Control components for VAV terminal units

Universal, dynamic

For different actuators

Modular control components for VAV terminal units

- Module selection based on application
- Actuators with selected actuator forces

Options

- Actuators with safety function for 'damper blade OPEN' and 'damper blade CLOSED' (spring return actuators)

Application

Application

- Electronic volume flow controllers of Type Universal (dynamic) are designed for use with VAV terminal units.
- Dynamic differential pressure transducer and electronic controller are fitted together in one casing
- Actuator or spring return actuator is separate
- The output signals of the room temperature controller, central BMS, air quality controller or similar units control the volume flow rate setpoint
- Override control by means of switches or relays
- Volume flow rate actual value is available as linear voltage signal
- Controller parameters are factory set
- On-site adjusting is not required

Standard filtration in comfort air conditioning systems allows for use of the controller in the supply air without additional dust protection. Since a partial volume flow is passed through the transducer in order to measure the volume flow rate, please note:

- With heavy dust levels in the room, suitable extract air filters must be provided.
- If the air is polluted with fluff or sticky particles or contains aggressive media, Universal (dynamic) controllers cannot be used

Description

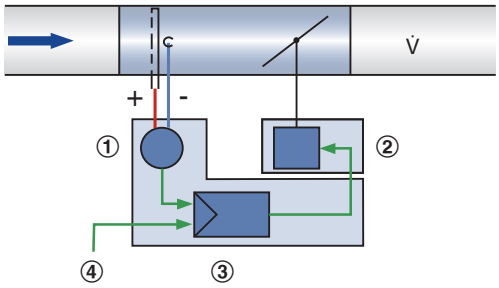
Parts and characteristics

- Sensor for dynamic differential pressure measurements
- Separate actuator
- Mechanical stops for limiting the damper blade positions
- Actuators with overload protection
- Release button to allow for manual operation

Functional description

VAV terminal units control the volume flow in a closed loop, i.e. measurement – comparison – control.
The volume flow rate is determined by measuring the differential pressure (effective pressure). For this purpose the VAV terminal unit is fitted with a differential pressure sensor.
The integral differental pressure transducer transforms the effective pressure into a voltage signal. The volume flow rate actual value is hence available as a voltage signal. The factory setting is such that 10 V DC always corresponds to the nominal volume flow rate ($\dot{V}_{nom}$).
The volume flow rate setpoint value comes from a higher-level controller (e.g. room temperature controller, air quality controller, central BMS) or from switch contacts. Variable volume flow control results in a value between $\dot{V}_{min}$ and $\dot{V}_{max}$. 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.
The volume flow rate parameters $\dot{V}_{min}$ and $\dot{V}_{max}$ are factory set on potentiometers. Voltage ranges are factory stored in the controller. Changes on the customer's site can easily be carried out using an adjustment device or a notebook with service tool.

Principle of operation – Universal



① Differential pressure transducer
② Actuator
③ Volume flow controller
④ Setpoint value signal

Volume flow control

- 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.
- The factory set volume flow rate parameters can be altered by the customer

Any attachments are to be defined with the order code of the VAV terminal unit.

Universal controller, dynamic, for VAV terminal units

Order code detail	Controller		Actuator		Type of VAV terminal unit
	Part number	Type	Part number	Type	
B13	M546GA4	VRD3	M466DJ8	NM24A-V	① ② ④
B11	M546GA4	VRD3	M466DG8	SM24A-V	③
B1B	M546GA4	VRD3	M466DR1	NF24A-V (spring return actuator)	① ② ③ ④
B27	M546GA4	VRD3	M466DJ8	NM24A-V	⑤
XC3	M546ED4	GUAC-D3	A00000051738	361C-024-20-V/ ST07 (spring return actuator)	① ② ③ ④

① TVR
② TVJ
③ TVT
④ TZ-Silenzio, TA-Silenzio, TVZ, TVA
⑤ TVM

Application
- Electronic volume flow controller VRD3 as Universal controller
- Variable air or constant air volume flow control
- The flow rate is measured using the dynamic measurement principle
- Voltage range for the actual and setpoint value signals 0 – 10 V DC or 2 – 10 V DC
- Separate inputs for override controls enable the centralised switching of groups of controllers

Construction
Volume flow controller VRD3 with
- B13: Actuator NM24A-V for TVR, TVJ, TZ-Silenzio, TA-Silenzio TVZ, TVA
- B11: Actuator SM24A-V for TVT
- B1B: Spring return actuator NF24A-V for TVR, TVJ, TVT, TZ-Silenzio, TA-Silenzio TVZ, TVA
- B27: Actuator NM24A-V for TVM

Signal voltage range
- 0: 0 – 10 V DC
- 2: 2 – 10 V DC with shut-off function (< 0.1 V DC)

Operating modes
E: Single and M: Master
- $\dot{V}_{min}$: Minimum volume flow rate
- $\dot{V}_{max}$: Maximum volume flow rate

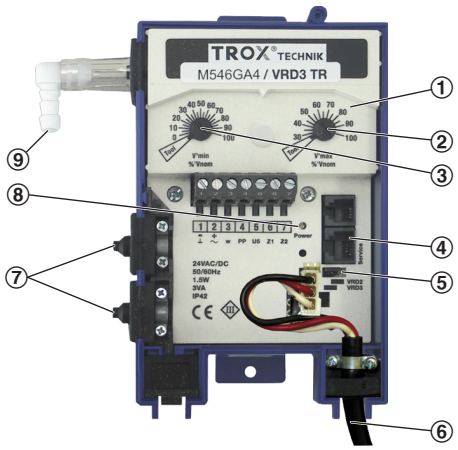
S: Slave operation
- $\dot{V}_{min}$: 0 %
- $\dot{V}_{max}$: Volume flow rate ratio to the master controller

F: Constant value
- $\dot{V}_{min}$: constant volume flow rate
- $\dot{V}_{max}$: 100 %

Parameters are factory set. The customer defines the required operating mode and the volume flow rates in the order code at the time of ordering. The jumper for input w is factory set to VRD3.

Commissioning
- On-site adjusting is not required
- When installing the VAV terminal units it is important to assign each room the correct unit based on the ordered volume flow rates
- After successful installation and wiring the controller is ready for use
- The volume flow rate parameters $\dot{V}_{min}$ and $\dot{V}_{max}$ can be adjusted at a later stage using a potentiometer or an adjustment device

B1*



① Controller VRD3
② $\dot{V}_{max}$ potentiometer
③ $\dot{V}_{min}$ potentiometer
④ Service socket
⑤ Jumper for input w
⑥ Actuator cable
⑦ Cable bushings for supply voltage, setpoint value signal and actual value signal
⑧ Indicator light
⑨ Connections for differential pressure sensor

Universal controller VRD3

Volume flow controller VRD3

Supply voltage (AC)	24 V AC ± 20 %, 50/60 Hz
Supply voltage (DC)	24 V DC –10/+20 %
Power rating (AC)	without actuator max. 3.5 VA
Power rating (DC)	without actuator max. 2 W
Setpoint value signal input	0 – 10 V DC, R_a > 100 kΩ
Actual value signal output	0 – 10 V DC, 0.5 mA max.
IEC protection class	III (protective extra-low voltage)
Protection level	IP 40
EC conformity	EMC according to 2014/30/EU
Weight	0.440 kg

Actuator NM24A-V

Actuators NM24A-V and NM24A-V-ST

Supply voltage	from the controller
Power rating (AC)	6 VA max.
Power rating (DC)	3.5 W max.
Torque	10 Nm
Running time for 90°	150 s
Control signal	from the controller
IEC protection class	III (protective extra-low voltage)
Protection level	IP 54
EC conformity	EMC according to 2014/30/EU
Weight	0.710 kg

Actuator NM24A-V

Actuators SM24A-V and SM24A-V-ST

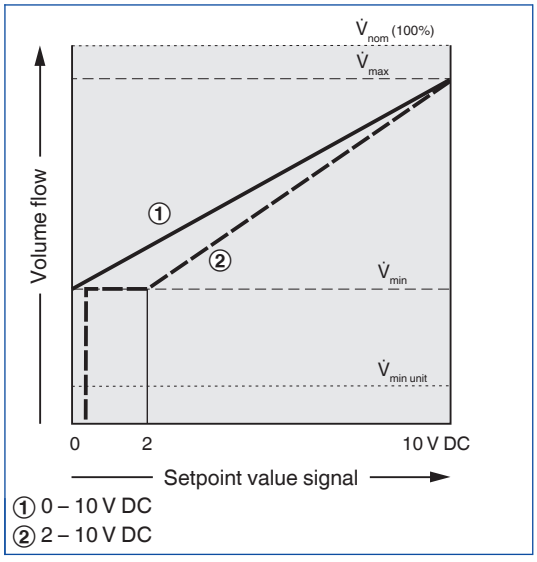
Supply voltage	from the controller
Power rating (AC)	6 VA max.
Power rating (DC)	4 W max.
Torque	20 Nm
Running time for 90°	150 s
Control signal	from the controller
IEC protection class	III (protective extra-low voltage)
Protection level	IP 54
EC conformity	EMC according to 2014/30/EU
Weight	0.910 kg

Spring return actuator
NF24A

Spring return actuators NF24A-V and NF24A-V-ST

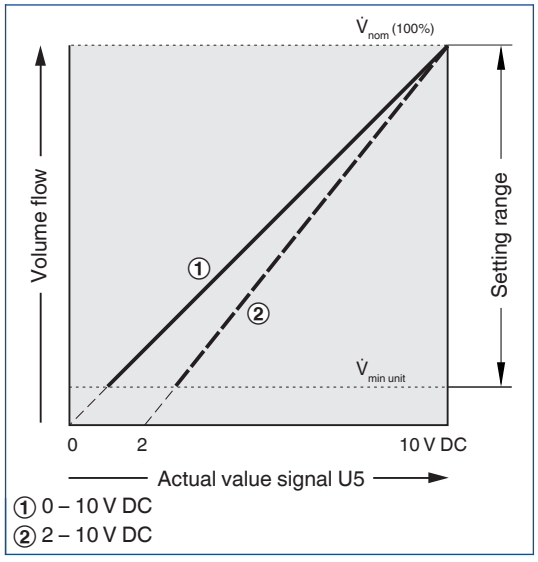
Supply voltage	from the controller
Power rating (AC)	9 VA max.
Power rating (DC)	6.5 W max.
Torque	10 Nm
Running time for 90°	200 – 300 s
Spring return time	< 20 s
Control signal	from the controller
IEC protection class	III (protective extra-low voltage)
Protection level	IP 54
EC conformity	EMC according to 2014/30/EU
Weight	1.91 kg

BC0, BP*, B1*, Characteristic of the setpoint value signal



LMV-D3-MP, NMV-D3-MP, VRD3, VRP-M

BC0, BP*, B1*, Characteristic of the actual value signal



LMV-D3-MP, NMV-D3-MP, NMV-D3LON, VRD3, VRP-M

Volume flow rate setpoint value

0 – 10 V DC

$$\dot{V}_{setpoint} = \frac{w}{10} (\dot{V}_{max} - \dot{V}_{min}) + \dot{V}_{min}$$

BC0, BP*, B1*

Volume flow rate actual value

0 – 10 V DC

$$\dot{V}_{actual} = \frac{U5}{10} \dot{V}_{nom}$$

BC0, BL0, BP*, B1*

Volume flow rate setpoint value

2 – 10 V DC

$$\dot{V}_{setpoint} = \frac{w - 2}{8} (\dot{V}_{max} - \dot{V}_{min}) + \dot{V}_{min}$$

BC0, BP*, B1*

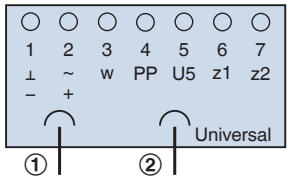
Volume flow rate actual value

2 – 10 V DC

$$\dot{V}_{actual} = \frac{U5 - 2}{8} \dot{V}_{nom}$$

BC0, BL0, BP*, B1*, BB*

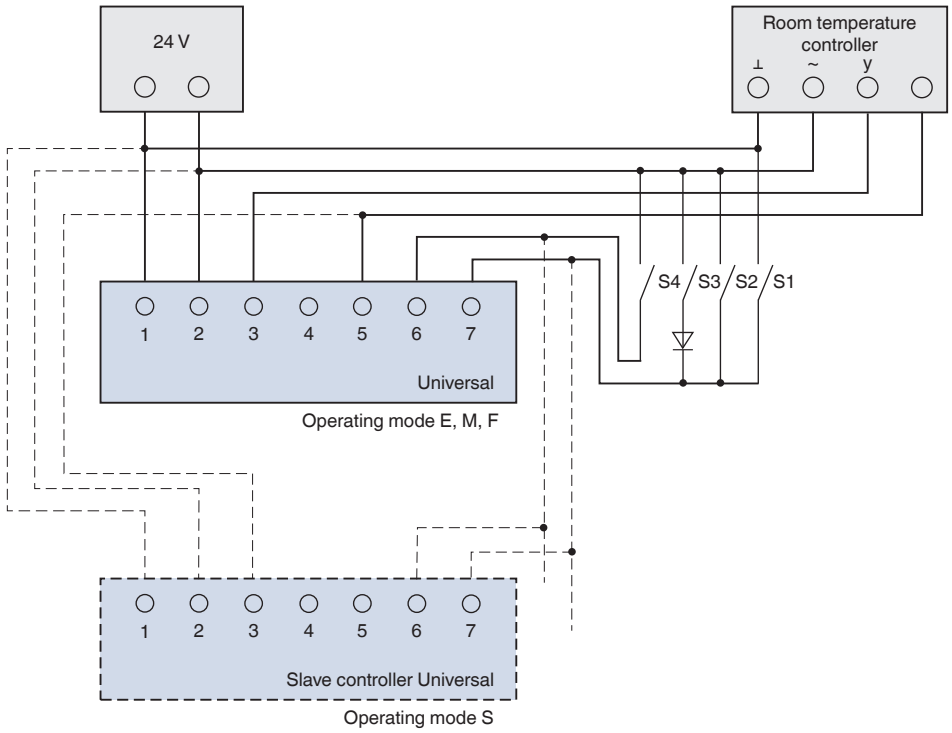
B1*, Terminal connections



① Plug connection for actuator
② Plug connection for adjustment device
1 ⊥, –: Ground, neutral
2 ~, +: Supply voltage
3 w: Setpoint value signal
4 PP: Connection for adjustment device
5 U5: Actual value signal
6 z1: Override control 1 (OPEN)
7 z2: Override control 2 (CLOSE, $\dot{V}_{min}$, $\dot{V}_{max}$)

Universal: VRD3

B1*, Variable volume flow control and override control

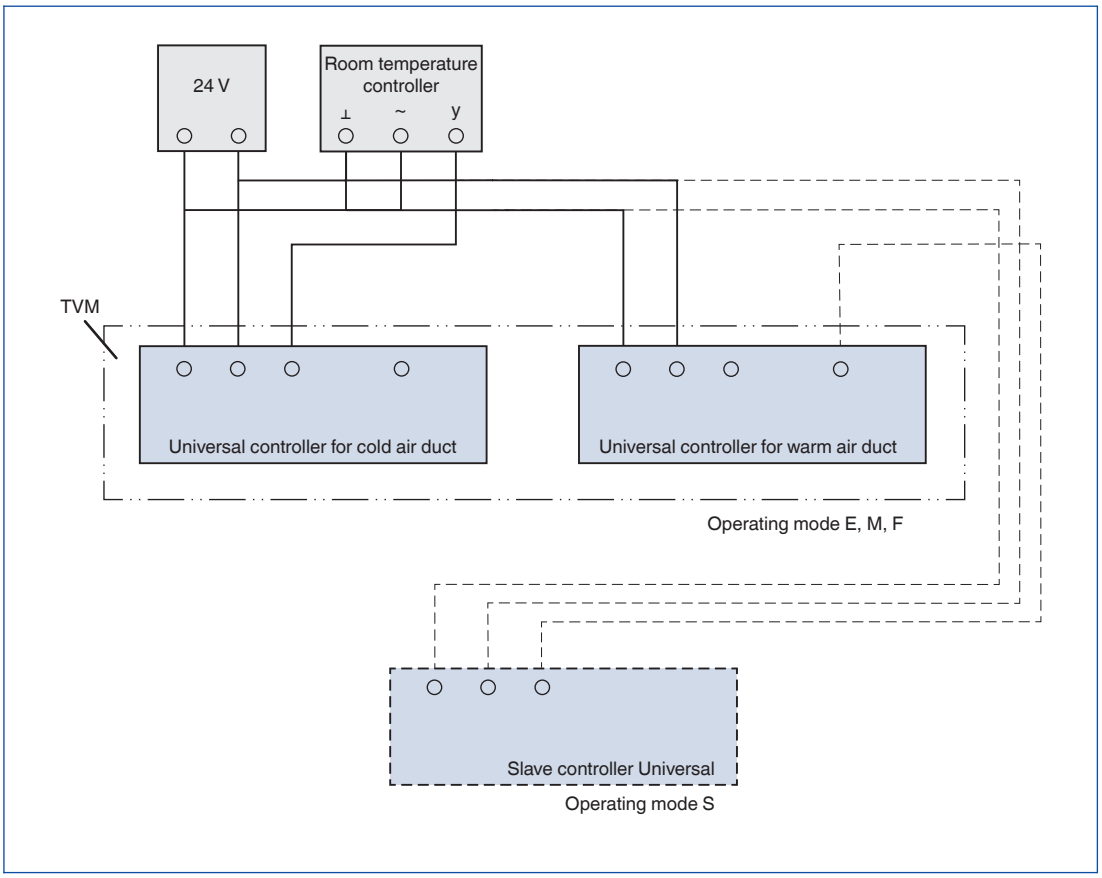


Switch functions
S1 Shut-off CLOSED
S2 Maximum volume flow rate $\dot{V}_{max}$
S3 Minimum volume flow rate $\dot{V}_{min}$ (only with supply voltage 24 V AC)
S4 Damper blade OPEN
All OPEN: Variable volume flow

When combining several override controls the switches must be interlocked to prevent short-circuits.
Diode: e.g. 1N 4007

Universal: VRD3

B1*, Dual duct terminal units Type TVM



Universal: VRD3

Application
- Electronic volume flow controller GUAC-D3 as Universal controller
- Variable air or constant air volume flow control
- The flow rate is measured using the dynamic measurement principle
- Voltage range for the actual and setpoint value signals 0 – 10 V DC or 2 – 10 V DC

Construction
XC3: Volume flow controller GUAC-D3 with spring return actuator 361C-024-20-V/ST07 for TVR, TVJ, TVT, TZ-Silenzio, TA-Silenzio, TVZ, TVA

Signal voltage range
- 0: 0 – 10 V DC
- 2: 2 – 10 V DC with shut-off function (< 0.8 V DC)

Operating modes
E: Single and M: Master
- $\dot{V}_{min}$: Minimum volume flow rate
- $\dot{V}_{max}$: Maximum volume flow rate

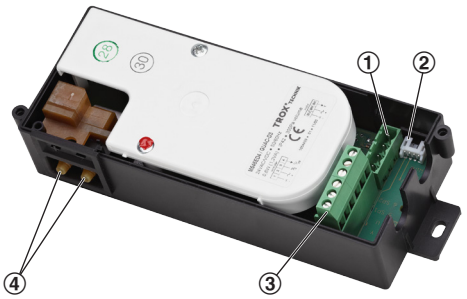
S: Slave operation
- $\dot{V}_{min}$: 0 %
- $\dot{V}_{max}$: Volume flow rate ratio to the master controller

F: Constant value
- $\dot{V}_{min}$: constant volume flow rate
- $\dot{V}_{max}$: 100 %

Parameters are factory set. The customer defines the required operating mode and the volume flow rates in the order code at the time of ordering.

Commissioning
- On-site adjusting is not required
- When installing the VAV terminal units it is important to assign each room the correct unit based on the ordered volume flow rates
- After successful installation and wiring the controller is ready for use
- The volume flow rate parameters $\dot{V}_{min}$ and $\dot{V}_{max}$ can be adjusted at a later stage using a potentiometer or an adjustment device

XC3



① Connection for actuator
② Service socket
③ Connection of supply voltage, setpoint value signal and actual value signal
④ Connections for differential pressure sensor

Universal controller GUAC-D3

Volume flow controller GUAC-D3

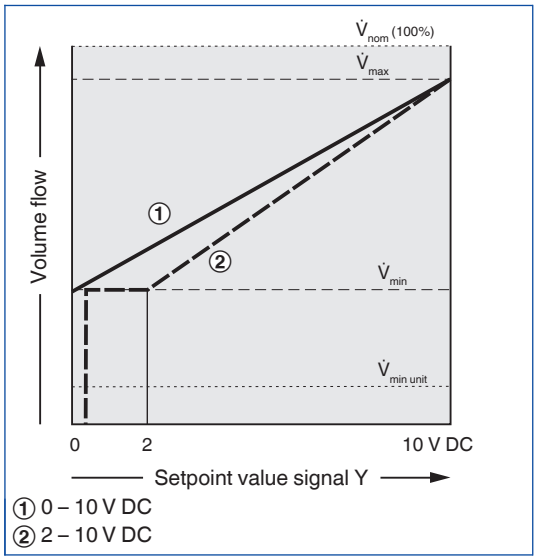
Supply voltage (AC)	24 V AC ± 20 %, 50/60 Hz
Supply voltage (DC)	24 V DC ± 20 %
Power rating (AC)	without actuator max. 1.2 VA
Power rating (DC)	without actuator max. 0.6 W
Setpoint value signal input	0 – 10 V DC, R_a > 100 kΩ
Actual value signal output	0 – 10 V DC, 0.5 mA max.
IEC protection class	III (protective extra-low voltage)
Protection level	IP 42
EC conformity	EMC according to 2014/30/EU

Spring return actuator
361C-024-20-V/ST07

Spring return actuator 361C-024-20-V

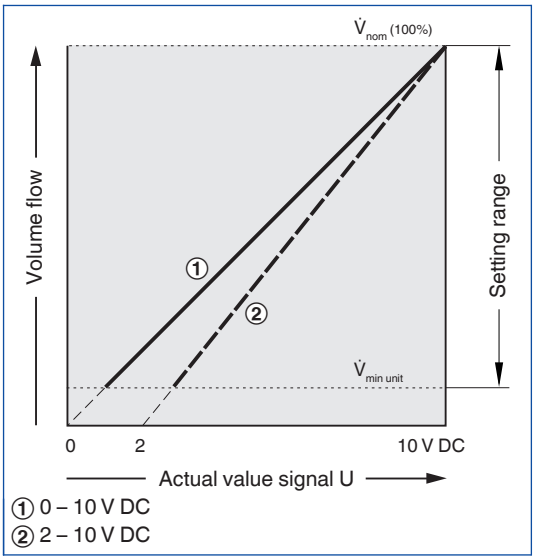
Supply voltage	from the controller
Power rating (AC)	10 VA max.
Power rating (DC)	8 W max.
Torque	20 Nm
Running time for 90°	150 s
Spring return time	< 15 s
Control signal	from the controller
IEC protection class	III (protective extra-low voltage)
Protection level	IP 54 (cable entry at the bottom)
EC conformity	EMC according to 2014/30/EU
Weight	1.8 kg

XC*, XD*, Characteristic of the setpoint value signal



GUAC-D3, GUAC-S3

XB0, XC*, XD*, Characteristic of the actual value signal



227V-024-10, GUAC-D3, GUAC-S3

Volume flow rate setpoint value

0 – 10 V DC
$\dot{V}_{setpoint} = \frac{Y}{10} (\dot{V}_{max} - \dot{V}_{min}) + \dot{V}_{min}$

XB0

Volume flow rate actual value

0 – 10 V DC
$\dot{V}_{actual} = \frac{U}{10} \dot{V}_{nom}$

XB0, XC*, XD*, LN0

Volume flow rate setpoint value

2 – 10 V DC
$\dot{V}_{setpoint} = \frac{Y - 2}{8} (\dot{V}_{max} - \dot{V}_{min}) + \dot{V}_{min}$

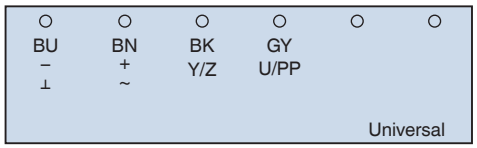
XB0

Volume flow rate actual value

2 – 10 V DC
$\dot{V}_{actual} = \frac{U - 2}{8} \dot{V}_{nom}$

XB0, XC*, XD*

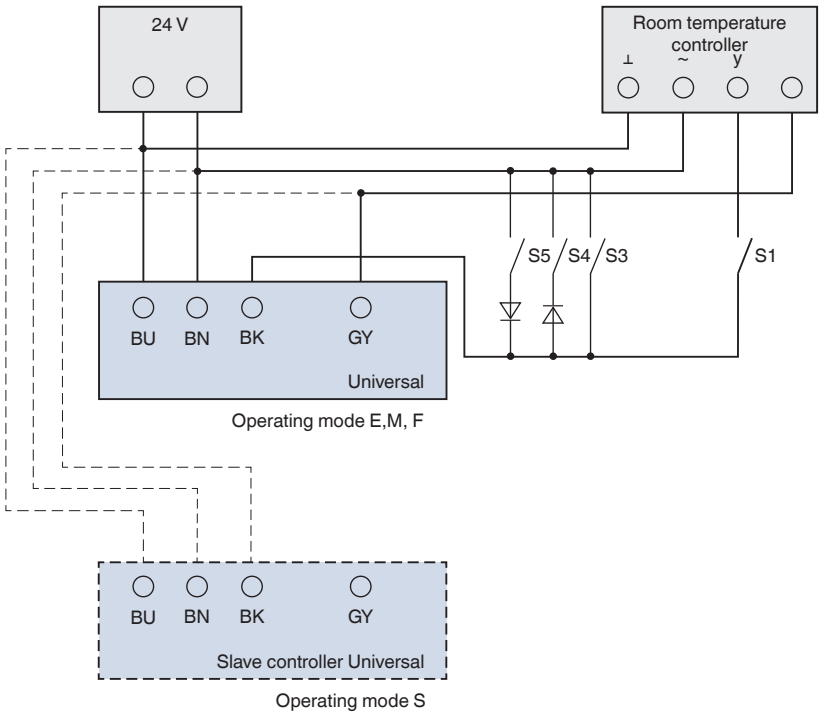
XC*, XD*, XE*, XF*, Terminal connections



BU ⊥, –: Ground, neutral
BN ~, +: Supply voltage
BK Y/Z: Setpoint value signal and override control
GY U/PP: Actual value signal and communication

Universal: GUAC-D3, GUAC-S3, GUAC-P1, GUAC-P6

XC*, XD*, Variable volume flow control and override control, voltage signal 0 – 10 V DC

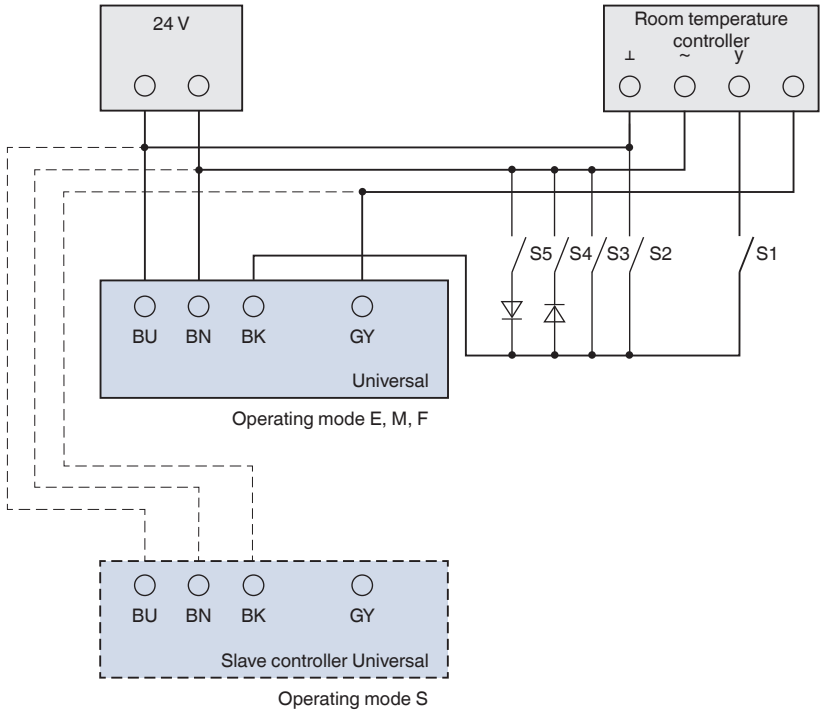


Switch functions
S1 Room temperature control
S3 Maximum volume flow rate $\dot{V}_{max}$
S4 Damper blade CLOSED (only with supply voltage 24 V AC)
S5 Damper blade OPEN (only with supply voltage 24 V AC); takes priority over all other override controls
All OPEN: Minimum volume flow rate $\dot{V}_{min}$

When combining several override controls the switches must be interlocked to prevent short-circuits.
Diode: e.g. 1N 4007

Universal: GUAC-D3, GUAC-S3

XC*, XD*, Variable volume flow control and override control, voltage signal 2 – 10 V DC



Switch functions
S1 Room temperature control
S2 Shut-off CLOSED
S3 Maximum volume flow rate $\dot{V}_{max}$
S4 Damper blade CLOSED (only with supply voltage 24 V AC)
S5 Damper blade OPEN (only with supply voltage 24 V AC); takes priority over all other override controls
All OPEN: Minimum volume flow rate $\dot{V}_{min}$

When combining several override controls the switches must be interlocked to prevent short-circuits.
Diode: e.g. 1N 4007

Universal: GUAC-D3, GUAC-S3