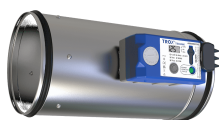




Static transducer type


Control component for type
TVE

Control component for type
TVE-Q


Control components

XSMB0



Control component with static transducer and BACnet-MS/TP as well as Modbus-RTU interface

Compact device for VAV terminal unit TVE and TVE-Q

- Controller, static differential pressure transducer and actuator in one casing
- Use in ventilation and air conditioning systems, for clean and contaminated air
- Simple terminal connection, no additional junction boxes needed
- Volume flow rates q_{vmin} and q_{vmax} are pre-set at the factory and saved in the controller as variable parameters
- High data transparency via standardised bus communication RS485
 - BACnet MS/TP: Object access
 - Modbus RTU: Register access
- Setpoint specifications, override controls via bus interface or analogue wiring, depending on configuration
- Integrated display for volume flow rate display, operating status display and setting of operating parameters
- Service access for manual adjustment devices and PC configuration software

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General information

Application

- All-in-one control device for VAV terminal units type TVE and TVE-Q
- Static differential pressure transducer, controller electronics and actuator combined in one casing
- For clean and contaminated air in ventilation and air conditioning systems:
 - E.g. in the extract air area with dust, fluff, sticky or moist components
 - Application examples: Extract air from changing rooms and shower areas as well as hospital bedrooms, production facilities and corridor areas - e.g. in schools
- Various control options based on corresponding setpoint specification
- Room temperature controller, management and control equipment (MCE), air quality controller and others control the variable volume flow regulation by specifying setpoints via communication interface or analogue signal
- Override control for activating q_{vmin} , q_{vmax} , shut-off or open position via BACnet object, Modbus register or switch/relay possible (depending on interface configuration)
- The actual volume flow rate is available as a network data point or as a linear voltage signal
- Damper blade position, e.g. for fan optimisation, is available as a network data point

Control strategy

- The volume flow controller works independently of duct pressure
- Pressure fluctuations do not cause any permanent volume flow deviations
- A dead zone (hysteresis), within which the damper blade is not moved, ensures stable regulation
- The volume flow range for the controller is factory-set (q_{vmin} : minimum volume flow, q_{vmax} : maximum volume flow)
- Operating parameters are defined in the order code and factory-set

Operating modes

BACnet (B):

- Setpoint specification via BACnet objects

Analogue – variable operation (V):

- Setpoint specification via analogue interface,
- Signal voltage range corresponds to $q_{vmin} - q_{vmax}$

Analogue - fixed value operation (F):

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

Modbus (M):

- Setpoint specification via Modbus register

Interface

Communication interfaces

- BACnet MS/TP, RS485, data points see tables BACnet PICS
- Modbus RTU, RS485, data points see Modbus-register list

Analogue interface with adjustable signal voltage range

- Analogue signal for volume flow setpoint
- Analogue signal for actual volume flow rate (factory setting)
- Alternatively: analogue signal for damper position (on-site adjustment required)

Note:

- Interface type according to order code detail
- Operating state parameterised at the factory, on-site adjustments possible

Signal voltage ranges

When using the analogue interface

- 0 – 10 V DC
- 2 – 10 V DC

Parts and characteristics

- Transducer based on static measurement principle
- Overload-protected actuator
- Connection terminals with cover
- Display and control elements for easy menu navigation
- Menu navigation for adjusting operating parameters
- Menu navigation for customising the communication interface
- Service interface

Construction

- TR0VM-024T-10I-DS12-BN
- Can only be used for type TVE and TVE-Q

Commissioning

- As the volume flow rates are factory-set, the air terminal units must be installed only at the designated locations
- Analogue interface: ready for use after installation and wiring
- BACnet and Modbus interface: additional commissioning steps required after installation and wiring
- Operating parameters can be customised on site (via bus interface, display operation, adjustment device, or PC software)

Useful additions

- Adjustment device type GUIV3-M (order code AT-VAV-G3)
- PC software

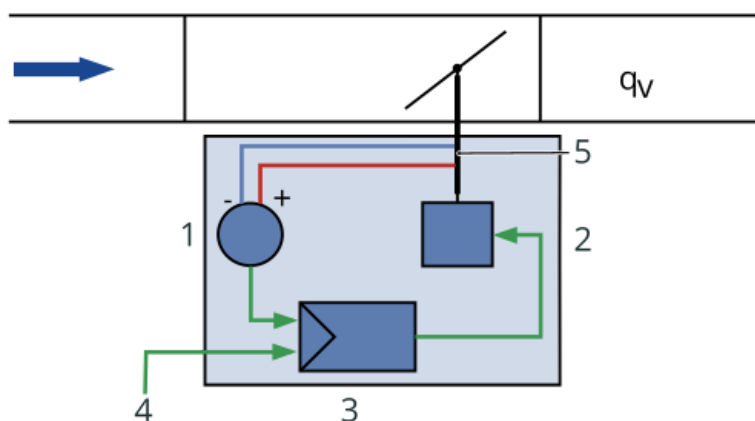
Function

Volume flow controllers are characterised by a closed control loop for controlling the volume flow, i.e. measuring - comparing - adjusting.

The volume flow is obtained by measuring a differential pressure. This is done via a differential pressure sensor. The integrated differential pressure transducer converts the differential pressure into a voltage signal. The actual volume flow value is available as a data point and voltage signal. Due to factory settings, 10 V DC always corresponds to the nominal volume flow (q_{vnom}).

The volume flow setpoint is specified by a higher-level controller (e.g. room temperature controller, air quality controller, MCE). Variable volume flow control can be set between q_{vmin} and q_{vmax} . It is possible to override the room temperature control by override control, e.g. via a shut-off.

The controller compares the volume flow setpoint with the current actual value and adjusts the internal actuator, according to the control deviation.



- 1 Differential pressure transducer
- 2 Actuator
- 3 Control component
- 4 Setpoint via Modbus
- 5 Shaft with effective pressure channel

Specification text

This specification text describes the general properties of the product. Texts for variants can be generated with our Easy Product Finder design programme.

Category

- Compact controller for volume flow

Anwendung

- Control of a constant or variable volume flow setpoint
- Electronic controller for input of a setpoint and tapping an actual value for integration into a BACnet- or Modbus-based MCE
- The actual value is referenced to the nominal volume flow, simplifying commissioning and subsequent adjustment

Area of application

- Static transducer for contaminated air in ventilation and air conditioning systems

Actuator

Integrated; slow-running (travel time 100 s for 90°)

Installation orientation

- Either direction

Connection

- Terminals with rubber cap cover, so no additional terminal box required
- Double terminal for supply voltage for easy wiring of up to 3 controllers

Supply voltage

- 24 V AC/DC

Interface/signalling

- BACnet MS/TP (RS485), Modbus RTU (RS485), or analogue signal 0 – 10 V DC or 2 – 10 V DC factory pre-set, depending on the order option
- Interface type is factory pre-set, as per order code

Interface information

- BACnet or Modbus: among other things, volume flow setpoint and actual value signal, damper blade position, override control

- Alternatively: Volume flow setpoint and actual value signal as analogue signal

Special functions

- Clearly visible external indicator light for signalling the functions: controlled, not controlled, and power failure
- Display for actual values, parameter setting, and for test functions
- Activation of override control functions q_{vmin} , q_{vmax} , Closed, Open via bus interface
- External switching contacts/wiring (for analogue interface)

Parameter setting

- Specific parameters for VAV terminal unit are factory-set
- Operating values: q_{vmin} , q_{vmax} and interface type are factory-set
- Subsequent adjustment via display and control element directly on the device or with optional tools:
 - Adjustment device, PC software (each wired)

Factory condition

- Functional test under air using reference measurement on a regularly validated test rig in accordance with DIN EN ISO 9001 to check the function and control accuracy of the complete volume flow controller
- Adjustment of the device-specific parameters under air by reference measurement on a regularly validated test rig if in accordance with DIN EN ISO 9001
- The test report of the factory parameterisation, functional test and adjustment must be made available after delivery of the volume flow controller

Equivalence criteria

- Electrical connections with screw terminals, no additional terminal boxes required
- The test report of the factory parameterisation, functional test and adjustment under air by reference measurement on a regularly validated test rig in accordance with DIN EN ISO 9001 is made available

Order code

TVE-D-P1-FL/4/G2/XSMB0/V0/117.72-529.72 [cfm]

1 2 3 4 5 6 7 8 9 10

1 Type

TVE VAV terminal unit

FL)

2 Acoustic cladding

No entry: without acoustic cladding

D With acoustic cladding

3 Material

No entry: galvanised sheet steel

P1 Air duct powder-coated RAL 7001 (silver grey)

A2 Stainless steel variant

4 Air duct connection

No entry: push-fit end for air ducts according to DIN EN 1506; with groove for optional seal

FL Flanges on both ends

5 Nominal size [in.]

4, 5, 6, 8, 10, 12, 16

6 Accessories

No entry: without accessories

D2 Double lip seal on both sides (only with push-fit end air duct connection)

G2 Matching flange for each flange (only with air duct connection)

Order example: TVE/4/D2/XS0/M/11.77-206.12 [cfm]

Acoustic cladding

Material

Nominal size

Accessories

Attachment

Operating mode

Volume flow rate

Without

Galvanised sheet steel

4 in.

Double lip seal both sides

Compact controller Modbus, static transducer

Modbus RTU

11.77-206.12 cfm

7 Attachment (control component)

XSMB0 Static volume flow controller with display, Modbus RTU or BACnet MS/TP or analogue interface

8 Operating state

F Fixed value operation, one setpoint (no external switch contact)

V Variable operation (setpoint specification via analogue signal)

M Modbus RTU interface (setpoint specification via Modbus register)

B BACnet-MS/TP interface (setpoint specification via BACnetObject)

9 Signal voltage range

Only for operating state F and V

0 0 – 10 V DC

2 2 – 10 V DC

10 Operating values for factory setting

Volume flow rate [m³/h or l/s]

q_{Vconst} (for operating state F)

$q_{Vmin} - q_{Vmax}$ (for operating state V, M, B)

Variants

Compact controller XSMB0 for TVE and TVE-Q



- 1 Compact controller
- 2 Damper blade position indicator and release button
- 3 Display
- 4 Rotary selector switch - Selection of options/setting values
- 5 LED button - Selection of menu entry
- 6 Connection terminal

Compact controller XSMB0 for TVE and TVE-Q (with attached terminal cover)



- 1 Terminal cover (part of the supply package)

Technical data

Compact controller for VAV terminal units

Part number	Type of installation component	VAV terminal units
A00000082306	TR0VM-024T-10I-DS12-BN	TVE, TVE-Q



Compact controller TR0VM-024T-10I-DS12-BN

Type of measurement/installation orientation	static measuring principle, position-independent
Supply voltage (AC)	24 V AC, $\pm 20\%$, 50/60 Hz
Supply voltage (DC)	24 V DC $\pm 20\%$
Power rating (AC)	TVE NW 4 - 6: maximum 4 VA TVE NW 8 - 16: maximum 6 VA TVE-Q up to height 8: maximum 4 VA TVE-Q from height 12: maximum 6 VA
Power rating (DC)	TVE-Q up to height 8: maximum 1.5 W TVE-Q from height 12: maximum 3 W TVE NW 4 - 6: maximum 1.5 W TVE NW 8 - 16: maximum 3 W
Power consumption (when running/when idle)	1 W
Run time for 90°	100 s
Setpoint value signal input (analogue optional)	0 - 10 V DC, input resistance $> 100\text{ k}\Omega$ or 2 - 10V DC $R_a > 50\text{ k}\Omega$
Actual value signal output	0 - 10 V DC or 2 - 10 V DC; maximum 5 mA
IEC protection class	III (Protective extra-low voltage)
Protection level	IP 42 (with attached terminal cover)
EC conformity	EMC to 2014/30/EU
Bus connection	RS485, BACnet MS/TP or Modbus RTU
Number of nodes (bus participants)	128
adjustable communication parameters for Modbus	1200 - 115,200 Bd Start bit: 1 Data bits: 8 Stop bits adjustable: 1 or 2 Parity adjustable: None, Even, Odd
adjustable communication parameters for BACnet	Selectable baud rate: 9600, 19200, 38400, 57600, 76800, 115200 baud Start bit: 1 Data bits: 8 Stop bits: 1 no parity



Setpoint/actual value interface	BACnet operation: via BACnet objects Modbus operation: via Modbus register list
Cable termination	externally required (120 Ω)

Interface selectionI

Interface configuration of the control component

Depending on the setting, the communication interfaces BACnet MS/TP, Modbus RTU or the analogue interface are available for the setpoint specification of volume flows.

Factory-set parameters can be selected via the order code.

On-site adjustment is possible via the integrated display menu, the bus interface, the adjustment device, or PC software.

Typical interface configuration

XSMB0	Setpoint specification via:	Actual value output via:	Order code option	Menu configuration via display (MODE, COM)
Analogue operation (0 – 10 V DC)	Analogue input Y (0 – 10 V DC)	Analogue input U (0 – 10 V DC) and bus interface	V or F	CA0
Analogue operation (2 – 10 V DC)	Analogue input Y (2 – 10 V DC)	Analogue output U (2 – 10 V DC) and bus interface	V or F	CA2
Modbus operation	Modbus register	Modbus register and analogue output U (2 – 10 V)	M	MODE = CB2 COM = b1 - b32
BACnet operation	BACnet object	BACnet object and analogue output U (2 – 10 V)	B	MODE = CB2 COM = bc1 - bc6

Mixed bus and analogue operation can be configured using special configurations.

In Modbus RTU operating mode, the setting is made via Modbus register 122 (Interface Mode).

In BACnet MS/TP operating mode, the setting is made via the BACnet object SpSource MV[122]

Supplementary use of the bus interface in analogue mode

In analogue mode, only the setpoint specifications at the analogue input are assessed by the controller. A setpoint specification via the

Bus interface via Modbus register 0 or 20 or BACnet object RelSpAnalog AI[1] is then not possible. Any write attempts are acknowledged with an error response.

Regardless of the selected interface configuration, other bus data points can also be used for analogue operation (CA0, CA2). When locally controlled by means of an analogue signal from a higher-level MCE, operating values such as the actual airflow rate (Modbus registers 6 and 7 or BACnet objects AI[6,7]) and the fan demand signal (Modbus register 4 or BACnet object AI[4]) can be read via the Modbus or BACnet interface. Central manual overrides can also be specified (Modbus register 1 or BACnet object MO[1]). The prerequisite for this is that the communication settings of the Modbus or BACnet interface (address, baud rate, etc.) are configured appropriately for the on-site network, for example via the display settings COM b1–b32 (Modbus) or bc1–bc6 (BACnet).

Commissioning

Commissioning

Detailed information on commissioning can be found in the installation and commissioning manual for the attachment XSMB0

After installation, wiring and connection of the supply voltage

When using the analogue interface:

- Air terminal unit immediately ready for operation

Additional commissioning steps are required when using bus communication:

- E.g. assigning the participant address and, if necessary, adjusting the communication settings via the integrated display menu
- Setpoint specification via BACnet objects or Modbus register, depending on the bus communication setting

Note:

Remove terminal cover of the control component only for wiring

Observe volume flow control ranges

- TVE: 4 – 100 % of q_{vnom}
- TVE-Q: 10 – 100 % of q_{vnom}
- In particular, do not set values below the minimum volume flow of the control unit

Setting options/Service tools

Function	Display menu	Modbus register	BACnet object	Adjustment device	PC tool
Adjustment operating range q_{vmin} , q_{vmax}	R, W	R, W	R, W	R, W	R, W
Setting channel for setpoint specification (bus or analogue signal)	R, W	R, W	R, W	R, W	R, W
Setting protocol for bus communication (Modbus RTU or BACnet MS/TP)	R, W	R, W	–	R, W	R, W
Setting communication parameters e.g. baud rate	R, W	R, W	–	R, W	R, W
Setting the Modbus/BACnet participant address	R, W	R, W	–	R, W	R, W
Trend display	–	–	–	–	R, W
Execute override control	R, W	R, W	R, W	R, W	R, W
de-energised parameterisation	–	–	–	R, W	R, W

R, W = function is readable and writable

– = Function is not available for the service tool

Note: The nominal volume flow q_{vnom} cannot be adjusted on site.

Display function

Range of display functions

Display functions

- Actual volume flow rate (unit either m³/h, l/s, cfm)
- The value is shown on a 3-character display, including place value indication and volume flow unit
- Status and error display for various operating states, including display of activated override control, display of nominal volume flow, firmware version and diagnostics function.

Parameterisation functions

- Adjustment option for the unit of the volume flow display m³/h, l/s, cfm
- Adjustment option for the operating range q_{vmin} , q_{vmax}
- Selection of the signal source for setpoint specification (interface mode)
 - Setpoint specification via bus (BACnet or Modbus depending on the communication parameter setting)
 - Setpoint specification via analogue signal (0 – 10 V DC or 2 – 10 V DC, depending on characteristic curve setting)
- Setting option for communication parameters in bus operation:
 - For Modbus: address, baud rate, stop bits, parity
 - For BACnet: Address, baud rate

Diagnostics functions

- Activation of a test run
- Activation of override controls Open, Closed, q_{vmin} , q_{vmax} , motor stop (observe prioritisation)
- Display of voltage value at analogue input and analogue output

Use and description of the display

The display menu is operated using the rotary selector switch and the LED button.

Details of the control elements



- 1 Display
- 2 Rotary selector switch
- 3 LED button

Communication interface

Communication interface - overview of data points on the bus

The following data points can be addressed for this control component via the bus:

Setpoint specification

- Volume flow setpoint [%] with reference to parameterised operating range $q_{vmin} - q_{vmax}$

Actual value queries

- Current actual volume flow Absolute [in selected volume flow unit] and Relative [%] with reference to q_{vnom}
- Damper blade position [°] and request signal [%]
- Nominal volume flow of the control unit (in selected volume flow unit)

Command data points

- Triggering override control (Open, Closed, q_{vmin} , q_{vmax})
- Triggering test and service functions (test, adaptation, synchronisation, reset)

Status data points

- Status/service information
- Serial number
- Type of actuator
- Firmware version of the control component

Settings

- Setpoint input channel
- q_{vmin} and q_{vmax} - Setting for the operating range of the setpoint signal
- Setting of the volume flow unit (m³/h, l/s, cfm)
- Bus failure monitoring (timeout time and action when bus failure is detected)

Notes:

Detailed description of data points such as associated Modbus register number, BACnet object designation
Numeric ranges, resolution and further information can be found in the installation and commissioning manual for the control component of the attachment XSMB0.

Analogue interface

Setpoint specification

- Operating mode V (variable operation): Volume flow setpoint with reference to parameterised operating range q_{vmin} and q_{vmax} and the selected signal voltage range is carried out with an analogue signal via terminal Y
- Operating mode F (fixed value operation): Fixed volume flow rate value corresponds to parameterised q_{vmin} , no analogue signal required via terminal Y

Actual value

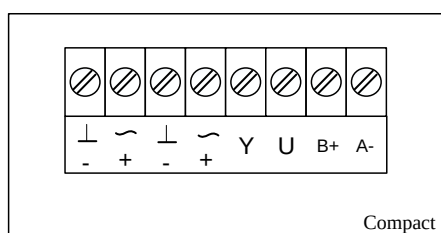
- Actual value can be tapped as a voltage signal with reference to the selected signal voltage range at terminal U
- If a bus interface is connected, it is also possible to query operating data via the bus in analogue mode.

Override control

- Triggering override control by appropriate wiring of signal input Y (Open*, Closed*, q_{vmin} , q_{vmax})
- If a bus interface is connected, it is also possible to set override controls via the bus in analogue mode.
- Override control CLOSED via control signal at signal input Y possible, if certain conditions are met

* only possible with AC voltage supply

Connection terminals



⊥, – = Ground, zero

~, + = Supply voltage 24 V AC/DC

Y = Analogue input

U = Actual value signal

B+ = RS485 (Modbus RTU or BACnet MS/TP)

A- = RS485 (Modbus RTU or BACnet MS/TP)

Note:

Only use the connection terminals for a cable cross-section of 0.0008 in² – 0.0023 in².

Nomenclature

q_{vNom} [cfm]

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 defined in the Easy Product Finder design programme. 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.

$q_{vmin Unit}$ [cfm]

Technical minimum volume flow: The value depends on product type, nominal size and control component (attachment). Values are defined in the Easy Product Finder design programme. Lower limit of the setting range and minimum volume flow 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} [cfm]

Adjustable by others at upper limit of the operating range for the VAV terminal unit: q_{vmax} can be set to less than or equal to q_{vnom} on the terminal unit. In case of analogue control of volume flow controllers (typically used), the maximum value of the setpoint signal (10 V) is assigned to the set maximum value (q_{vmax}) (see characteristics).

q_{vmin} [cfm]

Adjustable by others at lower limit of the operating range for the VAV terminal unit: q_{vmin} should be set to less than or equal to q_{vmax} . 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 control of volume flow controllers (typically used), the

minimum value of the setpoint signal (0 or 2 V) is assigned to the set minimum value (q_{vmin}) (see characteristics).

q_v [cfm]

Volume flow rate

Volume flow controller

Consists of a basic unit with an attached control component.

Basic unit

Unit for controlling volume flow rates without an attached control component. The main components include the casing with sensor(s) to measure the differential 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 connection variants, acoustic characteristics (e.g. optional acoustic cladding or integrated silencers), range of volume flow.

Control component

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

Important distinguishing features:

- Transmitter: dynamic transmitter for clean air or static transmitter for contaminated air
- Actuator: Standard actuator, slow-acting
- Interface technology: analogue interface or digital bus interface for connecting and recording signals and data

MCE

Management and control equipment (MCE)