# Control component

## Compact XDMB0




TROX

Read the instructions prior to performing any task!

**TROX SE**
Heinrich-Trox-Platz
47506 Neukirchen-Vluyn
Germany
Phone: +49 2845 202-0
Fax:  +49 2845 202-265
Email: trox-de@troxgroup.com
Internet:  http://www.troxtechnik.com

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# 1 General information

## 1.1 About this manual

These installation and commissioning instructions enable the safe and efficient handling of the *Compact XDMB0* type control components and the associated terminal unit.

The term "bus" is used in this document to distinguish it from analogue control. This can refer to both Modbus and BACnet. If a section deals specifically with one of the two systems, the term "bus" refers to the bus system described in each case.

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.

### Other applicable documentation

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

- Installation and commissioning instructions of the terminal unit
- Product data sheets
- Project-specific wiring documents from the system planner, 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!**

   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

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 Correct use

The electronic control component type Compact XDMB0 is used in combination with the TROX TVE or TVE-Q control units for variable and constant volume flow control in ventilation and air conditioning systems (AHUs).

The control component is designed for indoor use.

**Area of application supply air**

The usual conditioning in ventilation and air conditioning systems allows use in the supply air without additional dust protection measures.

**Area of application extract air**

Use in the extract air is possible with a low proportion of dust or lint (e. g. offices) without additional dust protection measures.

If the air is heavily contaminated with dust, lint, sticky and/or moist particles, an attachment with a static differential pressure transducer must be used, e.g. XS0 or XSMB0.

Control units may only be used in kitchen extract air systems if it is ensured that the extract air is cleaned as well as possible by highly effective aerosol separators. Observe the specifications of VDI 2052.

**Incorrect use**

**WARNING!**

**Danger due to unauthorised use!**

Incorrect use of the control component can lead to dangerous situations.

NEVER use the control component/device:

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

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

## 2.2 Safety signs

The following symbols and signs are usually found in the work area. They apply to the very location where they are found.

**WARNING!**

**Danger due to illegible signage!**

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.

- Ensure that all of the safety, warning and operating information is clearly legible.
- Replace illegible signs or stickers immediately.

**Electrical voltage**



Only skilled qualified electricians are allowed to work in areas marked as having electrical voltage.

Unauthorised people must not enter areas, open cabinets or work on components where an electrical voltage is present and which are hence marked with this symbol.

## 2.3 Dangers when handling the unit

The unit is a state-of-the-art product and meets current safety requirements. Residual risks cannot be excluded, however, and you should proceed with caution. This section describes the residual risks that have been identified in a risk assessment.

Always follow the safety notes in this manual to reduce health hazards and prevent any hazardous situations.

### 2.3.1 Electric shock hazards

**Electric current**

**DANGER!**

**Danger of death due to electric current!**

Contact with live parts poses an immediate danger to life due to electric shock. Damaged insulation or damaged parts are a life threatening hazard.

- Work on the electrical system must only be carried out by skilled qualified electricians.
- If the insulation is damaged, disconnect the power supply immediately and have the insulation repaired.
- Before you start 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 the earth; short circuit connection.
- Do not bypass or disable any circuit breakers. Be sure to maintain the correct current rating when you replace a circuit breaker.
- Ensure that live parts do not come into contact with moisture. Moisture can cause a short circuit.

## 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 commercial use. The system owner is therefore subject to the legal obligations of occupational health and safety regulations.

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

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, troubleshooting and removal.
- The system owner has to ensure that all individuals who handle or use the unit have read and understood this manual.
- The system owner must provide the employees with the required personal protective equipment.
- The system owner must comply with the local fire regulations.

**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 Staff qualifications

**WARNING!**

**Danger of injury if insufficiently qualified!**

Incorrect use may cause considerable injury or damage to property.

– Only specialist personnel must carry out work.

The following degrees of qualification are required for the work described in the operating manual.

**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 General safety measures

**Large temperature differences**

Be careful when there is a large temperature difference. If the unit has been kept in an unheated area, wait two hours before switching on the supply voltage. Condensation may damage the electronic components beyond repair. Only after about 2 hours will the system have reached room temperature.

**Foreign matter and liquids**

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

## 2.8 Repair and replacement parts

The devices must be repaired by qualified personnel using genuine replacement parts only. This particularly applies to work on the electrical equipment. For safety reasons, defective devices should therefore be repaired by the TROX Technical Service, *1.3 'TROX Contact information' on page 6*.

# 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 its control components, the damper blade or the differential pressure sensor.
– Only lift the device by the casing.

## 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.

The product is typically delivered mounted on a control unit.

Check the following items on delivery:

- Control component Compact XDMB0
  – mounted on the control unit and fixed with anti-rotation lock
  – Adjustment sticker on the control unit,
  *9.3 'Adjustment label' on page 34*
  – Rubber cap for terminal cover present

## 3.2 Transport on site

- If possible, take the product in its transport packaging up to the installation location.
- 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 -10 °C or above +50 °C.
- The relative humidity must not exceed 95%**(non-condensing**).
- After storage and prior to installation, first allow the unit to acclimatise to the installation temperatures for at least 2 hours.

## 3.4 Packaging

After unpacking, properly dispose of packaging material.

# 4 Installation

**Personnel:**

- HVAC technician

**Protective equipment:**

- Protective gloves
- Safety shoes
- Industrial safety helmet

Only trained and authorised specialist personnel may carry out the described work on the control unit.

Only skilled 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.

The control component is delivered mounted on the control unit so that the work is limited to the electrical wiring *7 'Electrical connection' on page 23* and to the setting of the control component *9.5 'Adjusting the settings of the control component' on page 36*.

Pay particular attention to the following points when installing the control unit:

- Upstream section
  – a special upstream section/length is not required for the TVE or TVE-Q terminal unit.
- Airflow direction
  – For TVE or TVE-Q terminal units with a control component of type Compact XDMB0, a preferred airflow direction is indicated with regard to acoustics (air direction arrow). Alternative installation is possible.
- Fixing/suspension
- Accessibility for maintenance work

▸ Install the control unit with the mounted control component as described.

*You can find specific information on installing the control unit in the **Installation and commissioning manual for the control unit.***

### Installation orientation

The control unit can be installed in any position. The volume flow controller may be installed so that the position of the control component is above, below or to the side of the air duct.

# 5 Parts and function

## 5.1 Product overview

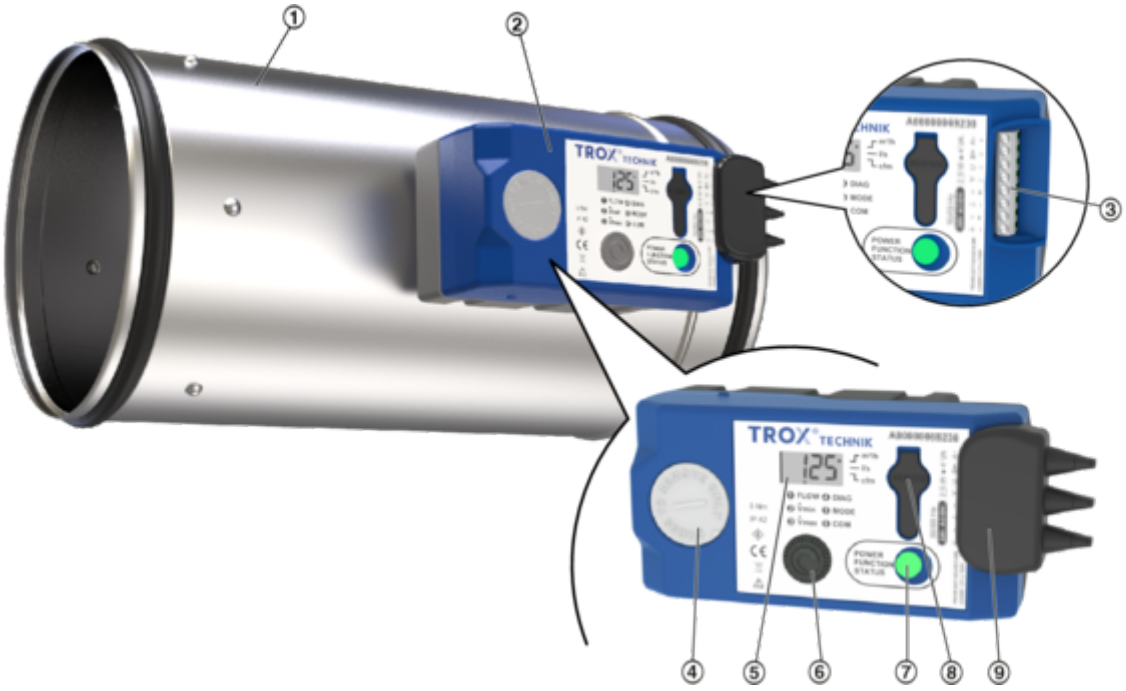



*Fig. 1: Compact control component mounted on the control unit*

1 Terminal unit TVE
2 Compact control component
3 Connection terminal
4 Release button
5 Display
6 Control element - selection of options/settings
7 LED / control element selection of menu item, ↳ *9.5 'Adjusting the settings of the control component' on page 36*
8 Service socket
9 Terminal cover with cable gland (part of the supply package)

## 5.2 Display of the damper blade position

**TVE / TVE-Q control unit**

The damper blade position corresponds to the mark on the release button and is therefore recognisable from the outside.

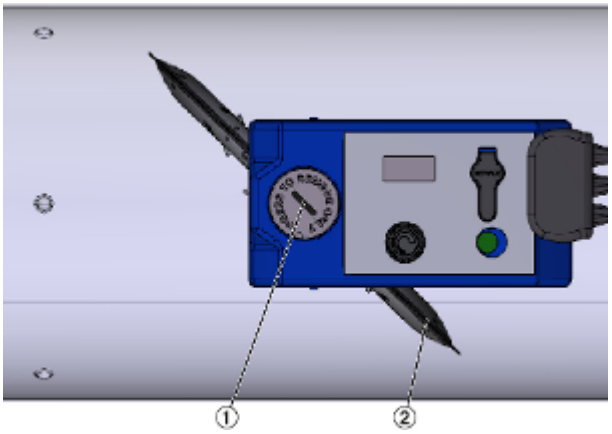



*Fig. 2: Position indicator of the damper blade*

1 Release button with marking for position indication
2 Damper blade

## 5.3 Functional description

### Basic function

The electronic control component is used for variable and constant volume flow control for the TROX control unit type TVE/TVE-Q. The control component consists of three functional units:

- dynamic differential pressure transducer
- Controller
- Actuator

### Closed-loop control system

The control component operates in a closed-loop system, i.e. measure – compare – adjust.

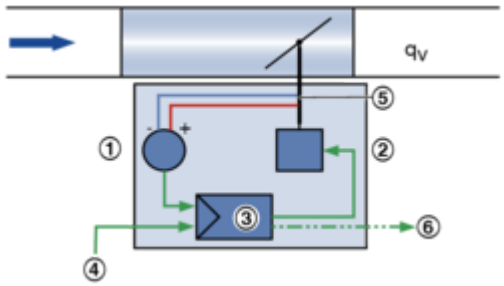



*Fig. 3: Principle of operation*

1 Differential pressure transducer
2 Actuator
3 Controller
4 Setpoint via bus or analogue signal
5 Shaft with differential pressure channel
6 Actual value signal

The determination of the current volume flow takes place by measuring a differential pressure (effective pressure) directly on the damper blade. The differential pressure is passed through the damper blade shaft to the differential pressure transducer (1) integrated in the control component, where it is converted into a voltage signal.

The actual volume flow rate (6) is thus available to the internal control circuit and for external use, e. g. MCE or Client-Server sequential control, either as an analogue voltage signal 0 – 10 V DC / 2 – 10 V DC or as a digital data point via BUS.

In standard operation, the integrated actuator (2) is activated by permanent evaluation of the control deviation (setpoint/actual) in the controller (3), which adjusts the damper blade of the air terminal unit via the shaft adapter and thus regulates the volume flow to the setpoint.

Due to the factory adjustment, the maximum starting value 10 V DC always corresponds to the nominal volume flow ($q_{vnom}$) indicated on the adjustment sticker on the control unit. The factory-set $q_{vmin}$ and $q_{vmax}$ values can also be found on the adjustment sticker or the order code. The $q_{vmin}$ and $q_{vmax}$ values can be set individually on the display, via the setting device or via PC software.

### Setpoint control independent of the duct pressure

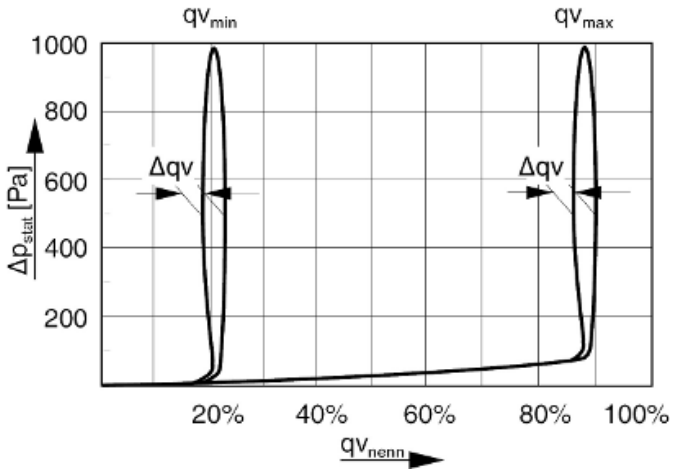



*Fig. 4: Control behaviour independent of the duct pressure*

If the duct pressure changes, for example due to a change in airflow from other devices, this is detected and corrected by the control component. The control component therefore works independently of the duct pressure, and pressure fluctuations do not result in any permanent changes in volume flow.

To prevent the volume flow control from becoming unstable, the volume flow controller maintains a dead zone (hysteresis) within which the damper blade is not moved. This dead zone and the tolerances of the measurement lead to a volume flow deviation $\Delta q_v$, in accordance with the product data sheets of the control units. If the conditions specified in the product data sheets (e.g., minimum differential pressure, upstream conditions) are not met, the volume flow controller will no longer function correctly or more significant system deviations can be expected.

## 5.4 Applications

### 5.4.1 Operation with constant volume flow setpoint

**Operation with a fixed setpoint**

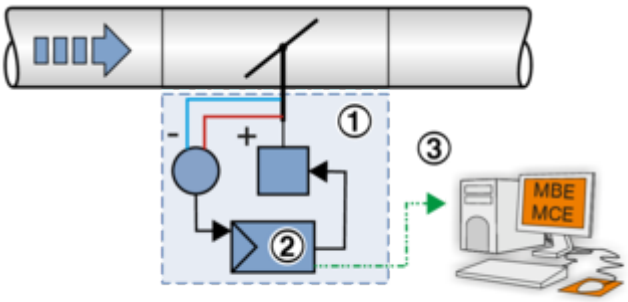



*Fig. 5: Constant control*

1 Compact control component
2 Controller with factory-set volume flow setpoint ($q_{vmin}$)
3 Actual volume flow rate as analogue voltage signal or digital via Modbus or BACnet e. g. to the MCE

In the simplest case, the control component is operated with a constant volume flow rate setpoint. The constant setpoint ($q_{vconst}$ = $q_{vmin}$) is already set by the factory default. To adjust the factory-set constant values, see: ↳ *9.5 'Adjusting the settings of the control component' on page 36* .

The control signal at terminal Y must not be connected in this case.

In bus operation, the value ($q_{vconst=}$= $q_{vmin}$) must be specified via the bus.

**Operation with two fixed setpoints (min./max. switching)**

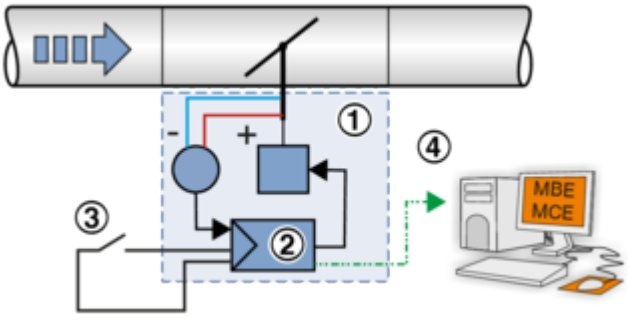



*Fig. 6: Min./max. switching*

1 Compact control component
2 Controller with factory-set volume flow setpoints ($q_{vmin}$ and $q_{vmax}$)
3 Volt-free switch contacts for switching between $q_{vmin}$ and $q_{vmax}$
4 Actual volume flow rate as analogue voltage signal or digital via Modbus or BACnet e. g. to the MCE

The factory-set constant values ($q_{vmin}$ and $q_{vmax}$) can be activated alternately by volt-free switch contacts, e. g. day/night switching, ↳ *7.3.3 'Control - min/max switching' on page 25* .

Adjustment of the factory-set constant values: ↳ *9.5 'Adjusting the settings of the control component' on page 36*

In bus operation, the values $q_{vmin}$ and $q_{vmax}$ must be specified via the bus as override control.

### 5.4.2 Operation with variable volume flow setpoint

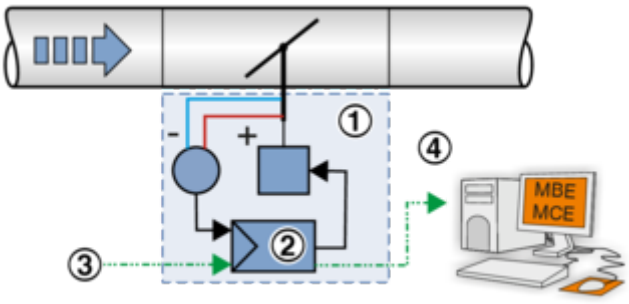



*Fig. 7: Variable volume flow control*

1 Control component
2 Controller with factory-set volume flow operating range ($q_{vmin}$ - $q_{vmax}$)
3 Control signal as analogue voltage signal or digital via Modbus or BACnet as setpoint specification
4 Actual volume flow rate as analogue voltage signal or digital via Modbus or BACnet e. g. to the MCE

To use variable volume flow setpoints, an electrical control signal must be specified by a higher-level controller (e.g. e.g. room temperature controller, air quality controller, MCE, etc.). After a change in the reference value, the airflow is adjusted to a new setpoint. The variable volume flow rate range is limited to a minimum value and a maximum value. The factory-set constant values can be adjusted as described: ↳ *9.5 'Adjusting the settings of the control component' on page 36*

In bus operation, the setpoint must be specified via the bus.

### 5.4.3 Override control

The constant or variable control can be overridden by override controls. For example, a window switch can stop the ventilation of the room when the window is open by closing the damper blade.

Further application examples:

- Circuits for intensive ventilation (boost / $q_{vmax}$)
- Opening the damper blade

Further information can be found here:

- Override control for analogue operation:
  *7.3.4 'Control variable operation / override controls' on page 25*
- Override control for Modbus operation:
  *9.7 'Modbus register list' on page 38*
- Override control for BACnet operation:
  *9.8 'Configuring the BACnet interface' on page 42*

### 5.4.4 Supply/extract air tracking control

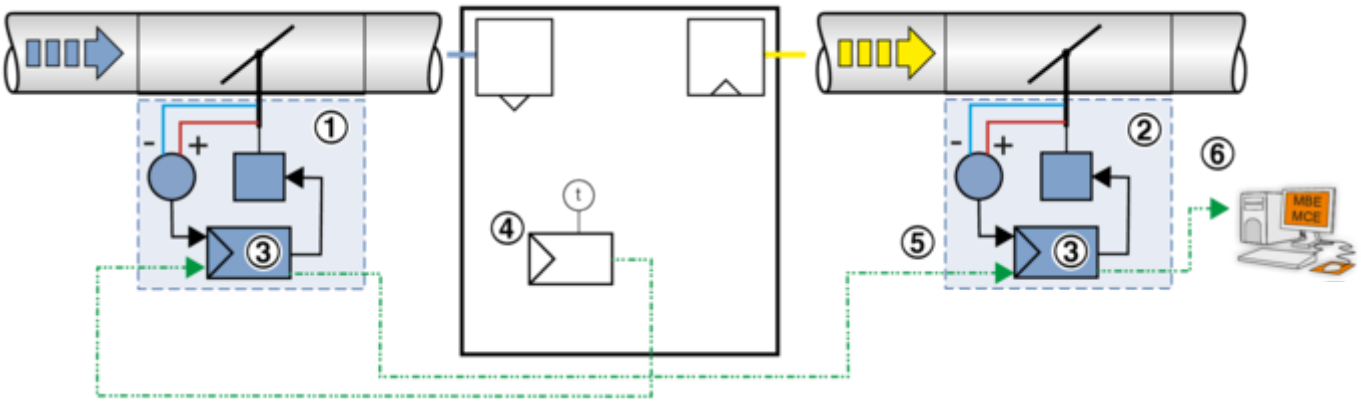



*Fig. 8: Supply/extract air tracking control*

1 Supply air control component
2 Extract air control component
3 Controller with volume flow operating range ($q_{vmin}$ and $q_{vmax}$)
4 Room temperature controller (control signal for supply air controller)
5 Actual volume flow rate of the supply air controller (control signal for extract air controller)
6 Actual volume flow rate for the extract air controller

In single rooms and closed office zones, the balance between supply and extract air flow must be maintained. Otherwise, annoying whistling noises can occur at door gaps, and the doors might be difficult to open. The extract air must therefore also be regulated variably.

In this example, the control signal from the room temperature controller is connected to the supply air controller. The actual value signal of the supply air controller is then connected to the extract air controller (secondary controller) as a setpoint signal. The actual volume flow rate of the supply air controller (Server) is thus used as the reference value for the extract air controller (Client). The connection can be made as an analogue signal or digitally via the Modbus. This way, the extract air automatically follows the supply air.

Setting for the secondary controller in the simplest case (same air terminal units and dimensions):

- $q_{vmin}$ = 0 m³/h
- $q_{vmax}$ = $q_{vnom}$
  ⇨ $q_{vnom}$ is specified on the adjustment sticker.

If different control unit types or dimensions are used for secondary control, special setting instructions for $q_{vmin}$ and $q_{vmax}$ of the secondary controller must be observed due to the different nominal volume flows.

Alternatively, the control signal of the room temperature controller can also be connected in parallel to the supply air and the extract air controller. The limitation by the technical data of the controller outputs (current) and controller inputs (input resistances) must be observed.

No special wiring of the controllers is required for bus operation, as all data points are available via the bus communication. The data must still be linked accordingly.

# 6 Operating modes

## 6.1 Setpoint and actual value in different operating modes

**Setpoint and actual value signals**

The operating mode of the control component(analogue 0 (2) - 10 V DC, Modbus or BACnet) is set at the factory depending on the control component and is specified by the order code. The operating mode can be changed on the control component (setting menu in the display), with a setting device or PC tool.

| Operating mode | Menu configuration (Mode, COM) |
|---|---|
| Analogue (0 – 10 V DC) | CA0 |
| Analogue (2 – 10 V DC) | CA2 |
| Modbus RTU | MODE = CB2<br>COM = b1 - b32 |
| BACnet MS/TP | MODE = CB2<br>COM = bc1 - bc6 |

Mixed bus and analogue operation can be configured using a special configuration, allowing additional operating values to be read out from a higher-level management and control equipment (MCE) with local control using an analogue signal via the bus interface.

In Modbus RTU operating mode, the setting is made via Modbus register 122 (Interface Mode) *9.7 'Modbus register list' on page 38*.

In BACnet MS/TP operating mode, the setting is made via the BACnet object SpSource MV[122] *'Object details' on page 44*.

**Setpoint specification / actual value feedback in the overview**

| Function | | Analogue signals | Modbus communication | BACnet communication |
|---|---|---|---|---|
| Analogue operation | Setpoint specification analogue | Y Input<br>0 ... 10 V or 2 ... 10 V | - | |
| | Actual value query [2] | U Signal<br>0 ... 10 V or 2 ... 10 V | Hybrid operation:<br>Register 6 (relative)<br>Register 7 (absolute) | Hybrid operation:<br>Object RelActual_Value AI[6] (relative)<br>Object AbsActual_Value AI[7] (Absolute) (hybrid mode) |
| | Override control[3] | Switch contact Y Signal | Register 1 | Object override MO[1] |
| Bus operation | Setpoint specification Bus[1] | - | Register 0 (relative)<br>or<br>Register 20 (absolute) | Object RelSpBus AO[0] |
| | Actual value query [2] | U Signal 2 ... 10 V<br>(Hybrid operation) | Register 6 (relative)<br>Register 7 (absolute) | Object RelActual_Value AI[6] (relative)<br>Object AbsActual_Value AI[7] (absolute) |
| | Override control[3] | Switch contact Y Signal | Register 1 | Object override MO [1] |

[1] Relative values for setpoints in per cent refer to the operating range $q_{Vmin}$-$q_{Vmax}$

[2] Relative values for actual values in per cent refer to the range 0 - nominal volume flow $q_{Vmin}$

[3] Observe prioritisation for override control: Bus specifications have higher priority than local wiring; diagnostic wiring of service tools has the highest priority

## 6.2 Analogue operation

### 6.2.1 Characteristic curves and formulas 0 – 10 V and 2 – 10 V

**Setpoint signal**

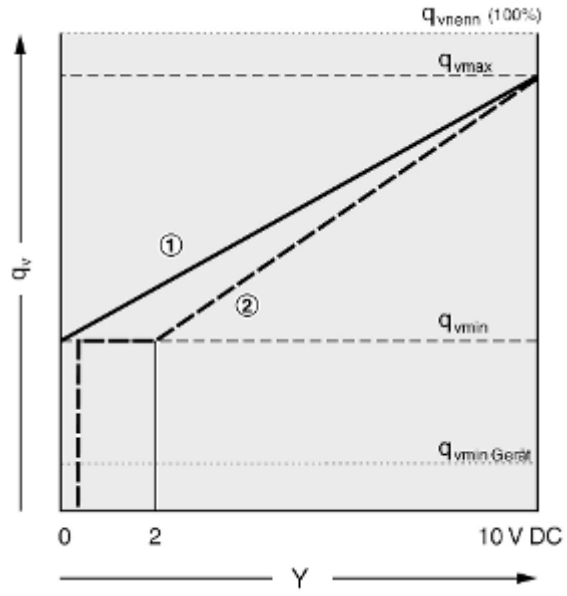



*Fig. 9: Characteristic curve of the setpoint signal*

1 Characteristic curve for signal voltage range 0 – 10 V DC
2 Characteristic curve for signal voltage range 2 – 10 V DC
$q_v$ Volume flow
Y Setpoint input

The volume flow setpoint must be specified as follows, depending on the operating mode:

- **in analogue operation:** at terminal Y, a voltage signal 0 – 10 V DC or 2 – 10 V DC, 0 (2) V DC = $q_{vmin}$, 10 V DC = $q_{vmax}$

The relationship between the volume flow rate setpoint and the associated voltage signal can be calculated from the formula below. The setting for $q_{vmin}$ and $q_{vmax}$ must be taken into account.

**0 – 10 V DC**

$$q_{vsoll} = \frac{Y}{10\ V} \times (q_{vmax} - q_{vmin}) + q_{vmin}$$

**2 – 10 V DC**

$$q_{vsoll} = \frac{Y - 2}{(10\ V - 2\ V)} \times (q_{vmax} - q_{vmin}) + q_{vmin}$$

> ***Calculation examples***
> *10.4.2 'Sample calculations' on page 50*

**Actual value signal**

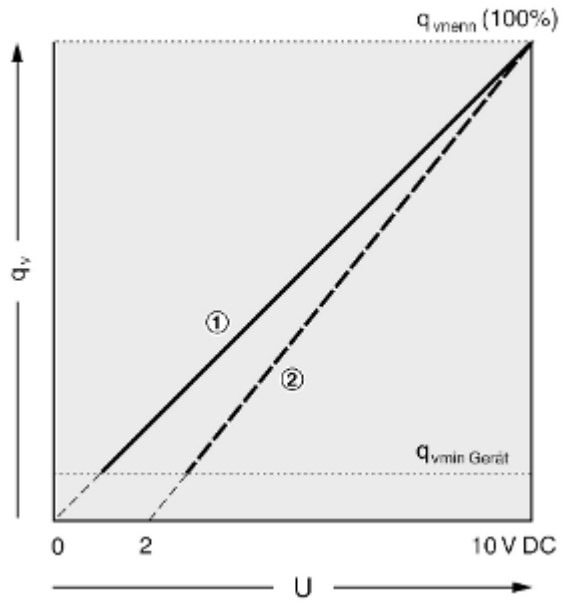



*Fig. 10: Characteristic curve of the actual value signal*

1 Characteristic curve for signal voltage range 0 – 10 V DC
2 Characteristic curve for signal voltage range 2 – 10 V DC
$q_v$ Volume flow
U Actual value signal

The actual volume flow rate can be tapped as a voltage signal at the terminal (U). The measuring range is adapted to the size of the air terminal unit at the factory so that the respective nominal volume flow of the device ($q_{vnom}$) always corresponds to an actual value signal of 10 V DC. In digital and hybrid operation, the actual value in Modbus register 6 can be read out as a percentage value of $q_{vnom}$.

The actual volume flow rate can be calculated from the measured voltage at the output (U) using the formula below.

**0 – 10 V DC**

$$q_{vist} = \frac{U}{10\ V} \times q_{vnenn}$$

**2 – 10 V DC**

$$q_{vist} = \frac{U - 2}{(10\ V - 2\ V)} \times q_{vnenn}$$

### 6.2.2 Activation Override control Damper CLOSED via a characteristic

| Characteristic 0 – 10 V | | |
|---|---|---|
| **Setpoint signal Y** | **$q_{vmin}$ = 0** | **$q_{vmin}$* > 0** |
| <= 0.3 V | Damper CLOSED | Standard operation |
| >= 0.4 V | Standard operation | Standard operation |

* if $_{qvmin}$ > 0 is set, shut-off via setpoint signal Y is not possible

| Characteristic 2 – 10 V | |
|---|---|
| **Setpoint signal Y** | **$q_{vmin}$ = 0** |
| <= 2.3 V | Damper CLOSED |
| >= 2.4 V | Standard operation |

| Characteristic 2 – 10 V | |
|---|---|
| **Setpoint signal Y** | **$q_{vmin}$ > 0** |
| <= 0.8 V | Damper CLOSED |
| > 0,9 V* – < 2 V | Regulation to $q_{vmin}$ |
| >= 2 V | Standard operation |

*programmable threshold

## 6.3 Digital operation - Modbus RTU

### 6.3.1 Formulas for relative setpoint specification

In bus mode, the setpoint specification can be absolute or relative. If the setpoint specification is relative [0 - 100%] 0% = $q_{Vmin}$, 100% = $q_{Vmax}$, the following formulas can be used to convert between relative and absolute figures.

**Setpoint specification**

0 – 100 %

$$q_{vsoll} = \frac{\%\text{-Wert}}{100\ \%} \times (q_{vmax} - q_{vmin}) + q_{vmin}$$

0 – 100 %

$$q_{vist} = \frac{\%\text{-Wert}}{100\ \%} \times q_{vnenn}$$

### 6.3.2 Modbus RTU basics

The Modbus RTU is a client-server bus system. The Modbus RTU enables simple wiring of up to 32 control components (servers) which can be controlled centrally via a Modbus client (e.g. a control cabinet) and can be parameterised, written to and read out. This makes it easy to check the function of up to 32 volume flow controllers.

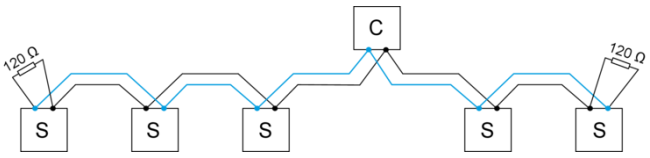



*Fig. 11: Example: Modbus segment with one client and 5 servers*

C Client
S Server

Modbus allows a line structure (daisy chain) as a bus structure. Due to on-site circumstances, signal feedback can occur at the end of a Modbus line. To filter this, a 120 Ω terminating resistor is required at the end of the bus line. Communication between the bus participants is based on a serial two-wire line (twisted pair) in accordance with the EIA/TIA-RS485 standard with client-server configuration. All Modbus participants must be given a unique Modbus address (1 - 32) for system affiliation.

**Specifications for Modbus installations**

The Modbus wiring must be set up in accordance with the specification "Modbus over Serial Line Specification and Implementation Guide" of the Modbus organisation (published on the website *www.modbus.org)* .

- The Modbus wiring must always be set up in a linear fashion. Stub lines should be avoided or, if necessary, kept as short as possible.
- According to the specification, e.g., only a maximum length of approx. 1 m is permitted for the stub lines with maximum configuration of the network participants.
- The cable length of the entire network is limited and depends on the baud rate, the cable cross-section and the number of bus participants.
- Shielded cables must be used.
- The Modbus wiring must always be earthed. Earthing only takes place at the client via the shielding of the cable.

**Stub lines**

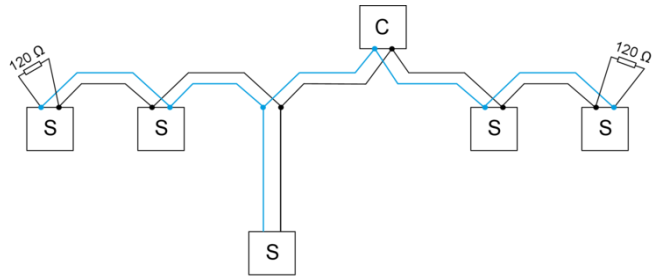



*Fig. 12: Example: Modbus segment with one stub line*

C Client
S Server

The Modbus organisation specifications listed above apply in particular to stub lines, as the installation should generally be linear.

### 6.3.3 Modbus RTU - Setpoint specification / actual value query

In Modbus operation, no analogue control signal is required. The setpoint is transmitted digitally to the control component via the Modbus. In this case, if connected, the analogue setpoint signal is ignored. To ensure smooth data exchange in the Modbus RTU network provided by the client, it is necessary to set the communication parameters and the participant address for the Modbus interface. The control component can be easily addressed using one of the following three service tools ( *9.4 'Service tools' on page 35* ):

- the GUIV3-M adjustment device
- the WIN-VAV2 PC software
- on the internal display

Various standardised Modbus registers are available for setpoint specification, actual value feedback or status messages. Therefore, for example, the volume flow rate setpoint value is specified with the Modbus address by transferring the new setpoint to Modbus register 0. The volume flow rate actual value is queried for each control component with the Modbus address by reading out Modbus register 6. Further Modbus registers are explained in the following section: *9.7 'Modbus register list' on page 38*

***Observe the installation instructions!***

*7 'Electrical connection' on page 23*

## 6.4 Digital operation - BACnet MS/TP

### 6.4.1 BACnet MS/TP basics

BACnet MS/TP (Building Automation and Control networks) is a bus system that is used in building technology. It offers a high level of interoperability between different devices and manufacturers. The high level of interoperability due to standardised, detailed rules and structures for communication exchange represents the key added value compared to other communication systems. Accordingly, there is a very complex certification process for the BACnet protocol.

BACnet MS/TP is based on a serial transmission of RS485 and stands for Multidrop Serial Bus/Token Passing. MS/TP regulates access to the bus using a token passing procedure. This means that there can be several managers in one network who take turns accessing the bus. Once communication is complete, a token is passed on to the next manager. Managers can communicate if they have the token. Subordinates only respond to requests from managers, but have no communication rights of their own.

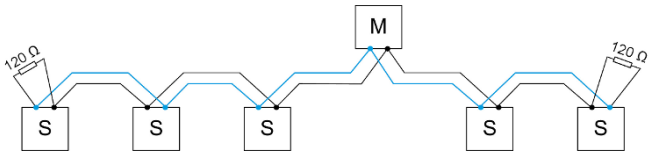



*Fig. 13: Example: BACnet segment with one manager and 5 subordinates*

M Manager
S Subordinate

BACnet MS/TP allows a line structure (daisy chain) as the bus structure. Due to on-site circumstances, signal feedback can occur at the end of a BACnet MS/TP line. To filter this, a 120 Ω terminating resistor is required at the end of the bus line. Up to 127 participants can be operated in one BACnet MS/TP network.

### 6.4.2 BACnet MS/TP - Setpoint setting / actual value enquiry

In BACnet operation, no analogue control signal is required. The setpoint is transmitted digitally to the control component via the BACnet connection. In this case, if connected, the analogue setpoint signal is ignored. To ensure smooth data exchange in the BACnet MS/TP network provided by the client, the communication parameters and the participant address for the BACnet interface must be set. The control component can be easily addressed using one of the following three service tools ( *9.4 'Service tools' on page 35* ):

- the GUIV3-M adjustment device
- the WINVAV2 PC software
- on the internal display

Various standardised BACnet objects are available for setpoint specification, actual value feedback or status messages. This means, for example, that the volume flow setpoint is specified with the BACnet address by transferring the new setpoint in the BACnet object AO[0]. The actual volume flow rate is queried for each control component by specifying the BACnet address and reading the BACnet object RelActual_Value AI[6] (Relative) or object AbsActual_Value AI[7] (Absolute).

Further BACnet objects are explained here: *'Object details' on page 44 .*

***Observe the installation instructions!***

*7 'Electrical connection' on page 23*

# 7 Electrical connection

## 7.1 Installation instructions

**Safety instructions**

**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.

The air terminal unit was manufactured and configured on a project-specific basis. The control components are mounted and adjusted at the factory. For installation, the supply voltage and, if necessary, signal lines, must be connected for electrical control components.

The connection is established based on the information specified on the control components or connection diagrams in this manual. The voltage ranges specified on the control components and the terminal assignments must be observed!

**Personnel:**

- Qualified electrician

Observe the following during installation:

- Legal and official regulations, in particular VDE guidelines.
- Only use the connection terminals for a cable cross-section of 0.5 mm² - 1.5 mm².
- If a cable cross-section of 2.5 mm² is required, short stub lines with smaller cross-sections can be used ( *'Alternative wiring option with stub lines' on page 24* ).
- Observe the Technical Connection Rules (TCR) of the local grid operator.
- Wiring work for supply voltage and signal lines provided by the client.
- Rating and establishing customer-side connections and wiring must be carried out in accordance with the recognised rules of electrical engineering.
- Observe the wiring guidelines and the customer's project-specific connection diagrams of the control component.
- The electrical connection to the volume flow controller may only be made if the installation has been carried out correctly.
- The 24 V supply voltage may only be supplied with a safety power supply unit.
- If several control components are connected to a 24 V network, it must be ensured that a common zero/ground line is defined and not reversed.
- The control component contains no parts that can be replaced or repaired by the user and may only be opened by the manufacturer.
- Lay power supply lines in such a way that mechanical or thermal damage is excluded.

When using the Modbus RTU or BACnet MS/TP interface, it is essential to observe the following:

- Comply with the relevant RS485 guidelines when wiring.
- Galvanically isolate the supply voltage and communication.
- Connect the ground of the bus participants with each other.
- Further information and wiring examples for
  – Modbus RTU, *Chapter 6.3 'Digital operation - Modbus RTU' on page 20* and *9.7 'Modbus register list' on page 38*
  – BACnet MS/TP, *Chapter 6.4 'Digital operation - BACnet MS/TP' on page 21* and *9.8 'Configuring the BACnet interface' on page 42*

**Electrical safety**

The control component complies with all relevant standards and guidelines, see declaration of conformity.

**Open terminals**

In accordance with electrotechnical regulations, protection against accidental contact is only required for active parts.

As control components of type Compact XDMB0 are operated with safety extra-low voltage (SELV), the screw terminals are not considered active parts.

To ensure IP protection, the terminal cover included in the scope of delivery must always be installed.

**Strain relief**

Devices that are permanently installed in buildings are stationary electrical equipment for which no strain relief is required for the connecting cables.

## 7.2 Connection terminals

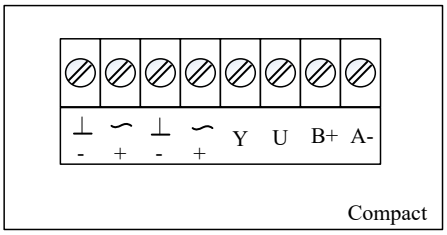



*Fig. 14: Connection terminals*

Only use the connection terminals for a cable cross-section of 0.5 mm² - 1.5 mm².

| Terminal | Function |
|---|---|
| ⊥ - | Ground, neutral |
| ~ + | Supply voltage 24 V AC / DC |
| Y | Setpoint signal (Y) 0 – 10 V DC or 2 – 10 V DC and override control |
| U | Actual value signal (U) 0 – 10 V DC or 2 – 10 V DC |
| B+ | Modbus RTU, BACnet MS/TP |
| A- | |

*Double connection terminals for the supply voltage easy wiring. **Attention:** To protect the terminals and conductor tracks from overload, the supply voltage for a maximum of three control components may be wired through. Connection terminals for cables from 0.5 mm² - 1.5 mm², rigid and flexible.*

**Alternative wiring option with stub lines**

If cross-sections greater than 1.5 mm² are used due to longer cable lengths, these can no longer be connected directly to the terminals. Alternatively, the connection can be made using stub lines with a cross-section of 1.5 mm².

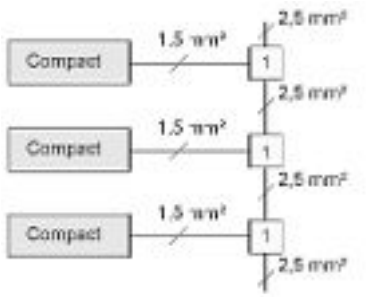



*Fig. 15: Wiring stub lines*

1 Junction box

If stub lines are used in bus operation, the notes on stub line lengths *6.3.2 'Modbus RTU basics' on page 20* must be observed.

## 7.3 Wiring for analogue operation

### 7.3.1 Variable volume flow control

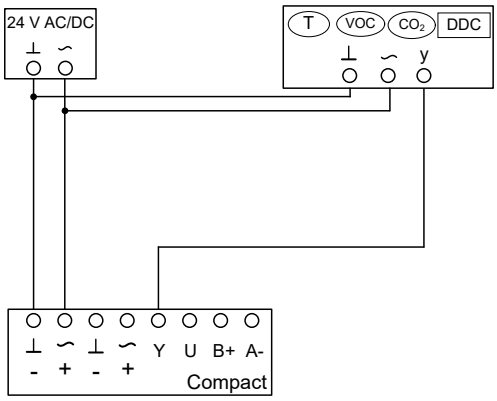



*Fig. 16: Variable volume flow control*

If the volume flow rate must be specified by a higher-level controller (e. g. for room temperature, air quality or a DDC substation), its 0 (2) – 10 V DC output must be connected to terminal Y on the control component as a control signal in accordance with the connection diagram. With a common 24 V supply voltage for the control component and control signal, a common earth must be used.

**Parallel connection**

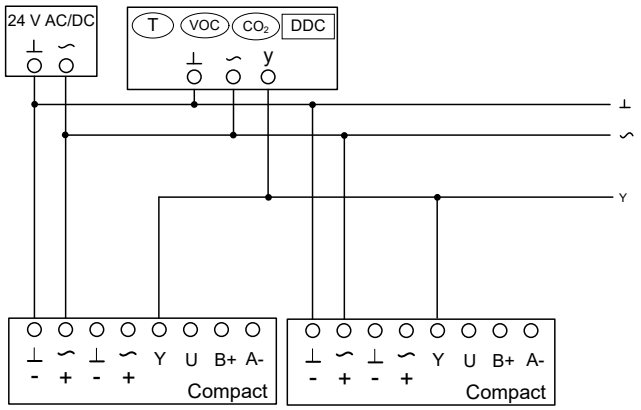



*Fig. 17: Parallel connection*

If several control components are to be controlled simultaneously, this is possible in constant variant ( Fig. 20 , Fig. 21 , Fig. 22 ) and in variable variant ( Fig. 17 ). For this purpose, the reference signal is duplicated and at the same time applied to terminal Y of the control component.

**Sequential control**

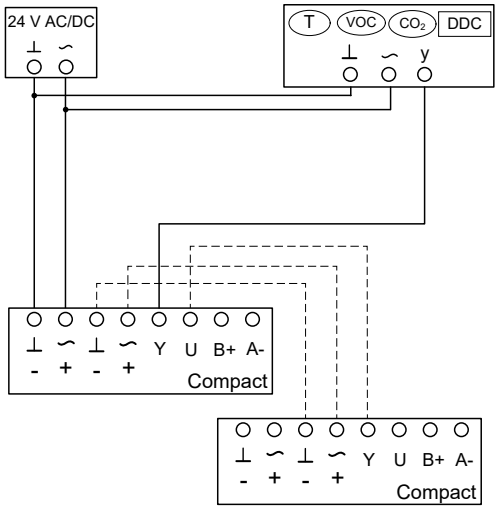



*Fig. 18: Variable volume flow control in a sequential control*

If the volume flow balance between two control components should always be the same, e. g., supply and extract air in a closed room, this is achieved via a sequential control. Here, the control signal from the room temperature controller is connected to the supply air controller, for example. The actual value signal of the supply air controller is then connected to the extract air controller. For more information, ↳ *on page 16*

## 7.3.2 Control of constant volume flow

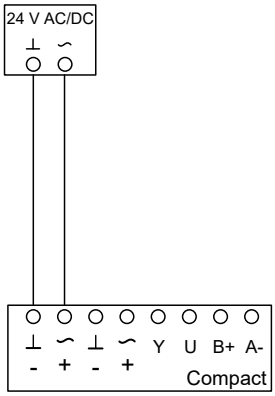



*Fig. 19: Constant volume flow $q_{vmin}$*

After applying the 24 V supply voltage, the control component performs a synchronisation and then throttles the volume flow to $q_{vmin}$ (factory setting). A setpoint signal is not required. The actual volume flow rate can be tapped at the terminal (U).

## 7.3.3 Control - min/max switching

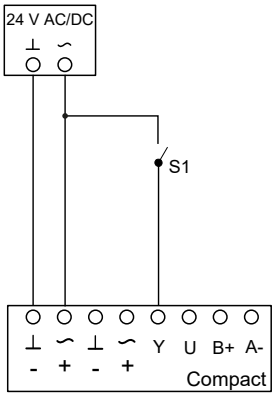



*Fig. 20: Switching between volume flow $q_{vmin}$ / $q_{vmax}$*

If the volume flow rate is to be switchable between two fixed values (e. g., day/night changeover), a volt-free switch contact provided by the client can be used to switch between the volume flow setpoints $q_{vmin}$ and $q_{vmax}$ (factory setting).

Switch S1 open - $q_{vmin}$

Switch S1 closed - $q_{vmax}$

## 7.3.4 Control variable operation / override controls

If the volume flow rate is to be switchable between several fixed values (e. g., day/night changeover / CLOSED / OPEN), volt-free switch contacts provided by the customer can be used to switch between four or five different fixed operating states. The switches must be interlocked to avoid short circuits. A service tool is required to adjust volume flow rate setpoints, ↳ *9.4 'Service tools' on page 35* .

### Override controls for actuation with 0 – 10 V

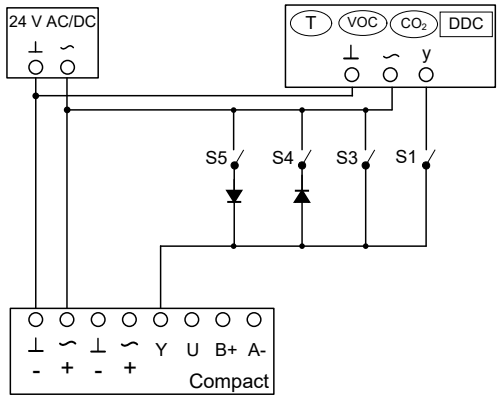



*Fig. 21: Staged operation 0 – 10 V DC*

| Switch | Control input signal 0 – 10 V |
|---|---|
| all open | Minimum volume flow rate $q_{vmin}$ |
| S1 closed | Standard operation (e.g. room temperature or air quality control) |
| S3 closed | Maximum volume flow rate $q_{vmax}$ |
| S4 closed* | Damper blade CLOSED |
| S5 closed* | Damper blade OPEN |

* only applies to 24 V AC supply voltage; the S4 and S5 functions are not available for the DC supply.

### Override controls for actuation with 2 – 10 V

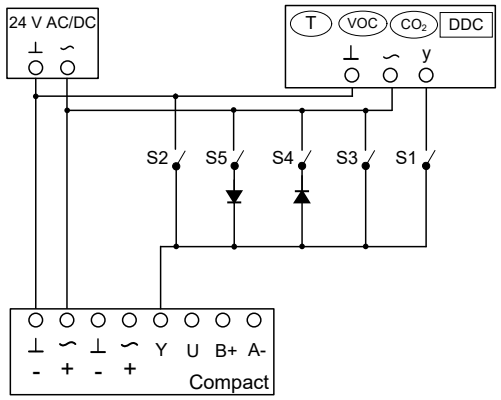



*Fig. 22: Staged operation 2 – 10 V DC*

T Temperature sensor
VOC Room air quality sensor
$CO_2$ Carbon dioxide sensor
DDC Building automation and control systems

| Switch | Control input signal 2 – 10 V |
|---|---|
| All open | Minimum volume flow rate $q_{vmin}$ |
| S1 closed | Standard operation (e.g. room temperature or air quality control) |
| S2 closed | Damper blade CLOSED |
| S3 closed | Maximum volume flow rate $q_{vmax}$ |
| S4 closed* | Damper blade CLOSED |
| S5 closed* | Damper blade OPEN |

* only applies to 24 V AC supply voltage; the S4 and S5 functions are not available for the DC supply.

- The functions shown in the tables refer to the respective actuated switch.
- The switches must be interlocked against each other.
- Never operate more than one switch.

**NOTICE!**

**Analogue forced switching in Modbus operation**

In bus mode (cb2), all local override controls at setpoint input Y via external switching contacts are ignored.

These circuits can be recognised via a Modbus query of register 769 and can be evaluated by a higher-level instance and used by this instance via a Modbus command to trigger specifications to the control component. Analogue circuits can thus lead to override control via commands in Modbus register 1 via the central evaluation.

**Analogue override wiring in BACnet mode**

The method described above is not available.

## 7.4 Wiring for bus operation

*The notes on the basic principles of wiring Modbus installations in ↳ 6.3.2 'Modbus RTU basics' on page 20 or to BACnet installations in ↳ Chapter 6.4.1 'BACnet MS/TP basics' on page 21 must be observed.*

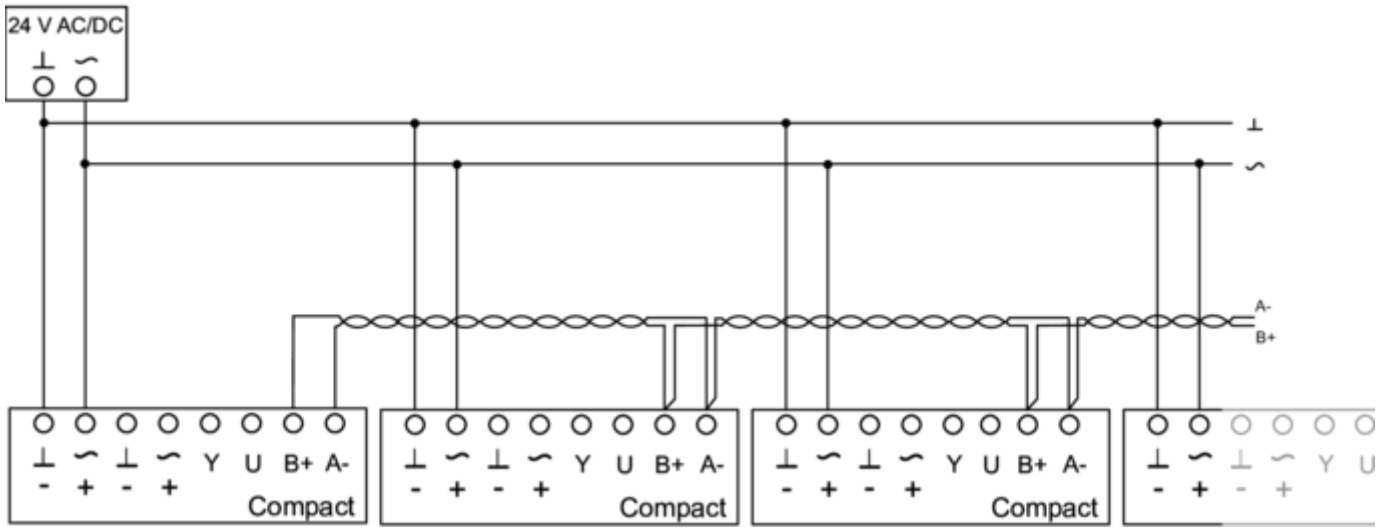



*Fig. 23: Bus operation with one supply voltage*

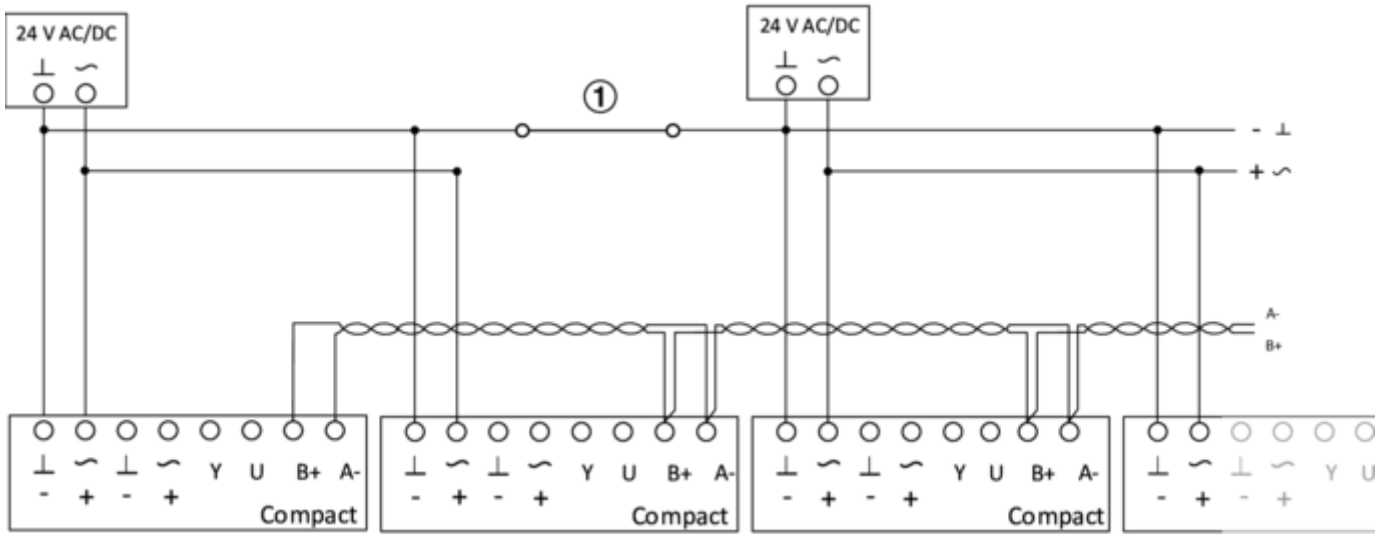



*Fig. 24: Bus operation with multiple supply voltages*

1 If there are several supply voltages, connect the grounds of the bus participants to one another.

No analogue control signal is required for bus operation. The setpoint is transmitted digitally to the control component via bus operation. If the control component is set to bus operation, the analogue setpoint signal is ignored.

Setpoint and actual values as well as override controls are transmitted for all control components via digital communication in the common bus network.

- The volume flow setpoint is specified for each control component by specifying the Modbus address and transferring the new setpoint to Modbus register 0 or by specifying the BACnet address via BACnet object AO[0].
- The actual volume flow rate is queried for each control component by specifying the Modbus address and reading out Modbus register 6 or by specifying the BACnet address via BACnet object AI[6].

## 7.5 Wiring for hybrid operation (analogue default/bus query)

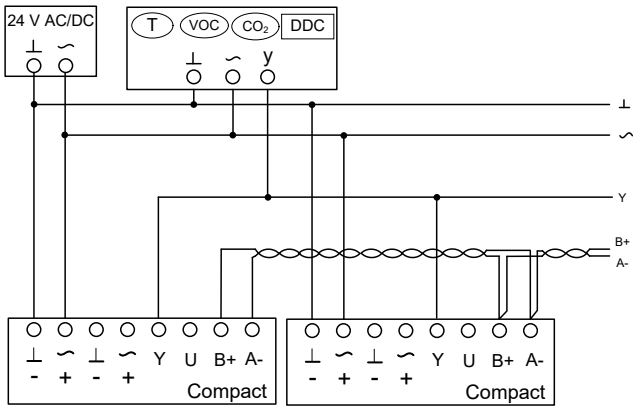



*Fig. 25: Analogue mode with bus operation feedback*

In hybrid mode, the control component is provided with an analogue command signal. Actual value signals from several control components can be called up in parallel via bus operation. In hybrid operation, no control signal can be specified via the bus operation. In this case, bus operation is only used for feedback and display of actual values of the control component.

# 8 Operation and status of the control component

### Display and control elements

At the control component, current operating values can be read, operating parameters can be set and the controller status can be queried for diagnostics.

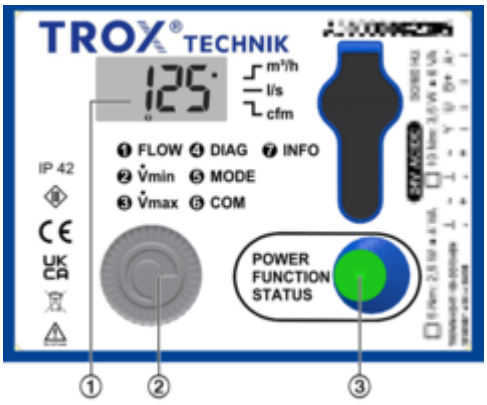



*Fig. 26: Display and control elements Compact XDMB0*

1 Display of actual values and operating states
2 Rotary selector switch
3 LED push button

### Display description

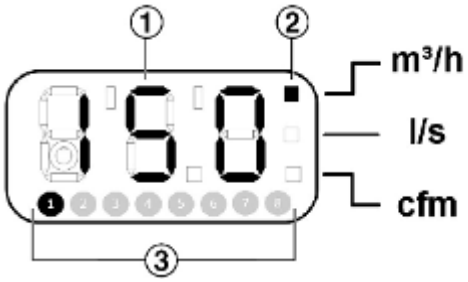



*Fig. 27: Display*

1 Display range
2 Display of volume flow unit
3 Display of the menu level

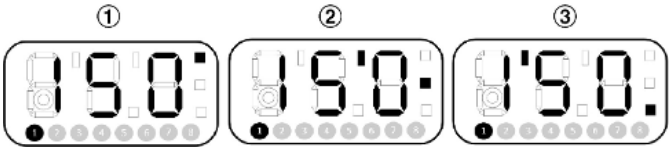



*Fig. 28: Display examples of volume flow rates*

1 150 m³/h
2 15 l/s
3 1.5 cfm

Decimal point values are indicated by an apostrophe.

### Menu selection

Pressing the LED button briefly (<3 s) switches to the next menu item ❶ - ❻; see the table below for a description of the menus.

### Editing mode

Pressing the LED button for a long time (>3 s) switches to editing mode.

### Value change

Value change with rotary selector switch
Save by briefly pressing the LED button (<3 s).

After 60 seconds without an entry, the system switches back to menu item ❶.

| Menu description | |
|---|---|
| ❶ | **Flow**<br>Display in set volume flow unit [m³/h] – [l/s] – [cfm] |
| ❷ | **$V_{min}$**<br>Display and setting of $q_{vmin}$ |
| ❸ | **$V_{max}$**<br>Display and setting of $q_{vmax}$ |
| ❹ | **Diagnostics**<br>Display of control signal and feedback signal alternately in [V]<br>Activation of override controls for test and diagnostic purposes:<br>▪ `oFF` = override control OFF<br>▪ `oP` = damper OPEN / `cL` = damper CLOSED<br>▪ `Hi` = $q_{vmin}$ / `Lo` = $q_{vmax}$<br>▪ `St` = motor stop<br>▪ `tst` = test run<br>▪ `000` = display firmware version (up to firmware 112) |
| ❺ | **Mode**<br>Selection of the operating mode:<br>▪ `cA0` = setpoint specification and actual value feedback via analogue interface (0 – 10 V)<br>▪ `cA2` = setpoint specification and actual value feedback via analogue interface (2 – 10 V)<br>▪ `cb2` = setpoint specification and actual value feedback via Modbus or BACnet, additional actual value feedback via analogue interface (2 – 10 V) |

| | Menu description |
|---|---|
| ❻ | **COM**<br>Setting communication parameters<br>Modbus RTU:<br>■ Baud rate, parity and stop bits, (`b1` – `b32`)<br>■ Address (1 – 247)<br>BACnet MS/TP:<br>■ Baud rate, parity and stop bits, (`bc1` – `bc6`)<br>■ Address (1 – 127) |
| ❼ | **Info**<br>Display of additional information<br>■ PoS - Position (0 - 100 %)<br>■ qno - Nominal volume flow in requested unit<br>■ Fir - Firmware version from firmware 117 |

**Menu navigation**

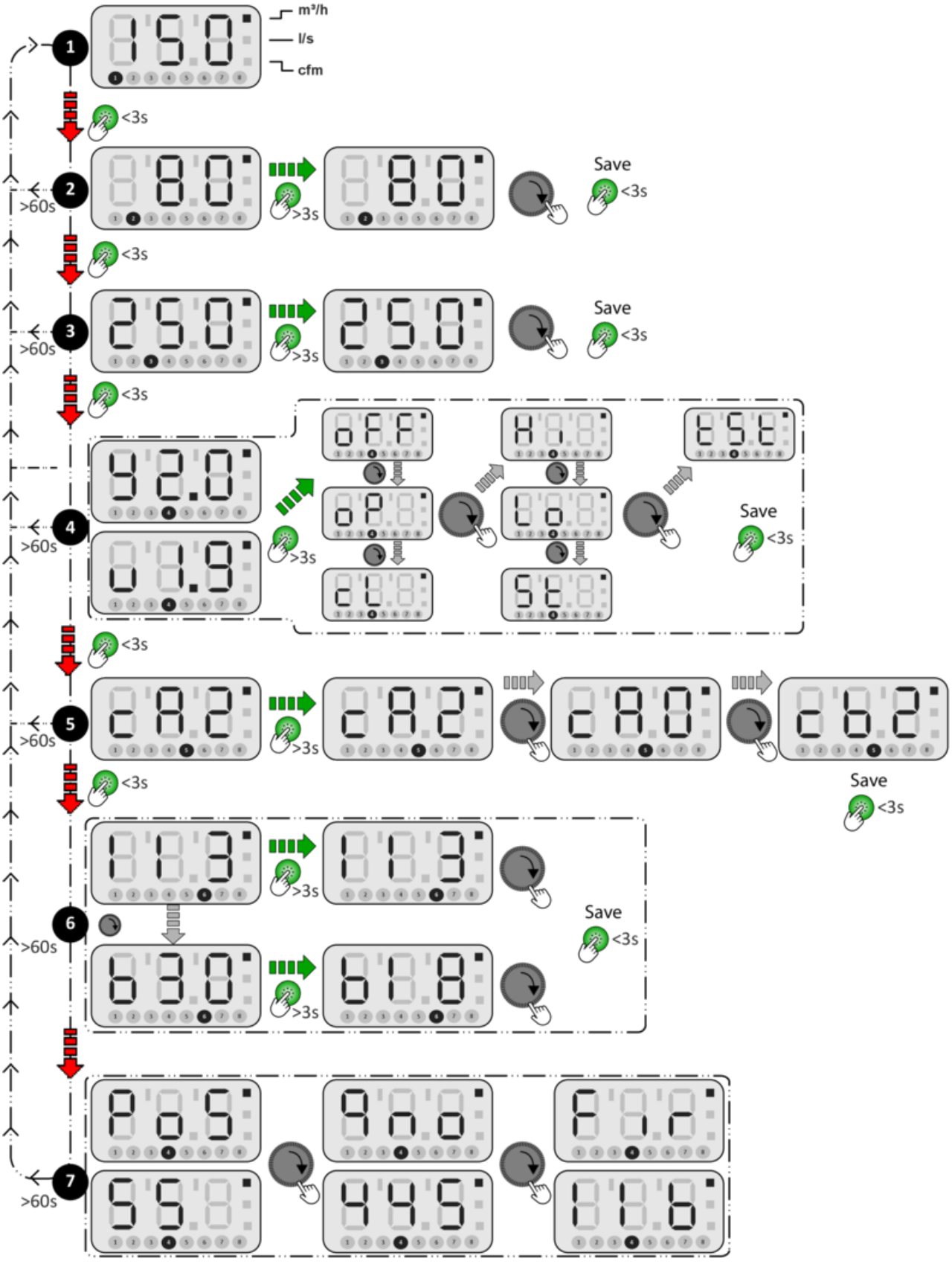
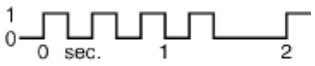
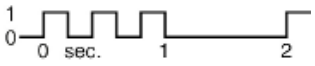
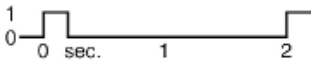
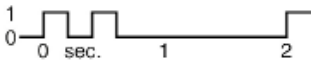
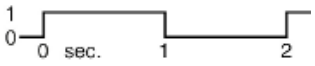
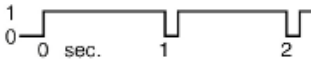
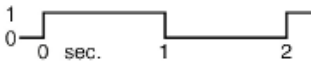
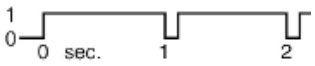
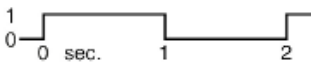
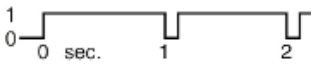
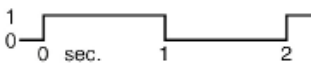
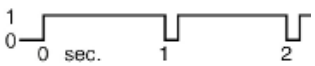
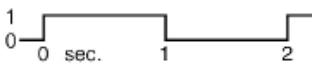
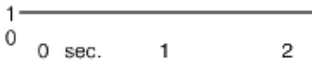



*Fig. 29: Menu navigation*

### Status and error messages

| Display | Flashing signal LED button | Status |
|---|---|---|
| OFF | OFF | no supply voltage connected |
| Pc | ON | Service tool plugged in.<br>On-site network connection deactivated.<br>Override controls from the service tool have priority. |
| Low | ON | Undervoltage detected.<br>Supply voltage outside the tolerance range.<br>Control function not guaranteed. |
| E C |  | Incomplete parameterisation was detected during power-on/reset<br>Inform TROX Service |
| bLc |  | Overload of the actuator<br>▪ Check for mechanical blockage! |
| rEF | | Synchronisation after voltage recovery<br>▪ Wait for automatic end position detection (open position). |
| tSt |  | Test mode is active<br>▪ End position OPEN is approached,<br>▪ end position CLOSED is approached,<br>▪ then back to normal position |
| o |  | Overpressure detected at the sensor:<br>▪ Dynamic transducer: $\Delta p \geq 1500$ Pa |
| Hi |  | Override control $\mathbf{q_{vmax}}$ activated, but not yet reached<br>Display switches between Hi and actual volume flow rate |
| |  | Override control $\mathbf{q_{vmax}}$ reached<br>Display switches between Hi and actual volume flow rate |
| Lo |  | Override control $\mathbf{q_{vmin}}$ activated, but not yet reached<br>Display switches between Lo and actual volume flow rate |
| |  | Override control $\mathbf{q_{vmin}}$ reached<br>Display switches between Lo and actual volume flow rate |
| oP |  | Override control **OPEN** activated, but not yet reached<br>Display switches between op and actual volume flow rate |
| |  | Override control **OPEN** reached<br>Display switches between op and actual volume flow rate |
| cL |  | Override control **CLOSED** activated, but not yet reached<br>Display switches between cl and actual volume flow rate |
| |  | Override control **CLOSED** reached.<br>Display switches between cl and actual volume flow rate |

The flashing signal always describes a 2-second interval.
1 = LED lights up, 0 = LED does not light up.

| Display | Flashing signal LED button | Status |
|---|---|---|
|  |   | Setpoint or override control position not yet reached. Display switches between e. g. Hi and actual volume flow rate |
| |   | Controlled. Is signalled as long as the actuator is not rotating to adjust the setpoint. |

The flashing signal always describes a 2-second interval.
1 = LED lights up, 0 = LED does not light up.

# 9 Commissioning and operation

## 9.1 Safety instructions

**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.

## 9.2 Factory default settings

The volume flow controller is set at the factory and set to the operating mode and operating parameters specified in the order code. As the volume flow rates are factory-set, the air terminal units have to be installed at the specified locations only.

The factory-set operating parameters can be found on the adjustment sticker on the terminal unit.
( *9.3 'Adjustment label' on page 34* )

**Analogue (0 – 10 V / 2 – 10 V) – constant value mode (F)**

Factory-set operating parameters:

$q_{vmin}$ [m³/h]; [l/s] - The constant volume flow rate value $q_{vconst}$ is set in parameter $q_{vmin}$.

$q_{vmax}$ [m³/h]; [l/s] - The parameter $q_{vmax}$ is set to $q_{vnom}$.

**Analogue (0 – 10 V / 2 – 10 V) – variable operation (V)**

Factory-set operating parameters:

$q_{vmin}$ [m³/h]; [l/s] - lower limit of the operating range for the terminal unit

$q_{vmax}$ [m³/h]; [l/s] - upper limit of the operating range for the terminal unit

**Modbus (M)**

Factory-set operating parameters:

$q_{vmin}$ [m³/h]; [l/s] - lower limit of the operating range for the terminal unit

$q_{vmax}$ [m³/h]; [l/s] - upper limit of the operating range for the terminal unit

Additional commissioning steps required
*9.7 'Modbus register list' on page 38*

**BACnet (B)**

Factory-set operating parameters:

$q_{vmin}$ [m³/h]; [l/s] - lower limit of the operating range for the terminal unit

$q_{vmax}$ [m³/h]; [l/s] - upper limit of the operating range for the terminal unit

Additional commissioning steps required *9.8 'Configuring the BACnet interface' on page 42*

## 9.3 Adjustment label

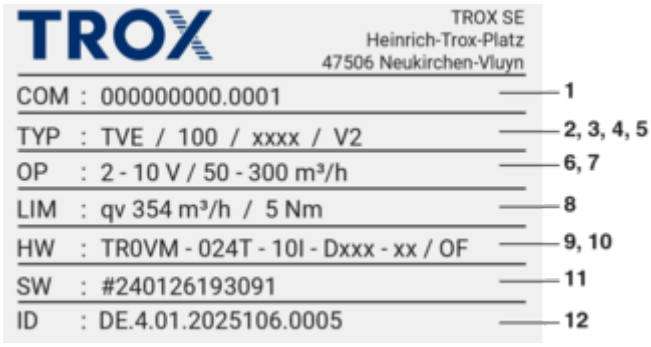



*Fig. 30: Example of an adjustment sticker*

① Commission number. Position number
② Type name of terminal unit
③ Nominal size
④ Control component
⑤ Operating mode
M ⇨ Modbus
F ⇨ constant value
V ⇨ variable
0 or 2 ⇨ characteristic type
B ⇨BACnet
⑥ Characteristics 0 – 10 V or 2 – 10 V
⑦ Volume flow rate ranges $q_{vmin}$ – $q_{vmax}$ or constant value
⑧ Nominal volume flow rate $q_{vnom}$
⑨ Hardware type designation
⑩ Control component:
OF ⇨ equipped at the factory
SP ⇨ spare part
⑪ Serial number
⑫ Test ID number

## 9.4 Service tools

### 9.4.1 Functional overview service tools

**Service tools functional overview**

| Functions | Display | Adjustment device | PC software |
|---|---|---|---|
| Actual value display | ✔ | ✔ | ✔ |
| Change of $q_{vmin}$ and $q_{vmax}$ | ✔ | ✔ | ✔ |
| Mode setting (0...10 V / 2...10 V / Modbus, BACnet) | ✔ | ✔ | ✔ |
| Record runtimes (operating time, runtime, ratio) | ✖ | ✖ | ✔ |
| Perform test run function | ✔ | ✔ | ✔ |
| Setpoint signal in Y [V] | ✔ | ✔ | ✔ |
| Actual value feedback U [V] | ✔ | ✔ | ✔ |
| Assign bus address | ✔ | ✔ | ✔ |
| Setting bus parameter sets | ✔ | ✔ | ✔ |
| offline parameter setting | ✖ | ✔ | ✖ |

### 9.4.2 Display on the control component

On the control component, current values can be read, operating parameters can be set and the status can be read.
After applying the supply voltage, various functions are available.

Additional information:

- *8 'Operation and status of the control component' on page 29*

### 9.4.3 Adjustment device GUIV3-M

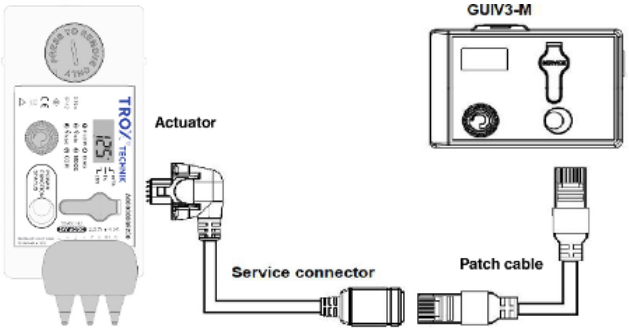



*Fig. 31: GUIV3-M is connected to the control component using the cable supplied.*

The GUIV3-M adjustment device offers the same range of functions as the internal display of the control component; adjustment via the device is useful if the control component is difficult to access due to an unfavourable installation position. Connecting and patch cables allow for easy commissioning.

Adjustment devices can be operated with batteries. This enables an offline parameterisation without applying voltage to the control component.

All connection cables shown and the operating manual are included with the adjustment device. The rechargeable battery (2.4V, 2x AA NiMH) is not included in the scope of delivery. The cables supplied must be used to ensure that the adjustment device functions correctly.

The GUIV3-M adjustment device can be ordered with the TROX order code **AT - VAV - G3**.

### 9.4.4 PC-Software WIN-VAV2

The WIN-VAV2 software can be used to read and parameterise current values and create timing diagrams. The software is installed on PC provided by the client.

The GUIV3-S interface adapter, all connection cables shown and an operating manual are included with the software. To ensure proper function, the cables included in the scope of delivery must be used.

The exact name of the software is: WIN-VAV2-A-Bundle (Gruner item number 46076).

The control component is connected to the GUIV3-S interface adapter using a service plug and patch cable. The USB cable is then used to connect the PC and GUIV3-S.

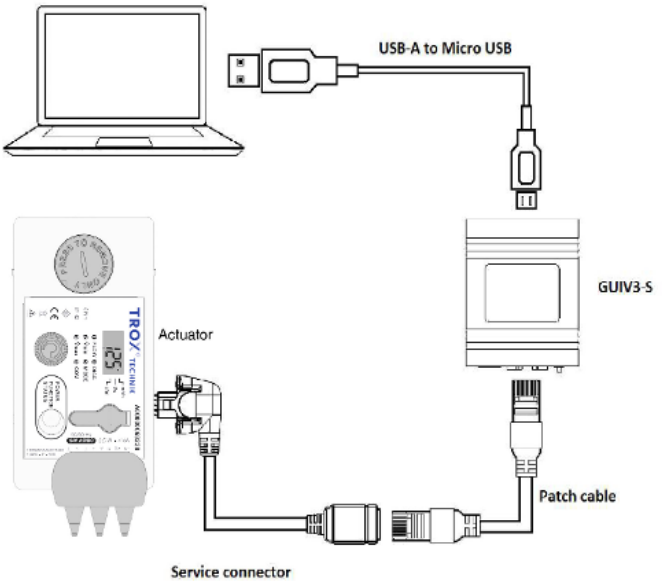



*Fig. 32: Connection to the PC with interface adapter GUIV3-S*

## 9.5 Adjusting the settings of the control component

### 9.5.1 Setting constant value operation (F)

If the factory-set value $qv_{vconst}$ is to be changed, or an ordered variable volume flow controller is to be converted to a constant volume flow controller, this can be adjusted on the internal display or via the service tools described.

The fixed value is set at $q_{vmin}$, as $q_{vmin=}$= $q_{vconst}$ for constant control. The $q_{vmax}$ value has no relevance in this case and no further setting is required.

For constant value operation, no control signal may be specified at terminal Y.

### 9.5.2 Setting variable operation (V)

The factory-set values for $q_{vmin}$ and $q_{vmax}$ can be adjusted on the internal display or using the service tools described.
$q_{vmin}$ to $q_{vmax}$ is the variable limited volume flow operating range, which is controlled via the control signal at terminal Y.

The following points must be observed for the control input signal:

- Observe the usable control range of the terminal unit:
  - Type TVE: 4 – 100 %
  - Type TVE-Q: 10 – 100 %
- The settings $q_{vmin}$ und $q_{vmax}$ define the controllable operating range of the control component
  ↳ *6.2.1 'Characteristic curves and formulas 0 – 10 V and 2 – 10 V' on page 19*
- In order to achieve a higher resolution of the assignment voltage signals to the volume flow setpoints, the operating range can be restricted by $q_{vmin}$ und $q_{vmax}$.

#### 9.5.2.1 Setting the entire control range for control via the management and control equipment

If the volume flow is to be specified by the MCE over the entire control range, $q_{vmin}$ must be set to 0 m³/h and $q_{vmax}$ to $q_{vnom}$.

The following points must be observed for the control input signal:

- Observe the usable control range.
  For example, with a signal voltage range of 0 – 10 V DC and settings of $q_{vmin}$ = 0 m³/h and $q_{vmax}$ = $q_{vnom}$, the control range is only reached from a control signal of 0.4 V DC.
- If the control signal falls below 0.3 V DC with an actuation of 0 – 10 V and $q_{vmin}$ = 0, the damper blade moves to the CLOSED shut-off position.

**! NOTICE!**

**Safe shut-off function**

Compliance with a control signal ≤ 0.3 V DC is not always given due to interference voltages on the supply lines. Therefore, the forced switching should always be preferred for a safe shut-off,
↳ *7.3.4 'Control variable operation / override controls' on page 25*

### 9.5.3 Changing the control input signal analogue or bus operation

In menu item ❺, the control input signal of the control component can be adjusted as follows. ↳ *'Setpoint and actual value signals' on page 17*

`CB2` - Bus operation

`CA0` - Analogue 0 – 10 V – variable operation (V) or constant value operation (F)

`CA2` - Analogue 2 – 10 V – variable operation (V) or constant value operation (F)

## 9.6 Perform a functional test

**Initial commissioning**

1. Check that the wiring is correct ( *7 'Electrical connection' on page 23* ).
2. Switch on the power supply.
   ⇨ After switching on the supply voltage, the LED button lights up green to indicate that the wiring is correct.

When the supply voltage is switched on, the control component performs a synchronisation and the damper blade is moved to the OPEN position. The damper then returns to its original position. This can take up to three minutes; the status is shown on the display and the LED, *'Status and error messages' on page 32* .

**Personnel:**

- Qualified electrician
- HVAC technician

*For commissioning, we recommend creating commissioning documentation in which the function of the volume flow controller is checked and documented.*

The functional test of the volume flow controller can be carried out in various ways.
The internal display is sufficient for most functional tests, *9.4 'Service tools' on page 35*

To check the function of the volume flow controller, check the position of the damper blade on the damper blade shaft (marking), *5.2 'Display of the damper blade position' on page 12* .

Preparation:

- Switch on the supply voltage; the green LED indicates that the supply voltage is properly connected.
- Wait until the synchronisation run has been completed.
- Switch on the ventilation and air conditioning system.
  **Note:** The system pressure at the volume flow controller must be sufficient for a proper functional test.

1. Perform the test function:
   For this purpose, select menu item `tst` in the display menu ❹ *'Diagnostics'*, *8 'Operation and status of the control component' on page 29* .
   ⇨ The test function is started, and the LED flashes briefly once at 2-second intervals.
   - Actuator moves the damper blade to the OPEN position.
   - Actuator moves the damper blade to the CLOSED position.
   - Actuator moves the damper blade back to the standard position.
2. Activate override control $q_{vmin}$
   For this purpose, select menu item `Lo` in the display menu ❹ *'Diagnostics'*, *8 'Operation and status of the control component' on page 29* .
   ⇨ Measure the actual value signal with a voltmeter and record the actual volume flow rate
3. Activate the override control $q_{vmax}$
   For this purpose, select menu item `Hi` in the display menu ❹ *'Diagnostics'*, *8 'Operation and status of the control component' on page 29* .
   ⇨ Measure the actual value signal with a voltmeter and record the actual volume flow rate.

## 9.7 Modbus register list

The Modbus parameters can be set on the internal display, via a service tool *9.4 'Service tools' on page 35* or via external Modbus software.
The following table lists and explains all Modbus registers.

Explanation of the access right / storage:
R = register readable
R,W = register readable and writeable
RAM = register value volatile
EEPROM = non-volatile register value, permanently stored (max. 1 million write cycles)
FLASH = permanent programme memory

| Register | Explanation | Access right | Storage |
|---|---|---|---|
| 0 | Volume flow rate setpoint [%]<br>■ Reference: Vmin – Vmax ($q_{vmin}$ – $q_{vmax}$)<br>■ Figure display: 0 – 10000<br>■ Volume flow rate setpoint: 0.00 – 100.00% | R, W | RAM |
| 1 | Activation of an override control;<br>■ 0 = none;<br>■ 1 = OPEN position;<br>■ 2 = CLOSED position, shut-off;<br>■ 3 = $q_{vmin}$;<br>■ 4 = $q_{vmax}$ | R, W | RAM |
| 2 | Command triggering<br>■ 0 = none;<br>■ 1 = Synchronisation;<br>■ 2 = Test run;<br>■ 4 = Controller reset | R, W | RAM |
| 4 | Request signal [%]<br>■ Figure display: 0 – 10000<br>■ Damper blade position: 0.00 – 100.00% | R | RAM |
| 5 | Damper blade position [°]<br>■ Figure display: without decimal places | R | RAM |
| 6 | Actual volume flow rate [%]<br>■ Reference: $q_{vnom}$<br>■ Figure display: 0 – 10000<br>■ Actual volume flow rate: 0.00 – 100.00% | R | RAM |
| 7 | Current actual volume flow rate in volume flow unit according to the setting in register 201 [m³/h], [l/ s], [cfm] | R | RAM |
| 8 | Voltage value at analogue input setpoint Y [mV] | R | RAM |
| 20 | Volume flow setpoint in volume flow unit [m³/h], [l/s], [cfm] in accordance with register 201 | R, W | RAM |
| 103 | Firmware version | R | Flash |

| Register | Explanation | Access right | Storage |
|---|---|---|---|
| 104 | Status information<br>■ Bit 5 = Mechanical overload<br>■ Bit 8 = Internal activity, e. g., test run, synchronisation<br>■ Bit 10 - Bus timeout monitoring triggered<br>**Note:** all other bits for internal purposes only | R | RAM |
| 105 | Lower limit of operating range:<br>■ Operating parameter Vmin ($q_{vmin}$) [%]<br>■ Reference: $q_{vnom}$ (see adjustment sticker)<br>■ Figure display: 0 – 10000<br>■ Vmin: 0.00 – 100.00%<br>**Note:** Modbus registers 105 and 120 influence each other; the last setpoint specification is valid. | R, W | EEPROM |
| 106 | Upper limit of operating range:<br>■ Operating parameter Vmax ($q_{vmax}$) [%]<br>■ Reference: $q_{vnom}$<br>■ Figure display: 0 – 10000 Vmax: 0.00 – 100.00%<br>**Note:** Modbus registers 106 and 121 influence each other; the last setpoint specification is valid. | R, W | EEPROM |
| 108 | Behaviour in case of bus failure (bus timeout);<br>■ 0 = Control of the last setpoint value;<br>■ 1 = OPEN position;<br>■ 2 = CLOSED position, shut-off;<br>■ 3 = $q_{vmin}$;<br>■ 5 = $q_{vmax}$ | R, W | EEPROM |
| 109 | Definition of bus timeout [s] | R, W | EEPROM |
| 120 | Definition of lower operating range:<br>Operating parameter $q_{vmin}$ in the volume flow unit [m³/h], [l/ s], [cfm] according to the setting in register 201<br>**Note:** Modbus registers 120 and 105 influence each other; the last setpoint specification is valid. | R, W | EEPROM |
| 121 | Definition of upper operating range:<br>Operating parameter $q_{vmax}$ in the volume flow unit [m³/h], [l/s], [cfm] according to the setting in register 201<br>**Note:** Modbus registers 121 and 106 influence each other; the last setpoint specification is valid. | R, W | EEPROM |
| 122 | Interface definition (Interface mode) For assignment see separate table | R, W | EEPROM |
| 130 | Modbus address (participant address), factory setting: Modbus address 1 | R, W | EEPROM |
| 201 | Volume flow unit<br>■ 0 = l/s;<br>■ 1 = m³/h;<br>■ 6 = cfm | R, W | EEPROM |

| Register | Explanation | Access right | Storage |
|---|---|---|---|
| 231 | Determination of signal voltage range (mode):<br>■ Bit 0 defines the characteristic of the analogue interface.<br>– Bit 0 = 0 characteristic: 0 – 10 V<br>– Bit 0 = 1 characteristic: 2 – 10 V<br>■ Bit 4 defines the feedback signal as an actual volume flow rate or angle (request signal in per cent).<br>– Bit 4 = 0 actual volume flow rate<br>– Bit 4 = 1 request signal<br>■ All other bits must not be changed. | R, W | EEPROM |
| 568 | Modbus parameter set, communication settings:<br>■ Baud rate,<br>■ parity,<br>■ stop bits,<br>See separate table for assignment | R, W | EEPROM |
| 569 | Modbus communication settings:<br>Modbus Response Time = 10 ms + delay;<br>with delay = 3 ms × register value 0 – 255 | R, W | EEPROM |
| 572 | Setting of switching threshold for override control CLOSE via control signal for signal voltage range 2 – 10 V:<br>■ Setting range 0.2 V – 1.8 V<br>■ Default value 0.8 V (register value = 20)<br>■ Adjustable in 40 mV steps | R, W | EEPROM |
| 769 | Override control status for diagnostics | R | RAM |

**Detailed information on register 122 (communication interface setpoint/actual value - interface mode)**

| Register value | Setpoint specification | Actual value |
|---|---|---|
| 0 | Analogue input at terminal Y Signal voltage range 0 (2) - 10 V DC according to register 231 | Analogue signal at terminal U; signal voltage range 0 (2) - 10 V DC according to register 231 |
| 1 | Modbus via register 0 | 0 (2) – 10 V DC |
| 2 | Modbus via register 0 | Modbus register 10 |
| 3 | Analogue input at terminal Y Signal voltage range 0 (2) - 10 V DC according to register 231 | Modbus register 10 |

**Detailed information on register 568 (Modbus communication parameters)**

| Setting value | | Baud rate | Parity | Stop bits |
|---|---|---|---|---|
| Modbus register | Display | | | |
| 0 | b1 | 1200 | None | 2 |
| 1 | b2 | 1200 | Even | 1 |

*Standard parameters

b1 - b32 = Modbus RTU parameter
bc1 - bc6 = BACnet MS/TP parameters
bc3 = Factory setting

| Setting value | | Baud rate | Parity | Stop bits |
|---|---|---|---|---|
| Modbus register | Display | | | |
| 2 | b3 | 1200 | Odd | 1 |
| 3 | b4 | 2400 | None | 2 |
| 4 | b5 | 2400 | Even | 1 |
| 5 | b6 | 2400 | Odd | 1 |
| 6 | b7 | 4800 | None | 2 |
| 7 | b8 | 4800 | Even | 1 |
| 8 | b9 | 4800 | Odd | 1 |
| 9 | b10 | 9600 | None | 2 |
| 10 | b11 | 9600 | Even | 1 |
| 11 | b12 | 9600 | Odd | 1 |
| 12 | b13 | 19200 | None | 2 |
| 13 | b14 | 19200 | Even | 1 |
| 14 | b15 | 19200 | Odd | 1 |
| 15 | b16 | 38400 | None | 2 |
| 16 | b17 | 38400 | Even | 1 |
| 17 | 1b8 | 38400 | Odd | 1 |
| 18 | b19 | 1200 | None | 1 |
| 19 | b20 | 2400 | None | 1 |
| 20 | b21 | 4800 | None | 1 |
| 21 | b22 | 9600 | None | 1 |
| 22 | b23 | 19200 | None | 1 |
| 23 | b24 | 38400 | None | 1 |
| 24 | b25 | 76800 | None | 1 |
| 25 | b26 | 115200 | None | 1 |
| 26 | b27 | 76800 | None | 2 |
| 27 | b28 | 76800 | Even | 1 |
| 28 | b29 | 76800 | Odd | 1 |
| 29 | b30 | 115200 | None | 2 |
| 30 | b31 | 115200 | Even | 1 |
| 31 | b32 | 115200 | Odd | 1 |
| 32 | bc1 | 9600 | None | 1 |
| 33 | bc2 | 19200 | None | 1 |
| **⇒ 34** | **bc3*** | **38400** | **None** | **1** |
| 35 | bc4 | 57600 | None | 1 |

*Standard parameters

b1 - b32 = Modbus RTU parameter
bc1 - bc6 = BACnet MS/TP parameters
bc3 = Factory setting

| Setting value | | Baud rate | Parity | Stop bits |
|---|---|---|---|---|
| Modbus register | Display | | | |
| 36 | bc5 | 76800 | None | 1 |
| 37 | bc6 | 115200 | None | 1 |

*Standard parameters

b1 - b32 = Modbus RTU parameter
bc1 - bc6 = BACnet MS/TP parameters
bc3 = Factory setting

**Detailed information on register 572 (setting threshold value CLOSE 2 – 10 V)**

| Register | Threshold value CLOSE 2 – 10 V (adjustable in 40 mV steps) | |
|---|---|---|
| 572 | 5 – 0.2 V | 30 – 1.2 V |
| | 10 – 0.4 V | 35 – 1.4 V |
| | 15 – 0.6 V | 40 – 1.6 V |
| | 20 – 0.8 V | 35 – 1.8 V |
| | 25 – 1.0 V | |

**Detailed information on register 769 (Override control status for diagnostics)**

| Register | Explanation | Access right |
|---|---|---|
| 769 | Override control status for diagnostics<br>■ Bit 2 - Override control Closed<br>■ Bit 3 - Override control Open<br>■ Bit 4 - Override control Btw<br>■ Bit 5 - Override control max<br>■ Bit 7 - Override control motor stop<br>■ Bit 8 - Override control Min | Digital |
| | Override control status for diagnostics<br>■ Bit 9 - Negative half-wave<br>■ Bit 10 - Positive half-wave<br>■ Bit 11 - Full wave<br>■ Bit 12 - Analogue Min<br>■ Bit 13 - Analogue Max<br>■ Bit 14 - Ground | Analogue |

## 9.8 Configuring the BACnet interface

**General Information**

| | |
|---|---|
| Date | 4 Dec 2023 |
| Vendor Name | Trox SE |
| Vendor ID | 329 |
| Description/Name for Model/Product | Controller for VAV/CAV application |

| | |
|---|---|
| Object/Device Name | for TROX attachments as follows<br>■ XDMB0: Object/device name = "TR0VM-024T-10I-DD15-BN"<br>■ XSMB0: Object/device name = "TR0VM-024T-10I-DS15-BN" |
| Application software version | SW 116.955.11.2022 |
| Firmware Revision | FW 101.1.10.2020/GR |
| BACnet Protocol Revision | 15 |
| BACnet Standard Device Profile | BACnet Application Specifc Controller (B-ASC) |
| Segmentation capability | No |
| Data Link Layer Options | MS/TP Master;<br>Communication speed configurable to:<br>9600, 19200, 38400, 57600, 76800, 115200 Baud |
| Address range | 0..127 (default = 1) |
| Number of nodes | max. 128 (1/4 unit load) |
| Termination | 120 Ohm (external) |
| Device Address Binding | No static device binding supported |
| Gateway Options | None |
| Network Security Options | Non-secure device |
| Character set supported | ISO 10646 (UTF-8) |
| Write Cycles Persistent Objects | max. 1.000.000 |
| Parameterisation | Display, PC software tool WIN-VAV2 |

**BACnet - Interoperability Building Blocks (BIBBs)**

| | |
|---|---|
| Data Sharing | ReadProperty-B (DS-RP-B) |
| | ReadPropertyMultiple-B (DS-RPM-B) |
| | WriteProperty-B (DS-WP-B) |
| | WritePropertyMultiple-B (DS-WPM-B) |
| | Change Of Value-B (DS-COV-B) |
| Device Management | Dynamic Device Binding-B (DM-DDB-B) |
| | Dynamic Object Binding-B (DM-DOB-B) |
| | DeviceCommunicationControl-B (DM-DCC-B) |
| | ReinitialiseDevice-B (DM-RD-B) |

**Protocol Implementation Conformance Statement (PICS) - Supported Objects**

| Object type | Optional properties | Writeable properties |
|---|---|---|
| Device | Description | Object Identifier |
| Device | Location | Object Name |
| Device | Active COV Subscriptions | Location |
| Device | Max Master | Description |
| Device | MaxInfo Frames | APDU Timeout (1000…60.000) |

| Object type | Optional properties | Writeable properties |
|---|---|---|
| Device | Profile Name | Number of APDU Retries (0…10) |
| Device | | Max Master (1…127) |
| Device | | Max Info Frames (1…255) |
| Analogue Input [AI] | Description | COV Increment |
| Analogue Input [AI] | COV Increment | |
| Analogue Output [AO] | Description | Present Value |
| Analogue Output [AO] | COV Increment | COV Increment |
| Analogue Output [AO] | | Relinquish Default |
| Analogue Value [AV] | Description | Present Value COV Increment |
| Analogue Value [AV] | COV Increment | |
| Binary Input [BI] | Active Text | |
| Binary Input [BI] | Inactive Text | |
| Multi-state Input [MI] | Description State Text | |
| Multi-state Output [MO] | Description State Text | Present Value |
| Multi-state Output [MO] | | Relinquish Default |
| Multi-state Value [MV] | Description State Text | Present Value |

Notes:

The device does not support the services CreateObject and DeleteObject. Maximum length of writeable strings based on single-byte character

- Object name: 32 char
- Location: 64 char
- Description: 64 char

Service processing
The device supports the DeviceCommunicationControl and ReinitialiseDevice service functions
A password is not required
A maximum of 6 active COV subscriptions (logins) with a runtime of 1 - 28,800 seconds (8 hours) are supported

**Object details**

**Protocol Implementation Conformance Statement (PICS) - Object details**

| Object name | Object Type [Instance] | Description Comment Status_Flags | Values | COV Increment | Access |
|---|---|---|---|---|---|
| Device | Device [Inst. No.] | 0…4194302 Default: 1 | | - | W |
| RelSpAnalogue | AI[0] | only if setpoint specification via SpSource MV[122] = analogue: volume flow setpoint [%] detected at analogue input Y<br>if setpoint specification via SpSource MV[122] = Bus, then Out_of_Service = TRUE | 0...100.00 | 0.01...100.00<br>Default: 1 | R |

| Object name | Object Type [Instance] | Description Comment Status_Flags | Values | COV Increment | Access |
|---|---|---|---|---|---|
| RelPos | AI[4] | Fan request signal Degree of opening of the damper between 0... 100%, whereby 0% corresponds to the closed position and 100% to the maximum opening. Note: With TVE(-Q) control units, 100% opening does not correspond to a damper blade angle of approx. 90° as with conventional control units, as the damper blade does not exceed a certain setting angle due to its design. | 0...100.00 | 0.01...100.00 Default: 1 | R |
| AbsPos | AI[5] | Damper movement [°] from closed position Note: The readable value can only be used for service and diagnostic purposes. The RelPos data point must be used to evaluate the Open and Closed position. | 0 ... max. angle of rotation of the TVE(- Q) damper movement range | 0.01...655.35 Default: 1 | R |
| RelActual_Value | AI[6] | Current actual volume flow [%] Reference: qvNom Nominal volume flow see object AbsNom-Value AV[233] | 0...100.00 | 0.01...100.00 Default: 1 | R |
| AbsAc-tual_Value | AI[7] | Current actual volume flow as an absolute value in the set volume flow unit; unit see object UnitSet MV[201] | 0 … qvNominal | 0…65535 Default: 1 | R |
| Sens1Analogue | AI[8] | Signal voltage [mV] at input Y; If setpoint specification with object SpSource[MV122] is set to analogue (1), then Out_Of_Service = TRUE | 0 – 65535 | Default: 1 | R |
| RelSpBus | AO[0] | Volume flow setpoint via bus specification as a percentage of the set operating range from Min [AV105] to Max [AV[106]. If setpoint specification with object SpSource[MV122] is set to analogue (1), then Out_Of_Service = TRUE | 0 – 100.00 Default: 0 | 0.01 – 100 Default: 1 | C |
| Min | AV[105] | Limitation of operating range qvmin [%]: Lower limit for setpoint as a percentage of the nominal volume flow qvnom; see object AbsNom-Value AV[233] | 0...100.00 Default: 0 | 0.01...100.00 Default: 1 | W[1] |
| Max | AV[106] | Limitation of operating range qvmax [%]: Upper limit operating range for setpoint [%] of the nominal volume flow qvnom; see object AbsNom-Value AV[233] | 0...100.00 Default: 100 | 0.01...100 Default: 1 | W[1] |

| Object name | Object Type [Instance] | Description Comment Status_Flags | Values | COV Increment | Access |
|---|---|---|---|---|---|
| Mid | AV[118] | Object visible but not fully supported | - | - | - |
| AbsNomValue | AV[233] | Nominal volume flow of the control unit (depending on type and dimensions) in set volume flow unit; see object UnitSet MV[201] | 0 … 65535 | 0.01...100 Default: 1 | R |
| BusFail-Watchdog | AV[109] | Definition of timeout (watchdog) for bus failure in seconds. 0 = Watchdog deactivated Timeout is active after switching on until the first write access to object RelSpBus AO[0] or override MO[1] takes place. The watchdog is reset with every successful write access of a setpoint or override. Relinguish_Default becomes valid if bus failure watchdog is active. Bus failure watchdog is deactivated if the setpoint specification via object SpSource MV[122] is set to analogue (1). | 0 … 65535 Default: 120 | 0 … 65535 Default: 1 | W[1] |
| SummaryStatus | BI[0] | Error flag - collective fault signal; contains the objects StatusActuator MI[104] and Status Device MI[109] | Inactive_Text: OK Active_Text: Not_OK | - | R |
| Sens1Switch | BI[8] | Object visible, but not supported | - | - | R |
| InternalActivity | MI[2] | Identification of an internal controller activity, e.g. during an active test function or adaptation run | 1: None<br>2: Test<br>3: Adaptation | - | R |
| StatusActuator | MI[104] | Status of the control component:<br>■ Failure Program memory<br>■ Supply voltage too low<br>■ Mechanical blockage<br>■ Actuator was moved outside the adapted operating range | 1: OK<br>2: EEPROM Error<br>3: Under voltage<br>4: Actuator cannot move (actuator blocked) | - | R |
| StatusDevice | MI[109] | Bus failure monitoring status: Bus failure watchdog triggered because timeout has expired | 1: OK<br>2: Bus watchdog triggered | - | R |

| Object name | Object Type [Instance] | Description Comment Status_Flags | Values | COV Increment | Access |
|---|---|---|---|---|---|
| Override | MO[1] | Activation of override control (overrides the setpoint specification)<br>In bus mode, the setpoint specification is overridden via the RelSpBus AO[0] object. In analogue mode, the setpoint specification at analogue input Y is overridden by override control via the bus. | 1: None<br>2: Open (move to open position)<br>3: Close (move to closed position)<br>4: Min (activate setpoint qvmin)<br>5: Max (activate setpoint qvmax)<br>6, 7, 8: not in use: Use not authorised for this platform!<br>9: Stop (stop actuator in current position; for diagnostic purposes only)<br>Default: None (1) | - | C |
| Command | MV[2] | Triggering commands for service and test<br>Triggers a power-up (switch-on) sequence<br>Note:<br>After the command has been sent, the current value of the object changes back to None (1) | 1: None<br>2: Adaptation (adapt angle of rotation range)<br>3: Test (trigger test run)<br>4: Reset (restart controller)<br>Default: None (1) | - | W |
| Sens1Type | MV[107] | Object visible but not supported with TVE(-Q) | - | - | - |
| SpSource | MV[122] | Setpoint Source Selection of the signal source for setpoint specifications:<br>■ Analogue: Setpoint specifications at connection Y via analogue signal with set characteristic 0-10V or 2-10V. Bus specifications via RelSpBus AI[0] are ignored.<br>■ Bus: Setpoint value specifications via BACnet Object RelSpBus AI[0] Specifications at the analogue input (connection Y) are ignored. | 1: Analogue (setpoint specification only via analogue input)<br>2: Bus (setpoint specification only via bus interface)<br>Default: Setpoint via bus (2) | - | W[1] |
| ControlMode | MV[123] | Object visible but only ClosedLoop (standard operation) permitted | Default: Standard operation (2) do not change | - | - |
| UnitSel | MV[201] | Setting of the volume flow unit | Volume flow unit:<br>1: l/s<br>2: m³/h<br>5 cfm<br>Default: m³/h (2) | - | W[1] |

Note:
Access - Access right
R = Read - Read access
W = Write - Write and read access

C = Commandable with priority array
[1]Cyclic writing of marked BACnet objects is not permitted due to storage of the setting data in the EEPROM

# 10 Faults

## 10.1 Troubleshooting

TROX volume flow controllers are technically tested before delivery. The factory-set operating parameters are documented on the adjustment sticker and must be checked during commissioning *9.3 'Adjustment label' on page 34*.

If faults occur after commissioning, they can usually be resolved using the following descriptions.

If a fault cannot be resolved independently, the contact persons at TROX will be happy to help you rectify the fault (contact *1.3 'TROX Contact information' on page 6*).

The following information is required for this purpose:

- Order number, line and item number (see order code)
- Type and nominal size of the control unit (see adjustment sticker):
- $q_{vmin}$ / $q_{vmax}$ setting
- Control input signal

## 10.2 Common faults

### 10.2.1 Incorrect wiring

In many cases wiring errors are the cause of faults. For this reason, only the 24 V supply voltage should initially be connected when troubleshooting a control component.

1. If present, disconnect the connecting cables at the setpoint value input (terminal Y) and the actual value output (terminal U). This switches off all external circuit influences.
2. Check if the 24 V supply voltage is switched on and is within the permitted tolerance zone.

   ⇨ When the supply voltage is switched on and there is an adequate minimum differential pressure in the duct, the control component attempts to adjust the volume flow rate to the setpoint value $q_{vmin}$.
3. Check whether the volume flow controller has reached the setpoint value.

   Reading out with service tool or voltage signal *10.4.1 'Use of voltmeters to control setpoint values and feedback signals' on page 50*.

   ⇨ If the setpoint value is reached, the volume flow controller will work properly.
4. The test can be repeated for different setpoint values by adjusting the $V_{min}$ value.

### 10.2.2 System pressure too low

The aim of volume flow control is to regulate the actual volume flow rate to the specified setpoint. However, this requires a sufficient fan output so that the control unit can regulate (restrict) the desired volume flow rate setpoint. If the required minimum differential pressure is not reached due to an inadequate fan output, the setpoint of the terminal unit cannot be reached either.

If the system pressure is too low, the volume flow controller will attempt to open the damper blade further to reach the desired volume flow rate setpoint. This can be recognised on the damper blade shaft of the control unit *5.2 'Display of the damper blade position' on page 12*.

If the damper blade is still in the OPEN position with the setpoint signal present, instead of in a control position (throttle position), the volume flow rate is not high enough to set the setpoint.

**Remedy:**

- Check fan output,
- Check duct section blocking, e.g., fire damper closed
- *A 'Systematic troubleshooting' on page 61*

### 10.2.3 Use outside the control range

If the unit-specific control range is left with the $q_{vmin}$- / $q_{vmax}$ setting, the setpoints cannot be reached. The actual value reached by the volume flow controller is undefined.

Adapt the settings for $q_{vmin}$ and $q_{vmax}$ with the specific control ranges of the terminal unit.

Additional information:

- Usable control range (see adjustment sticker):
  - Type TVE: 4 - 100 % of $q_{vnom}$
  - Type TVE-Q: 10 - 100 % of $q_{vnom}$
- *6.2.1 'Characteristic curves and formulas 0 – 10 V and 2 – 10 V' on page 19*

### 10.2.4 Deviation between setpoint value and actual value signal

Frequently, in the regulated condition, the same signal voltage is expected at the setpoint value input and the actual value output of the control component. However, this only applies if $q_{vmin}$ is set to 0 m³/h and $q_{vmax}$ is set to $q_{vnom}$, since the same characteristic curve vertices are used for the setpoint value input and the actual value output.

Furthermore, in the controlled state, due to the permissible control tolerance, small deviations between the signal voltages of the setpoint value and actual value can always be expected.

If the $q_{vmin}$ and $q_{vmax}$ settings restrict the usable control range, this changes the characteristic profile of the setpoint value signal. Since the signal voltage of the actual value is always assigned to the characteristic profile of $q_{vnom}$, this results in a restriction of the usable control range in a different characteristic profile of the signal voltages for setpoint and actual values.

In this case, a direct inference due to different signal voltages at the setpoint value input or actual value output without (rollover) calculation is not possible.

## 10.3 Systematic troubleshooting

If the control unit malfunctions, we recommend systematic troubleshooting using our flow chart, *A 'Systematic troubleshooting' on page 61*.

## 10.4 Further diagnostic options

### 10.4.1 Use of voltmeters to control setpoint values and feedback signals

In analogue mode, a voltmeter can be used to electrically measure both the setpoint signal Y (terminal Y to ground) and the actual value signal U (terminal U to ground). Using the following formulas, the associated volume flow rate setpoints and actual values can be calculated and thereby checked:

**Voltage signal 0 – 10 V**

$$q_{vsoll} = \frac{Y}{10\ V} \times (q_{vmax} - q_{vmin}) + q_{vmin}$$

$$q_{vist} = \frac{U}{10\ V} \times q_{vnenn}$$

**Voltage signal 2 – 10 V**

$$q_{vsoll} = \frac{Y - 2}{(10\ V - 2\ V)} \times (q_{vmax} - q_{vmin}) + q_{vmin}$$

$$q_{vist} = \frac{U - 2}{(10\ V - 2\ V)} \times q_{vnenn}$$

**Note:** Depending on the selected setting of the $q_{vmin}$- / $q_{vmax}$ values, the setpoint signal voltage and actual value voltage can be different even in a correctly regulated state, *10.2.4 'Deviation between setpoint value and actual value signal' on page 49*.

### 10.4.2 Sample calculations

**Example 1:**

Calculation of the volume flow rates by means of setpoint and actual value signal voltage

| | | |
|---|---|---|
| Volume flow controller Nominal volume flow $q_{vnom}$ | - | 1828 m³/h |
| Set $q_{vmin}$ | - | 600 m³/h |
| Set $q_{vmax}$ | - | 1000 m³/h |
| Characteristic curve setting | - | 0 – 10 V |
| Voltage (Y) | - | 8.24 V |
| Voltage (U) | - | 5.4 V |

$$q_{vsoll} = \frac{Y}{10\ V} \times (q_{vmax} - q_{vmin}) + q_{vmin}$$

**Calculation solution:**

$q_{vset}$ = (8.24 V / 10 V) × (1000 m³/h – 600 m³/h) + 600 m³/h

$q_{vset}$ = 929.6 m³/h

$$q_{vist} = \frac{U}{10\ V} \times q_{vnenn}$$

$q_{vact}$ = 5.4 V / 10 V × 1828 m³/h

$q_{vact}$ = 987.12 m³/h

Deviation = 987.12 m³/h – 929.6 m³/h

Deviation = 57.52 m³/h

$$\Delta q_v = 1 - \frac{q_{vsoll}}{q_{vist}} \times 100\%$$

$\Delta q_v$ = 1 – (929.6 m³/h / 987.12 m³/h) × 100

$\Delta q_v \approx$ 6%

**Example 2:**

Calculation of the setpoint voltage (Y) for desired volume flow rate

| | | |
|---|---|---|
| Volume flow controller Nominal volume flow $q_{vnom}$ | - | 2293 m³/h |
| Set $q_{vmin}$ | - | 500 m³/h |
| Set $q_{vmax}$ | - | 2000 m³/h |
| Characteristic curve setting | - | 0 – 10 V |
| Desired volume flow rate $q_{vset}$ | - | 1500 m³/h |

$$Y = \frac{q_{vsoll} - q_{vmin}}{\left(\frac{q_{vmax} - q_{vmin}}{10\ V}\right)}$$

**Calculation solution:**

Y = 1500 m³/h – 500 m³/h / (2000 m³/h – 500 m³/h / 10 V)

Y = 6.6 V

**Example 3:**

Calculation of the setpoint voltage (Y) for desired volume flow rate

| | | |
|---|---|---|
| Volume flow controller Nominal volume flow $q_{vnom}$ | - | 1513 m³/h |
| Set $q_{vmin}$ | - | 250 m³/h |
| Set $q_{vmax}$ | - | 800 m³/h |
| Characteristic curve setting | - | 2 – 10 V |
| Desired volume flow rate $q_{vset}$ | - | 650 m³/h |

$$Y = \frac{q_{vsoll} - q_{vmin}}{\left(\frac{q_{vmax} - q_{vmin}}{(10V - 2V)}\right)} + 2V$$

**Calculation solution:**

Y = 650 m³/h – 250 m³/h / (800 m³/h – 250 m³/h / (10 V– 2 V)) + 2 V

Y = 7.81 V

# 11 Spare parts

## 11.1 Order of replacement control components

The unit type, nominal size/dimensions as well as operating mode, signal voltage ranges, operating values ($q_{vmin}$, $q_{vmax}$) and the nominal flow rate are required for ordering spare parts. Additional information such as order number and delivery date help to specify parameters of the control unit.

*The adjustment sticker on the terminal unit provides all the information required for ordering replacement parts for a control component, which can be sent as a photo when ordering.*

## 11.2 Install spare part

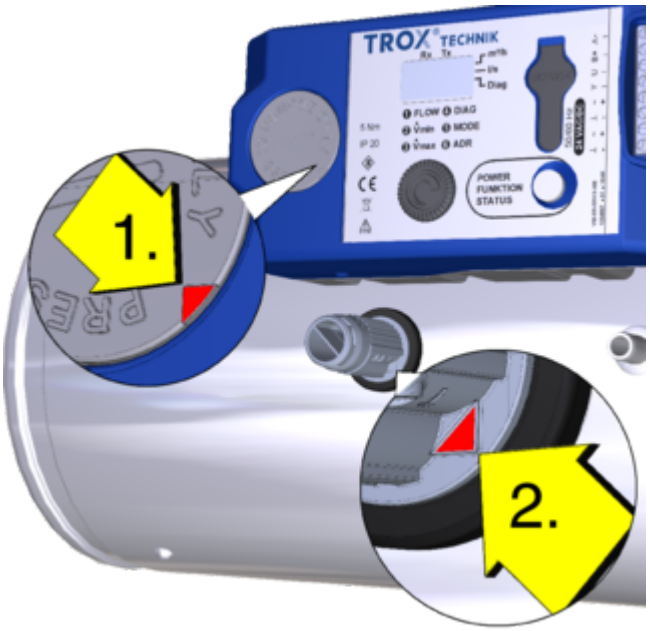



*Fig. 33: Plug the control component onto the basic device*

**NOTICE!**

Observe correct installation!

1. ▸ Align the markings to each other.
2. ▸ Attach the controller without force
3. ▸ Engage the controller – done!

# 12 Decommissioning

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

## 12.1 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 incorrect 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 toppling.
– When in doubt, contact the manufacturer.

## 12.2 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.

## 12.3 Disposal

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

- Scrap the metals.
- Take plastic parts to be recycled.
- 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.

# 13 Technical data

**General operating conditions of the control components**

| | |
|---|---|
| Ambient temperature | 10 - 50 °C |
| Ambient humidity | 5 - 90% rH |




*Fig. 34: Compact XDMB0*

| | Compact XDMB0 |
|---|---|
| Type of attachment | TR0VM-024T-10I-DD15-BN |
| Supply voltage (AC voltage) | 24 V AC ± 20%, 50/60 Hz |
| Supply voltage (DC voltage) | 24 V DC ± 20% |
| Power rating (AC voltage) | TVE nominal width 100 – 160: max. 4 VA<br>TVE nominal width 200 – 400: max. 6 VA<br><br>TVE-Q up to height 200: max. 4 VA<br>TVE-Q at height 300: max. 6 VA |
| Power rating (DC voltage) | TVE nominal width 100 - 160: max. 1.5 W<br>TVE nominal width 200 - 400: max. 3 W<br><br>TVE-Q up to height 200: max. 1.5 W<br>TVE-Q at height 300: max. 3 W |
| Power consumption (operation/idle state) | 1 W |
| Measuring principle / installation orientation | Dynamic measuring principle, any installation orientation |
| Runtime for 90° | approx. 100 s |
| Setpoint signal input (analogue optional) | 0 – 10 V DC, Ra > 100 kΩ<br><br>or 2 - 10V DC Ra> 50 kΩ |
| Actual value signal output | 0 – 10 V DC or 2 – 10 V DC, max. 5 mA |
| Setpoint/actual value bus interface | via Modbus register list or BACnet objects |
| Bus connection | Modbus RTU and BACnet MS/TP, RS485 |
| Number of nodes | 128 |
| Adjustable communication parameters Modbus RTU | 1200 – 115,200 Baud<br>Start bit: 1<br>Data bits: 8 stop bits: 1 or 2<br>Parity: None, Even, Odd |
| Adjustable communication parameters BACnet MS/TP | 9600 – 115,200 Baud |
| Termination | externally required (120 Ω) |

| | Compact XDMB0 |
|---|---|
| IEC protection class | III (protective extra-low voltage) |
| Protection level | IP 42 (with attached terminal cover) |
| EC conformity | EMC according to 2014/30/EU |
| Connection terminals | Cable cross-section 0.5 $mm^2$ - Max. 1.5 $mm^2$ |

# 14 Declaration of conformity

We hereby declare that the control component complies with all relevant provisions of the following EC guidelines:

- Richtlinie 2014/30/EU
- Richtlinie 2014/35/EU
- Richtlinie 2011/65/EU

The individual CE certificates can be found at *www.trox.de* .

# 15 Glossary

**Basic device**

Device for controlling volume flow rates without attached control components. The main components are the casing with sensor element(s) to measure the differential pressure and the damper blade to restrict the volume flow. The basic device is also referred to as a terminal unit or control unit. Important distinguishing features: Geometry or device shape, material and connection variants, acoustic characteristics (e.g. optional acoustic cladding or integrated silencers), range of volume flow.

**Control component**

Electronic unit(s) mounted on the basic device to control the volume flow rate, or the duct pressure, or the room pressure by adjusting the damper blade position. The electronic unit basically consists of a controller with differential pressure transducer (integrated or external) and an integrated actuator (Easy and Compact control components).

Important distinguishing features:

- Transducer: dynamic transducer for clean air or static transducer for contaminated air
- Actuator: standard actuator, slow-running
- Interface technology: analogue interface or digital bus interface for connecting and tapping signals and information

**MCE**

Management and control equipment

Central control system for building technology, usually realised by a software solution (internet or intranet-based or software installed on a local PC with its own user interface). It is operated via a user interface. The settings made are often transmitted to the components installed in the building via bus communication (Modbus or BACnet).

**$q_{vmax}$**

$q_{vmax}$ [m³/h]; [l/s]

Upper limit of the operating range of the terminal unit, to be set by the client: $q_{vmax}$ can only be set to less than or equal to $q_{vNom}$. With analogue control of volume flow controllers (typically used), the set maximum value ($q_{vmax}$) is assigned to the maximum value of the setpoint signal(10 V), see characteristic curve.

**$q_{vmin}$**

$q_{vmin}$ [m³/h]; [l/s]

Lower limit of the operating range of the terminal unit, to be set by the client: $q_{vmin}$ should only be set to less than or equal to $q_{vmax}$. Do not set $q_{vmin}$ to less than $q_{vmin}$ device, otherwise control will be unstable or damper blade will close. $q_{vmin}$ = 0 is a valid value. With analogue control of volume flow controllers (typically used), the set minimum value ($q_{vmin}$) is assigned to the minimum value of the setpoint signal(0 or 2 V), see characteristic curve.

**$q_{vmin\ device}$**

$q_{vmin\ device}$ [m³/h]; [l/s]

Technically possible minimum volume flow rate: The value depends on product type, nominal size and control component (attachment). Values are defined in the Easy Product Finder design programme. Lower limit of the setting range and minimum volume flow setpoint for the terminal unit. Setpoints below $q_{vmin\ device}$ (if $q_{vmin}$ is set to 0) lead to unstable control or shut-off, depending on the controller.

**$q_{vNom}$**

$q_{vNom}$ [m³/h]; [l/s]

Nominal volume flow (100 %): The value depends on product type, nominal size and control component (attachment). Values are published on the internet and in technical leaflets and stored in the Easy Product Finder design programme. Reference value for calculating percentage values (e. g. $q_{vmax}$). Upper limit of the setting range and maximum volume flow setpoint for the terminal unit.

**Volume flow controller**

Consists of a basic device and an attached control component.

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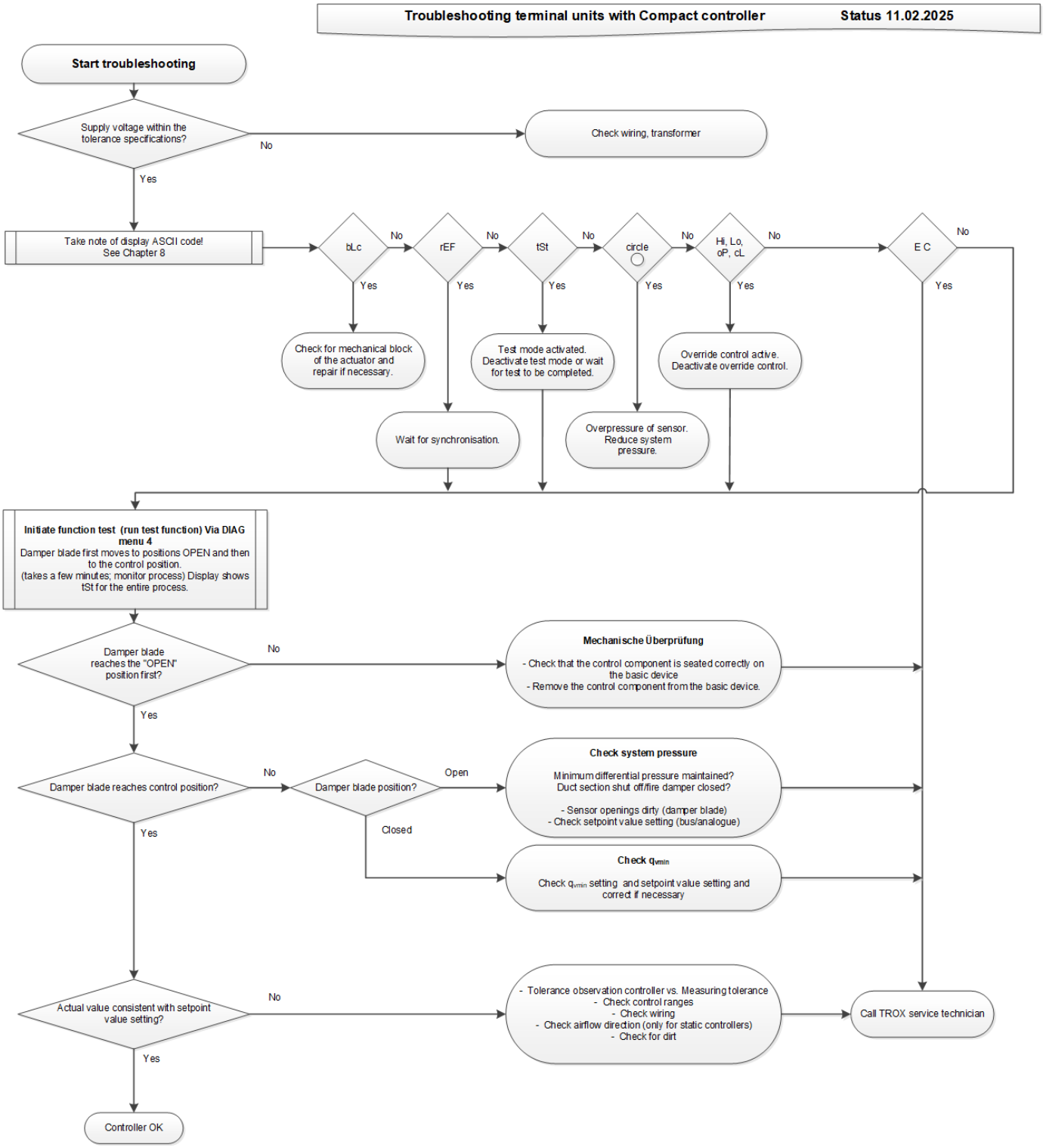
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# Appendix

# Systematic troubleshooting



**TROX SE**
Heinrich-Trox-Platz
47506 Neukirchen-Vluyn
Germany

Phone: +49 2845 202-0
+49 2845 202-265
Email: trox-de@troxgroup.com
http://www.troxtechnik.com

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