Control component

XB0

XB0 for other series

XB0 for TVE

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 parameterised 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)

General information

Application
- All-in-one control devices for VAV terminal units
- Dynamic differential pressure transducer, electronic controller, and actuator are fitted together in one casing
- Suitable for different control tasks depending on the specification of the setpoint value
- The room temperature controller, central BMS, air quality controller or similar units control the variable volume flow control by specifying the setpoint values via the analogue signal
- Override controls for activating q_{vmin}, q_{vmax}, shut-off, OPEN position via switch or relay possible
- Volume flow rate actual value is available as linear voltage signal
- Standard filtration in comfort air conditioning systems allows for use of the controller in the supply air without additional dust protection.

With heavy dust levels in the room
- Install appropriate exhaust 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 loaded with aggressive operating fluids
- Use of compact controller modules with static differential pressure transducer instead of the compact controller XB0 described here:
  XD0 (for type TVR, TVJ, TVT, TZ-Silenzio, TA-Silenzio, TVZ, TVA, TVM),
  XS0 (for type TVE)

Control concept
- The volume flow controller works independent 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.
- Volume flow rate range parameterised in the controller in the factory
  q_{vmin}: minimum volume flow rate
  q_{vmax}: maximum volume flow rate
- Operating parameters are specified via the order code and parameterised in the factory

Operating modes
- Variabel oder Festwert
Variabler Betrieb (V)
- Sollwertvorgabe über Analogschnittstelle
- Signalspannungsbereich entspricht q_{vmin} bis q_{vmax}
Festwert-Betrieb (F)
- Kein Sollwertsignal erforderlich, Sollwert entspricht 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 – 10V DC
- 2 – 10V DC

Parts and characteristics
- Transducer for dynamic measurement principle
- Actuators with overload protection
- Release button to allow for manual operation (omly Type 227V-024-10-DD3)
- Connecting cable with 4 wires, approx. 0.9 m, halogen-free (omly Type 227V-024-10-DD3)
- Terminals with cover (only Type TROV-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 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 TROV-024T-05I-DD15 for TVE

Commissioning
- Due to the volume flow rates set in the factory, always ensure that the control units are only installed in 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 type GUIV-A (order code AT-VAV-G) for Typ 227V-024-10-DD3
- Adjustment device type GUIV3-M (order code AT-VAV-G3) for type TROV-024T-05I-DD15

Function

Functional description

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 is measured by measuring a 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 hence available as a voltage signal. The

factory setting is such that 10 V DC always corresponds to the nominal volume flow rate (qvnom).

The volume flow setpoint is specified by a higher-level controller (eg room temperature controller, air quality controller, building control system). Variable volume flow control results in a value between qvmin and qvmax. 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 accordingly.
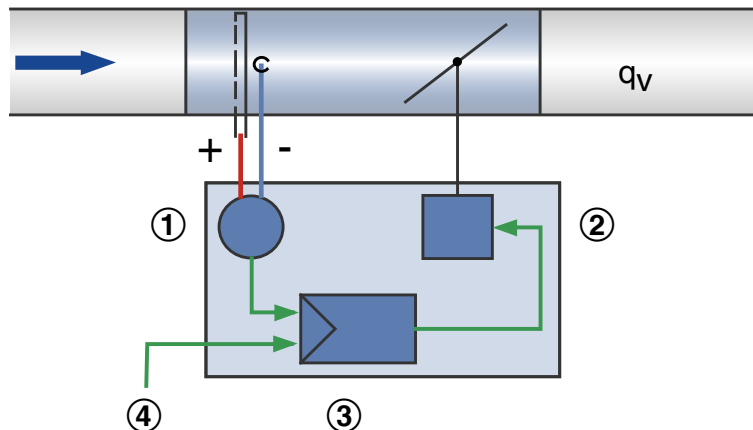
Principle of operation for type TROV-024T-05I-DD15 (Type TVE)
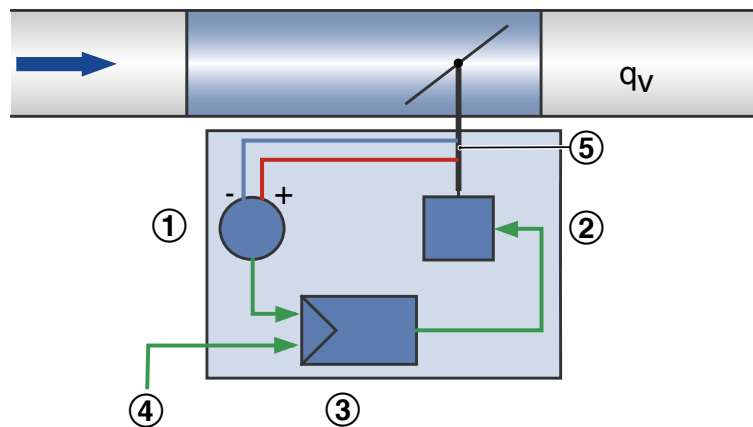
① Differential pressure transducer
② Actuator
③ Volume flow controller
④ Setpoint value via analogue signal
⑤ Shaft with effective pressure channel

Principle of operation Easy controller: LVC, TVR, TVJ, TVT, TZ-/TA-Silenzio, TVZ, TVA

① Differential 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.
- Regulation of a constant or variable volume flow rate setpoint
- Electronic controller for applying a reference variable 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 transmitter for clean air in ventilation and air conditioning systems

Supply voltage
- 24 V AC / DC

Actuator
- Integrated; Slow running (running time <150s for 90°)

Installation orientation
- either direction

Interface/Control
- Analogue signals (0 – 10V or 2 – 10V 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
- Actual value of volume flow rate, at the factory
- Actual value cannot be configured by others on damper blade position

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

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

Factory settings
- Electronic controller factory-mounted on the terminal 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

6 Accessories
No entry: none
D2 Double lip seal both sides
G2 Matching flanges for both ends

7 Attachments (control component)
XB0 Compact controller of dynamic transducer

8 Operating mode
F Constant value (a setpoint value)
V Variable (setpoint value range)

9 Signal voltage range
0 0 – 10V DC
2 2 – 10V DC

10 Operating values for factory setting
Volume flow rates [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 unit
m³/h
l/s

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 0-10V DC
Volume flow rate	20 – 350 m³/h

Order example: TVJ-D/600x300/XB0/F2/6000 m³/h

Acoustic cladding	With
Material	Galvanised sheet steel
Dimensions	600 x 300
Accessories	None
Attachment	Compact controller
operating mode	Constant value mode, signal voltage range 2-10V DC
Volume flow rate	6000 m³/h

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Variants

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

① Compact controller
② Release button
③ Connection service tool
⑤ Test push button and LED to display the operating states
⑥ Terminal

Compact controller with aufgesetzter attached terminal cover

① Terminal cover (Part of the supply package)

① Compact controller
④ Tube connections for differential pressure transducer
③ Connection service tool
④ Connecting cable
⑤ Gear release button

Actuator 227V-024-10-DD3

Rear with nameplate

Technical data

Compact controller for VVS controller

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

XB0 for TVE

Compact controller TROV-024T-05I-DD15

Supply voltage (AC)	24 V AC ±20%, 50/60 Hz
Supply voltage (DC)	24 V DC ± 20%
Power rating (AC)	4 VA max.
Power rating (DC)	Max. 2.5 W
Running time for 90°	100 s
Setpoint value signal input	0 – 10 V DC, Ra > 100 kΩ or 2 – 10 V DC, Ra > 50 kΩ
Actual value signal output	0 – 10 V DC or 2 – 10 V DC, 5 mA max.
IEC protection class	III (protective extra-low voltage)
Protection level	IP 42 (with attached terminal cover)
EC conformity	EMC to 2014/30/EU

Actuator 227V-024-10-DD3

Compact controller 227V-024-10-DD3

Supply voltage (AC)	24 V AC ±20%, 50/60 Hz
Supply voltage (DC)	24 V DC ± 20%
Power rating (AC)	5 VA max.
Power rating (DC)	Max. 2.5 W
Torque	10 Nm
Setpoint value signal input	0 – 10 V DC, Ra > 100 kΩ or 2 – 10 V DC, Ra > 50 kΩ
Actual value signal output	0 – 10 V DC or 2 – 10 V DC, 0.5 mA max.
IEC protection class	III (protective extra-low voltage)
Protection level	IP 42
EC conformity	EMC to 2014/30/EU

Product details

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

The analogue interface can be adjusted for the signal voltage range 0 – 10V DC or 2 – 10V DC. The assignment of the volume flow rate setpoint value or actual value for voltage signals is shown in the characteristic curves.
- The set signal voltage range is always equally valid for setpoint value and actual value signals.
- The signal voltage range is pre-set in the factory in accordance with the order code entries.
- The signal voltage range can be adjusted by others with an adjustment device.

Setpoint value 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 – 10V or 2 – 10V DC is assigned to the volume flow rate range $q_{vmin} – q_{vmax}$ a change packet.
- Volume flow rate range $q_{vmin} – q_{vmax}$ is pre-set in the factory according to the order code entries.
- Subsequent adjustment of q_{vmin} or q_{vmax} possible with adjustment device.

- In the operating mode F (constant value mode), an analogue signal is not required on terminal Y.
- It is controlled by the volume flow rate constant value set by q_{vmin}
- Volume flow rate q_{vmin} is pre-set in the factory according to the order code entry.
- Subsequent adjustment of q_{vmin} possible with adjustment device.

Actual value as feedback for monitoring or tracking control

- On terminal U, the actual volume flow rate measured by the controller can be tapped as a voltage signal.
- The selected signal voltage range 0 – 10V DC or 2 – 10V DC is shown in the volume flow rate range $0 – q_{vnom}$

Override control

For special operating situations, the volume flow controller can be put in a special operating mode (override control). The following are possible: control q_{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).
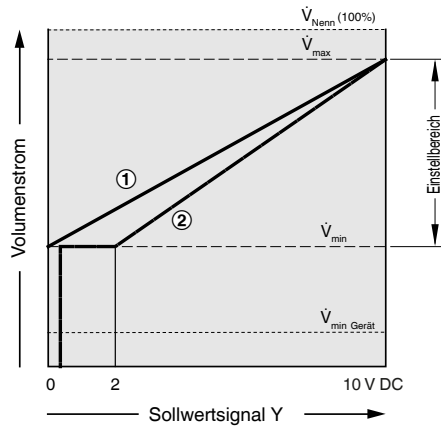
Override control CLOSED via control signal Y

- With signal voltage range 0 – 10V DC: CLOSED is activated when $q_{vmin} = 0$ is set and the control signal is Y < 0.5V DC.
- With signal voltage range 2 – 10V DC: CLOSED is activated when control signal is Y < 0.8V [*1] DC.
  [*1] 0.8V = factory setting

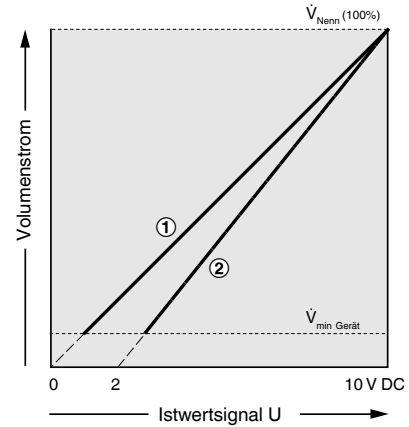### Override control for diagnostic purposes

- 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 wiring on the Y signal input of the controller

XD0, Characteristic of the setpoint value signal

① Signal voltage range 0 – 10 V DC
② Signal voltage range 2 – 10 V DC

Calculation volume flow rate setpoint value at 0 – 10 V:

0 – 10 V DC

$$\dot{V}_{Soll} = \frac{Y}{10}\,(\dot{V}_{max} - \dot{V}_{min}) + \dot{V}_{min}$$

Calculation volume flow rate setpoint value at 2 – 10 V:

2 – 10 V DC

$$\dot{V}_{Soll} = \frac{Y - 2}{8}\,(\dot{V}_{max} - \dot{V}_{min}) + \dot{V}_{min}$$

XD0, Characteristic of the actual value signal

① Signal voltage range 0 – 10 V DC
② Signal voltage range 2 – 10 V DC

Calculation volume flow rate actual value at 0 – 10 V:

0 – 10 V DC

$$\dot{V}_{Ist} = \frac{U}{10}\,\dot{V}_{Nenn}$$

**Calculation volume flow rate actual value at 2 – 10 V:**

2 – 10 V DC

$$\dot{V}_{Ist} = \frac{U - 2}{8}\,\dot{V}_{Nenn}$$

Commissioning

- On-site adjusting is not required
- Due to the volume flow rates set in the factory, always ensure that the control units are only installed in 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
- Only briefly remove the transparent protective cap of the control components during wiring (only XB0 for TVE)

**Terminal connections for TROV-024T-05I-DD15 (for TVE)**
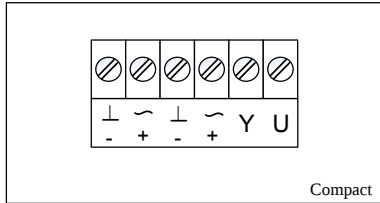
⊥, –: Ground, neutral
~, +: Supply voltage 24 V
Y: Setpoint value signal 0 – 10 V DC or 2 – 10 V DC und override control
U: Actual value signal 0 – 10 V DC or 2 – 10 V DC

Connecting cable core identification at 227V-024-15-DS3 (for TVR, TVJ, TVT, TZ-Silenzio, TA-Silenzio, TVZ, TVA, TVM)
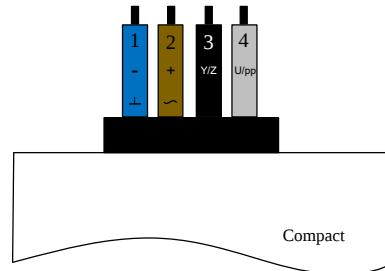
1: BU, ⊥, –: Ground, neutral
2: BN, ~, +: Supply voltage 24 V
3: BK, Y/Z: Setpoint value signal Y and override control
4: GY, U/pp: Actual value signal for service tool

XB0, Variable volume flow control and Override control, voltage signal 0 – 10 V DC
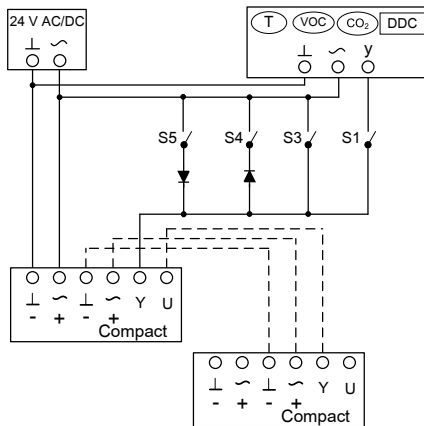
Switch functions
S1 Room temperature control
S3 Maximum volume flow rate $q_v$max
S4 Damper blade CLOSED (only with supply voltage 24 V AC)
S5 Damper blade OPEN (only with supply voltage 24 V AC)
T, VOC, CO2, DDC = Setpoint value setting
All OPEN: Minimum volume flow rate $q_v$min
When combining several override controls the switches must be interlocked to prevent short-circuits.
Diode: e.g. 1N 4007

valid for both variants of the XB0

XB0, Variable volume flow control and Override control, voltage signal 2 – 10 V DC
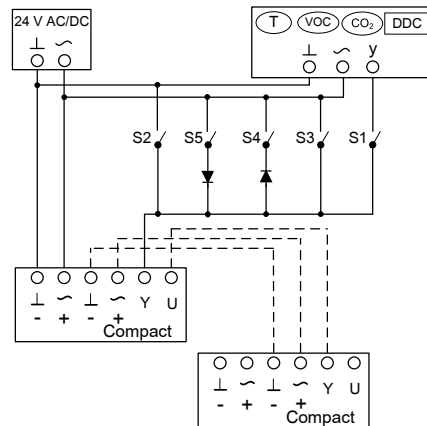
Switch functions
S1 Room temperature control
S2 Shut-off CLOSED
S3 Maximum volume flow rate q_v max
S4 Damper blade CLOSED (only with supply voltage 24 V AC)
S5 Damper blade OPEN (only with supply voltage 24 V AC)
T, VOC, CO2, DDC = Setpoint value setting
All OPEN: Minimum volume flow rate q_v min
When combining several override controls the switches must be interlocked to prevent short-circuits.
Diode: e.g. 1N 4007

valid for both variants of the XB0

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Explanation

q_{vnom}
[m³/h]; [l/s]
Nominal volume flow rate (100 %): The value depends on product type and nominal size. Values are published on the internet and in technical leaflets, and stored in the Easy Product Finder design software. Reference value for calculating percentages (e.g. qvmax). 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 software. Lower limit of the setting range and minimum volume flow rate setpoint value for the VAV terminal unit. Depending on the controller, setpoint values below qvmin unit (if qvmin 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: qvmax can only be smaller than or equal to qvnom. In case of analogue signalling to volume flow controllers (which are typically used), the set maximum value (qvmax) is allocated to the setpoint signal maximum (10 V) (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: qvmin should be smaller than or equal to qvmax. Do not set qvmin smaller than qvmin unit, otherwise the control may become unstable or the damper blade may close. qvmin may equal zero. In case of analogue signalling to volume flow controllers (which are typically used), the set minimum value (qvmin) is allocated to the setpoint signal minimum (0 or 2 V) (see characteristic).

q_v
[m³/h]; [l/s]
Volume flow rate

Δ_{pst}
[Pa]
Static differential pressure

$\Delta_{pst\ min}$
[Pa]
Static differential pressure, minimum: The static minimum differential pressure is equal to the pressure loss of the VAV controller when the damper blade is open, caused by flow resistance (damper blade). If the pressure on the VAV controller is too low, the setpoint volume flow rate may not be achieved, not even when the damper blade is open. Important factor in designing the ductwork and in rating the fan including speed control. Sufficient differential pressure must be ensured for all operating conditions and for all controllers, and the measurement point or points for speed control must have been selected accordingly to achieve this.