

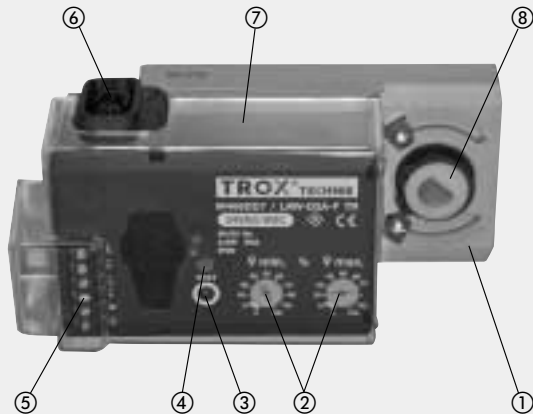
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## VARYCONTROL<sup>®</sup> Air terminal units TROX Compact-controller Instruction manual

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### TROX Compact-controller



- |                           |                                   |
|---------------------------|-----------------------------------|
| ① TROX Compact-controller | ⑥ Tube connections for transducer |
| ② Potentiometers          | ⑦ Protection cover                |
| ③ Indicator light         | ⑧ Shaft clamp                     |
| ④ Service button          |                                   |
| ⑤ Connection terminals    |                                   |

### Area of application

The TROX Compact-controller is a complete control device designed for VAV air terminal units. The dynamic differential pressure transducer, damper actuator and electronic controls are combined in one housing.

The control signal input is wired based on the required operating mode. For variable flow rate control, a suitable room temperature controller (alternatively, an air quality controller or similar) or a DDC outstation must be used. The control signal is 0 to 10 VDC voltage.

Switches or relays are used for constant flow rate control with 2 set values.

The actual value of the flow rate is output as a standard linear, electrical signal. The voltage range is 0 to 10 VDC.

- Factory settings are  $\dot{V}_{\min} = 40\%$  and  $\dot{V}_{\max} = 80\%$ .
- Changes of setpoints on site by means of potentiometers.
- Several controllers can be connected to a common room temperature controller for parallel operation.
- Supply air – extract air tracking control can be provided.

Standard filtration in air-conditioning systems allows the use of the flow rate controller in the supply air without dust protection filters. Since a small volume flow is passed through the transducer in order to measure the flow rate, the following must be noted:

- With heavy dust load in the room, suitable extract air filters must be provided.
- If the air is contaminated with fluff or sticky particles or contains aggressive media, the TROX Compact-controller should not be used.

### Proper application

The VAV terminal units are suitable for use in ventilation and air conditioning systems. Particular conditions can restrict the functioning capacity and must be taken into account during the design stage:

- Installation and wiring should only be carried out by specialists. During installation, wiring and commissioning, the normal rules of site working, in particular the health and safety regulations must be complied with.
- Safety transformers must be used.
- For aggressive air, only air terminal units made of plastic materials should be used after extensive tests for suitability.
- Galvanised sheet steel units must not be installed in contaminated environments (e.g. acetic acid).
- For hazardous areas, only use units with explosion proof electrical components.
- For protected exterior areas, only use units with membrane pressure transducers.
- Use in aircraft is not allowed.
- If there is a risk of fire due to flammable solids, the electric equipment must be rated IP 4X (see VdS 2033 fire safety guidelines or appropriate regulations).

TROX Compact-controllers are used in the air terminal units of the Easy type as follows.  
Technical and acoustic data see relevant leaflet:



#### TVR-Easy

Leaflet 5/3.5/EN/..



#### TVJ-/TVT-Easy

Leaflet 5/4.1/EN/..



#### TVZ-/TVA-Easy

Leaflet 5/1.2/EN/..

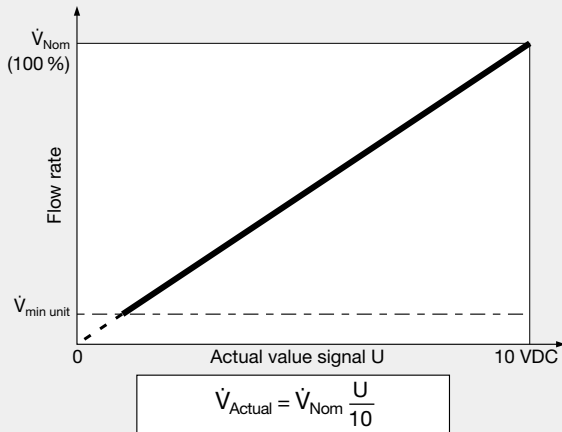
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### Characteristic of actual value signal



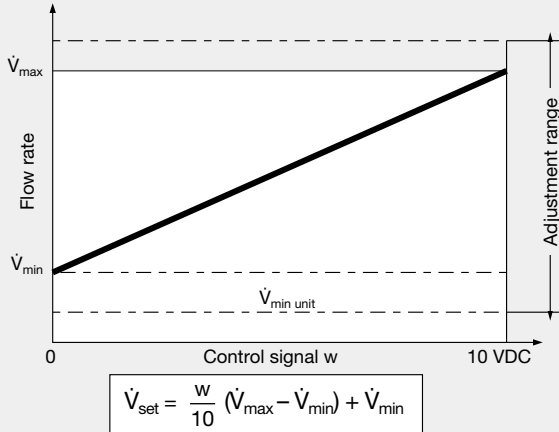
### Description of function

The flow rate is measured using the dynamic differential pressure principle. The effective pressure ( $\Delta p_w$ ) from the differential pressure sensor is based on a partial volume flow passing through the transducer. The characteristic of effective pressure is calibrated in the controller to provide a linear actual value signal.

The actual flow rate can be monitored as the voltage signal U. The measurement range is factory set to match the unit size so that the 10 VDC always corresponds to the unit nominal flow rate ( $\dot{V}_{\text{Nom}}$ ).

The required flow rate is set by the room temperature controller or by switch contacts. The controller determines the set flow rate in accordance with the characteristic shown opposite and compares this with the actual value. The integral damper actuator is controlled based on the deviation. The factory pre-settings of  $\dot{V}_{\text{min}} = 40\%$  and  $\dot{V}_{\text{max}} = 80\%$  can be easily readjusted on site.

### Characteristics of the control signal



$$\dot{V}_{\text{max-set value}} = \frac{\dot{V}_{\text{max}}}{\dot{V}_{\text{Nom}}} \cdot 100\%$$

$$\dot{V}_{\text{min-set value}} = \frac{\dot{V}_{\text{min}}}{\dot{V}_{\text{Nom}}} \cdot 100\%$$

### Control signal range limiting

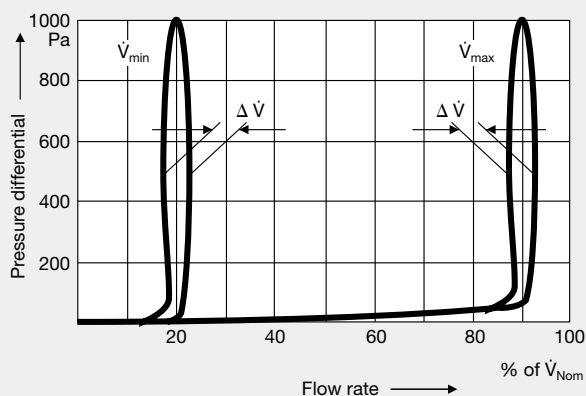
For settings between  $\dot{V}_{\text{min}} = 0\%$  and  $\dot{V}_{\text{max}} = 100\%$ , the control signal must be limited in the DDC outstation. In this case, the full published flow rate range can be used for future adjustment via the BMS.

### Flow rate control

The flow rate controller works independently of the duct pressure, i.e. the system pressure variations do not result in flow rate changes. To prevent the flow rate control becoming unstable, a dead band (hysteresis) must be built in within which the damper blade does not move.

This dead band, coupled with the measuring tolerances, produces a flow rate deviation as shown opposite. If the conditions stated in the sales leaflet (e.g. minimum pressure differential, inlet flow conditions) are not observed, greater deviations must be expected.

### Pressure independent control characteristics



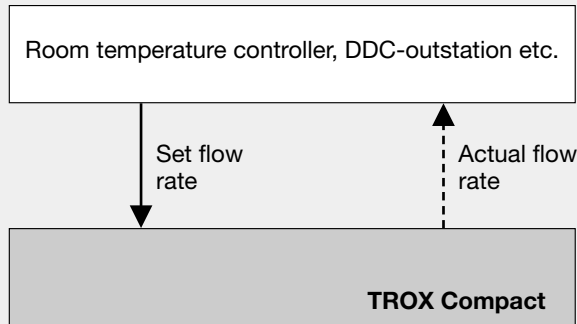
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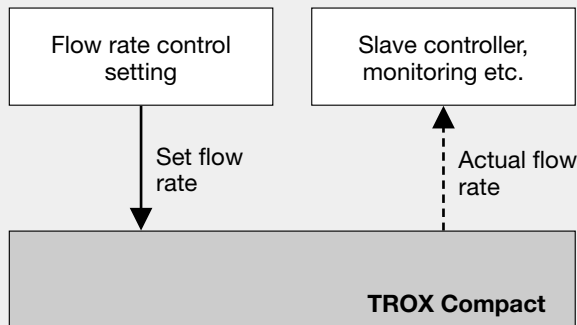
### Variable flow rate control



### Variable volume flow

The TROX Compact-controller controls the set flow rate, between  $\dot{V}_{\min}$  and  $\dot{V}_{\max}$ , from the control signal. Override to CLOSED or OPEN is available.

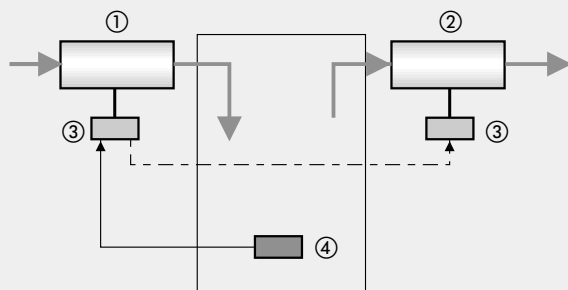
### Constant flow rate control



### Constant volume flow

By wiring the control signal input terminal w via switch contacts, constant flow rates  $\dot{V}_{\min}$  and  $\dot{V}_{\max}$ , and various override controls can be achieved.

### Supply – extract tracking control



- ① Supply terminal unit
- ② Extract terminal unit
- ③ TROX Compact-controller
- ④ Room temperature controller

### Supply – extract tracking control

With parallel control of the systems, an unacceptable difference between supply and extract air can occur if the pressure in one duct is too low.

It is therefore preferable to use the actual value signal, usually that of the supply air, as a control signal for the slave flow rate controller. If the extract air is not controlled by the temperature controller (DDC), slave control is also implemented.

Only ratio control can be implemented with the TROX Compact-controller, i.e. supply and extract air are always in the same ratio to each other under all operating conditions.

The flow rate ratio is set as follows at the  $\dot{V}_{\max}$ -potentiometer of the slave controller.

$$\dot{V}_{\max\text{-set value}} = \frac{\dot{V}_{\max\text{ supp.}}}{\dot{V}_{\max\text{ extr.}}} \cdot \frac{\dot{V}_{\text{Nom supp.}}}{\dot{V}_{\text{Nom extr.}}} \cdot 100\%$$

With the same unit sizes and flow rates, 100 % is set.

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### Potentiometers

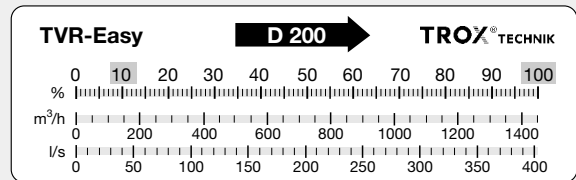


### Flow rate adjustment on site

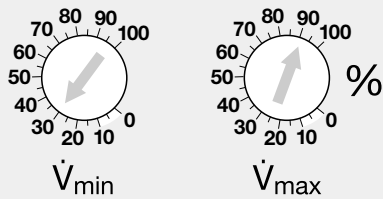
There are potentiometers for the adjustment of the flow rate limits. The values can be calculated using the formula on page 2 or determined from the flow rate scale which is on each unit.

### Flow rate scale

(example for TVR-Easy 200)

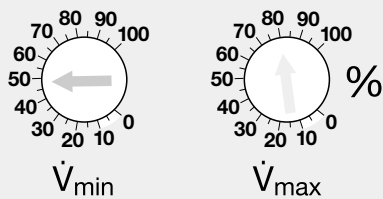


### Variable flow rate control



The required flow rates must be adjusted by the customer. If  $\dot{V}_{min}$  is set higher than  $\dot{V}_{max}$ , then  $\dot{V}_{min}$  is provided as a constant flow rate, even if a control signal is transmitted. If  $\dot{V}_{min}$  is set on 0 %, then control is between shut-off and  $\dot{V}_{max}$ . If the control signal falls below 0.1 VDC, the control damper closes (leakage flow only).

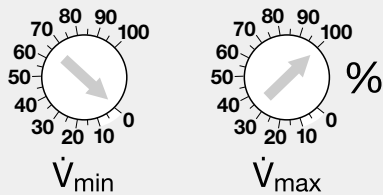
### Constant flow rate control



The constant flow rate can be set with the  $\dot{V}_{min}$ -potentiometer.

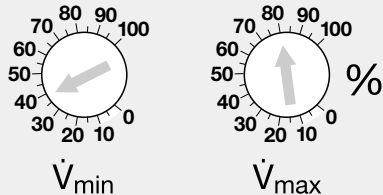
The setting of the  $\dot{V}_{max}$ -potentiometer is unimportant.

### BMS operation



If the flow rate is set by the BMS, the  $\dot{V}_{min}$ -potentiometer must be set at 0 % and the  $\dot{V}_{max}$ -potentiometer must be set at 100 %. If the control signal falls below 0.1 VDC, the control damper closes (leakage flow only).

### Factory setting



For delivery, settings are,  $\dot{V}_{min} = 40 \%$  and  $\dot{V}_{max} = 80 \%$ .

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### Terminal allocation

○	○	○	○	○	○
1	2	1	2	3	4
⊥	~	⊥	~	w	U
-	+	-	+		
<b>TROX Compact</b>					

1, ⊥, - : Ground, neutral  
2, ~, + : 24 V supply voltage  
w : Control signal input 0 to 10 VDC  
U : Actual value signal output 0 to 10 VDC

### Wiring

The 24 V supply voltage must be wired by the customer. Safety transformers must be used (EN 60742). If several flow rate controllers are connected to one 24 V network, it is important to ensure that a common neutral or ground wire is used and that this is not connected to other wires. Wiring must be carried out in compliance with local legal regulations!

### Electrical safety

#### 1. Contact safety of the connection terminals

In addition to the pertinent EMC standards for compliance with the Electromagnetic Compatibility (EMC) Directive, actuators and compact controllers must comply with the following standards:

- DIN EN 60335: Safety of electric devices for household use and similar purposes (part 1: general requirements).
- DIN EN 60730: Automatic electric regulators and controllers for household use and similar applications (part 1: general requirements; parts 2-14: special requirements for electric actuators).

According to these standards, a touchable component (screw-type terminals, for example) is considered inactive if there is a safety extra low voltage (SELV). SELV must have a peak value of 42.4 V or less for alternating current and 42.5 V or less for direct current.

The TROX Compact-controller is compliant with the above standards according to protection class III with a protection rating of IP20.

The circumstances mentioned below result in protection level IP23 (see photograph):

- Damper blade shaft vertically, TROX Compact-controller on top.
- Transparent protection cover in place.



#### 2. Operation in areas subjected to moisture or vapour

Installation locations must meet ambient conditions of 0-50 °C at 5-95 % relative humidity without condensation. IP20 does not protect against dripping water, but IP54 also offers no protection against vapour condensation inside the actuator (not moisture tight). The printed circuit boards do have a lacquer coating, which insulates the circuit paths. The solder joints are also insulated because of the fluxing agent used.

#### 3. Strain relief on connecting cables

The connection terminals are designed according to DIN VDE 0631-1 section 10 and exhibit the corresponding retention forces for the wire gauges indicated therein. For a tightening torque of up to 0.4 Nm (see standard and manufacturer specifications), this results in a retention force of 20 N for a flexible cable with a cross section of 0.75 mm<sup>2</sup>.

A wire clamping bracket is fixed to the casing of all air terminal units of the Easy type.

### Summary

The TROX Compact-controller meets the standards for compliance with the Low Voltage Directive. The controller is also compliant with the Electromagnetic Compatibility (EMC) Directive. The manufacturer's statement has been justified and the product may be marketed with a CE mark.

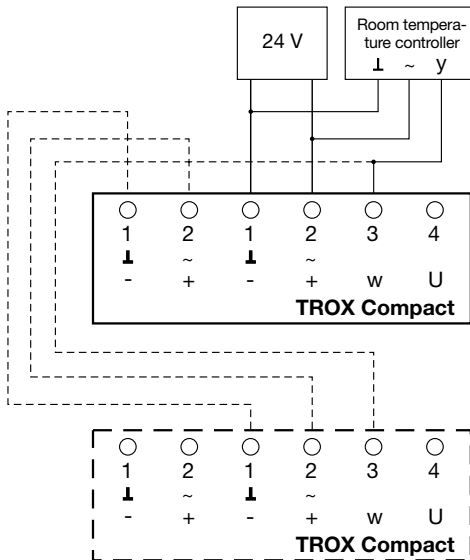
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### Room temperature control



### Room temperature control

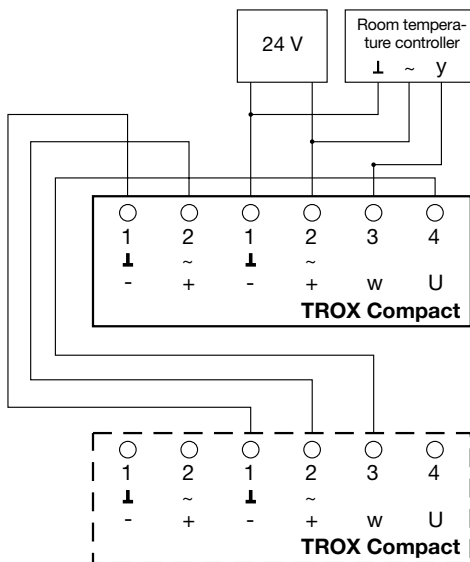
A dedicated room temperature controller or a DDC outstation with 0 to 10 VDC output is connected as shown opposite. If the controllers is on the same mains make sure that terminal 1 of the TROX Compact is identical to the ground of the control signal.

### Parallel control

Several flow rate controllers (supply or extract air) are run in parallel by one controller. If the air terminal units are of the same size and the  $\dot{V}_{\min}$ - and  $\dot{V}_{\max}$ -values are set the same, all units will control to the same flow rate.

If there are different settings, then the controls will maintain a constant percentage between the flow rates.

### Tracking control

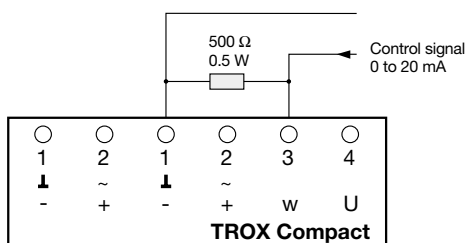


### Supply – extract tracking control

If the units are controlled in parallel and if the pressure in one duct area is too low there may be an undesirable difference in flow rate between supply and extract air.

It is therefore more beneficial to use the actual value signal, usually that of the supply air, as the control signal for the slave flow rate (extract) controller.

### Control using 0 to 20 mA



### Control using 0 to 20 mA

It is possible to control using 0 to 20 mA by wiring a 500  $\Omega$  resistor to ground and input w in parallel.

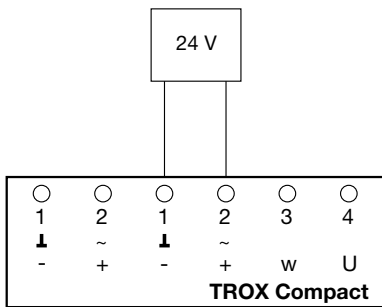
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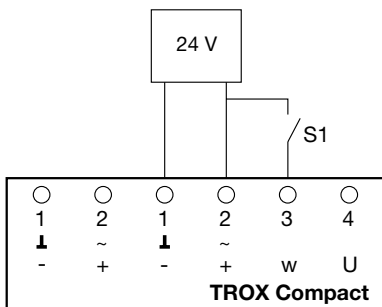
### Constant flow rate control



### Constant flow rate control

As soon as the 24 V supply voltage is applied, the controller runs the set  $\dot{V}_{\min}$ -value as a constant flow rate.

### $\dot{V}_{\min}$ / $\dot{V}_{\max}$ changeover

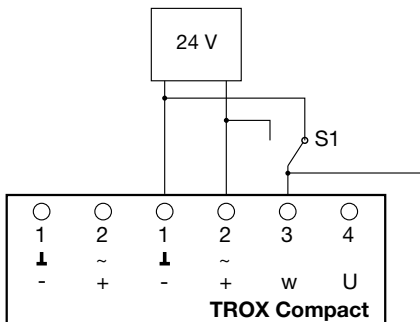


### $\dot{V}_{\min}$ / $\dot{V}_{\max}$ changeover

The switch S1 enables a changeover between the two constant flow rates of  $\dot{V}_{\min}$  and  $\dot{V}_{\max}$ .

- Switch S1 open:  $\dot{V}_{\min}$
- Switch S1 closed:  $\dot{V}_{\max}$

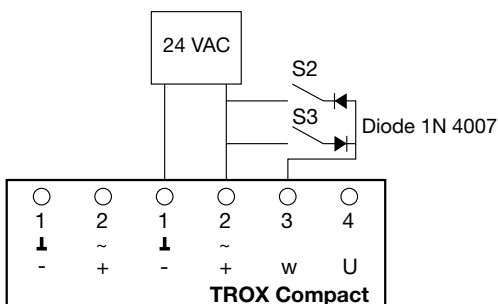
### Changeover of multiple controllers



### Changeover of multiple controllers

When there is parallel connection of multiple TVR-Easy controllers, the switch S1 must be used as changeover switch and the contact for the  $\dot{V}_{\min}$  operation must be connected to the ground (terminal 1).

### Override controls OPEN / CLOSED



### Override controls OPEN / CLOSED

The override control to provide OPEN and CLOSED can be achieved using external switches (potential-free contacts), only for a.c. voltage.

- Switch S2 closed: Damper blade CLOSED
- Switch S3 closed: Damper blade OPEN

All override controls can be combined among themselves and with the different circuit options.

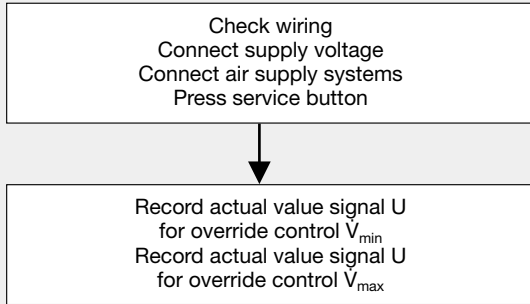
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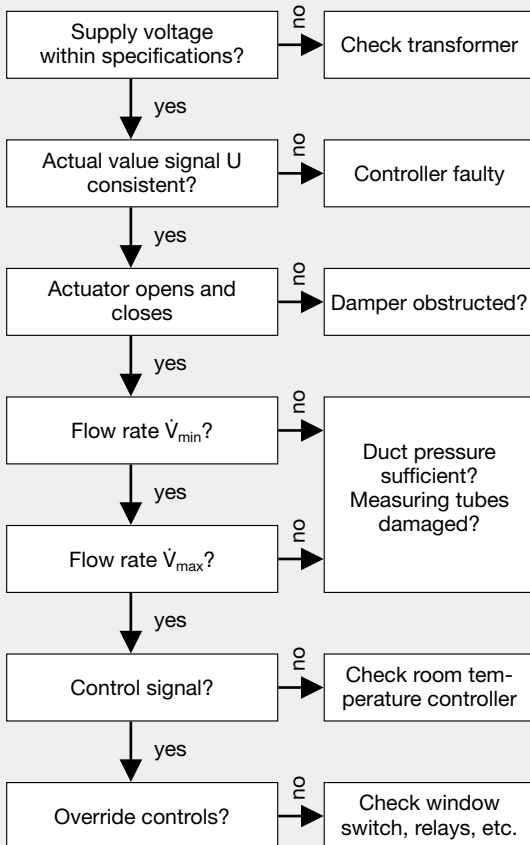
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### Functional test



### Fault finding check



### Order example spare controller

TROX Compact-controller for TVR-Easy  
 No. M466DD7

### Commissioning

With the service button and the indicator light a functional test can easily be carried out.

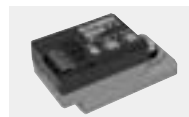
- Press service button for at least 1 second
- Actuator opens damper blade
- Actuator closes damper blade
- Actuator returns damper blade to previous position
- When the set flow rate is controlled the indicator light remains permanently on.

In many cases, incorrect wiring can be the reason for malfunctions. Therefore a close examination of all connections should be made. Wires in terminals 3 and 4 should be disconnected. The flow rate control is checked by setting a setpoint to which the actual value must correspond after a short time. The setpoint signal is a voltage signal or a switch contact.

### Replacement controller

When replacing a faulty controller only the unit type (e.g. TVR-Easy) must be specified when ordering a replacement controller. This information could be taken from the label of the unit. The flow rate adjustment is then done on site.

Available TROX Compact-controllers:



**M466DC3 or M466DD7**  
 for TVR-Easy



**M466EP9**  
 for TVZ/TVA-Easy



**M466DB4**  
 for TVJ/TVT-Easy