- Clean the contaminated area with water.
- If the substance enters bodies of water or sewer systems, the relevant authorities must be informed.

Also observe the safety data sheet provided by the manufacturer, ↳ *Appendix 'Compressor oil' on page 133*.

Coolant, glycol

The points listed below generally apply with respect to coolants containing glycol.

Personal protection:

- Bring people to safety.
- Wear protective equipment.
- Ensure good ventilation and/or extraction in the work areas.
- Do not inhale vapours/aerosols. Avoid contact with the eyes and skin.

Environmental protection:

- Do not allow the substances to enter sewer systems or bodies of water. Use collection pans.
- Absorb the substance with sand, soil or a similar absorbent material and place it in containers for disposal.
- If the substance enters bodies of water or sewer systems, the relevant authorities must be informed.

Also observe the safety data sheet provided by the manufacturer.

Lubricants

Observe the safety data sheet provided by the manufacturer.

Batteries

Batteries contain toxic heavy metals. They are subject to special waste treatment and must be deposited at local authority collection points or disposed of by a specialist company.

2 Funktionsbeschreibung

Die Gerätezeichnung und die Technischen Datenblätter wurden als Freigabedokumente übermittelt. Wir empfehlen diese Unterlagen dieser Betriebsanleitung beizufügen.

2.1 Symbole am RLT-Gerät

In der folgenden Tabelle sind die verbauten Komponenten und deren Symbolik aufgeführt.

Symbol	Bezeichnung
	Filtereinheit, *'Filter unit' on page 20*
	Schalldämpfer, *'Sound attenuators' on page 20*
	Radialventilator, *'Centrifugal fan' on page 20*
	Jalousieklappen, *'Multileaf dampers' on page 20*
	Rotationswärmeübertrager, *'Rotary heat exchangers' on page 20*
	Kühler, *'Cooler' on page 20*
	Erhitzer, *'Heater' on page 20*
	Dampfbefeuchter, *'Steam humidifier' on page 21*
-	Dämmstutzen, *'Noise insulation connector' on page 21*
	Verdampfer, *'Evaporator' on page 21*
	Verflüssiger, *'Condenser' on page 21*
	Elektrolufterhitzer, *'Electric duct air heater' on page 21*
	Hochdruckbefeuchter, *'High-pressure humidifier' on page 21*
	Kontaktbefeuchter, *'Contact humidifier' on page 21*
	Kreislaufverbundsystem, *'Run around coil system' on page 20*
	Kreislaufverbundsystem inkl. Hydraulikstation, *'Run around coil system with hydraulic unit' on page 20*
	Plattenwärmeübertrager, *'Plate heat exchanger' on page 20*
-	Dämmstutzen, *'Noise insulation connector' on page 21*
-	Umluftkammer, *'Air recirculation chamber' on page 21*
	Druckmessumformer
	Differenzdruckmesser, *Chapter 2.5.3 'Differential pressure gauge' on page 22*
	Medienanschlüsse Kühler/Erhitzer *'Media connections for cooler/heater' on page 22*
	Medienanschlüsse Kondensatabfluss, *'Media connections for condensate drain' on page 22*
FOL	Fortluft
ZUL	Zuluft
AUL	Außenluft
ABL	Abluft

2.2 Funktion des RLT-Geräts

General function of the air handling unit

The air handling unit is a unit consisting of several AHU components and a casing. The air handling unit can perform one or more of the following functions with air:

- Circulation
- Filtering
- Heating
- Cooling
- Heat recovery
- Humidification
- Dehumidification

2.3 Betriebsarten

The operating modes are created and set up by the operator in agreement with the manufacturer of the on-site central building management system.

2.4 Funktionen der Baugruppen

Centrifugal fan

The centrifugal fan moves air through the air handling unit and the connected ventilation system.

Access to the centrifugal fan by unauthorised persons is blocked by inspection access doors that prevent access to the hazardous area. Before accessing the centrifugal fan, the air handling unit must be switched off at the main switch and secured against restarting.

Filter unit

The filter unit is used to process the supplied air with respect to purity. The filter unit can be fitted with different classes of filter depending on the application. The filter unit is accessible via an inspection access door, enabling the filter media to be replaced easily.

The filter consists of:

- a filter chamber,
- a filter frame and
- a filter element

Heater

The heater is used to process the supplied air with respect to temperature. It heats the supply air to the value specified by the open loop control as required. The required heat energy is transferred to the airflow from an external energy source by an air-water heat exchanger. The heater is accessible via an inspection access door, enabling cleaning and maintenance to be performed easily.

Cooler

The cooler is used to process the supplied air with respect to temperature. It cools the supply air to the value specified by the open loop control as required. The required cooling energy is transferred to the airflow from an external energy source by an air-water heat exchanger. The cooler is easily accessible via an inspection access door, enabling cleaning and maintenance to be performed easily.

Multileaf dampers

The multileaf dampers are used to control and close off the airflow. The multileaf dampers are accessible via an inspection access door, enabling cleaning and maintenance to be performed easily.

Sound attenuators

The sound attenuator consists of splitter sound attenuators and reduces noises resulting from the fan and air treatment. The splitters are easily accessible via an inspection access door and can be removed for cleaning.

Rotary heat exchangers

The thermal mass of the heat exchanger consists of fine alternately smooth and corrugated aluminium layers, the flow channels. Based on slow rotation, extract air and supply air flow through the heat exchanger in counterflow to transfer the temperatures of the airflows.

Plate heat exchanger

The plate heat exchanger consists of corrugated profiled plates that are arranged so that the medium that is to be heated and then the medium that loses its heat flow in alternate spaces.

Run around coil system with hydraulic unit

At least one heat exchanger in the supply air flow and one in the extract air flow are connected via a TROX pump (hydraulic unit) and tubes. This arrangement forms the run around coil system with hydraulic unit. The extract air heat is transferred to the heat transfer medium. The pump supplies the medium to the heat exchanger for the supply air flow. The heat is removed from the heat transfer medium and conveyed to the supply air. The heat transfer medium is connected in counterflow to the airflow. Due to the separate systems, both airflows are completely separate.

Run around coil system

At least one heat exchanger in the supply air flow and one in the extract air flow are connected via a pump provider by the operator and tubes. This arrangement forms the run around coil system. The extract air heat is transferred to the heat transfer medium. The pump supplies the medium to the heat exchanger for the supply air flow. The heat is removed from the heat transfer medium and conveyed to the supply air. The heat transfer medium is connected in counterflow to the airflow. Due to the separate systems, both airflows are completely separate.

Fan array

The fan array moves air through the air handling unit and the connected ventilation system. The volume flow is provided by all of the fans.

Steam humidifier

The steam humidifier consists of two components, the steam generator and the steam distributor. The supply air is humidified when the water in the steam generator evaporates and is supplied to the air through the distribution system. The air takes in the moisture, resulting in humidification.

Electric duct air heater

The electric duct air heater is used to process the supplied air temperature. It heats the supply air to the value specified by the open loop control as required. The required heat energy is transferred to the airflow using electric heating elements.

High-pressure humidifier

The high-pressure humidifier is used to humidify the supply air without heat exchange. Atomiser nozzles are used to distribute the supplied fresh water as mist in the humidifier chamber.

Contact humidifier

The contact humidifier is used to humidify the extract air without heat exchanger to enable indirect extract air cooling. In the event of high outside temperatures, the extract air is cooled, enabling the warm outdoor air to be precooled without the use of an external cooling medium. This enables the required cooling capacity to be reduced. It is possible to choose between two constructions, either for flow-through operation or for recirculation of water.

Noise insulation connector

The noise insulating connector is the connection between the air handling unit and ducting. The noise insulating connector has a vibration-absorbing element for the purposes of damping sound and vibration between the air handling unit and ducting.

Evaporator

The evaporator is used to process the supplied air with respect to temperature. It cools the supply air to the value specified by the open loop control as required. The freezing agent used in the evaporator evaporates as the heat is transferred, cooling the air.

Condenser

The condenser is used on the one hand to recondense the freezing agent that has evaporated in the evaporator, and, on the other, to process the air temperature. It either dissipates the heat that arises during evaporation via the exhaust air or heats the supply air to the value specified as required.

Air recirculation chamber

The air recirculation chamber is a central chamber in the air handling unit in which controlled air recirculation operation is achieved by controlling internal multileaf dampers. Depending on requirements, air recirculation operation can be freely selected between 0 and 100%.

2.5 Bedien- und Anzeigeelemente

2.5.1 Hauptschalter

Main switch

The air handling unit is not fitted with a main switch at the factory. It is operated by the main switch (provided by others).

Rotary isolator switch

‘Rotary isolator switch ’ on page 8

2.5.2 Revisionstüren mit Verriegelung

Inspection access doors

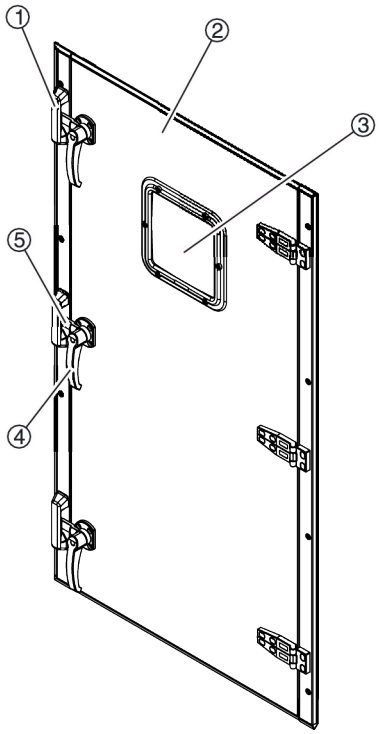

Fig. 10: Inspection access door

1 Lock
2 Inspection access door
3 Inspection window
4 Handle
5 Latch

The inspection access doors (Fig. 10/2) are located on the front of the air handling unit and allow access to the interior of the AHU components. Depending on the AHU component, the inspection access doors have an inspection window (Fig. 10/3).

The inspection access doors are closed via a latch (Fig. 10/5) and lock (Fig. 10/1) and, depending on the AHU component in question, opened using a handle (Fig. 10/4) or special key (not shown).

Depending on the AHU component and design of the air handling unit, the inspection access doors are fitted with the following safety devices:

- *Quadrant stay*
- *Safety catch*
- *Internal handle*
- *Internal handle with safety catch*
- *Safety lock*

2.5.3 Differential pressure gauge

Analogue differential pressure gauge

Fig. 11: Analogue differential pressure gauge

The analogue differential pressure gauges are installed on the operating side of the air handling unit at each filter unit. The measuring devices are used to measure the air pressures upstream and downstream of the filter elements. The difference between the air pressure measurements can be read from the gauge (Fig. 11/1). The higher the difference, the higher the air resistance of the filter element. Once a specified measured value has been exceeded, the filter element must be replaced.

2.6 Anschlüsse und Schnittstellen

Duct connections on the air handling unit

Duct connection	Meaning
Extract air (ETA)	This duct is used to convey the air that is extracted from the rooms to the air handling unit.
Supply air (IDA)	This duct is used to convey the air that is supplied to the rooms from the air handling unit.
Outdoor air (ODA)	This duct is used to convey the air that is drawn in from the surroundings to the air handling unit.
Exhaust air (EHA)	This duct is used to convey the air that is released into the surroundings from the air handling unit.

Media connections for cooler/heater

These connections are used to convey the heat transfer medium (provided by others) to and from the cooler/heater.

Media connections for condensate drain

These connections are used to discharge any condensate that arises.

Media connections for humidifier

These connections are used to convey the processed humidification medium to the distributor unit.

Media connections for evaporator/condenser

These connections are used to convey the medium (provided by others) to and from the evaporator/condenser.

Media connections for live parts

Cable glands are fitted in the panels for components that require a supply voltage or control cable (e.g. fans, actuators, anti-frost thermostats).

3 Bedienung

3.1 Sicherheitshinweise zur Bedienung

Incorrect operation

WARNING!

Risk of injury due to improper operation!

Improper operation can cause serious injuries and considerable property damage.

- Read the operating manual.
- Perform all operating steps in accordance with the information and instructions provided in this manual.
- Before starting work, ensure that:
  - all inspection access doors and covers have been closed
  - all safety equipment has been installed and functions correctly
  - there are no persons in the air handling unit.
- Never open inspection access doors or covers during operation.
- Never disable the safety equipment or bypass it during operation.

Working at great heights

WARNING!

Danger of falling when carrying out work at great heights.

Working at great heights can cause people, tools or materials to fall. This can result in serious injuries or even death.

- Wear a safety harness.
- Only access rooftop installations if ladders, railings and safety harnesses are available and are in working order.
- Only perform work on the air handling unit if the AHU components in question are easily accessible.
- Secure tools and materials against falling.
- Always wear safety shoes, protective work clothing, and a safety helmet.

3.2 Ausschalten im Notfall

- Switch off the main switch and secure the air handling unit against restarting, if possible, *Chapter 1.5 'Securing against restarting' on page 9*.
- Raise the alarm.
- If there is no risk to your own health, rescue people from the hazardous zone.
- Notify the emergency services.
- Perform first aid.
- Get yourself to safety. Bring those in danger with you.

3.3 Ausschalten im Brandfall

Das RLT-Gerät wird vom Betreiber der Lüftungsanlage in das Brandschutzkonzept des Gebäudes eingebunden. Der Betreiber legt für einen Brandfall individuelle Verhaltensregeln fest.

3.4 (Wieder-) Einschalten vorbereiten

Entrapment in the air handling unit

WARNING!

Risk of injury due to entrapment in the air handling unit!

Entrapment in the air handling unit can result in serious injuries or even death for the persons concerned.

- Secure the air handling unit against restarting when carrying out all work in the AHU.
- Before switching it on, check that no persons are in the air handling unit.

Before switching on

Before switching on, ensure the following:

- There are no persons or objects in the air handling unit.
- Filter elements are installed and intact.
- All media connections are intact and open.
- The AHU casing is completely closed.

3.5 RLT-Gerät einschalten

RLT-Gerät am Hauptschalter einschalten

Personnel:

- Properly trained person

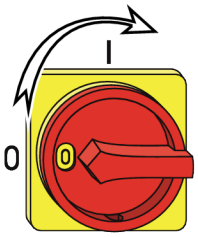

Fig. 12: Hauptschalter drehen

1. Bauseitigen Hauptschalter des RLT-Geräts in Stellung "I" drehen.
2. Das RLT-Gerät über die bauseitige Gebäudeleittechnik gemäß den Anweisungen des Betreibers hochfahren.

   ⇨ RLT-Gerät ist betriebsbereit.

3.6 Prüfungen während des Betriebs

Während des Betriebs müssen wöchentlich folgende Prüfungen am RLT-Gerät ausgeführt werden.

- Druckdifferenz an der Filtereinheit prüfen, *Chapter 3.10 Reading the differential pressure on the filter unit' on page 25*.
- Den Anlagendruck der Wärmeübertragermedien gemäß Herstellerangaben der bauseitigen Anlagen prüfen.
- Das RLT-Gerät auf Störungen prüfen.

3.7 Tipps für den Betrieb

Compliance with maintenance intervals

To ensure that the unit is operated in as economical and energy-efficient a manner as possible, the maintenance intervals for the AHU components must be observed. Contaminated filter elements increase the power consumption of the fan and the air handling unit.

Requirements-based use

The air handling unit must be adapted to the respective use requirements. If the building use changes, the air handling unit's operating mode may also have to be adapted.

Demand-based control

Demand-based control ensures optimum operation and prevents unwanted energy expenditure.

3.8 Shutting down the air handling unit

Personnel:

- Properly trained person

1. Shut down the air handling unit via the on-site central building management system in accordance with the operator's instructions.
2. Secure the air handling unit against restarting, *Chapter 1.5 'Securing against restarting' on page 9*.

   ⇨ The air handling unit is secured against restarting. Work may begin.

3.9 Nach dem Abschalten

Außerbetriebnahme

WARNING!

Gefahr durch unsachgemäße Außerbetriebnahme!

Durch unsachgemäße Außerbetriebnahme können gefährliche Situationen für Personen entstehen.

– Anlagenmechaniker für Sanitär-, Heizungs- und Klimatechnik für die Außerbetriebnahme bestellen.
– Elektro- und Kältefachkraft für die Außerbetriebnahme bestellen.

Decommissioning if there is a risk of frost

The air handling unit must be protected against frost when decommissioned. Once the air handling unit has been switched off, the components listed below must be drained if water is the only heat transfer medium that is used.

- Heater
- Coolers
- Humidifier
- Condensate drip trays
- Siphons
- Run around coil system

Decommissioning rotary heat exchangers

In the event of a shutdown of up to 3 months (e.g. during the summer), place the rotor in operation every 2 weeks to ensure it retains its self-cleaning function.

After an idle time of 3 months

After an idle time of 3 months

- the drive belts on the rotary heat exchangers must be removed to prevent bearing loads from occurring at certain points,
- the entire energy supply must be physically separated from the air handling unit,
- any stored residual energy must be discharged and
- any operating and auxiliary materials and residual processing materials must be removed and disposed of in an environmentally friendly manner.

After an idle time of 1 year

After an idle time of more than 1 year

- the bearings must be replaced.
- In the case of bearings with a relubrication device, the old lubricant must be removed and new must be applied in line with the instructions of the fan manufacturer.
- Droplet eliminator and commutator profiles must be removed for cleaning.

Removing motors

When removing motors, only suitable and approved load handling equipment must be used. When using an integrated actuator removal device, ensure that it is in a stable position, e.g. by fastening it to the foundation.

3.10 Reading the differential pressure on the filter unit

Reading the analogue differential pressure gauge

Personnel:

- Properly trained person

Protective equipment:

- Industrial safety helmet

Fig. 13: Reading the differential pressure gauge

1. Read the differential pressure from the gauge (Fig. 13/1).

   ⇨ If the maximum permissible differential pressure is exceeded, the filter element must be cleaned or replaced, *Chapter 4.4.4 'Replacing the filter element' on page 37*.

> *The maximum permissible differential pressure is printed on the filter label on the inspection access door.*

4 Wartung

Das RLT-Gerät muss regelmäßig gewartet werden. Eine regelmäßige Pflege und Instandhaltung sichert die Betriebsbereitschaft, Betriebssicherheit und Lebensdauer des RLT-Geräts.

Die aufgeführten Wartungsarbeiten können optional auch vom TROX-Service übernommen werden (‘TROX Technical Service’ on page 3).

4.1 Sicherheitshinweise zur Wartung

Improper maintenance work

WARNING!

Risk of injury due to improper maintenance work!

Improper maintenance can cause serious injuries and considerable property damage.

- Before performing maintenance work, switch off the air handling unit and secure against restarting.
- Never allow unauthorised persons to perform maintenance work.
- Before starting the work, ensure there is enough space to complete the assembly work.
- Ensure that the assembly site is tidy and clean. Components and tools that are loosely stacked or left lying around can cause accidents.
- If components have been removed, ensure that they are assembled correctly, reinstall all of the fastening elements and observe the screw tightening torque.
- Before recommissioning, ensure the following:
  - all maintenance work has been performed and completed in accordance with the information and instructions provided in this manual
  - there are no persons in the air handling unit
  - all inspection access doors and covers have been closed
  - all safety equipment has been installed and functions correctly.

Working at great heights

WARNING!

Danger of falling when carrying out work at great heights.

Working at great heights can cause people, tools or materials to fall. This can result in serious injuries or even death.

- Wear a safety harness.
- Only access rooftop installations if ladders, railings and safety harnesses are available and are in working order.
- Only perform work on the air handling unit if the AHU components in question are easily accessible.
- Secure tools and materials against falling.
- Always wear safety shoes, protective work clothing, and a safety helmet.

Rotating parts on the fan

WARNING!

Risk of injury due to rotating parts!

Rotating parts in the fan can cause severe injuries.

- Never reach into the moving fan wheel or tamper with the fan wheel.
- Never open covers or maintenance ports during operation.
- Make sure that the fan wheel is inaccessible during operation.
- Observe the stopping time: look through the inspection window to ensure that none of the parts are moving before opening the inspection access doors.
- Switch off the system before working on moving fan parts and secure the system against restarting. Wait until all parts have come to a stop.

  Switch off the air handling unit before working on moving fan parts and secure the unit against restarting, *Chapter 1.5 ‘Securing against restarting’ on page 9*. Wait until all parts have come to a stop.

Moving parts of the multileaf dampers

WARNING!

Danger of crushing due to moving parts!

The closing multileaf damper blades can cause injury to the upper limbs.

- Never reach between the multileaf damper blades
- Only operate multileaf dampers with ducts or safety guards
- Before opening the inspection access doors, switch off the air handling unit and secure against restarting

4.2 Sichern gegen Wiederschalten

Siehe: *Sichern gegen Wiedereinschalten.*

4.3 Wartungsplan

The maintenance work required for optimum and fault-free operation of the unit is detailed in the following chapters.

If increased wear is detected during regular checks, the required maintenance intervals must be reduced based on the actual signs of wear and tear. If you have any questions about maintenance work and intervals, please contact the TROX Technical Service, *'TROX Technical Service' on page 3*.

All maintenance work can also be performed by the TROX Technical Service ('TROX Technical Service' on page 3*).*

AHU hygiene inspection

Interval	Maintenance work	Personnel
every two years	Hygiene inspection at the air handling unit.	Skilled qualified personnel for hygiene inspection

Air duct system and air diffusers

Interval	Maintenance work	Personnel
every 6 months	Check supply air and extract air diffusers for contamination, damage and corrosion. If necessary, clean and repair them in accordance with the specifications of the air diffuser manufacturer.	Properly trained person
	Check external louvres for contamination, damage and corrosion. If necessary, clean and repair them in accordance with the specifications of the external louvre manufacturer.	Properly trained person
	Check air ducts for damage. If necessary, repair them in accordance with the specifications of the air duct manufacturer.	Properly trained person
	Check flexible spigots for tightness, function and damage. If necessary, repair them in accordance with the specifications of the spigot manufacturer.	Properly trained person
every 12 months	Clean supply air and extract air diffusers.	Properly trained person
	Check outdoor air and exhaust air diffusers for contamination, damage and corrosion. If necessary, clean and repair them in accordance with the specifications of the outdoor air and exhaust air diffuser manufacturer.	Properly trained person
	Check the internal ducting surface at least 2 points for contamination, damage, corrosion and build-up of water. If necessary, check the ducting at additional points and determine whether cleaning is required.	Properly trained person
	Check flexible spigots for tightness, function and damage.	Properly trained person

Air handling unit casing

Interval	Maintenance work	Personnel
every 6 months	Carry out visual inspection to check casing components for contamination, damage and corrosion. Clean if necessary.	Properly trained person
every 12 months	Check AHU component interfaces for leaks.	Properly trained person
	Check casing for condensation.	Properly trained person
	Check panel seals.	Properly trained person
	Check panel seals and sash fasteners for firm fit and function.	Properly trained person
	Check the equipotential bonding	Properly trained person

Filter unit

Interval	Maintenance work	Personnel
every month	Carry out visual inspection to check filter element for contamination, *Chapter 3.10 Reading the differential pressure on the filter unit' on page 25*. Replace the filter element if the maximum permissible differential pressure has been exceeded, *Chapter 4.4.4 Replacing the filter element' on page 37*.	Properly trained person
	Check filter element for odours and moisture penetration. Replace filter element if necessary, *Chapter 4.4.4 Replacing the filter element' on page 37*.	Properly trained person
	Check filter frames and rails for contamination, firm fit, damage and corrosion. Clean if necessary.	Properly trained person
every 6 months	Measure and compare the differential pressure of the filter stages.	Properly trained person
every 12 months	Replace filter elements for the first stage, *Chapter 4.4.4 Replacing the filter element' on page 37*.	Properly trained person
	Check filter frames and rails for firm fit, damage and corrosion.	Properly trained person
	Check filter monitoring.	Properly trained person
every two years	Replace filter elements for the second stage, *Chapter 4.4.4 Replacing the filter element' on page 37*.	Properly trained person

Kühler

Interval	Maintenance work	Personnel
alle drei Monate	Entfeuchtungskühler, Kondensatwanne und Tropfenabscheider auf Verschmutzung, Beschädigung, Korrosion und Dichtheit prüfen. Bei Bedarf reinigen und instand setzen.	Properly trained person
	Kondensatablauf und Siphon auf Funktion prüfen. Bei Bedarf reinigen und instand setzen.	Properly trained person
halbjährlich	Wärmeübertrager auf Verschmutzung, Beschädigung, Korrosion und Dichtheit prüfen.	HVAC technician
jährlich	Vor- und Rücklauf auf Funktion prüfen.	HVAC technician
	Entfeuchtungskühler, Kondensatwanne und Tropfenabscheider auf Verschmutzung, Beschädigung und Korrosion prüfen.	Properly trained person
	Kondensatablauf und Siphon auf Funktion prüfen.	Properly trained person

Erhitzer

Interval	Maintenance work	Personnel
halbjährlich	Wärmeübertrager auf Verschmutzung, Beschädigung, Korrosion und Dichtheit prüfen.	HVAC technician
jährlich	Vor- und Rücklauf auf Funktion prüfen.	HVAC technician

Rotationswärmeübertrager

Interval	Maintenance work	Personnel
alle drei Monate	Rotationswärmeübertrager durch Sichtkontrolle auf Fremdkörper, Verschmutzung, hygienischen Zustand, Beschädigung und Korrosion prüfen. Bei Bedarf reinigen.	Properly trained person
	Dichtleisten durch Sichkontrolle auf Verschleiß, Verschmutzungen, Fremdkörper und Anpressung prüfen. Die Dichtleisten müssen nah an der Speichermasse sitzen, dürfen jedoch nicht schleifen. Bei Bedarf reinigen.	Properly trained person
	Antriebsriemen auf Verschleiß und Spannung prüfen.	Properly trained person
	Rotor durch Sichtkontrolle auf Unwucht und Seitenschlag prüfen.	Properly trained person
	Lager auf unzulässige Erwärmung, Vibrationen und Laufgeräusche prüfen.	Properly trained person
	Kondensatwanne, Kondensatablauf und Siphon auf Funktion prüfen. Bei Bedarf reinigen.	Properly trained person
	Rotorlaufkontrolle auf Funktion und Ausrichtung prüfen.	HVAC technician

Jalousieklappen

Jalousieklappen mit Zahnradantrieb nicht ölen oder fetten.

Interval	Maintenance work	Personnel
halbjährlich	Durch Sichtkontrolle auf Verschmutzung, Beschädigung und Korrosion prüfen.	Properly trained person
	Klappen auf Leichtgängigkeit prüfen.	Properly trained person
	Klappenlager und Gestänge auf Funktion prüfen.	Properly trained person
jährlich	Stellantriebe auf Funktion prüfen.	HVAC technician

Electric duct air heater

Interval	Maintenance work	Personnel
every 6 months	Carry out visual inspection to check electric duct air heater for contamination and damage.	Properly trained person
	Check function of electric duct air heater.	Skilled qualified electrician

High-pressure humidifier

Interval	Maintenance work	Personnel
every 6 months	Carry out visual inspection to check high-pressure humidifier for contamination, damage and corrosion.	Properly trained person

Electric motors

Interval	Maintenance work	Personnel
every 6 months	Carry out visual inspection to check for contamination, damage and corrosion.	Properly trained person
	Check motors for bearing noise.	Properly trained person
every 12 months	Check electrical connections.	Skilled qualified electrician
	Take measurement to compare current consumption with nominal current.	Skilled qualified electrician
	Check function of safety equipment.	Skilled qualified electrician

Fan array

Interval	Maintenance work	Personnel
every 6 months	Check for contamination, damage and corrosion. If necessary, clean and repair it, and check water drain.	Properly trained person
	Check seals for fit and damage. Repair or replace them if necessary.	Properly trained person
	Check the equipotential bonding. Repair if necessary.	Skilled qualified electrician
	Check motor for bearing noise. Repair or replace bearings if necessary.	Properly trained person

Centrifugal fan with direct drive

Interval	Maintenance work	Personnel
every 6 months	Carry out visual inspection to check for contamination, damage and corrosion. Clean if necessary.	Properly trained person
	Carry out visual inspection to check vibration damper for damage and function.	Properly trained person
	Check seals for fit and damage.	Properly trained person
	Check impeller for imbalance.	Properly trained person
	Check motor for bearing noise.	Properly trained person
	Check the equipotential bonding. Repair if necessary.	Skilled qualified electrician

Pumpen

Interval	Maintenance work	Personnel
halbjährlich	Auf Verschmutzung, Beschädigung und Korrosion prüfen. Bei Bedarf reinigen.	Properly trained person
	Flansche und Stopfbuchsen auf Dichtheit prüfen.	Properly trained person
	Pumpen auf Funktion prüfen.	HVAC technician

Regelventile

Interval	Maintenance work	Personnel
halbjährlich	Durch Sichtkontrolle auf Verschmutzung, Beschädigung und Korrosion prüfen. Bei Bedarf reinigen.	Properly trained person
	Anschlussverbindungen und Gängigkeit prüfen.	Properly trained person
jährlich	Regelventile auf Funktion prüfen.	HVAC technician

Sound attenuators

Interval	Maintenance work	Personnel
every 6 months	Carry out visual inspection to check for contamination, damage and corrosion. Clean if necessary.	Properly trained person

Air recirculation chamber

Interval	Maintenance work	Personnel
every 6 months	Carry out visual inspection to check air recirculation chamber for contamination, damage and corrosion. Clean if necessary.	Properly trained person
	Check dampers for smooth movement.	Properly trained person
	Check function of damper bearings and rods.	Properly trained person

Plate heat exchanger

Interval	Maintenance work	Personnel
every three months	Check condensate drain, condensate drip tray and siphon for function and contamination. Clean if necessary.	Properly trained person
every 6 months	Carry out visual inspection to check plate heat exchanger for contamination, damage and corrosion. Clean if necessary.	Properly trained person
	Check heat exchanger for tightness.	Properly trained person

Refrigeration system compressor

Interval	Maintenance work	Personnel
every 6 months	Carry out visual inspection to check the compressor fastening and vibration isolators.	Properly trained person
every 12 months	Check the compressor fastening and vibration isolators.	Properly trained person
	Check Rotalock valves.	Skilled qualified refrigeration technicians
	Check flange connections, quick-release fasteners and seals.	Skilled qualified refrigeration technicians
	Check the crankcase heater.	Skilled qualified refrigeration technicians
	Check collectors and connections.	Skilled qualified refrigeration technicians
	Check function of HP and LP sensors.	Skilled qualified refrigeration technicians
	Measure current consumption to check full motor protection.	Skilled qualified refrigeration technicians
	Check the levels of the freezing agent and oil.	Skilled qualified refrigeration technicians
	Check the power control.	Skilled qualified refrigeration technicians
	Check scroll compressor.	Skilled qualified refrigeration technicians
	Check refrigeration system safety valve.	Skilled qualified refrigeration technicians
	Check refrigeration system tightness.	Skilled qualified refrigeration technicians

☒ **Refrigeration system evaporator**

Interval	Maintenance work	Personnel
every 6 months	Carry out visual inspection to check for contamination, damage, corrosion and tightness. Clean if necessary.	Properly trained person
	Carry out visual inspection to check for signs of freezing.	Properly trained person
	Check droplet eliminator, condensate drip tray, drain and siphon for function and contamination. Clean and repair them if necessary.	Properly trained person
every 12 months	Check function of expansion valve.	Skilled qualified refrigeration technicians

⍁ **Refrigeration system condenser**

Interval	Maintenance work	Personnel
every 6 months	Carry out visual inspection to check for contamination, damage, corrosion and tightness. Clean if necessary.	Properly trained person
	Check function of condenser.	Properly trained person

Electrical components, units

Interval	Maintenance work	Personnel
every 6 months	Carry out visual inspection to check sensors for contamination, damage and corrosion. Clean if necessary.	Properly trained person
every 12 months	Check sensor connections.	Skilled qualified electrician
	Check function of sensors.	Skilled qualified electrician
	Check actuators for contamination, damage and corrosion.	Properly trained person
	Check actuators for input signals and operating and adjustment ranges.	Skilled qualified electrician
	Check anti-frost thermostat.	Properly trained person
	Check frequency converters.	Skilled qualified electrician
	Check fan vibration monitors.	Skilled qualified electrician
	Check rotary isolator switches.	Skilled qualified electrician
	Check CO sensor.	Skilled qualified electrician

Contact humidifier

Interval	Maintenance work	Personnel
every 6 months	Check for contamination, damage and corrosion. Clean and repair them if necessary.	Properly trained person

Dampfbefeuchter

Interval	Maintenance work	Personnel
wöchentlich	Wasser- und Dampf-Installation auf Dichtheit und Beschädigungen prüfen.	Properly trained person
	Ablaufleitung auf Verschmutzung prüfen.	Properly trained person
	Elektrische Installation auf lose Kabel und beschädigte Komponenten prüfen.	Properly trained person
	Dampf-Luftbefeuchter auf Beschädigung prüfen.	Properly trained person
halbjährlich	Dampfzylinder entleeren und Kalkauffangbehälter reinigen.	HVAC technician
jährlich	Dampfzylinder ausbauen und reinigen.	HVAC technician
	Geräteinnenraum reinigen.	HVAC technician
	Durch Sichtkontrolle Komponenten (Heizkabelstecker am Dampfzylinder, Niveaueinheit usw.) im Geräteinnenraum auf Beschädigungen prüfen.	HVAC technician

4.4 Wartungsarbeiten

4.4.1 Revisionstüren öffnen

Opening the standard inspection access doors

Personnel:

- Properly trained person

Protective equipment:

- Safety harness
- Industrial safety helmet
- Protective gloves

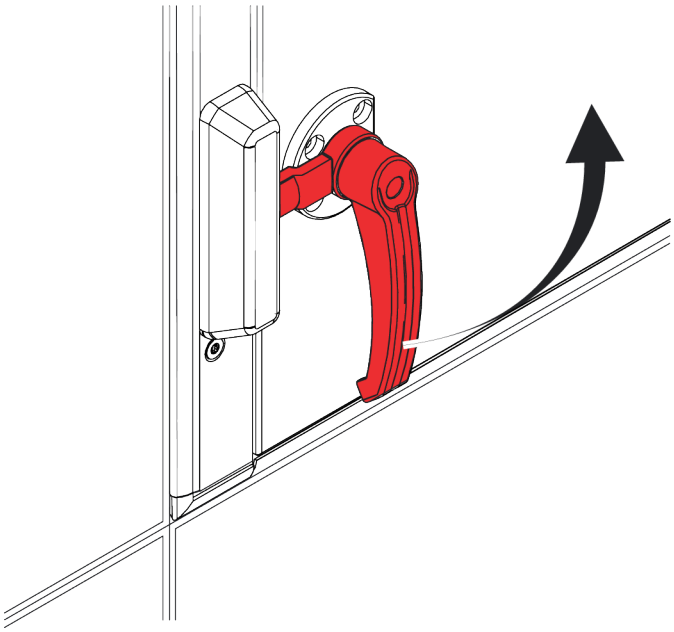

Fig. 14: Opening the door lock

- Turn the door handle 90° anticlockwise (Fig. 14).
  - ⇨ The door lock is unlocked and the door can be opened.

Opening the inspection access doors to hazardous areas

Personnel:

- Properly trained person

Protective equipment:

- Safety harness
- Industrial safety helmet
- Protective gloves

Special tool:

- TROX special key

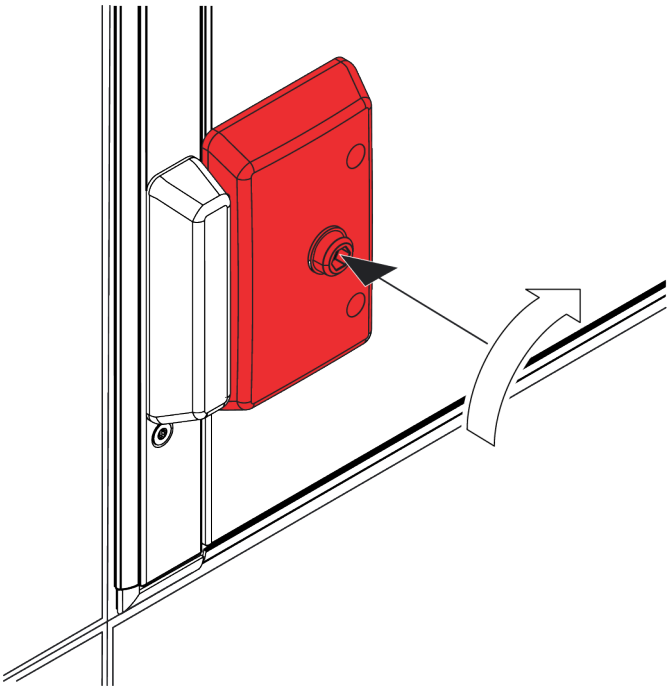

Fig. 15: Opening the door lock to hazardous areas

- Insert the TROX special key into the door lock and turn it anticlockwise as far as it will go (Fig. 15).
  - ⇨ The door lock is unlocked and the door can be opened.

Opening the inspection access doors on the pressure side

Personnel:

- Properly trained person

Protective equipment:

- Safety harness
- Industrial safety helmet
- Protective gloves

⚠ CAUTION!

Airflow on the pressure side of the fan can cause injury!

The airflow on the pressure side of the fan can throw open inspection access doors as far as the safety catch when opened, which can lead to injuries.

– Open the inspection access doors on the pressure side carefully.

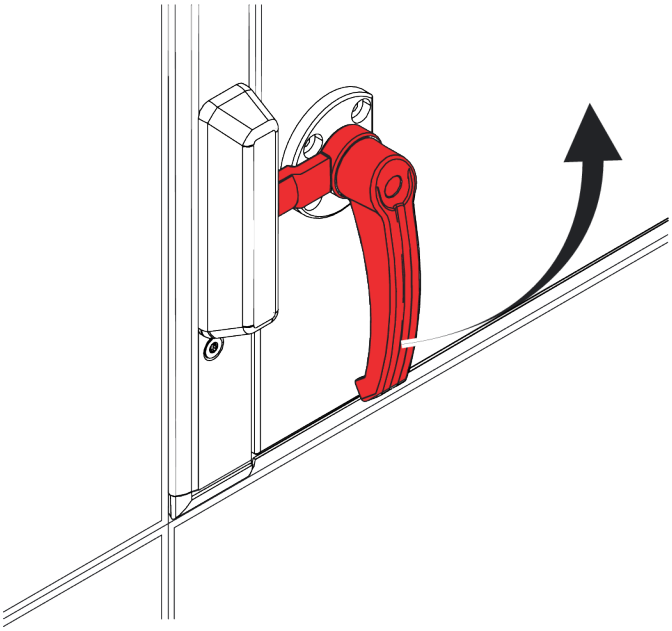

Fig. 16: Opening the door lock

1. ▸ Turn the door handle 90° anticlockwise (Fig. 16).
   ⇨ The door lock is unlocked.

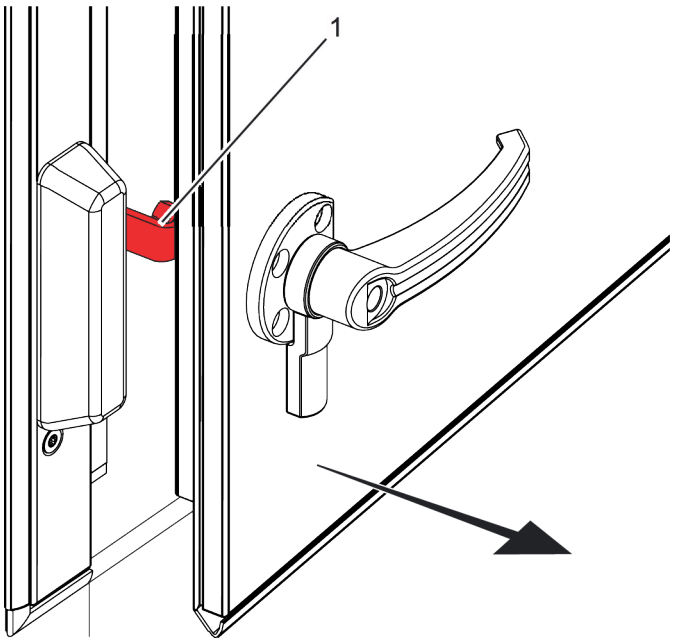

Fig. 17: Applying the safety catch

2. ▸ Carefully open the inspection access door as far as the safety catch will go (Fig. 17/1).

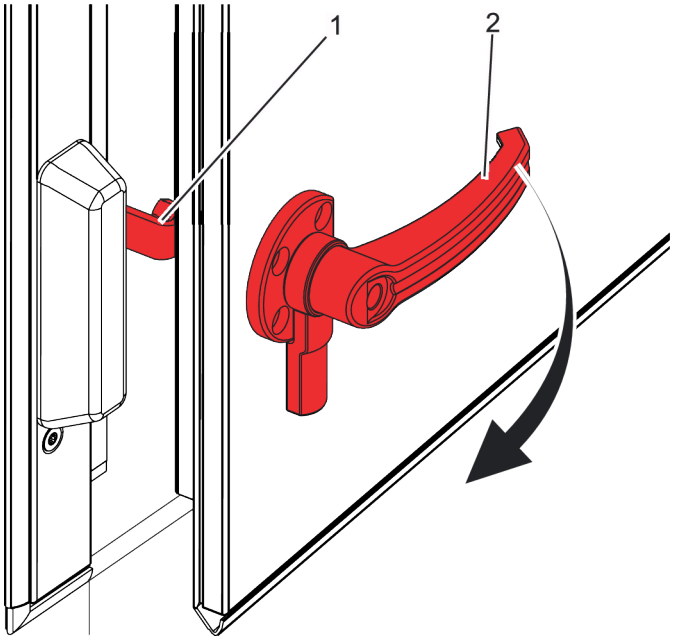

Fig. 18: Releasing the safety catch

3. ▸ Turn the door handle (Fig. 18/2) 90° clockwise.
   ⇨ The safety catch (Fig. 18/1) is released and the inspection access door can be opened.

4.4.2 Checking the filter element for contamination

The filter element is checked for contamination by reading the differential pressure, ↳ *Chapter 3.10 'Reading the differential pressure on the filter unit' on page 25*.

If the maximum permissible differential pressure is exceeded, the filter must be replaced, *Chapter 4.4.4 'Replacing the filter element' on page 37*.

The maximum permissible differential pressure is printed on the filter label on the inspection access door.

4.4.3 RLT-Gerät reinigen

Performing general cleaning of the air handling unit

Unless specified otherwise, the air handling unit and the AHU components are cleaned:

- with lint-free cloths,
- with non-corrosive and silicone-free cleaning agents.

gereinigt.

Any dirt that is removed must not penetrate adjacent system components. Remove dirt and dirty water carefully and dispose of them correctly.

You must comply with any special regulations regarding cleaning for use in the pharmaceuticals or food industries or for hospitals.

Cleaning the heater

WARNING!

Risk of injury caused by hot surfaces!

The surfaces of the heater can heat up to 100 °C during operation. Skin contact with hot surfaces causes severe skin burns.

– Wear heat-resistant protective work closing and protective gloves when carrying out all work in the vicinity of hot surfaces.
– Before all work, make sure that all surfaces have cooled down to the ambient temperature.

CAUTION!

Danger of injury at sharp edges, sharp corners and thin sheet metal parts!

Sharp edges, sharp corners and thin sheet metal parts of the heater may cause cuts or grazes.

– Be careful when carrying out work on the heater.
– Wear protective gloves, safety shoes and a hard hat.

Clean the heater when installed and only pull it out if it is not accessible.

During cleaning, you must ensure that:

- only water, compressed air or a vacuum cleaner are used,
- no high-pressure cleaner or high-pressure steam cleaner is used,
- the air control blades do not become bent,
- only cleaning agents with a pH value between 7 and 9 are used, as required,
- dirt does not penetrate adjacent system components,
- dirt and dirty water is carefully removed and
- dirt and dirty water is disposed of correctly.

Cleaning the cooler

WARNING!

Risk of injury due to cold surfaces!

The surfaces of the cooler can cool down to -20 °C during operation. Skin contact with cold surfaces causes frostbite.

– Wear cold-resistant protective work clothing and protective gloves when carrying out all work in the vicinity of cold surfaces.
– Before all work, make sure that all surfaces have warmed up to the ambient temperature.

CAUTION!

Danger of injury at sharp edges, sharp corners and thin sheet metal parts!

Sharp edges, sharp corners and thin sheet metal parts of the cooler may cause cuts or grazes.

– Be careful when carrying out work on the cooler.
– Wear protective gloves, safety shoes and a hard hat.

Clean the cooler when installed and only pull it out if it is not accessible.

During cleaning, you must ensure that:

- only water, compressed air or a vacuum cleaner are used,
- no high-pressure cleaner or high-pressure steam cleaner is used,
- the air control blades do not become bent,
- only cleaning agents with a pH value between 7 and 9 are used, as required,
- dirt does not penetrate adjacent system components,
- dirt and dirty water is carefully removed and
- dirt and dirty water is disposed of correctly.

Cleaning the rotary heat exchanger

CAUTION!

Danger of injury at sharp edges, sharp corners and thin sheet metal parts!

Sharp edges, sharp corners and thin sheet metal parts of the rotary heat exchanger may cause cuts or grazes.

– Be careful when carrying out work on the rotary heat exchanger.
– Wear protective gloves, safety shoes and a hard hat.

If the rotary heat exchanger has been idle for 14 days or more, clean it when installed and only dismantle it if it is not accessible.

During cleaning, you must ensure that:

- only water, compressed air or a vacuum cleaner are used,
- no high-pressure cleaner or high-pressure steam cleaner is used,
- the air control blades do not become bent,
- only cleaning agents with a pH value between 7 and 9 are used, as required,
- dirt does not penetrate adjacent system components,
- dirt and dirty water is carefully removed and
- dirt and dirty water is disposed of correctly.

Cleaning the plate heat exchanger

CAUTION!

Danger of injury at sharp edges, sharp corners and thin sheet metal parts!

Sharp edges, sharp corners and thin sheet metal parts of the plate heat exchanger may cause cuts or grazes.

– Be careful when carrying out work on the plate heat exchanger.
– Wear protective gloves, safety shoes and a hard hat.

Clean the plate heat exchanger when installed and only dismantle it if it is not accessible.

During cleaning, you must ensure that:

- only water, compressed air or a vacuum cleaner are used,
- no high-pressure cleaner or high-pressure steam cleaner is used,
- air or water jets are only directed at the surfaces at a 90° angle,
- the air control blades do not become bent,
- only cleaning agents with a pH value between 7 and 9 are used, as required,
- dirt does not penetrate adjacent system components,
- dirt and dirty water is carefully removed and
- dirt and dirty water is disposed of correctly.

4.4.4 Replacing the filter element

Missing filter element

CAUTION!

Danger due to missing filter element!

Operating the unit without a filter element allows dirt and germs to circulated in the building through the air handling unit. This can result in personal injuries.

– Never operate the air handling unit without a filter element.
– Always ensure you have enough filter elements.

Replacing filter elements with clips

Personnel:

- Properly trained person

Protective equipment:

- Safety harness
- Industrial safety helmet
- Safety shoes
- Protective gloves

1. Switch off the air handling unit and secure it against restarting, *Chapter 1.5 'Securing against restarting' on page 9*.
2. Open the filter unit inspection access doors on the dust side, .

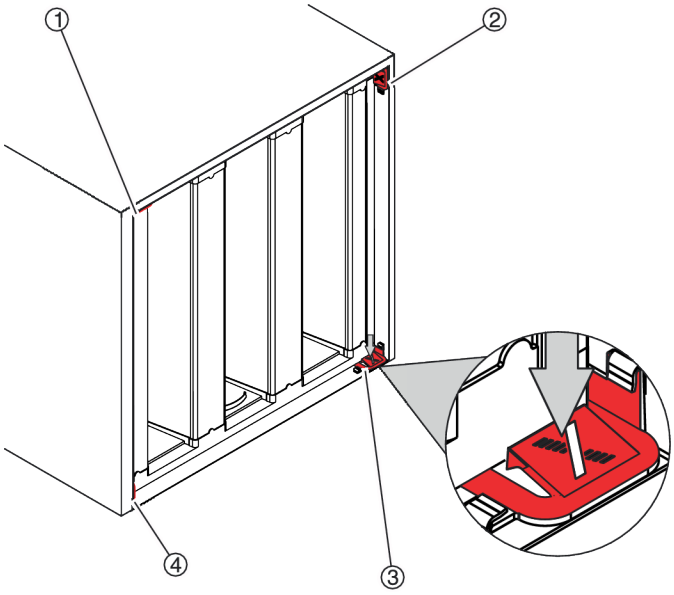

Fig. 19: Loosening the clips

3. Press down the clips (Fig. 19/1 to 4) in the corners one after the other.

   ⇨ The fastening for the filter element is released.

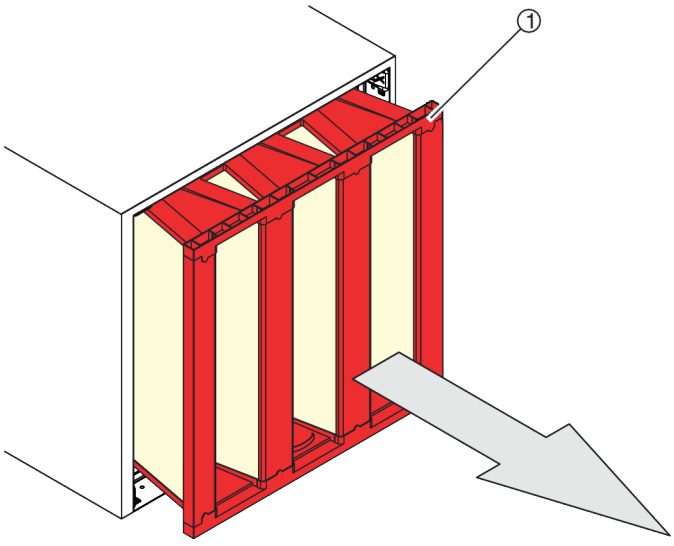

Fig. 20: Pulling out the filter element

4. Pull out the filter element (Fig. 20/1).

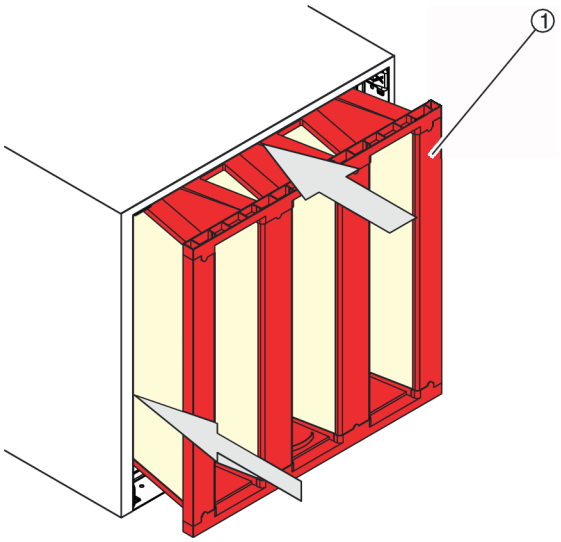

Fig. 21: Sliding in the filter element

5. Insert a new filter element.

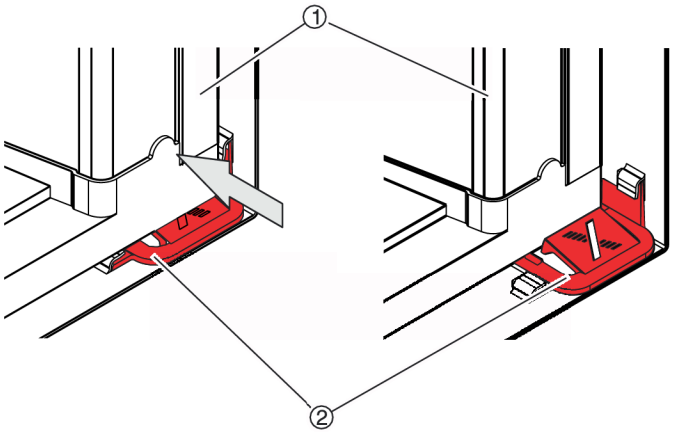

Fig. 22: Securing the filter element

6. Slide the filter element (Fig. 22/1) in further over the clips (Fig. 22/2) until the filter element clicks into place.

   ⇨ The filter element is secured in the air handling unit.

7. Close the inspection access doors.
8. Perform offset calibration on the pressure monitor, *Appendix 'Offset calibration' on page 57*.
9. Prepare to restart the unit, *'Before switching on' on page 23*.
10. Remove the padlock from the main switch.
11. Restart the air handling unit, *'RLT-Gerät am Hauptschalter einschalten' on page 24*.
12. If necessary, set the new filter element in the software (provided by others) of the on-site central building management system.

Replacing filter elements with slides

Personnel:

- Properly trained person

Protective equipment:

- Safety harness
- Industrial safety helmet
- Safety shoes
- Protective gloves

Special tool:

- TROX special key

1. Switch off the air handling unit and secure it against restarting, *Chapter 1.5 'Securing against restarting' on page 9*.
2. Open the filter unit inspection access doors, .

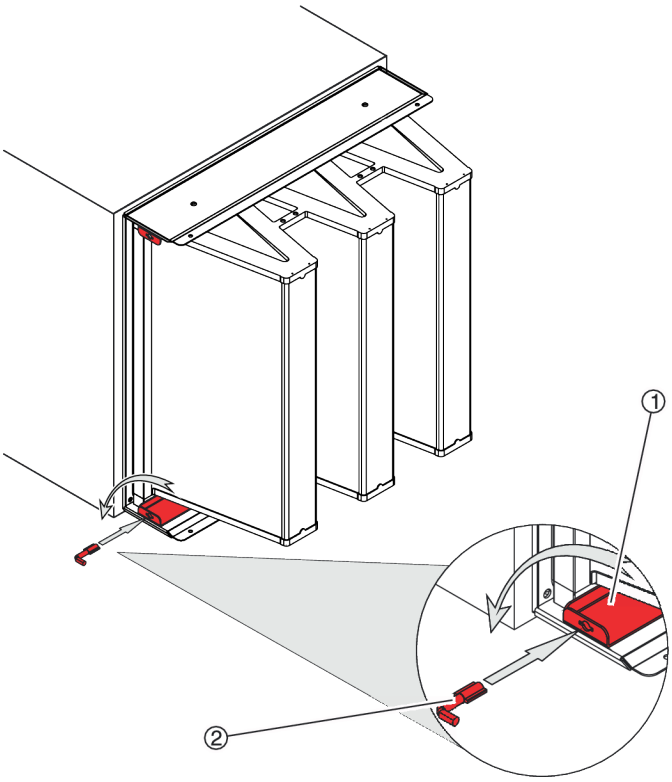

Fig. 23: Inserting the special key

3. Insert the special key (Fig. 23/2) in the opening provided in the clamping rail (Fig. 23/1) and turn it 90° anticlockwise.

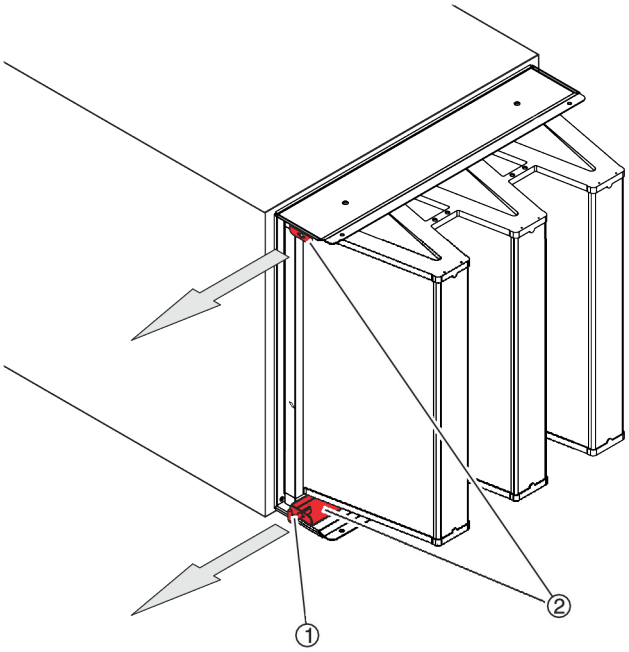

Fig. 24: Releasing the clamping rails

4. Use the special key (Fig. 24/1) to pull out the clamping rails (Fig. 24/2) as far as they will go.

   ⇨ The filter element is released.

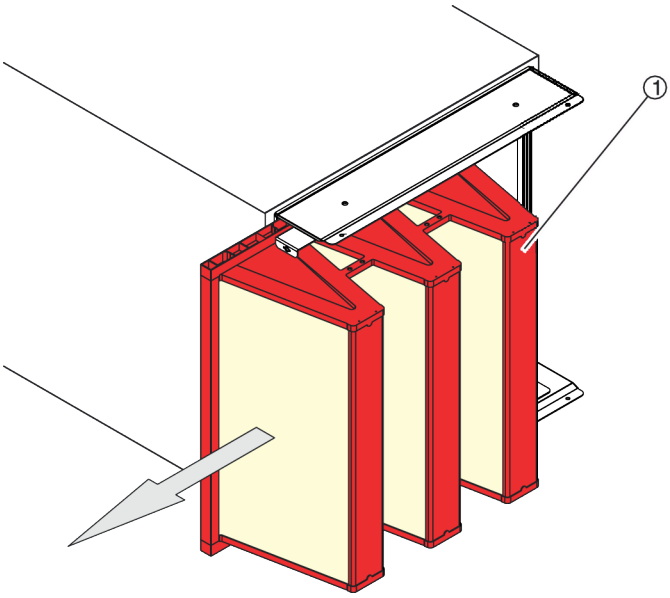

Fig. 25: Pulling out the filter element

5. Pull out the filter element (Fig. 25/1) sideways.

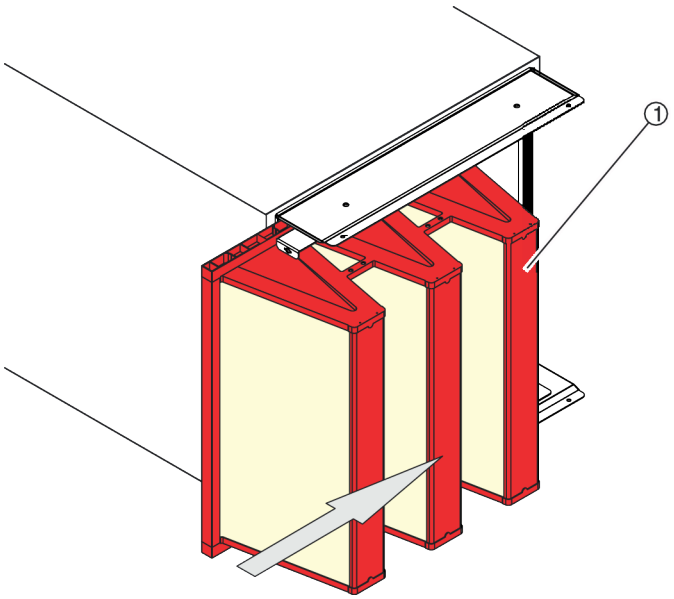

Fig. 26: Sliding in the filter element

6. Slide the filter element (Fig. 26/1) into the air handling unit from the side.

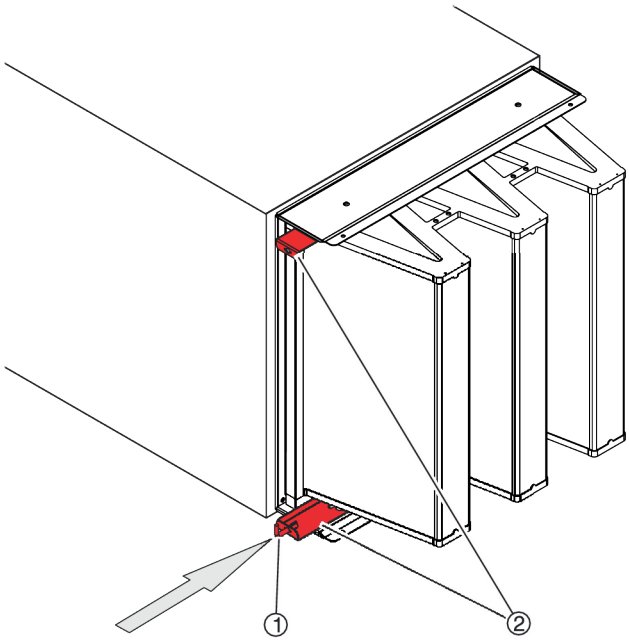

Fig. 27: Retracting the clamping rails

7. Use the special key (Fig. 27/1) to slide the clamping rails (Fig. 27/2) in as far as they will go.

   ⇨ The filter element is secured.

8. Close the inspection access doors.
9. Perform offset calibration on the pressure monitor, *Appendix 'Offset calibration' on page 57*.
10. Prepare to restart the unit, *'Before switching on' on page 23*.
11. Remove the padlock from the main switch.
12. Restart the air handling unit, *'RLT-Gerät am Hauptschalter einschalten' on page 24*.
13. If necessary, set the new filter element in the software (provided by others) of the on-site central building management system.

4.5 Nach der Wartung

Personnel:

- Properly trained person

1. Wiedereinschalten vorbereiten, *'Before switching on' on page 23*.
2. Das Vorhängeschloss vom Hauptschalter entfernen.
3. Das RLT-Gerät wieder einschalten, *'RLT-Gerät am Hauptschalter einschalten' on page 24*.

5 Störungen

5.1 Sicherheitshinweise zur Störungsbehebung

Improper troubleshooting work

⚠ WARNING!

Risk of injury due to improper troubleshooting!

Improper troubleshooting work can cause serious injuries and considerable property damage.

- Before performing maintenance work, switch off the air handling unit and secure against restarting.
- Always have faults rectified by the personnel stated in the fault table.
- Before starting the work, ensure there is enough space to complete the assembly work.
- Ensure that the assembly site is tidy and clean. Components and tools that are loosely stacked or left lying around can cause accidents.
- Before recommissioning, ensure the following:
  - all troubleshooting work has been performed and completed in accordance with the information and instructions provided in this manual
  - there are no persons in the air handling unit
  - all inspection access doors and covers have been closed
  - all safety equipment has been installed and functions correctly.

Rotating parts on the fan

⚠ WARNING!

Risk of injury due to rotating parts!

Rotating parts in the fan can cause severe injuries.

- Never reach into the moving fan wheel or tamper with the fan wheel.
- Never open covers or maintenance ports during operation.
- Make sure that the fan wheel is inaccessible during operation.
- Observe the stopping time: look through the inspection window to ensure that none of the parts are moving before opening the inspection access doors.
- Switch off the system before working on moving fan parts and secure the system against restarting. Wait until all parts have come to a stop.

  Switch off the air handling unit before working on moving fan parts and secure the unit against restarting, ☞ *Chapter 1.5 'Securing against restarting' on page 9*. Wait until all parts have come to a stop.

5.2 Störungsanzeigen am RLT-Gerät

Differential pressure measuring devices

The differential pressure on the pressure gauge can be read from the air handling unit, ☞ *'Analogue differential pressure gauge' on page 22*. A fault is present if the maximum permissible differential pressure is exceeded.

The maximum permissible differential pressure is printed on the filter label on the inspection access door.

5.3 Fault table

Fault description	Cause	Remedy	Personnel
No air is being supplied to the room air conditioning system.	Fan in fan array is not functioning correctly.	In this order: ■ Switch off the air handling unit and secure it against restarting, *Chapter 1.5 'Securing against restarting' on page 9*. ■ Cover the fan by inserting a baffle. ■ Shut off the pressure measurement hose for measuring the volume flow rate at the fan nozzle. ■ Cover the pressure tap on the inside of the inlet nozzle with adhesive strips. ■ Contact the TROX Technical Service, *'TROX Technical Service' on page 3*.	
The yellow LED is flashing and the message *'Minor maintenance due'* appears on the display.	Steam humidifier is not functioning correctly.	In this order: ■ Carry out weekly maintenance of the steam humidifier, *'Dampfbefeuchter' on page 33*. ■ Drain steam cylinder and clean scale collector tank.	
The yellow LED is lighting up and the message *'Major maintenance due'* appears on the display.	Steam humidifier is not functioning correctly.	Carry out full maintenance on the steam humidifier, *'Dampfbefeuchter' on page 33*.	
Maximum permissible differential pressure at the filter unit is exceeded.	Filter element is contaminated.	In this order: ■ Switch off the air handling unit via the central building management system and secure it against restarting, *Chapter 1.5 'Securing against restarting' on page 9*. ■ Replace filter element, *Chapter 4.4.4 'Replacing the filter element' on page 37*.	Properly trained person
Pressure of the heat transfer medium in the on-site systems is too high/too low.	On-site systems are not functioning correctly.	In this order: ■ Switch off the air handling unit via the central building management system and secure it against restarting, *Chapter 1.5 'Securing against restarting' on page 9*. ■ Rectify faults in the on-site systems in accordance with the specifications provided by the system manufacturers.	Properly trained person

5.4 Arbeiten zur Störungsbehebung

Filterelement austauschen

Siehe: *Chapter 4.4.4 'Replacing the filter element' on page 37*

5.5 Nach der Störungsbehebung

Personnel:

- Properly trained person

1. Wiedereinschalten vorbereiten, *'Before switching on' on page 23*
2. Das Vorhängeschloss vom Hauptschalter entfernen.
3. Das RLT-Gerät wieder einschalten, *'RLT-Gerät am Hauptschalter einschalten' on page 24*.

6 Ersatzteile

6.1 Sicherheitshinweise zu Ersatzteilen

Incorrect replacement parts

⚠ WARNING!

Risk of injury due to the use of incorrect replacement parts!

The use of incorrect or defective replacement parts may cause dangers for personnel, damage, malfunctions or total failure.

– Only use original spare parts from TROX GmbH.

⚠ WARNING!

Gefahr durch unsachgemäßen Einbau von Ersatzteilen!

Durch unsachgemäßen Einbau von Ersatzteilen kann es zu gefährlichen Situationen für Personen kommen.

– Unterwiesene Personen dürfen ausschließlich die Filterelemente austauschen.
– Alle weiteren Ersatzteile werden vom Technischen Service von TROX, Elektrofachkräften und/oder Anlagenmechanikern für Sanitär-, Heizungs- und Klimatechnik eingebaut.

6.2 Ersatzteilbestellung

TROX empfiehlt, dass stets ein Filterelement auf Vorrat gehalten wird, damit das RLT-Gerät nicht abgeschaltet werden muss.

Die Ersatzteilbestellung erfolgt über den Technischen Service von TROX, ↳ *'TROX Technical Service' on page 3*.

7 Zubehör

Zubehör

TROX special key

8 Demontage und Entsorgung

8.1 Sicherheitshinweise zur Demontage und Entsorgung

Unsachgemäße Demontage

⚠ DANGER!

Lebensgefahr durch unsachgemäße Montage!

Durch unsachgemäße Montage können Gefahren für die Gesundheit bis zur Lebensgefahr und Gefährdungen der Umwelt auftreten.

- Vor Beginn der Demontage alle elektrischen Anschlussleitungen fachgerecht trennen.
  - Energieversorgung ausschließlich durch eine Elektrofachkraft trennen lassen.
  - Spannungsfreiheit feststellen.
- Vor Beginn der Demontage alle Medien fachgerecht ablassen.
  - Medienleitungen trennen.
  - Medien der fachgerechten Entsorgung zuführen.
- Für Fragen beim Rückbau die Montagehinweise in dieser Anleitung heranziehen.

  Dokumente der Komponentenhersteller beachten.
- Demontage ausschließlich durch ausgebildetes Fachpersonal durchführen lassen.
- Bei Außenaufstellung ggf. weitere persönliche Schutzausrüstung wie etwa Auffanggurt verwenden.

Unsachgemäßer Transport

⚠ WARNING!

Lebensgefahr bei unsachgemäßen Transport!

Wenn die Packstücke ohne die dafür vorgesehenen Transportvorrichtungen und -sicherungen gehoben werden oder während des Transports herunterfallen, besteht Lebensgefahr.

- Die Packstücke ausschließlich in Verwendungslage transportieren.
- Niemals unter schwebenden Lasten aufhalten.
- Niemals zusätzliche Lasten mit dem Packstück transportieren.
- Ausschließlich vorgesehene Anschlagpunkte verwenden.
- Niemals die Ver-/Entsorgungsanschlüsse weder direkt noch indirekt belasten.
- Ausschließlich geeignete und zugelassene Hebezeuge und Anschlagmittel mit ausreichender Tragfähigkeit einsetzen.
- Niemals Seile und Ketten knoten oder an scharfe Kanten anlegen.
- Transportvorrichtungen nur in vertikaler Richtung belasten.
- Sicherstellen, dass sich Seile, Gurte und Ketten nicht verdrehen.
- Die Packstücke nur mit korrekt montierten und auf festen Sitz geprüften Transportvorrichtungen und -sicherungen heben.
- Alle Türen, Klappen und Paneele fixieren und sichern.
- Die Packstücke vorsichtig ohne ruckartige Bewegungen transportieren und beim Verlassen des Arbeitsplatzes absenken.
- Transportschlaufen einmalig und nicht für dauerhafte Geräteaufhängung verwenden.
- Transportrohre einmalig und nicht für dauerhafte Geräteaufhängung verwenden.

Außermittiger Schwerpunkt

WARNING!

Verletzungsgefahr durch fallende oder kippende Packstücke!

Packstücke können einen außermittigen Schwerpunkt aufweisen. Bei falschem Anschlag kann das Packstück kippen und fallen. Durch fallende oder kippende Packstücke können schwere Verletzungen verursacht werden.

– Bei Transport mit dem Kran den Kranhaken so anschlagen, dass er sich über dem Schwerpunkt der Packstücke befindet.
– Die Packstücke vorsichtig anheben und beobachten, ob sie kippen. Falls erforderlich, den Anschlag verändern.

Sharp edges, sharp corners and thin sheet metal parts

CAUTION!

Danger of injury at sharp edges, sharp corners and thin sheet metal parts!

Sharp edges, sharp corners and thin sheet metal parts of the plate and rotary heat exchangers or of the cooling or heating coil may cause cuts or grazes.

– Be careful when working on these components.
– Wear protective gloves, safety shoes and a hard hat.

ENVIRONMENT!

Gefahr für die Umwelt durch falsche Entsorgung!

Durch falsche Entsorgung können Gefahren für die Umwelt entstehen.

– Elektroschrott, Elektronikkomponenten sowie Kühlmittel, Kältemittel, Kompressoröl und Schmierstoffe von zugelassenen Entsorgungsfachbetrieben entsorgen lassen.

8.2 Demontage

Personnel:

- HVAC technician
- Skilled qualified electrician

Protective equipment:

- Industrial safety helmet
- Protective clothing
- Hearing protection
- Protective gloves
- Safety shoes

1. ▸ Elektrische Anschlussleitungen trennen.

   Spannungsfreiheit feststellen.

2. ▸ Medien entleeren.

   Medien fachgerecht entsorgen.

3. ▸ Medienleitungen trennen.
4. ▸ Geräteverbindungen der Bauteile an den Verbindungsstellen (Modulverbinder und Grundrahmenverbinder) lösen.
5. ▸ Einzelne Gerätekomponenten entnehmen.

   Gerätekomponenten fachgerecht abtransportieren.

8.3 Entsorgung

Sofern keine Rücknahme- oder Entsorgungsvereinbarung getroffen wurde, RLT-Bauteile des zerlegten RLT-Geräts durch zugelassenen Entsorgungsfachbetrieb unter Berücksichtigung der Gefahrstoffe entsorgen lassen.

Nicht mehr benötigte Bauteile der Wiederverwertung zuführen:

- Metalle verschrotten.
- Kunststoffelemente zum Recycling geben.
- Übrige Komponenten und Abfälle nach Materialbeschaffenheit sortiert entsorgen.

Elektro- und Elektronikbauteile

Elektro- und Elektronikbauteile können gesundheits- und umweltgefährdende Stoffe enthalten, die nicht in den Haus- und Gewerbeabfall gelangen dürfen.

Da Elektro- und Elektronikbauteile außerdem Wertstoffe (z. B. Edelmetalle) enthalten können, müssen sie der Wiederverwertung bzw. der Entsorgung durch einen Entsorgungsfachbetrieb zugeführt werden.

Chemikalien

Chemikalien (Lösungsmittel, Reinigungsmittel, Medien etc.) können unterschiedliche Wirkungen auf Luft, Boden, Wasser sowie die menschliche Gesundheit haben. Unter Umständen können aus ihnen wertvolle Substanzen wiedergewonnen werden.

Chemikalien dürfen deshalb nicht in Luft, Boden, Kanalisation, Oberflächen- oder Grundwasser gelangen.

Für Verwertung oder Entsorgung ausgewiesenen Entsorgungsfachbetrieb beauftragen.

Kältemittel, R-410A

Kältemittel können giftige und umweltgefährdende Substanzen enthalten bzw. bei ihrer Freisetzung umweltgefährdende Zersetzungsprodukte entwickeln. Diese dürfen nicht in die Umwelt gelangen. Die Entsorgung muss durch einen Entsorgungsfachbetrieb erfolgen.

Kühlflüssigkeit, Glykol

Kühlflüssigkeiten können giftige und umweltgefährdende Substanzen enthalten. Sie dürfen nicht in die Umwelt gelangen. Die Entsorgung muss durch einen Entsorgungsfachbetrieb erfolgen.

Batterien

Bestandteile von Batterien sind giftig und stellen eine Gefahr für die Umwelt dar. Batterien dürfen niemals im Hausmüll entsorgt werden. Die Entsorgung von Batterien darf nur durch am Einsatzort zugelassene Fachbetriebe erfolgen.

Schmierstoffe

Schmierstoffe wie Fette und Öle enthalten giftige Substanzen. Sie dürfen nicht in die Umwelt gelangen. Die Entsorgung muss durch einen Entsorgungsfachbetrieb erfolgen.

Kompressoröl

Kompressoröl darf nicht in die Kanalisation oder Gewässer gelangen. Die Entsorgung muss durch einen Entsorgungsfachbetrieb erfolgen.

9 Technische Daten

9.1 Technisches Datenblatt

Die Gerätezeichnung und die Technischen Datenblätter wurden als Freigabedokumente übermittelt. Wir empfehlen diese Unterlagen dieser Betriebsanleitung beizufügen.

9.2 Betriebsbedingungen

Betriebsbedingungen des RLT-Geräts

Data	Value	Unit
Betriebstemperatur	-30...50	°C

9.3 CE-Konformitätserklärung

Hiermit bestätigen wir, dass das RLT-Gerät ohne Mess-Steuer-Regelungstechnik (MSR) den folgenden EU-Richtlinien entspricht.

- Maschinenrichtlinie 2006/42/EG (unvollständige Maschine)
- Richtlinie 2014/30/EG Elektromagnetische Verträglichkeit
- Richtlinie 2009/125/EG Umweltgerechte Gestaltung energieverbrauchsrelevanter Produkte
- Druckgeräterichtlinie 97/23/EG (nur bei RLT-Geräten mit integrierter Kälteanlage)

Die Richtlinie 2014/35/EG wurde hinsichtlich ihrer Schutzziele eingehalten (s. Anhang I, Nr. 1.5.1 der Richtlinie 2006/42/EG)

Die entsprechende Konformitätserklärung/Einbauerklärung befindet sich im Anhang dieser Anleitung.

Wichtige Hinweise:

- Zur Einhaltung der Richtlinie 2009/125/EG ist das Gerät mit einer geeigneten Drehzahlregelung auszustatten, wenn diese nicht im Lieferumfang enthalten ist.
- Das auf dem RLT-Gerät angebrachte CE-Zeichen gilt nicht in Bezug auf die Maschinenrichtlinie 2006/42/EG, im Sinne dieser Richtlinie ist das RLT-Geräte ohne MSR als unvollständige Maschine zu betrachten.
- Die unvollständige Maschine darf erst dann in Betrieb genommen werden, wenn gegebenenfalls festgestellt wurde, dass die Maschine, in die die unvollständige Maschine eingebaut werden soll, den Bestimmungen der Richtlinie 2006/42/EG entspricht.

10 Glossary

Exhaust air – EHA

Exhaust air (EHA) is airflow that flows outside.

Extract air – ETA

Extract air (ETA) is airflow that leaves the treated room.

ODA – Outdoor air

Outdoor air (ODA) is the untreated air that flows into the air handling unit or into an opening.

Overflow air – TRA

Room air that flows from the treated room into another treated area is referred to as overflow air.

Recirculation air – RCA

Recirculation air is extract air that is resupplied to the air handling unit for treatment and recycled as supply air.

Room air – SUP

Room air is the air in the treated room or area.

Secondary air – SEC

Secondary air is airflow that is removed from a room and resupplied to the same room after treatment.

Skilled qualified electrician

Skilled qualified electricians are trained individuals who have specialist knowledge and experience and who know the relevant standards and guidelines to be able to work on electrical systems and to recognise and avoid potential dangers.

Skilled qualified refrigeration technicians

Skilled qualified refrigeration technicians are trained in and certified for the specific sector in which they are employed and are aware of the applicable standards and conditions. Due to their specialist training and experience, skilled qualified refrigeration technicians are able to carry out work on refrigeration systems and recognise and avoid possible dangers.

Supply air – IDA

Supply air (IDA) is supply air that enters the treated room or air that enters the air handling unit after it has been treated.

Systems mechanic for sanitary engineering, heating engineering, and air conditioning

Systems mechanics for sanitary engineering, heating engineering, and air conditioning (systems mechanics) are trained for the specific sector in which they are employed and independently carry out their work in compliance with the applicable guidelines and safety regulations according to documentation and instructions. Systems mechanics have in-depth knowledge and skills in the ventilation technology sector.

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Appendix

A Konformitätserklärung

EG-Konformitätserklärung / EC declaration

im Sinne der EG-Druckgeräterichtlinie 97/23/EG, Anhang VII
of conformity according to the EU PED 97/23/EG, Annex VII

TROX® TECHNIK
The art of handling air

Hersteller: *Manufacturer:*	**TROX GmbH** Heinrich-Trox-Platz 47504 Neukirchen-Vluyn Germany
Bevollmächtigter für die Zusammenstellung der technischen Unterlagen *Person residing within the Community authorised to compile the relevant technical documentation:*	Jan Heymann, TROX GmbH Heinrich-Trox-Platz 47504 Neukirchen-Vluyn Germany
Produkt: *Product:*	**X-CUBE mit integrierter Kälteanlage**
Herstellnummer / Datum *Manufacturing number / date*	**Siehe Typenschild der Anlage** *See nameplate oft he unit*
Angewandte Konformitätsverfahren: *Applied conformity assessment procedure:*	**DGRL 97/23/EG, Kategorie II, Modul A1** *PED 97/23/EC, Category Module A1*
Benannte Stelle nach Anhang IV: *Notified Body acc. To Annex IV:*	CE 0045 **TÜV NORD Systems GmbH** Meidericher Str. 14-16 47058 Duisburg
Zertifakt Nr. *Certificate-No.*	**07 202 1411 Z 0152 / 14 / D /**

Hiermit erklären wir, dass das oben genannte Produkt allen einschlägigen Bestimmungen der folgenden EG-Richlinien entspricht:
It is expressly declared that the product fulfils all relevant provisions of the following EU Directives:

- **Druckgeräterichtlinie 97/23/EG**
  EU Pressure Equipment Directive 97/23/EG
- **Maschinenrichtlinie 2006/42/EG**
  Machinery Directive 2006/42/EC
- **Richtlinie 2014/30/EG Elektromagnetische Verträglichkeit**
  Directive 2014/30/EC Electromagnetic Compatibility
- **Richtlinie 2009/125/EG Umweltgerechte Gestaltung energieverbrauchsrelevanter Produkte**
  Directive 2009/125/EC Ecodesign requirements for energy-related products

Angewandte harmonisierte Normen:
Applied harmonized standards

- **EN 378-1 bis 4, Kälteanlagen und Wärmepumpen**
  EN 378-1 to 4, Refrigerating systems and heat pumps
- **EN ISO 12100, Sicherheit von Maschinen**
  EN ISO 12100, Machinery safety
- **EN ISO 13857, Sicherheitsabstände gegen Berührung**
  EN ISO 13857, Safety distances
- **EN 60204-1, Elektrische Ausrüstung von Maschinen**
  EN 60204-1, Electrical equipment of machinery
- **EN 61000-6-1, Störfestigkeit**
  EN 61000-6-1, Electromagnetic Compatibility, Immunity for residential, commercial and light-industrial environments
- **EN 61000-6-2, Störfestigkeit**
  EN 61000-6-2, Electromagnetic Compatibility, Immunity standard for industrial environments
- **EN 61000-6-3, Störaussendung**
  EN 61000-6-3, Electromagnetic Compatibility, Emission standard for residential, commercial and light-industrial environments
- **EN 61000-6-4, Störaussendung**
  EN 61000-6-4, Electromagnetic Compatibility, Emission standard for industrial environments

Bei einer nicht mit uns abgestimmten Änderung der Maschine/Baugruppe verliert diese EG-Konformitätserklärung ihre Gültigkeit.
This declaration of EC conformity shall become null and void when the maschine/modul is subjected to any modification that has not met with our approval.

Die Inbetriebnahme ist so lange untersagt bis festgestellt wurde, dass die Maschine, in die diese Maschine eingebaut werden soll, den Bestimmungen der Maschinenrichtlinie 2006/42/EG entspricht.
The machinery must not be put into service until the machinery into which it is to be incorporated, has been declared in conformity with the provisions of the Directive 2006/42/EC

Neukirchen-Vluyn, 28.01.2016

i.V. Heymann

Jan Heymann
CE-Beauftragter, TROX GmbH

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B Einbauerklärung

Einbauerklärung

im Sinne der EG-Maschinenrichtlinie 2006/42/EG, Anh. II 1. B
für unvollständige Maschinen

TROX® TECHNIK
The art of handling air

Hersteller
TROX GmbH
Heinrich-Trox-Platz
D - 47504 Neukirchen-Vluyn

In der Gemeinschaft ansässige Person, die bevollmächtigt ist, die relevanten technischen Unterlagen zusammenzustellen
Jan Heymann, TROX GmbH

Beschreibung und Identifizierung der unvollständigen Maschine

Produkt / Erzeugnis	RLT-Gerät für Zu- und Abluft
Typ	X-CUBE (ohne Mess-Steuer-Regelungstechnik)
Funktion	Behandlung und Aufbereitung von Luft zur Belüftung von Gebäuden Hinweis: Zur Einhaltung der Richtlinie 2009/125/EG ist das Gerät mit einer geeigneten Drehzahlregelung auszustatten, wenn diese nicht im Lieferumfang enthalten ist.

Es wird erklärt, dass die folgenden grundlegenden Anforderungen der Maschinenrichtlinie 2006/42/EG erfüllt sind.

1.3., 1.3.3, 1.3.4, 1.3.7, 1.3.8, 1.3.9, 1.5.3, 1.5.14, 1.6.1, 1.6.3, 1.5.1

Ferner wird erklärt, dass die speziellen technischen Unterlagen gemäß Anhang VII Teil B erstellt wurden.

Es wird ausdrücklich erklärt, dass die unvollständige Maschine allen einschlägigen Bestimmungen der folgenden EG-Richtlinien entspricht.

2006/42/EG	Richtlinie 2006/42/EG des Europäischen Parlaments und des Rates vom 17. Mai 2006 über Maschinen und zur Änderung der Richtlinie 95/16/EG (Neufassung) (1)
2009/125/EG	Richtlinie 2009/125/EG des Europäischen Parlaments und des Rates vom 21. Oktober 2009 zur Schaffung eines Rahmens für die Festlegung von Anforderungen an die umweltgerechte Gestaltung energieverbrauchsrelevanter Produkte (Neufassung)
2014/30/EU	Richtlinie 2014/30/EU des Europäischen Parlaments und des Rates vom 26. Februar 2014 zur Harmonisierung der Rechtsvorschriften der Mitgliedstaaten über die elektromagnetische Verträglichkeit (Neufassung)

Fundstelle der angewandten harmonisierten Normen entsprechend Artikel 7 Absatz 2

EN ISO 12100:2010-11	Sicherheit von Maschinen - Allgemeine Gestaltungsleitsätze - Risikobewertung und Risikominderung (ISO 12100:2010)
EN ISO 13857:2008	Sicherheit von Maschinen - Sicherheitsabstände gegen das Erreichen von Gefährdungsbereichen mit den oberen und unteren Gliedmaßen (ISO 13857:2008)
EN 60204-1:2006/A1	Sicherheit von Maschinen - Elektrische Ausrüstung von Maschinen - Teil 1: Allgemeine Anforderungen (IEC 60204-1:2005)
EN 1037:1995+A1	Sicherheit von Maschinen - Vermeidung von unerwartetem Anlauf

Der Hersteller bzw. der Bevollmächtigte verpflichten sich, einzelstaatlichen Stellen auf begründetes Verlangen die speziellen Unterlagen zu der unvollständigen Maschine zu übermitteln. Diese Übermittlung erfolgt
per Post

Die gewerblichen Schutzrechte bleiben hiervon unberührt!

Wichtiger Hinweis! Die unvollständige Maschine darf erst dann in Betrieb genommen werden, wenn gegebenenfalls festgestellt wurde, dass die Maschine, in die die unvollständige Maschine eingebaut werden soll, den Bestimmungen dieser Richtlinie entspricht.

Neukirchen-Vluyn, 28.01.2016

i.V. Heymann

Jan Heymann
CE-Beauftragter

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C Zulieferdokumente

C.1 Offset calibration

Name	Data
Designation	TROX MD
Type	Pressure monitor
Number	
Type of manual	Manual
Manufacturer	

Nullpunktaufnahme / *Zero offset adjustment*

Serie MD - Digitaler Druckwächter /
Type MD - Digital pressure monitor

Entfernen Sie die Messschläuche /
Remove the measuring tubes

Bitte halten Sie das Gerät vor sich und gleichen die folgende Tastenbelegung ab **(Tasten sind auf dem Gerät nicht mit den Zahlen versehen)**:

Please hold the device in front of you and match the assignment of keys as below ***(the keys are not equipped with numbers)****:*

Drücken Sie die Tasten hintereinander in folgender Reihenfolge:

1 2 2 3 1 3 4

Das Display zeigt nun **"Hysterese 50 Pa"**

Drücken Sie die folgenden Tasten:

2 2

Das Display zeigt **"Offset-Kalibration"**

Drücken Sie die folgende Taste:

4

Der Wert wird ***invertiert*** angezeigt

Drücken Sie die folgende Taste:

1

Die Nullpunkteinstellung erfolgt

Nach einigen Sekunden ist der Druckwächter bereit für den Einsatz

Press the keys one after another in the prescribed order:

1 2 2 3 1 3 4

*The display shows "**Hysterese 50 Pa**"*

Press the keys as follows:

2 2

*The display shows "**Offset -Kalibration**"*

Press the keys as follows:

4

The value is shown ***inverted***

Press the keys as follows:

1

The zero offset adjustment takes place

After a few seconds the digital pressure monitor is ready for use

C.2 Damper actuator Belimo GM24A-SR

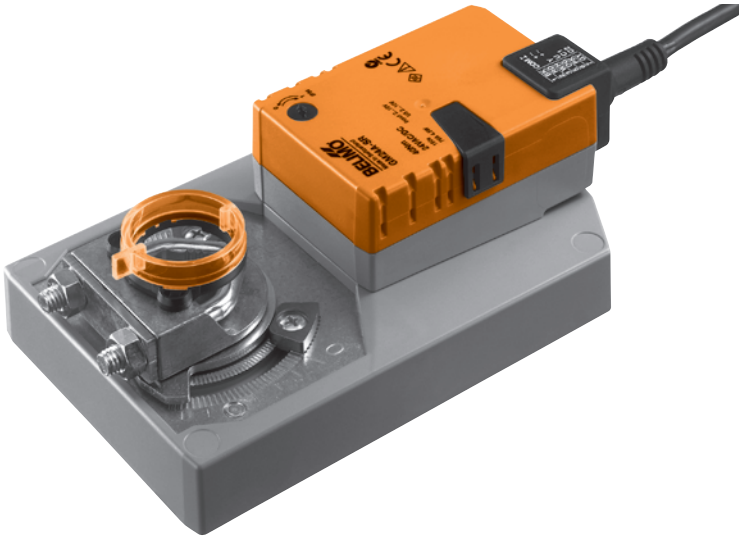
Name	Data
Designation	Belimo GM24A-SR
Type	Damper actuator
Number	
Type of manual	Technical data sheet
Manufacturer	

BELIMO

Technical data sheet GM24A-SR

Modulating damper actuator for operating air control dampers in ventilation and air-conditioning systems for building services installations

- **For air control dampers up to approx. 8 m²**
- **Torque 40 Nm**
- **Nominal voltage AC/DC 24 V**
- **Control: modulating DC 0 ... 10 V, position feedback DC 2 ... 10 V**



Technical data

Electrical data	Nominal voltage		AC 24 V, 50/60 Hz DC 24 V
	Nominal voltage range		AC/DC 19.2 ... 28.8 V
	Power consumption	In operation	4.5 W @ nominal torque
		At rest	2 W
		For wire sizing	6.5 VA
	Connection		Cable 1 m, 4 x 0.75 mm²
Functional data	Torque (nominal torque)		Min. 40 Nm @ nominal voltage
	Control	Control signal Y	DC 0 ... 10 V, typical input impedance 100 kΩ
		Operating range	DC 2 ... 10 V
	Position feedback (Measuring voltage U)		DC 2 ... 10 V, max. 1 mA
	Posotion accuracy		±5%
	Direction of rotation		Reversible with switch 0 / 1
	Direction of rotation at Y = 0 V		bei Schalterstellung 0 ↶ or 1 ↷
	Manual override		Gearing latch disengaged with pushbutton, detentable
	Angle of rotation		Max. 95°∢, limited on both sides by means of adjustable, mechanical end stops
	Running time		150 s / 90°∢
	Sound power level		Max. 45 dB (A)
	Position indication		Mechanical, pluggable
Safety	Protection class		**III** Safety extra-low voltage
	Degree of protection		IP54 in any mounting position
	EMC		CE according to 89/336/EEC
	Mode of operation		Type 1 (EN 60730-1)
	Rated impulse voltage		0.8 kV (EN 60730-1)
	Control pollution degree		3 (EN 60730-1)
	Ambient temperature range		–30 ... +50°C
	Non-operating temperature		–40 ... +80°C
	Ambient humidity range		95% r.H., non-condensating (EN 60730-1)
	Maintenance		Maintenance-free
Dimensions / Weight	Dimensions		See «Dimensions» on page 2
	Weight		Approx. 1'700 g

Safety notes

⚠

- **The damper actuator is not allowed to be used outside the specified field of application, especially in aircraft or any other form of air transport.**
- **Assembly must be carried out by trained personnel. Any legal regulations or regulations issued by authorities must be observed during assembly.**
- **The device may only be opened at the manufacturer's site. It does not contain any parts that can be replaced or repaired by the user.**
- **The cable must not be removed from the device.**
- **When calculating the required torque, the specifications supplied by the damper manufacturers (cross section, design, installation site), and the air flow conditions must be observed.**

Safety notes

(Continue)

- **The device contains electrical and electronic components and is not allowed to be disposed of as household refuse. All locally valid regulations and requirements must be observed.**

Product features

Mode of operation
The actuator is controlled by means of a standard control signal DC 0 ... 10 V. It opens to the position dictated by this signal. The measuring voltage U allows the damper position (0 ... 100%) to be electrically indicated and serves as a follow-up control signal for other actuators.

Simple direct mounting
Simple direct mounting on the damper spindle with a universal spindle clamp, supplied with an anti-rotation strap to prevent the actuator from rotating.

Manual override
Manual operation is possible with the pushbutton (the gearing latch remains disengaged as long as the pushbutton is pressed or detented).

Adjustable angle of rotation
Adjustable angle of rotation with mechanical end stops.

High functional reliability
The actuator is overload-proof, requires no limit switches and automatically stops when the end stop is reached.

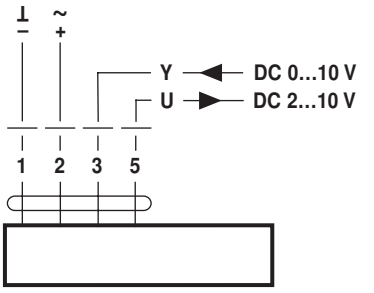
Accessories

	Description	Data sheet
Electrical accessories	Auxiliary switch, type S..A..	T2 - S..A..
	Feedback potentiometer, type P..A..	T2 - P..A..
	Range controller, type SBG24	T2 - SBG24
	Positioner, type SG..24	T2 - SG..24
	Digital position indication, type ZAD24	T2 - ZAD24
Mechnical accessories	Various accessories (Damper and actuator crank arms, anti-rotation strap etc.)	T2 - Z-GM..A..

Electrical installation

Wiring diagram

Notes
- Connection via safety isolating transformer.
- Other actuators can be connected in parallel. Please note the performance data.

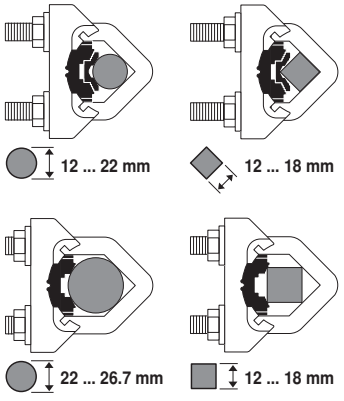


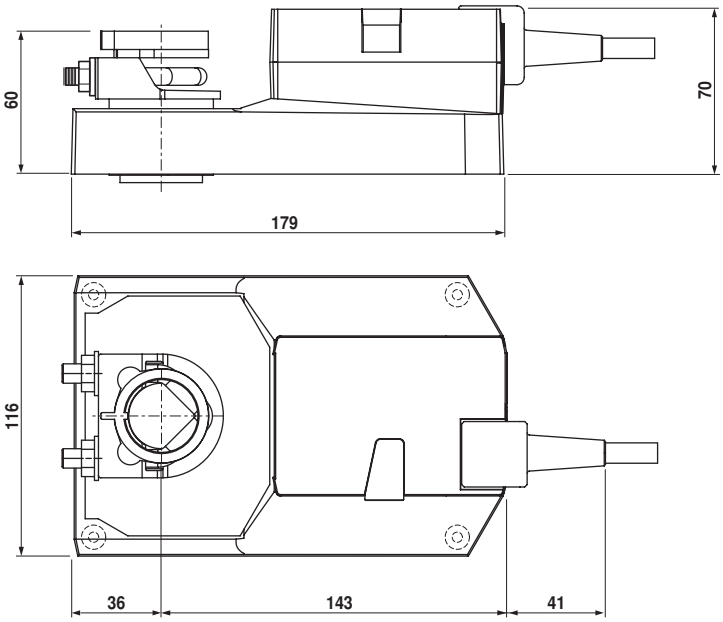
Cable colours:
1 = black
2 = red
3 = white
5 = orange

Dimensions [mm]

Dimensional drawings

Damper spindle	Length			
	>52	12 ... 26.7	>12	<25.2
	>20	12 ... 26.7	>12	<25.2





70214-00007.H

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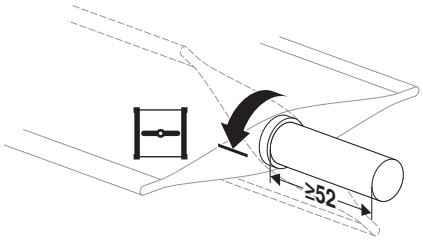

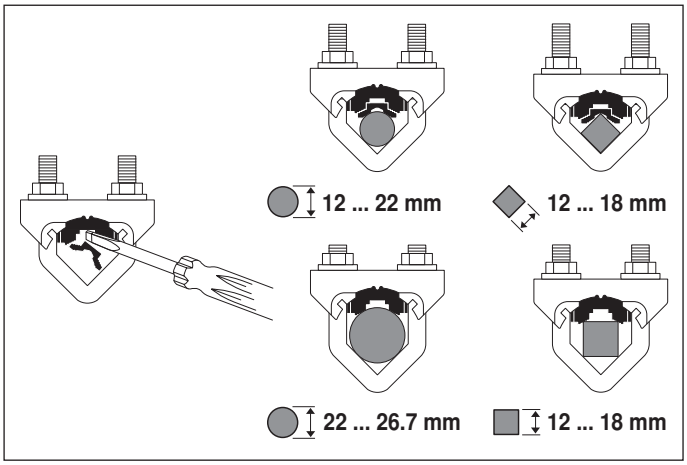

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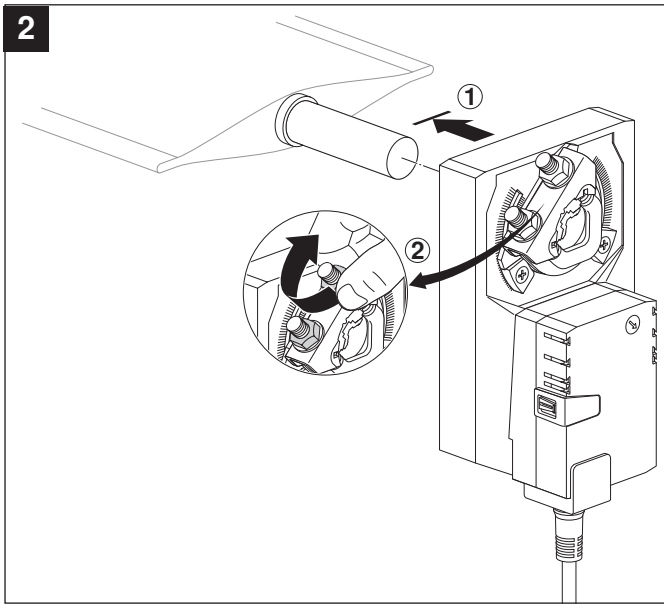

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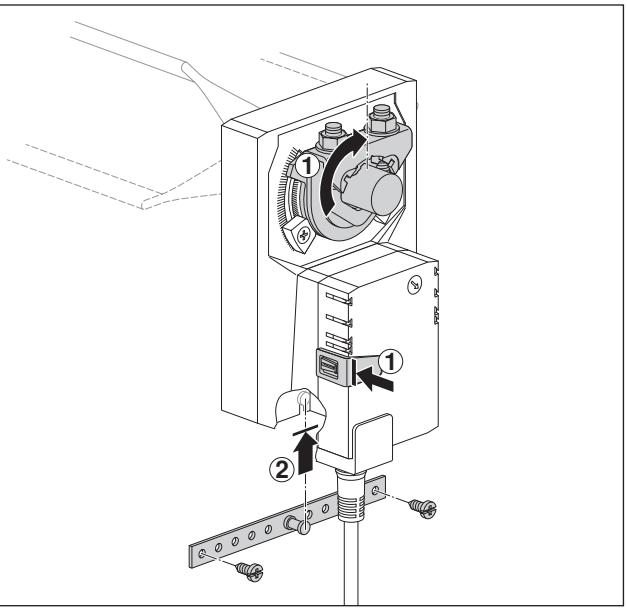

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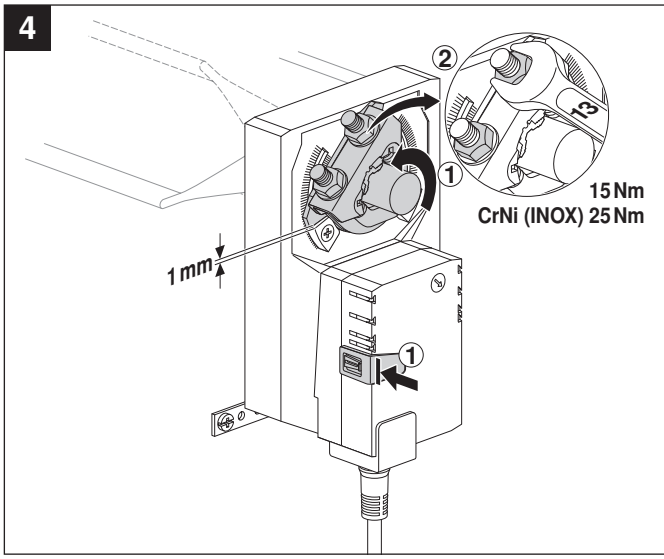

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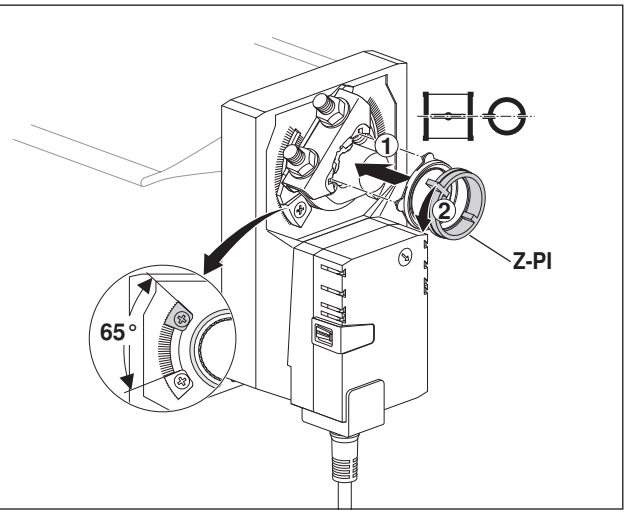
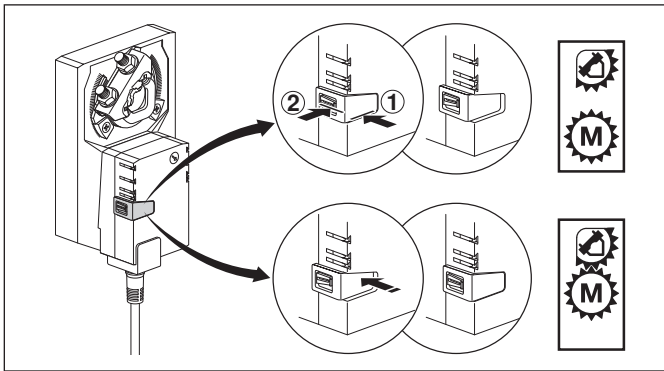
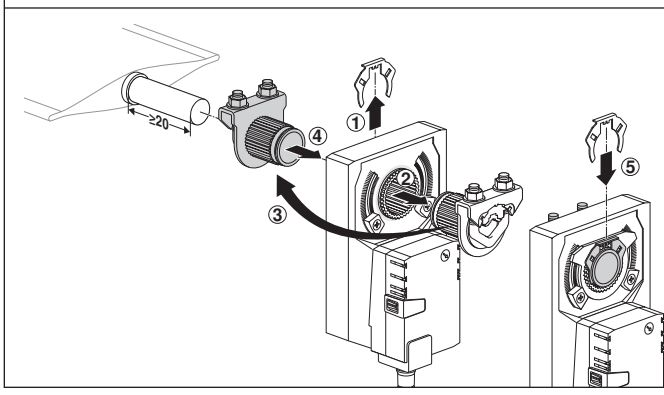
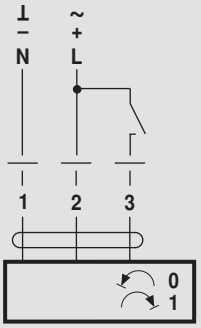
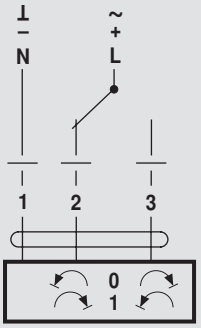


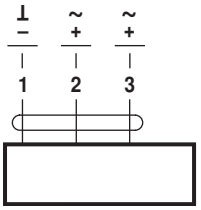






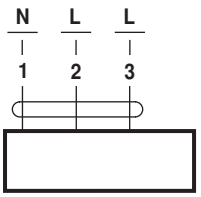


AC 24 V / DC 24 V

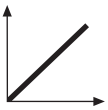


GM24A..

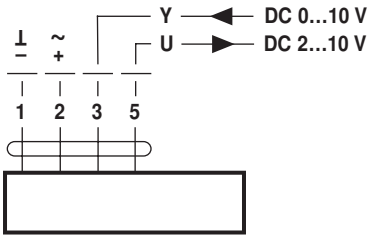
AC 100 ... 240 V ⚠



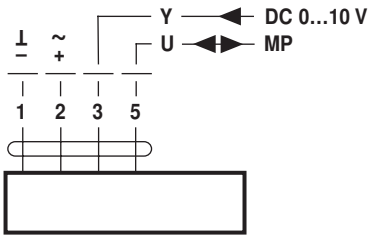
GM230A..



AC 24 V / DC 24 V

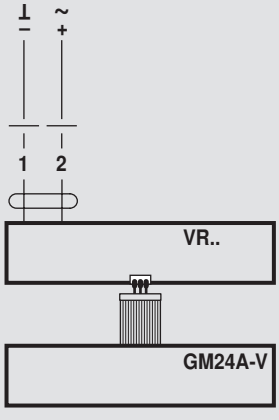


GM24A-SR..
GM24A-MF..



GM24A-MP..

AC 24 V / DC 24 V
(GM24A-V / VR..)



GM24A-V / VR..

C.3 Damper actuator Belimo NM24A-SR

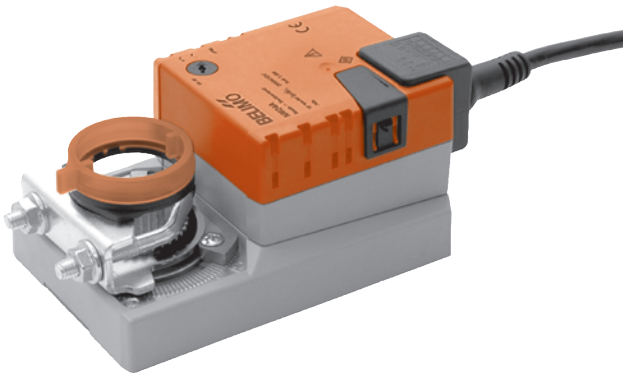
Name	Data
Designation	Belimo NM24A-SR
Type	Damper actuator
Number	
Type of manual	Technical data sheet
Manufacturer	

BELIMO

Technical data sheet Damper actuator NM24A-SR

Damper actuator for operating air control dampers in ventilation and air-conditioning systems for building services installations

- **For air control dampers up to approx. 2 m²**
- **Torque 10 Nm**
- **Nominal voltage AC/DC 24 V**
- **Control: modulating DC 0 ... 10 V, position feedback DC 2 ... 10 V**



Technische Daten

Electrical data	Nominal voltage		AC 24 V, 50/60 Hz DC 24 V
	Nominal voltage range		AC/DC 19.2 ... 28.8 V
	Power consumption	In operation	2 W @ nominal torque
		At rest	0.4 W
		For wire sizing	4 VA
	Connection		Cable 1 m, 4 x 0.75 mm²
Functional data	Torque (nominal torque)		Min. 10 Nm @ nominal voltage
	Control	Control signal Y	DC 0 ... 10 V, typical input impedance 100 kΩ
		Working range	DC 2 ... 10 V
	Position feedback (Measuring voltage)		DC 2 ... 10 V, max. 1 mA
	Position accuracy		±5%
	Direction of rotation		Reversible with switch 0 / 1
	Direction of rotation at Y = 0 V		at switch position 0 ↶ resp. 1 ↷
	Manual override		Gearing latch disengaged with pushbutton, self-resetting
	Angle of rotation		Max. 95°∢, limited on both sides by means of adjustable, mechanical end stops
	Running time		150 s
	Sound power level		Max. 35 dB (A)
	Position indication		Mechanical, pluggable
Safety	Protection class		**III** Safety extra-low voltage
	Degree of protection		IP54 in any mounting position
	EMC		CE according to 89/336/EEC
	Mode of operation		Type 1 (to EN 60730-1)
	Ambient temperature range		–30 ... +50°C
	Non-operating temperature		–40 ... +80°C
	Ambient humidity range		95% r.H., non-condensating (EN 60730-1)
	Maintenance		Maintenance-free
Dimensions / Weight	Dimensions		See «Dimensions» on page 2
	Weight		Approx. 800 g

Safety notes

⚠

- **The damper actuator is not allowed to be used outside the specified field of application, especially in aircraft or any other form of air transport.**
- **Assembly must be carried out by trained personnel. Any legal regulations or regulations issued by authorities must be observed during assembly.**
- **The device may only be opened at the manufacturer's site. It does not contain any parts that can be replaced or repaired by the user.**
- **The cable must not be removed from the device.**
- **When calculating the required torque, the specifications supplied by the damper manufacturers (cross section, design, installation site), and the air flow conditions must be observed.**
- **The device contains electrical and electronic components and is not allowed to be disposed of as household refuse. All locally valid regulations and requirements must be observed.**

Product features

Mode of operation
The actuator is controlled by means of a standard control signal DC 0 ... 10 V. It opens to the position dictated by this signal. The measuring voltage U allows the damper position (0 ... 100%) to be electrically indicated and serves as a follow-up control signal for other actuators.

Simple direct mounting
Simple direct mounting on the damper spindle with a universal spindle clamp, supplied with an anti-rotation strap to prevent the actuator from rotating.

Manual override
Manual operation is possible with the self-resetting pushbutton (the gearing latch remains disengaged as long as the pushbutton is pressed).

Adjustable angle of rotation
Adjustable angle of rotation with mechanical end stops.

High functional reliability
The actuator is overload-proof, requires no limit switches and automatically stops when the end stop is reached.

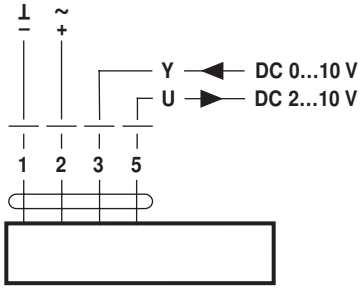
Accessories

	Description	Data sheet
Electrical accessories	Auxiliary switch S..A..	T2 - S..A..
	Feedback potentiometer P..A..	T2 - P..A..
	Range controller SBG24	T2 - SBG24
	Positioner SG..24	T2 - SG..24
	Digital position indication ZAD24	T2 - ZAD24
Mechanical accessories	Various accessories (clamps, shaft extensions etc.)	T2 - Z-NM..A..

Electrical installation

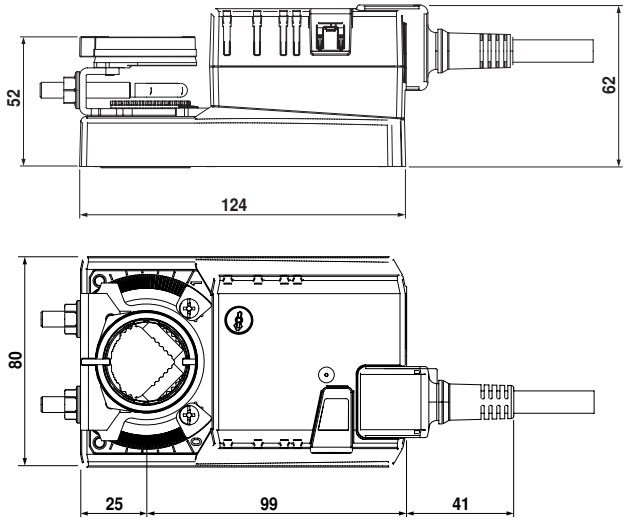
Wiring diagrams

Notes
- Connection via safety isolating transformer.
- Other actuators can be connected in parallel. Please note the performance data.



Dimensions [mm]

Dimensional drawings

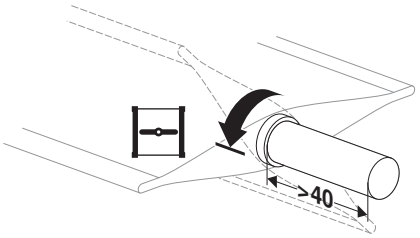


Damper spindle	Length	○I◇
Clamp on top	min. 40	8 ... 26.7
Clamp on bottom *	min. 20	8 ... 20

* Option (Accessory K-NA)

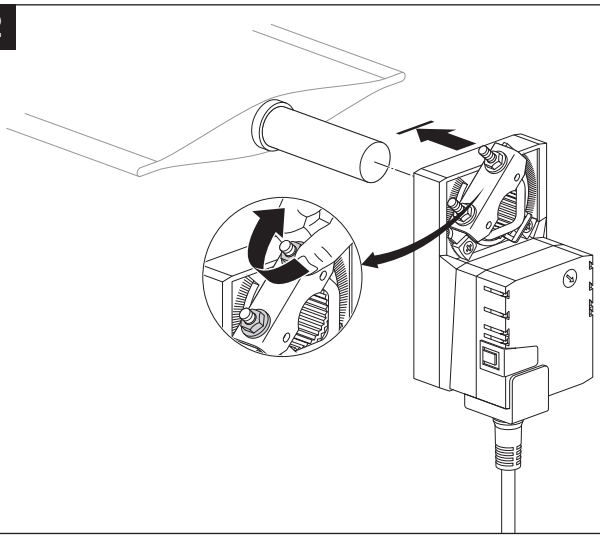
70214-00002.D

1



8 ... 26.7	> 8	< 26.7

2



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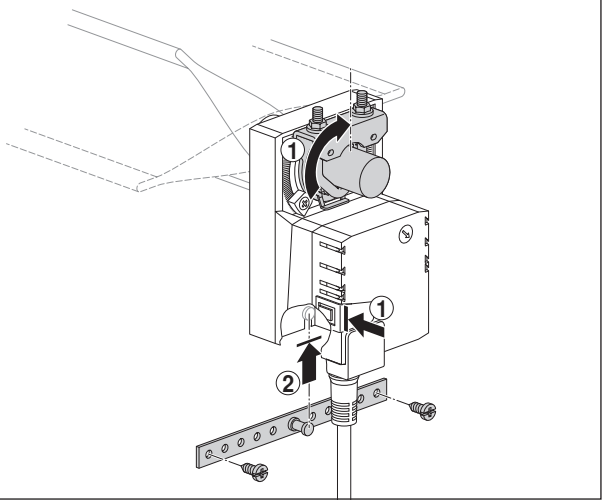

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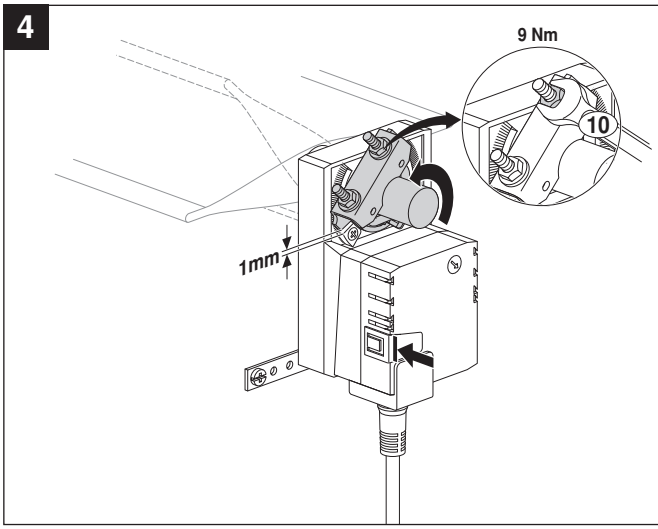

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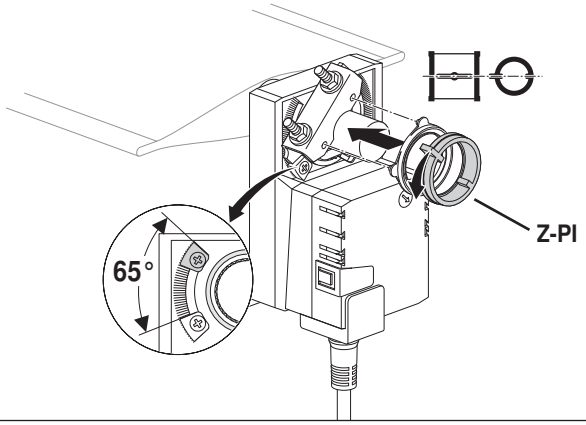
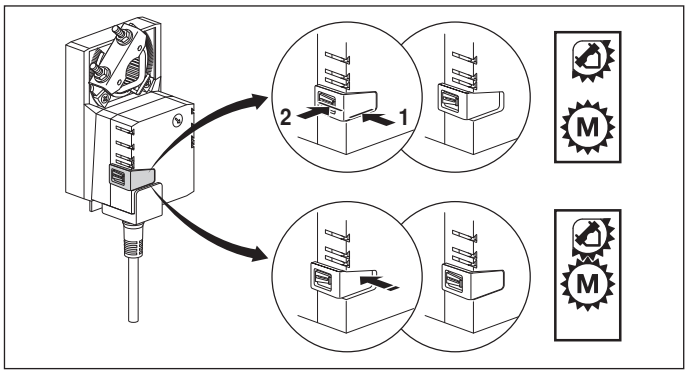
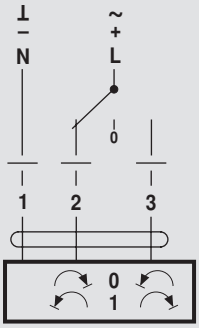
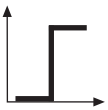


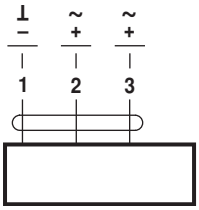




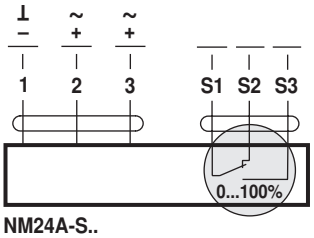


AC 24 V / DC 24 V

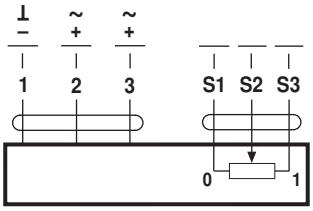
DC 48 ... 110 V ⚠
(NM72A..)



NM24A..
NM72A..

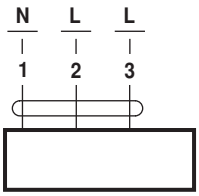


NM24A-S..

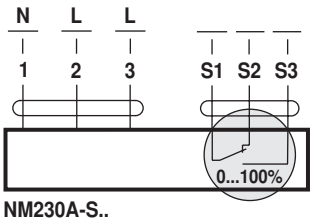


NM24AP5..

AC 100 ... 240 V ⚠



NM230A..



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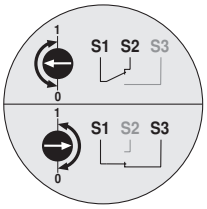
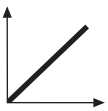
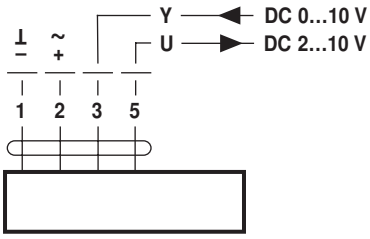
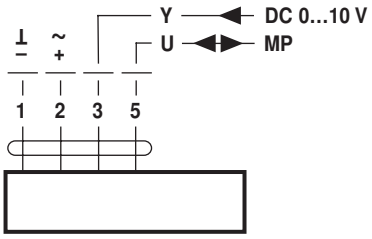




AC 24 V / DC 24 V

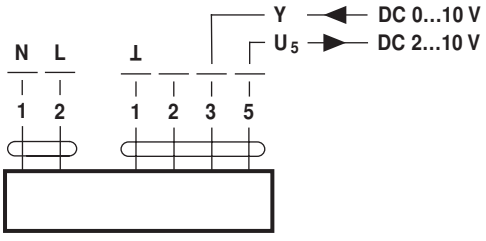


NM24A-SR..
NM24A-MF..



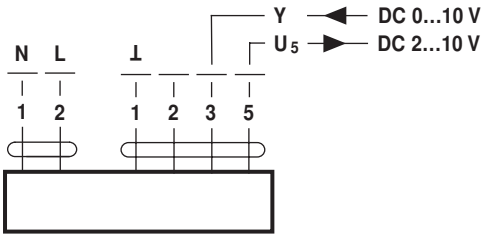
NM24A-MP..

DC 48 ... 110 V ⚠
(NM72A-SR..)



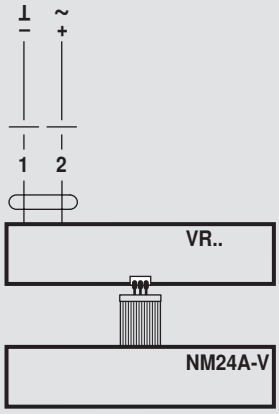
NM72A-SR..

AC 100 ... 240 V ⚠



NM230ASR..

AC 24 V / DC 24 V
(NM24A-V / VR..)



NM230A-V / VR..

C.4 Damper actuator Belimo SM24A-SR

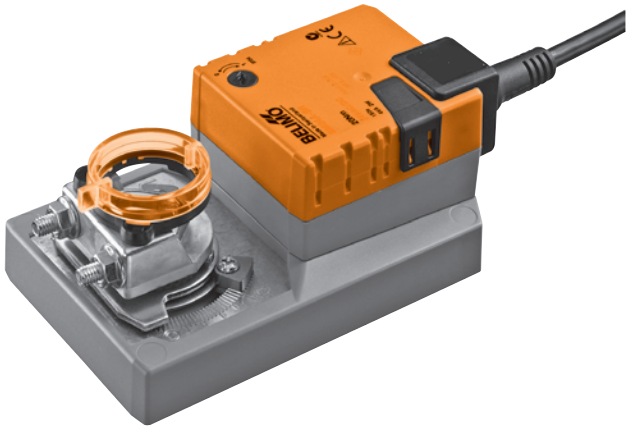
Name	Data
Designation	Belimo SM24A-SR
Type	Damper actuator
Number	
Type of manual	Technical data sheet
Manufacturer	

BELIMO

Technical data sheet SM24A-SR

Modulating damper actuator for adjusting air dampers in ventilation and air-conditioning systems for building services installations

- **For air dampers up to approx. 4 m²**
- **Torque 20 Nm**
- **Nominal voltage AC/DC 24 V**
- **Control: Modulating DC 0 ... 10 V**
- **Position feedback DC 2 ... 10 V**



Technical data

Electrical data	Nominal voltage		AC 24 V, 50/60 Hz / DC 24 V
	Nominal voltage range		AC 19.2 ... 28.8 V / DC 21.6 ... 28.8 V
	Power consumption	In operation	2 W @ nominal torque
		At rest	0.4 W
		For wire sizing	4 VA
	Connection		Cable 1 m, 4 x 0.75 mm²
Functional data	Torque (nominal torque)		Min. 20 Nm @ nominal voltage
	Control	Control signal Y	DC 0 ... 10 V, typical input impedance 100 kΩ
		Operating range	DC 2 ... 10 V
	Position feedback (Measuring voltage U)		DC 2 ... 10 V, max. 1 mA
	Position accuracy		±5%
	Direction of rotation		Reversible with switch 0 / 1
	Direction of motion at Y = 0 V		In switch position 0 ↶ resp. 1 ↷
	Manual override		Gearing latch disengaged with pushbutton, can be locked
	Angle of rotation		Max. 95°∢, can be limited at both ends with adjustable mechanical end stops
	Running time		150 s / 90°∢
	Sound power level		Max. 45 dB (A)
	Position indication		Mechanical, pluggable
Safety	Protection class		**III** Safety extra-low voltage / UL Class 2 Supply
	Degree of protection		IP54 in any mounting position NEMA 2, UL Enclosure Type 2
	EMC		CE according to 2004/108/EC
	Certification		cULus according to UL 60730-1A and UL 60730-2-14 and CAN/CSA E60730-1:02 Certified to IEC/EN 60730-1 and IEC/EN 60730-2-14
	Mode of operation		Type 1
	Rated impulse voltage		0.8 kV
	Control pollution degree		3
	Ambient temperature range		–30 ... +50°C
	Non-operating temperature		–40 ... +80°C
	Ambient humidity range		95% r.h., non-condensating
	Maintenance		Maintenance-free
Dimensions / Weight	Dimensions		See «Dimensions» on page 2
	Weight		Approx. 1.05 kg

Safety notes

⚠

- **The actuator is not allowed to be used outside the specified field of application, especially in aircraft or any other form of air transport.**
- **Assembly must be carried out by trained personnel. Any legal regulations or regulations issued by authorities must be observed during assembly.**
- **The device may only be opened at the manufacturer's site. It does not contain any parts that can be replaced or repaired by the user.**
- **The cable must not be removed from the device.**
- **When calculating the required torque, the specifications supplied by the damper manufacturers (cross section, design, installation site), and the air flow conditions must be observed.**

Safety notes

(Continued)

- **The device contains electrical and electronic components and is not allowed to be disposed of as household refuse. All locally valid regulations and requirements must be observed.**

Product features

Mode of operation
The actuator is controlled with a standard modulating signal of DC 0 ... 10 V and travels to the position defined by the control signal. Measuring voltage U serves for the electrical display of the damper position 0 ... 100% and as slave control signal for other actuators.

Simple direct mounting
Simple direct mounting on the damper spindle with a universal spindle clamp, supplied with an anti-rotation strap to prevent the actuator from rotating.

Manual override
Manual override with push-button possible (the gear is disengaged for as long as the button is pressed or remains locked).

Adjustable angle of rotation
Adjustable angle of rotation with mechanical end stops.

High functional reliability
The actuator is overload-proof, requires no limit switches and automatically stops when the end stop is reached.

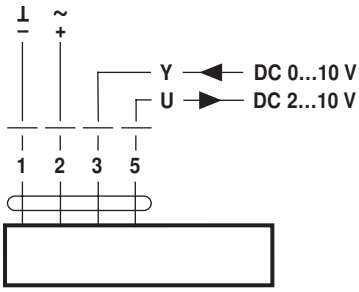
Accessories

	Description	Data sheet
Electrical accessories	Auxiliary switch S..A..	T2 - S..A..
	Feedback potentiometer P..A..	T2 - P..A..
	Range controller SBG24	T2 - SBG24
	Position sensor SGA24, SGE24 and SGF24	T2 - SG..24
	Digital position indication ZAD24	T2 - ZAD24
Mechanical accessories	Various accessories (clamps, shaft extensions etc.)	T2 - Z-SM..A..

Electrical installation

Wiring diagram

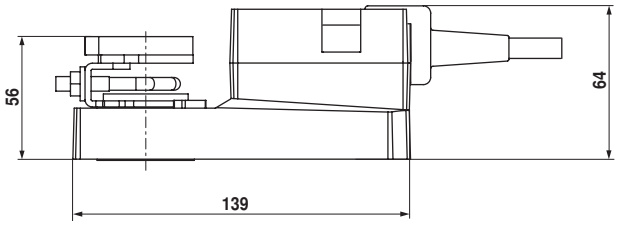
Notes
- Connection via safety isolating transformer.
- Other actuators can be connected in parallel. Please note the performance data.

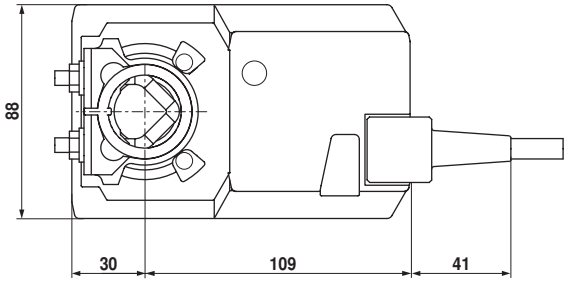


Cable colours:
1 = black
2 = red
3 = white
5 = orange

Dimensions [mm]

Dimensional drawings



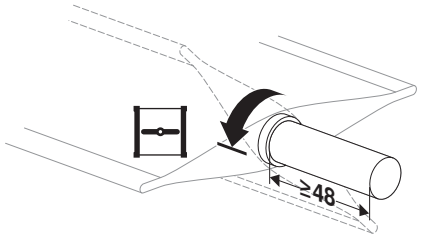


Damper spindle	Length			
	≥48	10 ... 20 [1]	≥10	≤20
	≥20	10 ... 20 [1]	≥10	≤20

[1] CrNi (INOX) 12 ... 20

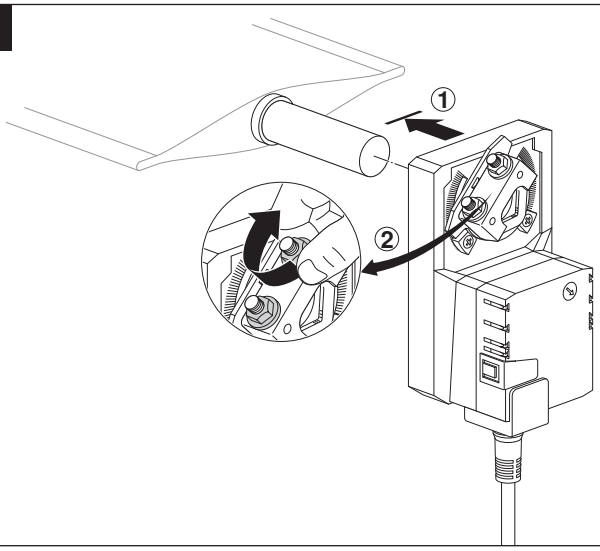
70214-00003.D

1



	○↕	□↕	◇↕
	10 ... 20	≥10	≤20
CrNi (INOX)	12 ... 20	≥10	≤20

2



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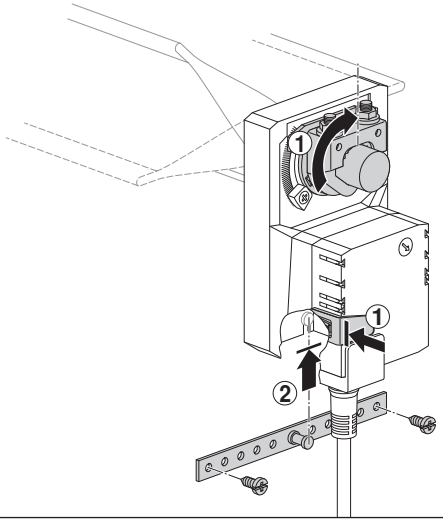

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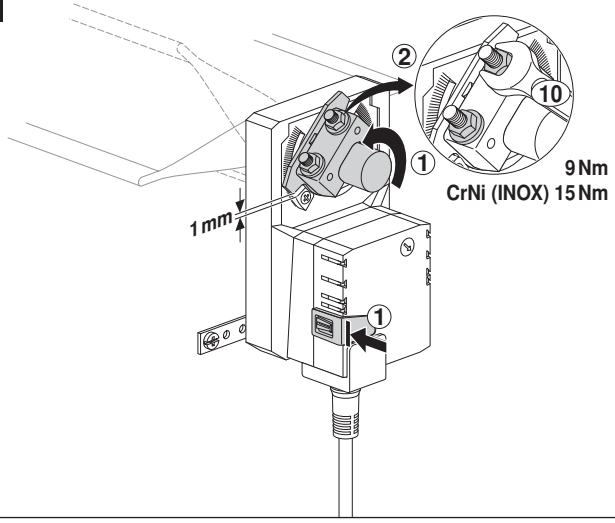

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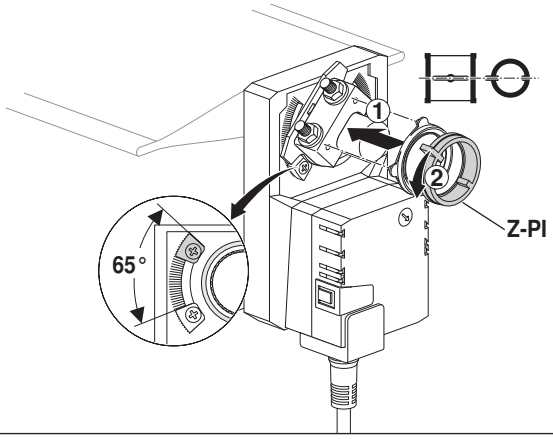
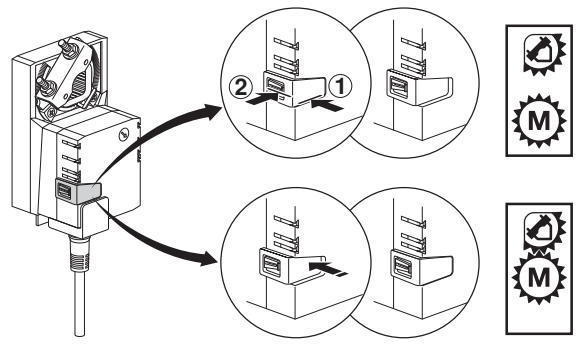
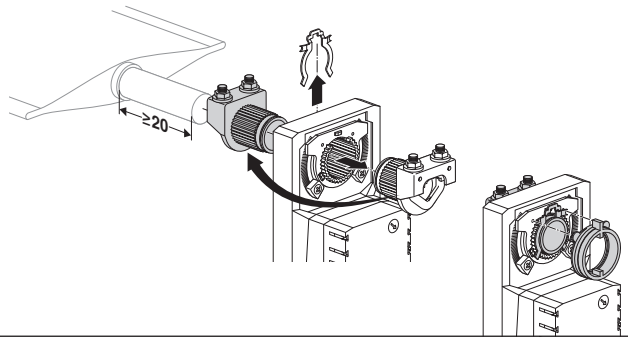
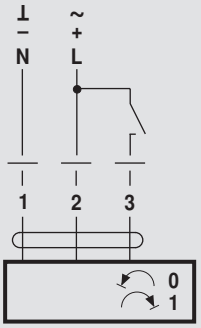
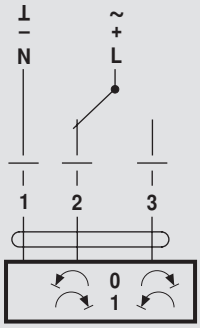
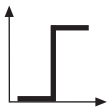




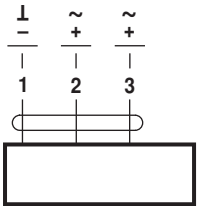




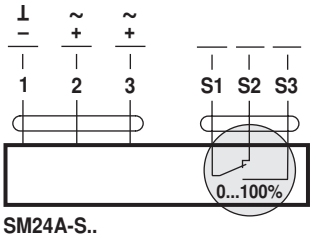




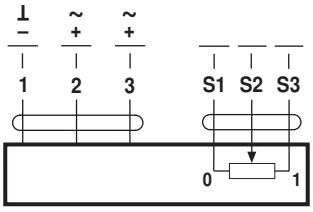
AC 24 V / DC 24 V



SM24A..

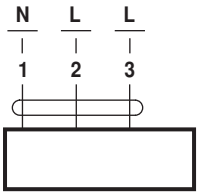


SM24A-S..

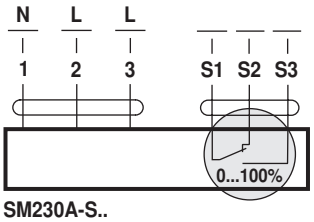


SM24AP5..

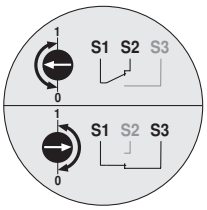
AC 100 ... 240 V ⚠

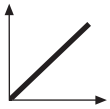


SM230A..

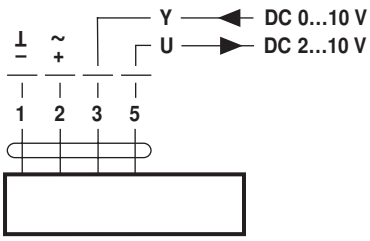


SM230A-S..

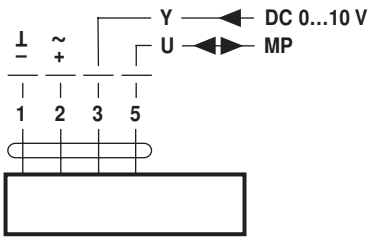




AC 24 V / DC 24 V

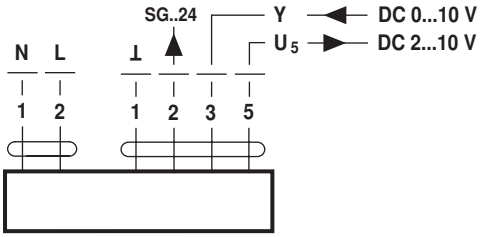


SM24A-SR..
SM24A-MF..



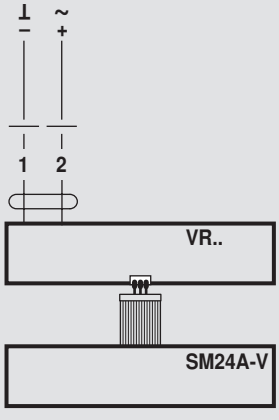
SM24A-MP..

AC 100 ... 240 V ⚠



SM230ASR..

AC 24 V / DC 24 V
(SM24A-V / VR..)



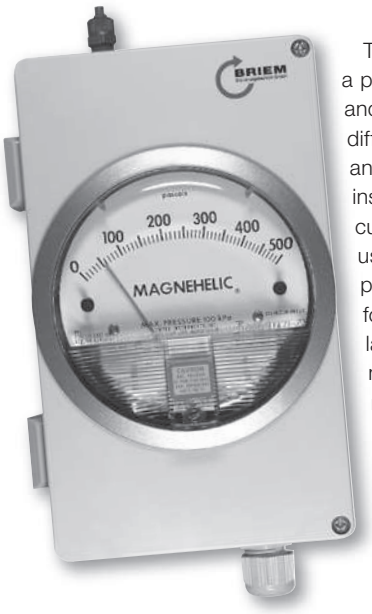
SM230A-V / VR..

C.5 Differential pressure gauge Briem MD 201MB

Name	Data
Designation	Briem MD 201MB
Type	Differential pressure gauge
Number	
Type of manual	Technical data sheet
Manufacturer	

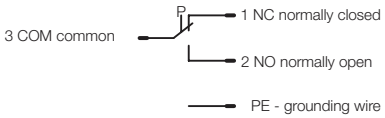
MD 201 MB

Differential pressure measuring instrument
with analogue scale and one switch-over contact for filter control

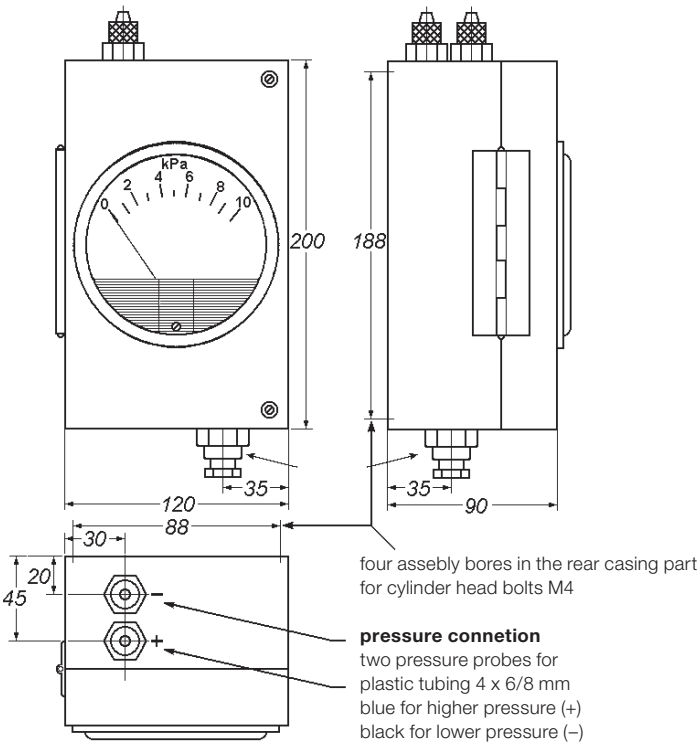


The well-proven MD201 MB combines a pressure gauge and a pressure switch and is therefore suited to control pressure differentials of filters used in cleanroom and climate technology. The MD201 MB instruments feature a high reading accuracy and repeatability. They can be used in negative pressure and/or overpressure conditions. This is essential for air halls or research/experimental laboratories which for safety reasons need to be kept above or below atmospheric pressure level. Differential pressure gauge and switch are assembled in a bi-partite, weather-proof and shock-resistant plastic housing and are ready for connection. The device needs almost no maintenance, as it works without any manometer fluids. After opening the housing, the switching point can be set at each individual differential pressure switch (alternatively for rising or falling pressure) by means of the adjusting knob with scale. Due to its high reading accuracy, the integrated differential pressure gauge can also be used for pre-setting the switching point.

circuit diagram MD 201 MB



Technical data
Media compatibility
air or non-corrosive gases
Measuring ranges*
refer to data table
Measuring accuracy
± 2.0 % of full scale
Max. permissible pressure
70 kPa
Max. lowest pressure limit
–68 kPa (recommended)
Max. permissible temperature
–20 to +65 °C
Pressure connection
two pressure probes for plastic tubing 4 x 6/8 mm
Electrical connection
screw clamps with a cable gland M16
Microswitch
one SPDT contact 230/480 V at 50 Hz, 5A
Protection class
IP 54 (on request IP 65)
Dimensions of housing
200 x 120 x 90 mm (HxWxD)
Weight
~ 1 kg



Standard types			
Type	**Measuring range***	**Adjusting range***	**Switch-back difference**
MD 201– 3 MB	0–300 Pa	40–300 Pa	20 Pa
MD 201– 5 MB	0–500 Pa	100–1000 Pa	40 Pa
MD 201–10 MB	0–1.0 kPa	0.1–1.0 kPa	40 Pa
MD 201–15 MB	0–1.5 kPa	0.3–5.0 kPa	100 Pa
MD 201–30 MB	0–3.0 kPa	0.3–5.0 kPa	100 Pa
MD 201–50 MB	0–5.0 kPa	0.3–5.0 kPa	100 Pa

*** other measuring/indicating and adjusting ranges on request**

Briem
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Lauterstraße 23
D-72622 Nürtingen
Phone +49 (0)7022-6092-0
Fax +49 (0)7022-6092-60
info@briem.de
www.briem.de

C.6 thermokon PS differential pressure switch

Name	Data
Designation	thermokon PS
Type	Differential pressure switch
Number	
Type of manual	Technical data sheet
Manufacturer	

PS

Differenzdruckschalter
Differential Pressure Switch

thermokon
Sensortechnik GmbH

DE - Datenblatt

Technische Änderungen vorbehalten
Stand: 25.03.2009

EN - Datasheet

Subject to technical alteration
Issue date: 2009/03/25

Anwendung

Differenzdruckschalter zur Überwachung des Differenzdrucks in Luft und anderen nichtbrennbaren und nichtaggressiven Gasen.

Mögliche Einsatzgebiete sind:
Überwachung von Luftfiltern, Gebläsen, industriellen Kühlluftkreisen, Strömungen in Lüftungskanälen sowie Überhitzungsschutz bei Lufterhitzern, Regelung von Luft- und Brandschutzklappen, Frostschutz bei Wärmetauschern.

Application

Differential pressure switch for monitoring the differential pressure of air and other nonflammable and non-aggressive gases.

Possible applications: Monitoring of air filters, fans, industrial cooling air cycles as well as overheating protection, control of air and fire dampers, anti-freeze with heat exchangers.

Typenübersicht

Typ	Messbereich
PS200	20...200 Pa
PS300	30...300 Pa
PS500	30...500 Pa
PS600	40...600 Pa
PS1500	100...1500 Pa
PS4500	500...4500 Pa

Types Available

Type	Measuring range
PS200	20...200 Pa
PS300	30...300 Pa
PS500	30...500 Pa
PS600	40...600 Pa
PS1500	100...1500 Pa
PS4500	500...4500 Pa

Normen und Standards

Konformität: Niederspannungsrichtlinie 2006/95/EC
EMV-Richtlinie 2004/108/EC

Norms and Standards

Conformity: Low-voltage Directive 2006/95/EC
EMC-Directive 2004/108/EC

Technische Daten

Allgemein:

Gehäuse:	ABS	
Gehäusedeckel:	PC	
Membrane:	Silikon	
Anschlussstutzen:	ABS	
Anschlusschlauch:	PVC, soft	
Schutzart:	IP54	
Abmessungen:	105 x 73 x 63mm (LxBxH)	
Max. Druck:	50kPa	
Medium:	Luft und nichtaggressive Gase	
Arbeitstemperatur:	-20...60°C	
Lagertemperatur:	-40...85°C	
Mikroschalter:	Goldkontakte:	PS200
	Silberkontakte:	PS300 / PS500 / PS600 / PS1500 / PS4500
Lebensdauer:	>1.000.000 Schaltspiele	
Anschluss:	Schraubklemmen	
Kabeleinführung:	M16	
Gewicht:	150g (ohne Zubehör)	

PS200:	Messbereich:	20...200Pa
	Schaltdifferenz:	10Pa
	Schaltleistung:	0,1A ohmsche Last (max. 250VAC)
PS300:	Messbereich:	30...300Pa
	Schaltdifferenz:	20Pa
	Schaltleistung:	3A ohmsche Last 2A induktive Last (250VAC) (max. 250VAC)
PS500:	Messbereich:	30...500Pa
	Schaltdifferenz:	20Pa
	Schaltleistung:	3A ohmsche Last 2A induktive Last (250VAC) (max. 250VAC)
PS600:	Messbereich:	40...600Pa
	Schaltdifferenz:	30Pa
	Schaltleistung:	3A ohmsche Last 2A induktive Last (250VAC) (max. 250VAC)
PS1500:	Messbereich:	100...1500Pa
	Schaltdifferenz:	80Pa
	Schaltleistung:	3A ohmsche Last 2A induktive Last (250VAC) (max. 250VAC)
PS4500:	Messbereich:	500...4500Pa
	Schaltdifferenz:	180Pa
	Schaltleistung:	5A ohmsche Last 2A induktive Last (250VAC) (max. 250VAC)

Sicherheitshinweis  Achtung

Einbau und Montage elektrischer Geräte dürfen nur durch eine Fachkraft erfolgen.

Die Module dürfen nicht in Verbindung mit Geräten benutzt werden, die direkt oder indirekt menschlichen, gesundheits- oder lebenssichernden Zwecken dienen oder durch deren Betrieb Gefahren für Menschen, Tiere oder Sachwerte entstehen können.

Technical Data

General:

Housing:	ABS	
Housing cover:	PC	
Membrane:	Silicone	
Duct connectors:	ABS	
Tubing:	PVC, soft	
Protection:	IP54	
Dimensions:	105 x 73 x 63mm (LxWxH)	
Max. pressure:	50kPa	
Media:	Air and non-aggressive gases	
Operation temperature:	-20...60°C	
Storage temperature:	-40...85°C	
Sub miniature switches:	Gold contacts:	PS200
	Silver contacts:	PS300 / PS500 / PS600 / PS1500 / PS4500
Service life:	>1.000.000 switching operations	
Connections:	Screw terminals	
Cable entry:	M16	
Weight:	150g (without accessories)	

PS200:	Measuring range:	20...200Pa
	Switching difference:	10Pa
	Switching load:	0,1A resistive load (max. 250VAC)
PS300:	Measuring range:	30...300Pa
	Switching difference:	20Pa
	Switching load:	3A resistive load 2A inductive load (max. 250VAC)
PS500:	Measuring range:	30...500Pa
	Switching difference:	20Pa
	Switcing load:	3A resistive load 2A inductive load (max. 250VAC)
PS600:	Measuring range:	40...600Pa
	Switching difference:	30Pa
	Switching load:	3A resistive load 2A inductive load (max. 250VAC)
PS1500:	Measuring range:	100...1500Pa
	Switching difference:	80Pa
	Switching load:	3A resistive load 2A inductive load (max. 250VAC)
PS4500:	Measuring range:	500...4500Pa
	Switching difference:	180Pa
	Switching load:	5A resistive load 2A inductive load (max. 250VAC)

Security Advice  Caution

The installation and assembly of electrical equipment may only be performed by a skilled person.

The modules must not be used in any relation with equipment that supports, directly or indirectly, human health or life or with applications that can result in danger for people, animals or real value.

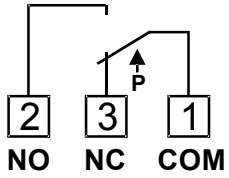
Montagehinweise

Die Angaben für den Schaltdruck beziehen sich auf vertikale Einbaulage.
Bei horizontaler Einbaulage verändert sich der Schaltdruck wie folgt:
- Gehäusedeckel nach oben +15 Pa
- Gehäusedeckel nach unten -15 Pa

Inbetriebnahme

Voraussetzung für die Inbetriebnahme ist die ordnungsgemäße Installation aller elektrischen Versorgungs-, Schalt- und Messleitungen und der Druckanschlussleitungen.
Vor Inbetriebnahme ist die Dichtigkeit der Druckanschlussleitungen zu prüfen.

Anschlussplan



Wenn der Differenzdruck erreicht ist:
- 1-3 geöffnet
- 1-2 geschlossen

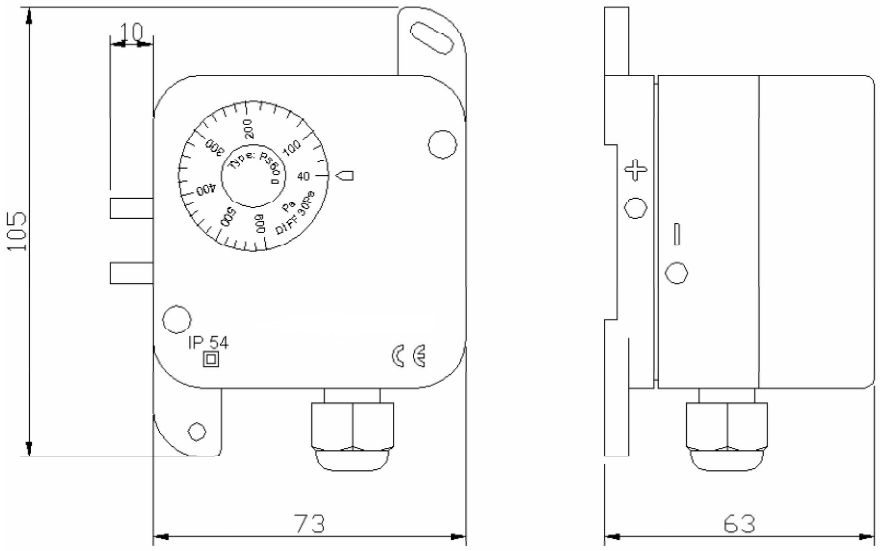
Mitgeliefertes Zubehör

2 Befestigungsschrauben
2 Kunststoffkanalstutzen
2m PVC-Schlauch soft, ø 4/7mm

Optionales Zubehör

Metallkanalstutzen

Abmessungen (mm)



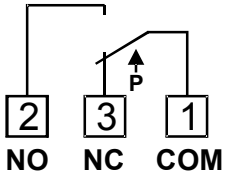
Mounting Advices

The pressure switch is factory-calibrated in the vertical position. If installed horizontally, this will affect the switching point as follows:
- With cover facing upwards +15 Pa
- With cover facing downwards -15 Pa

Installation

A prerequisite for the operation is a proper installation of all electrical supply,control and sensing leads as well as the pressurized connection line. Before installing the device, the leak tightness of the pressurized connection lines must be inspected.

Terminal Connection Plan



When differential pressure increases:
- 1-3 open
- 1-2 close

Standard accessories

2 fixing screws
2 plastic duct connectors
2m PVC-tube soft, ø 4/7mm

Optional accessories

Metal duct connectors

Dimensions (mm)

C.7 Rotary heat exchanger Klingenburg

Name	Data
Designation	Rotary heat exchanger
Type	Rotary heat exchanger
Number	
Type of manual	Technical data sheet
Manufacturer	Klingenburg GmbH

Rotary heat exchangers
Installation, initial operation and maintenance

KLINGENBURG
ENERGY RECOVERY

Table of contents

Frame / Sheets

Frame and sheets are made of seawater resistant aluminum respectively of galvanized steel and thus, do not require maintenance.

Storage mass

Prior to initial operation especially of vertical rotors take care that no objects or pressing felt packings are blocking free movement. The storage mass of the rotary heat exchanger is made of lapped aluminum foil. In most cases and due to the countercurrent principle self-cleaning is realized being absolutely sufficient for the self-cleaning of the storage mass. In case self-cleaning is insufficient the storage mass can be periodically (dependent on the degree of soiling) cleaned with compressed air or in case of tenacious impurities with high-pressure cleaners (medium: purely water without chemical admixtures).

Attention: Impinge air or water jet rectangular onto the storage mass!

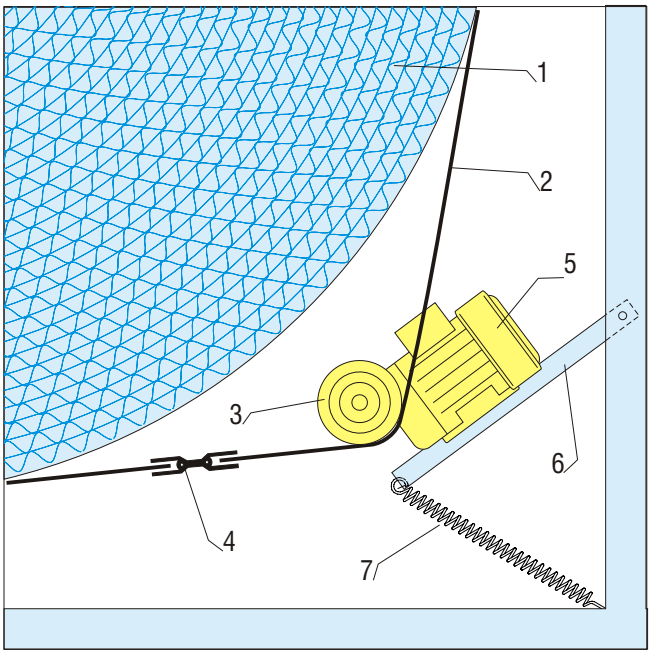
Direction of rotation

Take care that the storage mass is rotating from the exhaust air across the cleaning sector into the supply air. This direction of rotation of the storage mass is marked by a yellow arrrow in the edge of the driving motor.

Attention: In case of initial operation check direction of rotation.

V-belt

The drive V-belt is designated SPZ or SPA and is commercially supplied with the designation "Endless V-belt". Connection is done by flexible locks. Due to the fact that the V-belt is subject to natural stretching which may well exceed the size of the tensioning device it is recommended to periodically check the tension of the V-belt. Particulary in the first 400 operating hours. In case the drive of the storage mass can no longer be guaranteed because the V-belt is insufficiently tensioned, the latter has to be shortened. For simplicity of execution this procedure does not need any explanation.



1 Rotor wheel
2 V-belt
3 V-belt pulley
4 Hinge connector
5 Motor
6 Motor frame
7 Spring

Gaskets

Felt gaskets of the type: NF-PES-LE 0.32 grey are inserted in normal temperature rotors. The felts shall be pushed as close as possible towards the storage medium while direct abrading has to be prevented. Felts are pressed by manufacturer but may change their position due to transport.

Attention: Check felts and gaskets prior to initial operation and lay on the felts when the fans are operating.

Ball-bearings

The ball-bearings used are of low-maintenance and designed for an operating lime of 100.000 hours. Generally, they can be used for temperatures of up to +120°C (+248°F).
Under normal operating conditions maintenance is not required.

Driving motor

Rotary heat exchnagers are equipped with threephase current backgeared motors for 3 x 380 / 220 Volt with thermal protection contacts at 140°C (284°F). Should the rotors be delivered without wiring, the motor is always star-connected. In connection with the controllers KR 4/ KR 7 the motors have to be run in triangulated wiring connection 220 Volt and connected thermal protection contacts! Otherwise warranty is excluded.
The motor may easily be mounted at another edge of the device in case mounting shows that the location is not suitable. Under normal operating conditions the motor does not require maintenance (gearing with lifelong grease lubrication).

Attention: Special motors for e.g. enamelling lines with oil filling (opening at the top).

Controll

For this see corresponding controller instructions (attached to the controller).

Final inspection by manufacturer

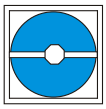
Final inspection by the manufacturer is confirmed by a yellow label being attached at the inside of the inspection door.
Among others, the completeness of the delivery (with special regard of the rotor control and its components) is confirmed. In case of questions we´d ask you to indicate the corresponding inspection number / date and the respective rotor size and number.
The rotor size and number are indicated on the rating plate which is attached at the outside of the inspection door. It is additionally imprinted in the frame of the inspection door.

Assembly

Assembly of the rotor has to be done on a horizontal surface. The exact rotor fitting position is determined by the designation "Abluft" (exhaust air). This mark at the rotor frame corresponds to the inlet side of the exhaust air. In case of horizontal rotors it has to be observed, however, that the circumferential support frame incl. middle frame is needed. The respective sketch may be ordered. Diagonal flow of the rotors has to be avoided because the rotor mass may be driven by the air stream. If necessary install guiding plates.

Connections of conduits

- Inlet of forces through the connection conduits into the frames of the rotary heatexchangers has to be prevented.
- Fixing of the rotor ist the best by drilling screws. -
- For insprection works the rotor has to be accessible within the installation.
- The rotors are designed for countercurrent operation supply air / exhaust air. If this is not the case we´d expect consultations.
- Direct current operation leads to a considerable decrease in performance. In addition, danger of soiling is increased.



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C.8 Rotor controller Klingenburg KR4 & KR7

Name	Data
Designation	Klingenburg KR4 & KR7
Type	Rotor controller
Number	
Type of manual	Technical data sheet
Manufacturer	Klingenburg GmbH

Brief description of KR 4 and KR 7 controllers

KLINGENBURG
ENERGY RECOVERY

1. Function of the controller

We have only two controllers for all rotor sizes:
KR4 = 400 Watt – for wheel diameter ≤ 3760 mm
KR4 = 750 Watt – for wheel diameter <3760 mm

Special features:

- the controllers are usable worldwide
- all known regulations are taken into account by us for construction of the controller
- it is therefore the most modern generation of controllers by far
- the controllers are operated using only three buttons. The results and messages are displayed in a lighted, two-part display
- In hardwired condition, the controller is immediately ready to operate after turning on the mains voltage
- Faults are shown in the display

- most modern processor technology
- CE tested
- housing IP 54
- short-circuit proof outlet
- EN 55011 tested
- EN 61000-3 tested
- EN 61000-4-2 tested
- EN 61000-4-3 (burst) tested
- EN 61000-4-4 (surge) tested
- EN 61800-3 tested
- every individual module is tested

- detailed fault message
- thermal contact monitoring
- two-line, colourful display lit by LCD
- operating message
- start-up and discharge circuit
- menu-driven programming
- clear text display on LCD
- three button operation
- processing of signals from other controllers
- self cleaning cycle

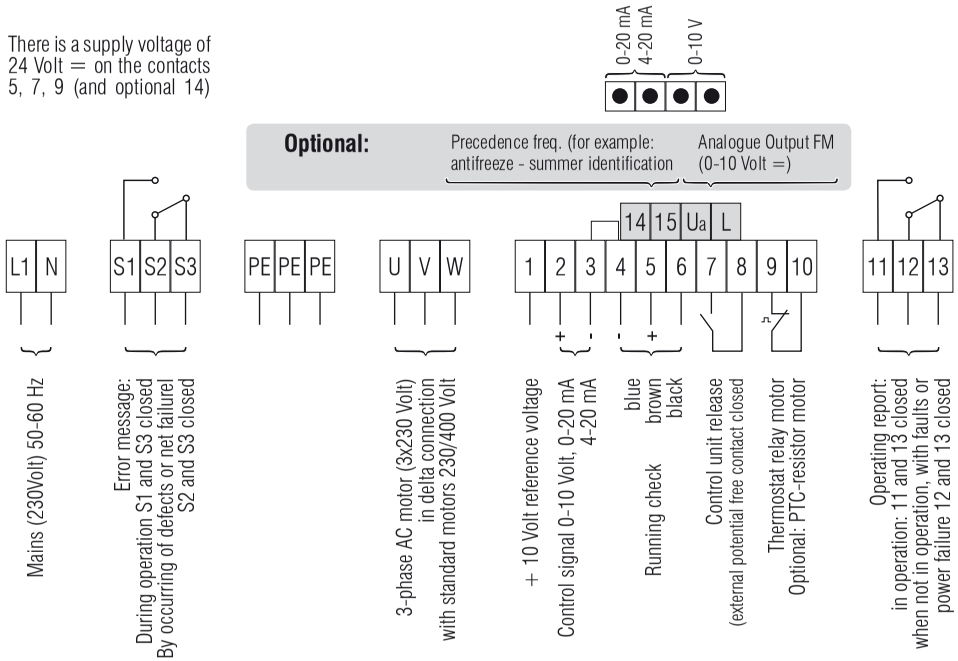
Optionally available accessories:

- rotor run control including function display
- priority rpm (adjustable)
- analogue output (0 - 10 Volt =)
- resistor evaluation (PTC)

Accessories used with the Z-controller

- Summer operation including function display
  - Enthalpy comparison
  - Temperature comparison
  - Temperature switchover
- Supply air temperature regulation
- Sequence switchover including function display
- Rotor run control including function display

2. Terminals at the control units KR 4 / KR7



3. Technical data

Controller typ	KR4	KR7
Output	0,4 kW	0,75 kW
Fuse (internal)	6,3 A delay (5 x 20 mm)	10 A delay (5 x 20 mm)
Mains voltage	220-240 Volt / 50-60 Hz 1~	
Weight	3200 g	3500 g
Environmental temperature	from -10°C bis +40°C (for temperatures lower than 0°C it is necessary to switch on the mains voltage to the device without the motor running so that the controller can warm up)	
temperature adjustment range (only KR 4 Z / KR 7 Z)	Air supply temperature regulation 10°C - 40°C /summer switchover 18°C - 42°C Other adjustment ranges must be specifically set	
Type of protection	IP 54	
Output frequency	0-120 Hz (factory setting 80 Hz)	
Frequency resolution	0,08 Hz	
Controller signal	0-10 V, 0-20 mA, 4-20 mA	
Fault message relay	Potential-free changeover contact, 250 V AC, 1 A capacity	
Motor connecting line	The connecting line must be shielded; chokes should be provided for lengths of over 50 m. Please inquire!	
Dimensions	L=256 mm B=232 mm H=128 mm	

4. Initial operation of the KR4 / KR7 base controller

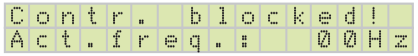
The KR controller is operated with only three buttons. The selection is made with the left (▲) and the right buttons (▼). The selection is confirmed with the middle button (↵). When all three buttons are pressed at the same time, you access the programming mode.

Initial operation

After connection to the mains voltage, the software version appears briefly in the display.

Then for connected controller enabling:

If the controller is not enabled, this appears:



Start by pressing all three buttons: ▲ ↵ ▼ A message appears after about 2 seconds:

Navigating through the menu items

You can choose between English and German. Other menu languages are available upon request. The change is made by activating the selection button ▲ ▼.

Confirm by selecting the enter button ↵. Next this appears:

As before, use the select buttons to choose and confirm with Enter (↵). Per your selection, the controller navigates through the query options for “manual mode” or “external mode”, as described below.

5. Manual mode / External mode

Manual mode

This image appears:

A frequency can be set by using the selection button, which will be started after programming is completed and the start command is entered (via ↵) Continued to page 8 “ ● Display in Manual Mode and External Mode”.

External mode:

This image appears:

The start point is adjustable from 5-40% based on the controller signal. With a setting of 10%, the controller reacts only with 1V controller signal. With this, the interference voltage is suppressed, which could lead to unwanted running of the controller.

- **Display in Manual Mode and External Mode:**

Contained in this menu item is the maximum end frequency that the controller can start in full controller signal (10 volt =); adjustable in the range of 50 -120 Hz At maximum frequency the rotor must turn at approx. 10 rpm. The maximum rpm adjusts itself according to the type of drive unit. **Caution!** All motors from Klingenburg are suitable for frequencies up to 120Hz. This appears next:

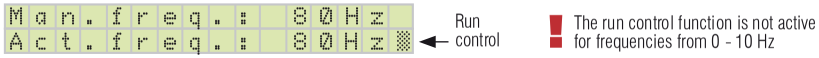
If you select „cleaning cycle on," the value is preset to 20 minutes. You must be absolutely certain that the controller release is set during the entire operation time of the ventilation system and that the activation takes place via the controller signal or the keypad. The cleaning cycle ensures that the rotor moves regularly in a half rotation if no request comes from the controller signal or keypad for longer than 20 minutes.

Continuous operation in „stealth mode“ between 0-1V is not implementable.
Using the selection buttons ▲ ▼ the cleaning interval can be adjusted for 40, 60, 80 and 100 minutes.
Press enter to confirm ↵.

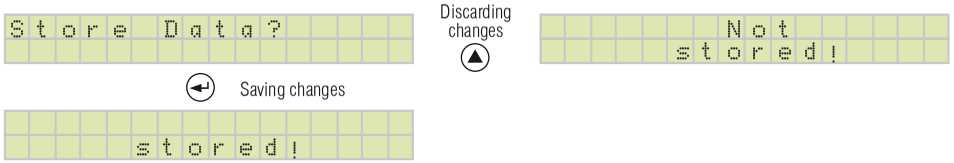
Manual mode / external mode

The turning of the rotor can be monitored with run control. If you have ordered a controller with the “run control” option, selec:

Switching on/off the run control takes place with the selection buttons, and is confirmed with the enter key.
During operation the run control function will be indicated with a black field (>10 Hz).



In order to apply the changes that have been input, it is necessary to save them.
To save these values, press enter ↵



The following image appears in the display in **manual mode**:

To start or stop the controller in manual mode, press the enter key ↵

This image appears in **external operation**:

If a request comes from the controller signal, the desired frequency is displayed and the controller goes into operation.

6. Trouble-shooting and fault messages

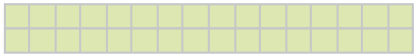
Trouble-shooting:

Error-free running, for example 50% demand, is indicated with the following image:

If the following image should appear instead:

Check the following table of errors.

Search method for KR4/KR7 base controller



(no display is visible) test the fuse / check the mains voltage

Controller not enabled. **No fault message!**

- Test thermal contact/PTC-resistor. The fault message contact is activated when the overtemperature fault occurs
- Connection of thermal contact/PTC resistor to controller
- A supply voltage of 24V = must be on terminals 5, 7 and 9 to earth (terminal 3 or 4). If no voltage is available, check control cables, possibly remove short-circuit.

For operation with run control:

- Space from proximity switch to rotor
- Connect the proximity switch to the controller
- V-belt jumps off
- V-belt over or under tension

For operation without run control:

- Change the controller programming (see run control description)

Even though controller signal is present, this appears:

or

- Placement of the jumpers according to description
- Is the controller signal there?
- Connect controller signal to controller (polarity!)

- The controller is set to manual mode

Fault codes:

In addition to the run control fault and motor overtemperature, the controller 7 also recognizes different faults. These faults are indicated in the display with a two place error code:

01	Overvoltage (motor / rotor blocked, short circuit between U, V, W)
05	Overload (controller / motor overloaded)
09	Mains under voltage
14	Earth fault
15	Mains overvoltage
21	Overtemperature in the power amplifier, environmental temperature too high, controller overloaded
99	Software error

The controller is again operation-ready when the fault is erased by removal of the error via interruption of the mains voltage or by pressing all three buttons at the same time.

Caution!

When using a restart mode integrated into the software, the controller does not go directly to fault with over- or undervoltage and overcurrent. Rather, it tries within 10 minutes to reset itself. If a reset takes place within the 10 minutes, the controller continues to run in normal mode. If the KR4/7 cannot reset itself during a longer lasting malfunction, after 10 minutes a fault message occurs on the fault message outlet and the fault indicator appears on the controller display.

Warning

This function causes an independent restart of the frequency converter along with the drive if there is still a malfunction after the expiration of a set wait time – when a start command is still there. In the case of a restart, ensure that no people are endangered.

7. Safety and precautions

Before installation and initial operation of the frequency converter, please read through the product handbook carefully and observe all warnings and safety precautions. Make sure that the product manual is easily reachable in the area of the frequency converter.

Definition of tips:
Warning! Failure to comply with this information could cause death, severe bodily injury or significant physical damage.
Caution! Failure to comply with this information could cause minor bodily injury or physical damage.
General: During operation it must be ensured that the mains voltage is constantly on.

Warning!

- This frequency converter creates dangerous electrical voltage and controls dangerous rotating parts. Failure to comply with the information in this manual could cause death, severe bodily injury or significant physical damage.
- The installation, initial operation and maintenance of this drive may only be performed by expert staff that are well versed in the functionality and equipment as well as the machine.
- The device contains intermediate circuit capacitors that also carry out switchover of dangerously high voltages on the grid side. After switching off the voltage, wait at least 15 minutes before opening the device and working on it. Please be sure that no live parts are touched.
- The ground fault safety serves only as protection for the frequency converter and not as personal protection. In accordance with VDE 0160 (German abbreviation for the Association for Electrical, Electronic &Information Technologies), the three-phase frequency converter must not be operated on a leakage current circuit breaker, because a possible direct current component will reduce the sensitivity of the leakage current circuit breaker in the event of a fault.
- The provisions of VDE 0160 should be observed as protective measures.
- Ground the frequency converter to the connection provided for it.
- To avoid injury and damage, do not touch any parts within the housing – not with hands or any kind of object – when mains voltage is present or the intermediate circuit capacitor is not loaded. Do not work on wiring or test signals when mains voltage is present.

- Pay special attention when the automatic restart is activated. To avoid injury from possible uncontrolled restart of the frequency converter after a power outage, install a switch element on the grid side that de-energises in a power outage and can only be turned on after return of voltage by manual confirmation (e.g., contactor, etc.).
- Ensure that the input voltage corresponds with the voltage listed on the label. Environmental influences such as high temperature and high humidity are to be avoided as well as dust, dirt and aggressive gases.
- The install location should be a well-ventilated location away from direct sunlight. Install the device on a non-flammable, vertical wall that does not transmit vibrations. Do not connect mains voltage to the output terminals U/T1, V/T2, W/T3.
- Please contact the motor or machine manufacturer if standard motors with a frequency of > 60 Hz will be operated.
- All frequency converters are tested for dielectric strength and insulation resistance measurements. Insulation resistance measurements, for example, in the course of inspection, must not be conducted between the power terminals and earth. Do not carry out insulation resistance measurements on the control terminals.
- During operation it must be ensured that the mains voltage is constantly on. Control commands and operating signals (such as start/stop) must only be implemented via the control terminals or the control panel and not by switching the mains supply or a motor contactor.
- Do not install capacitors or overvoltage arrestors in the motor lead.

Caution!

- In order to guarantee that your Klingenburg frequency converter operates securely and reliably, all respective safety regulations, such as accident prevention regulations, VDE regulations, etc,. must be observed.
- As these regulations could contain different details within the German speaking areas, the user must observe the requirements that are valid for their area.
- Klingenburg GmbH cannot exonerate the user from the obligation to follow the most current safety regulations. The technical data and descriptions in these operating instructions are compiled according to the best of our knowledge and belief. Product improvements are constantly performed. For this reason, Klingenburg GmbH reserves the right to make such changes without prior notice.
- Despite the careful creation of these instructions, Klingenburg GmbH cannot be held liable for errors or damage which arise from use of this manual.

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DNKR4/7 Status 04.11

C.9 thermokon TFR anti-frost thermostat

Name	Data
Designation	thermokon TFR
Type	Anti-frost thermostat
Number	
Type of manual	Technical data sheet
Manufacturer	

Frostschutzthermostat TFR

Frostschutzthermostat
Antifreeze Thermostat

thermokon
Sensortechnik GmbH

DE - Datenblatt

Technische Änderungen vorbehalten
Stand 19.04.2010

EN - Data Sheet

Subject to technical alteration
Issue date 2010/04/19

Anwendung

Das Frostschutzthermostat TFR wird eingesetzt für die luftseitige Temperaturüberwachung von Wasser-Lufterwärmern in Lüftungs- und Klimaanlagen zur Verhinderung von Frostschäden. Es besitzt eine kleine Schaltdifferenz und eine hohe Reproduzierbarkeit. Die Rückstellung erfolgt automatisch; bei TFR ... -R manuell mittels Taste.

Durch das Schalten des Frostschutzthermostats können beispielsweise folgende Frostschutzmaßnahmen ausgelöst werden:
- Ventilator AUS
- Außenluftklappe ZU
- Luftwärmeventil 100% AUF
- Lufterwärmerpumpe EIN
- Kältemaschine (Verdichter) und Luftbefeuchter AUS
- Auslösung der Frostgefahrmeldung optisch und/oder akustisch

Typenübersicht

TFR 1,8	Frostschutzthermostat, Kapillarrohrlänge 1,8m, automatische Rückstellung
TFR 3	Frostschutzthermostat, Kapillarrohrlänge 3m, automatische Rückstellung
TFR 6	Frostschutzthermostat, Kapillarrohrlänge 6m, automatische Rückstellung
TFR 1,8-R	Frostschutzthermostat, Kapillarrohrlänge 1,8m, manuelle Rückstellung
TFR 3-R	Frostschutzthermostat, Kapillarrohrlänge 3m, manuelle Rückstellung
TFR 6-R	Frostschutzthermostat, Kapillarrohrlänge 6m, manuelle Rückstellung

Normen und Standards

CE-Konformität:	2004/108/EG Elektromagnetische Verträglichkeit
Produktsicherheit:	2001/95/EG Produktsicherheit
EMV:	EN 60730-1: 2002
Produktsicherheit:	EN 60730-1: 2002

Application

The antifreeze thermostat TFR is used for downstream temperature monitoring of water air heaters in ventilation and air-conditioning systems to prevent frost damages. It has a small differential gap and a good repeatability. The reset can be done automatically. For model TFR...-R reset is made manually by a button.

The antifreeze thermostat can be used to initiate the following frost protection functions:
- Stop fan
- Close outside air dampers
- Open heating coil valve 100%
- Star heating coil pump
- Switch-off chiller (condenser) and humidifier
- Trip visual and/or audible frost alarm

Types Available

TFR 1,8	Antifreeze thermostat, capillary tube length 1,8 m, automatic reset
TFR 3	Antifreeze thermostat, capillary tube length 3 m, automatic reset
TFR 6	Antifreeze thermostat, capillary tube length 6 m, automatic reset
TFR 1,8-R	Antifreeze thermostat, capillary tube length 1,8 m, manual reset
TFR 3-R	Antifreeze thermostat, capillary tube length 3 m, manual reset
TFR 6-R	Antifreeze thermostat, capillary tube length 6 m, manual reset

Norms and Standards

CE-Conformity:	2004/108/EG Electromagnetic compatibility
Product safety:	2001/95/EG Product safety
EMC:	EN 60730-1: 2002
Product safety:	EN 60730-1: 2002

Technische Daten

Sollwert-Einstellbereich Wh:	-10 ... +15°C (Werkseinstellung: 5°C)
Schaltdifferenz:	<= 2 +/- 1°C
Reproduzierbarkeit:	+/- 0,5°C
Fühler-Ansprechlänge:	ca. 60cm
Kapillarrohrlänge:	1,8m, 3m oder 6m (je nach Typ)
Schaltausgang:	Wechslerkontakt, max. 250VAC, max. 10A, Kontaktmaterial: Ag/Ni(90%/10%) vergoldet (3µm)
Rückstellung:	TFR 1,8 ... 6: Automatisch TFR 1,8 ... 6-R: Manuell
Zulässiges Medium:	Luft
Einbaulänge:	Beliebig
Anschlußklemme:	Schraubklemme max. 2,5mm²
Kabeleinführung:	Kabelverschraubung M16x1,5
Schutzart:	IP65 gemäß EN60529
Umgebungstemperatur:	w+mind. 2K ... 70°C
Transport:	-30...70°C / max. 85%rF, nicht kond.
Gehäuse:	Material Unterteil: PA GK30 Material Deckel: ABS transparent
Kapillarrohr:	Material: Kupfer Kapillarrohrfüllung: R 507

Gefahrenhinweis

Achtung: Einbau und Montage elektrischer Geräte dürfen nur durch eine Elektrofachkraft erfolgen. Vor Entfernen des Deckels Installation freischalten (Sicherung ausschalten) und gegen Widereinschalten sichern!
Die Module dürfen nicht in Verbindung mit Geräten benutzt werden, die direkt oder indirekt menschlichen, gesundheits- oder lebenssichernden Zwecken dienen oder durch deren Betrieb Gefahren für Menschen, Tiere oder Sachwerte entstehen können.

Elektrischer Anschluss

Beim elektrischen Anschluss der Geräte gelten die techn. Daten der Geräte. Die Geräte müssen bei einer konstanten Betriebsspannung betrieben werden. Strom-/Spannungsspitzen beim Ein-/Ausschalten der Versorgungsspannung müssen bauseits vermieden werden.

Montagehinweis

Kanaleinschub
Es ist empfehlenswert, das Frostschutzthermostat auf eine dazu bestimmte Schublade (Kanaleinschub) unmittelbar nach dem Lufterwärmer zu montieren. Dabei ist auf ein genügend langes Anschlusskabel für ungehindertes Ein- und Ausfahren der Schublade zu achten. Bei Lufterwärmern mit sehr großem Querschnitt können mehrere Frostschutzschalter montiert und seriell verdrahtet werden. In solchen Fällen ist der Temperatursollwert bei jedem Frostschutzschalter individuell einzustellen.

Frostschutzthermostat
Die Umgebungstemperatur beim Frostschutzthermostatgehäuse (mit Testschlaufe) muss mindestens 2°C höher sein als der eingestellte Sollwert. Ist dies nicht gewährleistet, z.B. im Freien oder in ungeschützten Räumen, muß das Gehäuse mit der Testschlaufe im Innern des Zuluftgerätes montiert werden.

Kapillarrohr
Das Kapillarrohr wird auf der warmen Seite des zu schützenden Lufterwärmers (bei Luftkühlern vor dem Luftkühlen) im Abstand von ca. 5cm quer zu den Wärmetauscherrohren gleichmäßig über die ganze Fläche verlegt. Es wird empfohlen, für Testzwecke eine Schlaufe von ca. 60 cm direkt unter dem Gehäuse und vor dem Eintritt in den Luftkanal anzubringen. Damit das Kapillarrohr nicht beschädigt wird, ist ein minimaler Biegeradius von 20 mm einzuhalten. Die Montage wird durch Verwendung der im Zubehör erhältlichen Montageklammern vereinfacht.

Technical Data

Set point adjustment range:	-10…+15°C (factory setting: 5°C)
Differential gap:	<= 2 +/- 1°C
Repeatability:	+/- 0,5°C
Sensor operating length:	approx. 60 cm
Capillary tube length:	1,8m, 3m or 6m (depending on type)
Switching output:	Change-over contact, max. 250 VAC, max. 10A Contact material: Ag/Ni(90%/10%) gold plated (3µm)
Reset:	TFR 1,8…6: automatically TFR R 1,8…6-R: manually
Admissible medium:	Air
Mounting length:	Any
Connecting terminal:	Screwing terminal max. 2,5 mm²
Cable entry:	Cable connection M16x1,5
Protection class:	IP65 accord. To EN60529
Ambient temperature:	w+mind. 2K…70°C
Transport:	-30…70°C/ max. 85%rH, no condensate
Enclosure:	Material lower part: PA6 GK30 Material cover: ABS, transparent
Capillary tube:	Material: copper Capillary tube filling: R 507

Warning Advice

Caution: The installation and assembly of electrical equipment may only be performed by a skilled electrician. Isolate installation before removal of cover (disconnect fuse) and protect against reconnection.
The modules must not be used in any relation with equipment that supports, directly or indirectly, human health or life or with applications that can result in danger for people, animals or real value.

Electrical Connection

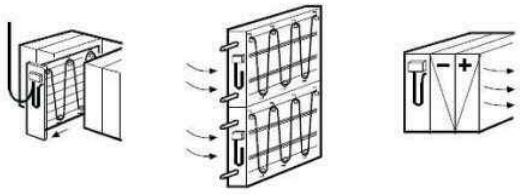
For the electrical connection, the technical data of the corresponding device are valid.
The devices must be operated at a constant supply voltage. When switching the supply voltage on/off, power surges must be avoided on site.

Mounting Advice

Withdrawable Tray
It is recommended to mount the antifreeze thermostat on a special withdrawable tray directly downstream of the heating coil. The connecting cable must be long enough to enable the tray to be inserted and removed smoothly. For heating coils with a large cross section several antifreeze thermostats can be fitted and connected in series. In such cases, the temperature set point is set individually for each antifreeze thermostat.

Antifreeze Thermostat
The ambient temperature of antifreeze thermostat housing (with the test loop) must be at least 2°C above the pre-adjusted set point. If this cannot be guaranteed (e.g. outdoors or in exposed spaces), housing and test loop must be installed inside the supply air unit.

Capillary Tube
The capillary tube must be mounted on the downstream side of the heating coil (and on the upstream side in case of cooling coils). It should be looped diagonally across the heat exchanger pipes at a distance of approx. 5 cm and should cover the entire area evenly.
For test purposes, it is recommended to have a loop of approx. 60 cm directly beneath the housing outside the entry to the duct. To prevent damage to the capillary tube a minimum bending radius of 20 mm must be ensured. Mounting can be facilitated by using the capillary tube clamps (optional accessory).

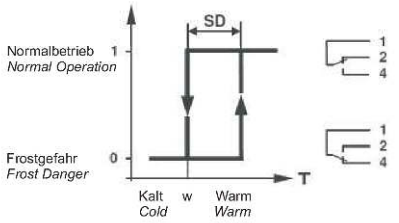


Funktionsbeschreibung

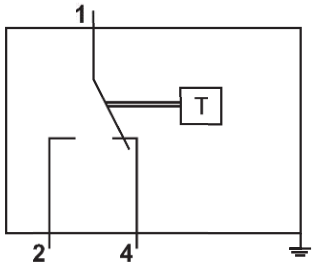
Der Schalter im Frostschutzthermostat spricht an, wenn die Temperatur auf einer Kapillarrohrlänge von mindestens 60 cm den eingestellten Temperatursollwert unterschreitet (schließt Kontakt 1-4). Kontakt 1-2 öffnet gleichzeitig und kann als Signalkontakt verwendet werden. Die Rückstellung erfolgt automatisch (Kontakt schließt 1-2), wenn die Temperatur wieder über den eingestellten Sollwert ansteigt (beim Typ TFR ... -R muß die Rückstellung manuell über die Reset-Taste erfolgen). Der TFR... ist „eigensicher", d.h. bei Beschädigung des Kapillarrohr-Membransystems schaltet er automatisch in die Heizfunktion. Kontakt 1-4 schließt und kann deshalb als Arbeitskontakt verwendet werden. Die Lufttemperatur wird über die ganze Fühlerlänge (Kapillarrohr) erfasst. Das mit Gas (R 507) gefüllte Membransystem und das Kapillarrohr bilden eine Meßeinheit. Diese ist mechanisch mit dem Mikroschalter gekoppelt.

Function Description

The antifreeze thermostat trips when the temperature of drops below the selected set point over a capillary length of 60 cm (contact 1-4 closes). Simultaneously contact 1-2 breaks and can be used as a signal contact. An automatic reset is made when the temperature exceeds the the adjusted set point again (contact 1-2 closes). For model TFR...-R manual reset is required by means of the reset button. The TFR... is "self-secured", i.e. in case of a capillary tube diaphragm damage, it switches automatically to the heating function. Contact 1-4 closes and can thus be used as an operating contact. The air temperature is measured over the full length of the capillary tube. The gas filled diaphragm system and the capillary tube are forming a unit of measurement which is mechanically linked to the micro-switch.



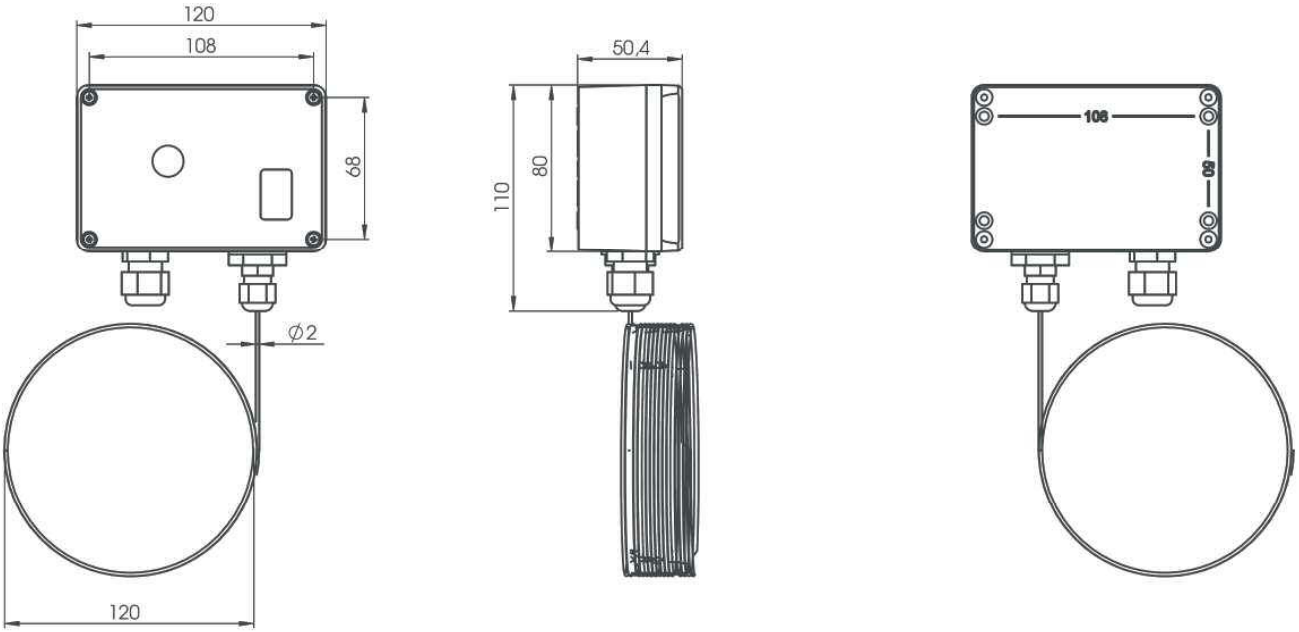
Anschlussplan



Terminal Connection Plan

1 - 2 Normalbetrieb / *Normal Operation*
1 - 4 Frostgefahr / *Frost Danger*

Abmessungen (mm)



Dimensions (mm)

Zubehör (im Lieferumfang enthalten)

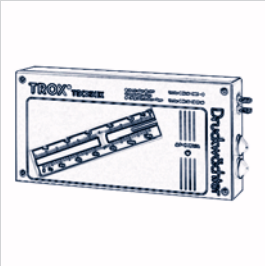
Montageklammern, 6 Stück bei 6m Kapillarrohrlänge.

Accessories (Included in Delivery)

Mounting clamps, 6 pcs. for 6m capillary tube length.

C.10 Pressure monitor TROX M536A

Name	Data
Designation	TROX M536A
Type	Pressure monitor
Number	
Type of manual	Technical data sheet
Manufacturer	



Digital Pressure Monitor

» Display and monitoring of the differential pressure in gaseous media
» Stepless adjustment of limiting value
» Illuminated display with warning function

Content overview

TROX® TECHNIK
The art of handling air

Detail

Digital pressure monitor

Application

» Monitoring of differential pressure in gaseous media, e.g. air or inert gases.
» Measuring range from 0 to 2000 Pa.

Materials

» Rigid ABS plastic casing.

Construction

» Type M536AB3:
230 V AC
» Type M536AB4:
24 V AC / DC

Equipment

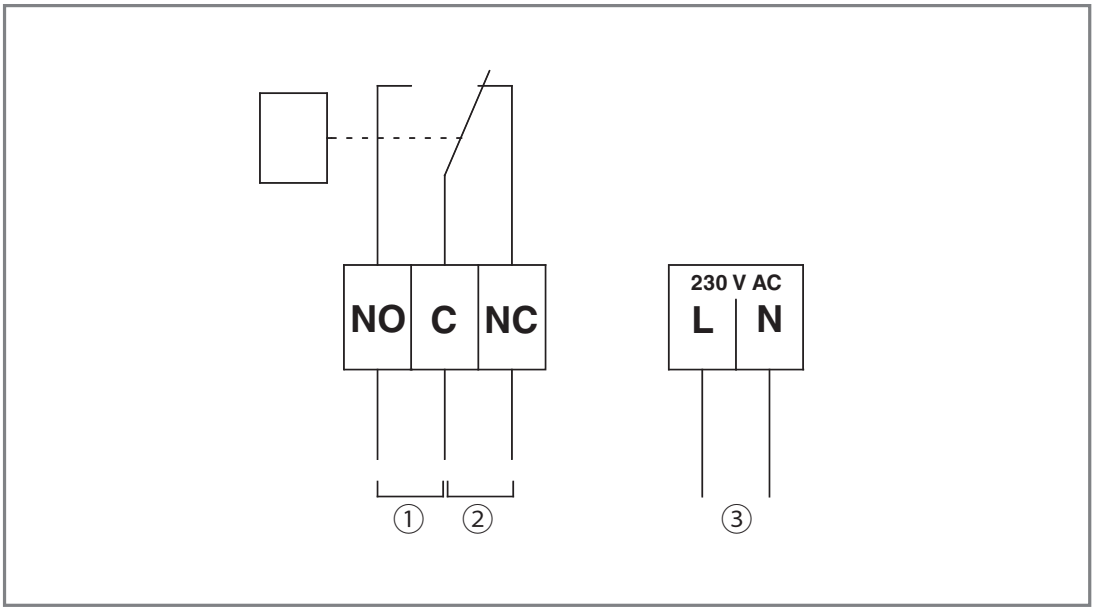
» Illuminated display with warning function; a warning is issued when the pressure differential exceeds the set limiting value.
» Push buttons to precisely set the limiting value.
» Relay output with potential-free contact to connect an external display device.

Technical data

Parameters	Value
Measuring range	0 ... 2000 Pa
Measuring tolerance	< 5 % of the measuring range
Overload protection	Up to 16000 Pa
Medium	Air and inert gases
Supply voltage	230 V/50 Hz or 24 V AC/DC
Protection level	IP 40
Relay output	Relay with make/break contact 250 V / 2 A
Operating temperature	0 ... 50 °C
Display	LCD with 124 x 64 dots
Operation	4 push buttons, protected by a membrane
Casing	2-part casing from ABS plastic
Tube connection	6 mm
Casing dimensions (L x B x H)	115 x 86 x 45 mm
Order code for supply voltage 230 V, 50 Hz	**M536AB3**
Order code for supply voltage 24 V, AC / DC	**M536AB4**

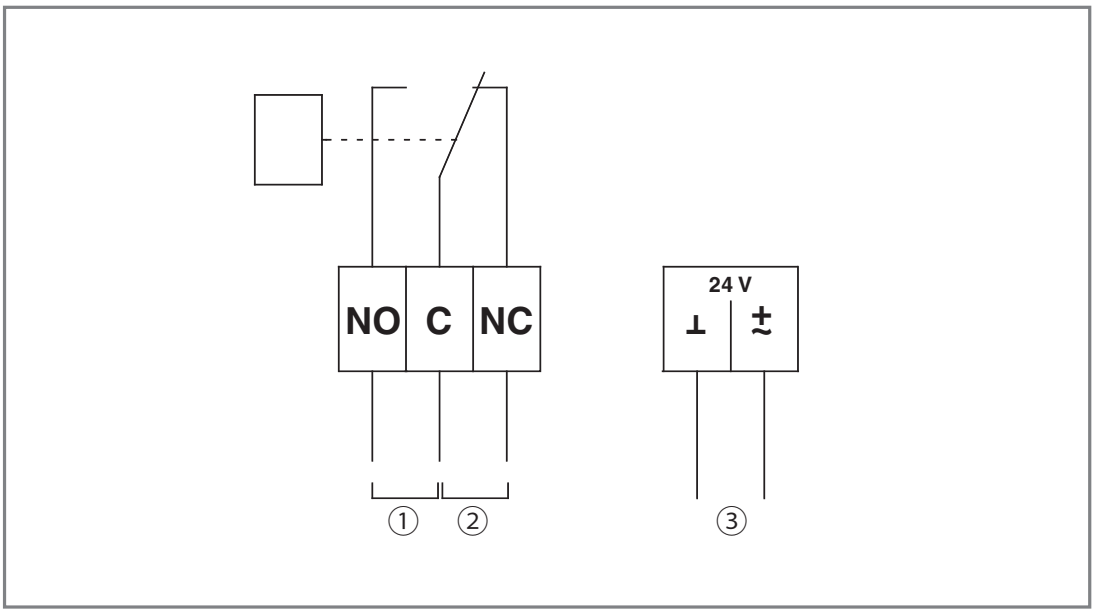
Table 1: Technical data for digital pressure monitor

Wiring diagram



① Normally open contact
② Normally closed contact
③ L / N – 230 V AC / 50 Hz

Detail drawing 1: Wiring diagram for type M536AB3



① Normally open contact
② Normally closed contact
③ 24 V AC / DC

Detail drawing 2: Wiring diagram for type M536AB4

TROX® TECHNIK

The art of handling air

Filters

C.11 LED-Leuchtmittel TROX W850

Name	Data
Designation	TROX W850
Type	LED-Leuchtmittel
Number	
Type of manual	Technisches Datenblatt
Manufacturer	

TROX GmbH

Heinrich-Trox-Platz
D-47504 Neukirchen-Vluyn
Phone +49(0)28 45/2 02-0
Fax +49(0)28 45/2 02-265
www.trox.de
Mail trox@trox.de

Product data sheet
LED lamp

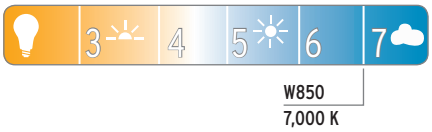
Status 02/2016

7.2 Watt/piece

238 lumen/piece

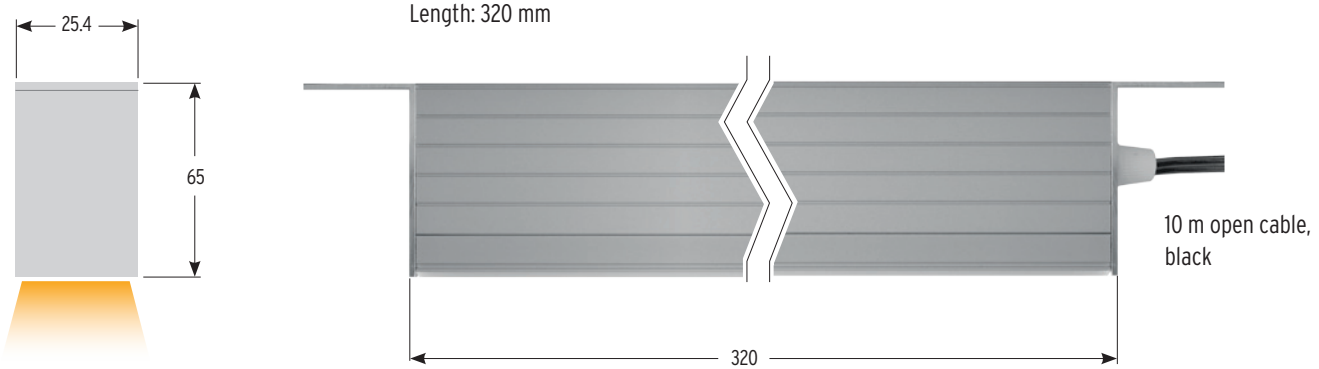
Integraded ballast (PSU)

Protection class



Construction & Dimensions

Surface: anodised aluminium
Length: 320 mm



Electrical & optical data

Dimensions	320 mm x 25.4 mm x 65 mm
Power	7.2 W/Piece
Voltage (V)	230 Volt (220 V_{min}, 240 V_{max})
Temperature	tc_{min} = -25 °C, tc_{max} = +50 °C
Storage temperature	t_{min} = -25 °C, t_{max} = +85 °C
Reverse voltage	-5 Volt
Ambient temperature	ta_{min} > -25 °C, ta_{max} = +45 °C

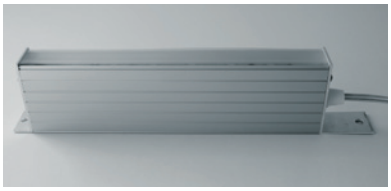
LED lamp	Lumen / piece	Color temperature (K)
W850	238	7,000 K

L70, 50,000 hrs — Service life

LM 79 — LM 79 compliant

LM 80 — LM 80 compliant

Order code: XOOLUM ZEUS W850/0,320-CL-NA-FS

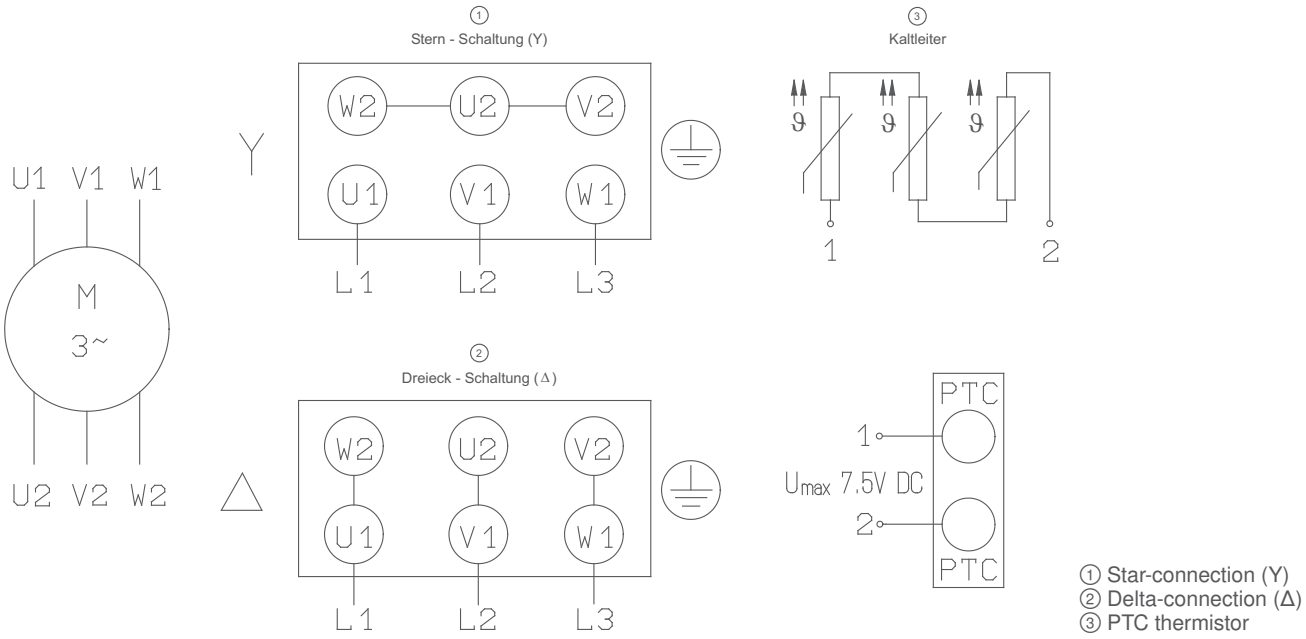


C.12 Fan electric motor Ziehl Abegg

Name	Data
Designation	Fan electric motor
Type	ER...Cpro/ER...C, GR...Cpro/GR...C
Number	
Type of manual	Connections
Manufacturer	Ziehl Abegg

Connection diagram for motors

Three-phase A.C. motor with PTC thermistor for one speed



① Star-connection (Y)
② Delta-connection (Δ)
③ PTC thermistor

Reversible rotation by interchanging phases

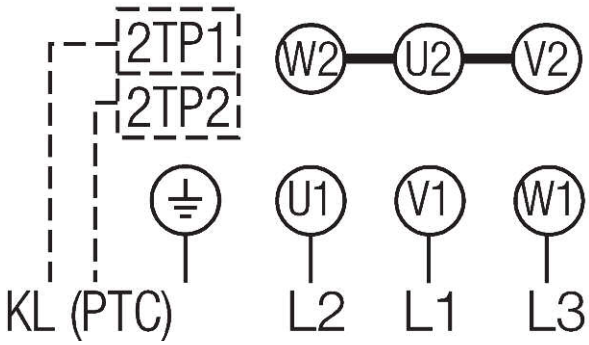
Rated voltage:
Motor size ≤ 90: 230 V Δ / 400 V Y
Motor size ≥ 100: 400 V Δ / 690 V Y

C.13 Nicotra Gebhardt fan electric motor

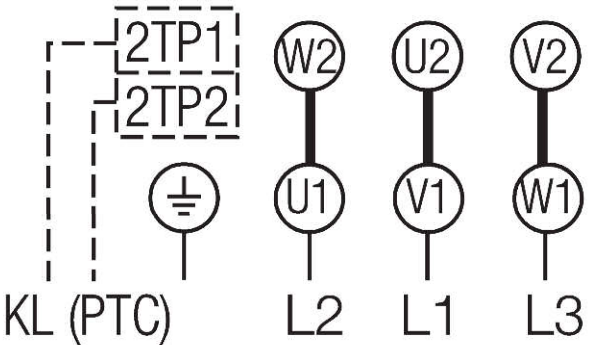
Name	Data
Designation	Fan electric motor
Type	
Number	
Type of manual	Connections
Manufacturer	Nicotra Gebhardt

Eintouriger Drehstrommotor, optional mit PTC
Three-phase A.C. motor, optional w/PTC Thermistor
Moteur triphasé à 1 vitesse, PTC Sonde en option

Stern - Schaltung (Y)
Star - connection
Branchement ètoile



Dreieck - Schaltung (△)
Delta - connection
Branchement triangle



420 08-12-2005

Weitere Informationen finden Sie unter:

www.nicotra-gebhardt.com

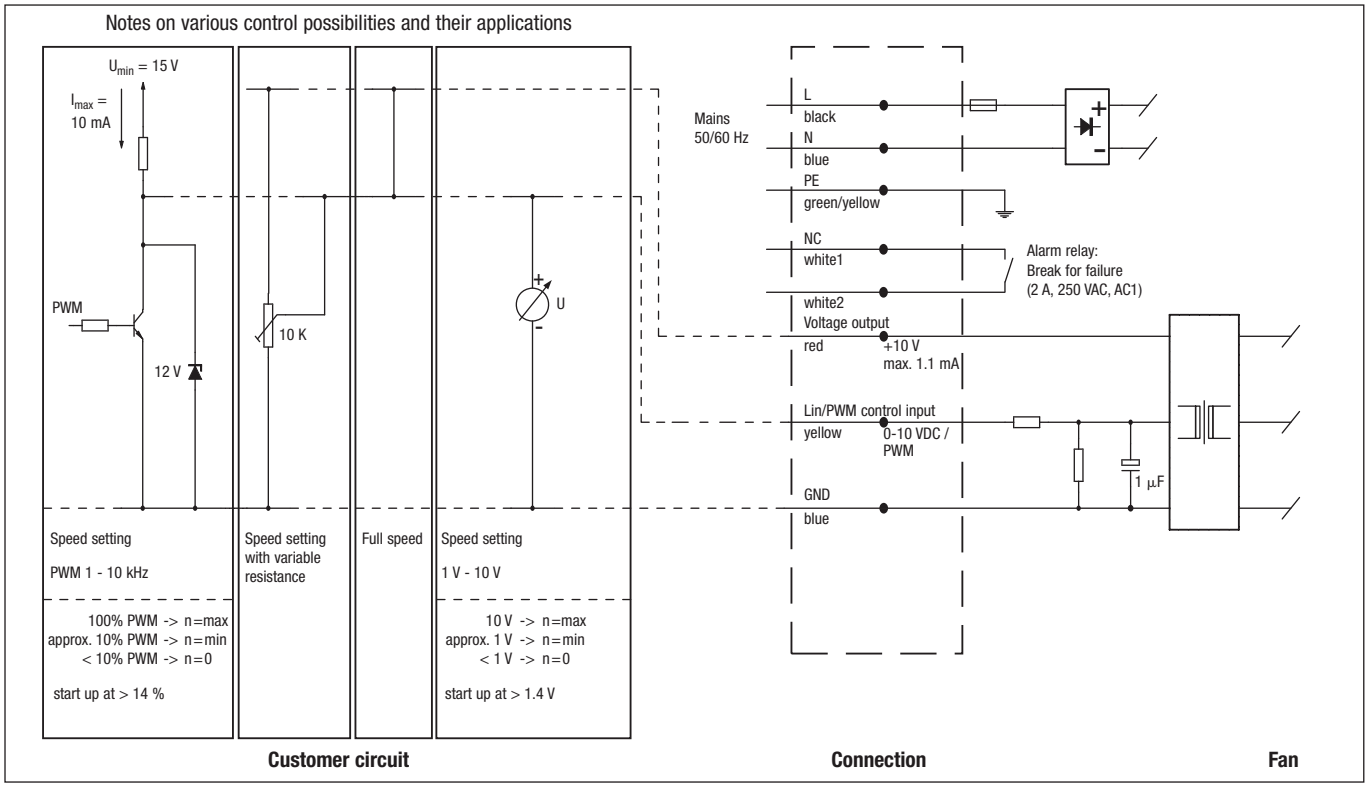
C.14 Fan electric motor ebm-pabst

Name	Data
Designation	Fan electric motor
Type	EC
Number	
Type of manual	Connections
Manufacturer	ebm-papst

Electrical connections EC K1)

Technical features:

- PFC (passive)
- Control input 0-10 VDC / PWM
- Output 10 VDC max. 1,1 mA
- Alarm relay
- Over-temperature protected electronics / motor



Line	Connection	Colour	Assignment / function
1	L	black	Mains 50/60 Hz, phase
	N	blue	Mains 50/60 Hz, neutral
	PE	green/yel	Protective earth
	NC	white1	Status relay, floating status contact, break with error
	COM	white2	Status relay, floating status contact, changeover contact, common connection (2 A, 250 V, min. 10 mA, AC1)

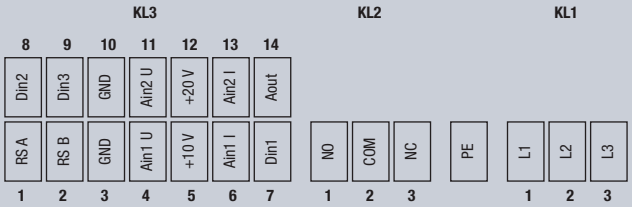
Line	Connection	Colour	Assignment / function
2	+10 V	red	Voltage output +10 V max. 1.1 mA
	0-10 V / PWM	yellow	Control input (Impedance 100 kΩ)
	GND	blue	GND

ebmpapst

Electrical connections EC M3)

Technical features:

- PFC (passive)
- integrated PID controller
- Control input 0-10 VDC / PWM
- Input for sensor 0-10 V or 4-20 mA
- Slave output 0-10 V max. 5 mA
- Output 20 VDC (±20 %) max. 50 mA
- Output 10 VDC (+10 %) max. 10 mA
- RS485 MODBUS-RTU
- Motor current limitation, Alarm relay
- Line undervoltage / phase failure detection
- Over-temperature protected electronics / motor
- Reverse polarity and locked-rotor protection, Soft start
- External 24 V input (programming)
- External release input
- Operation and alarm display
- Control interface with SELV potential safely disconnected from the mains



Connector	Pin	Connection	Assignment / function
KL1	1	L1	Mains supply connection, supply voltage 3~380-480 VAC; 50/60 Hz
	2	L2	Mains supply connection, supply voltage 3~380-480 VAC; 50/60 Hz
	3	L3	Mains supply connection, supply voltage 3~380-480 VAC; 50/60 Hz
PE		PE	Earth connection, PE connection
KL2	1	NO	Status relay, floating status contact, close with error
	2	COM	Status relay, floating status contact, changeover contact, common connection (2 A, 250 V, min. 10 mA, AC1)
	3	NC	Status relay, floating status contact, break with error
KL3	1	RSA	Bus connection RS485; RSA; MODBUS RTU
	2	RSB	Bus connection RS485; RSB; MODBUS RTU
	3/10	GND	Signal ground for control interface
	4	Ain1 U	Analogue input 1 (set value); 0-10 V; Ri= 100 kΩ; parametrisable curves; only usable as alternative to input Ain1 I
	5	+10 V	Fixed voltage output 10 VDC; +10 V ±3 %; max. 10 mA; short circuit proof; power supply for ext. devices (e.g. potentiometer)
	6	Ain1 I	Analogue input 1 (set value); 4-20 mA; Ri= 100 Ω; parametrisable curve; only usable as alternative to input Ain1 U
	7	Din1	Digital input 1: enabling of electronics; enabling: open pin or applied voltage 5 to 50 VDC; disabling: bridge to GND or applied voltage < 1 VDC; reset function: triggers software reset after a level change to < 1V
	8	Din2	Digital input 2: parameter set switch 1/2; according to EEPROM setting, thr valid/used parameter set is selectable per BUS or per digital input Din2. Parameter set 1: open oin or applied voltage 5 to 50 VDC; parameter set 2: bridge to GND or applied voltage < 1 VDC
	9	Din3	Digital input 3: Control characteristic of the integrated controller; according to EEPROM setting, the control characteristic of the integrated controller is normally/inversely selectable per BUS or per digital input; normal: open pin or applied voltage 5 to 50 VDC (control deviation = actual sensor value - set value); inverse: bridge to GND or applied voltage < 1 VDC control deviation = set value - actual sensor value)
	11	Ain2 U	Analogue input 2; actual sensor value 0-10 V; Ri= 100 kΩ; parametrisable curve; only usable as alternative to input Ain2 I
	12	+20 V	Fixed voltage output 20 VDC; +20 V +25/-10 %; max. 50 mA; short circuit proof; power supply for ext. devices (e.g. sensors)
	13	Ain2 I	Analogue input 2; actual sensor value 4-20 mA; Ri= 100 Ω; parametrisable curve; only usable as alternative to input Ain2 U
	14	Aout	Analogue output 0-10 V; max. 5 mA; output of the actual motor control factor (output voltage of electronics)/of the actual motor speed; function selectable per BUS; parametrisable curve

Electrical connections EC L6)

Technical features:

- PFC (passive)
- Integrated PID controller
- Control input 0-10 VDC / PWM
- Input for sensor 0-10 V or 4-20 mA
- Slave output 0-10 V max. 3 mA
- Output 20 VDC (±20 %) max. 50 mA
- Output 10 VDC (+10 %) max. 10 mA
- RS485 MODBUS
- Alarm relay
- Line undervoltage / phase failure detection
- Motor current limitation
- Over-temperature protected electronics / motor
- Locked-rotor protection
- Soft start

Connector	Connection	Assignment / function
PE	PE	Protective earth
KL1	L3	Mains; L3
	L2	Mains; L2
	L1	Mains; L1
KL2	NC	Status relay, floating status contact, break with error
	COM	Status relay, floating status contact, changeover contact, common connection (2 A, 250 V, min. 10 mA, AC1)
	NO	Status relay, floating status contact, close with error

Connector	Connection	Assignment / function
KL3	OUT	Master output 0-10 V max. 3 mA
	GND	GND
	0-10 V / PWM	Control / Actual value input (Impedance 100 kΩ)
	+10 V	Supply for external potentiometer, 10 VDC (+10 %) max. 10 mA
	+20 V	Supply for external sensor, 20 VDC (±20 %) max. 50 mA
	4-20 mA	Control / Actual value input
	0-10 V / PWM	Control / Actual value input
	GND	GND
	RSB	RS485 interface for MODBUS RTU; RSB
	RSA	RS485 interface for MODBUS RTU; RSA
	RSB	RS485 interface for MODBUS RTU; RSB
	RSA	RS485 interface for MODBUS RTU; RSA

Electrical connections EC L7)

Technical features:

- PFC (active)
- Integrated PID controller
- Control input 0-10 VDC / PWM
- Input for sensor 0-10 V or 4-20 mA
- Slave output 0-10 V max. 3 mA
- Output 20 VDC (±20 %) max. 50 mA
- Output 10 VDC (+10 %) max. 10 mA
- RS485 MODBUS
- Alarm relay
- Line undervoltage detection
- Motor current limitation
- Over-temperature protected electronics / motor
- Locked-rotor protection
- Soft start

Connector	Connection	Assignment / function
PE	PE	Protective earth
KL1	N	Mains 50/60 Hz. neutral
	L	Mains 50/60 Hz, phase
KL2	NC	Status relay, floating status contact, break with error
	COM	Status relay, floating status contact, changeover contact, common connection (2 A, 250 V, min. 10 mA, AC1)
	NO	Status relay, floating status contact, close with error

Connector	Connection	Assignment / function
KL3	OUT	Master output 0-10 V max. 3 mA
	GND	GND
	0-10 V / PWM	Control / Actual value input (Impedance 100 kΩ)
	+10 V	Supply for external potentiometer, 10 VDC (+10 %) max. 10 mA
	+20 V	Supply for external sensor, 20 VDC (±20 %) max. 50 mA
	4-20 mA	Control / Actual value input
	0-10 V / PWM	Control / Actual value input
	GND	GND
	RSB	RS485 interface for MODBUS RTU; RSB
	RSA	RS485 interface for MODBUS RTU; RSA
	RSB	RS485 interface for MODBUS RTU; RSB
	RSA	RS485 interface for MODBUS RTU; RSA

Fan	Wiring diagram
K3G 250-AV29 -B2	L7)
K3G 280-AU11 -C2	L6)
K3G 310-BB49 -02	M3)
K3G 310-AZ88 -02	M3)
K3G 355-AY40 -02	M3)
K3G 400-AQ23 -01	M3)
K3G 450-AQ24 -01	M3)
K3G 450-AZ30 -01	M3)
K3G 500-AP25 -01	M3)
K3G 500-AQ33 -01	M3)
K3G 560-AP23 -01	M3)
K3G 560-AQ04 -01	M3)

C.15 PTH-xF electronic pressure transducer

Name	Data
Designation	Electronic pressure transducer
Type	PTH-xF
Number	
Type of manual	Technical data sheet
Manufacturer	OJ Electronics A/S

INSTRUCTIONS

Type PTH-xF

57069 11/06 (BJ)

- Svenska
- Norsk
- Dansk
- English
- Deutsch
- Francais

Svenska

PTH är en elektronisk tryckgivare som mäter total- och differenslufttrycket i en ventilationsanläggning. När man använder tryckgivaren tillsammans med ett standardspjäll kan man mäta luftflöde, eftersom omräkning från differenstryck till flöde är inbyggt i givaren. Tryckgivaren används i samband med övervakning, kontroll och reglering via en regulator, PLC eller en övervakningsanläggning.
Normala användningsområden är:
- Fixering/styrning av ett konstant tryck på en given plats i ventilationskanalsystemet.
- Fixering/styrning av ett önskat undertryck i ventilationskanalsystemet.
- Differenstryckmätning över ventilationsfilter för optimalt filterbyte
- Volymflödesmätning (flöde) med differenstryckmätning över ett standardspjäll

PRODUKTPROGRAM

Typ	Produkt
PTH-3202-DF	Tryckgivare 0 – 2500 Pa, teckenfönster, flöde
PTH-3202-BF	Tryckgivare 0 – 2500 Pa, bakgrundsbelyst teckenfönster, flöde

FUNKTION
PTH är en tryckgivare för komfortventilation som avger en aktiv ström- eller spänningssignal som är proportionell mot det uppmätta trycket. Om tryckgivaren ställs om till flödesmätning omräknas differenstrycket (Δp) till volymflöde (q_V) med hjälp av den följande formeln:
$qv = k \bullet \sqrt{\Delta p}$. PTH är uppbyggd med halvledarelement utan luftgenomströmning vilket skyddar mot damm från ventilationsanläggningen. Tryckelementet är temperaturkompenserat så att trycket mäts optimalt över hela det specificerade temperaturområdet.

Tryckgivaren kan ställas in på önskat mätområde med 3 tryckknappar. De samma knapparna används för att ställa in k-faktorn, som används vid omräkning till flöde. Man väljer mellan tryck eller flöde genom att bara ändra läget på en DIP-switch och byta ut Pa mot m³/h eller l/s på frontskylten.

PTH-tryckgivaren kan omedelbart ersätta tryckgivare med kvadratrotsutgång och visning av flöde i % genom att ställa om den till flödesområde P.

Utgångssignalen kan ändras från spänning [V] till ström [mA] genom att flytta en jumper. Två olika dämpningar kan väljas med DIP-switch så att ev. trycksvängningar i ventilationsanläggningen dämpas i givarens utgångssignal. Om det aktuella trycket/flödet ligger utanför det inställda området blinkar teckenfönstret.

CE-MÄRKNING
OJ Electronics A/S intygar under ansvar att produkten uppfyller Rådets Direktiv 92/31 och efterföljande ändringar betr. elektromagnetisk kompatibilitet samt Rådets Direktiv 73/23 betr. elektriskt materiel ämnat för användning inom vissa spänningsgränser.
Använda normer:
EN 61000-6-2 och EN 61000-6-3

TEKNISKA DATA

Fullskaligt tryckområde:	0-2500Pa
Mätområden tryck:	-50..+50Pa, 0..+100Pa, 0..+150Pa, 0..+300Pa, 0..+500Pa, 0..+1000Pa, 0..1600Pa, 0..2500Pa.
Mätområden flöde:	P, 100 m³/h, 300 m³/h, 500 m³/h, 1000 m³/h, 3 000 m³/h, 5000 m³/h, 9 999 m³/h, 30.00 m³/h x 1000, 50.00 m³/h x 1000, 99.99 m³/h x 1000. Enheten m³/h kan bytas mot l/s.
Kvadratrotsutgång:	I flödesområdet P mäts differenstrycket i % full skala av tryckmät området med beräkning av kvadrat roten.
k-faktor:	1 - 2000
Strömförsörjning:	24V AC ±15%, 50/60 Hz 13,5 - 28V DC
Effektförbrukning:	2,5 VA (+5/+40°C), 4 VA (-20/+5°C),
Utgångssignal (valfri)	0-10V DC, 2-10V DC 4-20 mA, 0-20 mA
Precision (> 350Pa)	±3% (avläst värde)
Precision (< 350Pa)	±10Pa
Linjaritet (@ -20/+40 °C)	<1% av givarens fullskala
Dämpning (valfri)	0,4 s eller 10 s
Max tryck	20 kPa
Omgivningstemperatur	0/+50°C (Teckenfönster) -20/+40°C (konstant drift) -30/+50°C (kortvarigt) -50/+70°C (Lagring)
Dimensioner	75 x 36 x 91 mm (se figur 1)
Kabeldimensioner	3 x max. 1,5 mm²
Tryckstudsar	2 x Ø 6,2 mm
Kapslingsklass	IP54
Vikt	110 g

MONTERING
PTH ska skruvas fast på en plan yta. PTH är inte känslig för monteringsriktning men av hänsyn till upprätthållande av kapslingsgraden bör det finnas slangar på båda slangstudsar om de vänds uppåt. Kapslingen har inbyggda fastgöringshål, fig. 1.

Tryck ansluts med slangar så att det högsta trycket går till ”+ studsen” och det lägsta till ”- studsen”. Om slangarna förväxlas av misstag och trycket hamnar utanför mätområdet kommer teckenfönstret att blinka.
Tryckslangarna ska vara så korta som möjligt och anslutas så att vibrationer undviks. Optimal tryckmätning uppnås där minsta möjliga risk för turbulent strömning finns. Dvs. mitt i ventilationskanalerna och med tillräckligt avstånd till rörböjar och förgreningar. Se fig. 2.
Kapslingen öppnas utan att använda verktyg genom att trycka på snäpplåset som går ner på sidan av studsarna. Givarkabeln kan vara upp till 50 m och anslutas enligt fig. 3.
Undvik att placera givarkabeln parallellt med strömförsörjningskablar eftersom spänningssignaler från dessa kan störa givarens funktion.

INSTÄLLNINGAR
Man väljer mellan tryck och flöde på DIP-switchen (se fig. 3 och 4), och mätområdet visas genom att man trycker en gång på knapparna ”▲”, ”▼” eller ”OK” på undersidan av locket (se fig. 5). Om knapparna inte används inom 60 sekunder växlar givaren automatiskt tillbaka till visning av aktuellt mätvärde. Upprepade tryckningar på “▲” och “▼” växlar mätområdet uppåt/neråt. Mätområdet blinkar i teckenfönstret tills inställningen lagras genom att trycka på ”OK”.

Tryckmätning (fig. 11): Om DIP-switchen är inställd på tryck växlas det därefter till visning av aktuellt tryck.

Flödesmätning (fig. 12): Om DIP-switchen är inställd på flöde kommer en tryckning på ”OK” därefter att växla till inställning av k-faktorns första siffra, som blinkar och ställs in med knapparna “▲” och “▼”. Följande tryckningar på ”OK” växlar till inställning av siffrorna 2, 3 och 4. Den inställda k-faktorn lagras med en avslutande tryckning på ”OK”. Därefter växlar teckenfönstret automatiskt till visning av det aktuella mätvärdet. När man väljer vanlig flödesmätning är det inte nödvändigt att ställa in något tryckområde. Exempel på flödesberäkning visas i fig. 13.

Kvadratrotsutgång (fig. 14): Om flödesområde väljs fungerar PTH som en tryckgivare med kvadratrotsutgång och visning av flödet i % (Delta P [%]). Full skala bestäms av det inställda tryckområdet (p-område). Visningen i teckenfönstret beräknas då som Delta P [%] = 100x√(Δp/p-område). När flödesområde P har valts kommer nästa tryckning på ”OK” få PTH att växla till inställning av tryckområdet. Tryckområdet lagras med en avslutande tryckning på ”OK”. Därefter växlar teckenfönstret automatiskt till visning av det aktuella mätvärdet.

Ändring av måttenheter: Beroende på k-värdets enhet och val av flödesområde ska en av de medföljande, självhäftande enhetsetiketterna monteras på tryckgivarens frontplåt. Se fig. 6 och 7.

Utgångssignal [V / mA] väljs med en jumper och utgångssignalens minimum ställs in med DIP-switch. Se fig. 3 och 8.

Dämpningen ställs in på en DIP-switch. Se fig. 3 och 9. Tryckgivaren mäter trycket flera gånger

och genomsnittsvärdet för valt tidsutrymme återges löpande i givarens utgångssignal. På detta sätt dämpas ventilationsanläggningens ev. trycksvängningar i utgångssignalen.

NOLLSTÄLLNING
När givaren är monterad och strömförsörjningen ansluten kan den nollställas vid behov. Det bästa resultatet får man när tryckgivaren har uppnått normal arbetstemperatur. Innan nollställningen aktiveras bör man säkerställa att tryck på + och -studsar är lika genom att t.ex. stanna ventilationsanläggningen. Visar teckenfönstret ett differenstryck som överstiger 10 Pa kan det bero på ett oavsiktligt tryck i systemet (drag eller avklämda slangar).
Rekommendationen är att tryckslang(ar) avlägsnas från "+" och "-" studsar när nollställningen genomförs. Nollställningen startas genom att aktivera den inbyggda zero-set switch (se fig. 3). Den gula lysdioden blinkar tills nollställningen avslutats.

LYSDIODINDIKERING
Den gröna lysdioden lyser när korrekt matningsspänning är ansluten. Den gula lysdioden blinkar i ca. 3 sekunder medan nollställningen utförs.

Lysdiod	ON (till)	Blinkar	Off (från)
Grön	OK		Ingen försörjning
Gul		Nollställning utförs	OK

FIGURER
Fig. 1: Måttritning
Fig. 2: Tryckgivarens placering i förhållande till böjar och förgreningar
Fig. 3: Anslutningsritning
Fig. 4: Inställning av tryck/flöde
Fig. 5: Val av mätområde
Fig. 6: Ändring av måttenheter
Fig. 7: Val av måttenhetsskylt
Fig. 8: Val av utgångssignal
Fig. 9: Val av dämpning
Fig. 10: Tillgängliga DIP
Fig. 11: Tryckinställningar
Fig. 12: Inställning av flöde
Fig. 13: Exempel på flödesberäkning
Fig. 14: Inställning av kvadratrot

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Norsk

PTH er en elektronisk trykkgiver som primært måler total- og differanselufttrykk i et ventilasjonsanlegg. Når trykkgiveren brukes sammen med en standard blende, kan den måle luftstrøm, siden omregning fra differansetrykk til flyt er innebygd i giveren. Trykkgiveren benyttes i forbindelse med overvåkning, kontroll og regulering via en regulator, PLC eller et overvåkningsanlegg.

Typiske bruksområder er:
- Fastholding/styring av et konstant trykk på et bestemt sted i ventilasjonskanalsystemet.
- Fastholding/styring av et ønsket undertrykk i ventilasjonskanalsystemer.
- Differansetrykkmåling over ventilasjonsfilter for optimal utskifting av filter
- Volumstrømmåling (flyt) ved differansetrykkmåling over standard blende.

PRODUKTPROGRAM

Type	Produkt
PTH-3202-DF	Trykkgiver 0-2500 Pa, display, flyt
PTH-3202-BF	Trykkgiver 0-2500 Pa, bakgrunnsbelyst display, flyt

FUNKSJON
PTH er en trykktransmitter til komfortventilasjon som avgir et aktivt strøm- eller spenningssignal som er proporsjonalt med det målte trykket. Innstilles trykkgiveren til flytmåling, omregnes differansetrykket (Δp) til volumstrøm (qv) vha. flg. formel: $q_V = k \bullet \sqrt{\Delta p}$. PTH er oppbygd med et halvleder trykkelement uten luftgjennomstrømning. Det beskytter mot støv fra ventilasjonsanlegget. Trykkelementet er temperaturkompensert, slik at det oppnås optimal trykkmåling i hele det spesifiserte temperaturområdet.

Trykkgiveren kan innstilles til ønsket måleområde vha. 3 trykknapper. De samme knappene innstiller k-faktoren som brukes ved omregning til flyt. Man velger mellom trykk og flyt ved bare å endre stilling på en DIP-switch, og bytte Pa med m³/h eller l/s på frontskiltet. PTH trykkgiver kan umiddelbart erstatte trykkgivere med kvadratrotutgang og visning av flyt i %, ved innstilling til flytområde P.

Utgangssignalet kan endres fra spenning [V] til strøm [mA] ved å flytte en bro. Det kan velges to ulike dempinger med DIP-switch, slik at ev. trykksvingninger i ventilasjonsanlegget kan dempes i trykkgiverens utgangssignal. Hvis aktuelt trykk/flyt er utenfor valgt område, blinker displayet.

CE-MERKING
OJ Electronics A/S erklærer herved at produktet oppfyller Rådets direktiv 92/31 og senere endringer om elektromagnetisk kompatibilitet og Rådets direktiv 73/23 om elektrisk materiell som er bestemt til bruk innenfor visse spenningsgrenser.
Anvendte standarder
EN 61000-6-2 og EN 61000-6-3

TEKNISKE DATA

Fullskala trykkområde:	0-2500Pa
Måleområder trykk:	-50..+50Pa, 0..+100Pa, 0..+150Pa, 0..+300Pa, 0..+500Pa, 0..+1000Pa, 0..1600Pa, 0..2500Pa.
Måleområder flyt:	P, 100 m³/h, 300 m³/h, 500 m³/h, 1000 m³/h, 3000 m³/h, 5000 m³/h, 9999 m³/h, 30,00 m³/h x 1000, 50,00 m³/h x 1000, 99,99 m³/h x 1000. Enheten m³/h kan skiftes ut med l/s.
Kvadratrotutgang:	I flytområde P måles differansetrykk i % i full skala av trykkmåle området med kvadratrotberegning.
k-faktor:	1 til 2000
Matespenning:	24V AC ±15%, 50/60 Hz 13,5-28 V DC
Effektforbruk:	2,5 VA (+5/+40 °C), 4 VA (-20/+5 °C),
Utgangssignal (valgfri)	0-10 V DC, 2-10 V, DC 4-20 mA, 0-20 mA
Nøyaktighet (>350 Pa)	±3 % (avlest verdi)
Nøyaktighet (<350 Pa)	±10 Pa
Linearitet (@ -20/+40 °C)	<1 % av giverens fullskala
Demping (valgfri)	0,4 s eller 10 s
Maks. trykk	20 kPa
Omgivelsestemperatur	0/+50 °C (Display) -20/+40°C (konstant drift) -30/+50°C (kortvarig) -50/+70°C (Oppbevaring)
Dimensjoner	75x36x91 mm (se figur 1)
Kabeldimensjoner	3 x maks. 1,5 mm2
Trykkstusser	2 x Ø6,2 mm
Kapslingsklasse	IP54
Vekt	110 g

MONTERING
PTH må skrus fast på en plan flate. PTH er ikke følsom overfor montasjeretning, men for å opprettholde kapslingsgraden bør det være slanger på begge slangestussene hvis de vender opp. Kapslingen har innebygde festehuller, se fig. 1.

Trykket tilkobles vha. slanger, slik at det største trykket går til "+ stussen" og det minste til "- stussen". Hvis slangene byttes om ved en feil, og trykket er utenfor måleområdet, vil displayet blinke. Trykkslangene må være så korte som mulig, og festes slik at man unngår vibrasjoner. Optimal trykkmåling oppnås der det er minst mulig risiko for turbulent luftstrøm. Det vil si midt i ventilasjonskanaler og med tilstrekkelig avstand til bend og forgreninger. Se fig. 2. Åpning av kapslingen foregår uten bruk av verktøy ved å trykke på smekklåsen, som går ned ved siden av stussene. Giverkabelen kan være opp til 50 m og kobles til som vist i fig. 3. Man må unngå å plassere giverkabelen parallelt med effektkabler, siden spenningssignaler fra disse kan forstyrre funksjonen til giveren.

INNSTILLINGER
Man velger mellom trykk og flyt på DIP-switch (se fig. 3 og 4), og måleområde vises ved å trykke én gang på "▲", "▼" eller "OK"-knappene på undersiden av lokket (se fig. 5). Hvis knappene ikke aktiveres i 60 sekunder, skiftes det automatisk tilbake til visning av aktuell måleverdi. Gjentatte trykk på "▲" og "▼" skifter måleområdet opp/ned, og måleområdet blinker i displayet inntil innstillingen lagres ved å trykke på "OK".

Trykkmåling (fig. 11): Hvis DIP-switchen blir innstilt til trykk, vil det skifte til visning av aktuelt trykk.

Flytmåling (fig. 12): Hvis DIP-switchen er innstilt til flyt, vil et trykk på "OK" deretter skifte til innstilling av k-faktorens 1. siffer som blinker og innstilles vha. "▲" og "▼"-knappene. Påfølgende trykk på "OK" skifter til innstilling av hhv. siffer 2, 3 og 4. Innstilt k-faktor lagres ved å trykke på "OK" igjen, dermed skiftes det automatisk til visning av aktuell måleverdi. Når det skal velges alminnelig flytmåling, må det ikke innstilles trykkområde. Eksempel på flytberegning er vist i fig. 13.

Kvadratrotutgang (fig. 14): Hvis man velger flytområde P, fungerer PTH som en trykkgiver med kvadratrotutgang og visning av flyt i prosent (Delta P [%]). Fullskala bestemmes av innstilt trykkområde (p-range), siden displayvisningen beregnes som Delta P [%] = 100x√(Δp/p-range). Når flytområde P er valgt, vil neste trykk på "OK" bytte til innstilling av trykkområdet. Trykkområdet lagres ved å trykke på "OK" igjen, dermed skiftes det automatisk til visning av aktuell måleverdi.

Endring av måleenheter: Avhengig av enheten til k-verdien og valg av flytområde må et av de medfølgende selvklebede enhetsskiltene monteres på frontplaten av tryktgiveren. Se fig. 6 og 7.

Utgangssignal [V / mA] velges vha. en bro og utgangssignalets minimumsverdi innstilles vha. DIP-switchen. Se fig. 3 og 8.

Dempingen innstilles på DIP-switch. Se fig. 3 og 9. Giver måler trykket flere ganger, og gjennomsnittsverdien for det valgte tidsrommet

gjengis fortløpende i utgangssignalet fra giveren. Dermed dempes ventilasjonsanleggets ev. trykksvingninger i utgangssignalet.

NULLSTILLING
Når giveren er montert og strømmen tilkoblet, kan giveren ev. nullstilles. Det beste resultatet oppnås når giveren har nådd normal driftstemperatur. Før nullstillingen aktiveres, bør man sikre at trykket på "+" og "-"-stussene er likt, f.eks. ved å stoppe ventilasjonsanlegget. Viser displayet over 10 Pa differansetrykk, kan det skyldes utilsiktet trykk i anlegget (trekk eller avklemte slanger). Det anbefales at trykkslangen(ene) er fjernet fra "+" og "-"-stussene når nullstillingen utføres. Nullstilling startes ved å aktivere den innebygde "zero-set"-switchen (se fig. 3). Dermed blinker den gule lysdioden inntil nullstillingen er avsluttet.

LYSDIODEVISNING
Grønn LED lyser ved korrekt tilkoblet matespenning. Gul LED blinker i ca. 3 sekunder mens nullstillingen utføres.

Lysdiode	PÅ	Blink	AV
Grønn	OK		Ingen tilførsel
Gul		Nullstilling utføres	OK

FIGURER
Fig. 1: Målskisse
Fig. 2: Plassering av giver i forhold til bend og grenrør
Fig. 3: Tilkoblingsdiagram
Fig. 4: Innstilling trykk/flyt
Fig. 5: Valg av måleområde
Fig. 6: Endring av måleenheter
Fig. 7: Valg av måleenhetsskilt
Fig. 8: Valg av utgangssignal
Fig. 9: Valg av demping
Fig. 10: Disponible DIP
Fig. 11: Trykkinnstillinger
Fig. 12: Flytinnstillinger
Fig. 13: Flytberegningseksempel
Fig. 14: Kvadratrotsinnstilling

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Dansk

PTH er en elektronisk tryktransducer der primært måler total- og differens-lufttryk i et ventilationsanlæg.
Når tryktransduceren bruges sammen med en standard blænde, kan den måle luftflow, da omregning fra differenstryk til flow er indbygget i transduceren. Tryktransduceren anvendes i forbindelse med overvågning, kontrol og regulering via en regulator, PLC eller et overvågningsanlæg.

Typiske anvendelses områder er:
- Fastholdelse/styring af et konstant tryk på et givet sted i ventilationskanalsystemet.
- Fastholdelse/styring af et ønsket undertryk i ventilationskanalsystemer.
- Differenstrykmåling over ventilationsfilter for optimal udskiftning af filter
- Volumenstrømsmåling (flow) ved differenstrykmåling over standard blænde.

PRODUKTPROGRAM

Type	Produkt
PTH-3202-DF	Tryktransducer 0-2500Pa, display, flow
PTH-3202-BF	Tryktransducer 0-2500Pa, baggrundsbelyst display, flow

FUNKTION
PTH er en tryktransmitter til komfortventilation som afgiver et aktivt strøm- eller spændings-signal, der er proportionalt med det målte tryk. Indstilles tryktransduceren til flowmåling omregnes differenstrykket (Δp) til volumenstrøm (q_v) vha. flg. formel : $q_v = k \bullet \sqrt{\Delta p}$. PTH er opbygget med et halvleder trykelement uden luftgennemstrømning, hvilket beskytter mod støv fra ventilationsanlægget. Trykelementet er temperaturkompenseret, således at der opnås optimal trykmåling i hele det specificerede temperaturområde.

Tryktransduceren kan indstilles til ønsket måleområde vha. 3 trykknapper. De samme knapper indstiller k-faktoren som benyttes ved omregning til flow. Valg mellem tryk eller flow udføres blot ved at ændre en DIP-switch stilling, og udskifte Pa med m³/h eller l/s på frontskiltet.

PTH tryktransduceren kan umiddelbart erstatte tryktransducere med kvadratrodsudgang og visning af flow i %, ved indstilling til flowområde P.

Udgangssignalet kan ændres fra spænding [V] til strøm [mA] ved at flytte en jumper. To forskellige dæmpninger kan vælges med DIP-switch, så evt. tryksvingninger i ventilations-anlægget kan dæmpes i tryktransducerens udgangssignal. Hvis aktuelt tryk/flow er uden for valgt område blinker displayet.

CE MÆRKNING
OJ Electronics A/S erklærer under ansvar, at produktet opfylder Rådets Direktiv 92/31 og efterfølgende ændringer om elektromagnetisk kompatibilitet, samt Rådets Direktiv 73/23 om elektrisk materiel bestemt til anvendelse inden for visse spændingsgrænser.

Anvendte standarter
EN 61000-6-2 og EN 61000-6-3.

TEKNISKE DATA

Fuldskala trykområde:	0-2500Pa
Måleområder tryk:	-50..+50Pa, 0..+100Pa, 0..+150Pa, 0..+300Pa, 0..+500Pa, 0..+1000Pa, 0..1600Pa, 0..2500Pa.
Måleområder flow :	P, 100m³/h, 300m³/h, 500m³/h, 1000m³/h, 3000m³/h, 5000m³/h, 9999m³/h, 30.00m³/h x 1000, 50.00m³/h x 1000, 99.99m³/h x 1000. Enheden m³/h kan udskiftes med l/s.
Kvadratrodsudgang:	I flowområde P måles differenstryk i % fuld-skala af trykmåle området med kvadrat rodsberegning.
k-faktor:	1 til 2000
Forsyningsspænding:	24V AC ±15%, 50/60 Hz 13,5-28V DC
Effektforbrug:	2,5 VA (+5/+40°C), 4 VA (-20/+5°C),
Udgangssignal (valgfri)	0-10V DC, 2-10V DC 4-20mA, 0-20mA
Nøjagtighed (>350Pa)	±3% (aflæst værdi)
Nøjagtighed (<350Pa)	±10 Pa
Linearitet (@ -20/+40°C)	<1% af transducerens fuldskala
Dæmpning (valgfri)	0,4s eller 10s
Maks. tryk	20 kPa
Omgivelsestemperatur	0/+50°C (display) -20/+40°C (konstant drift) -30/+50°C (kortvarigt) -50/+70°C (opbevaring)
Dimensioner	75x36x91 mm (se figur 1)
Kabeldimensioner	3 x maks. 1,5mm²
Trykstudse	2 x Ø6,2mm
Kapsling	IP54
Vægt	110 g

MONTERING
PTH skal skrues fast på en plan flade. PTH er ikke følsom overfor montageretningen, men af hensyn til opretholdelsen af kapslingsgraden bør der være slanger på begge slange studser, hvis de vendes opad. Kapslingen har indbyggede fastgørelseshuller, se fig. 1.

Tryk tilsluttes vha. slanger, så det største tryk går til "+ studsen" og de mindste til "- studsen". Hvis slangerne fejlagtigt ombyttes, og trykket er uden for måleområdet, vil displayet blinke. Trykslangerne skal være så korte som muligt og fastgøres, så vibrationer undgås. Optimal trykmåling opnås, hvor der er mindst mulig risiko for turbulent luftstrømning, hvilket vil sige midt i ventilationskanaler og med tilstrækkelig afstand til bøjninger og forgreninger. Se fig. 2.

Åbning af kapslingen foregår uden brug af værktøj ved at trykke på snaplåsen, som går ned ved siden af studserne. Transducerkablet må være op til 50m og forbindes som vist i fig. 3. Det skal undgås at transducerkablet placeres parallelt med effektkabler, da spændingssignaler fra disse kan forstyrre transducerens funktion.

INDSTILLINGER
Valg mellem tryk og flow indstilles på DIP-switch (se fig. 3 og 4), og måleområde vises ved at trykke én gang på "▲", "▼" eller "OK" knapperne på undersiden af låget (se fig. 5). Hvis knapperne ikke aktiveres i 60 sekunder skiftes automatisk tilbage til visning af aktuel måleværdi. Gentagne tryk på "▲" og "▼" skifter måleområdet op/ned og måleområdet blinker i displayet indtil indstillingen gemmes ved tryk på "OK".

Trykmåling (fig. 11): Hvis DIP-switch er indstillet til tryk, vil der herefter skiftes til visning af aktuelt tryk.

Flowmåling (fig. 12): Hvis DIP-switch er indstillet til flow, vil tryk på "OK" herefter skifte til indstilling af k-faktorens 1. ciffer som blinker og indstilles vha. "▲" og "▼" knapperne. Efterfølgende tryk på "OK" skifter til indstilling af hhv. ciffer 2, 3 og 4. Indstillet k-faktor gemmes med et afsluttende tryk på "OK", hvorved der automatisk skiftes til visning af aktuel måleværdi. Når der vælges almindelig flowmåling skal der ikke indstilles trykområde. Eksempel på flow-beregning er vist i fig. 13.

Kvadratrodsudgang (fig. 14): Vælges flow område P fungerer PTH som en tryktransducer med kvadratrodsudgang og visning af flow i procent (Delta P [%]). Fuldskala bestemmes af indstillet trykområde (p-range), idet display visningen beregnes som Delta P [%] = 100x√(Δp/p-range). Når flow område P er valgt vil næste tryk på "OK" skifte til indstilling af trykområdet. Trykområdet gemmes med et afsluttende tryk på "OK", hvorved der automatisk skiftes til visning af aktuel måleværdi.

Ændring af måleenheder: Afhængig af k-værdiens enhed og valg af flowområde, skal et af de medfølgende selvklæbede enhedsskilte monteres på tryktransducerens frontplade. se fig. 6 og 7.
Udgangssignal [V / mA] vælges vha. en jumper og udgangssignalets minimum indstilles vha. DIP-switch. Se fig. 3 og 8.

Dæmpningen indstilles på DIP-switch. Se fig. 3 og 9. Transduceren måler trykket flere gange, og gennemsnitsværdien for det valgte tidsrum gengives løbende i transducerens udgangs-

signal. Herved dæmpes ventilationsanlæggets evt. tryksvingninger i udgangssignalet.

NULSTILLING
Når transduceren er monteret og strømmen tilsluttet, kan transduceren evt. nulstilles. Det bedste resultat opnås når transduceren har nået normal driftstemperatur. Før nulstilling aktiveres, bør det sikres, at tryk på "+" og "-" studse er ens, f.eks. ved at stoppe ventilationsanlægget. Viser displayet over 10Pa differenstryk, kan det skyldes utilsigtet tryk i anlægget (træk eller afklemte slanger). Det anbefales, at trykslange(r) er fjernet fra "+" og "-" studse, når nulstilling udføres. Nulstilling startes ved at aktivere den indbyggede "zero-set" switch (se fig. 3), hvorved den gule lysdiode blinker indtil nulstillingen er afsluttet.

LYSDIODE INDIKERING
Grøn LED lyser ved korrekt tilsluttet forsyningsspænding. Gul LED blinker i ca. 3 sekunder imens nulstilling udføres.

Lysdiode	ON	Blink	Off
Grøn	OK		Ingen forsyning
Gul		Nulstilling udføres	OK

FIGURER
Fig. 1: Målskitse
Fig. 2: Placering af transducer ifht. bøjninger og forgreninger
Fig. 3: Tilslutningsdiagram
Fig. 4: Indstilling tryk/flow
Fig. 5: Valg af måleområde
Fig. 6: Ændring af måleenheder
Fig. 7: Valg af måleenhedsskilt
Fig. 8: Valg af udgangssignal
Fig. 9: Valg af dæmpning
Fig. 10: Disponible DIP
Fig. 11: Trykindstilling
Fig. 12: Flow-indstilling
Fig. 13: Flow-beregningseksempel
Fig. 14: Kvadratrods-indstilling

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English

PTH is an electronic pressure transducer designed primarily to measure total and differential air pressures in ventilation systems. When used together with a standard aperture, the pressure transducer can also measure air flow as a formula for converting differential pressure to air flow is incorporated in the transducer. The pressure transducer is used for monitoring, control and regulation purposes via a controller, PLC or monitoring system.

Typical applications include:
- The maintenance/control of constant pressure at a given position within the ventilation duct system.
- The maintenance/control of desired underpressure within the ventilation duct system.
- Differential pressure measurement across ventilation filter for optimum filter replacement.
- Volume flow determination via differential pressure measurement across a standard aperture.

PRODUCT PROGRAMME

Type	Product
PTH-3202-DF	Pressure transducer, 0-2500 Pa, display, flow
PTH-3202-BF	Pressure transducer, 0-2500 Pa, back-lit display, flow

FUNCTION
PTH is a pressure transmitter for comfort ventilation systems. It provides an active current or voltage signal proportional to the measured air pressure. If the pressure transducer is set for flow measurement, differential pressure (Δp) is converted to volume flow (qv) using the following formula: $qv = k \bullet \sqrt{\Delta p}$. PTH consists of a semiconductor pressure element with no air throughput, thus protecting the unit against dust in the ventilation system. The pressure element is temperature compensated to provide accurate pressure measurement throughout the specified temperature range.

The required measurement range of the pressure transducer is set using three push buttons. The buttons are also used to set the k-factor to be used for flow calculation. Pressure or flow is selected by simply changing a DIP switch setting and replacing Pa with m3/h or l/s on the front cover.

By selecting flow range P, PTH pressure transducers can directly replace pressure transducers with existing square root output and flow display in %.

The output signal can be changed from voltage [V] to current [mA] by setting a jumper. A DIP switch allows two different damping times to be selected so that pressure fluctuations within the ventilation system are attenuated in the transducer output signal. If the actual pressure / flow is outside the selected measurement range, the display flashes.

CE MARKING
OJ Electronics A/S hereby declares that the product is manufactured in accordance with Council Directive 92/31/EEC on electromagnetic compatibility (and subsequent amendments) and Council Directive 73/23/EEC on electrical equipment designed for use within certain voltage limits.
Applied standards
EN 61000-6-2 and EN 61000-6-3

TECHNICAL DATA

Full-scale pressure range	0-2500 Pa
Measurement ranges, pressure	-50..+50Pa, 0..+100Pa, 0..+150Pa, 0..+300Pa, 0..+500Pa, 0..+1000Pa, 0..1600Pa, 0..2500Pa.
Measurement ranges, flow	P, 100 m^3/h, 300 m^3/h, 500 m^3/h, 1000 m^3/h, 3000 m^3/h, 5000 m^3/h, 9999 m^3/h, 30.00 m^3/h x 1000, 50.00 m^3/h x 1000, 99.99 m^3/h x 1000. m^3/h can be replaced by l/s.
Square root output	In the flow range P, differential pressure is measured as % of full-scale pressure range using square root calculation.
k-factor	1 to 2000
Supply voltage	24V AC ±15%, 50/60 Hz 13.5-28 V DC
Power consumption	2.5 VA (+5/+40°C), 4 VA (-20/+5°C),
Output signal (selectable)	0-10 V DC, 2-10 V, DC 4-20 mA, 0-20 mA
Accuracy (> 350 Pa)	±3% (recorded value)
Accuracy (< 350 Pa)	±10 Pa
Linearity (at -20/+40°C)	<1% of transducer full scale
Damping (selectable)	0.4 s or 10 s
Max. pressure	20 kPa
Ambient temperature	0/+50°C (display) -20/+40°C (constant operation) -30/+50°C (transient) -50/+70°C (storage)
Dimensions	75 x 36 x 91 mm (see figure 1)
Cable dimensions	3 x max. 1.5 mm^2
Pressure connector	2 x Ø6.2 mm
Enclosure	IP54
Weight	110 g

INSTALLATION
PTH must be securely mounted on a level surface using screws. PTH is insensitive to mounting orientation. However, in order to maintain the specified enclosure rating, tubes should be attached to both tube connectors if the connectors point upwards. The enclosure is equipped with screw holes, see fig. 1.
Pressure is connected by means of tubes. The higher pressure must be connected to the "+" connector and the lower pressure to the "-" connector. If the tubes are unintentionally exchanged, or the pressure is outside the measurement range, the display flashes. The pressure tubes must be as short as possible and must be secured in position to prevent vibration. To obtain the best possible results, pressure must be measured where there is least risk of turbulent air flow, i.e. in the centre of the ventilation duct and at a suitable distance from bends and branches. See fig. 2.

The enclosure is opened without the use of tools by pressing the snap lock at the side of the connectors. The transducer cable may be up to 50 m in length and must be connected as shown in fig. 3.

The transducer cable must be kept separate from mains-carrying cables as voltage signals from these may affect transducer function.

SETTINGS
Select pressure or flow by setting the DIP switch (see figs 3 and 4). To display the measurement range, press the "▲" , "▼" or "OK" button on the rear cover once (see fig. 5). If the buttons are not pressed again within 60 seconds, the display will revert to showing the actual measured value. Press "▲" or "▼" repeatedly to change the measurement range up/down. The measurement range will flash on the display until the setting has been saved by pressing the "OK" button.

Pressure measurement (fig. 11): If the DIP switch is set for pressure measurement, actual pressure will be shown on the display.

Flow measurement (fig. 12): If the DIP switch is set for flow measurement, pressing the "OK" button allows the first digit of the k-factor to be set. The value will flash and can be set using the "▲" and "▼" buttons. When set correctly, press "OK" and set the second, third and fourth digits correspondingly. Then press "OK" to save the k-factor and the display will automatically begin showing the actual measured value. If standard flow measurement is selected, no pressure range need be set. An example of flow calculation is shown in fig. 13.

Square root output (fig. 14): If flow range P is selected, PTH functions as a pressure transducer with square root output and flow is displayed in per cent (Delta P [%]). Full-scale is determined by the set pressure range (p-range) and the value shown on the display is calculated as Delta P [%] = $100x\sqrt{(\Delta p/p\text{-range})}$. When flow range P is selected, pressing "OK"

allows the pressure range to be selected. Once the pressure range has been selected, press "OK" to save the setting and the display will automatically begin showing the actual measured value.

Changing measurement unit: Depending on the k-factor unit and the selected flow range, attach one of the accompanying self-adhesive unit labels to the front cover of the transducer (see figs 6 and 7).

Select whether the output signal is to be V or mA on the jumper, and set the minimum value of the output signal with the DIP switch (see figs 3 and 8).

Set the damping time with the DIP switch (see figs. 3 and 9). The transducer measures the pressure several times within the set time and the average of these measurements is continuously reproduced in the output signal. This allows any pressure fluctuations within the ventilation system to be dampened in the transducer output signal.

ZEROING
If necessary, the transducer can be zeroed after it has been mounted and the power supply connected. For best results, wait until the transducer has reached usual operating temperature. Before zeroing the transducer, it is important to ensure that the pressure on the "+" and "-" connectors is equal (e.g. by stopping the ventilation system). If the display shows a differential pressure of more than 10 Pa there may be unintended pressure in the system (draughts or pinched tubes). It is recommended that pressure tubes be removed from the "+" and "-" connectors during zeroing. Zeroing is activated by pressing the integrated "Zero-set switch" (see fig. 3), after which the yellow LED will continue to flash until zeroing has been completed.

LED INDICATION
The green LED is lit when the power supply has been connected correctly. The yellow LED flashes for approx. 3 seconds during zeroing.

LED	ON	Flashing	Off
Green	OK		No power
Yellow		Zeroing in progress	OK

FIGURES
Fig. 1: Dimensioned sketch
Fig. 2: Transducer position in relation to bends and branches
Fig. 3: Wiring diagram
Fig. 4: Pressure/flow selection
Fig. 5: Measurement range selection
Fig. 6: Measurement unit indication
Fig. 7: Measurement unit label selection
Fig. 8: Output signal selection
Fig. 9: Damping time selection
Fig. 10: Unused DIP switches
Fig. 11: Pressure settings
Fig. 12: Flow settings
Fig. 13: Flow calculation example
Fig. 14: Square root settings

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Deutsch

PTH ist ein elektronischer Druckmessumformer, der hauptsächlich zur Messung des Gesamt- und Differenzluftdrucks in Lüftungsanlagen dient. Wird der Druckmessumformer verbunden mit einer Standardblende eingesetzt, kann der Luftstrom gemessen werden, da die Umrechnung von Differenzdruck auf Flow im Messumformer eingebaut ist. Der Druckmessumformer kommt in Verbindung mit der Überwachung, Steuerung und Regelung mittels Regler, SPS oder Überwachungsanlage zum Einsatz.

Typische Anwendungsbereiche sind:
- Aufrechterhaltung/Steuerung eines konstanten Drucks an einer gegebenen Stelle im Lüftungskanalsystem.
- Aufrechterhaltung/Steuerung eines vorgegebenen Unterdrucks im Lüftungskanalsystem.
- Differenzdruckmessung über Lüftungsfiltern für optimalen Filteraustausch.
- Volumenstrommessung (Flow) mittels Differenzdruckmessung über Standardblende.

PRODUKTPROGRAMM

Typ	Produkt
PTH-3202-DF	Druckmessumformer, 0-2500 Pa, Display, Durchflussmessung
PTH-3202-BF	Druckmessumformer 0-2500 Pa, hintergrundbeleuchtetes Display, Durchflussmessung

FUNKTION
PTH ist ein Druckmessumformer für Komfortlüftungen, der ein aktives Strom- oder Spannungssignal, proportional mit dem gemessenen Druck, abgibt. Ist der Druckmessumformer auf Durchflussmessung eingestellt, wird der Differenzdruck (Δp) auf Volumenstrom (qv) mit Hilfe folgender Formel umgerechnet: $qv = k \bullet \sqrt{\Delta p}$. PTH besteht aus einem Halbleiter-Druckelement ohne Luftdurchfluss, was vor Staub aus der Lüftungsanlage schützt. Das Druckelement ist temperaturkompensiert, sodass im gesamten spezifizierten Temperaturbereich eine optimale Druckmessung erzielt wird.

Der Druckmessumformer lässt sich mit Hilfe von drei Drucktasten auf den gewünschten Messbereich einstellen. Mit den gleichen Tasten wird der zur Umrechnung auf Durchfluss benötigte k-Faktor eingestellt. Die Umstellung von Druck- auf Durchflussmessung lässt sich durch bloße Änderung einer DIP-Schaltereinstellung und der Auswechslung von Pa mit m³/h oder l/s am Frontschild vornehmen.

Der PTH-Druckmessumformer kann bei Einstellung auf Flowbereich P ohne weiteres Druckmessumformer mit Effektivwert-Ausgangssignal und Durchflussanzeige in % ersetzen.

Das Ausgangssignal kann mit einem Brückenstecker von Spannung [V] auf Strom [mA] umgestellt werden. Zwei verschiedene Dämpfungen lassen sich mittels DIP-Schalter vorwählen, um evt. Druckschwingungen in der Lüftungsanlage im Ausgangssignal des Druckmessumformers zu unterdrücken. Liegt der aktuelle Druck/Durchfluss außerhalb des gewählten Bereichs, blinkt das Display.

CE-KENNZEICHNUNG
OJ Electronics A/S erklärt in Eigenverantwortung, dass das Produkt die EU-Richtlinie 92/31 und spätere Änderungen über elektromagnetische Verträglichkeit sowie die EU-Richtlinie 73/23 über elektrische Betriebsmittel zur Anwendung innerhalb bestimmter Spannungsgrenzen erfüllt.

Angewandte Normen
EN 61000-6-2 und EN 61000-6-3

TECHNISCHE DATEN

Gesamtdruckbereich:	0-2500 Pa
Druckmessbereiche:	-50..+50 Pa, 0..+100 Pa, 0..+150 Pa, 0..+300 Pa, 0..+500 Pa, 0..+1000 Pa, 0..1600 Pa, 0..2500 Pa.
Durchflussmessbereiche	P, 100 m³/h, 300 m³/h, 500 m³/h, 1000 m/h, 3000 m³/h, 5000 m³/h, 9999 m³/h, 30,00 m³/h x 1000, 50,00 m³/h x 1000, 99,99 m³/h x 1000. Die Einheiten m³/h oder l/s können angezeigt werden.
Effektivwert-Ausgangssignal:	Im Messbereich P wird die Quadratwurzel des gemessenen Differenzdrucks gebildet und in % des Druck messbereich-Vollskalen werts angezeigt.
k-Faktor:	1 bis 2000
Spannungsversorgung:	24 V AC ±15%, 50/60 Hz 13,5-28 V DC
Leistungsaufnahme:	2,5 VA (+5/+40 °C), 4 VA (-20/+5 °C),
Ausgangssignal (wahlweise)	0-10 V DC, 2-10 V DC 4-20 mA, 0-20 mA
Genauigkeit (> 350 Pa)	±3% (abgelesener Wert)
Genauigkeit (< 350 Pa)	±10 Pa
LINEARITÄT (@ -20/+40 °C)	<1 % des vollen Skalen ausschlags des Mess umformers
Dämpfung (wahlweise)	0,4 s oder 10 s
Max. Druck	20 kPa
Umgebungstemperatur	0/+50 °C (Display) -20/+40 °C (Dauerbetrieb) -30/+50 °C (kurzzeitig) -50/+70°C (Aufbewahrung)
Abmessungen	75 x 36 x 91 mm (siehe Abbildung 1)
Kabeldimensionen	3 x max. 1,5 mm2
Druckstutzen	2 x Ø6,2 mm
Schutzart	IP 54
Gewicht	110 g

MONTAGE
PTH ist auf einer ebenen Fläche zu befestigen. PTH funktioniert unabhängig von der Montageposition, zur Bewahrung des Schutzgrads sollten jedoch beide Schlauchstutzen, wenn sie nach oben zeigen, mit Schläuchen versehen sein. Die Kapselung verfügt über Befestigungslöcher, siehe Abb. 1.

Der Druckanschluss erfolgt mittels Schläuchen, wobei der größte Druck am "+"-Stutzen und der niedrigste Druck am "-"-Stutzen anzuschließen sind. Werden die Schläuche irrtümlich vertauscht, und der Druck liegt außerhalb des Messbereichs, blinkt das Display. Druckschläuche sind so kurz wie möglich zu halten und zu befestigen, um Schwingungen zu vermeiden. Optimale Druckmessung erzielt man an Stellen mit geringstem Risiko für turbulente Luftströmung, das heißt in der Mitte von Lüftungskanälen und mit ausreichendem Abstand zu Biegungen und Abzweigungen. Siehe Abb. 2.
Die Öffnung der Kapselung erfolgt ohne

Werkzeug durch Druck auf den Schnappverschluss, der sich seitlich der Stutzen befindet. Das Messumformerkabel kann bis zu 50 m lang sein und ist wie in Abb. 3 dargestellt anzuschließen.

Um die Funktion des Messumformers beeinträchtigende Spannungssignale zu vermeiden, darf das Messumformerkabel nicht parallel mit Leistungskabeln verlegt werden.

EINSTELLUNGEN
Die Funktion als Druck- oder Durchflussmesser wird am DIP-Schalter eingestellt (siehe Abb. 3 und 4), und der Messbereich wird bei einmaligem Betätigen der "▲", "▼"- oder „OK"-Taste auf der Unterseite des Deckels angezeigt (siehe Abb. 5). Werden binnen 60 Sekunden die Tasten nicht aktiviert, erfolgt wieder die Anzeige des aktuellen Messwerts. Bei wiederholtem Betätigen von "▲" und "▼" wird auf einen größeren/kleineren Messbereich gewechselt, der bis zum Speichern durch Betätigen von „OK" blinkend am Display angezeigt wird.

Druckmessung (Abb. 11): Wird der DIP-Schalter auf Druckmessung eingestellt, kommt anschließend der aktuelle Druck zur Anzeige.

Durchflussmessung (Abb. 12): Wird der DIP-Schalter auf Durchflussmessung eingestellt, ist anschließend „OK" zu betätigen", wonach Ziffer 1 des k-Faktors blinkt und sich mit Hilfe der "▲" und "▼"-Tasten einstellen lässt. Bei anschließendem Betätigen von „OK" wechselt die Einstellung auf Ziffer 2, 3 und 4 beziehungsweise. Der eingestellte k-Faktor wird mit abschließendem Betätigen von „OK" gespeichert und danach automatisch auf die Anzeige des aktuellen Messwerts gewechselt. Wird gewöhnliche Durchflussmessung gewählt, muss kein Druckbereich eingestellt werden. Abb. 13 zeigt ein Beispiel zur Flow-Berechnung.

Effektivwert-Ausgangssignal (Abb. 14): Bei Einstellung auf Durchflussbereich P wirkt PTH als Druckmessumformer mit Effektivwert-Ausgangssignal und Durchflussanzeige in Prozent (Delta P [%]). Der Vollskalenwert bestimmt sich aus dem eingestellten Druckbereich (p-Bereich), da sich die Displayanzeige aus Delta P [%] = 100x√(Δp/p-Bereich) berechnet. Wurde Durchflussbereich P gewählt, führt das erneute Betätigen von „OK" zur Einstellung des Druckbereichs. Der Druckbereich wird mit abschließendem Betätigen von „OK" gespeichert und danach automatisch auf die Anzeige des aktuellen Messwerts gewechselt.

Änderung der Messeinheiten: Abhängig von der Einheit des k-Werts und der Wahl des Durchflussbereichs ist eines der mitgelieferten selbstklebenden Einheitsschilder auf der Frontplatte des Druckmessumformers anzubringen, siehe Abb. 6 und 7.

Das Ausgangssignal [V / mA] wird mit Hilfe eines Brückensteckers festgelegt und der Mindestwert am DIP-Schalter eingestellt. Siehe Abb. 3 und 8.

Die Dämpfung wird am DIP-Schalter eingestellt. Siehe Abb. 3 und 9. Der Messumformer misst den Druck mehrmals, und das Ausgangssignal des Messumformers entspricht dem laufenden Durchschnittswert während des gewählten Zeitraums. Dadurch werden evt. Druckschwingungen der Lüftungsanlage gedämpft.

NULLSTELLUNG
Nach Montage des Messumformers und Anschluss an die Stromversorgung ist der Messumformer ggf. nullzustellen. Das beste Ergebnis wird nach Erreichen der normalen Betriebstemperatur des Messumformers erzielt. Vor dem Nullstellen ist zu gewährleisten, dass der gleiche Druck auf den "+"- und "-"-Stutzen wirkt, z.B. durch Stoppen der Lüftungsanlage. Zeigt das Display einen Differenzdruck größer 10 Pa an, kann dies auf unbeabsichtigten Druck in der Anlage zurückzuführen sein (Zugluft oder geklemmte Schläuche). Es wird empfohlen, während des Nullstellens den Druckschlauch / die Druckschläuche vom "+"- und "-"-Stutzen zu entfernen. Zu Beginn des Nullstellens den eingebauten Nullstellungsschalter (Zero-set switch) aktivieren (siehe Abb. 3), wonach die gelbe Leuchtdiode, bis das Nullstellen abgeschlossen ist, blinkt.

LEUCHTDIODENANZEIGE
Die grüne LED leuchtet bei korrekt angeschlossener Spannungsversorgung. Die gelbe LED blinkt ca. 3 Sekunden lang, während das Nullstellen ausgeführt wird.

Leuchtdiode	**EIN**	**Blinkt**	**AUS**
Grün	OK		Keine Stromversorgung
Gelb		Nullstellung wird ausgeführt	OK

ABBILDUNGEN
Abb. 1: Maßskizze
Abb. 2: Positionierung des Messumformers im Verhältnis zu Biegungen und Abzweigen
Abb. 3: Anschlussdiagramm
Abb. 4: Einstellung von Druck/Durchfluss
Abb. 5: Wahl des Messbereichs
Abb. 6: Änderung der Messeinheiten
Abb. 7: Wahl des Messeinheitsschilds
Abb. 8: Wahl des Ausgangssignals
Abb. 9: Wahl der Dämpfung
Abb. 10: Verfügbare DIPs
Abb. 11: Druckeinstellungen
Abb. 12: Durchflusseinstellungen
Abb. 13: Durchfluss-Berechnungsbeispiel
Abb. 14: Effektivwert-Einstellung

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Français

Le PTH est un transducteur de pression électronique conçu pour mesurer principalement la pression d'air totale et différentielle dans les installations de ventilation. Lorsque le transducteur de pression est utilisé avec un obturateur standard, il peut mesurer le flux d'air, la conversion de la pression différentielle en flux étant intégrée dans le transducteur. Le transducteur de pression est utilisé pour la surveillance, le contrôle et la régulation, via un régulateur, un automate programmable ou une installation de surveillance. Ses domaines d'application les plus courants sont :
- maintien et commande d'une pression constante en un lieu donné d'un réseau de conduits.
- maintien et commande d'une dépression souhaitée dans un réseau de conduits.
- mesure de la pression différentielle dans les filtres de ventilation permettant d'optimiser le remplacement des filtres
- mesure du volume courant (flux) par mesure de la pression différentielle dans l'obturateur standard.

GAMME DE PRODUITS

Type	**Produit**
PTH-3202-DF	Transducteur de pression 0-2500Pa affichage, flux
PTH-3202-BF	Transducteur de pression 0-2500Pa affichage rétroéclairé, flux

FONCTIONNEMENT
Le PTH est un transmetteur de pression pour ventilation de confort qui émet un signal électrique (courant ou tension) proportionnel à la pression d'air mesurée. En cas d'utilisation du transducteur de pression à la mesure de flux, la pression différentielle (Δp) est convertie en volume courant (qv) à l'aide de la formule suivante : qv = k•√Δp. Le PTH est composé d'éléments semi-conducteurs et conçu sans passage d'air, ce qui assure sa protection contre les poussières provenant de l'installation de ventilation. L'élément de pression est compensé en température, de façon à pouvoir obtenir une mesure de pression optimale sur toute la plage de température spécifiée.
Le transducteur de pression peut être réglé sur la plage de mesure souhaitée à l'aide de trois touches. Les mêmes touches permettent de régler le facteur k utilisé pour la conversion en flux. Le passage de la pression au flux (et inversement) se fait en modifiant simplement la position d'un commutateur DIP et en remplaçant Pa par m3/H ou l/s sur le panneau frontal.
Le transducteur de pression PTH peut sans problème remplacer le transducteur de pression par une sortie racine carrée et un affichage du flux en % via un réglage sur la plage de flux P.

Le type de signal de sortie peut être modifié (tension [V] ou courant [mA]) en déplaçant un cavalier. Le commutateur DIP permet de sélectionner deux atténuations différentes, de manière que d'éventuelles variations de pression dans l'installation de ventilation puissent être atténuées dans le signal de sortie du transducteur. Si la pression ou le flux actuel est hors de la plage choisie, l'affichage clignote.

MARQUAGE CE
OJ Electronics A/S déclare que le produit respecte la Directive Européenne 92/31 (et ses modifications ultérieures) relative à la compatibilité électromagnétique (CEM), ainsi que la Directive Européenne 73/23 sur la sécurité des matériels électriques utilisés dans certaines plages de tension.
Normes appliquées
EN 61000-6-2 et EN 61000-6-3

CARACTÉRISTIQUES TECHNIQUES

Plage de pression à pleine échelle :	0 à 2 500Pa
Plages de mesure de pression :	- 50..+ 50Pa, 0..+ 100Pa, 0..+ 150Pa, 0..+ 300 Pa, 0..+ 500Pa, 0..+ 1000Pa, 0..1 600Pa, 0..2500Pa.
Plages de mesure de flux :	P, 100 m³/h, 300 m³/h, 500 m³/h, 1 000 m³/h, 3 000 m³/h, 5 000 m³/h, 9 999 m³/h, 30,00 m³/h x 1000, 50,00 m³/h x 1000, 99,99 m³/h x 1000. L'unité de mesure m³/h peut être remplacée par l/s.
Sortie racine carrée :	Dans la plage de flux P, la pression différentielle est mesurée en % à pleine échelle de la plage de mesure de pression avec calcul de racine carrée.
Facteur k :	1 à 2000

Tension d'alimentation:	24 Vca ±15%, 50/60 Hz 13,5 à 28 Vcc
Puissance :	2,5 VA (+ 5 / + 40 °C), 4 VA (- 20 / + 5 °C),
Signal de sortie (fonction au choix)	0-10 Vcc, 2-10 Vcc 4-20 mA, 0-20 mA
Précision (> 350 Pa)	± 3 % (valeur lue)
Précision (< 350 Pa)	± 10 Pa
Linéarité (@ - 20 / + 40 °C)	< 1 % de la pleine échelle du transducteur
Atténuation (fonction au choix)	0,4 s ou 10 s
Pression maximale	20 kPa
Température ambiante	0 / + 50 °C (écran) - 20 / + 40 °C (exploitation continue) - 30 / + 50 °C (courte durée) - 50 / + 70 °C (stockage)
Dimensions	75 x 36 x 91 mm (voir figure 1)
Dimension des câbles	3 x 1,5 mm^2 maxi
Embouts de pression	2 x Ø 6,2 mm
Blindage	IP54
Poids	110 g

MONTAGE
Le PTH doit être vissé sur une surface plane. Le sens de montage n'a aucune incidence sur le fonctionnement du PTH ; cependant, il est nécessaire d'installer des flexibles sur les deux embouts s'ils sont orientés vers le haut, afin de ne pas altérer le degré de protection de l'équipement. La protection est équipée de trous de fixation intégrés ; se reporter à la figure 1.
Le raccordement de la pression s'effectue à l'aide de flexibles ; brancher la pression la plus importante à "l'embout +" et les plus faibles à "l'embout -". Si les flexibles sont inversés par inadvertance et si la pression est hors de la plage de mesure, l'affichage clignote. Afin d'éviter toute vibration, les flexibles de pression doivent être aussi courts que possible et fixés correctement. La mesure de pression est optimale là où le risque d'écoulement turbulent est le plus faible, c'est-à-dire au milieu des conduits de ventilation et à une distance suffisante des coudes et des ramifications. Voir figure 2.

L'ouverture de la protection s'effectue sans outillage, en appuyant sur la serrure à ressort placée à côté des embouts. Le câble du transducteur, dont la longueur peut atteindre 50 mètres, est raccordé comme indiqué sur la figure 3.

Eviter d'installer le câble du transducteur à côté des câbles de puissance, les signaux de tension pouvant perturber le fonctionnement du transducteur.

RÉGLAGES
Le choix entre pression et flux se fait sur le commutateur DIP (voir figures 3 et 4) et la plage de mesure est affichée en appuyant une fois sur les touches "▲", "▼" ou "OK" placées sur la partie inférieure du couvercle (voir figure 5). Si les touches ne sont pas activées durant une période de 60 secondes, l'affichage revient automatiquement à la valeur mesurée actuelle. Appuyer de nouveau sur "▲" et "▼" pour changer de plage de mesure (haut-bas) et la plage de mesure clignote sur l'affichage jusqu'à ce que le réglage soit sauvegardé en appuyant sur "OK".

Mesure de pression (figure 11) : Si le commutateur DIP est réglé pour la pression, l'affichage passe ensuite à la pression actuelle.

Mesure de flux (figure 12) : Si le commutateur DIP est réglé pour le flux, une pression sur "OK" entraîne ensuite l'affichage du premier chiffre du facteur k, qui clignote et peut être réglé via les touches " " et " ". Les pressions suivantes exercées sur "OK" font ensuite passer au réglage du 2e, 3e et 4e chiffre. Le facteur k choisi est sauvegardé via une pression finale sur "OK", l'affichage basculant alors automatiquement sur la valeur mesurée actuelle. En cas de choix de mesure de flux normale, il n'est pas nécessaire de régler la plage de pression. Un exemple de calcul de flux est fourni en figure 13.

Sortie racine carrée (figure 14) : En cas de choix de la plage de flux P, le PTH fonctionne comme un transducteur de pression avec sortie racine carrée et affichage du flux en pourcentage (Delta P [%]). La pleine échelle est fixée par la plage de pression choisie (p-range), les valeurs affichées étant calculées comme Delta P [%] = 100x√(Δp/p-range). Lorsque la zone de flux P est choisie, appuyer sur "OK" pour passer au réglage de la zone de pression. La plage de pression choisie est sauvegardée via une pression finale sur "OK", l'affichage basculant alors automatiquement sur la valeur mesurée actuelle.

Modification des unités de mesure : Selon l'unité de valeur k retenue et le choix de la plage de flux, une des étiquettes autocollantes jointes doit être montée sur la plaque frontale du transducteur, voir figures 6 et 7.

Sélectionner le signal de sortie [V / mA] à l'aide du cavalier et régler sa valeur minimale au moyen du commutateur DIP. Voir les figures 3 et 8.

L'atténuation est réglée à l'aide du commutateur DIP. Voir les figures 3 et 9. Le transducteur mesure la pression plusieurs fois et la valeur moyenne de la période choisie est restituée au fil de l'eau par le signal de sortie du transducteur. De cette façon, les variations de pression éventuelles de l'installation de ventilation sont atténuées dans le signal de sortie.

REMISE À ZÉRO
Lorsque le transducteur est monté et que l'alimentation est raccordée, le transducteur peut être remis à zéro. Les meilleurs résultats sont atteints lorsque le transducteur est à température d'exploitation normale. Avant d'actionner la remise à zéro, s'assurer que la pression sur les embouts "+" et "-" est identique, par exemple en arrêtant l'installation de ventilation. Si l'affichage indique une pression différentielle supérieure à 10 Pa, cela peut être dû à une pression inadéquate dans l'installation (par exemple flexibles coincés). Lors de la remise à zéro, il est conseillé de déconnecter les flexibles de pression des embouts "+" et "-". Démarrer la remise à zéro en activant le commutateur intégré "zero-set" (se reporter à la figure 3) ; la diode lumineuse jaune se met alors à clignoter jusqu'à la fin de la remise à zéro.

FONCTION DES DIODES LUMINEUSES
La diode électroluminescente verte reste allumée en situation de tension d'alimentation correcte. La diode électroluminescente jaune clignote environ 3 secondes durant la remise à zéro.

Diode lumineuse	**ON (marche)**	**Clignote**	**Off (arrêt)**
Verte	OK		Aucune alimentation
Jaune		Remise à zéro en cours	OK

FIGURES

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Fig. 1 - Dimensioned sketch

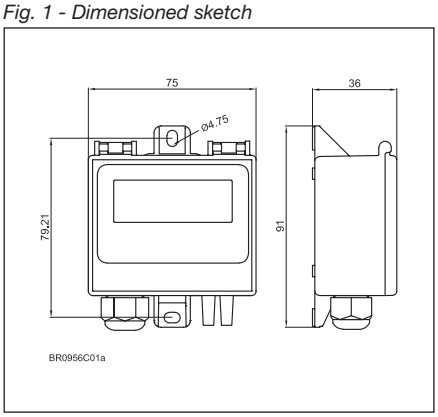


Fig. 2 - Transducer position in relation to bends and branches

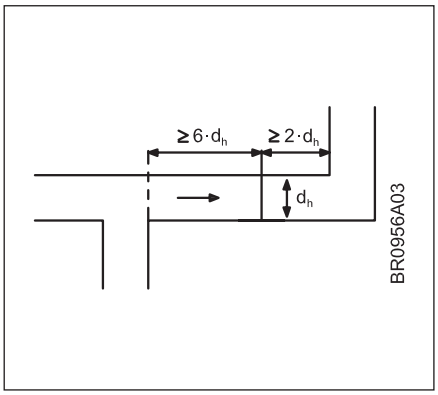


Fig. 3 - Wiring diagram

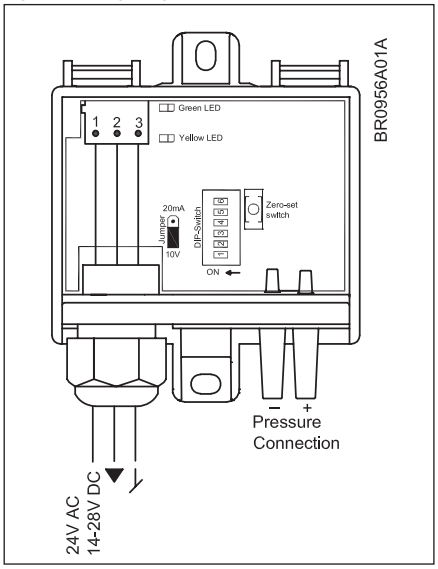


Fig. 4 - Pressure/flow selection

Mode	Dip 4
Pressure [Pa]	Off
Flow	On

BR0956C03a

Fig. 5 - Measurement range selection

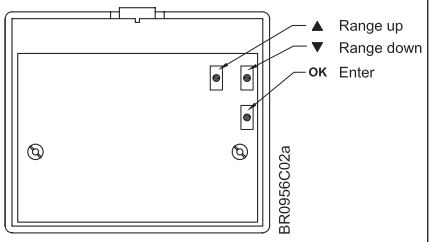


Fig. 6 - Measurement unit indication

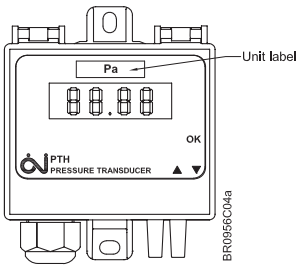


Fig. 7 - Measurement unit label selection

Mode	Range	K-factor	Unit label
Pressure	±50 to + 2500		Pa
Flow q_V	100 to 9999 ($q_V = K\sqrt{\triangle p}$)	m^3/h	m^3/h
		l/s	l/s
	30.00 to 99.99 ($q_V = K\sqrt{\triangle p}$)	m^3/h	m^3/h x 1000
		l/s	l/s x 1000
	P (Delta p [%] = 100 $\sqrt{\frac{\triangle p}{p\text{-range}}}$)		$\triangle p\%$

BR0956C05a

Fig. 8 - Output signal selection

Output	Dip 6	Jumper position
0-10V	OFF	10V
2-10V	ON	
0-20 mA	OFF	20mA
4-20 mA	ON	

BR0956C06a

Fig. 9 - Damping time selection

Damping	DIP5
0.4s	OFF
10s	ON

BR0956C07a

Fig. 10 - Unused DIP switches

Not used	Dip 1	Dip 2	Dip 3
Not used	X	X	X

BR0956C08a

Fig. 11 - Pressure settings

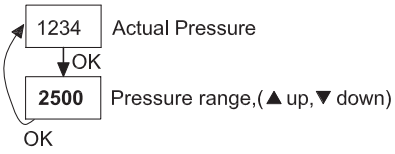


Fig. 12 - Flow settings

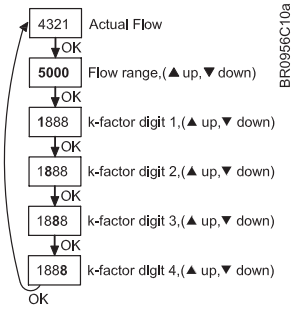


Fig. 13 - Flow calculation example

Flow calculation example

$\triangle P = 700Pa \quad k = 381$

$q_V = k \cdot \sqrt{\triangle p} = 381 \cdot \sqrt{700} = 10080\ m^3/h$

Conversion from m^3/h to l/s :

$q_V = k \cdot \sqrt{\triangle p} = \frac{381}{3.6}\sqrt{700} = 106\sqrt{700} = 2804$ l/s

Set k-factor to 106

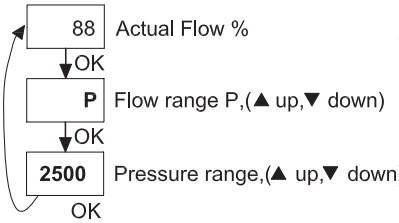
Conversion from l/s to m^3/h:

$q_V = k \cdot \sqrt{\triangle p} = 106 \cdot 3.6\sqrt{700} = 381\sqrt{700} = 10080\ m^3/h$:

Set k-factor to 381

BR0956C12a

Fig. 14 - Square root settings



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D Safety data sheets

D.1 Compressor oil

EMKARATE RL 32-3MAF
Material Safety Data Sheet
Date(s): : 2005-09-12 15:50:00
Version 3
MSDS#: 808802

1. CHEMICAL PRODUCT AND COMPANY IDENTIFICATION

Product Name	**EMKARATE RL 32-3MAF**
Product Use	Lubricant
Address/Telephone number	Uniqema Uniqema Corporate Center 1000 Uniqema Boulevard New Castle, DE 19720-2790 Uniqema Operator (Mon.-Fri., 8:15 AM - 4:30 PM Eastern): (302) 574-5000 Medical Emergency (24 hr.): (888) 456-6218 Transportation Emergency Involving Chemical Spills, Leaks, Fires, or Accidents (24 hr.): (800) 424-9300

Uniqema is an international business of Imperial Chemical Industries PLC.
Uniqema operates through ICI affiliated companies in the relevant countries such as ICI Americas Inc., Unichema, a division of ICI Uniqema Inc., and Mona Industries Inc. in the USA.

2. COMPOSITION/INFORMATION ON INGREDIENTS

Component Name	CAS Number	% (w/w)	OSHA PEL	ACGIH TLV
Polyol ester	---	>99	No PEL established	No TLV established
Additives	---	<1	No PEL established	No TLV established

Ingredients not precisely identified are proprietary or nonhazardous.
Values are not product specifications.

3. HAZARDS IDENTIFICATION

Emergency Overview

Color	clear yellow
Form	Liquid
Odor	No data.

INHALATION OR INGESTION MAY CAUSE MUCOUS MEMBRANE IRRITATION.
MAY CAUSE EYE IRRITATION
REPEATED/PROLONGED CONTACT MAY CAUSE SKIN IRRITATION.

Routes of Exposure Eye contact Skin contact Inhalation

Eye contact	May cause eye irritation in man.
Skin contact	Short contact periods with human skin are not usually associated with skin irritation. Repeated contact can result in slight skin irritation. Prolonged contact can result in slight skin irritation. Systemically toxic concentrations of this product will probably not be absorbed through human skin.
Inhalation	High concentrations of mists or aerosols may irritate respiratory passages. No toxic effects are known to be associated with inhalation of this material.
Ingestion	In humans, irritation of the mouth, pharynx and esophagus can develop following ingestion of this product. No toxic effects are expected following ingestion of this product.
Other	Not listed by ACGIH, IARC, NIOSH, NTP OR OSHA.

4. FIRST AID MEASURES

Eye contact	Immediately flush with plenty of water for at least 15 minutes. If redness, itching, or a burning sensation develops, have eyes examined and treated by medical personnel.
Skin contact	Wash material off of the skin with plenty of soap and water. If redness, itching, or a burning sensation develops, get medical attention.
Inhalation	Remove victim to fresh air. If a cough or other respiratory symptoms develop, consult medical personnel.
Ingestion	DO NOT INDUCE VOMITING. Give one or two glasses of water to drink and refer to medical personnel or take direction from either a physician or a poison control center. Never give anything by mouth to an unconscious person.

5. FIRE-FIGHTING MEASURES

Flash Point (ºF)	> 392
Flash Point (ºC)	> 200
Autoignition Temperature (ºF)	No data.
Autoignition Temperature (ºC)	No data.
Flammable Limits	No data.
Extinguishing Media	Water fog, alcohol foam, carbon dioxide, dry chemical.
Special fire-fighting protective equipment	A self contained breathing apparatus and suitable protective clothing must be worn in fire conditions.
Fire and explosion hazards	None known.
Explosion data	
Sensitivity to mechanical impact	No data.
Sensitivity to static discharge	No data.

6. ACCIDENTAL RELEASE MEASURES

Personal precautions	Refer to section 8 for proper personal protective equipment.

Steps to be taken in case material is released or spilled	Contain spill. Soak up material with absorbent and shovel into a chemical waste container. Wash residue from spill area with water containing detergent and flush to a sewer serviced by a permitted wastewater treatment facility.

7. HANDLING AND STORAGE

Handling	
	Prevent eye contact. Prevent skin contact. Avoid breathing this material. Do not swallow.
Storage	50 - 70 ° F Store in original containers.

8. EXPOSURE CONTROLS/PERSONAL PROTECTION

Exposure limits

OSHA PEL

Component Name	Exposure limits	Notes
No OSHA PEL assigned. Minimize exposure in accordance with good hygiene practice.		

ACGIH TLV

Component Name	Exposure limits	Notes
No ACGIH TLV assigned. Minimize exposure in accordance with good hygiene practice.		

Engineering controls	Provide adequate ventilation.
Eye protection	Chemical tight goggles.
Protective clothing	Impervious gloves.

Respiratory protection	Respiratory protection is not normally needed if controls are adequate.
Other	Eyewash and safety shower easily accessible to the work area.

9. PHYSICAL AND CHEMICAL PROPERTIES

Color	clear yellow
Form	Liquid
Odor	No data.
pH	No data.
Boiling Point (ºF)	No data.
Boiling Point (ºC)	No data.
Flash Point (ºF)	> 392
Flash Point (ºC)	> 200
Autoignition Temperature (ºF)	No data.
Autoignition Temperature (ºC)	No data.
Flammable Limits	No data.
Explosive Properties	No data.
Oxidizing Properties	No data.
Specific Gravity	~1
Solubility (water)	Insoluble
Solubility (other)	No data.
Partition Coefficient	No data.

10. STABILITY AND REACTIVITY

Stability	Stable under normal conditions.
Materials to avoid	Strong oxidizing agents.
Conditions to avoid	None known.
Hazardous decomposition products	Carbon dioxide, carbon monoxide.
Hazardous polymerization	Will not occur.

11. TOXICOLOGICAL INFORMATION

No data available on this material.

Toxicologically synergistic products	None known.

12. ECOLOGICAL INFORMATION

No data is available on this product.

13. DISPOSAL CONSIDERATIONS

RCRA (Resource Conservation and Recovery Act) Classification:

Specifically Listed Wastes	Not applicable.	
Characteristic Wastes	**Ignitability**	Not applicable.
	Corrosivity	Not applicable.
	Reactivity	Not applicable.
	Toxicity	Not applicable.

Disposal method	Disposal should be in accordance with local, state or national legislation.
Container disposal	Empty container retains product residue. Observe all hazard precautions. Do not distribute, make available, furnish or reuse empty container except for storage and shipment of original product. Remove all product residue from container and puncture or otherwise destroy empty container before disposal.

14. TRANSPORT INFORMATION

Department of Transportation:
Not regulated.

TDG (Transportation of Dangerous Goods):
Not regulated.

Not classified in RID/ADR - ADNR - IMDG - ICAO/IATA-DGR.

15. REGULATORY INFORMATION

Inventory Status

USA (TSCA)	Compliant.
OSHA Hazard Communication Standard, 29 CFR 1910.1200, Hazard Summary:	
Health Hazards	Irritant (eye)
Physical Hazards	None
WHMIS Classification	Class D, Division 2 -- Toxic.
CERCLA and SARA Regulations (40 CFR 355, 370, and 372):	
This material contains the following chemicals subject to the reporting requirements of SARA 313:	No 313-listed chemicals in this product

SARA 311/312 Hazard Categories:

Immediate	Y
Delayed	N
Fire	N
Pressure	N
Reactivity	N

16. OTHER INFORMATION

We assigned NFPA ratings and HMIS ratings to this product based on the hazards of its ingredient(s). Because the customer is most aware of the application of the product, he must ensure that the proper personal protective equipment (PPE) is provided consistent with information contained in the product MSDS.

HMIS Information	
Health	1
Flammability	1
Physical Hazards	0

The HMIS ratings displayed above are from the HMIS III Third Edition. There have been significant changes made to the system. "Physical hazard" stands for physical hazard as defined in the OSHA Hazard Communication Standard and replaces the former code for reactivity. For a more detailed explanation of the system and the ratings, please contact our Product Safety and Regulatory Affairs group.

NFPA Information	
Health	1
Flammability	1
Reactivity	0

This information is intended solely for the use of individuals trained in the particular hazard rating system.

The following sections contain revisions or new statements:

See also www.uniqema.com

D.2 Freezing agent

DuPont™ Suva® 410A Refrigerant

Version 2.0

Revision Date 03/23/2015 Ref. 130000050990

This SDS adheres to the standards and regulatory requirements of the United States and may not meet the regulatory requirements in other countries.

SECTION 1. PRODUCT AND COMPANY IDENTIFICATION

Product name	:	DuPont™ Suva® 410A Refrigerant
Tradename/Synonym	:	Suva® 9100 R-410A Suva® R-410A 410A HFC 410A
Product Grade/Type	:	ASHRAE Refrigerant number designation: R-410A
Product Use	:	Refrigerant, For professional users only.
Restrictions on use	:	Do not use product for anything outside of the above specified uses
Manufacturer/Supplier	:	DuPont 1007 Market Street Wilmington, DE 19898 United States of America
Product Information	:	+1-800-441-7515 (outside the U.S. +1-302-774-1000)
Medical Emergency	:	1-800-441-3637 (outside the U.S. 1-302-774-1139)
Transport Emergency	:	CHEMTREC: +1-800-424-9300 (outside the U.S. +1-703-527-3887)

SECTION 2. HAZARDS IDENTIFICATION

Product hazard category

Gases under pressure Liquefied gas

Label content

Pictogram :

Signal word : Warning

Hazardous warnings : Contains gas under pressure; may explode if heated.

Hazardous prevention measures : Protect from sunlight. Store in a well-ventilated place.

Other hazards

Misuse or intentional inhalation abuse may lead to death without warning.
Vapours are heavier than air and can cause suffocation by reducing oxygen available for breathing.
Rapid evaporation of the liquid may cause frostbite.

SECTION 3. COMPOSITION/INFORMATION ON INGREDIENTS

Component	CAS-No.	Concentration
Pentafluoroethane (HFC-125)	354-33-6	50 %
Difluoromethane (HFC-32)	75-10-5	50 %

SECTION 4. FIRST AID MEASURES

General advice	:	Never give anything by mouth to an unconscious person. When symptoms persist or in all cases of doubt seek medical advice.
Inhalation	:	Remove from exposure, lie down. Move to fresh air. Keep patient warm and at rest. Artificial respiration and/or oxygen may be necessary. Consult a physician.
Skin contact	:	Take off contaminated clothing and shoes immediately. Flush area with lukewarm water. Do not use hot water. If frostbite has occurred, call a physician.
Eye contact	:	Rinse immediately with plenty of water and seek medical advice.
Ingestion	:	Is not considered a potential route of exposure.
Most important symptoms/effects, acute and delayed	:	Anaesthetic effects Light-headedness irregular heartbeat with a strange sensation in the chest, heart thumping, apprehension, feeling of fainting, dizziness or weakness
Protection of first-aiders	:	If potential for exposure exists refer to Section 8 for specific personal protective equipment.
Notes to physician	:	Because of possible disturbances of cardiac rhythm, catecholamine drugs, such as epinephrine, that may be used in situations of emergency life support should be used with special caution.

SECTION 5. FIREFIGHTING MEASURES

Suitable extinguishing media	:	Use extinguishing measures that are appropriate to local circumstances and the surrounding environment.
Unsuitable extinguishing media	:	No applicable data available.

Specific hazards	:	Cylinders are equipped with pressure and temperature relief devices, but may still rupture under fire conditions. Decomposition may occur. Contact of welding or soldering torch flame with high concentrations of refrigerant can result in visible changes in the size and colour of the torch flame. This flame effect will only occur in concentrations of product well above the recommended exposure limit. Therefore stop all work and ventilate to disperse refrigerant vapors from the work area before using any open flames. This substance is not flammable in air at temperatures up to 100 deg. C (212 deg. F) at atmospheric pressure. However, mixtures of this substance with high concentrations of air at elevated pressure and/or temperature can become combustible in the presence of an ignition source. This substance can also become combustible in an oxygen enriched environment (oxygen concentrations greater than that in air). Whether a mixture containing this substance and air, or this substance in an oxygen enriched atmosphere become combustible depends on the inter-relationship of 1) the temperature 2) the pressure, and 3) the proportion of oxygen in the mixture. In general, this substance should not be allowed to exist with air above atmospheric pressure or at high temperatures; or in an oxygen enriched environment. For example this substance should NOT be mixed with air under pressure for leak testing or other purposes. Experimental data have also been reported which indicate combustibility of this substance in the presence of certain concentrations of chlorine.
Special protective equipment for firefighters	:	In the event of fire, wear self-contained breathing apparatus. Use personal protective equipment. Wear neoprene gloves during cleaning up work after a fire.
Further information	:	Cool containers/tanks with water spray. Self-contained breathing apparatus (SCBA) is required if containers rupture and contents are released under fire conditions. Water runoff should be contained and neutralized prior to release.

SECTION 6. ACCIDENTAL RELEASE MEASURES

NOTE: Review FIRE FIGHTING MEASURES and HANDLING (PERSONNEL) sections before proceeding with clean-up. Use appropriate PERSONAL PROTECTIVE EQUIPMENT during clean-up.

Safeguards (Personnel)	:	Evacuate personnel to safe areas. Ventilate area, especially low or enclosed places where heavy vapours might collect.

Environmental precautions	:	Should not be released into the environment. In accordance with local and national regulations.
Spill Cleanup	:	Evaporates. Ventilate area using forced ventilation, especially low or enclosed places where heavy vapors might collect.
Accidental Release Measures	:	Avoid open flames and high temperatures. Self-contained breathing apparatus (SCBA) is required if a large release occurs.

SECTION 7. HANDLING AND STORAGE

Handling (Personnel)	:	Avoid breathing vapours or mist. Avoid contact with skin, eyes and clothing. Provide sufficient air exchange and/or exhaust in work rooms. For personal protection see section 8.
Handling (Physical Aspects)	:	The product should not be mixed with air for leak testing or used with air for any other purpose above atmospheric pressure. Contact with chlorine or other strong oxidizing agents should also be avoided.
Dust explosion class	:	Not applicable
Storage	:	Valve protection caps and valve outlet threaded plugs must remain in place unless container is secured with valve outlet piped to use point. Do not drag, slide or roll cylinders. Use a suitable hand truck for cylinder movement. Use a pressure reducing regulator when connecting cylinder to lower pressure (<3000 psig) piping or systems. Never attempt to lift cylinder by its cap. Use a check valve or trap in the discharge line to prevent hazardous back flow into the cylinder. Cylinders should be stored upright and firmly secured to prevent falling or being knocked over. Separate full containers from empty containers. Keep at temperature not exceeding 52°C. Do not store near combustible materials. Avoid area where salt or other corrosive materials are present. The product has an indefinite shelf life when stored properly.
Storage period	:	> 10 yr
Storage temperature	:	< 52 °C (< 126 °F)

SECTION 8. EXPOSURE CONTROLS/PERSONAL PROTECTION

Engineering controls : Use sufficient ventilation to keep employee exposure below recommended limits. Local exhaust should be used when large amounts are released. Mechanical ventilation should be used in low or enclosed places. Refrigerant Concentration monitors may be necessary to determine vapor concentrations in work areas prior to use of torches or other open flames, or if employees are entering enclosed areas.

Personal protective equipment

Respiratory protection : Under normal manufacturing conditions, no respiratory protection is required when using this product.

Hand protection : Additional protection: Impervious gloves

Eye protection : Wear safety glasses with side shields. Additionally wear a face shield where the possibility exists for face contact due to splashing, spraying or airborne contact with this material.

Protective measures : Self-contained breathing apparatus (SCBA) is required if a large release occurs.

Exposure Guidelines

Exposure Limit Values

Pentafluoroethane			
AEL *	(DUPONT)	1,000 ppm	8 & 12 hr. TWA
Difluoromethane			
AEL *	(DUPONT)	1,000 ppm	8 & 12 hr. TWA

* AEL is DuPont's Acceptable Exposure Limit. Where governmentally imposed occupational exposure limits which are lower than the AEL are in effect, such limits shall take precedence.

SECTION 9. PHYSICAL AND CHEMICAL PROPERTIES

Appearance

Physical state : gaseous

Form : Liquefied gas

Color : colourless

Odor	:	slight, ether-like
Odor threshold	:	No applicable data available.
pH	:	neutral
Melting point/range	:	No applicable data available.
Boiling point/boiling range	:	Boiling point -51.4 °C (-60.5 °F)
Flash point	:	does not flash
Evaporation rate	:	> 1 (CCL4=1.0)
Flammability (solid, gas)	:	No applicable data available.
Upper explosion limit	:	Method: None per ASTM E681
Lower explosion limit	:	Method: None per ASTM E681
Vapor pressure	:	16,574 hPa at 25 °C (77 °F)
Vapor density	:	2.5 at 25°C (77°F) and 1013 hPa (Air=1.0)
Density	:	1.062 g/cm3 at 25 °C (77 °F) (as liquid)
Density	:	0.0066 g/cm3 at ca. 26 °C (79 °F) at (1,013 hPa)
Specific gravity (Relative density)	:	1.06 at 25 °C (77 °F)
Water solubility	:	not determined
Solubility(ies)	:	No applicable data available.
Partition coefficient: n-octanol/water	:	No applicable data available.
Auto-ignition temperature	:	No applicable data available.
Decomposition temperature	:	No applicable data available.

Viscosity, kinematic	:	No applicable data available.
Viscosity	:	No applicable data available.
% Volatile	:	100 %

SECTION 10. STABILITY AND REACTIVITY

Reactivity	:	Stable at normal ambient temperature and pressure.
Chemical stability	:	Stable under recommended storage conditions.
Possibility of hazardous reactions	:	Polymerization will not occur.
Conditions to avoid	:	Avoid open flames and high temperatures.
Incompatible materials	:	Alkali metals Alkaline earth metals, Powdered metals, Powdered metal salts
Hazardous decomposition products	:	Decomposition products are hazardous., This material can be decomposed by high temperatures (open flames, glowing metal surfaces, etc.) forming hydrofluoric acid and possibly carbonyl fluoride., These materials are toxic and irritating., Avoid contact with decomposition products

SECTION 11. TOXICOLOGICAL INFORMATION

Pentafluoroethane (HFC-125)

Inhalation 4 h LC50	:	> 800000 ppm , Rat
Inhalation No Observed Adverse Effect Concentration	:	100000 ppm , Dog Cardiac sensitization
Inhalation Low Observed Adverse Effect Concentration (LOAEC)	:	75000 ppm , Dog Cardiac sensitization
Skin sensitization	:	Does not cause respiratory sensitisation., human
Repeated dose toxicity	:	Inhalation Rat - gas NOAEL: > 50000, No toxicologically significant effects were found.

Carcinogenicity	:	Not classifiable as a human carcinogen. Overall weight of evidence indicates that the substance is not carcinogenic.
Mutagenicity	:	Animal testing did not show any mutagenic effects. Evidence suggests this substance does not cause genetic damage in cultured mammalian cells. Did not cause genetic damage in cultured bacterial cells.
Reproductive toxicity	:	No toxicity to reproduction Animal testing showed no reproductive toxicity.
Teratogenicity	:	Animal testing showed no developmental toxicity.
Further information	:	Cardiac sensitisation threshold limit : 490000 mg/m3

Difluoromethane (HFC-32)

Inhalation 4 h LC50	:	> 520000 ppm , Rat
Inhalation Low Observed Adverse Effect Concentration (LOAEC)	:	> 350000 ppm , Dog Cardiac sensitization
Inhalation No Observed Adverse Effect Concentration	:	350000 ppm , Dog Cardiac sensitization
Skin irritation	:	No skin irritation, Not tested on animals Not expected to cause skin irritation based on expert review of the properties of the substance.
Eye irritation	:	No eye irritation, Not tested on animals Not expected to cause eye irritation based on expert review of the properties of the substance.
Skin sensitization	:	Does not cause skin sensitisation., Not tested on animals Not expected to cause sensitization based on expert review of the properties of the substance. There are no reports of human respiratory sensitization.
Repeated dose toxicity	:	Inhalation Rat - No toxicologically significant effects were found.

Mutagenicity	:	Animal testing did not show any mutagenic effects. Tests on bacterial or mammalian cell cultures did not show mutagenic effects.
Reproductive toxicity	:	No toxicity to reproduction Animal testing showed no reproductive toxicity. Information given is based on data obtained from similar substances.
Teratogenicity	:	Animal testing showed no developmental toxicity.
Further information	:	Cardiac sensitisation threshold limit : > 735000 mg/m3

Carcinogenicity

The carcinogenicity classifications for this product and/or its ingredients have been determined according to HazCom 2012, Appendix A.6. The classifications may differ from those listed in the National Toxicology Program (NTP) Report on Carcinogens (latest edition) or those found to be a potential carcinogen in the International Agency for Research on Cancer (IARC) Monographs (latest edition).

None of the components present in this material at concentrations equal to or greater than 0.1% are listed by IARC, NTP, or OSHA, as a carcinogen.

SECTION 12. ECOLOGICAL INFORMATION

Aquatic Toxicity

Pentafluoroethane (HFC-125)

96 h LC50	:	Oncorhynchus mykiss (rainbow trout) 450 mg/l Information given is based on data obtained from similar substances.
96 h ErC50	:	Algae 142 mg/l Information given is based on data obtained from similar substances.
72 h NOEC	:	Pseudokirchneriella subcapitata (green algae) 13.2 mg/l Information given is based on data obtained from similar substances.
48 h EC50	:	Daphnia magna (Water flea) 980 mg/l Information given is based on data obtained from similar substances.

Difluoromethane (HFC-32)

96 h LC50	:	Fish 1,507 mg/l

96 h EC50	:	Algae 142 mg/l
48 h EC50	:	Daphnia (water flea) 652 mg/l
30 d	:	NOEC Fish (unspecified species) 65.8 mg/l

Environmental Fate

Difluoromethane (HFC-32)

Biodegradability : 5 % OECD Test Guideline 301D
Not readily biodegradable.

SECTION 13. DISPOSAL CONSIDERATIONS

Waste disposal methods - Product : Can be used after re-conditioning. Recover by distillation or remove to a permitted waste disposal facility. Comply with applicable Federal, State/Provincial and Local Regulations.

Contaminated packaging : Empty pressure vessels should be returned to the supplier.

SECTION 14. TRANSPORT INFORMATION

DOT	UN number	: 3163
	Proper shipping name	: Liquefied gas, n.o.s. (Pentafluoroethane, Difluoromethane)
	Class	: 2.2
	Labelling No.	: 2.2
IATA_C	UN number	: 3163
	Proper shipping name	: Liquefied gas, n.o.s. (Pentafluoroethane, Difluoromethane)
	Class	: 2.2
	Labelling No.	: 2.2
IMDG	UN number	: 3163
	Proper shipping name	: LIQUEFIED GAS, N.O.S. (Pentafluoroethane, Difluoromethane)
	Class	: 2.2
	Labelling No.	: 2.2

SECTION 15. REGULATORY INFORMATION

TSCA	:	On the inventory, or in compliance with the inventory
SARA 313 Regulated Chemical(s)	:	This material does not contain any chemical components with known CAS numbers that exceed the threshold (De Minimis) reporting levels established by SARA Title III, Section 313.
PA Right to Know Regulated Chemical(s)	:	Substances on the Pennsylvania Hazardous Substances List present at a concentration of 1% or more (0.01% for Special Hazardous Substances): Difluoromethane
NJ Right to Know Regulated Chemical(s)	:	Substances on the New Jersey Workplace Hazardous Substance List present at a concentration of 1% or more (0.1% for substances identified as carcinogens, mutagens or teratogens): Difluoromethane
California Prop. 65	:	Chemicals known to the State of California to cause cancer, birth defects or any other harm: none known

SECTION 16. OTHER INFORMATION

Suva® is a registered trademark of E. I. du Pont de Nemours and Company
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Before use read DuPont's safety information.
For further information contact the local DuPont office or DuPont's nominated distributors.

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Significant change from previous version is denoted with a double bar.

TROX® TECHNIK

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