

Control component

XB0



XB0 for TVE



XB0 for TVR, TVJ, TVT,
TZ-Silenzio, TA-Silenzio,
TVZ, TVA, TVM



Control components for VAV terminal unit with dynamic transducer

Compact device for use with VAV terminal units

- Controller, dynamic differential pressure transducer and actuator in one casing
- Use in ventilation and air conditioning systems, only with clean air
- Suitable for constant and variable volume flow rates
- Activation of override controls via external switch contacts
- Volume flow rates q_{vmin} and q_{vmax} are set in the factory and saved in the controller
- Change of operating parameters using adjustment devices
- Service access for manual adjustment devices and PC configuration software
- Simple terminal connection without the use of additional junction boxes (for type TVE)

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General information

Application

- All-in-one control devices for VAV terminal units
- Dynamic effective pressure transducer, electronic controller and actuator are fitted together in one casing
- For use with clean air only
- Standard filtration in comfort conditioning systems allows for use of the controller in the supply air without additional dust protection
- Choice of various control options based on setpoint value default setting
- Volume flow rate control is based on setpoint values received from room temperature controller, central BMS, air quality controller or other devices as an analogue signal.
- Override control for activating q_{vmin} , q_{vmax} , shut-off or OPEN position can be set with a switch or relay
- The volume flow rate actual value is available as a linear voltage signal
- Standard filtration in comfort conditioning systems allows for use of the controller in the supply air without additional dust protection

With heavy dust levels in the room

- Install suitable extract air filters upstream, as a partial volume flow is routed through the transducer for volume flow rate measurement

If the air is contaminated with fluff, sticky components or aggressive substances

- Use Compact controller XS0 or XD0 with static effective pressure transducer instead of the Compact controller XB0 described here
- XS0 (for TVE)
- XD0 (for TVR, TVJ, TVT, TZ-Silenzio, TA-Silenzio, TVZ, TVA, TVRK)

Control strategy

- The volume flow controller works dependently of the duct pressure
- Differential pressure fluctuations do not result in permanent volume flow rate changes
- To prevent the control from becoming unstable, a dead band is allowed within which the damper blade does not move
- Flow rate range in the controller set in the factory
 - q_{vmin} : Minimum volume flow rate
 - q_{vmax} : Maximum volume flow rate
- Operating parameters are specified via the order code and set in the factory

Operating modes

- Variable or constant value

Variable operation (V)

- Setpoint value default setting via analogue interface
- Signal voltage range corresponds to q_{vmin} to q_{vmax}

Constant value mode (F)

- A setpoint signal is not required, setpoint value corresponds to q_{vmin}

Interface

Analogue interface with adjustable signal voltage range

- Analogue signal for volume flow rate setpoint value
- Analogue signal for volume flow rate actual value (factory setting), alternatively: analogue signal for damper blade position (adjustment by others required)

Signal voltage ranges

- 0 – 10 V DC
- 2 – 10 V DC

Parts and characteristics

- Transducer for dynamic measurements
- Actuators with overload protection
- Release button to allow for manual operation (only 227V-024-10-DD3)
- Connecting cable with 4 wires, approx. 0.9 m, halogen-free (only 227V-024-10-DD3)
- Terminals with cover (only TR0V-024T-05I-DD15)
- Service interface

Construction

- Type 227V-024-10-DD3 for TVR
- Type 227V-024-10-DD3 for TVJ
- Type 227V-024-10-DD3 for TVT up to 1000x300 or 800x400
- Type 227V-024-10-DD3 for TZ-Silenzio, TA-Silenzio
- Type 227V-024-10-DD3 for TVZ, TVA
- Type 227V-024-10-DD3 for TVM
- Type TR0V-024T-05I-DD15 for TVE

Commissioning

- Due to the volume flow rates set at the factory, always ensure that the terminal units are only installed at the specified locations
- After successful installation and wiring, the controller is ready for use
- Operating parameters can be adjusted by the customer (via the adjustment device)

Useful additions

- Adjustment device GUIV-A (order code AT-VAV-G) for 227V-024-10-DD3
- Adjustment device GUIV3-M (order code AT-VAV-G3) for TR0V-024T-05I-DD15

Function

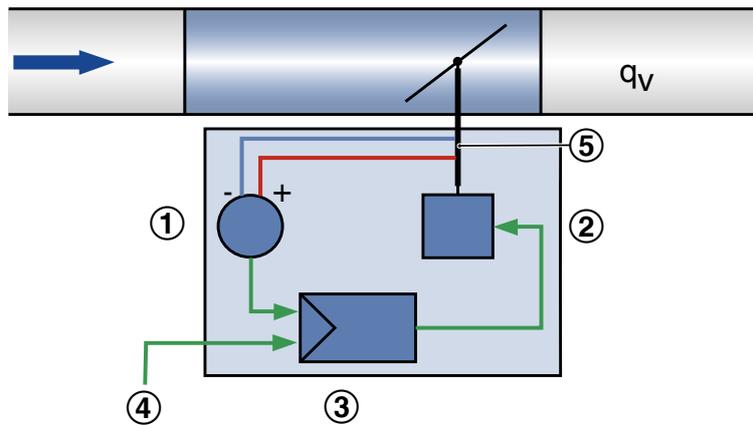
A closed control circuit for regulation of the volume flow rate, i.e. measuring - comparing - adjusting, is characteristic of air terminal units.

The volume flow rate is measured via the differential pressure (effective pressure). This is done via a differential pressure sensor. An integrated differential pressure transducer converts the effective pressure into a voltage signal. The volume flow rate actual value is available as a voltage signal. The factory setting is such that 10 V DC always corresponds to the nominal volume

flow rate (q_{vNom}).

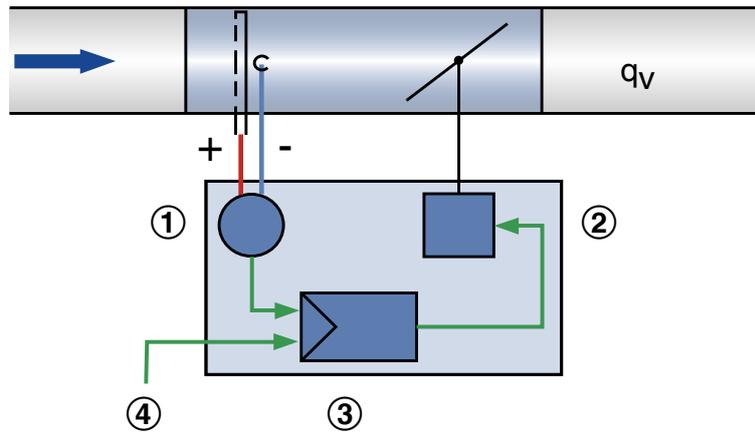
The volume flow rate setpoint value is specified by a higher-level controller (e.g. room temperature controller, air quality controller, central BMS). Variable volume flow control results in a value between q_{vmin} and q_{vmax} . It is possible to override the room temperature control, e.g. by a complete shut-off of the duct. The controller compares the volume flow rate setpoint value to the actual value and controls the integral actuator according to the system deviation.

Principle of operation – TR0V-024T-05I-DD15 (type TVE)



- ① Effective pressure transducer
- ② Actuator
- ③ Volume flow controller
- ④ Setpoint value via analogue signal
- ⑤ Shaft with effective pressure channel

Principle of operation – LVC, TVR, TZ-Silenzio, TA-Silenzio, TVZ, TVA, TVJ, TVT



- ① Effective pressure transducer
- ② Actuator
- ③ Volume flow controller
- ④ Setpoint value signal

Specification text

This specification text describes the general properties of the product.

Category

- Compact controller for volume flow rate
- Control of a constant or variable volume flow rate setpoint
- Electronic controller for connecting a reference value and tapping an actual value
- The actual value relates to the nominal volume flow rate such that commissioning and subsequent adjustment are simplified
- Stand-alone operation or integration in central building management system

Application

- Dynamic transducer for clean air in ventilation and air conditioning systems

Supply voltage

- 24 V AC/DC

Actuator

- Integrated; slow running (run time <150 s for 90°)

Installation orientation

- Either direction

Interface/signalling

- Analogue signals (0 – 10 V or 2 – 10 V DC)

Connection

- Terminals with rubber cap cover, no additional terminal box required (control components for TVE)
- Connecting cable with 4 wires (control components for other types)

Interface information

Analogue:

- Volume flow rate actual value and setpoint value
- Factory-set actual value: volume flow rate
- Actual value cannot be configured by others at damper blade position

Special functions

- Activation q_{vmin} , q_{vmax} , closed, open by external switch contacts

Parameter setting

- Parameters specific to VAV terminal unit set at the factory
- Operating values: q_{vmin} , q_{vmax} and interface type set at the factory
- Subsequent adjustment via optional tools: adjustment device, PC software (wired in each case)

Factory condition

- Electronic controller factory mounted on control unit
- Factory parameter settings
- Functional test under air; certified with sticker

Order code

TVE – D / 200 / D2 / XB0 / V / 0 / qvmin – qvmax m³/h
 | | | | | | | | | |
 1 2 5 6 7 8 9 10 11

1 Type
TVE VAV terminal unit

2 Acoustic cladding

No entry: none

D With acoustic cladding

3 Material

Galvanised sheet steel (standard construction)

P1 Powder-coated RAL 7001, silver grey

A2 Stainless steel construction

5 Nominal size [mm]
100, 125, 160, 200, 250, 315, 400
6 Accessories

No entry: none

D2 Double lip seal both ends

G2 Matching flanges for both ends

Order example: TVE/100/D2/XB0/V0/20-350 m³/h
Acoustic cladding

Without

Material

Galvanised sheet steel

Nominal size

100 mm

Accessories

Double lip seal both sides

Attachment

Compact controller

Operating mode

Variable operation - signal voltage range 0 – 10 V DC

Volume flow rate

20 – 350 m³/h

Order example: TVJ-D/600×300/XB0/F2/6000 m³/h
Acoustic cladding

With

Material

Galvanised sheet steel

Dimensions

600×300

Accessories

Without

Attachment

Compact controller

Operating mode

Constant value mode, signal voltage range 2 – 10 V DC

Volume flow rate

6000 m³/h

7 Attachments (control components)
XB0 Compact controller with dynamic transducer

8 Operating mode
FL Constant value (one setpoint value)

V Variable (setpoint value range)

9 Signal voltage range
0 0 – 10 V DC

2 2 – 10 V DC

10 Operating values for factory setting

Volume flow rates in m³/h or l/s

 q_{vconst} (only with operating mode F)

 q_{vmin} (only with operating mode V)

 q_{vmax} (only with operating mode V)

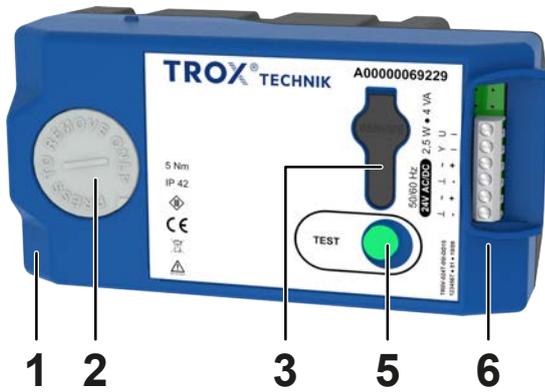
11 Volume flow rate unit

m³/h

l/s

Variants

Compact controller XB0, TR0V-024T-05I-DD15 für TVE



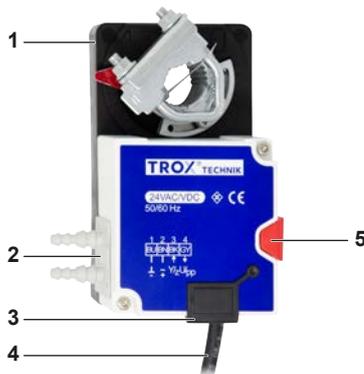
- ① Compact controller
- ② Damper blade position indicator and release button
- ③ Service tool connection
- ⑤ Test push button and LED to display the operating states
- ⑥ Terminal

Compact controller with attached terminal cover



- ① Terminal cover (part of the supply package)

Compact controller XB0, 227V-024-10-DD3



- ① Compact controller
- ② Connections for effective pressure transducer
- ③ Service tool connection
- ④ Connecting cable
- ⑤ Gear release button

Compact controller XB0, 227V-024-10-DD3



Reverse side with rating plate

Technical data

Compact controllers for VAV terminal units

VAV terminal units	Type of installation component	Part number
TVR, TVJ, TVT, TZ-Silenzio, TA-Silenzio, TVZ, TVA, TVM	227V-024-10-DD3	A00000041355
TVE	TROV-024T-05I-DD15	A00000069229

Compact controller XB0, 227V-024-10-DD3



Compact controller XB0, 227V-024-10-DD3

Measurement principle	Dynamic
Supply voltage (AC)	24 V AC \pm 20%, 50/60 Hz
Supply voltage (DC)	24 V DC \pm 20 %
Power rating (AC)	5 VA max.
Power rating (DC)	Max. 2.5 W
Power consumption (when running/when idle)	1.5 W
Torque	10 Nm
Run time for 90°	Approx. 120 s
Setpoint value signal input	0 – 10 V DC, Ra > 100 k Ω or 2 – 10 V DC, Ra > 50 k Ω
Actual value signal output	0 – 10 V DC or 2 – 10 V DC, max. 0.5 mA
Connection	Approx. 0.9 m cable, 4 x 0.75 mm ²
IEC protection class	III (protective extra-low voltage)
Protection level	IP 42
EC conformity	EMC to 2014/30/EU
Weight	0.570 kg

Compact controller XB0, TR0V-024T-05I-DD15 for TVE

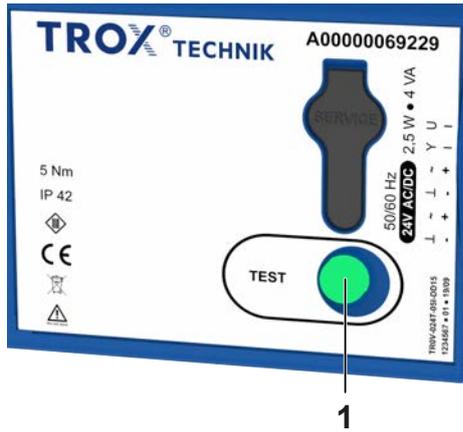
Compact controller XB0, TR0V-024T-05I-DD15

Measurement principle	Dynamic
Supply voltage (AC)	24 V AC \pm 20%, 50/60 Hz
Supply voltage (DC)	24 V DC \pm 20 %
Power rating (AC)	NW 100 – 200: max. 4 VA NW 250 – 400: max. 7 VA
Power rating (DC)	NW 100 – 200: max. 2,5 W NW 250 – 400: max. 4 W
Power consumption (when running/when idle)	1 W
Power consumption (when running/when idle)	1.5 W
Torque	10 Nm
Run time for 90°	100 s
Setpoint value signal input	0 – 10 V DC, Ra > 100 k Ω or 2 – 10 V DC, Ra > 50 k Ω
Actual value signal output	0 – 10 V DC or 2 – 10 V DC, max. 5 mA
Connection	Screw terminals (cable cross-section max. 1.5 mm ²)
IEC protection class	III (protective extra-low voltage)
Protection level	IP 42 (with attached terminal cover)
EC conformity	EMC to 2014/30/EU
Weight	0.65 kg

Release of a test function

Pressing the LED push button for > 2 seconds activates the test drive.

Section of the LED push button



1: LED push button

Starting a test run

Pressing the LED push button for > 2 s starts a test run.

Description of status and error messages via LED flashing signal for TROV-024T-05I-DD15

Flashing signal of LED button	Flashing signal in words	Status
	LED off	No supply voltage
	LED lights up permanently.	Regulated. Signalled as long as the actuator does not rotate to readjust the setpoint value.
	LED flashes 1 time in a 2-second interval.	Setpoint value or override control position not yet reached.
	LED flashes 2 times in a 2-second interval.	Override control position reached.
	LED flashes once briefly at 2-second intervals.	Synchronisation drive after Power Up
	LED flashes once briefly at 2-second intervals.	Test mode activated
	LED flashes 2 times in quick succession at 2-second intervals.	Overpressure sensor (overpressure)
	LED flashes 2 times in quick succession at 3-second intervals.	Actuator overload detected (block)
	LED flashes 4 times in quick succession at 2-second intervals.	Inform TROX service technicians

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

Product details

Analogue interface 0 – 10 V or 2 – 10 V DC (operating mode V, F)

The analogue interface can be set for signal voltage range 0 – 10 V DC or 2 – 10 V DC. The assignment of the volume flow rate setpoint value or actual value to the voltage signals is shown in the characteristic curves.

- The set signal voltage range always applies equally for setpoint value and actual value signals.
- The signal voltage range is pre-set in the factory according to the order code entries.
- The signal voltage range can be adjusted by others with an adjustment device

Setpoint value default setting

In the operating mode V (variable operation), the setpoint value is specified with an analogue signal on terminal Y.

- The selected signal voltage range 0 – 10 V or 2 – 10 V DC is assigned to the volume flow rate range $q_{vmin} - q_{vmax}$.
- Volume flow rate range $q_{vmin} - q_{vmax}$ is preset at the factory according to the order code
- Subsequent adjustment of q_{vmin} or q_{vmax} is possible with adjustment device
- In operating mode F (constant value mode), an analogue signal at terminal Y is not required
The volume flow rate constant value set by q_{vmin} is controlled
- Volume flow rate q_{vmin} is preset at the factory according to the order code
- Subsequent adjustment of q_{vmin} is possible with adjustment device

Actual value as feedback for monitoring or tracking control

- The actual volume flow rate measured by the controller can be captured as a voltage signal at terminal U
- The selected signal voltage range 0 – 10 V DC or 2 – 10 V DC is mapped to the volume flow rate range 0 – q_{vNom} .
- The actual value output U can be reconfigured (by others) to output the damper blade position
- The selected signal voltage range, 0 – 10 V DC or 2 – 10 V DC, is then mapped to the damper blade position as a percentage value between 0 % (CLOSED) and 100 % (OPEN)

Override control

For special operating situations, the volume flow controller can be put in a special operating mode (override control). The following modes are possible: control P_{vmin} , control q_{vmax} , damper blade in the OPEN position or damper blade CLOSED.

Override control via signal input Y

With appropriate wiring on the signal input Y, the override controls can be activated according to the connection diagrams via wiring with external switch contacts/relays. OPEN and CLOSED are only available if the controller is supplied with alternating current (AC).

Override control CLOSED via control signal Y

- With signal voltage range 0 – 10 V DC: CLOSE is activated if $q_{vmin} = 0$ and the control signal on Y < 0.5 V DC
- With signal voltage range 2 – 10V DC: CLOSE is activated if control signal Y < 0.8 DC (*1)

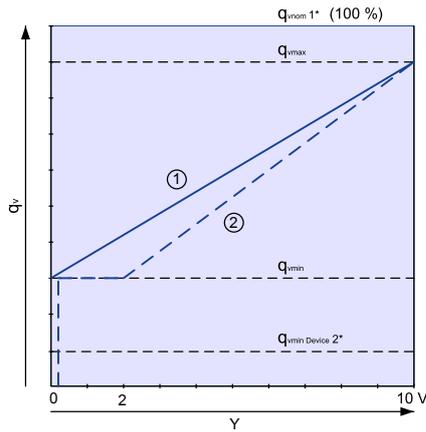
(*1) 0.8 V DC = factory setting

Override control for diagnostic purposes

- For test purposes, the override control can also be activated via the service tools (adjustment device, PC software).

Prioritisation of various setting options

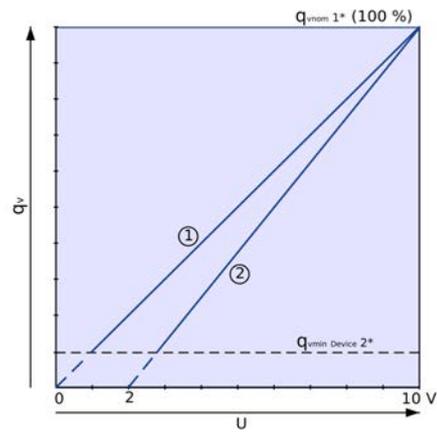
- High priority: settings via the service connector (adjustment device, PC software) for test purposes
- Low priority: settings via Y signal input of the controller

Characteristic of the setpoint value signal


- ① Signal voltage range 0 – 10 V
- ② Signal voltage range 2 – 10 V
- 1* = q_{vnom} ; nominal volume flow rate
- 2* = $q_{vmin\ unit}$ Minimum controllable volume flow rate

Calculation of nominal volume flow at 0 – 10 V

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

Characteristic of the actual value signal


- ① Signal voltage range 0 – 10 V
- ② Signal voltage range 2 – 10 V
- 1* = q_{vnom} nominal volume flow rate
- 2* = $q_{vmin\ unit}$ Acceptable minimum volume flow rate

Calculation of actual volume flow at 0 – 10 V

$$q_{vact} = \frac{U}{10\ V} \times q_{vnom}$$

Calculation of nominal volume flow at 2 – 10 V

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

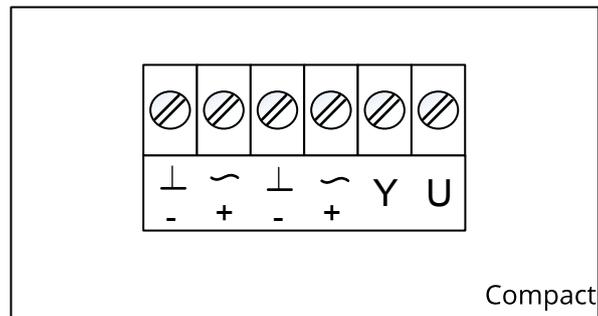
Calculation of actual volume flow at 2 – 10 V

$$q_{vact} = \frac{U - 2}{10\ V - 2\ V} \times q_{vnom}$$

Commissioning

- On-site adjusting is not required
- As the volume flow rates are factory set, the terminal units have to be installed at the specified locations
- After successful installation and wiring, the controller is ready for use
- Comply with the volume flow rate control ranges of the VAV terminal units, do not set a volume flow rate which is below the minimum flow rate
- Remove the terminal cover of the control component only temporarily for wiring (applies only to XB0 for TVE).

Terminal connections with TR0V-024T-05I-DD15 (for TVE)



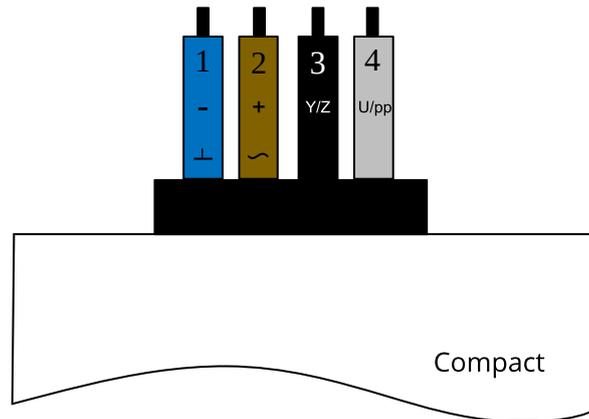
\perp , -: Earth, neutral

\sim , +: Supply voltage 24 V

Y: Setpoint value signal 0 – 10 V DC or 2 – 10 V DC and override control

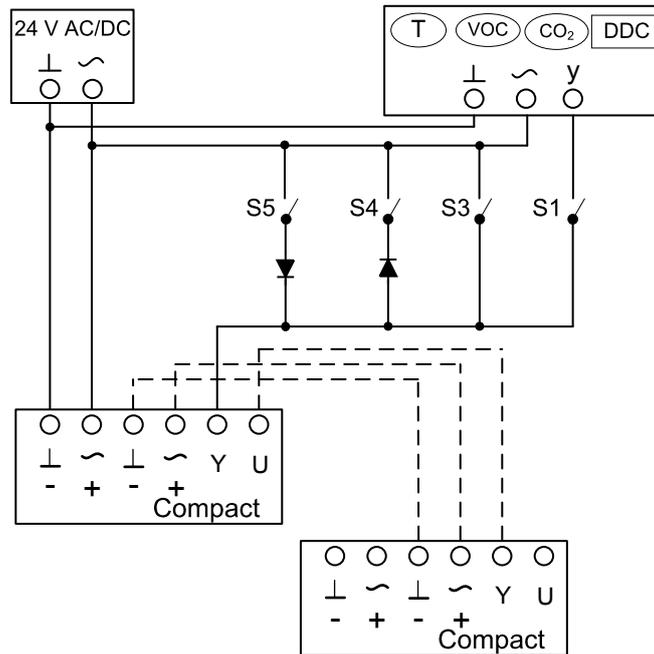
U: Actual value signal 0 – 10 V DC or 2 – 10 V DC

Connecting cable core identification for 227V-024-15-DS3
(for TVR, TVJ, TVT, TZ-Silenzio, TA-Silenzio, TVZ, TVA,
TVM)



- 1: BU, ⊥, -: Ground, neutral
- 2: BN, ~, +: Supply voltage 24 V
- 3: BK, Y/Z: Setpoint value signal Y and override control
- 4: GY, U/pp: Actual value signal for service tool

XB0, variable volume flow control and override control, signal voltage range 0 – 10 V DC



Valid for both variants of the XB0

Switch functions

- S1 Room temperature control
- S3 Maximum volume flow rate $q_{v,max}$
- S4 Damper blade CLOSED (only with supply voltage 24 V AC)
- S5 Damper blade OPEN (only with supply voltage 24 V AC)
- All OPEN: minimum volume flow rate $q_{v,min}$

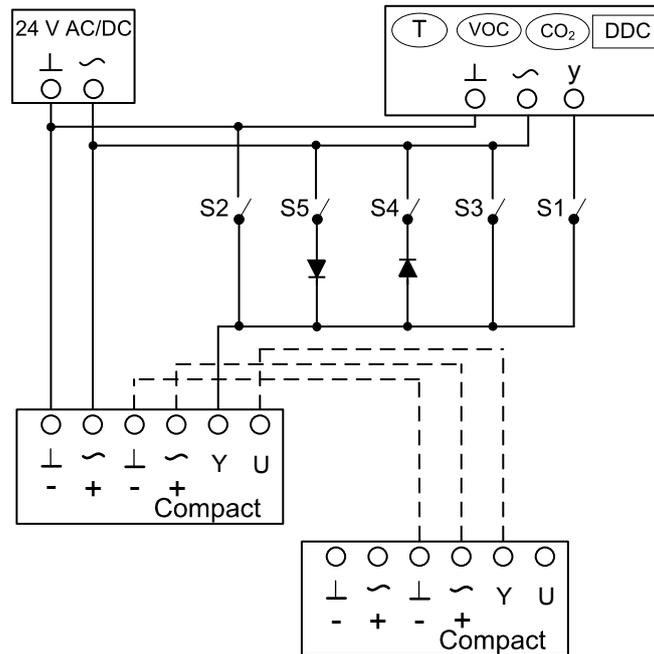
Note:

T, VOC, CO₂, DDC = Setpoint value default setting

When combining several override controls the switches must be interlocked to prevent short-circuits.

Diode: e.g. 1N 4007

XB0, variable volume flow control and override control, signal voltage range 2 – 10 V DC



Valid for both variants of the XB0

Switch functions

- S1 Room temperature control
- S2 Shut-off CLOSED
- S3 Maximum volume flow rate $q_{v,max}$
- S4 Damper blade CLOSED (only with supply voltage 24 V AC)
- S5 Damper blade OPEN (only with supply voltage 24 V AC)
- All OPEN: minimum volume flow rate $q_{v,min}$

Note: T, VOC, CO₂, DDC = setpoint value default setting

When combining several override controls the switches must be interlocked to prevent short circuits.

Diode: e.g. 1N 4007

Nomenclature

 q_{vNom} [m³/h]; [l/s]

Nominal flow rate (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 program. Reference value for calculating percentages (e.g. q_{vmax}). Upper limit of the setting range and maximum volume flow rate setpoint value for the VAV terminal unit.

 $q_{vmin Unit}$ [m³/h]; [l/s]

Technically possible minimum volume flow rate: The value depends on product type, nominal size and control component (attachment). Values are stored in the Easy Product Finder design program. Lower limit of the setting range and minimum volume flow rate setpoint value for the VAV terminal unit. Setpoint values below $q_{vmin unit}$ (if q_{vmin} equals zero) may result in unstable control or shut-off.

 q_{vmax} [m³/h]; [l/s]

Upper limit of the operating range for the VAV terminal unit that can be set by customers: q_{vmax} can be set to less than or equal to q_{vnom} . For analogue signalling to volume flow controllers (typically used), the maximum value of the setpoint signal (10 V) is assigned the set maximum value (q_{vmax}) (see characteristic).

 q_{vmin} [m³/h]; [l/s]

Lower limit of the operating range for the VAV terminal unit that can be set by customers: q_{vmin} should be set to less than or equal to q_{vmax} . Do not set q_{vmin} to less than $q_{vmin unit}$ as the control may become unstable or the damper blade may close. q_{vmin} may equal zero. In case of analogue signalling to volume flow controllers (which are typically used), the set minimum value (q_{vmin}) is

allocated to the minimum setpoint signal (0 or 2 V) (see characteristic).

 q_v [m³/h]; [l/s]

Volume flow rate

VAV terminal unit

Consists of a basic unit with an attached control component.

Basic unit

Unit for controlling a volume flow without an attached control component. The main components include the casing with sensor(s) to measure the effective pressure and the damper blade to restrict the volume flow. The basic unit is also referred to as a VAV terminal unit. Important distinguishing features: Geometry or unit shape, material and types of connection, acoustic characteristics (e.g. acoustic cladding or integral sound attenuator), volume flow rate range.

Control component

Electronic unit(s) mounted on the basic unit to control the volume flow rate or the duct pressure or the room pressure by adjusting the damper blade position. The electronic unit consists basically of a controller with effective pressure transducer (integral or external) and an integral actuator (Easy and Compact controllers) or external actuator (Universal or LABCONTROL controllers). Important distinguishing features: Transducer: dynamic transducer for clean air or static transducer for contaminated air. Actuator: slow-running actuator as standard, spring return actuator for safe position, or fast-running actuator. Interface: analogue interface or digital bus interface for the capturing of signals and data.