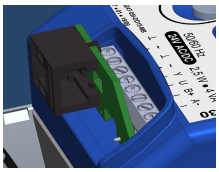
XM0-J6

Room control



RJ12 socket

Control component with dynamic transducer and Modbus RTU interface for X-AIRCONTROL

Compact device for use with VAV terminal units TVE

- Controller, dynamic differential pressure transducer and actuator in one casing
- Use in ventilation and air conditioning systems, only with clean air
- Simple plug connection RJ12 for supply voltage and network
- Compatible with X-AIRCONTROL zone module Modbus
- Volume flow rates q_{vmin} and q_{vmax} are pre-set in the factory and saved in the controller as changed parameters
- High data transparency through standardised bus communication Modbus RTU, RS485
- Setpoint value settings, override controls, parameter adjustment via Modbus register
- Integrated display for volume flow rate display, operating mode display and setting of operating parameters
- Service access for manual adjustment devices and PC configuration software

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
- Suitable for room control X-AIRCONTROL Modbus zone module
- Closed circuits for temperature, moisture and air quality, for example, control the variable volume flow control by specifying the setpoint values via a communication interface or analogue signal.
- Simple connection for supply voltage and network with common plug connection RJ12
- Override controls for activating q_{vmin}, q_{vmax}, shut-off, OPEN position via Modbus register possible
- Volume flow rate actual value is available as a network data point
- Damper blade position is available as a network data point
- 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 dust, fluff or sticky components

- Use of the XS0-J6 module instead of the XM0-J6 compact controller described here

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.
- Flow rate range parameterised in the controller at 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

- Modbus (M): setpoint value specification via X-AIRCONTROL

Communication interface

- Modbus RTU, RS485
- List of data points, see Modbus register list

Parts and characteristics

- Transducer for dynamic measurement principle
- Overload protection
- Connection socket RJ12 with cover
- Display and operating elements for simple menu guidance
- Menu guidance for adjusting operating parameters and communication interface
- Service interface

Construction

- TROVM-024T-05I-DD15-MB with plug connection RJ12
- Can only be used for type TVE

Commissioning

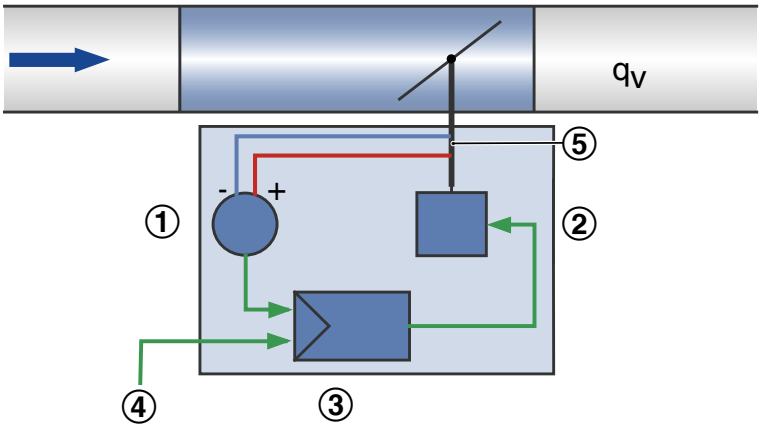
- Due to the volume flow rates set in the factory, always ensure that the control units are only installed in the specified locations
- Commissioning steps for network integration required
- Operating parameters can be adjusted by the customer (using the display panel, adjustment device or Modbus register)

Useful additions

- Adjustment device type GUIV3-M (order code AT-VAV-G3)
- Room control X-AIRCONTROL with zone module Modbus X-AIR-ZMO-MOD

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 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 available as a data point. The factory setting is such that it always 100% 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 accordingly.



① Differential pressure transducer
② Actuator
③ Volume flow controller
④ Setpoint via Modbus
⑤ Shaft with effective pressure channel

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 controlled variable and tapping an actual value for integration into the X-AIRCONTROL
- The actual value relates to the nominal volume flow rate such that commissioning and subsequent adjustment are simplified

Application
- Dynamic transmitter for clean air in ventilation and air conditioning systems

Supply voltage
- 24 V AC / DC

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

Installation orientation
- either direction

Interface/Control
- Modbus RTU (RS-485)

Connection
- Connection socket RJ12 for simple connection with X-AIRCONTROL, with cover via a rubber cap cover
- Suitable for X-AIRCONTROL zone module X-AIR-ZMO-MOD

Interface information
- Modbus: including reading and writing of volume flow rate setpoint value and actual value signal, damper blade position, override control

Special functions
- Clearly visible external indicator light for signalling the functions: Set, not set, and power failure
- Display for actual values, parameterisation and for test functions
- Activation q_{vmin}, q_{vmax}, closed, open by X-AIRCONTROL

Parameter settings
- Parameters specific to VAV terminal unit parameterised at the factory
- Operating values: q_{vmin}, q_{vmax}Factory parameterised
- Subsequent adjustment via display and control element directly on the device or with optional tools: adjustment device, PC software (wired in each case), in Modbus mode as well as via Modbus register access

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 / XM0-J6 / M / qvmin – qvmax m³/h
1 2 5 6 7 8 9 10

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
D2Double lip seal both sides
G2 Matching flanges for both ends

7 Attachments (control component)
XM0-J6 Compact controller of dynamic transducer, Modbus RTU, display, RJ12 connection socket

8 Operating mode
M Modbus RTU

9 Operating values for factory setting
Volume flow rates [m³/h or l/s]
q_{vmin}
q_{vmax}

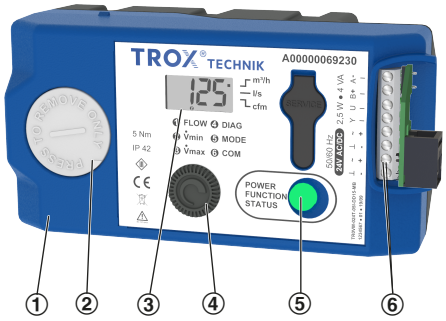
10 Volume flow unit
m³/h
l/s

Order example: TVE/100/D2/XM0-J6/M/20-350 m³/h

Acoustic cladding	Without
Material	Galvanised sheet steel
Nominal size	100 mm
Accessories	Double lip seal both sides
Attachment	Compact controller Modbus, dynamic transducer, for X-AIRCONTROL
operating mode	Modbus RTU
Volume flow rate	20 – 350 m³/h

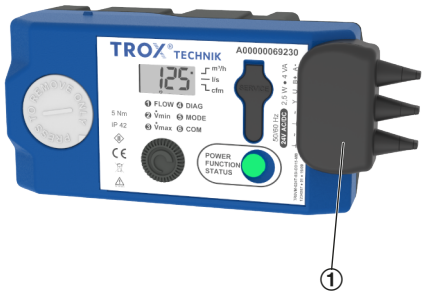
Variants

Compact controller XM0-J6 for TVE



① Compact controller
② Release button
③ Display
④ Control element Selection Options/Setting values
⑤ Control element Selection Menu entry
⑥ Connection socket RJ12

Compact controller XM0-J6 for TVE (with attached terminal cover)



① Cover connection socket (Part of the supply package)

Technical data

Compact controllers for VAV terminal units

VAV terminal units	Type of installation component	Part number
TVE	TROVM-024T-05I-DD15-MB	A00000069230

Compact controller TROVM-024T-05I-DD15-MB with connection socket RJ12

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
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	Modbus RTU, RS485
Number of nodes	128
Adjustable communication parameters	1200 – 115,200 Bd Start bit: 1 Data bits: 8 Stop bits: 1 or 2 Parity: None, Even, Odd
Setpoint / actual value interface (Modbus)	via X-AIRCONTROL/Modus register list
Cable termination	externally required

Interface configuration of control components

The communication interface for the control component is pre-set to Modbus at the factory for use with the X-AIRCONTROL zone module. Only the Modbus address must be adjusted by others in the supply air and extract air. For other applications, data transmission speed and format must be adapted according to the network environment. Using the analogue interface is not possible in combination with the connection socket RJ12 of the variant XM0-J6. For this reason, the configuration register 122 (interface mode) may not be changed by others. To use an analogue interface, the variant XM0 must be used.

Communication interface Modbus RTU (operating mode M)

Register	Meaning	Access right	Storage
0 Installation components	Volume flow rate setpoint value [%] Reference: Vmin – Vmax (qvmin – qvmax) Resolution: 0 – 10000 Volume flow rate setpoint: 0.00 – 100.00%	R, W	RAM
1	Activation of an override control; 0 = no; 1 = Open; 2 = Close; 3 = Vmin; 4 = Vmax	R, W	RAM
2	Command triggering 0 = none; 1 = adaptation; 2 = test run; 4 = controller reset	R, W	RAM
4	Current damper blade position [%] Resolution: 0 – 10000 Damper blade position: 0.00 – 100.00%	R	RAM
5	Current damper blade position [°] Reference: without decimal places	R	RAM
6	Current actual volume flow rate [%] Resolution: Vnom Resolution: 0 – 10000 Volume flow rate actual value: 0.00 – 100.00%	Compact controller analogue and Modbus RTU Display	RAM
7	Current actual volume flow rate in volume flow unit [m³/h], [l/s], [cfm] acc. Register 201	R	RAM
8	Voltage value at analog input Y [mV] Note: Connection terminal analogue input Y not accessible with variant with connection socket	R	RAM

103	Firmware version	R 0.00 – 100.00 %	EEPROM
104	Status information (Bit = 1 active, bit = 0 inactive) Bit 2 mechanical overload Bit 8 internal activity e.g. Test run, adaptation Bit 10 bus timeout monitoring triggered	R	RAM
105	Work area limitation: Operating parameters Vmin (qvmin) [%] Resolution: Vnom Resolution: 0 – 10000 Vmin: 0.00 – 100.00%	R, W	EEPROM
106	Work area limitation: Operating parameters Vmax (qvmax) [%] Resolution: Vnom Resolution: 0 – 10000 Vmax: 0.00 – 100.00%	R, W	EEPROM
108	Behavior on bus timeout; 0 = no; 1 = To; 2 = open; 3 = qvmin; 5 = qVmax	R, W	EEPROM
109	Definition bus timeout [s]	R, W	EEPROM
110	Vnom in volume flow unit [m³/h] ,[l/s],[cfm]	R	EEPROM
120	Definition work area: operating parameters Vmin (qvmin) in volume flow unit [m³/h], [l/s], [cfm] acc. Register 201	R, W	EEPROM
121	Definition work area: operating parameters Vmax (qvmax) in volume flow unit [m³/h], [l/s], [cfm] acc. Register 201	R, W	EEPROM
122	Interface definition (Interface mode) For assignment see separate table	R, W	EEPROM
130 *	Modbus address (user address)	R, W	EEPROM
201	Volume flow unit 0 = l/s; 1 = m³/h; 6 = cfm	R, W	EEPROM
231	Adjustment mode: Bit 0 defines the characteristic selection of the analogue interface.	R, W	EEPROM

	Bit 0 = 0 characteristic: 0 – 10 V Bit 0 = 1 characteristic: 2 – 10 V Bit 4 defines the actual value signal as volume flow rate actual value or damper position. Bit 4 = 0 volume flow rate actual value Bit 4 = 1 Damper blade position All other bits must not be changed.		
568	Modbus parameter kit communication settings: baud rate, parity, stop bits, assignment see separate table	R, W	EEPROM
569	Modbus communication settings: Modbus Response Time = 10 ms + delay; with delay= 3 ms × register value 0 – 255	R, W	EEPROM

* Factory setting: Modbus address 1
R = Register can be read
R,W = Register can be read and written
RAM = Register value temporary
EEPROM = Register value not temporary, but saved permanently (max. 1 million. write processes)

Detailed information on register 122 (communication interface setpoint/actual value - Interface Mode)

Register value	Signal input	Feedback signal
0 Installation components	Analogue (0) 2 – 10 V	(0)2 – 10 V
1	Modbus via Register 0	(0)2 – 10 V
2	Modbus via Register 0	Register 10
3	Analogue (0) 2 – 10 V	Register 10

Note: For the control component XS0-J6, only the register value 2 is practical, as the analogue input and the analogue feedback signal is not available on the connection socket.

Detailed information on register 568 (Modbus communication parameters)

Register value	Display setting value	Baud rate	Parity	Stop bits
0 Installation components	1	1200	None	2
1	2	1200	Straight	1
2	3	1200	Uneven	1
3	4	2400	None	2
4	5	2400	Straight	1
5	6	2400	Uneven	1
6	7	4800	None	2
7	8	4800	Straight	1
8	9	4800	Uneven	1
9	10	9600	None	2
10	11	9600	Straight	1
11	12	9600	Uneven	1
12	13	19200	None	2
13	14	19200	Straight	1
14	15	19200	Uneven	1
15 **	16	38400	None	2
16	17	38400	Straight	1
17	18	38400	Uneven	1
18	19	1200	None	1
19	20	2400	None	1
20	21	4800	None	1
21	22	9600	None	1
22	23	19200	None	1
23	24	38400	None	1
24	25	76800	None	1
25	26	115200	None	1
26	27	76800	None	2
27	28	76800	Straight	1
28	29	76800	Uneven	1
29	30	115200	None	2
30	31	115200	Straight	1
31	32	115200	Uneven	1

** factory setting: Modbus communication parameters

XM0, Display

Display range of functions
Display functions

- Volume flow rate actual value (unit optionally m³/h, l/s, cfm)
- 3-character display with position valuation labelling
- Status and error display for various operating modes, including display of activated override control, display of diagnostic function

Parameterisation functions

- Adjustment option for the unit of the volume flow rate display m³/h, l/s, cfm
- Adjustment option for the work area q_{vmin}, q_{vmax}
- Selection of the interface configuration Modbus or analogue including signal voltage range 0 – 10 V or 2 – 10 V DC
- Adjustment option for Modbus communication settings (address, baud rate, stop bits, parity)

Diagnosis

- Activation of a test run
- Activation of override controls Open, Closed, q_{vmin}, q_{vmax}, motor stop (note prioritisation)
- Display of the voltage value on the analogue input

Commissioning

After installation, wiring and connection of the supply voltage

- When using the Modbus interface: set the Modbus communication parameters via the integrated menu, the air terminal unit is then ready
- Setpoint value setting via Modbus register
- When using the analogue interface: air terminal unit is immediately ready for use
- Comply with volume flow rate control range from 4 – 100 % of $q_{vnenn;}$ do not set a volume flow rate which is below the minimum flow rate of the control unit
- Only briefly remove the protective cap of the control component during wiring

Product details

Modbus mode (order code, operating mode M)

For smooth data exchange in the Modbus RTU network, the communication parameters and user address must be set for the Modbus interface.
The interface offers standardised Modbus register access to the available data points via the functions ReadHoldingRegister (3) and WriteSingleRegister (6).

Setpoint value setting

- In the operating mode M, the setpoint value is only set by specifying the volume flow rate set point value [%] in the Modbus register 0.
- The transferred percentage value refers to the volume flow rate range specified by q_{vmin} – q_{vmax} .
- 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} is possible in the setup menu on the display, with the adjustment device or using the Modbus interface or X-AIRCONTROL.

Actual value as feedback

- The current actual volume flow rate can be called up using the display, adjustment device or X-AIRCONTROL.
- In addition to the volume flow rate actual value, further information can be read out via X-AIRCONTROL.

Override control options

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.

- This is set via X-AIRCONTROL.
- Override control for bus timeout monitoring:
  When there is a failure in communication, the controller executes the last saved status as a result of its factory setting. Using corresponding software, the factory setting can be changed via the Modbus register 108.
  Each communication resets the timeout of the bus failure monitoring.

Override controls for diagnostic purposes

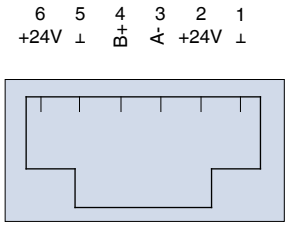
Activation of the diagnostic menu on the display of the controller or via X-AIRCONTROL.

Override control prioritisation

Settings via service tools are prioritised over Modbus settings.

- Highest priority: settings via the service connector (adjustment device, PC software) for test purposes
- Lowest priority: settings via Modbus 1 or the diagnostic menu on the controller

XM0-J6, connection socket pin identification RJ12



1 ⊥, - = Ground, neutral
2 ~, + = Supply voltage 24 V
3 B+ = Modbus RTU
4 A- = Modbus RTU
5 ⊥, - = Ground, neutral
6 ~, + = Supply voltage 24 V

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.