Installation and commissioning instructions GB/en

Control component BC0-Compact

for VAV terminal units

LVC • TVR • TVJ • TVT • TZ-/TA-Silenzio • TVZ • TVA • TVM

TROX® TECHNIK

The art of handling air

Read the instructions prior to performing any task!

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General information

Information about installation and commissioning instructions

These installation and commissioning instructions enable the safe and efficient handling of the *BC0-Compact* type control components and the associated VAV terminal unit. Also referred to as control component or compact controller in the following document.

The 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 the safety notes and all 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 unit design.

Other applicable documentation

In addition to these instructions, the following documents must be observed:

- Installation and commissioning instructions of the VAV terminal unit
- Product data sheets
- Project-specific wiring documents of the system planner if any

TROX Technical Service

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

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

Online	*www.troxtechnik.com*
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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 as part of instructions

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

Example:

1. Loosen the screw.
2.

> **CAUTION!**
>
> **Danger of finger entrapment when closing the lid.**

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

Specific safety notes

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

Warning signs	Type of danger
	Warning – high-voltage.
	Warning – danger zone.

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1 Safety

1.1 Correct use

The electronic control component type BC0-Compact is used in combination with a TROX air terminal unit for variable volume flow rate control in ventilation and air conditioning systems.

The Compactregler is designed for use indoors to control clean indoor air.

- Supply air area of application:
  - The usual conditioning in ventilation and air conditioning systems allows use in the supply air without additional dust protection measures.
- Extract air area of application:
  - Extract air with a low content of dust or lint (e.g., office) allows use without additional dust protection measures.
  - For dry extract air with a higher proportion of dust or lint, a suitable filter must be used in front of the VAV terminal unit.
  - For extract air with a high content of dust, lint or sticky components, or extract air with aggressive operating fluids, use a TROX controller with a static differential pressure transducer.
  - Do not use VAV terminal units in extract air systems in commercial kitchens unless the extract air has been cleaned as much as possible with high-efficiency aerosol separators; see VDI 2052.

In unspecified applications, or when combined with contaminated air (e.g., dust) and moisture, a TROX controller with static differential pressure transducer should be used.

Incorrect use

WARNING!

Danger of injury or risk of damage to property due to incorrect use!

Misuse of the control component can lead to dangerous situations.

Never use the control component/device:

- in explosion-proof areas
- in aircraft
- outdoors without sufficient protection against the effects of weather
- in humid air (even temporarily, i.e., in wet areas, such as bathrooms with showers)
- for areas of application that are not described in this manual

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

1.2 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.

1.3 Residual risks

The VAV terminal unit is state of the art and designed in accordance with 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.

1.3.1 Electric shock hazards

Electric current

DANGER!

Danger of death due to electric current!

Danger of electric shock! Do not touch any live components! Damaged insulation or damaged parts are a life threatening hazard.

- Have work on the electrical system carried out only by skilled qualified electricians.
- If the insulation is damaged, switch off the supply voltage 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 power supply.
  - 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.

1.4 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 observe 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.

1.5 Staff

Qualification

The work described in this manual has to be carried out by individuals with the qualification, training, knowledge and experience described below:

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

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

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

TROX Technical Service
Staff of TROX Technical Service or of service partner companies approved and assigned by TROX GmbH.

1.6 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.

1.7 General safety measures

NOTICE!

Risk of damage to property due to large temperature differences

If any electronic components have been kept in an unheated area, condensation may form and damage the electronic components beyond repair.

– Before you start commissioning, make sure that all devices have warmed up to the ambient temperature. Only after about 2 hours will the system have reached ambient temperature.

Foreign matter and liquids

NOTICE!

Risk of damage to property due to foreign matter and liquids!

Foreign matter and liquids that get into the unit may damage the electronic parts.

– Do not use any liquids for cleaning.
– Remove foreign matter, if any.
– If the device emits a smell or smoke, have it checked by the manufacturer.
– If liquid gets into the module, let the module completely dry before commissioning.

1.8 Repair and replacement parts

Only qualified personnel can repair the devices, and only genuine replacement parts are allowed to be used. This applies to work on the electrical equipment. Therefore, for safety reasons, have defective devices repaired by TROX Technical Service, *'TROX Technical Service' on page 3*.

2 Transport, storage and packaging

Sharp edges and sheet metal parts

CAUTION!

Danger of injury from sharp edges and sheet metal parts.

– Always wear protective gloves when handling the unit.

Damage to the VAV terminal unit

NOTICE!

Risk of damage to the VAV terminal unit!

– Handle the unit with care.
– Do not lift the VAV terminal unit by its control components, the damper blade or differential pressure sensor.
– Lift the unit only by lifting the entire casing.

2.1 Delivery check

Check delivered items immediately after arrival for transport damage and completeness. In case of any damage or an incomplete shipment, contact the shipping company and your supplier immediately.

The delivery is typically completed mounted on a VAV terminal unit.

Check the following items on delivery:

- Compactregler
  – mounted on the VAV terminal unit and fixed with anti-rotation lock
  – Measuring hoses without kinks connected to the VAV terminal unit
  – Adjustment sticker on the VAV terminal unit
- With replacement controllers:
  – Check differential or effective pressure connections for blockage and cleanliness.

2.2 Transport on site

- If possible, transport the VAV terminal unit to the installation location in the shipping container.
- Do not remove the protective wrapping until just before installation.

2.3 Bearing

If the product must be stored:

- Moisture and lack of ventilation can lead to oxidation, even on galvanised components. Remove any plastic wrapping in order to avoid oxidation.
- Protect the product from dust and contamination.
- Store the product in a dry place and away from direct sunlight.
- Do not store the product below -10 °C or above +50 °C.
- After storage and prior to installation, first allow the unit to acclimatise to the installation temperatures for at least 2 hours.

2.4 Packaging

Properly dispose of packaging material.

3 Structure and functional description

3.1 Product overview

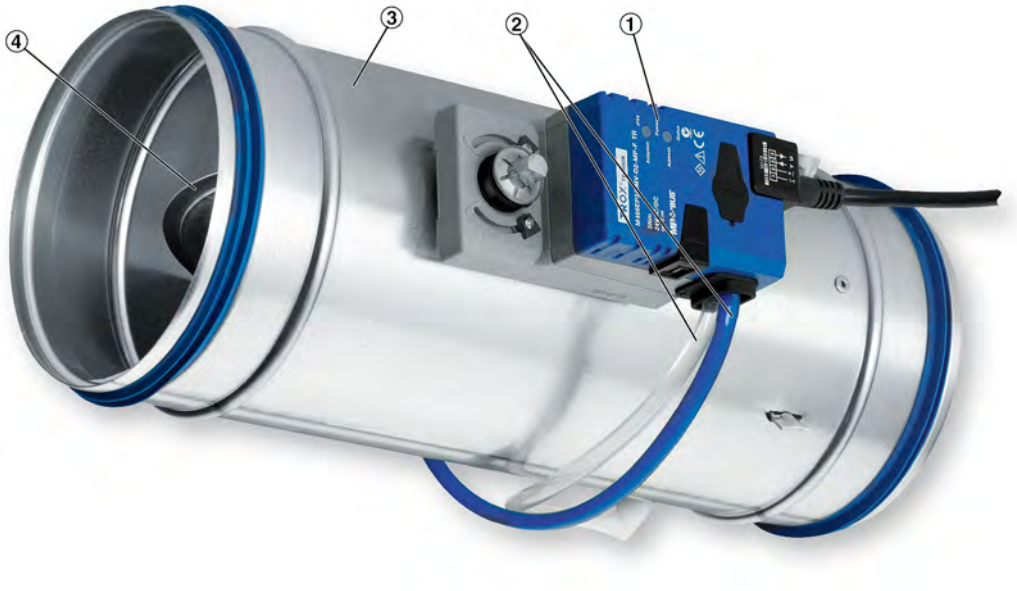

Fig. 1: BC0 Compact controller mounted on the terminal unit e.g., TVR

1 BC0 Compact controller
2 Test hoses
3 VVS basic unit
4 Damper blade

Fig. 2: BC0 Compact controller

1 Type designation
2 Gear release button
3 Tube connections differential pressure
4 Service socket
5 Connecting cable
6 NFC interface
7 Power/Test push button LED (green) function see table ↳ *11*
8 Status LED (yellow) function see table ↳ *11*
9 Rotation stop
10 Axle mounting (clamping device or positive connection)

Detection of operating states

Power LED (green)

State	Operating status
OFF	No supply voltage or fault
ON	Operation
Press key	Triggering of the rotation angle adaptation (CLOSED-OPEN)

Status LED (yellow)

State	Operating status
OFF	Normal operation
ON	Adaptation or synchronisation process active
Flashing (irregular)	MP communication active
Flashing (regular)	Request for addressing from the MP master or connected ZTH.
Press key	Triggering of the addressing

3.2 Position of the damper blade

The position of the damper blade corresponds to the mark on the shaft and is thus recognisable from the outside.

Positive lock connection

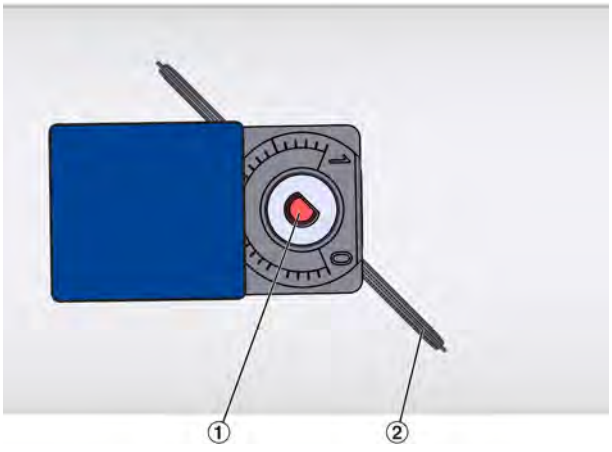

Fig. 3: Controller with lock connection

1 Shaft with marking for position indication
2 Damper blade

Clamping device (frictional connection)

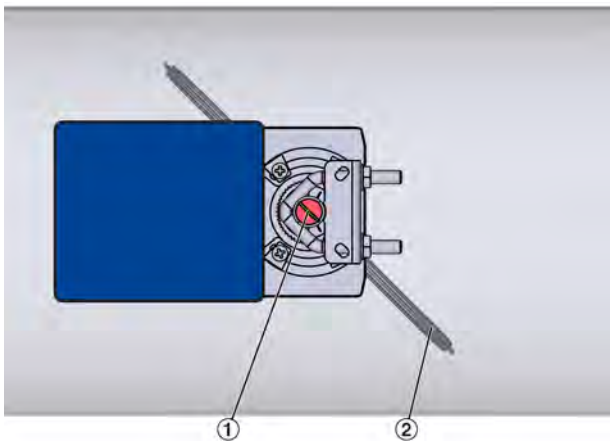

Fig. 4: Controller with clamping device

1 Shaft with marking for position indication
2 Damper blade

3.3 Function description

Basic function

The Compactregler is an electronic control component for variable volume flow control for various TROX VAV terminal units. Its functional units consist of a dynamic differential pressure transducer, the controller electronics and the actuator.

Closed control circuit

The controller operates in closed control circuit, i.e., to measure – compare – control.

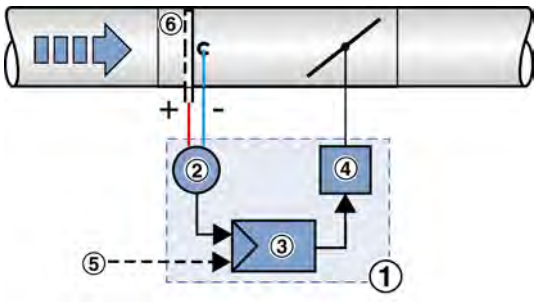

Fig. 5: Principle of operation of control components

1 Compact controller
2 Differential pressure transducer
3 Volume flow controller
4 Actuator
5 Setpoint value signal
6 Differential pressure sensor

The determination of the current volume flow rate takes place by the differential pressure sensor (6) measuring a differential pressure (effective pressure). The effective pressure is forwarded through the measuring hoses to the differential pressure transducer (2) integrated in the control component and converted here into a voltage signal.

The volume flow rate actual value is thus available to the internal control loop as well as an external use, e.g., central BMS or master-slave sequential circuit, either as analogue voltage signal 0-10 V / 2-10 V or as digital MP bus information.

The volume flow rate setpoint (5) is specified as a constant value either by an analogue voltage signal or digitally via MP bus at the setpoint value input. In regular operation, the integrated actuator (4) is controlled by permanent evaluation of the system deviation (setpoint value-actual) of the volume flow controller (3) that adjusts the damper blade of the air terminal unit via the axle mounting and thus regulates the volume flow rate to the setpoint value.

Due to the factory adjustment, the maximum output value 10 VDC always corresponds to the nominal flow rate (q_{vnom}) indicated on the adjustment sticker on the VAV terminal unit. The factory-set q_{vmin} and q_{vmax} values can also be taken from the adjustment sticker or the order code. The q_{vmin} and $q_{vmax\ value}$ can be individually adjusted at any time using the corresponding service tools.

Setpoint value control independent of the duct pressure

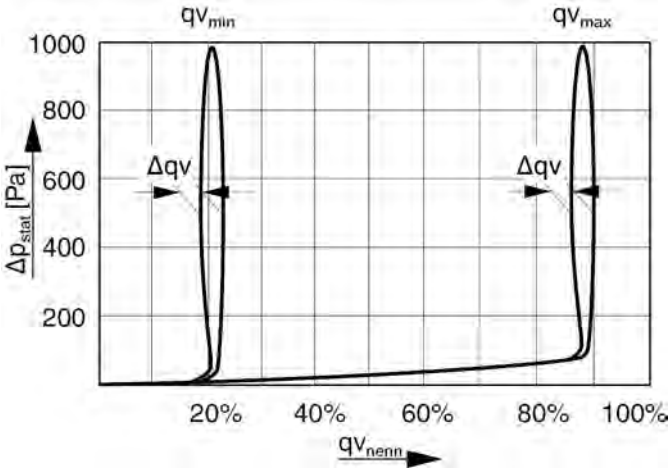

Fig. 6: Pressure independent control characteristics

The controller detects and corrects changes of the duct pressure that may occur, for example, due to volume flow rate changes from other units. The Compact controller thus operates independently of the duct pressure, and pressure fluctuations cause no lasting changes to the volume flow rate.

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

Diagnostic options

A functional test is possible by means of test push button (Fig. 1 /8) and LED indicator light (Fig. 1 /9). The LED makes it possible to distinguish between operating and fault states.

Setting the controller, *7.1 'Setting of the control component' on page 23* .

3.4 Operating modes

3.4.1 Operation with constant volume flow rate setpoint value

3.4.1.1 Operation with a fixed setpoint value

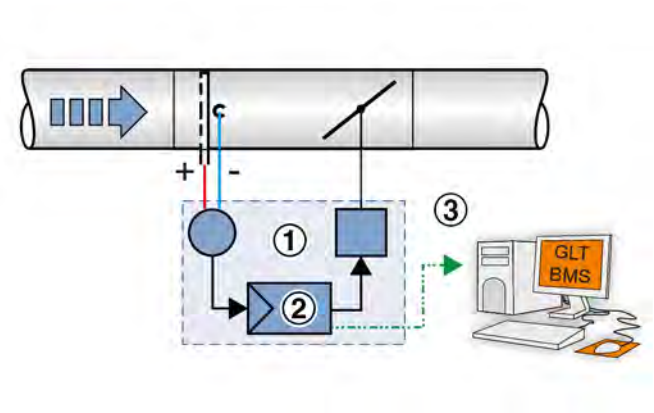

Fig. 7: Constant control

1 Compact controller
2 Factory-set volume flow rate setpoint value (q_{vmin})
3 Volume flow rate actual value as analogue voltage signal or digital via MP bus e.g., to the central BMS or slave controller

In the simplest case, the controller is operated with a constant volume flow rate setpoint value specification. The constant setpoint value (q_{vmin}) is already set by the factory presetting. Adaptation of the factory-set constant values, *7.1 'Setting of the control component' on page 23* .

The control signal at terminal Y is not allowed to be connected in this case.

3.4.1.2 Operation with two fixed setpoint values (min./max. switching)

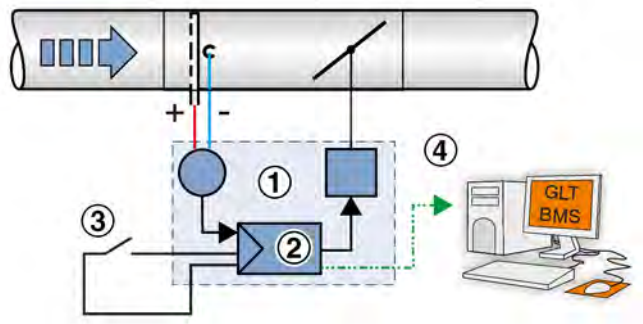

Fig. 8: Min./max. switching

1 Compact controller
2 Factory set volume flow rate setpoint values (q_{vmin} and q_{vmax})
3 Switch or relay for switching between q_{vmin} and q_{vmax}
4 Volume flow rate actual value as analogue voltage signal or digital via MP bus e.g., to the central BMS

The factory-set constant values (q_{vmin} and q_{vmax}) can be activated alternately by volt-free switch contacts. Switching is accomplished by switches or relays, e.g., day/night switching. Adaptation of the factory-set constant values with adjustment device, ↳ *7.1 'Setting of the control component' on page 23*

3.4.2 Operation with variable volume flow rate setpoint value

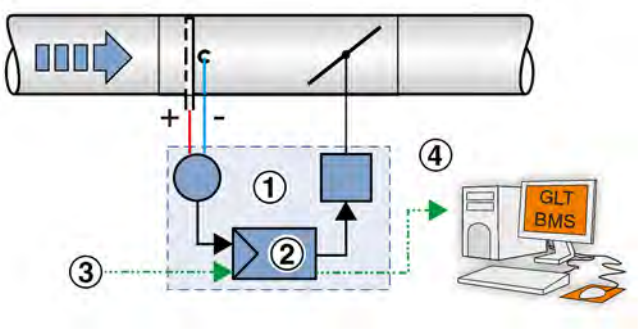

Fig. 9: Variable volume flow control

1 Compact controller
2 Factory-set volume flow rate setpoint value (q_{vmin} and q_{vmax})
3 Control signal as analogue voltage signal or digitally via MP bus as setpoint value specification e.g., from room temperature controller or DDC outstation or the like.
4 Volume flow rate actual value as analogue voltage signal or digital via MP bus e.g., to the central BMS

For the use of variable volume flow rate setpoint values, the specification of an electrical control signal must be made by a higher-level controller (e.g., room temperature controller, air quality controller, central building management system, etc.). If the input signal is changed, the controller adjusts the volume flow rate to the new setpoint. The variable volume flow rate is limited to a minimum and maximum volume flow rate value, ↳ *Chapter 3.5 'Characteristics' on page 15*. Adaptation of the factory-set constant values, ↳ *7.1 'Setting of the control component' on page 23*

3.4.3 Override control

The constant or variable control can be disabled by override controls, e.g., when the sash is open, a window switch stops ventilation of the room by closing the damper blade.

Further application examples:

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

3.4.4 Supply/extract air tracking control

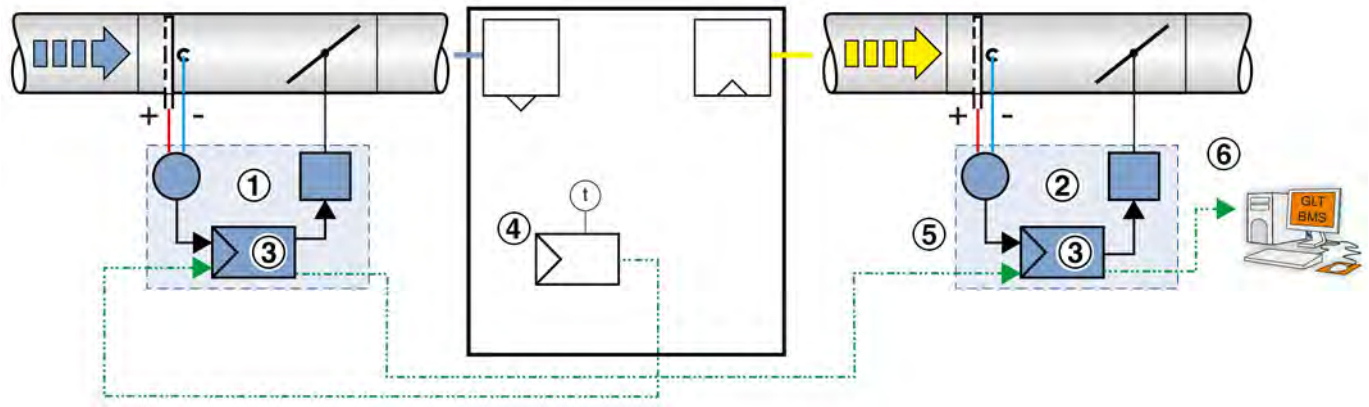

Fig. 10: Supply/extract air tracking control

1 Master controller, e.g., Compact controller
2 Slave controller, e.g., Compact controller
3 Volume flow rate limit specification (q_{vmin} and q_{vmax})
4 Room temperature controller (control signal for supply air controller)
5 Volume flow rate actual value as analogue voltage signal or digital via MP bus to the extract air controller
6 Volume flow rate actual value as analogue voltage signal or digital via MP bus e.g., to the central BMS

In individual rooms and closed-off office areas, where the balance between supply and extract air flow rate has to be maintained. Otherwise, annoying whistling noises can occur at door gaps, and the doors can be difficult to open. For this reason, the extract air should also have variable control in a VAV system.

The control signal from the room temperature controller is switched to the supply air controller in this example. The actual value signal of the supply air controller is then connected to the extract air controller (slave controller) as a setpoint value signal. The volume flow rate actual value of the supply air controller (master) is used as a reference variable for the extract air controller (slave). The connection can be made as an analogue signal or digitally via the Modbus. As a consequence, the extract air always follows the supply air.

Setting for the slave controller in the simplest case (same VAV terminal units and dimensions):

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

When using different air terminal unit types or dimensions for tracking control, special setting instructions for q_{vmin} and q_{vmax} of the slave controller must be observed due to the different nominal volume flow rates.

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 due to the technical data of the controller outputs (current) and the controller inputs (input resistances) must be observed.

3.5 Characteristics

Setpoint value signal

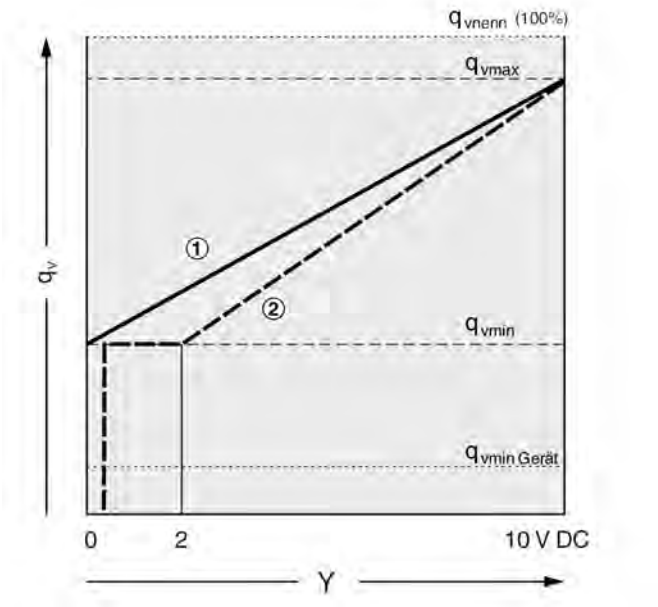

Fig. 11: Characteristic of the setpoint value signal

1 Characteristic with signal voltage range 0 – 10 VDC
2 Characteristic with signal voltage range 2 – 10 VDC
q_v Volume flow rate
Y Set value input

In order to specify a volume flow rate setpoint value to the Compactregler, a DC voltage signal in the range of 0–10 VDC or 2–10 VDC must be applied to terminal (Y).

The relationship between the volume flow rate setpoint value and the associated voltage signal can be calculated from the formula below. The setting for q_{vmin} and q_{vmax} must be considered in this case.

0 – 10 V DC

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

2 – 10 V DC

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

Sample calculations

Chapter 8.3.2 'Sample calculations' on page 29

Actual value signal

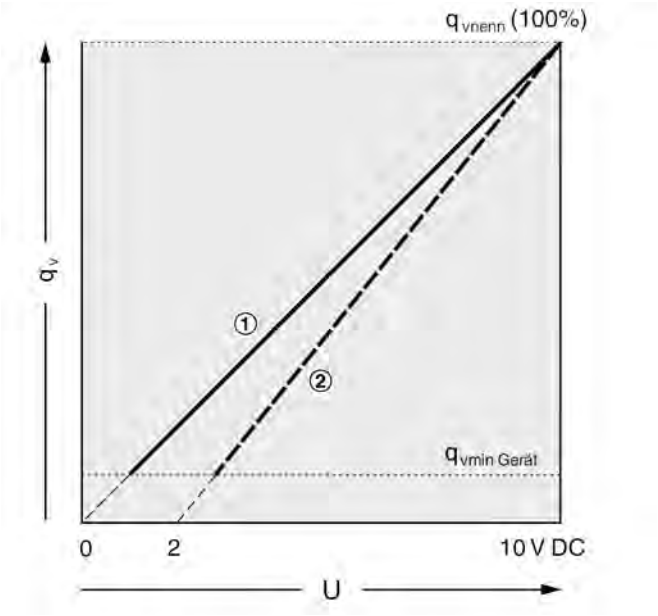

Fig. 12: Characteristic of the actual value signal

1 Characteristic with signal voltage range 0 – 10 VDC
2 Characteristic with signal voltage range 2 – 10 VDC
q_v Volume flow rate
U Actual value signal

The volume flow rate actual value can be tapped as a voltage signal at the terminal (U). The measuring range is factory-set to the size of the VAV terminal unit, so that the respectively rated nominal flow rate (q_{vnom}) always corresponds to an actual value signal of 10 VDC.

The current volume flow rate actual value 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

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

Activation of override control CLOSED via characteristic

0 – 10 V characteristic			2 – 10 V characteristic		
Setpoint value signal Y	**q_{vmin} = 0**	**q_{vmin} > 0**	**Setpoint value signal Y**	**q_{vmin} = 0**	**q_{vmin} > 0**
≤ 0.5 V	Damper CLOSED	Operation	≤ 2.4 V	Damper CLOSED	Operation
> 0.5 V	Operation	Operation	> 2.4 V	Operation	Operation

4 Installation

Personnel:

- HVAC technician

Protective equipment:

- Protective gloves
- Safety shoes
- Industrial safety helmet

Only specialist personnel are allowed to perform the described work on the VAV terminal 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 when handling the unit.

The Compactregler is delivered mounted on the VAV terminal unit, so that the work is limited to the electrical wiring ↳ *5 'Wiring' on page 18* and to the setting ↳ *7.1 'Setting of the control component' on page 23*.

When installing the VAV terminal unit, take note of the following points:

- Upstream section
- Direction of airflow
- Fixing/suspension
- Accessibility for service work

Information on this can be found in the VAV terminal unit installation and commissioning instructions.

Installation orientation

The installation orientation of the VAV terminal unit is arbitrary due to the dynamic differential pressure transducer in the Compactregler. The Compactregler can be mounted on, under or at the side of the duct.

5 Wiring

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.
– Switch off the power supply before working on any electrical equipment.

5.1 Installation instructions

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

The connection is made according to the information given on the control components or connection diagrams in this manual. These must be observed for project-specific wiring diagrams. The voltage ranges and the terminal connections specified on the control components must be observed!

Personnel:

- Skilled qualified electrician

Please note during installation:

- Legal and official regulations, in particular VDE guidelines.
- Consideration of the technical connection rules (TCR) of the local network operators.
- Wiring work for supply voltage and signal lines to be performed by others.
- The rating and manufacture of customer-side connections and wiring must be carried out in accordance with the recognised rules of electrical engineering.
- Observe wiring guidelines and project-specific circuit diagrams of the control component.
- The electrical connection to the terminal unit must only be made if the installation has been carried out correctly.
- The 24 V supply voltage must only be supplied with a safety transformer.
- If several volume flow rate controllers are connected to a 24 V network, it must be ensured that a common neutral or ground line is defined and not interchanged.
- The control component contains no parts that can be replaced or repaired by the user and must only be opened by the manufacturer.
- Lay connecting cables in such a way that they cannot be accidentally damaged by mechanical impact or by heat.

Electrical safety

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

5.2 Connection diagrams

Connecting cable

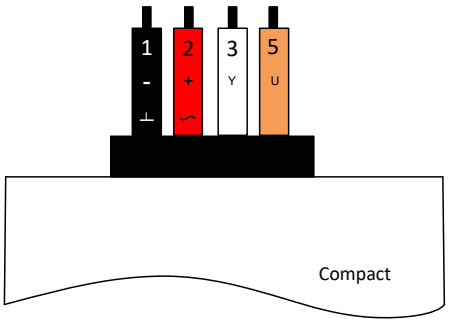

Fig. 13: Connecting cable

No.	Function	Wire colour
1	Ground, neutral	Black (BK)
2	Supply voltage 24 VAC/DC	Red (RD)
3	Setpoint value signal (Y) 0–10 or 2–10 VDC	White (WH)
5	Actual value signal (U) 0–10 VDC or 2–10 VDC or MP-BUS	Orange (OG)

Control constant volume flow rate q_{vmin}

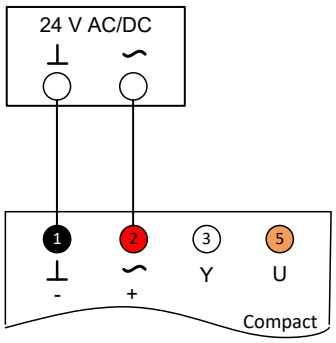

Fig. 14: Constant volume flow rate q_{vmin}

After the 24 V supply voltage is applied, the controller performs a synchronisation and then restricts the volume flow rate to q_{vmin} (factory setting). A setpoint signal is not required. The current volume flow rate actual value can be tapped at the terminal (U).

Control of constant volume flow rate q_{vmin} or q_{vmax} (switching)

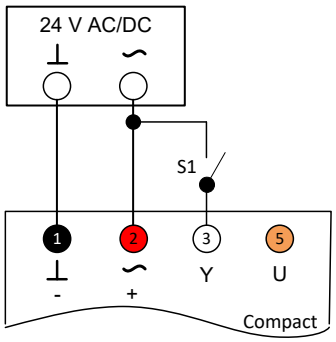

Fig. 15: Switching volume flow rate q_{vmin} / q_{vmax}

If the volume flow rate between two constant values can be switched (i.e., day/night switching), it is possible to switch over between the volume flow rate setpoint values q_{vmin} and q_{vmax} (factory setting) using an on-site volt-free switch contact.

Switch S1 open - q_{vmin}

Switch S1 closed - q_{vmax}

Control constant mode / override controls

If the volume flow rate between several constant values can be switched (e.g., day/night switching / CLOSED / OPEN), it is possible to switch between four different fixed volume flow rate setpoint values using on-site volt-free switch contacts. A service tool is required to adjust the volume flow setpoint values, *'Overview of the service tool functions' on page 23*.

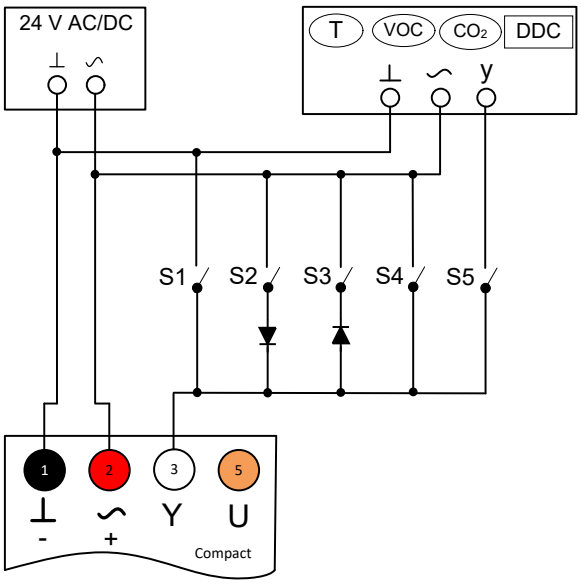

Fig. 16: Staged operation

T Temperature sensor
VOC Room air quality sensor
CO^2 Carbon dioxide sensor
DDC Building automation

The functions shown in the tables refer to the switch that is actuated in the case, more than one switch must never be actuated.

Override controls CLOSED / q_{vmin} / q_{vmax} / OPEN

Switch	0 – 10 V control input signal	2 – 10 V control input signal
S1 closed	q_{vmin}	CLOSED
S2 closed	OPEN	OPEN
S3 closed	CLOSED	CLOSED
S4 closed	q_{vmax}	q_{vmax}
S5 closed	Room temperature control	Room temperature control

Note:

- With DC supply, the functions S2 and S3 are not available.

Control of variable volume flow rate q_{vmin}…q_{vmax}

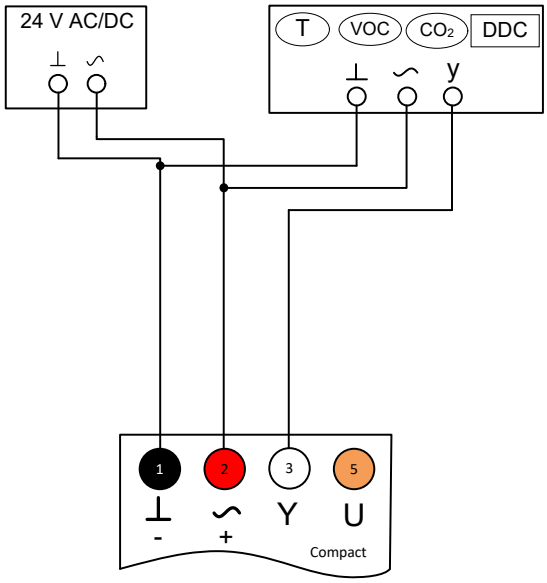

Fig. 17: Variable volume flow control

If the volume flow rate is to be specified by a higher-level controller (e.g., for room temperature, air quality or a DDC outstation), its 0 – 10 (2 – 10) VDC output must be connected by at least 2 wires (wires 1 and 3) to the wires for the control signal (Y) of the Compact controller in accordance with the connection diagram. With a common supply voltage of 24 V, note that wire 1 on the Compact controller is also ground for the control signal.

Parallel connection

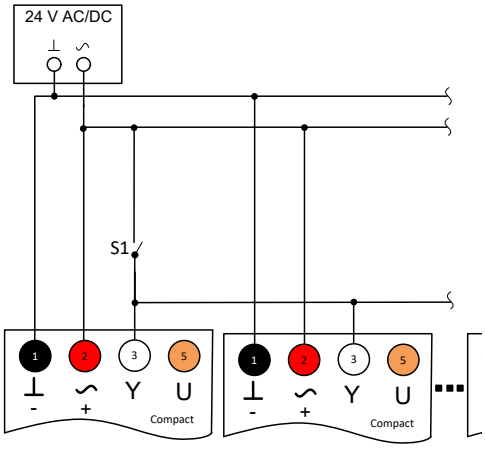

Fig. 18: Parallel connection

If several Compact controllers are to be switched simultaneously with a switch contact between q_{vmin} und q_{vmax}, the switch S1 must be designed as a changeover switch, and the contact for q_{vmin} operation must be connected to the ground (wire 1)

6 Information on the MP bus

The MP bus is a Belimo master/slave bus system. It enables simple wiring of up to eight volume flow controllers (slaves) which can be parameterised and read out centrally (e.g., switch cabinet) via an MP master. This makes it easy to check the function of up to eight volume flow controllers. The ZTH-EU and PC-Tool service tools described previously make it possible to address the slaves easily. With the MP bus, there is no restriction regarding line topology. Star, ring, tree or mixed forms are permitted.

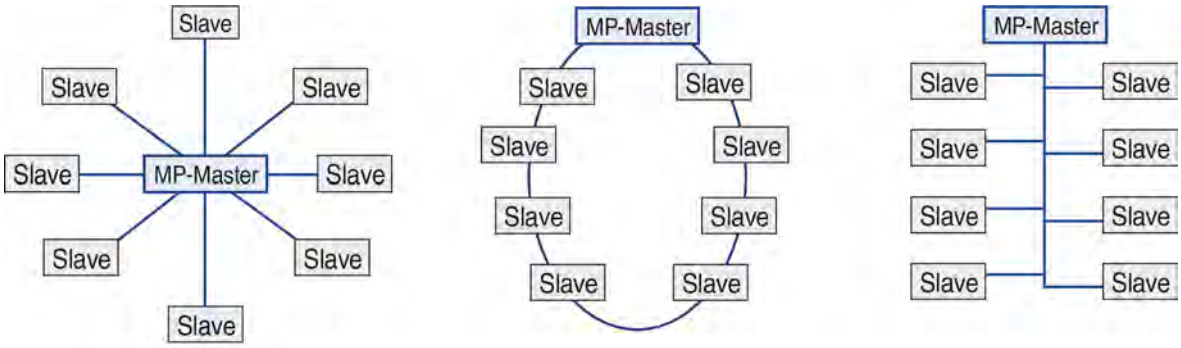

Fig. 19: MP bus line topology: star, ring and bus

In MP bus mode, one sensor (e.g., temperature) can be connected per actuator. The sensor value is recorded by the actuator and transferred in digital form to the MP bus. The scaling and evaluation of the sensor value is done centrally in the MP master. The MP bus has integrated bus failure monitoring. The behaviour of the volume flow controllers in the event of a bus failure can be specified.

Data exchange between master and slaves

Send values to the actuator:

- Setpoint value 0-100% (q_{vmin} … q_{vmax})
- Override OPEN, CLOSED, q_{vmin}, q_{vmid}, q_{vmax}
- Fault reset

Return values from the actuator:

- Relative volume flow rate in %
- Relative position in %
- Absolute volume flow rate m³/h
- Sensor value
- Fault messages[1)]
- Operating state (e.g., disengagement button pressed)
- Min/max limits

1) Mechanical overload, travel increased, Stop&Go ratio

Note: Because terminal U5 is used for MP bus operation, an analogue actual value signal is no longer available for evaluation. This means that the sequential circuit as described above is not possible in MP bus operation.

For more information on cable lengths, wiring options, bus failure monitoring and commissioning of the MP bus, see the Belimo homepage *https://www.belimo.ch* .

7 Commissioning and operation

Before initial commissioning and switch-on of the supply voltage, check the correct wiring of wires 1, 2, 3, 5.

The power LED (green) signals the correct wiring of the supply voltage after the supply voltage is switched on.

When the supply voltage is switched on, the Compact controller performs a synchronisation, moving the damper blade once to the CLOSED position and then back to the OPEN position. This can take up to three minutes, the condition is indicated on the indicator lights. (Status LED lights yellow, ↳ *11*).

7.1 Setting of the control component

7.1.1 Control ranges of VAV terminal units

The usable control range in relation to the nominal flow rate (V_{nom}) of the type and the dimensions are shown in the following table.

Type of VAV terminal units	Volume flow rate range	BC0 Compact controller types	Usable control range
LVC	low airflow velocity and low duct pressure	▪ LMV-D3L-MP-F	10 – 100%
TVR	various applications in the standard volume flow rate range	▪ LMV-D3-MP-F	10 – 100%
TVJ	normal to high volume flow rate ranges	▪ NMV-D3-MP	20 – 100%
TVT	normal to high volume flow rate ranges with air-tight shut-off	▪ NMV-D3-MP	20 – 100%
TZ-SILENZIO	high acoustic requirements at low airflow velocity in the supply air area	▪ LMV-D3-MP	10 – 100%
TA-SILENZIO	high acoustic requirements at low airflow velocity in the extract air area	▪ LMV-D3-MP	10 – 100%
TVZ	high acoustic requirements in the supply air area	▪ LMV-D3-MP	10 – 100%
TVA	high acoustic requirements in the extract air area	▪ LMV-D3-MP	10 – 100%
TVM	VAV dual duct terminal units for dual duct systems with demanding acoustic requirements	▪ LMV-D3-MP	30 – 100%

Functional test and commissioning with service tool

Overview of the service tool functions

Functions	Adjustment device ZTH	Smartphone app	PC-Tool
Display of actual values in real time:	✔	✔	✔
Display of setpoint values, actual values, damper blade position	✔	✔	✔
Changes of q_{vmin}, q_{vmid}, q_{vmax}	✔	✔	✔
Setting mode (0…10 V, 2…10 V)	✔	✔	✔
Record run times (operating time, run time, ratio)	✖	✖	✔
Simulations (damper CLOSED/OPEN, q_{vmin}, q_{vmid}, q_{vmax}, motor stop)	✔	✖	✔
Settings of the CAV functions	✖	✖	✔
Actual control signal Y [q_v]	✔	✔	✔
Actual feedback U [q_v]	✔	✔	✔
Assign bus address	✔	✔	✔
Define position on bus failure (last setpoint value: damper CLOSED/OPEN, q_{vmin}, q_{vmax})	✖	✖	✔

Adjustment device ZTH-EU

Momentary values can be read, and operating parameters can be changed using the ZTH-EU adjustment device. The ZTH-EU is connected to the service sleeve on the controller using the cable (Fig. 20 /1) included in the supply package. Various functions are available after the adjustment device is started.

Fig. 20: Connection of ZTH to controller

Push button	Function
↑ / ↓	■ Next/previous ■ Change value/status
OK	■ Confirm entry ■ Show submenu
ESC	■ Cancel ■ Back ■ Discard changes
i	■ Show additional information (if available)

ZTH menu structure

Appendix A 'ZTH menu structure' on page 38

For more information, see www.Belimo.ch

Setting with smartphone

An NFC chip is fitted in TROX volume flow controllers which have the NFC logo. NFC or Bluetooth-enabled smartphones can be connected to the controller using the TROX app. TROX app: -> Apple Store or Google Play Store.

NFC-enabled smartphone (not iPhone)

After the TROX app is started, place the smartphone on the NFC symbol of the controller. After successful connection to the controller, the momentary values can be read out or parameters can be set.

Note: A direct NFC connection is not possible with an NFC-enabled smartphone with the IOS operating system (e.g., iPhone). In this case, a Bluetooth adapter must be used, Fig. 22

Fig. 21: Connection with NFC-enabled smartphone

Bluetooth-enabled mobile phone

An additional NFC Bluetooth converter (ZIP-BT-NFC) is required to connect the TROX app to a Bluetooth-enabled smartphone. The converter is placed on the volume flow controller. To do this, the NFC symbol of the Compact controller must be visible through the circular aperture (Fig. 22 /1) on the converter. After the converter is switched on and successfully connected to the volume flow controller, the converter lights up green. Following that, a Bluetooth connection to the controller can be established using the TROX app.

Fig. 22: Bluetooth adapter

Setting with PC-Tool

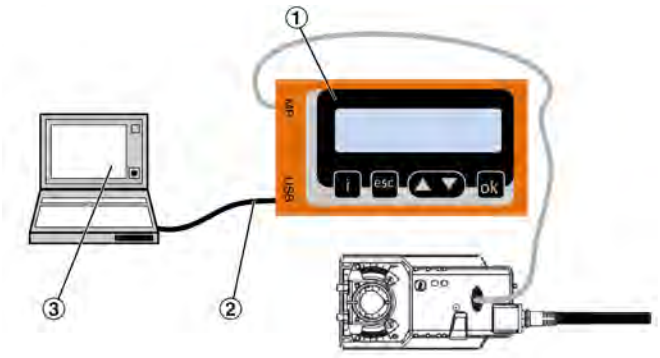

Fig. 23: Connection of PC to controller with ZTH-EU

The *'PC-Tool'* software makes it possible to read momentary values, set parameters and create time diagrams. Software download and documentation: www.belimo.ch

For the connection to the controller, the PC (Fig. 23 /3) is connected to the ZTH-EU (Fig. 23 /1) using a USB cable (Fig. 23 /2). The ZTH-EU is then connected to the controller as in Fig. 20 .

7.1.2 Factory settings

If the volume flow controller is ordered for variable volume flow control (V0, V2), it is pre-parameterised at the factory and delivered with the values for q_{vmin} and q_{vmax} specified in the purchase order (Fig. 24 /7).
If the volume flow controller is ordered for constant volume flow control (F0, F2), it is pre-parameterised at the factory and delivered with the value for $q_{vconst} = q_{vmin}$ specified in the purchase order. If ordered as a constant volume flow controller, q_{vmax} is factory-set to q_{vnom}. The control mode (V0) or (F0, F2) can be found on the adjustment sticker on the terminal unit. (Fig. 24 /5).

During commissioning, the settings can be adjusted according to the requirements with a service tool, ↯ *7.1 'Setting of the control component' on page 23* .

Adjustment sticker

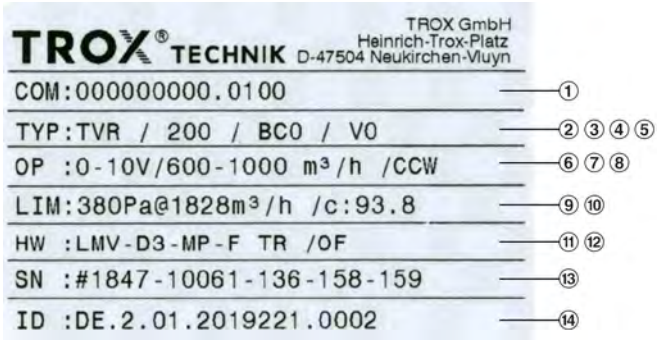

Fig. 24: Adjustment sticker

① Order number. ser. no.
② Terminal unit type
③ Nominal size
④ Control component
⑤ Operating mode
F ⇨ constant value
V ⇨ variable
0 or 2 ⇨ characteristic type
⑥ Characteristic 0 – 10 V or 2 – 10 V
⑦ Volume flow rate ranges q_{vmin}-q_{vmax} or constant value
⑧ Direction of rotation
CW ⇨ clockwise
CCW ⇨ counterclockwise
⑨ ΔP @ Vnom (effective pressure at nominal flow rate)
⑩ K value
⑪ Hardware type designation
⑫ Control components:
OF ⇨ factory-equipped
SP ⇨ replacement part
⑬ Serial number
⑭ Test ID number

7.1.3 Setting constant volume flow control

If the factory-set value q_{vconst} should be adapted or an ordered variable air volume controller is to be converted into a constant volume flow controller, the constant set-point is set at q_{vmin}. This is because $q_{vmin} = q_{vconst}$ with constant control. In this case, the q_{vmax} value is irrelevant, and no additional setting is required. For constant volume flow control, no control signal Y can be specified on wire 3, Fig. 14 .

7.1.4 Setting variable volume flow control

If the factory-set values for q_{vmin} and q_{vmax} should be subsequently adjusted, this is done using the service tools described. q_{vmin} and q_{vmax} is the variable, limited volume flow rate operating range that is controlled via the control signal at terminal Y.

The following points should be noted for the control input signal:

- Usable control range of the VAV terminal unit ↯ *Chapter 7.1.1 'Control ranges of VAV terminal units' on page 23*
- The q_{vmin} and q_{vmax} settings define the working range of the controller that can be controlled by input signal ↯ *Chapter 3.5 'Characteristics' on page 15* .
- In order to achieve a higher resolution of the assignment of voltage signals to the volume flow rate set-point values, the operating range can be restricted by q_{vmin} and q_{vmax}.

7.1.4.1 Setting the entire control range for the control input signal of the central building management system

If the volume flow rate should be specified by the central BMS over the entire control range, q_{vmin} must be set to 0 m³/h and q_{vmax} must be set to q_{vnom}.

The following points should be noted for the control input signal:

- The usable control range must be observed depending on the terminal unit type *Chapter 7.1.1 'Control ranges of VAV terminal units' on page 23*.
  For example, with a signal voltage range of 0-10 VDC and settings of q_{vmin} = 0 m³/h and q_{vmax} = q_{vnom}, the control range is only reached from a control signal of between 1 V and 3 V DC.
- If the control signal falls below 0.5 VDC with a control input signal of 0-10 V and if q_{vmin} = 0 is set, the damper blade moves to the shut-off position.

! NOTICE!

Safe shut-off

Compliance with a control signal ≤ 0.5 VDC is not always given due to interference voltages on the supply lines. Therefore, the positive circuit should always be preferred for a safe shut-off, *'Control constant mode / override controls' on page 19*

7.2 Functional test

Personnel:

- Skilled qualified electrician
- HVAC technician

For commissioning, we recommend creating commissioning documentation in which the function of the terminal unit is checked and documented.

7.2.1 with service tool

The functional test of the terminal unit with a service tool offers many functions and a quick and easy overview of the actual values, *7.1 'Setting of the control component' on page 23*.

To check the function of the VAV terminal unit, check the position of the damper blade on the damper blade shaft (marked), *3.2 'Position of the damper blade' on page 11*.

Preparation:

- Switch on the power supply.
- Switch on ventilation and air conditioning system.
  Note: For a proper functional test of the controller, the system pressure at the volume flow controller must be sufficient.

1. Press adaptation key (green LED).
   ⇨ Test function is started (yellow LED lights).
   - Actuator moves the damper blade to the CLOSED position.
   - Actuator moves the damper blade to the OPEN position.
   - Actuator moves the damper blade back to the control position.
2. Override control q_{vmin} on the master controller, *Chapter 5.2 'Connection diagrams' on page 18*.
   ⇨ Logging actual value signal U and volume flow rate actual value
3. Override control q_{vmax} on the master controller, *Chapter 5.2 'Connection diagrams' on page 18*.
   ⇨ Logging actual value signal U and volume flow rate actual value

7.2.2 with voltmeter

To check the function of the VAV terminal unit, check the position of the damper blade on the damper blade shaft (marked), *3.2 'Position of the damper blade' on page 11*.

Preparation:

- Switch on the power supply.
- Switch on ventilation and air conditioning system.
  Note: For a proper functional test of the controller, the system pressure at the volume flow controller must be sufficient.

1. Press adaptation key (green LED).
   ⇨ Test function is started (yellow LED lights).
   - Actuator moves the damper blade to the CLOSED position.
   - Actuator moves the damper blade to the OPEN position.
   - Actuator moves the damper blade back to the control position.
2. Override control q_{vmin} on the master controller, *Chapter 5.2 'Connection diagrams' on page 18*.
   ⇨ Logging actual value signal U
3. Override control q_{vmax} on the master controller, *Chapter 5.2 'Connection diagrams' on page 18*.
   ⇨ Logging actual value signal U

The volume flow rate actual value can alternatively be checked with the service tool.

7.3 Switching the direction of rotation

Personnel:

- TROX Technical Service

Attention: only for service personnel – release by untrained personnel endangers the control function!

With volume flow rate deviations, an incorrect effect of direction of action (direction of rotation) of the controller could be the cause.

Test:

1. ▸ For testing, disconnect the setpoint value signal at terminal (Y) and set the q_{vmin} to 0 m³/h, e.g., with the ZTH-EU service tool.

   ⇨ If the actuator then moves the damper blade to the OPEN position, the direction of rotation is set incorrectly.

Reversing the direction of rotation

2. ▸ Switch direction of rotation, e.g., with the ZTH-EU service tool:

   CW - Clockwise

   CCW - Counterclockwise

   ⇨ The actuator then performs a synchronisation and then returns to normal operation.

8 Troubleshooting

TROX air terminal units and control components are tested technically before delivery. The factory-set operating parameters are documented on the adjustment sticker and must be checked during commissioning *'Adjustment sticker' on page 25*.

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

If a fault cannot be remedied on its own, TROX Service will be happy to assist you with troubleshooting, simply contact *'TROX Technical Service' on page 3*

For this, the following information is needed:

- Order number and item or serial number (see order code)
- Type and nominal size of VAV terminal unit (see adjustment sticker):
- q_{vmin} / q_{vmax} settings
- Control input signal

8.1 Common mistakes

8.1.1 Volume flow rate deviation due to unfavourable installation situation

If the desired volume flow rate value is not adhered to precisely enough, which is the most frequent cause of error, this creates an unfavourable installation situation of the VAV terminal unit.

If the straight inflow length upstream of the air terminal unit is too short, the airflow becomes turbulent, and the measurement of the volume flow rate becomes inaccurate. This is especially true when installing behind sharp edged bridges, fittings or junctions. The necessary straight inflow lengths are specified in the installation and commissioning instructions of the VAV terminal unit.

8.1.2 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 *8.3.1 'Use of voltmeters to control setpoint values and feedback signals' on page 29*.

   ⇨ 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.

8.1.3 System pressure too low

The aim of the volume flow control is to regulate the volume flow rate actual value to the specified setpoint value. However, this requires a sufficient fan output so that the terminal unit can regulate (restrict) the desired volume flow rate setpoint value. If the required minimum differential pressure is not reached due to an inadequate fan output, the setpoint value 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 value. This can be detected on the damper blade shaft of the VAV terminal unit *3.2 'Position of the damper blade' on page 11*.

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 value.

Remedy:

- Check fan output,
- Check if the duct section is blocked, e.g., fire damper closed
- *B 'Systematic troubleshooting' on page 39*

8.1.4 Use outside the control area

The setpoint values cannot be achieved if the control range of the specific unit is exited with the q_{vmin} / q_{vmax} setting. The actual value reached by the controller is undefined.

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

Additional information:

- *Chapter 7.1.1 'Control ranges of VAV terminal units' on page 23*
- *3.5 'Characteristics' on page 15*

8.1.5 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.

8.2 Systematic troubleshooting

In case of malfunctions of the VAV terminal unit, we recommend systematic troubleshooting based on our flow chart, ↳ *B 'Systematic troubleshooting' on page 39*.

8.3 Further diagnostic options

8.3.1 Use of voltmeters to control setpoint values and feedback signals

With a voltmeter, both the setpoint signal Y (wire 3 against wire 1) and the actual value signal U (wire 5 against wire 1) can be measured electrically. Using the following formulas, the associated setpoint value and actual value volume flow rates can be calculated and thus 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 value voltage and actual voltage may well be different, even if they are correctly regulated, ↳ *8.1.5 'Deviation between setpoint value and actual value signal' on page 29*.

8.3.2 Sample calculations

Example 1: TVR / 200 / BC0

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

Terminal unit nominal flow rate q_{vnom}	-	1828 m³/h
Set q_{vmin}	-	600 m³/h
Set q_{vmax}	-	1000 m³/h
Characteristic 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

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

Δq = 1 – (929.6 m³/h / 987.12 m³/h) × 100

$\Delta q \approx 6\%$

Example 2: TVR / 400 / BC0

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

Terminal unit nominal flow rate q_{vnom}	-	7591 m³/h
Set q_{vmin}	-	1500 m³/h
Set q_{vmax}	-	6200 m³/h
Characteristic setting	-	0 – 10 V
Desired volume flow rate q_{vset}	-	3500 m³/h

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

Calculation solution:

Y = 3500 m³/h – 1500 m³/h / (6200 m³/h – 1500 m³/h / 10 V)

Y = 4.25 V

Example 3: LVC / 250 / BC0

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

Terminal unit nominal flow rate q_{vnom}	-	1080 m³/h
Set q_{vmin}	-	250 m³/h
Set q_{vmax}	-	800 m³/h
Characteristic 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

8.3.3 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 replacement parts. Additional details such as the order number make it easier to identify the delivery status of the VAV terminal unit.

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

9 Disposal

Have the VAV terminal unit with control component disposed of by an authorised company following its final decommissioning. The device contains electrical and electronic components and must not be disposed of as domestic waste. When disposed of, local up to date regulations must be complied with.

10 Technical data

General operating conditions of the control components

Ambient temperature	10-50 °C
Ambient humidity	5-90% rh

VAV terminal units	Type	Part number
LVC	LMV-D3L-MP-F	A00000043143
TVR	LMV-D3-MP-F	A00000043141
TVJ, TVT	NMV-D3-MP	A00000043142
TZ-Silenzio, TA-Silenzio, TVZ, TVA	LMV-D3-MP	A00000043140
TVM	2 × LMV-D3-MP	A00000043140

Compact controller LMV-D3L-MP-F		
	Supply voltage ~	24 VAC ± 20%, 50/60 Hz
	Supply voltage ⎓	24 VDC -10/+20%
	Power rating ~	3.5 VA max.
	Power rating ⎓	Max. 2 W
	Torque	5 Nm
	Run time for 90°	120 – 150 s
	Setpoint value signal input	0 – 10 or 2 – 10 VDC, Ra > 100 kΩ
	Actual value signal output	0 – 10 or 2 – 10 VDC, max. 0.5 mA
	IEC protection class	III (protective extra-low voltage)
	Protection level	IP 54
	EC conformity	EMC to 2014/30/EU

Compact controllers LMV-D3-MP and LMV-D3-MP-F		
	Supply voltage ~	24 VAC ± 20%, 50/60 Hz
	Supply voltage ⎓	24 VDC -10/+20%
	Power rating ~	4 VA max.
	Power rating ⎓	Max. 2 W
	Torque	5 Nm
	Run time for 90°	110 – 150 s
	Setpoint value signal input	0 – 10 or 2 – 10 VDC, Ra > 100 kΩ
	Actual value signal output	0 – 10 or 2 – 10 VDC, max. 0.5 mA
	IEC protection class	III (protective extra-low voltage)
	Protection level	IP 54
	EC conformity	EMC to 2014/30/EU

Compact controller NMV-D3-MP		
	Supply voltage ~	24 VAC ± 20%, 50/60 Hz
	Supply voltage ⎓	24 VDC -10/+20%
	Power rating ~	5.5 VA max.
	Power rating ⎓	Max. 3 W
	Torque	10 Nm
	Run time for 90°	110 – 150 s
	Setpoint value signal input	0 – 10 or 2 – 10 VDC, Ra > 100 kΩ
	Actual value signal output	0 – 10 or 2 – 10 VDC, max. 0.5 mA
	IEC protection class	III (protective extra-low voltage)
	Protection level	IP 54
	EC conformity	EMC to 2014/30/EU

11 Declaration of conformity

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

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

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

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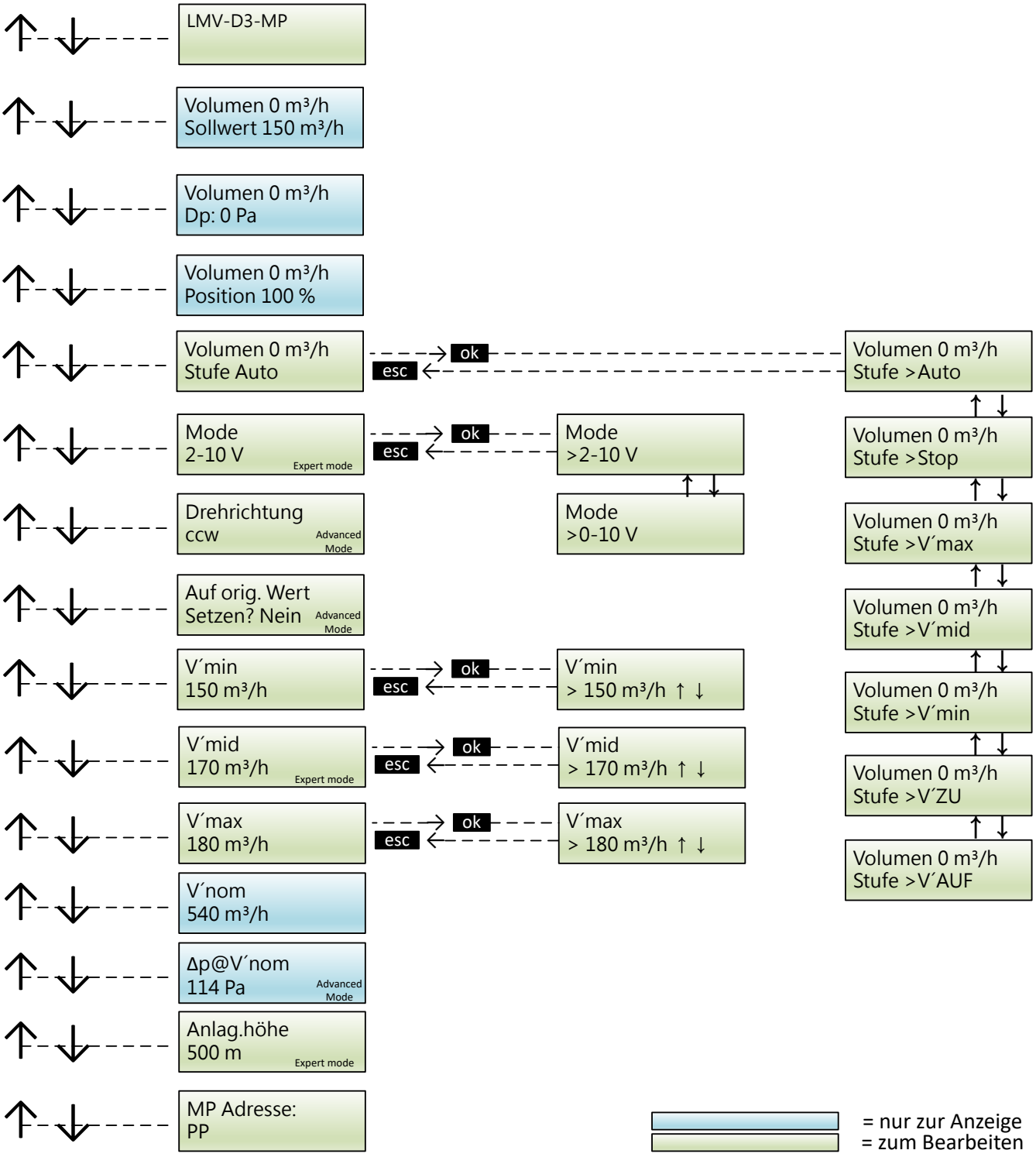
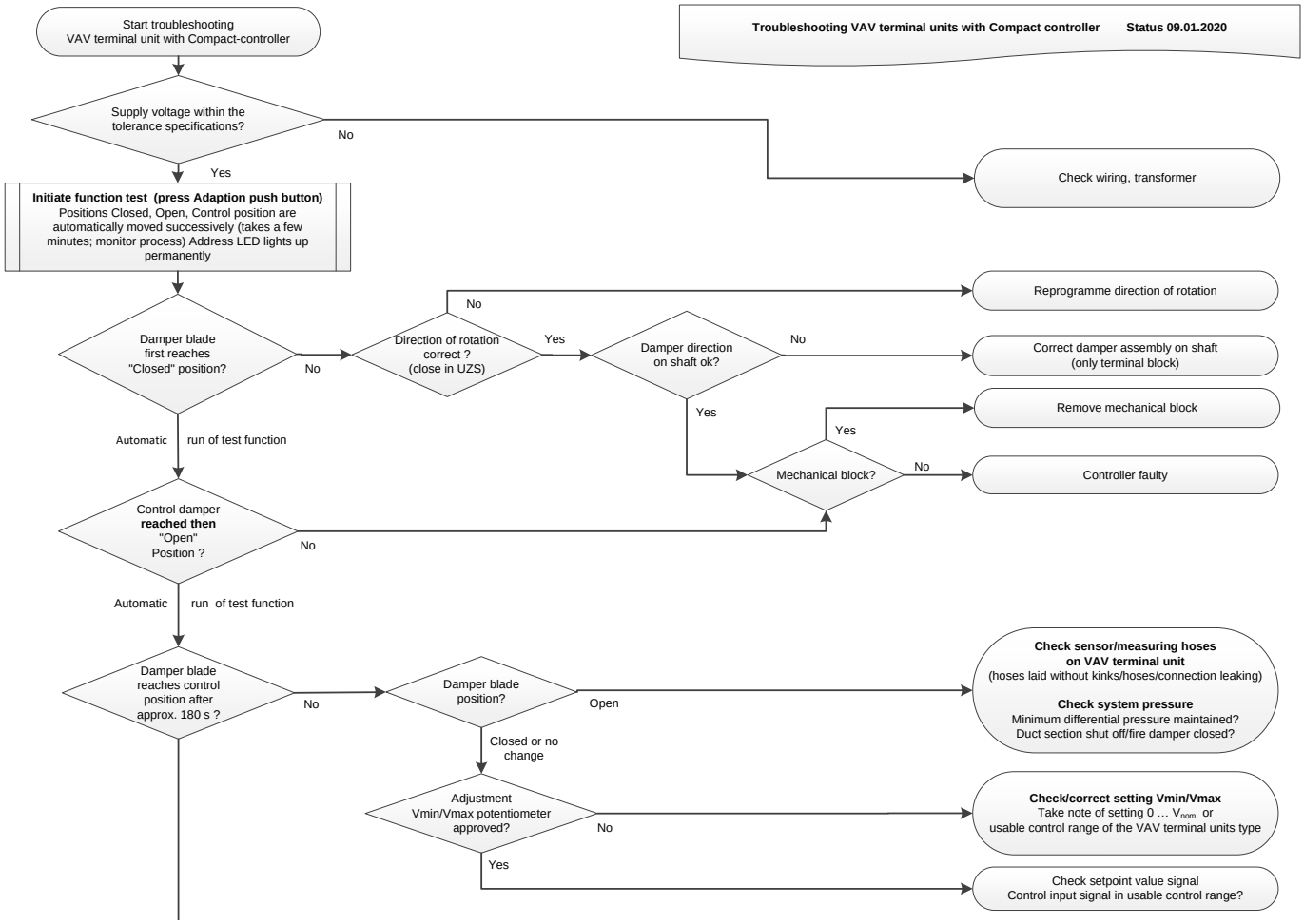
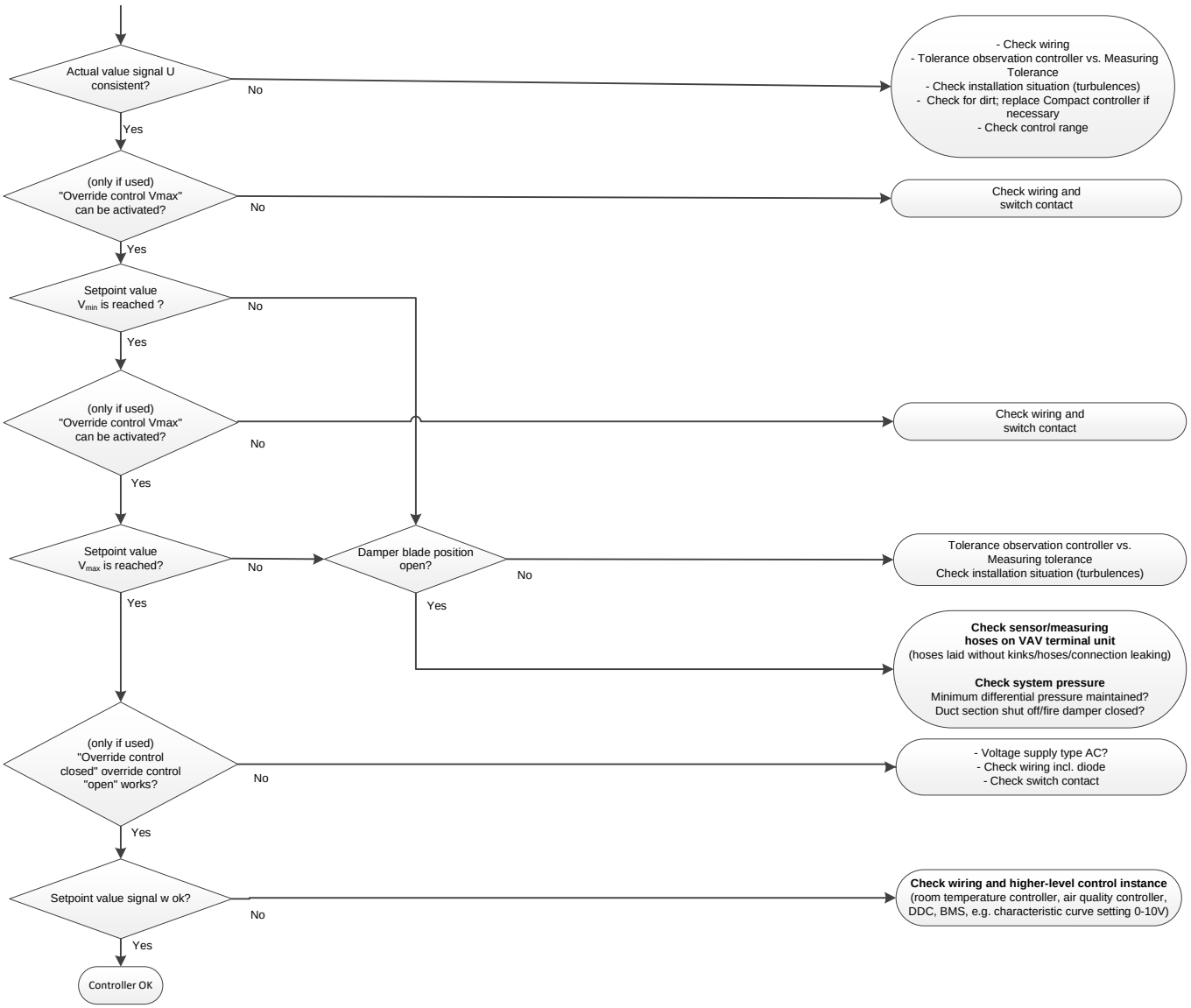
Appendix

A ZTH menu structure



B Systematic troubleshooting




Actual value signal U consistent?
No
- Check wiring
- Tolerance observation controller vs. Measuring Tolerance
- Check installation situation (turbulences)
- Check for dirt; replace Compact controller if necessary
- Check control range
Yes
(only if used) "Override control Vmax" can be activated?
No
Check wiring and switch contact
Yes
Setpoint value V_{min} is reached ?
No
Yes
(only if used) "Override control Vmax" can be activated?
No
Check wiring and switch contact
Yes
Setpoint value V_{max} is reached?
No
Damper blade position open?
No
Tolerance observation controller vs. Measuring tolerance
Check installation situation (turbulences)
Yes
Yes
Check sensor/measuring hoses on VAV terminal unit
(hoses laid without kinks/hoses/connection leaking)
Check system pressure
Minimum differential pressure maintained?
Duct section shut off/fire damper closed?
(only if used) "Override control closed" override control "open" works?
No
- Voltage supply type AC?
- Check wiring incl. diode
- Check switch contact
Yes
Setpoint value signal w ok?
No
Check wiring and higher-level control instance
(room temperature controller, air quality controller, DDC, BMS, e.g. characteristic curve setting 0-10V)
Yes
Controller OK

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The art of handling air

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