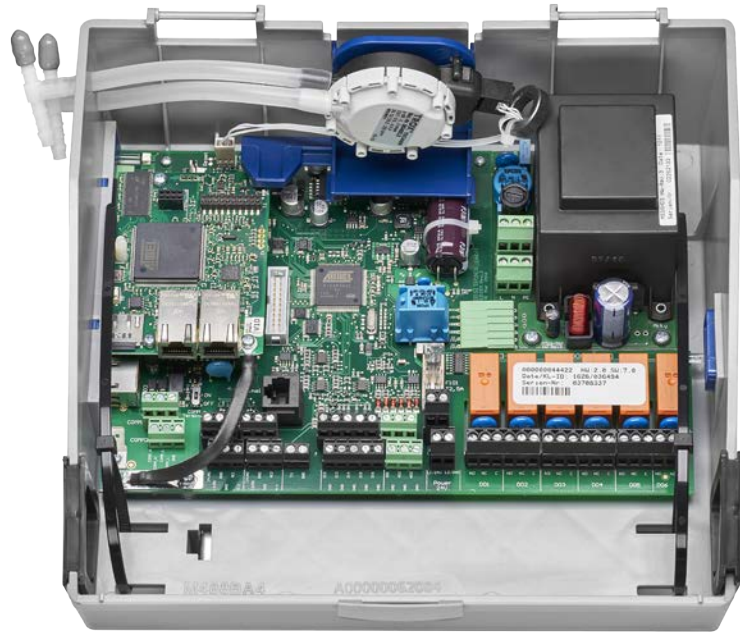


Control components for VAV terminal units

TROX UNIVERSAL



Plug sockets on the outside



For hospitals



For clean rooms, e.g. in semiconductor manufacturing

TROX UNIVERSAL controllers for the most demanding control engineering tasks

Electronic controller that offers plug and play communication for demanding control tasks, yet simple wiring and commissioning

- Maximum control comfort for clean rooms, hospital wards, and offices
- Demand-based control of supply air, extract air, room pressure and duct pressure
- Interactive configuration software with commissioning wizard, functional testing procedure and Bluetooth adapter
- Perfect system for complete room solutions from a single source
- Plug-in communication cable for easy wiring
- Adaptable control panel and many special functions allow for individual operating modes and control strategies

Expansion options

- Expansion modules with LonWorks, BACnet or Modbus standard interfaces to the central BMS
- Automatic zero point correction for long-term stability and reduced maintenance
- Connection to the mains (230 V)
- Adaptable control panel

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Application

Application

- Electronic controller Type TROX UNIVERSAL, for the control of volume flow rate, room pressure or duct pressure, suitable for supply air and extract air and also as an attachment to VAV terminal units
- For use in clean rooms in the pharmaceutical and semiconductor industries, operating theatres, intensive care units, and offices with very demanding control and data transparency requirements
- Fast and stable control of the supply air and extract air flow rates as well as of room pressure and duct pressure
- For extract air led areas such as kitchens
- For supply air led areas such as clean rooms, offices and patient rooms in hospitals
- Options for the integration of additional volume flows into the room balance
- Room pressure and duct pressure control; supply air or extract air flow rate measurement as an option (expansion module)

Features

- Controllers can be used individually or combined with other controllers for a complete room solution
- System solution for the volume flow control in rooms (room balance)
- Central BMS interface, 0 – 10 V voltage signals, digital inputs and outputs, expansion modules for LonWorks, BACnet, Modbus

Special characteristics

- Plug and play communication system with automatic controller identification, no component addressing required
- Modular system for functional expansion
- Connections and status displays on the outside of the controller casing
- Project-specific adjustments with adaptable room control panel
- Project-specific adjustments can be achieved with configurable special functions, monitoring, and alarm signalling
- Permanent function monitoring of the system and the connected sensors
- Very simple commissioning with software wizard for configuration changes, maintenance and diagnosis
- Centralised configuring and permanent signalling of room settings (room management function)
- EasyConnect configuration software enables interactive navigation (with optional BlueCon adapter, wireless controller configuration)
- Factory tested and configured with project-specific parameters

Description

Parts and characteristics

- Ready-to-commission controller, as an attachment for air terminal units
- Static differential pressure transducer for rapid actual value measurement
- Microprocessor system with programme and system data stored in nonvolatile memory
- Double-stack terminal block for supply voltage connection
- Connections for two control panels
- Connection of communication cable to plug socket or screw terminals
- Digital inputs with screw terminals or plug socket
- Analogue inputs with screw terminals or plug socket
- Analogue outputs with screw terminals or plug socket (actuator)
- Control input signal for various actuators: standard actuator with 150 s running time, actuator with 150 s running time and safe position (spring return), fast-running 3 s actuator; all actuators for 90° damper blade position
- Integral terminal resistor for the communication cable
- Alarm indicator lights on both sides of the casing
- Status indicator lights (heartbeat, communication and terminal resistor)

Attachments

Expansion modules are factory mounted or can be fitted at a later stage

- T: EM-TRF, power supply unit for connecting the controller to the 230 V AC mains voltage
- U: EM-TRF-USV, power supply unit for connecting the controller to the 230 V AC mains voltage, including uninterruptible power supply (with battery backup, 4 h), volume flow rate measurement for room and duct pressure controllers
- Z: EM-AUTOZERO, automatic zero point correction for long-term stable volume flow rate measurement and hence reduced maintenance.
- L: EM-LON, LonWorks FTT-10A interface
- B: EM-BAC-MOD-01, interface for BACnet MS/TP
- M: EM-BAC-MOD-01, interface for Modbus RTU
- I: EM-IP, BACnet-IP, Modbus-IP, web server interface
- R: EM-IP, BACnet-IP, Modbus-IP, web server interface with real time clock

Useful additions

- BE-LCD: Room control panel
- Static differential pressure transducer for room pressure control
- Static differential pressure transducer for duct pressure control, including tube and pressure tap
- EasyConnect: Configuration software for the commissioning and diagnosis of TROX UNIVERSAL and EASYLAB systems; BlueCon Bluetooth adapter module available as an option
- EasyCon Android app for maintenance and diagnosis as well as for reading and writing certain parameters (only with TROX BlueCon adapter module)

Construction features

- Control unit complete with all expansion modules in a plastic casing and attached to the air terminal unit
- Controller casing can be opened without tools, except for controllers with EM-TRF or EM-TRF-USV
- Expansion modules can be easily retrofitted (automatic recognition, plug and play)
- Pin header socket for the connection of expansion modules
- Plug sockets for the most important connections on the outside of the casing
- Static differential pressure transducer with room air induction to protect the sensor

Materials and surfaces

- Casing made of ABS plastic, UL94, V0, lower part in grey (RAL 7037), with blue cover (RAL 5002)

Maintenance

- Zero point correction of the static differential pressure transducer should be carried out once per year (recommendation)
- If you use expansion module EM-AUTOZERO for automatic zero point correction, no manual correction is required

Supply voltage	24 V AC \pm 15 %; 230 V AC as option; 50/60 Hz
Power rating	15 VA with standard actuator, 20 VA with spring return actuator, 29 VA with fast-running actuator, plus 4 VA for each BE-LCD control panel
Micro fuse	2 A, slow blow, 250 V
Operating temperature	10 – 50 °C
IEC protection class	III (protective extra-low voltage), with EM-TRF or EM-TRF-USV II (protective insulation)
Protection level	IP 20
EC conformity	EMC to 2014/30/EU
Weight	1.4 kg

Recovery time	500 ms
2 interfaces for communication cable	Network cable SF-UTP, 300 m max.; up to 24 devices
2 interfaces for control panels	Network cable SF-UTP, 40 m max.
6 digital inputs	For volt-free switch contacts, configured as NO contacts
6 digital outputs	Relay with NO/NC contact, 250 V, 8 A; switch-on current 12 A
5 analogue inputs	0 – 10 V, input resistance > 100 k Ω , characteristic can be configured
4 analog outputs	0 – 10 V, 10 mA max., characteristic can be configured



Actuator LM24A-SR

Actuator LM24A-SR for control component TUN

Supply voltage (AC)	From the TROX UNIVERSAL controller
Supply voltage (DC)	24 V DC \pm 20 %
Power consumption – when running	1 W
Power consumption – when idle	0.4 W
Power rating for cable sizing	2 VA
Torque	5 Nm
Running time for 90°	150 s
Control signal	2 – 10 V DC, $R_a > 100$ k Ω
Connecting cable	4 \times 0.75 mm ² , 1 m long
IEC protection class	III (protective extra-low voltage)
Protection level	IP 54
EC conformity	EMC to 2014/30/EU, RoHS 2011/65/EU
Operating temperature	–30 to 50 °C
Weight	0.5 kg



Actuator NM24A-SR

Actuator NM24A-SR for control component TUN

Supply voltage (AC)	From the TROX UNIVERSAL controller
Supply voltage (DC)	24 V DC \pm 20 %
Power rating (AC)	4 VA max.
Power rating (DC)	2 W max.
Torque	10 Nm
Running time for 90°	150 s
Control signal	2 – 10 V DC, $R_a > 100$ k Ω
Connecting cable	4 \times 0.75 mm ² , 1 m long
IEC protection class	III (protective extra-low voltage)
Protection level	IP 54
EC conformity	EMC to 2014/30/EU, RoHS 2011/65/EU
Operating temperature	-30 to 50 °C
Weight	0.8 kg



Actuator NF24A-SR

Spring return actuator NF24A-SR for control component TUNF

Supply voltage (AC)	From the TROX UNIVERSAL controller
Supply voltage (DC)	24 V DC \pm 20 %
Power rating (AC)	6.5 VA max.
Power rating (DC)	3.5 W max.
Torque	10 Nm
Actuator running time for 90°	150 s
Spring return	20 s (for < -20 °C up to 60 s)
Control signal	2 – 10 V DC, $R_a > 100$ k Ω
Connecting cable	4 \times 0.75 mm ² , 1 m long
IEC protection class	III (protective extra-low voltage)
Protection level	IP 54
EC conformity	EMC to 2014/30/EU, RoHS 2011/65/EU
Operating temperature	-30 to 50 °C
Weight	1.8 kg



Actuator NMQ24A-SR

Fast-running actuator NMQ24A-SR for control component TUS

Supply voltage	From the TROX UNIVERSAL controller
Power rating (AC)	24 VA max.
Power rating (DC)	14 W max.
Torque	8 Nm
Running time for 90°	4 s
Control signal	2 – 10 V DC, $R_a > 100$ k Ω
Connecting cable	4 \times 0.75 mm ² , 1 m long
IEC protection class	III (protective extra-low voltage)
Protection level	IP 54
EC conformity	EMC to 2014/30/EU
Operating temperature	-30 to 50 °C
Weight	0.970 kg

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

Volume flow rate

Circular VAV terminal units for variable and constant volume flow systems, suitable for supply or extract air, available in 7 nominal sizes.

High control accuracy (even with upstream bend $R = 1D$).

Ready-to-operate unit which consists of the mechanical parts and the electronic control components (attachments). Each unit contains an averaging effective pressure sensor for volume flow rate measurement, and a control damper blade. Factory assembled control components (attachments) complete with wiring and tubing. Effective pressure sensor with 3 mm measuring holes, hence resistant to dust and pollution. Spigot with groove for lip seal, suitable for connecting ducts according to EN 1506 or EN 13180. Position of the damper blade indicated externally at shaft extension.

Closed blade air leakage to EN 1751, class 4 (nominal size 100, class 2; nominal sizes 125 and 160, class 3).

Casing air leakage to EN 1751, class C.

Materials and surfaces

- Casing made of ABS plastic, blue (RAL 5002)

Technical data

- Nominal sizes: 100 to 400 mm
- Volume flow rate range: 12 to 1680 l/s or 44 to 6048 m³/h
- Volume flow rate control range: approx. 15 – 100 % of the nominal volume flow rate
- Differential pressure range: 5 – 1000 Pa

Control component (attachments)

Electronic controller for the demand-based supply air or extract air flow control.

Factory mounted to a VAV terminal unit, wired, tested and set to customer-specific parameters (immediately ready for use once installed).

Control electronics using a microprocessor, with firmware and configuration settings stored in EEPROM memory and hence safe in case of a power failure.

Choice of three actuator variants to ideally meet project-specific requirements.

- Slow-running actuator (standard): running time 150 s
- Actuator that ensures safe position in case of power failure – damper blade OPEN/CLOSED (spring return actuator): running time 150 s
- Fast-running actuator: running time 3 – 4 s

Basic functions

- RS: Supply air control
- RE: Extract air control

It should be possible to configure and save up to 3 flow rate setpoint values; it should also be possible to close and open the damper blade by an external signal (override function).

The controller should have a 0(2) – 10 V input for a flow rate setpoint value from an external source and be able to process this signal.

It should be possible to implement the functions mentioned above with an optional expansion module for LonWorks, Modbus or BACnet.

The controller monitors and controls the flow rate setpoint values and issues an alarm if there is a deviation.

It should be possible to set alarm thresholds (parameters) as deviations (higher/lower) from the setpoint value.

It should be possible to use the software to easily change control parameters so that they meet system or room requirements.

Connections for all important communication and peripheral devices are located on the outside of the casing and are hence easily accessible.

Indicator lights for alarms (on both sides), controller function (heartbeat) and communication should also be placed on the outside of the casing.

Conventional interfaces should be provided to connect the controller to higher-level systems:

- 4 analogue inputs for the setpoint and for additional actual flow rate values
- 3 analogue outputs for signalling the actual volume flow rate and the damper blade position as well as the volume flow rate setpoint to the slave controller
- 5 digital inputs for volt-free contacts, selection of operating modes only with master (RMF) (\dot{V}_{\min} , \dot{V}_{\max} , closed, open, modulating)
- 6 digital outputs (relays) for alarms, signalling of the operating mode; lighting and shading only with master (RMF)

2 control panels can be connected to the controller for the output of visual and acoustic alarms in case of volume flow rate deviations. Display of flow rate actual and setpoint values; also for room users to enter and set values.

The controller should be designed for integration with a control system and hence allow for the connection of up to 24 TROX UNIVERSAL controllers to a communication cable; no addressing should be required (plug and play). It is possible to combine different equipment functions (volume flow rate, room pressure, duct pressure) within a system.

It should be possible to expand the range of functions with expansion modules for different project requirements.

A transformer module allows for the connection of 230 V AC in case no 24 V AC/DC supply voltage can be provided.

A transformer module with UPS function should be provided.

A special valve (optional) should be provided for the automatic zero point correction of the differential pressure transducer; the controller should automatically recognise the valve.

It should be possible to connect the controller with optional communication modules to open bus systems (LonWorks, BACnet MS/TP, Modbus RTU, BACnet/IP and Modbus/IP).

This will allow for the reading and writing of defined data points and parameters such as volume flow rate actual and setpoint values, extract and supply air flow rate total values, damper blade position, overrides and alarms.

Room pressure or duct pressure controllers

Circular VAV terminal units for variable and constant volume flow systems, suitable for supply or extract air, available in 7 nominal sizes.

High control accuracy (even with upstream bend $R = 1D$).

Ready-to-operate unit which consists of the mechanical parts and the electronic control components (attachments). Each unit contains an averaging effective pressure sensor for volume flow rate measurement, and a control damper blade. Factory assembled control components (attachments) complete with wiring and tubing. Effective pressure sensor with 3 mm measuring holes, hence resistant to dust and pollution. Spigot with groove for lip seal, suitable for connecting ducts according to EN 1506 or EN 13180.

Position of the damper blade indicated externally at shaft extension.

Closed blade air leakage to EN 1751, class 4 (nominal size 100, class 2; nominal sizes 125 and 160, class 3).

Casing air leakage to EN 1751, class C.

Materials and surfaces

- Casing made of ABS plastic, V0, lower part in grey (RAL 7037), with blue cover (RAL 5002)

Technical data

- Nominal sizes: 100 to 400 mm
- Volume flow rate range: 12 to 1680 l/s or 44 to 6048 m³/h
- Volume flow rate control range: approx. 15 – 100 % of the nominal volume flow rate
- Differential pressure range: 5 – 1000 Pa

Control component (attachments)

Electronic controller for the demand-based control of supply air pressure or extract air pressure in rooms or ducts.

Factory mounted to a VAV terminal unit, wired, tested and set to customer-specific parameters. Control electronics using a microprocessor, with firmware and configuration settings stored in EEPROM memory and hence safe in case of a power failure

Equipment function

- PRS: Room pressure control, supply air
- PRE: Room pressure control, extract air
- PDS: Duct pressure control, supply air
- PDE: Duct pressure control, extract air

Maintenance of the required differential pressure through a permanent setpoint/actual value comparison in a closed loop.

The pressure setpoint is either a parameter (constant pressure) or a controlled variable (variable pressure) that is received via an analogue input or a communication module (expansion). Room pressure control requires that positive pressure, negative pressure and 0 Pa differential pressure can be achieved.

The controller should allow for override control to fully open or close the damper blade.

An external differential pressure transducer measures the room or duct pressure; the measured value is then transmitted to the

controller by means of a 0 – 10 or a 2 – 10 V DC voltage signal. This allows for some flexibility with regard to the differential pressure transducer for a project.

An optional expansion module for volume flow rate measurement should allow for measuring the volume flow rate by means of the pressure controller.

The controller monitors the required differential pressure and emits an alarm in case of deviations. Alarm thresholds (parameters) can be individually set and changed as deviations from the setpoint value. With a volt-free door contact on a digital input it should be possible to suppress alarms (for a certain period of time) and to freeze the damper blade in its current position.

The controller should allow for override control to fully open or close the damper blade (digital inputs or communication modules).

Connections for all important communication and peripheral devices are located on the outside of the casing and hence easily accessible. Indicator lights for alarms (on both sides), controller function (heartbeat), and communication are also on the outside of the casing.

Conventional interfaces should be provided to connect the controller to higher-level systems: 4 analogue inputs for actual pressure and setpoint pressure, room volume flow rate, connection of external volume flow rates; 3 analogue outputs for actual pressure, damper blade position, actual volume flow rate (only with option V); 6 digital inputs (for volt-free contacts) and 6 digital outputs (relays) for alarms and control panels.

2 control panels can be connected to the controller for the emission of visual and acoustic alarms and for the display of room actual and setpoint pressure values, lighting, shading and operating modes; they also allow for control by users.

The controller is designed for integration with a control system; up to 24 TROX UNIVERSAL controllers can be connected to a communication cable (plug and play, no addressing required). It is possible to combine different equipment functions (volume flow rate, room pressure, duct pressure) within a system.

It should be possible to expand the range of functions with expansion modules for different project requirements.

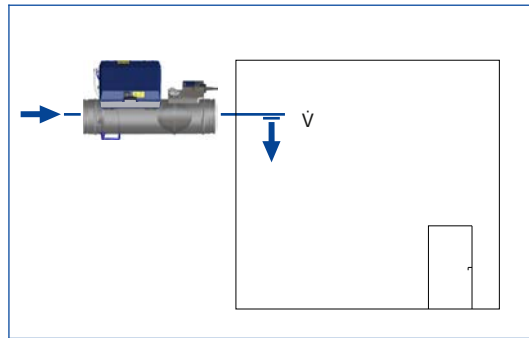
A transformer module allows for the connection of 230 V AC in case no 24 V AC/DC supply voltage can be provided. A transformer module with UPS function should be provided.

It should be possible to expand optional volume flow rate measurement with a function for automatic zero point correction.

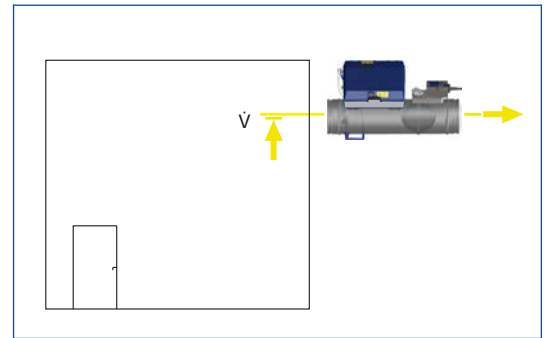
It should be possible to connect the controller with communication modules to open bus systems (LonWorks, BACnet MS/TP, Modbus RTU, BACnet/IP and Modbus/IP). This will allow for the reading and writing of defined data points and parameters. This includes: differential pressure actual and setpoint values, damper blade position, override functions and alarms.

For updated order code, see price list

Supply air terminal unit



Extract air terminal unit



Volume flow control

Application

- Extract air and supply air volume flow rate control and volume flow rate measurement
- Can be combined with galvanised sheet steel VAV terminal units Type TVR, TVJ, TVT, TVA, TVZ, TZ-Silenzio or TA-Silenzio, and with plastic VAV terminal units Type TVRK
- Can be combined with stainless steel volume flow rate measuring units Type VMR or VME, and with plastic volume flow rate measuring units of Type VMRK
- Variable volume flow control to save energy while providing maximum safety and data transparency
- Controllers can be easily expanded (optional expansion modules) for use with Modbus, BACnet or LonWorks systems

Monitoring and alarm function

- Monitoring of the volume flow rate can be configured
- Alarm thresholds can be individually configured, independently of deviation
- Alarms can be individually configured, e.g. no alarm during reduced operation
- Optical alarms on the outside of the controller casing
- Alarm signalling to switch contact and communication modules (expansion)
- Optical and acoustic alarms are emitted on the optional room control panel
- Display of volume flow rate actual and setpoint values on the control panel

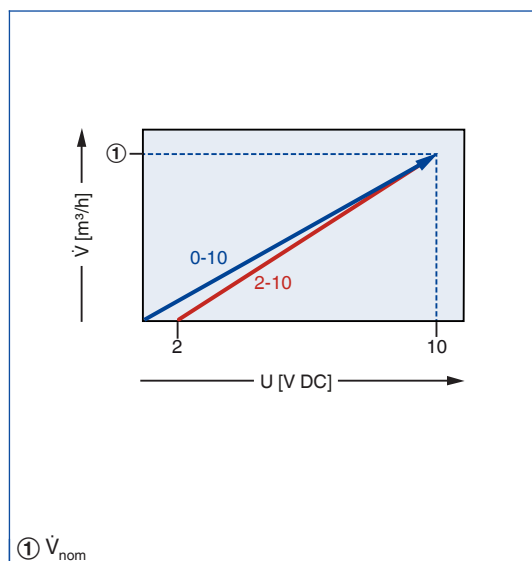
Operating modes

- Standard mode, variable flow rate default setting or constant setpoint value
- Special operating modes: Increased operation (\dot{V}_{max}), reduced operation (\dot{V}_{min}), shut-off and OPEN position
- Shut-off is possible if 2 – 10 V signal voltage range is used and signal is below 1 V

Default setting options

- Three levels for setting operating mode defaults (central BMS, control panel BE-LCD, digital inputs on the controller)
- Operating mode default setting for all controllers in the room
- Configuration options for prioritisation and shut-off
- Volume flow rate setting with voltage signal (0 – 10 V or 2 – 10 V DC)
- Volume flow rate setting with switch contacts
- Volume flow rate setting via central BMS (standard protocol LonWorks, Modbus or BACnet) using optional interface modules
- Operating mode default setting with integral timer and expansion module EM-IP

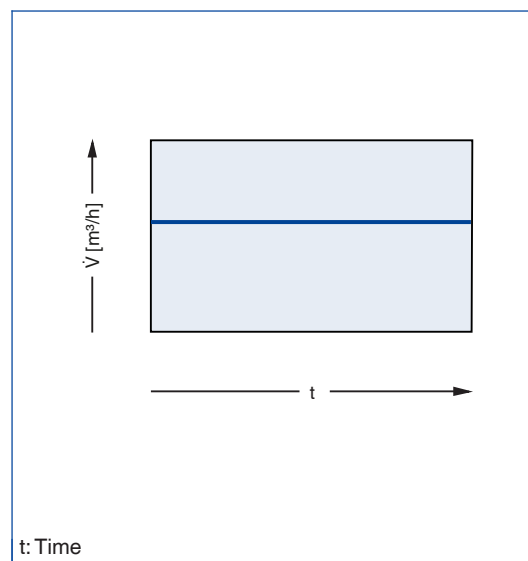
Control diagram – Variable volume flow control



Variable control

- Default setting of variable volume flow rates with a 0 – 10 or 2 – 10 V DC voltage signal, or by the central BMS with network variables
- Signal source by others
- Default setting by means of communication modules (expansion)

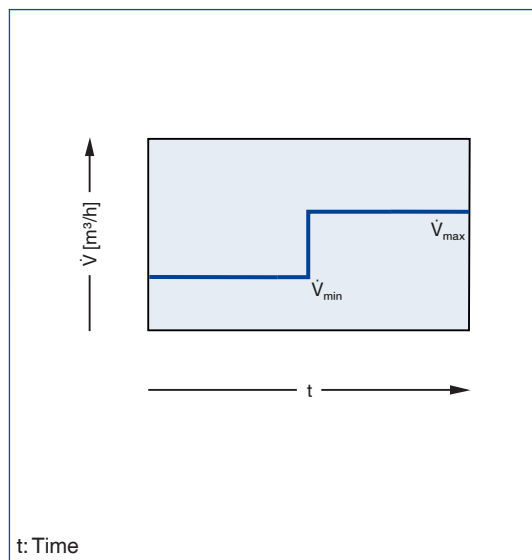
Control diagram – Constant volume flow control



Volume flow rate constant value

- Volume flow control with a constant setpoint value

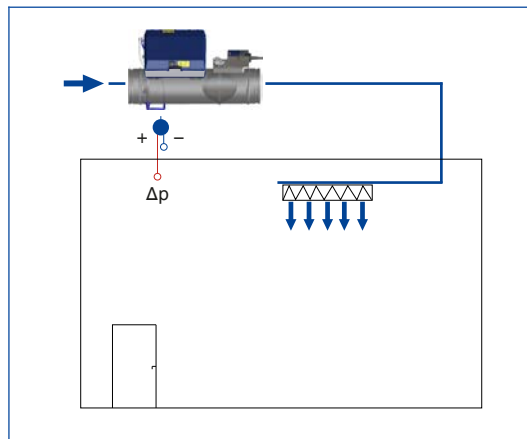
Control diagram – Switching between volume flow rate setpoint values



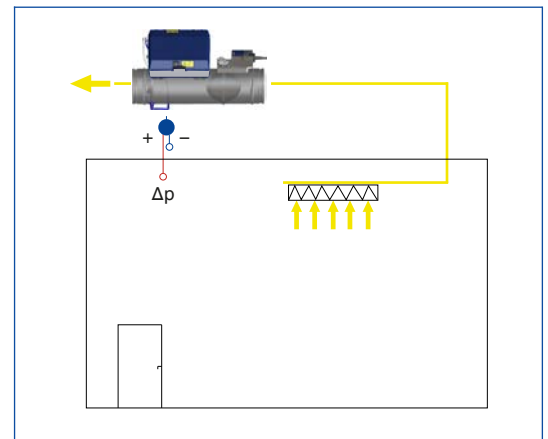
Switching between volume flow rate setpoint values

- Volume flow control with two setpoint values (configured in the controller)
- Switching by using volt-free digital inputs or control panel BE-LCD
- Switching is possible with communication modules

Room pressure control based on supply air



Room pressure control based on extract air



Room pressure control

Application

- Room pressure control based on supply air; typically used for maintaining negative pressure
- Room pressure control based on extract air; typically used for maintaining positive pressure
- Can be combined with galvanised sheet steel VAV terminal units Type TVR, TVJ, TVT, TVZ, TVA, TZ-Silenzio or TA-Silenzio, and plastic VAV terminal units Type TVRK
- Variable pressure control to save energy while providing maximum safety and data transparency
- Adding of a door contact in order to optimise the control function and to emit or suppress an alarm when the door is open
- Supply air or extract air flow rate measurement as an option (expansion module)
- Controllers can be easily expanded (optional expansion modules) for use with Modbus, BACnet or LonWorks systems

Monitoring and alarm function

- Monitoring of the room pressure can be configured
- Alarm thresholds can be individually configured, independently of deviation
- Alarms can be individually configured, e.g. no alarm if a door is open
- Optical alarms on the outside of the controller casing
- Alarm signalling to switch contact and communication modules (expansion)
- Optical and acoustic alarms are emitted on the room control panel
- Pressure setpoint and actual values are displayed on the optional control panel BE-LCD

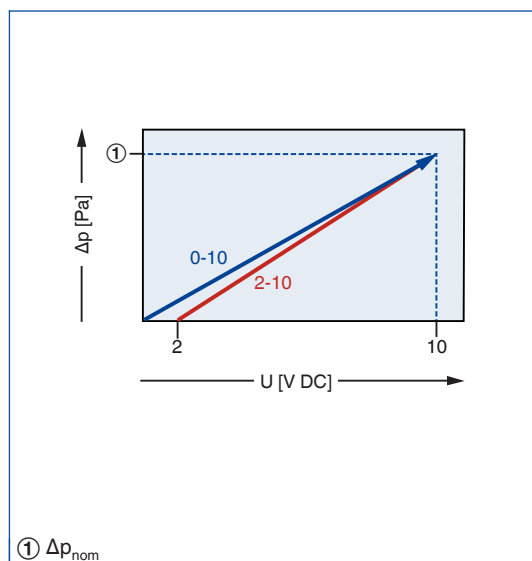
Operating modes

- Standard mode, variable pressure default setting or constant setpoint value
- Special operating modes: Shut-off and OPEN position

Operating mode default setting

- Three levels for setting operating mode defaults (central BMS, control panel BE-LCD, digital inputs on the controller)
- Operating mode default setting for all controllers in the room
- Configuration options for prioritisation and shut-off
- Room pressure default setting via voltage signal (0 – 10 V DC or 2 – 10 V DC)
- Room pressure setting by means of central BMS (standard protocol LonWorks, Modbus or BACnet) using optional interface modules

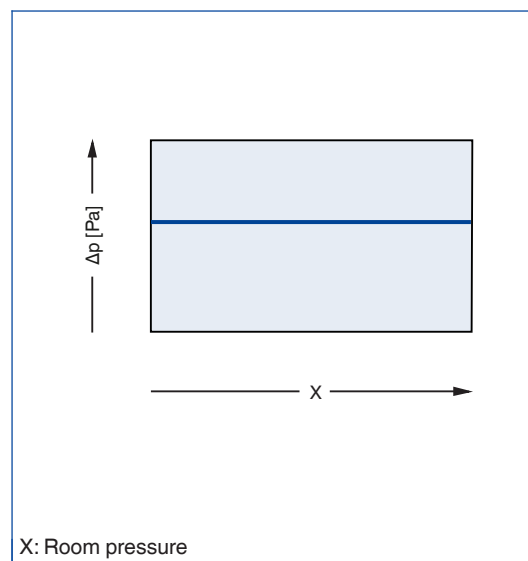
Control diagram – MVP/0, SVP/0, MVP/2, SVP/2



Variable control

- Default setting of variable room pressures with a 0 – 10 or 2 – 10 V DC voltage signal, or by the central BMS with network variables
- Signal source by others
- Default setting by means of communication modules (expansion)

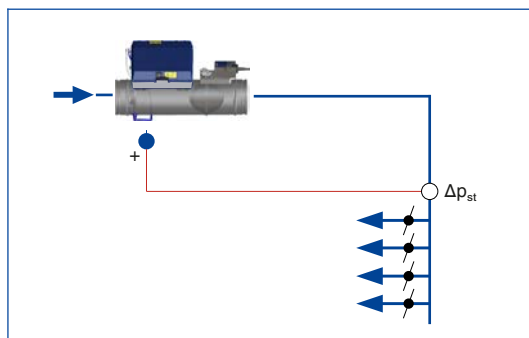
Control diagram – MFP/0, SFP/0, MFP/2, SFP/2



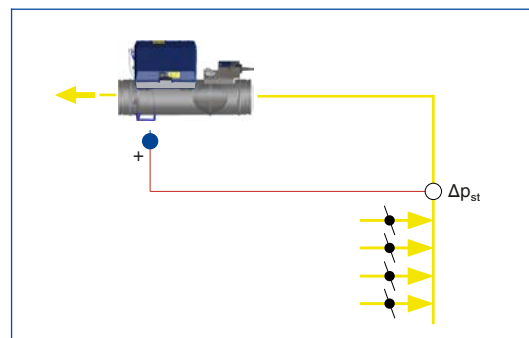
Room pressure constant value

- Room pressure control with a constant setpoint value

Duct pressure control, supply air



Duct pressure control, extract air



Duct pressure control

Application

- Duct pressure control, supply or extract air duct
- Can be combined with galvanised sheet steel VAV terminal units Type TVR, TVJ, TVT, TVZ, TVA, TZ-Silenzio or TA-Silenzio, and plastic VAV terminal units Type TVRK
- Variable pressure control to save energy while providing maximum safety and data transparency
- Supply air or extract air flow rate measurement as an option (expansion module)
- Controllers can be easily expanded (optional expansion modules) for use with Modbus, BACnet or LonWorks systems

Monitoring and alarm function

- Monitoring of the duct pressure can be configured
- Optical alarms on the outside of the controller casing
- Alarm signalling to switch contact and communication modules (expansion)
- Optical and acoustic alarms are emitted on the room control panel
- Display of differential pressure actual and setpoint values on the control panel

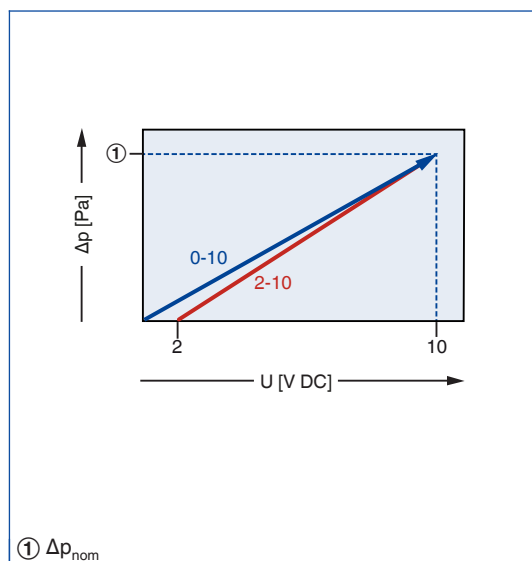
Operating modes

- Standard mode, variable pressure default setting or constant setpoint value
- Special operating modes: Shut-off and OPEN position
- Pressure setpoint and actual values are displayed on the optional control panel BE-LCD

Operating mode default setting

- Three levels for setting operating mode defaults (central BMS, control panel BE-LCD, digital inputs on the controller)
- Configuration options for prioritisation and shut-off
- Operating mode default setting for all controllers in the room
- Duct pressure default setting by means of voltage signal (0 – 10 V DC or 2 – 10 V DC), switch contact or network variable
- Duct pressure default setting by means of central BMS (standard protocol LonWorks, Modbus or BACnet) using optional interface modules

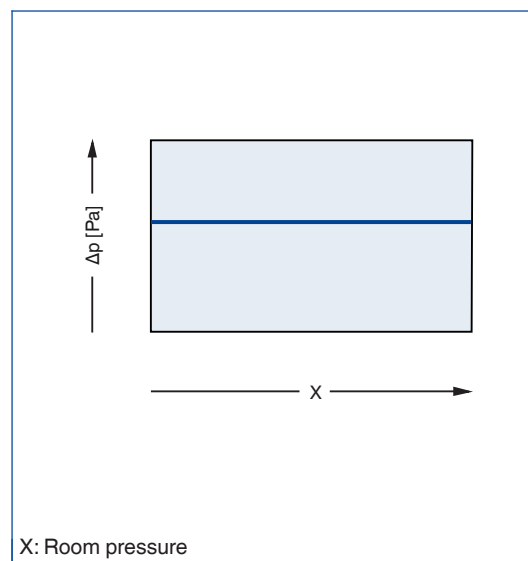
Control diagram – MVP/0, SVP/0, MVP/2, SVP/2



Variable control

- Default setting of variable duct pressures with a 0 – 10 or 2 – 10 V DC voltage signal, or by the central BMS with network variables
- Signal source by others
- Default setting by means of communication modules (expansion)

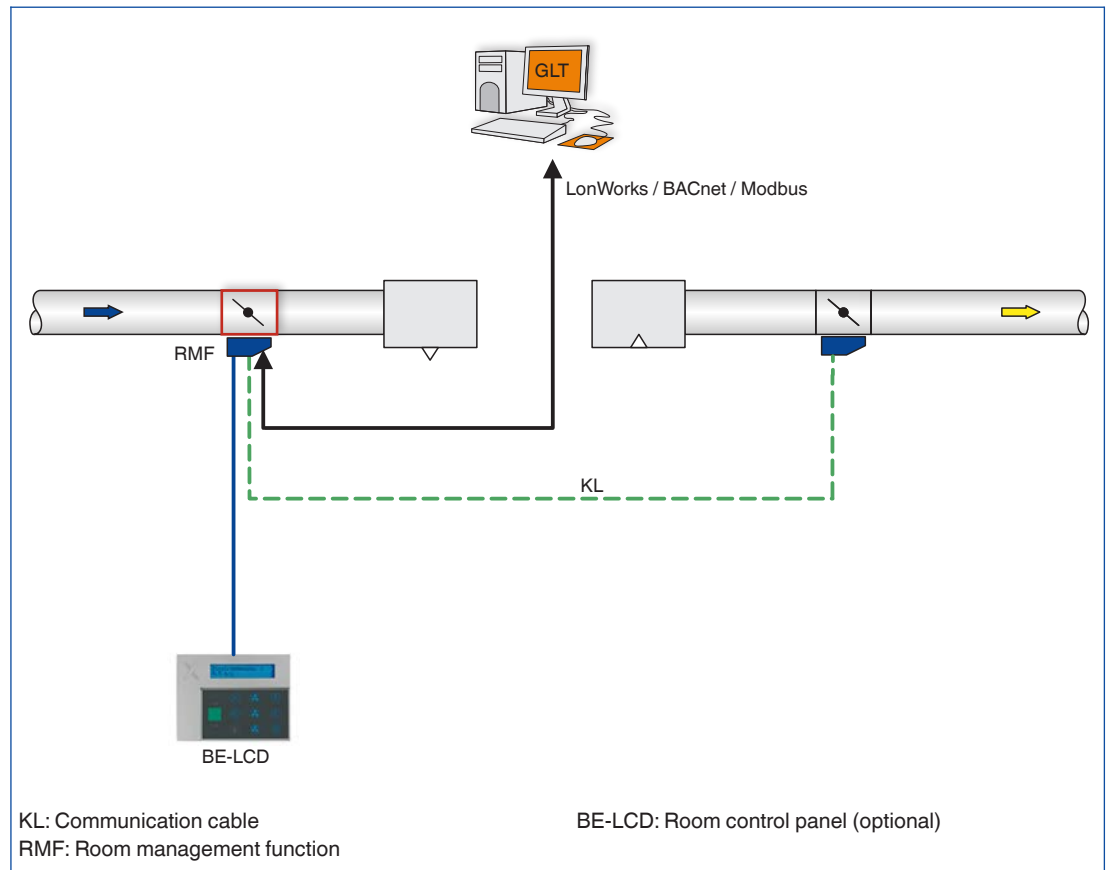
Control diagram – MFP/0, SFP/0, MFP/2, SFP/2



Duct pressure constant value

- Duct pressure control with a constant setpoint value

TROX UNIVERSAL system solution for extract air and supply air



The system

Application

The TROX UNIVERSAL controller meets diverse, project-specific control requirements and can be used as a single controller or as part of a control system. The controller is typically attached to a VAV terminal unit, both in supply air and extract air systems, and controls volume flow rate, room pressure and duct pressure, either as a single device or in a system with other controllers. The desired range of functions depends on how you configure equipment function, control parameters and monitoring parameters. You can also use expansion modules to add more functions. Optional control panels allow you to be notified of alarms, see control status values, and change or influence operating modes.

TROX UNIVERSAL controller

VAV terminal units with a TROX UNIVERSAL controller are typically installed in ventilation and air conditioning systems, at points where an airflow has to be changed in some way. You can use the controller as a single component for the control of a variable or constant supply air flow, for example, or to maintain a constant pressure in a duct. The controller does, however, not only fulfil its control function, but also alarm and monitoring functions.

An actuator moves the damper blade of the VAV terminal unit. Various suitable actuators are available: actuators with normal and short running times (150 s and 3 s) as well as spring return actuators with normal running time (150 s) for safety-related applications. Voltage signals and/or switch contacts as well as (optional) communication modules are used to send default setting values and status values to the controller or receive them from the controller. The TROX plug and play communication system allows you to combine up to 24 controllers into one functional unit, e.g. for the master-slave control of supply air or extract air.

Communication system

Combining several TROX UNIVERSAL controllers to a system offers the highest potential. You can connect up to 24 TROX UNIVERSAL controllers in a room to one communication cable, even if they are used for different equipment functions (volume flow rate control, room pressure control, duct pressure control); they will then be automatically recognised and integrated, i.e. by plug and play. The communication cable may be up to 300 m long.

You can define one controller in such a system as the master controller by activating the room management function (RMF) on that controller and by setting on this controller all of the parameters that are relevant to the volume flow control of the room. You can also use this master controller to have inputs or outputs for analogue signals and for flow rate setpoint values (out), actual values (in), alarms (out) and operating modes (in/out).

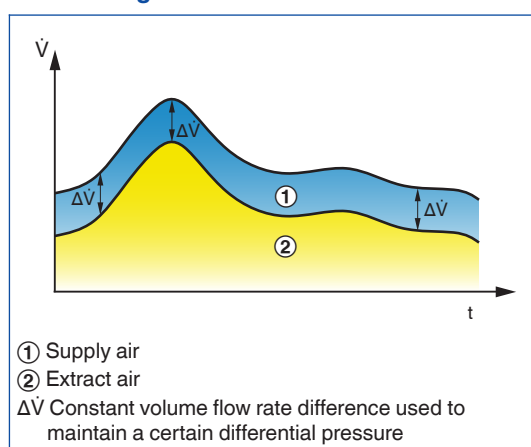
If the master controller includes a communication module, the values mentioned and other information are made available to higher level systems.

Control panel

The control panel (optional) allows you to access the system and display relevant information. Using it is simple. Function buttons for enabled functions are shown and easy to use.

An integral service socket provides service staff with direct access to the controller for configuration and diagnosis.

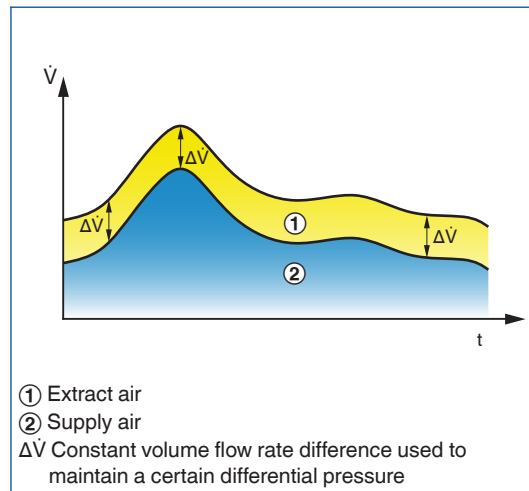
Control diagram – room balance



Supply air led system

- Supply air: Controls constant or variable volume flow rate for the room
- Extract air: Follows the supply air
- Demand-based supply air control based on setpoint value
- Extract air flow rate control: Based on supply air flow rate actual value while a set volume flow rate difference is maintained

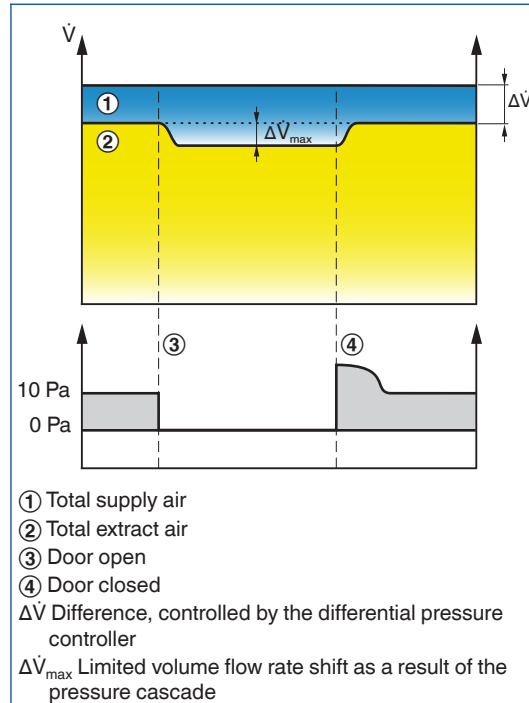
Control diagram – room balance



Extract air led system

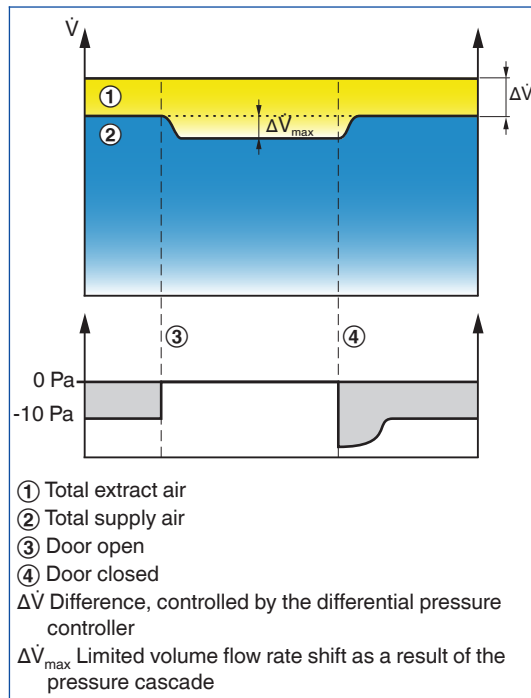
- Extract air: Controls constant or variable volume flow rate for the room
- Supply air: Follows the extract air
- Demand-based extract air control based on setpoint value
- Supply air flow rate control: Based on extract air flow rate actual value while a set volume flow rate difference is maintained

Control diagram – room with positive pressure



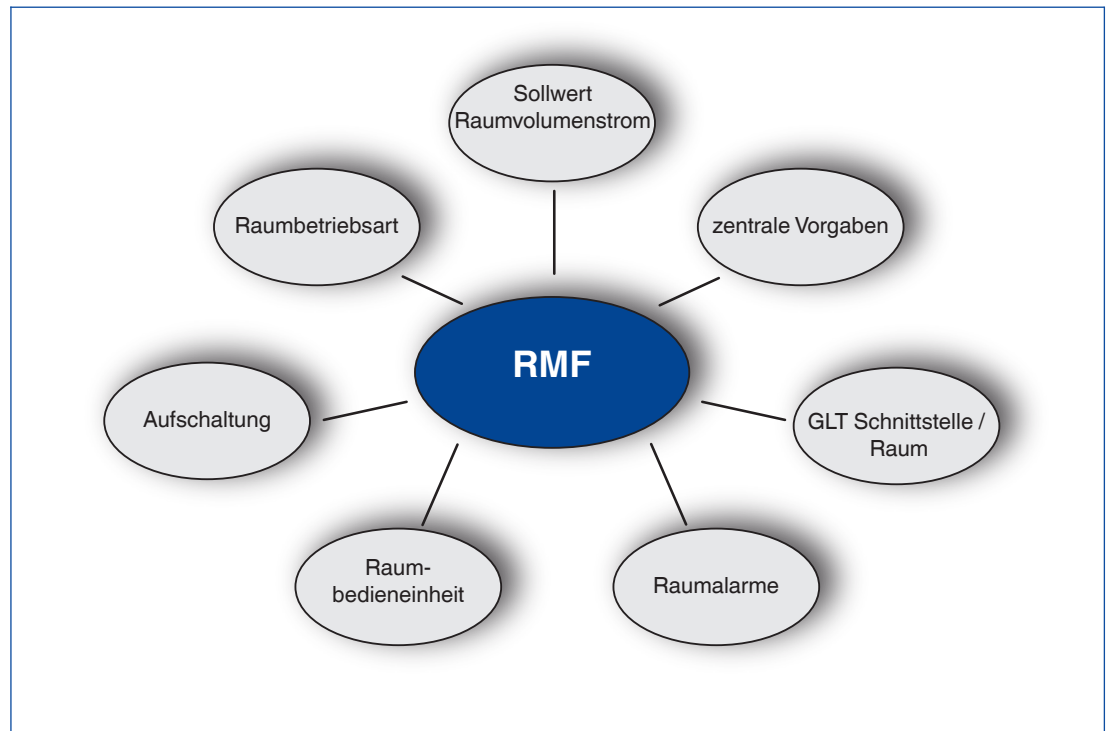
- Differential pressure control to quickly achieve a balanced and stable pressure
- The difference between supply air and extract air is variable in the case of differential pressure control
- Area of application: Maintaining positive pressure in clean rooms, for example
- A room pressure controller in the extract air controls the pressure

Control diagram – room with negative pressure



- Differential pressure control to quickly achieve a balanced and stable pressure
- The difference between supply air and extract air is variable in the case of differential pressure control
- Area of application: Maintaining negative pressure in commercial kitchens, for example
- A room pressure controller in the supply air controls the pressure

Room management function



Room management function

Application

- The room management function is a software option that provides functions for the entire room
- Within a system of up to 24 TROX UNIVERSAL controllers you can activate the room management function on one controller (supply air, extract air, room pressure or duct pressure controller)
- Factory set parameters for the room management function (if ordered as a master)
- On-site activation using the EasyConnect configuration software or TROX app EasyCon

Central interface point for room functions

- Room operating mode default setting for all controllers in the room; priority can be selected
- Room operating mode default setting using switch contacts, LonWorks, BACnet, Modbus, or room control panel
- Volume flow rate setpoint for the room

Centralised configuring of the room parameters and functions

- Supply air and/or extract air flow rate setpoint values for the room
- Default setting for the supply air to extract air difference
- Incorporation of constant volume flow rates
- Automatic or manual distribution of the total volume flow rate to several VAV terminal units

Configurable consolidated alarms

- Consolidated alarm means that all alarms for all controllers of a TROX UNIVERSAL system are consolidated

Use of room control panels

- Connection of 2 BE-LCD room control panels
- Status display for the volume flow rate or differential pressure control of a room, e.g. pressure setpoint value and pressure actual value
- Display of actual room parameters, e.g. volume flow rate actual and setpoint values
- Service interface for accessing room parameters
- Control of shading (to be provided by others) and lighting (switch outputs)

Volume flow controller with or without RMF

Inputs

- 4 analogue inputs
 - Volume flow rate setpoint value (only RMF/master)
 - 3 analogue inputs with configurable characteristics for the integration of variable air volume flows
- 6 digital inputs
 - Operating mode default setting (only RMF/master)
 - Standard mode
 - Reduced operation
 - Increased operation
 - Shut-off
 - OPEN position

Outputs

- 3 analogue outputs
 - Volume flow rate actual value
 - Damper blade position
 - Volume flow rate setpoint value for the slave controller (only RMF/master)
- 6 digital outputs
 - Alarm state
 - Lighting control – controlled from the control panel (only RMF/Master)
 - OPEN shading (only RMF/Master)
 - CLOSE shading (only RMF/Master)

- Configurable control (1), depending on room operating mode
 - Configurable control (2), depending on room operating mode
- RMF: Room management function

Expansion modules as interfaces to the central BMS

- LonWorks FTT-10A (EM-LON)
- BACnet MS/TP (EM-BAC-MOD)
- Modbus RTU (EM-BAC-MOD)
- BACnet-IP (EM-IP)
- Modbus-IP (EM-IP)
- Web server (EM-IP)

Actual operating values and fault messages of the room controller are transferred via the network

- Volume flow rate actual value and setpoint value
- Damper blade position
- Room operating modes
- Alarm state
- Switching state of the digital inputs and outputs
- Number of TROX UNIVERSAL controllers
- Additional values (see documentation for expansion modules)

In addition, extract air and supply air volume flow rates can be connected and be used for room balancing.

Differential pressure controller with or without RMF

Inputs

- 4 analogue inputs
 - Volume flow rate setpoint value (only RMF/master)
 - Differential pressure setpoint value
 - Differential pressure actual value (voltage signal from the differential pressure transducer)
 - 1 analogue input with configurable characteristics for the integration of variable air volume flows
- 6 digital inputs
 - Door contact (only RMF/Master)
 - Operating mode default setting (only RMF/master)
 - Standard mode
 - Reduced operation
 - Increased operation
 - Shut-off
 - OPEN position

Outputs

- 3 analogue outputs
 - Volume flow rate actual value (only with expansion module EM-V)
 - Differential pressure actual value
 - Damper blade position
- 6 digital outputs
 - Alarm state
 - Lighting control – controlled from the control panel (only RMF/Master)
 - OPEN shading (only RMF/Master)
 - CLOSE shading (only RMF/Master)

- Configurable control (1), depending on room operating mode
 - Configurable control (2), depending on room operating mode
- RMF: Room management function

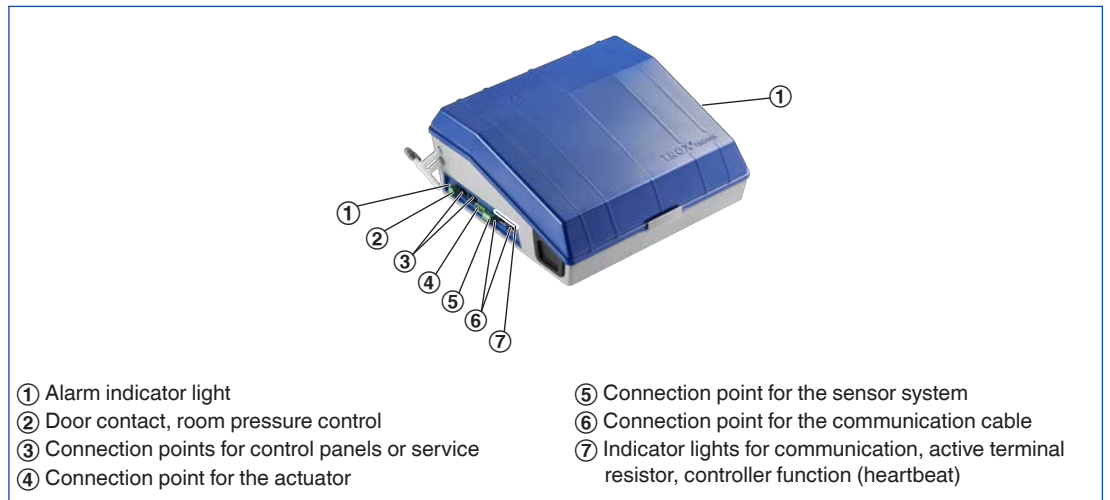
Expansion modules as interfaces to the central BMS

- LonWorks FTT-10A (EM-LON)
- BACnet MS/TP (EM-BAC-MOD-01)
- Modbus RTU (EM-BAC-MOD-01)
- BACnet-IP (EM-IP)
- Modbus-IP (EM-IP)
- Web server (EM-IP)

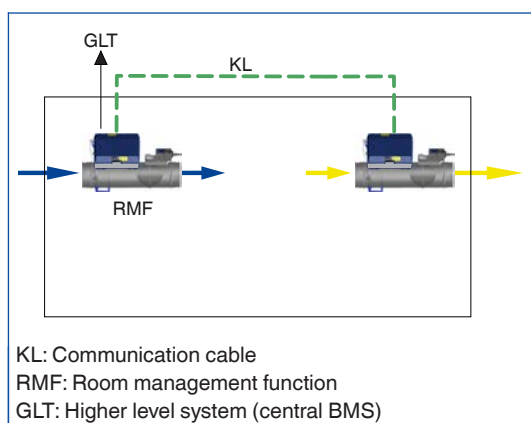
Actual operating values and fault messages of the room controller are transferred via the network

- Differential pressure actual and setpoint values
- Volume flow rate actual value
- Damper blade position
- Room operating mode
- Alarm state
- Switching state of the digital inputs and outputs
- Number of TROX UNIVERSAL controllers
- Additional values (see documentation for expansion modules)

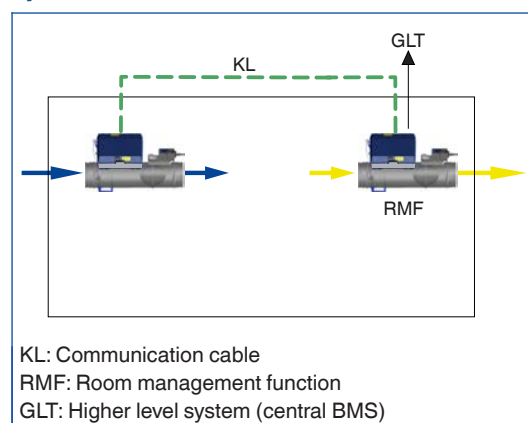
Connections and status displays



Volume flow control in a supply air led system



Volume flow control in an extract air led system



Supply air and extract air control with a master-slave setup

Application

- Offices, large and small meeting rooms, kitchens with special requirements
- For demanding requirements on volume flow control
- Data communication with a higher level system

System setup

The system consists of a VAV terminal unit with a TROX UNIVERSAL controller for supply air, and a VAV terminal unit with a TROX UNIVERSAL controller for extract air. A plug-in communication cable connects the two controllers. The system can be expanded: Up to 24 TROX UNIVERSAL controllers can be connected to a communication cable.

You can activate the room management function on a supply air controller or on an extract air controller, depending on project requirements. The controller with the RMF then acts as the master controller for the room.

- Extract air led system: Based on extract air flow rate setpoint value for the room; extract air controller with room management function as master, supply air controller as slave
- Supply air led system: Based on supply air flow rate setpoint value for the room; supply air controller with room management function as master, extract air controller as slave

Use the controller with the RMF to set the room parameters. The master controller sends the volume flow rate actual value (and other values) via the communication cable to the slave controller. The slave controller uses this value to determine the flow rate setpoint value. In case of air transfer a constant supply air to extract air difference will be maintained.

Room management function

- Setpoint volume flow rate default setting for a room
- Centralised operating mode default setting for all controllers in a room (standard mode, reduced operation, increased operation, shut-off, OPEN position)

- Connection of BE-LCD control panel, optional
- Consolidated alarms for a room

Connection to higher-level systems

The controller can be connected to higher level systems with expansion modules for open bus systems (LonWorks, Modbus, BACnet). The function varies according to the controller equipment function.

- Master controller (RMF): Central interface point for room data
- Slave controller: Local data interface for this controller

Order example – Supply air led system

Supply air led system

VAV terminal unit for supply air and room management function

TVR/200/TUN/RS/M/2/TBZ/500/900/–50

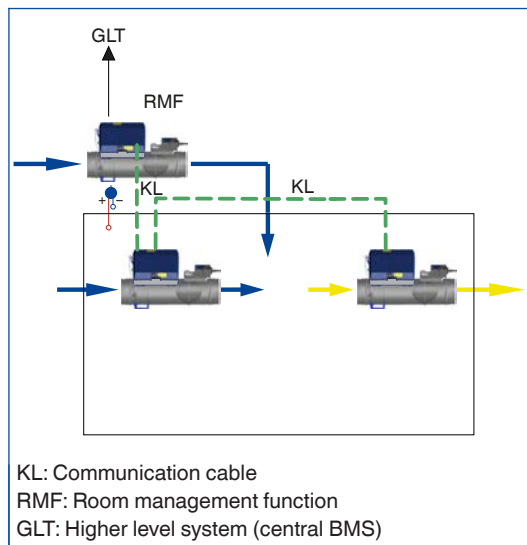
- TVR/200: Circular VAV terminal unit, nominal size 200
- TUN: TROX UNIVERSAL controller and actuator, running time 150 s
- RS: Supply air control
- M/2: Master, signal voltage range 2 – 10 V DC
- TBZ: 230 V AC supply voltage, communication module BACnet MS/TP, solenoid valve for automatic zero point correction
- 500/900/–50: Room setpoint values \dot{V}_{\min} 500 m³/h, \dot{V}_{\max} 900 m³/h, supply air to room air difference, –50 m³/h

VAV terminal unit for extract air

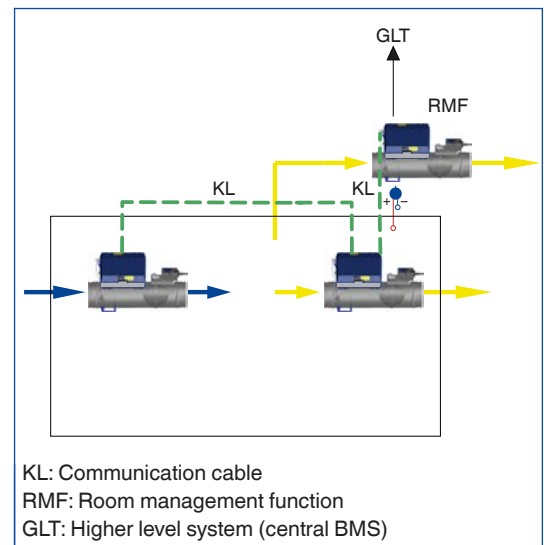
TVR/200/TUN/RE/S/2/TZ

- TVR/200: Circular VAV terminal unit, nominal size 200
- TUN: TROX UNIVERSAL controller and actuator, running time 150 s
- RE: Extract air control
- S/2: Slave, signal voltage range 2 – 10 V DC
- TZ: 230 V AC supply voltage, solenoid valve for automatic zero point correction

Room pressure control based on supply air, in a supply air led system



Room pressure control in an extract air led system



Supply air control, extract air control and room pressure control with a master-slave setup

Application

- Kitchens with special requirements, isolation wards, clean rooms, operating theatres
- For demanding requirements on volume flow control and pressure control
- Data communication with higher level systems

System setup

The system consists of a VAV terminal unit with a TROX UNIVERSAL controller for supply air, a VAV terminal unit with a TROX UNIVERSAL controller for extract air, and a room pressure controller. A plug-in communication cable connects the controllers. The system can be expanded: Up to 24 TROX UNIVERSAL controllers can be connected to a communication cable. Only one room pressure controller can be used per room. Whether room pressure control is based on supply air or on extract air depends on the project. Use the room pressure controller to activate the room management function. The controller with the RMF then acts as the master controller for the room.

- Extract air led system: Room pressure controller with room management function in the extract air flow; the extract air controller controls the volume flow rate for the room based on demand; the supply air controller follows the extract air controller; the room pressure controller ensures that the setpoint pressure is maintained
- Supply air led system: Room pressure controller with room management function in the supply air flow; the supply air controller controls the volume flow rate for the room based on demand; the extract air controller follows the supply air controller; the room

pressure controller ensures that the setpoint pressure is maintained

The master controller sends the volume flow rate actual value (and other values) via the communication cable to the slave controller. The slave controller uses this value to determine the flow rate setpoint value. The room pressure controller maintains the variable or constant setpoint pressure by opening the control damper blade to a greater or lesser degree. Use the controller with the RMF to set the room parameters.

Room management function

- Setpoint volume flow rate default setting for a room
- Centralised operating mode default setting for all controllers in a room (standard mode, reduced operation, increased operation, shut-off, OPEN position)
- Connection of BE-LCD control panel, optional
- Consolidated alarms for a room

Connection to higher-level systems

The controller can be connected to higher level systems with expansion modules for open bus systems (LonWorks, Modbus, BACnet). The function varies according to the controller equipment function.

- Master controller (RMF): Central interface point for room data
- Slave controller: Local data interface for this controller

Order example

Supply air led system
 VAV terminal unit for room pressure control based on supply air, controller with room management function
 TVR/100/TUN/PRS/MFP/2/TBVZ/-20 Pa/500/900/-50

- TVR/100: Circular VAV terminal unit, nominal size 100
- TUN: TROX UNIVERSAL controller and actuator, running time 150 s
- PRS: Room pressure control based on supply air
- MFP/2: Master, constant pressure control, signal voltage range 2 – 10 V DC
- TBVZ: 230 V AC supply air, interface configured for BACnet MS/TP, volume flow rate measurement (supply air), solenoid valve for automatic zero point correction
- $-20 \text{ Pa}/500/900/-50$: $\Delta p_{\text{const}} -20 \text{ Pa}$, $\dot{V}_{\text{min}} 500 \text{ m}^3/\text{h}$, $\dot{V}_{\text{max}} 900 \text{ m}^3/\text{h}$, supply air to room air difference $-50 \text{ m}^3/\text{h}$

VAV terminal unit for supply air
TVR/200/TUN/RS/S/2/TZ

- TVR/200: Circular VAV terminal unit, nominal

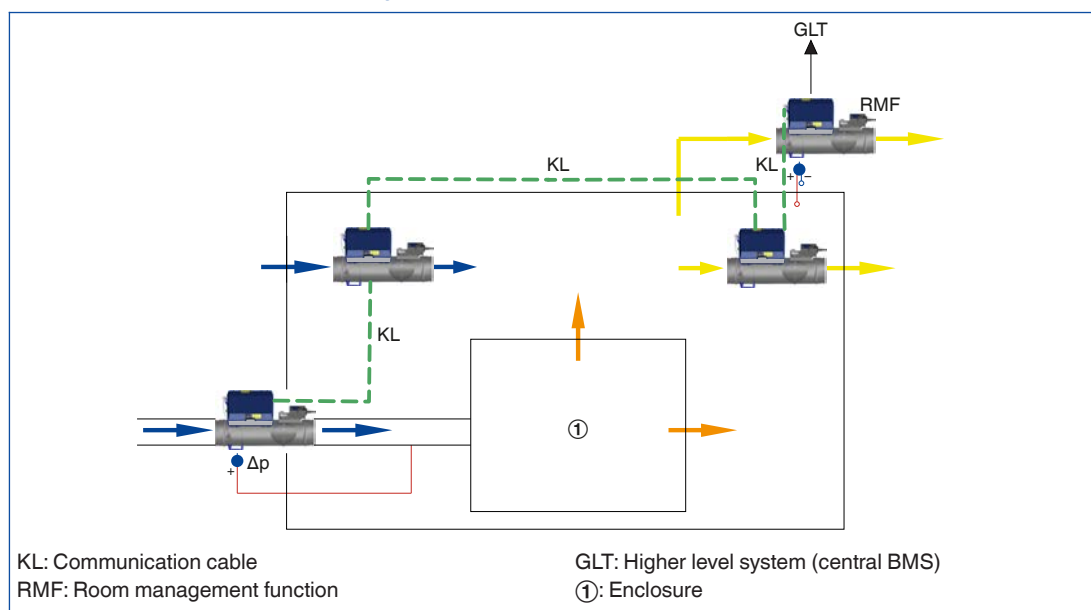
size 200

- TUN: TROX UNIVERSAL controller and actuator, running time 150 s
- RS: Supply air control
- S/2: Slave, signal voltage range 2 – 10 V DC
- TZ: 230 V AC supply voltage, solenoid valve for automatic zero point correction

VAV terminal unit for extract air
TVR/200/TUN/RE/S/2/TZ

- TVR/200: Circular VAV terminal unit, nominal size 200
- TUN: TROX UNIVERSAL controller and actuator, running time 150 s
- RE: Extract air control
- S/2: Slave, signal voltage range 2 – 10 V DC
- TZ: 230 V AC supply voltage, solenoid valve for automatic zero point correction

Room pressure control based on extract air, in an extract air led system, additionally with duct pressure control based on supply air



Supply air control, extract air control and room pressure control with a master-slave setup, combined with duct pressure control

Application

- Clean rooms, ICUs, operating theatres
- For demanding requirements on volume flow control and pressure control
- Data communication with higher level systems

System setup

The system consists of a VAV terminal unit with a TROX UNIVERSAL controller for supply air, a VAV terminal unit with a TROX UNIVERSAL controller for extract air, and a room pressure controller. In the room there is also an enclosure that is to be provided with supply air. A VAV terminal unit maintains a constant duct pressure in the supply

air duct. A plug-in communication cable connects the controllers. The system can be expanded: Up to 24 TROX UNIVERSAL controllers can be connected to a communication cable.

Whether room pressure control is based on supply air or on extract air depends on the project. Use the room pressure controller to activate the room management function. The controller with the RMF then acts as the master controller for the room.

- Extract air led system: Room pressure controller with room management function in the extract air flow; the extract air controller controls the volume flow rate for the room based on demand; the supply air controller follows the extract air controller; the room pressure controller ensures that the setpoint

- pressure is maintained
- Supply air led system: Room pressure controller with room management function in the supply air flow; the supply air controller controls the volume flow rate for the room based on demand; the extract air controller follows the supply air controller; the room pressure controller ensures that the setpoint pressure is maintained

Use the controller with the RMF to set the room parameters. Room pressure and duct pressure values can be configured with the respective pressure controller and are output on that same controller. The room pressure controller is used to maintain the variable or constant setpoint pressure by opening the control damper blade to a greater or lesser degree. The master controller sends the volume flow rate actual value via the communication cable to the slave controller. The slave controller uses this value to determine the flow rate setpoint value. In case of air transfer a constant supply air to extract air difference will be maintained. The duct pressure controller maintains the constant or variable setpoint pressure; the duct pressure controller can also be fitted with an optional volume flow rate measuring point. The controller then transmits the volume flow rate actual value to the system such that it can be used for room balancing. Control of the damper blade of VAV terminal units with a pressure controller is a closed loop.

Room management function

- Connection and use of BE-LCD control panel
- Centralised operating mode default setting for all controllers in a room (standard mode, reduced operation, increased operation, shut-off, OPEN position)
- Setpoint volume flow rate default setting for a room
- Consolidated alarms for a room, including pressure alarm

Connection to higher-level systems

Expansion modules for open bus systems (LonWorks, Modbus, BACnet) can be used to connect the controller to higher-level systems; these modules can be used as follows:

- on the controller with the RMF: central interface point for room data
- on the slave controller: local data interface for this controller

Order example

Extract air led system

VAV terminal unit for room pressure control based on extract air, controller with room management function

TVR/100/TUN/PRE/MFP/2/TBVZ/-20 Pa/500/900/-50

- TVR/100: Circular VAV terminal unit, nominal size 100
- TUN: TROX UNIVERSAL controller and actuator, running time 150 s
- PRE: Room pressure control based on extract air
- MFP/2: Master, constant pressure control, signal voltage range 2 – 10 V DC
- TBVZ: 230 V AC supply voltage, communication module BACnet MS/TP, volume flow rate measurement (extract air), solenoid valve for automatic zero point correction
- -20 Pa/500/900/-50: Δp_{const} -20 Pa, \dot{V}_{min} 500 m³/h, \dot{V}_{max} 900 m³/h, supply air to room air difference -50 m³/h

VAV terminal unit for supply air

TVR/200/TUN/RS/S/2/TZ

- TVR/200: Circular VAV terminal unit, nominal size 200
- TUN: TROX UNIVERSAL controller and actuator, running time 150 s
- RS: Supply air control
- S/2: Slave, signal voltage range 2 – 10 V DC
- TZ: 230 V AC supply voltage, solenoid valve for automatic zero point correction

VAV terminal unit for extract air

TVR/200/TUN/RE/S/2/TZ

- TVR/200: Circular VAV terminal unit, nominal size 200
- TUN: TROX UNIVERSAL controller and actuator, running time 150 s
- RE: Extract air control
- S/2: Slave, signal voltage range 2 – 10 V DC
- TZ: 230 V AC supply voltage, solenoid valve for automatic zero point correction

VAV terminal unit for the supply pressure control in ducts

TVR/125/TUN/PDS/SFP/2/TVZ/150 Pa

- TVR/125: Circular VAV terminal unit, nominal size 125
- TUN: TROX UNIVERSAL controller and actuator, running time 150 s
- PDS: Duct pressure control, supply air
- SFP/2: Slave, constant pressure control, signal voltage range 2 – 10 V DC
- TZ: 230 V AC supply voltage, volume flow rate measurement (supply air), solenoid valve for automatic zero point correction
- Setpoint pressure: 150 Pa

Installation and commissioning

- Any installation orientation (some installation orientations may require adjusting the position of the differential pressure transducer in the controller casing)
- Carry out zero point correction of the static differential pressure transducer, except for TROX UNIVERSAL with EM-AUTOZERO (Z) expansion module
- For systems with several controllers (up to 24) in a room: Connect the communication cable and activate the terminal resistors on both ends (required only if there are several TROX UNIVERSAL controllers connected in a system)
- Component addressing and network management tool are not required
- If necessary, make adjustments using the EasyConnect configuration software or Android app (EasyCon)
- Set parameters for room control
- Carry out a functional test for all components and functions

Volume flow control

- Define signalling of the setpoint; alternatively define a constant value on the controller; connect switch contacts

Room pressure control

- Connect the differential pressure transducer (room pressure); also connect the tubes; be sure to choose a suitable measurement point for the reference value
- Define signalling of the setpoint; alternatively define a constant value on the controller
- Tubing of the static differential pressure transducer by others
- For positive room pressure: Connect room pressure to Plus, reference room to Minus
- For negative room pressure: Connect room pressure to Minus, reference room to Plus
- Choose a suitable measurement point for the reference value

Duct pressure control

- Connect the differential pressure transducer (duct pressure); also connect the tubes; be sure to choose a suitable measurement point for the reference value
- Define signalling of the setpoint; alternatively define a constant value on the controller
- Tubing of the static differential pressure transducer by others
- For supply air duct pressure: Connect static pressure of the duct to Plus
- For extract air duct pressure: Connect static pressure of the duct to Minus

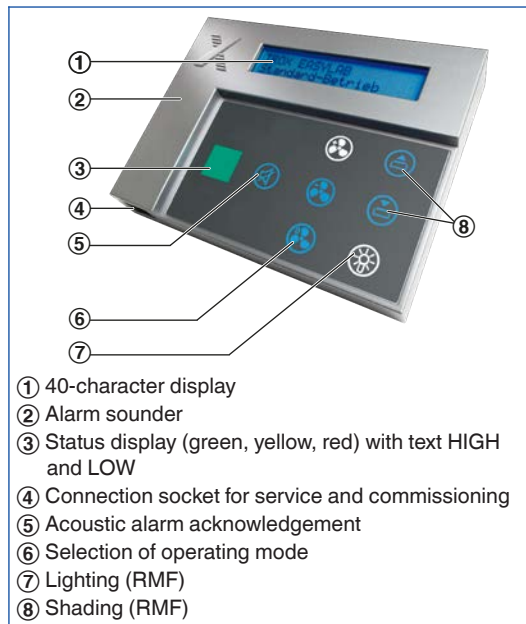
Room management function

- Set parameters for room control

Functional test

- Use the functional test wizard of EasyConnect to carry out a functional test and to document the test procedure

Control panel BE-LCD, display and control elements



Control panel features

- Push buttons and functions can be configured individually
- Easy to use – available function buttons are shown, unavailable function buttons are not shown
- Buttons for available functions are blue
- Buttons for active functions are white
- Integral service socket for configuration and diagnosis of the controller
- Service tool can also be connected to a slave controller (without room management function) for easy diagnosis with selected operating values

Other useful additions

- Transducer PT699, for room pressure and duct pressure
- EM-AUTOZERO: Optional expansion for automatic zero point correction of the differential pressure transducer that is part of the TROX UNIVERSAL controller and used for volume flow rate measurement
- EM-TRF: Optional expansion for 230 V AC voltage supply to TROX UNIVERSAL
- EM-TRF USV: Optional USP expansion module for 230 V AC voltage supply to TROX UNIVERSAL
- EM- LON: Optional expansion module, LonWorks (FTT-10A) interface for connecting TROX UNIVERSAL to higher-level systems
- EM-BAC-MOD: Optional expansion module, BACnet MS/TP or Modbus RTU interface for connecting TROX UNIVERSAL to higher-level systems
- EM-IP: Optional expansion module, BACnet MS/TP or Modbus RTU interface and web server for connecting TROX UNIVERSAL to higher-level systems