



CAV control unit

VFC



TROX

TROX SE

Heinrich-Trox-Platz

47506 Neukirchen-Vluyn

Germany

Phone: +49 2845 202-0

Fax: +49 2845 202-265

E-Mail: trox-de@troxgroup.com

Internet: <http://www.troxgroup.com>

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1 General information

1.1 About this manual

This installation and operating manual enables the safe and efficient handling of the constant volume flow controller (hereinafter also referred to as the CAV control unit or device).

This manual must be kept near the unit to be available for use at all times.

The personnel performing work on the device must read and understand this manual carefully before starting any work. The basic prerequisite for safe working is to comply with all safety notes and instructions in this manual.

In addition, the local health and safety regulations and general safety regulations apply to the area of application of the device.

Illustrations in this manual are mainly for information and may differ from the actual design.

Applicable documents

In addition to this manual, the following documents shall be observed:

- Product data sheets
- Project-specific wiring documents, if applicable

1.2 Explanation of symbols

Safety notes

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

Comply with all safety instructions and proceed carefully to avoid accidents, injuries and damage to property.



DANGER!

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



WARNING!

Potentially hazardous situation which, if not avoided, may 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.

Tips and recommendations



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

Safety notes in the operating instructions

Safety notes can refer to specific, individual instructions. Such safety instructions are embedded in the instructions so that they do not interrupt the flow of reading when carrying out the task. The above listed signal words will be used.

Example:

1 ▶ Loosen the screw.

2 ▶



CAUTION!

Risk of jamming on the lid!

2 ▶ Close the lid carefully.

3 ▶ Tighten the screw.

Further symbols/markings

The following markings are used to highlight instructions, results, lists, references and other elements in this manual:

Marking	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
[Push button]	Control elements (e.g. push buttons, switches) or display elements (e.g. LEDs)
'Display'	Screen elements (e.g. buttons, assignment of function keys)

1.3 TROX contact information

To ensure that your request is processed as quickly as possible, please have the following information available:

- Product name
- TROX order number and line number
- Delivery date
- Issue or fault report  Chapter 9.1 'Troubleshooting' on page 26

Please refer to your local TROX website for the latest contact information.

1.4 Legal information

Claims for material defects

Claims for material defects are subject to the seller's terms of delivery.

Copyright

This documentation – including all illustrations – is protected by copyright and pertains only to the corresponding product.

Any use without our consent may be an infringement of copyright, and the violator shall be liable for damages.

This applies in particular to:

- Publishing content
- Copying content
- Translating content
- Microfilming
- Saving and processing in electronic systems

2 Safety

2.1 Intended use

The mechanical self-acting volume flow controller VFC is used for constant volume flow control in ventilation and air conditioning systems within closed rooms.

Use in an HVAC system with dusty-laden indoor air is permitted, provided that the air does not contain moisture and/or sticky substances (e.g. nicotine, hairspray, adhesive vapours or similar substances). A combination of dust with moisture or sticky substances can lead to adhering deposits (agglomeration), which can impair the mechanical structure of the control-relevant components. This can result in increased control deviations, impermissible volume flow deviations or, in extreme cases, complete functional failure of the device. For applications with such ambient conditions, we recommend using a variable volume flow controller whose control component works with a static differential pressure transducer.

The volume flow controller may only be used in kitchen exhaust systems when the exhaust air is cleaned by high-efficiency aerosol separators, refer to VDI 2052 for details.

Improper use

WARNING!

Danger due to unauthorised use!

Improper use of the CAV control unit can lead to dangerous situations.

Never use CAV control units:

- in areas with potentially explosive atmospheres (EX)
- in aircraft
- outdoors without sufficient protection against the effects of weather
- in wet areas
- for areas of application that are not described in the product brochure

Modifying the device or using spare parts that have not been approved by TROX is not permitted.

2.2 Safety signs

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

WARNING!

Danger due to illegible labelling!

Over time, stickers and signs may fade or become otherwise illegible, meaning that hazards cannot be identified, and necessary operating instructions cannot be followed. There is then a risk of injury.

- Keep all safety signs, warning and operating instructions in a legible condition at all times.
- Replace illegible hazard and safety signs or labels immediately.

Electrical voltage



Only qualified electricians may work in the areas labelled in this way.

Unauthorised persons may not enter or open the marked areas, nor work on the marked components.

2.3 Dangers when handling the unit

The device is designed in accordance with the latest state-of-the-art technology and current safety requirements. Residual risks cannot be excluded, however, and you should proceed with caution. The residual risks identified in a risk assessment are listed below.

To reduce health hazards and avoid dangerous situations, observe the safety instructions listed here and the safety instructions in the other chapters of this manual.

2.3.1 Electric shock hazards

Electric current



DANGER!

Danger to life due to electric current!

Contact with live parts poses an immediate danger to life due to electric shock. Damage to the insulation or individual components can be life-threatening.

- Work on the electrical system may only be carried out by qualified electricians.
- If the insulation is damaged, disconnect the power supply immediately and have the insulation repaired.
- Before starting any working on electric systems and equipment, switch off the supply voltage and secure it against being switched on accidentally. Comply with the following safety rules:
 - Switch off the supply voltage.
 - Secure it against being switched on accidentally.
 - Ensure that no voltage is present.
 - Connect to earth; and short-circuit.
 - Cover neighbouring live parts.
- Never bypass or disable any fuses. Be sure to maintain the correct current rating when replacing a fuse.
- Ensure that live parts do not come into contact with moisture. Moisture can cause a short circuit.

This applies in particular:

- The system owner must be aware of the applicable occupational health and safety regulations and carry out a risk assessment to determine any additional hazards that may exist or result from the specific working conditions at the installation location. The system owner has to create operating instructions for the unit that reflect the results of this risk assessment.
- The system owner has to ensure, throughout the entire operating period of the unit, that these operating instructions conform to applicable standards and guidelines. In case of any deviation, the system owner has to adapt the instructions.
- The system owner must secure the unit to prevent access by unauthorised individuals.
- The system owner must clearly define the responsibilities for operation, maintenance, cleaning, and troubleshooting.
- The system owner has to ensure that all individuals who handle the unit have read and understood this manual.
- The system owner must provide the necessary protective equipment to the personnel.
- The system owner must ensure that maintenance is carried out in the intervals specified in this manual.
- The system owner must have all safeguards checked regularly for functionality and completeness.
- The system owner must comply with the local fire regulations.

2.4 System owner's responsibility

System owner

The system owner is a natural or legal person who for commercial or business purposes owns or manages the ventilation system or component or allows third parties to use or operate it, but continues to bear legal responsibility for the safety of users, staff or third parties while the product is in use.

System owner's obligations

The unit is intended for use in commercial environments. The system owner is therefore subject to the legal obligations of occupational safety.

In addition to the safety notes in this manual, the applicable regulations for safety, accident prevention and environmental protection must also be complied with.

Hygiene requirements

The system owner has to comply with the local regulations and harmonised standards for hygiene requirements. These include, among other things, compliance with the corresponding maintenance and test intervals.

2.5 Personnel qualifications

WARNING!

Danger of injury if insufficiently qualified!

Improper handling may cause considerable personal injury and property damage.

- All activities must only be carried out by qualified personnel.

This manual lists the following qualifications for various areas of activity.

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.

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.

2.6 Personal protective equipment

Personal protective equipment is equipment that protects the user against health or safety risks at work.

Personal protective equipment must be worn for various types of work; the protective equipment required is listed in this manual together with the description of each type of work.

Description of personal protective equipment

Industrial safety helmet



Industrial safety helmets protect the head from falling objects, suspended loads, and the effects of striking the head against stationary objects.

Protective gloves



Protective gloves protect hands from friction, abrasions, punctures, deep cuts, and direct contact with hot surfaces.

Safety shoes



Safety shoes protect the feet from crushing, falling parts and prevent slipping on a slippery floor.

2.7 Repair and spare parts

Only qualified personnel may repair the equipment, using only original spare parts. This particularly applies to work on the electrical equipment. Defective equipment should therefore only be repaired by TROX for safety reasons,  1.3 'TROX contact information' on page 5.

2.8 General safety measures (only for devices with electronic components)

Large temperature differences

Be careful with large temperature differences. Do not start the device immediately after bringing it from an unheated room into a warm room. Condensation may damage the electronic components beyond repair. The room temperature is only reached after about 2 hours.

Foreign matter and liquids

Be careful when objects or liquids have got into the casing, or if the device emits a smell or smoke. Decommission the device and have it checked by the manufacturer.

Electrostatic discharges when handling electronic components

When working on electronic components, electrostatic discharges may damage electrical circuits.

- Avoid touching components and conductor tracks on the motherboard or any expansion boards that may be present.
- Work with personal protective equipment for ESD protection (ElectroStaticDischarge). For example, the following items can be used to prevent discharges:
 - Antistatic wrist strap
 - ESD protection work shoes
 - Conductive clothing
 - Grounding mat

3 Transport, storage and packaging

Safety notes on handling the device



CAUTION!

Danger of injury from sharp edges and sheet metal parts!

- Always wear protective gloves during transport and installation.



NOTICE!

Risk of damage to the device!

- Handle the device with care.
- Do not lift the device by the actuator or the damper blade.
- Only lift the device by the casing.

3.4 Packaging

After unpacking, properly dispose of packaging material.

3.1 Delivery check

Check delivered items immediately for transport damage and completeness. In case of transport damage or incomplete delivery, inform the forwarding agent and your supplier immediately.

3.2 Transport on site

- If possible, take the product in its transport packaging up to the installation location.
- Use only lifting and transport gear designed for the required load.
- Do not remove the protective wrapping until just before installation.

3.3 Storage

If the product has to be stored temporarily, observe the following points:

- Moisture and a lack of ventilation can lead to oxidation, even on galvanised components. Remove any plastic wrapping in order to avoid oxidation.
- Protect the device from dust and contamination.
- Protect the device (even when packed) from moisture and direct sunlight.
- Do not store the device below 14 °F or above +122 °C.
- The relative humidity must not exceed 95% (**no condensation**).
- After storage and prior to installation, allow the unit to acclimatise to the installation temperatures for at least 2 hours.

4 Product description

4.1 Product overview

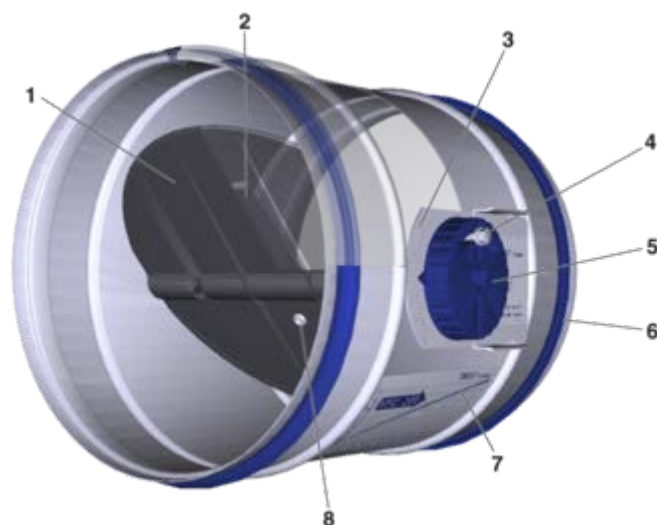


Fig. 1: VFC Product overview

- 1 Damper blade
- 2 Leaf spring
- 3 Volume flow rate scale
- 4 Rotary knob locking screw
- 5 Handwheel
- 6 Lip seal
- 7 Diagram with setting values
- 8 Bellows inlet

Application

- For constant air flow
- Volume flow rate is set on site using the rotary knob
- Factory setting: 5

4.1.1 Actuators (optional)

E01, E02 and E03



Fig. 2: VFC/160/E01

Application

- For variable air flow or min/max switching
- Volume flow rate is set on potentiometers
- Shut-off down to air leakage is possible (setting value: 0)
Note: Airtight sealing is not possible!
- Factory setting:
 - q_{vmin} value to be set: 4
 - q_{vmax} value to be set: 8

Actuator M01 and M02



Fig. 3: VFC/160/M01

Application

- Min/max switching
- Volume flow rate is set using mechanical stops
- Shut-off down to air leakage is possible (setting value: 0)
Note: Airtight sealing is not possible!
- Flat design, actuator height 35 mm

4.2 Functional description

The volume flow controller VFC is a mechanical self-powered unit and works without external power supply. A damper blade with low-friction bearings is adjusted by aerodynamic forces such that the set volume flow rate is maintained within the differential pressure range.

The aerodynamic forces of the airflow create a closing torque on the damper blade. An inflating bellows amplifies this force and at the same time acts as a damping element. The closing torque is countered by a leaf spring that unrolls over a cam plate. The cam plate is adapted in such a way that the damper blade moves when the differential pressure changes. As a result, the volume flow rate remains constant within narrow tolerances.

The volume flow rate setpoint value can be set using the pointer on the external scale. If the system pressure changes, e.g. by opening or closing a line, the controller reacts immediately and keeps the set volume flow constant.

Operating modes

- **Constant volume flow rate>**
The volume flow controller keeps the set flow rate constant independently of the duct pressure.
- **Min/max switching (E01/E02, M01/M02):**
The volume flow controller works with two setpoint values that are switched over using switches or relays.
- **Variable volume flow (E03):**
The volume flow controller keeps a variable set flow rate constant independently of the duct pressure. For this purpose, the volume flow controller receives a control variable from a room temperature controller or air quality controller, a set point adjuster or a DDC outstation. The control variable is a 0 to 10 V DC voltage signal.
- **An airtight shut-off of the volume flow is not possible with the VFC control unit.** If the setpoint is set to 0, a residual volume flow (leakage air flow) is always let through.

4.3 Display of the damper blade position

The position of the damper blade is not visible from the outside. If necessary, the damper position can be checked through adjacent inspection openings

4.4 Labelling on unit

4.4.1 Diagram with setting values

A diagram with setting values is affixed to the control unit. The desired volume flow can be set on the hand-wheel using the setting diagram.

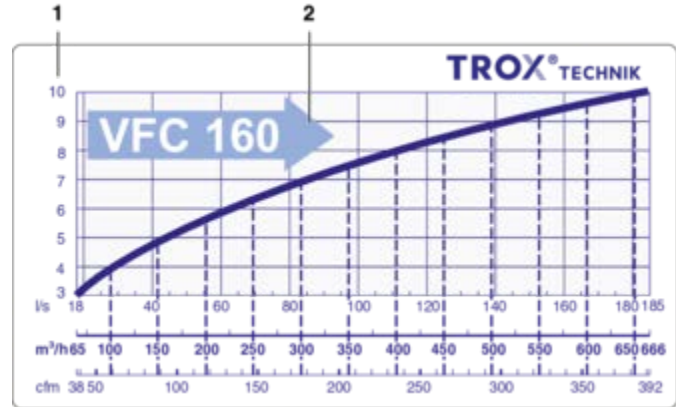


Fig. 4: Diagram with setting values VFC (example)

- 1 Setting value
- 2 Arrow indicating the airflow direction

4.4.2 CE marking / declaration of incorporation

The VFC unit complies with the Machinery Directive 2006/42/EC as partly completed machinery, as it does not fulfil an independent function on its own. A CE mark and a Declaration of Conformity are therefore not permitted in accordance with the Machinery Directive. In accordance with the Machinery Directive, partly completed machinery obtains a Declaration of Incorporation. This Declaration of Incorporation confirms that the basic safety aspects of the Machinery Directive and any other directives are observed.

You can download the Declaration of Incorporation on the Internet at www.troxtechnik.com.

5 Installation

5.1 Safety

Personnel:

- HVAC technician

Protective equipment:

- Protective gloves
- Safety shoes
- Industrial safety helmet

Only specialist personnel are allowed to perform the described work on the RAC system controller.

Only trained and qualified electricians are allowed to work on the electrical system.



CAUTION!

Danger of injury from sharp edges and sheet metal parts!

- Always wear protective gloves during transport and installation.



NOTICE!

Risk of damage to the device!

- Handle the device with care.
- Do not lift the device by the actuator or the damper blade.
- Only lift the device by the casing.

5.2.1 Installation of sound attenuators, fire dampers and heat exchangers

If additional components are arranged upstream of a control unit in the airflow direction, the clearances specified in the table must be observed. Shorter distances lead to measurement inaccuracies on the terminal unit. The components can be arranged directly behind the terminal unit.

Distances to other components

Component	Clearance in airflow direction	
	in front of VFC	behind VFC
Circular silencer without core, e.g. TROX series CA, CAH, CF	No clearance	No clearance
Circular silencer with core, e.g. TROX CK series	At least 1.5D	1D ¹⁾
Fire damper	At least 1.5D	1D ¹⁾
Volume flow measuring equipment (VMR)	At least 1.5D	No clearance
¹⁾ to comply with the technical data of the downstream component		

5.2 General installation information

- **ATTENTION:** Pay attention to the air direction arrow on the type plate on the unit! ↪ 4.4 'Labelling on unit' on page 12
- Select the installation location such that the unit, inspection accesses and optionally the actuator remain accessible for the following work:
 - Adjustment work (service socket if necessary)
 - Wiring
 - Maintenance and servicing, e.g. to replace the actuator.

For information on space requirements, see product data sheets.

- Installation in kitchen extract air systems may only take place downstream of aerosol separators (>90 %); observe VDI 2052.

5.2.2 Installation position

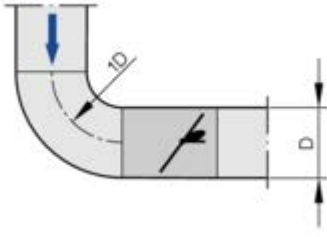
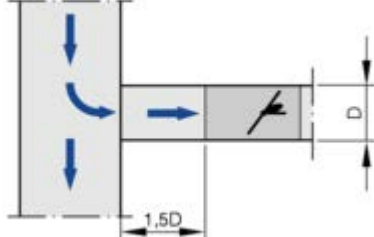
The installation position is freely selectable, but the upstream flow conditions for the unit must be met, ↪ Chapter 5.2.4 'Upstream flow conditions' on page 14.

5.2.3 Airflow direction

Volume flow control devices must be installed in their intended airflow direction. An arrow indicating the correct airflow is attached to the control unit for this purpose.

5.2.4 Upstream flow conditions

The volume flow rate accuracy of the unit applies to a straight upstream airflow. Bends, junctions or a narrowing or widening of the duct cause turbulences that may affect measurement. The following upstream airflow conditions must be observed in order to achieve the specified volume flow accuracy.

Bend	Junction from a main duct
	
In front of the unit, a bend with a curvature radius of $\geq 1D$ has only a negligible effect on the volume flow rate accuracy Δq_v.	A junction from a main duct causes strong turbulence. The specified volume flow rate accuracy Δq_v can only be achieved with a straight upstream duct section of at least $1.5D$.

5.2.4.1 Inflow via an open duct (extract air mode)

When airflow enters the open end of an air duct, the following conditions must be met with regard to the positioning of the volume flow control unit in order to obtain a laminar airflow and thus sufficient control accuracy.

Inflow via an open duct

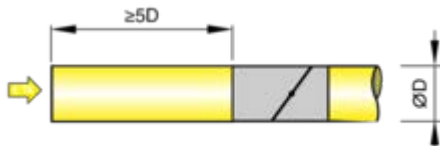


Fig. 5: Upstream flow conditions at open duct end

The inflow at the open end of a duct causes strong turbulence.

The specified volume flow rate accuracy is achieved with a minimum straight upstream duct section of $5D$.

Inflow via inflow aid

Alternatively, an inflow aid can be installed at the open end of the duct before the control unit:

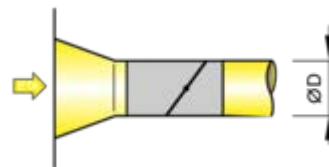


Fig. 6: Upstream flow conditions with inflow aid

The specified volume flow rate accuracy is achieved when an inflow aid is connected directly to the control unit.

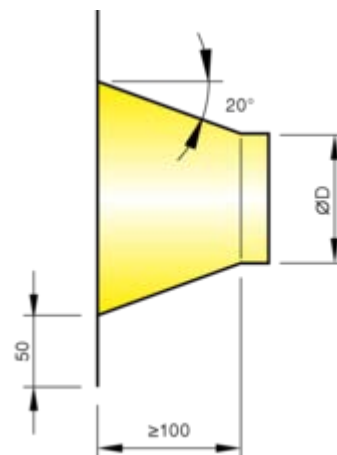


Fig. 7: Dimensions of inflow aid [mm]

5.3 Fixing/suspension

General installation information

- When designing and constructing ventilation and air conditioning systems, take into account the requirements of VDI 6022, in particular:
 - Hygienic, clean installation of all components and their air distribution surfaces.
 - Planning inspection/cleaning openings in the ducting system.
 - Avoidance of leaks.
- Affix the unit proficiently and only to load-bearing components.
- Load suspension systems only with the dead weight of the unit. Adjacent components and connecting air ducts must be supported separately.
- Only use approved and sufficiently dimensioned suspensions for fixing. Ensure screw connections cannot loosen on their own, e.g., by locking them. Fixing material is not included in the scope of delivery.
- Only use the shortest possible drilling screws for fixing into place; these screws must not be screwed into the movement and sealing area of the damper blade.

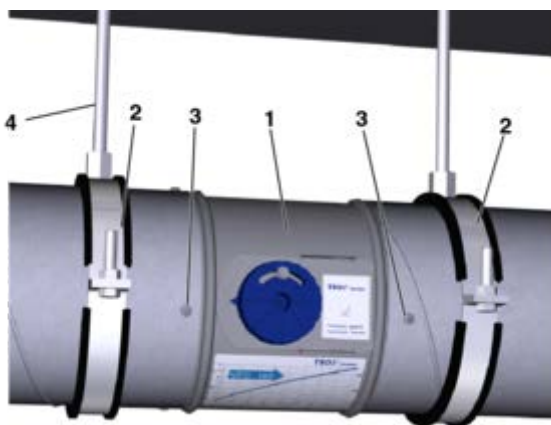


Fig. 8: Installation example for VFC CAV control unit

- 1 VFC CAV control unit
- 2 Drilling screw for fixing to the ducting
- 3 Pipe clamp
- 4 Suspension, e.g., with threaded rod

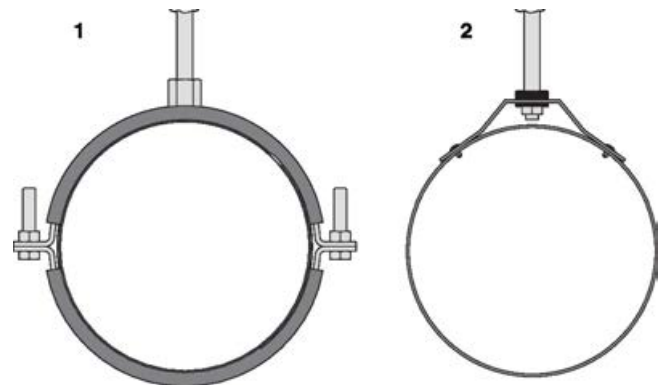


Fig. 9: Examples of fixings for circular units

- 1 Fixing to pipe clamps
- 2 Fixing to suspension element

5.4 Assembly of circular silencers

Circular silencers are supplied separately and are to be installed at the installation location between the VAV terminal unit and the room. Suspend the silencers separately, ➔ Assembly instructions for circular silencers.

5.5 Connecting the air duct

When connecting the ducting, the customer must ensure that the connection points are installed as airtight as possible in order to avoid negative influences from leakages such as air volume deviations, power consumption, etc. Unless otherwise stated, the connecting material is not included in the supply package.

Before connecting the ducting:

- Check the inside of the unit for damage and loose parts.
- Remove any contamination from the ducting.



Fig. 10: Spigot with lip seal

- Plug-in mounting on ducting in accordance with EN 1506 or EN 13180.
- Connect the spigot with the ducting, e.g., using drilling screws.
- No further sealing required.

5.6 Retrofitting the actuator

5.6.1 E01, E02, E03

The VFC version with handwheel can easily be retro-fitted with an actuator.

VFC retrofit kits

Order code	Actuators for switching between minimum and maximum position
NR-VAV – VFC-E01	3-point (min/max) actuator 24 V AC/DC with potentiometer setting
NR-VAV – VFC-E02	3-point (min/max) actuator 230 V AC/DC with potentiometer setting
NR-VAV – VFC-M01	3-point (min/max) actuator 24 V AC/DC with mechanical stops
NR-VAV – VFC-M02	3-point (min/max) actuator 230 V AC/DC with mechanical stops

Order code	Actuator for variable control
NR-VAV – VFC-E03	Variable actuator 24 V AC/DC with potentiometer setting

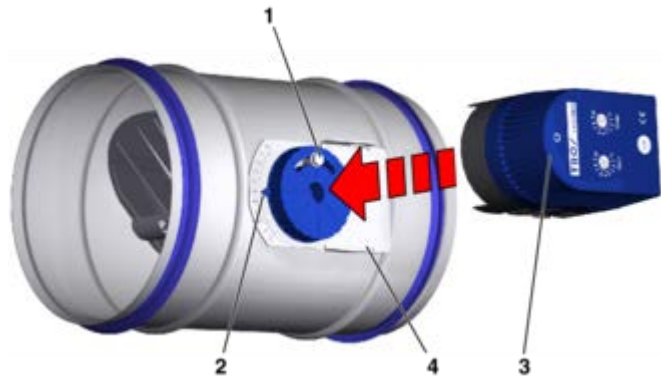


Fig. 11: Attach VFC (E01-E03)

Carry out the following assembly steps:

- Disassemble the locking screw (1).
- Set the pointer (2) on the handwheel to the setting value 5.
- Attach the actuator (3) until the fastening lugs engage on the bracket (4).
- Set the target volume flows ↗ Chapter 7.3.1 'Volume flow rate setting' on page 21

5.6.2 M01, M02



Fig. 12: VFC basic unit with retrofit kit

- 1 VFC, basic version
- 2 Handwheel
- 3 Mounting bracket
- 4 Coupling
- 5 Anti-rotation lock
- 6 Actuator



Fig. 13: Attaching the coupling

- 1 ▶ ■ Disassemble the locking screw (1)
- Set the pointer on the handwheel to the setting value 5.
- Insert the coupling (4)

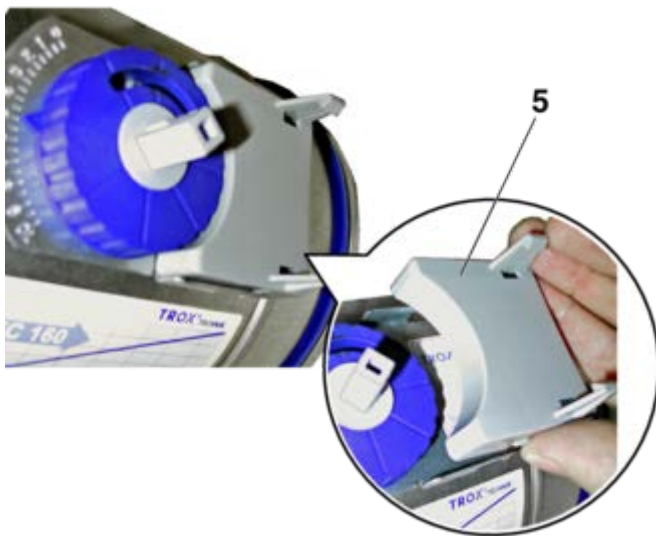


Fig. 14: Plugging in the console

- 2 ▶ Engage the anti-rotation lock (5) on the bracket

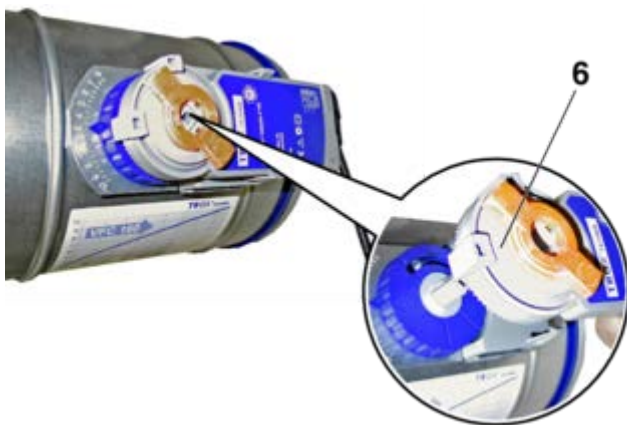


Fig. 15: Plugging in the actuator

- 3 ▶ Attach the actuator, the actuator engages on the anti-rotation lock.

Set the target volume flows ↗ Chapter
7.3.1 'Volume flow rate setting' on page 21

6 Electrical connection

6.1 Safety notes

DANGER!

Danger of electric shock! Do not touch any live components. Electrical equipment carries a dangerous electrical voltage.

- Only skilled qualified electricians are allowed to work on the electrical system.
- Before working on the electrical system, switch off the supply voltage and secure it against being switched on again.

6.2 Installation instructions

The CAV control unit has been manufactured specifically for the project; for devices with electric actuators, the supply voltage and any signalling or bus lines must be connected.

The connection is made in accordance with the information on the actuators or connection diagrams in the product data sheet or commissioning instructions for the respective actuators, www.trox.de. The voltage ranges and the terminal connections specified on the actuators must be observed!

Personnel:

- Qualified electrician

Observe the following during installation:

- Legal and official regulations, in particular VDE guidelines.
- Observe the Technical Connection Conditions of the local grid operator.
- All wiring work for supply voltage and signal lines is to be carried out by the customer.
- Supply voltage and signal lines must be routed separately. It is recommended to use shielded signal cables and to connect the shield at one end.
- For maintenance work, it must be possible to disconnect all poles of the appliance from the power supply (e.g. fuse, circuit breaker) contact spacing of at least 0.12 in. must be provided in the vicinity of the unit.
- Sizing and establishing customer-side connections and wiring must be carried out in accordance with the recognised rules of electrical engineering.
- The responsibility for planning, sizing, design of the electrical and network installations as well as their on-site execution lies with the planner, plant engineer and commissioning engineer commissioned by the operator of the plant. This includes in particular the rating of the power supplies as well as cable types and cross-sections.
- Follow wiring guidelines and project-specific connection diagrams.

- The electrical connection must only be made after the unit has been fully installed.
- For units with 24 V supply voltage, note the following:
 - Electrical connection only via safety transformer.
 - Ensure that all connected devices use the same ground reference point for their power supply.
- Suitable wire clamping brackets must be provided for all connecting cables.
- Electronic components contain no user-replaceable or repairable parts and may only be opened by the manufacturer!

6.3 Connection of min/max actuators

1-wire control

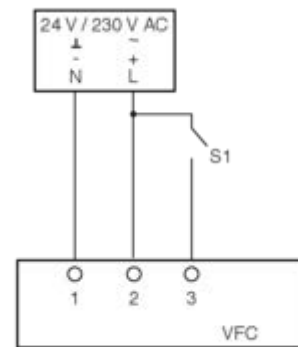


Fig. 16: 1-wire control

S1 Potential-free switch (customer-side)

Switch positions

Switch S1	E01/E02	M01/M02
Open	q _{vmin}	q _{vmax}
Closed	q _{vmax}	q _{vmin}

2-wire control

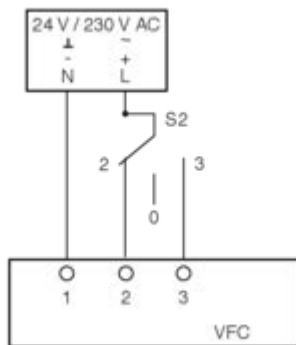


Fig. 17: 2-wire control

S2 Potential-free switch (customer-side)

Switch positions

Switch S2	E01/E02	M01/M02
0	Drive at	
2	q_{vmin}	q_{vmax}
3	q_{vmax}	q_{vmin}

6.4 Continuous actuator connection

Wiring E03

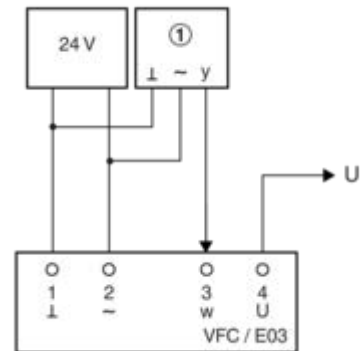


Fig. 18: Continuous control

1 Room temperature controller

Y Reference signal: 0-10 V DC $R_a > 100 \text{ k}\Omega$

U Actual value output position angle: 0-10 V DC

Note: Due to its design, a CAV control unit does not provide a volume flow actual value signal.

Room temperature control

A suitable room temperature controller (1) or a DDC substation with 0-10 V DC output is connected according to the circuit diagram with at least 2 wires (terminals 1 and 3).

When using a common supply voltage of 24 V, it should be noted that terminal 1 on the VFC is also ground for the guide signal.

Note: Priority control q_{vmax} at 24 V DC at terminal 3.

Supplement to wiring E03

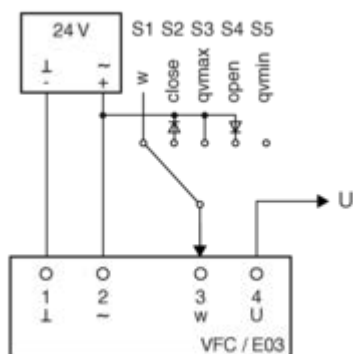


Fig. 19: Continuous control with override switching

S1 w Control setting value via characteristic curve between q_{vmin} and q_{vmax}

S5 Control setpoint q_{vmin}

S3 Control setpoint q_{vmax}

S2* Activation start of scale (setting value 0)

S4* Activation end of scale (setting value 10)

* only for 24 V AC supply with diode circuit (diode e.g. 1N4001):

Attention: Depending on the dimensions, the scale values 0 and 10 may lie outside the controllable volume flow range.

7 Commissioning and operation

7.1 Factory preparation

CAV control units from the VFC series are set to standard values at the factory and tested for function.

The target volume flow rate must generally be set by the customer on the construction site. Setting is performed without adjustment devices. Each volume flow controller has a label with a characteristic curve for setting the volume flow setpoint. The setting values read are transferred to the handwheel or the actuator (potentiometer or mechanical stops).

7.2 Requirement for commissioning

Contaminants, e.g. construction dust, can impair the functionality of the control unit.

Therefore, the ventilation and air conditioning system and its components may not be put into operation for the first time until the rooms connected to the ventilation system have been cleaned of any contamination resulting from construction work. Contamination of the ventilation system by construction dust and sucked-in dirt particles must be eliminated. In the case of systems that are heavily contaminated due to construction activities, the system may need to be cleaned before commissioning.

7.3 Commissioning



Code of good practice for commissioning

Commissioning is governed by the standard "DIN EN 12599 Testing and measuring procedures for the transfer of installed ventilation and air conditioning systems", and, if applicable, contractually agreed services between HVAC contractors, system owners and installation engineers. The standard describes the essential commissioning steps of the completeness check, function check, function measurement as well as report generation and handover.

7.3.1 Volume flow rate setting

Setting example

The setting values for the volume flow can be determined as follows:

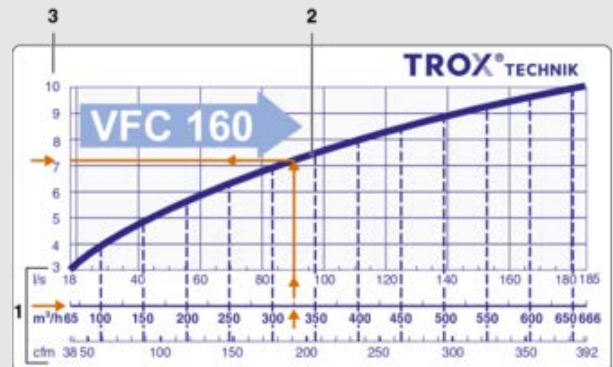


Fig. 20: VFC scale sticker

Target volume flow rate q_v : - 191.29 cfm

- 1 ▶ Select the corresponding volume flow scale below the diagram, then search for the value.
⇒ 191.29 cfm
- 2 ▶ Draw an imaginary line upwards to the graph.
- 3 ▶ Move the imaginary line to the left to the setting scale and read off the value.
⇒ Setting value: 7.2
- 4 ▶ Set the volume flow at the pointer on the hand-wheel.

When using an actuator for electrical scale adjustment, transfer the setting to the potentiometers or the mechanical stops depending on the actuator type, see description below.

Caution: Setting values below 3 result in a duct pressure-dependent, uncontrolled air flow that does not exceed q_{vmin} unit.

Constant volume flow rate (base unit)

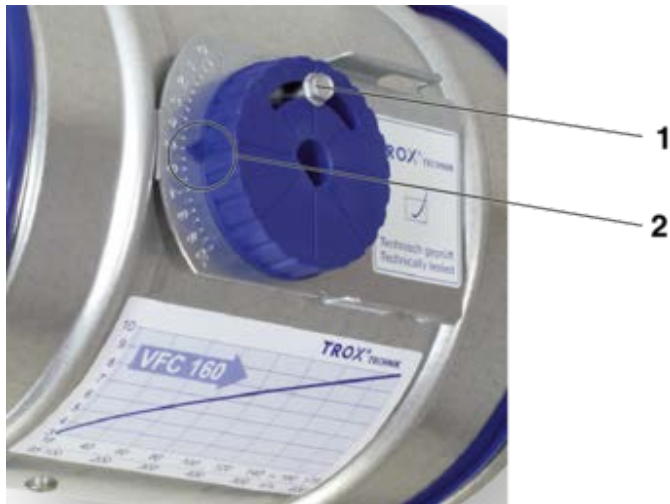


Fig. 21: VFC volume flow rate setting

- 1 ▶ Loosen the locking screw (1).
- 2 ▶ Set the pointer of the handwheel (2) to the setting value.
- 3 ▶ Tighten the locking screw again.

Min-max (E01 / E02 / E03)



Fig. 22: VFC E0x volume flow rate setting

Factory setting:

q_{vmin} - 4

q_{vmax} - 8

- 1 ▶ Set the minimum volume flow rate using the min potentiometer (1).
Shut-off down to leakage airflow is possible, value to be set: 0
- 2 ▶ Set the maximum volume flow rate using the max potentiometer (2).

Actuator E03 – setting value

The relationships between the setting value E, setpoint value W and the actual value U are shown in the characteristics below.

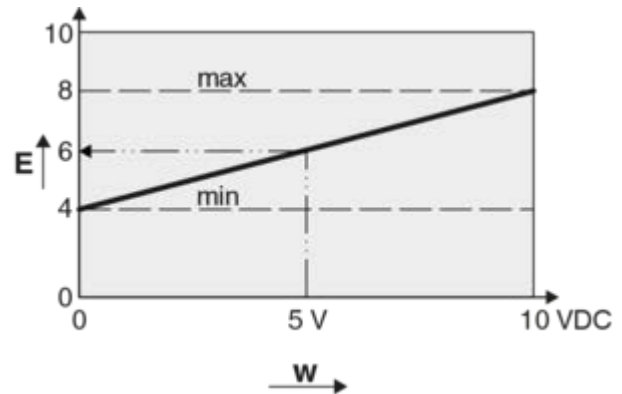


Fig. 23: Characteristic of setpoint value w

Example: VFC/160

Required volume flow rate - 127.13 cfm = E6

q_{vmin} - 4

q_{vmax} - 8

- with selected q_{vmin} setting = 4 $\Rightarrow$ characteristic corner point 0V
- with selected q_{vmax} setting = 8 $\Rightarrow$ characteristic curve corner point 10V

Required set value (E): 6 $\Rightarrow$ required set value w = 5 V

Actuator E03 – output signal

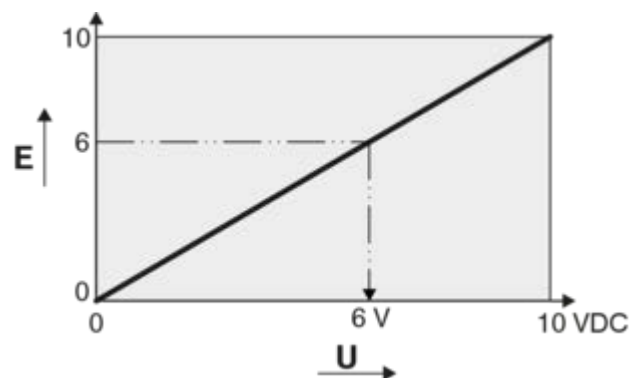


Fig. 24: Characteristic of actual value signal U

The output signal (actual value U) reflects the set position of the actuator, not the current volume flow. The volume flow rate is not measured with a CAV controller due to its design.

Min-max (M01 / M02)



- 1 ▶ Remove the position indicator, there is a magnet on the back (1)
- 2 ▶ Place the magnet on the point marked "magnetic gear release" (2).
⇒ The gearbox is disengaged and the actuator can be moved.



- 3 ▶ Remove the mechanical limiters (3)



- 4 ▶ Set q_{vmin} or q_{vmax} on the pointer (4) of the hand-wheel, refit the mechanical limiters (3) at the corresponding positions.
- 5 ▶ Remove the position indicator with magnet and reattach it to the axle mount.

7.3.2 Functional test

Prerequisites for the functional test

- CAV control unit has been correctly installed in the ducting system:
 - Airflow direction, according to airflow direction arrows
 - Upstream flow conditions correct, ↗ *Chapter 5.2 'General installation information' on page 13*
- Ventilation and air conditioning system is in operation (fans running).
- Air circulation is guaranteed (shutoff dampers and fire dampers are open).

With optional actuator:

- Electrical connections have been correctly installed and tested.
- The supply voltage is switched on.

Only for actuators E01, E02, E03

Press the test button for at least 2 seconds.

During the test run, the actuator moves $\pm 30^\circ$ from its actual position and also exceeds the set values q_{vmin} and q_{vmax} .

Status display:

- | | |
|--------------------|------------------------|
| LED on | - Set position reached |
| LED flashes (1 Hz) | - Actuator moves |
| LED flashes (2 Hz) | - Actuator blocks |
| LED off | - No power |

7.4 Operation

Once commissioning has been completed, the CAV control unit will operate in a self-powered manner and require no intervention from the system owner.

Depending on the area of application of the CAV control unit, test specifications and intervals may have to be observed; for example, when used on fume cupboards, an annual functional test must be carried out and documented.

In the event of a malfunction, decommission the CAV control unit and have it repaired before commissioning it again.

8 Maintenance

8.1 System owner's responsibility



WARNING!

Only authorised specialist personnel may perform the described maintenance measures.

The system owner is responsible for maintenance. With their maintenance management, the system owner is responsible for creating a maintenance plan, for defining the maintenance goals, and for the functional reliability of the equipment.

The legal regulations must be observed during maintenance, e.g. the system owner is responsible for hygienic operation in accordance with VDI 6022.

8.2 Maintenance

The CAV control unit and the actuator are maintenance-free with regard to wear and tear, but the CAV control unit must still be included in the regular cleaning of the ventilation system. Regular care and maintenance ensure operational readiness, operational reliability and long service life of the CAV control unit.

8.3 Inspection measures



DANGER!

Danger of electric shock! Do not touch any live components. Electrical equipment carries a dangerous electrical voltage.

- Only skilled qualified electricians are allowed to work on the electrical system.
- Before working on the electrical system, switch off the supply voltage and secure it against being switched on again.

Personnel:

- Qualified electrician

Protective equipment:

- Safety shoes

Testing measures:

- 1 ▶ Remove any contamination that affects the function of the CAV control unit.
- 2 ▶ Check all screw connections for tightness and retighten them, if necessary.
- 3 ▶ Check electrical feeder cables for damage and firm seating in the terminals.
- 4 ▶ Test the functions of the closed circuits (including volume flow rate) and, if necessary, correct the set operating parameters.
- 5 ▶ Check if the measured values are plausible.

- 6 ▶ Document maintenance measures and measurement results.

8.4 Repair work

Repair work may only be carried out by specialist personnel or by the manufacturer. Only original spare parts may be used.

8.5 Maintenance service

To ensure the operational readiness, operational safety and service life of your units, we recommend regular maintenance by TROX.

Our experts can assess the actual condition of the unit and verify that it is in proper condition after maintenance. Setting and adjustment work is integrated directly into the maintenance process so that the ventilation system maintains a high level of safety.

9 Faults

9.1 Troubleshooting

To troubleshoot the problem, check and log the following points. Take appropriate action if necessary. If sending inquiries to TROX Service, please send the fault log.

System/area:	
TROX CAV control unit series	
Actuator (if available):	

Description	Yes	No	Not applicable
Installation situation			
Is accessibility to the CAV control unit and actuator sufficient?	☐	☐	☐
Specified airflow direction maintained? ↳ Chapter 5.2 'General installation information' on page 13	☐	☐	☐
Required upstream section maintained? ↳ Chapter 5.2 'General installation information' on page 13	☐	☐	☐
Are the specified distances to other ventilation components, such as sound attenuators, fire dampers and heat exchangers, observed? ↳ Chapter 5.2 'General installation information' on page 13	☐	☐	☐
System readiness			
Fan switched on?	☐	☐	☐
Is there sufficient pre-pressure at the CAV control unit, i.e., is the minimum pressure differential according to the data sheet maintained?	☐	☐	☐
Fire dampers/shutoff devices opened in the duct section?	☐	☐	☐
Check the actuator			
Error-free wiring and supply voltage within tolerance zone?	☐	☐	☐
Characteristic curve of the setpoint control matching the actuator or its set characteristic curve Example: Characteristic line 0-10 V DC	☐	☐	☐
Adaptation of the actuators carried out again if necessary (only required for certain actuators)	☐	☐	☐
Check control operation			
Setpoint control within the control range of the CAV control unit.	☐	☐	☐
Check operating point at q_{vmin}.	☐	☐	☐
Check operating point at q_{vmax}.	☐	☐	☐

10 Decommissioning

Once the device has reached the end of its service life, it must be dismantled and disposed of in an environmentally friendly manner.

10.1 Safety

Personnel

- Disassembly may only be carried out by specially trained personnel.
- Only trained and qualified electricians may work on the electrical system.

Electrical system



DANGER!

Danger of death due to electric current!

Danger of electric shock! Do not touch any live components! Live electrical components may suddenly move uncontrollably and seriously injure people.

Therefore:

- Switch off the power supply and disconnect the product permanently before you begin to disassemble it.



WARNING!

Risk of injury due to improper disassembly!

Stored residual energy, sharp-edged components, sharp points and corners on and in the device or on the required tools can cause injuries.

Therefore:

- Make sure there is sufficient space before starting work.
- Handle all open, sharp-edged components with care.
- Disassemble components professionally. Be aware that some components are very heavy. Use lifting gear if necessary.
- Secure components to prevent them from falling or tipping over.
- When in doubt, contact the manufacturer.

10.2 Disassembly

Before you start disassembly:

- Switch off the device and secure it against being switched on accidentally.
- Physically disconnect the entire power supply from the device and discharge any stored residual energy.
- Remove operating and auxiliary materials as well as residual processing materials and dispose of them in an environmentally friendly manner.

Then professionally clean subassemblies and components and disassemble them in compliance with local occupational safety and environmental protection regulations.

10.3 Disposal

If no return or disposal agreement has been made, disassembled components must be recycled:

- Scrap the metals.
- Send plastic elements for recycling.
- Dispose of other components appropriately, depending on their material properties.



ENVIRONMENT!

Risk of harm to the environment due to improper disposal!

Electronic waste, electronic components, lubricants and other auxiliary materials are considered hazardous waste and may only be disposed of by authorised specialist companies!

Contact the local authorities or specialised disposal companies for details on environmentally safe disposal.

11 Technical data

11.1 General data

Nominal sizes	3 – 10 in.
Volume flow range	12.71 - 783.99 cfm
Volume flow rate control range	Approx. 10 to 100 % of the nominal volume flow rate
Accuracy of the set volume flow	Approx. ±10% of the nominal volume flow
Minimum differential pressure	0.12 in. w.g.
Maximum permissible differential pressure	2.01 in. w.g.
Operating temperature	50 – 122 °F

Weights [lbs]

NS	VFC	VFC/.../E0*	VFC/.../M0*
3	0.5	0.8	0.7
4	0.6	0.9	0.8
5	0.7	1.0	0.9
6	0.8	1.1	1.0
8	1.0	1.3	1.2
10	1.3	1.6	1.5

11.2 Actuators

Electrical connection data

Actuator	E01	E02	E03	M01	M02
Supply voltage	24 V AC ±20% 24 V DC ±20%	230 V AC	24 V AC ±20% 24 V DC ±20%	24 V AC ±20% 24 V DC ±20%	230 V AC
Mains frequency	50/60 Hz				
Current consumption	AC: 4.5 VA DC: 2.5 W	AC: 4.5 VA	AC: 4.5 VA DC: 2.5 W	AC: 1 VA DC: 0.5 W	3 VA
Control signal	–	–	0-10 V DC Ra > 100 kOhm	–	–
Actual value output	–	–	0-10 V DC	–	–

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TROX SE

Heinrich-Trox-Platz
47506 Neukirchen-Vluyn
Germany

Phone: +49 2845 202-0

+49 2845 202-265

E-Mail: trox-de@troxgroup.com

<http://www.troxgroup.com>

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