Control components for VAV terminal units

LK0

With digital KNX bus interface

Compact unit for VAV terminal units TVR, TVJ, TVT, TZ-Silenzio, TA-Silenzio, TVZ, TVA and TVM

- Controller, dynamic effective pressure transducer and actuator in one casing
- Use in ventilation and air conditioning systems, only with clean air
- Volume flow rates q_{vmin} and q_{vmax} are factory set and and stored in the controller (but can be changed)
- Data transparency due to bus communication
- Communication interface KNX (S-mode, LTE-mode and PL-link)
- Setpoint value default setting, override control and parameter adjustment by means of bus communication
- Service access for manual adjustment devices and PC configuration software

General information

Application

- All-in-one control device for VAV terminal units
- Dynamic differential pressure transducer, electronic controller, and actuator are fitted together in one casing
- Choice of various control options based on setpoint value default setting
- Setpoint value defaults and override controls by means of communication with a higher-level system
- Support of central BMS optimisation functions by providing network communication
- The volume flow rate actual value is available as a network data point
- The damper blade position is available as a network data point
- Standard filtration in comfort air conditioning systems allows for use of the controller in the supply air without additional dust protection

With heavy dust levels in the room

- Install suitable exhaust air filters upstream because a partial volume flow is routed through the transducer for volume flow rate measurement

If the air is contaminated with fluff, sticky components or aggressive substances

- Use a control component with static differential pressure transducer

Control strategy

- 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 flow rate range for the controller is set in the factory
  - q_{vmin}: Minimum volume flow rate
  - q_{vmax}: Maximum volume flow rate
- Operating parameters are set in the factory according to the order code

Operating parameters

- q_{vmin} = 0 – 100% of the nominal volume flow rate q_{vnom} adjustable
- q_{vmax} = 20 – 100% of the nominal volume flow rate q_{vnom} adjustable
- If necessary for special applications, customers can use setting ranges that are different from the factory settings. Be sure to see the Siemens basic documentation for GLB181.1E/KN for information

Operating modes

- Variable operation (V): The setpoint defaults at the KNX digital bus interface
- Constant value operation: A constant setpoint defaults or can be entered

Interface

- Digital bus communication with KNX
- KNX-TP, galvanically isolated
- Communication interface KNX (S-mode and LTE-mode)
- Communication interface KNX PL-link (Siemens peripheral bus)
- Group objects for setpoint value default setting, override control, volume flow rate actual value, damper blade position and status

System environments

- Building automation with Siemens peripheral bus PL-link (Desigo Total Room Automation)
- Building automation with KNX LTE-mode (Siemens Synco 700 from product type C)
- Building automation with KNX S-mode (third-party integration and free programming)
- Support for ETS device profiles v1.x and v2.x

Parts and characteristics

- Transducer for dynamic measurements
- Overload protection
- Release button to allow for manual operation
- 2 connecting cables (supply voltage, communication) with 2 wires each
- Service interface for service tools
- Status LED for supply voltage and errors
- Push-button for starting test functions and activating the programming mode
- Removable address sticker with unique KNX ID (both alphanumeric and as a barcode)
- The KNX-certified Compact controller can be used with all KNX devices suitable for the desired application, provided that the required data points are available

Construction

- GLB181.1E/KN for TVR, TVJ, TZ-Silenzio, TA-Silenzio, TVZ, TVA
- GLB181.1E/KN for TVT up to size 1000 × 300 or 800 × 400
- GLB181.1E/KN (2 pieces) for TVM, but not for TVM-S

Commissioning

- As the operating values are factory set, the terminal units have to be installed at the specified locations
- Commissioning requires basic knowledge on how to use the required project planning and commissioning tools

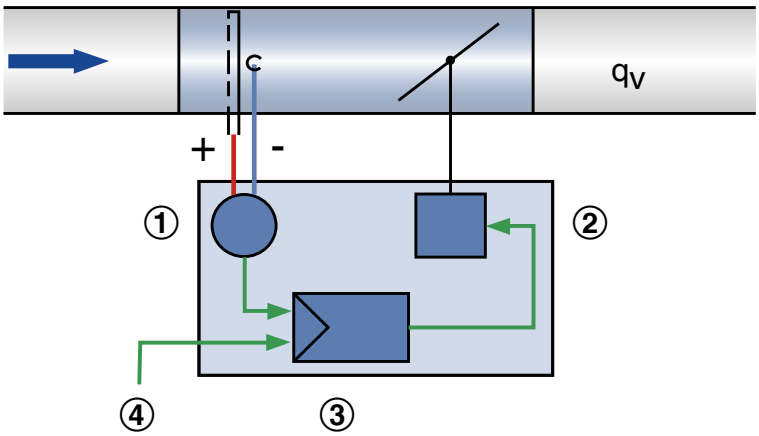
Useful additions

- AT-VAV-S: Adjustment device AST20
- Project planning and commissioning tools, see the product details

Function

VAV terminal units control the volume flow in a closed loop, i.e. measurement – comparison – correction. For volume flow rate measurement the effective pressure is measured first. This is done via a differential pressure sensor. The integral differential pressure transducer transforms the effective pressure into a voltage signal. The volume flow rate actual value is available as a network data point. The factory setting is such that 100% correspond to the nominal volume flow rate (q_{vnom}). The volume flow rate setpoint value comes from a higher-level controller (e.g. room temperature controller, air quality controller, central BMS). Variable volume flow control results in a value between q_{vmin} and q_{vmax}. It is possible to override the room temperature control, e.g. by a complete shut-off of the duct. The controller compares the differential pressure setpoint value to the actual value and controls the actuator accordingly if there is a difference.

Principle of operation



① Differential pressure transducer
② Actuator
③ Volume flow controller
④ Setpoint via KNX communication interface

Specification text

This specification text describes the general properties of the product.

Category
- Compact controller for volume flow rate

Application
- Control of a constant or variable volume flow rate setpoint
- Electronic controller for applying a reference value and capturing an actual value for integration with a KNX-based central BMS
- The actual value relates to the nominal volume flow rate such that commissioning and subsequent adjustment are simplified

Area of application
- Dynamic transducer for clean air in ventilation and air conditioning systems

Actuator
- Integral; slow running (run time 125–150 s for 90°)

Installation orientation
- Either direction

Connection
- Connecting cable with 2 wires (supply voltage)
- Connecting cable with 2 wires (communication)

Supply voltage
- 24 V AC

Interface/signalling
- KNX-TP, galvanically isolatedfor KNX S-mode, KNX LTE-mode, KNX PL-link

Interface information
- KNX group objects for (among others) volume flow rate setpoint and actual values, damper blade position, error status and override control
- Support for ETS device profiles v1.x and v2.x

System connections
- KNX bus for optional expansion

Special functions
- Activation of q_{vmin}, q_{vmax}, CLOSE and OPEN by means of KNX group object
- Operating modes that can be activated as an option: position control

Parameter setting
- Parameters specific to the VAV terminal unit are factory set
- Operating values q_{vmin}, q_{vmax} are factory set
- Subsequent adjustment using network access or optional tools: adjustment device, PC software (wired in each case)

Factory condition
- Electronic controller is factory mounted on the control unit
- Factory-set parameters
- Functional test with air (see sticker)

Order code

TVR – D / 100 / D2 / LK0 / V / qvmin – qvmax m³/h
1 2 5 6 7 8 10 11

1 Type
TVR VAV terminal unit

2 Acoustic cladding
No entry: none
D With acoustic cladding

3 Material
Galvanised sheet steel (Standard construction)
P1 Powder-coated RAL 7001, silver grey
A2 Stainless steel construction

5 Nominal size [mm]
100, 125, 160, 200, 250, 315, 400

6 Accessories
No entry: none
D2 Double lip seal both ends
G2 Matching flanges for both ends

7 Attachments (control components)
LK0 Compact controller, dynamic transducer, KNX interface

8 Operating mode
V Variable (setpoint value range)

10 Operating values for factory setting
Volume flow rates in m³/h or l/s
q_{vmin}
q_{vmax}

11 Volume flow rate unit
m³/h
l/s

Order example: TVT/200×100/D2/LK0/V/200-800 m³/h

Acoustic cladding	None
Material	Galvanised sheet steel
Nominal size	200 × 100 mm
Accessories	Double lip seal both ends
Attachment	Compact controller, dynamic transducer, KNX interface
Operating mode	V variable operation
Volume flow rate	200 – 800 m³/h

Variants

Compact controller GLB181.1E/KN

① Rotation stop
② Clamping device
③ Position indicator
④ Indicator light
⑤ Push button
⑥ Service socket
⑦ Gear release button (side)
⑧ Connections for differential pressure sensor
⑨ Connecting cable

Technical data

Compact controllers for VAV terminal units

VAV terminal units	Type of installation component	Part number
TVR, TVJ, TVT, TZ-Silenzio, TVZ, TVA	GLB181.1E/KN	A00000043586
TVM	2 × GLB181.1E/KN	A00000043586

Compact controller GLB181.1E/KN

Measurement principle/installation orientation	Dynamic measurements, any installation orientation
Supply voltage/frequency	24 V AC ± 20%, 50/60 Hz SELV (Safety Extra Low Voltage) or PELV (Protective Extra Low Voltage)
Functional range	19.2 V – 28.8 V AC
Power consumption – when running	3 VA / 2.5 W
Power consumption – when idle	1 VA / 0.5 W
Torque	10 Nm
Run time for 90°	125 s (60 Hz) – 150 s (50 Hz)
Bus interface	KNX, TP1-256 (electrically insulated), current consumption of the bus: 5 mA
Addressing	For example, assignment of physical addresses to the unique KNX IDs on the compact controllers (by others, using commissioning tools)
Setpoint / actual value interface	with KNX group objects
Connections (supply voltage/communication)	2 connecting cables supply/communication separated each approx. 0.9 m, with 2 wires 2 × 0.75 mm²
IEC/EN protection class	III (protective extra-low voltage)
Protection level	IP 54
EMC	EMC to 2014/30/EU
Weight	0.6 kg

Product details

Bus mode
- The customer's bus network has to be commissioned in order to ensure smooth data exchange
- See the sections on Commissioning and Project design and commissioning tools

Setpoint value default setting
- The setpoint value defaults as a percentage value via KNX group objects
- The percentage value refers to the volume flow rate range specified by q_{vmin} – q_{vmax} .
- If q_{vmin} = 0 and q_{vmax} = q_{vnom} are set, the entire flow rate range of the VAV terminal unit is available to the building automation system. The volume flow rate range that can be controlled depends on the VAV terminal unit type.
- Volume flow rate range q_{vmin} – q_{vmax} is set in the factory according to the order code
- Subsequent adjustment of q_{vmin} or q_{vmax} is possible using service tool AST20 or the customer's network
- If just one constant setpoint value is used, the Compact controller works as a constant volume flow controller

Actual value as feedback for monitoring or tracking control
- The volume flow rate actual value is available in m³/h and as a percentage value at the bus connection. The 0 – 100 % range corresponds to the flow rate range 0 – q_{vnom}
- In addition to the flow rate actual value, the actual damper blade position can be read using an additional data point

Override control
For special operating situations, the volume flow controller can be put in a special operating mode (override control) . The following modes are available: damper blade OPEN or damper blade CLOSED.
This can be activated by setting specific values:
- For OPEN position: q_{vmax} = 100 % and setpoint value = 100 %
- For CLOSED position: q_{vmin} < 0 % and setpoint value = 100 %

Override control for diagnosis
This can be activated using the bus system, AST20 or PC software.

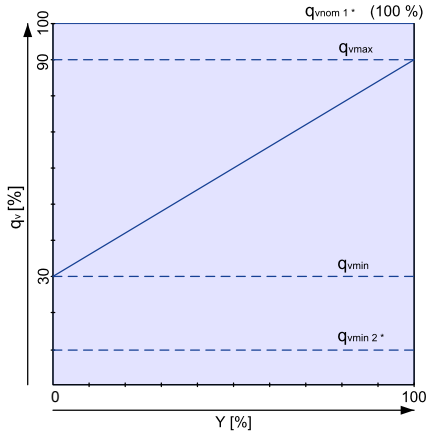
Commissioning
Configuration of the communication interface is required. For this purpose, the controller carries a removable address sticker with the unique KNX ID (both alphanumeric and as a barcode). Commissioning requires basic knowledge on how to use the required project planning and commissioning tools More communication parameters may have to be set.

Project design and commissioning tool

Interface mode	Project design and commissioning tool
KNX S-mode	KNX Association ETS4, ETS5,
KNX LTE-mode	Siemens Synco ACS790
Siemens peripheral bus PL-link	Siemens Desigo ABT, SSA

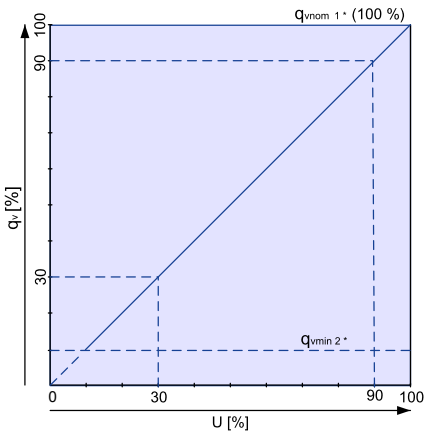
Supplementary manufacturer documentation
- Data sheet (N3547) VAV compact controller KNX PL-link
- For additional, detailed information about this control component see the Siemens HIT portal. See https://hit.sbt.siemens.com/ – search for GLB181.E/KN
- Detailed technical information P3547 on the controller
- Installation manual M3547

Characteristic of the setpoint value (Y)



q_v * = $q_{vnom;}$
q_{vmin} * = $q_{vmin\ unit}$

Characteristic of the actual value (U)



q_v * = $q_{vnom;}$
q_{vmin} * = $q_{vmin\ unit}$

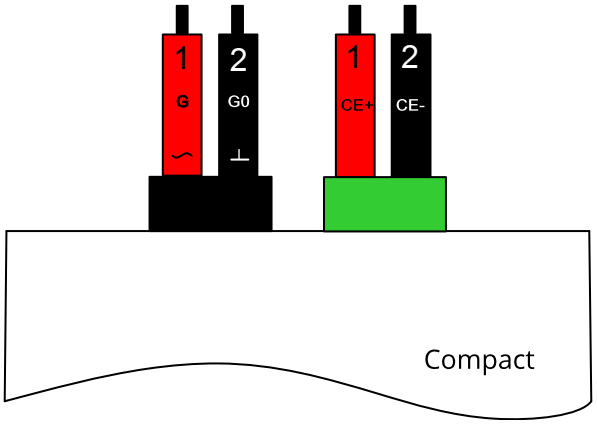
Berechnung Volumenstromsollwert

$$q_{vset} = \frac{Y}{100\ \%} \times (q_{vmax} - q_{vmin}) + q_{vmin}$$

Berechnung Volumenstromistwert

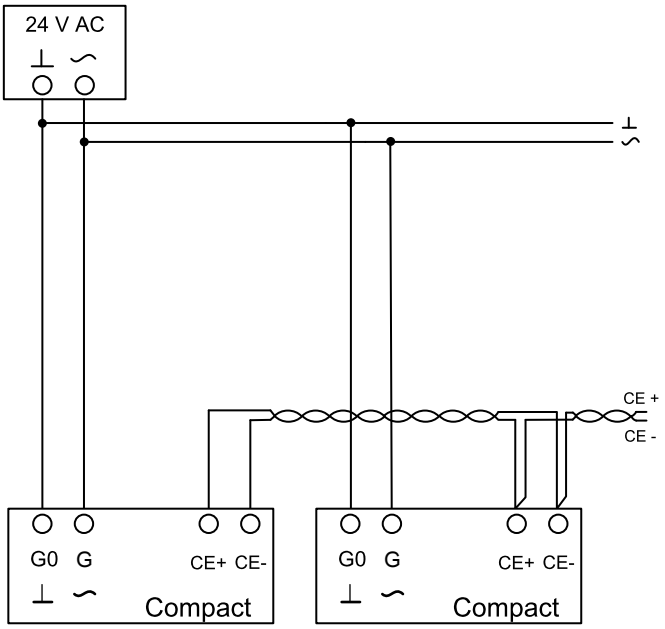
$$q_{vact} = \frac{U}{100\ \%} \times q_{vnom}$$

Connecting cable core identification Siemens GLB 181.1E/ KN



1: RD, G, ⊥, -: Supply voltage AC 24 V
2: BK, G0, ⊥: Earth, neutral
1: RD, CE+: Bus connection (KNX PL-link)
2: BK, CE-: Bus connection (KNX PL-link)

Connecting cable core identification – KNX TP1 bus



G0 = Neutral conductor 24 V AC
G = Live wire 24 V AC
CE+ = Bus connection KNX PL-link
CE- = Bus connection KNX PL-link

Nomenclature

q_{vNom} [m³/h]; [l/s]
Nominal flow rate (100 %): The value depends on product type, nominal size and control component (attachment). Values are published on the internet and in technical leaflets and stored in the Easy Product Finder design program. Reference value for calculating percentages (e.g. q_{vmax}). Upper limit of the setting range and maximum volume flow rate setpoint value for the VAV terminal unit.

$q_{vmin\ Unit}$ [m³/h]; [l/s]
Technically possible minimum volume flow rate: The value depends on product type, nominal size and control component (attachment). Values are stored in the Easy Product Finder design program. Lower limit of the setting range and minimum volume flow rate setpoint value for the VAV terminal unit. Setpoint values below $q_{vmin\ unit}$ (if q_{vmin} equals zero) may result in unstable control or shut-off.

q_{vmax} [m³/h]; [l/s]
Upper limit of the operating range for the VAV terminal unit that can be set by customers: q_{vmax} can be set to less than or equal to q_{vnom} For analogue signalling to volume flow controllers (typically used), the maximum value of the setpoint signal (10 V) is assigned the set maximum value (q_{vmax}) (see characteristic).

q_{vmin} [m³/h]; [l/s]
Lower limit of the operating range for the VAV terminal unit that can be set by customers: q_{vmin} should be set to less than or equal to q_{vmax} . Do not set q_{vmin} to less than $q_{vmin\ unit}$ as the control may become unstable or the damper blade may close. q_{vmin} may equal zero. In case of analogue signalling to volume flow controllers (which are typically used), the set minimum value (q_{vmin}) is allocated to the minimum setpoint signal (0 or 2 V) (see characteristic).

q_v [m³/h]; [l/s]
Volume flow rate

VAV terminal unit
Consists of a basic unit with an attached control component.

Basic unit
Unit for controlling a volume flow without an attached control component. The main components include the casing with sensor(s) to measure the effective pressure and the damper blade to restrict the volume flow. The basic unit is also referred to as a VAV terminal unit. Important distinguishing features: Geometry or unit shape, material and types of connection, acoustic characteristics (e.g. acoustic cladding or integral sound attenuator), volume flow rate range.

Control component
Electronic unit(s) mounted on the basic unit to control the volume flow rate or the duct pressure or the room pressure by adjusting the damper blade position. The electronic unit consists basically of a controller with effective pressure transducer (integral or external) and an integral actuator (Easy and Compact controllers) or external actuator (Universal or LABCONTROL controllers). Important distinguishing features: Transducer: dynamic transducer for clean air or static transducer for contaminated air. Actuator: slow-running actuator as standard, spring return actuator for safe position, or fast-running actuator. Interface: analogue interface or digital bus interface for the capturing of signals and data.